33T Braking system - toe brakes

Overview

Two separate brake systems are to be installed, one for each wheel brake. The two master cylinders provided require their operating lever to be substituted by a brake pedal. Only one set of brakes, those for the pilot, are described for installation.

The brake system on the Tri-gear Europa uses mineral based hydraulic fluid for its operation, **not** automotive brake fluid. The seals in the master cylinders must be changed to make them suitable for the hydraulic fluid (the seals in the wheel brake cylinders are already correct).

Mounting brackets are bolted to plates and angle brackets which are bonded to the floor between the rudder pedals. The master cylinders are, in turn, fastened to the mounting brackets. The hydraulic lines are run from the master cylinders, under the central tunnel and into the rear fuselage before routing forward through the baggage bay rear bulkhead and down the gear leg to the brake calipers.

Master cylinders

Step 1 - Adaptation

The lever supplied with each master cylinder is unsuitable for its application in the Europa Tri-gear so a longer cranked brake pedal lever B01 is provided - see figure 1.

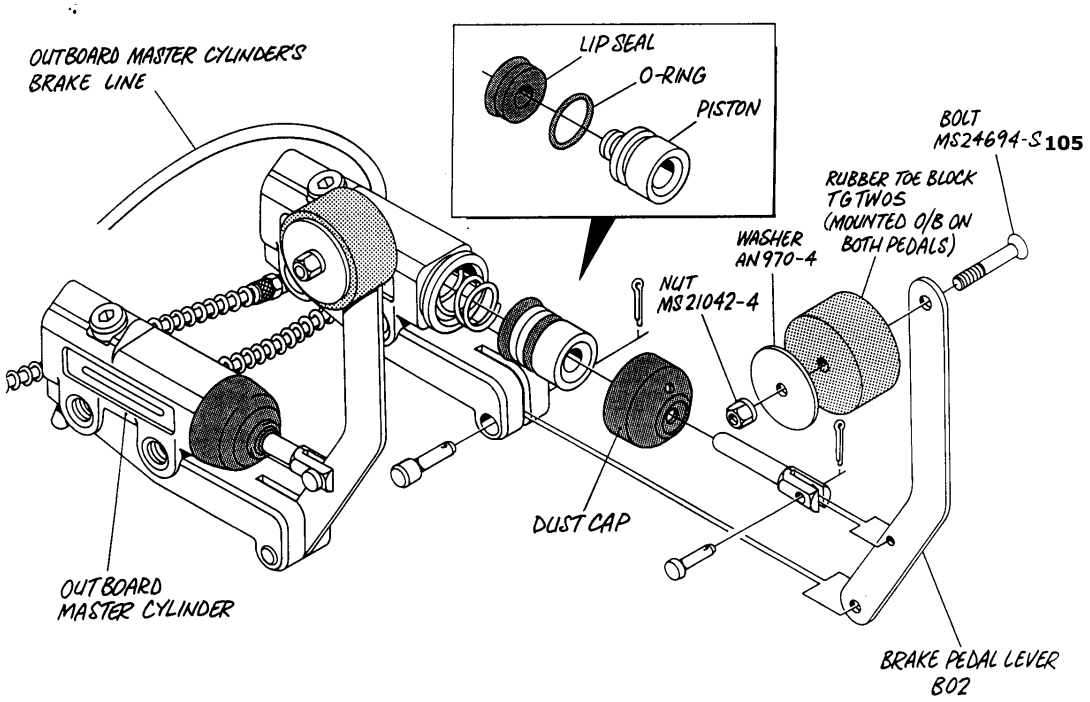

Fig 1. Brake master cylinders and brake levers.

The seals within the master cylinders are not compatible with aviation type hydraulic fluids. These must be removed and destroyed so that they can never be confused with the correct seals which are provided.

Remove both split pins and clevis pins attaching the operating lever to the master cylinder. Noting that the piston is pushed by a spring, which acts to let the brake off, carefully peel back the rubber dust cover and remove the piston from the cylinder body. Remove the "O" ring and, having noted its orientation, the lip seal from the piston and discard them. Replace them with the nitrile rubber "O" ring and lipseal provided. Lubricate the new seals with hydraulic fluid *not automobile brake fluid* and carefully reassemble the piston into the cylinder.

Fit the new lever B01 ensuring that the hole positions at the pivot end of the lever are the same as the original. The original lever may now be discarded.

Finally, attach the rubber toe blocks to the end of the pedal levers with the countersunk bolts MS24694-S58.

Step 2 - Master cylinder mounting brackets

To fasten the angle mounting brackets to the floor between the rudder pedals, a fixing bracket and two fixing plates are required to be permanently attached to the floor.

The fixing bracket is to be made using the 38mm x 25mm x 1.5mm (1.5" x 1" x 1/16") light alloy angle and the fixing plates from the 1.5mm (1/16") thick alloy sheet material. Drill the holes in the alloy angle and both plates as indicated in figure 2.

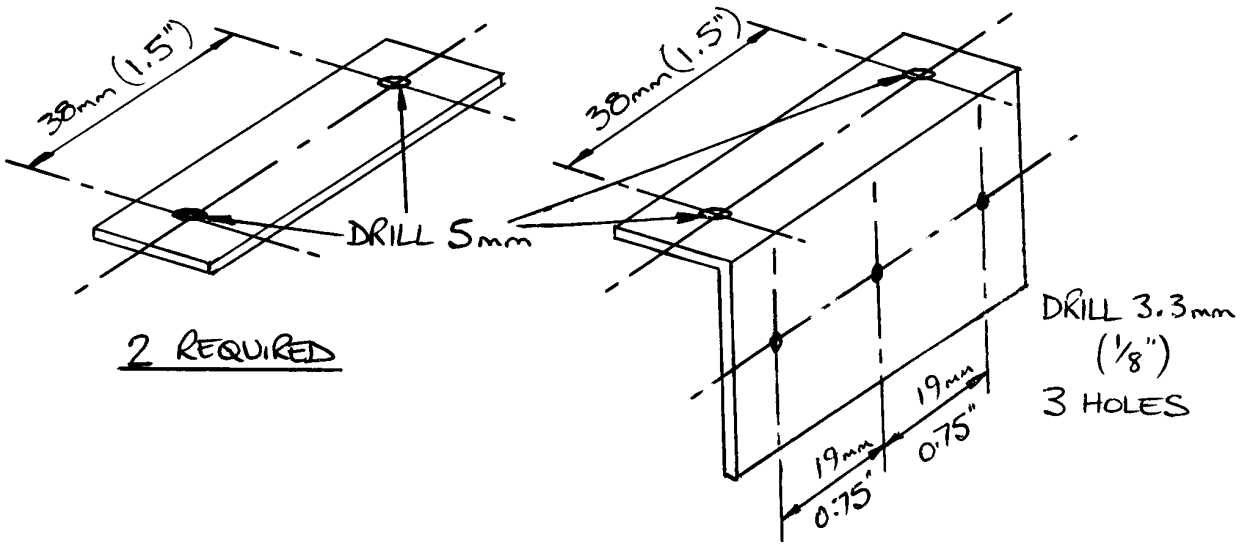

Fig 2. Rudder pedal mounting bracket and plates.

The spacing apart and fore and aft positioning of the brake pedal mounting brackets is determined by the alignment of their rearmost holes with the holes in the floor mounted angle bracket. Sideways positioning of the mounting brackets must be arranged such that there is adequate clearance between the brake pedals and the foot well side walls for your feet to reach the rudder pedals.

To check sideways alignment, temporarily assemble the two mounting brackets B01P and B01S with the top plate B05 and the rear angle bracket B04. Use AN3-5A bolts inserted from the underside and plain nuts to hold things together temporarily. Figure 3 below shows an exploded view of the final permanent assembly.

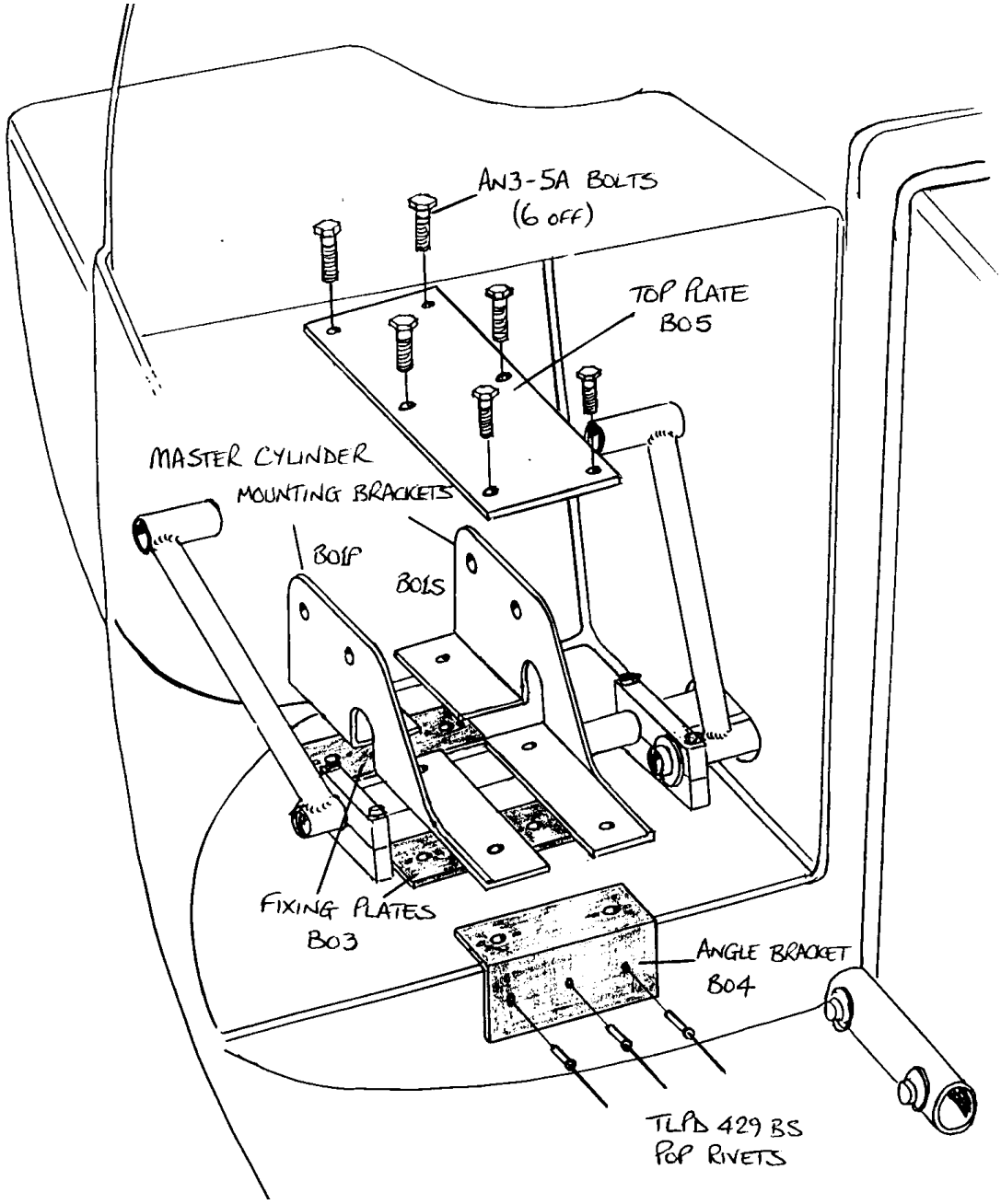

Fig 3. Master cylinder mounting brackets.

Bolt the master cylinders to the port side of the mounting brackets using the 8mm x 25mm bolts. This ensures maximum foot clearance to the side of each pedal for access to the rudder pedals. Place the assembly between the rudder pedals on the port side of the aircraft and move it sideways so that the inboard brake pedal lever is 115mm(4.5") from the inboard side of the foot well. Mark the positions of the mounting brackets then, removing the AN5 bolts one at a time and making sure the assembly is back in the desired position, drill through the floor with a 4.8mm drill, using the holes in the brackets as a guide. Once all six holes have been drilled the brake pedal assembly may be dismantled.

Attach MS21047-3 anchor nuts to the underside of both the fixing plates and the angle bracket using TAPK33BS rivets. Use a 2.4mm (3/32") drill for the rivet holes, and don*t forget to countersink them to ensure that the rivets are flush with the top when installed.

Open up the holes in the floor to accommodate the anchor nuts complete with their attaching lugs and rivets, so that the plates and bracket can sit flush against the surface.

Drill 3.3mm holes for the rivets through the front of the angle bracket and the vertical bulkhead.

Assemble the plates and angle bracket to the master cylinder mounting brackets, including the top plate, using AN3-5A bolts, scuff sand the undersides of the plates and bracket, and the relevant places on the floor, then bond the assembly into place with Redux 420 and flox. Don*t be too generous with the adhesive, you don*t want accidentally to bond the mounting brackets as well. Before the Redux cures rivet the angle bracket to the vertical bulkhead with 3 TLPD429BS pop rivets.

Step 3 - Installation

Carefully adjust the angle at which the elbow fitting, screwed into the underside of the master cylinder, is orientated.

When the master cylinders are installed the elbows need to be pointing towards each other to enable smooth runs of the hydraulic lines. Cut the hydraulic line supplied into two equal lengths of about 3.25 metres (11 feet). This amount should be more than enough but leave the lines as long as they can be until you connect them to the brake calipers.

Make sure that the ends are cut square and then, with nut from the elbow slid onto the brake line first, push the line onto the elbow such that it goes at least as far as the larger diameter piece. Screw the nut up tight which will seal the line to the fitting.

Note: *The line seals onto the fitting on the brake caliper in a different way which will be detailed later in this chapter.*

Run the hydraulic lines so that they both route towards the outboard side of the aircraft; this will require the outboard master cylinder*s line to loop around back on itself. Don*t try to make the loop too tight a radius.

Both lines should be routed towards the outboard side of the fuselage before running aft, then across in front of the seat, through into the central tunnel to route aft into the rear fuselage. This routing, although not the most direct, ensures that a line will not be damaged by the heel of a shoe resting on it, which could happen if they went the other way.

Loop the brake lines behind the baggage bay rear bulkhead then outboard, each to its appropriate side, and forward to pass through a small hole 2-3 cm (1") above the floor in the bulkhead and about 40 cm (15") from the centreline. Now pass the line through a hole in the floor 2-3 cm (1") behind the main gear leg and run it down towards the brake caliper.

Secure the brake line along its length and ensure that it cannot chafe where it passes through bulkheads etc. Use silicone sealant at bulkheads to limit movement here.

Once you are happy with its route, cut the line to the length required to terminate at the elbow fitting in the brake caliper. If required, rotate the elbow fitting to orientate it to facilitate easy attachment of the line, then remove the nut and plastic olive from the elbow and slide them onto the line. Check that the tapered end of the olive is towards the end of the hydraulic line. Push the line into the elbow fitting as far as it will go then, sliding the olive up to it, screw the nut up tight. This action compresses the olive onto the line and so seals it to the elbow fitting.

Filling with hydraulic fluid and bleeding

To ensure air does not become entrapped during filling it would be advisable to remove the master cylinders from their mountings and raise them as high as possible. Try to arrange for the brake lines to be gaining height all the way from the calipers to the master cylinders to reduce the chance of air entrapment.

It is best to fill the system from the lowest point to purge all the air upwards so, using a hydraulic fluid filling container that can be slightly pressurized (such as a thoroughly cleaned plastic detergent bottle), connect a short length of plastic pipe from it to the bleed nipple of the caliper.

Note: *Use only aviation type hydraulic fluid.*

With the filler screw of the master cylinder removed, undo the bleed nipple about one turn and squeeze hydraulic fluid into the system until it appears at the master cylinder. Tighten the bleed nipple then screw on the filler screw ensuring that air doesn*t enter the master cylinder.

Re -attach the master cylinder to its mounting bracket and repeat the process with the other brake.

The brake pedal should not move more than 2 - 3cm before a good application of brake is achieved. If there is more movement than this or the brakes feel spongy there is, more than likely, air in the system and further bleeding will be required.

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