



Revised Tailwheel and Rudder Drive Mod 77

APPLICABILITY : **All Europa variants except Classic**

Mod Type : **New build or Retro-fit**

1. Introduction:

The standard Europa XS has the rudder operated by cables, which exit the fuselage and connect to a horn fitted on the base of the rudder. The cables and their connections attract dirt, and the horn is fitted below the lower rudder hinge which can cause additional wear in the hinge. This design helps to reduce wear and places the majority of the drive mechanism inside the fuselage, with the rudder connection closer to the rudders centre of pressure. This modification is based on a variation of the push rod drive mechanism used on the Europa Classic.

2. Parts List:

Qty	Part No.	Description	Source
		Access panel	
4	MS21047-3	Anchor nuts (for access panel)	Mod 77 Kit
8	TAPK33BS	Rivets (for nuts above)	Mod 77 Kit
4	AN525-10R8	Washer head screw	Mod 77 Kit
		Bell Crank Assembly	
1	BC4W10	Bell Crank Bearing	Mod 77 Kit
6	AN470-AD4-7	Rivets (bearing to steering arm)	Mod 77 Kit
1	CS33	Steering Arm	Mod 77 Kit
2	CS32	Bulkhead Brackets	Mod 77 Kit
2	CS37A	Tube spacer (between CS32s)	Mod 77 Kit
1	CS37B	Tube spacer (above bearing_	Mod 77 Kit
1	CS37C	Tube spacer (below bearing	Mod 77 Kit
3	AN4-17A	Bolts (spacers and bearing)	Mod 77 Kit
3	AN960-416	Washer (for bolts above)	Mod 77 Kit
3	MS21042-4	Nuts (for for bolts above)	Mod 77 Kit
4	MS21047-3	Anchor nuts (on CS32)	Mod 77 Kit
8	TAPK33BS	Rivets (for nuts above)	Mod 77 Kit
4	AN3-6A	Bolts (CS32 to fuse)	Mod 77 Kit
4	AN970-3	Large washers (CS32 to fuse)	Mod 77 Kit
		Pushrod and ends	Mod 77 Kit
1	CS38	17" TU3RM, Push rod, plated	Mod 77 Kit
2	AN490HT8P	Rod ends	Mod 77 Kit
4	TLPD435BS	Pop rivets (rod end fixing)	Mod 77 Kit
2	AN316-4R	Check Nuts	Mod 77 Kit
2	MW4	Rod end bearings	Mod 77 Kit
2	AN4-10A	Bolt (rod end to arm & CS29M77)	Mod 77 Kit
2	Eur001	¼" washer (safety washer above rod end)	
4	AN960-416	Washers (below above bolt)	Mod 77 Kit
2	AN960-416L	Washers (under nuts below)	Mod 77 Kit
2	MS21042-4	Nuts (for bolts above)	Mod 77 Kit
		Cable ends	
2	AN115-21	Shackle	Mod 77 Kit
2	SP4Y-B3	Shackle Pins (AN393-11)	Mod 77 Kit
4	MS24665-153.	Split pins for above	Mod 77 Kit
4	28-2-G	Nicopress sleeves (to change cable length)	Mod 77 Kit
2	AN100C-4	Cable timble (new cable ends)	Mod 77 Kit



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Rudder Mount			
1	CS29M77	Push rod socket	Mod 77 Kit
5	TLPK429BS	Rivets (CS29b to rudder)	Mod 77 Kit
	Ampreg 21, Duralac	92125 BID (Cut at $\pm 45^\circ$), Flox	Builder stock
	3mm Ply		Builder stock
Mono Only			
1	CS34	Tail wheel horn	Mod 77 Kit
1	CS35	Tail wheel limit stop	Mod 77 Kit
2	AN4-11A	Bolts (Horn and stop to tail wheel)	Mod 77 Kit
2	MS21042-4	Nuts	Mod 77 Kit
2	AN960-416	Washer (bolts above)	Mod 77 Kit
4	AN115-21	Shackle	Mod 77 Kit
4	SP4Y-B3	Shackle Pins (AN393-11)	Mod 77 Kit
4	MS24665-153.	Split pins for above	Mod 77 Kit
4	28-2-G	Nicopress sleeves (to change cable length)	Mod 77 Kit
4	AN100C-4	Cable timble (new cable ends)	Mod 77 Kit
1	7x7 Cable	Cable (2.2 meters)	Mod 77 Kit
2	TU50rm	3/16" Nylon fairleads (150 mm)	Mod 77 Kit

See the manufacturer's documentation for recommended GPS units and connection details.

List of related Drawings / Photo's:

Drawing No.	Title / Description	Issue
	All are included in this text	1

3 Action:

3.1 Inspection hole: The inspection hole below the tail plane, which is now standard, is required (see 23M-2). An alternative method to that given in the manual can be used if the top moulding has not been fitted. Lay up a 4 ply splash moulding for the flange inside the fuselage, using release wax. Mark its exact position by drilling two holes through the area of the flange and inserting cocktail sticks. Remove the splash moulding. Cut out the access panel disc with a very narrow cut using a model maker's jig saw. This allows the disc to be used for the actual panel. Seal the foam edges of both the panel and hole with flox to a depth of 5-6 mm. When other work is complete the flange is bonded onto the fuselage, then drilled for 4 anchor nuts with the panel in place. The flox edge filling must be deeper where the bolts go through to provide support against crushing.

3.2 Bellcrank assembly: the bell crank and brackets are assembled on the bench as per Fig 1. Leave installing the MS21047-3 stiff nuts until the holes have been drilled through the bulkhead.

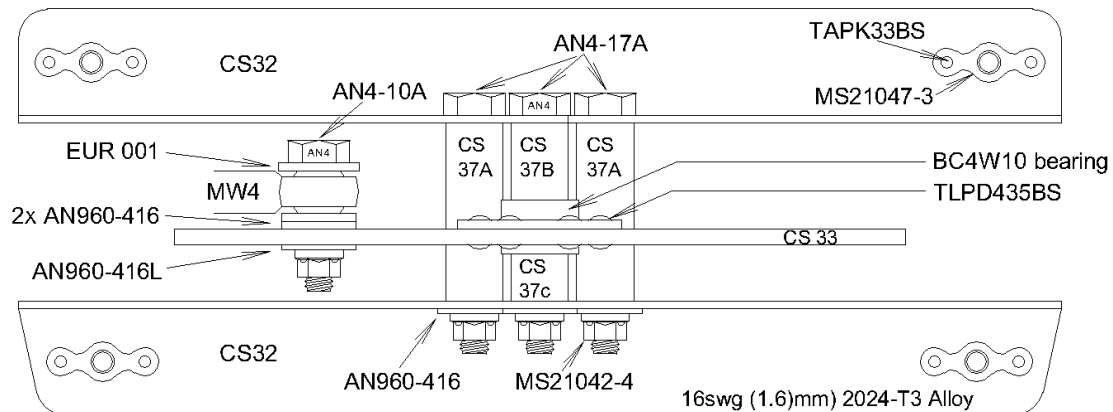
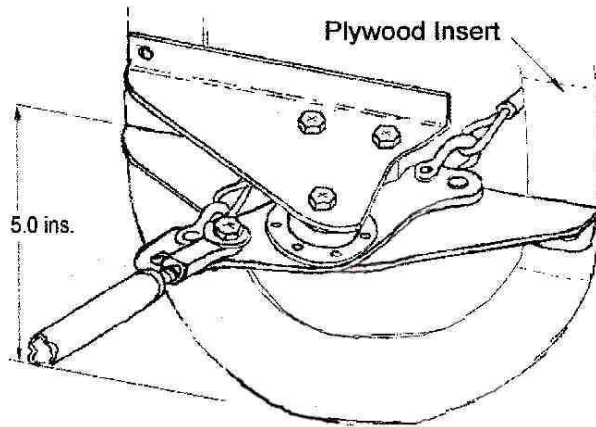


Figure 1



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3.3 Bellcrank Assembly installation: Mark a level line on the rear face of the rear bulkhead 5.00 inches up from the inside bottom skin then set up the assembly so that the lower of the two brackets has its upper surface level with this line. The four outboard edges are bevelled and trimmed to give a snug fit against the bulkhead. See figure 2.



Remove the foam core of the bulkhead under the "feet" (using small router bit in a mini drill) and flox in 3 mm ply insets to form hard points for the four AN3-6A attachment bolts. Apply a 90° degree corner ply of BID on both sides of the bulkhead extending an inch above and below the brackets. After cure mark and drill the bolts holes (you may need a small corner drill). Fit the MS21047-3 anchor nuts to the brackets. Make a bed of Flox under the "feet" and bolt the assembly in place with AN970-3 washers under the heads (grease the bolts and nuts well to avoid epoxy locking the bolts to the nuts).

Figure 2

3.4 Rudder Cables: Shorten the existing cables to the rudder and connect to the CS33 steering arm with the AN115-21 shackles and SP4Y-B3 pins. The XTW11 spacers are not required. Adjust the length of the cables so that the pedals and bell crank are both in their central position at the same time and can achieve full deflection, i.e. bell crank hitting its stops. Swage the end fittings of the cables when satisfied.

3.5 Rudder CS29M77 installation: A cavity is required in the leading edge of the rudder (see Photo 1 and Fig 3 & 4) to accept the CS29M77. First remove two of the pop rivets from the hinge (the second and third from the top edge). Use a sharp drill to remove the head and take great care not to damage the rudder skin behind the hinge. The position of the CS29M77 is fixed by the jig as shown in the photo 2 and Fig 5. Check that the 2.5 in. dimension from the hinge centre line is correct. In this position the left hand flange of the CS29M77 should be against the port rudder skin.

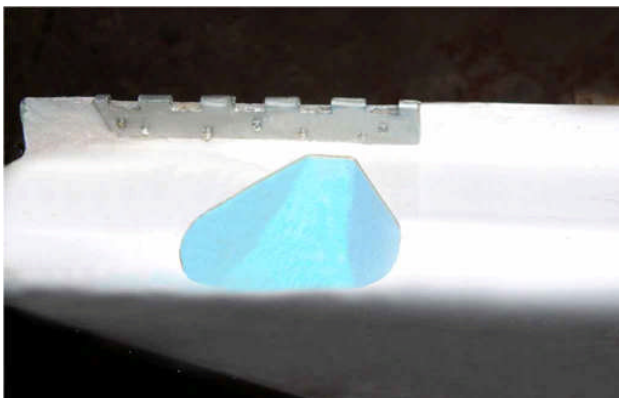


Photo 1 Cutting the hole for the CS29M77

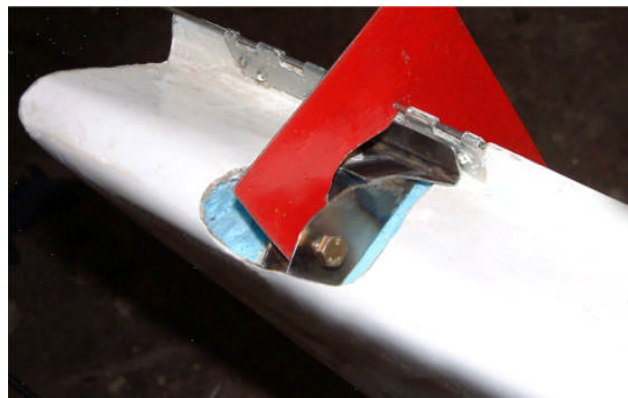


Photo 2 Using the setting jig

The Europa Club has a jig available for loan



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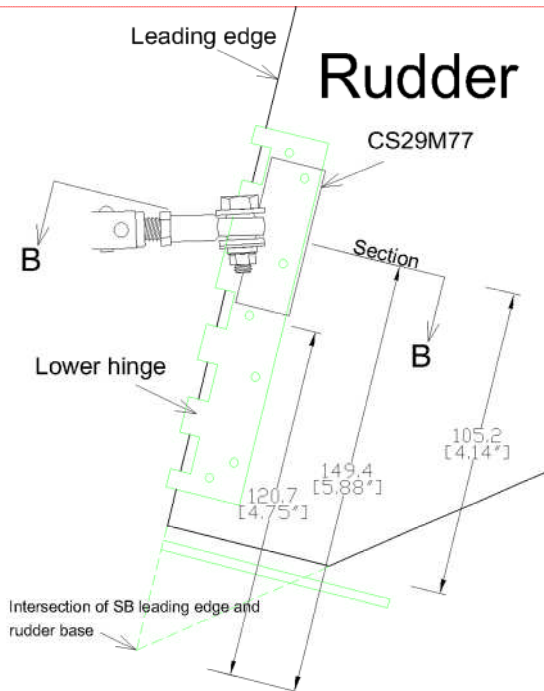


Fig 3 Position on Rudder

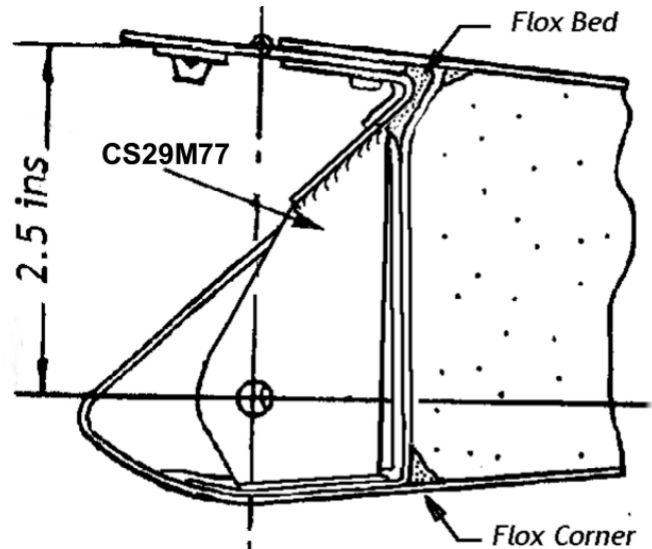


Fig 4 Section B-B

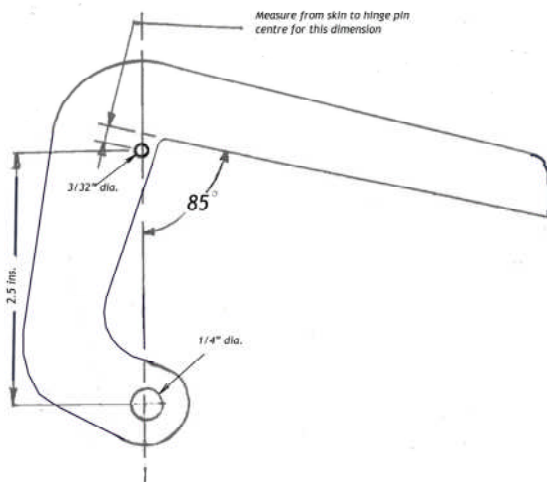


Fig 5 Setting Jig

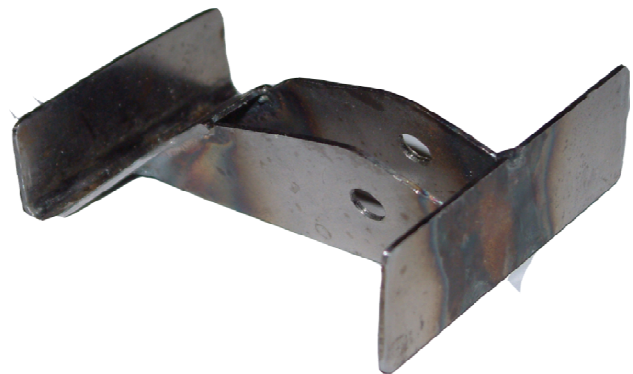


Photo 3 CS29M77 push rod socket

When satisfied with the position of the CS29M77 scuff sand all the areas to be bonded. Put a 0.25" (6mm) flox corner in around the edge of the cut out and the bottom of the recess, (see Fig 4 & 6) then lay up two plies of BID over the exposed blue foam. Fit the CS29M77 with a bed of flox at the back edge of the hinge and under the port flange. Peel ply and leave to cure with the template installed to maintain an accurate position.

After cure trim the edges and lay up two more plies of BID over the flanges of the CS29M77 and the sides of the cut out (see fig 6). These lay ups should cover the port side plate completely (but not between the cross plates) extend over the starboard (hinge) flange and overlap onto the front face of the rudder leading edge by 0.75" (19mm). Do not lap onto the hinge and be careful to avoid resin getting onto the hinge pin area. It would be wise to wax the hinge and pin. Drill the five holes 0.125" (3.3 mm) dia. and install pop rivets (TLPK429BS) through the hinge and bracket and through the port skin and side plate of the socket. See fig 7



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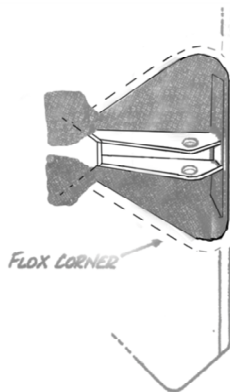


Fig 5. Layout in rudder leading edge.

Fig 6

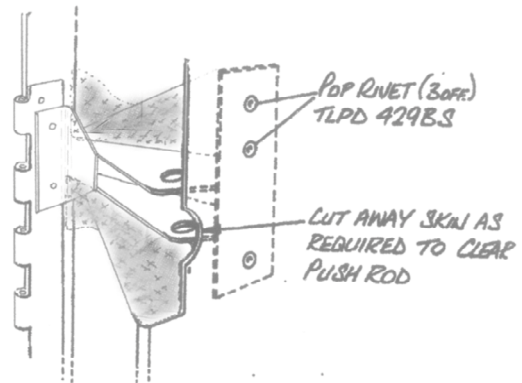


Fig 7

3.6 Rudder pushrod:

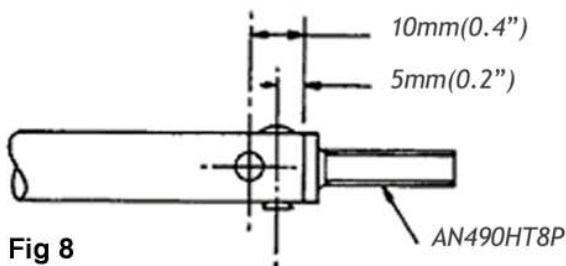


Fig 8

The push rod is assembled from a 15" length of 0.5" by .050" 4130 steel tubing with two AN490HT8P push rod end fittings. The bore of the tube is reamed out to 0.375" to fit the end fittings. Protect the inside of push rods with ACF50 corrosion inhibitor. Install two VSUÖI H ÖÜÄivets as shown in Fig 8. (Duralac or similar jointing compound should be used). At this stage only install one end fitting. The other end is left loose until the exact length is established. Install the MW4 rod end ball joints, each with an AN316-4R check nut.

3.7 Pushrod installation:

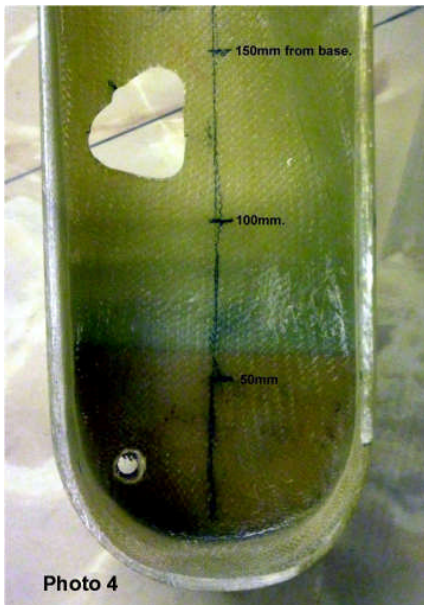


Photo 4

To fit the pushrod a hole will need to be cut in the stern post. This hole needs to be kept to a minimum. Estimate the position by drawing a line on the outside of the fuselage from a level opposite the bell crank to the centre of the CS29M77. Initially a 1" hole should be cut to the left of the vertical centre line of the fin closeout (see photo 4). Hang the rudder from its uppermost hinge screw and one screw in the bottom hinge. Install the pushrod and the un-riveted end in the CS29M77 and establish the pushrod length. Enlarge the hole as required to allow full rudder movement. The final shape of the hole will be a fat "C" shape, roughly 2 inches square. The push rod can be removed for trimming by releasing the bottom hinge and swinging the rudder to one side. Check for $\pm 30^\circ$ of rudder range. This can be quite a tricky operation. If needed, rudder travel can be increased by filing the CS33 to allow more travel before contacting the two stop bolt sleeves (CS37A). Check that the push rod end fittings do not exceed their angular limits and cause bending of the push rod. With everything adjusted correctly remove the pushrod and rivet the AN490HT8P in place.

4 Monowheel Aircraft Only:

4.1 Overview: The geometry is designed so that the tailwheel turns through 60° when full rudder deflection of 30° is applied. The limit stop is necessary to prevent the tail wheel turning more than 90° . Remove the cable and spring assembly between the rudder and tail wheel. Separate the EUR034 spring assemblies and the steel wire cable rings for reuse. The XTW11 spacers are not required.



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4.2 Tailwheel Arm and stop:

Remove the tail wheel fork and cut off the steering arms as shown in the figure 9. Drill two holes to mount the replacement horn (CS34) and the limit stop (CS35) to the fork with the AN4-11A bolts, MS21042-4 nuts and AN960-416 washers. Reassemble the fork onto the tail wheel spring.

Make up the forward end of the cables with AN100-C4 cable thimbles and 28-2-G Nicopress sleeves

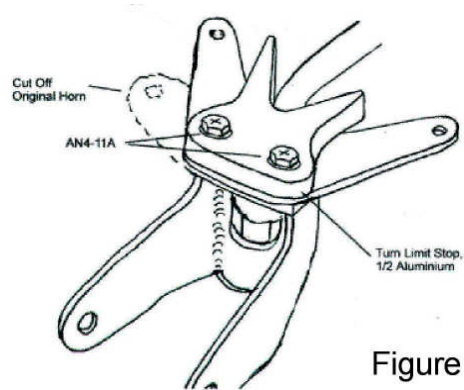
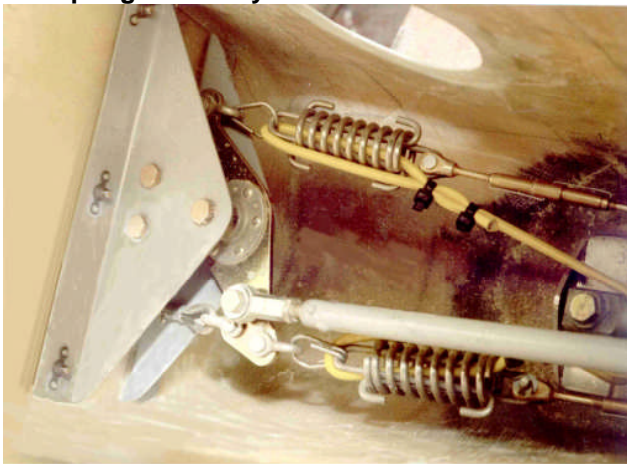


Figure 9

4.3 Spring Assembly:



Connect an AN115-21 shackle, SP4Y-B3 clevis pin to the outer holes on steering arm (The shackles help to provide adequate clearance between the springs and the brackets). These are then connected to the spring assembly with the steel wire cable rings (removed from the old installation). See photo 5. The tail wheel cables can now be attached directly to the spring assemblies.

Photo 5

4.4 Cable Fairleads:

Two 3" lengths of 3/16" OD nylon tube (TU50RM) are installed as fairleads for the steering cables through the base of the sternpost and aircraft skin. Align the holes as accurately as possible with the "run" of the cable. See figure 10. Thread the cables through the nylon tubes and pull tight against the tailwheel arm (CS34) to check the alignment. Leave 0.5" of nylon tube protruding from the aircraft skin. With the cable still tensioned, flox the tubes in place and cover with one ply of BID inside the aircraft (peel ply for neatness).

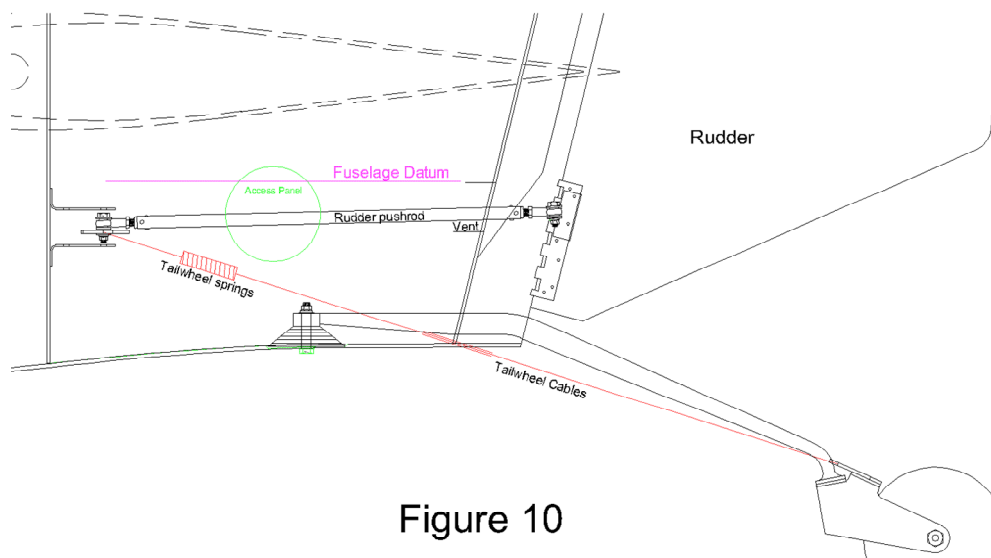


Figure 10



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4.5 Attachment to Tailwheel:

Attach the tail wheel cables to the tail wheel horn with the AN115-21 shackles, SP4Y-B3 clevis pins, AN100-C4 cable thimbles and 28-2-G Nicopress sleeves but don't squeeze the sleeves. The spring assemblies need to be compressed about 0.2" to 0.4" (5 to 10mm). Pull the cable tight through the ferrule then use a small vice grip to clamp on the free end to prevent the cable slipping back. You can then assess the tension and tighten if necessary. When satisfied swage the ferrule and cut off the surplus cable. Use a cut off wheel in a Dremel but be very careful not to cut into the cable.

4.6 Turnbuckles:

Spring tension can be made adjustable by the use of turnbuckles or more simply a pair of drilled strips with clevis pins. If turnbuckles are used they should be installed inside the fuselage just behind the springs. See Photo 5.

The parts needed for this are

2x MS21251-B3S Turnbuckle body, 2x MS21255-3RS Cable eye end
2x MS21252-3LS Fork end, 2x MS21256-1 Locking Clips
2x MS20392-2C-11, (AN393-11) 3/16" Clevis pins, 2x MS24665-153 Split pins

4.7 Safety strap:

Should a tail wheel cable break or become detached a spring assembly could jam the steering arm. To prevent this, a loop of light shock cord MUST be run through the coils of each spring and tethered at its mid point to the front end of the tailwheel leg. Adjust the length such that it begins to tighten as the rudder reaches full deflection. See Photo 4. A placard is required to be fixed inside the inspection panel: "Inspect security of shock cord safety line regularly"

5. Weight and Balance Effects:

- 5.1 If installed during the construction of the aircraft the weight will be recorded during the weight and balance calculations prior to granting of a permit to test.
- 5.2 If fitted to an existing aircraft, the aircraft should be weighed and a new weight and balance calculation prepared. The likely change is:-

Weight Change	Moment arm	Moment Change
+ 0.5 lb	170.0 in	85.0 lb in

6. Flight Test and Special Inspections:

- 6.1 Checking that the rudder turns through 30° +2°, -0° and the tail wheel about 60° each side when the bell crank is moved to its limits. There should be very little friction in the system.
- 6.2 The warning placard must be fitted inside the inspection hatch

6.3 For UK registered aircraft, LAA inspector to check the completed work, raise a log-book entry including reference to Europa Mod 77, update weight schedule and issue PMR (Permit Maintenance Release).