MAMBA
STEERING SYSTEMS

LEWMAR®

LEWMAR PLC Southmoor Lane, Havant
Hampshire PO9 1JJ, UK
Tel +44 (0)23 9247 1741 Fax +44 (0)23 9248 5761
e-mail info@lewmar.com website www.lewmar.com

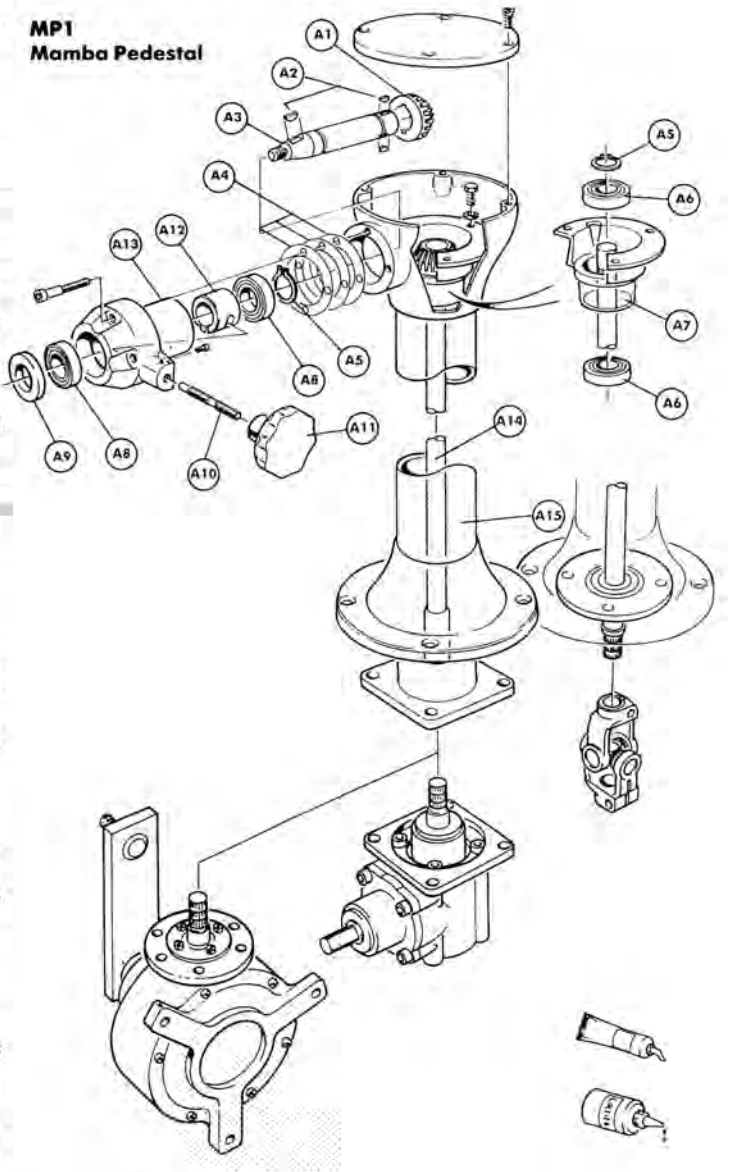
MAMBA STEERING SYSTEMS INSTALLATION & MAINTENANCE INSTRUCTIONS

Congratulations! Your craft is fitted with a Whitlock Mamba system — widely recognised as the world's best marine steering system. Providing it is properly serviced and maintained, it should last the lifetime of the boat to which it is fitted.

This guide is intended to enable the owner of the boat to check through the system and carry out routine maintenance. For major services — which we recommend once every 5-7 years, depending on usage — we have a world wide network of distributors who will be pleased to assist you.

Please note that due to the wide range of types and sizes of Mamba steering components available, this guide can only be representative of a typical system. If you have any queries, please contact your nearest Whitlock dealer with details of your boat for additional guidance.

MP1
Mamba Pedestal



Pedestals Mamba 3R-DL/ Mamba 12R-DL

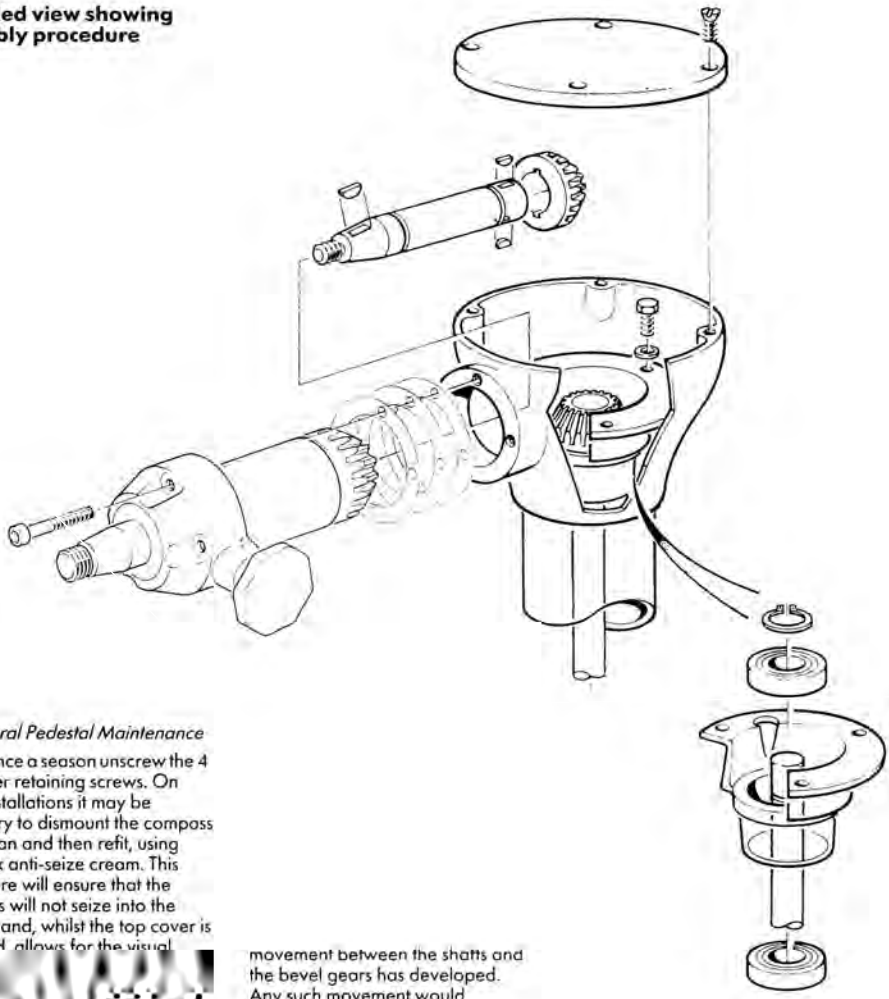
1. Pedestal Finish

1.1 The pedestal is coated with a stove enamelled polyester coating which is extremely hardwearing and weather resistant. To maintain the finish, regularly wash down the pedestal with fresh water and apply a coat of good quality car wax polish.

1.2 If any paint has been accidentally chipped, immediately rub down the area locally using a fine grade of wet and dry abrasive and touch in with yacht enamel designed for aluminium surfaces. International Yacht Paints have suitable products.

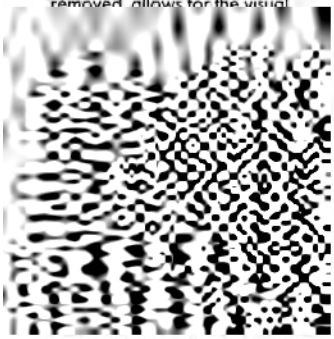
1.3 We recommend the use of socket countersunk screws for fixing the pedestal to the deck. This type of deck bolt has a perfectly smooth seat into the countersink in the deck flange and unlike conventional cross headed screws will not damage the paint finish. If the boatbuilder has not installed this type of deck bolt, we suggest that you slacken all four deck bolts and reseat them using a non-setting mastic. When re-tightening, hold the screw stationary and turn the nut! Internal socket type pedestal bolt sets are available from all Whitlock agents in the size M12 x 90, are manufactured from stainless steel and come with heavy duty washer and nut.

Exploded view showing assembly procedure



2. General Pedestal Maintenance

2.1 Once a season unscrew the 4 top cover retaining screws. On some installations it may be necessary to dismount the compass first. Clean and then refit, using Whitlock anti-seize cream. This procedure will ensure that the fasteners will not seize into the housing and, whilst the top cover is removed, allows for the visual



2.3 Check for play between the gears and shafts as follows: Rotate the steering wheel until the rudder stop is reached at the end of each lock. As load is applied against each stop, check that no relative movement between the shafts and the bevel gears has developed. Any such movement would indicate wear in the keys which secure the bevels to the shafts — this would necessitate replacing the keys and refitting of the gears, a task which we recommend is carried out by a recognised Whitlock service agent.

2.4 After inspection, re-grease gears if necessary and refit the top plate. Particular care should be taken to ensure that no water can gain access to the pedestal head, either through the compass cable grommet, or the neoprene gasket sealing the top plate to the head casting. (Salt water is the greatest enemy of any engineering part and the steering mechanism is no exception.)

2.5 Once a season you should also remove the 4 stainless steel socket screws which retain the input assembly. Clean and refit using anti-seize cream. This procedure is to ensure that these fasteners do not seize into the housing, making it impossible to remove the socket which would be necessary for re-shimming or major overhaul. To access these screws, it is necessary to remove the wheel from the tapered wheel shaft — take care not to lose the steering wheel key!

3.0 Pedestals — Mamba 3R Premiere and Mamba 12R Premiere

3.1 Pedestal Finish

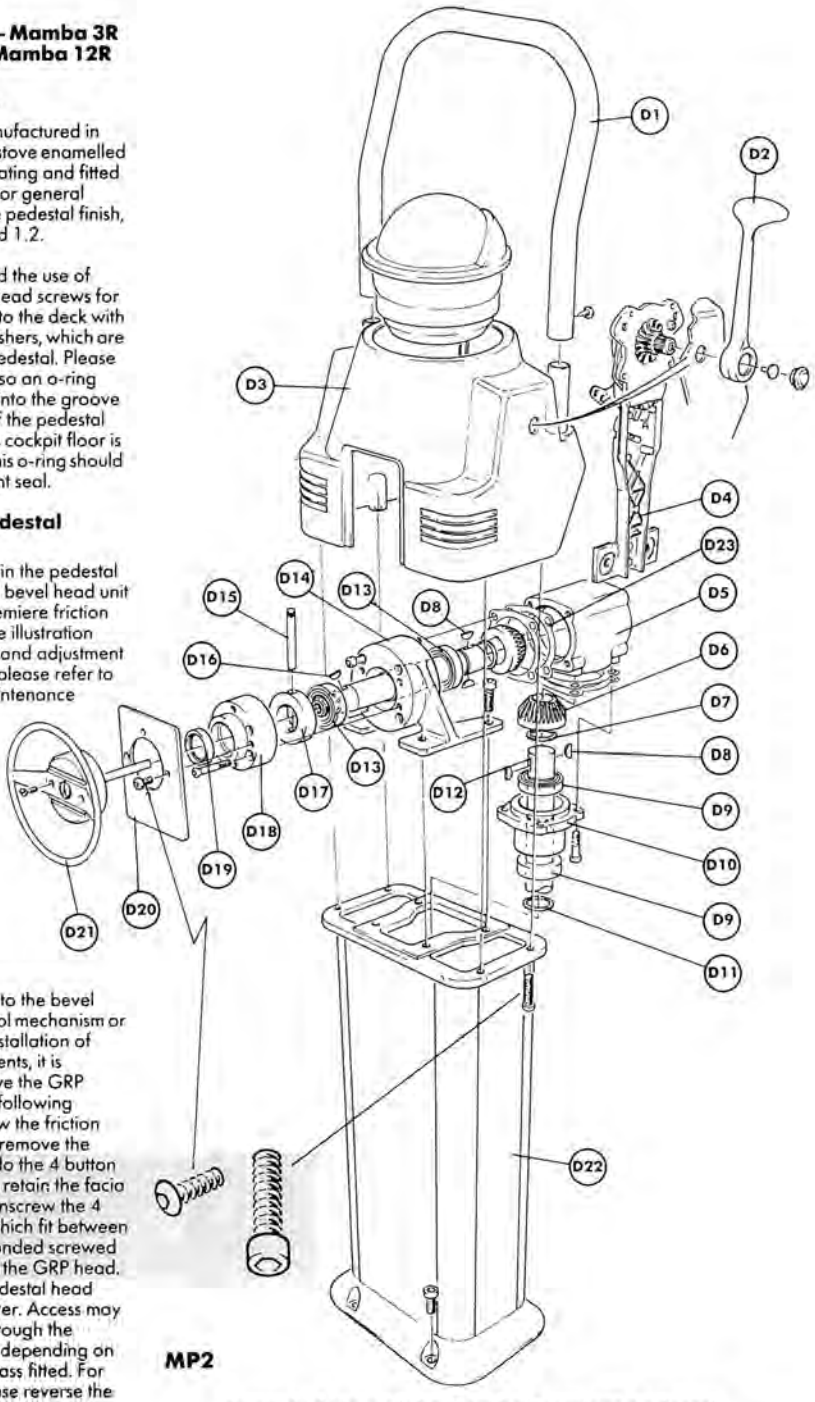
The pedestal is manufactured in aluminium which is stove enamelled with a polyester coating and fitted with a GRP head. For general maintenance of the pedestal finish, see sections 1.1 and 1.2.

3.2 We recommend the use of stainless steel cap head screws for fixing the pedestal to the deck with nylon insulating washers, which are supplied with the pedestal. Please note that there is also an o-ring supplied which fits into the groove on the underside of the pedestal base. Providing the cockpit floor is smooth and level, this o-ring should provide a watertight seal.

4.0 General Pedestal Maintenance

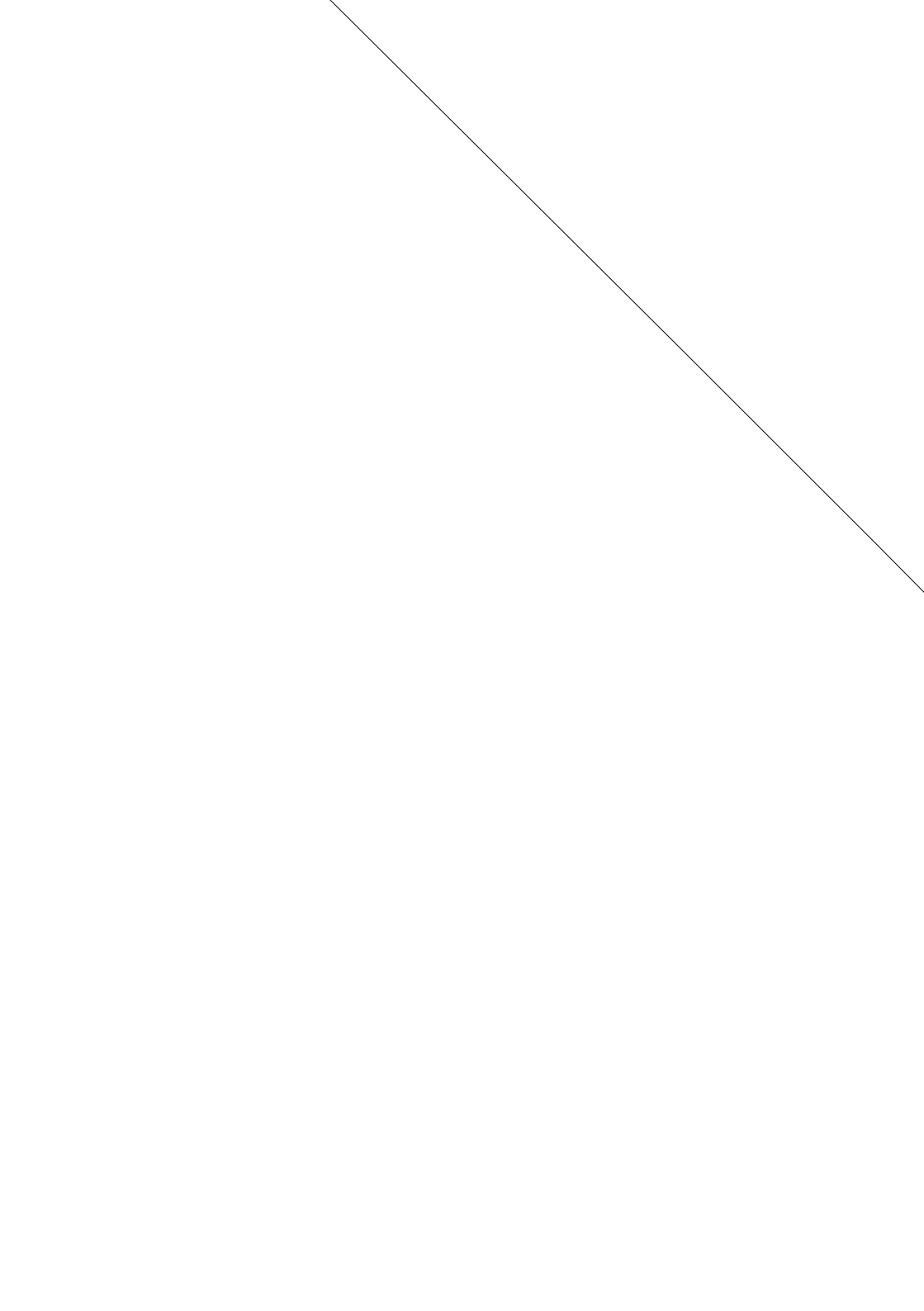
4.1 Contained within the pedestal head moulding is a bevel head unit with an integral Premiere friction brake — please see illustration MP2. For servicing and adjustment of the bevel head, please refer to the bevel head maintenance section.

4.2 To gain access to the bevel head, engine control mechanism or guardrail for the installation of cabling for instruments, it is necessary to remove the GRP binnacle using the following procedure. Unscrew the friction brake spinner and remove the steering wheel, undo the 4 button head screws which retain the facia plate and gasket, unscrew the 4 cap head screws which fit between the tulip and the bonded screwed pillars integral with the GRP head. Gently ease the pedestal head from the tulip register. Access may also be possible through the compass aperture, depending on the model of compass fitted. For re-installation, please reverse the above procedure.

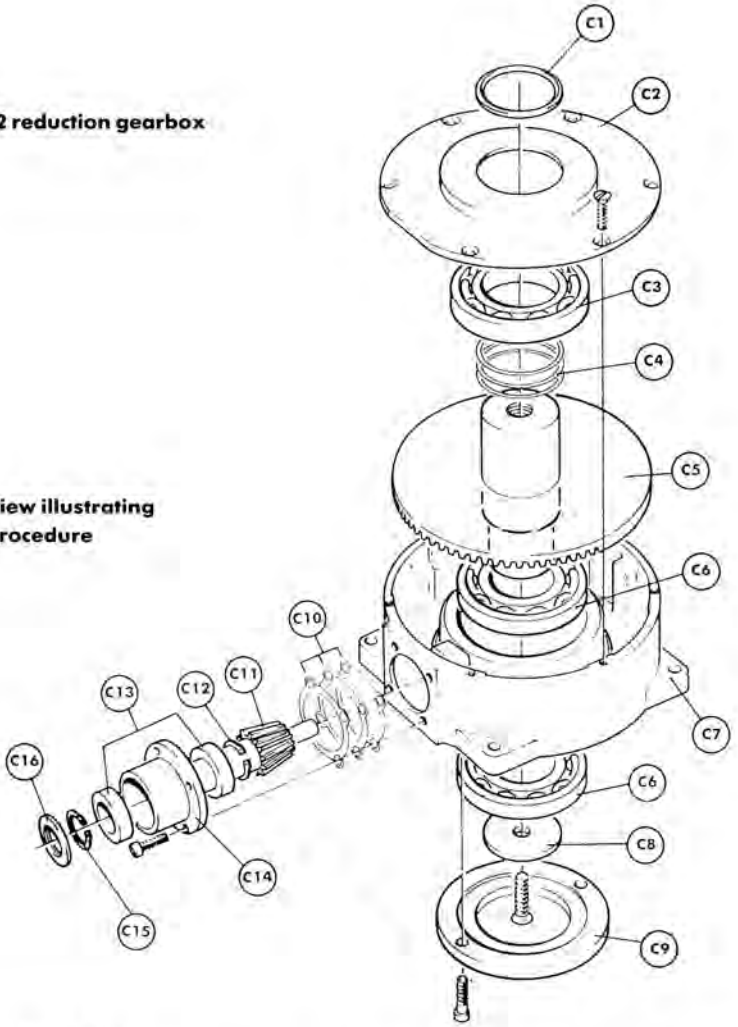


MP2

Exploded view of the Mamba Premiere pedestal



MP4
BG 30/MK 2 reduction gearbox



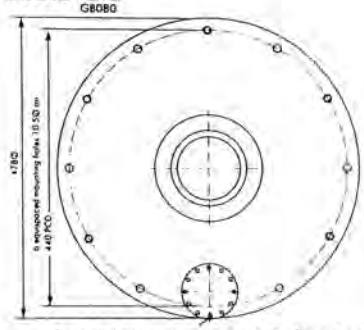
Exploded view illustrating assembly procedure

3.4 *Gearbox Mesh (BG10, BG12, BG30)*

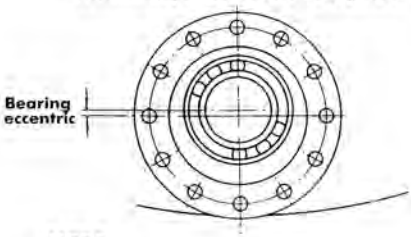
Bevel reduction gearboxes can be re-meshed in a manner somewhat similar to the bevelheads previously described. Damage to the bearings can be easily seen by asking a colleague to turn the steering wheel until the system reaches the rudder stops. Further slight pressure will cause the output shaft/output lever of the gearbox to move visibly sideways relative to the gearbox casing if the bearings are damaged. Due to shock loadings there is sometimes damage to the key securing the output shaft to its gear. Again this can be detected usually by running the system lightly on to one stop and then applying extra pressure. Repeat procedure on the opposite lock. If movement occurs between the input and output shafts when the pressure is applied when the rudder stop has been reached, it indicates key damage. The gearbox should be returned at a convenient time to a Whitlock service agent or an engineer called out to attend at the boat. Whilst key wear in the gearbox will cause unwanted backlash, it will not result in steering breakdown unless ignored for a considerable period!

If backlash is present in the gearbox, remove the universal joint from the input socket and undo the retaining screws securing same, (see illustration Fig. MP4). Remove a shim, re-assemble, and check the gear mesh again. Should it be necessary, remove further shims until correct mesh is achieved. Whilst the gearbox is dismantled it is worth regreasing it and checking the condition of the oilseals. Please remember to use thread locking compound when finally re-assembling the input socket assembly if it is retained via socket caps.

WRG18 Part No. GB080

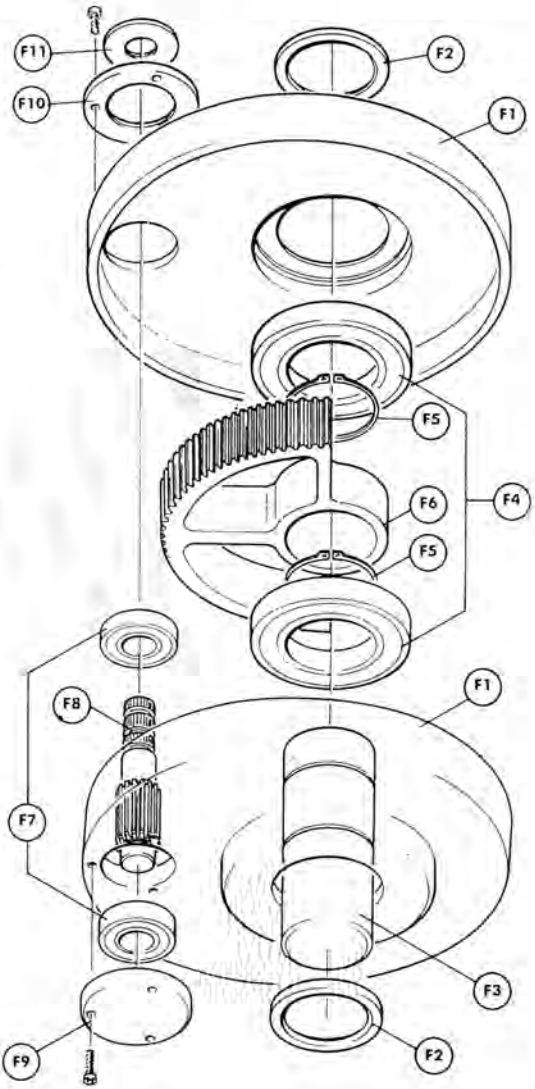


Eccentric caps must be rotated in phase



MP5A

MP5
WRG12 reduction gearbox.
Exploded view
illustration assembly procedure



3.5 *Gearbox Mesh (WRG18, WRG20, WRG45)*
On the larger spur reduction gearboxes the mesh is adjusted during manufacture by rotating the two input sockets which are machined with an eccentric, (please see Fig. MP5A).

Due to the massive strength of the components it is unlikely that sufficient wear will ever take place to require them to be re-adjusted. It is worth checking however for any bearing damage (normally only caused by ingress of water), and for the condition of the oil seals. Should any gear wear become apparent we strongly recommend that the unit be adjusted by a Whitlock service engineer, as it is essential that the eccentric caps are kept correctly aligned with each other to prevent "skewing" of the gear which would result in rapid wear and potential failure.

3.6 *WRG10,11,12, WG08,16*
These particular gearboxes have no method of gear mesh adjustment, but due to their strength of construction it is unlikely that any significant wear would occur. Please check for bearing damage and condition of oil seals as for the previous gearboxes.

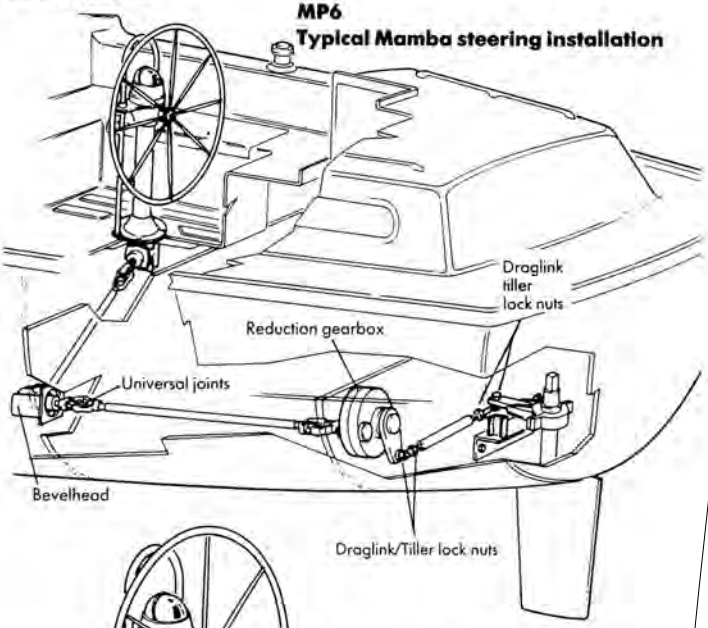
INSTALLATION INSTRUCTIONS

1. *Torque Tubes*
These are generally supplied with one end unwelded and the tube over length. It is the boat builder's responsibility to cut the tube to the correct length and weld the fitting to the tube. The shaft and the tube are manufactured in stainless steel, except in the case of the 08 series, where the shaft work is carbon steel. In both cases, we recommend that dissimilar welding rods be used. Typical examples of this are Sudachrom D or Tec-Arc 312.

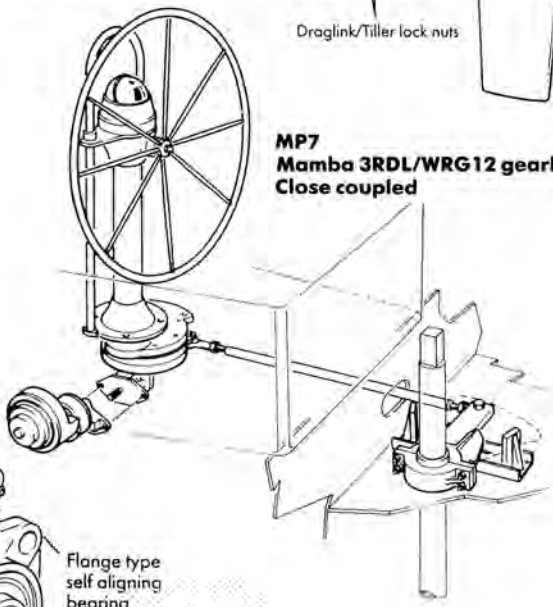
The end fittings are adjustable for length in the case of the 08/10 Series, by ¾Ø and ⅞Ø, 48 serration splines respectively. On the 125 and 150 series, the adjustment is achieved via a flatted shaft and in all instances, it is essential that after their final adjustment that the shaft fully engages with the full length of the universal joint boss and that the clamping bolts are torqued up to a setting of 30Nm in the case of the 8mm fasteners and 40Nm in the case of the 10mm fasteners.

2. *Universal Joints*
Universal joints are necessary on the end of each torque tube, and enable the torque tubes to work at a maximum angle of 25° to each other — please see illustration MP8. For maximum smoothness of rotation, it is important that the universal joints are mounted 90° rotated to each other on each torque tube. It is also recommended, where possible, that the working angle of each pair of universal joints be equalised.

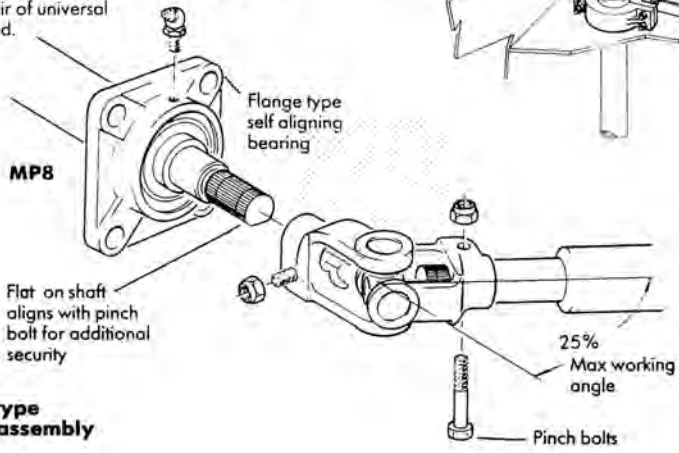
MP6
Typical Mamba steering installation



MP7
Mamba 3RDL/WRG12 gearbox Close coupled



MP8



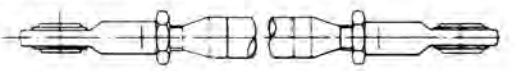
AMK8/AMK10 type universal joint assembly

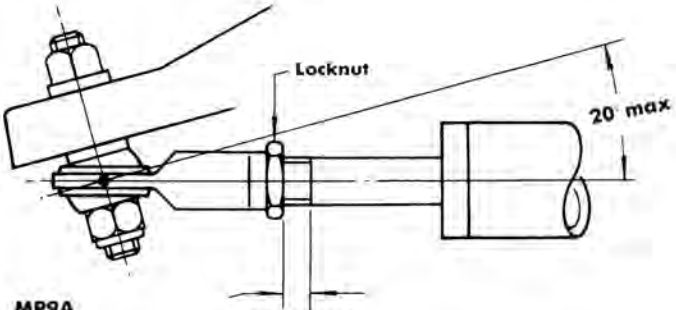
3. *Draglink Assembly*
The draglink assembly (MP9) is normally finished to the correct length before supply. Where it is not possible to specify the length, the tube may be left with one end loose, to be cut and welded by the boat builder. The tube and fittings are both manufactured from stainless steel and we recommend that TEC Weld 312 welding rods or similar, are used.

The draglink is provided with threaded ends to enable adjustments to be carried out to the final centres. It is essential that after adjustment a length of at least 1½ times the diameter of the thread is still engaged within the rose joint body. Nyloc nuts are provided to prevent the draglink from coming loose. These locking nuts should be tightened to 40Nm torque.

The rose joints on the draglinks incorporate a spherical setting to allow for misalignment. They will generally work up to a maximum deflection of 20° — please see illustration MP9A.

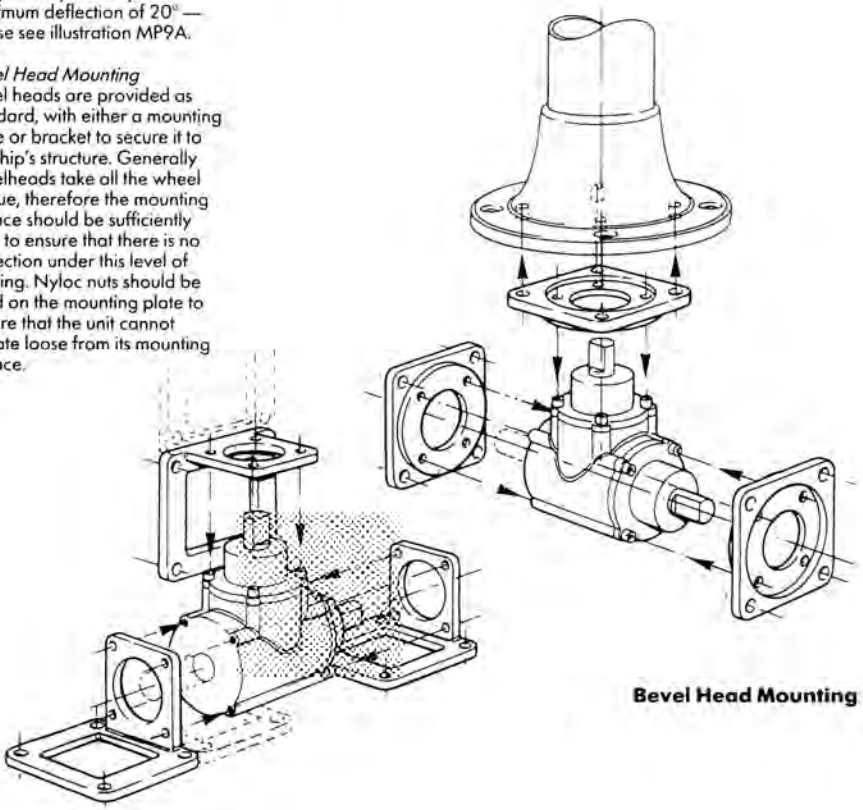
MP9
Draglink assembly
AHFT 10/AHFT 12/RFQ 16



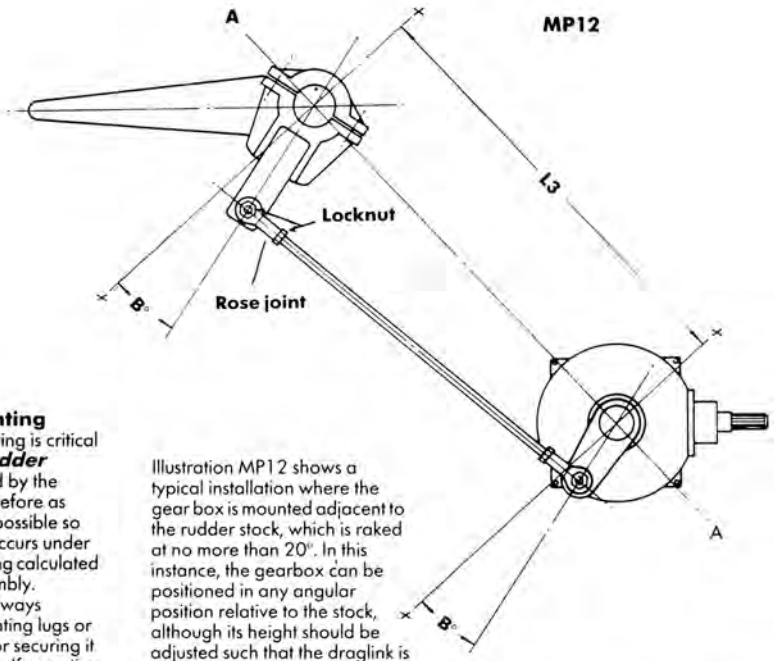


MP9A

4. *Bevel Head Mounting*
Bevel heads are provided as standard, with either a mounting plate or bracket to secure it to the ship's structure. Generally bevelheads take all the wheel torque, therefore the mounting surface should be sufficiently rigid to ensure that there is no deflection under this level of loading. Nyloc nuts should be fitted on the mounting plate to ensure that the unit cannot vibrate loose from its mounting surface.



Bevel Head Mounting



Gear Box Mounting

The gearbox mounting is critical as it sees the full ***rudder torque*** developed by the boat. It must be therefore as rigid as practically possible so that no deflection occurs under the maximum loading calculated for the rudder assembly.

The gearbox is always provided with mounting lugs or pre-tapped holes for securing it to the ship's structure. If mounting bolts are used, we recommend the use of high strength Loctite, in addition to load spreading washers and spring washers. In the case of a pre-studded assembly, it is essential to use Nyloc nuts or equivalent.

The positioning of the gearbox and its lever is critical for the correct operation of the steering. As a guide, we illustrate 3 alternative arrangements.

Illustration MP12 shows a typical installation where the gear box is mounted adjacent to the rudder stock, which is raked at no more than 20°. In this instance, the gearbox can be positioned in any angular position relative to the stock, although its height should be adjusted such that the draglink is as close to as possible to the horizontal. Having determined the most appropriate position for mounting the gearbox, it is necessary to calculate the correct orientation of the gearbox and tiller levers. To achieve this you need to measure the distance L3, between the centre of the gearbox and the centre of the rudder stock. If you refer to table Fig. 3 a, b and c, you will find the corresponding offset angle B°, which needs to be incorporated when the rudder is at midships.

Where the rudder stock is raked at greater than 20° it is necessary to mount the gearbox generally athwartships to the rudder stock at the point at which the tiller arm is fitted. See illustration MP13. The gearbox centre then needs to be displaced according to Fig. 4, to achieve the correct lever geometry. It is permissible to rotate the gearbox around its output shaft to allow for the input shaft to offset from the fore and aft line of the ship. It is also permissible for the gearbox to be mounted at an angle from the horizontal.

Fig. 3(a) Ref. MP12
For output lever 5¼"/133mm
Tiller Lever 8"/253mm

Draglink centres L3	B°
200-225	25°
226-250	23°
251-300	20°
301-350	17°
351-400	14°
401-500	12°
501-750	10°
751-1000	8°
1000+	5°

Fig. 3(b)
For output lever 7⅜"/187mm
Tiller Lever 11¼/286mm

L3	$B°_2$
251-300	25°
301-350	23°
351-400	20°
401-500	15°
501-750	10°
751-1000	8°
1000+	5°

Fig. 3(c)
For output lever 13"/332mm
Tiller Lever 20"/508mm

L3	$B°_3$
350-400	28°
401-500	25°
501-750	20°
751-1000	15°
1000-1500	10°
1501+	8°

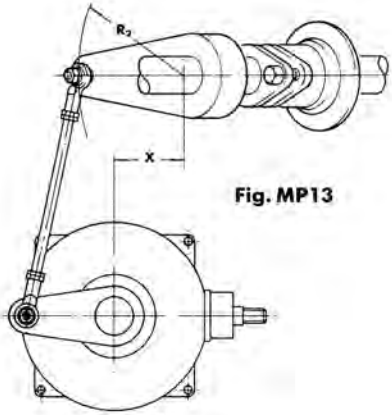


Fig. MP13

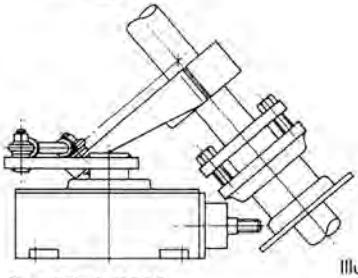


Fig. 4 Ref. MP13

X	R_1 Output Lever Centres	R_2 Tiller Lever Centres
104 ± 5	133	203
146 ± 5	187	286
260 ± 5	332	508

Special Gearbox Installations
Where the WRG11,12,18,20 or 45/WRG18/WRG20/WRG45 gearbox is mounted directly under the pedestal there will be fitted an adapter torque plate which transmits the torque loads directly back on to the cockpit floor rather than via the pedestal tube, (please see illustrations MP15/15A). The integrity of the mounting plate attachment to the cockpit floor is **CRITICAL** and should be checked visually at least once a season. Ask a colleague to turn the steering wheel until it reaches the rudder stops and then apply further load. Look for any signs of movement between the adapter plate and the cockpit floor. Check that the fixing bolts are tight. Under no circumstances should it be possible to get relative movement between the torque plate and the cockpit floor.

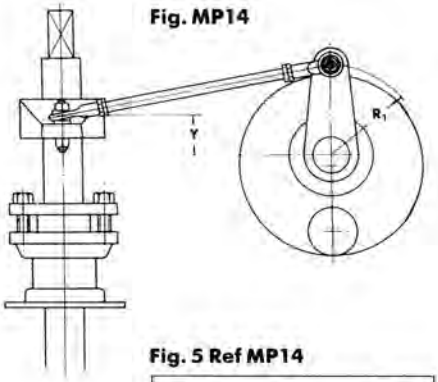


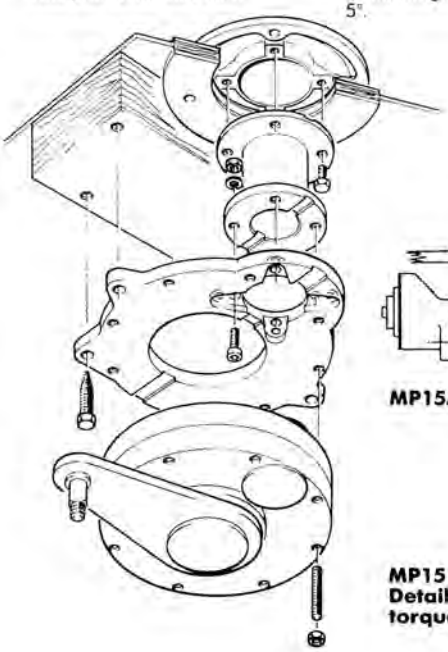
Fig. MP14

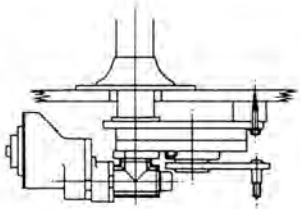
Fig. 5 Ref MP14

Y	R_1 Output Lever Centres	R_2 Tiller Lever Centres
60	133	203
84	187	286
150	332	508

Illustration MP14 shows a vertically mounted gearbox. In this instance, the height of the output lever shaft and hence the position of the rose joint on the gearbox lever is critical with reference to the height of the rose joint on the tiller arm.

Please refer to Fig. 5 for the correct offset distance required.
This arrangement can be used with raked rudder stocks. The fore and aft position of the gearbox should be arranged such that at midships the angle on the draglink does not exceed 5°.





MP15A

MP15
Details of an adapter torque plate illustration

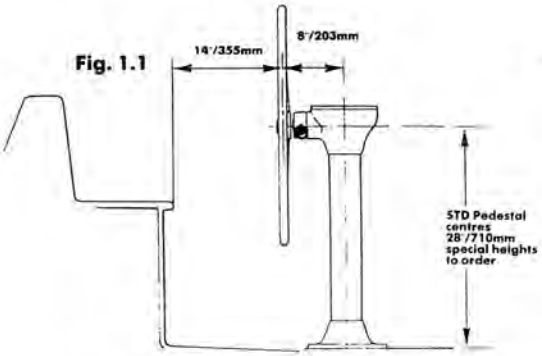


Fig. 1.1

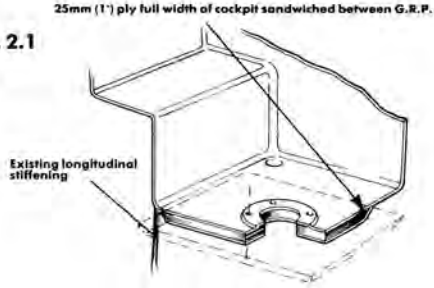


Fig. 2.1

Typical application for G.R.P. cockpits

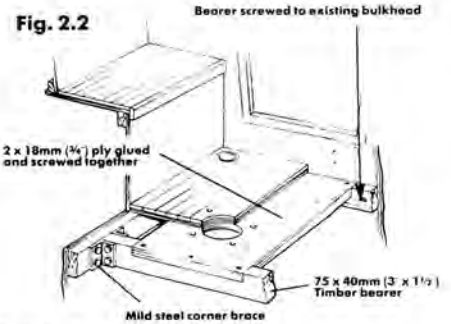


Fig. 2.2

Typical application for Plywood cockpits

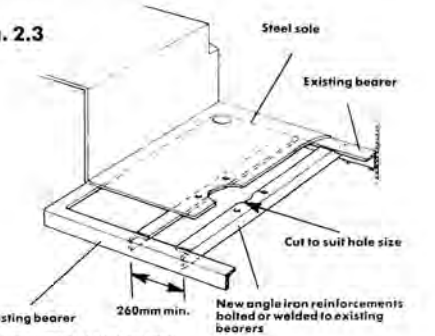


Fig. 2.3

Typical application for Steel cockpits

Pedestal Mounting

The pedestal should be installed in a position where there is adequate space to fully control the craft at all times whilst providing sufficient shelter for the helmsman to brace himself in severe sea conditions. Care should be taken to ensure that it will not obstruct members of the crew from operating bilge pumps, sheet winches and cockpit locker lids etc. Alternatively these items may require resighting. Where the pedestal is situated near the mainsheet a guard should always be fitted to help prevent the sheet snagging the pedestal in an inadvertent gybe.

The optimum position for mounting the pedestal relative to a helmsman's seat is shown in Figure 1.1.

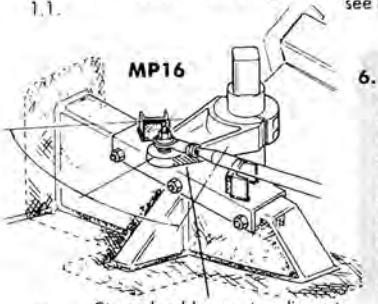
The cockpit sole must be sufficiently rigid to withstand the steering loads or the force of the helmsman thrown onto the wheel in severe sea conditions without deflecting significantly. As a guideline — for g.r.p. boats the cockpit floor should have a total thickness of at least 40mm. There are many ways of providing additional reinforcement for fibreglass construction and an example is shown in the following illustration. Figure 2.1.

Where a plywood sole is used, local reinforcing by the way of ply doublers, e.g. 2 x 18mm ply glued and screwed together between fore, aft and transverse bearers should be used. The minimum thickness for solid hardwood should be no less than 50mm (2"), see Figure 2.2.

Where a steel sole is used local stiffening with 75 x 60 x 6mm angle iron bolted directly to the pedestal mounting bolts and either athwartships or fore and aft existing bearers may be used, see Figure 2.3.

When finally bolting the pedestal to its reinforcement use either Whitlock pedestal bolt sets incorporating heavy stainless steel washers or supply 4 off 75 x 40 x 6 plates to spread the load.

We strongly recommend the use of Whitlock pedestal bolt sets which incorporate internal socket countersunk screws. This type of deck bolt has a perfectly smooth seat into the countersink of the deck flange and unlike conventional cross headed screws will not damage the paint finish when tightened.



Stops should operate adjacent to operating centres

6. *Rudder Stops*

The importance of the rudder stops cannot be over emphasised. They should be designed to operate on the side of the tiller arm, adjacent to the rose joint. They should be sufficiently rigid that at a load of 150% of the maximum rated rudder torque, no significant deflection occurs. It is recommended that a resilient facing is bonded to the rudder stop to absorb some impact loading. Typical examples of rudder stop can be seen in illustration MP16.