

# Hydraulic Steering Systems

Rev. 04



## Installation instructions and owner's manual

L'esame CE del tipo sistemi di governo Mavimare, secondo la direttiva 94/25 CE, è stato effettuato dal Registro Italiano Navale.





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## ■ ■ ■ General safety rules and warranty

Thank you for having chosen a **MAVIMARE** product.

The present installation and maintenance manual is an integral part of the product and must be easily available for use by staff assigned in use and maintenance of the same. The user is required to know the contents of the manual. **MAVIMARE** disclaims any responsibility for any inaccuracies due to printing errors contained in this manual. Without prejudice to the essential characteristics of product described, the **MAVIMARE** reserves the right to make any changes to descriptions, information, and illustrations that should be determined for the improvement of the same, or for manufacturing or commercial requirements at any time and without being required to update this publication.

Before proceeding with the installation, read this instructions thoroughly. **MAVIMARE** cannot accept responsibility for installations where instructions have not been followed, where substitute parts have been used or where have been made to our products.

The hydraulic steering system shall be installed by authorised and skilled technicians. Particularly the interventions on the hydraulic piping system shall be carried out of expert technician only.

Mavi mare declines any responsibility for losses or damages resulting from the incorrect use of the product.

For eventual anomalies or problems in the system operation, please call the authorised technicians immediately.

**MAVIMARE** guarantees its products have been precisely built and have no manufacturing and material defects.

The warranty period is of two years, starting from the date of production to exception of the cases in which these are installed and used on working or commercial boats where the warranty is limited to a year from the date of manufacture and limited to substitution or free repair of the part which, within said period of time, will be mailed us back and which we will ascertain is really defective in materials and/or manufacturing.

This warranty does not cover the products installed on race boats or boats used in competition.

## ■ ■ ■ Safety warnings

YOU MUST STRICTLY RESPECT the precautions and the advisable criterions of safety here below. **MAVIMARE** declines every responsibility in the case you do not observe it and also for any case of negligence that might be committed during the utilization of the system.

- Do not enter hands between the moving parts.
- Do not deactivate or do not operative in any way the safety devices.
- Do not change or add devices to the system, without written authorization or previous technical intervention of **MAVIMARE** which confirm it.
- Do not use the system for an other purpose than for which it was specified in the installation and maintenance manual.
- Do not perform the installation to personal no specialized.
- Do not disassemble the hydraulic connections without before to have the entire discharging of the oil in the system. The tube can contain high pressure oil.

### ATTENTION

- do not climb with your feet on the cylinder
- after installation and bleeding the system, check before you start the navigation Turn the steering wheel until the cylinder or cylinders installed at the stroke end to repeat the maneuver rotating the steering wheel in the opposite direction.
- Make special caution in the material liquid capacity of application (type Loctite). In case of introduction in the hydraulic system, this would cause damages and disruptions.
- to seal the fittings, do not use for any circumstances Teflon tape or any type of tape that could be extracted from the system and cause irreparable damage to the same.
- During installation of the system take special care to maintain maximum cleaning, to avoid foreign matter can enter a system. Even the smallest object could result in permanent damage not immediately detectable.
- Avoid bending the tubes too tight.
- Avoid contact with piping edges or sharp corners.
- avoid contact of pipe with heat.

### Very important points to note

- DO NOT USE BRAKE FLUID – IT WILL DAMAGE SEALS AND OTHER COMPONENTS. USE ONLY **MAVIMARE** SHEEL TELLUS T15 HYDRAULIC OIL.

#### WARNING:

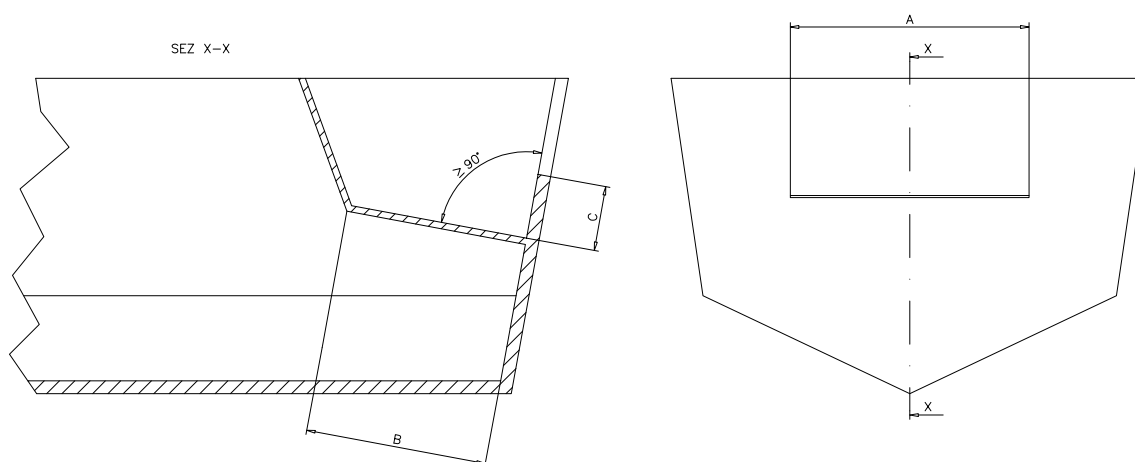
Use of alternative hydraulic fluids may result in premature seal wear and possibly cause damage to your system.

**DO NOT USE Automatic Transmission Fluid.**

- DO NOT RE-USE OIL FROM BLEEDING THE SYSTEM** without first filtering it to remove foreign material ( which will come out of the lines), and ALWAYS allow the air to settle out of it first. YOU WILL REQUIRE FAR MORE OIL TO BLEED THE SYSTEM THAN YOU NEED TO FILL THE SYSTEM. Allow about 2 litres, for small single station unit and about 5 litres for a small dual station unit.
- WHEN INSTALLING **MAVIMARE** STEERING SYSTEMS YOU MUST USE ONLY **MAVIMARE** HOSES.  
The performance of the steering can be seriously affected by the wrong tubing being installed. Before making any change to the tubing specs, contact your authorised **MAVIMARE** dealer or the factory direct.
- IMPORTANT NOTES RE OUTBOARD MOTORS:** All outboard motors are equipped with small “TRIM” tabs immediately behind the propeller. In some motors, these also act as Anodes. **DO NOT UNDERESTIMATE THE IMPORTANCE OF THESE SMALL ITEMS.** These must be adjusted once the motors are installed on the boat, and should be done for the normal cruising speed of the vessel. For high horsepower/performance motors, these are of critical importance as incorrect position can **INCREASE** steering torques as much as 500%. They are **NOT** factory set and **MUST** be done after proper installation. Experimentation is the only means of arriving at the best results.
- BE CLEAN** when installing the unit. Strain all oil - even if is new (unless out of new PLASTIC containers). It only takes a few moments to be particular.  
Keep the filler cap and the plugs in the pump at all times until the tubing is ready for attachment. Never leave the pump with the filler cap open or fittings un-covered to avoid dirt, sawdust etc from entering the pump unit.  
Ensure that pipe joints and fittings are tight and carefully sealed using **LOC-TITE THREAD SEALANT** or similar products. **Avoid the use of Teflon Tape as it can be introduced into the system by inexperienced installers. THIS MAY CAUSE VALVE FAILURE.**
- After installation, check the security of all bolts, nuts, and split pins on the steering mechanism. Vibration can often result in nuts becoming loose. This should be carried out every 6 months.
- Use compressed air and blow out all tubing to remove dust and debris from storage. DO NOT CUT WITH A HACHSAW – USE ONLY PIPE CUTTER.
- Where the tubing is to be bent, you should use a proper tube – bender to avoid kinking the tubing, which could result in firm steering.

### Minimum Splashwell Dimensions

Before attempting installation, ensure that the splashwell of your boat has the following minimum dimensions.



MINIMUM SPLASHWELL DIMENSIONS			
Number of engines	A	B	C
1	560mm–21.25"	152mm–5.98"	152mm–5.98"
2	1110mm–21.25"	152mm–5.98"	152mm–5.98"

## ■■■ Installation of the steering pump GM2-MRA01 / GM2-MRA03 / GM2-MRA04

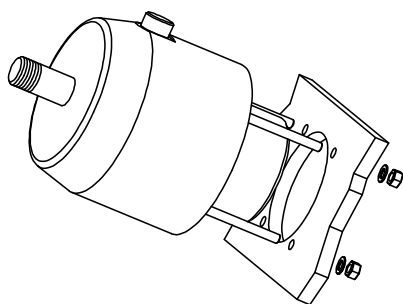
Select a suitable place for the steering pump and steering wheel.

Make sure that there is enough manoeuvring space for the steering wheel and for the steering pump and its connections and pipes. You must mount the helm unit in horizontal axis, 20° inclination maximum is authorised. The filler plug must always be in the uppermost position. Cut a hole for the steering pump housing of diam.78 mm for standard helm mounting or 123 mm with back mount kit and four holes diam. 6,5 mm for the fixing bolts. Use the template. Use only self-locking fasteners.

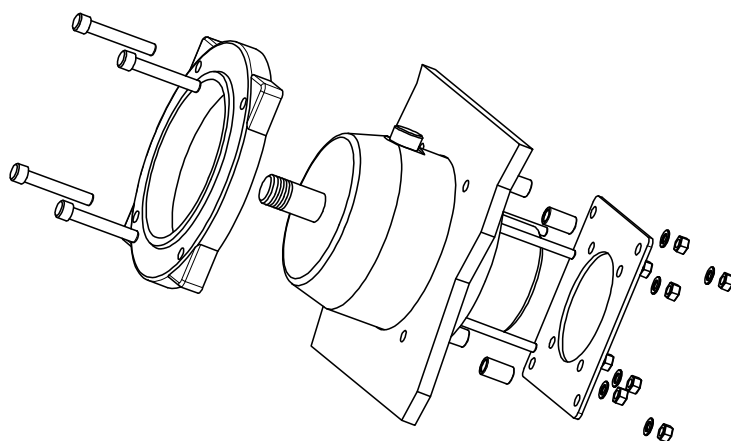
The pump is supplied with two straight fittings and two 90 ° fittings with a ¼ NPT thread. Do not overtighten the fitting plug.

**Keep the filler cap and the plugs in the pump at all times until the tubing is ready for attachment. Never leave the pump with the filler cap open or fittings uncovered to avoid dirt, sawdust etc. from entering the pump unit.**

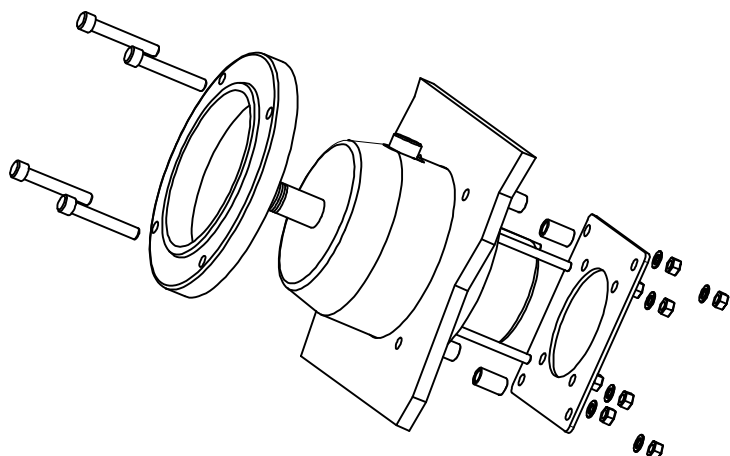
GM2 - MRA01/03/04 standard helm mounting configuration



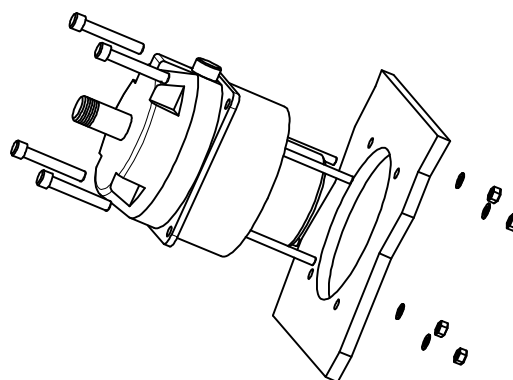
Back mounting configuration for GM2 - MRA01/03/04



GM0 - MRA installation



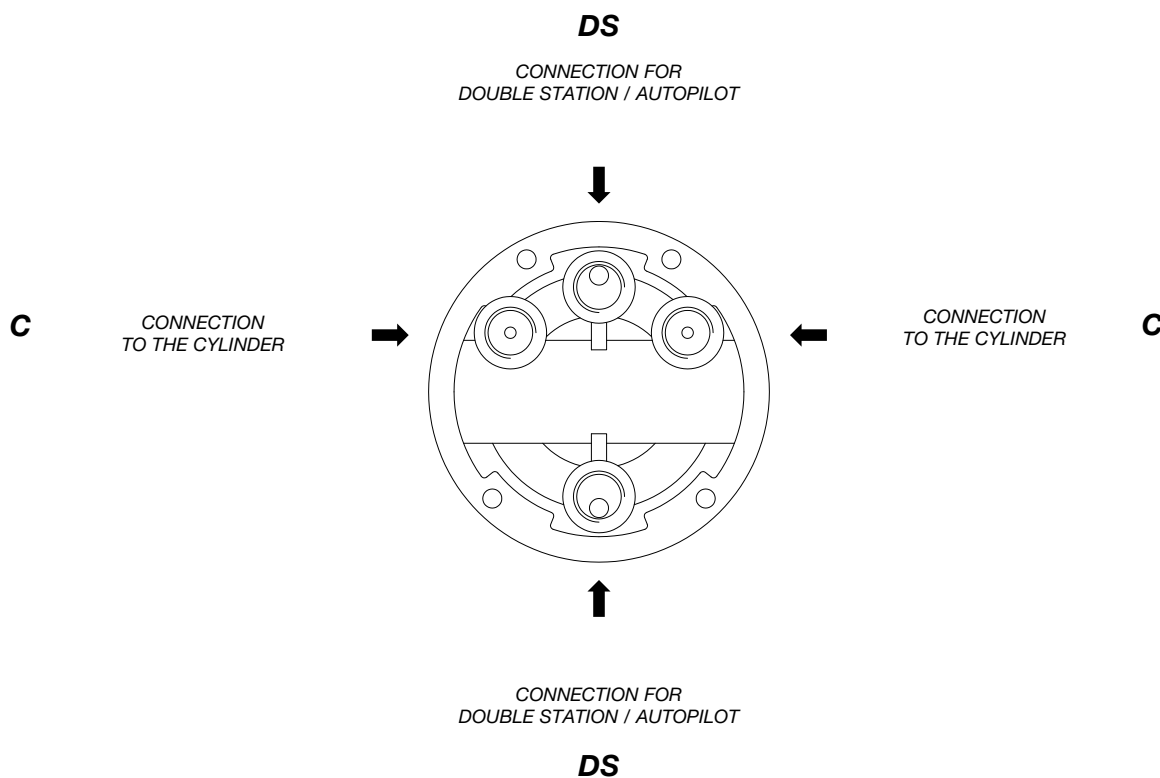
GM3 - MRA installation

**VALVE PORTS CONNECTION:**

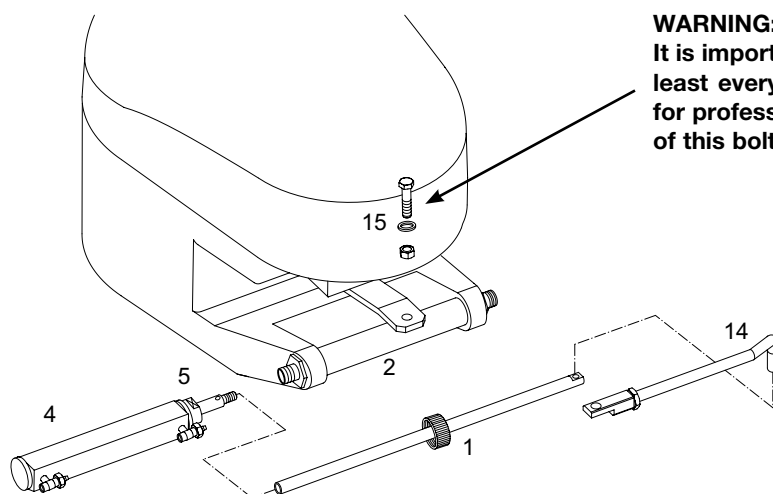
Port marked "C": connections to the cylinder/s

Port marked "DS": connections to the additional stations or autopilot

Always use Loctite 577 on 1/4npt thread fittings



## ■■■ Installation instructions of the cylinder type MC 150 - MC 150E



RIF.	QUANTITY	DESCRIPTION
1	1	Extension rod
2	-	Motor tilt tube
4	1	Cylinder
5	-	Adjusting nut
14*	1	Tiller arm*
15	1	Screw, washer, self-locking nut

**\*Attention:**

The tiller arm is not supplied

Proper cylinder installation is the key to the successful operation of the hydraulic steering system. An incorrectly installed cylinder is subject to rapid seal and bearing wear and non-repairable damage. Protect cylinder rods from nicks and scratches, which can cause cylinder to leak, and result in loss of steering.

**Installation:**

- Ensure that the motor tilt tube is perfectly dry and clean.
- Screw the extension rod (1) on the cylinder's shaft. Grease the extension rod (1) with grease of good quality. Insert the extension rod on left side of motor tilt tube. Screw the cylinder by the adjusting nut (5) to the left threaded side of motor tilt tube, keeping the bleeders on the upper side of the cylinder.
- Connect the tiller arm (14) to the extension rod as show in the drawing.
- Put the cylinder and the motor in middle of it's stroke, and adjust the tiller arm distance. Connect the tiller arm at the motor with screw, washer and self-locking nut (15).

**IMPORTANT**

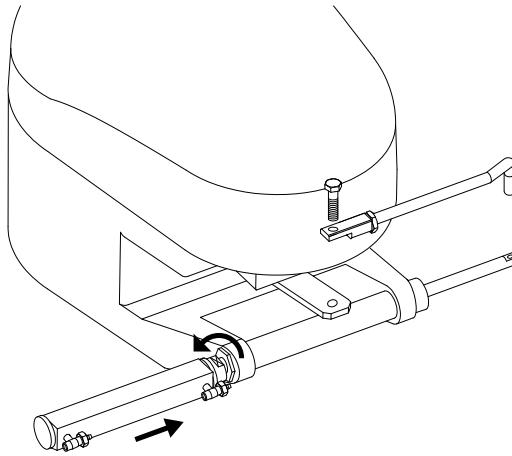
Notice regarding adjustment of T fitting on steering cylinder. If interference occurs between the splashwell and hydraulic hose or hose fitting, the fitting can be adjusted but must be removed completely prior to establishing desired orientation.

We recommend: once a fitting has been backed off, is important to remove the fitting completely to avoid leakage. Remove the fitting, clean the threads and re-apply Loctite (use Loctite 577). This will ensure that the fitting does not leak once re-oriented to desired angle.

**All the systems are not intended for racing boat application.**



### ■■■ Removal instructions MC 150 - MC 150E cylinder



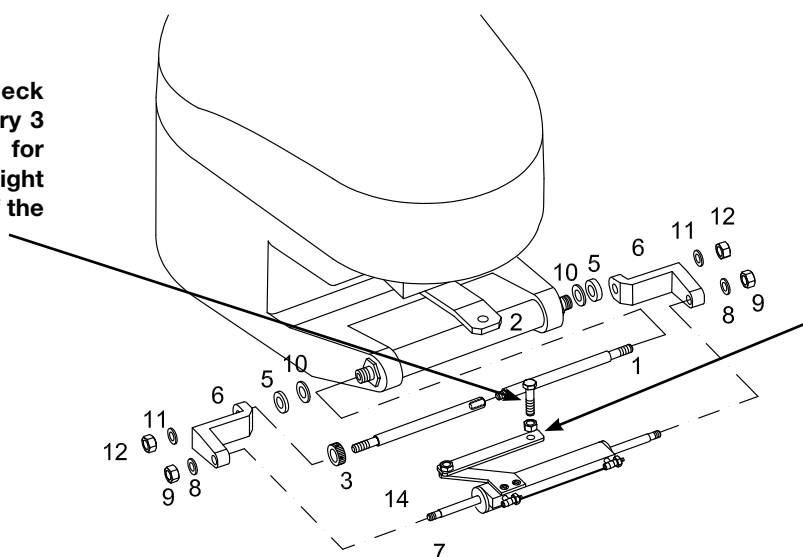
#### REMOVAL CYLINDER

Caution: In case you want to remove the cylinder, rotate the nut (5) counterclockwise holding the cylinder pressed against the nut itself. Failure to observe this warning may result in the breaking of the nut itself.

## ■■■ Installation instructions of the cylinder type MC 90B

### WARNING:

It is important to check periodically, at least every 3 months (or every month for professional uses), the right torque of this bolt and of the locknut.



The cylinder arm ( 14 ) should be attached on the top of the engine tiller arm on most brands of outboards. In the event that the tiller interferes with other parts of the outboard, then it can be mounted under the tiller instead.

RIF.	QUANTITY	DESCRIPTION
1	1	Support rod
2	-	Motor tilt tube
3	1	Adjusting nut
5	6	Plastic spacer
6	2	Support brackets

RIF.	QUANTITY	DESCRIPTION
7	1	Cylinder
8-11	2+2	Washer
9-12	2+2	Self-locking nut
10	2	Stainless steel washer

Proper cylinder installation is the key to the successful operation of the hydraulic steering system. An incorrectly installed cylinder is subject to rapid seal and bearing wear and non-repairable damage. Protect cylinder rods from nicks and scratches, which can cause cylinder to leak, and result in loss of steering.

### Installation:

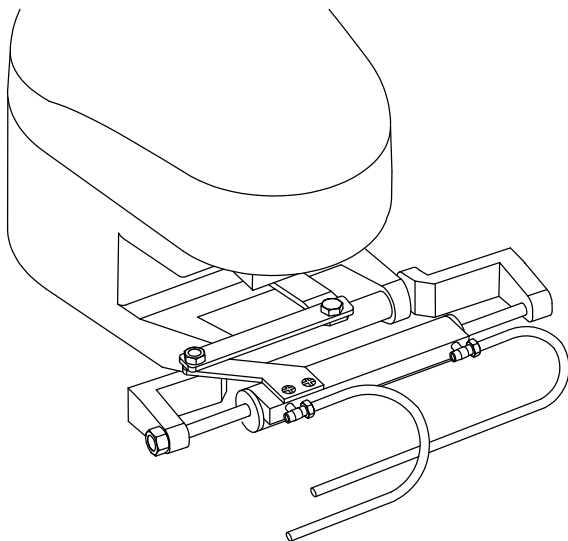
- Ensure that the motor tilt tube is perfectly dry and clean, grease the tilt tube rod (1) and slide into the tilt tube. Use grease of good quality. Completely screw the brass nut (3) to the left threaded side of the tilt tube.
- Grease the end holes of the support brackets (6) and connect them to the tilt tube rod with the cylinder in the middle of it's stroke (7). Use washers (11) and nuts (12) to fix the assembly.
- Ensure that the cylinder body is centered on the rod and that the engine is perpendicular to the transom. Adjust the link arm length to meet the connection to the motor. Connect the link arm to the motor.
- Control the space between motor tilt tube (2) and support brackets (6) whether left and right of the motor tilt tube, and to compensate it adding a combination of plastic spacers (5). Warning: Always leave a minimum clearance between spacers and brackets in order to allow the rod tilting in the tilt tube. Between motor tilt tube (on the right side) and first spacer put stainless steel washer (10).
- Make sure that the brackets completely enter in their housing on the tilt tube rod (1) without being obstructed by the spacers.
- Use washers (11) and self-locking nut (12) to fix all (before that fix the selflocking nuts 9 of the shaft).
- Do not over tighten the self-locking nuts (12). Infact, this may imply the fixing of the support brackets (6) against the motor tilt tube (2), whereas they should be free to turn when you are going to tilt the engine. Failing to observe this warning may cause problems when you are going to tilt the engine.
- Unscrew the brass nut (3) in order to balance the remaining clearance and tighten the brass nut (3). Do not use any tool for this operation.
- Check once again the fastening of all the self-locking nuts which however must not obstruct the turnover of the motor and its oscillation.
- Make sure that the motor can turn side to side without any interference.
- Check that all mechanical parts of the cylinder are not in contact with the motor of force in their movements.

**IMPORTANT**

Notice regarding adjustment of T fitting on steering cylinder. If interference occurs between the splashwell and hydraulic hose or hose fitting, the fitting can be adjusted but must be removed completely prior to establishing desired orientation.

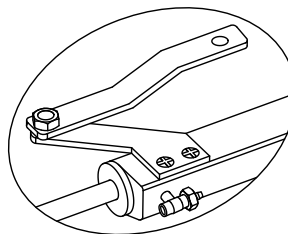
We recommend: once a fitting has been backed off, is important to remove the fitting completely to avoid leakage. Remove the fitting, clean the threads and re-apply Loctite. This will ensure that the fitting does not leak once re-oriented to desired angle.

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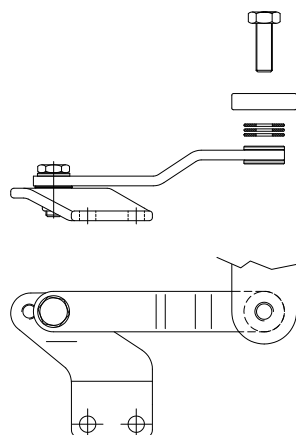
**Warning: Hoses must not go directly to the cylinder from the bulkhead rubber, but must be left loose so as to make them a smooth curve before reaching the cylinder.**

**Attention:** use Kit X.342 for Yamaha 40/50/60/70 engine.



X342

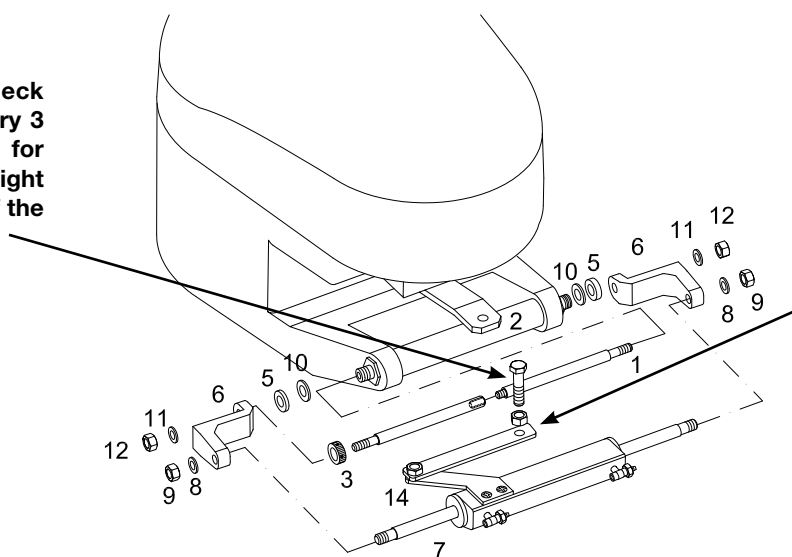
**Attention:** with some motor, the s.s. lever of the cylinder must be installed under the engine tiller plate with the addition of some washers.



## ■■■ Installation instructions of the cylinder type MC 150BR

### WARNING:

It is important to check periodically, at least every 3 months (or every month for professional uses), the right torque of this bolt and of the locknut.



The cylinder arm ( 14 ) should be attached on the top of the engine tiller arm on most brands of outboards. In the event that the tiller interferes with other parts of the outboard, then it can be mounted under the tiller instead.

RIF.	QUANTITY	DESCRIPTION
1	1	Support rod
2	-	Motor tilt tube
3	1	Adjusting nut
5	6	Plastic spacer
6	2	Support brackets

RIF.	QUANTITY	DESCRIPTION
7	1	Cylinder
8-11	2+2	Washer
9-12	2+2	Self-locking nut
10	2	Stainless steel washer

Proper cylinder installation is the key to the successful operation of the hydraulic steering system. An incorrectly installed cylinder is subject to rapid seal and bearing wear and non-repairable damage. Protect cylinder rods from nicks and scratches, which can cause cylinder to leak, and result in loss of steering.

### Installation:

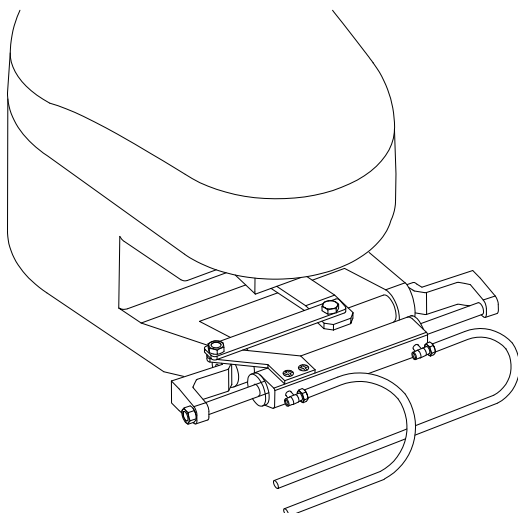
- Ensure that the motor tilt tube is perfectly dry and clean, grease the tilt tube rod (1) and slide into the tilt tube. Use grease of good quality. Completely screw the brass nut (3) to the left threaded side of the tilt tube.
- Grease the end holes of the support brackets (6) and connect them to the tilt tube rod with the cylinder in the middle of it's stroke (7). Use washers (11) and nuts (12) to fix the assembly.
- Ensure that the cylinder body is centered on the rod and that the engine is perpendicular to the transom. Adjust the link arm length to meet the connection to the motor. Connect the link arm to the motor.
- Control the space between motor tilt tube (2) and support brackets (6) whether left and right of the motor tilt tube, and to compensate it adding a combination of plastic spacers (5). Warning: Always leave a minimum clearance between spacers and brackets in order to allow the rod tilting in the tilt tube. Between motor tilt tube (on the right side) and first spacer put stainless steel washer (10).
- Make sure that the brackets completely enter in their housing on the tilt tube rod (1) without being obstructed by the spacers.
- Use washers (11) and self-locking nut (12) to fix all (before that fix the selflocking nuts 9 of the shaft).
- Do not over tighten the self-locking nuts (12). Infact, this may imply the fixing of the support brackets (6) against the motor tilt tube (2), whereas they should be free to turn when you are going to tilt the engine. Failing to observe this warning may cause problems when you are going to tilt the engine.
- Unscrew the brass nut (3) in order to balance the remaining clearance and tighten the brass nut (3). Do not use any tool for this operation.
- Check once again the fastening of all the self-locking nuts which however must not obstruct the turnover of the motor and its oscillation.
- Make sure that the motor can turn side to side without any interference.
- Check that all mechanical parts of the cylinder are not in contact with the motor of force in their movements.

**IMPORTANT**

Notice regarding adjustment of T fitting on steering cylinder. If interference occurs between the splashwell and hydraulic hose or hose fitting, the fitting can be adjusted but must be removed completely prior to establishing desired orientation.

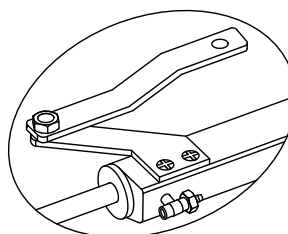
We recommend: once a fitting has been backed off, is important to remove the fitting completely to avoid leakage. Remove the fitting, clean the threads and re-apply Loctite. This will ensure that the fitting does not leak once re-oriented to desired angle.

**All the systems are not intended for racing boat application.**



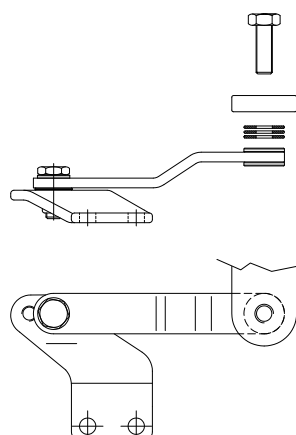
**Warning:** Hoses must not go directly to the cylinder from the bulkhead rubber, but must be left loose so as to make them a smooth curve before reaching the cylinder.

**Attention:** use Kit X.342 for Yamaha 40/50/60/70 engine.



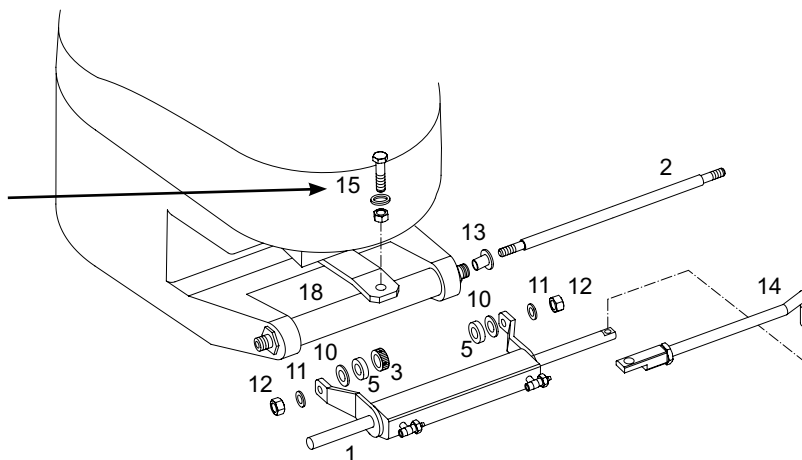
X342

**Attention:** with some motor, the s.s. lever of the cylinder must be installed under the engine tiller plate with the addition of some washers.



**■■■ Installation instructions of the cylinder type MC 150R - MC300R****WARNING:**

It is important to check periodically, at least every 3 months (or every month for professional uses), the right torque of this bolt and of the locknut.



RIF.	QUANTITY	DESCRIPTION
2	1	Support rod
18	-	Motor tilt tube
3	1	Adjusting nut
5	6	Plastic spacer
13	1	Plastic bushing
1	1	Cylinder

RIF.	QUANTITY	DESCRIPTION
11	2	Washer
12	2	Self-locking nut
10	2	Stainless steel washer
14	1	Tiller arm
15	1	Screw, washer, self-locking nut

Proper cylinder installation is the key to the successful operation of the hydraulic steering system.

An incorrectly installed cylinder is subject to rapid seal and bearing wear and non-repairable damage.

Protect cylinder rods from nicks and scratches, which can cause cylinder to leak, and result in loss of steering.

**Installation:**

- Ensure that the motor tilt tube (18) is perfectly dry and clean. Completely screw the brass nut (3) to left threaded side of the tilt tube and put the plastic bushing (13) into the right threaded part of the tilt tube.
- Grease the tilt tube rod (2) with grease of good quality. Put the cylinder (1) frontally respect the motor tilt tube (18) and insert the tilt tube rod (2) starting from the right side. Control the space between motor tilt tube (18) and support brackets of the cylinder whether left and right of the motor tilt tube, and to compensate it adding a combination of plastic spacers (5). Between motor tilt tube (on the right side) and first spacer put stainless steel whaser (10). Complete the insertion of the tilt tube rod (2).
- Use whaser (11) and self-locking nut (12) to fix all. Do not over tighten the self-locking nuts (12). Infact, this may imply the fixing of the support brackets against the motor tilt tube (18), whereas they should be free to turn when you are going to tilt the engine. Failing to observe this warning may cause problems when you are going to tilt the engine. Now unscrew the brass nut (3) in order to balance the remaining clearance and tighten the brass nut (3). Check once again the fastening of all the self-locking nuts which however must not obstruct the turnover of the motor and its oscillation.
- Place the shaft of the cylinder in the middle of its travel.
- Connect the tiller arm (14) to the shaft of the cylinder and to the motor, as shown in the drawing.
- Connect with nut and washer the tiller arm (14) to the shaft of the cylinder.
- Make sure that the motor can turn side to side without any interference. Check that all the mechanical parts of the cylinder are not in contact with the motor or force in their movements.

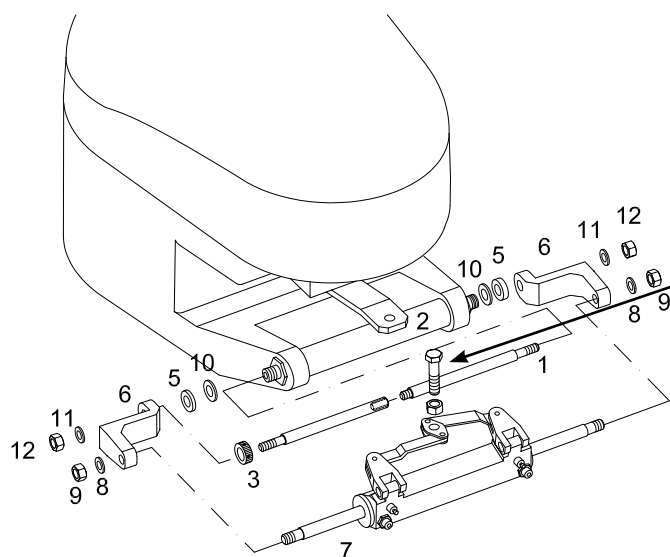
**IMPORTANT**

Notice regarding adjustment of T fitting on steering cylinder. If interference occurs between the splashwell and hydraulic hose or hose fitting, the fitting can be adjusted but must be removed completely prior to establishing desired orientation.

We recommend: once a fitting has been backed off, is important to remove the fitting completely to avoid leakage. Remove the fitting, clean the threads and re-apply Loctite. This will ensure that the fitting does not leak once re-oriented to desired angle.

**All the systems are not intended for racing boat application.**

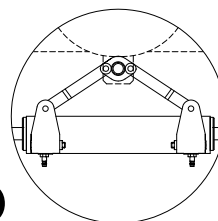
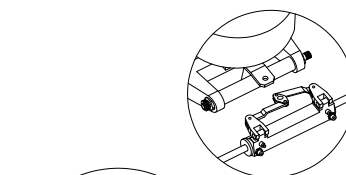
## ■■■ Installation instructions of the cylinder type MC 300A



### WARNING:

It is important to check periodically, at least every 3 months (or every month for professional uses), the right torque of this bolt and of the locknut.

**NO**



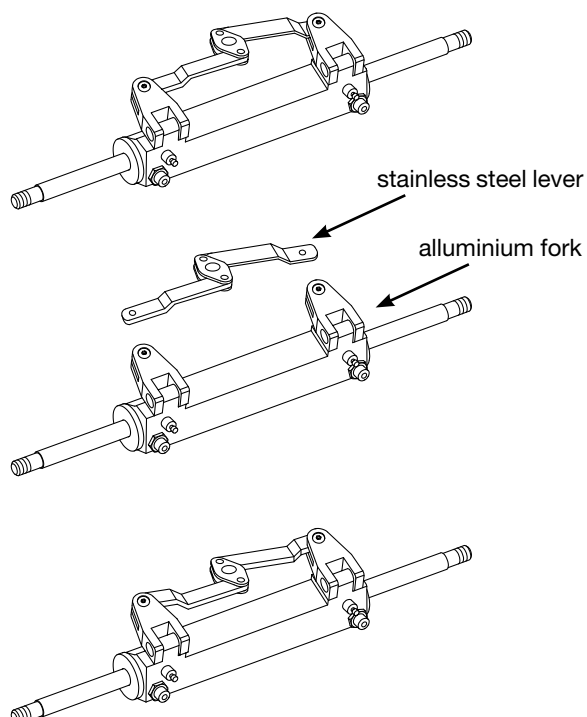
**YES**

The cylinder s.s. lever should be attached on the top of the engine tiller arm on most brands of outboards. In the event that the s.s. lever or alluminium forks interfere with other parts of the outboard, then it can be mounted under the tiller arm or the s.s. lever can be disassembled and reassembled upsidedown (see picture 2) and attached under the tiller arm of the engine.

RIF.	QUANTITY	DESCRIPTION
1	1	Support rod
2	-	Motor tilt tube
3	1	Adjusting nut
5	6	Plastic spacer
6	2	Support brackets

RIF.	QUANTITY	DESCRIPTION
7	1	Cylinder
8-11	2+2	Washer
9-12	2+2	Self-locking nut
10	2	Stainless steel washer

Picture 2



### Warning:

In the event that the stainless steel lever or the alluminium forks of the cylinder interfere with other parts of the outboard, then it must be mounted upsidedown and attached under the tiller arm of the engine.

Remove the 2 screws with self-locking nuts, overturn the lever and reassemble it to the cylinder.

This operation is useful also when with regular lever installation, the cylinder touches the transom before the engine is completely tilted.

Remove only the stainless steel lever! Do not remove the lever along with the alluminium forks!

Proper cylinder installation is the key to the successful operation of the hydraulic steering system.  
An incorrectly installed cylinder is subject to rapid seal and bearing wear and non-repairable damage.  
Protect cylinder rods from nicks and scratches, which can cause cylinder to leak, and result in loss of steering.

#### Installatio:

- Ensure that the motor tilt tube is perfectly dry and clean, grease the tilt tube rod (1) and slide into the tilt tube. Use grease of good quality.  
Completely screw the brass nut (3) to the left threaded side of the tilt tube.
- Grease the end holes of the support brackets (6) and connect them to the tilt tube rod with the cylinder in the middle (7). Use washers (11) and nuts (12) to fix the assembly.
- Ensure that the cylinder body is centered on the rod and that the engine is perpendicular to the transom. Adjust the link arm length to meet the connection to the motor. Connect the link arm to the motor plate.
- Check the space between motor tilt tube (2) and support brackets (6) whether left and right side of the motor tilt tube, and to compensate it adding a combination of plastic spacers (5). Warning: Always leave a minimum clearance between spacers and brackets in order to allow the rod tilting in the tilt tube. Between motor tilt tube (on the right side) and first spacer put stainless steel washer (10).
- Make sure that the brackets completely enter in their housing on the tilt tube rod (1) without being obstructed by the spacers.
- Use washers (11) and self-locking nut (12) to fix all (before that fix the selflocking nuts 9 of the shaft).
- Do not over tighten the self-locking nuts (12). Infact, this may imply the fixing of the support brackets (6) against the motor tilt tube (2), whereas they should be free to turn when you are going to tilt the engine. Failing to observe this warning may cause problems when you are going to tilt the engine.
- Unscrew the brass nut (3) in order to balance the remaining clearance and tighten the brass nut (3). Don ot use any tool for this operation.
- Check once again the fastening of all the self-locking nuts which however must not obstruct the turnover of the motor and its oscillation.
- Make sure that the motor can turn side to side without any interference.
- Check that all mechanical parts of the cylinder are not in contact with the motor of force in their movements.

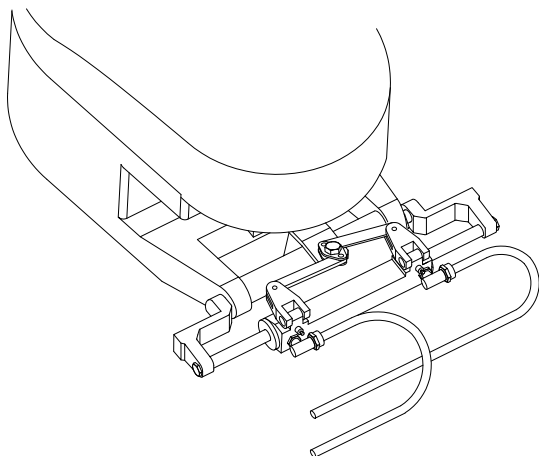
#### IMPORTANT

Notice regarding adjustment of 90° fitting on steering cylinder. If interference occurs between the splashwell and hydraulic hose or hose fitting, the fitting can be adjusted but must be removed completely prior to establishing desired orientation.

We recommend: once a fitting has been backed off, is important to remove the fitting completely to avoid leakage. Remove the fitting, clean the threads and re-apply Loctite. This will ensure that the fitting does not leak once re-oriented to desired angle.

**All the systems are not intended for racing boat application.**

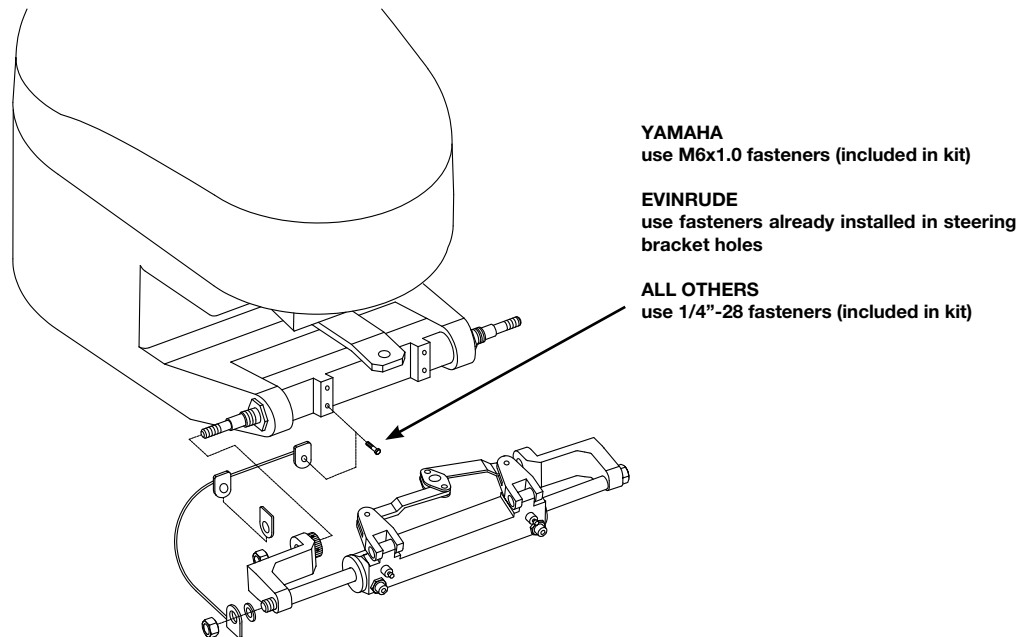
**Warning: Hoses must not go directly to the cylinder from the bulkhead rubber, but must be left loose so as to make them a smooth curve before reaching the cylinder.**





## ■■■ Ground strap installation instructions for MC300A cylinder

Picture 4



### Notice for salt water applications

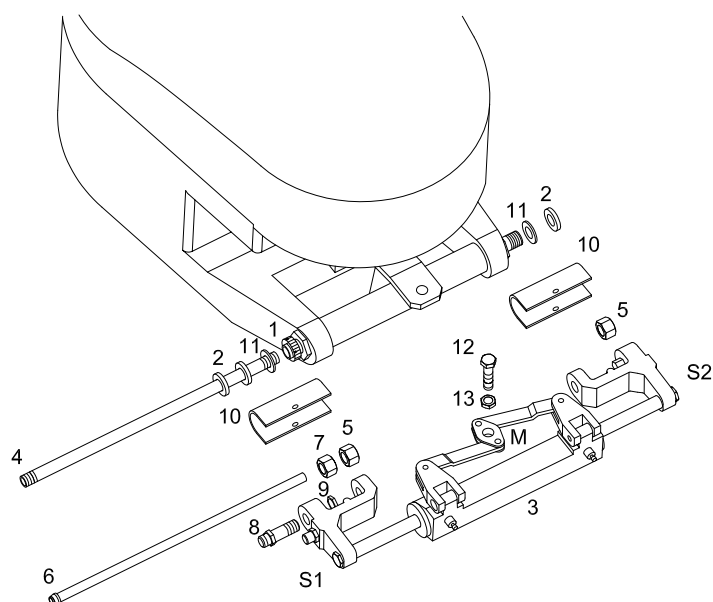
**MAVIMARE** strongly recommends use of a ground strap on any outboard hydraulic steering cylinder with an exposed shaft where the vessel will be used in salt water. This ground strap will provide added protection against corrosion caused by stray current.

- Attach end terminal to the starboard side lower midsection steering bracket hole (wire facing downwards) using correct fasteners.
- Route ground strap UNDER the tilt tube. Install ground strap large and terminal to cylinder as per Picture 4.
- Install cylinder shaft nut.
- Attach small middle terminal to unused hole in rear of cylinder support bracket. Orient terminal as shown in Picture 4.
- Ensure there is enough slack in the strap to allow the engine to pivot freely in ALL trim/tilt positions and throughout the entire steering range of the engine.

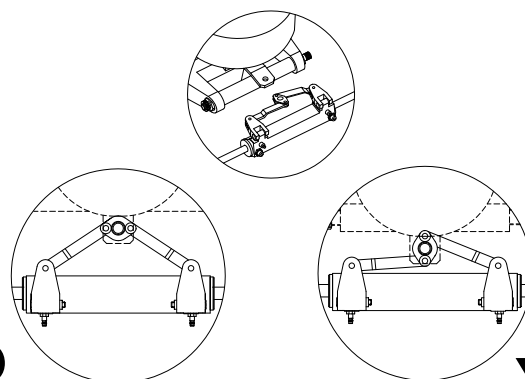
### Caution:

Ensure ground strap is routed 'under' the tilt tube. Installation of the strap 'above' the tilt tube may lead to a hang up, or restriction.

## ■ ■ ■ MC 300B - MC 300C - MC 300BV Evolution installation instructions



**NO**



**YES**

The cylinder s.s. lever should be attached on the top of the engine tiller arm on most brands of outboards. In the event that the s.s. lever or aluminium forks interfere with other parts of the outboard, then it can be mounted under the tiller arm or the s.s. lever can be disassembled and reassembled upsidedown (see picture 2) and attached under the tiller arm of the engine.

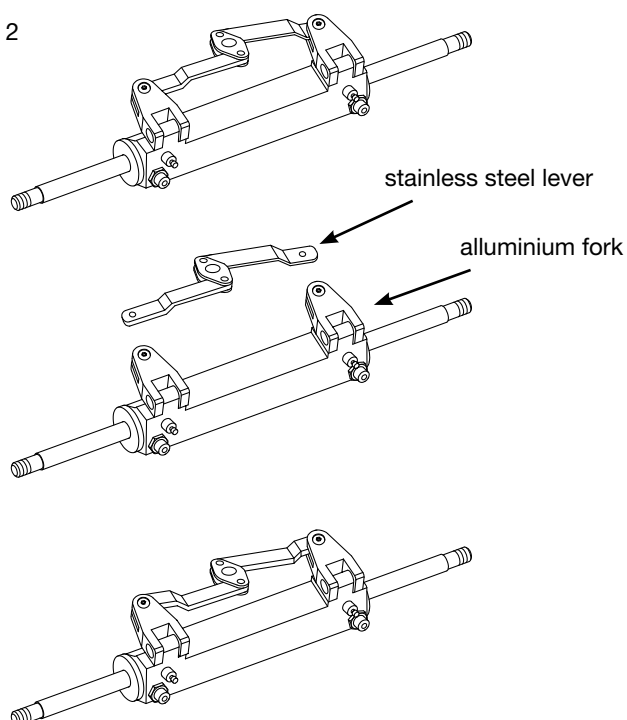
### Attention:

All the systems are not intended for racing boat application.

RIF.	QUANTITY	DESCRIPTION
1	1	Adjusting nut
S1	1	Left support bracket
S2	1	Right support bracket
2	6	Spacer
3	1	Cylinder
4	1	Ø 15,9 rod
5	2	Esagonal nut 27 mm

RIF.	QUANTITY	DESCRIPTION
6	1	Feeding oil rod
7	1	Esagonal nut 19 mm
8	1	Fitting
9	1	Esagonal nut 22 mm
10	2	Plastic cover
11	2	s.s. washer
12-13	1	Screw 3/8" + nut 3/8"

Picture 2



### **Warning :**

In the event that the stainless steel lever or the aluminium forks of the cylinder interfere with other parts of the outboard, then it must be mounted upsidedown and attached under the tiller arm of the engine.

Remove the 2 screws with self-locking nuts, overturn the lever and reassemble it to the cylinder.

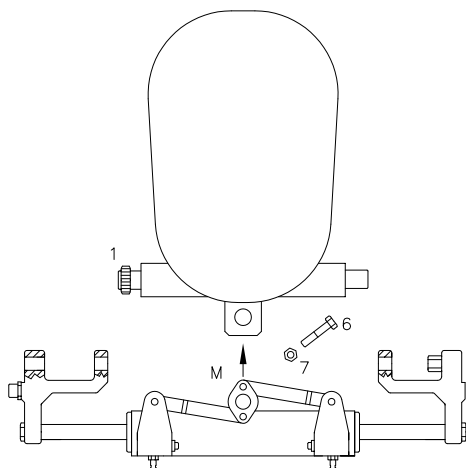
This operation is useful also when with regular lever installation, the cylinder touches the transom before the engine is completely tilted.

Remove only the stainless steel lever! Do not remove the lever along with the aluminium forks!

Proper cylinder installation is the key to the successful operation of the hydraulic steering system. An incorrectly installed cylinder is subject to rapid seal and bearing wear and non-repairable damage. Protect cylinder rods from nicks and scratches, which can cause cylinder to leak, and result in loss of steering.

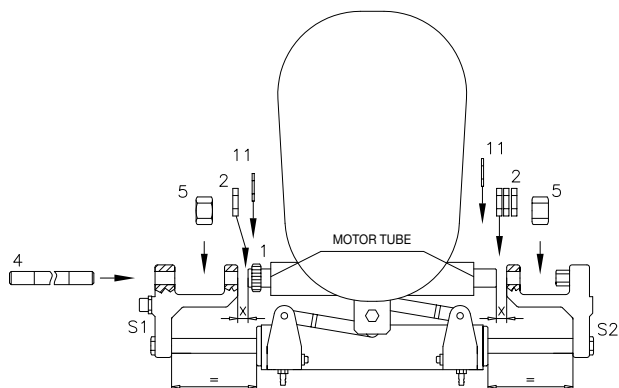
### STEP N° 1

- A) Connect the link arm (M) to the engine by the 3/8" bolt (12-13).
- B) Screw the adjusting nut (1) on motor tilt tube.



### STEP N° 2

- A) Ensure that the cylinder body is centered on the rod and that the engine is perpendicular to the transom.
- B) Check the space "x" between the support brackets (S1 - S2) and the motor tilt tube, and to compensate it adding a combination of plastic spacers (2) and (1) washer (11) for each side. (If it needs them).
- C) Put the rod (4) through the holes of the two support brackets and slide it into the motor tilt tube. Then block it using the nuts (5)
- D) After having inserted the rod (4) into the motor tilt tube, check that it is perfectly clean and there are not impurity inside of it.
- E) Screw the regulation nuts (1) in order to eliminate the clearance, avoiding to block the supports (S1 - S2) to the motor tilt tube. Ensure that the motor and the cylinder are free to rotate on own axis. Do not use a wrench of any type on the adjusting ring nut. Tight it by hand only. Lock the ring nut in place by securely tightening the set screw



### STEP N° 3

- A) Introduce the feeding rod (6) on the "Z" hole and put the nut (7) on the rod as fig. A, then complete the connection up to the fitting (R) after having removed the plastic protection place on the fitting.

#### Attention:

Before completing the connection, lubricate the rod (6) and ensure that the internal hole of the rod is clean and without impurities.

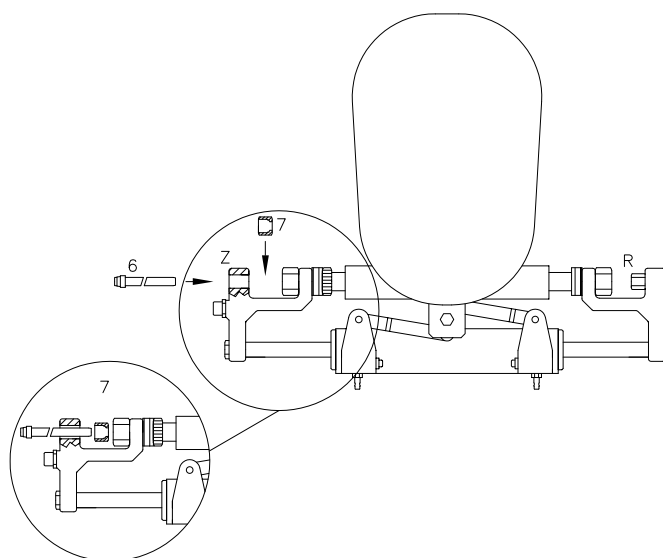
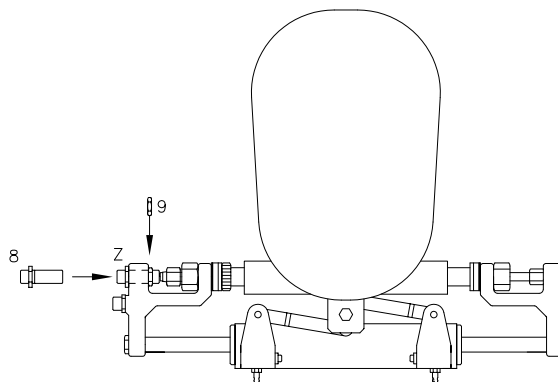


FIG. A

### STEP N° 4

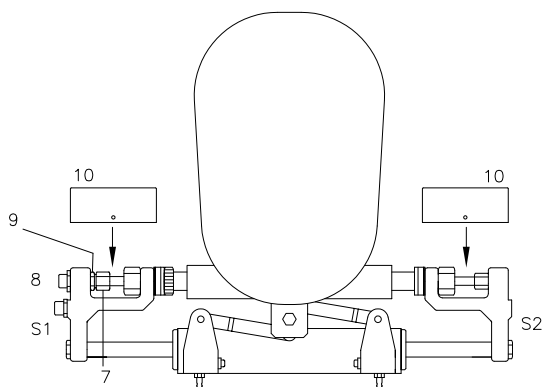
- A) Put the fitting (8) into the "Z" hole of the support bracket.
- B) As soon as the fitting (1) has passed the hole screw the nut (9) on it. **Without tight the nut.**



Kit X.344 see pag. 20

### STEP N° 5

- A) Screw the nut (7) to the fitting (8).
- B) Screw the nut (9).
- C) Insert the covers on the support brackets.
- D) Screw the screws on the covers tightening them on the support brackets.

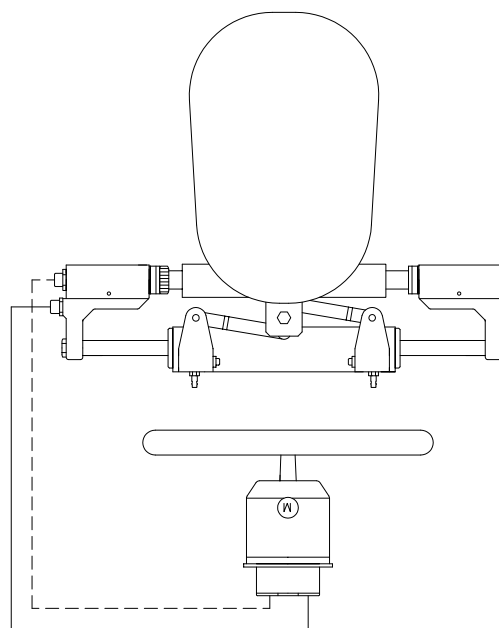


### STEP N° 6

- A) Connect the hoses as the figure.

#### **Attention:**

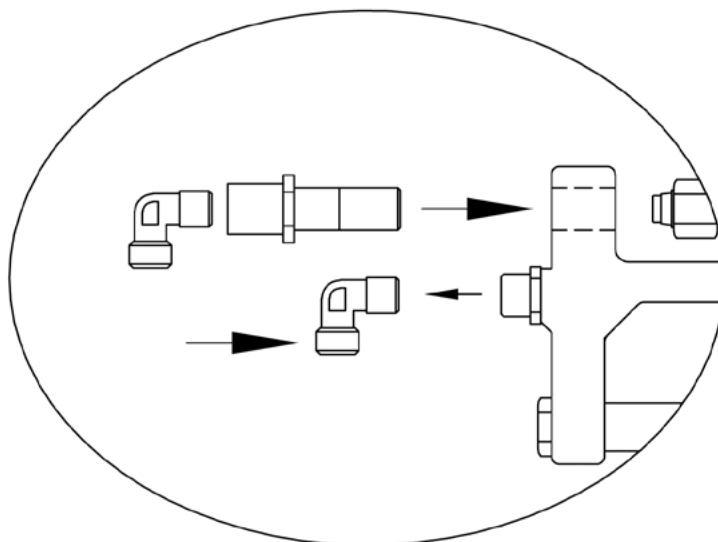
In order to simplify this operation is better to mark both ends one hose before proceeding with the installation.



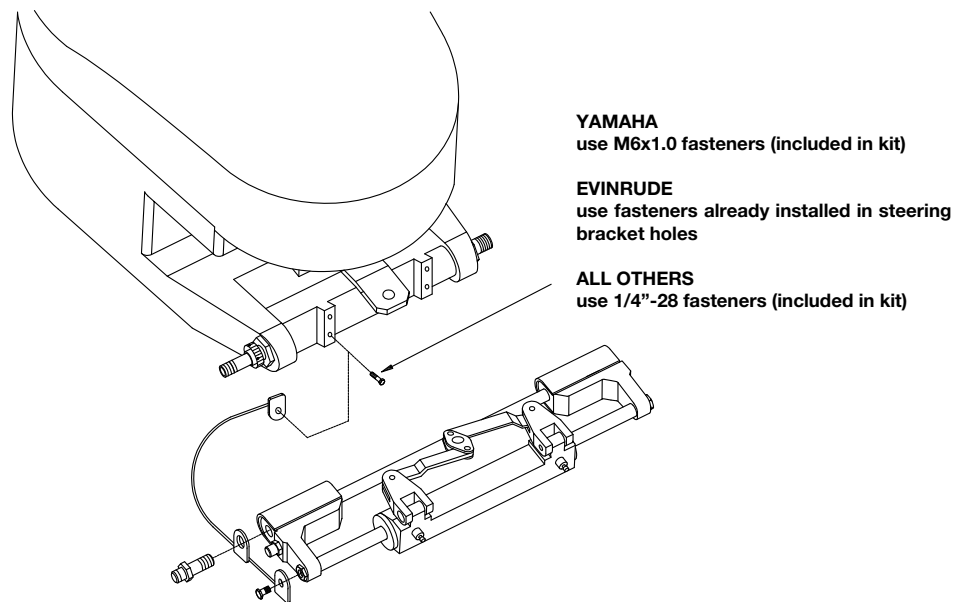
### ■■■ Kit X.344 installation

If interference is present between the end of the steering cylinder to the motorwell wall and there is not enough clearance sideways for the hoses, it could be eliminated with Kit X.344 90° fittings.

Straight fitting must be substituted with elbow fitting. Use a pipe sealant such as loctite 577 or equivalent on 1/4NPT thread fittings.



## ■■■ Ground strap installation instructions for MC300B cylinder



Notice for salt water applications

**MAVIMARE** strongly recommends use of a ground strap on any outboard hydraulic steering cylinder with an exposed shaft where the vessel will be used in salt water. This ground strap will provide added protection against corrosion caused by stray current.

- Attach end terminal to the starboard side lower midsection steering bracket hole (wire facing downwards) using correct fasteners.
- Route ground strap UNDER the tilt tube. Install ground strap large end terminal to cylinder as per Picture 4.
- Install cylinder shaft nut.
- Attach small middle terminal to unused hole in rear of cylinder support bracket. Orient terminal as shown in Picture 4.
- Ensure there is enough slack in the strap to allow the engine to pivot freely in ALL trim/tilt positions and throughout the entire steering range of the engine.

### **Caution:**

Ensure ground strap is routed 'under' the tilt tube. Installation of the strap 'above' the tilt tube may lead to a hang up, or restriction.

# Double cylinder MC 300B installation scheme

Diagram A

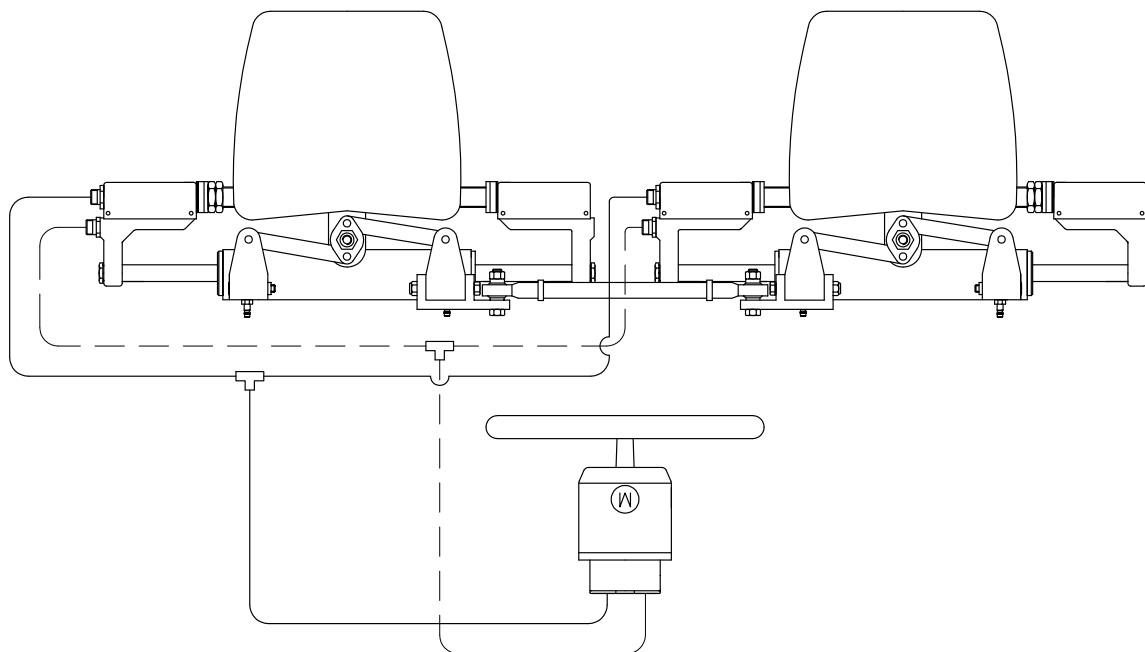
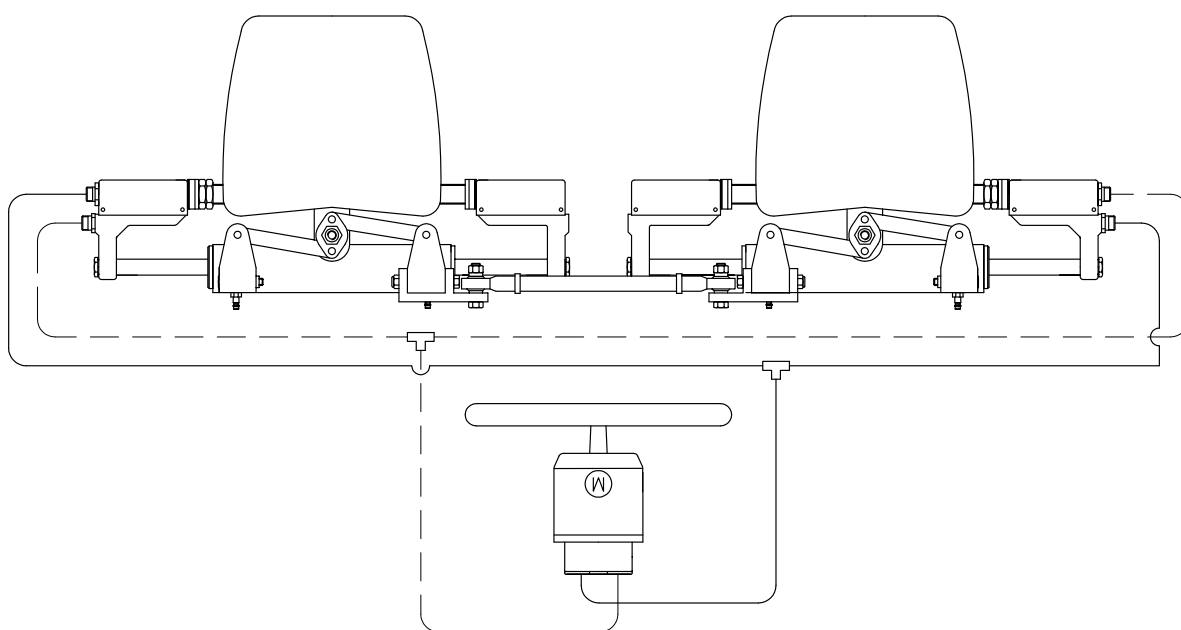
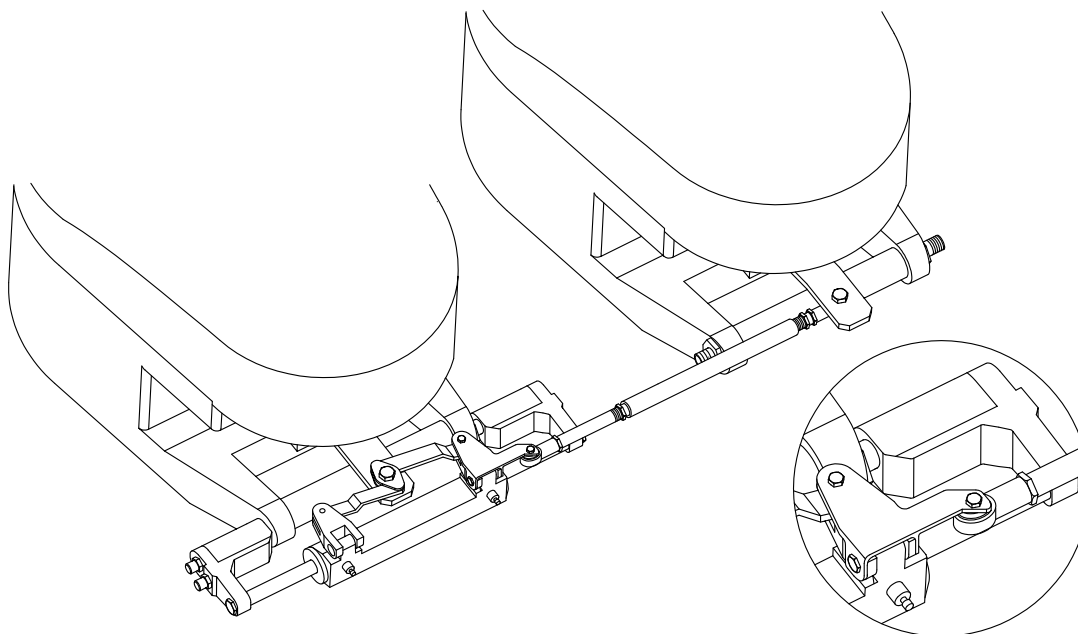


Diagram B



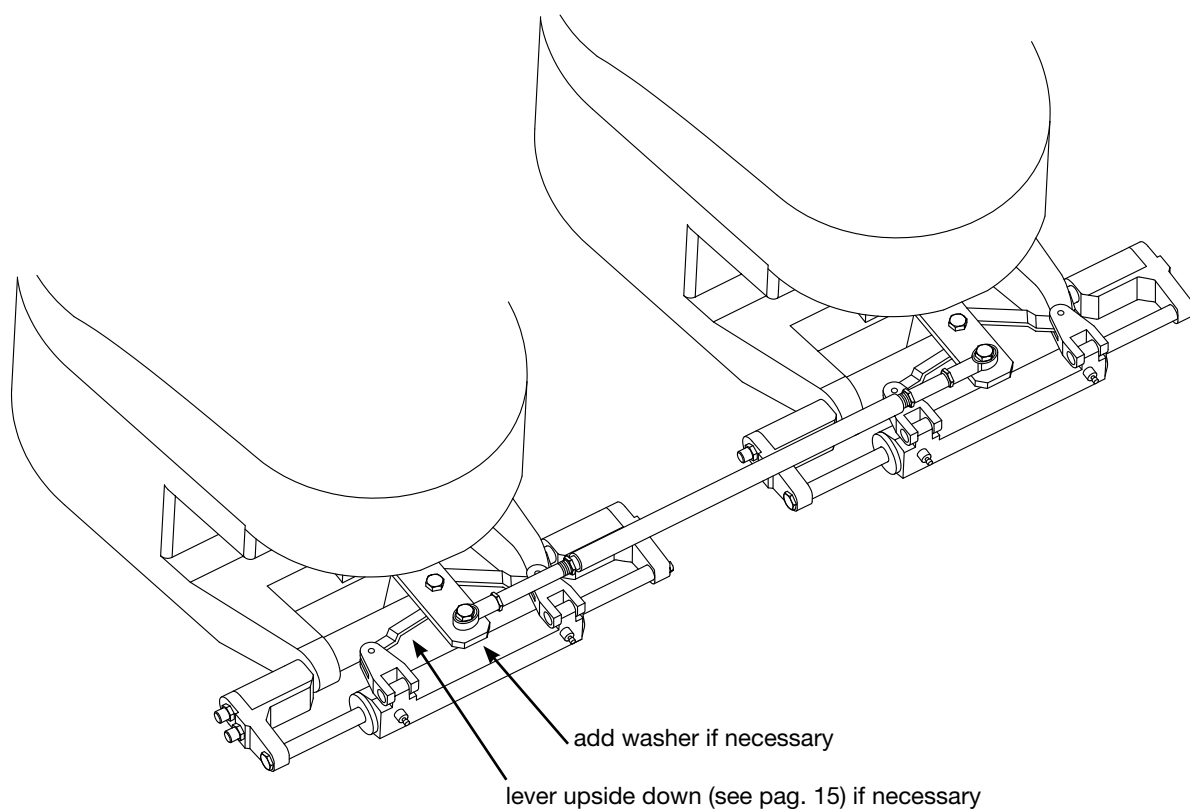
### ■■■ Twin engines application with tie bar Art.358.00 + kit X.345

The s.s. plate present in the X.345 Kit must be fit properly onto one of the two alluminium brackets of the cylinder as the figure.



#### Installation instructions:

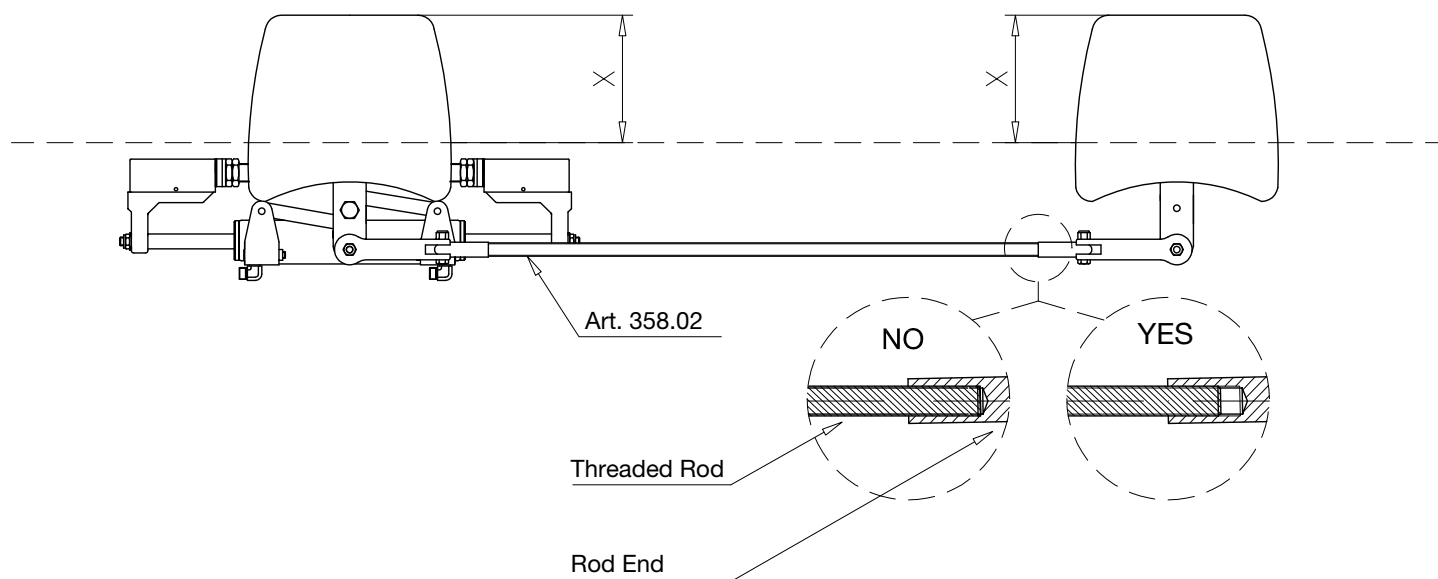
- Remove the screws of the alluminium fork of the cylinder.
- Place the stainless steel plate on the alluminium fork an fix it with the new screws included in the kit.
- Check there is no any interference between the cylinder / tie bar and the engines.

**■■■ Twin engines application with tie bar Art. 358.00 - 358.06**

For tie bar application art. 358.00/358.06, the stainless steel lever of the cylinder must be mounted upside down and attached under the tiller arm of the engine (see pag. 15). One additional washer between the joint ball of the tie bar and the tiller arm could be necessary.



### ■ ■ ■ Twin engines installation with tie bar Art. 358.02



#### **Attention:**

As the tiller arm position varies from engine to engine and the distance between two engines is not predictable, unexpected interferences may occur while tilting.

A duly check of the tie bar installation is then strongly recommended.

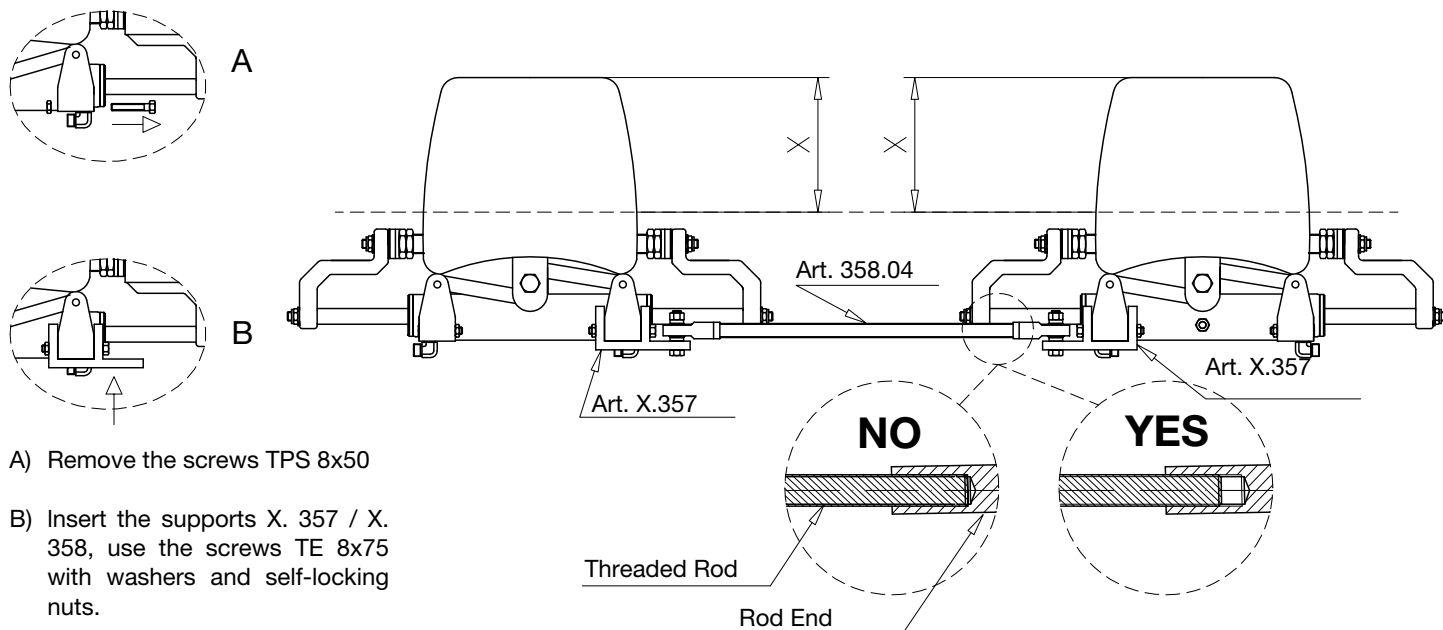
#### **Attention:**

Do not block the threaded rod against the rod end terminal. The threaded rod should be able to rotate freely. Do not apply loctite. Failing to observe this warning may result in damage of the tie bar while tilting one of the two engines.



For tie bar application art. 358.02, the stainless steel lever of the cylinder must be mounted upside down and attached under the tiller arm of the engine (see pag. 15). One additional washer between the joint ball of the tie bar and the tiller arm could be necessary.

# Double engine application with double cylinder and tie bar Art. 358.04



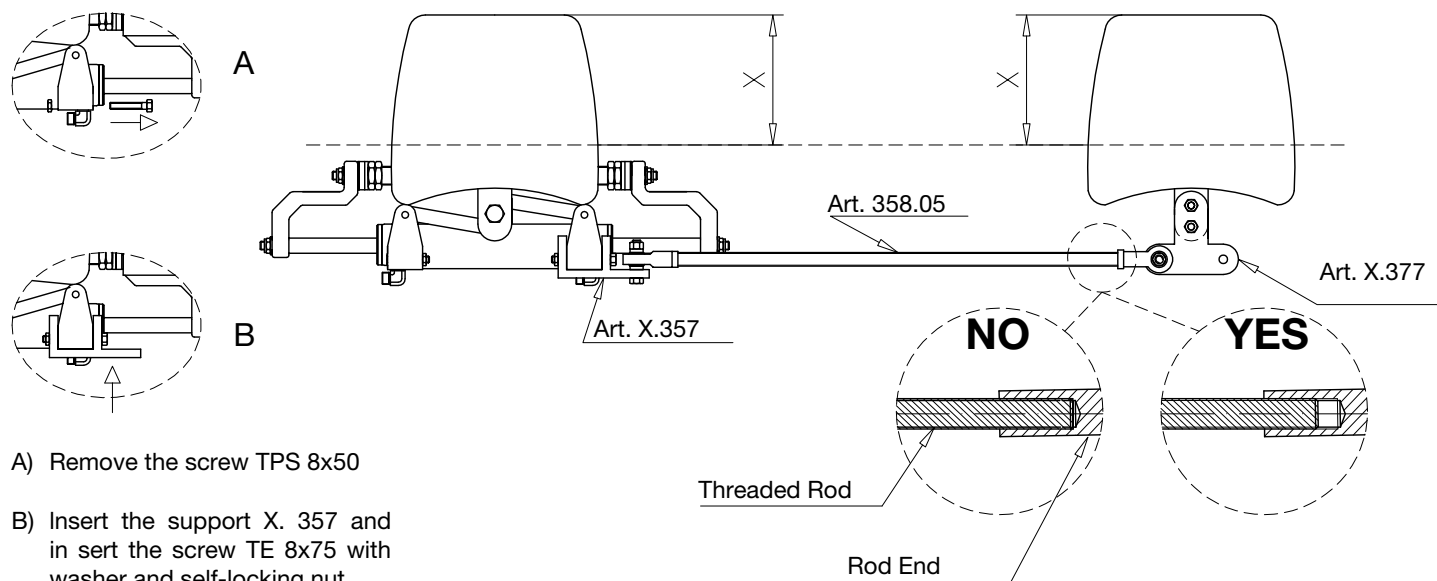
## Attention:

As the tiller arm position varies from engine to engine and the distance between two engines is not predictable, unexpected interferences may occur while tilting. A duly check of the tie bar installation is then strongly recommended.

## Attention:

Do not block the threaded rod against the rod end terminal. The threaded rod should be able to rotate freely. Do not apply loctite. Failing to observe this warning may result in damage of the tie bar while tilting one of the two engines.

## Double engine application with single cylinder and tie bar Art. 358.05



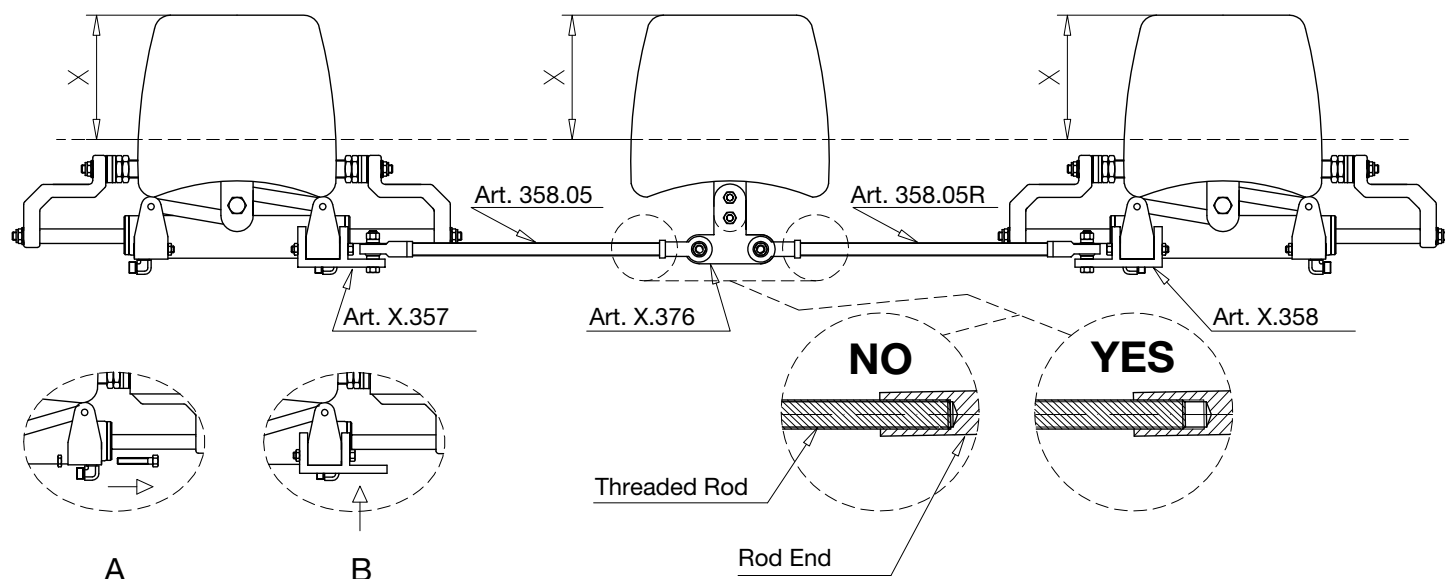
### **Attention:**

As the tiller arm position varies from engine to engine and the distance between two engines is not predictable, unexpected interferences may occur while tilting. A duly check of the tie bar installation is then strongly recommended.

### **Attention:**

Do not block the threaded rod against the rod end terminal. The threaded rod should be able to rotate freely. Do not apply loctite. Failing to observe this warning may result in damage of the tie bar while tilting one of the two engines.

### ■ ■ ■ Triple engine application with two cylinder and tie bar Art. 358.05 + 358.05R



A) Remove the screws TPS 8x50

B) Insert the supports X. 357 / X. 358 and insert the screws TE 8x75 with washers and self-locking nuts.

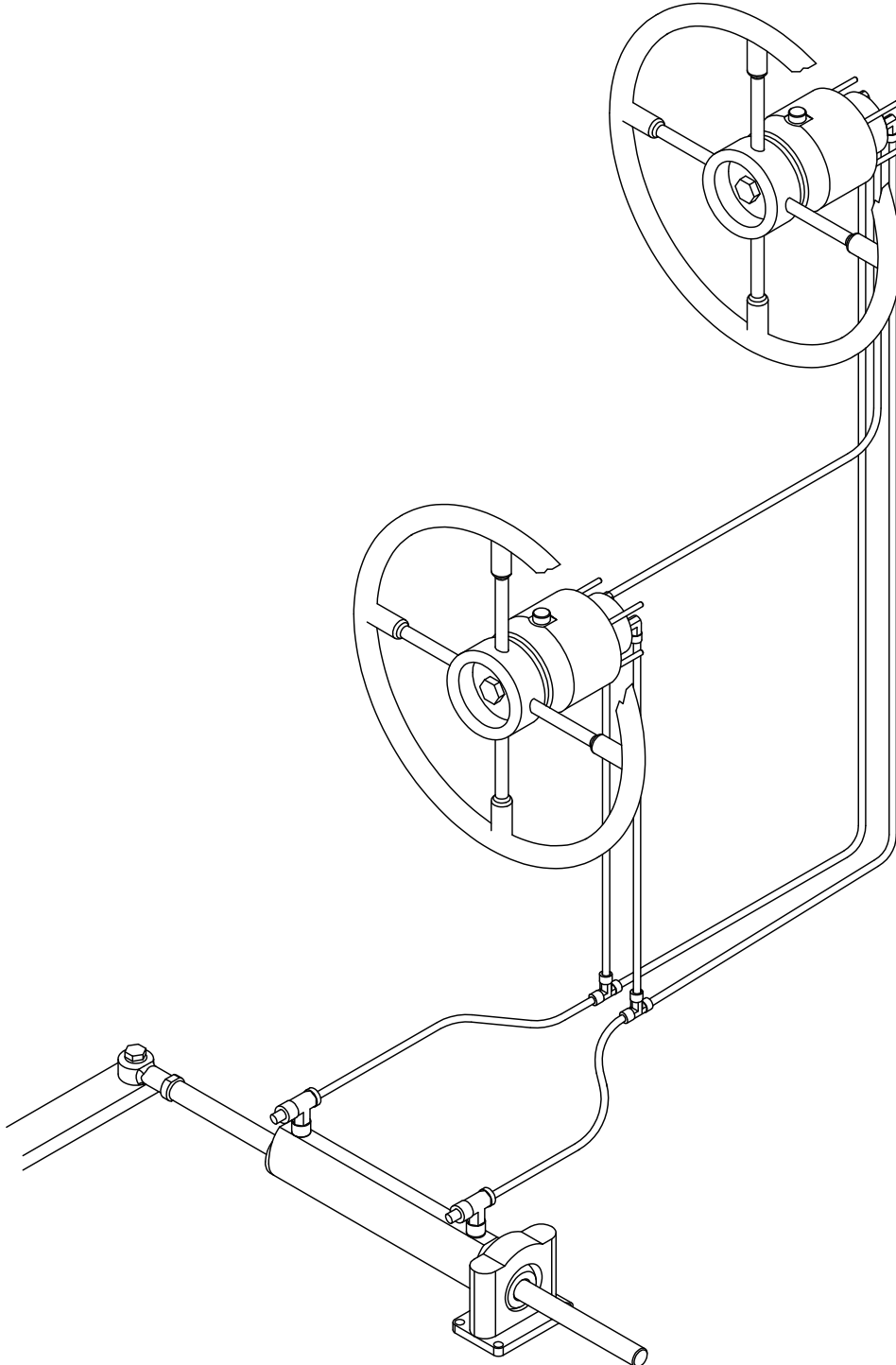
#### **Attention:**

As the tiller arm position varies from engine to engine and the distance between two engines is not predictable, unexpected interferences may occur while tilting. A duly check of the tie bar installation is then strongly recommended.

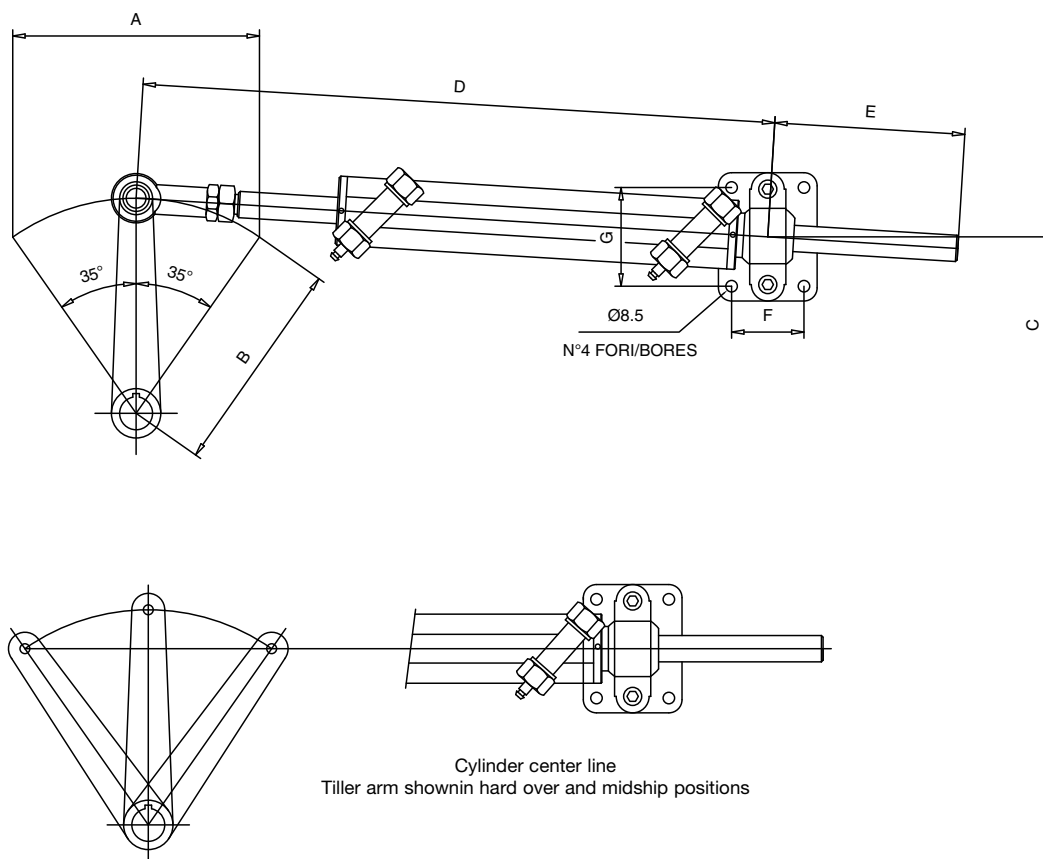
#### **Attention:**

Do not block the threaded rod against the rod end terminal. The threaded rod should be able to rotate freely. Do not apply loctite. Failing to observe this warning may result in damage of the tie bar while tilting one of the two engines.

### Typical Inboard Steering System



## Cylinder assembly for GE30 - GE50 - GE75 - GE100



TYPE	A		B		C		D		E		F		G	
	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches
CE30	150	5.9	131	5.16	107	4.2	383	15.1	96	3.8	44	1.73	60	2.36
CE50	150	5.9	131	5.16	107	4.2	405	16	96	3.8	44	1.73	60	2.36
CE75	215	5.9	187	7.36	155	6.1	530	20.9	130	5.1	44	1.73	60	2.36
CE100	215	5.9	187	7.36	155	6.1	530	20.9	130	5.1	44	1.73	60	2.36

## INBOARD MOUNTING SYSTEMS

Proper cylinder installation is the key to the successful operation of the hydraulic steering system.

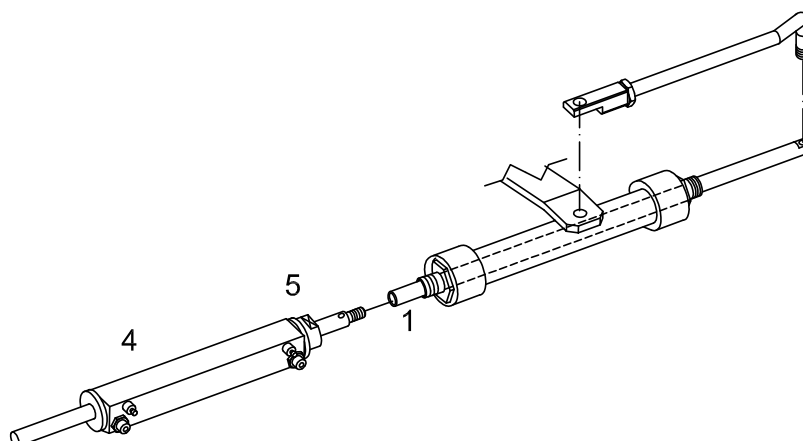
**An incorrectly installed cylinder is subject to rapid seal and bearing wear and non-repairable damage.**

Installation:

- Select your cylinder size in the table.
- To achieve maximum cylinder performance it is suggested that an imaginary line is drawn through the tiller arm hole at both hard over positions, this will create the cylinder center line. With the tiller arm at hard over positions, angle X and Y should be the same.
- Line up helm in bow-stern direction. Join the piston rod ball joint to the tiller helm.
- Loosen pipe fitting nuts. Keeping bow-stern direction and using piston rod stroke, place the bracket complying with "D", "E" and "C" sizes, as indicated in the table.
- Place the cylinder bracket complying with dimensions indicated in the table and fasten using the four 8 mm [5/16"] bolts (not supplied) and the four inox steel locknuts (not supplied). For a correct installation check the cylinder in each stroke position and in horizontal alignment (Transom alignment).
- Move the tiller and check that the cylinder stroke is free. Check that ball joints are free. When linking two tillers by tie rod, the cylinder may be mounted on the tie rod or on each tiller.

Protect cylinder rods from nicks and scratches, which can cause cylinder to leak and result in loss of steering.

## ■■■ Installation instructions of the cylinder type MC 150BE - MC 300BE



RIF.	QUANTITY	DESCRIPTION
1	1	Extension rod
4	1	Cylinder
5	-	Adjusting nut

**\*Attention:**

The tiller arm is not supplied

**Installation:**

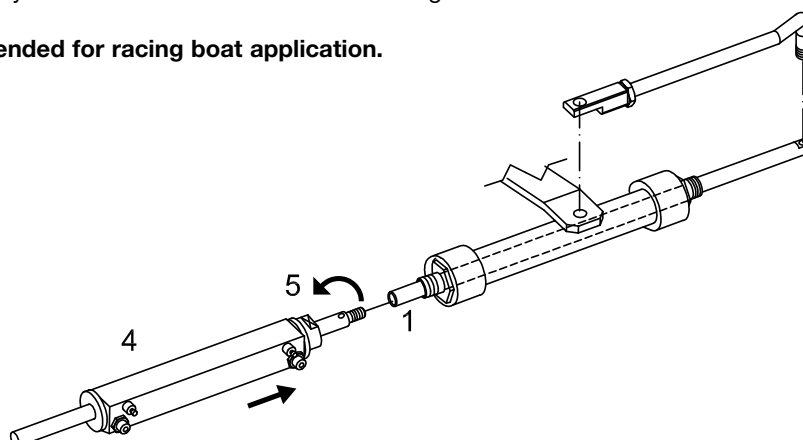
- Ensure that the motor tilt tube is perfectly dry and clean.
- Screw the extension rod (1) on the cylinder's shaft. Grease the extension rod (1) with grease of good quality. Insert the extension rod on left side of motor tilt tube. Screw the cylinder by the adjusting nut (5) to the left threaded side of motor tilt tube, keeping the bleeders on the upper side of the cylinder.
- Connect the tiller arm to the extension rod as show in the drawing.
- Put the cylinder and the motor in middle of it's stroke, and adjust the tiller arm distance. Connect the tiller arm at the motor with screw, washer and self-locking nut (15).

### IMPORTANT

Notice regarding adjustment of 90° fitting on steering cylinder. If interference occurs between the splashwell and hydraulic hose or hose fitting, the fitting can be adjusted but must be removed completely prior to establishing desired orientation.

We recommend: once a fitting has been backed off, is important to remove the fitting completely to avoid leakage. Remove the fitting, clean the threads and re-apply Loctite. This will ensure that the fitting does not leak once re-oriented to desired angle.

**All the systems are not intended for racing boat application.**

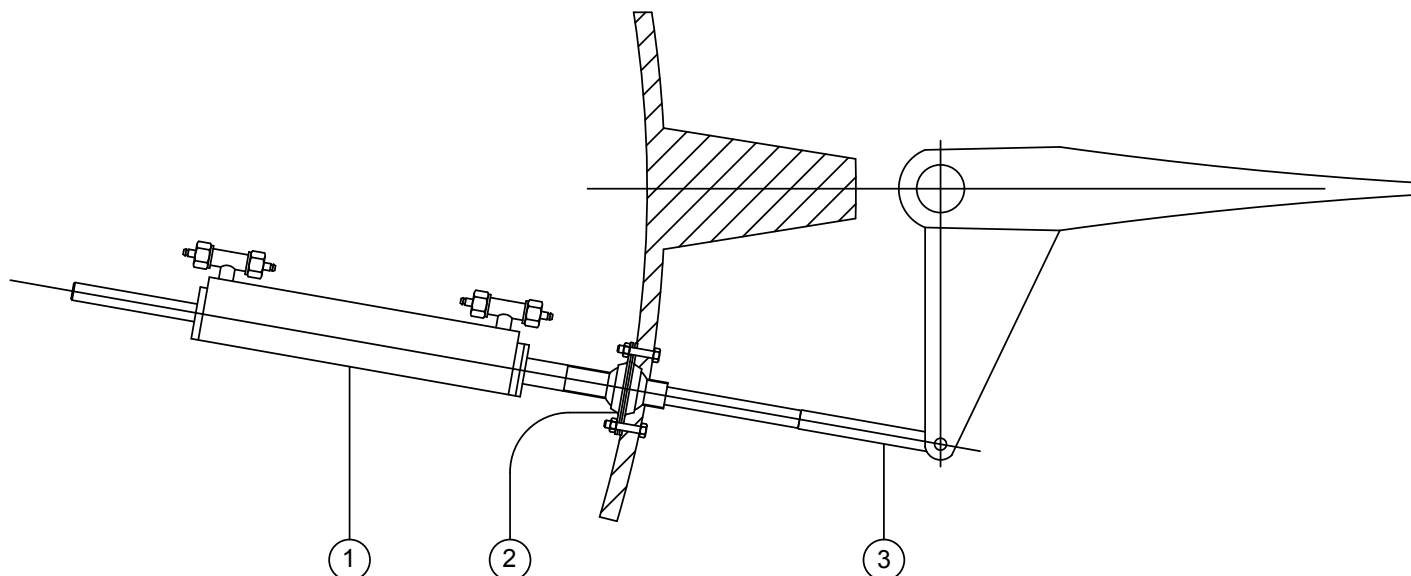


### REMOVAL CYLINDER INSTRUCTIONS

**Attention:**

In case you want to remove the cylinder, rotate the nut (5) counterclockwise holding the cylinder pressed against the nut itself. Failure to observe this warning may result in the breaking of the nut itself.

## ■■■ Cylinder assembly CE50S



RIF.	QUANTITY	DESCRIPTION
1	1	CE50S
2	-	A.185*
3	-	Support rod

\*The art. A.185 (ball joint with adjustable flange) is not supplied with the cylinder

- Install the art. A.185 (2) if it's not already installed on the boat.
- Screw the cylinder (1) to the ball joint with adjustable flange (2) and connect the support rod (3) to the tiller arm

**IMPORTANT**

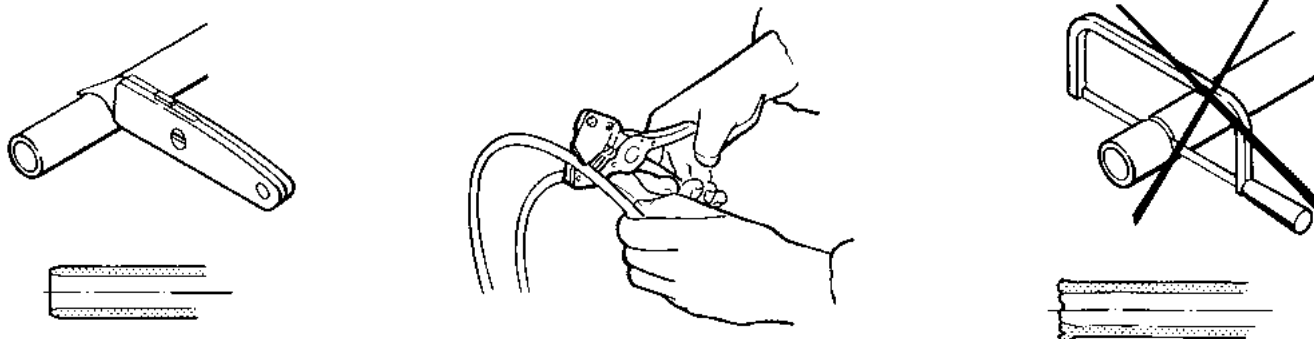
Notice regarding adjustment of T fitting on steering cylinder. If interference occurs between the splashwell and hydraulic hose or hose fitting, the fitting can be adjusted but must be removed completely prior to establishing desired orientation.

We recommend: once a fitting has been backed off, is important to remove the fitting completely to avoid leakage. Remove the fitting, clean the threads and re-apply Loctite. This will ensure that the fitting does not leak once re-oriented to desired angle.

**All the systems are not intended for racing boat application.**



## ■■■ Hydraulic hose installation



**MAVIMARE** recommends the use of **MAVIMARE** steering hoses only.

Always try to route the hoses via the shortest path in order to avoid any possible loss of power. In order to make the air bleeding of the system easier, it is suggested to mount the hoses horizontally with an inclination of about 3 cm per meter; the pump side has to be higher than the cylinder side.

Always protect the hoses which have to pass through a different compartement or use suitable bulkhead connectors or sleeve. Hoses have to be installed in such a way they don't represent an obstacle for other components.

Do not remove protective end covers until the hoses have been routed and are ready to be connected to the helm pump, hose fitting or steering cylinder (s).

Provide sufficient hose lengths to allow for cylinder movement throughout the turning arc and up/down trim/tilt settings of the engine (s). Throughout the hose installation, ensure the protective caps remain installed onto the end of the hoses.

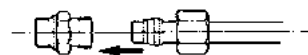
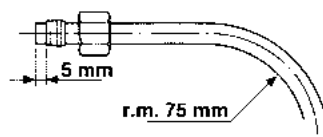
### **Attention:**

Do not install hoses in an area where they will be exposed to high heat. Extreme heat reduces the hose bursting pressure and can cause the hose melting. Exercise great cleanliness. Make sure that pipes and hoses are perfectly clean and free from swarf.

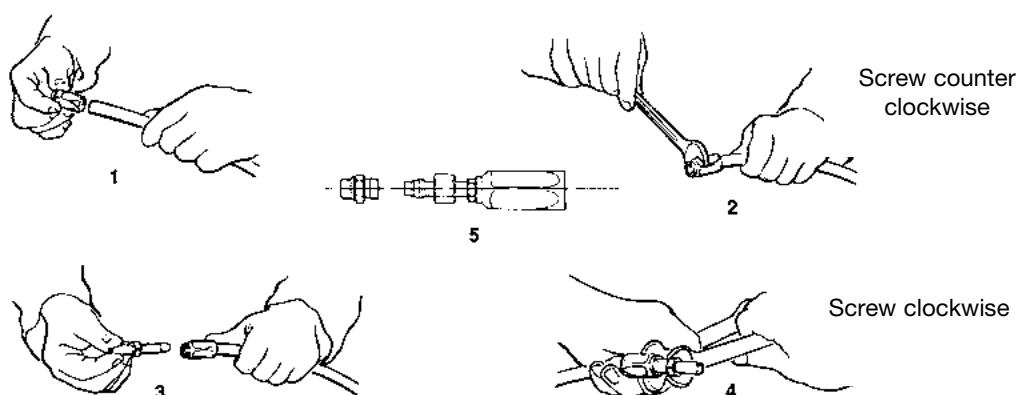
**Note:** Flexible hoses have to be cut by means of a sharp knife; never use a saw, as fragments of nylon in the hydraulic system cause serious problems.

## Hydraulic hose installation

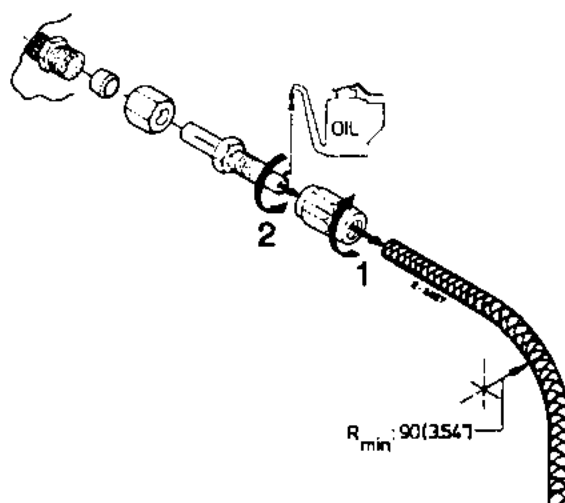
After cutting the nylon hose, fit the coupling nut and the support sleeve on the hose (check it is properly positioned in relation to the end of the hose). After the mounting of the nut, you have to tight by means of a spanner.



Otherwise, you can mount nylon flexible hose type SAE100R7 with recuperable fittings.



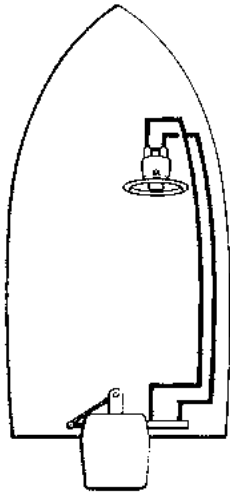
After the installation clean the inside of the hoses by blowing through using compressed air, in order to avoid any obstructions and to remove dust and debris from storage. Before the air bleeding it is also suggested to make a rinsing of the system. Do not use water.



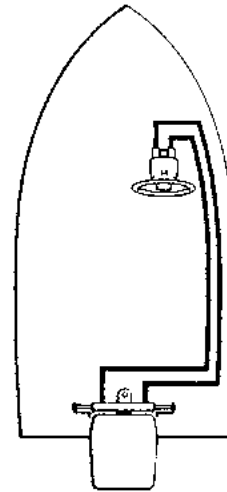
- 1 After cutting, screw the tube coupling sleeve onto the tubing (left-handed thread).
- 2 Oil the tube coupling and screw it into the sleeve. Make sure that the internal sheathing of the tubing does not follow while tightening the screw! Also make sure that the internal sheathing of the tubing is not squeezed while tightening the screw.
- 3 Check there is no internal interference putting a small screwdriver into the tube coupling before proceeding with hose installation to helm or cylinder.

### ■■■ Hose connection

Refer to illustrations below for the correct connection of hoses from helm pump to cylinder.

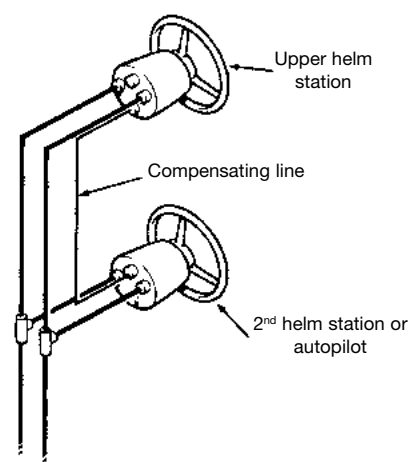
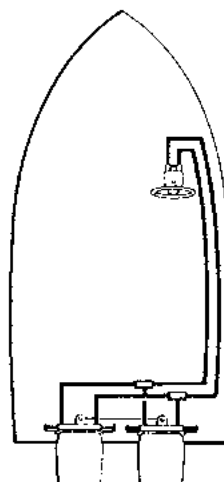
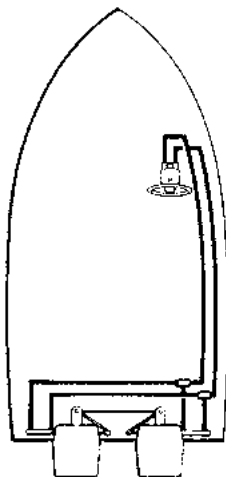


for MC150 / MC150E / MC150BE / MC150R / MC300R  
for CE30 / 50 / 75 / 100

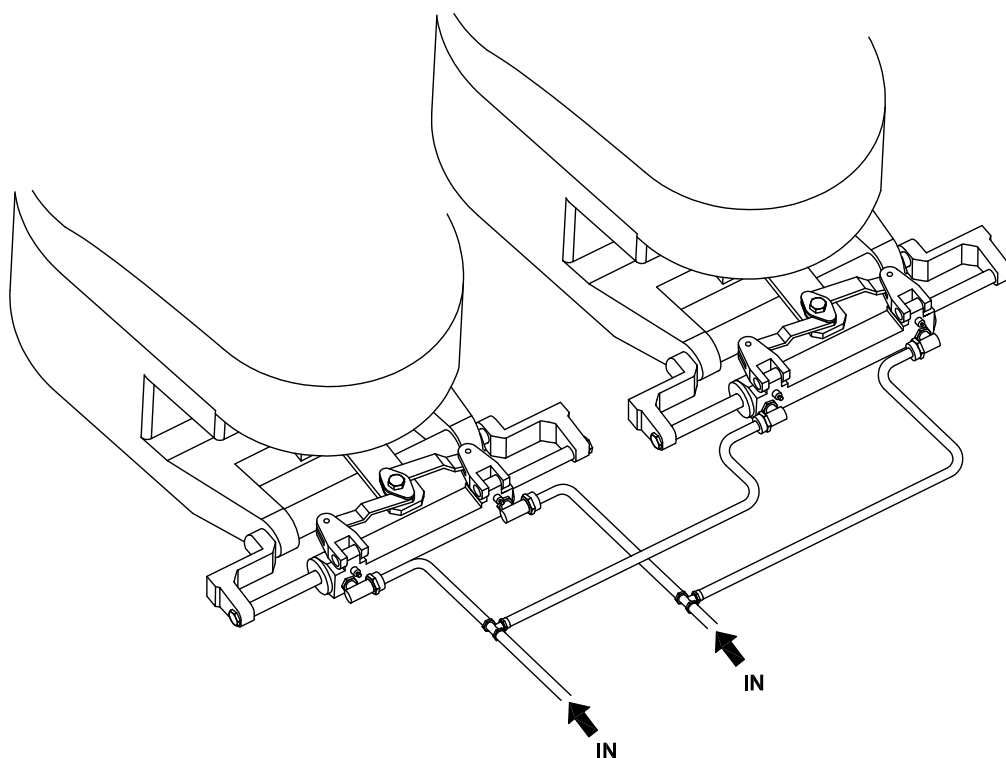


for MC300A  
for MC150BR - MC90B

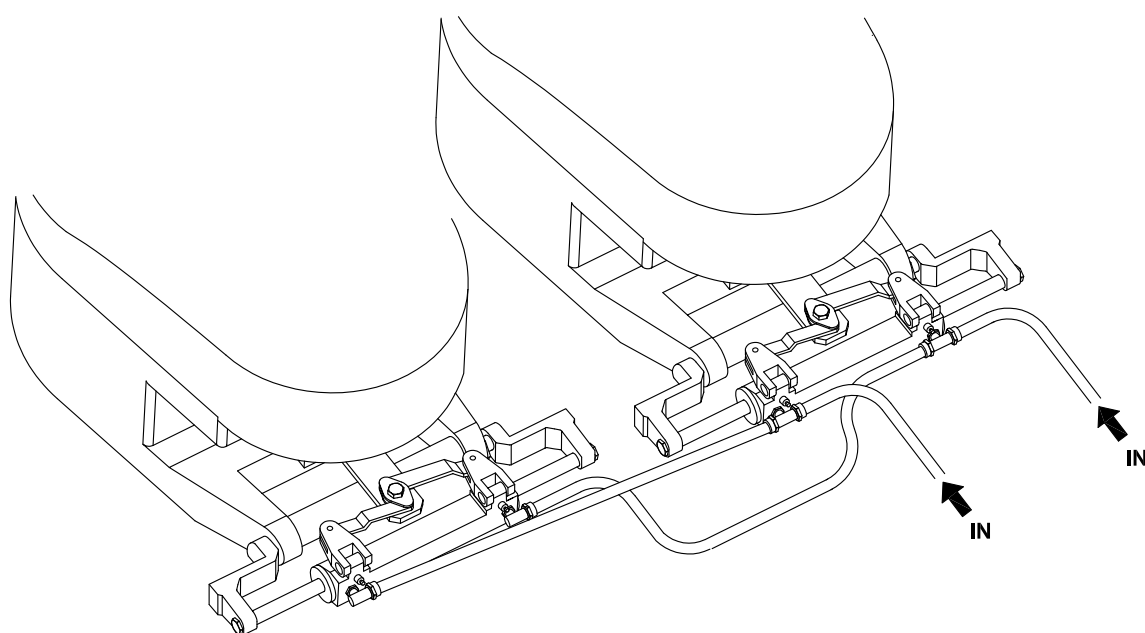
### ■■■ Hose connection



■■■ Connection scheme for double hydraulic cylinder Art. X.351



■■■ Connection scheme for double hydraulic cylinder Art. X.352



## ■■■ Hydraulic Fluid

Recommended oils for your steering system are:

**MAVIMARE** HYDRALUIC FLUID SHELL TELLUS T15 (CL T15 HIV)

Viscosity	15 cst
Viscosity index	142
Solidification point	c° -38

Note: Automation transmission fluid Dexron II may be used in an emergency.

Never use brake fluid. Any non-approved fluid may cause irreparable damage, loss of steering, and cancellation of warranty.

## ■■■ Filling and purging the outboard systems (single station)

This Procedure requires two people. One person may not be able to remove all the air from the system which will results in spongy, unresponsive steering.

During the entire filling procedure , oil must be visible in the filler tube. Do not allow the oil level to disappear in to the helm pump as this may introduce air into the system and increase your filling time.

### Step n. 1

Connect the threaded end of the filler tube to the oil bottle and screw it into the helm filler port. Poke hole in the bottom of the bottle. Fill the helm pump full of hydraulic oil so that it is visible in the filler tube.

Do not proceed with step two untill helm is full of oil.

### Step n. 2

Turn the steering wheel clockwise until the cylinder rod is fully extended on the right side of the cylinder.

Open right side bleeder.

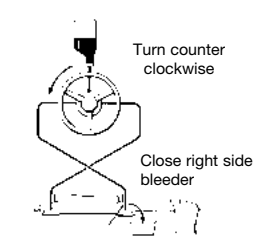
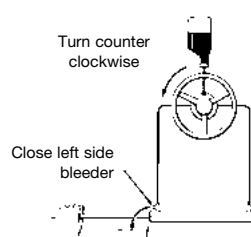
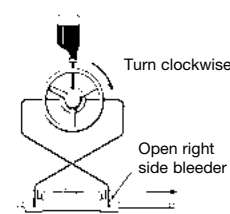
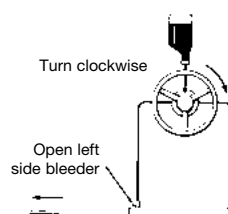
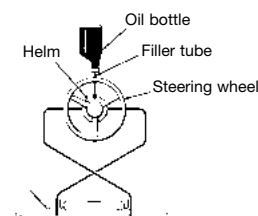
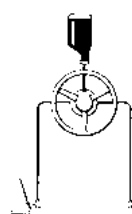
### Step n. 3

Holding the cylinder body (Front Mount Cylinder) or rod (Side Mount Cylinder) to prevent the body / rod from moving, turn the steering wheel counter-clockwise until a steady stream of air free oil comes out of the bleeder. Do not use anything other than your hands to restrain the cylinder body/rod.

While continuing to turn the wheel close the right side bleeder and let go of the cylinder body/rod.

Side mount cylinder

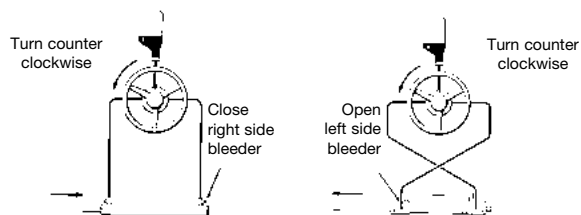
Front mount cylinder



#### Step n. 4

Continue turning the steering wheel counter-clockwise until the cylinder rod is fully extended to the left (Steering wheel will come to stop).

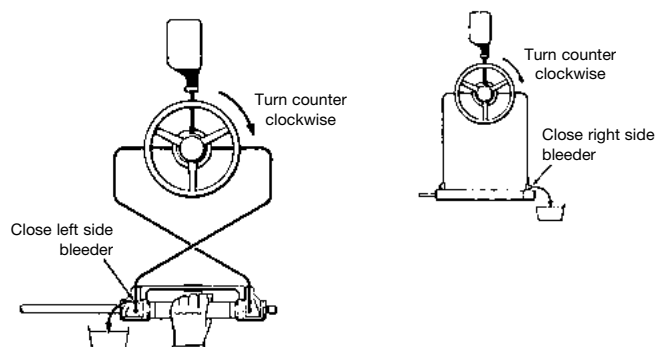
Open the left bleeder and perform the same operation as step 3 (turning the wheel clockwise).



#### Step n. 5

Holding the cylinder body (Front Mount cylinder) or rod (Side Mount cylinder) to prevent the body/rod from moving, turn the steering wheel clockwise until a steady stream of air free oil comes out of the bleeder.

While continuing to turn the wheel close the left side bleeder and let go of the cylinder body/rod.



#### Attention:

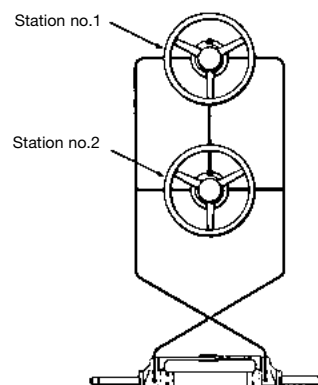
Side mount cylinders are unbalanced. The oil level in the helm must be set with the cylinder rod fully retracted. Failing to observe this caution will result in a oil spill at the helm. Turning the wheel to port (left) will retract the cylinder rod.

Now check the steering system. Turn the wheel (any one multi-steering station) and pressurise very hard to port. Apply enough force to the wheel to exceed pressure relief valve pressure. While pressure is maintained on steering wheel, check all port (left) fittings and line connections for leaks.

## ■■■ Filling and bleeding the systems

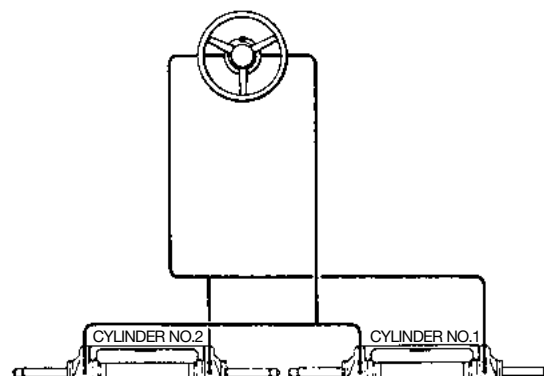
### TWIN STATION - SINGLE CYLINDER

Perform steps 1 through 5 at station no.1.  
Then repeat steps 1-5 at station no.2.  
Oil requirements 4-5 bottles.



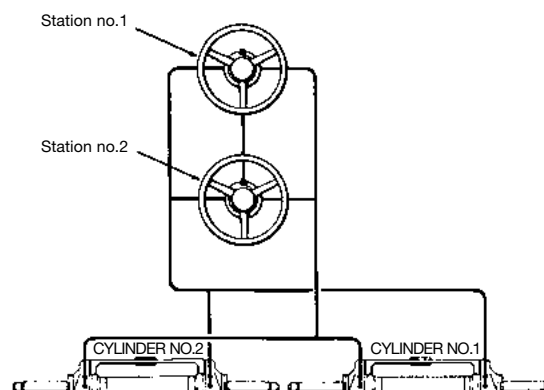
### SINGLE STATION - TWIN CYLINDER

When performing steps 1 through 5, perform instructions in each step first on cylinder no.1 and then on cylinder no.2, before proceeding to the next step. ie: Perform instructions referring to right side of cylinder first on cylinder no.1 and then on cylinder no.2.  
Oil requirements 4-5 bottles.



### TWIN STATION - TWIN CYLINDER

Follow same procedure as instructed for single-station / twin cylinders, beginning at station no.1 and repeat entire procedure at station no.2.



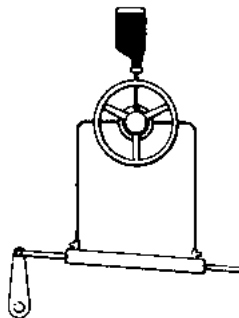
## ■■■ Filling and purging inboard/sterndrive balanced type single station one cylinder

This Procedure requires two people. One person may not be able to remove all the air from the system which will results in spongy, unresponsive steering.

During the entire filling procedure , oil must be visible in the filler tube. Do not allow the oil level to disappear in to the helm pump as this may introduce air into the system and increase your filling time.

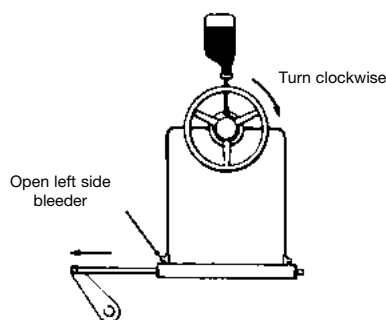
### Step no.1

Screw the threaded end of the filler tube into the helm filler hole. Remove the cap from the oil bottle and holding upright, screw into the filler tube bottle cap. Poke hole in the bottom of the bottle. Fill the helm pump full of oil (Oil should always be visible in the filler tube). Use the next bottle at any time throughout the procedure when the oil level drops in the filler tube. Do not proceed with step two until helm is full of oil.



### Step no.2

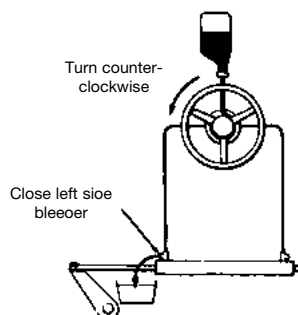
Turn the steering wheel clockwise until the cylinder rod is fully extended on the left side of the cylinder. Open left side bleeder.



### Step no.3

Holding the cylinder rod (to prevent it from moving back into the cylinder) turn the steering wheel counter-clockwise until a steady stream of air free oil comes out of the bleeder. (Drain out approx. 1/2 bottle of oil or as required.)

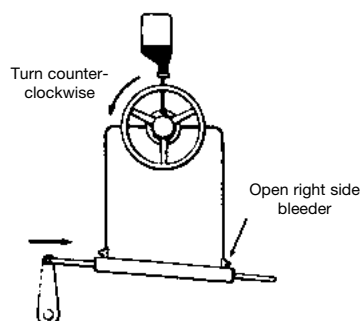
While continuing to turn the wheel, close the left side bleeder and let go of the cylinder rod.



### Step no.4

Continue turning the steering wheel counter-clockwise until the cylinder rod is fully extended to the right. (Steering wheel will come to a stop)

Open the right bleeder.

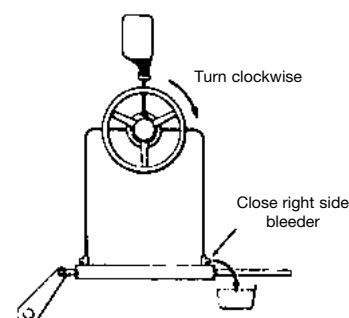




**Step no.5**

Holding the cylinder rod (to prevent it from moving back into the cylinder) turn the steering wheel clockwise until a steady stream of air free oil comes out of bleeder.

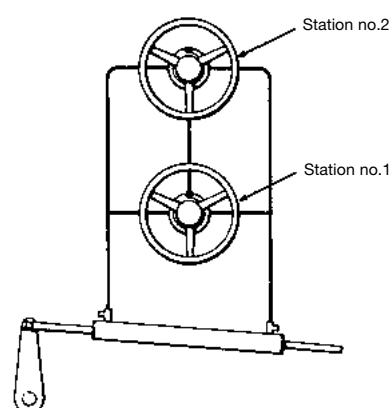
While continuing to turn the wheel, close the right side bleeder and let go of the cylinder rod.

**■■■ Filling and bleeding the inboard systems****TWIN STATION - SINGLE CYLINDER**

Perform steps 1 through 5 at station no.1.

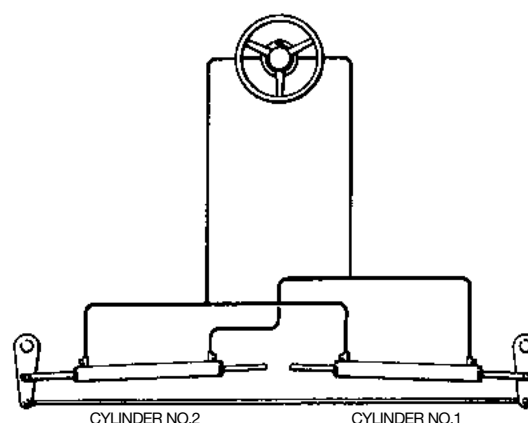
Then repeat steps 1-5 at station no.2.

Oil requirements 4-5 bottles.

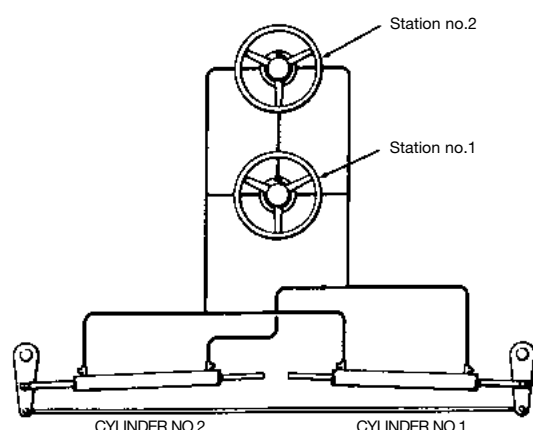
**SINGLE STATION - TWIN CYLINDER**

When performing steps 1 through 5, perform instructions in each step first on cylinder no.1 and then on the cylinder no.2, before proceeding to the next step. ie: Perform instructions referring to right side of cylinder first on cylinder no.1 and then on cylinder no.2.

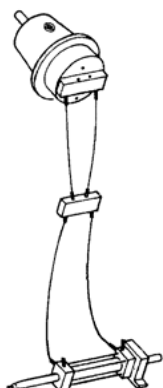
Oil requirements 4-5 bottles.

**TWIN STATION - TWIN CYLINDER**

Follow same procedure as instructed for single-station / twin cylinders, beginning at station no.1 and repeat entire procedure at station no.2.

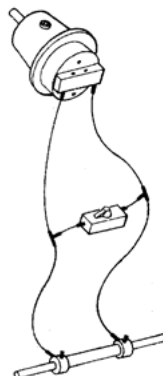


## ■■■ Valves installation



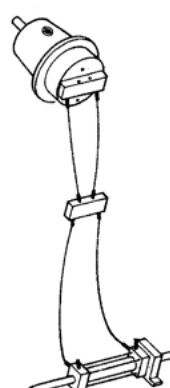
MR4 LOCK VALVE:

In-line mounting. It keep the rudder stop-  
ped in its position, avoiding any shock  
caused by heavy sea.



MBY4 BY PASS VALVE:

In-line mounting. It makes possible the  
short-circuit in the system to execute  
the manual control in an emergency.



MM4 SAFETY VALVE:

In-line mounting. It avoids the  
overpressures.

## ■■■ Dual station installation schemes

The system has been designed to avoid maintenance. Anyway, if the hydraulic steering system has to stop for much time, it would be better, before starting again, to turn the wheel up to the stroke's and towards one side, and then, towards the other

- grease abundantly the exterior of the inboard cylinder
- vaporize regularly a lubricant on the outboard cylinder.

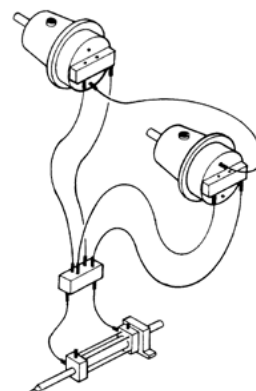
### Warning:

- we advise to use oil "SHELL TELLUS T15"
- make sure the oil is perfectly cleaned and that no impurities have entered in the system
- avoid strong shocks to the pump and to the cylinder (collision, hammer-blows, etc.)
- avoid to force the wheel at stroke's end.



Outboard double  
station scheme

In more than one steering station  
is installed the fill-vent plug on  
all but the uppermost helm must  
be replaced with a non-vent plug  
which is included in a dual station  
fitting kit



Inboard double  
station scheme  
with MRD4 valve

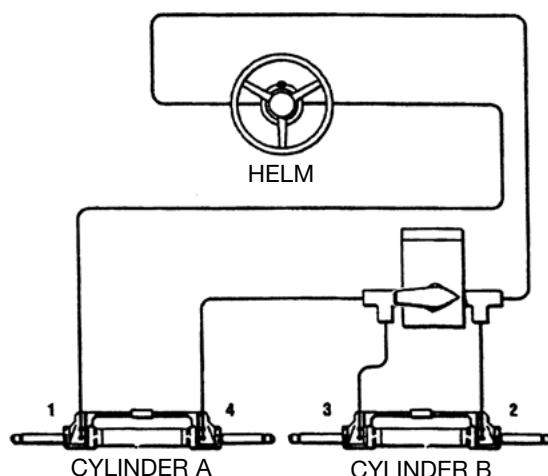
### ■■■ Catamaran outboard systems

In applications where a mechanical tiebar cannot be fitted, it is recommended that you use a "Liquid Tiebar Valve ". This valve will serve two purposes; assisting with the air removal from the system and allows the user to re-align the engines when they came out of sync. Due to the potential for leakage across the piston seals, it is possible for the engines to get out of synchronization. We are unable to predict , due to circumstances beyond our control, the frequency that misalignment may occur, therefore engine alignment should be checked and corrected as required before leaving the dock.

Due to plumbing requirements, "Liquid Tiebar" systems should use 27cc helm pump. Even though there are physically two cylinders in the system, the total volume of the system is that of one cylinder. Use of 32cc helm will result in heavier steering effort.

Bleeding of a "Liquid Tiebar System" is different than a system fitted with a mechanical tiebar. Please refer to your installation and manual.

Bleeding system instruction:



Fill helm with oil and attach filler device/container to helm.

OPEN valve.

OPEN bleed fitting 1 and pull cylinder shaft all the way out on fitting 1 side of cylinder.

Turn steering wheel clockwise until an air free stream of oil comes forth from bleed fitting 1.

CLOSE bleeder 1.

OPEN bleed fitting 2 and pull cylinder shaft all the way out on fitting 2 side of cylinder.

Turn steering wheel counter-clockwise until an air free stream of oil comes forth from bleed fitting 2.

CLOSE bleed fitting 2.

OPEN bleed fitting 3 and pull cylinder shaft all the way out on fitting 3 side of cylinder.

Turn steering wheel counter-clockwise until an air free stream of oil exits bleeder fitting 3.

CLOSE bleeder 3.

OPEN bleed fitting 4 and pull cylinder shaft all the way out on fitting 4 side of cylinder.

Turn steering wheel counter-clockwise until an air free stream of oil exits bleeder fitting 4.

CLOSE bleeder 4.

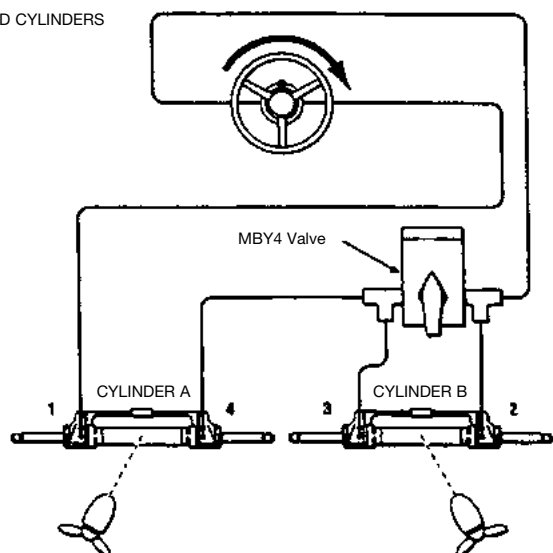
CLOSE alignment valve.

## Realignment Instructions

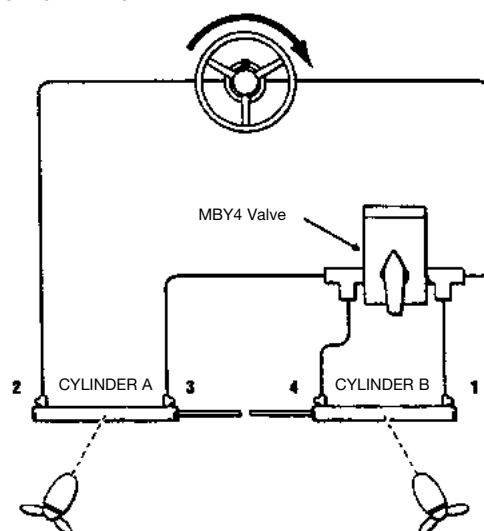
Engines Toe'd Outwards; Props too far apart.

Turn the wheel hard over to Starboard. (Both cylinders move: cylinder B reaches hard over first).  
Open the valve.  
Continue to turn the wheel hard over to Starboard. (Only cylinder A moves and reaches hard over).  
Close the valve.

BALANCED CYLINDERS



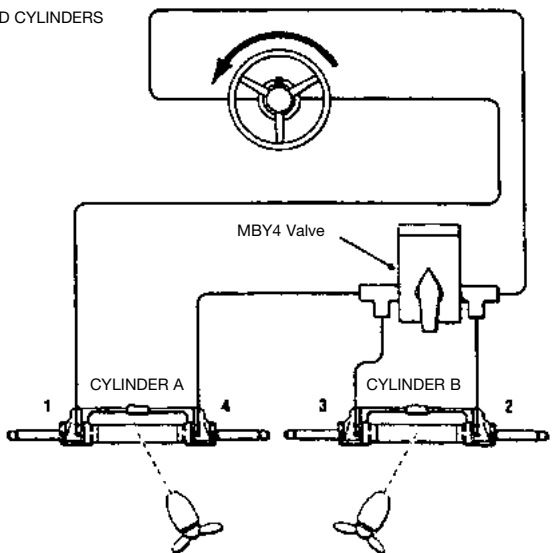
UNBALANCED CYLINDERS



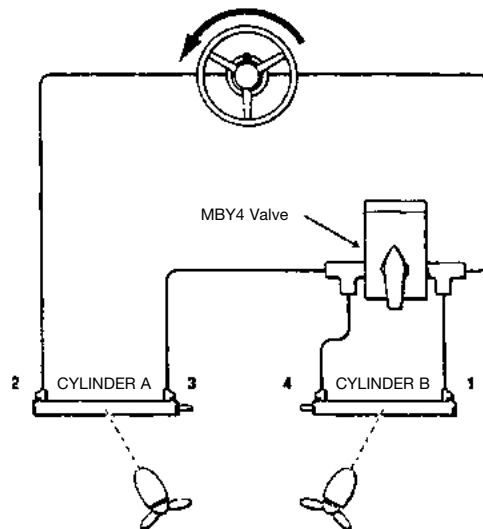
Engines Toe'd Inwards; Props too close together.

Turn the wheel hard over to Port. (Both cylinders move; cylinder B reaches hard over first).  
Open the valve.  
Continue to turn the wheel hard over to Port. (Only cylinder A moves and reaches hard over).  
Close the valve.

BALANCED CYLINDERS



UNBALANCED CYLINDERS



## ■■■ Trouble shooting guide

### **LUMPY OR NOTCHY STEERING**

The most common case of this complaint is air in the system. Check all fittings and re-bleed the system. It is important to note that a fitting which does not leak oil can still leak air into the system. Any fittings should be very carefully inspected.

Another cause is the use of the wrong grade of tubing. High pressure flexible hoses can allow expansion, and the result in notchy steering. Be very careful – not all black nylon tubing is rated at 2500 psi. The most common 1000 psi tubing looks the same IS NOT! It is dangerous – take it off the boat IMMEDIATELY, and get the right tubing

### **OIL OVERFLOWING**

Do not overfill the pump unit, but leave the oil level about 2,5 cm from the top of the pump (about 1,2 cm from the bottom of the thread). If it still overflows on a hot day, then you have a pocket of air present in the system. Re-bleed the system.

### **TIGHT STEERING**

Once again, the most common causes are air in the system, and the wrong grade of tubing used. Both faults allow compression of either the air or the tubing and the storage of pressure. This stored pressure results in heavy steering. Correct either of these faults. Another cause of stiff steering is mechanical. To eliminate the steering as the source of the problem and not merely the means of feeling a problem in the rudders/engines, disconnect the steering from the tiller arm. If the hydraulic steering is now light to operate with the wheel, then you will find the rudders / engines very heavy to move by hand. This should be the case. Even large rudders/heavy engines should move freely in their bearings. Correct the mechanical fault with the rudder gear arm engine and the steering will then deliver the designed performance.

Check the self-locking nuts and adjusting nut of the cylinder: they must not be overtightened.

The final cause of stiff steering can be the entry of foreign material in the lock–valve assembly which can jam the piston. Failure of the piston to move freely can cause a hydraulic lock effect. Cleaning the valve is not difficult but requires that the unit be returned to the factory to be cleaned and tested, whilst under warranty.

### **STEERING SLIPPING**

Should the pump appear to be slipping easily or turning without moving the cylinder, then the problem is probably related to some dirt or foreign body lodged in one of the pick up valves inside the pump. It may affect one or if very dirty, can affect both directions of the pump.

The simplest step to take is to dry bleeding again with good clean oil. Often the object will be dislodged with rapid purge of clean oil. If this does not fix the problem, then the pump should be return to a qualified service centre to be carried out by someone familiar with our equipment. This fault most often occurs when first installing and bleeding the unit, or after carrying out some other service work requiring re-bleeding of the system.

The entry of such foreign materials is not covered by warranty, and good cleanliness would have avoided the problem.

## ■ ■ ■ Faults and solutions

Below are the most common faults and their likely cause and solution.

Sometimes when returning the wheel from a hardover position, a slight resistance may be felt and clicking sound heard. This should be not mistaken as a fault as is it a normal situation caused by the release of the lockspool.

FAULT	CAUSE	SOLUTION
During filling the helm becomes completely jammed.	Lockage in the line between the helm(s) and the cylinder(s).	Make certain that hoses are not collapsed during installation. In this case replace hoses. The damaged hose must be replaced. Otherwise it may cause loss of steering and severe personal injury or property damage.
System is very difficult to fill. Air keeps burping out top of helm even after system appears full.	Air in system.	Review filling instruction. Excess of oil in the pump.
	Bleed fitting leaking.	Tighten bleed fitting.
Steering is stiff and hard to turn, even when the vessel is not moving.	Adjusting nut on tilt tube over-tightened.	To test disconnect cylinder(s) from the tiller arm and turn the steering wheel. If it turns easily, correct above-mentioned problems. Please note that excessively loose connections to tiller arm or tie bar can also cause mechanical binding.
	Restriction in hose tubing or fittings.	Note: a kinked hose will cause stiff steering and should be replaced.
	Wrong oil has been used.	Check the right oil way. Drain the filling and bleeding system
Steering is easy to turn at the dock, but becomes hard to turn when vessel is underway	Steering wheel is too small.	Fit larger wheel if possible, see installation instruction.
	Uncorrect setting of trim tab(s) engine.	Adjust tab(s)
	Air in oil.	Check the oil level and repeat the bleeding procedure as explained in this manual.
When the steering wheel is slowly turned, the rod (movable rod cylinders) or the body (fixed cylinder rod) of the cylinder do not move	Air in the system.	Repeat the filling and bleeding procedure of the system.
	Impurities into the valve.	Contact Mavimare assistance Service.

A small amount of hydraulic drift when helm pump reaches its stop point (cylinder is full stroke out) is normal. The helm pumps are not 100% locking.

## ■■■ Maintenance

### Warning:

Following the routine maintenance schedules as outlined below, in the time frame noted will ensure years of service from your Mavimare Steering System, as well as keep you and your passengers safe from the dangers that are present on and off water.

Failure to comply with maintenance checks may result in loss of steering, causing property damage and / or personal injury.

Inspections are necessary every year and must be carried out by specialized marine mechanics.

Check the shaft and the orings of the cylinder , the orings of the helm pump, the fittings of the cylinder and helm pump in order to prevent leaks.

Check tightness of all fasteners/ fittings throughout the steering system.

Clean the system using fresh water and non – abrasive liquid.

Cleaning fluids containing ammonia, acids or any other corrosive ingredients must not be used for cleaning any parts of the hydraulic steering system.

Do not use brake oils or automatic transmission fluid ( ATF ).

Use only compatible hydraulic oils.

### Prior to every use:

- Check Fluid level in highest helm pump
- Verify immediate steering response when turning steering wheel(s)  
(Ensure engine turns when steering wheel is turned).
- Visually inspect all steering hoses and fittings for wear, kinking and/or leaks.
- Check for binding, loose, worn or leaking steering components.

Warning: DO NOT operate boat if any component is not in proper working condition.

In this case please send a picture showing the installation to [service@mavimare.com](mailto:service@mavimare.com)

After first 20 hours, then every 100 hours or 6 months thereafter (which ever comes first):

- All points noted above
- Check tightness of ALL fasteners/fittings throughout the steering system. Tighten to correct torque specifications are required.
- Check for mechanical play or slop throughout steering system, correct as required.
- Check for signs of corrosion. If corrosion is present contact your dealer.

After every 200 hours or 12 months (which ever comes first)

- All points noted above.
- Remove support rod from engine steering/tilt tube. Clean engine steering/tilt tube and re-grease using a good quality marine grease.
- Grease support rod liberally
- Grease all contact points shown in the cylinder and tiebar installations.  
DO NOT remove tiller bolt to re-grease.
- Remove steering wheel and re-grease wheel shaft using a good quality marine grease.
- Inspect hydraulic oil for cleanliness, flush if required.

Any work being performed with the steering system MUST be completed by a qualified mechanic with the working knowledge of the system.

## ■■■ Technical information

TYPE	GE30	GE50	GE75	GE100	GF150	GF150E	GF150R	GF150BR	GF300A-B-C	GF300R	GF150BE	GF300BE
PUMPS	GM0MRA	GM2MRA01	GM2MRA01	GM2MRA03	GM2MRA01		GM0MRA	GM0MRA	GM2MRA01	GM2MRA01	GM2MRA01	GM2MRA03
N° OF PISTONS	7	7	7	7	7		7	7	7	7	7	7
TURNS OF WHEEL	3,9	3,3	4,3	6,3	3,3	4,5	5,2	5,2	4,8	4,8	3,1	4,5
CAPACITY CM³	16	27	27	32	27		16	16	27	27	27	32
MAX PRESSION BARS	60	60	60	60	60		60	60	60	60	60	60
CYLINDERS	CE30	CE50	CE75	CE1000	MC150	MC150E	MC150R	MC150BR	MC300A-B-C	MC300R	MC150BE	MC300BE
BORE Ø [mm]	28	32	32	40	28		28	28	34	34	28	34
VOLUME CM³	62	90	118	202	88	123	83	83	130	130	83	146
STROKE [mm]	150	150	215	215	200		200	200	200	200	200	200

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