

Hydraulic Steering System For Stern Drive

Manual for Owner, Installer

MS 250S TYPE



SEAFIRST
ENGINEERING

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1. Introduction

On board the boat, correct operation and handling according to this manual is essential at any time to assure the safety and the proper function. Incorrect operation and /or handling without fully understanding the contents of the manual can cause irreparable damage or fatal accident in the worst case. Read this manual carefully to have good understanding on the contents before setting out to sea.

- Read this manual carefully to have good understanding on the contents
- Always bring this manual with you to the boat, and keep it where it is readily available.
- Pay attention that the manual will not be lost or contaminated while not in use.
- In case of resale or transfer of the system, be sure to give this manual to the new owner.
- Please note that the illustration and/or contents of this manual may partly differ from the actual product due to the specification change. Etc.

• Notice to Customers :

Thank you for purchasing Seafirst Hydraulic steering system.

This manual provides the information for correct installation, operation, maintenance and inspection of the system with cautionary remarks. Please read this manual carefully before starting operation to ensure the correct use of the system.

This system is intended for the installation by a person who has basic understanding and skill in the servicing of hydraulic steering system. Without such knowledge and skill, attempted installation could cause failures or mechanical damages to the system. Please have your system installed by your dealer, if you are not a specialized mechanic.

In the course of boat operation, always keep this manual on board where it would not be lost or get wet. If you transfer or resell this hydraulic steering system, be sure to give this manual to the new owner.

• Notice to Dealers :

Please explain the product and address any cautionary remark to the customer. Make sure that this manual and part of it removed during the installation work be handed over to the customers.

Special attention should be paid for the cylinder installation. Notice to the transom limitation and mechanical interference of the cylinder, its linkage in steering and tilting-up operation

2. Instruction Symbols

CAUTION

CAUTION indicates special precautions that must be taken to avoid damages to the outboard engine

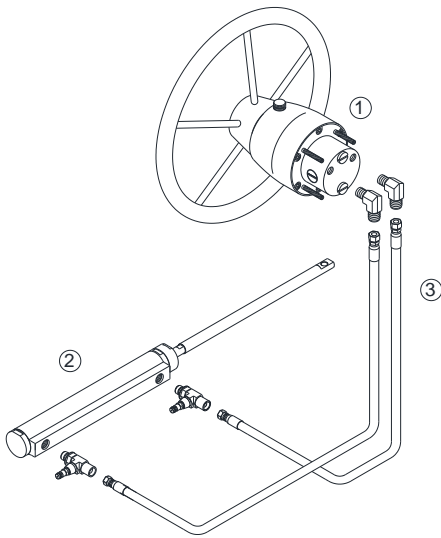
IMPORTANT

IMPORTANT is an importation to proper operation, inspection or maintenance.

Operating Instruction

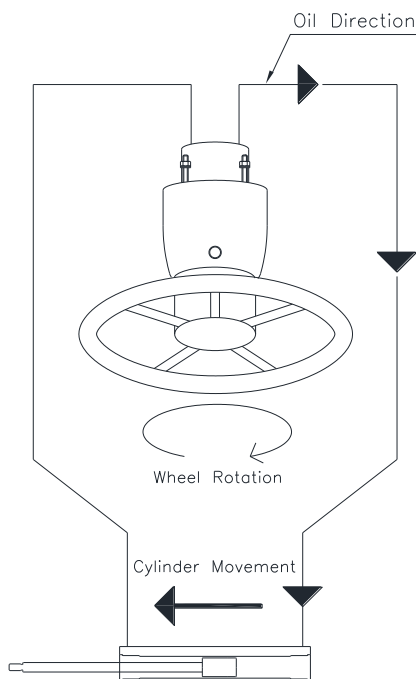
1. Components and its role

Our hydraulic steering system is consist of as table



Component	Description
1. Helm Pump	The piston pump is designed for manual hydraulic steering. It has inbuilt lock valve.
2. CYLINDER	Distinguished largely, it has two type of cylinder SSC 3214U and SSC 3214B. SSC3214U is for Power Assist, and SSC3214B is for Non Power Assist.
3. Hydraulic Hose	It s path for the oil to flow from the helm pump to the cylinder

2. How it works



If Steering wheel is rotated in clock wise, oil is pump out from the port (right port from the front view) into the port of cylinder (Starboard side). This cause the cylinder rod move to the port side, which move the boat to right side (starboard) Oil displaced from the opposite end of the cylinder flows back to the helm pump For steering in the opposite direction, simply turn the helm pump the other way When no course corrections are required, the inbuilt lock valve holds the engine stationary

MAXIMUM OPERATING PRESSURE : 80 BAR
RECOMMENDATIONS FOR THREAD SEALANT IF REQUIRED: LOCTITE 572

1. Packaged system

1-1) MS 250S-U1

Applicable Stern Drive		Remark
Maker	Model	
Mercruiser	Mercruiser 1, Alpha, Bravo 1/2/3,	Power Assist Stern Drive
Volvo	280, 290, DP-S	
BMW	All	
OMC	Cobra, King Cobra	
Yamaha	All	

1-2) MS 250S-B1

Applicable Stern Drive		Remark
Maker	Model	
Mercruiser	Alpha, Bravo 1/2/3,	Non-Power Assist Stern Drive
Volvo	280, 290, Diesel	

1-3) Components included

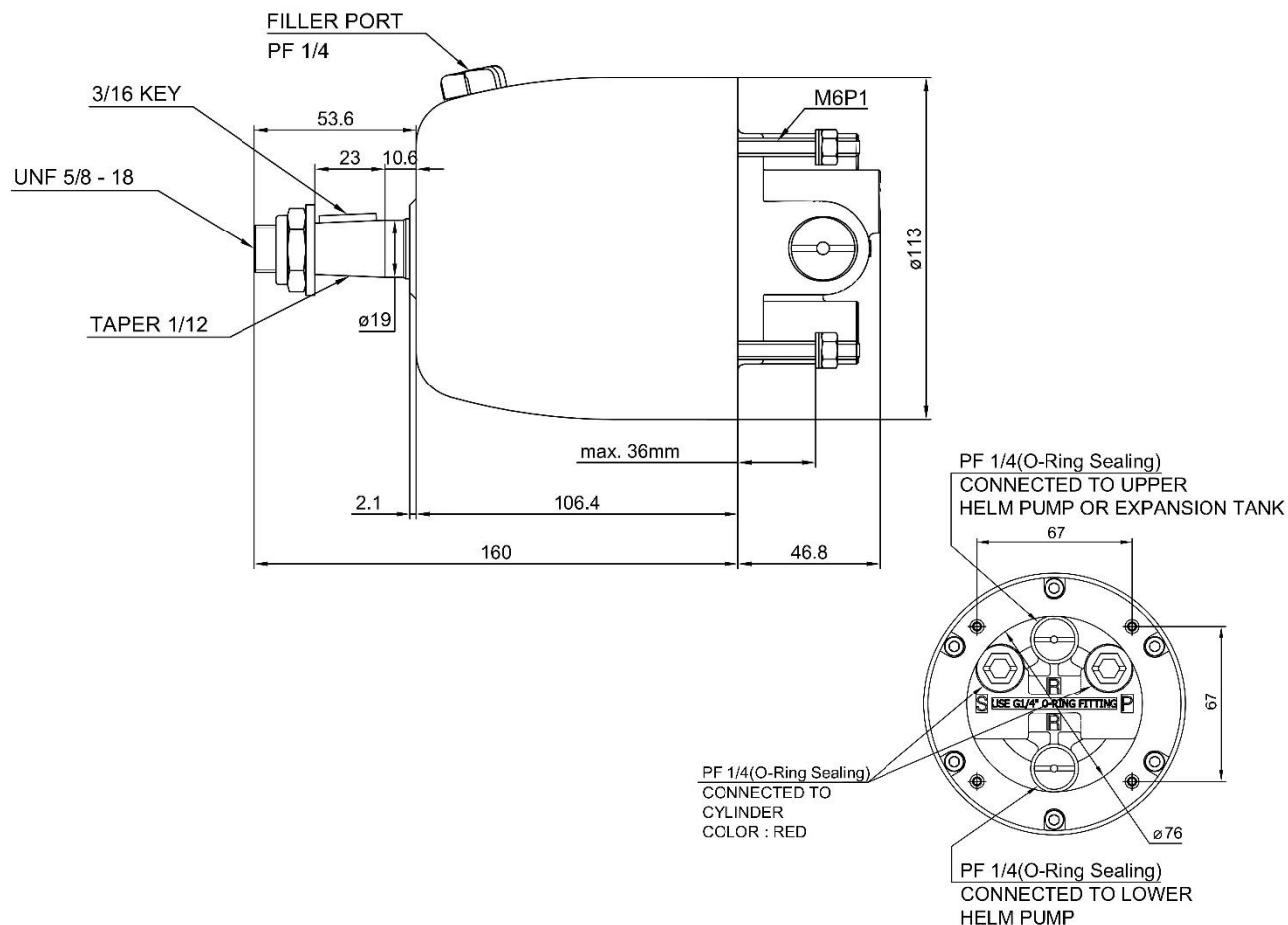
Model	Description
NSH 030 or 025 Helm Pump	Front Mount Helm pump 30cc or 25cc
SOC 3214U1/U2 CYLINDER	Side Mount cylinder. When ordering, specify the engine model.
SF OIL 15 Hydraulic Oil	Hydraulic oil 1 liter x 3 bottles. SAE NO 15.
NH 06-SS-20 Hydraulic Hose	3/8" Hydraulic Hose 20 meter x 1pcs, including two reusable hose couplings
Accessories Included	Helm pump fittings, Helm pump mounting hardware kit, Accessories kit OAK-100 (Bleed tube, Funnel, Oil supply tube)
The Steering Wheel is not included in the package.	

1. HELM PUMP

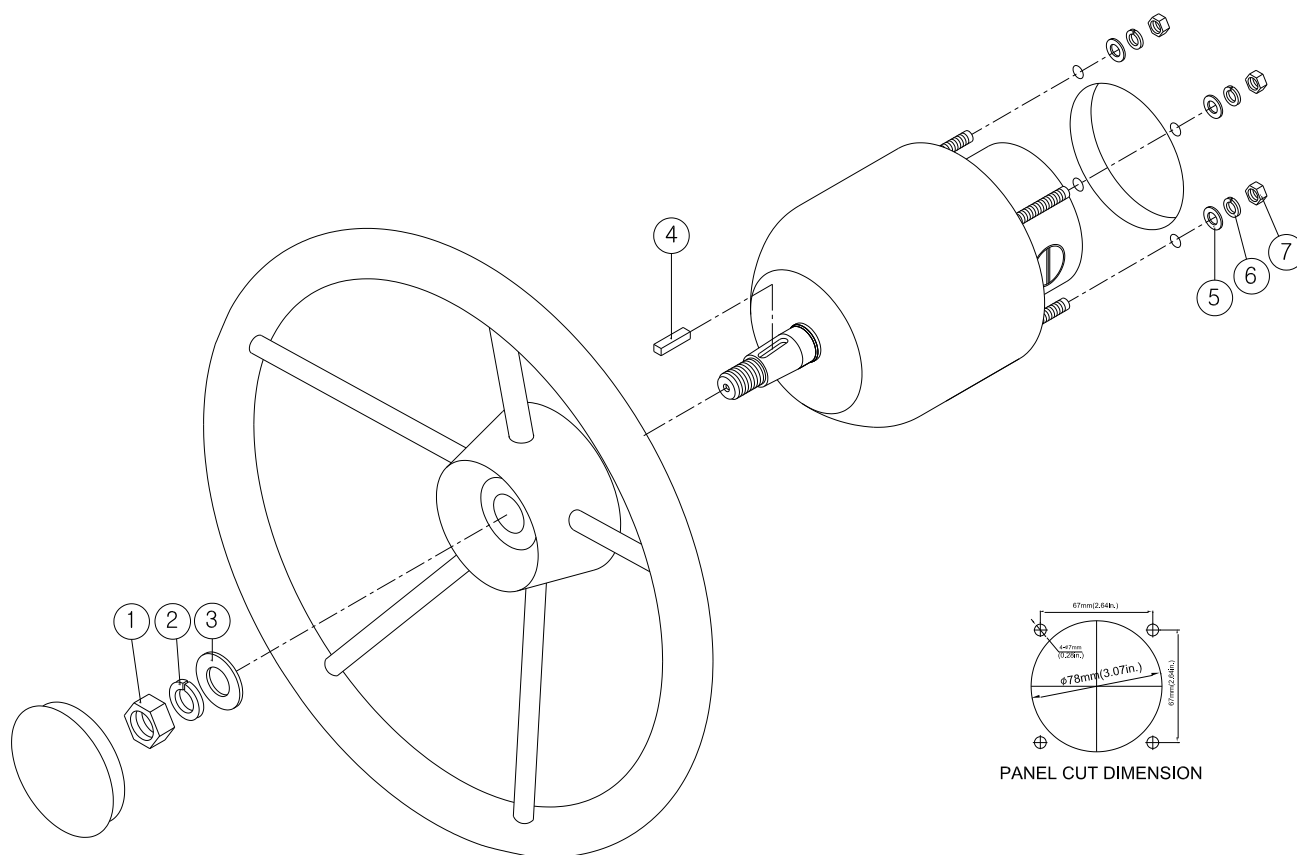
1-1) : SPECIFICATION & FUNCTION

Model	Displacement		Lock valve	Steering Wheel
	cc / rev	cu.in / rev		
NSH 025	25	1.52	Built-in	Min Dia 350mm
NSH 030	30	1.83		Min Dia 350mm

- Maximum durability
- 3 ball bearings supporting the rotar, which make the helm pump be used for heavy duty use.
- SS 304 shaft
- At factory, the two ports on the rear are blocked tightly with black plugs while the two ports are blocked loosely with red plugs for an easy open to connect hydraulic hose fittings.
- Fixed displacement
- Lock Valve Inbuilt
- Mounting Hardware and steering wheel mounting hardware supplied as standard
- Interconnecting ports (black plugs) for dual stations of steering .
- Common dash hole mount for easy replacement with other brand



1-2) MOUNTING THE HELM PUMP IN FRONT



Mounting the helm pump (NSH series)

1. To install the pump, cut a hole of diameter 78mm in the dash board (panel).
2. Mark the location of the four holes by using Template supplied additionally
3. Drill 4 holes with Diameter 7mm.
4. Install the helm pump into the hole and tighten the helm pump with 4 x Nuts and Washers supplied as mounting hardware.

Mounting the wheel

1. Make sure that your steering wheel is suitable for 3/16" straight key and taper on 3/4" shaft.
2. Grease the shaft cone and install the wheel on the shaft with key supplied.
3. Tighten the wheel with M8 screw, Plain Washer and Spring Washer supplied as mounting hardware.

Mounting Hardware Kit

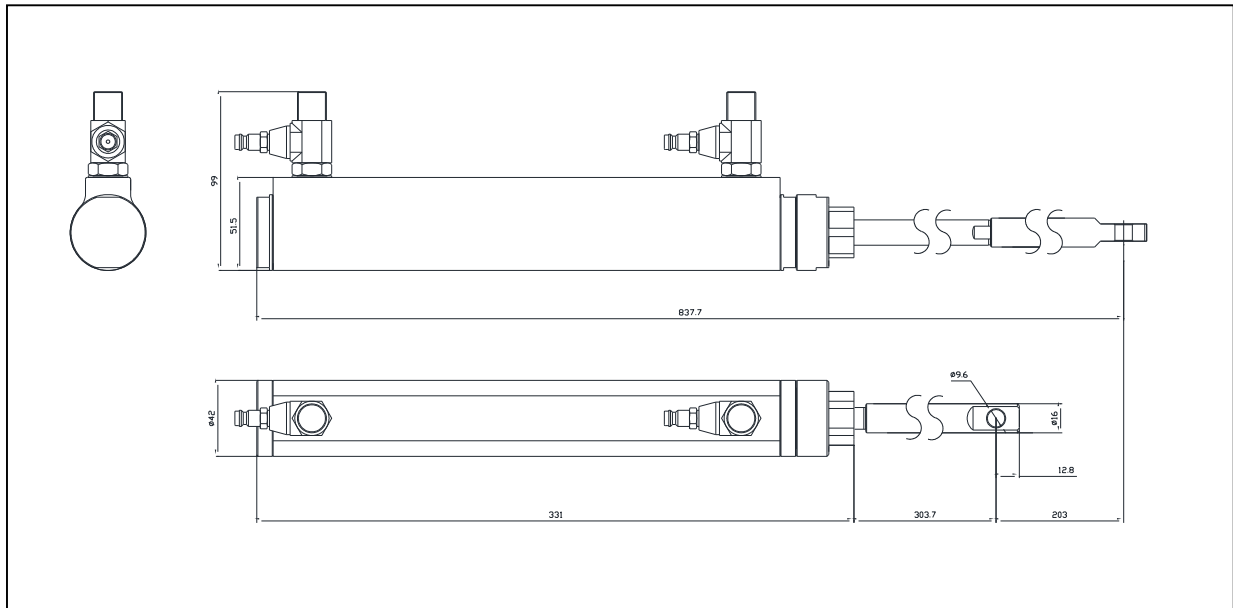
No	Description	Q'ty	No	Description	Q'ty
1	Nut M14	1	5	Plain Washer M6	4
2	Spring Washer M14	1	6	Spring Washer M6	4
3	Plain Washer M14	1	7	Nut M6	4
4	Straight Key 3/16"	1			

2 Cylinder 2-1) Specification

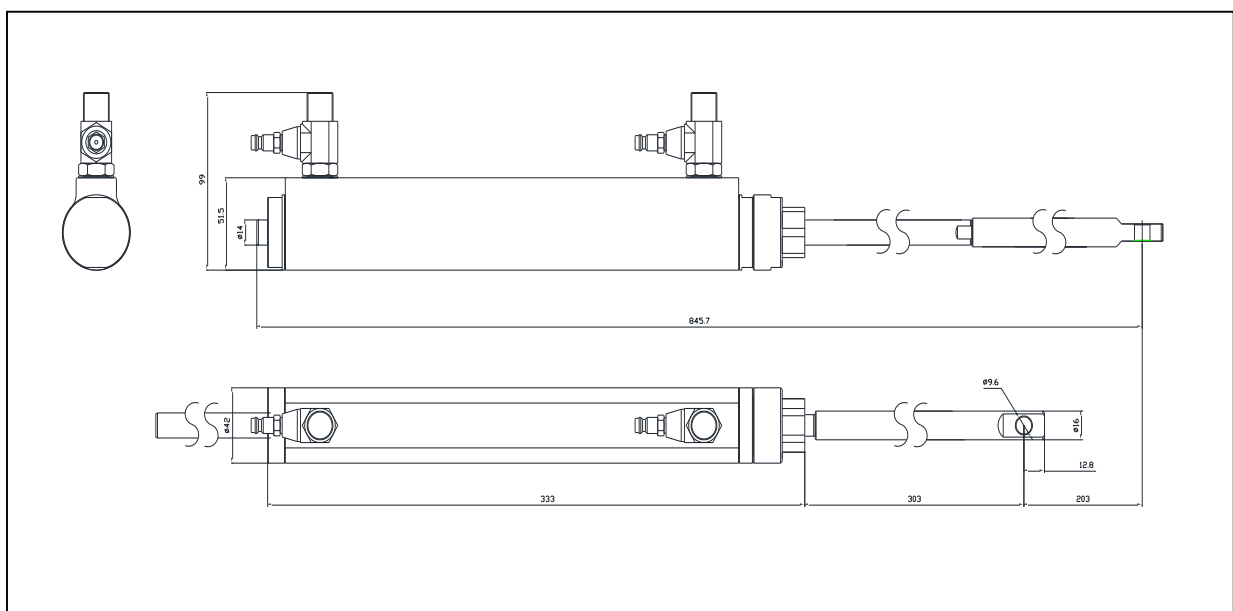
Model	SSC3214U	SSC3214B
Volume	164cc/132cc	132cc
Shaft diameter	14mm	14mm
Bore diameter	32mm	32mm
Stroke	203mm	203mm

- Stainless steel shaft with hard chrome plate
- Aluminum tube with anodizing
- Compact Design for less space installation

2-2) Dimension of Cylinder (SSC3214U)

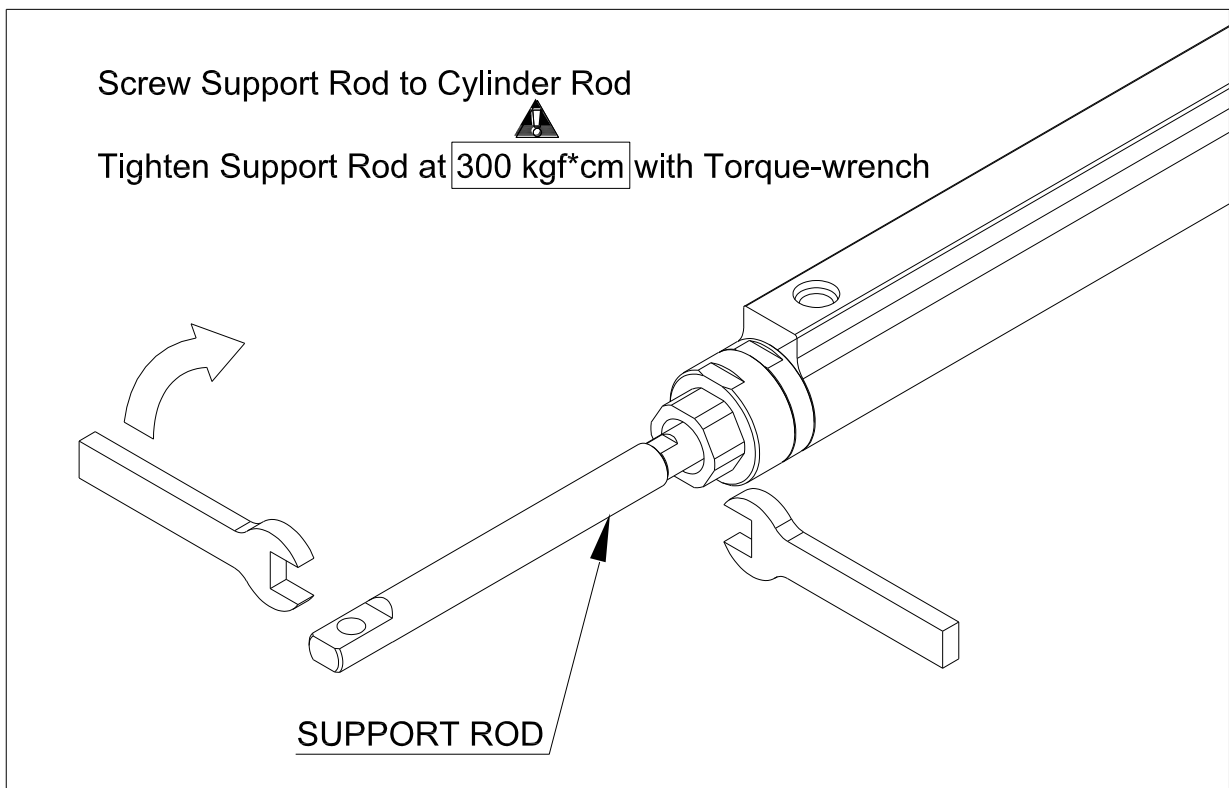
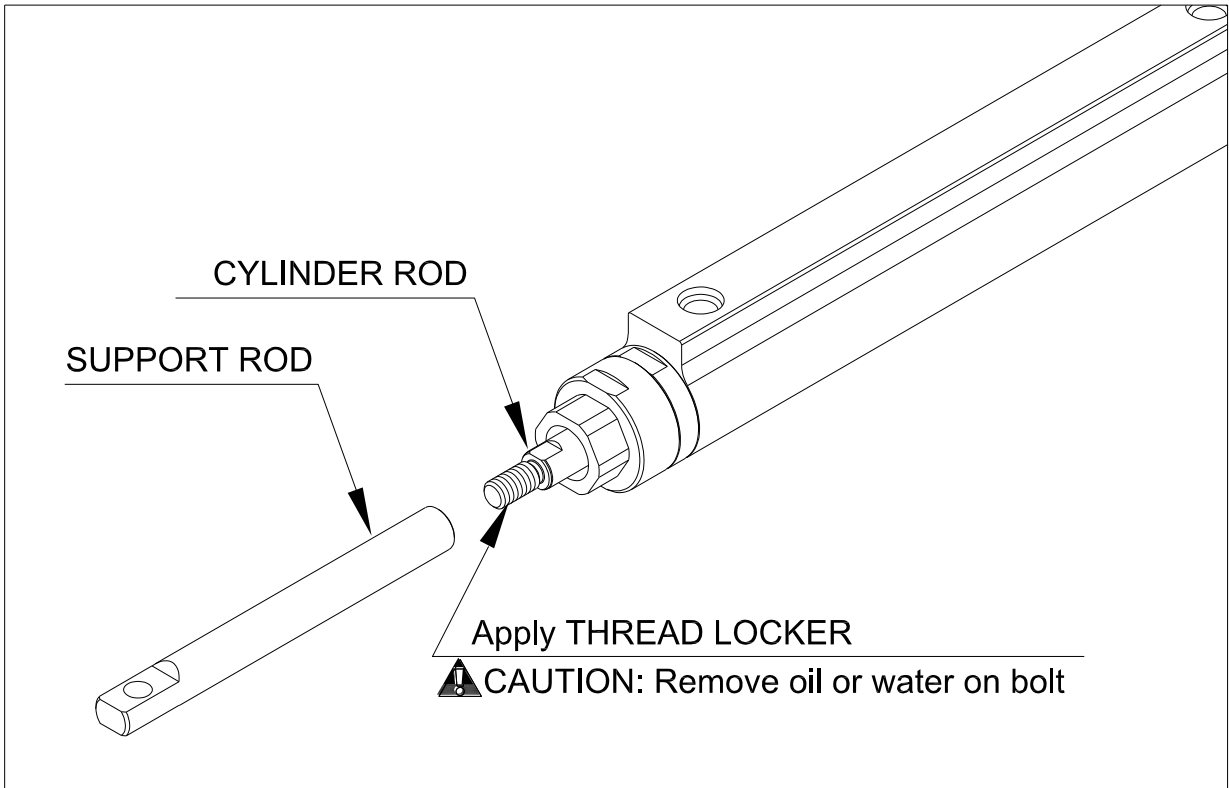


2-3) Dimension of Cylinder (SSC3214B)



2 Cylinder

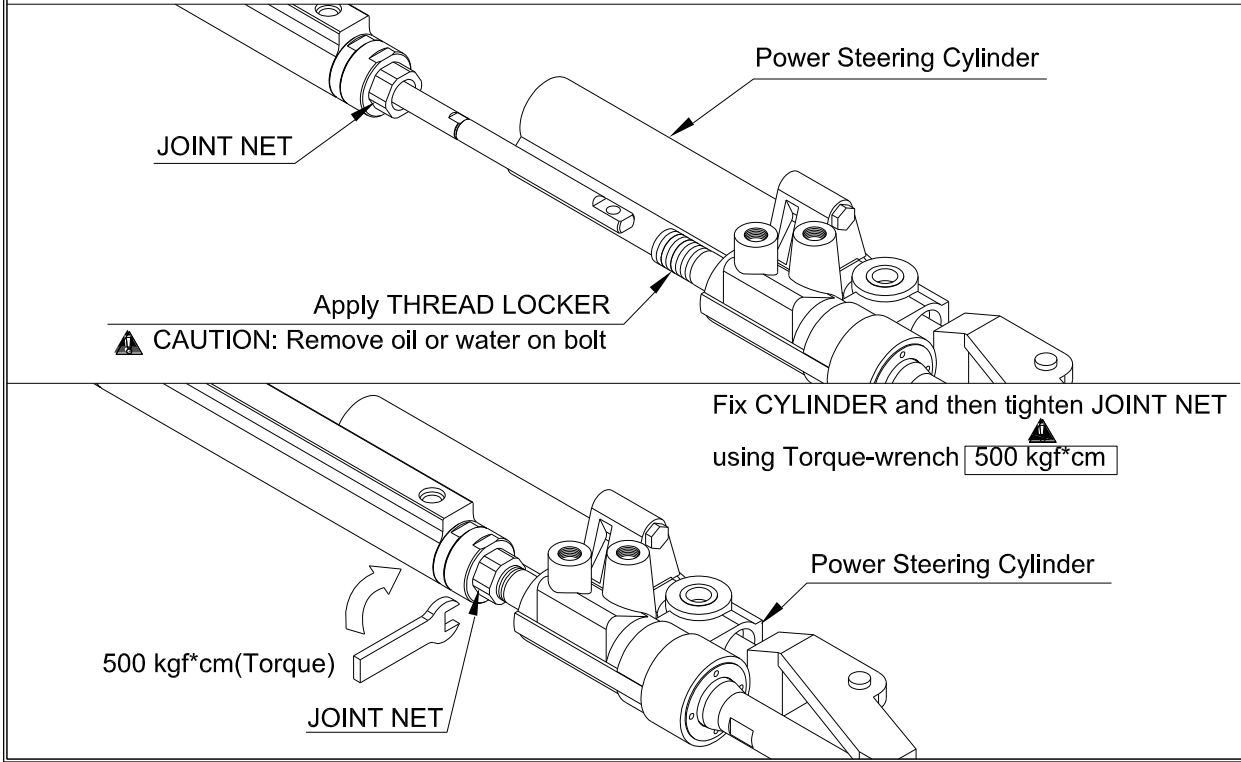
2-4) How to assemble Cylinder Rod and Support Rod



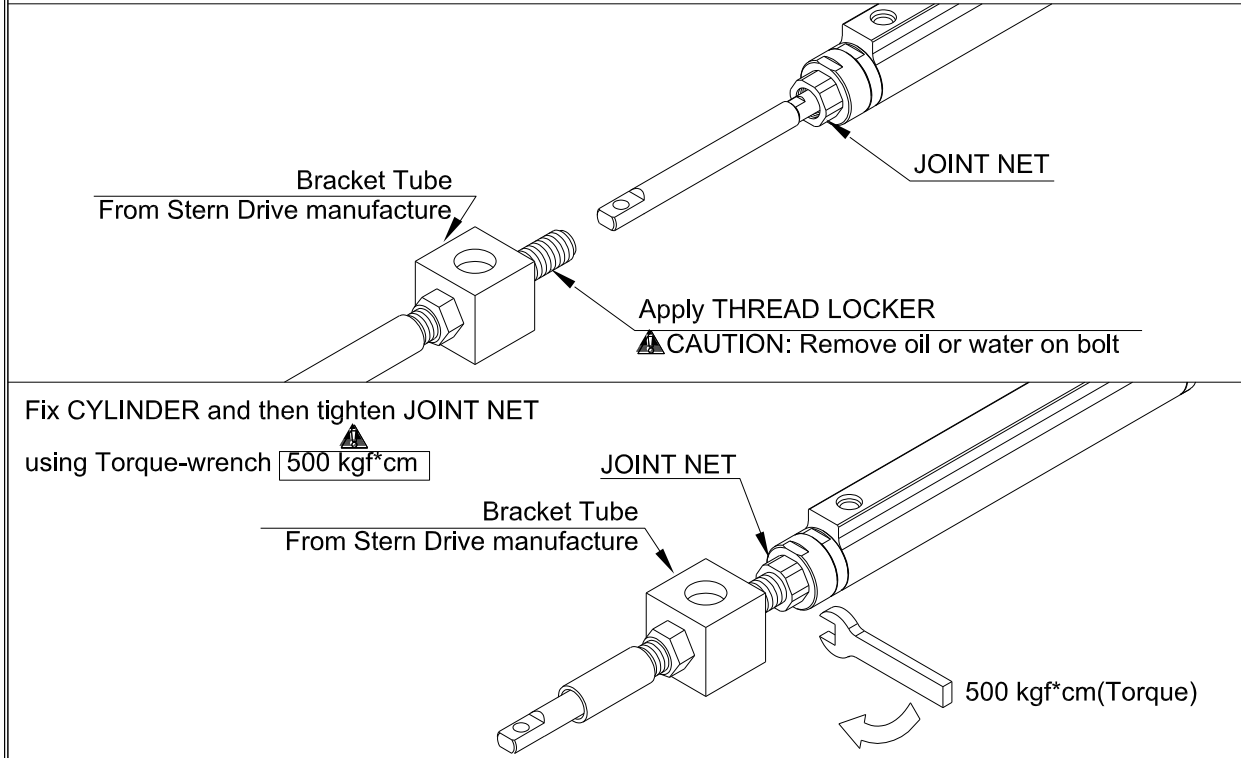
2 Cylinder

2-5) How to assemble cylinder according to power assist and non-power assist

Power Assist



Non-Power Assist



Installation – Hose connection

3. Hose Connection

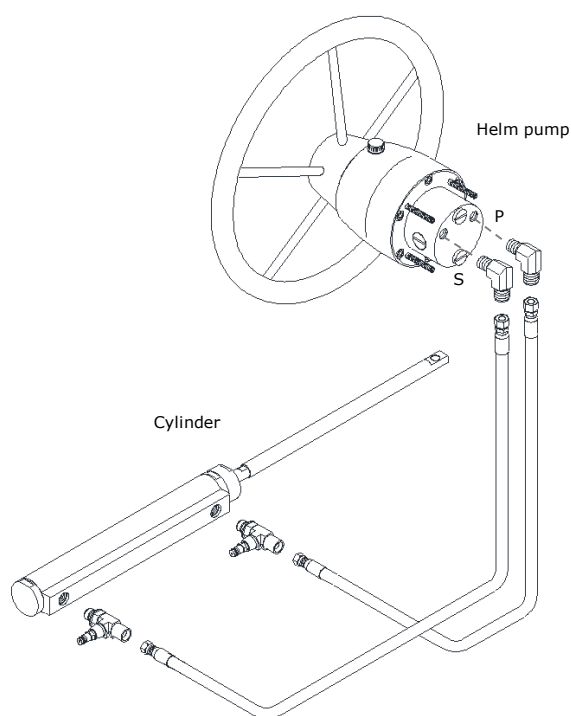
Hydraulic Steering Kit MS250S type has standard hose of 3/8" which has below specification.

- Material : Nylon Core tube with braided synthetic fiber, covered with TPU

Part number	I.D	O.D	Maximum Working Pressure	Minimum burst Pressure	Minimum Bend Radius	Temperature range
	(mm)	(mm)	MPa (kgf/cm ²)	MPa (kgf/cm ²)	(mm)	(°C)
NH06-SS-XX	9.5	14.0	10.5 (107)	42.0 (429)	50	-40~100

* XX indicate the length of the hose.

- 1) Before connect hose, check the distance from helm pump to cylinder. Our standard hose length is 30meter x 1ea, cut the hose in half according to your boat measurement, from helm to cylinder then use the reusable hose coupling enveloped.
- 2) Connect the hose end to the helm pump.
- 3) Connect the other hose end to the cylinder.
- 4) Make sure starboard side of helm port (S engraved) connects to starboard side of cylinder, and port side of helm port (P engraved) connects to port side of cylinder.



⚠ CAUTION




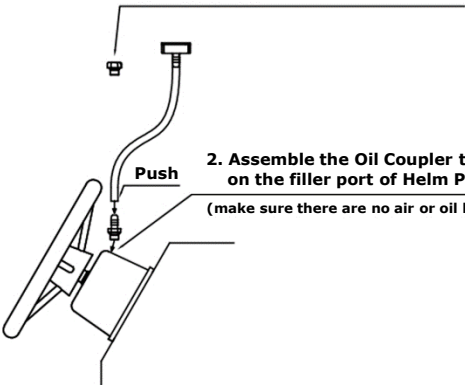
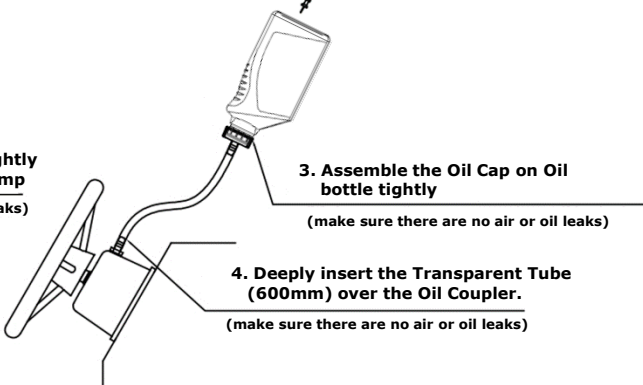
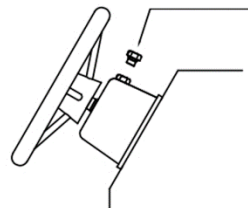
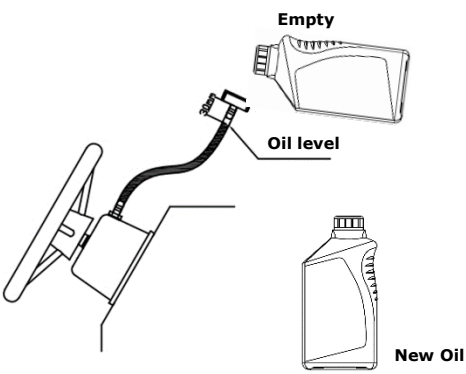
While hose tubing, apply hose cap if possible to prevent any dirt or foreign subject goes into the system. Make sure the hose is not tangled or over-bent and keep away from abrasion, any interference with other equipment.

Installation – Oil Filling and bleeding

4-1. Oil Filling

These instructions show how to fill and purge the manual hydraulic steering system. Incorrect oil supply or incorrect air-vent will cause helm-mans feel heavy of the steering wheel while rotation of the steering wheel and will cause a continuous wheel turn without stopping.

Recommend Hydraulic Fluid : ISO 15.

FILLING & PURGING		
1. Filling & Purging Kit (OAK-300) includes		
1) Oil coupler, Oil cap, Transparent tube (600mm)	2) Transparent Tube (1meter) for bleeding from cylinder	3) Push Pin
		
How to fill and Purge the system		
<p>①</p> <p>1. Remove the oil plug (keep it for reuse) from Helm Pump</p>  <p>2. Assemble the Oil Coupler tightly on the filler port of Helm Pump (make sure there are no air or oil leaks)</p> <p>Push</p>	<p>②</p> <p>3. Assemble the Oil Cap on Oil bottle tightly (make sure there are no air or oil leaks)</p> <p>4. Deeply insert the Transparent Tube (600mm) over the Oil Coupler. (make sure there are no air or oil leaks)</p> <p>5. Make 3-4 holes on bottom of the oil bottle by using Push Pin (see drawing)</p> 	
<p>③</p> <p>6. After completing Filing & Purging, black the Helm Pump with oil plug</p> 	<p>※ CAUTION</p>  <p>Empty</p> <p>Oil level</p> <p>New Oil</p> <p>※ Caution!</p> <p>Do not let oil level fall down to 30mm from oil cap while Exchanging oil bottle.</p>	

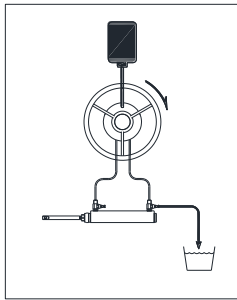
▲ CAUTION

During the filling the oil, turn the steering wheel slowly. If you turn the steering wheel too fast, foam may grow in the oil. In this case you can continue the filling after 24 hours.

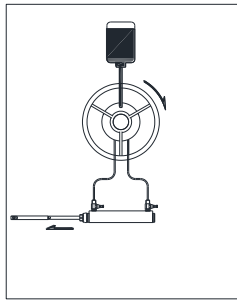
Installation – Oil Filling and bleeding

4-2. Air Bleeding

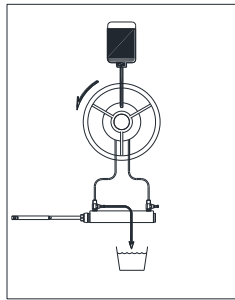
Step 1 : Fill the helm pump full of oil.



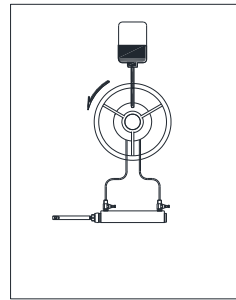
Step 2



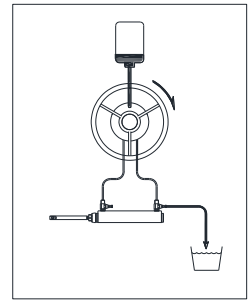
Step 3



Step 4



Step 5



Step 6

Step 3 : Close the right bleeder. Continue to turn steering wheel clockwise until the cylinder rod is fully pulled out. Open the left bleeder

Step 4 : Holding the cylinder rod (to prevent it from moving back)
slowly turn the steering wheel anti-clockwise until a steady stream of air free oil comes out of the left bleeder .
While continuing to turn the wheel, close the left bleeder and let go of the cylinder rod.

Step 5 : Continue turning the steering wheel anti-clockwise until the cylinder tube is fully pushed in.
The steering wheel will come to a stop. Open right bleeder .

Step 6 : Slowly turn the steering wheel clockwise until a steady stream of air free oil comes out of bleeder. While continuing to turn the steering wheel, close the right bleeder.
Now, fill and purge is complete.

CAUTION

During the filling the oil, turn the steering wheel slowly. If you turn the steering wheel too fast, foam may grow in the oil. In this case you can continue the filling after 24 hours.

Installation – Test Procedures

5. Test Procedures

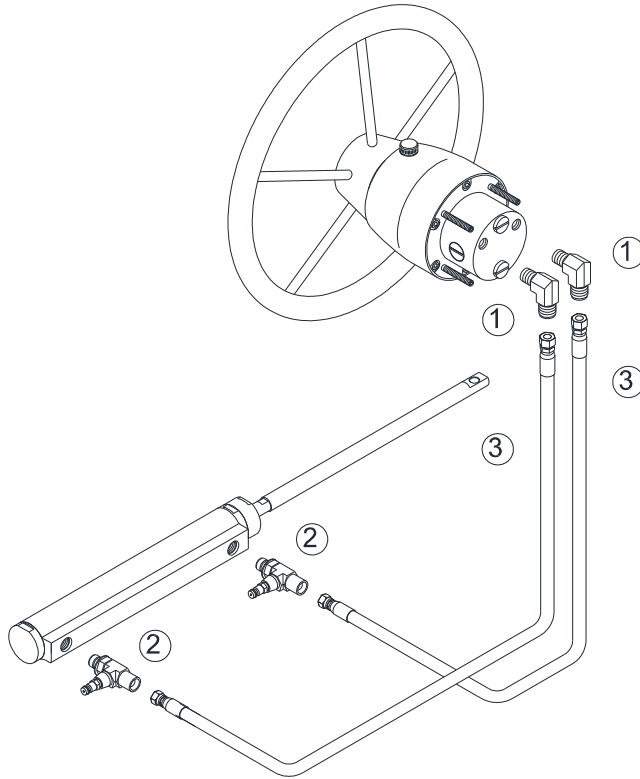
5-1) Test Procedures after Installation

Procedure	Test	Check Point
1. Leakage Test	For the test, apply a pressure on the cylinder, hose and helm pump by rotating steering wheel further at the end of steering.	<ul style="list-style-type: none"> •Helm pump : Two ports which oil come out •Hose : Hose couplings •Cylinder : Two ports which oil come out/in
2. Wheel turn	For the test, rotate steering wheel from left to right and count the wheel turn. Also count the wheel turn from right to left	<p>Ideal wheel turn to achieve with SSC3514U</p> <ul style="list-style-type: none"> •25cc helm pump : 6.5 / 5.3 •30cc helm pump : 5.5 / 4.4 <p>Ideal wheel turn to achieve with SSC3514B</p> <ul style="list-style-type: none"> •25cc helm pump : 5.3 •30cc helm pump : 4.4
3. Hose kinked	For the test, check the entire hose from helm pump to cylinder	
4. Cylinder interface	For the test, rotate steering wheel. Check if any interference of cylinder , hose etc	

System Diagram –Single Engine

1. SINGLE ENGINE

1-1) For single station



Fitting and Hose supply

No	Part Number	Description	Q'TY	Remark
1	HLO14N0	Elbow fitting (PF 1/4 O-ring x PF 3/8)	2	Standard Supply in MS 250U1 / U2 package.
2	C3214118	Elbow fitting-SUS (PF1/4 O-ring x PF 3/8)	2	
3	NH06-SS-30	Hose 30 Meter (PF 3/8 hose coupling)	1	
4	C3520149	Reusable hose coupling	2	

Maintenance

Check Point (Before every use)

- Make sure the hydraulic oil level is in highest Helm pump.
- Check steering response when turning the steering wheel
- Inspect hose and hose coupling to the cylinder and helm pump for leak
- Check binding, loose, or worn components in the system
- Check the cylinder fittings and seals and the helm O-ring for leak

Check Point (Regularly, at least every year)

- Make sure the hydraulic oil level is topped up.
- Check the tightness of all bolts and nuts
- Check steering response when turning the steering wheel
- Inspect Seals, hose, and hose coupling throughout the hydraulic system for leak
- Apply Marine Grease (Where applicable)
- If the Hydraulic oil becomes contaminated, please change the oil

Trouble Shooting

Description of failure	Cause of failure	Corrective action
There is some instability when the steering wheel is turned	Air remain	Repeat the air bleeding procedure
	Low oil level in the helm pump	Add the hydraulic oil
	Oil leak	Repair
Steering is hard to turn	The cylinder is not connected properly to the outboard engine	Check and correct the connecting area on the cylinder
	Interference or breakage of hoses and/or fittings	Check for any sharp bent of the hose, or interference and/or breakage on the hose fittings.
	Application of unauthorized hydraulic oil having higher viscosity	Replace the oil with SEAFIRST OIL or alternatively ISO # 15
	Failure of steering pivot shaft on the outboard engine	Contact your dealer for system inspection
Cylinder does not move in response to the steering wheel operation	Foreign matters stuck between the check valve and the seat in the helm pump	Contact your dealer for the check valve replacement
Cylinder returns to the initial position as the steering wheel stops its operation	Air remains in the system	Repeat the air bleeding procedure
	Foreign matters stuck between the check valve and the seat in the helm pump	Contact your dealer for the check valve replacement

Oil level check

Oil level on helm pump need to be checked every three month and if there is lack of oil, re-fill the oil to the maximum level of helm pump.

- If helm pump is installed horizontally, oil level should be close to the bottom of plug hole.
- If helm pump is installed in 20°, oil level should be within 10mm to the top of plug hole.

Oil Maintenance

Hydraulic oil used in this system requires regular maintenance.

Check the viscosity, cleanliness, air mixing of the oil on a regular basis. We recommend to replace the oil every 100 to 200 hours or a year.

As contaminated oil can cause poor steering performance, cylinder failure, and even lead to a boating accident, make sure to perform oil replacement and bleeding procedures in accordance with the product manual standards.

Oil re-filling and changing

We highly recommend to use Seafirst hydraulic steering oil only. If you are forced to use the oil other then Seafirst, it should meet the grade of SAE 15 or ISO VG 15 requirement.

Color change, clarity, foam generation, etc. of the hydraulic oil are signs of deterioration in the quality of the hydraulic oil and should be replaced immediately if above cases occurs.

In case of oxidation: dark brown or black oil color

Contamination or water infusion: becoming cloudy or opaque

The extracted oil can be re-used if foreign matter or impurities can be filtered through a fine mesh or strainer.

WARNING

Do not use brake fluid. Using unauthorized oil may cause abnormal operation of the hydraulic steering system and may cause irreparable damage.

Cleaning

Hydraulic steering system exterior surfaces should be cleaned after every use of the boat. Clean the system using water and non-abrasive soap on a routine basis.

WARNING

Poor installation and maintenance may result in loss of steering and cause property damage and/or personal injury. Maintenance requirement change according to climate, frequency and the use. Inspections are necessary at least every year and must carry out by specialized marine mechanics. Check the cylinder fittings and the seals and the helm O-rings to prevent leaks. Replacement if necessary. To keep a suitable oil level in the helm pump, fill and bleed the system as described in the manual. Check the hose and entire system wear, the nut and bolt tightening every six months and make sure that they are not damaged.

MEMO

MEMO



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