Hydraulic Steering System
For Outboard Engine

Manual for Owner, Installer

MO 350H TYPE

CE

SEAFIRST ENGINEERING

Seafirst Engineering Co
137, Tekeunobaelli-ro, Jillye-myeon,
Gimhae-si, Gyeongsangnam-do, Korea
Tel : 82 55 338 1640 Fax : 82 55 338 1641
http://www.seafirst.co.kr
Manual Version : SCSM-350H-Ver.1

CONTENTS

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 Outboard 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

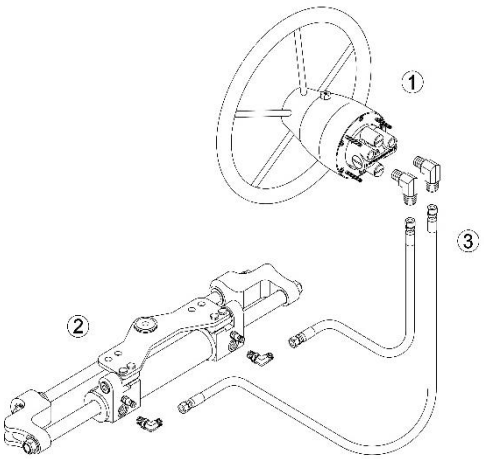
CAUTION

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.

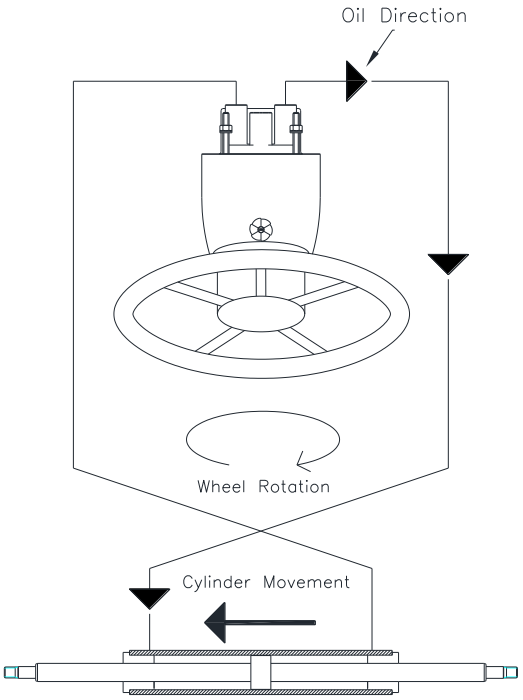
1. Components and its role



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	SOC3520H type is universal installation.
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 (port side).

This cause the cylinder tube 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 outboard engine stationary.

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

1. Packaged system

1-1) MO 350H type : Complete system for single engine

System Model	Description	Remark
MO 350H - R1	Yamaha 4stroke : From 75hp to 350hp Yamaha 2stroke : 50hp, 60hp and From 100hp to 250hp Suzuki 4stroke : From 70hp to 300hp Honda 4stroke : From BF 50to BF 250 except old BF115A / old BF130A Mercury 50hp to 250hp except old 4 stroke 75hp and 115hp Tohatsu : M120, M140 Evinrude : From 65hp to 300hp	SOC 3520H-R1

350HP APPLICABLE

MO 350H type package

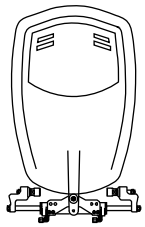
Cylinder based on SOC 3520H type

1-2) Components of MO 350H

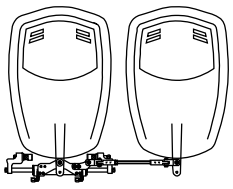
Model	Description	Page
NSH Helm Pump	Front Mount Helm pump	8
SOC 3520 CYLINDER	Front Mount Outboard cylinder. When ordering, specify the engine model.	10
SF OIL 15 Hydraulic Oil	Hydraulic oil 1 liter x 2 bottles. SAE NO 15.	-
NH 06-SS-07 Hydraulic Hose	3/8” Hydraulic Hose 7 meter x 2pcs	
Accessories included	Helm pump fittings, Helm pump mounting hardware kit, Accessories kit OAK-300 (Bleed tube, Funnel, Oil supply tube)	-
The Steering Wheel is not included in the package.		-

2. General Order Guide

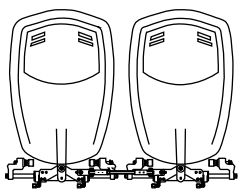
2-1) MO 350H - Single engine, Single Cylinder

System	Application	Wheel Turns	Components	Model	Q'ty	Remark
	Up to 350HP	5.3	Cylinder Helm Pump Hose Oil Accessories kit	SOC 3520 NSH 025 NH 06-SS-07 SF OIL 15 OAK-300	1 1 2 2 1	MO 350H Package kit
For a second station, add below : Refer to Dual Station Kit. Page 24						

2-2) MO 350HT1 - Twin engine, Single Cylinder

System	Application	Wheel Turns	Components	Model	Q'ty	Remark
	Up to 600HP (counter rotating engine) Up to 450HP (non-counter rotating engine)	5.3	Cylinder Helm Pump Hose Oil Accessories kit Tie Bar	SOC 3520 NSH 025 NH 06-SS-07 SF OIL 15 OAK-300 TBK 800S	1 1 2 2 1 1	MO 350HT1 package kit
For a second station, add below : Refer to Dual Station Kit. Page 24						

2-3) MO 350HT2 - Twin engine, Two Cylinder

System	Application	Wheel Turns	Components	Model	Q'ty	Remark
	Up to 700HP (counter rotating engine) Up to 600HP (non-counter rotating engine)	10.6	Cylinder Helm Pump Hose Hose T fitting Oil Accessories kit Tie Bar	SOC 3520 NSH 025 NH 06-SS-07 NH 06-SS-01 HTO14NNS SF OIL 15 OAK-300 TBK 800T	2 1 2 2 2 2 1 1	MO 350HT2 package kit
For a second station, add below : Refer to Dual Station Kit. Page 24						

3. Single Engine Application Guide (Cylinder)

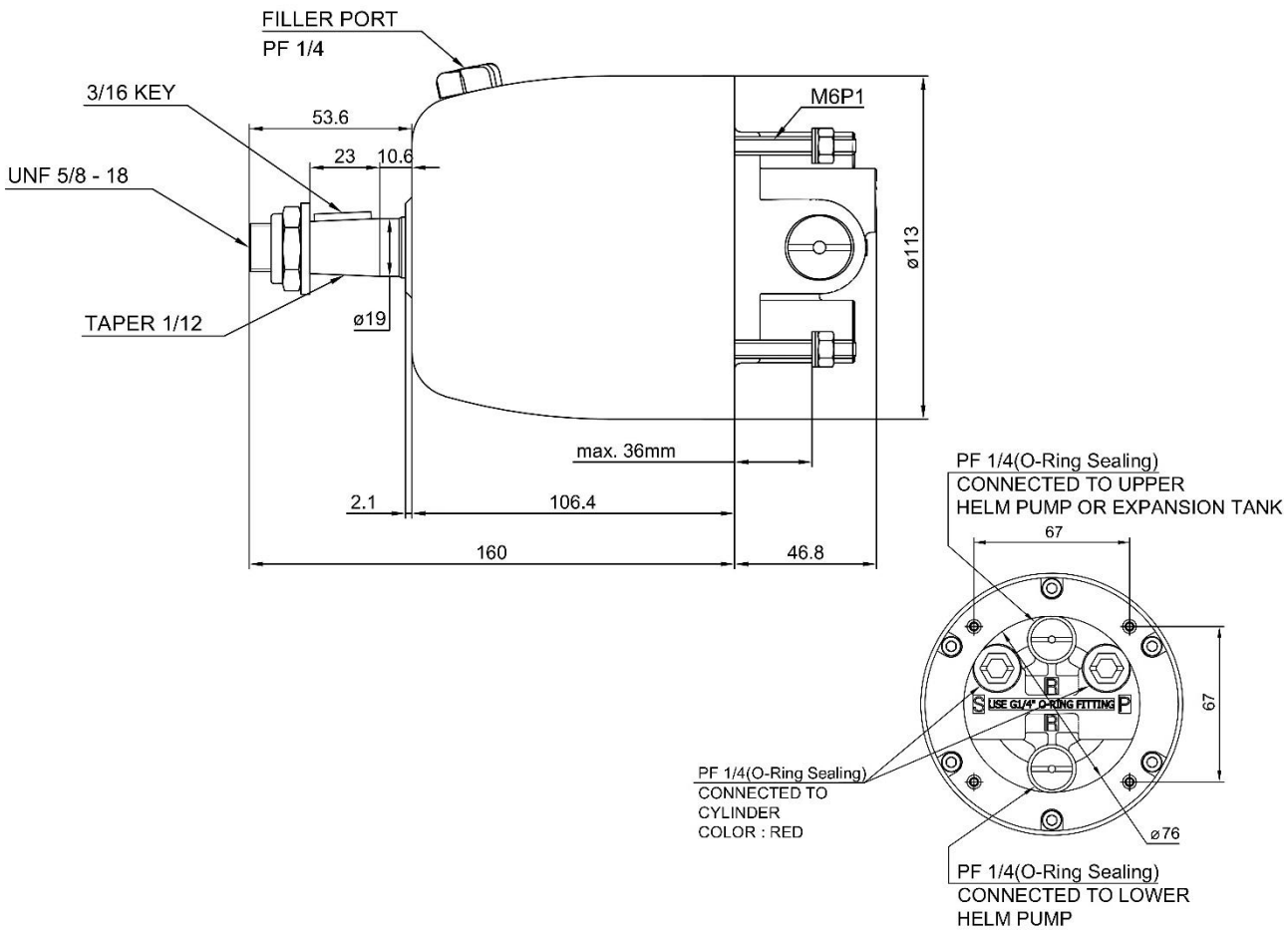
ENGINE MANUFACTURER	MODEL	CYLINDER
YAMAHA	F75, 90, 100	SOC 3520H-R1
	F115A / FL115A	
	F150A ~ F300A	
	115~250HP – 2stroke	
SUZUKI	DF70 / 80 /90	SOC 3520H-R1
	DF 100 / 115	
	DF140	
	DF150 / DF 175	
	DF200 / 225	
	DF250 / DF 300	
MERCURY / MARINER	75-250HP – 2STROKE	SOC 3520H-R1
	50HP ~115HP- 4STROKE	
	150HP – 4 STROKE	
HONDA	BF75D	SOC 3520H-R1
	BF90D	
	BF115D	
	BF135A	
	BF150A	
	BF175A	
	BF200A	
	BF225A	
	BF250A	
EVINUDE	E 75 / E 90 INLINE	SOC 3520H-R1
	E 115 V4 / E 115 V4 HO	
	E 130 V4	
	E 150 V6 / E 150 V6 HO	
	E 175 V6	
	E 200 V6 / E 200 V6 HO	
	E 225 V6 / E 225 V6 HO	
	E 250 V6 / E 250 V6 HO	
TOHATSU	M 120 – 2Stroke	SOC 3520H-R1
	M 140 – 2Stroke	

1. HELM PUMP

1-1) : SPECIFICATION & FUNCTION

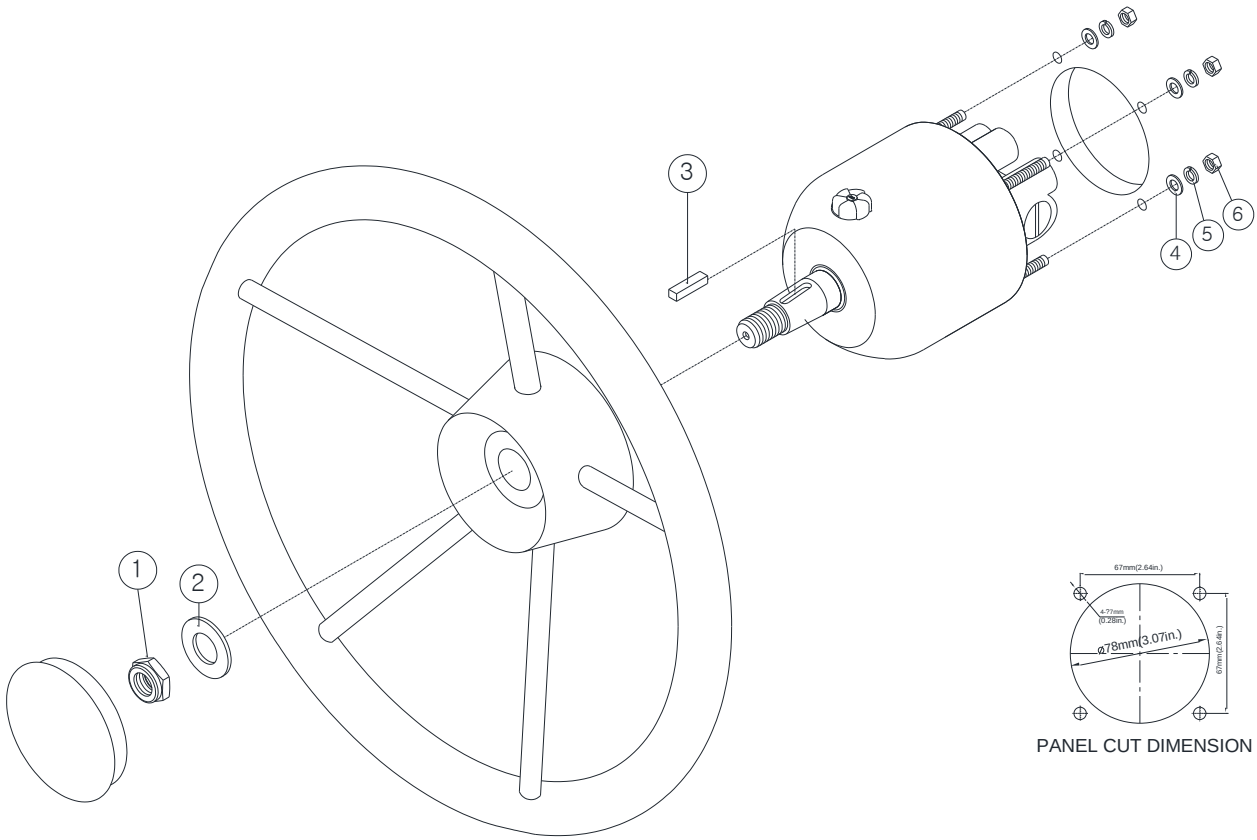
Model	Displacement		Lock valve	Steering Wheel
	cc / rev	cu.in / rev		
NSH 018	18	1.09	Built-in	Min Dia 260mm
NSH 022	22	1.34		Min Dia 350mm
NSH 025	25	1.52		Min Dia 350mm
NSH 030	30	1.83		Min Dia 350mm
NSH 037	37	2.26		Min Dia 395mm
NSH 044	44	2.68		Min Dia 395mm

- 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



SEAFIRST ENGINEERING

1-2) MOUNTING THE HELM PUMP IN FRONT



PANEL CUT DIMENSION

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 ¾" shaft.
2.Grease the shaft cone and install the wheel on the shaft with key supplied.
3.Tighten the wheel with UNF 5/8-18 Nylon Nut and Plain Washer supplied as mounting hardware.

Mounting Hardware Kit

No	Description	Q'ty	No	Description	Q'ty
1	UNF 5/8-18 Nylon Nut	1	4	Plain Washer M6	4
2	Plain Washer	1	5	Spring Washer M6	4
3	Straight Key 3/16"	1	6	Nut M6	4

2 Cylinder

2-1) Specification

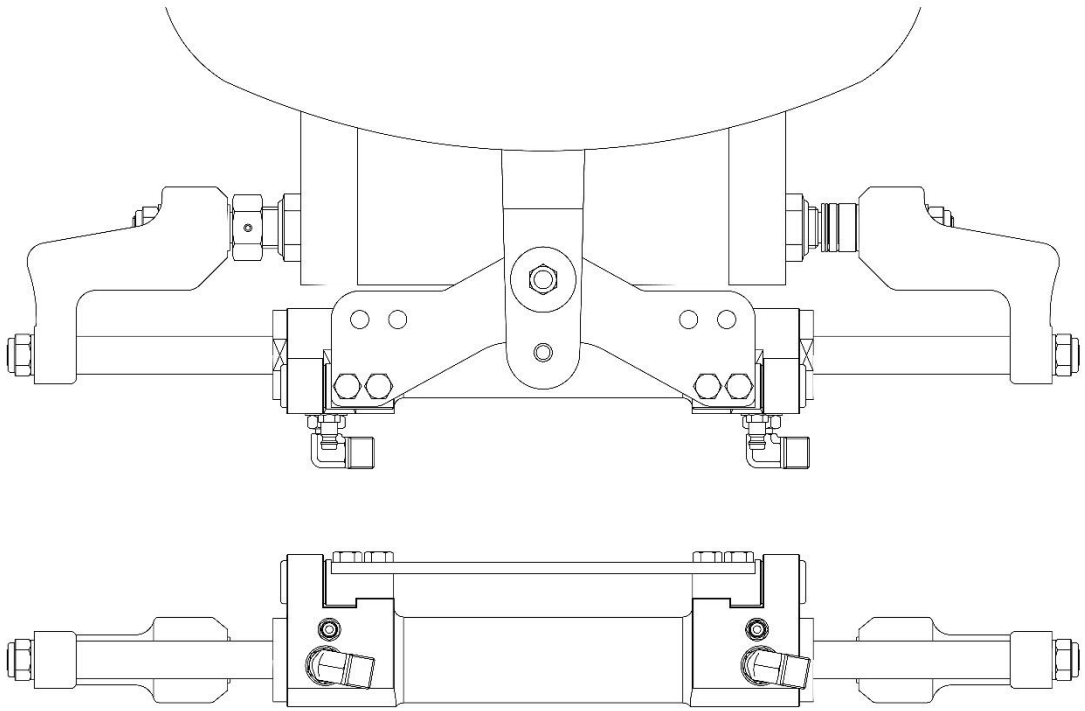
Basic Model : SOC 3520H	
Volume	132cc
Output force	454kg
Shaft diameter	20mm
Bore diameter	35mm
Stroke	203mm

- Stainless steel shaft with hard chrome plate
- Aluminum tube with anodizing
- Aluminum arms with anodizing
- Stainless steel lock nuts
- Compact Design for less space installation
- Install for single and multi engines
- Balanced cylinder : The number of turns lock to lock is equal port to starboard

CAUTION

Never damage the cylinder rod.
Oil will leak through the rod seals.

SOC 3520H type

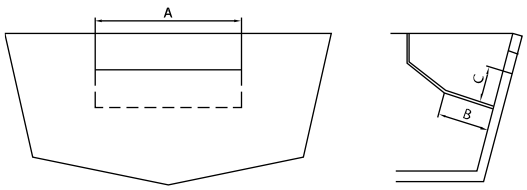


2-2) Application to Engine horse power

No of Cylinder	Outboard Motor Installation	Max Allowable hp
1	Single (1)	Application up to 350hp
1	Twin (2)	non-counter rotating application up to 450hp Counter rotating engines applications up to 600hp
2	Twin (2)	non-counter rotating application up to 600hp Counter rotating engine application up to 700hp

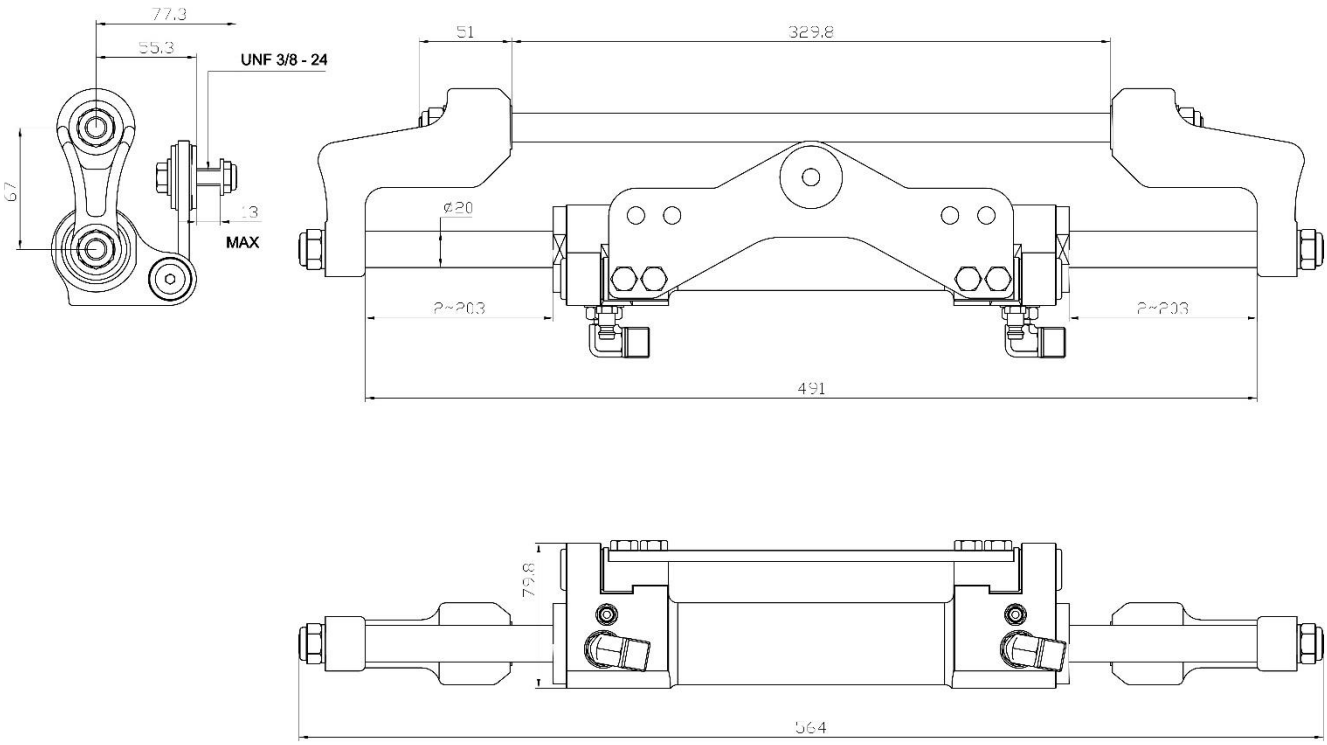
2-3) Splashwell Dimension Requirements

No of Engine	A	B	C	Min. engine center distance
1	570mm	152mm	127mm	N/A
2	1180mm	152mm	127mm	660mm



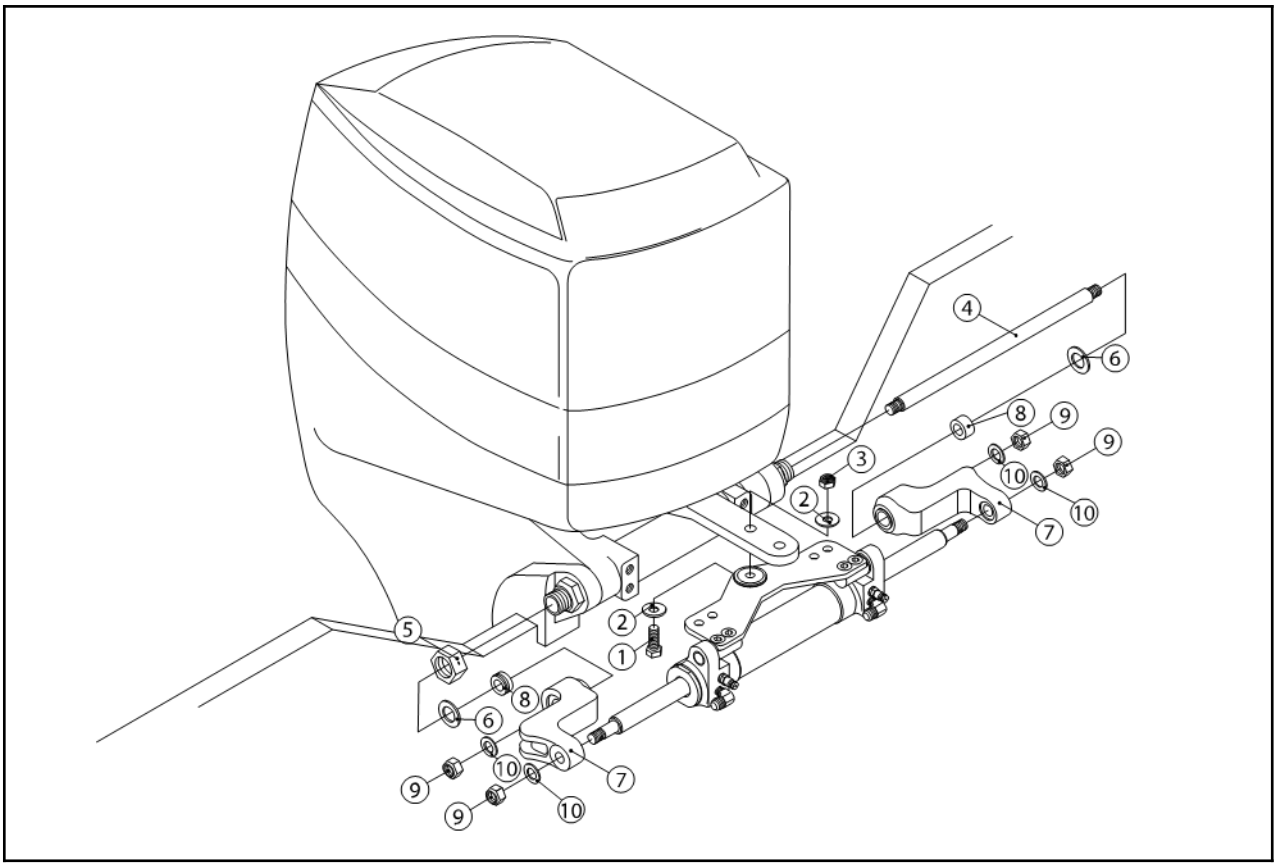
2-4) Dimension of Cylinder

SOC 3520H type



2-5) Install cylinder to engine

Cylinder model : SOC 3520H – R1

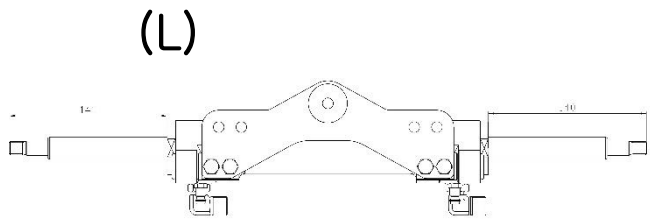


No	Part Number	Q' TY	Description
①	B30824038S	1	Bolt
②	PW1018020S	2	Plain washer
③	NY030824014SS	1	Nylock Nut
④	C3520137	1	Support rod
⑤	C3520139	1	ADJ. nut
⑥	PW1625025S	2	1.5T Plain washer
⑦	C3520153	2	Arm
⑧	C3520123-H	2	Space ring kit
⑨	NY12150019S	4	Nylock Nut
⑩	PW1224020S	4	Plain Washer

2-5) Install cylinder to engine

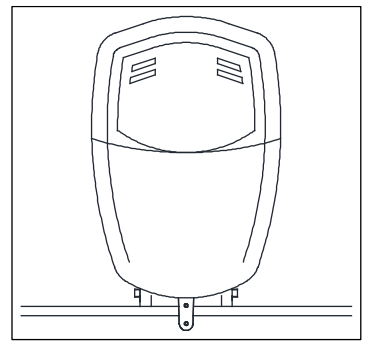
SOC 3520H – R1 CYLINDER

1. After removing the protective caps of the fittings, manually center the rod of the cylinder body.
For the center, "(L)" length should be 140mm.

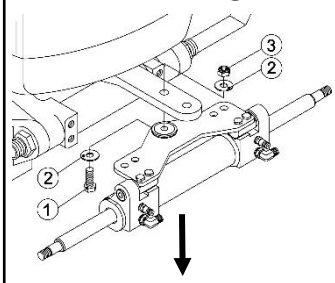


❗ CAUTION
During this process an oil leak from the fittings can occur. This oil must not be discharged into the sea in any case.

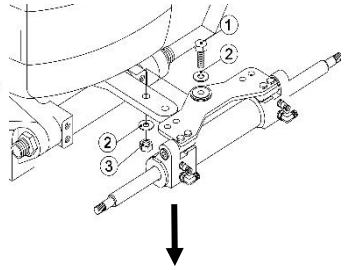
2. Position the engine straight so that its arm is perpendicular to the transom.



3. Connect the cylinder plate to the engine steering arm by means of the bolt ①. and tighten this bolt with a torque 25[Nm] after insert the washer ②. Thread on the Lock nut③ and tighten it with torque 15[Nm] after insert the washer ②.

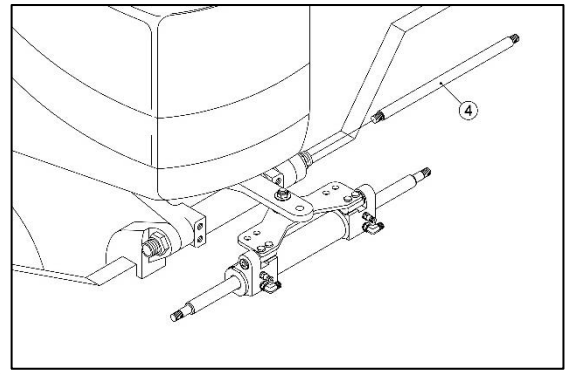


For YAMAHA, SUZUKI, TOHATSU, ETC



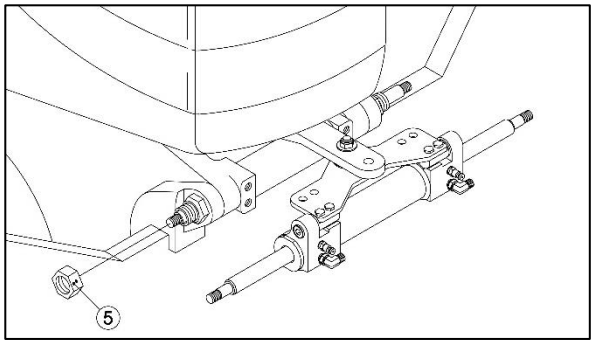
For HONDA, MERCURY, YAMAHA 115BEF, 130BEF

4. Insert the support rod ④ into the tilt tube.

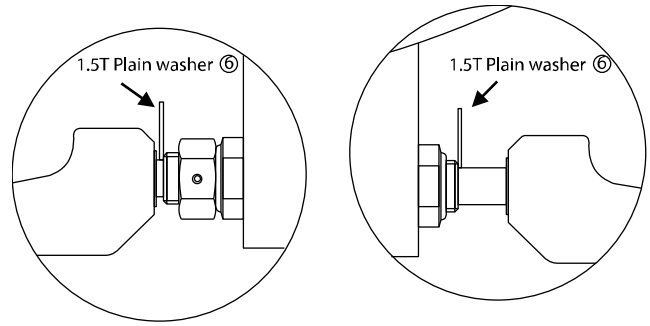


❗ Grease the support rod ④, by using marine grease to prevent the corrosion of the metal parts.

5. Insert the ADJ nut ⑤ to the left part of the tilt tube. And then screw it until it comes into contact with the stop nut.



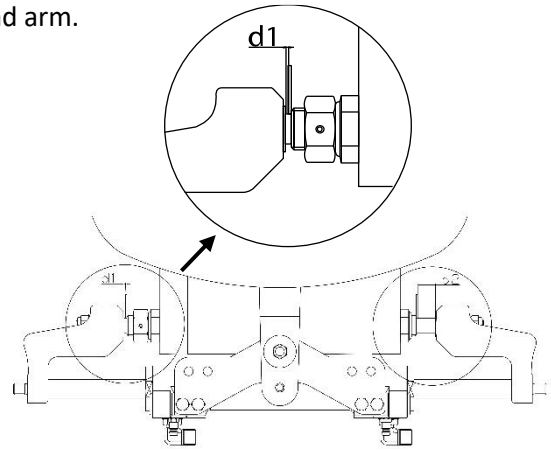
6. Insert the right and left arm. Then, position the 1.5T plain washer ⑥ between tilt tube end and arm as shown in the picture.



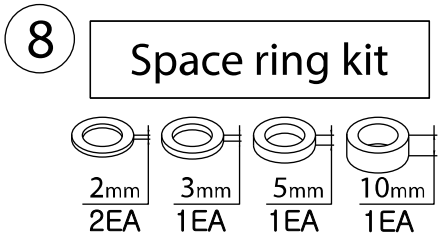
2-5) Install cylinder to engine

SOC 3520H – R1 CYLINDER

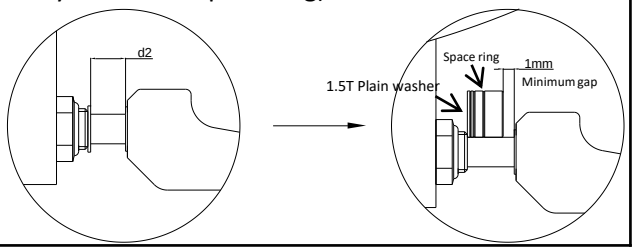
7. Measure the gap (d1) between 1.5T plain washer and arm.



8. If the gap(d1) is less than 1mm, do not use any space ring.
However, if it is more than 1mm, using the proper space ring ⑧ to fill up the gap.



9. Measure the gap(d2) between 1.5T plain washer to arm and choose the proper space rings to fill the gap. Leave 1mm as maximum gap after choosing proper space rings to make engine tilting easy.
(Refer to the ' Example '. That will be useful formula when you choose space ring)



◆Example

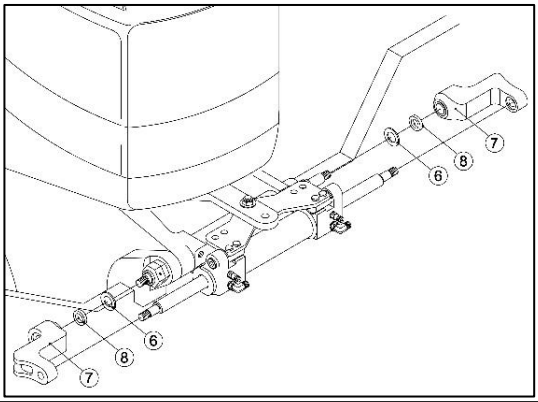
d2 = 21mm (Normal measurement)
- 1mm (Minimum space)

20mm

(You may need 2T+3T+5T+10T Space ring = 20mm)

10. Once the correct space ring have been chosen for d1 and d2, remove the arm.

11. Insert the 1.5T plain washer⑥ and correct space ring ⑧. Then, Insert the right and left arm as shown in the picture.

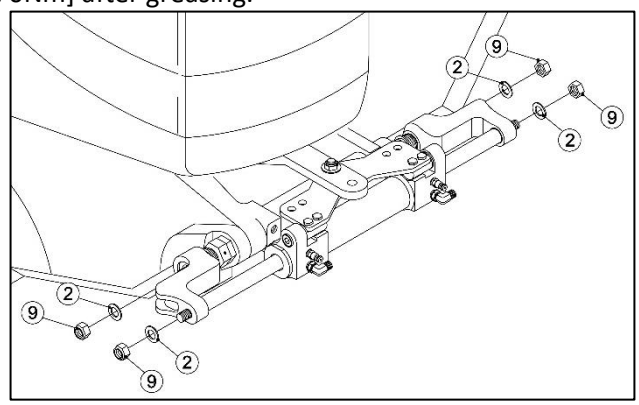


2-5) Install cylinder to engine

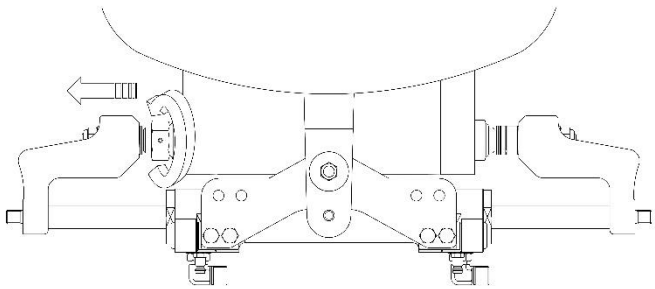
SOC 3520H – R1 CYLINDER

◆ NOTICE
Both the 1.5T stainless washer must be positioned towards the tilt tube on the opposite side of the arm to avoid their wear during engine lifting and lowering.

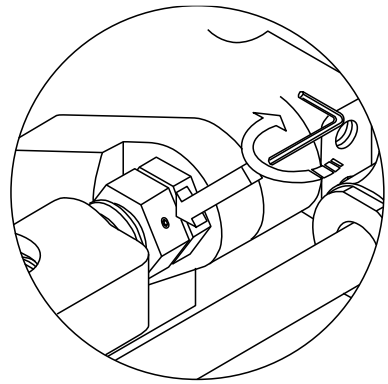
12. Insert the washers ②on the ends of the support rod and cylinder rod. and tighten the nuts ⑨ with a torque [70Nm] after greasing.



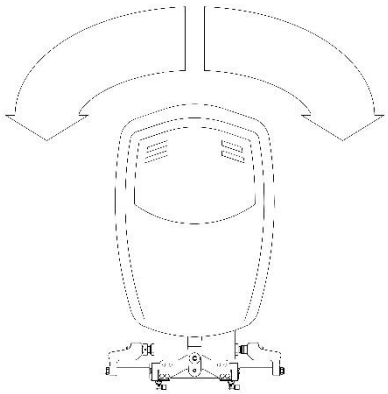
13. Screw the ADJ nut to the left side and bring it into contact with the 1.5T plain washer, until clearance is eliminated.



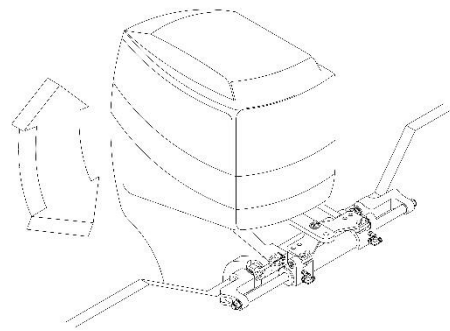
14. Tighten the set screw on ADJ nut with a 2mm allen key(hex key).



15. Check the correct cylinder installation by moving manually the engine on the right and on the left. The rotation must be as symmetric as possible so that the steering angle is the same on both sides.



16. Check again in the correct engine movement during the tilting.



◆WARNING
In case of the any contact with the transom, stop the installation and contact the specialized staff.

3. Test Procedures

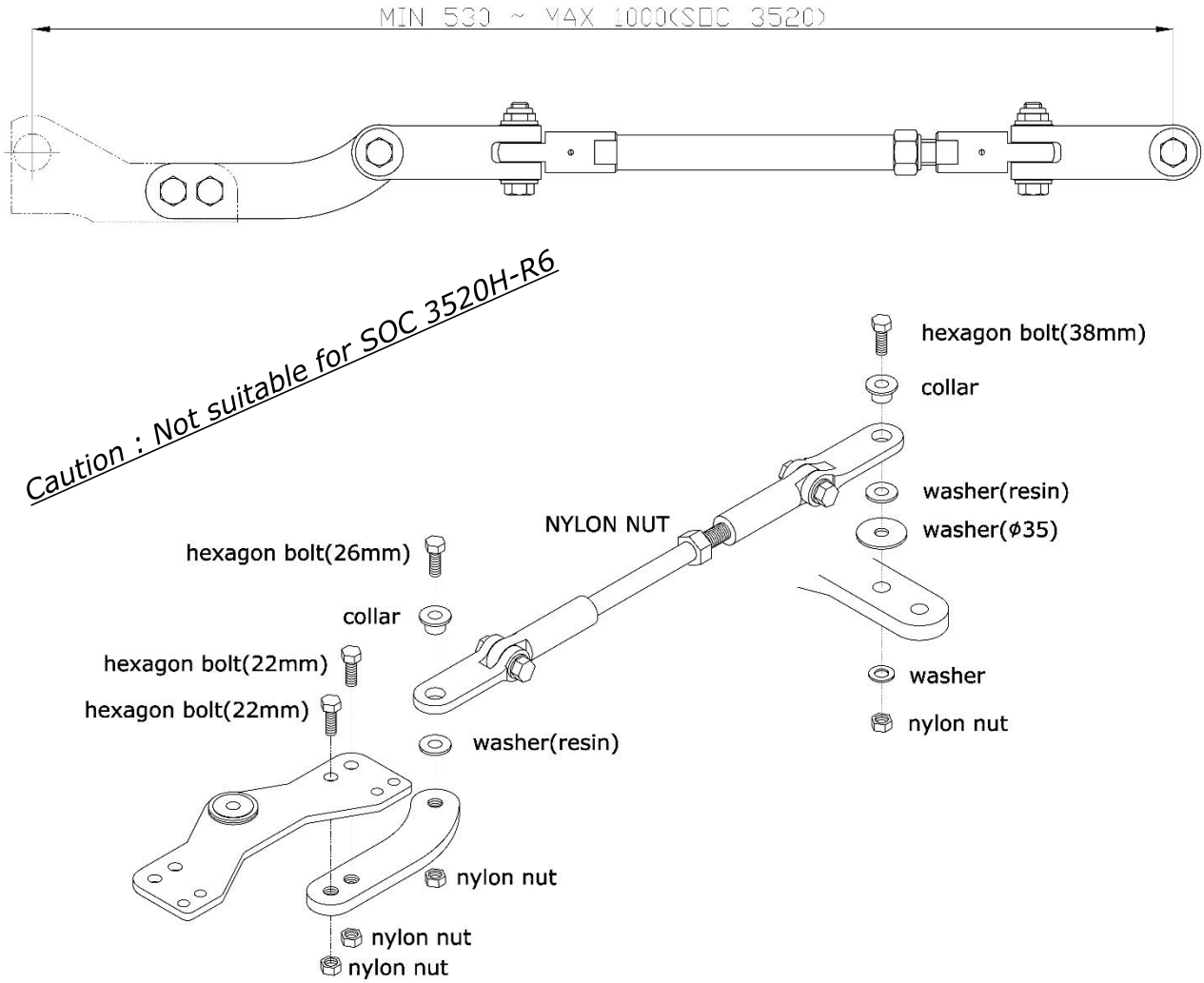
3-1) Test Procedures after Installation

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.	•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	Ideal wheel turn to achieve •18cc helm pump with SOC3520 cylinder : 7.3 •22cc helm pump with SOC3520 cylinder : 6 •25cc helm pump with SOC3520 cylinder : 5.3 •30cc helm pump with SOC3520 cylinder : 4.4 •37cc helm pump with SOC3520 cylinder : 3.6 •44cc helm pump with SOC3520 cylinder : 3
3. Hose kinked	For the test, check the entire hose from helm pump to cylinder	
4. Cylinder interface	For the test, tilt up the engine fully. Check if any interference of cylinder , hose etc	

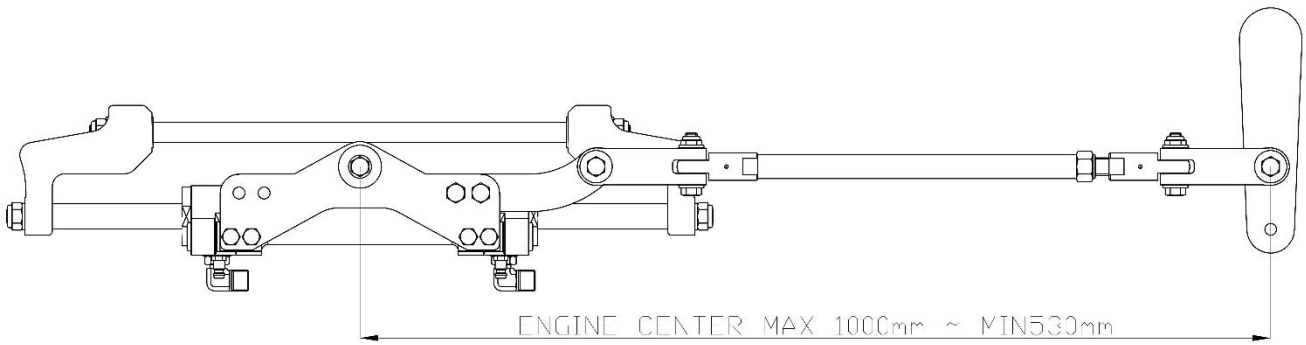
4. TIE BAR

4-1) TIE BAR MODEL : TBK 800S (Single Cylinder for Twin Engines)

4-1-1) Specification



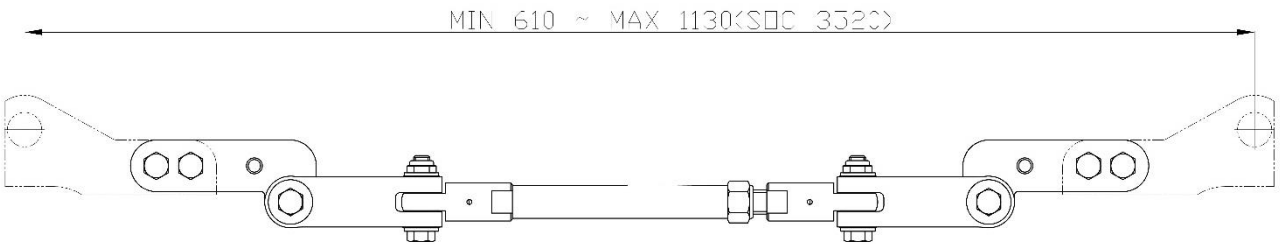
4-1-2) Application

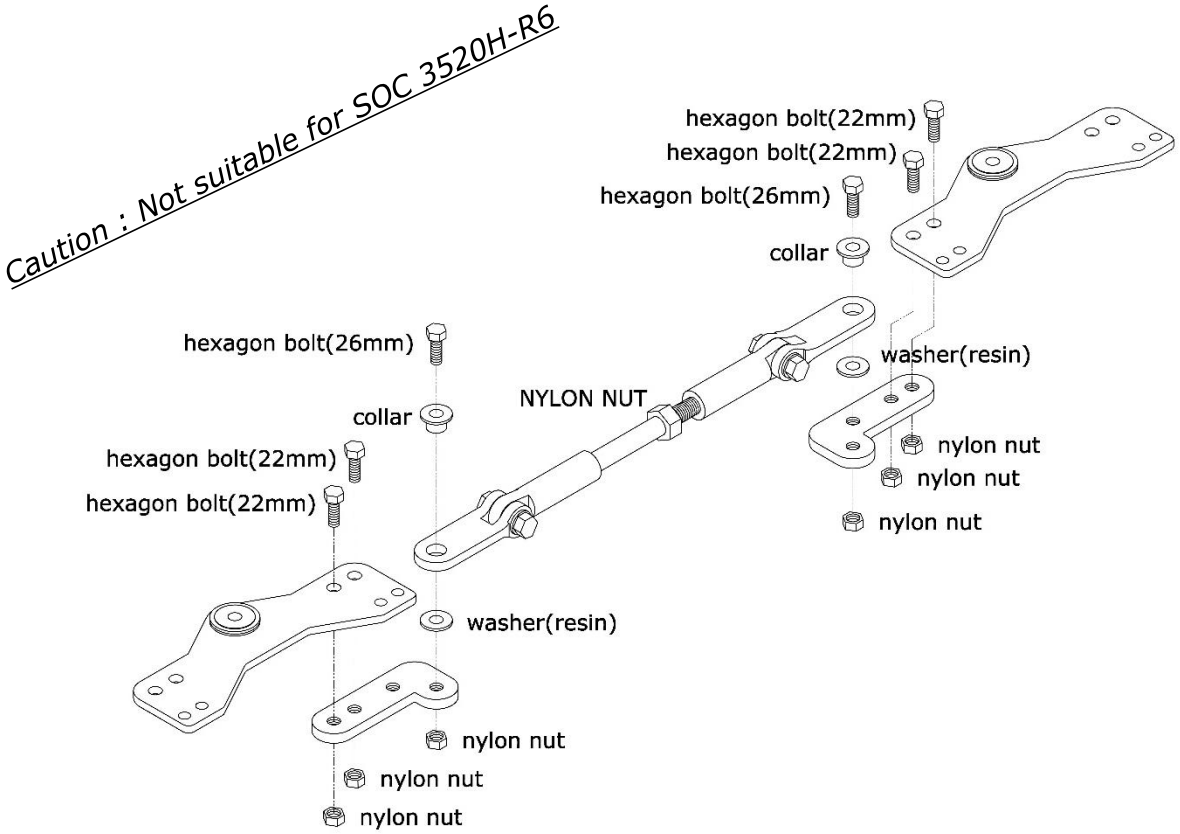


4. TIE BAR

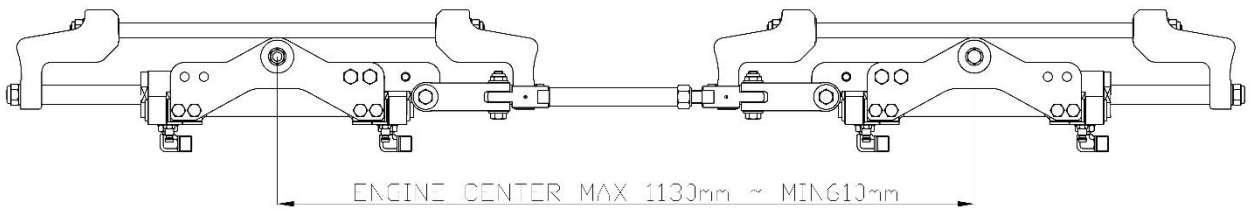
4-2) TIE BAR MODEL : TBK 800T (Two Cylinders for Twin Engines)

4-2-1) Specification

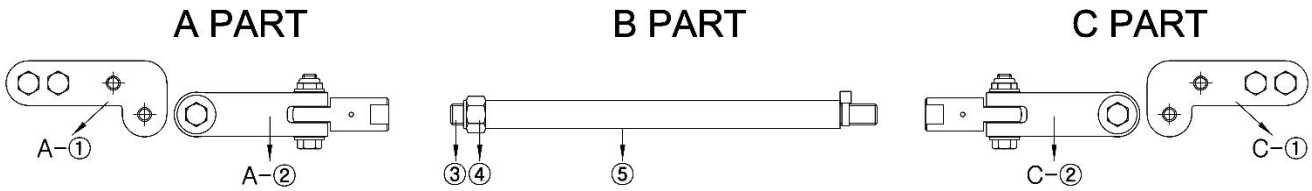




4-2-2) Application



4-3) Parts of Tie Bar

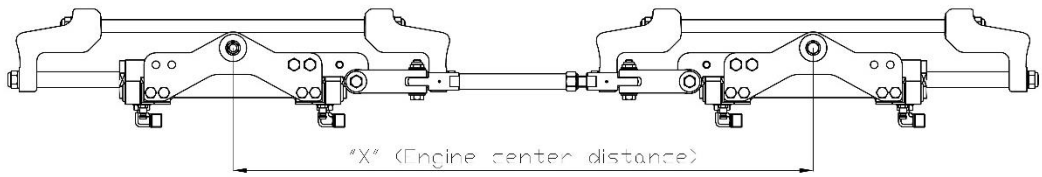


A-① PLATE
A-② ROD END L

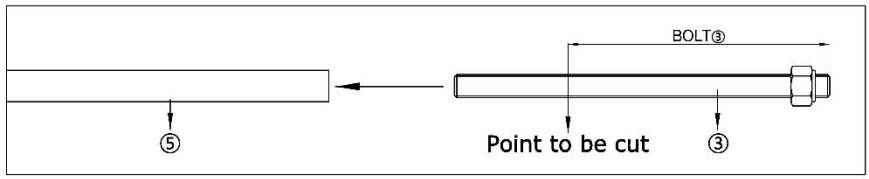
③ BOLT
④ NYLOCK NUT
⑤ PIPE

C-① PLATE
C-② ROD END R

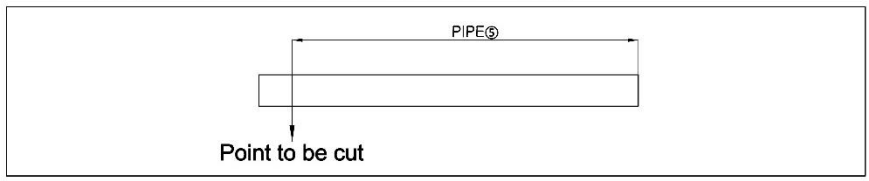
4-4) Cutting the tie rod and Protect tube



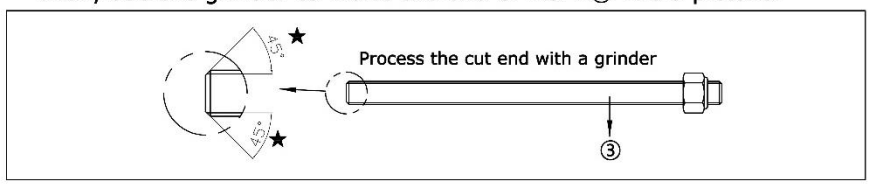
1) Take PIPE⑤ out from B PART as shown,
then mark the point to be cut on B PART BOLT③.
"X" (Engine center distance)-517=BOLT③



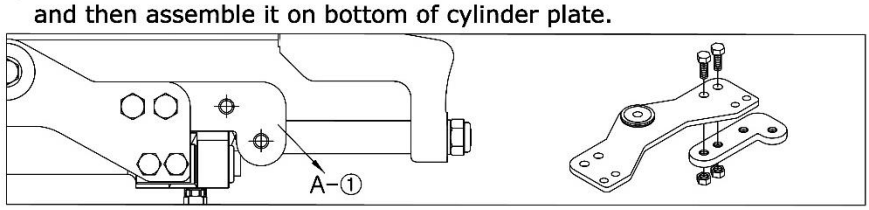
2) Use the given formula below and mark the point to cut off on PIPE⑤.
"X" (Engine center distance)-591=PIPE⑤



3) Use cutting machine to cut off the marked points on BOLT③ and PIPE⑤.
Then, use the grinder to make the end of BOLT③ like a picture.

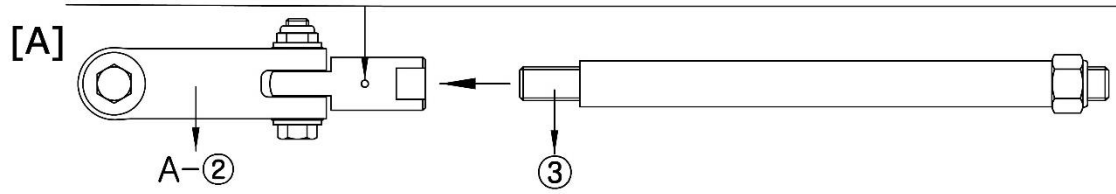


4) Disassemble A-① PLATE from A PART
and then assemble it on bottom of cylinder plate.

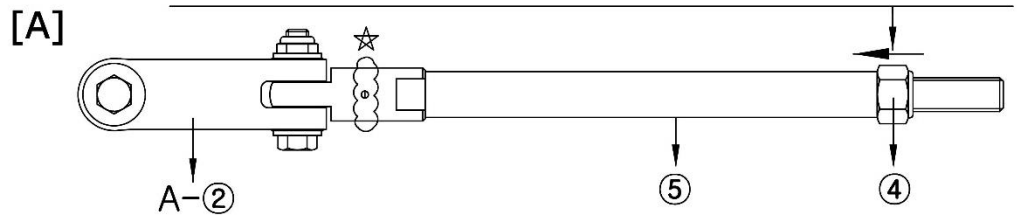


4-5) INSTALLATION

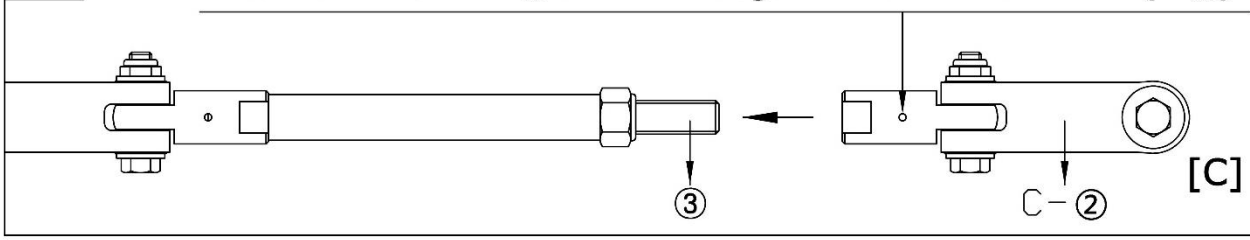
1 Screw BOLT③ into the hole of ROD END L(A-②)
until the end of BOLT③ is seen through the window hole on ROD END L(A-②).



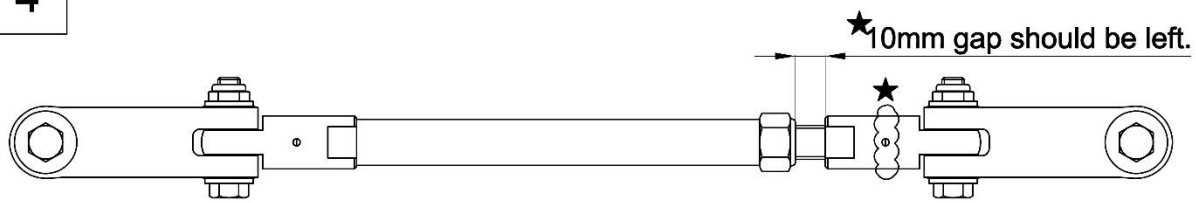
2 Push PIPE⑤ until it reaches the end of ROD END L(A-②)
and tighten NYLOCK NUT④ to fix it.



3 Screw BOLT③ into the hole of ROD END R(C-②)
until the end of BOLT③ is seen through the hole on ROD END R(C-②).



4



5. Oil Filling and Air Bleeding

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

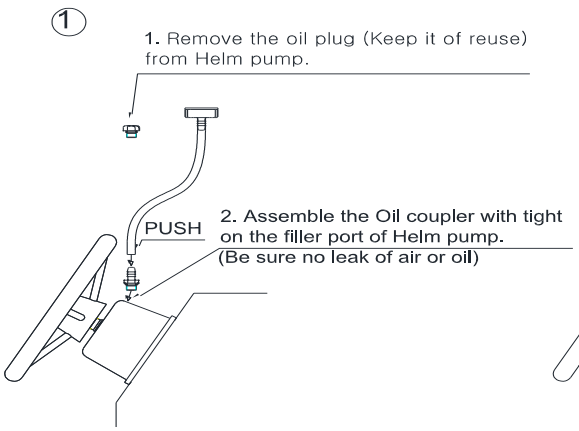
1. Filling & Purging Kit (OAK-300) includes

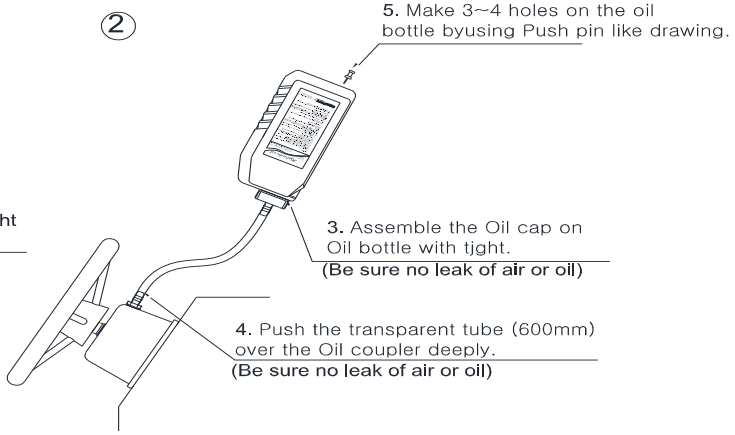
1) Oil coupler, Oil cap, transparent tube (600mm)

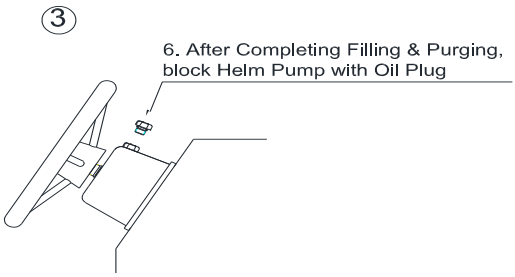
2) Transparent tube (1meter) for bleeding from cylinder

3) Push Pin

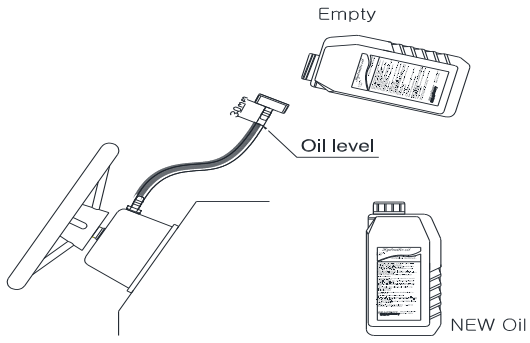
How to fill and Purge the system





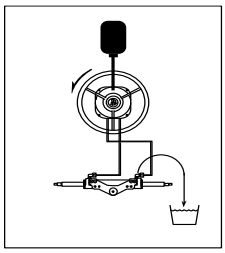


※CAUTION



※Caution
Do not let oil level fall down to 30mm from Oil cap while exchanging new oil bottle.

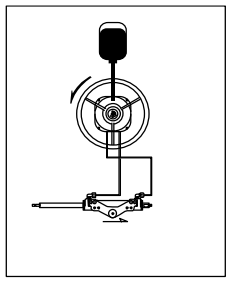
5. Oil Filling and Air Bleeding



Step 2

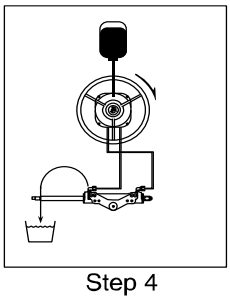
Step 1 : Fill the helm pump full of oil.

Step 2 : Open the right bleeder.
Slowly turn steering wheel anti-clockwise until a steady stream of air free oil comes out of the right bleeder.



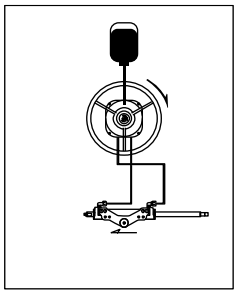
Step 3

Step 3 : Close the right bleeder. Continue to turn steering wheel anti-clockwise until the cylinder tube is fully moved on one side of the rod.
Open the left bleeder



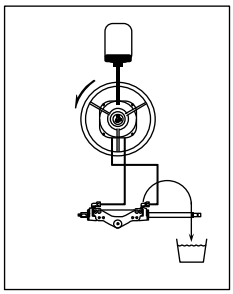
Step 4

Step 4 : Holding the cylinder tube (to prevent it from moving back)
slowly turn the steering wheel 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 tube.



Step 5

Step 5 : Continue turning the steering wheel clockwise
until the cylinder tube is fully moved at other side of rod.
The steering wheel will come to a stop. Open right bleeder .



Step 6

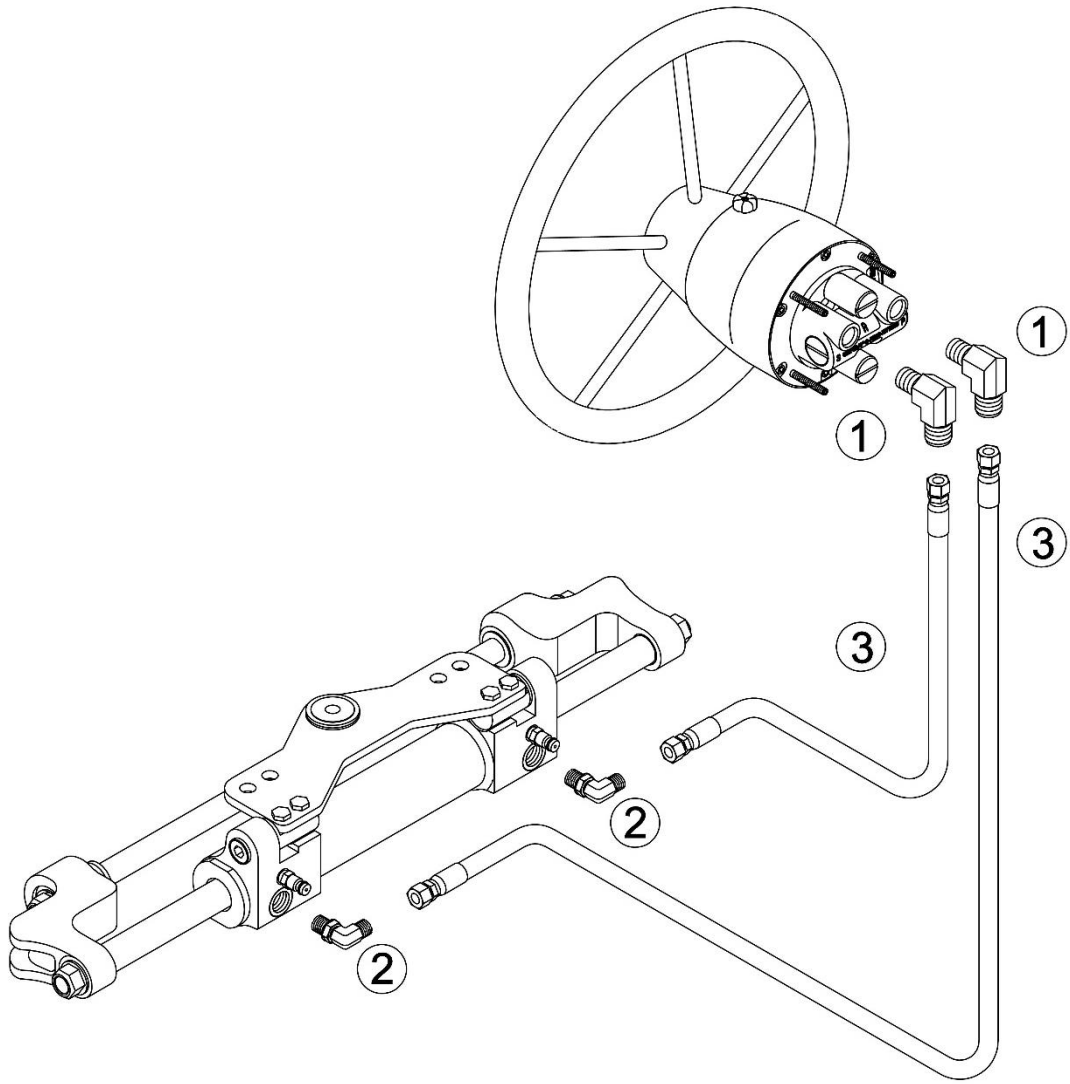
Step 6 : Slowly turn the steering wheel anti-clockwise
until a steady stream of air free oil comes out of bleeder.
While continuing to turn the steering wheel, close the right bleeder.
Now, fill and purge is complete.

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.

1. SINGLE ENGINE

1-1 Single Station



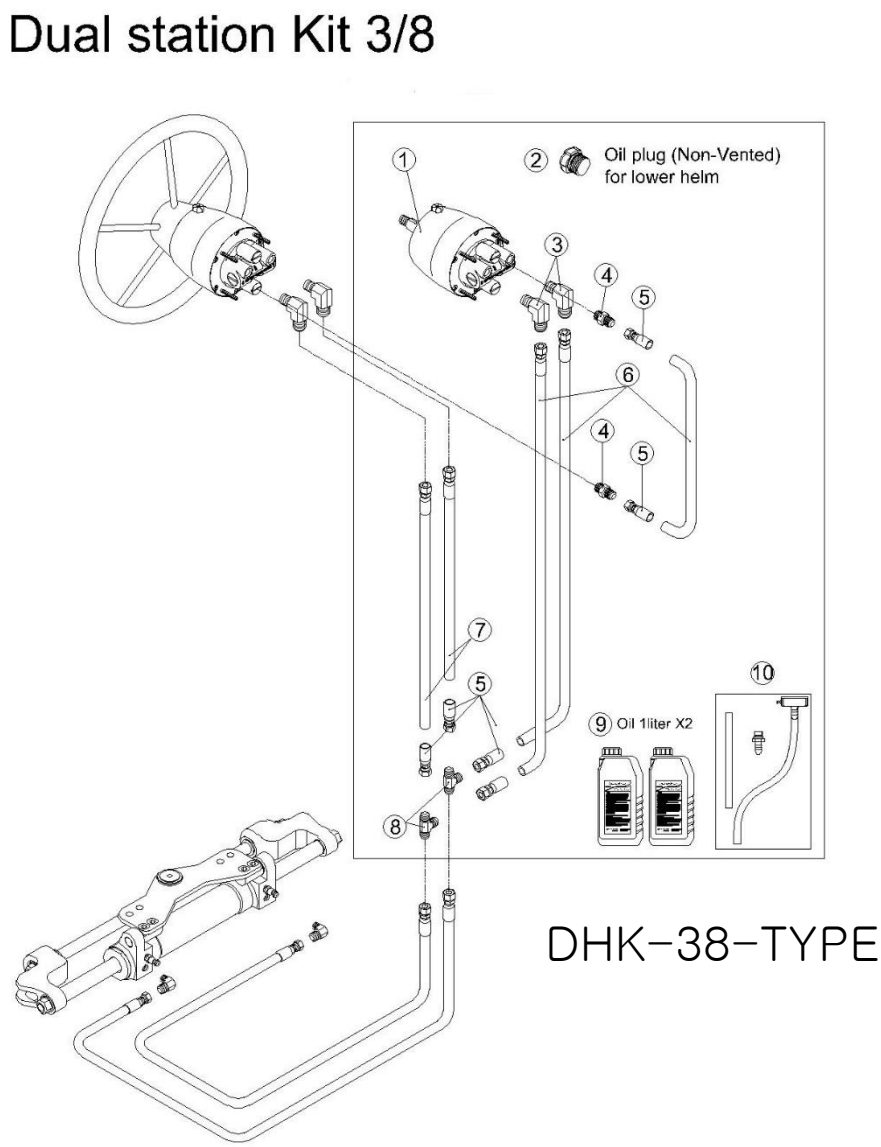
Fitting and Hoses For MO 350H

No	Part Number	Part Name	Q'TY	Remark
1	HLO14N0S	Elbow fitting (PF 1/4 Oring x PF 3/8)	2	Standard Supply in MO350H package.
2	HLO14N0S	Elbow fitting (PF 1/4Oring x PF 3/8)	2	
3	NH06-SS-07	Hose 7M (PF 3/8 hose coupling)	2	

*Fittings & Hose specification could depend on market requirement

1. SINGLE ENGINE

1-2 Dual Station



Dual Steering Kits Includes

No	Description	DUAL STATION 3/8 DHK-38-TYPE	Q'TY
1	HELM PUMP	CHOOSE MODEL	1
2	CAP(Ø1)	C1800802	1
3	ELBOW FIITTINGS	HLO14N0S	2
4	STRAIGHT FITTINGS	HSO14N0	2
5	REUSABLE HOSE COUPLING	C3520149	6
6	HOSE 30M	NH06-SS-30	1
7	HOSE 04M	NH06-SS-04	1
8	TEE FIITNGS	HTN300	2
9	OIL (1LITTER)	SF OIL 15	2
10	OIL ACCESSORIES KIT	OAK-300	1

CAUTION

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.

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

Cleaning
Clean the system using water and non-abrasive soap

SEAFIRST ENGINEERING

공장 : Seafirst Engineering Co
경남 김해시 진례면 테크노밸리로 137, 50875
전화 : 055 338 1640 팩스 : 055 338 1641
http://www.seafirst.co.kr
Manual Version : SF-M-O1505