Hand Hydraulic Steering System

Instruction Manual February, 2012

UNIKAS MHS

HAND HYDRAULIC STEERING SYSTEM SINCE 1979

MHS-series / Model Number

- **□ MHS-28G**
- **☐ MHS-28B**
- **□** MHS-28H
- ☐ MHS-32G
- ☐ MHS-32B
- □ MHS-32H
- ☐ MHS-32VX
- ☐ MHS-32VH
- ☐ MHS-32FS
- ☐ MHS-36VX
- ☐ MHS-36VH
- ☐ MHS-40Bi
- ☐ MHS-L40Bi

Unikas

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1. Introduction

- Thank you for selecting UNIKAS Hand Hydraulic Steering System "MHS Series".

 This instruction manual describes how to install, operate, maintain, and inspect the auto pilot system. Please read this manual before starting operation.
- Always keep this manual in your pilot house so that you can consult the manual any time. If this manual is extremely damaged, fouled, or missing, please contact us. We will send you another copy.
- If the system is subject to change, the specifications described in this manual may differ from those of the actual system. If you find a difference, please contact us.
- If you transfer or resell your auto pilot system to someone, be sure to give this manual to the new owner.
- Do not modify the system, or connect additional units to the system. This is because modification or additional units may cause problems. If there is an unclear point, be sure to contact us.
- To ensure safety during system operation, the following symbols are used in this manual. These symbols respectively show the following hazardous levels:



: Observe the items to prevent hazard that may cause death or serious injury.



Warning

: Observe the items to prevent accidents that may cause death or serious injury.



Caution

: Observe the items to prevent accidents that may cause slight injury, or to protect the steering system and peripherals from damage.

图

Advice

Observe the items to prolong the service life of the steering system, and to ensure safe operation.

This manual describes various safety items to be observed during installation, operation, inspection, or maintenance, however this manual cannot describe all the safety items. If there is possibility of an accident due to the situations that are not described here, please take appropriate measures to prevent the accident on your own responsibility.

2. Safety Precautions

- Be sure to perform inspections before leaving port.
- Do not leave port when the weather is bad or when the weather forecast says the weather will become bad.
- If spare parts are stocked, periodically check the storing place and contents.
- Taking a sharp turn at a high speed is very dangerous, which should be avoided.
- Even if an auto pilot or dial remote control system is installed, steer the boat in the hand steering mode when the sea condition becomes worse.
- Be sure to perform inspections after returning to port.
- When steering the boat, do not leave the steering place and be sure to keep watch.
- There are two types of steering gears: one type moves the rod in and out; the other type moves the main body together with the high-pressure hose. Instruct the passengers aboard not to place an obstruction within the operating range of the steering gear or step on the steering gear main body.

A Caution

- If an abnormal condition or unusual phenomenon is found in the steering system when performing inspections before leaving port, do not leave port and carefully inspect the steering system.
- Placing a person or an obstruction within the operating range of the steering could result in personal injury, cause oil leakage due to unbalanced load on the cylinder, or hamper steering the boat.

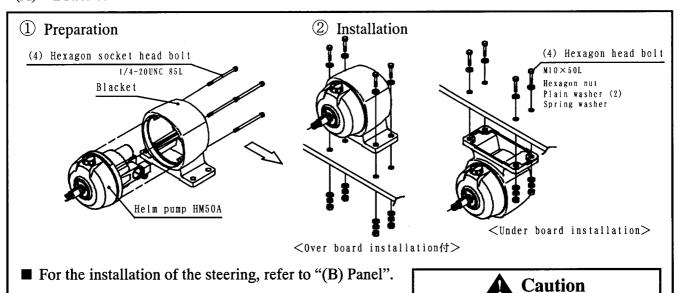
3. Specifications

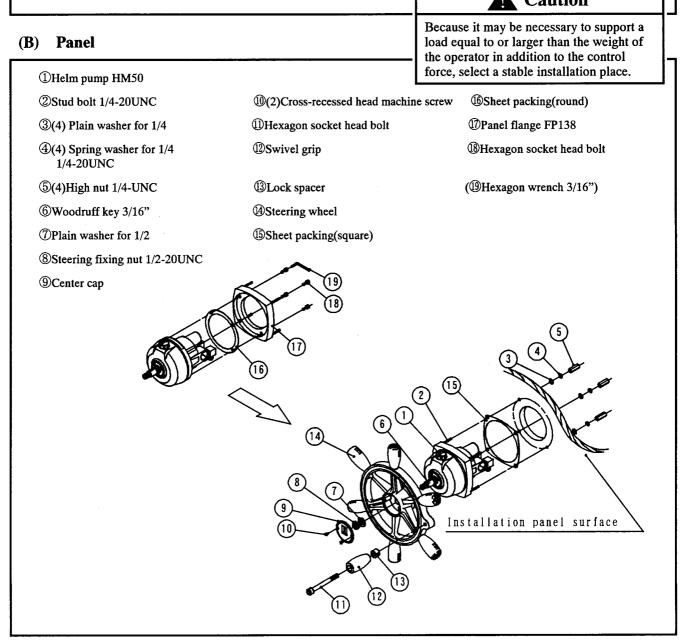
As the UNIKAS hand hydraulic steering system "MHS series", UNIKAS provides the products shown in the table below, which can be selected according to the type of your hull and engine.

System model number	Boat type	Steering wheel rotation (turns)	Steering gear model	Produced torque N-m
MHS-28G	Inboard-outdrive	4.9	28G	468
MHS-32G	Outboard	7.0	32G	668
MHS-28B		4.9	28B	468
MHS-32B	Inboard engine	7.0	32B	668
MHS-40Bi	Inboard-outdrive Outboard	7.8	40Bi	869
MHS-L40Bi		9.6	L40Bi	1068
MHS-28H	D: 1	4.9	28H	468
MHS-32H	Drive boat	7.0	32H	668
MHS-32VX		6.9	32VX	659
MHS-32VH	1	6.9	32VH	824
MHS-32FS	Outboard	4.7	32FS	522
MHS-36VX		7.3	36VX	1043
MHS-36VH]	7.3	36VH	1043

4. How to Install the Helm Pump

(A) Bracket

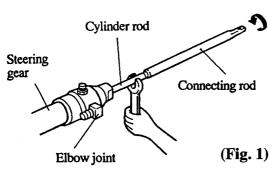


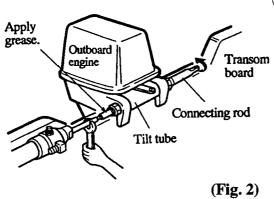


5. How to Install the Steering Gear

Because the steering gear produces relatively large thrust in proportion to the control force, install it on a robust portion of the boat. If the steering gear is to be installed on a thin plate for lack of space, be sure to use a reinforcing plate for installation.

(A) In the case of 28G/32G





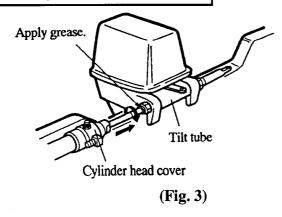
- ① Screw the connecting rod onto the threaded end of the cylinder rod. (Fig. 1)
 - If the connecting rod connected to the steering gear cannot be passed through the tilt tube because there is not enough space to the right and left of the outboard engine, pass the connecting rod through the tilt tube before screwing it onto the cylinder rod as shown in Fig. 2.
- ② Then screw the cylinder head cover completely onto the 7/8-14UNF screw. If the elbow joint interfere with the corner of the transom board at this time, remove the joint beforehand. (Fig. 3)
- 3 Adjust the connector bar (local procurement) so that the outboard engine is located in the center position when the piston of the cylinder is at half stroke. (Fig. 4)

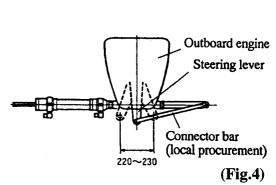
A Caution

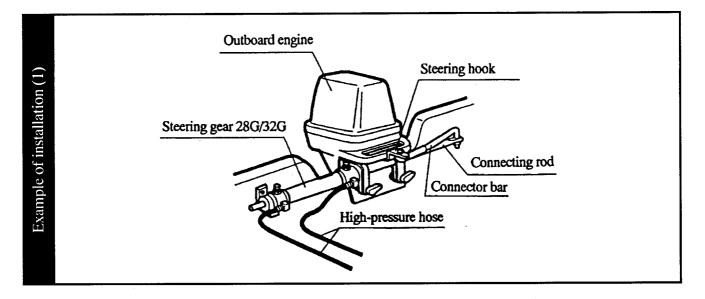
Select a hole position of the steering lever so that the steering lever does not strike against outboard-engine-side stopper within the stroke range of the cylinder. If the steering lever is stopped before the piston of the cylinder reaches the end of the stroke, an unbalanced load is applied to the outboard engine main body stopper section and the cylinder rod, causing damage to the cylinder or oil leakage, which may result in loss of control in the worst case.

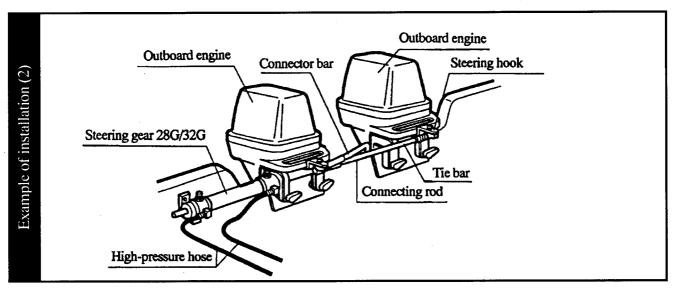
C Advice

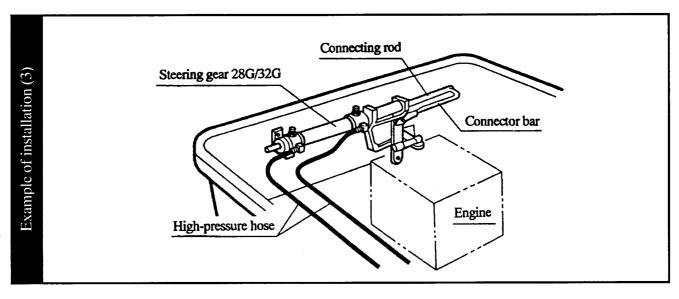
Apply grease to the surface of the connecting rod before passing it through the tilt tube so that the inside surface of the tilt tube is greased sufficiently.



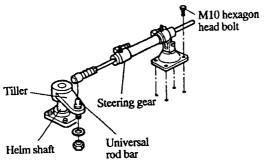








In the case of 28B/32B/40Bi/L40Bi

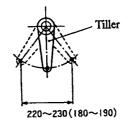


1 Using the attached M10 hexagon head bolt, securely fix the steering gear main body (Fig. 1). Install it so that the steering lever (tiller) is located in the center position when the piston of the cylinder is at half stroke.

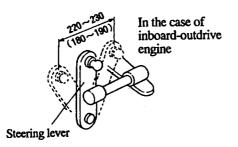
② Referring to Fig. 2 and Fig. 3, select a position to fix the universal rod bar according to the

stroke of the cylinder.





(Fig. 2)

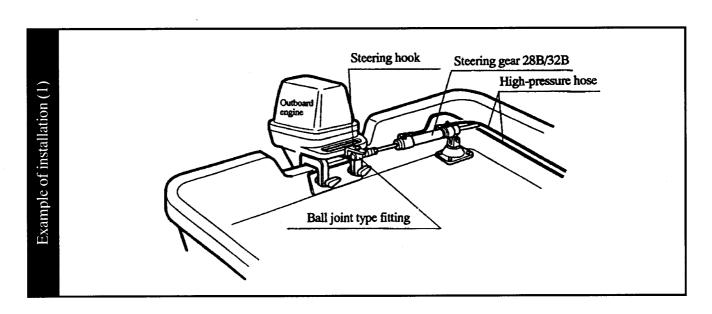


(Fig. 3)

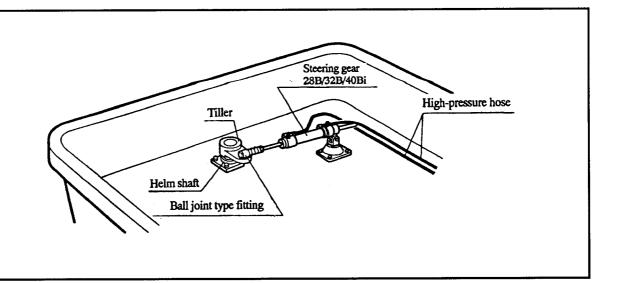
Refer to the dimensions shown in the parentheses when the cylinder stroke is 180 mm.

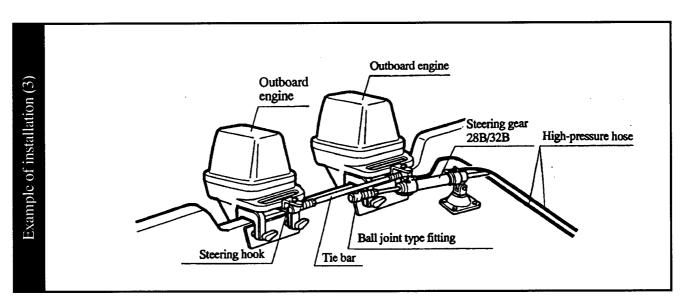
Caution

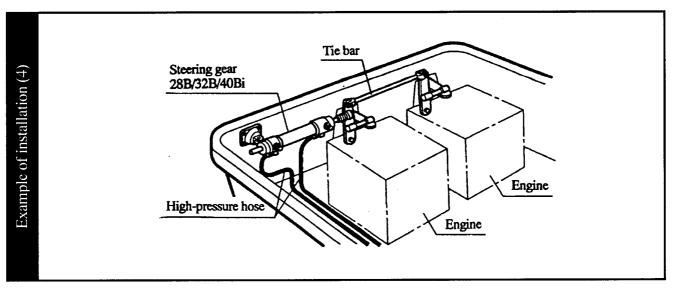
Select an installation position so that the steering lever (tiller) does not strike against stopper within the stroke range of the cylinder. If the steering lever (tiller) is stopped before the piston of the cylinder reaches the end of the stroke, an unbalanced load is applied to the helm board stopper section and the cylinder rod, causing damage to the cylinder or oil leakage, which may result in loss of control in the worst case.



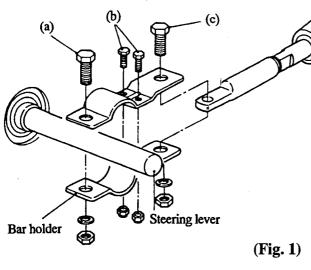


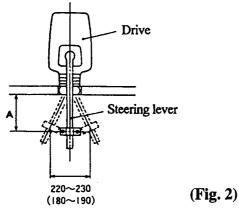






(C) In the case of 28H/32H





Refer to the dimensions shown in the parentheses when the cylinder stroke is 180 mm.

① Fit the bar holder on the steering lever of the drive boat and temporarily tighten it with the hexagon head bolts (a) and (b). (Fig. 1)

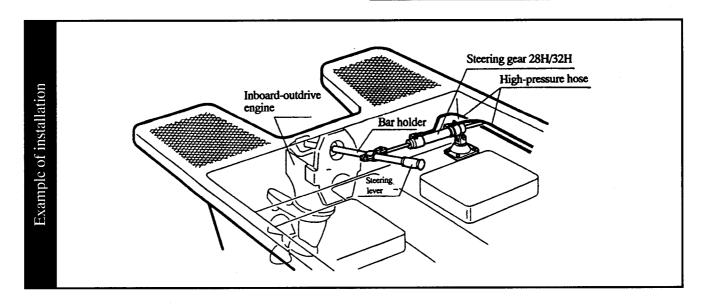
Steering gear

- ② Install the steering gear main body while referring to the dimensional drawing on page 38. In principle, install it so that the drive is located in the center position when the piston of the cylinder is at half stroke.
- 3 Determine the position of the bar holder while referring to Fig. 2. Tighten the hexagon head bolts (a), (b) and (c).

A Caution

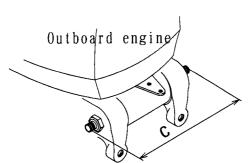
Select an installation position so that the steering lever does not strike against stopper within the stroke range of the cylinder. If the steering lever is stopped before the piston of the cylinder reaches the end of the stroke, an unbalanced load is applied to the steering lever and the cylinder rod, causing damage to the cylinder or oil leakage, which may result in loss of control in the worst case.

In such cases, make adjustments by shifting the bar holder so that dimension A in Fig. 2 is increased.



(D) In the case of 32VX

① Measure the length (Dimension C) of the tilt tube.



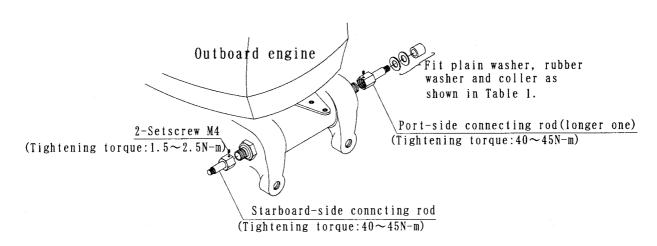
It is necessary to select a washer, rubber washer and collar according to the length of the tilt tube as shown in Table 1. (It is for adjusting the arm setting position.)

Referring to Table 1, determine which plain washer, rubber washer and collar should be used in which manner.

(Table 1)

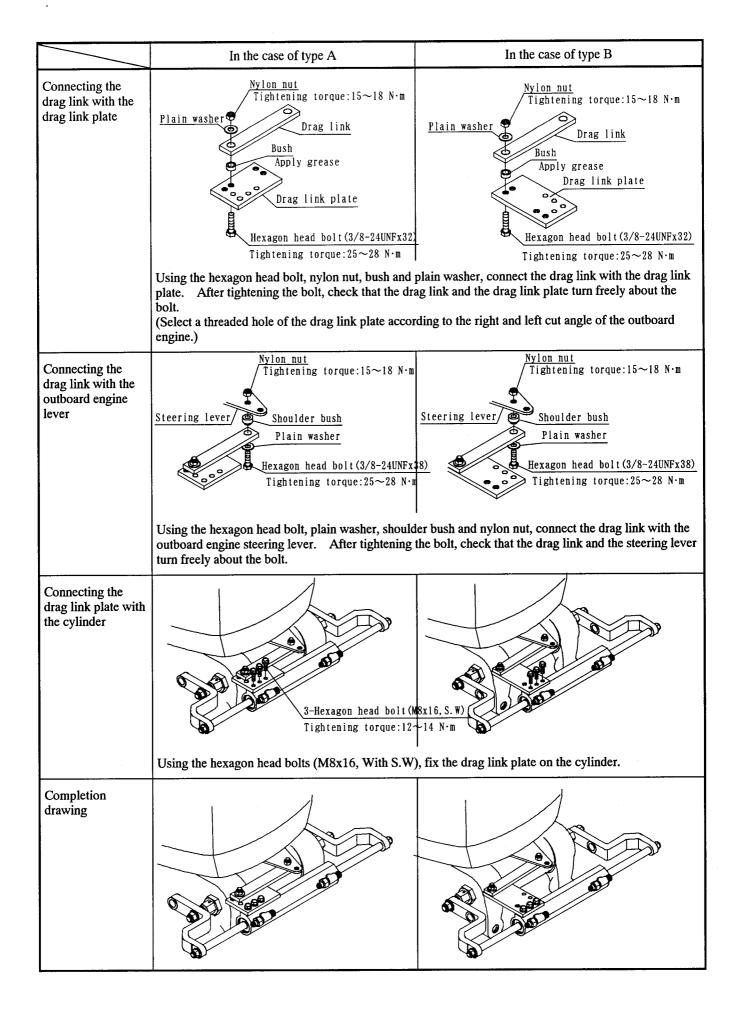
,	Tilt tube length C Detailed instructions for fitting plain washers, rubber washers and collars			
1	283 mm	Flange bush 283 Rubber washer 31 Plain washer 31 Plain washer 2t Outboard engine tilt tube Coller 201		
2	304.5 ~ 305 mm	Rubber washer 3t Plain washer 2t Plain washer 3t Coller 20t		
3	308 mm	308 Plain washer 2t Rubber washer 3t Plain washer 3t Coller 20t		
4	310 mm	310 Plain washer 2t Plain washer 3t Plain washer 3t Connecting rod R Connecting rod L Coller 20t		

② Referring to Table 1, attach the connecting rods R & L to the tilt tube and fit the plain washer, rubber washer and collar so that you are ready to attach the arm.



③ Two installing methods, type A and type B are used. Select type A or type B according to the length (Dimension D) of the hook of the outboard engine.
Perform installation work following the instructions shown in the figures below.

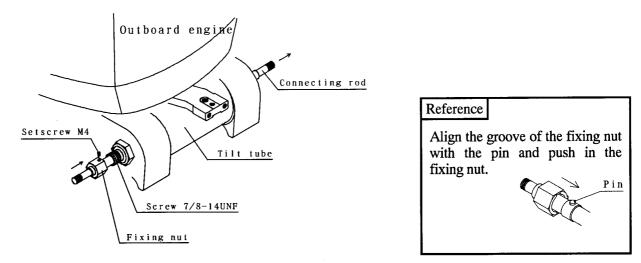
	In the case of type A	In the case of type B
Length of outboard engine hook	Outboard engine	Outboard engine
Installing the arm and cylinder main body	 tighten the nylon nut M12. (2) With the port-side arm fit to the cylinder rod, while fitting the port-side arm to the port-side (3) Tighten the nylon nuts M12 of the connecting the cylinder rod. (4) While manually moving up and down the asset 	grods R and L rods and the nylon nuts 3/8-24UNF of embly composed of the cylinder and arms, check that it eck the cylinder operates smoothly while manually Arm Up and down Cylinder
		Caution /down the assembly, the cylinder will be damaged ed or damaged as a result of material fatigue while ssible to control the boat.



(E) In the case of 32VH

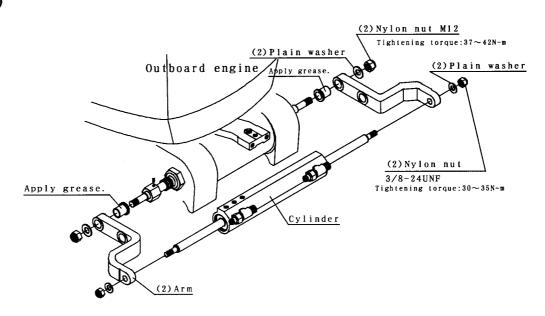
① Apply grease to the connecting rod and insert it into the tilt tube.

(Fig. 1)

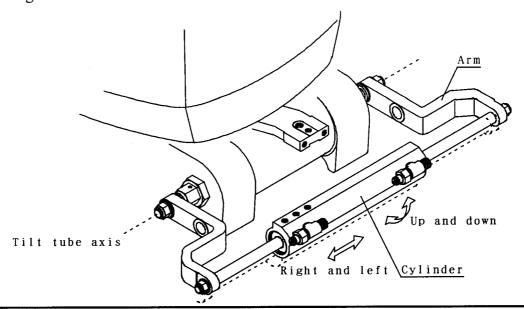


- ② Screw the fixing nut onto the 7/8-14UNF screw of the tilt tube and tighten it. (Tightening torque: 350 to 400 kgf-cm)
- ③ Set the fixing nut by tightening the attached setscrew M4. (Fig. 1)
- 4 Referring to Fig. 2, fit the connector bushes to both ends of the connecting rod.
- (5) Attach the arm to the starboard side of the connecting rod and temporarily tighten the nylon nut (M12).
- 6 With the port-side arm fit to the cylinder rod, insert the cylinder rod into the starboard-side arm while fitting the port-side arm to the port side of the connecting rod.
- Tighten the nylon nuts (M12) of the connecting rod and the nylon nuts (3/8-24UNF) of the cylinder rod.

(Fig. 2)



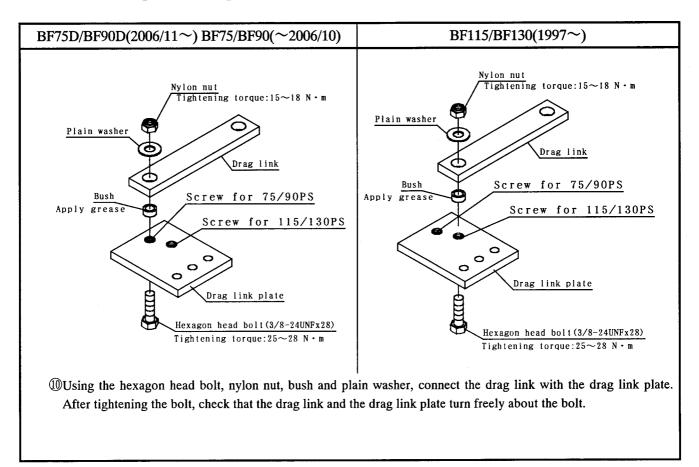
While manually moving up and down the assembly composed of the cylinder and arms, check that it turns freely about the tilt tube axis. Also check the cylinder operates smoothly while manually moving it right and left.

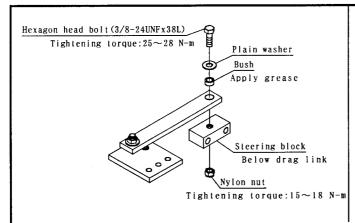


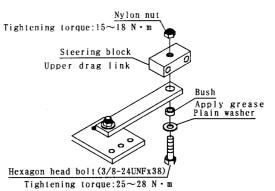
A Caution

If it is difficult or impossible to move up/down the assembly, the cylinder will be damaged initially when the outboard engine is tilted or damaged as a result of material fatigue while you are steering the boat, making it impossible to control the boat.

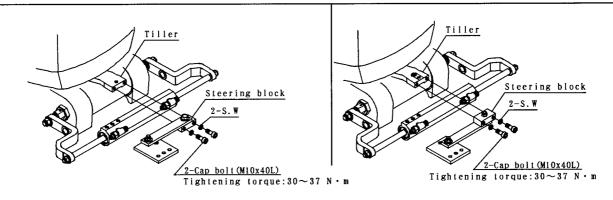
The installation position depends on the horsepower of the outboard machine from here.



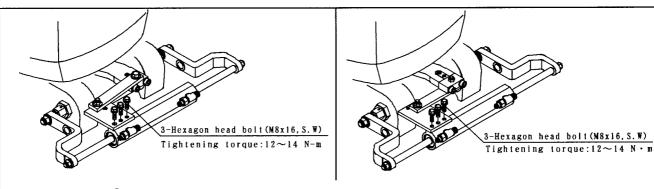




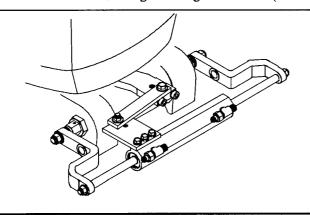
①Using the hexagon head bolt, plain washer, bush and nylon nut, connect the drag link with the attached steering block. After tightening the bolt, check that the drag link and the steering block turn feely about the bolt.

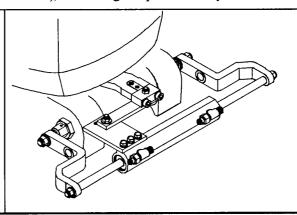


②Using the cap bolt(M10×40,S.W), fix the steering block on the outboard engine tiller.

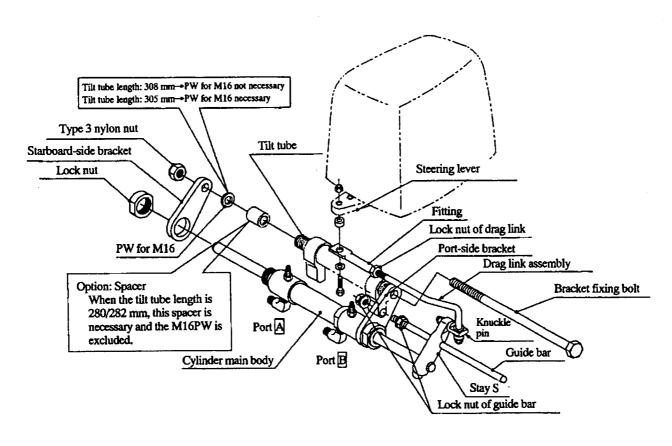


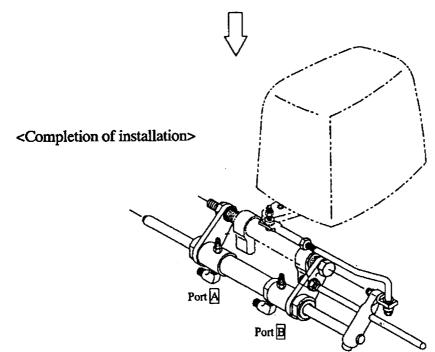
③Using the hexagon head bolts (M8x16, With S.W), fix the drag link plate on the cylinder.





(F) In the case of 32FS/L32FS

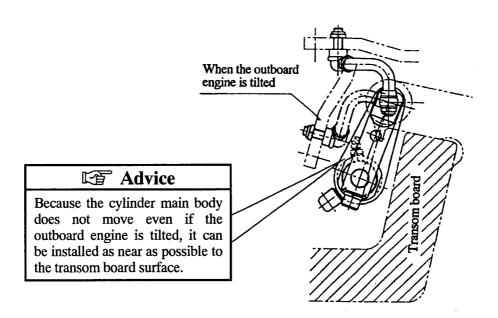




- (1) Install the cylinder main body so that the stay is located in the port side of the outboard engine.
- ② Insert the bracket fixing bolt into the tilt tube from the stay side. Set the attached PW for M16 between the tilt tube and the starboard-side bracket only when the tilt tube length is 305 mm. Fix the bracket by tightening the lock nut and type 3 nylon nut (5/8-11UNC).

G Advice

If the tilt tube length is 280/282 mm, the spacer (option) should be used instead of the PW for M16. In the case of 280 mm, the shoulder of the spacer should be faced outward. In the case of 282 mm, the shoulder of the spacer should be faced inward.



- 3 Insert the guide bar into the hole of the port-side stay and tighten the two lock nuts to clamp the bracket.
- ④ Using the outer or inner threaded hole of the steering lever, attach the drag link assembly. Adjust the fitting of the drag link so that the outboard engine swings right and left equally. Then tighten the lock nut of the drag link.

A Caution

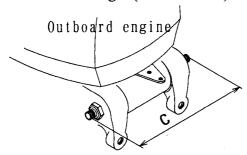
Select the outer or inner threaded hole of the steering lever so that the steering lever does not strike against the stopper of the outboard engine within the stroke range of the cylinder. If the steering lever is stopped before the piston of the cylinder reaches the end of the stroke, an unbalanced load is applied to the cylinder, causing oil leakage.

Note that this leads to damage to the cylinder or oil leakage, which may result in loss of control in the worst case.

⑤ After check that the bolts and nuts are tightened securely, tilt up the outboard engine in the helm starboard and helm a port positions and make sure that it does not interfere with the cylinder.

(G) In the case of 36VX

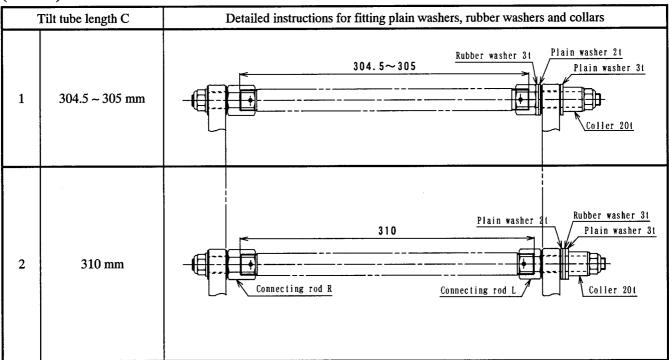
① Measure the length (Dimension C) of the tilt tube.



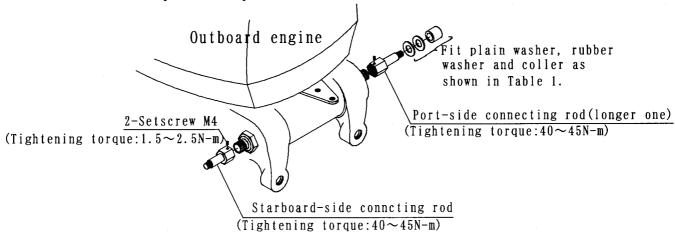
It is necessary to select a washer, rubber washer and collar according to the length of the tilt tube as shown in Table 1. (It is for adjusting the arm setting position.)

Referring to Table 1, determine which plain washer, rubber washer and collar should be used in which manner.

(Table 1)

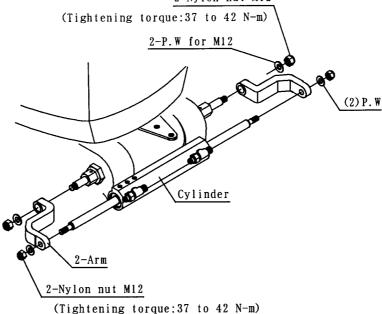


② Referring to Table 1, attach the connecting rods R & L to the tilt tube and fit the plain washer, rubber washer and collar so that you are ready to attach the arm.

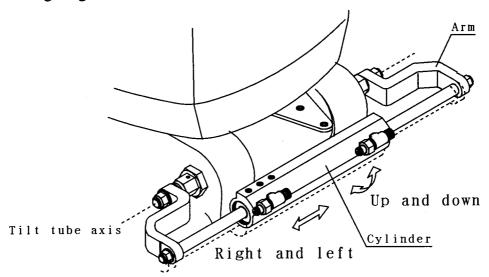


- 4 Refer to the figure, attach the arm to the starboard-side connecting rod and temporarily tighten the nut M12.
- (5) With the port-side arm fit to the cylinder rod, insert the cylinder rod into the starboard-side arm while fitting the port-side arm to the port-side connecting rod.
- 6 Tighten the nylon nuts M12 of the connecting rods R and L rods the nylon nuts M12 of the cylinder rod.

 2-Nylon nut M12



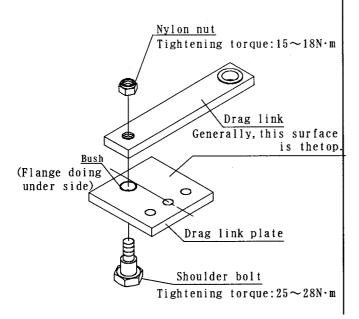
While manually moving up and down the assembly composed of the cylinder and arms. check that it turns freely about tilt tube axis. Also check the cylinder operates smoothly while manually moving it right and left.



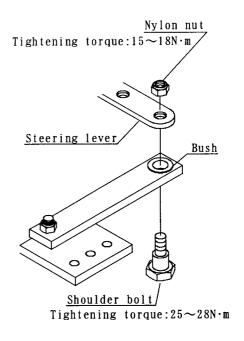
A Caution

If it is difficult or impossible to move up/down the assembly, the cylinder will be damaged initially when outboard engine is tilted or damaged as a result of material fatigue while you are steering the boat, making it impossible to control the boat.

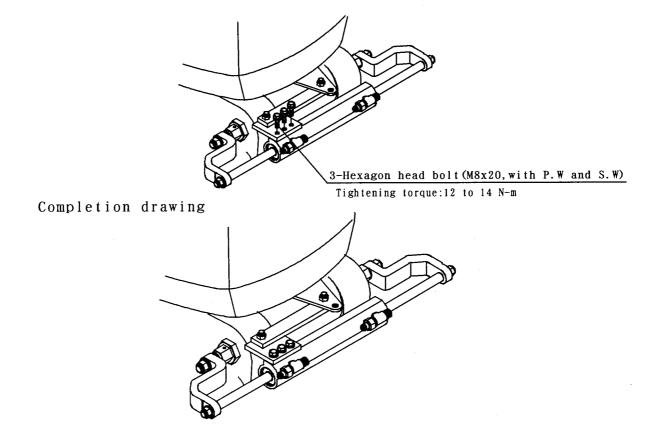
(Slect a threaded hole of the drag link plate according to the horsepower of the outboard engine.) After tightening the bolt, check that The drag link and the drag link plate turn Freely about the bolt.



 Using the soulder bolt nylon nut, connect the drag link with the attached steering block. After tightening the bolt, check that the drag link and the steering block tern freely about the bolt.

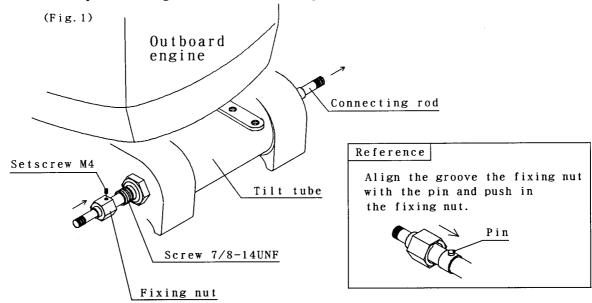


1 Using the hexagon head bolts(M8×20, with P.W and S.W), fix the drag link plate on the cylinder.

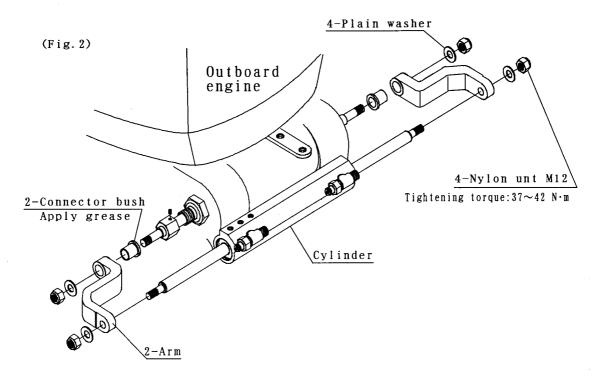


(H) In the case of 36VH

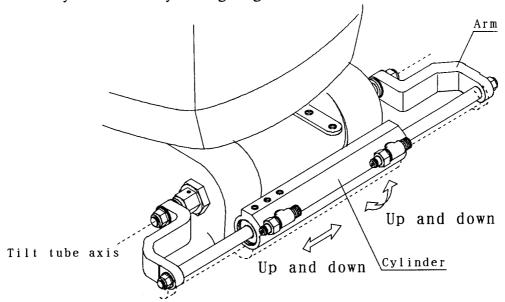
①Grease is put in for Fig.1 into an outboard engine tilt tube.



- ②Screw the fixing nut into the 7/8-14UNF screw of the tilt tube and tighten it. (Tightening torque: $35\sim40$ N-m.)
- ③Set the fixing nut by tightening the attached setscrew M4.(Fig1)
- (4) Referring to Fig.2, fit the connector bushes to both ends of the connecting rod.
- ⑤Attach the arm to the starboard side of the connecting rod and temporarily tighten nylon nut (M12).
- (6) With the port-side arm fit to the cylinder rod, insert the cylinder rod into the starboard-side arm while fitting the port-side arm to the port side of the connecting rod.
- Tighten the nylon nuts(M12) of the connecting rod and the nylon nuts(3/8-24 UNF) of the cylinder rod.



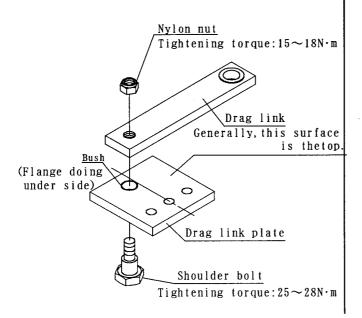
®While manually moving up and down the assenbly conposed of the cylinder and arms, check that it turns freely, about the tilt tube axis. Also check the cylinder operates smoothly while manually moving it right and left.



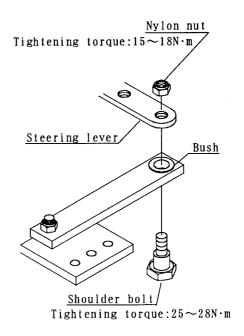
A Caution

If it is difficult or impossible to move up/down the assembly, the cylinder will be damaged initially when the outboard engine is tilted or damaged as a result of material fatigue while you are steering the boat, making it impossible to control the boat.

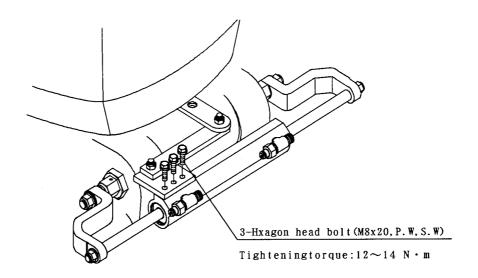
(9) Using the soulder bolt, nylon nut connect the drag link with the drag link plate. (Slect a threaded hole of the drag link plate according to the horsepower of the outboard engine.) After tightening the bolt, check that The drag link and the drag link plate turn Freely about the bolt.



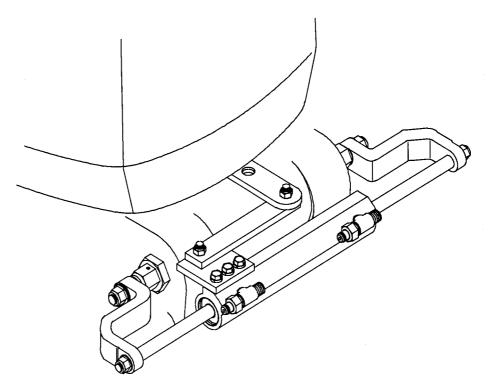
①Using the soulder bolt nylon nut, connect the drag link with the attached steering block. After tightening the bolt, check that the drag link and the steering block tern freely about the bolt.



①Using the hexagon head bolts(M8×20, P.W, S.W), fix the drag link plate on the cylinder.



Completion drawing



6. Piping

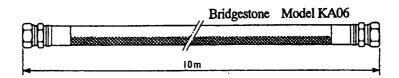
1. Piping material

	Standard	Standard
	3/8 size	1/4 size
Campucka fitting	Item number: CF-G-06-14	Item number: CE-G-04-14
Thin flex hose	Item number: 1000-06	Item number: 1000-04

2. Attaching method

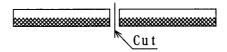
1 Attach the fitting

Screw and tighten the campucka fittings into the ports of the helm pump and cylinder. (Tightening torque: 3/8 size $44\sim49$ N-m. 1/4 size $19\sim21$ N-m.)



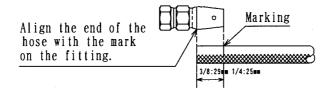
2 Cutting the hose

Using a hose cutter or an edged knife, cut the hose so that the cut edge is perpendicular. (Optional hose cutter: HC03)



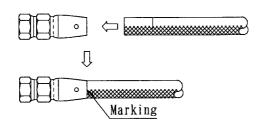
3 Marking

Align the end of the hose with the mark on the socket section of the campucka fitting and put on the hose a mark to indicate the inserting length.



4 Fitting the hose

Fit the hose onto the campucka fitting until the end of the fitting reaches the mark on the hose. Then fit the other end of the hose onto the fitting attached to the other device in the same manner.

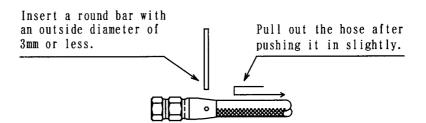




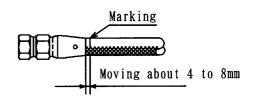
Fitting the hose insufficiently could cause oil leakage when it is pressurized, which may result in loss of control in the worst case.

G Advice

If the length of the cut hose is improper, it is possible to detach the hose from the fitting by using the special jig or a round-headed bar <u>only before it is hydraulically pressurized</u>. After the hose is hydraulically pressurized or pulled out, it cannot be detached from the fitting. (Option: Special jig)



When the hose is pressurized or pulled out after it is fitted onto the campucka fitting, the hose moves outward as shown in the figure to the right, which does not indicate an abnormal condition but a proof of secure sealing.



A

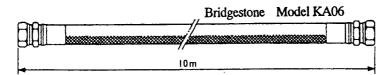
Caution

When passing a copper pipe or high-pressure hose through a hole in the boat wall, partition, etc., do so after covering the end of the pipe or hose with vinyl tape, etc. in order to prevent entry of dirt. If dirt enters the circuit, a failure will occur in the system, which may result in loss of control in the worst case.

(B) In the case of high-pressure hitron hose and reusable fitting

1. Piping material

Female parallel pipe thread PF3/8B · Hose inside diameter: 9.5 mm

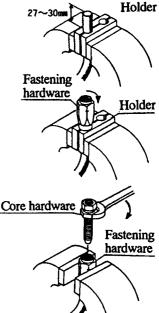


2. Attaching method

① Cut the hose according to the distance between the helm pump and the steering gear so that you can obtain two hoses with a fitting on one end.



- ② Hold one hose with the holder (option) as shown in the figure to the right and fix it with a vise. At this time, the hose should protrude from the holder for about 27 to 30 mm.
- 3 Apply grease or lubricant to the outside surface of the high-pressure hose, fit the fastening hardware onto the hose and screw in the fastening hardware clockwise. At this time, take care not to twist the hose excessively.
- Remove the holder and directly fix the fastening hardware with the vise. Apply grease or lubricant to the core hardware and screw it into the fastening hardware as shown in the figure to the right. At this time, screw in the core hardware until it bottoms Core hardware against the fastening hardware.
- 5 The other reusable fittings should also be equipped by following steps 3 to 4.
- 6 Referring to the piping drawing, connect the hoses between the helm pump and the steering gear.



A Caution

When passing a copper pipe or high-pressure hose through a hole in the boat wall, partition, etc., do so after covering the end of the pipe or hose with vinyl tape, etc. in order to prevent entry of dirt. If dirt enters the circuit, a failure will occur in the system, which may result in loss of control in the worst case.

(C) In the case of copper pipe

1. Piping material

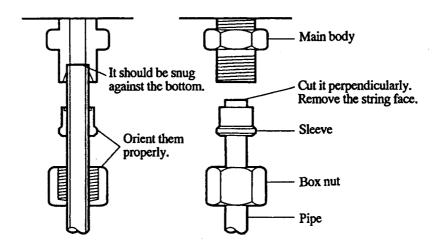
Use a copper pipe with an outside diameter of 10 mm and a wall thickness of 1.2 mm.

2. Cautions in piping

- ① Because the steering gear oscillates, connect the copper pipe to it through a high-pressure hose.
- ② When cutting the copper pipe, be sure to use a pipe cutter (do not use a saw). Take care not to allow chippings to enter the pipe.
- 3 Before completing the piping installation, sufficiently flush the pipe using high pressure air, nitrogen gas, etc.
- ④ Try to avoid bending in the piping as much as possible.

A Caution

If chippings enter the copper pipe, it could cause the check valve of the helm pump to malfunction, which may result in loss of control in the worst case.



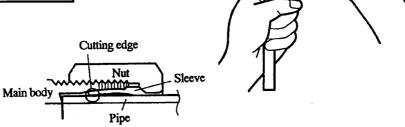
TT Advice

- 1. Cut the pipe so that the cut edge is almost perpendicular.
- 2. Take care to follow the proper assembling order. If the sleeve is oriented reversely and tightened, oil leakage will be caused, which may result in loss of control in the worst case.

3. Tightening method

- ① First fit the nut and then the sleeve (with the cutting edge faced toward the end of the pipe) onto the pipe.
- ② Insert the pipe into the main body until the end of the pipe is snug against the bottom of the main body.
- ③ While pushing the pipe against the main body with one hand, tighten the nut with a spanner. Then suddenly it becomes hard to tighten the nut, after which the pipe cannot be turned by hand. (A great force is necessary for tightening the nut.) The sleeve starts to dig into the pipe as the nut is tightened.
- ④ The cutting edge of the sleeve digs into the pipe completely when the nut is tightened 1-1/4 to 1-1/2 turns after it becoming hard to tighten the nut.
- ⑤ After connecting the pipe, fix the pipe on the body of the boat with the attached copper pipe holders. The portions largely affected by the vibrations created by the engine should be fixed at closer intervals.
- 6 Refer to the table below for the tightening torque.

Outside diameter of copper pipe	Tightening torque N-m(kgf-cm)
ф12	27~34(280~350)
ф15	44~54(450~550)



State of digging portion after tightening

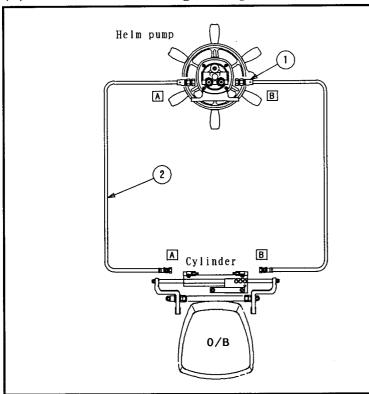
A Caution

When passing a copper pipe or high-pressure hose through a hole in the boat wall, partition, etc., do so after covering the end of the pipe or hose with vinyl tape, etc. in order to prevent entry of dirt. If dirt enters the circuit, a failure will occur in the system, which may result in loss of control in the worst case.

7. Piping Drawing

Various piping layouts are used for different boat types: outboard engine, inboard-outdrive engine, single-engine and double-engine types. The typical piping drawings are shown below, which should be refereed to for piping installation.

(A) In the case of steering at one position



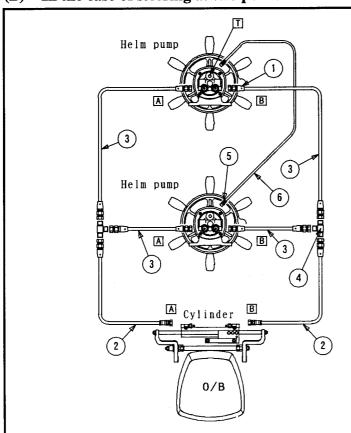
<Necessary piping materials>

	· · · · ·	
No.	Name	Quantity
1	Campucka fitting CF-G-06-14	2
2	Thin flex hose 1000-06	15 m

C Advice

When the one-way piping length is 6 m or more, use a copper pipe in the middle. If only a high-pressure hose is used for a long distance, the operation of the cylinder becomes unstable due to the expansion of the high-pressure hose.

(B) In the case of steering at two positions



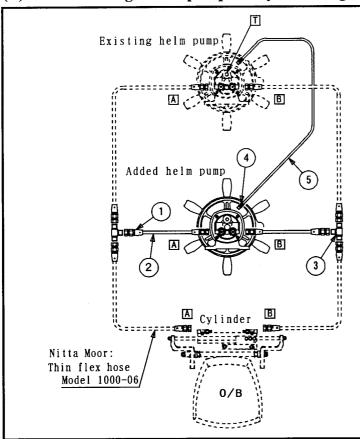
T Advice

In the case of the standard pipe arrangement, turning the steering wheel clockwise will starboard the helm. If you want to reverse the action of the cylinder, interchange the connections in the helm pump or cylinder side.

<Necessary piping materials>

No.	Name		Quantity
1	Campucka fitting CF-G-06-14		10
2	Thin flex hose 1000-06	0	15 m
3	Thin flex hose 1000-06		10 m
4	T joint 3/8 female seat	- Ca	2
5	Connector 20 368U1414		2
6	Nylon tube TH04	Q	10 m

(C) When adding a helm pump to a system using 3/8 campucka fittings



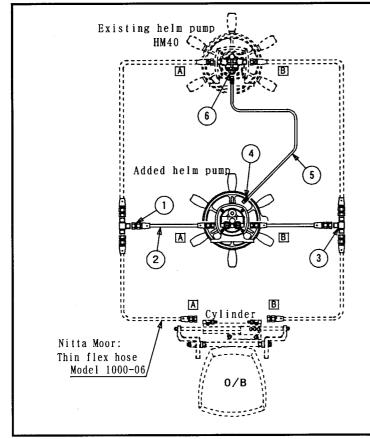
<Necessary piping materials>

No.	Name		Quantity
1	Campucka fitting CF-G-06-14		8
2	Thin flex hose 1000-06		10 m
3	T joint 3/8 female seat		2
4	Connector 20 368U1414		2
5	Nylon tube TH04	Q	10 m

酒 Advice

In the case of a high-pressure hose for which the campucka fitting can be used, it is possible to cut the hose for adding a helm pump. Because on-site use of the fitting is impossible for many types of high-pressure hoses, however, take care not to cut the high-pressure hose carelessly. A model symbol is printed on a high-pressure hose. After checking this symbol, consult the dealer about this matter.

(D) When adding a helm pump to a system (HM40) using 3/8 campucka fittings



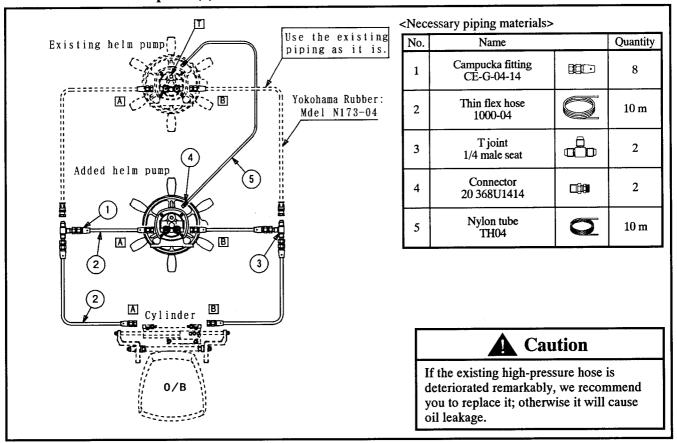
A Caution

If the existing high-pressure hose is deteriorated remarkably, we recommend you to replace it; otherwise it will cause oil leakage.

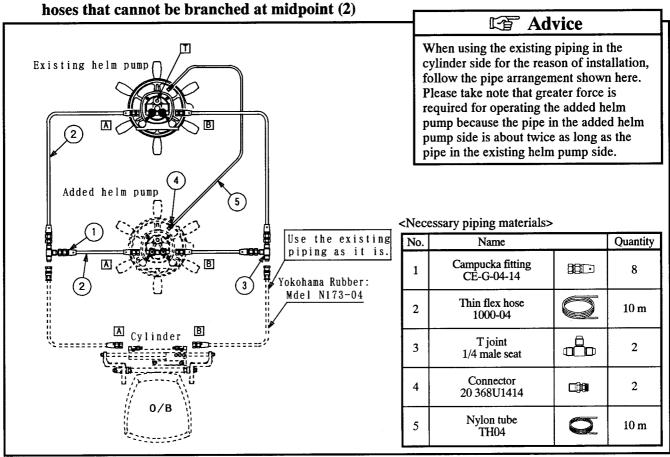
<Necessary piping materials>

No.	Name	:	Quantity
1	Campucka fitting CF-G-06-14		8
2	Thin flex hose 1000-06		10 m
3	T joint 3/8 female seat		2
4	Connector 20 368U1414		2
5	Nylon tube TH04	<u></u>	10 m
6	Adjustable elbow for T port Rc1/4		1

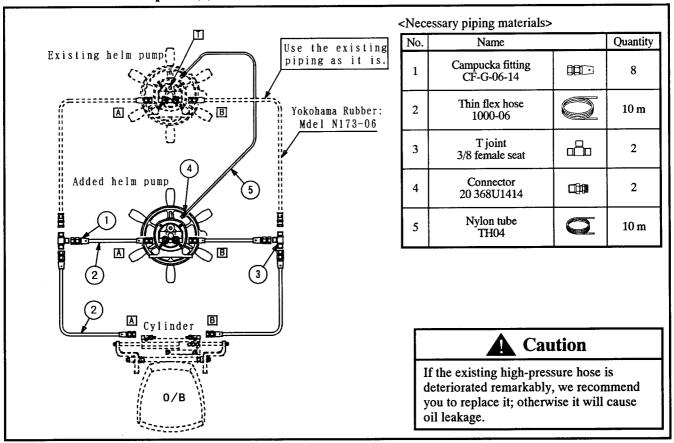
(E) When adding a helm pump to a system using 1/4 high-pressure hoses that cannot be branched at midpoint (1)



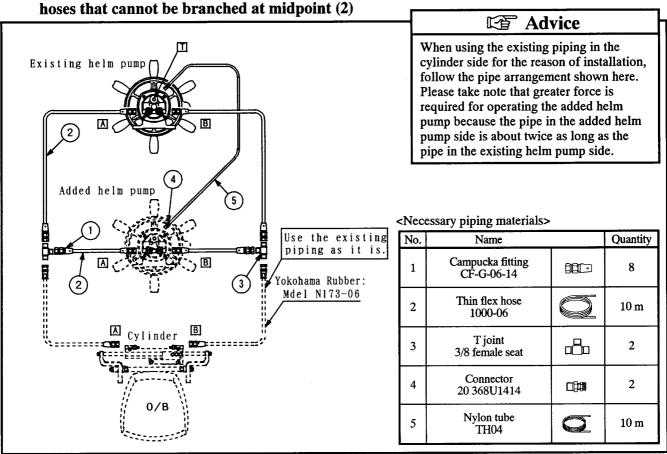
(F) When adding a helm pump to a system using 1/4 high-pressure



(G) When adding a helm pump to a system using 3/8 high-pressure hoses that cannot be branched at midpoint (1)

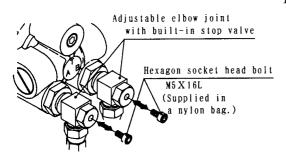


(H) When adding a helm pump to a system using 3/8 high-pressure



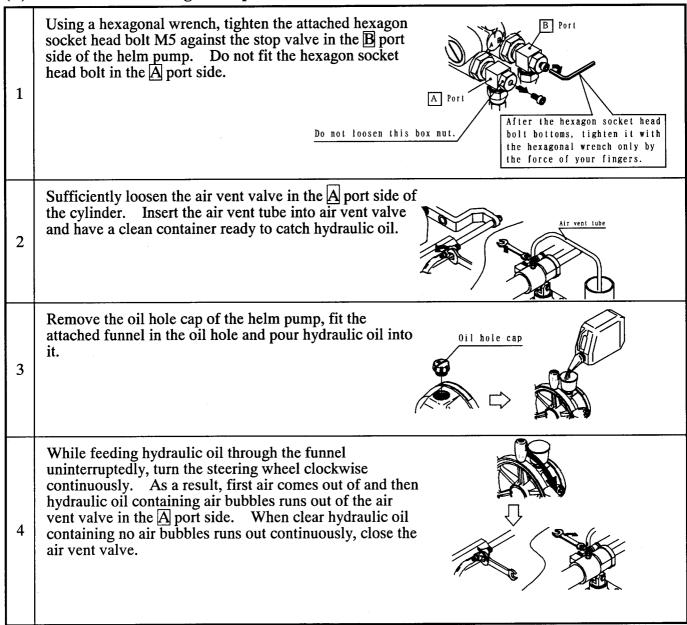
8. Bleeding

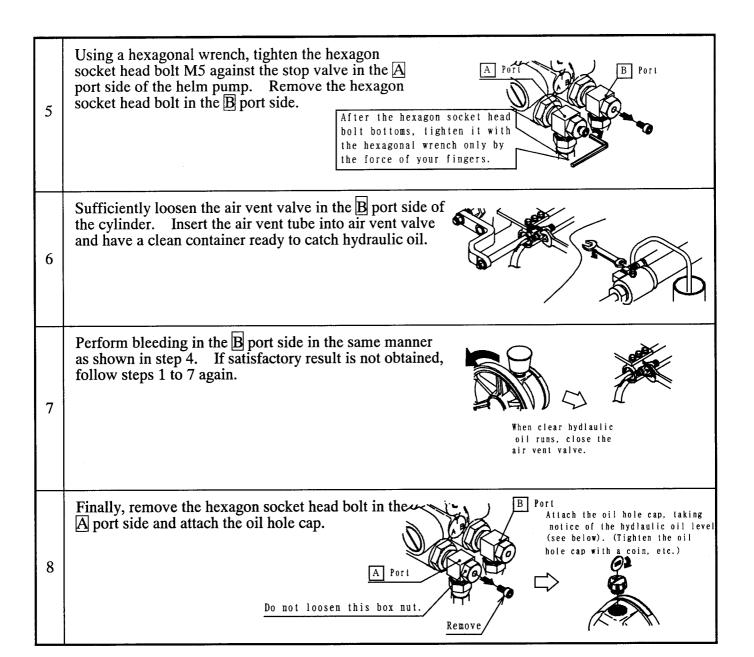
Why is the stop valve used for bleeding?



The high-pressure hose is empty when it is bled for the time. The stop valve is used to prevent air from returning from the opposite side to the helm pump when hydraulic oil is sent from the helm pump. This method allows you to complete bleeding operation in a shorter period of time than the conventional bleeding method, because air does not mix with the hydraulic being sent. If you are familiar with the conventional bleeding method, you may perform bleeding without using the stop valve. The conventional bleeding method can be applied with the joint with built-in stop valve left as it is, in which case the hexagon socket head bolt is not used.

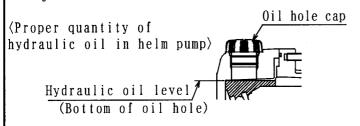
(A) In the case of steering at one position





A Caution

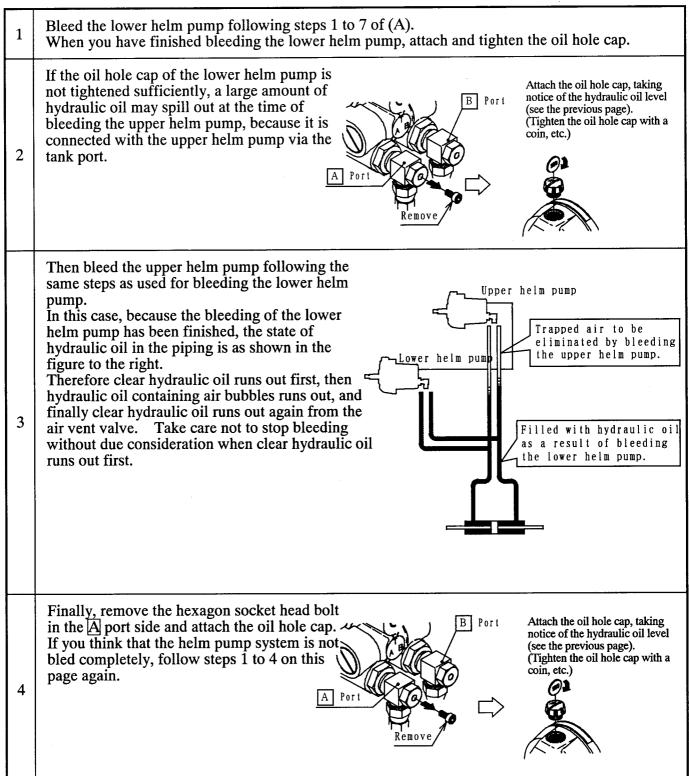
Before attaching the oil hole cap, check the hydraulic oil level. If it is excessive, reduce the quantity of hydraulic oil so that the oil level is at the lower end of the threaded portion of the oil hole as shown in the figure below. Even if the tank is filled up and the temperature rises to increase the internal pressure, the built-in valve relieves the increased internal pressure. However, take note of the hydraulic oil level just to be on the safe side.



酒 Advice

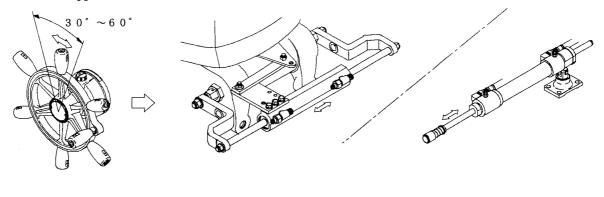
After the completion of bleeding, increase the pressure in the piping by applying a force of about 10 kg (lightly applying your weight) to the steering wheel clockwise and counter clockwise after the piston of the cylinder reaches the stroke and check for oil leakage in the piping joint sections.

(B) In the case of steering at two positions



A Caution

It is OK if the cylinder operates right and left when the steering wheel is turned within the range of 30° to 60° with the boat stopped.

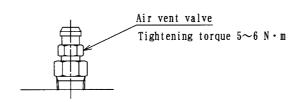


A Caution

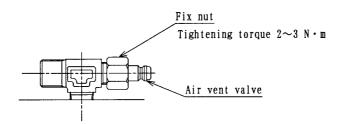
Check the oil level in the tank at the time of a shakedown or during sailing two or three times. If the oil level in the tank is lowered due to hydraulic oil flowing into the tank port piping, replenish hydraulic oil.

(C) Air vent valve tightening torque

① Independent type



② T type



9. Steering Method



Operate the steering wheel while securely holding a part of the body of the boat.

Turning the helm to the right (Helm starboard):

Turn the steering wheel clockwise.

Turning the helm to the left (Helm aport):

Turn the steering wheel counterclockwise.

For the total number of turns of the steering wheel between helm starboard and helm aport, refer to the specifications shown on page 3.

Know as early as possible how the boat turns and tilts according as the steering wheel is turned.

A

Caution

When operating the steering wheel, securely hold the handrail, etc. of the boat with one hand and operate the steering wheel with the other hand. If you hold only the steering wheel, you may tumble when the boat turns or much rolls because the steering wheel itself is easy to turn.

When the piston of the cylinder reaches the stroke end in fully starboarding or porting the helm, it becomes hard to turn the steering wheel.

After the piston of the cylinder reaches the stroke end, you can turn the steering wheel very slowly by continuing to apply force to it, which indicates no abnormal condition. If the steering wheel turns easily after the piston of the cylinder reaches the stroke end, it is probable that oil leakage or an equipment failure have occurred. In this case, refer to page 33.



Warning

Be sure to avoid taking a sharp turn at a high speed, which could cause passengers aboard to tumble or fall into the sea or cause the boat to capsize.



Caution

In the case of a double-steering system, instruct the passengers aboard not to touch the steering wheel not being used. Doing so could result in a mistake in steering in the worst case.

Maintenance and Inspection 10.

Maintenance and inspection will prevent the system from malfunctioning. Referring to the table below, periodically perform maintenance and inspection before leaving port after returning to port.

Component	Inspection item	Criteria	Schedule
Helm pump	Check the oil level in the tank.	The oil level should be at the lower end of the threaded portion of the oil hole. (See page 28.)	Before leaving port
	Check the steering wheel for play.	The cylinder should operate within the steering wheel turning angle range of 30° to 60°. (If it is impossible to check the operation of the cylinder, check the number of turns of the steering wheel instead.)	Before leaving port
	Check the number of turns of the steering wheel.	Remember the normal number of turns and check the number of turns of the steering wheel while turning it clockwise and counterclockwise. (See page 3.)	Before leaving port
	Check the oil for deterioration.	We recommend you to change the hydraulic oil once every 6 months if you use the boat frequently and once every year if you do not use the boat frequently.	Every 6 months
	Check the shaft seal section.	No leakage should be caused.	Before leaving port
Cylinder	Check the fixing bolt for looseness.	No looseness should be caused.	Before leaving port
	Check the ball joint section and rotating section for greasing conditions.	Sufficient grease should be applied.	Every month
High-pressure hose, copper pipe and coupling	Check for oil leakage.	No oil leakage or exudation should be caused.	Before leaving port
	Check for surface flaws.	There should be no significant flaws leading to oil leakage.	Every 2 to 3 months
	Check the high-pressure hose on the outside deck for deterioration.	There should be no crazing, large cracks or cracks caused by metal rust.	Every 2 to 3 months

A Caution

Never mix hydraulic oil used for other hydraulic equipment or engine oil, fuel, etc. with the hydraulic oil used in this system. Doing so will cause an equipment failure, which may result in loss of control in the worst case.

G Advice

For the disposal of waste oil resulting at the time of hydraulic oil changing and bleeding, refer to the gas station, etc. from which you purchased the hydraulic oil.

11. Troubleshooting

Symptom	Possible cause	What to do
The steering wheel turns idly in one direction.	① The check valve spool is stuck.	① Disassemble and wash.
When the steering wheel is released, the helm returns to the neutral position (snaking).	 Foreign matter caught in the check valve Oil leakage in the piping Air mixed in 	 Disassemble and wash. Repair the piping and perform bleeding again. Perform bleeding completely.
The steering wheel turns idly in both directions.	 Excessive leak in the check valve spool Oil leakage in the piping A large amount of air mixed in 	 Replace the check valve. Repair the piping. Check the oil level and perform bleeding again.
The number of turns of the steering wheel is larger than the specified one.	① Air mixed in ② Excessive leak in the check valve spool	 Perform bleeding completely. Replace the check valve.
The play of the steering wheel is too long.	① Air mixed in	① Perform bleeding completely.
It is abnormally hard to turn the steering wheel.	 Improper steering gear installation position Damage inside the steering gear Jamming between the helm shaft and bearing Insufficient torque Bending of the high-pressure hose or copper pipe Deterioration of hydraulic oil 	 Refer to the dimensional installation drawing. Drain the oil and manually move the steering gear. If it does not move smoothly, replace it. Repair. Replace with a steering gear that can produce sufficient torque. Repair the piping. Change the hydraulic oil.
When one steering wheel is turned, the other steering wheel turns (in the case of steering at two positions).	 Foreign matter caught in the check valve of the helm pump in the side of the other steering wheel. Damage to the seat of the check valve 	① Disassemble and wash. ② Replace the part.

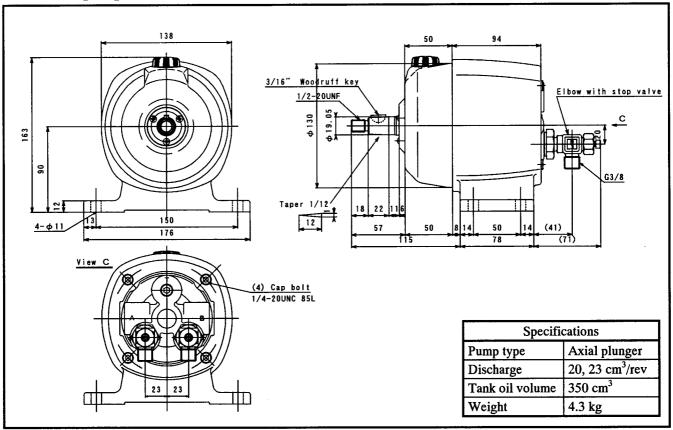
12. Recommended Hydraulic Oil

	Name	Name (For cold district)
JX Nippon Oil & Energy	Super highland 32	Highland wide 22
Idemitsu	Daphne neo fluid 32	Daphne super hydro X22
Cosmo	Cosmo hydro AW32	Cosmo hydro HV22
Kygnus	Unit oil WR32	Unit oil E22
Showa Shell	Teras S2M 32	Teras S2V 22
Exxon Mobil	Mobil DTE 24(#32)	Mobil DTE 22

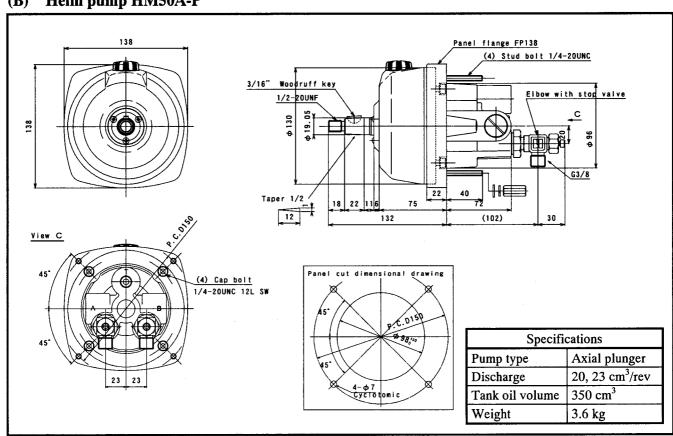
- (Notes) 1. Our standard-attached hydraulic oil is equivalent to "Super highland 32" and "Highland wide 22 for cold district".
 - 2. When changing hydraulic oil, discharge the used hydraulic oil as much as possible.
 - 3. When replenishing or changing hydraulic oil, try to avoid mixing different types of hydraulic oil.

13. Dimensional Outline Drawing

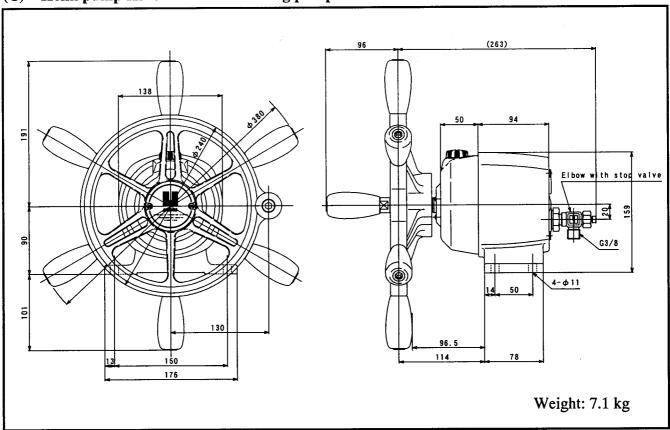
(A) Helm pump HM50A-B



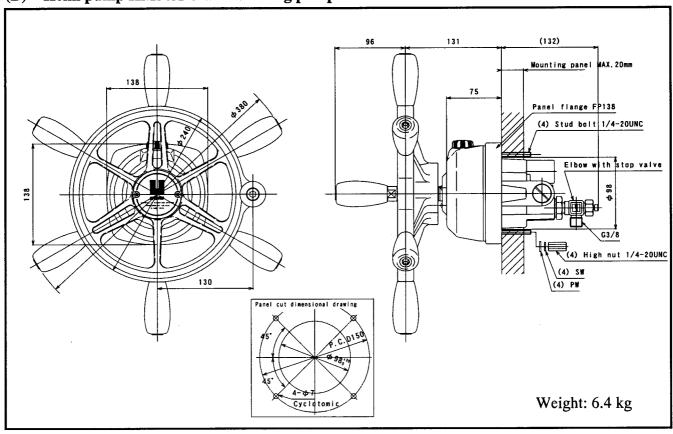
(B) Helm pump HM50A-P



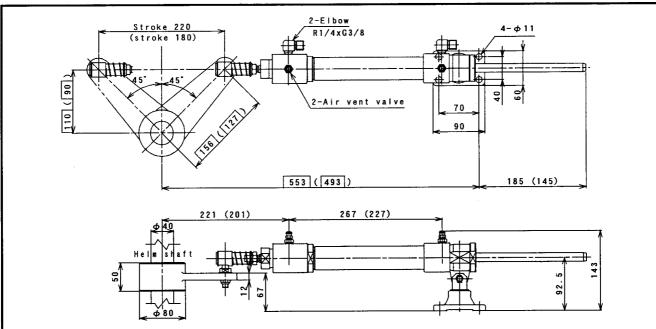
(C) Helm pump HM50A-B with steering pump S-N380



(D) Helm pump HM50A-P with steering pump S-N380



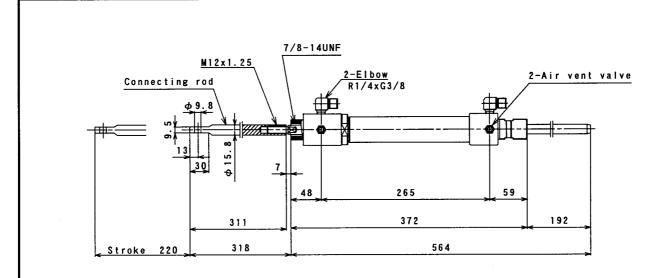
(E) 28B/32B



- ① Strictly follow the dimensions shown here.
- ② The elbow joint can be located in the opposite side by counterchanging the air vent valve and elbow joint so that the air vent valve is positioned in the upper side.
- 3 Refer to the dimensions shown in the parentheses when the stroke is 180 mm.

Model	28B		32B
Stroke	180 mm	220 mm	220 mm
Necessary oil quantity	97 cm ³	97 cm ³	138 cm ³
Weight	2.1 kg	2.3 kg	2.5 kg

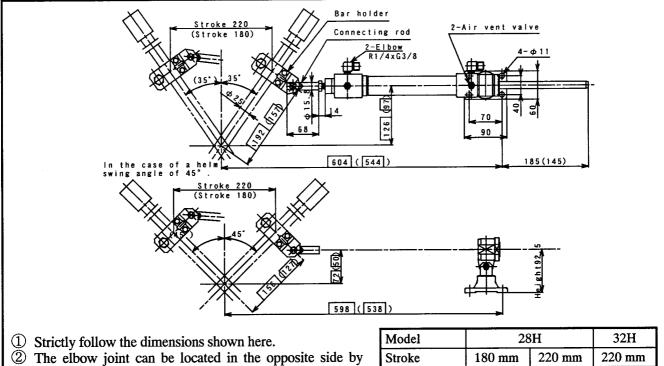
(F) 28G/32G



① The elbow joint can be located in the opposite side by counterchanging the air vent valve and elbow joint so that the air vent valve is positioned in the upper side.

Model	28G	32G
Stroke	220 mm	220 mm
Necessary oil quantity	97 cm ³	138 cm ³
Weight	2.1 kg	2.3 kg

(G) 28H/32H

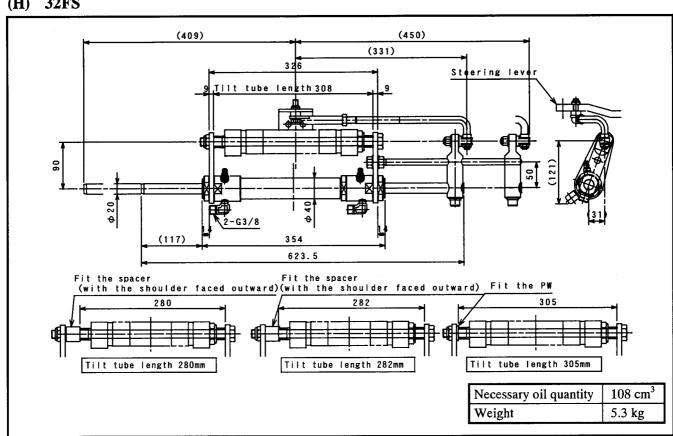


2 The elbow joint can be located in the opposite side by counterchanging the air vent valve and elbow joint so that the air vent valve is positioned in the upper side.

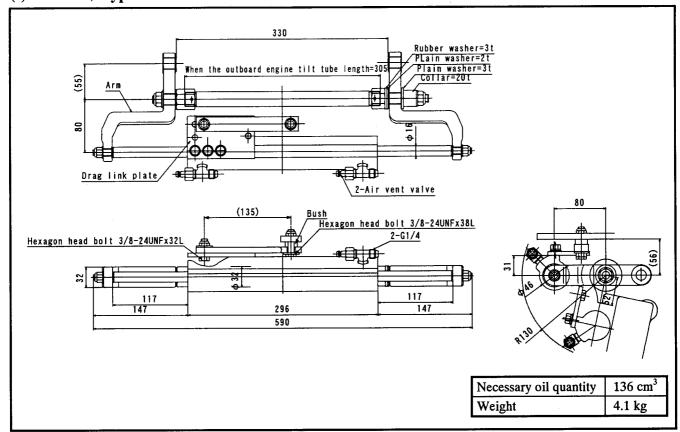
3 Refer to the dimensions shown in the parentheses when the stroke is 180 mm.

Model	28H		32H
Stroke	180 mm	220 mm	220 mm
Necessary oil quantity	79 cm ³	97 cm ³	138 cm ³
Weight	2.2 kg	2.4 kg	2.6 kg

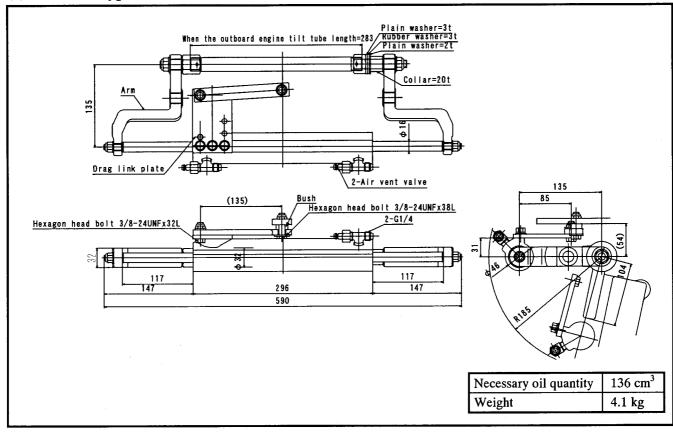
32FS (H)



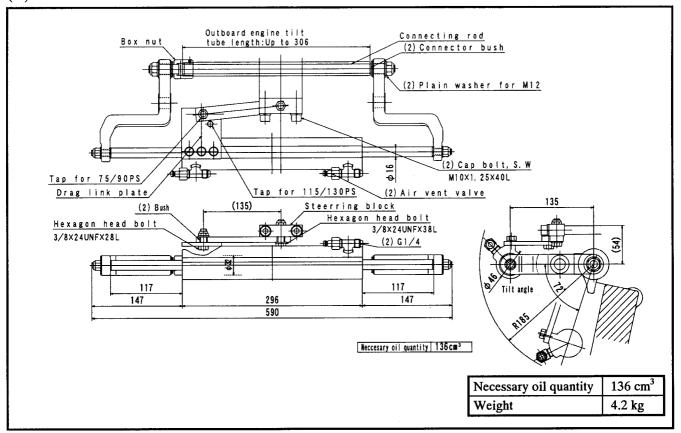
(I) 32VX / Type A



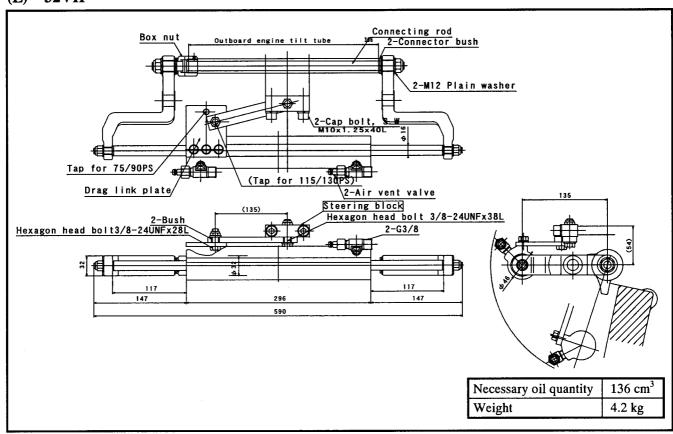
(J) 32VX / Type B



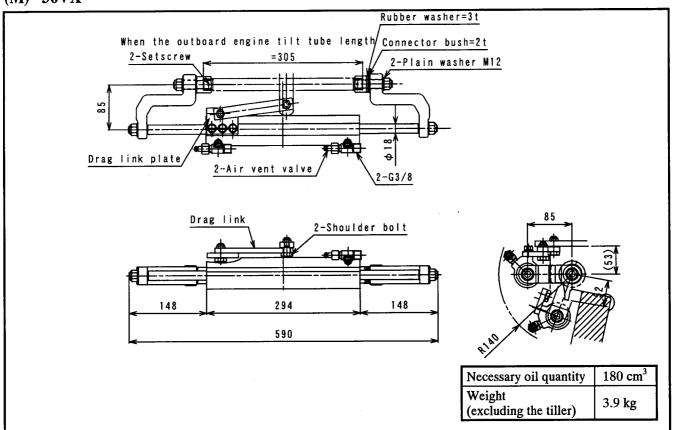
(K) 32VH



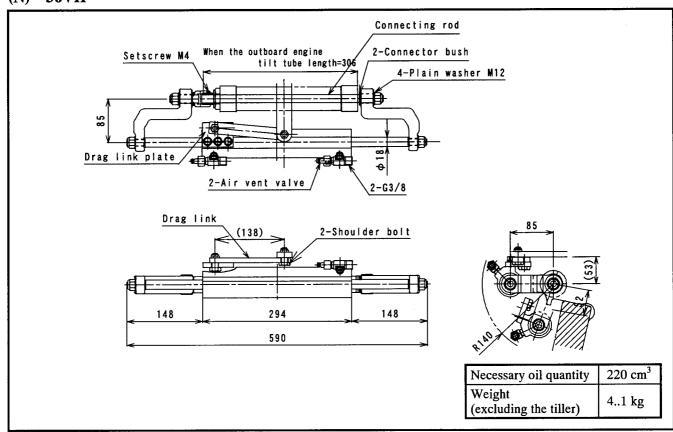
(L) 32VH



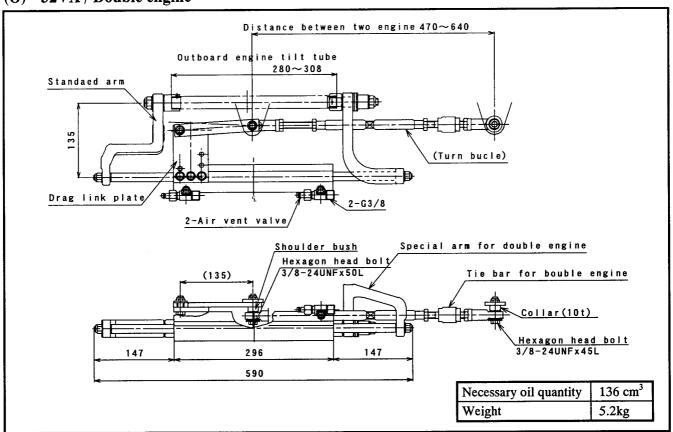
(M) 36VX



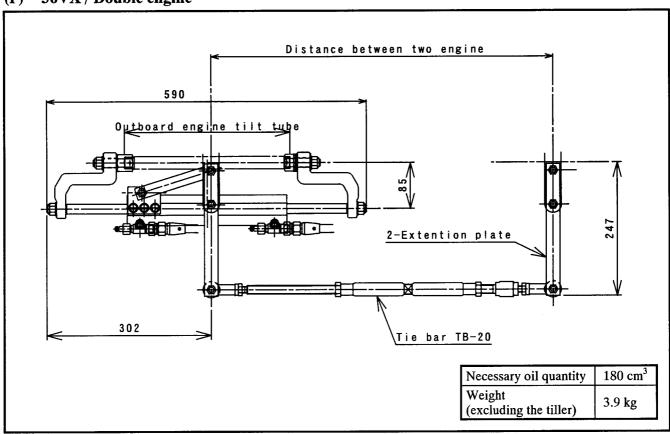
(N) 36VH



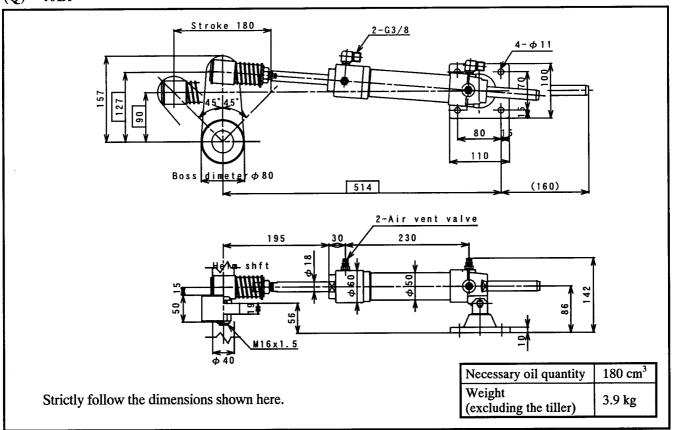
(O) 32VX / Double engine



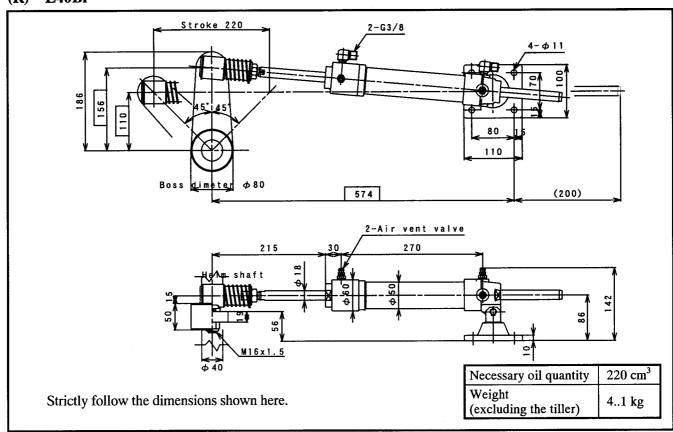
(P) 36VX / Double engine



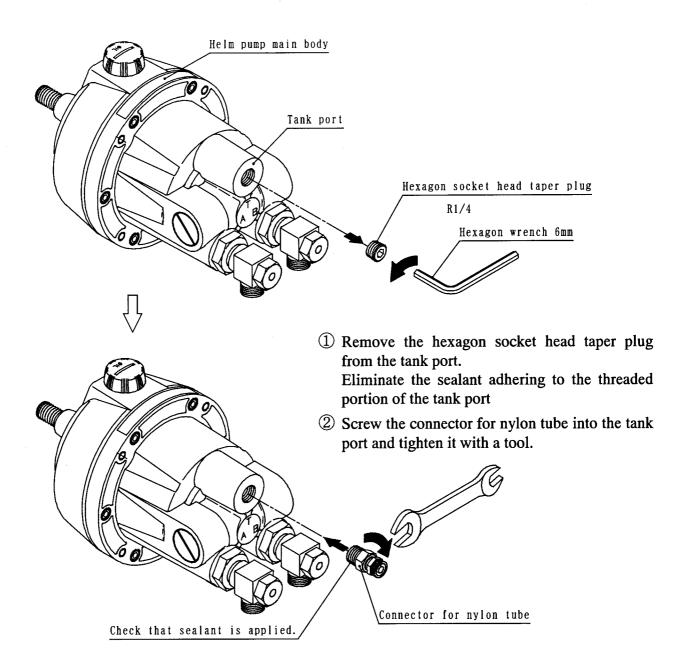
(Q) 40Bi



(R) L40Bi



14. Installation of Tank Port on Helm Pump HM50 / HM50A



15. Installation of Tank Port on Helm Pump HM40

