Manual Hydraulic Engine Remote Controls

Installation Instructions

Owners Manual

MB-150103-0E

PREFACE

Thank you for purchasing MAROL manual Hydraulic Engine Remote Control System.
The MRS System has the following features as compared to conventional mechanical and wire cable engine remote controls:

Due to the nature of the oil hydraulic system, the system offers:

1. Smooth and light operation, especially for multiple station installations.
2. Flexibility in the routing of hydraulic tubes.
3. A longer service life since most of the parts are hydraulically sealed and most mechanical parts are not subject to corrosion or stiffness.
4. Smoothness and lightness in operation does not change over years of use.

CAUTION: Without proper installation, operation and maintenance, however, the system cannot offer the above features and may cause malfunctions which may result in a possible accident.

Before proceeding to the installation and operation, please read the instruction thoroughly and understand the full details of the installation and the functions.

⚠ WARNING

THE MRS SYSTEM IS DESIGNED FOR ENGINES WHICH HAVE THE SHIFT AND THROTTLE LEVER OPERATING TORQUE OF UNDER 686N–cm (70Kgf-cm).

BEFORE STARTING THE ENGINE, THE FOLLOWING INSPECTION AND OPERATION SHOULD BE PERFORMED. (For details, refer to chapter 8. OPERATIONAL PRECAUTIONS)

1. Accumulating pressure of the Charge Tank Unit ACV-100.
2. Operate the Control Head full strokes back and forth several times and confirm that the handle positions of the Control Head match the Throttle Shift lever positions accordingly.
3. Set the Control Head so that its Shift Handle is at Neutral and Throttle Handle is at Idle before starting the engine.

WITHOUT ABOVE INSPECTION AND OPERATION, MISOPERATION MAY OCCUR UPON STARTING THE ENGINE DUE TO MISMATCHING OF LEVER POSITIONS.

NOTE:•@Please keep this instruction manual on hand.

Table of Contents

1.SPECIFICATIONS

NAME	CONTROL HEAD	SHIFT RECIVER	THROTTLE RECEIVER
MODEL	CH-22A	MMR-22S	MMR-22T
CYLINDER DIAMETER	Φ22mm		
EFFECTIVE STROKE	23mm		
EFFECTIVE WORKING ANGLE	90 degree		
MAXIMUM WORKING ANGLE	110 degree	100 degree	
DISPLACEMENT	8.7cm^3		
TRANSMITTING TORQUE	12N-m (1.22f-m)		
SYSTEM PRESSURE (NOTE 1)	2.8MPa (28.4kgf/cm^2)		
CABLE ADJUST STROKE		18 - 56 mm (NOTE 2)	**35 - 112 mm (NOTE 3)**
WEIGHT	2.7 kg	2.0 kg	

(NOTE 1) Generating pressure is at 12N.m {1.22kgf.m}, and the control handle operating angle of 45

(NOTE 2) Cable stroke from Neutral to Forward (Reverse).

(NOTE 3) Cable stroke from Idle to Full

NAME	CHARGE TANK UNIT
MODEL	ACV-100
ACCUMLATING PRESSURE	0.6 MPa {6 kgf/cm^2}
EFFECTIVE ACCUMLATOR OIL QUANTITY	105 cm^3
SAFETY VALVE SETTING PRESSURE	3.4MPa {35kgf / cm^2}
RESERVOIR CAPACITY	500 cm^3
WEIGHT	5 kg

2. SYSTEM COMPONENTS

NAME	MODEL	SINGLE ENGINE			TWIN ENGINE		
		SS1	SS2	SS3	WS1	WS2	WS3
CONTROL HEAD	CH-22A	1	2	3	2	4	6
HEAD COVER	HC-CH-22	1	2	3	2	4	6
SHIFT RECIVER	MMR-22S	1	1	1	2	2	2
THROTTLE RECIVER	MMR-22T	1	1	1	2	2	2
CHARGE TANK UNIT	ACV-100	1	1	1	2	2	2
DECAL	for CONTROL HEAD	1	2	3	2	4	6
STANDARD TUBING (NYLON)	Nylon Tube TH04 50m	1	1	2	2	2	3
	Connector 20CC334XX	Installed prior to shipment					
	Union Tee 20364-U1/4	2	2	2	4	4	4
AIR PURGE VINYL TUBE	1m Transparent	1	1	1	1	1	1
MOUNTING BOLT SET (NOTE 2)		12 SET	16 SET	20 SET	24 SET	32 SET	40 SET

NOTE: 1 The numbers after SS and WS denote the number of control station.

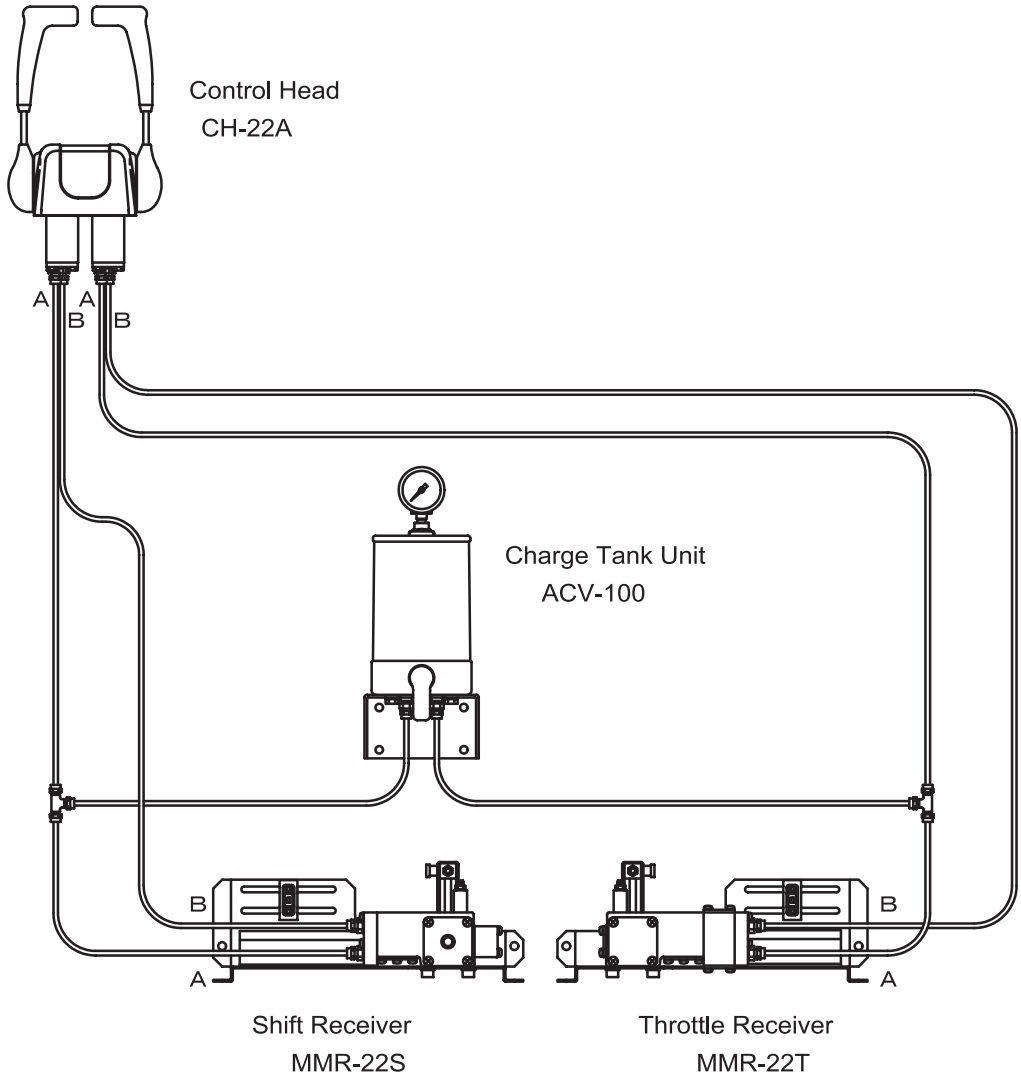
NOTE: 2 Mounting Bolts (Stainless steel) of M8, nuts, plain and spring washers are not included in the system kit and should be provided by the customers

3. HYDRAULIC TUBING DIAGRAMS

All the diagrams denote the shift cable Pull – Forward, the throttle cable Pull – Acceleration.
Refer to Chapter 5. Piping (page 16) for other application.

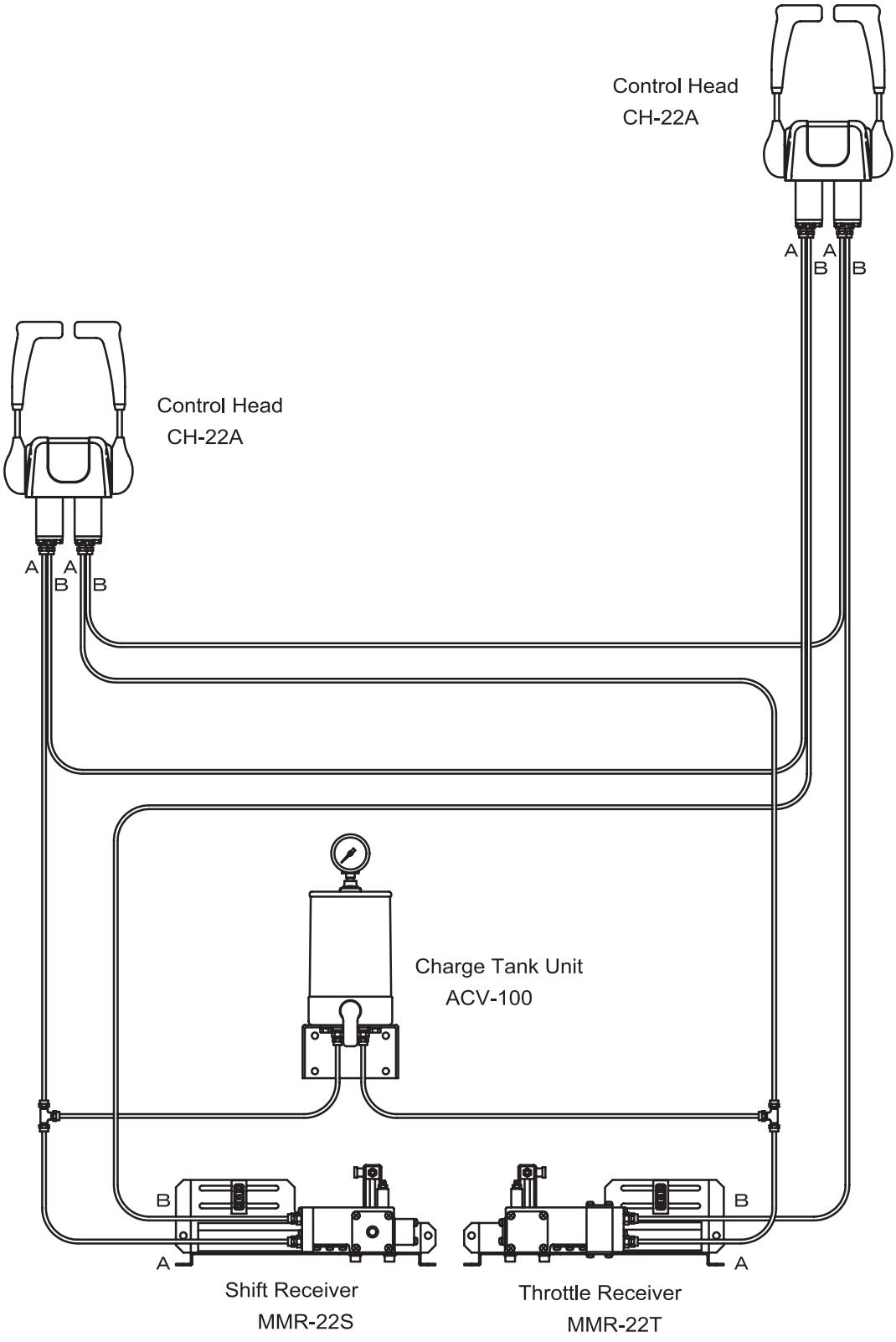
3-1.SINGLE ENGINE / SINGLE STATION

Model : MRS-SS1



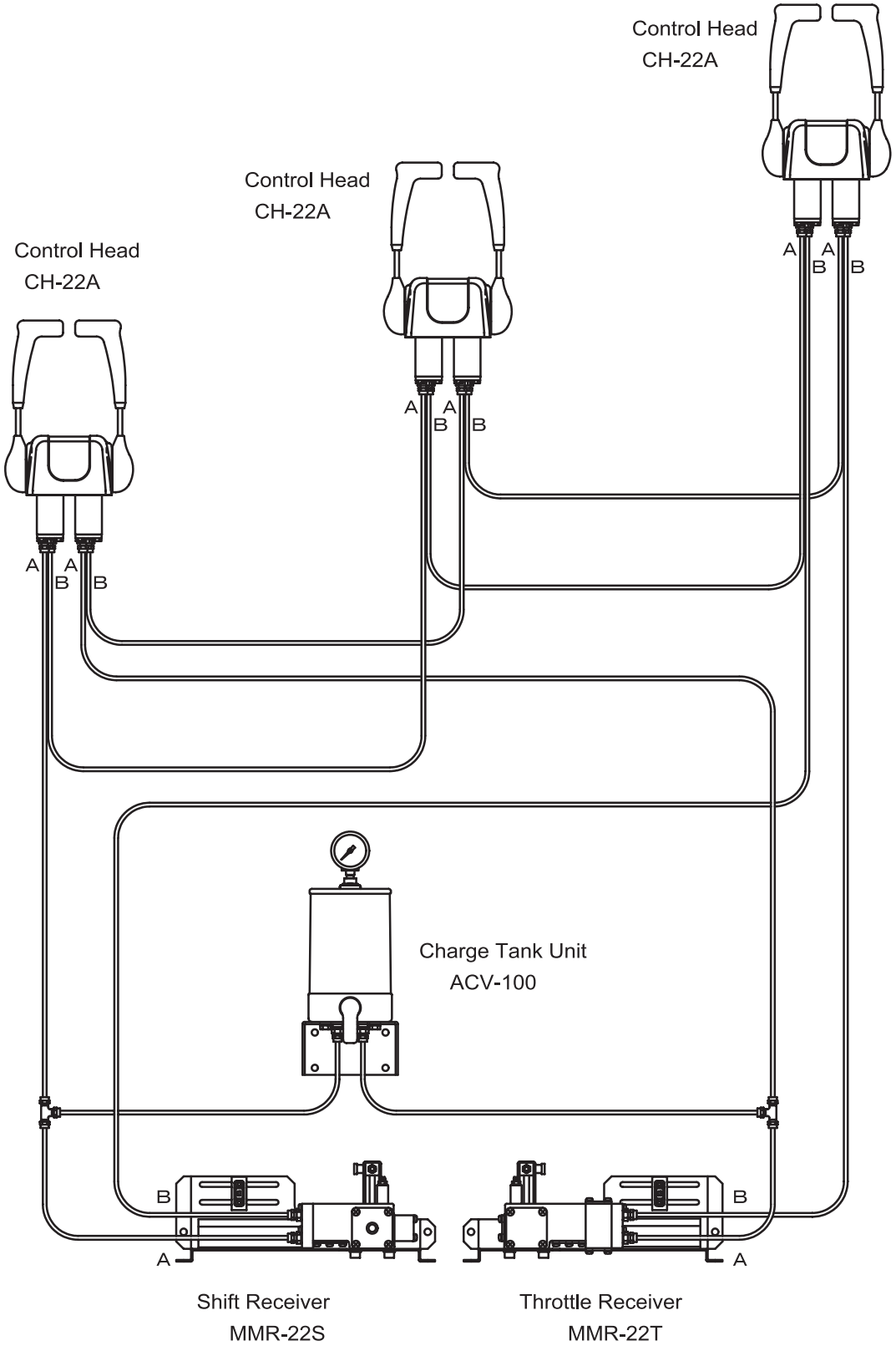
3-2.SINGLE ENGINE / TWIN STATION

Model : MRS-SS2



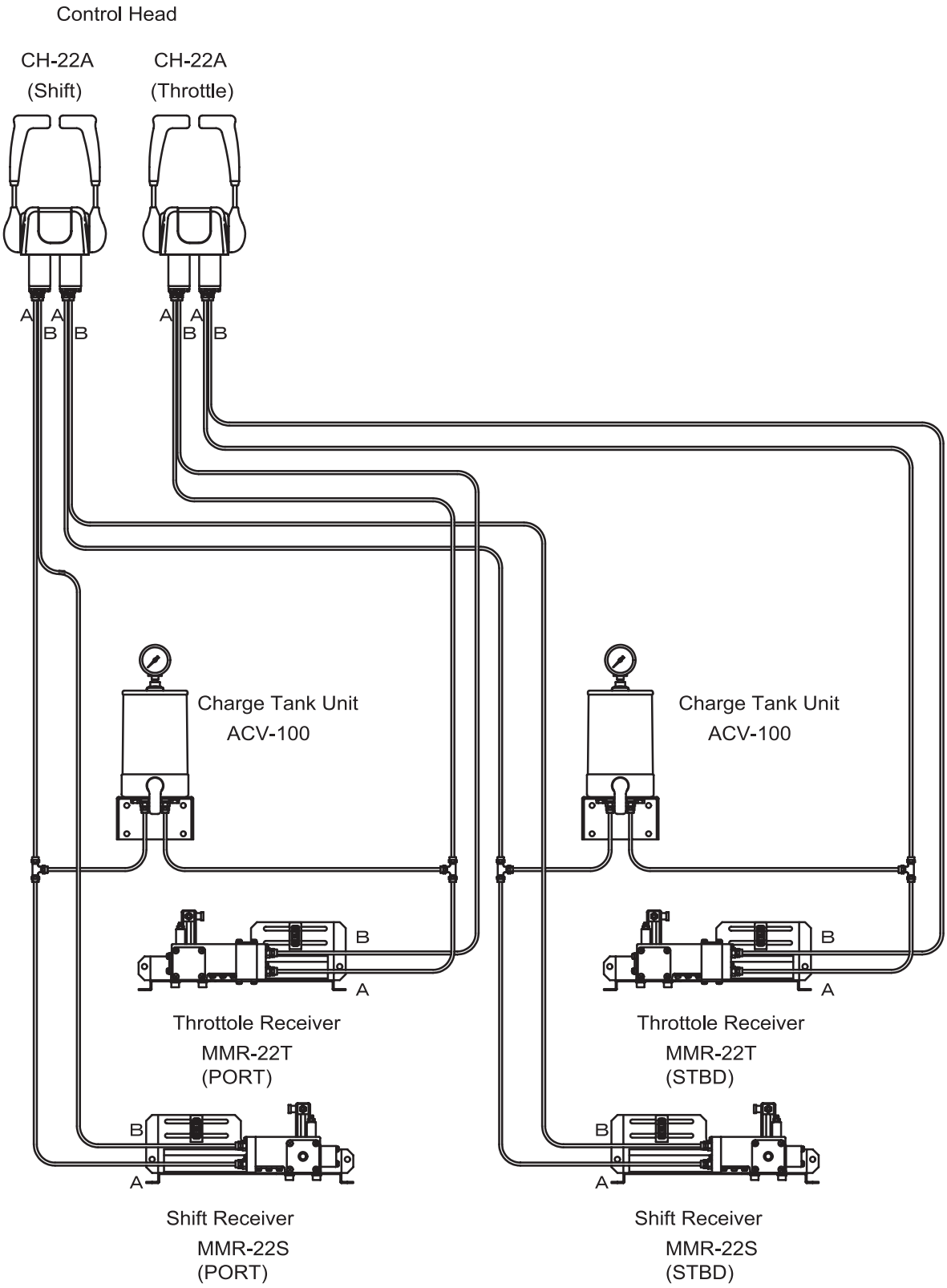
3-3. SINGLE ENGINE / TRIPLE STATION

Model : MRS-SS3



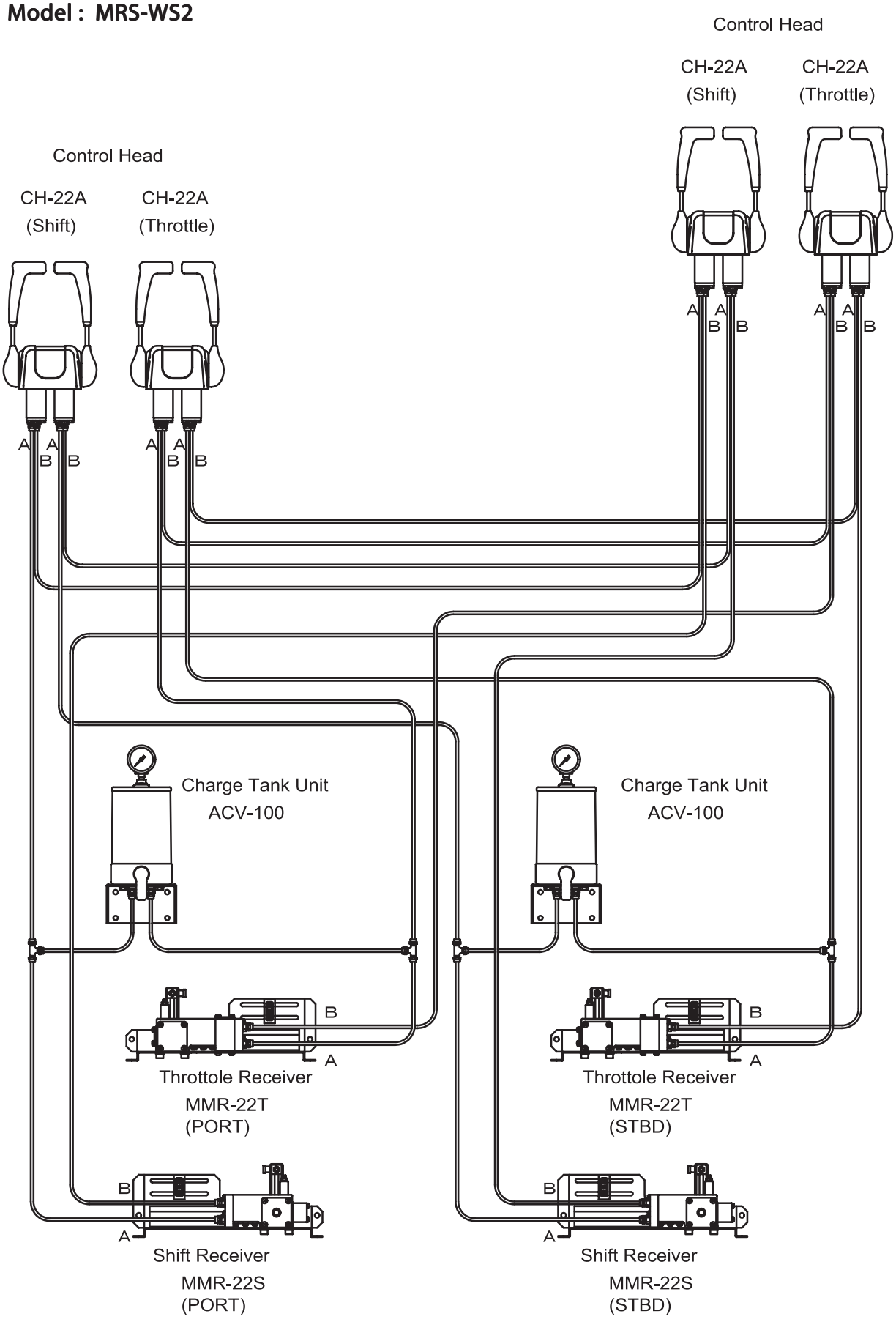
3-4. TWIN ENGINE / SINGLE STATION

Model : MRS-WS1



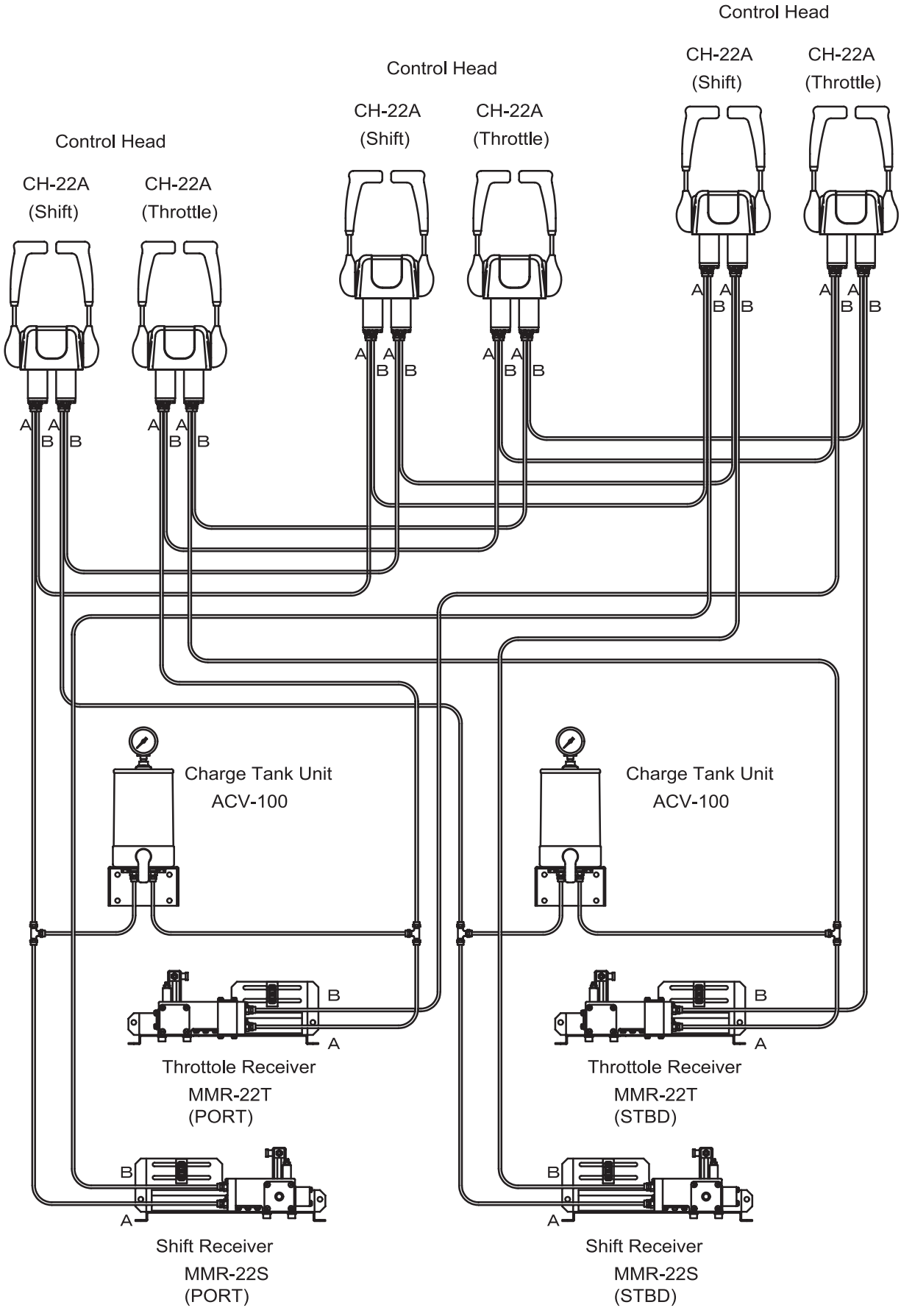
3-5. TWIN ENGINE / TWIN STATION

Model : MRS-WS2



3-6. TWIN ENGINE / TRIPLE STATION

Model : MRS-WS3



4. COMPONENT I NSTALLATION

The following tools and parts will be necessary for the installation, piping, oil filling/air purging and adjustments:

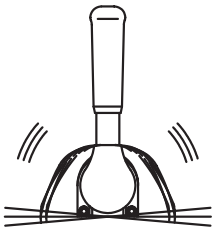
1.Spanners (8mm, 10mm, 12mm, 13mm, 14mm)
2.Allen Wrench (3mm, 4mm, 5mm)
3.Drill (9mm)
4.Jig Saw
5.Stainless steel mounting bolts, nuts, plain washers, spring washers.
(Refer also to Chapter 2. SYSTEM COMPONENTS)

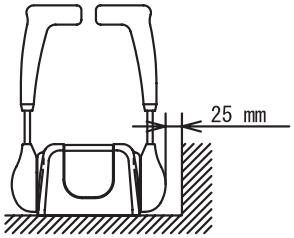
4-1 CONTROL HEAD

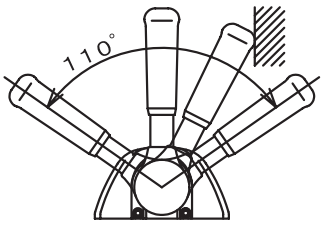
4-1-1. Decide Installation Location

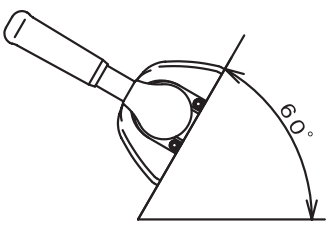
Decide the installation location of the control head considering the following points.

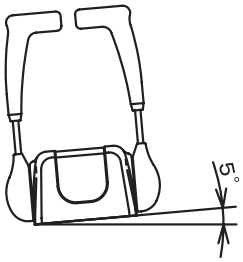
1. Should be installed at rigid part of the structure to withstand the operation of the handles.
2. At least 25mm of clearances are necessary for both sides of the handle to remove the cover and adjust the handle positions.
3. Maximum handle working angle is 100. Interference should be checked for its working radius.
4. The Control Head should be installed within 60 vertical from the horizontal plane and within 5 slant sideways.







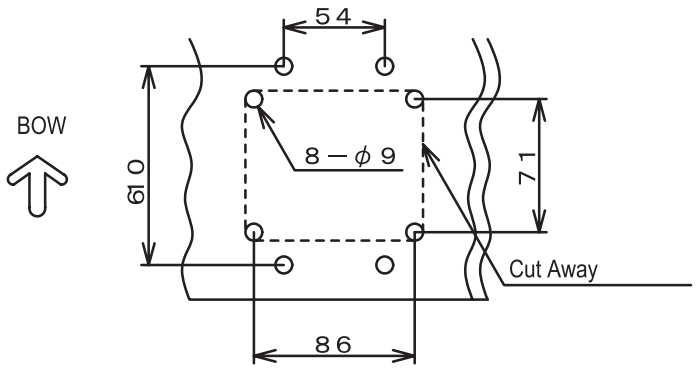




4-1-2 Drilling the Mounting Holes

When the installation location is decided, proceed for drilling as follows:

1. By using the template attached to this instruction manual, mark the 4 installation bolt holes and 4 corner holes for the square cut away portion.
2. Drill the 8 holes marked above.
3. Cut away the square portion by using a jig saw



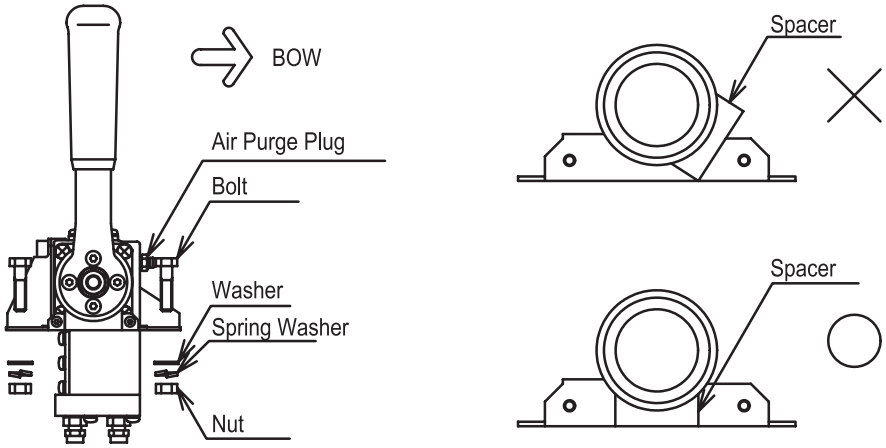
4-1-3 Control Head Installation

Installation bolts, nuts, washers are not included in the system kit since the thickness of the dash varies. Please provide suitable length of M8 bolts, nuts, plain and spring washers. Stainless steel (SUS304) is recommended.

1. Bring the Control Head in place and affix it to the dash by using the bolts, plain washers, spring washers and nuts. See the figure below.

Caution: Air Purge Valves should face the vessel's bow direction.
The Spacer (black rubber seal between the cover and the handle) should be placed straight as shown in the figure below.

2. In order to avoid dirt getting into the system, the rubber caps on the pipe fittings should be kept on until ready for piping work.
3. The cover for the control head is packed separately in the system kit. It should be assembled after finishing the oil filling / air purging and adjustment procedures.

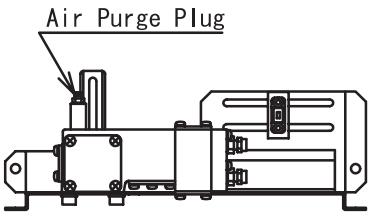


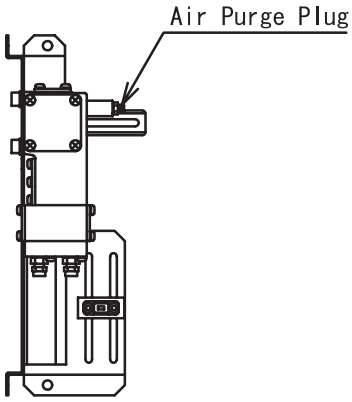
4-2Receivers

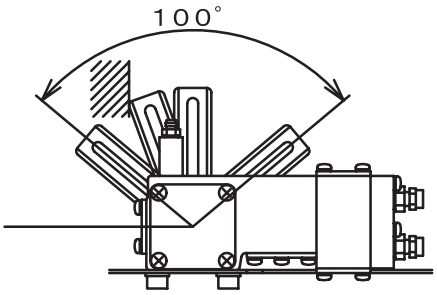
4-2-1. Decide Installation Location

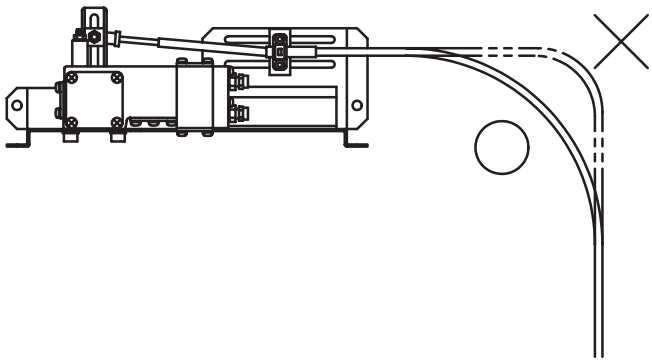
Please note the following points:

1. The receivers are so designed that they are connected to the short length of wire push-pull cables from the engine. Select an appropriate location where:
   a) Distance from the engine throttle and shift lever is as short as possible and away from the engine heat or other conditions hazardous to the tubing, such as vibrations.
   b) Install the receivers at rigid part of the vessel structure. Reinforce the mounting part if necessary.
2. The maximum lever working angle is 100 degree (effective working angle is 90 degree). Look for interference of lever movement. If the lever movement is limited, it may become a source of malfunction.
3. Although the receivers can either be mounted on floor or on the wall, the units should be installed so that they face either horizontal or straight vertical and air purge valves face up or positioned high.
4. As mentioned in 1, push-pull cables are used in the connection of the receiver units to the engine levers. The locations must be selected so that route of push-pull able is as straight and as short as possible.
   If push-pull cables are routed tightly and too long, the system may fail to offer smooth and light operation.





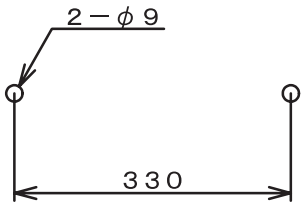




4-2-2. Drilling the Mounting Holes

When the installation location is decided, proceed for drilling as follows:

1. Refer to Page 31 – Page 32 dimensional drawings, mark the 2 installation bolt holes.
2. Drill the 2 holes (9mm diameter) marked the above.



4-2-3. Installation of Receivers

Installation bolts (M8), nuts, washers are not included in the system kit since the thickness of the mounting location varies. Please provide suitable length of M8 bolts, nuts, plain and spring washers. Stainless steel (SUS304) is recommended.

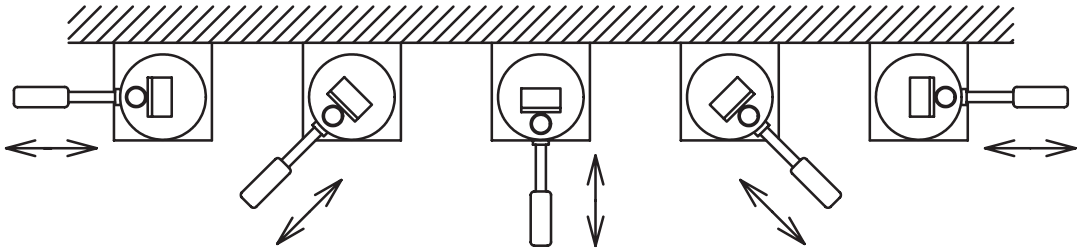
1. The receivers are installed by using 2 M8 bolts either on the floor (horizontal plane) or on the wall (straight vertical).
2. In order to avoid getting dirt into the system, the rubber caps on the pipe fittings should be kept on until ready for piping work.
3. Do not connect the wire push-pull cables at this point in time.

4-3. Charge Tank Unit

4-3-1. Decide Installation Location

Please note the following points.

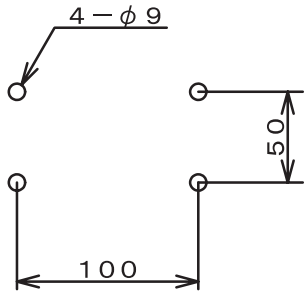
1. Select a rigid part of the vessel's structure and reinforce the mounting members if necessary.
2. Avoid any location where there is any strong vibration and high heat.
3. Install the unit horizontally and facing the oil filling port up.
4. It is necessary to operate the handle to accumulate the pressure. Leave enough space for handle operation. The handle direction can be changed by reassembling the body to its mounting base as shown in the figure below.
5. As daily maintenance, inspection, and accumulating operation are required, the unit should be installed at a location convenient for such an inspection and operation.
6. Although a relief valve is installed in the unit for the pressure rise caused by thermal expansion of hydraulic oil, the unit should be installed away from direct sunlight and frequent heat influences.



4-3-2. Drilling the Mounting Holes

When the installation location is decided, proceed for drilling as follows:

1. Refer to Page 33 dimensional drawings, mark the 4 installation bolt holes.
2. Drill the 4 holes (9mm diameter) marked the above.



4-3-3 Installation of Charge Tank Unit

Installation bolts (M8), nuts, washers are not included in the system kit since the thickness of the mounting location varies. Please provide suitable length of M8 bolts, nuts, plain and spring washers. Stainless steel (SUS304) is recommended.

1. Install the Mounting base separately supplied with the unit on the wall by using 4 bolt sets (not supplied with the unit).
2. Assemble the body to the mounting base using the 4 bolt set included in the system kit. At this stage, the direction of the operating handle is decided.

In order to avoid getting dirt into the system, the rubber caps of the pipe fittings should be kept on until ready for piping work.

5.PIPING

WARNING: FOR HYDRAULIC SYSTEM, DIRT AND FOREIGN MATERIAL CAUSE MALFUNCTION OF THE SYSTEM. PAY UTMOST ATTENTION TO PREVENT DIRT OR FOREIGN MATERIAL FROM GETTING INTO THE SYSTEM.

5-1. TUBE SELECTION

1. There are two types of piping material available: Nylon tubes and copper tubes. We recommend nylon tubes.
   A. Nylon Tube (Standard Supply)
   Tube Specification: Bridgestone TH-04
   (6.35mm O.D., 1.02mm Wall Thickness)
   Total Piping Length Allowed: Under 30m/one line
   Ambient Temperature: - 15C ~ +80C
   B.Copper Tube (Optional)
   Tube Specification: JIS H3300 C1220T
   (6mm O.D., 1mm Wall Thickness)
   Total Piping Length Allowed: Under 50m/one line
   Ambient Temperature:- 15C ~ +80C

   NOTE: Allowable total piping length is noted as "one line" which is, for example, the total piping length of the shift line of the port engine shift. The total piping length should be less than 30 meters per line.

2. Nylon tube offers easier routing work but it tends to expand due to the internal oil pressure.
   CAUTION: When the operating pressure is high (the levers of engine are heavy to operate), the receiver may not move full strokes and the Phase Adjust Function does not work due to the tube expansion. When this condition becomes evident, copper tubing should be used partially or exclusively even though the total routing is short.
   Transmitting torque should be less than 686N-cm(70 kgf-cm)

5-2. CONFIRM PORT CONNECTION

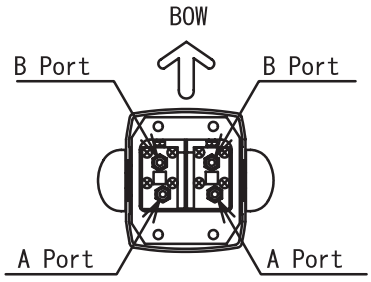
Check the port connection (A and B ports).

NOTE: See extra page to the Shift Receiver as its port connection differs according to the engine lever specification. (see extra page)

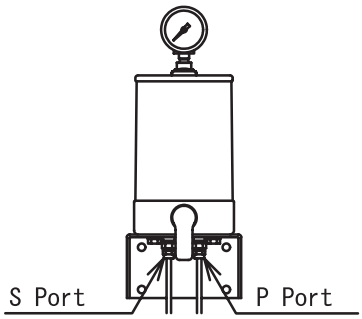
1. The control head has fixed port connection: B port for the cylinder cover and A port for the other.
2. Two ports of the Charge Tank Unit are both A ports.
3. The Throttle Receiver may require interchanging the mounting base, but its port connection is fixed so that B port is at the pilot check valve.
4. Port connection differs for the shift receiver according to the engine lever working direction. The piping ports change is shown in the chart and figures on the next page.

Depending on the engine specification, the direction of the push/pull throttle may cause the engine to accelerate or reverse. A port and B port will be determined according to the engine specifications. Please check first with the engine specification to determine the direction of the throttle.

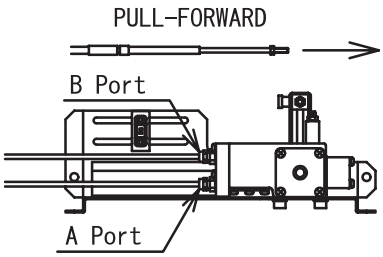
SHIFT RECEIVER	SHIFT PULL-FORWARD	Shift Receiver's Cylinder Cover B port
	SHIFT PUSH-FORWARD	Shift Receiver's Cylinder Cover A port
THROTTLE RECEIVER	THROTTLE PULL-ACCELERATION	THROTTLE Receiver's Cylinder Cover B port
	THROTTLE PUSH-ACCELERATION	THROTTLE Receiver's Cylinder Cover A port

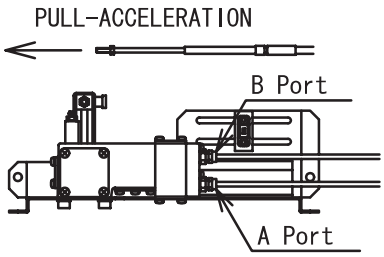


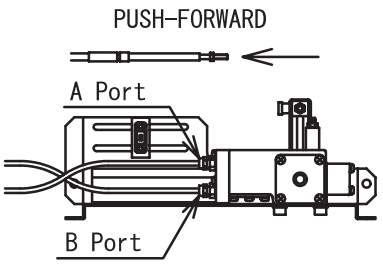
Control Head

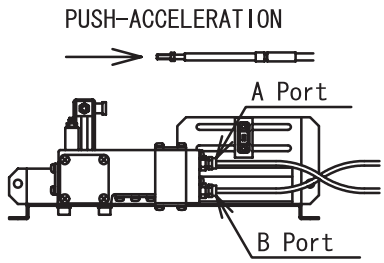


Charge Tank Unit





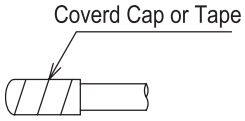


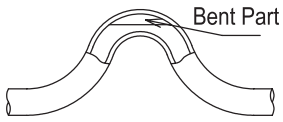


5-3 LAYING TUBING

Referring to Chapter 3: HYDRAULIC DIAGRAM (page 4~9), the tubes are laid in the vessel. The connection between the control head and receivers is from A port to A port (from B port to B port). The connection between two control head is from A port to B port (B port to A port).

1. In order to avoid getting dirt into the system, the end of tubes should be covered by a cap or plugged by tapes.
2. When routing tubes, lay the tube as straight as possible and do not bend it vertically as shown in the figure. It allows air to stay in the bent part and becomes the cause of irresponsive control. It is recommended to mark the tube with port mark to avoid misconnection.
3. Avoid routing around locations where high heat is expected.
4. Minimum bending radius is 50mm. When bending copper tubes, use a pipe bender of proper size. Do not squash the tube.
5. When cutting nylon tube, use a sharp knife or a tube cutter and cut the end squarely. When cutting copper tube, use a pipe cutter and cut the end squarely.
   Do not use a saw as it creates saw dust and notches on the cut end which causes system malfunction.
6. When routing of tubes is finished, remove the end cap of tubes and flush the tube with compressed air.

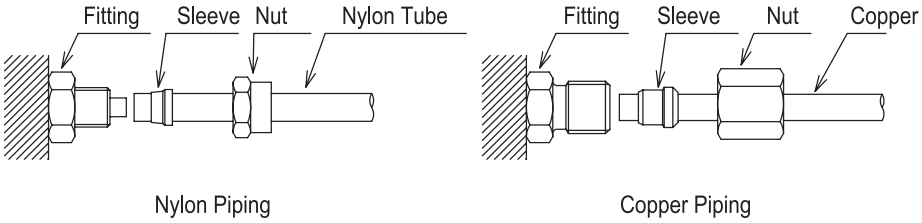




5-4 PIPING CONNECTION

Connection of tubes to the connectors is then performed. Compression fittings are used for both nylon and copper tubes and the connecting manner is the same for both tubes.

1. Put the nut and sleeve to the tube in this sequence. Look for the direction of the nut and sleeve.
2. Insert the tube into the fitting until the tube is pushed against the bottom of the fitting.
3. While pressing the tube against the bottom of the fitting, tighten the nut with a spanner. When heaviness is felt, that is the point where the sleeve is biting the wall of the tube. Tighten the nut further for 1.25 to 1.5 turns.



5-5 FINISH

1. When piping layout and tightening of fittings are finished, fix the tubes to the vessel's structure securely using pipe clamps which are included in the system kit.
   If there are not enough clamps, provide suitable clamps.
2. Nylon tubes should be protected by a spiral tube where necessary.

6. OIL FILLING/AIR PURGING

1. PREPARATION

Before starting oil filling/air purging process, confirm:

1. The levers of control head and receivers move full stroke; do not install the control head where it may be blocked or come in contact with any object.
2. The tightness of pipe fittings and air bleeders.

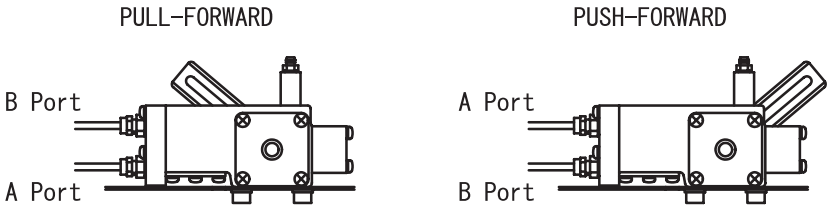
2. OIL FILLING

Specified hydraulic fluid is BARREL #3 (Red)
Please do not use steering fluid oil and brake oil.

1. Remove the filler cap of the charge tank unit and fill the specified oil in the reservoir.
   NOTE: Do not allow dirt to get into the reservoir.

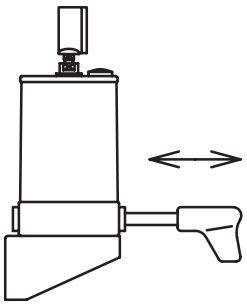
3. AIR PURGE AT RECEIVERS

1. Air purge is done from the unit close to the charge tank unit. Thus, air purge is done from the receivers. Now, start from the shift receiver.
2. Move the lever of the shift receiver to the stroke end of the reverse position.



stroke end of the reverse position

3. Accumulate the pressure of the charge tank unit by operating its handle slowly.



NOTE: Do not operate the handle too fast as it may cause cavitation and air may be displaced into the lines. Operate the handle slowly at speed of 1 second per push or pull stroke.

4. According to the handle operation, the pressure gauge shows the rise of the pressure. When its indicating needle reaches the blue marked area, accumulation is finished. (As a relief valve is assembled, the pressure does not increase over the blue marked area).

NOTE: If the pressure does not rise or drop instantly, oil is leaking through loose fittings or loose air purge valves.

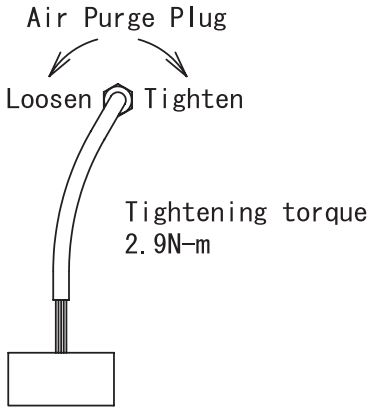
5. As the handle of the charge tank unit is operated and oil is displaced into the lines, oil level of the reservoir drops. Add oil when the oil level drops near the "E" (empty) mark. (About 30 to 40 strokes of the handle operation make the oil level drop to the "E" level).

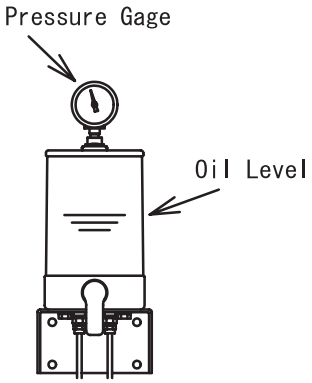
NOTE: Look for the oil levels as air will be taken into the lines if the oil level drops below the "E" mark. If air is taken in, air purging must be done again from the beginning.

6. Put one end of the attached transparent vinyl tube over the air bleeder and put the other end to a clean empty oil container.
7. Oil which comes out of the air purge valve can be used again if it is received by a clean container. But, it is recommended to filtrate with a filter of 20

   WARNING: IF OIL IS CONTAMINATED BY DIRT, IT MAY CAUSE MALFUNCTION OF THE SYSTEM.
8. Loosen the air purge valve (counter clock wise for 0.5 to 1 turn). NOTE: Be careful because in large quantities of compressed air and oil gush out.
9. When oil does not comes out, tighten the air purge valve and accumulate the pressure of the charge tank unit and repeat step 8.

   NOTE: Do not tighten the air purge valve too strongly. (Tightening torque is 2.9N-m)
10. While performing oil filling/air purging, the levers of control head and the receivers move. This is not abnormal. A neutral detent is assembled for the shift receiver. Make sure that the lever is not limited by this detent. Move the lever to the reverse stroke end by hand if it has stopped at the neutral detent.





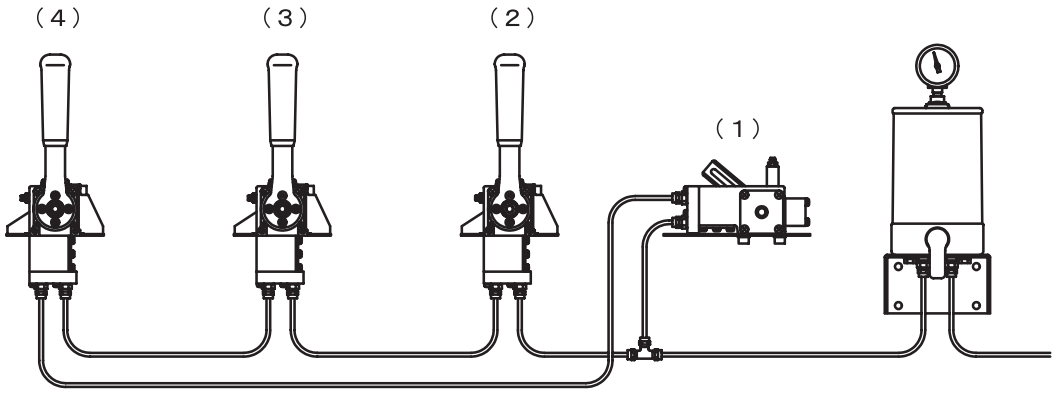
11 It is faster and more effective to perform oil filling/air purging with two persons, one operating the charge tank unit and other purging air, because air purging is done with higher pressure and faster oil flow.

12 Tighten the air purge valve when clear oil without air bubbles flows out continuously from the air purge valve. Leave it for about one minute and loosen the air purge valve again to see if clear oil without air bubbles comes out. If no air is observed, oil filling/air purging of this line (Shift) is finished. Tighten the air purge valve.

In the same manner mentioned in steps 1 through 12, oil filling/air purging should be carried out for the throttle lines. As there is no neutral detent for the throttle receiver, it is not necessary to move the lever to its stroke end.

6-4 AIR PURGE AT CONTROL HEAD

1. After finishing the receivers, air purging is performed for the control head. In the multiple station controls, air purging should be performed first for the control head, which is closer to the charge tank unit. The numbers in the figure ( ) shows the sequence of air purging process.

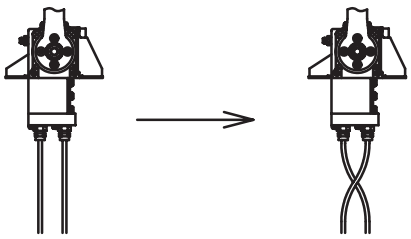


2.. The manner and process of air purging are the same as mentioned in the proceeding Section 6-3.

3. While performing oil filling / air purging, oil flow from the air purge plug at the highest control head (3) or (4) may become weak compared to air purge at receivers, this is because there are many bypass valves which operation oil passes, and is not abnormal.

6-5 CONFIRMATION

1. When air purging is finished for all the components, confirm the movement of the receivers and the control heads by operating the control handle.
2. If the direction of receiver is opposite, interchange the two piping lines.



WARNING: Before interchanging the piping, be sure that the pressure is dropped by loosening the air purge valve (Check with the pressure gauge). Otherwise, compressed oil will gush out when the fitting is loosened.

3. When the movement is confirmed, accumulate the pressure of the charge tank unit and confirm again whether air purging is complete by loosening each air purge valve and checking for clear oil without air bubbles.

6-6 FINISH

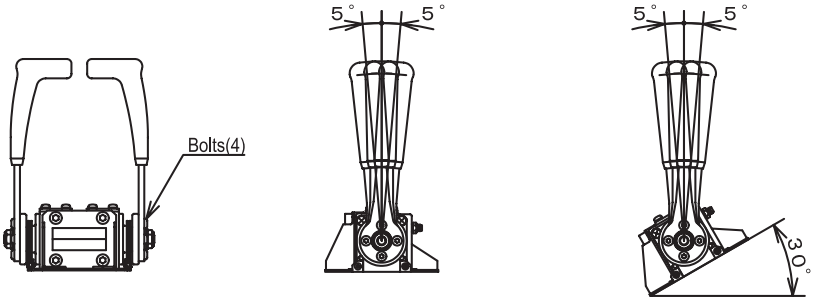
1. After confirming the above, accumulate the pressure of the charge tank unit, fill oil in the reservoir up to the “F” (full) mark and close the filler cap.

7. ADJUSTMENT

WARNING: ADJUSTMENT SHOULD BE PERFORMED WITHOUT RUNNING THE ENGINE

7-1. ADJUSTMENT OF CONTROL HEAD

The control handles can be adjusted for +-30 to neutralize the position of handles and to avoid interference of the levers around dashboard. Moreover, the control handles can be adjusted +- 5 in order to align a handle position on either side.

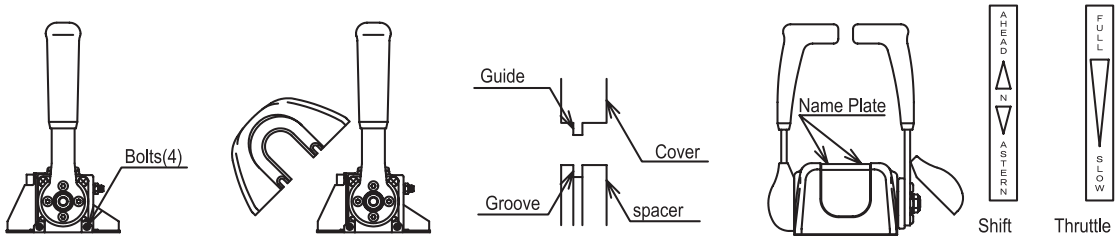


1. Loosen the bolts (4 each), adjust the neutral position or the handle position and tighten the bolts. Tightening torque is 4.9N-m {0.5kgf-m}.

WARNING: Pay extra attention to the tightness of the bolts and watch that the tightening face does not get wet with oil. Loose handles may cause system malfunction and a possible accident.

7-2. INSTALLATION OF HEAD COVER, HANDLE CAP AND NAME PLATE

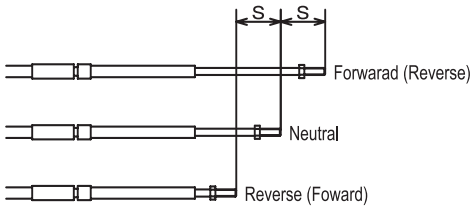
1. Remove the bolts (4 each) from the mounting base of the control head, put the head cover over the mounting base. Be sure that the guide flange of the head cover is slid into the groove of the spacer. Tightening torque is 2.9N-m {0.3kgf-m}.
2. Put the handle cap to the handle boss by pressing the cap. Twist and pull when removing the cap.
3. Attach the name plate on the head cover. Note type of the shift and throttle.



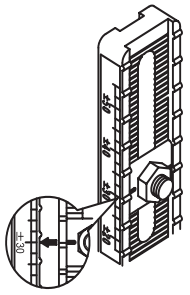
7-3. ADJUSTMENT OF SHIFT RECEIVER

The positions of the control head handles and the receiver levers may become mismatched due to a very slight internal oil leak during operation and/or due to ambient temperature changes over a long period of mooring. To adjust this mismatching of the handles and the levers, a by passing function is provided at each stroke end of the cylinders of the control heads and the receivers.
Phase between the control head handles and the receiver lever is adjusted automatically by operating the control head full strokes back and forth.
During normal operation, phase is adjusted automatically.

In order to work an automatic phase adjustment function effectively, it is necessary to operate the receivers levers at an effective working angle (90).

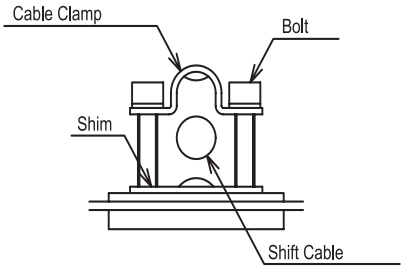


1. Move the shift lever to the neutral position at its neutral detent.
2. Measure the stroke "S" (Neutral to Forward and Neutral to Reverse) of the shift cable of the engine. Then, set the shift lever of the engine at its neutral position.
   Forward (Reverse) Neutral Reverse (Forward)
   MEASURE STROKE "S"
3. Adjust the red indicating needle of washer attached to the lever to this "S" position and tighten it securely. Tightening torque is 4.9N-m {0.5kgf-m}.
   For example, S=30mm

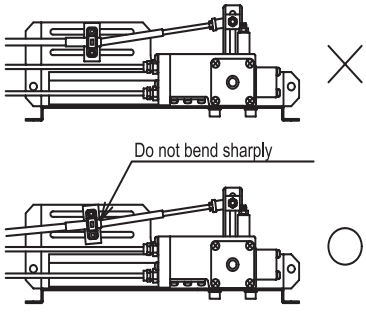


For example
S=30mm

4. Connect the shift cable to the ball joint. Screw for the ball joint M5
5. After confirming the shift lever and the engine shift lever at its neutral position, fix the shift cable to the shift receiver. Tightening torque is 2.9N-m {0.3kgf-m}. Remove the support plate from the base and fix the shift cable to the support plate by using the shim, cable clamp.
   Do not bend sharply.



GUIDE, COVER, BOLT, GROOVE, SPACER, NAME PLATES, SHIFT, THROTTLE
Remove the bolts, Put the head cover over the mounting base, The guide flange of the head cover is slid into the groove of the spacer.



6. It is important to confirm the actual positioning of neutral, forward and reverse of the shift gear by operating the control head.
   Confirm the effective working angle 90, if the receiver does not move full strokes, phase adjust function at stroke ends will not work and the handle position becomes mismatched to the lever of

the shift gear. The effective working angle of the shift receiver lever should be the same whether it is free or the cable connected. Check the working angles of the shift receiver lever with and without the ball joint of the shift cable connected. If the positioning is not quite satisfactory, adjust the installation position of the washer.

Not enough stroke Make to move outside
Over stroke Make to move inside

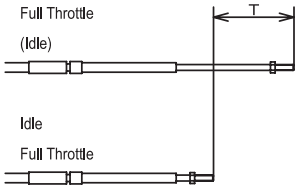
WARNING: IF THE RECEIVER DOES NOT MOVE FULL STROKES, PHASE ADJUST FUNCTION AT STROKE ENDS WILL NOT WORK AND THE HANDLE POSITION BECOMES MISMATCHED TO THE LEVER OF THE SHIFT GEAR (REFER TO CHAPTER 8: OPERATIONAL PRECAUTIONS)

If the washer in one slot of the shift receiver lever is moved, in about 1.2mm stroke will fluctuate.

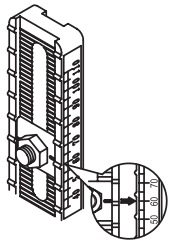
7-3. ADJUSTMENT OF THROTTLE RECEIVER

1. Set the throttle receiver lever at the idling position.

NOTE: The throttle receiver lever is only activated by a hydraulic system.



2. Measure the stroke of the engine throttle from idle to full throttle. After measuring the stroke, set the engine throttle lever at the idle position.
   Full Throttle (Idling) Idling (Full Throttle)
   Measure the stroke "T" For example, at "T" = 60mm•@



3. Fix the washer to the lever scale "T", connect the throttle cable to the throttle receiver in the same manner mentioned in the shift receiver.

4. Confirm the actual positioning of idle and full throttle of the engine throttle by operating the control head. If the positioning is not quite satisfactory, adjust the length "T" of the washer position. Check the working angles of the shift receiver lever with and without the ball joint of the shift cable connected.
   If the positioning is not quite satisfactory, adjust the installation position of the washer. If the lever length of the throttle receiver is changed, positioning of Idle will also change. Readjust cable clamp position accordingly.

If the washer in one slot of the shift receiver lever is moved, in about 2.5mm stroke will fluctuate.

8. OPERATIONAL PRECAUTIONS

8-1. PHASE ADJUSTMENT FUNCTION

1. The positions of the control head handles and the receiver levers may become mismatched due to a very slight internal oil leak during operation and/or due to a very slight internal oil leak during operation and/or due to ambient temperature changes over a long period of mooring. To adjust this mismatching of the handles and the levers, a bypassing function is provided at each stroke end of the cylinders of the control heads and the receivers.
2. Phase between the control head handles and the receiver levers is adjusted automatically by operating the control head full strokes back and forth.
3. During normal operation, phase is adjusted automatically.

WARNING: IF THE RECEIVER DOES NOT MOVE FULL STROKES, PHASE ADJUST FUNCTION AT STROKE ENDS WILL NOT WORK AND THE HANDLE POSITION BECOMES MISMATCHED TO THE LEVER OF THE SHIFT GEAR (REFER TO CHAPTER 7: ADJUSTMENT OF SHIFT RECEIVER)

8-2. CHARGE TANK UNIT

The MRS manual hydraulic engine remote control system is operated under accumulated oil pressure of 0.34 ~ 0.64 Mpa {3.5~6.5kgf/cm2} via charge tank unit.
The pressure is accumulated by the charge tank unit and its pressure is confirmed by the pressure gauge.

1. Check whether the indicating needle of the pressure gauge is in the range of the blue marked area.
2. If the needle is not in the blue marked area, operate the handle to accumulate. Be sure to check the oil level.
3. If the oil level is below the “E” mark, fill the specified hydraulic fluid “BARREL #3 (Red Color)” before pumping.

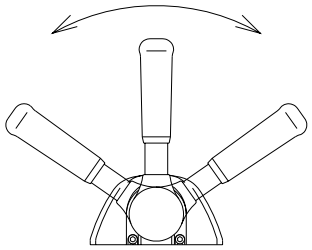
NOTE: Pumping when the oil level is below “E” lets air pumped into the system.
This will cause malfunction of the system and air purging must be done thoroughly again.

4. With frequent ambient temperature changes, the accumulated pressure may drop. If the pressure drops frequently and oil level decreases, an external oil leak is suspected. Check for loose air purge valves.

8-3. INSPECTION BEFORE SAILING

Before each sailing and prior to starting the engine, check the functions of the system by the following inspection and operation.
WARNING: STARTING THE ENGINE WITHOUT CHECKING THE FUNCTION MAY RESULT IN A SERIOUS ACCIDENT.

1. Check the accumulated pressure of the charge tank unit. Check whether the indicating needle of the pressure gauge is in the range of the blue marked area.
2. Perform the phase adjust operation by moving the shift and throttle control handles full strokes back and forth several times. Check whether the positions of the engine gear and throttle match the positions of the shift and throttle receivers. For the multiple station controls, this operation can be done by one of the control heads. Other stations will be automatically adjusted.



2～3度ハンドルをフルストローク作動させる。

WARNING: BEFORE EACH SAILING AND PRIOR TO STARTING ENGINE, CONFIRM THE ACCUMULATED PRESSURE AND PHASE ADJUSTMENT

8-4. MAINTENANCE AND INSPECTION

The following items should be inspected periodically to find any abnormalities and to keep the system free from trouble.

INSPECTION POINTS	INSPECTION PERIOD			
	1 MONTH	3 MONTH	6 MONTH	1 YEAR
LOOSE INSTALLATION At each components At each pipe fitting At each air purge valve At connection of cable to ball joint	○	○	○	○
GREASE THE BALL JOINT	○		○	○
STROKE ADJUSTMENT	○		○	○
PUSH-PULL CABLE	○		○	○

9.TROUBLESHOOTING

WARNING: When performing overhaul, be sure that the pressure is dropped by loosening the air purge valve (Check with the pressure gauge).
Otherwise, compressed oil will gush out when the fitting is loosened. After performing overhaul, air purging and adjustment must be done thoroughly.

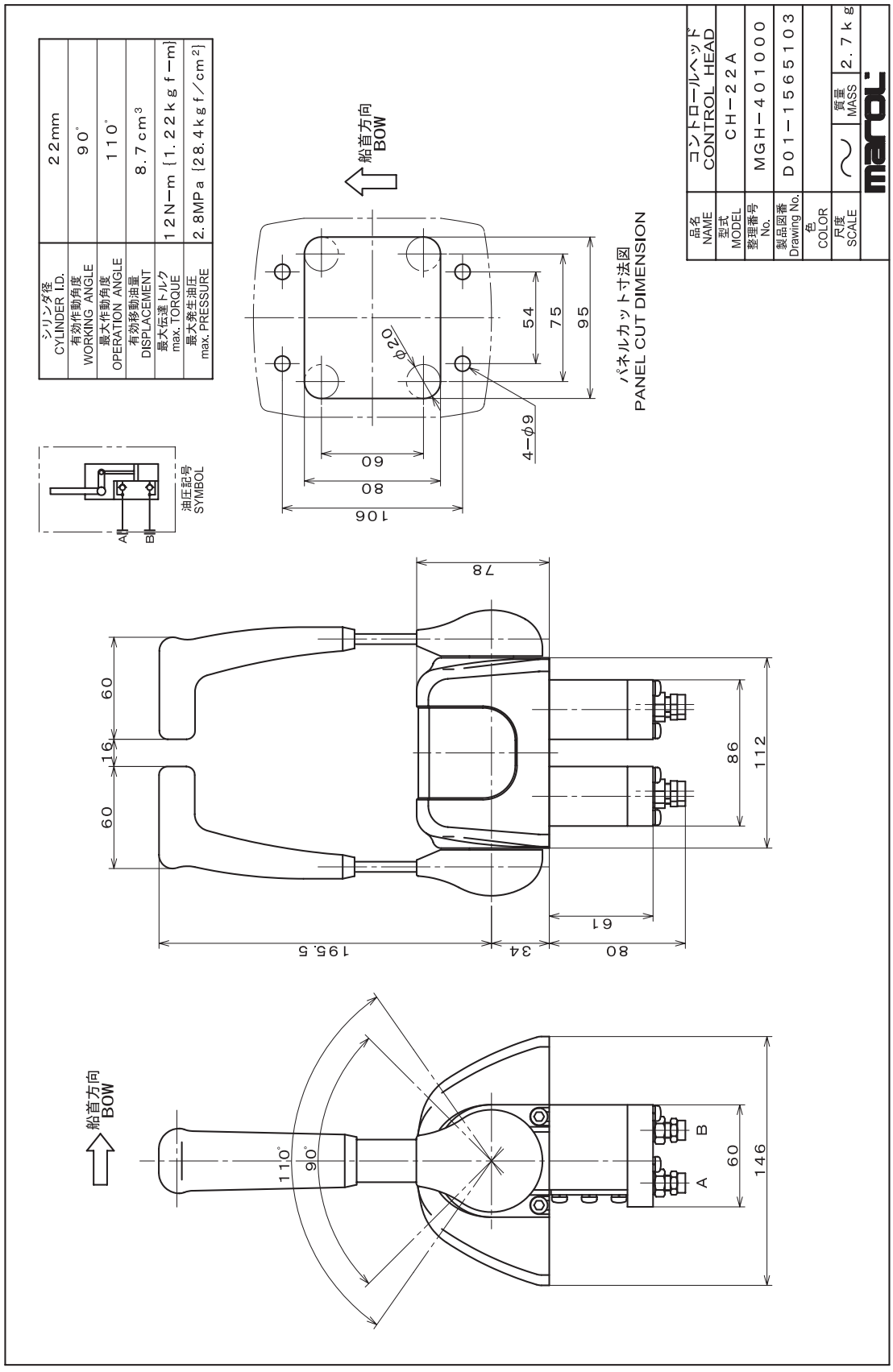
PHENOMENON	PROBABLE CAUSE	COUNTERMEASURE	PAGE
When purging air, oil does not flow out of the air purge valve or oil flow is slow.	Air purge valve is not loose enough.	Loosen air purge valve. (0.5 ~ 1 turn counter-clockwise)	20
	Handles or levers do not move full strokes due to interference in installation.	Remove the cause.	10 20
	Shift lever is stopped at the neutral detent.	Move the lever to reverse position by hand.	20
	Hydraulic piping is plugged, kinked or smashed.	Repair or replace.	18
	Hydraulic oil is not suitable. Viscosity is high.	Change to the specified oil.	20
Phase adjust function does not work.	Due to misalignment, the levers of receivers do not work full strokes.	Adjust the position of ball joint.	24
	Handles or levers do not move full strokes due to interference in installation.	Remove the cause.	10 20
Operation of control handle is extremely heavy.	Hydraulic oil is not suitable.	Change to the specified oil.	20
	Operating torque of the engine shift gear or throttle lever is too heavy.	Check and repair. Check also the required torque.	
Engine throttle drops and control handle is moved back to idle.	Pilot check valve of throttle receiver is damaged at its seal.	Disassemble pilot check valve and repair or replace the seal.	
	Pilot piston of throttle receiver is not working right.	Disassemble pilot check valve and repair or replace the piston.	
Engine throttle drops and control handle does not come back to the idle position.	External leakage of oil	Check and repair piping. Check fittings.	
	Seal of receiver piston may be damaged.	Replace the seal.	
Two handles of control head do not match.	Wrong adjustment of the handle position	Readjust	23

PHENOMENON	PROBABLE CAUSE	COUNTERMEASURE	PAGE
Receiver does not move exactly with the movement of control head. Handle position becomes mismatched. Handle is moved back when freed.	Air purging is not complete.	Purge air again.	20
	Accumulated pressure is low.	Check pressure gauge.	26
	Piping distance of nylon tube is too long.	Change nylon tubing to copper tubing. Recommended piping distance is 30m one line.	16
	Operating torque of the engine shift gear or throttle is too heavy.	Check required torque. Change to copper tubing.	16
	Ball joint position of the lever is not adjusted right.	Readjust.•B	24
	External oil leakage	Check and repair piping. Check fittings.	
	Loose installation at lever of receiver to the wire cable	Check, retighten and readjust.	
	Seal of bypass valve is damaged.	Disassemble pilot check valve and wash or replace the parts.	
Operating one control head does not make other control head move simultaneously or the handle position becomes mismatched.	Seal of bypass valve of the control head which does not move or becomes mismatched is damaged.	Disassemble pilot check valve and wash or replace the parts.	

NOTE: Handle denotes the handle of control head and lever denotes the lever of the receiver.

10.DIMENTIONAL DRAWINGS OF COMPONENTS

10-1. CONTROL HEAD



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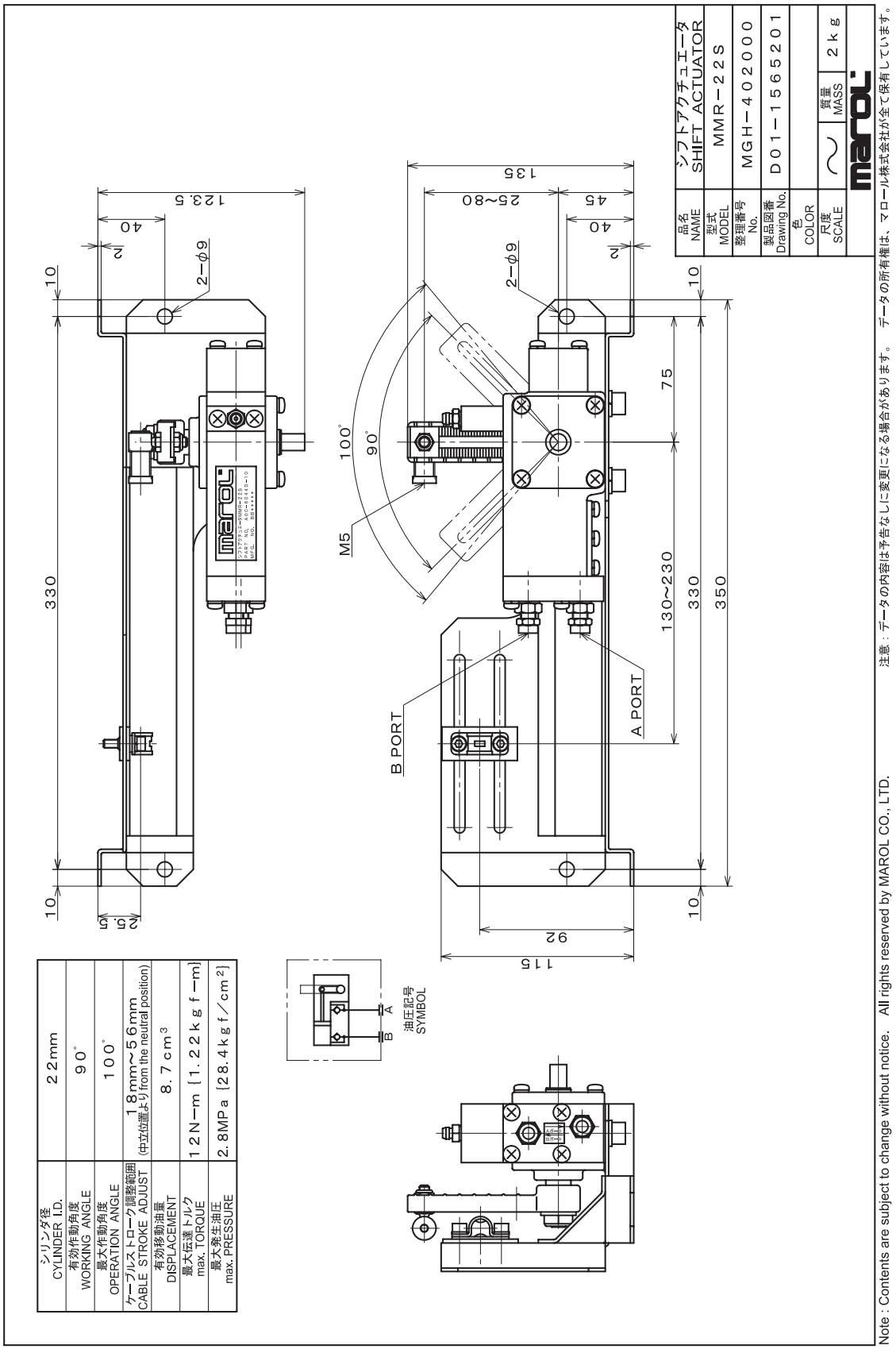
10-2. SHIFT RECIVER



Note : Contents are subject to change without notice.

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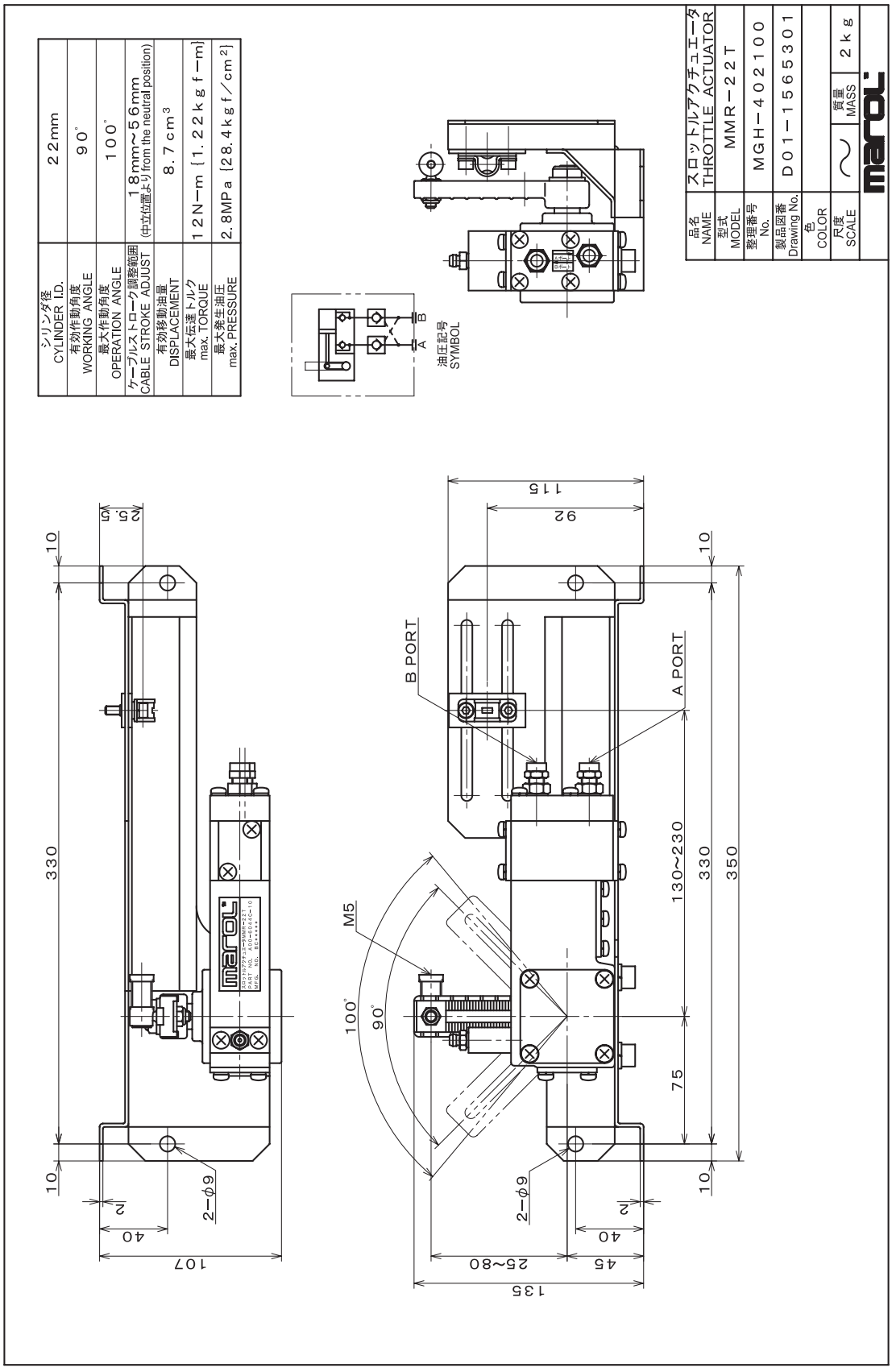
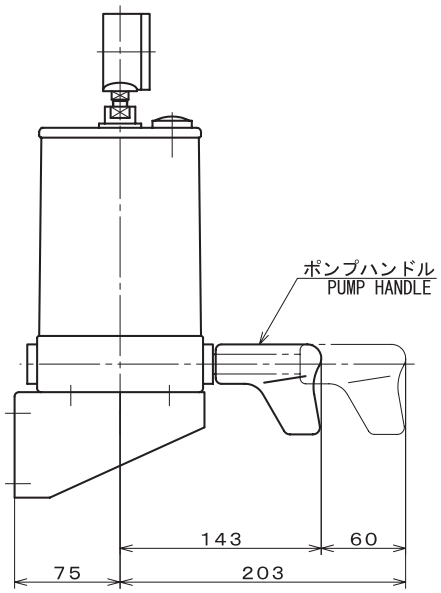
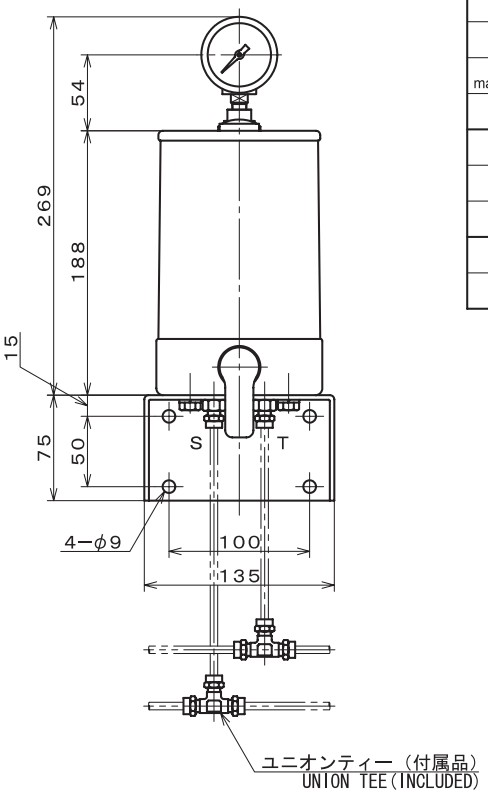
10-3. THROTTLE RECIVER



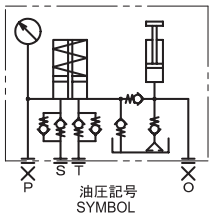
Note : Contents are subject to change without notice.

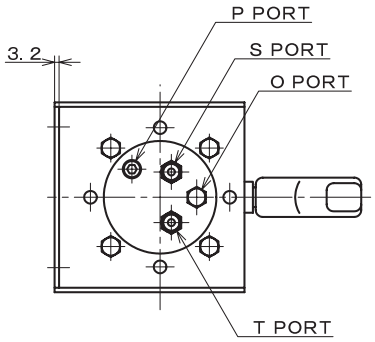
注意：データの内容は予告なしに変更になる場合があります。





アキュムレータ部 ACCUMULATOR	
有効油量 DISPLACEMENT	105cm³
最大蓄圧力 max. ACCUMULATOR PRESSURE	0.59MPa {6kgf／cm²}
安全弁設定圧力 RELIEF SET PRESSURE	3.4MPa {35kgf／cm²}
ポンプ部 PUMP	
吐出量 DISPLACEMENT	9.2cm³
最大操作力 MAX. OPERATING FORCE	92.2N {9.4kgf}
タンク部 TANK	
有効油量 RESERVIRE CAPACITY	500cm³





注意
1.本図は、ポンプハンドル位置が正面の時を示す。ポンプハンドル位置は45°単位で変更できます。
2.S（シフト）ポートとT（スロットル）ポートは、逆になっても問題はありません。

CAUTION
1.This drawing shows Pump Handle front position. The Handle position can be changed in every 45° pitch by resetting, the pump body to the base.
2.S(shift) port and T(Throttle) port connection can be reversed.

品名 NAME	チャージタンクユニット CHARGE TANK UNIT		
型式 MODEL	ACV−100		
整理番号 No.	MGH−400000		
製品図番 Drawing No.	D01−1566101		
色 COLOR			
尺度 SCALE	～	質量 MASS	5kg

MEMO

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