



**Hydraulic Steering System
MSS
Installation Manual**

~Reference~

Thank you so much for your purchase of Marol Hydraulic Steering System.

This Installation Manual explains installation method of System and the matters to be cared. For full play of function of this equipment, read this manual carefully and handle the equipment correctly.

Keep this manual at the place where it will not be lost or damaged, and carry it with you whenever you get on board. If you resale or transfer this equipment to a third party, hand this manual over to new owner.

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For Safety Precautions

Precautions when installing and operating Hydraulic Steering System are explained hereunder.



Warning

WARNING shows the assumptive details which may lead to the possibilities of death or serious injury.

As to Thunder

When thunderclap is heard, don't touch any metal parts of equipments.

Induction of thunder is in danger of getting a shock.

As to Use

During normal operation, be sure to observe all around the boat and watch the course.



Caution

CAUTION shows the assumptive details which may lead to the possibilities of injury or damage of materials.

As to Inspection before Sailing Out

Before sailing out, operate handle and confirm it to work normally.

Check oil level.

As to Periodical Inspection

Inspect or maintain all the equipment periodically. Inspection and maintenance should be done periodically in accordance with Installation Manual.

As to Piping

Don't use saw when cutting copper tubes. Once finished piping works, clean up all around piping and flush connectors once removed.

Sawdust and/or fins by saw cutting may cause poor operation.

Be sure to use pipe cutter and cut the edges at right angle.

As to Helm Pump

Don't install it at the places where it may disturb the steering.

Accidents may occur, if it will be installed at the places where it may impede front visibility and disturb steering.

On the fitting surface, apply caulking materials, if necessary.

This is for prevention against penetration of water into inside of boat.

As to Receiving Cylinder Direct-driving type

Install Receiving Cylinder and connecting link of tiller on even level with same height.

If the connecting link is listed, it may drop during steering.

Be sure to fasten the locknuts of cylinder tightly.

After installation or stroke adjustment, be sure to fasten locknuts tightly. Otherwise it may cause the falling down of cylinder.

As to Receiving Cylinder Rotary type

Install Receiving Cylinder and connecting link of tiller on even level with the same height. If the connecting link is listed, it may drop during steering.

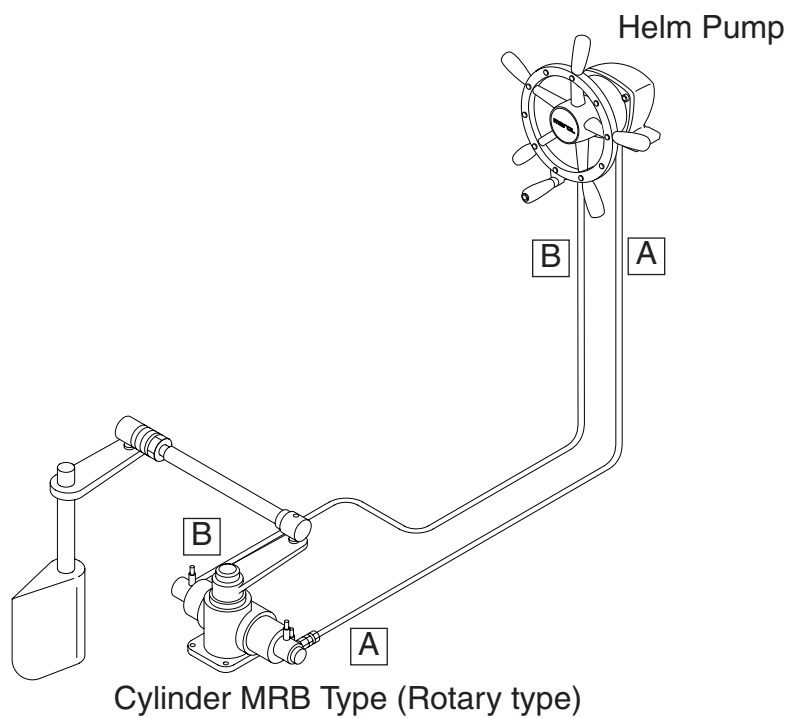
1 System Configuration and Parts

Parts List of System Configuration

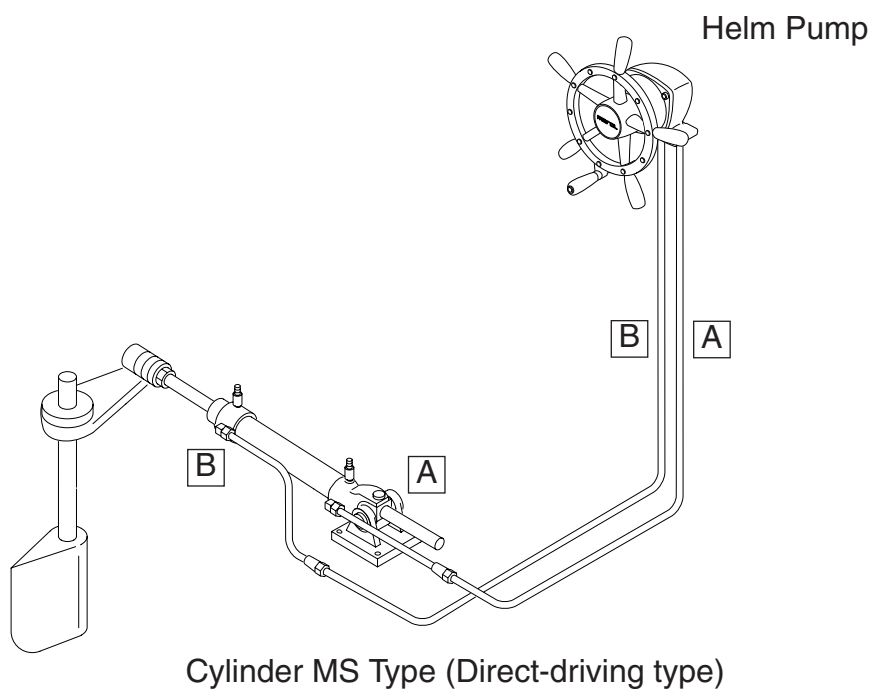
Article	Model	Cylinder Rotary type						Cylinder Direct-driving type							Additional set				
		S-1850-S1	S-1863-S1	S-3075-S1	S-3875-S1	S-3080-S1	S-3880-S1	S-1835-S1	S-1842-S1	S-2342-S1	S-3042-S1	S-3042L-S1	S-3842L-S1	S-3055L-S1	S-3855L-S1	S-18R-10R	S-23R-12R	S-30R-12R	S-38R-12R
Helm Pump	HRP-18-2	1	1					1	1							1			
	HRP-23									1							1		
	HRP-30-2			1		1					1	1		1				1	
	HRP-38				1		1					1		1					1
Installing Stand	MBF-18-2	1	1					1	1	1						1	1		
	MBF-30-2			1	1	1	1				1	1	1	1	1			1	1
Wheel	WR-240	1	1					1	1	1						1	1		
	WR-340			1	1	1	1				1	1	1	1	1			1	1
Cylinder	MRB-50A	1																	
	MRB-63A	1	1																
	MRB-75A			1	1														
	MRB-80A					1	1												
	MSB-35							1											
	MS-42								1	1	1								
	MS-42L											1	1						
Connector	JB-5063	1	1																
	JB-7580			1	1	1	1												
	JB-35							1											
	JB-42								1	1	1	1	1						
	JB-55													1	1				
Tiller	TA-2835							1											
	TA-42								1	1	1								
	TA-42L											1	1						
	TA-55													1	1				
Boss	TB-2835							1											
	TB-42								1	1	1	1	1						
	TB-55													1	1				
Copper Tube	CUT-10	2						2	2							2			
	CUT-12		2	2	2	2	2			2	2	2	2	2	2		2	2	2
Accessory Set	CL-10SET	1						1	1							1			
	CL-12SET		1	1	1	1	1			1	1	1	1	1	1		1	1	1
Pipe Fitting	KC10-PT1/4							2	2										
	KC12-PT1/4									2	2	2	2	2	2				
Elbow Fitting	KLN10-PT1/4	2						2	2							2			
	KLN12-PT1/4		2	2	2	2	2			2	2	2	2	2	2		2	2	2
Trident Fitting	KT-10															2			
	KT-12																2	2	2
High Pressure Rubber Hose	HRH-S2-S2-610							2	2	2	2	2	2	2	2				
Hose Adapter	BS-3005F04							2	2	2	2	2	2	2	2				
Elbow	BKJ-44							2	2	2	2	2	2	2	2				
Hydraulic Oil	HF-15-3.6Y	1	1	1	1	1	1	1	1	1	1	1	1	1	1				
Guide for Refueling Hole	OG36	1	1	1	1	1	1	1	1	1	1	1	1	1	1				
Polyvinyl Chloride Tube	VT-1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tube exclusive for Refueling	VT-2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Installation Manual	MB-030200-1E	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

System Configuration

Configuration of Rotary type



Configuration of Direct-driving type



2 Installation of System

Prior to installing

Do not install equipment to places where

- the spot will be submerged by splashes of seawater and/or rainfall.
- the spot will become difficult in works of inspection, maintenance, piping or else.
- the spot will suffer high temperature under direct sunbeams or close to high temperature pipings.
- the spot will be affected by intensive vibration close to engine or else.

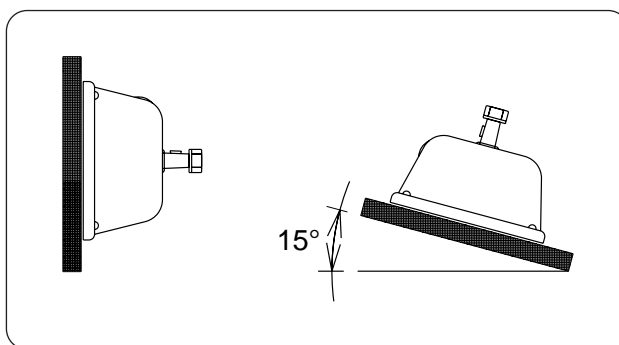
Outline and installing dimensions of each unit are shown on Drawings. Receiving Cylinder must be installed especially just as shown on Drawings.

Installing Position and Angle of Helm Pump

1. Install Helm Pump on the place in bridge or so where its height is easy to steer. Select steady position not rickety when steering wheel is turned.
2. Installing angle can be chosen widely from vertical to nearby horizontal.

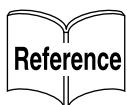


Don't install it at the place where steering is disturbed. When installing it at such a place where front visibility is impeded or steering is disturbed, it may cause damage.



Installation of Helm Pump (HRP-18-II/HRP-23)

1. Foot mount type or Dashboard mount type can be installed depending on installing place. By using template appended at the end of this manual, drill holes for fixing bolts and piping, and fix the unit tightly with bolts and nuts.



For installation of Foot mount type, use M8 x 25 bolts. For installation of Dashboard mount type, use M8 x 45 bolts.

2. Peel off protection plugs of Helm Pump and fit adapters beforehand, then insert them to elbow fittings.

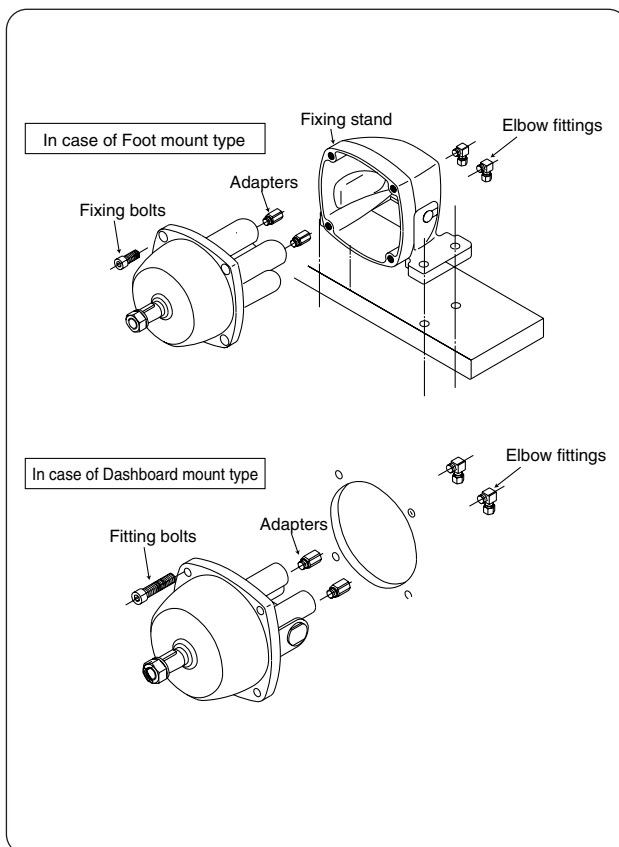


Apply caulking materials to fitting surface, if necessary, to avoid water penetration into inside of boat.

3. Once installed Helm Pump, mount wheel to Helm Pump and fix it with nuts.

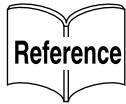


Be sure to install semicircular key along key fitting groove when installing wheel.



Installation of Helm Pump (HRP-30-Ⅱ/HRP-38)

1. Either Foot mount type or Dashboard mount type can be installed depending on installing place. By using template appended at the end of this manual, drill holes for fixing bolts and piping, and fix the unit tightly with bolts and nuts.



For installation of Foot mount type, use M8 x 70 bolts. For installation of Dashboard mount type, use M8 x 50 bolts.

2. Peel off protection plugs of Helm Pump and fit adapters beforehand, then insert them to elbow fittings.

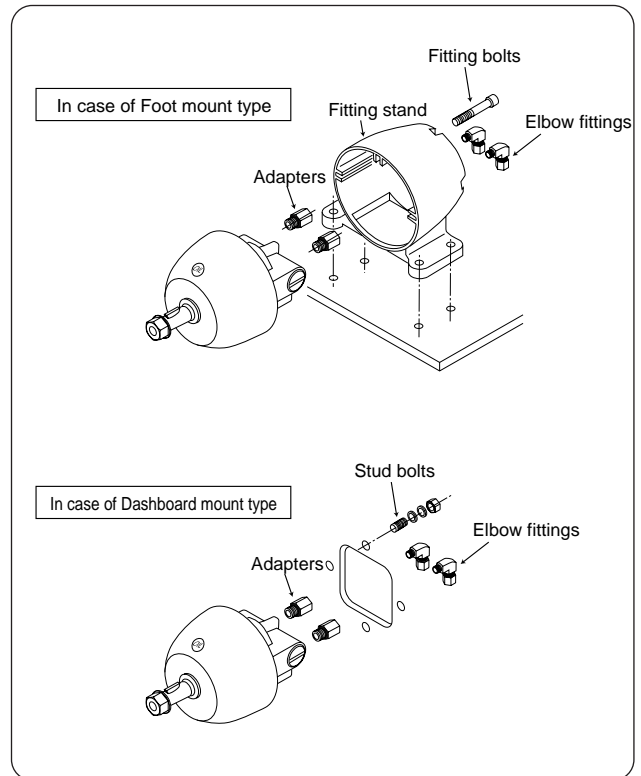


Apply caulking materials to fitting surface, if necessary, to avoid water penetration into inside of boat.

3. Once installed Helm Pump, mount wheel to Helm Pump and fix it with nuts.



Be sure to install semicircular key along key fitting groove when installing wheel.



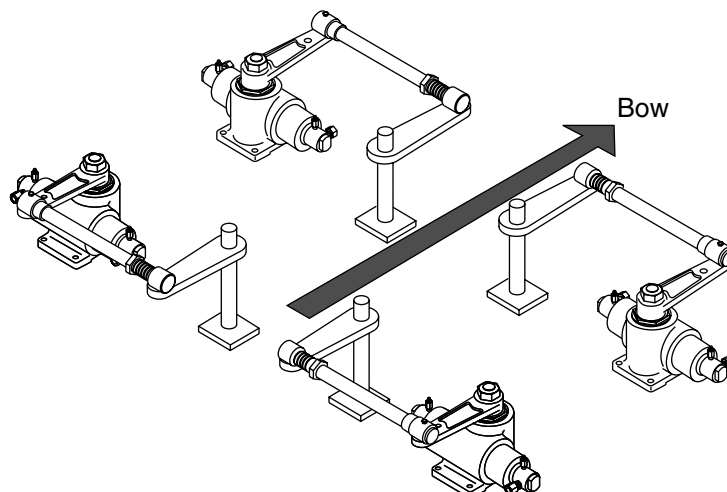
Installation of Receiving Cylinder

- It is important to install Receiving Cylinder to robust part of the hull, since it may generate large torque to move tiller.
- Upon installing Receiving Cylinder apply waterproof grease sufficiently on receiving portion of joint link, ball joints, etc.



For installation of Receiving Cylinder, install it in accordance with dimensions of Drawings attached at the end of this manual.

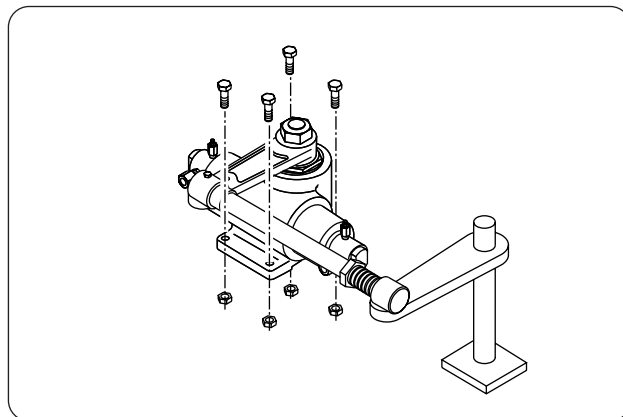
- Position of Receiving Cylinder and linkage can be as shown in figure below. Accordingly install it matching to layout and/or system of the boat.



• Installation of Cylinder MRB Type (Rotary type)

1. Drill 4 holes according to the table and install Cylinder tightly by bolts and nuts to the place to be installed.

Receiving Cylinder type	Diameter of fitting holes
MRB-63A	13mm
MRB-75A	18mm
MRB-80A	18mm

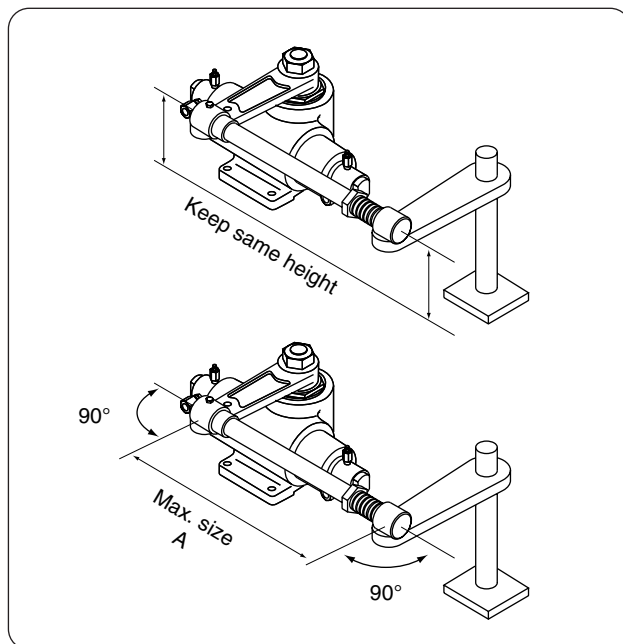


2. Install it by paying attention to dimensions, positions and angles of the figure.

Receiving Cylinder type	Max. size A
MRB-63A	400mm
MRB-75A	500mm
MRB-80A	500mm



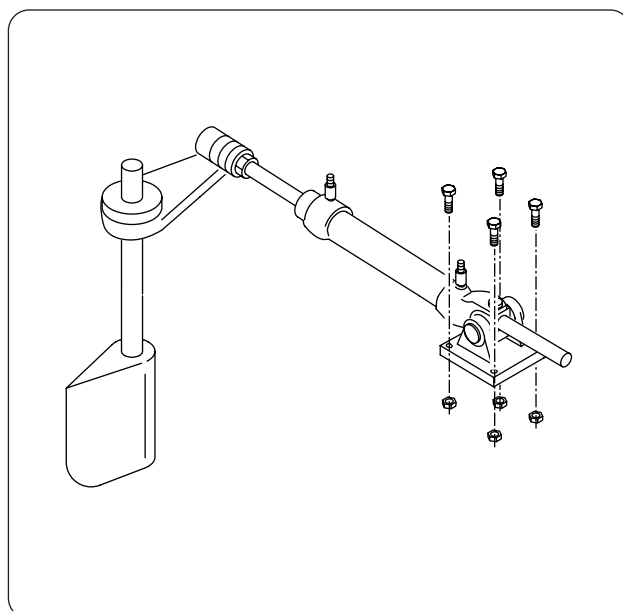
Make the same height the connection link between Receiving Cylinder and tiller lever, and install it on even level. If connection link is listed, the connection link may come off during steering.



• Installation of Cylinder MS Type (Direct-driving type)

1. Drill 4 holes according to the table and install Cylinder tightly by bolts and nuts to the place to be installed.

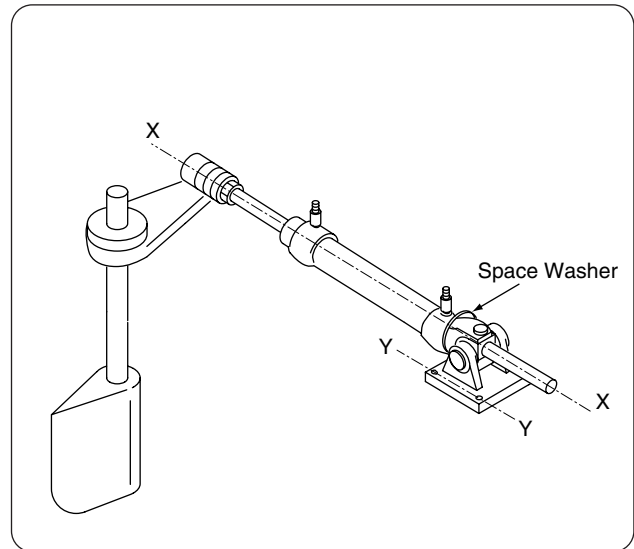
Receiving Cylinder type	Diameter of fitting holes
MSB-35	13mm
MS-42	13mm
MS-42L	13mm
MS-55L	18mm



2. Install it with care in installing position and angle. Once finished the installation of Cylinder, remove space washer for protection.



Confirm that X-X and Y-Y axes remain parallel at the position where helm stands neutral. If not parallel, not only Cylinder becomes not move smoothly, but also rod may be flawed or bent.



3 Hydraulic Piping

Prior to Hydraulic Piping

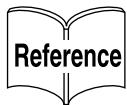
- Copper tube is to be used for whole piping. Use correct size copper tube shown on Parts List of System Configuration in page 3.
- Once decided copper tube piping arrangement, cut tube by pipe cutter to the length necessary.



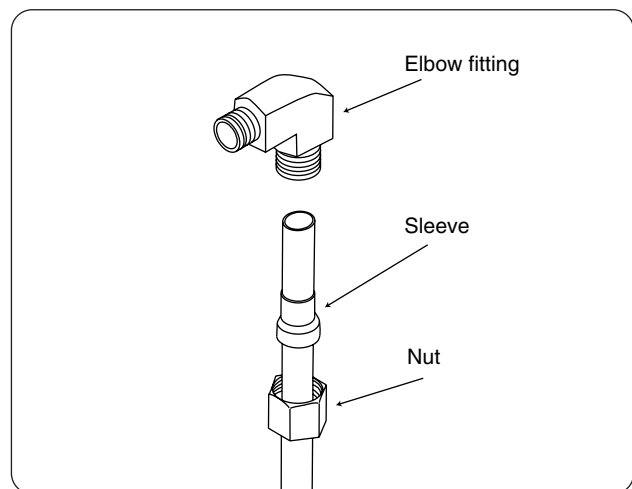
If tubes are cut by saw, sawdust and/or fins may cause damage of equipment.

Piping to Helm Pump

1. Insert nut and then sleeve to the tip of copper tube.
Insert tip of copper tube to elbow fitting firmly, then screw nut by wrench so that sleeve will be squeezed into it. Screw nut further 3/4-1 rotation from the point beginning to feel heavy to rotate.



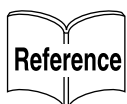
Make sure not to mistake the direction of sleeve.



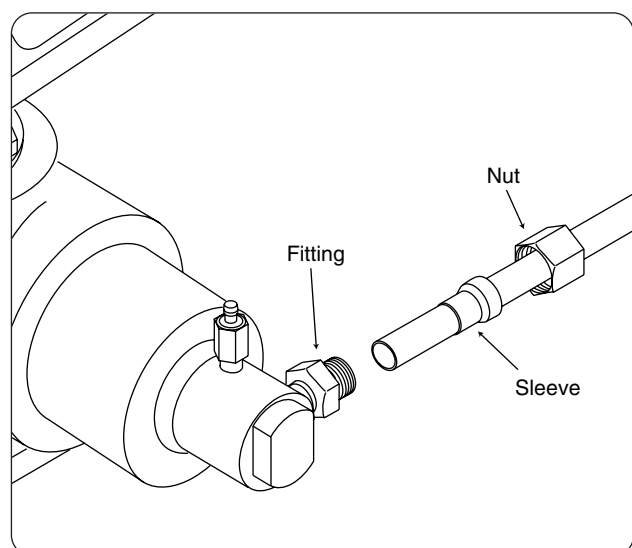
Piping to Cylinder

•Piping to Cylinder MRB Type (Rotary type)

1. Connect another end of copper tube to fitting of Receiving Cylinder.
Insert nut and then sleeve to the tip of copper tube. Insert tip of copper tube to fitting firmly and then screw nut by wrench so that sleeve will be squeezed into it. Screw nut further 3/4-1 rotation from the point beginning to feel heavy to rotate.



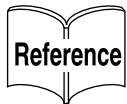
Make sure not to mistake the direction of sleeve.



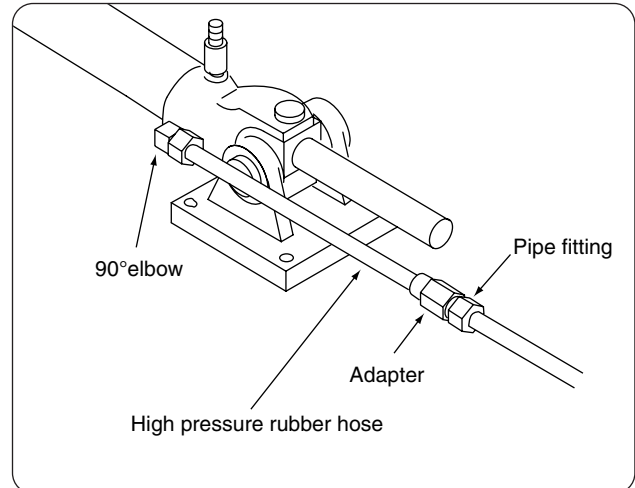
2. Be sure to connect A port of Helm Pump to A port of Receiving Cylinder, and B port of Helm Pump to B port of Receiving Cylinder.

•Piping to Cylinder MS Type (Direct-driving type)

1. High pressure tube is to be used only for cylinder side, because Cylinder MS Type (Direct-driving type) shakes interlocking with steering.
2. Connect copper tube to Receiving Cylinder through 90° elbow, high pressure hose, adapter and pipe fitting.
3. Connect copper tube to pipe fitting same as the case of Cylinder Rotary type.



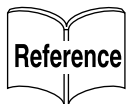
Make sure not to mistake the direction of sleeve.



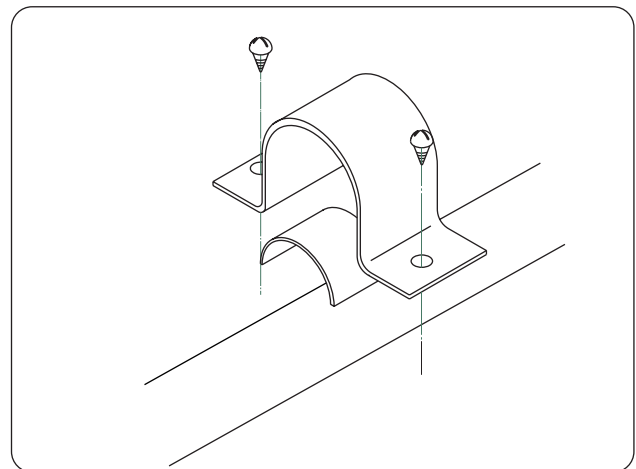
4. Be sure to connect A port of Helm Pump to A port of Receiving Cylinder, and B port of Helm Pump to B port of Receiving Cylinder.

Completion of Piping

1. Fix piping by metal fitting for piping as shown in figure.



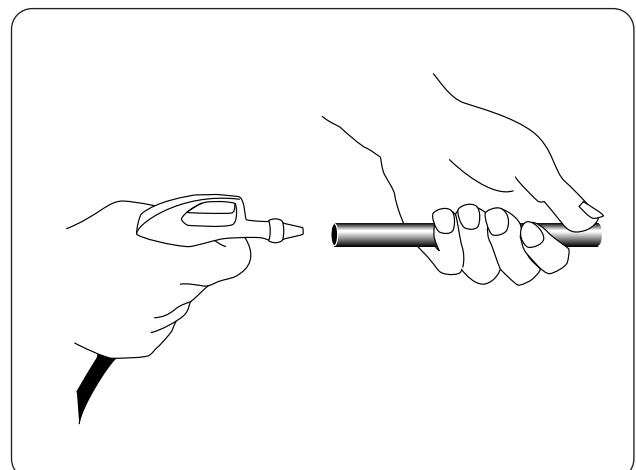
Fix pipe by metal fitting every 1 meter for strait line and every 30 cm for curving portion.



2. Once completed the piping works, clean up all around piping, and flush connectors once removed.
After flushing, reassemble the connectors.



Be sure that no dust enter the piping while flushing.



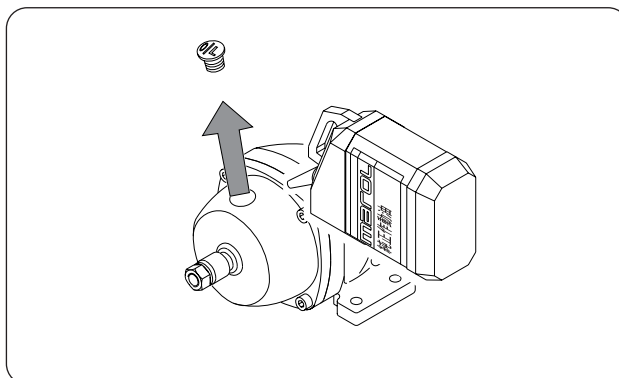
4 Oil Filling and Air Purging

Preparation of air purging

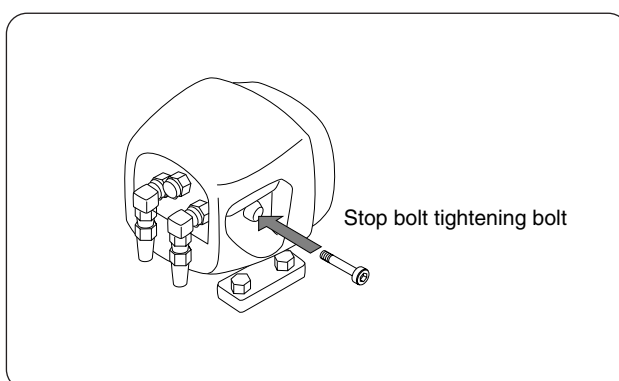
1. Firstly, once remove metal fitting connecting Receiving Cylinder and tiller and make Receiving Cylinder move at full stroke.
2. Remove filling cap on Helm Pump and fill it with hydraulic oil.



At this juncture, make sure that no dust enter Helm Pump.

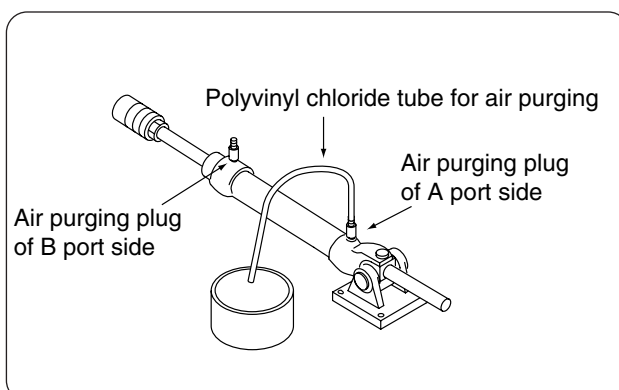
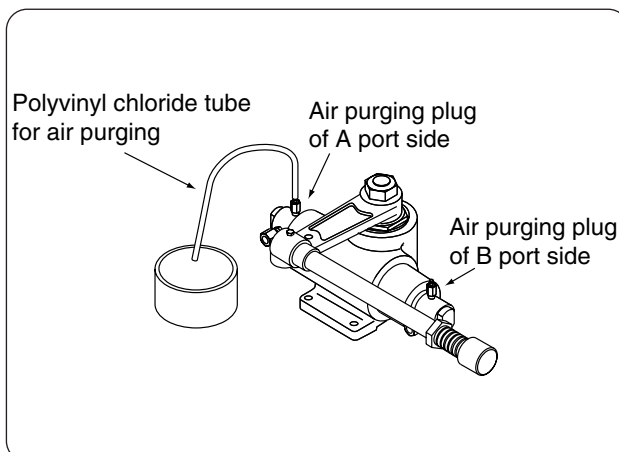


3. Fit attached tube exclusive for oil filling. Fit tube to Helm Pump side firmly so as not to suck air. Insert the other end of tube into can of hydraulic oil so as not to float up from oil level.
4. Screw in stop valve tightening bolt (M6 x 25 bolt with hexagonal hole) about 6 rotations until stop it and lastly tighten it lightly by wrench up to 10 degree.



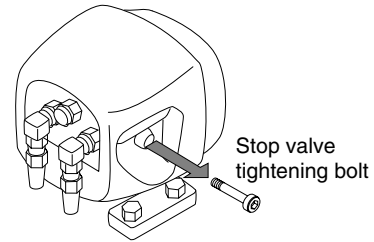
Air purging works of A port side

1. Insert attached polyvinyl chloride tube for air purging to the tip of air purging plug of A port side of Receiving Cylinder. When can of receiving hydraulic oil is provided, release air purging plug of A port side. (Don't release plug of B port side yet.)
2. Turn wheel clockwise continuously at the speed of 1 rotation per sec. When turning 3~4 rotations, oil level will go down but hydraulic oil will be filled automatically through oil filling tube.
3. As soon as clear hydraulic oil comes out constantly without bubble from air purging plug of A port side, close air purging plug of A port side.

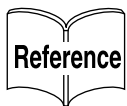
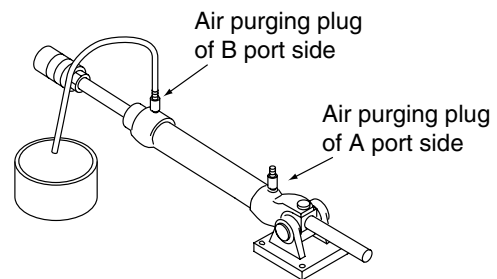
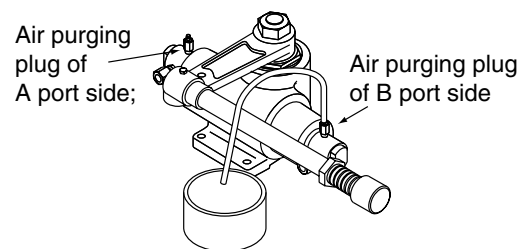


Air purging works of B port side

1. Release fully remove stop valve tightening bolt (M6 x 25 bolt with hexagonal hole) of Helm Pump side and remove it.



2. Remove polyvinyl chloride tube for air purging from A port side, change it to fit to B port side and release air purging plug of B port side.
 3. After confirmation of correct connection of oil filling tube between Helm Pump and can of hydraulic oil, turn wheel anti-clockwise slowly but continuously.
 4. As soon as clear hydraulic oil comes out constantly without bubble from air purging plug of B port side, close air purging plug of B port side.
 5. When wheel works smoothly by operating from side to side after completion of air purging works, remove oil filling tube and close filling cap tightly. Further works will finish by re-connecting Receiving Cylinder and tiller as it was.
- Last of all, check oil leakage from every unit and pipe fitting section.



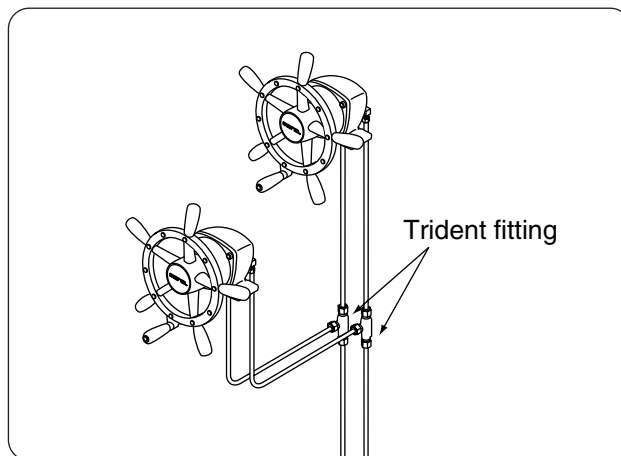
In case of reverse connection, namely connection between A port of Helm Pump and B port of Receiving Cylinder, or B port of Helm Pump and A port of Receiving Cylinder for convenience of installation space of Receiving Cylinder, conduct air purging works by replacement of A port with B port of Receiving Cylinder.

5 In case of steering at 2 places

- Hydraulic Steering System can be operated at 2 places by additional installation of Helm Pump. Even in this case, working load of wheel operation does not change.

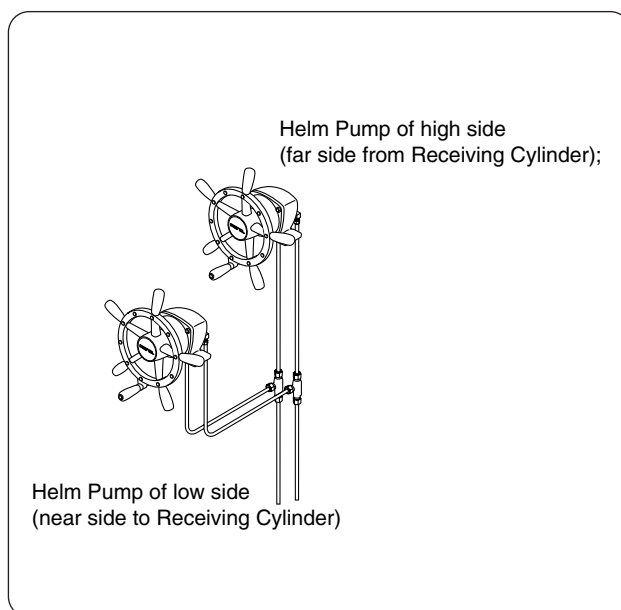
Piping for steering at 2 places

- After decision of installing location of Helm Pumps, cut copper tubes by pipe cutter considering piping arrangement.
- Connect A to A, B to B of both Helm Pumps correctly using trident fitting as per right side drawing.
- After piping works, conduct flushing and fixing of copper tubes same as steering at 1 place.



Air purging of steering at 2 places

- Fill Helm Pump of low side (or near side to Receiving Cylinder) with hydraulic oil and close filling cap tightly.
- Purge air from Helm Pump of high side (or far side from Receiving Cylinder). Air purging procedure is same as Clause 11~12.
- At next step, purge air from Helm Pump of low side (or near side to Receiving Cylinder).
- For further perfect air purging, remove oil filling cap of Helm Pump of high side (or far side from Receiving Cylinder) and repeat turning of wheel from side to side at full stroke several times. Air will return to tank gradually.



6

Periodical Inspection and Maintenance

- For prevention against damage or troubles of System, routine inspection and periodical maintenance are necessary. When abnormal condition is found on inspection, immediately repair it or keep it in good condition.

Item	Period	Contents
Inspection of oil quantity	Daily for 10 days after installation and every 10 days thereafter.	During dead ship, after turning wheel slowly 1~2 rotation from side to side at neutral position, open oil filling cap and inspect hydraulic oil. If reduced, refill with oil immediately. (Recommended hydraulic oil: ISO VG15 equivalent)
Inspection of oil leakage	Daily for 10 days after installation and every 10 days thereafter.	Inspect oil leakage from pipe fitting section, Helm Pump, shaft of Receiving Cylinder or so. If leakage is found, repair the spot immediately.
Additional tightening	Daily for 10 days after installation and every 10 days thereafter.	Tighten additionally fitting bolts and nuts of Helm Pump, Receiving Cylinder and pipe fitting section.
Supplementation of grease	Every 1 month	Supplement of grease to ball joints and connecting pins of metal fitting between Receiving Cylinder and tiller.

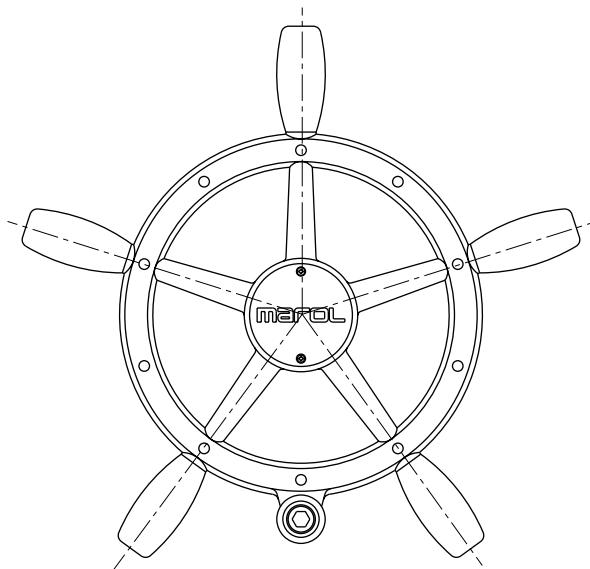
7 Troubleshooting

- When abnormal parts are found, don't use as it is and take suitable countermeasure looking for the cause. If using under abnormal condition, serious accident may be occurred as the case may be. Therefore, when no solution found by the following table, contact our agent or our company.

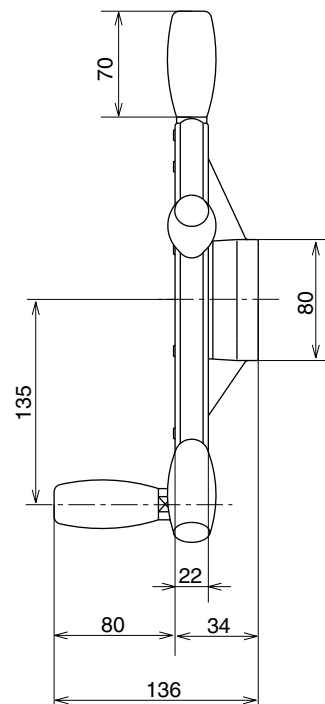
Symptom	Cause	Countermeasure
Wheels are vacillating and rudder does not work correctly. Steering is out of control.	Air purging remains imperfect.	Purge air again.
	Leakage of hydraulic oil.	Repair leaking spot of connecting section and/or piping, refill with oil and purge air again.
	Shortage of hydraulic oil inside of oil tank.	Refill with hydraulic oil and purge air again.
Wheel turning is heavy and power is needed.	Malfunction of wheel shaft.	Repair and/or lubricate.
	Shortage of hydraulic oil viscosity.	Replace to genuine hydraulic oil. (ISO VG15 equivalent)
	Clogging of filter of Helm Pump.	Rinse or replace filter.
Receiving Cylinder does not work when turning wheel.	Dust to suction valve inside of plunger of Helm Pump.	Overhaul and rinse.
	Malfunction of lock valve of Helm Pump.	Overhaul and rinse, or replace.
Receiving Cylinder returns even when wheel is suspended.	Malfunction of lock valve of Helm Pump.	Overhaul and rinse, or replace.
In case of steering at 2 places, while rotating Helm Pump of one side, Helm Pump of the other side also rotates.	Malfunction of lock valve of Helm Pump.	Overhaul and rinse, or replace.
	Dust to check valve of Helm Pump.	Overhaul and rinse.

Drawings

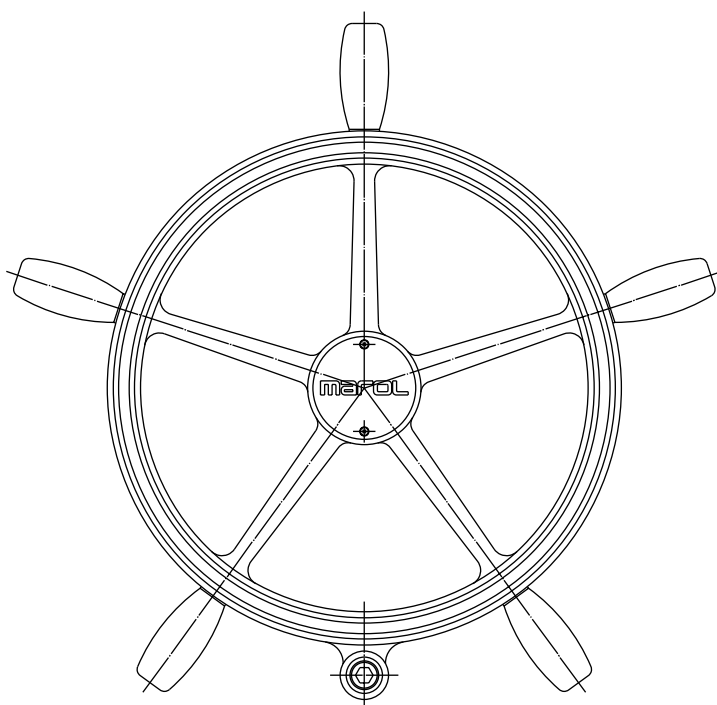
•Wheel (WR-240)



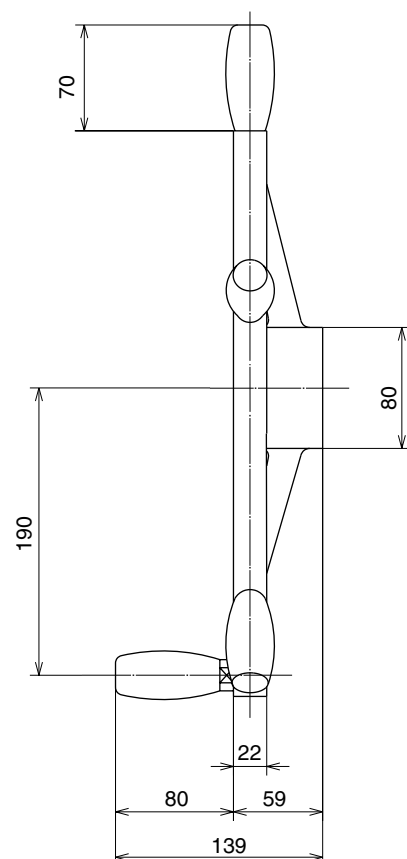
Weight	2.6kg
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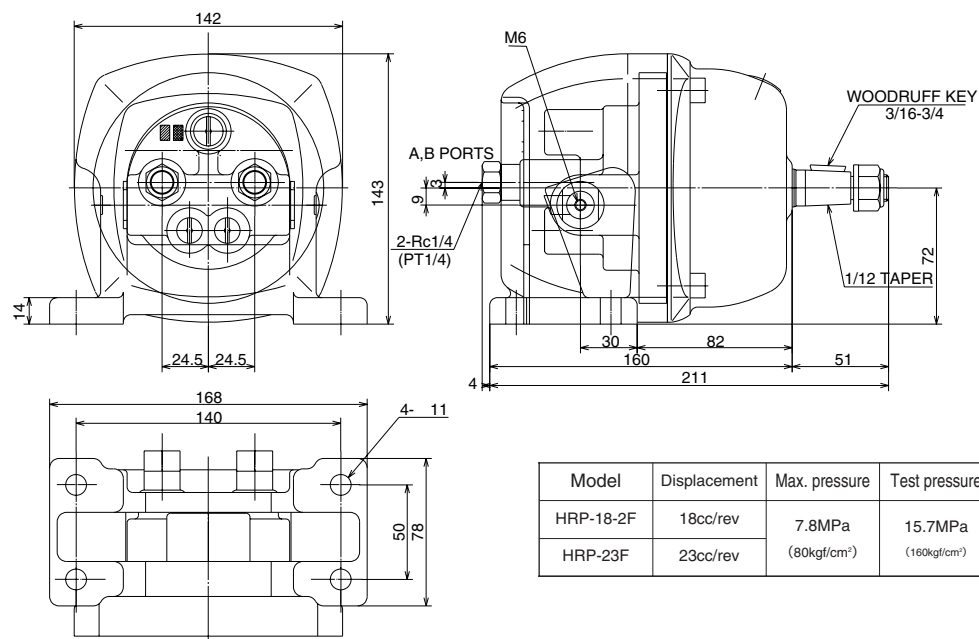
•Wheel (WR-340)



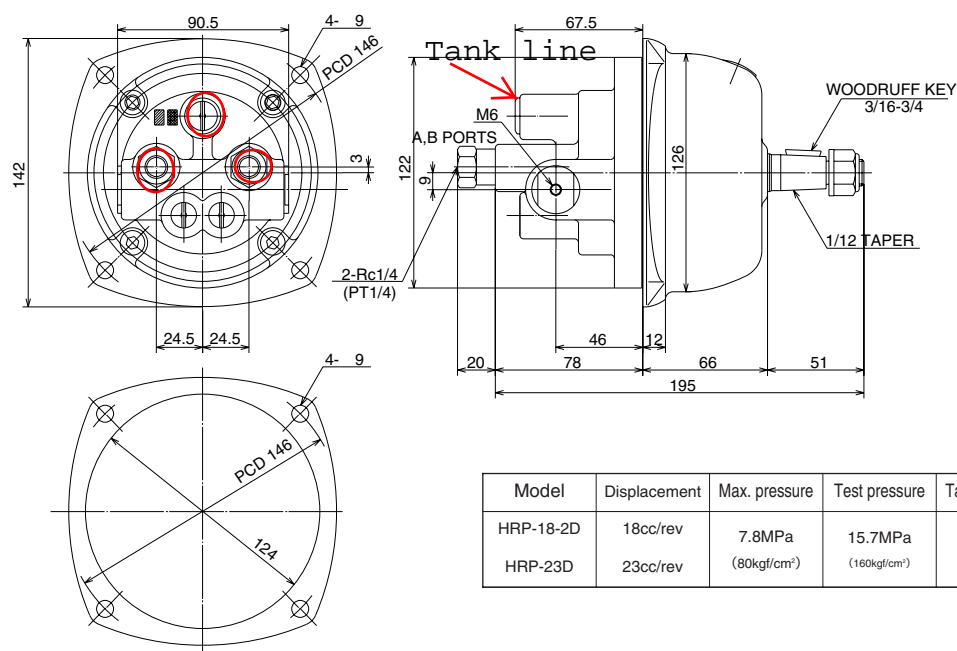
Weight	3kg
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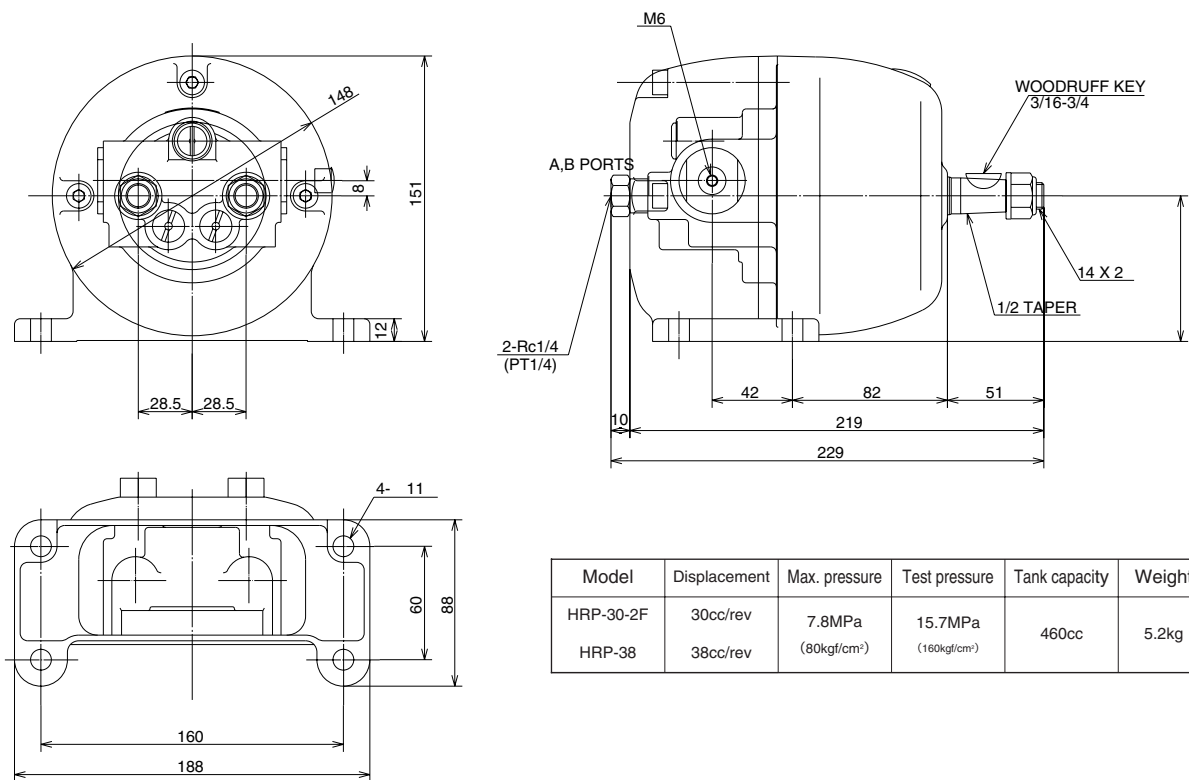
•Helm Pump (HRP-18-2F / HRP-23F)



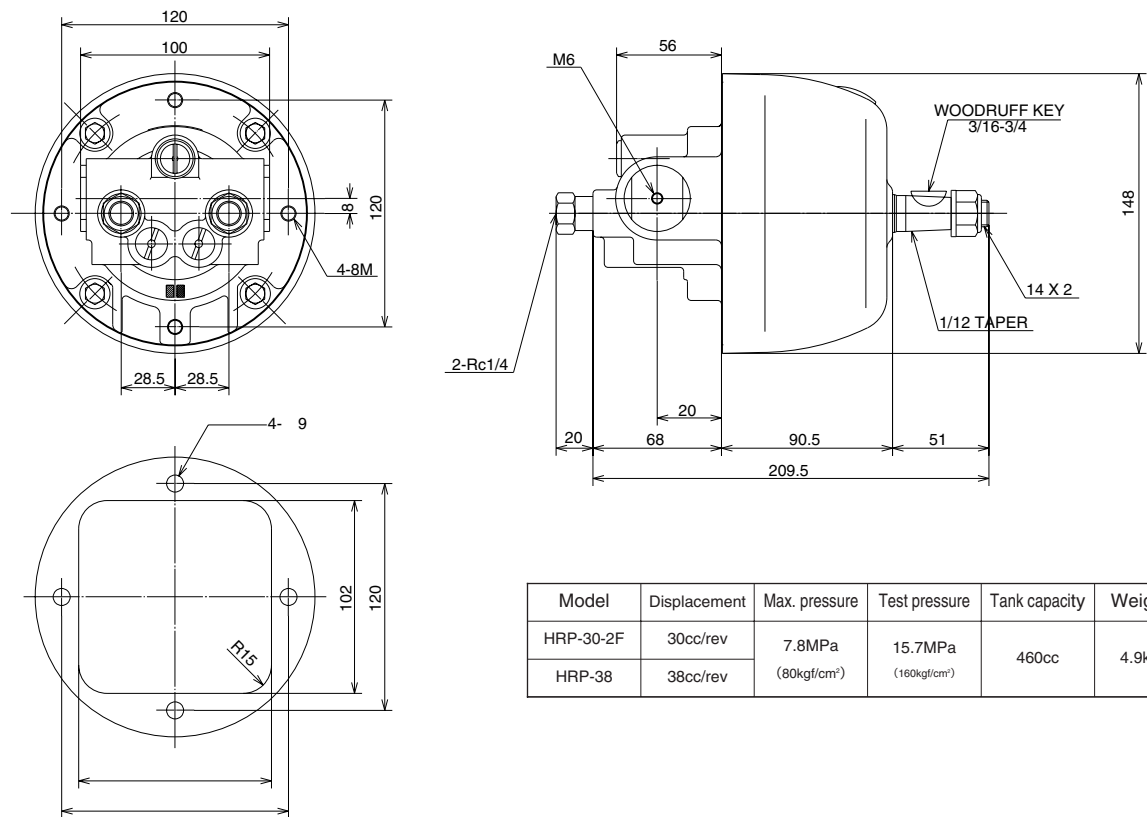
•Helm Pump (HRP-18-2D / HRP-23D)



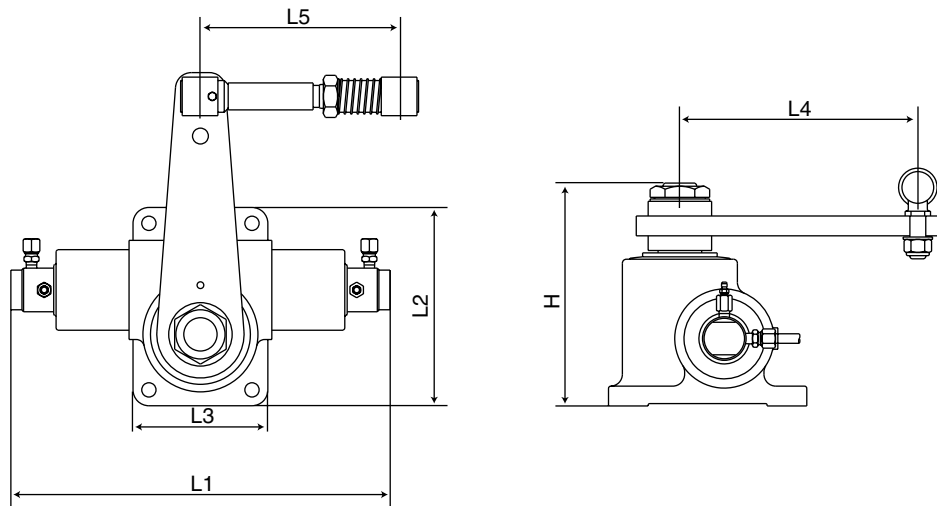
•Helm Pump (HRP-30-2F / HRP-38F)



•Helm Pump (HRP-30-2D / HRP-38D)

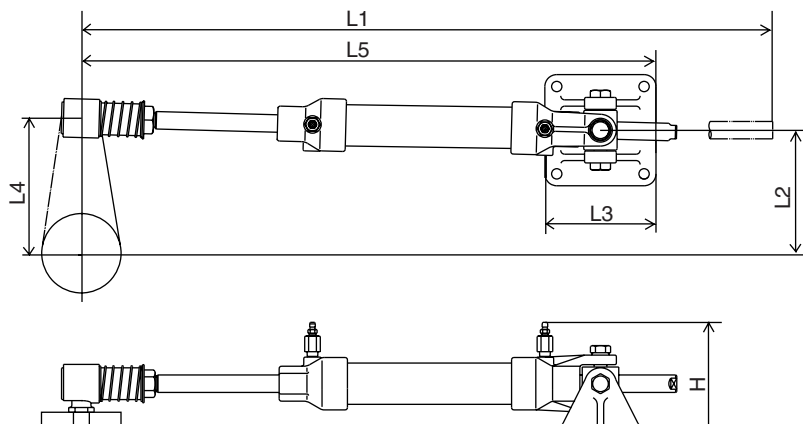


•Receiving Cylinder Rotary type (MRB-50A / 63A / 75A / 80A)



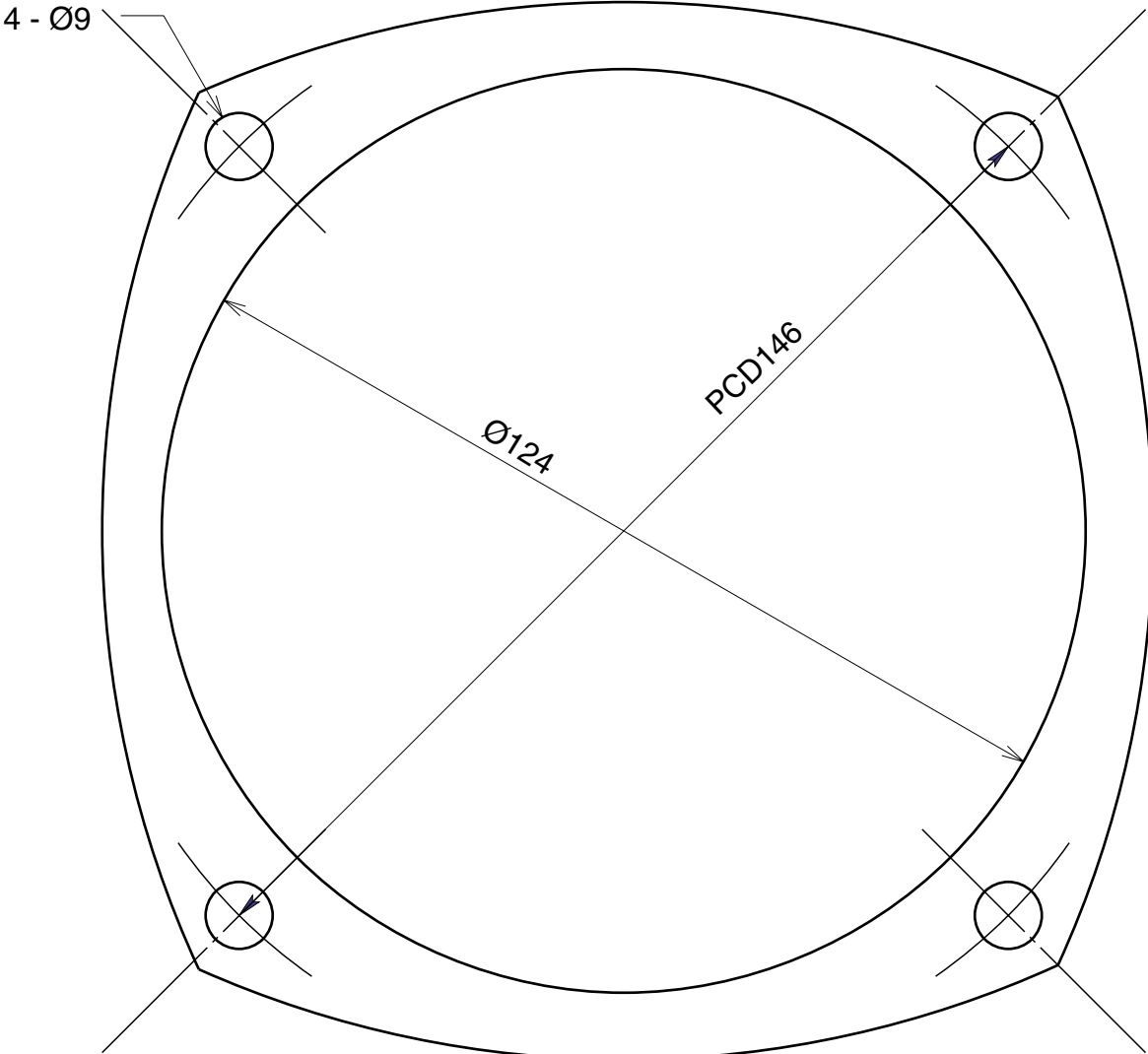
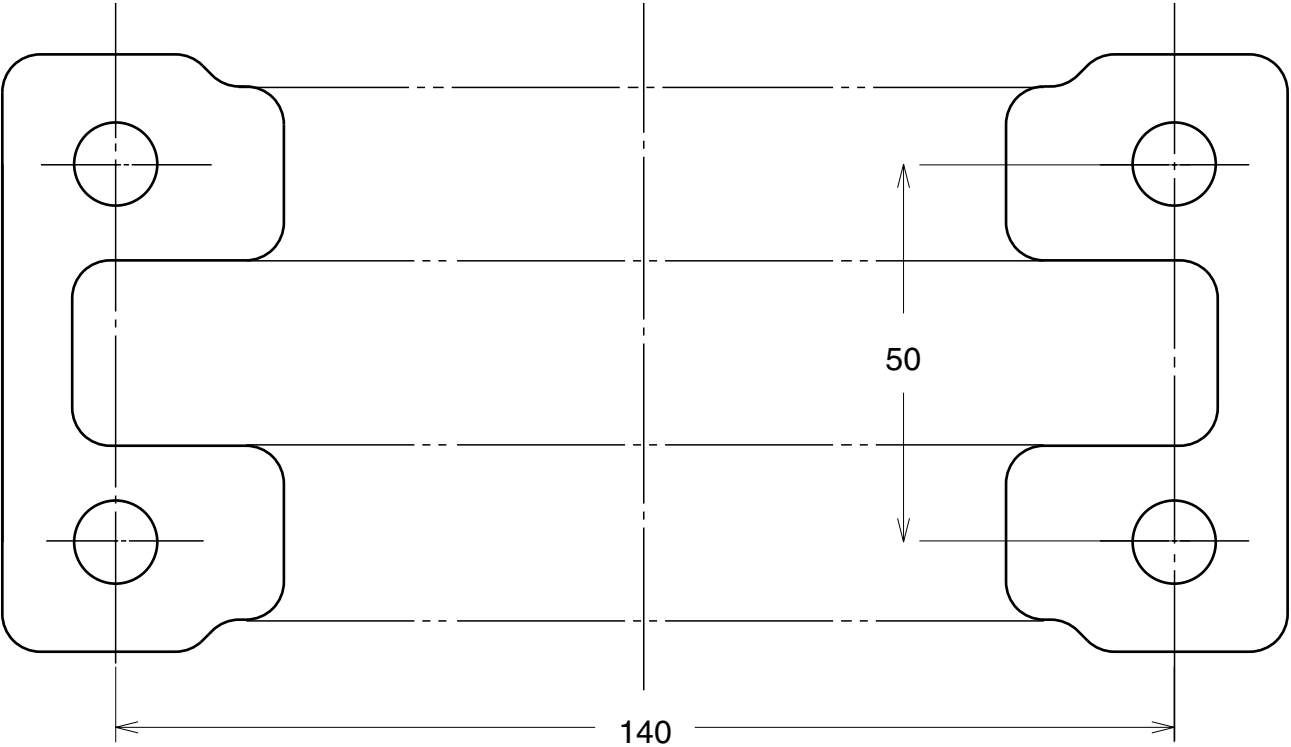
Model	L1	L2	L3	L4	L5	H	Breaking torque	Working angle	Oil quantity needed	Max. pressure	Test pressure	Weight
MRB-50A	314	165	105	200	400	185	392N·m (40kgf·m)	90°	77cc	7.8MPa (80kgf/cm ²)	15.6MPa (160kgf/cm ²)	13kg
MRB-63A	364	170	120	200	400	205	785N·m (80kgf·m)		154cc			18kg
MRB-75A	426	221	146	250	500	245	1569N·m (160kgf·m)		317cc			35kg
MRB-80A	478	250	170	300	500	281	1961N·m (200kgf·m)		395cc			51kg

•Receiving Cylinder Direct-driving type (MSB-35) (MS-42 / 42L / 55L)

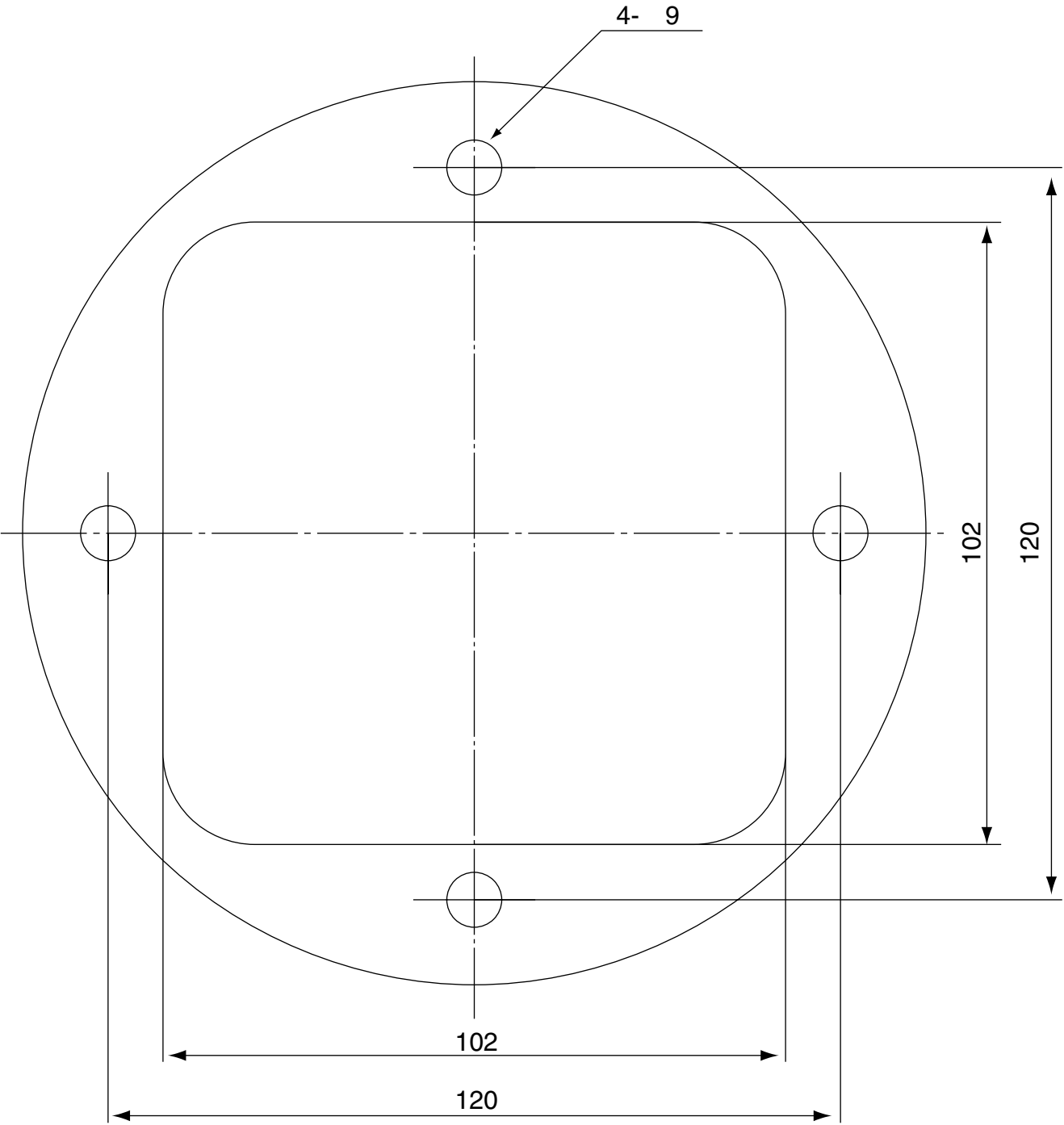


Model	L1	L2	L3	L4	L5	H	Breaking torque	Working angle	Oil quantity needed	Max. pressure	Test pressure	Weight
MSB-35	779	110	140	155	643	145	637N·m (65kgf·m)	90°	146cc	7.8MPa (80kgf/cm ²)	15.6MPa (160kgf/cm ²)	7.8kg
MS-42	807	105	140	150	670	147	918N·m (100kgf·m)	90°	221cc			15kg
MS-42L	982	140	140	200	776	147	1275N·m (130kgf·m)	90°	291cc			16kg
MS-55L	1033	140	150	200	868	148	2250N·m (230kgf·m)	86°	482cc			22kg

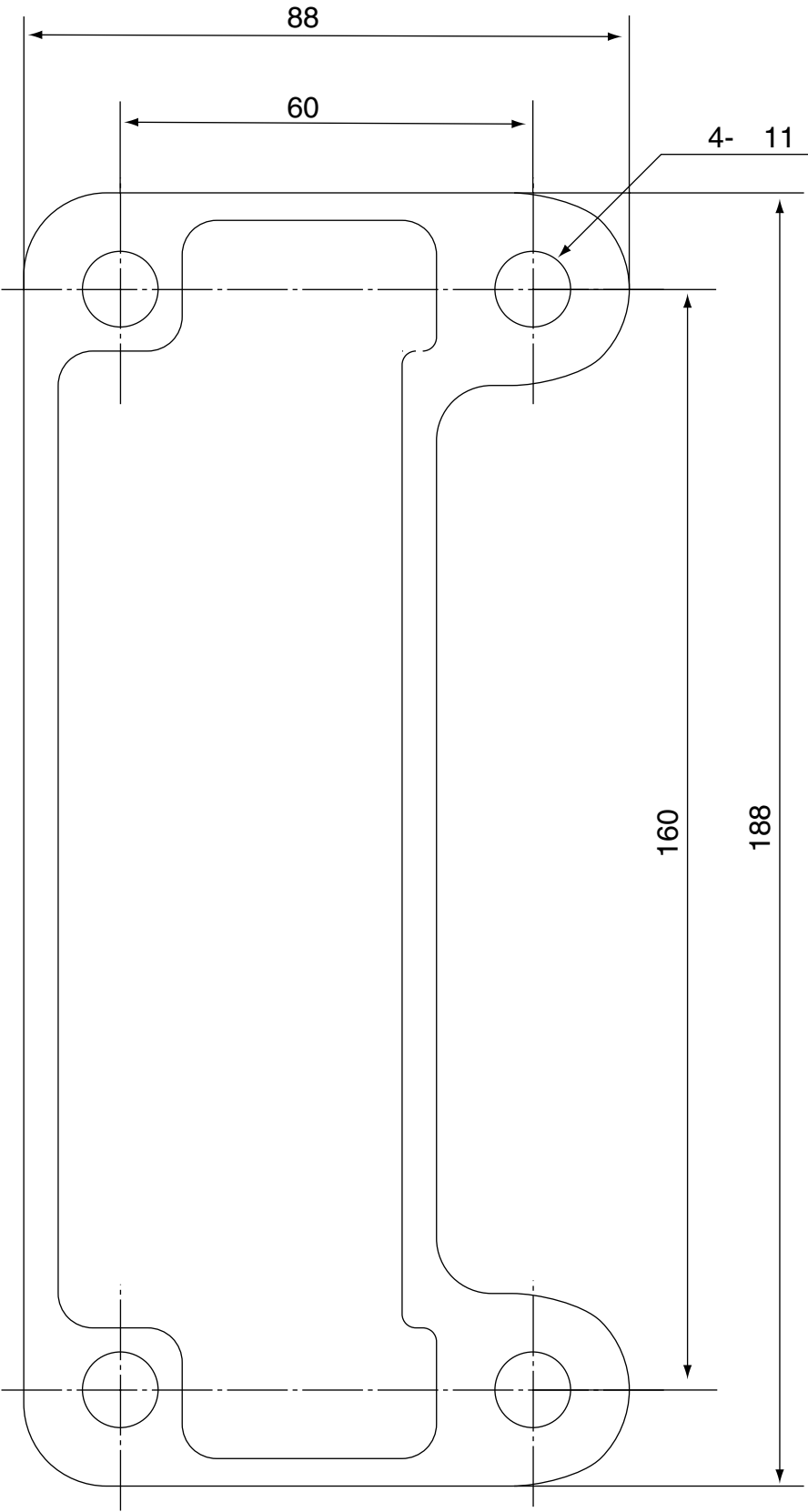
•Template of Helm Pump (HRP-18-2F-D / HRP-23F-D)



•Template of Helm Pump (HRP-30-2F / HRP-38F)



•Helm Pump (HRP-30-2D / HRP-38D)



MAROL CO., LTD

2-1-34, Ohashi-cyo, Nagata-ku, Kobe, Japan

TEL:81-78-611-2159

FAX:81-78-641-2908