SERVICE MANUAL

MULTIQUIP ®

MVH-208 • 508 SERIES PLATE COMPACTORS

MAINTENANCE ○ DISASSEMBLY DIAGRAMS ○ TROUBLESHOOTING

Manual No. 410-01504

CALIFORNIA

Proposition 65 Warning:

Engine exhaust and some of its constituents, and some dust created by power sanding, sawing, grinding, drilling and other construction activities contains chemicals known to the State of California to cause cancer, birth defects and other reproductive harm.

Some examples of these chemicals are:

- Lead and lead-based paint.
- Crystalline silica from bricks.
- Cement and other masonry products.
- Arsenic and chromium from chemically treated lumber.

Your risk from these exposures varies, depending on how often you do this type of work. To reduce your exposure to these chemicals: ALWAYS work in a well ventilated area, and work with approved safety equipment, such as dust mask that are specially designed to filter out microscopic particles.

TABLE OF CONTENTS

1. INTRODUCTION

- For correct operation, maintenance and service of Reversible Compactor, please read the separate operation manual before your work for your safe work.
- For the handling of engine, please read the separate engine operation manual and maintenance/service manual.
- This service manual explains the maintenance standard and how to disassemble and assemble for Reversible Compactor. Please read this service manual for a better understanding of the maintenance standard, the structure and function of each part.
- To improve the performance and quality of this machine, the change might be made in this machine without notice. If you have any questions, please contact with our distributor. For parts list, Mikasa WEB parts list is available at our homepage (http://www.mikasas.com/).

2. WARNING SIGNS

The triangle shaped ⚠ marks used in this manual and on the decals stuck on the main body indicate common hazards. Be sure to read and observe the cautions described.

⚠ **Warning labels indicating hazards to humans and to equipment.**	
⚠ **DANGER**	Denotes an extreme hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, is likely to result in serious injury or death.
⚠ **WARNING**	Denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in serious injury or death.
⚠ **CAUTION**	Denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury to people and may damage or destroy the product.
CAUTION (without at ⚠)	Failure to follow the instructions may result in damage to property.

3. CAUTIONS FOR MAINTENANCE TO SECURE SAFETY

3.1 Work Site

⚠ DANGER

- Do not work indoor or inside a tunnel where ventilation is poor. The emission from the engine contains toxic gas such as carbon monoxide, and it is very dangerous if this toxic gas and dust are inhaled. Also, to improve ventilation, please keep a proper distance between this machine and a building when operating the machine.

⚠ CAUTION

- Maintenance should be done in a place with a flat and hard surface to keep the machine stable. Also, do maintenance at sufficient work space.
- Before maintenance work, clean the floor. Oil on the floor, in particular, becomes the cause of falling accident.
- For maintenance work, have sufficient lighting in the work site. A portable lamp used to illuminate the work area has to be protected by wire. In case if the lamp is broken, fuel and oil might ignite.
- To prepare for an accident, please have emergency medical supplies and fire extinguisher ready at an easily accessible area.

3.2 Clothes And Protective

⚠ CAUTION

- To work safely, wear work clothes of appropriate size, and use suitable protective gear such as helmet and safety shoes. The work clothes that do not fit the body size might result in unpredicted injury because the clothes easily get caught by rotating part of the machine.

3.3 Cautions During Refuelinglothes And Protective

⚠ CAUTION

- When adding fuel
  - ○ Always refuel in the well ventilated area.
  - ○ Always refuel after the engine stopped and cooled sufficiently.
  - ○ Select a flat surface location away from flammable material and Do not overfill the tank. If spilled fuel, wipe it off well.
  - ○ Never put fire near the refueling area. (Never refuel while smoking.)
- If fuel is filled to the top, it might overflow, and is dangerous.
- After refueling, securely tighten the tank cap.

3.4 Prevention Of Burn And The Accident Of Getting Caught

⚠ WARNING

- Start your work after the machine temperature drops. Especially, the muffler gets very hot, and it will pose a danger of burn accident. Also, engine and engine oil as well as vibrator become hot. Be careful not to get a burn.
- If maintenance work is started with the engine running, injury might occur because you might get caught by the rotating part such as pulley and V-belt. Always stop the engine before maintenance.
- Before maintenance work, remove the starter key of the engine.
- Before starting maintenance, always remove the minus (-) terminal of the battery.

3.5 Tools And Equipment

⚠ WARNING

- When lifting the machine body and the engine, always use a crane. When lifting the machine and the engine, follow the cautions listed below. If the machine or the engine is dropped, a serious accident might occur.
- To operate a crane, a crane handling qualification is required. Have someone qualified to handle and operate a crane do this work.
- Before lifting, check the parts (especially, hook and anti-vibration rubber) of this machine for damage and loosening/lack of bolts to secure safety.
- Before lifting, stop the engine and shut the fuel cock.
- Use sufficiently strong wire rope.
- For lifting, use only the lifting hook. Do not use other part for lifting.
- Never allow anyone or any animal come under the lifted machine.
- For safety, do not lift to the height more than necessary.
- Use an appropriate tool. If the tool that is not suitable for the part is used, not only the damage on the part, but also unpredicted accident might occur.

3.6 Handling Of Battery

⚠ WARNING

- Before starting maintenance, always remove the minus terminal of the battery. If short circuit occurs, ignition might occur.
- The battery gas might become a cause of explosion. Do not put fire nearby.
- Especially, during charging, flammable gas is released. Do not put fire nearby.
- The battery fluid is very toxic. Be careful when handling. If the battery fluid gets on your skin, eye or on your clothes, wash it off with plenty of water, then see a doctor.

3.7 Use Of Genuine Parts And Appropriate Oil And V-belt

⚠ CAUTION

- Always use genuine parts.
  If inappropriate parts are used, not only it will shorten the machine life, but it might lead to unpredicted accident.

3.8 Tightening Torque Of Bolts And Nuts

⚠ WARNING

- Tighten bolts and nuts with the tightening torque specified in this maintenance manual.
  Over tightening torque and lack of tightening torque not only affect the machine life, but also might occur unexpected accident.

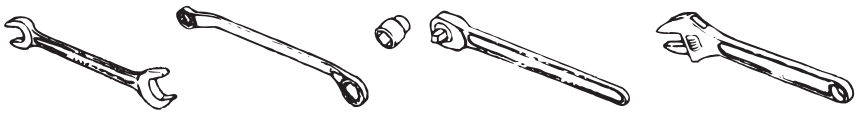
3.9 Disposal Of Waste Material

⚠ CAUTION

- Unnecessary engine oil, hydraulic oil and fuel should be kept in a container. Never dump it on the ground or pour into the sewage system such as side ditch.
- For disposal of unnecessary engine oil, hydraulic oil and fuel, follow the law and other regulations.

4. TOOLS

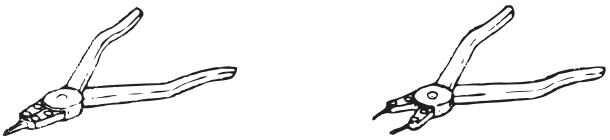
1. Wrench 10mm, 12mm, 13mm, 14mm, 17mm, 19mm, 22mm, 24mm, 27mm
   (Offset wrench / Socket wrench / Adjustable wrench)



2. Hexagonal Wrench 5mm, 8mm, 10mm, 12mm, 14mm

3. Plier

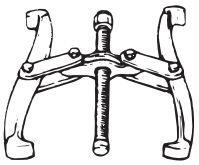
4. External snap ring plier / Internal snap ring plier (bent type can be also used)



5. Screwdriver, flat and cross

6. Metal and plastic hammers

7. Pulley puller

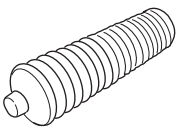


8. Screw lock agent
   (Locktite 242, 271 and 638)

9. Torch burner

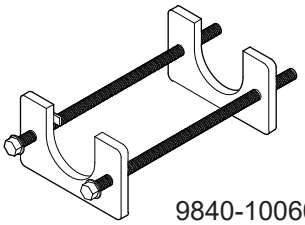
10. Liquid gasket (ThreeBond 1211)

11. Grease



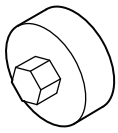
12. Pressing machine

13. Disassembly and Assembly Special Jigs for Hand Pump



9840-10060
Spring compression tool

9840-10040
Disassembling tool
(Spring Plug)



9840-10040
Disassembling tool
(Plug)

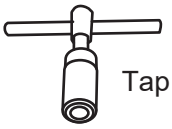
9540-01040
CAP PF1/4 MALE

9540-01070
PLUG PF1/4 FEMALE

Punch (For Spring Pin 8mm)

Bolt Extractor Set

Bolt Extractor



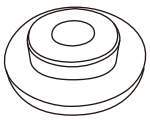
Tap Handle

14. Disassembly and Assembly Special Jigs for Vibrator

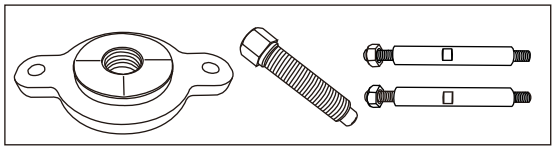
<For MVH-208, 209>

Bearing insertion cup

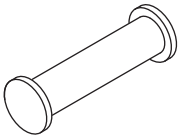
Bearing insertion ring



Bearing holder



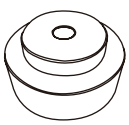
Bearing insertion puller



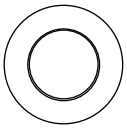
9844-72410
Bearing remover
MVH-208

9849-20010 Bearing insertion jig (driven shaft and drive one) set / MVH-208

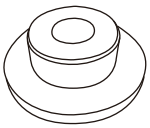
<For MVH-308, 408, 508>



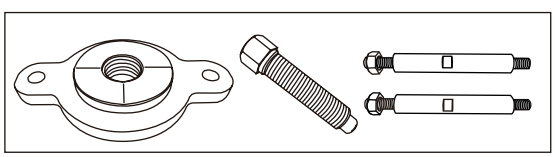
Bearing insertion cup



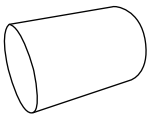
Bearing insertion ring



Bearing holder



Bearing insertion puller



9840-10070
Bearing remover
MVH-308

9849-10011 Bearing insertion jig (driven shaft and drive one) set / MVH-308

5. INSPECTION PROCEDURE

5.1 Appearance Check

(1) Assembly condition of each component (bolt loosening, defective parts, etc.)
(2) Damage on machine body
(3) Oil check (oil level, dirtiness)
  a. Engine oil (when shipped, SAE10W30) (For oil level, please see the table below.)
  b. Vibrator oil
  c. Hydraulic oil (forward/backward travel)
(4) V-belt check (tension, scratch, crack, deterioration, etc.)
(5) Anti-vibration rubber check (scratch, crack, setting, deterioration, etc.)

5.2 Operation Check

(1) Engine
(2) Engine speed check (Operating speed, idling speed)
  Travel
  a. Forward/backward travel switch check
  b. Forward/backward travel speed check
(3) Check for abnormal noise during operation

Standard torque table Table 1

Screw diameter		The collar screws materials	
		Aluminum Aluminum type+Helisert	SS,FCD
M6	N·m	11.8 - 14.7	14.7 - 17.7
	Kgf·cm	120 - 150	150 - 180
	ft·lbf	8.7 - 10.8	10.8 - 13.0
M8	N·m	24.5 - 29.4	32.4 - 35.3
	Kgf·cm	250 - 300	330 - 360
	ft·lbf	18.1 - 21.7	23.9 - 26.0
M10	N·m	58.8 - 68.6	73.5 - 78.5
	Kgf·cm	600 - 700	750 - 800
	ft·lbf	43.4 - 50.6	54.2 - 57.9
M12	N·m	98.1 - 107.9	112.8 - 122.6
	Kgf·cm	1000 - 1100	1150 - 1250
	ft·lbf	72.3 - 79.6	83.2 - 90.4
M14	N·m	117.7 - 127.5	166.7 - 176.5
	Kgf·cm	1200 - 1300	1700 - 1800
	ft·lbf	86.8 - 94.4	123.0 - 130.2

Engine oil level table Table 2

Model	MVH-208DSY MVH-308DSY (PAS)	MVH-408DSC (PAS)	MVH-208DSZ MVH-308DSZ (PAS)	MVH-408DSZ (PAS)
Engine type	YANMAR L70V L70N	YANMAR L100V L100N	HATZ 1B30	HATZ 1B50
Capacity of Lubricant for Engine	1,050cc	1,600cc	1,100cc	1,500cc
Model	MVH-508DSC (PAS)	MVH-308GE	MVH-208/209GH MVH-308GH	MVH-408GH MVH-508GHS (PAS)
Engine type	HATZ 1D81	ROBIN EX27	HONDA GX270	HONDA GX390
Capacity of Lubricant for Engine	1,900cc	1,050cc	1,100cc	1,100cc

6. SPECIFICATION

MODEL		MVH-208DSZ	MVH-208DSY	MVH-209DSZ	MVH-308DSZ MVH-308DSZ-PAS
Main Dimensions					
Overall Length	mm	1310	1310	1310	1540
Overall Height (Handle)	mm	1010	1010	1010	1030
Overall Width	mm	500	500	600	445 (595, 745)
Vibrating Plate					
Width	mm	500	500	600	445 (595, 745)
Length	mm	720	720	720	860
Weight					
Operating Weight	kg	240	237	247	345 (360, 375)
Engine					
Manufacturer/Type		HATZ, 1B30	YANMAR, L70N6	HATZ, 1B30	HATZ, 1B30
Type Of Engine		Air-cooled 4-cycle diesel engine	Air-cooled 4-cycle diesel engine	Air-cooled 4-cycle diesel engine	Air-cooled 4-cycle diesel engine
Maximum Power	kw/rpm PS/rpm	4.9/3300 6.7/3300	4.9/3600 6.7/3600	4.9/3300 6.7/3300	4.9/3300 6.7/3300
Set Engine Revolution	rpm	3350	3100	3350	3350
Electric Start		○	○	○	○
Performance					
Vibrating Frequency	Hz/VPM	87/5200	87/5200	87/5200	73/4400
Centrifugal Force	kN/kgf	37/3772	35/3570	37/3772	45/4600
Max. Traveling Speed	m/min	0～27	0～26	0～26	0～27
Hand Arm Vibration (Ahv)	m/sec^2	3.8	-	4.4	6.1

MODEL		MVH-308DSY MVH-308DSY-PAS	MVH-408DSZ MVH-408DSZ-PAS	MVH-408DSY MVH-408DSY-PAS	MVH-508DSZ MVH-508DSZ-PAS
Main Dimensions					
Overall Length	mm	1540	1570	1570	1600
Overall Height (Handle)	mm	1030	1030	1030	1070
Overall Width	mm	445 (595, 745)	500 (650, 800)	500 (650, 800)	650 (800)
Vibrating Plate					
Width	mm	445 (595, 745)	500 (650, 800)	500 (650, 800)	650 (800)
Length	mm	860	900	900	900
Weight					
Operating Weight	kg	341 (356, 371)	408 (423, 438)	407 (422, 437)	525 (540)
Engine					
Manufacturer/Type		YANMAR, L70N	HATZ, 1B50	YANMAR, L100N	HATZ, 1D81S
Type Of Engine		Air-cooled 4-cycle diesel engine	Air-cooled 4-cycle diesel engine	Air-cooled 4-cycle diesel engine	Air-cooled 4-cycle diesel engine
Maximum Power	kw/rpm PS/rpm	4.9/3600 6.7/3600	6.7/2500 9.1/2500	7.0/3200 9.5/3200	8.9/2500 12.1/2500
Set Engine Revolution	rpm	3600	2350	3200	2350
Electric Start		○	○	○	○
Performance					
Vibrating Frequency	Hz/VPM	73/4400	73/4400	73/4400	69/4150
Centrifugal Force	kN/kgf	45/4600	55/5600	50/5100	65/6600
Max. Traveling Speed	m/min	0～27	0～28	0～27	0～29
Hand Arm Vibration (Ahv)	m/sec^2	-	4.7	-	5.5

※ Specifications are subject to change without notice.

※ The number in parentheses is the dimensions with “extension plate (option)” .

“( )” : MVH-308,408: (standard type, wide type)
MVH-508: (wide type)

MODEL		MVH−208GH	MVH−209GH	MVH−308GH	MVH−408GH
Main Dimensions					
Overall Length	mm	1310	1310	1540	1570
Overall Height (Handle)	mm	1010	1010	1030	1030
Overall Width	mm	500	600	445 (595, 745)	500 (650, 800)
Vibrating Plate					
Width	mm	500	600	445 (595, 745)	500 (650, 800)
Length	mm	720	720	860	900
Weight					
Operating Weight	kg	210	217	310 (325, 340)	364 (379, 394)
Engine					
Manufacturer/Type		HONDA, GX270	HONDA, GX270	HONDA, GX270	HONDA, GX390
Type Of Engine		Air-cooled 4-cycle petrol engine	Air-cooled 4-cycle petrol engine	Air-cooled 4-cycle petrol engine	Air-cooled 4-cycle petrol engine
Maximum Power	kw/rpm PS/rpm	6.3/3600 8.6/3600	6.3/3600 8.6/3600	6.3/3600 8.6/3600	8.7/3600 11.8/3600
Set Engine Revolution	rpm	3400	3400	3600	3200
Electric Start		×	×	×	×
Performance					
Vibrating Frequency	Hz/VPM	87/5200	87/5200	73/4400	73/4400
Centrifugal Force	kN/kgf	37/3772	37/3772	45/4600	55/5600
Max. Traveling Speed	m/min	0～27	0～26	0～27	0～28
Hand Arm Vibration (Ahv)	m/sec^2	4.0	3.7	2.8	3.7

MODEL		MVH−508GHS MVH−508GHS−PAS
Main Dimensions		
Overall Length	mm	1570
Overall Height (Handle)	mm	1030
Overall Width	mm	650 (800)
Compacting Board		
Width	mm	650 (800)
Length	mm	900
Weight		
Operating Weight	kg	425 (440)
Engine		
Manufacturer/Type		HONDA, GX390
Type Of Engine		Air-cooled 4-cycle petrol engine
Maximum Power	kw/rpm PS/rpm	8.7/3600 11.8/3600
Set Engine Revolution	rpm	3600
Electric Start		○
Performance		
Vibrating Frequency	Hz/VPM	73/4400
Centrifugal Force	kN/kgf	60/6120
Max. Traveling Speed	m/min	0～29
Hand Arm Vibration (Ahv)	m/sec^2	3.6

Remarks:
Vibration Level is in comply with EU Directive 2002/44/EC and the value is shown as 3 axix min vibration level.
Test course (Crushed gravel) is in comply with EN500-4.

The above values are subject to change in case that the machine is modified or/and the required regulations change.

※ Specifications are subject to change without notice.
※ The number in parentheses is the dimensions with “extension plate (option)” .
“( )” : MVH-308,408: (standard type, wide type)
MVH-508: (wide type)

7. CAUTIONS BEFORE MAINTENANCE WORK

1. Disassembly and assembly of this machine, with inspection and change of vibrator oil included, should be done on a horizontal surface area. Before disassembly and assembly, understand well the normal assembly condition so that you will not make assembly error.

2. If oil seal, gasket, packing, O-ring or lock washer is disassembled, replace it with a new one each time.

3. The contact surface between vibrator case and vibrator top cover should be sealed with O-ring. (Clean the contact surface and be careful about O-ring position when assembling.)

4. When tightening bolts and nuts, tighten them according to the specified standard torque and applying the screw lock agent (Loctite, etc.). For bolts and nuts with no specification, refer to the “Tightening torque list”. (When applying screw lock agent, degrease and clean the screw part with the brake cleaner, etc.)
   Note) The bolts used on this machine are all of the right hand thread.

5. When disassembling and assembling, work in the maintenance shop without dirt and dust.

Tightening torque list (unit: kgf−cm, 1kgf−cm=9.80665N−cm)

		Thread diameter							
		6mm	8mm	10mm	12mm	14mm	16mm	18mm	20mm
Material	4T(SS41)	70	150	300	500	750	1,100	1,400	2,000
	6−8T(S45C)	100	250	500	800	1,300	2,000	2,700	3,800
	11T(SCM3)	150	400	800	1,200	2,000	2,900	4,200	5,600
	When the mating material is aluminum.	100	300～350	650～700	(Bolts used on the machine are all right-hand thread.)				

To change the unit to kgf·cm, convert with 1 N·m = 10.197 kgf·cm.

6. When the bolts applied the screw lock agent (Loctite, etc.) are difficult to loosen, they loosen easily by heating them with a torch burner. Then, replace the heated bolt with a new one. It should be a specified high tension bolt (genuine parts).

7. Use correct tools correctly.

8. First of all, the machine with battery remove the minus terminal before starting disassembly. After assembly is done completely, install the minus terminal.

8. DISASSEMBLY AND ASSEMBLY

8.1 How To Remove The Battery

1. Remove the stopper at the two locations on the top portion of the rear cover to open the rear cover.(Fig.1)

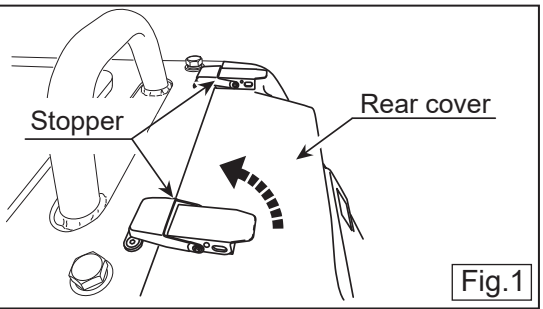


Fig.1

2. Loosen, but not remove, the M8 bolts (2 bolts) used for cyclone cleaner attachment. Take out the cyclone cleaner downward.(Fig.2)

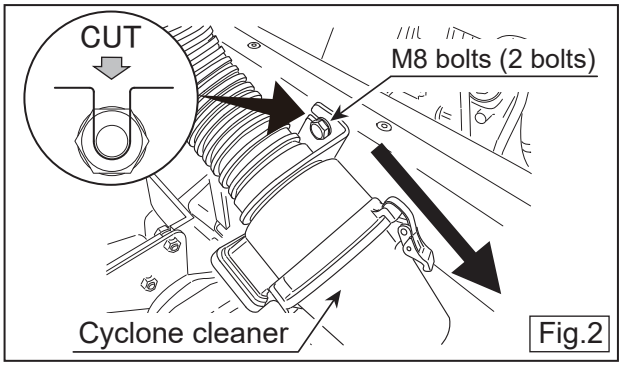


Fig.2

3. Take off the nuts and remove the battery holder. After tilting the battery backward, disconnect the battery terminal. When doing so, always disconnect the black terminal on the minus side first.
4. By holding the top surface handle, pull upward to remove the battery from the machine.(Fig.3)

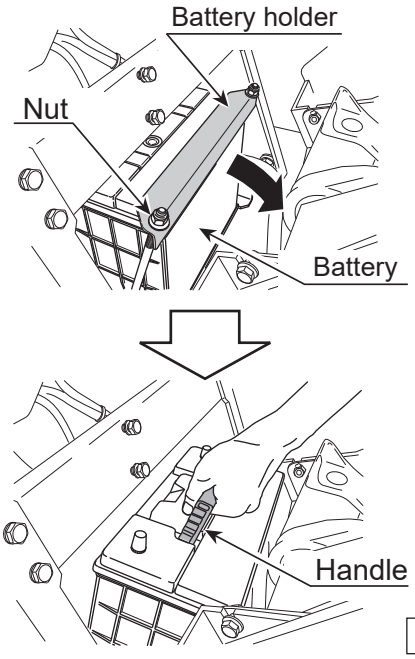


Fig.3

⚠ CAUTION

Pay sufficient attention so that the battery terminal will not touch the frame.

8.2 Control

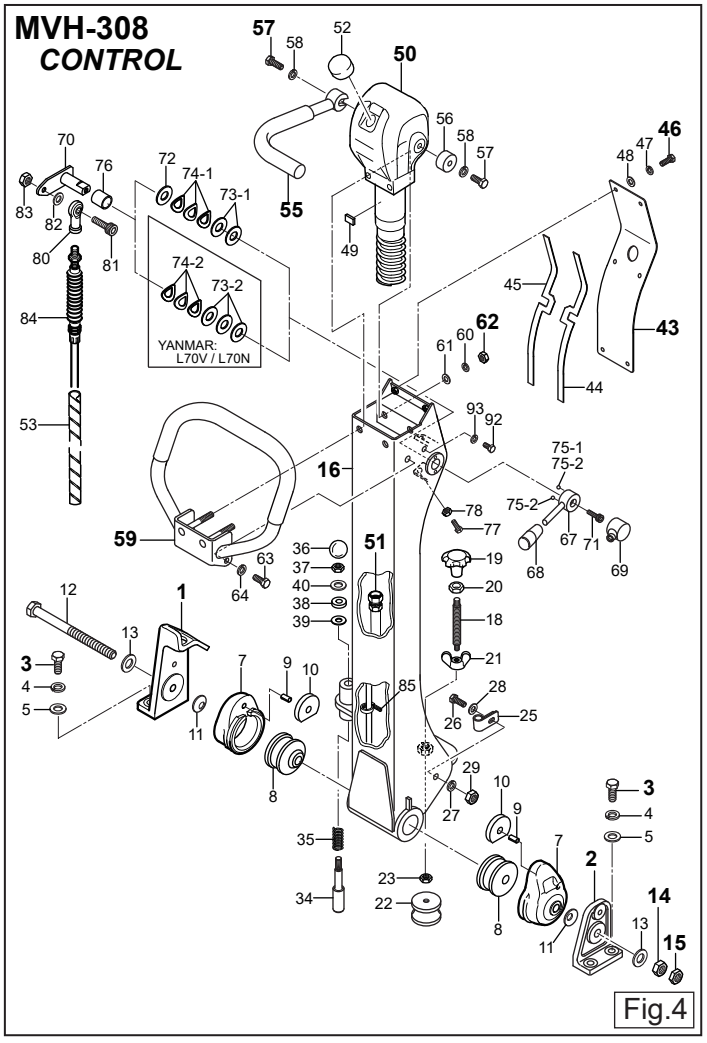


Fig.4

(1) Disassembly

⚠ CAUTION

Start your work after the temperature of hydraulic oil gets sufficiently lowered.

a. Remove 6 bolts (46), then remove the handle cover (43).
b. Remove a bolt (57), then remove the travel lever (55).
c. Remove 2 bolts (63) and 2 nuts (62), then remove the handle grip (59).
d. Remove the hydraulic hose (51) from hand pump (50), then remove the hand pump (50) from the handle (16). (Fig. 4)

⚠ CAUTION

After the hydraulic hose is removed, tighten the caps on both ends to prevent entry of dust.

e. Remove the wire terminal on engine side.

⚠ CAUTION

- Be very careful not to have your fingers get caught by the hand pump spring.
- Be very careful not to damage the wiring, when pulling out the hand pump.

f. Remove the hose clamp (33), then remove the hydraulic hose (51) from the cylinder on vibrator side. (Fig. 5)

⚠ CAUTION

Before removing the hydraulic hose, clean up dirt and soil on its connection part.

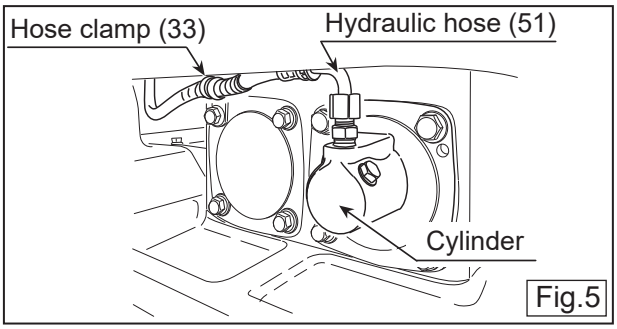


Fig.5

g. Remove the throttle wire on the engine.
h. Remove the hour and tachometer (96) on the rear cover. (Fig. 6)
i. Remove 6 bolts (21), then remove the rear cover (18). (Fig. 6)
j. Remove 4 bolts (3), then remove the handle (16). (Fig. 4)

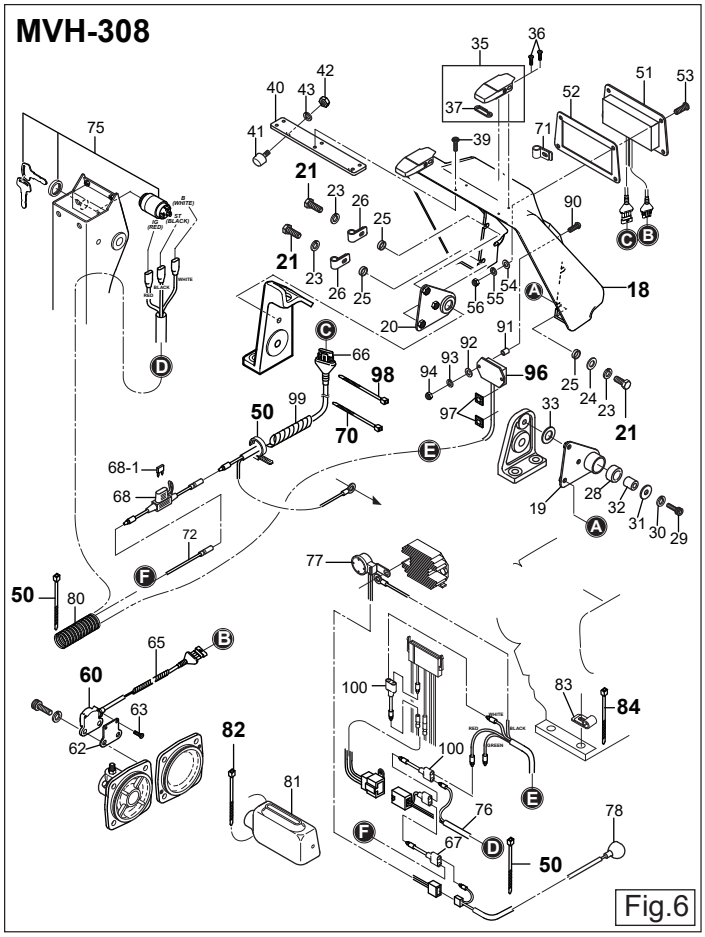


Fig.6

(2) **Assembly**

Assemble with the reversed procedure of disassembly, but be careful about the following points.

- Fix the wire (coupler) inside rear cover (18) with cable tie certainly. (Fig. 6)
- When installing the handle assembly to the engine base, tighten 4 bolts (3) for the handle brackets of right(1) and left(2) temporarily. Then after adjusting the handle operation with double nuts (14, 15), tighten 4 bolts (3) completely. (Fig. 4)
- Apply the grease to the shaft and washer.

⚠ CAUTION

Be very careful not to have your finger get caught by the hinge part.

For Inspection and Charge of the hydraulic oil, See the “9-8. Inspection & Change of Hydraulic Oil”.

8.3 Main Body (Separation of Engine Base and Vibrating Plate Assembly)

(1) **Disassembly**

a. Remove 4 bolts (35), then remove the belt cover OUT (33). (Fig. 9)
b. Remove the V-belt (22).

⚠ WARNING

When removing V-belt, after hanging the waste cloth on the V-belt, then remove the V-belt by rotating while pulling the waste cloth. Be very careful not to have your finger get caught.
In case of the V-belt have damage, it might be broken by the pulling force. Your body might damage due to this broken, so be very careful about level of pulling force.

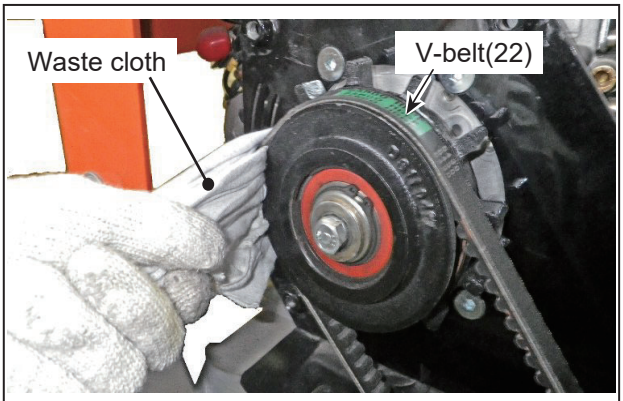


Fig.7

For the machine with COMPAS II, acceleration sensor and clip (38) have to be removed.

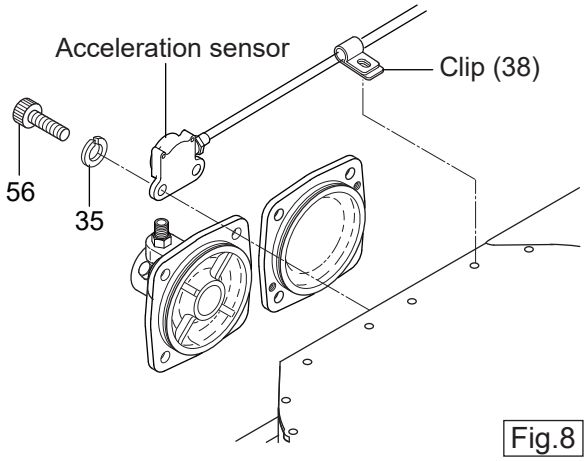


Fig.8

c. Remove 4 bolts of anti-vibration rubber that are fixing the engine base(1). then engine base and vibrating plate AY are separated by lifting the lifting hook on main body. (Fig. 9)

⚠ WARNING

To secure safety, check the no crack and no breakage on the guard hook, and check to tighten the bolts completely, before lifting the engine base.
Also, use the lifting wire which have sufficient strong. And use the lifting machine which have sufficient lifting capability.

MVH-308
BASE AND ENGINE (YANMAR: L70N, L70V)

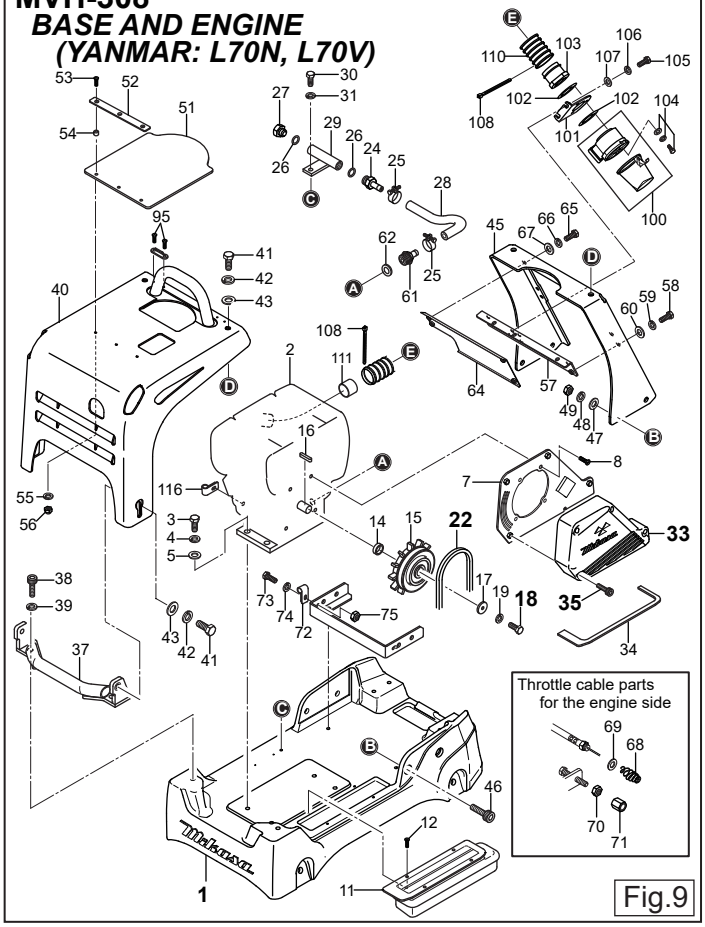


Fig.9

(2) Assembly

Assemble with the reversed procedure of disassembly, but be careful about the following points.

a. Apply Loctite #243 to bolts and nuts for assembling anti-vibration rubber.
b. Apply Loctite #243 to the all bolts for assembling the BASE AND ENGINE.
c. When installing the clutch, put the shoe side of it to engine side.
d. Use HDPF type V-belt for Mikasa genuine parts.

8.4 Vibrator

- During disassembly and assembly, be careful not to damage each part.
- Replace O-ring, oil seal, and packing with new one.

⚠ CAUTION

During disassembly and assembly of vibrator, be very careful not to have your fingers get caught by gear, eccentric rotator, and vibrator case.

(1) Disassembly (Fig.10)

a. Remove 5 bolts (52), then remove the belt cover, lower (51).
b. Remove a bolt (43), then remove the vibrator pulley (40).
c. Remove 18 bolts that are fixing vibrator top cover, then remove the vibrator top cover from vibrating plate.

MVH-308
VIBRATOR (With compaction sensor)

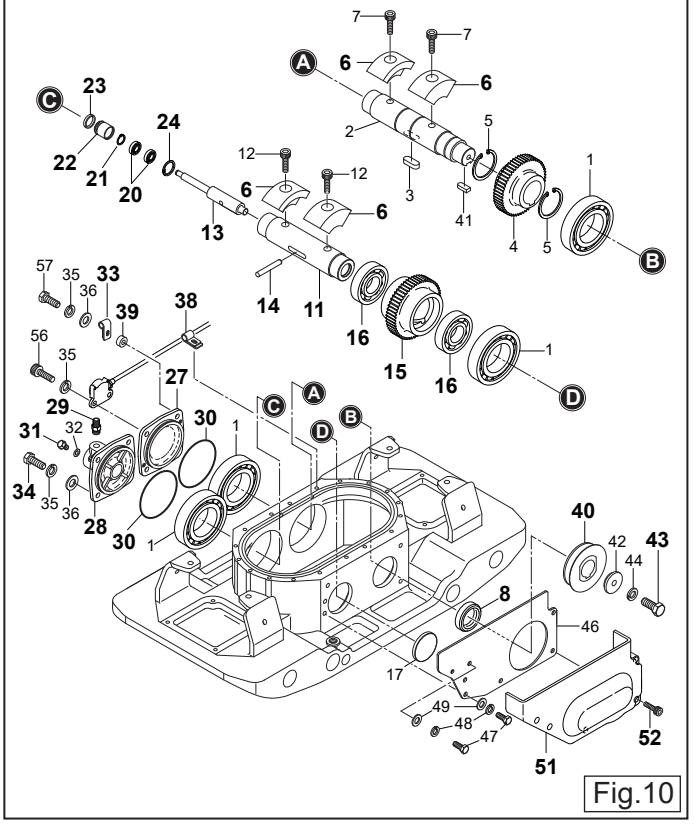


Fig.10

d. Remove each 2 bolts (7 & 12), then remove 4 eccentric rotator (6). (Fig.11)

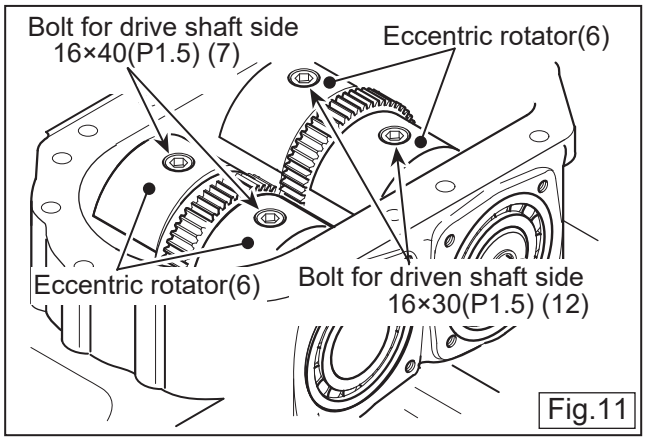


Fig.11

e. Disassembly of piston(Fig.12)

① Remove 4 bolts (34), then remove the cylinder (28).
When removing the cylinder, use the screw hole for cylinder removal.

② By rotating the driven gear (15), the piston (22) AY come out of the vibrator case.

③ Remove the stop ring for internal, R-26 (24), from the inside of piston. (Use internal snap ring plier with bent nose.)

④ Pull out the piston.

⑤ Remove the stop ring for external, S-10 (21), then remove 2 bearings (20) and the stop ring for internal (24) that was already removed.

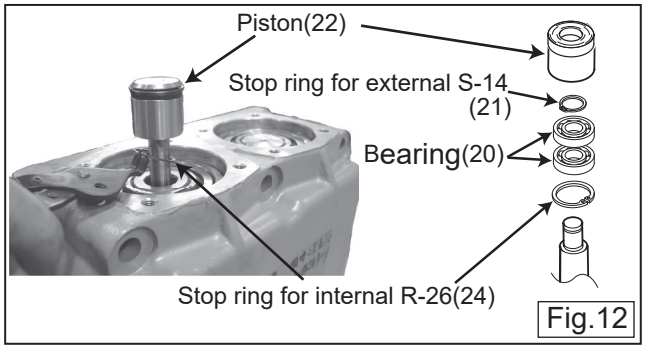


Fig.12

f. Disassembly of driven shaft (11) AY

① Remove the seal cap (17).
The seal cap can remove easily by hitting its bottom side.

② By Inserting the bearing remover from seal cap side, the driven shaft (11) AY come out to piston side, then remove the bearing outer for piston side. (Fig.13)

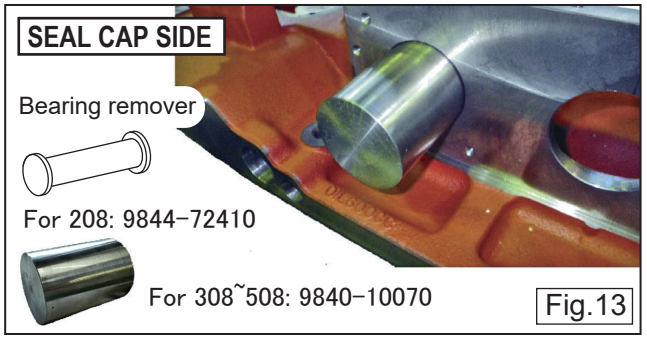


Fig.13

③ Remove the bearing outer for seal cap side with the bearing remover, then remove the driven shaft (11) AY from the inside of vibrator case. (Fig.14)

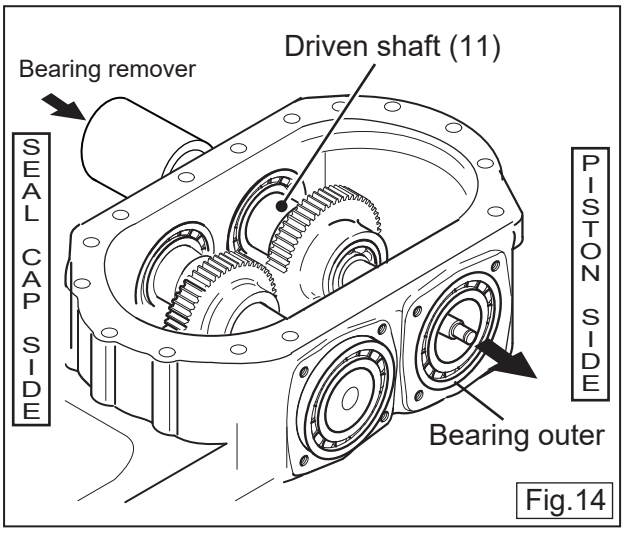


Fig.14

④ Remove the bearing inner from driven shaft (11) AY with pulley puller. (Fig. 15)

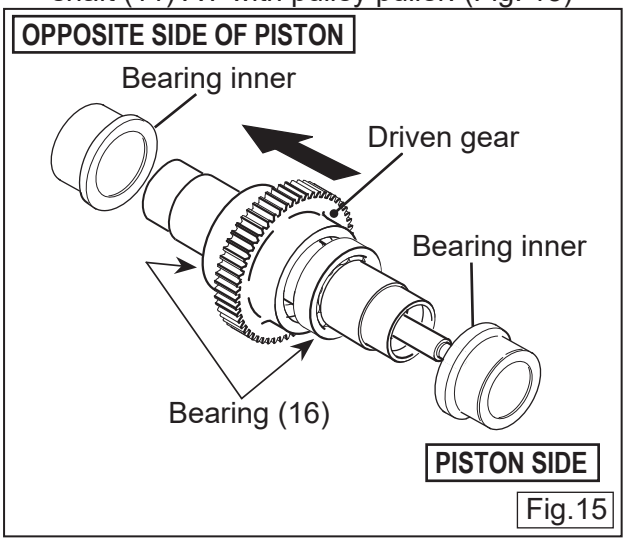


Fig.15

⑤ By pushing out the driven gear to opposite side of piston, Remove the bearing (16) of opposite side of piston.
In case of it is difficult to push out driven gear, push out it with pressing machine do not hit it with a hammer. (Fig. 15)

⑥ Remove the knock pin (14), then remove the piston rod (13). (Fig. 16)

⑦ Remove the bearing (16) on piston side. (Fig. 16)

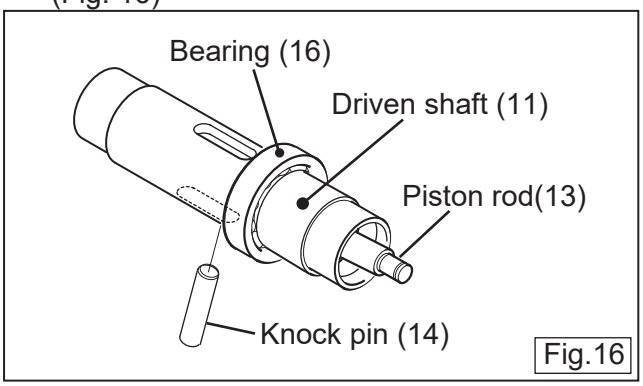


Fig.16

g. Disassembly of drive shaft (2) AY

① Remove 4 bolts (34), then remove bearing cover (27).
When removing the bearing cover, use screw hole for bearing cover removal.

② By hitting the end of pulley side on the drive shaft (2) with plastic hammer, the drive shaft AY come out to bearing cover side, then remove the bearing outer for bearing cover side. (Fig.17)

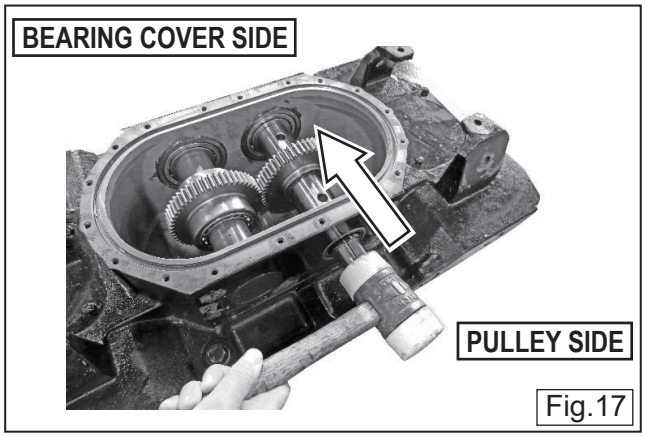


Fig.17

③ Remove the oil seal (8), then remove the bearing outer of pulley side by inserting the bearing remover from pulley side.

④ Remove the drive shaft (2) AY from the inside of vibrator case.

⑤ Remove the bearing inner from drive shaft (2) AY with pulley puller.

⑥ Remove the stop ring (5) for external, then remove the drive gear. (Fig. 18)
In case of it is difficult to push out the drive gear, push out it with pressing machine do not hit it with a hammer.

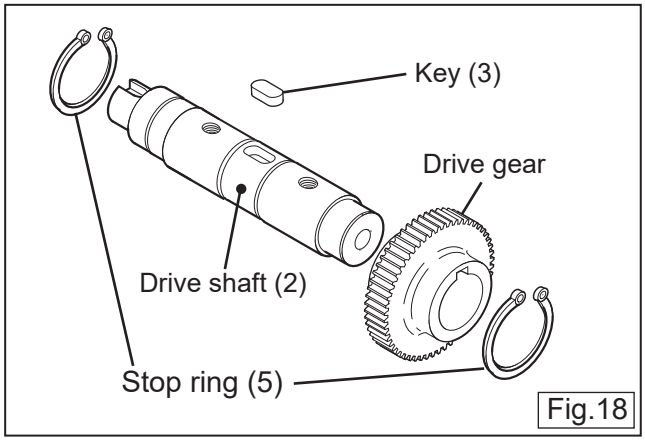


Fig.18

⑦ Remove the key (3).

(2) Assembly

Degrease and clean the contact surface between the vibrator case and vibrator top cover, and other parts.

a. Assembly of drive shaft

① Assemble the key to drive shaft (2), then press fit drive gear (4). Fix both sides with stop ring (5) for external.(Fig.18)

- Apply the grease to the drive gear (4) before press fitting.
- The punch mark of drive gear (4) should put the pulley side. (Fig.19)
- Be careful about the direction of the stop ring. (The edge side should put outside.)

② Press fit the bearing inner to drive shaft (2).

- The flange of bearing inner should put to the eccentric rotator side. (Fig.19)

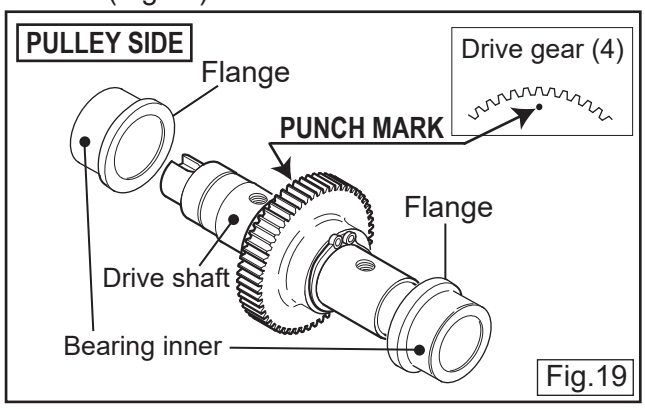


Fig.19

③【MVH-208, 209】
After inserting the drive shaft (2) into the vibrator case, move it to the opposite side of the pulley side. Insert the bearing outer to the pulley side of drive shaft, then insert the bearing insert ring to the bearing inner. (Fig.20)

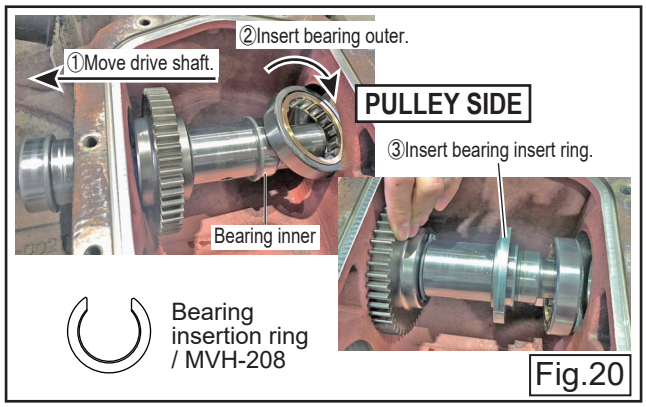


Fig.20

【MVH-308, 408, 508】
After Assembling the bearing insert ring to the bearing inner on the pulley side of drive shaft (2), assemble the bearing outer there. Then insert this drive shaft into the vibrator case. (Fig.21)

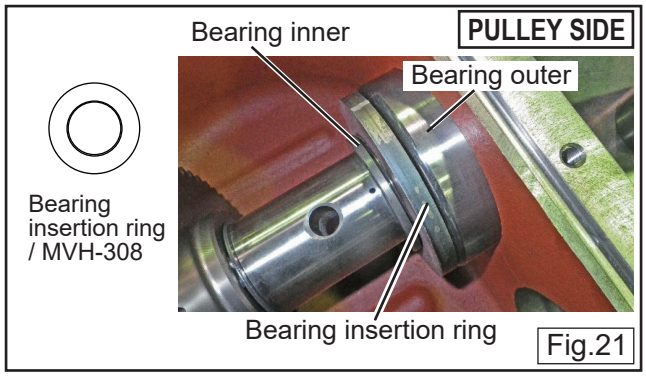


Fig.21

④ Assemble the bearing insertion puller to threaded hole of bearing cover, then assemble the bearing insertion cup between the center bolt and the bearing housing. (Fig. 22)

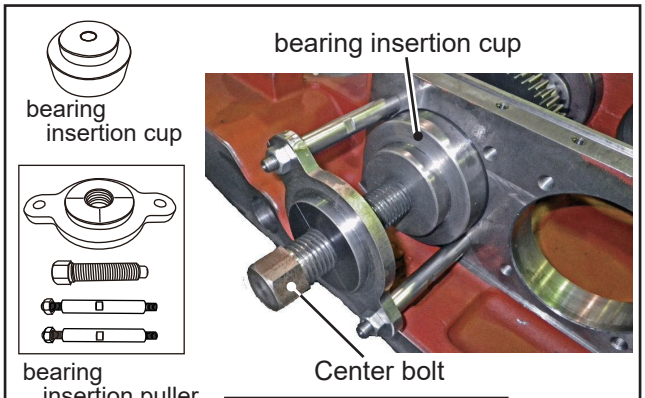


Fig.22

⑤ Press fit the bearing outer of pulley side by tightening the center bolt of bearing insertion puller. (Fig. 22)

⑥ Remove the bearing insertion ring of ③ from the drive shaft (2).

⑦ Press fit the bearing outer of bearing cover side with the bearing insertion puller and bearing insertion cup. At this time, press fit the bearing outer 2 to 3 mm deep from the mounting surface for bearing cover. (Fig. 23, 24)

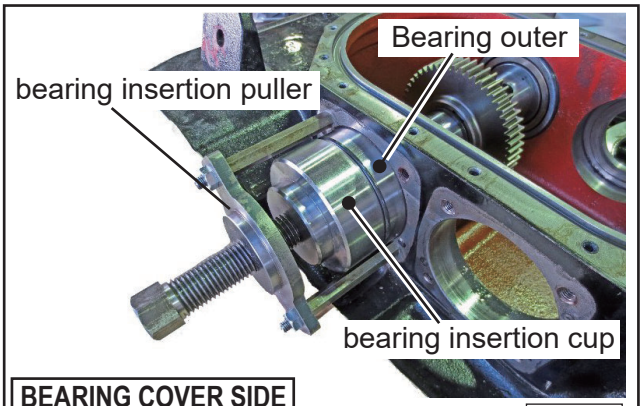
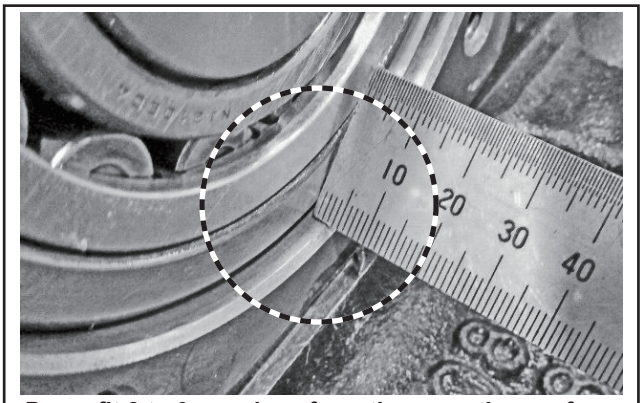


Fig.23



Press fit 2 to 3 mm deep from the mounting surface for bearing cover.
Fig.24

⑧【MVH-208/209】
Apply the liquid gasket (Threebond#1211) to the bearing cover (27).
【MVH-308/408/508】
Assemble the O-ring (30) to the bearing cover (27).

⑨ Aassemble it to the vibrator case for the bearing cover side.

⑩ After assembled the bearing cover, check the thrust gap of drive shaft.
(Standard value: 0.5mm to 1.0mm).

⑪ Insert oil seal (8) into vibrator case of pulley side of drive shaft. (Fig.25)

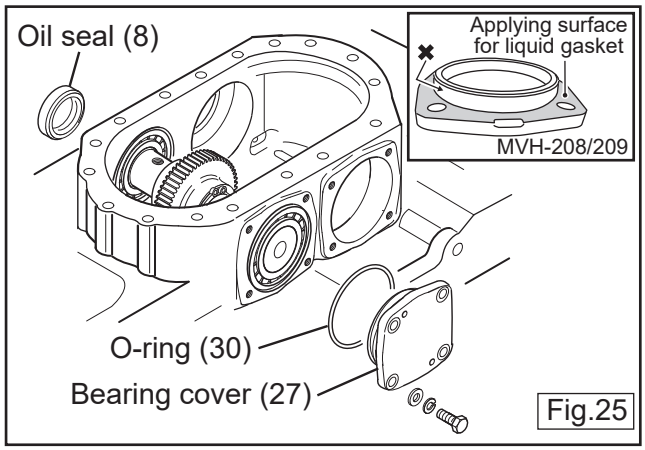


Fig.25

⚠ CAUTION
- Assemble the bearing after applying grease.
- Assemble the O-ring after applying grease.
- When inserting oil seal, make sure that there is no bend on oil seal and no damage on the lip.
- Apply Loctite #243 to the bolts for assembling the bearing cover.
  Tightening torque: 35 N·m

b. Assembly of driven shaft

① Assemble an eccentric rotator (6) to the pulley side (inside: straight) on the driven shaft (11) by tightening a bolt (12). Then, press fit bearing (16) to driven shaft. (Fig.26)

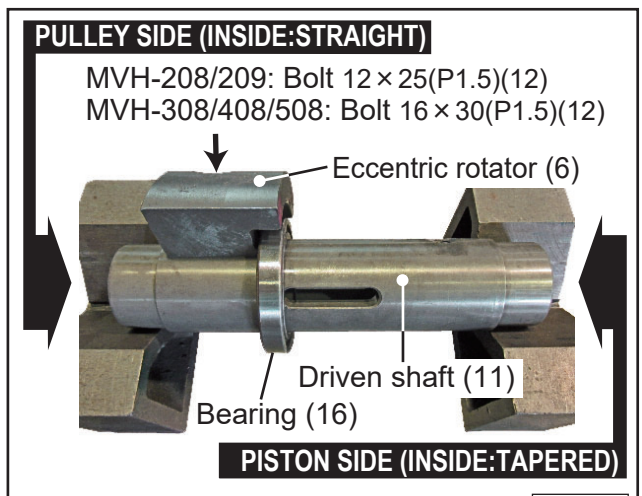


Fig.26

② Insert the piston rod (13) from the piston side (inside: tapered) of driven shaft. (Fig. 27)

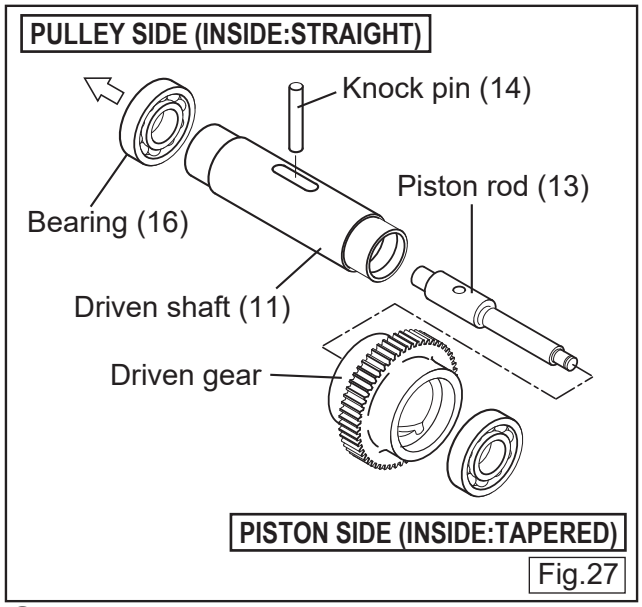


Fig.27

③ Insert knock pin (14) into the hole of piston rod through the groove of driven shaft. (Fig. 28)

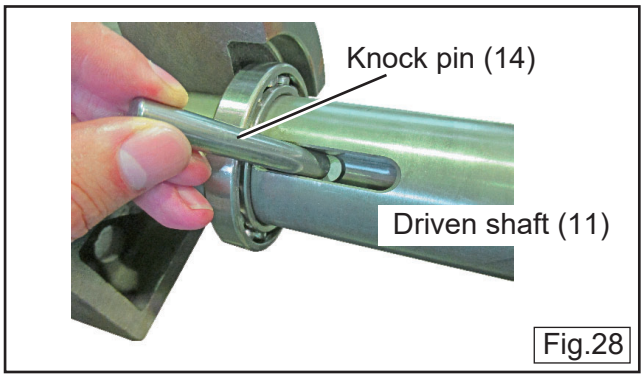


Fig.28

④ Put the eccentric rotator of driven shaft to the upper side, then push the piston rod into the driven shaft.
Put the punch mark of driven gear to the pulley side, then insert it to the driven shaft. At this time, set the driven gear by turning its punch mark to the right side when seeing from the pulley side. (Fig. 29)

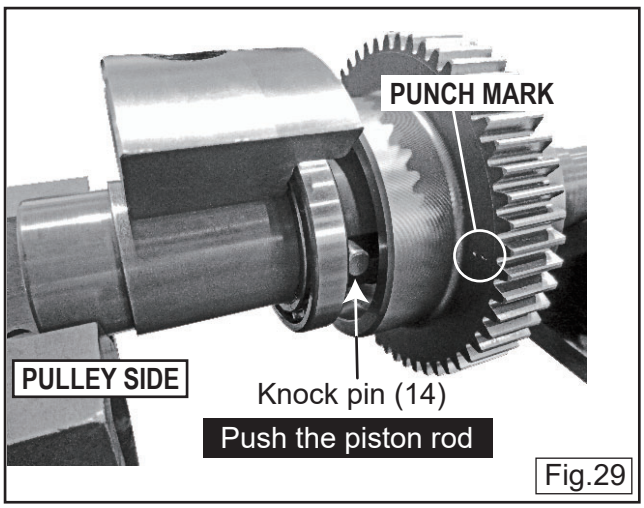


Fig.29

In case of the driven gear is assembled correctly, when pulling out the piston rod, the punch mark of driven gear and the threaded holes for eccentric rotator of driven shaft should be set in the same straight line. (Fig. 30)

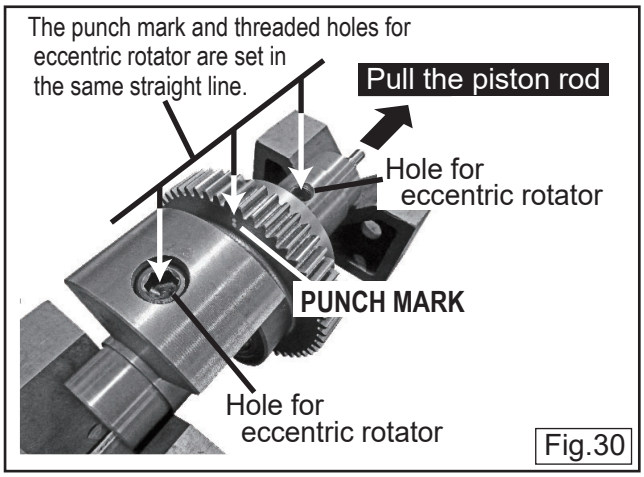


Fig.30

⑥ Press fit the bearing (16), then fix the drive gear (15). (Fig. 31)

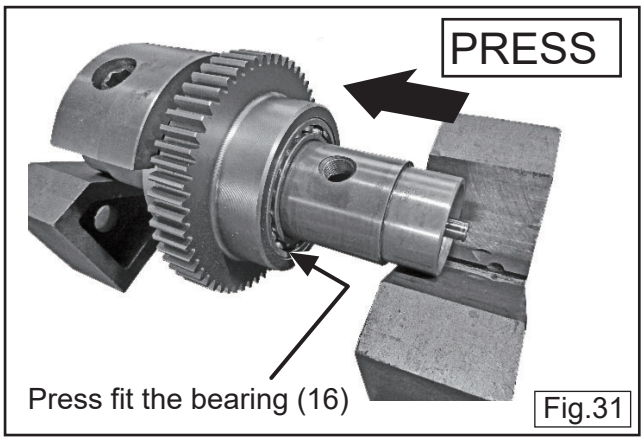


Fig.31

⑦ Press fit the bearing inner to the driven shaft (11).
The flange of bearing inner should put to the eccentric rotator side.

⑧ Press fit the bearing outer of pulley side from the inside of vibrator case with the bearing insertion puller and bearing holder. (Fig. 32)

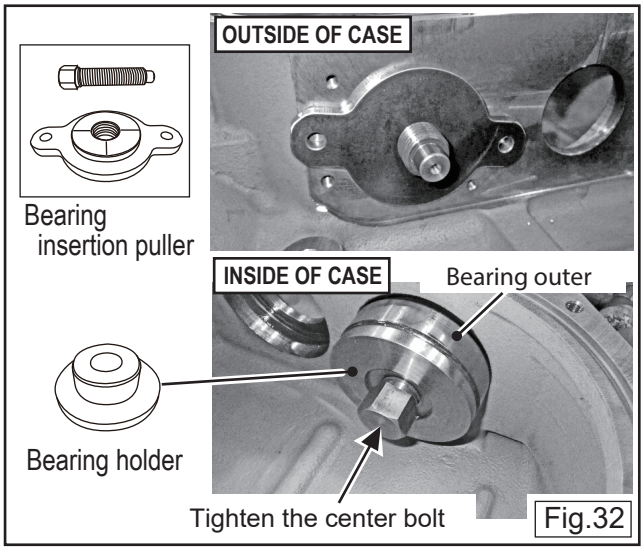


Fig.32

⑨ Insert from the piston side of driven shaft (11) AY into the vibrator case, then align the punch mark between the drive gear and driven gear. (Fig. 33)

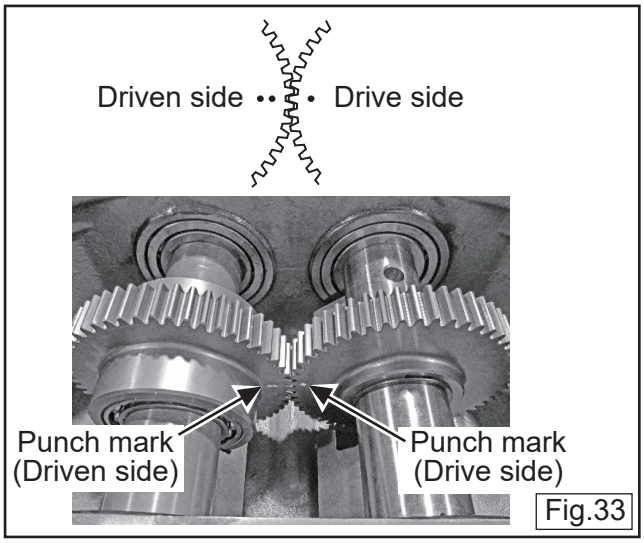


Fig.33

⑩ Press fit the bearing outer of piston side with the bearing insertion puller and bearing insertion cup. At this time, press fit the bearing outer 2 to 3 mm deep from the mounting surface for cylinder cover.
See the “a. Assembly of drive shaft ⑦” on P14 .

⚠ CAUTION

When press fitting the bearing outer of piston side, push the piston rod until the end of groove of driven shaft.

c. Assemble the eccentric rotators to the drive shaft and driven shaft. (Fig.34)

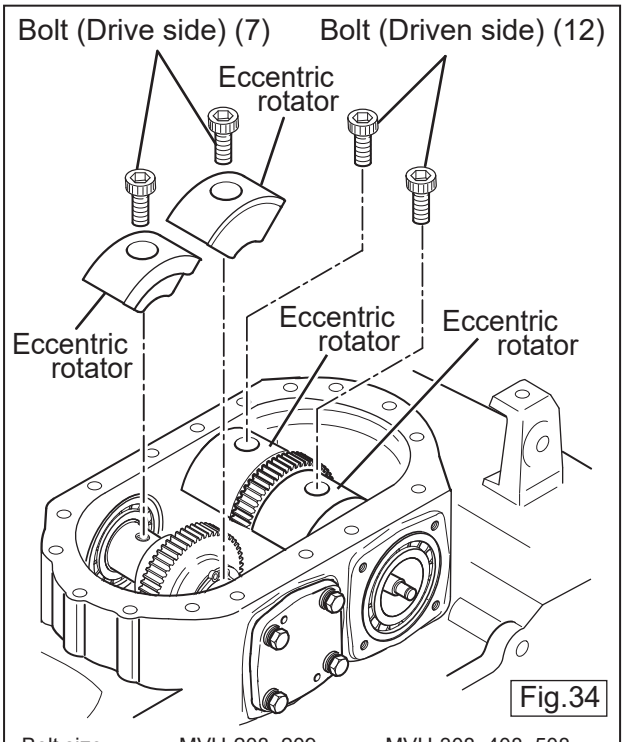


Fig.34

Bolt size	MVH-208, 209	MVH-308, 408, 508
Drive side	M12 x 40, P1.25	M16 x 40, P1.5
Driven side	M12 x 25, P1.25	M16 x 30, P1.5

⚠ CAUTION

- Check the bolts size.
- Apply Loctite #263 to the each bolts (7 & 12).
- Do not turn the drive shaft and driven shaft, when tightening the bolts for eccentric rotator with torque wrench.
  Tightening torque:
  M12 (MVH-208, 209): 118 N·m
  M16 (MVH-308, 408, 508): 275 N·m

⚠ WARNING

Be very careful not to have your fingers get caught by gear, eccentric rotator, and vibrator case.

d. Assembly of piston

① First, insert the stop ring for internal (24) to piston rod. (Fig. 35)

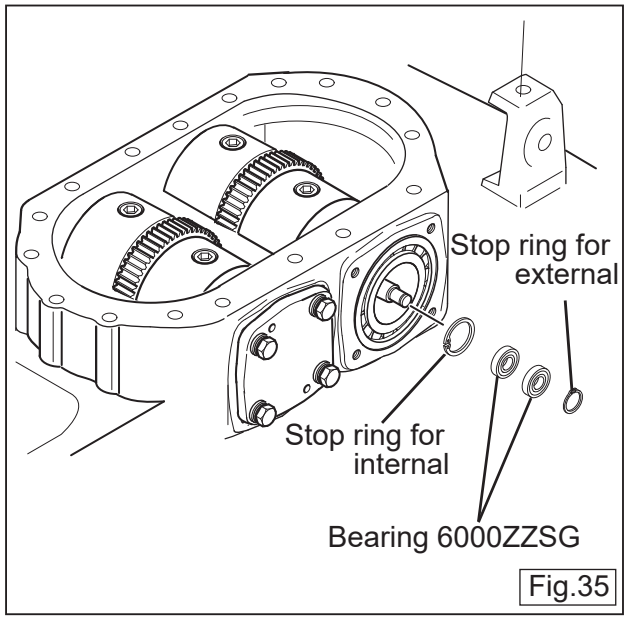


Fig.35

② Insert 2 bearings (20) to piston rod, then fix them with stop ring for external (21). (Fig. 35)

⚠ CAUTION

- Apply the grease to the bearing insertion part of piston rod.
- Use the genuine parts for bearing (20).

③ Assemble the UHS packing (23) to piston (22).
(After applying hydraulic oil to UHS packing, assemble it with your finger.) (Fig. 36)

⚠ CAUTION

- Make sure that there is no scratch and no damage on the piston.
- Make sure that there is no damage on the UHS packing.
- Be careful about the direction of the UHS packing.

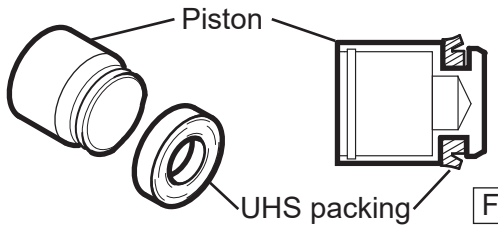


Fig.36

④ Assemble the piston (22) to bearings (20), then fix it by assembling the stop ring for internal (24) that was already inserted.

⚠ CAUTION

- When assembling the piston, push it with your hand or hit it with a plastic hammer lightly.
- When assembling the stop ring for internal, use internal snap ring plier with bent nose. Make sure that it assembles into the groove certainly.
- After assembled the piston, make sure that it rotates smoothly.
- The edge side of the stop ring should put outside.

⑤【MVH-208/209】
Apply the liquid gasket (Threebond#1211) to the cylinder (28).
【MVH-308/408/508】
Assemble the O-ring (30) to the cylinder (28).

⑥ Aassemble it to the vibrator case for the piston side.

⑦ After assembled the cylinder, check the thrust gap of driven shaft.
(Standard value: 0.5～1.0mm)

⚠ CAUTION

- Apply Loctite #243 to the bolts (34) for assembling cylinder.
  Tightening torque: 35 N·m
- When inserting the piston to the cylinder, be careful not to damage USH packing.
- Assemble the O-ring after applying grease.

⑧ Assemble the connector (29), air release bolt (31), and packing (32) to the cylinder.

⚠ CAUTION

Apply the seal tape around the connector (29).

⑨ Assemble the seal cap (17) to the vibrator case at the opposite side of the cylinder.

By the above steps, the assembly of the vibrator is completed. As a final step, turn the drive shaft with your hand to make sure that it rotates smoothly.
If it does not rotate smoothly, adjust it by hitting the side of gear with a plastic hammer lightly.

⚠ WARNING

Be very careful not to have your fingers get caught between gear and eccentric rotator.

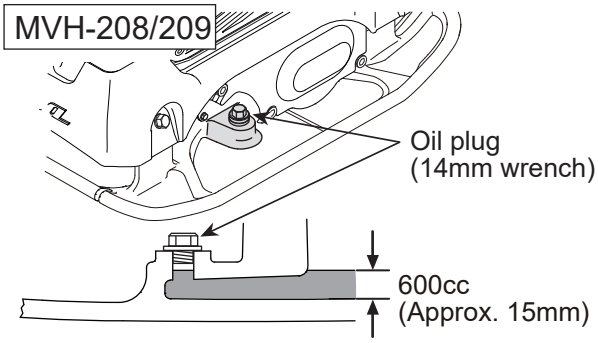
⚠ CAUTION

Never hit the gear teeth.

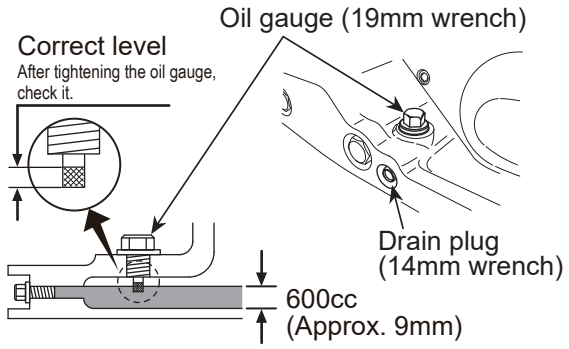
⑩ Add the new vibrator oil to vibrator case as specified level.

Use engine oil SAE10W-30 as lubrication oil.
Vibrator oil capacity ⇒ 600cc

MVH-208/209



MVH-308/408/508



- Measure the vibrator oil quantity correctly.
- If it is more than the specified value, it might cause over-load.
- If it is less than the specified value, noise and shortening of bearing life might occur.

⑪ Degrease the contact surface between the vibrator case and vibrator top cover, then after assembling O-ring to the vibrator case, assemble them by tightening bolts. (Fig. 37)

○ Apply Loctite #243 to the bolts.
Tightening torque: 35 N·m
○ Tighten the bolts in a crisscross pattern.

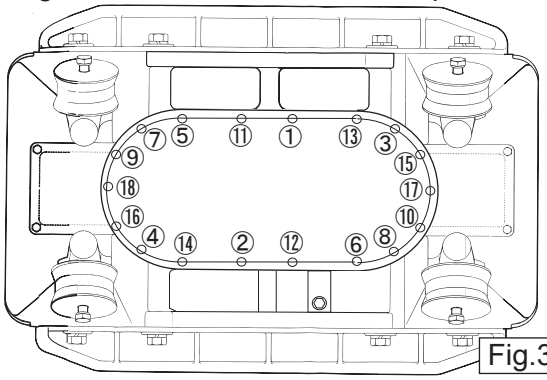


Fig.37

8.5 Hand pump for MVH-208, 209

⚠ CAUTION

- During disassembly and assembly, be careful not to damage each part.
- Replace the O-ring, oil seal, and packing with a new one.
- Work in a clean workplace to prevent entry of dust and foreign material.

(1) Disassembly

a. Remove the breather plug, then remove the hydraulic oil from the inside of hand pump. (Fig.1)

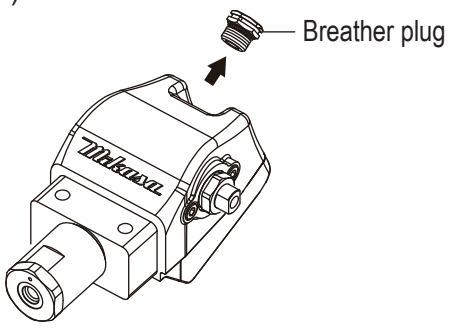


Fig. 1

b. Remove the hydraulic oil from the cylinder cap.(Fig.2)

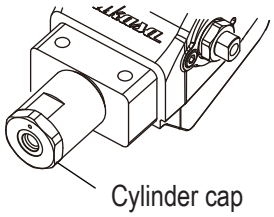


Fig. 2

c. Remove the hexagon socket plug.(Fig.3)

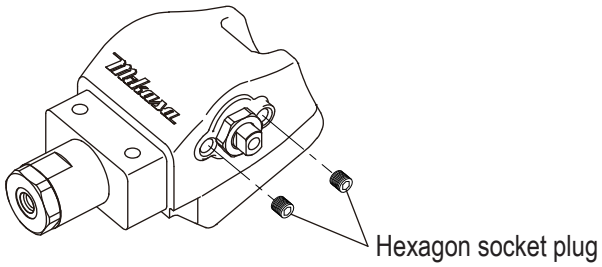


Fig. 3

d. Use air to remove dust from the hexagon socket plug and the fixing part of it.(Fig.4)

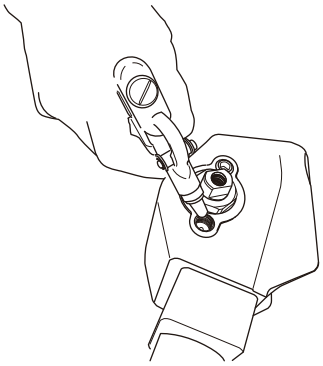


Fig. 4

e. Insert the screw extractor into the deepest of stopper pin.(Fig.5)

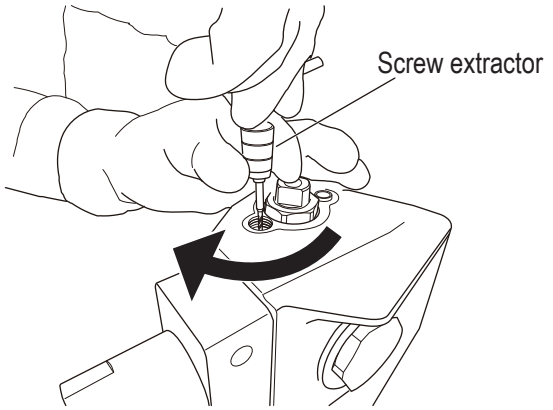


Fig. 5

f. Pull out the stopper pin together with the screw extractor.(Fig.6)

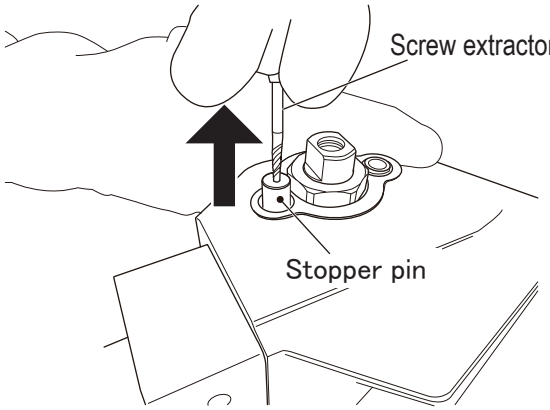


Fig. 6

g. Re-fix the cleaned hexagon socket plug.

h. While removing the valve assembly, turn the control shaft in the reverse direction, then remove the link joint of the valve assembly from the control arm.(Fig.7)

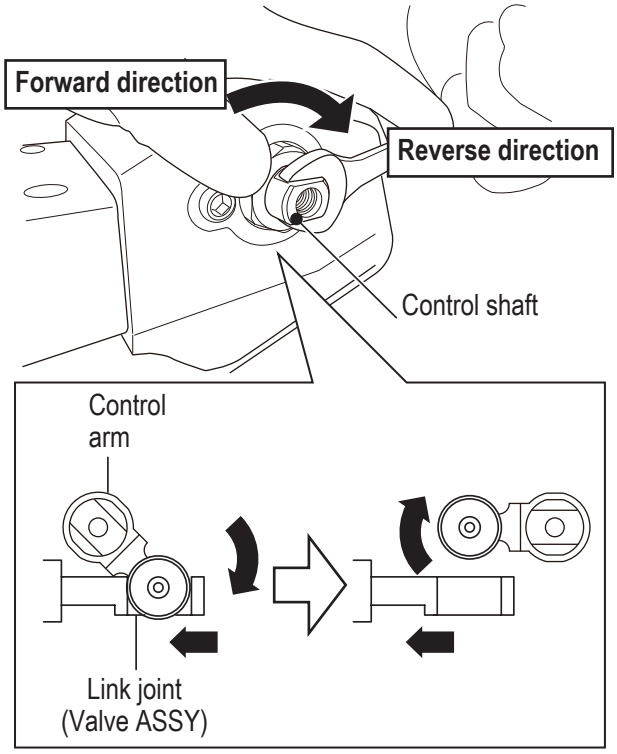


Fig. 7

i. Remove the cylinder & valve assembly from the pump head. (Fig.8)

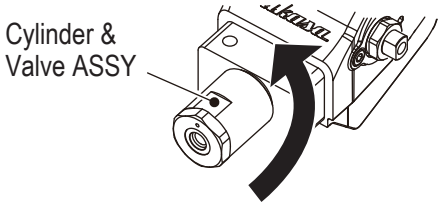


Fig. 8

j. Remove the O- ring of the breather. (Fig. 9)

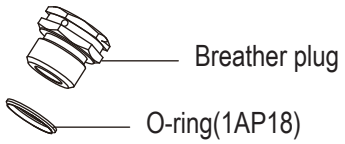


Fig. 9

k. Disassembly of the hand pump assembly is completed.
About disassembly and assembly of pump head assembly, valve assembly, and accumulator assembly, please refer to Chapters 8.2 to 8.3.

(2) Assembly

Assemble is the reversed procedure of disassembly, but pay attention to the following points.

* Degrease and clean each parts.
* During assembling, be careful not to damage each parts.
* Replace the O-ring and dust seal with a new one.
* Apply lithium grease to the O-ring and sliding parts.
* Be careful to prevent entry of dust or foreign matter.

a. Attach the O-ring to the breather.(Fig.10)

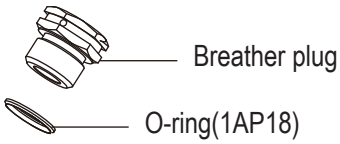


Fig.10

b. Insert the cylinder & valve assembly into the pump head. By setting the flat surface of the link joint to the direction of the Mikasa mark of the pump head and making the control shaft in the forward direction, the control arm and the link joint will be engaged. (Fig. 11)

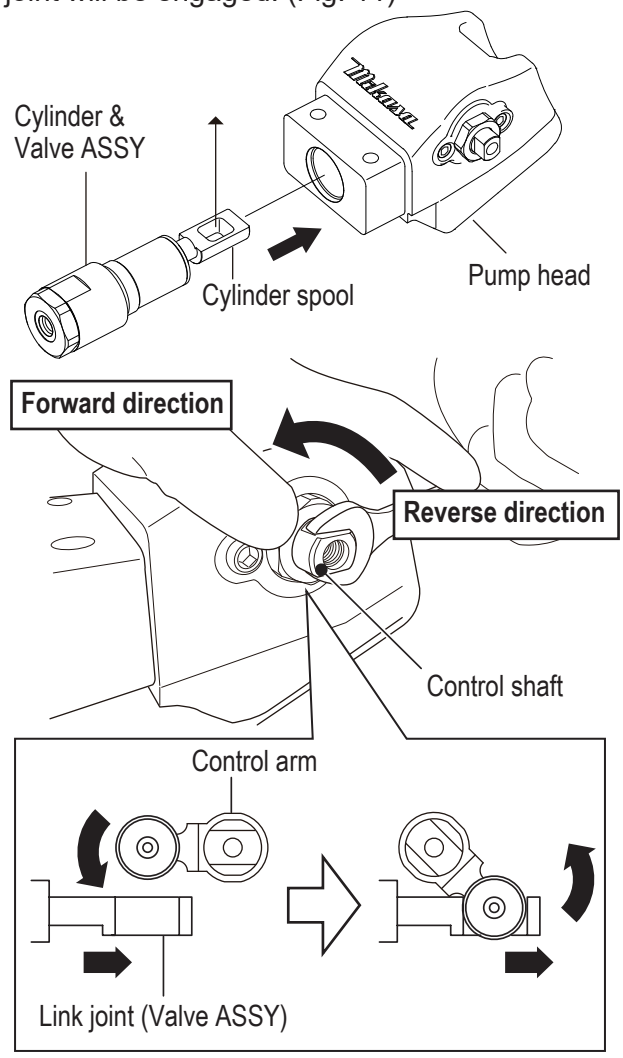


Fig.11

c. Assemble the cylinder & valve assembly to the pump head. (Fig.12)

※ **Tightening torque of cylinder & valve AY: 100±10N・m**

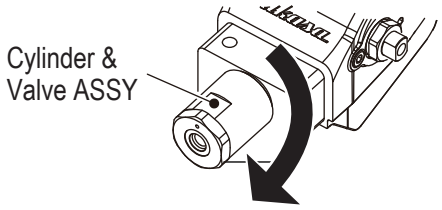


Fig.12

d. Make sure that the cylinder cap, accumulator assembly, and valve assembly are fixed.

e. Install the stopper pin of pump head. At this time, make sure that the hole is visible before installing.(Fig.13)

⚠ CAUTION

Be careful not to install the stopper pin in the opposite direction. Since it will not be able to be removed.

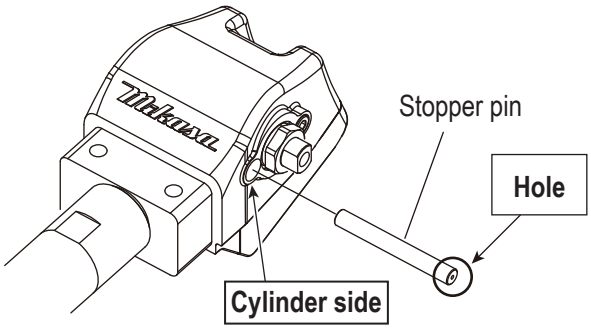


Fig.13

f. Wrap the pipe seal around the hexagon socket plug, then fix it to the pump head. (Fig.14)

※ **Tightening torque of hexagon socket plug: 14±2N・m**

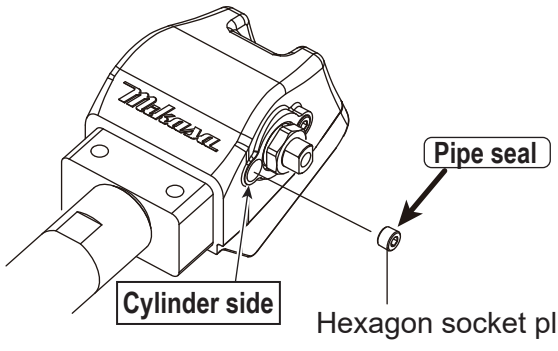


Fig.14

g. Install the breather plug.(Fig.15)

※ **Tightening torque of breather plug: 50±5N・m**

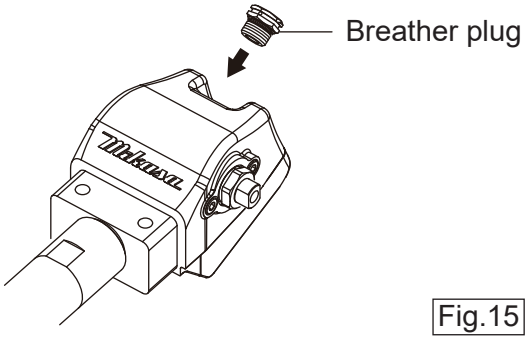


Fig.15

8-5-1 Disassembly and assembly of the Valve ASSY

(1) Disassembly

a. Disassemble rhe cylinder cap and the cylinder cap from the cylinder & valve assembly. (Fig. 16)

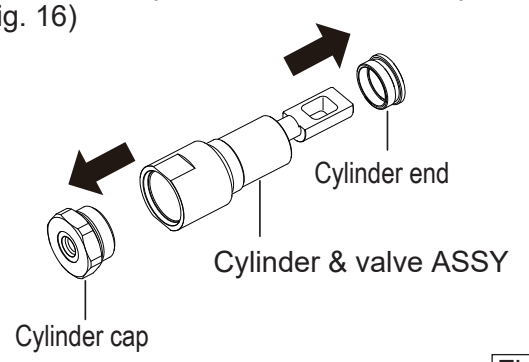


Fig.16

b. Pull out the valve from the cylinder. (Fig. 17)

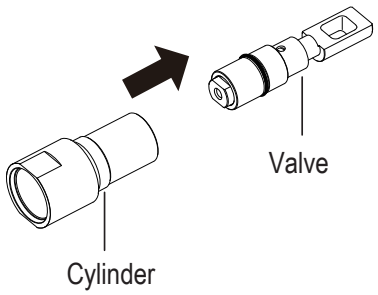


Fig.17

c. Remove the O-rings. (Fig. 18)

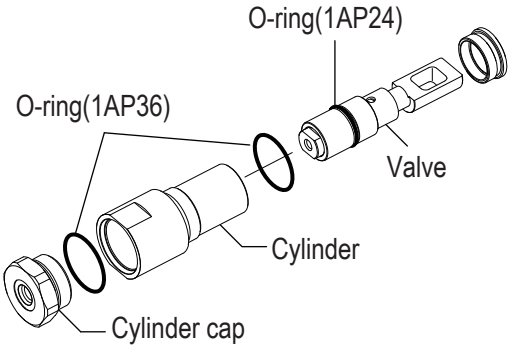


Fig.18

(2) Assembly

Assemble is the reversed procedure of disassembly, but pay attention to the following points.

* Degrease and clean each parts.
* During assembling, be careful not to damage each parts.
* Replace the O-ring and dust seal with a new one.
* Apply lithium grease to the O-ring and sliding parts.
* Be careful to prevent entry of dust or foreign matter.

a. Attach O-rings to cylinder, cylinder cap and valve.(Fig. 19)

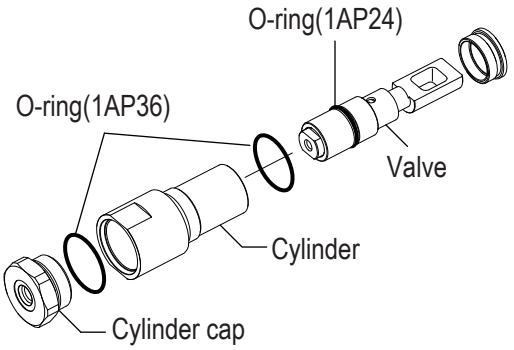


Fig.19

b. Insert the valve into the cylinder. (Fig. 20)

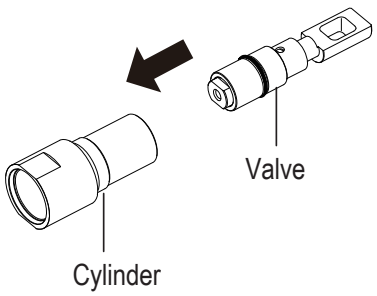


Fig.20

c. Attach the cylinder cap and the cylinder end to cylinder.(Fig. 21)

※ **Tightening torque of cylinder end: 90±5N・m**

※ **Tightening torque of cylinder cap: 100±5N・m**

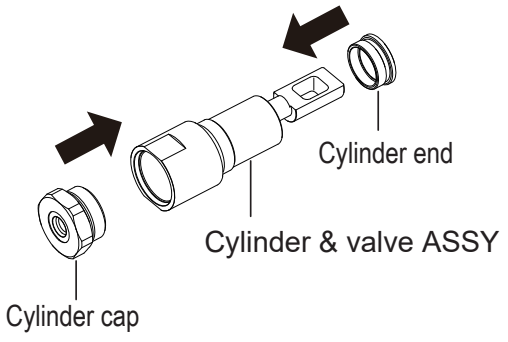


Fig.21

8-5-2 Disassembly and assembly of the Pump head ASSY

(1) Disassembly

a. Drain the hydraulic oil in the pump head. (Fig.22)

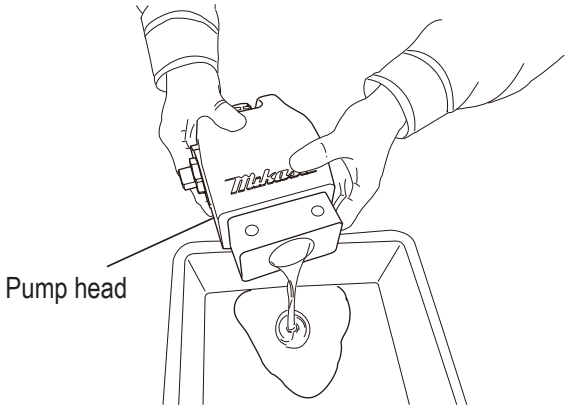


Fig.22

b. Fix the handle insertion part of the pump head with a vise.(Fig.23)

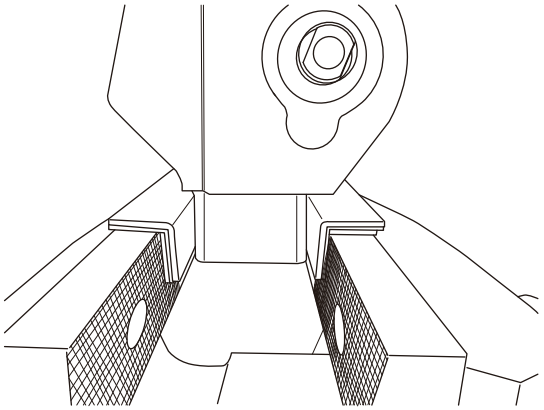


Fig.23

c. Remove the plug.(Fig.24)

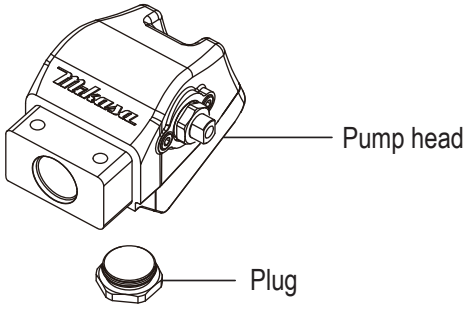


Fig.24

d. Fix the hand pump in horizontal. Insert the punch with hand press from hole of plug and remove the half of two spring pins (8mm). Then, fix the hand pump in vertical. Insert the punch with hand press from hole of breather plug and remove the other half of two spring pins (8mm). (Fig. 25)

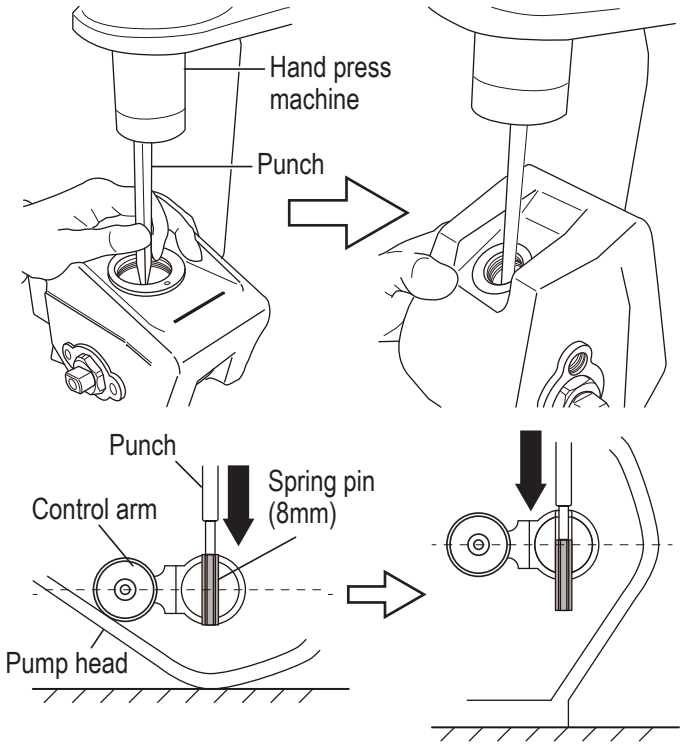


Fig.25

e. Remove the control shaft with a plastic hammer and remove the control arm. (Fig.26)

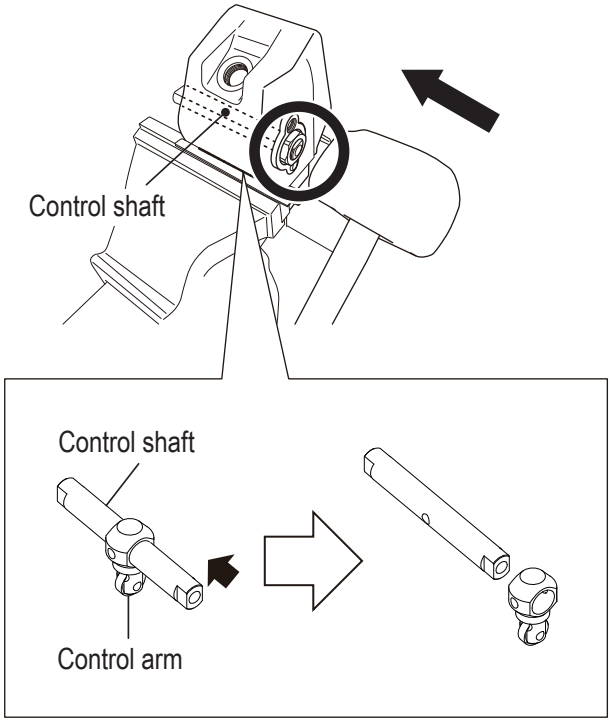


Fig.26

f. Remove the bushes (Fig.27)

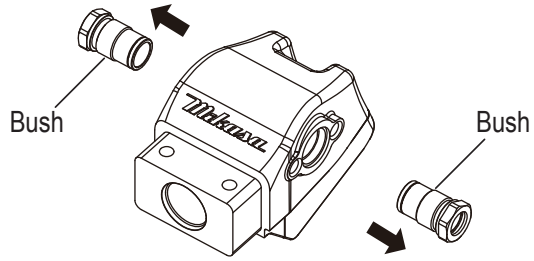


Fig.27

g. Remove the O-rings. (Fig.28)

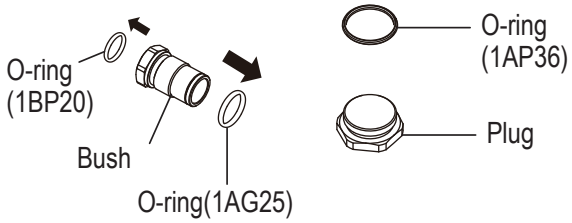


Fig.28

(2) Assembly

Assemble is the reversed procedure of disassembly, but pay attention to the following points.

* Degrease and clean each parts.
* During assembling, be careful not to damage each parts.
* Replace the O-ring and dust seal with a new one.
* Apply lithium grease to the O-ring and sliding parts.
* Be careful to prevent entry of dust or foreign matter.

a. Attach the O-rings to the bushes and plug. (Fig.29)

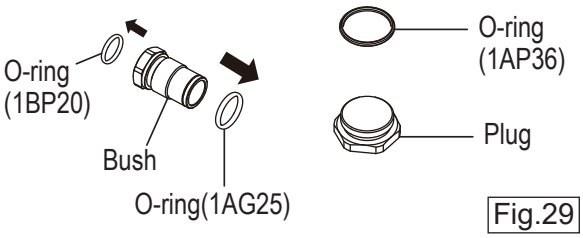


Fig.29

b. Install the bush on the right side of the pump head.(Fig.30)

※ **Tightening torque of bush: 45±5N・m**

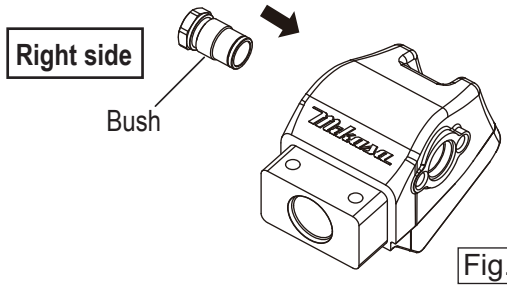


Fig.30

c. Insert the control shaft from the hole on the opposite side of the bush (on the left side of the pump head), and assemble the control shaft and control arm inside the pump head. At this time, align the positions of the holes for the spring pins.(Fig.31)

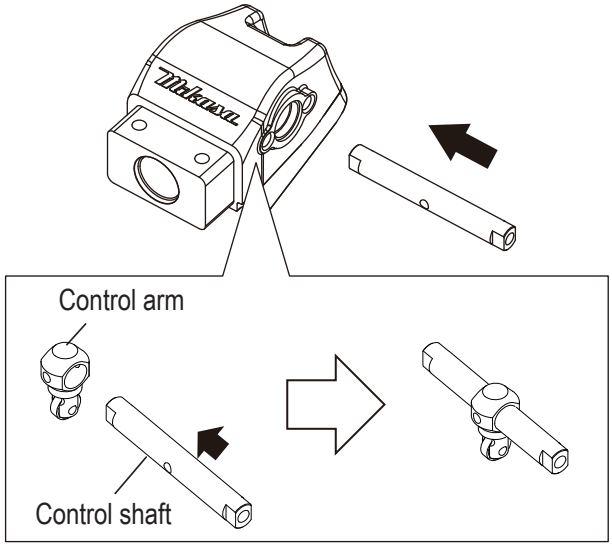


Fig.31

8.6 Hand pump for MVH-308, 408, 508

⚠ CAUTION

- During disassembly and assembly, be careful not to damage each part.
- Replace the O-ring, oil seal, and packing with a new one.
- Work in a clean workplace to prevent entry of dust and foreign material.

(1) Disassembly

a. Remove the breather plug, then remove the hydraulic oil from the inside of hand pump. (Fig. 38)

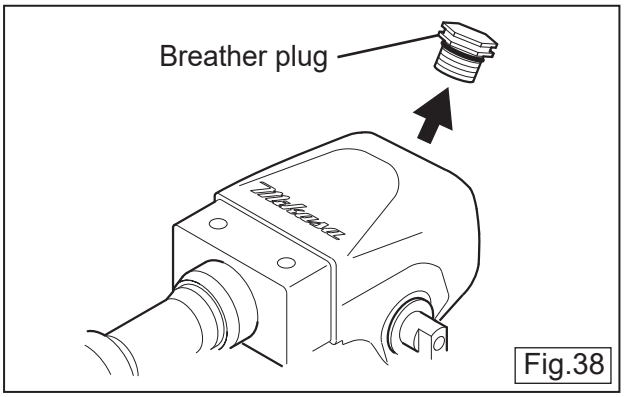


Fig.38

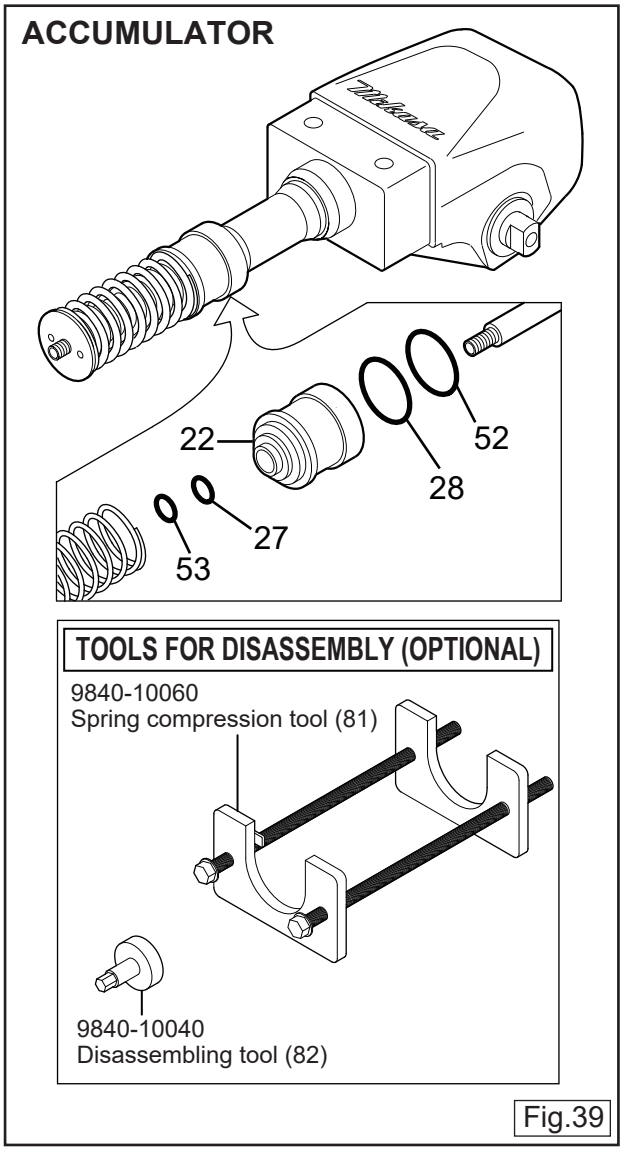


Fig.39

b. Fix the pump head with the vise. (Fig. 40)
Fix the handle insertion part of the pump head.

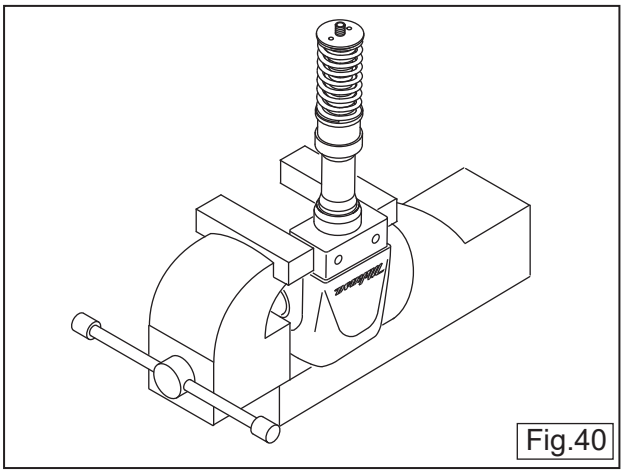


Fig.40

c. Compress the springs of accumulator by using the spring compression tool (81). (Fig. 39)

① Securely assemble the spring compression jig to accumulator case and its springs. (Fig. 41)

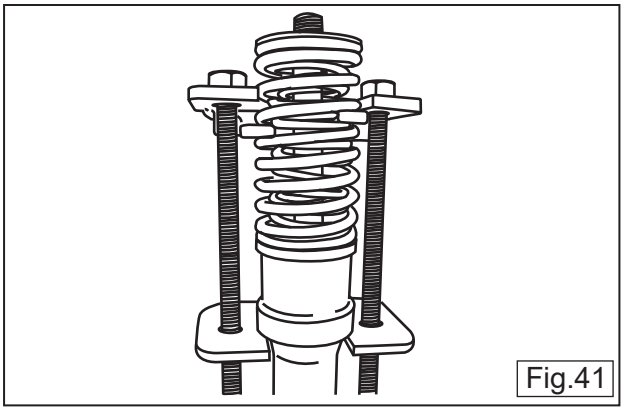


Fig.41

② Compress the spring by tightening the two bolts of spring compression tool evenly.

③ Compress the springs until there is no spring pressure to the spring holder. (Fig. 42)

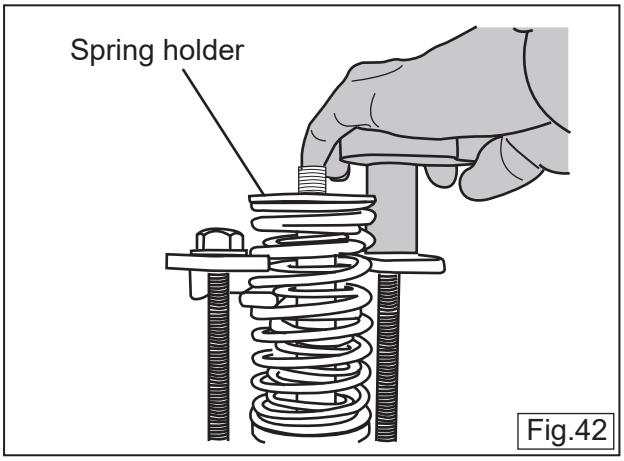


Fig.42

d. Heat the spring holder with torch burner so that the spring holder can be removed easily. (Fig. 43)

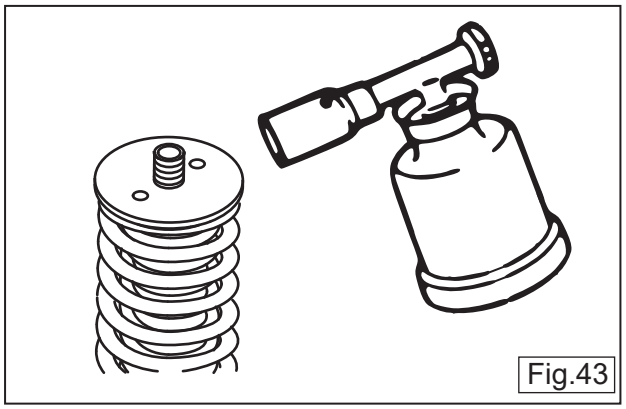


Fig.43

e. Remove the spring holder with the spring holder disassembling tool. (Fig. 44)

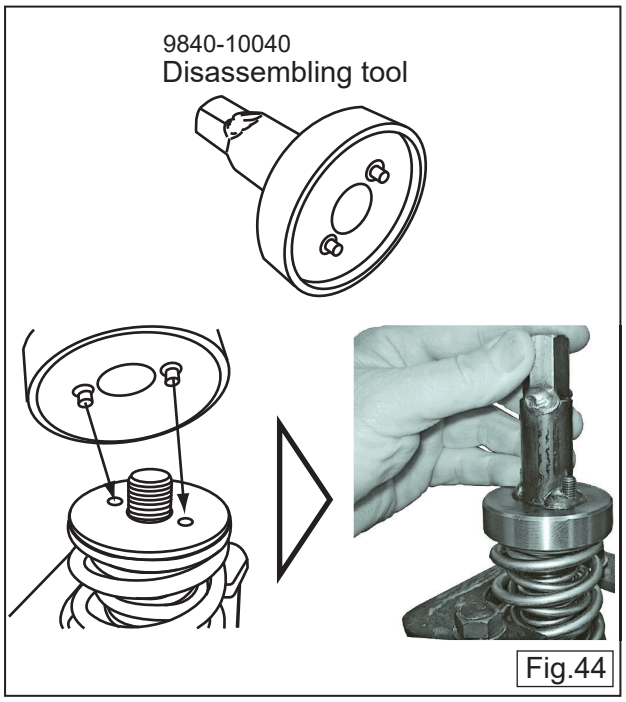


Fig.44

f. Loosen the two bolts of spring compression tool evenly. After making sure there is no spring pressure, remove the spring compression tool.
g. Remove the springs.
h. Degrease and clean the shaft of accumulator, then remove the accumulator case. (Fig. 45)

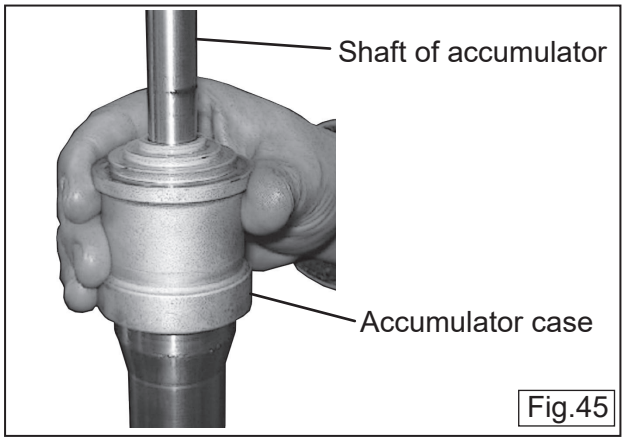


Fig.45

i. Remove the dust seal and O-ring from the inside of accumulator case.

(2) Assembly

Assemble with the reversed procedure of disassembly, but be careful about the following points.

① Degrease and clean the each parts.
② Be careful not to damage each parts, during assembly.
③ Replace the O-ring and dust seal with a new one.
④ Apply the molybdenum grease to the O-ring, dust seal and sliding area.
⑤ Be careful to prevent entry of dust and foreign matter.

a. Assemble the dust seal and O-ring into the accumulator case.
Put the lip of dust seal to the outside. (Fig. 46)

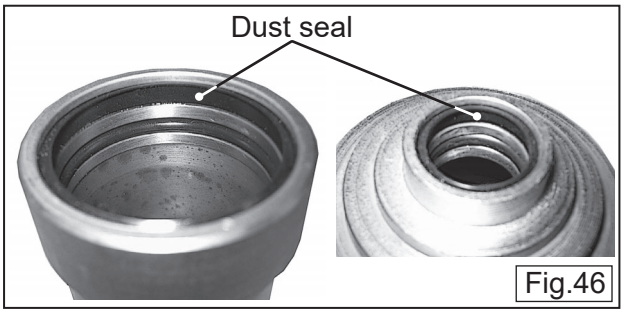


Fig.46

b. Insert the accumulator case to the accumulator shaft.
To prevent damage of the dust seal and O-ring, apply the tape to the thread on the end of accumulator shaft for protection. (Fig. 47)

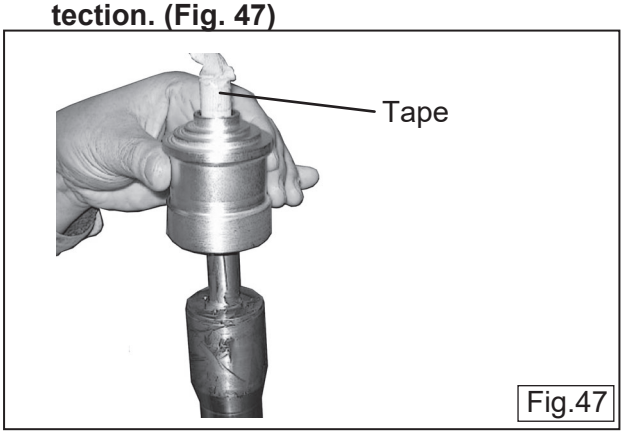


Fig.47

c. Degrease and clean the thread on the end of accumulator shaft, then apply 2 to 3 drops of Loctite #638. (Fig. 48)

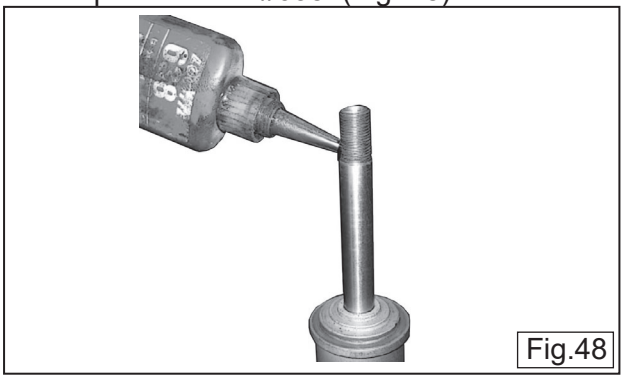


Fig.48

d. d. Assemble the springs to the accumulator. Then, compress the springs with the spring compression tool until the thread on the end of accumulator shaft is out completely. (Fig.49)

⚠CAUTION

Be very careful not to have your fingers get caught between the springs and spring compression tool.

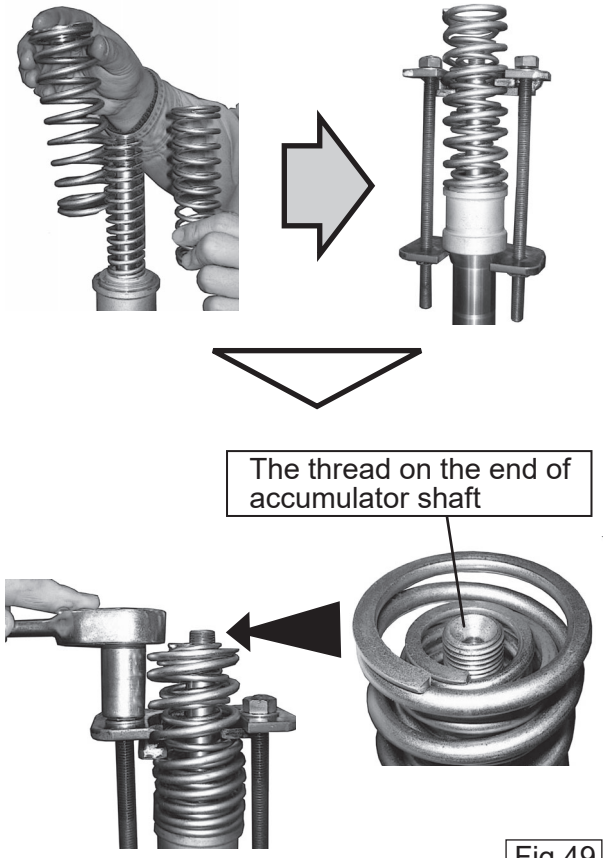


Fig.49

e. Assemble the spring holder with the spring holder disassembling tool. (Fig. 50)
The spring holder tightening torque:
20N·m

⚠CAUTION

When assembling the spring holder, be very careful for the spring pressure.

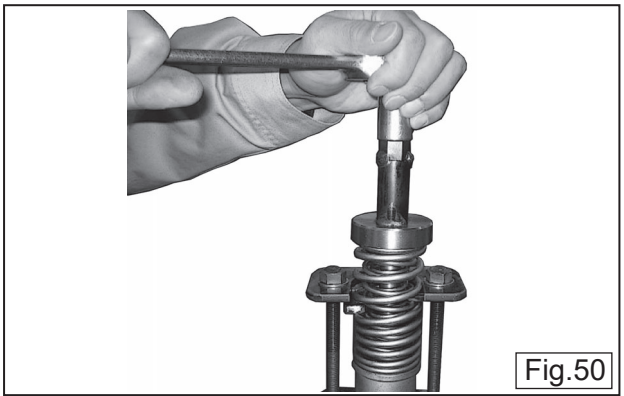


Fig.50

f. Remove the spring compression tool.

By the above steps, the assembly of hand pump and accumulator is completed.

9. REGULAR CHECK AND ADJUSTMENT

⚠CAUTION Do inspection and maintenance work in a place with a flat and hard surface to keep the machine stable, after stopped the engine certainly.

9.1 Inspection and Maintenance Chart

To use the machine in good condition all the time, always do the inspection and maintenance according to the following inspection sheet.

Check frequency	Check parts	Check items	Oils
Daily (before starting)	Appearance	Flaw, deformation	
	Fuel tank	Leakage, oil level, dirt	Light oil, gasoline
	Fuel system	Leakage, oil level, dirt	
	Engine oil	Leakage, oil level, dirt	Engine oil
	Shock absorber	Crack, damage, wear	
	Hand pump	Leakage	Hydraulic oil
	Vibrator oil	Leakage	Engine oil
	Hydraulic pipe system	Leakage, looseness,flaw, wear Dust on sponge	Hydraulic oil
	Air cleaner	Breakage, flaw, loosenedor	
	Guard frame	missing bolts and nuts Missing, breakage, flaw,loose-	
	Back and forth motion lever, linking parts	ness or missingbolts and nuts Operation check, play	
	Back and forth motion lever		
	operation	Looseness, missing	
	Bolts and nuts	Crack, damage	
	Duct hose	Replace only afterthe first 20	
Every 20 hours	Engine oil	hours Replace only afterthe first 20	
	Engine oil filter	hours Change	
Every 100 hours	Engine oil	Washing	
	Engine oil filter	Leakage, oil level, dirt	Engine oil
	Vibrator oil	Leakage, oil level, dirt	
	Hydraulic oil	Cleaning	Engine oil
	Battery terminal	Flaw, tension	Hydraulic oil
Every 200 hours	V-belt for vibrator	Dirt, flaw, wear	
	Clutch	Change	
Every 300 hours	Vibrator oil	Change	
	Hydraulic oil	Change	Engine oil
	Fuel filter	Change	Hydraulic oil
	Engine oil filter	Change	
Every 2 years	Fuel pipes	Change	
Irregular	Air cleaner element	Change	
	Hydraulic hose	Cleaning	
	Cyclone cleaner	Change	
	Duct hose(Cyclone cleaner)		

For details about the check and maintenance of the engine, please refer to the attached engine operation manual.
Caution: The above table shows the check frequency for standard condition.
The check frequency may vary depending on the condition in which the machine is used.

9.2 Oil Application Table

Oil type	Quality	Temperature (℃)													
		-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	35
Engine oil	For diesel CE/CF class	SAE 5W-20 / 5W-30													
						SAE 10W-30									
	SAE 10W-40 or SAE 15W-40										SAE 20W-40				
								SAE 15W-40							
								SAE 10W-40							
Vibrator oil	Engine oil SAE 10W-30						SAE 10W-30								
Hydraulic oil	Hydraulic oil ISO VG46	ISO VG32													
								ISO VG45							

⚠CAUTION Fuel pipes should be changed every two year.

Check for fuel and oil leakage.
Check the hand pump and pipe hose for oil leakage.
Check whether the hose joint is loose or not with the wrench, because the fuel and oil leakage might be occurred due to the loose of hose joint.

⚠ CAUTION

- Always stop the engine before maintenance and set the machine on hard and level ground.
- Start your work after the machine and engine cool down completely.
- Be careful to get caught the finger when opening and closing the front cover.
- Do not touch the hot parts because the engine and muffler become very hot.

9.3 Open The Front Cover

- Makes easier inspection and maintenance.

1 Remove the bolts on the front cover. Loosen the bolts on the side of front cover without removing them. (Fig.51)

Model	Bolt Size
MVH-208,209	M12X35
MVH-308,408,508	M14X45

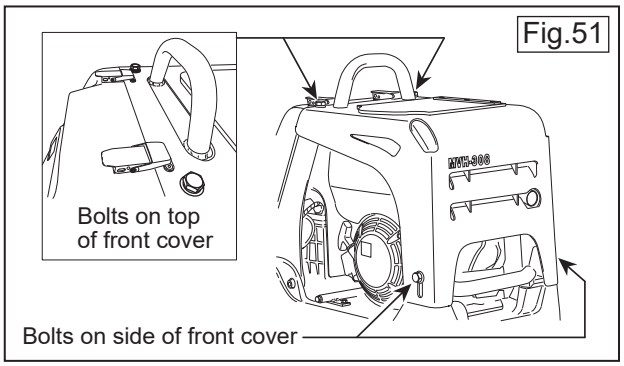


Fig.51

2 Hold the side of front cover, and pull up it to open position. (Fig.52)

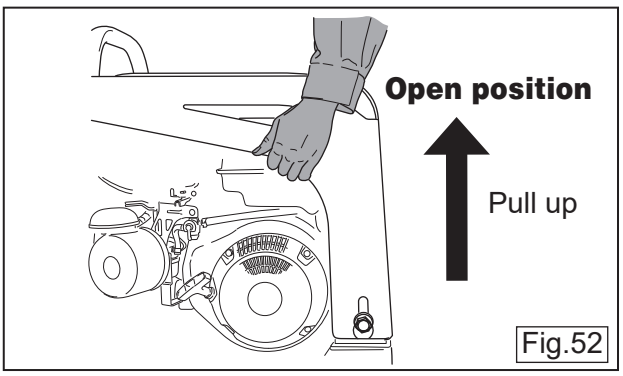


Fig.52

3 Open the front cover slowly.(Fig.53)

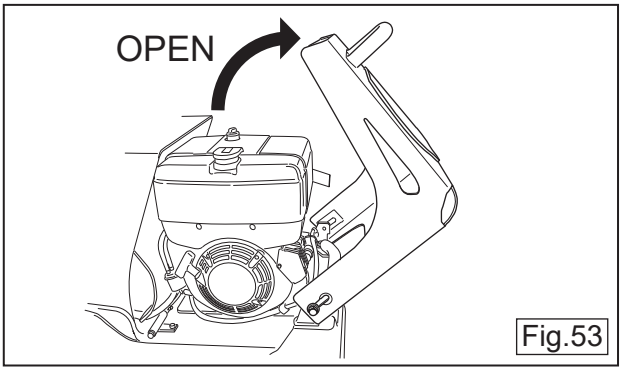


Fig.53

4 Return the front cover to original position slowly.Tighten the bolts in the specified torque. (Fig.54)

Size	Tightening torque	Remarks
Bolt M12X35	117.6N•m (86.8lbf•ft)	Apply Loctite #243
Bolt M14X45	176.6N•m (130.2lbf•ft)	Apply Loctite #243

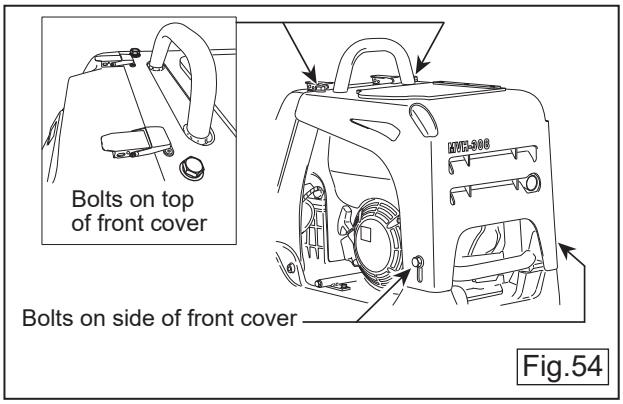


Fig.54

⚠ CAUTION

- Do not return the front cover in its open position.
- Do not start the engine when opening the front cover.
- Tighten the bolts firmly.

9.4 Change The Engine Oil

- Change the engine oil, first in 20 hours of operation and every 100 hours afterwards. (Fig.55)

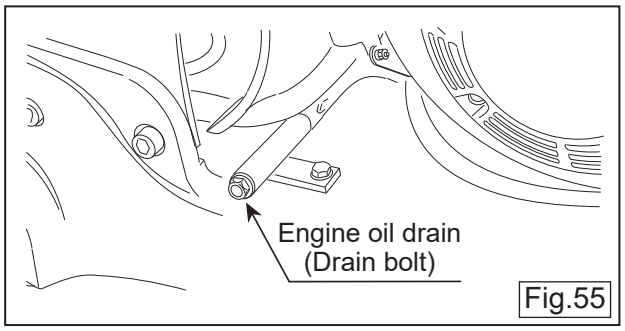


Fig.55

9.5 Clean The Air Cleaner

● **Engine Air Cleaner**

When the air cleaner element becomes dirty, the engine will not start smoothly, and will not get sufficient output.
It will affect the machine operation and will short the engine life greatly.
Do not forget to clean the element. (For details, please see the separate engine operation manual.)
If the element cannot be cleaned, replace it with a new one. (Fig.56)

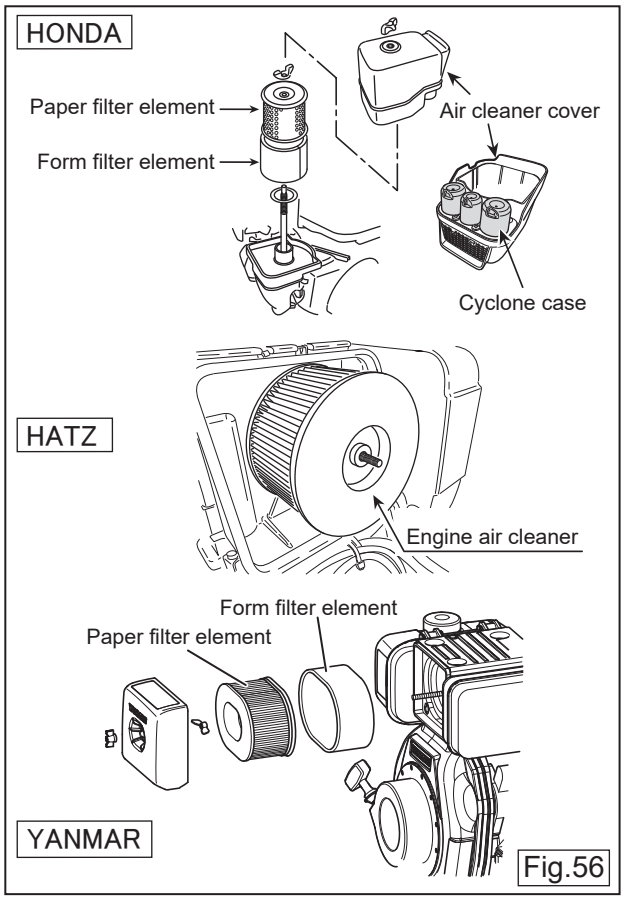


Fig.56

● **Cyclone Cleaner**

Always clean the dust pot of cyclone cleaner. Clogged dust pot will reduce cyclone effect and will clog cleaner element easily.

● ***How to clean the dust pot***

i) Take off the latch of dust pot and remove it. (Fig.57)

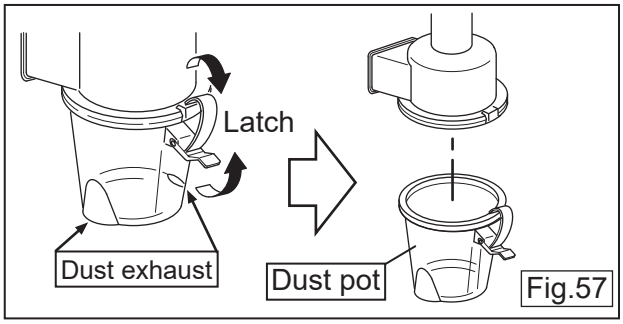


Fig.57

⚠ CAUTION

Be careful to avoid pinched fingers.

ii) Clean the dust pot inside with water and neutral detergent.

⚠ CAUTION

Do not use organic solvent like paint thinner, which may cause damage or deformation of Dust Pot.

iii) Set the dust pot to air cleaner, then fasten the latch of it securely. (Fig. 58)

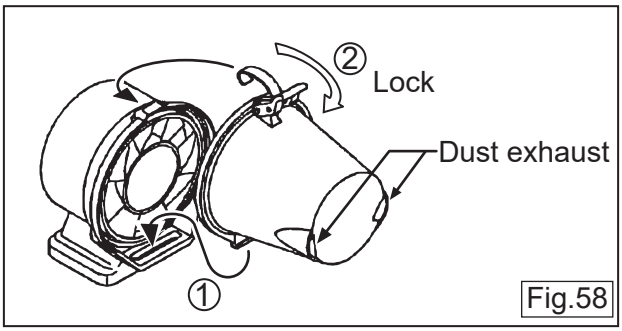


Fig.58

9.6 Check/Change The V-belt & Clutch

1 **Check of V-belt** (Fig. 59)

At every 200 hours, remove the belt cover (upper) to check the tension of the V-belt.
The V-belt tension is proper if V-belt bends 10 to 15 mm when depressed with finger at midway between the clutch and vibration pulley.
A loose V-belt will decrease the power transmission output, causing reduced compaction and premature wear of the V-belt.

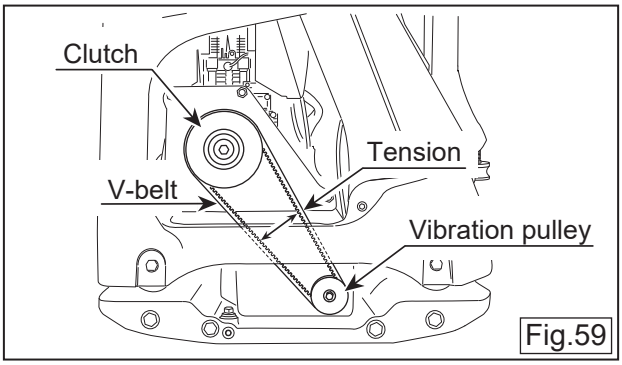


Fig.59

2 **Change the V-belt**

● ***Remove the V-belt***

Remove the upper and lower belt covers. Engage the wrench to the tightening bolt of the vibrator pulley (lower side). Engage waste cloth or the like at the midway of the V-belt on the left side, and while pulling it back strongly, rotate the wrench clockwise so that the V-belt will come off.

● ***Install the V-belt***

Engage the V-belt to the lower vibrator pulley and push the V-belt to the left side of the upper clutch, and rotate the tightening bolt of lower vibrator pulley clockwise with the wrench so that the V-belt moves onto the pully.

⚠CAUTION

- Stop the engine when checking or changing the V-belt.
- Be careful not to get caught your hand or clothes between the V-belt and the clutch.
- Always wear work gloves.

3 **Inspection of clutch**

The clutch should be inspected at the time of V-belt inspection. Remove the belt cover and visually check the clutch for burning, wearing, and damaging on the clutch drum and its V groove.

Also, if its V groove is dirty, degrease and clean it.

The clutch lining shoe wear should be checked by operation inspection.

In case of wearing of the clutch lining shoe, the engine power is not fully transmitted to the vibrator by the clutch slipping.

When stopping this inspection, move the throttle lever to the low speed position at once.

⚠CAUTION

Be very careful not to have your fingers get caught between the belt and clutch pulley. There is a danger of injury. Also, wear gloves when working.

● Change of clutch

① Move the V-belt.
(See belt removal of the previous section.)

② Remove the bolt for assembling the clutch with impact wrench or by hitting the wrench with the hammer. (Counter-clockwise)

③ Remove the clutch with the pulley puller.
Assemble with the reversed procedure of disassembly.

④ When tightening the bolt for assembling the clutch, tighten it with impact wrench or by hitting the wrench with the hammer certainly.

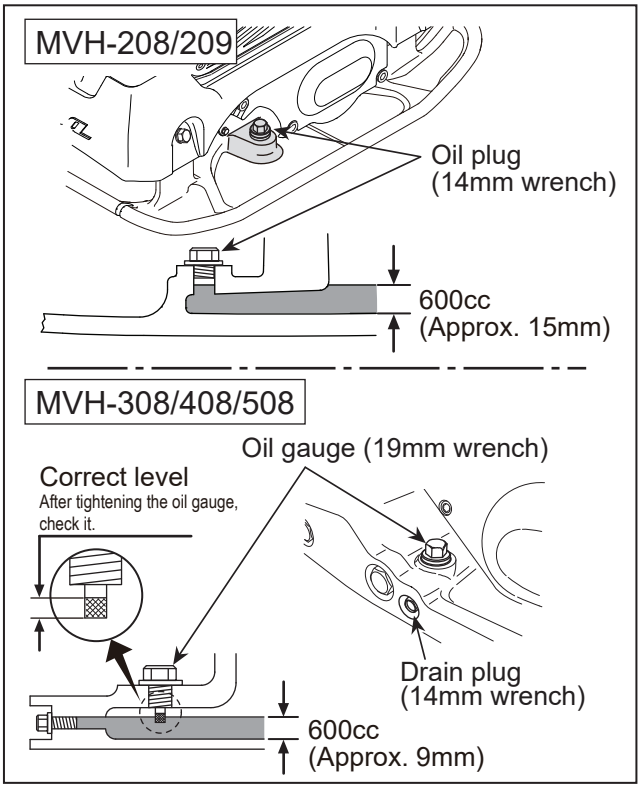
9.7 Check/Change The vibrator Oil

- At every 100 hours of operation, check the vibrator oil level if it is within the allowable range by removing the oil gauge or oil plug of vibrator. (Fig.60)
- At every 300 hours operation, change the vibrator oil.

i) MVH-208/209:
For draining the oil from the port of oil plug, tilt the machine with a sleeper or the like placed under the vibrating plate or use the oil changer.

ii) MVH-308/408/508:
Drain the oil from the drain plug.

Use engine oil SAE10W-30 as lubrication oil.
Vibrator oil capacity ⇒ 600cc



⚠CAUTION

- Measure the vibrator oil quantity correctly.
- If it is more than the specified value, it might cause over-load.
- If it is less than the specified value, noise and shortening of bearing life might occur.

⚠ CAUTION

- Appropriate maintenance is required to ensure safe and efficient operation of the machine.
- Pay special attention to the parts used for lifting, if they are not maintained properly, it might result in a serious accident.
- When checking the vibrator oil, clean around the oil plug beforehand to prevent entering dust and other foreign materials into the vibrator oil.
- Whenever there is an oil leakage from the vibrator, check the oil level.
- After draining the vibrator oil, some oil still remains in vibrator case. So be sure to check the oil level correctly after filling oil.
- Do not overfill the vibrator oil. The engine is overloaded and It may cause the increased fuel consumption and lower machine performance.

9.8 Check/Change The Hydraulic Oil

- **Check the hydraulic oil**
  At every 100 hours of operation, check the hydraulic oil. With the handle at the operation position, remove the breather plug at the top of the hand pump and check if the hydraulic oil is at the specified level (OIL LEVEL). (Fig. 61)

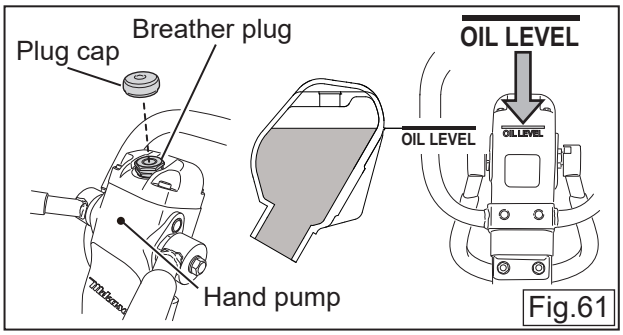


Fig.61

- **Change the hydraulic oil**

1 Remove the plug cap of the hand pump, then remove the breather plug (with 24mm wrench). (Fig.61)
2 Remove the hydraulic hose connected to the cylinder on the vibrator and fix the travel operation lever at maximum forward position with rope, then drain the hydraulic oil in the hand pump. (Fig.62, 63)

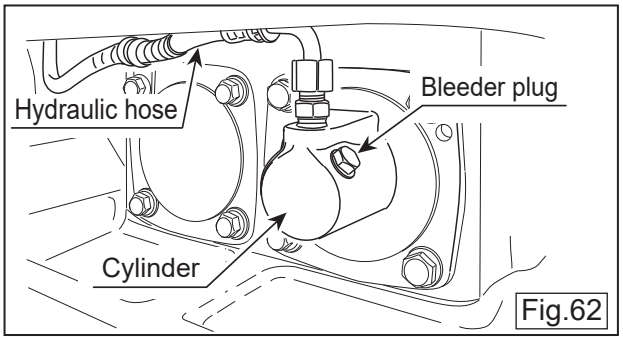


Fig.62

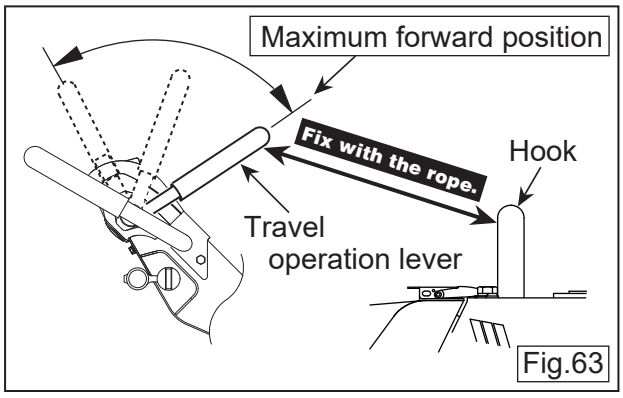


Fig.63

3 After draining, reassemble the hydraulic hose to the cylinder on the vibrator. (Fig.62)
4 Fill the hydraulic oil from the hole of breather plug on the hand pump. (Fig.61)

⚠ CAUTION

- The hydraulic oil should be at OIL LEVEL. Do not overfill. Overfilling will cause to blow out excess oil from the breather plug.
- Be careful not entering dust and other foreign materials into the hand pump during inspection or replacement. It may cause hand pump failure.

5 Loosen the bleeder plug located at the top of cylinder on the vibrator, after a while oil with air bubbles will come out. After air bubbles in oil are free, tighten the bleeder plug firmly. (Fig.62)
6 Regarding MVH-308, 408, 508, remove the handle cover, than the travel operation lever move to the maximum forward and reverse position several dozen times.
The check valve in the hand pump is opened at the maximum forward position and air bubble will come out from the oil tank of the hand pump.
Air bleeding is complete when the accumulator cylinder of the hand pump moves 2 - 3 cm as shown in Figure 64.
7 After making sure to check that the hydraulic oil should be at OIL LEVEL, reassemble the breather plug of the hand pump. (Fig.61)

Hydraulic oil:
Shell Terrace Oil #32 or equivalent
Hydraulic oil capacity:
MVH-208: 400cc
MVH-308, 408, 508: 550cc

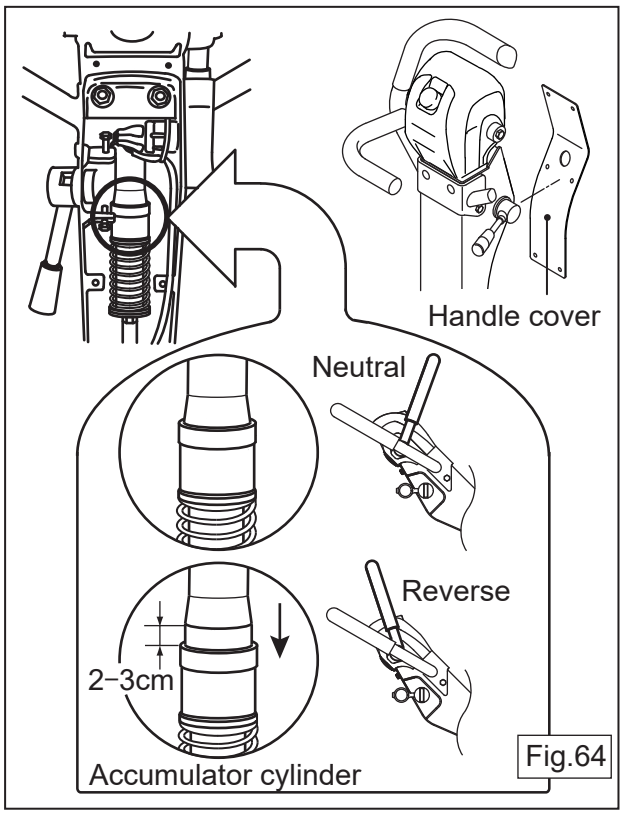


Fig.64

9.9 Battery

- Check the battery
  The standard battery installed is a maintenance free battery. It is not necessary to supply battery fluid. If the battery voltage is low and cannot be charged, replace it with a new battery.
- **Check of battery capacity by battery checker (Only diesel engine)**
  When the battery charge level is low, the battery checker of the hour tachometer lights up in red.(Fig.65)

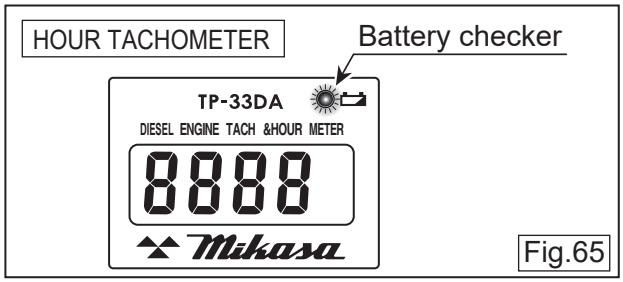


Fig.65

⚠ CAUTION

If the old battery is used, even when the battery checker is not lighted, the electric starter might not operate. In this case, change the battery with the new one.

(1) **Inspection and cleaning of battery**

a. Check the battery for damage such as scratch and deterioration.
b. Check the terminal for corrosion. If corroded, grind with wire brush or sanding paper, and apply grease at the terminal
c. Also clean outside of the battery.
d. Do inspection and cleaning also at the battery storage area of main machine side. Check also the anti-vibration mat. If it is necessary to replace with a new one due to deterioration or breakage, replace it.
e. After the battery inspection is completed, securely fix it with the battery holder.

(2) **When battery is dead**

"Battery is dead" when the starter does not rotate. Also, even when the starter rotates, if the rotation is weak and the engine does not start, then the battery is dead.

Method taken for emergency

a. Start the engine manually (use recoil starter or crank handle)
b. If impossible to start the engine manually due to breakage or breakdown, jump-start the engine using another vehicle.

- **Starting method using booster cable (Jump-starting)(Fig. 66)**

a. Connect the booster cable by the following order.
① + (red) terminal of the battery of machine side
② + (red) terminal of the battery of another vehicle side
③ - (black) terminal of the battery of another vehicle side
④ Unpainted and protruded part of the crank case of the engine shown by "Fig. 66" (Connect the ground wire.)

b. Disconnect the booster cable with the reversed procedure of connecting it.

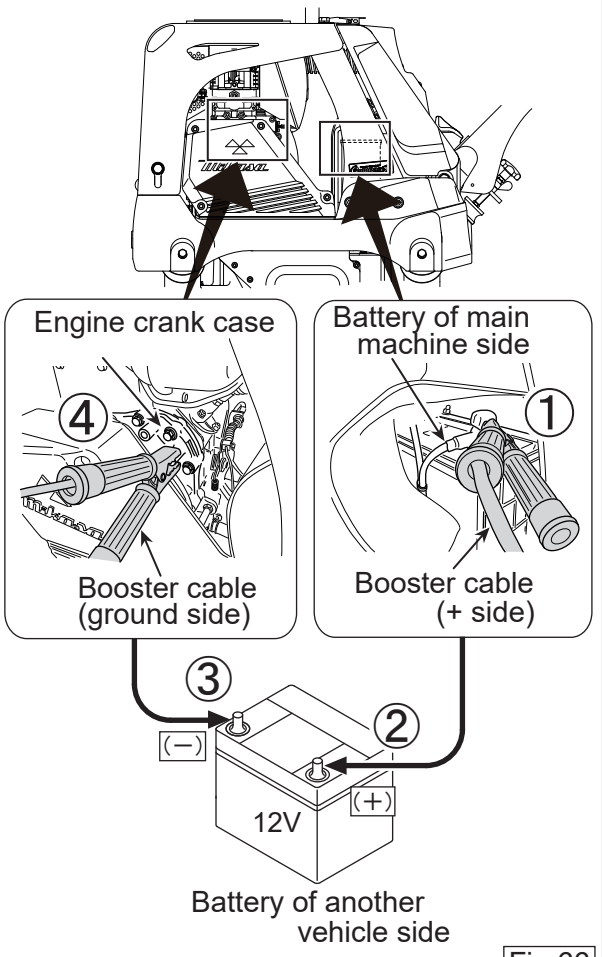


Fig.66

⚠ WARNING

- For the above connection at ④, never connect the minus (black) terminal of battery directly. Spark occurs, and then explosion of the battery might occur due to ignite to the flammable gas from the battery by sparking.
- When connecting the booster cable, never contact the plus (+) terminal and the minus (-) terminal. Spark occurs, and then explosion of the battery might occur due to ignite to the flammable gas from the battery by sparking.
- Do not put fire near the battery. There is a danger of explosion.
- During charging the battery, do not go near the battery. Battery fluid that contains dilute sulfuric acid might be ejected. Eye and skin that contacted with such fluid might lead to serious injury. In case of contacting with battery fluid wash with plenty of water, then see a doctor.

⚠ CAUTION

Do not keep using the deteriorated battery.
Do not operate with the battery removed.
Engine regulator might be damaged.

● **Mountable battery size table**

	L	W	H	SIZE	
MVH-308	238	129	203	55B24L(JIS) No.51R(BCI)	STD
	245	175	175	DIN 55Ah or equivalent	Replacement
	245	175	190		
	245	129	203	JIS/BCI TYPE Maximum capacity	
	245	175	190	DIN TYPE Maximum capacity	
MVH-408	238	129	203	55B24L (JIS) No.51R(BCI)	STD
	232	175	203	75D23L(JIS) No.35(BCI)	Replacement
	245	175	175	DIN 55Ah or equivalent	
	245	175	190		
	245	175	203	Maximum capacity	
MVH-508	232	175	203	75D23L(JIS) No.35(BCI)	STD
	245	175	175	DIN 75Ah or equivalent	Replacement
	245	175	190		
	245	175	203	Maximum capacity	

10. TROUBLESHOOTING

10.1 Gasoline Engine

(1) Starting problems

- Fuel is supplied, but the spark plug does not ignite.
  - Electricity reaches the high voltage cable.
    - Gap bridging on the spark plug.
    - Carbon or oil fouling on the spark plug.
    - Short circuit due to faulty insulation of the spark plug.
    - Faulty gap of the spark plug.
  - Electricity does not reach the high voltage cable.
    - Short circuit of the ON-OFF switch.
    - Ignition coil problems.
    - Dirt or faulty gap of the ignition coil.
    - Breaking or short circuit of the ignition coil.
- Fuel is supplied, and the spark plug ignites.
  - Compression is good.
    - Improper fuel is used.
    - Water or foreign materials are entered in the cylinder.
    - Clogging of the air cleaner.
  - Compression is not good.
    - Intake/exhaust valve is stuck or warped.
    - Piston ring, cylinder wear.
    - Cylinder head, spark plug tightening problem.
    - Head gasket, spark plug gasket breakage.
- Fuel does not reach the carburetor.
  - No fuel in the fuel tank.
  - Fuel cock is not open.
  - Clogging of the fuel filter.
  - Clogging of the air vent of tank cap.
  - Air in the fuel pipe.
- Too low starter speed.

(2) Operation problems

- Low output or engine speed dose not increase.
  - Clogging of the air cleaner.
  - Clogging of the fuel filter.
  - Clogging exhaust system due to carbon deposits.
  - Carbon deposits on the piston top and cylinder.
  - Improper the fuel is used.
  - Dirt or wet of the spark plug.
  - Carburetor ploblems.
  - Ignition coil problems.
- Engine Overheats.
  - Engine overloaded.
  - Improper the spark plug heat range.
  - Dirt and breakage of the cooling fins.
  - Too much engine oil.
- Engine speed fluctuates.
  - Improper the governor adjustment.
  - Fuel does not flow properly.
  - Air is intruded from intake pipe system.

(3) Recoil starter problems

- Recoil starter operation is not good.
  - Clogging of foreign materials at the rotating part.
  - Recoil spring problems.

10.2 Diesel Engine

(1) Starting problems

(A) In case of compression problems

- No compression.
  - Intake/exhaust valve is stuck or warped.
  - Decompressor adjustment problems.
- Almost no compression.
  - Improper valve seat clearance.
  - Improper tappet clearance.
  - Piston ring wear.
  - Cylinder wear.
  - Cylinder gasket problems.
  - Fuel injection looseness.

(B) In case of fuel injection problems

- Fuel flow is low or not flow.
  - Clogging of the air vent of tank cap.
  - Clogging of the fuel filter.
  - Fuel cock is not open.
  - Air in the fuel pipe.
- Fuel dose not injected.
  - Fuel injection pump problems.
  - Clogging of the nozzle hole of fuel injector.
  - Nozzle of fuel injector is stuck.
- No fuel in the fuel tank.
- Improper fuel is used.

(C) Fuel and compression are normal, but the engine does not start yet.

- Improper starting procedure.
- Too low starter speed.

(2) Operation problems

- Low output or engine speed dose not increase.
  - Clogging of the air cleaner.
  - Clogging of the fuel filter.
  - Clogging exhaust system due to carbon deposits.
  - Carbon deposits on the piston top and cylinder.
  - Improper the fuel is used.
  - Fuel injection ploblems.
- Engine overheats (with black smoke.)
  - Engine overloaded.
  - Fuel injection problems.
  - Dirt and breakage of cooling fins.
  - Too much engine oil.
- Engine speed fluctuates.
  - Improper the governor adjustment.
  - Fuel does not flow properly.
  - Air is intruded from intake pipe system.

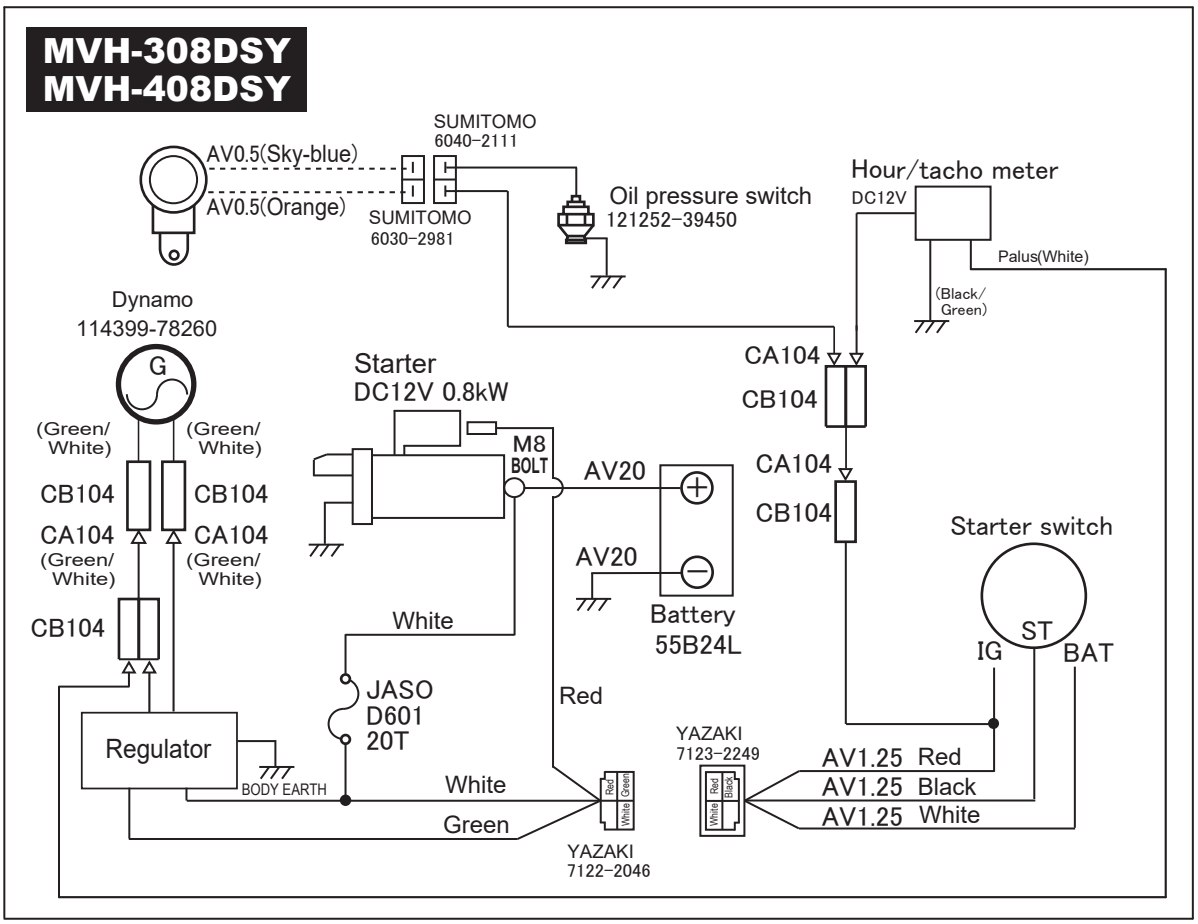
- Firing problems (with white smoke)
  - Piston, piston ring, cylinder wear.
  - Piston ring stuck.
  - Piston ring is installed upside down.
  - Fuel injection problems.
  - Improper the valve seat clearance.
  - Improper the tappet clearance.
  - Improper the injection timing
  - Water is mixed with in fuel.
- Fuel economy is too low. (with black smoke)
  - Engine is overloaded.
  - Fuel leaks from the fuel system.
  - Clogging of the air cleaner.
  - Fuel injection problems.
- Sliding part extremely is worn or piston ring is stuck.
  - Improper engine oil is used.
  - Engine oil is not changed.
  - Without the air cleaner.
  - Breakage of the air cleaner.
- Stopped suddenly with abnormal noise. — Seizure of the sliding part of the engine.
- Engine oil is increased. — Engine oil is diluted with fuel due to internal leakage of the fuel injection.
- Engine does not stop even though the fuel supply is off (or over-running)
  - Engine overheats.
  - Carbon deposits on the piston top and cylinder.
  - Too much the engine oil.

10.3 Main Body

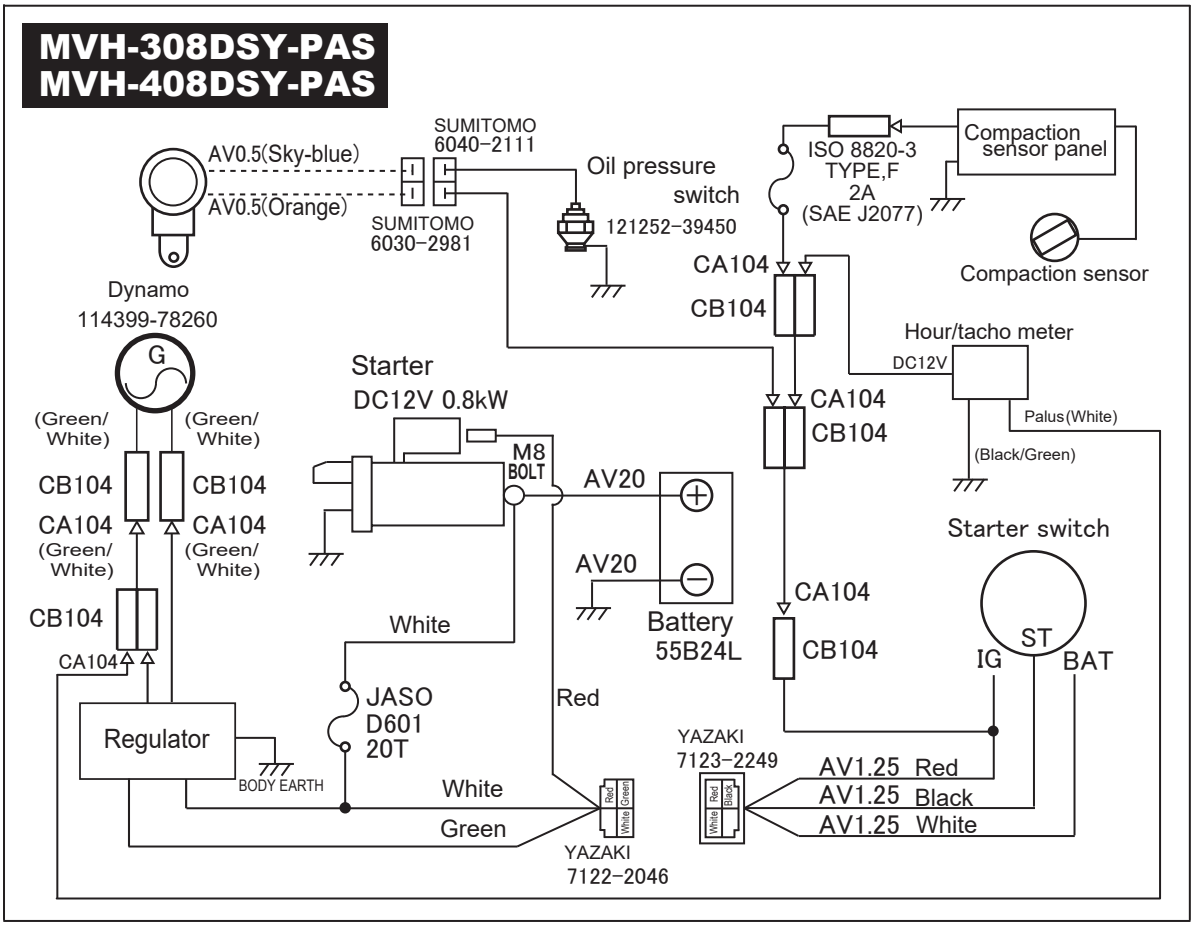
- Travel speed is low and vibration is weak.
  - Insufficient the engine output.
  - Improper operating speed of the engine.
  - Slipping of the clutch.
  - Slipping of the V-belt.
  - Settling of the shock absorber.
  - Too much the vibrator oil.
  - Failure inside the vibrator.
- Moves to forward or reverse, but unable to switch direction.
  - Hand pump problems.
  - Clogging of the valve inside the hand pump.
  - Hydraulic oil leaks from the oil seal in the hand pump.
  - Breakage of the hydraulic oil hose.
  - Air in the hydraulic oil hose.
  - Hydraulic oil leaks from the piston in the cylinder on the vibrator.
- Dose not move to forward and reverse.
  - Breakage or coming off of the V-belt.
  - Breakage or slipping of the clutch.
  - Breakage of the vibrator.
- Travel operation lever is heavy.
  - Hand pump problems.
  - Piston and cylinder on the vibrator problems.

11. WIRING DIAGRAM

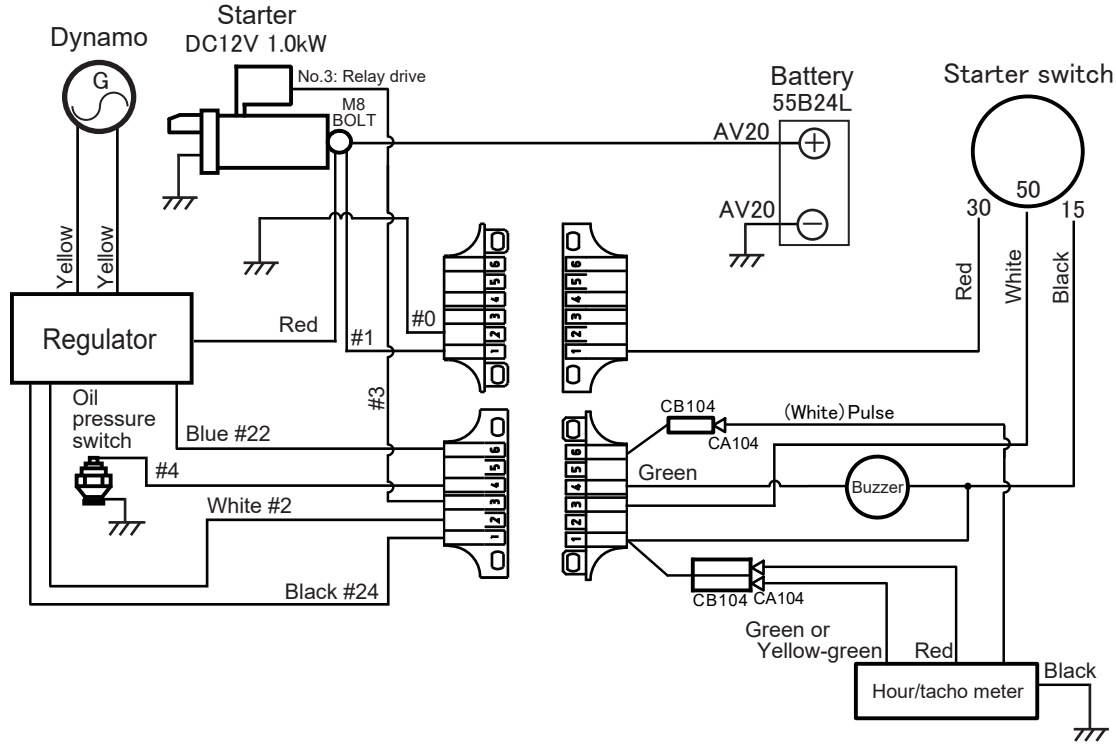
MVH-308DSY
MVH-408DSY



MVH-308DSY-PAS
MVH-408DSY-PAS



MVH-308DSZ
MVH-408DSZ



MVH-308DSZ-PAS
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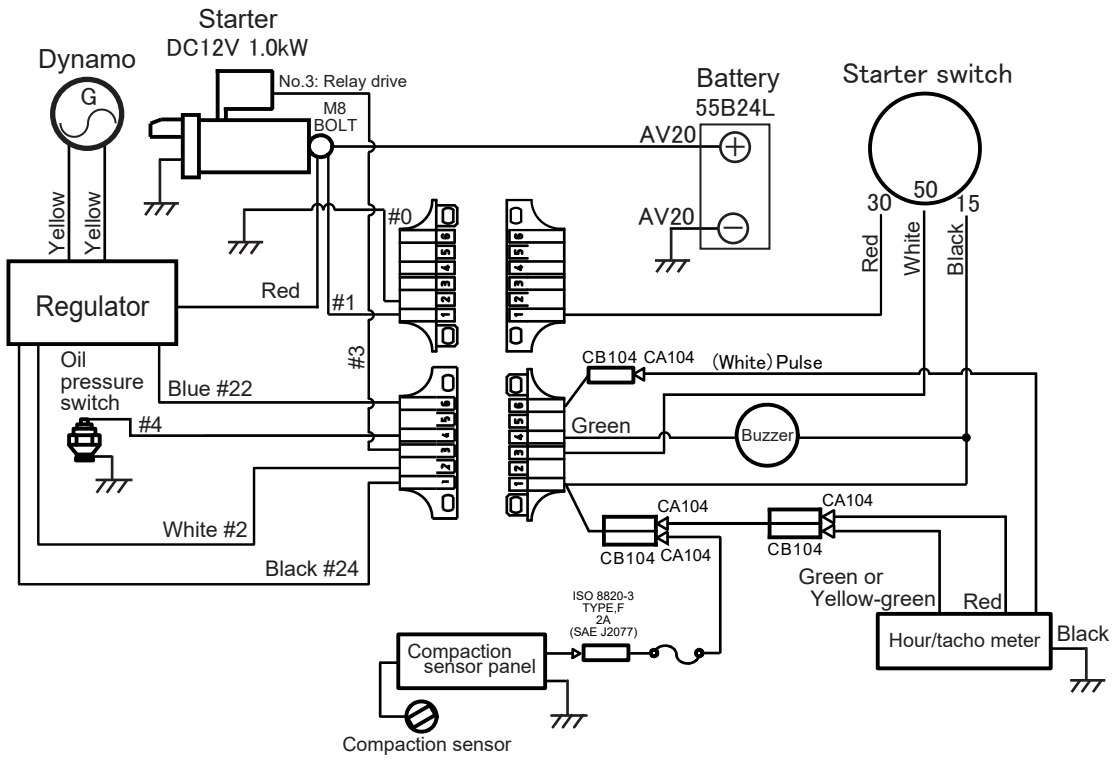
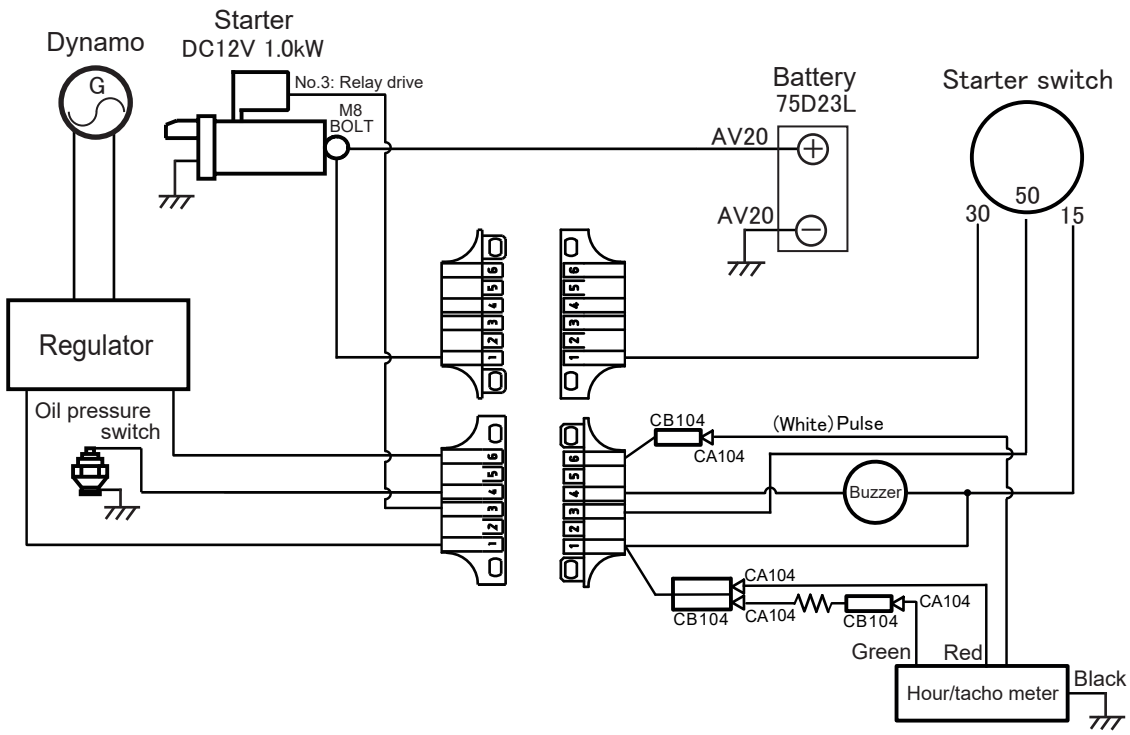
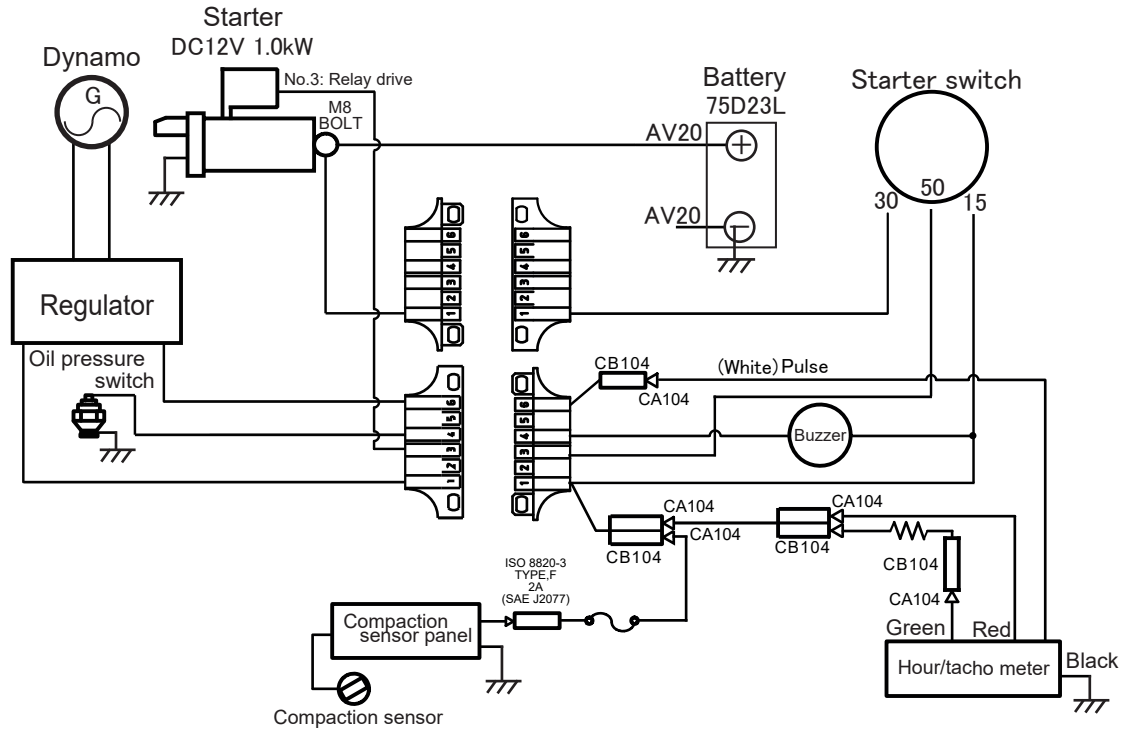


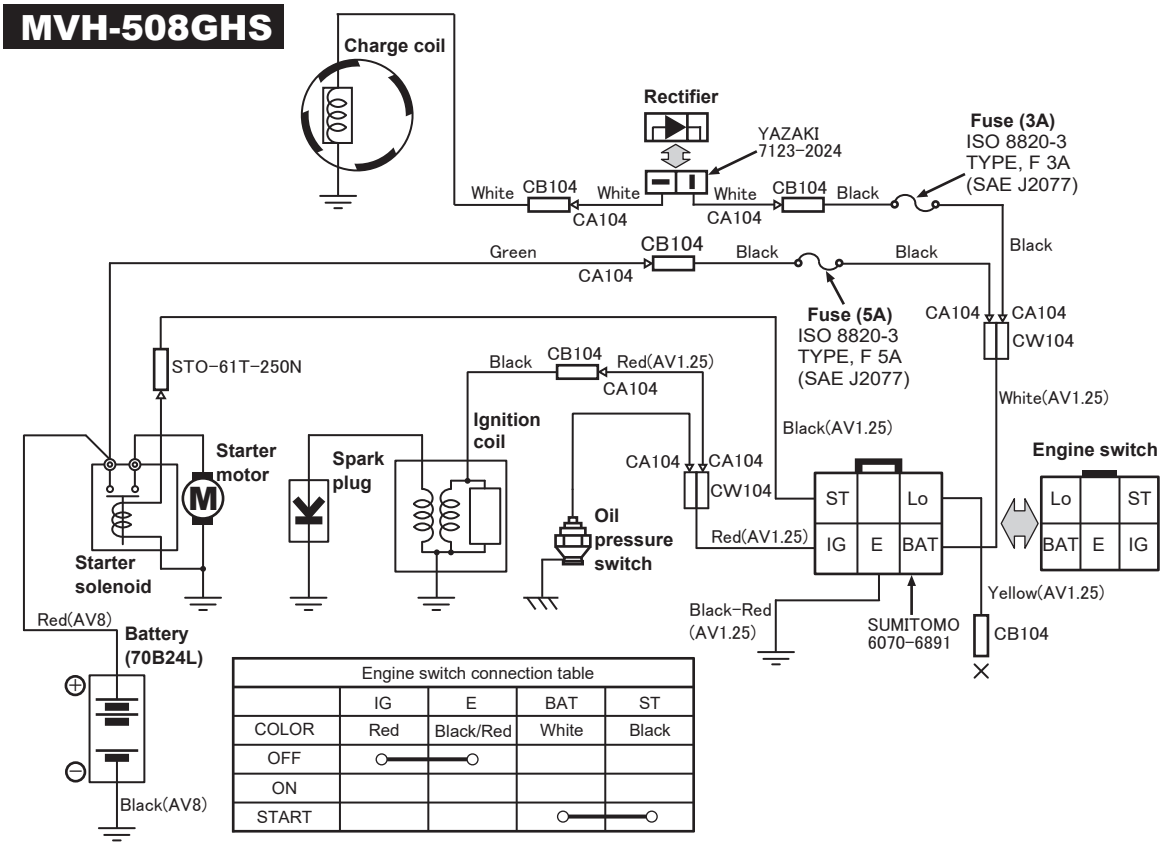
MVH-508DSZ



MVH-508DSZ-PAS



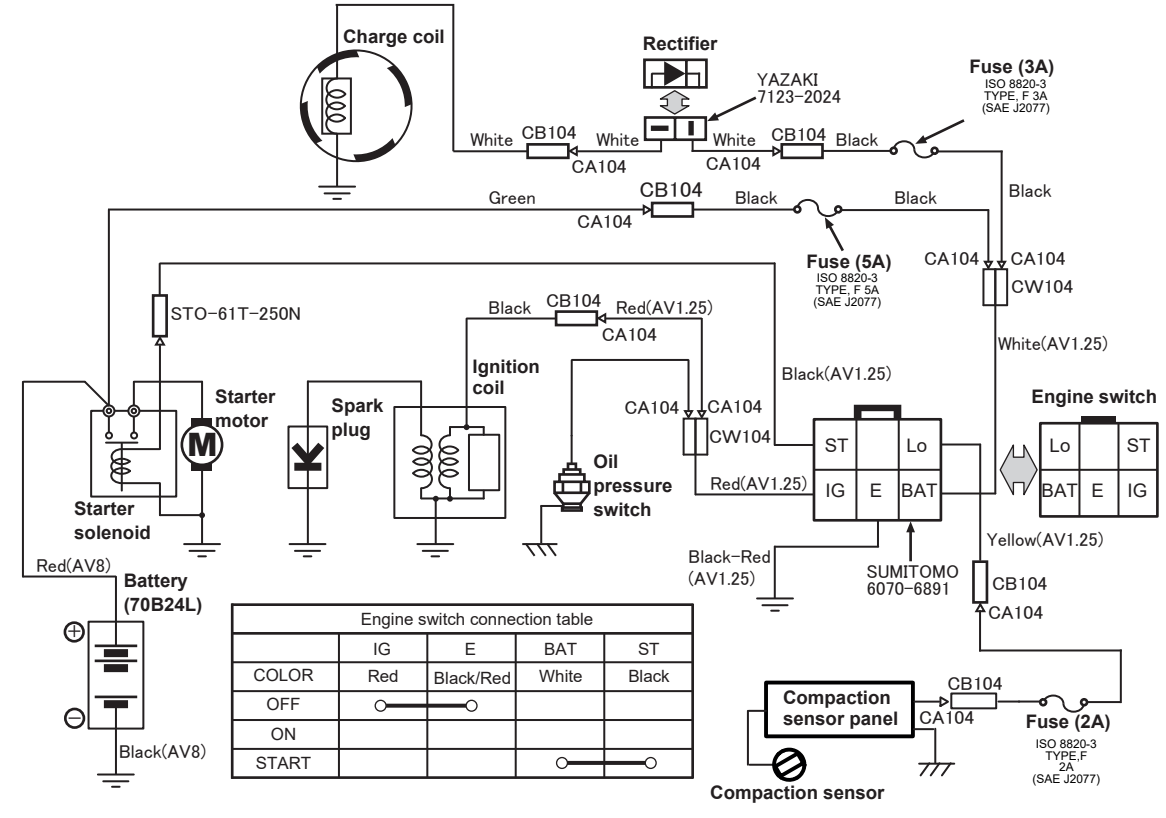
MVH-508GHS



Engine switch connection table

	IG	E	BAT	ST
COLOR	Red	Black/Red	White	Black
OFF	○	○		
ON				
START			○	○

MVH-508GHS PAS



Engine switch connection table

	IG	E	BAT	ST
COLOR	Red	Black/Red	White	Black
OFF	○	○		
ON				
START			○	○