

# **SW652-1**

# **SHOP MANUAL**

**SAKAI®**

3498-65594-0



# Introduction

This manual provides important information to familiarize you with safe operating and maintenance procedures for your SAKAI roller. Even though you may be familiar with similar equipment you must read and understand this manual before operating or servicing this unit.

Safety is everyone's business and it is one of your primary concerns. Knowing the guidelines presented in this manual will help provide for your safety, for the safety of those around you and for the proper operation and maintenance of the machine. Improper operation is dangerous and can result in injury or death.

Sakai Heavy Industries cannot foresee all possible circumstances or varying conditions to which the operator, serviceman or machine may be exposed to that might lead to a potential hazard. Therefore, the warnings and cautions listed in this manual and those placed on the machine are not intended to be all inclusive and liability for personal injury or damage to equipment or property cannot be assumed.

All information, specifications and illustrations in this publication are based on the product information available at the time that the publication was written. The contents may change without prior notice due to modifications of the model.



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# **SAFETY**

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# 1. GENERAL SAFETY

## 1-1. Understanding the Safety Symbols and Words

The words DANGER, WARNING, and CAUTION are used with the safety-alert symbol. DANGER identifies the most serious hazard. When the symbols DANGER, WARNING and CAUTION are displayed, become alert. Your safety or those around you may be involved. NOTICE is used to provide important information that is not hazard related.

 **DANGER:** Indicates an imminently hazardous situation or condition which if not avoided can result in serious personal injury or death.

 **WARNING:** Indicates a potentially hazardous situation or condition which if not avoided can result in serious personal injury or death.

 **CAUTION:** Indicates a potentially hazardous situation or condition which if not avoided may result in moderate personal injury or damage to the machine or personal property.

(NOTICE): Indicates important information about operation or maintenance of the machine that may cause damage, breakdown, or shortened service life of the machine if you fail to observe or important point to maintain of quality in maintenance works.

★: Indicates standard value to judge whether measured value is good or not.



Items that indicate the weight of a part or equipment and require attention in wire selection and operating posture for slinging operation.



In the assembly operation, tightening torque in locations that require particular attention.

## 1-2. General

- Operators and maintenance personnel must be alert to recognize and avoid potential hazards. They should also have comprehensive training, the required skills and necessary tools to perform the job safely.
- The machine was built in accordance to the latest safety standards and recognized safety rules. Nevertheless, misuse of the machine may result in risk to life and limb of the user or nearby personnel and may cause damage to the machine or other property.
- The machine must only be used for its intended purpose as described in the Operator's Manual. It must be operated by safety-conscious persons who are fully aware of the risks involved when operating the machine. Any malfunctions especially those affecting the safety of the machine must be corrected immediately.

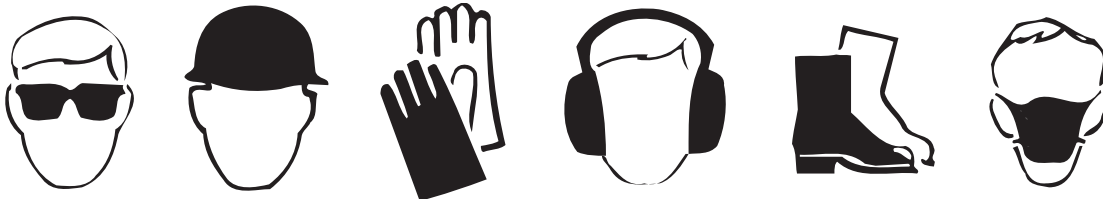
- The machine is designed specifically for the compaction of asphalt or soil road construction materials. Use of the machine for other purposes such as towing other equipment is considered contrary to the designated use. The manufacturer cannot be responsible or held liable for any damage resulting from such use. The risk for such use lies entirely with the user.
- Operating the machine within the limits of its designated use also involves compliance with the inspection and maintenance requirements contained in the Operation and Maintenance Manual.

### 1-3. Qualifications of Operators and Maintenance Personnel

- Work on the machine must be performed by qualified personnel only. Individual responsibilities of personnel regarding operation, maintenance, repair of the machine must be clearly stated.
- Define the operator's responsibilities; the operator should have authority to refuse instructions that are contrary to safety.
- Do not allow persons being trained to operate or perform maintenance on the machine without constant supervision by an experienced person.
- Work on the electrical system of the machine must be done only by an experienced person or under the guidance of a skilled electrician and according to electrical engineering rules and regulations.
- Work on the frame, brakes, hydraulic and steering systems must be performed by skilled personnel with special knowledge and training for such work.

### 1-4. Safety Practices and Policies

- Keep the manuals in the container provided on the machine. Manuals must always be available at the site where the machine is being used.
- The operator or user of the machine must be aware of all applicable or legal and mandatory regulations relevant to accident prevention and environmental protection. These regulations may also deal with handling of hazardous substances, the required proper personal safety and protective equipment and traffic or jobsite regulations.
- Machine operating instructions should also be supplemented with detailed instructions pertaining to the specific jobsite or work location.
- Always be sure the persons working on the machine have read the operating instructions and all safety precautions before beginning work. Reading safety instructions after work has already begun is too late.
- Wear close fitting garments and always tie back and secure long hair, also avoid wearing jewelry such as rings. Injury can result from loose clothing, hair or jewelry being caught up in the machinery or rotating parts.
- Use protective equipment as required by the circumstances or by law.





- Observe all safety instructions and warnings attached to the machine.
- Make sure all safety instructions and warnings on the machine are complete and perfectly legible.
- Stop the machine immediately in the event of any malfunction. Report any malfunction immediately to the supervisor or other person of authority.
- Never perform service or maintenance on the machine unless the drums or tires are adequately blocked, articulation lock bar and pin is in the locked position and the parking brake is applied.
- Never make any modifications to the machine which might affect safety without the manufacturer's approval.
- Always perform the recommended routine inspections and adjustments according to the prescribed intervals.

### **1-5. Pre Start Inspection**

- Inspect your machine daily. Ensure that the routine maintenance and lubrication are properly performed. Repair or replace any malfunctioning, broken or missing parts before using the machine. Refer to the maintenance schedule in the Operator's Manual.
- Check that all instructions and safety stickers are in place and readable.
- Never fill the fuel tank with the engine running or while near an open flame or while smoking.
- Always clean up any spilled fuel.
- Check for any warning tags placed on the machine, do not operate the machine until all repairs have been made and warning tags have been removed by authorized personnel.
- Check the seat belt for wear or damage; inspect the belt hardware and fabric. Replace if hardware is damaged or the belt is frayed or nicked or stitching is loose. Check that mounting hardware is tight.
- Clean the steps and operating platform of dirt and foreign matter to reduce danger of slipping.
- Know how to shut-down or stop the machine immediately in case of emergency.
- Know the capabilities and limitations of the machine such as speed, gradeability, steering and braking.
- Be aware of the dimensions of the machine such as height, weight especially for transporting.

### **1-6. Safety Instructions**

- Take all necessary precautions to ensure that the machine is used only when in a safe and reliable condition.
- Avoid any operational mode that might compromise safety.
- Operate the machine only if all protective and safety devices are in place and fully functional.
- Always use the hand rails and steps to get on and off your machine maintaining 3-point contact (using both hands).

## **1-7. Starting**

- Start the machine only from the driver's seat and always wear the seat belt.
- Watch that the warning lights and indicators during start-up and shutdown are working in accordance with operating instructions.
- Watch that no one is in danger before starting and when moving the machine.
- Check that braking, steering, signals and lights are fully functional before starting work or traveling with the machine.

## **1-8. Operating**

- Always make sure that there are no obstructions or persons in your line of travel before starting the compactor in motion.
- Never climb on and off the machine while it is in motion.
- Always remain seated with the seat belt fastened when traveling, compacting or loading or unloading the machine.
- Use caution and be very observant when operating in close quarters and congested areas.
- Obey all traffic regulations when working on public roads and make sure machine is compatible with these regulations.
- Never carry passengers.
- Know and use the hand signals for particular jobs and who has the responsibility for signaling.
- Do not work close to edges or in the vicinity of overhanging banks or on grades that could cause the compactor to slide or roll over. Avoid any areas that may be a risk to machine stability.
- Avoid side hill travel. Always operate up and down the slope. Always keep the propulsion (travel control) lever in low speed range when climbing or descending hills or steep grades.
- Make sure there is sufficient clearance when crossing underpasses, bridges and tunnels or when passing under overhead power lines.
- Never allow anyone to stand in the articulation area of the machine when the engine is running.
- Always look in all directions before reversing the direction of travel.
- Always switch on the lighting system (if equipped) during poor visibility conditions and after dark.
- Do not attempt to control the compactor travel speed with the throttle control. Maintain engine speed at the full operating RPM.
- Do not run the engine in a closed building for an extended period of time. Exhaust fumes can kill.

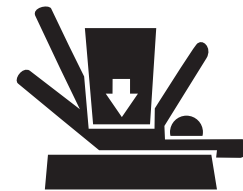
## **1-9. Stopping**

- Always park the machine in a safe area on solid and level ground. If this is not possible, always park at a right angle to the slope and block the drums or tires.
- Do not leave the operator's platform with the engine running. Always move the travel lever to neutral position and apply the parking brake then turn the starter switch to OFF.
- Lock all lockable compartments.

- Park behind a safe barrier, use proper flags, and warning devices, especially when parking in areas of heavy traffic.

## 1-10. Maintenance

- In any performing any work concerning the operation, adjustment or modification of the machine or it's safety devices or any work related to maintenance, inspection or repair, always follow the start-up and shut-down procedures in the Operator's Manual and the Maintenance Manual.
- Ensure that the maintenance area is safe and secure.
- If the machine is shut down for maintenance or repair work it must be secured against inadvertent starting by removing the starter key and attaching a warning sign to the starter switch.
- The machine must be parked on stable and level ground with the drums or tires blocked to prevent inadvertent movement.
- Immediately after the engine has stopped, the exhaust system, engine, radiator coolant, engine oil, hydraulic fluid and other lubricants and components will be very hot. Fluids can be under pressure, removing the radiator cap or draining oil or changing filters can cause serious burns. Wait until the machine has cooled down.
- Use care when attaching and securing lifting tackle to individual parts and large assemblies being removed or repositioned for repair purposes to avoid the risk of accident. Use lifting devices that are in perfect condition and of sufficient lifting capacity. Never stand under suspended loads.
- Always use the proper tools and workshop equipment in good condition when performing maintenance or repairs on the machine.
- Always use specially designed safety ladders and working platforms when working above floor level. Never use machine parts as a climbing aid.
- Keep all steps, handles, handrails, platforms and ladders free from mud, dirt, grease, ice or snow.
- Clean the machine, especially threaded connections of any traces of oil or fuel before carrying out any maintenance or repairs. Never use aggressive detergents. Use lint free cleaning rags.
- Examine all fuel, lubricant and hydraulic fluid lines and connectors for leaks, loose connections chafe marks or damage after cleaning.
- Repair or replace defective parts immediately.
- Whenever possible, avoid servicing or maintenance when the engine is running unless the drums or tires are adequately blocked, the articulation lock bar is in the locked position and the parking brake is applied.



## SAFETY

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- Never fill the fuel tank with the engine running, while near an open flame or while smoking. Always clean up any spilled fuel.
- Ensure safe operation, optimum performance of the machine and its warranty by using only genuine SAKAI replacement parts.
- Use only the specified fluids and lubricants. Substitute only products known to be equivalent from reputable manufacturers.
- Disconnect the battery cables when working on the electrical system or when welding on the compactor.
- Be sure the battery area is well ventilated (clear of fumes) should it be necessary to connect a jumper cable or battery charger. Fumes can ignite from a spark and may explode.
- Be sure battery charger is OFF when making connections if charging is required.
- Use only original fuses with the specified rating. Switch off the machine immediately if trouble occurs in the electrical system.
- Work on the electrical system may only be carried out by a qualified electrician or by a specially trained person according to electrical engineering principles.
- Inspect the electrical equipment of the machine at regular intervals. Defects such as loose connections or burnt or scorched wires must be repaired or replaced immediately.
- Do not weld, flame cut or perform grinding on the machine unless expressly authorized, as there may be a risk of fire or explosion. Disconnect the battery when welding on the machine.
- Clean the machine and its surrounding from dust or other flammable substances and make sure the area is adequately ventilated before beginning welding, flame cutting or grinding operations.
- Inspect hydraulic hoses at regular intervals and immediately replace if they show signs of chafing, cracking, brittleness, deformation, blistering, fitting separation, leakage, corrosion or other damage which may affect their function or strength.
- Do not work on hydraulic system while the engine is running and the system is under pressure. The hydraulic system remains pressurized even after the engine has stopped.
- Do not disconnect hydraulic hoses or fittings until the pressure has been properly relieved.
- Wait until the systems and fluid have cooled down before disconnecting.
- Never use your hands to check for leaks when inspecting a hydraulic system. Use a piece of cardboard and always wear gloves and safety glasses.



- Get immediate medical attention if fluid has been injected under your skin. Fluid penetration from a pin hole leak can cause severe injury or death.
- Ensure that hydraulic lines and hoses are routed and fitted properly. Ensure that no connections are interchanged. All fittings, lengths and specifications of hoses must comply with the technical requirements.

- Observe all product safety regulations when handling fuel, oils, grease, engine coolant and other chemical substances. Be careful especially when these items are hot as there is a risk of burning or scalding.
- Operate internal combustion engines and fuel operated heating systems only in adequately ventilated premises. Before starting the engine in an enclosed area, make sure there is sufficient ventilation.



## 1-11. Transporting the Machine

- Use only suitable and approved trailers and haul vehicles and lifting equipment of sufficient capacity.
- Entrust to experienced personnel the fastening and lifting of loads and instructing of crane operators.
- Only experienced persons familiar with the operation of the machine may load and unload the machine.
- Use ramps or a loading dock when loading or unloading the machine. Ramps must be the proper strength, low angle and the proper height and width.
- Block the drums or tires (front and rear) of the hauling vehicle when loading and unloading the compactor. Ensure that the haul vehicle is on level ground and approach the loading ramps squarely to make sure that the compactor does not slide off the edge of the ramp.
- Keep the deck clear of mud, oil, ice or snow or other materials that can make the deck slippery.
- Position the compactor on the trailer or transport vehicle centered from side to side, and apply the brake. Shut off the engine and lock all lockable compartments.
- Block the drums or tires and lock the articulation lock bar. Chain the machine down properly using the appropriate tackle.
- Know the overall height of the compactor and hauling vehicle. Observe height and weight regulations and be sure you can pass safely at overhead obstructions.
- Obey all traffic regulations and be sure that the proper clearance flags, lights and warning signs including "Slow Moving Vehicle" emblem are displayed when traveling on public roads.
- Know the approximate stopping distance at any given speed.
- Drive Safely. Never turn corners at excessive speeds.



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# **SPECIFICATIONS**

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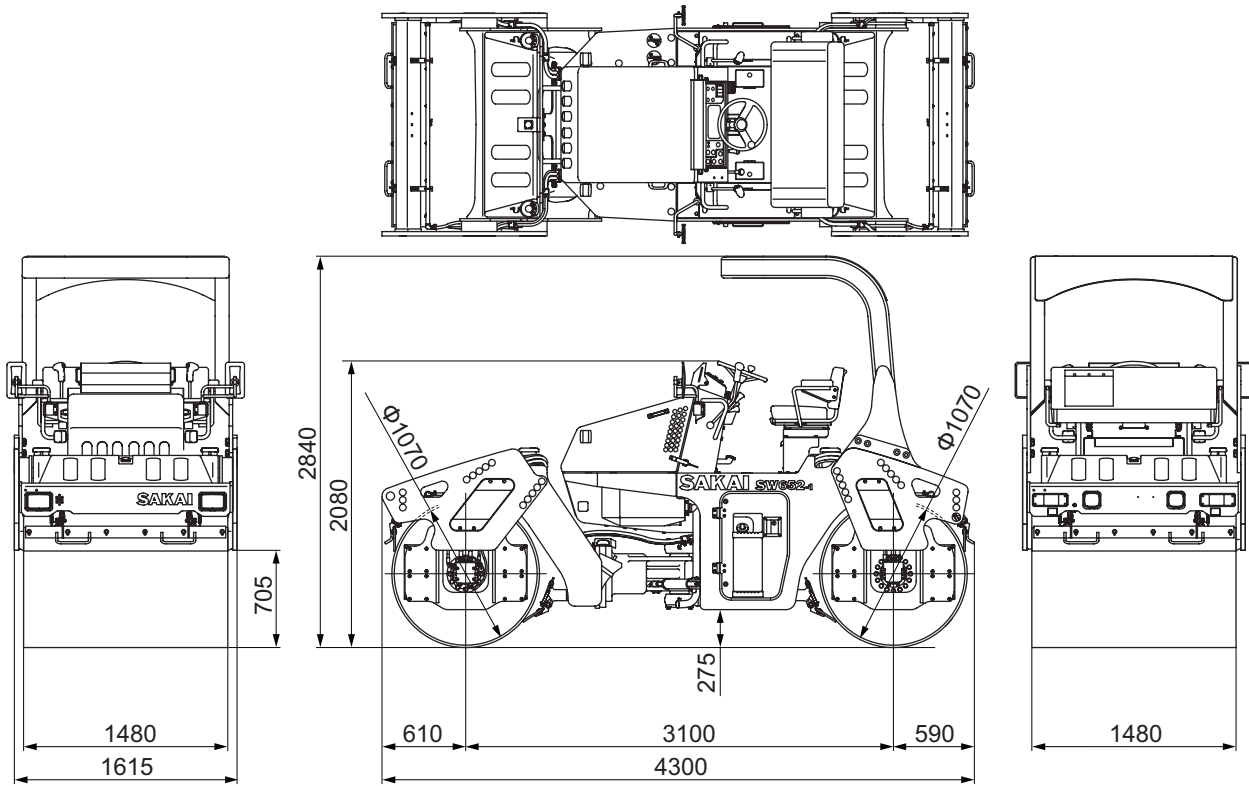






# 1. SPECIFICATION DATA

## 1-1. SW652-1



0559-99032-0-10595-0

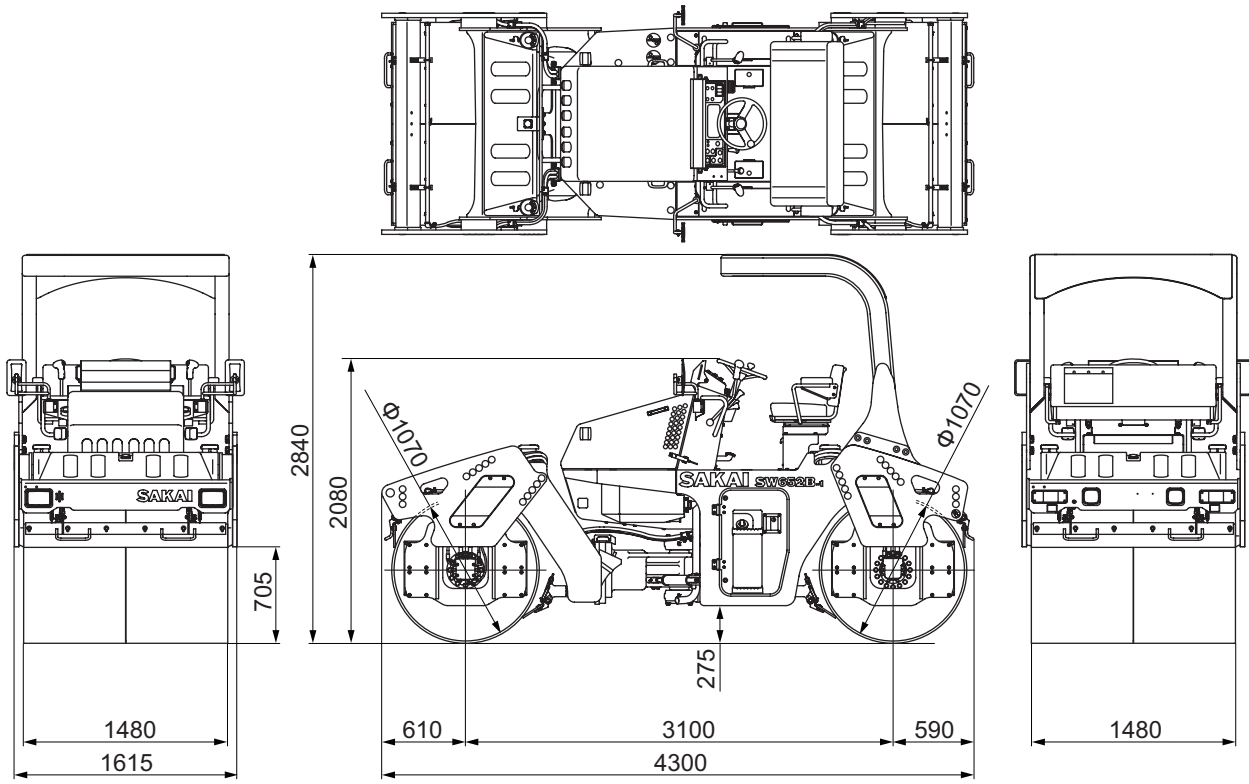
Model		SW652-1	
Weight	Operating weight		7,350 kg ( 16,205 lbs. )
	Front axle		3,490 kg ( 7,695 lbs. )
	Rear axle		3,860 kg ( 8,510 lbs. )
Dimensions	Overall length		4,300 mm ( 169 in. )
	Overall width		1,615 mm ( 64 in. )
	Overall height	Steering wheel	2,080 mm ( 82 in. )
		ROPS	2,840 mm ( 112 in. )
	Wheelbase		3,100 mm ( 122 in. )
	Compaction width		1,480 mm ( 58 in. )
	Minimum height above ground		275 mm ( 11 in. )
	Curb clearance		705 mm ( 28 in. )
	Speed (Forward & Reverse)	Low	1st
2nd			0 to 4 km/h ( 0 to 2.5 mile/h )
3rd			0 to 6 km/h ( 0 to 3.7 mile/h )
High		1st	0 to 4 km/h ( 0 to 2.5 mile/h )
		2nd	0 to 8 km/h ( 0 to 5.0 mile/h )
		3rd	0 to 13 km/h ( 0 to 8.1 mile/h )
Vibration performance	Frequency	Low amplitude	67 Hz
		High amplitude	50 Hz
	Centrifugal force	Low amplitude	62 kN ( 13,940 lbs. )
		High amplitude	69 kN ( 15,510 lbs. )
Minimum turning radius		5.1 m ( 201 in. )	
Gradability *1		34 % ( 19 ° )	

\*1: The gradability is the calculated value. It may vary based on the ground surface conditions.

Engine	Name		KUBOTA V3307-DI-T-KDN Diesel Engine with turbocharger		
	Model		Water-cooled, 4-cycle, 4-cylinder, in-line, vertical mounted, overhead valve, direct-injection type		
	Number of cylinders - Bore × Stroke		4-94 mm × 120 mm (4-3.701 in. × 4.724 in.)		
	Displacement		3.331 L ( 203 cu.in )		
	Performance	Rated speed		2,200 min <sup>-1</sup> ( 2,200 rpm )	
		Rated output (SAE J1995 JUN95)		55.4 kW ( 74 HP ) at 2,200 min <sup>-1</sup>	
		Max. torque (SAE J1995 JUN95)		265 N·m ( 195 lbf·ft ) at 1,500 min <sup>-1</sup>	
		Fuel consumption (SAE J1995 JUN95)		239 g/kW·h ( 0.393 lb/HP·h ) at rated speed	
	Governor		Mechanical all-speed type		
	Lubrication system		Pressure lubrication by gear pump		
	Oil filter		Full-flow: paper		
	Air cleaner		Dry type		
	Cooling system		Centrifugal pump forced feeding system		
	Cooling fan		Exhaling type		
	Electrical system	Alternator		12 V 80 A	
Starter		12 V 3.0 kW			
Battery		12 V 72 Ah × 1 pcs. (12 V)			
Power line	Transmission	Type	Hydrostatic transmission		
		Speeds	6 speed shifts		
	Reverser	Switching the direction of flow delivered from the variable pump			
Final drive		Planetary gear			
Vibrating system	Transmission		Hydrostatic transmission		
	Vibrator		Eccentric shaft type		
Braking device	Service brake		Hydrostatic and mechanical, multi-wet disc type		
	Parking brake		Mechanical, multi-wet disc type		
Steering system	Steering control type		Hydraulic type (Articulated type)		
	Steering control angle		± 39 °		
	Oscillation angle		± 9 °		
Drums	Use	Front drum		Vibrate & Drive × 1	
		Rear drum		Vibrate & Drive × 1	
	Dimension	Front drum	width × diameter	1,480 mm × 1,070 mm (58 in. × 42 in.)	
		Rear drum	width × diameter	1,480 mm × 1,070 mm (58 in. × 42 in.)	
	Suspension system	Front		Rubber damper type	
Rear		Rubber damper type			
Water spray system		Pressurized type			
Others	Ropes		Steel frame		
	Instruments & lights		1 set		

**SPECIFICATIONS**

**1-2. SW652B-1**



0559-99034-0-10597-0

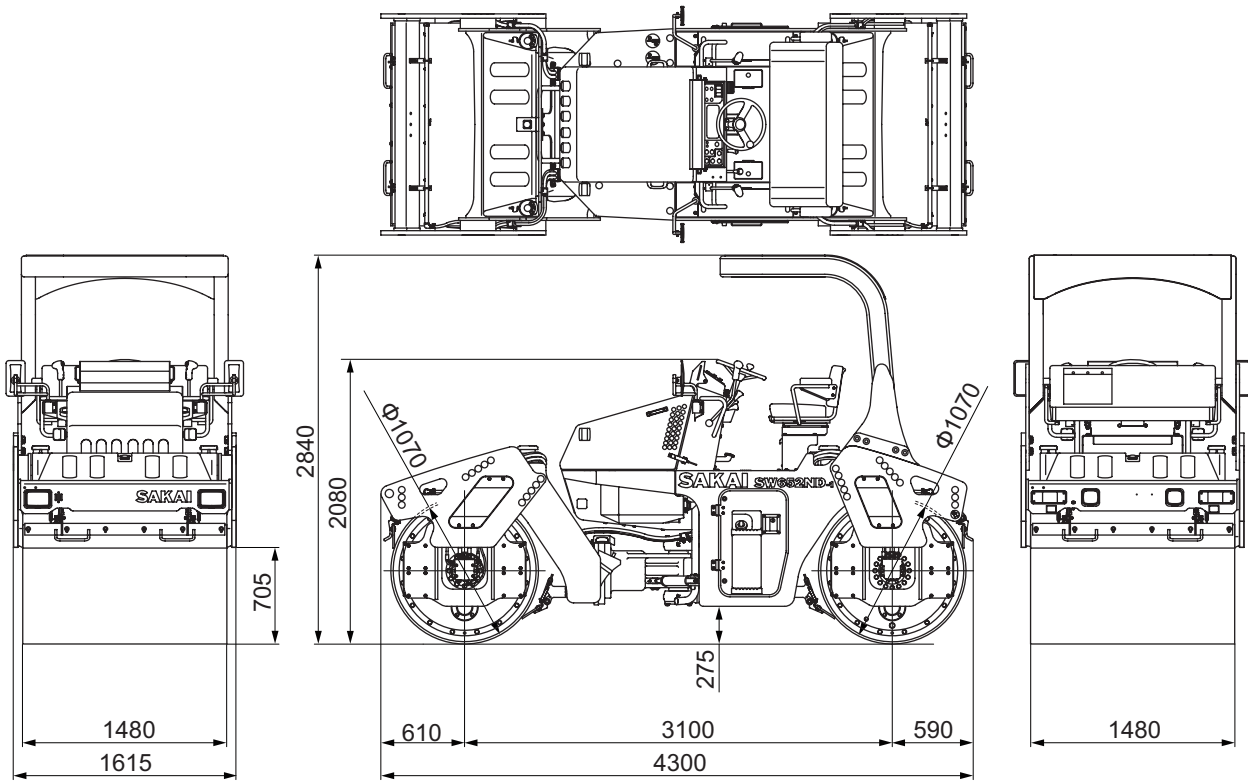
Model		SW652B-1		
Weight	Operating weight	8,250 kg	( 18,185 lbs. )	
	Front axle	3,940 kg	( 8,685 lbs. )	
	Rear axle	4,310 kg	( 9,500 lbs. )	
Dimensions	Overall length	4,300 mm	( 169 in. )	
	Overall width	1,615 mm	( 64 in. )	
	Overall height	Steering wheel	2,080 mm	( 82 in. )
		ROPS	2,840 mm	( 112 in. )
	Wheelbase	3,100 mm	( 122 in. )	
	Compaction width	1,480 mm	( 58 in. )	
	Minimum height above ground	275 mm	( 11 in. )	
	Curb clearance	705 mm	( 28 in. )	
	Speed (Forward & Reverse)	Low	1st	0 to 2 km/h ( 0 to 1.2 mile/h )
2nd			0 to 4 km/h ( 0 to 2.5 mile/h )	
3rd			0 to 6 km/h ( 0 to 3.7 mile/h )	
High		1st	0 to 4 km/h ( 0 to 2.5 mile/h )	
		2nd	0 to 8 km/h ( 0 to 5.0 mile/h )	
		3rd	0 to 13 km/h ( 0 to 8.1 mile/h )	
Vibration performance	Frequency	Low amplitude	67 Hz	
		High amplitude	50 Hz	
	Centrifugal force	Low amplitude	61 kN ( 13,715 lbs. )	
		High amplitude	67 kN ( 15,060 lbs. )	
Minimum turning radius		5.1 m	( 201 in. )	
Gradability *1		29 %	( 16 ° )	

\*1: The gradability is the calculated value. It may vary based on the ground surface conditions.

Engine	Name		KUBOTA V3307-DI-T-KDN Diesel Engine with turbocharger		
	Model		Water-cooled, 4-cycle, 4-cylinder, in-line, vertical mounted, overhead valve, direct-injection type		
	Number of cylinders - Bore × Stroke		4-94 mm × 120 mm (4-3.701 in. × 4.724 in.)		
	Displacement		3.331 L ( 203 cu.in )		
	Performance	Rated speed		2,200 min <sup>-1</sup> ( 2,200 rpm )	
		Rated output (SAE J1995 JUN95)		55.4 kW ( 74 HP ) at 2,200 min <sup>-1</sup>	
		Max. torque (SAE J1995 JUN95)		265 N·m ( 195 lbf-ft ) at 1,500 min <sup>-1</sup>	
		Fuel consumption (SAE J1995 JUN95)		239 g/kW·h ( 0.393 lb/HP·h ) at rated speed	
	Governor		Mechanical all-speed type		
	Lubrication system		Pressure lubrication by gear pump		
	Oil filter		Full-flow: paper		
	Air cleaner		Dry type		
	Cooling system		Centrifugal pump forced feeding system		
	Cooling fan		Exhaling type		
	Electrical system	Alternator		12 V 80 A	
Starter		12 V 3.0 kW			
Battery		12 V 72 Ah × 1 pcs. (12 V)			
Power line	Transmission	Type	Hydrostatic transmission		
		Speeds	6 speed shifts		
	Reverser	Switching the direction of flow delivered from the variable pump			
Final drive		Planetary gear			
Vibrating system	Transmission		Hydrostatic transmission		
	Vibrator		Eccentric shaft type		
Braking device	Service brake		Hydrostatic and mechanical, multi-wet disc type		
	Parking brake		Mechanical, multi-wet disc type		
Steering system	Steering control type		Hydraulic type (Articulated type)		
	Steering control angle		± 39 °		
	Oscillation angle		± 9 °		
Drums	Use	Front drum		Vibrate & Drive × 2, Split type	
		Rear drum		Vibrate & Drive × 2, Split type	
	Dimension	Front drum	width × diameter	1,480 mm × 1,070 mm (58 in. × 42 in.)	
		Rear drum	width × diameter	1,480 mm × 1,070 mm (58 in. × 42 in.)	
	Suspension system	Front		Rubber damper type	
Rear		Rubber damper type			
Water spray system		Pressurized type			
Others	Ropes		Steel frame		
	Instruments & lights		1 set		

**SPECIFICATIONS**

**1-3. SW652ND-1**



0559-99033-0-10596-0

Model		SW652ND-1		
Weight	Operating weight	7,650 kg	( 16,865 lbs. )	
	Front axle	3,640 kg	( 8,025 lbs. )	
	Rear axle	4,010 kg	( 8,840 lbs. )	
Dimensions	Overall length	4,300 mm	( 169 in. )	
	Overall width	1,615 mm	( 64 in. )	
	Overall height	Steering wheel	2,080 mm	( 82 in. )
		ROPS	2,840 mm	( 112 in. )
	Wheelbase	3,100 mm	( 122 in. )	
	Compaction width	1,480 mm	( 58 in. )	
	Minimum height above ground	275 mm	( 11 in. )	
	Curb clearance	705 mm	( 28 in. )	
	Speed (Forward & Reverse)	Low	1st	0 to 2 km/h ( 0 to 1.2 mile/h )
2nd			0 to 4 km/h ( 0 to 2.5 mile/h )	
3rd			0 to 6 km/h ( 0 to 3.7 mile/h )	
High		1st	0 to 4 km/h ( 0 to 2.5 mile/h )	
		2nd	0 to 8 km/h ( 0 to 5.0 mile/h )	
		3rd	0 to 13 km/h ( 0 to 8.1 mile/h )	
Vibration performance	Frequency	Normal	49 Hz	
		Horizontal	49 Hz	
	Centrifugal force	Normal	68 kN ( 15,285 lbs. )	
		Horizontal	124 kN ( 27,875 lbs. )	
Minimum turning radius		5.1 m	( 201 in. )	
Gradability *1		32 %	( 18 ° )	

\*1: The gradability is the calculated value. It may vary based on the ground surface conditions.

Engine	Name		KUBOTA V3307-DI-T-KDN Diesel Engine with turbocharger		
	Model		Water-cooled, 4-cycle, 4-cylinder, in-line, vertical mounted, overhead valve, direct-injection type		
	Number of cylinders - Bore × Stroke		4-94 mm × 120 mm (4-3.701 in. × 4.724 in.)		
	Displacement		3.331 L ( 203 cu.in )		
	Performance	Rated speed		2,200 min <sup>-1</sup> ( 2,200 rpm )	
		Rated output (SAE J1995 JUN95)		55.4 kW ( 74 HP ) at 2,200 min <sup>-1</sup>	
		Max. torque (SAE J1995 JUN95)		265 N·m ( 195 lbf·ft ) at 1,500 min <sup>-1</sup>	
		Fuel consumption (SAE J1995 JUN95)		239 g/kW·h ( 0.393 lb/HP·h ) at rated speed	
	Governor		Mechanical all-speed type		
	Lubrication system		Pressure lubrication by gear pump		
	Oil filter		Full-flow: paper		
	Air cleaner		Dry type		
	Cooling system		Centrifugal pump forced feeding system		
	Cooling fan		Exhaling type		
	Electrical system	Alternator		12 V 80 A	
Starter		12 V 3.0 kW			
Battery		12 V 72 Ah × 1 pcs. (12 V)			
Power line	Transmission	Type	Hydrostatic transmission		
		Speeds	6 speed shifts		
	Reverser	Switching the direction of flow delivered from the variable pump			
Final drive		Planetary gear			
Vibrating system	Transmission		Hydrostatic transmission		
	Vibrator		Twin eccentric shaft type		
Braking device	Service brake		Hydrostatic and mechanical, multi-wet disc type		
	Parking brake		Mechanical, multi-wet disc type		
Steering system	Steering control type		Hydraulic type (Articulated type)		
	Steering control angle		± 39 °		
	Oscillation angle		± 9 °		
Drums	Use	Front drum		Vibrate & Drive × 1	
		Rear drum		Vibrate & Drive × 1	
	Dimension	Front drum	width × diameter	1,480 mm × 1,070 mm (58 in. × 42 in.)	
		Rear drum	width × diameter	1,480 mm × 1,070 mm (58 in. × 42 in.)	
	Suspension system	Front		Rubber damper type	
Rear		Rubber damper type			
Water spray system		Pressurized type			
Others	Ropes		Steel frame		
	Instruments & lights		1 set		

## 2. TABLE OF STANDARD VALUES

### 2-1. Engine


Item		Standard value		Remarks
Engine model		KUBOTA V3307-DI-T-KDN Diesel Engine with turbocharger		
Rated output		54.6/2,200 kW/ min <sup>-1</sup> ( 74.2/2,200 HP/rpm )		
Max. rpm under no load		2,400 ± 50 rpm		
Min. rpm under no load		1,000 ± 50 rpm		
Cylinder head tightening torque		187 to 196 N·m ( 138 to 145 lbf·ft )		
Intake manifold tightening torque		23.5 to 27.5 N·m ( 17.3 to 20.3 lbf·ft )		
Exhaust manifold tightening torque		23.5 to 27.5 N·m ( 17.3 to 20.3 lbf·ft )		
Fan belt tension		10 to 15 mm ( 0.39 to 0.59 in. )		When midpoint of belt pressed at 98 N (22 lbf)
Valve clearance (intake)		0.13 to 0.17 mm ( 0.005 to 0.007 in. )		
Valve clearance (exhaust)		0.13 to 0.17 mm ( 0.005 to 0.007 in. )		
Compression pressure	Standard value	3.92 MPa ( 568 psi )		250 min <sup>-1</sup> (rpm)
	Allowable limit	2.90 MPa ( 421 psi )		250 min <sup>-1</sup> (rpm)
Injection pressure	1st stage	18.64 to 19.61 MPa ( 2,703 to 2,843 psi )		
	2nd stage	22.56 to 23.53 MPa ( 3,271 to 3,412 psi )		
Fuel consumption rate		239 g/kW·h ( 0.39 lb/HP·h )		
Engine dry weight		268 kg ( 591 lbs. )		

### 2-2. Propulsion

Item		Standard value		Remarks
Travel speed (Forward/reverse)	Low	1st	0 to 2 km/h ( 0 to 1.2 mile/h )	
		2nd	0 to 4 km/h ( 0 to 2.5 mile/h )	
		3rd	0 to 6 km/h ( 0 to 3.7 mile/h )	
	High	1st	0 to 4 km/h ( 0 to 2.5 mile/h )	
		2nd	0 to 8 km/h ( 0 to 5.0 mile/h )	
		3rd	0 to 13 km/h ( 0 to 8.1 mile/h )	



### 2-3. Hydraulic System

Item		Standard value	Remarks	
Propulsion	High pressure relief valve setting	33.0 ± 1.0 MPa ( 4,785 ± 145 psi )	Differential pressure	
	Cut off valve setting	30.0 ± 1.0 MPa ( 4,350 ± 145 psi )		
	Charge relief valve setting	2.4 ± 0.2 MPa ( 348 ± 29 psi )		
	Case pressure	Pump	0.4 MPa ( 58.0 psi ) or less	
		Front motor	0.4 MPa ( 58.0 psi ) or less	
		Rear motor	0.4 MPa ( 58.0 psi ) or less	
	Brake release pressure	Front motor	More than 1.8 ± 0.2 MPa ( 261 ± 29 psi )	
		Rear motor	More than 1.8 ± 0.2 MPa ( 261 ± 29 psi )	
		Rear axle	—	
	Drainage	Front motor	5.2 L/min ( 1.4 gal./min )	 , 3rd
Rear motor		5.2 L/min ( 1.4 gal./min )		
Vibration	High pressure relief valve setting	34.5 ± 1.0 MPa ( 5,003 ± 145 psi )	Differential pressure	
	Cut off valve setting	32.5 ± 1.0 MPa ( 4,713 ± 145 psi )		
	Charge relief valve setting	—		
	Case pressure	Pump	0.4 MPa ( 58.0 psi ) or less	
		Motor	0.2 MPa ( 29.0 psi ) or less	
	Drainage	SW652-1	9.4 L/min ( 2.5 gal./min )	
SW652B-1				
SW652ND-1		6.9 L/min ( 1.8 gal./min )		
Steering oil pressure		17.6 ± 1.0 MPa ( 2,552 ± 145 psi )	(orbitroll relief pressure + charge relief pressure)	

### 2-4. Steering

Item	Standard value	Remarks
Play in steering wheel	5 to 10 mm ( 0.2 to 0.4 in. )	Steering wheel circumference
	0.5 mm ( 0.02 in. ) or less	Steering column shaft direction

## SPECIFICATIONS

### 2-5. Brakes

Item	Standard value	Remarks
Clearance between brake pedal and floorboard (as released)	112 mm (4.4 in.) Note 1: See dimensions	<p>SW652-1-02001</p>
Clearance between brake pedal and floorboard (when pressed down)	52 mm (2.0 in.) Note 2: See dimensions	
Propulsion motor inner brake wear limit Thickness of disc assembly (15 discs)	19.9 mm (0.78 in.) Note 3: See dimensions	<p>SW652-1-02002</p>

### 2-6. Capacities

Item	Standard value	Remarks
Engine oil pan	11.2 L ( 3.0 gal. )	
Fuel tank	120 L ( 32 gal. )	
Coolant	12.4 L ( 3.3 gal. )	
Gear box	1.2 L × 2 ( 0.3 gal. × 2 )	
Hydraulic oil tank	51 L ( 13.5 gal. )	
Vibrator case	SW652-1	4.0 L × 2 ( 1.1 gal. × 2 )
	SW652B-1	1.7 L × 2 ( 0.4 gal. × 2 )
	SW652ND-1	10.4 L × 2 ( 2.7 gal. × 2 )
Water spray tank	300 L × 2 ( 79 gal. × 2 )	

### 3. FUEL AND LUBRICANTS SPECIFICATION

#### 3-1. Rating

Lubricant	Service classification	Ambient temp. and applicable viscosity rating			Applicable Standards
		-15 to 30°C (5 to 86°F) Cold	0 to 40°C (32 to 104°F) Moderate	15 to 55°C (59 to 131°F) Tropical	
Engine oil	API grade CF	SAE10W-30	SAE30	SAE40	MIL-L-2104D
Gear oil	API grade GL4	SAE80W-90	SAE90	SAE140	MIL-L-2105
Hydraulic oil	Wear resistant	ISO-VG32 Over VI 140	ISO-VG46 Over VI 140	ISO-VG68 Over VI 110	ISO-3448
Grease	Lithium type extreme pressure				NLGI-2
Fuel	Diesel oil				ASTM D975-2D

#### 3-2. Recommended Lubricants

Lubricant Oil company	Engine oil API CF	Gear oil API GL 4	Hydraulic oil VG 46	Grease (NLGI-2)
CALTEX	DELO 400 oil	Universal Thuban 90	Rando Oil HD 46	Martifack EP 2
BP	BP Vanellus C	BP Gear Oil EP 90	BP Energol HLP 46	BP Energrease LS-EP 2
ESSO	Esso super flo	Esso Gear Oil GP 90	Nuto H 46	Beacon EP 2
MOBIL	Mobile Delvac HP	Mobil Pegasus Gear oil 90	Mobile DTE 25	Mobil UX EP 2
SHELL	Shell RIMULA	Shell Spirax 90 EP	Shell Tellus Oil T46	Shell Alvania EP Grease 2

# 4. TIGHTENING TORQUE CHART

N·m	(lbf·ft)
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	Nominal Dia.	Pitch	Strength Classification							
			6.8		8.8		10.9		12.9	
Metric coarse screw	5	0.8	4.9	(3.6)	5.9	(4.4)	7.8	(5.8)	7.8	(5.8)
	6	1.0	7.8	(5.8)	9.8	(7.2)	13	(9.6)	13	(9.6)
	8	1.25	17	(13)	23	(17)	31	(23)	31	(23)
	10	1.5	39	(29)	49	(36)	59	(44)	59	(44)
	12	1.75	69	(51)	78	(58)	108	(80)	108	(80)
	14	2.0	98	(72)	127	(94)	167	(123)	167	(123)
	16	2.0	157	(116)	196	(145)	265	(195)	265	(195)
	18	2.5	196	(145)	245	(181)	343	(253)	343	(253)
	20	2.5	294	(217)	392	(289)	539	(398)	539	(398)
	22	2.5	441	(325)	539	(398)	686	(506)	686	(506)
	24	3.0	539	(398)	637	(470)	883	(651)	883	(651)
	27	3.0	785	(579)	981	(724)	1324	(977)	1324	(977)
30	3.5	1079	(796)	1324	(977)	1765	(1302)	1765	(1302)	
Metric fine screw	10	1.25	39	(29)	49	(36)	69	(51)	69	(51)
	12	1.25	69	(51)	88	(65)	118	(87)	118	(87)
	14	1.5	108	(80)	137	(101)	186	(137)	186	(137)
	16	1.5	167	(123)	206	(152)	284	(209)	284	(209)
	18	1.5	245	(181)	294	(217)	392	(289)	392	(289)
	20	1.5	343	(253)	441	(325)	588	(434)	588	(434)
	22	1.5	490	(361)	588	(434)	785	(579)	785	(579)
	24	2.0	588	(434)	735	(542)	981	(724)	981	(724)
	27	2.0	834	(615)	1030	(760)	1422	(1049)	1422	(1049)
	30	2.0	1177	(868)	1422	(1049)	1961	(1446)	1961	(1446)

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# **ENGINE AND CONTROLS**

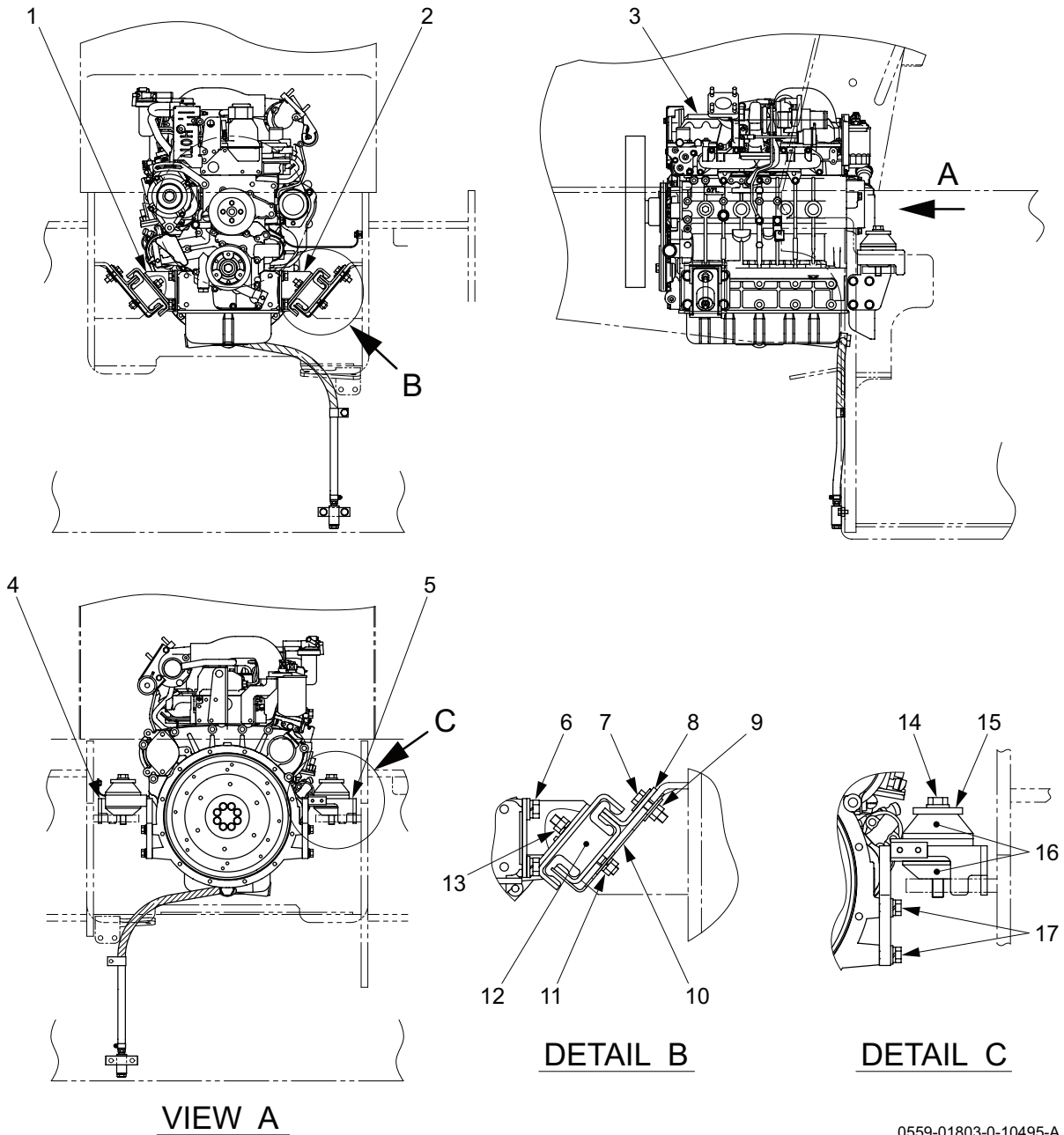
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# 1. ENGINE

## 1-1. Engine Mount



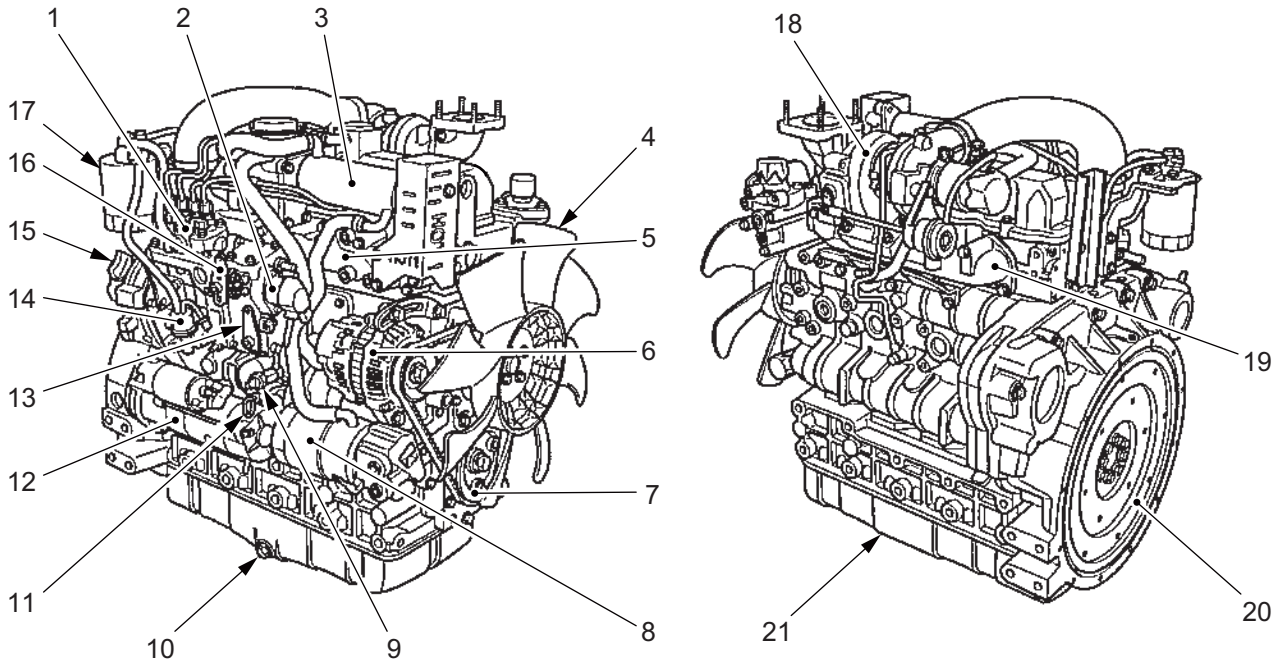
0559-01803-0-10495-A

- |                         |                       |                           |
|-------------------------|-----------------------|---------------------------|
| (1) Bracket             | (7) Bolt : M12×45     | (13) Nut : M12 P=1.25     |
| (2) Bracket             | (8) Stopper           | (14) Bolt : M16×130       |
| (3) Engine              | (9) Nut : M12         | (15) Plate                |
| (4) Bracket             | (10) Stopper          | (16) Damper               |
| (5) Bracket             | (11) Nut : M12 P=1.25 | (17) Bolt : M12×40 P=1.25 |
| (6) Bolt : M14×35 P=1.5 | (12) Damper           |                           |



- |                       |                          |                         |                          |
|-----------------------|--------------------------|-------------------------|--------------------------|
| (6) Bolt M14×35 P=1.5 | : 186 N·m ( 137 lbf·ft ) | (14) Bolt M16×130       | : 265 N·m ( 195 lbf·ft ) |
| (11) Nut M12 P=1.25   | : 78 N·m ( 58 lbf·ft )   | (17) Bolt M12×40 P=1.25 | : 108 N·m ( 80 lbf·ft )  |
| (13) Nut M12 P=1.25   | : 78 N·m ( 58 lbf·ft )   |                         |                          |

## 1-2. Engine Exterior



★ The actual equipment may differ from that shown above.

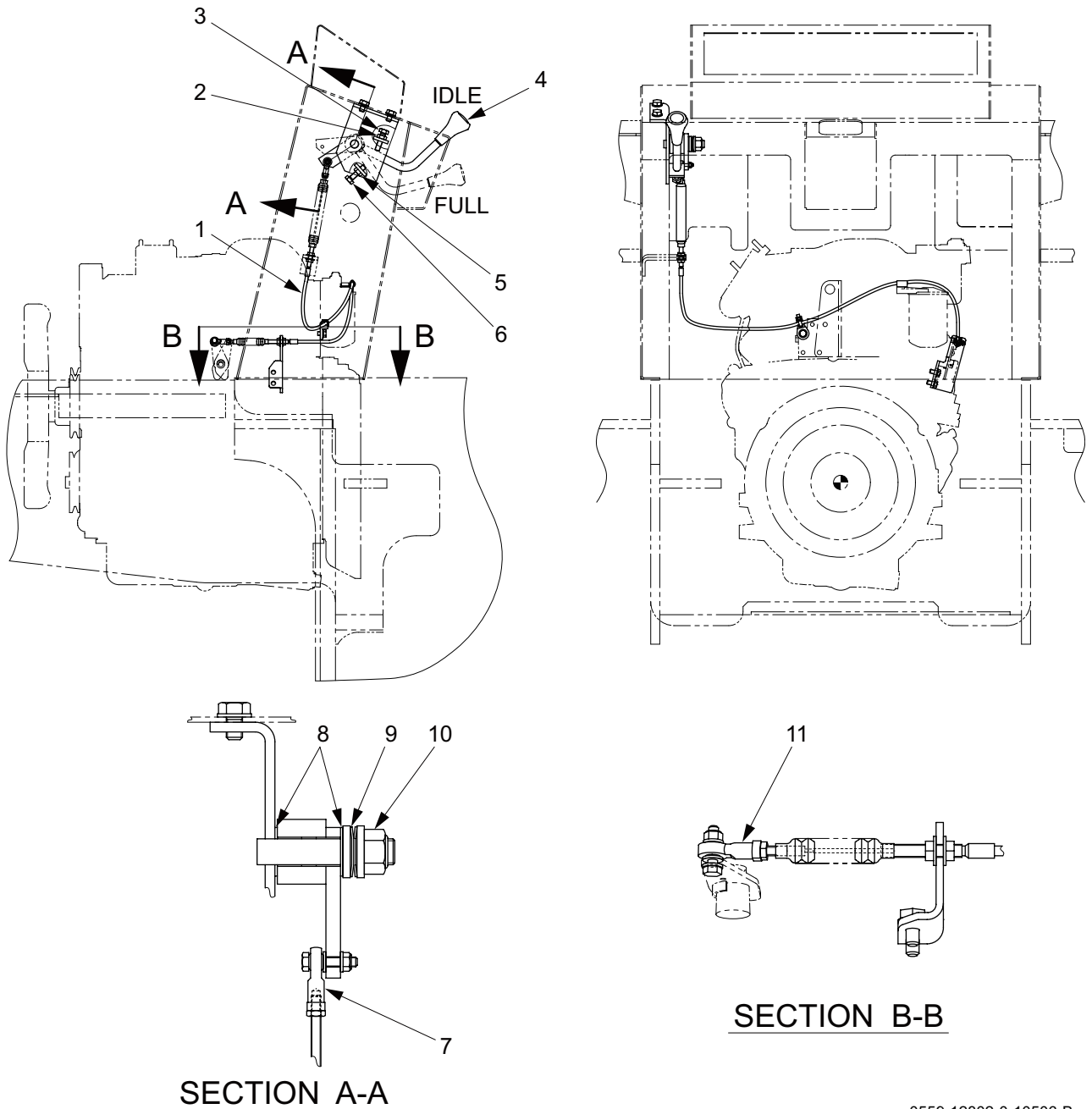
SW652-1-03001

- |                          |                         |                          |
|--------------------------|-------------------------|--------------------------|
| (1) Injection pump       | (8) Engine oil filter   | (15) Oil filler cap      |
| (2) Engine stop solenoid | (9) Oil pressure switch | (16) Speed control lever |
| (3) EGR valve            | (10) Oil drain plug     | (17) Fuel filter         |
| (4) Cooling fan          | (11) Oil level gauge    | (18) Turbocharger        |
| (5) Intake manifold      | (12) Starter motor      | (19) Exhaust manifold    |
| (6) Alternator           | (13) Engine stop lever  | (20) Flywheel            |
| (7) Fan drive pulley     | (14) Fuel supply pump   | (21) Oil pan             |



## 2. CONTROL SYSTEM

### 2-1. Throttle Control



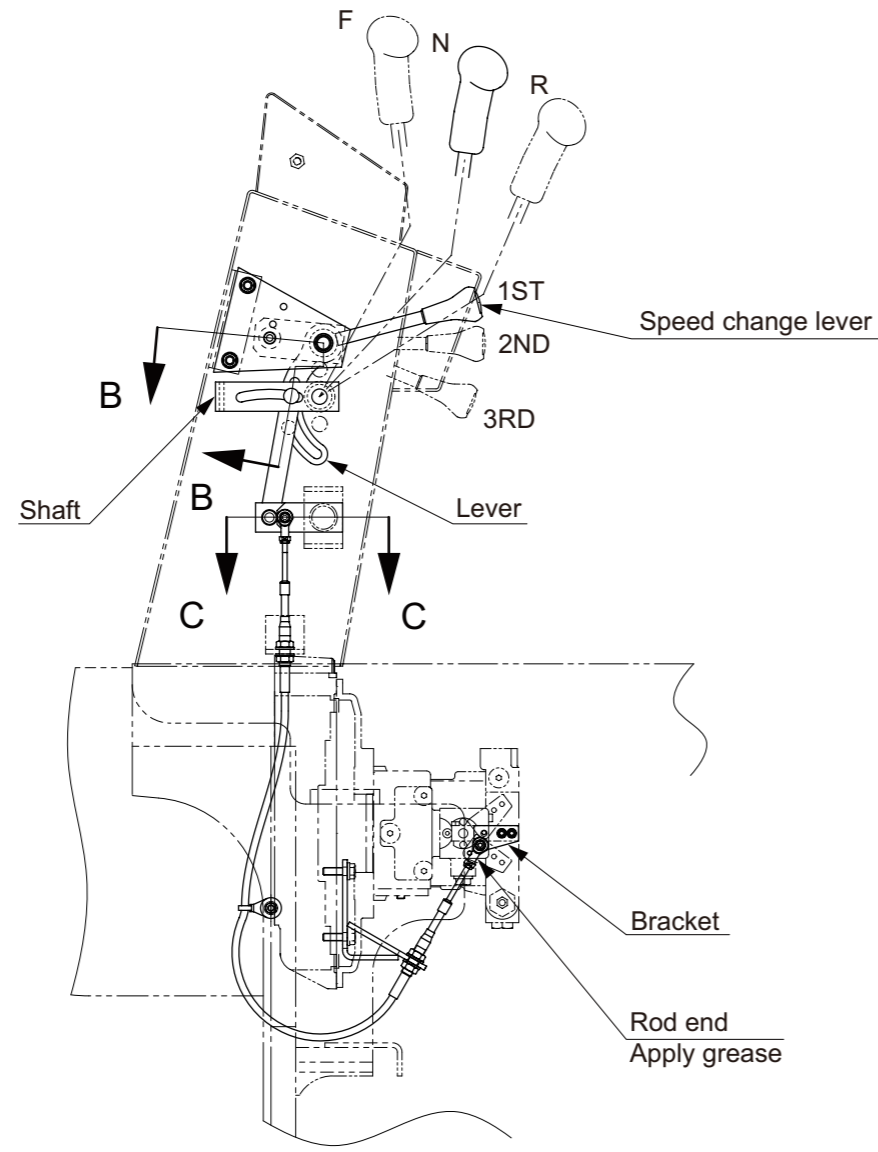
- (1) Control cable
- (2) Lock nut : M10
- (3) Stopper bolt (IDLE) : M10×40
- (4) Throttle lever
- (5) Lock nut : M10
- (6) Stopper bolt (FULL) : M10×40

- (7) Rod end (Apply grease)
- (8) Washer (Apply grease)
- (9) Disc spring (Do not apply grease)
- (10) Nut : M16
- (11) Rod end (Apply grease)

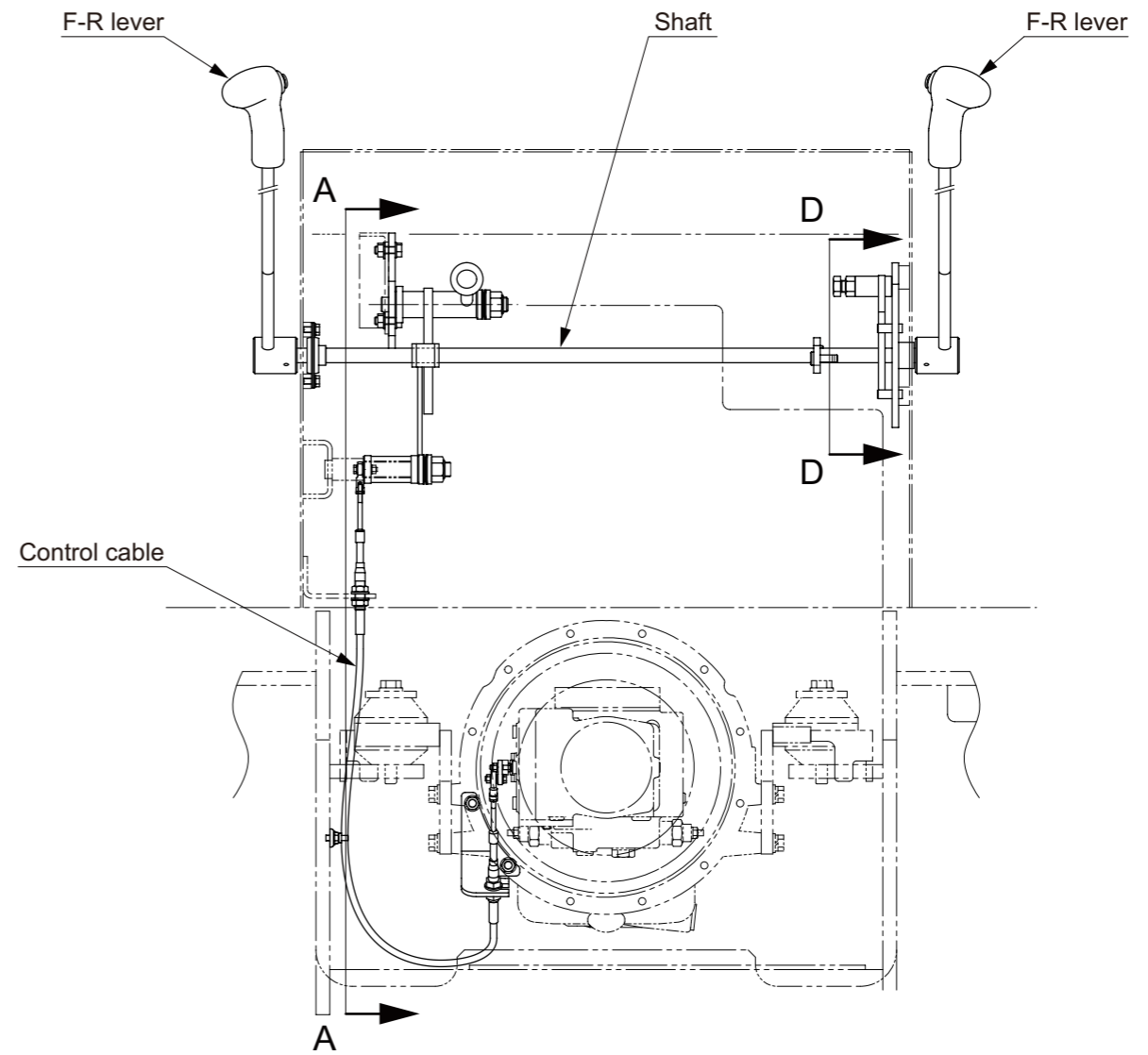
0559-12802-0-10506-B



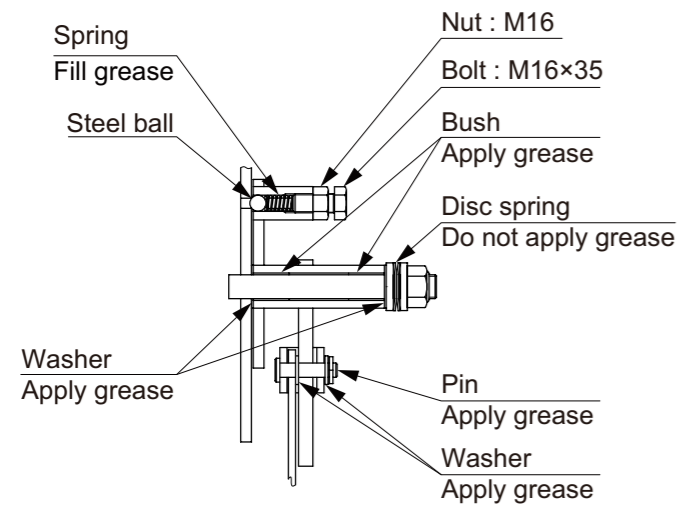
2-2. Forward-reverse Control



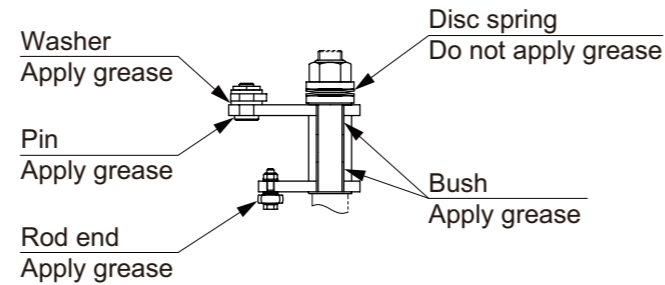
SECTION A-A



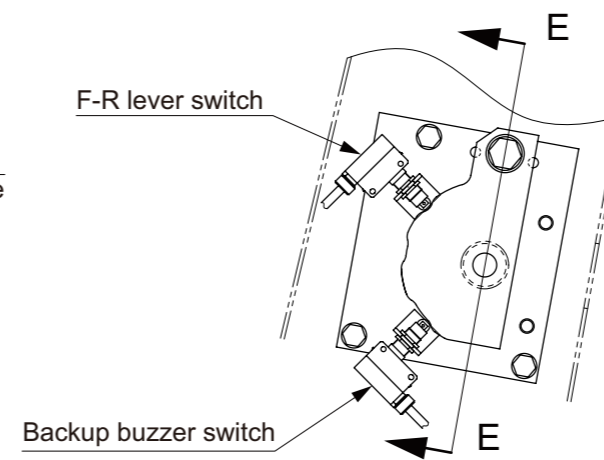
A



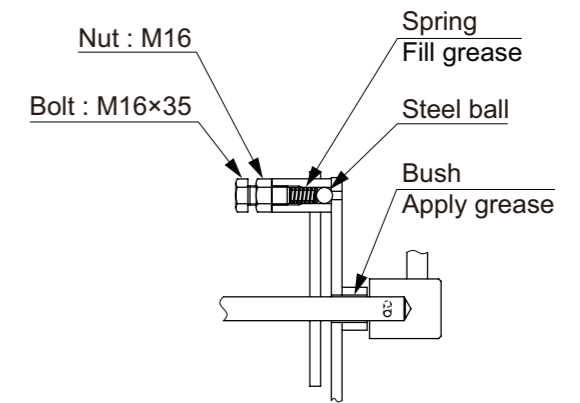
SECTION B-B



SECTION C-C



SECTION D-D

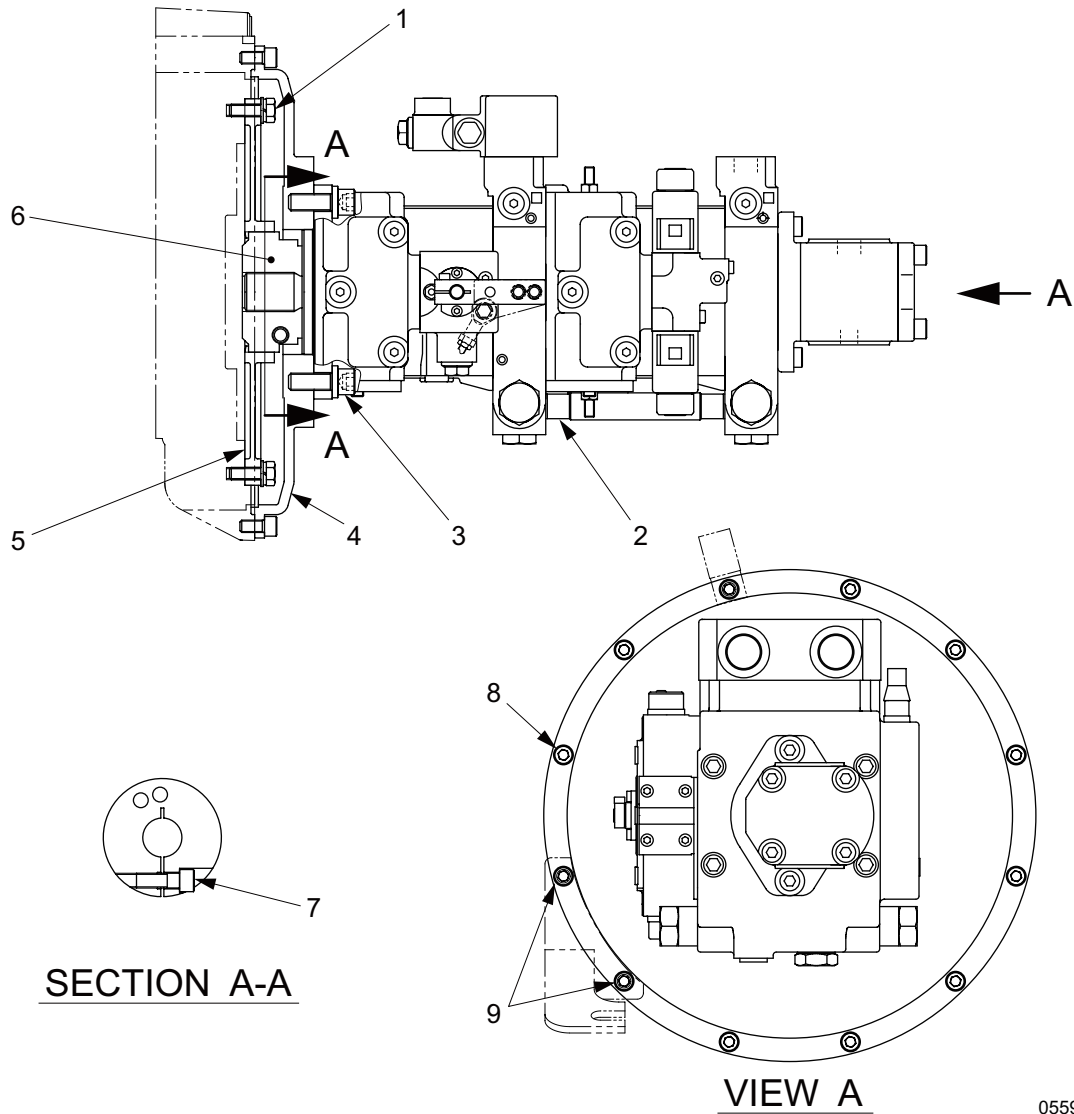


SECTION E-E



### 3. PUMP MOUNT

#### 3-1. Pump Mount



0559-36807-0-10516-A

- (1) Bolt : M10×30 P=1.25  
 (2) Pump  
 (3) Bolt : M14×40  
 (4) Housing  
 (5) Flange

- (6) Hub  
 (7) Bolt : M12×35  
 (8) Bolt : M10×20 P=1.25  
 (9) Bolt : M10×30 P=1.25



- |          |        |        |   |         |   |            |   |
|----------|--------|--------|---|---------|---|------------|---|
| (1) Bolt | M10×30 | P=1.25 | : | 49 N·m  | ( | 36 lbf·ft  | ) |
| (3) Bolt | M14×40 |        | : | 167 N·m | ( | 123 lbf·ft | ) |
| (7) Bolt | M12×35 |        | : | 86 N·m  | ( | 63 lbf·ft  | ) |
| (8) Bolt | M10×20 | P=1.25 | : | 69 N·m  | ( | 51 lbf·ft  | ) |
| (9) Bolt | M10×30 | P=1.25 | : | 69 N·m  | ( | 51 lbf·ft  | ) |


### 3-1-1. Installation of pump

- When the pump has been removed from the engine for repair or replacement, reinstall it in accordance with the following procedure.


- ① Apply adequate amount of lithium-based grease to pump (2) and hub (6) splines.
- ② Set hub (6) on pump (2) to the specified dimension.

★ Specified dimension a: 2 mm (0.08 in.)


- ③ Secure hub (6) with bolts (7).

 (7) Bolt M12×35 : 86 N·m (63 lbf·ft)

- ④ Secure housing (4) to pump (2) with two bolts (3) and washers.



 (3) Bolt M14×40 : 167 N·m (123 lbf·ft)

- ⑤ Secure flange (5) to engine flywheel with eight bolts (1), spring washers, and washers.

 (1) Bolt M10×30 P=1.25 : 49 N·m (36 lbf·ft)

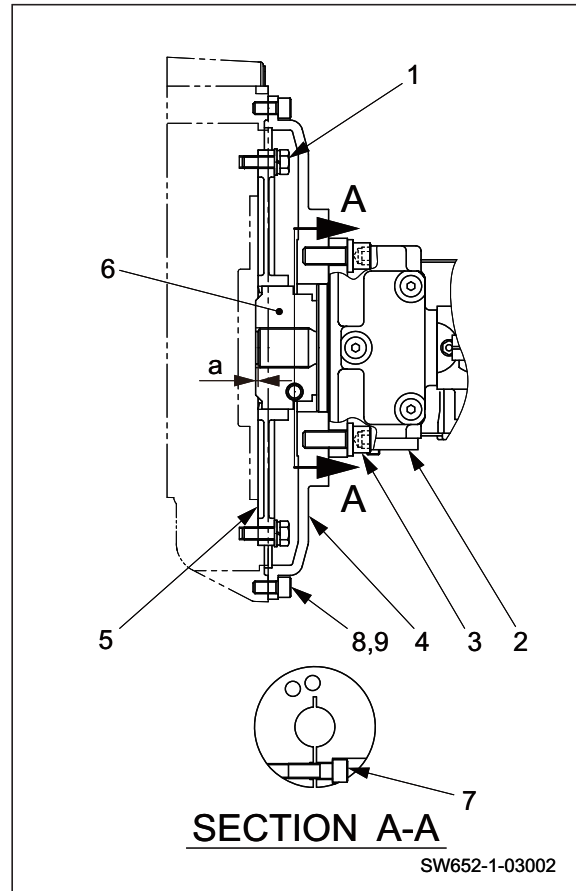
- ⑥ Engage hub (6) with flange (5).

- ⑦ Secure pump subassembly to engine with ten bolts (8) and two bolts (9).

 (8) Bolt M10×20 P=1.25 : 69 N·m (51 lbf·ft)  
 (9) Bolt M10×30 P=1.25 : 69 N·m (51 lbf·ft)

**(NOTICE)**

- Bolts (1), (8), and (9) are treated with thread-locking fluid. Use new thread-locking fluid treated bolts for installation.



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# **HYDRAULIC SYSTEMS**

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# 1. SYSTEM CIRCUIT DIAGRAM

## 1-1. Graphic Symbols for Hydraulic Circuits

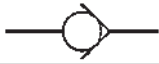

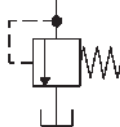

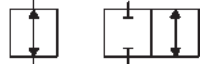
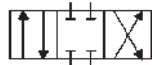

### Basic Symbols

DESCRIPTION	SYMBOL
Lines:	
Main working	
Pilot control	
Drain or bleed	
Lines, joining	
Not connected	
Component outline	
Arrow indicates direction of flow.	
Line with fixed restriction (orifice).	
Test port, pressure measurement.	
Temperature measurement gauge	
Pressure measurement gauge	
Reservoir (vented)	
Filter or strainer	
Heat exchanger, lines indicate flow of coolant.	
Quick disconnect:	
Connected with mechanically opened checks.	
Disconnected.	
Sloping arrow through a symbol at 45° indicates that a component can be adjusted or varied.	


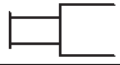

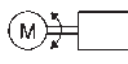
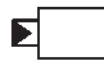

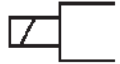


### Pump, Motors and Cylinders

DESCRIPTION	SYMBOL
Hydraulic pumps:	
Fixed displacement	
Unidirectional	
Bidirectional	
Variable displacement	
Unidirectional	
Bidirectional	
Variable displacement pressure compensated Unidirectional	
Hydraulic Motor:	
Unidirectional	
Bidirectional	
Double acting hydraulic cylinder	
Differential cylinder	
Electric motor	

**Valves**

DESCRIPTION	SYMBOL
Check valve	
Manual shut off (On-Off)	
Pressure relief	
Flow control, adjustable	
Valve symbols: The basic valve symbol one or more squares with lines representing flow paths and flow conditions between ports.	
Multiple squares indicate a valve with as many distinct positions there are squares providing various flow path options for the fluid. The multiple square moves to represent how flow paths change when the valving element is shifted within the component.	
Valves with infinite positioning between certain limits are symbolized with lines parallel to the squares.	

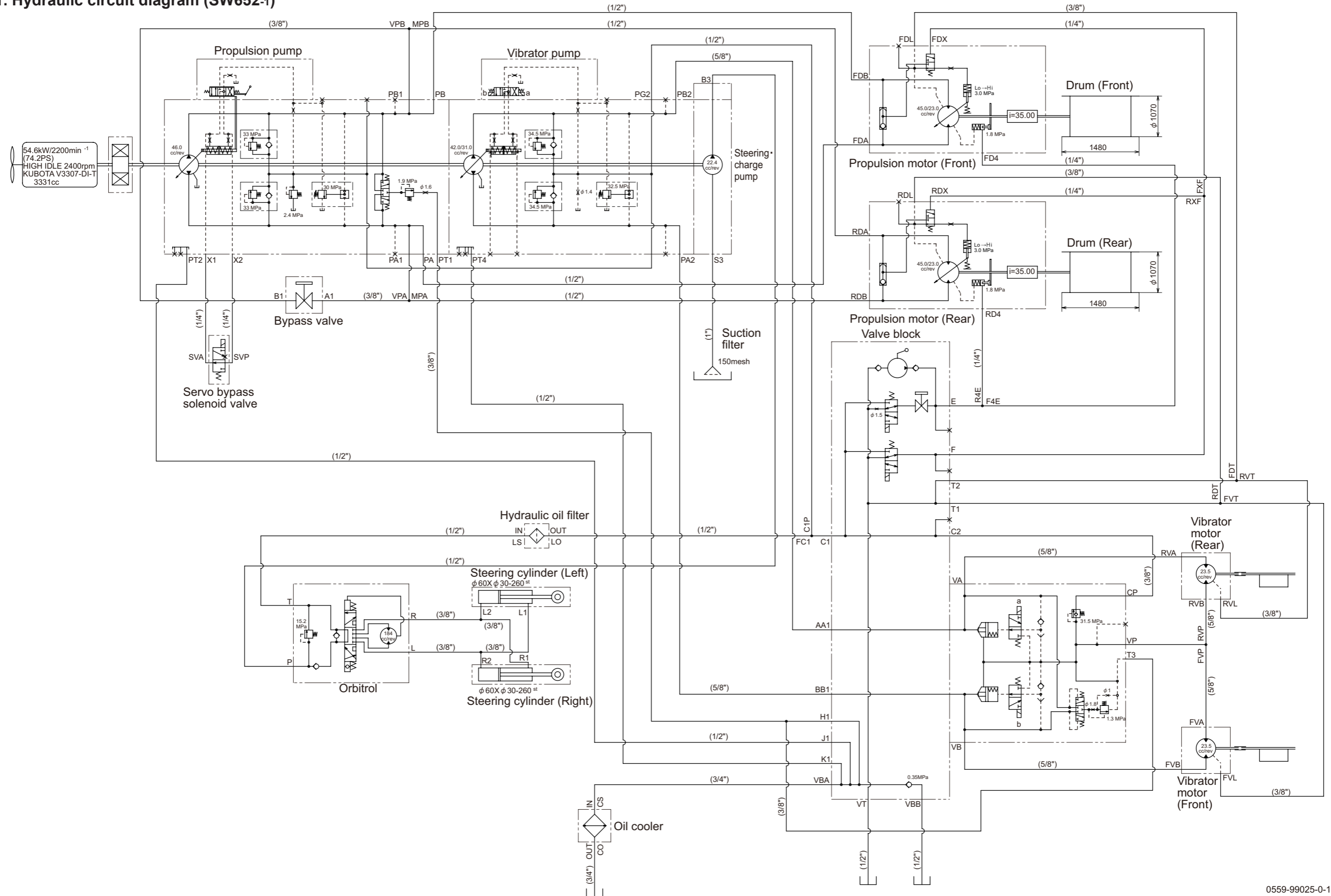
**Methods of Operation**

DESCRIPTION	SYMBOL
Spring	
Manual	
Pressure compensated	
Reversing motor	
Pilot pressure: Internal supply	
Remote supply	
Solenoid: Single winding	
Two windings operating in opposite directions.	
Pilot directional valve is actuated by the solenoid.	



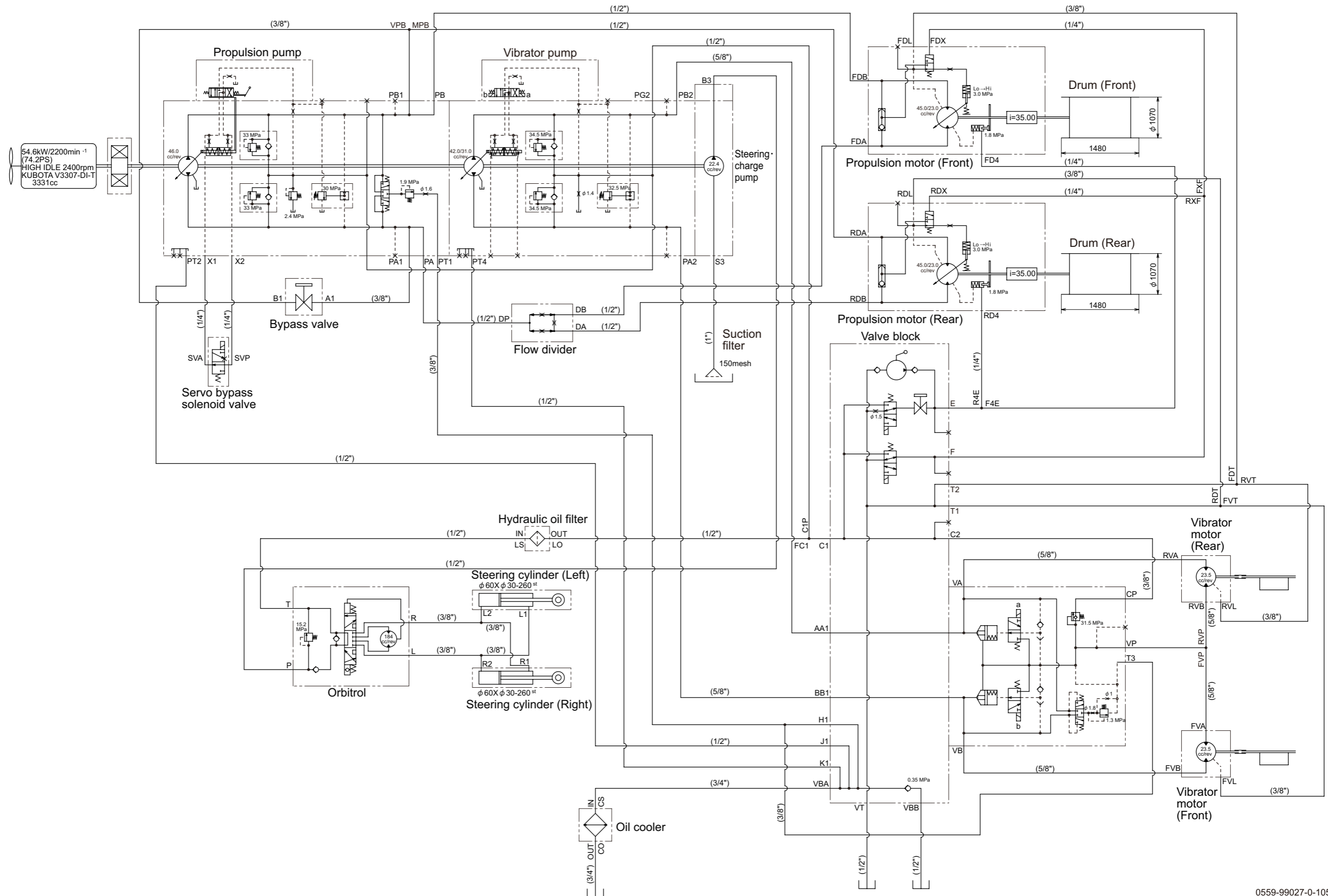
## 1-2. Hydraulic Circuit Diagram

### 1-2-1. Hydraulic circuit diagram (SW652-1)





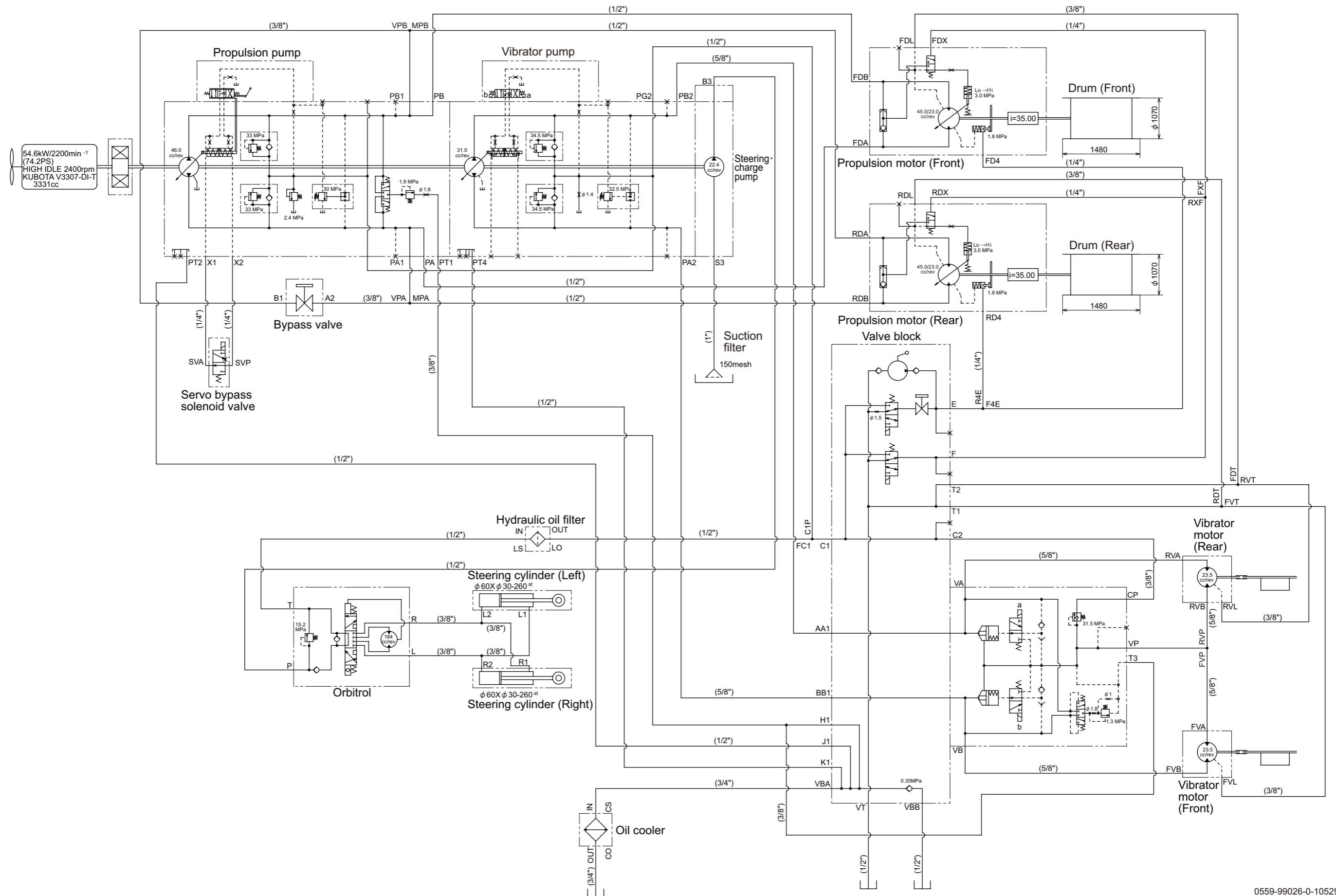
1-2-2. Hydraulic circuit diagram (SW652B-1)







1-2-3. Hydraulic circuit diagram (SW652ND-1)

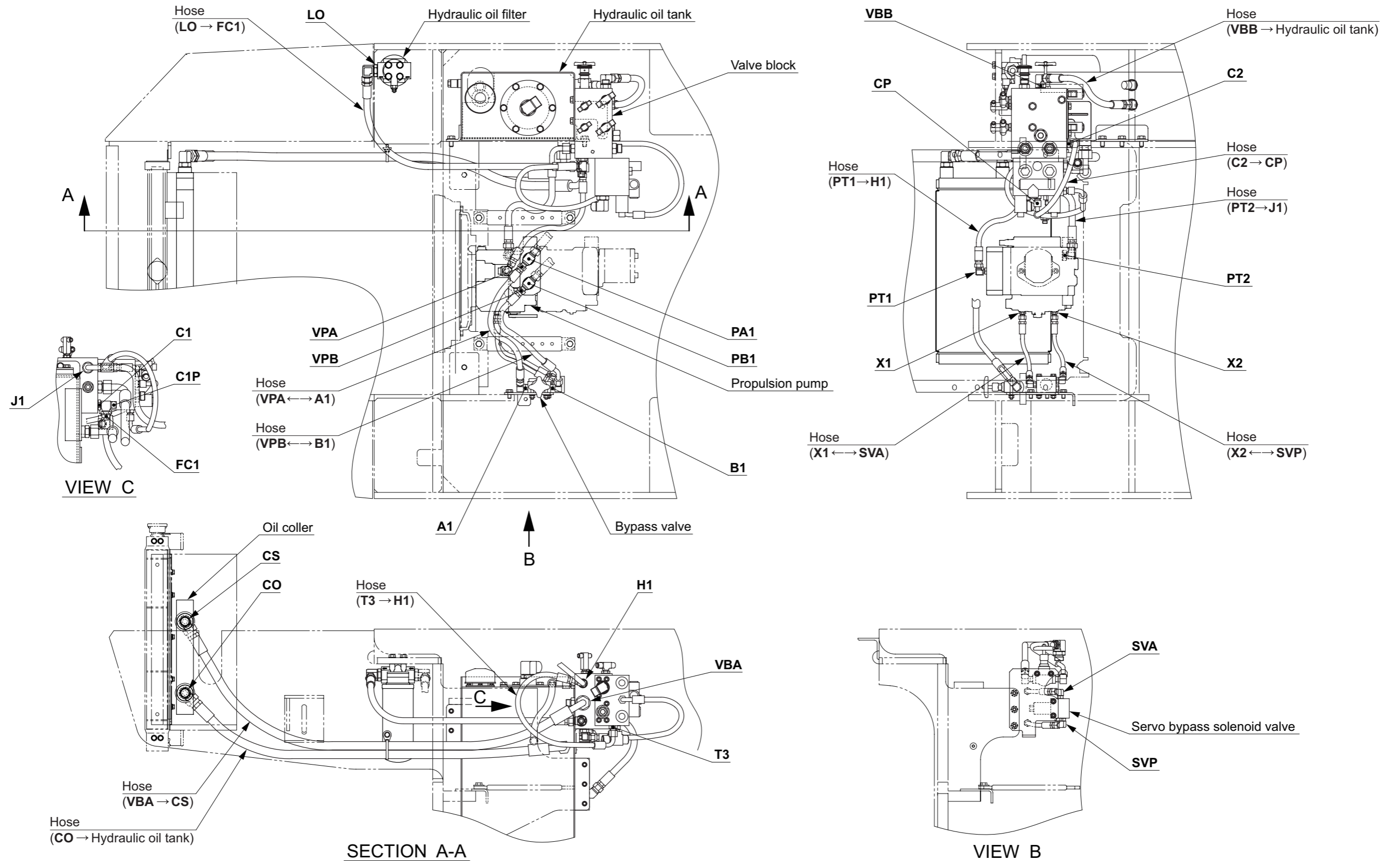




## 2. PROPULSION HYDRAULIC SYSTEM

### 2-1. Propulsion Hydraulic Piping

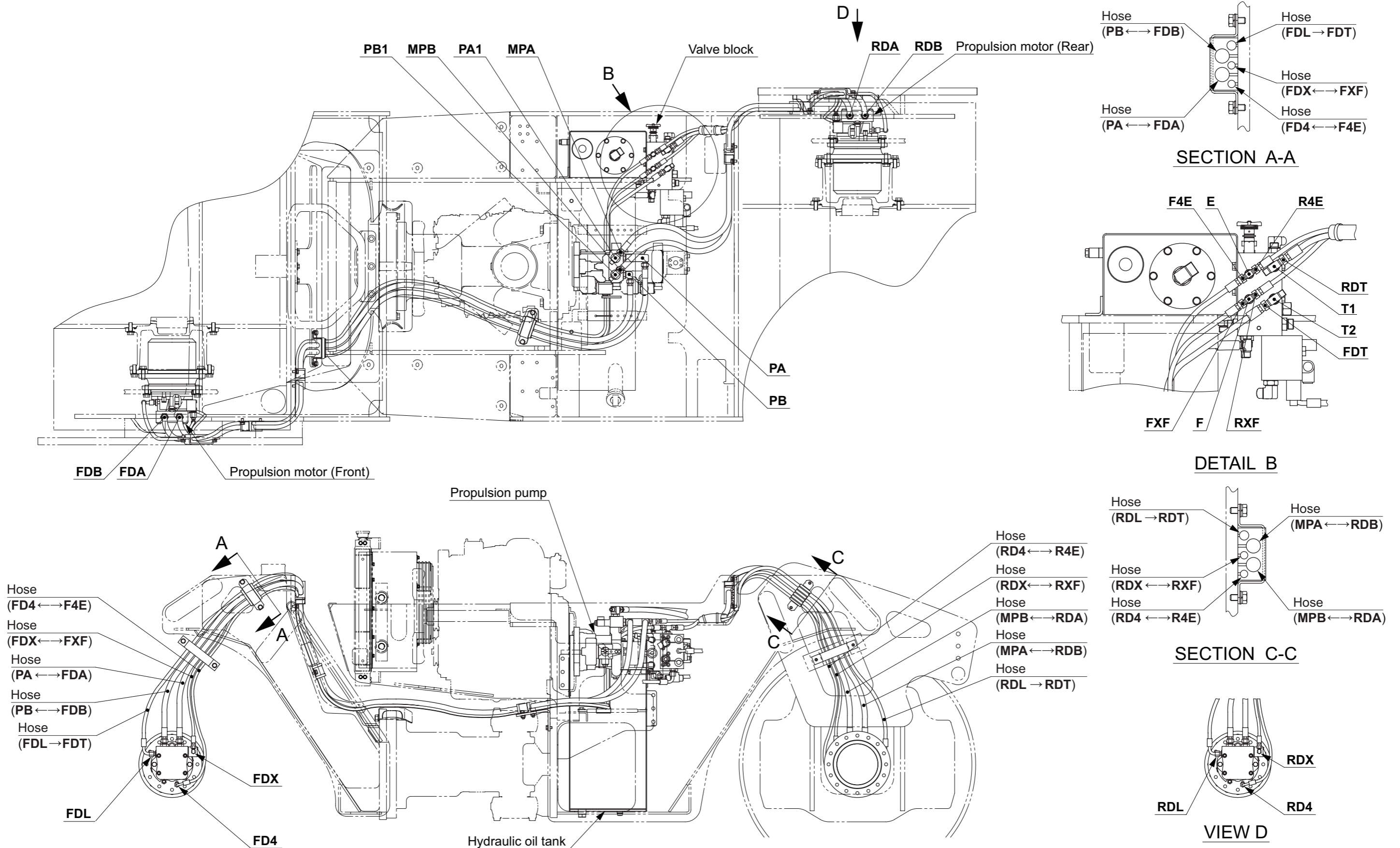
#### 2-1-1. Propulsion hydraulic piping (1)



• The letters and figures (such as VBA and CS) show each port and the arrow (←→;→) symbols show the hose connection and the direction of the flow of the oil.



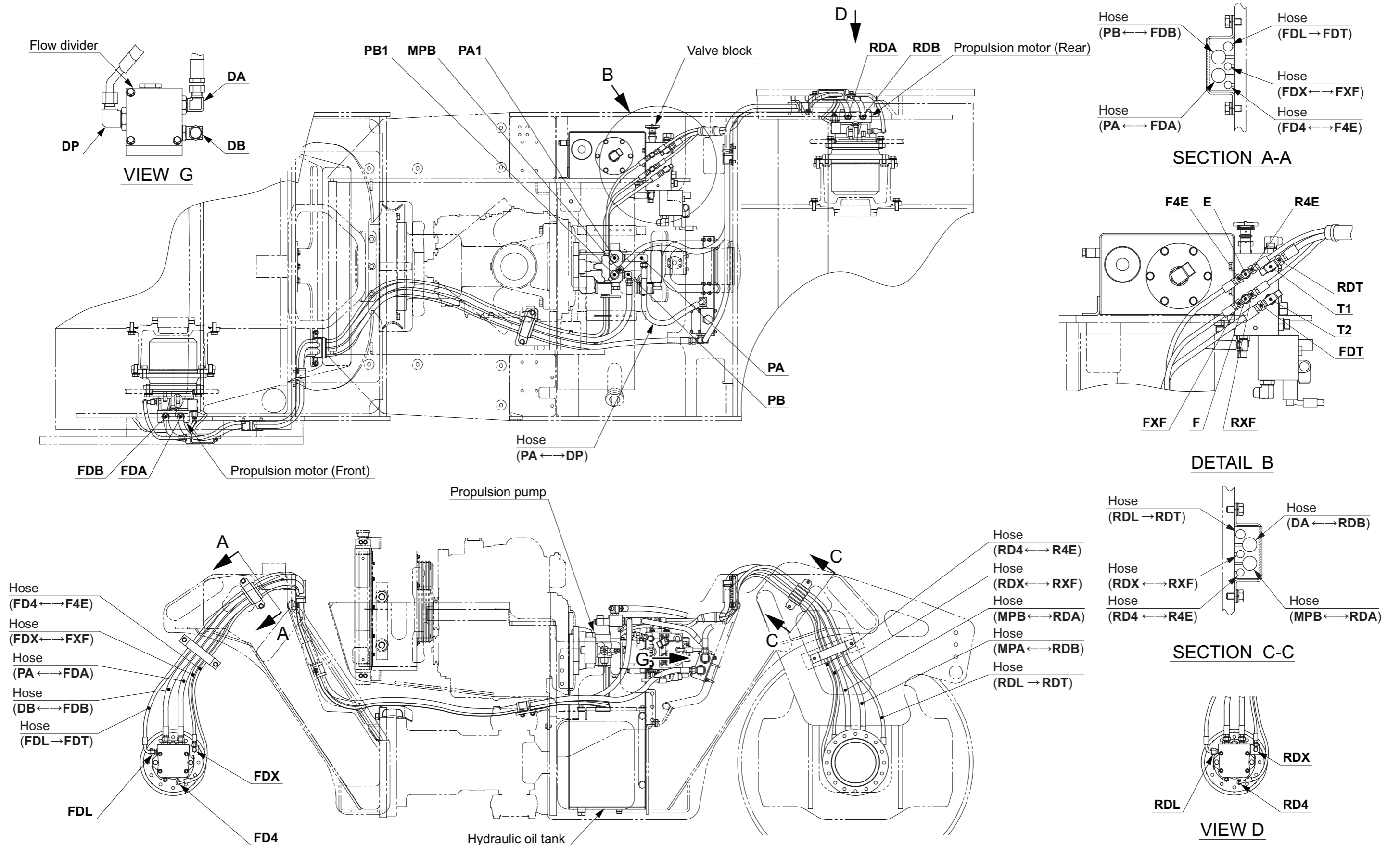
2-1-2. Propulsion hydraulic piping (2) (SW652-1, SW652ND-1)



• The letters and figures (such as FDL and FDT) show each port and the arrow (←→; →) symbols show the hose connection and the direction of the flow of the oil.



2-1-3. Propulsion hydraulic piping (2) (SW652B-1)



• The letters and figures (such as FDL and FDT) show each port and the arrow (←→; →) symbols show the hose connection and the direction of the flow of the oil.

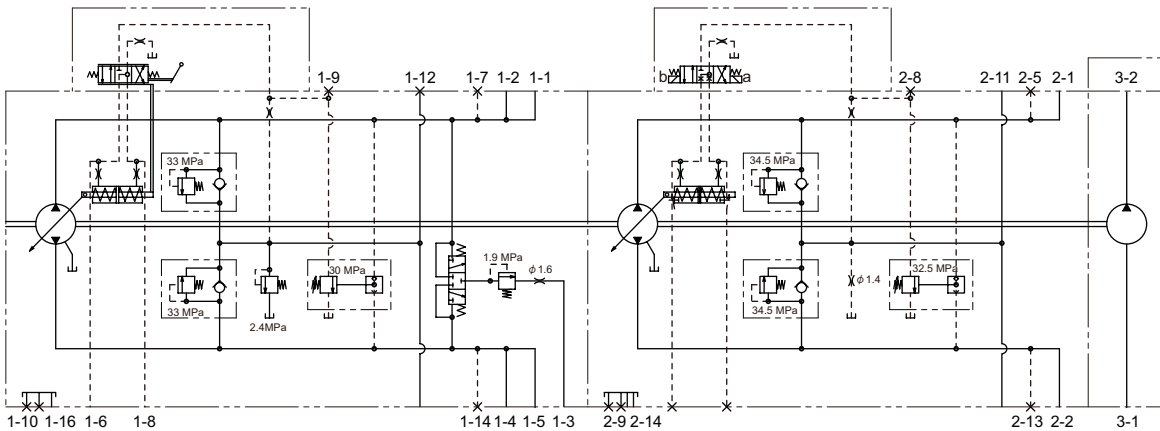
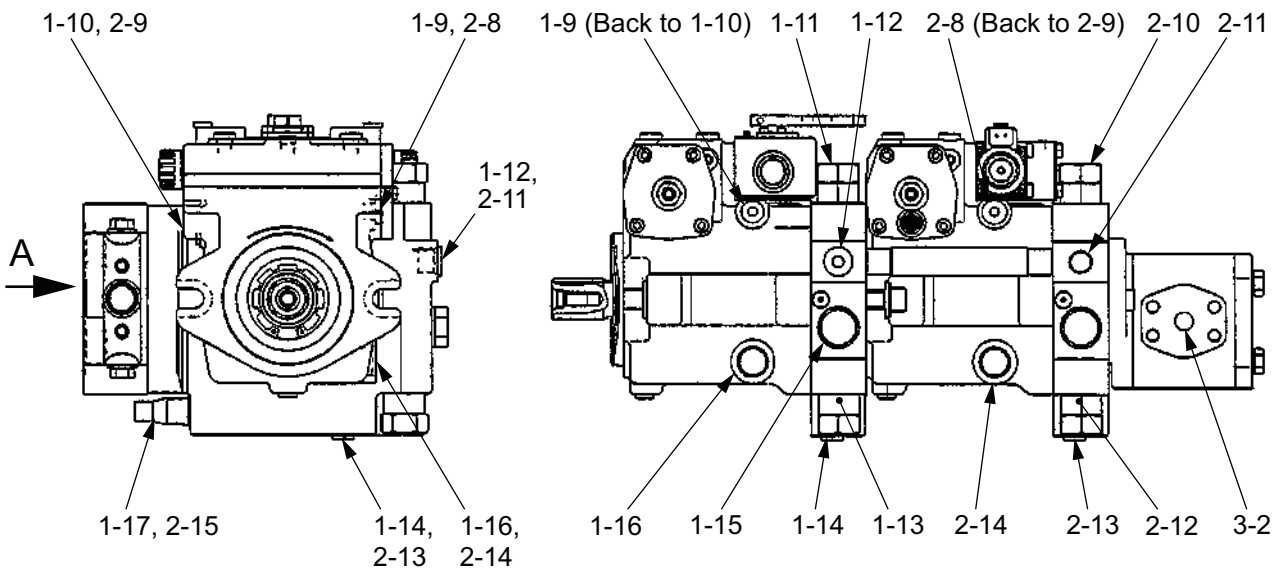
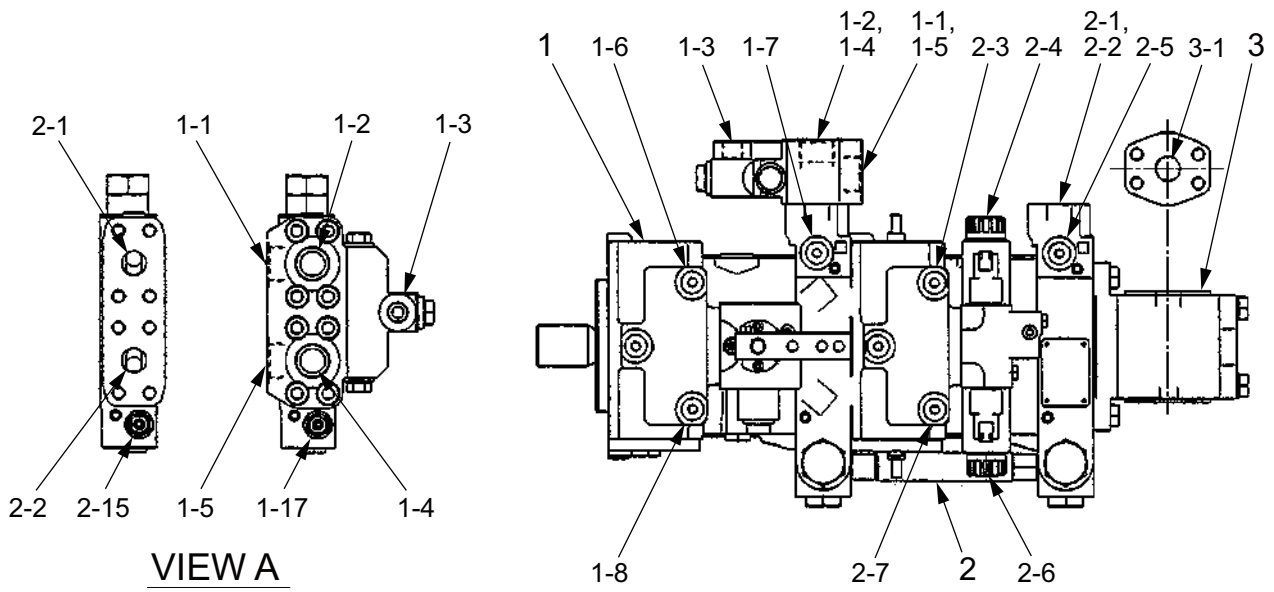






## 2-2. Hydraulic Component Specifications

### 2-2-1. Hydraulic pump assembly (propulsion + vibrator + steering)



Pump circuit diagram

(1) Propulsion pump

(1-1) Port B (Forward)	<b>[PB]</b>	: 1 1/16-12UN
(1-2) Port B1 (Forward)	<b>[PB1]</b>	: 1 1/16-12UN
(1-3) Drain port	<b>[PT1]</b>	: 9/16-18UNF
(1-4) Port A1 (Reverse)	<b>[PA1]</b>	: 1 1/16-12UN
(1-5) Port A (Reverse)	<b>[PA]</b>	: 1 1/16-12UN
(1-6) Servo pressure gauge port	<b>[X1]</b>	: 7/16-20UNF
(1-7) High pressure gauge port (For port B)		: 7/16-20UNF
(1-8) Servo pressure gauge port	<b>[X2]</b>	: 7/16-20UNF
(1-9) Control pressure port		: 9/16-18UNF
(1-10) Drain port or Filler port		: 7/8-14UNF
(1-11) High pressure relief valve (For port B)		
(1-12) Charge pressure gauge port		: 3/4-16UNF
(1-13) High pressure relief valve (For port A)		
(1-14) High pressure gauge port (For port A)		: 7/16-20UNF
(1-15) Charge relief valve		
(1-16) Drain port	<b>[PT2]</b>	: 7/8-14UNF
(1-17) Cut off valve		

Specifications

• Displacement	:	46 cm <sup>3</sup> /rev ( 2.8 cu.in./rev )
• High pressure relief valve pressure setting	:	33.0 MPa ( 4,785 psi )
• Charge relief valve pressure setting	:	2.4 MPa ( 348 psi )
• Cut off valve pressure setting	:	30.0 MPa ( 4,350 psi )

(2) Vibrator pump

(2-1) Port B2 (Low amplitude/Horizontal)	<b>[PB2]</b>	: SAE 3/4"
(2-2) Port A2 (High amplitude/Normal)	<b>[PA2]</b>	: SAE 3/4"
(2-3) Servo pressure gauge port		: 7/16-20UNF
(2-4) Solenoid valve a (High amplitude/Normal)		
(2-5) High pressure gauge port (For port B)		: 7/16-20UNF
(2-6) Solenoid valve b (Low amplitude/Horizontal)		
(2-7) Servo pressure gauge port		: 7/16-20UNF
(2-8) Control pressure port		: 9/16-18UNF
(2-9) Drain port or Filler port		: 7/8-14UNF
(2-10) High pressure relief valve (For port B)		
(2-11) Charge pressure gauge port	<b>[PG2]</b>	: 3/4-16UNF
(2-12) High pressure relief valve (For port A)		
(2-13) High pressure gauge port (For port A)		: 7/16-20UNF
(2-14) Drain port	<b>[PT4]</b>	: 7/8-14UNF
(2-15) Cut off valve		

Specifications

• Displacement		
SW652-1, SW652B-1 (Low amplitude)	:	42.0 cm <sup>3</sup> /rev ( 2.6 cu.in./rev )
(High amplitude)	:	31.0 cm <sup>3</sup> /rev ( 1.9 cu.in./rev )
SW652ND-1	:	31.0 cm <sup>3</sup> /rev ( 1.9 cu.in./rev )
• High pressure relief valve pressure setting	:	34.5 MPa ( 5,003 psi )
• Cut off valve pressure setting	:	32.5 MPa ( 4,713 psi ) (at 20 L/min)

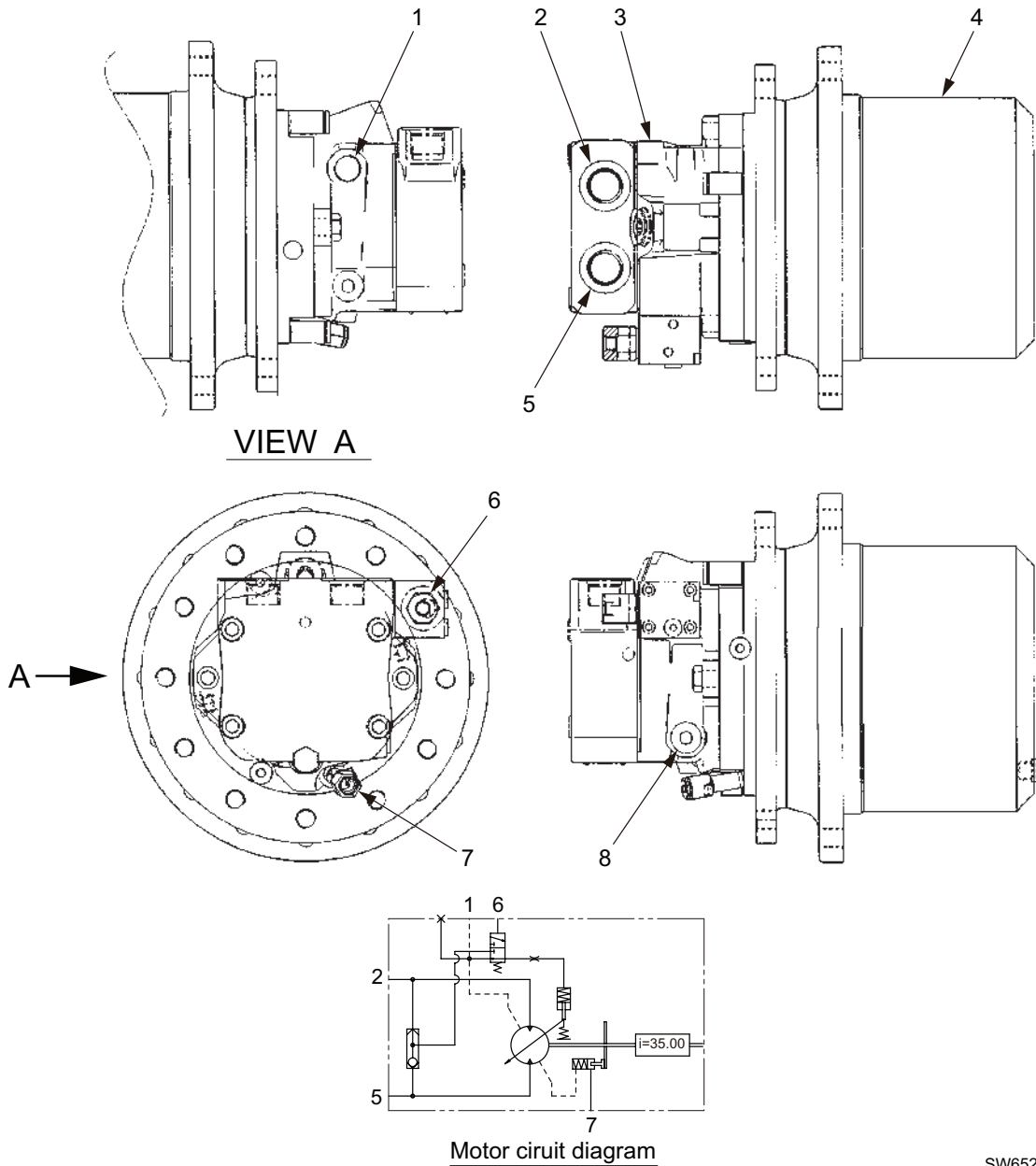
(3) Steering pump

(3-1) Discharge port	<b>[S3]</b>	: SAE 3/4"
(3-2) Suction port	<b>[B3]</b>	: SAE 3/4"

Specifications

• Displacement	:	22.4 cm <sup>3</sup> /rev ( 1.4 cu.in./rev )
• Allowable pump case pressure	:	0.4 MPa ( 58.0 psi ) or less
• Pump assembly weight	:	60 kg ( 132 lbs. )

2-2-2. Propulsion hydraulic motor



SW652-1-04002

- |                    |                                   |                         |                                   |
|--------------------|-----------------------------------|-------------------------|-----------------------------------|
| (1) Drain port     | <b>[FDL] [RDL]</b> : 7/8-14UNF    | (5) Port A              | <b>[FDA] [RDA]</b> : 1 1/16-12UNF |
| (2) Port B         | <b>[FDB] [RDB]</b> : 1 1/16-12UNF | (6) Pilot pressure port | <b>[FDX] [RDX]</b> : 7/16-20UNF   |
| (3) Motor          |                                   | (7) Brake release port  | <b>[FD4] [RD4]</b> : G1/4         |
| (4) Reduction gear |                                   | (8) Drain port          | : 7/8-14UNF                       |

Motor specifications

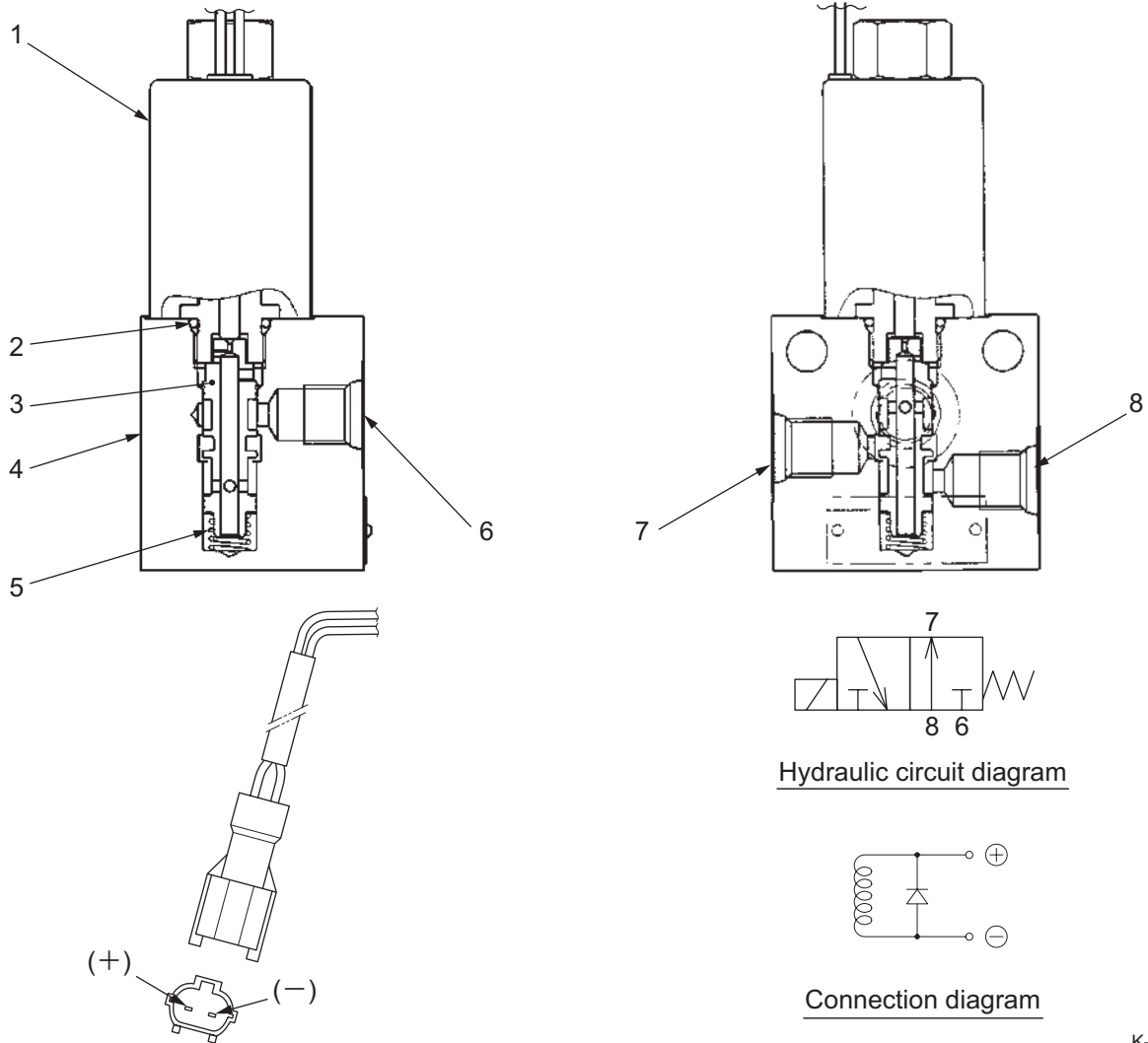
- Displacement (max) : 45.0 cm<sup>3</sup>/rev ( 2.8 cu.in./rev )
- Displacement (min) : 23.0 cm<sup>3</sup>/rev ( 1.4 cu.in./rev )
- Maximum working pressure : 30.0 MPa ( 4,350 psi )
- Allowable motor case pressure : 0.4 MPa ( 58.0 psi ) or less
- Brake release pressure : More than 1.8 MPa ( 261 psi )
- Speed change pressure : 2.4 MPa ( 348 psi )

Reduction gear specifications

- Reduction ratio : 1/35.000

- Weight : 60 kg ( 132 lbs. )

2-2-3. Servo bypass solenoid valve



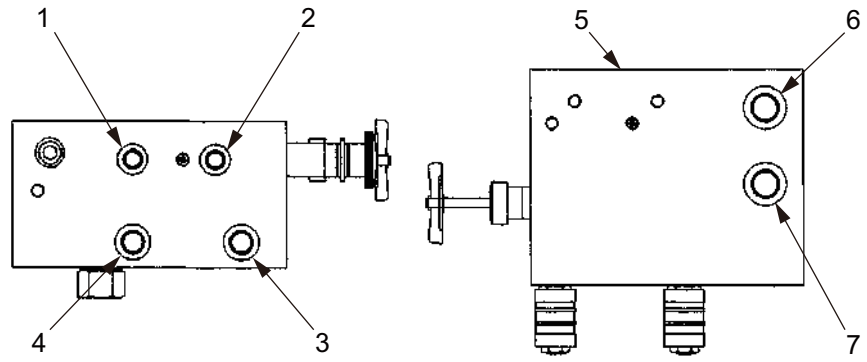
- (1) Solenoid
- (2) O-ring (1B P14)
- (3) Spool (K)
- (4) Body
- (5) Spring
- (6) Port T : G1/4
- (7) Port A **[SVA]** : G1/4
- (8) Port P **[SVP]** : G1/4

Specifications

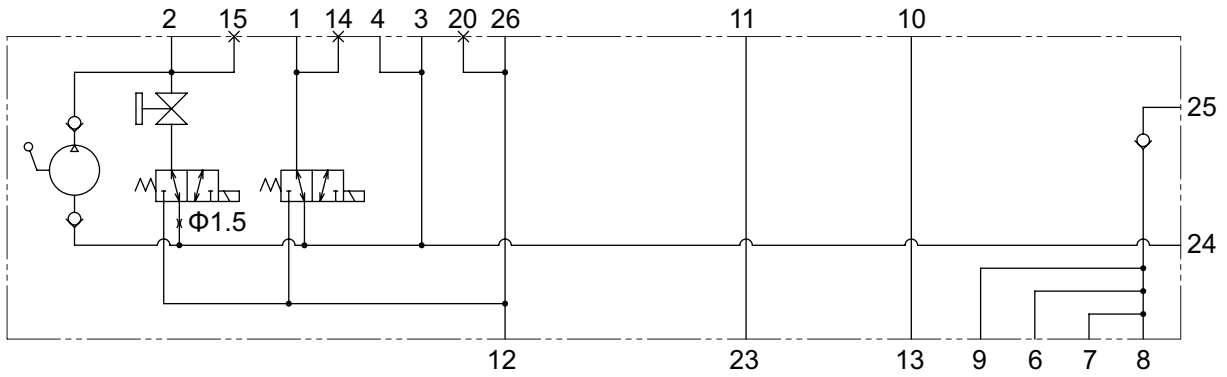
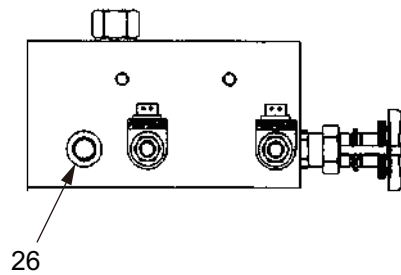
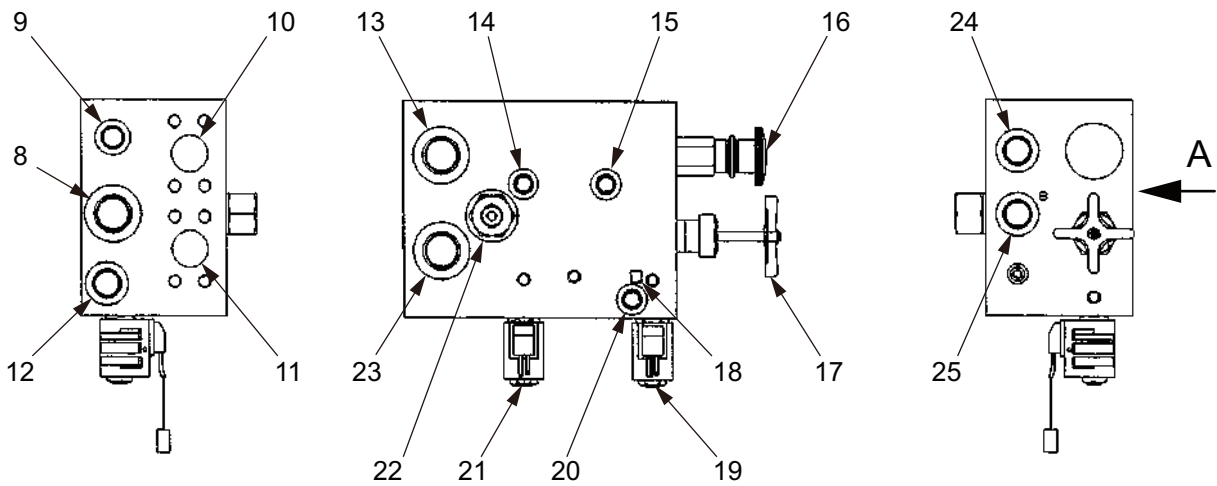
- Rated pressure : 4.9 MPa ( 711 psi ) (7, 8)
- : 0.5 MPa ( 72.5 psi ) (6)
- Rated flow : 30 L/min ( 7.9 gal./min )
- Weight : 1.5 kg ( 3.3 lbs. )

K-40026

2-2-4. Valve block



VIEW A



Hydraulic diagram

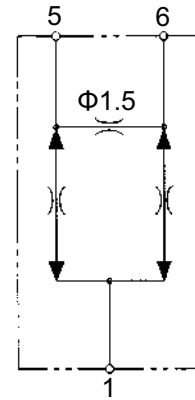
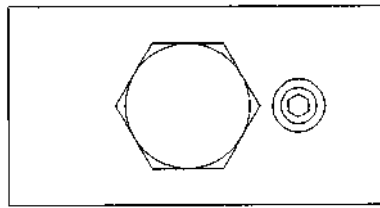
SW652-1-04004

(1) Port F	[F]	: G1/4
(2) Port E	[E]	: G1/4
(3) Port T1	[T1]	: G3/8
(4) Port T2	[T2]	: G3/8
(5) Block		
(6) Port J1	[J1]	: G1/2
(7) Port K1	[K1]	: G1/2
(8) Port A	[VBA]	: G3/4
(9) Port H1	[H1]	: G3/8
(10) Port B1		: $\Phi$ 19
(11) Port A1		: $\Phi$ 19
(12) Port C1	[C1]	: G1/2
(13) Port BB1	[BB1]	: G3/4
(14) Port L		: G1/4
(15) Port M		: G1/4
(16) Hand pump		
(17) Stop valve		
(18) Orifice plug		: $\Phi$ 1.5
(19) Solenoid valve (Parking brake)		
(20) Port N		: G1/4
(21) Solenoid valve (Speed change)		
(22) Check valve		
(23) Port AA1	[AA1]	: G3/4
(24) Port T	[VT]	: G1/2
(25) Port B	[VBB]	: G1/2
(26) Port C2	[C2]	: G3/8

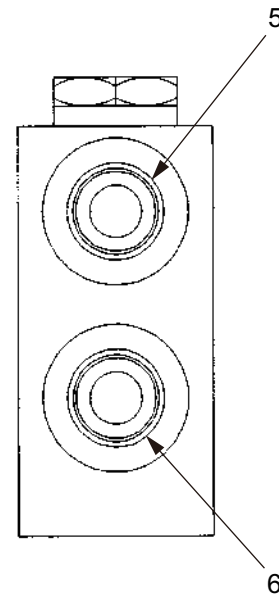
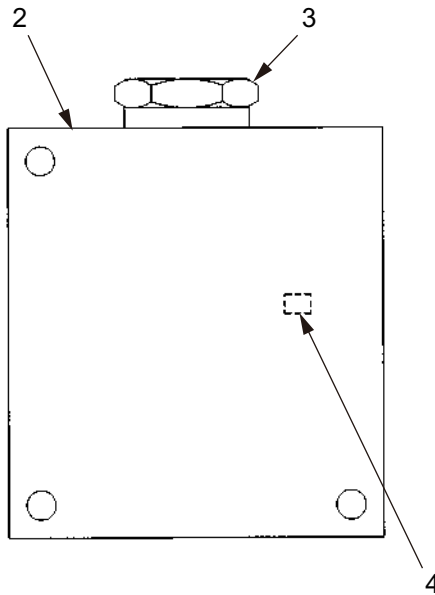
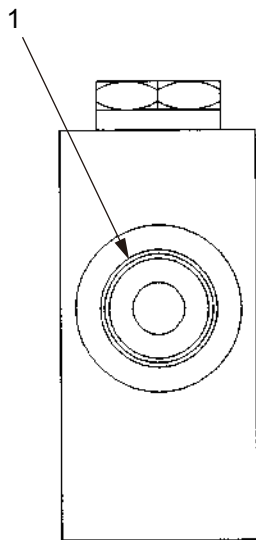
Specifications

- Maximum working pressure : 25 MPa ( 3,625 psi ) (6 to 9, 24, 25)  
 : 35 MPa ( 5,075 psi ) (1 to 4, 10 to 15, 20, 23, 26)
- Maximum flow : 50 L/min ( 13.2 gal./min ) (6 to 9, 24, 25)  
 : 10 L/min ( 2.6 gal./min ) (1 to 4, 10 to 15, 20, 23, 26)
- Hand pump displacement : 5.7 mL/stroke ( 0.0015 gal./stroke )
- Weight : 13 kg ( 29 lbs. )

2-2-5. Flow divider



Hydraulic circuit diagram



SW652-1-04003

- (1) Port P      **[DP]** : G1
- (2) Block
- (3) Valve
- (4) Orifice plug      :  $\Phi 1.5$
- (5) Port A      **[DA]** : G3/4
- (6) Port B      **[DB]** : G3/4

Specifications

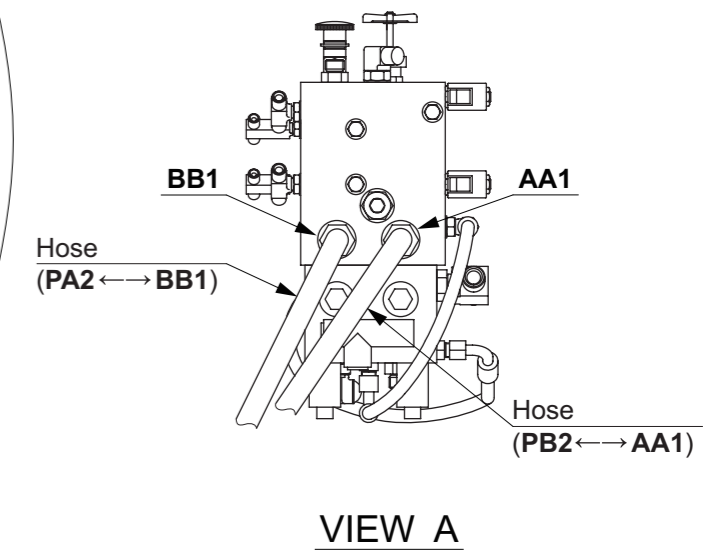
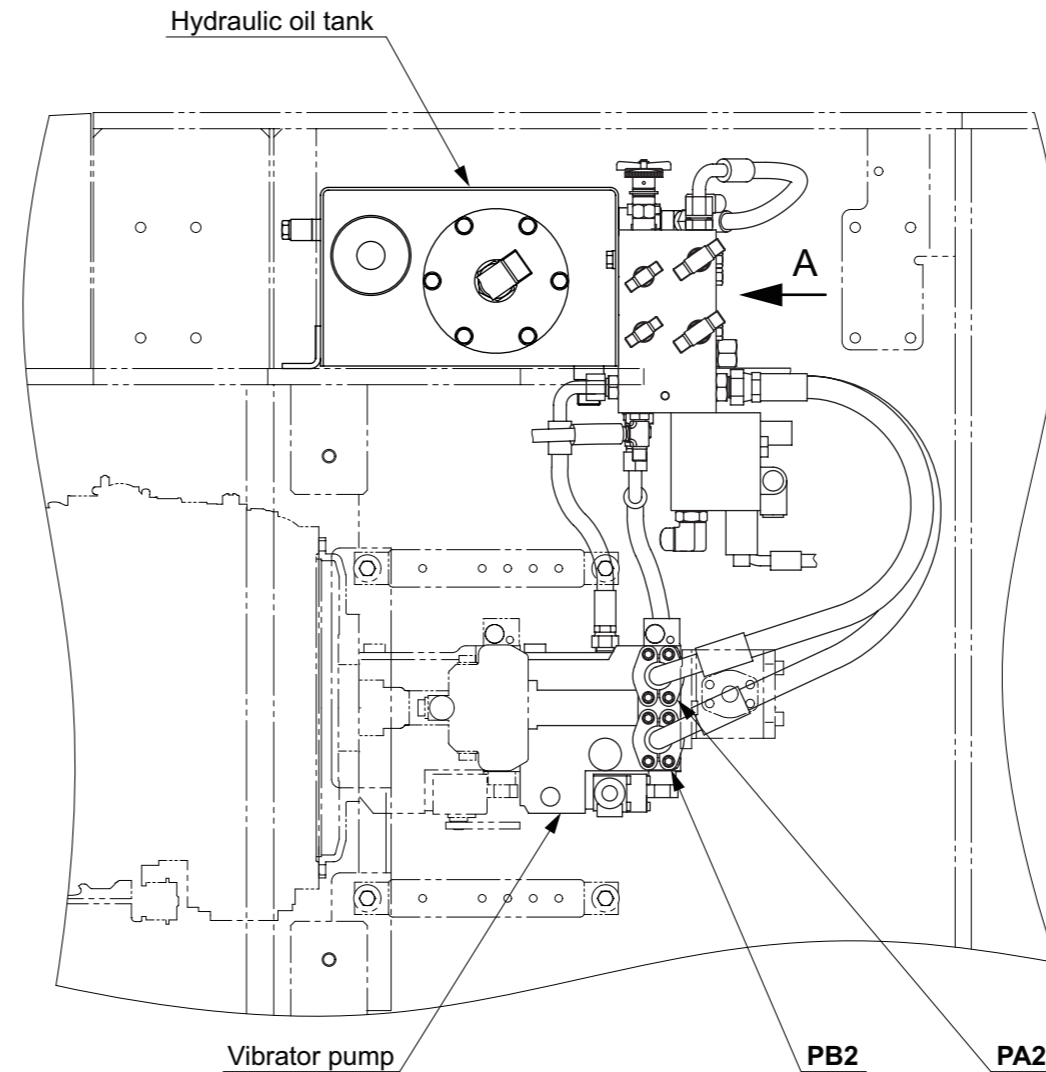
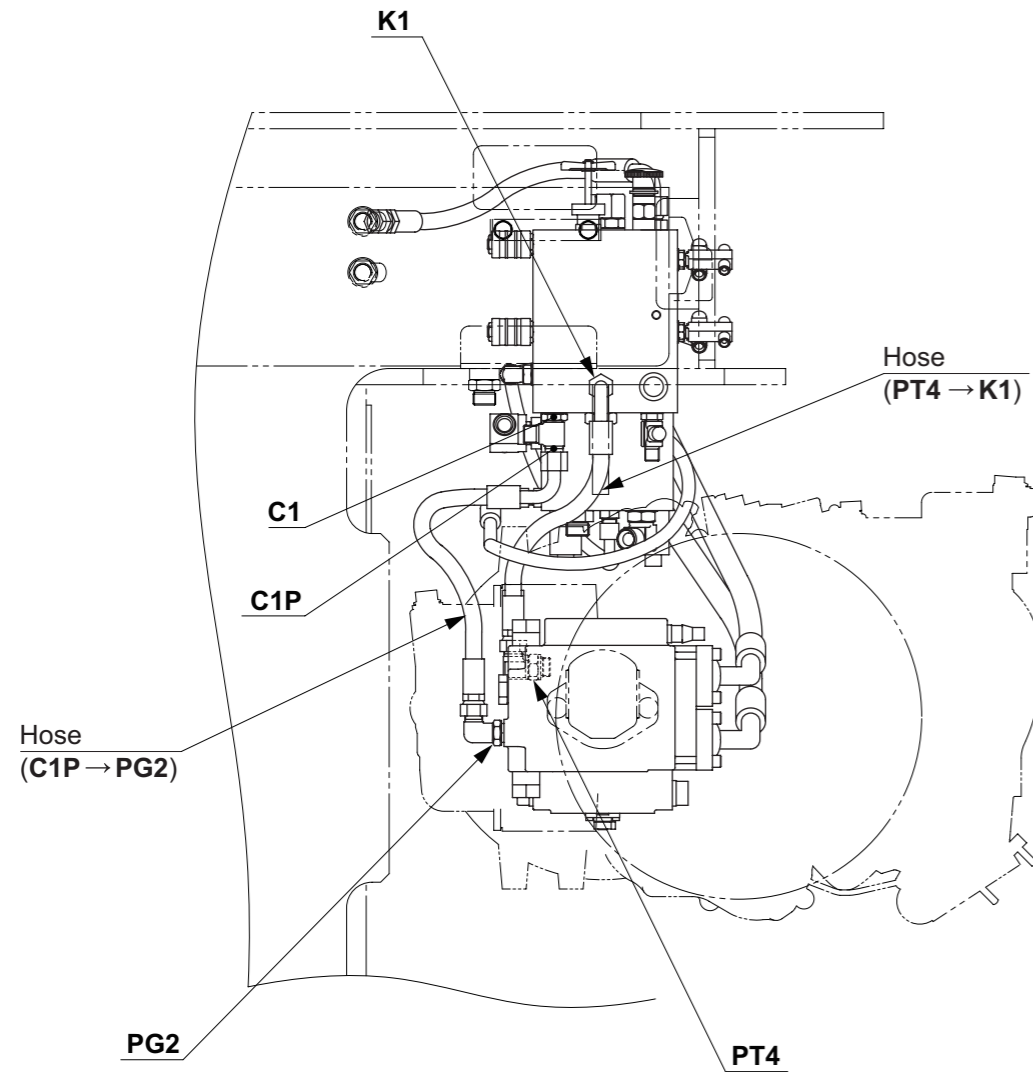
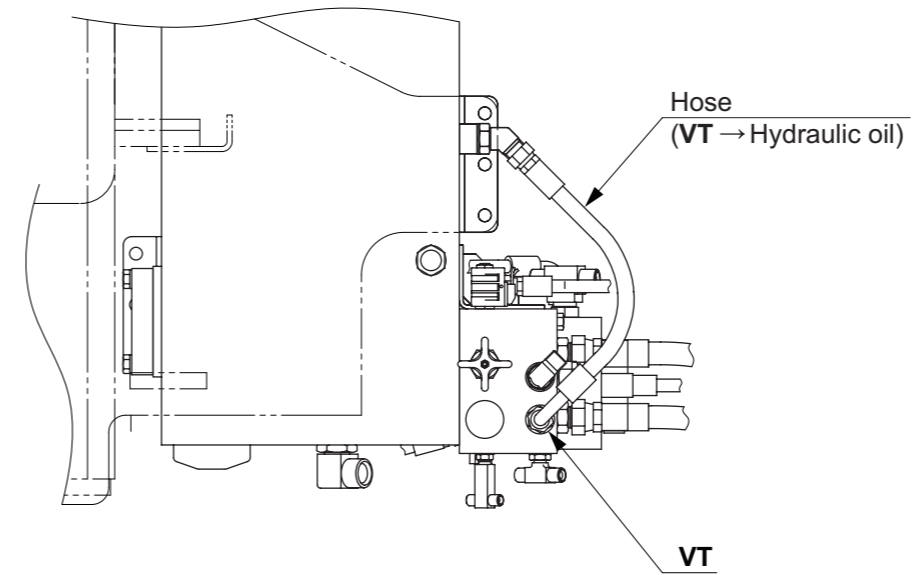
- Maximum working pressure : 34.3 MPa ( 4,974 psi )
- Maximum flow : 100 L/min ( 26 gal./min )
- Flow division ratio ( A : B ) : 50 : 50
- Weight : 2 kg ( 4.4 lbs. )



### 3. VIBRATOR HYDRAULIC SYSTEM

#### 3-1. Vibrator Hydraulic Piping

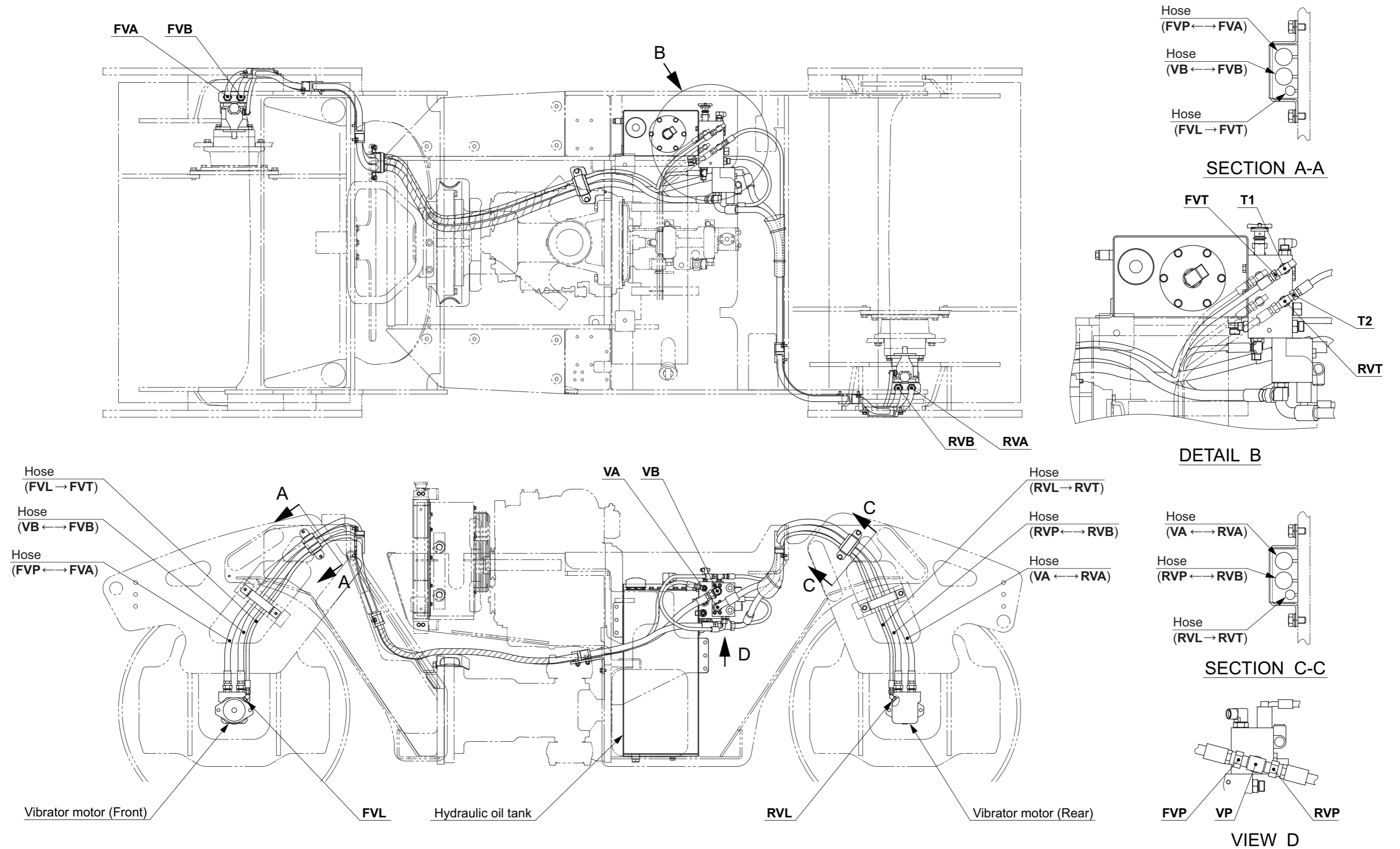
##### 3-1-1. Vibrator hydraulic piping (1)



• The letters and figures (such as PG2 and PT4) show each port and the arrow (←→; →) symbols show the hose connection and the direction of the flow of the oil.



3-1-2. Vibrator hydraulic piping (2)

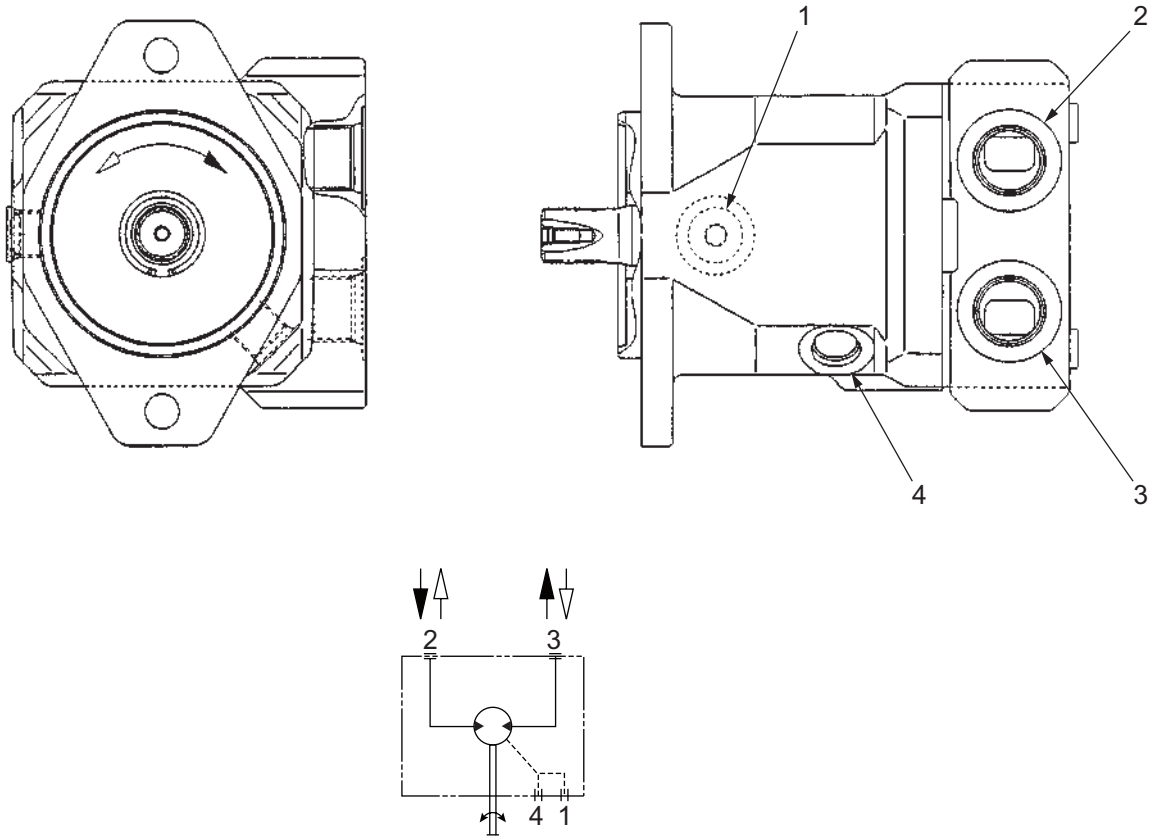


• The letters and figures (such as FVA and FVB) show each port and the arrow (←→; →) symbols show the hose connection and the direction of the flow of the oil.



### 3-2. Hydraulic Component Specifications

#### 3-2-1. Vibrator hydraulic motor



Hydraulic circuit diagram

Flow of oil

- 2→3 Clockwise rotation
- 3→2 Counterclockwise rotation

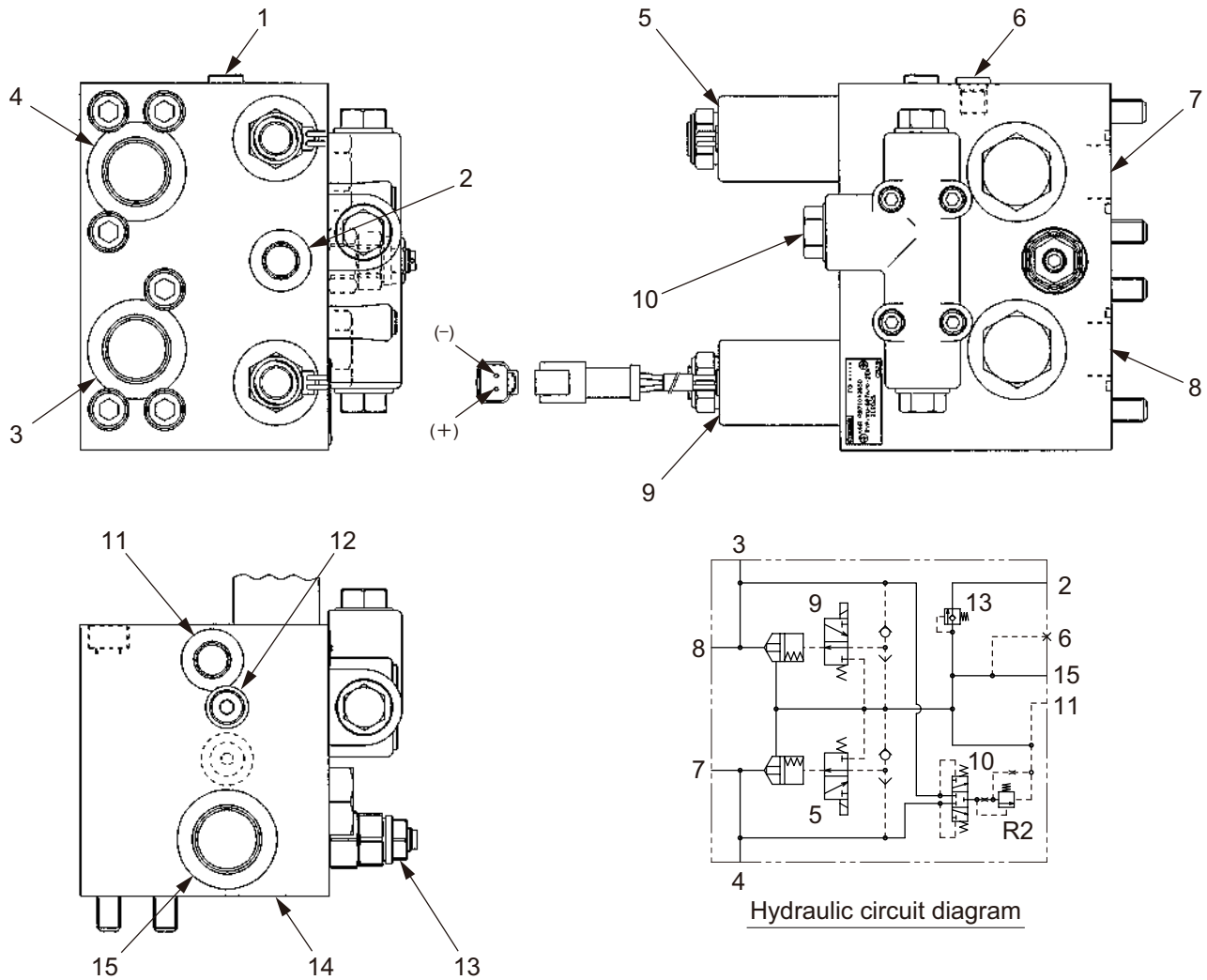
SW652-1-04005

(1) Drain port		:	3/4-16UNF
(2) Port A	<b>[FVA, RVA]</b>	:	1 1/16-12UN
(3) Port B	<b>[FVB, RVB]</b>	:	1 1/16-12UN
(4) Drain port	<b>[FVL, RVL]</b>	:	3/4-16UNF

Specifications

• Displacement	:	23.5 cm <sup>3</sup> /rev	(	1.43 cu.in./rev	)
• Working pressure	:	28 MPa	(	4,060 psi	)
• Allowable motor case pressure	:	0.2 MPa	(	29 psi	)
• Weight	:	12 kg	(	26 lbs	)

3-2-2. Valve block



Hydraulic circuit diagram

Connection diagram

SW652-1-04006

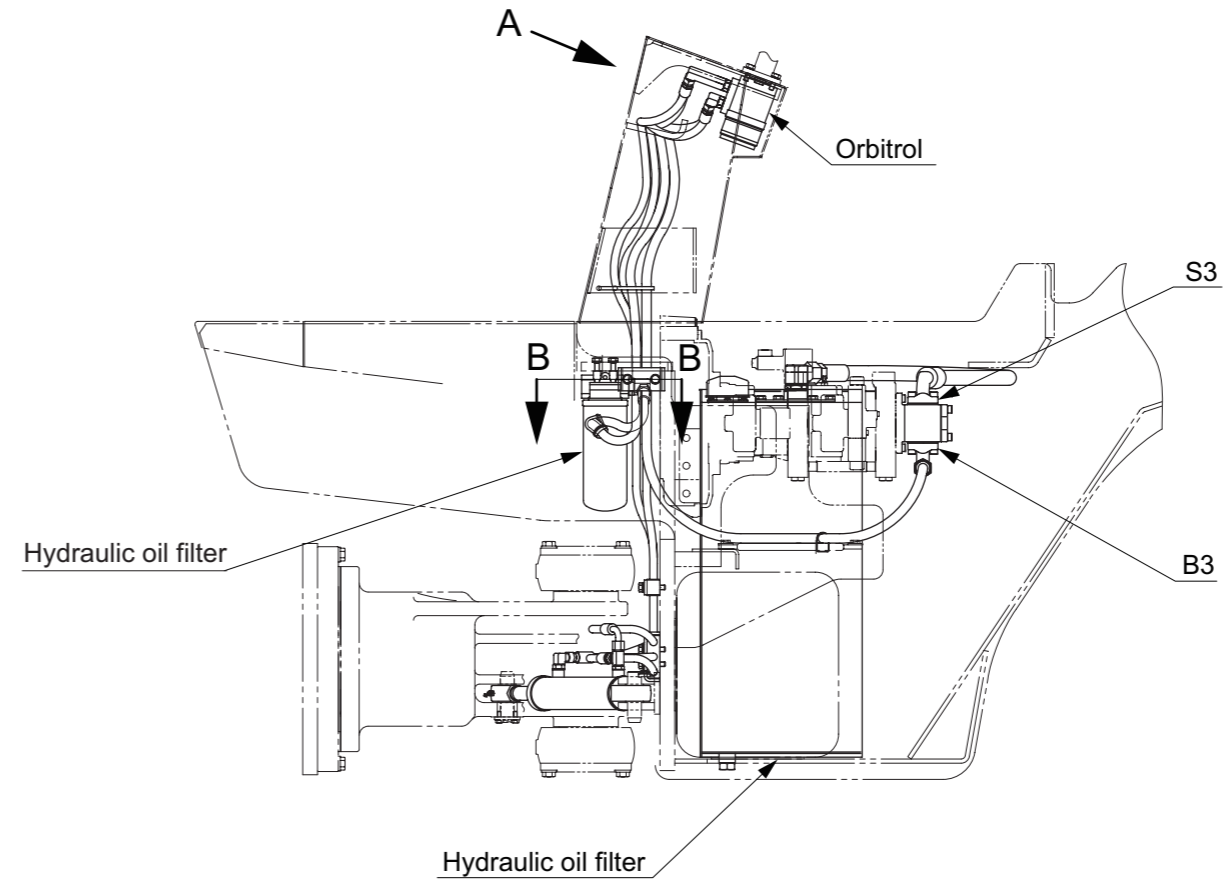
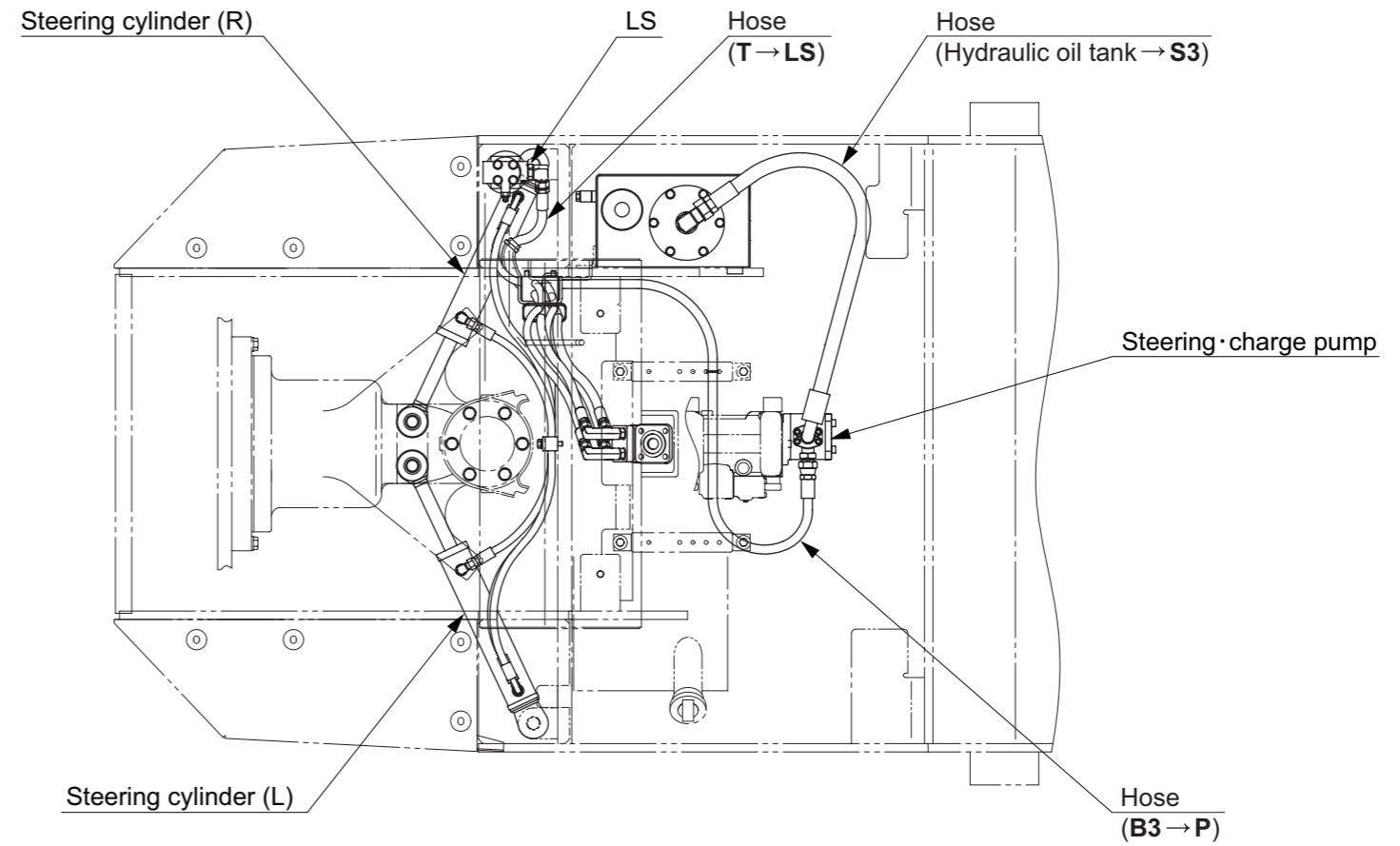
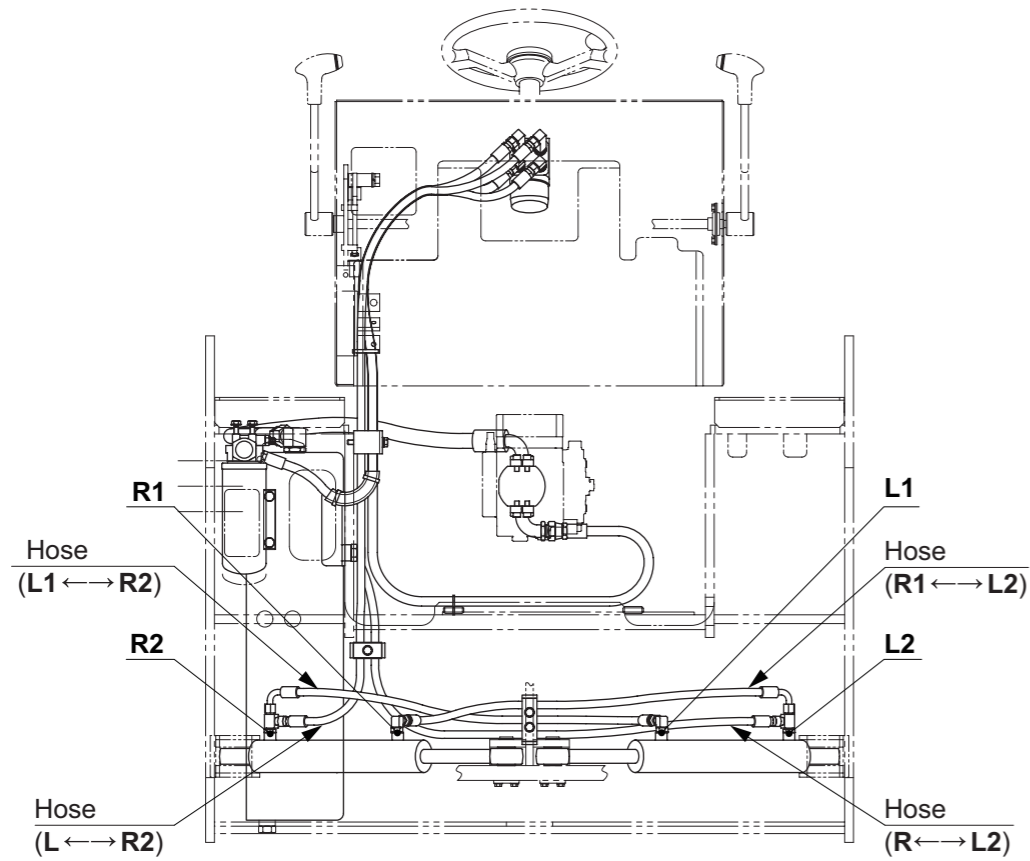
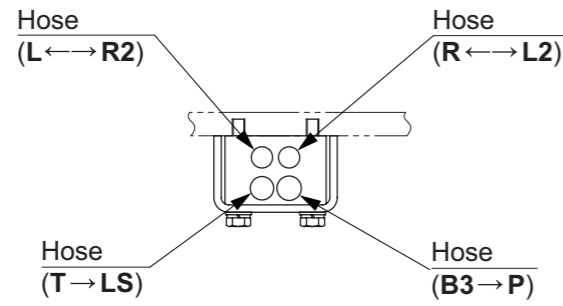
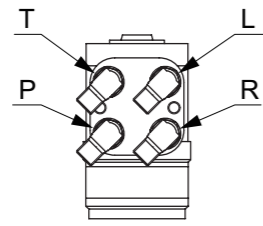
- |                      |                    |                        |                    |
|----------------------|--------------------|------------------------|--------------------|
| (1) Check valve      |                    | (9) Solenoid valve a   |                    |
| (2) Port CP          | [CP] : 9/16-18UNF  | (10) Flushing valve    |                    |
| (3) Port A           | [VA] : 1 1/16-12UN | (11) Port T            | [T3] : 9/16-18UNF  |
| (4) Port B           | [VB] : 1 1/16-12UN | (12) Check valve       |                    |
| (5) Solenoid valve b |                    | (13) Relief valve (R1) |                    |
| (6) Port MP          | : 7/16-20UNF       | (14) Body              |                    |
| (7) Port B1          |                    | (15) Port P            | [VP] : 1 1/16-12UN |
| (8) Port B2          |                    |                        |                    |

Specifications

- Rated pressure : 35 MPa ( 5,075 psi ) (2 to 4, 6, 15)
- : 0.5 MPa ( 72.5 psi ) (11)
- Relief valve pressure setting : 31.5 MPa ( 4,568 psi ) (13)
- : 1.3 MPa ( 189 psi ) (R2)
- Rated flow : 100 L/min ( 26.4 gal./min )
- Weight : 16 kg ( 35.3 lbs. )

# 4. STEERING SYSTEM

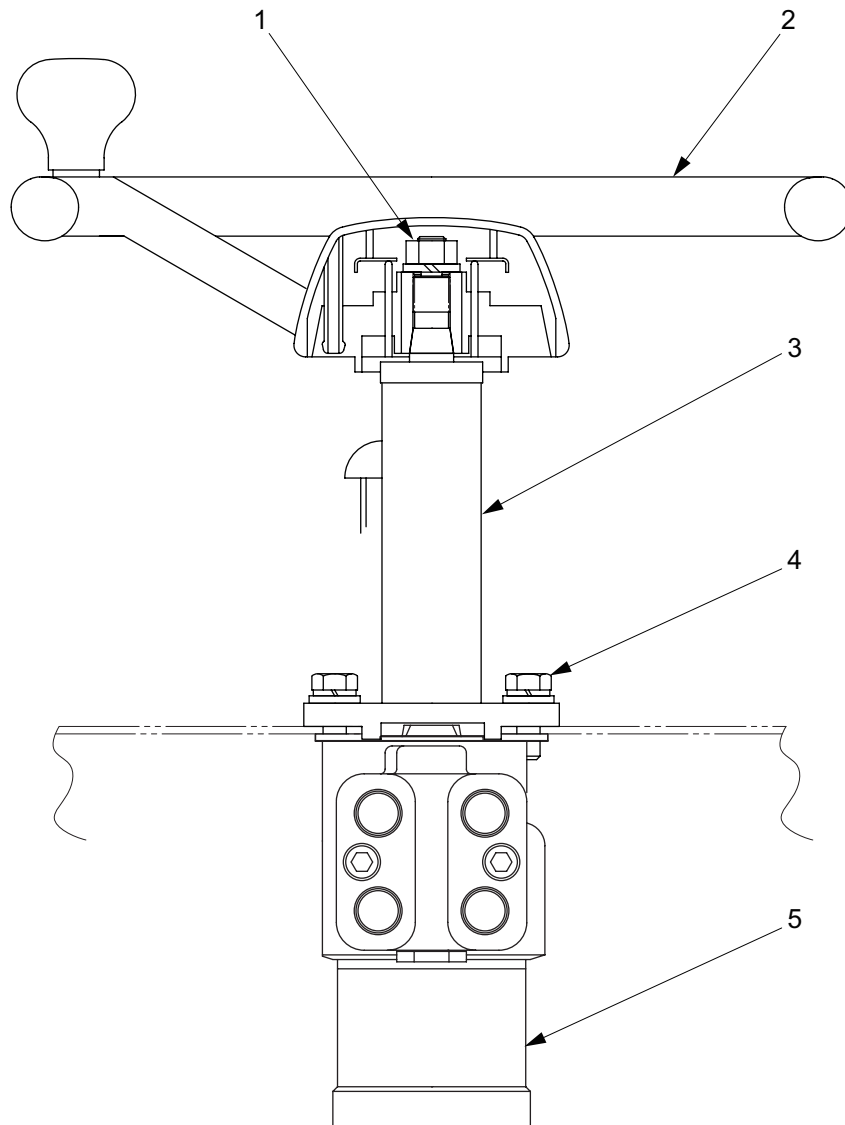
## 4-1. Steering Hydraulic Piping







## 4-2. Steering Wheel



0559-32802-0-20493-0

(1) Nut : M12 P=1.25  
 (2) Steering wheel  
 (3) Column shaft

(4) Bolt : M10×30  
 (5) Orbitrol

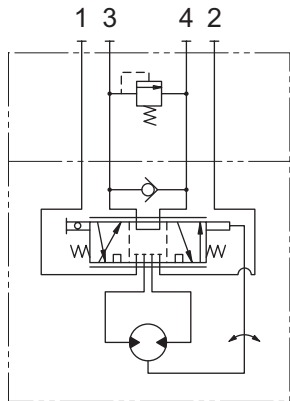
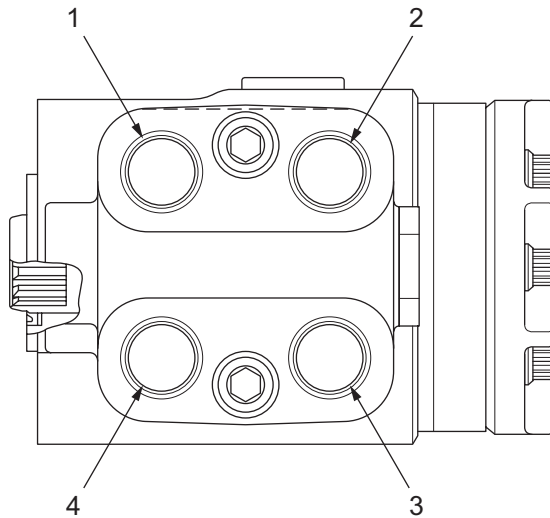
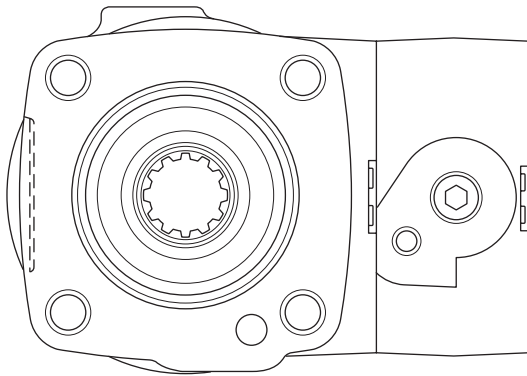


(1) Nut M12 P=1.25 : 54 to 64 N·m ( 40 to 47 lbf·ft )  
 (4) Bolt M10×30 : 49 N·m ( 36 lbf·ft )

• Steering wheel assembly weight : 10 kg ( 22 lbf·ft )

### 4-3. Hydraulic Component Specifications

#### 4-3-1. Orbitrol



Hydraulic circuit diagram

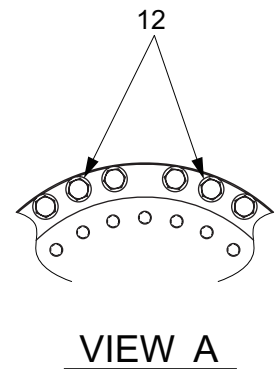
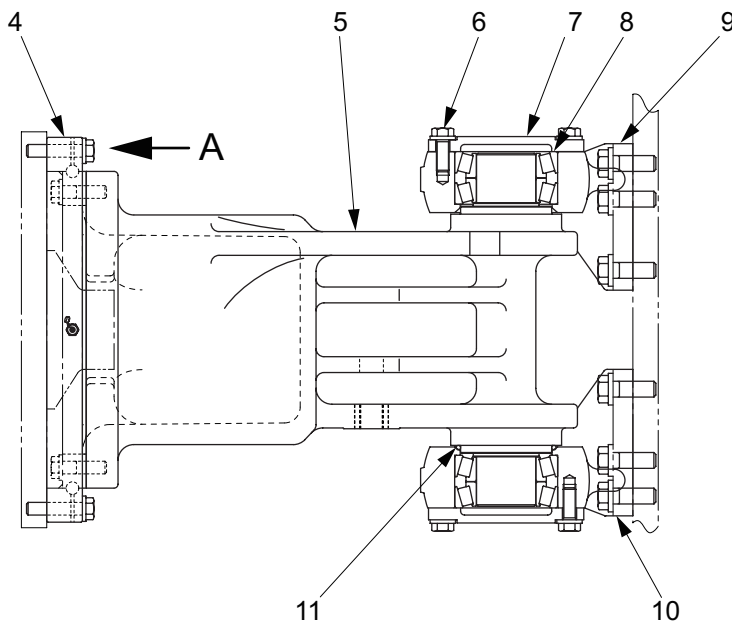
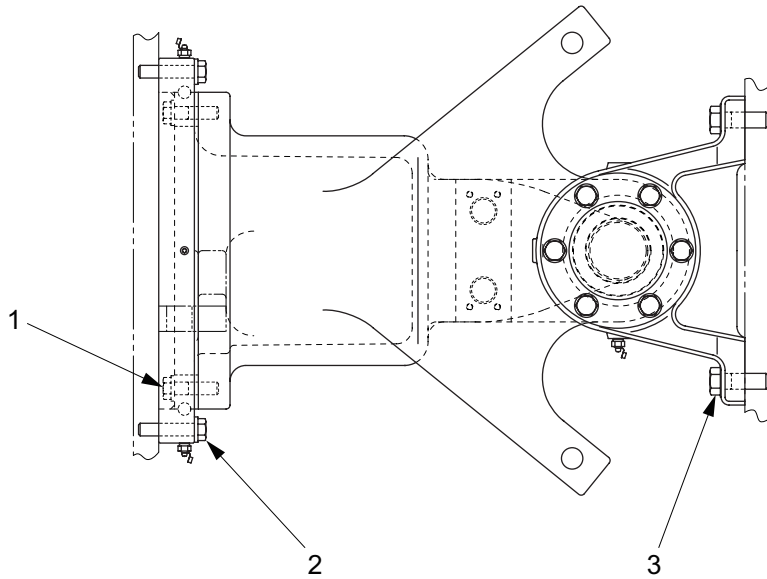
SW800-04018

- (1) Port L     **[L]**    : 3/4-16UNF
- (2) Port R     **[R]**    : 3/4-16UNF
- (3) Port P     **[P]**    : 3/4-16UNF
- (4) Port T     **[T]**    : 3/4-16UNF

Specifications

- Displacement                    :    184 cm<sup>3</sup>/rev ( 11.2 cu.in./rev )
- Relief valve pressure setting :    15.2 MPa    ( 2,204 psi       )
- Weight                            :       7.5 kg     ( 16.5 lbs.       )

### 4-4. Frame (Center Pin)



0559-61803-0-10352-A

- |                   |          |                    |          |                      |           |
|-------------------|----------|--------------------|----------|----------------------|-----------|
| (1) Bolt          | : M16×60 | (5) Yoke           |          | (9) Bracket (upper)  |           |
| (2) Bolt          | : M16×75 | (6) Bolt           | : M16×45 | (10) Bracket (lower) |           |
| (3) Bolt          | : M20×60 | (7) Cover          |          | (11) O-ring          |           |
| (4) Swing bearing |          | (8) Roller bearing |          | (12) Bolt            | : M16×110 |



- |                   |                          |
|-------------------|--------------------------|
| (1) Bolt M16×60   | : 265 N·m ( 195 lbf·ft ) |
| (2) Bolt M16×75   | : 265 N·m ( 195 lbf·ft ) |
| (3) Bolt M20×60   | : 539 N·m ( 398 lbf·ft ) |
| (6) Bolt M16×45   | : 265 N·m ( 195 lbf·ft ) |
| (12) Bolt M16×110 | : 265 N·m ( 195 lbf·ft ) |



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# **ELECTRICAL SYSTEM**

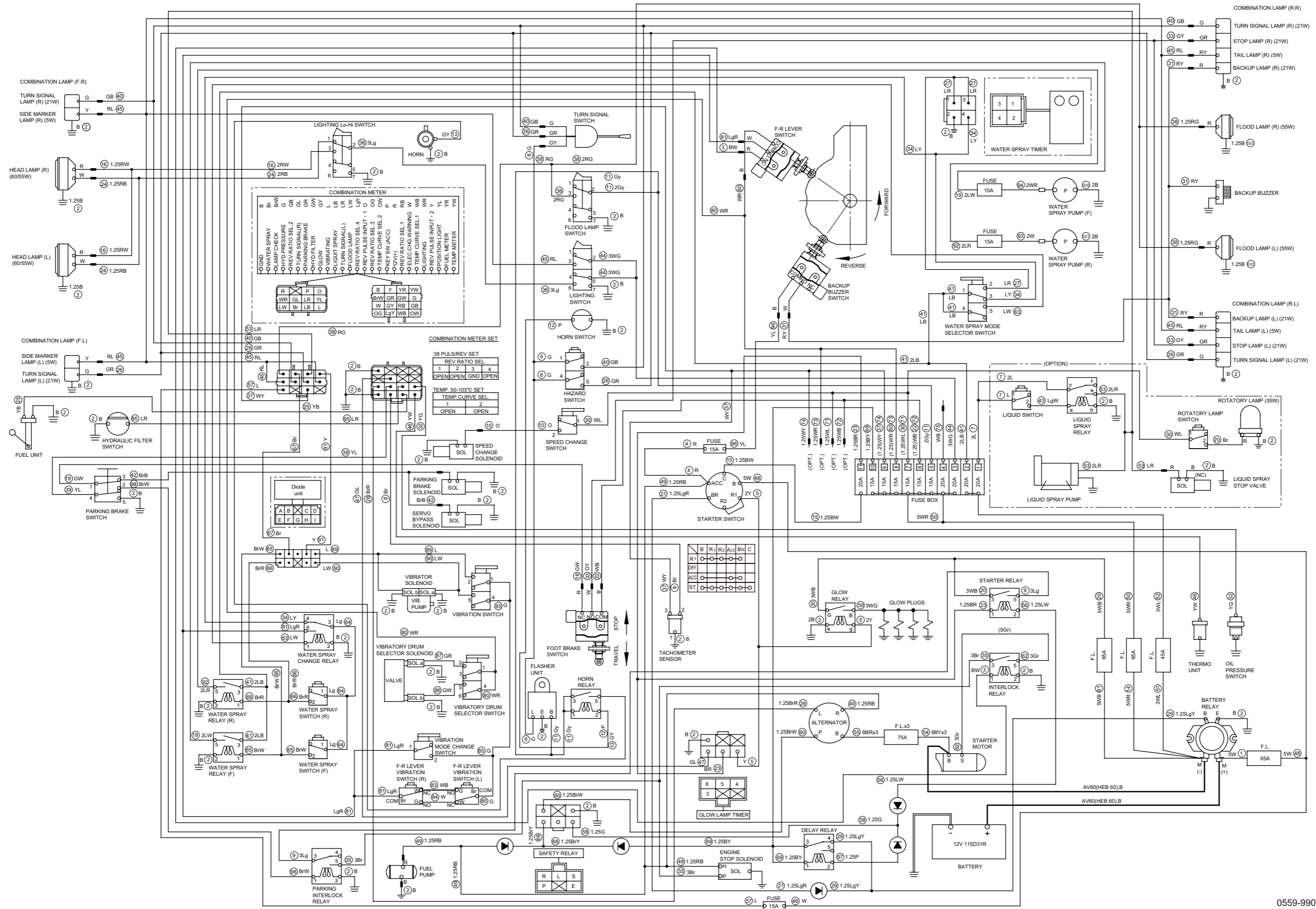
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# 1. SYSTEM CIRCUIT DIAGRAM

## 1-1. Electrical Circuit Diagram

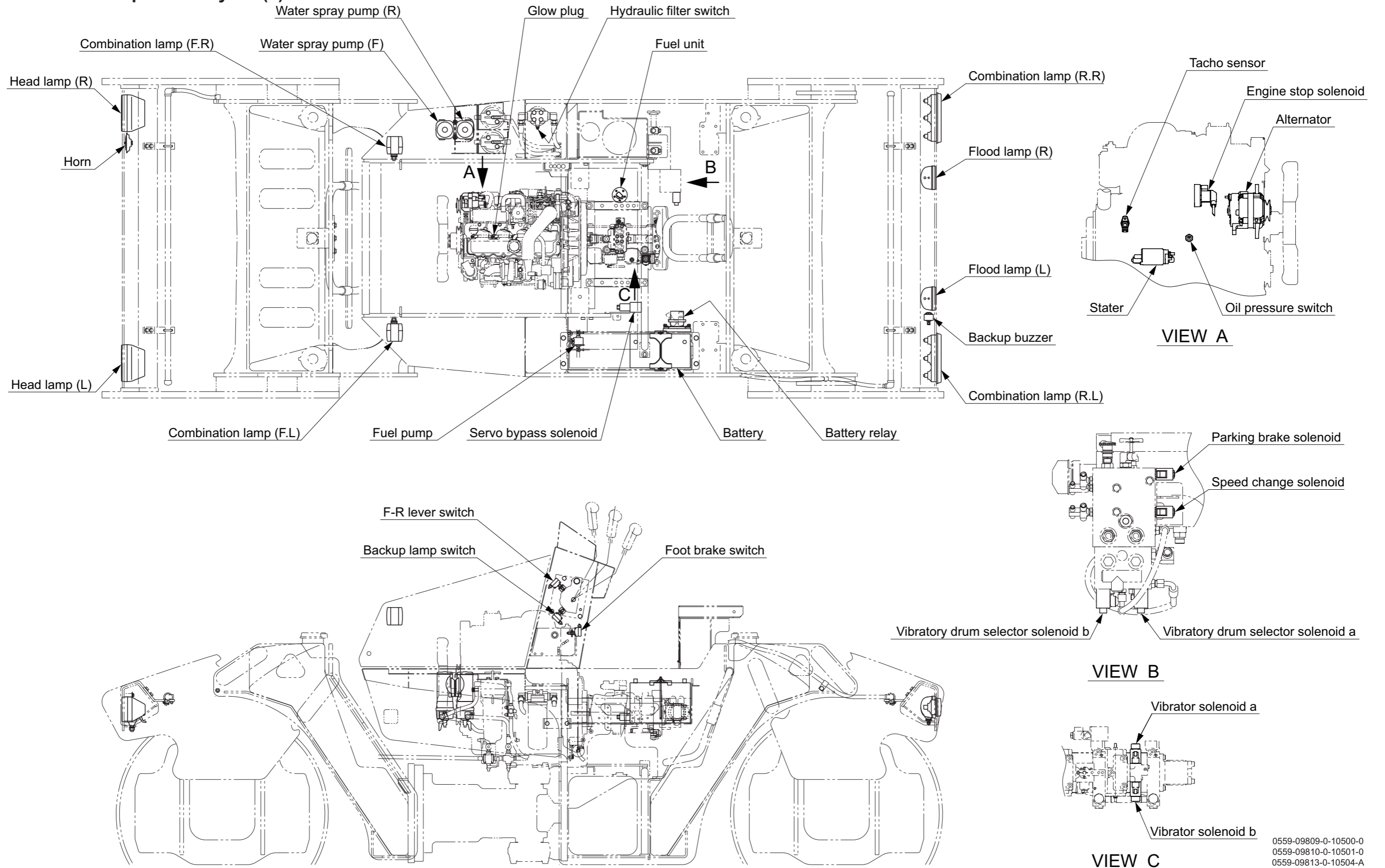






## 2. ELECTRICAL COMPONENTS

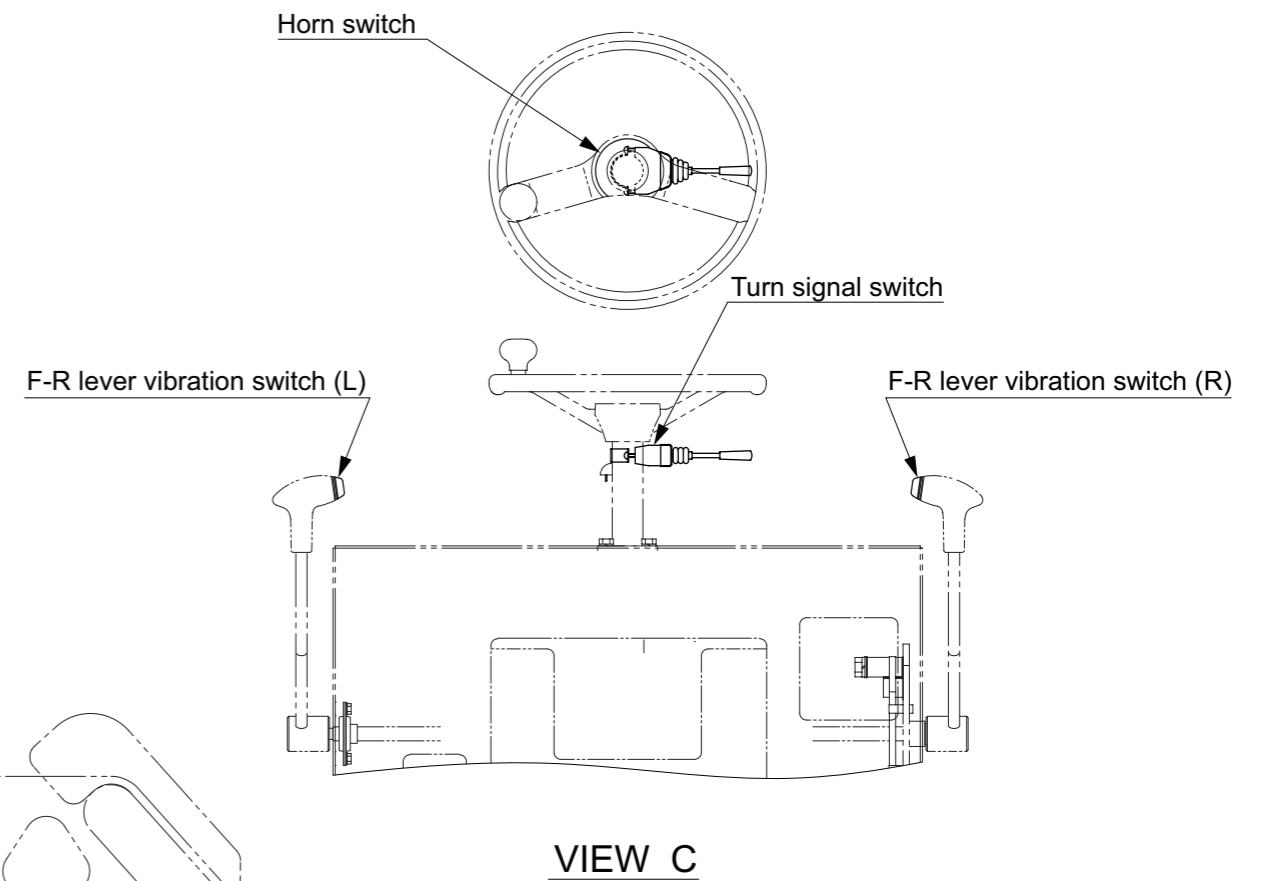
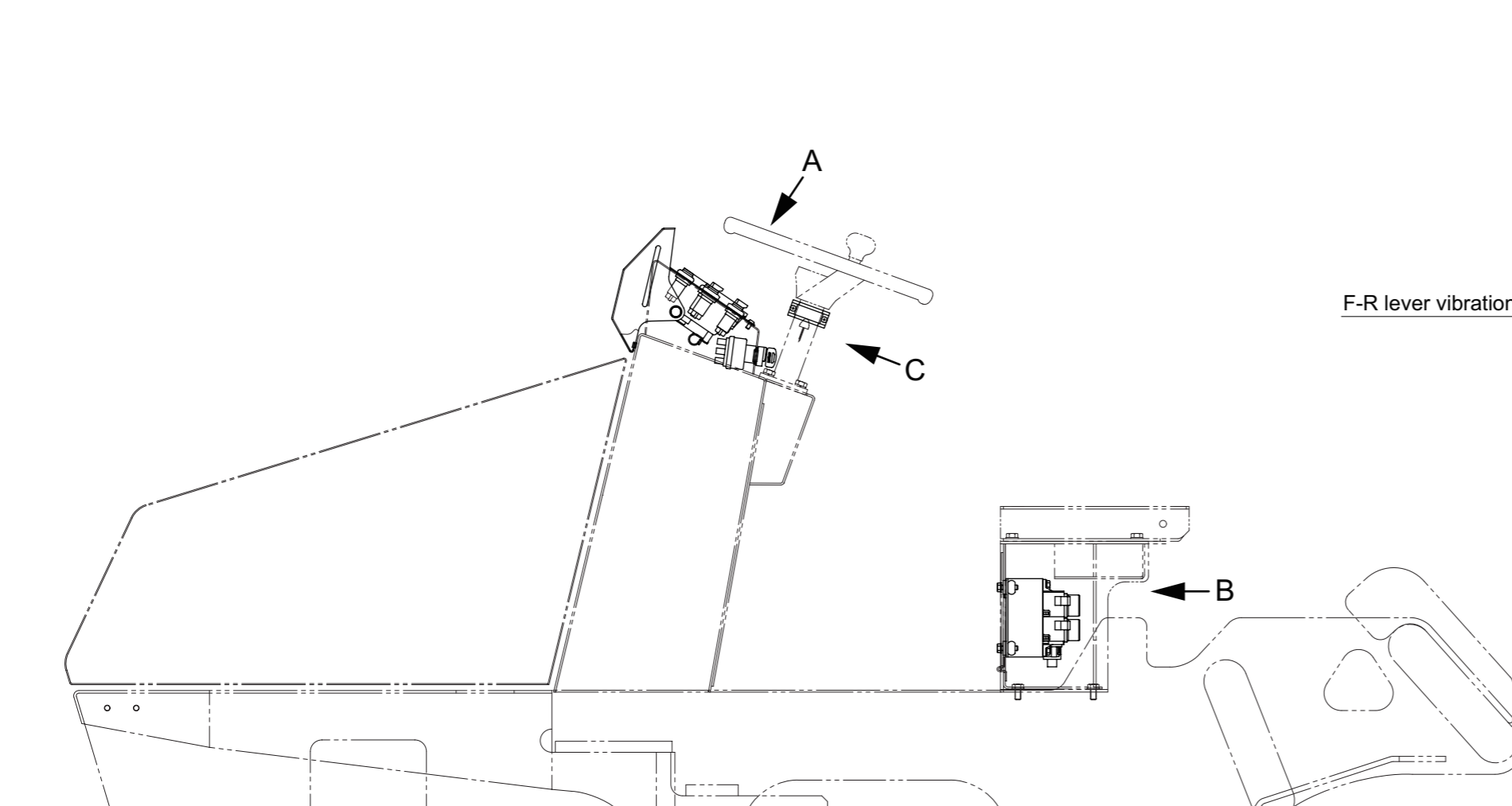
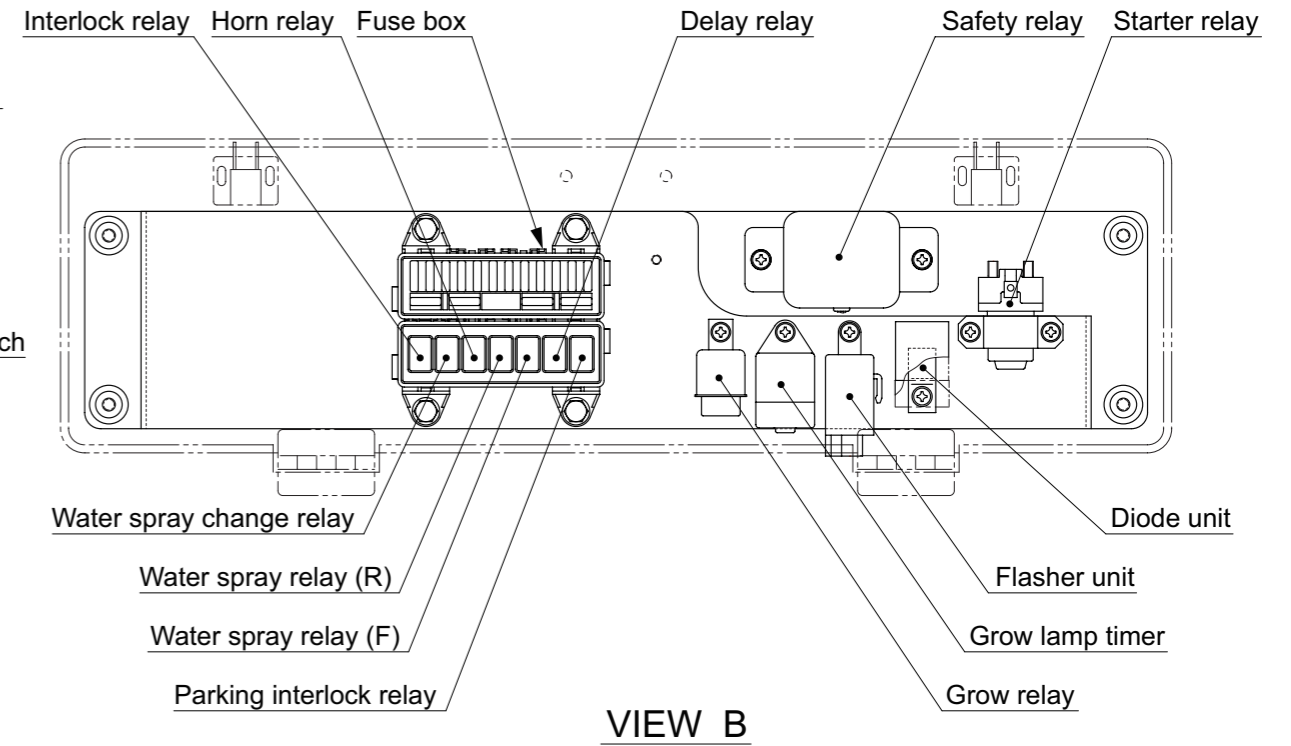
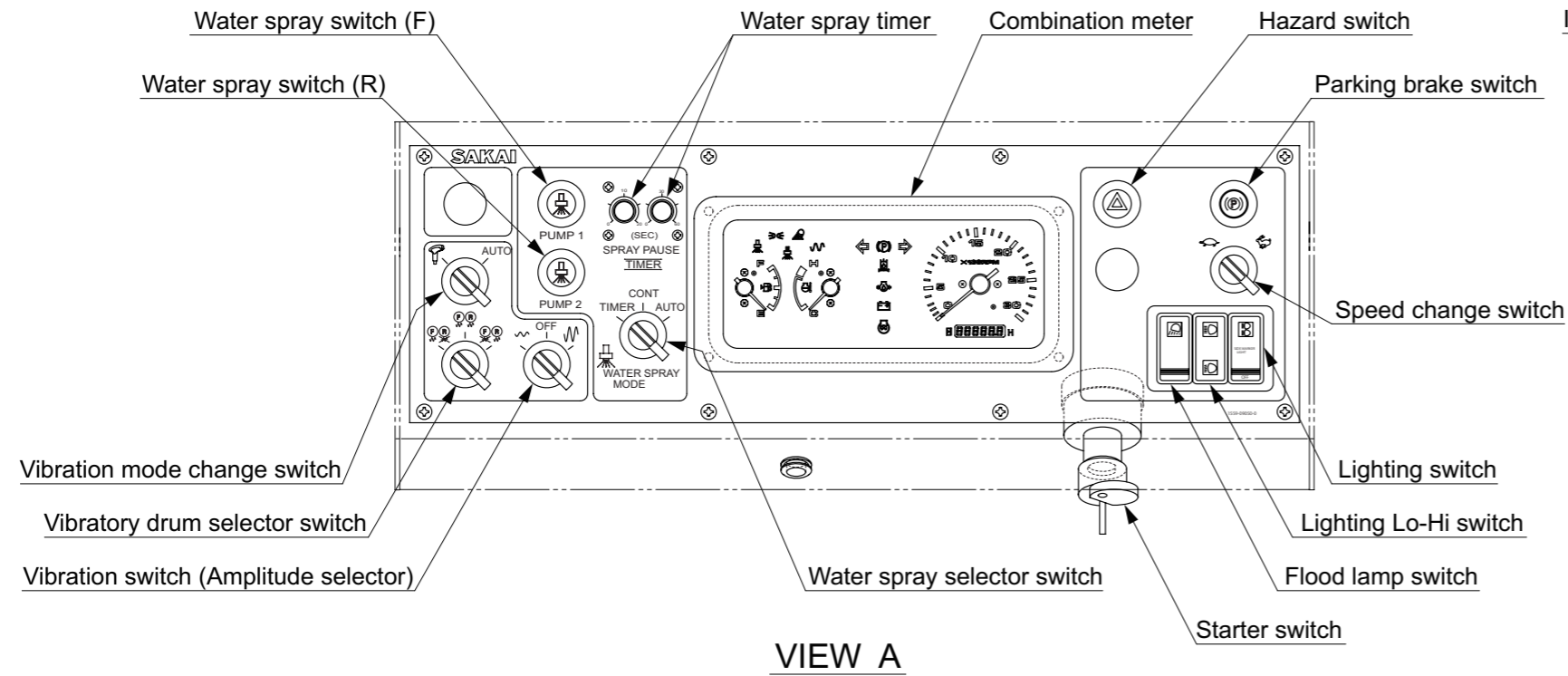
### 2-1. Electrical Component Layout (1)



0559-09809-0-10500-0  
0559-09810-0-10501-0  
0559-09813-0-10504-A  
0559-09813-0-10505-A

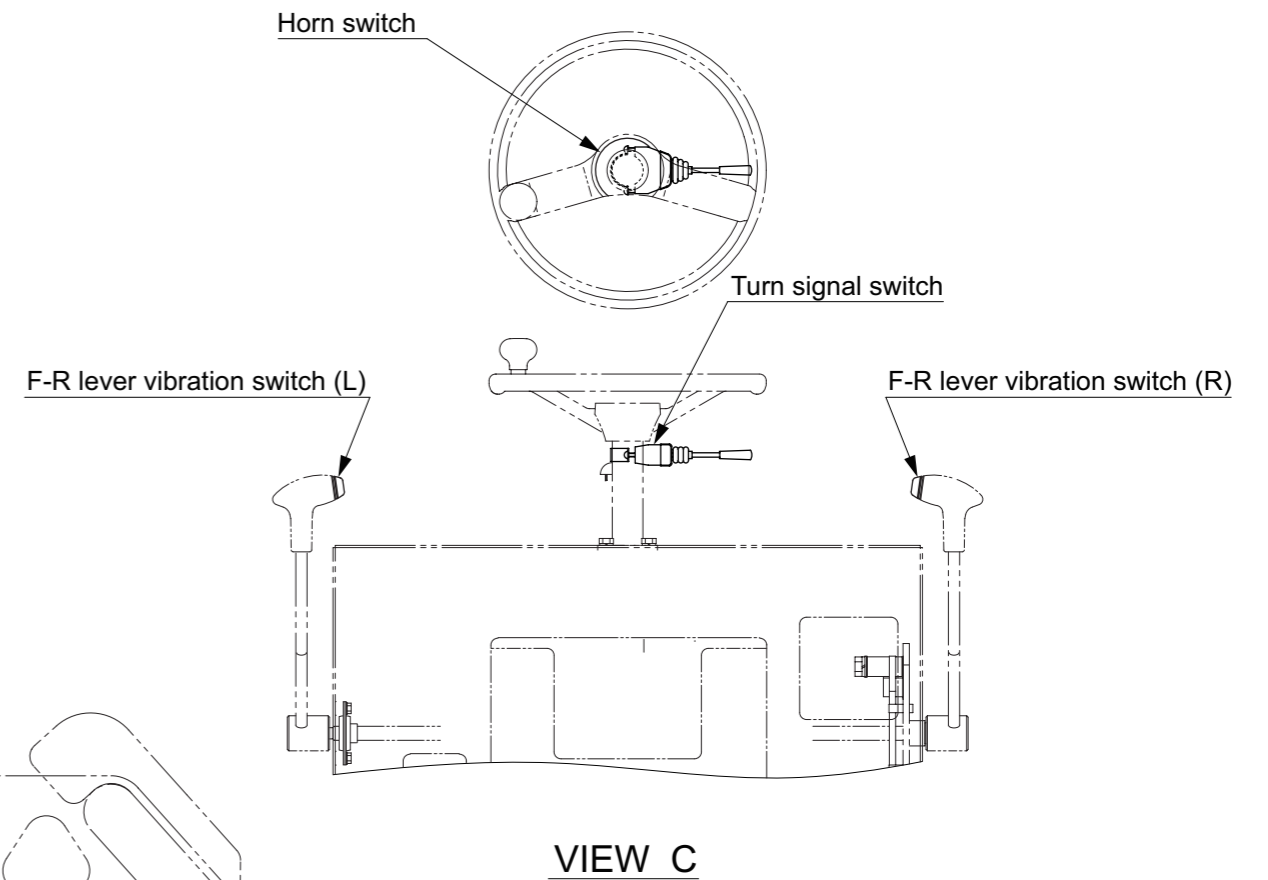
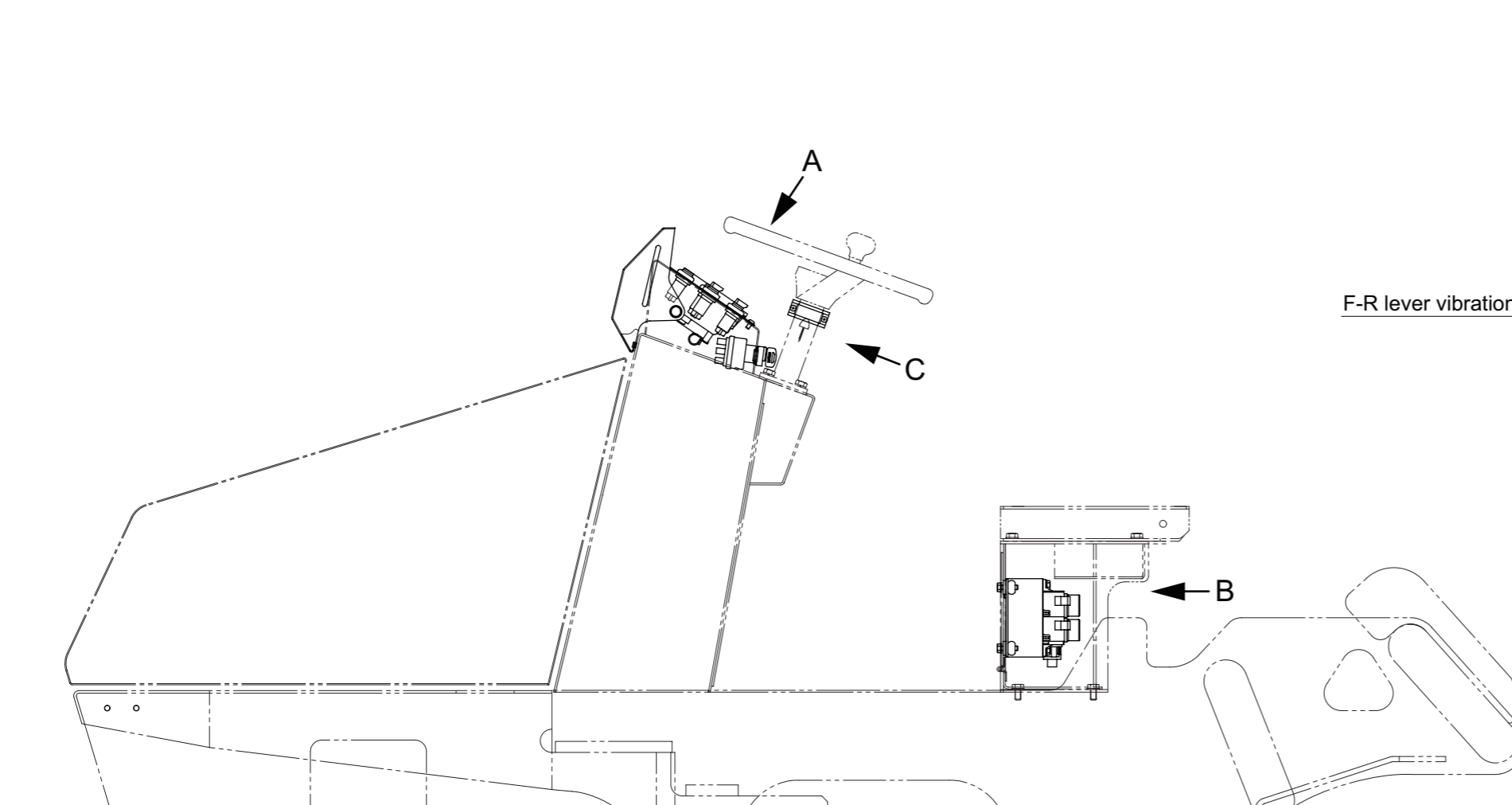
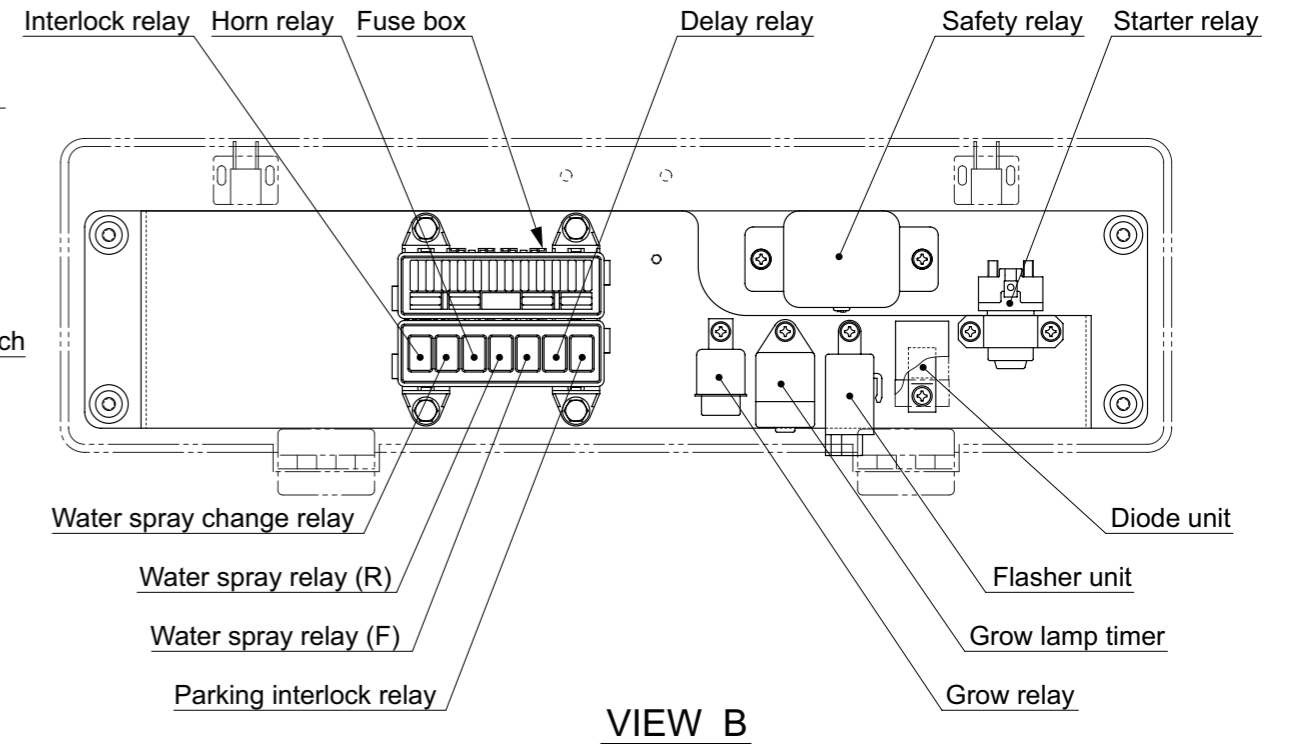
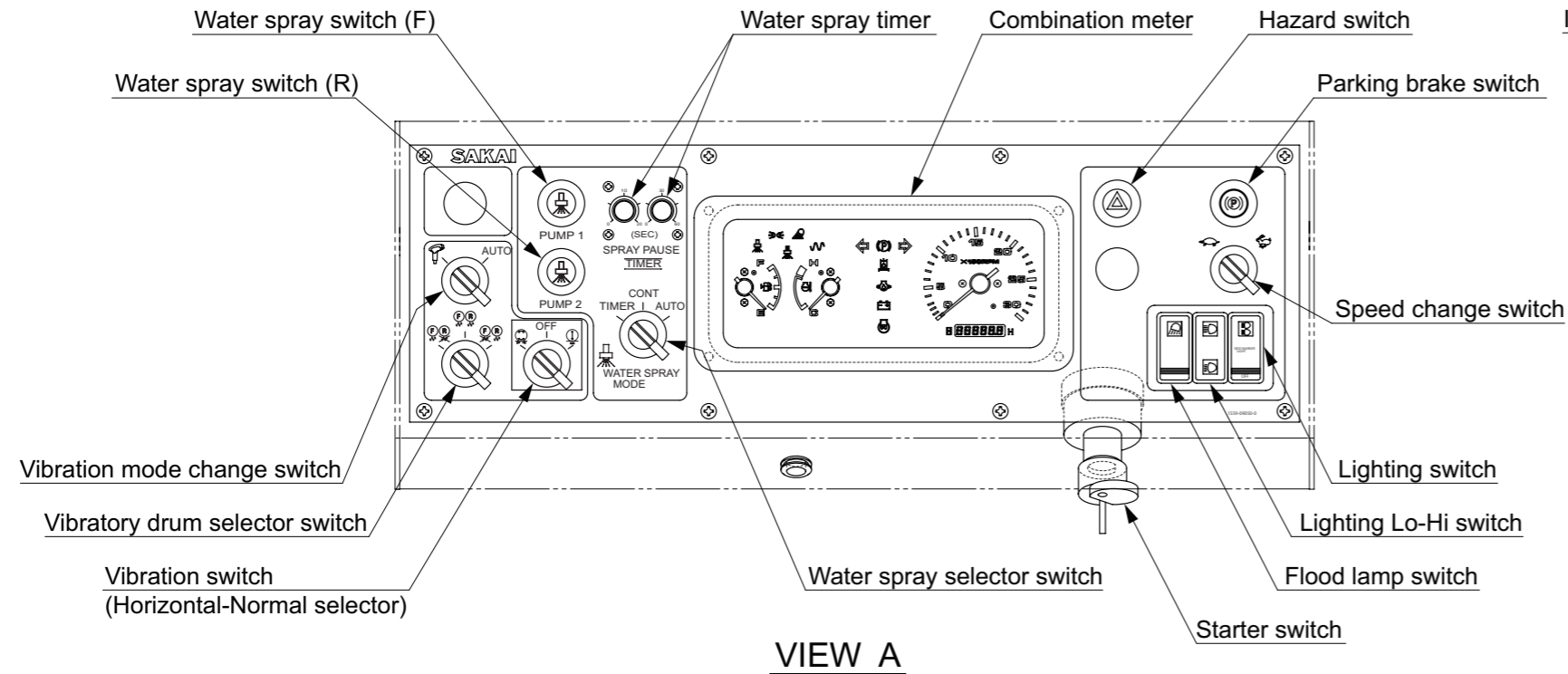


2-2. Electrical Component Layout (2) (SW652-1, SW652B-1)





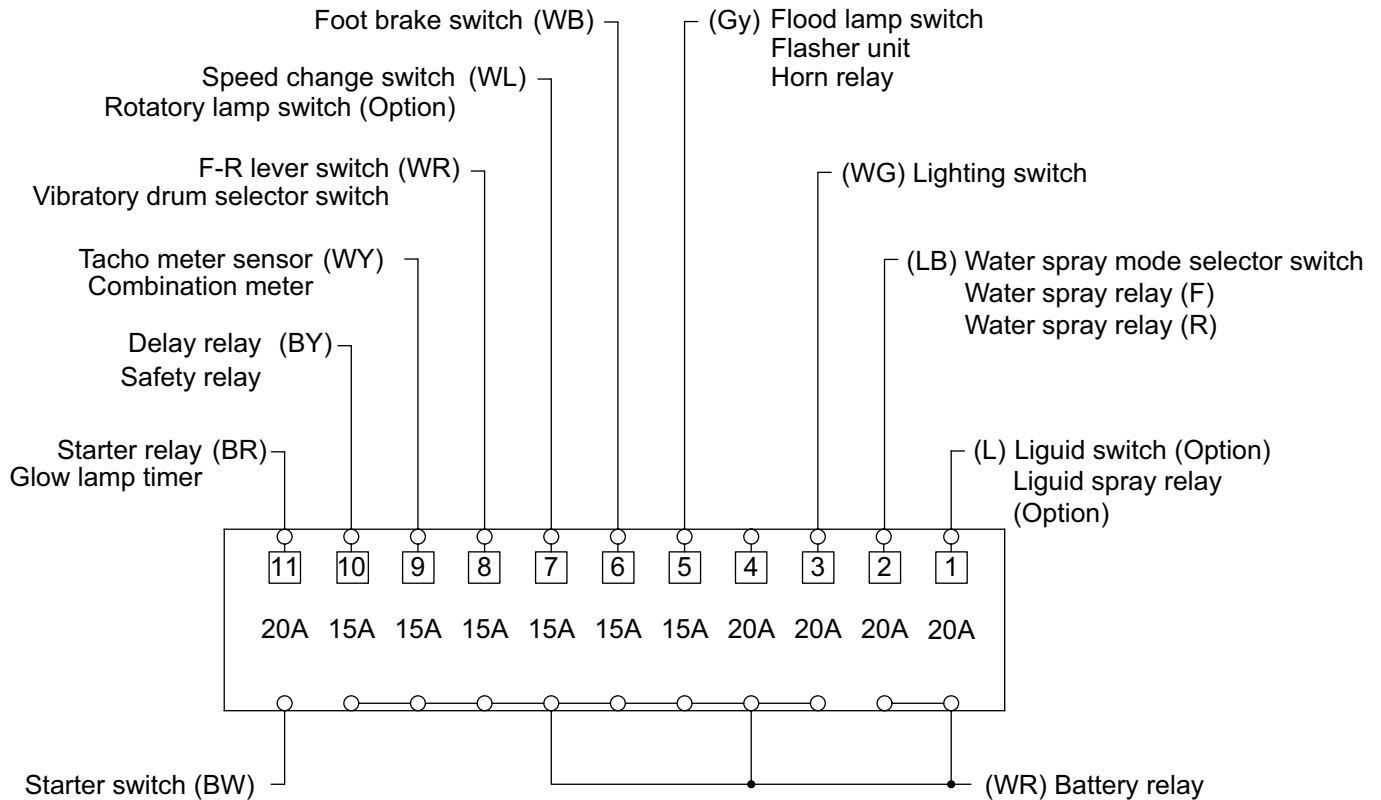
2-3. Electrical Component Layout (2) (SW652ND-1)





### 3. ELECTRICAL COMPONENT SPECIFICATIONS

#### 3-1. Fuse Box

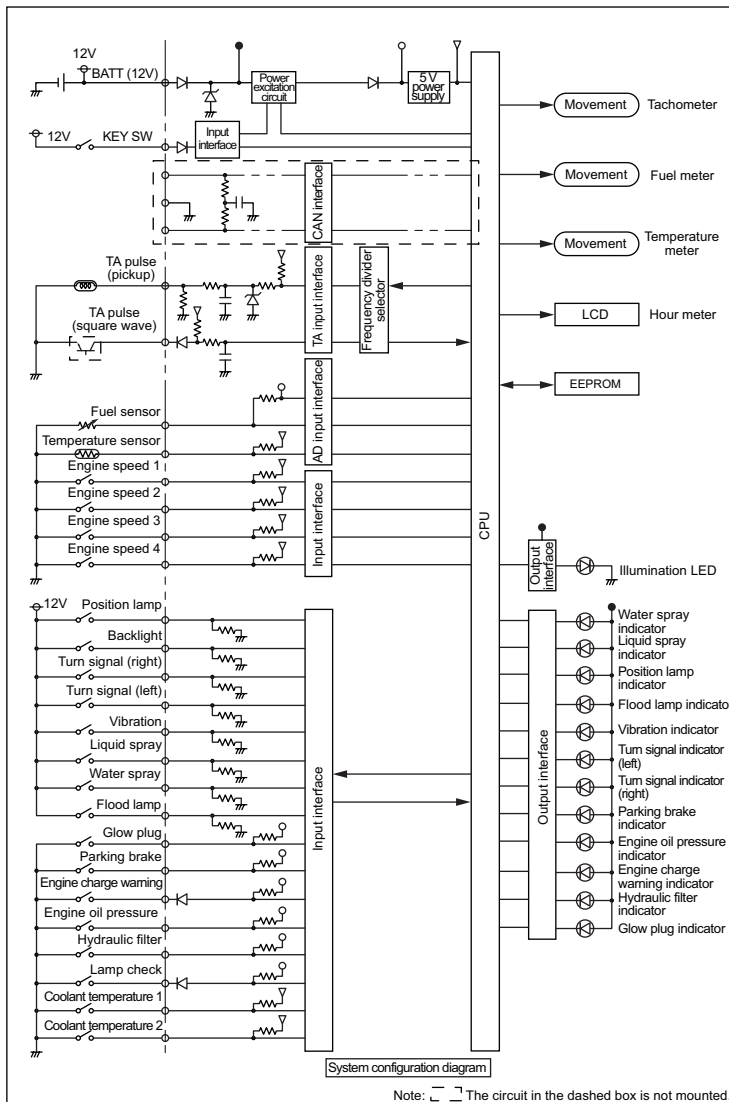
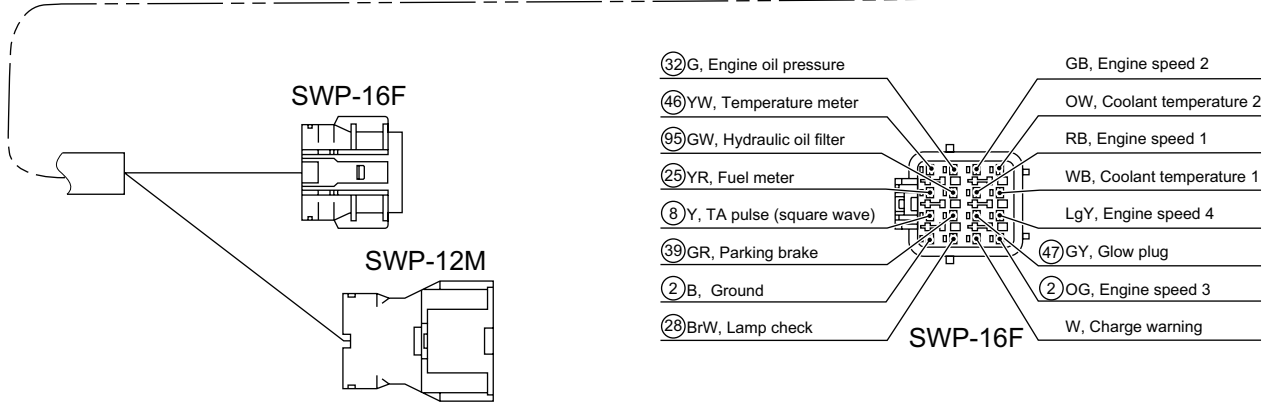
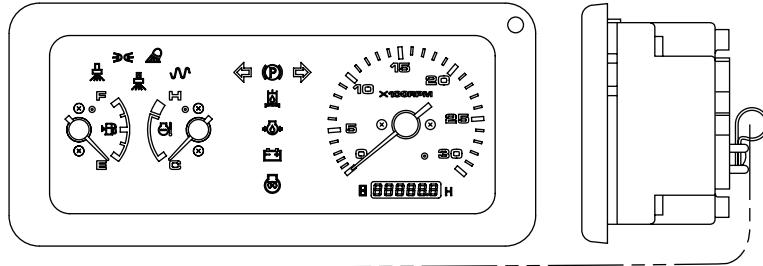


SW652-1-05001

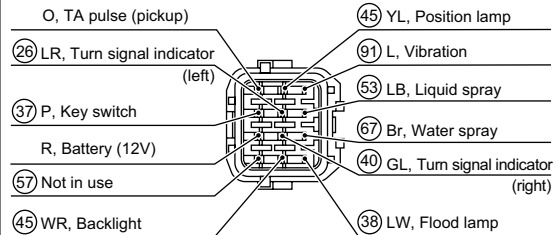
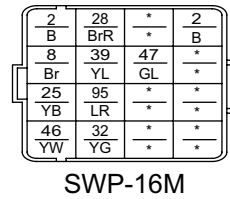
#### Harness color codes

L : Blue	WL : White/Blue stripe
BW : Black/White stripe	BrY : Brown/Yellow stripe
WR : White/Red stripe	WY : White/Yellow stripe
BY : Black/Yellow stripe	LB : Blue/Black stripe
WB : White/Black stripe	WG : White/Green stripe
BR : Black/Red stripe	Gy : Gray

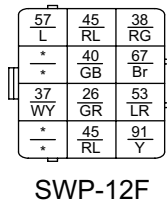
### 3-2. Combination Meter



Harness side



Harness side



Wire color and number  
(Refer to "1-4 Wire Color Code and number" of TROUBLESHOOTING.)

- The arrangement of connector terminals shown below is that of connecting surfaces on the connector side.





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# **VIBRATORY DRUM**

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# 1. PRECAUTIONS FOR DISASSEMBLY AND REASSEMBLY

- When removing, installing, disassembling or reassembling the unit, observe the general precautions described below.

## 1) Precautions for removal work

- Coolant that contains antifreeze should be treated as a chemical, and must not be drained carelessly on the ground.
- To prevent dust from getting into disconnected hoses and tubes, cover them with a plug or similar means.
- When draining oil, use a receptacle with sufficient capacity to receive it.
- Before proceeding with the work, look for matchmarks that show the installation location. For reassembly, place matchmarks in the required locations to prevent errors. Then remove.
- When disconnecting wiring connectors, hold the connector components so that unreasonable force is not applied to the wires.
- Label wires and hoses to ensure correct installation location.
- Confirm the number and thickness of shims prior to storage.
- When lifting parts, use lifting equipment of sufficient capacity.
- When separating parts by using pull bolts, tighten the bolts alternately.
- Before removing a unit, clean its surrounding area. Then after removal, cover it to prevent dust and other substances from getting in.
- Before removing piping for hydraulic oil or coolant, or removing related parts, satisfactorily release internal pressure.

## 2) Precautions for installation work

- Tighten bolts and nuts (sleeve nuts) to the specified torque (screw tightening torque table).
- When installing hoses, do not twist them or allow them to interfere with other parts.
- Replace gaskets, O-rings, split cotter pins, and lock plates with new parts.
- Properly bend split cotter pins and lock plates.
- When applying an adhesive, first clean and remove oil/grease from the surfaces properly. Then apply two or three drops to the threaded areas.
- When applying a liquid gasket, first clean and remove oil/grease from the application surface properly, and confirm that the surface is free of dust and damage. Then apply the product evenly.
- Clean parts well. Repair scratches, dents, burrs, rust, etc.
- Apply gear oil to rotating and sliding components.
- Apply grease to the surfaces of press-fit parts.
- After installing snap rings, confirm that they are properly seated in the grooves.
- Connect wiring connectors securely after cleaning off adhering oil, dust and water.
- Use lifting bolts that are not fatigued or deformed. Screw them in fully.
- When tightening a split flange, tighten screws alternately to prevent uneven tightening.
- Before installing hydraulic parts, confirm that they are free of damage and dust, etc.

### 3) Precautions when work is completed

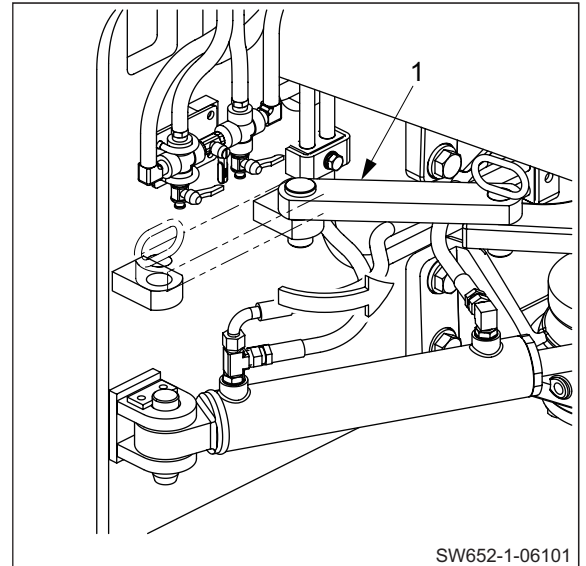
- If coolant has been drained, securely retighten the drain cock and fill with coolant (mixing in long-life coolant) to the specified level. Start the engine and allow the coolant to circulate through the piping. Then add coolant again to the specified level.
- If hydraulic equipment has been removed and reinstalled, fill with hydraulic oil to the specified level. Start the engine and allow the oil to circulate through the piping. Then add oil again to the specified level.

## 2. VIBRATORY DRUM

### 2-1. Removal and Installation of Vibratory Drum

#### 2-1-1. Removal of vibratory drum

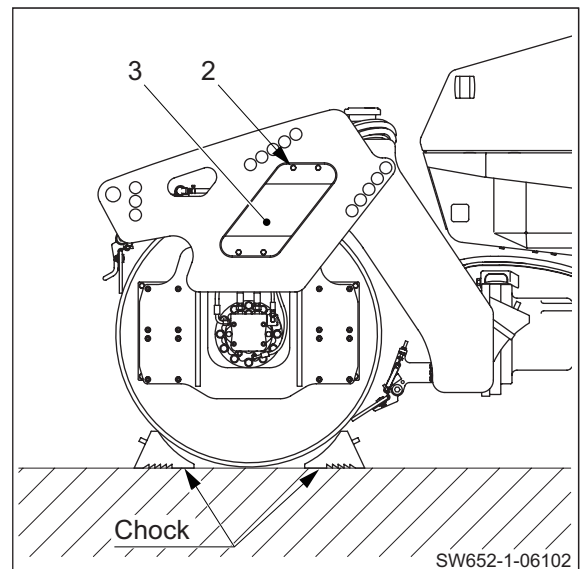
- 1) Securing machine
  - Hold drum with chocks.
  - Lock front and rear frames with steering lock bar (1).



### **⚠ WARNING**

The hydraulic oil in the machine is hot and compressed immediately after the machine is stopped. Disconnecting the hydraulic hoses in this condition can cause burns. Wait for the hydraulic oil to cool down before starting the work.

- 2) Disconnecting piping
  - 2-1) Disconnecting propulsion motor piping
    - Remove bolts (2).
    - Remove cover (3).

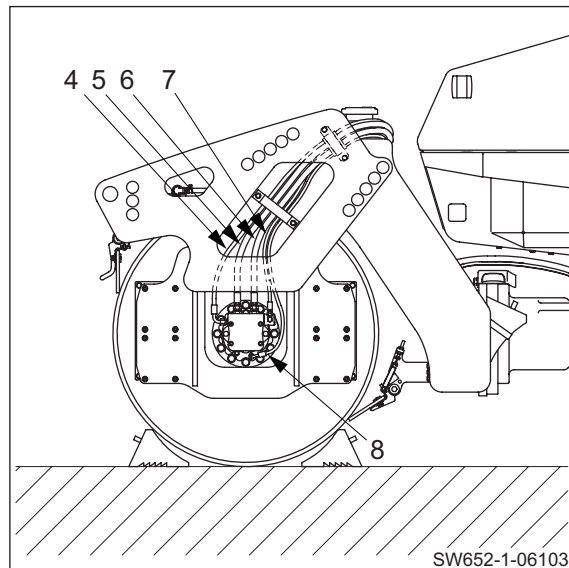


## VIBRATORY DRUM

- Disconnect hydraulic hoses (4), (5), (6), (7) and (8) connecting to propulsion motor.

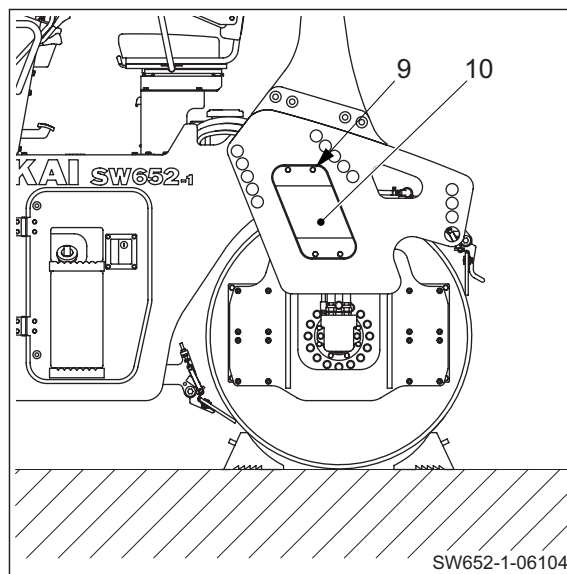
### (NOTICE)

- Plug both ends of the disconnected hoses or implement other actions to prevent entry of foreign matter.

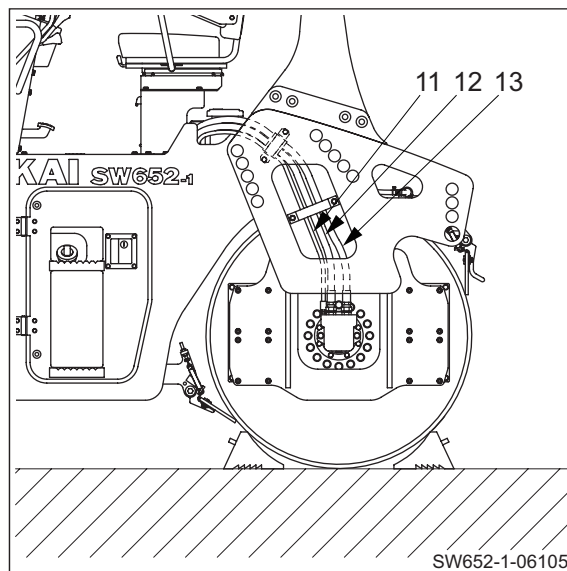


### 2-2) Disconnecting vibrator motor piping

- Remove bolts (9).
- Remove cover (10).



- Disconnect hydraulic hoses (11), (12), and (13) connecting to vibrator motor.



**⚠ DANGER**

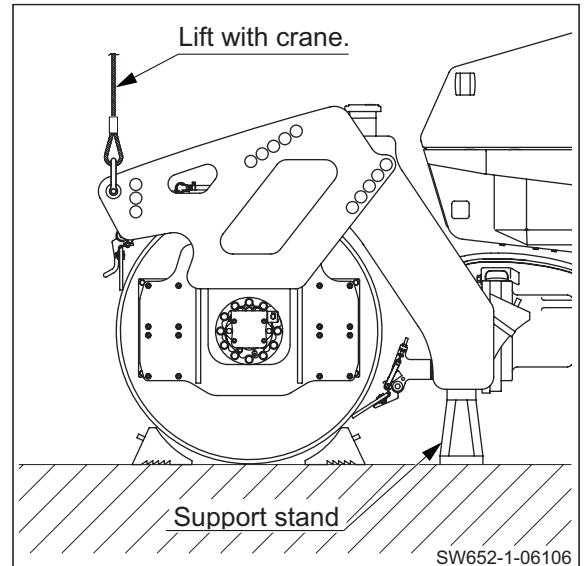
When lifting the machine body, use an appropriate hoist of sufficient strength. Confirm that the surrounding area is safe, and work in a natural, unstrained posture. Also, to firmly secure the machine body, use a support stand of sufficient strength.

3) Supporting frame

- Lift frame with a crane.
- Place support stands under frame when drum is slightly off ground to support machine body.

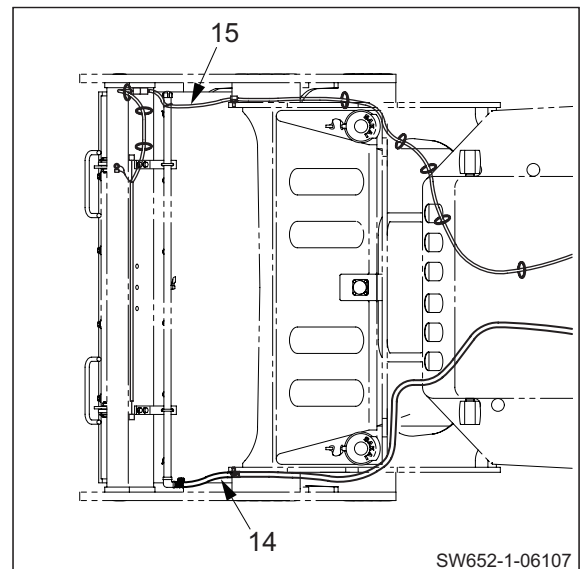


	Front axle	Rear axle
SW652-1	: 3,490 kg (7,695 lbs.)	3,860 kg (8,510 lbs.)
SW652B-1	: 3,940 kg (8,685 lbs.)	4,310 kg (9,500 lbs.)
SW652ND-1	: 3,640 kg (8,025 lbs.)	4,010 kg (8,840 lbs.)



4) Removal of cross member

- 4-1) Remove water spray pipe (14) and electrical harness (15).

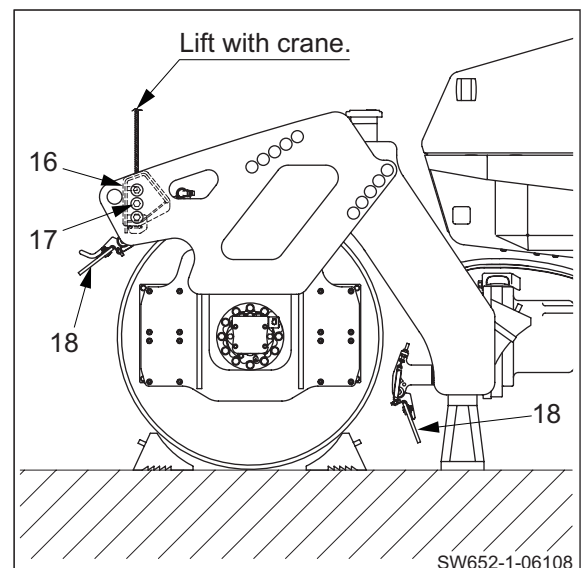


4-2) Flip up scraper blade (18).

- Lift cross member (16) with a crane and hold it.
- Remove bolts (17) (left and right sides).
- Remove cross member (16).



(16) Cross member	Front	Rear
	: 110 kg (243 lbs.)	: 110 kg (243 lbs.)




## VIBRATORY DRUM

### 5) Removal of drum assembly

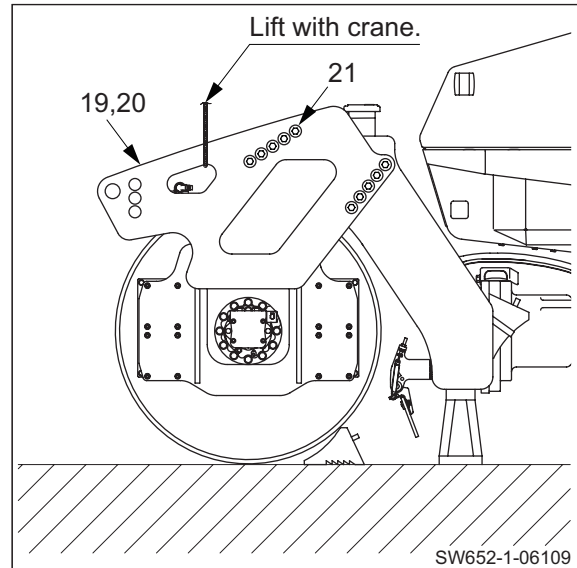
- Lift left plate (19), right plate (20) and hold them.
- Remove bolts (21) (left and right sides).
- Remove drum assembly together with plates (19), (20) from frame.
- Remove rear drum assembly in same way.

#### (NOTICE)

- **Damper mounting bolts and nuts must not be stressed during the removal.**


 Front and rear drum assembly

	Front drum assembly	Rear drum assembly
SW652-1	: 1,820 kg (4,012 lbs.)	1,815 kg (4,001 lbs.)
SW652B-1	: 2,300 kg (5,071 lbs.)	2,295 kg (5,060 lbs.)
SW652ND-1	: 2,020 kg (4,453 lbs.)	2,015 kg (4,442 lbs.)




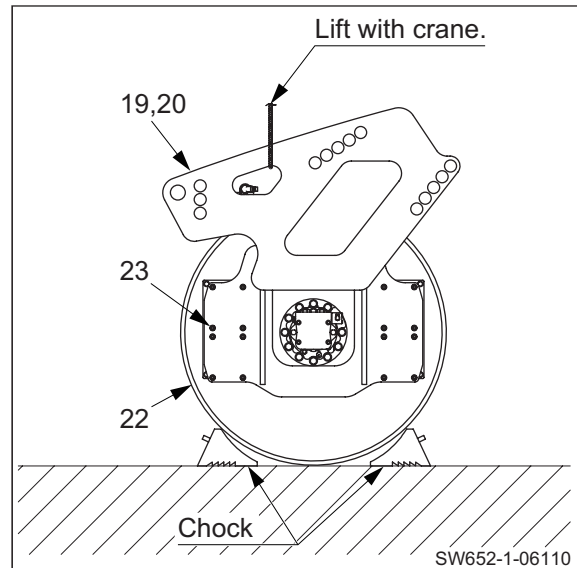
### 6) Removal of plates

- Hold drum (22) with chocks.
- Remove nuts and bolts (23) (left and right sides).
- Remove plate (19), (20).

 (19) Front left plate : 175 kg (386 lbs.)  
 (20) Front right plate : 190 kg (419 lbs.)

- Remove rear drum assembly in same way.

 Rear left plate : 185 kg (408 lbs.)  
 Rear right plate : 170 kg (375 lbs.)





## 2-1-2. Installation of vibratory drum

- 1) Install vibratory drum in reverse order in which it was removed.
  - Tightening torque for bolts where particular care is required when installing vibratory drum.



- (2) Bolt M10×16 : 49 N·m ( 36 lbf·ft)
- (9) Bolt M10×16 : 49 N·m ( 36 lbf·ft)
- (17) Bolt M16×50 : 265 N·m (195 lbf·ft)
- (21) Bolt M16×50 : 265 N·m (195 lbf·ft)
- (23) Nut M12 : 110 N·m ( 81 lbf·ft)

- 2) Upon installing vibratory drum, pay particular attention to items mentioned below.
  - Fill hydraulic oil tank to specified level to make up for any oil leakage.
  - Start engine and circulate oil through piping. Then check oil level again, ensuring that oil is at specified level.

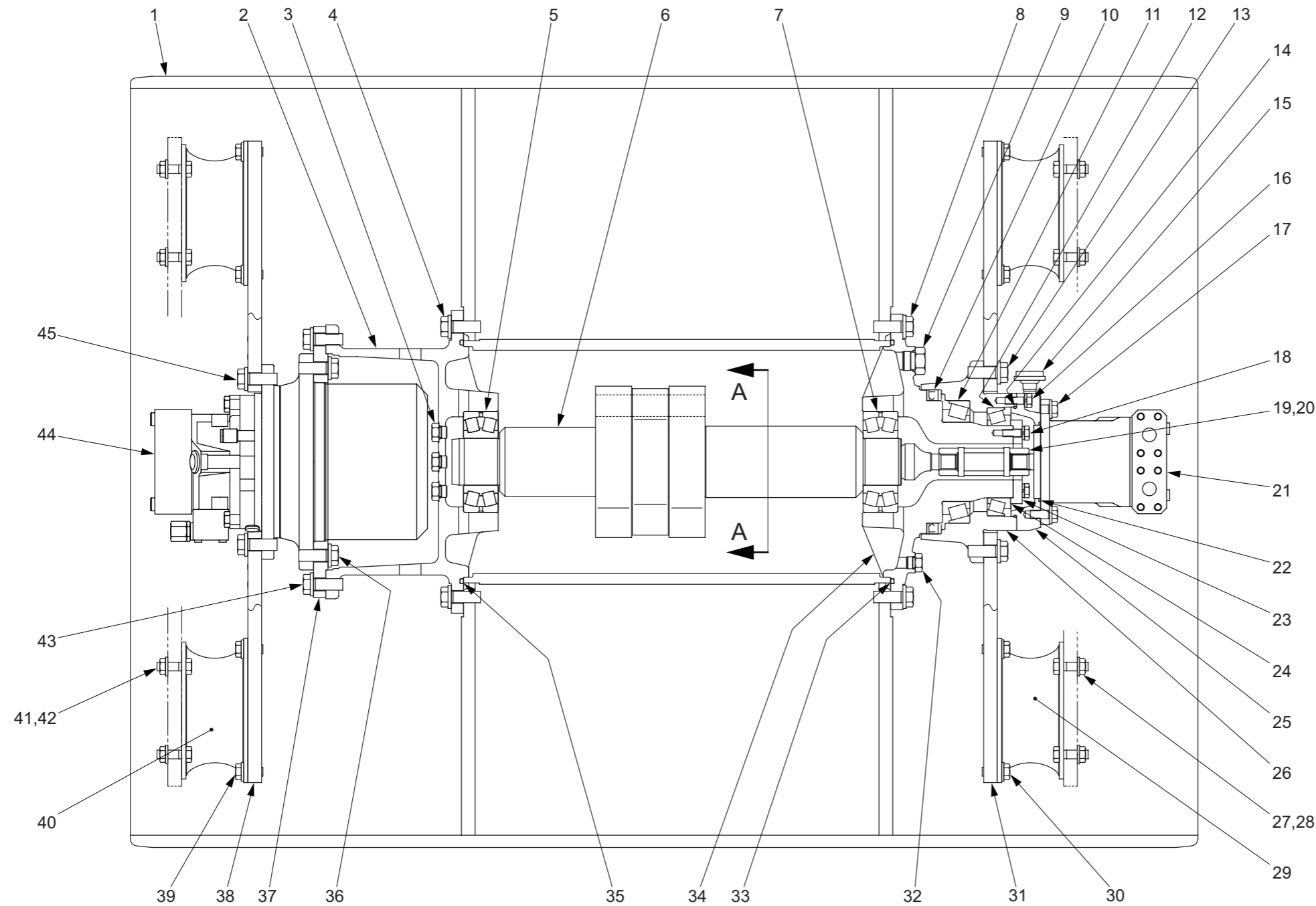
### (NOTICE)

- **If the engine is run at high speed or the cylinder is operated to full stroke when the engine is started for the first time after the work is completed, the piston packing or other items may be damaged by air entering into the cylinder.**

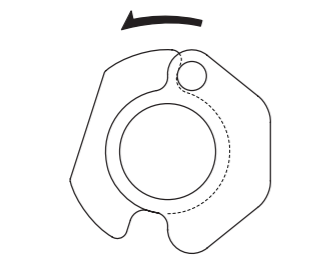


### 3. VIBRATORY DRUM ASSEMBLY

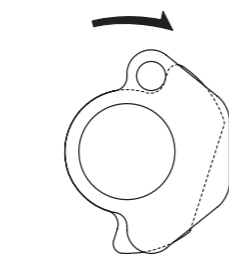
#### 3-1. Vibratory Drum Assembly (SW652-1)



- (1) Drum
- (2) Housing
- (3) Plug
- (4) Bolt : M16×45
- (5) Vibrator bearing
- (6) Eccentric shaft
- (7) Vibrator bearing
- (8) Bolt : M16×45
- (9) Plug
- (10) Oil seal
- (11) Roller bearing
- (12) Roller bearing
- (13) Bolt : M16×45
- (14) O-ring
- (15) Breather
- (16) Bolt : M10×30
- (17) Bolt : M12×30
- (18) Bolt : M10×30
- (19) Sleeve
- (20) Spring pin
- (21) Vibrator motor
- (22) O-ring
- (23) Cover
- (24) Shim
- (25) Flange
- (26) Housing
- (27) Bolt : M12×40
- (28) Nut : M12
- (29) Damper
- (30) Bolt : M12×30
- (31) Disc
- (32) Level plug
- (33) O-ring
- (34) Axle shaft
- (35) O-ring
- (36) Bolt : M16×45
- (37) Disc
- (38) Disc
- (39) Bolt : M12×30
- (40) Damper
- (41) Bolt : M12×40
- (42) Nut : M12
- (43) Bolt : M16×45
- (44) Propulsion motor
- (45) Bolt : M16×45

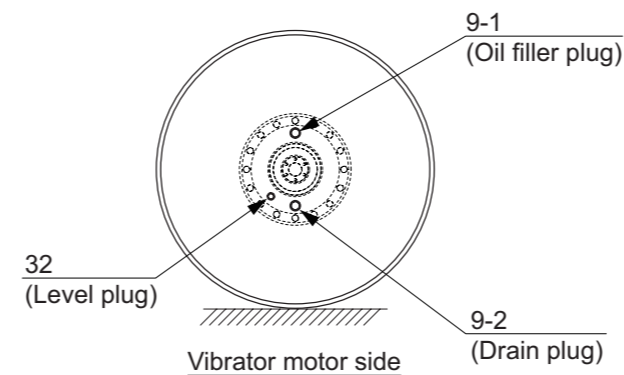


Vibration mode: Low  
Counterclockwise rotation



Vibration mode: High  
Clockwise rotation

#### SECTION A-A



0558-43801-0-10013-F




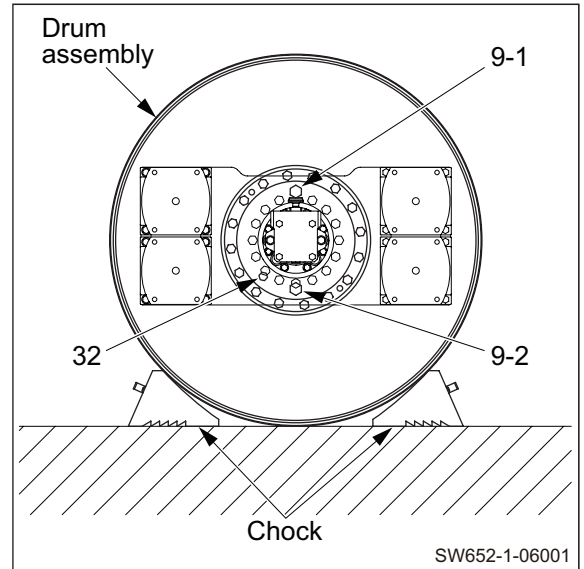
### 3-2. Disassembly and Reassembly of Vibratory Drum (SW652-1)

- Lead line numbers shown in the illustrations for the following vibratory drum disassembly and reassembly procedures are constant with part numbers of vibratory drum assembly shown on page 6-008.

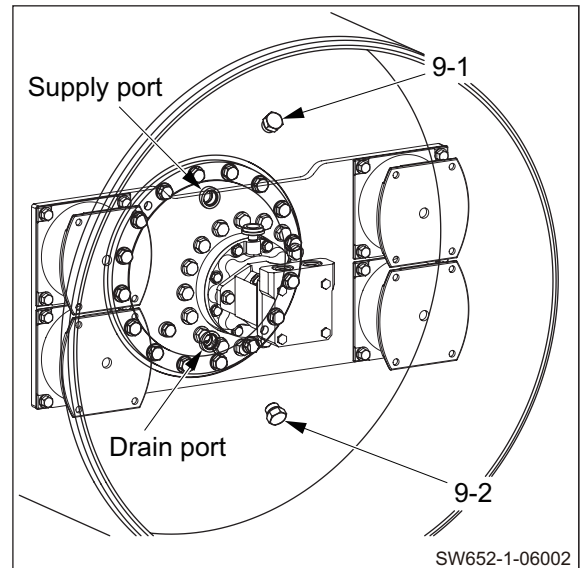
#### 3-2-1. Disassembly of vibratory drum

- 1) Lay vibratory drum assembly with plugs (9-1), (9-2), and (32) positioned as shown on the right.
  - Hold with chocks.

 Vibratory drum assembly : 1,455 kg (3,208 lbs.)




- 2) Remove plugs (9-1) and (9-2).
  - Drain gear oil.
  - Quantity of gear oil : 4.0 L (1.1 gal.)

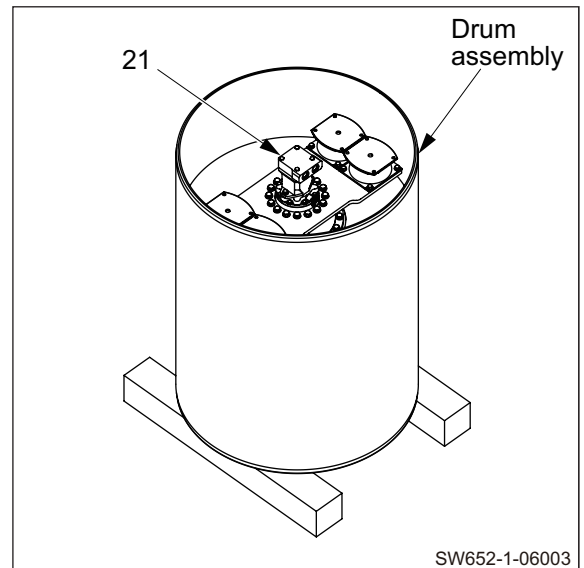


### WARNING

- When standing the vibratory drum, use wooden blocks of sufficient strength to securely support the drum.
- Carry out the work in an unstrained posture using a work stool or the like.

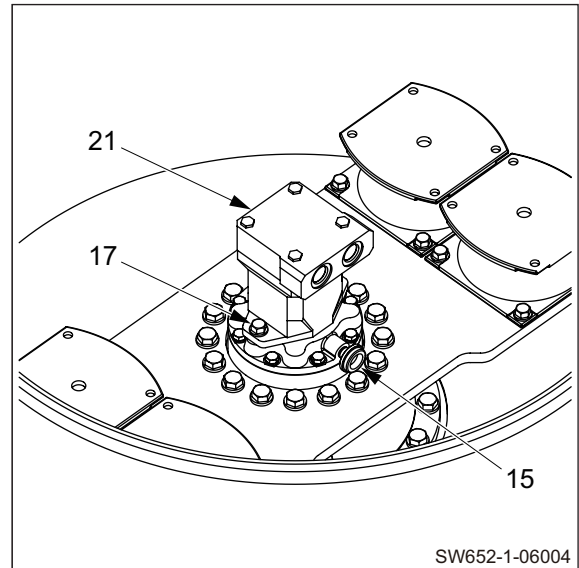
- 3) Stand vibratory drum assembly with its vibrator motor (21) side facing up.

 Vibratory drum assembly : 1,455 kg (3,208 lbs.)

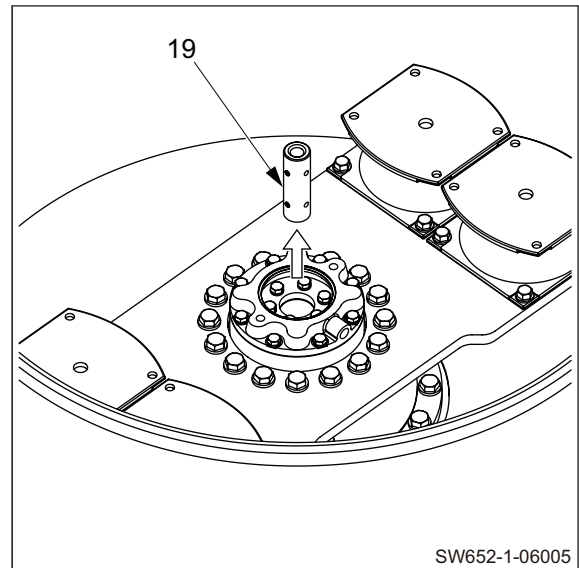


- 4) Remove breather (15).
  - Remove bolts (17).
  - Remove vibrator motor (21).

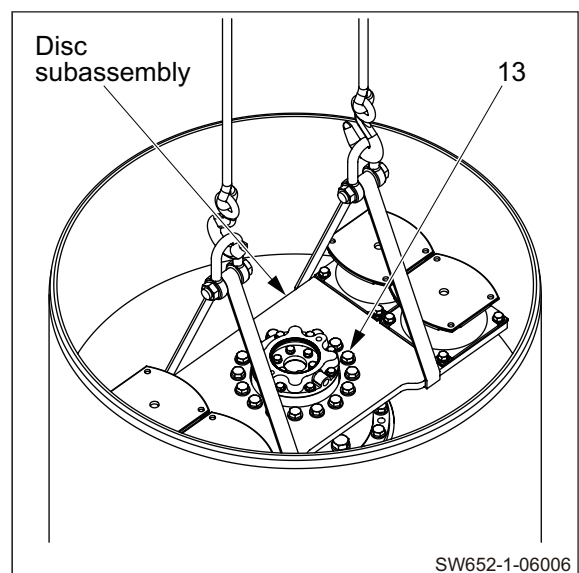
$\mathcal{J}_{kg}$  (21) Vibrator motor : 15 kg (331 lbs.)




- 5) Remove sleeve (19).

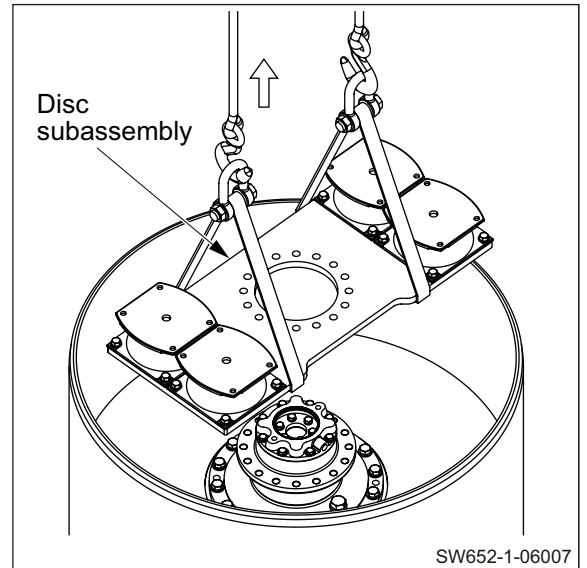


- 6) Lift disc subassembly.
  - Remove bolts (13).

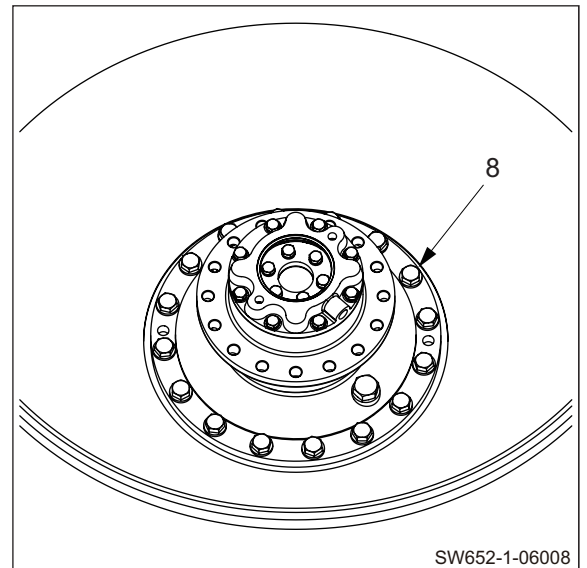


7) Remove disc subassembly.

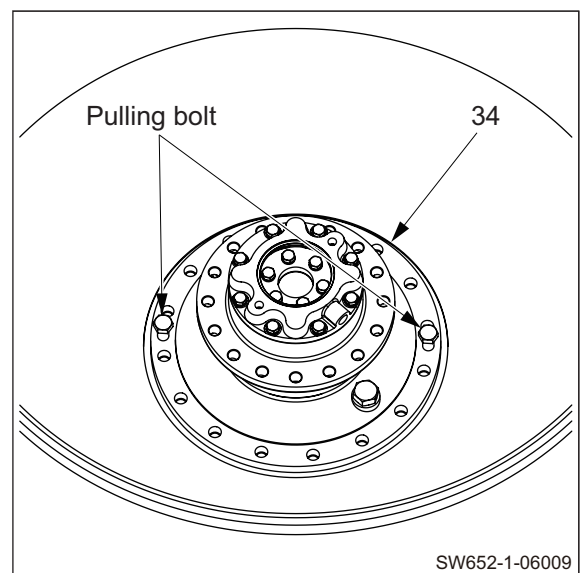
 Disc subassembly : 75 kg (165 lbs.)



8) Remove bolts (8).

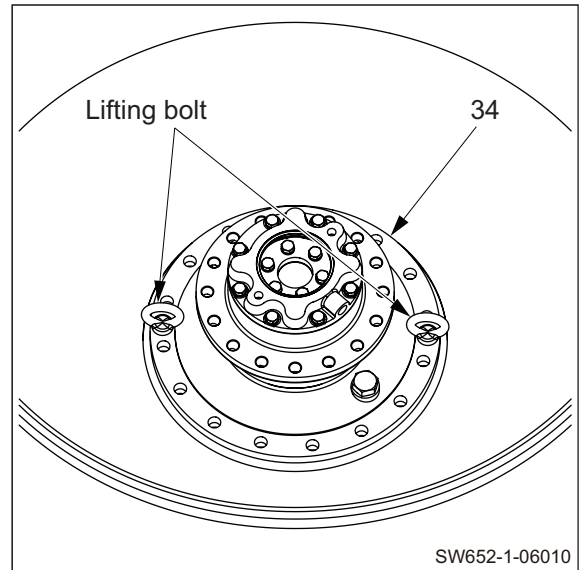


9) Lift axle shaft (34) using two pulling bolts (M16×45).



**⚠ WARNING**  
 When installing lifting bolts, screw in the threads fully before using.


10) Install lifting bolts (M16) to axle shaft (34).

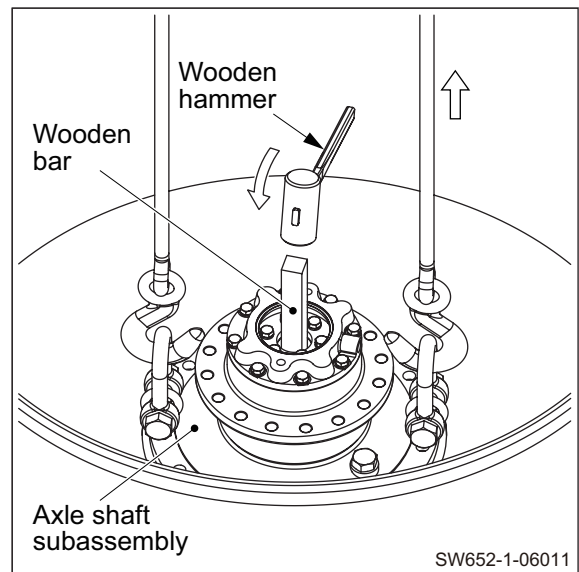


11) Remove axle shaft subassembly.

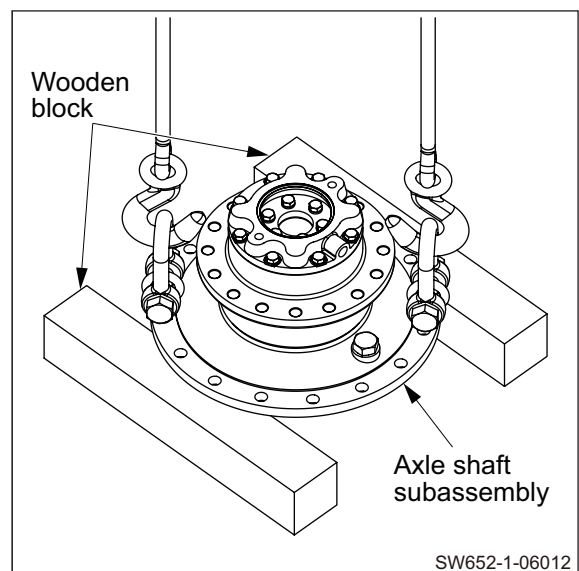
**(NOTICE)**

- In order not to lift eccentric shaft together with axle shaft subassembly, tap on the eccentric shaft end with a wooden hammer via a wooden bar during lifting.

 Axle shaft subassembly : 65 kg (143 lbs.)

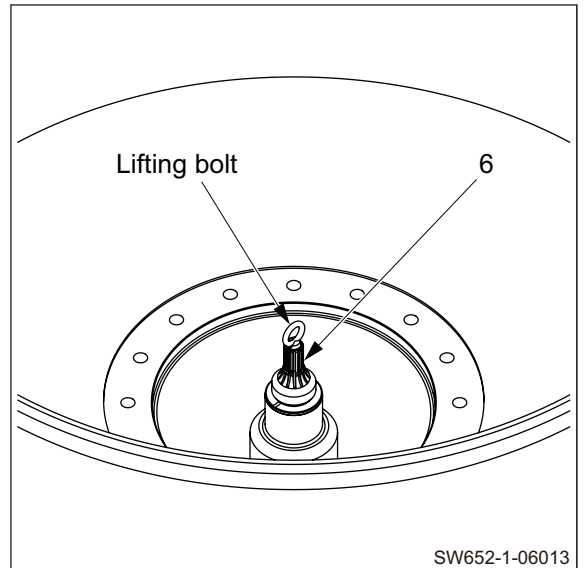


12) Put axle shaft subassembly on wooden blocks.





13) Install a lifting bolt (M8) to eccentric shaft (6).

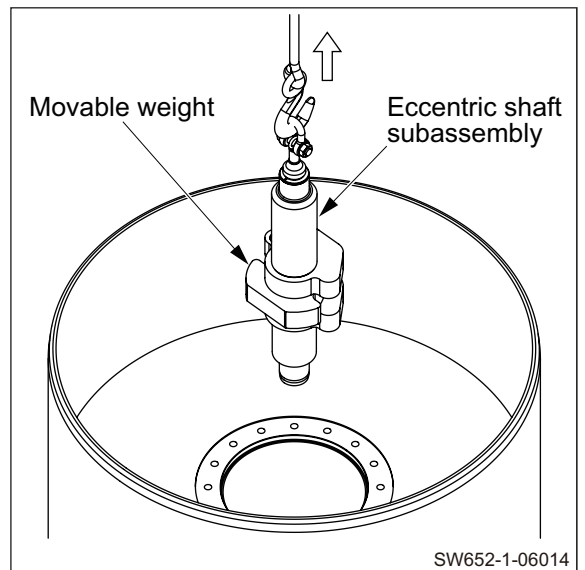


14) Remove eccentric shaft subassembly.

$\mathfrak{J}_{kg}$  Eccentric shaft subassembly : 60 g (132 lbs.)

**(NOTICE)**

- Put the movable weight at its outmost position.

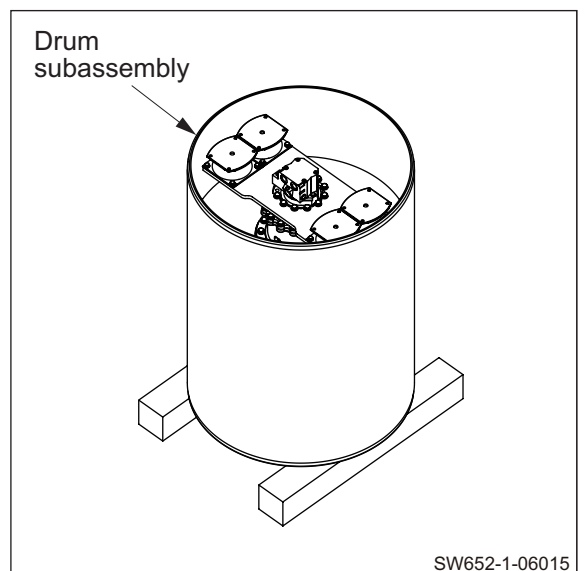


**! WARNING**

Be careful because reversing the vibratory drum involves risk. Confirm that the surrounding area is safe, and work in a natural, unstrained posture.

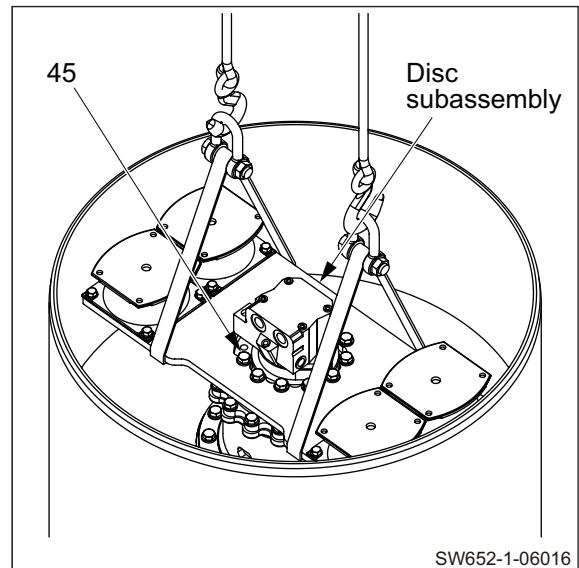
15) Reverse vibratory drum subassembly.

$\mathfrak{J}_{kg}$  Vibratory drum subassembly : 1,240 kg (2,734 lbs.)




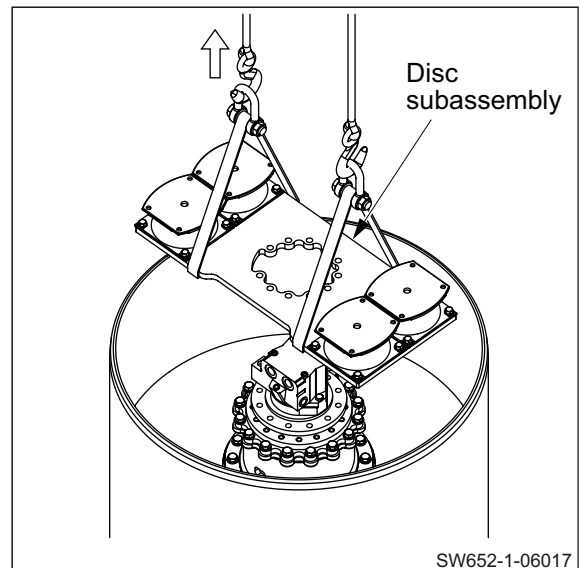
16) Lift disc subassembly.

- Remove bolts (45).



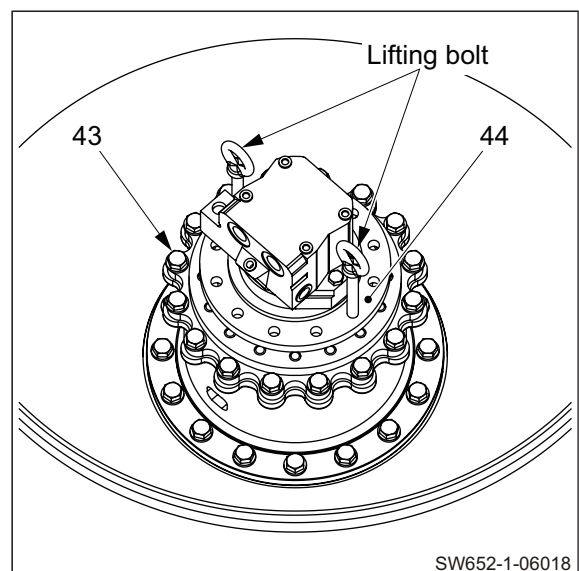
17) Remove disc subassembly.

 Disc subassembly : 70 kg (154 lbs.)




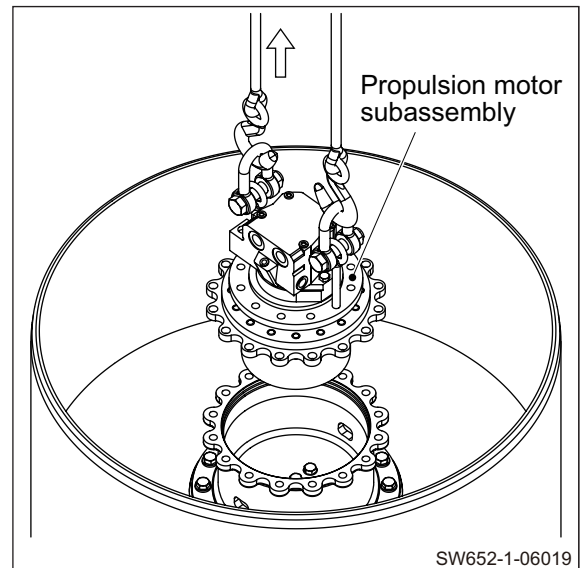
18) Install lifting bolts (M16) to propulsion motor (44).

- Remove bolts (43).



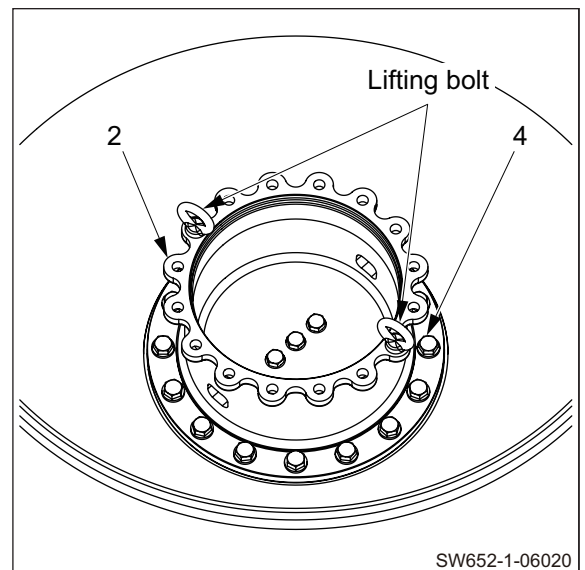
19) Remove propulsion motor subassembly.

 Propulsion motor subassembly : 75 kg (165 lbs.)




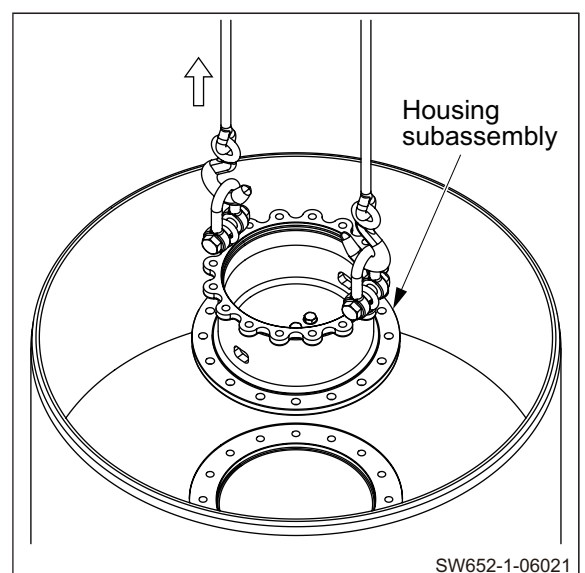
20) Install lifting bolts (M16) to housing (2).

- Remove bolts (4).



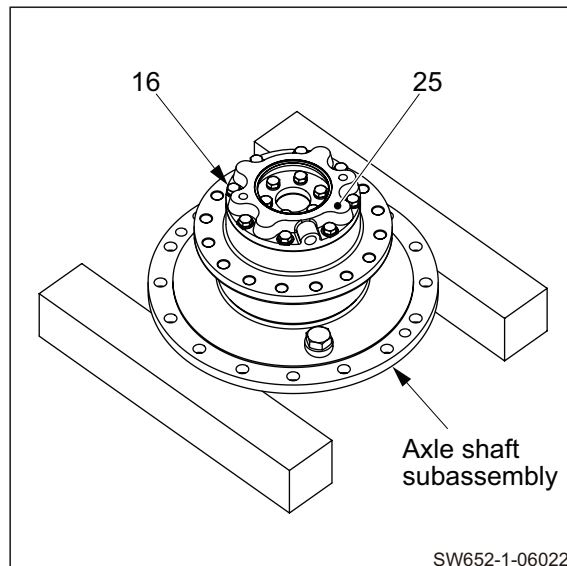
21) Remove housing subassembly.

 Housing subassembly : 50 kg (110 lbs.)



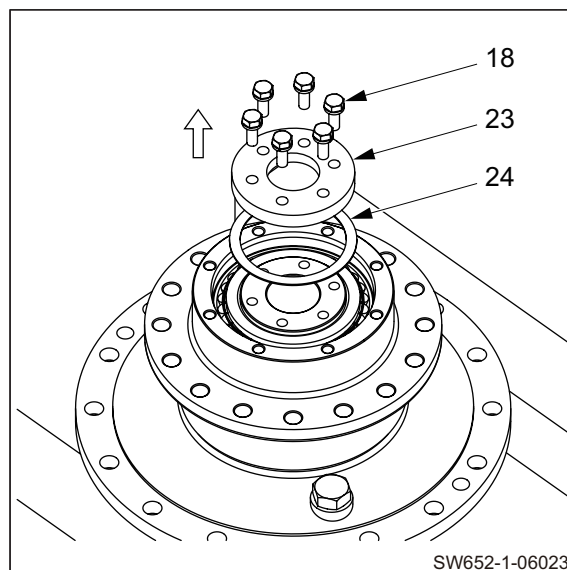
## 22) Disassembly of axle shaft subassembly.

- Remove bolts (16).
- Remove flange (25).



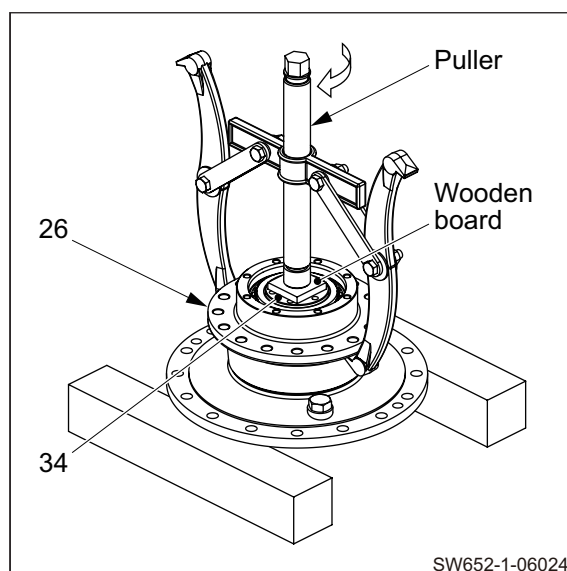
## 23) Remove bolts (18).

- Remove cover (23).
- Remove shim (24).

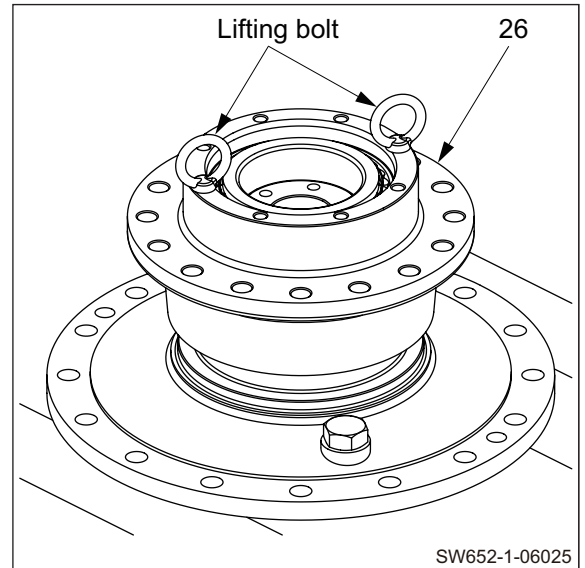


## 24) Put a piece of wooden board on end of axle shaft (34).


- Set a puller on housing (26).
- Remove housing subassembly from axle shaft subassembly.

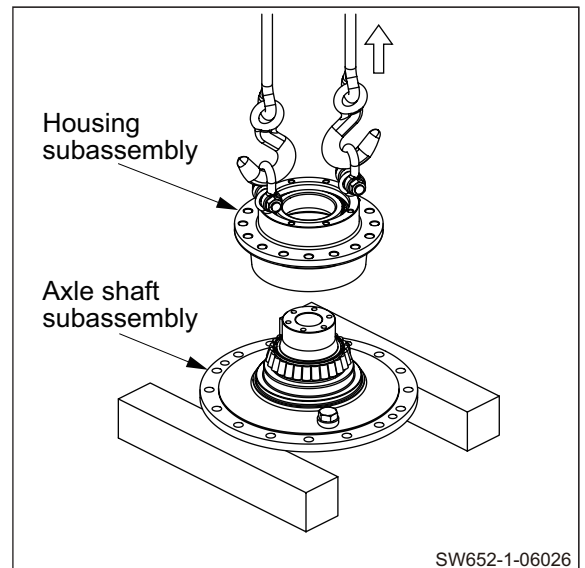


25) Install lifting bolts (M10) to housing (26).



26) Remove housing subassembly from axle shaft subassembly.

 Housing subassembly : 20 kg (44 lbs.)



### 3-2-2. Reassembly of vibratory drum

- Before reassembling, clean disassembled parts well and check that there is no abnormality.

## **⚠ WARNING**

- When standing the vibratory drum, use wooden blocks of sufficient strength to securely support the drum.
- Carry out the work in an unstrained posture using a work stool or the like.

- 1) Stand vibratory drum (1) with its propulsion motor side facing up.

$\text{kg}$  (1) Vibratory drum : 1,035 kg (2,282 lbs.)

#### (NOTICE)

- Propulsion motor side dimension "a" : 459 mm (18 in.)

- 2) Reassembly of housing subassembly

2-1) Apply a coat of gear oil to vibrator bearing (5) on its surface to be press-fitted.

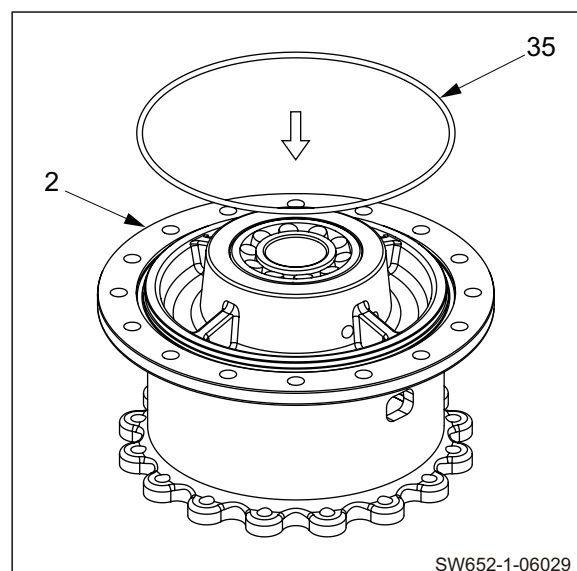
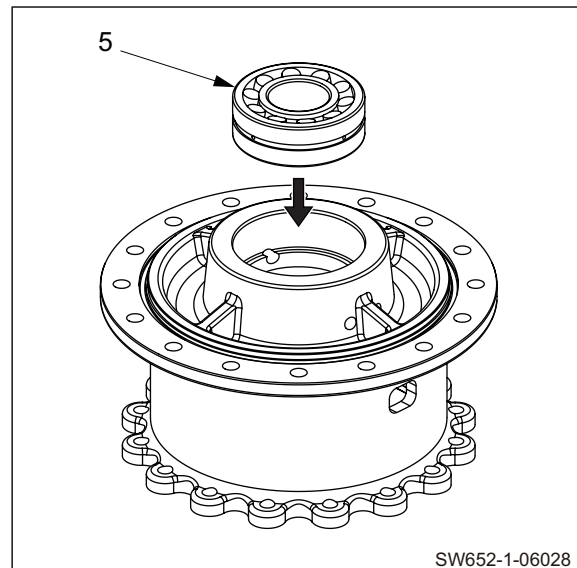
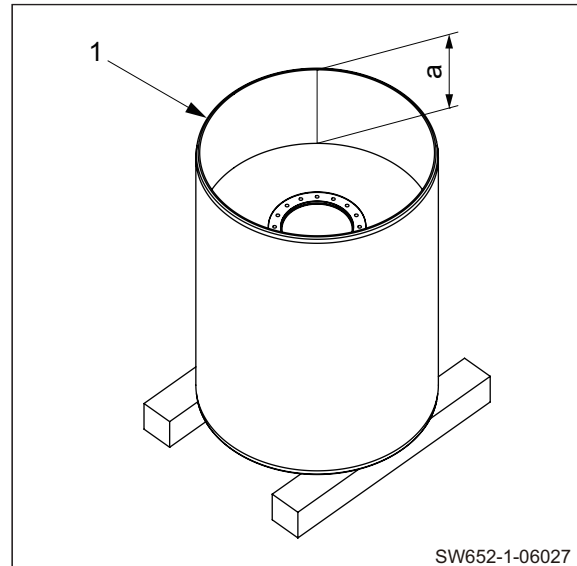
- Drive in vibrator bearing (5).

#### (NOTICE)


- Take care not to damage the bearing when installing it.

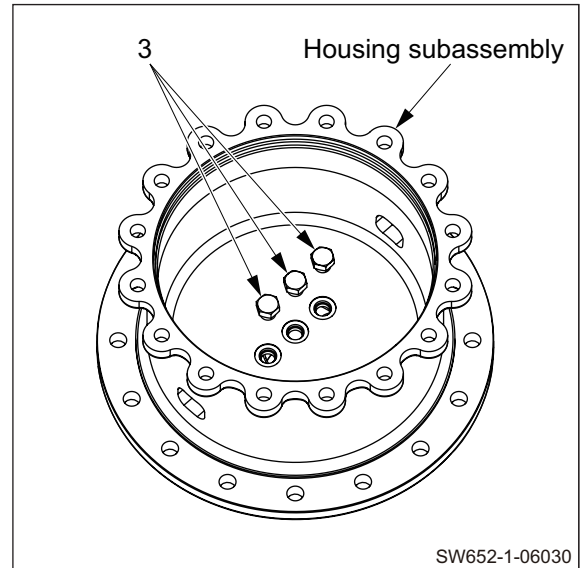
2-2) Apply grease to O-ring (35).

- Install O-ring (35) to housing (2).



- 2-3) Reverse housing subassembly.
- Apply grease to O-rings for plugs (3).
  - Install plugs (3) to housing subassembly.

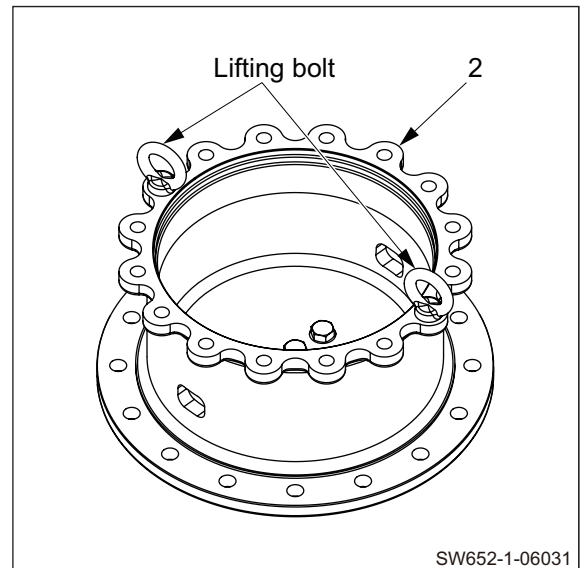
 Housing subassembly : 50 kg (110 lbs.)




**⚠ WARNING**

When installing lifting bolts, screw in the threads fully before using.

- 3) Install lifting bolts (M16) to housing (2).

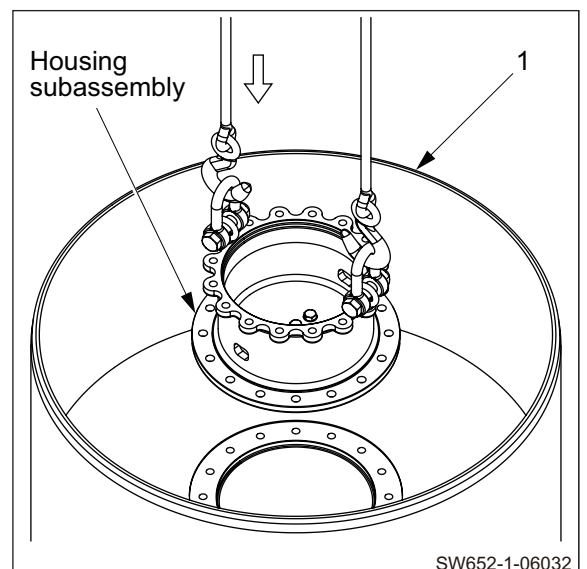


- 4) Lower housing subassembly on mounting surface of vibratory drum (1).


 Housing subassembly : 50 kg (110 lbs.)

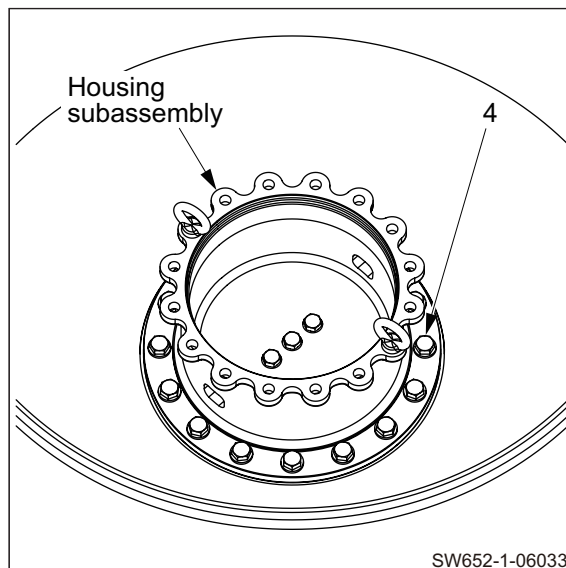
**(NOTICE)**

- Take care not to let O-ring to protrude from its groove.




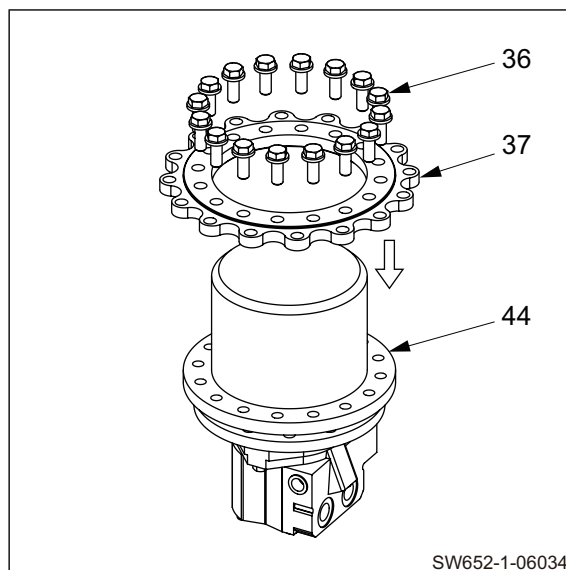
- 5) Secure housing subassembly with sixteen bolts (4) and washers.

 N·m (4) Bolts M16×45 : 265 N·m (195 lbf-ft)




- 6) Reassembly of propulsion motor subassembly
- Secure disc (37) to propulsion motor (44) with sixteen bolts (36) and washers.

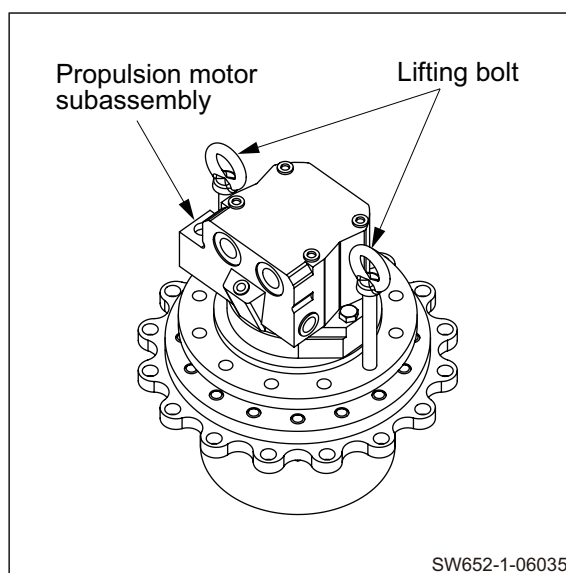
 N·m (36) Bolts M16×45 : 265 N·m (195 lbf-ft)



- 7) Reverse propulsion motor subassembly.


 kg Propulsion motor subassembly : 75 kg (165 lbs.)

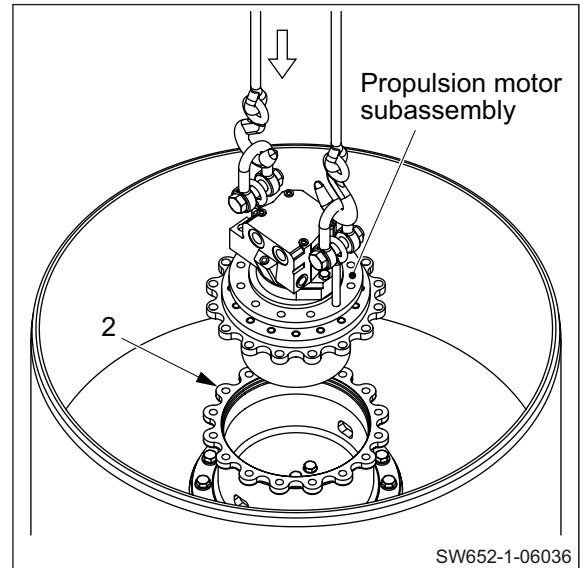
- Install lifting bolts (M16) to propulsion motor (44).






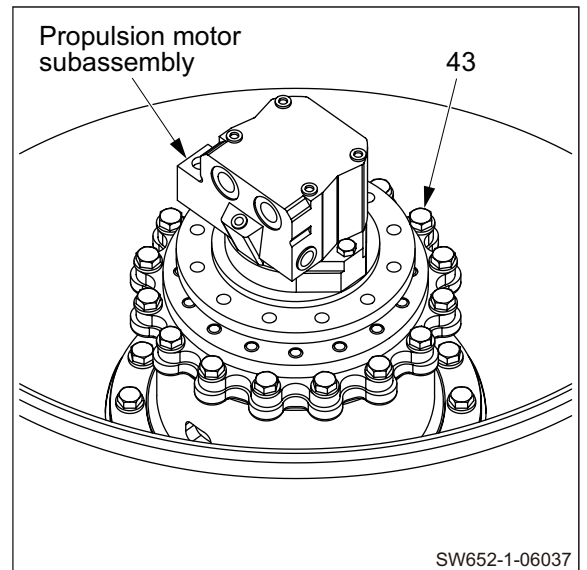
- 8) Lower propulsion motor subassembly on mounting surface of housing (2).

 Propulsion motor subassembly : 75 kg (165 lbs.)

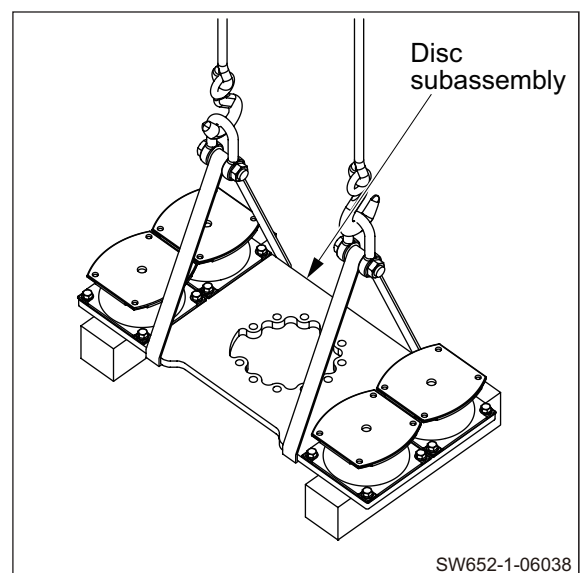


- 9) Secure propulsion motor subassembly with sixteen bolts (43) and washers.

 (43) Bolts M16×45 : 265 N·m (195 lbf·ft)

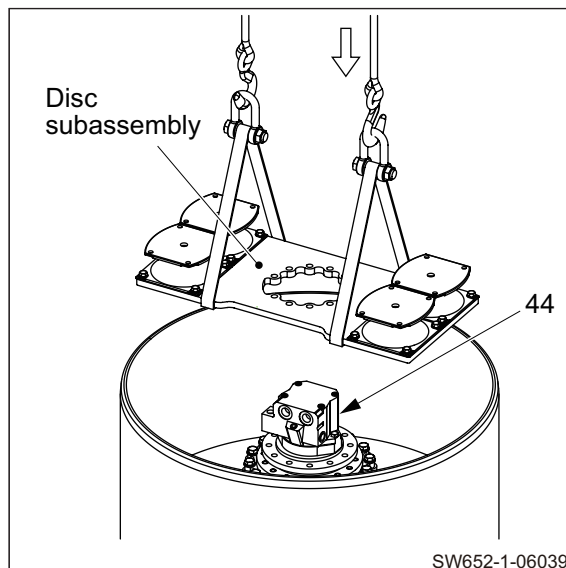


- 10) Lift disc subassembly.



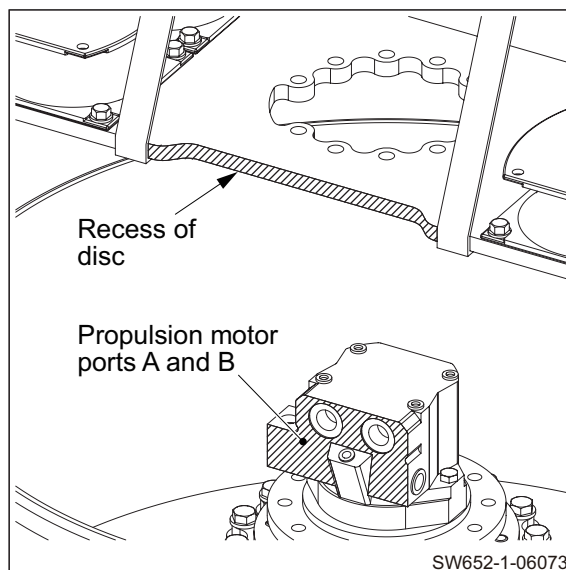
11) Lower disc subassembly on mounting surface of propulsion motor (44).

 Disc subassembly : 70 kg (154 lbs.)




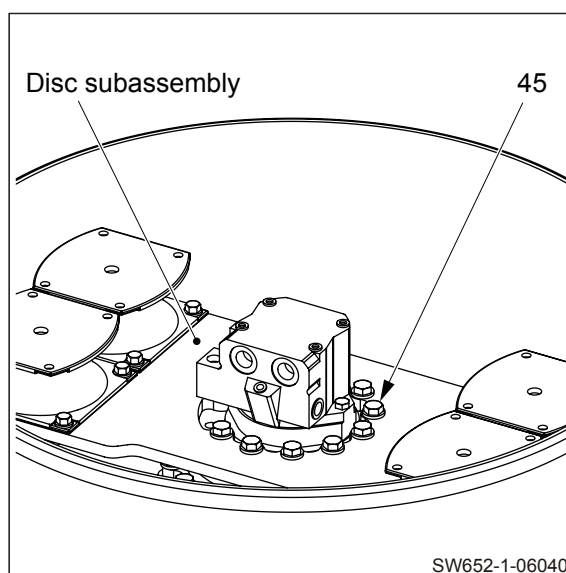
**(NOTICE)**

- The recess of the disc must be parallel with the side of the propulsion motor ports A and B.



12) Secure disc subassembly with eleven bolts (45) and washers.

 (45) Bolts M16×45 : 265 N·m (195 lbf·ft)

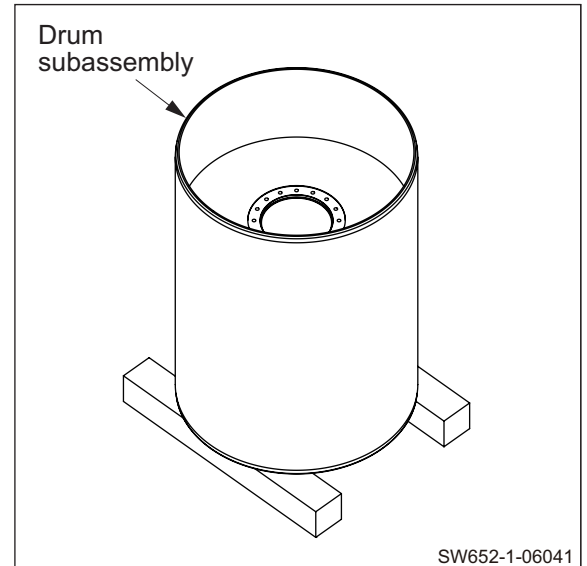


## ⚠ WARNING

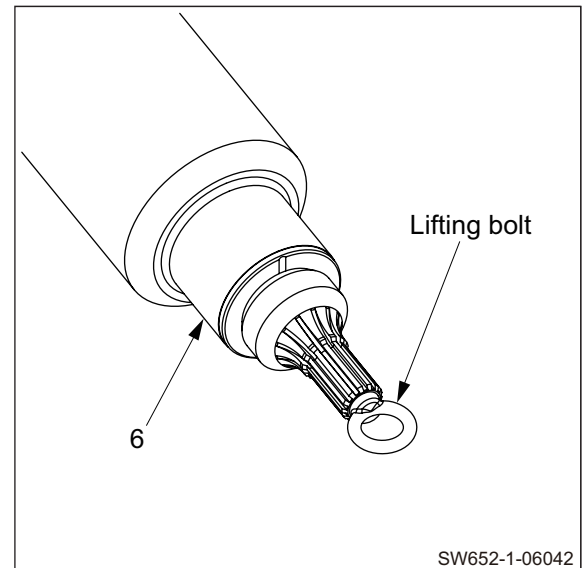
Be careful because reversing the vibratory drum involves risk. Confirm that the surrounding area is safe, and work in a natural, unstrained posture.

13) Reverse vibratory drum subassembly.

⚠<sub>kg</sub> Vibratory drum subassembly : 1,240 kg (2,734 lbs.)



14) Install a lifting bolt (M8) to eccentric shaft (6).



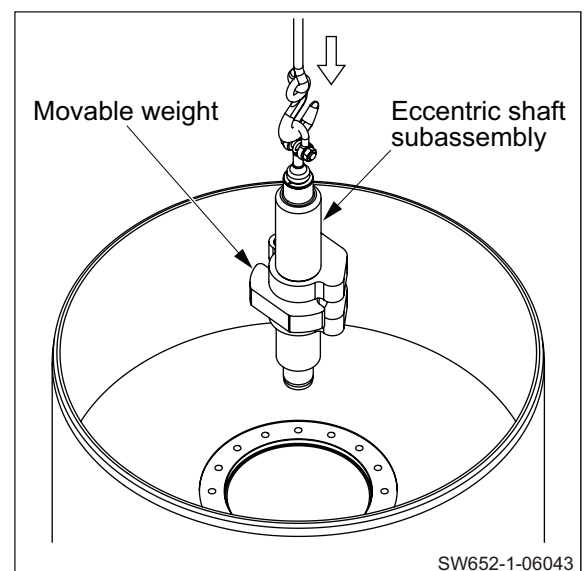
15) Apply a coat of gear oil to eccentric shaft subassembly at where vibrator bearing (5) will be installed.

- Install eccentric shaft subassembly.

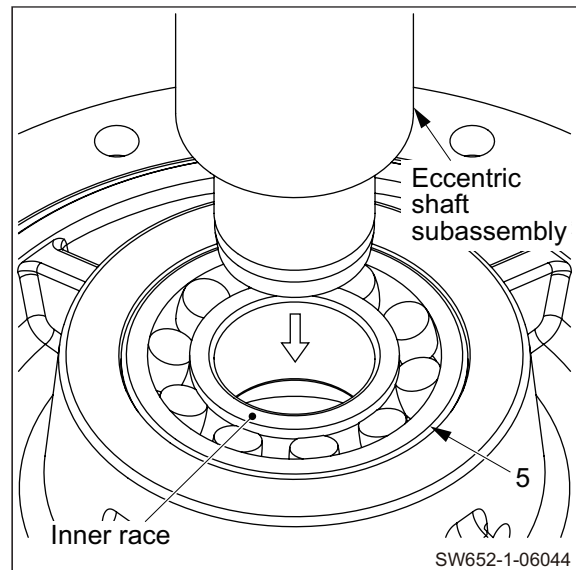
⚠<sub>kg</sub> Eccentric shaft subassembly : 60 kg (132 lbs.)

### (NOTICE)

- Put the movable weight at its outmost position.



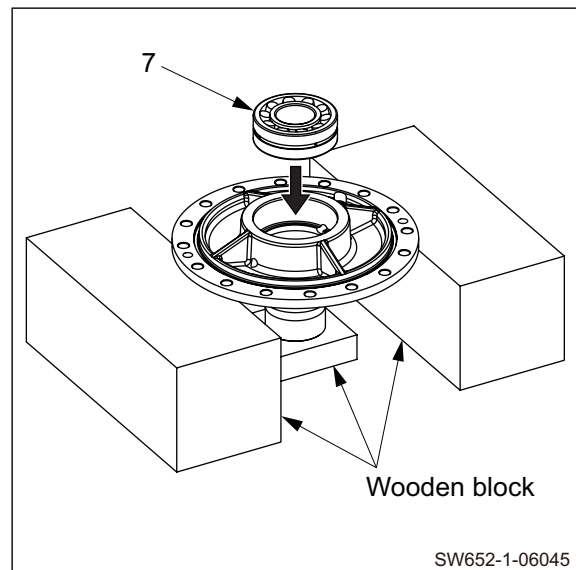
- 16) Insert eccentric shaft subassembly into vibrator bearing (5) while taking care not to tilt vibrator bearing inner race.



17) Reassembly of axle shaft subassembly

- 17-1) Apply a coat of gear oil to vibrator bearing (7) on its surface to be press-fitted.


- Drive in vibrator bearing (7).



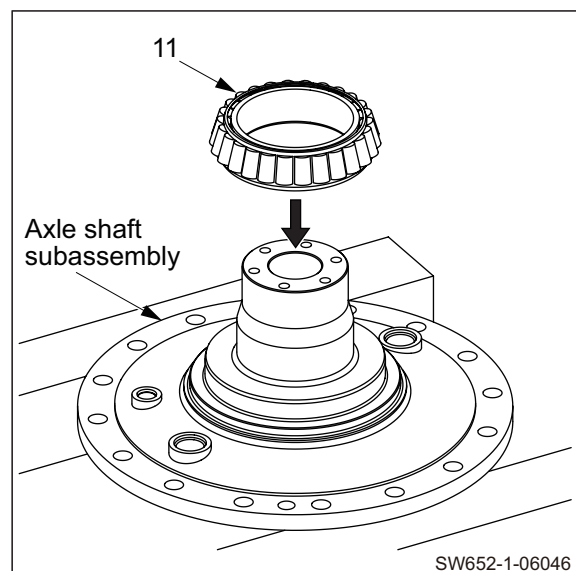
**WARNING**

Wear heat resistant gloves when handling heated parts to avoid burns.

17-2) Reverse axle shaft subassembly.

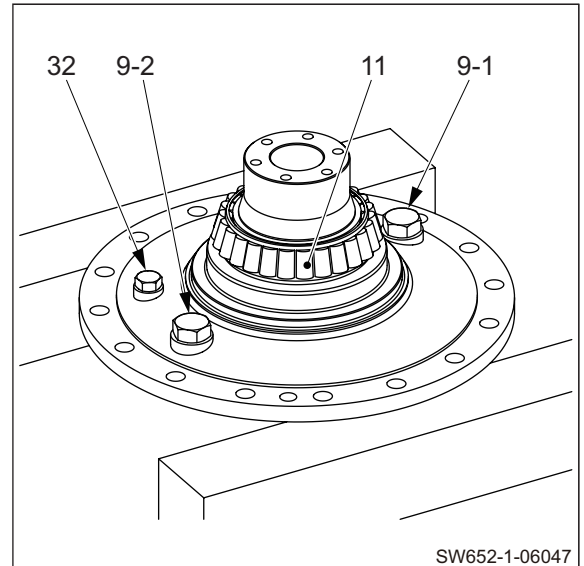
 Axle shaft subassembly : 40 kg (88 lbs.)

- Heat up roller bearing (11) inner race by using a ring heater or the like.
- Apply a coat of gear oil to roller bearing (11) inner race on its surface to be press-fitted.
- Drive in heated roller bearing (11) inner race.



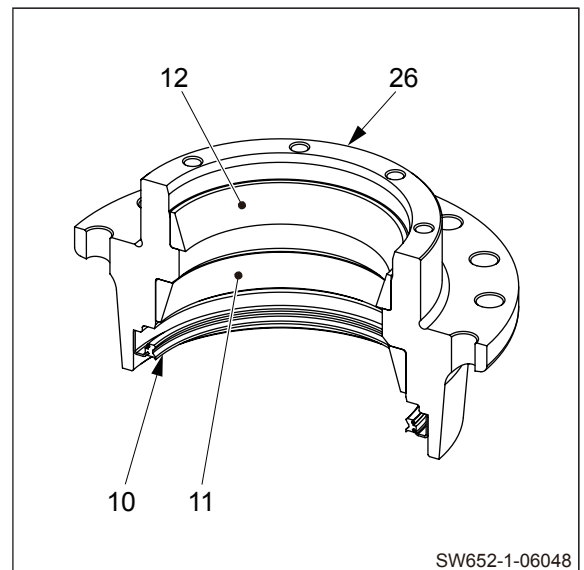
17-3) Apply grease to O-rings for plugs (9-1), (9-2) and (32).

- Install plugs (9-1), (9-2) and level plug (32).
- Apply sufficient amount of lithium-based grease to rollers of roller bearing (11) inner race.

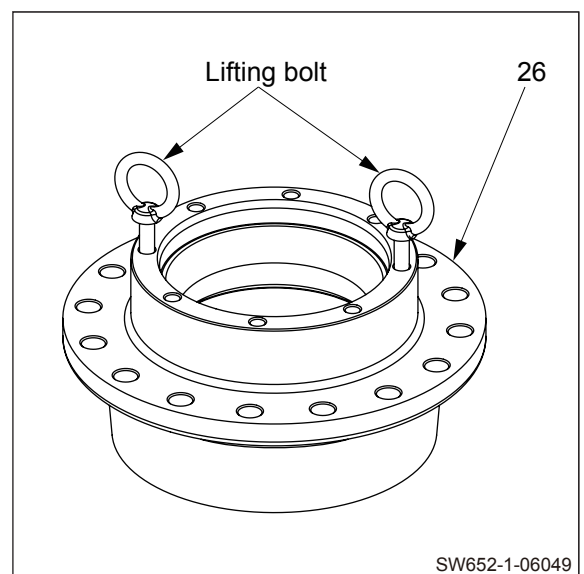


17-4) Apply a coat of gear oil to roller bearings (11) and (12) outer races on their surfaces to be press-fitted.

- Drive roller bearings (11) and (12) outer races into housing (26).
- Apply liquid packing to periphery of oil seal (10).
- Drive in oil seal (10).
- Apply grease to lip of oil seal (10).

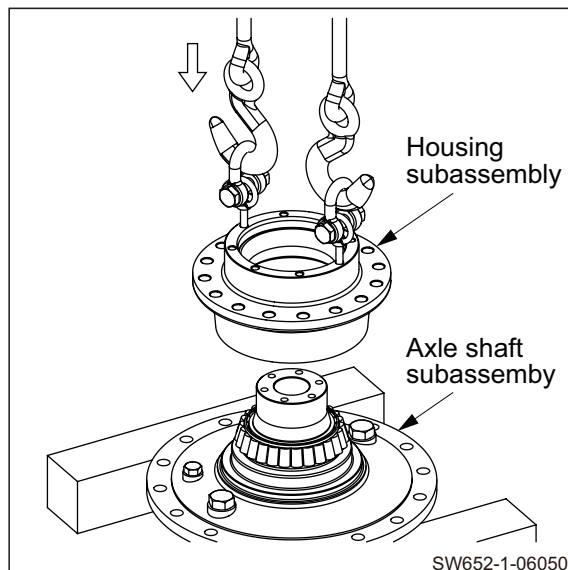


17-5) Install lifting bolts (M10) to housing (26).



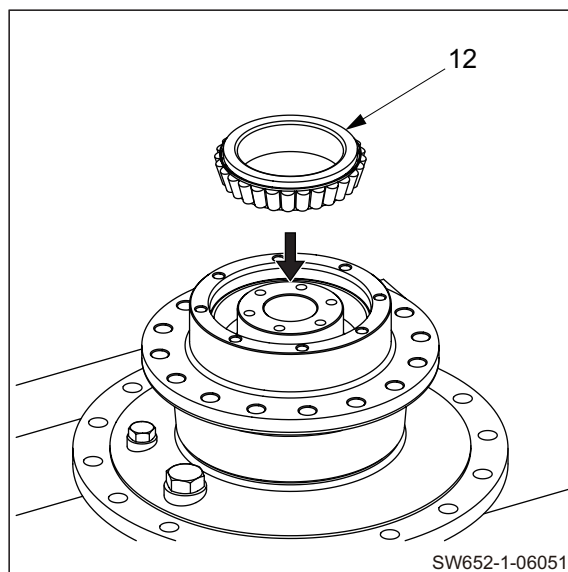
17-6) Install housing subassembly to axle shaft subassembly.

$\mathcal{U}_{kg}$  Housing subassembly : 20 kg (44 lbs.)



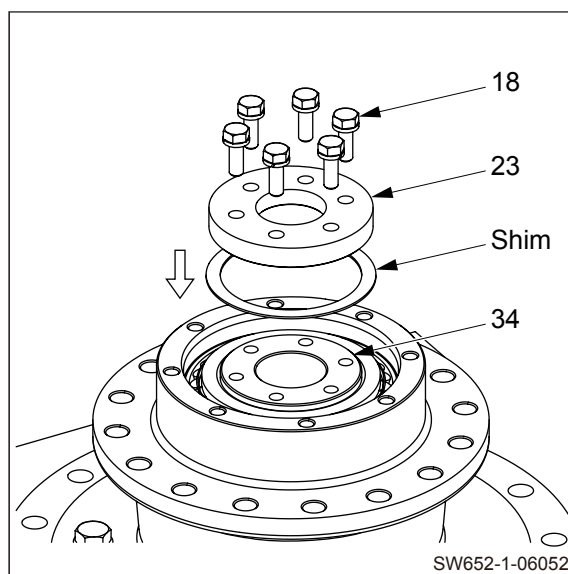
17-7) Apply sufficient amount of lithium-based grease to rollers of roller bearing (12) inner race.

- Drive in roller bearing (12) inner race until rollers come in contact with outer race.



17-8) Preload adjustment of roller bearing

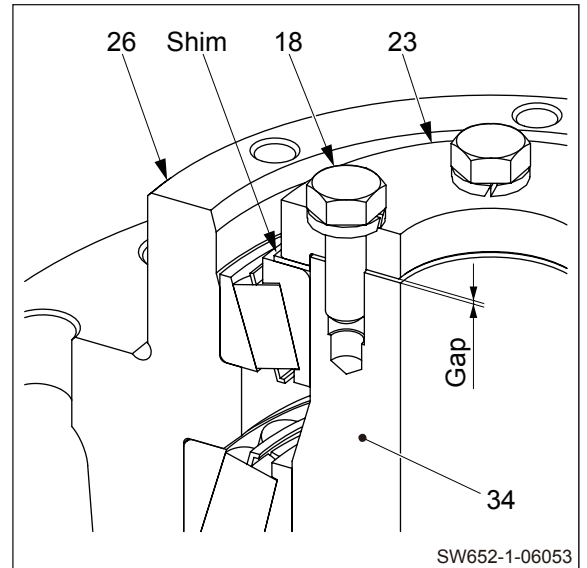
- ① Install a shim of about 1 mm (0.04 in.) and secure cover (23) to axle shaft (34) with six bolts (18) and spring washers.



- ② A gap will remain between end of axle shaft (34) and inside of cover (23).
- Tighten bolts (18) to a torque of 60 N·m (44 lbf-ft).
  - Give housing (26) two to three turns.
  - Tighten bolts (18) to a torque of 60 N·m (44 lbf-ft) again.
  - Repeat this work several times until tightening torque of bolts no longer fluctuates.

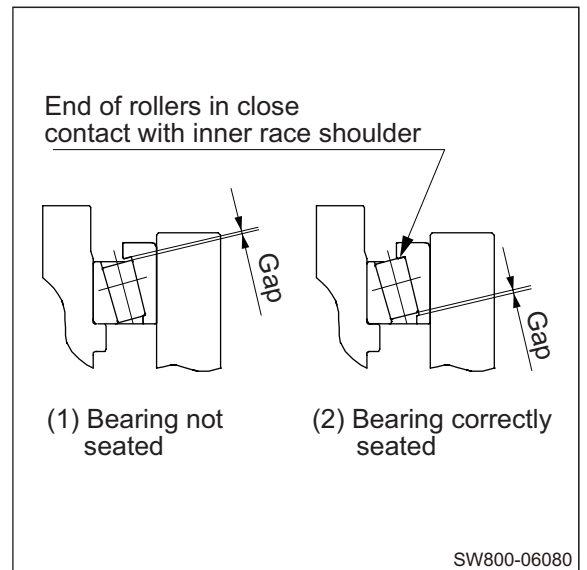
**(NOTICE)**

- Tighten the bolts alternately in diagonal directions.



**(NOTICE)**

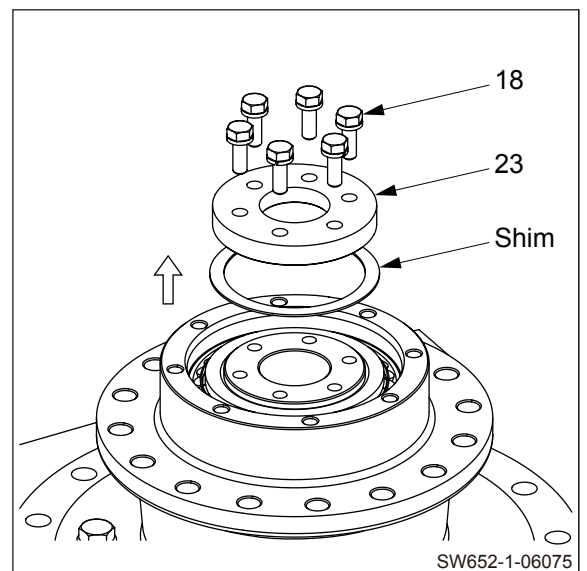
- Push in the inner race while rotating the bearing. Otherwise, even strongly trying to push the inner race, the bearing rollers will not be pushed up and therefore bearing will not be seated.



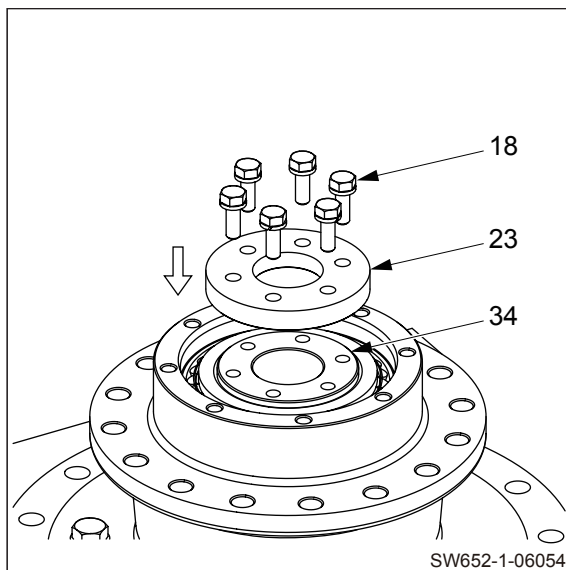
- ③ Remove bolts (18).
- Remove cover (23).
  - Remove shim.

**(NOTICE)**

- Do not turn the housing after the cover is removed.

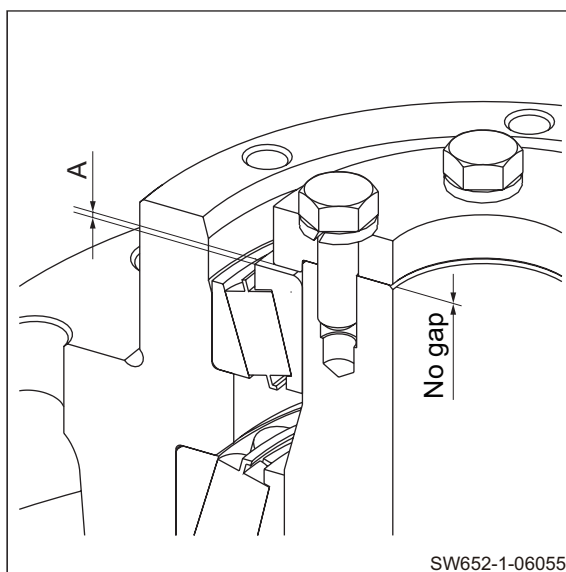


- ④ Without inserting shim, install cover (23) to axle shaft (34) with six bolts (18) and spring washers.

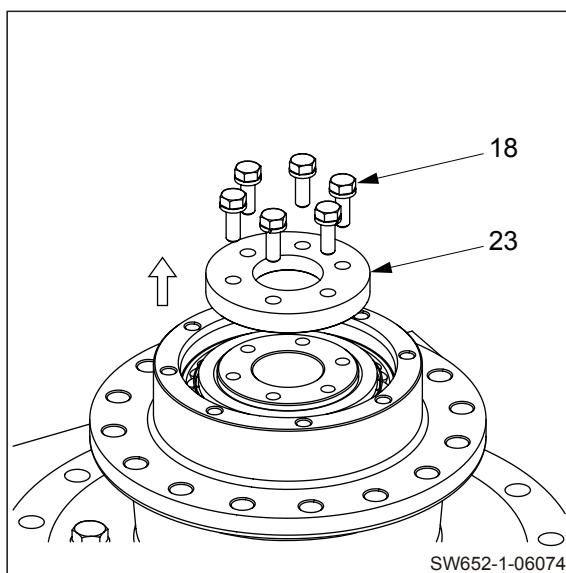


- ⑤ Using a thickness gauge, measure clearance “A”.

★ Preload adjusting shim thickness =  $A + 0.1 \text{ mm (0.04 in.)}$




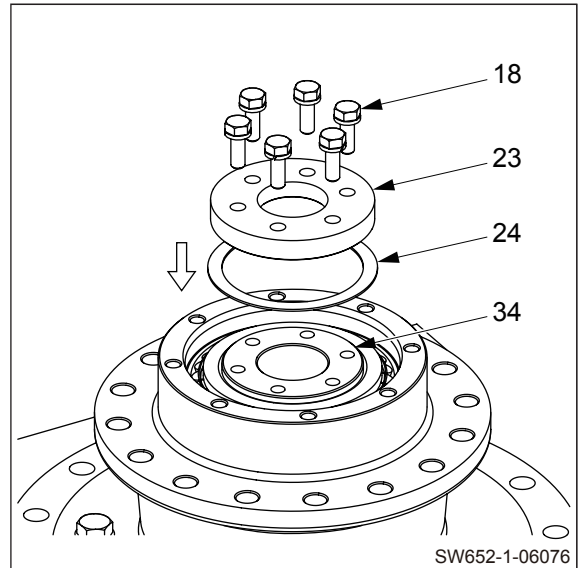
- ⑥ Remove bolts (18).  
• Remove cover (23).



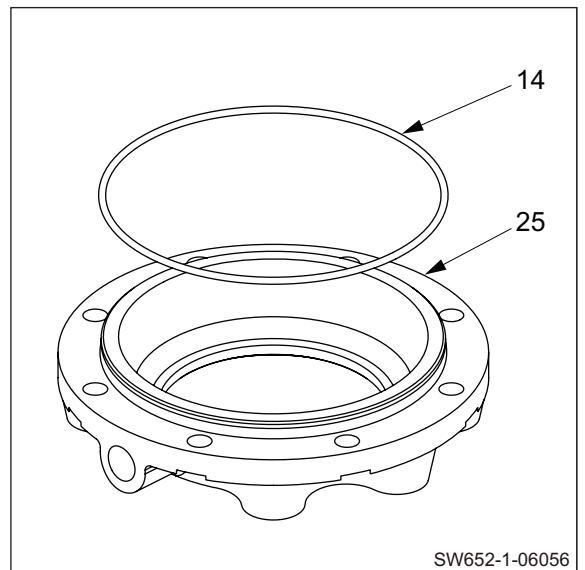


- ⑦ Install shim (24) of preload adjusting shim thickness = "A + 0.1 mm (0.04 in.)".
- Secure cover (23) to axle shaft (34) with six bolts (18) and spring washers.


 N·m (18) Bolts M10×30 : 60 N·m (44 lbf·ft)

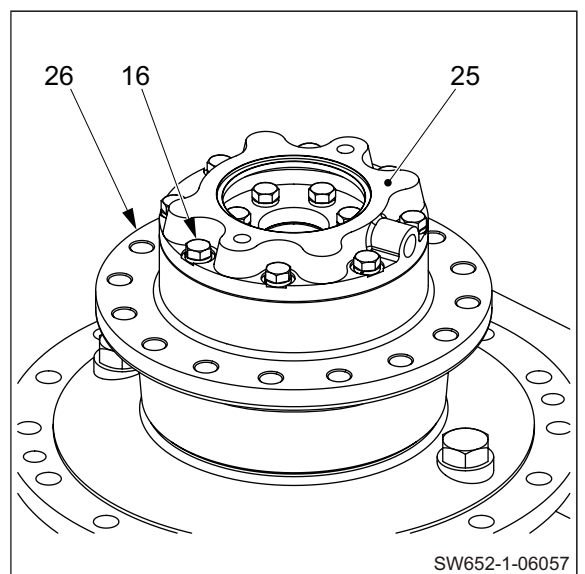


- 17-9) Apply grease to O-ring (14).
- Install O-ring (14) to flange (25).

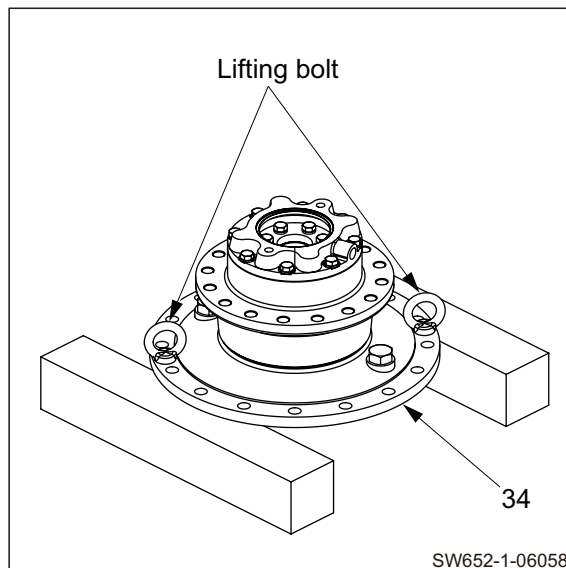


- 17-10) Secure flange (25) to housing (26) with eight bolts (16) and spring washers.

 N·m (16) Bolts M10×30 : 60 N·m (44 lbf·ft)

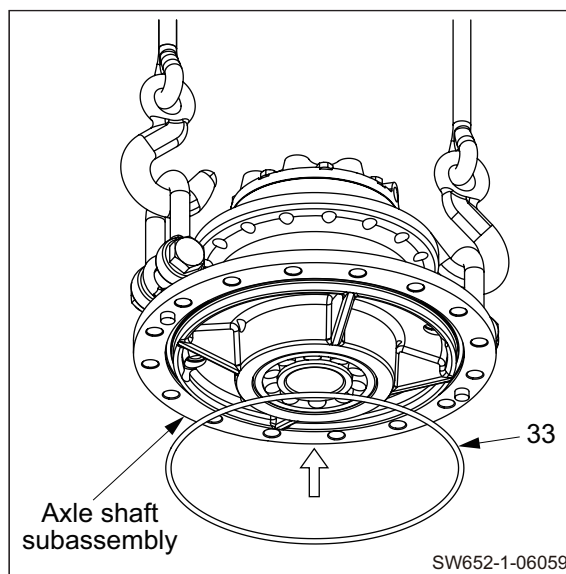


18) Install lifting bolts to axle shaft (34).



19) Lift axle shaft subassembly.

- Apply grease to O-ring (33).
- Install O-ring (33) to axle shaft (34).

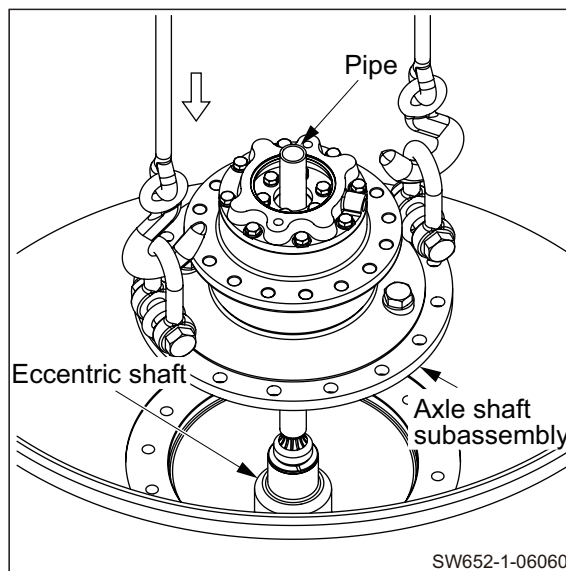


20) Lower axle shaft subassembly on mounting surface of vibratory drum slowly.


$\mathfrak{J}_{kg}$  Axle shaft subassembly : 65 kg (143 lbs.)

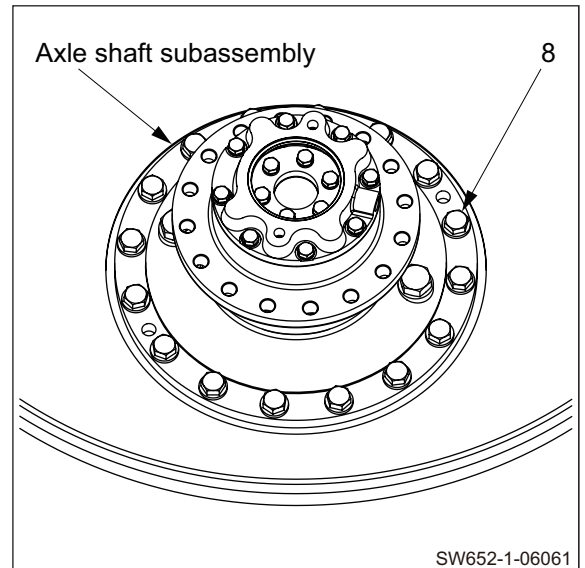
**(NOTICE)**

- Support the eccentric shaft with a pipe or the like, to prevent tilting of the vibrator bearing inner race during installation.

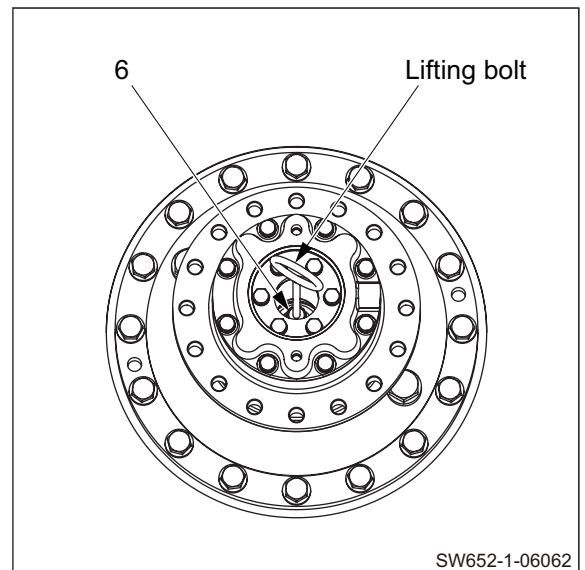


- 21) Secure axle shaft subassembly with sixteen bolts (8) and washers.

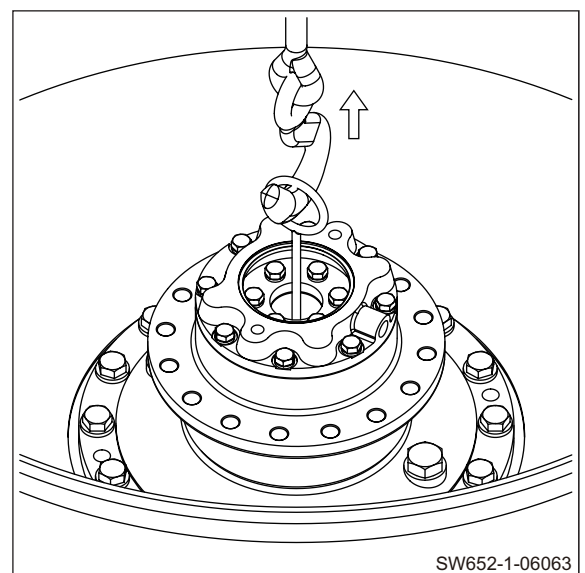
 N·m (8) Bolts M16×45 : 265 N·m (195 lbf·ft)



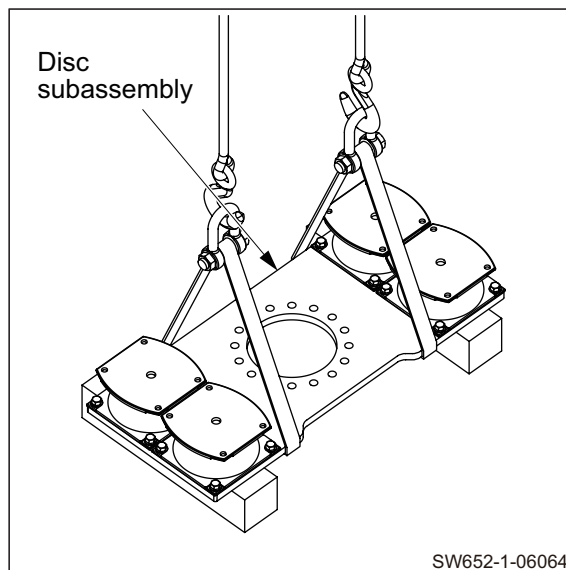
- 22) Install a lifting bolt (M8) to end of eccentric shaft (6).



- 23) Slowly lift eccentric shaft with a crane and check that there is an axial play of 1 to 3 mm (0.04 to 0.12 in.).

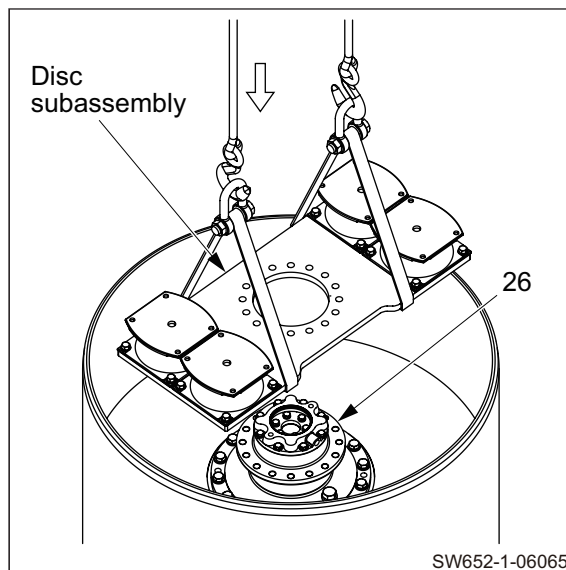


24) Lift disc subassembly.



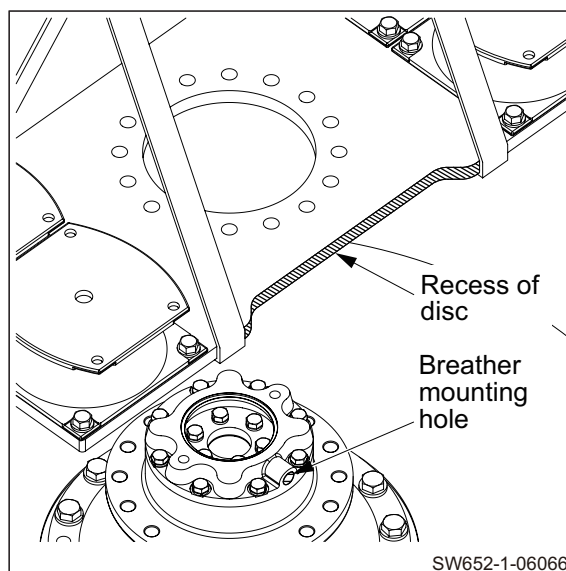
25) Lower disc subassembly on mounting surface of housing (26).

⚠ Disc subassembly : 75 kg (165 lbs.)




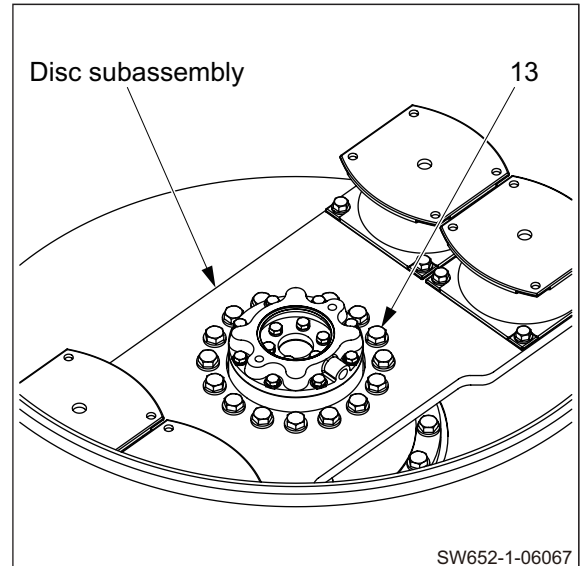
**(NOTICE)**

- The recess of the disc must face the same direction as the breather mounting hole in the flange.

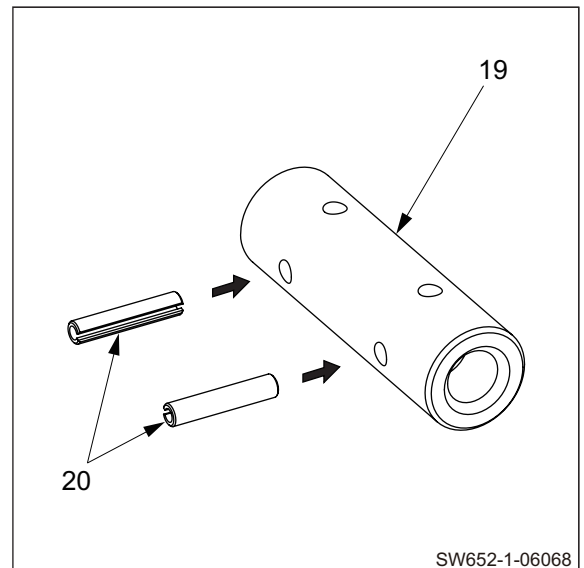


26) Secure disc subassembly with sixteen bolts (13) and washers.

 N·m (13) Bolts M16×45 : 265 N·m (195 lbf·ft)

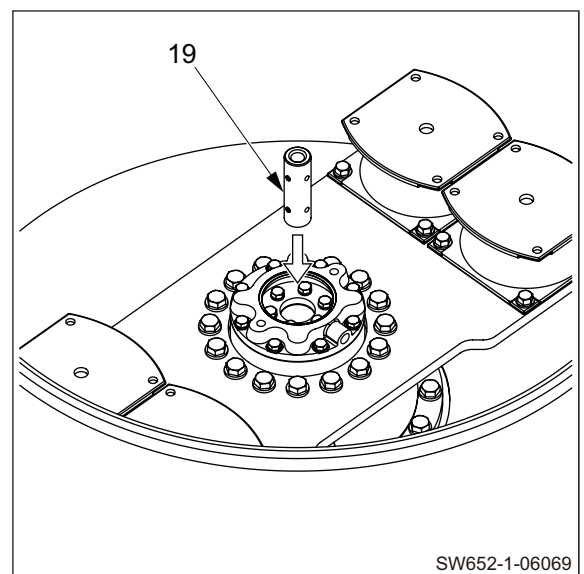


27) Drive two spring pins (20) into sleeve (19).

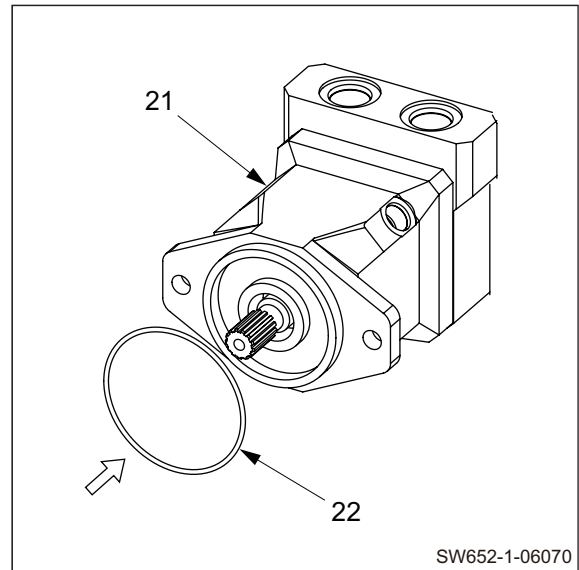


28) Apply molybdenum-based grease to splined portion of sleeve (19).

- Fit sleeve (19) to splined portion on eccentric shaft end.





- 29) Apply grease to O-ring (22).  
 • Install O-ring (22) to vibrator motor (21).

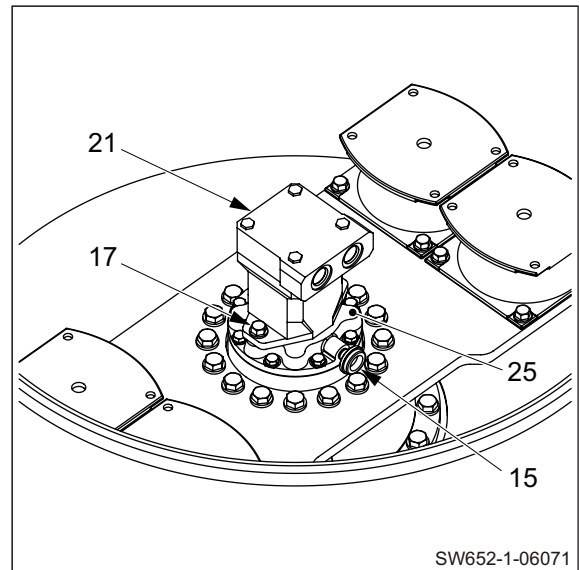


SW652-1-06070

- 30) Wind seal tape around threaded portion of breather (15).  
 • Install breather (15).  
 • Secure vibrator motor (21) to flange (25) with two bolts (17) and washers.


 (21) Vibrator motor :15 kg (33 lbs.)

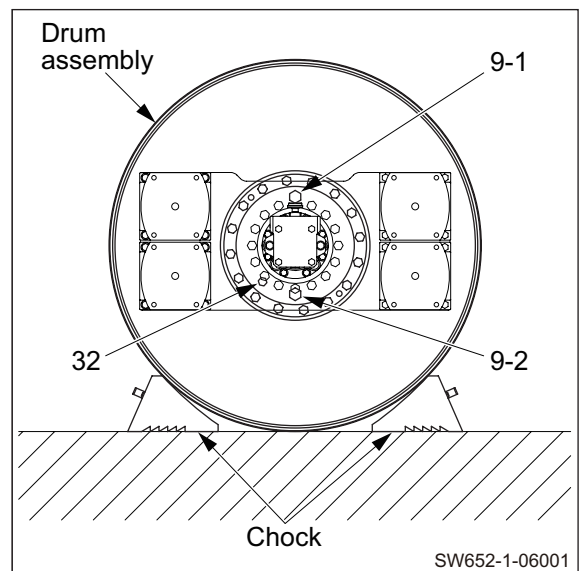
 (17) Bolts M12×30 : 110 N·m (81 lbf·ft)



SW652-1-06071

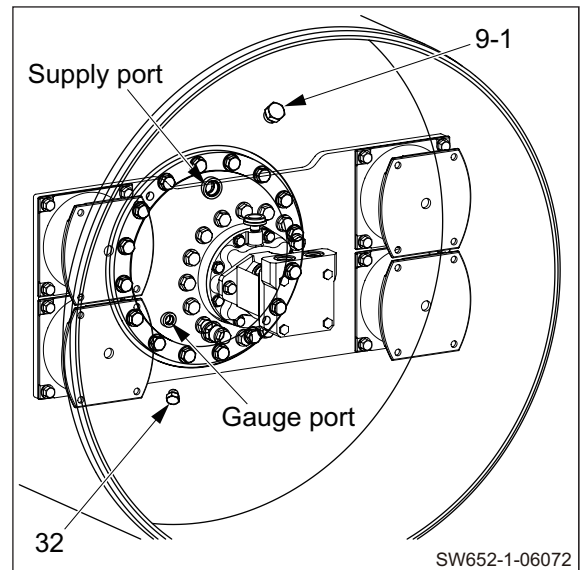
- 31) Lay vibratory drum assembly with plugs (9-1), (9-2), and (32) positioned as shown right.  
 • Hold with chocks.

 Vibratory drum assembly : 1,455 kg (3,208 lbs.)



SW652-1-06001

- 32) Remove plugs (9-1) and (32).
- Supply gear oil from oil supply port.
  - Check that oil drips from gauge port.
  - Quantity of gear oil : 4.0 L (1.1 gal.)
- Reinstall plugs (9-1) and (32).

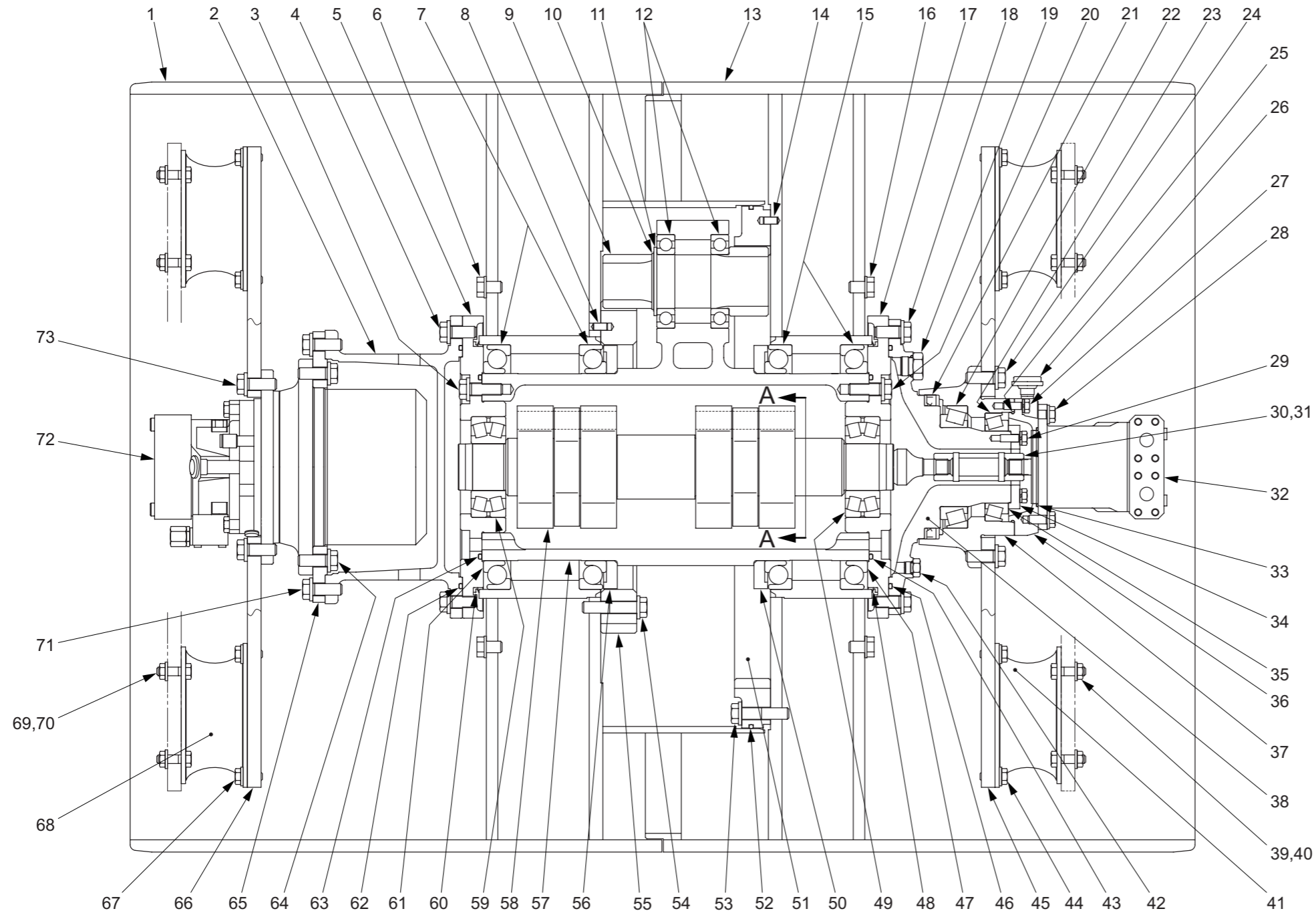




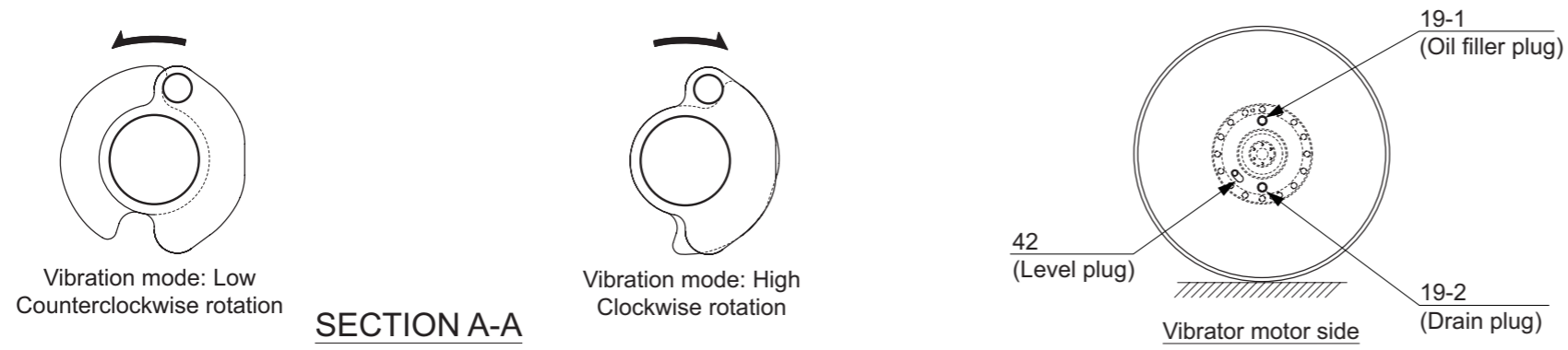


# 4. VIBRATORY DRUM ASSEMBLY

## 4-1. Vibratory Drum Assembly (SW652B-1)



- |                       |                       |
|-----------------------|-----------------------|
| (1) Drum              | (51) Gear             |
| (2) Housing           | (52) O-ring           |
| (3) Bolt : M16×50     | (53) Bolt : M16×70    |
| (4) Bolt : M16×40     | (54) Bolt : M16×80    |
| (5) Disc              | (55) Gear             |
| (6) Bolt : M16×25     | (56) Collar           |
| (7) Ball bearing      | (57) Case             |
| (8) Pin               | (58) Eccentric shaft  |
| (9) Gear              | (59) Vibrator bearing |
| (10) Retaining ring   | (60) V-ring           |
| (11) Washer           | (61) Shim             |
| (12) Ball bearing     | (62) O-ring           |
| (13) Drum             | (63) O-ring           |
| (14) Pin              | (64) Bolt : M16×45    |
| (15) Ball bearing     | (65) Disc             |
| (16) Bolt : M16×25    | (66) Disc             |
| (17) Disc             | (67) Bolt : M12×30    |
| (18) Bolt : M16×40    | (68) Damper           |
| (19) Plug             | (69) Bolt : M12×40    |
| (20) Bolt : M16×50    | (70) Nut : M12        |
| (21) Oil seal         | (71) Bolt : M16×45    |
| (22) Roller bearing   | (72) Propulsion motor |
| (23) Roller bearing   | (73) Bolt : M16×45    |
| (24) Bolt : M16×45    |                       |
| (25) O-ring           |                       |
| (26) Breather         |                       |
| (27) Bolt : M10×30    |                       |
| (28) Bolt : M12×30    |                       |
| (29) Bolt : M10×30    |                       |
| (30) Sleeve           |                       |
| (31) Spring pin       |                       |
| (32) Vibrator motor   |                       |
| (33) O-ring           |                       |
| (34) Cover            |                       |
| (35) Shim             |                       |
| (36) Flange           |                       |
| (37) Housing          |                       |
| (38) Axle shaft       |                       |
| (39) Bolt : M12×40    |                       |
| (40) Nut : M12        |                       |
| (41) Damper           |                       |
| (42) Level plug       |                       |
| (43) O-ring           |                       |
| (44) Bolt : M12×30    |                       |
| (45) Disc             |                       |
| (46) O-ring           |                       |
| (47) Shim             |                       |
| (48) V-ring           |                       |
| (49) Vibrator bearing |                       |
| (50) Collar           |                       |



SECTION A-A




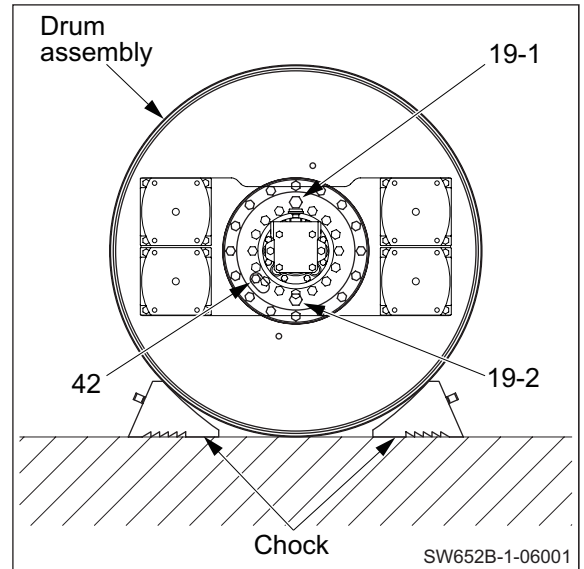
## 4-2. Disassembly and Reassembly of Vibratory Drum (SW652B-1)

- Lead line numbers shown in the illustrations for the following vibratory drum disassembly and reassembly procedures are constant with part numbers of vibratory drum assembly shown on page 6-036.

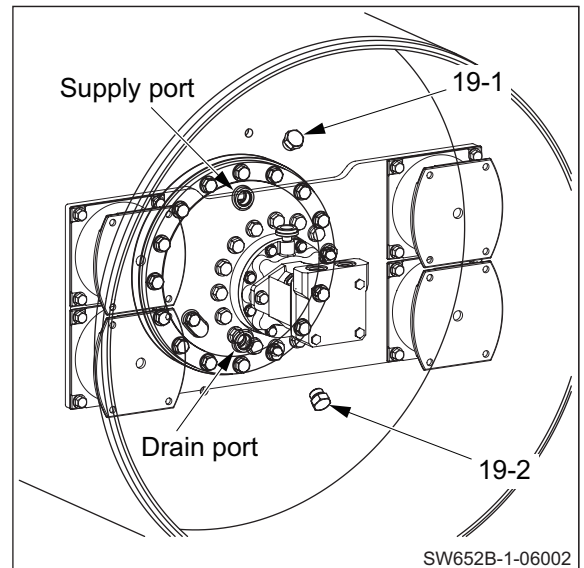
### 4-2-1. Disassembly of vibratory drum

- 1) Lay vibratory drum assembly with plugs (19-1), (19-2), and (42) positioned as shown on the right.
  - Hold with chocks.

 Vibratory drum assembly : 1,935 kg (4,266 lbs.)




- 2) Remove plugs (19-1) and (19-2).
  - Drain gear oil.
    - Quantity of gear oil : 1.7 L (0.4 gal.)

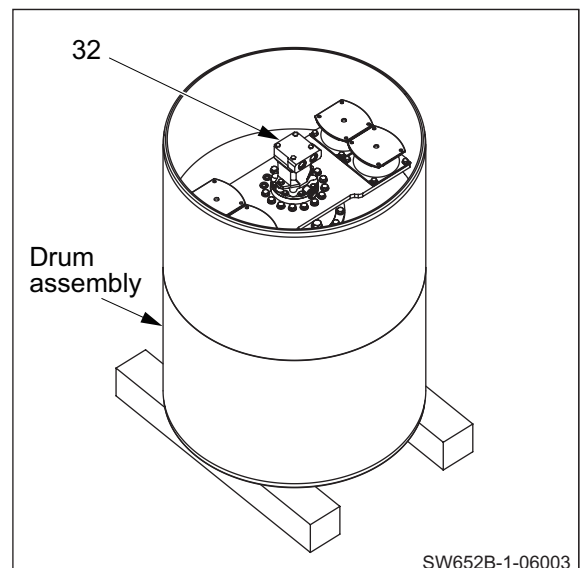


## WARNING


- When standing the vibratory drum, use wooden blocks of sufficient strength to securely support the drum.
- Carry out the work in an unstrained posture using a work stool or the like.

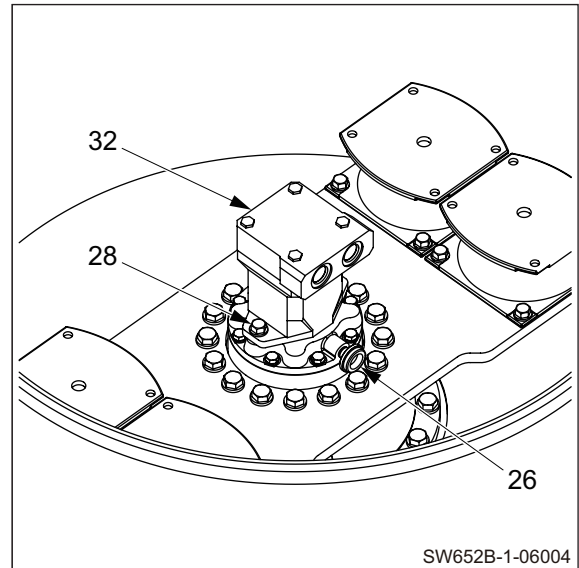
- 3) Stand vibratory drum assembly with vibrator motor (32) side facing up.

 Vibratory drum assembly : 1,935 kg (4,266 lbs.)

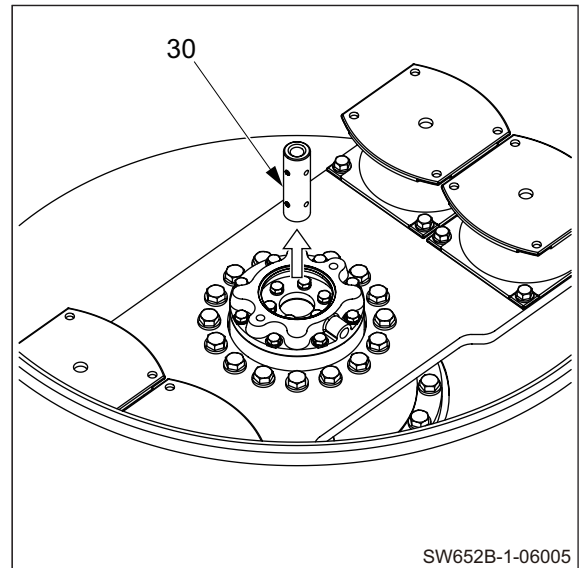


- 4) Remove breather (26).
  - Remove bolts (28).
  - Remove vibrator motor (32).

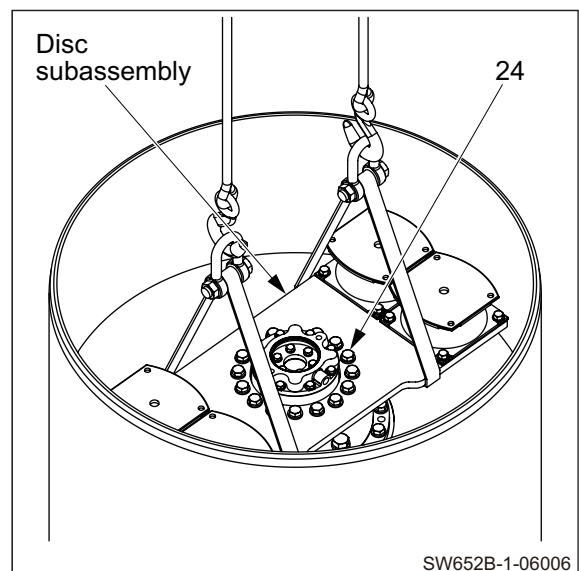
 (32) Vibrator motor : 15 kg (33 lbs.)




- 5) Remove sleeve (30).

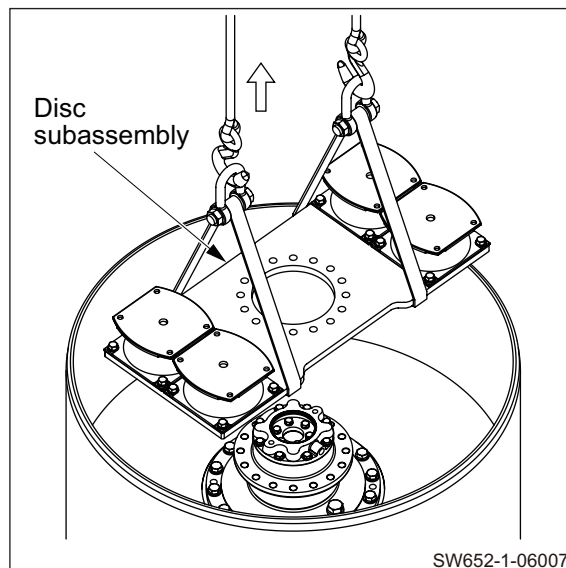


- 6) Lift disc subassembly.
  - Remove bolts (24).

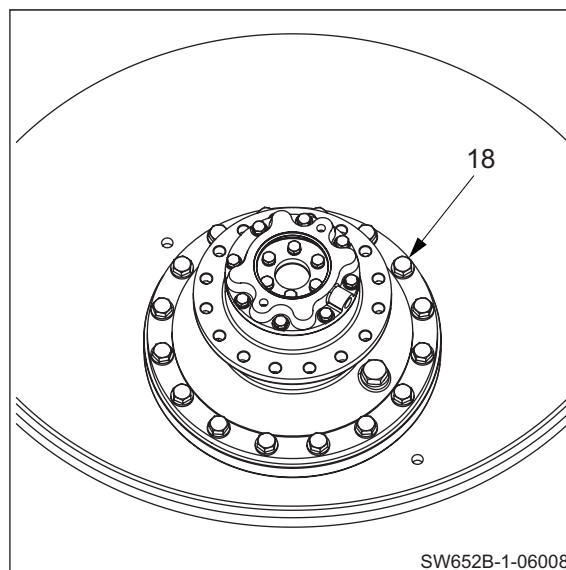


7) Remove disc subassembly.

 Disc subassembly : 75 kg (165 lbs.)



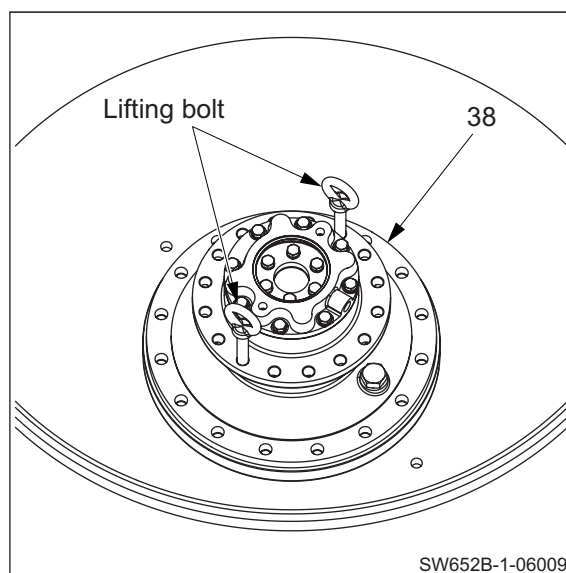
8) Remove bolts (18).



**⚠ WARNING**

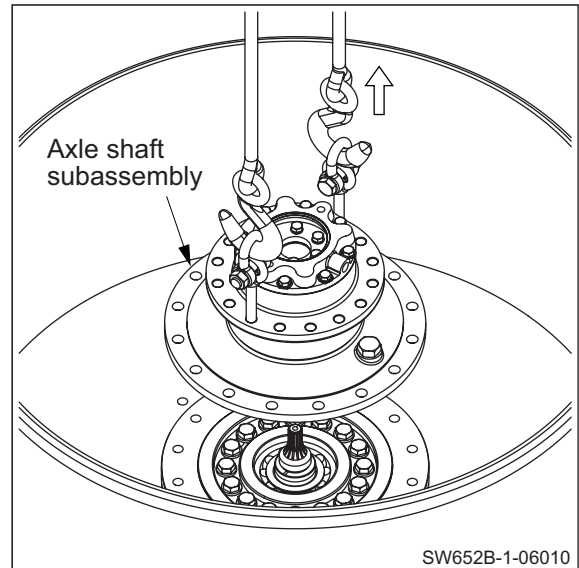
When installing lifting bolts, screw in the threads fully before using.

9) Install lifting bolts (M16) to axle shaft (38).

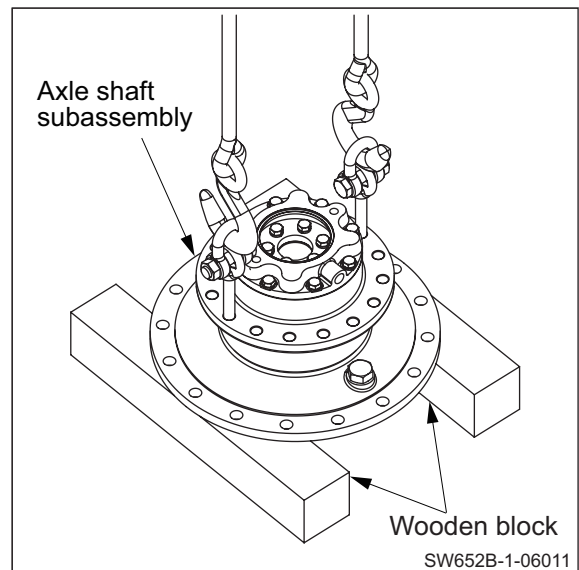


10) Remove axle shaft subassembly.

$\mathcal{U}_{kg}$  Axle shaft subassembly : 55 kg (121 lbs.)

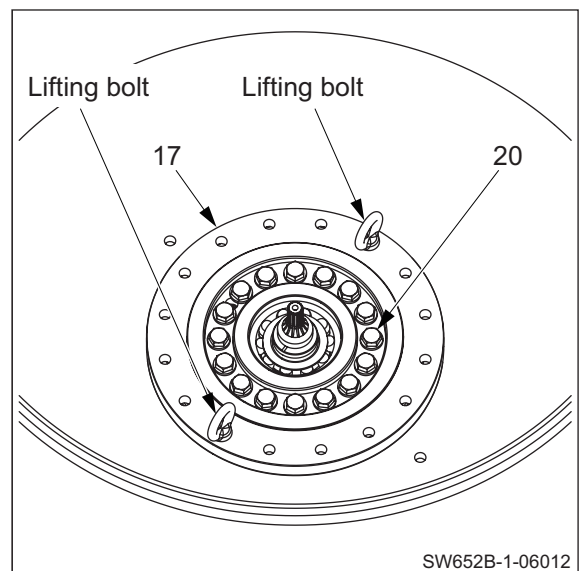


11) Put axle shaft subassembly on wooden blocks.



12) Install lifting bolts (M16) to disc (17).

- Remove bolts (20).

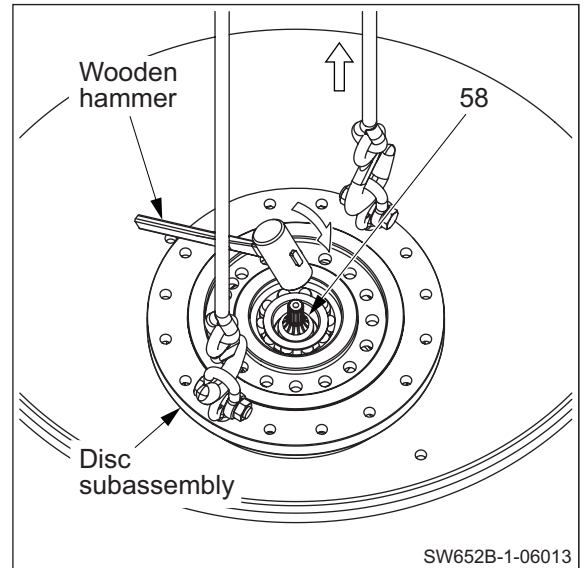


13) Remove disc subassembly.

**(NOTICE)**

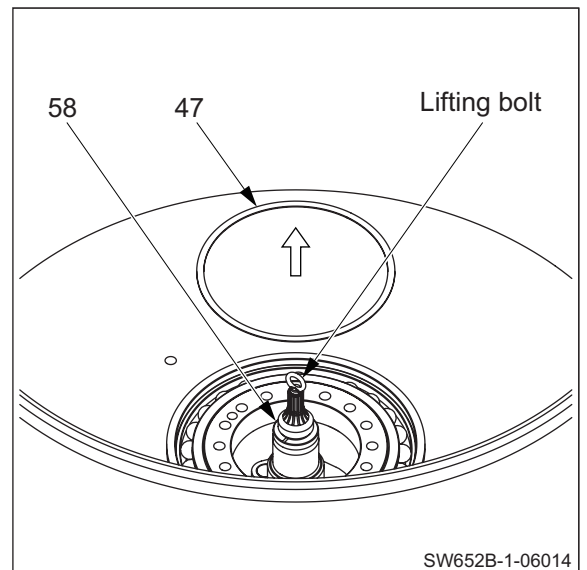
- In order not to lift eccentric shaft together with disc subassembly, tap on the eccentric shaft end with a wooden hammer during lifting.

$\mathfrak{J}_{kg}$  Disc subassembly : 30 kg (66 lbs.)



14) Remove shim (47).

- Install a lifting bolt (M8) to eccentric shaft (58).

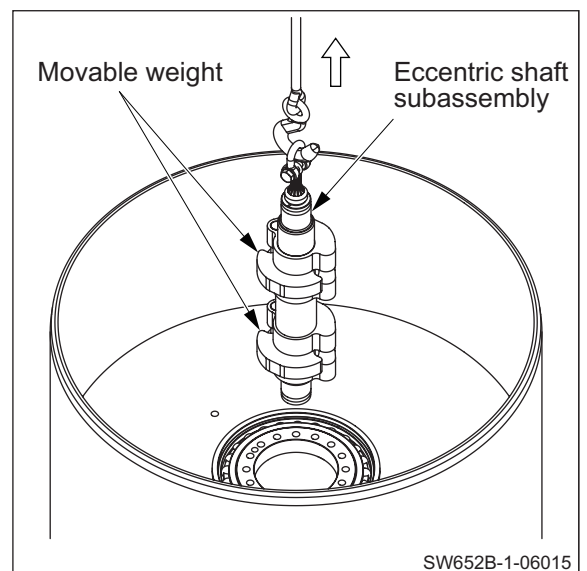


15) Remove eccentric shaft subassembly.

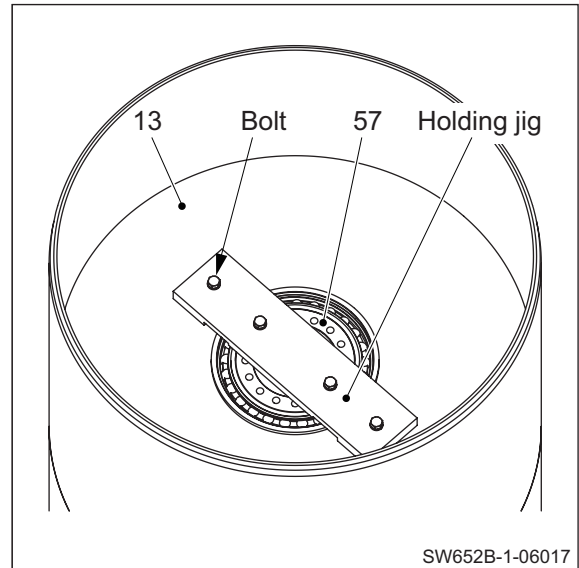
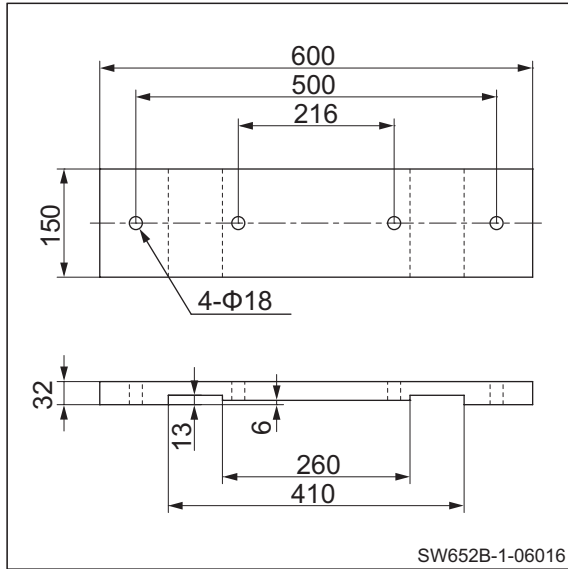
$\mathfrak{J}_{kg}$  Eccentric shaft subassembly : 50 kg (110 lbs.)

**(NOTICE)**

- Put the movable weights at their outmost position.



16) Set a holding jig to vibrator motor side drum (13) and case (57), and secure with bolts (M16×50) and spring washer.

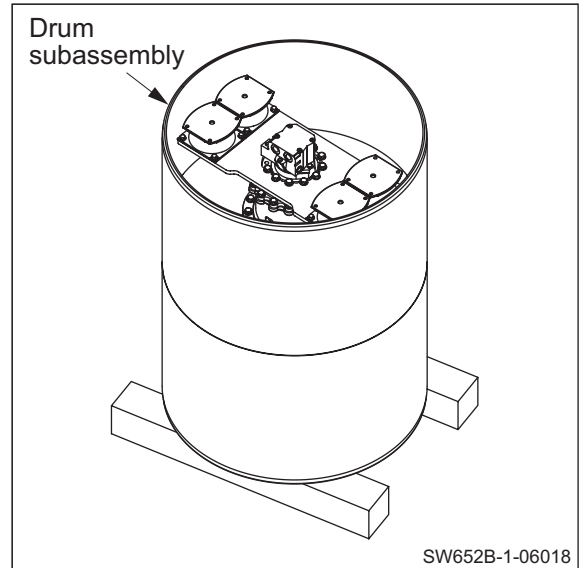


**⚠ WARNING**

Be careful because reversing the vibratory drum involves risk. Confirm that the surrounding area is safe, and work in a natural, unstrained posture.

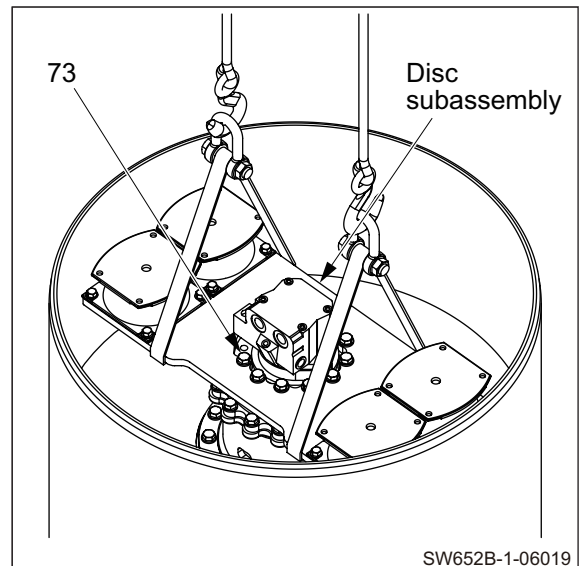
17) Reverse vibratory drum subassembly.

⚠<sub>kg</sub> Vibratory drum subassembly : 1,730 kg (3,814 lbs.)




18) Lift disc subassembly.

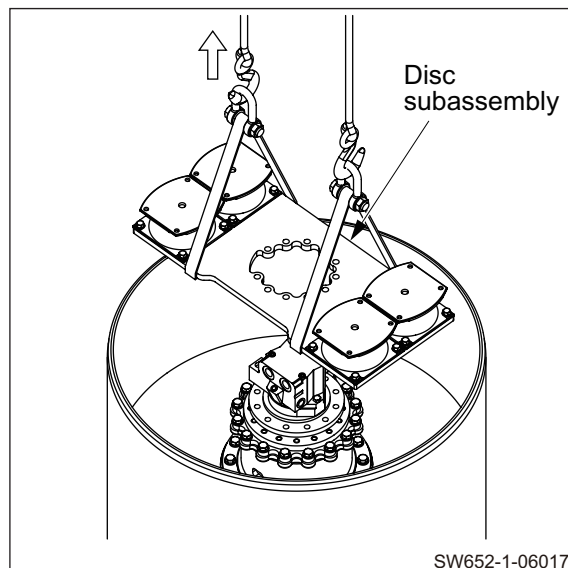
- Remove bolts (73).





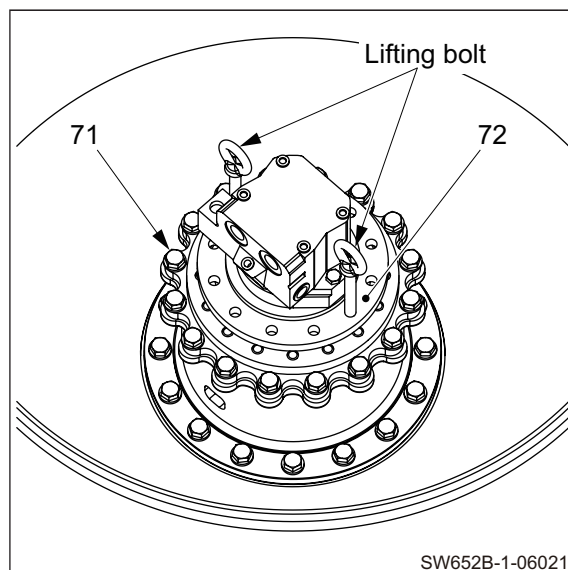
19) Remove disc subassembly.

 Disc subassembly : 70 kg (154 lbs.)




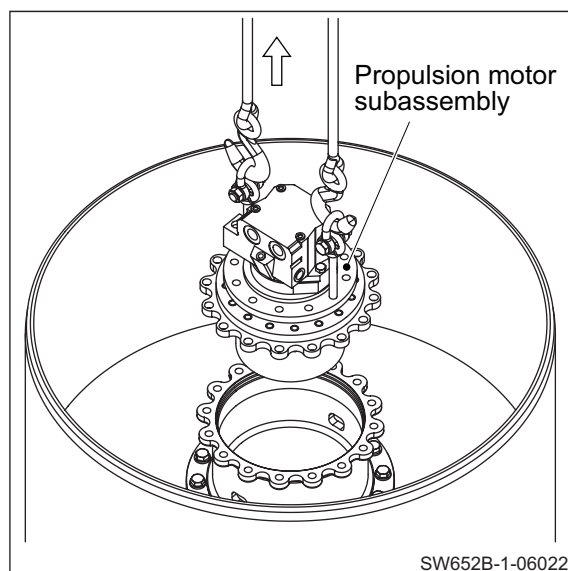
20) Install lifting bolts (M16) to propulsion motor (72).

- Remove bolts (71).



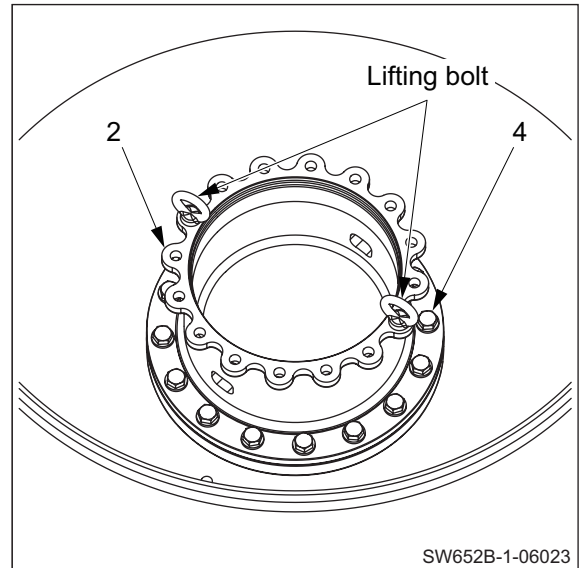
21) Remove propulsion motor subassembly.

 Propulsion motor subassembly : 75 kg (165 lbs.)




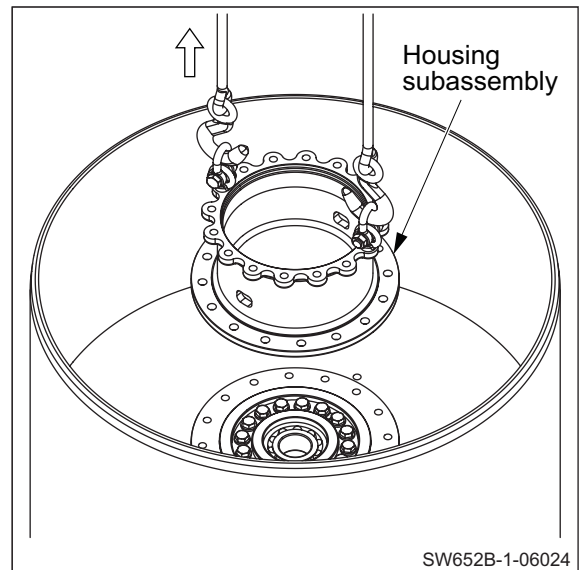
22) Install lifting bolts (M16) to housing (2).

- Remove bolts (4).



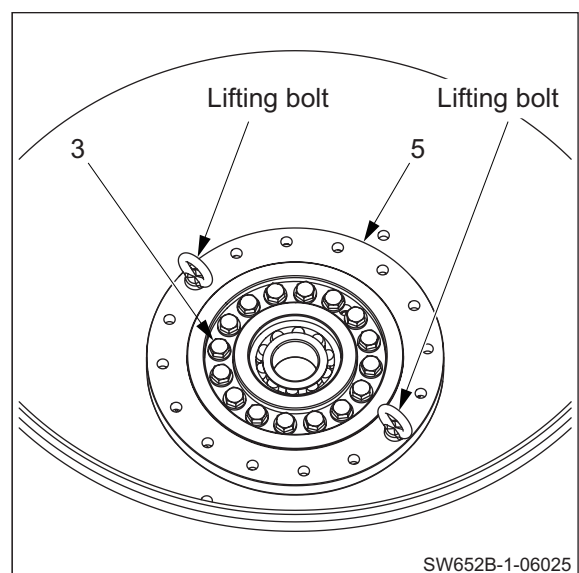
23) Remove housing subassembly.

 Housing subassembly : 35 kg (77 lbs.)




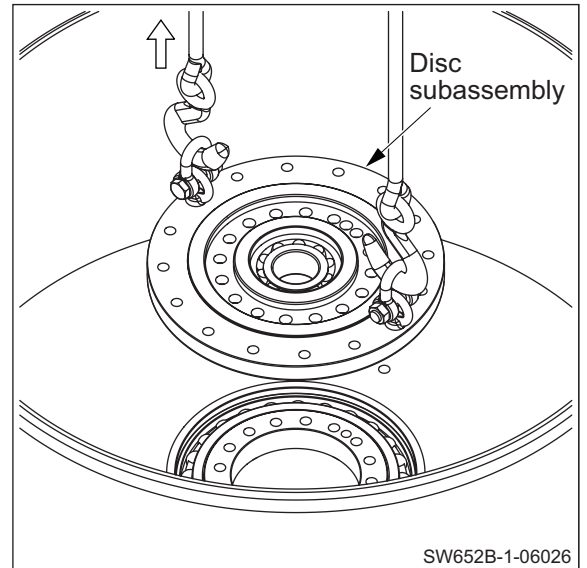
24) Install lifting bolts (M16) to disc (5).

- Remove bolts (3).

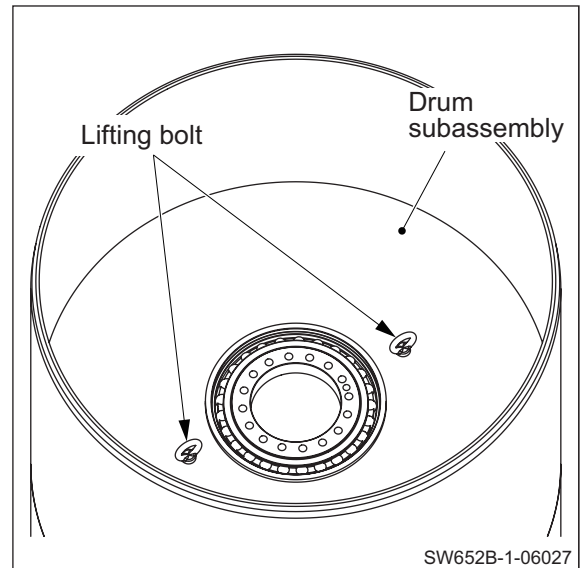


25) Remove disc subassembly.


 Disc subassembly : 30 kg (66 lbs.)



26) Install lifting bolts (M16) to propulsion motor side drum subassembly.

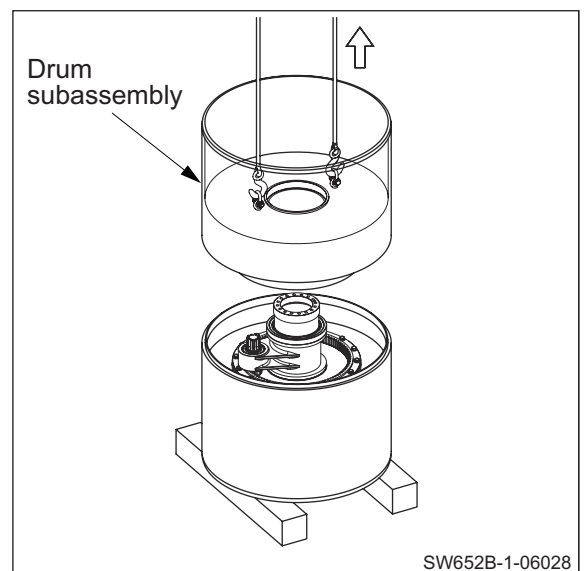


27) Remove propulsion motor side drum subassembly.

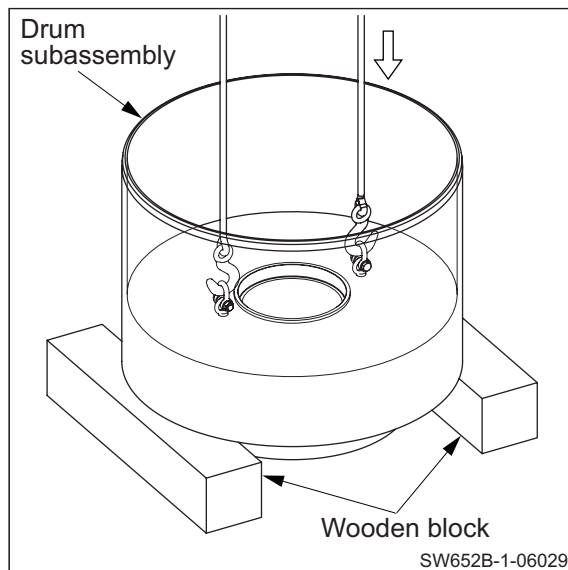
 (1) Propulsion motor side drum subassembly : 710 kg (1,565 lbs.)

**(NOTICE)**

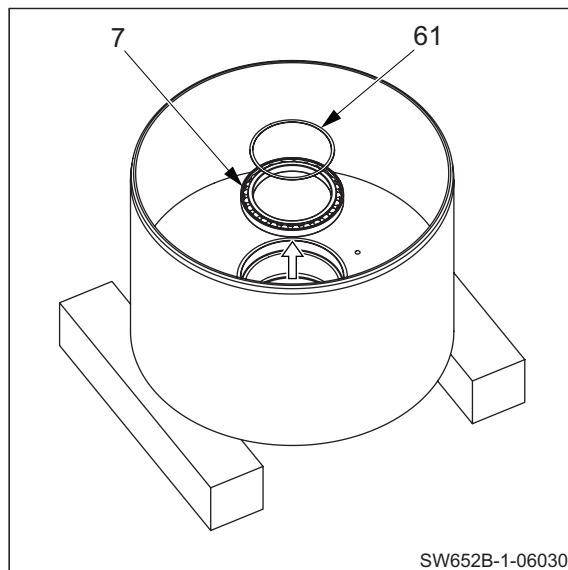
- Take care not to damage the gear on the case during removal.



28) Put propulsion motor side drum subassembly on wooden blocks.

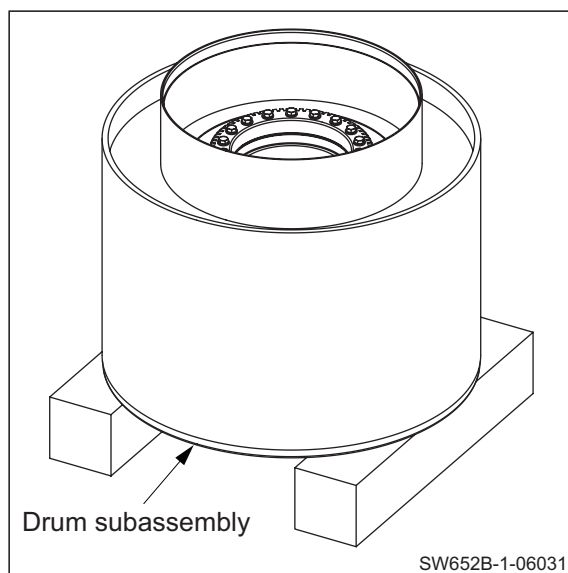


29) Remove shim (61).  
 • Remove ball bearing (7).

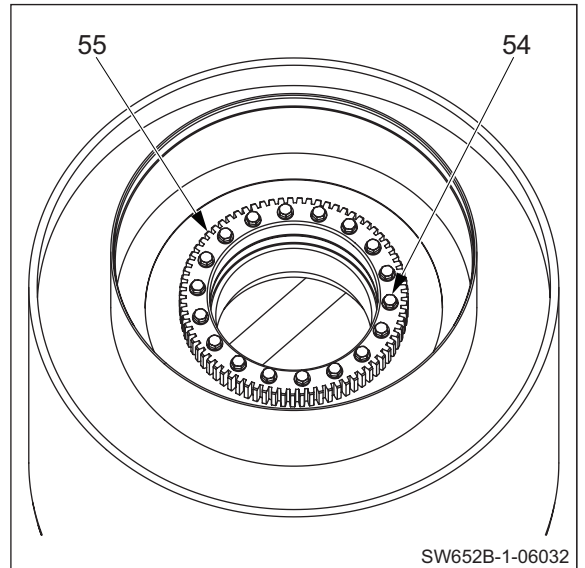


30) Reverse propulsion motor side drum subassembly.


$\mathfrak{J}_{kg}$  Propulsion motor side drum subassembly  
 : 700 kg (1,543 lbs.)

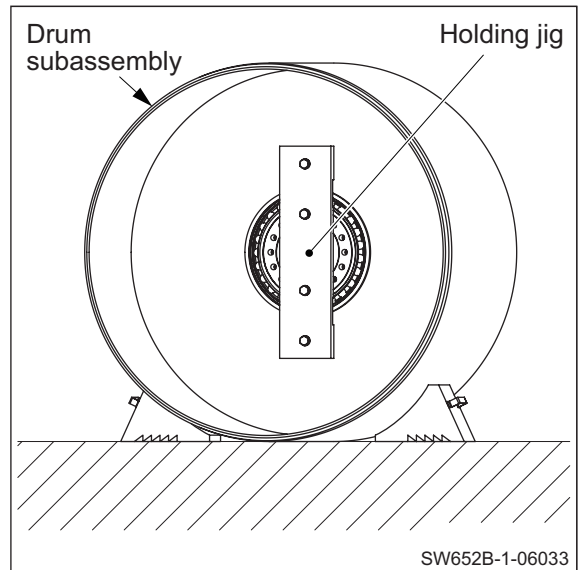


- 31) Remove bolts (54).  
 • Remove gear (55).

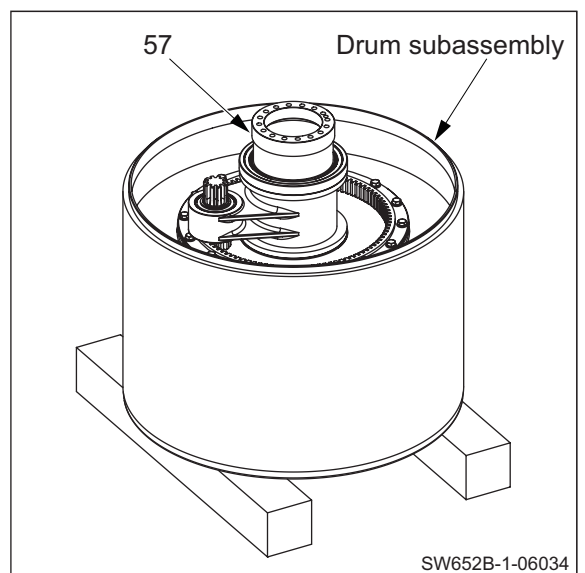


- 32) Lay vibrator motor side drum subassembly on its side and remove jig.

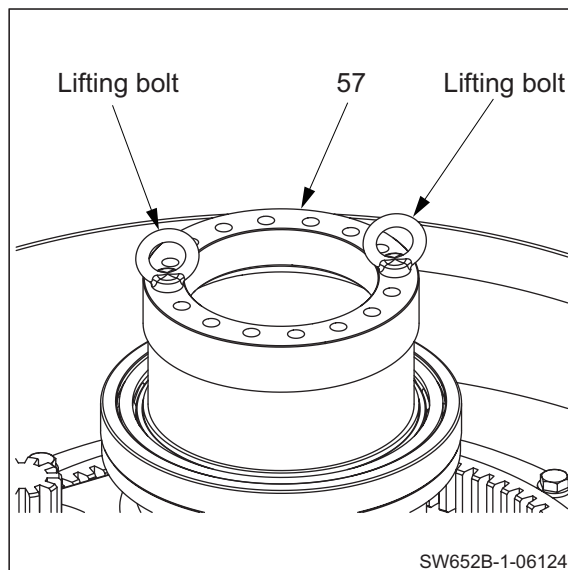
  $k_g$  Vibrator motor side drum subassembly  
 : 795 kg (1,753 lbs.)



- 33) Stand vibrator motor side drum subassembly again with case (57) facing up.



34) Install lifting bolts (M16) to case (57).

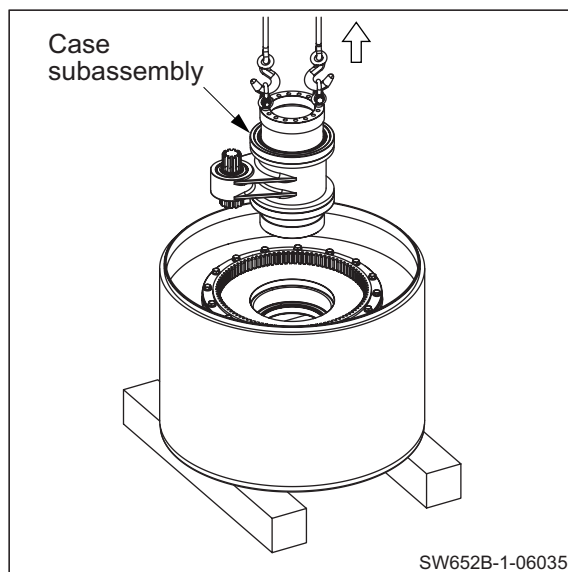


35) Remove case subassembly.

$\mathfrak{J}_{kg}$  Case subassembly : 125 kg (276 lbs.)

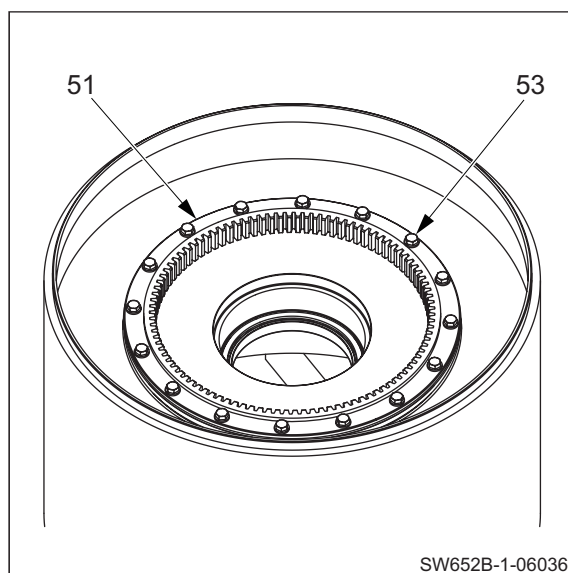
**(NOTICE)**

- Take care not to damage the gear on the case during removal.




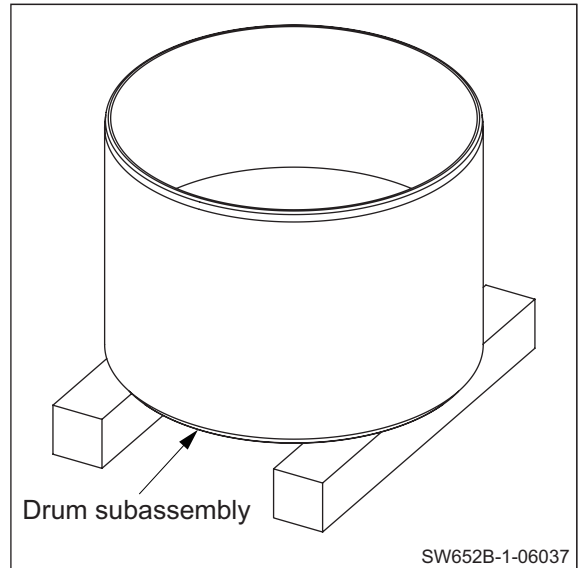
36) Remove bolts (53).

- Remove gear (51).

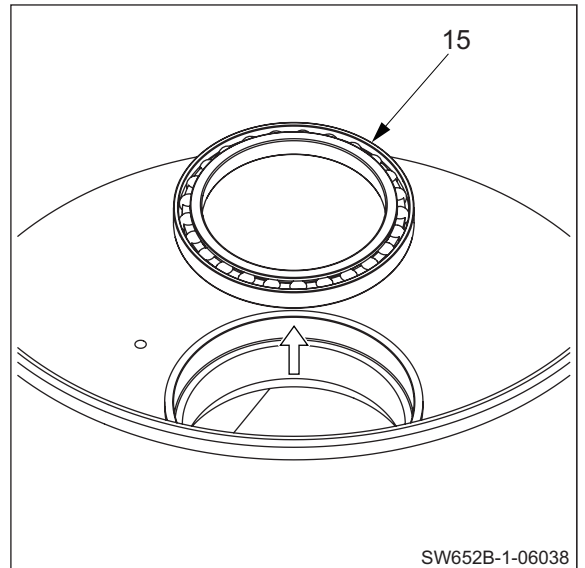


37) Reverse vibrator motor side drum subassembly.

 Vibrator motor side drum subassembly  
: 605 kg (1,334 lbs.)

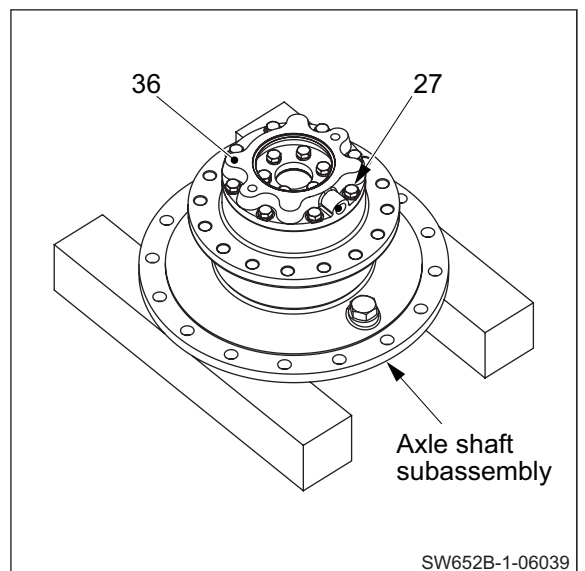


38) Remove ball bearing (15).



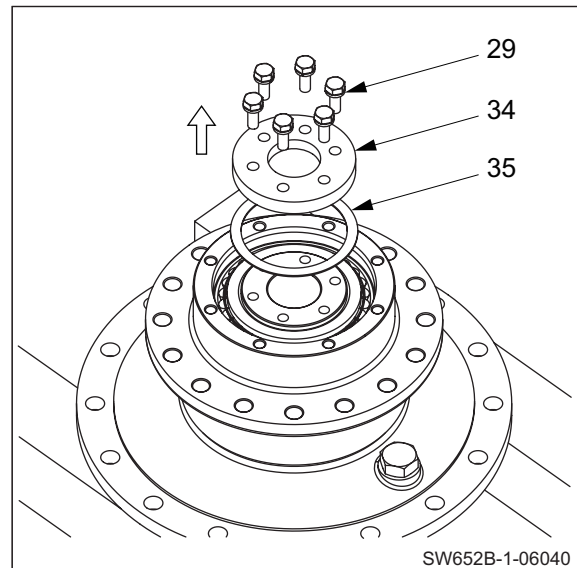
39) Disassembly of axle shaft subassembly.

- Remove bolts (27).
- Remove flange (36).



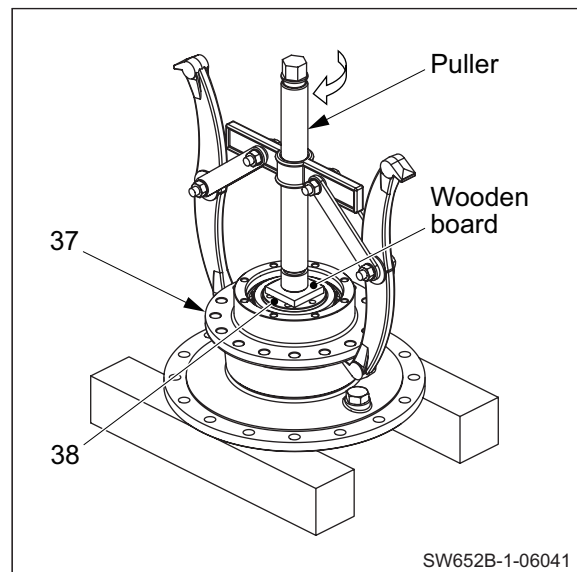
40) Remove bolts (29).

- Remove cover (34).
- Remove shim (35).

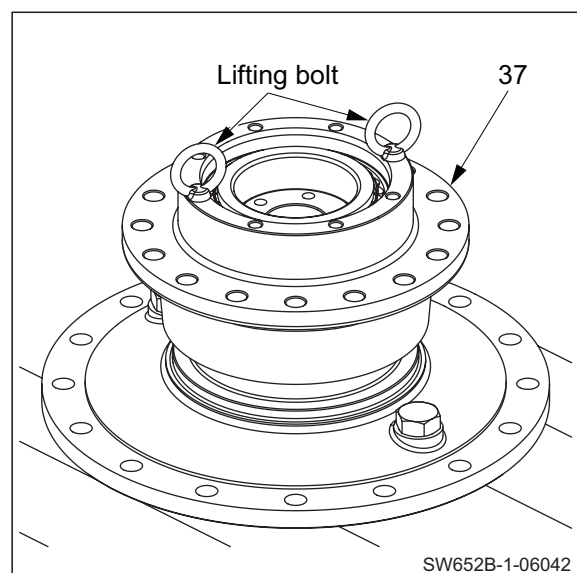


41) Put a piece of wooden board on end of axle shaft (38).

- Set a puller on housing (37).
- Remove housing subassembly from axle shaft subassembly.




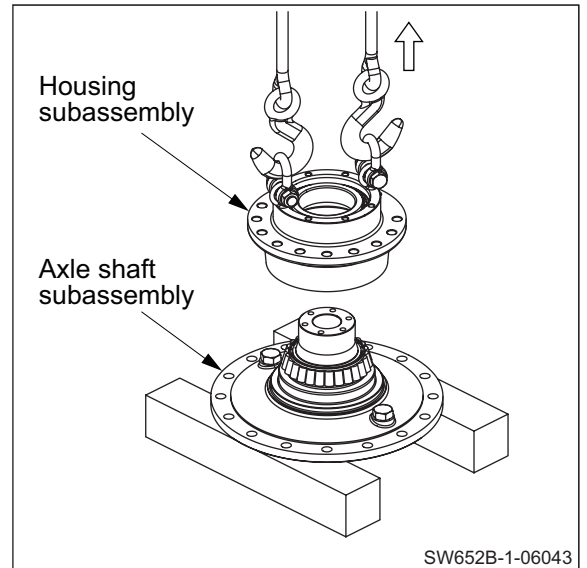
42) Install lifting bolts (M10) to housing (37).





43) Remove housing subassembly from axle shaft subassembly.

 Housing subassembly : 20 kg (44 lbs.)




## 4-2-2. Reassembly of vibratory drum

- Before reassembling, clean disassembled parts well and check that there is no abnormality.


### **⚠ WARNING**

- When standing the vibratory drum, use wooden blocks of sufficient strength to securely support the drum.
- Carry out the work in an unstrained posture using a work stool or the like.

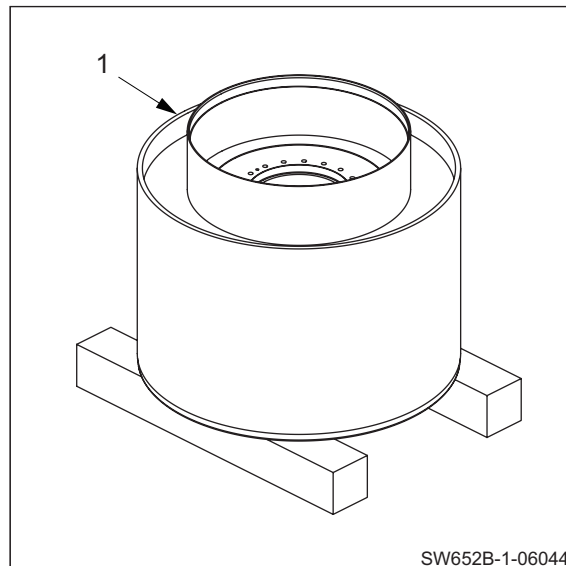
- 1) Stand propulsion motor side drum (1).

 (1) Propulsion motor side drum : 655 kg (1,444 lbs.)

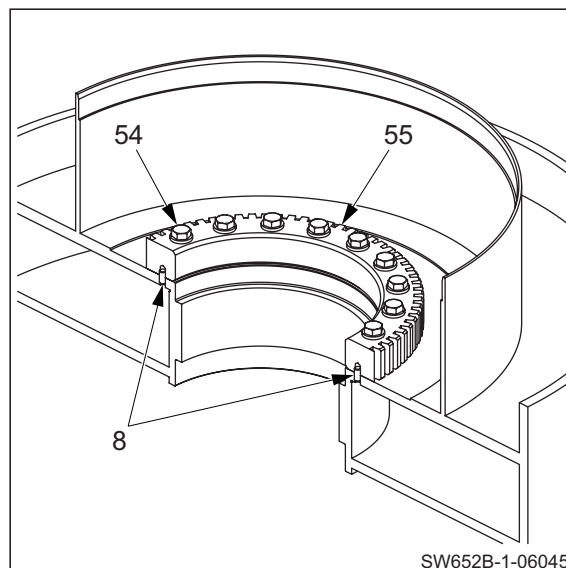
- 2) Position gear (55) by using two locating pins (8).
  - Secure gear (55) with eighteen bolts (54) and washers.

 (54) Bolts M16×80 : 265 N·m (195 lbf·ft)

- Apply lithium-based grease to teeth of gear (55).



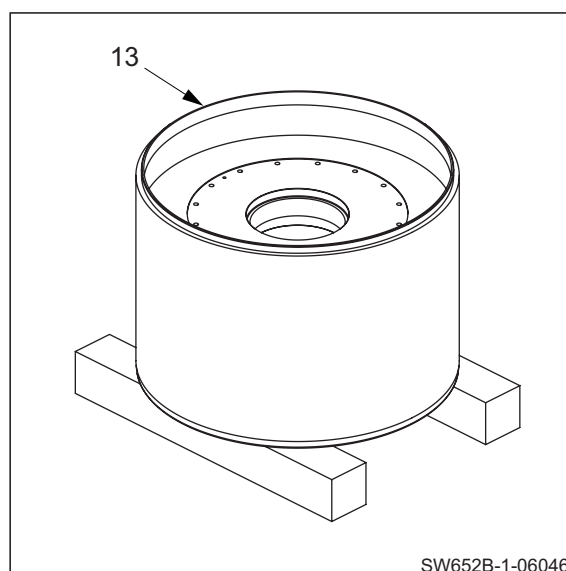
SW652B-1-06044



SW652B-1-06045

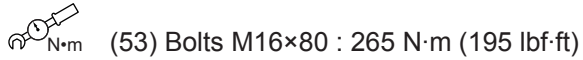
- 3) Stand vibrator motor side drum (13).

 (13) Vibrator motor side drum : 595 kg (1,312 lbs.)

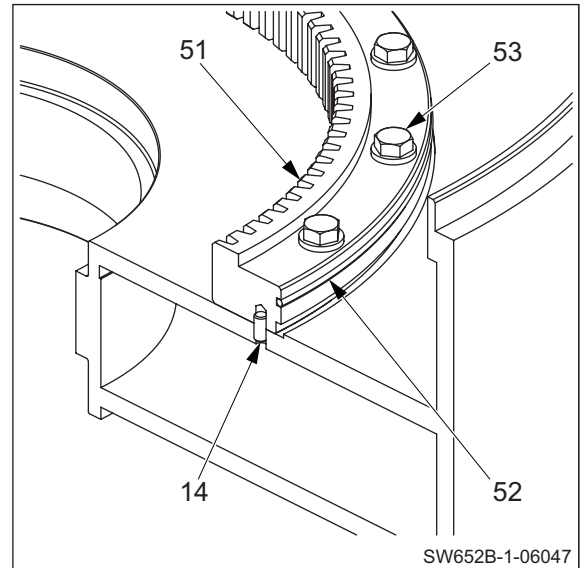


SW652B-1-06046

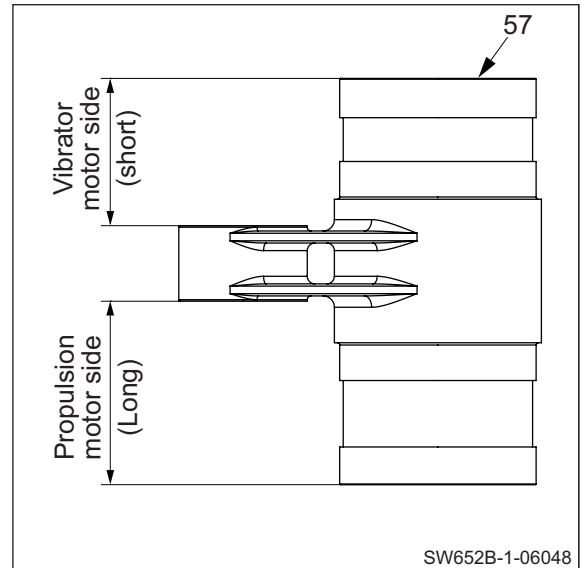
- 4) Apply grease to O-ring (52).
  - Install O-ring (52) to gear (51).
  - Position gear (51) by using two locating pins (14).
  - Secure gear (51) with sixteen bolts (53) and washers.



- Apply lithium-based grease to teeth of gear (51).



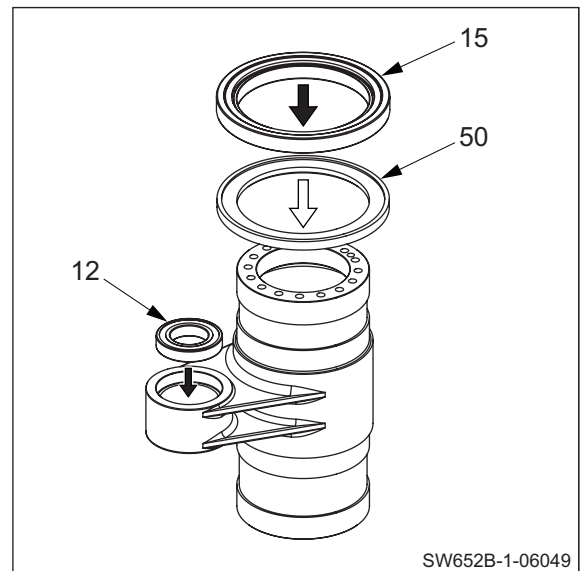
- 5) Reassembly of case subassembly
  - 5-1) Stand case (57) with its vibrator motor side (short) facing up.



- 5-2) Apply a coat of gear oil to ball bearings (12) and (15) on their surfaces to be press-fitted.
  - Install collar (50).
  - Drive in ball bearings (12) and (15).
  - Apply sufficient amount of lithium-based grease to ball bearings (12) and (15).

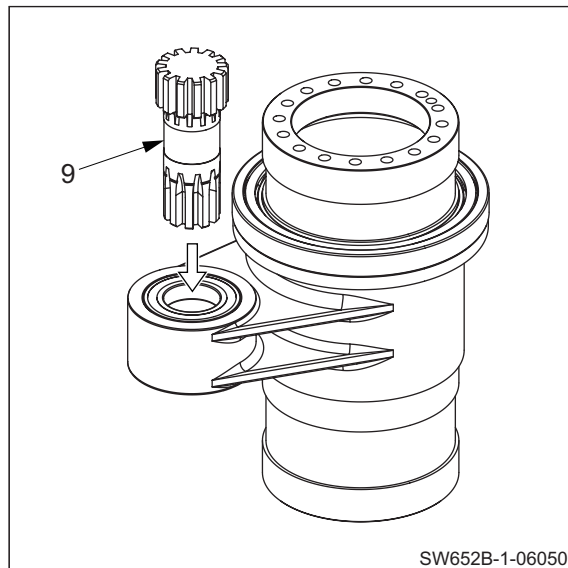
**(NOTICE)**

- Take care not to damage the bearing when installing it.



5-3) Apply a coat of gear oil to gear (9) on its surface to be press-fitted.

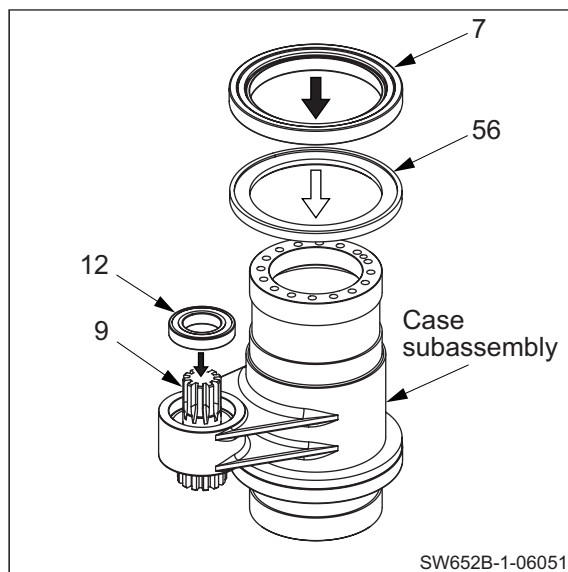
- Install gear (9).



5-4) While supporting gear (9) to prevent it from falling off, reverse case subassembly.

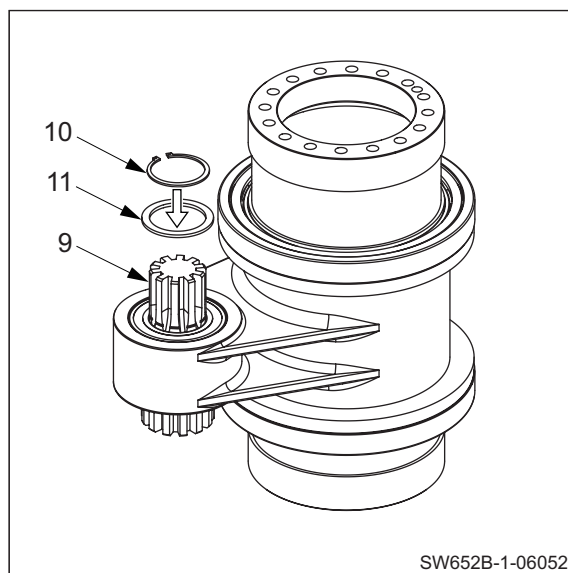
$\mathfrak{J}_{kg}$  Case subassembly : 110 kg (243 lbs.)

- Apply a coat of gear oil to ball bearings (7) and (12) on their surfaces to be press-fitted.
- Install collar (56).
- Drive in ball bearings (7) and (12).
- Apply sufficient amount of lithium-based grease to ball bearings (7) and (12).



5-5) Hold gear (9) with washer (11) and retaining ring (10).

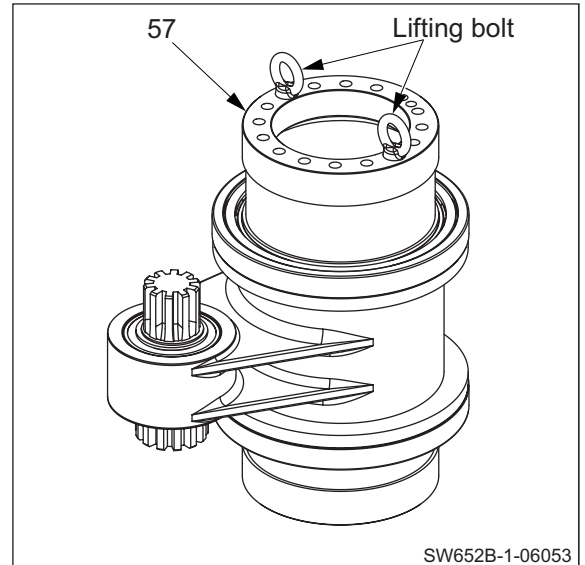
- Apply sufficient amount of lithium-based grease to teeth of gear (9).




## **⚠ WARNING**

When installing lifting bolts, screw in the threads fully before using.

- 6) Install lifting bolts (M16) to case (57).

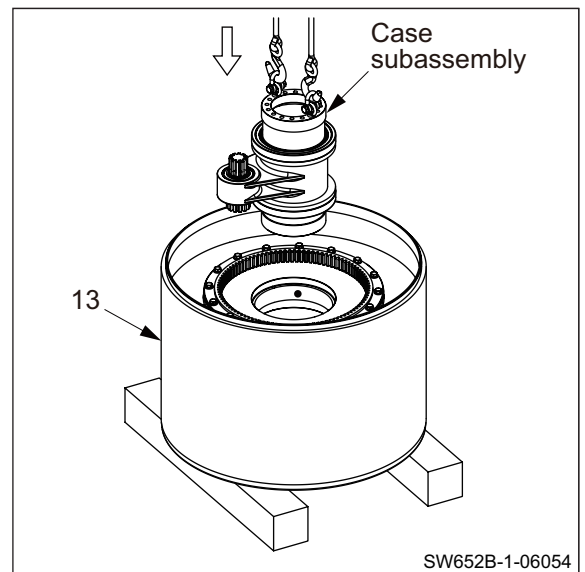


- 7) Apply a coat of gear oil to mounting surface of ball bearing.
- Install case subassembly to vibrator motor side drum (13).

 Case subassembly : 125 kg (276 lbs.)

### (NOTICE)


- Make sure that the gear on the case subassembly is meshed with the gear on the drum.



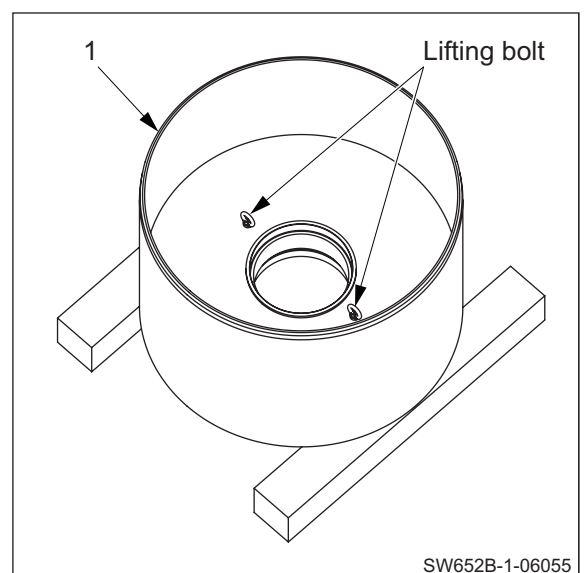
## **⚠ WARNING**

Be careful because reversing the vibratory drum involves risk. Confirm that the surrounding area is safe, and work in a natural, unstrained posture.

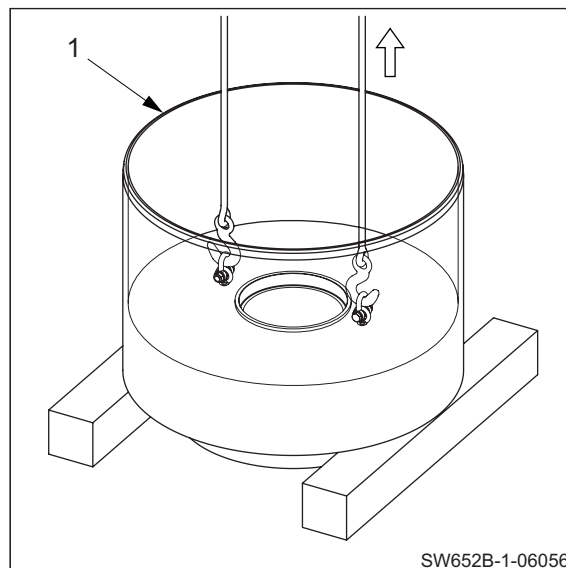
- 8) Reverse propulsion motor side drum (1).

 (1) Propulsion motor side drum : 700 kg (1,543 lbs.)

- Install lifting bolts (M16) to drum (1).



9) Lift propulsion motor side drum (1).



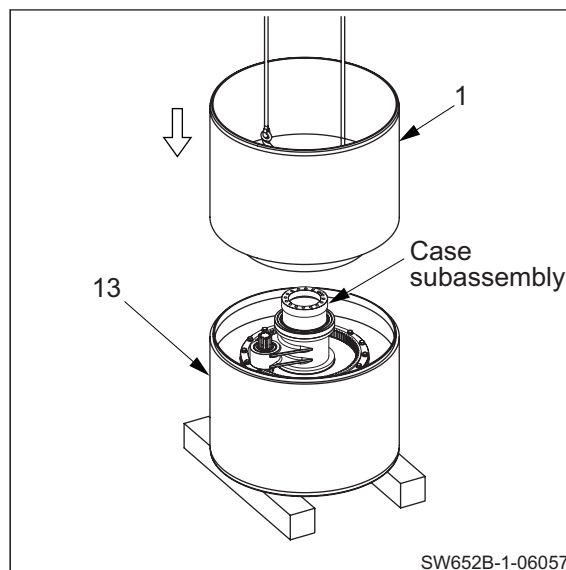
10) Apply a coat of gear oil to mounting surface of ball bearing.

- Install propulsion motor side drum (1) to vibrator motor side drum (13) with case subassembly.

$\mathfrak{J}_{kg}$  (1) Propulsion motor side drum : 700 kg (1,543 lbs.)

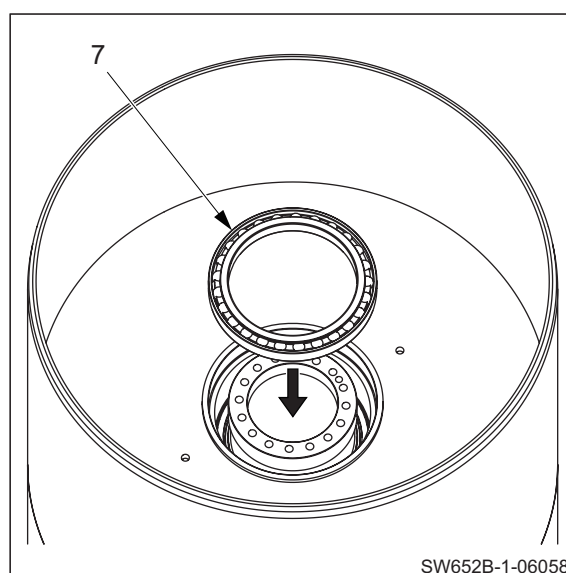
**(NOTICE)**

- Make sure that the gear on the case subassembly is meshed with the gear on the drum.



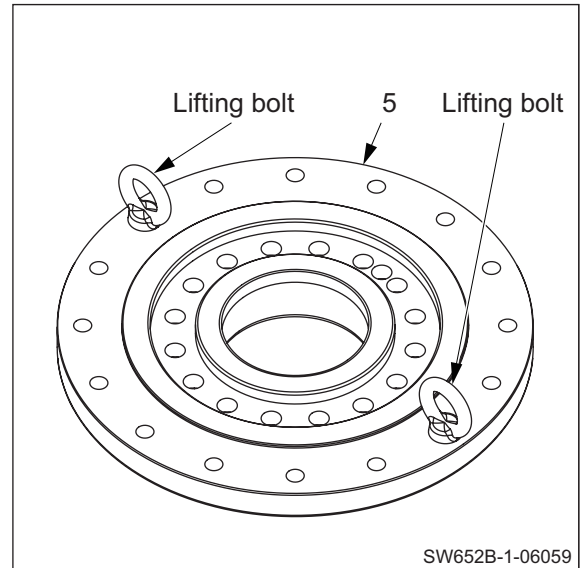
11) Apply a coat of gear oil to ball bearing (7) on its surface to be press-fitted.

- Drive in ball bearing (7).
- Apply sufficient amount of lithium-based grease to ball bearing (7).




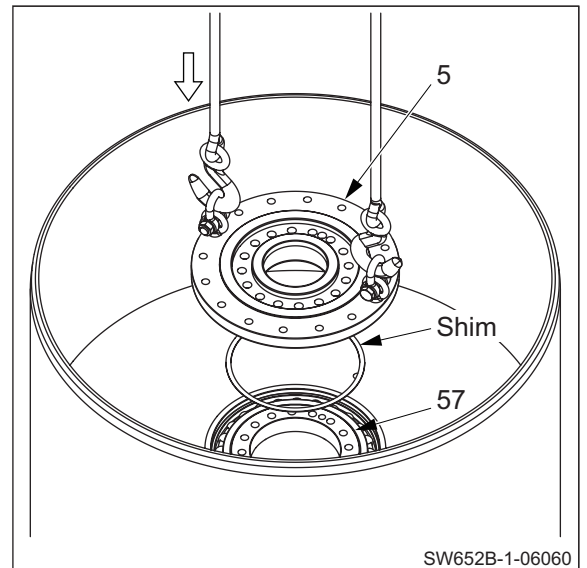
12) Preload adjustment of roller bearing

- ① Install lifting bolts (M16) to disc (5).




- ② Insert a shim of about 1.5 mm (0.06 in.) and lower disc (5) on mounting surface of case (57).

 (5) Disc : 25 kg (55 lbs.)



- ③ A gap will remain between end of case (57) and inside of disc (5).

- ④ Secure with eight bolts (3) and washers.


 (3) Bolts M16×50 : 265 N·m (195 lbf·ft)

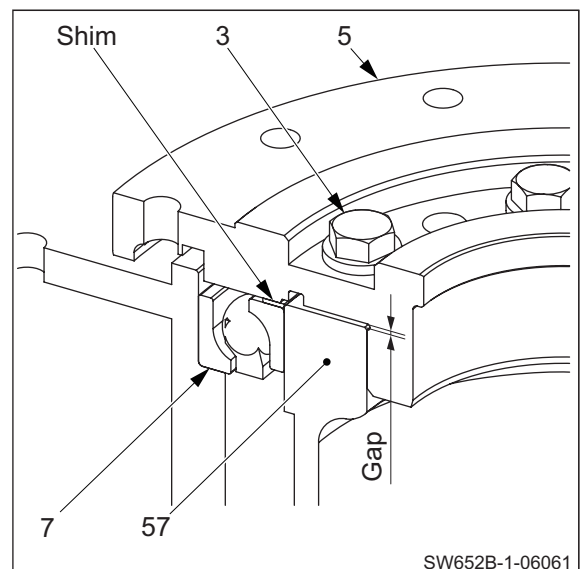
**(NOTICE)**

- **Tighten the bolts alternately in diagonal directions.**

- ⑤ Rotate propulsion motor side drum subassembly for more than one complete turn in both directions.

- ⑥ Let ball bearing (7) settle down and tighten bolts (3) again.

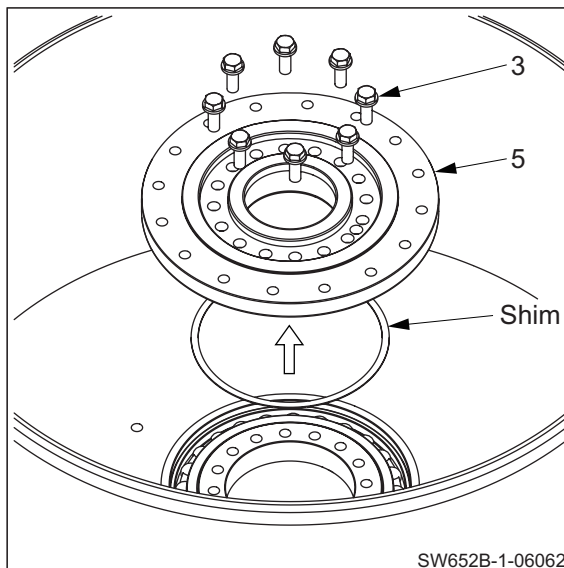
 (3) Bolts M16×50 : 265 N·m (195 lbf·ft)



- ⑦ Remove bolts (3).
- Remove disc (5).
- Remove shim.

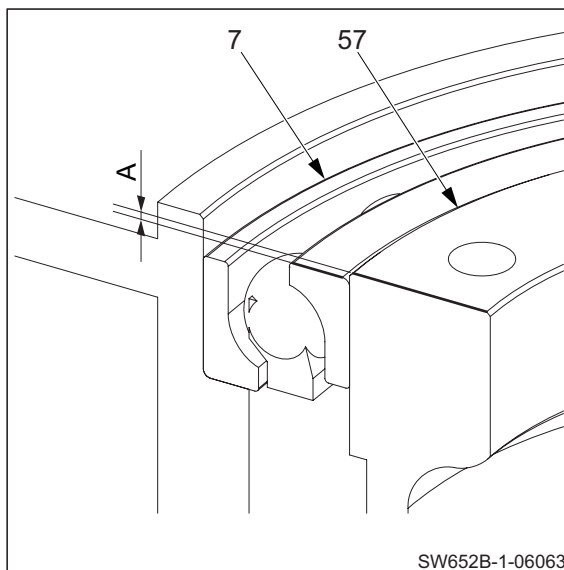
**(NOTICE)**

- Do not turn the drum after the disc is removed.



SW652B-1-06062

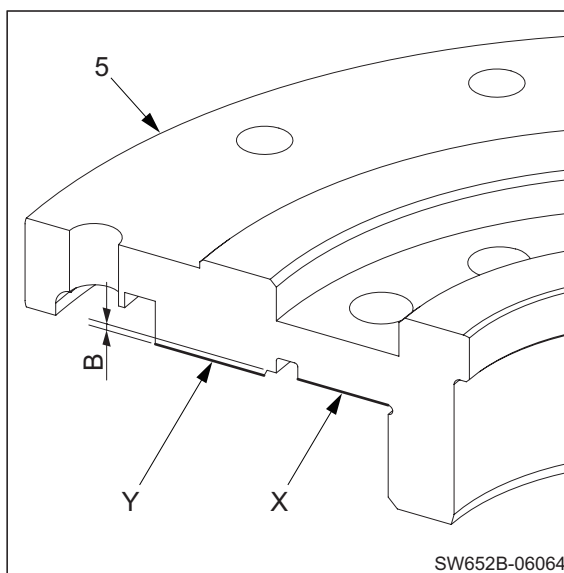
- ⑧ Measure dimension “A” between end of case (57) and ball bearing (7).



SW652B-1-06063

- ⑨ Measure dimension “B” between X and Y of disc (5).

★ Preload adjusting shim thickness = (A-B) + 0.1 mm (0.04 in.)

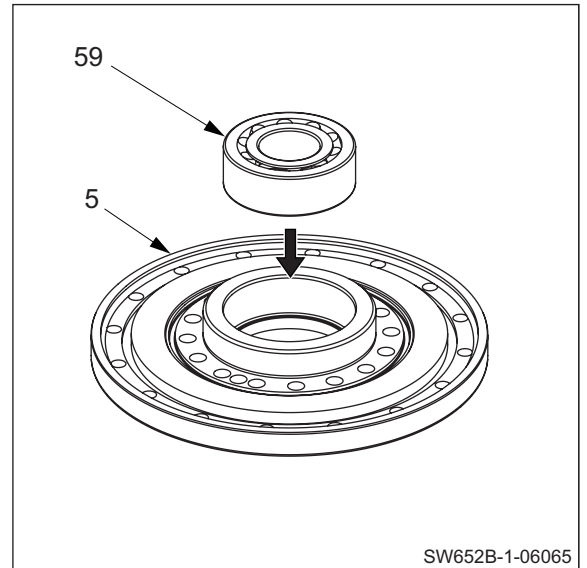


SW652B-06064



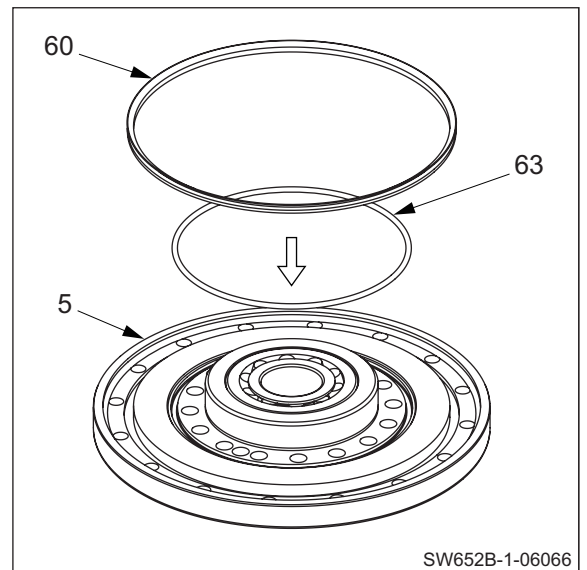
⑩ Reassembly of disc subassembly

- Apply a coat of gear oil to vibrator bearing (59) on its surface to be press-fitted.
- Drive vibrator bearing (59) into disc (5).




⑪ Apply grease to O-ring (63).

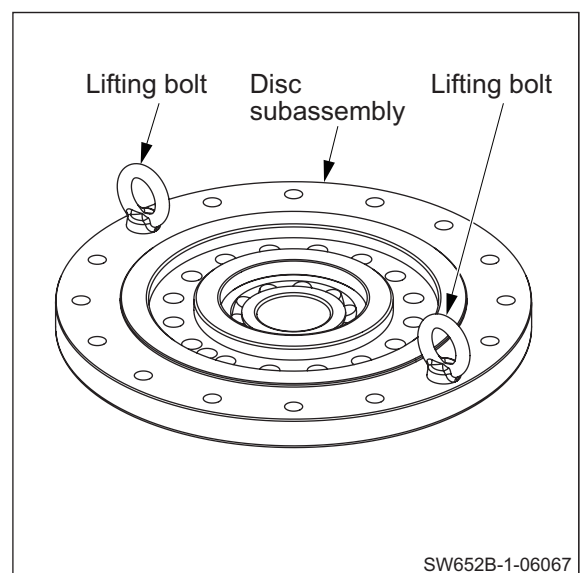
- Install O-ring (63) to disc (5).
- Install V-ring (60) to disc (5).
- Apply lithium-based grease to lip of V-ring (60).




⑫ Reverse disc subassembly.

 Disc subassembly : 30 kg (66 lbs.)

- Install lifting bolts (M16).

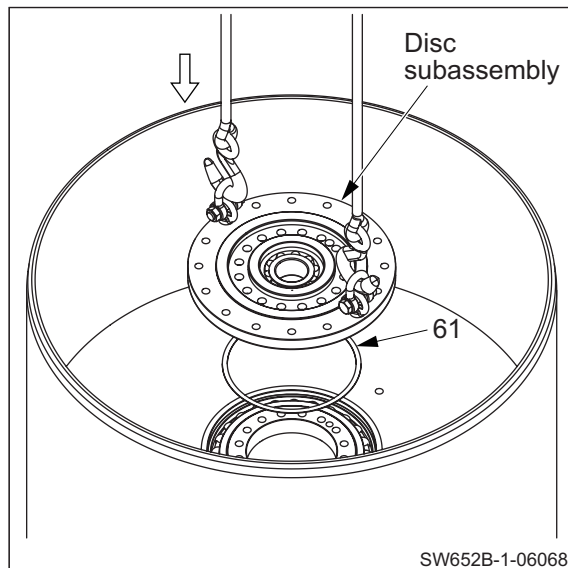


- ⑬ Insert a shim (61) of preload adjusting shim thickness and lower disc subassembly on mounting surface of case (57).


 Disc subassembly : 30 kg (66 lbs.)

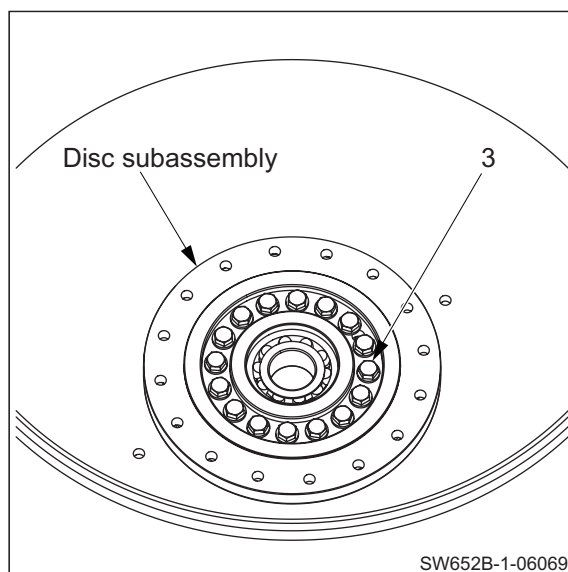
**(NOTICE)**

- Take care not to let O-ring or V-ring to protrude from their grooves.

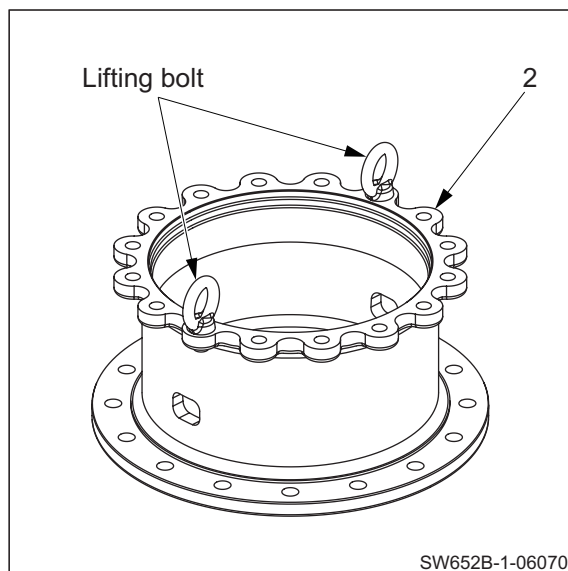


- ⑭ Secure disc subassembly to case with sixteen bolts (3) and washers.

 (3) Bolts M16×50 : 265 N·m (195 lbf-ft)

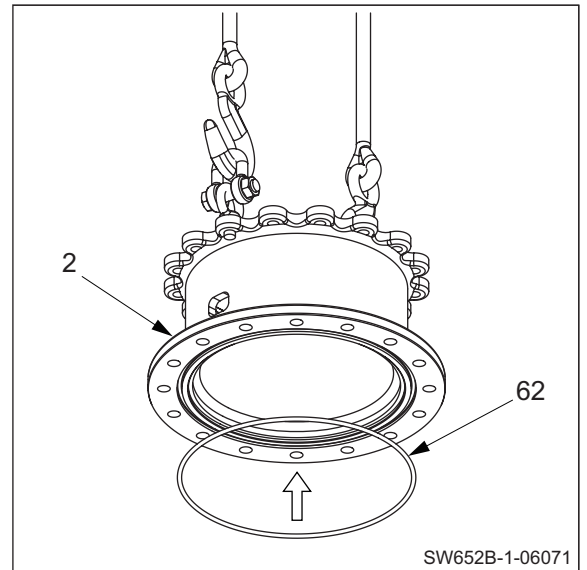


- 13) Install lifting bolts (M16) to housing (2).




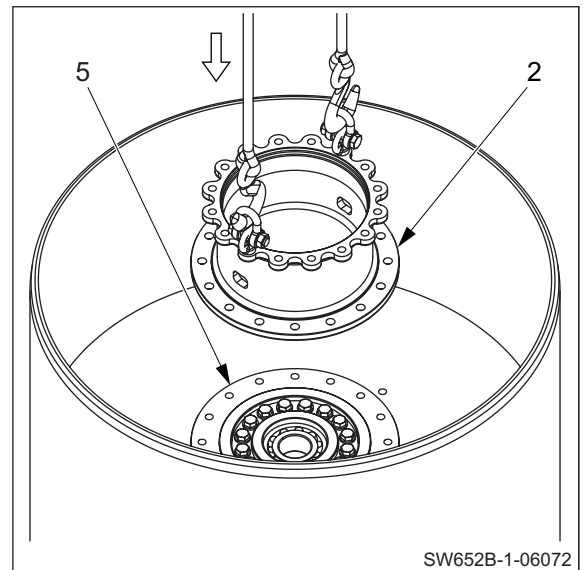
14) Lift housing (2).

- Apply grease to O-ring (62).
- Install O-ring (62) to housing (2).




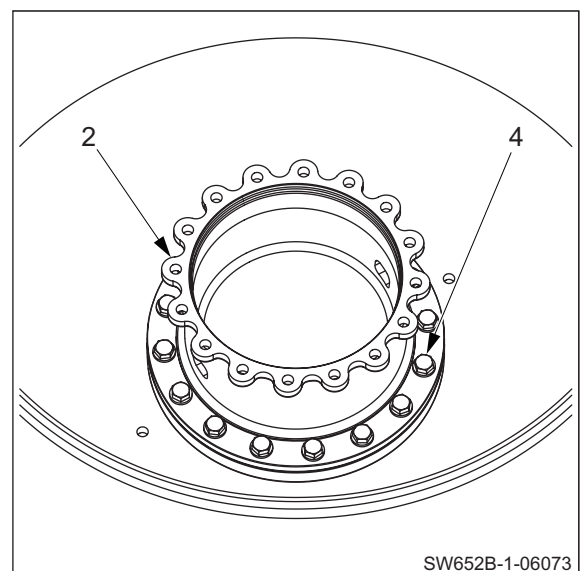
15) Lower housing (2) on mounting surface of disc (5).

 (2) Housing : 35 kg (77 lbs.)




16) Secure housing (2) with sixteen bolts (4) and washers.

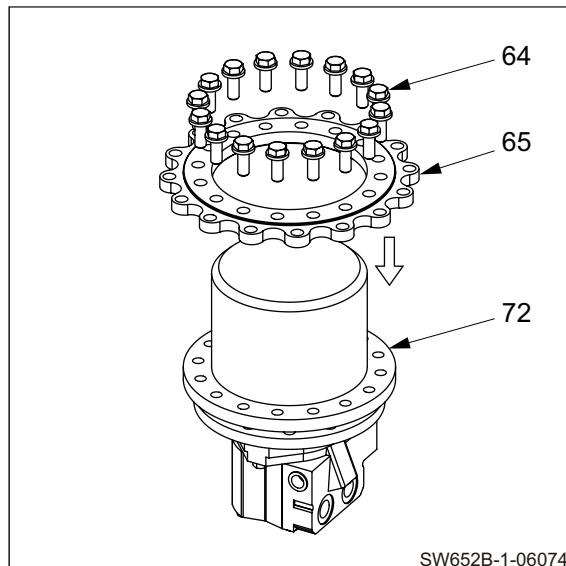
 N·m (4) Bolts M16×40 : 265 N·m (195 lbf·ft)




17) Reassembly of propulsion motor subassembly

- Secure disc (65) to propulsion motor (72) with sixteen bolts (64) and washers.

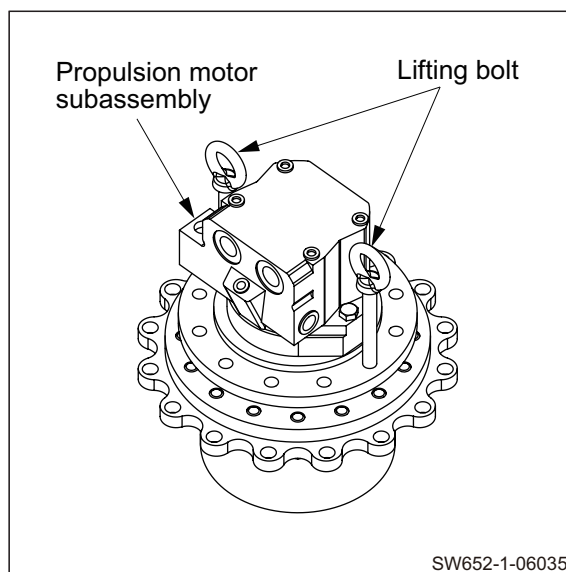
  $N \cdot m$  (64) Bolts M16×45 : 265 N·m (195 lbf·ft)




18) Reverse propulsion motor subassembly.

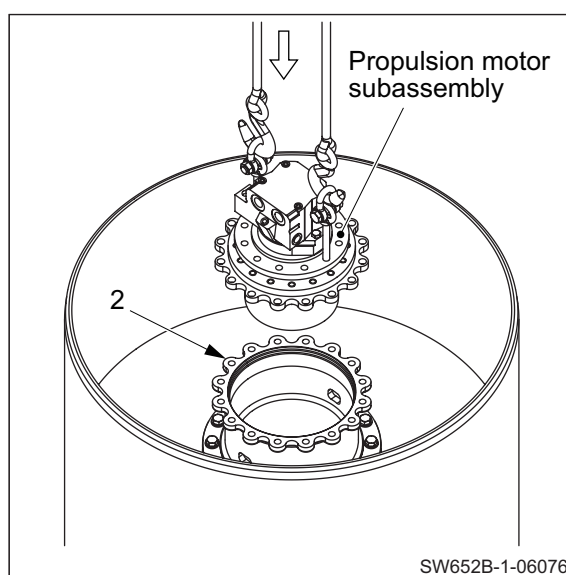
  $k_g$  Propulsion motor subassembly : 75 kg (165 lbs.)

- Install lifting bolts (M16) to propulsion motor (72).




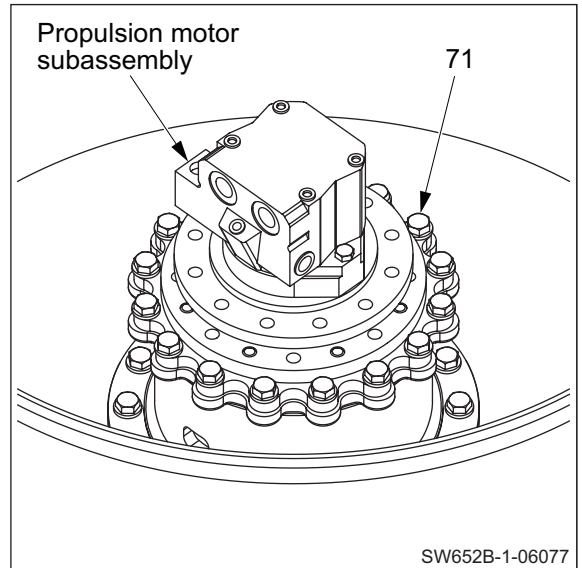
19) Lower propulsion motor subassembly on mounting surface of housing (2).

  $k_g$  Propulsion motor subassembly : 75 kg (165 lbs.)

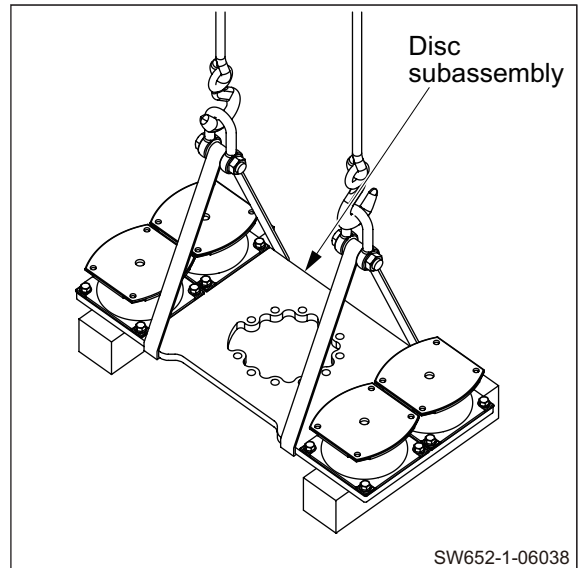


20) Secure propulsion motor subassembly to housing (2) with sixteen bolts (71) and washers.

 N·m (71) Bolts M16×45 : 265 N·m (195 lbf·ft)

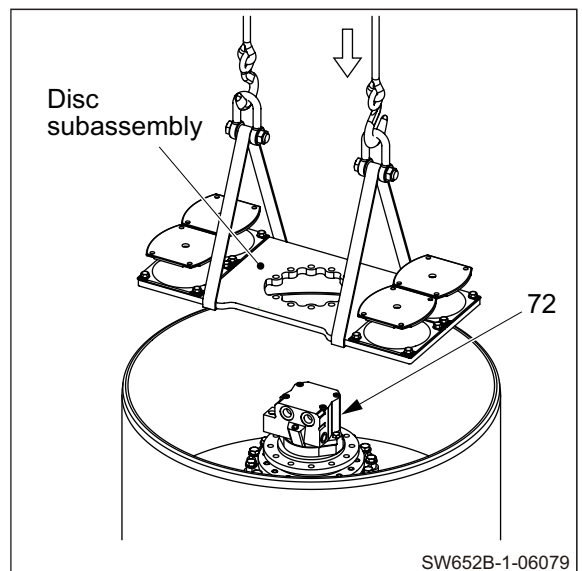


21) Lift disc subassembly.



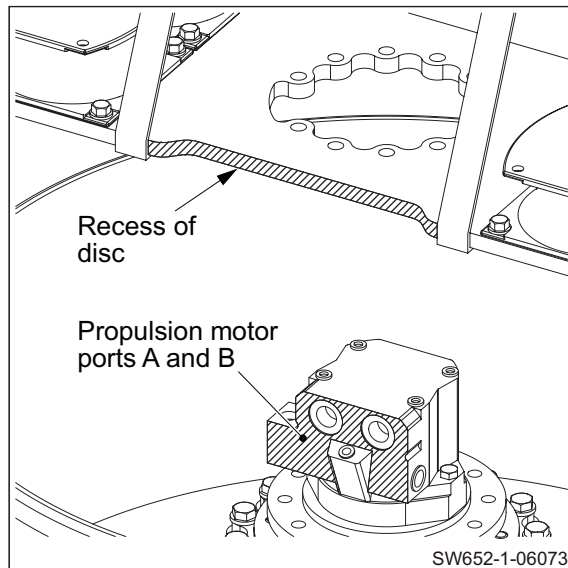
22) Lower disc subassembly on mounting surface of propulsion motor (72).

 kg Disc subassembly : 70 kg (154 lbs.)




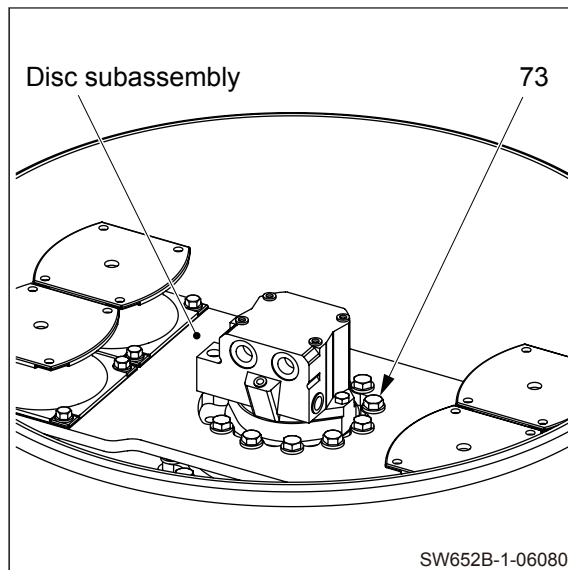
**(NOTICE)**

- The recess of the disc must be parallel with the side of the propulsion motor which have ports A and B.




- 23) Secure disc subassembly with eleven bolts (73) and washers.

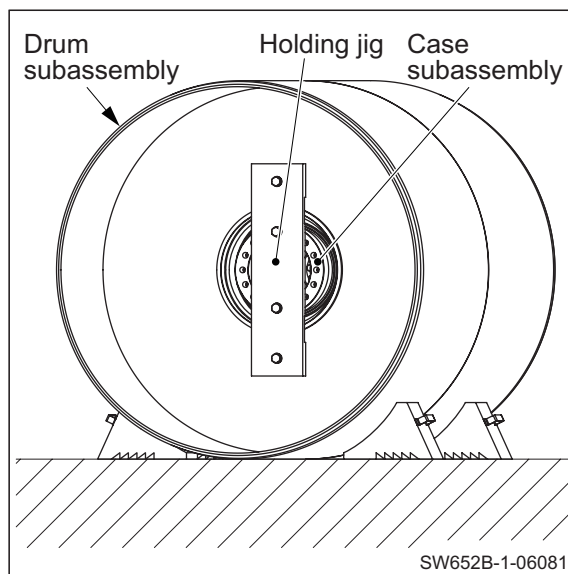
 N·m (73) Bolts M16×45 : 265 N·m (195 lbf-ft)




- 24) Lay vibratory drum subassembly on its side.

 Vibratory drum subassembly : 1,705 kg (3,759 lbs.)

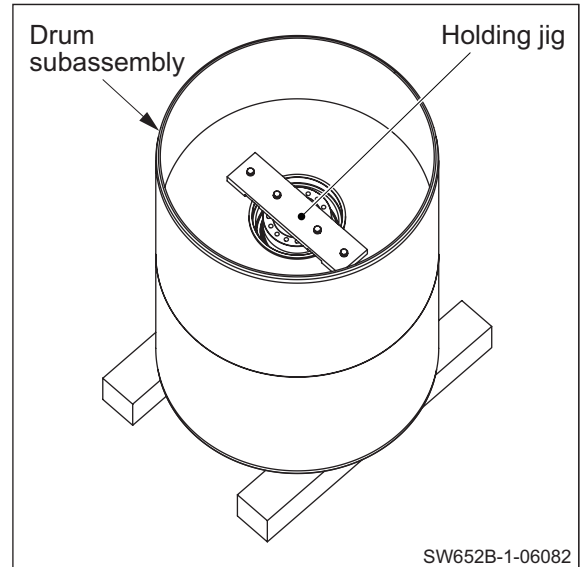
- Set a holding jig to vibrator motor side drum subassembly and case subassembly, and secure with bolts.



25) Stand drum with its propulsion motor side facing down.

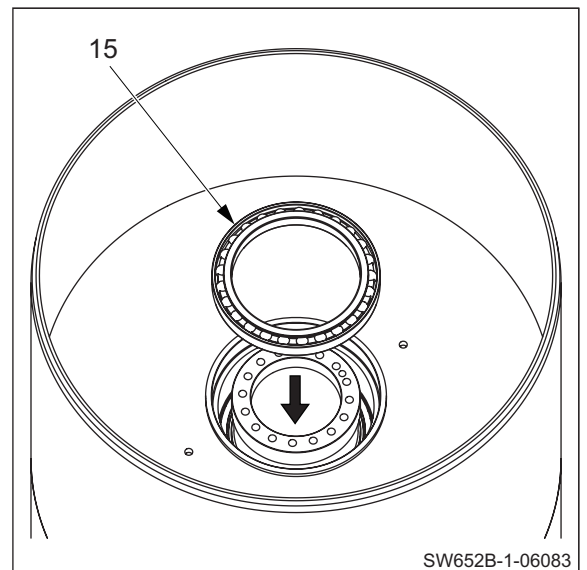
 Vibratory drum subassembly : 1,730 kg (3,814 lbs.)

- Remove holding jig.



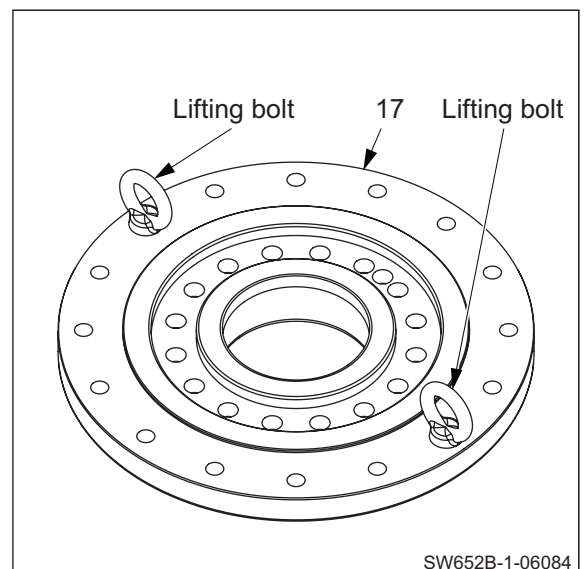
26) Apply a coat of gear oil to ball bearing (15) on its surface to be press-fitted.

- Drive in ball bearing (15).
- Apply sufficient amount of lithium-based grease to ball bearing (15).




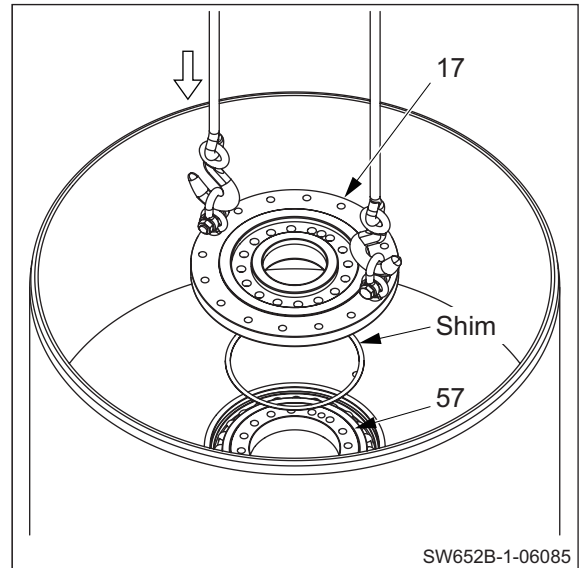
27) Preload adjustment of ball bearing

- ① Install lifting bolts (M16) to disc (17).




- ② Insert a shim of about 1.5 mm (0.06 in.) and lower disc (17) on mounting surface of case (57).

 (17) Disc : 25 kg (55 lbs.)




- ③ A gap will remain between end of case (57) and inside of disc (17).  
 ④ Secure with eight bolts (20) and washers.

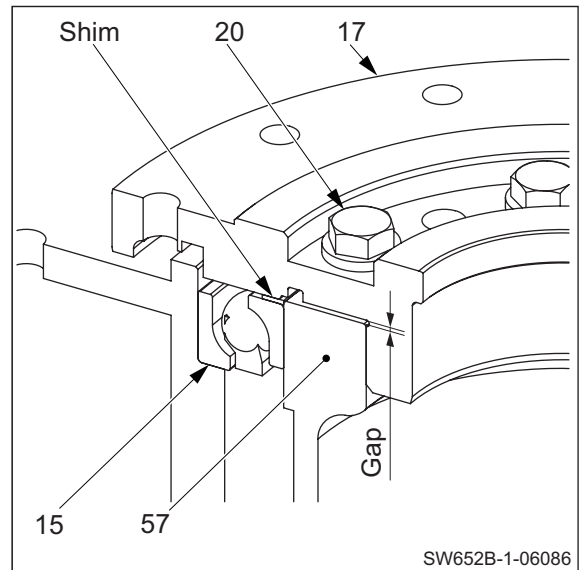
 (20) Bolts M16×50 : 265 N·m (195 lbf-ft)

**(NOTICE)**

- Tighten the bolts alternately in diagonal directions.

- ⑤ Rotate vibrator motor side drum subassembly for more than one complete turn in both directions.  
 ⑥ Let ball bearing (15) settle down and tighten bolts (20) again.

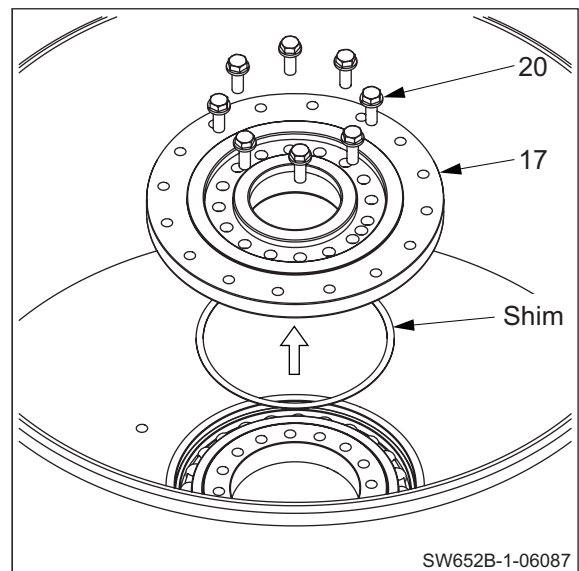
 (20) Bolts M16×50 : 265 N·m (195 lbf-ft)



- ⑦ Remove bolts (20).  
 • Remove disc (17).  
 • Remove shim.

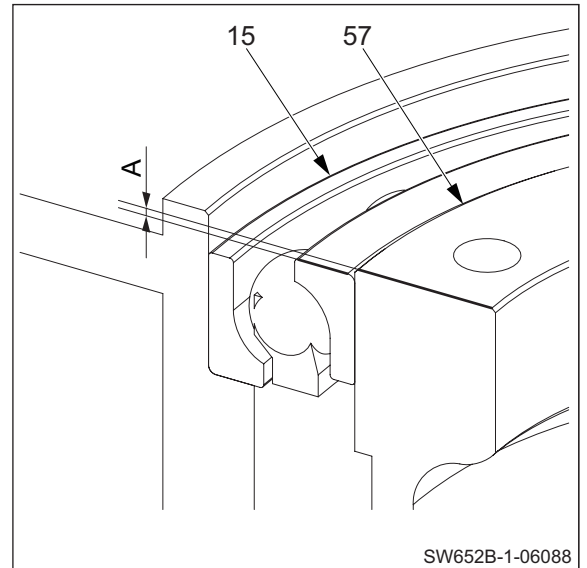
**(NOTICE)**

- Do not turn the drum after the disc is removed.



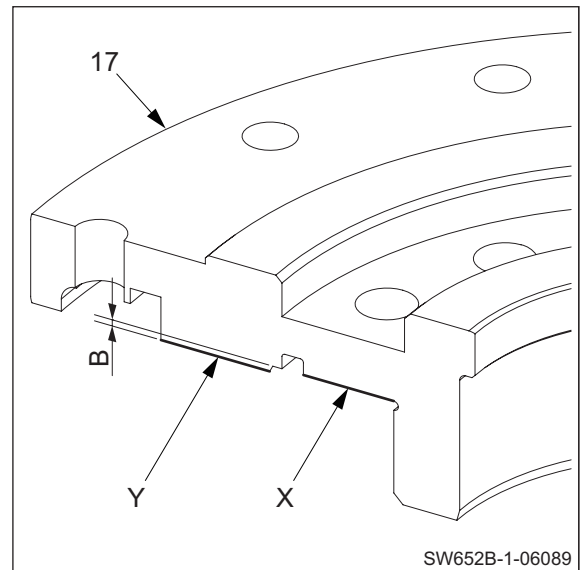


- ⑧ Measure dimension “A” between end of case (57) and ball bearing (15).

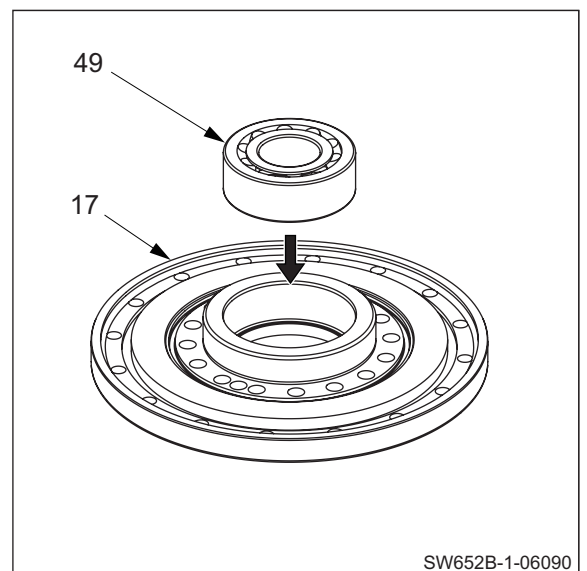


- ⑨ Measure dimension “B” between X and Y of disc (17).

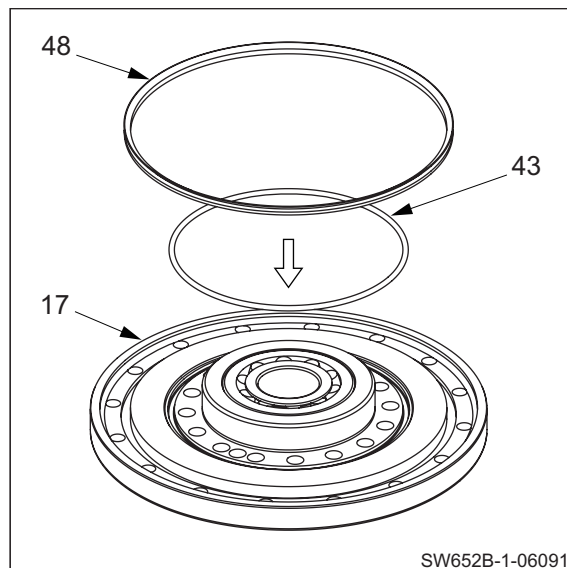
★ Preload adjusting shim thickness = (A-B) + 0.1 mm (0.04 in.)



- ⑩ Reassembly of disc subassembly
  - Apply a coat of gear oil to vibrator bearing (49) on its surface to be press-fitted.
  - Drive vibrator bearing (49) into disc (17).



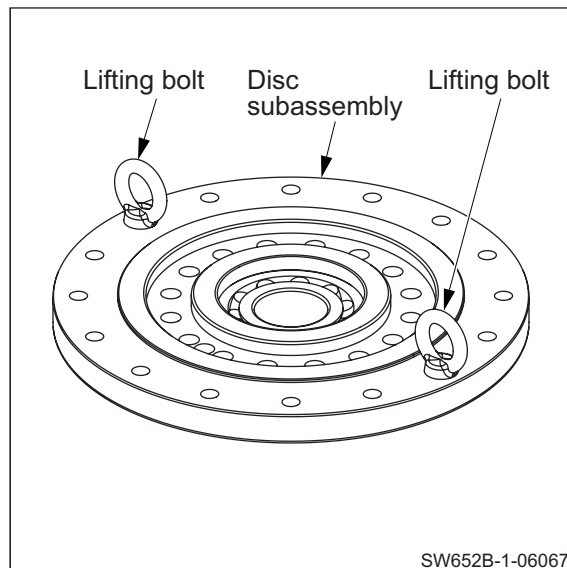
- ⑪ Apply grease to O-ring (43).
- Install O-ring (43) to disc (17).
  - Install V-ring (48) to disc (17).
  - Apply lithium-based grease to lip of V-ring (48).



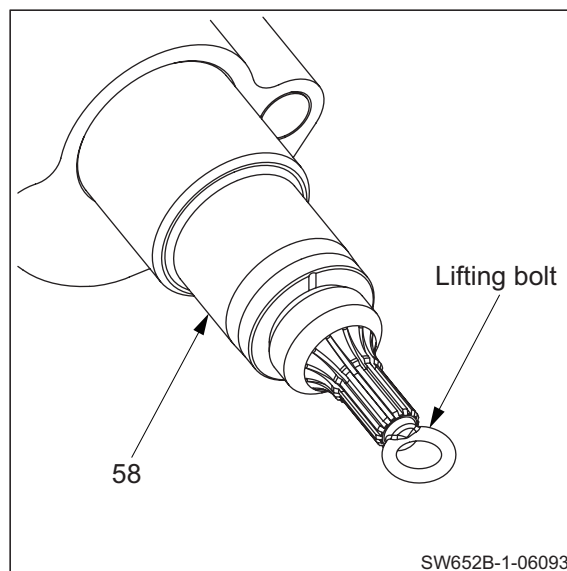
- ⑫ Reverse disc subassembly.

$\mathfrak{J}_{kg}$  Disc subassembly : 30 kg (66 lbs.)


- Install lifting bolts (M16).



- ⑬ Install a lifting bolt (M8) to eccentric shaft (58).

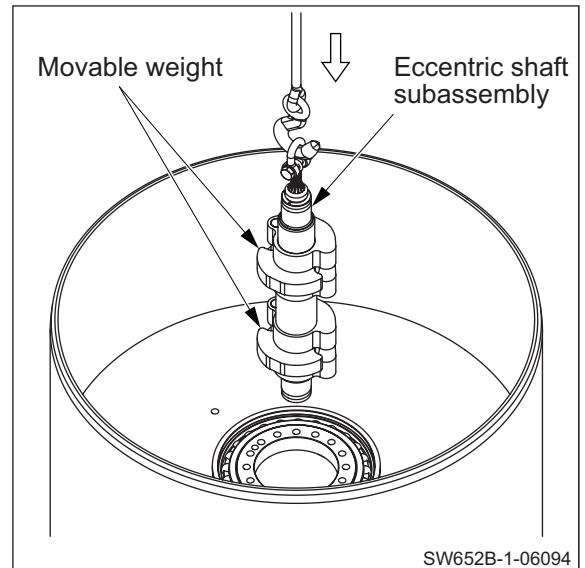


- ⑭ Apply a coat of gear oil to eccentric shaft subassembly at where vibrator bearing will be installed.
- Install eccentric shaft subassembly.

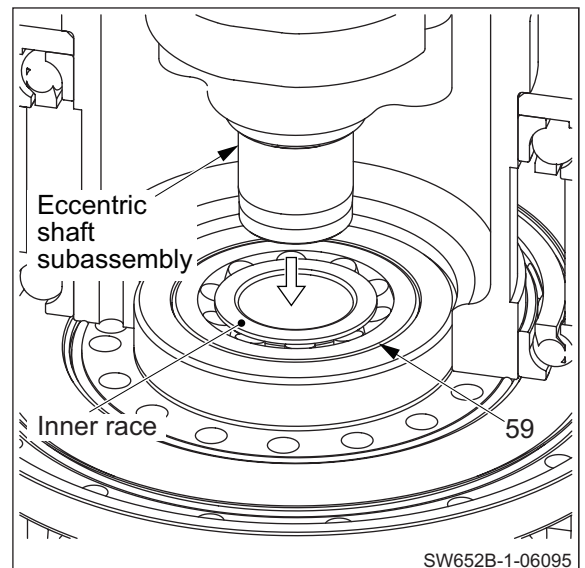
 Eccentric shaft subassembly : 50 kg (110 lbs.)

**(NOTICE)**


- **Put the movable weights at their outmost position.**



- ⑮ Insert eccentric shaft subassembly into vibrator bearing (59) while taking care not to tilt vibrator bearing inner race.

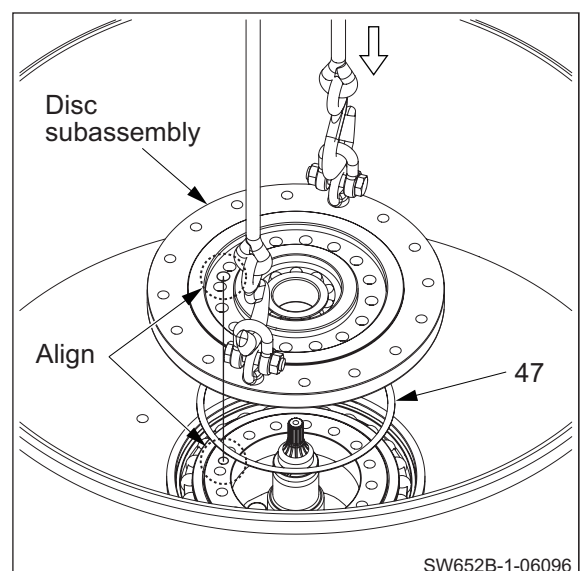


- ⑯ Apply a coat of gear oil to inner surface of vibrator bearing (49).
- Insert a shim (47) of preload adjusting shim thickness and lower disc subassembly on mounting surface of case.


 Disc subassembly : 30 kg (66 lbs.)

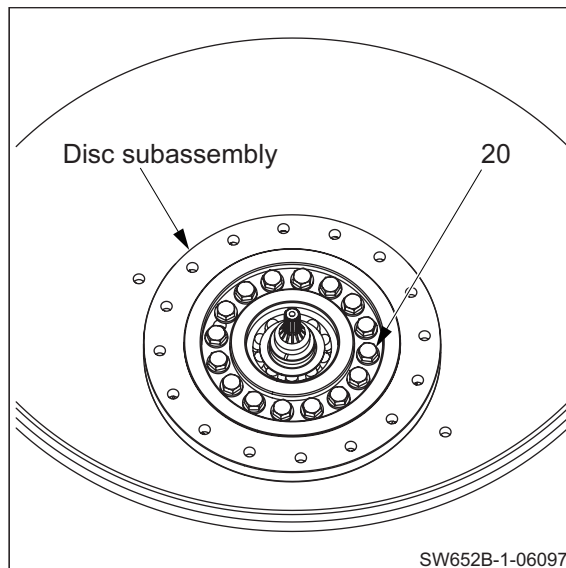
**(NOTICE)**

- **Align the 18 mm dia. hole in the disc with the 14 mm dia. hole in the case when installing the disc.**
- **Take care not to let the vibrator bearing inner race tilt during installation.**

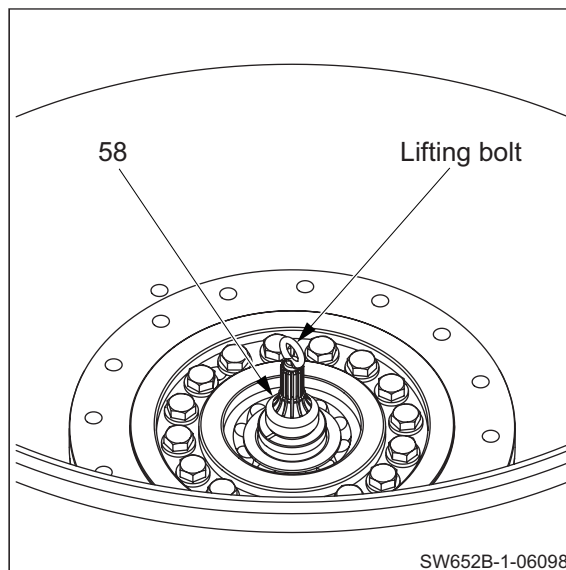


- 17) Secure disc subassembly with sixteen bolts (20) and washers.

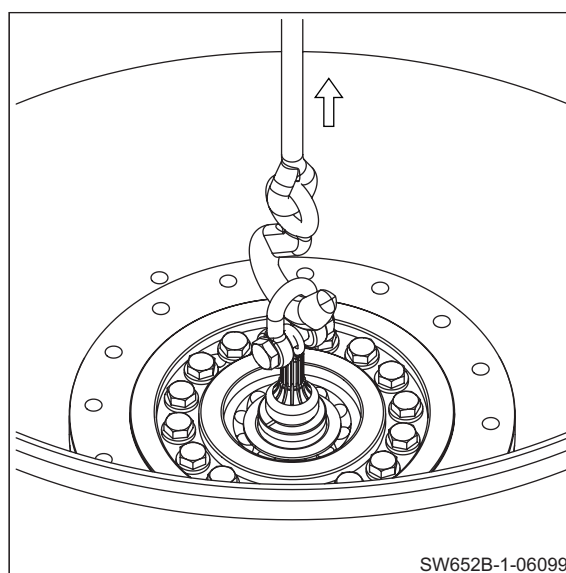
 N·m (20) Bolts M16×50 : 265 N·m (195 lbf·ft)



- 28) Install a lifting bolt (M8) to end of eccentric shaft (58).



- 29) Slowly lift eccentric shaft with a crane and check that there is an axial play of 1 to 3 mm (0.04 to 0.12 in.).



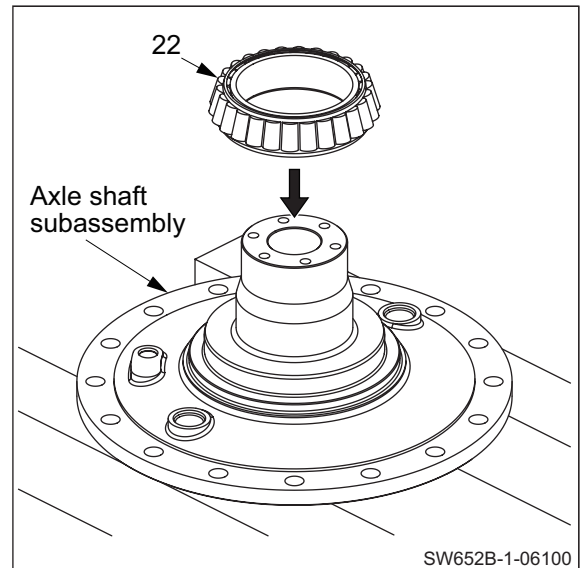
## **! WARNING**

**Wear heat resistant gloves when handling heated parts to avoid burns.**

### 30) Reassembly of axle shaft subassembly

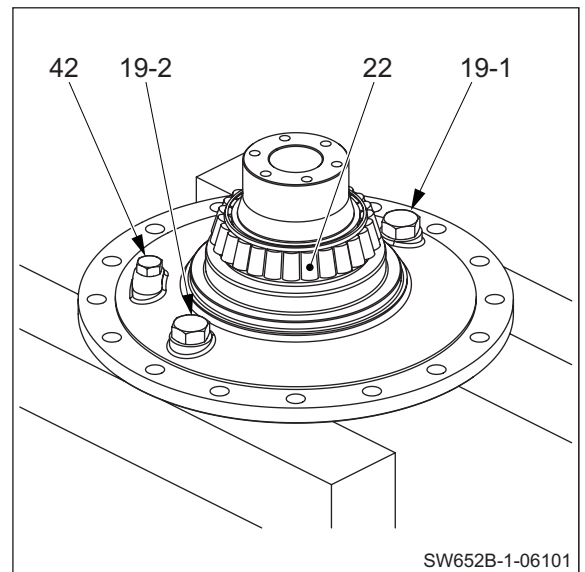
30-1) Heat up roller bearing (22) inner race by using a ring heater or the like.

- Apply a coat of gear oil to roller bearing (22) inner race on its surface to be press-fitted.
- Drive in heated roller bearing (22) inner race.



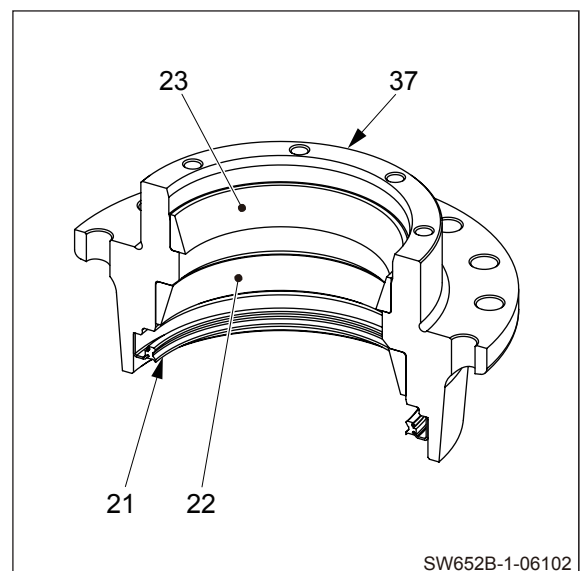
30-2) Apply grease to O-rings for plugs (19-1), (19-2), and level plug (42).

- Install plugs (19-1), (19-2), and level plug (42).
- Apply sufficient amount of lithium-based grease to rollers of roller bearing (22).

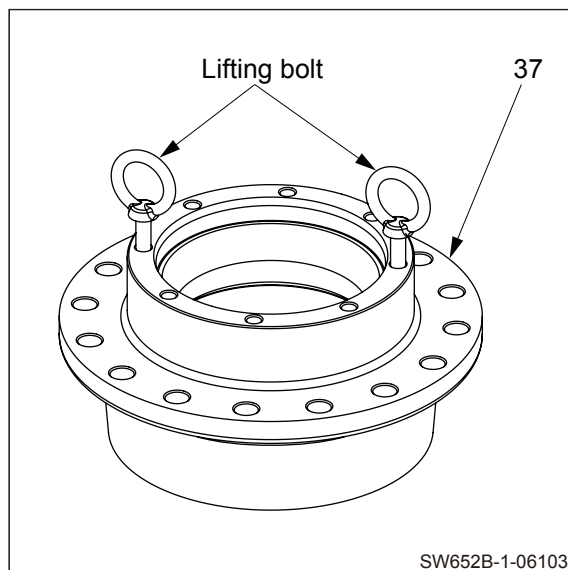


30-3) Apply a coat of gear oil to roller bearings (22) and (23) outer races on their surfaces to be press-fitted.

- Drive roller bearings (22) and (23) outer races into housing (37).
- Apply liquid packing to periphery of oil seal (21).
- Drive in oil seal (21).
- Apply grease to lip of oil seal (21).

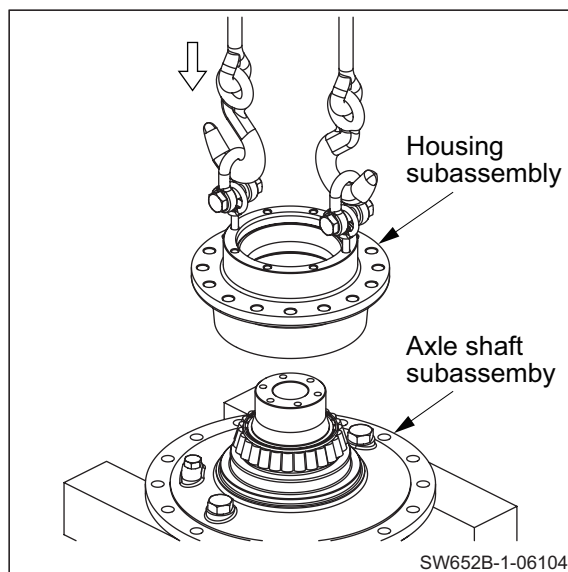


30-4) Install lifting bolts (M10) to housing (37).



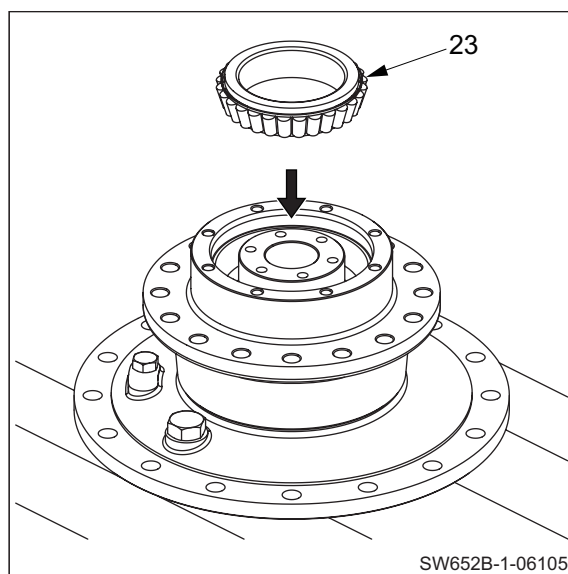
30-5) Install housing subassembly to axle shaft subassembly.

$\mathfrak{J}_{kg}$  Housing subassembly : 20 kg (44 lbs.)



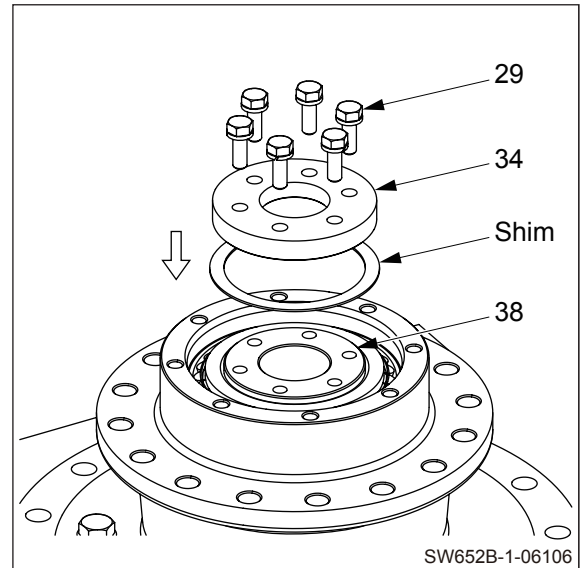
30-6) Apply sufficient amount of lithium-based grease to rollers of roller bearing (23) inner race.

- Drive in roller bearing (23) inner race until rollers come in contact with outer race.



30-7) Preload adjustment of roller bearing.

- ① Install a shim of about 1 mm (0.04 in.) and secure cover (34) to axle shaft (38) with six bolts (29) and spring washers.

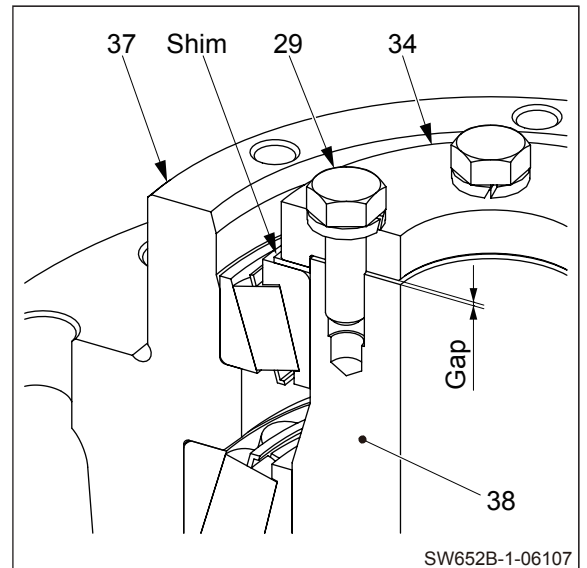


② A gap will remain between end of axle shaft (38) and inside of cover (34).

- Tighten bolts (29) to a torque of 60 N·m (44 lbf-ft).
- Give housing (37) two to three turns.
- Tighten bolts (29) to a torque of 60 N·m (44 lbf-ft) again.
- Repeat this work several times until tightening torque of bolts no longer fluctuates.

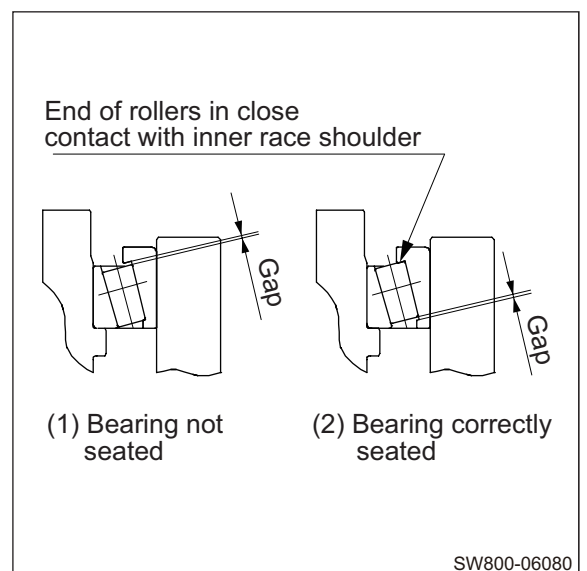
**(NOTICE)**

- Tighten the bolts alternately in diagonal directions.



**(NOTICE)**

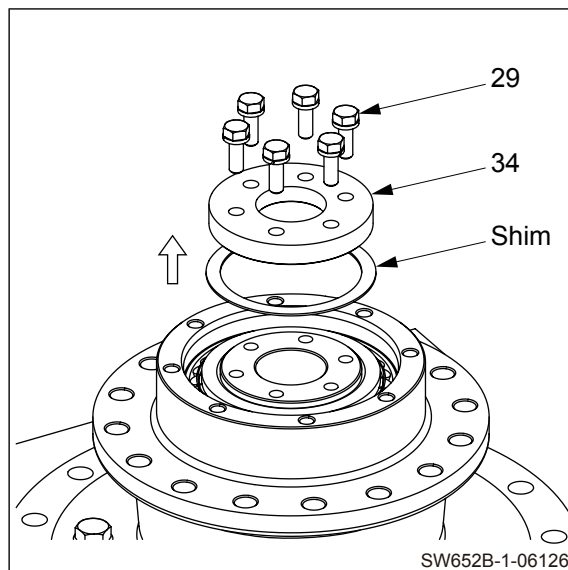
- Push in the inner race while rotating the bearing. Otherwise, even strongly trying to push the inner race, the bearing rollers will not be pushed up and therefore bearing will not be seated.



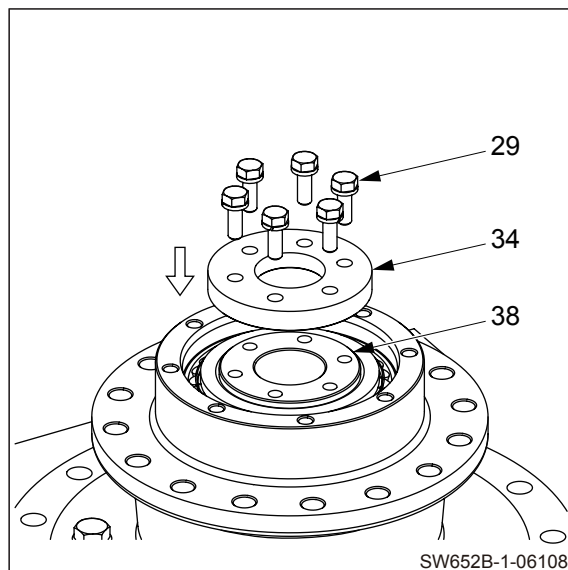
- ③ Remove bolts (29).
- Remove cover (34).
  - Remove shim.

**(NOTICE)**

- Do not turn the housing after the cover is removed.

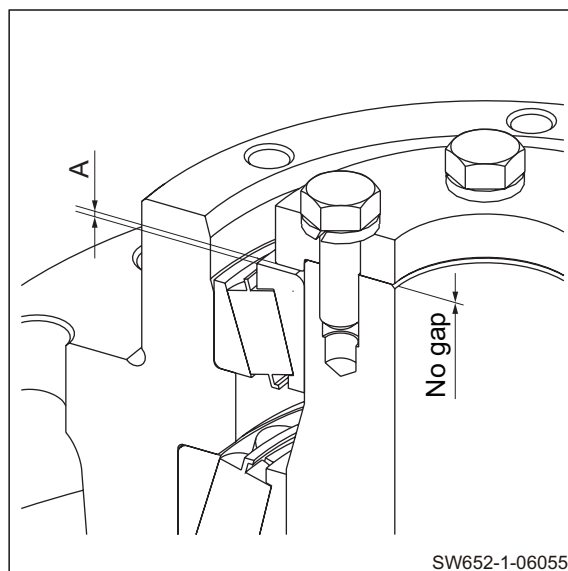


- ④ Without inserting shim, install cover (34) to axle shaft (38) with six bolts (29) and spring washers.



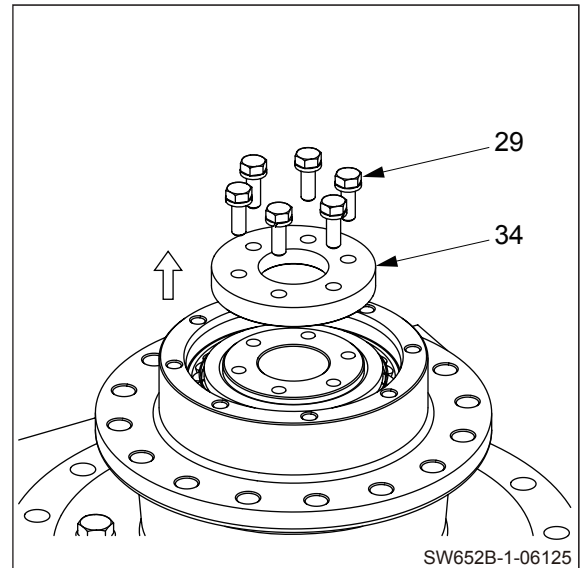
- ⑤ Using a thickness gauge, measure clearance "A".

★ Preload adjusting shim thickness =  $A + 0.1 \text{ mm (0.04 in.)}$




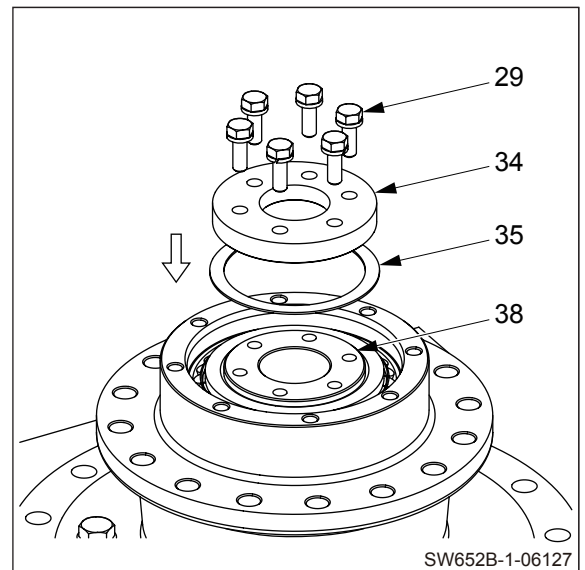


- ⑥ Remove bolts (29).  
 • Remove cover (34).

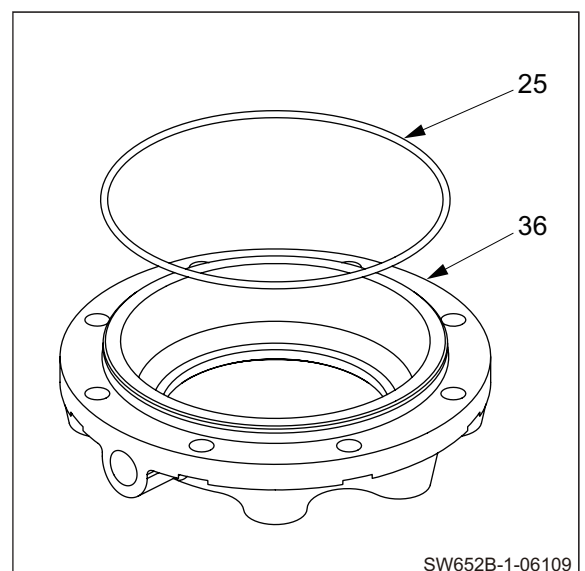


- ⑦ Install shim (35) of preload adjusting shim thickness = "A + 0.1 mm (0.04 in.)".  
 • Secure cover (34) to axle shaft (38) with six bolts (29) and spring washers.


 N·m (29) Bolts M10×30 : 60 N·m (441 lbf·ft)

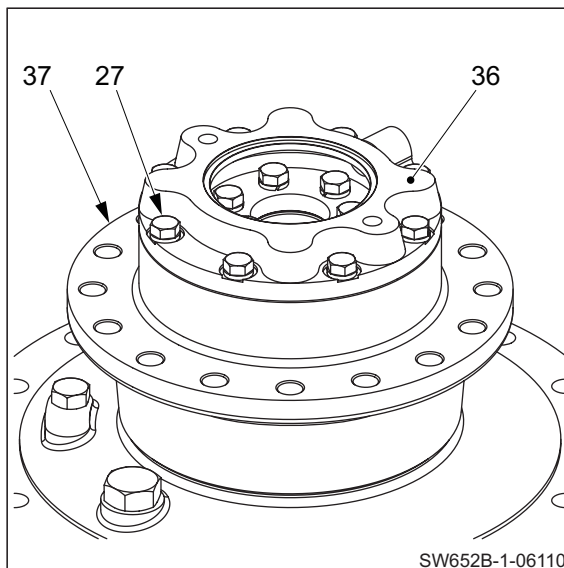


- 30-8) Apply grease to O-ring (25).  
 • Install O-ring (25) to flange (36).

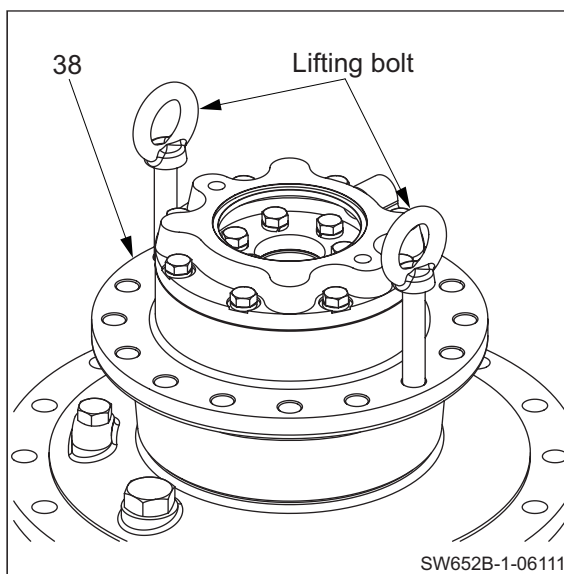


30-9) Secure flange (36) to housing (37) with eight bolts (27) and spring washers.

 N·m (27) Bolts M10×30 : 60 N·m (44 lbf·ft)

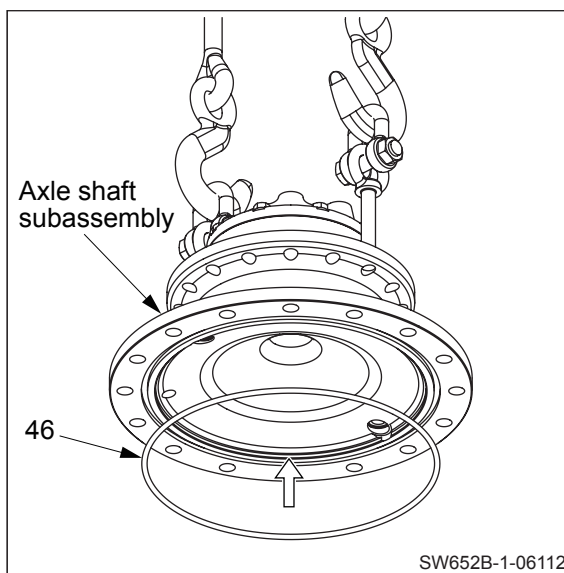


31) Install lifting bolts (M16) to axle shaft (38).




32) Lift axle shaft subassembly.

- Apply grease to O-ring (46).
- Install O-ring (46) to axle shaft subassembly.

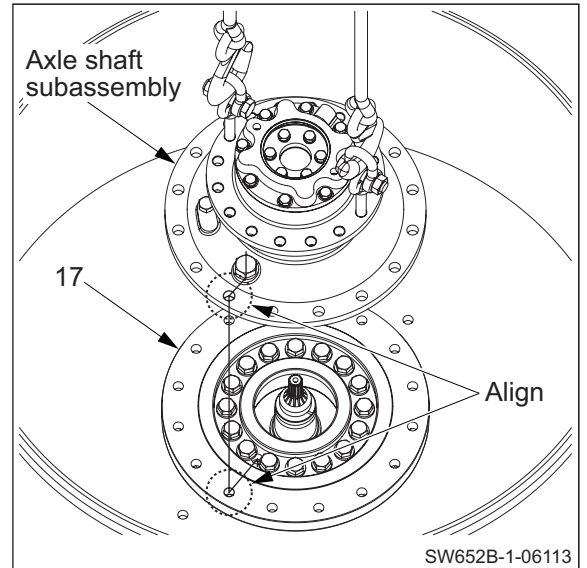


33) Lower axle shaft subassembly on mounting surface of disc (17) slowly.


 Axle shaft subassembly : 55 kg (121 lbs.)

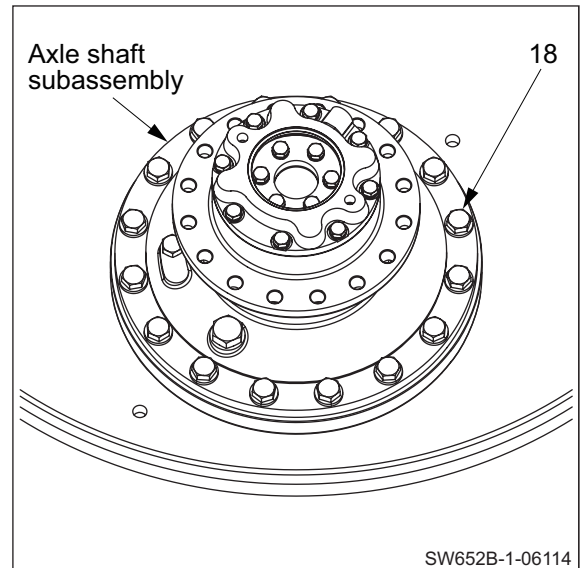
**(NOTICE)**

- The drain plug on the axle shaft must be aligned with the 18 mm diameter hole in the disc as shown on the right when installing the axle shaft subassembly.

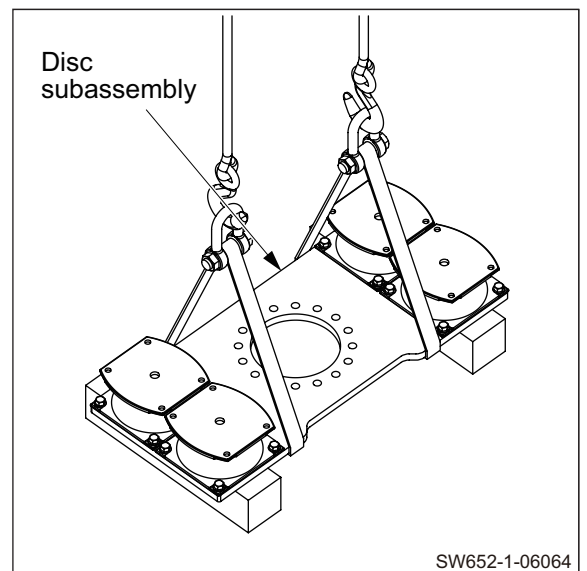


34) Secure axle shaft subassembly with sixteen bolts (18) and washers.


 (18) Bolts M16×40 : 265 N·m (195 lbf·ft)

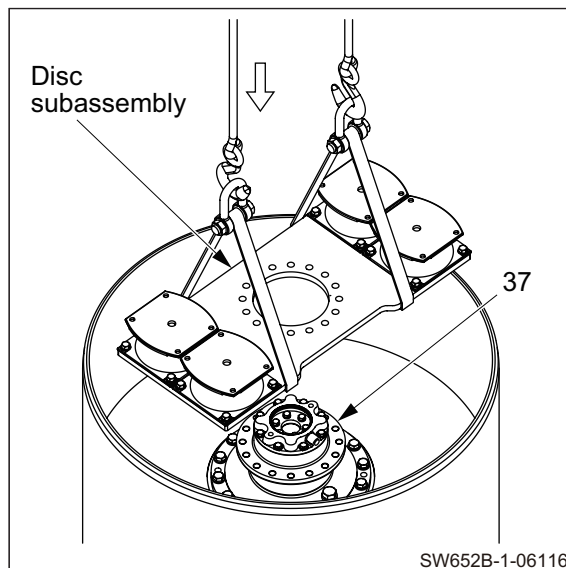


35) Lift disc subassembly.



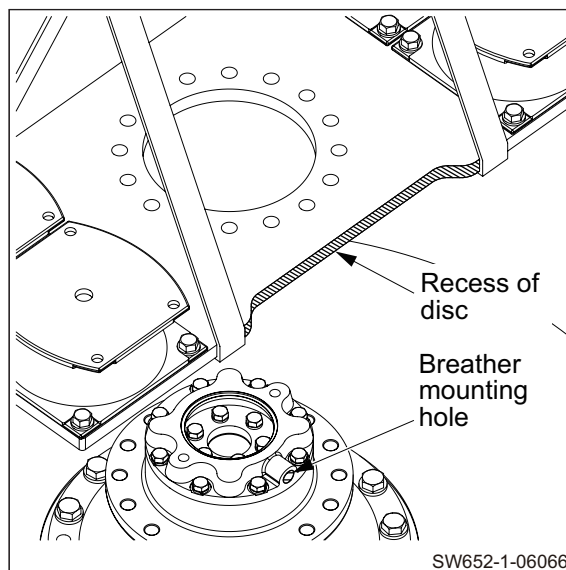
36) Lower disc subassembly on mounting surface of housing (37).

 Disc subassembly : 75 kg (165 lbs.)




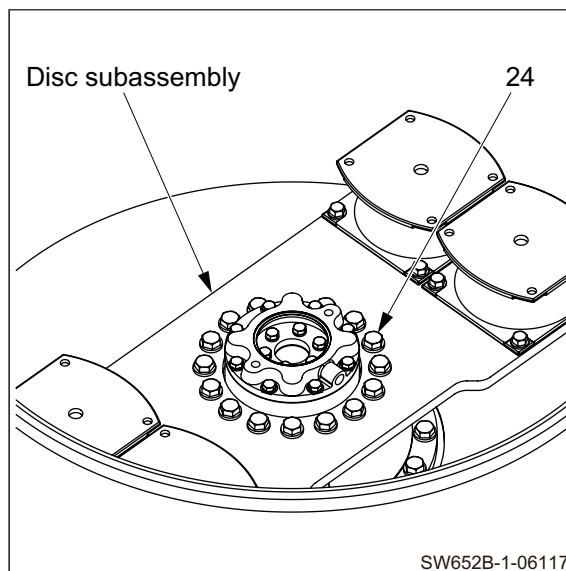
**(NOTICE)**

- The recess of the disc must face the same direction as the breather mounting hole in the flange.

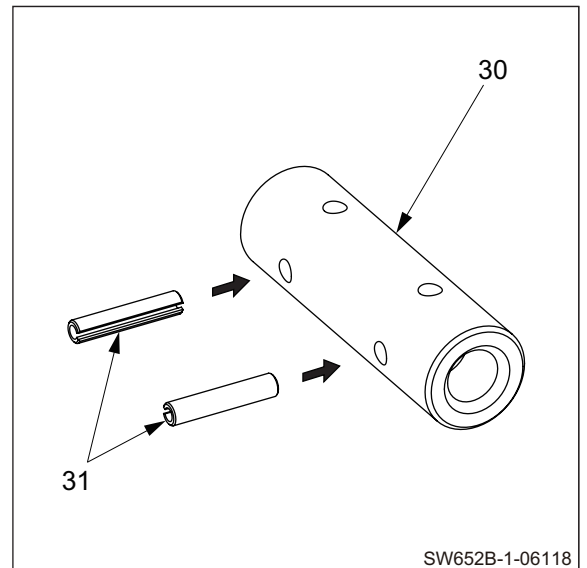


37) Secure disc subassembly with twelve bolts (24) and washers.

 (24) Bolts M16×45 : 265 N·m (195 lbf·ft)

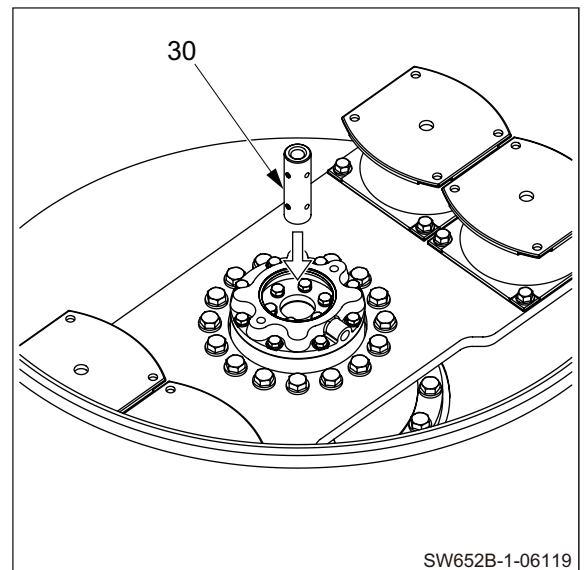


38) Drive two spring pins (31) into sleeve (30).



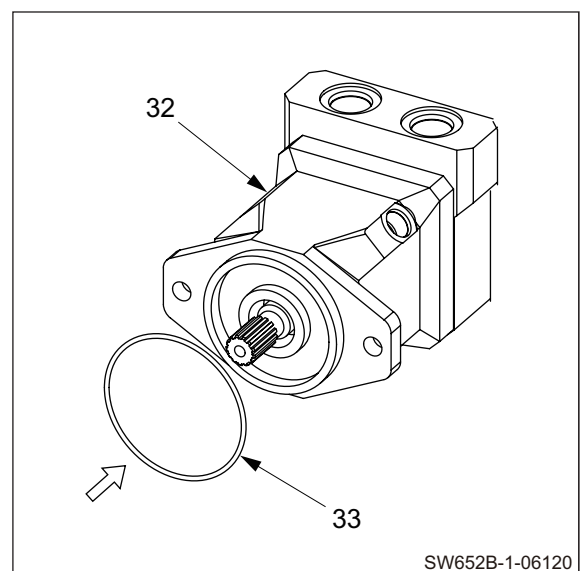
39) Apply molybdenum-based grease to splined portion of sleeve (30).

- Fit sleeve (30) to splined portion on eccentric shaft end.





40) Apply grease to O-ring (33).

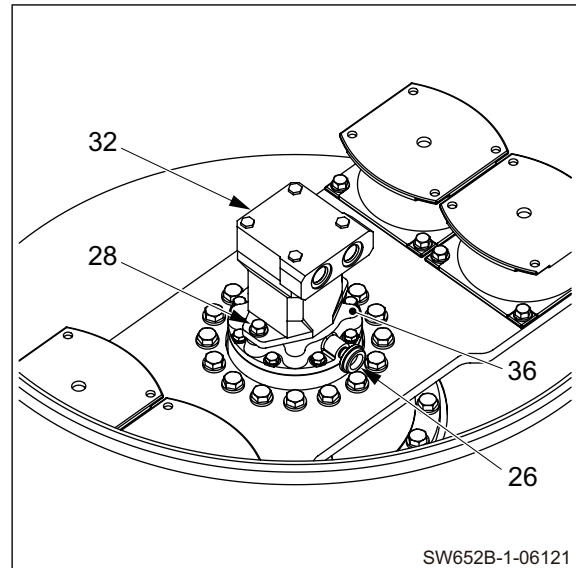
- Install O-ring (33) to vibrator motor (32).



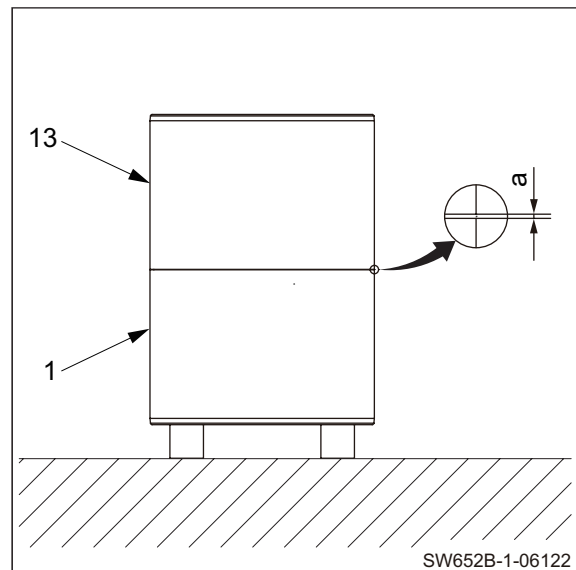
- 41) Wind seal tape around threaded portion of breather (26).
- Install breather (26).
  - Secure vibrator motor (32) to flange (36) with two bolts (28) and washers.

 (32) Vibrator motor : 15 kg (33 lbs.)


 (28) Bolts M12×30 : 110 N·m (81 lbf·ft)

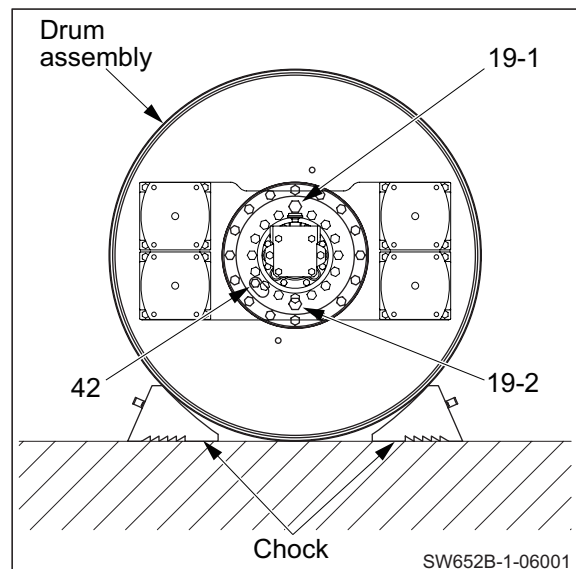


- 42) Measure clearance “a” between propulsion motor side drum (1) and vibrator motor side drum (13).
- ★ a = 1.4 to 2.3 mm (0.06 to 0.09 in).

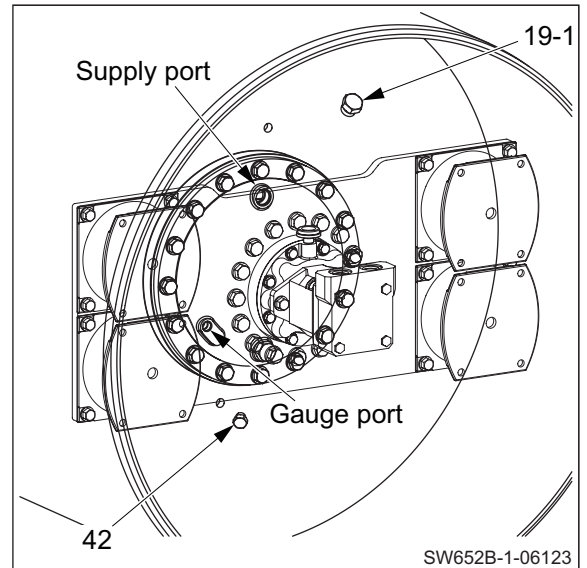


- 43) Lay vibratory drum assembly with plugs (19-1), (19-2), and (42) positioned as shown right.
- Hold with chocks.

 Vibratory drum assembly : 1,935 kg (4,266 lbs.)



- 44) Remove plugs (19-1) and (42).
- Supply gear oil from oil supply port.
  - Check that oil drips from gauge port.
  - Quantity of gear oil : 1.7 L (0.4 gal.)
- Reinstall plugs (19-1) and (42).

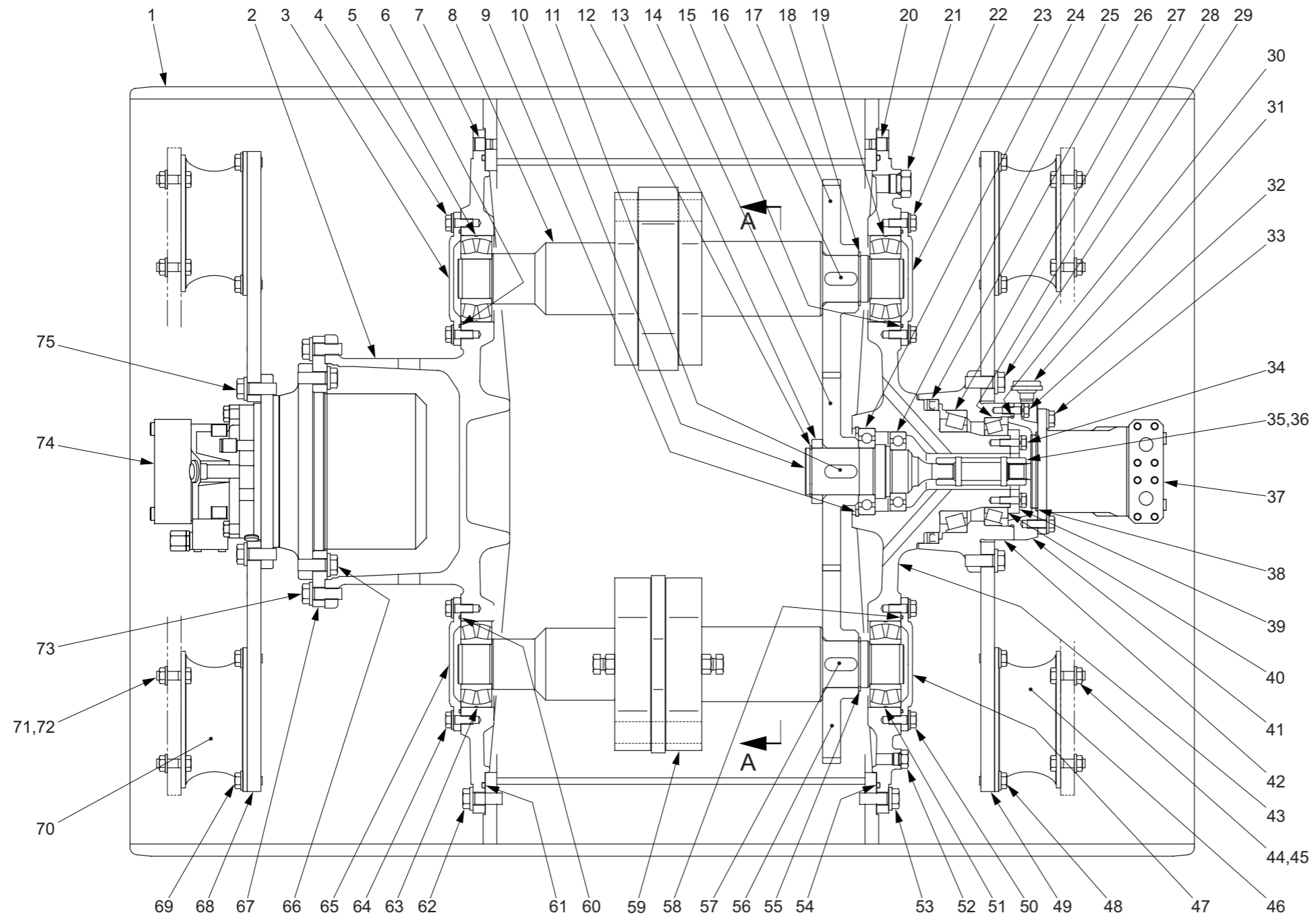




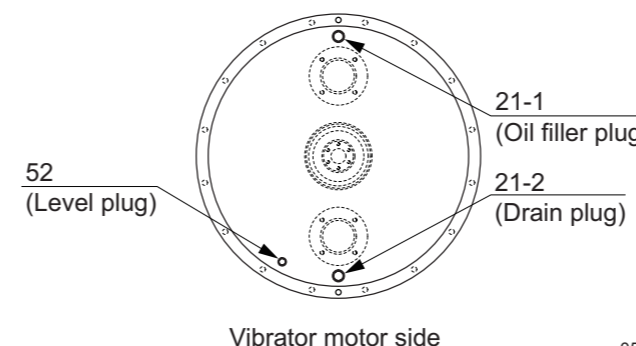
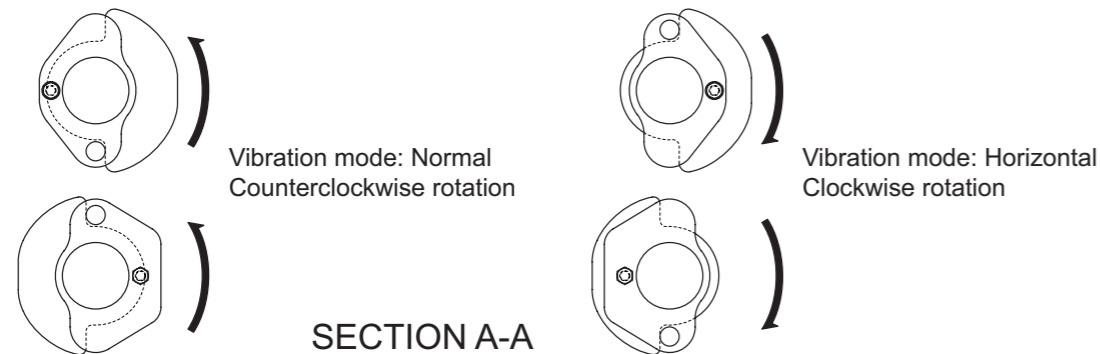


# 5. VIBRATORY DRUM ASSEMBLY

## 5-1. Vibratory Drum Assembly (SW652ND-1)



- |                       |                       |
|-----------------------|-----------------------|
| (1) Drum              | (51) Vibrator bearing |
| (2) Housing           | (52) Level plug       |
| (3) Cover             | (53) Bolt : M16×45    |
| (4) Bolt : M12×30     | (54) O-ring           |
| (5) Vibrator bearing  | (55) Retaining ring   |
| (6) O-ring            | (56) Gear             |
| (7) Pin               | (57) Sunk key         |
| (8) Eccentric shaft   | (58) O-ring           |
| (9) Retaining ring    | (59) Eccentric shaft  |
| (10) Shaft            | (60) O-ring           |
| (11) Sunk key         | (61) O-ring           |
| (12) Retaining ring   | (62) Bolt : M16×45    |
| (13) Collar           | (63) Vibrator bearing |
| (14) Gear             | (64) Bolt : M12×30    |
| (15) O-ring           | (65) Cover            |
| (16) Sunk key         | (66) Bolt : M16×45    |
| (17) Gear             | (67) Disc             |
| (18) Retaining ring   | (68) Disc             |
| (19) Vibrator bearing | (69) Bolt : M12×30    |
| (20) Pin              | (70) Damper           |
| (21) Plug             | (71) Bolt : M12×40    |
| (22) Bolt : M12×30    | (72) Nut : M12        |
| (23) Cover            | (73) Bolt : M16×45    |
| (24) Ball bearing     | (74) Propulsion motor |
| (25) Ball bearing     | (75) Bolt : M16×45    |
| (26) Oil seal         |                       |
| (27) Roller bearing   |                       |
| (28) Roller bearing   |                       |
| (29) Bolt : M16×45    |                       |
| (30) O-ring           |                       |
| (31) Breather         |                       |
| (32) Bolt : M10×30    |                       |
| (33) Bolt : M12×30    |                       |
| (34) Bolt : M10×30    |                       |
| (35) Sleeve           |                       |
| (36) Spring pin       |                       |
| (37) Vibrator motor   |                       |
| (38) O-ring           |                       |
| (39) Cover            |                       |
| (40) Shim             |                       |
| (41) Flange           |                       |
| (42) Housing          |                       |
| (43) Axle shaft       |                       |
| (44) Bolt : M12×40    |                       |
| (45) Nut : M12        |                       |
| (46) Damper           |                       |
| (47) Cover            |                       |
| (48) Bolt : M12×30    |                       |
| (49) Disc             |                       |
| (50) Bolt : M12×30    |                       |



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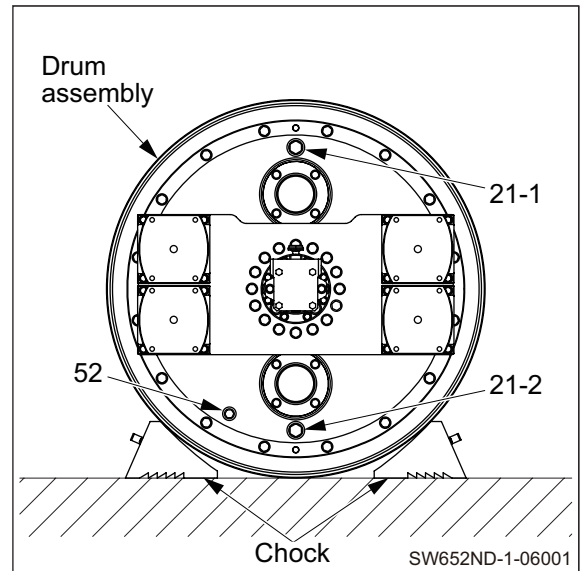
## 5-2. Disassembly and Reassembly of Vibratory Drum (SW652ND-1)

- Lead line numbers shown in the illustrations for the following vibratory drum disassembly and reassembly procedures are constant with part numbers of vibratory drum assembly shown on page 6-082.

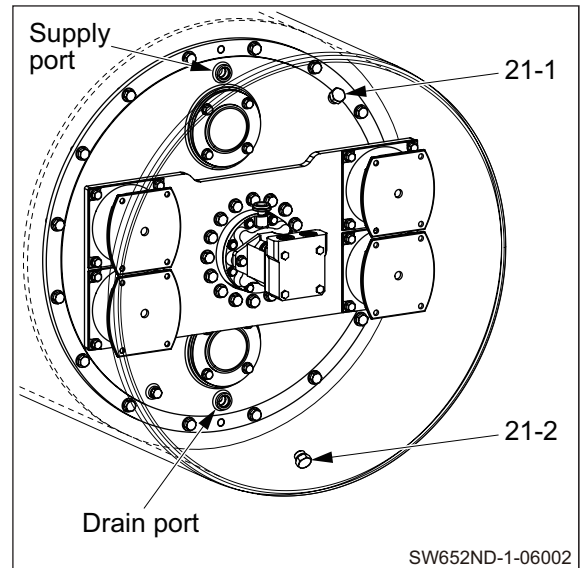
### 5-2-1. Disassembly of vibratory drum

- 1) Lay vibratory drum assembly with plugs (21-1), (21-2), and (52) positioned as shown on the right.
  - Hold with chocks.

 Vibratory drum assembly : 1,665 kg (3,671 lbs.)




- 2) Remove plugs (21-1) and (21-2).
  - Drain gear oil.
  - Quantity of gear oil : 10.4 L (2.7 gal.)

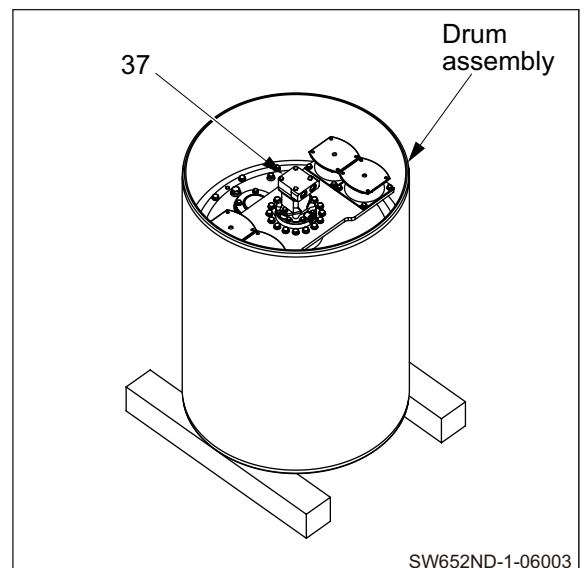


### **⚠ WARNING**


- When standing the vibratory drum, use wooden blocks of sufficient strength to securely support the drum.
- Carry out the work in an unstrained posture using a work stool or the like.

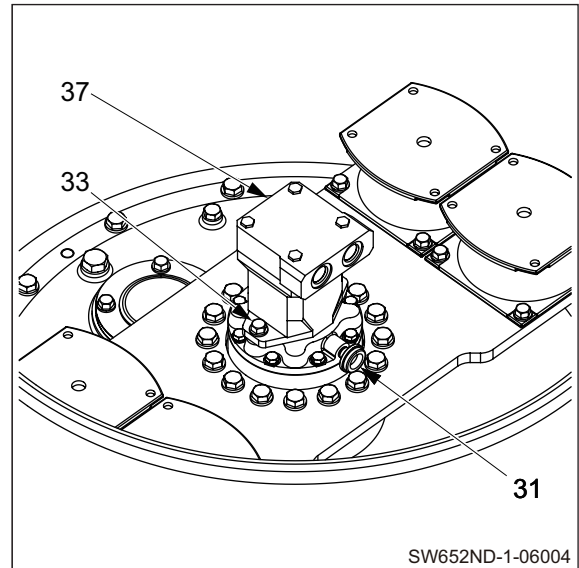
- 3) Stand vibratory drum assembly with its vibrator motor (37) side facing up.

 Vibratory drum assembly : 1,655 kg (3,649 lbs.)

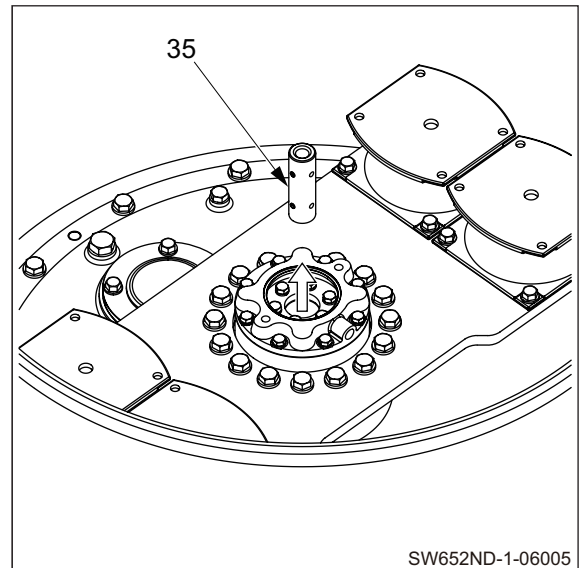


- 4) Remove breather (31).
  - Remove bolts (33).
  - Remove vibrator motor (37).

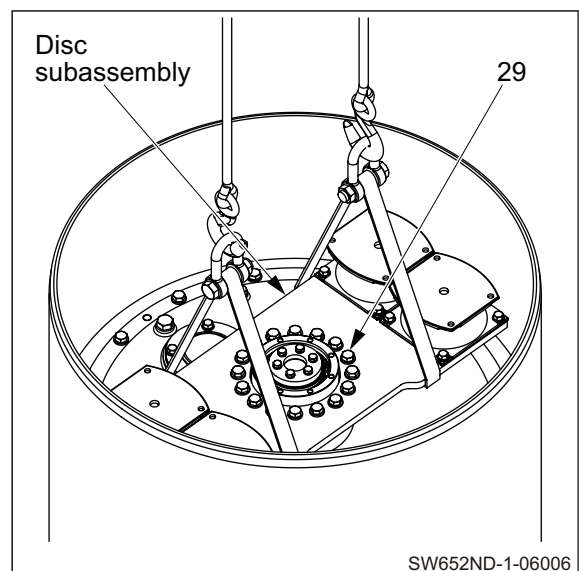
 (37) Vibrator motor : 15 kg (33 lbs.)




- 5) Remove sleeve (35).

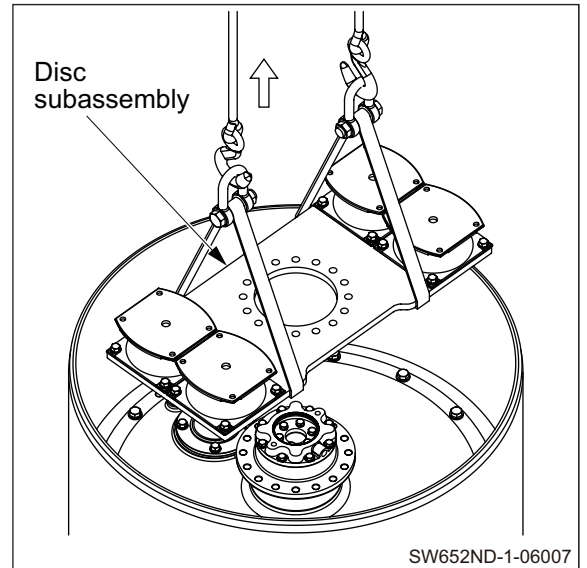


- 6) Lift disc subassembly.
  - Remove bolts (29).

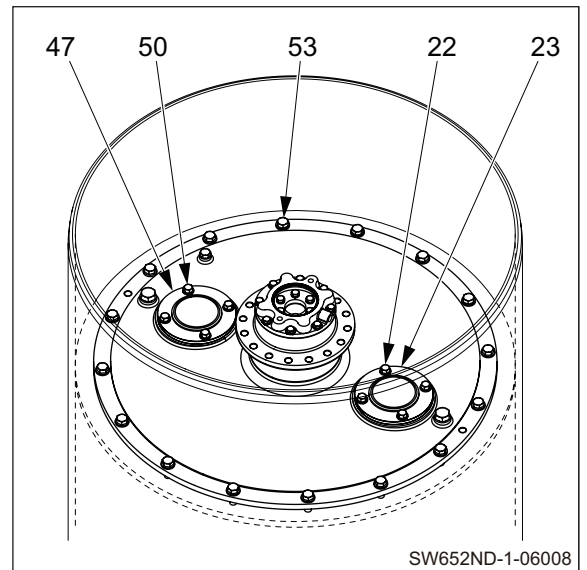


7) Remove disc subassembly.

 Disc subassembly : 75 kg (165 lbs.)



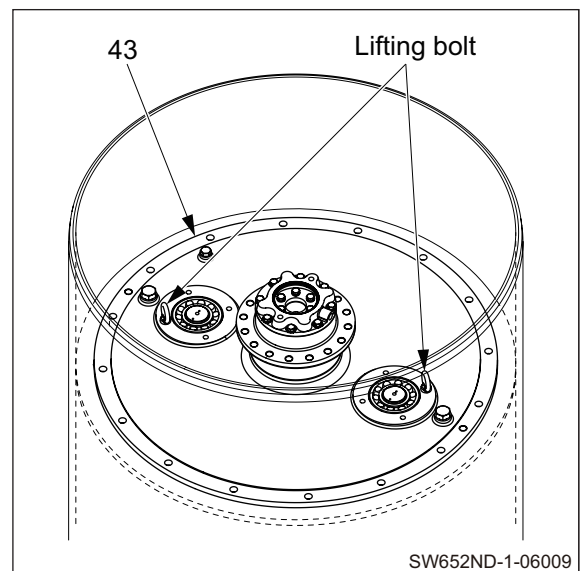
- 8) Remove bolts (22) and (50). (two places)
- Remove covers (23) and (47). (two places)
  - Remove bolts (53).



**⚠ WARNING**

When installing lifting bolts, screw in the threads fully before using.


9) Install lifting bolts (M12) to axle shaft (43).

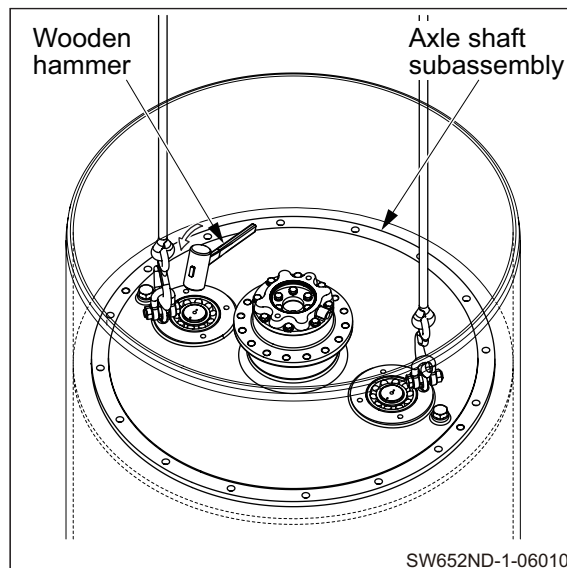


10) Remove axle shaft subassembly.

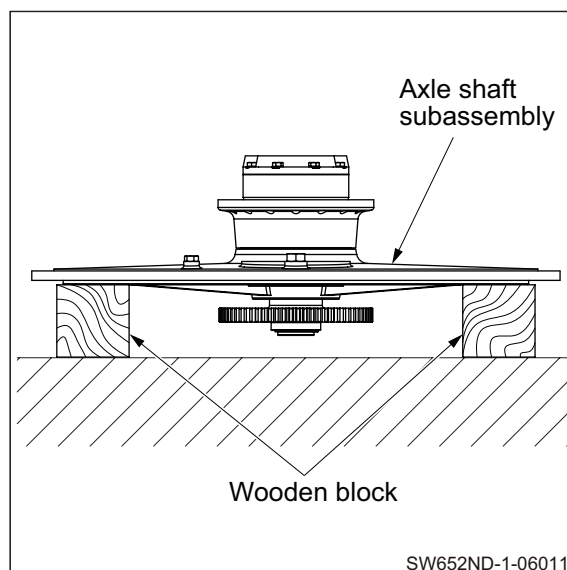
**(NOTICE)**

- In order not to lift eccentric shaft together with axle shaft subassembly, tap on the eccentric shaft ends alternately with a wooden hammer during lifting.

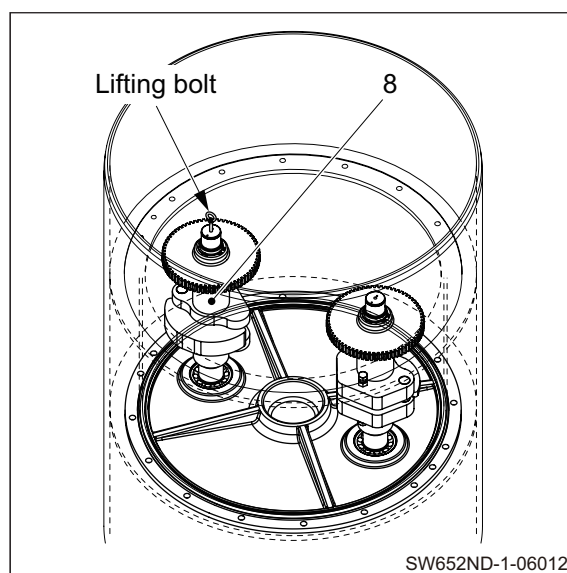
 Axle shaft subassembly : 200 kg (441 lbs.)




11) Put axle shaft subassembly on wooden blocks.



12) Install lifting bolts (M8) to eccentric shaft (8).

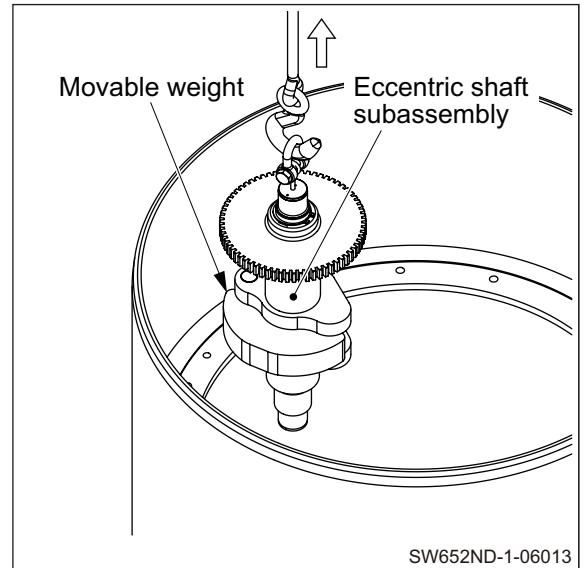


13) Remove eccentric shaft subassembly.

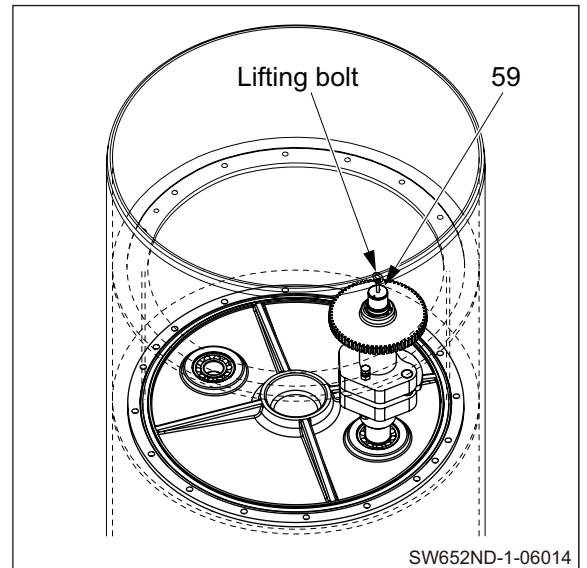
 Eccentric shaft subassembly : 70 kg (154 lbs.)

**(NOTICE)**


- Put the movable weight at its outmost position.



14) Install a lifting bolt (M8) to eccentric shaft (59).

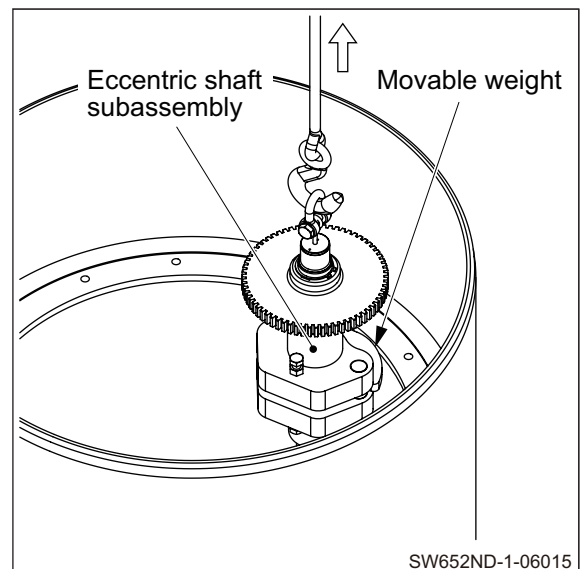


15) Remove eccentric shaft subassembly.

 Eccentric shaft subassembly : 70 kg (154 lbs.)

**(NOTICE)**

- Put the movable weight at its outmost position.

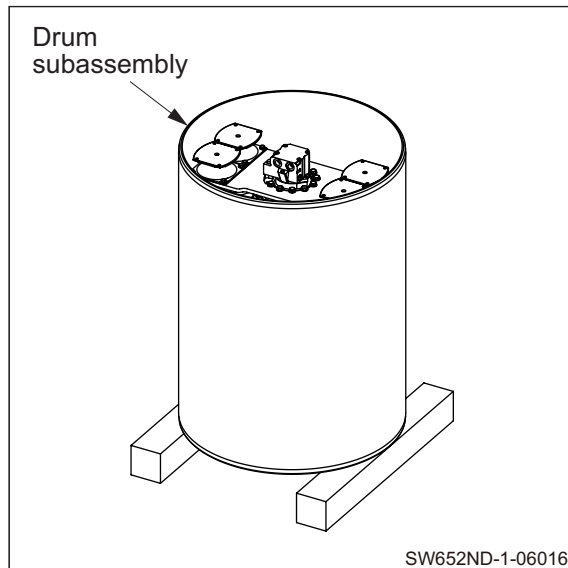


**⚠ WARNING**

Be careful because reversing the vibratory drum involves risk. Confirm that the surrounding area is safe, and work in a natural, unstrained posture.

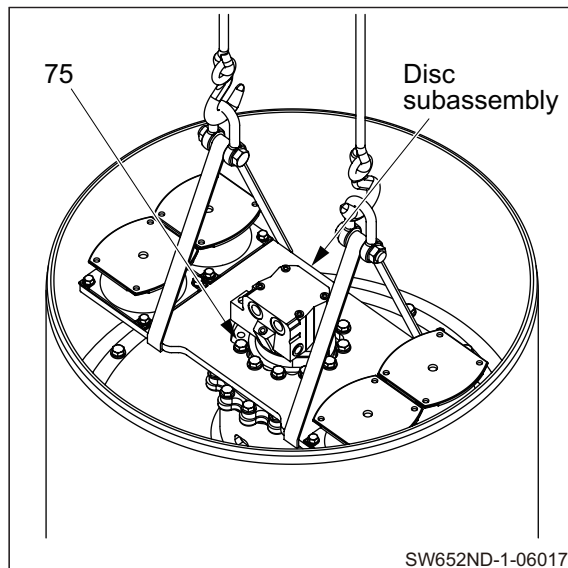
16) Reverse vibratory drum subassembly.

$\mathcal{J}_{kg}$  Vibratory drum subassembly : 1,225 kg (2,701 lbs.)



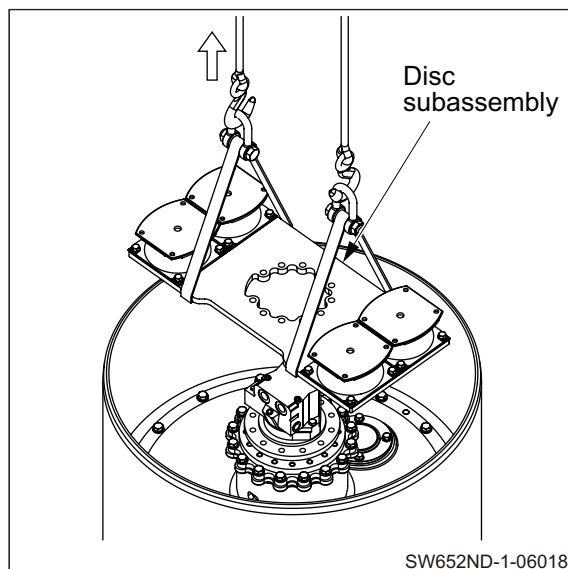
17) Lift disc subassembly.

- Remove bolts (75).



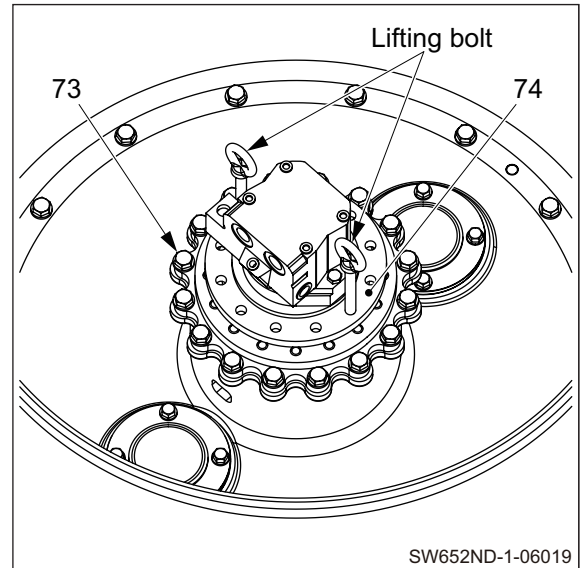
18) Remove disc subassembly.

$\mathcal{J}_{kg}$  Disc subassembly : 70 kg (154 lbs.)



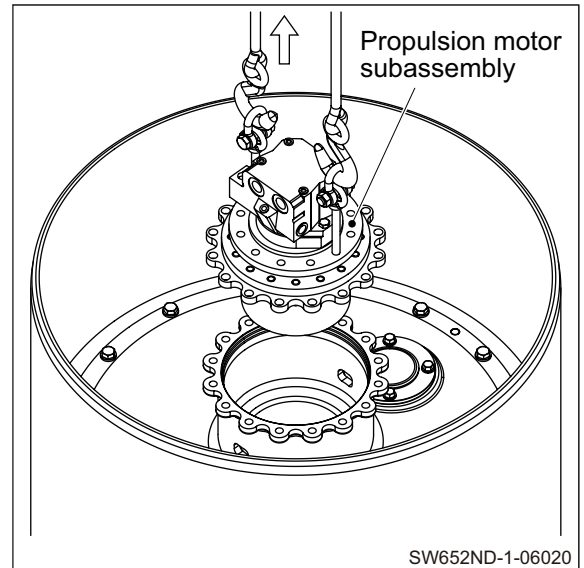


- 19) Install lifting bolts (M16) to propulsion motor (74).
- Remove bolts (73).

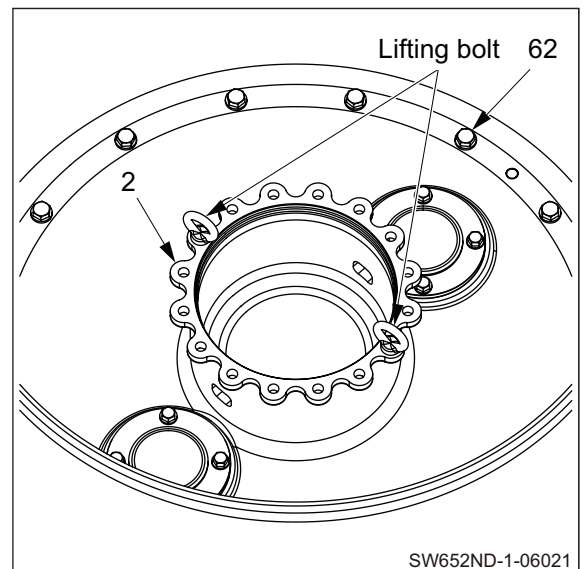


- 20) Remove propulsion motor subassembly.

$\mathcal{J}_{kg}$  Propulsion motor subassembly : 75 kg (165 lbs.)

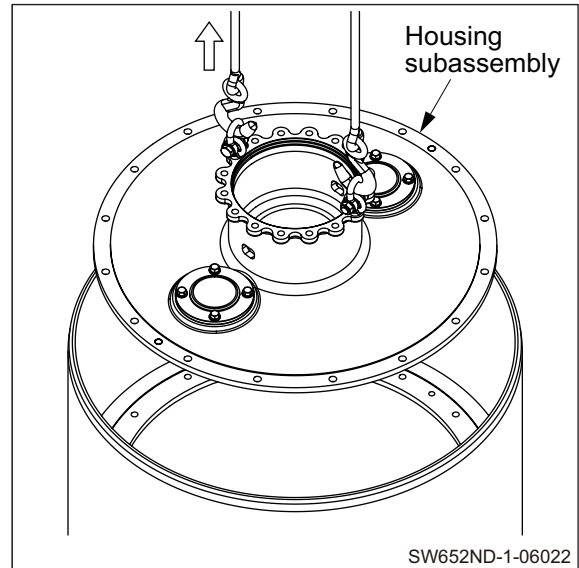


- 21) Install lifting bolts (M16) to housing (2).
- Remove bolts (62).

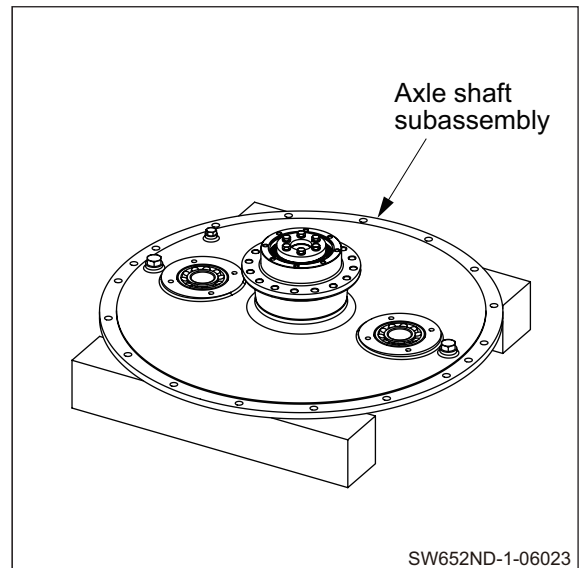


22) Remove housing subassembly.

 Housing subassembly : 160 kg (353 lbs.)

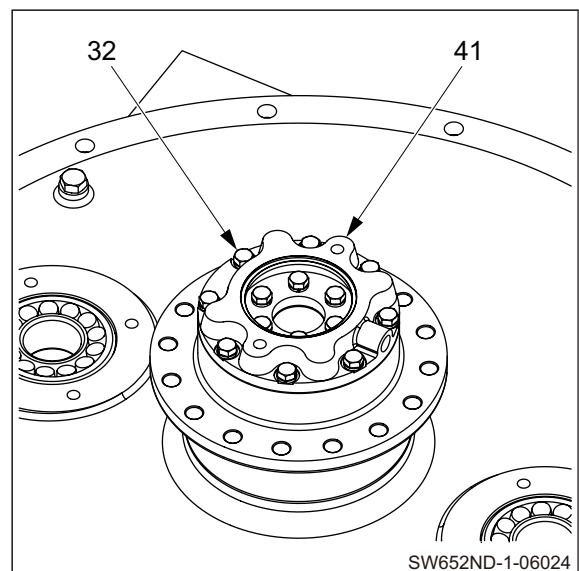


23) Disassembly of axle shaft subassembly

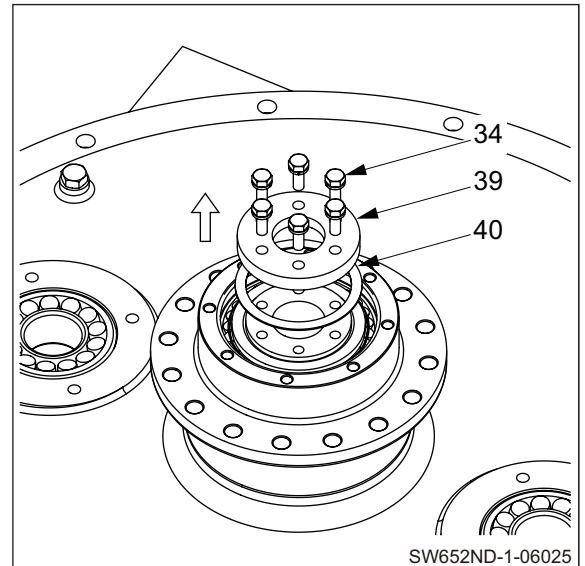


24) Remove bolts (32).

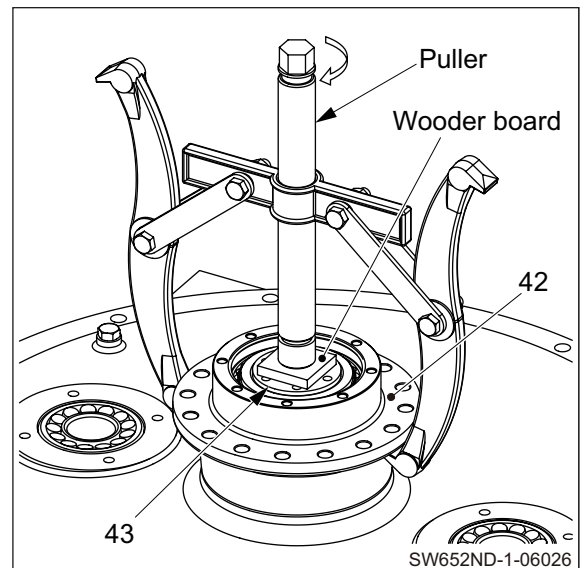
- Remove flange (41).



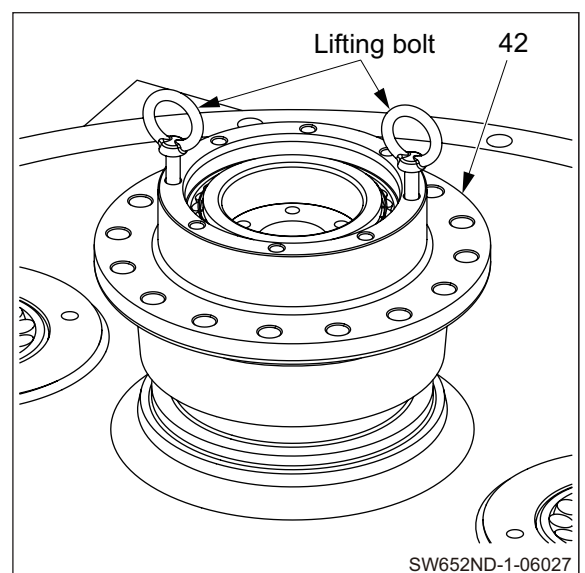
- 25) Remove bolts (34).
- Remove cover (39).
  - Remove shim (40).




- 26) Put a piece of wooden board on end of axle shaft (43).
- Set a puller on housing (42).
  - Remove housing subassembly from axle shaft subassembly.

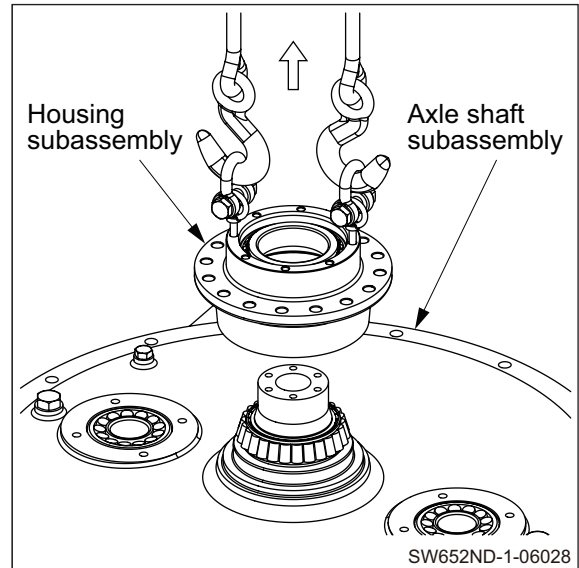


- 27) Install lifting bolts (M10) to housing (42).

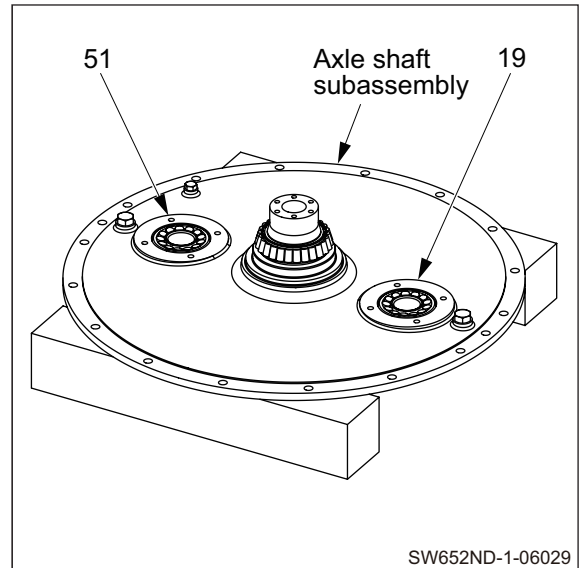


28) Remove housing subassembly from axle shaft subassembly.

 Housing subassembly : 20 kg (44 lbs.)



29) Remove vibrator bearings (19) and (51) from axle shaft subassembly.




### 5-2-2. Reassembly of vibratory drum

- Before reassembling, clean disassembled parts well and check that there is no abnormality.

#### **⚠ WARNING**

- When standing the vibratory drum, use wooden blocks of sufficient strength to securely support the drum.
- Carry out the work in an unstrained posture using a work stool or the like.

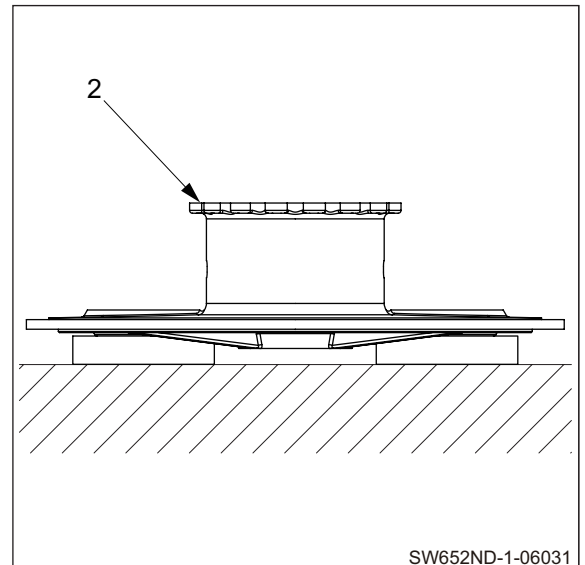
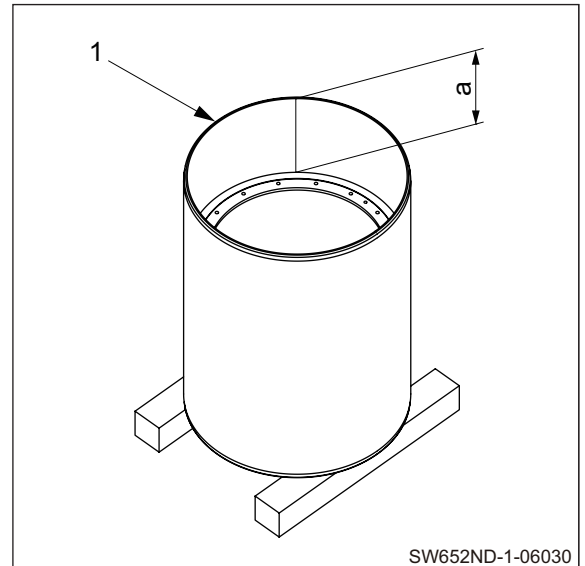
- 1) Stand vibratory drum (1) with its propulsion motor side facing up.

 (1) Vibratory drum : 910 kg (2,006 lbs.)

#### (NOTICE)

- Propulsion motor side dimension “a”  
: 491 mm (19 in.)

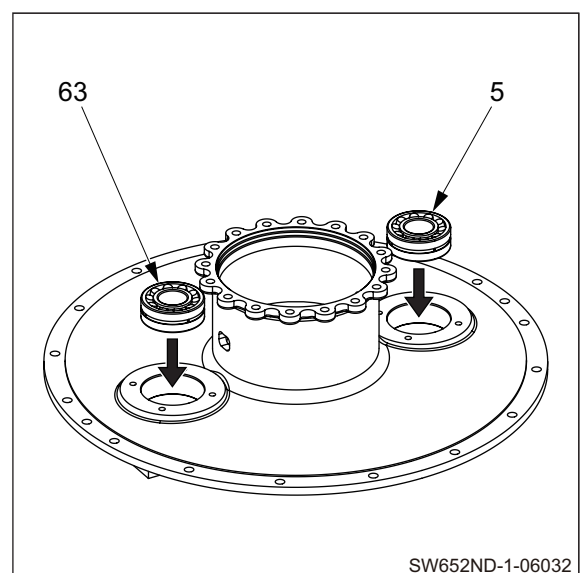
- 2) Reassembly of housing subassembly
  - Fix housing (2) with wooden blocks.



- 2-1) Apply a coat of gear oil to vibrator bearings (5) and (63) on their surface to be press-fitted.
  - Drive in vibrator bearings (5) and (63).

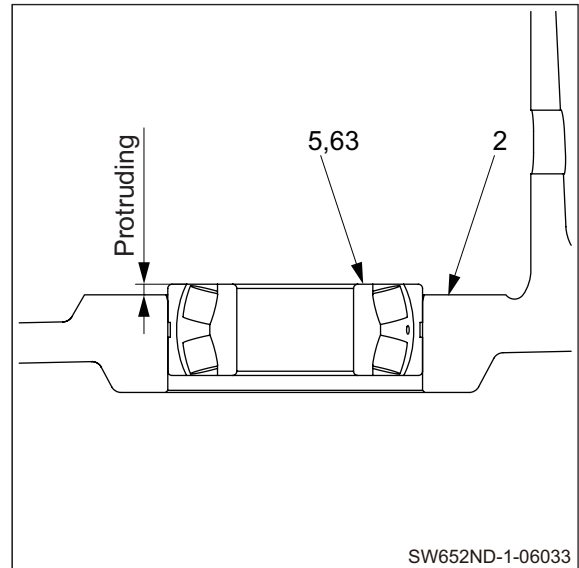
#### (NOTICE)

- Take care not to damage the bearings when installing them.

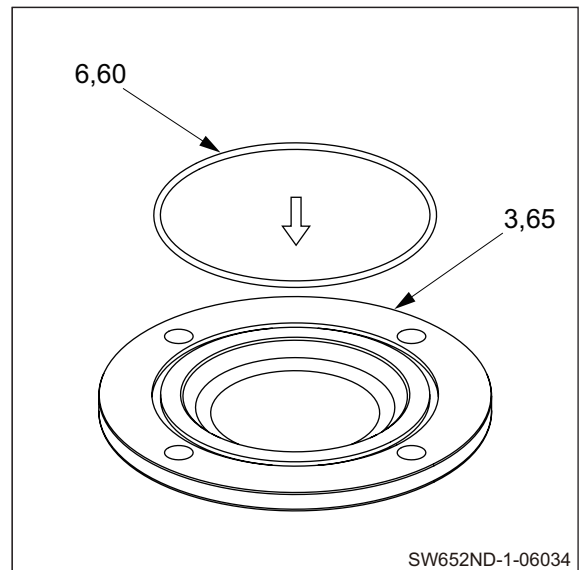


**(NOTICE)**

- Stop driving in vibrator bearings (5) and (63) when they come to a position slightly protruding from the boss surface of the housing (2) to avoid driving in too much.

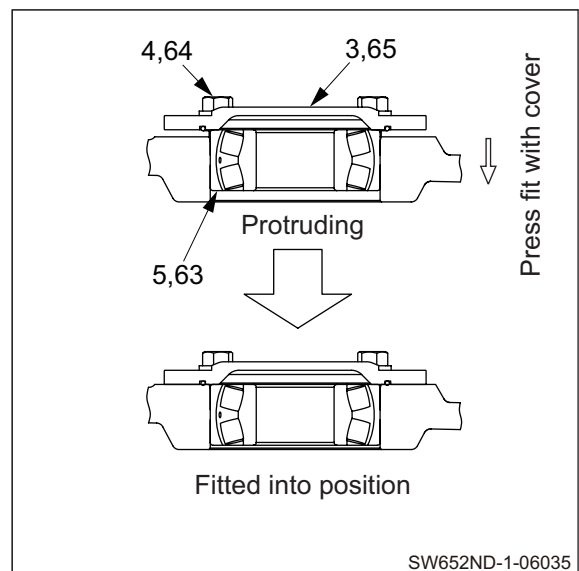


- 2-2) Apply grease to O-rings (6) and (60).
- Install O-rings (6) and (60) to covers (3) and (65).



- 2-3) Press fit slightly protruding vibrator bearings (5) and (63) into place by securing covers (3) and (65) with four bolts (4), four bolts (64), and washers.

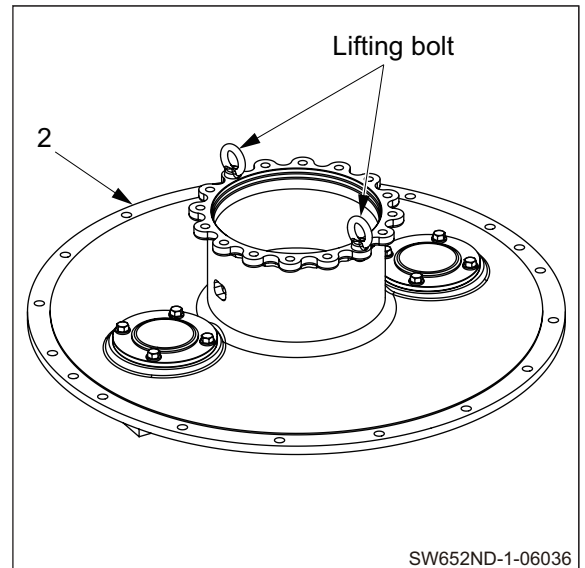
 (4) and (64) Bolts M12×30 : 110 N·m (81 lbf·ft)



## **⚠ WARNING**

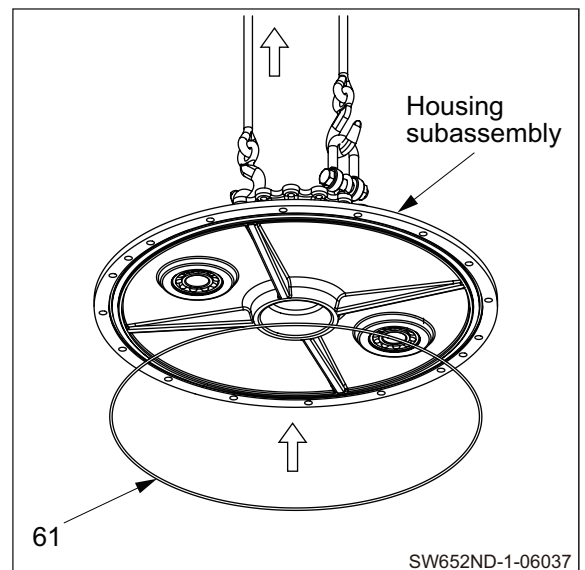
When installing lifting bolts, screw in the threads fully before using.

3) Install lifting bolts (M16) to housing (2).




4) Lift housing subassembly.

- Apply grease to O-ring (61).
- Install O-ring (61) to housing subassembly.

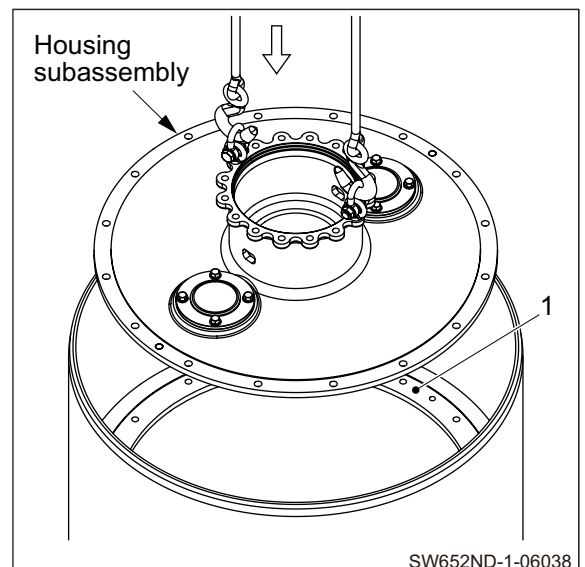


5) Lower housing subassembly on mounting surface of vibratory drum (1).

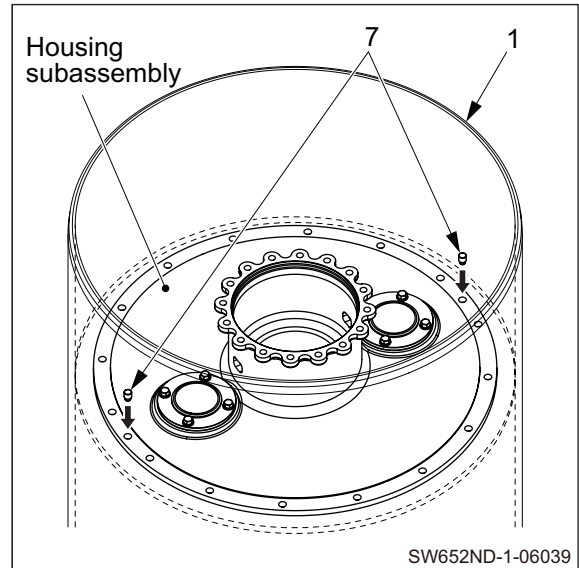
 Housing subassembly : 160 kg (353 lbs.)

### **(NOTICE)**

- Take care not to let O-ring to protrude from its groove.



- 6) Drive in two locating pins (7) for housing subassembly and vibratory drum (1) temporarily.

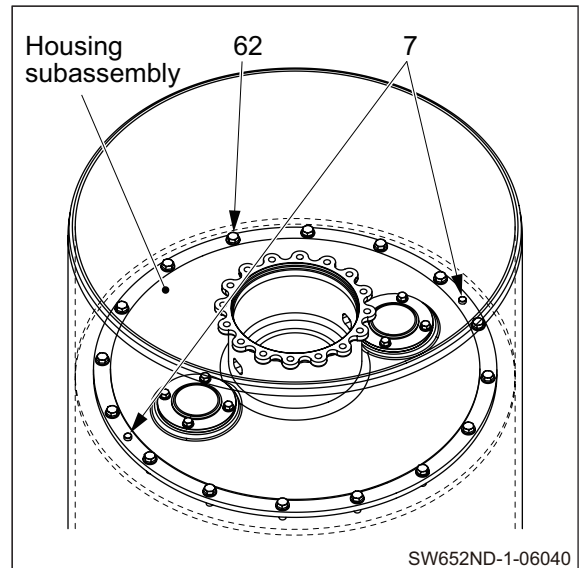


- 7) Secure housing subassembly with sixteen bolts (62) and washers.



(62) Bolts M16×45 : 265 N·m (195 lbf·ft)

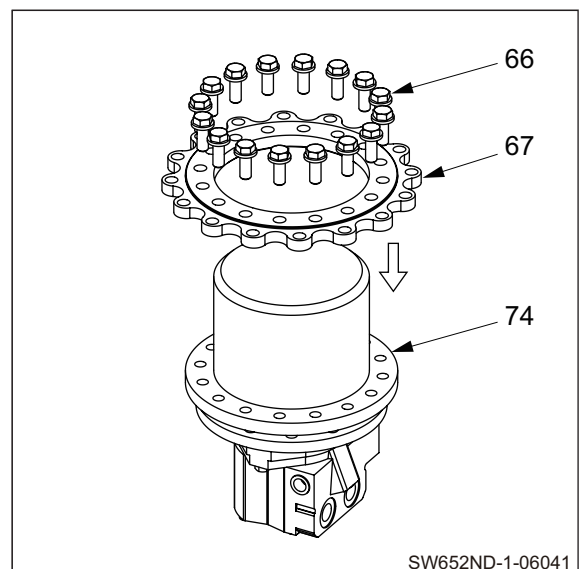
- Drive in locating pins (7) again.



- 8) Reassembly of propulsion motor subassembly
- Secure disc (67) to propulsion motor (74) with sixteen bolts (66) and washers.




(66) Bolts M16×45 : 265 N·m (195 lbf·ft)

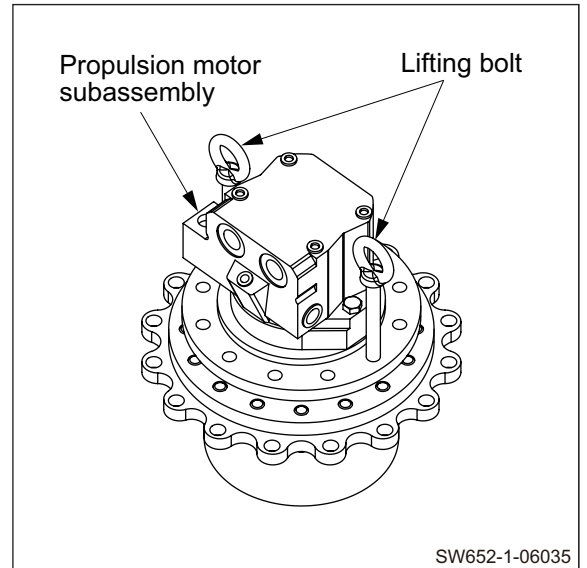





9) Reverse propulsion motor subassembly.

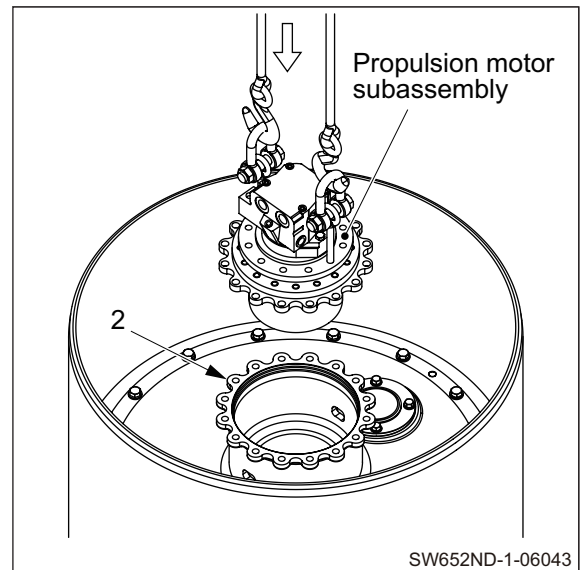
 Propulsion motor subassembly : 75 kg (165 lbs.)

- Install lifting bolts (M16) to propulsion motor (74).




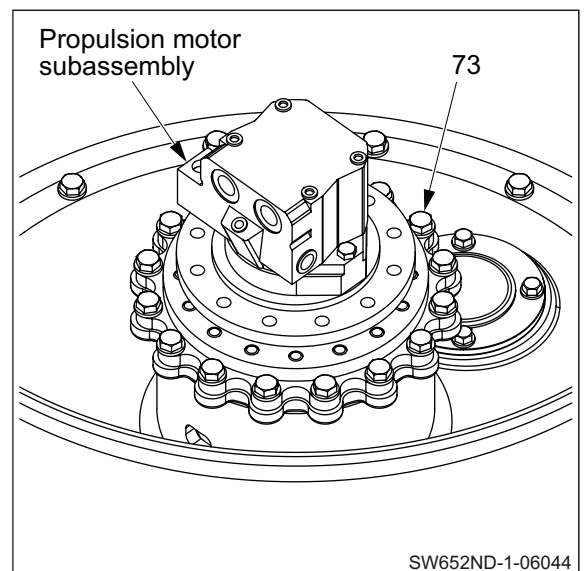
10) Lower propulsion motor subassembly on mounting surface of housing (2).

 Propulsion motor subassembly : 75 kg (165 lbs.)

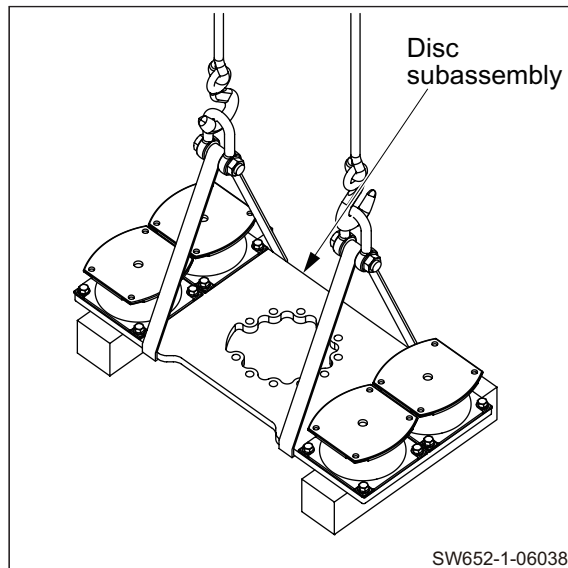


11) Secure propulsion motor subassembly with sixteen bolts (73) and washers.

 (73) Bolts M16×45 : 265 N·m (195 lbf·ft)

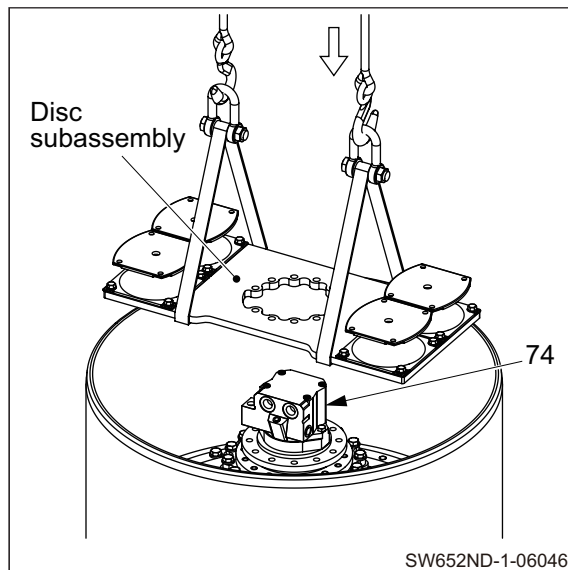


12) Lift disc subassembly.



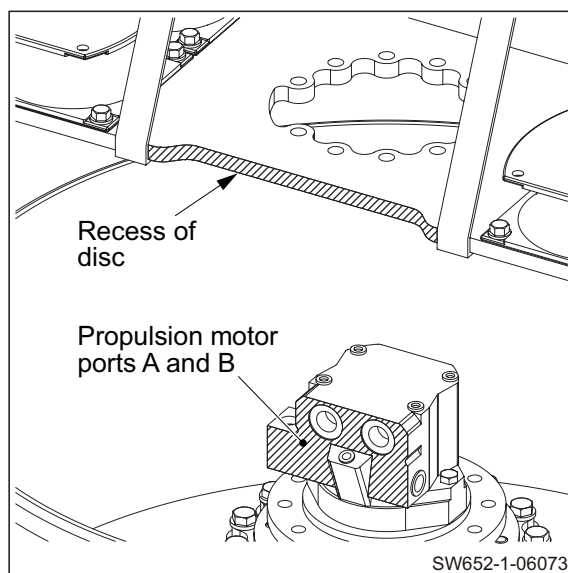
13) Lower disc subassembly on mounting surface of propulsion motor (74).

$\mathfrak{J}_{kg}$  Disc subassembly : 70 kg (154 lbs.)




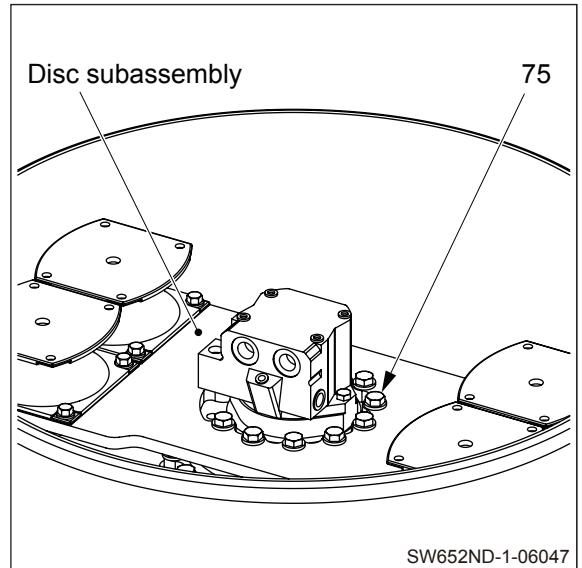
**(NOTICE)**

- The recess of the disc must be parallel with the side of the propulsion motor which have ports A and B.



14) Secure disc subassembly with eleven bolts (75) and washers.


 N·m (75) Bolts M16×45 : 265 N·m (195 lbf·ft)

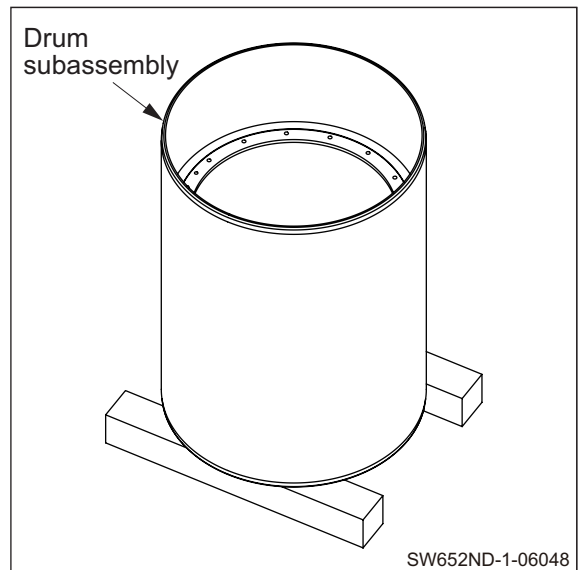


**⚠ WARNING**

Be careful because reversing the vibratory drum involves risk. Confirm that the surrounding area is safe, and work in a natural, unstrained posture.

15) Reverse vibratory drum subassembly.

 Vibratory drum subassembly : 1,225 kg (2,701 lbs.)



**⚠ WARNING**

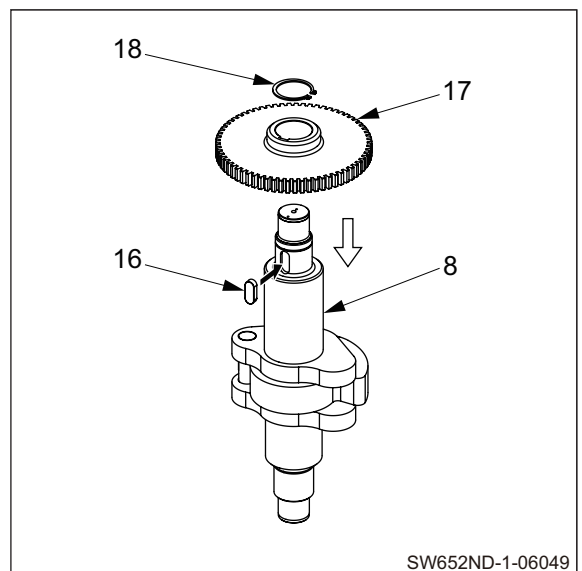
Wear heat resistant gloves when handling heated parts to avoid burns.

16) Heat up gear (17) by using a ring heater or the like.

- Drive sunk key (16) into eccentric shaft (8).
- Install heated gear (17).
- Install retaining ring (18).

**(NOTICE)**

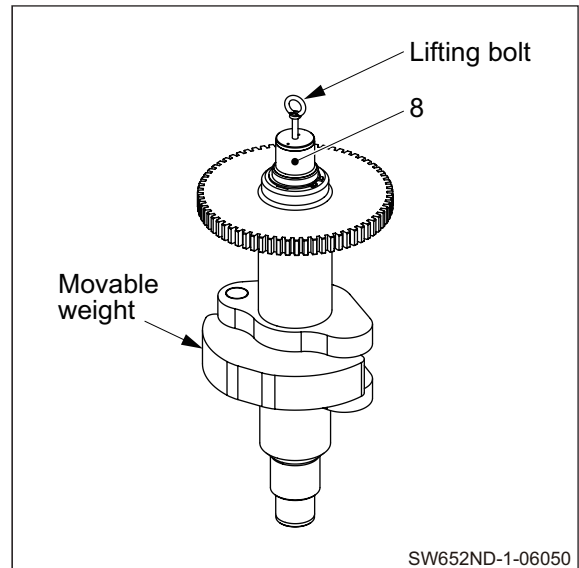
- Make sure that the retaining ring is fitted completely in its groove.



17) Install a lifting bolt (M8) to eccentric shaft (8).


**(NOTICE)**

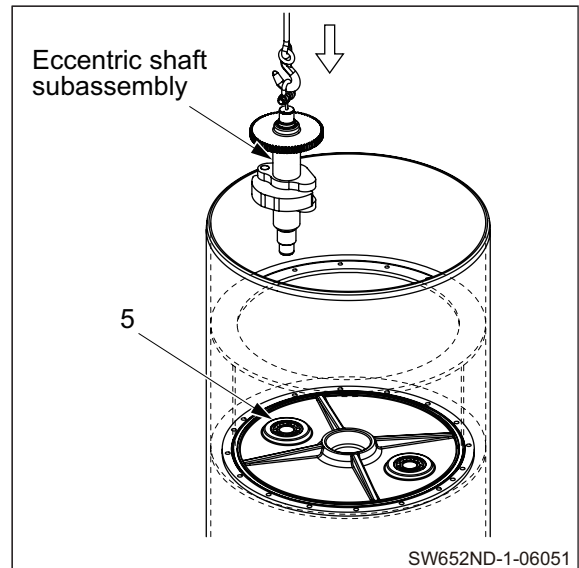
- Put the movable weight at its outmost position.



18) Apply a coat of gear oil to eccentric shaft subassembly at where bearing (5) will be installed.

- Install eccentric shaft subassembly.

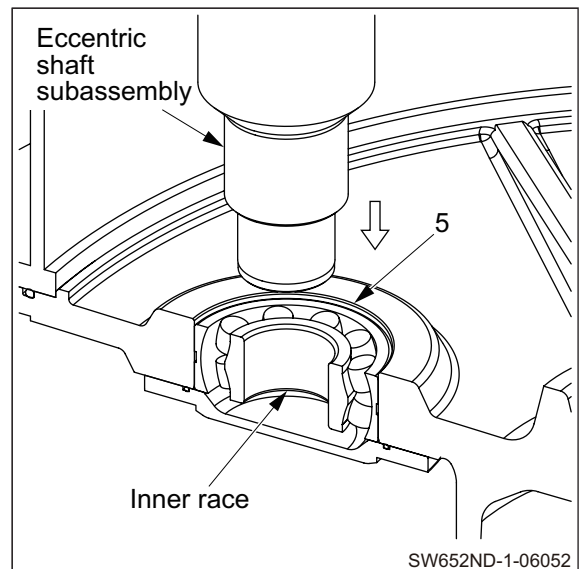
 Eccentric shaft subassembly : 70 kg (154 lbs.)



19) Insert eccentric shaft subassembly into vibrator bearing (5) while taking care not to tilt vibrator bearing inner race.

**(NOTICE)**

- After inserting the eccentric shaft subassembly into the bearing, lay the eccentric shaft subassembly against the inner wall of the drum so that it will not fall down.

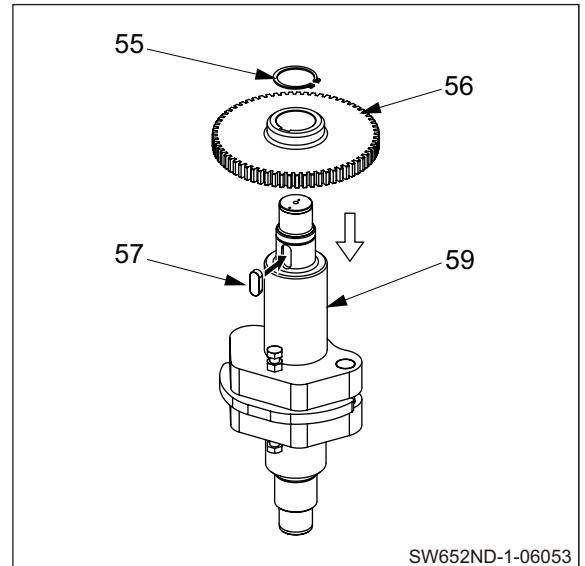


20) Heat up gear (56) by using a ring heater or the like.

- Drive sunk key (57) into eccentric shaft (59).
- Install heated gear (56).
- Install retaining ring (55).

**(NOTICE)**

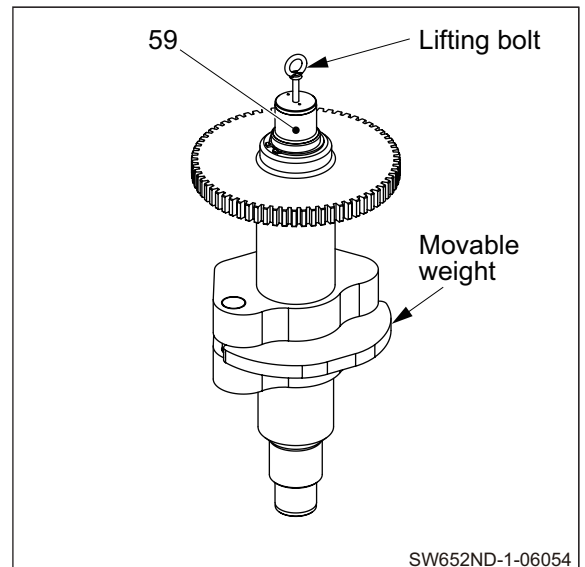
- **Make sure that the retaining ring is fitted completely in its groove.**



21) Install a lifting bolt (M8) to eccentric shaft (59).


**(NOTICE)**

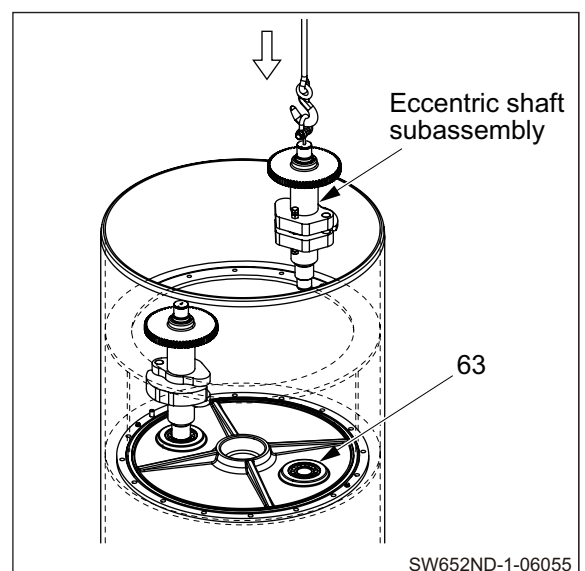
- **Put the movable weight at its outmost position.**



22) Apply a coat of gear oil to eccentric shaft subassembly at where vibrator bearing (63) will be installed.

- Install eccentric shaft subassembly.

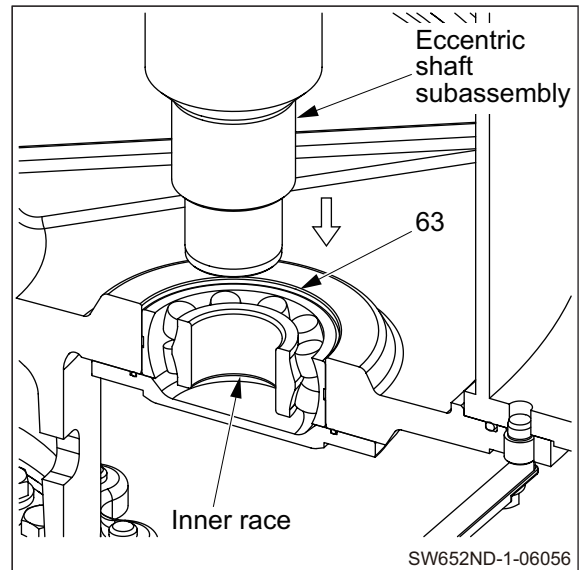
 Eccentric shaft subassembly : 70 kg (154 lbs.)



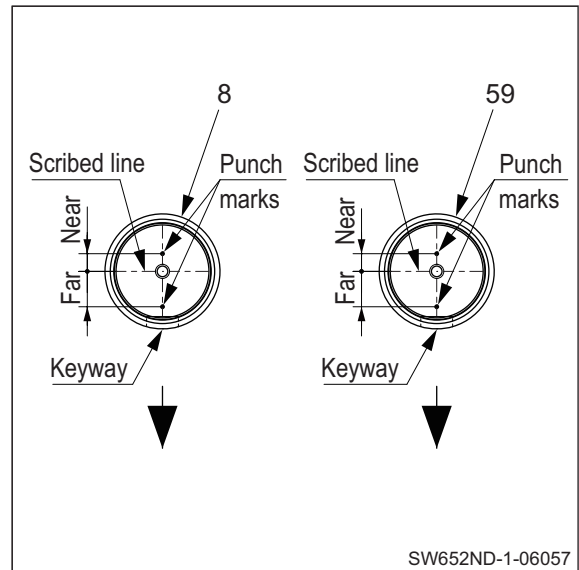
23) Insert eccentric shaft subassembly into vibrator bearing (63) while taking care not to tilt vibrator bearing inner race.

**(NOTICE)**

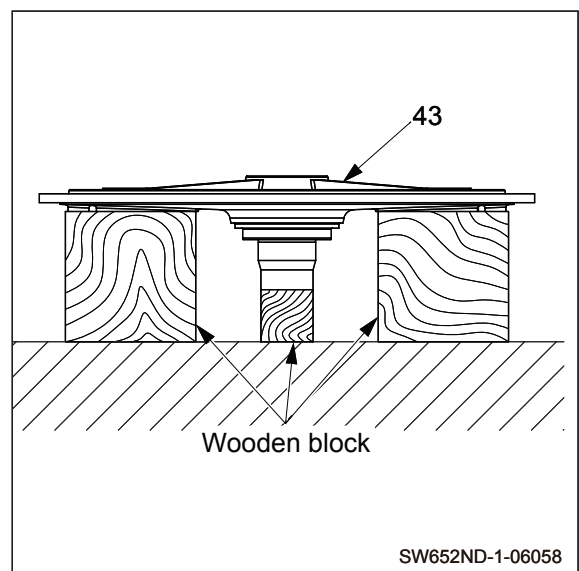
- After inserting the eccentric shaft subassembly into the vibrator bearing, lay the eccentric shaft subassembly against the inner wall of the drum so that it will not fall down.



24) Place punch marks on end of eccentric shafts (8) and (59) as shown right.

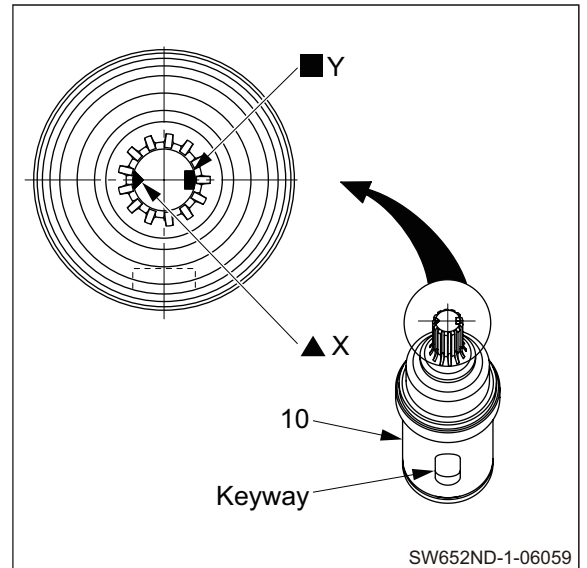


25) Reassembly of axle shaft subassembly  
 25-1) Fix axle shaft (43) with wooden blocks.



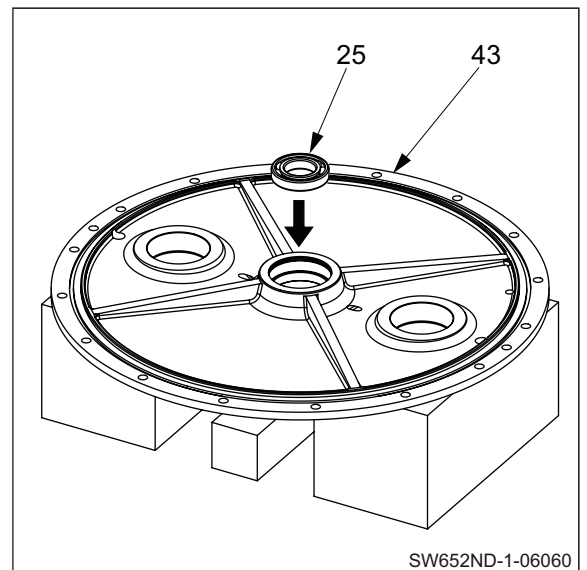
25-2) Making marks on shaft (10)

- Draw a ▲ X on left side with keyway facing down
- Draw a ■ Y on right side with keyway facing down



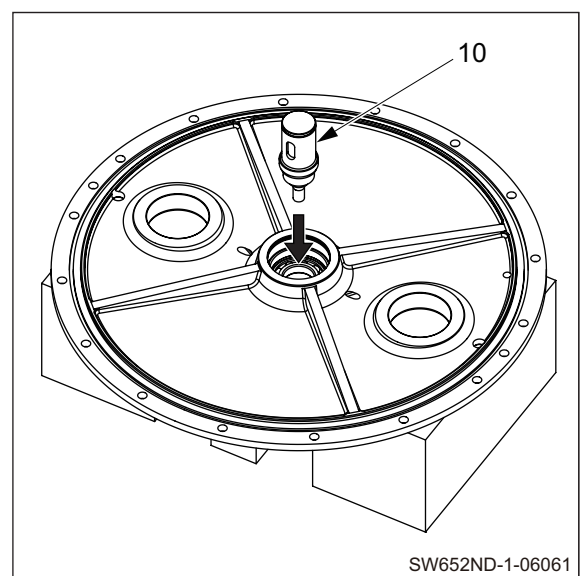
25-3) Apply a coat of gear oil to ball bearing (25) on its surface to be press-fitted.

- Drive ball bearing (25) into axle shaft (43).



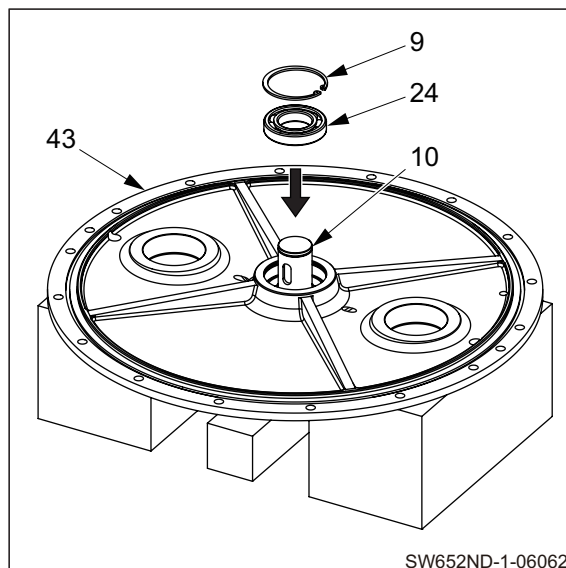
25-4) Apply a coat of gear oil to bearing mounting surface of shaft (10).

- Drive in shaft (10).



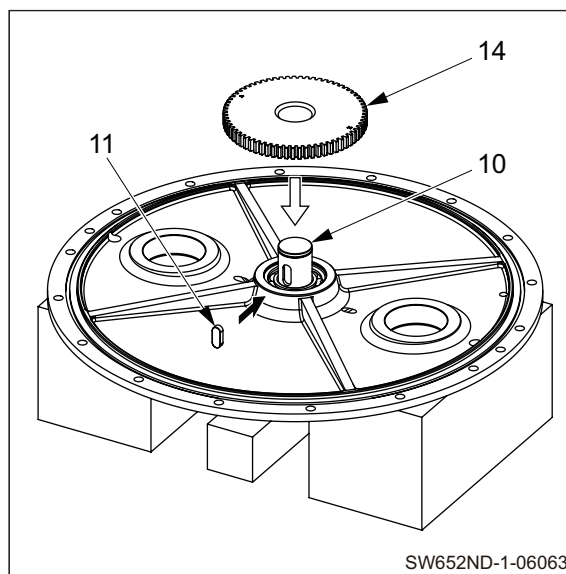
25-5) Apply a coat of gear oil to ball bearing (24) on its surface to be press-fitted and shaft (10) at where bearing will be installed.

- Drive ball bearing (24) into axle shaft (43).
- Install retaining ring (9).



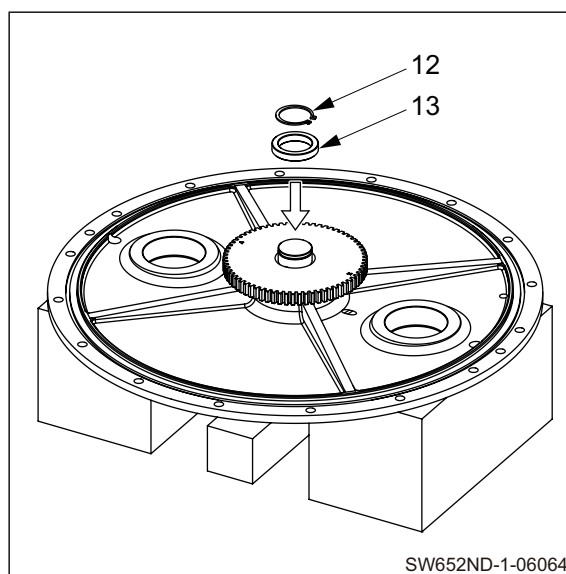
25-6) Heat up gear (14) by using a ring heater or the like.

- Drive sunk key (11) to shaft (10).
- Install heated gear (14).




25-7) Install collar (13).

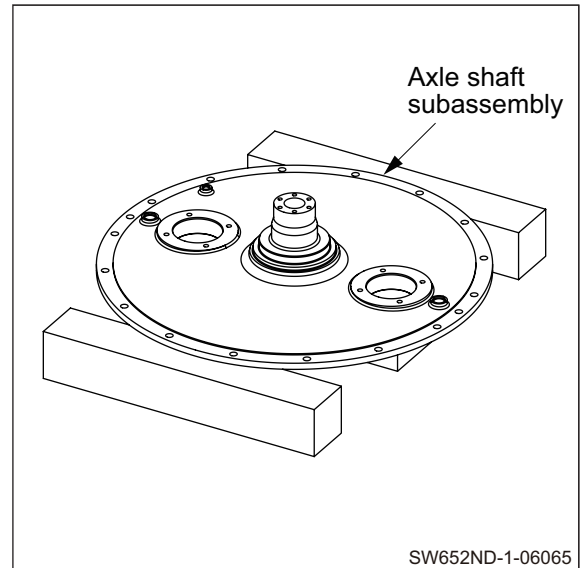
- Install retaining ring (12).





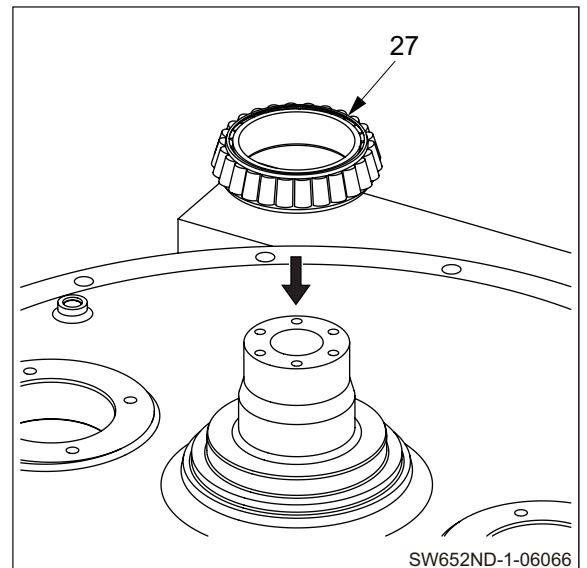
25-8) Reverse axle shaft subassembly.

 Axle shaft subassembly : 165 kg (364 lbs.)

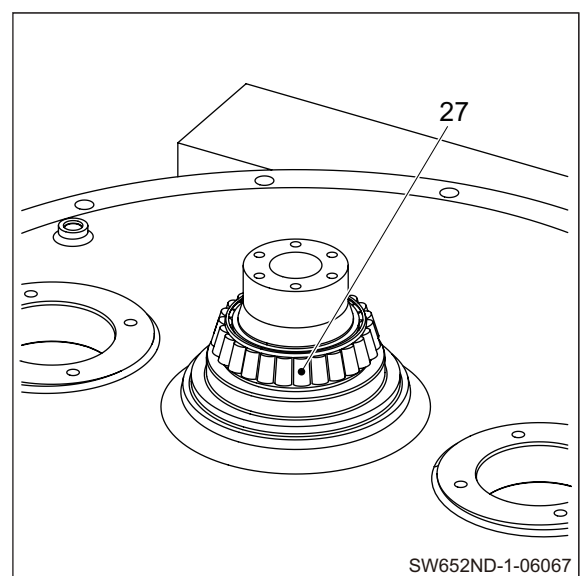


25-9) Heat up roller bearing (27) inner race by using a ring heater or the like.

- Apply a coat of gear oil to roller bearing (27) inner race on its surface to be press-fitted.
- Drive in heated roller bearing (27) inner race.

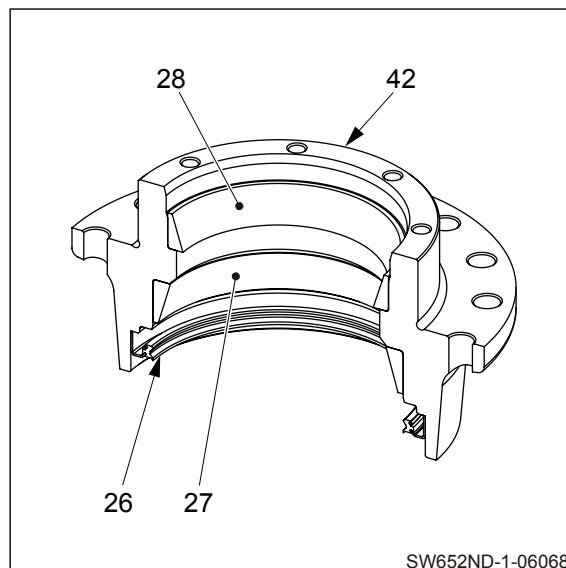


25-10) Apply sufficient amount of lithium-based grease to rollers of roller bearing (27).



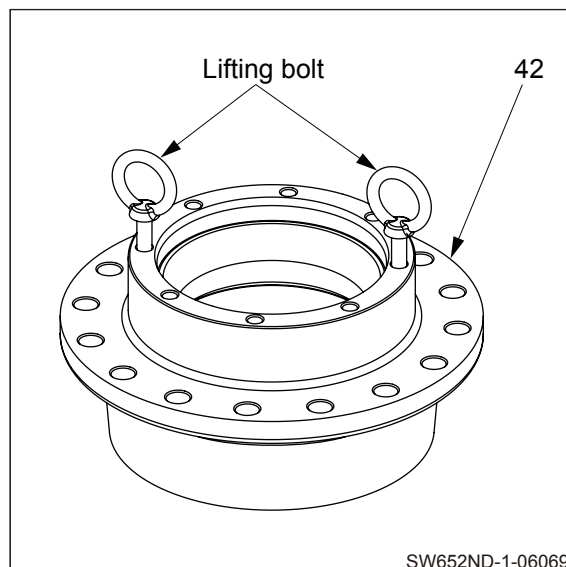
25-11) Apply a coat of gear oil to roller bearings (27) and (28) outer races on their surfaces to be press-fitted.

- Drive roller bearings (27) and (28) outer races into housing (42).
- Apply liquid packing to periphery of oil seal (26).
- Drive in oil seal (26).
- Apply grease to lip of oil seal (26).



SW652ND-1-06068

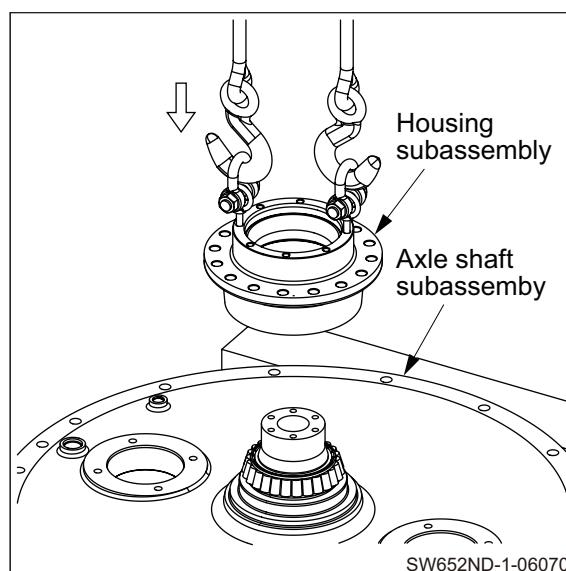
25-12) Install lifting bolts (M10) to housing (42).



SW652ND-1-06069

25-13) Install housing subassembly to axle shaft subassembly.

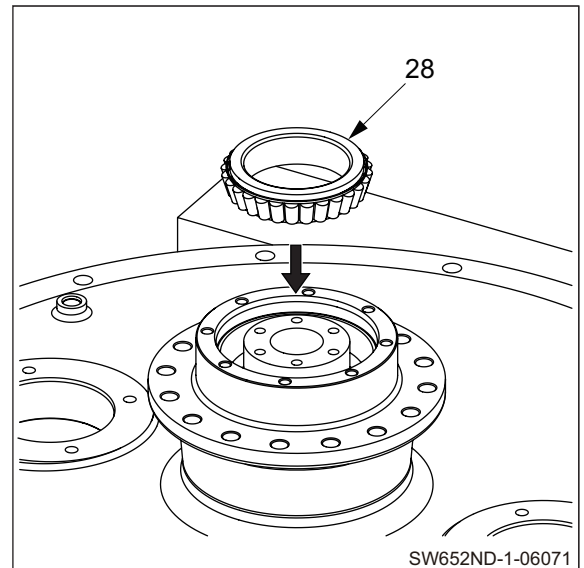
$\mathfrak{J}_{kg}$  Housing subassembly : 20kg (44 lbs.)



SW652ND-1-06070

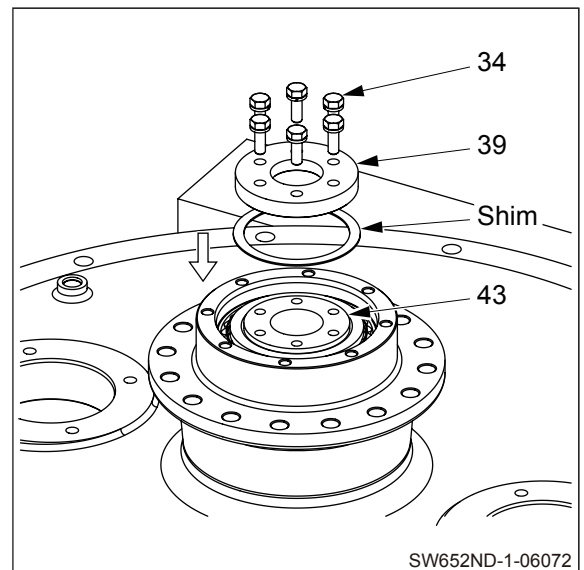
25-14) Apply sufficient amount of lithium-based grease to rollers of roller bearing (28) inner race.

- Drive in roller bearing (28) inner race until rollers come in contact with outer race.



25-15) Preload adjustment of roller bearing

- ① Install a shim of about 1 mm (0.04 in.) and secure cover (39) to axle shaft (43) with six bolts (34) and spring washers.

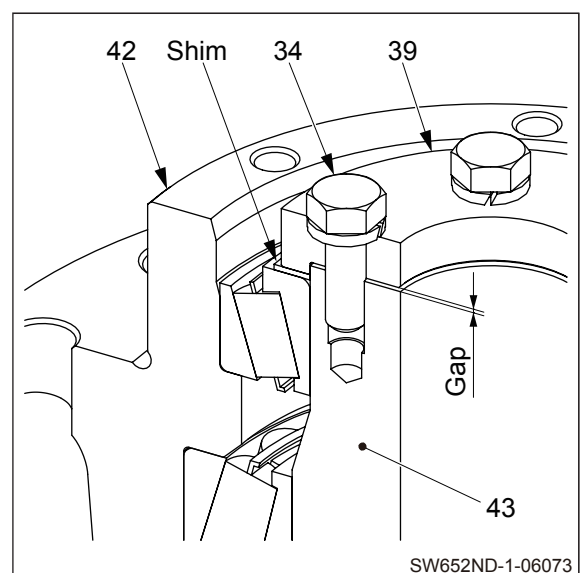


- ② A gap will remain between end of axle shaft (43) and inside of cover (39).

- Tighten bolts (34) to a torque of 60 N·m (44 lbf-ft).
- Give housing (42) two to three turns.
- Tighten bolts (34) to a torque of 60 N·m (44 lbf-ft) again.
- Repeat this work several times until tightening torque of bolts no longer fluctuates.

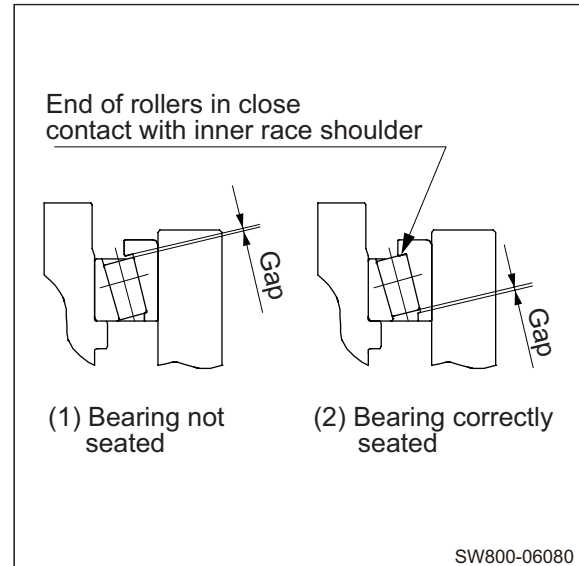
**(NOTICE)**

- Tighten the bolts alternately in diagonal directions.



**(NOTICE)**

- Push in the inner race while rotating the bearing. Otherwise, even strongly trying to push the inner race, the bearing rollers will not be pushed up and therefore bearing will not be seated.

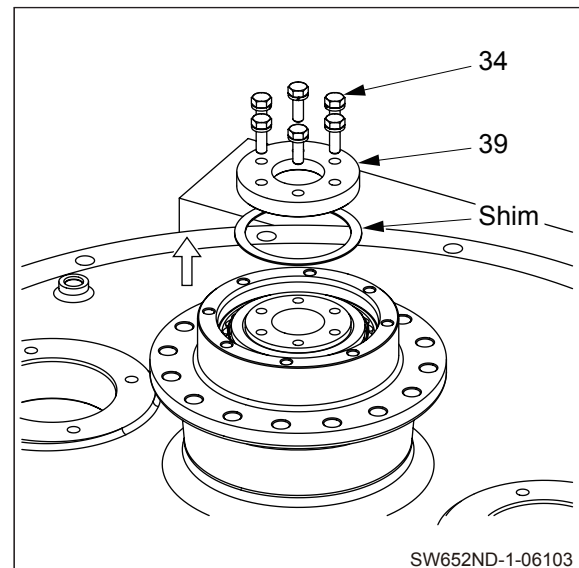


③ Remove bolts (34).

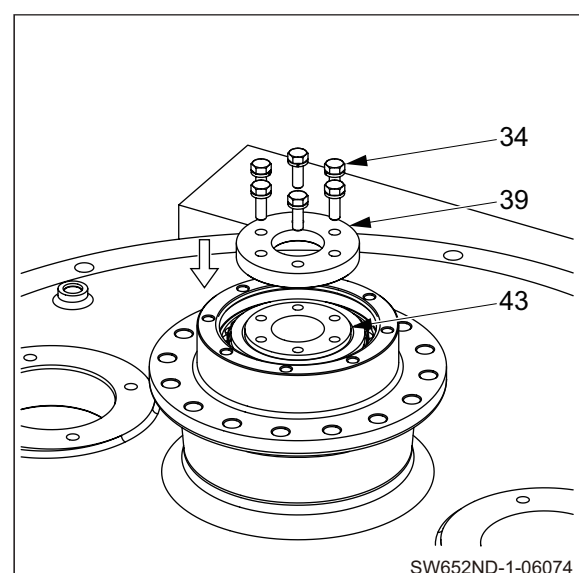
- Remove cover (39).
- Remove shim.

**(NOTICE)**

- Do not turn the housing after the cover is removed.

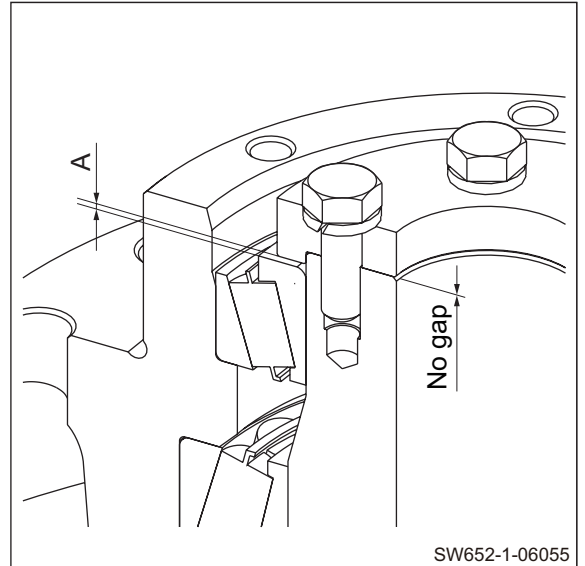


- ④ Without inserting shim, install cover (39) to axle shaft (43) with six bolts (34) and spring washers.



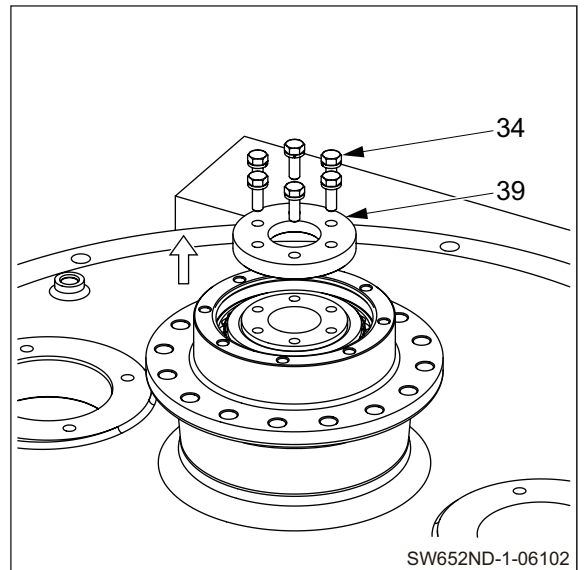
⑤ Using a thickness gauge, measure clearance “A”.

★ Preload adjusting shim thickness =  $A + 0.1 \text{ mm (0.04 in.)}$




⑥ Remove bolts (34).

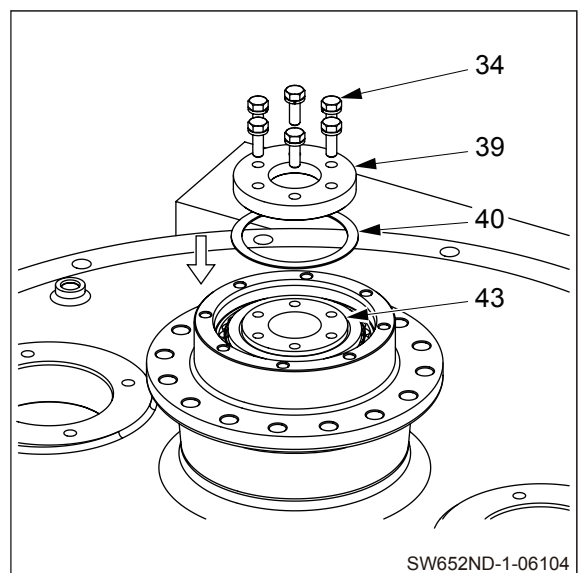
- Remove cover (39).



⑦ Install shim (40) of preload adjusting shim thickness = “ $A + 0.1 \text{ mm (0.04 in.)}$ ”.

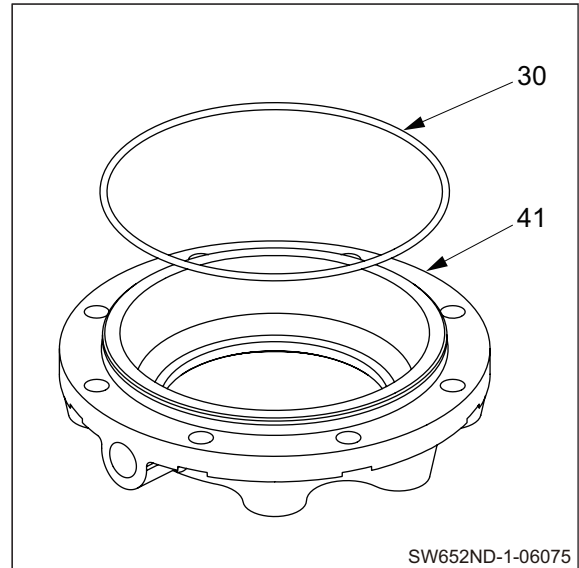
- Secure cover (39) to axle shaft (43) with six bolts (34) and spring washers.

 N·m (34) Bolts M10×30 : 60 N·m (44 lbf·ft)




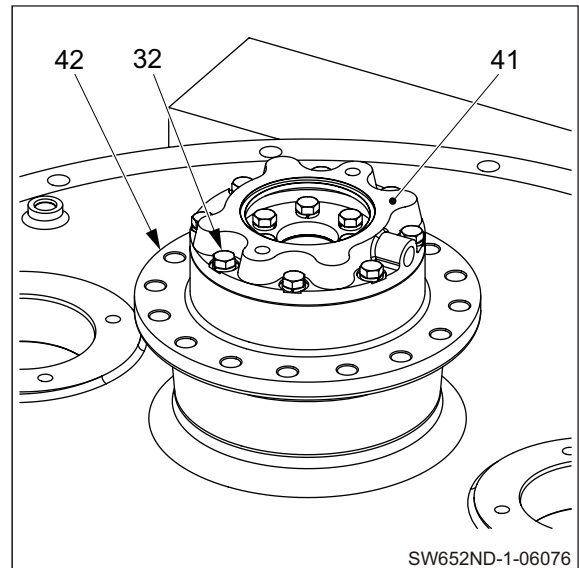
25-16) Apply grease to O-ring (30).

- Install O-ring (30) to flange (41).

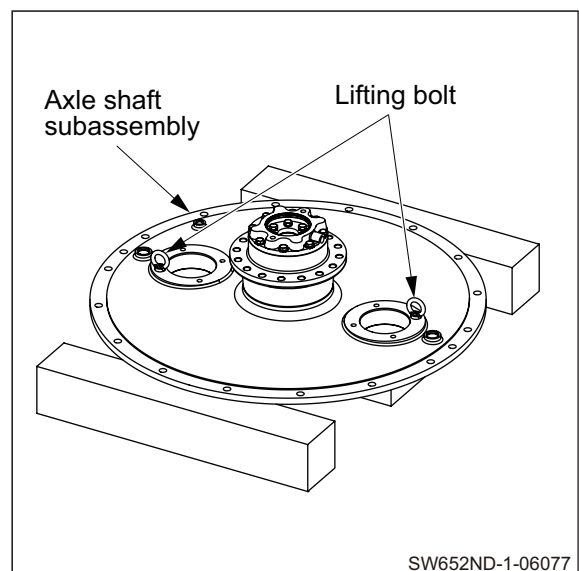


25-17) Secure flange (41) to housing (42) with eight bolts (32) and spring washers.

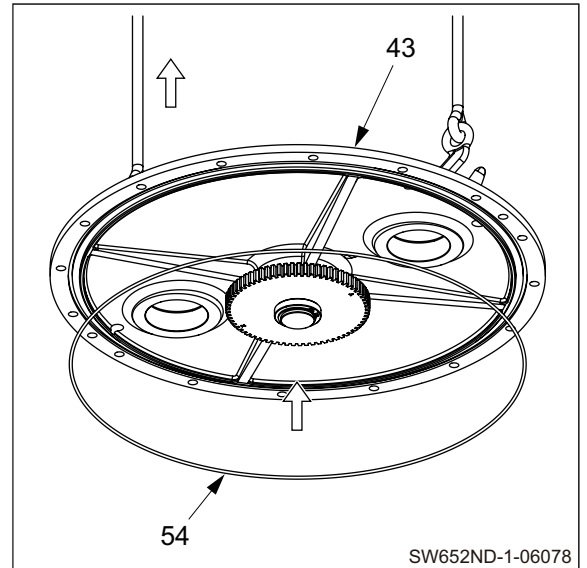
-  (32) Bolts M10×30 : 60 N·m (44 lbf·ft)



26) Install lifting bolts (M12) to axle shaft subassembly.



- 27) Lift axle shaft subassembly.
- Apply grease to O-ring (54).
  - Install O-ring (54) to axle shaft (43).

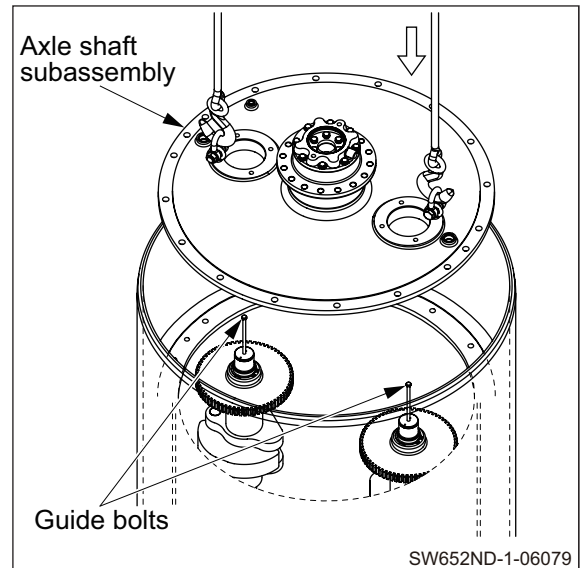


- 28) Install long guide bolts to end of both eccentric shafts.
- Lower axle shaft subassembly on mounting surface of vibratory drum while taking care not to move punch marks on each eccentric shaft.

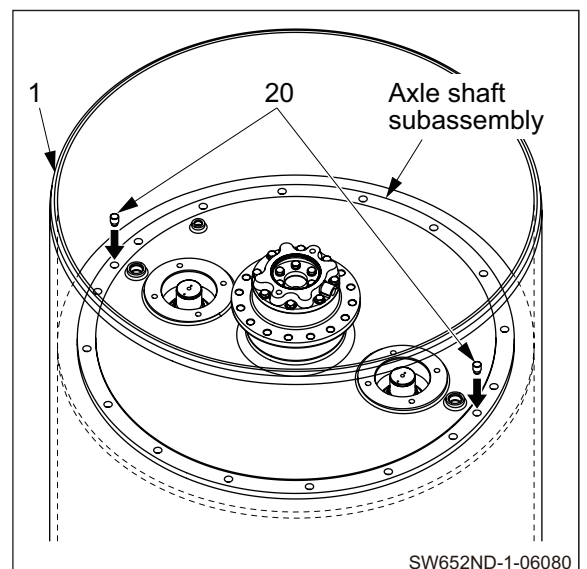
$\mathfrak{J}_{kg}$  Axle shaft subassembly : 190 kg (419 lbs.)

**(NOTICE)**


- **Take care not to let the eccentric shafts fall down.**



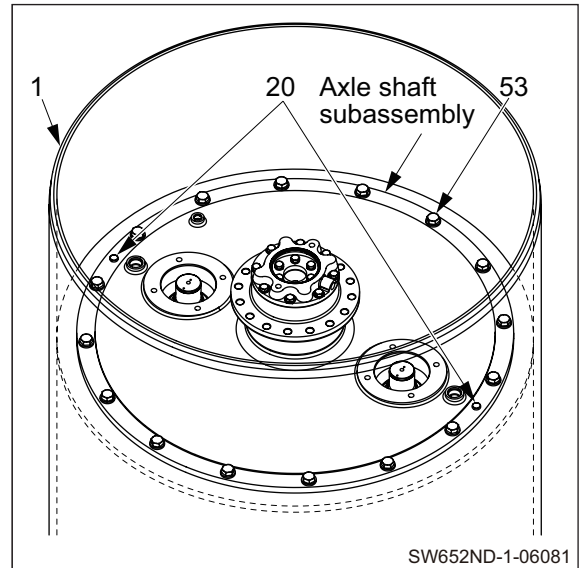
- 29) Drive in two locating pins (20) for axle shaft subassembly and vibratory drum (1) temporarily.



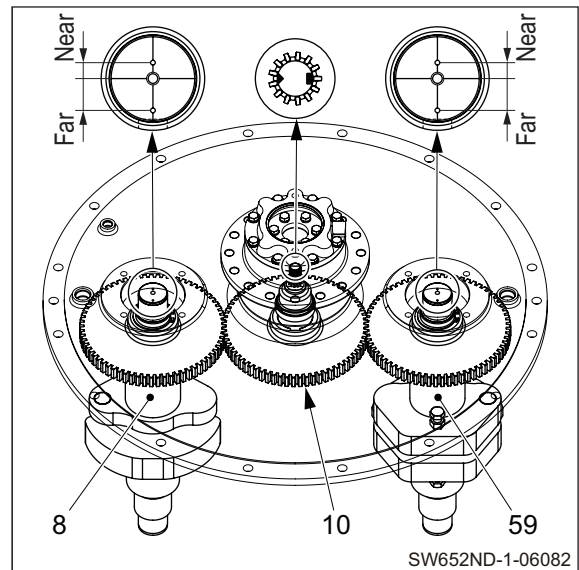
30) Secure axle shaft subassembly to vibratory drum (1) with sixteen bolts (53) and washers.

 N·m (53) Bolts M16×45 : 265 N·m (195 lbf·ft)

- Drive in locating pins (20) again.

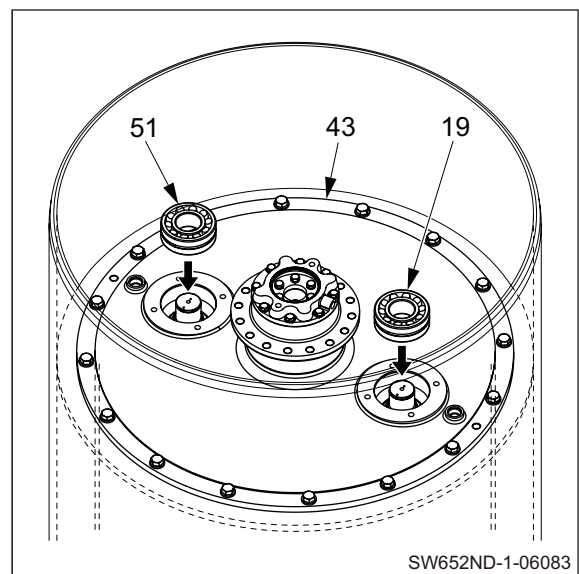


31) Make sure that punch marks on shaft (10) of eccentric shafts (8) and (59) are as shown right.



32) Apply a coat of gear oil to axle shaft (43) vibrator bearings (19) and (51) on their surface to be press-fitted, and to each shaft at where vibrator bearing will be installed.

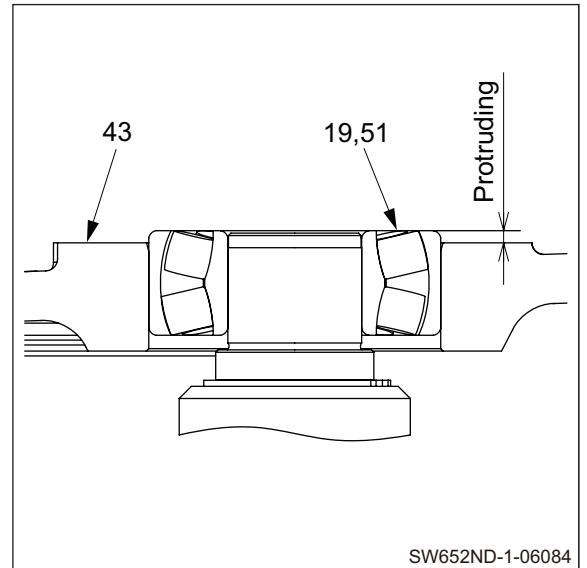
- Drive in vibrator bearings (19) and (51).





**CAUTION**

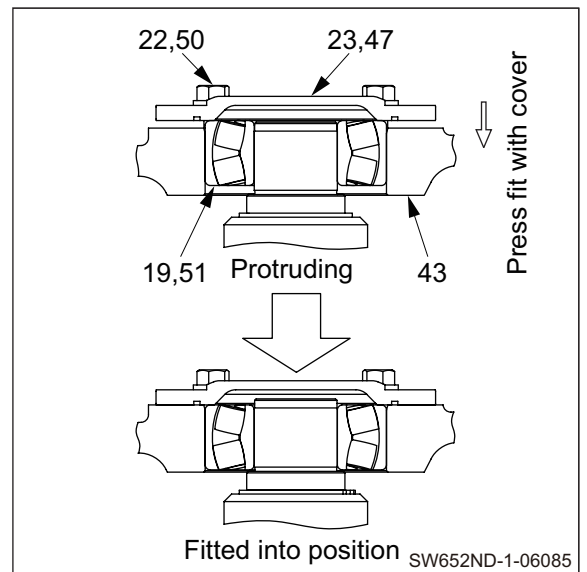
Stop driving in vibrator bearings (19) and (51) when they come to a position slightly protruding from the boss surface of axle shaft (43) to avoid driving in too much.



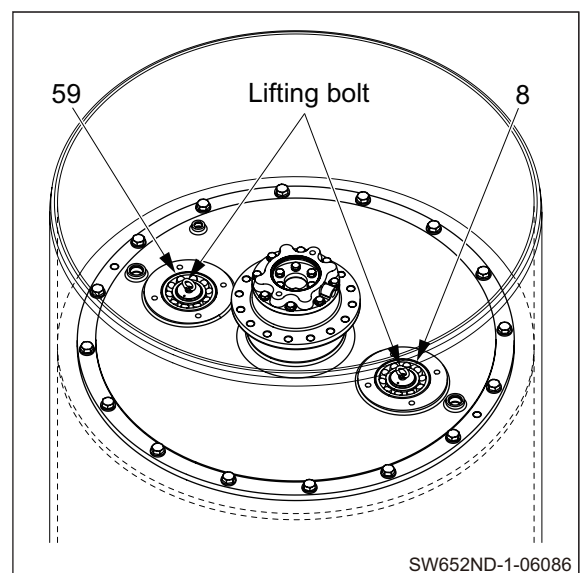
33) Press fit slightly protruding vibrator bearings (19) and (51) into place by securing covers (23) and (47) with four bolts (22), four bolts (50), and washers.

 (22) and (50) Bolts M12×30 : 110 N·m (81 lbf·ft)

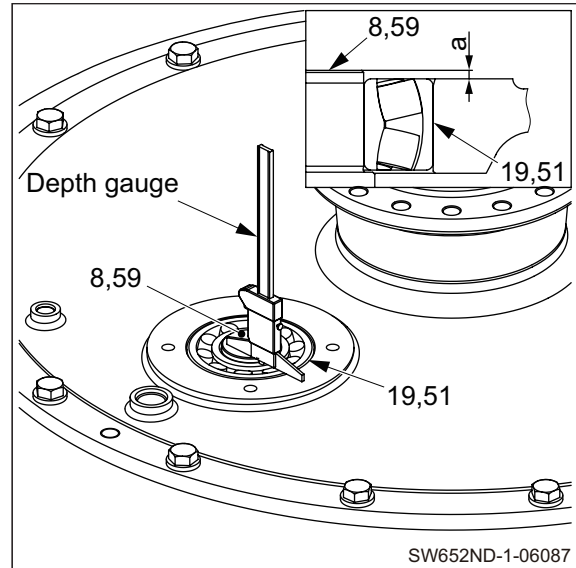
- After press fitting, remove covers (23) and (47) to make sure that vibrator bearings (19) and (51) are not protruding.



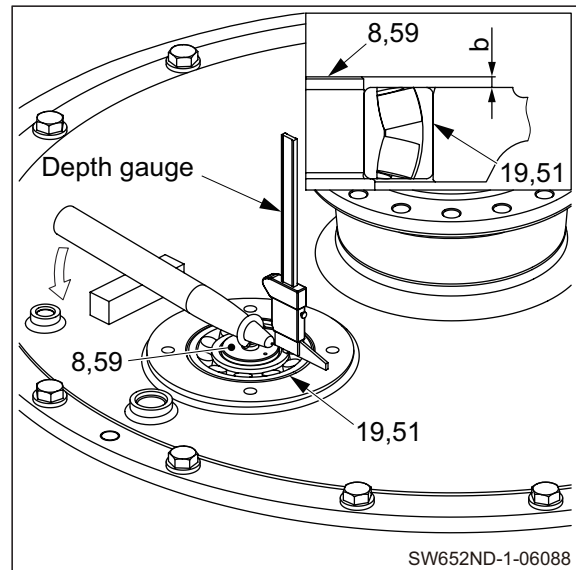
34) Install lifting bolts (M8) to end of eccentric shafts (8) and (59).



35) Measure dimension “a” from end of eccentric shafts (8) and (59) to top of vibrator bearings (19) and (51) by using a depth gauge.



36) Lift eccentric shafts (8) and (59), and measure dimension “b” from end of eccentric shafts (8) and (59) to top of vibrator bearings (19) and (51) again by using a depth gauge.

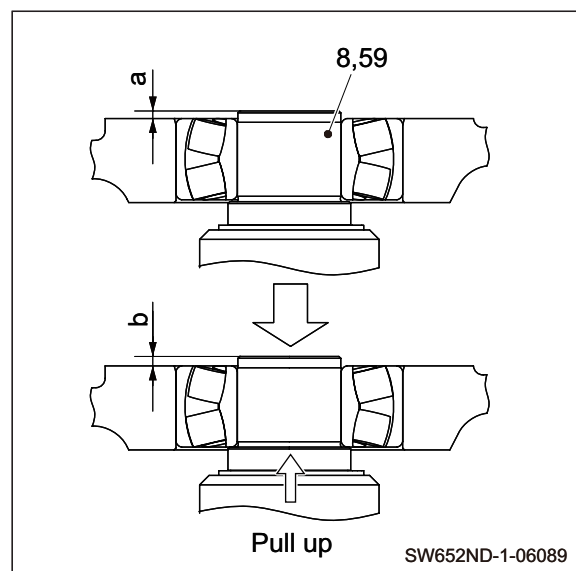


37) Make sure that eccentric shafts (8) and (59) have an axial play of 1 mm (0.04 in.) or more.

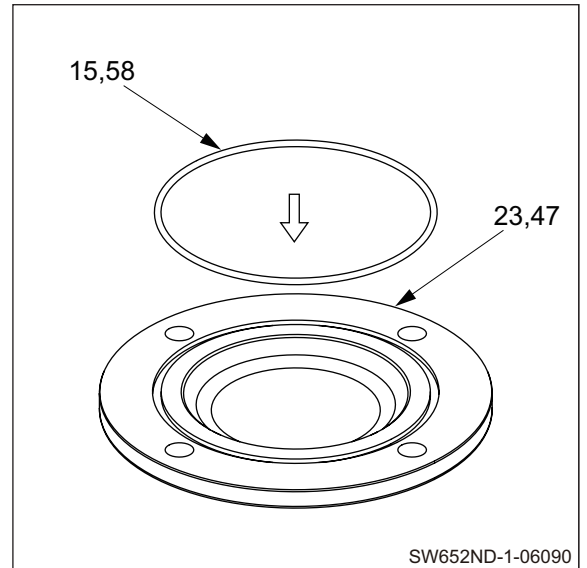
$$b = a + 1 \text{ mm (0.04 in.) or more}$$

**(NOTICE)**


- Two persons are required for taking measurements.

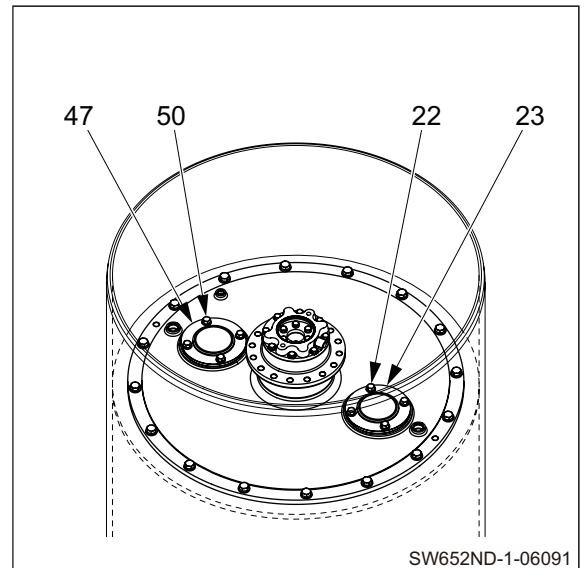


- 38) Apply grease to O-rings (15) and (58).
- Install O-rings (15) and (58) to covers (23) and (47).



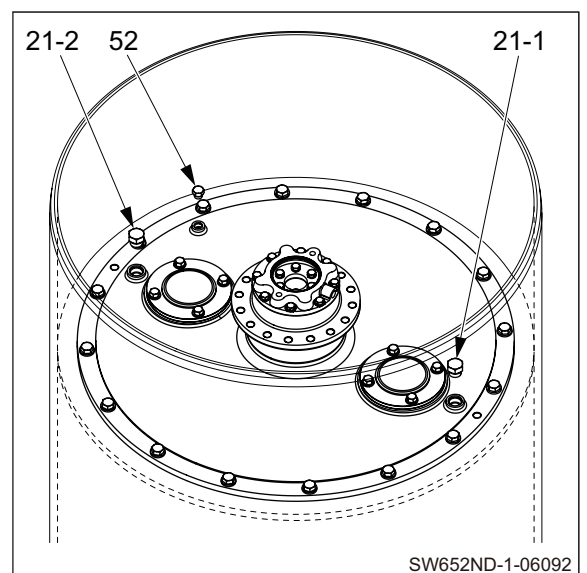
- 39) Secure covers (23) and (47) to axle shaft subassembly with four bolts (22), four bolts (50), and washers.

 N·m (22) and (50) Bolts M12×30 : 110 N·m (81 lbf·ft)

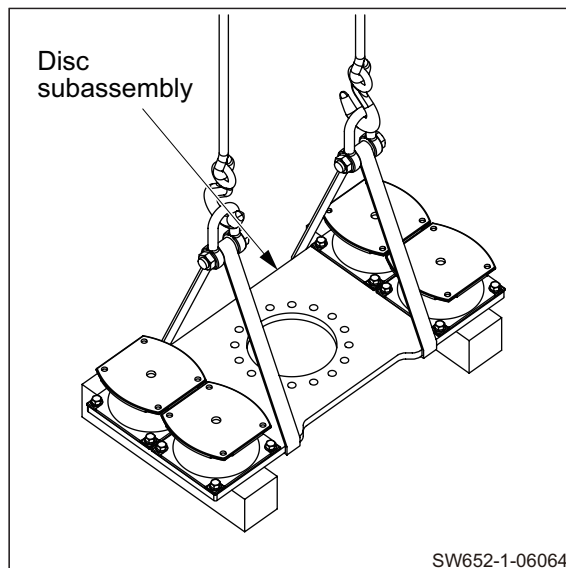


- 40) Apply grease to O-rings for plugs (21-1), (21-2), and level plug (52).

- Install plugs (21-1), (21-2), and level plug (52).

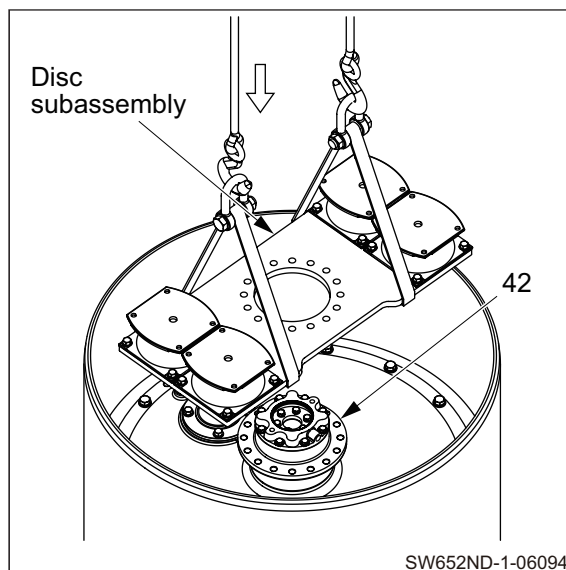


41) Lift disc subassembly.



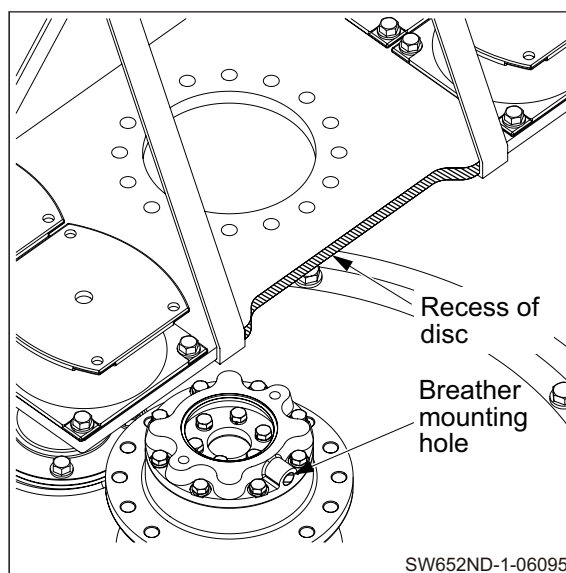
42) Lower disc subassembly on mounting surface of housing (42).

$\mathfrak{J}_{kg}$  Disc subassembly : 75kg (165 lbs.)




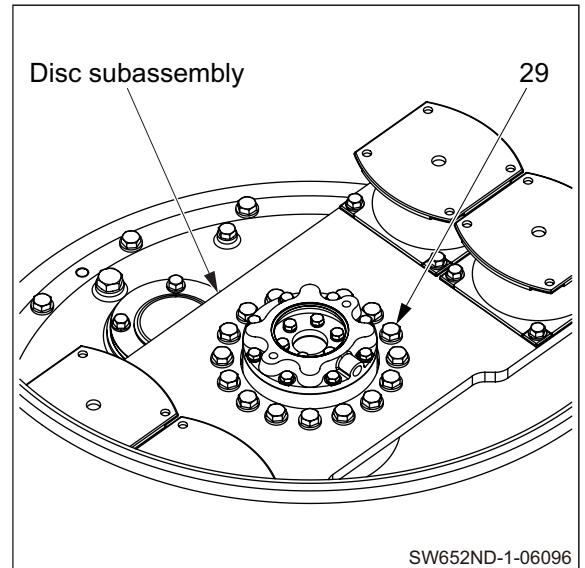
**(NOTICE)**

- The recess of the disc must face the same direction as the breather mounting hole in the flange.

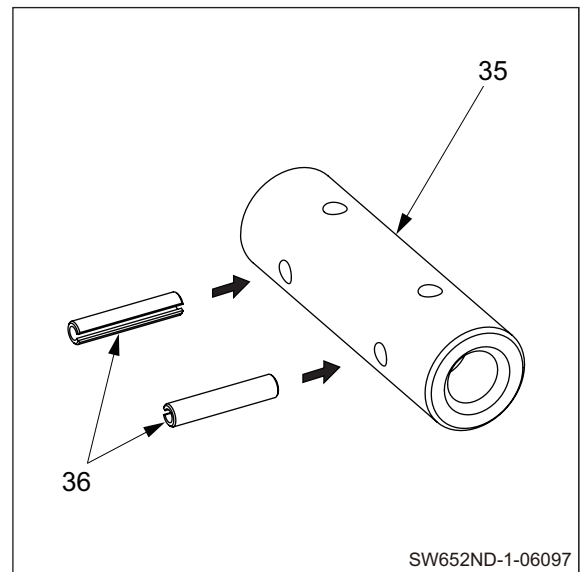


- 43) Secure disc subassembly with sixteen bolts (29) and washers.

 N·m (29) Bolts M16×45 : 265 N·m (195 lbf·ft)

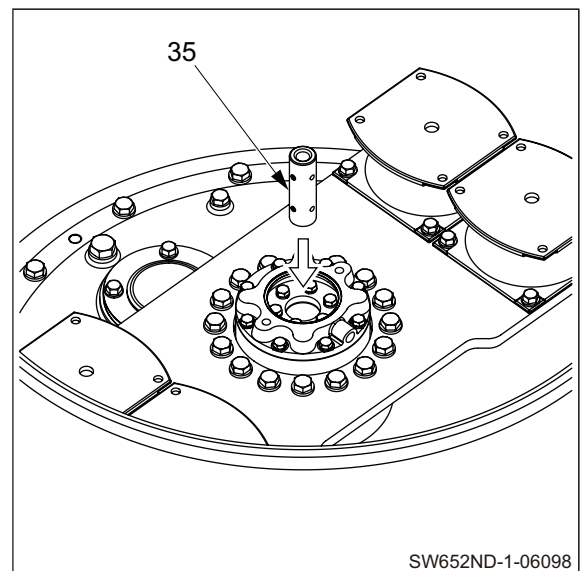


- 44) Drive two spring pins (36) into sleeve (35).

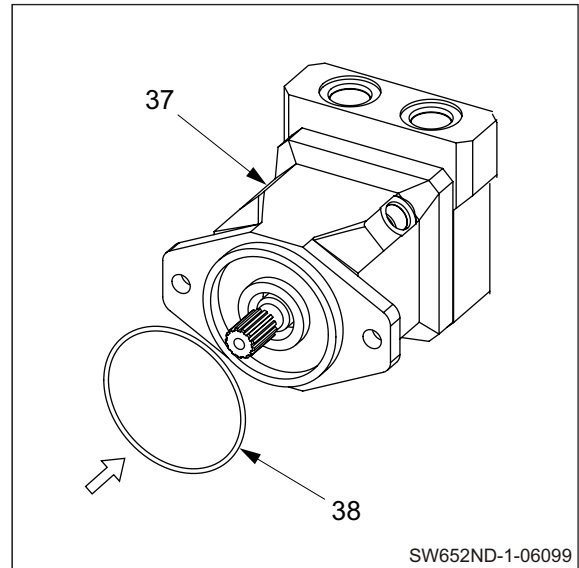


- 45) Apply molybdenum-based grease to splined portion of sleeve (35).



- Fit sleeve (35) to splined portion on drive shaft end.

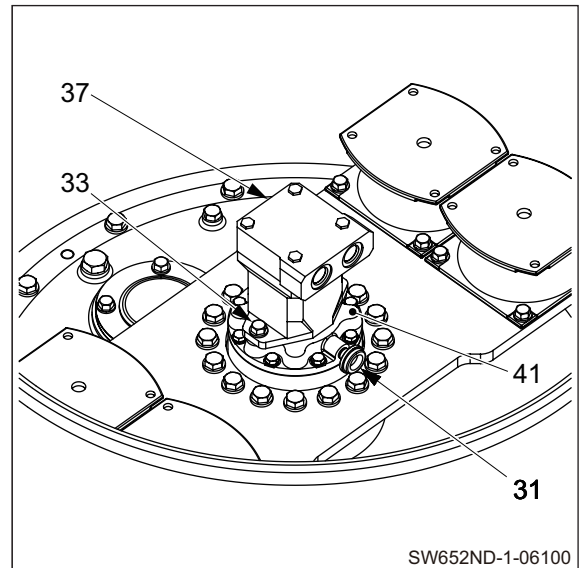


- 46) Apply grease to O-ring (38).  
 • Install O-ring (38) to vibrator motor (37).




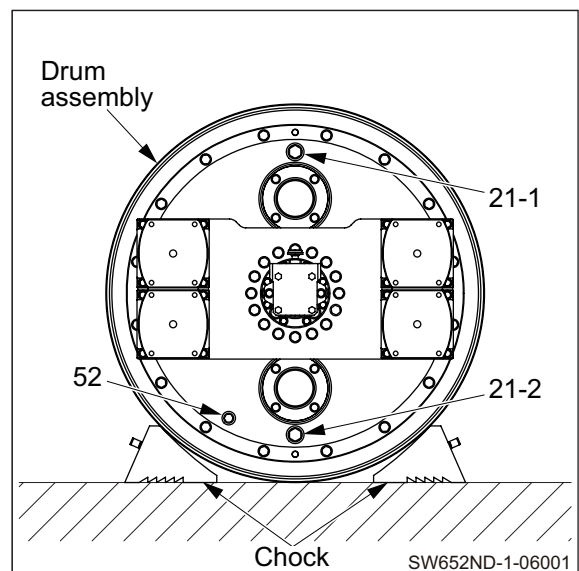
- 47) Wind seal tape around threaded portion of breather (31).  
 • Install breather (31).  
 • Secure vibrator motor (37) to flange (41) with two bolts (33) and washers.

-  (37) Vibrator motor : 15 kg (33 lbs.)  
 (33) Bolts M12×30 : 110 N·m (81 lbf·ft)



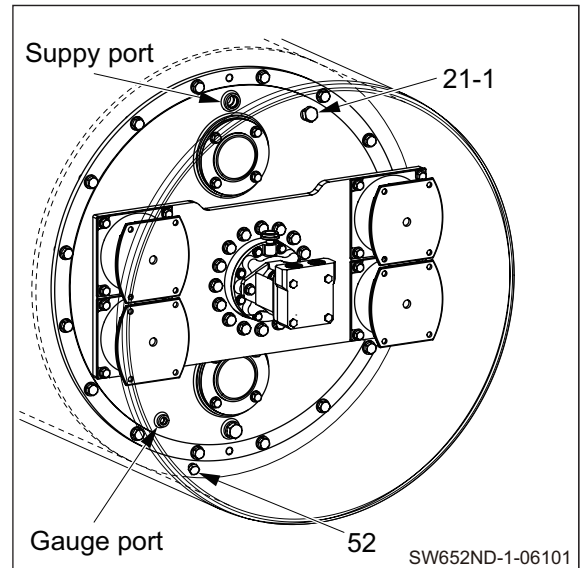
- 48) Lay vibratory drum assembly with plugs (21-1), (21-2), and (52) positioned as shown right.  
 • Hold with chocks.

-  Vibratory drum assembly : 1,655 kg (3,649 lbs.)



49) Remove plugs (21-1) and (52).

- Supply gear oil from oil supply port.
- Check that oil drips from gauge port.
- Quantity of gear oil : 10.4 L (2.7 gal.)
- Install plugs (21-1) and (52).







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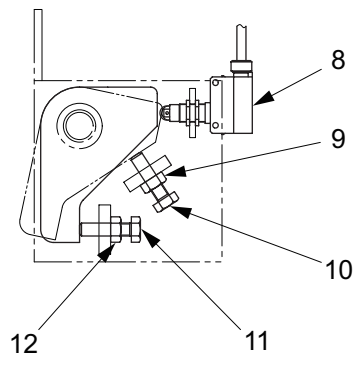
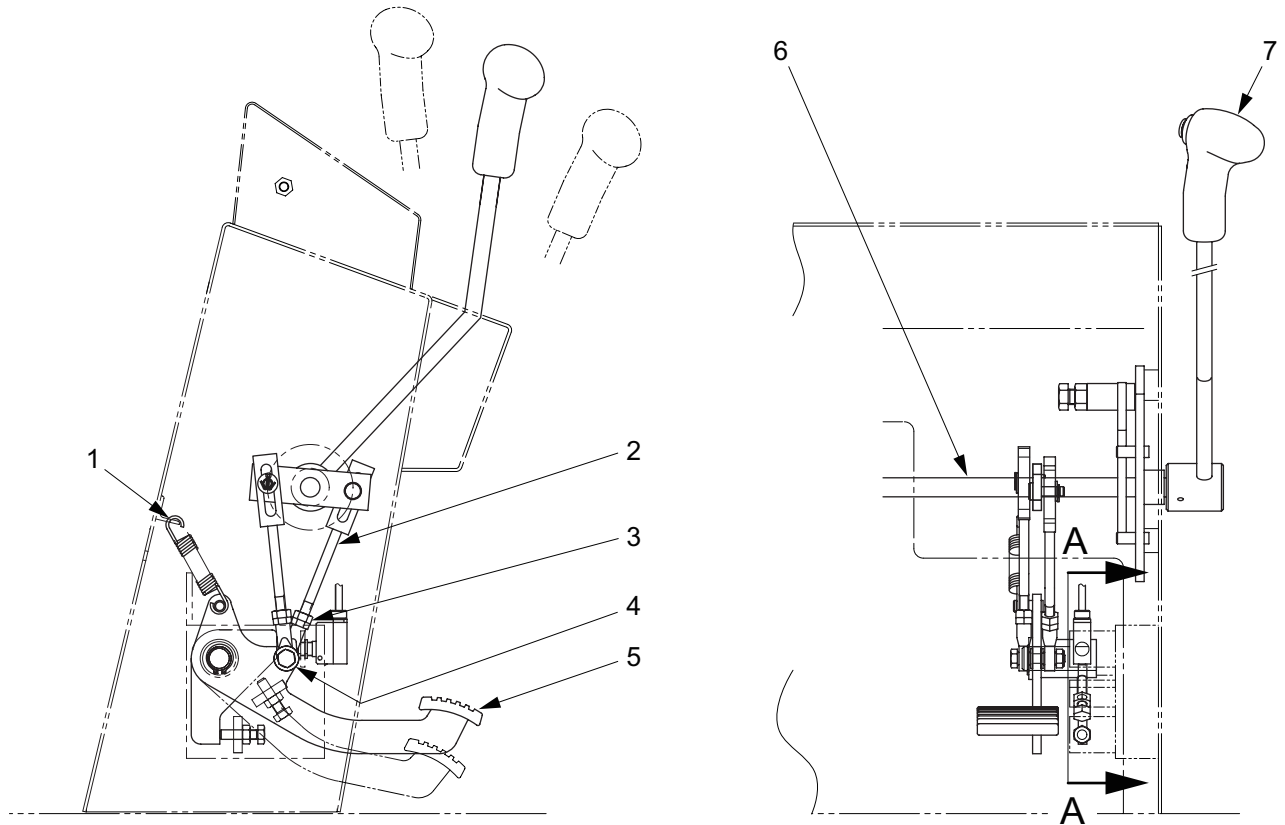
**BRAKE**

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# 1. BRAKE PEDAL



**SECTION A-A**

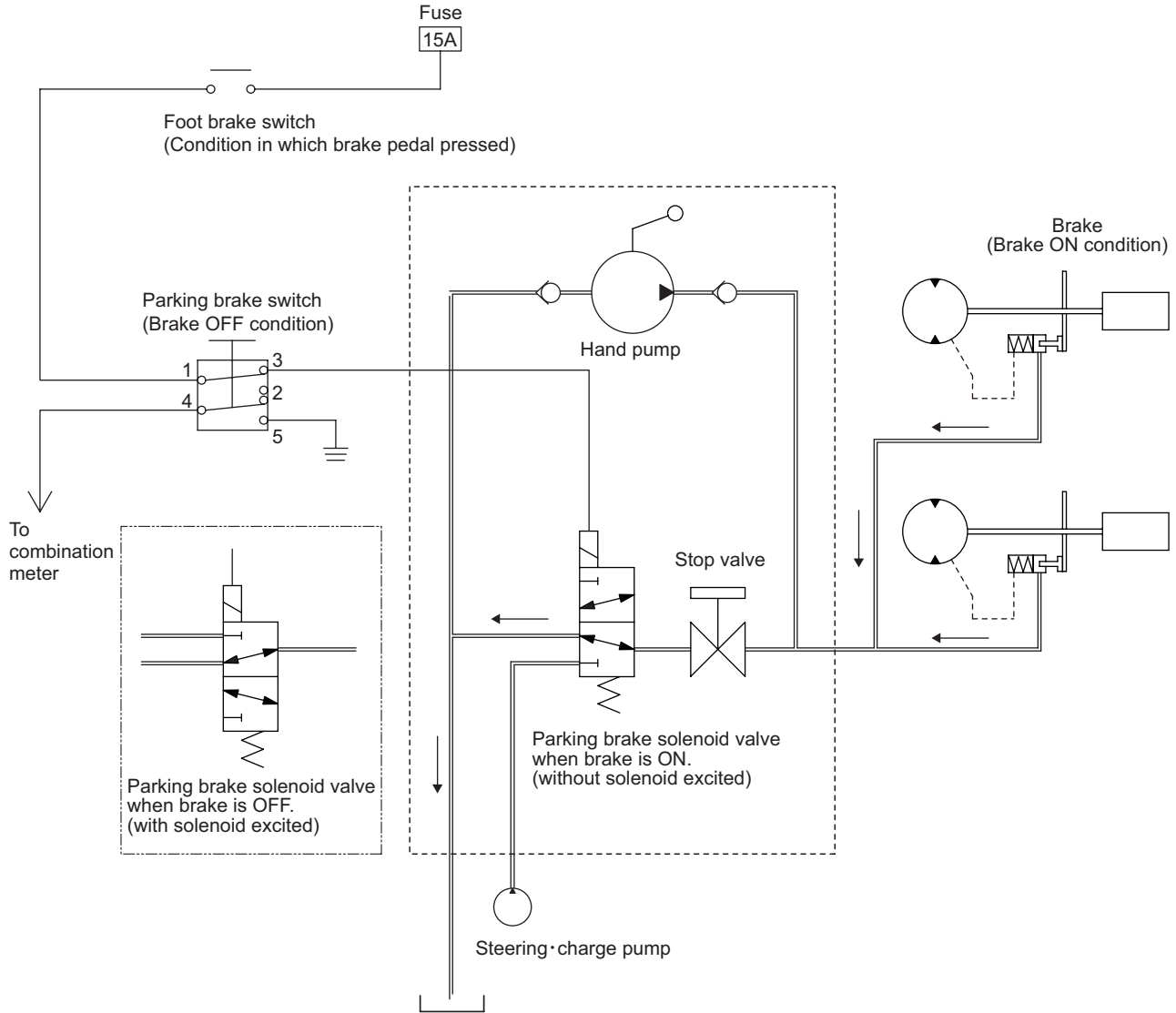
0559-51801-0-10587-0

- (1) Return spring
- (2) Rod
- (3) Nut : M10
- (4) Rod end

- (5) Brake pedal
- (6) Shaft
- (7) F-R lever
- (8) Foot brake switch

- (9) Nut : M10
- (10) Stopper bolt : M10×40
- (11) Stopper bolt : M10×40
- (12) Nut : M10

## 2. BRAKE SYSTEM



• The arrow (→) symbol shows the direction of the hydraulic oil flow.

SW652-1-07001

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# **WATER SPRAY SYSTEM**

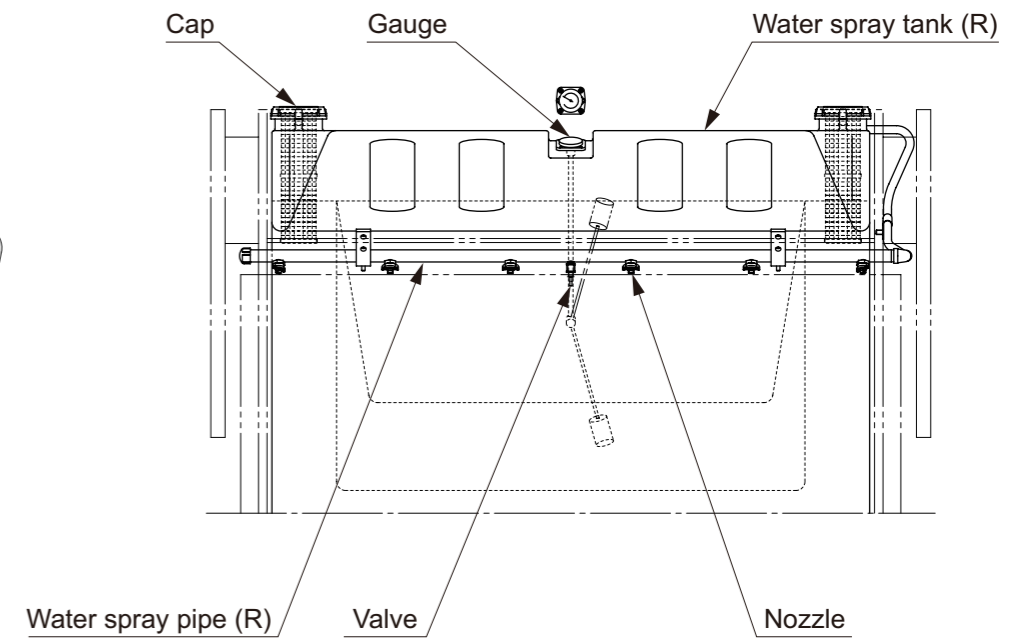
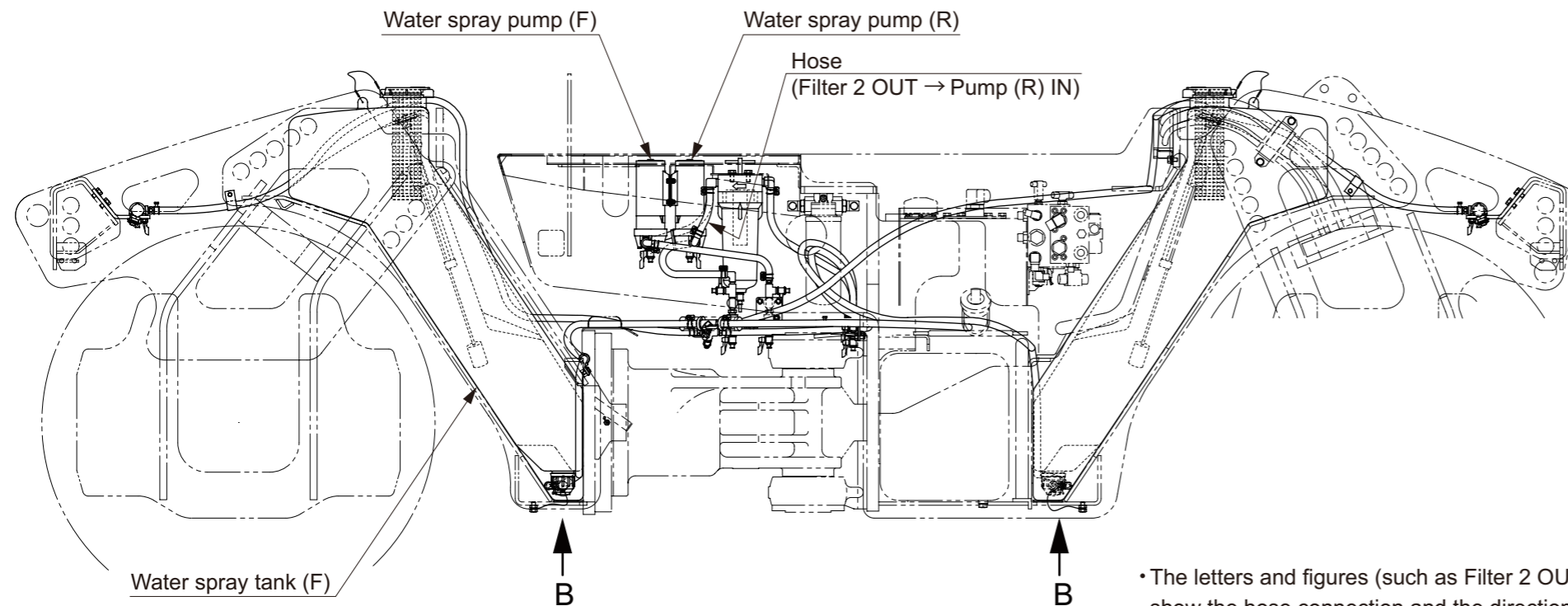
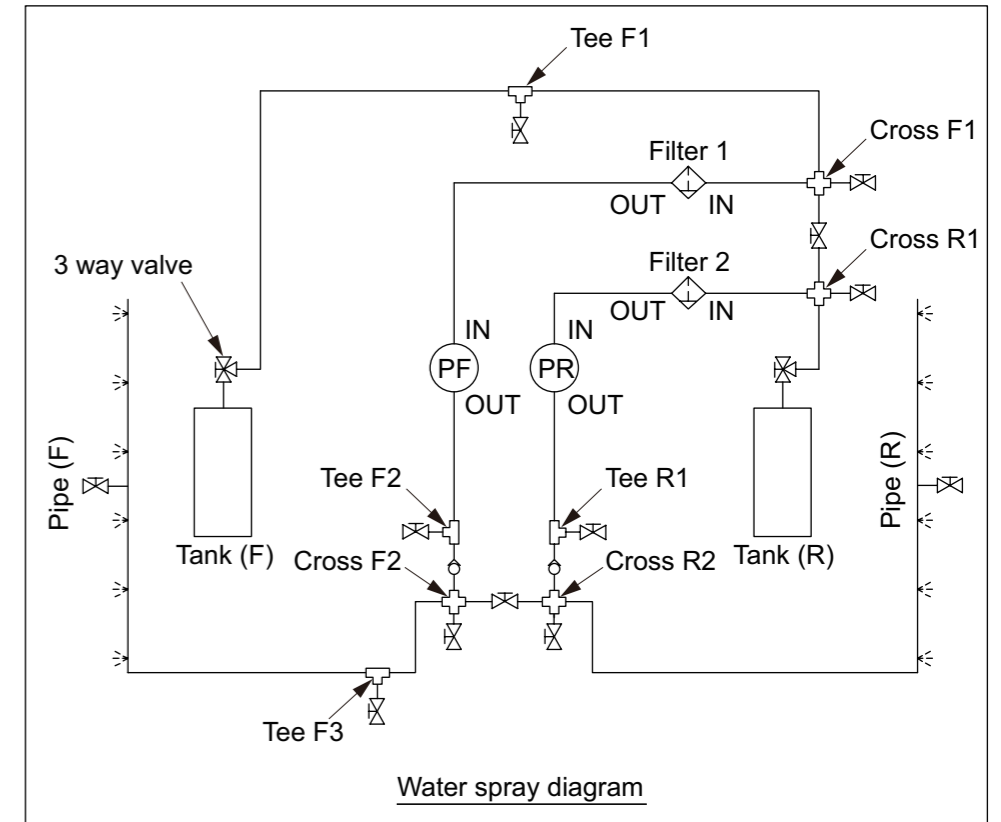
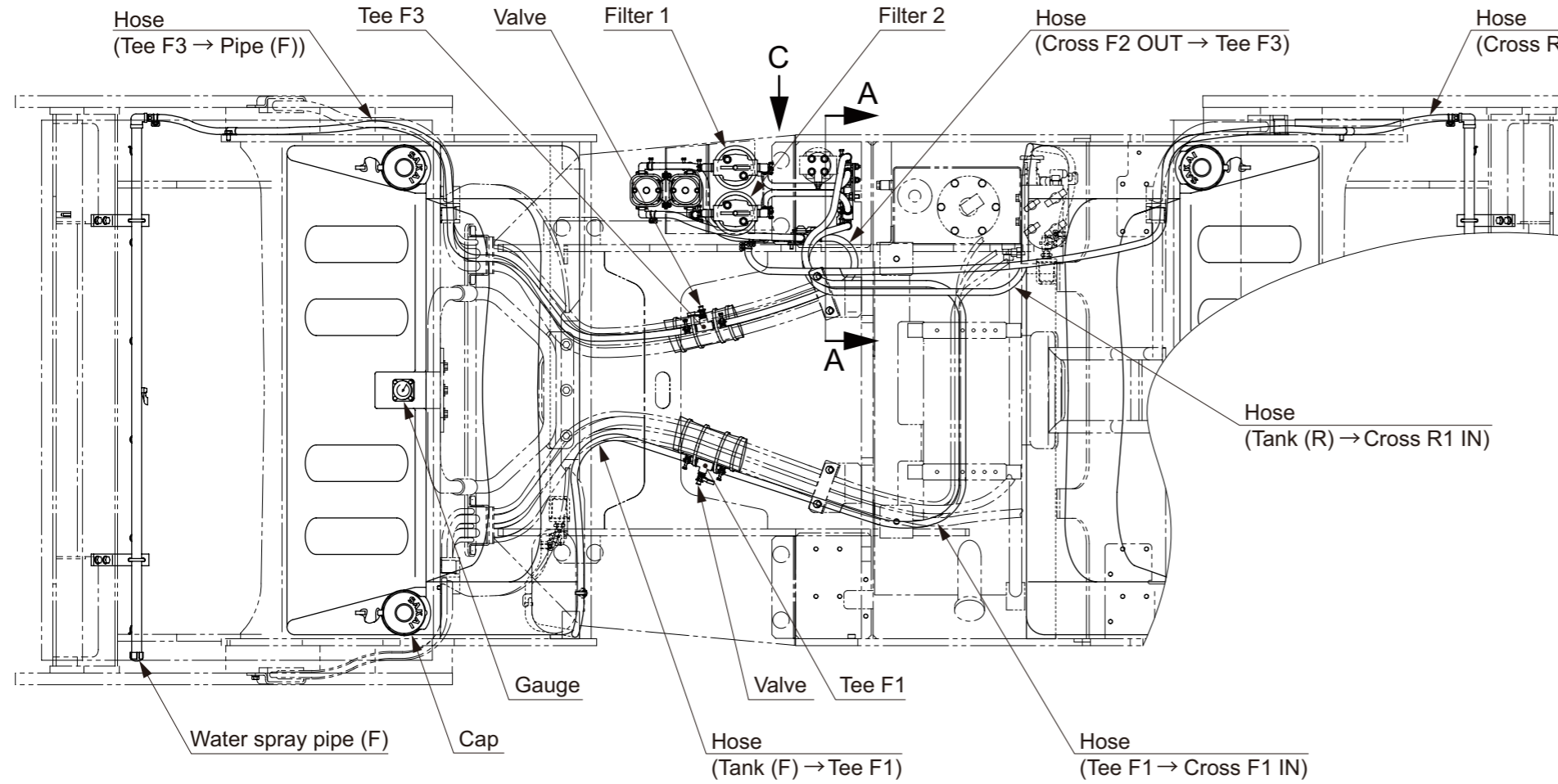
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# 1. WATER SPRAY PIPING

## 1-1. Water Spray Piping (1)

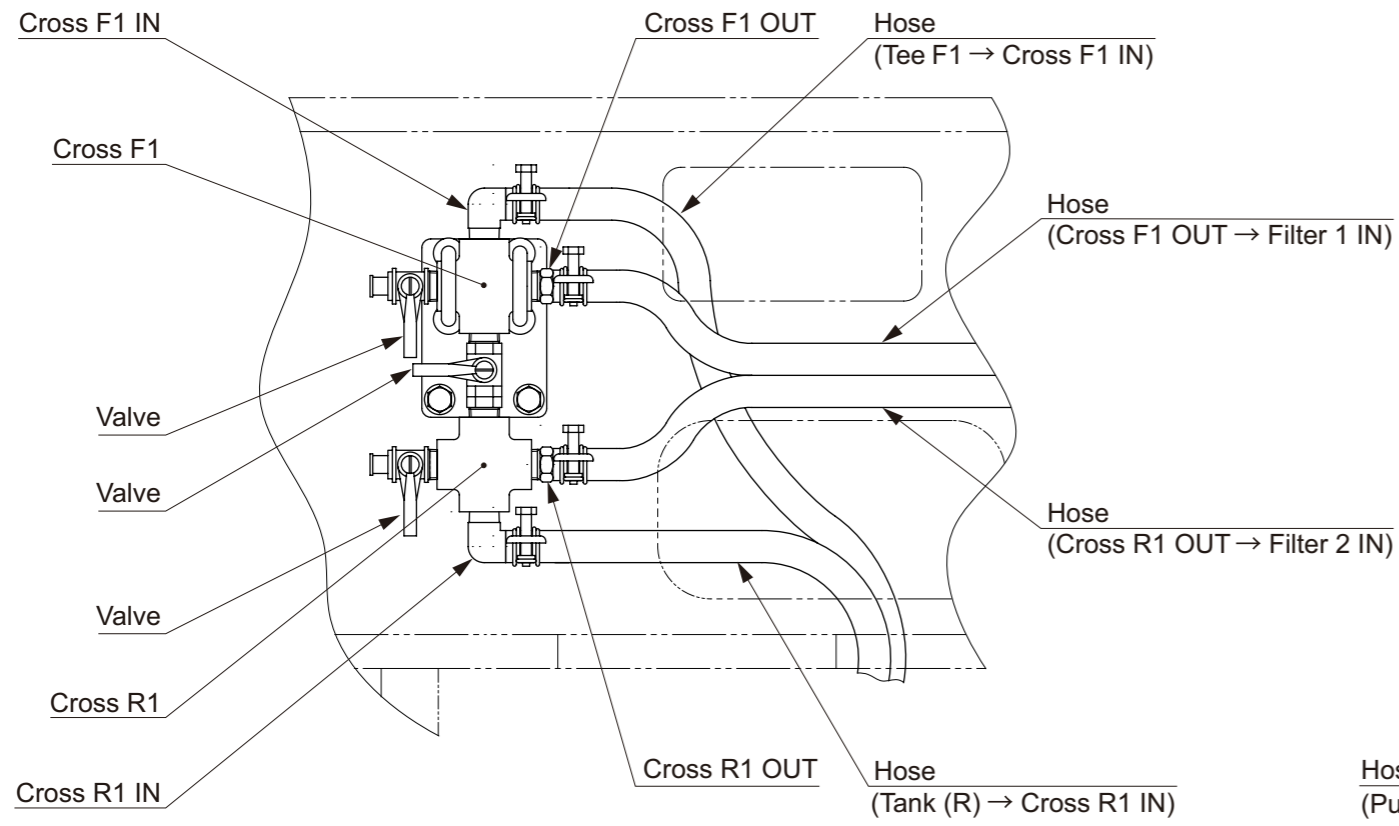


• The letters and figures (such as Filter 2 OUT and Pump (R) IN) show each port and the arrow (→) symbols show the hose connection and the direction of the flow of the water.

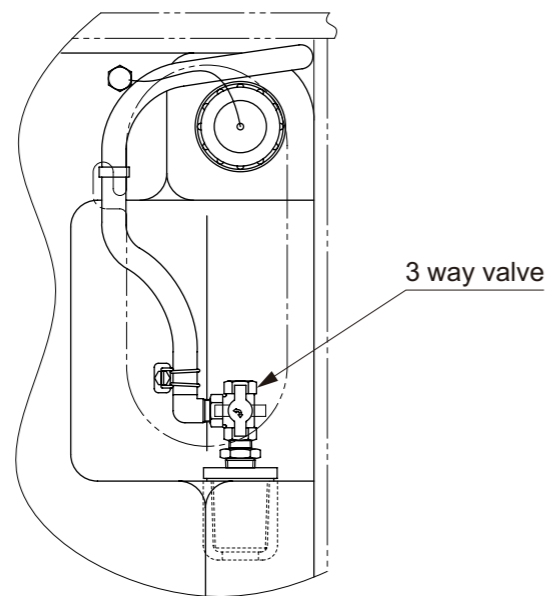




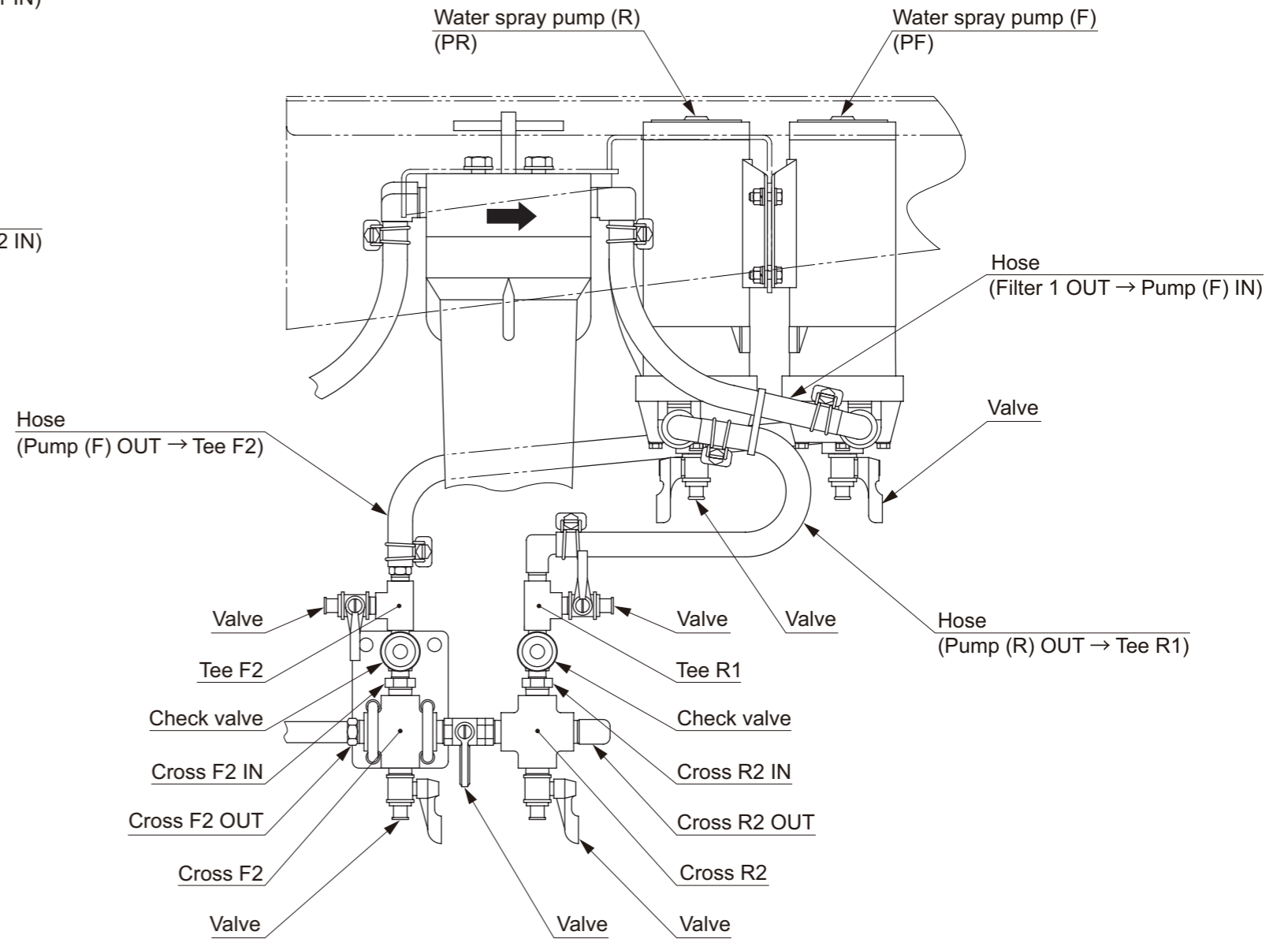
1-2. Water Spray Piping (2)



SECTION A-A



VIEW B



VIEW C

• The letters and figures (such as Pump (R) OUT and Tee R1) show each port and the arrow (→) symbols show the hose connection and the direction of the flow of the water.



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# **INSPECTION AND ADJUSTMENT**

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# 1. INSPECTION AND ADJUSTMENT

## 1-1. Safety Precautions for Inspection and Adjustment

### **⚠ WARNING**

Unexpected machine movement may cause a serious accident. When inspecting the machine while the engine is running, always follow the instructions below.

- Park the machine on level, flat ground.
- Apply the parking brake.
- Set chocks in front and behind each drum or tire.
- Make sure that service personnel are given the appropriate information at the appropriate time.
- Make sure that no one can enter any hazardous area.

### **⚠ CAUTION**

Do not work on the hydraulic system while the engine is running and the system is hot and under pressure. Do not disconnect hydraulic hoses or fittings until the system has cooled and pressure has been properly relieved.

Before removing any plugs from the pressure measurement ports, always release any residual pressure from the piping and open the cap of the fluid tank to release and pressure.

### **⚠ WARNING**

Inadvertent starting the engine may cause a serious accident.

When inspecting the engine, make sure to exchange the appropriate cues and hand signal with the person at the operator station to avoid any accidents.

### **⚠ CAUTION**

Before inspecting inside of the engine compartment, always stop the engine.

Contact with the fan, V-belt or exhaust system parts while the engine is running may cause serious injury.

## 1-2. Preparation for Inspection and Adjustment

- Prepare the necessary measuring instruments. In addition, particularly when measuring pressure values, make sure to prepare the appropriate hoses, adapters and a plug removal tool for the pressure reading port.
- Make sure that the instruments to be used operate normally.

When handling the instruments, exercise sufficient caution not to drop or apply any impact to them. Doing so may adversely affect the calibration. Another important point is to inspect the instruments regularly. An instrument that does not start from the appropriate zero point may give an inaccurate reading.

## 1-3. Precautions for Inspection and Adjustment

- When performing inspections and adjustments, pay special attention to safety.
- For each inspection, always take three measurements for each measurement point. If the measurements significantly differ, the measurement method may be incorrect. In such a case, take measurements once again and calculate their average.

## 1-4. Warm-up

- Machinery will not exhibit their true performance under the cold condition. Before taking measurements, always warm up the engine and make sure that the fluid and engine coolant are warmed to their specified normal operating temperatures.

## 1-5. Inspection and Adjustment of Engine Related Items


- Refer to shop manual of engine manufacturer for inspection and adjustment of engine itself.

## 2. MEASUREMENT AND ADJUSTMENT OF PROPULSION CIRCUIT PRESSURE

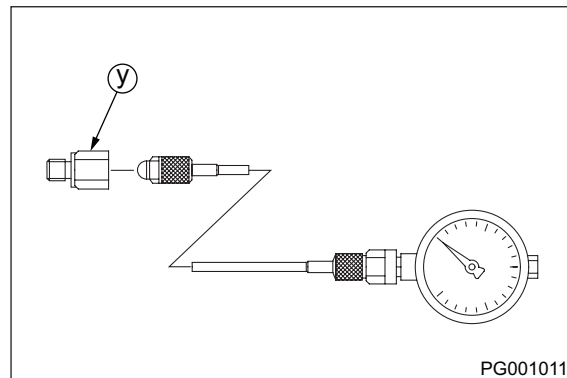
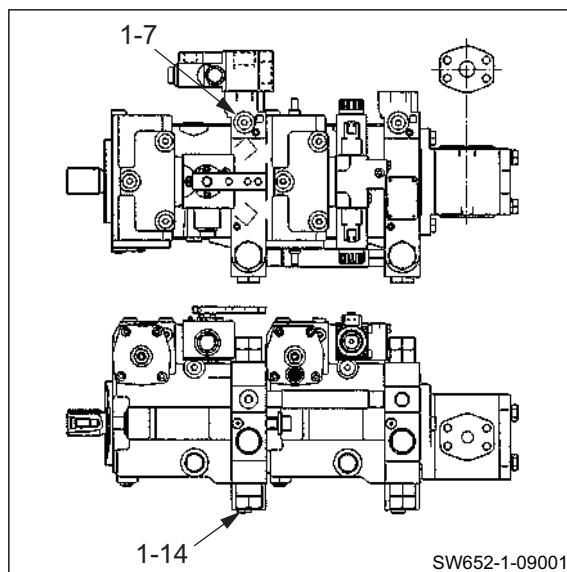
### 2-1. Measurement

#### **⚠ WARNING**

Confirm that the parking brake works properly before measurement.

- Oil temperature during measurement :  $50 \pm 5^{\circ}\text{C}$  ( $122 \pm 41^{\circ}\text{F}$ )
- ① Remove plugs from high pressure gauge port (1-7) and (1-14) of propulsion pump. Attach pressure gauge with adapter (Y) .
  - Adapter (Y) : 7/16-20UNF
  - High pressure gauge port (Forward) : (1-7)
  - High pressure gauge port (Reverse) : (1-14)
  - Pressure gauge : 0 to 50 MPa  
(0 to 7,250 psi)
- ② Set propulsion speed change switch to “”.
- ③ Set propulsion speed change lever to “1st”.
- ④ Start the engine and set throttle lever to “Full”.
- ⑤ Establish a condition in which machine propulsion load becomes maximum.  
(Pressure does not build up unless propulsion load is applied.)
- ⑥ With propulsion load at maximum, slowly move F-R lever to the side to be measured.
  - Then, read pressure indicated by pressure gauge.
- ⑦ After measuring, promptly return F-R lever to “N”.

★ **Maximum circuit pressure (cut off valve setting)**  
:  $30.0 \pm 1.0 \text{ MPa}$  ( $4,350 \pm 145 \text{ psi}$ )



- The numbers “1-7” and “1-14” appearing in above illustrations are consistent with lead line numbers shown in illustration of propulsion pump in “2-2. Hydraulic Component Specifications” (page 4-009).

## 2-2. Adjustment

- If measurement results indicate the pressure deviating from maximum circuit pressure range, make an adjustment in accordance with procedure described below.

### 2-2-1. If pressures on both forward and reverse sides deviate from maximum circuit pressure range by same value

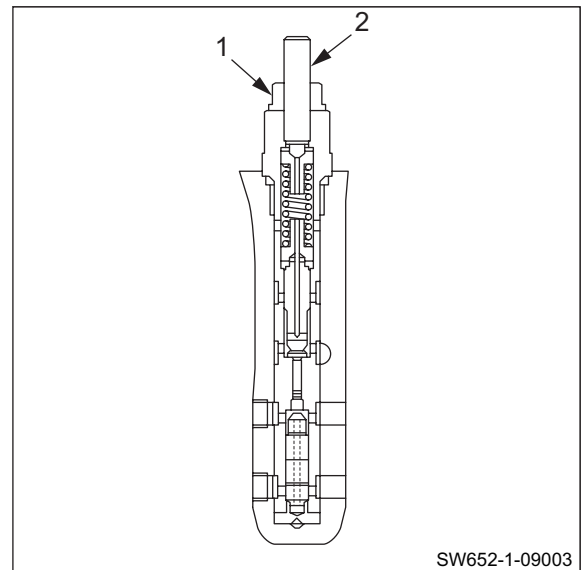
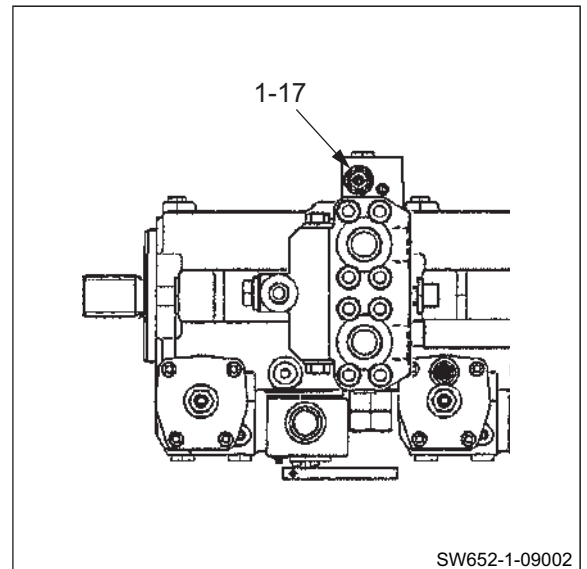
- ① Check nut (1) of cut off valve (1-17) for evidence of having loosened.
  - ② If there is evidence of nut having loosened, adjust cut off valve so that pressure becomes within maximum circuit pressure range while watching pressure gauge.
    - To adjust pressure, loosen nut and turn adjustment screw (2).
- Adjustment screw turned clockwise  
: Pressure rise
- Adjustment screw turned counterclockwise  
: Pressure drop
- Pressure change rate : 10 MPa/turn (1,450 psi/turn)
- ③ If there is no evidence of nut having loosened, remove cut off valve.
  - ④ Check removed cut off valve for trapped dirt and scratches on its seat.
  - ⑤ If trapped dirt is present, disassemble and clean cut off valve.
  - ⑥ If a scratch is found on seat, replace cut off valve.
  - ⑦ After adjustment, measure pressure again and check that pressure reaches maximum circuit pressure range.



- (1) Nut : 22 N·m (16 lbf·ft)  
 (1-17) Cut off valve : 35 N·m (26 lbf·ft)

#### (NOTICE)

- **Carefully disassemble and reassemble after taking steps to prevent foreign material from getting in.**
- The number “1-17” appearing in above illustrations is consistent with lead line numbers shown in illustration of propulsion pump in “2-2. Hydraulic Component Specifications” (page 4-009).

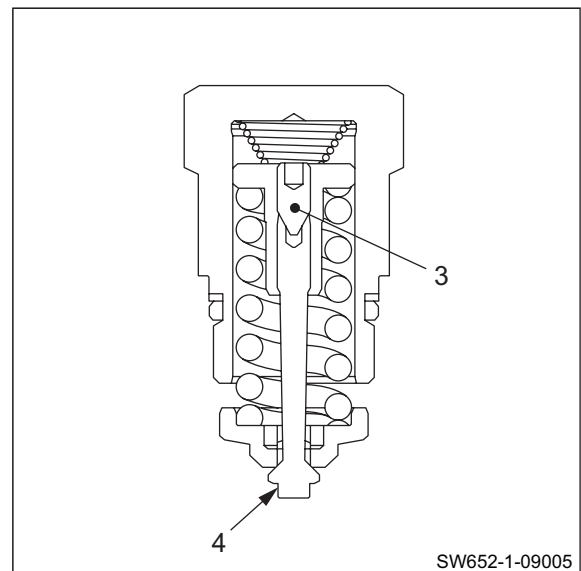
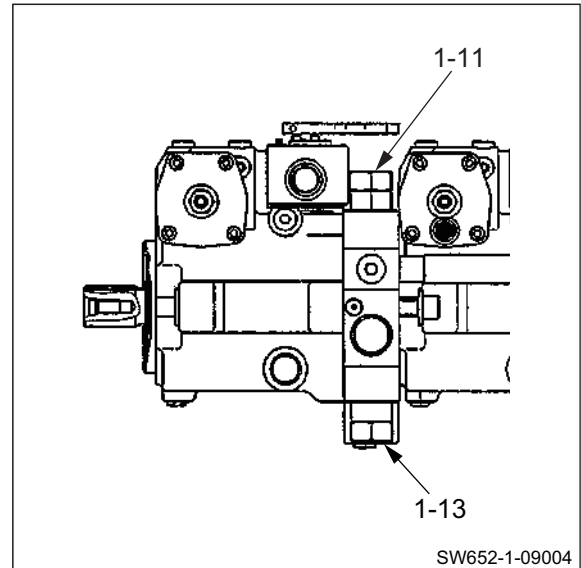


**2-2-2. If pressure on either forward or reverse side deviates from maximum circuit pressure range**

- ① Check high pressure relief valve (1-11) or (1-13) for evidence of having loosened.
  - High pressure relief valve (Forward) : (1-11)
  - High pressure relief valve (Reverse) : (1-13)
- ② If there is evidence of high pressure relief valve having loosened, adjust it so that pressure becomes within maximum circuit pressure range while watching pressure gauge.
- ③ Remove high pressure relief valve.
- ④ Remove lock screw (3).
- ⑤ Turn adjustment screw (4) to adjust pressure.
  - Adjustment screw turned clockwise : Pressure rise
  - Adjustment screw turned counterclockwise : Pressure drop
  - Pressure change rate : 4.5 MPa/turn (653 psi/turn)
- ⑥ If there is no evidence of high pressure relief valve having loosened, remove it.
- ⑦ Check removed high pressure relief valve for trapped dirt and scratches on its seat.
- ⑧ If trapped dirt is present, disassemble and clean high pressure relief valve.
- ⑨ If a scratch is found on seat, replace high pressure relief valve.
- ⑩ After adjustment, measure pressure again and check that pressure reaches maximum circuit pressure range.



(3) Lock screw : 6.5 N·m ( 4.8 lbf·ft)  
 (1-11) and (1-13) High pressure relief valve : 160 N·m ( 118 lbf·ft)



**(NOTICE)**

- Carefully disassemble and reassemble after taking steps to prevent foreign material from getting in.
- The number “1-11” and “1-13” appearing in above illustrations are consistent with lead line numbers shown in illustration of propulsion pump in “2-2. Hydraulic Component Specifications” (page 4-009).



### 3. MEASUREMENT AND ADJUSTMENT OF PROPULSION/ VIBRATOR CHARGE CIRCUIT PRESSURE

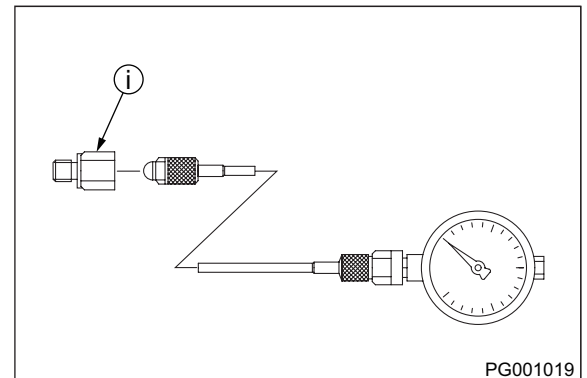
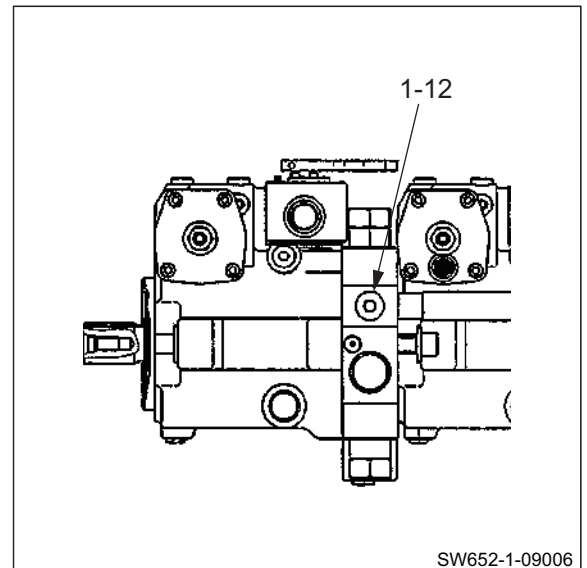
- Since oil in charge circuit is supplied from steering circuit, confirm that steering operation is normal before measurement.
- Ensure that neutral positions of F-R lever and hydraulic pump are aligned.

#### 3-1. Measurement

- Oil temperature during measurement :  $50 \pm 5^{\circ}\text{C}$  ( $122 \pm 41^{\circ}\text{F}$ )
- ① Remove plug from charge pressure gauge port (1-12).  
Attach pressure gauge with adapter ① .
  - Adapter ① : 3/4-16UNF
  - Pressure gauge : 0 to 5 MPa (0 to 725 psi)
- ② Apply parking brake by pressing parking brake switch button.
- ③ Start the engine and set throttle lever to "Full".
  - Then, read pressure indicated by pressure gauge.

★ **Standard charge relief valve setting**

:  $2.4 \pm 0.2$  MPa ( $348 \pm 29$  psi)



- The number "1-12" appearing in above illustrations is consistent with lead line numbers shown in illustration of propulsion pump in "2-2. Hydraulic Component Specifications" (page 4-009).

### 3-2. Adjustment

- If measurement results indicate the pressure deviating from standard charge relief pressure setting range, make an adjustment in accordance with procedure described below.

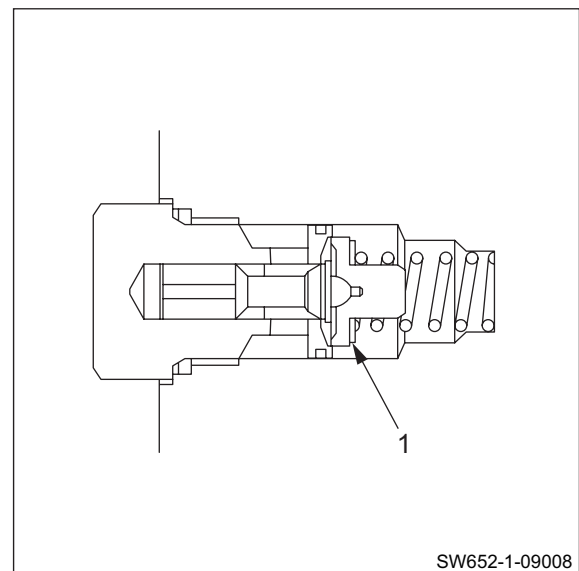
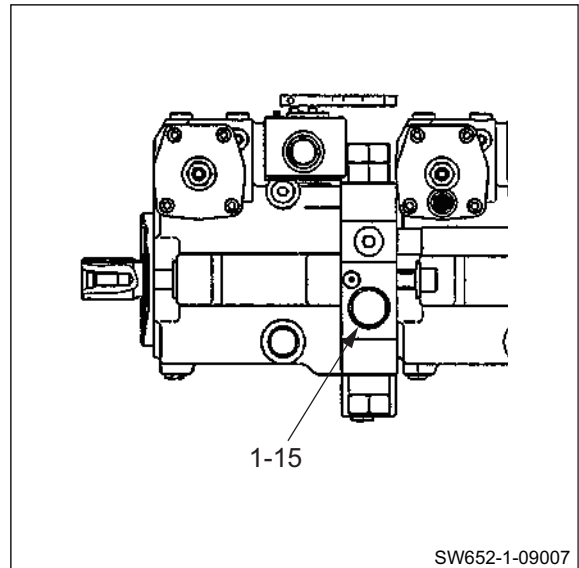
- ① Check charge relief valve (1-15) for evidence of having loosened.
- ② If there is evidence of charge relief valve having loosened, adjust it so that pressure becomes within standard charge relief valve pressure setting range while watching pressure gauge.
  - To adjust pressure, remove charge relief valve and change thickness of shims (1).
- ③ If there is no evidence of charge relief valve having loosened, remove it.  
 Pressure change rate : 0.4 MPa/mm (58 psi/mm)
- ④ Check removed charge relief valve for trapped dirt and scratches on its seat.
- ⑤ If trapped dirt is present, disassemble and clean charge relief valve.
- ⑥ If a scratch is found on seat, replace charge relief valve.
- ⑦ After adjustment, measure pressure again and check that pressure reaches standard charge relief valve setting range.



(1-15) Charge relief valve : 70 N·m (52 lbf·ft)

**(NOTICE)**

- **Carefully disassemble and reassemble after taking steps to prevent foreign material from getting in.**




- The number “1-15” appearing in above illustrations is consistent with lead line numbers shown in illustration of propulsion pump in “2-2. Hydraulic Component Specifications” (page 4-009).

## 4. MEASUREMENT OF MACHINE HIGH/LOW SPEED CHANGE CIRCUIT PRESSURE

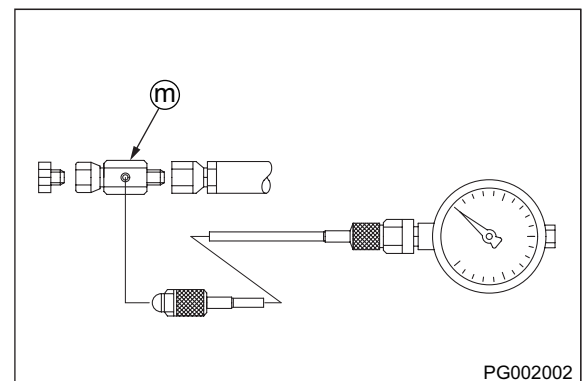
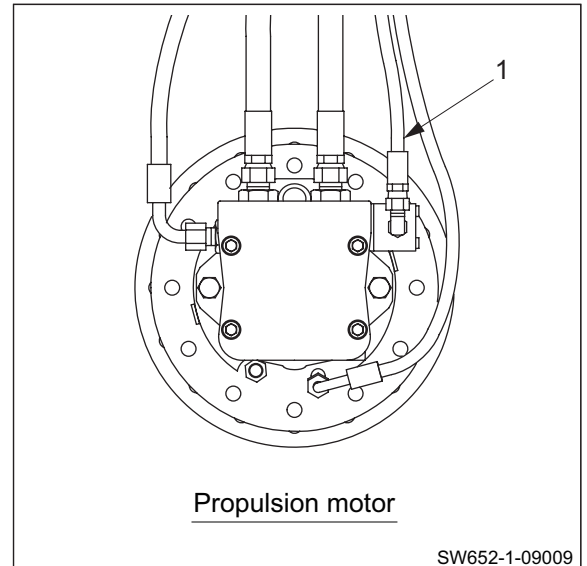
- Since oil in charge circuit is supplied from steering circuit, confirm that steering operation is normal before measurement.

### 4-1. Measurement

- Oil temperature during measurement :  $50 \pm 5^{\circ}\text{C}$  ( $122 \pm 41^{\circ}\text{F}$ )
- ① Disconnect hose (1) from propulsion motor. Attach pressure gauge through adapter (m) .
  - Adapter (m) : G1/4
  - Pressure gauge : 0 to 5 MPa (0 to 725 psi)
- ② Apply parking brake by pressing parking brake switch button.
- ③ Set propulsion speed change switch to “”.
- ④ Start the engine and set throttle lever to “Full”.
  - Then, read pressure indicated by pressure gauge.

#### ★ Standard charge relief valve setting

:  $2.4 \pm 0.2 \text{ MPa}$  ( $348 \pm 29 \text{ psi}$ )



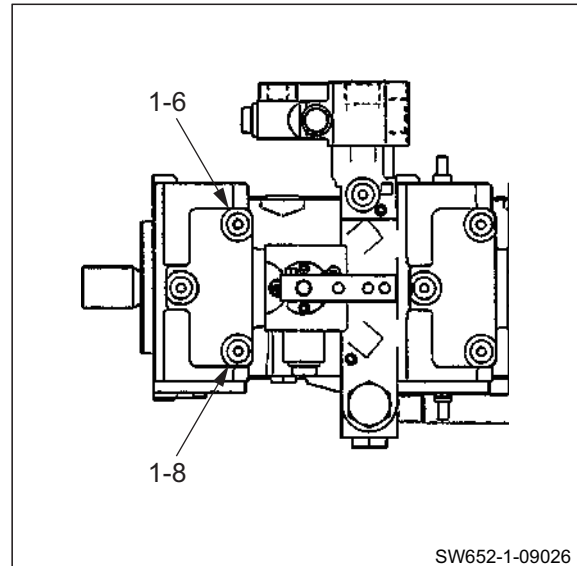
## 5. MEASUREMENT OF PROPULSION SERVO CIRCUIT PRESSURE

### 5-1. Measurement

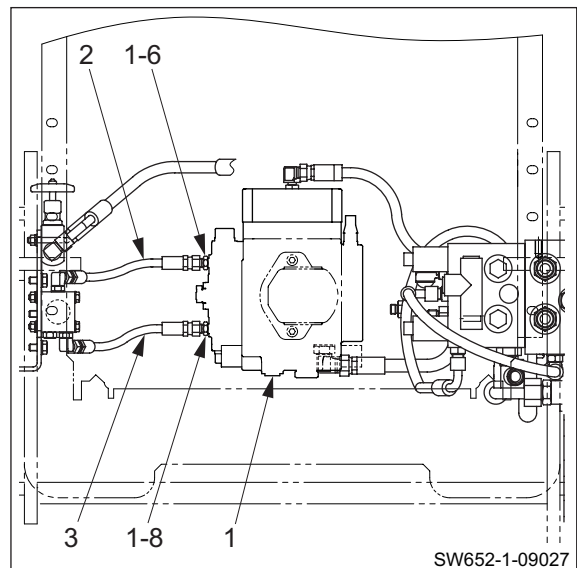
- Oil temperature during measurement :  $50 \pm 5^{\circ}\text{C}$  ( $122 \pm 41^{\circ}\text{F}$ )
- ① Disconnect hoses (2) and (3) from propulsion pump (1).  
Attach pressure gauge through adapter (m) .
  - Adapter (m) : G1/4
  - Pressure gauge : 0 to 5 MPa (0 to 725 psi)
- ② Apply parking brake by pressing parking brake switch button.
- ③ Start the engine and set throttle lever to "Full".
- ④ Operate F-R lever and then read pressure indicated by pressure gauge.
  - With parking brake applied (ON), measured pressures of (2) and (3) are same.
  - With parking brake released (OFF), measured pressures of (2) and (3) are different.

★ **Standard charge relief pressure setting**

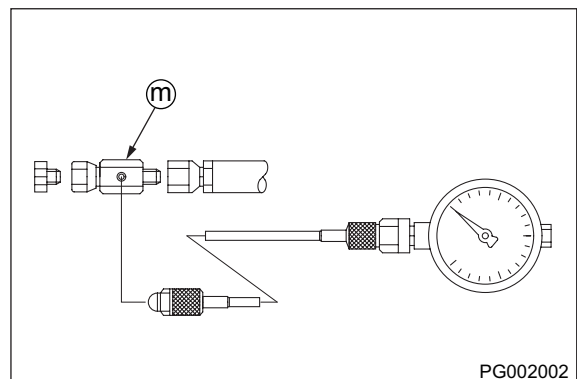
:  $2.4 \pm 0.2$  MPa ( $348 \pm 29$  psi)



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- The numbers "1-6" and "1-8" appearing in above illustrations are consistent with lead line numbers shown in illustration of propulsion pump in "2-2. hydraulic Component Specifications" (page 4-009).

## 6. MEASUREMENT OF PARKING BRAKE RELEASE PRESSURE

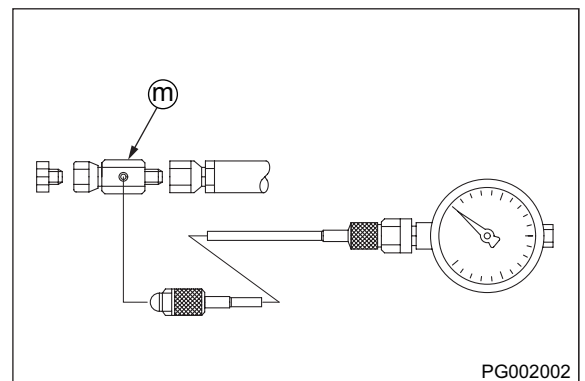
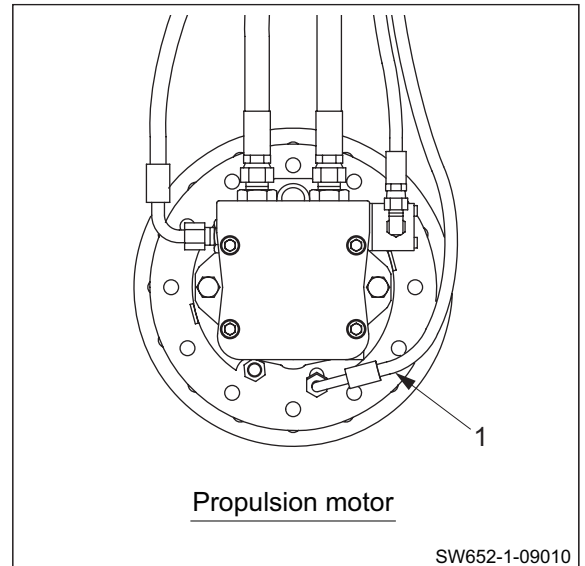
- Since oil in charge circuit is supplied from steering circuit, confirm that steering operation is normal before measurement.

### 6-1. Measurement

- Oil temperature during measurement :  $50 \pm 5^{\circ}\text{C}$  ( $122 \pm 41^{\circ}\text{F}$ )
- ① Disconnect hose (1) from propulsion motor. Attach pressure gauge through adapter (m) .
  - Adapter (m) : G1/4
  - Pressure gauge : 0 to 5 MPa (0 to 725 psi)
- ② Confirm that F-R lever is in "N".
- ③ Apply parking brake by pressing parking brake switch button.
- ④ Start the engine and set throttle lever to "Full".
- ⑤ Release parking brake by pressing parking brake switch button.
  - Then, read brake release pressure indicated by pressure gauge.

#### ★ Brake release pressure

: More than  $1.8 \pm 0.2$  MPa ( $261 \pm 29$  psi)



## 7. MEASUREMENT AND INSPECTION OF VIBRATOR CIRCUIT PRESSURE

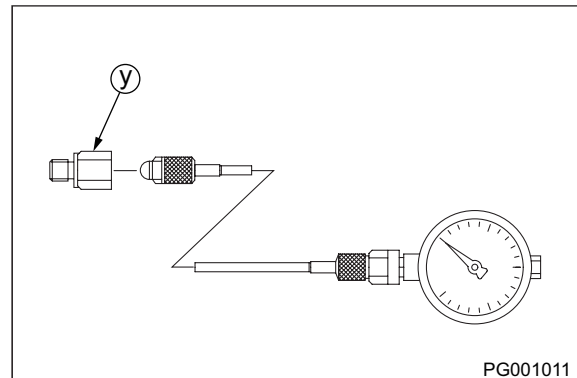
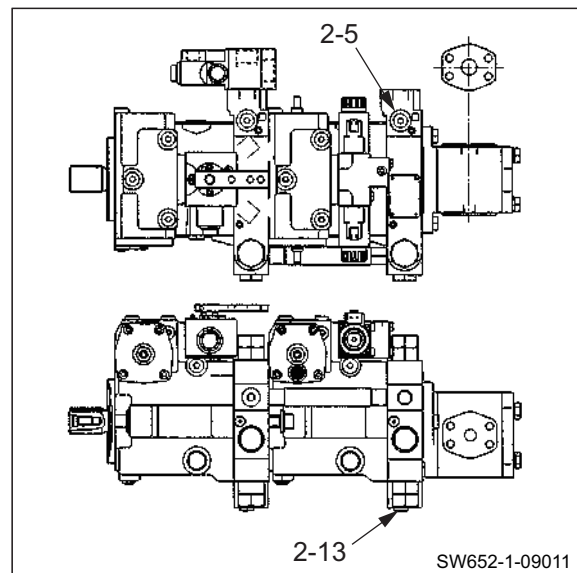
### 7-1. Measurement

#### **CAUTION**

Take care not to operate the vibratory drum for a longer period of time than necessary with the machine stationary. Otherwise, the vibrator bearing could be seized.

- Oil temperature during measurement :  $50 \pm 5^{\circ}\text{C}$  ( $122 \pm 41^{\circ}\text{F}$ )
- ① Remove plugs from high pressure gauge port (2-5) and (2-13) of vibrator pump. Attach pressure gauge with adapter ④ .
  - Adapter ④ : 7/16-20UNF
  - High pressure gauge port (Low amplitude/Horizontal) : (2-5)
  - High pressure gauge port (High amplitude/Normal) : (2-13)
  - Pressure gauge : 0 to 50 MPa (0 to 7,250 psi)
- ② Apply parking brake by pressing parking brake switch button.
- ③ Set speed change lever to "1st".
- ④ Set vibratory drum selector switch to "F R".
- ⑤ Set vibration mode change switch to "⚡".
- ⑥ Start the engine and set throttle lever to "Full".
- ⑦ Press F-R lever vibration switch ON.
- ⑧ Slowly move F-R lever to forward or reverse side.
  - Then, read pressure gauge for maximum value of vibrator circuit pressure.
- ⑨ Turn F-R lever vibration switch OFF or move back F-R lever to "N" as soon as measurement is finished.

★ **Maximum circuit pressure (cut off valve setting)**  
:  $32.5 \pm 1.0 \text{ MPa}$  ( $4,712 \pm 145 \text{ psi}$ )



- The numbers "2-5" and "2-13" appearing in above illustrations are consistent with lead line numbers shown in illustration of vibrator pump in "2-2. Hydraulic Component Specifications" (page 4-009).

## 7-2. Adjustment

- If measurement results indicate the pressure deviating from maximum circuit pressure range, make an adjustment in accordance with procedure described below.

### 7-2-1. If pressures on both Low amplitude/Horizontal and High amplitude/Normal sides deviate from maximum circuit pressure range by same value

- ① Check nut (1) of cut off valve (2-15) for evidence of having loosened.
- ② If there is evidence of nut having loosened, adjust cut off valve so that pressure becomes within maximum circuit pressure range while watching pressure gauge.
  - To adjust pressure, loosen nut and turn adjustment screw (2).

Adjustment screw turned clockwise

: Pressure rise

Adjustment screw turned counterclockwise

: Pressure drop

Pressure change rate : 10 MPa/turn (1,450 psi/turn)

- ③ If there is no evidence of nut having loosened, remove cut off valve.
- ④ Check removed cut off valve for trapped dirt and scratches on its seat.
- ⑤ If trapped dirt is present, disassemble and clean cut off valve.
- ⑥ If a scratch is found on seat, replace cut off valve.
- ⑦ After adjustment, measure pressure again and check that pressure reaches maximum circuit pressure range.

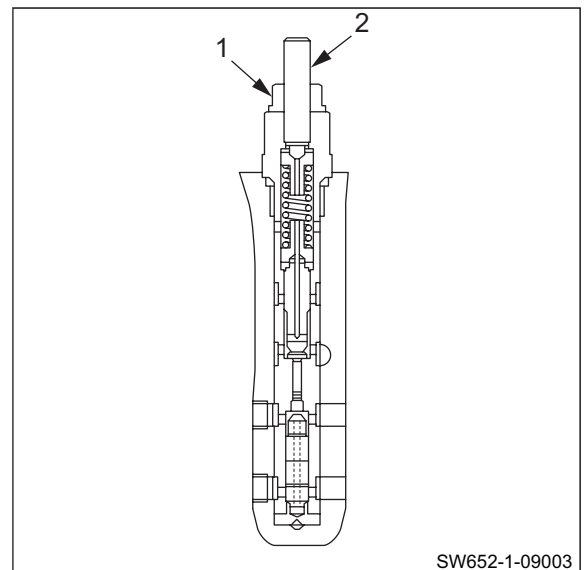
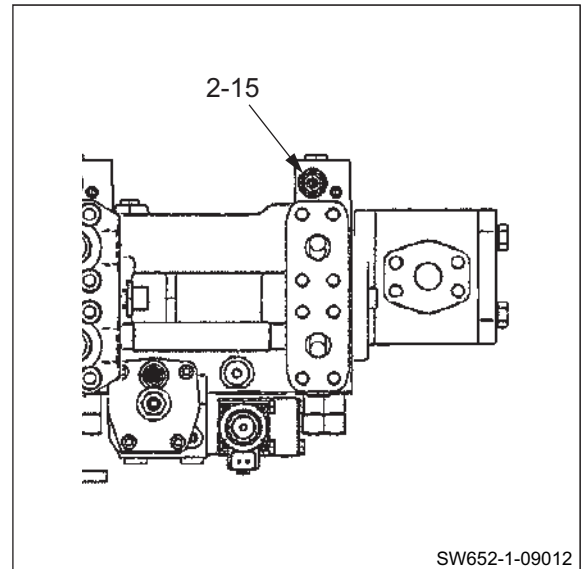


- (1) Nut : 22 N·m (16 lbf·ft)  
 (2-15) Cut off valve : 35 N·m (26 lbf·ft)

#### (NOTICE)

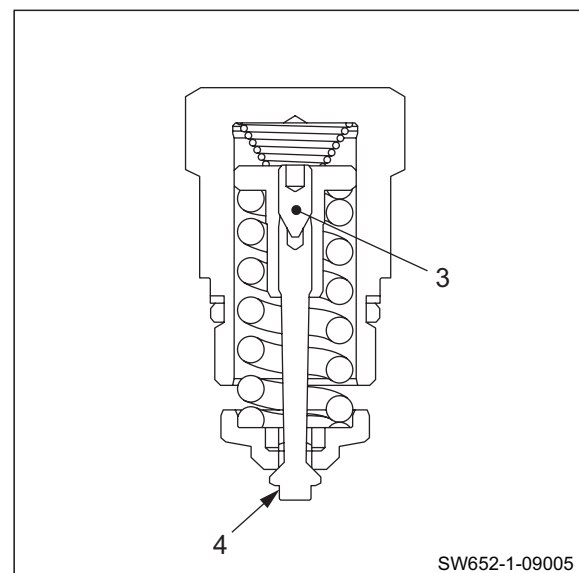
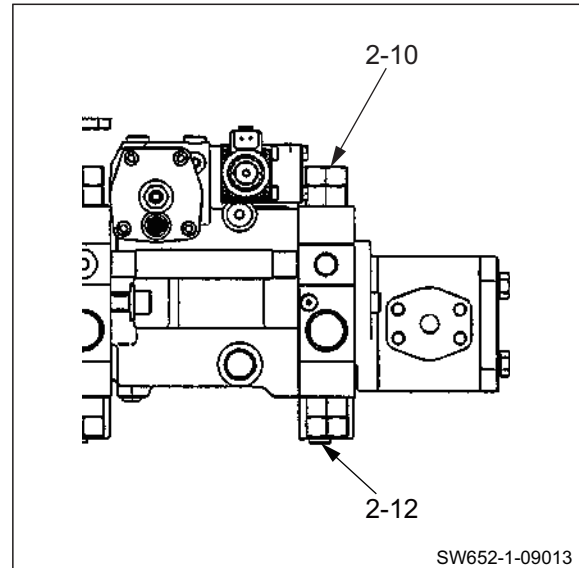
- **Carefully disassemble and reassemble after taking steps to prevent foreign material from getting in.**

- The number “2-15” appearing in above illustrations is consistent with lead line numbers shown in illustration of propulsion pump in “2-2. Hydraulic Component Specifications” (page 4-009).



**7-2-2. If pressure on either Low amplitude/Horizontal or High amplitude/Normal side deviates from maximum circuit pressure range**

- ① Check high pressure relief valve (2-10) or (2-12) for evidence of having loosened.
  - High pressure relief valve (High amplitude/Normal) : (2-12)
  - High pressure relief valve (Low amplitude/Horizontal) : (2-10)
- ② If there is evidence of high pressure relief valve having loosened, adjust it so that pressure becomes within maximum circuit pressure range while watching pressure gauge.
- ③ Remove high pressure relief valve.
- ④ Remove lock screw (3).
- ⑤ Turn adjustment screw (4) to adjust pressure.
  - Adjustment screw turned clockwise : Pressure rise
  - Adjustment screw turned counterclockwise : Pressure drop
  - Pressure change rate : 4.5 MPa/turn (653 psi/turn)
- ⑥ If there is no evidence of high pressure relief valve having loosened, remove it.
- ⑦ Check removed high pressure relief valve for trapped dirt and scratches on its seat.
- ⑧ If trapped dirt is present, disassemble and clean high pressure relief valve.
- ⑨ If a scratch is found on seat, replace high pressure relief valve.
- ⑩ After adjustment, measure pressure again and check that pressure reaches maximum circuit pressure range.



- (3) Lock screw : 6.5 N·m ( 4.8 lbf·ft)
- (2-10) and (2-12) High pressure relief valve : 160 N·m ( 118 lbf·ft)

**(NOTICE)**

- Carefully disassemble and reassemble after taking steps to prevent foreign material from getting in.

- The numbers “2-10” and “2-12” appearing in above illustrations are consistent with lead line numbers shown in illustration of propulsion pump in “2-2. Hydraulic Component Specifications” (page 4-009).



## 8. MEASUREMENT AND INSPECTION OF STEERING CIRCUIT PRESSURE

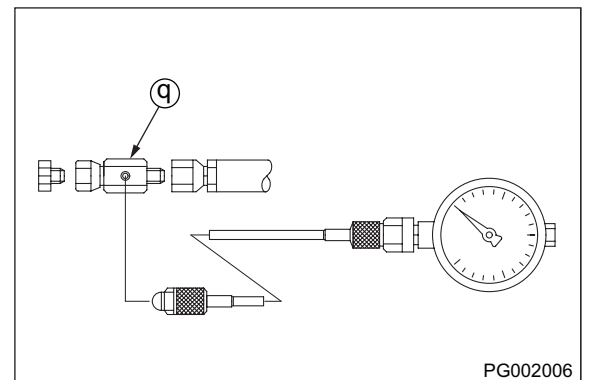
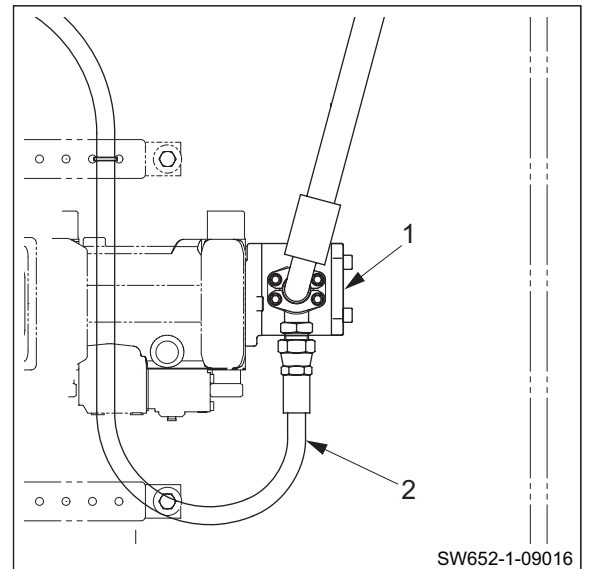
### 8-1. Measurement

#### **⚠ WARNING**

Make sure that there is no person around the articulated portion of the machine before operating the steering wheel.

- Oil temperature during measurement :  $50 \pm 5^{\circ}\text{C}$  ( $122 \pm 41^{\circ}\text{F}$ )
- ① Disconnect hose (2) from steering charge pump (1).  
Attach pressure gauge through the adapter ⑨ .
  - Adapter ⑨ : G3/4
  - Pressure gauge : 0 to 25 MPa (0 to 3,625 psi)
- ② Confirm that F-R lever is in "N" properly.
- ③ Start the engine and set throttle lever to "Full".
  - Turn steering wheel to operate relief valve.
  - Then, read pressure indicated by pressure gauge.

★ **Standard maximum circuit pressure**  
(orbitroll relief pressure + charge relief pressure)  
:  $17.6 \pm 1.0$  MPa ( $2,552 \pm 145$  psi)



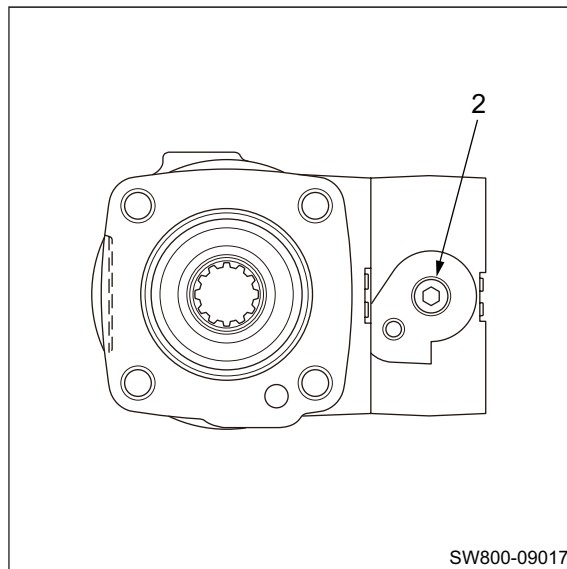
### 8-2. Inspection

- If measurement results indicate the pressure deviating from standard maximum circuit pressure range, make an adjustment in accordance with procedure described below.

- ① Remove relief valve (2) from orbitrol.
- ② Check removed relief valve for trapped dirt, scratches on its seat and other abnormalities.
- ③ If trapped dirt is present, disassemble and clean relief valve.
- ④ If a scratch or any other abnormality is found on seat, replace relief valve.
- ⑤ After inspection, measure pressure again and check that pressure reaches standard maximum circuit pressure range.




#### (NOTICE)

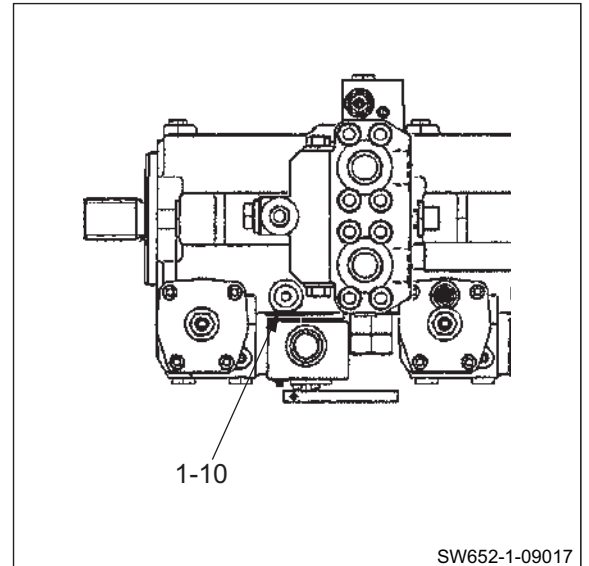
- **Carefully disassemble and reassemble after taking steps to prevent foreign material from getting in.**



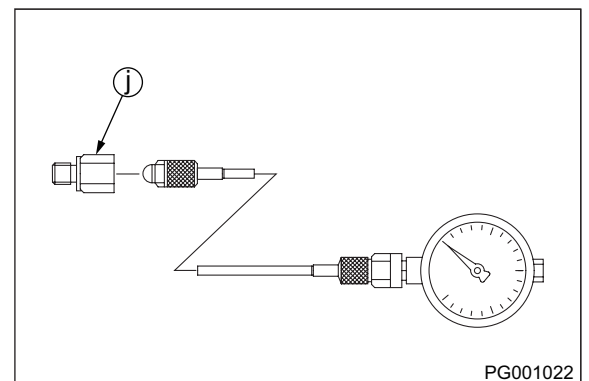
## 9. MEASUREMENT OF HYDRAULIC PUMP CASE PRESSURE

### 9-1. Measurement of Propulsion Pump Case Pressure

- Oil temperature during measurement :  $50 \pm 5^{\circ}\text{C}$  ( $122 \pm 41^{\circ}\text{F}$ )
- ① Remove plug from drain port (1-10). Attach pressure gauge with adapter ① .
  - Adapter ① : 7/8-14UNF
  - Pressure gauge : 0 to 5 MPa (0 to 725 psi)
- ② Set propulsion speed change switch to “”.
- ③ Set propulsion speed change lever to “1st”.
- ④ Start the engine and set throttle lever to “Full”.
- ⑤ Establish a condition in which machine propulsion load becomes maximum.  
(Pressure does not build up unless propulsion load is applied.)
- ⑥ With propulsion load at maximum, measure pressure when speed change switch is in “” and “” and F-R lever is in “N”, “F”, and “R”, respectively.



★ Pump case pressure : 0.4 MPa (58.0 psi) or less



- The number “1-10” appearing in above illustrations is consistent with lead line numbers shown in illustration of propulsion pump in “2-2. Hydraulic Component Specifications” (page 4-009).

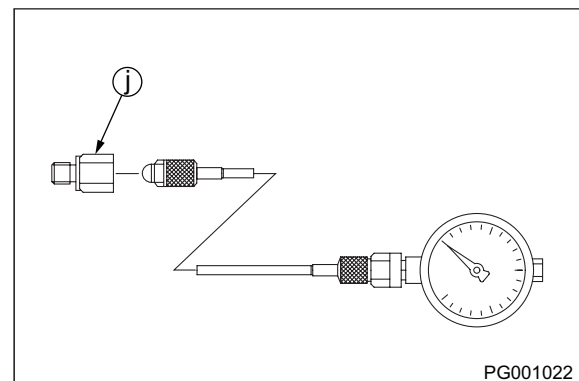
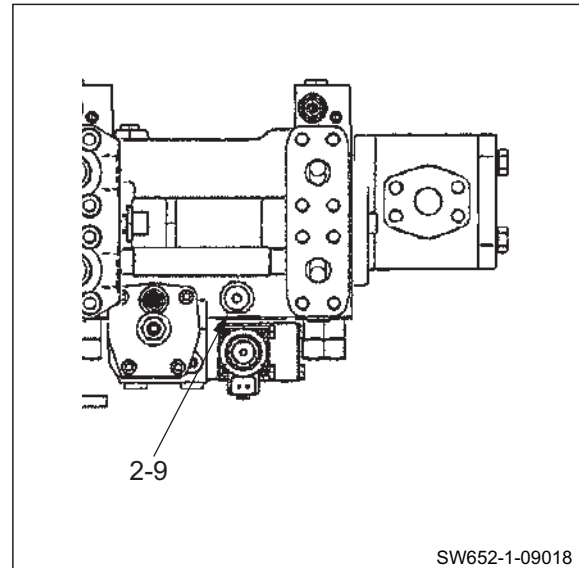
## 9-2. Measurement of Vibrator Pump Case Pressure

### **CAUTION**

Take care not to operate the vibratory drum for a longer period of time than necessary with the machine stationary. Otherwise, the vibrator bearing could be seized.

- Oil temperature during measurement :  $50 \pm 5^{\circ}\text{C}$  ( $122 \pm 41^{\circ}\text{F}$ )
- ① Remove plug from drain port (2-9). Attach pressure gauge through adapter ① .
  - Adapter ① : 7/8-14UNF
  - Pressure gauge : 0 to 5 MPa (0 to 725 psi)
- ② Apply parking brake by pressing parking brake switch button.
- ③ Set speed change lever to "1st".
- ④ Set vibratory drum selector switch to "F R".
- ⑤ Set vibration mode change switch to "V".
- ⑥ Start the engine and set throttle lever to "Full".
- ⑦ Press F-R lever vibration switch ON.
- ⑧ Slowly move F-R lever to forward or reverse side.
- ⑨ Measure pressure when vibration switch is in "V" / "V" and "V" / "V", respectively.
- ⑩ Turn F-R lever vibration switch OFF as soon as measurement is finished.




★ Pump case pressure : 0.4 MPa (58.0 psi) or less

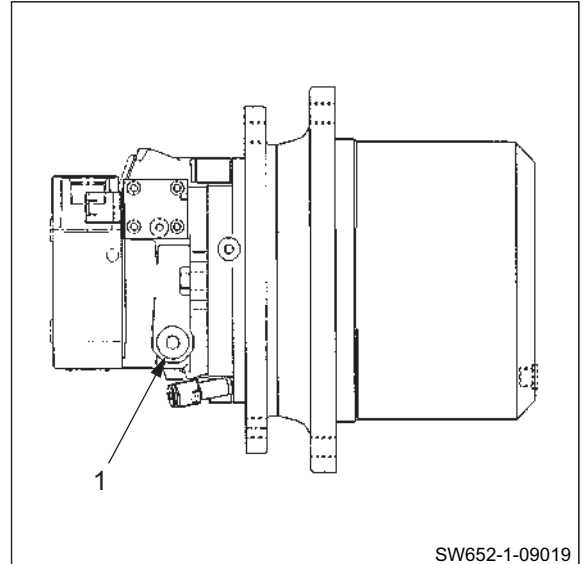


- The number "2-9" appearing in above illustrations is consistent with lead line numbers shown in illustration of propulsion pump in "2-2. Hydraulic Component Specifications" (page 4-009).

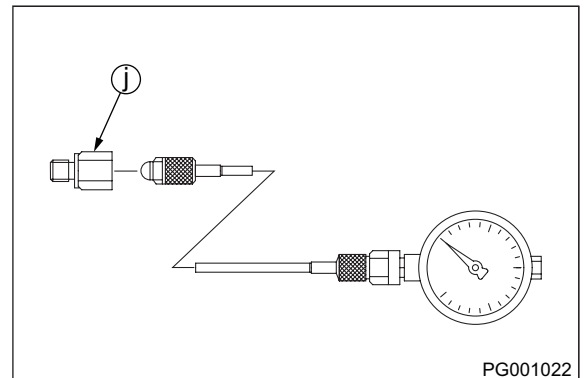
# 10. MEASUREMENT OF PROPULSION MOTOR CASE PRESSURE

## 10-1. Measurement

- Oil temperature during measurement :  $50 \pm 5^{\circ}\text{C}$  ( $122 \pm 41^{\circ}\text{F}$ )
- ① Remove plug from drain port (1). Attach pressure gauge and adapter ① .
  - Adapter ① : 7/8-14UNF
  - Pressure gauge : 0 to 5 MPa (0 to 725 psi)
- ② Set propulsion speed change switch to “”.
- ③ Set propulsion speed change lever to “1st”.
- ④ Start the engine and set throttle lever to “Full”.
- ⑤ Establish a condition in which machine propulsion load becomes maximum.  
(Pressure does not build up unless propulsion load is applied.)
- ⑥ With propulsion load at maximum, measure pressure when speed change switch is in “” and “” and F-R lever in “N”, “F”, and “R”, respectively.



★ Motor case pressure : 0.4 MPa (58.0 psi) or less



# 11. MEASUREMENT OF VIBRATOR MOTOR CASE PRESSURE

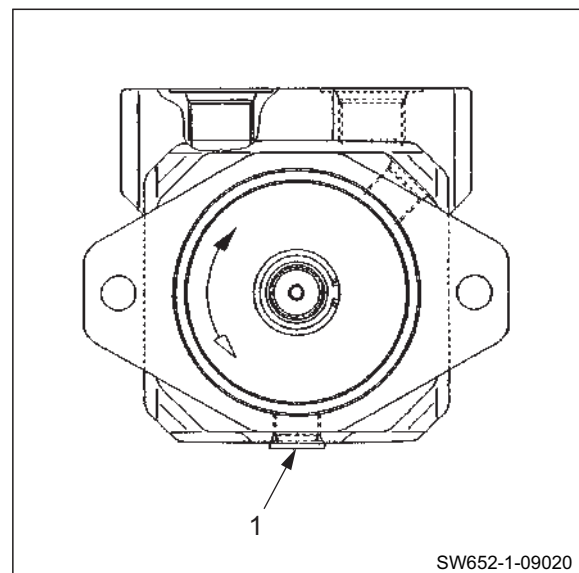
## 11-1. Measurement

### ⚠ CAUTION

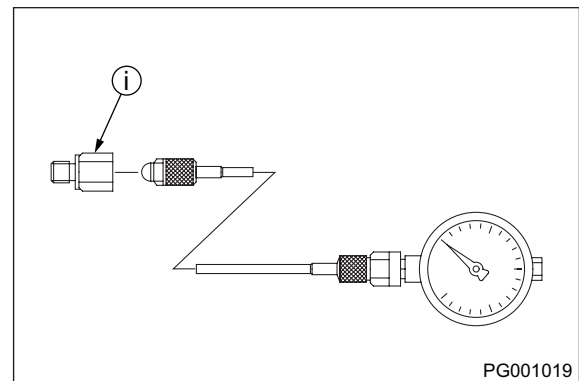
Take care not to operate the vibratory drum for a longer period of time than necessary with the machine stationary. Otherwise, the vibrator bearing could be seized.

- Oil temperature during measurement :  $50 \pm 5^{\circ}\text{C}$  ( $122 \pm 41^{\circ}\text{F}$ )
- ① Remove plug from drain port (1). Attach pressure gauge with adapter ①.
  - Adapter ① : 3/4-16UNF
  - Pressure gauge : 0 to 5 MPa (0 to 725 psi)
- ② Apply parking brake by pressing parking brake switch button.
- ③ Set speed change lever to "1st".
- ④ Set vibratory drum selector switch to "F R".
- ⑤ Set vibration mode change switch to "⚡".
- ⑥ Start the engine and set throttle lever to "Full".
- ⑦ Press F-R lever vibration switch ON.
- ⑧ Slowly move F-R lever to forward or reverse side.
- ⑨ Measure pressure when vibration switch is in "⚡" / "⚡" and "⚡" / "⚡", respectively.
- ⑩ Turn F-R lever vibration switch OFF as soon as measurement is finished.

★ Motor case pressure : 0.2 MPa (29.5 psi) or less



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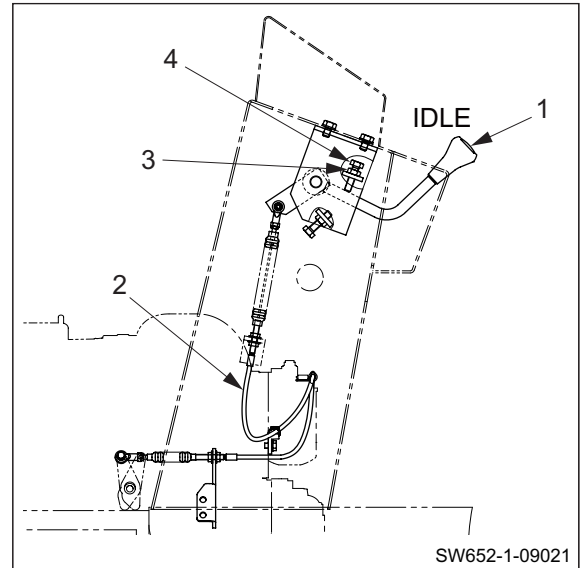


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## 12. ADJUSTMENT OF THROTTLE LEVER LINKAGE

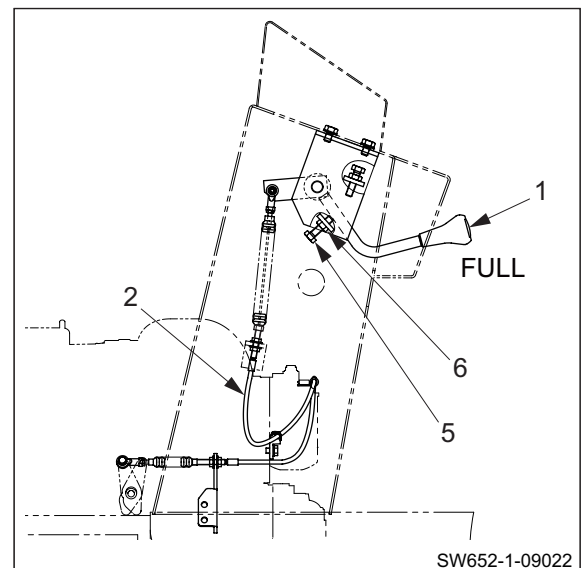
### 12-1. Adjustment

- If throttle lever linkage was replaced or maximum no-load rotational speed (minimum no-load rotational speed) deviates from standard value, make an adjustment in accordance with procedure described below.
  - Make the adjustment after amply warming up engine.
  - Oil temperature during measurement :  $50 \pm 5^{\circ}\text{C}$  ( $122 \pm 41^{\circ}\text{F}$ )
- ① Set throttle lever (1) to minimum no-load rotational speed position.
  - ② Attach control cable (2) to fuel injection pump's control lever (8).
  - ③ Start the engine.
  - ④ Loosen lock nut (3).
  - ⑤ Using stopper bolt (IDLE) (4), adjust so that standard minimum no-load rotational speed is achieved.



★ **Standard minimum no-load rotational speed**  
:  $1,000 \pm 50$  rpm

- ⑥ Set throttle lever (1) in maximum no-load rotational speed position.
- ⑦ Loosen lock nut (6).
- ⑧ Using stopper bolt (FULL) (5), adjust so that control lever (8) contacts stopper (7).
- ⑨ Confirm that engine speed is within standard range.

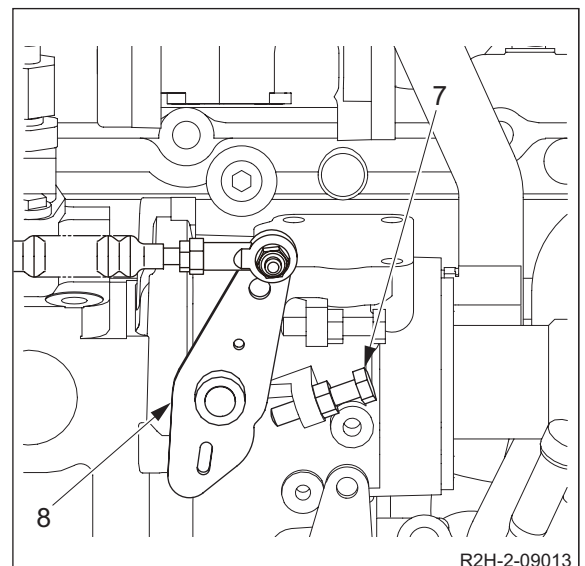


★ **Standard maximum no-load rotational speed**  
:  $2,400 \pm 50$  rpm

- ⑩ Using lock nuts (3 and 6), firmly secure stopper bolts (4 and 5).

#### (NOTICE)

- If maximum no-load rotational speed is not in standard range even when control lever (8) is against stopper (7), adjust injection nozzle, or repair or replace fuel injection pump.



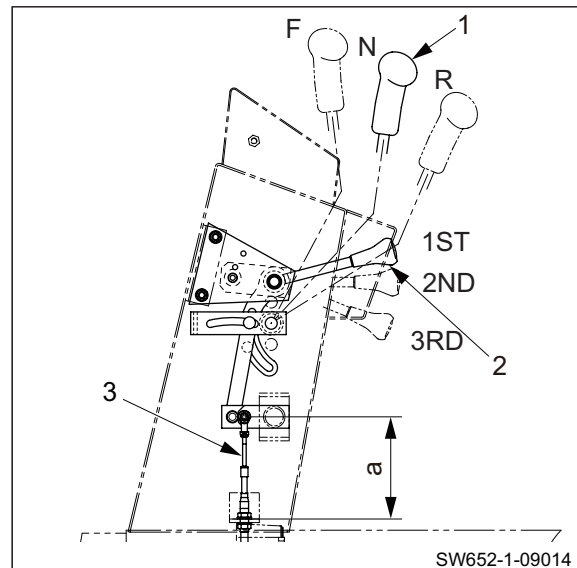
## 13. ADJUSTMENT OF F-R LEVER LINKAGE

### 13-1. Adjustment

- If F-R lever linkage was replaced, make an adjustment in accordance with procedure described below.
- Neutral position of F-R lever (1) and maximum stroke on forward-reverse side are positioned by notches.
- 1st, 2nd, and 3rd positions of speed change lever (2) are positioned by notches.

- ① Set F-R lever in "N".
- ② Set speed change lever to "1st".
- ③ Firmly secure both ends of control cable (3).

★ Specified dimension of control cable ends  
a: 171 mm (6.73 in.)

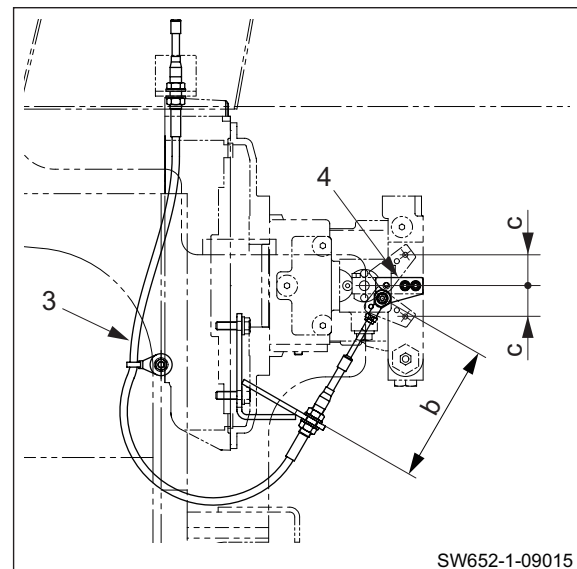


★ Specified dimension of control cable ends  
b: 171 mm (6.73 in.)

- ④ Confirm the stroke of control lever (4) on propulsion pump side.

★ Specified dimension of control lever

c: 1st	16 mm (0.6 in.)
2nd	25 mm (1.0 in.)
3rd	38 mm (1.5 in.)



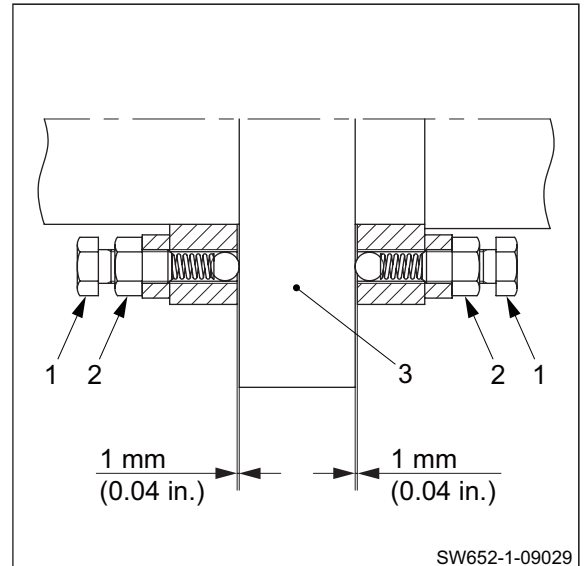


## 14. MOVABLE WEIGHT ADJUSTMENT

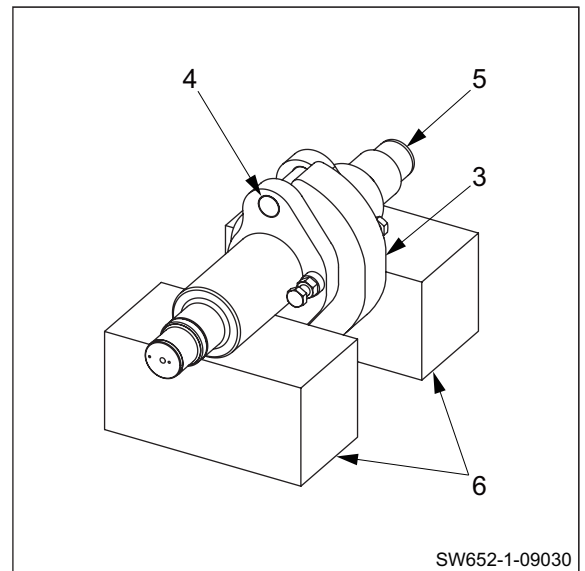
- When eccentric shaft is replaced, make adjustment as follows.
- Be sure to replace bolts and nuts with new ones as these are not allowed to reuse.

### 14-1. Movable Weight Adjustment

- ① Tighten bolts (1) until gaps at both sides of movable weight (3) becomes 1mm (0.04 in.) each.



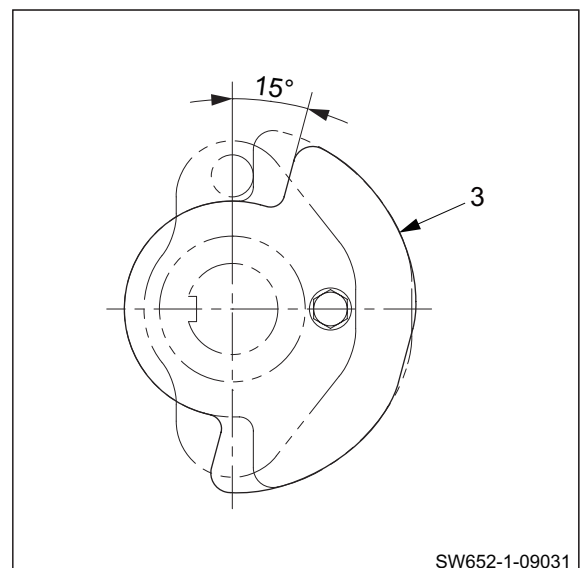
- ② Put eccentric shaft (5) on wooden blocks (6) with stopper (4) placed at top.
- ③ Put movable weight against stopper.



- ④ Make sure that movable weight starts to swing down by its own weight when movable weight is rotated away from stopper by 15°.
- ⑤ If swinging does not start at 15°, adjust with bolts.
- ⑥ Securely lock with nuts (2).

#### (NOTICE)

- After adjustment is made, be sure to caulk bolts and nuts to prevent turning.





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# **TROUBLESHOOTING**

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# 1. TROUBLESHOOTING

## 1-1. Safety Precautions for Troubleshooting

### WARNING

Unexpected machine movement may cause a serious accident. When inspecting the machine while the engine is running, always follow the instructions below.

- Park the machine on level, flat ground.
- Apply the parking brake.
- Set chocks in front and behind each drum or tire.
- Make sure that service personnel are given the appropriate information at the appropriate time.
- Make sure that no one can enter any hazardous area.

### CAUTION

Do not work on the hydraulic system while the engine is running and the system is hot and under pressure. Do not disconnect hydraulic hoses or fittings until the system has cooled and pressure has been properly relieved.

Before removing any plugs from the pressure measurement ports, always release any residual pressure from the piping and open the cap of the fluid tank to release and pressure.

### WARNING

Inadvertent starting the engine may cause a serious accident.

When inspecting the engine, make sure to exchange the appropriate cues and hand signal with the person at the operator station to avoid any accidents.

### CAUTION

Before inspecting inside of the engine compartment, always stop the engine.

Contact with the fan, V-belt or exhaust system parts while the engine is running may cause serious injury.

## 1-2. Important Information for Troubleshooting

Before conducting troubleshooting, it is important to carefully read the operation manual and workshop manual and understand the electric circuits for each component as well as the structure and function of each system. Sufficient knowledge of the systems will enable you to identify a possible cause much faster. A fault or problem may seem to be related to many different factors. To identify the true cause, some experience is needed. To perform the appropriate troubleshooting, it is important to learn not only the normal operations of the systems but also the possible symptoms that may occur when an abnormal condition is present.

This chapter explains the possible causes and remedies for likely incidents taken from past experience.

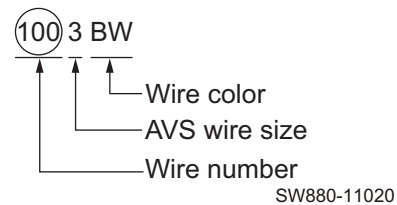
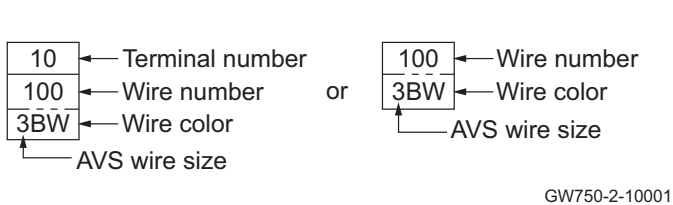
### 1-3. Before Starting

The information in this section is provided to assist the troubleshooter in understanding the systems and quickly determine the causes when operating abnormalities occur.

The following steps are recommended:

1. If not familiar with the machine, study the Operator's Manual and this Shop Manual.
2. Check with the operator for full details of the trouble, ask questions.
3. Verify the trouble by warming up the machine and operating it. Check the problem yourself.
4. Identify the problem with either a mechanical, hydraulic or electrical system source.
5. Isolate the problem to a particular component or circuit.
6. Eliminate the simplest or easiest to check possibilities first to prevent unnecessary disassembly of components.
7. Following repair or replacement of any parts, perform operational tests to verify that the problem has been eliminated and the performance of all the systems is normal.

### 1-4. Wire Color Code and Number



- The arrangement of connector terminals shown above is that of connecting surfaces on the connector side.

- Wire number, wire size and wire color are shown as above in electrical circuit diagrams.

B	Black	BW	Black/White stripe	BY	Black/Yellow stripe	BR	Black/Red stripe	BG	Black/Green stripe	BL	Black/Blue stripe			O	Orange	YO	Yellow/Orange stripe
W	White	WR	White/Red stripe	WB	White/Black stripe	WL	White/Blue stripe	WY	White/Yellow stripe	WG	White/Green stripe					LO	Blue/Orange stripe
R	Red	RW	Red/White stripe	RB	Red/Black stripe	RY	Red/Yellow stripe	RG	Red/Green stripe	RL	Red/Blue stripe					GO	Green/Orange stripe
G	Green	GW	Green/White stripe	GR	Green/Red stripe	GY	Green/Yellow stripe	GB	Green/Black stripe	GL	Green/Blue stripe			Gy	Gray	GyR	Gray/Red stripe
Y	Yellow	YR	Yellow/Red stripe	YB	Yellow/Black stripe	YG	Yellow/Green stripe	YL	Yellow/Blue stripe	YW	Yellow/White stripe					GyL	Gray/Blue stripe
Br	Brown	BrW	Brown/White stripe	BrR	Brown/Red stripe	BrY	Brown/Yellow stripe	BrB	Brown/Black stripe	BrG	Brown/Green stripe	BrL	Brown/Blue stripe	Sb	Sky blue		
L	Blue	LW	Blue/White stripe	LR	Blue/Red stripe	LY	Blue/Yellow stripe	LB	Blue/Black stripe	LG	Blue/Green stripe			P	Pink	PB	Pink/Black stripe
Lg	Light green	LgR	Light green/Red stripe	LgY	Light green/Yellow stripe	LgB	Light green/Black stripe	LgW	Light green/White stripe	LgL	Light green/Blue stripe			Pu	Purple		

## 2. ELECTRICAL SYSTEM TROUBLESHOOTING

### 2-1. When Performing Electrical System Fault Diagnosis

#### **⚠ WARNING**

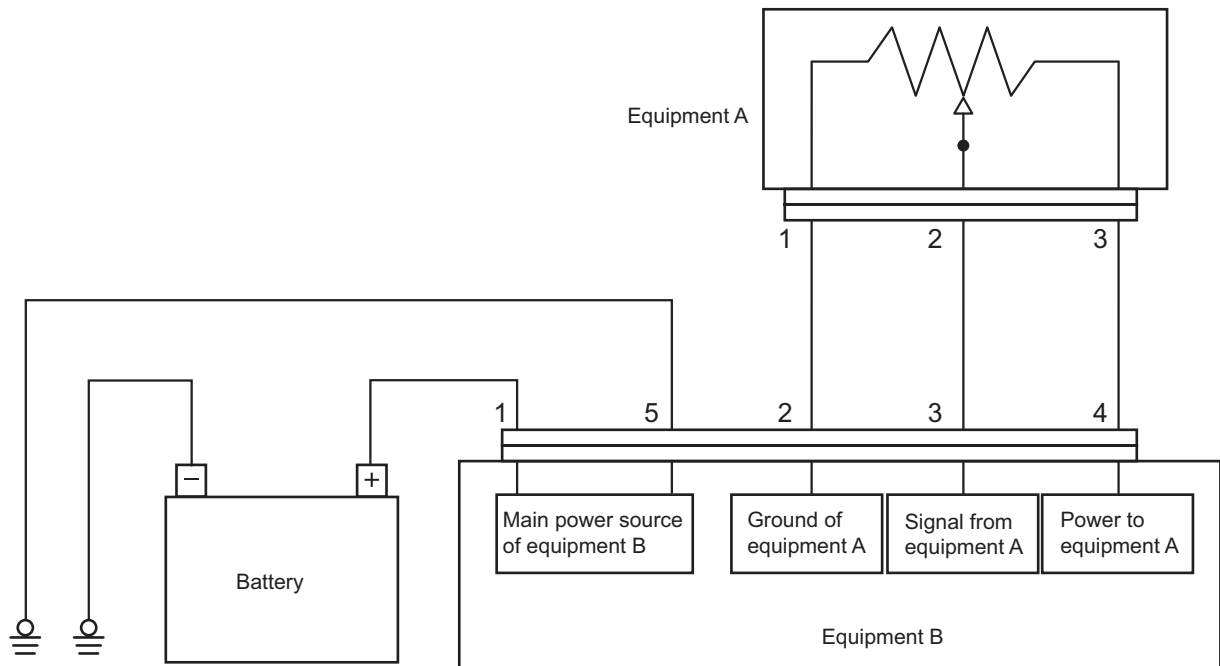
Be very careful because equipment can return to normal during an inspection and suddenly operate properly when a failure occurs due to a faulty contact or other such cause.

#### 2-1-1. Precautions to take during electrical circuit fault diagnosis

- When disconnecting or connecting a connector, be sure to turn the power supply OFF. (Electronic control parts such as the engine control unit, in particular, could be damaged internally.)
- Since connectors are not numbered, be sure to affix alignment marks so that you can restore them to their original condition.
- Before making a diagnosis, check related connectors for faulty connections. (Check by disconnecting and reconnecting related connectors several times.)
- Before proceeding to the next step, be sure to return the disconnected connectors to their original condition.
- When diagnosing a circuit (measuring the voltage, resistance, continuity and current), move related wiring and connectors several times, and check whether the tester's numerical values change. (If values change, faulty contact in the circuit is possible.)
- Do not ground the circuit of the control unit or apply voltage to it unless otherwise specified.

2-1-2. Inspection procedures using a tester

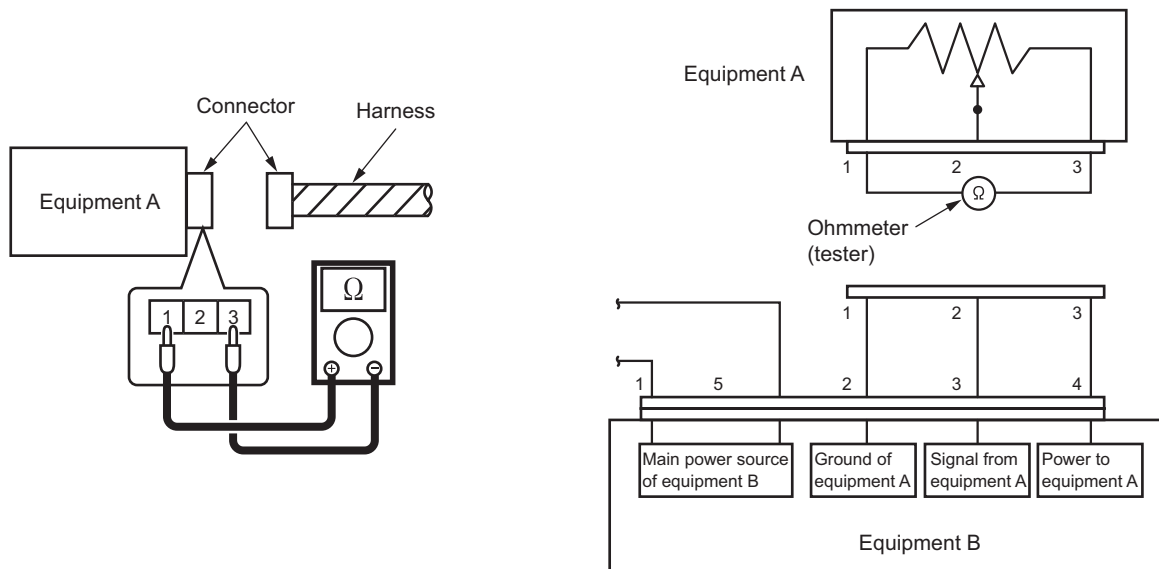
Some of the various inspection procedures are presented here for reference, using a sample circuit below.



GW750-2-10003

1) Measuring resistance using tester

1-1) Measuring resistance of equipment A (measuring resistance between terminals 1 and 3)



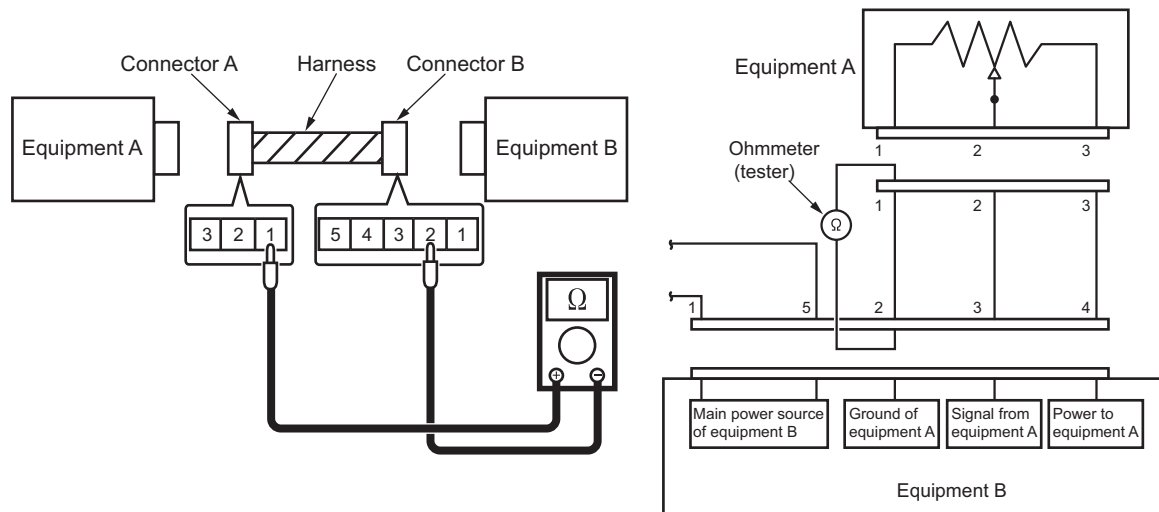
GW750-2-10004

Inspection procedure

- ① Disconnect the connector of equipment A.
- ② Connect the test probe (+) to connector terminal 1 of equipment A and the test probe (-) to connector terminal 3 of equipment A and measure the resistance. At this time, reversing the connector terminals between the probes (+) and (-) does not make any difference in the measurement.



- 1-2) Measuring resistance of harness (measuring resistance between terminal 1 of equipment A and terminal 2 of equipment B)



GW750-2-10005

#### Inspection procedure

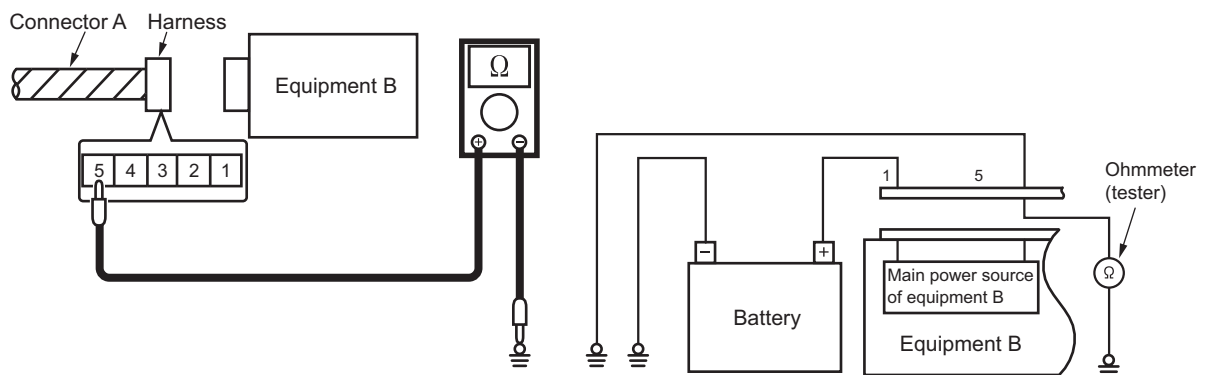
- ① Disconnect the connectors of equipment A and equipment B.
- ② Connect the test probe (+) to connector terminal 1 of equipment A and the test probe (-) to connector terminal 2 of equipment B and measure the resistance. At this time, reversing the connector terminals between the probes (+) and (-) does not make any difference in the measurement.

#### Criteria for harness defects

When there is no abnormality in the harness: Less than 10  $\Omega$  (measured value)

If there is any abnormality in the harness such as broken wire: 10  $\Omega$  or higher (measured value)

- 1-3) Measuring resistance of grounding wire (measuring resistance between terminal 5 of equipment B and ground)



GW750-2-10006

#### Inspection procedure

- ① Disconnect the connector of equipment B.
- ② Connect the test probe (+) to connector terminal 5 of equipment B and the test probe (-) to a machine ground point (the bolt fastening the ground terminal or an unpainted portion on the body) and measure the resistance. At this time, reversing the connector terminals between the probes (+) and (-) does not make any difference in the measurement.

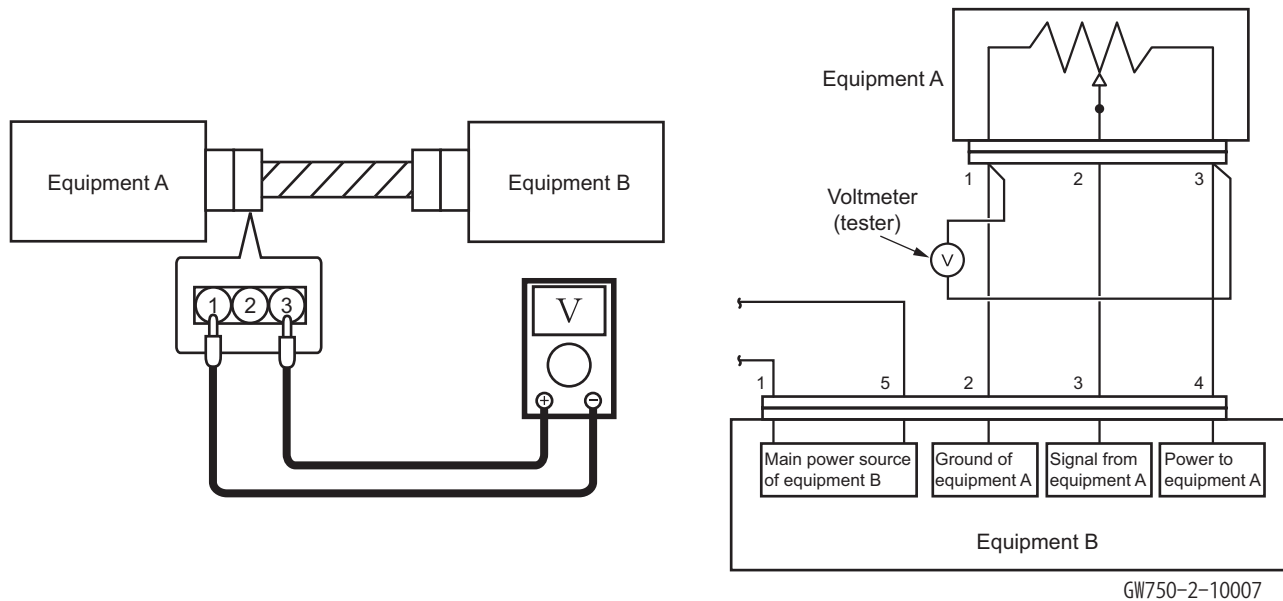
#### (NOTICE)

- When measuring the resistance, connect the test probes to both ends of the portion to be measured. Make also sure that no voltage is applied to the portion to be measured.
- When measuring the internal resistance of equipment, be sure first to disconnect all harnesses from the equipment.
- When measuring the resistance of a harness, disconnect the equipment connected to both ends of the harness.

## TROUBLESHOOTING

### 2) Measuring voltage and current flowing using tester

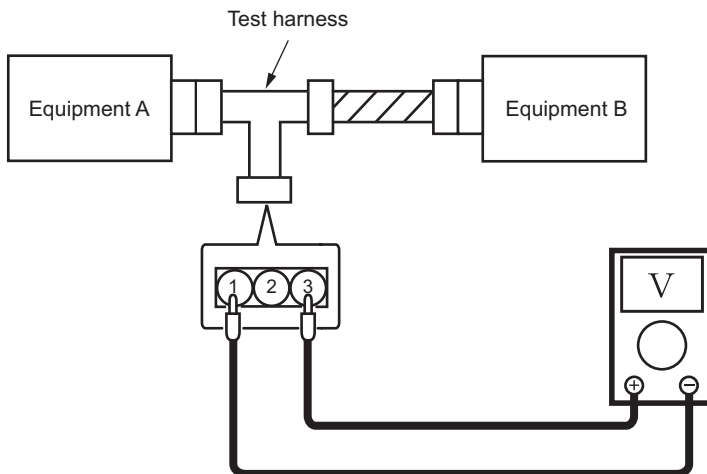
#### 2-1) Measuring voltage of equipment A (measuring voltage between terminals 1 and 3)



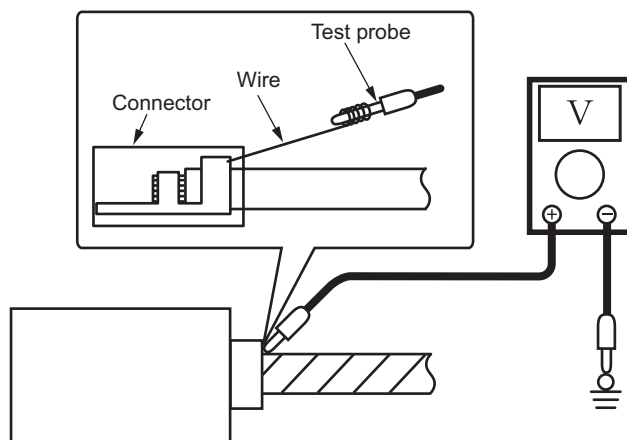
#### Inspection procedure

- ① Connect the connectors of equipment A and that of equipment B.
- ② Connect the test probe (+) to connector terminal 3 of equipment A and the test probe (-) to connector terminal 1 of equipment A and measure the voltage. Note that reversing the connector terminals between the probes (+) and (-) changes the result of the measurement. Be sure to connect the probe (+) to the power source side and the probe (-) to the ground side.

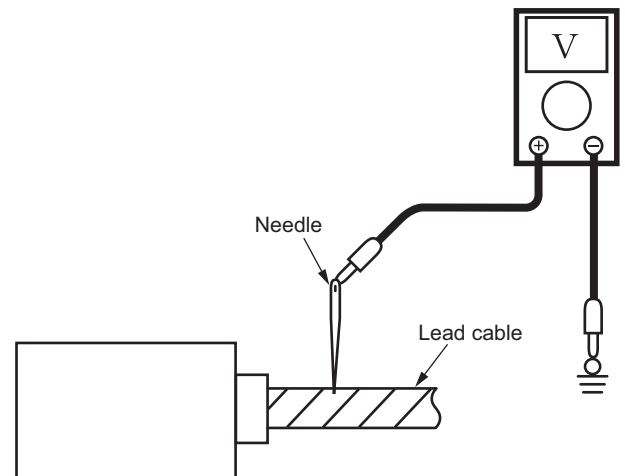
- Measurement using a test harness



- Measurement from the backside of connector



- Measurement on a lead cable



GW750-2-10002

#### Measurement method

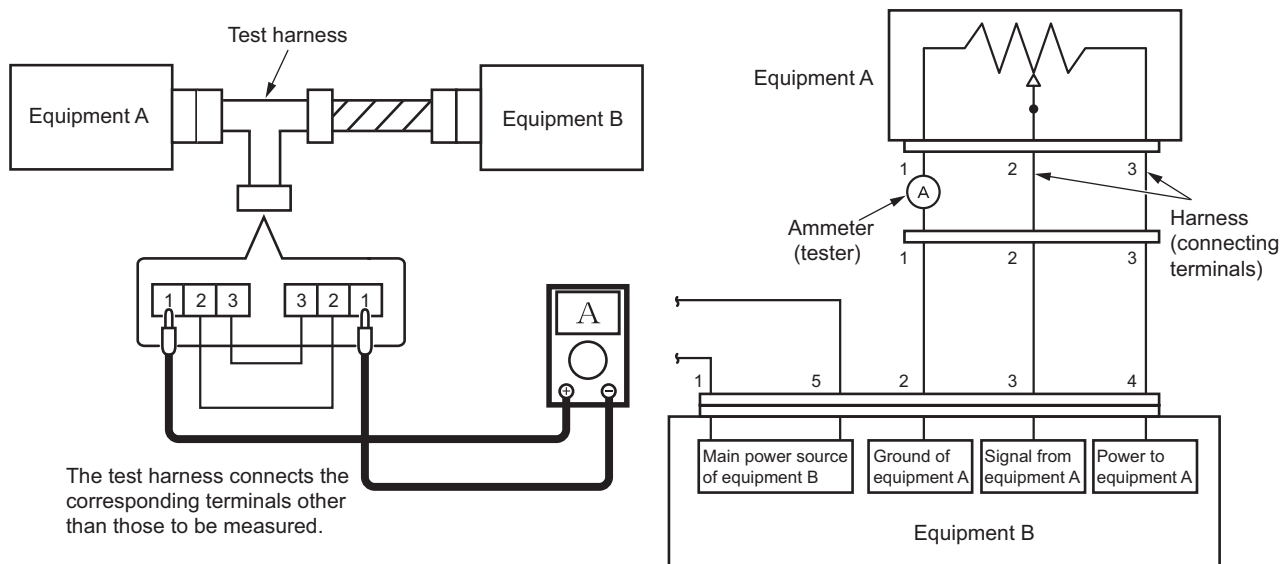
For measurement of voltage, connect the tester probes in parallel to the portion to be measured. Because the voltage can be measured only when the connector is connected in position, contact the tester probes to the terminals without disconnecting the connector. The following methods are available:

- Measurement using a test harness
  - Prepare the test harness for the measurement.
- Measurement from the backside of connector
  - Insert a wire from the backside of the connector.
- Measurement on a lead cable
  - Remove the bundling tape from the harness to separate each cable, and stick the needle into the relevant cable.

#### (NOTICE)

- Except for preparing the test harness, proper protection must be made after the measurement to prevent corrosion in the connector terminals or harnesses.

- 2-2) Measuring current flowing from equipment B to equipment A  
 (measuring current between terminal 2 of equipment B and terminal 1 of equipment A)



GW750-2-10008

### Inspection procedure

- ① Disconnect the connector of equipment A and connect the test harness.
- ② Connect the test probe (+) to connector terminal 1 (harness side) of equipment A and the test probe (-) to connector terminal 1 (equipment side) of equipment A and measure the current. Note that reversing the connector terminals between the probes (+) and (-) changes the result of the measurement. Be sure to connect the probe (+) to the power source side and the probe (-) to the ground side.

### Measurement method

When measuring the current, connect the tester in series to the portion to be measured. Because the current cannot be measured when the connector is connected in position, disconnect the connector to allow the test probe to connect between the terminals.

## 2-1-3. Inspection of electrical system

Operate the applicable switches and turn the relays ON and OFF. Ultimately, if the solenoid valve operates (makes a sound) and the pump runs, the electrical system is OK.

If there is a failure (fault), narrow the range of the inspection to the six broad steps described below.

### 1) Ground inspection

- Check for disconnected or loose ground. If rust or corrosion is present (which can cause faulty contact), remove the rust.

### 2) Fuse inspection

2-1) Check for blown fuses, disconnections and corrosion. (A fatigue open circuit cannot be identified visually. Use a tester for checking.)

#### 2-2) If a fuse is blown

Check whether a pump or valve (that is supposed to be protected by a blown fuse) burned, and whether there is a burning odor.

Especially if the pump and valve are not burned, check the harness for signs of burning. If it is burned, replace it.

If a fuse is blown and a relay along the pathway has failed, replace it. And if there is a timer, replace the timer, too. If a switch visually appears to be unsatisfactory (burned, melted, etc.) even though it operates, replace it.

- Simply replacing a fuse may not eliminate the true cause of a problem, and over current may flow again. Also, if over current secondarily causes an electrical path to fail (such as a wiring meltdown inside a solenoid valve), current will not flow. Thus, a fuse may not be blown out, but it also will not operate. If you do not know the location of burning or of an odor, investigate as described follows.

#### 2-3) How to find cause of failure when fuse blown is reproduced

- ① Turn the starter switch OFF, and remove the connector from the load (valve, pump).
- ② Referring to the circuit diagram, remove electrical parts that are connected to the circuit, such as relays, timers and diodes.
- ③ Turn the starter switch ON, and see whether the conditions can be reproduced (fuse is blown).
- ④ If a fuse is blown, a part such as a relay may have caused a short between the previous harness and ground (vehicle body). (Replace the harness.) If the conditions are not reproduced, check for signs of burning (odor) on the removed electrical parts.
- ⑤ If there is no problem, turn the starter switch OFF and reattach the parts.
- ⑥ Turn the starter switch ON and try again.
- ⑦ If a fuse is blown with this action, the problem was caused by a short between the harness and ground (vehicle body) that followed the attached electrical part. (Replace the harness.)
- ⑧ If the conditions are not reproduced, turn the starter switch OFF, and connect the loads (valve and pump) one at a time. Turn the starter switch ON and try again to see whether the fuse blown is reproduced.
- ⑨ If the fuse blown is reproduced, whatever was added at that time (including a harness added electrically) will be the cause of the failure.
  - Even if the fuse is not blown and the valve or pump is not burned, the valve or pump may be damaged electrically and may not operate. There may simply be a disconnection in the interior or an abnormal heat-up.
  - Even if the fuse is not blown, abnormal heat-up (hot enough to cause burns if touched) may occur if a relay, timer, diode or other semiconductor fails.

### 3) Connector inspection

- Is a connector disconnected or loose?
- Check that pins are not snapped or corroded.
- If faulty contact is suspected

Turn the starter switch OFF. Then disconnect and check the connectors (including relay and switch sockets).

If the terminal has no luster, faulty contact due to oxidation can be suspected. Therefore, polish the terminal by inserting and removing the connector (relay, switch) repeatedly at least five times. (Luster will return.)

### 4) Relay inspection (Check ON/OFF operation by sound.)

- Conduct without running the engine. (If you run the engine, you cannot hear the sound of operation.)

Sound heard : A relay failure occurred.

No sound heard : Using a tester, check the harness.

Sound heard : A relay failure occurred.

Still no sound : Using a tester, check the harness.

Continuity : Turn the starter switch OFF temporarily, disconnect the relay and check for continuity between the harness-side grounding terminal (color: black) and vehicle body ground. (If there is none, replace the harness.)

Voltage : With the relay disconnected, turn the starter switch ON and turn the operating switch ON. 24 V (or 12 V) (between vehicle body ground) should not reach the relay coil input terminal. Confirm this. Identify the location (section) to which 24 V (or 12 V) reaches. Then replace the harness or take other action.

### 5) Solenoid valve inspection (Check ON/OFF operation by sound.)

- Conduct without running the engine. (If you run the engine, you cannot hear the sound of operation.)

Sound heard : The electrical system is normal.

No sound heard : Check with a tester.

Continuity : ① Turn the starter switch OFF temporarily, disconnect the connector and check for continuity between the harness-side grounding terminal (color: black) and vehicle body ground. (If there is none, replace the harness.)

: ② Is the solenoid valve coil burnt?

(Turn the starter switch OFF, disconnect the connector and check the resistance between the solenoid valve terminals.)

Voltage : With the connector disconnected, turn the starter switch ON and check whether 24 V (or 12 V) exists between the harness-side connector and vehicle body ground.

If YES : Replace the valve.

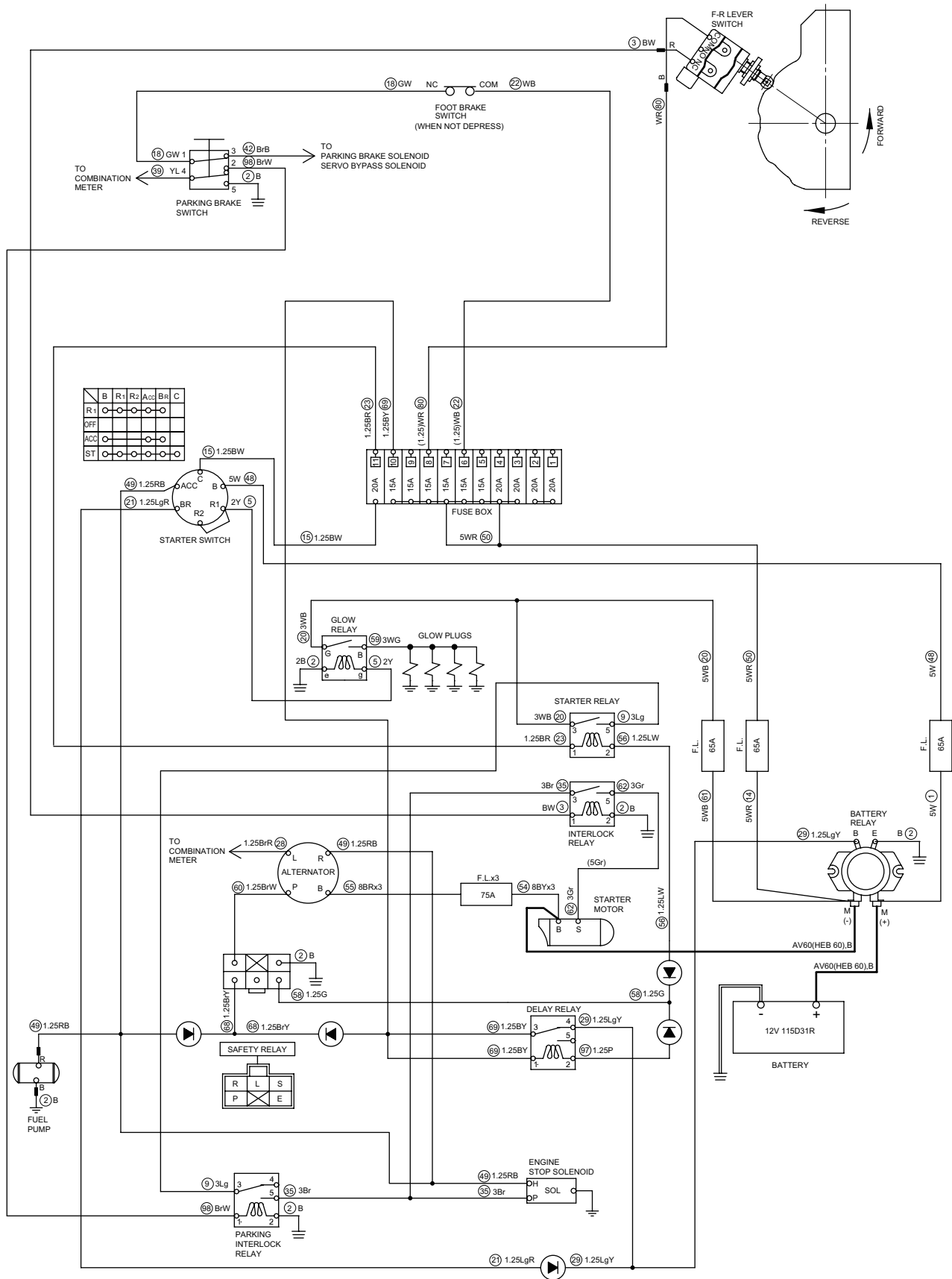
If NO : Investigate and identify the location (section) to which 24 V (or 12 V) reaches. Then replace the harness or take other action.

### 6) Harness check

- If an incomplete disconnection inside the harness is suspected, wiggle (move) the harness during the relay inspection and solenoid valve inspection to see whether the relay (valve) operates incorrectly.
- Check for burned areas of the harness.
- Turn the starter switch OFF, disconnect the connector and check the continuity, referring to the circuit diagram and wiring coloring.



Fig.: 2-2-1





## 2-2. Engine

Check following items before troubleshooting.

- No blown fuses and power is applied up to fuses.
- Check any ground circuit which belongs to components to be checked.

### 2-2-1. Engine will not start (Starter motor does not run) 1/3

- F-R lever must be in "N".
- Parking brake switch must be applied.
- Foot brake switch must be ON (Brake pedal is not depressed).

#### Reference Fig.: 2-2-1

Check point	Check/Cause	Action
1. Battery	<ul style="list-style-type: none"> <li>• Measure battery voltage or specific gravity. Standard voltage : 12 V or more Standard gravity : 1.26 or more</li> <li>• If value is below standard, battery capacity is insufficient.</li> </ul>	Charge or replace battery.
2. Starter Switch	<ul style="list-style-type: none"> <li>• Check continuity between O-O according to starter switch connection table. Switch is OK if there is continuity between connection O-O.</li> <li>• If there is no continuity, starter switch is faulty.</li> </ul>	Replace starter switch.
3. Starter Motor	<ol style="list-style-type: none"> <li>(1) When starter switch is ON, measure voltage between starter motor terminal B and chassis ground. Standard voltage : 12 V or more</li> <li>(2) When starter switch is START, measure voltage between starter motor terminal S and chassis ground. Standard voltage : 12 V or more</li> </ol> <ul style="list-style-type: none"> <li>• If starter motor does not run even though above items (1) and (2) are OK, starter motor is faulty.</li> </ul>	Replace starter motor.
4. Safety Relay	<ol style="list-style-type: none"> <li>(1) When starter switch is ON, measure voltage between safety relay terminal R inlet wire BrY and chassis ground. Standard voltage : 12 V or more</li> <li>(2) When starter switch is START, measure voltage between safety relay terminal S inlet wire G and chassis ground. Standard voltage : 12 V or more</li> <li>(3) Check that no abnormality is found in safety relay ground terminal.</li> </ol> <ul style="list-style-type: none"> <li>• If above items (1), (2) and (3) are OK and starter motor does not run, safety relay is faulty.</li> </ul>	Replace safety relay.
5. Battery Relay	<ol style="list-style-type: none"> <li>(1) When starter switch is OFF, measure voltage between battery relay primary terminal M (+) and chassis ground. Standard voltage : 12 V or more</li> <li>(2) When starter switch is ON, measure voltage between battery relay coil terminal B inlet wire LgY and coil ground terminal E. Standard voltage : 12 V or more</li> <li>(3) When starter switch is ON, measure voltage between battery relay secondary terminal M (-) and chassis ground. Standard voltage : 12 V or more</li> </ol> <ul style="list-style-type: none"> <li>• If above items (1) and (2) are OK and item (3) is NG, battery relay is faulty.</li> </ul>	Replace battery relay.



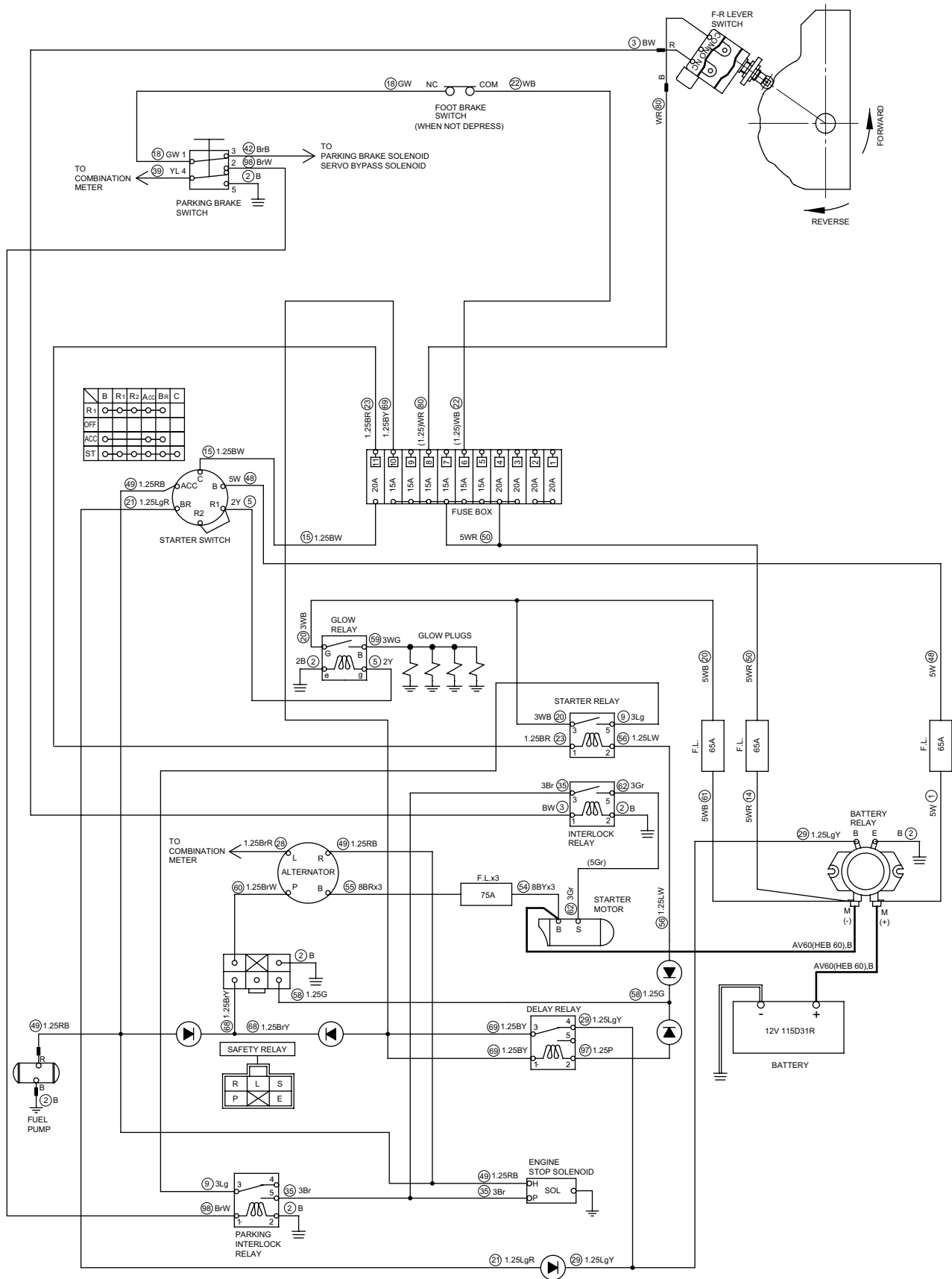
**2-2-1. Engine will not start (Starter motor does not run) 2/3**

- F-R lever must be in "N".
- Parking brake switch must be applied.
- Foot brake switch must be ON (Brake pedal is not depressed).

**Reference Fig.: 2-2-1**

Check point	Check/Cause	Action
6. F-R Lever Switch	<p>(1) When starter switch is ON, measure voltage between F-R lever switch terminal COM inlet wire WR and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between F-R lever switch terminal NC outlet wire BW and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, F-R lever switch is faulty.</li> </ul>	Replace F-R lever switch.
7. Interlock Relay	<p>(1) When starter switch is ON, measure voltage between interlock relay terminal 1 inlet wire BW and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is START, measure voltage between interlock relay terminal 3 inlet wire Br and chassis ground. Standard voltage : 12 V or more</p> <p>(3) When starter switch is START, measure voltage between interlock relay terminal 5 outlet wire Gr and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above items (1) and (2) are OK and item (3) is NG, interlock relay is faulty.</li> </ul>	Replace interlock relay.
8. Parking Interlock Relay	<p>(1) When starter switch is ON, measure voltage between parking interlock relay terminal 1 inlet wire BrW and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is START, measure voltage between parking interlock relay terminal 3 inlet wire Lg and chassis ground. Standard voltage : 12 V or more</p> <p>(3) When starter switch is START, measure voltage between parking interlock relay terminal 5 outlet wire Br and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above items (1) and (2) are OK and item (3) is NG, parking interlock relay is faulty.</li> </ul>	Replace parking interlock relay.

Fig.: 2-2-1



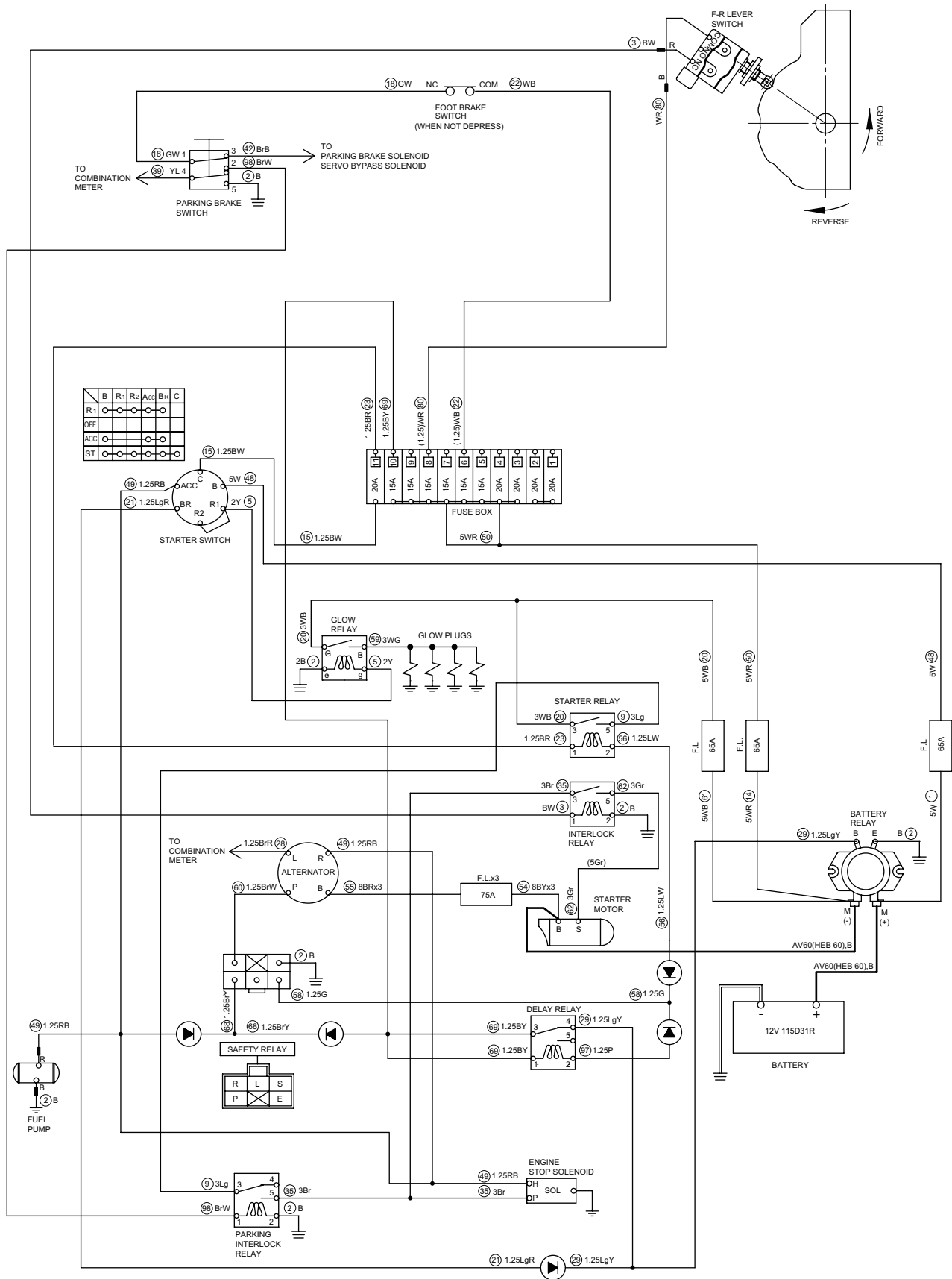
**2-2-1. Engine will not start (Starter motor does not run) 3/3**

- F-R lever must be in "N".
- Parking brake switch must be applied.
- Foot brake switch must be ON (Brake pedal is not depressed).

**Reference Fig.: 2-2-1**

Check point	Check/Cause	Action
9. Starter Relay	<p>(1) When starter switch is START, measure voltage between starter relay terminal 1 inlet wire BR and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between starter relay terminal 3 inlet wire WB and chassis ground. Standard voltage : 12 V or more</p> <p>(3) When starter switch is START, measure voltage between starter relay terminal 5 outlet wire Lg and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above items (1) and (2) are OK and item (3) is NG, starter relay is faulty.</li> </ul>	Replace starter relay.
10. Foot Brake Switch	<p>(1) When starter switch is ON, measure voltage between foot brake switch terminal COM inlet wire WB and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between foot brake switch terminal NC outlet wire GW and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, foot brake switch is faulty</li> </ul>	Replace foot brake switch.
11. Parking Brake Switch	<p>(1) When starter switch is ON, measure voltage between parking brake switch terminal 1 inlet wire GW and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between parking brake switch terminal 2 outlet wire BrW and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, parking brake switch is faulty.</li> </ul>	Replace parking brake switch.
12. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : 10 <math>\Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.

Fig.: 2-2-1



## 2-2-2. Engine will not start (But starter motor runs)

- In case of engine will not start while starter motor runs, generally trouble is caused by that fuel is not supplied, supply amount of fuel is extremely low, or selection of fuel is not appropriate.
- Check that fuel is supplied to inlet of fuel pump.

### Reference Fig.: 2-2-1

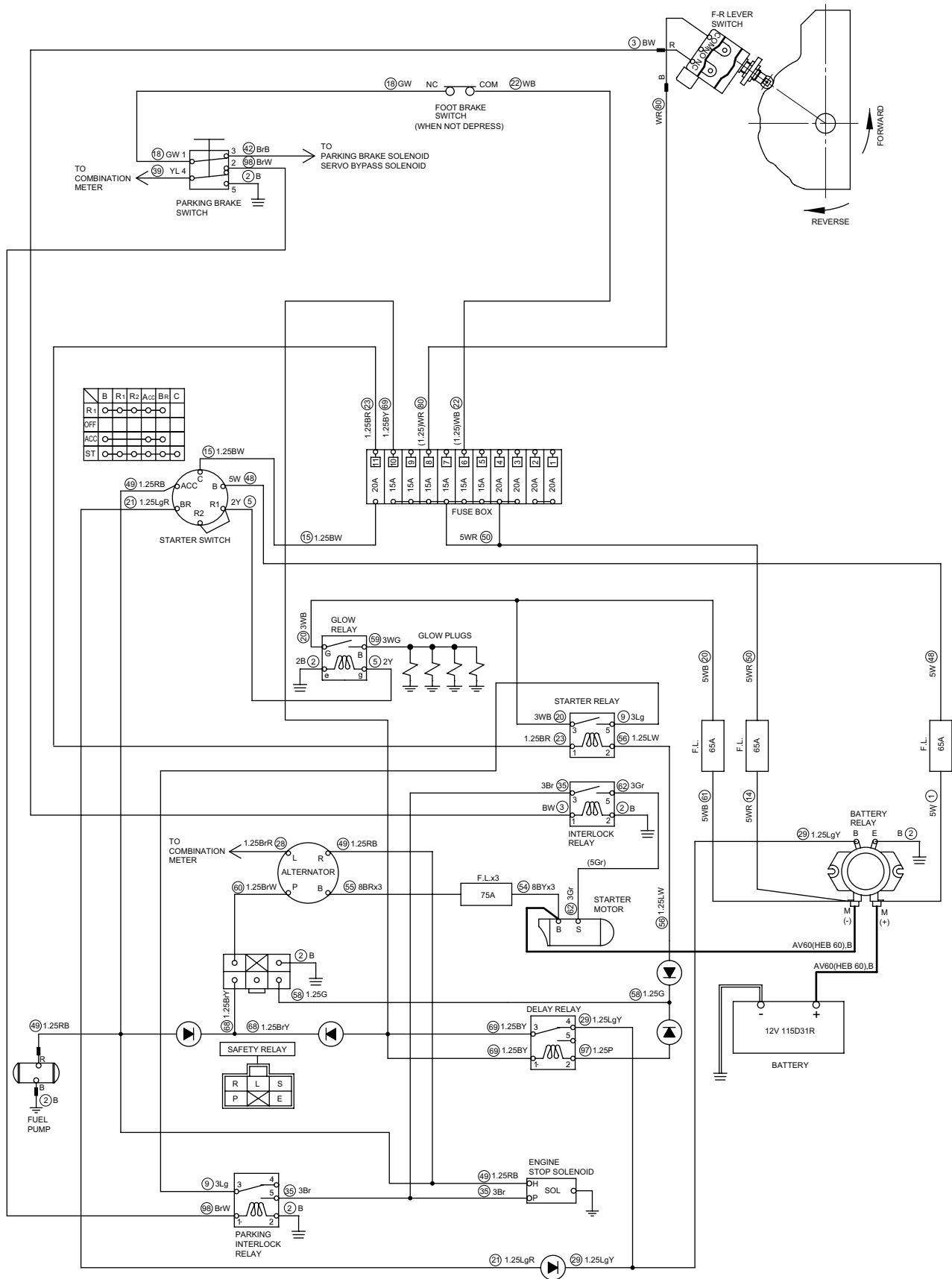
Check point	Check/Cause	Action
1. Fuel Pump	<ul style="list-style-type: none"> <li>• When starter switch is ON, measure voltage between fuel pump terminal inlet wire RB and chassis ground. Standard voltage : 12 V or more</li> <li>• If above item is OK and fuel pump does not operate, fuel pump is faulty.</li> </ul>	Repair or replace fuel pump.
2. Engine Stop Solenoid	<p>(1) When starter switch is ON, measure voltage between engine stop solenoid terminal H inlet wire RB and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is START, measure voltage between engine stop solenoid terminal P inlet wire Br and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above items (1) and (2) are OK and engine does not start, engine stop solenoid is faulty.</li> </ul>	Replace engine stop solenoid.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : 10 <math>\Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.

## 2-2-3. Engine does not stop running

### Reference Fig.: 2-2-1

Check point	Check/Cause	Action
1. Engine Stop Solenoid	<p>(1) When starter switch is OFF, measure voltage between engine stop solenoid terminal H inlet wire RB and chassis ground. There is no electricity in normal condition.</p> <p>(2) When starter switch is OFF, measure voltage between engine stop solenoid terminal P inlet wire Br and chassis ground There is no electricity in normal condition.</p> <ul style="list-style-type: none"> <li>• If above items (1) and (2) are OK and engine will not stop after started, engine stop solenoid is faulty.</li> </ul>	Replace engine stop solenoid.
2. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : 10 <math>\Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty</li> </ul>	Repair or replace harness.

Fig.: 2-2-1





**2-2-4. No charging**

Reference Fig.: 2-2-1

Check point	Check/Cause	Action
1. Alternator	<ul style="list-style-type: none"> <li>After starting engine, measure voltage between alternator terminal B wire BR and chassis ground. Standard voltage : At least intermediate engine speed, 14 V or more</li> <li>If voltage is lower than standard, alternator is faulty.</li> <li>If voltage is normal and battery is not charged, battery is faulty.</li> </ul>	Replace alternator or battery.

**2-2-5. Glow plug is not heated (Engine starting performance is bad in cold weather)**

Reference Fig. : 2-2-1

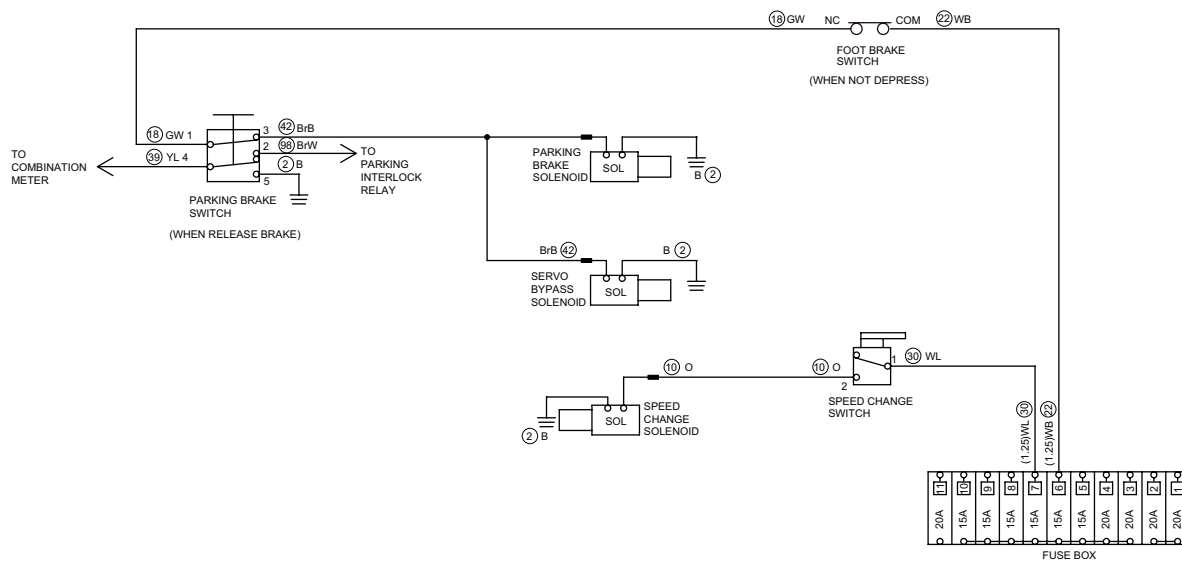
Check point	Check/Cause	Action
1. Glow Plug	<ul style="list-style-type: none"> <li>When starter switch is HEAT, measure voltage between glow plug inlet wire WG and chassis ground. Standard voltage : 12 V or more</li> <li>If voltage is normal, glow plug is faulty.</li> </ul>	Replace glow plug.
2. Glow Relay	<p>(1) When starter switch is HEAT, measure voltage between glow relay terminal g inlet wire Y and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is HEAT, measure voltage between glow relay terminal G inlet wire WB and chassis ground. Standard voltage : 12 V or more</p> <p>(3) When starter switch is HEAT, measure voltage between glow relay terminal B outlet wire WG and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>If above items (1) and (2) are OK and item (3) is NG, glow relay is faulty.</li> </ul>	Replace glow relay.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>Measure resistance of harness connecting between terminals. Standard resistance : 10 <math>\Omega</math> or less</li> <li>If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.

**2-2-6. Starter motor runs even when F-R lever is not at "N"**

Reference Fig.: 2-2-1

Check point	Check/Cause	Action
1. F-R Lever Switch	<ul style="list-style-type: none"> <li>When starter switch is OFF and F-R lever is in forward or reverse, check continuity between F-R lever switch terminal COM and terminal NC. There is no continuity in normal condition.</li> <li>If there is continuity, F-R lever switch is faulty.</li> </ul>	Replace F-R lever switch.

Fig.: 2-3-1



SW652-1-10002

## 2-3. Propulsion

Check following items before troubleshooting.

- No blown fuses and power is applied up to fuses.
- Check any ground circuit which belongs to components to be checked.

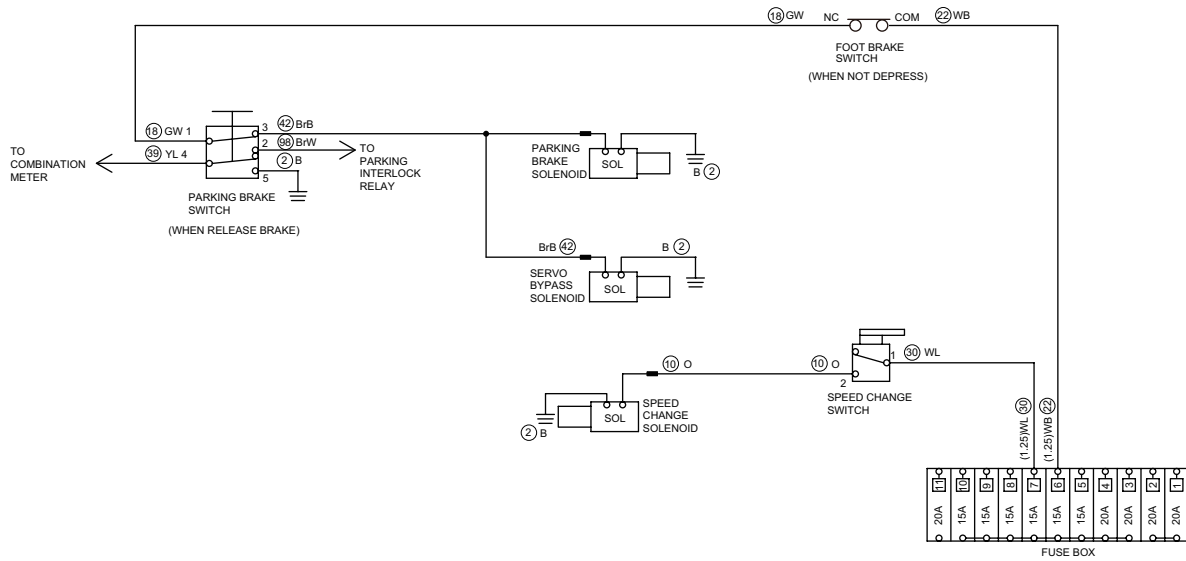
### 2-3-1. Machine moves neither forward nor backward

- Parking brake switch must be released.
- Foot brake switch must be ON (Brake pedal is not depressed).

#### Reference Fig.: 2-3-1

Check point	Check/Cause	Action
1. Servo Bypass Solenoid	<ul style="list-style-type: none"> <li>• Disconnect harness and measure resistance of coil. Standard resistance : <math>12.3 \pm 1.2 \Omega</math></li> <li>• If measured resistance is abnormal, servo bypass solenoid is faulty.</li> </ul>	Replace servo bypass solenoid.
2. Parking Brake Solenoid	<ul style="list-style-type: none"> <li>• Disconnect harness and measure resistance of coil. Standard resistance : <math>8 \pm 0.2 \Omega</math></li> <li>• If measured resistance is abnormal, parking brake solenoid is faulty.</li> </ul>	Replace parking brake solenoid.
3. Foot Brake Switch	<p>(1) When starter switch is ON, measure voltage between foot brake switch terminal COM inlet wire WB and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between foot brake switch terminal NC outlet wire GW and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, foot brake switch is faulty.</li> </ul>	Replace foot brake switch.
4. Parking Brake Switch	<p>(1) When starter switch is ON, measure voltage between parking brake switch terminal 1 inlet wire GW and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between parking brake switch terminal 3 outlet wire BrB and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, parking brake switch is faulty.</li> </ul>	Replace parking brake switch.
5. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : 10 <math>\Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.

Fig.: 2-3-1



SW652-1-10002

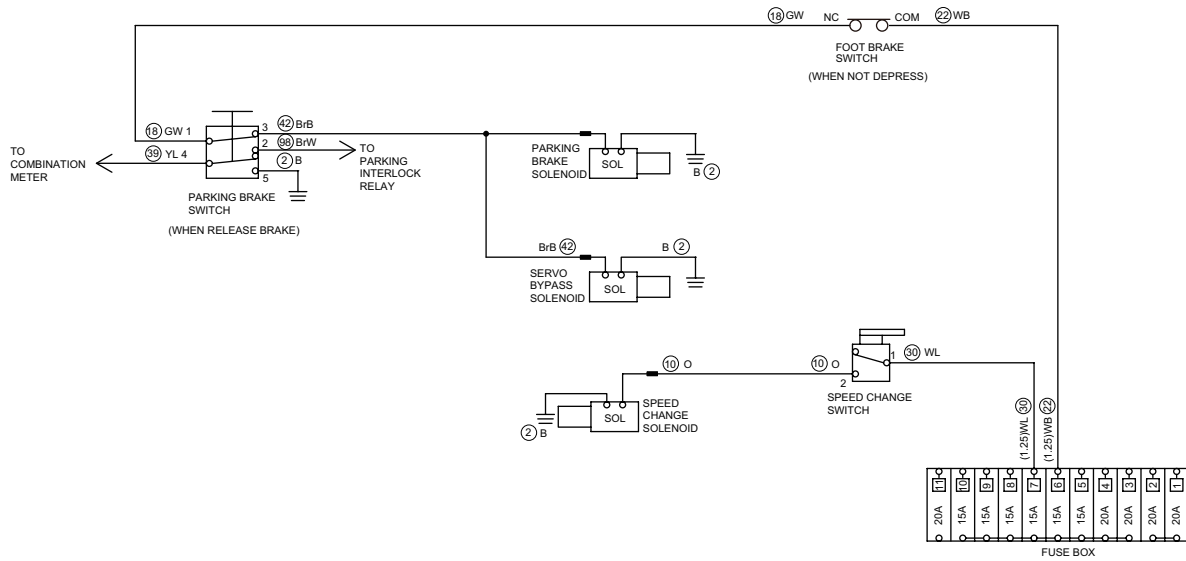
## 2-3-2. Machine speed cannot be changed

- Speed change switch must be “”.

### Reference Fig.: 2-3-1

Check point	Check/Cause	Action
1. Speed Change Solenoid	<ul style="list-style-type: none"> <li>• Disconnect harness and measure resistance of coil. Standard resistance : <math>8 \pm 0.2 \Omega</math></li> <li>• If measured resistance is abnormal, speed change solenoid is faulty.</li> </ul>	Replace speed change solenoid.
2. Speed Change Switch	<p>(1) When starter switch is ON, measure voltage between speed change switch terminal 1 inlet wire WL and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between speed change switch terminal 2 outlet wire O and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and (2) is NG, speed change switch is faulty.</li> </ul>	Replace speed change switch.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : <math>10 \Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.

Fig.: 2-3-1



SW652-1-10002

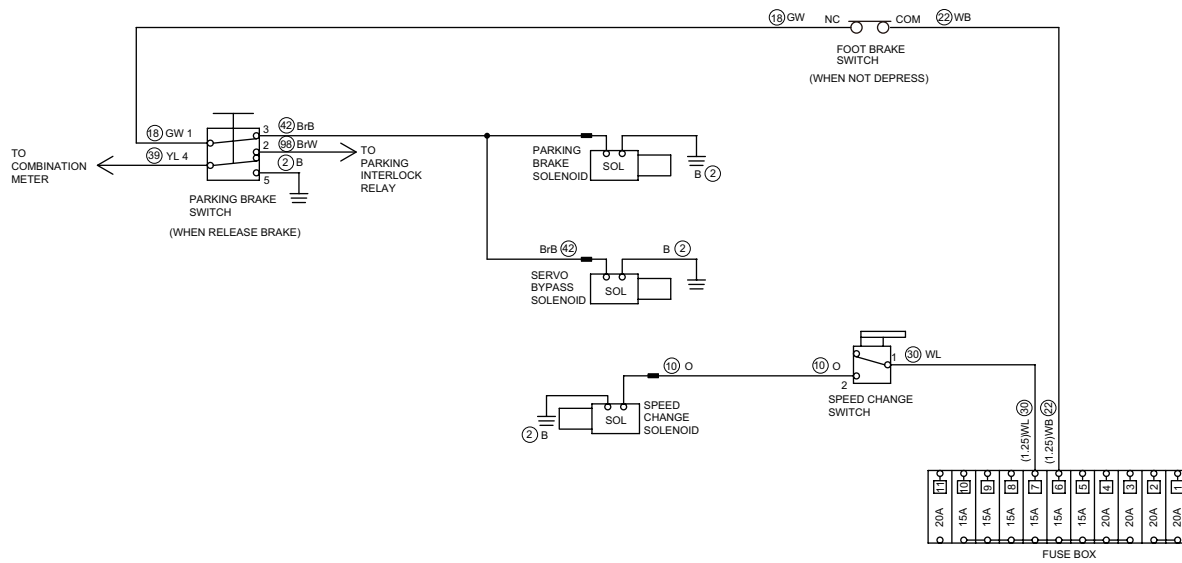
**2-3-3. Brake cannot be released**

- Parking brake switch must be released.
- Foot brake switch must be ON (Brake pedal is not depressed).

**Reference Fig.: 2-3-1**

Check point	Check/Cause	Action
1. Parking Brake Solenoid	<ul style="list-style-type: none"> <li>• Disconnect harness and measure resistance of coil. Standard voltage : <math>8 \pm 0.2 \Omega</math></li> <li>• If measured resistance is abnormal, parking brake solenoid is faulty.</li> </ul>	Replace parking brake solenoid.
2. Foot Brake Switch	<p>(1) When starter switch is ON, measure voltage between foot brake switch terminal COM inlet wire WB and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between foot brake switch terminal NC outlet wire GW and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, foot brake switch is faulty.</li> </ul>	Replace foot brake switch.
3. Parking Brake Switch	<p>(1) When starter switch is ON, measure voltage between parking brake switch terminal 1 inlet wire GW and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between parking brake switch terminal 3 outlet wire BrB and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, parking brake switch is faulty.</li> </ul>	Replace parking brake switch.
4. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : <math>10 \Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.

Fig.: 2-3-1



SW652-1-10002



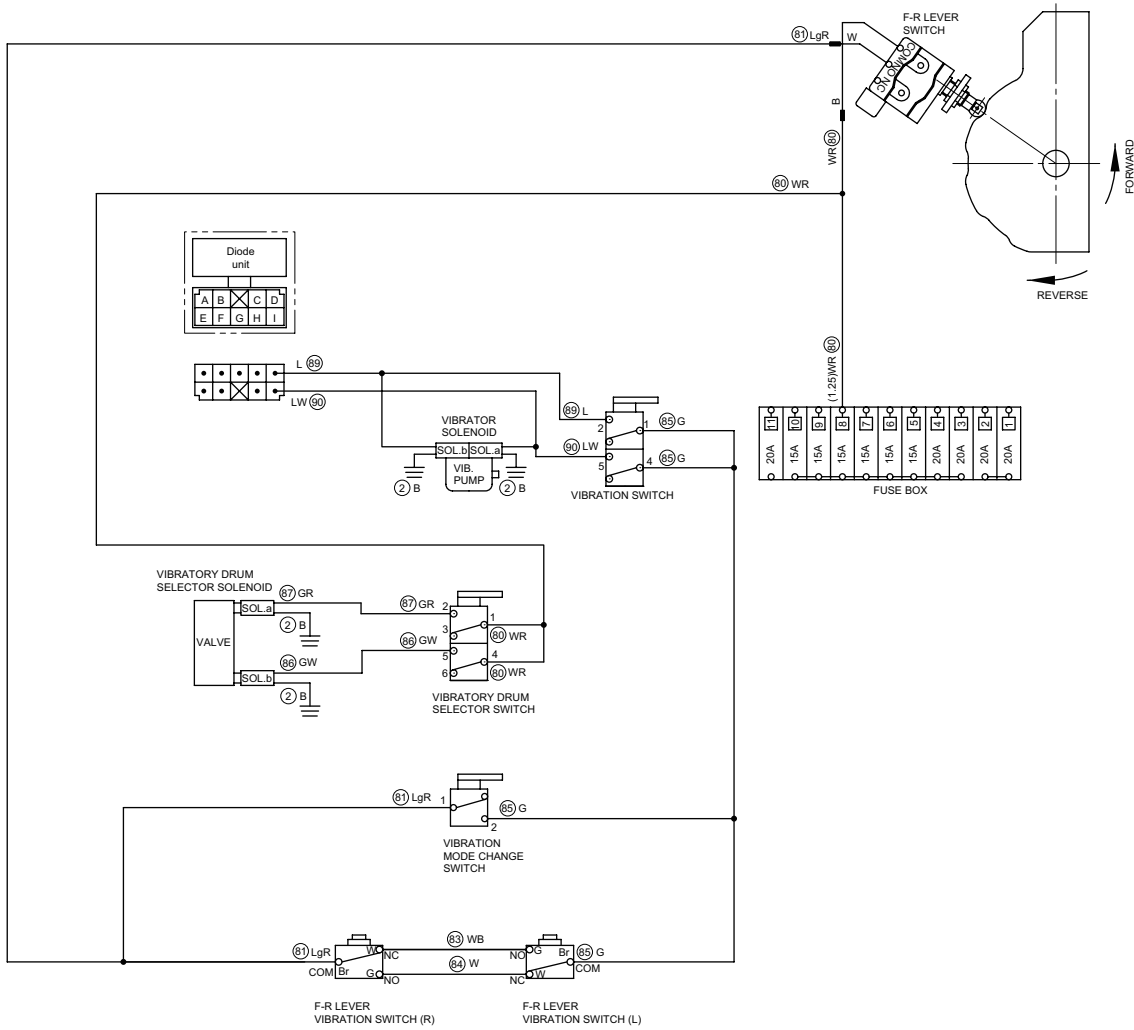
**2-3-4. Brake does not work**

- Parking brake switch must be applied.
- Foot brake switch must be OFF (Brake pedal is depressed).

**Reference Fig.: 2-3-1**

Check point	Check/Cause	Action
1. Parking Brake Solenoid	<ul style="list-style-type: none"> <li>• Disconnect harness and measure resistance of coil. Standard resistance : <math>8 \pm 0.2 \Omega</math></li> <li>• If measured resistance is abnormal, parking brake solenoid is faulty.</li> </ul>	Replace parking brake solenoid.
2. Parking Brake Switch	<ul style="list-style-type: none"> <li>• When starter switch is ON, measure voltage between parking brake switch terminal 3 outlet wire BrB and chassis ground. There is no electricity in normal condition.</li> <li>• If electricity flows, parking brake switch is faulty.</li> </ul>	Replace parking brake switch.
3. Foot Brake Switch	<ul style="list-style-type: none"> <li>• When starter switch is ON, measure voltage between foot brake switch terminal NC outlet wire GW and chassis ground. There is no electricity in normal condition.</li> <li>• If electricity flows, foot brake switch is faulty.</li> </ul>	Replace foot brake switch.
4. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : <math>10 \Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.

Fig.: 2-4-1



SW652-1-10005

## 2-4. Vibration

Check following items before troubleshooting.

- No blown fuses and power is applied up to fuses.
- Throttle switch must be "FULL".
- F-R lever must be in forward or reverse.
- Check any ground circuit which belongs to components to be checked.

### 2-4-1. No vibration occurs

- Vibration mode change switch must be "AUTO" (automatic mode).
- Vibration switch must not be "OFF".

#### Reference Fig.: 2-4-1


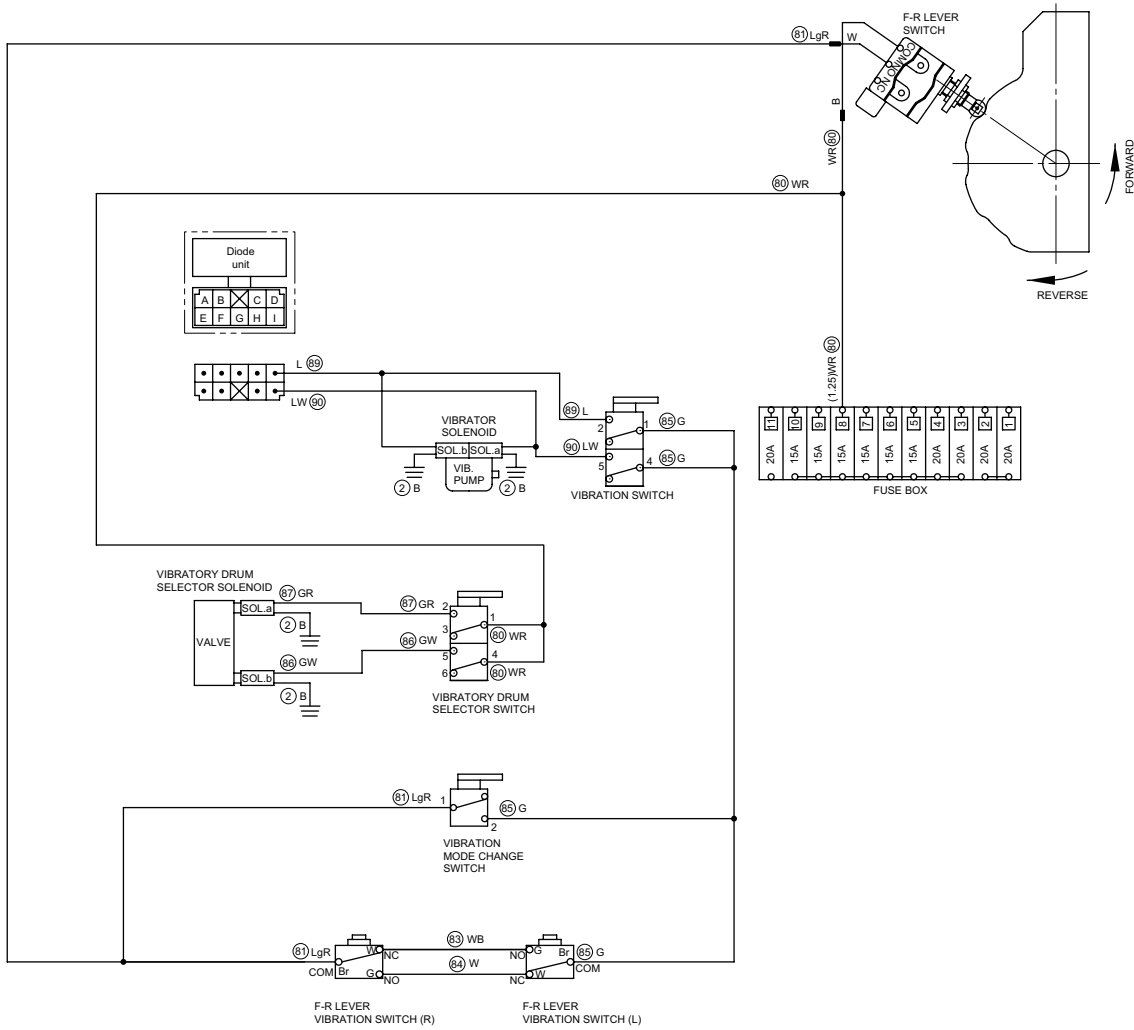
Check point	Check/Cause	Action
1. Vibrator Solenoid	<ul style="list-style-type: none"> <li>• Disconnect harness and measure resistance of coil. Standard resistance : 5.5 Ω</li> <li>• If resistance is abnormal, vibrator solenoid is faulty.</li> </ul>	Replace vibrator solenoid.
2. Vibration Switch	<p>(1) When starter switch is ON, measure voltage between vibration switch terminal 1 inlet wire G, terminal 4 inlet wire G and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and vibration switch is in below position, measure voltage between vibration switch terminal 2 outlet wire L and chassis ground. SW652ND-1 : "  " Except SW652ND-1 : "  " Standard voltage : 12 V or more</p> <p>(3) When starter switch is ON and vibration switch is in below position, measure voltage between vibration switch terminal 5 outlet wire LW and chassis ground. SW652ND-1 : "  " Except SW652ND-1 : "  " Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) or (3) is NG, vibration switch is faulty.</li> </ul>	Replace vibration switch.
3. Vibration Mode Change Switch	<p>(1) When starter switch is ON, measure voltage between vibration mode change switch terminal 1 inlet wire LgR and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between vibration mode change switch terminal 2 outlet wire G and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, vibration mode change switch is faulty.</li> </ul>	Replace vibration mode change switch.
4. F-R Lever Switch	<p>(1) When starter switch is ON, measure voltage between F-R lever switch terminal COM inlet wire WR and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between F-R lever switch terminal NO outlet wire LgR and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, F-R lever switch is faulty.</li> </ul>	Replace F-R lever switch.
5. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.

Fig.: 2-4-1



SW652-1-10005

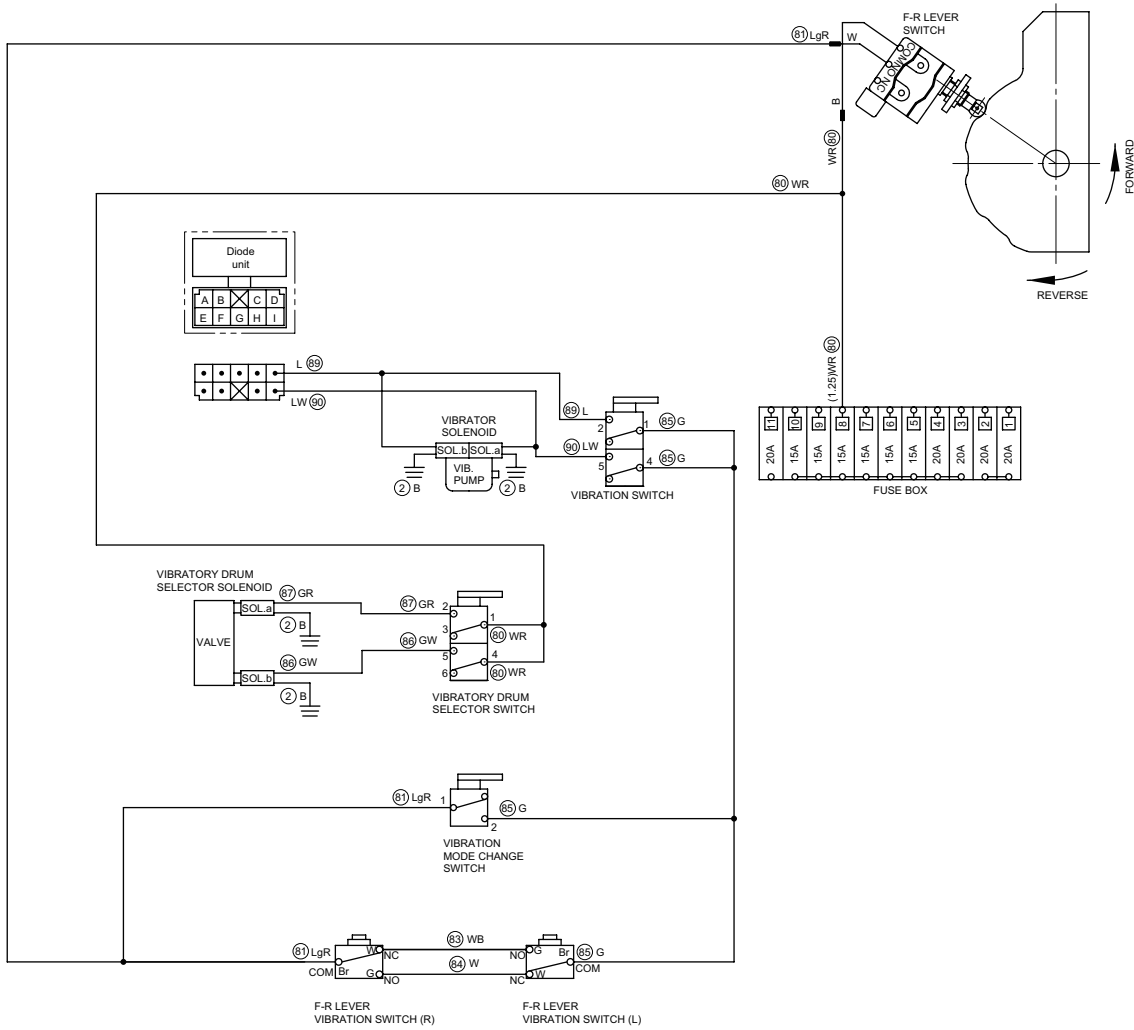
**2-4-2. Amplitude does not change (Remains either low or high) : Except SW652ND-1**

- Vibration mode change switch must be "AUTO" (automatic mode).

**Reference Fig. : 2-4-1**

Check point	Check/Cause	Action
1. Vibrator Solenoid	<ul style="list-style-type: none"> <li>• Disconnect harness and measure resistance of coil. Standard resistance : 5.5 <math>\Omega</math></li> <li>• If resistance is abnormal, vibrator solenoid is faulty.</li> </ul>	Replace vibrator solenoid.
2. Vibration Switch	<p>(1) When starter switch is ON, measure voltage between vibration switch terminal 1 inlet wire G terminal 4 inlet wire G and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and vibration switch is "OFF", measure voltage vibration switch terminal wires and chassis ground.</p> <ul style="list-style-type: none"> <li>• Vibration switch terminal 2 outlet wire L and chassis ground.</li> <li>• Vibration switch terminal 5 outlet wire LW and chassis ground.</li> </ul> <p>There is no electricity in normal condition.</p> <p>(3) When starter switch is ON and vibration switch is "√^", measure voltage between vibration switch terminal 2 outlet wire L and chassis ground. Standard voltage : 12 V or more.</p> <p>(4) When starter switch is ON and vibration switch is "√^", measure voltage between vibration switch terminal 5 outlet wire LW and chassis ground. Standard voltage : 12 V or more.</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2), (3) or (4) is NG, vibration switch is faulty.</li> </ul>	Replace vibration switch.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : 10 <math>\Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.

Fig.: 2-4-1



SW652-1-10005

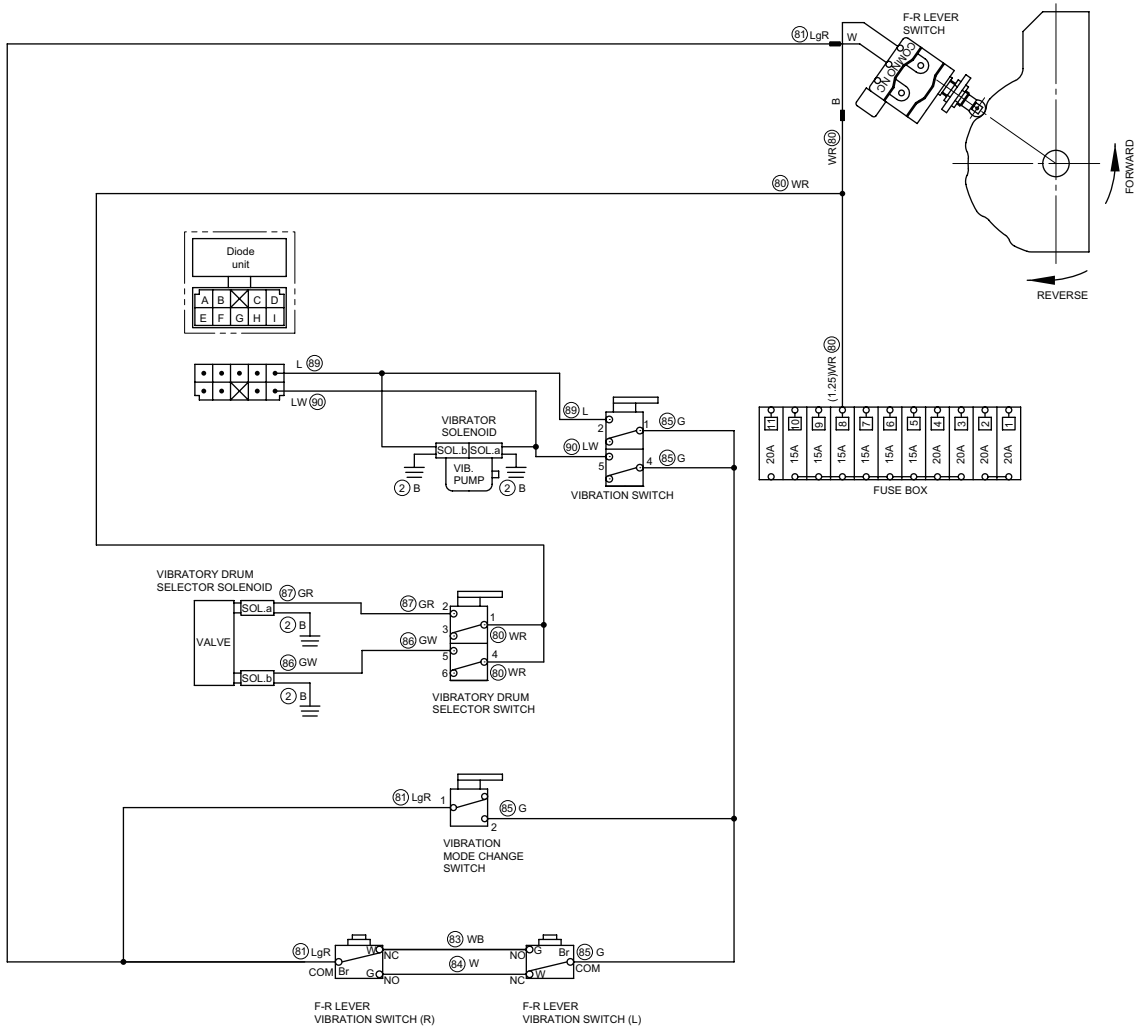
**2-4-3. Vibration does not change (Remains normal or horizontal vibration) : SW652ND-1**

- Vibration mode change switch must be "AUTO" (automatic mode).

**Reference Fig. : 2-4-1**

Check point	Check/Cause	Action
1. Vibrator Solenoid	<ul style="list-style-type: none"> <li>• Disconnect harness and measure resistance of coil. Standard resistance : 5.5 <math>\Omega</math></li> <li>• If resistance is abnormal, vibrator solenoid is faulty.</li> </ul>	Replace vibrator solenoid.
2. Vibration Switch	<p>(1) When starter switch is ON, measure voltage between vibration switch terminal 1 inlet wire G, terminal 4 inlet wire G and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and vibration switch is "OFF", measure voltage vibration switch terminal wires and chassis ground.</p> <ul style="list-style-type: none"> <li>• Vibration switch terminal 2 outlet wire L and chassis ground.</li> <li>• Vibration switch terminal 5 outlet wire LW and chassis ground.</li> </ul> <p>There is no electricity in normal condition.</p> <p>(3) When starter switch is ON and vibration switch is "Ⓐ", measure voltage between vibration switch terminal 2 outlet wire L and chassis ground. Standard voltage : 12 V or more.</p> <p>(4) When starter switch is ON and vibration switch is "Ⓑ", measure voltage between vibration switch terminal 5 outlet wire LW and chassis ground. Standard voltage : 12 V or more.</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2), (3) or (4) is NG, vibration switch is faulty.</li> </ul>	Replace vibration switch.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : 10 <math>\Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.


Fig.: 2-4-1



SW652-1-10005



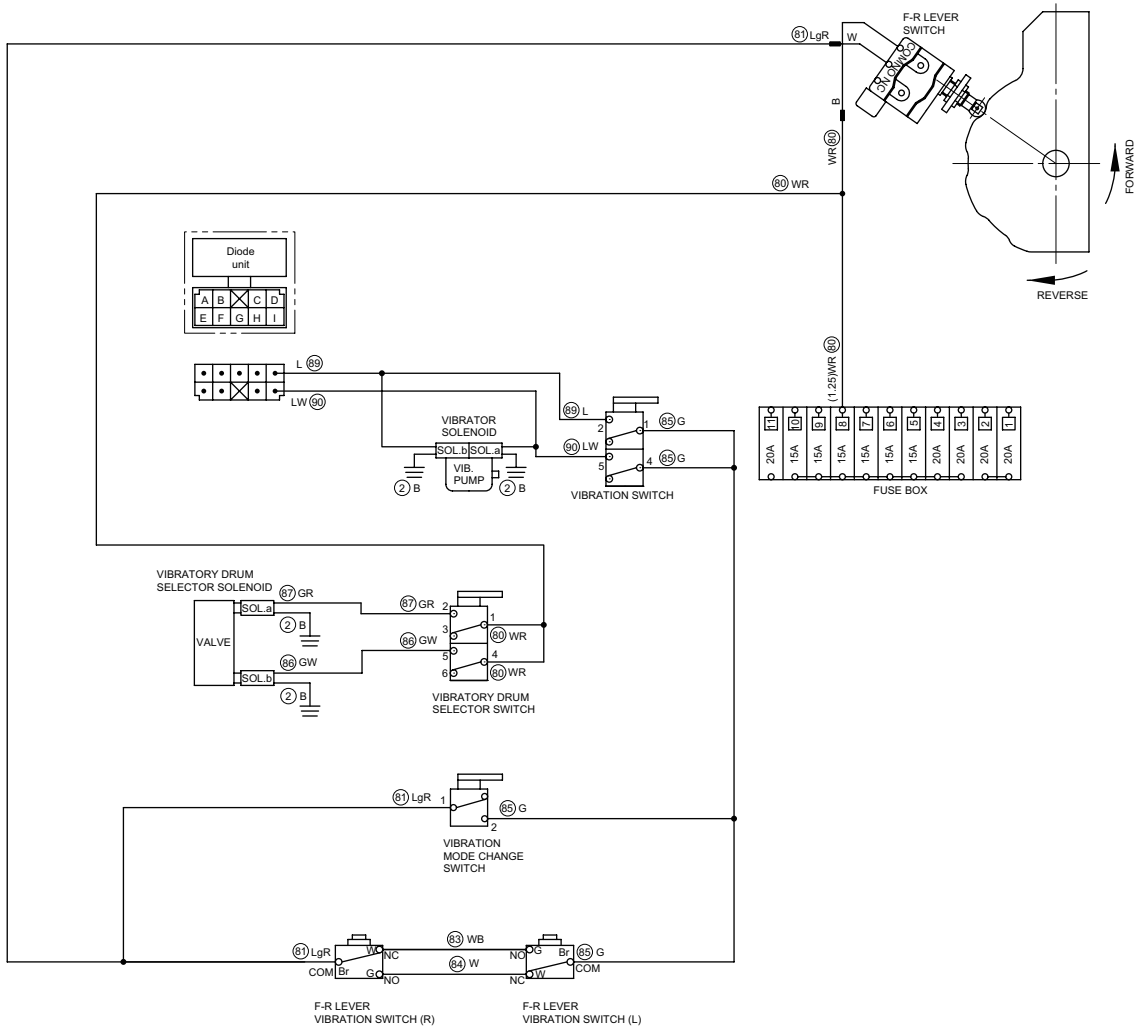
**2-4-4. Vibration mode cannot be switched (F-R lever vibration switch does not work)**

- Vibration mode change switch must be “” (manual mode).
- Vibration switch must not be “OFF”.

**Reference Fig. : 2-4-1**

Check point	Check/Cause	Action
1. Vibration Mode Change Switch	<p>(1) When starter switch is ON, measure voltage between vibration mode change switch terminal 1 inlet wire LgR and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between vibration mode change switch terminal 2 outlet wire G and chassis ground. There is no electricity in normal condition.</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, vibration mode change switch is faulty.</li> </ul>	Replace vibration mode change switch.
2. F-R Lever Vibration Switch (L)	<ul style="list-style-type: none"> <li>• Check continuity between F-R lever vibration switch (L) terminals. <ul style="list-style-type: none"> <li>• Terminal NC and terminal COM</li> <li>• Terminal NO and terminal COM</li> </ul> If continuity is made and broken when F-R lever vibration switch (L) is operated, switch is normal.</li> <li>• If continuity does not change, F-R lever vibration switch (L) is faulty.</li> </ul>	Replace F-R lever vibration switch (L).
3. F-R Lever Vibration Switch (R)	<ul style="list-style-type: none"> <li>• Check continuity between F-R lever vibration switch (R) terminals. <ul style="list-style-type: none"> <li>• Terminal NC and terminal COM</li> <li>• Terminal NO and terminal COM</li> </ul> If continuity is made and broken when F-R lever vibration switch (R) is operated, switch is normal.</li> <li>• If continuity does not change, F-R lever vibration switch (R) is faulty.</li> </ul>	Replace F-R lever vibration switch (R).
4. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : 10 <math>\Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.




Fig.: 2-4-1



SW652-1-10005

## 2-4-5. Vibratory drum cannot be switched

Reference Fig. : 2-4-1

Check point	Check/Cause	Action
1. Vibratory Drum Selector Solenoid (a), (b)	<ul style="list-style-type: none"> <li>• Disconnect harness and measure resistance of coil. Standard resistance : <math>12.3 \pm 1.2 \Omega</math></li> <li>• If resistance is abnormal, vibratory drum selector solenoid is faulty.</li> </ul>	Replace vibratory drum selector solenoid (a) or (b).
2. Vibratory Drum Selector Switch	<p>(1) When starter switch is ON, measure voltage between vibratory drum selector switch terminal 1 inlet wire WR, terminal 4 inlet wire WR and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and vibratory drum selector switch is in "  ", measure voltage between vibratory drum selector switch terminal 2 outlet wire GR and chassis ground. Standard voltage : 12 V or more</p> <p>(3) When starter switch is ON and vibratory drum selector switch is in "  ", measure voltage between vibratory drum selector switch terminal 5 outlet wire GW and chassis ground. Standard voltage : 12 V or more</p> <p>(4) When starter switch is ON and vibratory drum selector switch is in "  ", measure voltage between vibratory drum selector switch terminal 2 outlet wire GR, terminal 5 outlet wire GW and chassis ground. There is no electricity in normal condition.</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2), (3) or (4) is NG, vibratory drum selector switch is faulty.</li> </ul>	Replace vibratory drum selector switch.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : <math>10 \Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.



## 2-5. Water Spray

Check following item before troubleshooting.

- No blown fuse and power is applied up to fuses.
- Water spray switch (F) and (R) must be ON.
- Check any ground circuit which belongs to components to be checked.

### 2-5-1. Continuous water spray does not operate 1/2

- Water spray mode selector switch must be "CONT".

#### Reference Fig.: 2-5-1

Check point	Check/Cause	Action
1. Water Spray Pump (F)	(1) When starter switch is ON, measure voltage between water spray pump (F) terminal inlet wire WR and chassis ground. Standard voltage : 12 V or more (2) Check that no abnormality is found in water spray pump ground terminal. • If above items (1) and (2) are OK and water spray pump does not operate, water spray pump (F) is faulty.	Replace water spray pump (F).
2. Water Spray Pump (R)	(1) When starter switch is ON, measure voltage between water spray pump (R) terminal inlet wire W and chassis ground. Standard voltage : 12 V or more (2) Check that no abnormality is found in water spray pump ground terminal. • If above items (1) and (2) are OK and water spray pump does not operate, water spray pump (R) is faulty.	Replace water spray pump (R).
3. Water Spray Relay (F)	(1) When starter switch is ON, measure voltage between water spray relay (F) terminal 1 inlet wire BrW and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON, measure voltage between water spray relay (F) terminal 3 inlet wire LB and chassis ground. Standard voltage : 12 V or more (3) When starter switch is ON, measure voltage between water spray relay (F) terminal 5 outlet wire LW and chassis ground. Standard voltage : 12 V or more • If above items (1) and (2) are OK and item (3) is NG, water spray relay (F) is faulty.	Replace water spray relay (F).
4. Water Spray Relay (R)	(1) When starter switch is ON, measure voltage between water spray relay (R) terminal 1 inlet wire BrR and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON, measure voltage between water spray relay (R) terminal 3 inlet wire LB and chassis ground. Standard voltage : 12 V or more (3) When starter switch is ON, measure voltage between water spray relay (R) terminal 5 outlet wire LR and chassis ground. Standard voltage : 12 V or more • If above items (1) and (2) are OK and item (3) is NG, water spray relay (R) is faulty.	Replace water spray relay (R).



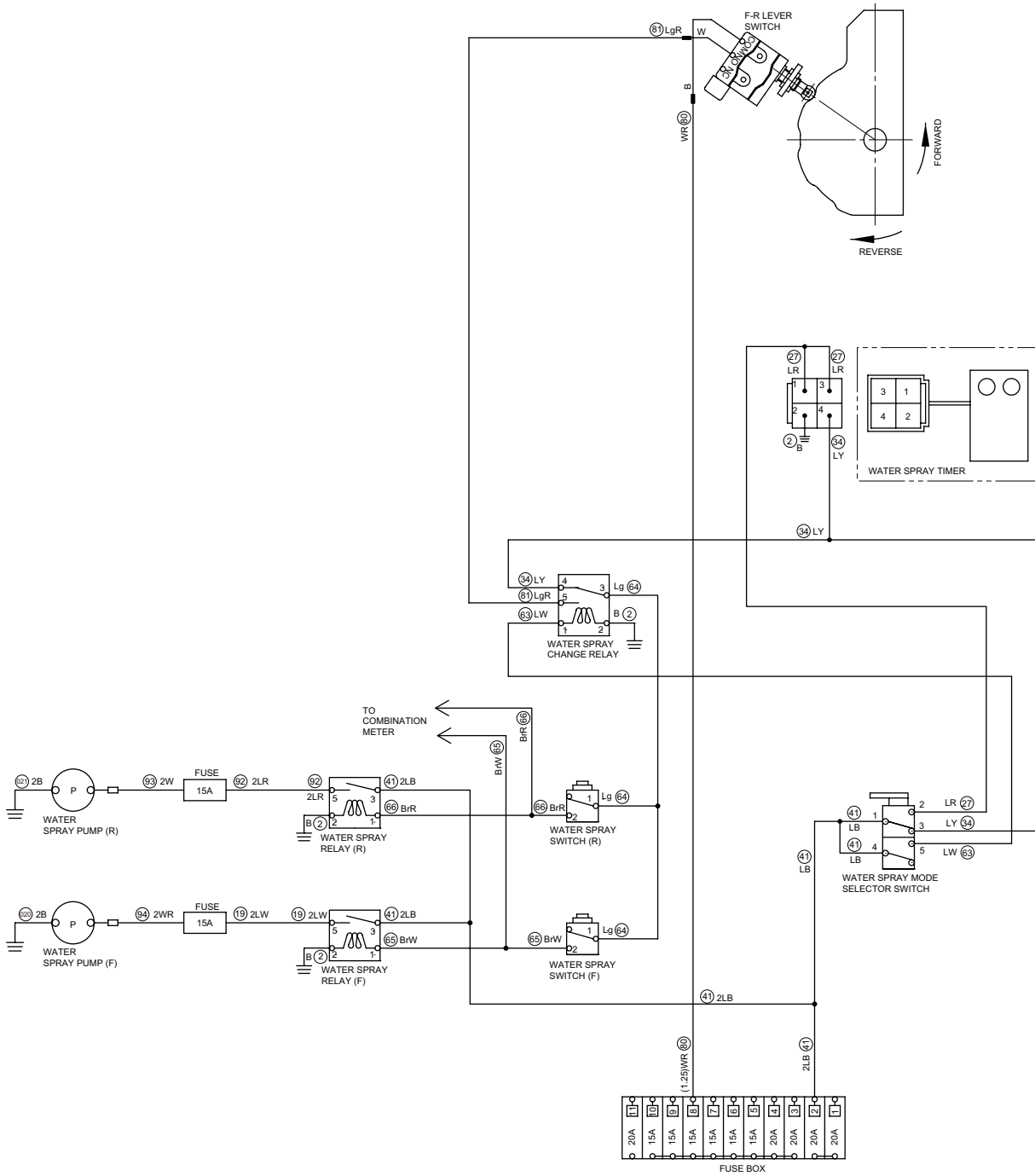
**2-5-1. Continuous water spray does not operate 2/2**

- Water spray mode selector switch must be "CONT".

**Reference Fig.: 2-5-1**

Check point	Check/Cause	Action
5. Water Spray Switch (F)	<p>(1) When starter switch is ON, measure voltage between water spray switch (F) terminal 1 inlet wire Lg and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between water spray switch (F) terminal 2 outlet wire BrW and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, water spray switch (F) is faulty.</li> </ul>	Replace water spray switch (F).
6. Water Spray Switch (R)	<p>(1) When starter switch is ON, measure voltage between water spray switch (R) terminal 1 inlet wire Lg and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between water spray switch (R) terminal 2 outlet wire BrR and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, water spray switch (R) is faulty.</li> </ul>	Replace water spray switch (R).
7. Water Spray Change Relay	<p>(1) When starter switch is ON, measure voltage between water spray change relay terminal 4 inlet wire LY and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between water spray change relay terminal 3 outlet wire Lg and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, water spray change relay is faulty.</li> </ul>	Replace water spray change relay.
8. Water Spray Mode Selector Switch	<p>(1) When starter switch is ON, measure voltage between water spray mode selector switch terminal 1 inlet wire LB and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between water spray mode selector switch terminal 3 outlet wire LY and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, water spray mode selector switch is faulty.</li> </ul>	Replace water spray mode selector switch.
9. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : 10 <math>\Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.

Fig.: 2-5-1





## 2-5-2. Continuous water spray works, but auto water spray does not operate

- Water spray mode selector switch must be "AUTO".
- F-R lever must be in forward or reverse.

### Reference Fig.: 2-5-1

Check point	Check/Cause	Action
1. Water Spray Change Relay	<p>(1) When starter switch is ON, measure voltage between water spray change relay terminal 1 inlet wire LW and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between water spray change relay terminal 5 inlet wire LgR and chassis ground. Standard voltage : 12 V or more</p> <p>(3) When starter switch is ON, measure voltage between water spray change relay terminal 3 outlet wire Lg and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above items (1) and (2) are OK and item (3) is NG, water spray change relay is faulty.</li> </ul>	Replace water spray change relay.
2. F-R Lever Switch	<p>(1) When starter switch is ON, measure voltage between F-R lever switch terminal COM inlet wire WR and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between F-R lever switch terminal NO outlet wire LgR and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, F-R lever switch is faulty.</li> </ul>	Replace F-R lever switch.
3. Water Spray Mode Selector Switch	<p>(1) When starter switch is ON, measure voltage between water spray mode selector switch terminal 4 inlet wire LB and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between water spray mode selector switch terminal 5 outlet wire LW and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, water spray mode selector switch is faulty.</li> </ul>	Replace water spray mode selector switch.
4. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : 10 <math>\Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.



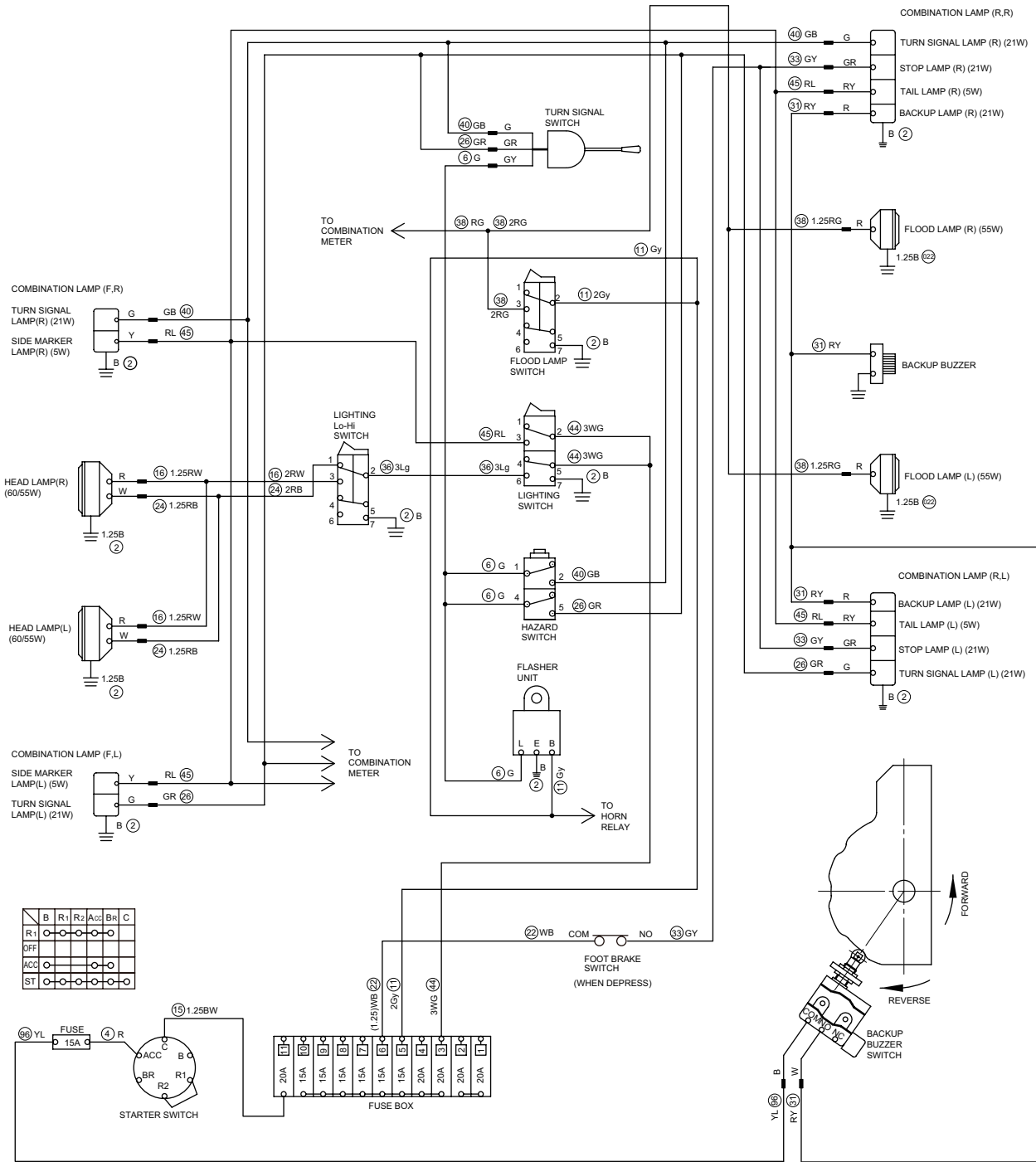
**2-5-3. Continuous water spray works, but intermittent water spray does not operate**

- Water spray mode selector switch must be "TIMER".

**Reference Fig.: 2-5-1**

Check point	Check/Cause	Action
1. Water Spray Timer	<p>(1) When starter switch is ON, measure voltage between water spray timer terminal 1 inlet wire LR, terminal 3 inlet wire LR and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between water spray timer terminal 4 outlet wire LY and chassis ground. Standard voltage : 12 V or more (Electricity flows for a definite time.)</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, water spray timer is faulty.</li> </ul>	Replace water spray timer.
2. Water Spray mode Selector Switch	<p>(1) When starter switch is ON, measure voltage between water spray mode selector switch terminal 1 inlet wire LB and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between water spray mode selector switch terminal 2 outlet wire LR and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, water spray mode selector switch is faulty.</li> </ul>	Replace water spray mode selector switch.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : 10 <math>\Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.

Fig.: 2-6-1








## 2-6. Lighting

Check following items before troubleshooting.

- No blown fuse and power is applied up to fuses.
- When measuring voltage and current without disconnecting connectors, refer to “measuring voltage and current following using tester” (P. 10-006 to P. 10-008).
- Check any ground circuit which belongs to components to be checked.

### 2-6-1. Head lamp, side marker lamp and tail lamp do not light


Reference Fig.: 2-6-1

Check point	Check/Cause	Action
1. Each Bulb	<ul style="list-style-type: none"> <li>• Check that none of lamp bulbs is burned out or has a contact failure.</li> <li>• Bulb is faulty or poorly connected.</li> </ul>	Replace each bulb.
2. Lighting Switch	<p>(1) When starter switch is ON, measure voltage between lighting switch terminal 2 inlet wire WG, terminal 5 inlet wire WG and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and lighting switch is “”, measure voltage between lighting switch terminal 3 outlet wire RL and chassis ground. Standard voltage : 12 V or more</p> <p>(3) When starter switch is ON and lighting switch is “”, measure voltage between lighting switch terminal 6 outlet wire Lg and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) or (3) is NG, lighting switch is faulty.</li> </ul>	Replace lighting switch.
3. Lighting Lo-Hi Switch	<p>(1) When starter switch is ON and lighting switch is “”, measure voltage between lighting Lo-Hi switch terminal 2 inlet wire Lg and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, lighting switch is “” and lighting Lo-Hi switch “”, measure voltage between lighting Lo-Hi switch terminal 1 outlet wire RB and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, lighting Lo-Hi switch is faulty.</li> </ul>	Replace lighting Lo-Hi switch.
4. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less</li> <li>• If resistance is abnormal, the harness is faulty.</li> </ul>	Repair or replace harness.



## 2-6-2. Flood lamp does not light

Reference Fig.: 2-6-1

Check point	Check/Cause	Action
1. Each Bulb	<ul style="list-style-type: none"> <li>• Check that none of lamp bulbs is burned out or has a contact failure.</li> <li>• Bulb is faulty or poorly connected.</li> </ul>	Replace each bulb.
2. Flood Lamp Switch	<p>(1) When starter switch is ON, measure voltage between flood lamp switch terminal 2 inlet wire Gy and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and flood lamp switch is “”, measure voltage between flood lamp switch terminal 3 inlet wire RG and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, flood lamp switch is faulty.</li> </ul>	Replace flood lamp switch.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.

## 2-6-3. High-beam of head lamp does not light

Reference Fig.: 2-6-1




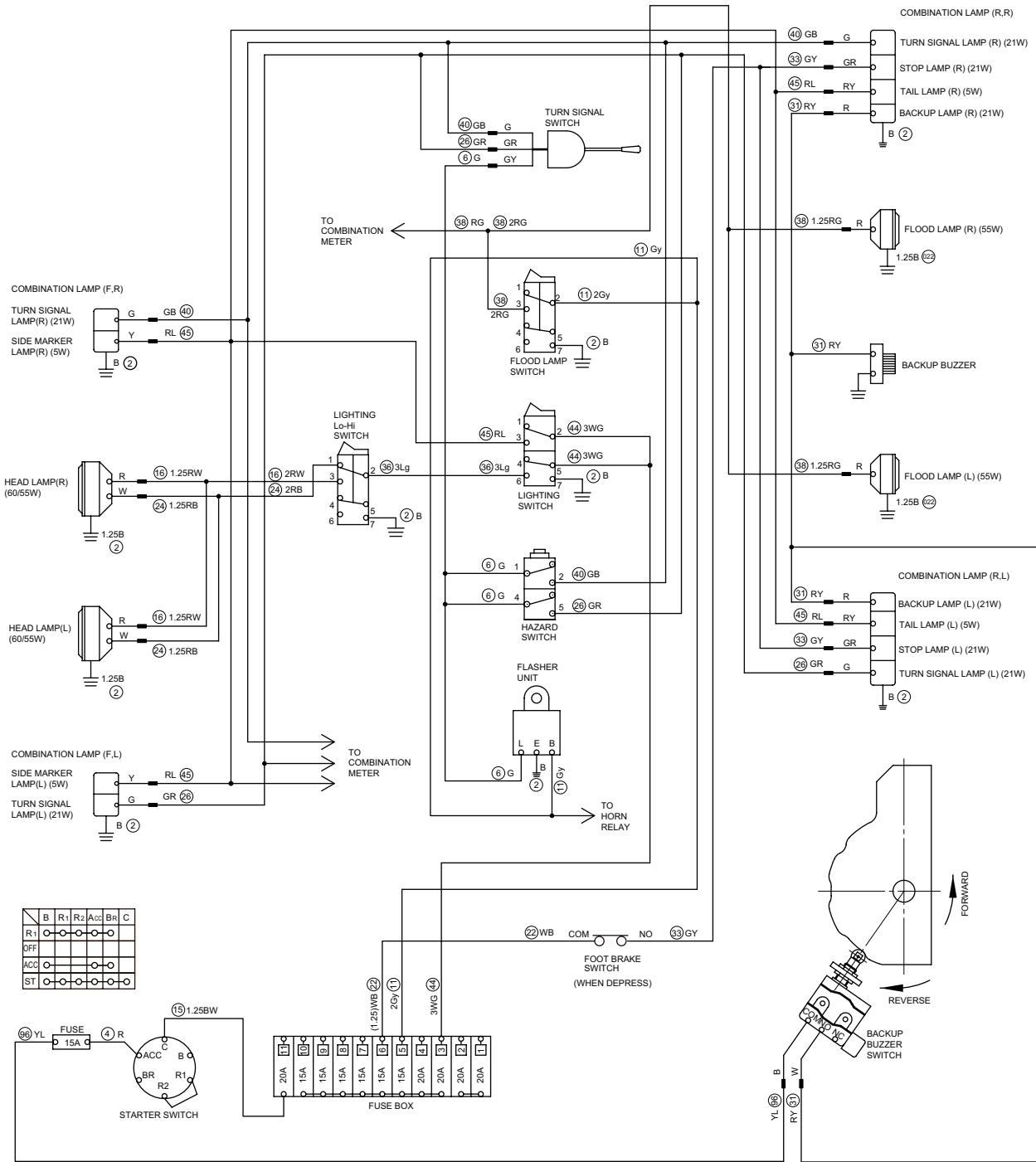
Check point	Check/Cause	Action
1. Each Bulb	<ul style="list-style-type: none"> <li>• Check that none of lamp bulbs is burned out or has a contact failure.</li> <li>• Bulb is faulty or poorly connected.</li> </ul>	Replace each bulb.
2. Lighting Lo-Hi Switch	<p>(1) When starter switch is ON and lighting switch is “”, measure voltage between lighting Lo-Hi switch terminal 2 inlet wire Lg and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, lighting switch is “” and lighting Lo-Hi switch “”, measure voltage between lighting Lo-Hi switch terminal 3 outlet wire RW and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, turn signal switch is faulty.</li> </ul>	Replace lighting Lo-Hi switch.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.

Fig.: 2-6-1



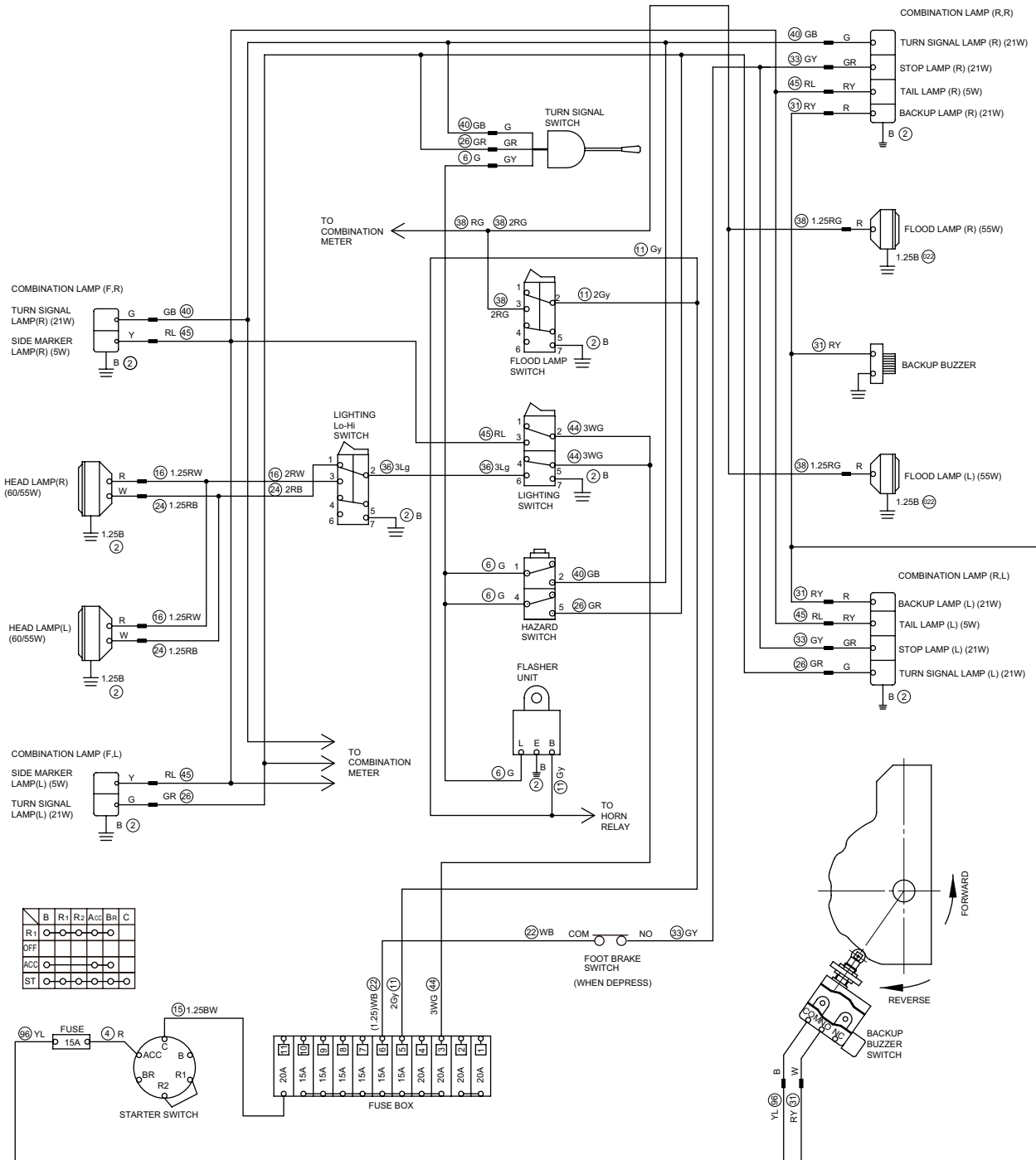


**2-6-4. Turn signal lamp does not blink**

Reference Fig.: 2-6-1

Check point	Check/Cause	Action
1. Each Bulb	<ul style="list-style-type: none"> <li>• Check that none of lamp bulbs is burned out or has a contact failure.</li> <li>• Bulb is faulty or poorly connected.</li> </ul>	Replace each bulb.
2. Flasher Unit	<p>(1) When starter switch is ON, measure voltage between flasher unit terminal B inlet wire Gy and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and turn signal lever is moved, measure voltage between flasher unit terminal L outlet wire G and chassis ground. Standard voltage : 12 V or more with constant intervals</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, flasher unit is faulty.</li> </ul>	Replace flasher unit.
3. Turn Signal Switch	<p>(1) When starter switch is ON and turn signal lever is moved, measure voltage between turn signal switch terminal inlet wire G and chassis ground. Standard voltage: 12 V or more with constant intervals</p> <p>(2) When starter switch is ON and turn signal lever is moved, measure voltage between turn signal switch terminals and chassis ground. Front and rear turn signal lamp (R) : Outlet wire GB Front and rear turn signal lamp (L) : Outlet wire GR Standard voltage : 12 V or more with constant intervals</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, turn signal switch is faulty.</li> </ul>	Replace turn signal switch.
4. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : 10 <math>\Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.

Fig.: 2-6-1



**2-6-5. Hazard lamp does not light (Turn signal blinks)**

Reference Fig.: 2-6-1

Check point	Check/Cause	Action
1. Each Bulb	<ul style="list-style-type: none"> <li>• Check none of lamp bulbs is burned out or has a contact failure.</li> <li>• Bulb is faulty or poorly connected.</li> </ul>	Replace each bulb.
2. Hazard Switch	<p>(1) When starter switch is ON and hazard switch is ON, measure voltage between hazard switch terminal 1 inlet wire G, terminal 4 inlet wire G and chassis ground. Standard voltage : 12 V or more with constant intervals</p> <p>(2) When starter switch is ON and hazard switch is ON, measure voltage between hazard switch terminal 2 outlet wire GB and chassis ground. Standard voltage : 12 V or more with constant intervals</p> <p>(3) When starter switch is ON and hazard switch is ON, measure voltage between hazard switch terminal 5 outlet wire GR and chassis ground. Standard voltage : 12 V or more with constant intervals</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) or (3) is NG, hazard switch is faulty.</li> </ul>	Replace hazard switch.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : 10 <math>\Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.



## 2-6-6. Backup lamp does not light

Reference Fig.: 2-6-1

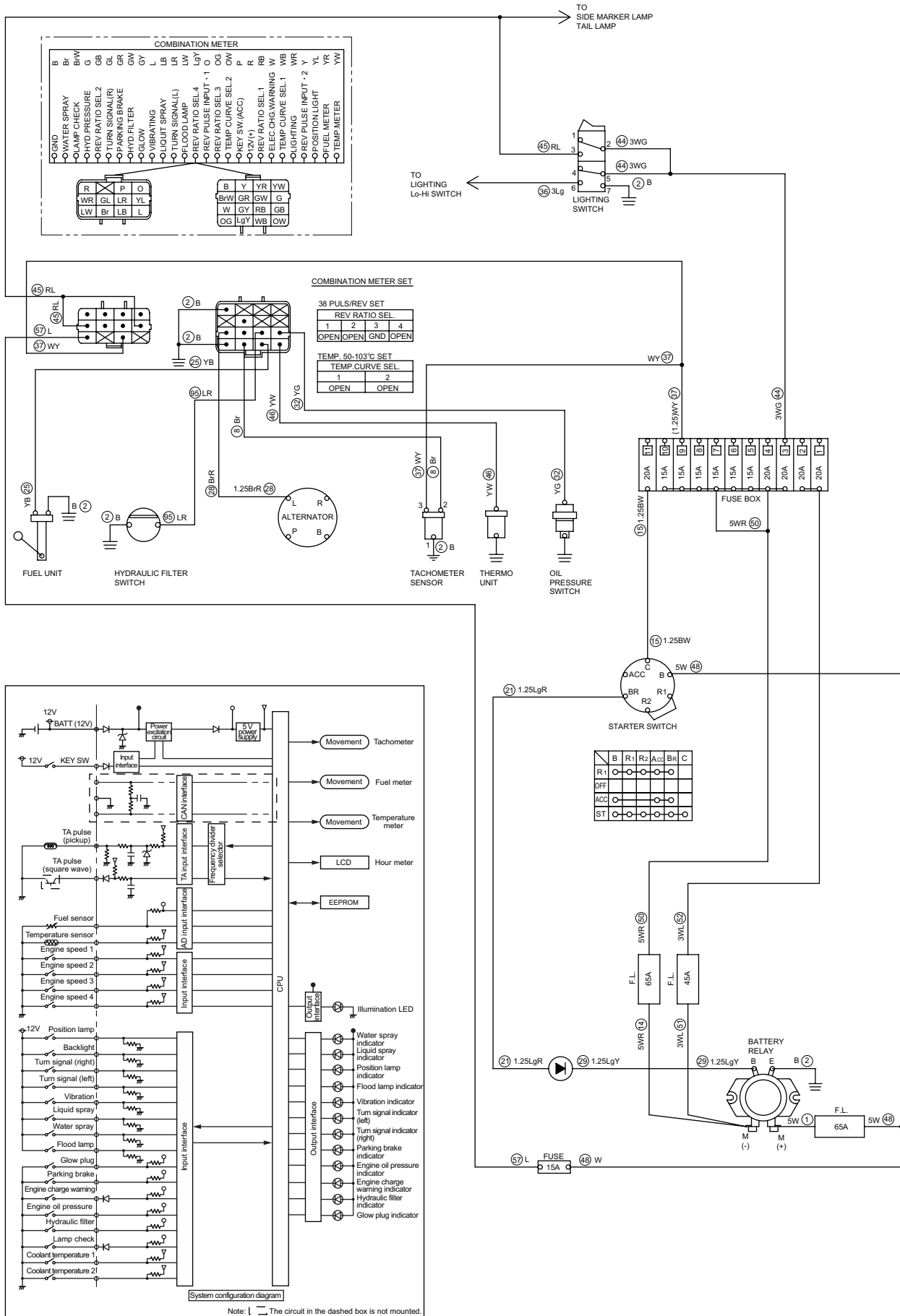
Check point	Check/Cause	Action
1. Each Bulb	<ul style="list-style-type: none"> <li>• Check that none of lamp bulbs is burned out or has a contact failure.</li> <li>• Bulb is faulty or poorly connected.</li> </ul>	Replace each bulb.
2. Backup Buzzer Switch	<p>(1) When starter switch is ON, measure voltage between backup buzzer switch terminal COM inlet wire YL and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and F-R lever is in reverse, measure voltage between backup buzzer switch terminal NO outlet wire RY and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, backup buzzer switch is faulty.</li> </ul>	Replace backup buzzer switch.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : 10 <math>\Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.

## 2-6-7. Stop lamp does not light

Reference Fig.: 2-6-1


Check point	Check/Cause	Action
1. Each Bulb	<ul style="list-style-type: none"> <li>• Check that none of lamp bulbs is burned out or has a contact failure.</li> <li>• Bulb is faulty or poorly connected.</li> </ul>	Replace each bulb.
2. Foot Brake Switch	<p>(1) When starter switch is ON, measure voltage between foot brake switch terminal COM inlet wire WB and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON while foot brake is depressed, measure voltage between foot brake switch terminal NO outlet wire GY and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, foot brake switch is faulty.</li> </ul>	Replace foot brake switch.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : 10 <math>\Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.

Fig.: 2-6-2



**2-6-8. Illumination of combination meter does not turn on**

Reference Fig. : 2-6-2

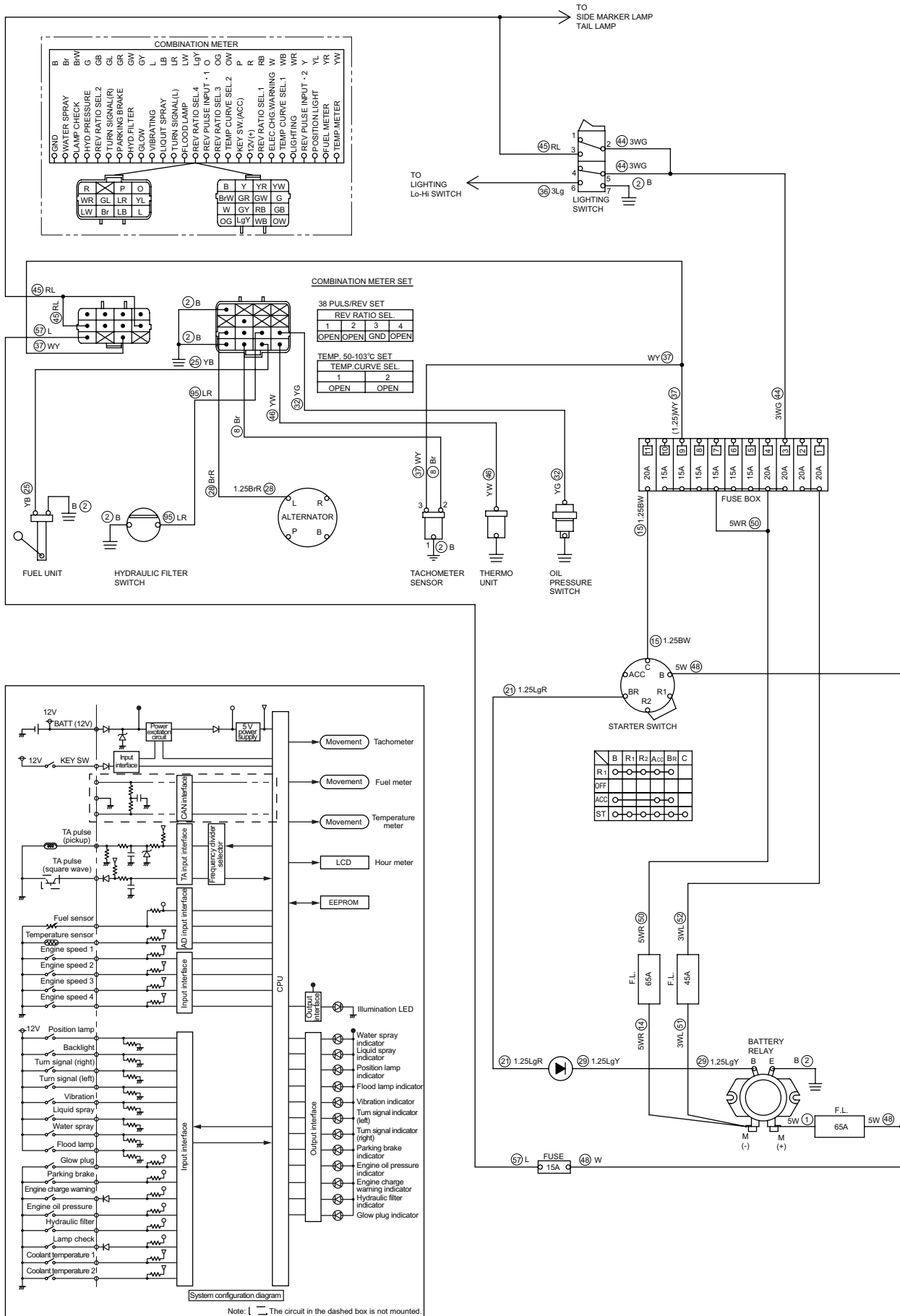
Check point	Check/Cause	Action
1. Harness	<ul style="list-style-type: none"> <li>• Measure resistance between lighting switch terminal 3 wire RL and combination meter connector terminal wire No. 45 wire RL. Standard resistance : 10 Ω or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.
2. Combination Meter (Backlight)	<p>(1) When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire.</p> <ul style="list-style-type: none"> <li>• Battery terminal wire No. 57 inlet wire L and ground terminal wire No.2 wire B</li> <li>• Starter switch terminal wire No. 37 inlet wire WY and ground terminal wire No.2 wire B</li> </ul> <p>Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and lighting switch is “”, measure voltage between combination meter back lighting terminal wire No.45 inlet wire RL and chassis ground.</p> <p>Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above items (1) and (2) are OK and combination meter does not turn on, combination meter is faulty.</li> </ul>	Replace combination meter.

**2-6-9. Combination meter warning lamp or indicator lamp is abnormal**

Reference Fig. : 2-6-2

Check point	Check/Cause	Action
1. Combination Meter (Lamp check)	<p>(1) When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire.</p> <ul style="list-style-type: none"> <li>• Battery terminal wire No. 57 inlet wire L and ground terminal wire No.2 wire B</li> <li>• Starter switch terminal wire No. 37 inlet wire WY and ground terminal wire No.2 wire B</li> </ul> <p>Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, check that parking brake indicator lamp, hydraulic oil filter warning lamp, oil pressure warning lamp and charge warning lamp illuminate and then go out after starting engine.</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, combination meter is faulty.</li> </ul> <p><b>(NOTICE)</b></p> <ul style="list-style-type: none"> <li>• <b>Since engine cannot start unless parking brake switch is applied, parking brake indicator lamp does not go out even after starting engine.</b></li> </ul>	Replace combination meter.

Fig.: 2-6-2





**2-6-10. Tachometer reading is abnormal**

Reference Fig. : 2-6-2

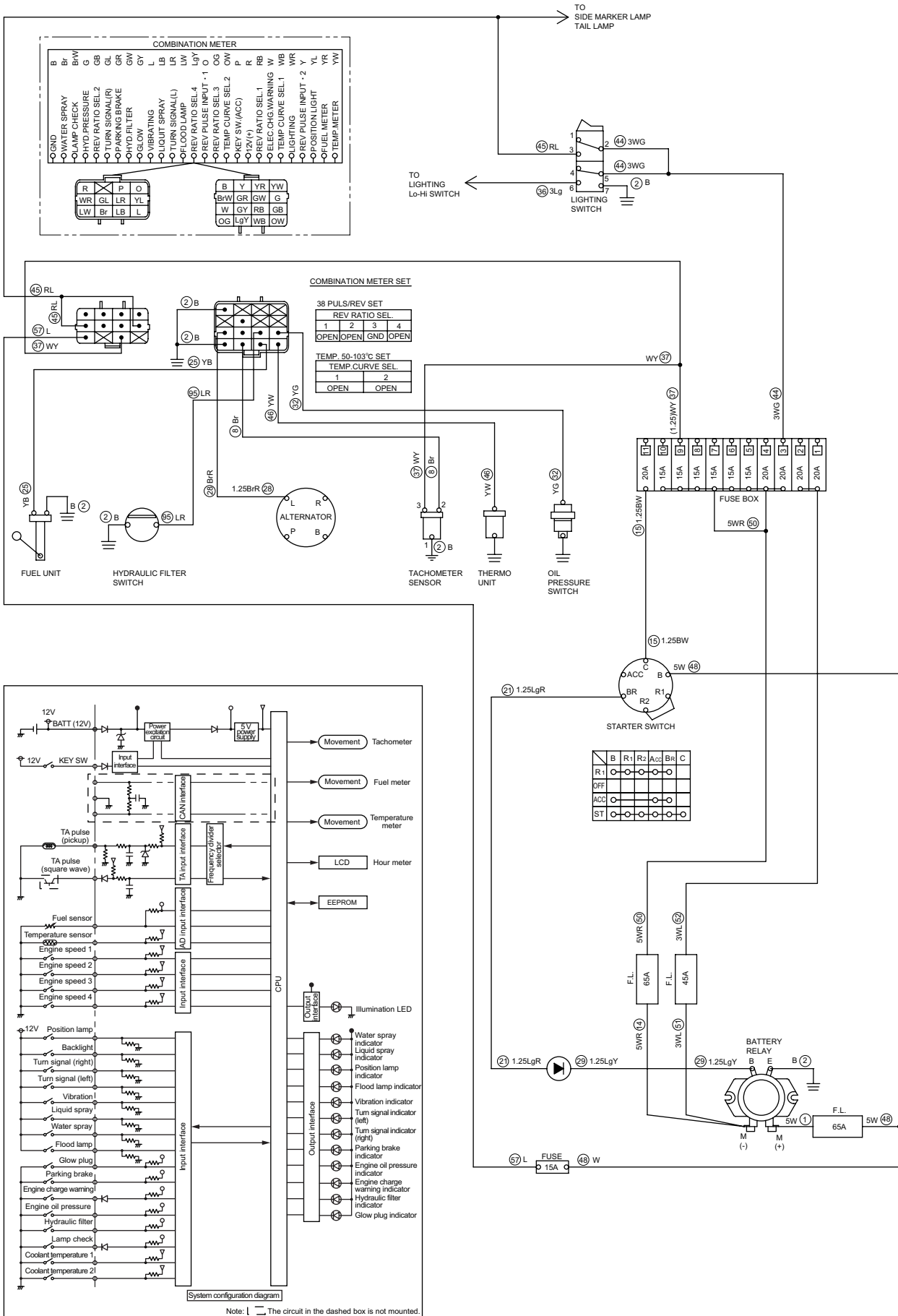
Check point	Check/Cause	Action
1. Combination Meter (Tachometer)	<p>(1) When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire.</p> <ul style="list-style-type: none"> <li>• Battery terminal wire No. 57 inlet wire L and ground terminal wire No.2 wire B</li> <li>• Starter switch terminal wire No. 37 inlet wire WY and ground terminal wire No.2 wire B</li> </ul> <p>Standard voltage : 12 V or more</p> <p>(2) Check that combination meter terminal B wire (rev. ratio 3) are grounded.</p> <p>(3) Start engine and measure pulse between combination meter TA pulse terminal wire No. 8 inlet wire Br and chassis ground.</p> <p>Standard pulse : 38 pulses/rotation of engine</p> <ul style="list-style-type: none"> <li>• If above items (1) and (2) are OK and pulse is NG in item (3), tacho sensor is faulty.</li> <li>• If above items (1) and (2) are OK and tachometer reading is NG in item (3), combination meter is faulty.</li> </ul>	Replace tacho sensor or combination meter.
2. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals.</li> </ul> <p>Standard resistance : 10 <math>\Omega</math> or less</p> <ul style="list-style-type: none"> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.

**2-6-11. Hour meter is abnormal**

Reference Fig. : 2-6-2

Check point	Check/Cause	Action
1. Combination Meter (Hour meter)	<ul style="list-style-type: none"> <li>• When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire.</li> <li>• Battery terminal wire No. 57 inlet wire L and ground terminal wire No.2 wire B</li> <li>• Starter switch terminal wire No. 37 inlet wire WY and ground terminal wire No.2 wire B</li> </ul> <p>Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If no abnormality is found, combination meter is faulty.</li> </ul>	Replace combination meter.

Fig.: 2-6-2



**2-6-12. Temperature meter is abnormal**

Reference Fig. : 2-6-2

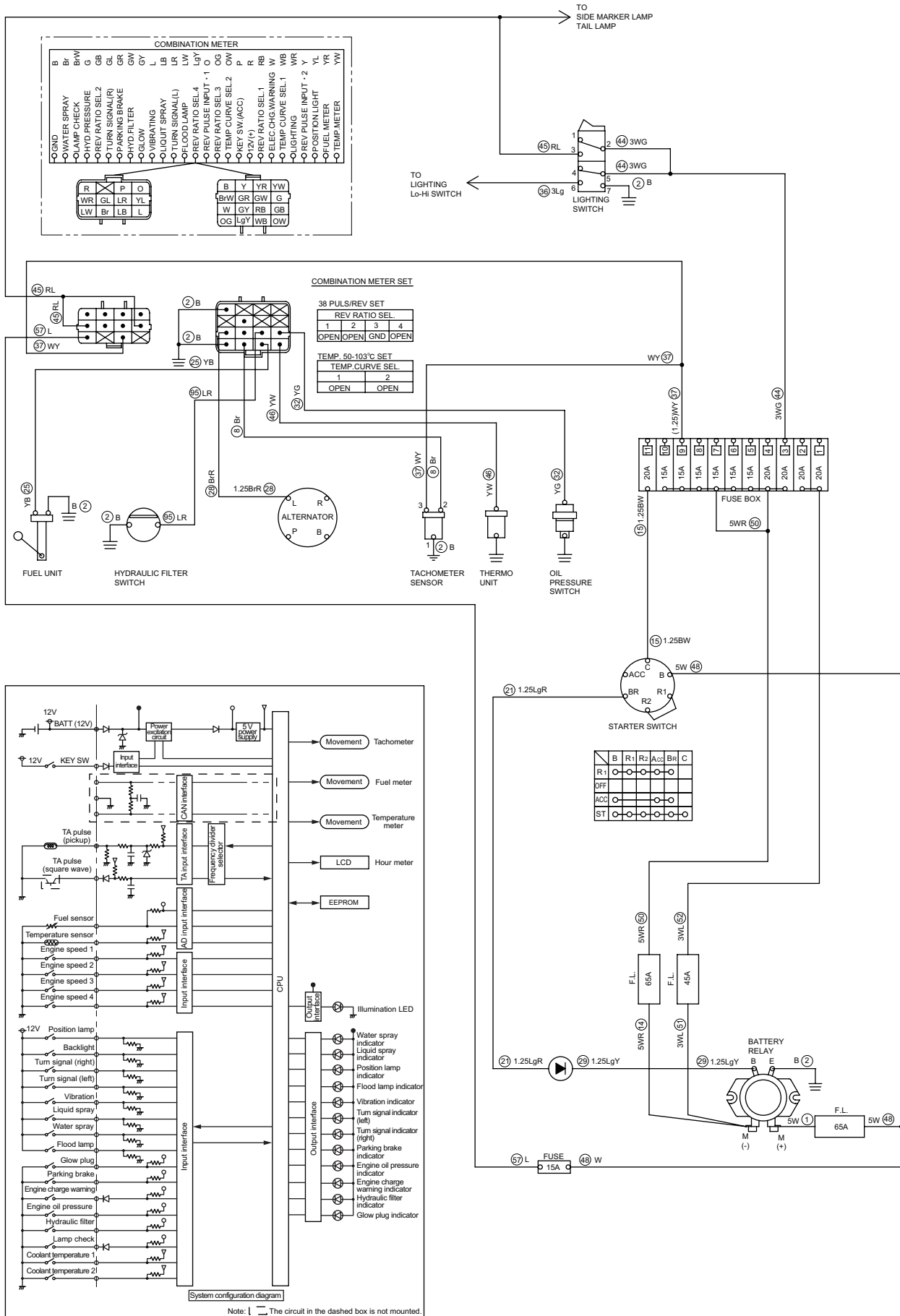
Check point	Check/Cause	Action
1. Thermo Unit	<ul style="list-style-type: none"> <li>• Disconnect harness and measure resistance of thermo unit. Standard resistance : 164.6 <math>\Omega</math> [(at unit temperature of 50°C (122°F))] 26.44 <math>\Omega</math> [(at unit temperature of 103°C (217°F))]</li> <li>• If resistance is abnormal, thermo unit is faulty.</li> </ul>	Replace thermo unit.
2. Combination Meter (Temperature meter)	<ul style="list-style-type: none"> <li>• When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire. <ul style="list-style-type: none"> <li>• Battery terminal wire No. 57 inlet wire L and ground terminal wire No.2 wire B</li> <li>• Starter switch terminal wire No. 37 inlet wire WY and ground terminal wire No.2 wire B</li> </ul> Standard voltage : 12 V or more </li> <li>• If no abnormality is found, combination meter is faulty.</li> </ul>	Replace combination meter.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : 10 <math>\Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.

**2-6-13. Fuel meter is abnormal**

Reference Fig. : 2-6-2

Check point	Check/Cause	Action
1. Fuel Unit	<ul style="list-style-type: none"> <li>• Disconnect harness and measure resistance of fuel unit. Standard resistance : 13.5 <math>\Omega</math> (with float in "F") 80.0 <math>\Omega</math> (with float in "E")</li> <li>• If resistance is abnormal, fuel unit is faulty.</li> </ul>	Replace fuel unit.
2. Combination Meter (Fuel meter)	<ul style="list-style-type: none"> <li>• When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire. <ul style="list-style-type: none"> <li>• Battery terminal wire No. 57 inlet wire L and ground terminal wire No.2 wire B</li> <li>• Starter switch terminal wire No. 37 inlet wire WY and ground terminal wire No.2 wire B</li> </ul> Standard voltage : 12 V or more </li> <li>• If no abnormality is found, combination meter is faulty.</li> </ul>	Replace combination meter.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : 10 <math>\Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.

Fig.: 2-6-2



**2-6-14. Hydraulic oil filter warning lamp remains ON**

Reference Fig. : 2-6-2

Check point	Check/Cause	Action
1. Hydraulic Oil Filter Switch	<ul style="list-style-type: none"> <li>• When starter switch is OFF, check continuity between hydraulic oil filter switch inlet terminal and chassis ground. There is no continuity in normal condition.</li> <li>• If there is continuity, hydraulic oil filter switch is faulty.</li> </ul>	Replace hydraulic oil filter switch.

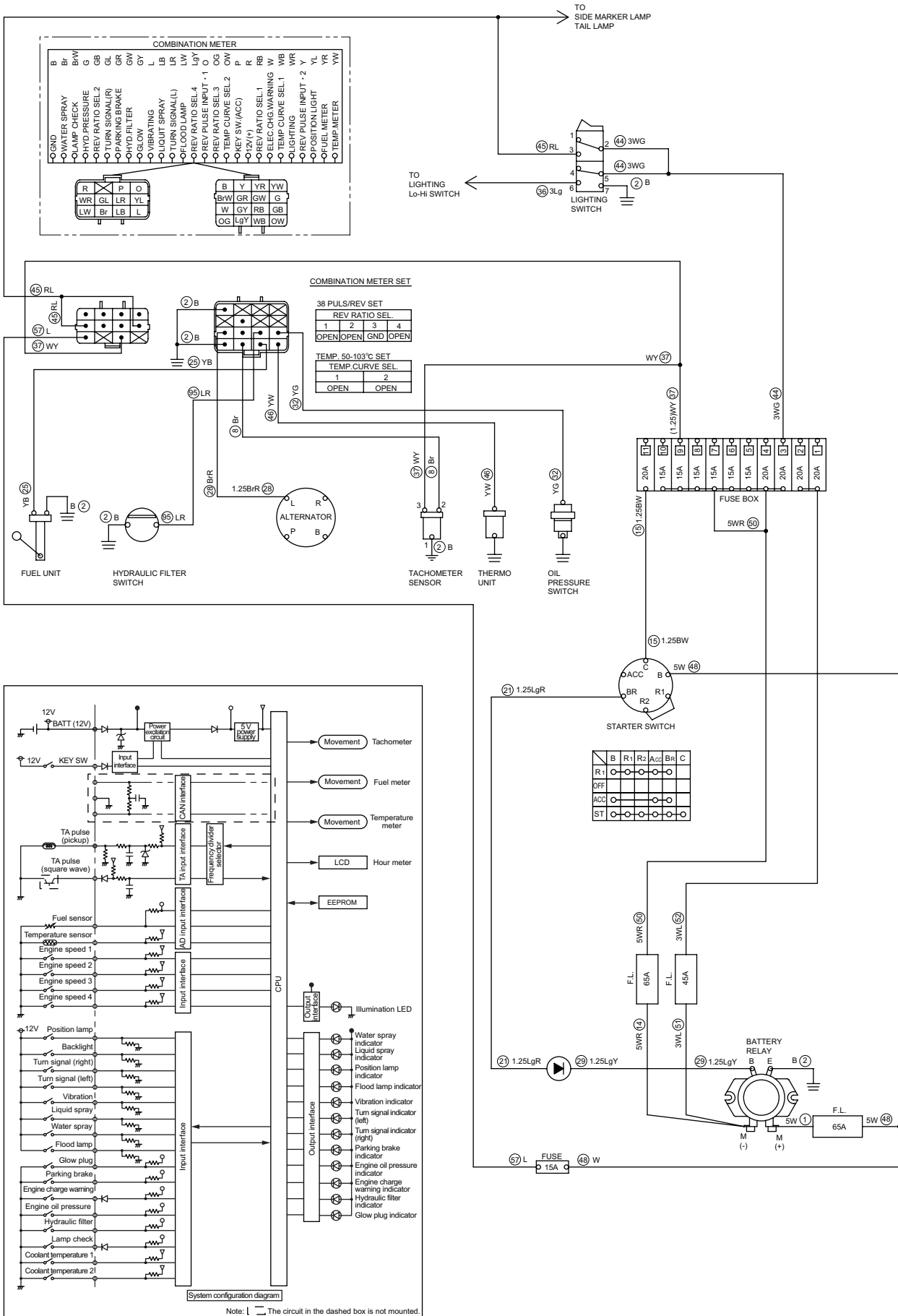
**2-6-15. Charge warning lamp remains ON**

- Check with engine running.

Reference Fig. : 2-6-2

Check point	Check/Cause	Action
1. Harness	<ul style="list-style-type: none"> <li>• Disconnect connectors between combination meter and alternator terminal L.</li> <li>• Measure resistance between terminals and chassis ground.               <ul style="list-style-type: none"> <li>• Combination meter connector terminal wire No. 28 wire and chassis ground.</li> <li>• Alternator terminal L and chassis ground Standard resistance : 100k <math>\Omega</math> or more</li> </ul> </li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.
2. Combination Meter (Charge warning)	<ul style="list-style-type: none"> <li>• Measure voltage between combination meter charge warning lamp terminal wire No. 28 outlet wire BrR and chassis ground. Standard voltage : 12 V or more</li> <li>• If voltage is OK, combination meter is faulty.</li> <li>• If voltage is abnormal, alternator is faulty.</li> </ul>	Replace combination meter or alternator.

Fig.: 2-6-2

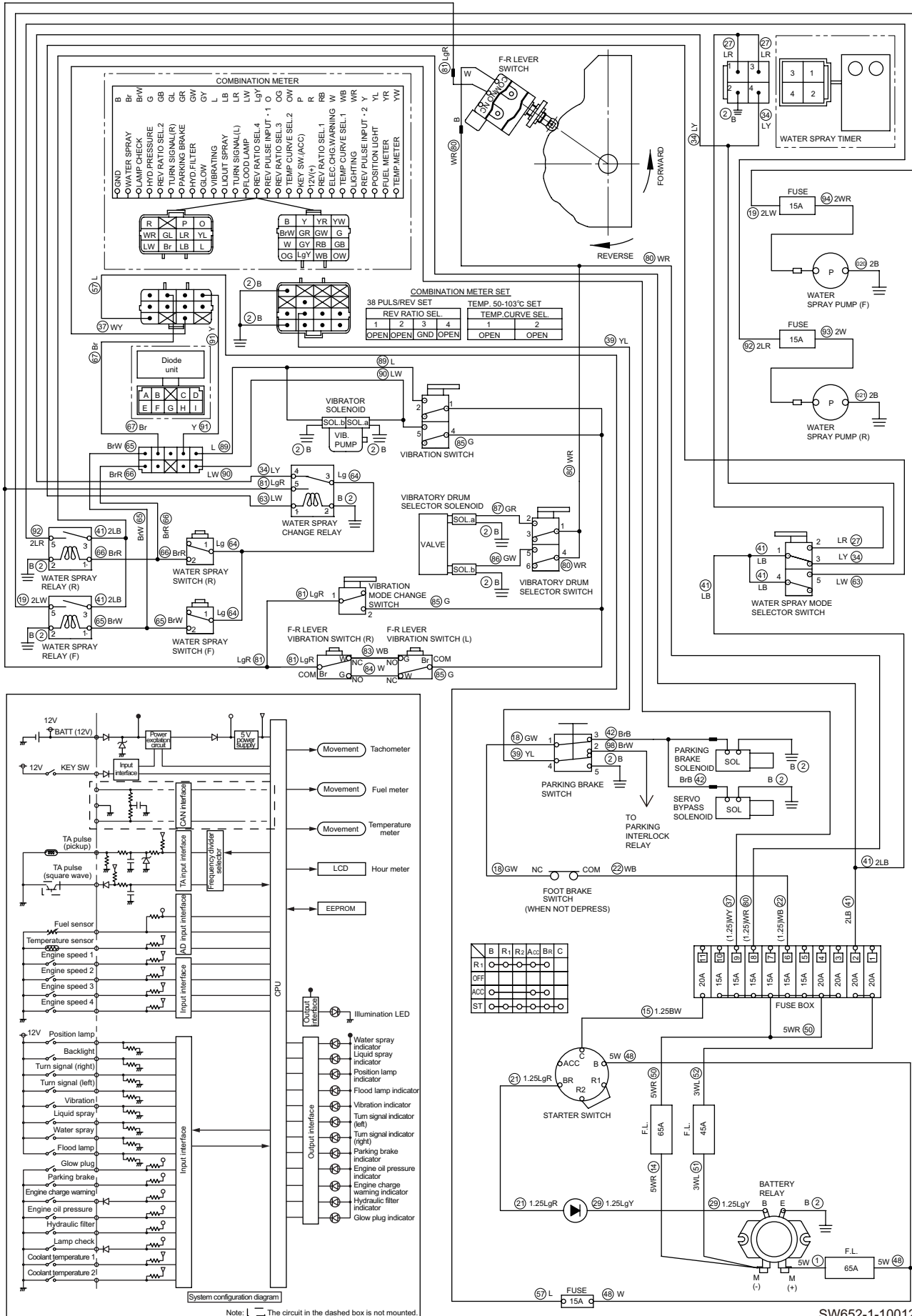


**2-6-16. Oil pressure warning lamp remains ON**

Reference Fig. : 2-6-2

Check point	Check/Cause	Action
1. Harness	<ul style="list-style-type: none"> <li>• Disconnect connectors between combination meter and oil pressure switch.</li> <li>• Measure resistance between terminals and chassis ground.               <ul style="list-style-type: none"> <li>• Combination meter connector terminal wire No.32 wire and chassis ground.</li> <li>• Oil pressure switch terminal wire YG and chassis ground.</li> </ul>               Standard resistance : 100 kΩ or more             </li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.
2. Oil Pressure Switch	<ul style="list-style-type: none"> <li>• Disconnect oil pressure switch and check continuity between its terminals. There is continuity in normal condition.</li> <li>• If there is continuity, oil pressure switch is faulty.</li> </ul>	Replace oil pressure switch.
3. Combination Meter (Oil pressure warning lamp)	<p>(1) When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire.</p> <ul style="list-style-type: none"> <li>• Battery terminal inlet wire No. 57 inlet wire L and ground terminal wire No.2 wire B.</li> <li>• Starter switch terminal inlet wire No. 37 inlet wire WY and ground terminal wire No.2 wire B.</li> </ul> <p>Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between combination meter oil pressure terminal outlet wire No. 32 wire YG and chassis ground.</p> <p>Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above items (1) and (2) are OK and no abnormality is found in oil pressure switch but oil pressure switch remains on after starting engine, combination meter is faulty.</li> </ul>	Replace combination meter.

Fig.: 2-6-3





## 2-6-17. Vibration indicator lamp does not light

- Check that vibrator can be operated.

Reference Fig. : 2-6-3





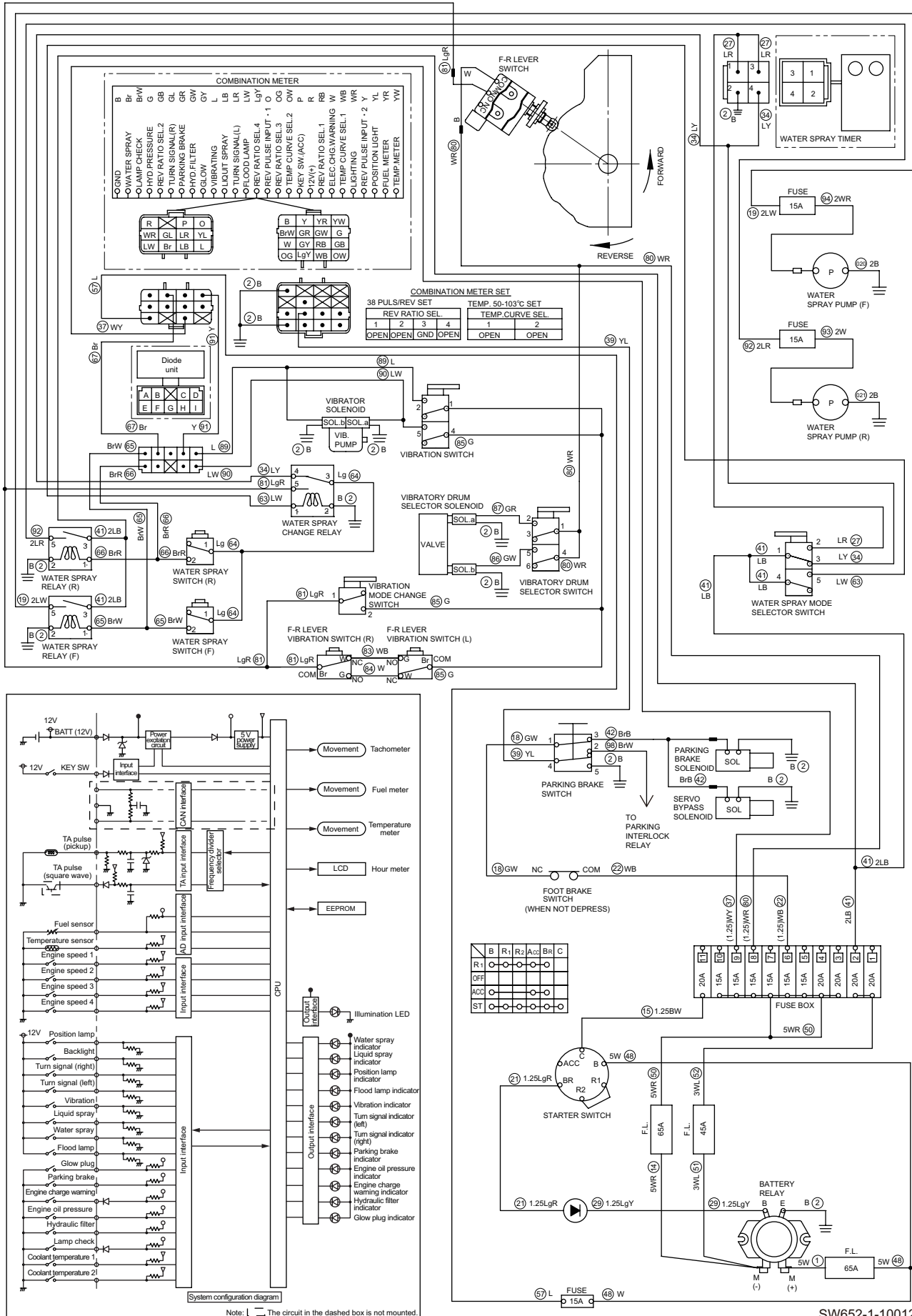
Check point	Check/Cause	Action
1. Harness	<p>(1) Measure resistance between vibration switch terminal 5 wire LW and diode unit terminal D wire LW. Standard resistance : 10 Ω or less</p> <p>(2) Measure resistance between vibration switch terminal 2 wire L and diode unit terminal I wire L. Standard resistance : 10 Ω or less</p> <p>(3) Measure resistance between diode unit terminal H wire Y and combination meter connector terminal wire No. 91 wire Y. Standard resistance : 10 Ω or less</p> <ul style="list-style-type: none"> <li>• If above item (1), (2) or (3) is NG, harness is faulty.</li> </ul>	Repair or replace harness.
2. Diode Unit	<p>(1) When starter switch is ON and vibration switch is in below position, measure voltage between diode unit terminal I inlet wire L and chassis ground. SW652ND-1 : “” Except SW652ND-1 : “” Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and vibration switch is in below position, measure voltage between diode unit terminal D inlet wire LW and chassis ground. SW652ND-1 : “” Except SW652ND-1 : “” Standard voltage : 12 V or more</p> <p>(3) When starter switch is ON, measure voltage between diode unit terminal H outlet wire Y and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above items (1) and (2) are OK and item (3) is NG, diode unit is faulty.</li> </ul>	Replace diode unit.
3. Combination Meter (Vibration indicator)	<p>(1) When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire.</p> <ul style="list-style-type: none"> <li>• Battery terminal wire No. 57 inlet wire L and ground terminal wire No.2 wire B</li> <li>• Starter switch terminal wire No. 37 inlet wire WY and ground terminal wire No.2 wire B</li> </ul> <p>Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, F-R lever and vibration mode change switch and vibration switch in below position, measure voltage between combination meter vibration indicator lamp terminal wire No. 91 inlet wire Y and chassis ground.</p> <p>F-R lever : Forward or reverse Vibration mode change switch : “AUTO” Vibration switch : Must not be “OFF”</p> <p>Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above items (1) and (2) are OK and vibration indicator lamp does not light, combination meter is faulty.</li> </ul>	Replace combination meter.

Fig.: 2-6-3

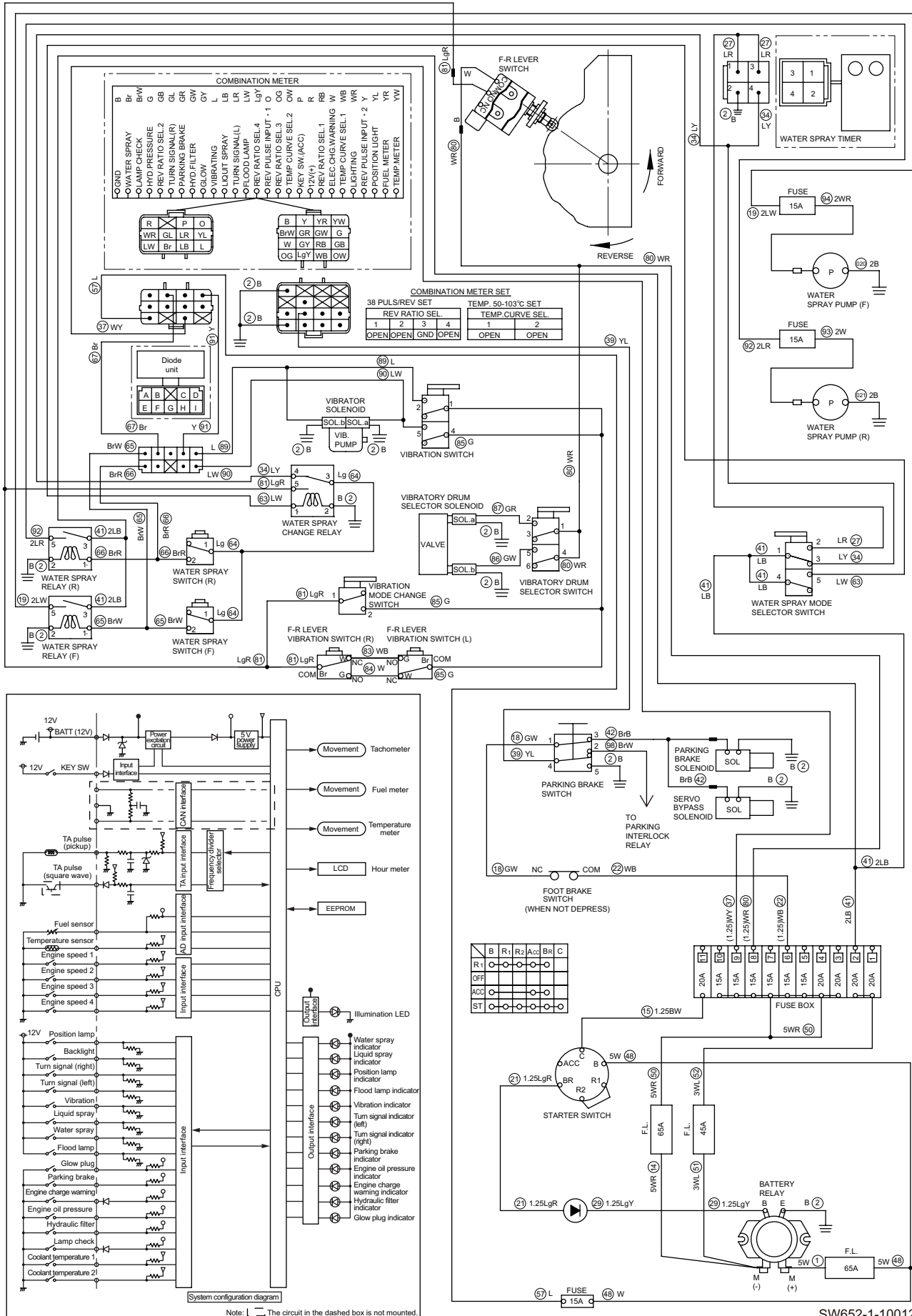


**2-6-18. Parking brake indicator lamp does not light**

Reference Fig. : 2-6-3

Check point	Check/Cause	Action
1. Harness	<ul style="list-style-type: none"> <li>• Measure resistance between parking brake switch terminal 4 wire YL and combination meter connector terminal wire No. 39 wire YL. Standard resistance : 10 Ω or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.
2. Parking Brake Switch	<ul style="list-style-type: none"> <li>• When parking brake is applied, check continuity between parking brake switch terminal 4 and 5. There is continuity in normal condition.</li> <li>• If there is no continuity, parking brake switch is faulty.</li> </ul>	Replace parking brake switch.
3. Combination Meter (Parking brake indicator)	<p>(1) When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire.</p> <ul style="list-style-type: none"> <li>• Battery terminal wire No. 57 inlet wire L and ground terminal wire No.2 wire B</li> <li>• Starter switch terminal wire No. 37 inlet wire WY and ground terminal wire No.2 wire B</li> </ul> <p>Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and parking brake is applied, measure voltage between combination meter parking brake indicator lamp terminal wire No. 39 outlet wire YL and chassis ground.</p> <p>Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above items (1) and (2) are OK and parking brake indicator lamp does not light, combination meter is faulty.</li> </ul>	Replace combination meter.

Fig.: 2-6-3



Note: [ ] The circuit in the dashed box is not mounted.

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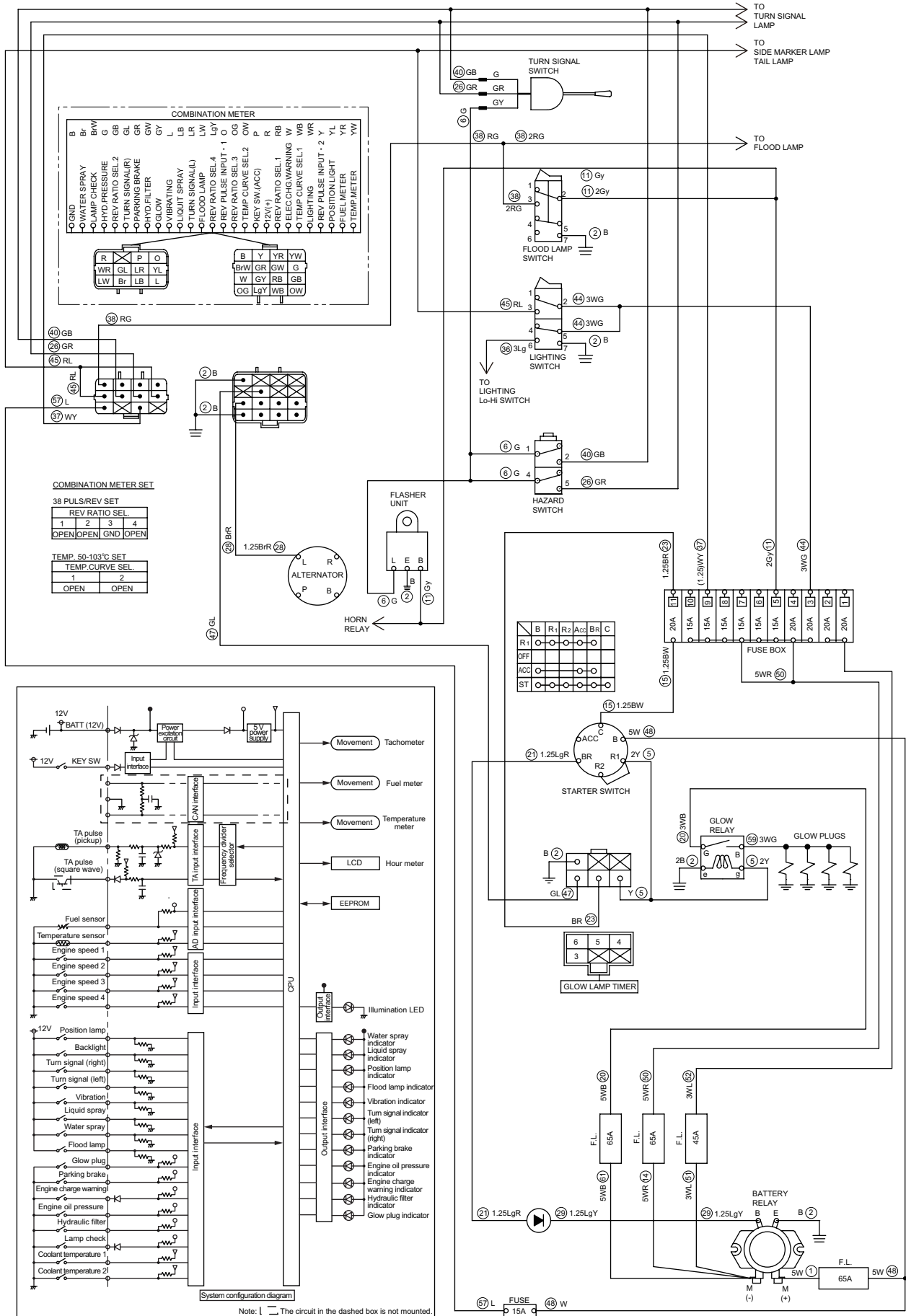
## 2-6-19. Water spray indicator lamp does not light

- Check that water spray pump can be activated.

Reference Fig. : 2-6-3

Check point	Check/Cause	Action
1. Harness	<p>(1) Measure resistance between water spray relay (F) terminal 1 wire BrW and diode unit terminal E wire BrW. Standard resistance : 10 Ω or less</p> <p>(2) Measure resistance between water spray relay (R) terminal 1 wire BrR and diode unit terminal A wire BrR. Standard resistance : 10 Ω or less</p> <p>(3) Measure resistance between diode unit terminal F wire Br and combination meter connector terminal wire No. 67 wire Br. Standard resistance : 10 Ω or less</p> <ul style="list-style-type: none"> <li>• If above items (1) , (2) or (3) is NG, harness is faulty.</li> </ul>	Repair or replace harness.
2. Diode Unit	<p>(1) When starter switch is ON, water spray switch (F) is ON and water spray mode selector switch is in "CONT", measure voltage between diode unit terminal E inlet wire BrW and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, water spray switch (R) is ON and water spray mode selector switch is in "CONT", measure voltage between diode unit terminal A inlet wire BrR and chassis ground. Standard voltage : 12 V or more</p> <p>(3) When starter switch is ON, water spray switch (F) or (R) is ON and water spray mode selector switch is in "CONT", measure voltage between diode unit terminal F outlet wire Br and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above items (1) and (2) are OK and item (3) is NG, diode unit is faulty.</li> </ul>	Replace diode unit.
3. Combination Meter (Water spray indicator)	<p>(1) When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire.</p> <ul style="list-style-type: none"> <li>• Battery terminal wire No. 57 inlet wire L and ground terminal wire No. 2 wire B.</li> <li>• Starter switch terminal wire No. 37 inlet wire WY and ground terminal wire No. 2 wire B.</li> </ul> <p>Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, water spray switch (F) or (R) is ON and water spray mode selector switch is in "CONT", measure voltage between combination meter water spray indicator lamp terminal wire No. 67 inlet wire Br and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above items (1) and (2) are OK and water spray indicator lamp does not light, combination meter is faulty.</li> </ul>	Replace combination meter.


Fig.: 2-6-4



**2-6-20. Flood lamp indicator lamp does not light**

- Check that flood lamp lights.

Reference Fig. : 2-6-4

Check point	Check/Cause	Action
1. Harness	<ul style="list-style-type: none"> <li>• Measure resistance between flood lamp switch terminal 3 wire RG and combination meter connector terminal wire No. 38 wire RG. Standard resistance : 10 <math>\Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.
2. Combination Meter (Flood lamp indicator)	<p>(1) When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire.</p> <ul style="list-style-type: none"> <li>• Battery terminal wire No. 57 inlet wire L and ground terminal wire No. 2 wire B</li> <li>• Starter switch terminal wire No. 37 inlet wire WY and ground terminal wire No. 2 wire B</li> </ul> <p>Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and flood lamp switch is , measure voltage between combination meter flood lamp indicator lamp terminal wire No. 38 inlet wire RG and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above items (1) and (2) are OK and flood lamp indicator lamp does not light, combination meter is faulty.</li> </ul>	Replace combination meter.

**2-6-21. Side marker lamp indicator lamp does not light**

- Check that head lamp, side marker lamp and fail lamp light.

Reference Fig.: 2-6-4


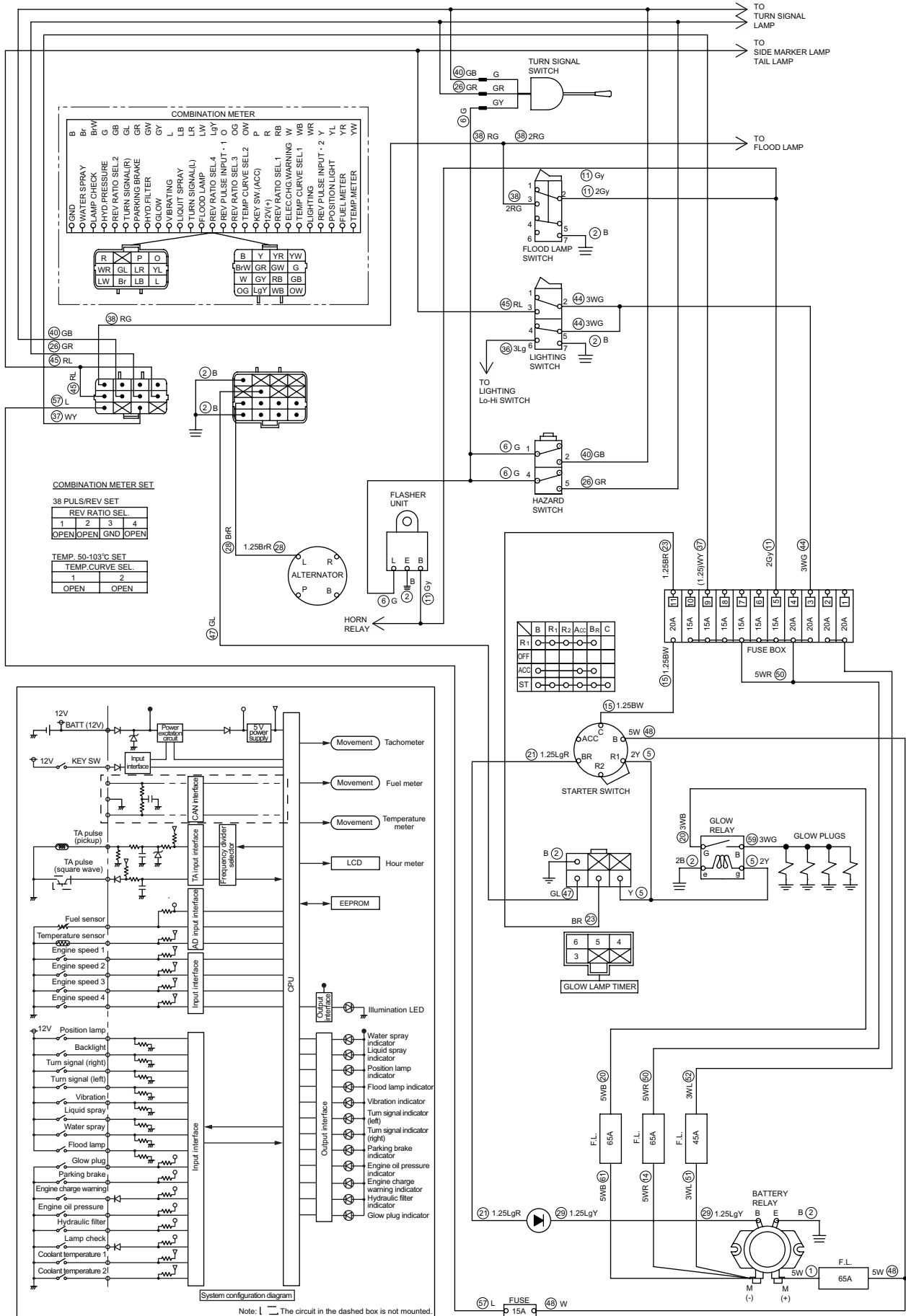
Check point	Check/Cause	Action
1. Harness	<ul style="list-style-type: none"> <li>• Measure resistance between lighting switch terminal 3 wire RL and combination meter connector terminal wire No. 45 wire RL. Standard resistance : 10 <math>\Omega</math> or less.</li> <li>• If above resistance value is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.
2. Combination Meter (Side marker lamp indicator)	<p>(1) When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire.</p> <ul style="list-style-type: none"> <li>• Battery terminal wire No. 57 inlet wire L and ground terminal wire No. 2 wire B.</li> <li>• Starter switch terminal wire No. 37 inlet wire WY and ground terminal wire No. 2 wire B.</li> </ul> <p>Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and lighting switch is , measure voltage between combination meter side marker lamp indicator terminal wire No. 45 inlet wire RL and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above items (1) and (2) are OK and side marker lamp indicator lamp does not turn on, combination meter is faulty.</li> </ul>	Replace combination meter.

Fig.: 2-6-4





**2-6-22. Turn signal indicator lamp does not light**

Reference Fig.: 2-6-4

Check point	Check/Cause	Action
1. Harness	(1) Measure resistance between turn signal switch terminal wire GR (left-hand side) and combination meter connector terminal wire No. 26 wire GR. Standard resistance : 10 Ω or less (2) Measure resistance between turn signal switch terminal inlet wire G (right-hand side) and combination meter connector terminal wire No. 40 wire GB. Standard resistance : 10 Ω or less • If above item (1) or (2) is NG, harness is faulty.	Repair or replace harness.
2. Turn Signal Switch	• Check continuity between turn signal switch terminals while turn signal switch is ON. Direction indicator switch : To the left : Between wire GY and GR To the right : Between wire GY and G There is continuity in normal condition. • If there is no continuity, turn signal switch is faulty.	Replace turn signal switch.
3. Combination Meter (Turn signal indicator)	(1) When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire. • Battery terminal wire No. 57 inlet wire L and ground terminal wire No. 2 wire B. • Starter switch terminal wire No. 37 inlet wire WY and ground terminal wire No. 2 wire B. Standard voltage : 12 V or more (2) When starter switch is ON and turn signal switch is ON, measure voltage between combination meter terminal wires and chassis ground. • Left-hand side turn signal terminal wire No. 26 inlet wire GR and chassis ground • Right-hand side turn signal terminal wire No. 40 inlet wire GB and chassis ground Standard voltage : 12 V or more • If above items (1) and (2) are OK and turn signal indicator lamp does not turn on, combination meter is faulty.	Replace combination meter.

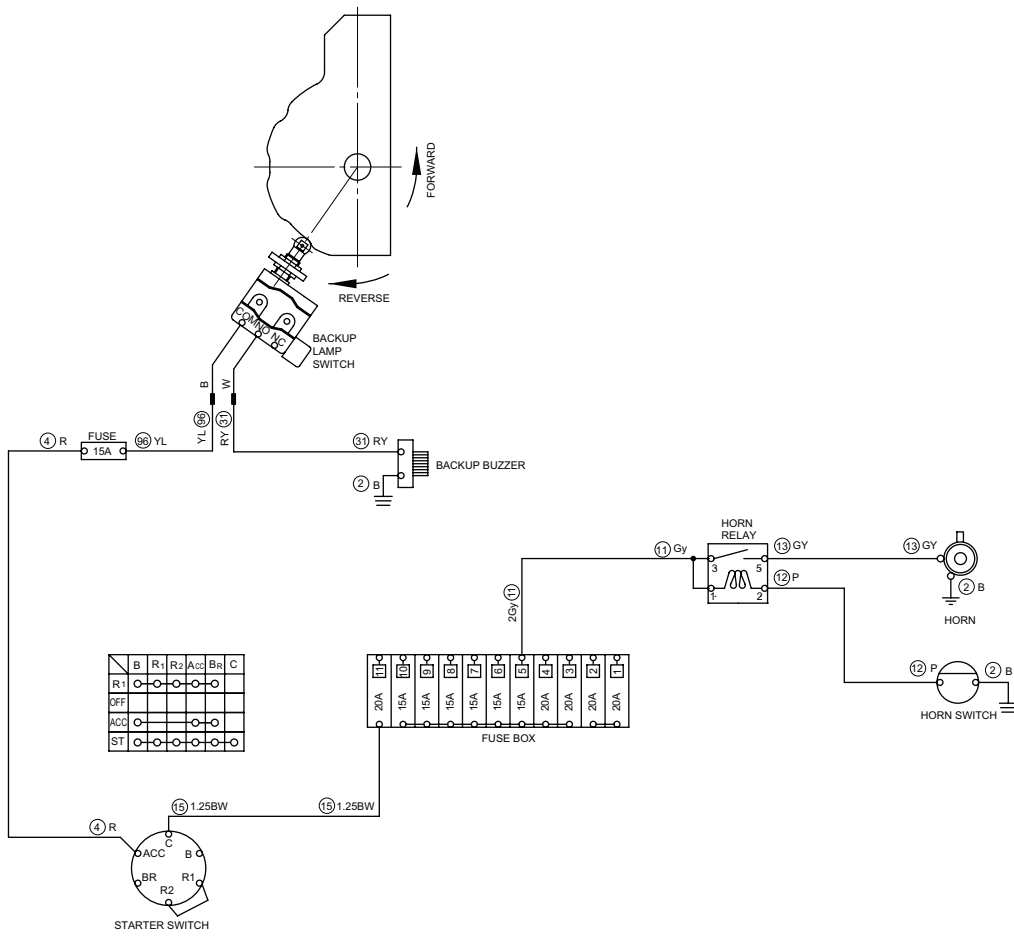


**2-6-23. Glow (Preheating plug) indicator lamp does not light**

Reference Fig. : 2-6-4

Check point	Check/Cause	Action
1. Harness	(1) Measure resistance between glow lamp timer terminal 6 wire GL and combination meter connector terminal wire No. 47 wire GL. Standard resistance : 10 Ω or less (2) Measure resistance between glow plug timer terminal 4 wire Y and starter switch terminal R1 wire Y. Standard resistance : 10 Ω or less (3) Measure resistance between glow lamp timer terminal 5 wire BR and fuse box terminal 11 wire BR. Standard resistance : 10 Ω or less • If item (1), (2) or (3) is NG, harness is faulty.	Repair or replace harness.
2. Glow lamp Timer	(1) When starter switch is HEAT, measure voltage between glow lamp timer terminal 4 inlet wire Y and chassis ground. Standard voltage : 12 V or more (2) When starter switch is START, measure voltage between glow lamp timer terminals and chassis ground. • Glow lamp timer terminal 4 inlet wire Y and chassis ground. • Glow lamp timer terminal 5 inlet wire BR and chassis ground. Standard voltage : 12 V or more (3) When starter switch is HEAT, measure voltage between glow lamp timer terminal 6 inlet wire GL and chassis ground. Standard voltage : 12 V or more (Electricity flows for a definite time) • If above items (1) and (2) are OK and item (3) is NG, glow lamp timer is faulty.	Replace glow lamp timer.
3. Combination Meter (Glow indicator)	(1) When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire. • Battery terminal wire No. 57 inlet wire L and ground terminal wire No. 2 wire B • Starter switch terminal wire No. 37 inlet wire WY and ground terminal wire No. 2 wire B Standard voltage : 12 V or more (2) When starter switch is HEAT, measure voltage between combination meter glow indicator terminal wire No. 47 outlet wire GL and ground terminal wire No. 2 wire B. Standard voltage : 12 V or more (for a certain period) • If above items (1) and (2) are OK and glow indicator lamp does not light, combination meter is faulty.	Replace combination meter.

Fig.: 2-6-5



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**2-6-24. Horn does not sound**

Reference Fig. : 2-6-5

Check point	Check/Cause	Action
1. Horn	<ul style="list-style-type: none"> <li>• Disconnect horn and directly connect battery positive terminal to horn terminal wire GY side and negative terminal to horn terminal wire B side.</li> <li>• If horn does not sound, horn is faulty.</li> </ul>	Replace horn.
2. Horn Relay	<p>(1) When starter switch is ON and horn switch is pressed, measure voltage between horn relay terminal 2 outlet wire P and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and horn switch is pressed, measure voltage between horn relay terminal 5 outlet wire GY and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, horn relay is faulty.</li> </ul>	Replace horn relay.
3. Horn Switch	<ul style="list-style-type: none"> <li>• When horn switch is OFF, measure resistance between horn switch terminals. Standard resistance : 100 k<math>\Omega</math> or more</li> <li>• If resistance is abnormal, horn switch is faulty.</li> </ul>	Replace horn switch.
4. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : 10 <math>\Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.

**2-6-25. Backup buzzer does not sound**

Reference Fig. : 2-6-5

Check point	Check/Cause	Action
1. Backup Buzzer	<ul style="list-style-type: none"> <li>• Disconnect backup buzzer and directly connect battery positive terminal to backup buzzer terminal wire RY side and negative terminal to backup buzzer terminal wire B side.</li> <li>• If backup buzzer does not sound, backup buzzer is faulty.</li> </ul>	Replace backup buzzer.
2. Backup Buzzer Switch	<p>(1) When starter switch is ON, measure voltage between backup buzzer switch terminal COM inlet wire YL and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and F-R lever is in reverse, measure voltage between backup buzzer switch terminal NO outlet wire RY and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> <li>• If above item (1) is OK and item (2) is NG, backup buzzer switch is faulty.</li> </ul>	Replace backup buzzer switch.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> <li>• Measure resistance of harness connecting between terminals. Standard resistance : 10 <math>\Omega</math> or less</li> <li>• If resistance is abnormal, harness is faulty.</li> </ul>	Repair or replace harness.

## 3. HYDRAULIC SYSTEM TROUBLESHOOTING

### 3-1. When Performing Hydraulic System Troubleshooting

- The largest factor in the majority of failures of hydraulic devices operating under conditions of higher pressure and greater precision is the entry of dirt (foreign substances) into the hydraulic circuit. Particular caution is required when supplying hydraulic oil or when disassembling and assembling hydraulic devices.

#### 1) Pay attention to the work environment.

As much as possible, avoid performing tasks such as supplying hydraulic oil, replacing filters and repair work on rainy days, when there is strong wind, or in locations where there is much dust.

#### 2) Disassembly and maintenance work in the field

There is the danger of dust entry when disassembly and maintenance work for hydraulic components is performed in the field. In addition, because performance verification after repairs are completed is difficult, replacement of the entire assembly is preferred. Perform disassembly and maintenance of hydraulic components in a special room protected from dust, and use special testers to verify the performance.

#### 3) Sealing of openings

Use caps, tape, plastic bags or other means to seal the openings of removed pipes and components in order to prevent foreign substances from entering. Never leave the openings exposed or put a shop cloth into them. There is the danger of foreign substances entering or of leaking oil causing environmental contamination. Do not dispose of waste oil on-site. Either deliver it to the customer and request disposal or take it back with you and dispose of it.

#### 4) Prevent entry of foreign substances when supplying oil.

Take care that foreign substances do not enter when supplying hydraulic oil. Clean the oil supply port and the area around it, as well as the supply pump, oilcan and other items. A more reliable method is to use oil cleaning equipment, which can filter out the contamination that occurred during storage.

#### 5) Change hydraulic oil while the temperature is still high.

All oils, including hydraulic oil, flow more readily when they are warm. Higher temperatures also make it easier to eject the sludge and other substances outside the circuit together with the oil. For these reasons, oil changes should be performed while the oil temperature is high. When changing the oil, it is necessary to drain out as much of the old hydraulic oil as possible. (In addition to the hydraulic oil tank, also drain the oil from the filter and circuit drain plugs.) If old hydraulic oil remains in the system, the contaminants and sludge in the old oil will mix with the new oil and shorten the hydraulic oil lifetime.

## 3-2. Propulsion System

If a problem occurs in the propulsion systems such as the propulsion pump, propulsion motor and brakes, determine the cause and carry out action as required, according to the following general troubleshooting items.

### (NOTICE)

- When checking whether or not the pressure is correct, refer to the pressure standard value for each hydraulic circuit.

### 3-2-1. Machine moves neither forward nor backward 1/2

Check point	Cause	Check/Action
1. Oil Level of Hydraulic Oil Tank	Oil level in hydraulic oil tank is low.	Fill tank until correct oil level is obtained.
2. Bypass Valve	Bypass valve is open.	Close bypass valve.
3. F-R Lever Linkage	F-R lever linkage is faulty.	Check and adjust F-R lever linkage or replace it if necessary.
4. Charge Circuit Pressure	Propulsion pump does not discharge oil because charge pressure is low.	<ul style="list-style-type: none"> <li>• Measure charge pressure.</li> <li>• If low, check and adjust charge relief valve or replace it if necessary.</li> </ul>
	Charge pressure decreases due to pressure leakage from pressure cut off valve.	Check and adjust pressure cut off valve or replace it if necessary.
	Insufficient charge pump discharge.	Repair charge pump or replace it if necessary.
	Charge pressure decreases due to internal leakage of solenoid valve connecting oil supply circuit with charge circuit. <ul style="list-style-type: none"> <li>• Parking brake solenoid valve</li> <li>• Speed change solenoid valve</li> </ul>	<ul style="list-style-type: none"> <li>• When solenoid is energized, check if oil flows in return circuit to tank.</li> <li>• If oil is flowing, repair solenoid valve or replace it if necessary.</li> </ul>
5. Servo Bypass Solenoid Valve	If spool of servo bypass solenoid valve is stuck, pressure in both sides of servo cylinder chamber is equalized. This causes propulsion pump unable to discharge oil.	<ul style="list-style-type: none"> <li>• Measure pressure in servo cylinder chambers.</li> <li>• If pressure is equal in both chambers, repair servo bypass solenoid valve or replace it if necessary.</li> </ul>
6. Suction Filter for Charge Pump	Charge pump flow is reduced due to clogged filter.	Clean suction filter or replace it if necessary.
7. Propulsion Circuit Pressure	Pump does not discharge oil because setting pressure of pressure cut off valve is low.	Measure propulsion circuit pressure. If low, check and adjust pressure cut off valve or replace it if necessary.
	Circuit does not obtain required pressure because setting pressure of high pressure relief is low.	<ul style="list-style-type: none"> <li>• Measure propulsion circuit pressure.</li> <li>• If low, check and adjust high pressure relief valve or replace it if necessary.</li> </ul>
8. Propulsion Motor	Propulsion circuit pressure is not held in propulsion motor case.	If pressure in propulsion motor case is not within allowable range, repair propulsion motor or replace it if necessary.
	Internal leakage of propulsion motor.	<ul style="list-style-type: none"> <li>• Measure drain quantity from propulsion motor.</li> <li>• If drain quantity is larger than standard value, repair propulsion motor or replace it if necessary.</li> </ul>
	Sticking of disc brakes causes brakes to remain applied.	<ul style="list-style-type: none"> <li>• Replace disc brakes.</li> </ul>

**3-2-1. Machine moves neither forward nor backward 2/2**

Check point	Cause	Check/Action
9. Propulsion Pump	Discharge flow rate is insufficient due to efficiency degradation of propulsion pump.	<ul style="list-style-type: none"> <li>• Measure discharge flow rate of propulsion pump with flow meter.</li> <li>• If discharge flow rate is not within specified range, repair propulsion pump or replace it if necessary.</li> </ul>
	Discharge flow rate is insufficient due to wear of propulsion pump drive shaft splines.	Replace propulsion pump.
	Propulsion circuit pressure is not held in propulsion pump case.	If pressure in propulsion pump case is not within allowable range, repair propulsion pump or replace it if necessary.
10. Parking Brake Solenoid Valve	Brake remains applied because spool of parking brake solenoid valve does not shift.	Repair parking brake solenoid valve or replace it if necessary.
11. Brake Inlet Pressure	Brake cannot be released because brake inlet pressure is low.	<ul style="list-style-type: none"> <li>• Measure brake release pressure.</li> <li>• If low, repair or replace propulsion motor.</li> </ul>
12. Flange	Drive torque is not transmitted to pump due to faulty flange.	Replace flange.

**3-2-2. Machine moves in one direction only (forward or backward)**

Check point	Cause	Check/Action
1. F-R Lever Linkage	F-R lever linkage is faulty.	Check and adjust F-R lever linkage or replace it if necessary.
2. High Pressure Relief Valve	Low circuit pressure due to incorrect high pressure relief setting or internal leakage of high pressure relief valve.	<ul style="list-style-type: none"> <li>• Interchange two high pressure relief valves.</li> <li>• If faulty condition is accordingly reversed, check and adjust high pressure relief valve or replace it if necessary.</li> </ul>

**3-2-3. Slow machine speed or small drive force 1/2**

Check point	Cause	Check/Action
1. Bypass Valve	Bypass valve is slightly open.	Close bypass valve completely.
2. F-R Lever Linkage	F-R lever linkage is faulty.	Check and adjust F-R lever linkage or replace it if necessary.
3. Charge Circuit Pressure	Stroke of propulsion pump swash plate is small because charge pressure is low, decreasing discharge rate of propulsion pump.	<ul style="list-style-type: none"> <li>• Measure charge pressure.</li> <li>• If low, check and adjust charge relief valve or replace it if necessary.</li> </ul>
	Insufficient charge pump discharge.	Repair charge pump or replace it if necessary.
	Charge pressure decreases due to internal leakage of solenoid valve connecting oil supply circuit with charge circuit. <ul style="list-style-type: none"> <li>• Parking brake solenoid valve</li> <li>• Speed change solenoid valve</li> </ul>	<ul style="list-style-type: none"> <li>• When solenoid is energized, check if oil flows in return circuit to tank.</li> <li>• If oil is flowing, repair solenoid valve or replace it if necessary.</li> </ul>
4. Suction Filter for Charge Pump	Flow rate of charge pump decreases as well as charge pressure decreases due to clogged filter.	Clean suction filter or replace it if necessary.



**3-2-3. Slow machine speed or small drive force 2/2**

Check point	Cause	Check/Action
5. Propulsion Motor	Propulsion motor inlet pressure is low.	<ul style="list-style-type: none"> <li>• Measure propulsion motor inlet pressure.</li> <li>• If low, check and adjust high pressure relief valve or replace it if necessary.</li> </ul>
	Propulsion circuit pressure is not held in propulsion motor case.	If pressure in propulsion motor case is not within allowable range, repair propulsion motor or replace it if necessary.
	Output of propulsion motor decreases and number of revolutions decreases due to internal leakage of propulsion motor.	<ul style="list-style-type: none"> <li>• Measure drain quantity from propulsion motor.</li> <li>• If drain quantity is larger than standard value, repair propulsion motor or replace it if necessary.</li> </ul>
6. Propulsion Pump	Discharge flow rate is insufficient due to efficiency degradation of propulsion pump.	<ul style="list-style-type: none"> <li>• Measure discharge flow rate of propulsion pump with flow meter.</li> <li>• If discharge flow rate is not within specified range, repair propulsion pump or replace it if necessary.</li> </ul>
	Discharge flow rate is insufficient due to wear of propulsion pump drive shaft splines.	Replace propulsion pump.
	Propulsion circuit pressure is not held in propulsion pump case.	If pressure in propulsion pump case is not within allowable range, repair propulsion pump or replace it if necessary.

**3-2-4. Machine speed cannot be switched**

Check point	Cause	Check/Action
1. Speed Change Solenoid Valve	Machine speed does not change because spool of speed change solenoid valve does not change.	Repair speed change solenoid valve or replace it if necessary.
2. Propulsion Motor Swash Plate Stroke Cylinder	Faulty propulsion motor swash plate stroke cylinder.	Repair propulsion motor or replace it if necessary.

**3-2-5. Machine does not stop completely with F-R lever in “N”**

Check point	Cause	Check/Action
1. F-R lever Linkage	F-R lever linkage is faulty.	Check and adjust F-R lever linkage or replace it if necessary.
2. Servo Control Valve	Servo control valve neutral position adjustment failure.	Check and adjust servo control valve or replace it if necessary.
3. Propulsion Pump Servo Cylinder	Faulty propulsion pump servo cylinder or faulty pump swash plate setting.	Repair propulsion pump or replace it if necessary.

## TROUBLESHOOTING

### 3-2-6. Propulsion system is overheating

Check point	Cause	Check/Action
1. Oil Level of Hydraulic Oil Tank	Oil level in hydraulic oil tank is low.	Fill tank until correct oil level is obtained.
2. Oil Cooler	Cooling efficiency is reduced due to clogged oil cooler fins.	Clean oil cooler fins.
3. Flushing Valve	Hydraulic oil in propulsion closed circuit is insufficiently cooled due to flushing valve shuttle spool sticking.	Repair flushing valve or replace it if necessary.
	Hydraulic oil in propulsion closed circuit is insufficiently cooled because flushing valve relief setting pressure is excessively high.	Check dust or damage in flushing relief valve and replace it if necessary.
	Hydraulic oil in propulsion closed circuit is insufficiently cooled due to flushing valve relief valve poppet sticking.	Clean flushing relief valve or replace it if necessary.
4. Propulsion Circuit Pressure	If circuit pressure setting is excessively low, relief valve opens, causing temperature of hydraulic oil in circuit to rise.	<ul style="list-style-type: none"><li>• Measure propulsion circuit pressure.</li><li>• If low, increase relief setting pressure.</li></ul>
	If load is excessively heavy, relief valve opens, causing temperature of hydraulic oil in circuit to rise.	<ul style="list-style-type: none"><li>• Measure propulsion circuit pressure.</li><li>• If high, decrease propulsion load.</li></ul>
5. Suction Filter for Charge Pump	Load of charge pump increases due to clogged filter, causing temperature of hydraulic oil in circuit to rise.	Clean suction filter or replace it if necessary.
6. Hydraulic Oil Filter	Charge circuit pressure increases due to clogged filter.	Clean hydraulic oil filter or replace it if necessary.

### 3-2-7. Abnormal noise from propulsion system

Check point	Cause	Check/Action
1. Axle Bearings	Axle bearings supporting front and rear drums are damaged.	Replace axle bearings.
2. Hydraulic Hose Clamp	Vibrator sound of hydraulic hose is generated because clamp securing hydraulic hose is loose.	Tighten bolts of loose hydraulic hose clamp to specified torque.
3. Suction Filter for Charge Pump	Cavitation is occurring in charge pump due to clogged filter.	Clean suction filter or replace it if necessary.
4. Charge Circuit Pressure	If charge pressure is low, brake cannot be released completely, which causes brake drag.	<ul style="list-style-type: none"><li>• Measure charge pressure.</li><li>• If low, check and adjust charge relief valve or replace it if necessary.</li></ul>
5. Propulsion Motor	Internal bearing of propulsion motor is damaged.	Repair propulsion motor or replace it if necessary.

### 3-3. Vibrator System

If a problem occurs in the vibrator systems such as the vibrator pump, vibrator motor and vibrator solenoid valve, determine the cause and carry out action as required, according to the following general troubleshooting items.

**(NOTICE)**

- When checking whether or not the pressure is correct, refer to the pressure standard value for each hydraulic circuit.

#### 3-3-1. No vibration 1/2

Check point	Cause	Check/Action
1. Oil Level of Hydraulic Oil Tank	Oil level in hydraulic oil tank is low.	Fill tank until correct oil level is obtained.
2. Charge Circuit Pressure	Vibrator pump does not discharge oil due to low charge pressure.	<ul style="list-style-type: none"> <li>• Measure charge pressure.</li> <li>• If low, check and adjust charge relief valve or replace it if necessary.</li> </ul>
	Charge pressure decreases due to pressure leakage from pressure cut off valve.	Check and adjust pressure cut off valve or replace it if necessary.
	Insufficient charge pump discharge.	Repair charge pump or replace it if necessary.
	Charge pressure decreases due to internal leakage of solenoid valve connecting oil supply circuit with charge circuit. <ul style="list-style-type: none"> <li>• Parking brake solenoid valve</li> <li>• Speed change solenoid valve</li> </ul>	<ul style="list-style-type: none"> <li>• When solenoid is energized, check if oil flows in return circuit to tank.</li> <li>• If oil is flowing, repair solenoid valve or replace it if necessary.</li> </ul>
3. Suction Filter for Charge Pump	Charge pump flow is reduced due to clogged filler.	Clean suction filter or replace it if necessary.
4. Vibrator Circuit Pressure	Pump does not discharge oil because setting pressure of pressure cut off valve is low.	Measure vibration circuit pressure. If low, check and adjust pressure cut off valve or replace it if necessary.
	Circuit does not obtain required pressure because setting pressure of high pressure relief is low.	<ul style="list-style-type: none"> <li>• Measure vibrator circuit pressure.</li> <li>• If low, check and adjust high pressure relief valve or replace them if necessary.</li> </ul>
5. Vibrator Solenoid Valve	Vibrator pump cannot discharge oil because spool of vibrator solenoid valve does not shift.	Repair vibrator solenoid valve or replace it if necessary.
6. Vibrator Motor	Vibrator circuit pressure is not held in vibrator motor case.	If pressure in vibrator motor case is not within allowable range, repair vibrator motor or replace it if necessary.
	Internal leakage of vibrator motor.	<ul style="list-style-type: none"> <li>• Measure drain quantity from vibrator motor.</li> <li>• If drain quantity is larger than standard value, repair vibrator motor or replace it if necessary.</li> </ul>
	Output torque is not transmitted due to worn spline of vibrator motor output shaft.	Replace vibrator motor.

**3-3-1. No vibration 2/2**

Check point	Cause	Check/Action
7. Vibrator Pump	Insufficient discharge rate from vibrator pump due to reduced efficiency of vibrator pump.	<ul style="list-style-type: none"> <li>• Measure discharge flow rate of vibrator pump with flow meter.</li> <li>• If discharge flow rate is not within specified range, repair vibrator pump or replace it if necessary.</li> </ul>
	Insufficient pump discharge due to wear of vibrator pump drive shaft spline.	Replace vibrator pump.
	Vibrator circuit pressure is not held in vibrator pump case.	If pressure in vibrator pump case is not within allowable range, repair vibrator pump or replace it if necessary.

**3-3-2. Vibrator frequency is too low**

Check point	Cause	Check/Action
1. Oil Level of Hydraulic Oil Tank	Oil level in hydraulic oil tank is low.	Fill tank until correct oil level is obtained.
2. Charge Circuit Pressure	Stroke of vibrator pump swash plate is small because charge pressure is low, decreasing discharge rate of vibrator pump.	<ul style="list-style-type: none"> <li>• Measure charge pressure.</li> <li>• If low, check and adjust charge relief valve or replace it if necessary.</li> </ul>
	Insufficient charge pump discharge.	Repair charge pump or replace it if necessary.
	Charge pressure decreases due to internal leakage of solenoid valve connecting oil supply circuit with charge circuit. <ul style="list-style-type: none"> <li>• Parking brake solenoid valve</li> <li>• Speed change solenoid valve</li> </ul>	<ul style="list-style-type: none"> <li>• When solenoid is energized, check if oil flows in return circuit to tank.</li> <li>• If oil is flowing, repair solenoid valve or replace it if necessary.</li> </ul>
3. Suction Filter for Charge Pump	Flow rate of charge pump decreases as well as charge pressure decreases due to clogged filter.	Clean suction filter or replace it if necessary.
4. Vibrator Motor	Vibrator motor inlet pressure is low.	<ul style="list-style-type: none"> <li>• Measure vibrator motor inlet pressure.</li> <li>• If low, check and adjust high pressure relief valve or replace it if necessary.</li> </ul>
	Vibrator circuit pressure is not held in vibrator motor case.	If pressure in vibrator motor case is not within allowable range, repair vibrator motor or replace it if necessary.
	Decrease in vibrator motor rpm due to internal leakage in vibrator motor.	<ul style="list-style-type: none"> <li>• Measure drain quantity from vibrator motor.</li> <li>• If drain quantity is larger than standard value, repair vibrator motor or replace it if necessary.</li> </ul>
5. Vibrator Pump	Insufficient discharge rate from vibrator pump due to reduced efficiency of vibrator pump.	<ul style="list-style-type: none"> <li>• Measure discharge flow rate of vibrator pump with flow meter.</li> <li>• If discharge flow rate is not within specified range, repair vibrator pump or replace it if necessary.</li> </ul>
	Insufficient pump discharge due to wear of vibrator pump drive shaft spline.	Replace vibrator pump.
	Vibrator circuit pressure is not held in vibrator pump case.	If pressure in vibrator pump case is not within allowable range, repair vibrator pump or replace it if necessary.

**3-3-3. Vibration mode does not switch**

Check point	Cause	Check/Action
1. Vibrator Solenoid Valve	Vibrator solenoid valve spool shifts only in one direction.	Repair vibrator solenoid valve or replace it if necessary.

**3-3-4. Vibratory drum does not changeover vibrating**

Check point	Cause	Check/Action
1. Vibratory Drum Selector Solenoid Valve	Vibratory drum does not changeover vibrating because spool of vibrator solenoid valve does not change.	Repair vibrator solenoid valve or replace it if necessary.

**3-3-5. Vibrator does not stop**

Check point	Cause	Check/Action
1. Vibrator Solenoid Valve	Vibrator solenoid valve spool does not return to neutral position.	Repair vibrator solenoid valve or replace it if necessary.
2. Vibrator Pump	Vibrator pump swash plate does not return to neutral position.	Repair or replace vibrator pump or replace it if necessary.

**3-3-6. Vibrator system is overheating**

Check point	Cause	Check/Action
1. Oil Level of Hydraulic Oil Tank	Oil level in hydraulic oil tank is low.	Fill tank until correct oil level is obtained.
2. Oil Cooler	Cooling efficiency is reduced due to clogged oil cooler fins.	Clean oil cooler fins.
3. Vibrator Circuit Pressure	If circuit pressure setting is excessively low, relief valve opens, causing temperature of hydraulic oil in circuit to rise.	<ul style="list-style-type: none"> <li>• Measure vibrator circuit pressure.</li> <li>• If low, increase relief setting pressure.</li> </ul>
	If load is excessively heavy, relief valve opens, causing temperature of hydraulic oil in circuit to rise.	<ul style="list-style-type: none"> <li>• Measure vibrator circuit pressure.</li> <li>• If high, decrease vibration load.</li> </ul>
4. Suction Filter for Charge Pump	Load of charge pump increases due to clogged filter, causing temperature of hydraulic oil in circuit to rise.	Clean suction filter or replace it if necessary.
5. Hydraulic Oil Filter	Charge circuit pressure increases due to clogged filter.	Clean hydraulic oil filter or replace it if necessary.

**3-3-7. Abnormal noise from vibrator system**

Check point	Cause	Check/Action
1. Vibrator Bearings	Vibrator bearings supporting eccentric shaft are damaged.	Replace vibrator bearings.
2. Hydraulic Hose Clamp	Vibrator sound of hydraulic hose is generated because clamp securing hydraulic hose is loose.	Tighten bolts of loose hydraulic hose clamp to specified torque.
3. Suction Filter for Charge Pump	Cavitation is occurring in charge pump due to clogged filter.	Clean suction filter or replace it if necessary.
4. Vibrator Motor	Internal bearing of vibrator motor is damaged.	Repair vibrator motor or replace it if necessary.

### 3-4. Steering System

If a problem occurs in the steering systems such as the steering pump and orbitrol, determine the cause and carry out action as required, according to the following general troubleshooting items.

**(NOTICE)**

- When checking whether or not the pressure is correct, refer to the pressure standard value for each hydraulic circuit.

#### 3-4-1. Steering wheel is hard to turn

Check point	Cause	Check/Action
1. Oil Level of Hydraulic Oil Tank	Oil level in hydraulic oil tank is low.	Fill tank until correct oil level is obtained.
2. Orbitrol	Relief valve is open or setting pressure is low.	<ul style="list-style-type: none"> <li>• Measure steering circuit pressure.</li> <li>• If low, check and clean relief valve or replace it if necessary.</li> </ul>
	Flow to steering cylinder circuit is insufficient due to leakage from check valve.	Check and clean check valve or replace it if necessary.
	Spool and sleeve of orbitrol are contaminated or clearance is incorrect.	Check and clean orbitrol or replace it if necessary.
3. Steering Circuit Pressure	Pressure in return circuit from orbitrol increases due to clogged charging hydraulic filter.	Clean hydraulic filter or replace it if necessary.
4. Steering Cylinder	Cylinder thrust decreases due to internal leakage of steering cylinder.	Repair steering cylinder or replace it if necessary.
5. Suction Filter for Charge Pump	Charge pump discharge rate decreases due to clogged filter.	Clean suction filter or replace it if necessary.
6. Charge Pump	Discharging pressure is insufficient due to efficiency degradation of charge pump.	<ul style="list-style-type: none"> <li>• Measure steering circuit pressure.</li> <li>• If low, replace charge pump.</li> </ul>
7. Steering Column	Column shaft and orbitrol shaft center are misaligned.	Align column shaft with orbitrol shaft center or replace it if necessary.
	Column shaft bearing is worn or damaged.	Repair column shaft or replace it if necessary.

#### 3-4-2. Steering response is slow

Check point	Cause	Check/Action
1. Oil Level of Hydraulic Oil Tank	Oil level in hydraulic oil tank is low.	Fill tank until correct oil level is obtained.
2. Orbitrol	Oil is bypassing because relief valve is open.	<ul style="list-style-type: none"> <li>• Measure steering circuit pressure.</li> <li>• If low, check and adjust relief valve or replace it if necessary.</li> </ul>
3. Steering Cylinder	Internal leakage of steering cylinder.	Repair steering cylinder or replace it if necessary.
4. Suction Filter for Charge Pump	Charge pump discharge rate decreases due to clogged filter.	Clean suction filter or replace it if necessary.
5. Charge Pump	Discharging pressure is insufficient due to efficiency degradation of charge pump.	<ul style="list-style-type: none"> <li>• Measure steering circuit pressure.</li> <li>• If low, replace charge pump.</li> </ul>

**3-4-3. Steering wheel backlash or play is large**

Check point	Cause	Check/Action
1. Steering Column	Spline of column shaft or orbitrol is worn.	Replace column shaft or orbitrol.
	Column shaft bearings are worn.	Replace column shaft bearings.
2. Steering Wheel	Serration (spline) of wheel or column shaft is worn.	Replace wheel or column shaft.

**3-4-4. Steering system is overheating**

Check point	Cause	Check/Action
1. Oil Level of Hydraulic Oil Tank	Oil level in hydraulic oil tank is low.	Fill tank until correct oil level is obtained.
2. Oil Cooler	Cooling efficiency is reduced due to clogged oil cooler fins.	Clean oil cooler fins.
3. Steering Circuit Pressure	If circuit pressure setting is excessively low, relief valve is open, causing temperature of hydraulic oil in circuit to rise.	<ul style="list-style-type: none"> <li>• Measure steering circuit pressure.</li> <li>• If low, replace relief valve.</li> </ul>
	If load is excessively heavy, relief valve is open, causing temperature of hydraulic oil in circuit to rise.	<ul style="list-style-type: none"> <li>• Measure steering circuit pressure.</li> <li>• If high, decrease steering load.</li> </ul>
4. Suction Filter for Charge Pump	Load of steering pump increases due to clogged filter, causing temperature of hydraulic oil in circuit to rise.	Clean suction filter or replace it if necessary.

**3-4-5. Abnormal noise from steering system**

Check point	Cause	Check/Action
1. Oil Level of Hydraulic Oil Tank	Pump suction pressure is high because oil level of hydraulic oil tank is low, causing cavitation in steering circuit system.	Fill tank until correct oil level is obtained.
2. Air in Steering Circuit	Cavitation is caused by air in circuit.	Bleed circuit.
3. Hydraulic Hose Clamp	Vibrator sound of hydraulic hose is generated because clamp securing hydraulic hose is loose.	Tighten bolts of loose hydraulic hose clamp to specified torque.
4. Suction Filter for Charge Pump	Cavitation is occurring in charge pump due to clogged filter.	Clean suction filter or replace it if necessary.

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