

**SW/TW354
TW504**

SHOP MANUAL

SAKAI®

3498-6446A-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


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.

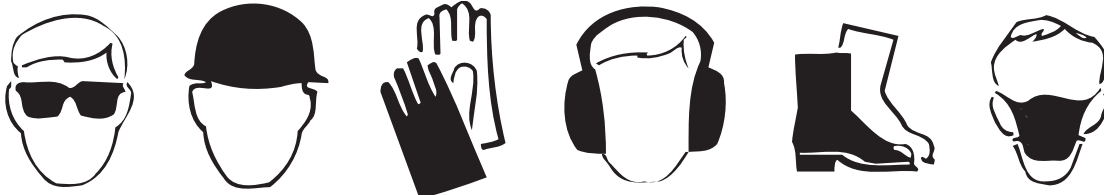
- The machine is designed specifically for the compaction of asphalt or soil road construction materials. Use of the machine for other purposes such as towing other equipment is considered contrary to the designated use. The manufacturer cannot be responsible or held liable for any damage resulting from 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

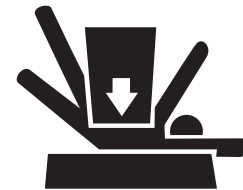
- Always make sure that there are no obstructions or persons in your line of travel before starting the compactor in motion.
- Never climb on and off the machine while it is in motion.
- Always remain seated with the seat belt fastened when traveling, compacting or loading or unloading the machine.
- 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.
- 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.



SAFETY

- 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.



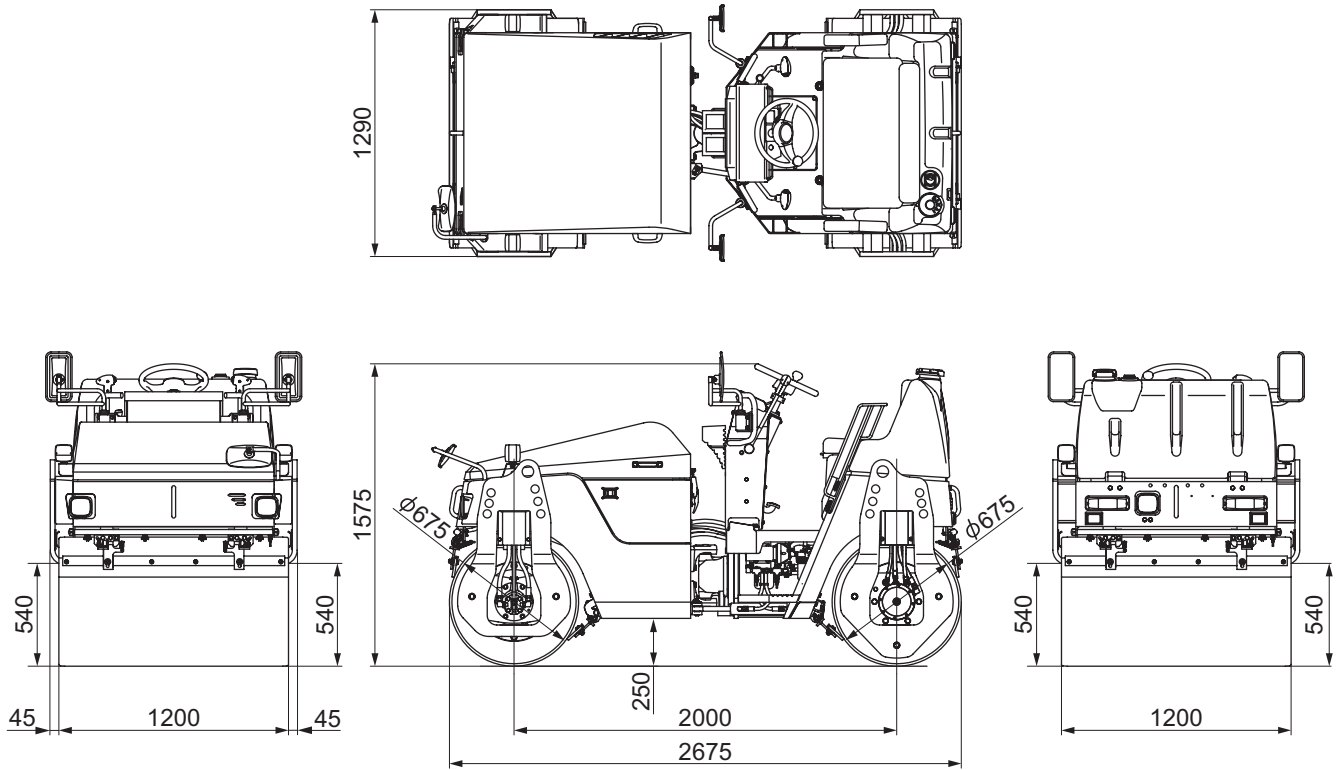
1-11. Transporting the Machine

- 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.

SPECIFICATIONS

1. SPECIFICATION DATA

1-1. SW354

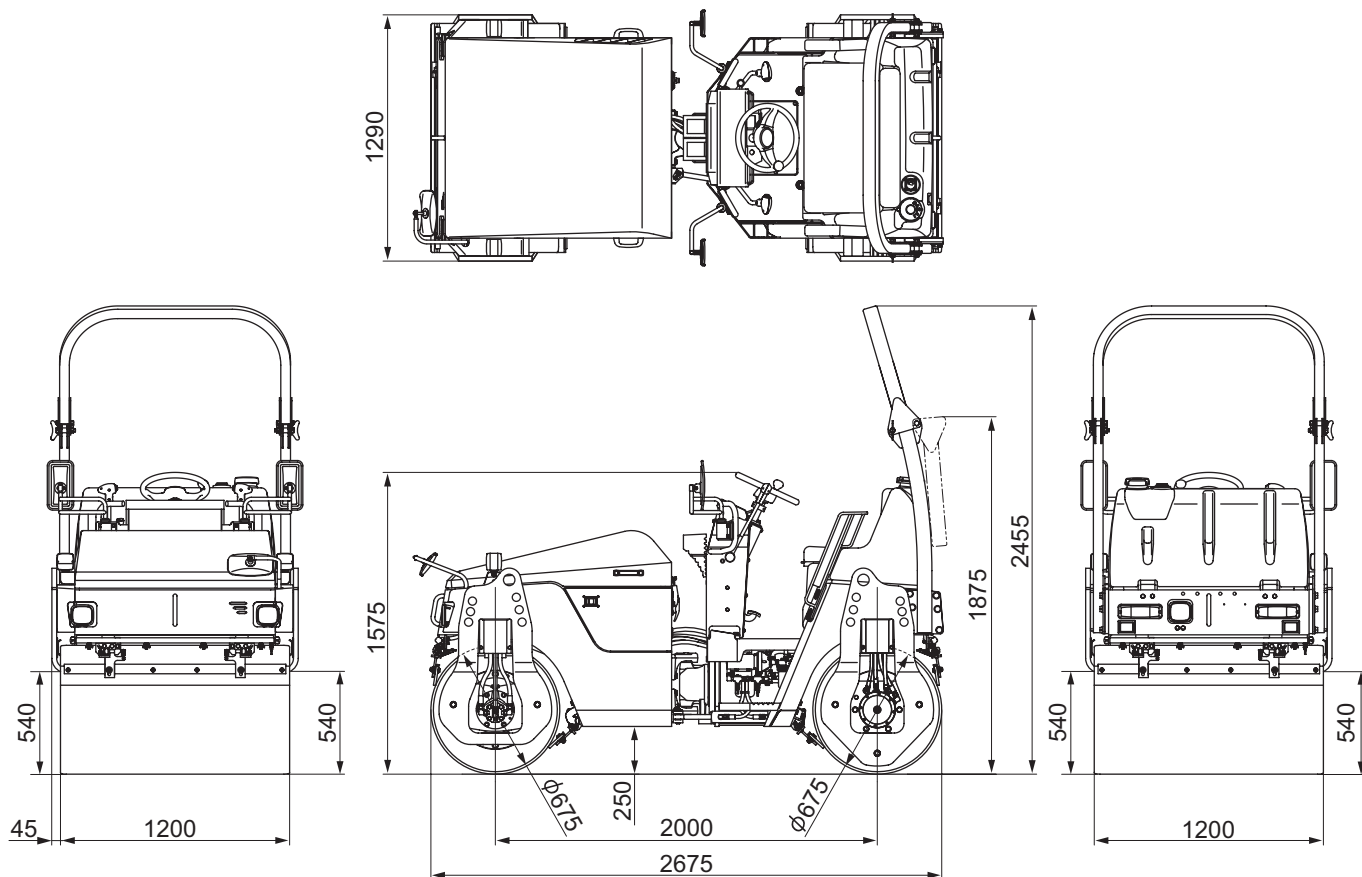


0446-99024-0-10967-0

Model & Type		SAKAI SW354	
Model Type		VIBRATORY TANDEM ROLLER	
Weight	Operating weight	without ballast	2,900 kg (6,395 lbs.)
		with ballast	N/A kg (N/A lbs.)
	Maximum weight	3,020 kg (6,660 lbs.)	
	Shipping weight	2,710 kg (5,975 lbs.)	
	Load on front axle with operating weight	1,470 kg (3,240 lbs.)	
	Load on rear axle with operating weight	1,430 kg (3,155 lbs.)	
Dimensions	Overall length	2,675 mm (105 in.)	
	Overall width	1,290 mm (51 in.)	
	Overall height	1,575 mm (62 in.)	
	Wheelbase	2,000 mm (79 in.)	
	Compaction width	1,200 mm (47 in.)	
	Front drum	width × dia. × thickness	1,200 mm × 675 mm × 13 mm (47 in. × 27 in. × 0.5 in.)
	Rear drum	width × dia. × thickness	1,200 mm × 675 mm × 13 mm (47 in. × 27 in. × 0.5 in.)
	Ground clearance		250 mm (10 in.)
	Kerb clearance	Right	540 mm (21 in.)
		Left	540 mm (21 in.)
	Side clearance	Right	45 mm (2 in.)
Left		45 mm (2 in.)	
Leveling blade width		N/A mm (N/A in.)	

Performance	Vibrator system	Front	Centrifugal force		29.0 kN (6,520 lbf)
			Frequency		66.7 Hz (4,000 vpm)
			Amplitude		0.31 mm (0.012 in.)
		Rear	Centrifugal force		29.0 kN (6,520 lbf)
			Frequency		66.7 Hz (4,000 vpm)
			Amplitude		0.31 mm (0.012 in.)
	Linear pressure	Static linear pressure	Front drum	Operating weight	120 N/cm (70 lbf./in.)
			Rear drum	Operating weight	117 N/cm (65 lbf./in.)
		Dynamic linear pressure	Front drum	Operating weight	362 N/cm (205 lbf./in.)
			Rear drum	Operating weight	358 N/cm (205 lbf./in.)
	Traveling speed	Number of speed shifts			2 speed
		Speed range	1st		0 to 7 km/h (0 to 4.3 mile/h)
			2nd		0 to 10 km/h (0 to 6.2 mile/h)
	Gradeability (without vibration)				38 % (21 °)
	Turning radius	Machine clearance radius inside			2.5 m (99 in.)
		Machine clearance radius outside			3.8 m (150 in.)
Turning radius inside compacted surface			2.6 m (103 in.)		
Turning radius outside compacted surface			3.7 m (146 in.)		
Steering / Oscillating angle				$\pm 35^\circ / \pm 4^\circ$	

1-2. SW354 ROPS

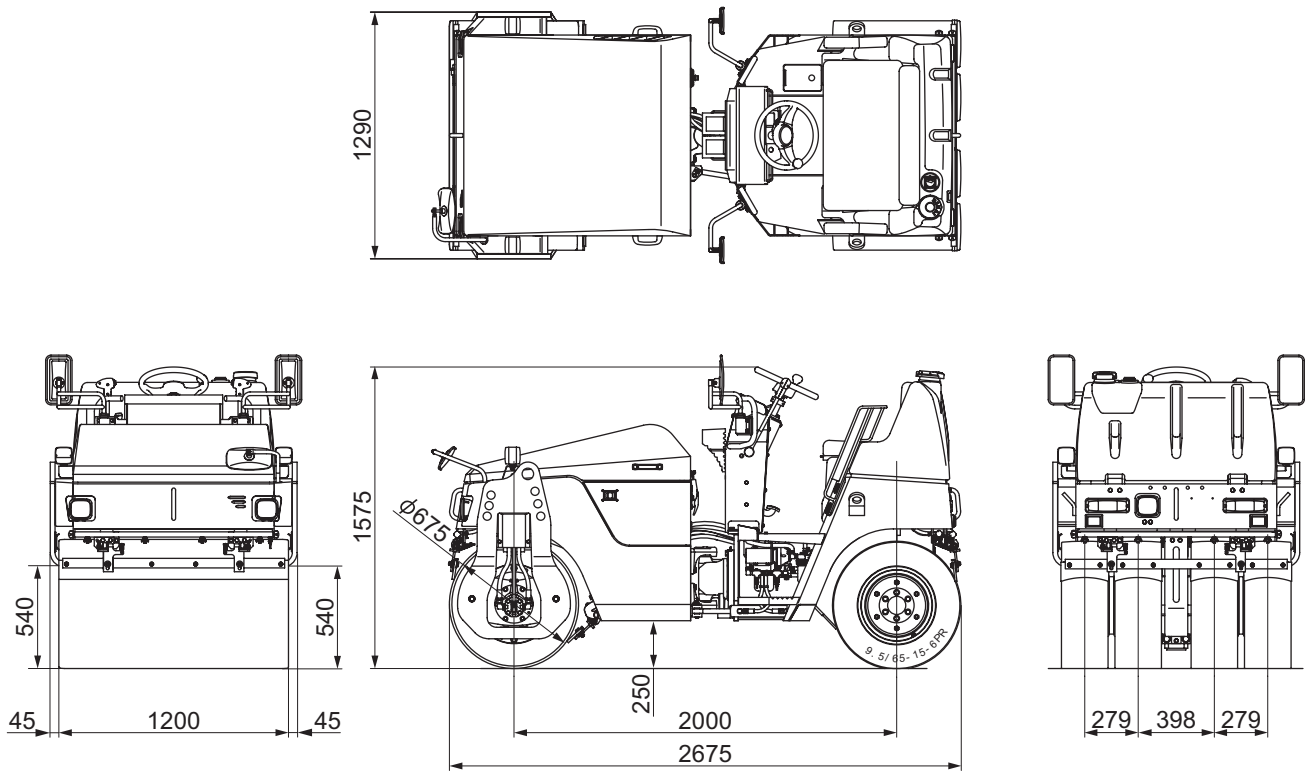


0446-99026-0-11005-0

Model & Type		SAKAI SW354 with ROPS		
Model Type		VIBRATORY TANDEM ROLLER		
Weight	Operating weight	without ballast	2,960 kg (6,525 lbs.)	
		with ballast	N/A kg (N/A lbs.)	
	Maximum weight		3,080 kg (6,790 lbs.)	
	Shipping weight	with ROPS	2,770 kg (6,105 lbs.)	
		without ROPS	2,710 kg (5,795 lbs.)	
	Load on front axle with operating weight		1,470 kg (3,240 lbs.)	
Load on rear axle with operating weight		1,490 kg (3,285 lbs.)		
Dimensions	Overall length		2,675 mm (105 in.)	
	Overall width		1,290 mm (51 in.)	
	Overall height	with ROPS		2,455 mm (97 in.)
		without ROPS		1,575 mm (62 in.)
	Wheelbase		2,000 mm (79 in.)	
	Compaction width		1,200 mm (47 in.)	
	Front drum	width × dia. × thickness		1,200 mm × 675 mm × 13 mm (47 in. × 27 in. × 0.5 in.)
	Rear drum	width × dia. × thickness		1,200 mm × 675 mm × 13 mm (47 in. × 27 in. × 0.5 in.)
	Ground clearance			250 mm (10 in.)
	Kerb clearance	Right		540 mm (21 in.)
		Left		540 mm (21 in.)
	Side clearance	Right		45 mm (2 in.)
		Left		45 mm (2 in.)
Leveling blade width			N/A mm (N/A in.)	

Performance	Vibrator system	Front	Centrifugal force		29.0 kN (6,520 lbf)
			Frequency		66.7 Hz (4,000 vpm)
			Amplitude		0.31 mm (0.012 in.)
		Rear	Centrifugal force		29.0 kN (6,520 lbf)
			Frequency		66.7 Hz (4,000 vpm)
			Amplitude		0.31 mm (0.012 in.)
	Linear pressure	Static linear pressure	Front drum	Operating weight	120 N/cm (70 lbf./in.)
			Rear drum	Operating weight	121 N/cm (70 lbf./in.)
		Dynamic linear pressure	Front drum	Operating weight	362 N/cm (205 lbf./in.)
			Rear drum	Operating weight	363 N/cm (205 lbf./in.)
	Traveling speed	Number of speed shifts			2 speed
		Speed range	1st		0 to 7 km/h (0 to 4.3 mile/h)
			2nd		0 to 10 km/h (0 to 6.2 mile/h)
	Gradeability (without vibration)				38 % (21 °)
	Turning radius	Machine clearance radius inside			2.5 m (99 in.)
Machine clearance radius outside			3.8 m (150 in.)		
Turning radius inside compacted surface			2.6 m (103 in.)		
Turning radius outside compacted surface			3.7 m (146 in.)		
Steering / Oscillating angle				$\pm 35^\circ / \pm 4^\circ$	

1-3. TW354

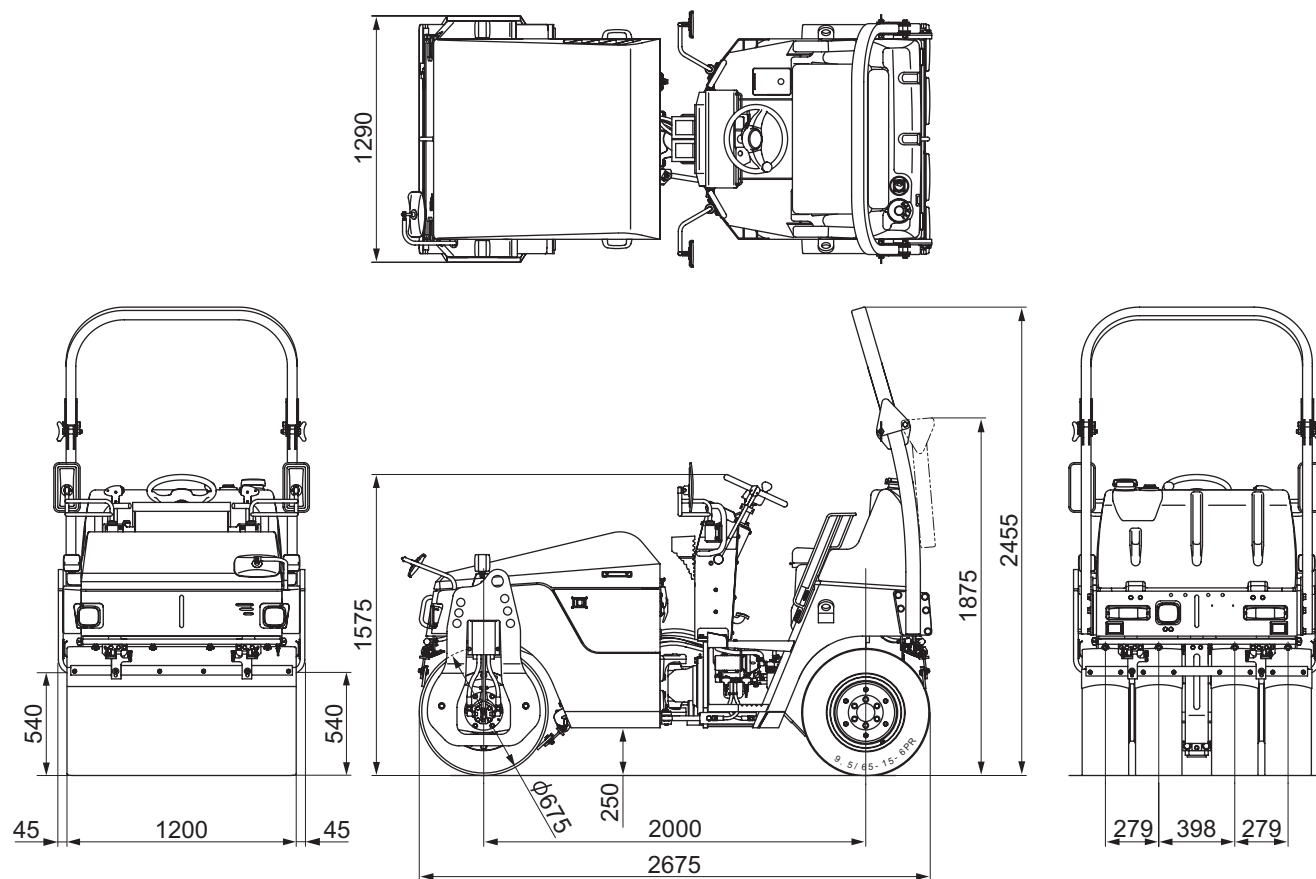


0447-99021-0-10193-A

Model & Type		SAKAI TW354	
Model Type		VIBRATORY COMBINED ROLLER	
Weight	Operating weight	without ballast	2,600 kg (5,730 lbs.)
		with ballast	N/A kg (N/A lbs.)
	Maximum weight	2,720 kg (5,995 lbs.)	
	Shipping weight	2,410 kg (5,315 lbs.)	
	Load on front axle with operating weight	1,470 kg (3,240 lbs.)	
	Load on rear axle with operating weight	1,130 kg (2,490 lbs.)	
Dimensions	Overall length	2,675 mm (105 in.)	
	Overall width	1,290 mm (51 in.)	
	Overall height	1,575 mm (62 in.)	
	Wheelbase	2,000 mm (79 in.)	
	Compaction width	1,200 mm (47 in.)	
	Front drum	width × dia. × thickness	1,200 mm × 675 mm × 13 mm (47 in. × 27 in. × 0.5 in.)
		width × dia.	1,199 mm × 671 mm (47 in. × 26 in.)
	Rear tyres (outer shell)	Size	9.5/65-15-6PR
		Inflation pressure	294 kPa (42.6 psi)
	Ground clearance	250 mm (10 in.)	
	Kerb clearance	Right	540 mm (21 in.)
		Left	540 mm (21 in.)
	Side clearance	Right	45 mm (2 in.)
Left		45 mm (2 in.)	
Leveling blade width	N/A mm (N/A in.)		

Performance	Vibrator system	Front	Centrifugal force		20.6 kN (4,630 lbf)	
			Frequency		52.0 Hz (3,120 vpm)	
			Amplitude		0.36 mm (0.014 in.)	
		Rear	Centrifugal force		N/A kN (N/A lbf)	
			Frequency		N/A Hz (N/A vpm)	
			Amplitude		N/A mm (N/A in.)	
	Linear pressure	Static linear pressure	Front drum	Operating weight	120 N/cm (70 lbf./in.)	
			Rear drum	Operating weight	N/A N/cm (N/A lbf./in.)	
		Dynamic linear pressure	Front drum	Operating weight	292 N/cm (165 lbf./in.)	
			Rear drum	Operating weight	N/A N/cm (N/A lbf./in.)	
	Traveling speed	Number of speed shifts			2 speed	
		Speed range	1st		0 to 7 km/h (0 to 4.3 mile/h)	
			2nd		0 to 10 km/h (0 to 6.2 mile/h)	
	Gradeability (without vibration)					38 % (21 °)
	Turning radius	Machine clearance radius inside			2.5 m (99 in.)	
Machine clearance radius outside			3.8 m (150 in.)			
Turning radius inside compacted surface			2.6 m (103 in.)			
Turning radius outside compacted surface			3.7 m (146 in.)			
Steering / Oscillating angle					± 35 ° / ± 4 °	

1-4. TW354 ROPS

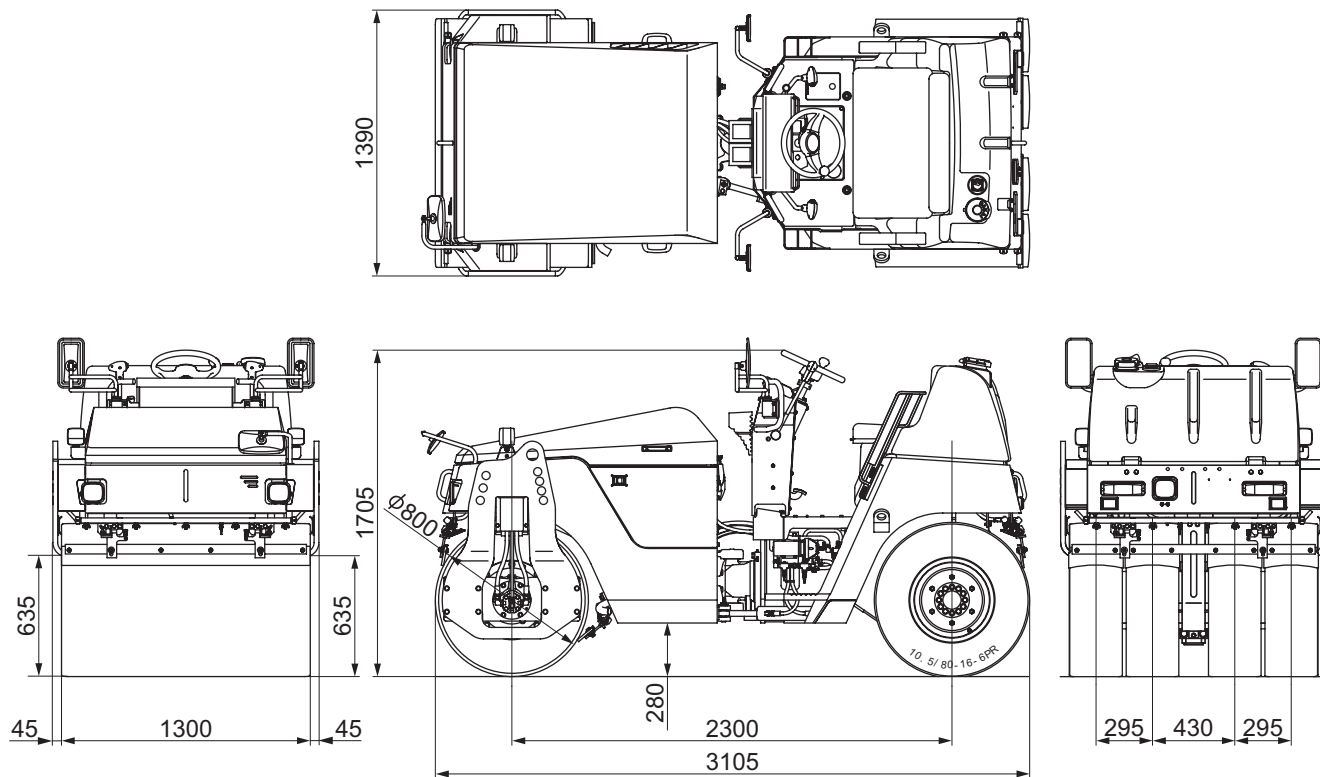


0447-99023-0-10198-0

Model & Type		SAKAI TW354 with ROPS		
Model		VIBRATORY COMBINED ROLLER		
Type		VIBRATORY COMBINED ROLLER		
Weight	Operating weight	without ballast	2,660 kg (5,865 lbs.)	
		with ballast	N/A kg (N/A lbs.)	
	Maximum weight	2,780 kg (6,130 lbs.)		
	Shipping weight	with ROPS	2,470 kg (5,445 lbs.)	
		without ROPS	2,410 kg (5,315 lbs.)	
	Load on front axle with operating weight	1,470 kg (3,240 lbs.)		
Load on rear axle with operating weight	1,190 kg (2,625 lbs.)			
Dimensions	Overall length	2,675 mm (105 in.)		
	Overall width	1,290 mm (51 in.)		
	Overall height	with ROPS	2,455 mm (97 in.)	
		without ROPS	1,575 mm (62 in.)	
	Wheelbase	2,000 mm (79 in.)		
	Compaction width	1,200 mm (47 in.)		
	Front drum	width × dia. × thickness	1,200 mm × 675 mm × 13 mm (47 in. × 27 in. × 0.5 in.)	
		width × dia.	1,199 mm × 671 mm (47 in. × 26 in.)	
	Rear tyres (outer shell)	Size	9.5/65-15-6PR	
		Inflation pressure	294 kPa (42.6 psi)	
	Ground clearance	250 mm (10 in.)		
	Kerb clearance	Right	540 mm (21 in.)	
		Left	540 mm (21 in.)	
Side clearance	Right	45 mm (2 in.)		
	Left	45 mm (2 in.)		
Leveling blade width	N/A mm (N/A in.)			

Performance	Vibrator system	Front	Centrifugal force		20.6 kN (4,630 lbf)
			Frequency		52.0 Hz (3,120 vpm)
			Amplitude		0.36 mm (0.014 in.)
		Rear	Centrifugal force		N/A kN (N/A lbf)
			Frequency		N/A Hz (N/A vpm)
			Amplitude		N/A mm (N/A in.)
	Linear pressure	Static linear pressure	Front drum	Operating weight	120 N/cm (70 lbf./in.)
			Rear drum	Operating weight	N/A N/cm (N/A lbf./in.)
		Dynamic linear pressure	Front drum	Operating weight	292 N/cm (165 lbf./in.)
			Rear drum	Operating weight	N/A N/cm (N/A lbf./in.)
	Traveling speed	Number of speed shifts			2 speed
		Speed range	1st		0 to 7 km/h (0 to 4.3 mile/h)
			2nd		0 to 10 km/h (0 to 6.2 mile/h)
	Gradeability (without vibration)				38 % (21 °)
	Turning radius	Machine clearance radius inside			2.5 m (99 in.)
Machine clearance radius outside			3.8 m (150 in.)		
Turning radius inside compacted surface			2.6 m (103 in.)		
Turning radius outside compacted surface			3.7 m (146 in.)		
Steering / Oscillating angle				± 35 ° / ± 4 °	

1-5. TW504

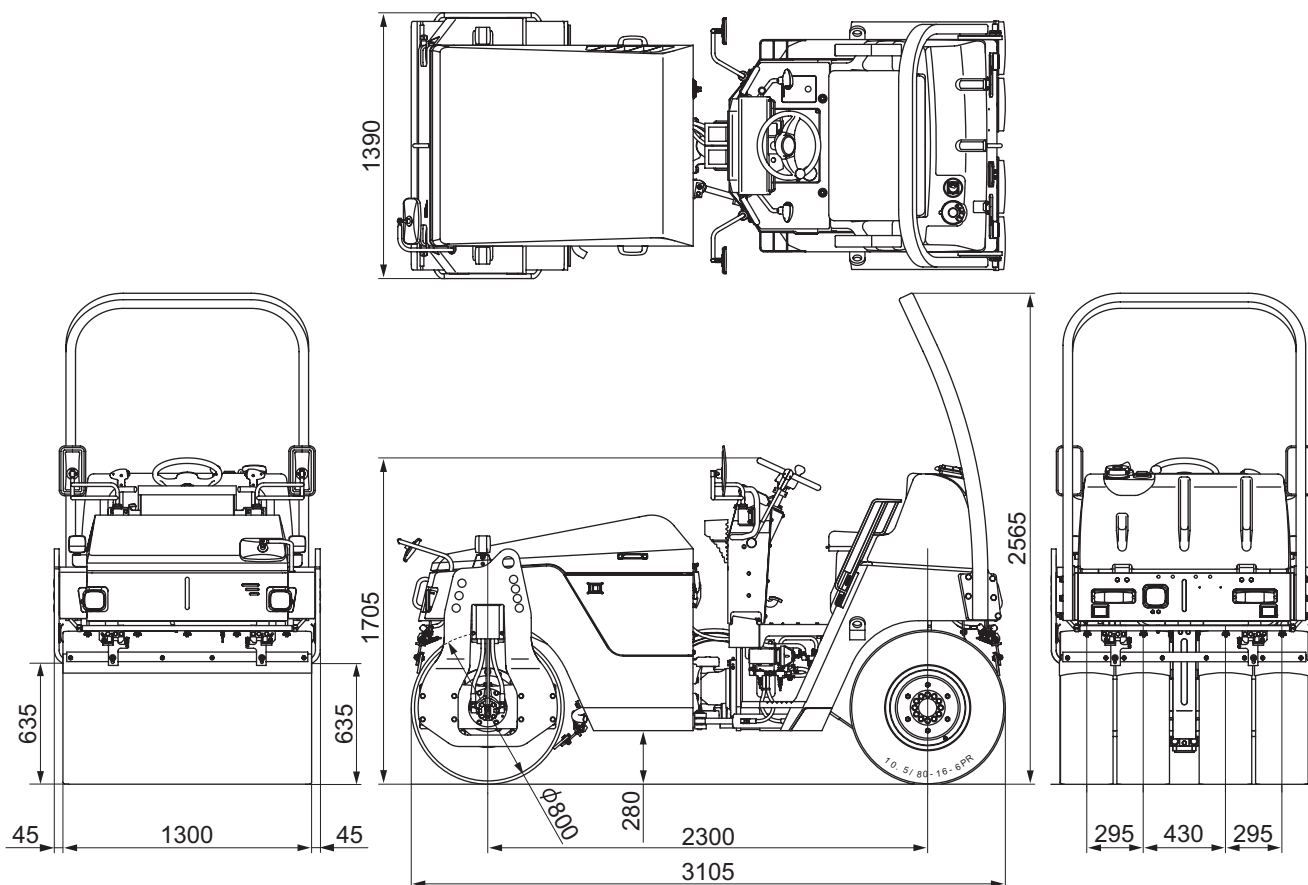


0449-99014-0-10234-A

Model & Type		SAKAI TW504	
Model		VIBRATORY COMBINED ROLLER	
Type		VIBRATORY COMBINED ROLLER	
Weight	Operating weight	without ballast	3,440 kg (7,585 lbs.)
		with ballast	N/A kg (N/A lbs.)
	Maximum weight	3,620 kg (7,980 lbs.)	
	Shipping weight	3,190 kg (7,035 lbs.)	
	Load on front axle with operating weight	1,980 kg (4,365 lbs.)	
	Load on rear axle with operating weight	1,460 kg (3,220 lbs.)	
Dimensions	Overall length	3,105 mm (122 in.)	
	Overall width	1,390 mm (55 in.)	
	Overall height	1,705 mm (67 in.)	
	Wheelbase	2,300 mm (91 in.)	
	Compaction width	1,300 mm (51 in.)	
	Front drum	width × dia. × thickness	1,300 mm × 800 mm × 17 mm (51 in. × 31 in. × 0.7 in.)
		width × dia.	1,295 mm × 812 mm (51 in. × 32 in.)
	Rear tyres (outer shell)	Size	10.5/80-16-6PR
		Inflation pressure	294 kPa (42.6 psi)
	Ground clearance	280 mm (11 in.)	
	Kerb clearance	Right	635 mm (25 in.)
		Left	635 mm (25 in.)
	Side clearance	Right	45 mm (2 in.)
Left		45 mm (2 in.)	
Leveling blade width	N/A mm (N/A in.)		

Performance	Vibrator system		Front	Centrifugal force	Low amplitude	26.5 kN (5,955 lbf)			
					High amplitude	34.3 kN (7,710 lbf)			
				Frequency	Low amplitude	52 Hz (3,100 vpm)			
					High amplitude	52 Hz (3,100 vpm)			
				Amplitude	Low amplitude	0.30 mm (0.012 in.)			
					High amplitude	0.40 mm (0.016 in.)			
			Rear	Centrifugal force	Low amplitude	N/A kN (N/A lbf)			
					High amplitude	N/A kN (N/A lbf)			
				Frequency	Low amplitude	N/A Hz (N/A vpm)			
					High amplitude	N/A Hz (N/A vpm)			
				Amplitude	Low amplitude	N/A mm (N/A in.)			
					High amplitude	N/A mm (N/A in.)			
	Linear pressure		Static linear pressure	Front drum	Operating weight		149 N/cm (85 lbf./in.)		
				Rear drum	Operating weight		N/A N/cm (N/A lbf./in.)		
			Dynamic linear pressure	Front drum	Operating weight	Low amplitude	353 N/cm (202 lbf./in.)		
						High amplitude	413 N/cm (236 lbf./in.)		
				Rear drum	Operating weight	Low amplitude	N/A N/cm (N/A lbf./in.)		
						High amplitude	N/A N/cm (N/A lbf./in.)		
			Traveling speed		Number of speed shifts			2 speed	
					Speed range		1st	0 to 7 km/h (0 to 4.3 mile/h)	
2nd	0 to 10 km/h (0 to 6.2 mile/h)								
Gradeability (without vibration)						38 % (21 °)			
Turning radius		Machine clearance radius inside			2.9 m (115 in.)				
		Machine clearance radius outside			4.4 m (174 in.)				
		Turning radius inside compacted surface			3.0 m (119 in.)				
		Turning radius outside compacted surface			4.3 m (170 in.)				
Steering / Oscillating angle						± 35 ° / ± 4 °			

1-6. TW504 ROPS



0449-99020-0-10260-A

Model & Type		SAKAI TW504 with ROPS		
Model Type		VIBRATORY COMBINED ROLLER		
Weight	Operating weight	without ballast	3,510 kg (7,740 lbs.)	
		with ballast	N/A kg (N/A lbs.)	
	Maximum weight	3,680 kg (8,115 lbs.)		
	Shipping weight	with ROPS	3,260 kg (7,185 lbs.)	
		without ROPS	3,190 kg (7,035 lbs.)	
	Load on front axle with operating weight	1,980 kg (4,365 lbs.)		
Load on rear axle with operating weight	1,530 kg (3,375 lbs.)			
Dimensions	Overall length	3,105 mm (122 in.)		
	Overall width	1,390 mm (55 in.)		
	Overall height	with ROPS	2,565 mm (101 in.)	
		without ROPS	1,705 mm (67 in.)	
	Wheelbase	2,300 mm (91 in.)		
	Compaction width	1,300 mm (51 in.)		
	Front drum	width × dia. × thickness	1,300 mm × 800 mm × 17 mm (51 in. × 31 in. × 0.7 in.)	
		width × dia.	1,295 mm × 812 mm (51 in. × 32 in.)	
	Rear tyres (outer shell)	Size	10.5/80-16-6PR	
		Inflation pressure	294 kPa (42.6 psi)	
	Ground clearance	280 mm (11 in.)		
	Kerb clearance	Right	635 mm (25 in.)	
		Left	635 mm (25 in.)	
	Side clearance	Right	45 mm (2 in.)	
Left		45 mm (2 in.)		
Leveling blade width	N/A mm (N/A in.)			

Performance	Vibrator system		Front	Centrifugal force	Low amplitude	26.5 kN (5,955 lbf)		
					High amplitude	34.3 kN (7,710 lbf)		
				Frequency	Low amplitude	52 Hz (3,100 vpm)		
					High amplitude	52 Hz (3,100 vpm)		
				Amplitude	Low amplitude	0.30 mm (0.012 in.)		
					High amplitude	0.40 mm (0.016 in.)		
			Rear	Centrifugal force	Low amplitude	N/A kN (N/A lbf)		
					High amplitude	N/A kN (N/A lbf)		
				Frequency	Low amplitude	N/A Hz (N/A vpm)		
					High amplitude	N/A Hz (N/A vpm)		
				Amplitude	Low amplitude	N/A mm (N/A in.)		
					High amplitude	N/A mm (N/A in.)		
	Linear pressure		Static linear pressure	Front drum	Operating weight		149 N/cm (85 lbf./in.)	
				Rear drum	Operating weight		N/A N/cm (N/A lbf./in.)	
			Dynamic linear pressure	Front drum	Operating weight	Low amplitude	353 N/cm (202 lbf./in.)	
						High amplitude	413 N/cm (236 lbf./in.)	
				Rear drum	Operating weight	Low amplitude	N/A N/cm (N/A lbf./in.)	
						High amplitude	N/A N/cm (N/A lbf./in.)	
	Traveling speed		Number of speed shifts			2 speed		
			Speed range		1st	0 to 7 km/h (0 to 4.3 mile/h)		
					2nd	0 to 10 km/h (0 to 6.2 mile/h)		
	Gradeability (without vibration)					38 % (21 °)		
	Turning radius		Machine clearance radius inside			2.9 m (115 in.)		
			Machine clearance radius outside			4.4 m (174 in.)		
Turning radius inside compacted surface			3.0 m (119 in.)					
Turning radius outside compacted surface			4.3 m (170 in.)					
Steering / Oscillating angle					± 35 ° / ± 4 °			

SPECIFICATIONS

1-7. Common Specifications

Engine	Model		KUBOTA D1703-M-DI-EF03 (Diesel, EPA-Tier 4)	
	Type		4-cycle, water-cooled, 3-cylinder in-line, vertical mounted, overhead valve, direct injection type	
	Bore × Stroke		87.0 mm × 92.4 mm (3.425 in. × 3.638 in.)	
	Displacement		1.647 L (100.5 cu.in.)	
	Performance	Rated speed		2,200 min ⁻¹
		Rated output		18.2 kW (24 HP)
		Max. torque		96.0 N·m (71 lbf·ft) at 1,500 min ⁻¹
		Fuel consumption rate		256 g/kW·h (0.421 lb/HP·h) at 2,200 min ⁻¹
		Fuel consumption		5.6 L/h with full load (1.5 gal. with full load)
	Fuel system	Fuel		Diesel (ASTM D975-2D)
		Fuel injection pump		Inline injection pump
		Fuel injection time regulator		Mechanical all speed governor
	Lubrication system	Lubrication type		Full forced pressure feed by gear pump
		Oil filter type		Full flow paper element
		Oil cooler type		N/A
	Air intake system	Air cleaner type		Dry
	Cooling system	Cooling type		Pressurized water forced circulation
		Cooling fan type		Inhale
	Electrical system	Alternator		12 V 60 A
		Starter		12 V 2.0 kW
Battery		12 V (78 Ah, CCA N/A) × 1 pc. (12 V)		
Dry weight		169 kg (373 lbs.)		
Drive system	Transmission	Type	Hydrostatic	
		Speeds	2 speed shifts	
	Reverser		Switching the direction of flow delivered from the variable pump	
	Differential type	Front	N/A	
		Rear	N/A	
Final drive	Front	Direct drive		
	Rear	Direct drive		
Vibration system	Power transmission type		Hydraulic	
	Vibrator type	SW/TW354	Single eccentric shaft	
TW504		Variable eccentric shaft		
Brake system	Service brake		Dynamic braking through hydrostatic drive system (F-N-R lever)	
	Secondary brake (Emergency brake)		Hydrostatic + spring applied hydraulically released type (Brake pedal)	
	Parking brake		Spring applied hydraulically released type (Panel button)	
Steering system	Power transmission type		Hydraulic	
	Steering type		Articulated	
Drums and tyres	Use	Front	Steel drum / Vibrate and drive / 1pc.	
		Rear	SW354	Steel drum / Vibrate and drive / 1pc.
			TW354,504	Rubber tyre / Drive / 4pcs.
	Suspension type	Front	Rubber isolation	
Rear		SW354	Rubber isolation	
	TW354,504		Rigid	
Sprinkler system	Water spray type		Pressurized	
	Liquid spray type	SW354	N/A	
		TW354,504		Pressurized
Others	ECO mode		Standard	
	ROPS		Option	

2. TABLE OF STANDARD VALUES

2-1. Engine


Item		Standard value		Remarks
Engine model		KUBOTA D1703-M-DI-E4B		
Rated output		17.7 kW	(24 HP)	
Max. rpm under no load		2,470 min ⁻¹		or less
Min. rpm under no load		1,050 to 1,150 min ⁻¹		
Cylinder head tightening torque		93.2 to 98.0 N·m	(68.8 to 72.3 lbf·ft)	
Intake manifold tightening torque		24 to 27 N·m	(18 to 20 lbf·ft)	
Exhaust manifold tightening torque		24 to 27 N·m	(18 to 20 lbf·ft)	
Fan belt tension		7.0 to 9.0 mm	(0.28 to 0.35 in.)	When midpoint of belt pressed at 98 N (22 lbf)
Valve clearance (intake)		0.18 to 0.22 mm	(0.0071 to 0.0086 in.)	
Valve clearance (exhaust)		0.18 to 0.22 mm	(0.0071 to 0.0086 in.)	
Compression pressure	Standard value	2.95 to 3.23 MPa	(427 to 469 psi)	290 min ⁻¹
	Allowable limit	2.35 MPa	(341 psi)	290 min ⁻¹

2-2. Propulsion

Item		Standard value		Remarks
Travel speed (Forward/reverse)	1st	0 to 7 km/h	(0 to 4.3 mph)	
	2nd	0 to 10 km/h	(0 to 6.2 mph)	
Hub bolt tightening torque (TW354,504)		167 N·m	(123 lbf·ft)	
Tyre inflation pressure (TW354,504)		294 kPa	(42.6 psi)	

SPECIFICATIONS

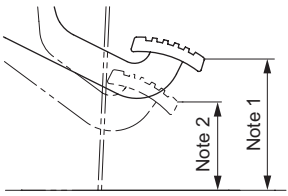
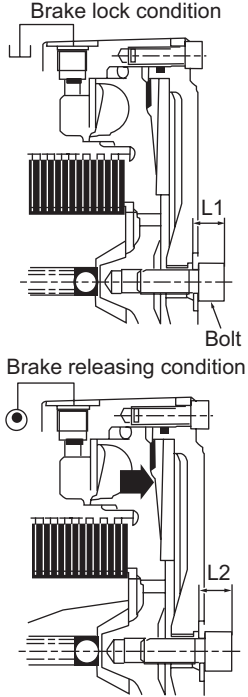
2-3. Hydraulic System

Item		Standard value			Remarks	
		SW354	TW354	TW504		
Propulsion	High pressure relief valve pressure setting	34.5 MPa (5,003 psi)				
	Charge relief valve pressure setting	1.9 ± 0.7 MPa (276 ± 100 psi)				
	Case pressure	Pump	0.25 MPa (36.3 psi) or less			
		Motor (F)	0.3 MPa (43.5 psi) or less			
		Motor (R)	0.3 MPa (43.5 psi) or less			
	Brake release pressure	Motor (F)	More than 1.5 MPa (218 psi)			
		Motor (R)	More than 1.5 MPa (218 psi)			
Drainage	Motor (F)	3.7 L/min (1.0 gal./min)	4.9 L/min (1.3 gal./min)			
	Motor (R)	3.7 L/min (1.0 gal./min)	1.8 L/min (0.5 gal./min)			
Vibration	High pressure relief valve pressure setting	12.7 MPa (1,842 psi)		14.0 MPa (2,030 psi)		
	Case pressure	Motor (F)	0.8 MPa (116 psi) or less			
		Motor (R)	0.8 MPa (116 psi) or less	N/A		
	Drainage	Motor (F)	3.4 L/min (0.9 gal./min)			
		Motor (R)	3.4 L/min (0.9 gal./min)	N/A		
Steering oil pressure		13.5 MPa (1,958 psi)				

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

2-5. Brakes

Item	Standard value	Remarks
Clearance between brake pedal and floorboard (as released)	Note 1: 119 mm (4.7 in.)	 <p style="text-align: right;">SW354-02002</p>
Clearance between brake pedal and floorboard (when pressed down)	Note 2: 79 mm (3.1 in.)	
Replacement standard brake stroke length	More than 3.5 mm (0.14 in.) (L2-L1)	 <p style="text-align: right;">SW300-1-02001</p>

2-6. Capacities

Item	Standard value			Remarks
	SW354	TW354	TW504	
Engine oil pan	7.0 L (1.8 gal.)			
Fuel tank	40 L (10.6 gal.)		50 L (13.2 gal.)	
Coolant	5.8 L (1.5 gal.)		6.5 L (1.7 gal.)	
Hydraulic oil tank	43 L (11.4 gal.)			
Vibrator case	5.0 L × 2 (1.3 gal.) × 2	5.0 L (1.3 gal.)	6.0 L (1.6 gal.)	
Water spray tank	200 L (52.8 gal.)		310 L (81.9 gal.)	
Liquid spray tank	N/A	10 L (2.6 gal.)		

SPECIFICATIONS

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 GL5	SAE75W-90	SAE75W-90	SAE140	MIL-L-2105
Hydraulic oil	Wear resisting	ISO-VG32 over VI 140	ISO-VG46 over VI 140	ISO-VG68 over VI 110	ISO-3448
Grease	Lithium type extreme pressure grease			NLGI-2	
Fuel	Ambient temp. -15 to -10°C		Ambient temp. -10 to 55°C		
	Diesel fuel ASTM D975 NO.1-D S15 or S500*1		Diesel fuel ASTM D975 NO.2-D S15 or S500*2		

*1: For EPA regulation: Diesel fuel ASTM D975 NO.1-D S15 only.

*2: For EPA regulation: Diesel fuel ASTM D975 NO.2-D S15 only.

3-2. Recommended Lubricants

Lubricant Oil company	Engine oil API-CF	Gear oil API GL 5	Hydraulic oil VG 46	Grease NLGI-2
Chevron	DELO 400	RPM UNIVERSAL GEAR LUBRICANTS	RANDO HDZ	MULTIFAK EP
BP	Vanellus C-Extra	Energear HYPO-U	Bartran HV	Energrease LS-EP
CASTROL	CW 30	EPX GEAR OILS	Castrol Hyspin AWH	Castrol Spheerol EPL
Shell	Shell Rimura Super	Shell Spirax S2 A 90	Shell Tellus S2 V	Shell Alvania Grease EP
ExxonMobil	Mobil Delvac MX	Mobilude HD	Mobil DTE 10 Excel	Mobilux EP

4. TIGHTENING TORQUE CHART

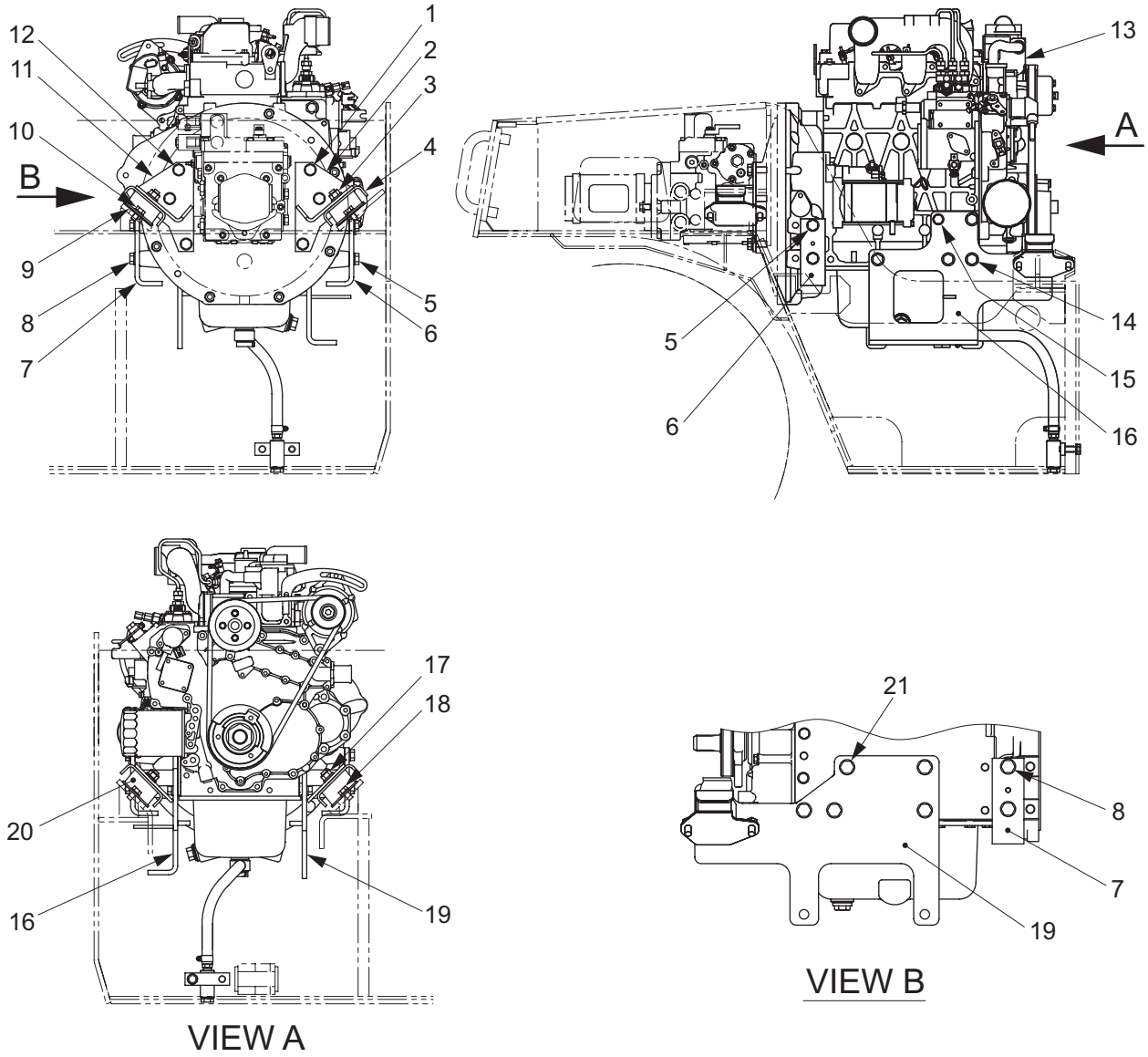
N·m	(lbf·ft)
-----	----------

	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)

ENGINE AND CONTROLS

1. ENGINE

1-1. Engine Mount



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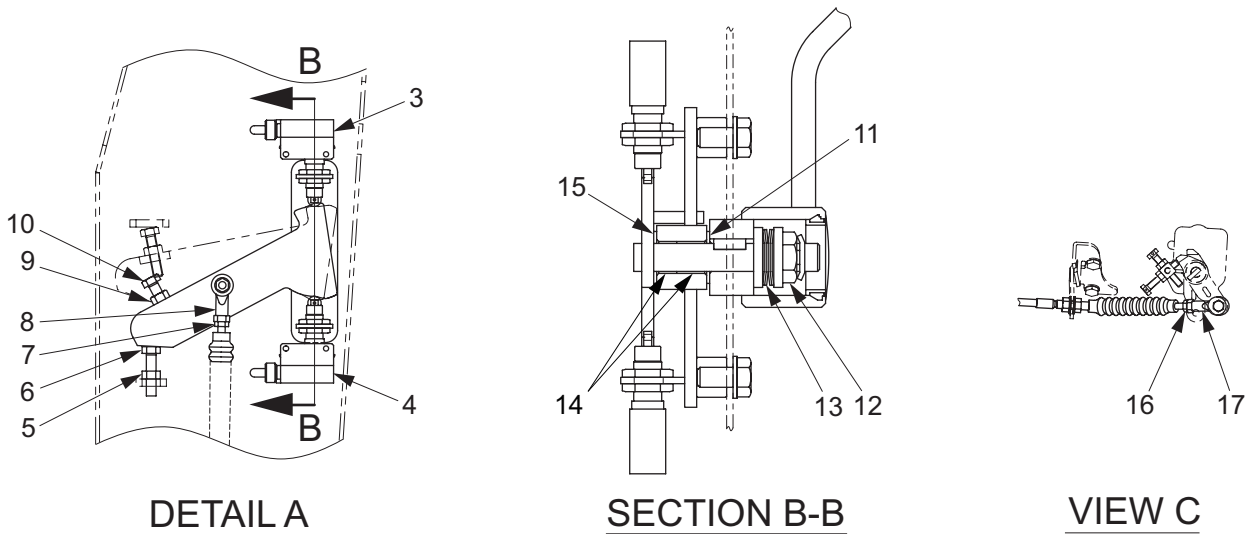
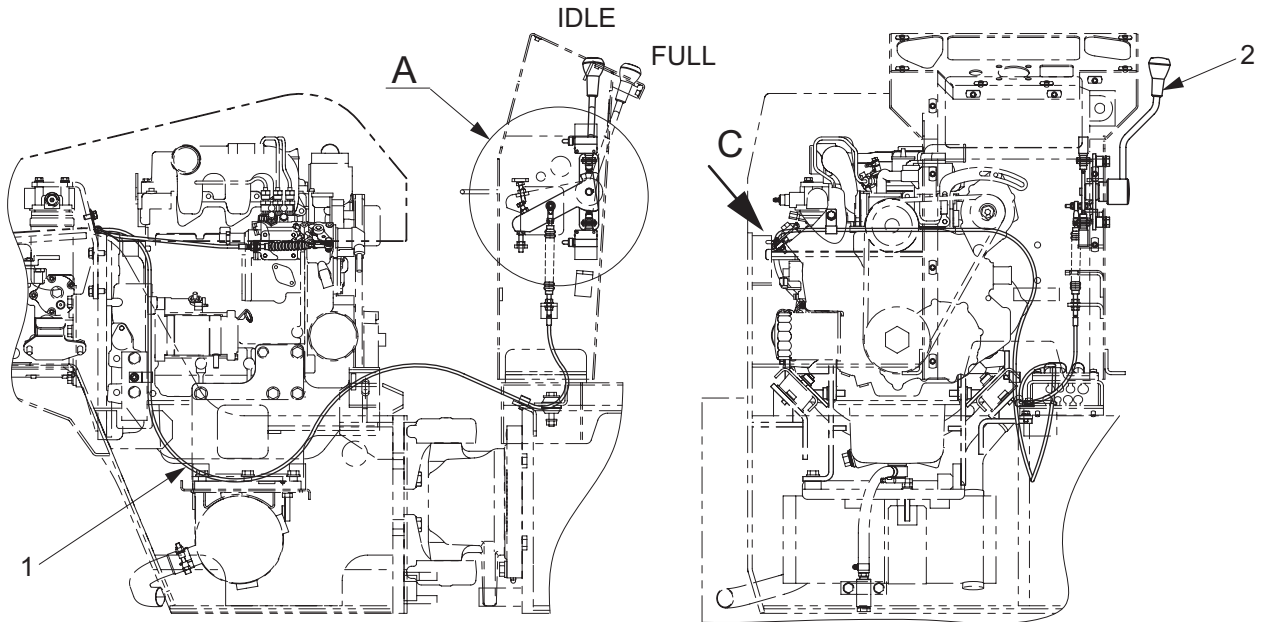
- | | | |
|--------------------------|---------------------------|---------------------------|
| (1) Bolt : M12×30 | (8) Bolt : M12×30 P=1.25 | (15) Bolt : M10×30 P=1.25 |
| (2) Bracket | (9) Spacer | (16) Bracket |
| (3) Nut : M12 | (10) Bolt : M10×20 | (17) Nut : M12 |
| (4) Rubber isolator | (11) Bracket | (18) Bolt : M10×20 |
| (5) Bolt : M12×30 P=1.25 | (12) Bolt : M12×30 | (19) Bracket |
| (6) Bracket | (13) Engine | (20) Rubber isolator |
| (7) Bracket | (14) Bolt : M12×35 P=1.25 | (21) Bolt : M12×35 P=1.25 |



- | | | | |
|-------------------------|-------------------------|-------------------------|-------------------------|
| (3) Nut M12 | : 88 N·m (65 lbf·ft) | (17) Nut M12 | : 88 N·m (65 lbf·ft) |
| (14) Bolt M12×35 P=1.25 | : 118 N·m (87 lbf·ft) | (21) Bolt M12×35 P=1.25 | : 118 N·m (87 lbf·ft) |
| (15) Bolt M10×30 | : 69 N·m (51 lbf·ft) | | |

2. CONTROL SYSTEM

2-1. Throttle Control



DETAIL A

SECTION B-B

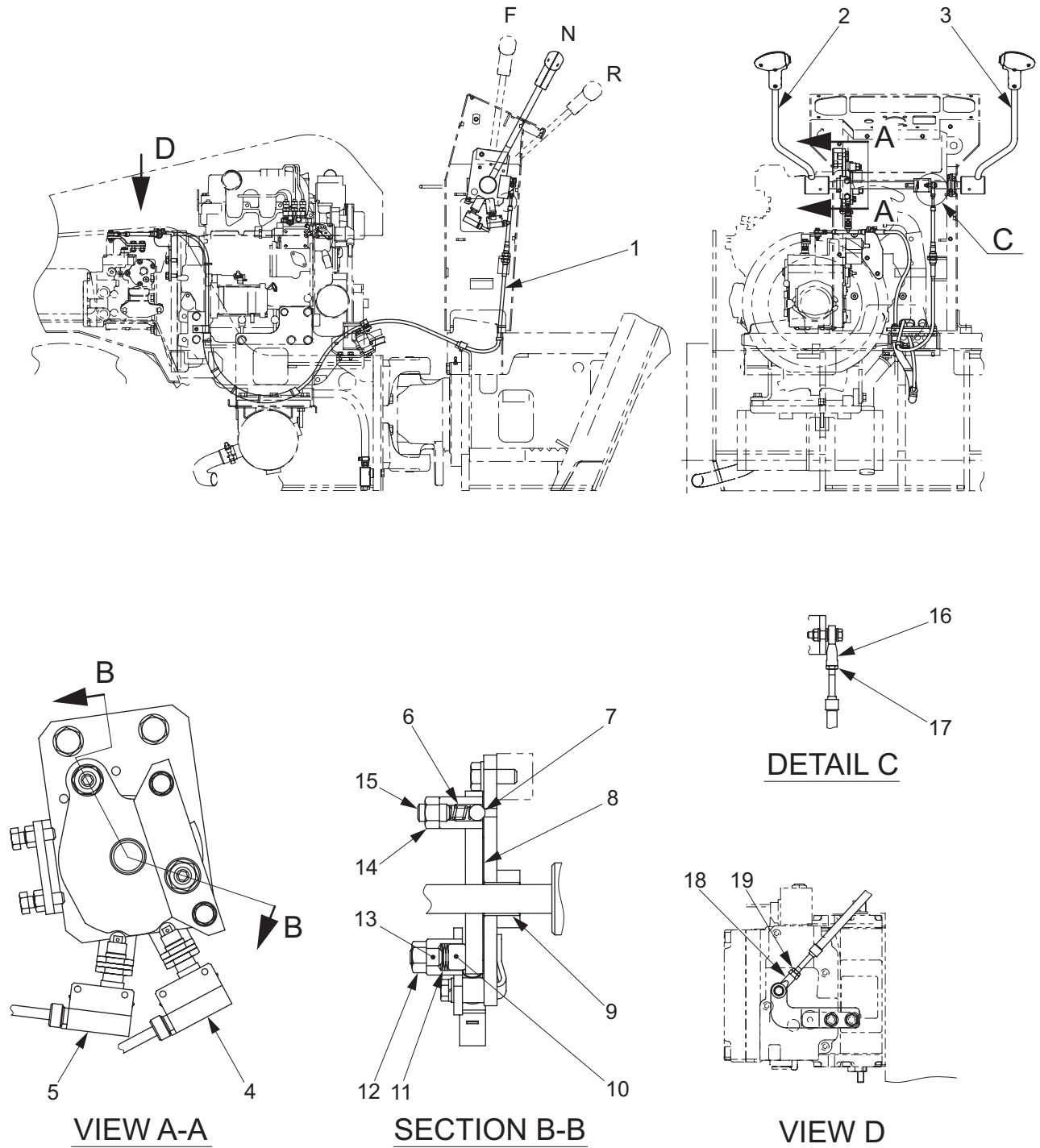
VIEW C

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- | | | |
|--------------------------------------|------------------------------|---------|
| (1) Control cable | (10) Stopper bolt (FULL) | : M8×35 |
| (2) Throttle lever | (11) Washer (Apply grease*) | |
| (3) ECO lamp switch 2 (Apply grease) | (12) Nut | : M14 |
| (4) ECO lamp switch 1 (Apply grease) | (13) Disc spring | |
| (5) Lock nut | (14) Bush | |
| (6) Stopper bolt (IDLE) | (15) Washer (Apply grease*) | |
| (7) Lock nut | (16) Lock nut | : M6 |
| (8) Rod end (Apply grease*) | (17) Rod end (Apply grease*) | |
| (9) Lock nut | | |

* : Lithium-based grease

2-2. Forward-reverse Control



- (1) Control cable
- (2) F-R lever (L)
- (3) F-R lever (R)
- (4) Backup buzzer switch
- (5) F-R lever switch
- (6) Spring (Fill grease*)
- (7) Steel ball (Apply grease)

- (8) Friction plate
- (9) Bush
- (10) Holder (Apply grease)
- (11) Disc spring (Apply grease*)
- (12) Lock nut : M12
- (13) Set screw : M12×22

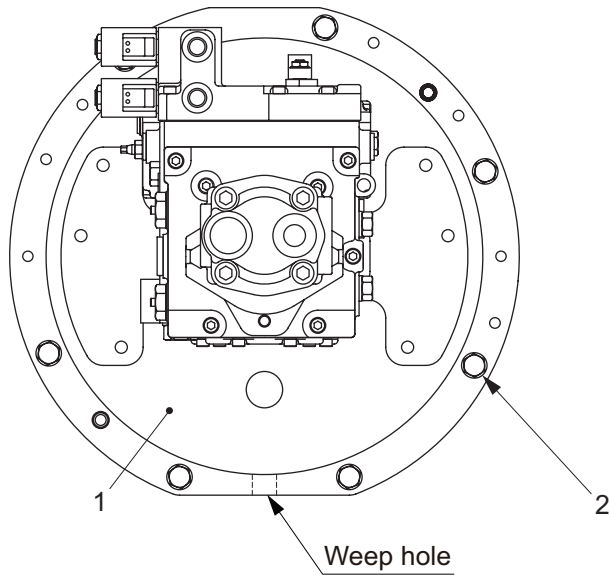
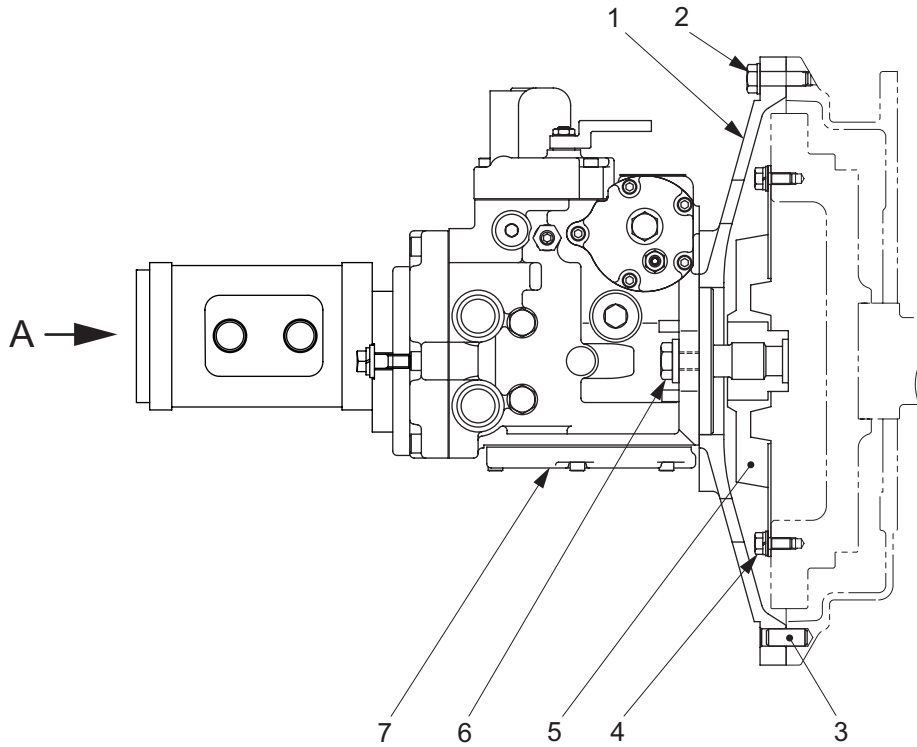
- (14) Lock nut : M12
- (15) Set screw : M12×22
- (16) Rod end
- (17) Lock nut : M6
- (18) Rod end
- (19) Lock nut : M6

* : Lithium-based grease

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3. PUMP MOUNT

3-1. Pump Mount



VIEW A

0446-36804-0-20215-B

- | | |
|--------------------------|-------------------|
| (1) Cover | (5) Coupling |
| (2) Bolt : M10×35 P=1.25 | (6) Bolt : M12×40 |
| (3) Pin | (7) Pump |
| (4) Bolt : M 8×20 | |



- (4) Bolt M 8×20 : 23 N·m (17 lbf·ft)
 (6) Bolt M12×40 : 108 N·m (80 lbf·ft)

3-1-1. Installation of pump

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

- ① Apply adequate amount of grease to pump (7) and coupling (5) splines.
- ② Secure coupling (5) to engine flywheel with six bolts (4), spring washers and washers.



(4) Bolt M8×20 : 23 N·m (17 lbf·ft)

- ③ Install pins (3) to flywheel housing.
- ④ Position cover (1) as shown in the figure, and secure to flywheel housing with seven bolts (2) and washers.
- ⑤ Engage spline of pump (7) with coupling (5).
- ⑥ Secure pump (7) to cover (1) with two bolts (6) and washers.



(6) Bolt M12×40 : 108 N·m (80 lbf·ft)

(NOTICE)

- **Bolts (4) is treated with thread-locking fluid. Use new thread-locking fluid treated bolts for installation.**

HYDRAULIC SYSTEMS

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

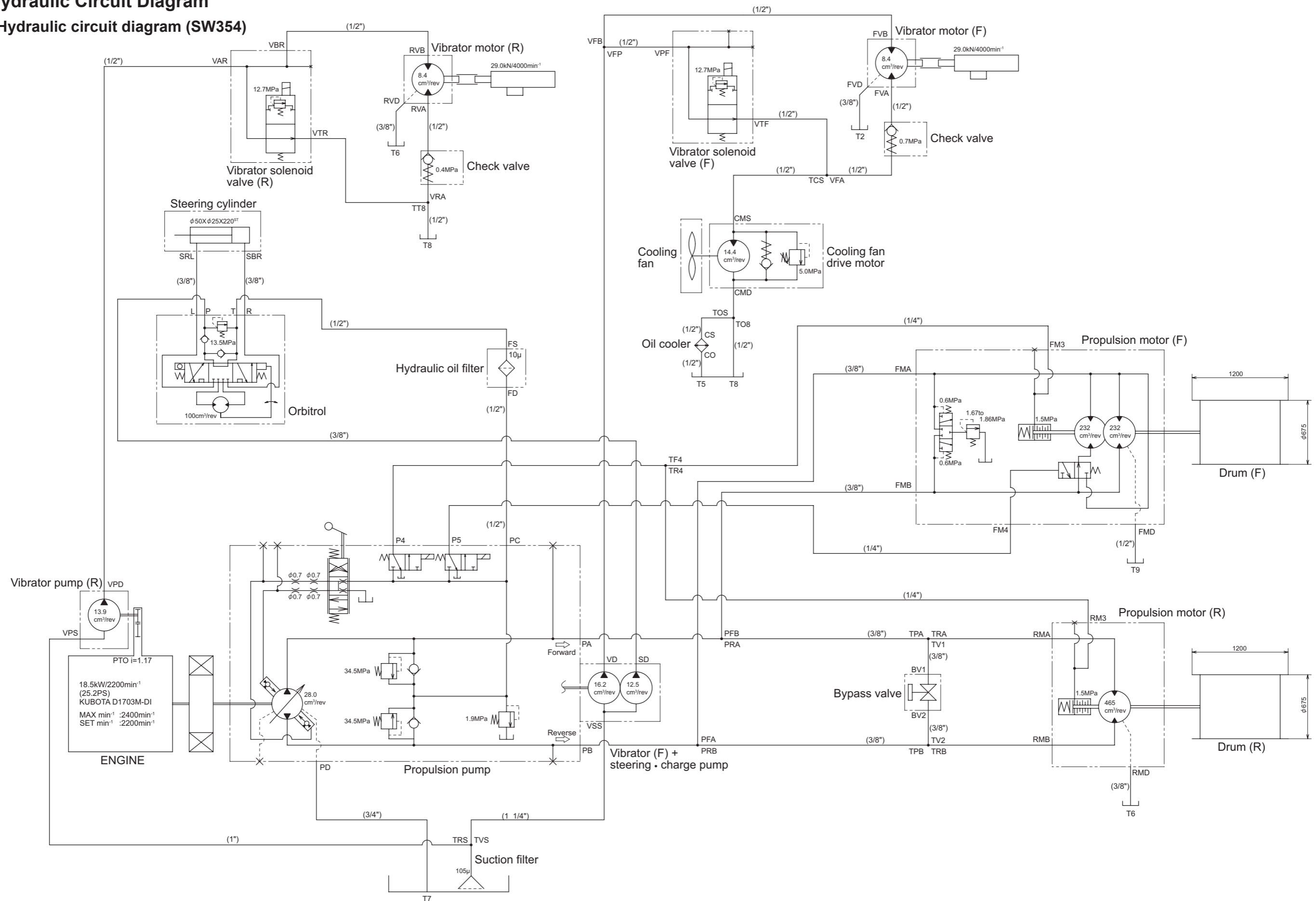
DESCRIPTION	SYMBOL
Check valve	
Manual shut off (On-Off)	
Pressure relief	
Flow control, adjustable	
Valve symbols: The basic valve symbol one or more squares with lines representing flow paths and flow conditions between ports.	
Multiple squares indicate a valve with as many distinct positions there 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

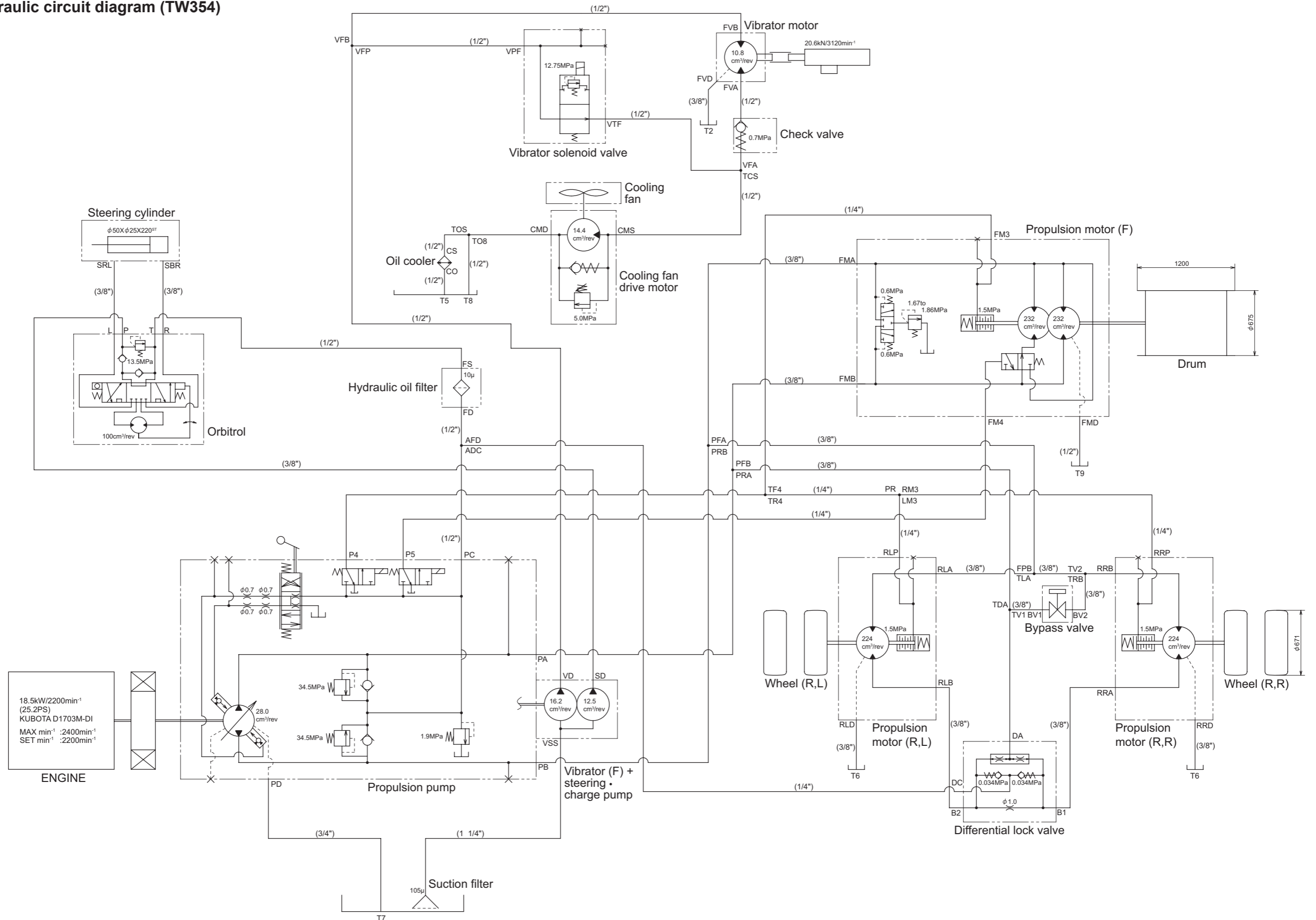
DESCRIPTION	SYMBOL
Spring	
Manual	
Pressure compensated	
Reversing motor	
Pilot pressure: Internal supply	
Remote supply	
Solenoid: Single winding	
Two windings operating in opposite directions.	
Pilot directional valve is actuated by the solenoid.	

1-2. Hydraulic Circuit Diagram

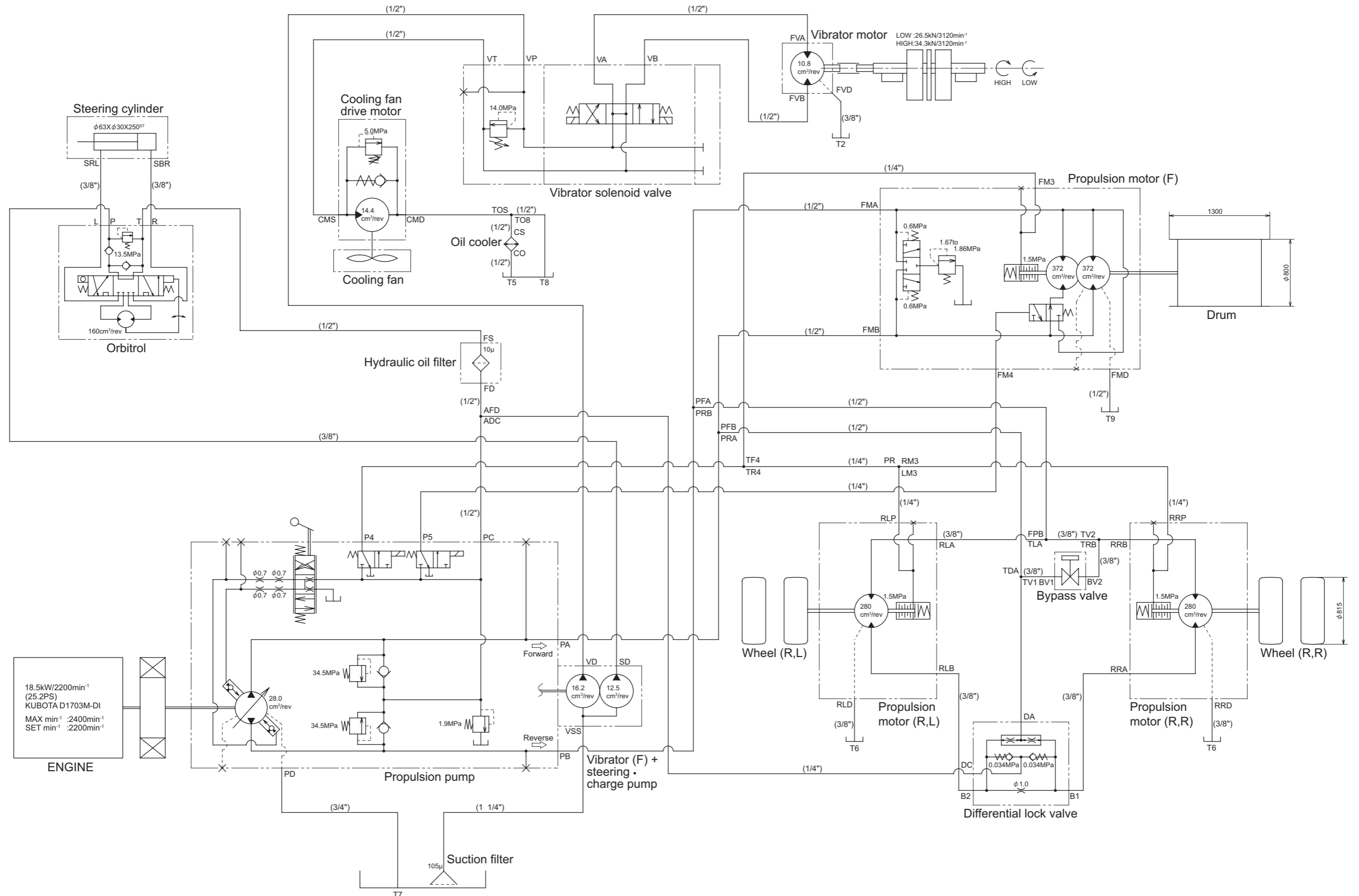
1-2-1. Hydraulic circuit diagram (SW354)



1-2-2. Hydraulic circuit diagram (TW354)



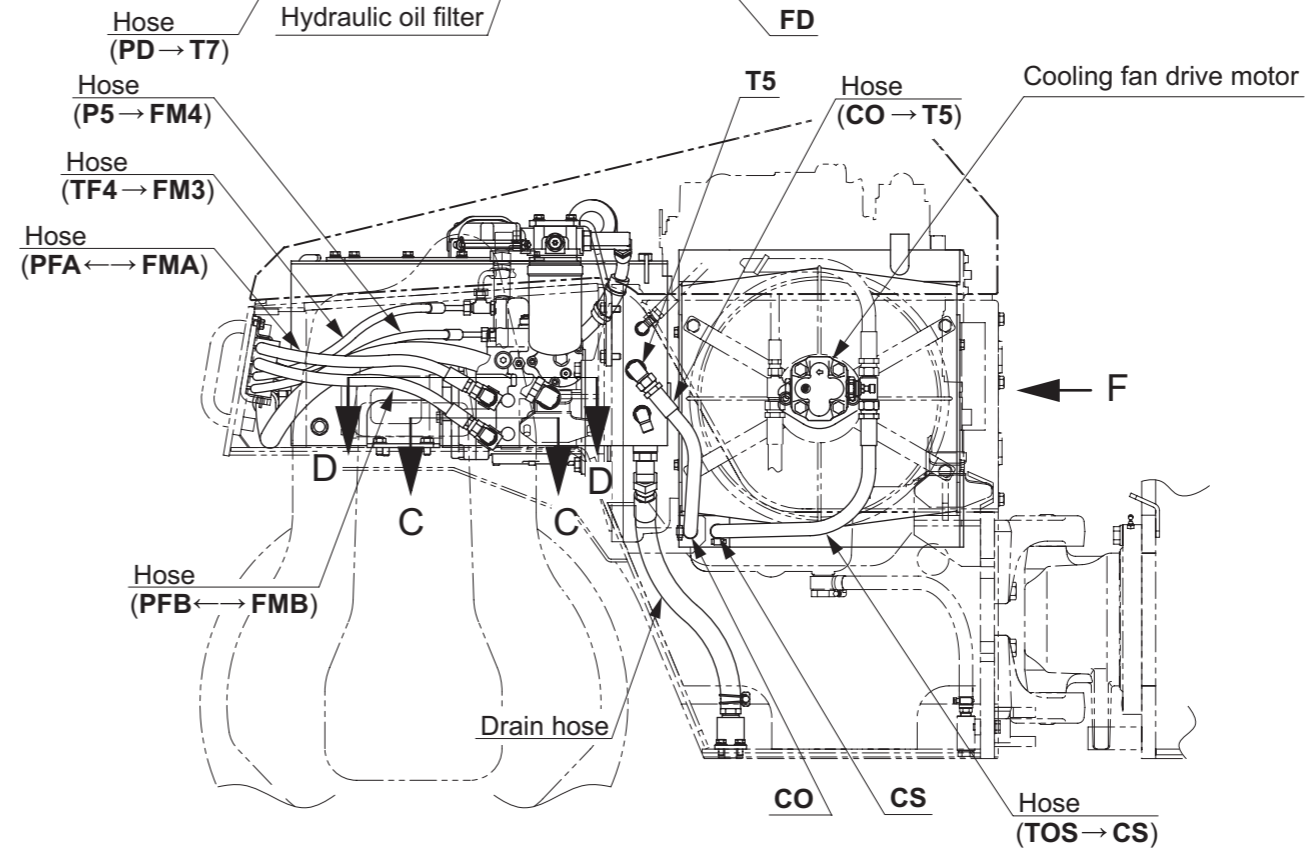
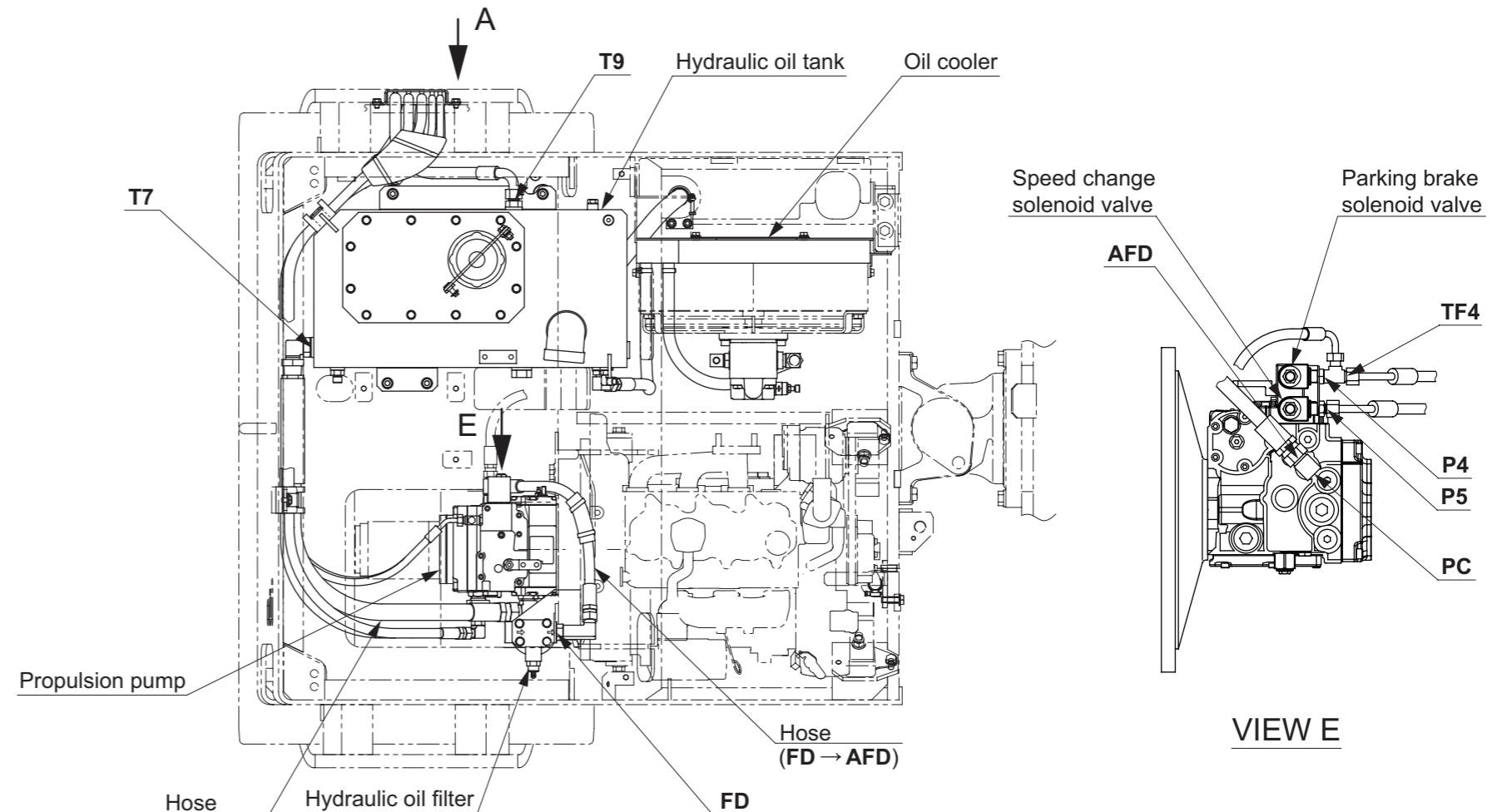
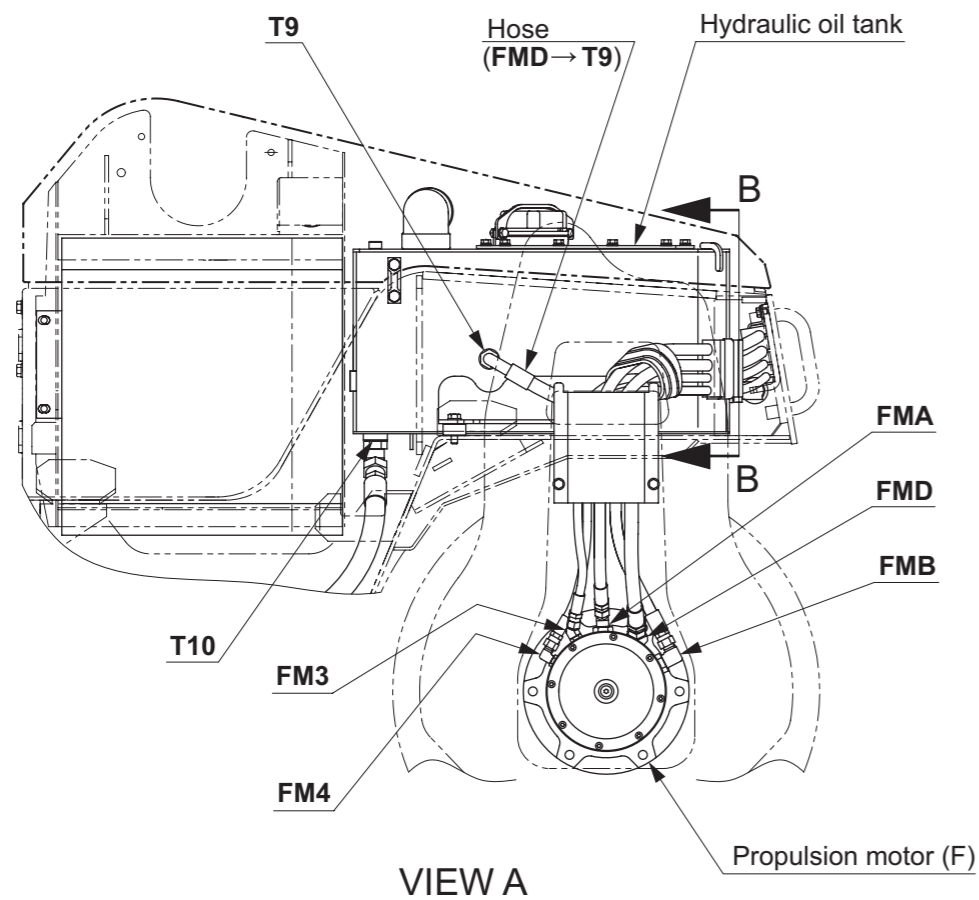
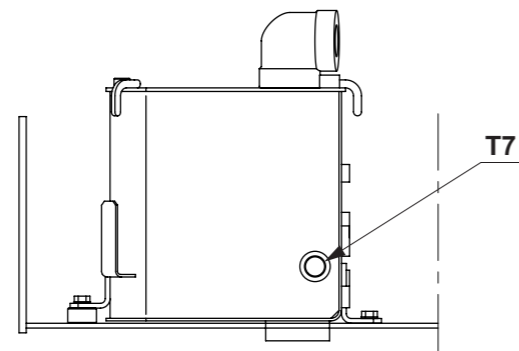
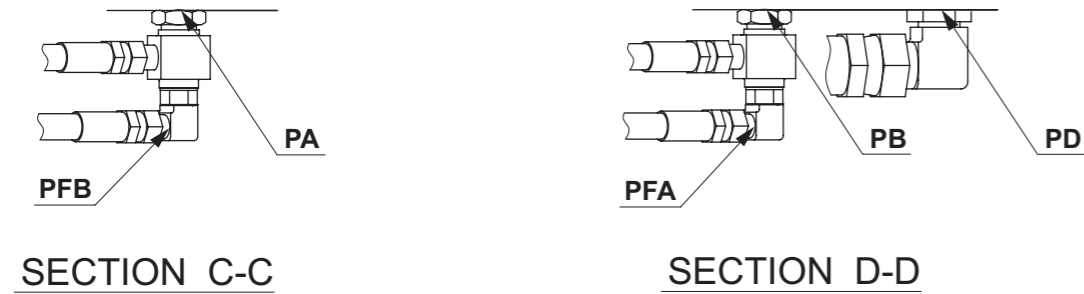
1-2-3. Hydraulic circuit diagram (TW504)



2. PROPULSION HYDRAULIC SYSTEM

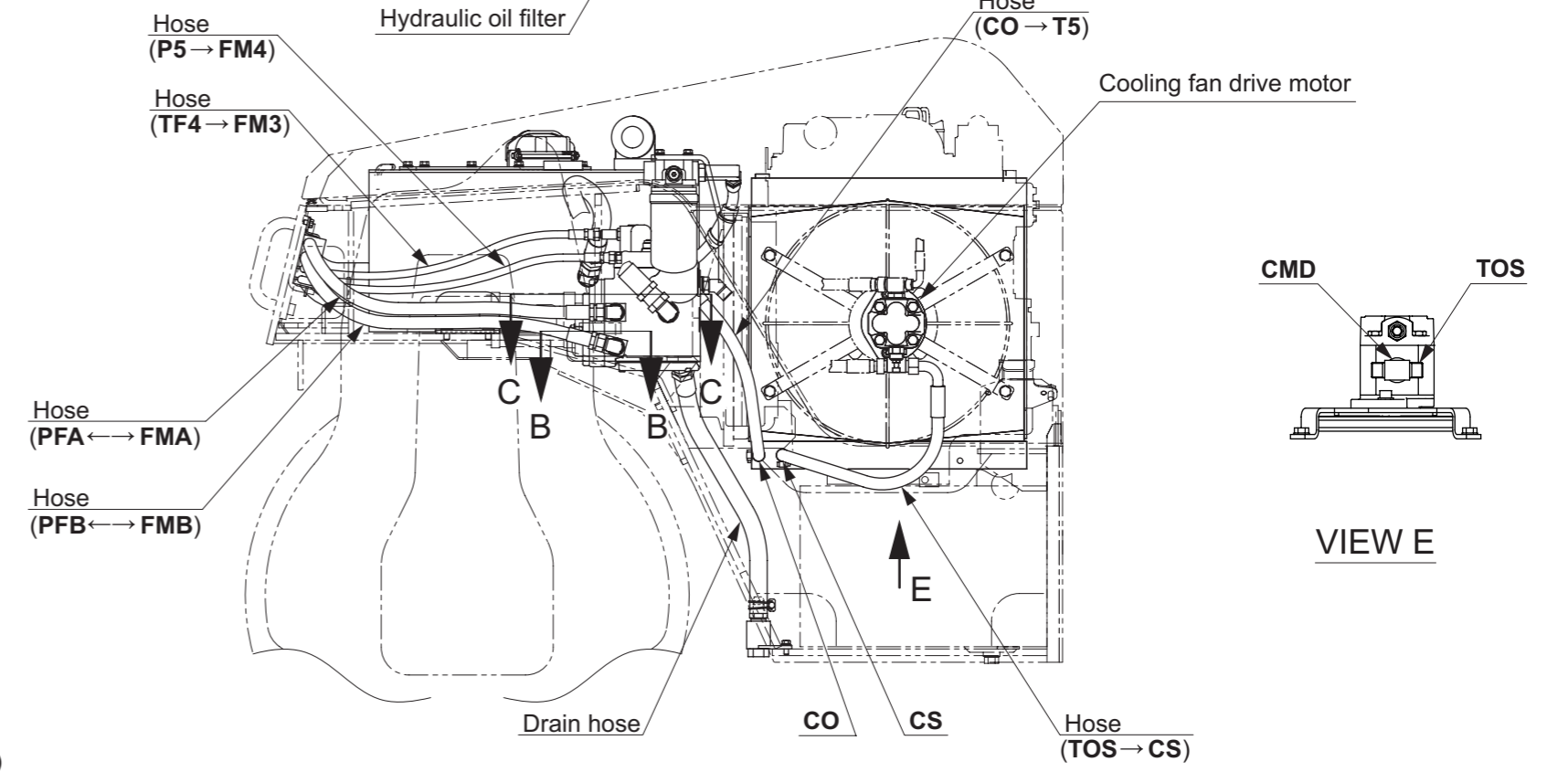
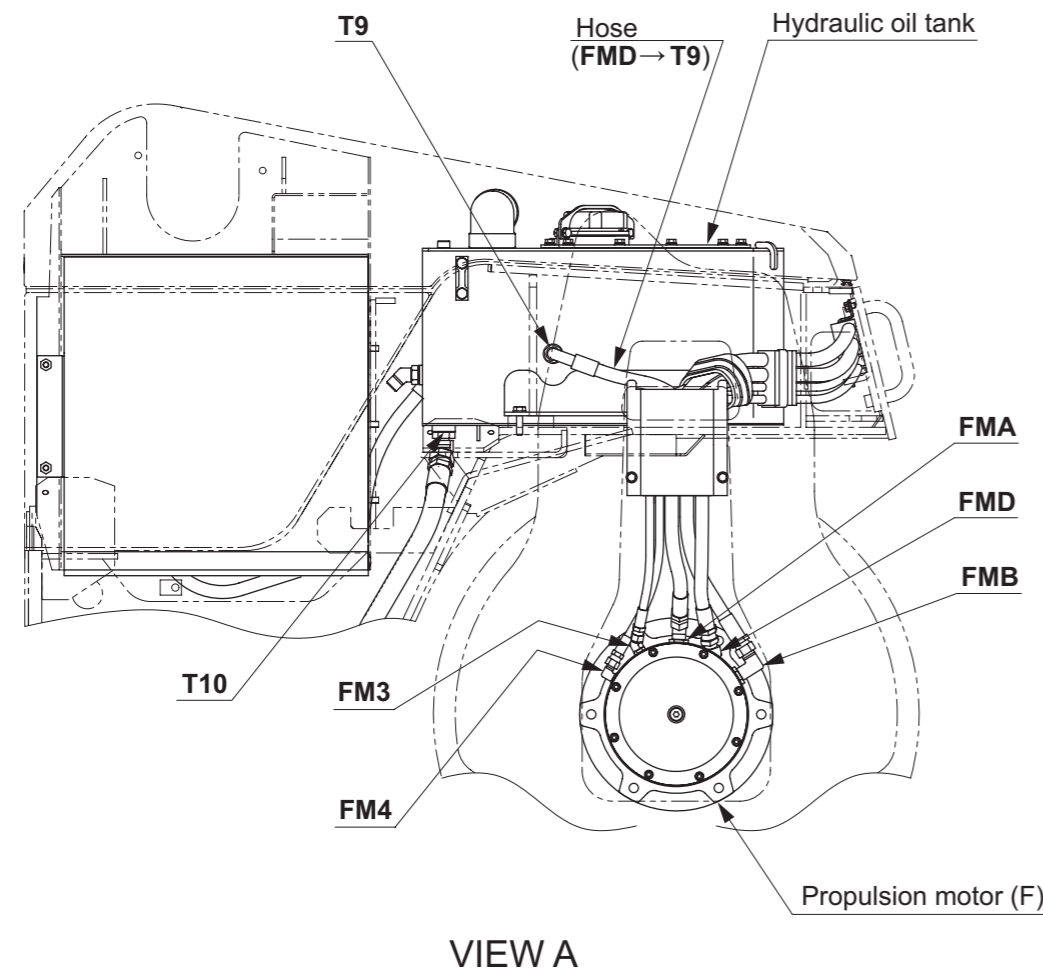
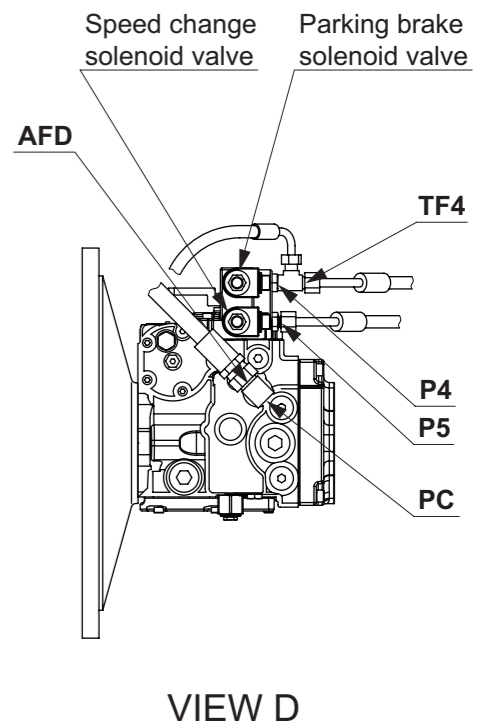
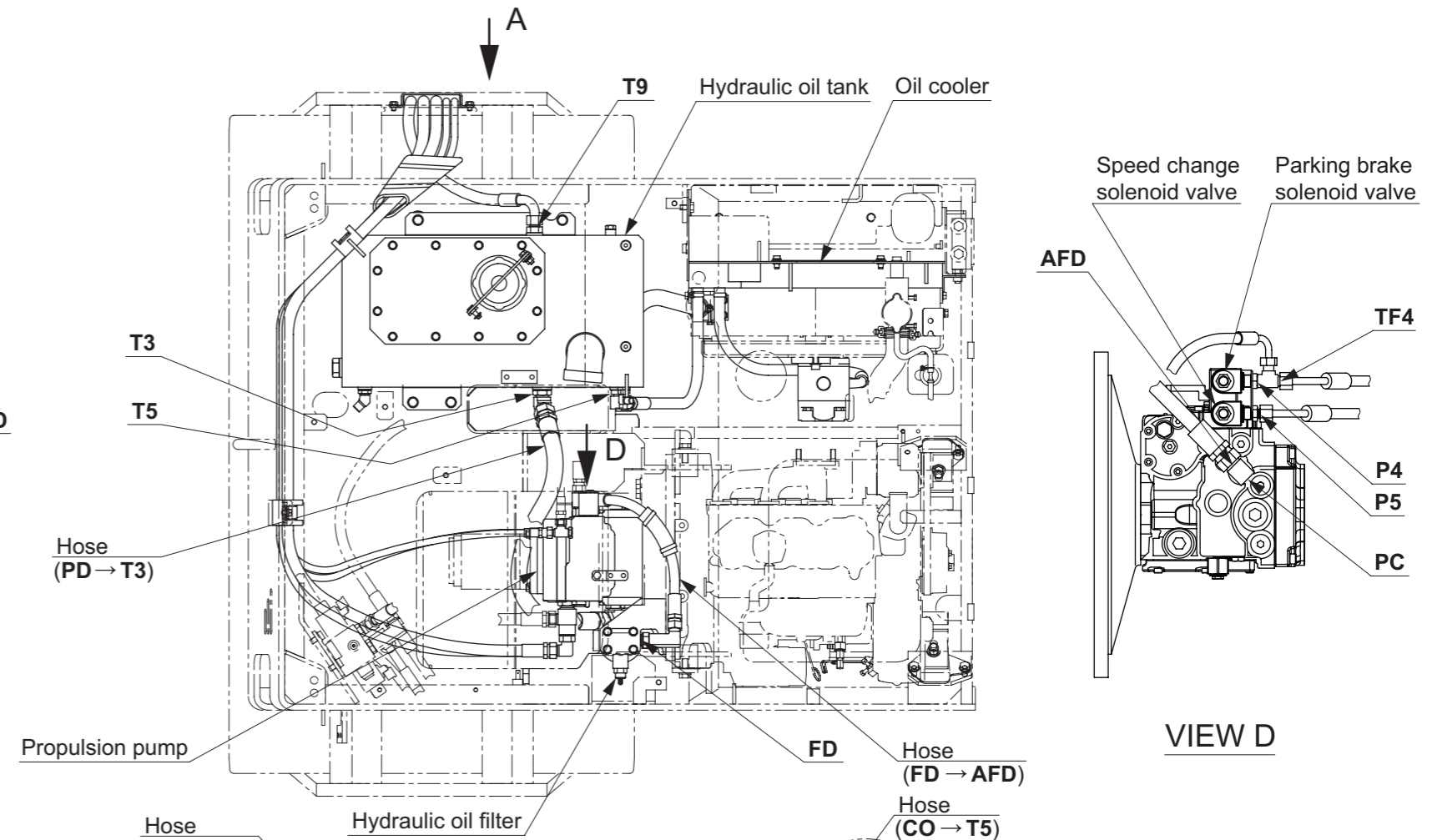
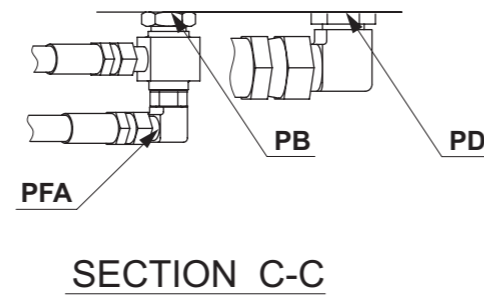
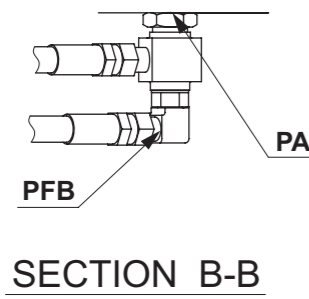
2-1. Propulsion Hydraulic Piping

2-1-1. Propulsion hydraulic piping (F) (SW/TW354)



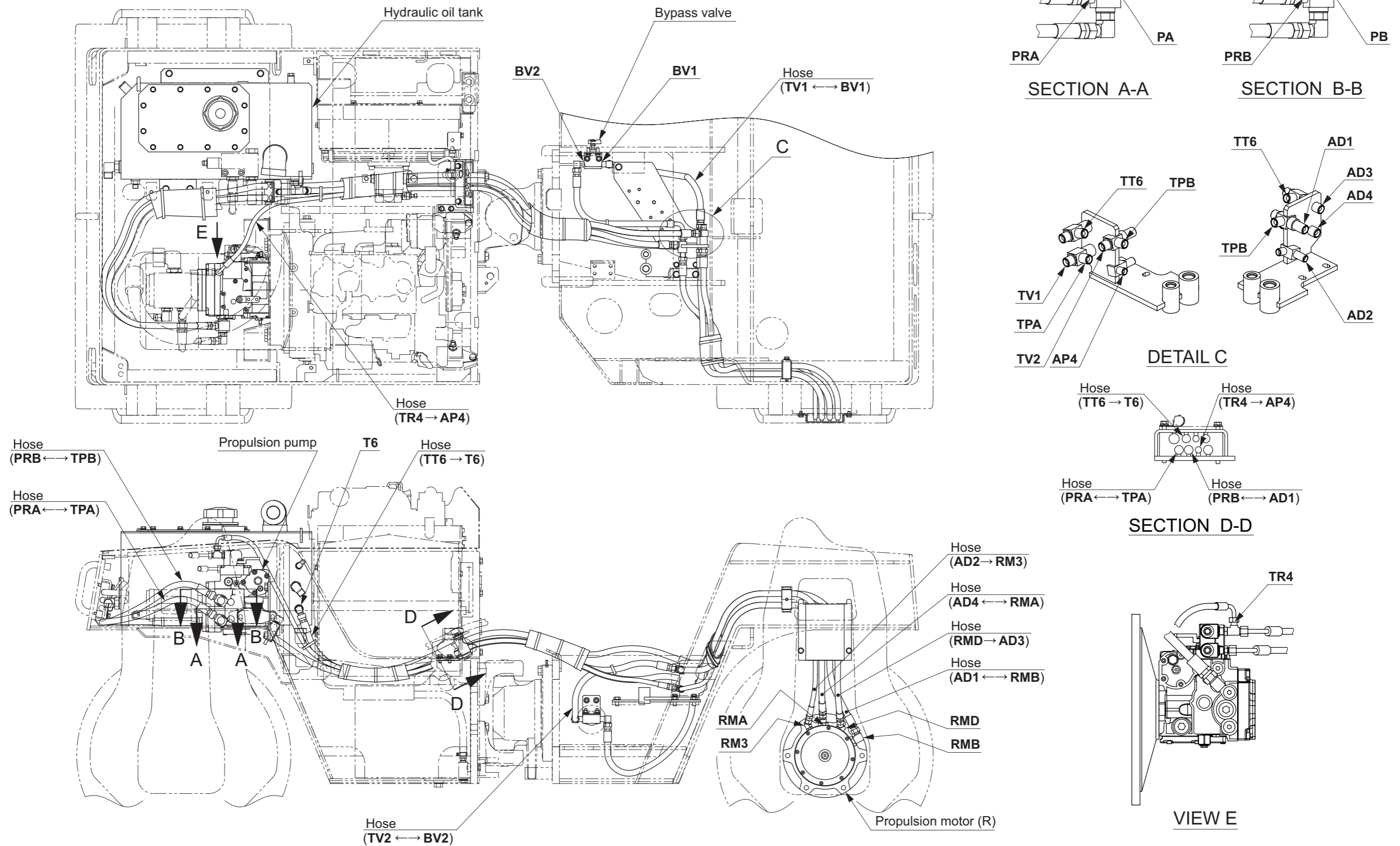
- The letters and numbers in the figure such as "PFA" and "FMA" show each port.
- Arrow "↔; →" symbols show the hose connection and the direction of the flow of the oil.

2-1-2. Propulsion hydraulic piping (F) (TW504)



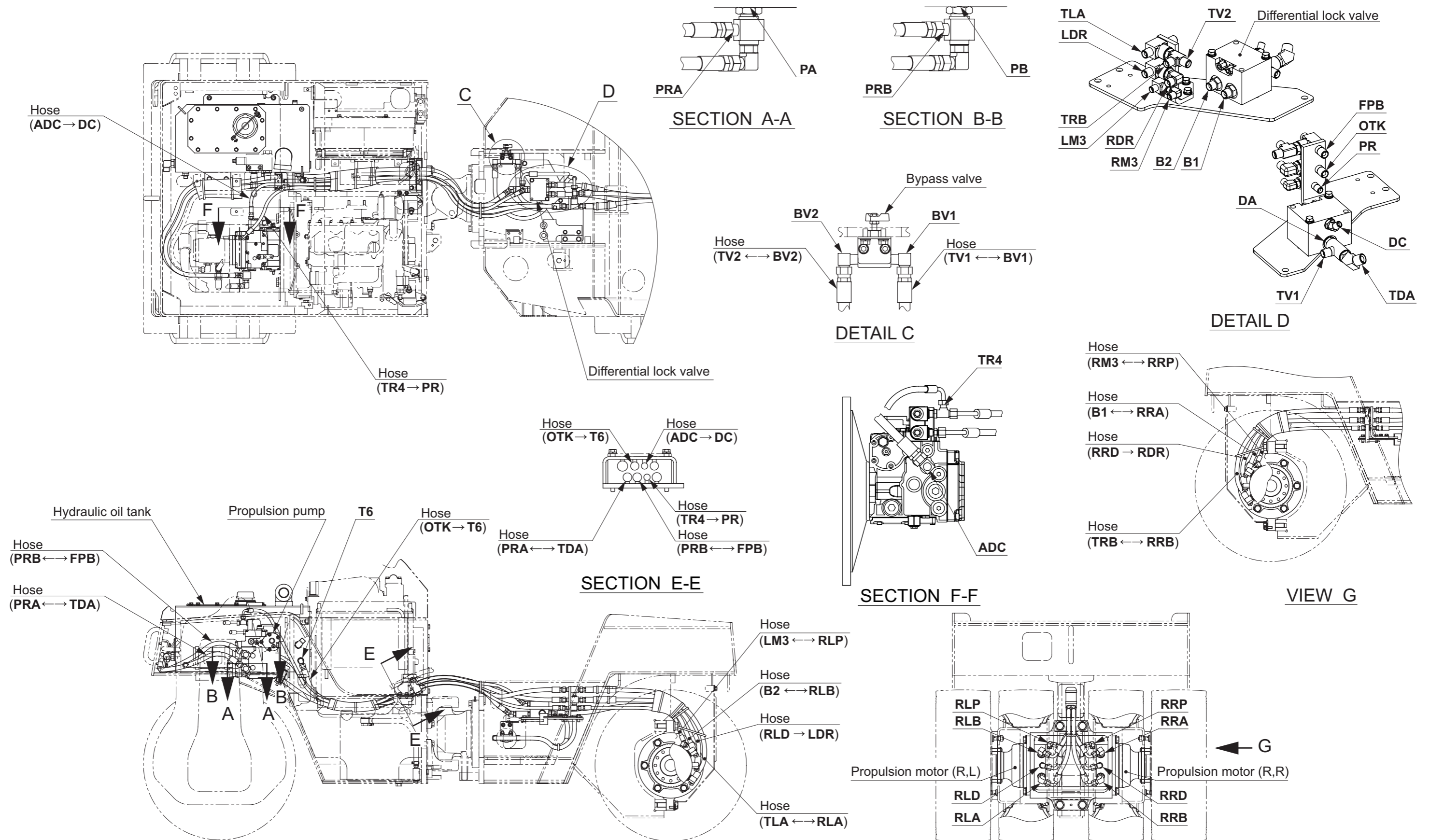
• The letters and numbers in the figure such as "PFA" and "FMA" show each port.
 • Arrow " ↔ ; → " symbols show the hose connection and the direction of the flow of the oil.

2-1-3. Propulsion hydraulic piping (R) (SW354)



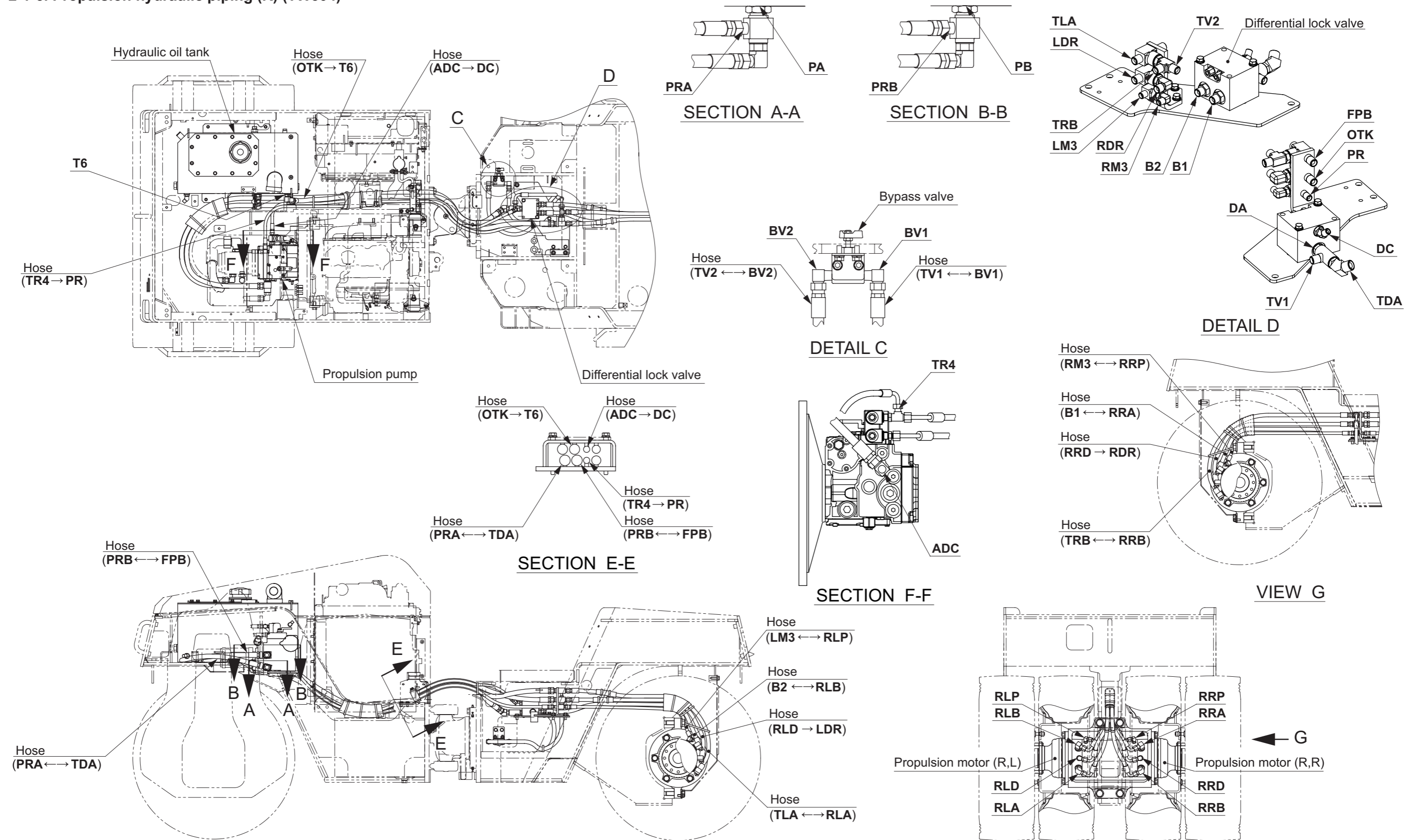
- The letters and numbers in the figure such as "PRA" and "TPA" show each port.
- Arrow " ↔ ; → " symbols show the hose connection and the direction of the flow of the oil.

2-1-4. Propulsion hydraulic piping (R) (TW354)



• The letters and numbers in the figure such as “TLA” and “RLA” show each port.
 • Arrow “ \longleftrightarrow ; \rightarrow ” symbols show the hose connection and the direction of the flow of the oil.

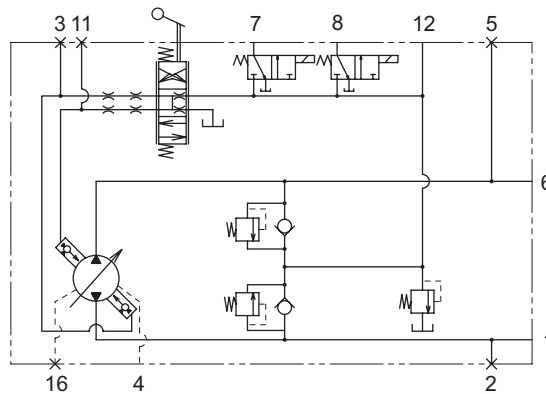
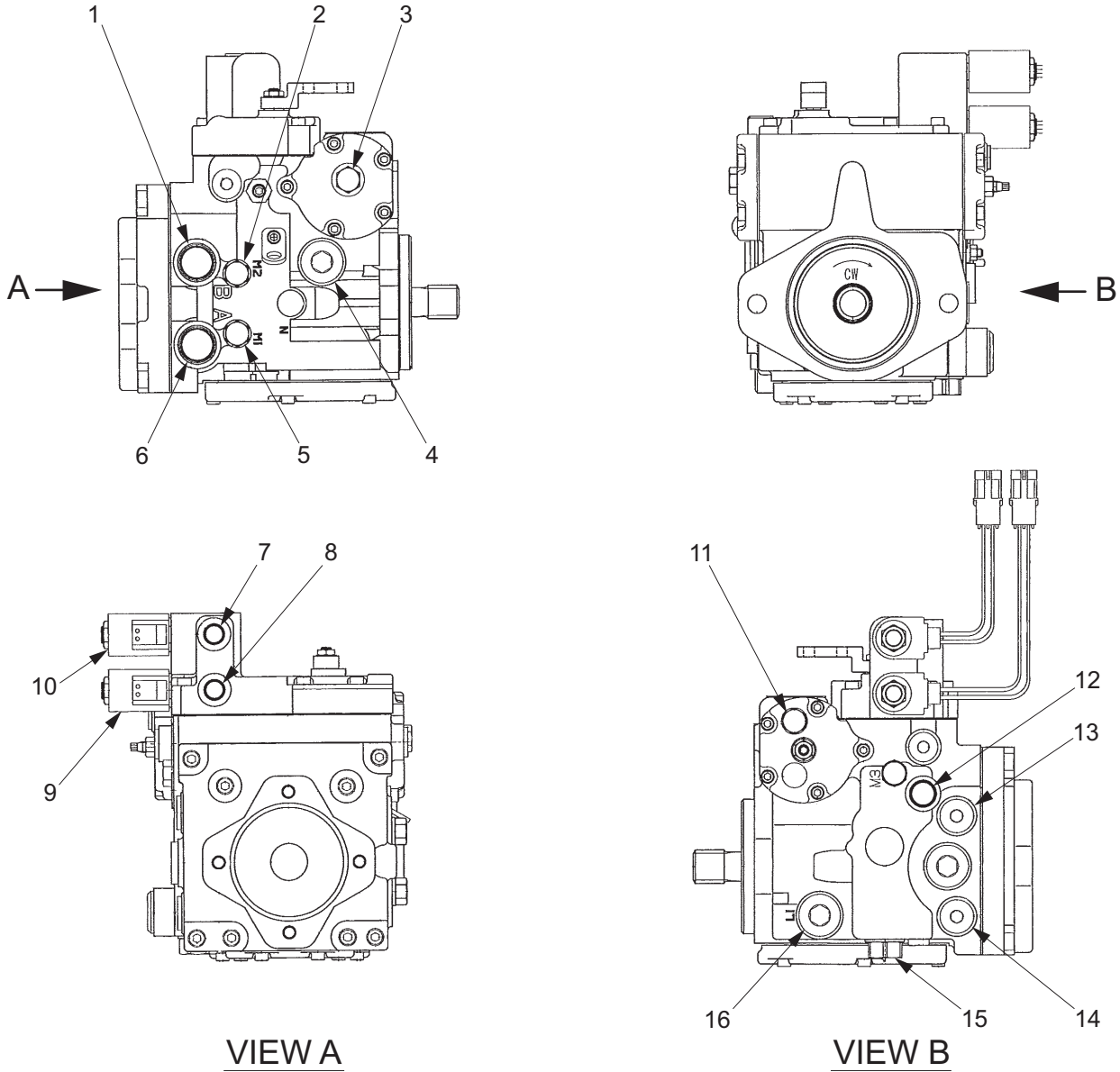
2-1-5. Propulsion hydraulic piping (R) (TW504)



- The letters and numbers in the figure such as "TLA" and "RLA" show each port.
- Arrow "↔; →" symbols show the hose connection and the direction of the flow of the oil.

2-2. Hydraulic Component Specifications

2-2-1. Propulsion hydraulic pump



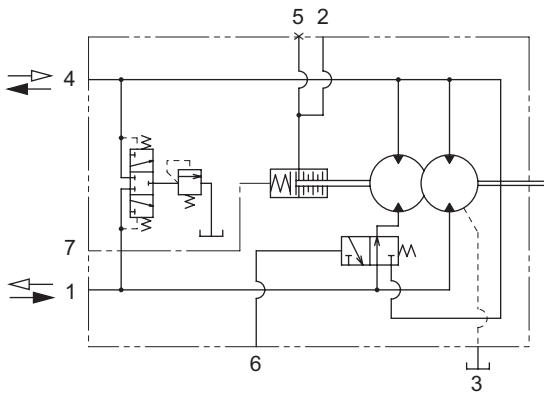
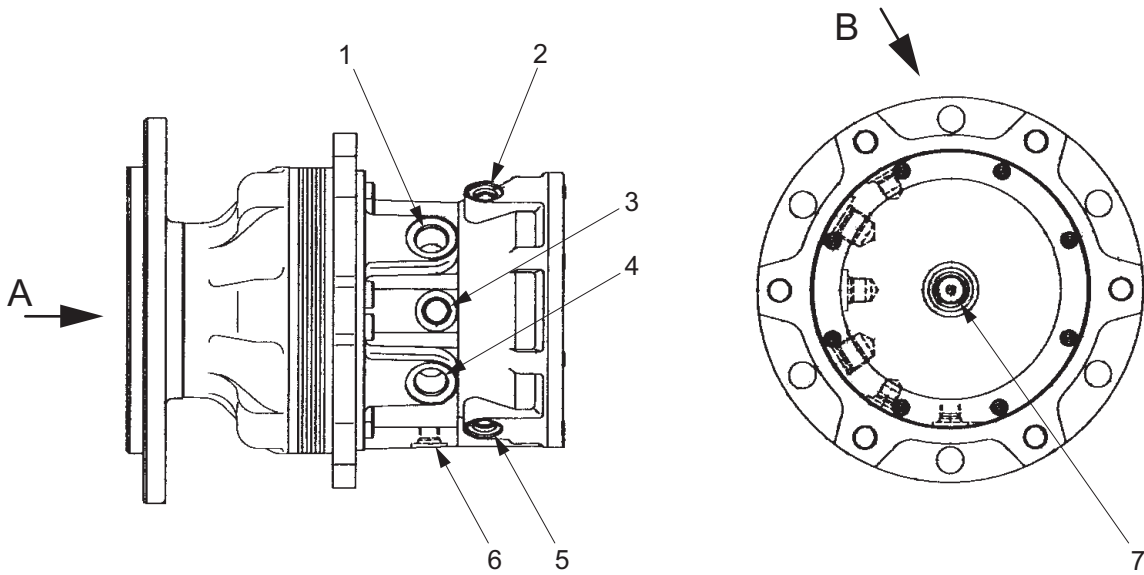
Hydraulic circuit diagram

(1) Port B (Reverse)	[PB] : 1 1/16-12UN
(2) High pressure gauge port (For port B)	: 9/16-18UNF
(3) Servo pressure gauge port	: 9/16-18UNF
(4) Drain port	[PD] : 1 1/16-12UN
(5) High pressure gauge port (For port A)	: 9/16-18UNF
(6) Port A (Forward)	[PA] : 1 1/16-12UN
(7) Parking brake release pressure port	[P4] : 9/16-18UNF
(8) Speed change pressure port	[P5] : 9/16-18UNF
(9) Speed change solenoid valve	
(10) Parking brake solenoid valve	
(11) Servo pressure gauge port	: 9/16-18UNF
(12) Charge pressure suction port	[PC] : 3/ 4-16UNF
(13) High pressure relief valve (For port B)	
(14) High pressure relief valve (For port A)	
(15) Charge relief valve	
(16) Drain port	: 1 1/16-12UN

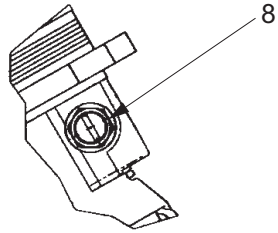
Specifications

• Displacement	: 28.0 cm ³ /rev (1.7 cu.in./rev)
• High pressure relief valve pressure setting	: 34.5 MPa (5,003 psi)
• Charge relief valve pressure setting	: 1.9 MPa (276 psi)
• Allowable pump case pressure	: 0.25 MPa (36.3 psi) or less
• Pump weight	: 34.5 kg (76.1 lbs.)

2-2-2. Propulsion hydraulic motor (F) (SW/TW354)



Motor circuit diagram



VIEW B

Flow of oil (Rotation direction is when viewed in direction of arrow A.)

- 4 → 1 Clockwise rotation
- 1 → 4 Counterclockwise rotation

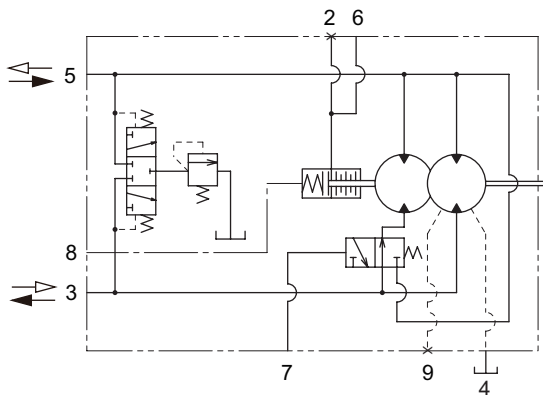
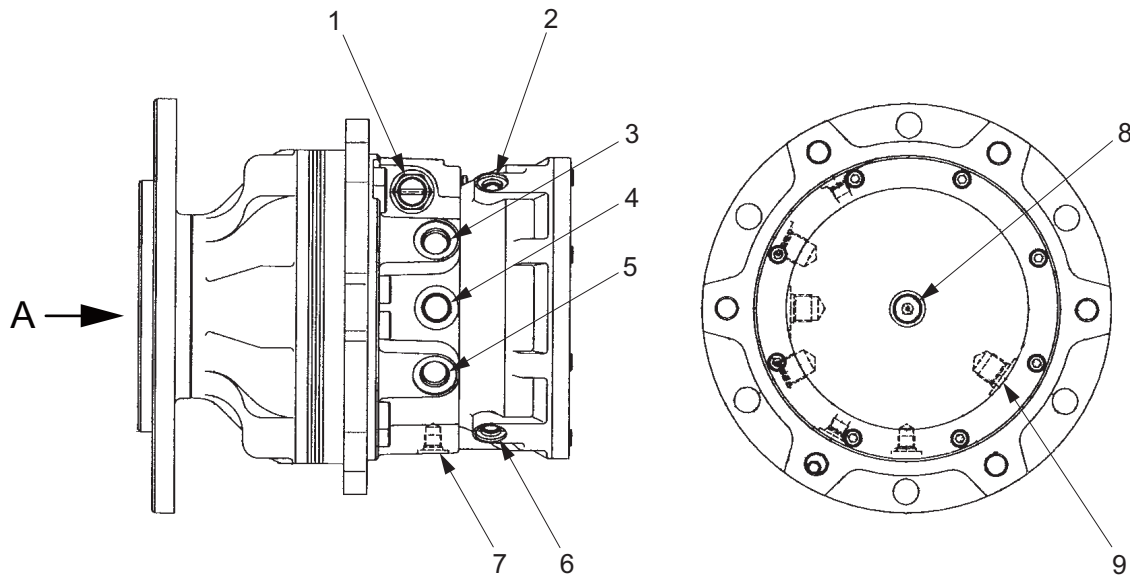
SW354-04002

(1) Port B	[FMB] : G1/2	(5) Parking brake pilot port	[FM3] : G1/4
(2) Parking brake pilot port	: G1/4	(6) Speed change port	[FM4] : G1/4
(3) Drain port	[FMD] : G3/8	(7) Manual brake release port	: M10
(4) Port A	[FMA] : G1/2	(8) Charge relief valve	

Specifications

• Displacement	:	465 cm ³ /rev (28 cu.in./rev)
• Maximum working pressure	:	34.3 MPa (4,974 psi)
• Charge relief valve pressure setting	:	1.67 to 1.86 MPa (242 to 270 psi)
• Allowable motor case pressure	:	0.3 MPa (43.5 psi)
• Brake release pressure	:	1.5 MPa (218 psi)
• Weight	:	42 kg (93 lbs.)

2-2-3. Propulsion hydraulic motor (F) (TW504)



Motor circuit diagram

Flow of oil (Rotation direction is when viewed in direction of arrow A.)

- 5 → 3 Clockwise rotation
- 3 → 5 Counterclockwise rotation

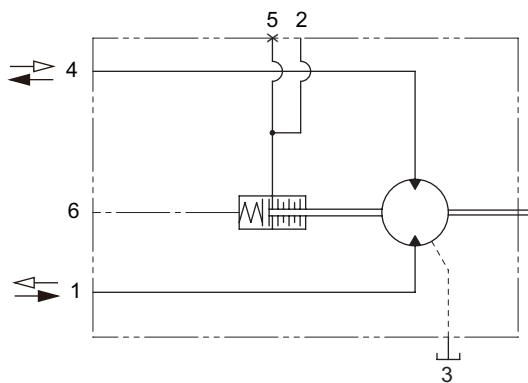
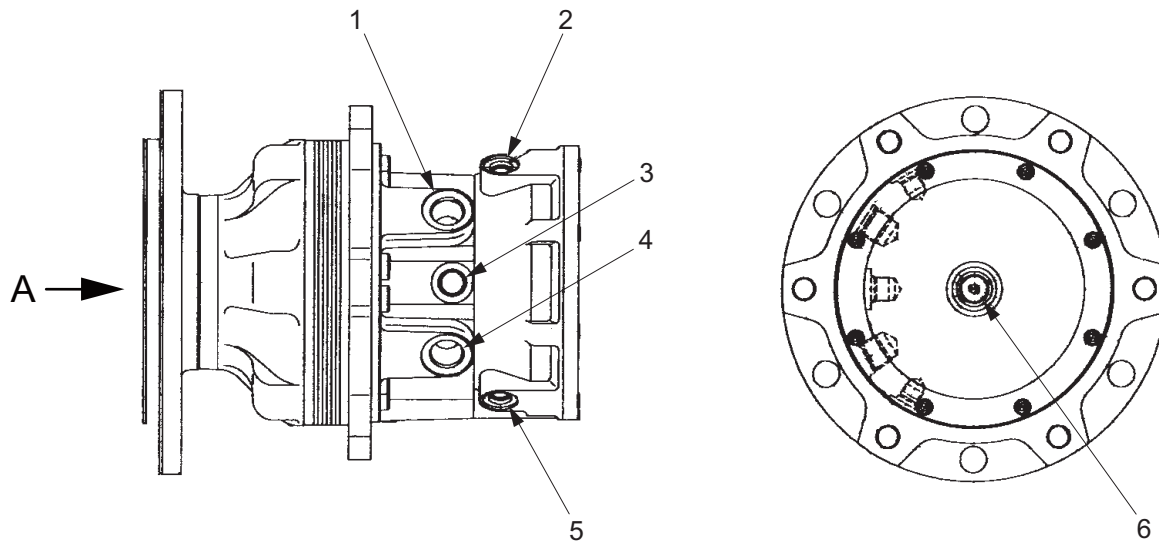
TW504-04001

- | | | | | |
|------------------------------|--------------|-------------------------------|--------------|--------|
| (1) Charge relief valve | | (6) Parking brake pilot port | [FM3] | : G1/4 |
| (2) Parking brake pilot port | : G1/4 | (7) Speed change port | [FM4] | : G1/4 |
| (3) Port B | [FMB] | (8) Manual brake release port | | : M12 |
| (4) Drain port | [FMD] | (9) Drain port | | : G1/2 |
| (5) Port A | [FMA] | | | |

Specifications

- Displacement : 745 cm³/rev (45 cu.in./rev)
- Maximum working pressure : 34.3 MPa (4,974 psi)
- Charge relief valve pressure setting : 1.67 to 1.86 MPa (242 to 270 psi)
- Allowable motor case pressure : 0.3 MPa (43.5 psi)
- Brake release pressure : 1.5 MPa (218 psi)
- Weight : 77 kg (170 lbs.)

2-2-4. Propulsion hydraulic motor (R) (SW354)



Motor circuit diagram

Flow of oil (Rotation direction is when viewed in direction of arrow A.)

- 4 → 1 Clockwise rotation
- 1 → 4 Counterclockwise rotation

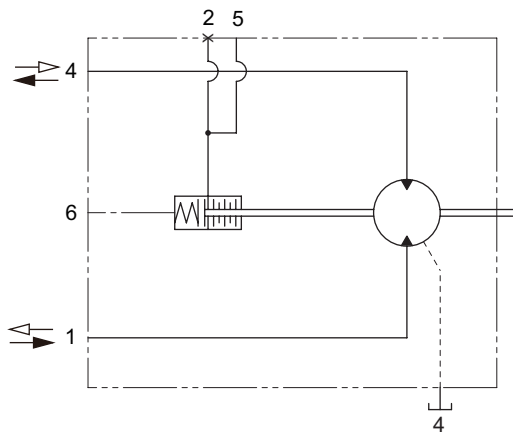
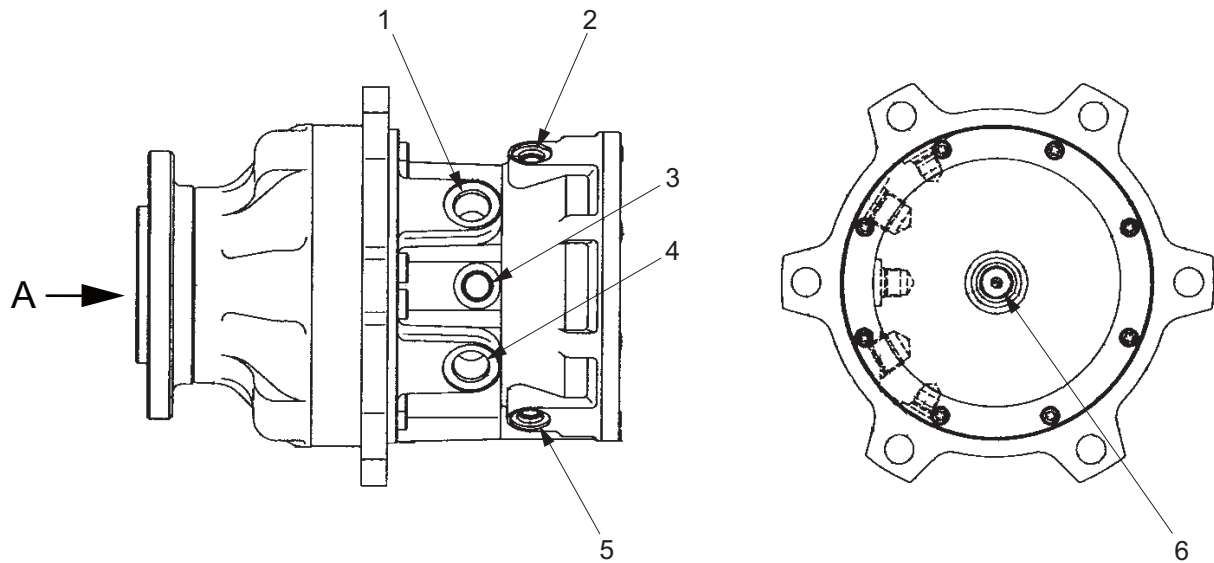
SW354-04003

(1) Port B	[RMB] : G1/2	(4) Port A	[RMA] : G1/2
(2) Parking brake pilot port	: G1/4	(5) Parking brake pilot port	[RM3] : G1/4
(3) Drain port	[RMD] : G3/8	(6) Manual brake release port	: M10

Specifications

- Displacement : 465 cm³/rev (28 cu.in./rev)
- Maximum working pressure : 34.3 MPa (4,974 psi)
- Allowable motor case pressure : 0.3 MPa (43.5 psi)
- Brake release pressure : 1.5 MPa (218 psi)
- Weight : 42 kg (93 lbs.)

2-2-5. Propulsion hydraulic motor (R) (TW354,504)



Motor circuit diagram

Flow of oil (Rotation direction is when viewed in direction of arrow A.)

- 4 → 1 Clockwise rotation
- 1 → 4 Counterclockwise rotation

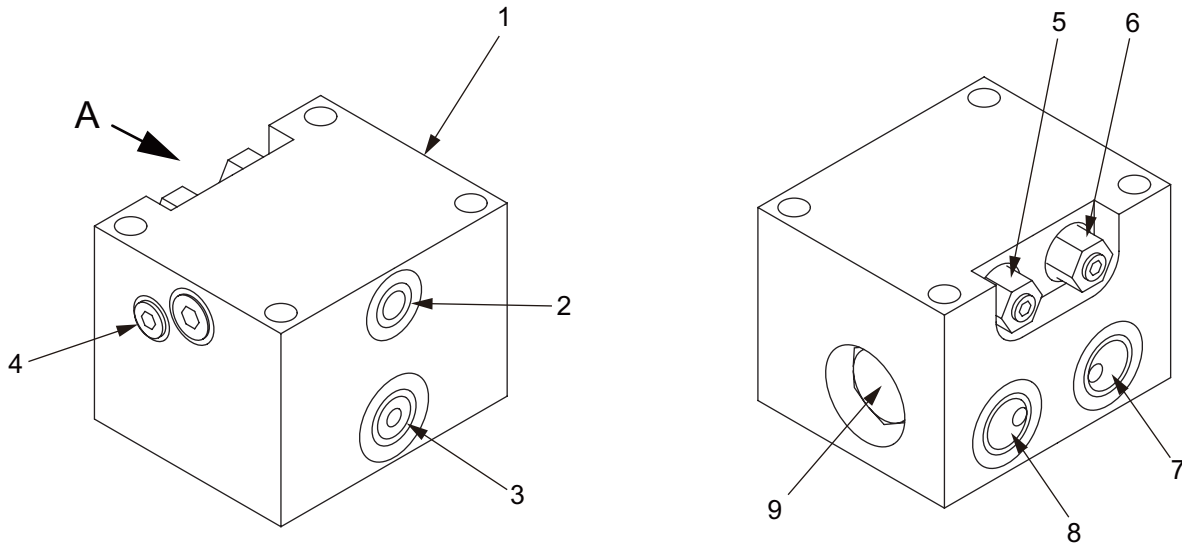
TW504-04002

(1) Port B	[RLB] [RRB] : G1/2	(4) Port A	[RLA] [RRA] : G1/2
(2) Parking brake pilot port	[RLP] : G1/4	(5) Parking brake pilot port	[RRP] : G1/4
(3) Drain port	[RLD] [RRD] : G3/8	(6) Manual brake release port	: M10

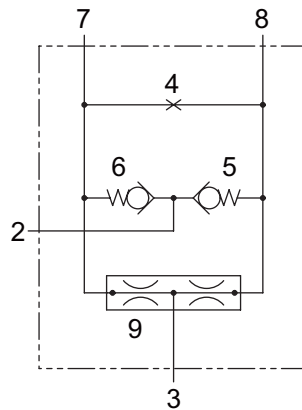
Specifications

- Displacement (TW354) : 224 cm³/rev (13.7 cu.in./rev)
- (TW504) : 280 cm³/rev (17.0 cu.in./rev)
- Maximum working pressure : 41.2 MPa (5,974 psi)
- Allowable motor case pressure : 0.3 MPa (43.5 psi)
- Brake release pressure : 1.5 MPa (218 psi)
- Weight : 77 kg (170 lbs.)

2-2-6. Differential lock valve (TW354,504)



VIEW A



Hydraulic diagram

SW300-1-04004

- | | |
|-------------------------------------|-------------------------------------|
| (1) Body | (6) Check valve |
| (2) Port C [DC] : 9/16-18UNF | (7) Port B1 [B1] : 3/4-16UNF |
| (3) Port A [DA] : 3/ 4-16UNF | (8) Port B2 [B2] : 3/4-16UNF |
| (4) Orifice | (9) Flow control valve |
| (5) Check valve | |

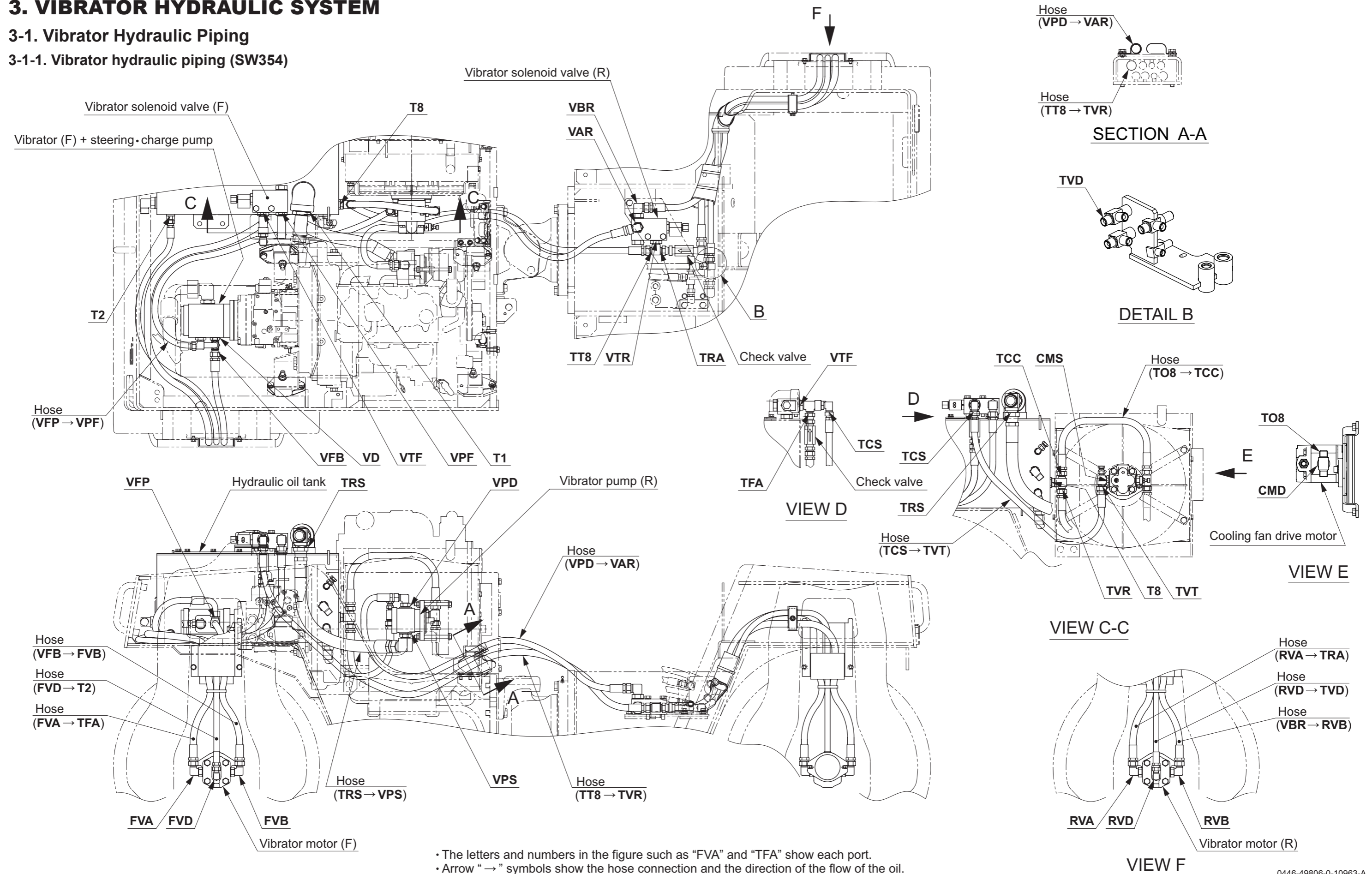
Specifications

- Maximum control flow (interflow) : 45 L/min (12 gal./min)
- Rated pressure : 20.6 MPa (2,987 psi)
- Check valve cracking pressure : 0.034 MPa (5 psi)
- Flow division ratio **[B1 : B2]** : 1 : 1
- Weight : 4.6 kg (10 lbs.)

3. VIBRATOR HYDRAULIC SYSTEM

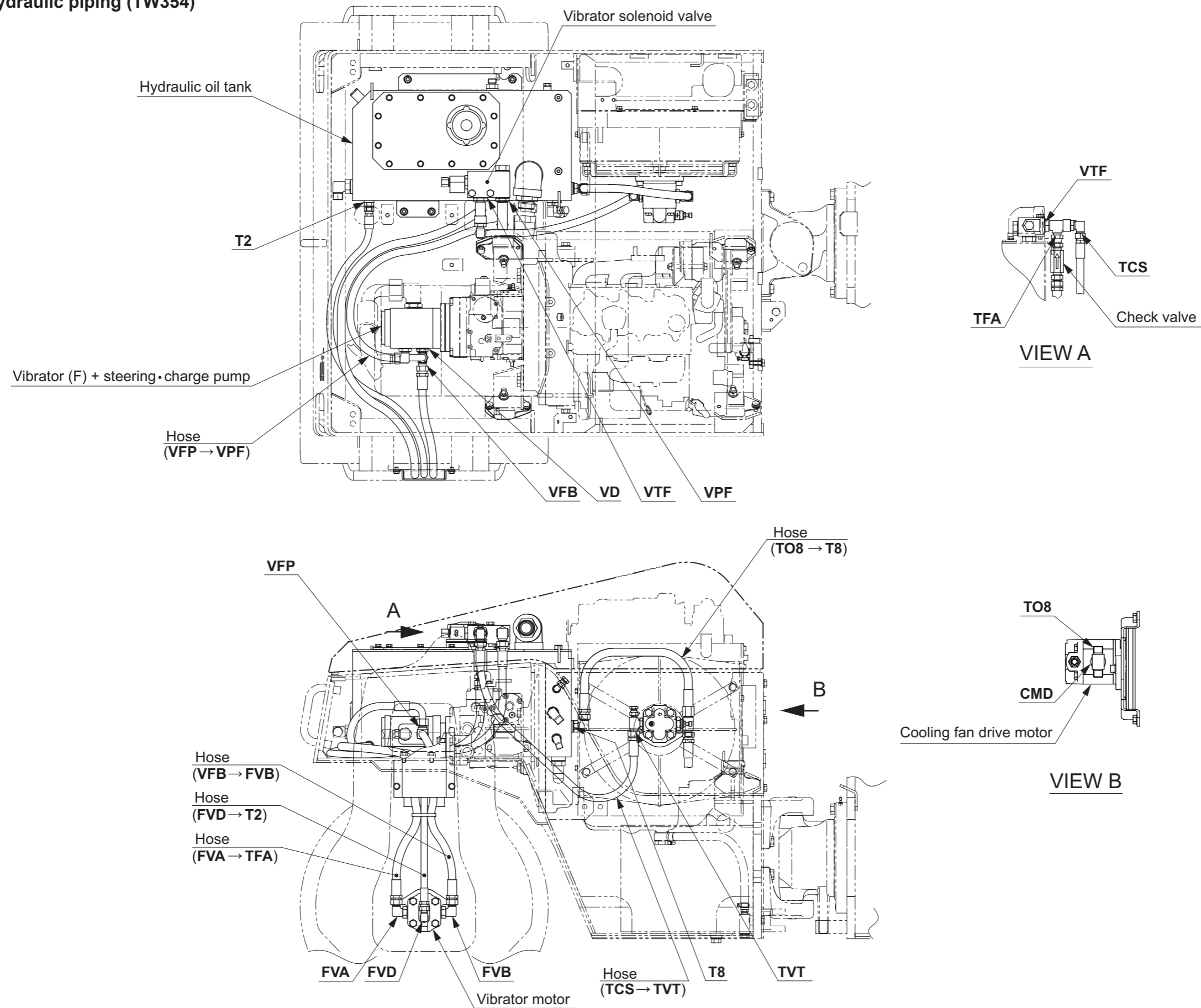
3-1. Vibrator Hydraulic Piping

3-1-1. Vibrator hydraulic piping (SW354)



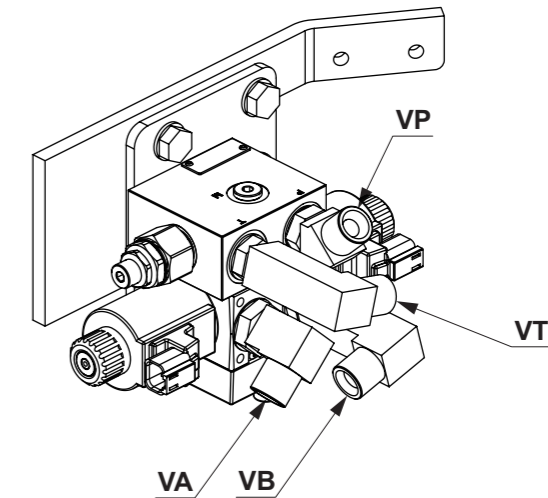
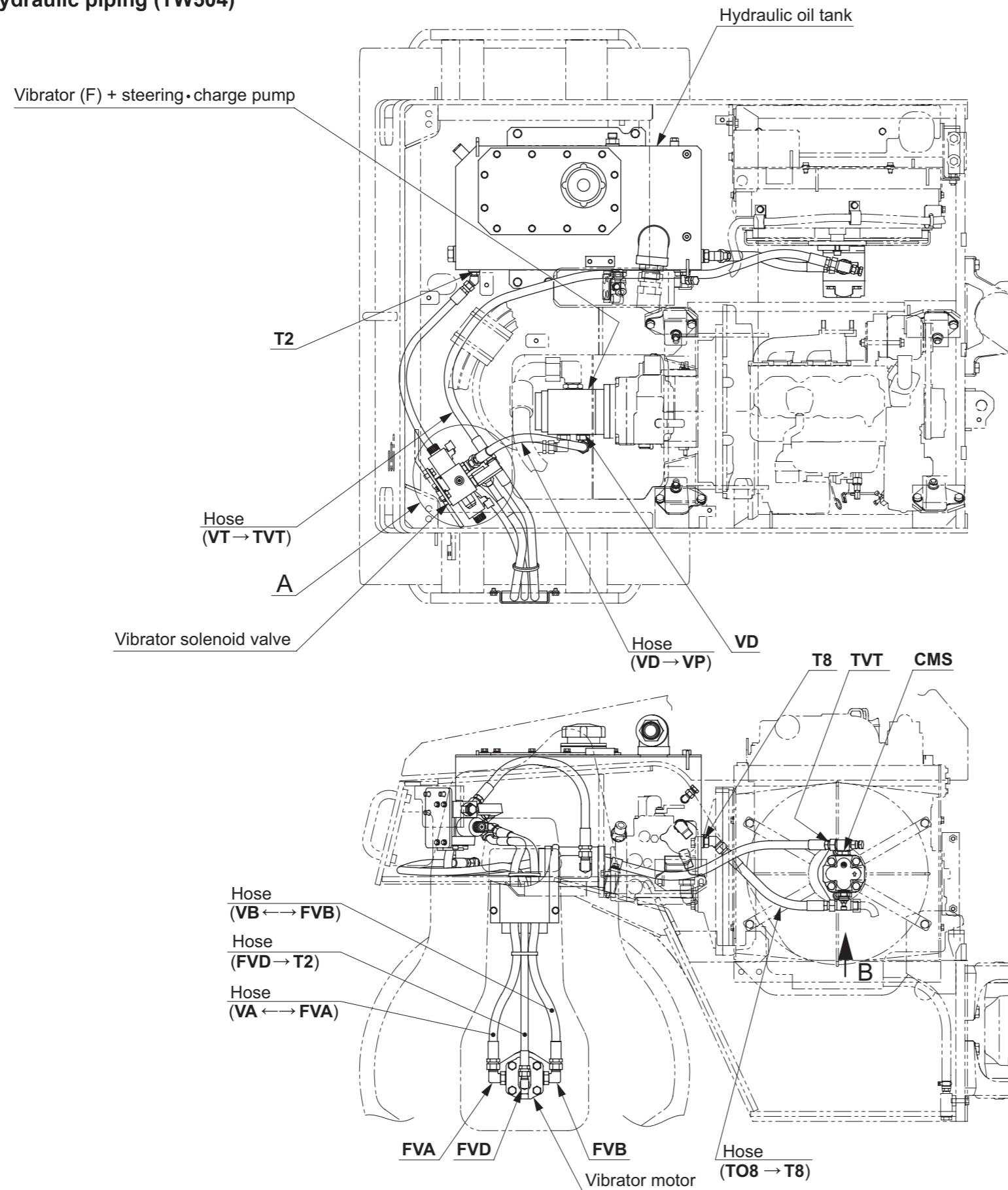
• The letters and numbers in the figure such as "FVA" and "TFA" show each port.
 • Arrow "→" symbols show the hose connection and the direction of the flow of the oil.

3-1-2. Vibrator hydraulic piping (TW354)

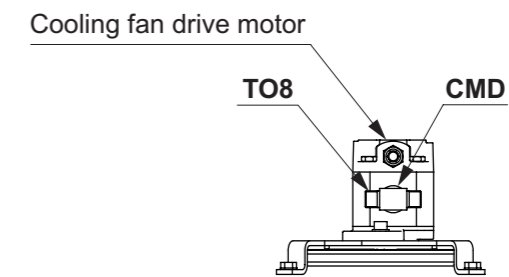


• The letters and numbers in the figure such as “FVA” and “TFA” show each port.
 • Arrow “→” symbols show the hose connection and the direction of the flow of the oil.

3-1-3. Vibrator hydraulic piping (TW504)



DETAIL A

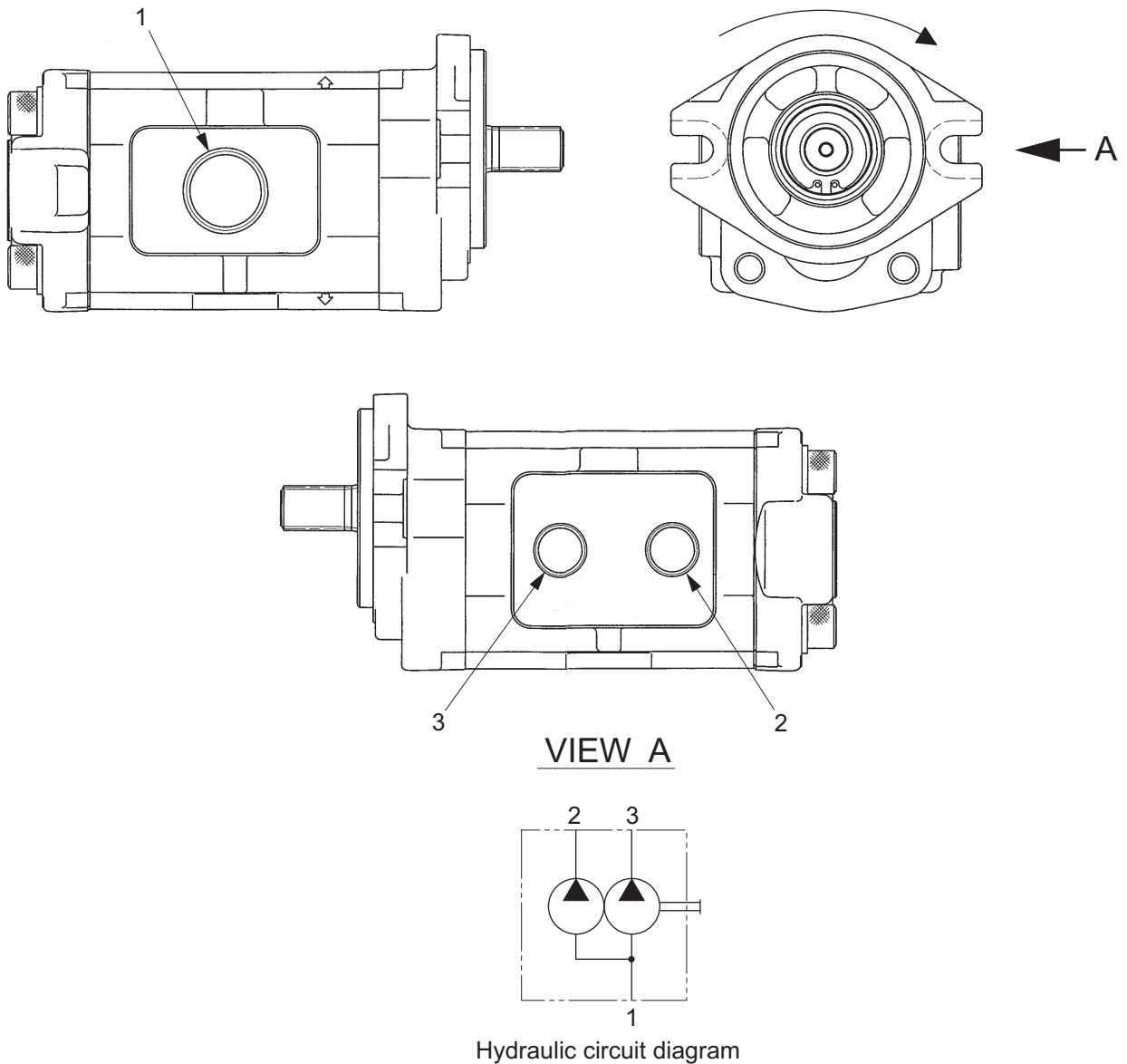


VIEW B

- The letters and numbers in the figure such as "VA" and "FVA" show each port.
- Arrow " ↔ ; → " symbols show the hose connection and the direction of the flow of the oil.

3-2. Hydraulic Component Specifications

3-2-1. Hydraulic pump assembly (vibrator (F) + steering • charge)



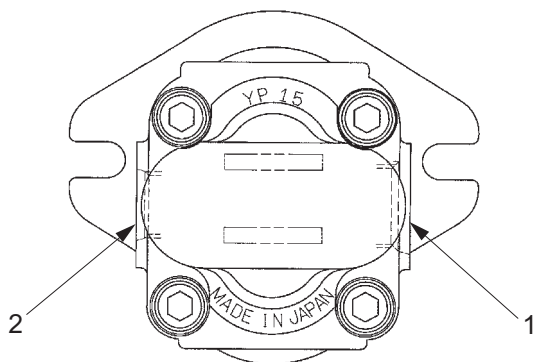
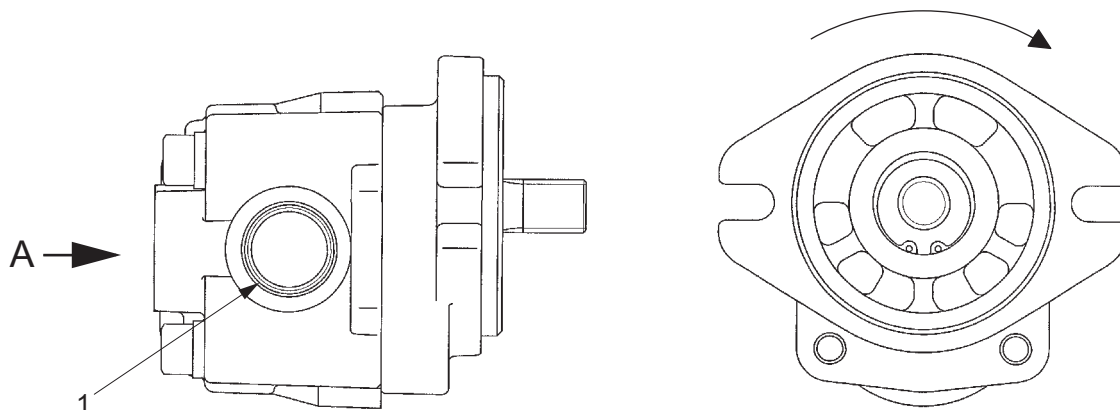
- (1) Suction port **[VVS]** : G1
- (2) Discharge port (steering) **[SD]** : G1/2
- (3) Discharge port (vibration) **[VD]** : G1/2

Specifications

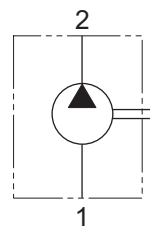
- Displacement (vibration) : 16.2 cm³/rev (0.99 cu.in./rev)
- (steering) : 12.5 cm³/rev (0.76 cu.in./rev)
- Rated pressure (vibration) : 20.6 MPa (2,987 psi)
- (steering) : 20.6 MPa (2,987 psi)
- Weight : 7.2 kg (15.9 lbs)

SW354-04004

3-2-2. Vibrator hydraulic pump (R) (SW354)



VIEW A



Hydraulic circuit diagram

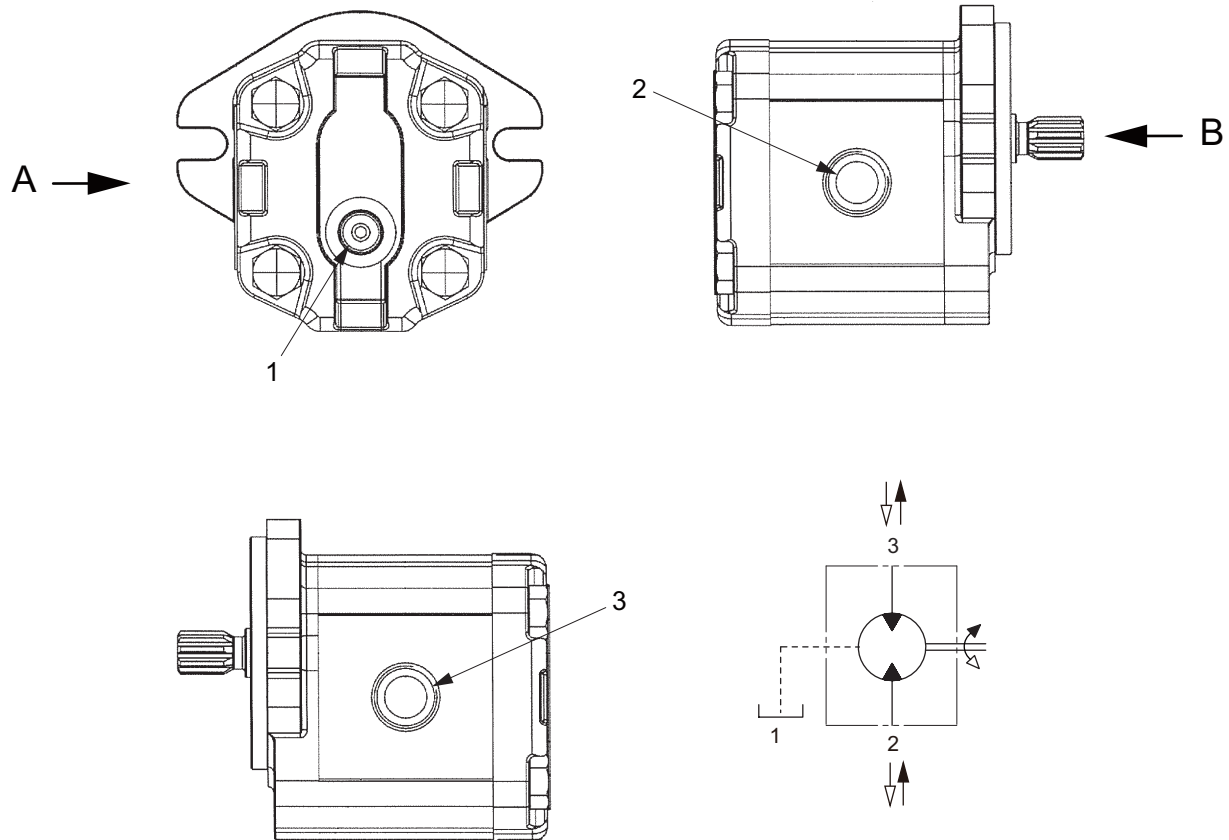
- (1) Suction port **[RVS]** : G3/4
- (2) Discharge port **[RVD]** : G1/2

Specifications

- Displacement : 13.9 cm³/rev (0.85 cu.in./rev)
- Rated pressure : 17.2 MPa (2,494 psi)
- Weight : 2.3 kg (5.1 lbs)

SW354-04005

3-2-3. Vibrator hydraulic motor



VIEW A

Motor circuit diagram

Flow of oil (Rotation direction is when viewed in direction of arrow B.)

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

SW354-04006

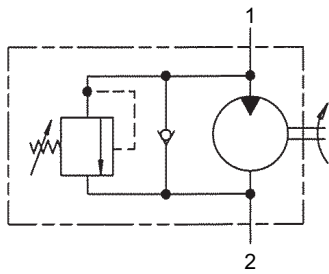
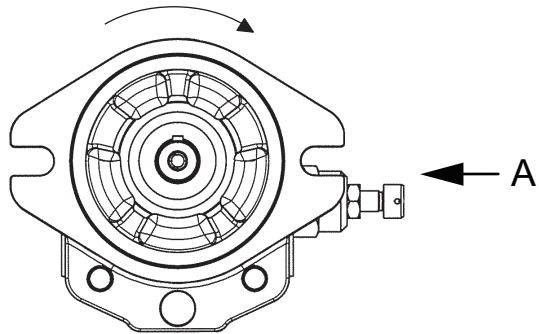
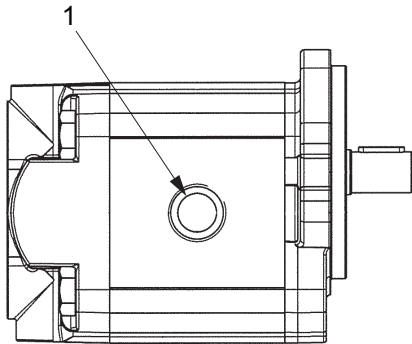
- (1) Drain port **[FVD] [RVD]*** : 9/16-18UNF
- (2) Port B **[FVB] [RVB]*** : 7/ 8-14UNF
- (3) Port A **[FVA] [RVA]*** : 7/ 8-14UNF

Specifications

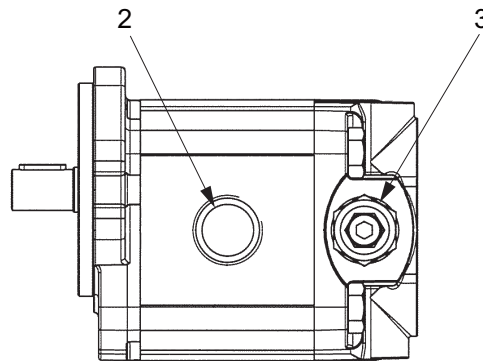
- Displacement (SW354) : 8.4 cm³/rev (0.51 cu.in./rev)
- (TW354,504) : 10.8 cm³/rev (0.66 cu.in./rev)
- Rated pressure : 25 MPa (3,625 psi)
- Allowable motor case pressure : 0.5 MPa (72.5 psi)
- Weight (SW354) : 2.5 kg (5.5 lbs.)
- (TW354,504) : 2.7 kg (6.0 lbs.)

* **[RVD], [RVA], [RVB]** : SW354 only

3-2-4. Cooling fan drive hydraulic motor



Motor circuit diagram



VIEW A

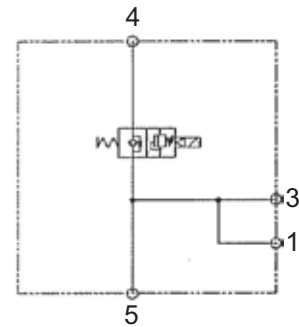
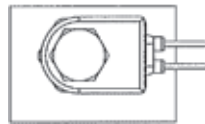
SW354-04007

- (1) Suction port [CMS] : 7/ 8-14UNF
- (2) Discharge port [CMD] : 1 1/16-12UN
- (3) Relief valve

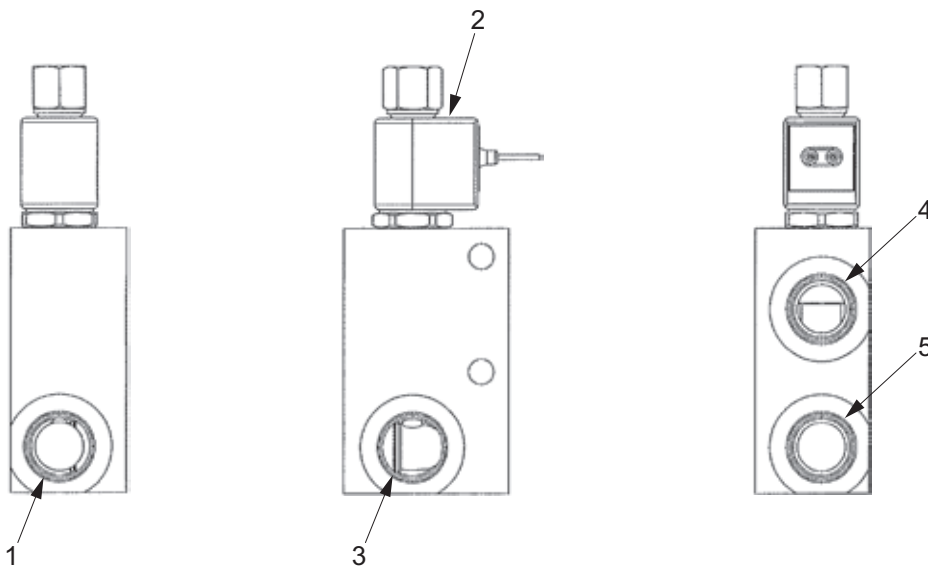
Specifications

- Displacement : 14.4 cm³/rev (0.88 cu.in./rev)
- Rated pressure : 5.0 MPa (725 psi)
- Relief valve pressure setting : 5.0 MPa (725 psi)
- Allowable motor case pressure : 0.5 MPa (72.5 psi)
- Weight : 3.14 kg (6.9 lbs.)

3-2-5. Vibrator solenoid valve (F), (R) (SW/TW354)



Hydraulic circuit diagram



SW654-04003

- (F)
- (1) Port B : G3/4
 - (2) Solenoid valve
 - (3) Port A : G3/4
 - (4) Port T **[VTF]** : G3/4
 - (5) Port P **[VPF]** : G3/4

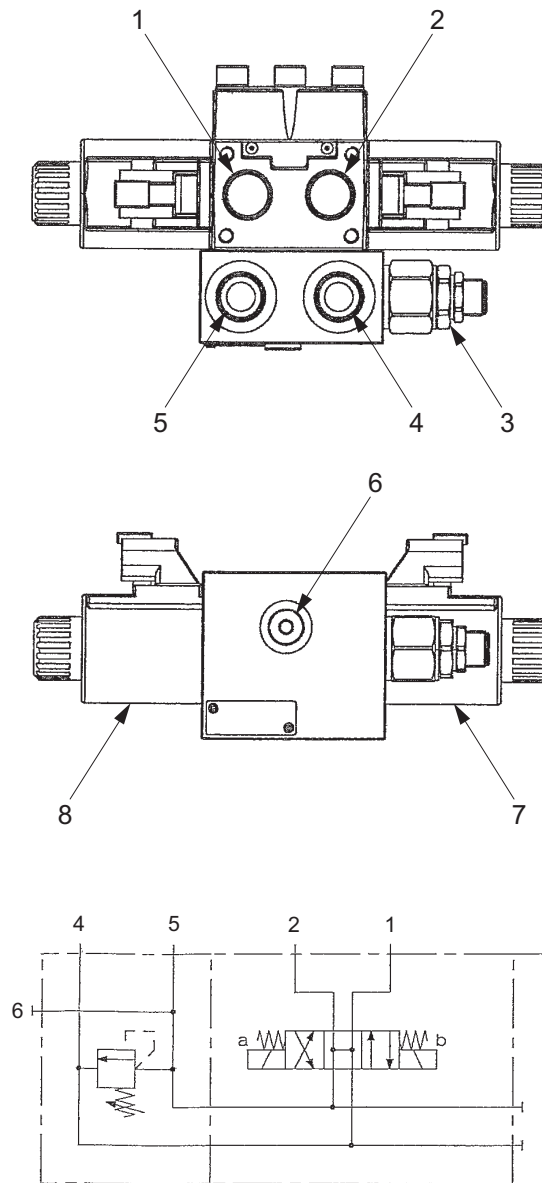
- (R)*
- (1) Port B **[VBR]** : G3/4
 - (2) Solenoid valve
 - (3) Port A **[VAR]** : G3/4
 - (4) Port T **[VTR]** : G3/4
 - (5) Port P : G3/4

Specifications

- Maximum flow : 75 L/min (19.8 gal./min)
- Maximum pressure : 21.0 MPa (3,045 psi)
- Relief valve pressure setting : 12.7 MPa (1,842 psi)
- Weight : 1.30 kg (2.9 lbs.)

* (R) : SW354 only

3-2-6. Vibrator solenoid valve (TW504)



Hydraulic circuit diagram

TW504-04003

- | | | | | | |
|------------------|-------------|-------------|----------------------|-------------|--------------|
| (1) Port B | [VB] | : 3/4-16UNF | (5) Port P | [VP] | : 3/ 4-16UNF |
| (2) Port A | [VA] | : 3/4-16UNF | (6) Port M | | : 7/16-20UNF |
| (3) Relief valve | | | (7) Solenoid valve a | | |
| (4) Port T | [VT] | : 3/4-16UNF | (8) Solenoid valve b | | |

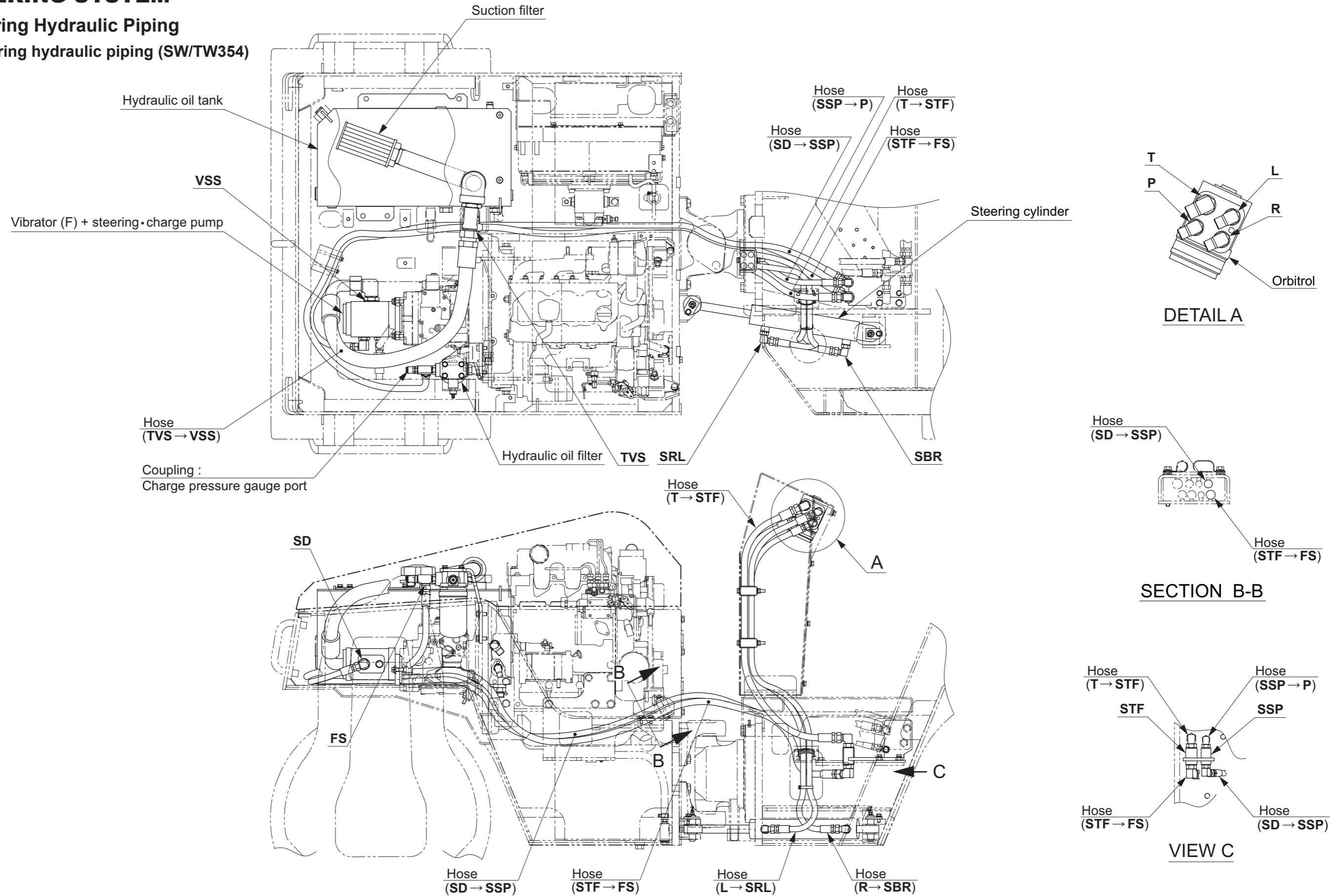
Specifications

- Rated flow : 50 L/min (13.2 gal./min)
- Rated pressure : 25 MPa (3,625 psi)
- Relief valve pressure setting : 14 MPa (2,030 psi)
- Weight : 2.9 kg (6.4 lbs.)

4. STEERING SYSTEM

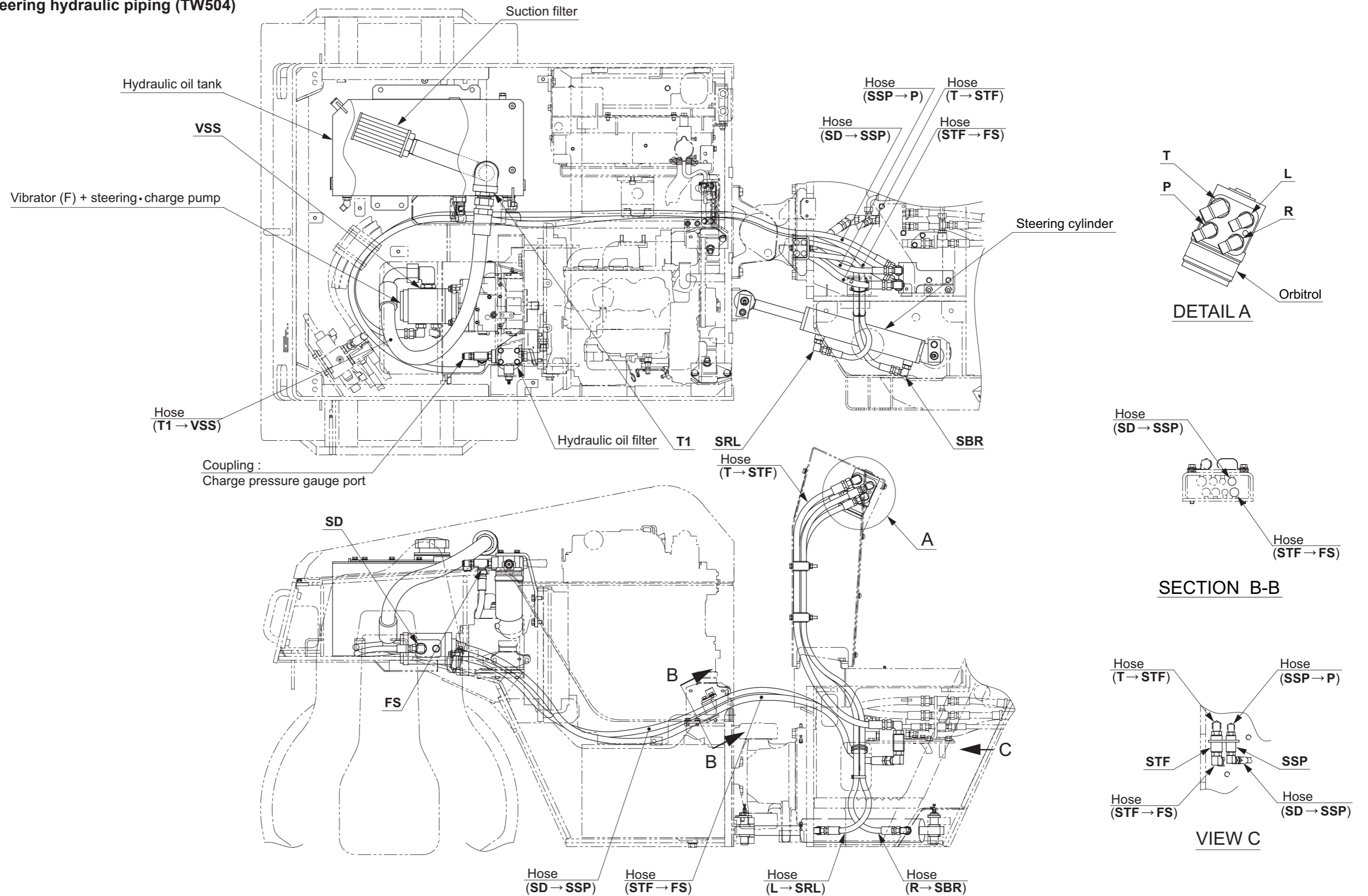
4-1. Steering Hydraulic Piping

4-1-1. Steering hydraulic piping (SW/TW354)



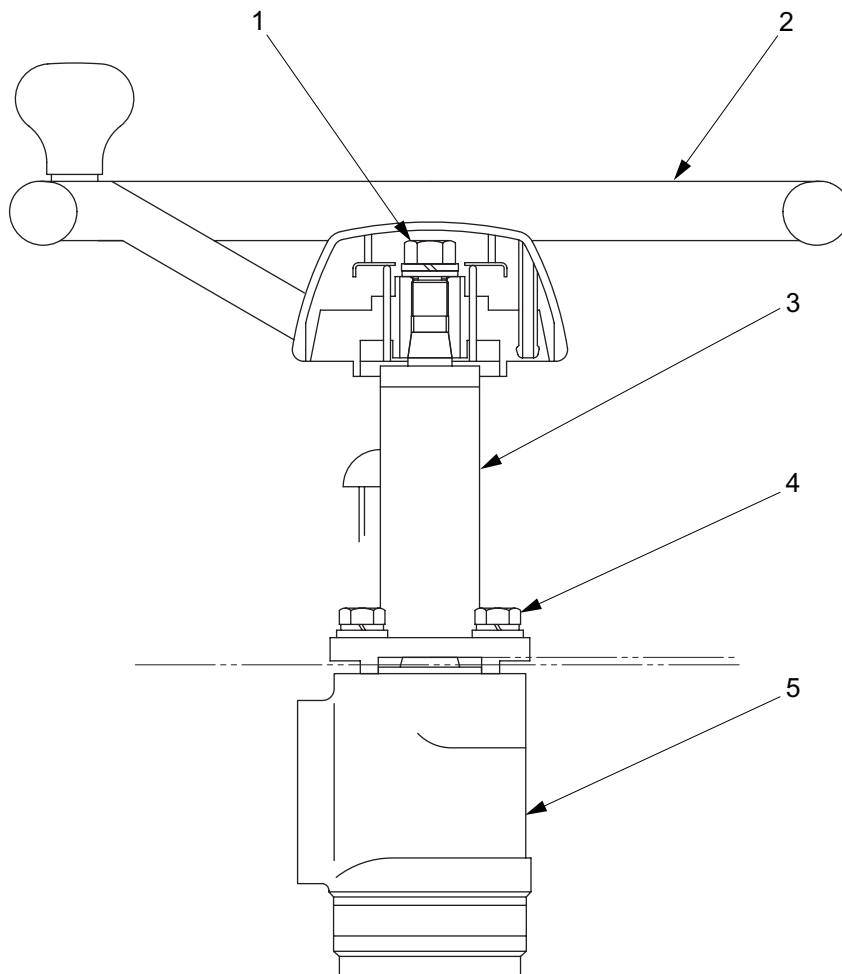
• The letters and numbers in the figure such as “R” and “SBR” show each port.
 • Arrow “→” symbols show the hose connection and the direction of the flow of the oil.

4-1-2. Steering hydraulic piping (TW504)



• The letters and numbers in the figure such as "R" and "SBR" show each port.
 • Arrow "→" symbols show the hose connection and the direction of the flow of the oil.

4-2. Steering Wheel



0446-32803-0-20620-A

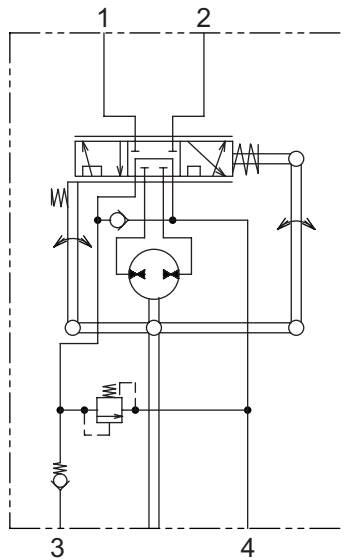
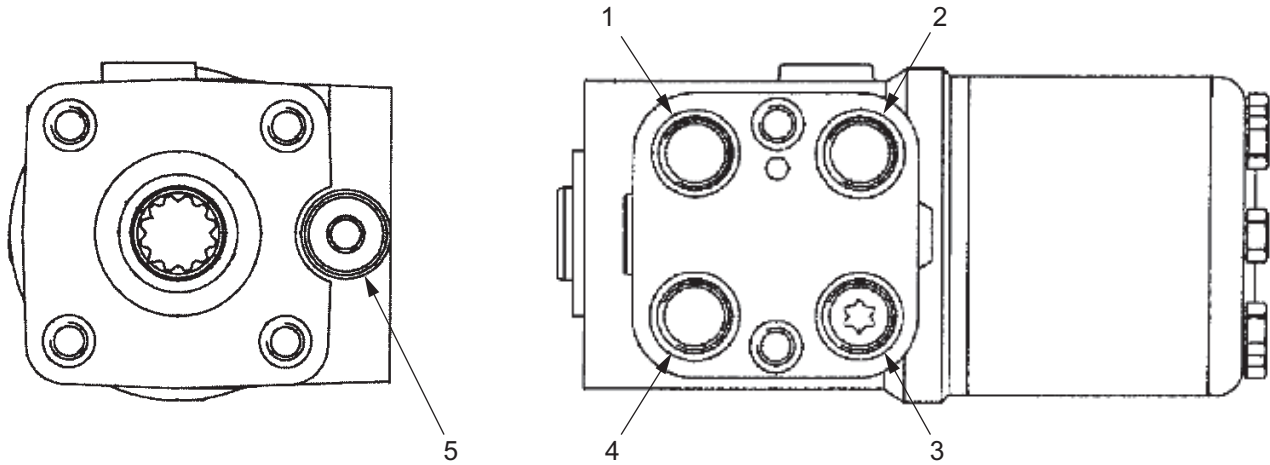
- (1) Nut : M12 P=1.25
- (2) Steering wheel
- (3) Column shaft
- (4) Bolt : M10×35
- (5) Orbitrol



- (1) Nut M12 P=1.25 : 64 N·m (47 lbf·ft)
- (4) Bolt M10×35 : 39.2 N·m (29 lbf·ft)

4-3. Hydraulic Component Specifications

4-3-1. Orbitrol



Hydraulic circuit diagram

ORB-SD-04140

- (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
- (5) Relief valve

Specifications

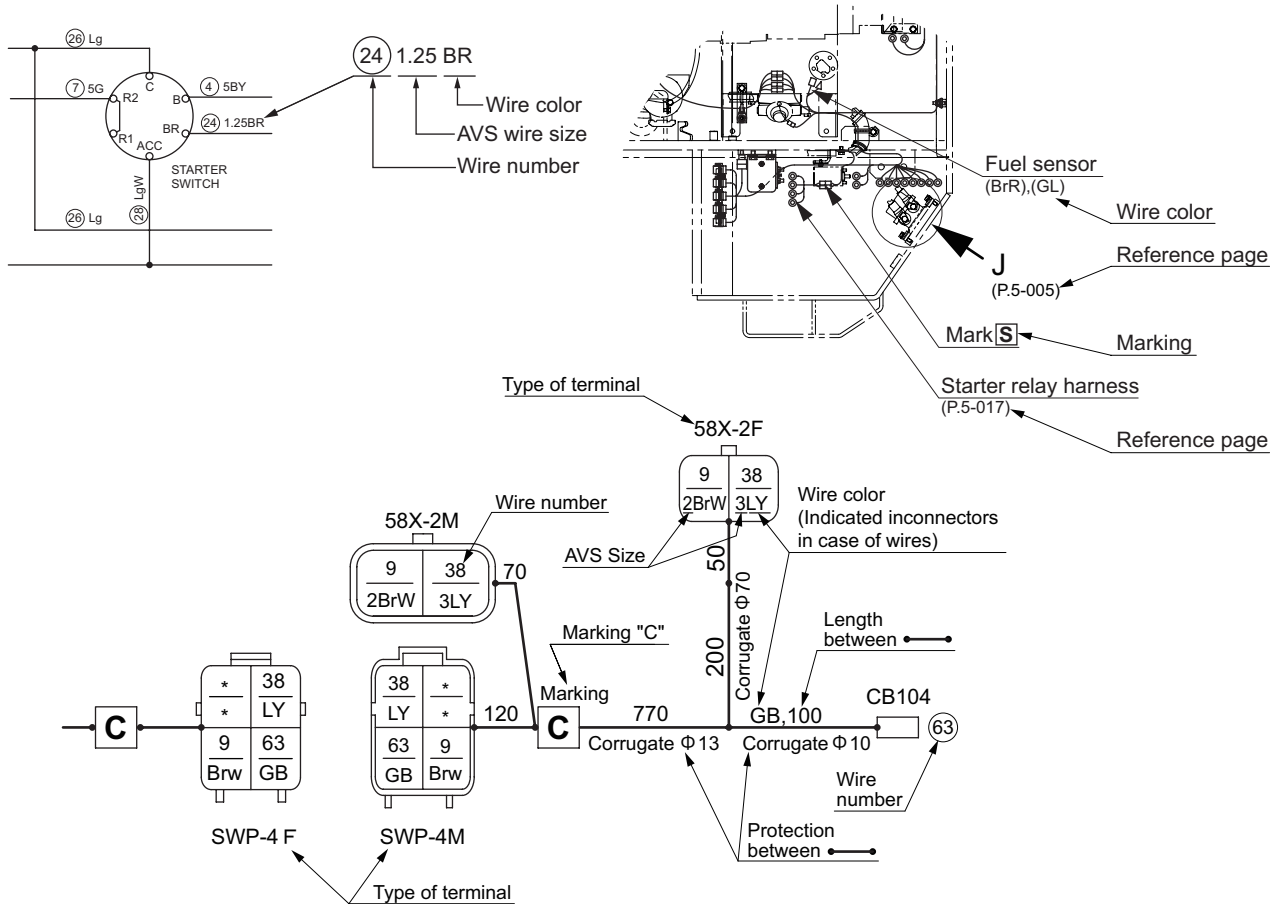
- Displacement (SW/TW354) : 100 cm³/rev (6.1 cu.in./rev)
 (TW504) : 160 cm³/rev (9.8 cu.in./rev)
- Maximum pressure : 17.5 MPa (2,538 psi)
- Relief valve pressure setting : 13.5 MPa (1,958 psi)
- Weight : 5.2 kg (11.5 lbs.)

ELECTRICAL SYSTEM

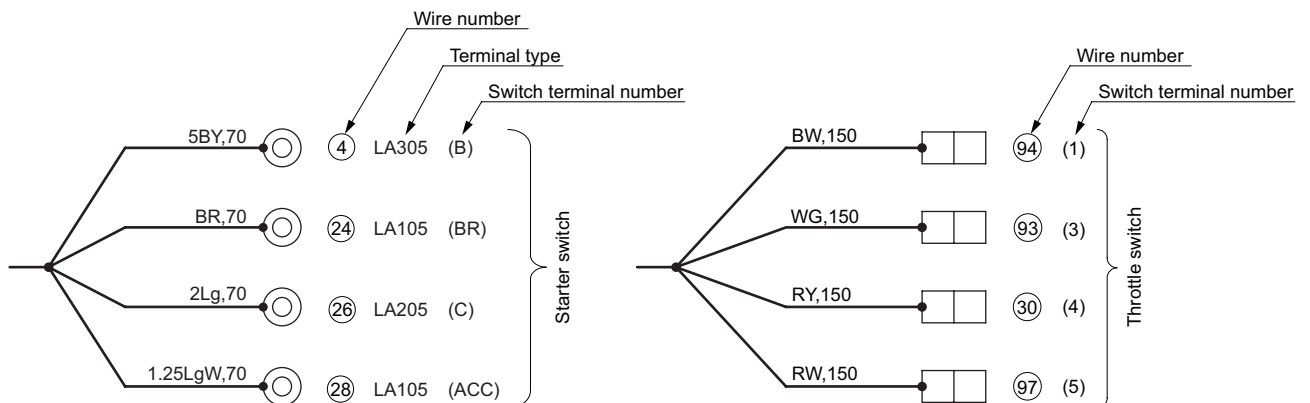
1. PRECAUTIONS FOR WORK

1-1. Wire Numbers, Wire Sizes, Wire Colors and Connectors Shown in Electrical Circuit Diagram, Wiring Harness Layout and Wiring Harnesses

- Codes used in electrical circuit diagrams give the following information.
- The wire size is AVS 0.85 unless otherwise specified.



- The pin or socket layout of mating connectors are symmetrical, either vertically or horizontally. When the connector valves are connected, the pin and socket that have the same number are connected.



ELECTRICAL SYSTEM

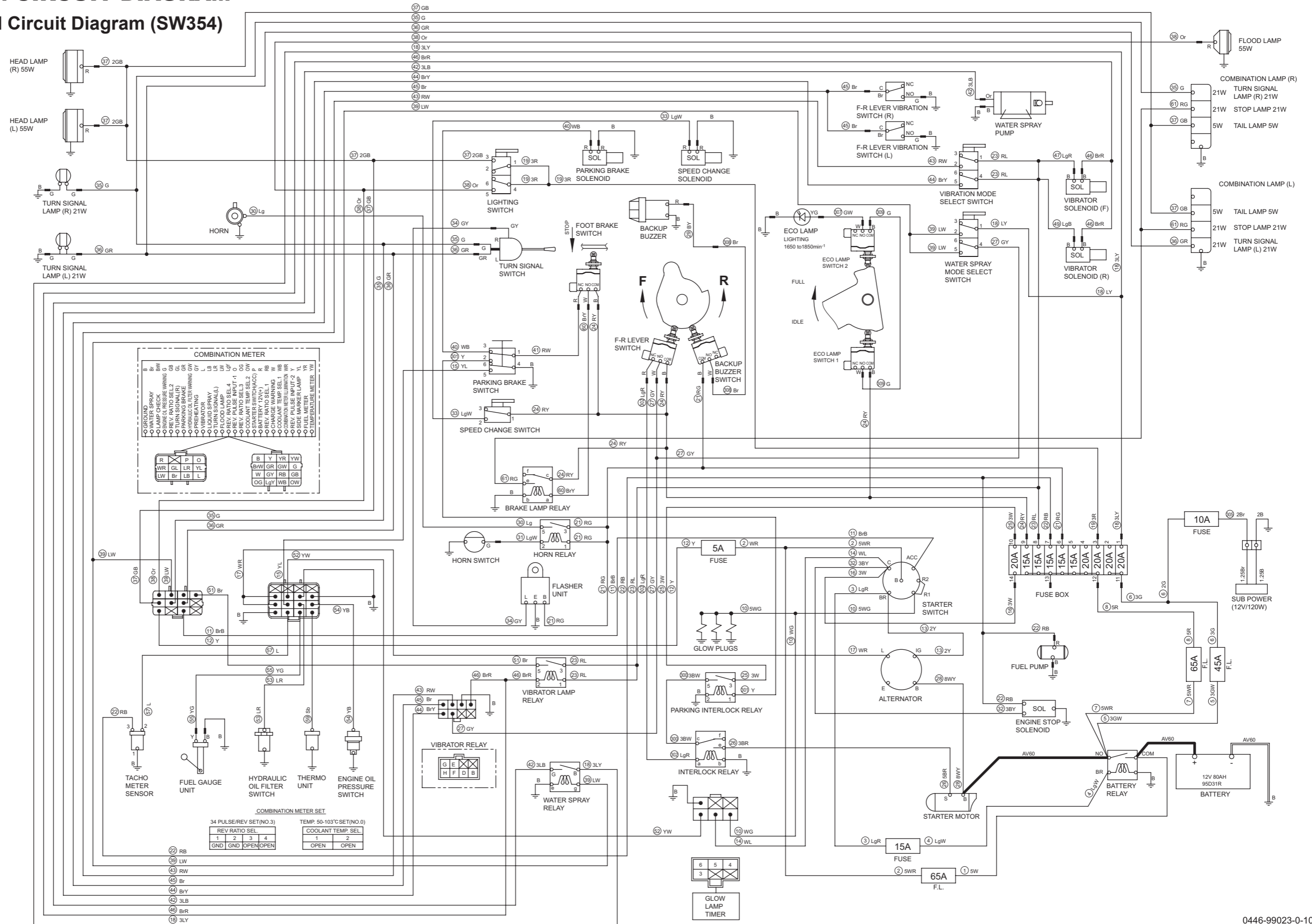
• Wire color code chart

B	Black	BW	Black/ White stripe	BY	Black/ Yellow stripe	BR	Black/ Red stripe	BG	Black/ Green stripe	BL	Black/ Blue stripe		
W	White	WR	White/ Red stripe	WB	White/ Black stripe	WL	White/ Blue stripe	WY	White/ Yellow stripe	WG	White/ Green stripe		
R	Red	RW	Red/ White stripe	RB	Red/ Black stripe	RY	Red/ Yellow stripe	RG	Red/ Green stripe	RL	Red/ Blue stripe		
G	Green	GW	Green/ White stripe	GR	Green/ Red stripe	GY	Green/ Yellow stripe	GB	Green/ Black stripe	GL	Green/ Blue stripe		
Y	Yellow	YR	Yellow/ Red stripe	YB	Yellow/ Black stripe	YG	Yellow/ Green stripe	YL	Yellow/ Blue stripe	YW	Yellow/ White 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
L	Blue	LW	Blue/ White stripe	LR	Blue/ Red stripe	LY	Blue/ Yellow stripe	LB	Blue/ Black stripe	LG	Blue/ Green 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		

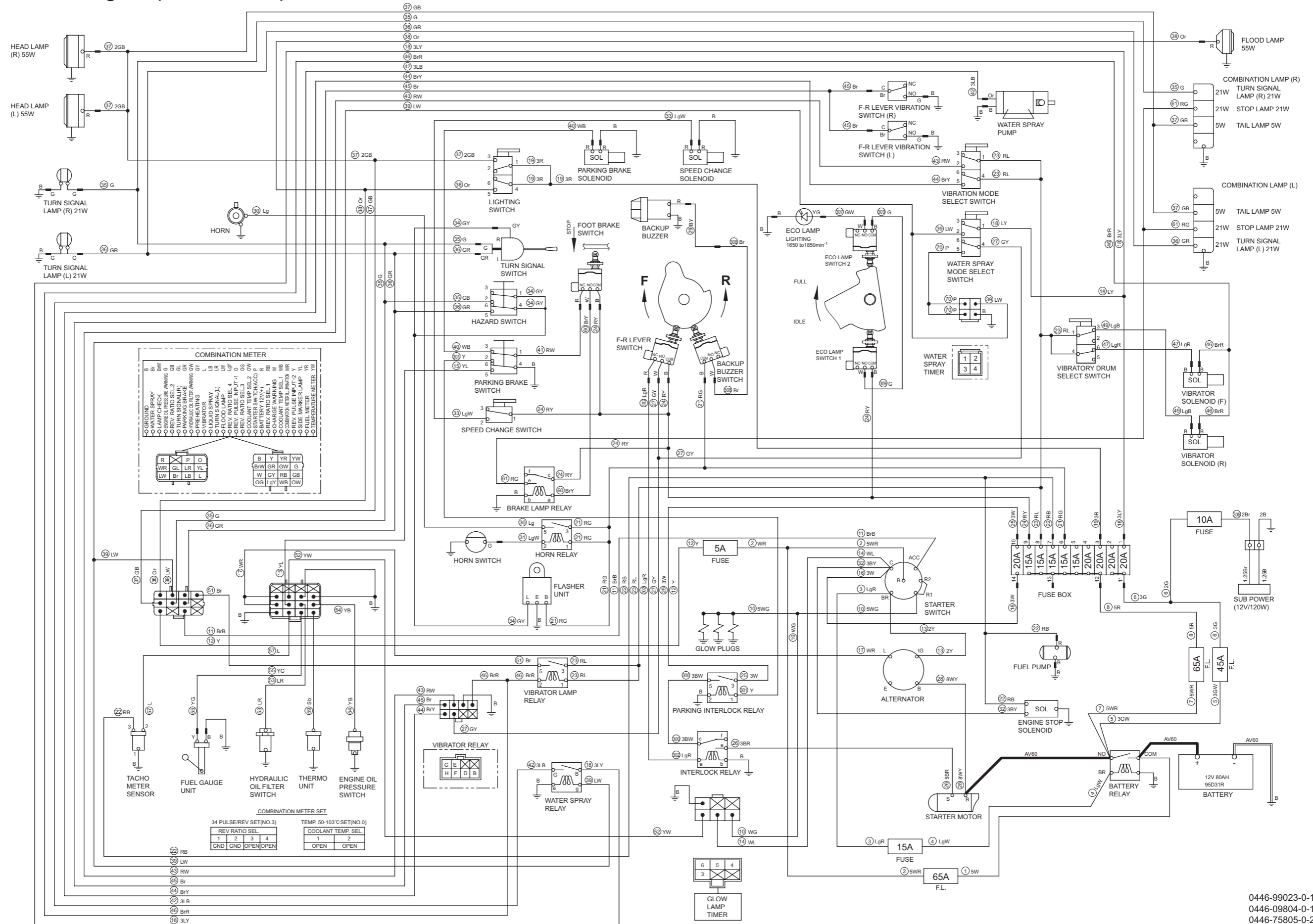
O (Or)	Orange	YO	Yellow/ Orange stripe	OW	Orange/ White stripe
		LO	Blue/ Orange stripe	OB	Orange/ Black stripe
		GO	Green/ Orange stripe	OG	Orange/ Green stripe
Gy (Gr)	Gray	GyR	Gray/ Red stripe	GrW	Gray/ White stripe
		GyL	Gray/ Blue stripe	GrY	Gray/ Yellow stripe
Sb	Sky blue			GrB	Gray/ Black stripe
P	Pink	PB	Pink/ Black stripe	PG	Pink/ Green stripe
Pu	Purple			PL	Pink/ Blue stripe

2. SYSTEM CIRCUIT DIAGRAM

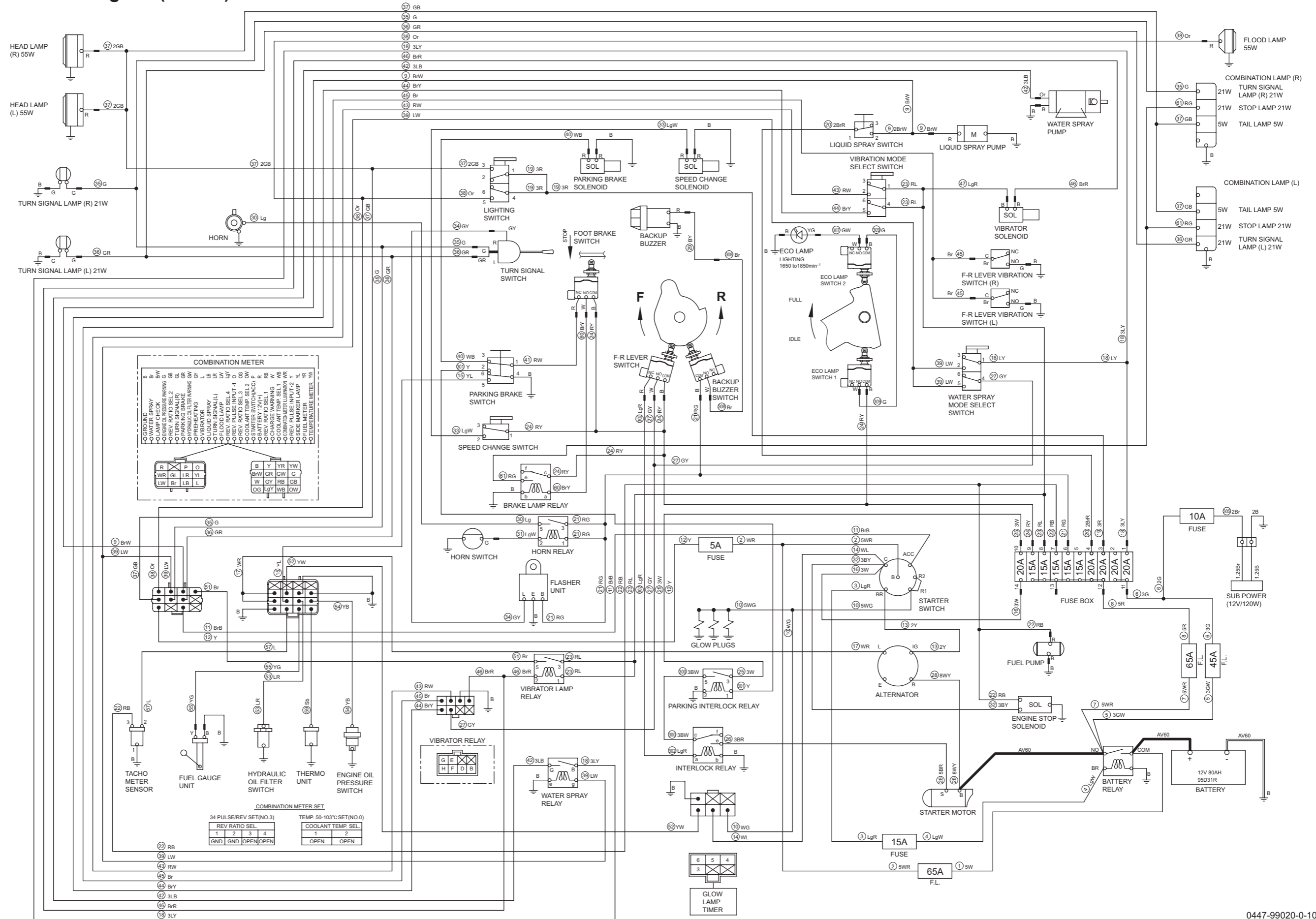
2-1. Electrical Circuit Diagram (SW354)



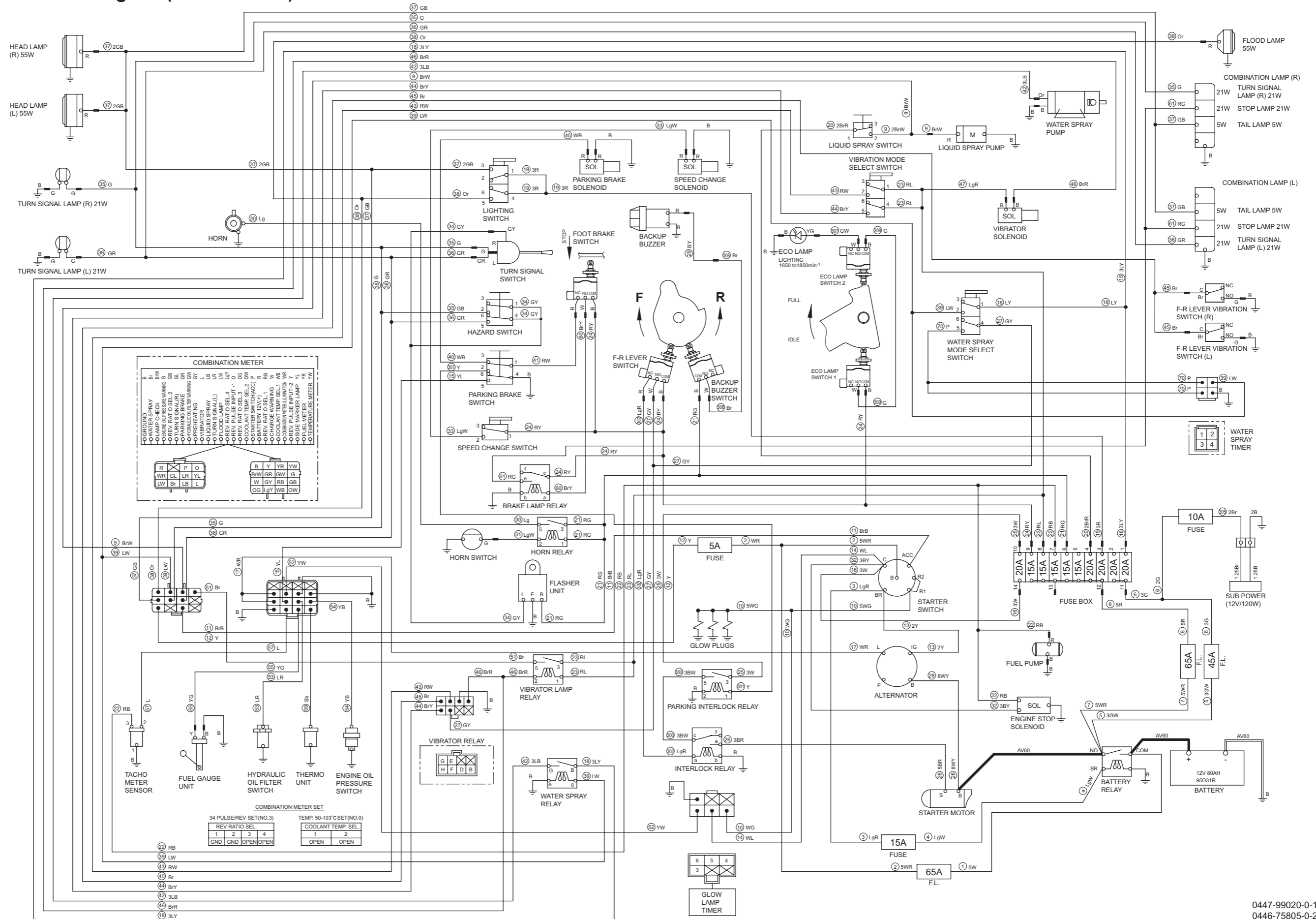
2-2. Electrical Circuit Diagram (SW354 ROPS)



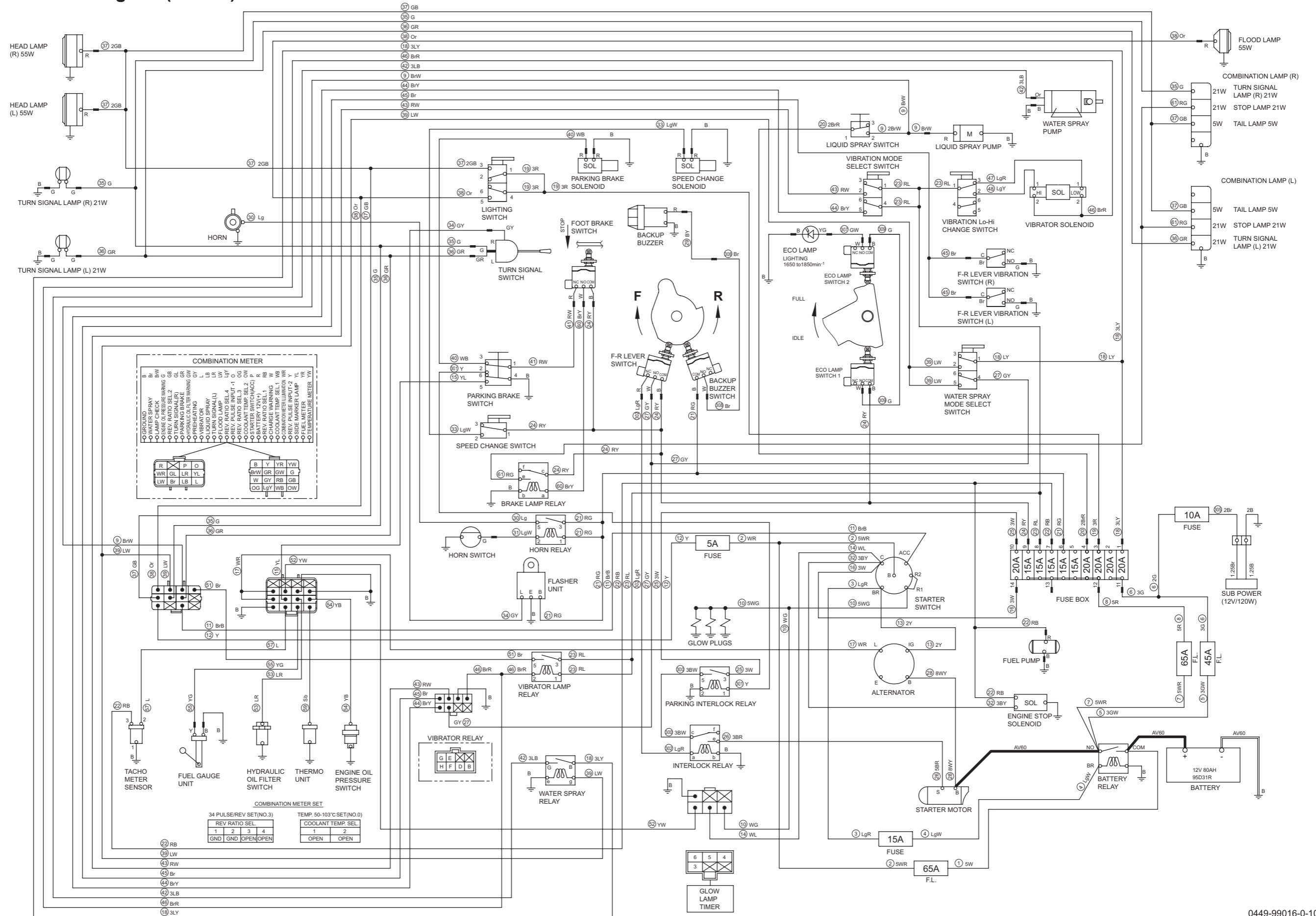
2-3. Electrical Circuit Diagram (TW354)



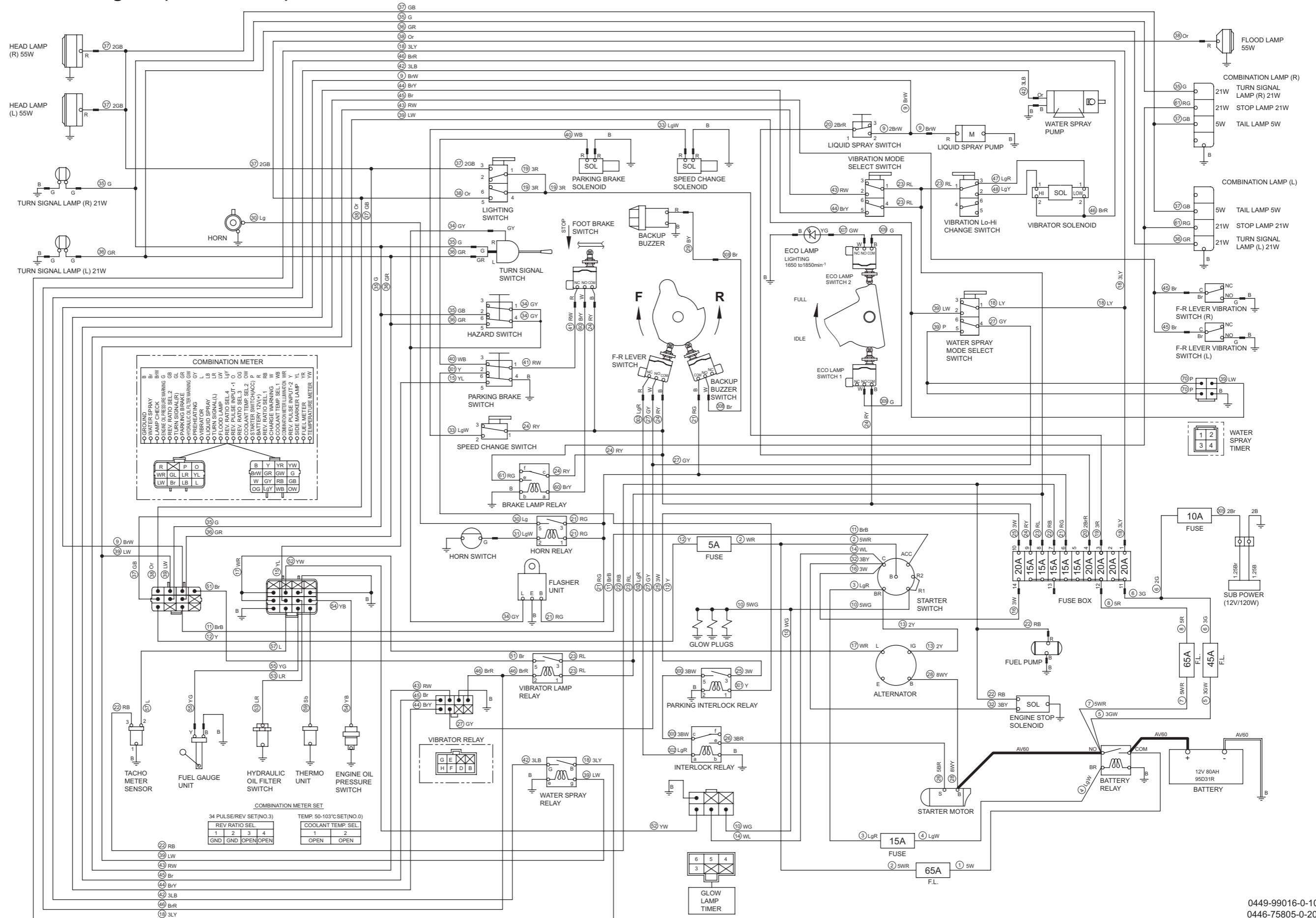
2-4. Electrical Circuit Diagram (TW354 ROPS)



2-5. Electrical Circuit Diagram (TW504)



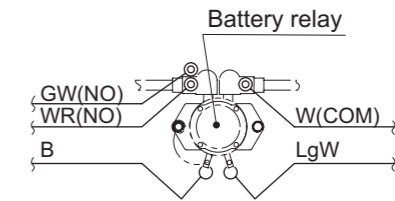
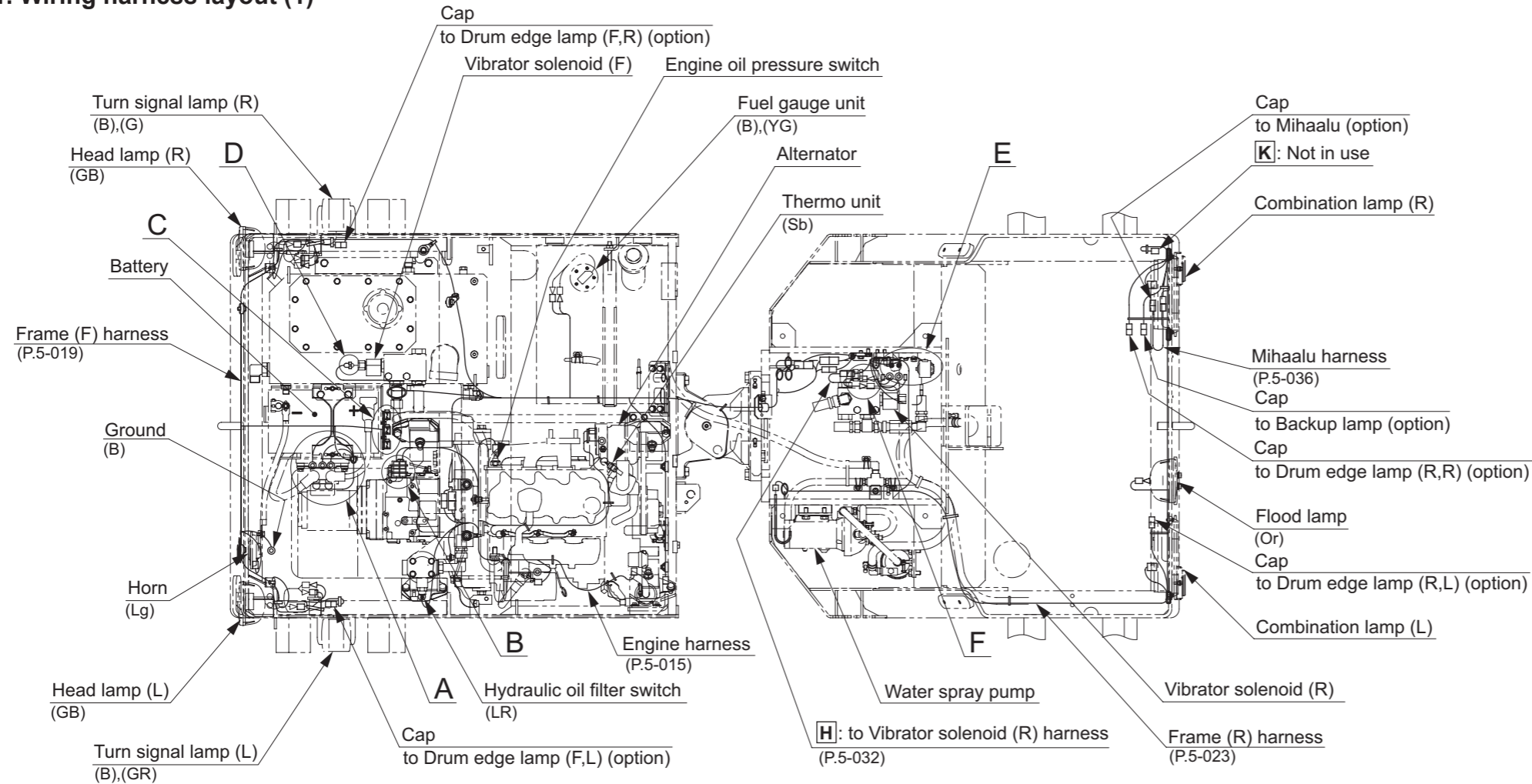
2-6. Electrical Circuit Diagram (TW504 ROPS)



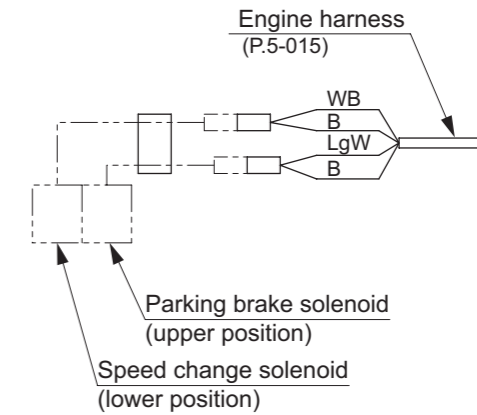
3. ELECTRICAL COMPONENTS

3-1. Wiring Harness Layout (SW354)

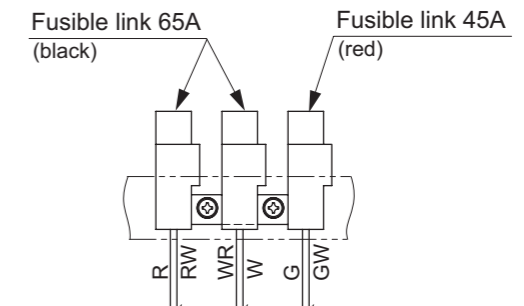
3-1-1. Wiring harness layout (1)



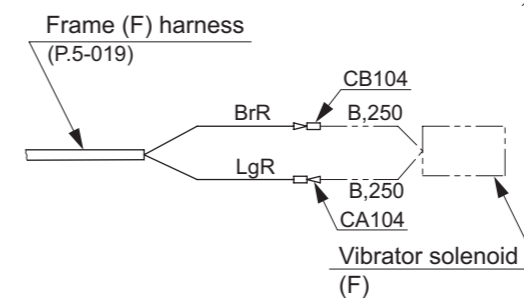
VIEW A



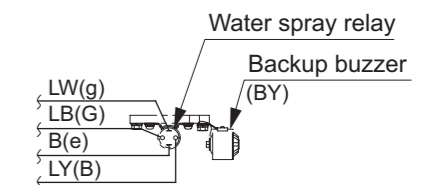
DETAIL B



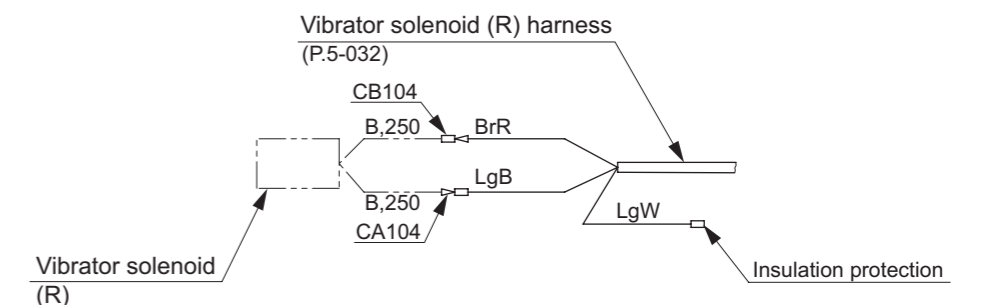
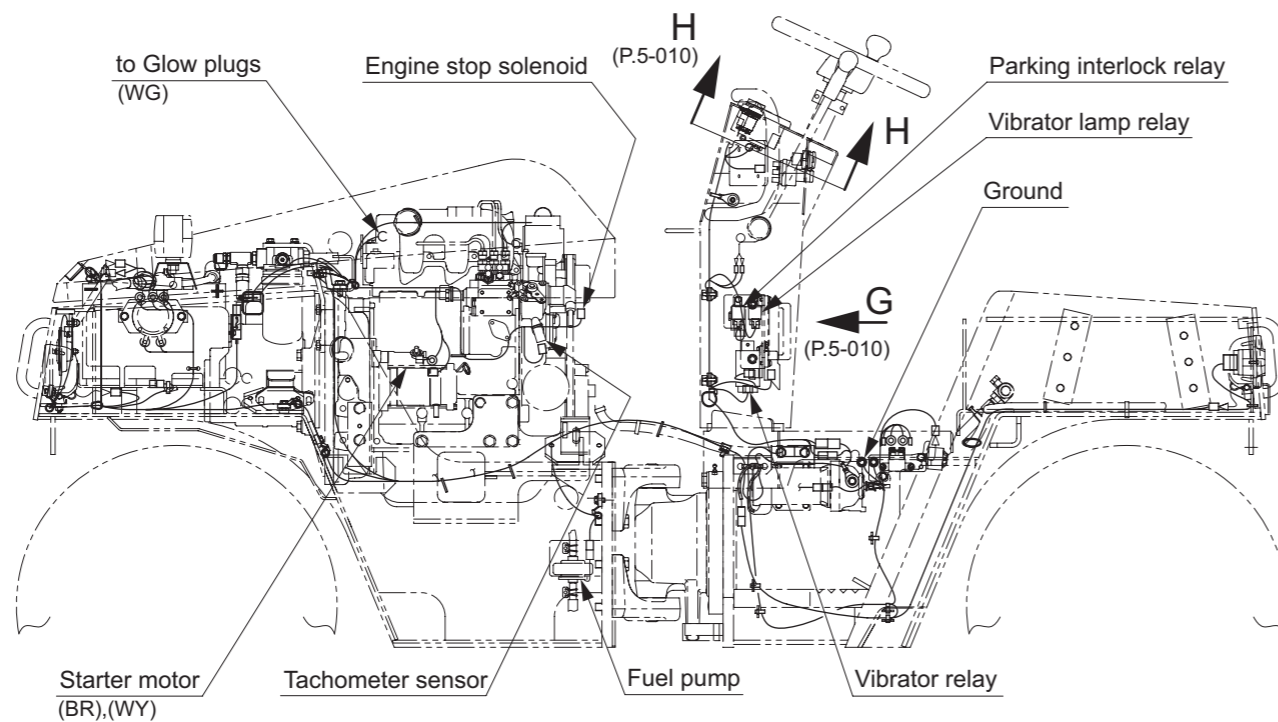
VIEW C



DETAIL D

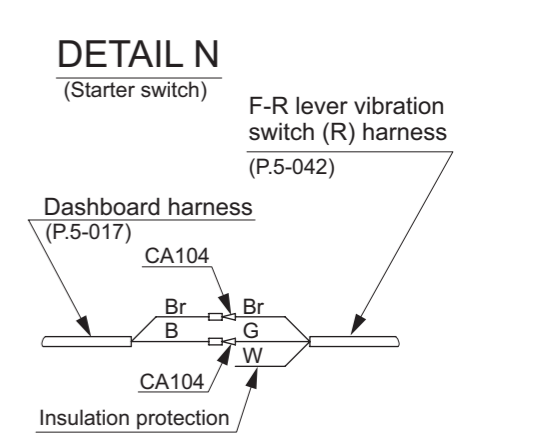
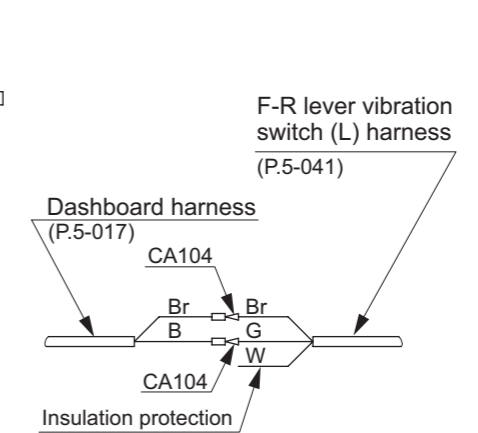
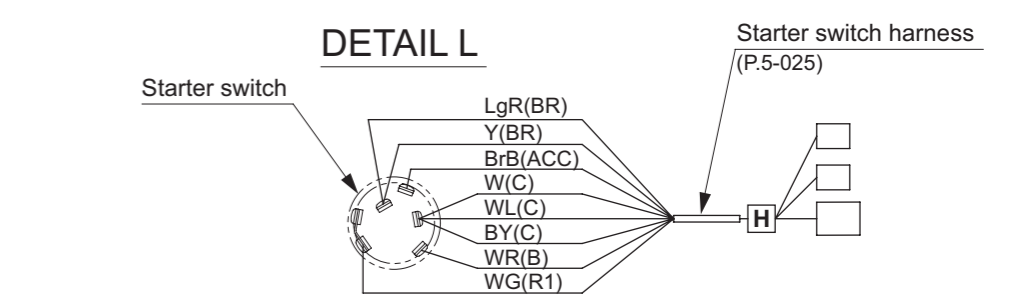
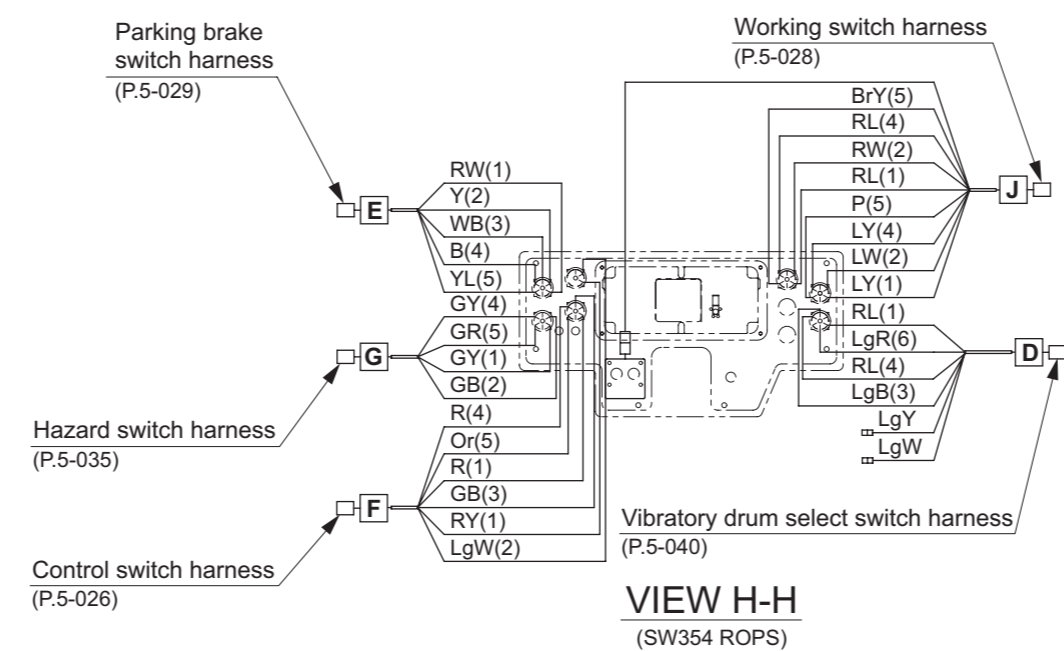
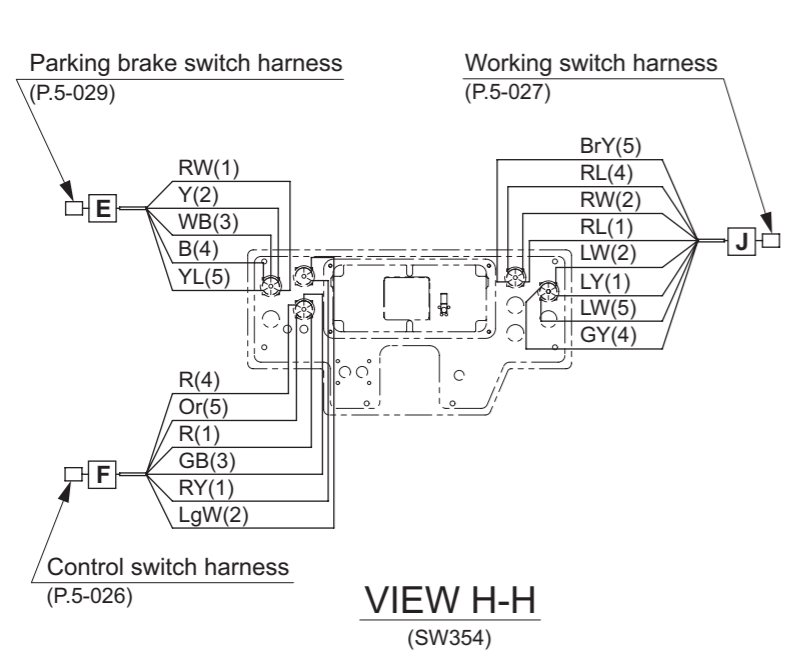
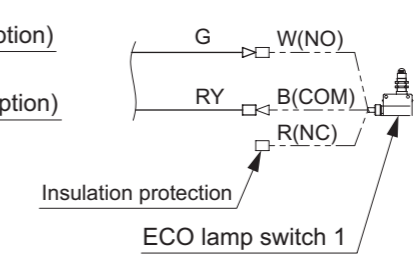
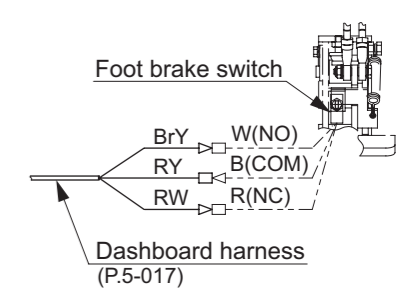
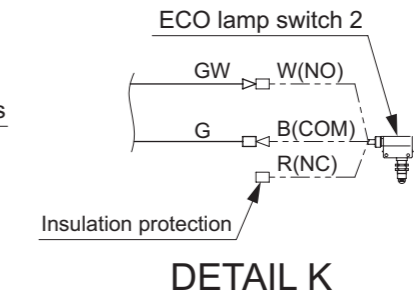
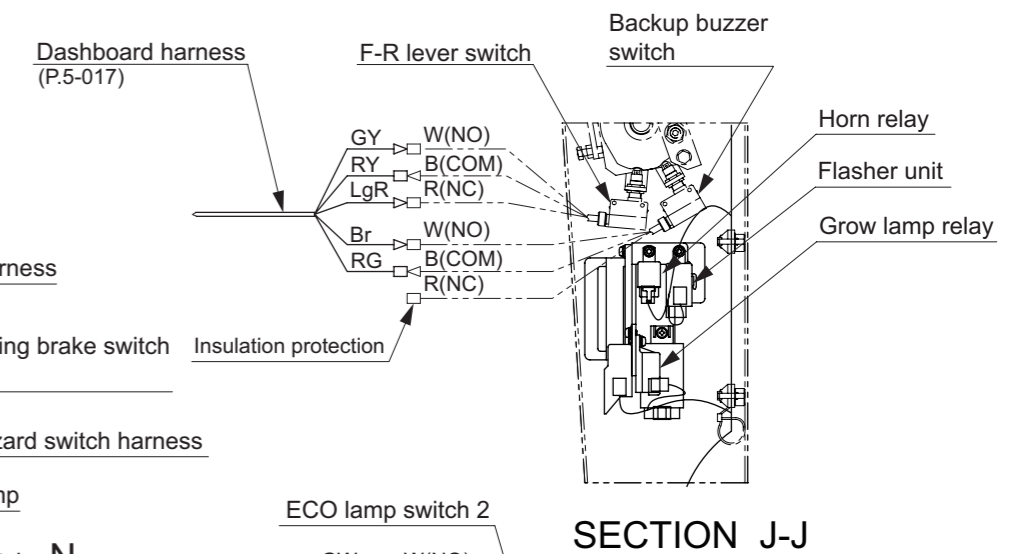
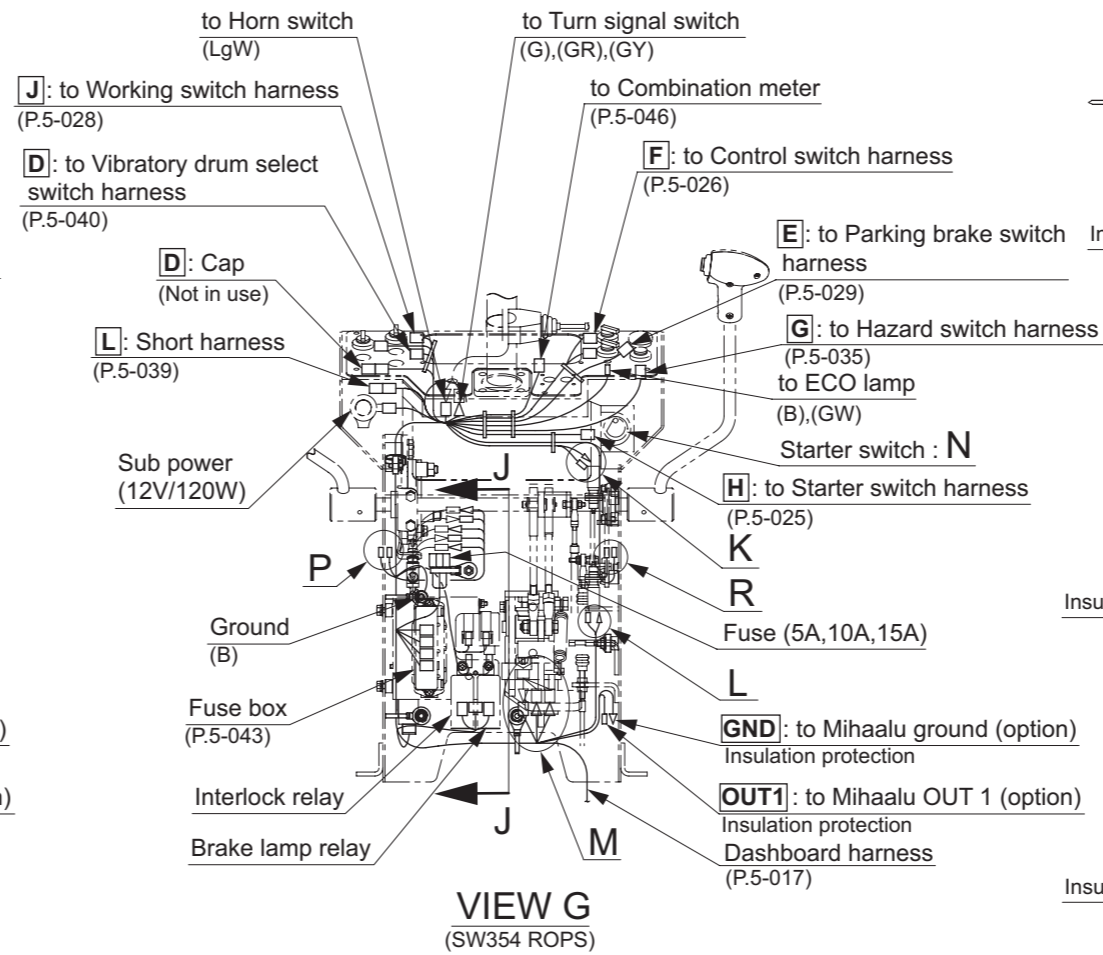
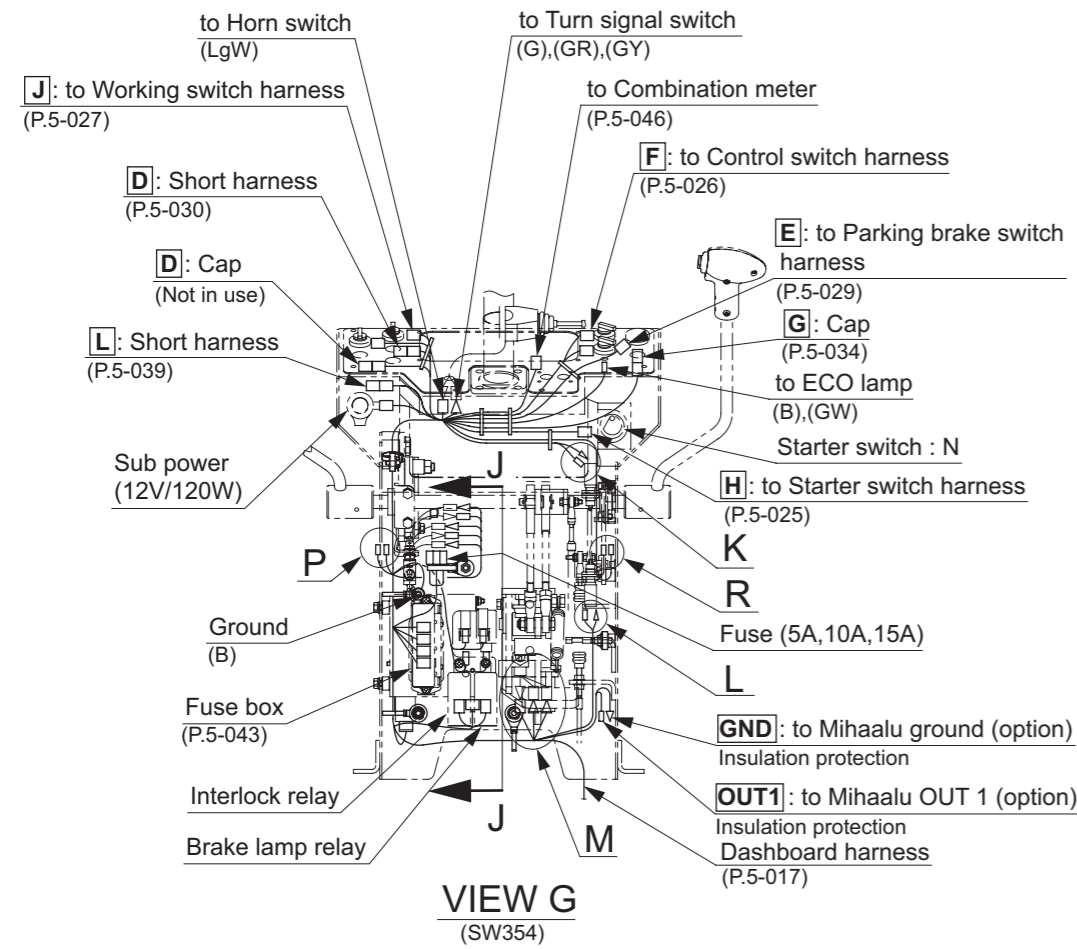


DETAIL E



DETAIL F

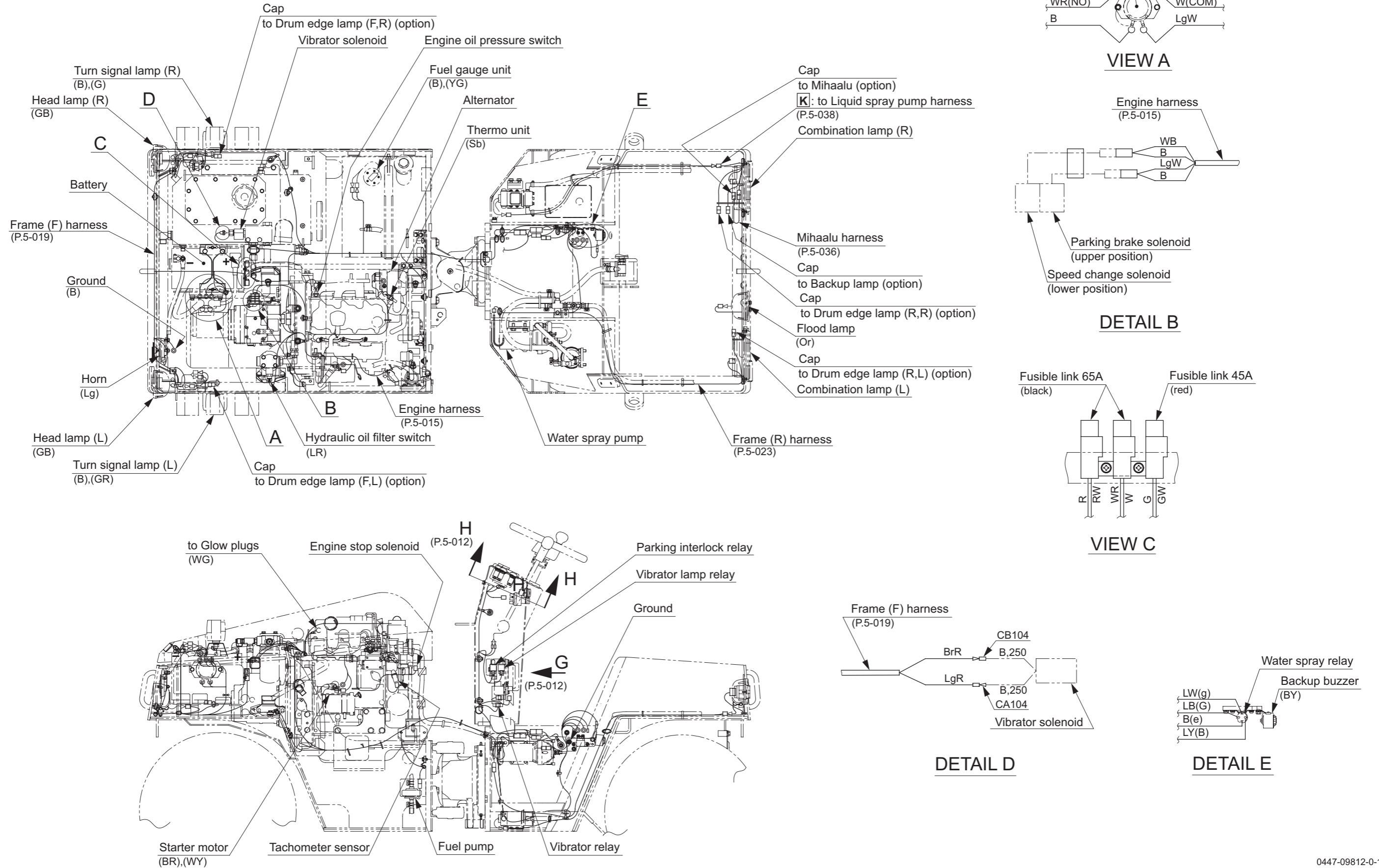
3-1-2. Wiring harness layout (2)



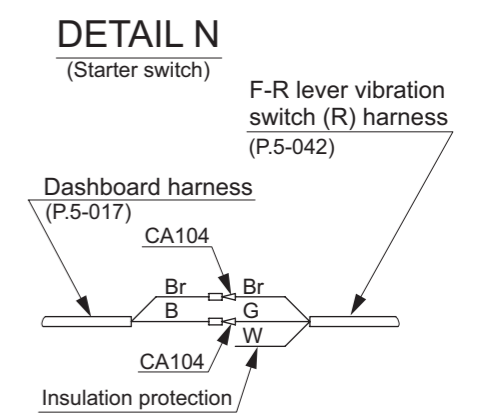
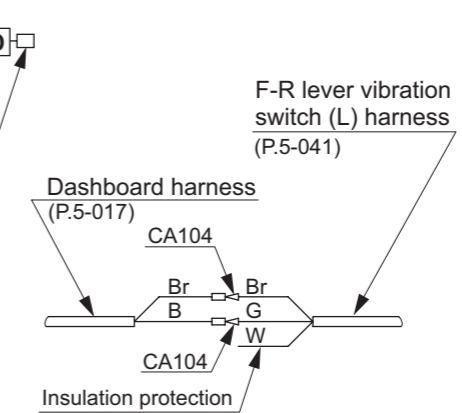
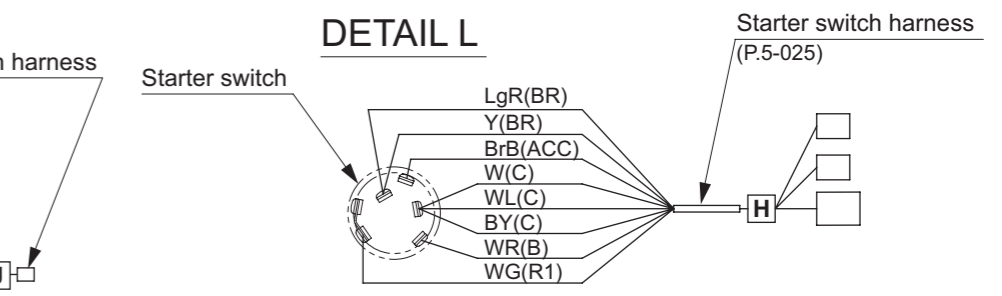
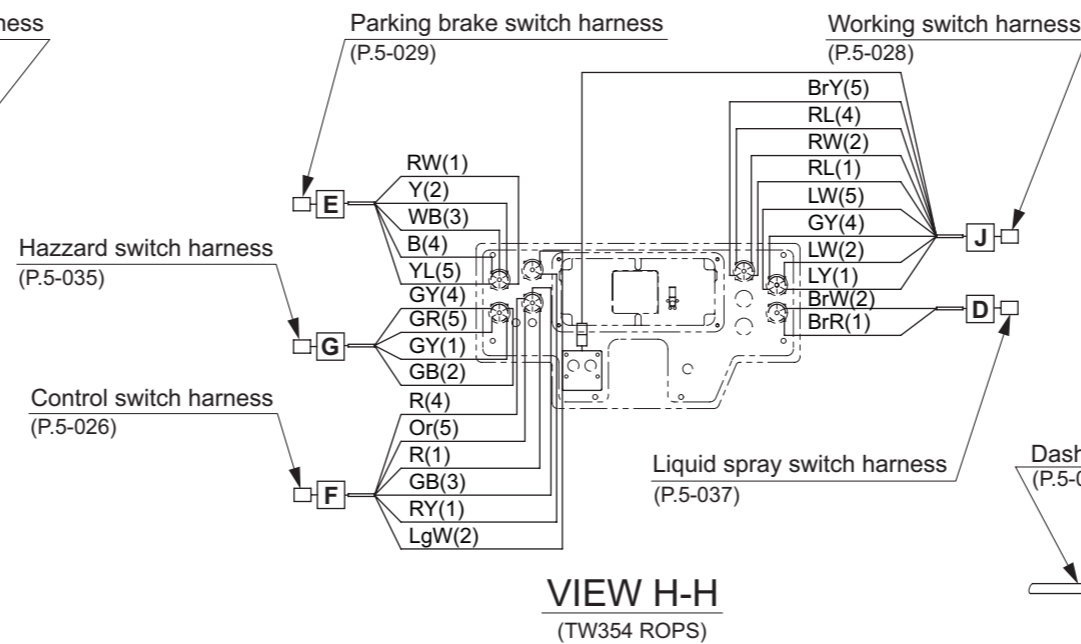
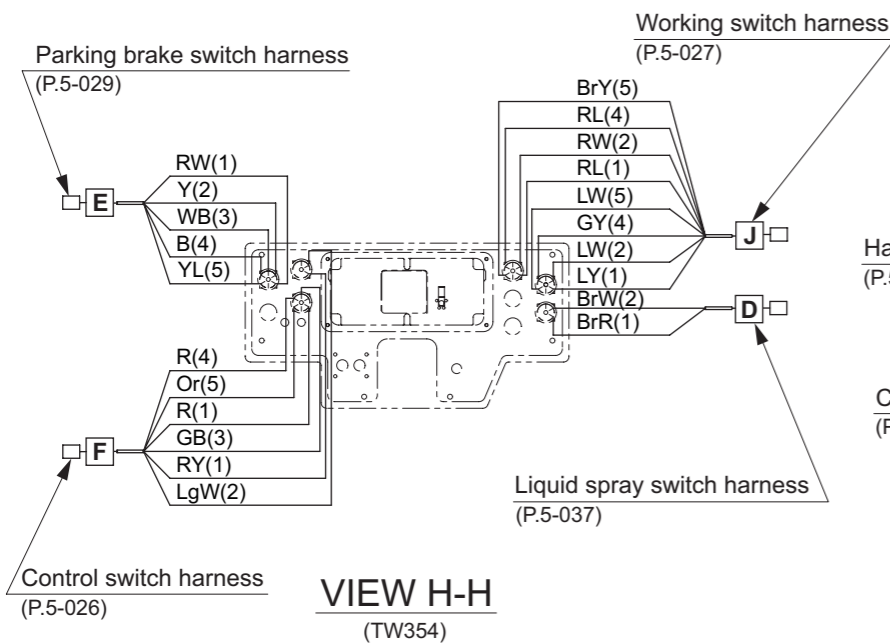
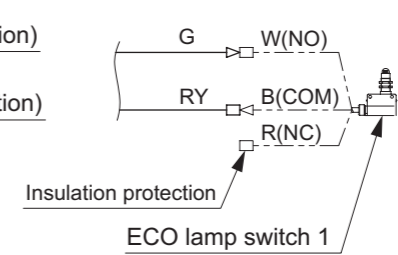
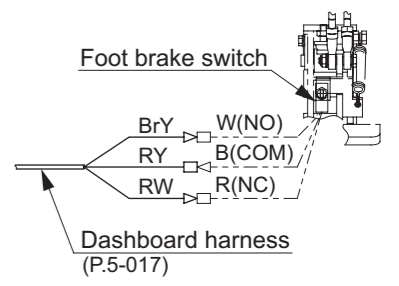
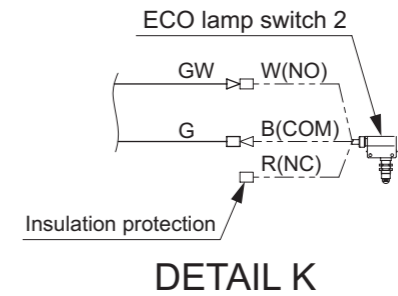
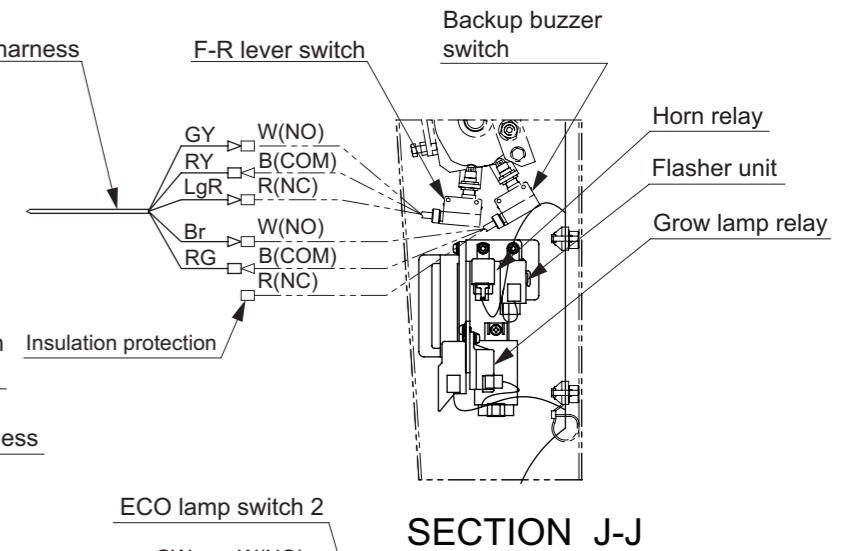
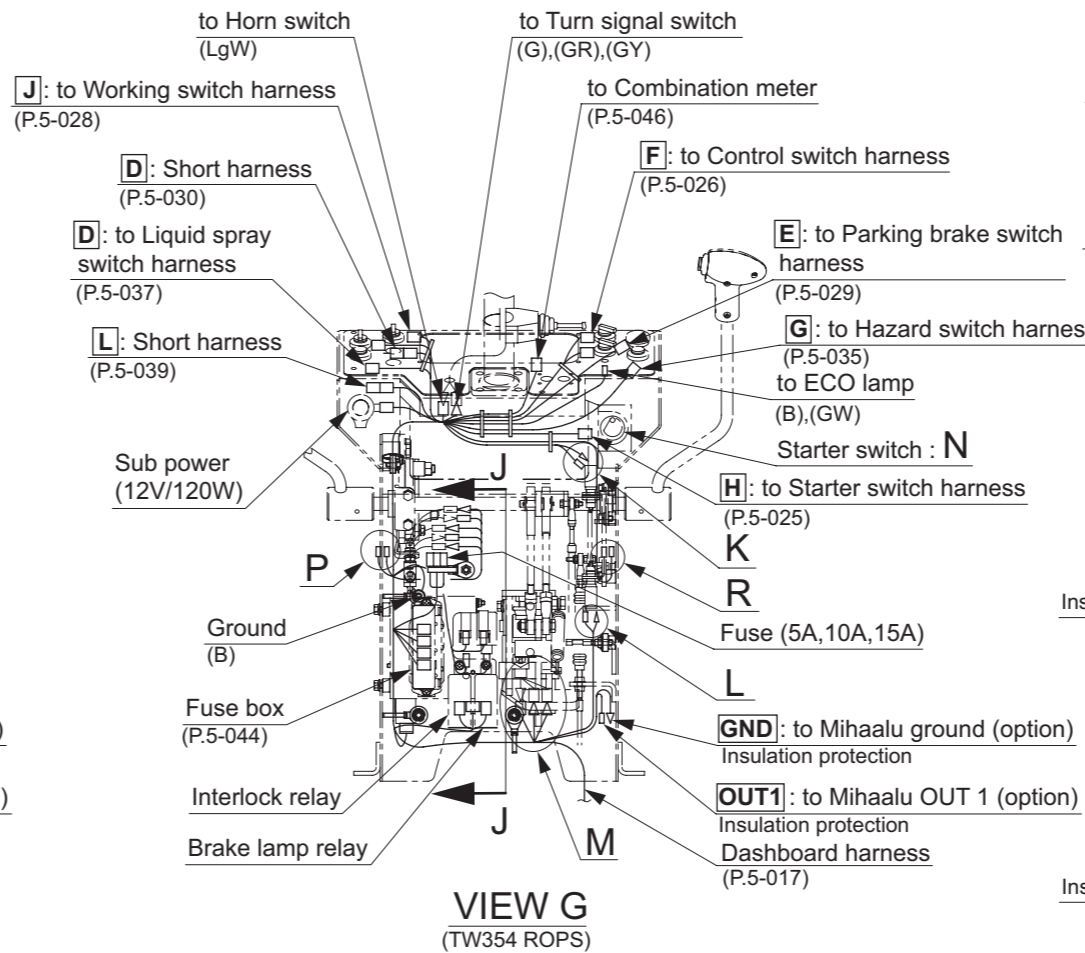
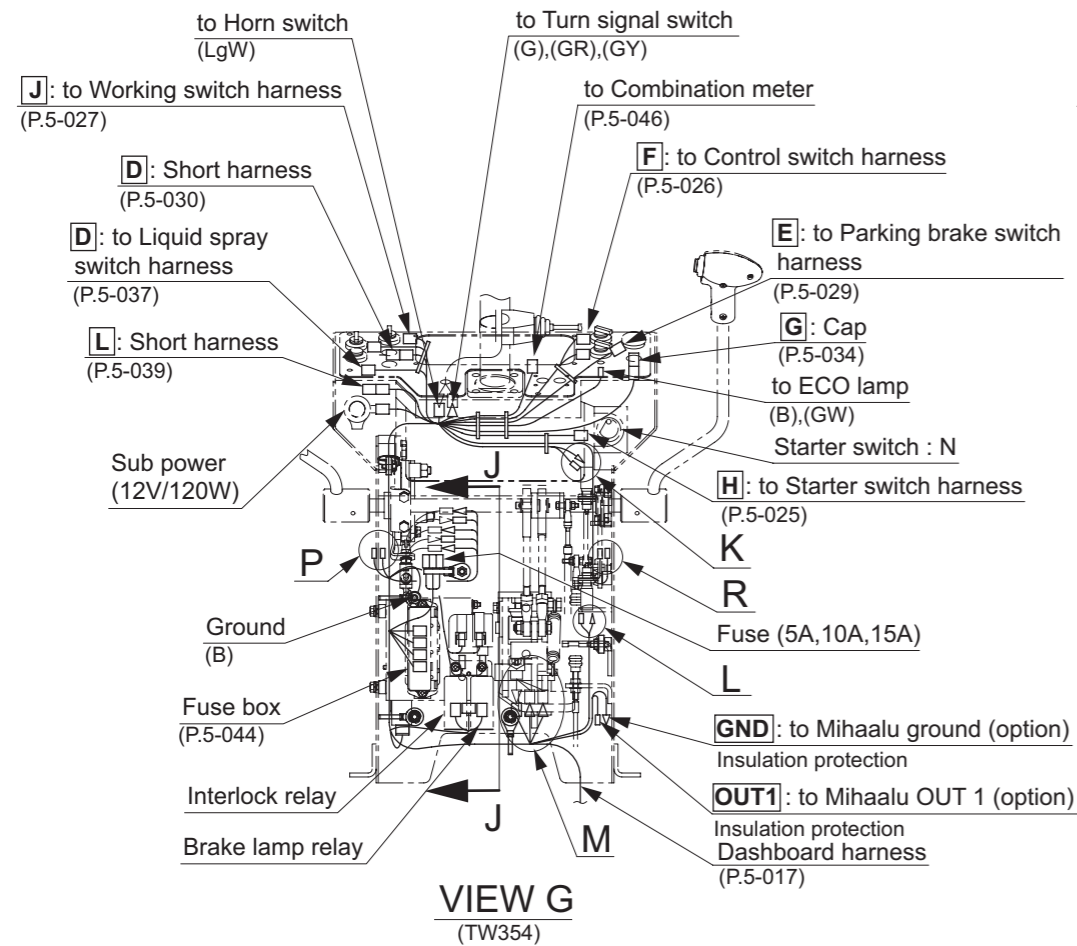
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3-2. Wiring Harness Layout (TW354)

3-2-1. Wiring harness layout (1)

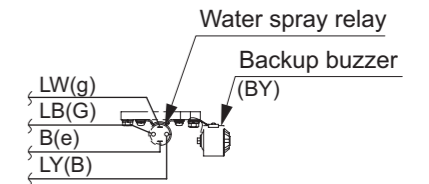
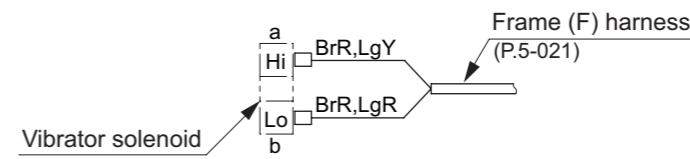
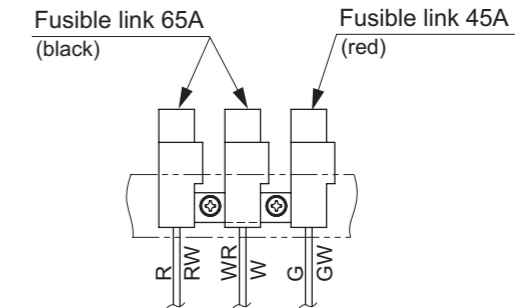
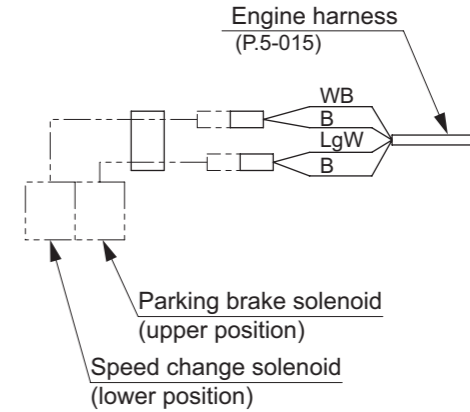
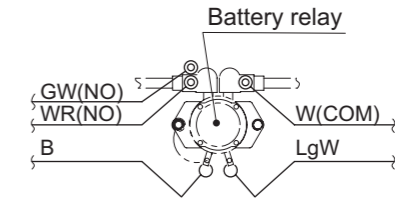
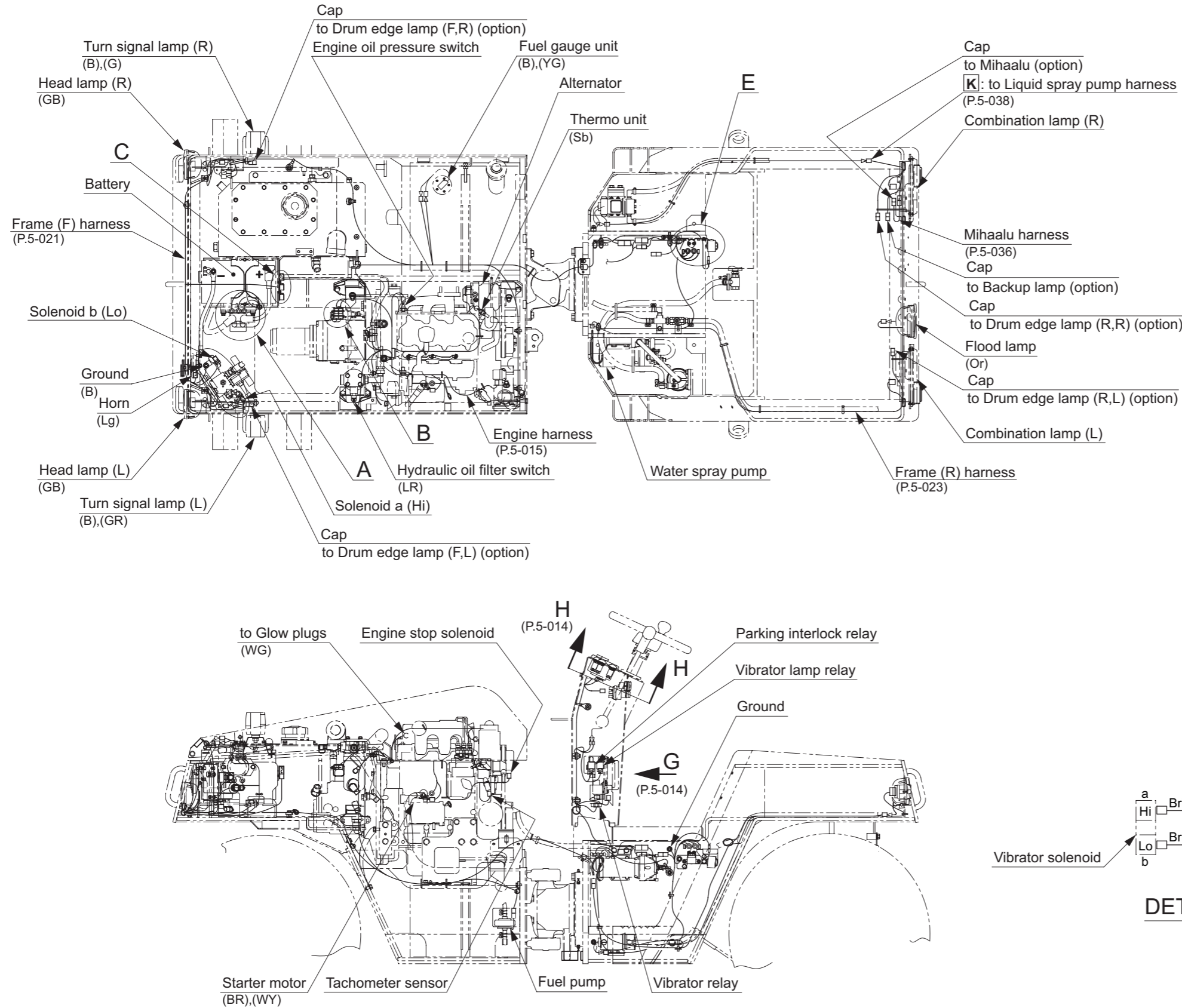


3-2-2. Wiring harness layout (2)

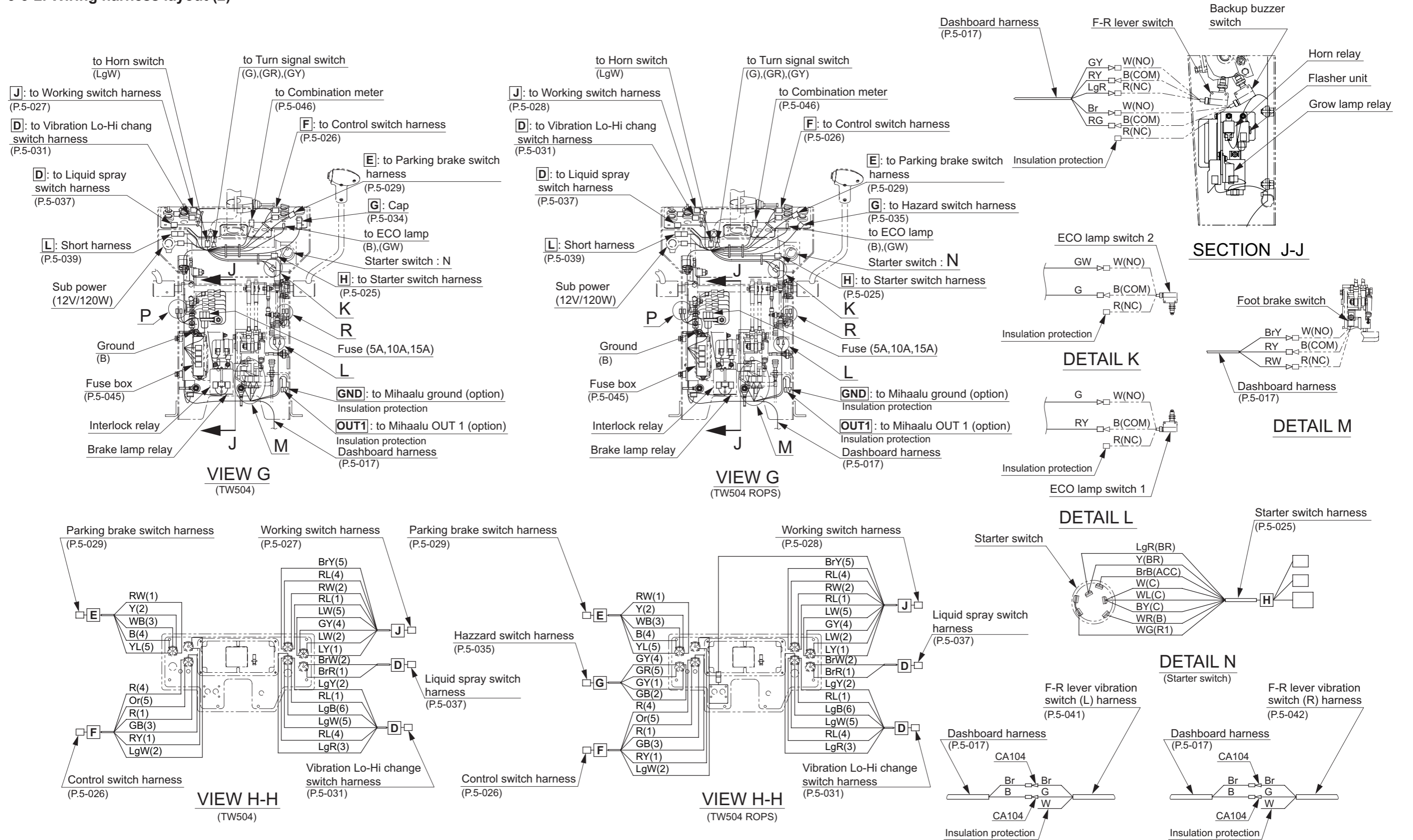


3-3. Wiring Harness Layout (TW504)

3-3-1. Wiring harness layout (1)

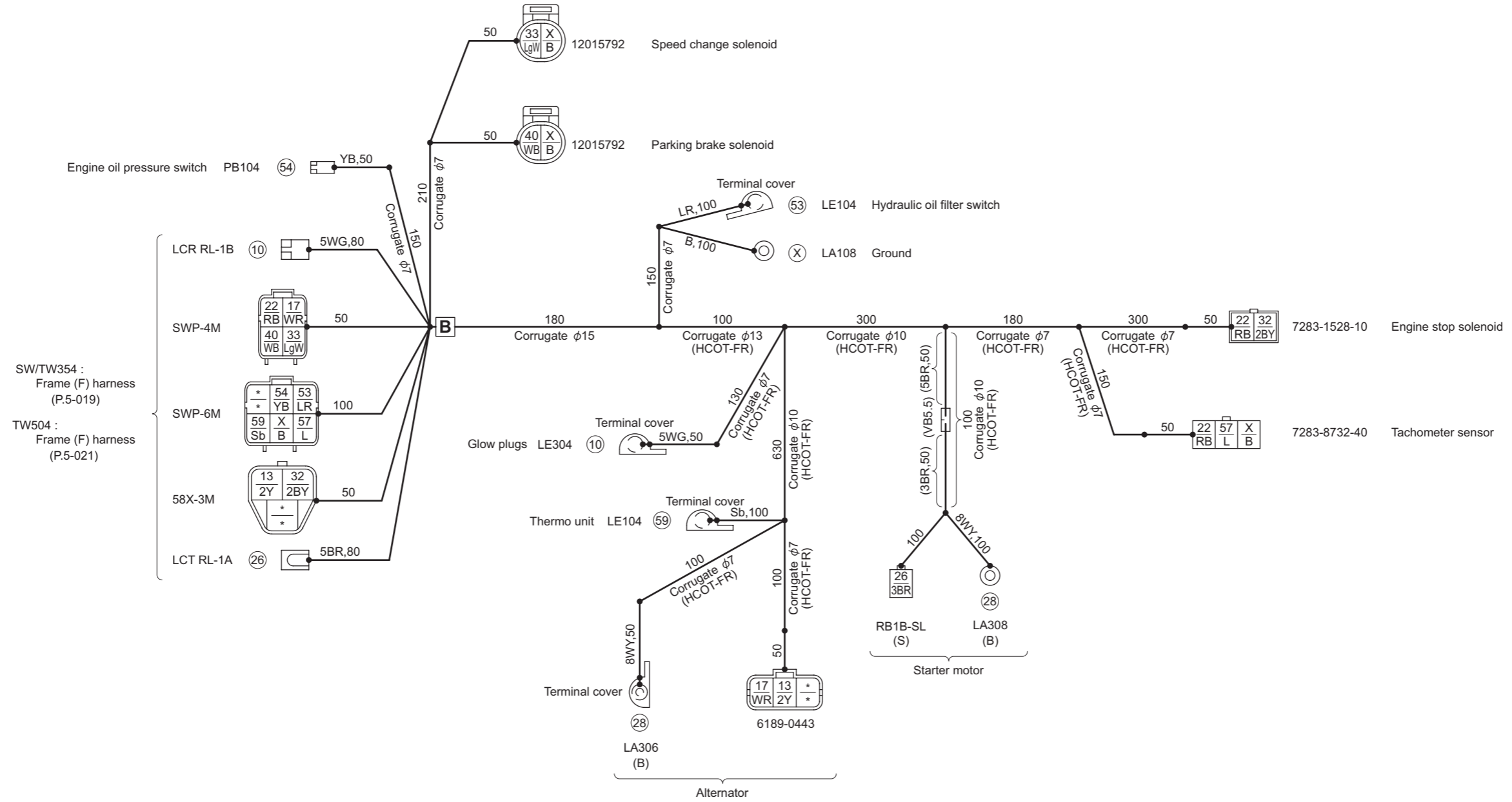


3-3-2. Wiring harness layout (2)



4. WIRING HARNESSSES

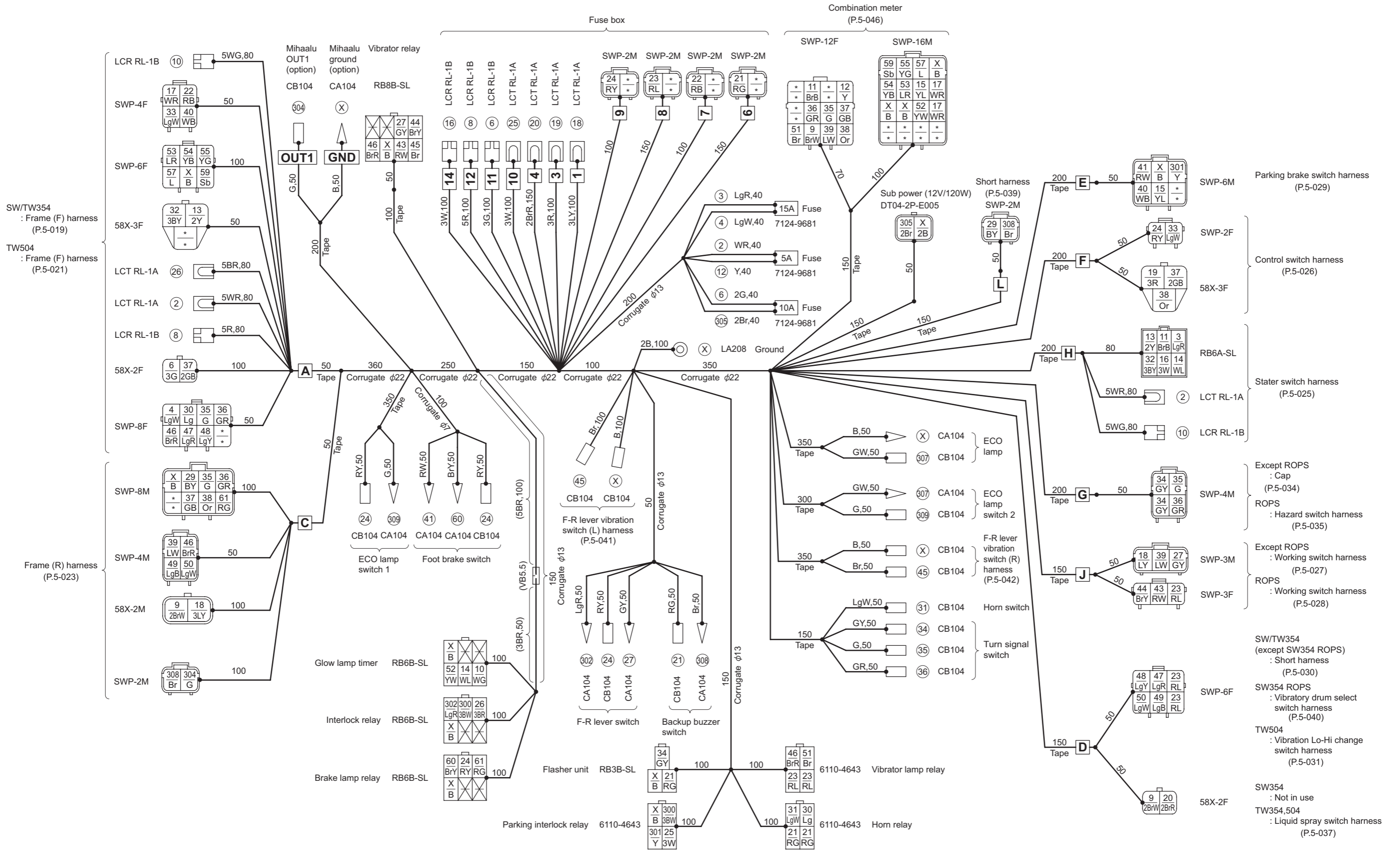
4-1. Engine Harness



NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
ⓧ	B	5	ⓑ × 3, Ground, Tachometer sensor
⑩	5GW	2	ⓑ, Glow plugs
⑬	2Y	2	ⓑ, Alternator
⑰	WR	2	ⓑ, Alternator
⑳	RB	3	ⓑ, Engine stop solenoid, Tachometer sensor
㉔	3BR,5BR	2	ⓑ, Starter motor-S
㉘	8WY	2	Alternator-B, Starter motor-B

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
㉚	2BY	2	ⓑ, Engine stop solenoid
㉛	LgW	2	ⓑ × 2
㉜	WB	2	ⓑ × 2
㉝	LR	2	ⓑ, Hydraulic oil filter switch
㉞	YB	2	ⓑ × 2
㉟	L	2	ⓑ, Tachometer sensor
㊱	Sb	2	ⓑ, Thermo unit

4-2. Dashboard Harness

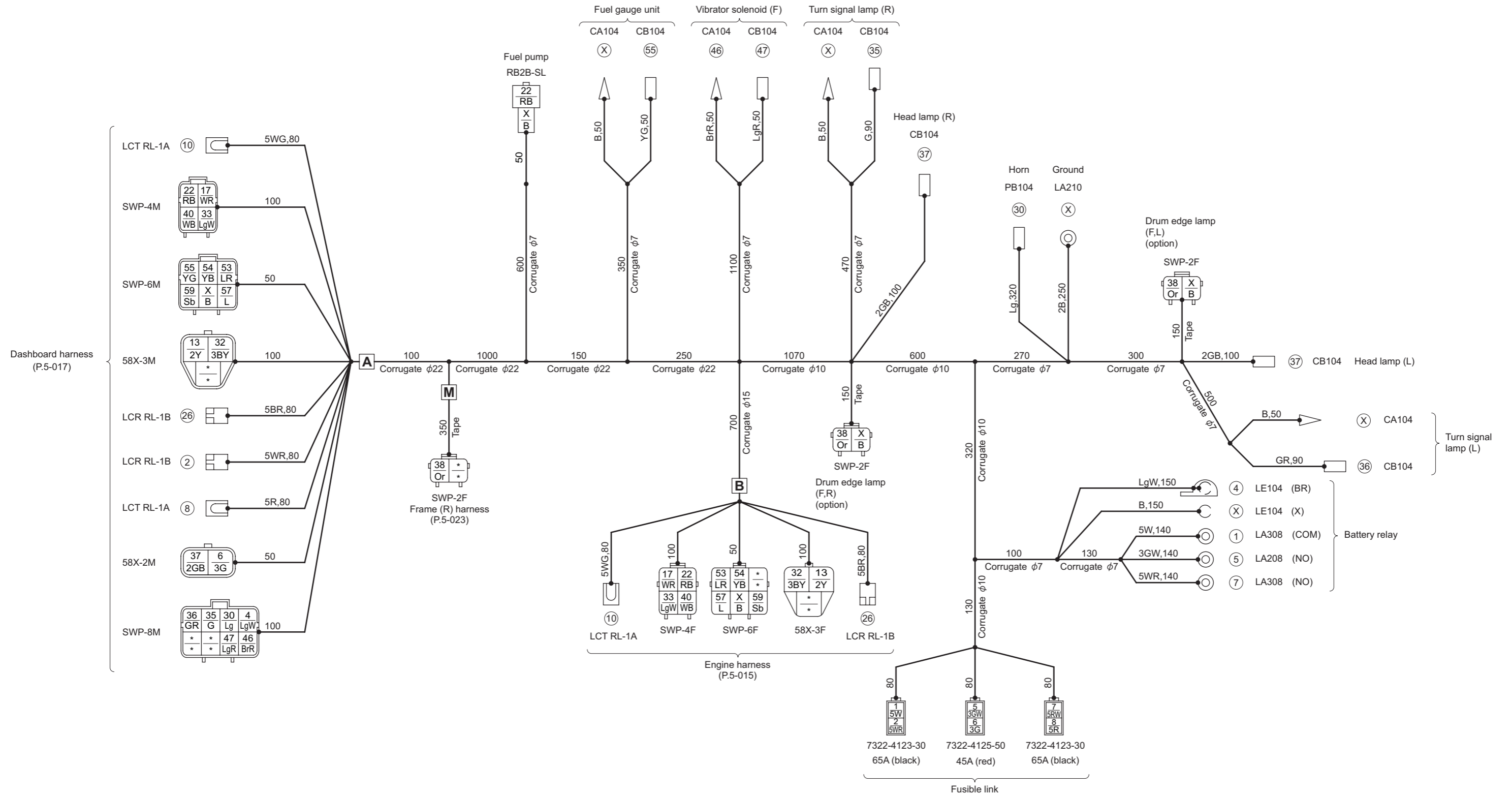


No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
ⓧ	B,2B	18	A (6F), C , E , Brake lamp relay, Combination meter (16M) × 3, ECO lamp, Flasher unit, F-R lever vibration switch (L) harness, F-R lever vibration switch (R) harness, Glow lamp timer, Ground, Interlock relay, Parking interlock relay, Sub power, Vibrator relay, GND (option)
②	WR,5WR	3	A , H , Fuse 5A
③	LgR	2	H , Fuse 15A
④	LgW	2	A (8F), Fuse 15A
⑥	2G,3G	3	11 , A (2F), Fuse 10A
⑧	5R	2	12 , A
⑨	BrW,2BrW	3	C , D , Combination meter (12F)
⑩	WG,5WG	3	A , H , Glow lamp timer
⑪	BrB	2	H , Combination meter (12F)
⑫	Y	2	Combination meter (12F), Fuse 5A
⑬	2Y	2	A (3F), H
⑭	WL	2	H , Glow lamp timer
⑮	YL	2	E , Combination meter (16M)
⑯	3W	2	14 , H
⑰	WR	3	A (4F), Combination meter (16M) × 2
⑱	LY,3LY	3	1 , C , J
⑲	3R	2	3 , F
⑳	2BrR	2	4 , D
㉑	RG	5	6 , Backup buzzer switch, Flasher unit, Horn relay × 2
㉒	RB	2	7 , A (4F)
㉓	RL	6	8 , D × 2, J , Vibrator lamp relay × 2
㉔	RY	6	9 , F , Brake lamp relay, ECO lamp switch 1, Foot brake switch, F-R lever switch
㉕	3W	2	10 , Parking interlock relay
㉖	3BR,5BR	2	A , Interlock relay
㉗	GY	3	J , F-R lever switch, Vibrator relay
㉙	BY	2	C , L
⑳	Lg	2	A (8F), Horn relay
㉑	LgW	2	Horn relay, Horn switch
㉒	3BY	2	A (3F), H
㉓	LgW	2	A (4F), F

No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
⑳	GY	4	G × 2, Flasher unit, Turn signal switch
㉑	G	5	A (8F), C , G , Combination meter (12F), Turn signal switch
㉒	GR	5	A (8F), C , G , Combination meter (12F), Turn signal switch
㉓	GB,2GB	4	A (2F), C , F , Combination meter (12F)
㉔	Or	3	C , F , Combination meter (12F)
㉕	LW	3	C , J , Combination meter (12F)
㉖	WB	2	A (4F), E
㉗	RW	2	E , Foot brake switch
㉙	RW	2	J , Vibrator relay
㉚	BrY	2	J , Vibrator relay
㉛	Br	3	F-R lever vibration switch (L) harness, F-R lever vibration switch (R) harness, Vibrator relay
㉜	BrR	4	A (8F), C , Vibrator lamp relay, Vibrator relay
㉝	LgR	2	A (8F), D
㉞	LgY	2	A (8F), D
㉟	LgB	2	C , D
㊱	LgW	2	C , D
㊲	Br	2	Combination meter (12F), Vibrator lamp relay
㊳	YW	2	Combination meter (16M), Glow lamp timer
㊴	LR	2	A (6F), Combination meter (16M)
㊵	YB	2	A (6F), Combination meter (16M)
㊶	YG	2	A (6F), Combination meter (16M)
㊷	L	2	A (6F), Combination meter (16M)
㊸	Sb	2	A (6F), Combination meter (16M)
㊹	BrY	2	Brake lamp relay, Foot brake switch
㊺	RG	2	C , Brake lamp relay
㊻	3BW	2	Interlock relay, Parking interlock relay
㊼	Y	2	E , Parking interlock relay
㊽	LgR	2	F-R lever switch, Interlock relay
㊾	G	2	C , OUT1 (option)
㊿	2Br	2	Fuse 10A, Sub power
㉑	GW	2	ECO lamp, ECO lamp switch 2
㉒	Br	3	C , L , Backup buzzer switch
㉓	G	2	ECO lamp switch 1,2

4-3. Frame (F) Harness

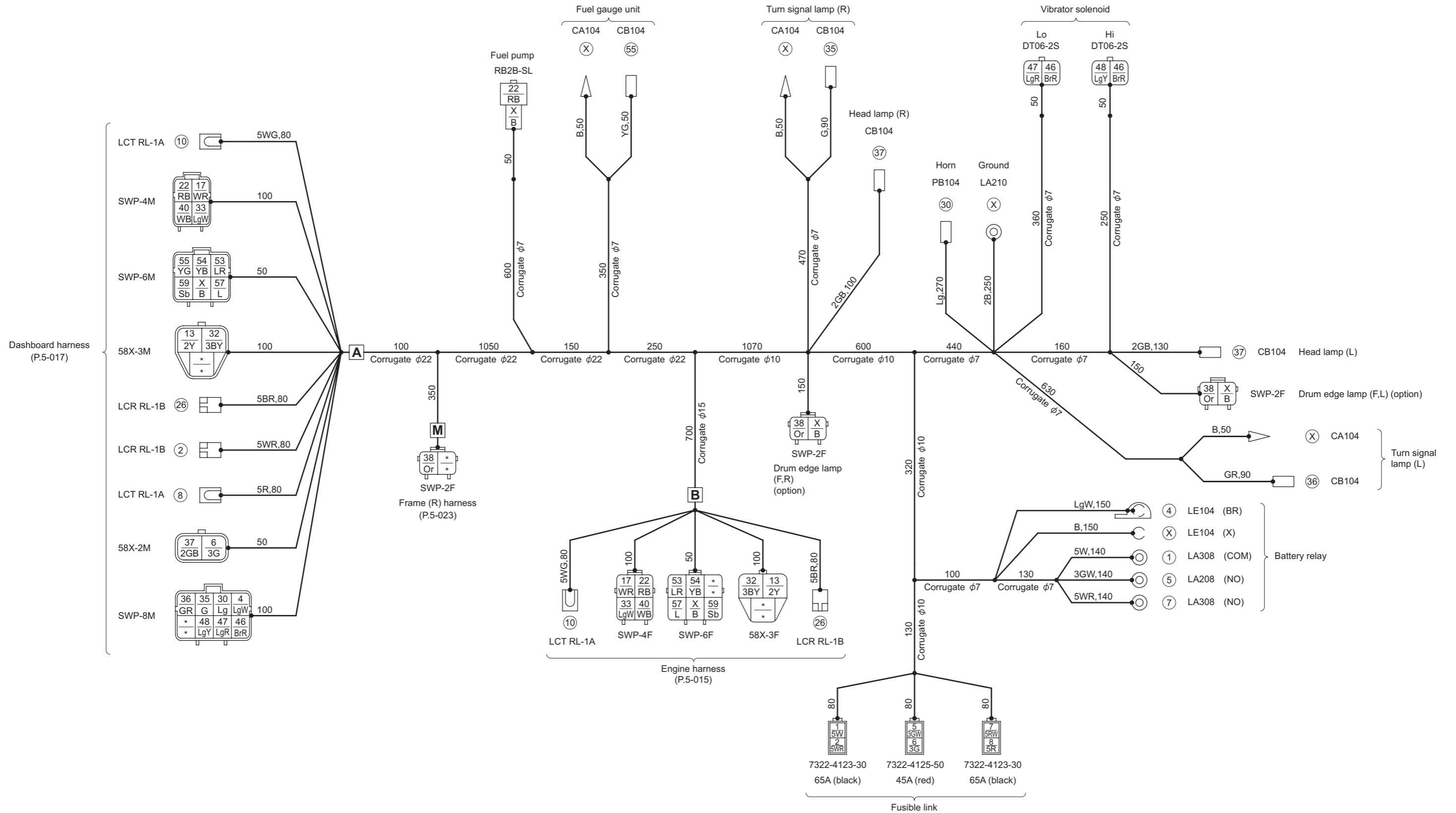
4-3-1. Frame (F) harness (SW/TW354)



No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
⊗	B,2B	10	A (6M), B , Battery relay-X, Fuel gauge unit, Fuel pump, Ground, Turn signal lamp (L), (R), Drum edge lamp (F,L) (option), (F,R) (option)
①	5W	2	Battery relay-COM, Fusible link 65A
②	5WR	2	A , Fusible link 65A
④	LgW	2	A (8M), Battery relay-BR
⑤	3GW	2	Battery relay-NO, Fusible link 45A
⑥	3G	2	A (2M), Fusible link 45A
⑦	5WR	2	Battery relay-NO, Fusible link 65A
⑧	5R	2	A , Fusible link 65A
⑩	5WG	2	A , B
⑬	2Y	2	A (3M), B
⑰	WR	2	A (4M), B
⑳	RB	3	A (4M), B , Fuel pump
㉔	5BR	2	A , B
㉚	Lg	2	A (8M), Horn

No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
⑳	3BY	2	A (3M), B
㉑	LgW	2	A (4M), B
㉓	G	2	A (8M), Turn signal lamp (R)
㉔	GR	2	A (8M), Turn signal lamp (L)
㉕	2GB	3	A (2M), Head lamp (L), (R)
㉖	Or	3	M , Drum edge lamp (F,L) (option), (F,R) (option)
㉘	WB	2	A (4M), B
㉚	BrR	2	A (8M), Vibrator solenoid (F)
㉛	LgR	2	A (8M), Vibrator solenoid (F)
㉝	LR	2	A (6M), B
㉞	YB	2	A (6M), B
㉟	YG	2	A (6M), Fuel gauge unit
㊱	L	2	A (6M), B
㊳	Sb	2	A (6M), B

4-3-2. Frame (F) harness (TW504)



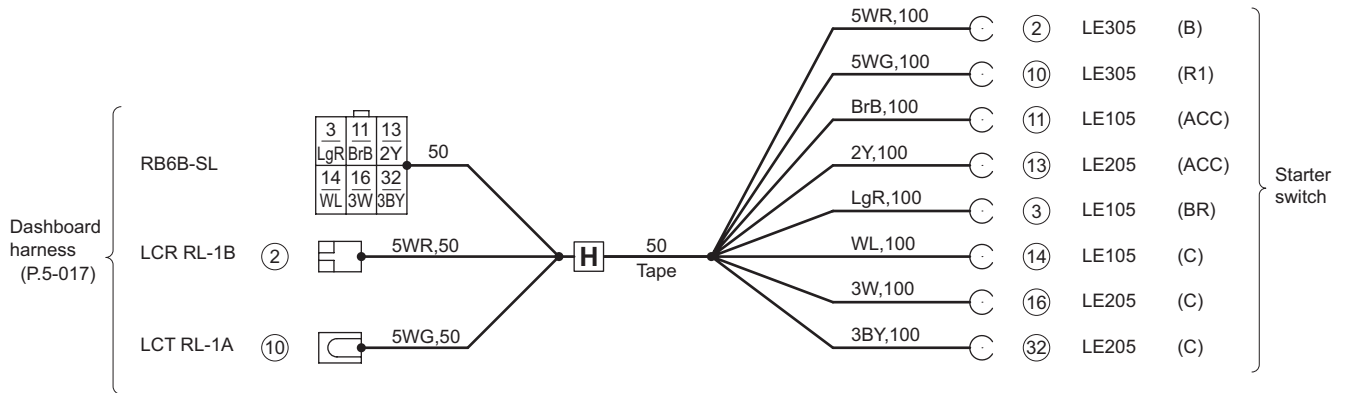
No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
ⓧ	B,2B	10	A (6M), B , Battery relay-X, Fuel gauge unit, Fuel pump, Ground, Turn signal lamp (L), (R), Drum edge lamp (F,L) (option), (F,R) (option)
①	5W	2	Battery relay-COM, Fusible link 65A
②	5WR	2	A , Fusible link 65A
④	LgW	2	A (8M), Battery relay-BR
⑤	3GW	2	Battery relay-NO, Fusible link 45A
⑥	3G	2	A (2M), Fusible link 45A
⑦	5WR	2	Battery relay-NO, Fusible link 65A
⑧	5R	2	A , Fusible link 65A
⑩	5WG	2	A , B
⑬	2Y	2	A (3M), B
⑰	WR	2	A (4M), B
⑳	RB	3	A (4M), B , Fuel pump
㉔	5BR	2	A , B
⑳	Lg	2	A (8M), Horn

No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
㉒	3BY	2	A (3M), B
㉓	LgW	2	A (4M), B
㉕	G	2	A (8M), Turn signal lamp (R)
㉖	GR	2	A (8M), Turn signal lamp (L)
㉗	2GB	3	A (2M), Head lamp (L), (R)
㉘	Or	3	M , Drum edge lamp (F,L) (option), (F,R) (option)
㉚	WB	2	A (4M), B
㉞	BrR	3	A (8M), Vibrator solenoid-Hi, Lo
㉟	LgR	2	A (8M), Vibrator solenoid-Lo
㊱	LgY	2	A (8M), Vibrator solenoid-Hi
㊳	LR	2	A (6M), B
㊴	YB	2	A (6M), B
㊵	YG	2	A (6M), Fuel gauge unit
㊷	L	2	A (6M), B
㊹	Sb	2	A (6M), B

No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
ⓧ	B,3B	11	C, Backup buzzer, Combination lamp (L), (R), Ground, Mihaalu harness, Water spray pump, Water spray relay-e, Backup lamp (option), Drum edge lamp (R,L) (option), (R,R) (option)
⑨	2BrW	2	C, K
⑱	3LY	2	C, Water spray relay-B
⑳	BY	2	C, Backup buzzer
㉓	G	2	C, Combination lamp (R)
㉔	GR	2	C, Combination lamp (L)
㉕	GB	3	C, Combination lamp (L), (R)
㉖	Or	6	C, M, Flood lamp, Drum edge lamp (R,L) (option), (R,R) (option)

No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
㉙	LW	2	C, Water spray relay-g
㉚	3LB	2	Water spray pump, Water spray relay-G
㉞	BrR	2	C, J
㉟	LgB	2	C, J
㊀	LgW	2	C, J
㊁	RG	3	C, Combination lamp (L), (R)
㊂	G	2	C, Mihaalu harness
㊃	Br	3	C, Mihaalu harness, Backup lamp (option)

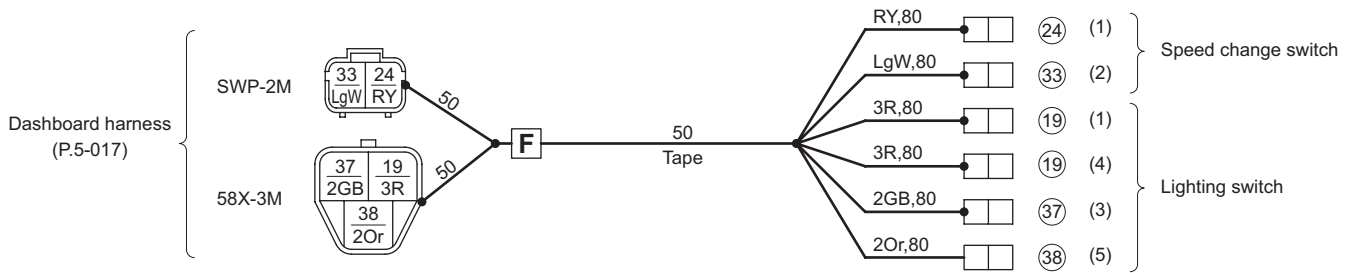
4-5. Stater Switch Harness



1446-09027-0-30316-0

No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
②	5WR	2	H , Starter swich-B
③	LgR	2	H , Starter swich-BR
⑩	5WG	2	H , Starter swich-R1
⑪	BrB	2	H , Starter swich-ACC
⑬	2Y	2	H , Starter swich-ACC
⑭	WL	2	H , Starter swich-C
⑯	3W	2	H , Starter swich-C
⑳	3BY	2	H , Starter swich-C

4-6. Control Switch Harness

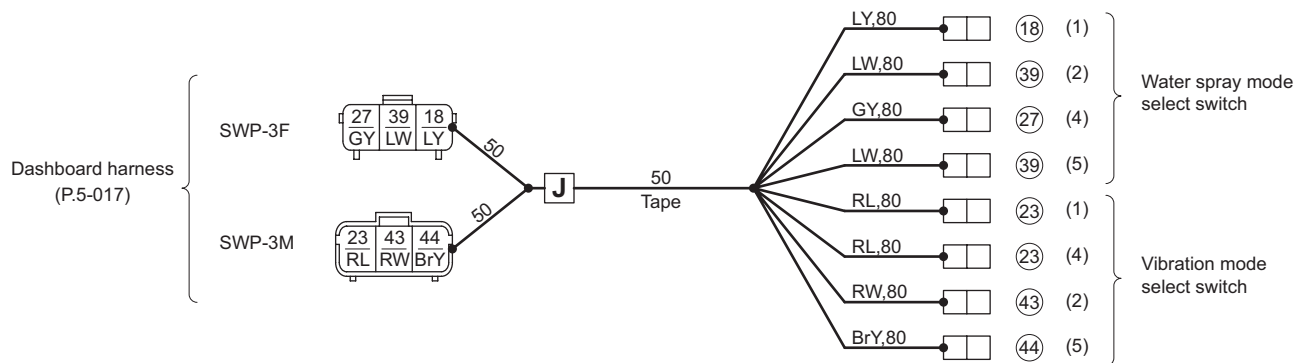


1446-09028-0-30317-A

No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
①⑨	2R,3R	3	F , Lighting swich-1, 4
②④	RY	2	F , Speed change swich-1
③③	LgW	2	F , Speed change swich-2
③⑦	2GB	2	F , Lighting swich-3
③⑧	2Or	2	F , Lighting swich-5

4-7. Working Switch Harness

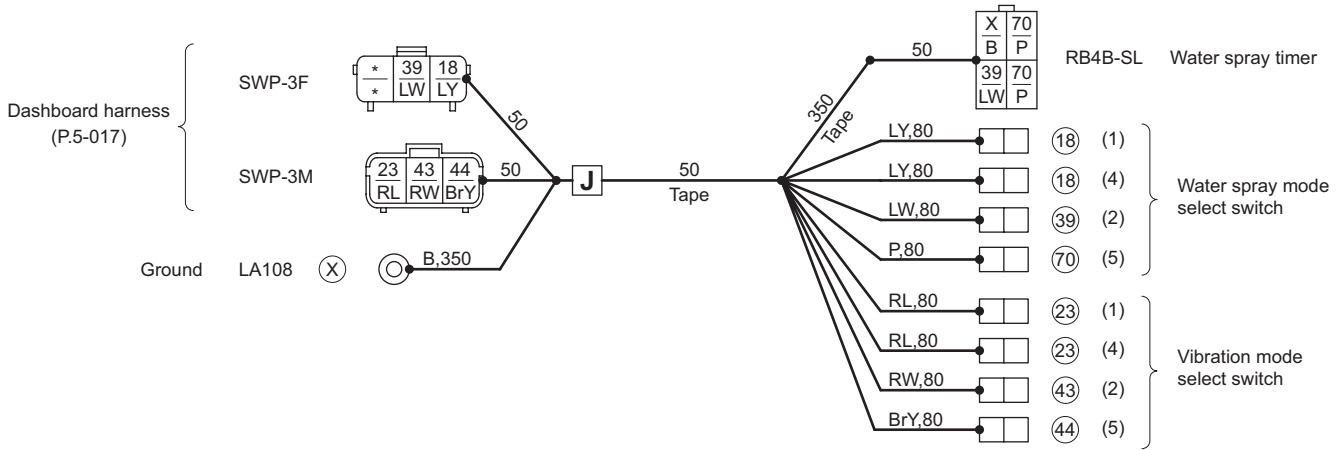
4-7-1. Working switch harness (except ROPS)



1446-09063-0-30837-0

No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
⑱	LY	2	J , Water spray mode select switch-1
⑳	RL	3	J , Vibration mode select switch-1, 4
㉑	GY	2	J , Water spray mode select switch-4
㉒	LW	3	J , Water spray mode select switch-2, 5
㉓	RW	2	J , Vibration mode select switch-2
㉔	BrY	2	J , Vibration mode select switch-5

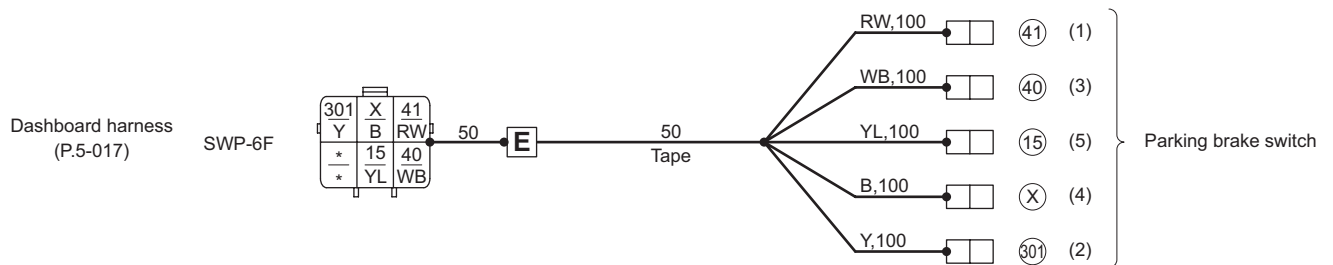
4-7-2. Working switch harness (ROPS)



1446-75052-0-30851-0

No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
(X)	B	2	J, Water spray timer
(18)	LY	3	J, Water spray mode select switch-1, 4
(23)	RL	3	J, Vibration mode select switch-1, 4
(39)	LW	3	J, Water spray mode select switch-2, Water spray timer
(43)	RW	2	J, Vibration mode select switch-2
(44)	BrY	2	J, Vibration mode select switch-5
(70)	P	3	Water spray mode select switch-5, Water spray timer × 2

4-8. Parking Brake Switch Harness

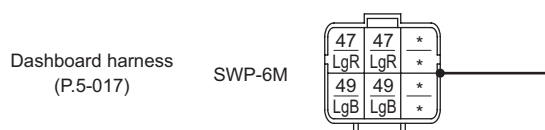


1446-09062-0-30834-0

No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
(X)	B	2	E, Parking brake switch-4
(15)	YL	2	E, Parking brake switch-5
(40)	WB	2	E, Parking brake switch-3
(41)	RW	2	E, Parking brake switch-1
(301)	Y	2	E, Parking brake switch-2

4-9. Vibration Lo-Hi Change Switch Harness

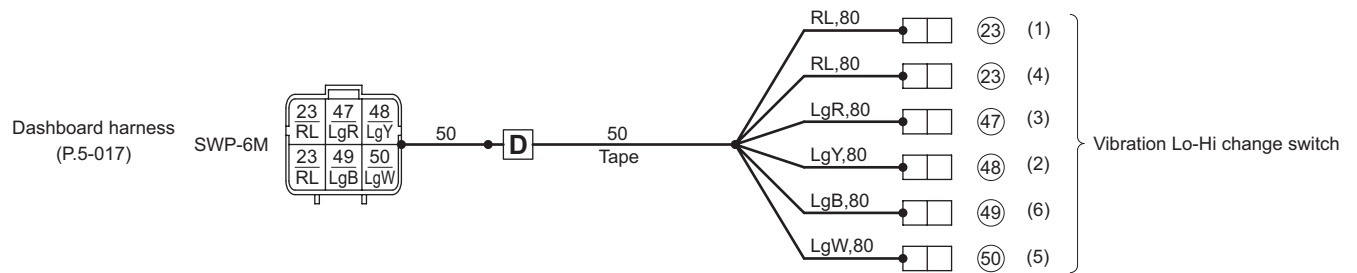
4-9-1. Short harness (SW/TW354 : except SW354 ROPS)



1446-09015-0-40121-0

No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
④7	LgR	2	Dashboard harness × 2
④9	LgB	2	Dashboard harness × 2

4-9-2. Vibration Lo-Hi change switch harness (TW504)

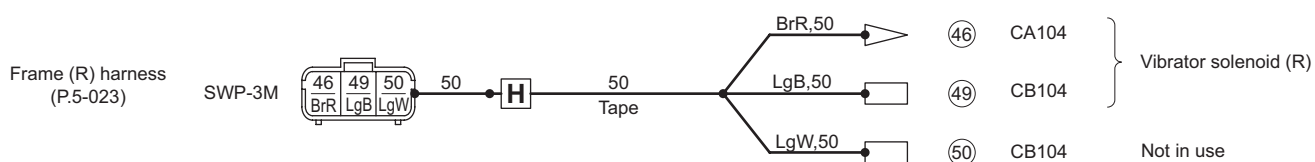


1448-09005-0-30064-A

No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
②③	RL	3	D , Vibration Lo-Hi change switch-1, 4
④⑦	LgR	2	D , Vibration Lo-Hi change switch-3
④⑧	LgY	2	D , Vibration Lo-Hi change switch-2
④⑨	LgB	2	D , Vibration Lo-Hi change switch-6
⑤⑩	LgW	2	D , Vibration Lo-Hi change switch-5

4-10. Vibrator Solenoid (R) Harness

4-10-1. Vibrator solenoid (R) harness (SW354)

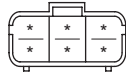


1446-09012-0-30118-0

No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
④⑥	BrR	2	H , Vibrator solenoid (R)
④⑨	LgB	2	H , Vibrator solenoid (R)
⑤⑩	LgW	2	H , CB104 (not in use)

4-10-2. Cap (TW354,504)

Frame (R) harness
(P.5-023) SWP-3M



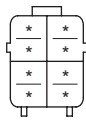
1447-09002-0-40043-0

4-11. Hazard Switch Harness

4-11-1. Cap (except ROPS)

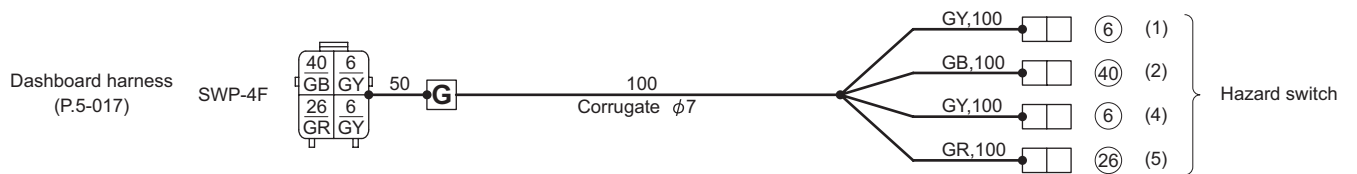
Dashboard harness
(P.5-017)

SWP-4F



1418-09044-0-40589-0

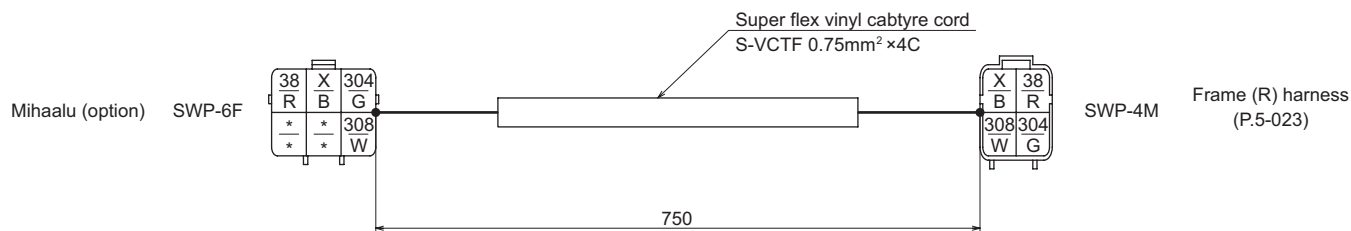
4-11-2. Hazard switch harness (ROPS)



1634-09078-0-31116-0

No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
⑥	GY	4	G × 2, Hazard switch-1, 4
②⑥	GR	2	G , Hazard switch-5
④⑩	GB	2	G , Hazard switch-2

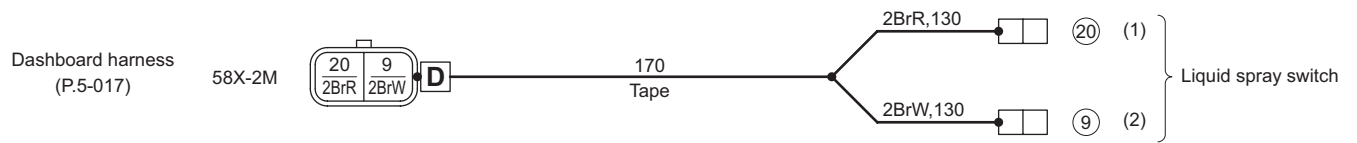
4-12. Mihaalu Harness



1446-70015-0-30858-0

No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
⊗	B	2	Frame (R) harness, Mihaalu (option)
⊗ ₃₈	R	2	Frame (R) harness, Mihaalu (option)
⊗ ₃₀₄	G	2	Frame (R) harness, Mihaalu (option)
⊗ ₃₀₈	W	2	Frame (R) harness, Mihaalu (option)

4-13. Liquid Spray Switch Harness (TW354,504)



1442-09001-0-30054-0

No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
⑨	2BrW	2	D, Liquid spray switch-2
⑳	2BrR	2	D, Liquid spray switch-2

4-14. Liquid Spray Pump Harness (TW354,504)



1447-09003-1-30081-A

No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
(9)	2BrW	2	[K], Liquid spray pump

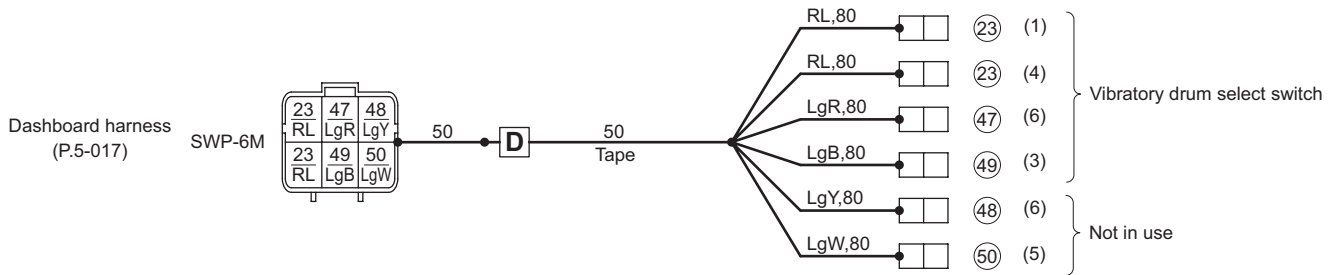
4-15. Short Harness



1446-09080-0-40879-0

No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
②9	BY	2	Dashboard harness × 2

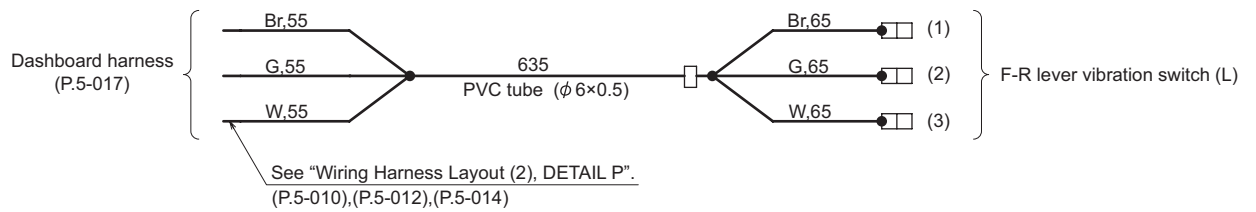
4-16. Vibratory Drum Select Switch Harness (SW354 ROPS)



1448-09005-0-30064-A

No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
②③	RL	3	D , Vibratory drum select switch-1, 4
④⑦	LgR	2	D , Vibratory drum select switch-6
④⑧	LgY	2	D , Vibratory drum select switch-6 (not in use)
④⑨	LgB	2	D , Vibratory drum select switch-3
⑤⑩	LgW	2	D , Vibratory drum select switch-5 (not in use)

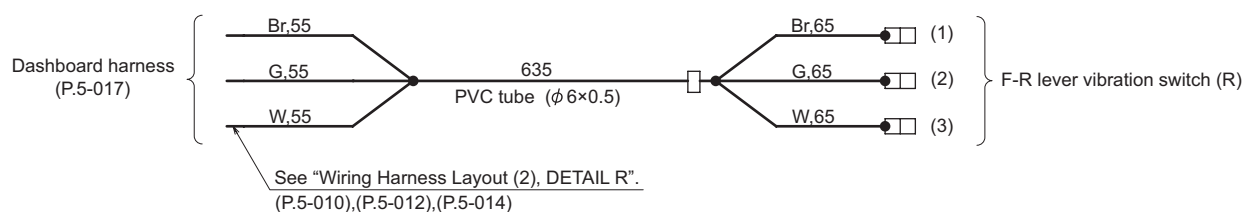
4-17. F-R Lever Vibration Switch (L) Harness



1539-12013-0-30226-0

No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
–	Br	2	Dashboard harness, F-R lever vibration switch (L)-1
–	G	2	Dashboard harness, F-R lever vibration switch (L)-2
–	W	2	Dashboard harness, F-R lever vibration switch (L)-3

4-18. F-R Lever Vibration Switch (R) Harness

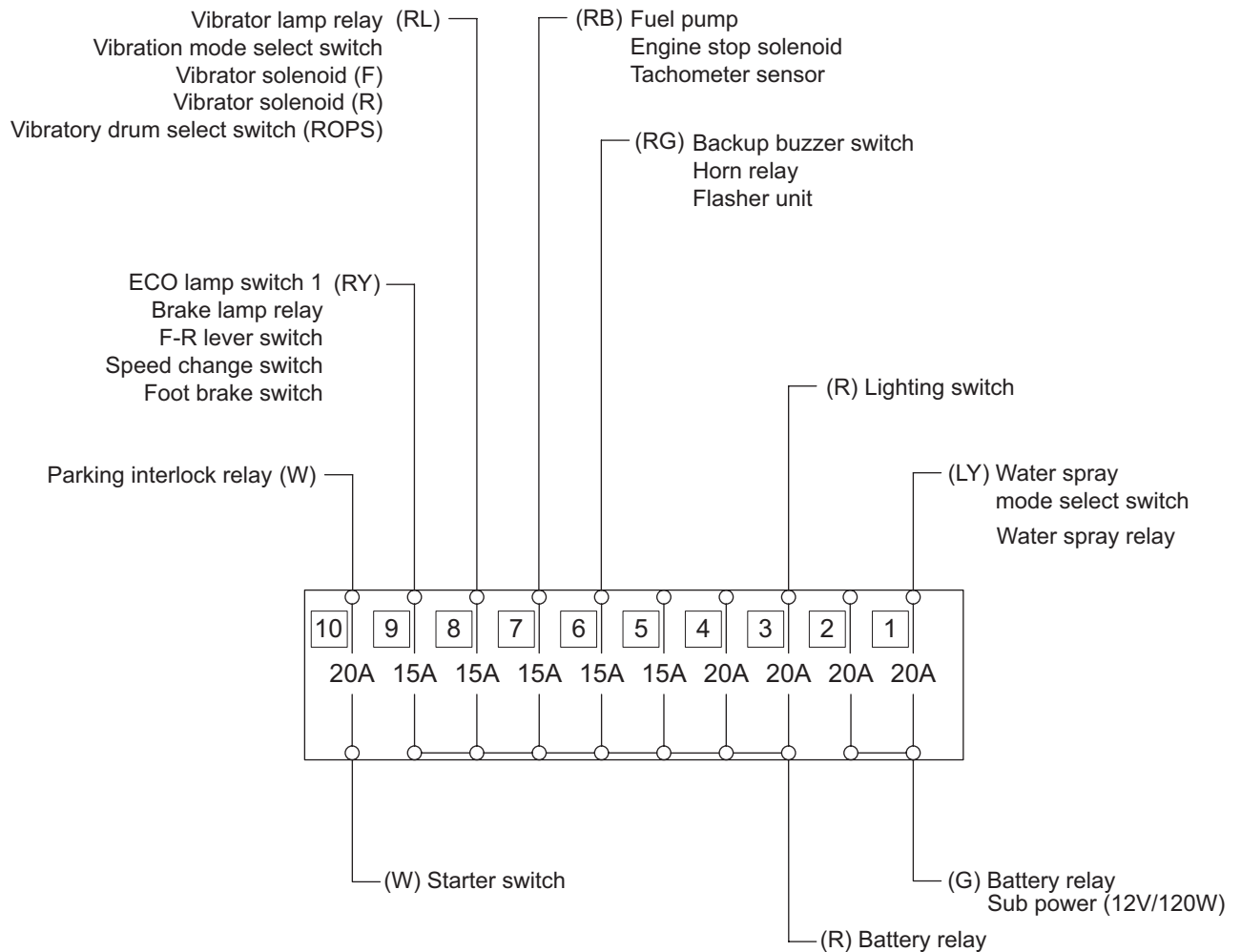


1539-12013-0-30226-0

No.	SIZE, COLOR	CONTACT POINTS	CONNECTION
-	Br	2	Dashboard harness, F-R lever vibration switch (R)-1
-	G	2	Dashboard harness, F-R lever vibration switch (R)-2
-	W	2	Dashboard harness, F-R lever vibration switch (R)-3

5. ELECTRICAL COMPONENT SPECIFICATIONS

5-1. Fuse Box (SW354)



SW354-05001

Harness color codes

W : White

R : Red

RB : Red/Black stripe

RY : Red/Yellow stripe

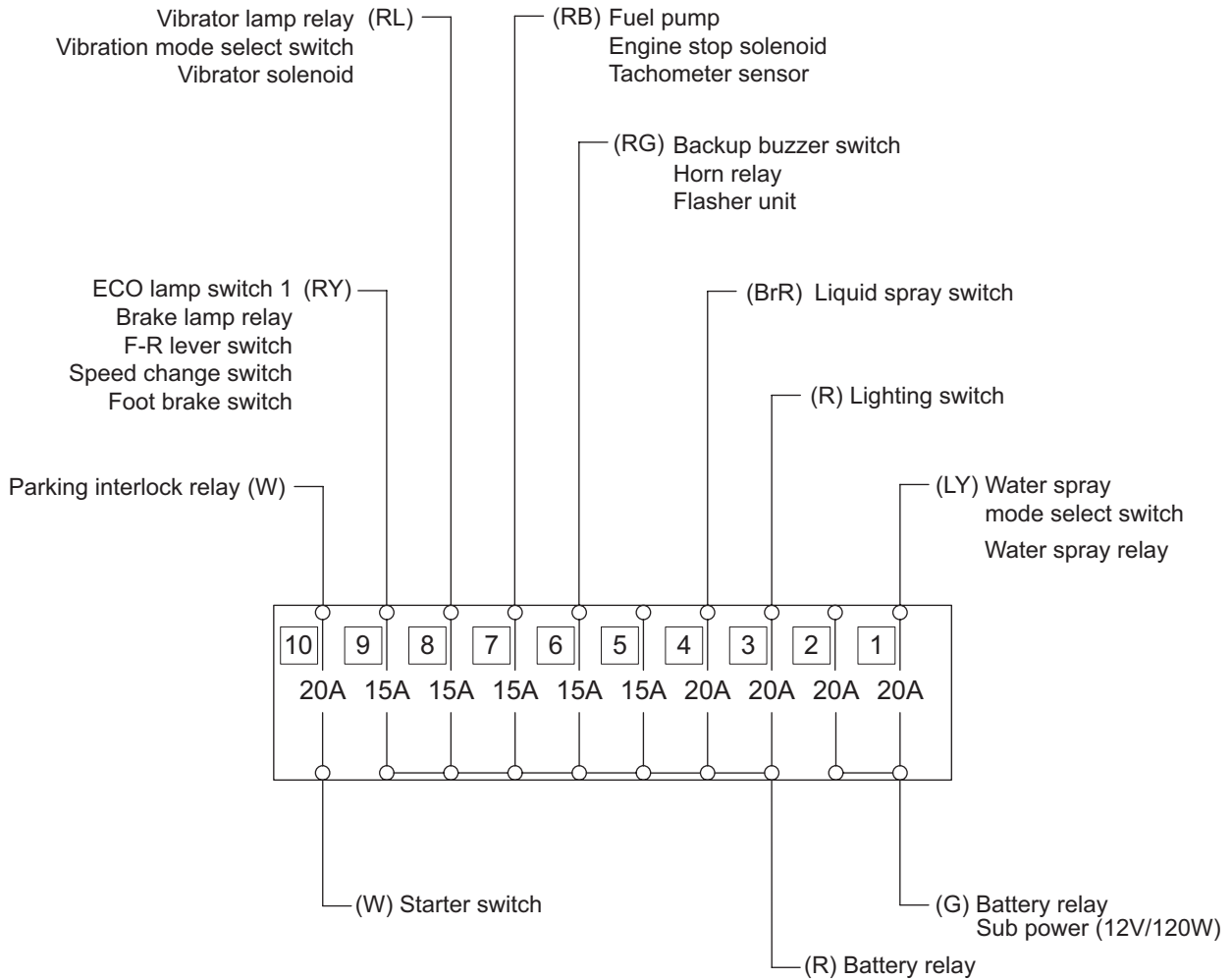
RG : Red/Green stripe

RL : Red/Blue stripe

G : Green

LY : Blue/Yellow stripe

5-2. Fuse Box (TW354)

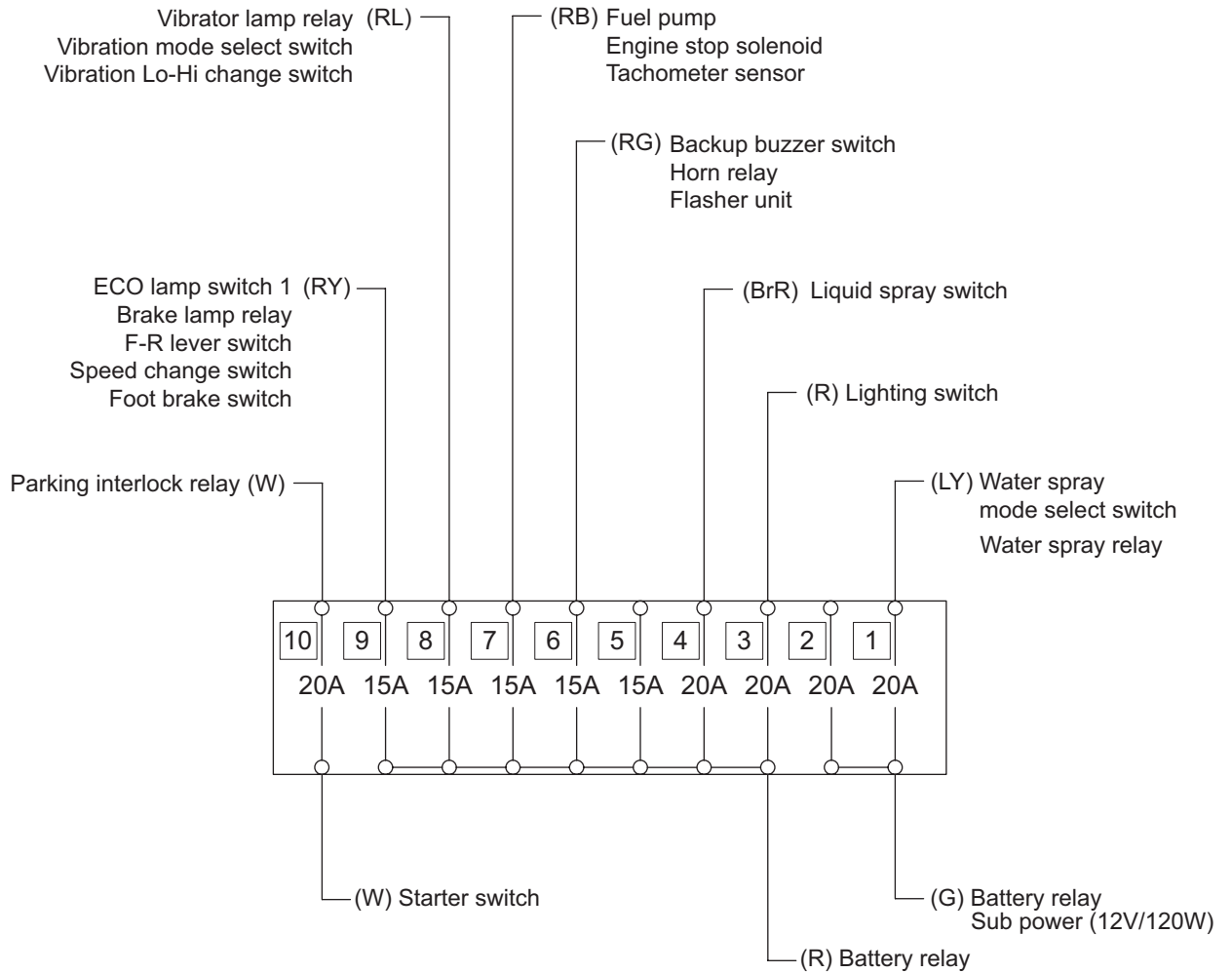


TW354-05001

Harness color codes

- | | |
|------------------------|-------------------------|
| W : White | RL : Red/Blue stripe |
| R : Red | G : Green |
| RB : Red/Black stripe | BrR : Brown/Red stripe |
| RY : Red/Yellow stripe | LY : Blue/Yellow stripe |
| RG : Red/Green stripe | |

5-3. Fuse Box (TW504)

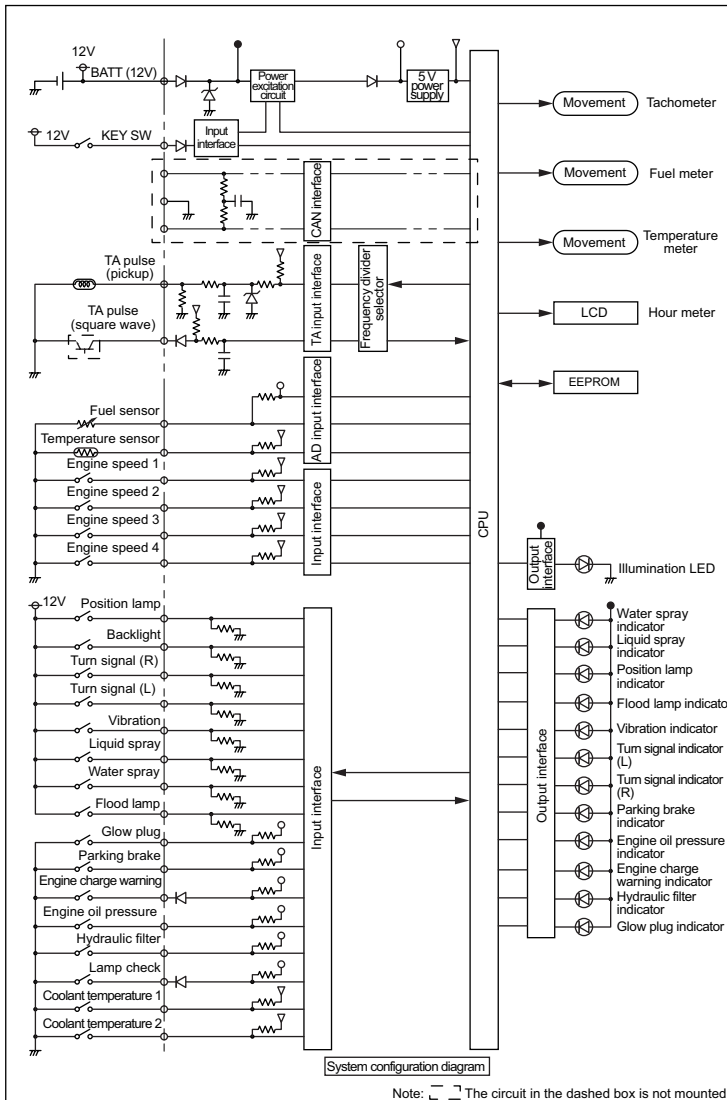
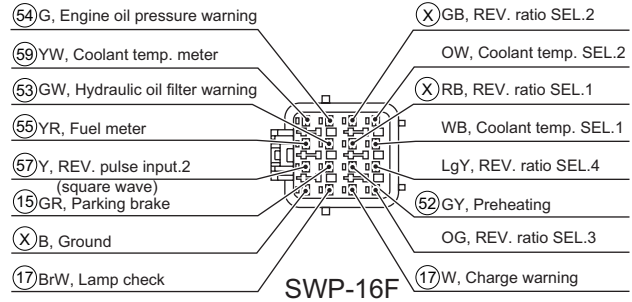
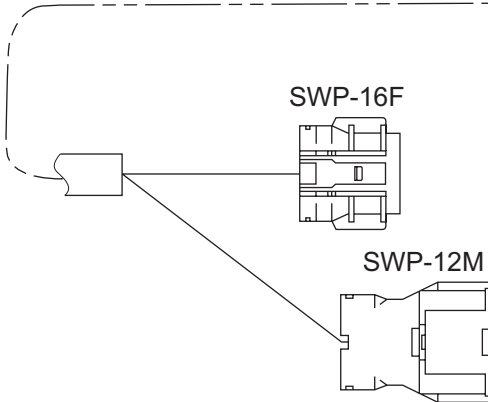
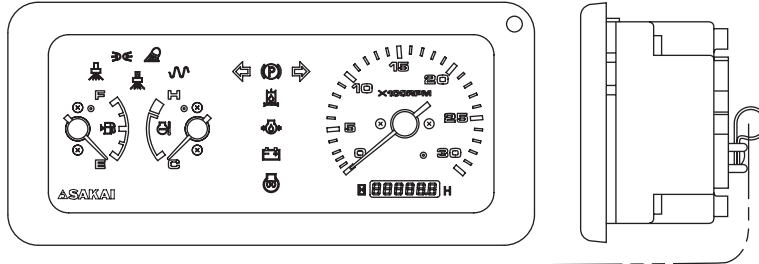


TW504-05001

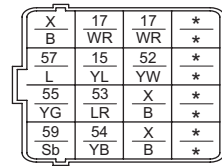
Harness color codes

- | | |
|------------------------|-------------------------|
| W : White | RL : Red/Blue stripe |
| R : Red | G : Green |
| RB : Red/Black stripe | BrR : Brown/Red stripe |
| RY : Red/Yellow stripe | LY : Blue/Yellow stripe |
| RG : Red/Green stripe | |

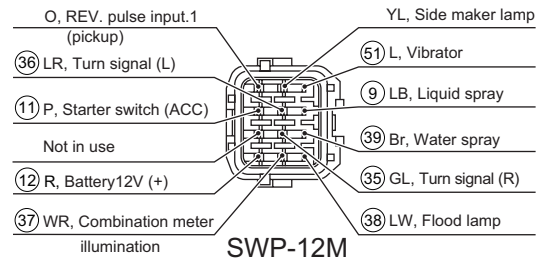
5-4. Combination Meter



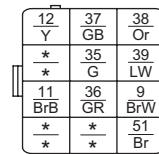
Harness side



SWP-16M



Harness side



SWP-12F

VIBRATORY DRUM • REAR WHEEL

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 pins, and lock plates with new parts.
- Properly bend split 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 grease to rotating and sliding components.
- Apply gear oil 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 valve 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

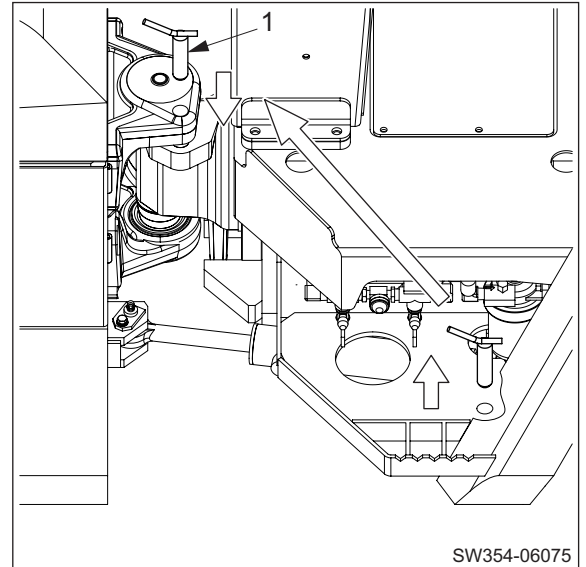
2-1. Removal and Installation of Vibratory Drum

2-1-1. Removal of vibratory drum

- Use same procedure to remove drum assembly from SW/TW354 front drum assembly and SW354 rear drum assembly.

1) Securing machine

- Hold drum with chocks.
- Lock front and rear frames with lock pin (1).



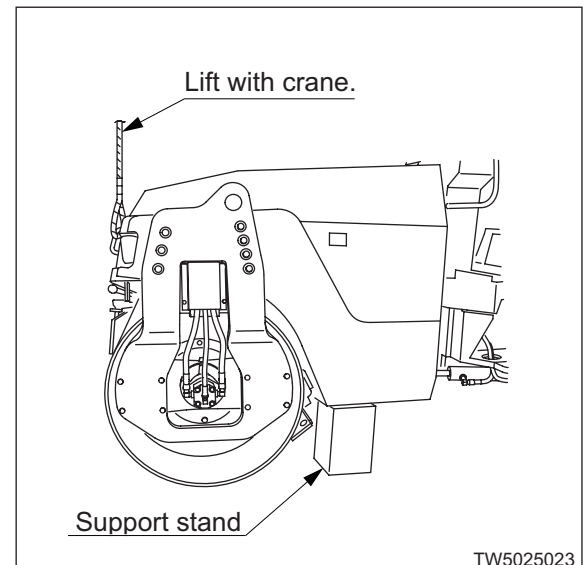
⚠ DANGER

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.

2) 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
SW354	: 1,470 kg (3,240 lbs.)	1,430 kg (3,155 lbs.)
TW354	: 1,470 kg (3,240 lbs.)	
TW504	: 3,510 kg (7,740 lbs.)	



⚠ 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.

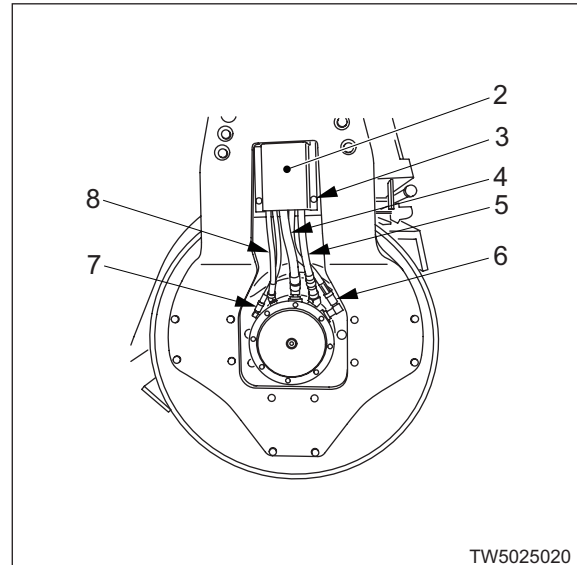
3) Disconnecting piping

3-1) Disconnecting propulsion motor piping

- Remove bolts (3).
- Remove cover (2).
- Disconnect hydraulic hoses (4), (5), (6), (7) and (8) connecting to propulsion motor.

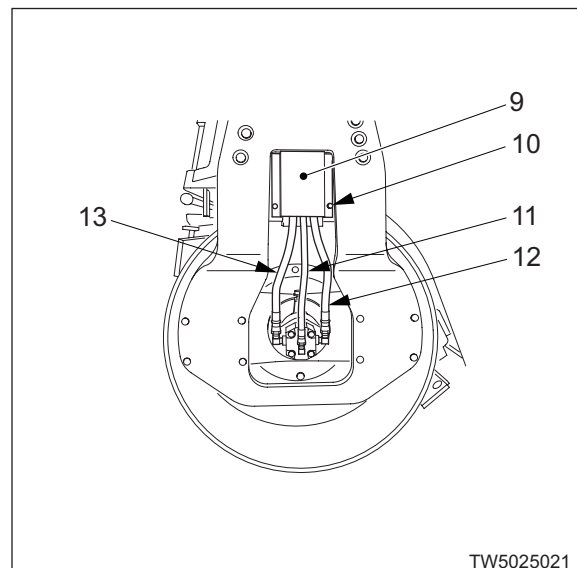
(NOTICE)

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



3-2) Disconnecting vibrator motor piping


- Remove bolts (10).
- Remove cover (9).
- Disconnect hydraulic hoses (11), (12), and (13) connecting to vibrator motor.

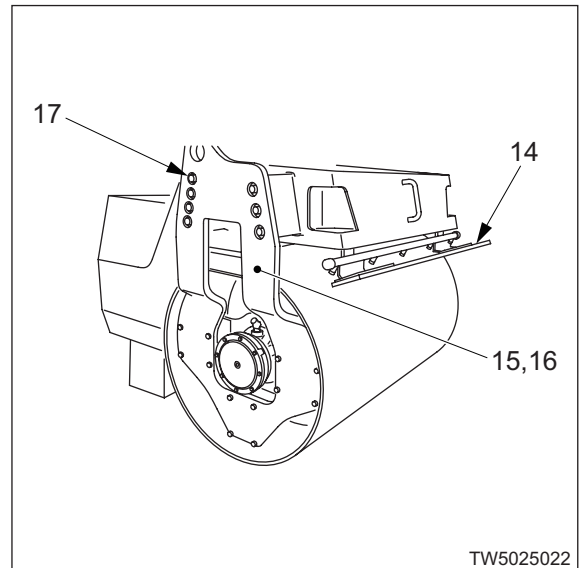


- 4) Removal of drum assembly
 - Flip up scraper blade (14).
 - Lift left plate (15), right plate (16) and hold them.
 - Remove bolts (17) (left and right sides).
 - Remove drum assembly together with plates (15), (16) from frame.
 - Remove rear drum assembly in same way. (SW354)


(NOTICE)

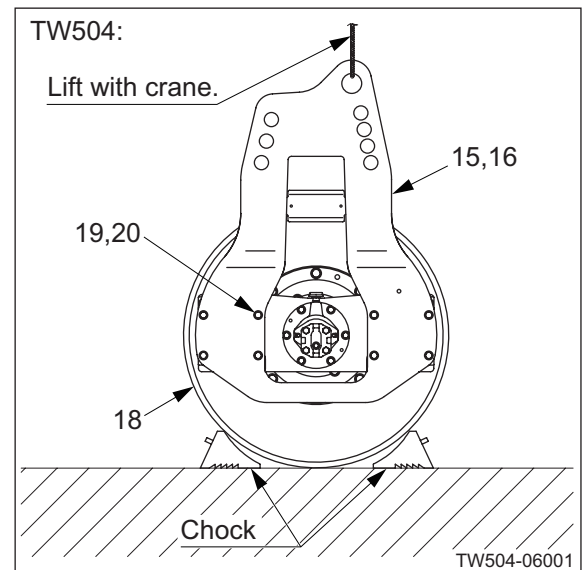
- **Damper mounting bolts and nuts must not be stressed during the removal.**

	k_g	Front drum assembly	Rear drum assembly
		SW354 : 710 kg (1,565 lbs.)	710 kg (1,565 lbs.)
		TW354 : 710 kg (1,565 lbs.)	
		TW504 : 1,060 kg (2,337 lbs.)	



- 5) Removal of plates (TW504)
 - Hold drum (18) with chocks.
 - Remove nuts (20) and bolts (19) (left and right sides).
 - Remove plate (15), (16).


	k_g	(15) Front left plate : 80 kg (176 lbs.)
		(16) Front right plate : 85 kg (187 lbs.)

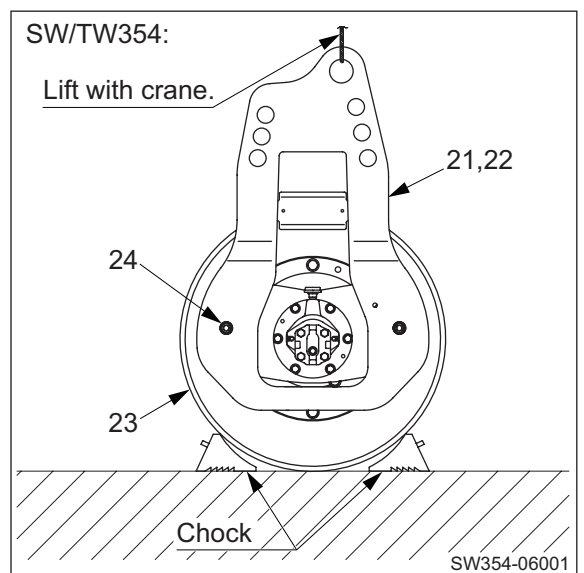


- 6) Removal of plates (SW/TW354)
 - Hold drum (23) with chocks.
 - Remove nuts (24) (left and right sides).
 - Remove plate (21), (22).

	k_g	(21) Front left plate : 60 kg (132 lbs.)
		(22) Front right plate : 65 kg (143 lbs.)

- Remove rear drum assembly in same way. (SW354)

	k_g	(22) Rear left plate : 65 kg (143 lbs.)
		(21) Rear right plate : 60 kg (132 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.



(17) Bolt M16×50 : 265 N·m (195 lbf-ft)

(19) Bolt M12×50 : 108 N·m (80 lbf-ft)

(24) Nut M16 : 196 N·m (145 lbf-ft)

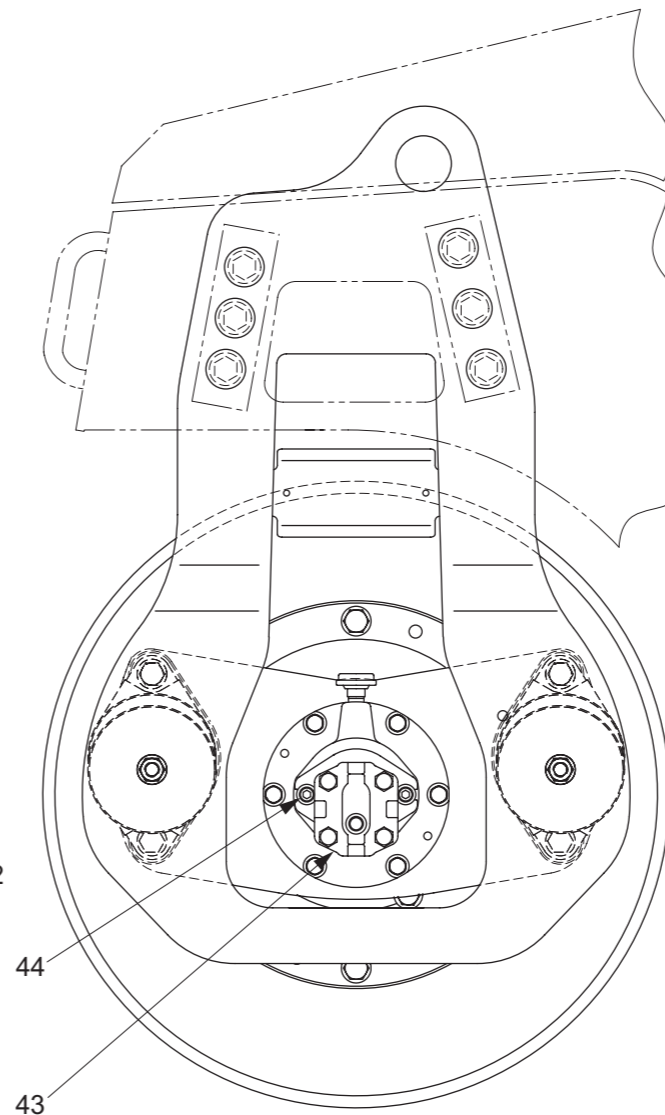
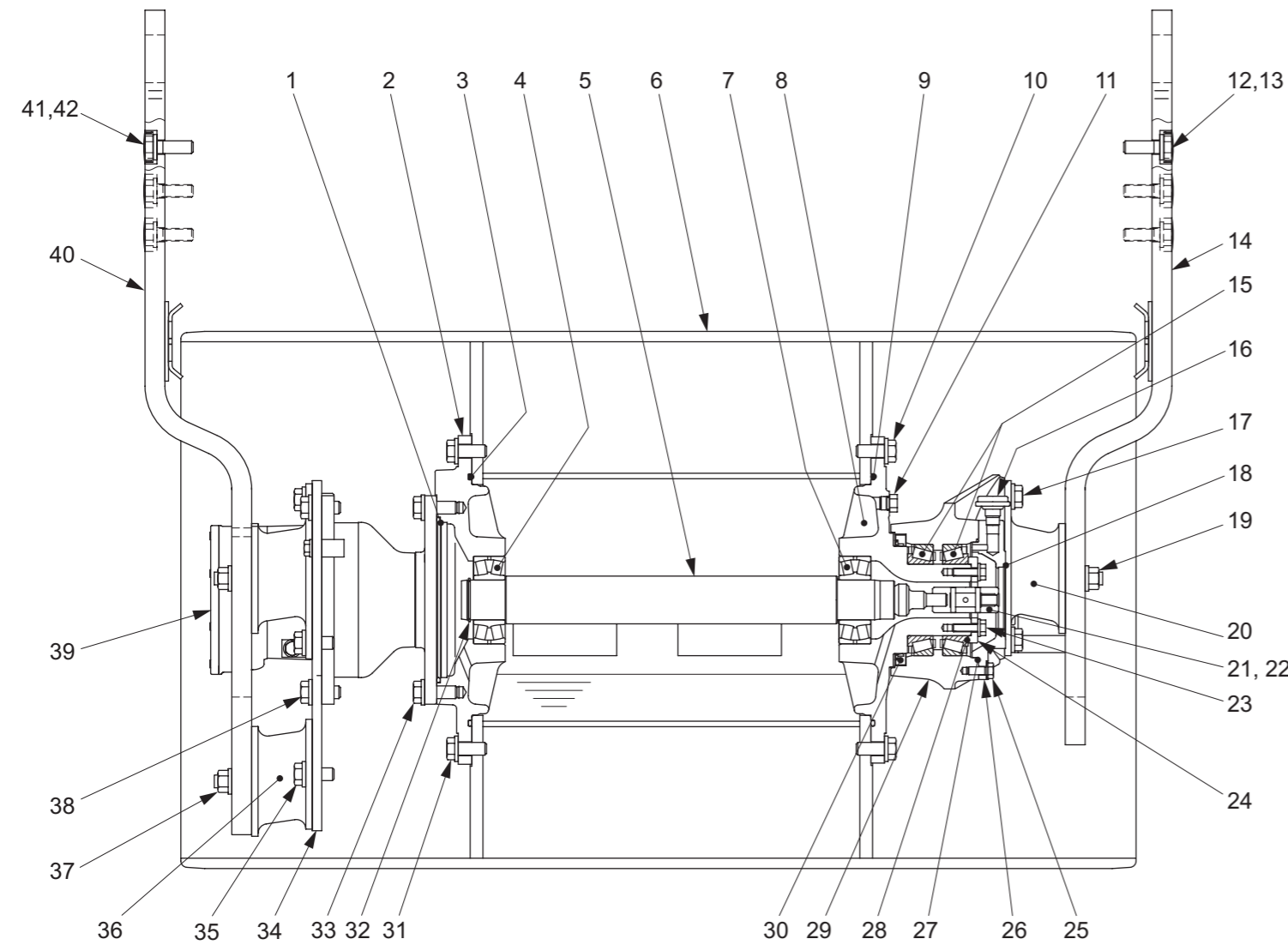
- 2) Upon installing vibratory drum, pay particular attention to items mentioned below.
 - Fill hydraulic oil tank to specified level to make up for any oil leakage.
 - Start engine and circulate oil through piping. Then check oil level again, ensuring that oil is at specified level.

(NOTICE)

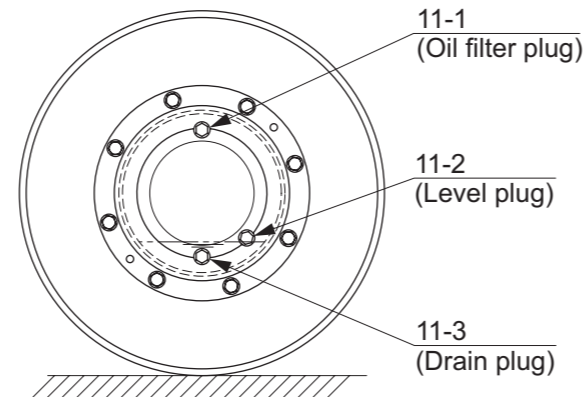
- **If the engine is run at high speed or the cylinder is operated to full stroke when the engine is started for the first time after the work is completed, the piston packing or other items may be damaged by air entering into the cylinder.**

3. VIBRATORY DRUM ASSEMBLY

3-1. Vibratory Drum Assembly (SW/TW354)

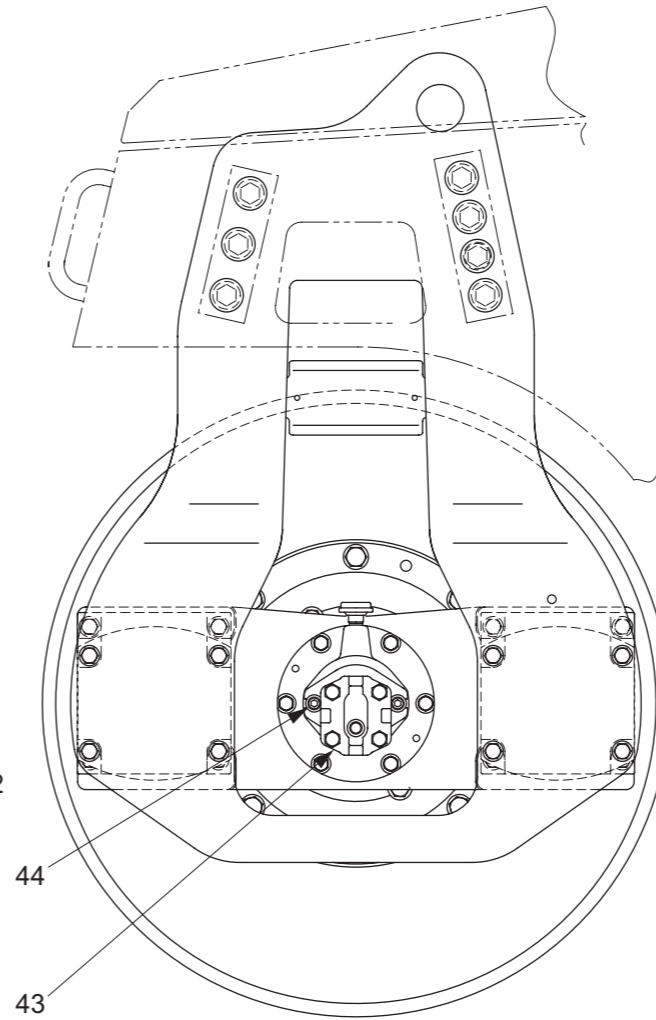
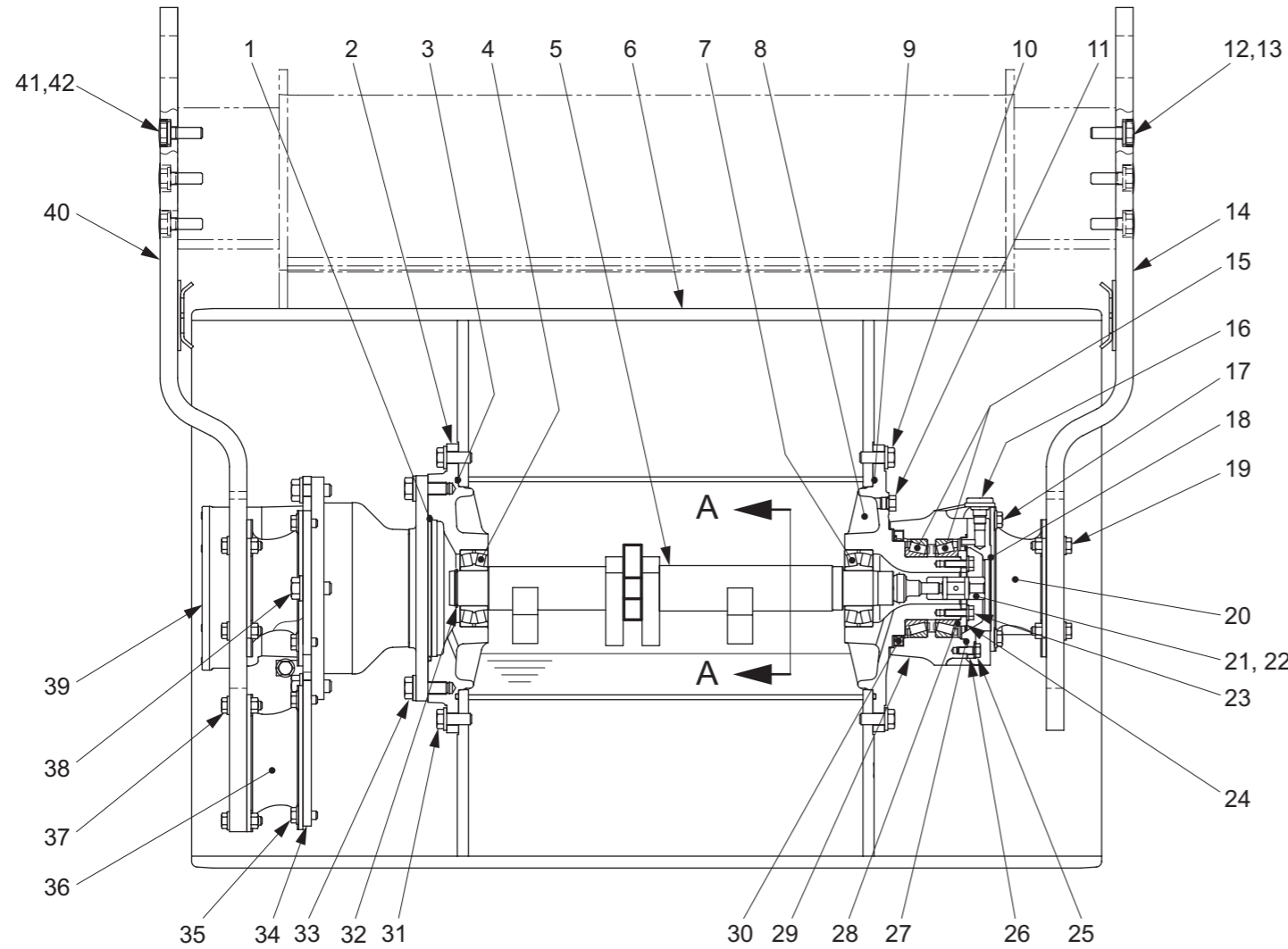


- (1) O-ring
- (2) Holder
- (3) O-ring
- (4) Vibrator bearing
- (5) Eccentric shaft
- (6) Drum
- (7) Vibrator bearing
- (8) Boss
- (9) O-ring
- (10) Bolt : M16×40
- (11) Plug
- (12) Bolt : M16×50
- (13) Plug
- (14) Plate
- (15) Roller bearing
- (16) Breather
- (17) Bolt : M16×40
- (18) O-ring
- (19) Nut : M16
- (20) Damper
- (21) Sleeve
- (22) Spring pin
- (23) Bolt : M10×35
- (24) Cover
- (25) Bolt : M10×25
- (26) Cover
- (27) O-ring
- (28) Shim
- (29) Disc
- (30) Oil seal
- (31) Bolt : M16×40
- (32) Snap ring
- (33) Bolt : M16×45
- (34) Disc
- (35) Bolt : M16×40
- (36) Damper
- (37) Nut : M16
- (38) Bolt : M16×40
- (39) Propulsion motor
- (40) Plate
- (41) Bolt : M16×50
- (42) Plug
- (43) Vibrator motor
- (44) Bolt : M10×35

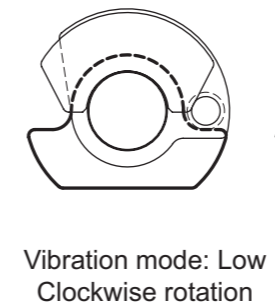
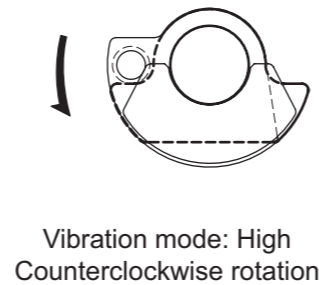
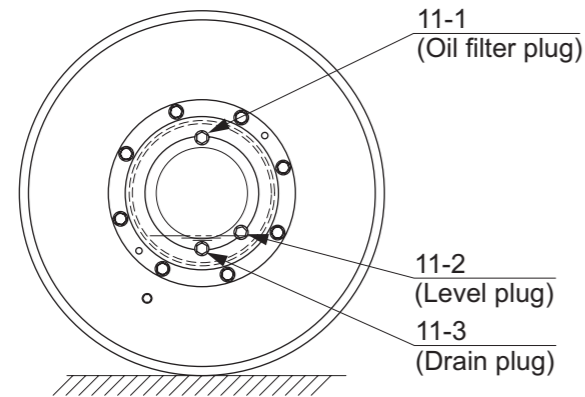


Vibrator motor side

3-2. Vibratory Drum Assembly (TW504)



- (1) O-ring
- (2) Holder
- (3) O-ring
- (4) Vibrator bearing
- (5) Eccentric shaft
- (6) Drum
- (7) Vibrator bearing
- (8) Boss
- (9) O-ring
- (10) Bolt : M16×40
- (11) Plug
- (12) Bolt : M16×50
- (13) Plug
- (14) Plate
- (15) Roller bearing
- (16) Breather
- (17) Bolt : M12×30
- (18) O-ring
- (19) Bolt : M12×50
- (20) Damper
- (21) Sleeve
- (22) Spring pin
- (23) Bolt : M10×35
- (24) Cover
- (25) Bolt : M10×25
- (26) Cover
- (27) O-ring
- (28) Shim
- (29) Disc
- (30) Oil seal
- (31) Bolt : M16×40
- (32) Snap ring
- (33) Bolt : M18×50
- (34) Disc
- (35) Bolt : M12×30
- (36) Damper
- (37) Bolt : M12×50
- (38) Bolt : M18×40
- (39) Propulsion motor
- (40) Plate
- (41) Bolt : M16×50
- (42) Plug
- (43) Vibrator motor
- (44) Bolt : M10×35



SECTION A-A


Vibrator motor side

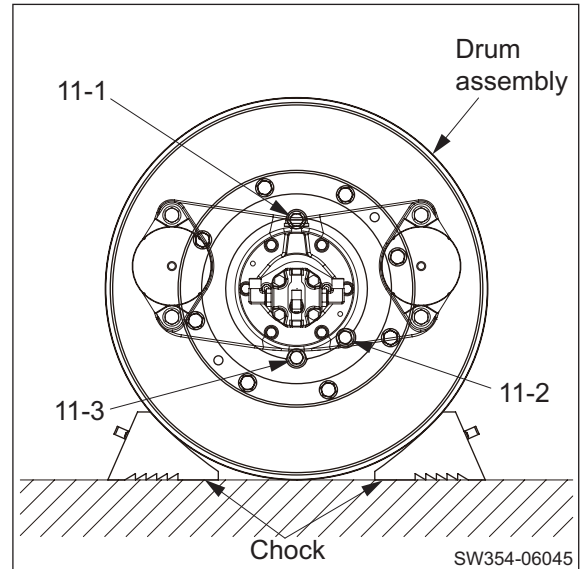
3-3. Disassembly and Reassembly of Vibratory Drum

- 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 6-007 (SW/TW354), page 6-008 (TW504).

3-3-1. Disassembly of vibratory drum

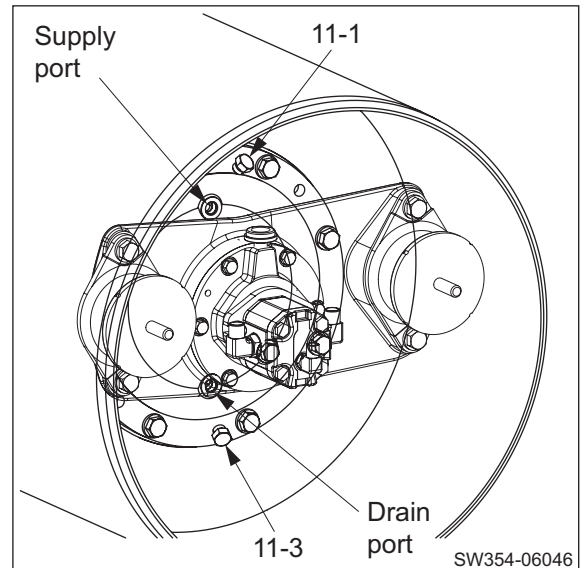
- 1) Lay drum assembly with plugs (11-1), (11-2), and (11-3) positioned as shown on the right.
 - Hold with chocks.

 k_g Drum assembly
 SW/TW354 : 590 kg (1,301 lbs.)
 TW504 : 890 kg (1,962 lbs.)



- 2) Remove plugs (11-1) and (11-3).


- Drain gear oil.
 - Quantity of gear oil
 - SW/TW354 : 5.0 L (1.3 gal.)
 - TW504 : 6.0 L (1.6 gal.)

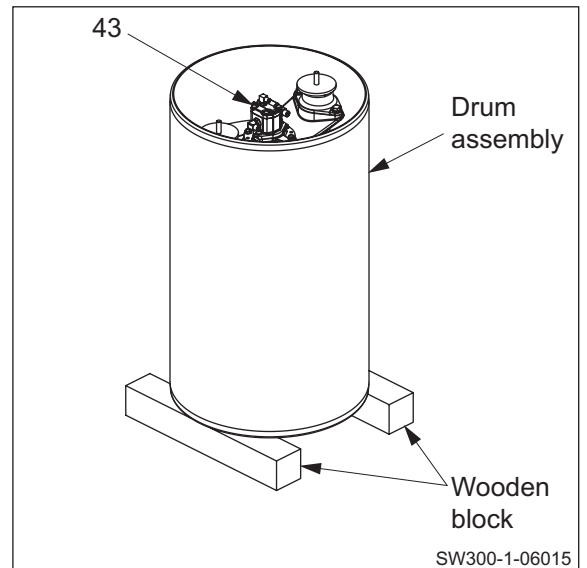


WARNING

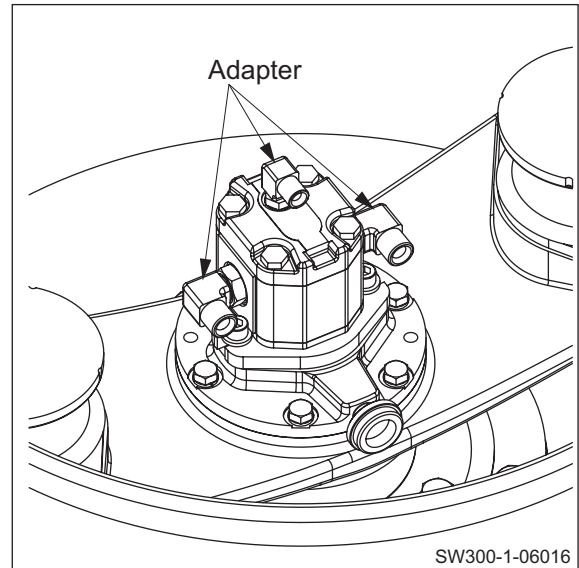
- When standing the vibratory drum, use wooden blocks of sufficient strength to securely support the drum.
- Carry out the work in an unstrained posture using a work stool or the like.

- 3) Stand drum assembly with its vibrator motor (43) side facing up.

 k_g Drum assembly
 SW/TW354 : 585 kg (1,290 lbs.)
 TW504 : 885 kg (1,951 lbs.)




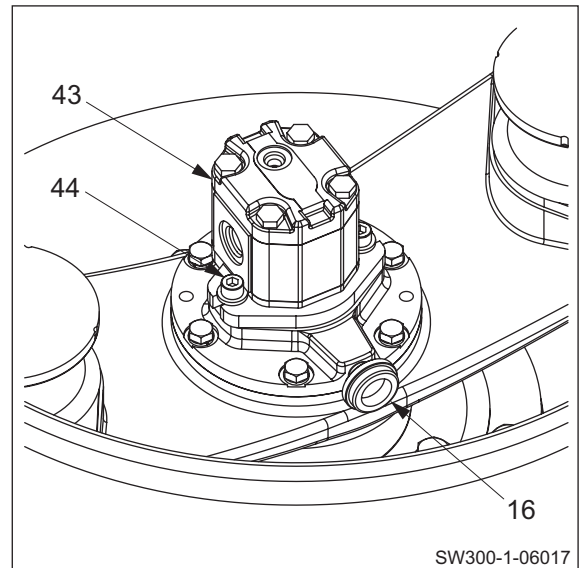
4) Remove adapters.



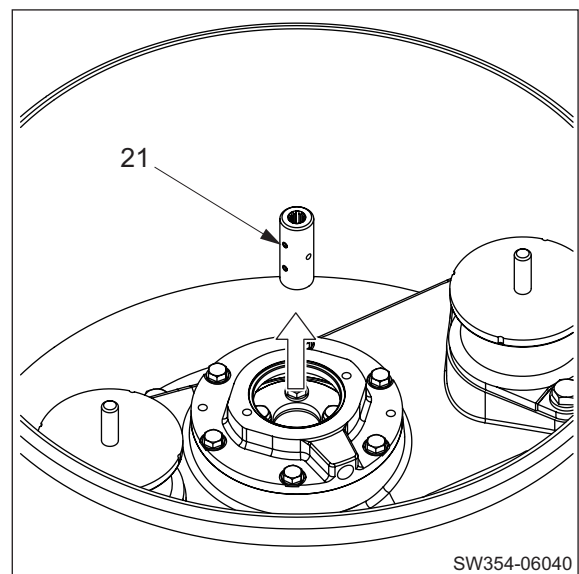
5) Remove bolts (44).

- Remove vibrator motor (43).
- Remove breather (16).

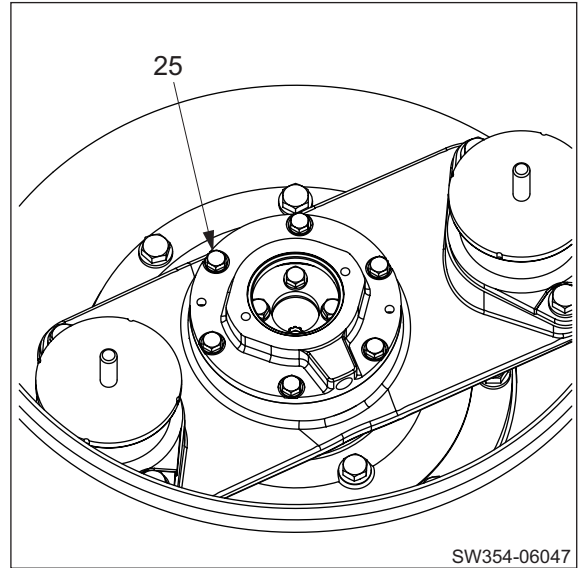
 (43) Vibrator motor : 5 kg (11 lbs.)



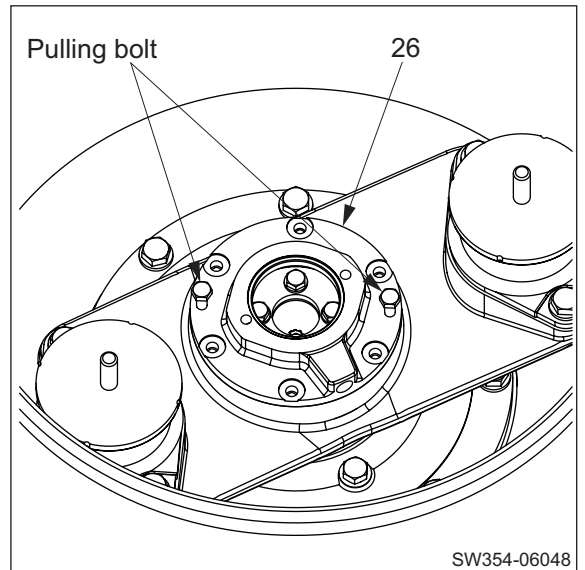
6) Remove sleeve (21).



7) Remove bolts (25).



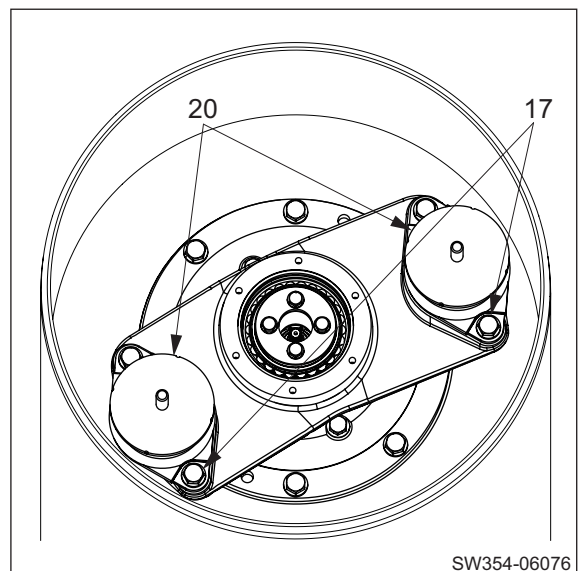
8) Lift cover (26) using two pulling bolts (M10×40).
 • Remove cover.



9) Remove bolts (17).

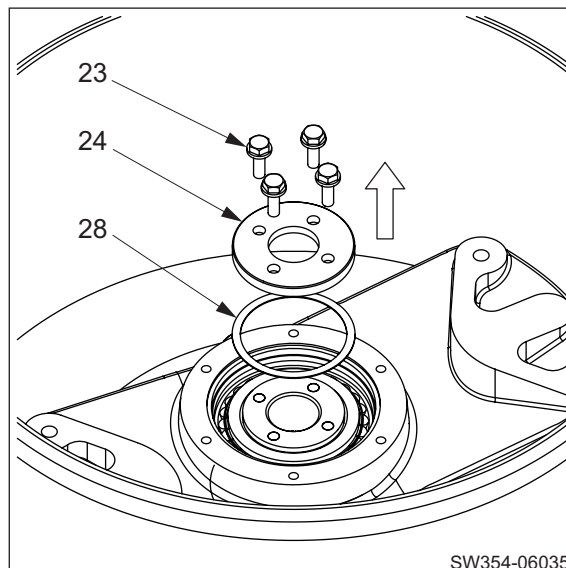
(17) Bolts
 SW/TW354 (four bolts)
 TW504 (eight bolts)

• Remove dampers (20).



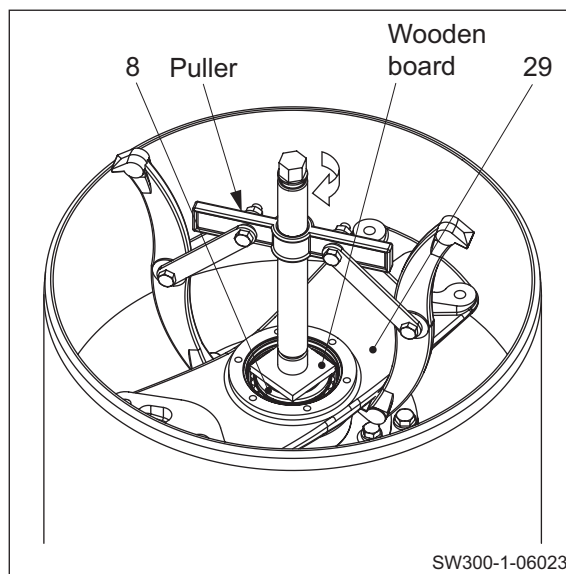
10) Remove bolts (23).

- Remove cover (24).
- Remove shim (28).



11) Put a piece of wooden board on end of boss (8).

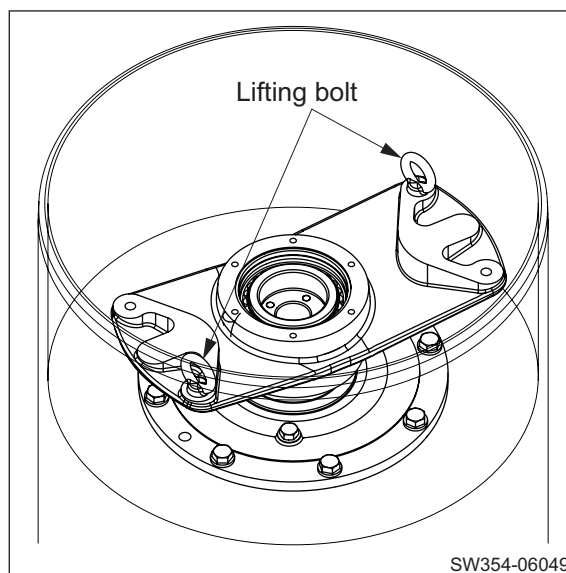
- Set a puller on disc (29).
- Remove disc subassembly with roller bearing from boss subassembly.




⚠ WARNING

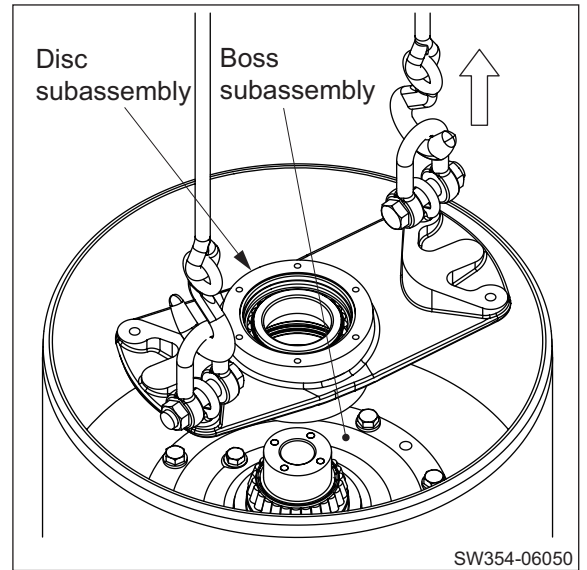
When installing lifting bolts, screw in the threads fully before using.

12) Install lifting bolts (SW/TW354 : M16, TW504 : M12) to disc subassembly.

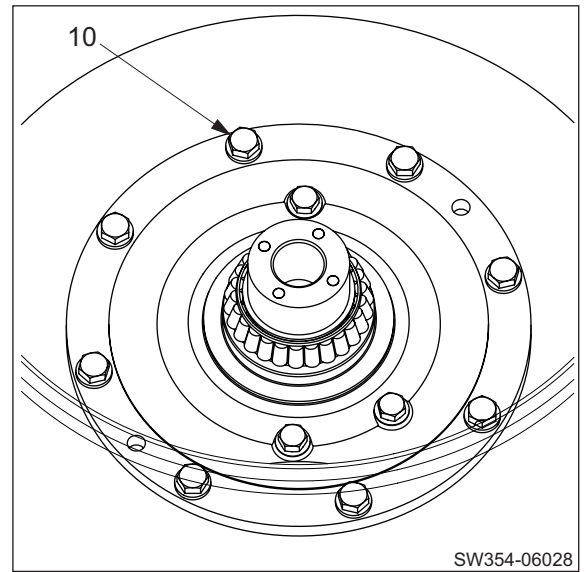


13) Lift disc subassembly with roller bearing from boss subassembly.

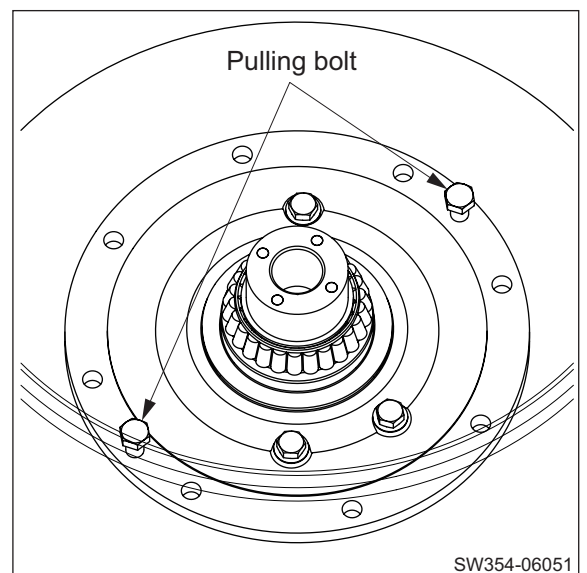
 Disc subassembly
 SW/TW354 : 35 kg (77 lbs.)
 TW504 : 45 kg (99 lbs.)



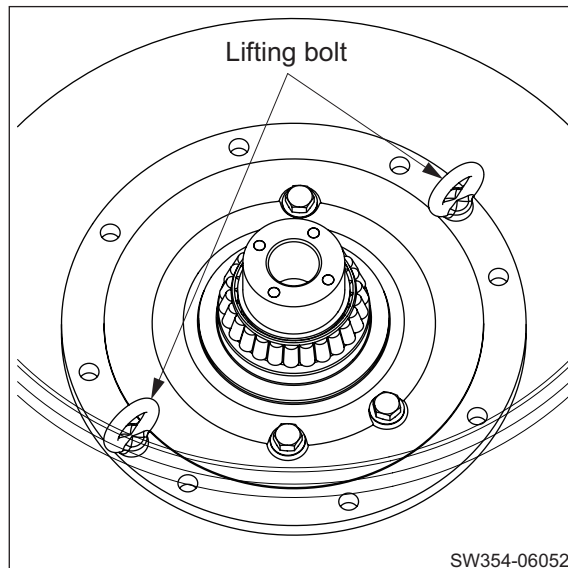
14) Remove bolts (10).



15) Lift boss subassembly using two pulling bolts (M16×40).

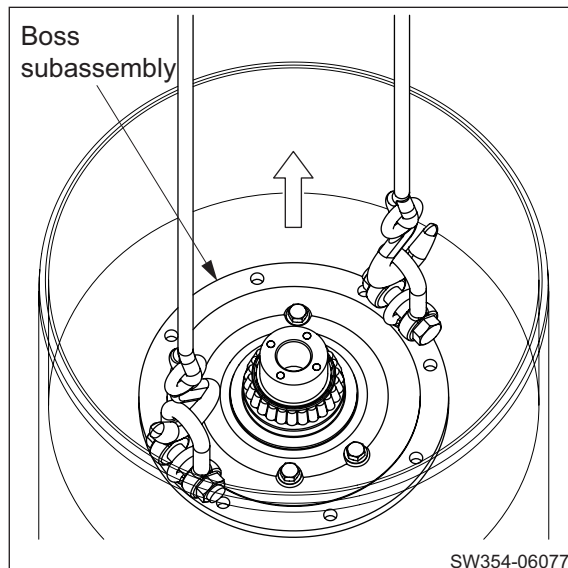


16) Install lifting bolts (M16) to boss subassembly.



17) Remove boss subassembly.


 Boss subassembly : 35 kg (77 lbs.)

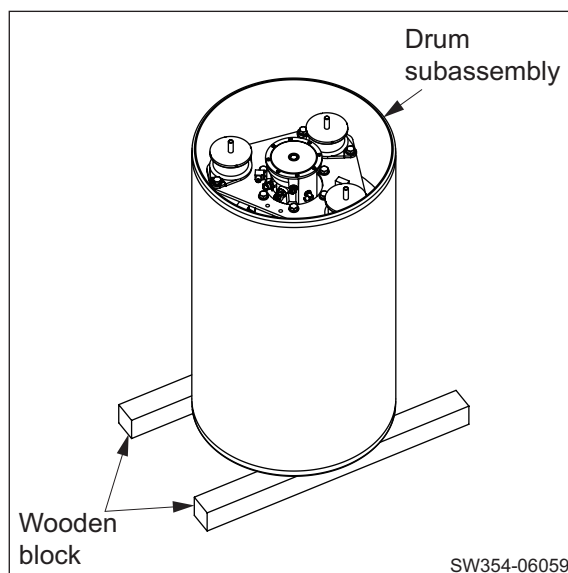


⚠ WARNING

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

18) Reverse drum subassembly.

 Drum subassembly
SW/TW354 : 500 kg (1,102 lbs.)
TW504 : 790 kg (1,742 lbs.)

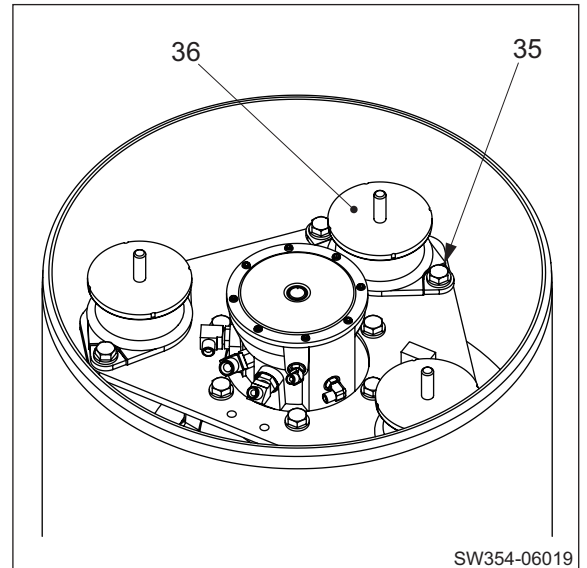


19) Remove dampers (36) and bolts (35).

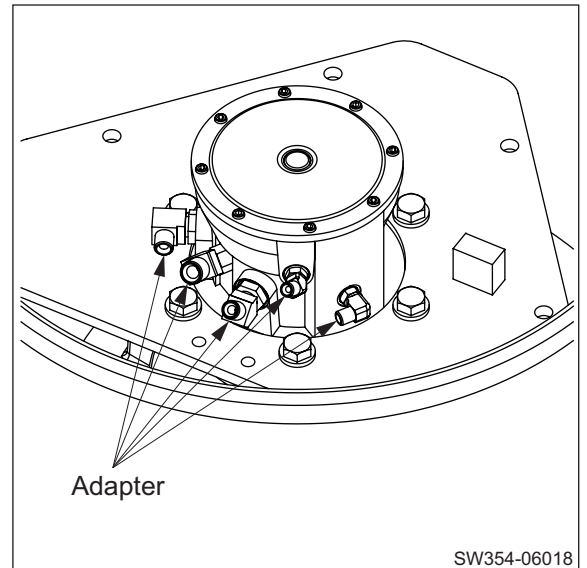
(35) Bolts

SW/TW354 (six bolts)

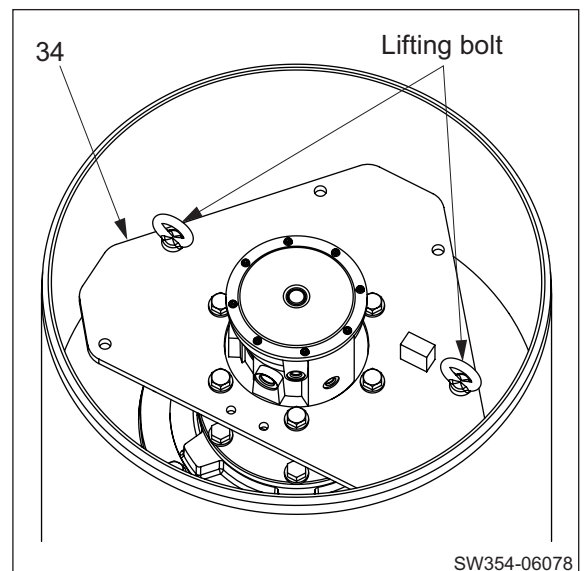
TW504 (twelve bolts)



20) Remove adapters.



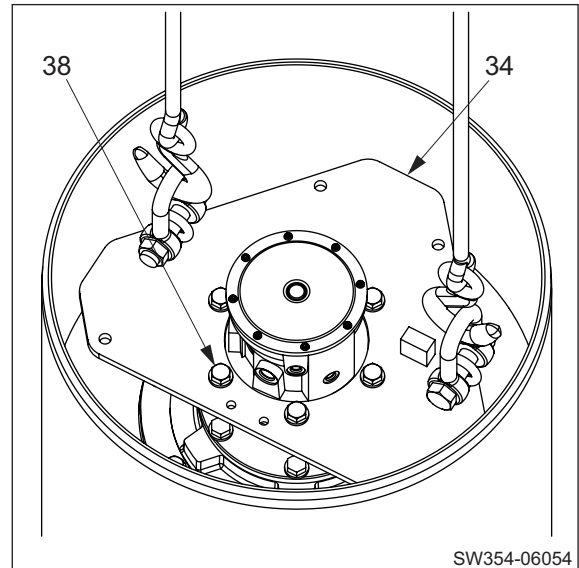
21) Install lifting bolts (SW/TW354 : M16, TW504 : M12) to disc (34).



VIBRATORY DRUM • REAR WHEEL

22) Lift disc (34).

- Remove bolts (38).



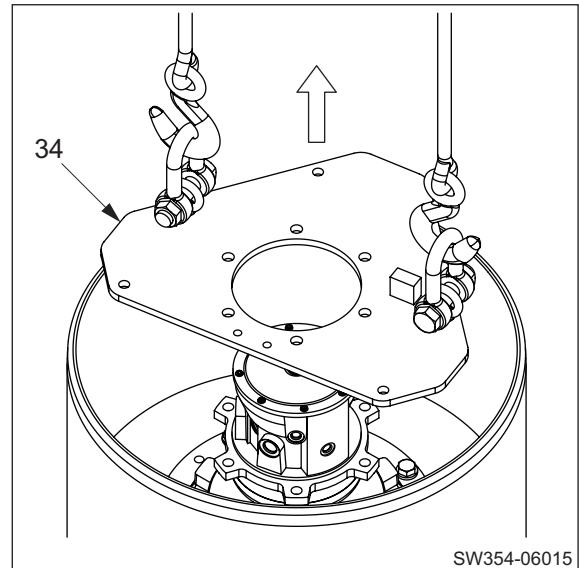
23) Remove disc (34).



(34) Disc

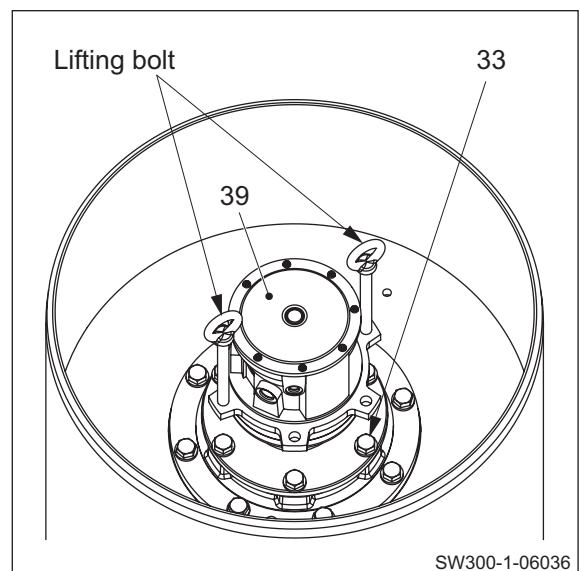
SW/TW354 : 15 kg (33 lbs.)

TW504 : 20 kg (44 lbs.)




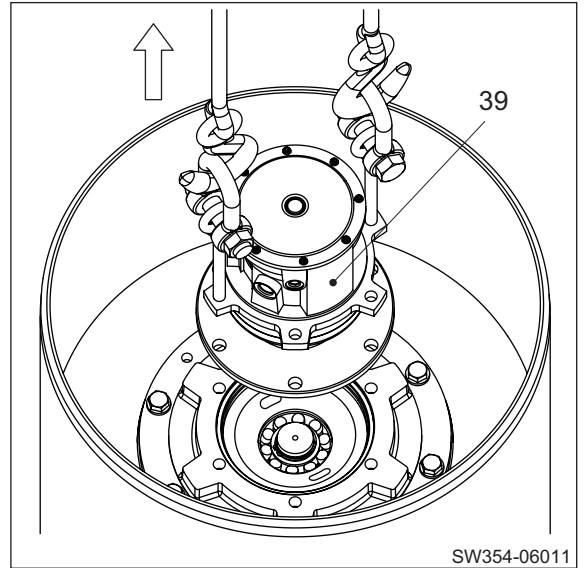
24) Install lifting bolts (SW/TW354 : M16, TW504 : M18) to propulsion motor (39).

- Remove bolts (33).

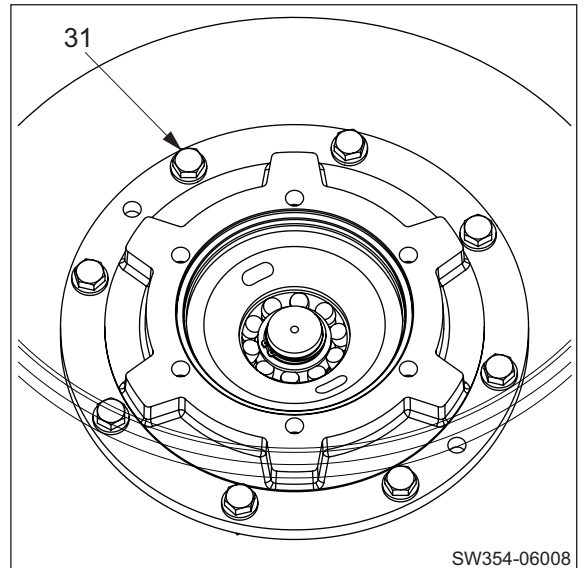


25) Remove propulsion motor (39).

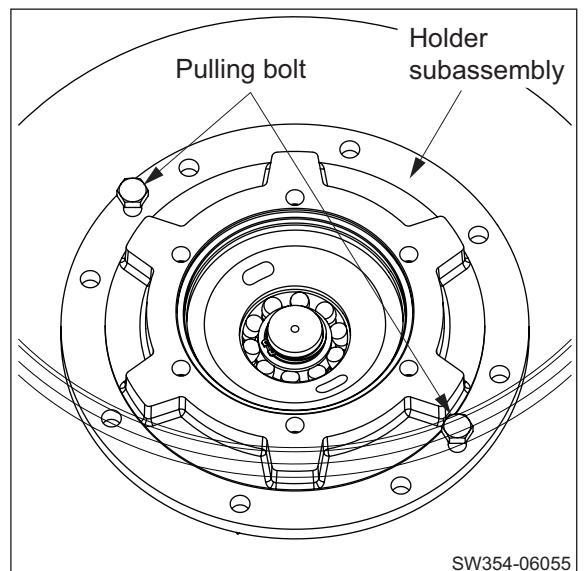
 (39) Propulsion motor
 SW/TW354 : 45 kg (99 lbs.)
 TW504 : 85 kg (187 lbs.)



26) Remove bolts (31).

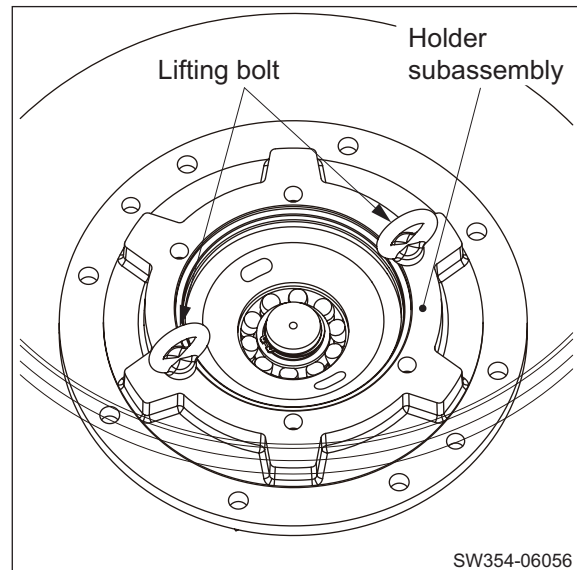


27) Lift holder subassembly using two pulling bolts (M16×40).



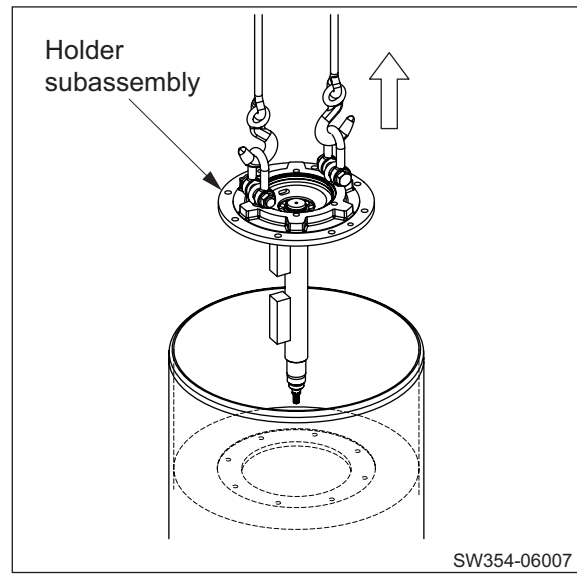
VIBRATORY DRUM • REAR WHEEL

- 28) Install lifting bolts (SW/TW354 : M16, TW504 : M18) to holder subassembly.

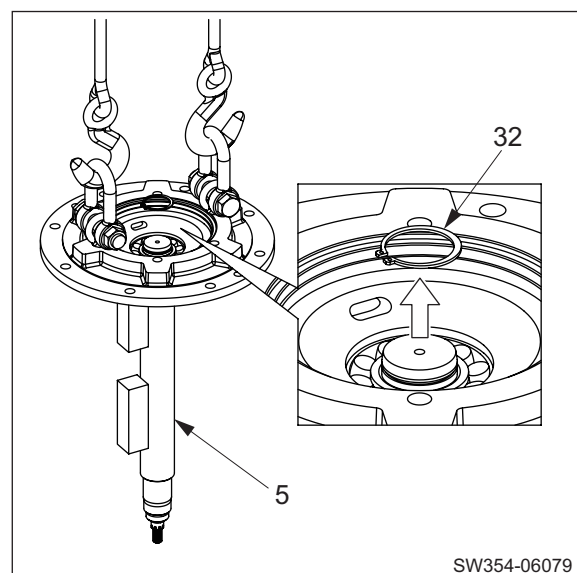


- 29) Remove holder subassembly.


3 kg Holder subassembly
SW/TW354 : 50 kg (110 lbs.)
TW504 : 60 kg (132 lbs.)

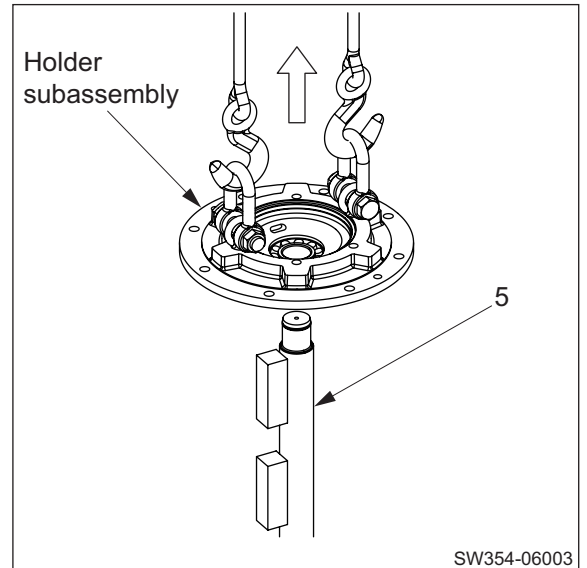


- 30) Remove snap ring (32) while supporting eccentric shaft (5).

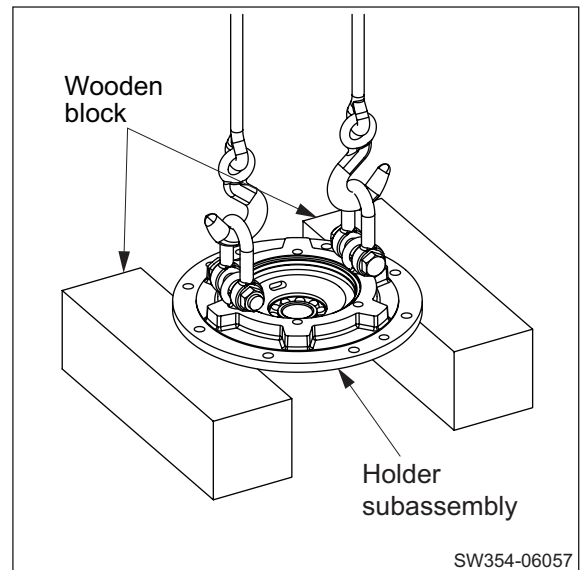


31) Remove holder subassembly.

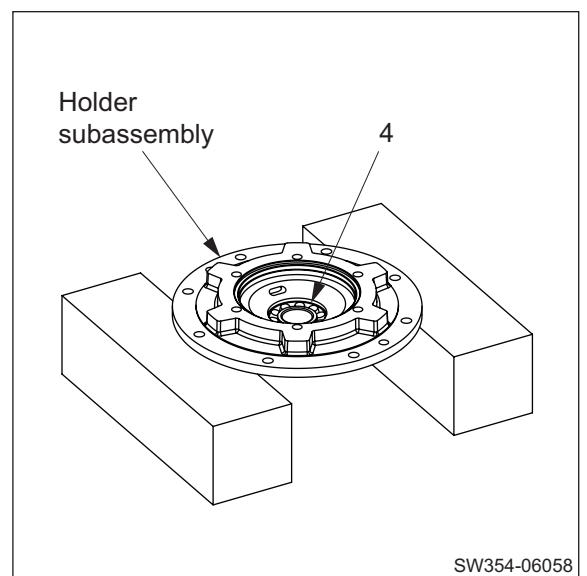
 Holder subassembly : 30 kg (66 lbs.)



32) Put holder subassembly on wooden blocks.



33) Remove vibrator bearing (4).



3-3-2. 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 drum (6) with its propulsion motor side facing up.

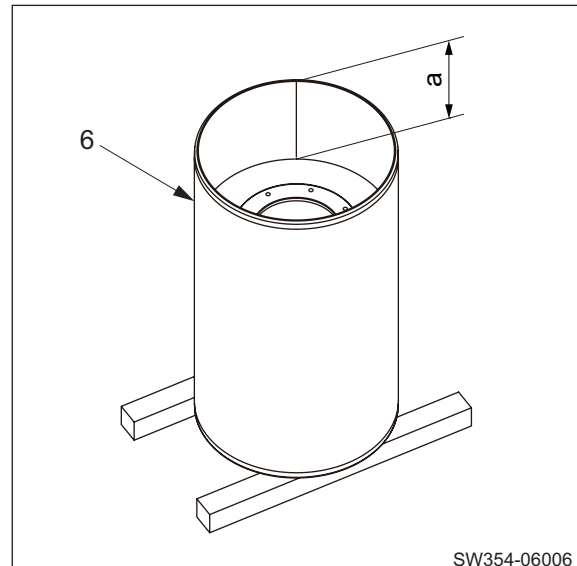
\mathfrak{J}_{kg} (6) Drum

SW/TW354 : 380 kg (838 lbs.)

TW504 : 605 kg (1,334 lbs.)

(NOTICE)

- Propulsion motor side dimension “a”
SW/TW354 : 363.5 mm (14.3 in.)
TW504 : 379.5 mm (14.9 in.)

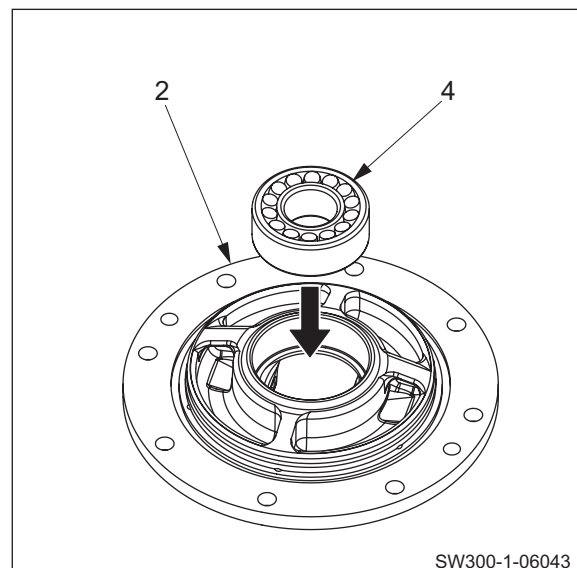


- 2) Reassembly of holder subassembly


- Apply a coat of gear oil to holder (2) at where bearing will be press-fitted.
- Drive in vibrator bearing (4)

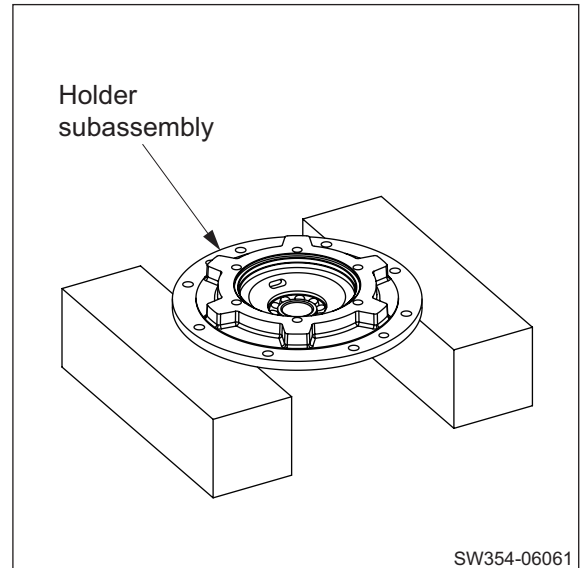
(NOTICE)

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



3) Reverse holder subassembly.

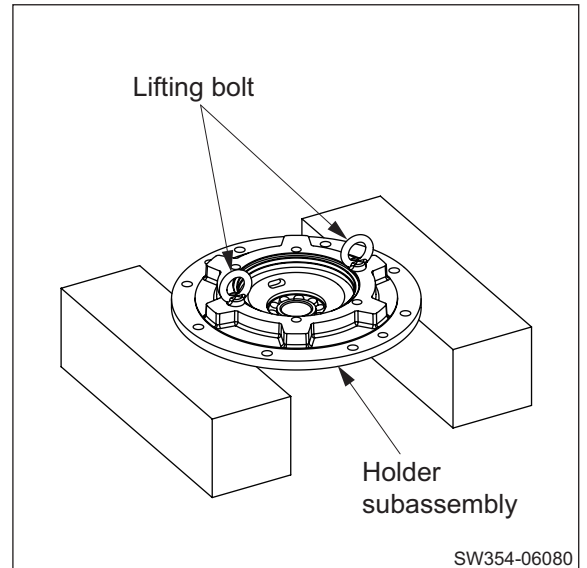
 Holder subassembly : 30 kg (66 lbs.)




⚠ WARNING

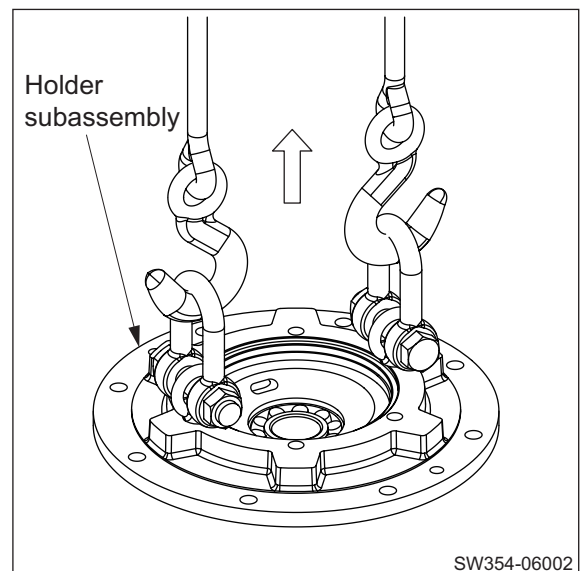
When installing lifting bolts, screw in the threads fully before using.

4) Install lifting bolts (SW/TW354 : M16, TW504 : M18) to holder subassembly.

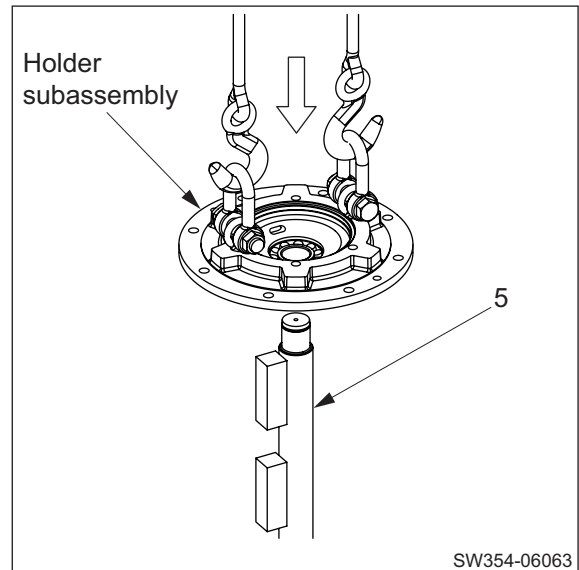


5) Lift holder subassembly.

 Holder subassembly : 30 kg (66 lbs.)



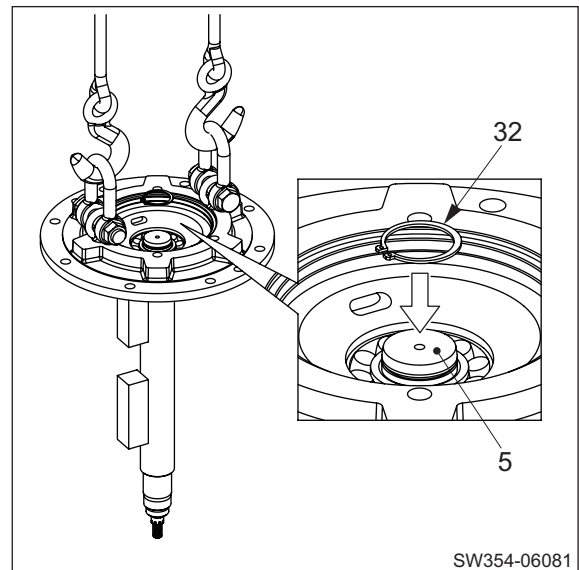
6) Install eccentric shaft (5) to holder subassembly.



7) Hold eccentric shaft (5) with snap ring (32).

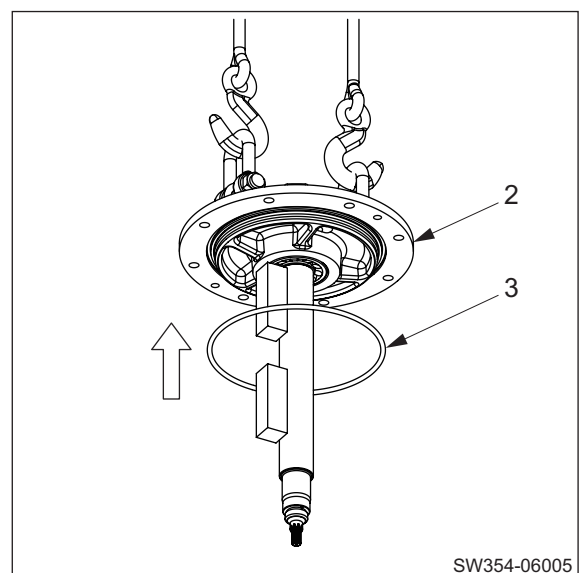
(NOTICE)

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




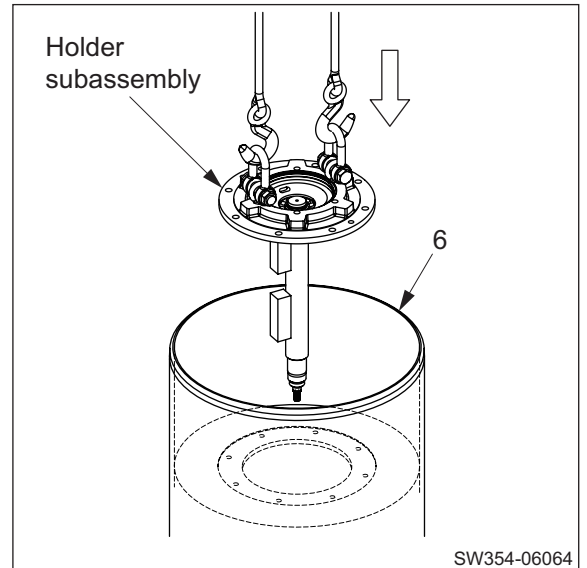
8) Apply grease to O-ring (3).

- Install O-ring to holder (2).




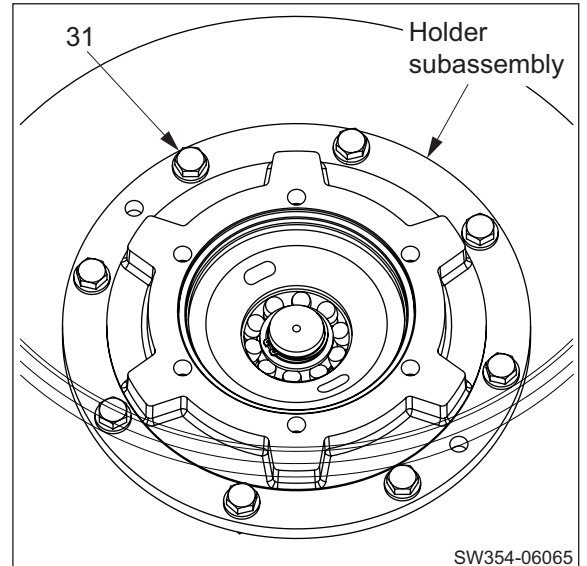
9) Lower holder subassembly on mounting surface of drum (6).

 Holder subassembly
 SW/TW354 : 50 kg (110 lbs.)
 TW504 : 60 kg (132 lbs.)

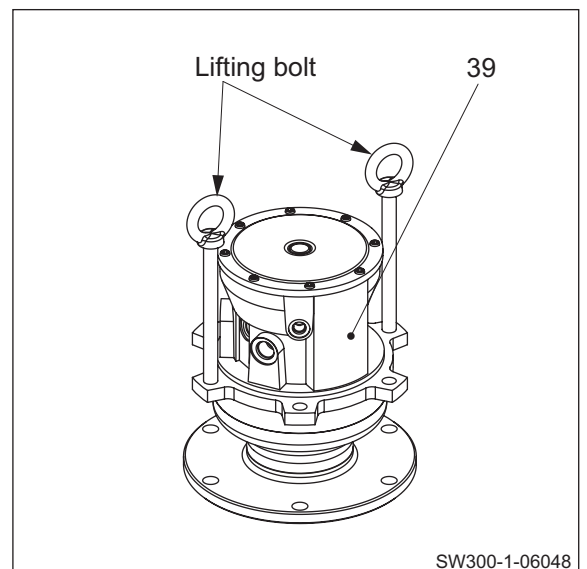


10) Secure holder subassembly with eight bolts (31) and washers.

 N·m (31) Bolts M16×40 : 265 N·m (195 lbf·ft)



11) Install lifting bolts (SW/TW354 : M16, TW504 : M18) to propulsion motor (39).



12) Lift propulsion motor (39).

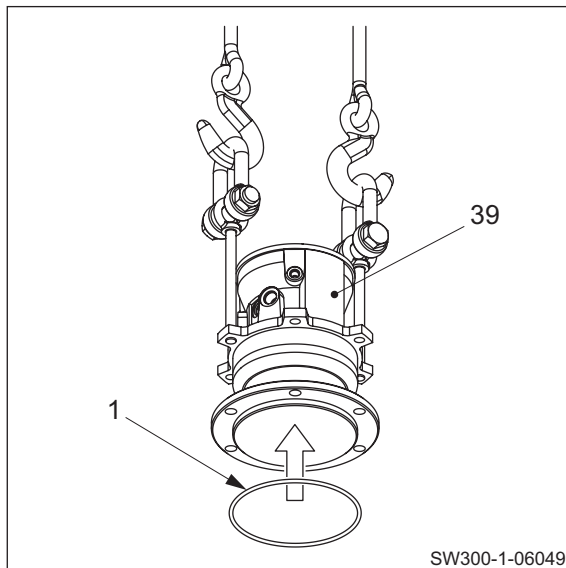


(39) Propulsion motor

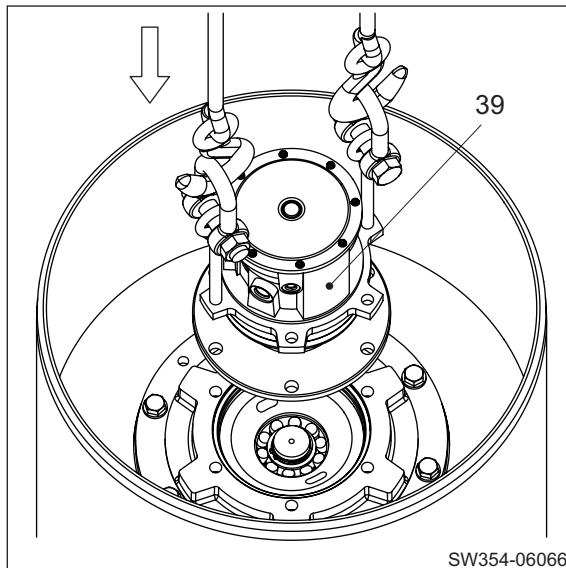
SW/TW354 : 45 kg (99 lbs.)

TW504 : 85 kg (187 lbs.)

- Apply grease to O-ring (1).
- Install O-ring to propulsion motor.



13) Lower propulsion motor (39) on mounting surface of holder subassembly.



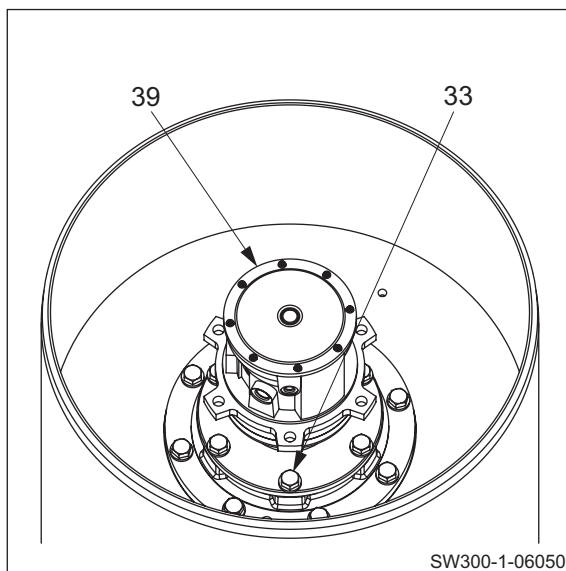
14) Secure propulsion motor (39) with six bolts (33) and washers.



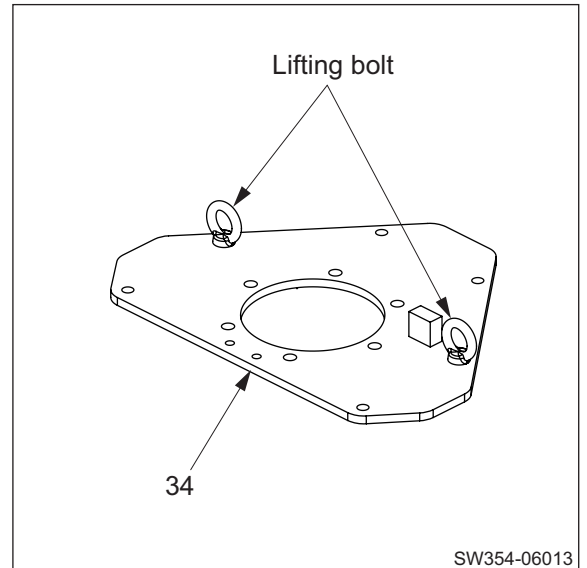
(33) Bolts

SW/TW354 : M16×45 : 265 N·m (195 lbf·ft)


TW504 : M18×50 : 343 N·m (253 lbf·ft)

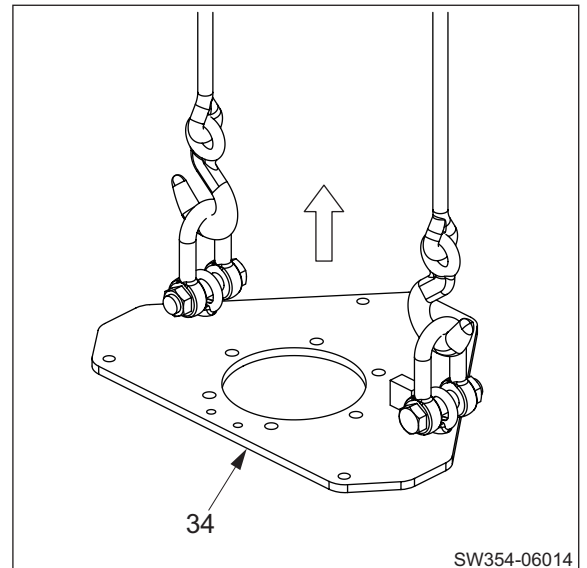


15) Install lifting bolts (SW/TW354 : M16, TW504 : M12) to disc (34).

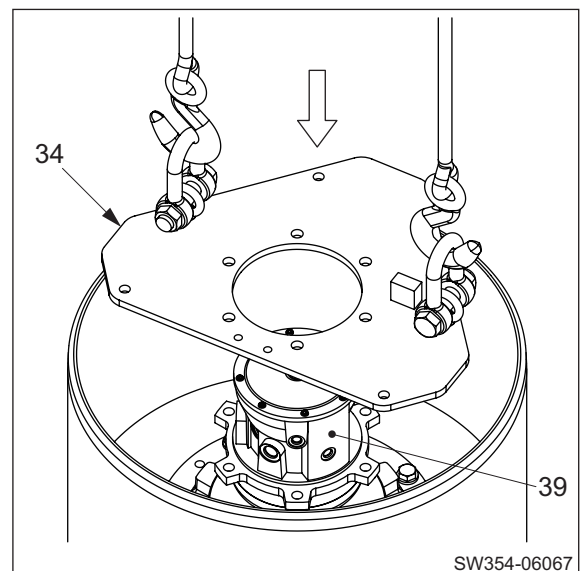


16) Lift disc (34).

 (34) Disc
 SW/TW354 : 15 kg (33 lbs.)
 TW504 : 20 kg (44 lbs.)

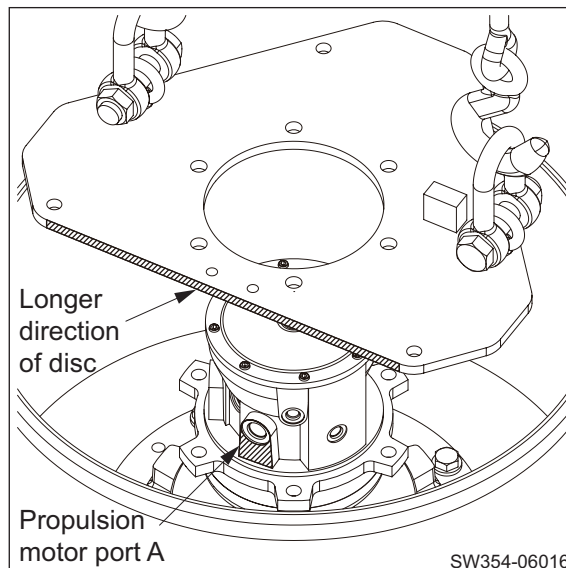


17) Lower disc (34) on mounting surface of propulsion motor (39).



(NOTICE)

- The longer direction of the disc must face the same direction as the propulsion motor port A.



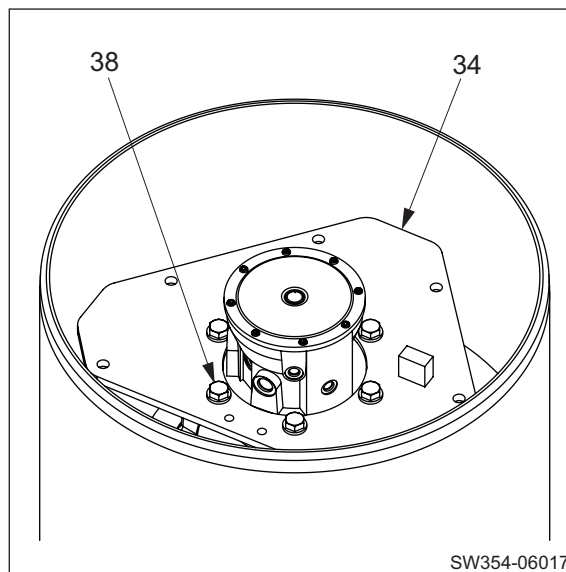
18) Secure disc (34) with six bolts (38) and washers.



(38) Bolts

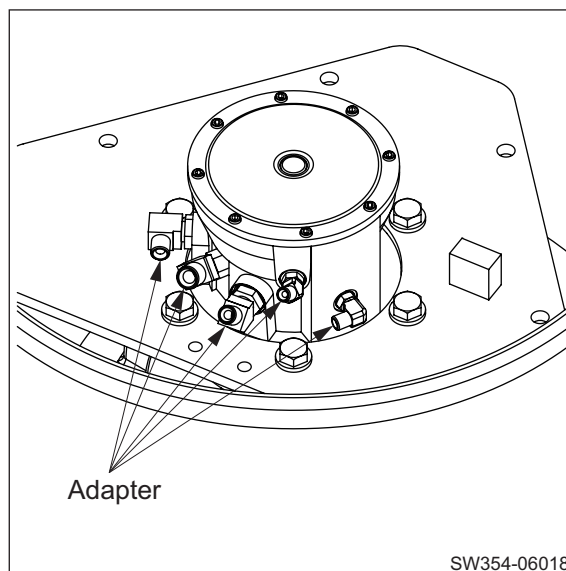
SW/TW354 : M16×40 : 265 N·m (195 lbf·ft)

TW504 : M18×40 : 343 N·m (253 lbf·ft)



19) Apply grease to O-rings for adapters.

- Install adapters.



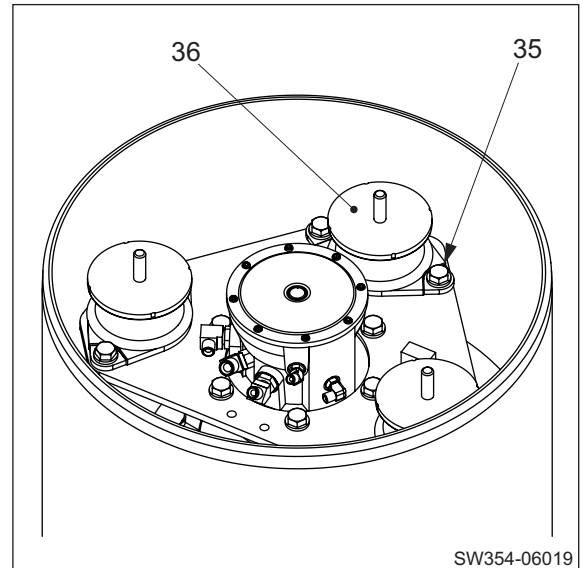
20) Secure three dampers (36) to disc subassembly with six / twelve bolts (35) and washers.



N•m (35) Bolts

SW/TW354 (six bolts) : M16×40 : 265 N•m (195 lbf-ft)

TW504 (twelve bolts) : M12×30 : 108 N•m (80 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.

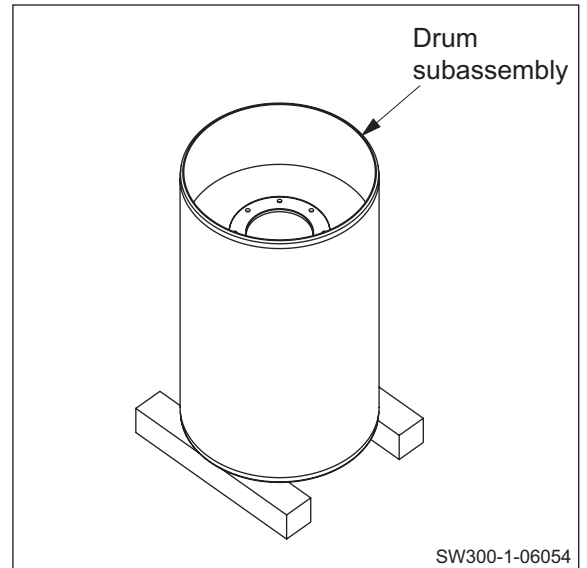
21) Reverse drum subassembly.



kg Drum subassembly

SW/TW354 : 500 kg (1,102 lbs.)

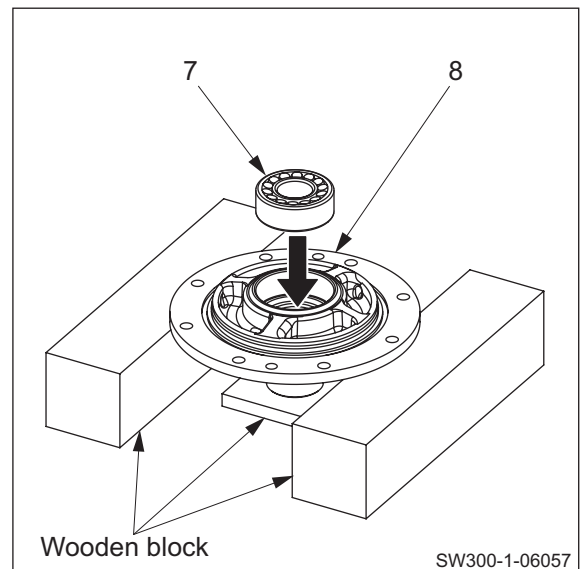
TW504 : 790 kg (1,742 lbs.)




22) Reassembly of boss subassembly

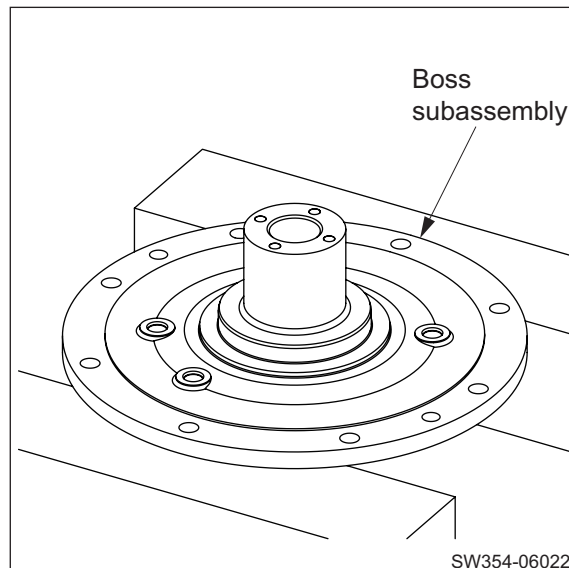
22-1) Apply a coat of gear oil to boss (8) at where bearing will be press-fitted.

- Drive in vibrator bearing (7).



22-2) Reverse boss subassembly.

 Boss subassembly : 30 kg (66 lbs.)

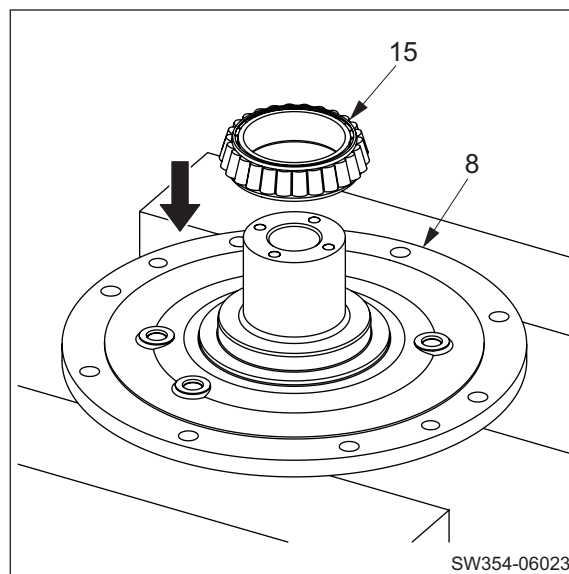


WARNING

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

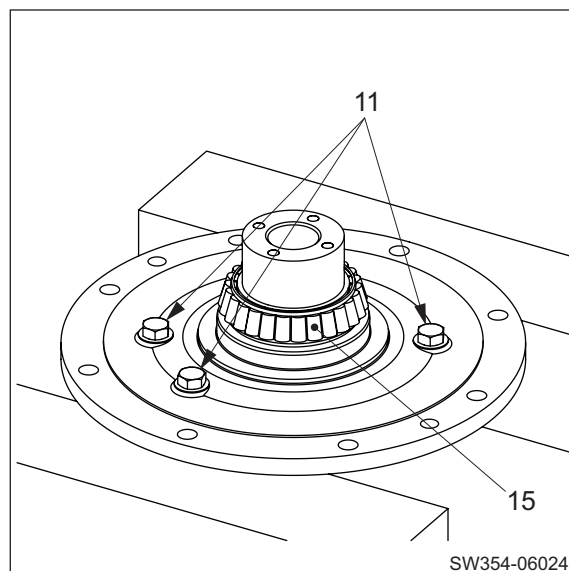
22-3) Heat up roller bearing (15) inner race by using a ring heater or the like.

- Apply a coat of gear oil to boss (8) at where bearing inner race will be press-fitted.
- Drive in heated roller bearing inner race.

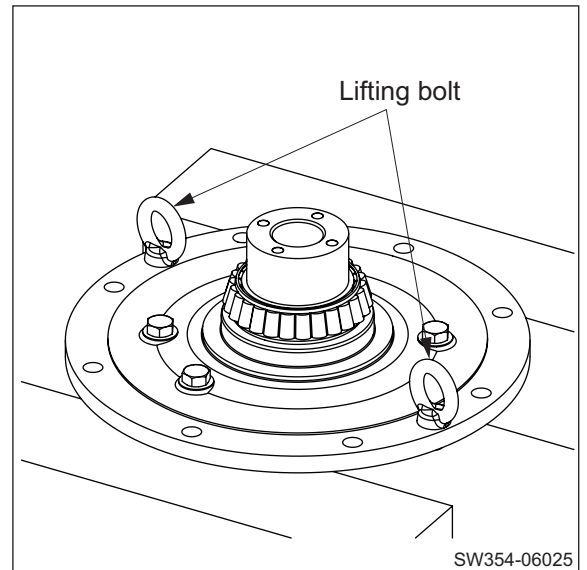


22-4) Apply grease to O-rings for plugs (11).

- Install plugs.
- Apply sufficient amount of lithium-based grease to rollers of roller bearing (15) inner race.



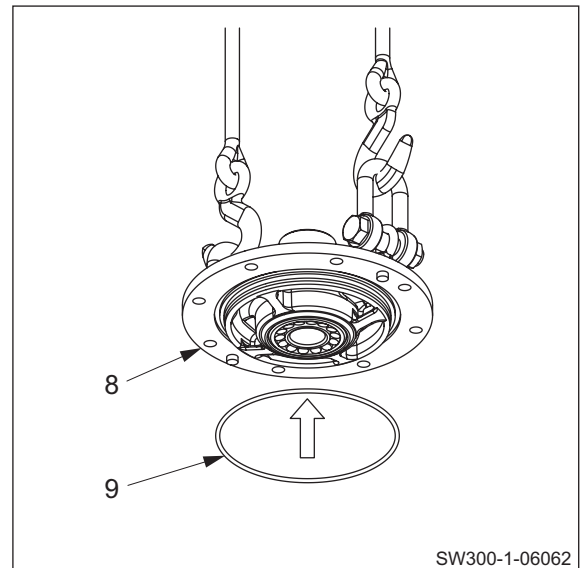
23) Install lifting bolts (M16) to boss subassembly.



24) Lift boss subassembly.

\mathcal{J}_{kg} Boss subassembly : 35 kg (77 lbs.)

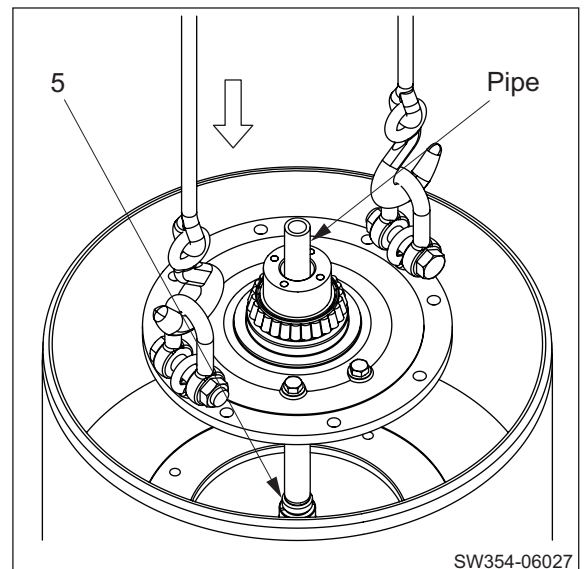
- Apply grease to O-ring (9).
- Install O-ring to boss (8).



25) Lower boss subassembly on mounting surface of drum subassembly slowly.

(NOTICE)

- **Support the eccentric shaft (5) with a pipe or the like, to prevents tilting of vibrator bearing inner race during installation.**

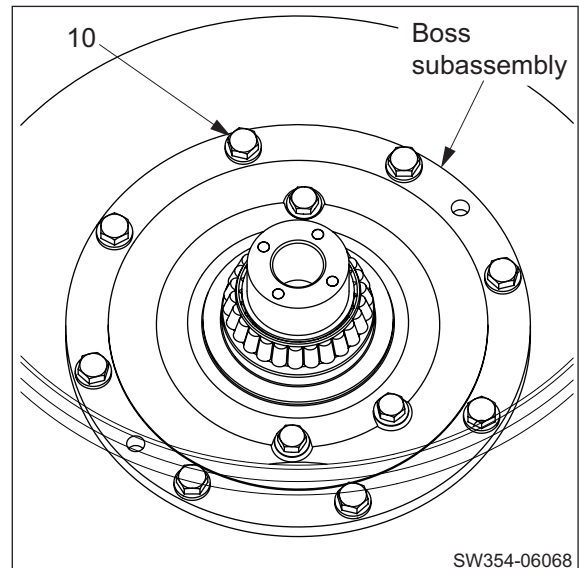


VIBRATORY DRUM • REAR WHEEL

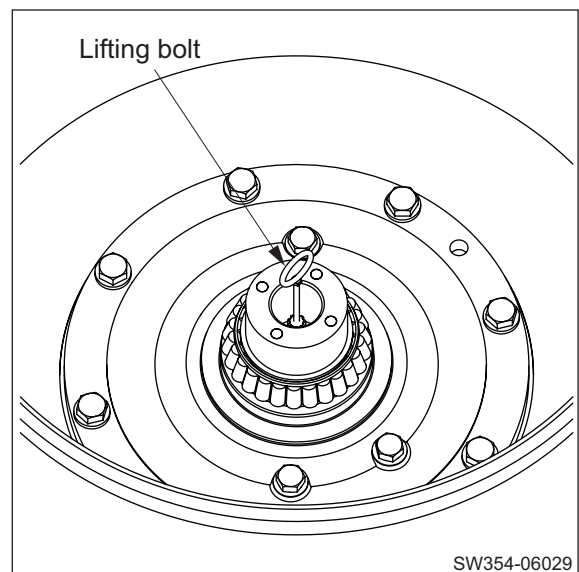
26) Secure boss subassembly with eight bolts (10) and washers.



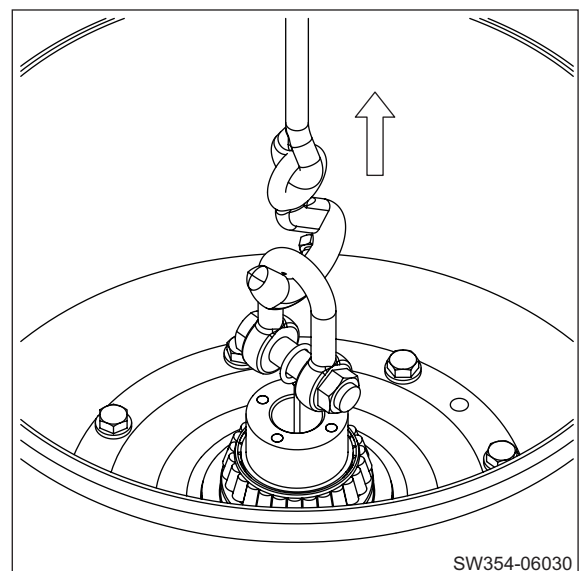
(10) Bolts M16×40 : 265 N·m (195 lbf·ft)



27) Install lifting bolts (M5) to end of eccentric shaft (5).

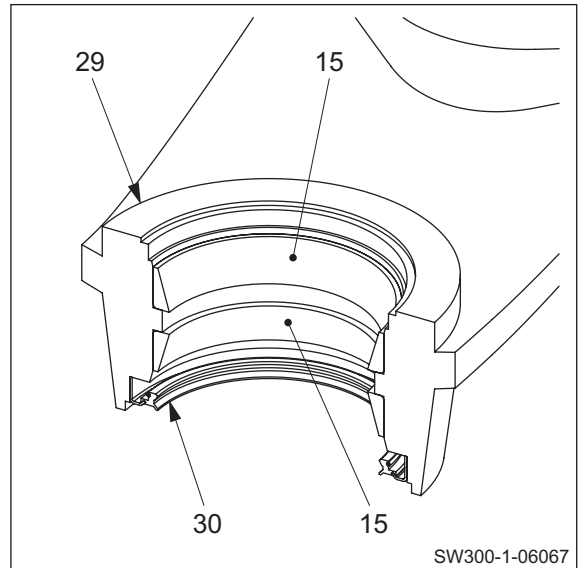


28) Slowly lift eccentric shaft (5) with a crane and check that there is an axial play of 2 to 4 mm (0.08 to 0.16 in.).

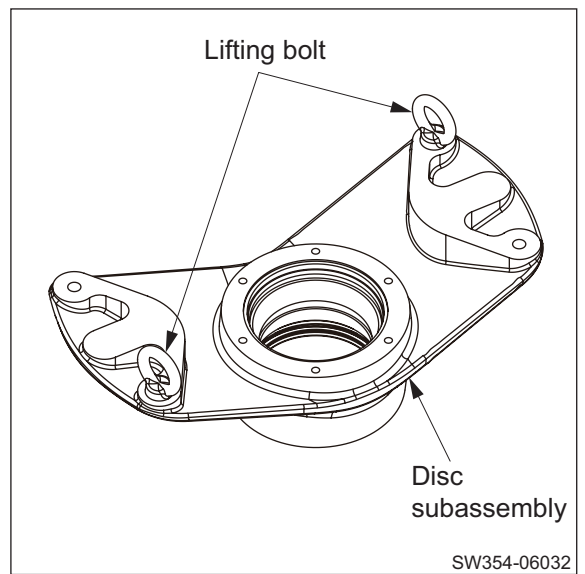


29) Apply a coat of gear oil to disc (29) at where bearing outer races will be press-fitted.


- Drive in roller bearings (15) outer races into disc.
- Apply liquid packing to periphery of oil seal (30).
- Drive in oil seal.
- Apply grease to lip of oil seal.

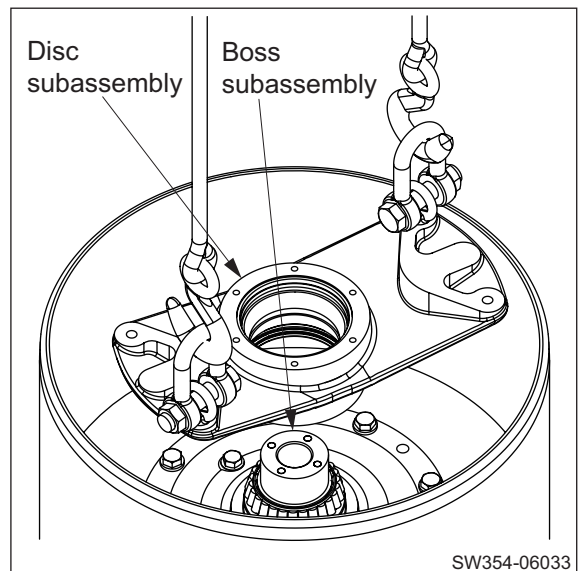


30) Install lifting bolts (SW/TW354 : M16, TW504 : M12) to disc subassembly.



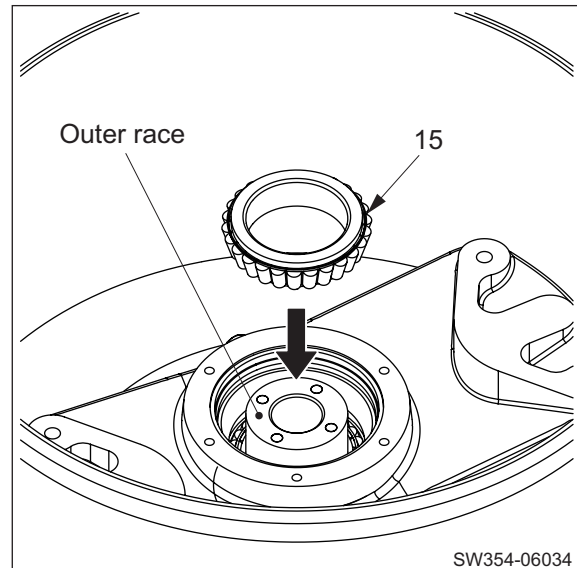
31) Lower disc subassembly on mounting surface of boss subassembly.

 Disc subassembly : 35 kg (77 lbs.)



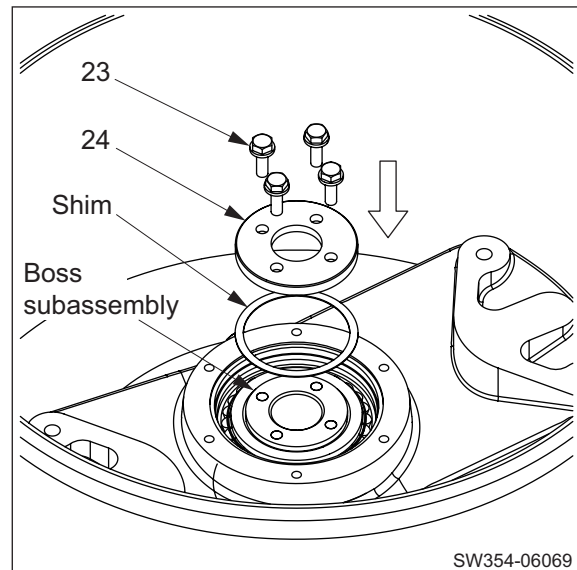
VIBRATORY DRUM • REAR WHEEL

- 32) Apply sufficient amount of lithium-based grease to rollers of roller bearing (15) inner race.
- Drive in roller bearing inner race until rollers come in contact with outer race.



33) Preload adjustment of roller bearing

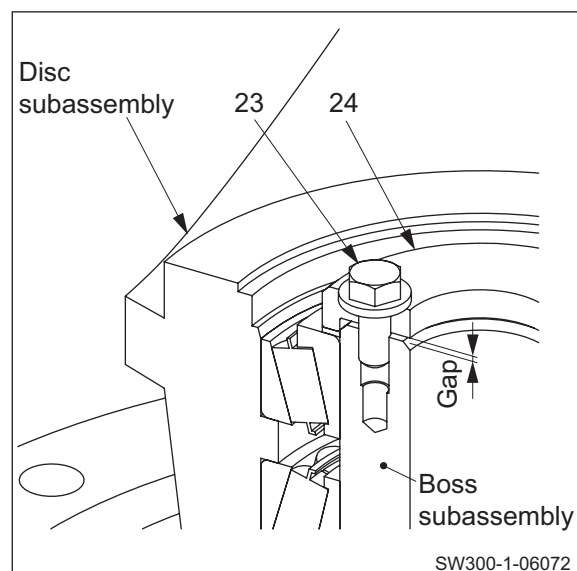
- ① Install a shim of about 1 mm (0.04 in.) and secure cover (24) to boss subassembly with four bolts (23) and washers.



- ② A gap will remain between end of boss subassembly and inside of cover (24).
- Tighten bolts (23) to a torque of 12.7 N·m (9.4 lbf-ft).
 - Give disc subassembly two to three turns.
 - Tighten bolts to a torque of 12.7 N·m (9.4 lbf-ft) again.
 - Repeat this work several times until tightening torque of bolts no longer fluctuates.

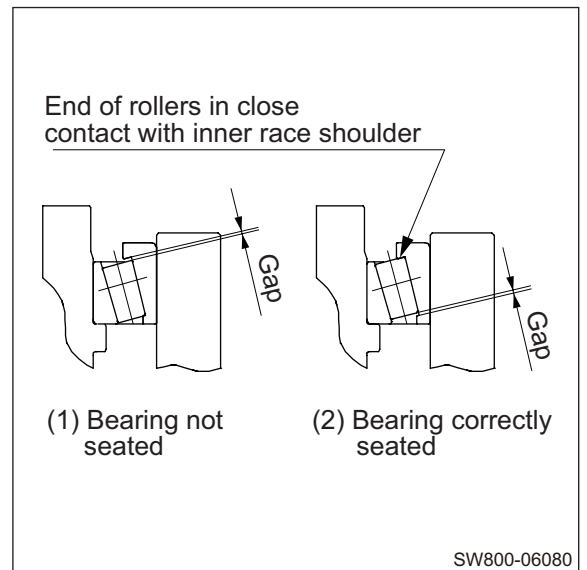
(NOTICE)

- 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.

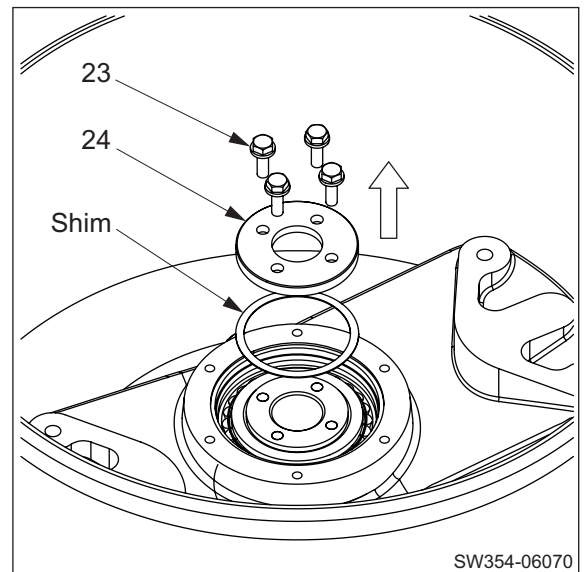


③ Remove bolts (23).

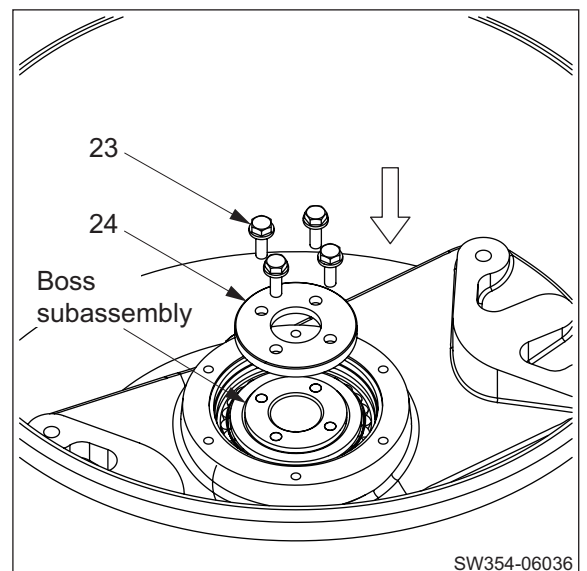
- Remove cover (24).
- Remove shim.

(NOTICE)

- Do not turn the disc subassembly after the cover is removed.



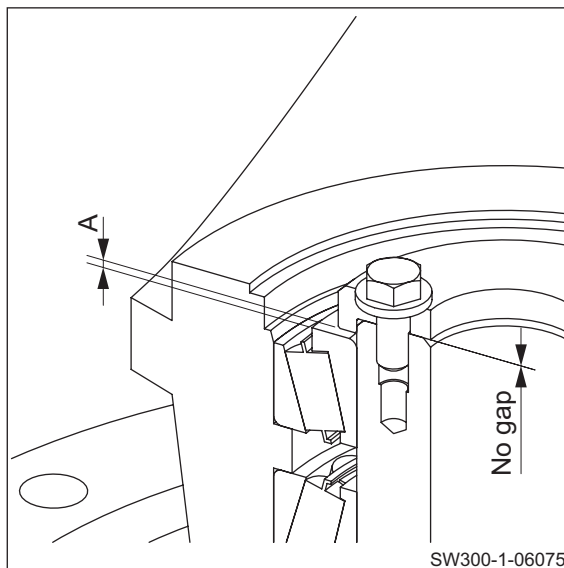
④ Without inserting shim, install cover (24) to boss subassembly with four bolts (23) and washers.



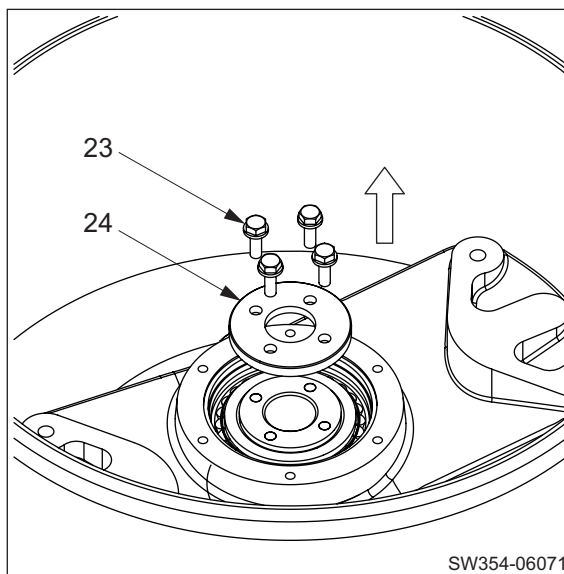
VIBRATORY DRUM • REAR WHEEL

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


★ Preload adjusting shim thickness = $A + 0.1 \text{ mm (0.004 in.)}$

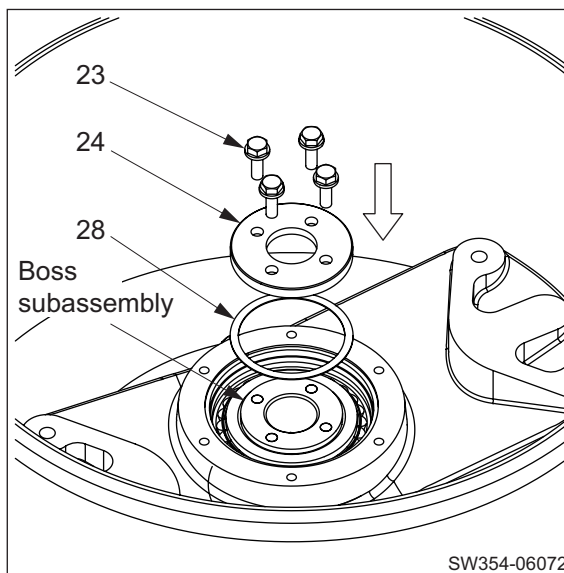


⑥ Remove bolts (23).
• Remove cover (24).

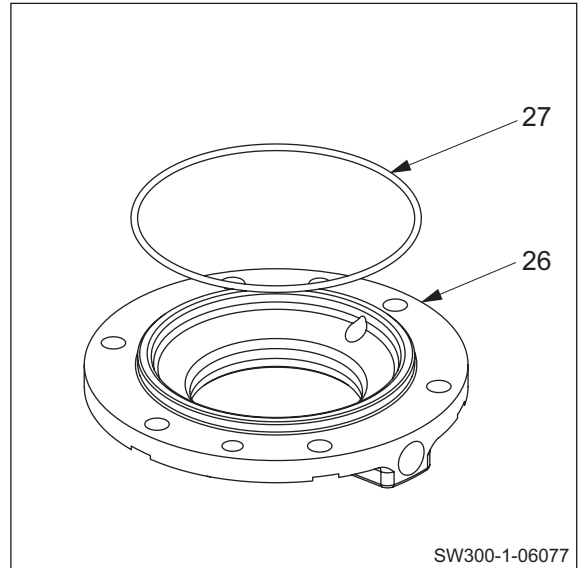


⑦ Install shim (28) of preload adjusting shim thickness = “ $A + 0.1 \text{ mm (0.004 in.)}$ ”.
• Secure cover (24) to boss subassembly with four bolts (23) and washers.

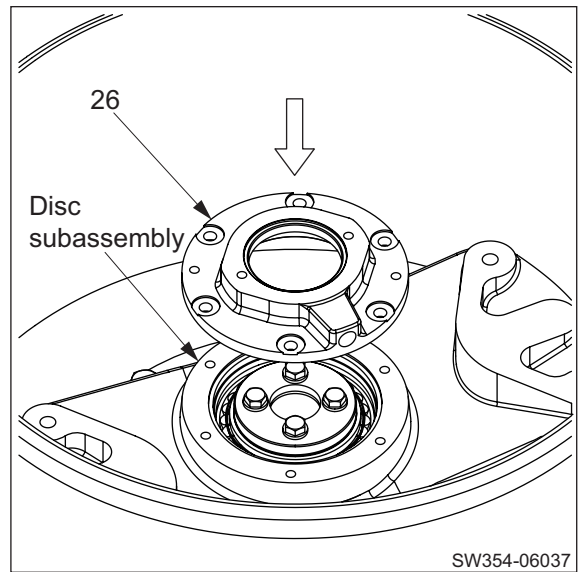
 N·m (23) Bolts M10×35 : 59 N·m (44 lbf·ft)



- 34) Apply grease to O-ring (27).
- Install O-ring (27) to cover (26).

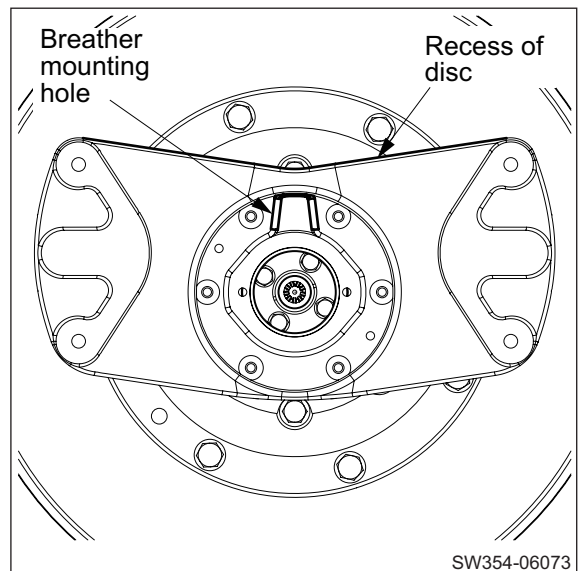


- 35) Lower cover (26) on mounting surface of disc subassembly.



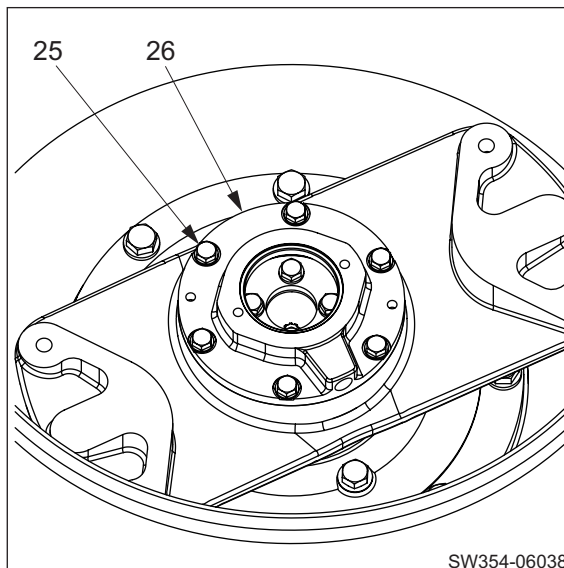
(NOTICE)

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



VIBRATORY DRUM • REAR WHEEL

- 36) Secure cover (26) to disc subassembly with six bolts (25) and washers



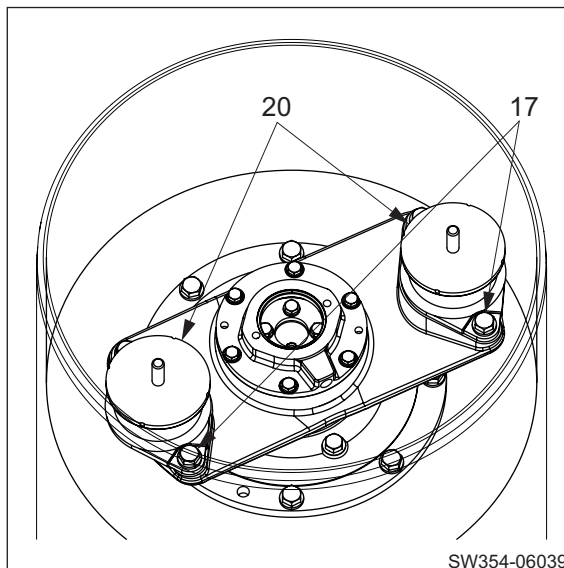
- 37) Secure two dampers (20) to disc subassembly with four / eight bolts (17) and washers.



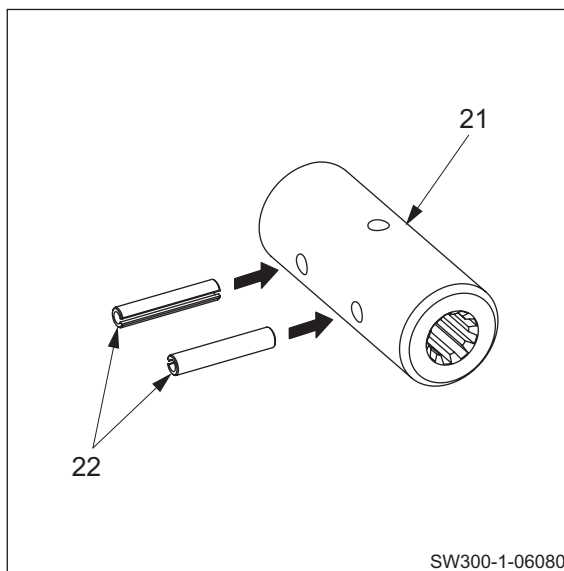
N·m (17) Bolts

SW/TW354 (four bolts) : M16×40 : 265 N·m (195 lbf·ft)

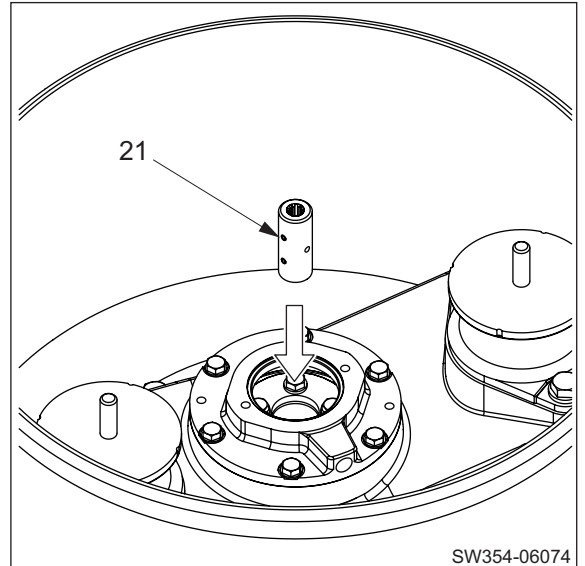
TW504 (eight bolts) : M12×30 : 108 N·m (80 lbf·ft)



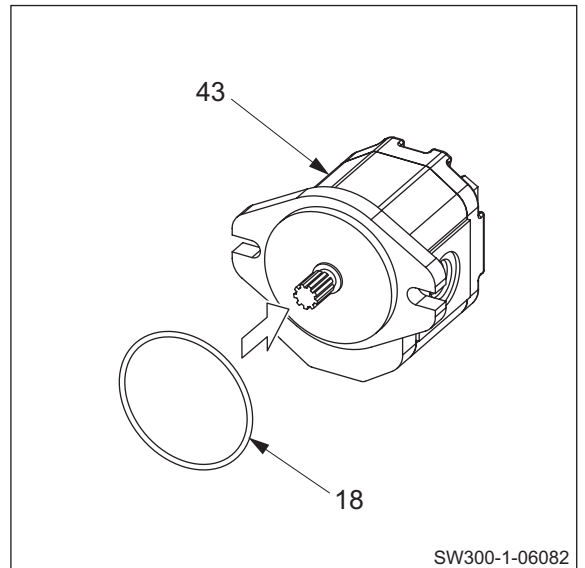
- 38) Drive two spring pins (22) into sleeve (21).




- 39) Apply molybdenum-based grease to splined portion of sleeve (21).
- Fit sleeve to splined portion on eccentric shaft end.




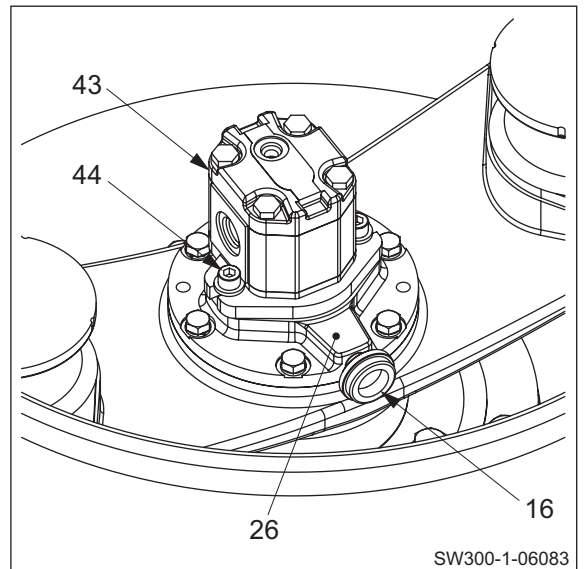
- 40) Apply grease to O-ring (18).
- Install O-ring to vibrator motor (43).



- 41) Wind seal tape around threaded portion of breather (16).
- Install breather.
 - Secure vibrator motor (43) to cover (26) with two bolts (44) and washers.

 (43) Vibrator motor : 5 kg (11 lbs.)

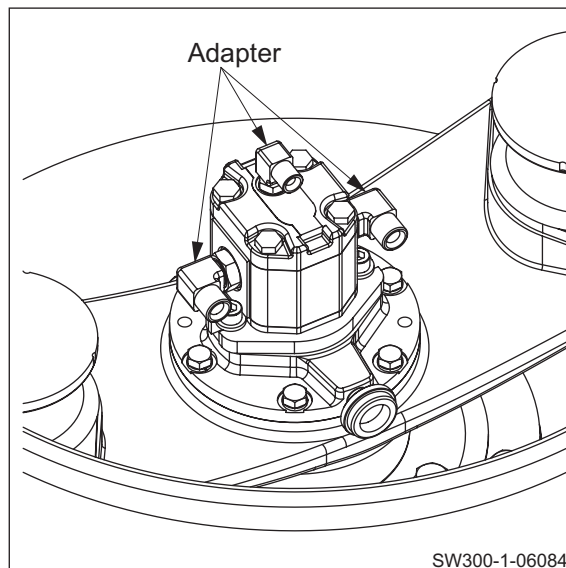
 (44) Bolts M10×35 : 49 N·m (36 lbf·ft)



VIBRATORY DRUM • REAR WHEEL

42) Apply grease to O-rings for adapters.

- Install adapters.



43) Lay drum assembly with plugs (11-1), (11-2) and (11-3) positioned as shown right.

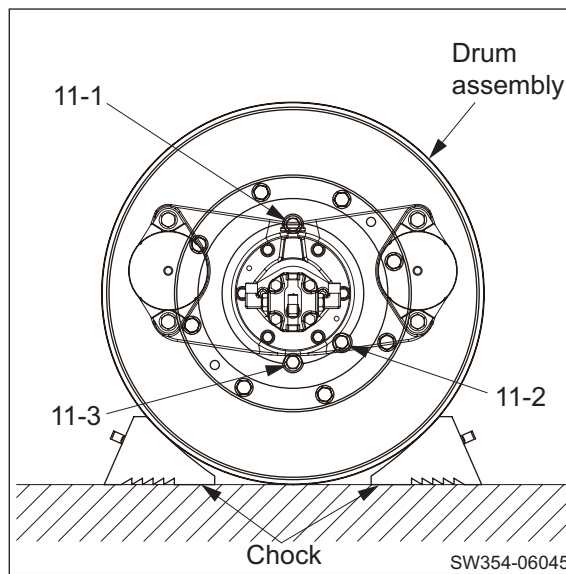
- Hold with chocks.



Drum assembly

SW/TW354 : 585 kg (1,290 lbs.)

TW504 : 885 kg (1,951 lbs.)



44) Remove plugs (11-1) and (11-2).

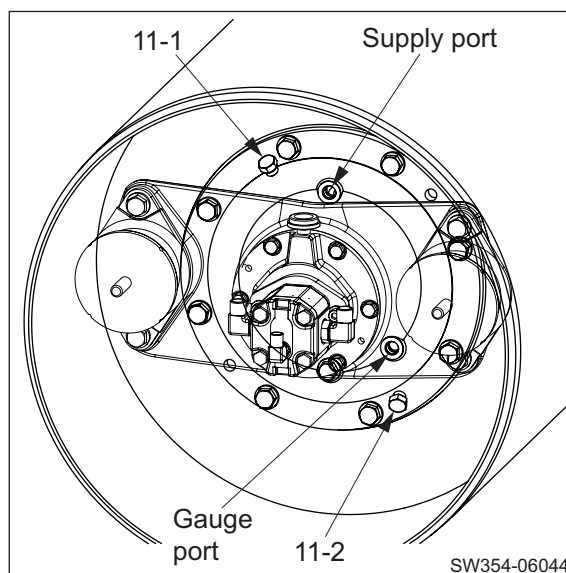
- Supply gear oil from oil supply port
- Check that oil drips from gauge port.

- Quantity of gear oil

SW/TW354 : 5.0 L (1.3 gal.)

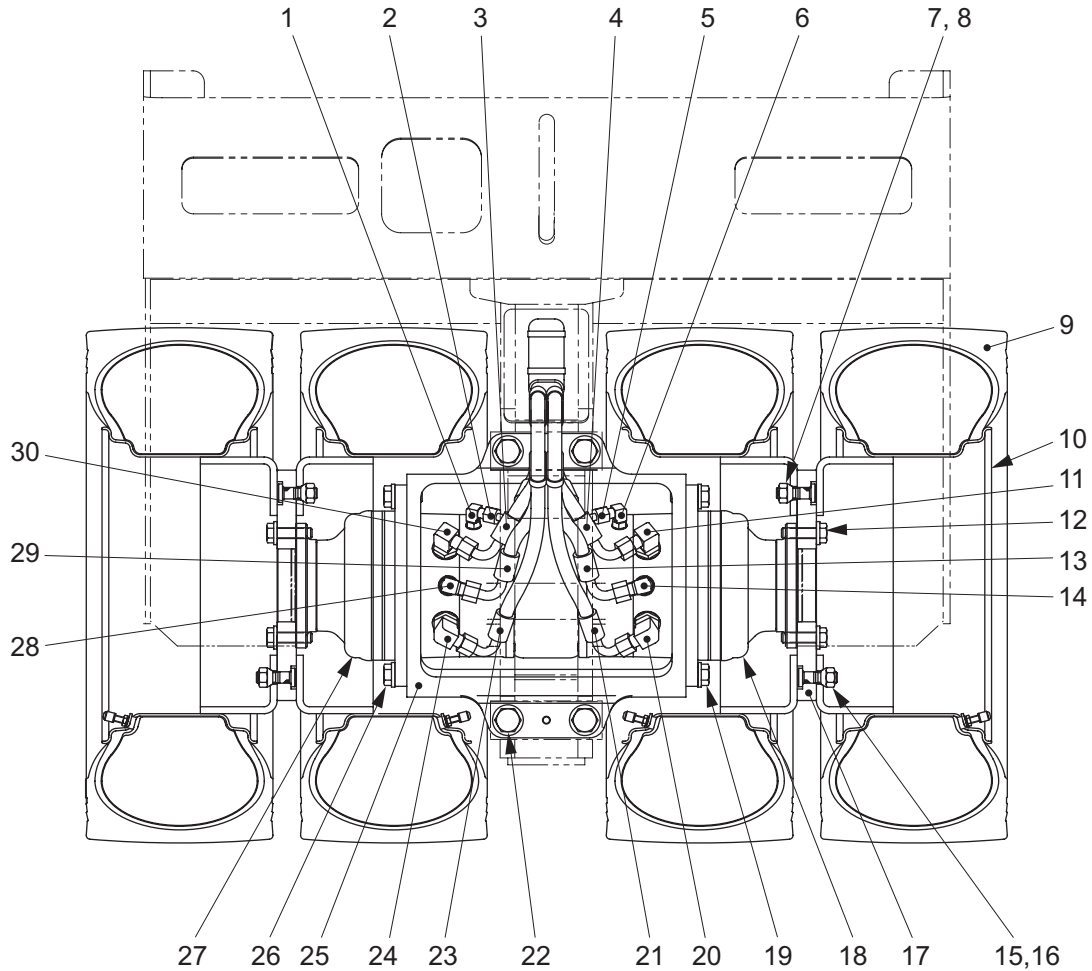
TW504 : 6.0 L (1.6 gal.)

- Reinstall plugs.



4. REAR AXLE

4-1. Rear Axle Assembly (TW types)



SW300-1-06097

- | | | |
|-----------------------------|------------------------------|-----------------------------|
| (1) Adapter | (11) Adapter | (21) Hose |
| (2) Hose | (12) Bolt : M14×50 | (22) Bolt : M20×80 |
| (3) Hose | (13) Hose | (23) Hose |
| (4) Hose | (14) Adapter | (24) Adapter |
| (5) Hose | (15) Hub bolt : M14×45 P=1.5 | (25) Bracket |
| (6) Adapter | (16) Hub nut : M14 P=1.5 | (26) Bolt : M16×40 |
| (7) Hub bolt : M14×45 P=1.5 | (17) Disc | (27) Propulsion motor (R,L) |
| (8) Hub nut : M14 P=1.5 | (18) Propulsion motor (R,R) | (28) Adapter |
| (9) Tire | (19) Bolt : M16×40 | (29) Hose |
| (10) Disc wheel | (20) Adapter | (30) Adapter |



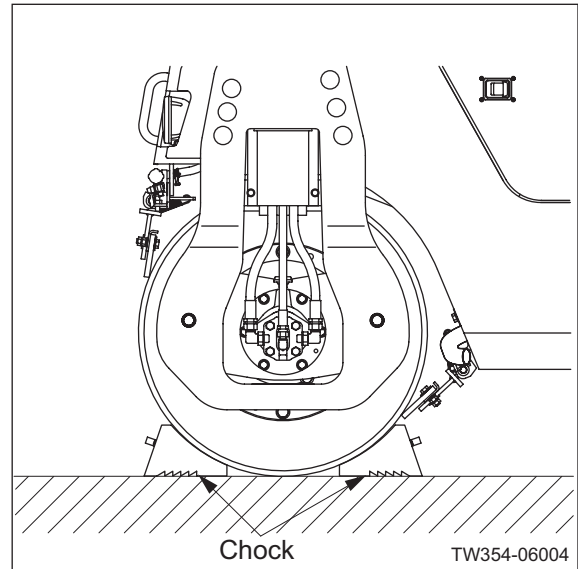
- | | |
|---|---|
| (8) Nut M14 P=1.5 : 186 N·m (137 lbf·ft) | (19) Bolt M16×40 : 265 N·m (195 lbf·ft) |
| (12) Bolt M14×50 : 167 N·m (123 lbf·ft) | (22) Bolt M20×80 : 539 N·m (398 lbf·ft) |
| (16) Nut M14 P=1.5 : 186 N·m (137 lbf·ft) | (26) Bolt M16×40 : 265 N·m (195 lbf·ft) |

Specification

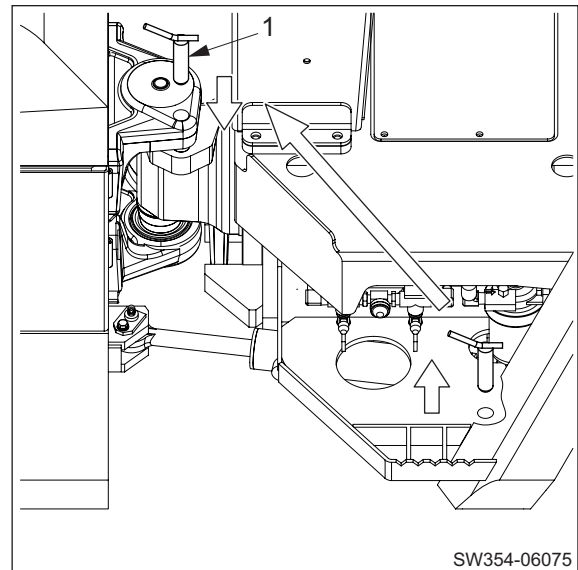
- Tire inflation pressure : 294 kPa (42.6 psi)

4-2. Removal and Installation of Rear Axle (TW types)

- 1) Hold drum with chocks.



- 2) Lock front and rear frames with lock pin (1).



4-2-1. Removal of rear axle

- Lead line numbers shown in the illustrations for the following rear axle removal and installation procedures are constant with part numbers of rear axle assembly (TW types) shown on page 6-039.

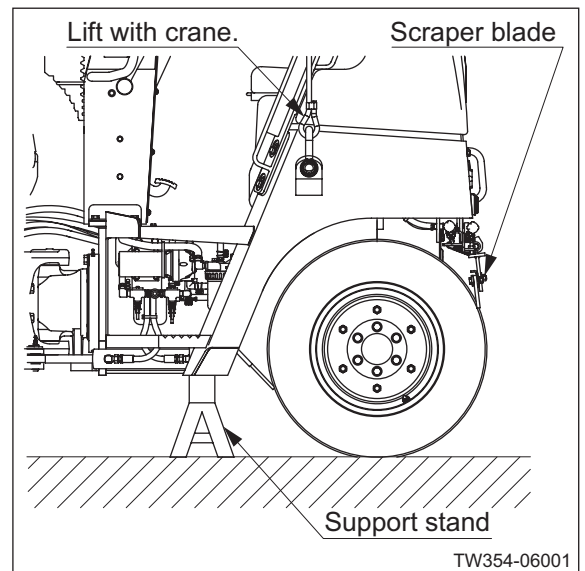
⚠ DANGER

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.

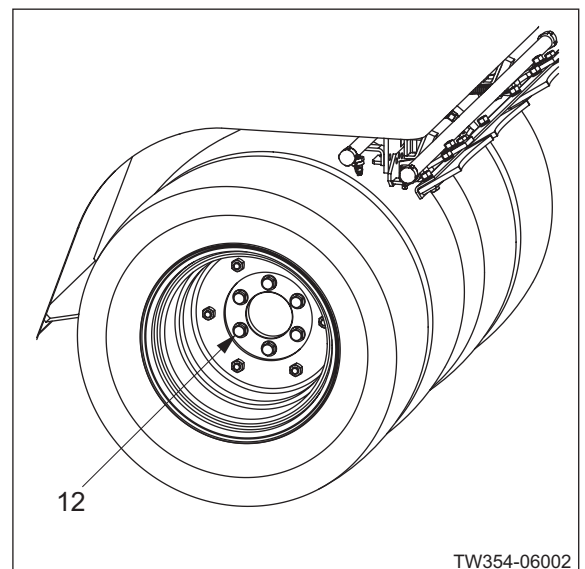
- 1) Supporting rear frame
 - Lift frame with a crane.
 - Place support stands under frame when tires are slightly off ground to support machine body.
 - Flip up scraper blade.

- J_{kg} Rear axle


TW354	: 1,130 kg (2,490 lbs.)
TW354 ROPS	: 1,190 kg (2,625 lbs.)
TW504	: 1,460 kg (3,220 lbs.)
TW504 ROPS	: 1,530 kg (3,375 lbs.)



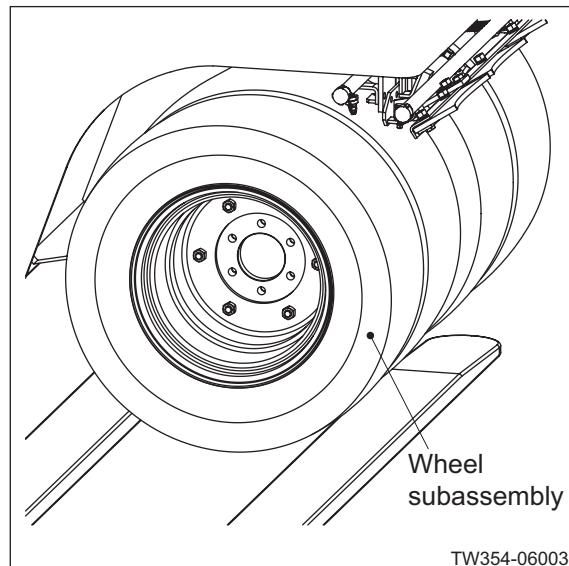
- 2) Remove bolts (12).



3) Remove wheel subassembly with forklift.

 Wheel subassembly
TW354 : 110 kg (243 lbs.)
TW504 : 145 kg (320 lbs.)

- Wheel subassembly of right side is also removed in the same procedure.



WARNING

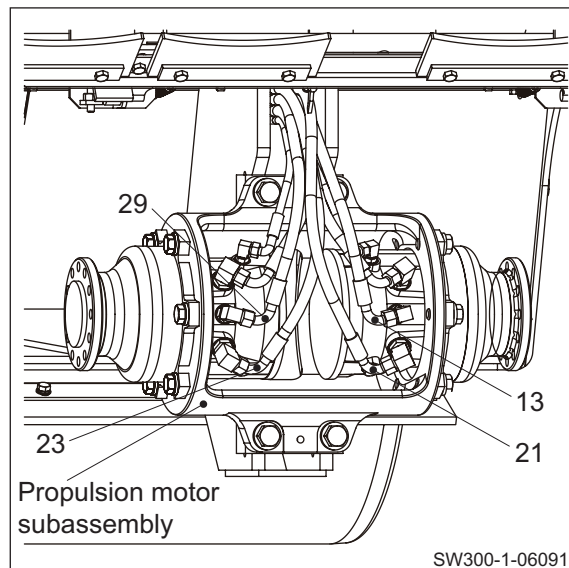
The hydraulic oil in the machine is hot and compressed immediately after the machine is stopped. Disconnecting the hydraulic hoses in this condition can cause burns. Wait for the hydraulic oil to cool down before starting the work.

4) Disconnecting piping

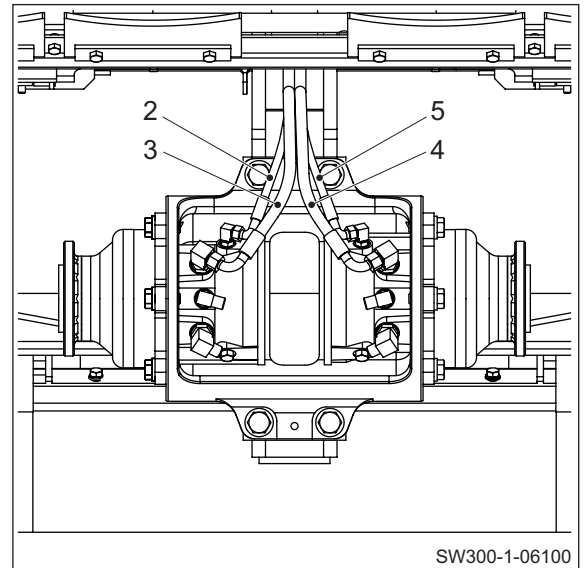
- 4-1) Disconnect hydraulic hoses (13), (21), (23) and (29) connecting to rear propulsion motor.

(NOTICE)


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

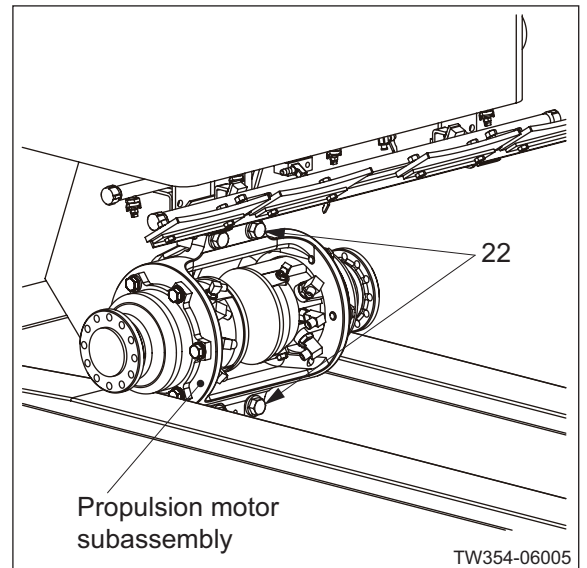


4-2) Disconnect hydraulic hoses (2), (3), (4) and (5) connecting to rear propulsion motor.



- 5) Hold up propulsion motor subassembly with forklift.
- Remove bolts (22).
 - Remove propulsion motor subassembly.

 k_g Propulsion motor subassembly : 130 kg (287 lbs.)



4-2-2. Installation of rear axle

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



(12) Bolt M14×50 : 167 N·m (123 lbf·ft)

(22) Bolt M20×80 : 539 N·m (398 lbf·ft)

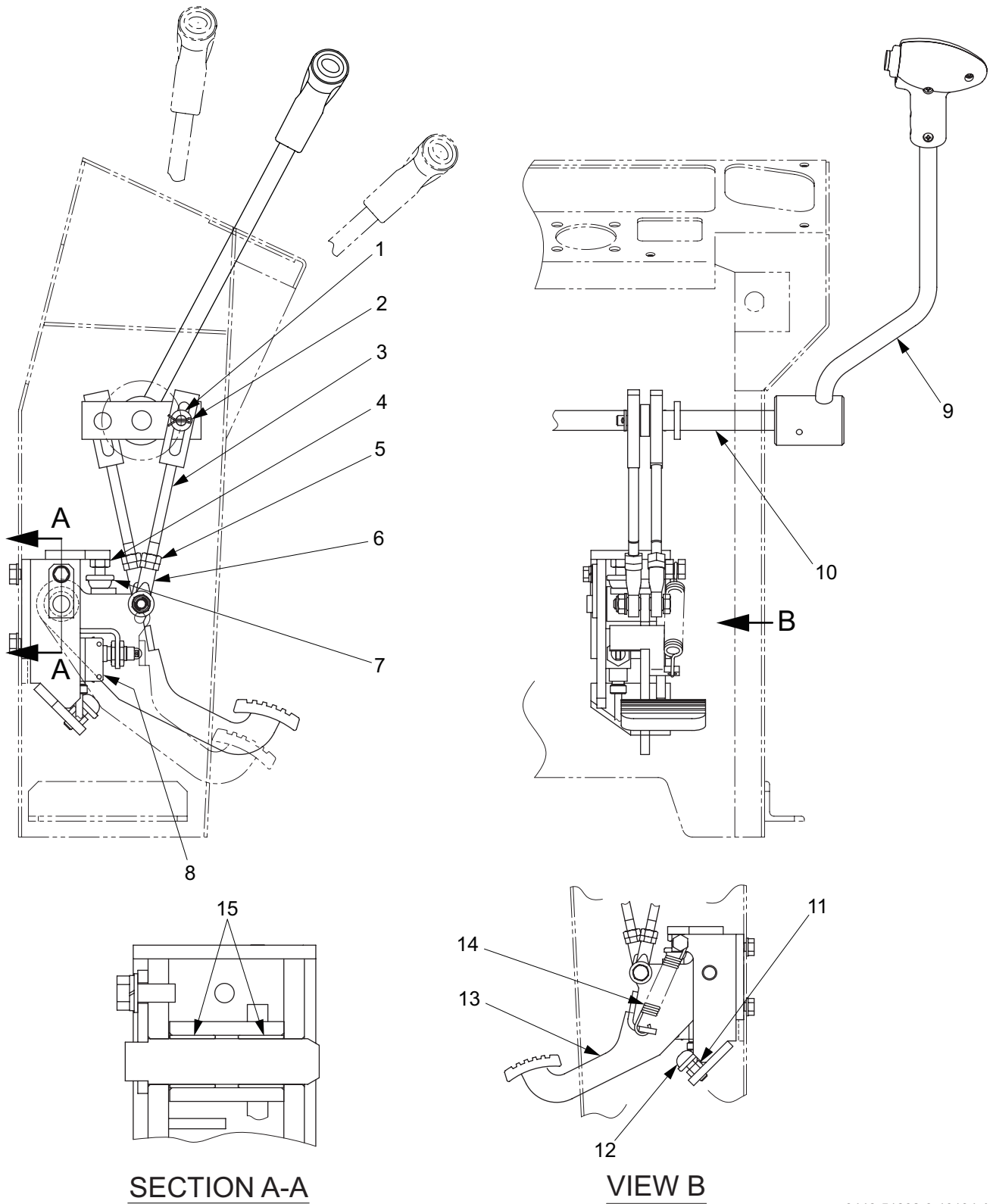
- 2) Upon installing rear axle, pay particular attention to items mentioned below.
 - Fill hydraulic oil tank to specified level to make up for any oil leakage.
 - Start engine and circulate oil through piping. Then check oil level again, ensuring that oil is at specified level.

(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.**

BRAKE

1. BRAKE PEDAL



SECTION A-A

VIEW B

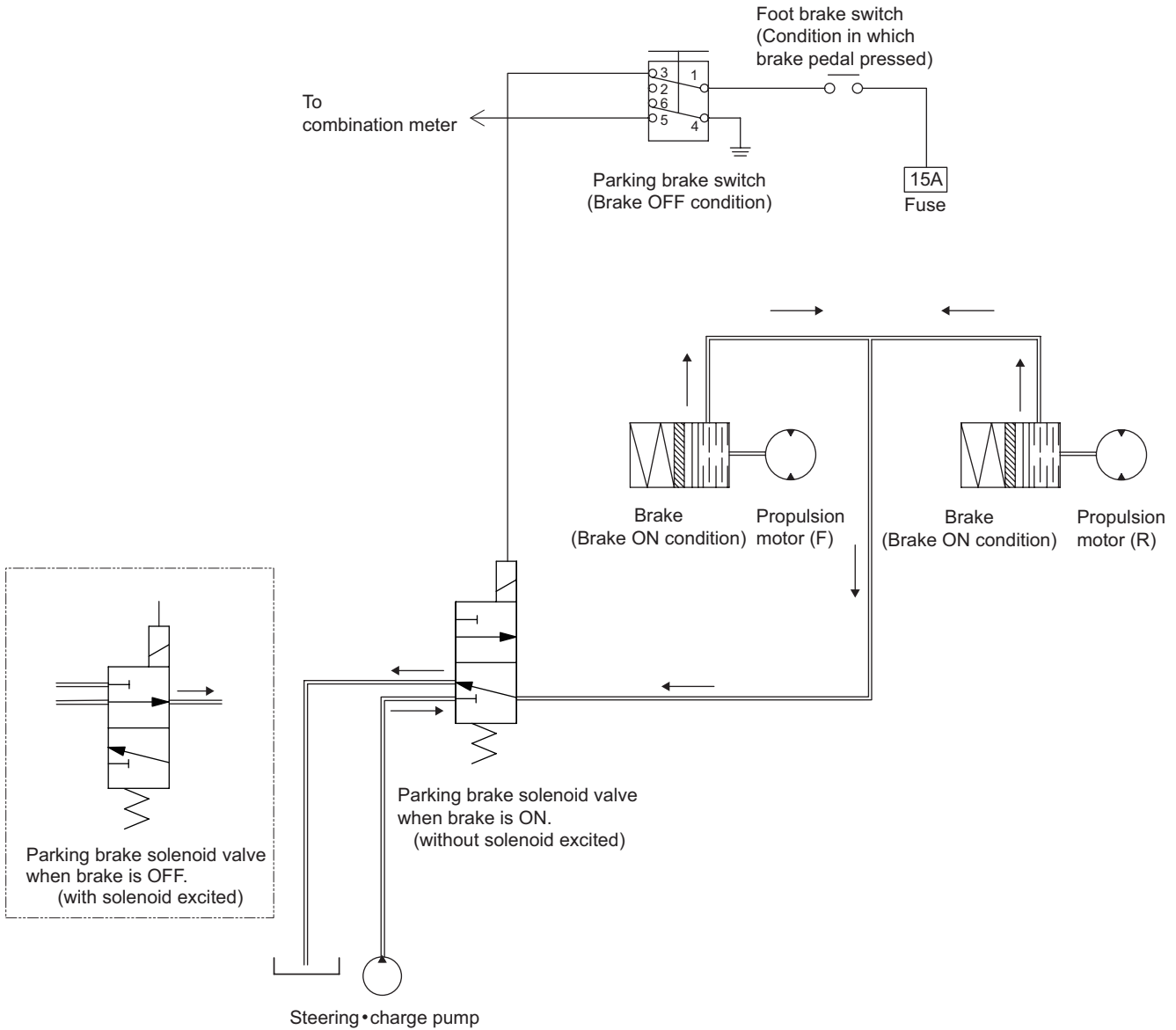
0446-51802-0-10194-A

- | | | |
|---------------------------------|---------------------------------|----------------------------------|
| (1) Washer | (6) Rod end : M10 | (11) Nut : M10 P=1.25 |
| (2) Split pin | (7) Rubber bolt : M10×25 P=1.25 | (12) Rubber bolt : M10×25 P=1.25 |
| (3) Rod (Apply grease to hole*) | (8) Foot brake switch | (13) Nut : M10 |
| (4) Nut : M10 P=1.25 | (9) F-R lever | (14) Spring |
| (5) Nut : M10 | (10) Shaft | (15) Bush (Apply grease) |

* : Lithium-based grease

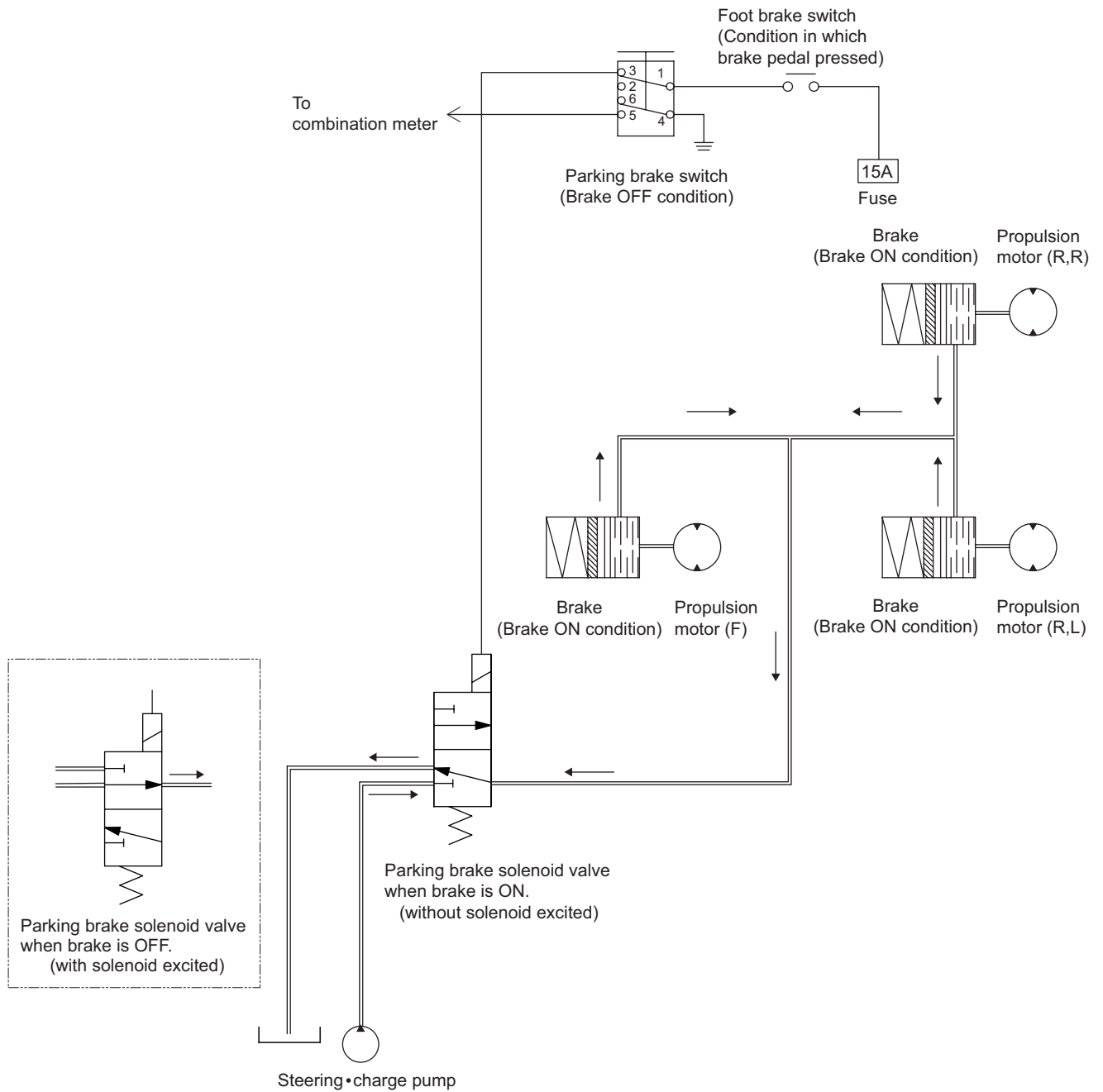
2. BRAKE SYSTEM

2-1. Brake System (SW354)



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

2-2. Brake System (TW354, 504)

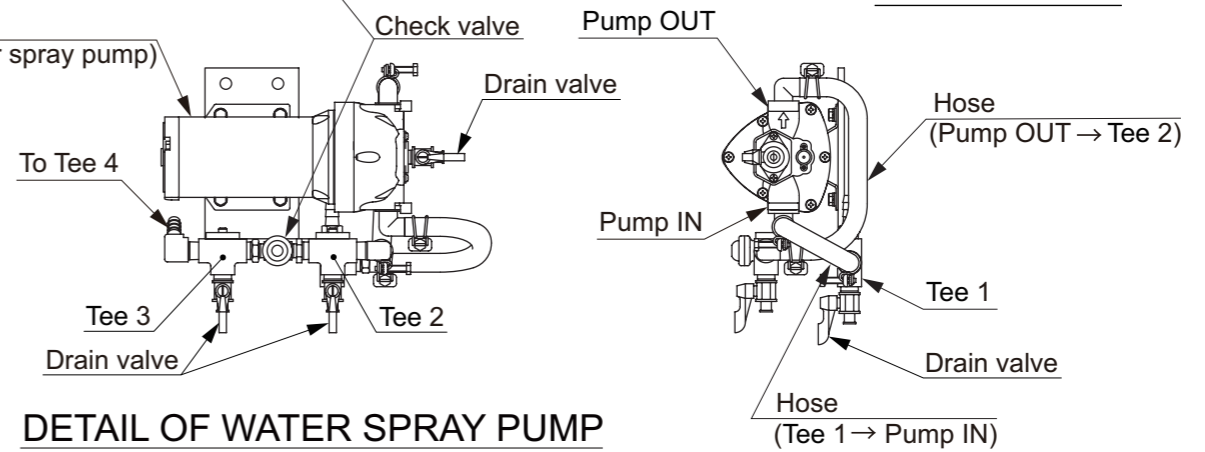
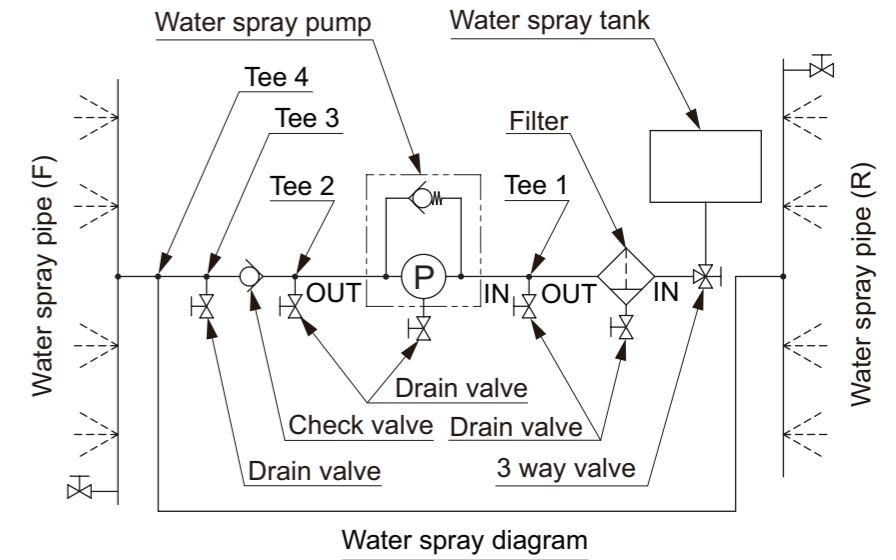
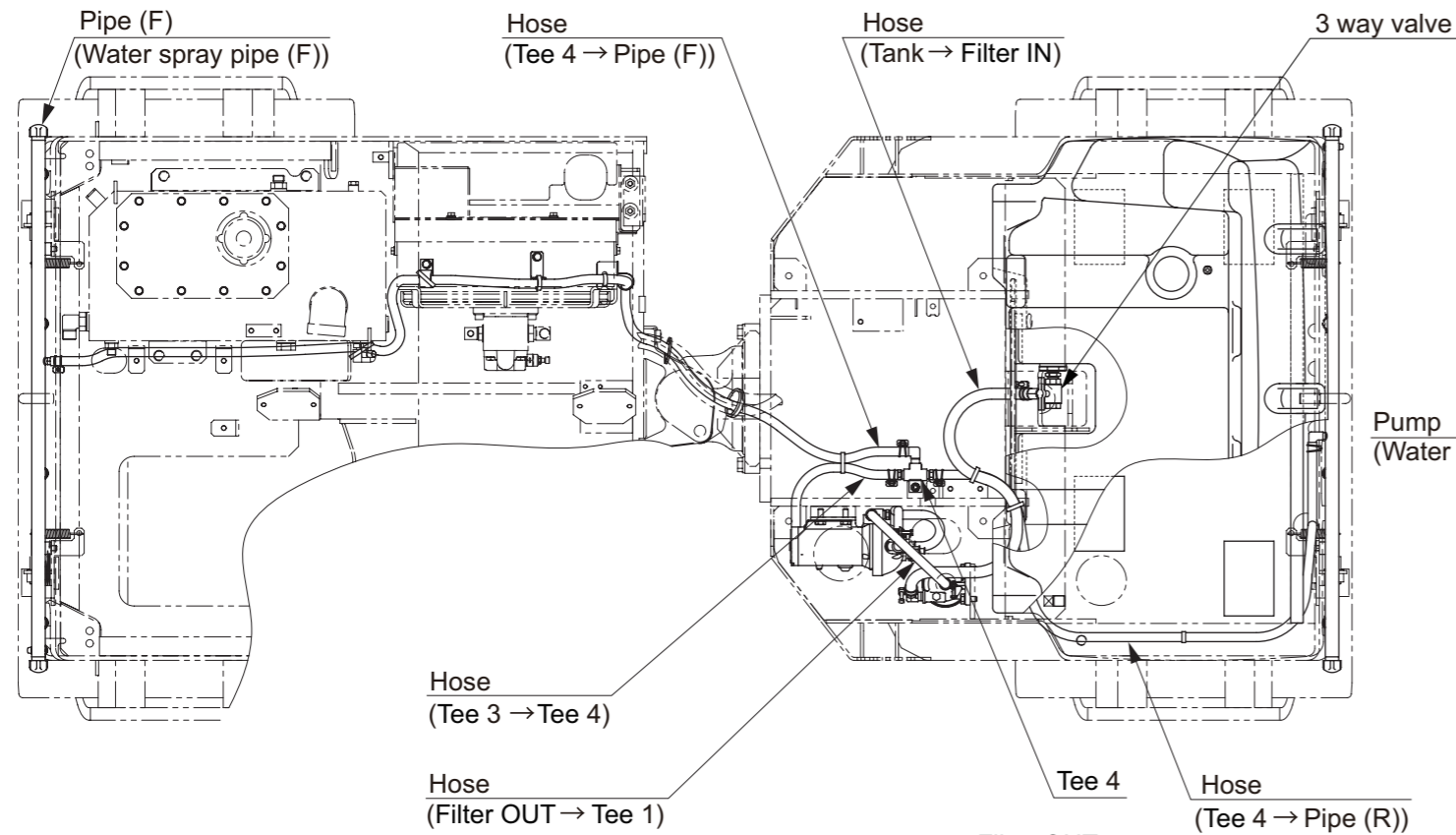


•The arrow (→) symbol shows the direction of the hydraulic oil flow.

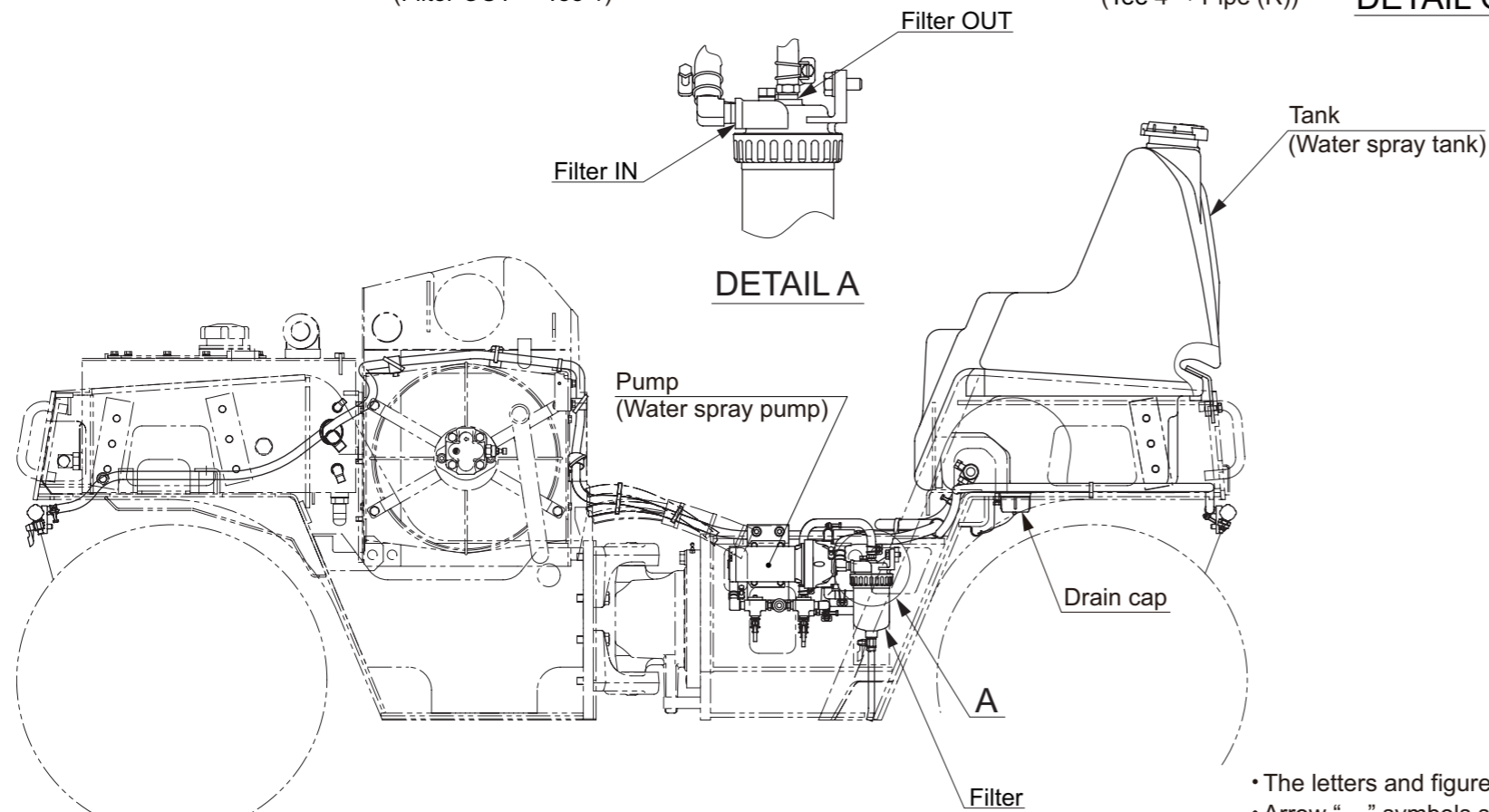
WATER SPRAY SYSTEM

1. WATER SPRAY PIPING

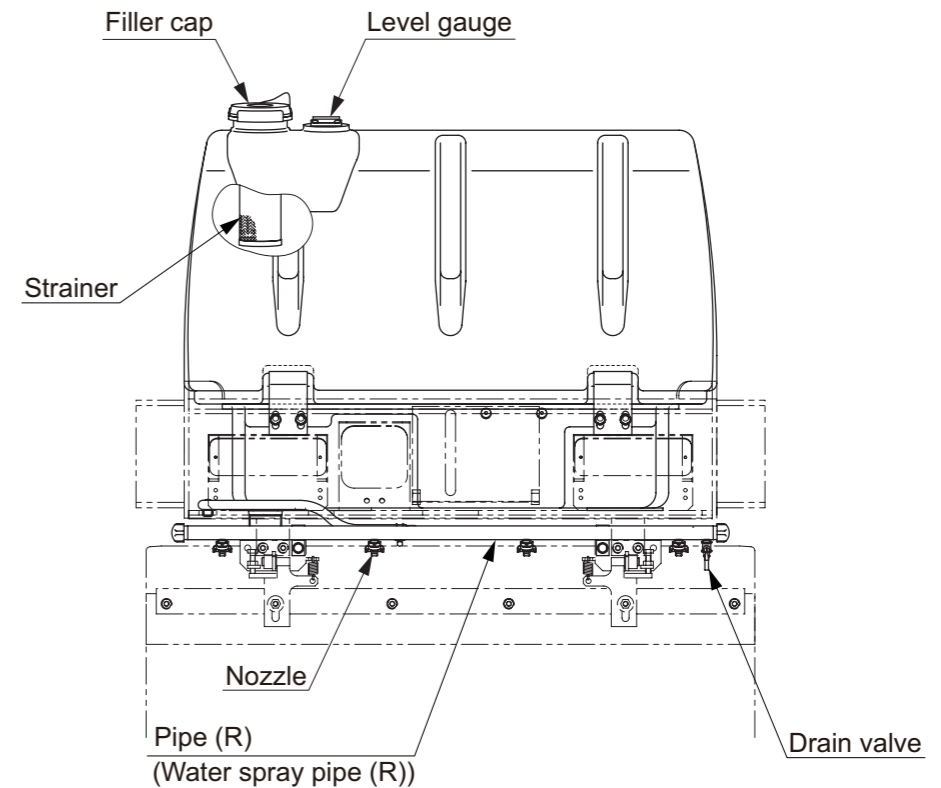
1-1. Water Spray Piping (SW354)



DETAIL OF WATER SPRAY PUMP

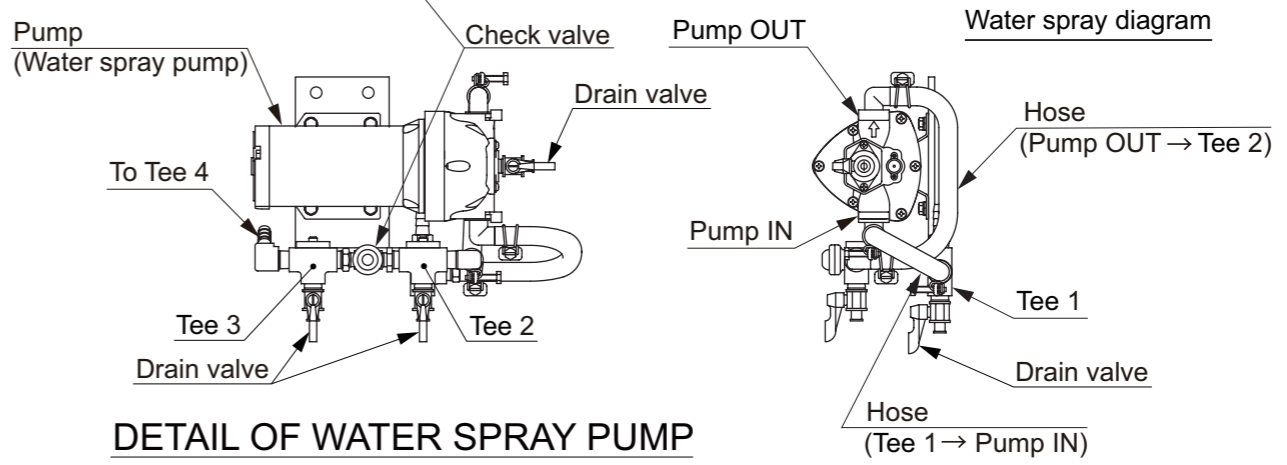
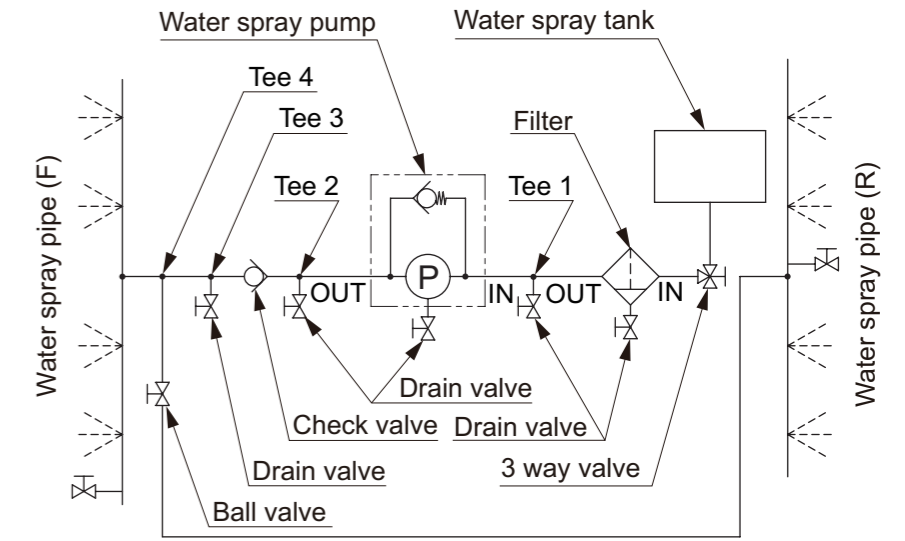
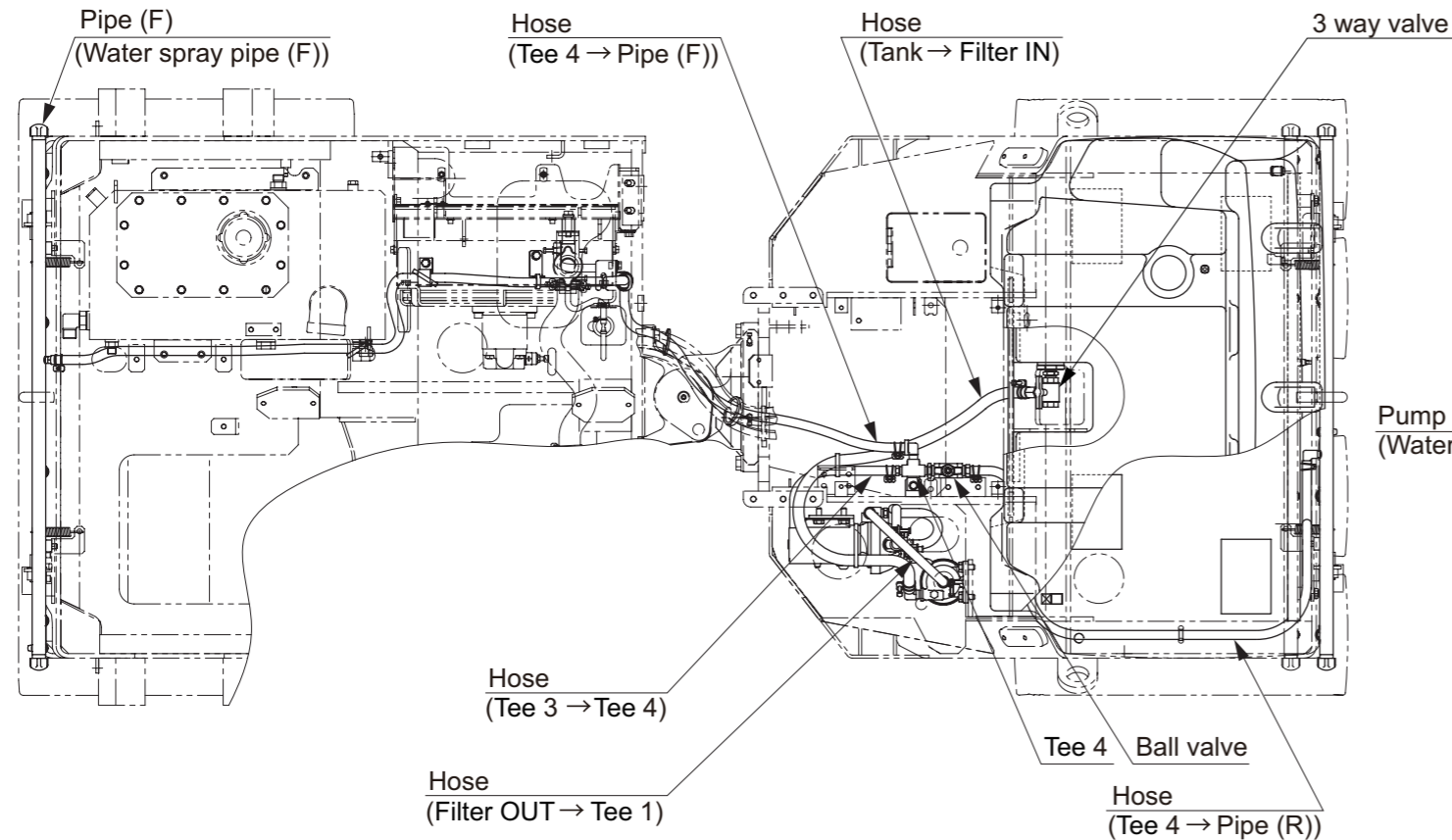


DETAIL A

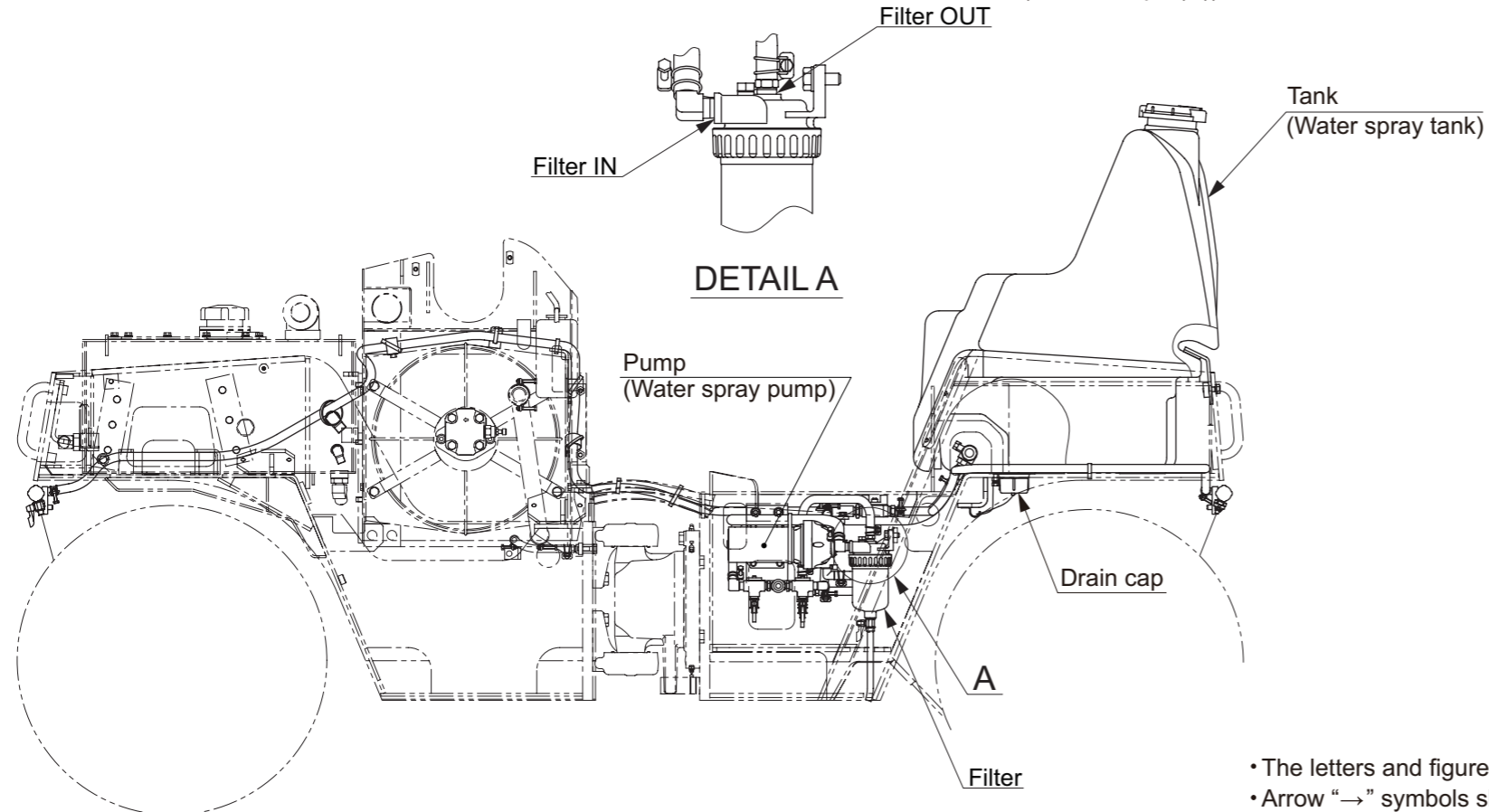


- The letters and figures such as "Filter IN" and "Pump OUT" show each port.
- Arrow "→" symbols show the hose connection and the direction of the flow of the water.

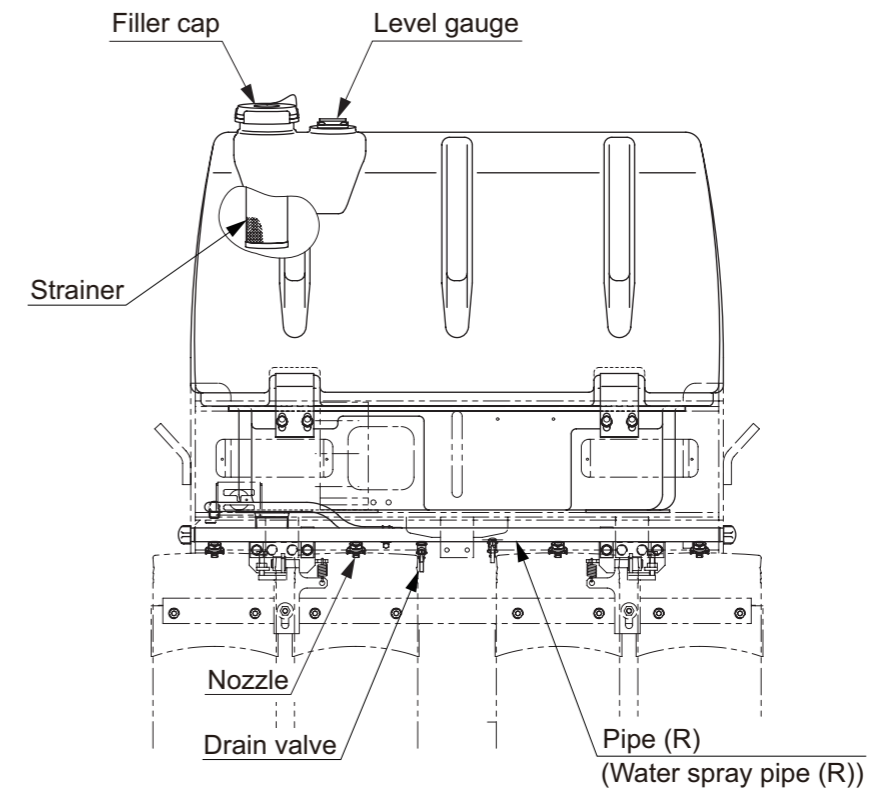
1-2. Water Spray Piping (TW354,504)



DETAIL OF WATER SPRAY PUMP



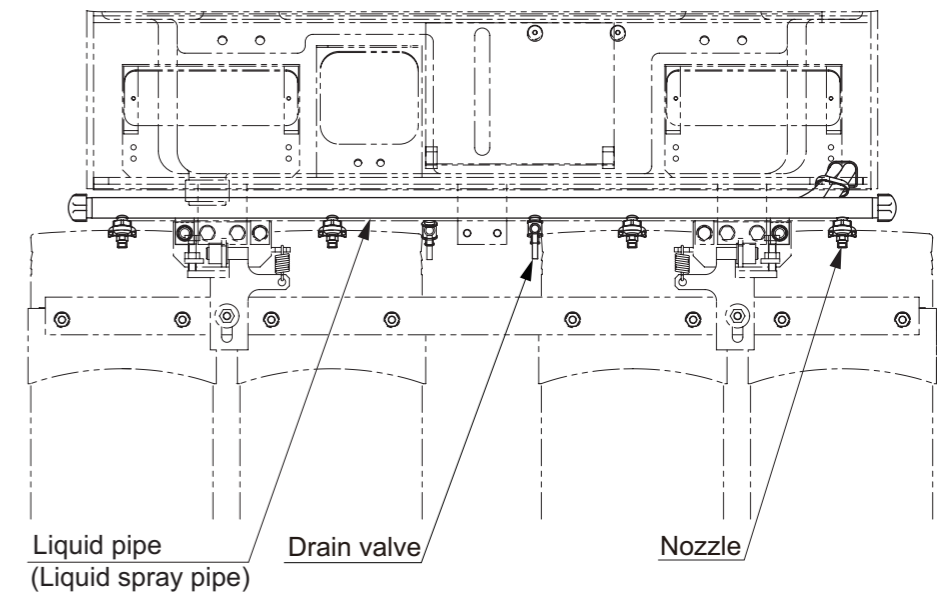
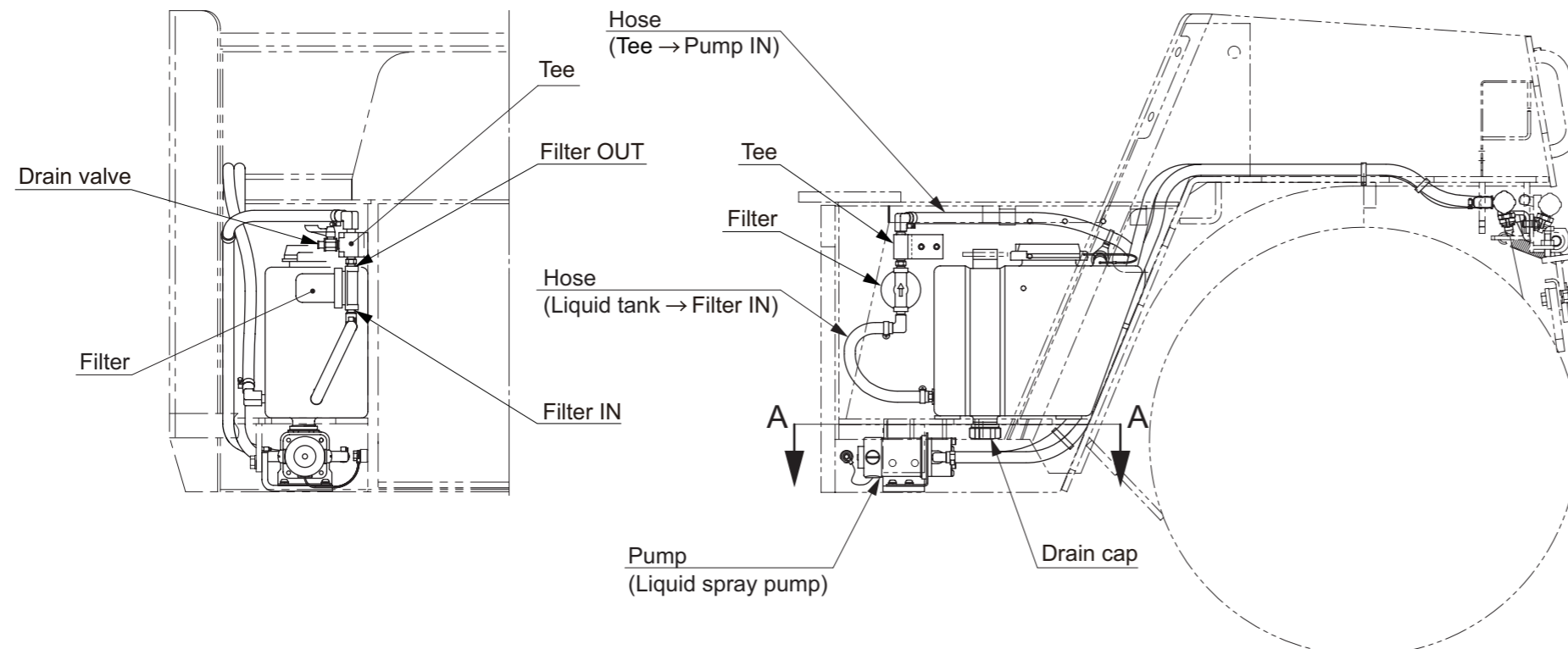
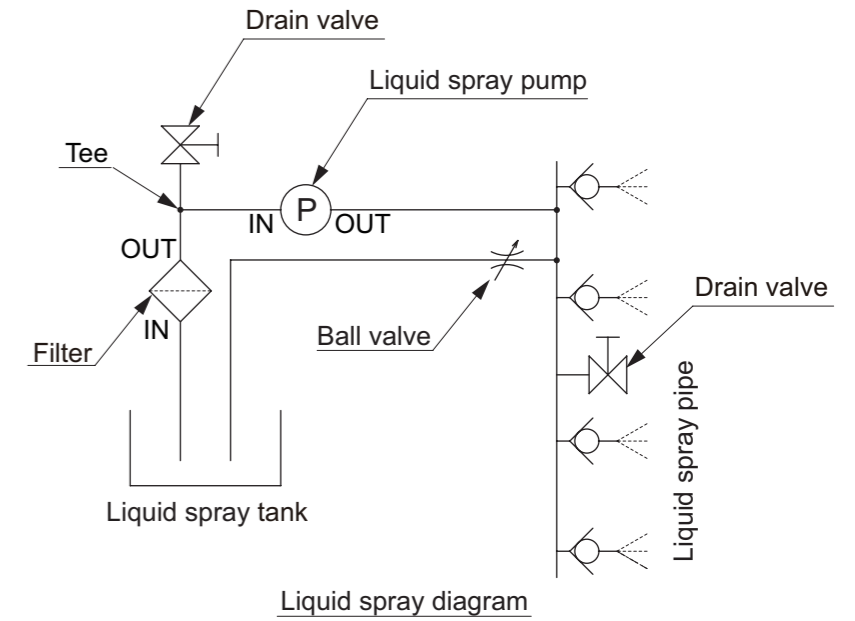
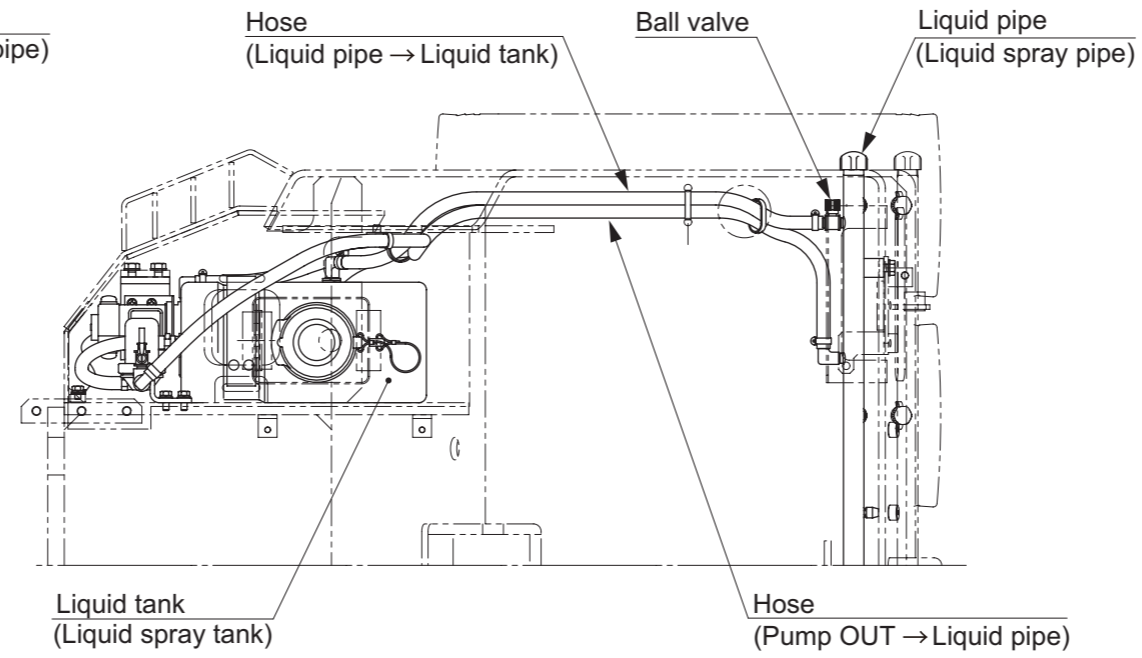
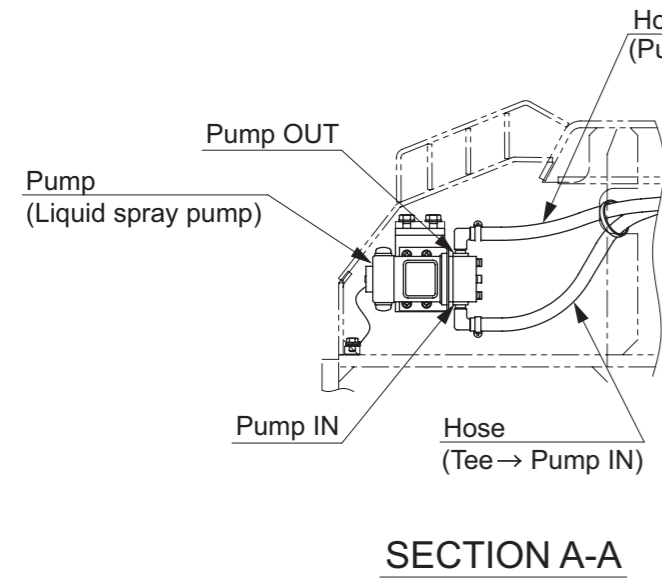
DETAIL A



- The letters and figures such as "Filter IN" and "Pump OUT" show each port.
- Arrow "→" symbols show the hose connection and the direction of the flow of the water.

2. LIQUID SPRAY SYSTEM

2-1. Liquid Spray Piping (TW354,504)



- The letters and figures such as “Filter IN” and “Pump OUT” show each port.
- Arrow “→” symbols show the hose connection and the direction of the flow of the liquid.

INSPECTION AND ADJUSTMENT

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 INSPECTION OF PROPULSION CIRCUIT PRESSURE

2-1. Measurement

⚠ WARNING

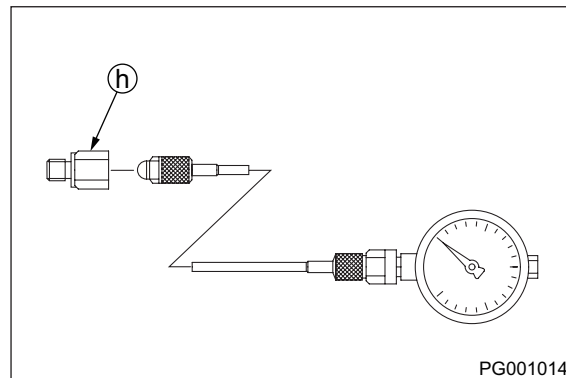
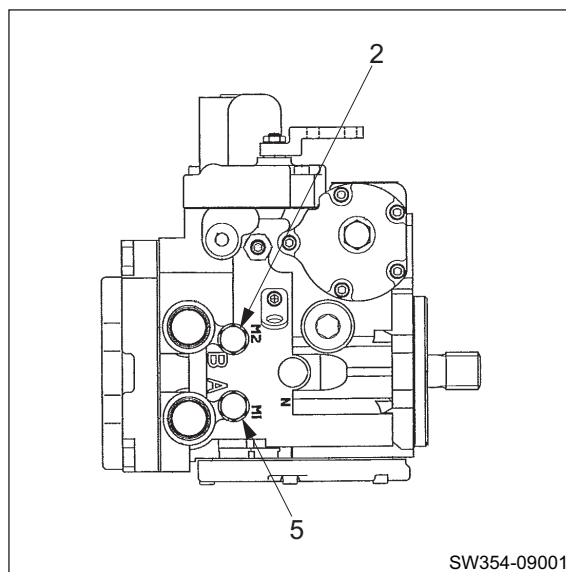
Confirm that the parking brake works properly before measurement.

- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)
- ① Remove plugs from high pressure gauge port (2) and (5) of propulsion pump. Attach pressure gauge with adapter (h).
 - Adapter (h) : 9/16-18UNF
 - High pressure gauge port (Reverse) : (2)
 - High pressure gauge port (Forward) : (5)
 - Pressure gauge : 0 to 50 MPa (0 to 7,250 psi)
- ② Confirm that F-R lever is "N".
- ③ Apply parking brake by pressing parking brake switch button.
- ④ Set propulsion speed change switch to "🐢".
- ⑤ Start the engine and set throttle lever to "Full".
- ⑥ Establish a condition in which machine propulsion load becomes maximum. (Pressure does not build up unless propulsion load is applied.)
- ⑦ With propulsion load at maximum, slowly move F-R lever to the side to be measured.
- ⑧ Read pressure indicated by pressure gauge.
- ⑨ After measuring, promptly return F-R lever to "N".

★ Maximum circuit pressure

(high pressure relief valve setting)

: 34.5 MPa (5,003 psi)



- The numbers "2" and "5" appearing in above illustrations are consistent with lead line numbers shown in illustration of hydraulic pump assembly in "2-2. Hydraulic Component Specifications" (P.4-011).

2-2. Inspection

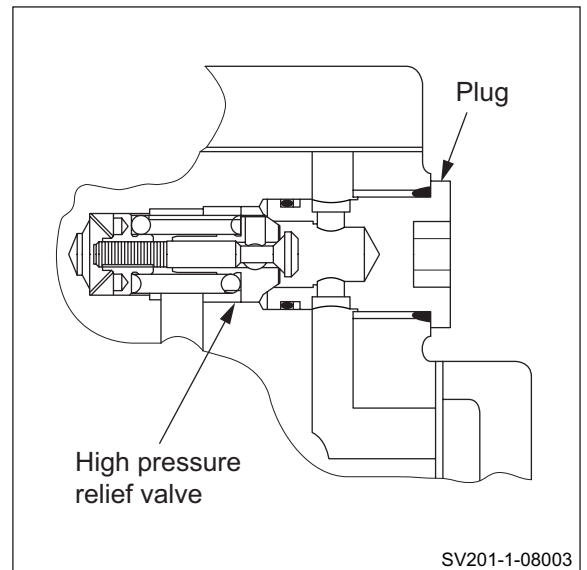
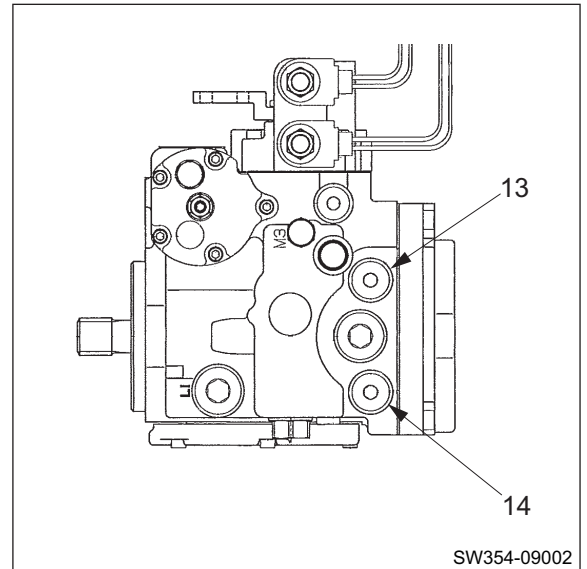
- If measurement results indicate the pressure deviating from maximum circuit pressure range, make an inspection in accordance with procedure described below.
 - ① Remove plug and valve from high pressure check relief valve port (13) or (14) of propulsion pump.
 - *High pressure relief valve (Reverse) : (13)
 - *High pressure relief valve (Forward) : (14)
 - ② Check removed high pressure relief valve for trapped dirt and other abnormalities.
 - ③ If trapped dirt is present, disassemble and clean high pressure relief valve.
 - ④ If pressure still deviates from maximum circuit pressure range after valve is disassembled and cleaned, replace high pressure relief valve.
 - ⑤ After inspection, measure pressure again and check that pressure reaches maximum circuit pressure range.



Plug : 70 N·m (52 lbf·ft)

(NOTICE)

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



- * High pressure relief valve = S.C.R. (System Check Relief) valve for charge check and high pressure relief.
- The numbers “13” and “14” appearing in above illustrations are consistent with lead line numbers shown in illustration of hydraulic pump assembly in “2-2. Hydraulic Component Specifications” (P.4-011).

3. MEASUREMENT AND ADJUSTMENT OF PROPULSION CHARGE CIRCUIT PRESSURE

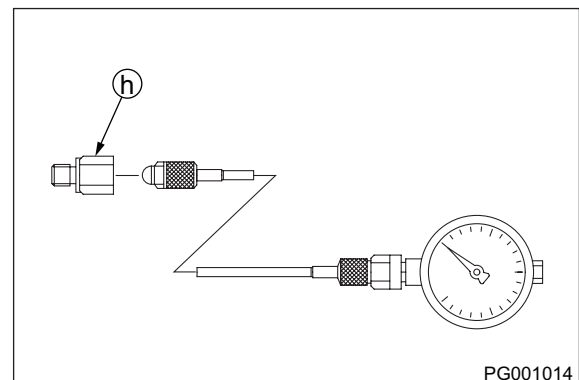
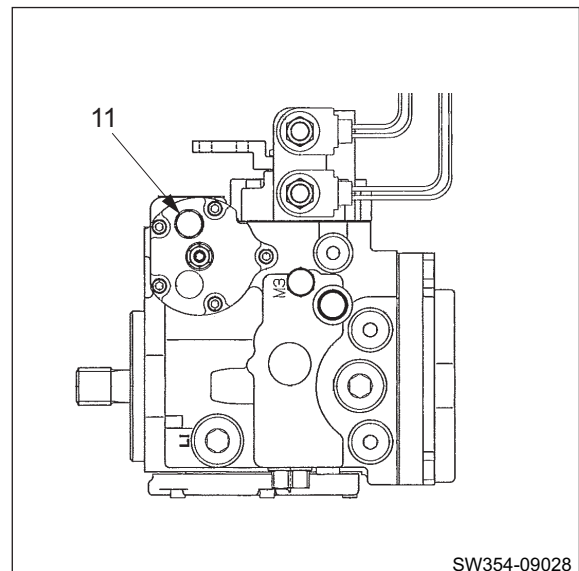
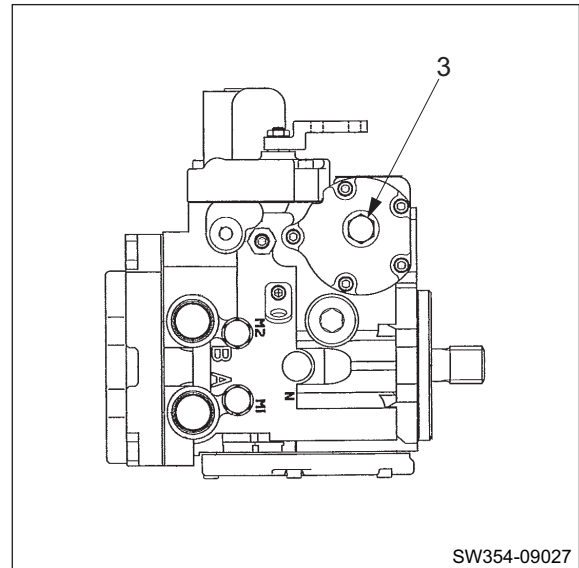
- Since oil in charge circuit is supplied from steering circuit, confirm that steering operation is normal before measurement.
- Ensure that neutral positions of F-R lever and hydraulic pump are aligned.

3-1. Measurement

- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)
- ① Remove plugs from servo pressure gauge port (3) and (11) of propulsion pump. Attach pressure gauge with adapter (h).
- Adapter (h) : 9/16-18UNF
- Pressure gauge : 0 to 50 MPa (0 to 7,250 psi)
- ② Confirm that F-R lever is "N".
- ③ Apply parking brake by pressing parking brake switch button.
- ④ Start the engine and set throttle lever to "Full".
- ⑤ Read pressure indicated by pressure gauge.

★ Standard charge relief valve setting

: $1.9 \pm 0.7 \text{ MPa}$ ($276 \pm 100 \text{ psi}$)



- The numbers "3" and "11" appearing in above illustrations are consistent with lead line numbers shown in illustration of hydraulic pump assembly in "2-2. Hydraulic Component Specifications" (P.4-011).

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 nut (1) of charge relief valve (15) for evidence of having loosened.
 - ② If there is evidence of nut having loosened, adjust charge relief valve so that pressure becomes within standard charge relief valve pressure setting 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 : 0.19 MPa/turn (27.6 psi/turn)

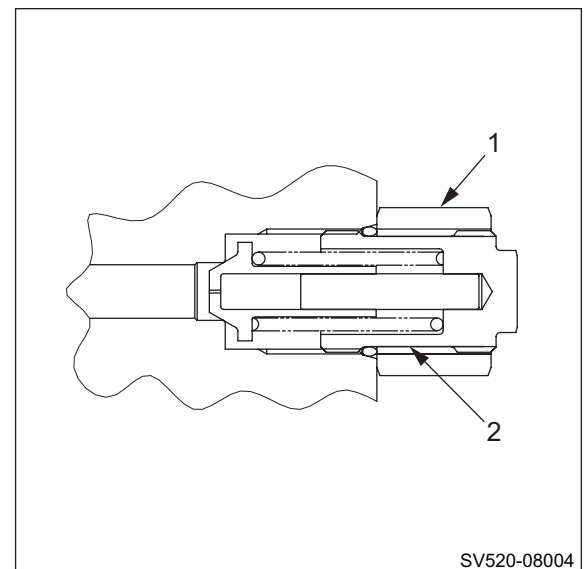
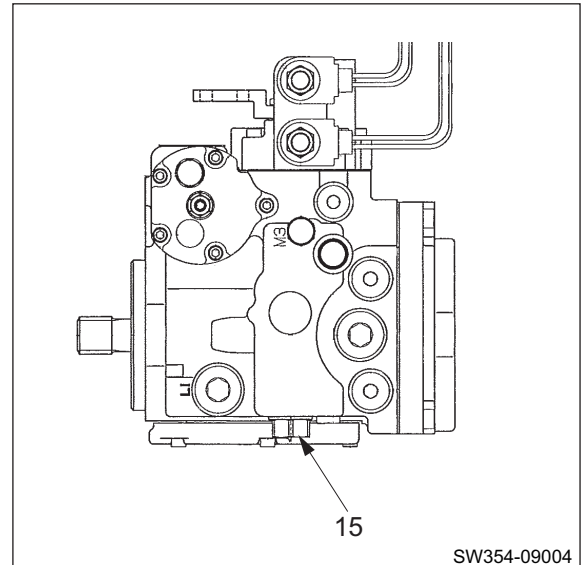
- ③ If there is no evidence of nut having loosened, remove charge relief valve.
- ④ Check removed charge relief valve for trapped dirt and scratches on its seat.
- ⑤ If trapped dirt is present, disassemble and clean charge relief valve.
- ⑥ If a scratch is found on seat, replace charge relief valve.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



(1) Nut : 24 N·m (18 lbf·ft)

(NOTICE)

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



- The number “15” appearing in above illustrations is consistent with lead line numbers shown in illustration of propulsion pump in “2-2. Hydraulic Component Specifications” (page 4-011).

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

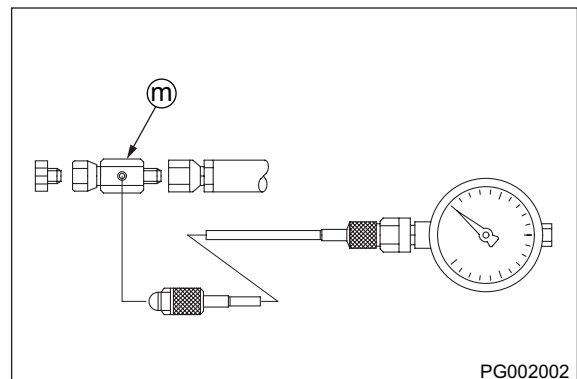
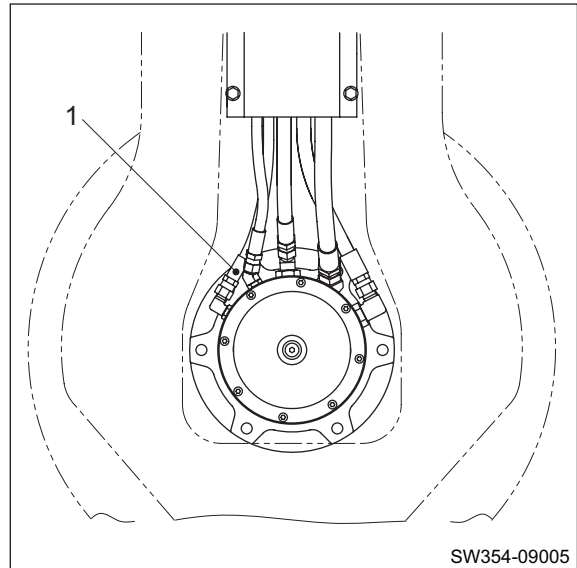
- Since oil in charge circuit is supplied from steering circuit, confirm that steering operation is normal before measurement.

4-1. Measurement

- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)
- ① Disconnect hose (1) from propulsion motor (F). 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 "N".
- ③ Apply parking brake by pressing parking brake switch button.
- ④ Set propulsion speed change switch to "Full".
- ⑤ Start the engine and set throttle lever to "Full".
- ⑥ Read pressure indicated by pressure gauge.

★ Standard charge relief valve setting

: 1.9 ± 0.7 MPa (276 ± 100 psi)



5. MEASUREMENT OF PARKING BRAKE RELEASE PRESSURE

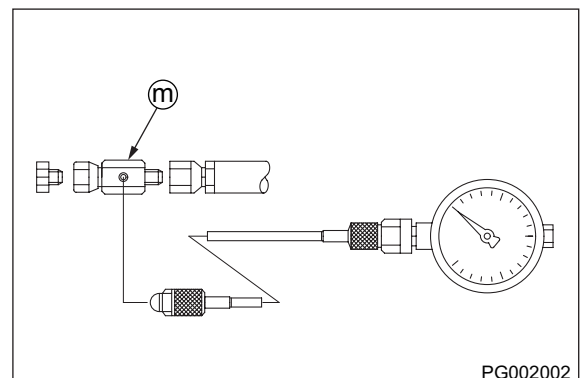
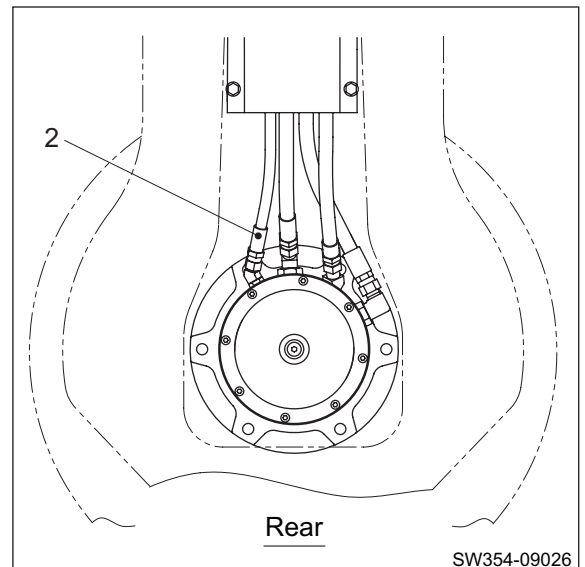
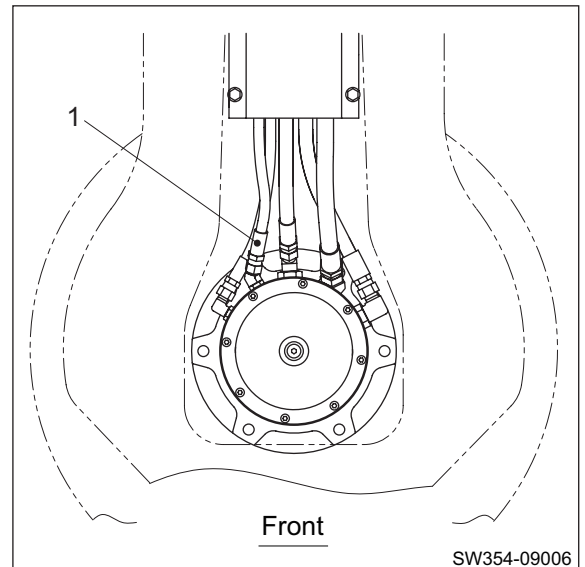
- Since oil in charge circuit is supplied from steering circuit, confirm that steering operation is normal before measurement.

5-1. Measurement

5-1-1. SW types: front and rear, TW types: front

- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)
- ① Disconnect hose (1) and (2) 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 "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.
- ⑥ Read brake release pressure indicated by pressure gauge.

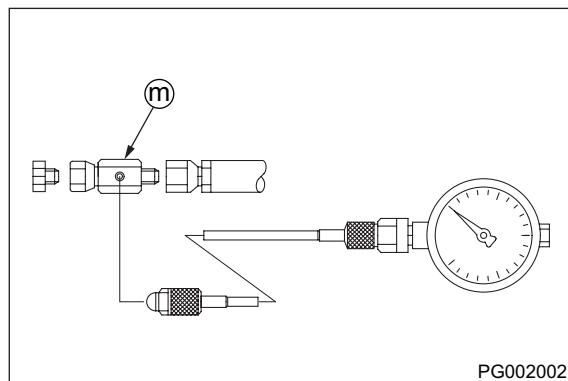
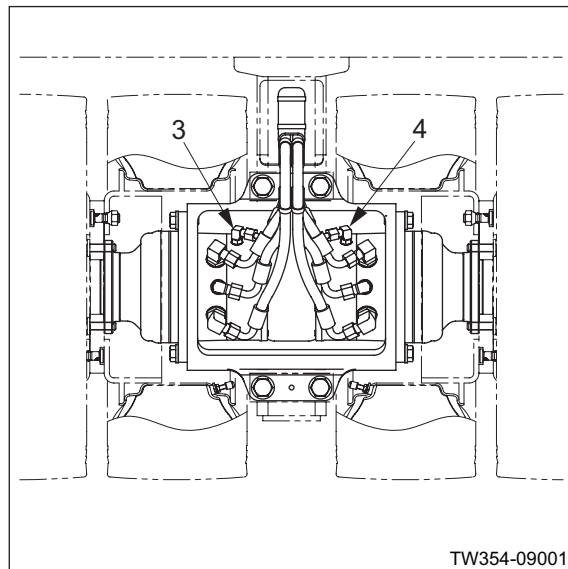
★ Brake release pressure : 1.5 MPa (218 psi)



5-1-2. TW types: rear

- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)
- ① Disconnect hose (3) and (4) from propulsion motor. Attach pressure gauge through adapter $\text{\textcircled{m}}$.
 - Adapter $\text{\textcircled{m}}$: G1/4
 - Pressure gauge : 0 to 5 MPa (0 to 725 psi)
- ② Confirm that F-R lever is "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.
- ⑥ Read brake release pressure indicated by pressure gauge.

★ Brake release pressure : 1.5 MPa (218 psi)



6. MEASUREMENT OF VIBRATOR CIRCUIT PRESSURE

6-1. Measurement

⚠ CAUTION

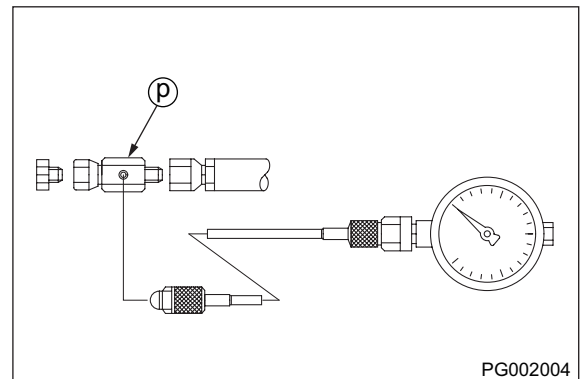
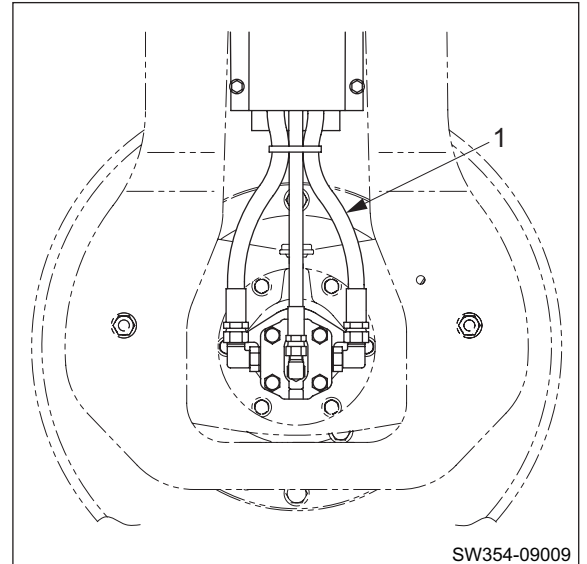
Take care not to operate the vibratory drum for a longer period of time than necessary with the machine stationary. Otherwise, the vibrator bearing could be seized.

- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)
- ① Disconnect hose (1) from vibrator motor. Attach pressure gauge through adapter (P) .
 - Adapter (P) : G1/2
 - Pressure gauge : 0 to 50 MPa (0 to 7,250 psi)
- ② Confirm that F-R lever is "N".
- ③ Apply parking brake by pressing parking brake switch button.
- ④ SW354 ROPS : Set vibratory drum select 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 Read pressure gauge for maximum value of vibrator circuit pressure.
- ⑩ Turn F-R lever vibration switch OFF or move back F-R lever to "N" as soon as measurement is finished.

★ **Maximum circuit pressure (relief valve setting)**

SW/TW354 : 12.7 MPa (1,842 psi)

TW504 : 14.0 MPa (2,030 psi)



7. MEASUREMENT AND INSPECTION OF STEERING CIRCUIT PRESSURE

7-1. 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 : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)

① Remove plug from coupling (1). Attach pressure gauge with hose (S) and connector (U).

- Coupling : 9/16-18UNF×M16
- Adapter for hose (S) : M16 P=2.0
- Pressure gauge connector (U) : M16×G3/8
- Pressure gauge : 0 to 25 MPa
(0 to 3,625 psi)

② Confirm that F-R lever is "N".

③ Apply parking brake by pressing parking brake switch button.

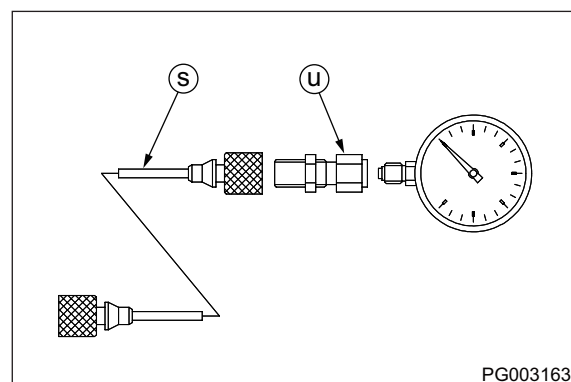
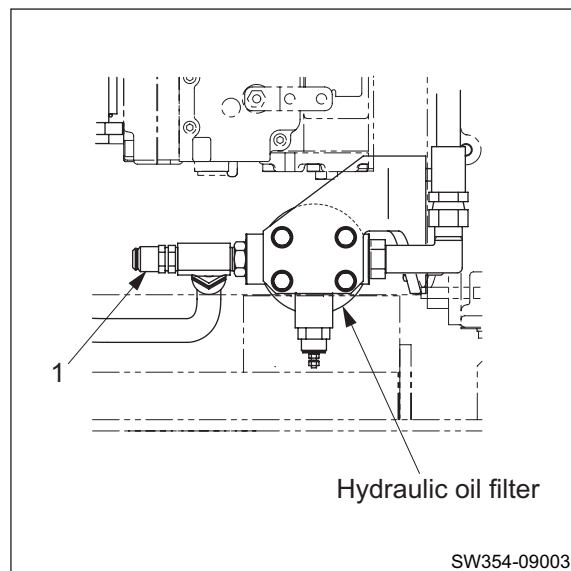
④ Start the engine and set throttle lever to "Full".

⑤ Turn steering wheel to operate relief valve.

⑥ Read pressure indicated by pressure gauge.

★ **Standard maximum circuit pressure
(orbitroll relief pressure)**

: 13.5 MPa (1,958 psi)

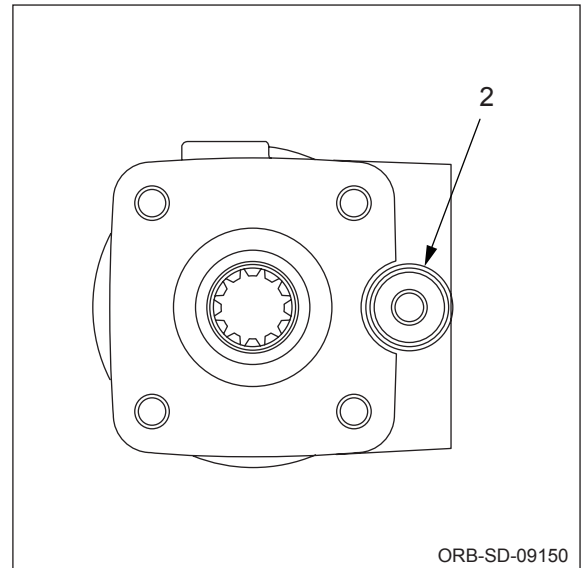


7-2. Inspection

- 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.**



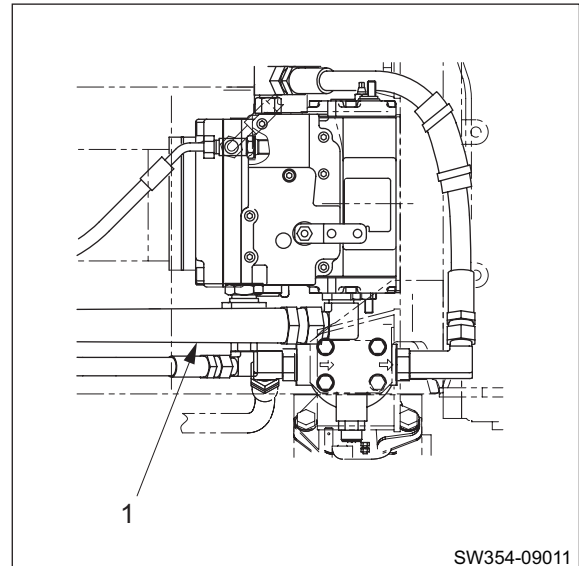
8. MEASUREMENT OF HYDRAULIC PUMP CASE PRESSURE

8-1. Measurement of Propulsion Pump Case Pressure

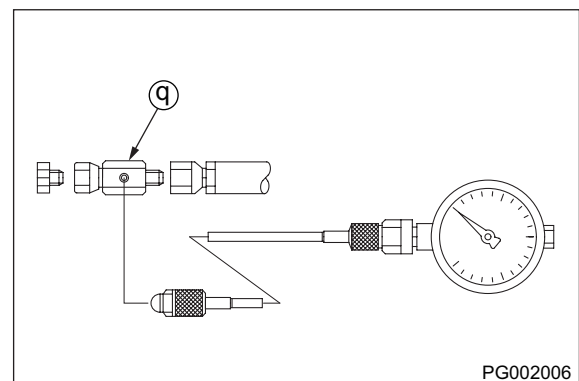
- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)
- ① Disconnect hose (1) from propulsion pump. Attach pressure gauge through adapter ⑨ .
 - Adapter ⑨ : G3/4
 - Pressure gauge : 0 to 5 MPa (0 to 725 psi)
- ② Confirm that F-R lever is "N".
- ③ Apply parking brake by pressing parking brake switch button.
- ④ Set propulsion speed change switch to "🐢".
- ⑤ Start the engine and set throttle lever to "Full".
- ⑥ Establish a condition in which machine propulsion load becomes maximum.
(Pressure does not build up unless propulsion load is applied.)
- ⑦ With propulsion load at maximum, measure pressure when speed change switch is "🐢" and "🐇" and F-R lever is "N", "F", and "R", respectively.

★ Allowable pump case pressure

: 0.25 MPa (36.3 psi) or less



SW354-09011



PG002006

9. MEASUREMENT OF PROPULSION MOTOR CASE PRESSURE

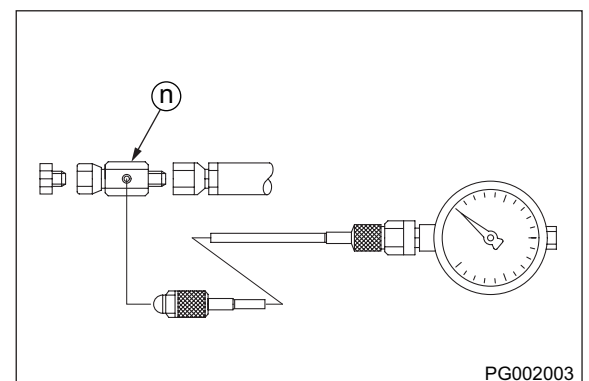
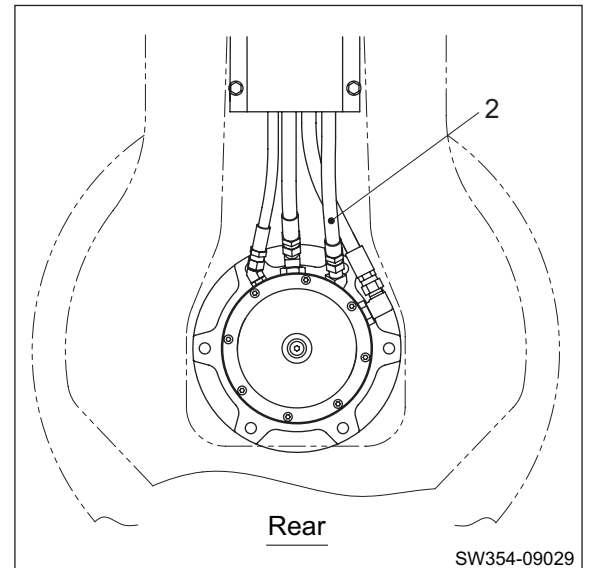
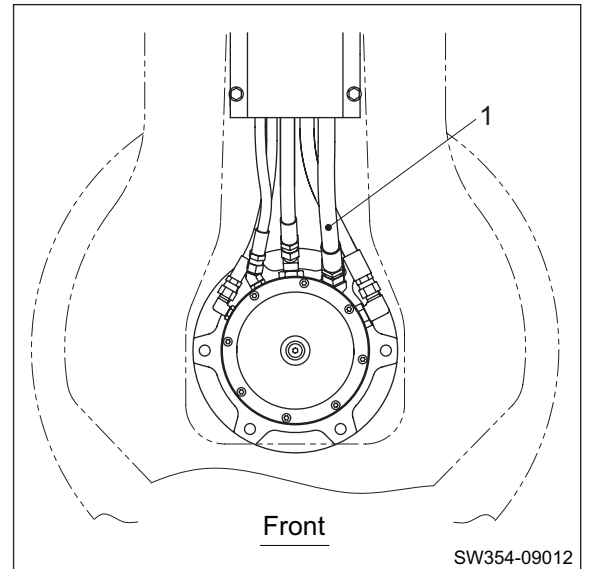
9-1. Measurement

9-1-1. SW types: front and rear, TW types: front

- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)
- ① Disconnect hose (1) and (2) from propulsion motor. Attach pressure gauge with adapter (n) .
 - Adapter (n) : G3/8
 - Pressure gauge : 0 to 5 MPa (0 to 725 psi)
- ② Confirm that F-R lever is "N".
- ③ Apply parking brake by pressing parking brake switch button.
- ④ Set propulsion speed change switch to "🐢".
- ⑤ Start the engine and set throttle lever to "Full".
- ⑥ Establish a condition in which machine propulsion load becomes maximum.
(Pressure does not build up unless propulsion load is applied.)
- ⑦ With propulsion load at maximum, measure pressure when speed change switch is "🐢" and "🐇" and F-R lever is "N", "F", and "R", respectively.

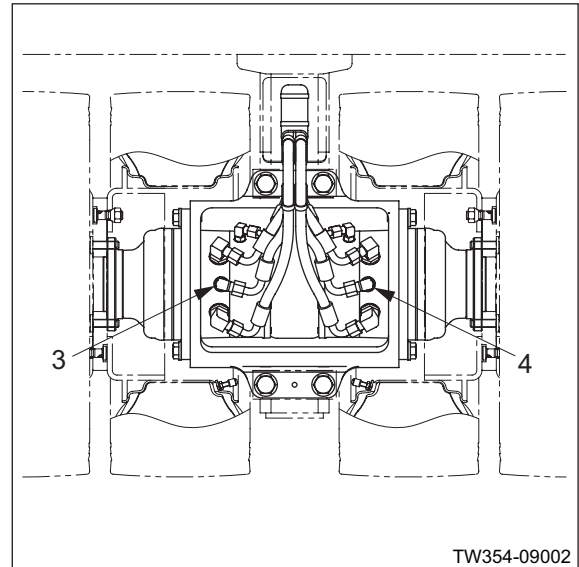
★ Allowable motor case pressure

: 0.3 MPa (43.5 psi) or less

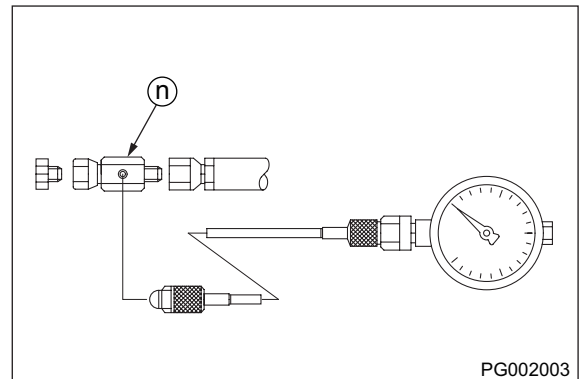


9-1-2. TW types: rear

- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)
- ① Disconnect hose (3) and (4) from propulsion motor. Attach pressure gauge with adapter (n) .
 - Adapter (n) : G3/8
 - Pressure gauge : 0 to 5 MPa (0 to 725 psi)
- ② Confirm that F-R lever is "N".
- ③ Apply parking brake by pressing parking brake switch button.
- ④ Set propulsion speed change switch to "🐢".
- ⑤ Start the engine and set throttle lever to "Full".
- ⑥ Establish a condition in which machine propulsion load becomes maximum.
(Pressure does not build up unless propulsion load is applied.)
- ⑦ With propulsion load at maximum, measure pressure when speed change switch is "🐢" and "🐎" and F-R lever is "N", "F", and "R", respectively.



TW354-09002



PG002003

★ Allowable motor case pressure

: 0.3 MPa (43.5 psi) or less

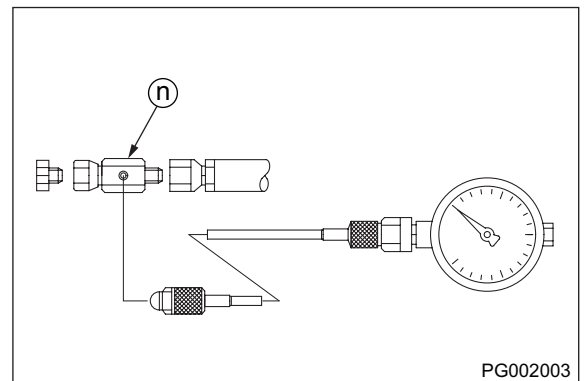
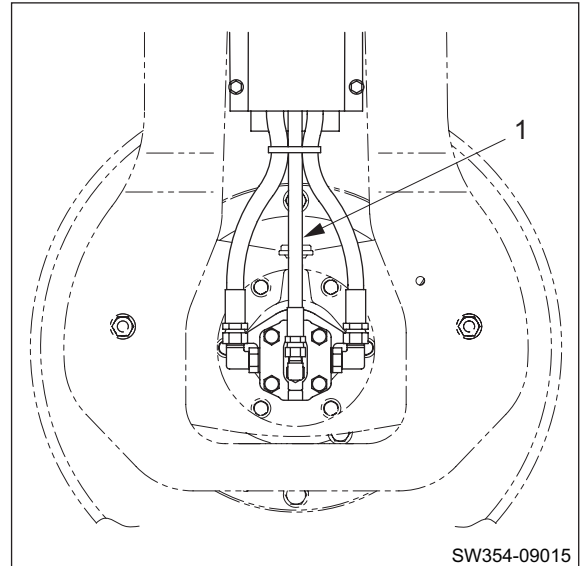
10. MEASUREMENT OF VIBRATOR MOTOR CASE PRESSURE (EXCEPT TW504)

10-1. Measurement

- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)
- ① Disconnect hose (1) from vibrator motor. Attach pressure gauge with adapter (n) .
 - Adapter (n) : G3/8
 - Pressure gauge : 0 to 5 MPa (0 to 725 psi)
- ② Confirm that F-R lever is "N".
- ③ Apply parking brake by pressing parking brake switch button.
- ④ SW354 ROPS : Set vibratory drum select 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 Read pressure indicated by pressure gauge.
- ⑩ Press F-R lever vibration switch OFF or move back F-R lever to "N" as soon as measurement is finished.

★ Allowable motor case pressure

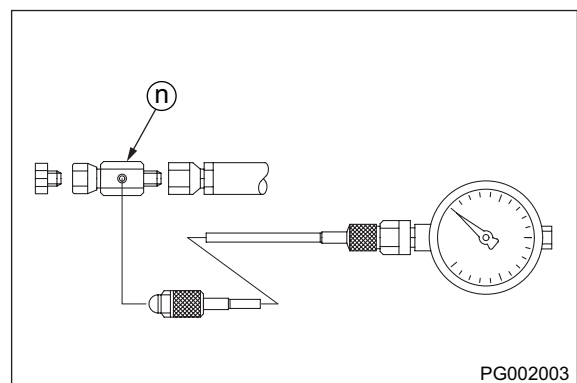
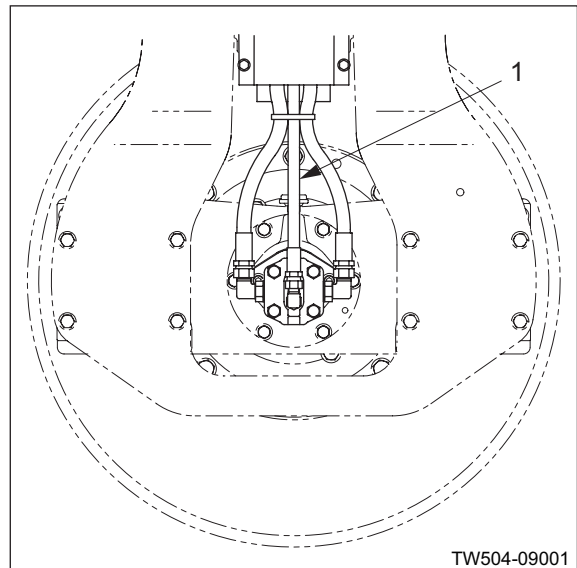
: 0.8 MPa (116 psi) or less



11. MEASUREMENT OF VIBRATOR MOTOR CASE PRESSURE (TW504)

11-1. Measurement

- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)
- ① Disconnect hose (1) from vibrator motor. Attach pressure gauge with adapter (n) .
 - Adapter (n) : G3/8
 - Pressure gauge : 0 to 5 MPa (0 to 725 psi)
- ② Confirm that F-R lever is "N".
- ③ Apply parking brake by pressing parking brake switch button.
- ④ Set vibration mode change switch to " " .
- ⑤ Start the engine and set throttle lever to "Full".
- ⑥ Press F-R lever vibration switch ON.
- ⑦ Slowly move F-R lever to forward or reverse side.
- ⑧ Measure pressure when vibration Lo-Hi change switch is " " and " " , respectively.
- ⑨ Press F-R lever vibration switch OFF or move back F-R lever to "N" as soon as measurement is finished.



★ Allowable motor case pressure

: 0.8 MPa (116 psi) or less

12. ADJUSTMENT OF THROTTLE LEVER

12-1. Adjustment of Linkage

- In cases such as maximum no-load rotational speed or minimum no-load rotational speed deviating from standard value, control cable is replaced, or throttle lever does not move smoothly, make an adjustment in accordance with procedure described below.
- Make the adjustment after amply warming up engine.
- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)

- ① Set throttle lever (1) to "IDLE".
- ② Attach control cable (4) to throttle lever (1).
- ③ Attach control cable (4) to fuel injection pump's control lever.
- ④ Start the engine.
- ⑤ Loosen lock nut (3).
- ⑥ Using stopper bolt (2), adjust so that standard minimum no-load rotational speed is achieved.

★ **Standard minimum no-load rotational speed**

: $1,050 \pm 50$ rpm

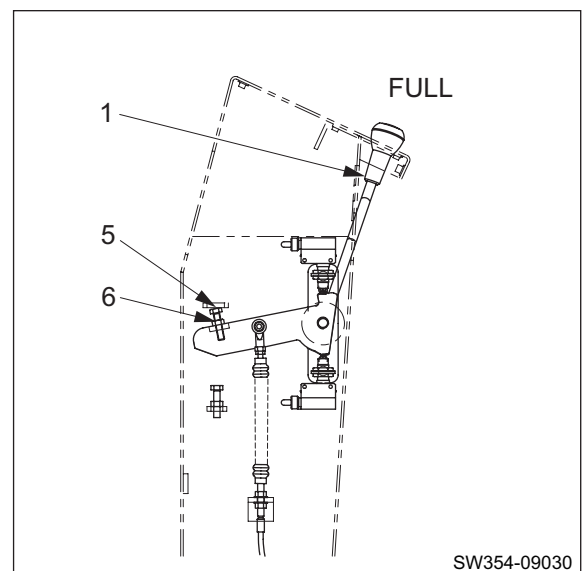
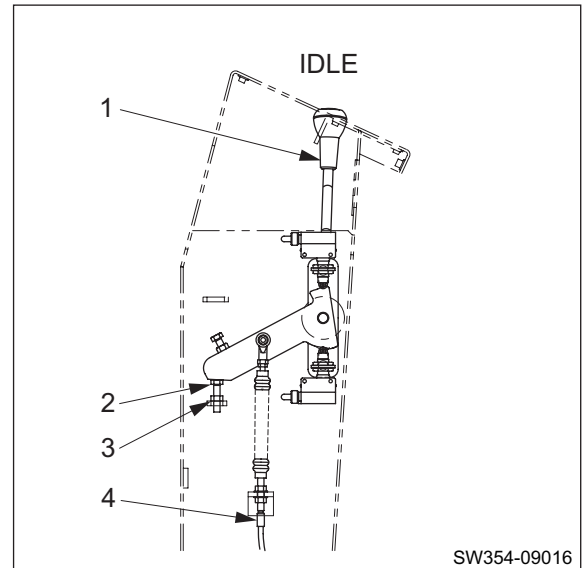
- ⑦ Using lock nut (3), firmly secure stopper bolt (2).

- ⑧ Set throttle lever (1) to "FULL".
- ⑨ Loosen lock nut (6).
- ⑩ Using stopper bolt (5), adjust so that standard maximum no-load rotational speed is achieved.

★ **Standard maximum no-load rotational speed**

: $2,200 \pm 50$ rpm

- ⑪ Using lock nut (6), firmly secure stopper bolt (5).



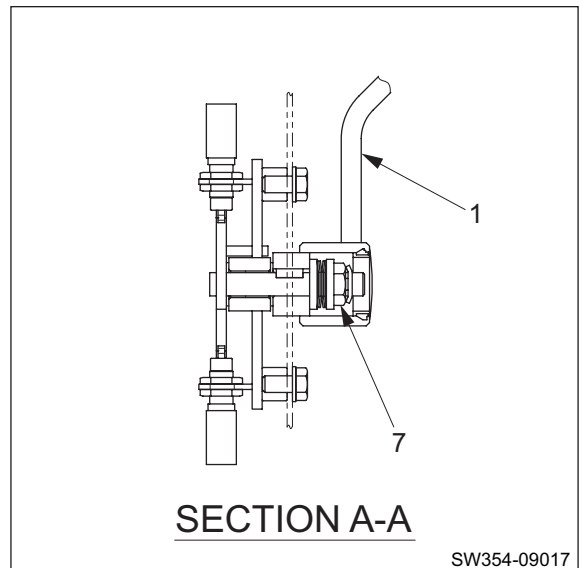
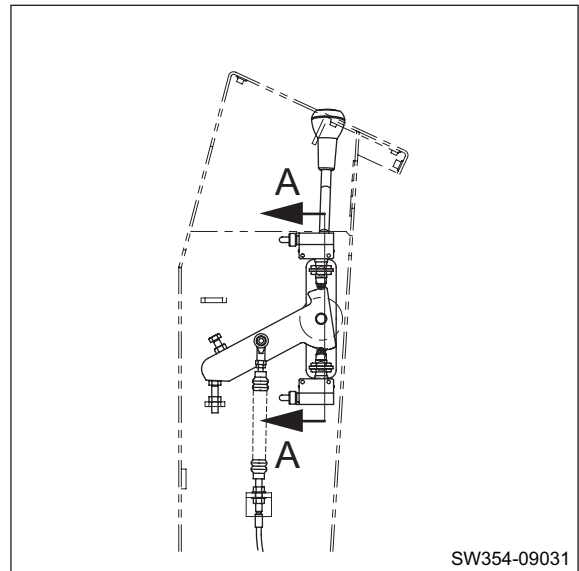
12-2. Adjustment of Operating Force

① Tighten nut (7) and set operating force at center of throttle lever (1) knob to standard operating force. Do not turn nut to the loosening direction.

★ Standard operating force : 44.1 ± 6.86 N (9.9 ± 1.5 lbf)

(NOTICE)

- In case of loosen nut (7), replace it with a new one.



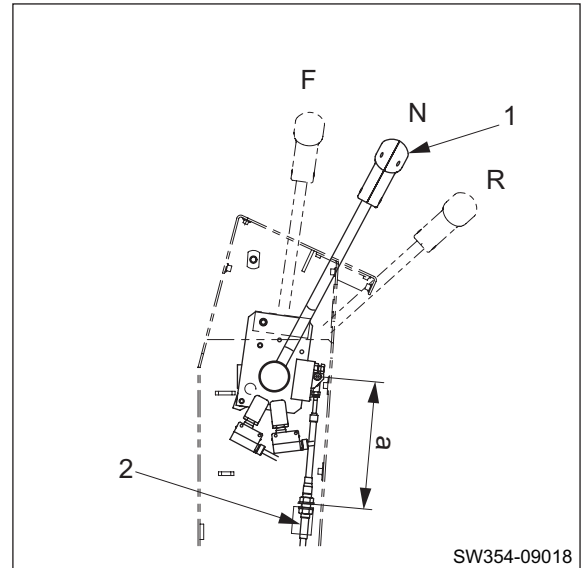
13. ADJUSTMENT OF F-R LEVER

13-1. Adjustment of Linkage

- In cases such as propulsion pump is replaced, control cable is replaced, or F-R lever does not move smoothly, make an adjustment in accordance with procedure described below.
- “N”, maximum “F”, and maximum “R” positions of F-R lever (1) are positioned by notches.

- ① Set F-R lever in “N”.
- ② Attach control cable (2) to F-R lever.

★ Specified dimension a: 208 mm (8.19 in.)



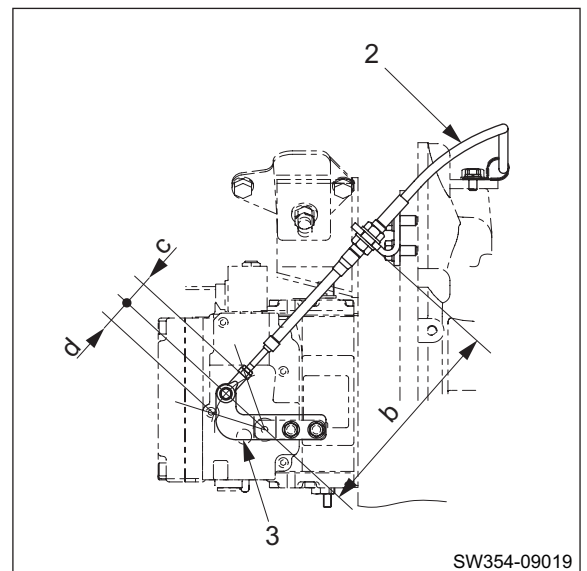
- ③ Attach control cable to propulsion pump control lever (3).

★ Specified dimension b: 208 mm (8.19 in.)

- ④ Confirm the strokes of propulsion pump control lever (3).

★ Specified dimension c: 24 mm (0.94 in.)

★ Specified dimension d: 23 mm (0.91 in.)



13-2. Adjustment of Operating Force

① Loosen lock nut (7), and set screw (6) so that operating force at center of F-R lever (1) knob matches standard operating force.

★ Standard operating force : 34.3 ± 4.9 N (7.7 ± 1.1 lbf)

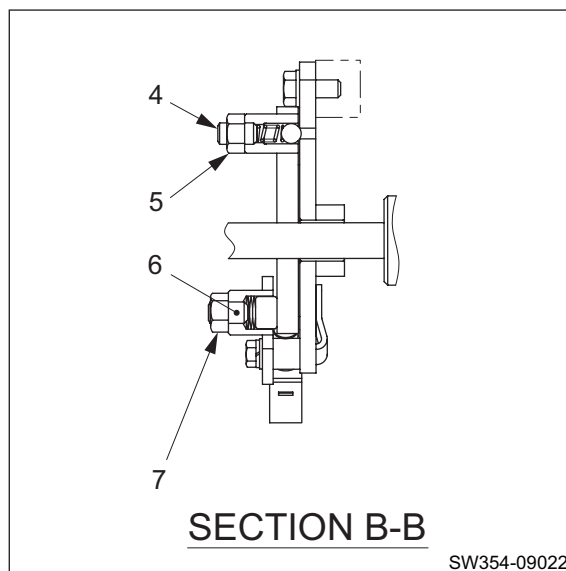
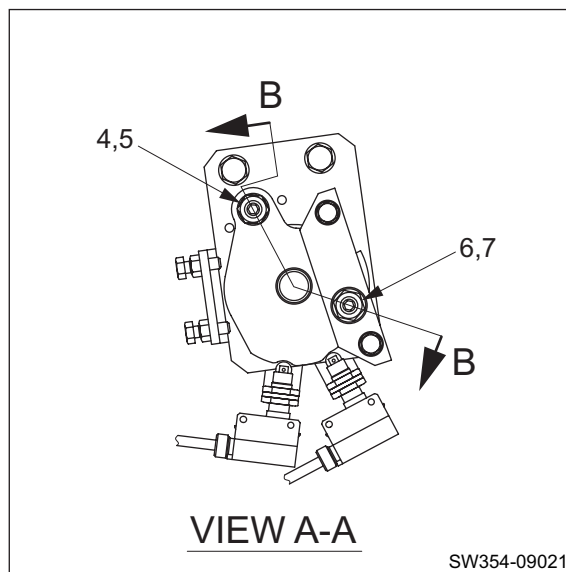
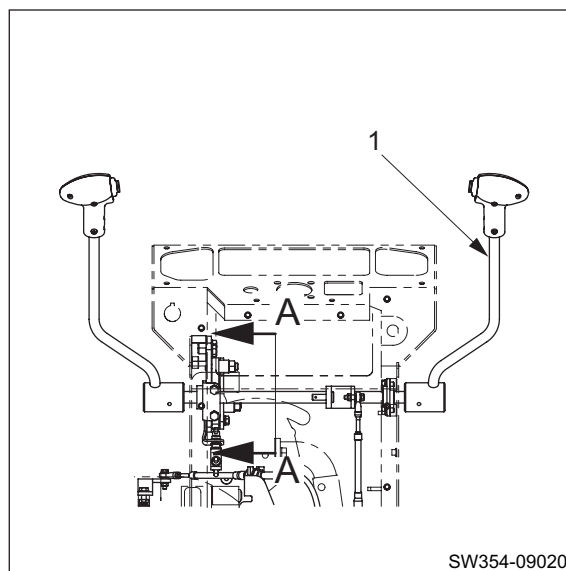
• After adjustment, fix set screw (6) with lock nut (7).

② Loosen lock nut (5), and set screw (4) to match operating force of lever to standard operating force +14.7 N, when getting over notch at center of F-R lever knob.

★ Operating force to move lever over notch

: 49 ± 4.9 N (11 ± 1.1 lbf)

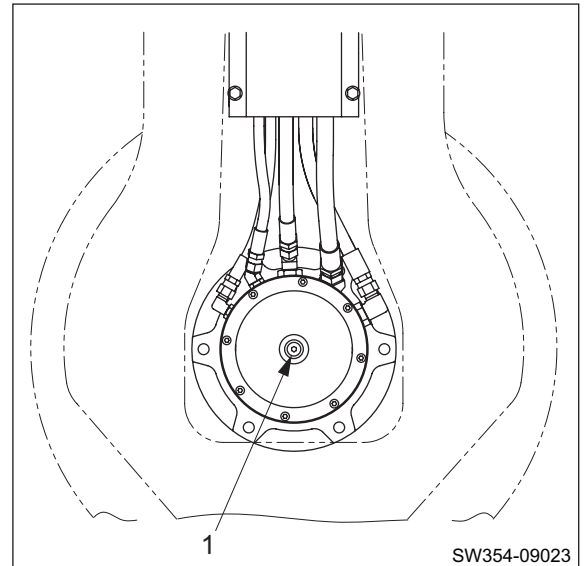
• After adjustment, fix set screw (4) with lock nut (5).



14. PROCEDURE FOR MEASURING QUANTITY OF BRAKE PISTON STROKE (REPLACEMENT STANDARD)

14-1. Measurement

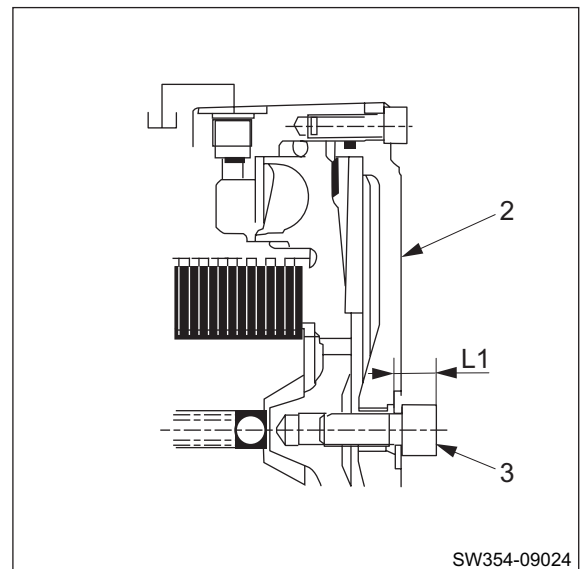
- ① Remove cap plug (1) from manual brake release port.



- ② Attach bolt (3) for forced brake releasing. Allow bolt to be out of contact with seating surface without tightening bolt completely.

(3) Bolt SW/TW354 : M10×25
 TW504 : M12×30

- ③ Leave manual brake release port open to atmosphere (brake lock state).
 ④ Measure distance (L1) between brake cover (2) and bolt (3) head with depth calipers.



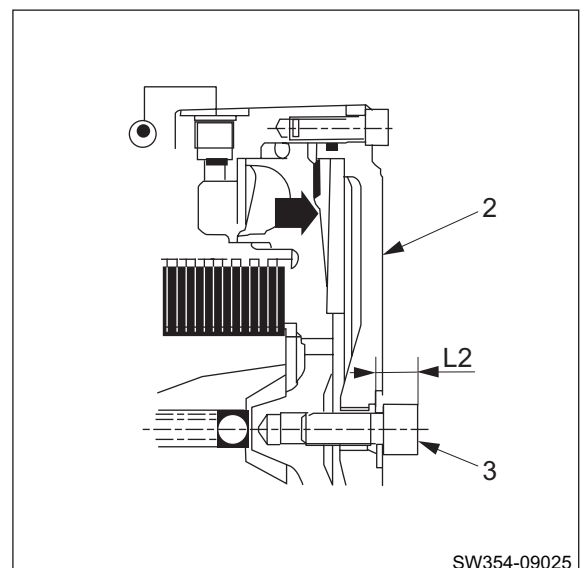
- ⑤ Measure distance (L2) up to bolt (3) head with depth calipers when complete release pressure is applied to manual brake release port.

Quantity of brake stroke = L2 - L1

(NOTICE)

- When brake stroke exceeds replacement standard shown below, replace all friction plates and separation plates.

★ Standard quantity of brake stroke for replacement
 : 3.5 mm (0.14 in.)



TROUBLESHOOTING

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.

2. ELECTRICAL SYSTEM TROUBLESHOOTING

2-1. When Performing Electrical System Fault Diagnosis

⚠ WARNING

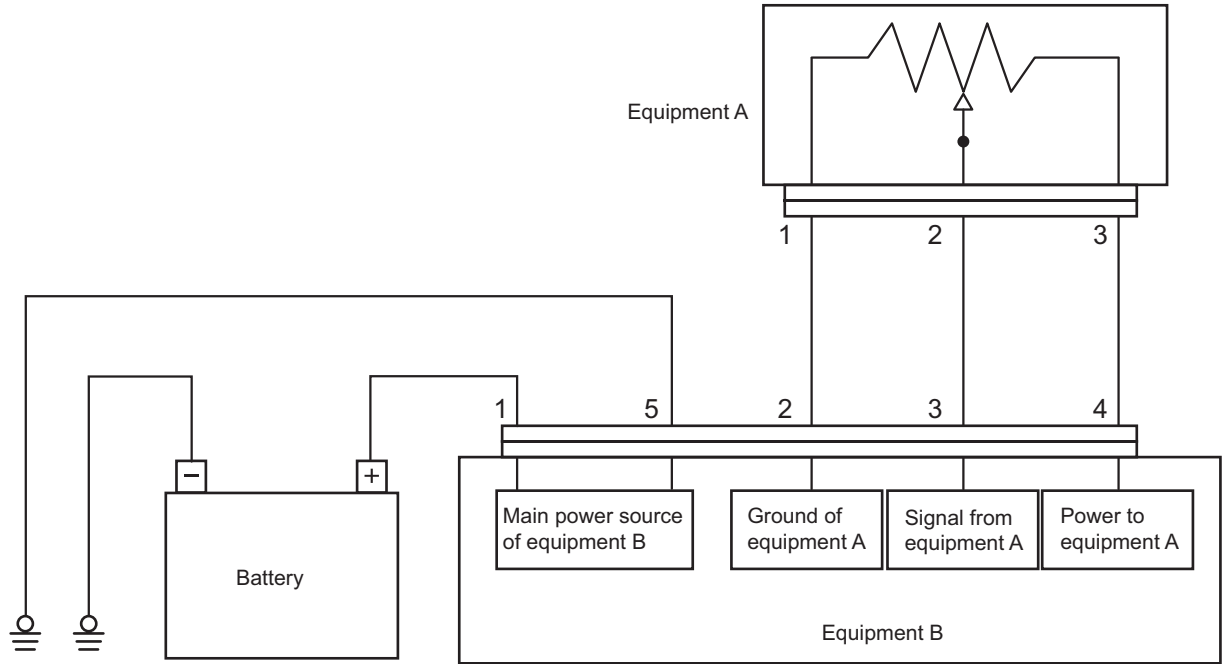
Be very careful because equipment can return to normal during an inspection and suddenly operate properly when a failure occurs due to a faulty contact or other such cause.

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.
- For information of wire number, wire size, and wire color used in the sample circuit diagrams, refer to "1-1. Wire Numbers, Wire Sizes, Wire Colors and Connectors Shown in Electrical Circuit Diagram, Wiring Harness Layout and Wiring Harnesses" (P.5-001).

2-1-2. Inspection procedures using a tester

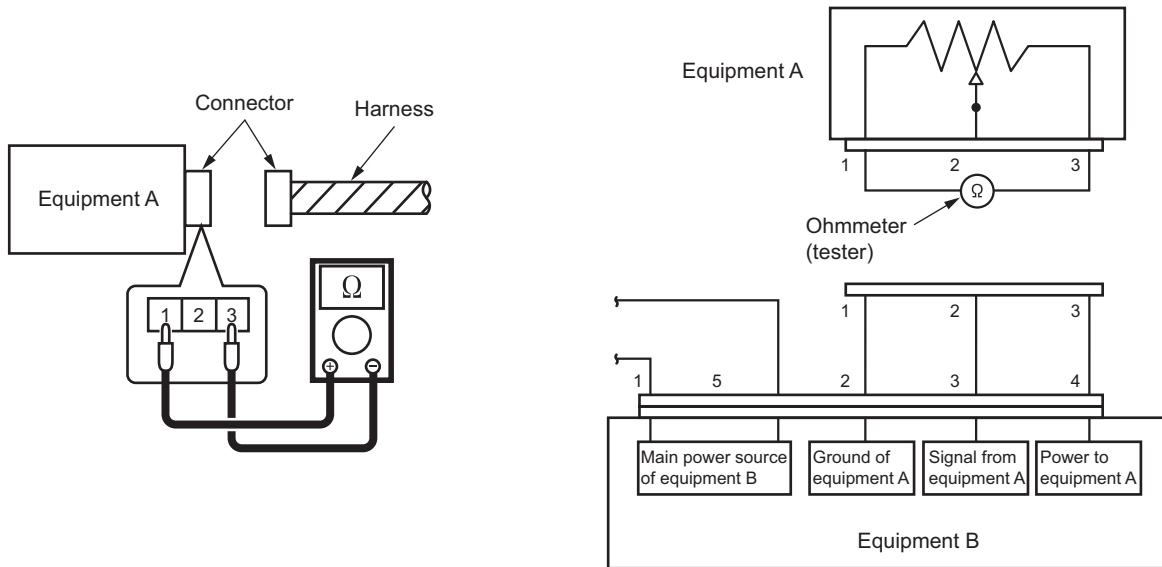
Some of the various inspection procedures are presented here for reference, using a sample circuit below.



TS-10001

1) Measuring resistance using tester

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

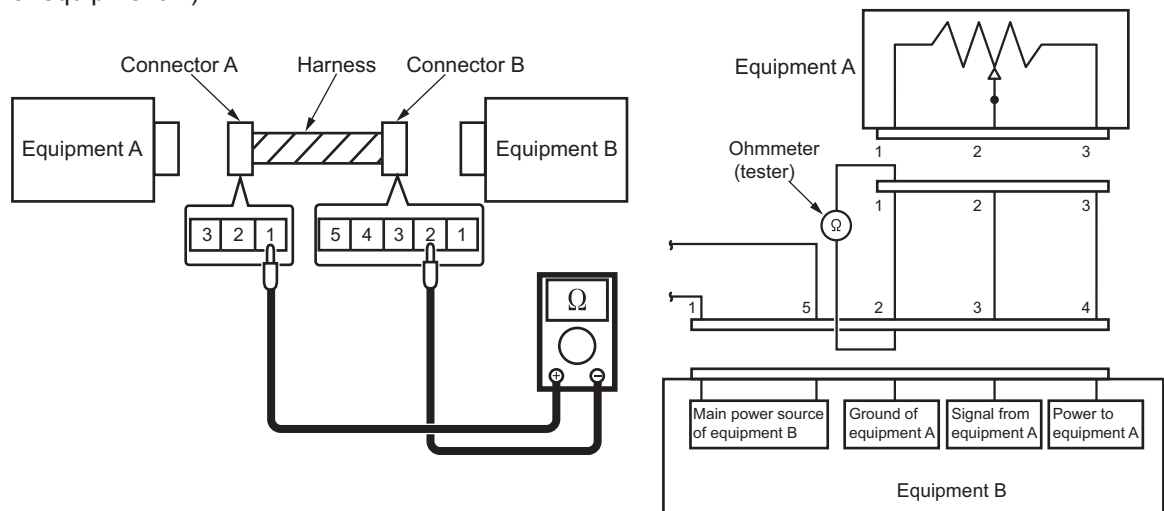


TS-10002

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)



TS-10003

Inspection procedure

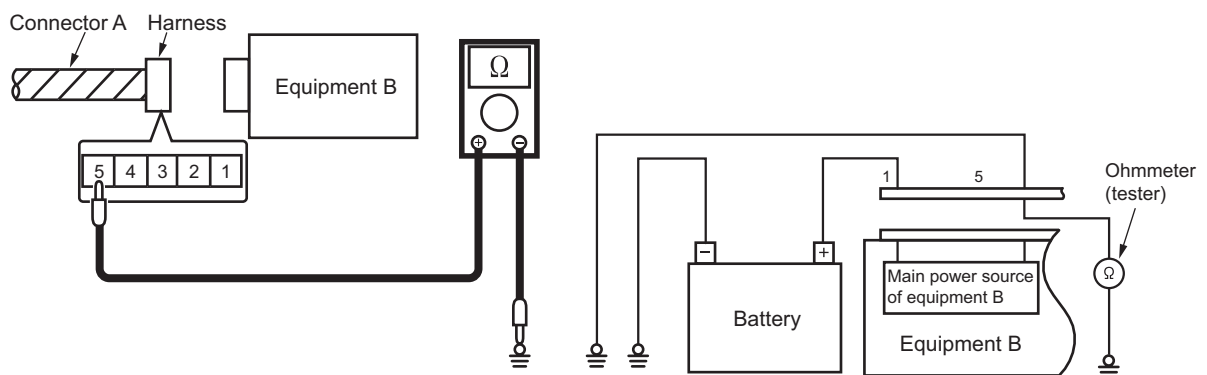
- ① Disconnect the connectors of equipment A and equipment B.
- ② Connect the test probe (+) to connector terminal 1 of equipment A and the test probe (-) to connector terminal 2 of equipment B and measure the resistance. At this time, reversing the connector terminals between the probes (+) and (-)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

Criteria for harness defects

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

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

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



TS-10004

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.

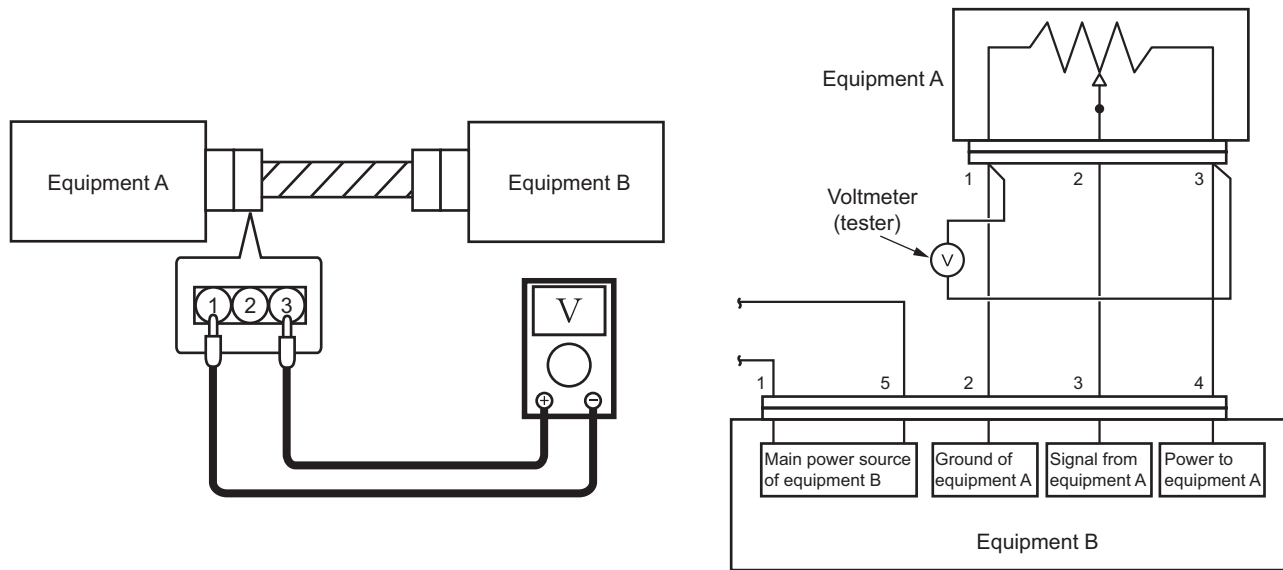
(NOTICE)

- 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)

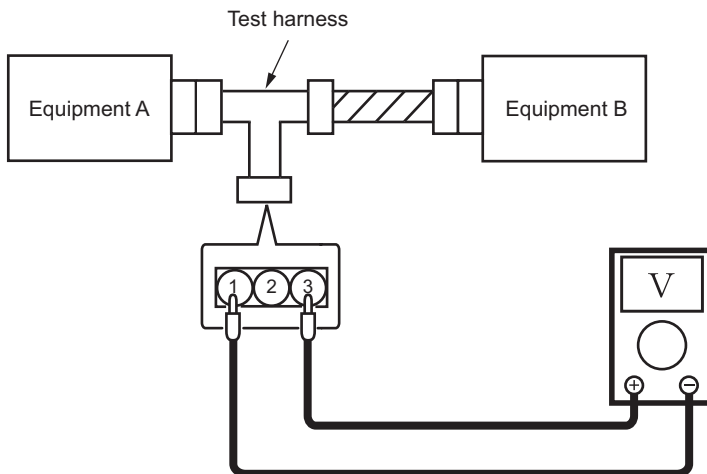


TS-10005

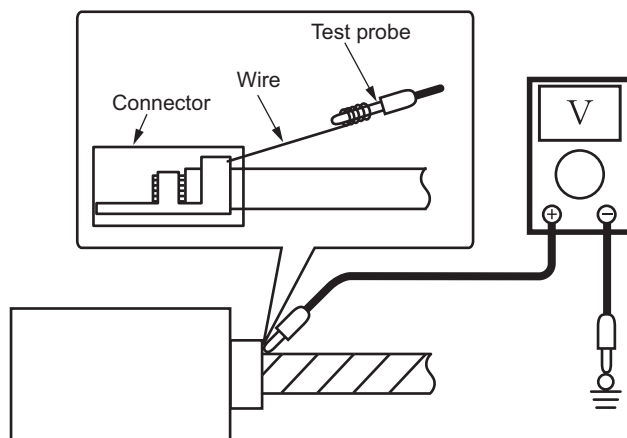
Inspection procedure

- 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.

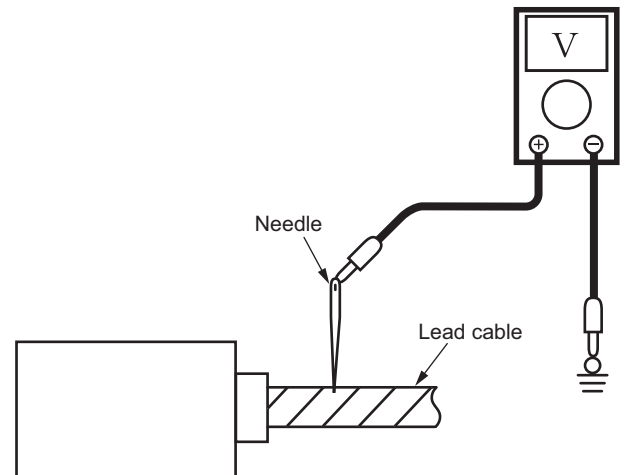
- Measurement using a test harness



- Measurement from the backside of connector



- Measurement on a lead cable



TS-10006

Measurement method

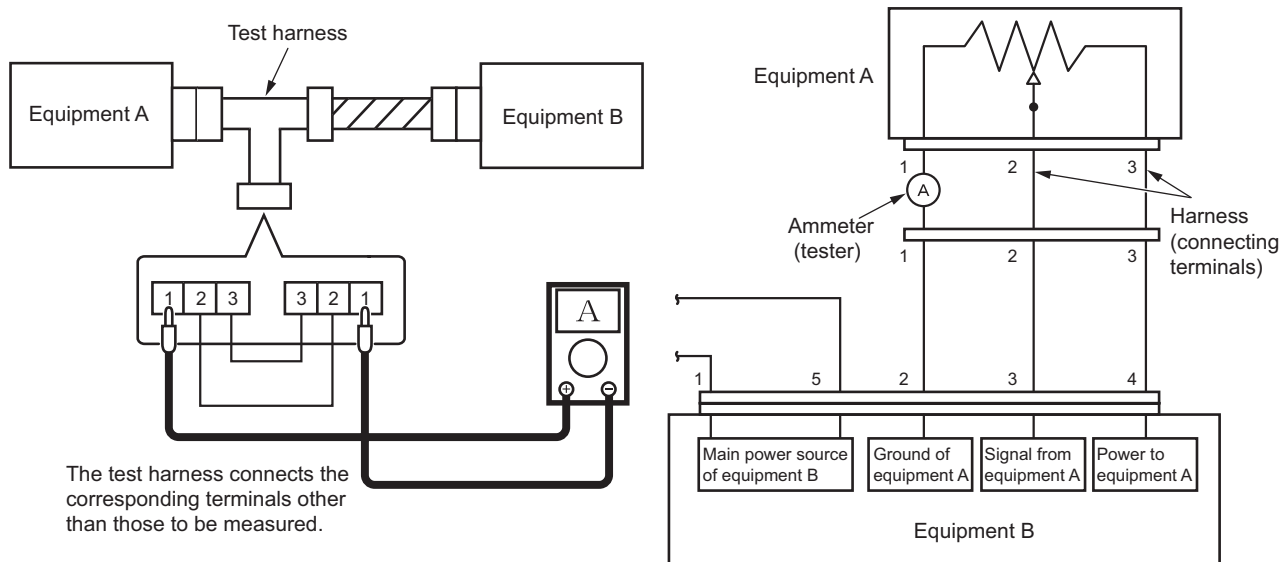
For measurement of voltage, connect the tester probes in parallel to the portion to be measured. Because the voltage can be measured only when the connector is connected in position, contact the tester probes to the terminals without disconnecting the connector. The following methods are available:

- 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)



TS-10007

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.

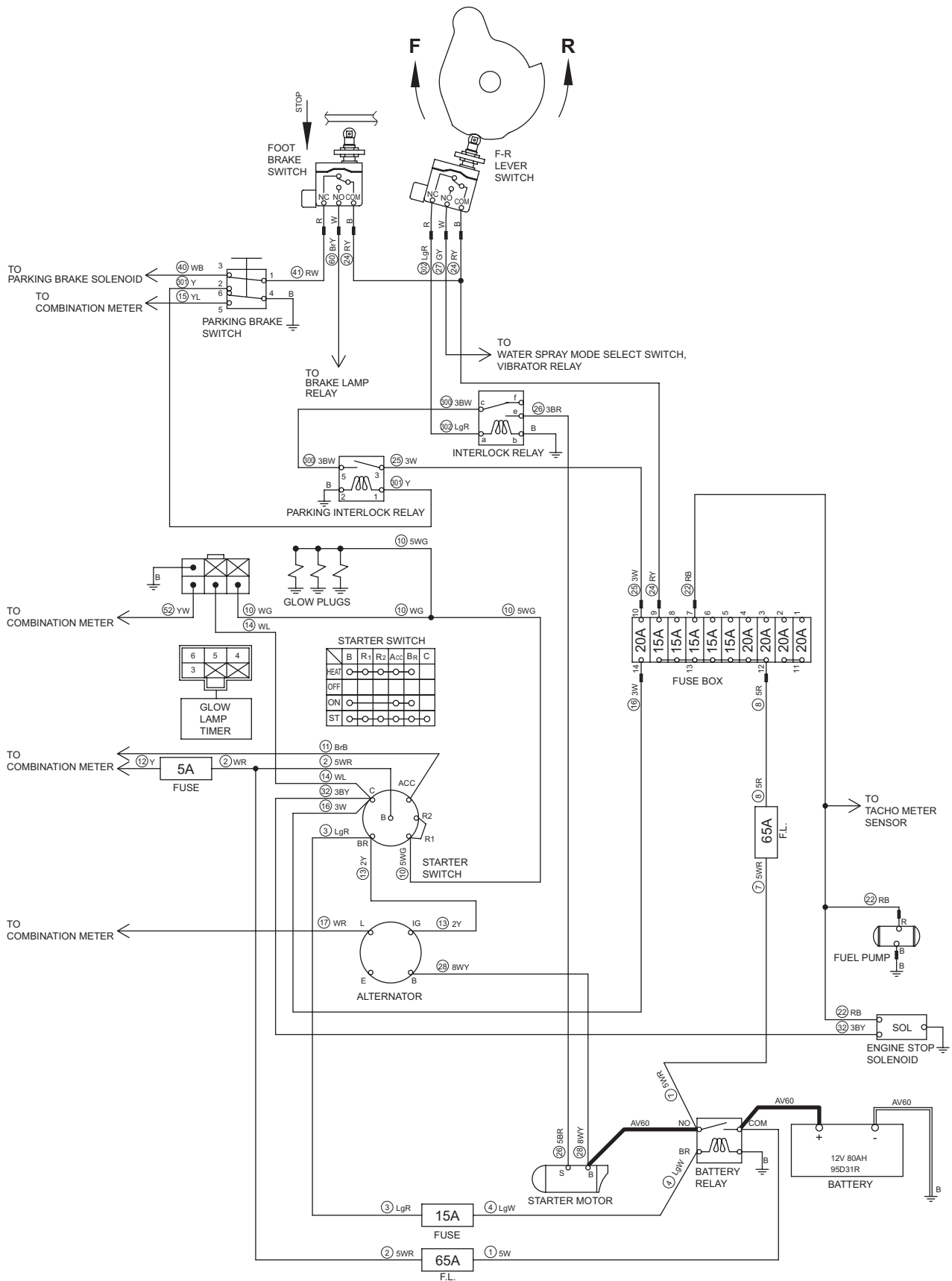
If YES : Replace the valve.

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.
- Brake pedal is not depressed.

Reference Fig.: 2-2-1

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

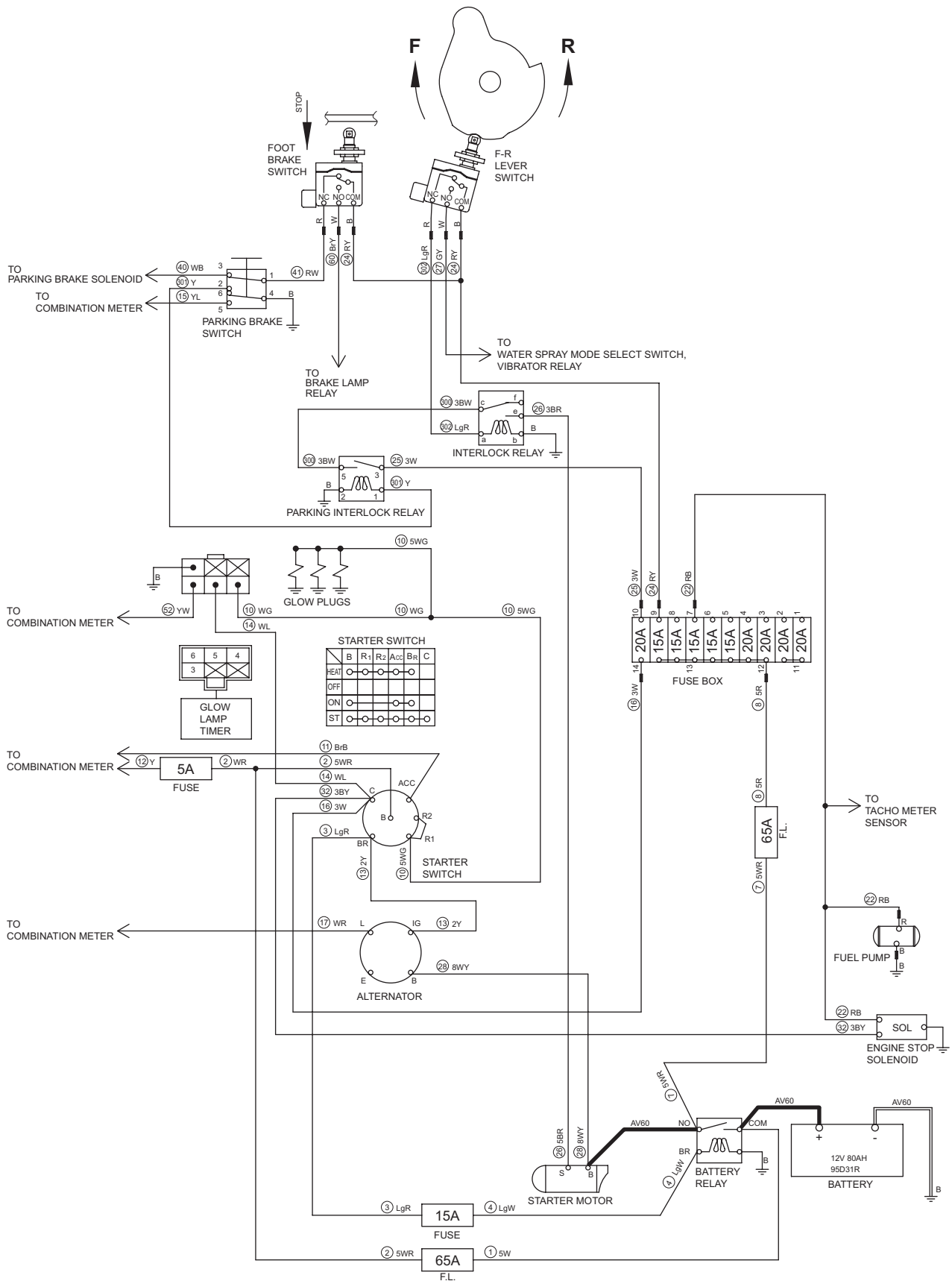
2-2-1. Engine will not start (Starter motor does not run) 2/3

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

Reference Fig.: 2-2-1

Check point	Check/Cause	Action
5. Interlock Relay	<p>(1) When starter switch is ON, measure voltage between interlock relay terminal a inlet wire LgR and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is START, measure voltage between interlock relay terminal c inlet wire BW and chassis ground. Standard voltage : 12 V or more</p> <p>(3) When starter switch is START, measure voltage between interlock relay terminal e outlet wire BR and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and item (3) is NG, interlock relay is faulty. 	Replace interlock relay.
6. Parking Interlock Relay	<p>(1) When starter switch is ON, measure voltage between parking interlock relay terminal 1 inlet wire Y 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 W 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 BW and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and item (3) is NG, parking interlock relay is faulty. 	Replace parking interlock relay.
7. F-R Lever Switch	<p>(1) When starter switch is ON, measure voltage between F-R lever switch terminal inlet wire RY 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 outlet wire LgR and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, F-R lever switch is faulty. 	Replace F-R lever switch.
8. Foot Brake Switch	<p>(1) When starter switch is ON, measure voltage between foot brake switch terminal inlet wire RY and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between foot brake switch terminal outlet wire RW and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, foot brake switch is faulty. 	Replace foot brake switch.

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.
- Brake pedal is not depressed.

Reference Fig.: 2-2-1

Check point	Check/Cause	Action
9. Parking Brake Switch	(1) When starter switch is ON, measure voltage between parking brake switch terminal 1 inlet wire RW and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON, measure voltage between parking brake switch terminal 2 outlet wire Y and chassis ground. Standard voltage : 12 V or more • If above item (1) is OK and item (2) is NG, parking brake switch is faulty.	Replace parking brake switch.
10. Harness Connecting Between Terminals	• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.

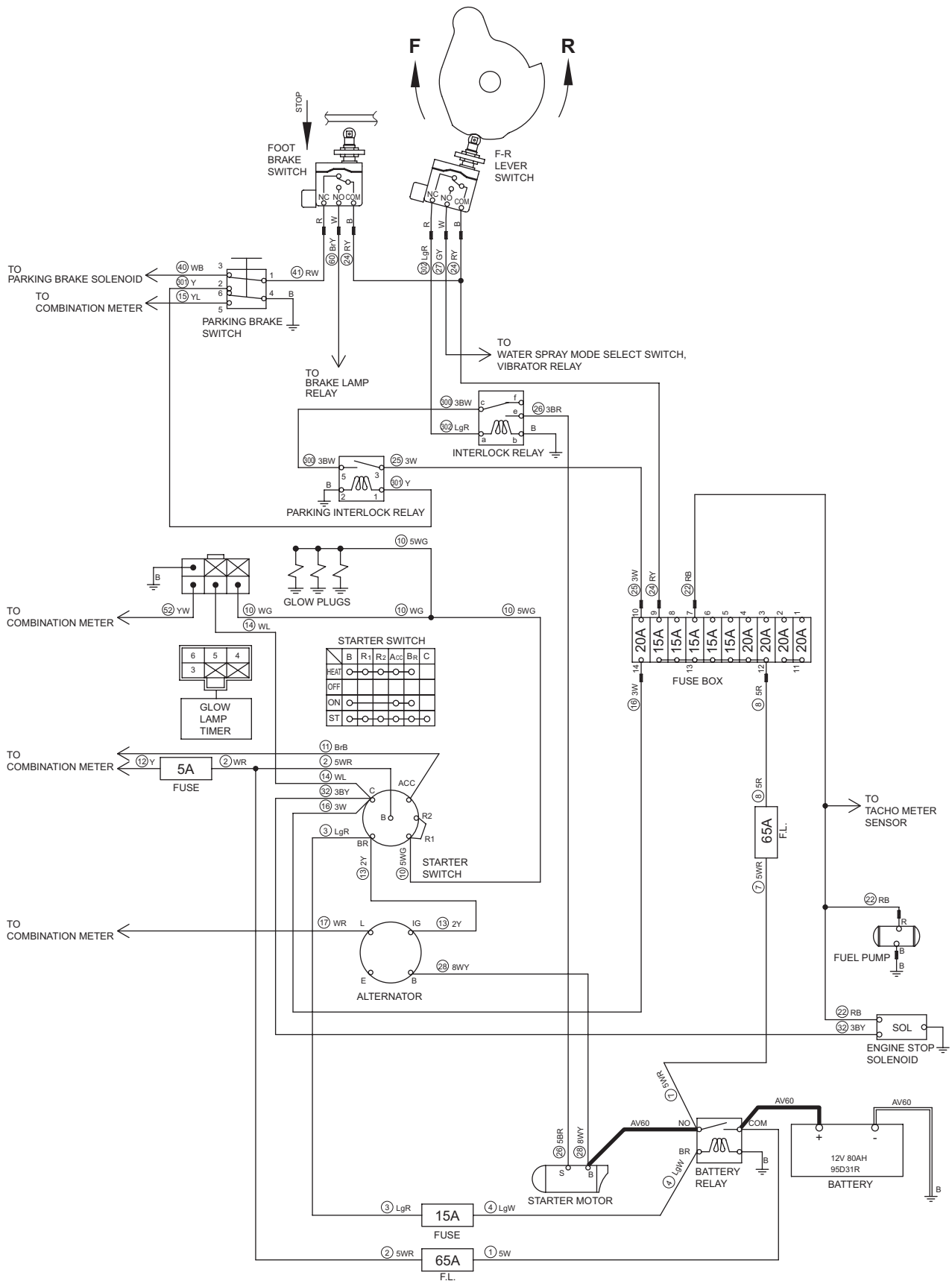
2-2-2. Engine will not start (But starter motor runs)

- 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	• When starter switch is ON, measure voltage between fuel pump terminal inlet wire RB and chassis ground. Standard voltage : 12 V or more • If above item is OK and fuel pump does not operate, fuel pump is faulty.	Repair or replace fuel pump.
2. Engine Stop Solenoid	(1) When starter switch is ON, measure voltage between engine stop solenoid terminal inlet wire RB and chassis ground. Standard voltage : 12 V or more (2) When starter switch is START, measure voltage between engine stop solenoid terminal inlet wire BY and chassis ground. Standard voltage : 12 V or more • If above items (1) and (2) are OK and engine does not start, engine stop solenoid is faulty.	Replace engine stop solenoid.
3. Harness Connecting Between Terminals	• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.

Fig.: 2-2-1



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 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 inlet wire BY and chassis ground. There is no electricity in normal condition</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and engine does not stop after started, engine stop solenoid is faulty. 	Replace engine stop solenoid.
2. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

2-2-4. No charging

Reference Fig.: 2-2-1

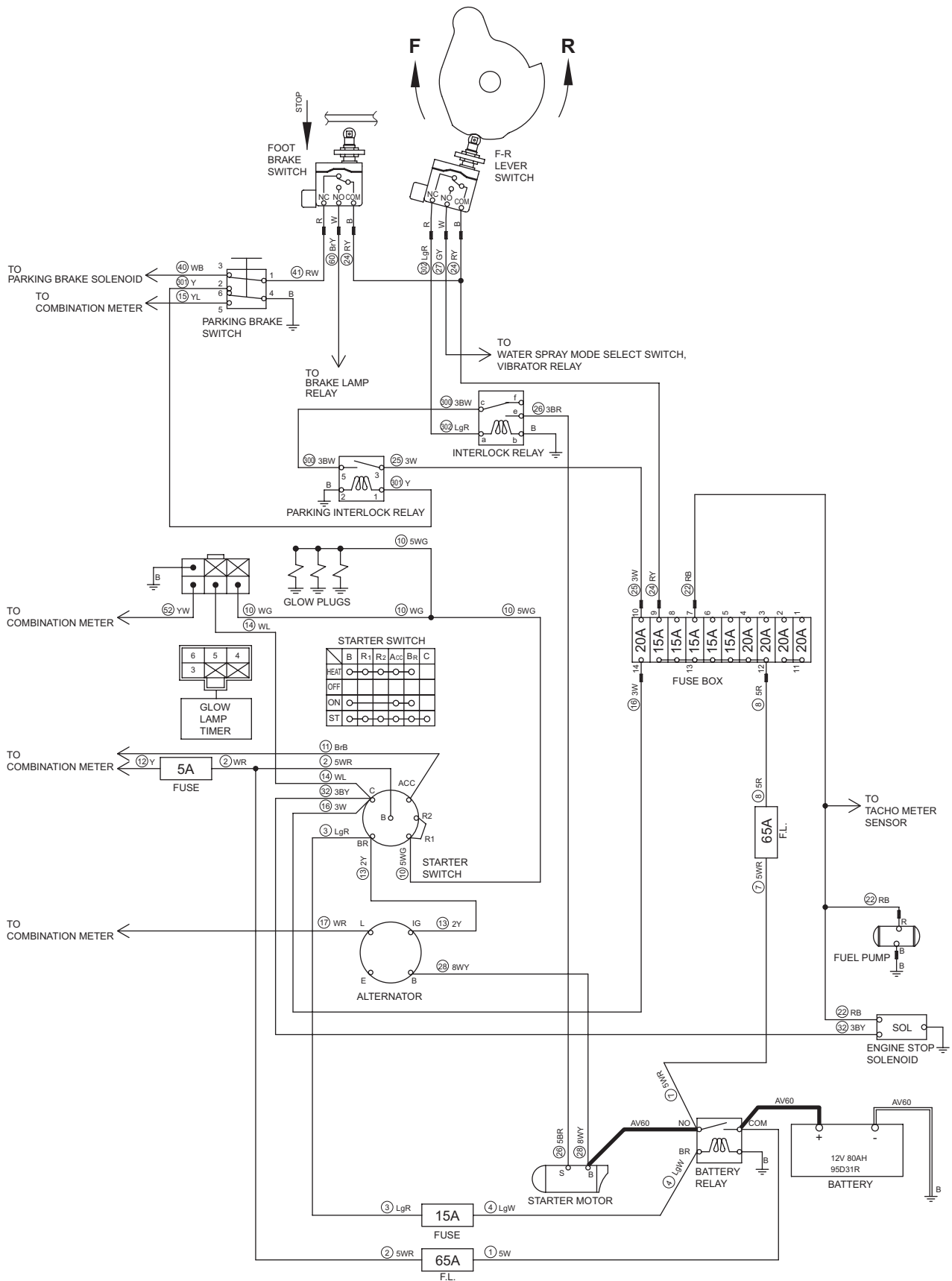
Check point	Check/Cause	Action
1. Alternator	<ul style="list-style-type: none"> • After starting engine, measure voltage between alternator terminal B wire WY and chassis ground. Standard voltage : At least intermediate engine speed, 14 V or more • If voltage is lower than standard, alternator is faulty. • If voltage is normal and battery is not charged, battery is faulty. 	Replace alternator or battery.

2-2-5. Glow plugs is not heated (Engine starting performance is bad in cold weather)

Reference Fig. : 2-2-1

Check point	Check/Cause	Action
1. Glow Plugs	<ul style="list-style-type: none"> • When starter switch is ON, measure voltage between glow plugs terminal inlet wire WG and chassis ground. Standard voltage : 12 V or more • If voltage is OK, glow plugs is faulty. 	Replace glow plugs.
2. Starter Switch	<ul style="list-style-type: none"> • Check continuity between O-O according to starter switch connection table. Switch is OK if there is continuity between connection O-O. • If there is no continuity, starter switch is faulty. 	Replace starter switch.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

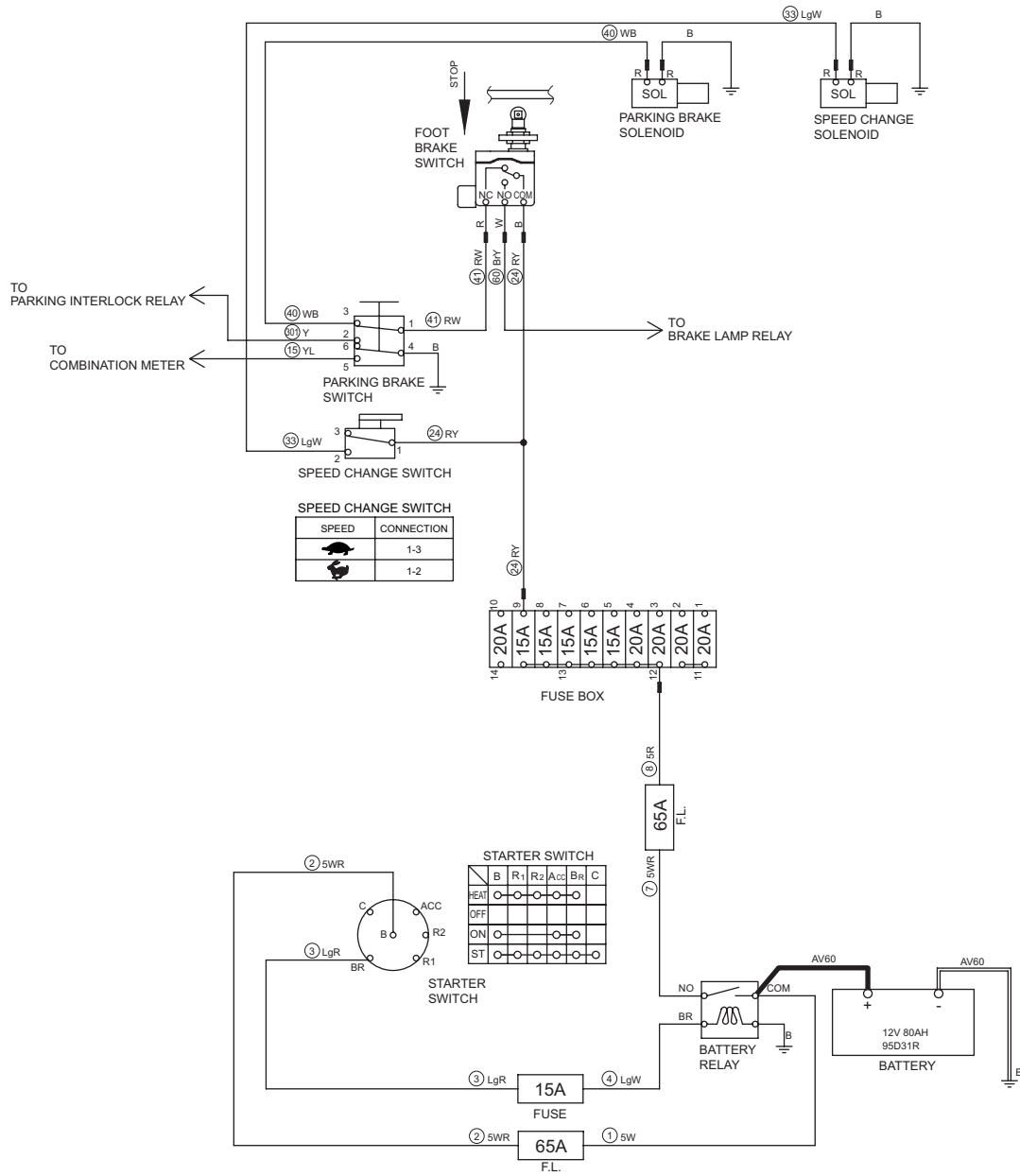
Fig.: 2-2-1



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">• When starter switch is OFF and F-R lever is “F” or “R”, check continuity between F-R lever switch terminal wire RY and terminal wire LgR. There is no continuity in normal condition.• If there is continuity, F-R lever switch is faulty.	Replace F-R lever switch.

Fig.: 2-3-1



2-3. Propulsion

Check following items before troubleshooting.

- No blown fuses and power is applied up to fuses.
- When measuring voltage and current without disconnecting connectors, refer to “Measuring voltage and current flowing using tester” (P.10-006 to P.10-008).
- 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.
- 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"> • Disconnect harness and measure resistance of coil. Standard resistance : 9.0 Ω • If measured resistance is abnormal, parking brake solenoid is faulty. 	Replace parking brake solenoid.
2. Parking Brake Switch	<p>(1) When starter switch is ON, measure voltage between parking brake switch terminal 1 inlet wire RW 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 WB and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, parking brake switch is faulty. 	Replace parking brake switch.
3. Foot Brake Switch	<p>(1) When starter switch is ON, measure voltage between foot brake switch terminal inlet wire RY and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between foot brake switch terminal outlet wire RW and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, foot brake switch is faulty. 	Replace foot brake switch.
4. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

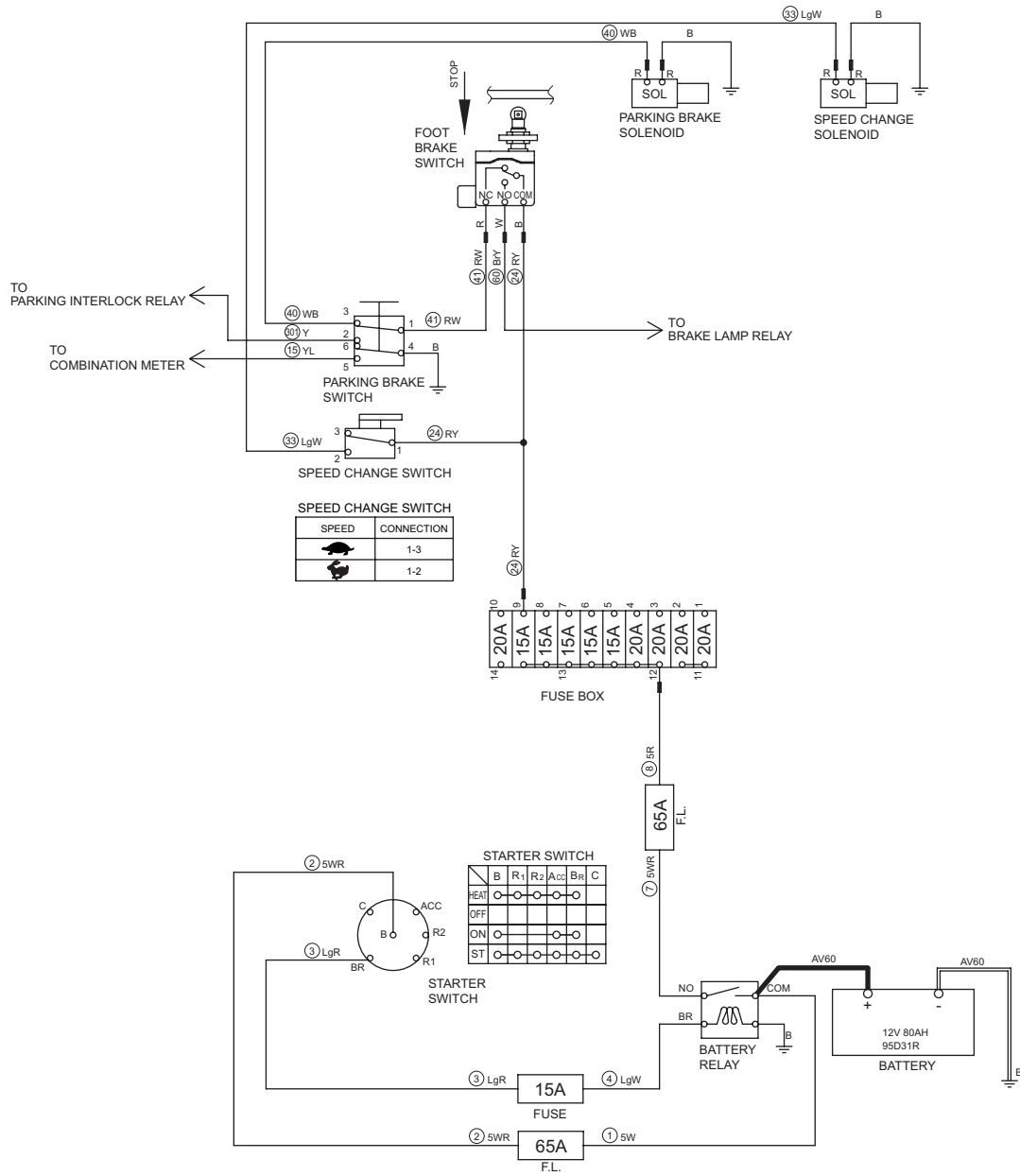
2-3-2. Machine speed cannot be changed

- 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"> • Disconnect harness and measure resistance of coil. Standard resistance : 9.0 Ω • If measured resistance is abnormal, speed change solenoid is faulty. 	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 RY 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 LgW and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and (2) is NG, speed change switch is faulty. 	Replace speed change switch.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

Fig.: 2-3-1



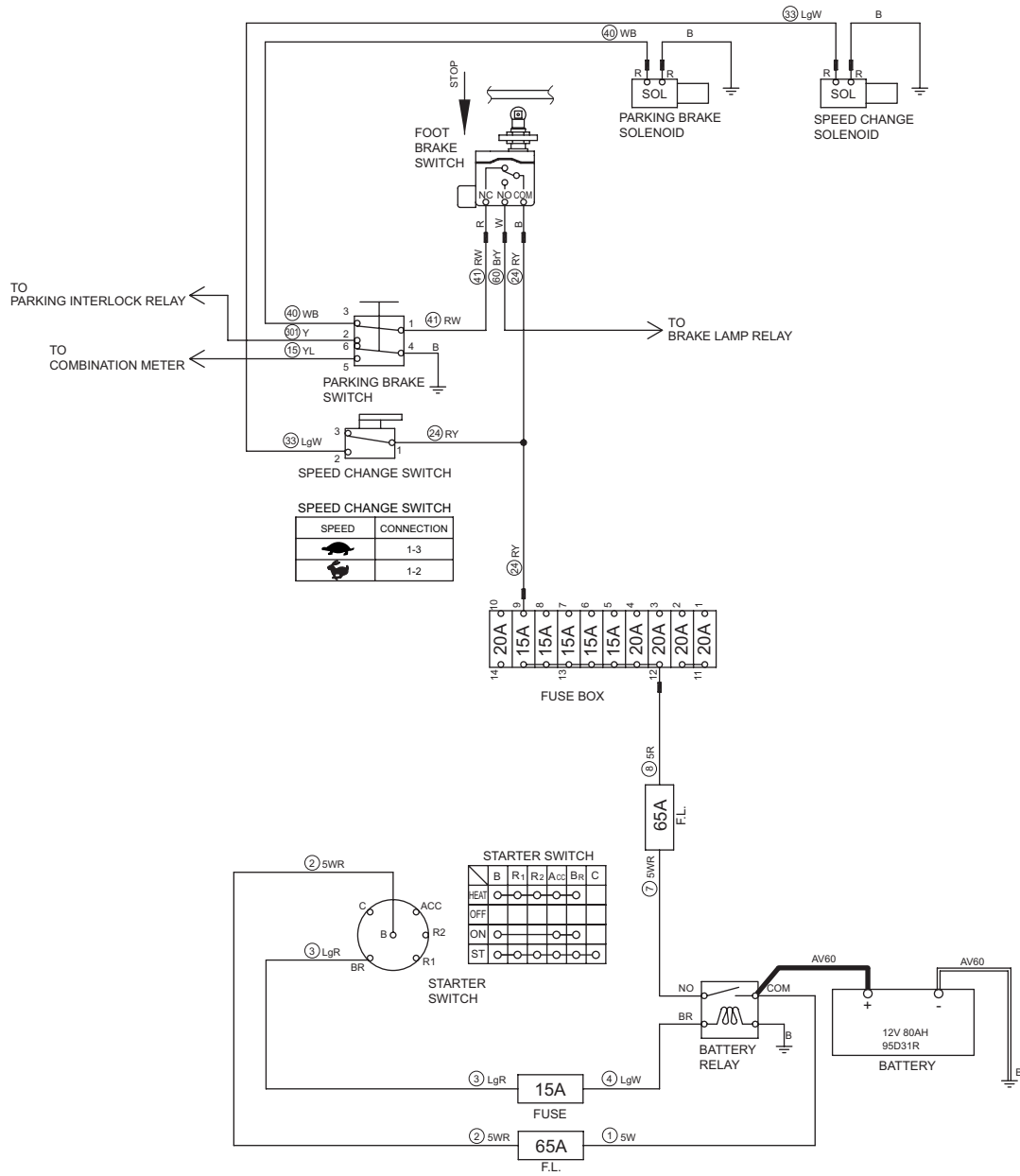
2-3-3. Brake cannot be released

- Parking brake switch must be released.
- 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"> • Disconnect harness and measure resistance of coil. Standard resistance : 9.0 Ω • If measured resistance is abnormal, parking brake solenoid is faulty. 	Replace parking brake solenoid.
2. Parking Brake Switch	<p>(1) When starter switch is ON, measure voltage between parking brake switch terminal 1 inlet wire RW 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 WB and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, parking brake switch is faulty. 	Replace parking brake switch.
3. Foot Brake Switch	<p>(1) When starter switch is ON, measure voltage between foot brake switch terminal inlet wire RY and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between foot brake switch terminal outlet wire RW and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, foot brake switch is faulty. 	Replace foot brake switch.
4. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

Fig.: 2-3-1



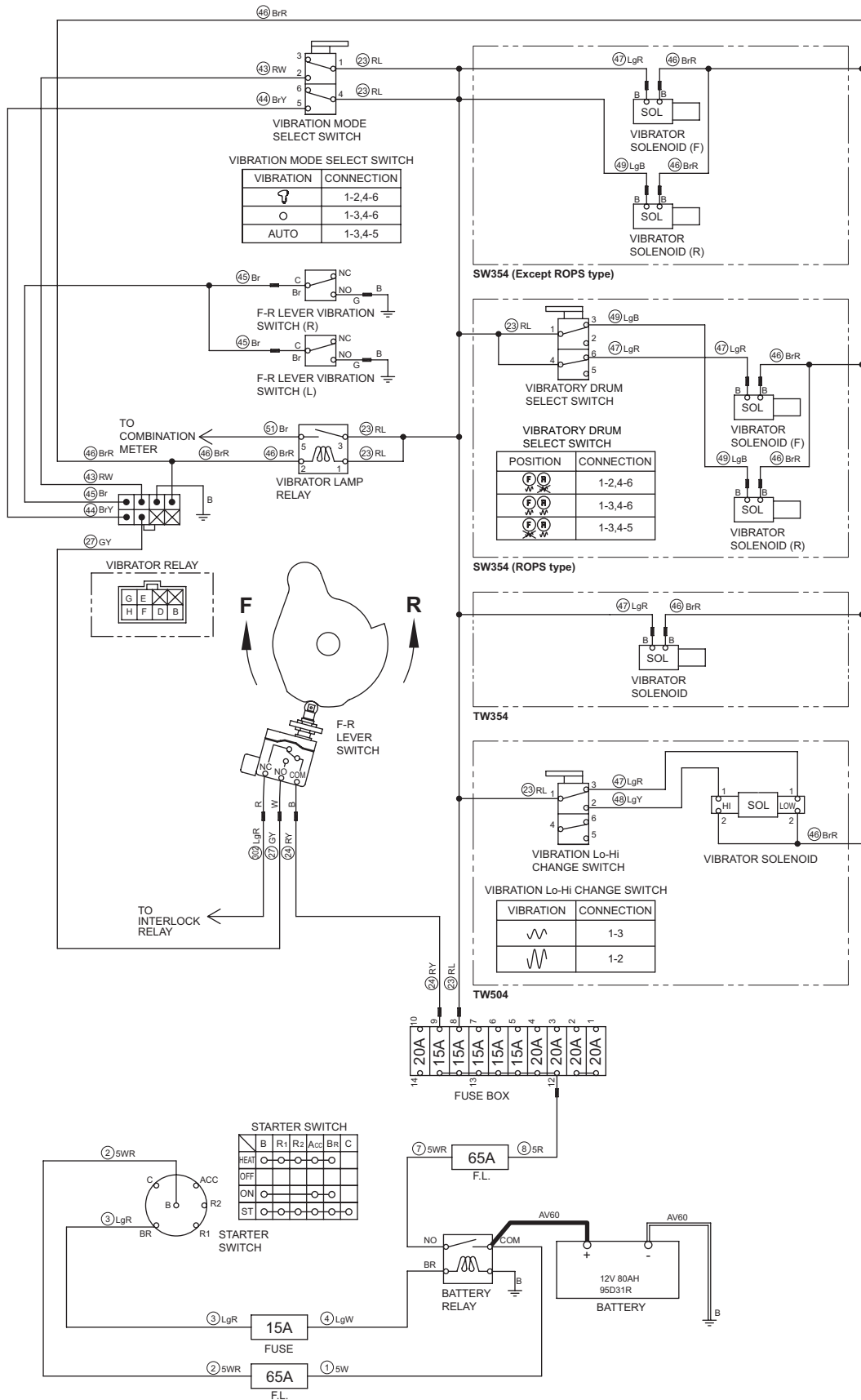
2-3-4. Brake does not work

- Parking brake switch must be applied.
- Brake pedal is depressed.

Reference Fig.: 2-3-1

Check point	Check/Cause	Action
1. Parking Brake Solenoid	<ul style="list-style-type: none"> • Disconnect harness and measure resistance of coil. Standard resistance : 9.0 Ω • If measured resistance is abnormal, parking brake solenoid is faulty. 	Replace parking brake solenoid.
2. Parking Brake Switch	<ul style="list-style-type: none"> • When starter switch is ON, measure voltage between parking brake switch terminal 3 outlet wire WB and chassis ground. There is no electricity in normal condition. • If there is electricity, parking brake switch is faulty. 	Replace parking brake switch.
3. Foot Brake Switch	<ul style="list-style-type: none"> • When starter switch is ON, measure voltage between foot brake switch terminal outlet wire RW and chassis ground. There is no electricity in normal condition. • If there is electricity, foot brake switch is faulty. 	Replace foot brake switch.
4. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

Fig.: 2-4-1



2-4. Vibration

Check following items before troubleshooting.

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

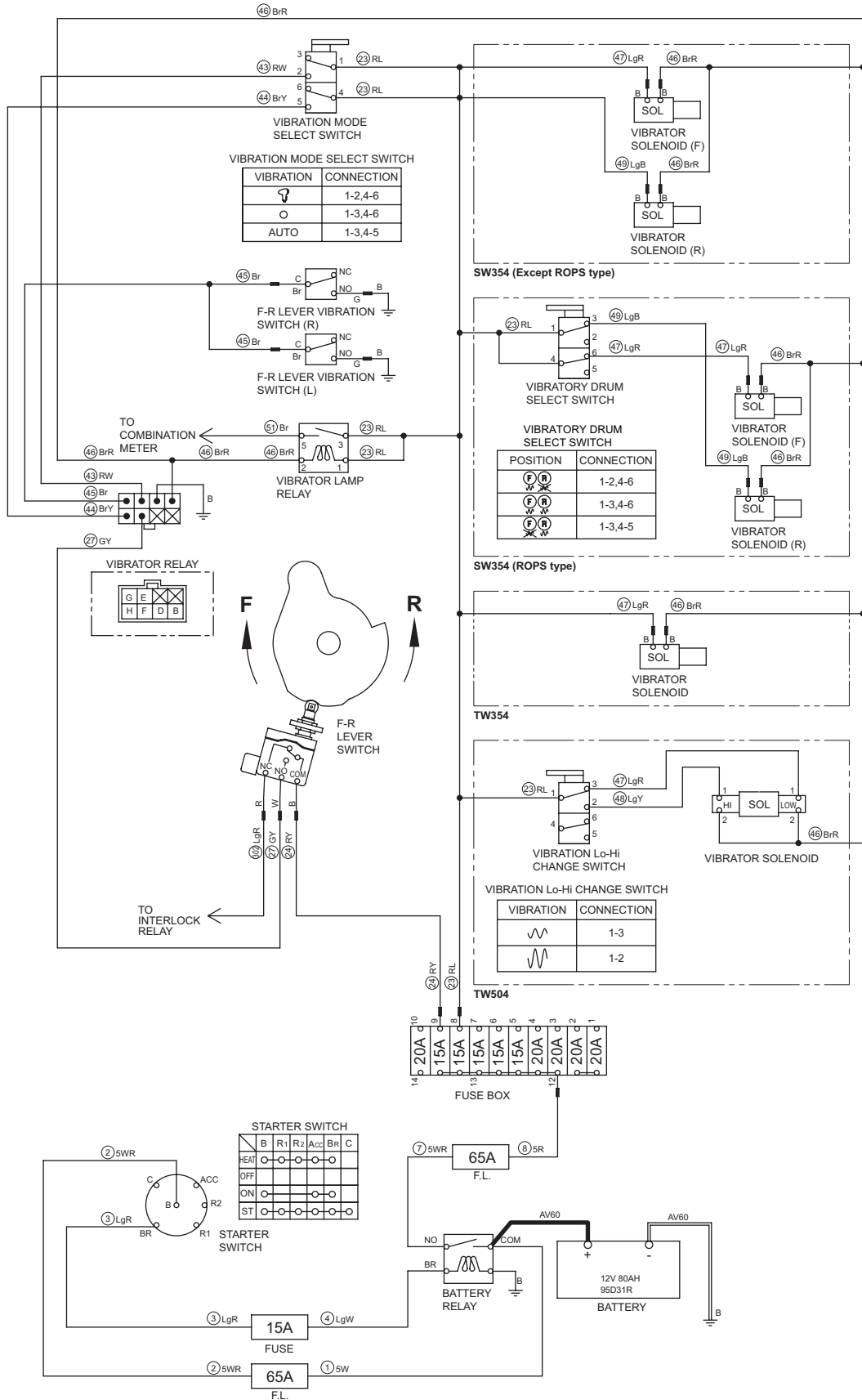
2-4-1. No vibration occurs 1/2

- F-R lever must be "F" or "R".
- Vibration mode select 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"> • Disconnect harness and measure resistance of coil. Standard resistance SW/TW354 : 8.6 to 8.8 Ω TW504 : 5.42 Ω • If measured resistance is abnormal, vibrator solenoid is faulty. 	Replace vibrator solenoid.
2. Vibration Mode Select Switch	<ol style="list-style-type: none"> (1) When starter switch is ON, measure voltage between vibration mode select switch terminal 4 inlet wire RL and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON, measure voltage between vibration mode select switch terminal 5 outlet wire BrY and chassis ground. Standard voltage : 12 V or more <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, vibration mode select switch is faulty. 	Replace vibration mode select switch.
3. Vibratory Drum Select Switch (SW354 ROPS)	<ol style="list-style-type: none"> (1) When starter switch is ON, measure voltage between vibratory drum select switch terminal 1 inlet wire RL, terminal 4 inlet wire RL and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON and vibratory drum select switch is in "F R", measure voltage between vibratory drum select switch terminal 6 outlet wire LgR and chassis ground. Standard voltage : 12 V or more (3) When starter switch is ON and vibratory drum select switch is in "F R", measure voltage between vibratory drum select switch terminal 6 outlet wire LgR, terminal 3 outlet wire LgB and chassis ground. There is no electricity in normal condition. (4) When starter switch is ON and vibratory drum select switch is in "F R", measure voltage between vibratory drum select switch terminal 3 outlet wire LgB and chassis ground. Standard voltage : 12 V or more <ul style="list-style-type: none"> • If above item (1) is OK and item (2), (3) or (4) is NG, vibratory drum select switch is faulty. 	Replace vibratory drum select switch.

Fig.: 2-4-1




2-4-1. No vibration occurs 2/2

- F-R lever must be “F” or “R”.
- Vibration mode select switch must be “AUTO” (automatic mode).

Reference Fig.: 2-4-1

Check point	Check/Cause	Action
4. Vibration Lo-Hi Change Switch (TW504)	<p>(1) When starter switch is ON, measure voltage between vibration Lo-Hi change switch terminal 1 inlet wire RL and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and vibration Lo-Hi change switch is “\sphericalangle”, measure voltage between vibration Lo-Hi change switch terminal 3 outlet wire LgR and chassis ground. Standard voltage : 12 V or more.</p> <p>(3) When starter switch is ON and vibration Lo-Hi change switch is “\sphericalcap”, measure voltage between vibration Lo-Hi change switch terminal 2 outlet wire LgY and chassis ground. Standard voltage : 12 V or more.</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) or (3) is NG, vibration Lo-Hi change switch is faulty. 	Replace vibration Lo-Hi change switch.
5. Vibrator Relay	<p>(1) When starter switch is ON, measure voltage between vibrator relay terminal E inlet wire GY and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between vibrator relay terminal G inlet wire BrY and chassis ground. Standard voltage : 12 V or more</p> <p>(3) When starter switch is ON, check continuity between vibrator relay terminal B inlet wire BrR and terminal D outlet wire B. There is continuity in normal condition.</p> <p>If above items (1) and (2) are OK and item (3) is NG, vibrator relay is faulty.</p>	Replace vibrator relay.
6. F-R Lever Switch	<p>(1) When starter switch is ON, measure voltage between F-R lever switch terminal inlet wire RY 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 outlet wire GY and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, F-R lever switch is faulty. 	Replace F-R lever switch.
7. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

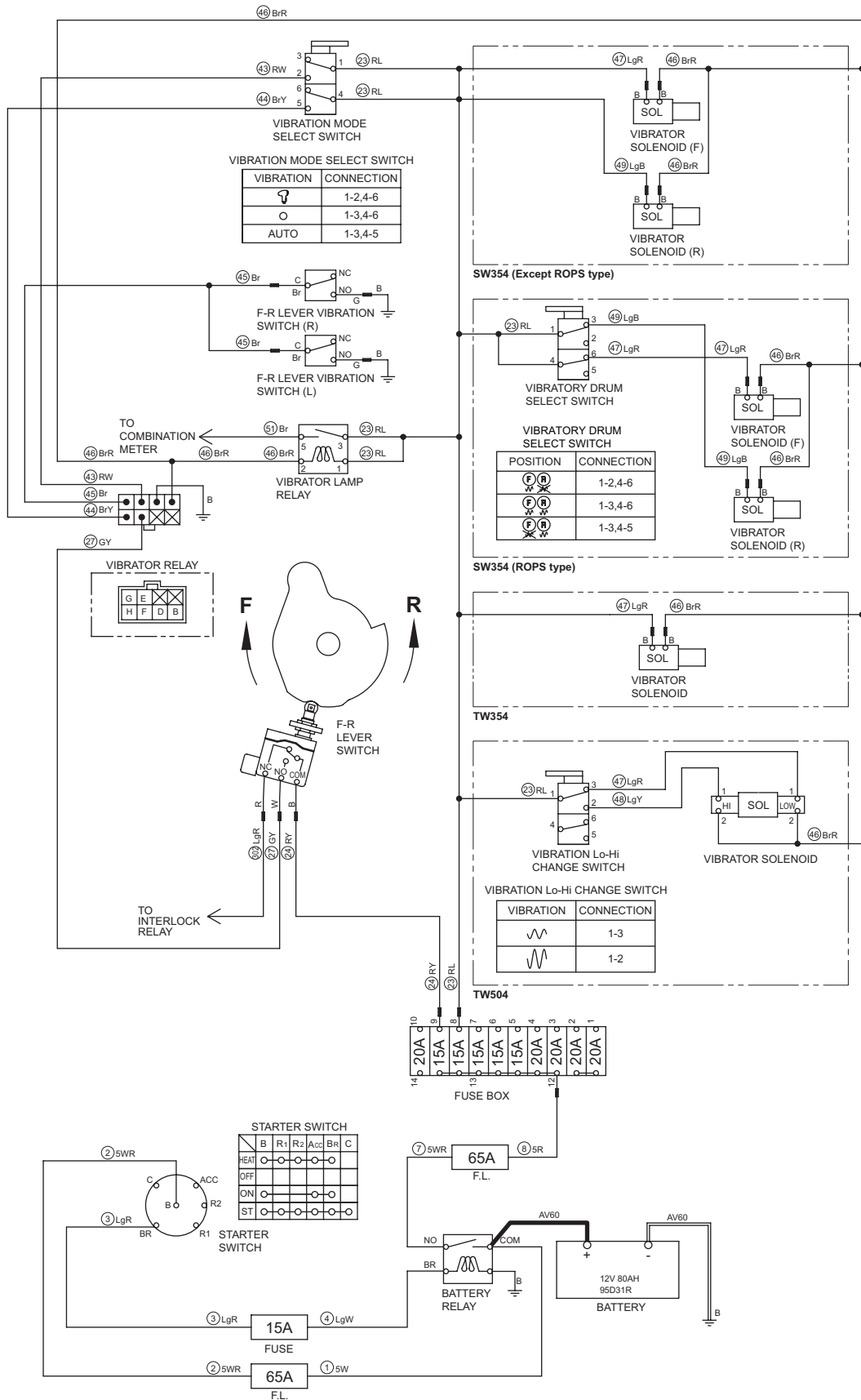
2-4-2. Vibration mode cannot be switched (F-R lever vibration switch does not work)

- Vibration mode select switch must be “” (manual mode).

Reference Fig.: 2-4-1

Check point	Check/Cause	Action
1. Vibration Mode Select Switch	<p>(1) When starter switch is ON, measure voltage between vibration mode select switch terminal 1 inlet wire RL and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between vibration mode select switch terminal 2 outlet wire RW and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, vibration mode select switch is faulty. 	Replace vibration mode select switch.
2. Vibrator Relay	<p>(1) When starter switch is ON and F-R lever is “F” or “R”, measure voltage between vibrator relay terminal E inlet wire GY and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between vibrator relay terminal F inlet wire RW and chassis ground. Standard voltage : 12 V or more</p> <p>(3) When starter switch is ON and F-R lever vibration switch pressed, check continuity between vibrator relay terminal H inlet wire Br and chassis ground. There is continuity in normal condition.</p> <p>(4) When starter switch is ON and F-R lever vibration switch pressed, check continuity between vibrator relay terminal B inlet wire BrR and terminal D outlet wire B. There is continuity in normal condition.</p> <p>If above items (1), (2) and (3) are OK and item (4) is NG, vibrator relay is faulty.</p>	Replace vibrator relay.
3. F-R Lever Vibration Switch (L)	<ul style="list-style-type: none"> • Check continuity between F-R lever vibration switch (L) terminals. <ul style="list-style-type: none"> • Terminal NC and terminal C • Terminal NO and terminal C • If continuity is made and broken when switch is operated, it is normal. If not, switch is faulty. 	Replace F-R lever vibration switch (L).
4. F-R Lever Vibration Switch (R)	<ul style="list-style-type: none"> • Check continuity between F-R lever vibration switch (R) terminals. <ul style="list-style-type: none"> • Terminal NC and terminal C • Terminal NO and terminal C • If continuity is made and broken when switch is operated, it is normal. If not, switch is faulty. 	Replace F-R lever vibration switch (R).
5. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

Fig.: 2-4-1



2-4-3. Vibratory drum cannot be switched (SW354 ROPS)

Reference Fig.: 2-4-1




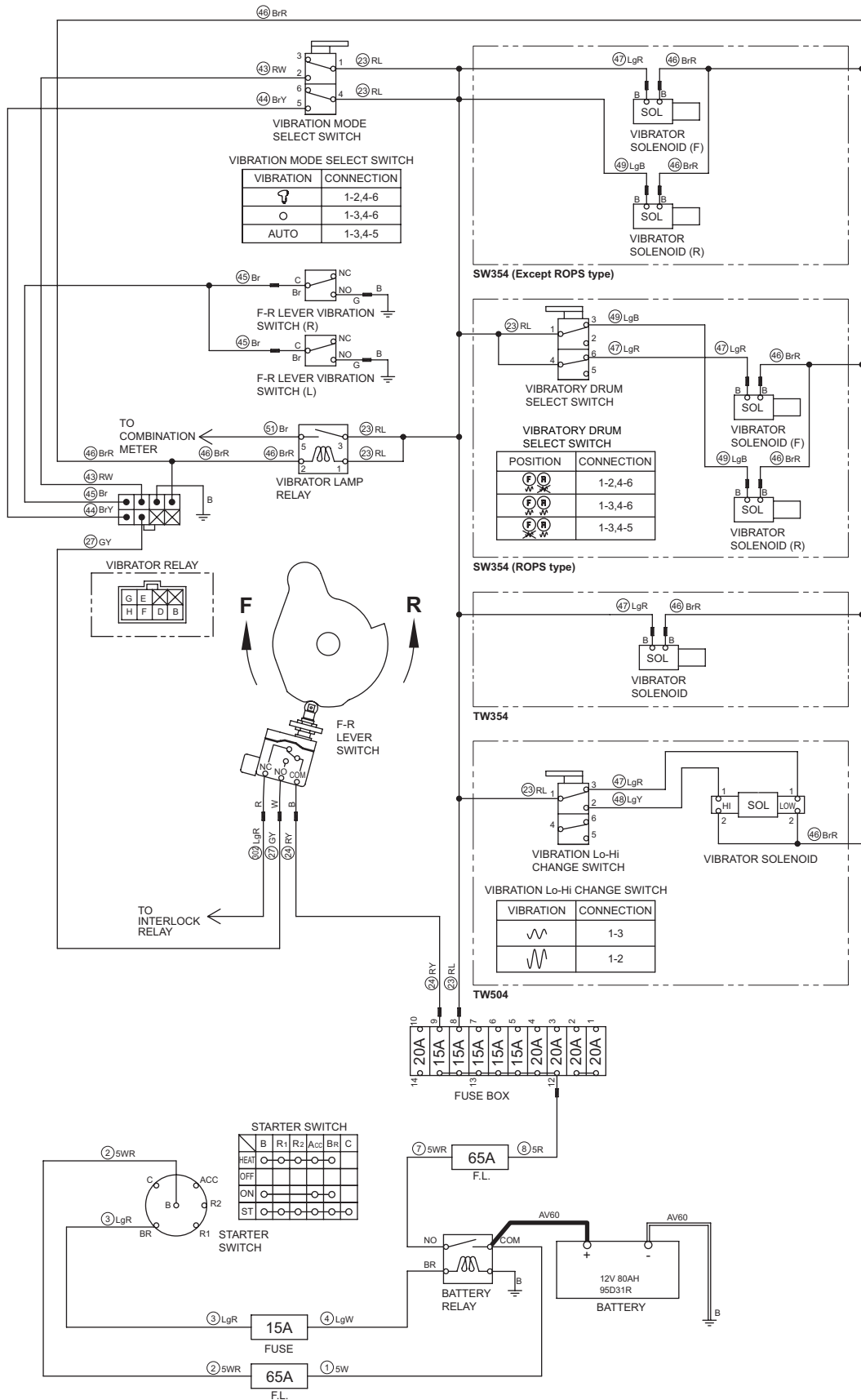
Check point	Check/Cause	Action
1. Vibratory Drum Select Switch	<p>(1) When starter switch is ON, measure voltage between vibratory drum select switch terminal 1 inlet wire RL, terminal 4 inlet wire RL and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and vibratory drum select switch is in "  ", measure voltage between vibratory drum select switch terminal 6 outlet wire LgR and chassis ground. Standard voltage : 12 V or more</p> <p>(3) When starter switch is ON and vibratory drum select switch is in "  ", measure voltage between vibratory drum select switch terminal 6 outlet wire LgR, terminal 3 outlet wire LgB and chassis ground. There is no electricity in normal condition.</p> <p>(4) When starter switch is ON and vibratory drum select switch is in "  ", measure voltage between vibratory drum select switch terminal 3 outlet wire LgB and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2), (3) or (4) is NG, vibratory drum select switch is faulty. 	Replace vibratory drum select switch.
2. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

Fig.: 2-4-1



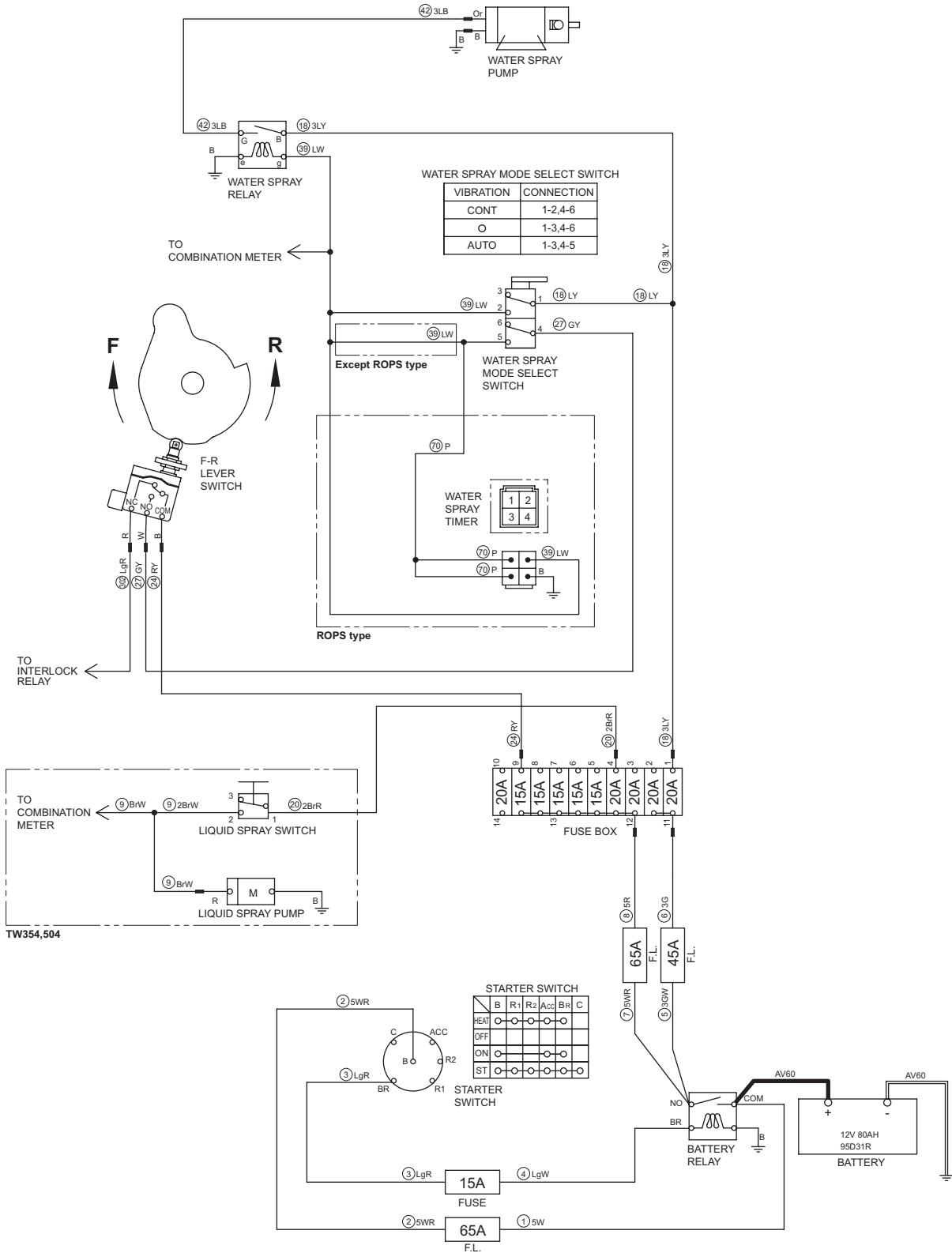
2-4-4. Amplitude does not change (Remains either low or high) (TW504)

- 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"> • Disconnect harness and measure resistance of coil. Standard resistance : 5.42 Ω • If measured resistance is abnormal, amplitude cylinder solenoid is faulty. 	Replace amplitude cylinder solenoid.
2. Vibration Lo-Hi Change Switch	<p>(1) When starter switch is ON, measure voltage between vibration Lo-Hi change switch terminal 1 inlet wire RL and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and vibration Lo-Hi change switch is " \sphericalangle ", measure voltage between vibration Lo-Hi change switch terminal 3 outlet wire LgR and chassis ground. Standard voltage : 12 V or more.</p> <p>(3) When starter switch is ON and vibration Lo-Hi change switch is " \sphericalcap ", measure voltage between vibration Lo-Hi change switch terminal 2 outlet wire LgY and chassis ground. Standard voltage : 12 V or more.</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) or (3) is NG, vibration Lo-Hi change switch is faulty. 	Replace vibration Lo-Hi change switch.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

Fig.: 2-5-1



2-5. Water Spray

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.

2-5-1. Continuous water spray does not operate

- Water spray mode select switch must be "CONT".

Reference Fig.: 2-5-1

Check point	Check/Cause	Action
1. Battery	<ul style="list-style-type: none"> • Measure battery voltage or specific gravity. Standard voltage : 12 V or more Standard gravity : 1.26 or more • If value is below standard, battery capacity is insufficient. 	Charge or replace battery.
2. Water Spray Pump	<p>(1) When starter switch is ON, measure voltage between water spray pump terminal inlet wire LB and chassis ground. Standard voltage : 12 V or more</p> <p>(2) Check that no abnormality is found in water spray pump ground terminal.</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and water spray pump does not operate, water spray pump is faulty. 	Replace water spray pump.
3. Water Spray Relay	<p>(1) When starter switch is ON, measure voltage between water spray relay terminal g 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 relay terminal B inlet wire LY and chassis ground. Standard voltage : 12 V or more</p> <p>(3) When starter switch is ON, measure voltage between water spray relay terminal G outlet wire LB and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and item (3) is NG, water spray relay is faulty. 	Replace water spray relay.
4. Water Spray Mode Select Switch	<p>(1) When starter switch is ON, measure voltage between water spray mode select switch terminal 1 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 mode select switch terminal 2 outlet wire LW and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, water spray mode select switch is faulty. 	Replace water spray mode select switch.
5. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

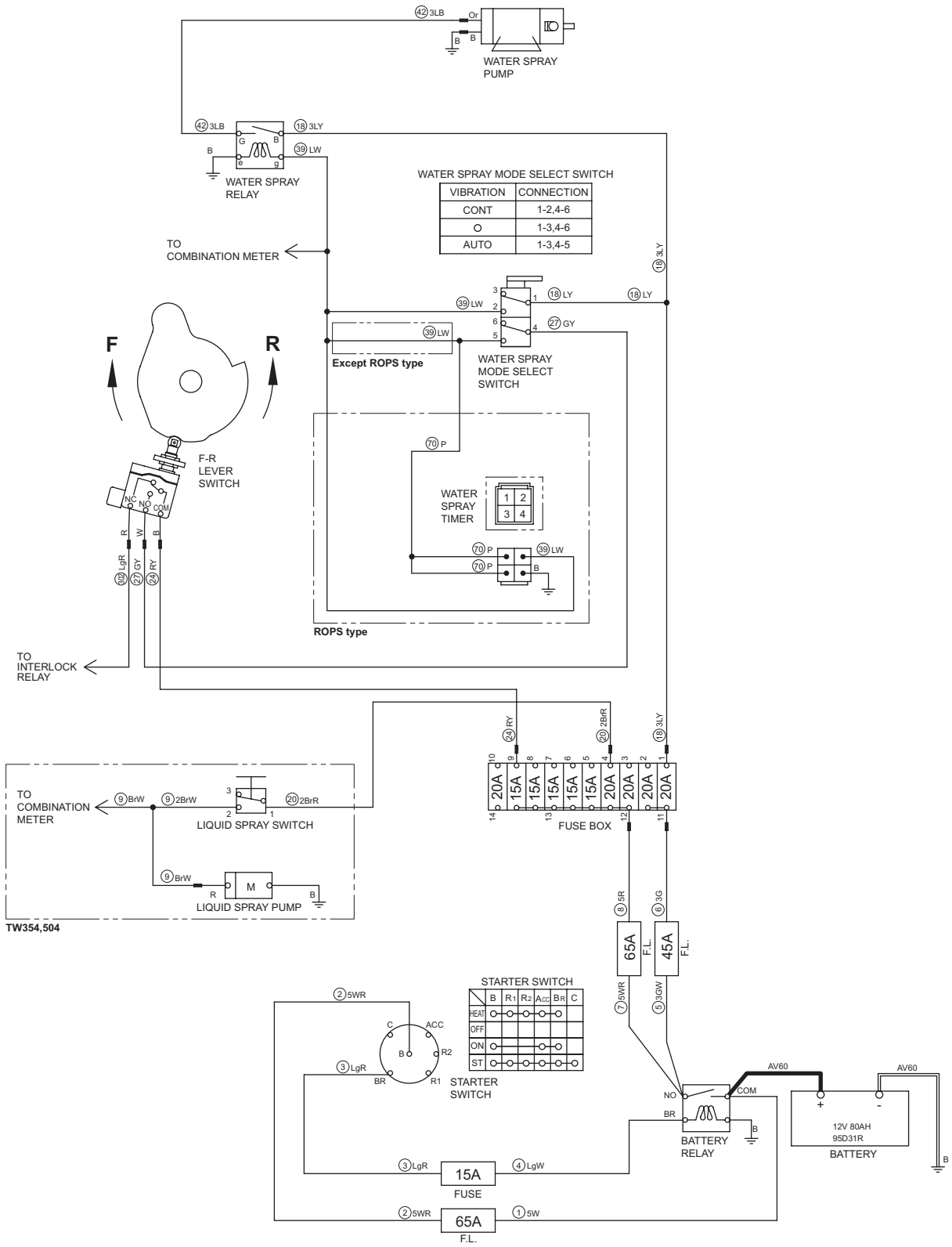
2-5-2. Continuous water spray works, but auto water spray does not operate

- Water spray mode select switch must be "AUTO".
- F-R lever must be "F" or "R".

Reference Fig.: 2-5-1

Check point	Check/Cause	Action
1. Water Spray Mode Select Switch	<p>(1) When starter switch is ON, measure voltage between water spray mode select switch terminal 4 inlet wire GY and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between water spray mode select switch terminals and chassis ground. Except ROPS type : Terminal 5 outlet wire LW ROPS type : Terminal 5 outlet wire P</p> <p>If above item (1) is OK and item (2) is NG, water spray mode select switch is faulty.</p>	Replace water spray mode select switch.
2. Water Spray Timer (ROPS type)	<p>(1) When starter switch is ON, measure voltage between water spray timer terminal 1 and 3 inlet wire P 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 LW and chassis ground. Standard voltage : 12 V or more (Electricity flows for a definite time.)</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, water spray timer is faulty. 	Replace water spray timer.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

Fig.: 2-5-1



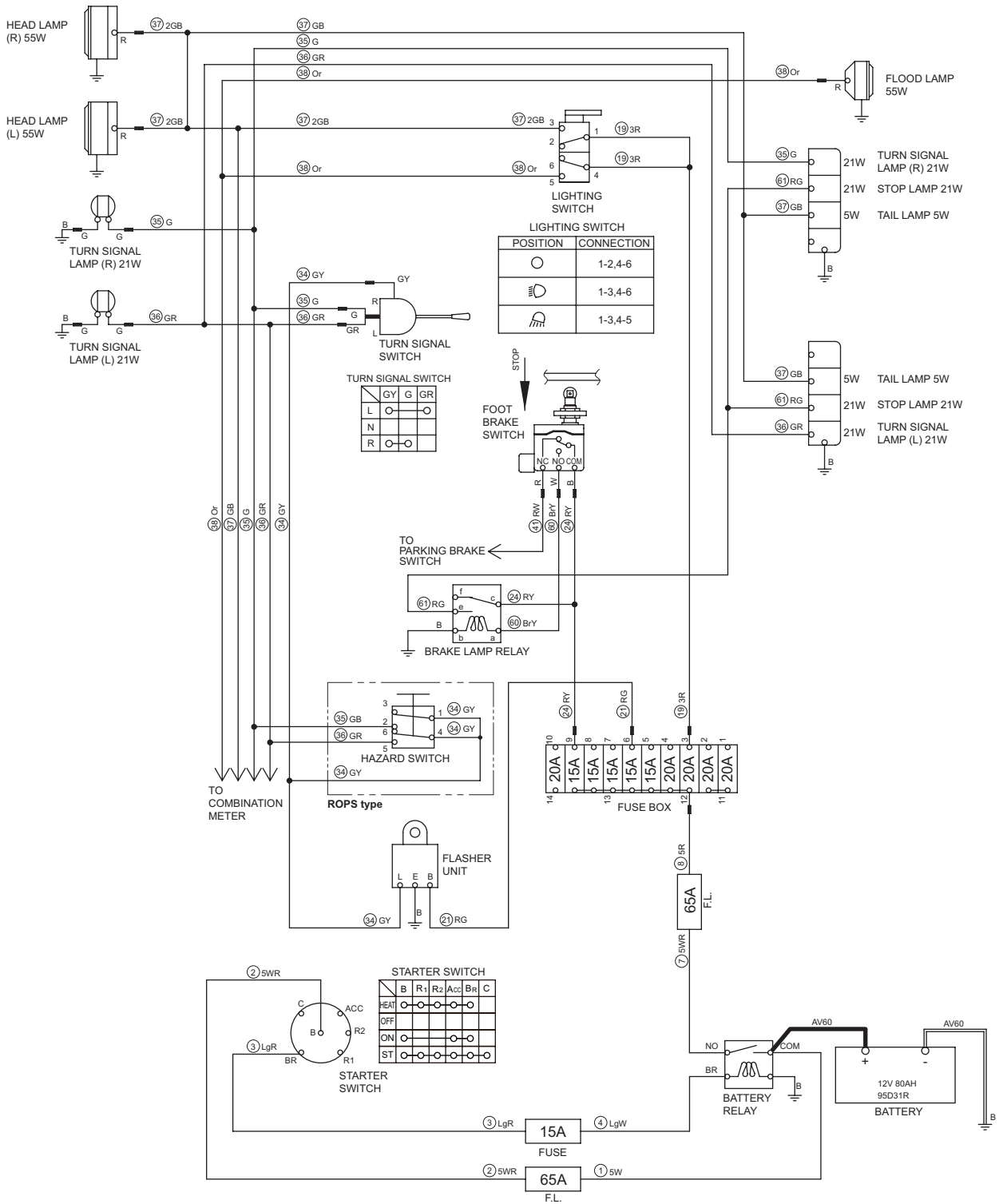
TW354.504

2-5-3. Liquid cannot be sprayed (TW354, 504)

Reference Fig. : 2-5-1

Check point	Check/Cause	Action
1. Liquid Spray Pump	<p>(1) When starter switch is ON and liquid spray switch pressed, measure voltage between liquid spray pump terminal inlet wire BrW and chassis ground. Standard voltage : 12 V or more</p> <p>(2) Check that no abnormality is found in liquid spray pump ground terminal.</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and liquid spray pump does not operate, liquid spray pump is faulty. 	Replace liquid spray pump.
2. Liquid Spray Switch	<p>(1) When starter switch is ON, measure voltage between liquid spray switch terminal 1 inlet wire BrR and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and liquid spray switch pressed, measure voltage between liquid spray switch terminal 2 outlet wire BrW and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, liquid spray switch is faulty. 	Replace liquid spray switch.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	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.

2-6-1. Head lamp and tail lamp do not light

Reference Fig. : 2-6-1

Check point	Check/Cause	Action
1. Battery	<ul style="list-style-type: none"> • Measure battery voltage or specific gravity. Standard voltage : 12 V or more Standard gravity : 1.26 or more • If value is below standard, battery capacity is insufficient. 	Charge or replace battery.
2. Each Bulb	<ul style="list-style-type: none"> • Check that none of lamp bulbs is burned out or has a contact failure. • Bulb is faulty or poorly connected. 	Replace each bulb.
3. Lighting Switch	<p>(1) When starter switch is ON, measure voltage between lighting switch terminal 1 inlet wire R 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 GB and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, lighting switch is faulty. 	Replace lighting switch.
4. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

2-6-2. Flood lamp does not light

Reference Fig. : 2-6-1


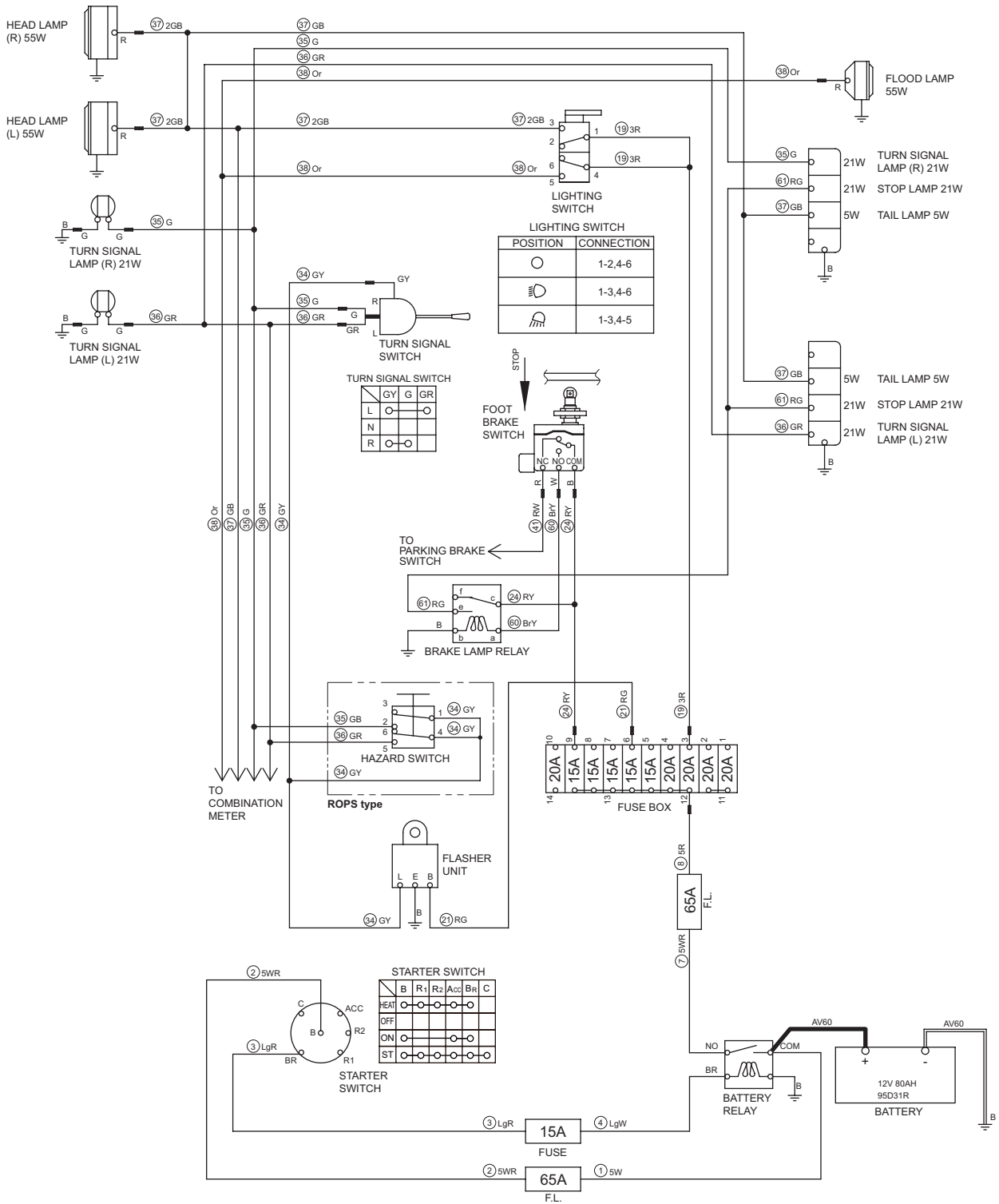
Check point	Check/Cause	Action
1. Each Bulb	<ul style="list-style-type: none"> • Check that none of lamp bulbs is burned out or has a contact failure. • Bulb is faulty or poorly connected. 	Replace each bulb.
2. Lighting Switch	<p>(1) When starter switch is ON, measure voltage between lighting switch terminal 4 inlet wire R 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 5 outlet wire Or and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, lighting switch is faulty. 	Replace lighting switch.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

Fig.: 2-6-1

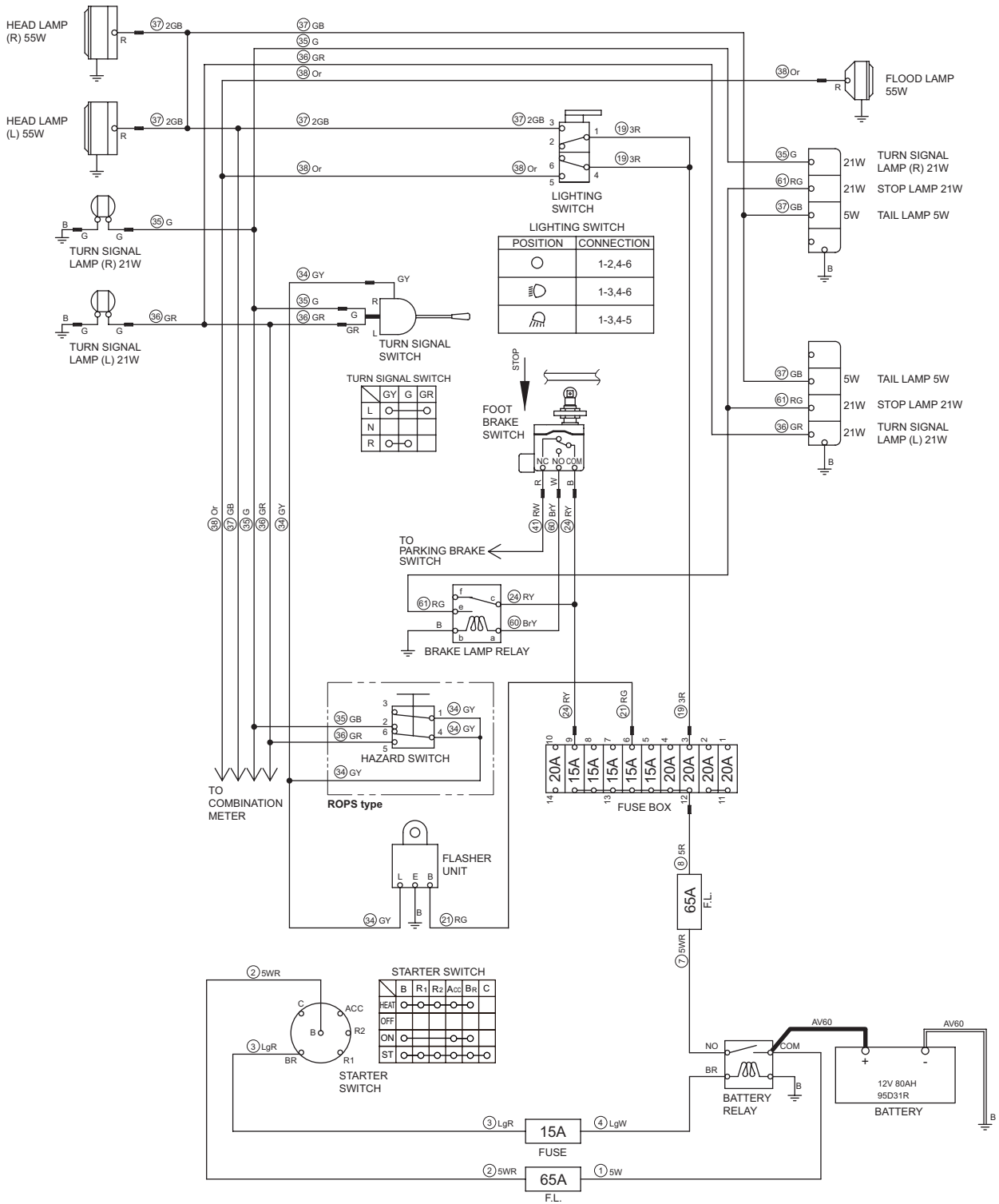


2-6-3. Turn signal lamp does not blink

Reference Fig. : 2-6-1

Check point	Check/Cause	Action
1. Each Bulb	<ul style="list-style-type: none"> • Check that none of lamp bulbs is burned out or has a contact failure. • Bulb is faulty or poorly connected. 	Replace each bulb.
2. Flasher Unit	<p>(1) When starter switch is ON, measure voltage between flasher unit terminal B inlet wire RG and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and turn signal switch lever is moved, measure voltage between flasher unit terminal L outlet wire GY and chassis ground. Standard voltage : 12 V or more with constant intervals</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, flasher unit is faulty. 	Replace flasher unit.
3. Turn Signal Switch	<p>(1) When starter switch is ON and turn signal switch lever is moved, measure voltage between turn signal switch terminal inlet wire GY and chassis ground. Standard voltage : 12 V or more with constant intervals</p> <p>(2) When starter switch is ON and turn signal switch lever is moved, measure voltage between turn signal switch terminals and chassis ground. Turn signal (L) : Wire No.36 outlet wire GR Turn signal (R) : Wire No.35 outlet wire G Standard voltage : 12 V or more with constant intervals</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, turn signal switch is faulty. 	Replace turn signal switch.
4. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

Fig.: 2-6-1



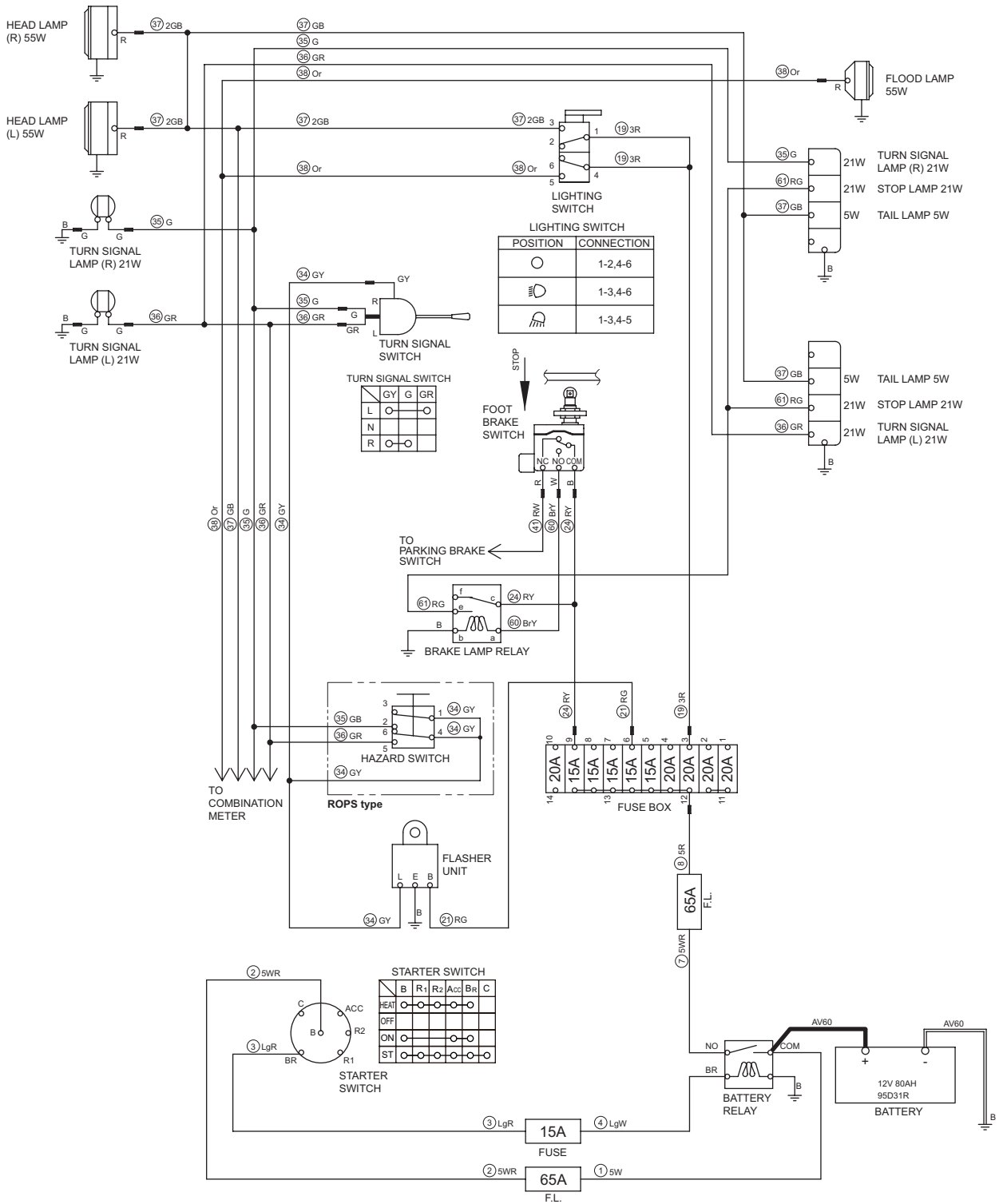
2-6-4. Hazard lamp does not light (Turn signal blinks) (ROPS type)

- Hazard switch must be ON.

Reference Fig. : 2-6-1

Check point	Check/Cause	Action
1. Each Bulb	<ul style="list-style-type: none"> • Check that none of lamp bulbs is burned out or has a contact failure. • Bulb is faulty or poorly connected. 	Replace each bulb.
2. Hazard Switch	<p>(1) When starter switch is ON, measure voltage between hazard switch terminal 1 and 4 inlet wire GY and chassis ground. Standard voltage : 12 V or more with constant intervals</p> <p>(2) When starter 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> <p>(3) When starter 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> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) or (3) is NG, hazard switch is faulty. 	Replace hazard switch.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

Fig.: 2-6-1

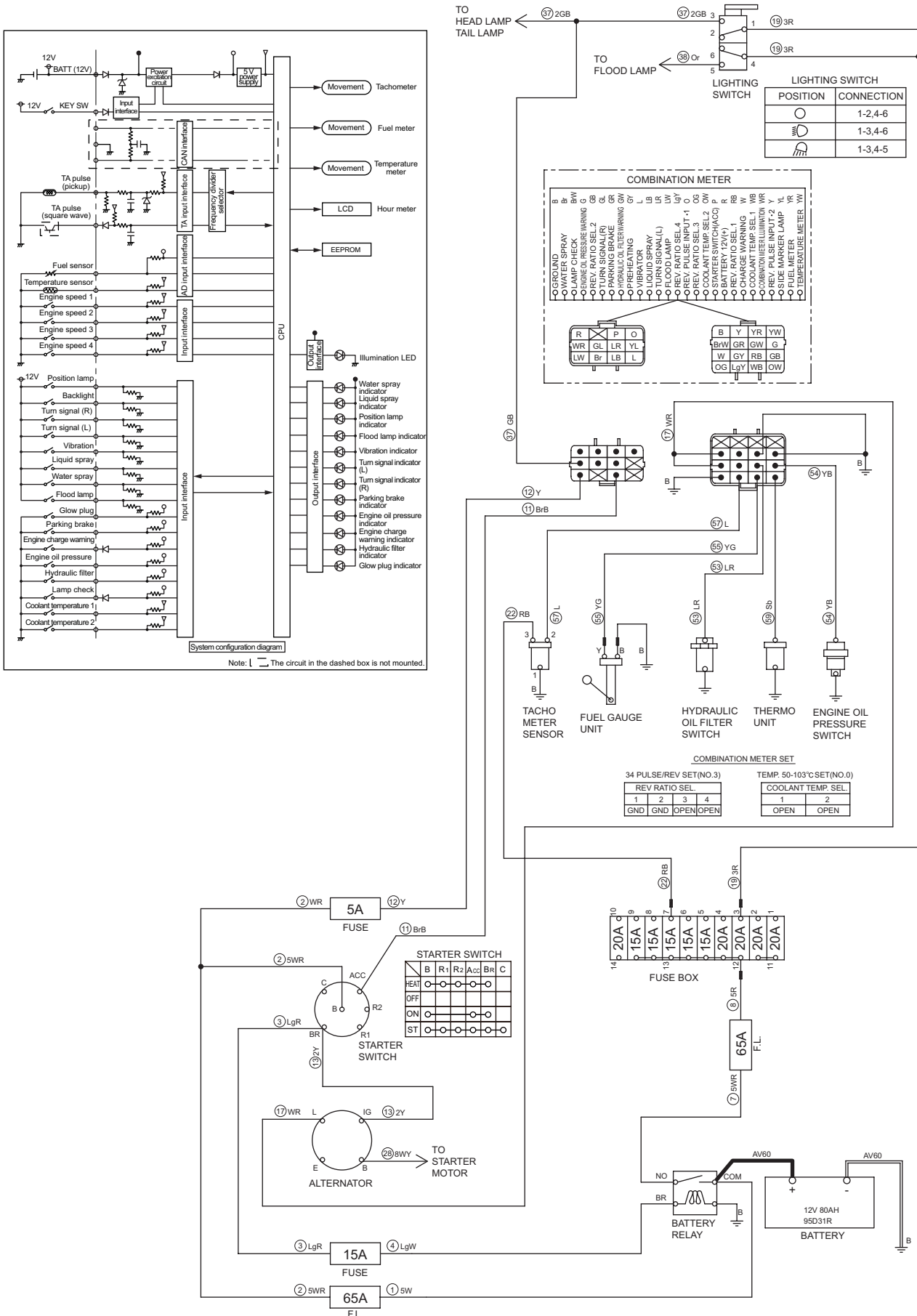


2-6-5. Stop lamp does not light

Reference Fig. : 2-6-1


Check point	Check/Cause	Action
1. Each Bulb	<ul style="list-style-type: none"> • Check that none of lamp bulbs is burned out or has a contact failure. • Bulb is faulty or poorly connected. 	Replace each bulb.
2. Foot Brake Switch	<p>(1) When starter switch is ON, measure voltage between foot brake switch terminal inlet wire RY 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 outlet wire BrY and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, foot brake switch is faulty. 	Replace foot brake switch.
3. Brake Lamp Relay	<p>(1) When starter switch is ON while foot brake is depressed, measure voltage between brake lamp relay terminal a inlet wire BrY and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, measure voltage between brake lamp relay terminal c inlet wire RY and chassis ground. Standard voltage : 12 V or more</p> <p>(3) When starter switch is ON while foot brake is depressed, measure voltage between brake lamp relay terminal e outlet wire RG and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and item (3) is NG, brake lamp relay is faulty. 	Replace brake lamp relay.
4. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

Fig.: 2-6-2



2-6-6. Illumination of combination meter does not light

Reference Fig. : 2-6-2

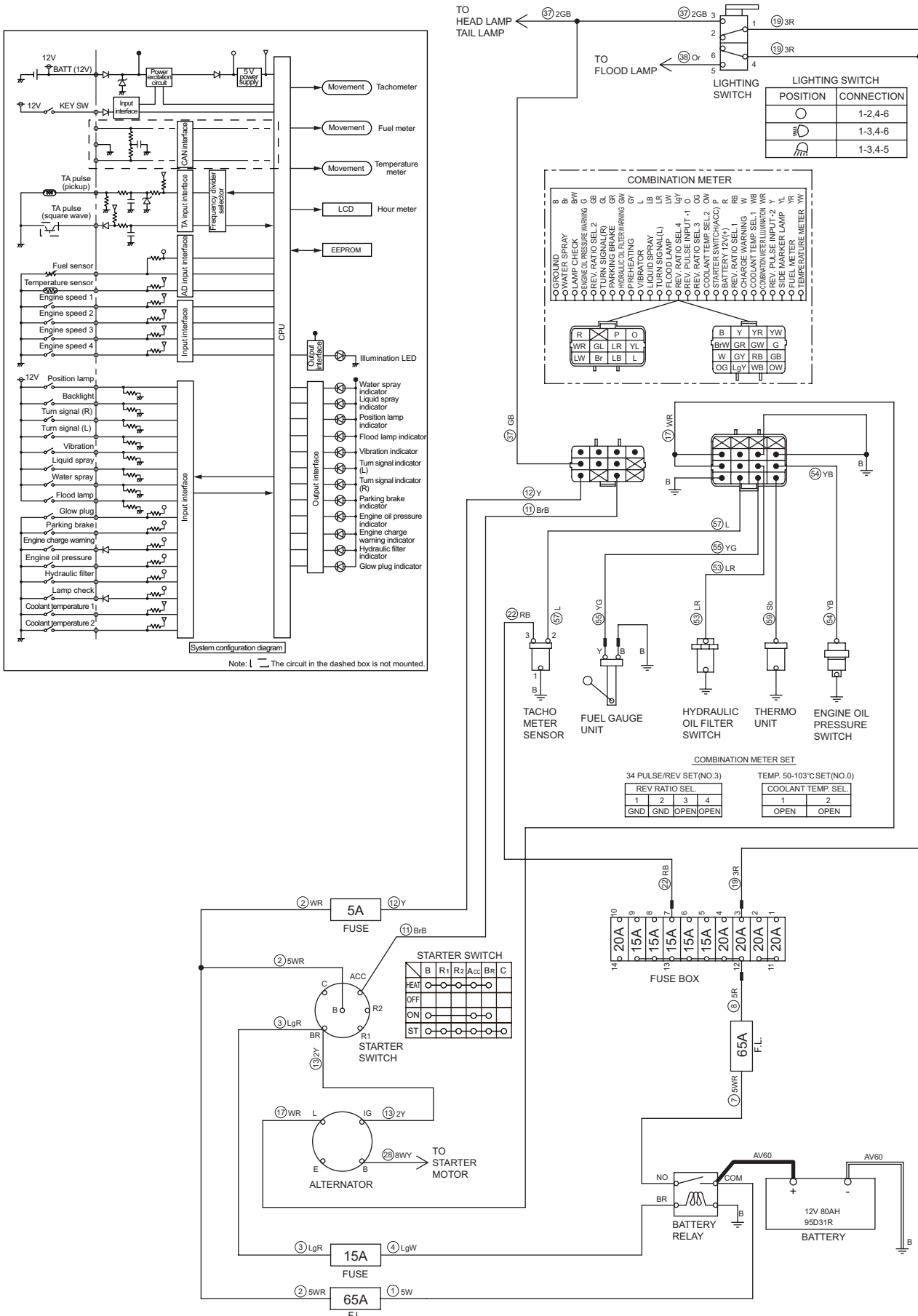
Check point	Check/Cause	Action
1. Harness	<ul style="list-style-type: none"> • Measure resistance between lighting switch terminal 3 wire GB and combination meter connector terminal wire No.37 wire GB. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.
2. Combination Meter (Combination meter illumination)	<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"> • Battery 12 V (+) terminal wire No.12 inlet wire Y and ground terminal wire B • Starter switch (ACC) terminal wire No.11 inlet wire BrB and ground terminal wire B <p>Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and lighting switch is “”, measure voltage between combination meter illumination terminal wire No.37 inlet wire GB and chassis ground.</p> <p>Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and combination meter does not turn on, combination meter is faulty. 	Replace combination meter.

2-6-7. 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"> • Battery 12 V (+) terminal wire No.12 inlet wire Y and ground terminal wire B • Starter switch (ACC) terminal wire No.11 inlet wire BrB and ground terminal wire B <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, engine oil pressure warning lamp and charge warning lamp illuminate and then go out after starting engine.</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, combination meter is faulty. <p>(NOTICE)</p> <ul style="list-style-type: none"> • Since engine cannot start unless parking brake switch is applied, parking brake indicator lamp does not go out even after starting engine. 	Replace combination meter.

Fig.: 2-6-2



2-6-8. Tachometer reading is abnormal

Reference Fig. : 2-6-2

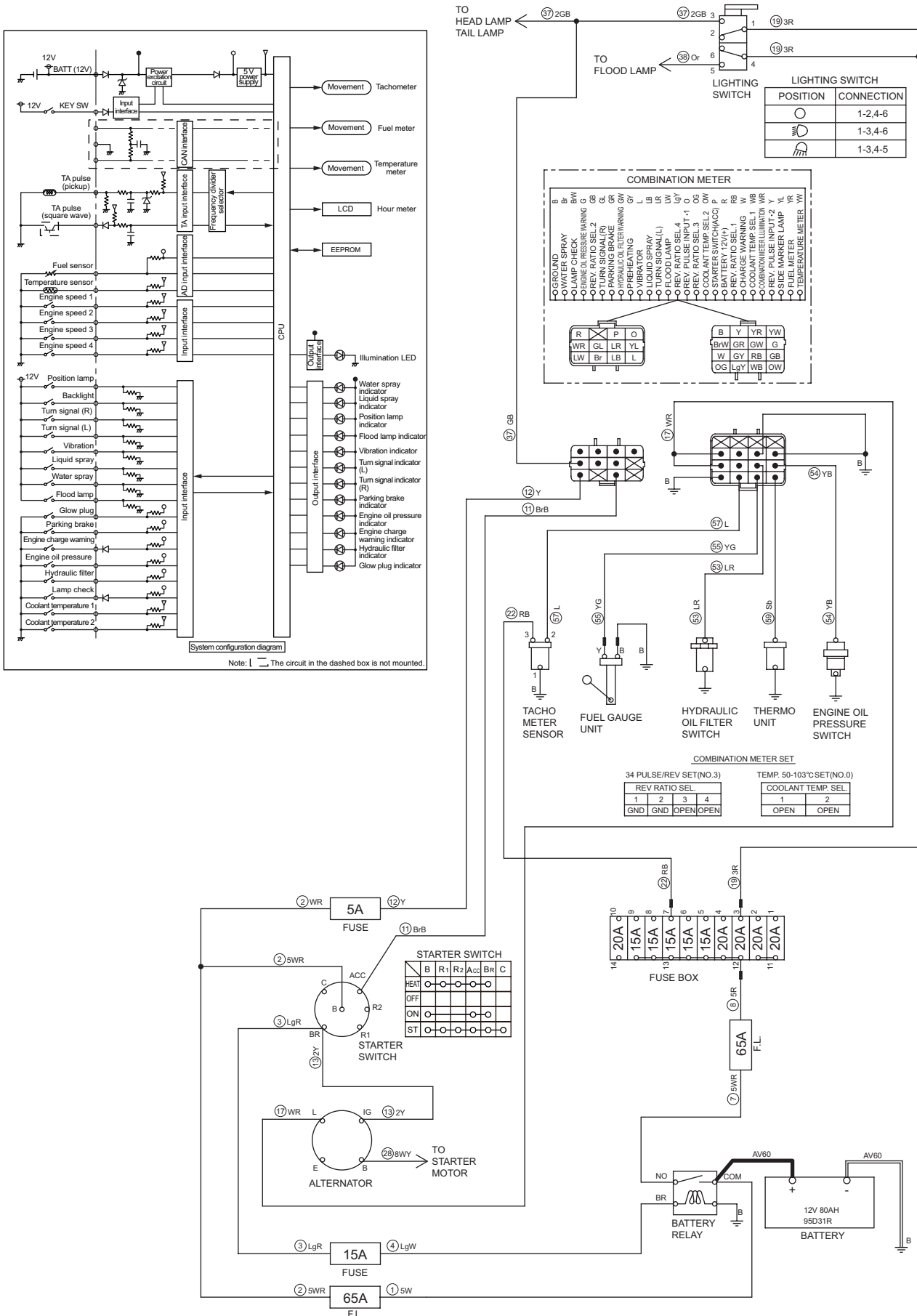
Check point	Check/Cause	Action
1. Combination Meter (Tachometer)	<p>(1) When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire.</p> <ul style="list-style-type: none"> • Battery 12 V (+) terminal wire No.12 inlet wire Y and ground terminal wire B • Starter switch (ACC) terminal wire No.11 inlet wire BrB and ground terminal wire B <p>Standard voltage : 12 V or more</p> <p>(2) Check that combination meter terminal wires B (rev. ratio sel. 1, 2) are grounded.</p> <p>(3) Start engine and measure pulse between combination meter rev. pulse input. 2 terminal wire No.57 wire L and chassis ground.</p> <p>Standard pulse : 34 pulses/rotation of engine</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and pluse is NG in item (3), tachometer sensor is faulty. • If above items (1) and (2) are OK and tachometer reading is NG in item (3), combination meter is faulty. 	Replace tachometer sensor or combination meter.
2. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. <p>Standard resistance : 10 Ω or less</p> <ul style="list-style-type: none"> • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

2-6-9. 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"> • When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire. <ul style="list-style-type: none"> • Battery 12 V (+) terminal wire No.12 inlet wire Y and ground terminal wire B • Starter switch (ACC) terminal wire No.11 inlet wire BrB and ground terminal wire B <p>Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If no abnormality is found, combination meter is faulty. 	Replace combination meter.

Fig.: 2-6-2



2-6-10. Temperature meter is abnormal

Reference Fig. : 2-6-2

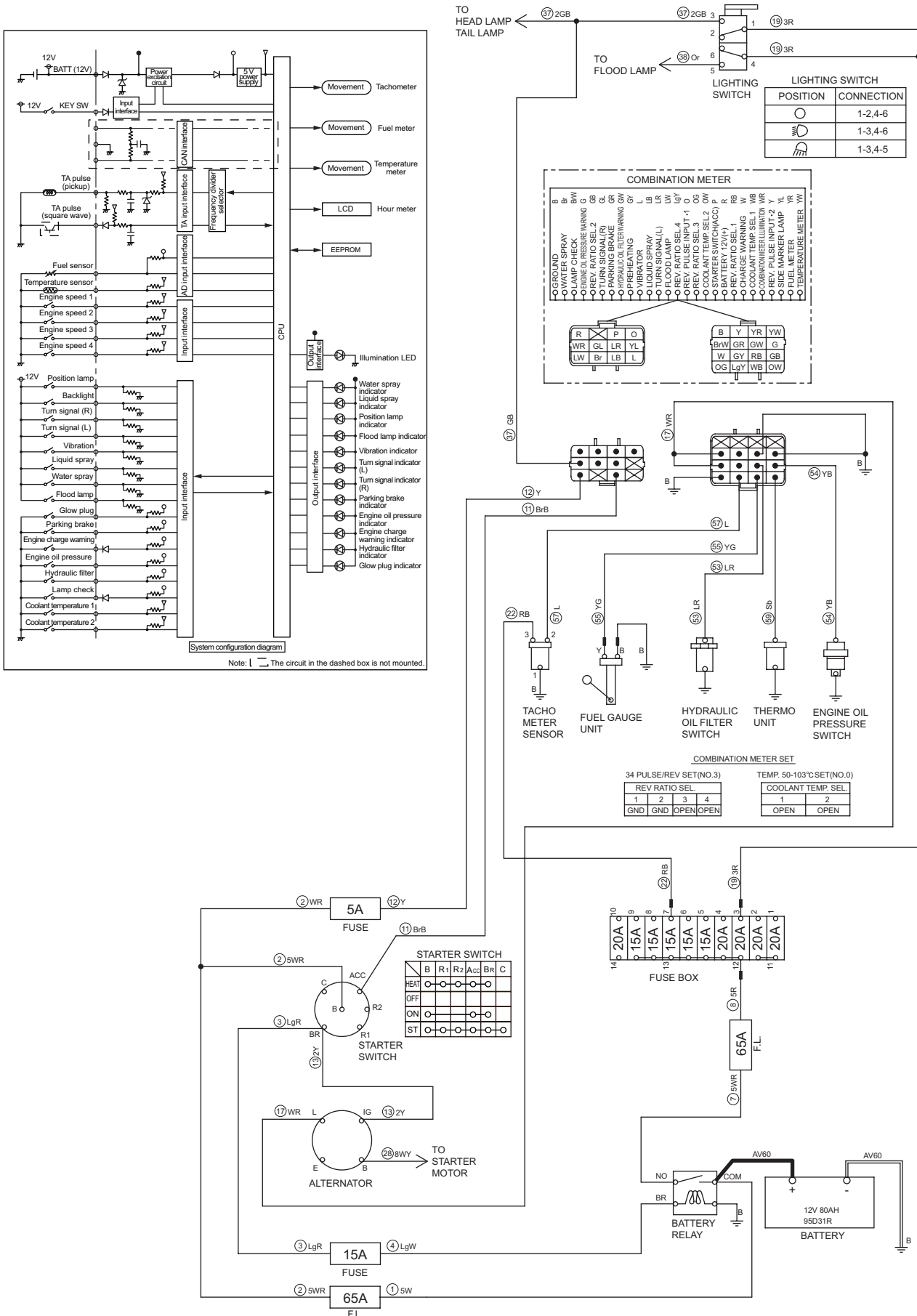
Check point	Check/Cause	Action
1. Thermo Unit	<ul style="list-style-type: none"> • Disconnect harness and measure resistance of thermo unit. Standard resistance : 164.6 Ω (at unit temperature of 50°C) 26.44 Ω (at unit temperature of 103°C) • If resistance is abnormal, thermo unit is faulty. 	Replace thermo unit.
2. Combination Meter (Temperature meter)	<ul style="list-style-type: none"> • When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire. <ul style="list-style-type: none"> • Battery 12 V (+) terminal wire No.12 inlet wire Y and ground terminal wire B • Starter switch (ACC) terminal wire No.11 inlet wire BrB and ground terminal wire B Standard voltage : 12 V or more • If no abnormality is found, combination meter is faulty. 	Replace combination meter.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

2-6-11. Fuel meter is abnormal

Reference Fig. : 2-6-2

Check point	Check/Cause	Action
1. Fuel Gauge Unit	<ul style="list-style-type: none"> • Disconnect harness and measure resistance of fuel gauge unit. Standard resistance : 13.5 Ω (with float in "F") 80.0 Ω (with float in "E") • If resistance is abnormal, fuel gauge unit is faulty. 	Replace fuel gauge unit.
2. Combination Meter (Fuel meter)	<ul style="list-style-type: none"> • When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire. <ul style="list-style-type: none"> • Battery 12 V (+) terminal wire No.12 inlet wire Y and ground terminal wire B • Starter switch (ACC) terminal wire No.11 inlet wire BrB and ground terminal wire B Standard voltage : 12 V or more • If no abnormality is found, combination meter is faulty. 	Replace combination meter.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

Fig.: 2-6-2



2-6-12. Hydraulic oil filter warning lamp remains ON

Reference Fig. : 2-6-2

Check point	Check/Cause	Action
1. Harness	<ul style="list-style-type: none"> • Disconnect connectors between combination meter and hydraulic oil filter switch. • Measure resistance between terminals and chassis ground. <ul style="list-style-type: none"> • Hydraulic oil filter switch terminal wire LR and chassis ground. • Combination meter connector terminal wire No.53 wire LR and chassis ground. Standard resistance : 100k Ω or more • If resistance is abnormal, harness is faulty. 	Repair or replace harness.
2. Hydraulic Oil Filter Switch	<ul style="list-style-type: none"> • When starter switch is OFF, check continuity between hydraulic oil filter switch inlet terminal wire LR and chassis ground. There is no continuity in normal condition. • If there is continuity, hydraulic oil filter switch is faulty. 	Replace hydraulic oil filter switch.
3. Combination Meter (Hydraulic oil filter warning)	<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"> • Battery 12 V (+) terminal wire No.12 inlet wire Y and ground terminal wire B • Starter switch (ACC) terminal wire No.11 inlet wire BrB and ground terminal wire B Standard voltage : 12 V or more <p>(2) When starter switch is ON, measure voltage between combination meter hydraulic oil filter warning terminal outlet wire No.53 wire LR and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK but hydraulic oil filter warning lamp remains on after starting engine, combination meter is faulty. 	Replace combination meter.

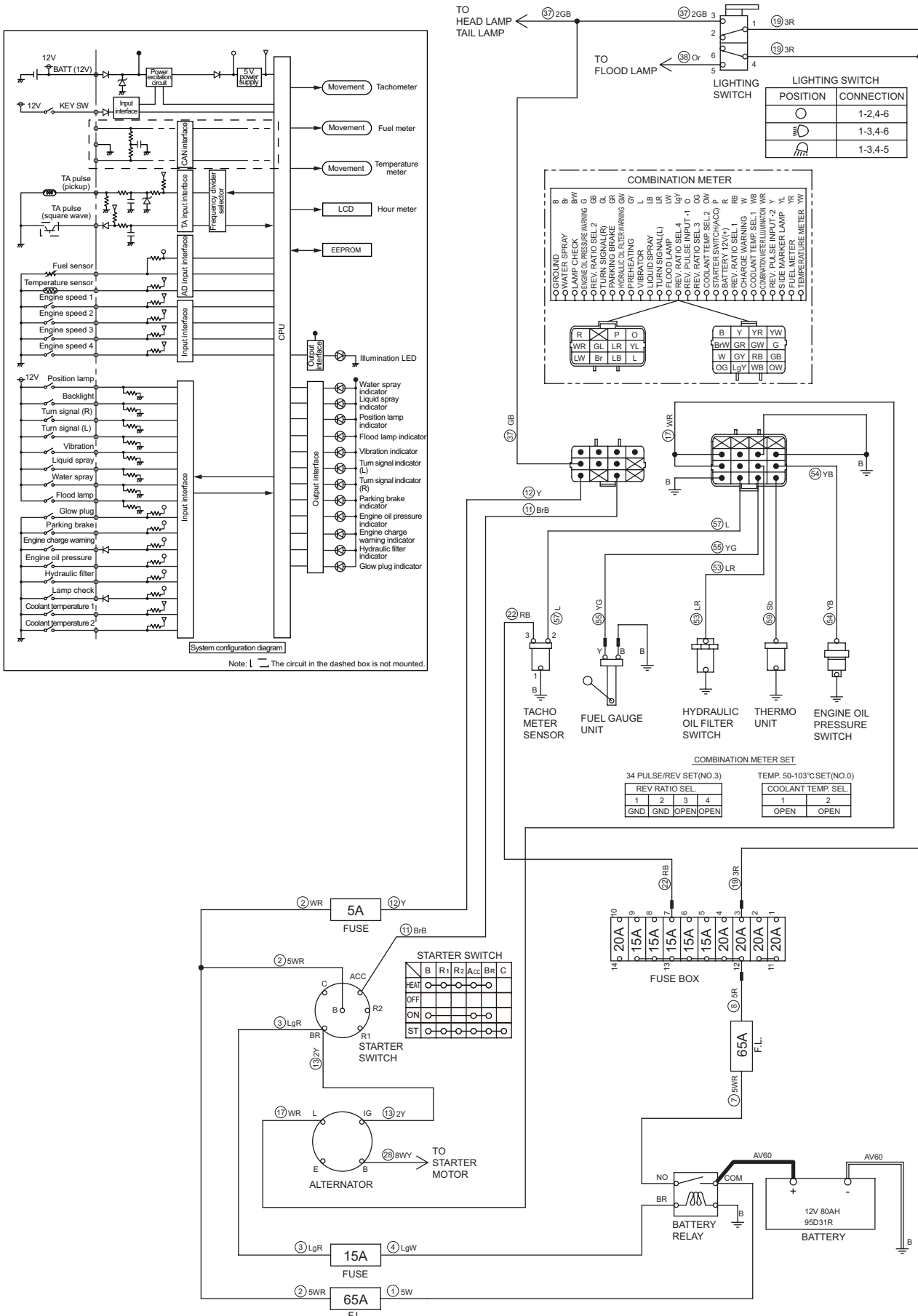
2-6-13. Charge warning lamp remains ON

- Check with engine running.

Reference Fig. : 2-6-2

Check point	Check/Cause	Action
1. Harness	<ul style="list-style-type: none"> • Disconnect connectors between combination meter and alternator terminal L. • Measure resistance between terminals and chassis ground. <ul style="list-style-type: none"> • Combination meter connector terminal wire No.17 wire WR and chassis ground. • Alternator terminal L wire WR and chassis ground Standard resistance : 100k Ω or more • If resistance is abnormal, harness is faulty. 	Repair or replace harness.
2. Combination Meter (Charge warning lamp)	<ul style="list-style-type: none"> • Measure voltage between combination meter charge warning terminal wire No.17 outlet wire WR and chassis ground. Standard voltage : 12 V or more • If no abnormality is found, combination meter is faulty. 	Replace combination meter.

Fig.: 2-6-2

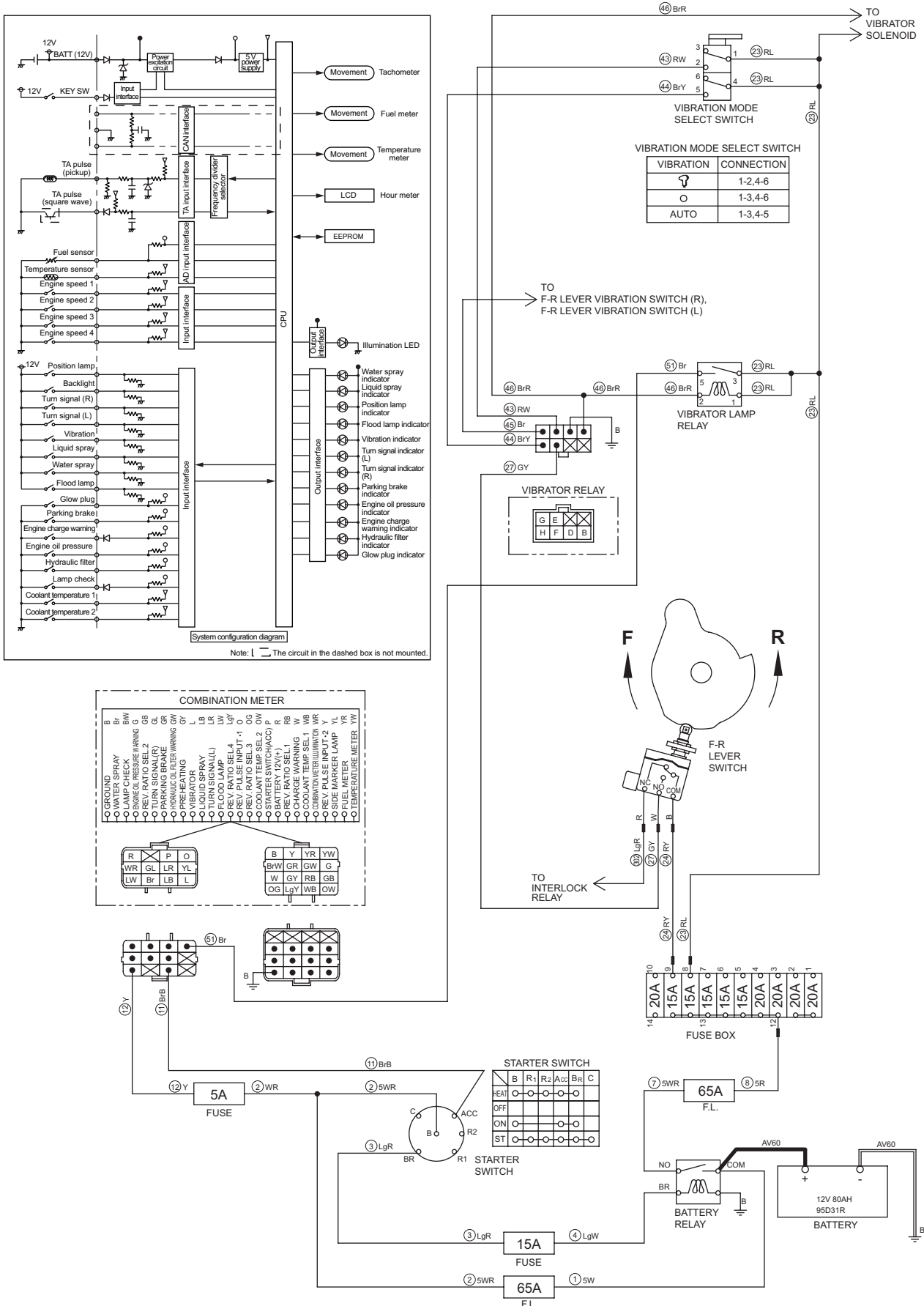


2-6-14. Engine oil pressure warning lamp remains ON

Reference Fig. : 2-6-2

Check point	Check/Cause	Action
1. Harness	<ul style="list-style-type: none"> • Disconnect connectors between combination meter and engine oil pressure switch. • Measure resistance between terminals and chassis ground. <ul style="list-style-type: none"> • Engine oil pressure switch terminal wire YB and chassis ground. • Combination meter connector terminal wire No.54 wire YB and chassis ground. Standard resistance : 100k Ω or more • If resistance is abnormal, harness is faulty. 	Repair or replace harness.
2. Engine oil pressure Switch	<ul style="list-style-type: none"> • After starting engine, check continuity between its terminals. There is no continuity in normal condition. • If there is continuity, engine oil pressure switch is faulty. 	Replace engine oil pressure switch.
3. Combination Meter (Engine oil pressure warning indicator 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"> • Battery 12 V (+) terminal wire No.12 inlet wire Y and ground terminal wire B • Starter switch (ACC) terminal wire No.11 inlet wire BrB and ground terminal wire B Standard voltage : 12 V or more <p>(2) When starter switch is ON, measure voltage between combination meter engine oil pressure warning terminal outlet wire No.54 wire YB and chassis ground.</p> Standard voltage : 12 V or more <ul style="list-style-type: none"> • If above items (1) and (2) are OK but engine oil pressure warning lamp remains on after starting engine, combination meter is faulty. 	Replace combination meter.

Fig.: 2-6-3



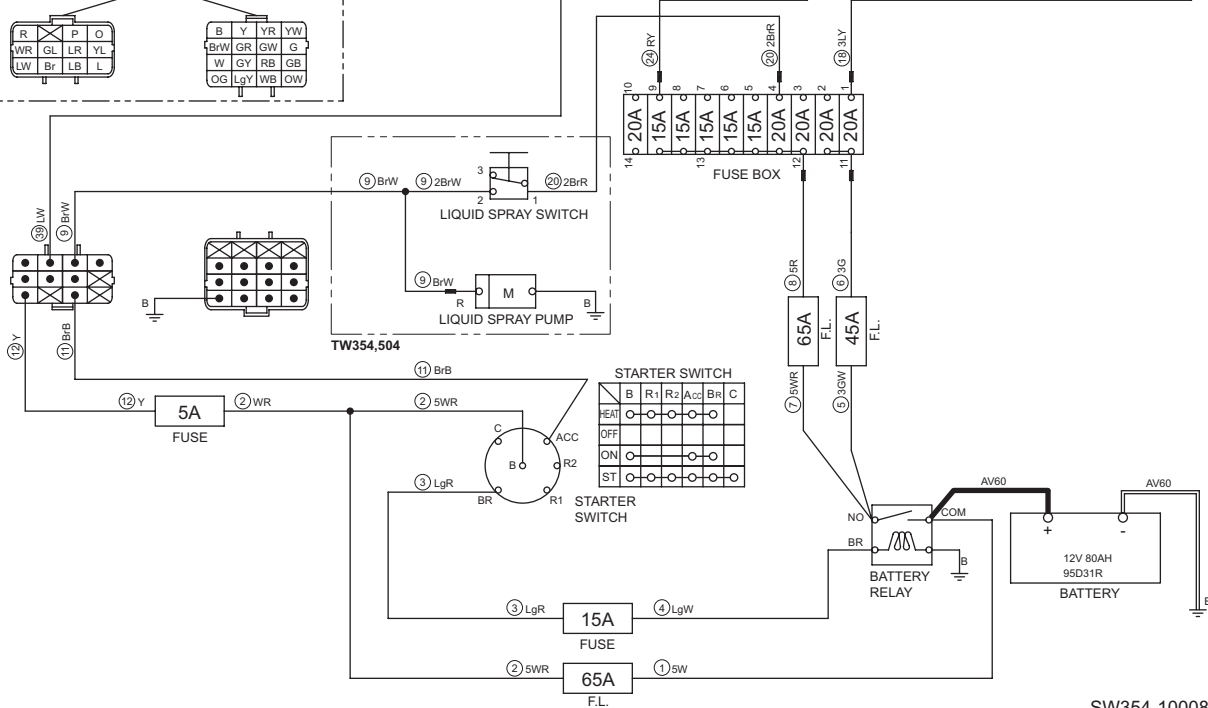
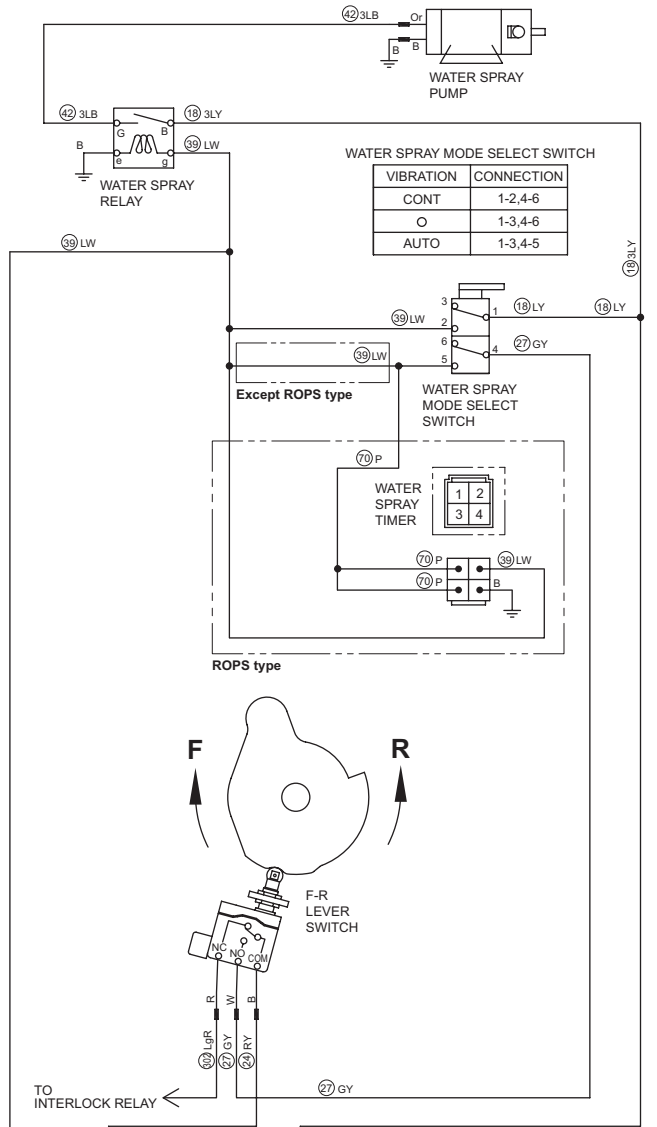
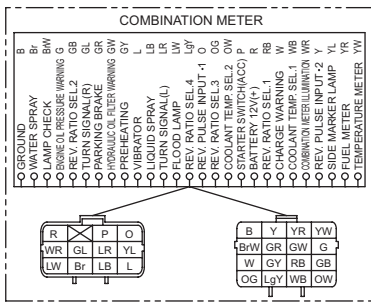
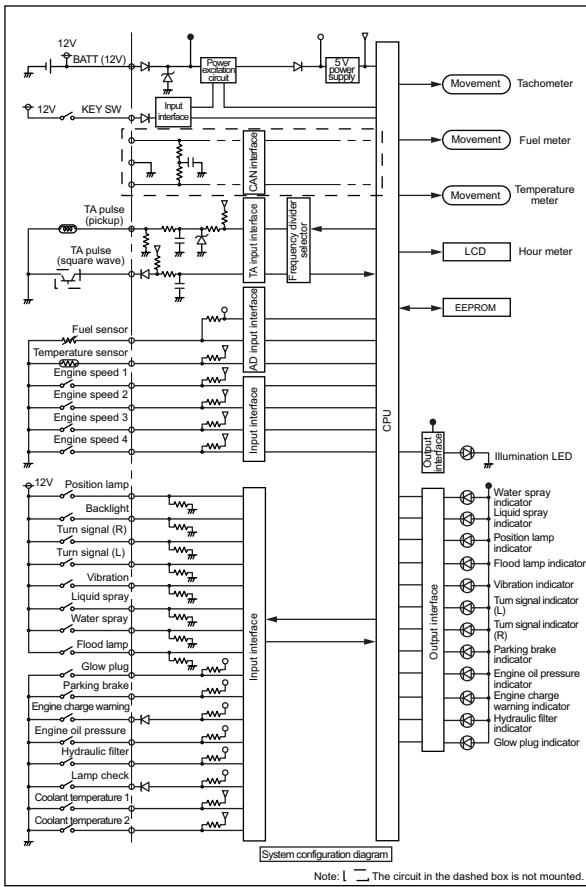
2-6-15. Vibration indicator lamp does not light

- Check that vibrator can be operated.

Reference Fig. : 2-6-3

Check point	Check/Cause	Action
1. Harness	<ul style="list-style-type: none"> • Measure resistance between vibrator lamp relay terminal 5 wire Br and combination meter connector terminal wire No.51 wire Br. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.
2. Vibrator Lamp Relay	<p>(1) When starter switch is ON, measure voltage between vibrator lamp relay terminal 1 and 3 inlet wire RL and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON, F-R lever and vibration mode select switch in below position, check continuity between vibrator lamp relay terminal 2 outlet wire BrR and chassis ground. F-R lever : "F" or "R" Vibration mode select switch : "AUTO" There is continuity in normal condition.</p> <p>(3) When starter switch is ON, F-R lever and vibration mode select switch in below position, measure voltage between vibrator lamp relay terminal 5 outlet wire Br and chassis ground. F-R lever : "F" or "R" Vibration mode select switch : "AUTO" Standard voltage : 12 V or more.</p> <p>If above items (1) and (2) are OK and item (3) is NG, vibrator lamp relay is faulty.</p>	Replace vibrator lamp relay.
3. Combination Meter (Vibration indicator 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"> • Battery 12 V (+) terminal wire No.12 inlet wire Y and ground terminal wire B • Starter switch (ACC) terminal wire No.11 inlet wire BrB and ground terminal wire B Standard voltage : 12 V or more <p>(2) When starter switch is ON, F-R lever and vibration mode select switch in below position, measure voltage between combination meter vibration terminal wire No. 51 inlet wire Br and chassis ground. F-R lever : "F" or "R" Vibration mode change switch : "AUTO" Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and vibration indicator lamp does not light, combination meter is faulty. 	Replace combination meter.

Fig.: 2-6-4



2-6-16. Water spray indicator lamp does not light

- Check that water spray pump can be activated.

Reference Fig. : 2-6-4

Check point	Check/Cause	Action
1. Harness	<ul style="list-style-type: none"> • Measure resistance between water spray mode select switch terminal 2 wire LW and combination meter connector terminal wire No.39 wire LW. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.
2. Combination Meter (Water spray indicator 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"> • Battery 12 V (+) terminal wire No.12 inlet wire Y and ground terminal wire B • Starter switch (ACC) terminal wire No.11 inlet wire BrB and ground terminal wire B Standard voltage : 12 V or more <p>(2) When starter switch is ON, water spray mode select switch is "CONT", measure voltage between combination meter water spray terminal wire No.39 inlet wire LW and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and water spray indicator lamp does not light, combination meter is faulty. 	Replace combination meter.

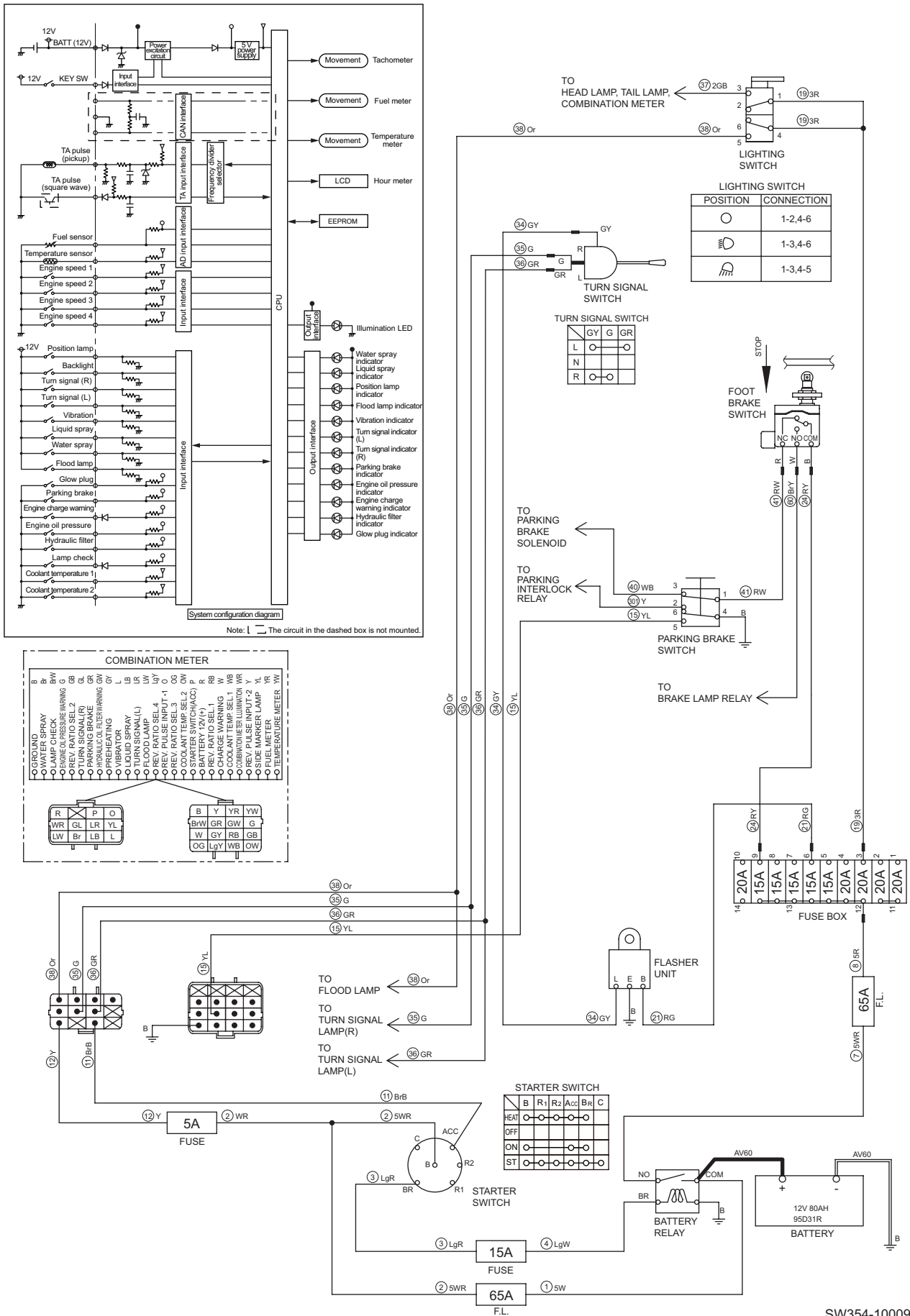
2-6-17. Liquid spray indicator lamp does not light (TW354, 504)

- Check that liquid spray pump can be activated.

Reference Fig. : 2-6-4

Check point	Check/Cause	Action
1. Harness	<ul style="list-style-type: none"> • Measure resistance between liquid spray switch terminal 2 wire BrW and combination meter connector terminal wire No.9 wire BrW. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.
2. Combination Meter (Liquid spray indicator 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"> • Battery 12 V (+) terminal wire No.12 inlet wire Y and ground terminal wire B • Starter switch (ACC) terminal wire No.11 inlet wire BrB and ground terminal wire B Standard voltage : 12 V or more <p>(2) When starter switch is ON, liquid spray switch pressed, measure voltage between combination meter liquid spray terminal wire No.9 inlet wire BrW and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and liquid spray indicator lamp does not light, combination meter is faulty. 	Replace combination meter.


Fig.: 2-6-5



2-6-18. Flood lamp indicator lamp does not light

- Check that flood lamp lights.

Reference Fig. : 2-6-5

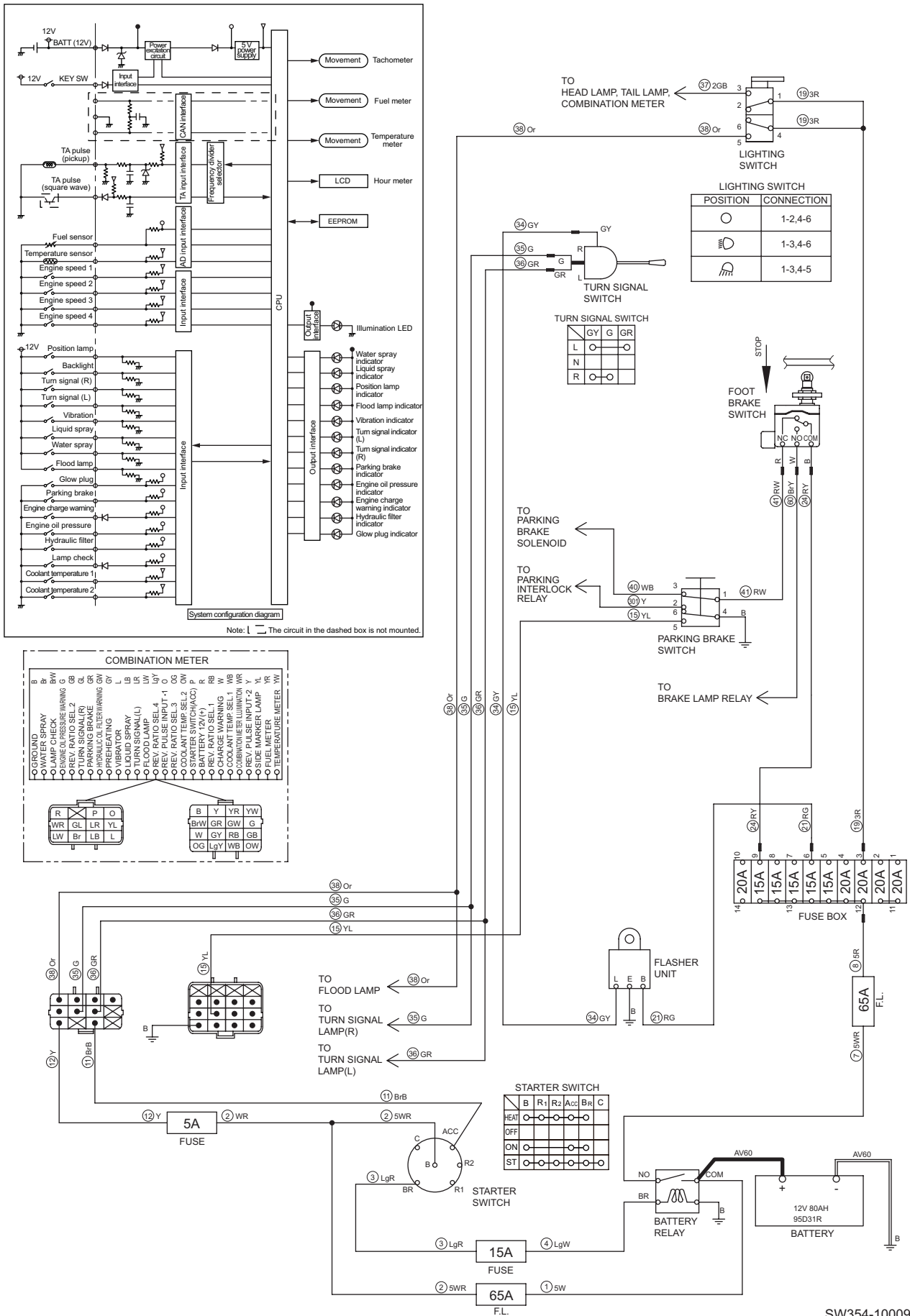
Check point	Check/Cause	Action
1. Harness	<ul style="list-style-type: none"> • Measure resistance between lighting switch terminal 5 wire Or and combination meter connector terminal wire No.38 wire Or. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.
2. Combination Meter (Flood lamp indicator 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"> • Battery 12 V (+) terminal wire No.12 inlet wire Y and ground terminal wire B • Starter switch (ACC) terminal wire No.11 inlet wire BrB and ground terminal wire B Standard voltage : 12 V or more <p>(2) When starter switch is ON and lighting switch is “”, measure voltage between combination meter flood lamp terminal wire No.38 inlet wire Or and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and flood lamp indicator lamp does not light, combination meter is faulty. 	Replace combination meter.

2-6-19. Parking brake indicator lamp does not light

Reference Fig. : 2-6-5

Check point	Check/Cause	Action
1. Harness	<ul style="list-style-type: none"> • Measure resistance between parking brake switch terminal 5 wire YL and combination meter connector terminal wire No.15 wire YL. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.
2. Parking Brake Switch	<ul style="list-style-type: none"> • When parking brake switch is applied, check continuity between parking brake switch terminal 5 wire YL and terminal 4 wire B. There is continuity in normal condition. • If there is no continuity, parking brake switch is faulty. 	Replace parking brake switch.
3. Combination Meter (Parking brake indicator 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"> • Battery 12 V (+) terminal wire No.12 inlet wire Y and ground terminal wire B • Starter switch (ACC) terminal wire No.11 inlet wire BrB and ground terminal wire B Standard voltage : 12 V or more <p>(2) When parking brake switch is applied and starter switch is ON, check continuity between combination meter parking brake terminal wire No.15 inlet wire YL and chassis ground. There is continuity in normal condition.</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and parking brake indicator lamp does not light, combination meter is faulty. 	Replace combination meter.

Fig.: 2-6-5



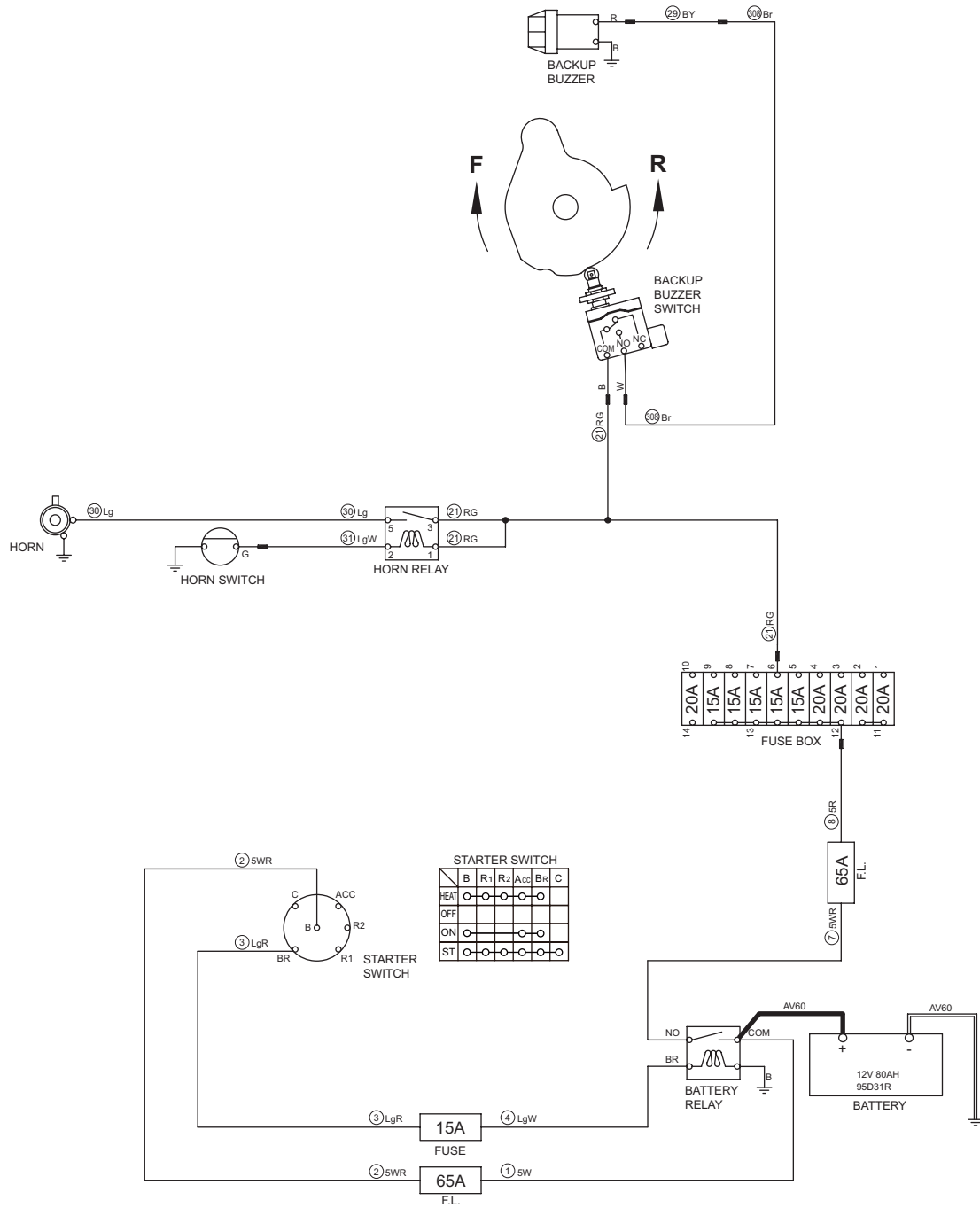
2-6-20. Turn signal indicator lamp does not light

- Check that turn signal lamp blinks.

Reference Fig. : 2-6-5

Check point	Check/Cause	Action
1. Harness	<p>(1) Measure resistance between turn signal switch terminal wire No.36 wire GR and combination meter connector terminal wire No.36 wire GR. Standard resistance : 10 Ω or less</p> <p>(2) Measure resistance between turn signal switch terminal wire No.35 wire G and combination meter connector terminal wire No.35 wire G. Standard resistance : 10 Ω or less</p> <ul style="list-style-type: none"> • If above item (1) or (2) is NG, harness is faulty. 	Repair or replace harness.
2. Turn Signal Switch	<ul style="list-style-type: none"> • When turn signal switch lever is moved, check continuity between turn signal switch terminals. Turn signal (L) : Between wire No.34 wire GY and wire No.36 wire GR Turn signal (R) : Between wire No.34 wire GY and wire No.35 wire 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 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"> • Battery 12 V (+) terminal wire No.12 inlet wire Y and ground terminal wire B • Starter switch (ACC) terminal wire No.11 inlet wire BrB and ground terminal wire B <p>Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and turn signal switch is moved, measure voltage between combination meter terminal wires and chassis ground.</p> <ul style="list-style-type: none"> • Turn signal (L) terminal wire No.36 inlet wire GR and chassis ground • Turn signal (R) terminal wire No.35 inlet wire G and chassis ground <p>Standard voltage : 12 V or more with constant intervals</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and turn signal indicator lamp does not light, combination meter is faulty. 	Replace combination meter.

Fig.: 2-6-6



2-6-21. Horn does not sound

Reference Fig. : 2-6-6

Check point	Check/Cause	Action
1. Horn	<ul style="list-style-type: none"> • Disconnect horn and directly connect battery positive terminal to horn terminal wire Lg side and negative terminal to horn terminal chassis ground side. • If horn does not sound, horn is faulty. 	Replace horn.
2. Horn Relay	<p>(1) When starter switch is ON, measure voltage between horn relay terminal 1 and 3 inlet wire RG and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and horn switch pressed, measure voltage between horn relay terminal 5 outlet wire Lg and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, horn relay is faulty. 	Replace horn relay.
3. Horn Switch	<ul style="list-style-type: none"> • When horn switch is ON, check continuity between horn switch terminals. There is continuity in normal condition. • If there is no continuity, horn switch is faulty. 	Replace horn switch.
4. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

2-6-22. Backup buzzer does not sound

Reference Fig. : 2-6-6

Check point	Check/Cause	Action
1. Backup Buzzer	<ul style="list-style-type: none"> • Disconnect backup buzzer and directly connect battery positive terminal to backup buzzer terminal wire BY side and negative terminal to backup buzzer terminal wire B side. • If backup buzzer does not sound, backup buzzer is faulty. 	Replace backup buzzer.
2. Backup Buzzer Switch	<p>(1) When starter switch is ON, measure voltage between backup buzzer switch terminal inlet wire RG and chassis ground. Standard voltage : 12 V or more</p> <p>(2) When starter switch is ON and F-R lever is "R" , measure voltage between backup buzzer switch terminal outlet wire Br and chassis ground. Standard voltage : 12 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, backup buzzer switch is faulty. 	Replace backup buzzer switch.
3. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	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"> • Measure charge pressure. • If low, check and adjust charge relief valve or replace it if necessary.
	Insufficient steering • charge pump discharge.	Repair steering • 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"> • Parking brake solenoid valve • Speed change solenoid valve 	<ul style="list-style-type: none"> • When solenoid is energized, check if oil flows in return circuit to tank. • If oil is flowing, repair solenoid valve or replace it if necessary.
5. Suction Filter for Steering • Charge Pump	Steering • charge pump flow is reduced due to clogged filter.	Clean suction filter or replace it if necessary.
6. Propulsion Circuit Pressure	Circuit does not obtain required pressure because setting pressure of high pressure relief is low.	<ul style="list-style-type: none"> • Measure propulsion circuit pressure. • If low, check and adjust high pressure relief valve or replace it if necessary.
7. Propulsion Motor	Propulsion circuit pressure is not held in propulsion motor case.	<ul style="list-style-type: none"> • Measure propulsion motor case pressure. • If case pressure is not within allowable pressure, repair propulsion motor or replace it if necessary.
	Internal leakage of propulsion motor.	<ul style="list-style-type: none"> • Measure drain quantity from propulsion motor. • If drain quantity is larger than standard value, repair propulsion motor or replace it if necessary.
	Sticking of disc brakes causes brakes to remain applied.	<ul style="list-style-type: none"> • Replace disc brakes.

3-2-1. Machine moves neither forward nor backward 2/2

Check point	Cause	Check/Action
8. Propulsion Pump	Discharge flow rate is insufficient due to efficiency degradation of propulsion pump.	<ul style="list-style-type: none"> Measure discharge flow rate of propulsion pump with flow meter. If discharge flow rate is not within specified range, repair propulsion pump or replace it if necessary.
	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.	<ul style="list-style-type: none"> Measure propulsion pump case pressure. If case pressure is not within allowable pressure, repair propulsion pump or replace it if necessary.
9. 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.
10. Brake Inlet Pressure	Brake cannot be released because brake inlet pressure is low.	<ul style="list-style-type: none"> Measure brake release pressure. If low, repair or replace propulsion motor.
11. Coupling	Drive torque is not transmitted to pump due to faulty coupling.	Replace coupling.

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"> Interchange two high pressure relief valves. If faulty condition is accordingly reversed, check and adjust high pressure relief valve or replace it if necessary.

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"> Measure charge pressure. If low, check and adjust charge relief valve or replace it if necessary.
	Insufficient steering • charge pump discharge.	Repair steering • 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"> Parking brake solenoid valve Speed change solenoid valve 	<ul style="list-style-type: none"> When solenoid is energized, check if oil flows in return circuit to tank. If oil is flowing, repair solenoid valve or replace it if necessary.
4. Suction Filter for Steering • Charge Pump	Flow rate of steering • 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"> • Measure propulsion motor inlet pressure. • If low, check and adjust high pressure relief valve or replace it if necessary.
	Propulsion circuit pressure is not held in propulsion motor case.	<ul style="list-style-type: none"> • Measure propulsion motor case pressure. • If case pressure is not within allowable pressure, 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"> • Measure drain quantity from propulsion motor. • If drain quantity is larger than standard value, repair propulsion motor or replace it if necessary.
6. Propulsion Pump	Discharge flow rate is insufficient due to efficiency degradation of propulsion pump.	<ul style="list-style-type: none"> • Measure discharge flow rate of propulsion pump with flow meter. • If discharge flow rate is not within specified range, repair propulsion pump or replace it if necessary.
	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.	<ul style="list-style-type: none"> • Measure propulsion pump case pressure. • If case pressure is not within allowable pressure, repair propulsion pump or replace it if necessary.

3-2-4. Machine speed cannot be switched

Check point	Cause	Check/Action
1. Charge Circuit Pressure	Insufficient steering • charge pump discharge.	Repair steering • 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"> • Speed change solenoid valve • Parking brake solenoid valve 	<ul style="list-style-type: none"> • When solenoid is energized, check if oil flows in return circuit to tank. • If oil is flowing, repair solenoid valve or replace it if necessary.
2. 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.
3. Propulsion Motor Speed Change Spool	Propulsion motor speed change spool is faulty.	Replace speed change spool.

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. Propulsion Pump Servo Cylinder	Faulty propulsion pump servo cylinder or faulty pump swash plate setting.	Repair propulsion pump or replace it if necessary.

3-2-6. Driving not possible with differential locked (TW354, 504)

Check point	Cause	Check/Action
1. Differential Lock Valve	Flow control valve is clogged or check valve is faulty.	Inspect flow control valve and check valve or replace it if necessary.

3-2-7. 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 (Propulsion motor (F))	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 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 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"> • Measure propulsion circuit pressure. • If low, increase relief setting pressure.
	If load is excessively heavy, relief valve opens, causing temperature of hydraulic oil in circuit to rise.	<ul style="list-style-type: none"> • Measure propulsion circuit pressure. • If high, decrease propulsion load.
5. Suction Filter for Steering • Charge Pump	Load of steering • 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.

3-2-8. 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 Steering • Charge Pump	Cavitation is occurring in steering • 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"> • Measure charge pressure. • If low, check and adjust charge relief valve or replace it if necessary.
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

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. Suction Filter for Vibrator Pump	Vibrator pump flow is reduced due to clogged filler.	Clean suction filter or replace it if necessary.
3. Vibrator Circuit Pressure	Circuit does not obtain required pressure because setting pressure of relief valve is low.	<ul style="list-style-type: none"> • Measure vibrator circuit pressure. • If low, check and clean relief valve or replace it if necessary.
4. Vibrator Solenoid Valve (SW/TW354)	Because spool of vibrator solenoid valve does not shift, oil flows in return circuit to tank.	Repair or replace vibrator solenoid valve if valve does not shift.
	Decrease in circuit pressure due to faulty setting of relief valve or internal leakage.	<ul style="list-style-type: none"> • Measure vibrator circuit pressure. • If low, check and clean relief valve or replace it if necessary.
5. Vibrator Solenoid Valve (TW504)	Because spool of vibrator solenoid valve does not shift, oil flows in return circuit to tank in neutral position.	Repair or replace vibrator solenoid valve if valve does not shift.
	Decrease in circuit pressure due to faulty setting of relief valve or internal leakage.	<ul style="list-style-type: none"> • Measure vibrator circuit pressure. • If low, check and clean relief valve or replace it if necessary.
6. Vibrator Motor	Vibrator circuit pressure is not held in vibrator motor case.	<ul style="list-style-type: none"> • Measure vibrator motor case pressure. • If case pressure is not within allowable pressure, repair vibrator motor or replace it if necessary.
	Internal leakage of vibrator motor.	<ul style="list-style-type: none"> • Measure drain quantity from vibrator motor. • If drain quantity is larger than standard value, repair vibrator motor or replace it if necessary.
	Output torque is not transmitted due to worn spline of vibrator motor output shaft.	Replace vibrator motor.
7. Vibrator Pump	Insufficient discharge rate from vibrator pump due to reduced efficiency of vibrator pump.	<ul style="list-style-type: none"> • Measure discharge flow rate of vibrator pump with flow meter. • If discharge flow rate is not within specified range, repair vibrator pump or replace it if necessary.
	Insufficient pump discharge due to wear of vibrator pump drive shaft spline.	Replace vibrator pump.
8. Vibrator Bearing	Although vibrator motor output shaft rotates, no vibration is generated because vibrator bearing is damaged or seized.	Remove vibrator motor and check rotation. If no vibration is generated, replace vibrator bearing.
9. Power Transmission Sleeve	Although vibrator motor output shaft rotates, no vibration is generated due to worn spline of power transmission sleeve.	Remove vibrator motor and check rotation. If no vibration is generated, replace power transmission sleeve.

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. Suction Filter for Vibrator Pump	Flow rate of vibrator pump decreases as well as charge pressure decreases due to clogged filter.	Clean suction filter or replace it if necessary.
3. Vibrator Motor	Vibrator motor inlet pressure is low.	<ul style="list-style-type: none"> • Measure vibrator motor inlet pressure. • If low, check and adjust high pressure relief valve or replace it if necessary.
	Vibrator circuit pressure is not held in vibrator motor case.	<ul style="list-style-type: none"> • Measure vibrator motor case pressure. • If case pressure is not within allowable pressure, 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"> • Measure drain quantity from vibrator motor. • If drain quantity is larger than standard value, repair vibrator motor or replace it if necessary.
4. Vibrator Pump	Insufficient discharge rate from vibrator pump due to reduced efficiency of vibrator pump.	<ul style="list-style-type: none"> • Measure discharge flow rate of vibrator pump with flow meter. • If discharge flow rate is not within specified range, repair vibrator pump or replace it if necessary.
	Insufficient pump discharge due to wear of vibrator pump drive shaft spline.	Replace vibrator pump.

3-3-3. Vibratory drum does not changeover vibrating (SW354 ROPS)

Check point	Cause	Check/Action
1. Vibrator 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.

3-3-4. Vibration mode does not switch (TW504)

Check point	Cause	Check/Action
1. Vibrator Solenoid Valve	Vibrator solenoid valve spool 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 (SW/TW354)	Vibrator solenoid valve spool does not change.	Repair vibrator solenoid valve or replace it if necessary.
2. Vibrator Solenoid Valve (TW504)	Vibrator solenoid valve spool does not return to neutral position.	Repair vibrator solenoid valve 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"> • Measure vibrator circuit pressure. • If low, increase relief setting pressure.
	If load is excessively heavy, relief valve opens, causing temperature of hydraulic oil in circuit to rise.	<ul style="list-style-type: none"> • Measure vibrator circuit pressure. • If high, decrease vibration load.
4. Suction Filter for Vibrator Pump	Load of vibrator pump increases due to clogged filter, causing temperature of hydraulic oil in circuit to rise.	Clean suction filter or replace it if necessary.

3-3-7. Abnormal noise from vibrator 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 vibrator circuit.	Fill tank until correct oil level is obtained.
2. Vibrator Circuit	Cavitation is caused by air in circuit.	Bleed circuit.
3. Vibrator Bearings	Vibrator bearings supporting eccentric shaft are damaged.	Replace vibrator bearings.
4. 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.
5. Suction Filter for Vibrator Pump	Cavitation is occurring in vibrator pump due to clogged filter.	Clean suction filter or replace it if necessary.
6. Vibrator Motor	Internal bearing of vibrator motor is damaged.	Repair vibrator motor or replace it if necessary.
7. Power Transmission Sleeve	Noise is generated from power transmission shaft because sleeve backlash is large.	If wear of sleeve spline is large, replace sleeve.

3-4. Steering System

If a problem occurs in the steering systems such as the steering • charge 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"> • Measure steering circuit pressure. • If low, check and clean relief valve or replace it if necessary.
	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 Steering • Charge Pump	Steering • charge pump discharge rate decreases due to clogged filter.	Clean suction filter or replace it if necessary.
6. Steering • Charge Pump	Discharging pressure is insufficient due to efficiency degradation of steering • charge pump.	<ul style="list-style-type: none"> • Measure steering circuit pressure. • If low, replace steering • charge pump.
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"> • Measure steering circuit pressure. • If low, check and clean relief valve or replace it if necessary.
3. Steering Cylinder	Internal leakage of steering cylinder.	Repair steering cylinder or replace it if necessary.
4. Suction Filter for Steering • Charge Pump	Steering • charge pump discharge rate decreases due to clogged filter.	Clean suction filter or replace it if necessary.
5. Steering • Charge Pump	Discharging pressure is insufficient due to efficiency degradation of steering • charge pump.	<ul style="list-style-type: none"> • Measure steering circuit pressure. • If low, replace steering • charge pump.

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"> • Measure steering circuit pressure. • If low, replace relief valve.
	If load is excessively heavy, relief valve is open, causing temperature of hydraulic oil in circuit to rise.	<ul style="list-style-type: none"> • Measure steering circuit pressure. • If high, decrease steering load.
4. Suction Filter for Steering • Charge Pump	Load of steering • charge 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. 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 Steering • Charge Pump	Cavitation is occurring in steering • charge pump due to clogged filter.	Clean suction filter or replace it if necessary.

3-5. Cooling System

If a problem occurs in the cooling systems such as the vibrator pump and cooling fan drive motor, 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.

3-5-1. Cooling fan does not rotate

Check point	Check/Cause	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. Cooling Circuit Pressure	Circuit does not obtain required pressure because setting pressure of relief valve is low.	<ul style="list-style-type: none"> • Measure cooling circuit pressure. • If low, check and clean relief valve or replace it if necessary.
3. Suction Filter for Vibrator Pump (also used for cooling system)	Vibrator pump discharge rate decreases due to clogged filter.	Clean suction filter or replace it if necessary.
4. Vibrator Pump (also used for cooling system)	Discharge flow rate is insufficient due to efficiency degradation of vibrator pump.	<ul style="list-style-type: none"> • Measure discharge flow rate of vibrator pump with flow meter. • If discharge flow rate is not within specified range, repair vibrator pump or replace it if necessary.
5. Cooling Fan Drive Motor	Internal leakage or internal failure of cooling fan drive motor.	Repair or replace cooling fan drive motor.
	Output torque is not transmitted due to worn spline of cooling fan drive motor output shaft.	Replace cooling fan drive motor.

3-5-2. Cooling system is overheating

Check point	Check/Cause	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 fin.
3. Pressure Setting in Cooling Circuit	If circuit pressure setting is excessively low, relief valve open, causing temperature of hydraulic oil in circuit to rise.	<ul style="list-style-type: none"> • Measure cooling circuit pressure. • If low, check and clean relief valve or replace it if necessary.
	If load is excessively heavy, relief valve open, causing temperature of hydraulic oil in circuit to rise.	<ul style="list-style-type: none"> • Measure cooling circuit pressure. • If high, decrease vibrator load.
4. Suction Filter for Vibrator Pump	Load of vibrator pump increases due to clogged filter, causing temperature of hydraulic oil in circuit to rise.	Clean suction filter or replace it if necessary.

SW/TW354,TW504

SHOP MANUAL

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