

SV540

SHOP MANUAL

SAKAI®

3498-6418A-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.

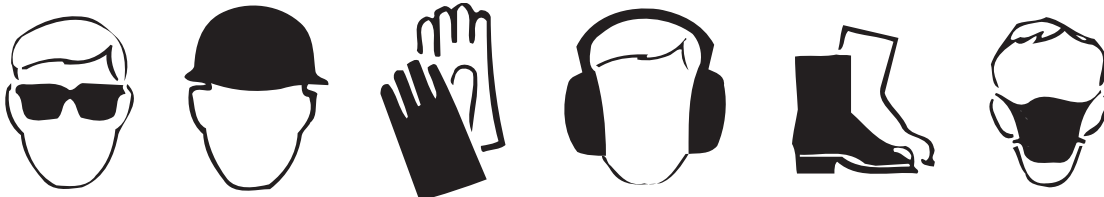
- The machine is designed specifically for the compaction of asphalt or soil road construction materials. Use of the machine for other purposes such as towing other equipment is considered contrary to the designated use. The manufacturer cannot be responsible or held liable for any damage resulting from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

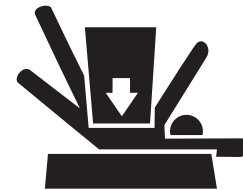
- Always make sure that there are no obstructions or persons in your line of travel before starting the compactor in motion.
- Never climb on and off the machine while it is in motion.
- Always remain seated with the seat belt fastened when traveling, compacting or loading or unloading the machine.
-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



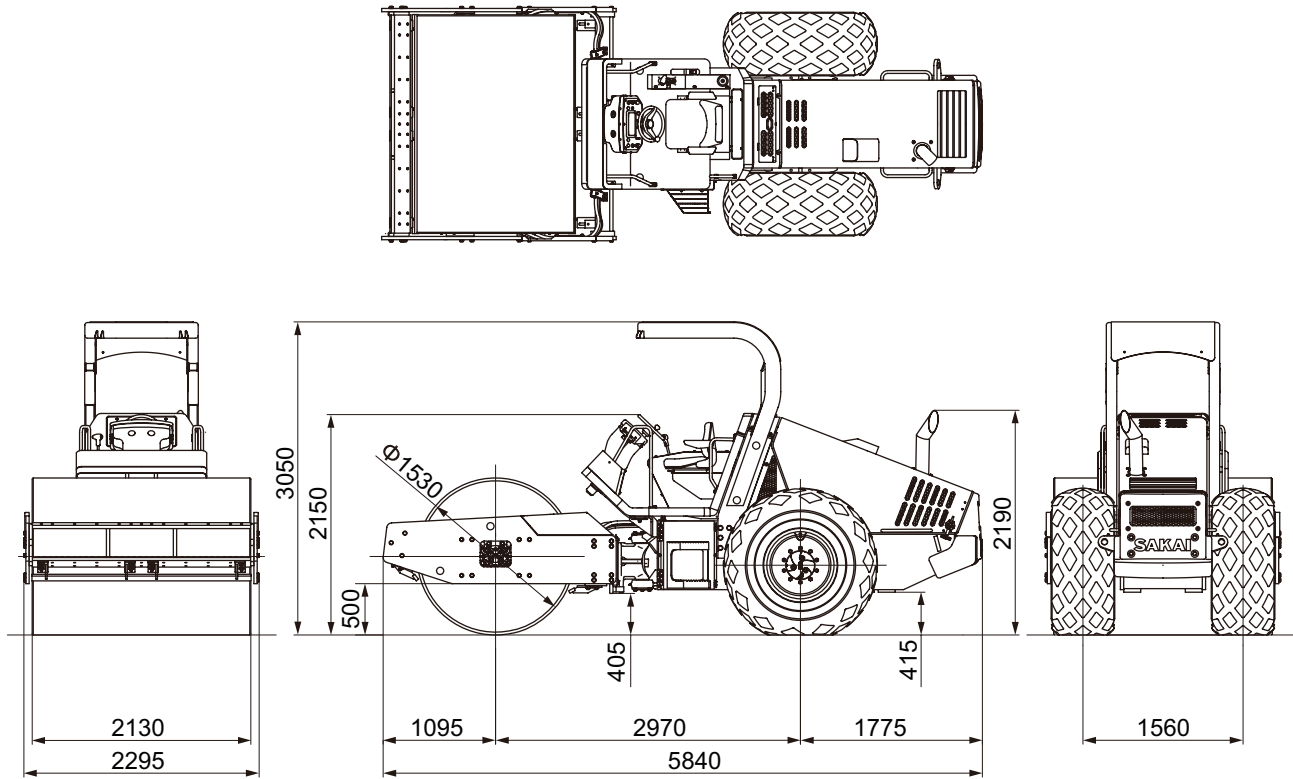
1-11. Transporting the Machine

- 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. SV540D



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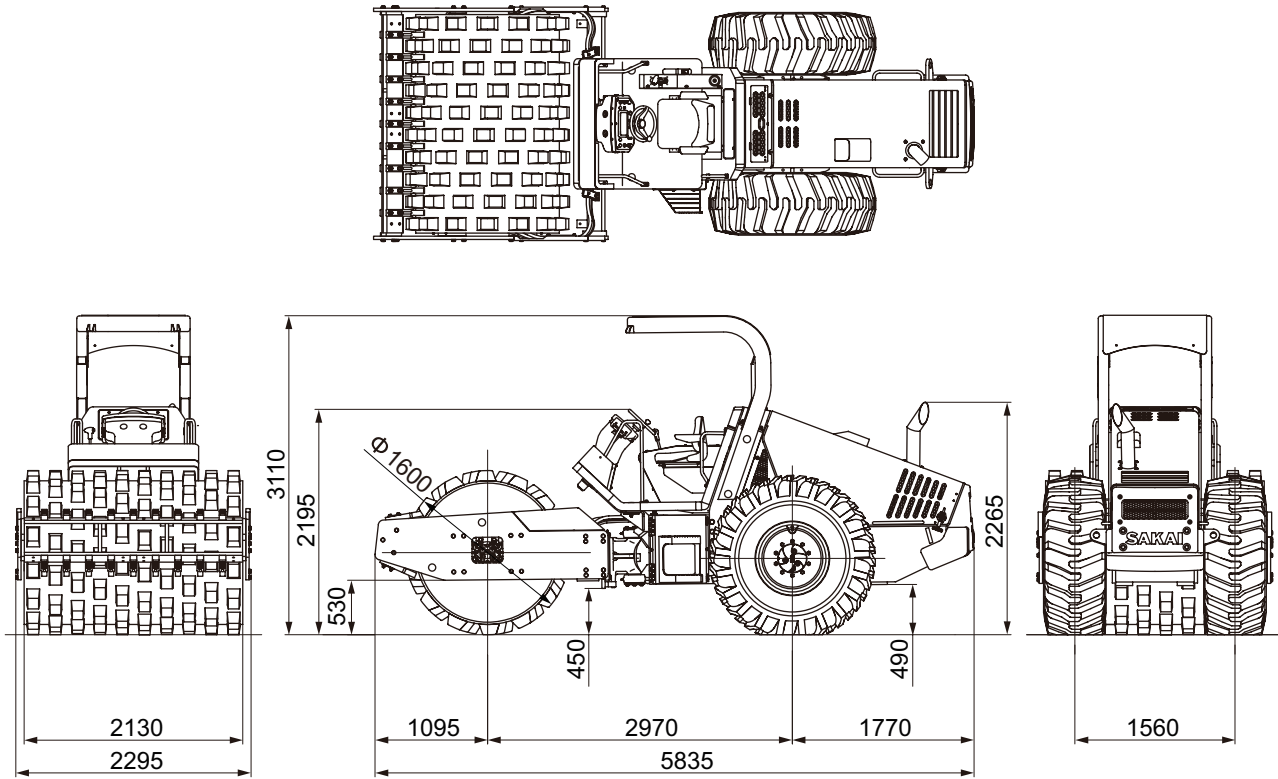
Model		SV540D		
Weight	Operating weight	10,710 kg	(23,610 lbs.)	
	Front axle	5,470 kg	(12,060 lbs.)	
	Rear axle	5,240 kg	(11,550 lbs.)	
Dimensions	Overall length	5,840 mm	(230 in.)	
	Overall width	2,295 mm	(90 in.)	
	Overall height	Steering wheel	2,150 mm	(85 in.)
		Tail pipe	2,190 mm	(86 in.)
		ROPS	3,050 mm	(120 in.)
	Wheelbase	2,970 mm	(117 in.)	
	Compaction width	2,130 mm	(84 in.)	
	Minimum height above ground	405 mm	(15.5 in.)	
Curb clearance	500 mm	(19.5 in.)		
Speed	1st	0 to 6 km/h	(0 to 3.7 mph)	
	2nd	0 to 10 km/h	(0 to 6.2 mph)	
Vibration performance	Frequency	Low amplitude	33.3 Hz	
		High amplitude	28.3 Hz	
	Centrifugal force	Low amplitude	172 kN (38,665 lbs.)	
		High amplitude	255 kN (57,325 lbs.)	
Amplitude	Low amplitude	1.02 mm (0.04 in.)		
	High amplitude	2.09 mm (0.08 in.)		
Minimum turning radius		5.6 m	(221 in.)	
Gradability *1		62 %	(32 °)	

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

SPECIFICATIONS

Engine	Name		CUMMINS QSB4.5 Diesel Engine with turbocharger (EPA Interim Tier 4)		
	Model		Water-cooled, 4-cycle, 4-cylinder, in-line, vertical mounted, overhead valve, direct injection type		
	Bore × Stroke		107 mm × 124 mm (4.213 in. × 4.882 in.)		
	Displacement		4.460 L (272.2 cu.in)		
	Performance	Rated speed		2,200 min ⁻¹ (2,200 rpm)	
		Rated output		119.0 kW (160 HP)	
		Max. torque		624 N·m (460 lbf·ft) at 1,500 min ⁻¹	
		Fuel consumption		215 g/kW·h (0.354 lb/HP·h) at rated speed	
	Governor		Full electrical control		
	Lubrication system		Pressure lubrication by gear pump		
	Oil filter		Full-flow: stratapore (synthetic)		
	Air cleaner		Dry type		
	Cooling system		Centrifugal pump forced feeding system (pressure type)		
	Cooling fan		Inhaling type		
	Electrical system	Alternator		24 V 70 A	
Starter		24 V 4.8 kW			
Battery		12 V CCA 760 × 2 pcs. (24 V)			
Engine dry weight			390 kg (860 lbs.)		
Power line	Transmission	Type	Hydrostatic transmission		
		Speeds	2 speed shifts		
	Reverser		Switching the direction of flow delivered from the variable pump		
	Differential		Auto lock type		
Final drive		Planetary gear			
Vibrating system	Transmission		Hydrostatic transmission		
	Vibrator		Eccentric shaft type		
Braking device	Service brake		Hydrostatic and mechanical type		
	Parking brake		Mechanical type		
Steering system	Steering control type		Hydraulic type (Articulated type)		
	Steering control angle		± 37 °		
	Oscillation angle		± 9 °		
Drum and wheels	Use	Front drum		Vibrate & drive × 1	
		Rear tires		Drive × 2	
	Dimension	Front drum	width × diameter	2,130 mm × 1,530 mm (84 in. × 60 in.)	
		Rear tires	size	23.1-26-8 PR (OR)	
	Suspension system	Front		Rubber damper type	
Rear		Rigid			
Others	ROPS		Steel frame		

1-2. SV540T



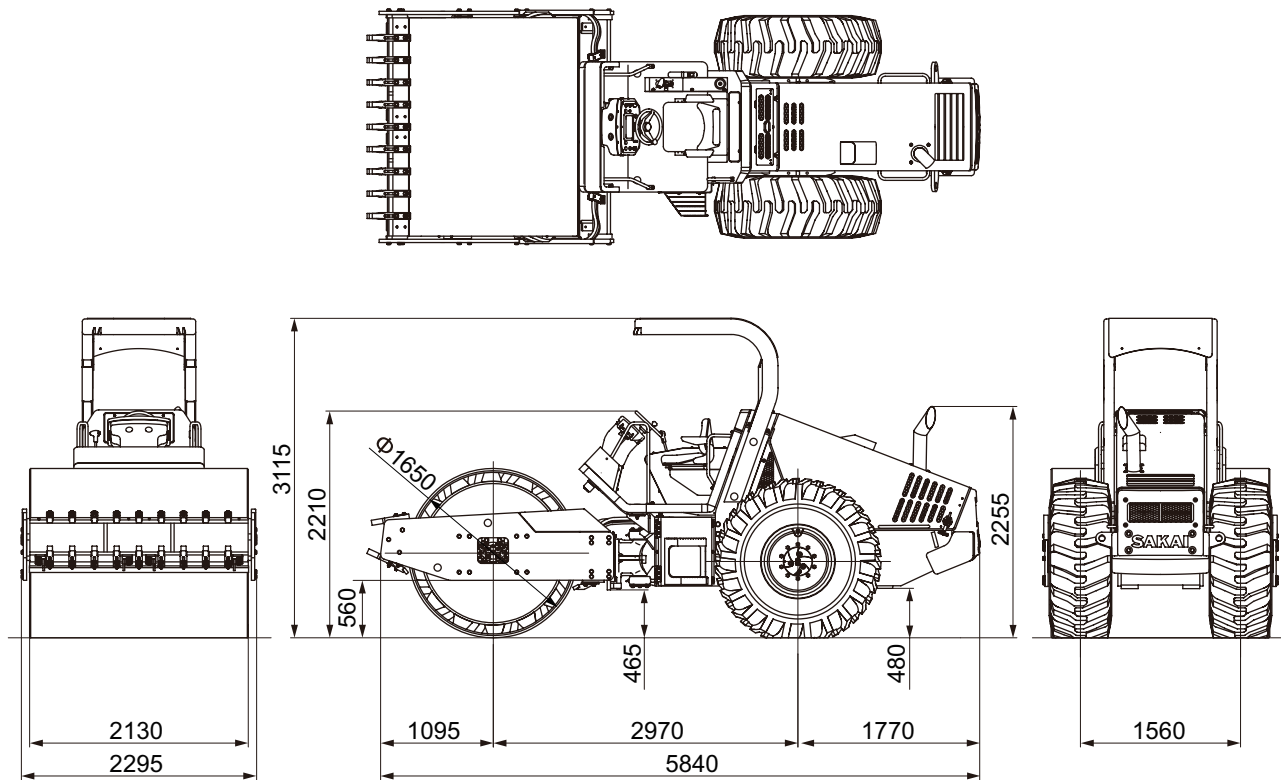
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Model		SV540T		
Weight	Operating weight	11,090 kg	(24,450 lbs.)	
	Front axle	5,855 kg	(12,910 lbs.)	
	Rear axle	5,235 kg	(11,540 lbs.)	
Dimensions	Overall length	5,835 mm	(230 in.)	
	Overall width	2,295 mm	(90 in.)	
	Overall height	Steering wheel	2,195 mm	(86 in.)
		Tail pipe	2,265 mm	(89 in.)
		ROPS	3,110 mm	(122 in.)
	Wheelbase	2,970 mm	(117 in.)	
	Compaction width	2,130 mm	(84 in.)	
	Minimum height above ground	450 mm	(17.5 in.)	
Curb clearance	530 mm	(20.5 in.)		
Speed	1st	0 to 6 km/h	(0 to 3.7 mph)	
	2nd	0 to 10 km/h	(0 to 6.2 mph)	
Vibration performance	Frequency	Low amplitude	33.3 Hz	
		High amplitude	28.3 Hz	
	Centrifugal force	Low amplitude	172 kN (38,665 lbs.)	
		High amplitude	255 kN (57,325 lbs.)	
	Amplitude	Low amplitude	0.95 mm (0.04 in.)	
High amplitude		1.94 mm (0.08 in.)		
Minimum turning radius		5.6 m	(221 in.)	
Gradability *1		62 %	(32 °)	

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

Engine	Name		CUMMINS QSB4.5 Diesel Engine with turbocharger (EPA Interim Tier 4)		
	Model		Water-cooled, 4-cycle, 4-cylinder, in-line, vertical mounted, overhead valve, direct injection type		
	Bore × Stroke		107 mm × 124 mm (4.213 in. × 4.882 in.)		
	Displacement		4.460 L (272.2 cu.in)		
	Performance	Rated speed		2,200 min ⁻¹ (2,200 rpm)	
		Rated output		119.0 kW (160 HP)	
		Max. torque		624 N·m (460 lbf·ft) at 1,500 min ⁻¹	
		Fuel consumption		215 g/kW·h (0.354 lb/HP·h) at rated speed	
	Governor		Full electrical control		
	Lubrication system		Pressure lubrication by gear pump		
	Oil filter		Full-flow: stratapore (synthetic)		
	Air cleaner		Dry type		
	Cooling system		Centrifugal pump forced feeding system (pressure type)		
	Cooling fan		Inhaling type		
	Electrical system	Alternator		24 V 70 A	
Starter		24 V 4.8 kW			
Battery		12 V CCA 760 × 2 pcs. (24 V)			
Engine dry weight			390 kg (860 lbs.)		
Power line	Transmission	Type	Hydrostatic transmission		
		Speeds	2 speed shifts		
	Reverser		Switching the direction of flow delivered from the variable pump		
	Differential		Auto lock type		
	Final drive		Planetary gear		
Vibrating system	Transmission		Hydrostatic transmission		
	Vibrator		Eccentric shaft type		
Braking device	Service brake		Hydrostatic and mechanical type		
	Parking brake		Mechanical type		
Steering system	Steering control type		Hydraulic type (Articulated type)		
	Steering control angle		± 37 °		
	Oscillation angle		± 9 °		
Drum and wheels	Use	Front drum		Vibrate & drive × 1	
		Rear tires		Drive × 2	
	Dimension	Front drum	Pad	width × diameter	2,130 mm × 1,600 mm (84 in. × 63 in.)
				Number of pads	140
		Pad height	100 mm (4.0 in.)		
		Pad area	130 cm ² (20 sq.in.)		
	Rear tires	size		23.1-26-10 PR (OR)	
Suspension system		Front		Rubber damper type	
	Rear		Rigid		
Others	ROPS		Steel frame		

1-3. SV540TF



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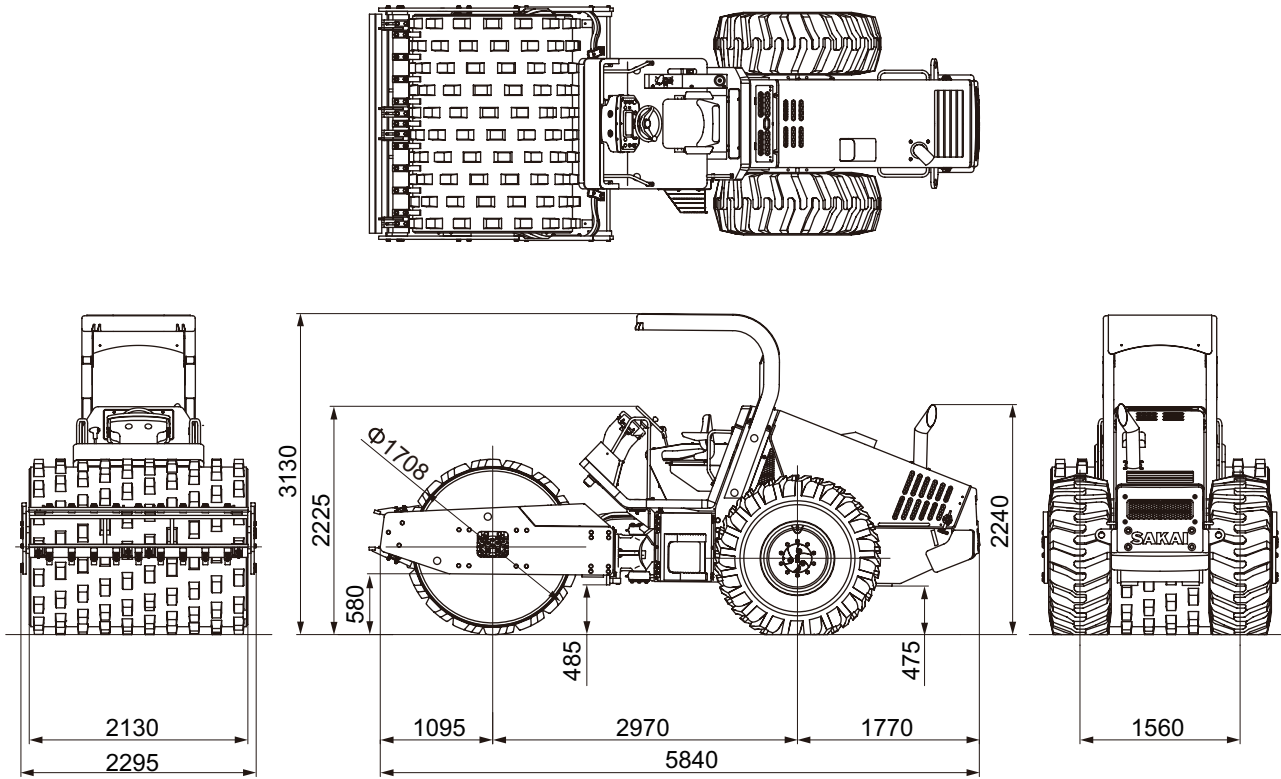
Model		SV540TF		
Weight	Operating weight	13,350 kg	(29,430 lbs.)	
	Front axle	8,120 kg	(17,900 lbs.)	
	Rear axle	5,230 kg	(11,530 lbs.)	
Dimensions	Overall length	5,840 mm	(230 in.)	
	Overall width	2,295 mm	(90 in.)	
	Overall height	Steering wheel	2,210 mm	(87 in.)
		Tail pipe	2,255 mm	(89 in.)
		ROPS	3,115 mm	(123 in.)
	Wheelbase	2,970 mm	(117 in.)	
	Compaction width	2,130 mm	(84 in.)	
	Minimum height above ground	465 mm	(18.0 in.)	
Curb clearance	560 mm	(22.0 in.)		
Speed	1st	0 to 6 km/h	(0 to 3.7 mph)	
	2nd	0 to 10 km/h	(0 to 6.2 mph)	
Vibration performance	Frequency	Low amplitude	33.3 Hz	
		High amplitude	28.3 Hz	
	Centrifugal force	Low amplitude	172 kN (38,665 lbs.)	
		High amplitude	255 kN (57,325 lbs.)	
	Amplitude	Low amplitude	0.62 mm (0.02 in.)	
High amplitude		1.27 mm (0.05 in.)		
Minimum turning radius		5.6 m	(221 in.)	
Gradability *1		46 %	(25 °)	

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

SPECIFICATIONS

Engine	Name		CUMMINS QSB4.5 Diesel Engine with turbocharger (EPA Interim Tier 4)		
	Model		Water-cooled, 4-cycle, 4-cylinder, in-line, vertical mounted, overhead valve, direct injection type		
	Bore × Stroke		107 mm × 124 mm (4.213 in. × 4.882 in.)		
	Displacement		4.460 L (272.2 cu.in)		
	Performance	Rated speed		2,200 min ⁻¹ (2,200 rpm)	
		Rated output		119.0 kW (160 HP)	
		Max. torque		624 N·m (460 lbf·ft) at 1,500 min ⁻¹	
		Fuel consumption		215 g/kW·h (0.354 lb/HP·h) at rated speed	
	Governor		Full electrical control		
	Lubrication system		Pressure lubrication by gear pump		
	Oil filter		Full-flow: stratapore (synthetic)		
	Air cleaner		Dry type		
	Cooling system		Centrifugal pump forced feeding system (pressure type)		
	Cooling fan		Inhaling type		
	Electrical system	Alternator		24 V 70 A	
Starter		24 V 4.8 kW			
Battery		12 V CCA 760 × 2 pcs. (24 V)			
Engine dry weight			390 kg (860 lbs.)		
Power line	Transmission	Type	Hydrostatic transmission		
		Speeds	2 speed shifts		
	Reverser		Switching the direction of flow delivered from the variable pump		
	Differential		Auto lock type		
	Final drive		Planetary gear		
Vibrating system	Transmission		Hydrostatic transmission		
	Vibrator		Eccentric shaft type		
Braking device	Service brake		Hydrostatic and mechanical type		
	Parking brake		Mechanical type		
Steering system	Steering control type		Hydraulic type (Articulated type)		
	Steering control angle		± 37 °		
	Oscillation angle		± 9 °		
Drum and wheels	Use	Front drum		Vibrate & drive × 1	
		Rear tires		Drive × 2	
	Dimension	Front drum	Smooth	width × diameter	2,130 mm × 1,650 mm (84 in. × 65 in.)
				width × diameter	2,130 mm × 1,600 mm (84 in. × 63 in.)
		Pad	Number of pads	140	
			Pad height	100 mm (4.0 in.)	
			Pad area	130 cm ² (20 sq.in.)	
	Rear tires	size	23.1-26-10 PR (OR)		
Suspension system	Front		Rubber damper type		
	Rear		Rigid		
Others	ROPS		Steel frame		

1-4. SV540DF



0418-99025-0-10981-0

Model		SV540DF		
Weight	Operating weight	12,385 kg	(27,305 lbs.)	
	Front axle	7,215 kg	(15,905 lbs.)	
	Rear axle	5,170 kg	(11,400 lbs.)	
Dimensions	Overall length	5,840 mm	(230 in.)	
	Overall width	2,295 mm	(90 in.)	
	Overall height	Steering wheel	2,225 mm	(88 in.)
		Tail pipe	2,240 mm	(88 in.)
		ROPS	3,130 mm	(123 in.)
	Wheelbase	2,970 mm	(117 in.)	
	Compaction width	2,130 mm	(84 in.)	
	Minimum height above ground	475 mm	(18.5 in.)	
Curb clearance	580 mm	(22.5 in.)		
Speed	1st	0 to 6 km/h	(0 to 3.7 mph)	
	2nd	0 to 10 km/h	(0 to 6.2 mph)	
Vibration performance	Frequency	Low amplitude	33.3 Hz	
		High amplitude	28.3 Hz	
	Centrifugal force	Low amplitude	172 kN (38,665 lbs.)	
		High amplitude	255 kN (57,325 lbs.)	
	Amplitude	Low amplitude	0.73 mm (0.03 in.)	
High amplitude		1.50 mm (0.06 in.)		
Minimum turning radius		5.6 m	(221 in.)	
Gradability *1		48 %	(26 °)	

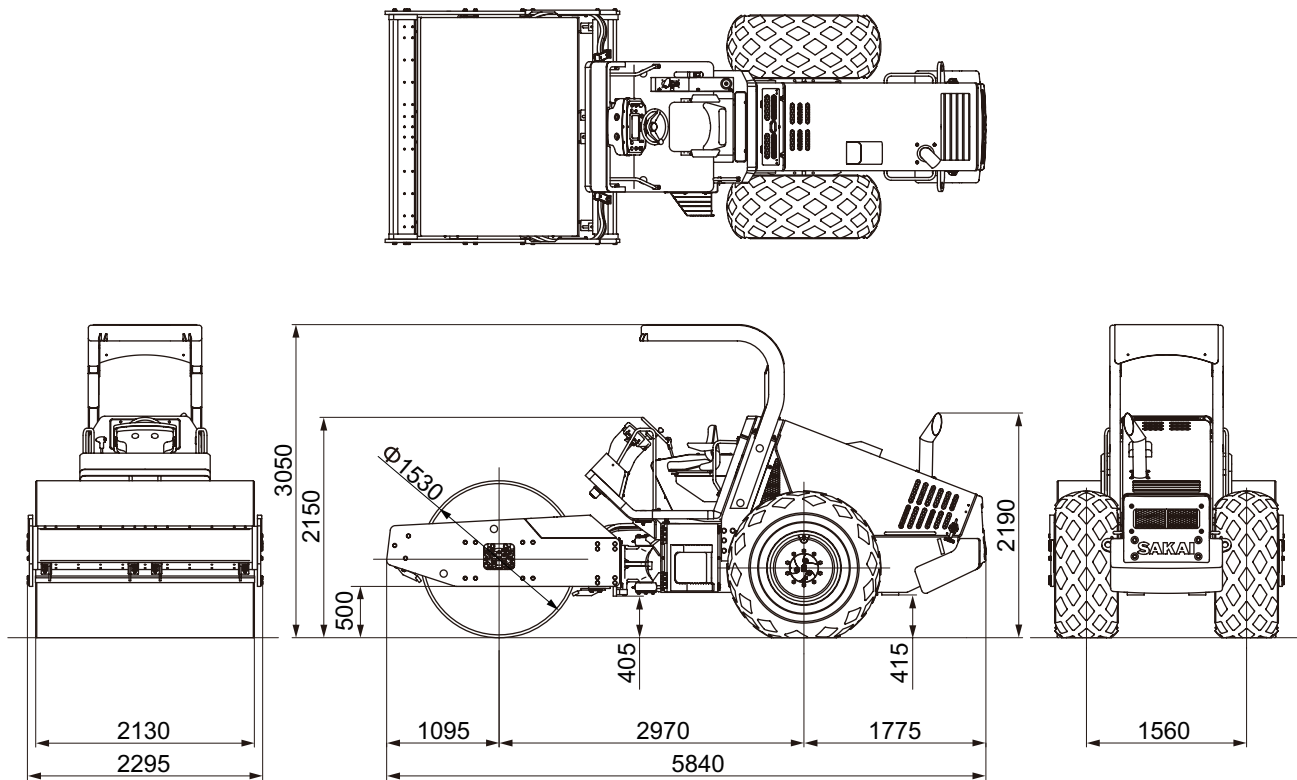
*1: The gradability is the calculated value. It may vary based on the ground surface conditions.

SPECIFICATIONS

Engine	Name		CUMMINS QSB4.5 Diesel Engine with turbocharger (EPA Interim Tier 4)		
	Model		Water-cooled, 4-cycle, 4-cylinder, in-line, vertical mounted, overhead valve, direct injection type		
	Bore × Stroke		107 mm × 124 mm (4.213 in. × 4.882 in.)		
	Displacement		4.460 L (272.2 cu.in)		
	Performance	Rated speed		2,200 min ⁻¹ (2,200 rpm)	
		Rated output		119.0 kW (160 HP)	
		Max. torque		624 N·m (460 lbf·ft) at 1,500 min ⁻¹	
		Fuel consumption		215 g/kW·h (0.354 lb/HP·h) at rated speed	
	Governor		Full electrical control		
	Lubrication system		Pressure lubrication by gear pump		
	Oil filter		Full-flow: stratapore (synthetic)		
	Air cleaner		Dry type		
	Cooling system		Centrifugal pump forced feeding system (pressure type)		
	Cooling fan		Inhaling type		
	Electrical system	Alternator		24 V 70 A	
Starter		24 V 4.8 kW			
Battery		12 V CCA 760 × 2 pcs. (24 V)			
Engine dry weight			390 kg (860 lbs.)		
Power line	Transmission	Type	Hydrostatic transmission		
		Speeds	2 speed shifts		
	Reverser		Switching the direction of flow delivered from the variable pump		
	Differential		Auto lock type		
	Final drive		Planetary gear		
Vibrating system	Transmission		Hydrostatic transmission		
	Vibrator		Eccentric shaft type		
Braking device	Service brake		Hydrostatic and mechanical type		
	Parking brake		Mechanical type		
Steering system	Steering control type		Hydraulic type (Articulated type)		
	Steering control angle		± 37 °		
	Oscillation angle		± 9 °		
Drum and wheels	Use	Front drum		Vibrate & drive × 1	
		Rear tires		Drive × 2	
	Dimension	Front drum	Smooth	width × diameter	2,130 mm × 1,530 mm (84 in. × 60 in.)
				width × diameter	2,130 mm × 1,708 mm (84 in. × 67 in.)
		Pad	Number of pads	160	
			Pad height	75 mm (3.0 in.)	
			Pad area	102 cm ² (16 sq.in.)	
	Rear tires	size	23.1-26-10 PR (OR)		
Suspension system	Front		Rubber damper type		
	Rear		Rigid		
Others	ROPS		Steel frame		

SPECIFICATIONS

1-5. SV640D



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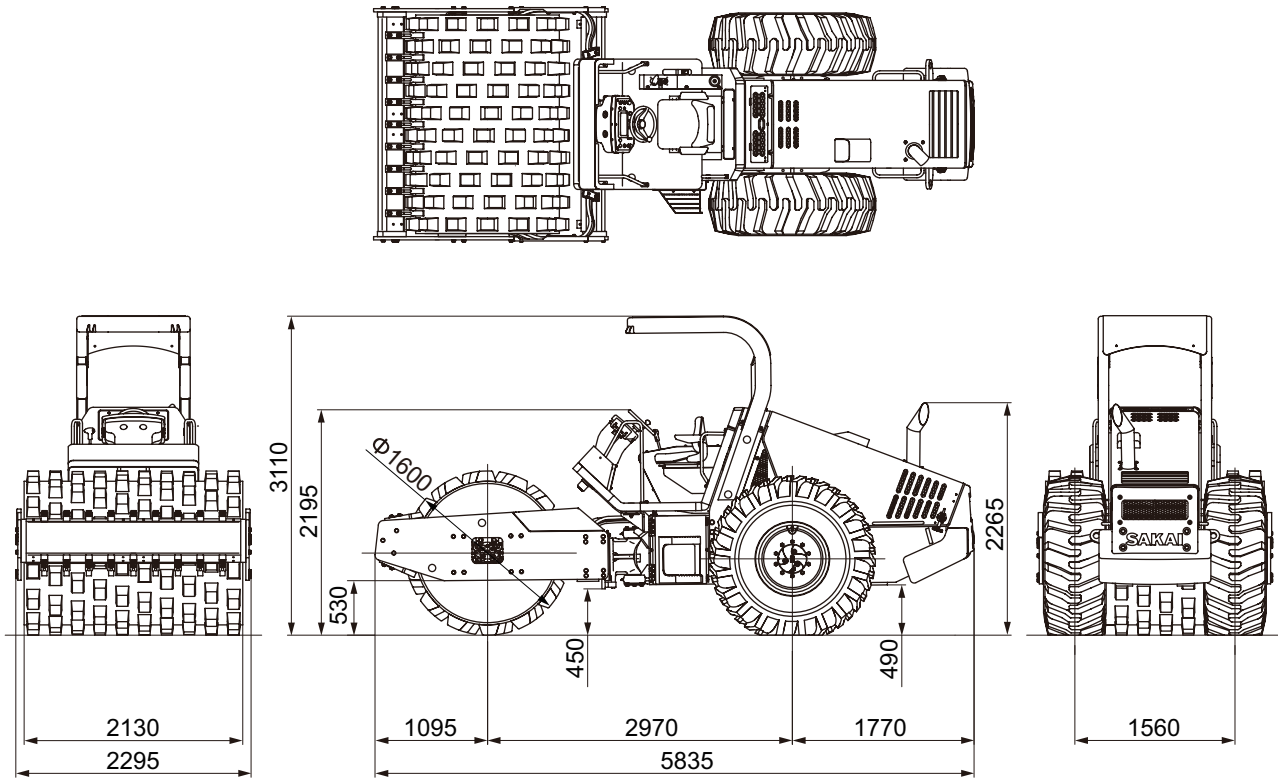
Model		SV640D		
Weight	Operating weight	13,150 kg	(28,990 lbs.)	
	Front axle	7,150 kg	(15,760 lbs.)	
	Rear axle	6,000 kg	(13,230 lbs.)	
Dimensions	Overall length	5,840 mm	(230 in.)	
	Overall width	2,295 mm	(90 in.)	
	Overall height	Steering wheel	2,150 mm	(85 in.)
		Tail pipe	2,190 mm	(86 in.)
		ROPS	3,050 mm	(120 in.)
	Wheelbase	2,970 mm	(117 in.)	
	Compaction width	2,130 mm	(84 in.)	
	Minimum height above ground	405 mm	(15.5 in.)	
Curb clearance	500 mm	(19.5 in.)		
Speed	1st	0 to 6 km/h	(0 to 3.7 mph)	
	2nd	0 to 10 km/h	(0 to 6.2 mph)	
Vibration performance	Frequency	Low amplitude	33.3 Hz	
		High amplitude	28.3 Hz	
	Centrifugal force	Low amplitude	172 kN (38,665 lbs.)	
		High amplitude	255 kN (57,325 lbs.)	
	Amplitude	Low amplitude	1.02 mm (0.04 in.)	
High amplitude		2.08 mm (0.08 in.)		
Minimum turning radius		5.6 m	(221 in.)	
Gradability *1		50 %	(27 °)	

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

SPECIFICATIONS

Engine	Name		CUMMINS QSB4.5 Diesel Engine with turbocharger (EPA Interim Tier 4)	
	Model		Water-cooled, 4-cycle, 4-cylinder, in-line, vertical mounted, overhead valve, direct injection type	
	Bore × Stroke		107 mm × 124 mm (4.213 in. × 4.882 in.)	
	Displacement		4.460 L (272.2 cu.in)	
	Performance	Rated speed		2,200 min ⁻¹ (2,200 rpm)
		Rated output		119.0 kW (160 HP)
		Max. torque		624 N·m (460 lbf·ft) at 1,500 min ⁻¹
		Fuel consumption		215 g/kW·h (0.354 lb/HP·h) at rated speed
	Governor		Full electrical control	
	Lubrication system		Pressure lubrication by gear pump	
	Oil filter		Full-flow: stratapore (synthetic)	
	Air cleaner		Dry type	
	Cooling system		Centrifugal pump forced feeding system (pressure type)	
	Cooling fan		Inhaling type	
	Electrical system	Alternator		24 V 70 A
Starter		24 V 4.8 kW		
Battery		12 V CCA 760 × 2 pcs. (24 V)		
Engine dry weight			390 kg (860 lbs.)	
Power line	Transmission	Type	Hydrostatic transmission	
		Speeds	2 speed shifts	
	Reverser		Switching the direction of flow delivered from the variable pump	
	Differential		Auto lock type	
Final drive		Planetary gear		
Vibrating system	Transmission		Hydrostatic transmission	
	Vibrator		Eccentric shaft type	
Braking device	Service brake		Hydrostatic and mechanical type	
	Parking brake		Mechanical type	
Steering system	Steering control type		Hydraulic type (Articulated type)	
	Steering control angle		± 37 °	
	Oscillation angle		± 9 °	
Drum and wheels	Use	Front drum		Vibrate & drive × 1
		Rear tires		Drive × 2
	Dimension	Dimension width × diameter		2,130 mm × 1,530 mm (84 in. × 60 in.)
		Rear tires size		23.1-26-8 PR (OR)
	Suspension system	Front		Rubber damper type
Rear		Rigid		
Others	ROPS		Steel frame	

1-6. SV640T



0418-99029-0-10985-0

Model		SV640T		
Weight	Operating weight	13,525 kg	(29,820 lbs.)	
	Front axle	7,485 kg	(16,500 lbs.)	
	Rear axle	6,040 kg	(13,320 lbs.)	
Dimensions	Overall length	5,835 mm	(230 in.)	
	Overall width	2,295 mm	(90 in.)	
	Overall height	Steering wheel	2,195 mm	(86 in.)
		Tail pipe	2,265 mm	(89 in.)
		ROPS	3,110 mm	(122 in.)
	Wheelbase	2,970 mm	(117 in.)	
	Compaction width	2,130 mm	(84 in.)	
	Minimum height above ground	450 mm	(17.5 in.)	
Curb clearance	530 mm	(20.5 in.)		
Speed	1st	0 to 6 km/h	(0 to 3.7 mph)	
	2nd	0 to 10 km/h	(0 to 6.2 mph)	
Vibration performance	Frequency	Low amplitude	33.3 Hz	
		High amplitude	28.3 Hz	
	Centrifugal force	Low amplitude	172 kN (38,665 lbs.)	
		High amplitude	255 kN (57,325 lbs.)	
	Amplitude	Low amplitude	0.94 mm (0.04 in.)	
High amplitude		1.92 mm (0.08 in.)		
Minimum turning radius		5.6 m	(221 in.)	
Gradability *1		46 %	(25 °)	

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

Engine	Name		CUMMINS QSB4.5 Diesel Engine with turbocharger (EPA Interim Tier 4)		
	Model		Water-cooled, 4-cycle, 4-cylinder, in-line, vertical mounted, overhead valve, direct injection type		
	Bore × Stroke		107 mm × 124 mm (4.213 in. × 4.882 in.)		
	Displacement		4.460 L (272.2 cu.in)		
	Performance	Rated speed		2,200 min ⁻¹ (2,200 rpm)	
		Rated output		119.0 kW (160 HP)	
		Max. torque		624 N·m (460 lbf·ft) at 1,500 min ⁻¹	
		Fuel consumption		215 g/kW·h (0.354 lb/HP·h) at rated speed	
	Governor		Full electrical control		
	Lubrication system		Pressure lubrication by gear pump		
	Oil filter		Full-flow: stratapore (synthetic)		
	Air cleaner		Dry type		
	Cooling system		Centrifugal pump forced feeding system (pressure type)		
	Cooling fan		Inhaling type		
	Electrical system	Alternator		24 V 70 A	
Starter		24 V 4.8 kW			
Battery		12 V CCA 760 × 2 pcs. (24 V)			
Engine dry weight			390 kg (860 lbs.)		
Power line	Transmission	Type	Hydrostatic transmission		
		Speeds	2 speed shifts		
	Reverser		Switching the direction of flow delivered from the variable pump		
	Differential		Auto lock type		
Final drive		Planetary gear			
Vibrating system	Transmission		Hydrostatic transmission		
	Vibrator		Eccentric shaft type		
Braking device	Service brake		Hydrostatic and mechanical type		
	Parking brake		Mechanical type		
Steering system	Steering control type		Hydraulic type (Articulated type)		
	Steering control angle		± 37 °		
	Oscillation angle		± 9 °		
Drum and wheels	Use	Front drum		Vibrate & drive × 1	
		Rear tires		Drive × 2	
	Dimension	Front drum	Pad	width × diameter	2,130 mm × 1,600 mm (84 in. × 63 in.)
				Number of pads	140
		Pad height	100 mm (4.0 in.)		
		Pad area	130 cm ² (20 sq.in.)		
	Rear tires	size		23.1-26-10 PR (OR)	
Suspension system		Front		Rubber damper type	
	Rear		Rigid		
Others	ROPS		Steel frame		

2. TABLE OF STANDARD VALUES


2-1. Engine

Item		Standard value		Remarks
Engine model		CUMMINS QSB4.5 T4i Diesel Engine with turbocharger		
Rated output		119.0/2,200 kW/ min ⁻¹ (160/2,200 HP/rpm)		
Max. rpm under no load		2,200 rpm		
Min. rpm under no load		700 rpm		
Cylinder head tightening torque	1st	90 N·m	(66 lbf·ft)	
	2nd	90 N·m	(66 lbf·ft)	
	3rd	Tighten additional 90°		
Intake manifold tightening torque		24 N·m	(18 lbf·ft)	
Exhaust manifold tightening torque		43 N·m	(32 lbf·ft)	
Valve clearance (intake)		0.254 mm	(0.01 in.)	
Valve clearance (exhaust)		0.508 mm	(0.02 in.)	
Crankcase blowby		101.6 mm of H ₂ O (4.0 in. of H ₂ O) 58 L/min (2.048 cfm/min)		Use mano meter

2-2. Propulsion

Item		Standard value		Remarks
Travel speed (Forward/reverse)	1st	0 to 6 km/h	(0 to 3.7 mph)	
	2nd	0 to 10 km/h	(0 to 6.2 mph)	
Rear wheel/hub nut		785 N·m	(579 lbf·ft)	
Tire inflation pressure		137 kPa	(20 psi)	

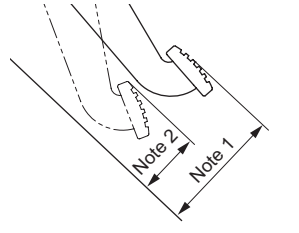
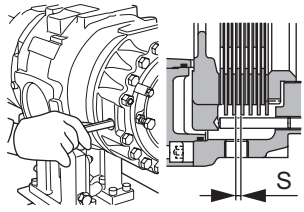
2-3. Hydraulic System

Item		Standard value		Remarks	
Propulsion	High pressure relief valve setting		42.0 ± 1.0 MPa (6,090 ± 145 psi)	at 1,800 min ⁻¹	
	Charge relief valve setting		2.4 ± 0.2 MPa (348 ± 29 psi)	at 40 L/min	
	Rear motor flushing valve pressure setting		2.0 MPa (290 psi)	at 10 L/min	
	Case pressure	Pump	0.3 MPa (43.5 psi)	or less	
		Front motor	0.3 MPa (43.5 psi)	or less	
		Rear motor	0.3 MPa (43.5 psi)	or less	
	Brake release pressure	Gear box	1.8 MPa (261 psi)	or more	
		Rear motor	—		
		Rear axle	1.5 to 3.0 MPa (218 to 435 psi)		
	Motor drainage	Front motor	8.9 L/min (2.4 gal./min)		
Rear motor		6.4 L/min (1.7 gal./min)			
Vibration	High pressure relief valve setting		28.0 ± 1.0 MPa (4,060 ± 145 psi)	at 3.8 to 5.6 L/min	
	Charge relief valve setting		2.4 ± 0.2 MPa (348 ± 29 psi)	at 18.9 L/min	
	Case pressure	Pump	0.3 MPa (43.5 psi)	or less	
		Motor	0.2 MPa (29 psi)	or less	
	Motor drainage		8.9 L/min (2.4 gal./min)		
Steering oil pressure		16.4 ± 1.0 MPa (2,378 ± 145 psi)		(orbitroll relief pressure + charge relief pressure)	

2-4. Steering

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

2-5. Brakes

Item	Standard value	Remarks
Clearance between brake pedal and floorboard (as released)	140 mm (5.5 in.) Note 1: See dimensions	 SV520-02001
Clearance between brake pedal and floorboard (when pressed down)	73 mm (2.9 in.) Note 2: See dimensions	
Brake disc wear limit	4.5 mm (0.18 in.) (S)	 SV700-02003

2-6. Capacities

Item	Standard value	Remarks
Engine oil pan	12.0 L (3.2 gal.)	
Fuel tank	265 L (70 gal.)	
Coolant	23.4 L (6.2 gal.)	
Gear box (front motor)	4.5 L (1.2 gal.)	
Gear box (rear axle)	2.0 L (0.53 gal.)	
Center housing (rear axle)	11.0 L (2.9 gal.)	
Hub reduction gear case (rear left and right)	1.75 L ×2 (0.46 gal. ×2)	
Hydraulic oil tank	50 L (13 gal.)	
Vibrator case (front)	34 L (9.0 gal.)	

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 CJ-4	SAE15W-40	SAE15W-40	SAE15W-40	MIL-L-2104B
Gear oil	API grade GL5	SAE80W-90	SAE90	SAE140	MIL-L-2105
Hydraulic oil	Anti wear	ISO-VG32 Over VI 140	ISO-VG46 Over VI 140	ISO-VG68 Over VI 110	ISO-3448
Grease	Lithium type extreme pressure				NLGI-2
Fuel	Diesel oil				ASTM D975-2D

3-2. Recommended Lubricants

Lubricant Oil company	Engine oil API-CJ4	Gear oil API GL 5	Hydraulic oil ISO-VG 46	Grease (NLGI-2)
CHEVRON	DELO 400 LE	RPM Universal Gear Lubricants	Rando HDZ 46	Multifak EP 2
BP	—	BP Energear HYPO-U	Bartran HV 46	BP Energear LS-EP 2
CASTROL	Tection Extra	EXP Gear OILS	Castrol Hyspin AWH 46	Castrol Spheerol ELP 2
EXXON MOBIL	Mobil Delvac 1 ESP	Mobilube HD	Mobil DTE 10 Excel 46	Mobilux EP 2
SHELL	Shell Rimula R4 L	Shell Spirax S2 A 90	Shell Tellus S2V 46	Shell Alvania Greases EP 2

4. TIGHTENING TORQUE CHART

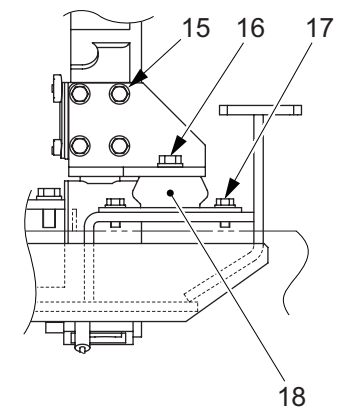
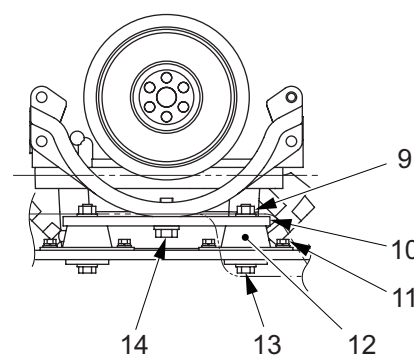
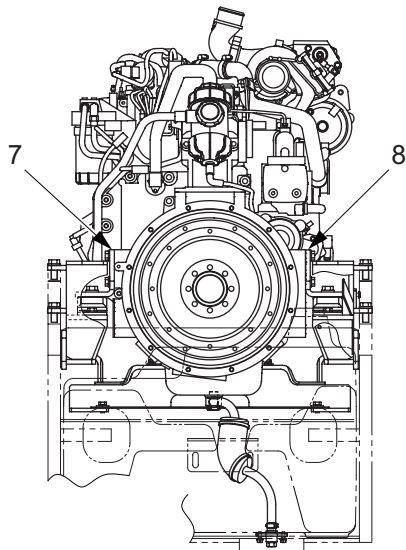
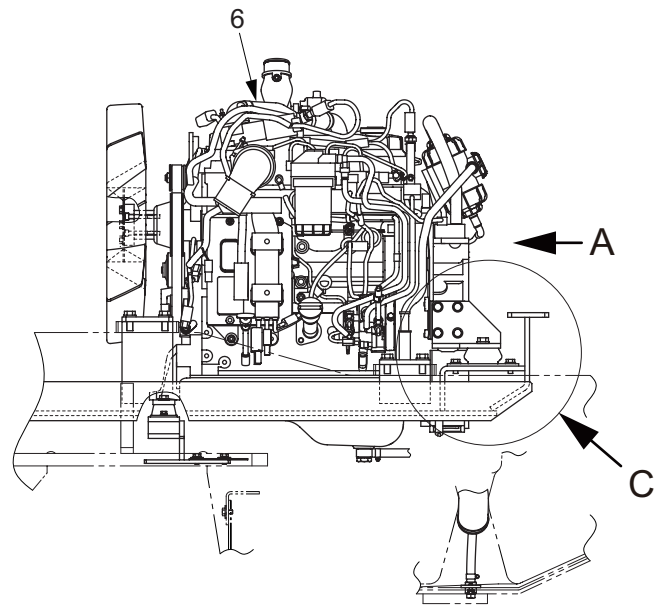
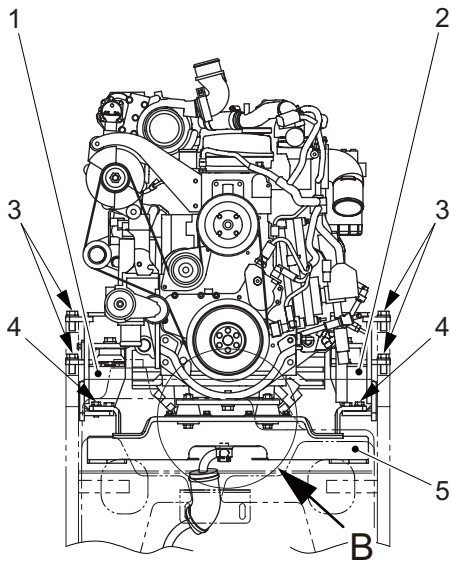
N·m	(lbf·ft)
-----	----------

	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



VIEW A

DETAIL B

DETAIL C

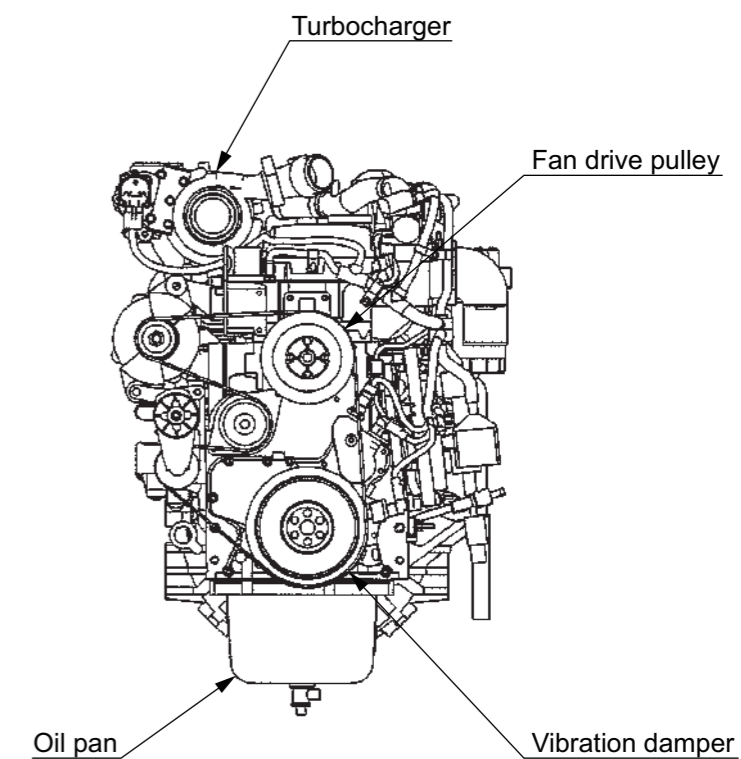
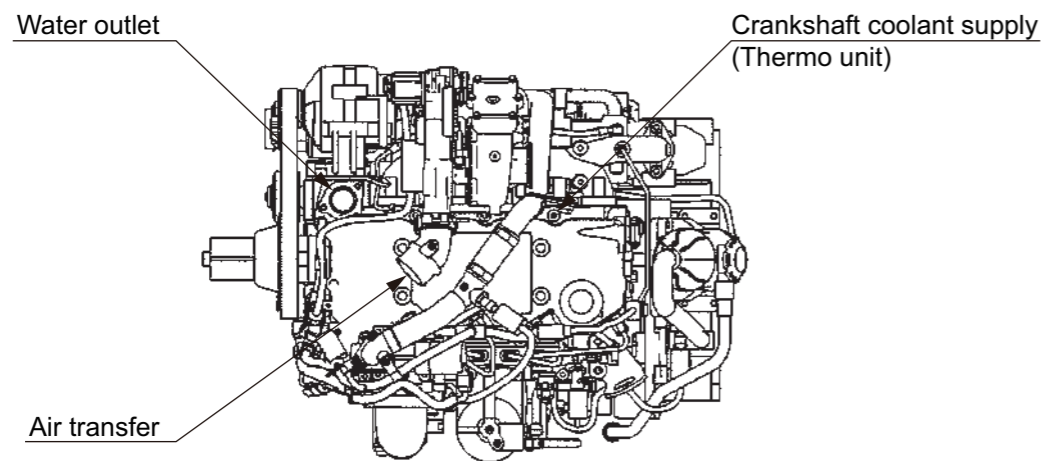
0418-01804-0-10898-A

- | | | | |
|-------------------|--------------------|-------------|----------|
| (1) Base | (7) Bracket | (13) Bolt | : M12×80 |
| (2) Base | (8) Bracket | (14) Bolt | : M16×40 |
| (3) Bolt : M16×40 | (9) Nut : M12 | (15) Bolt | : M12×40 |
| (4) Bolt : M12×30 | (10) Plate | (16) Bolt | : M16×50 |
| (5) Bracket | (11) Bolt : M 8×20 | (17) Bolt | : M12×25 |
| (6) Engine | (12) Damper | (18) Damper | |

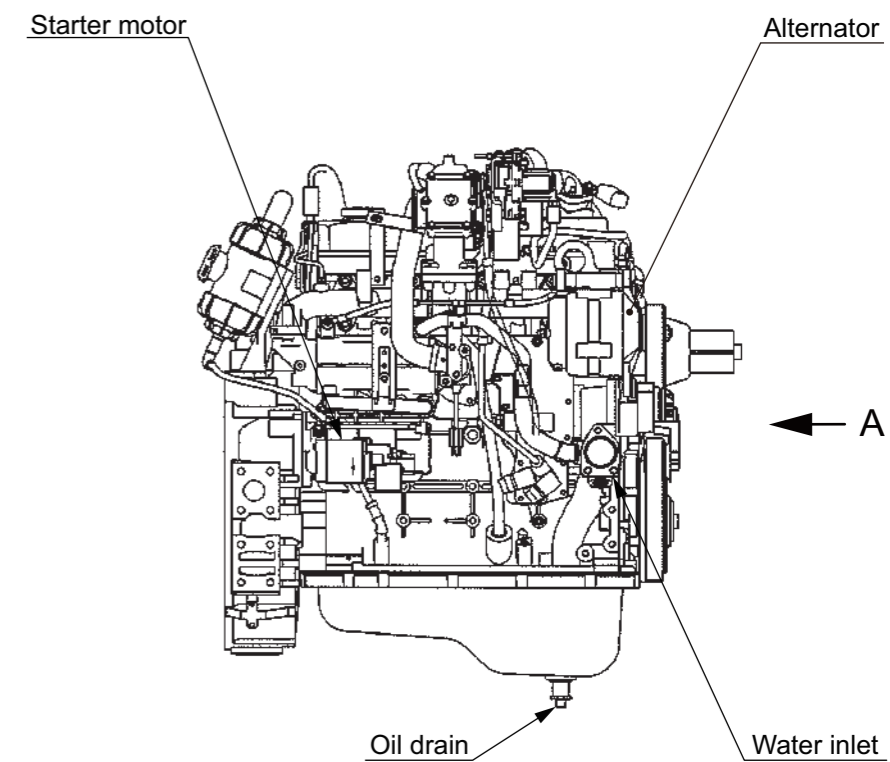
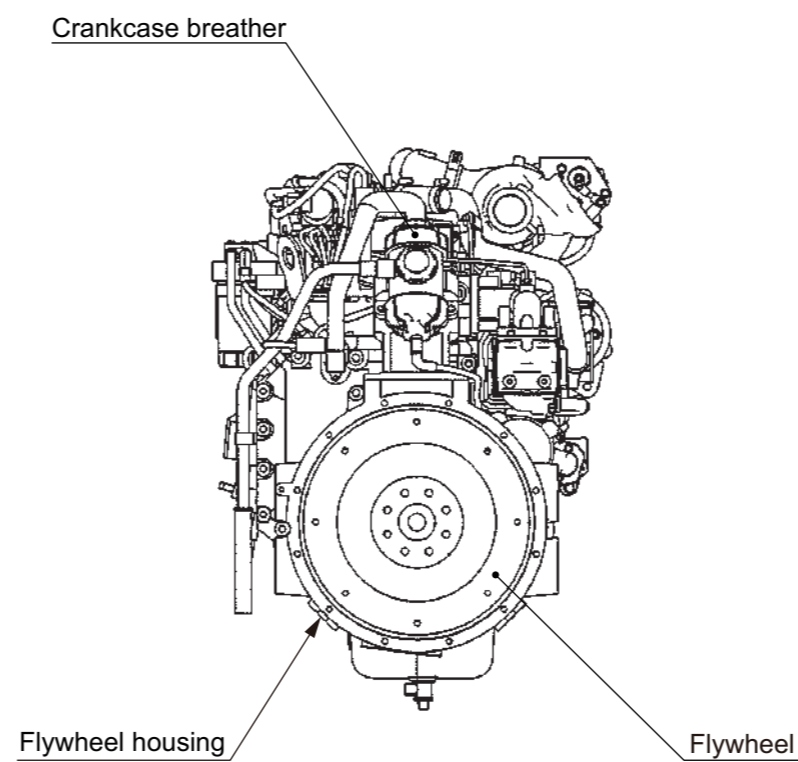
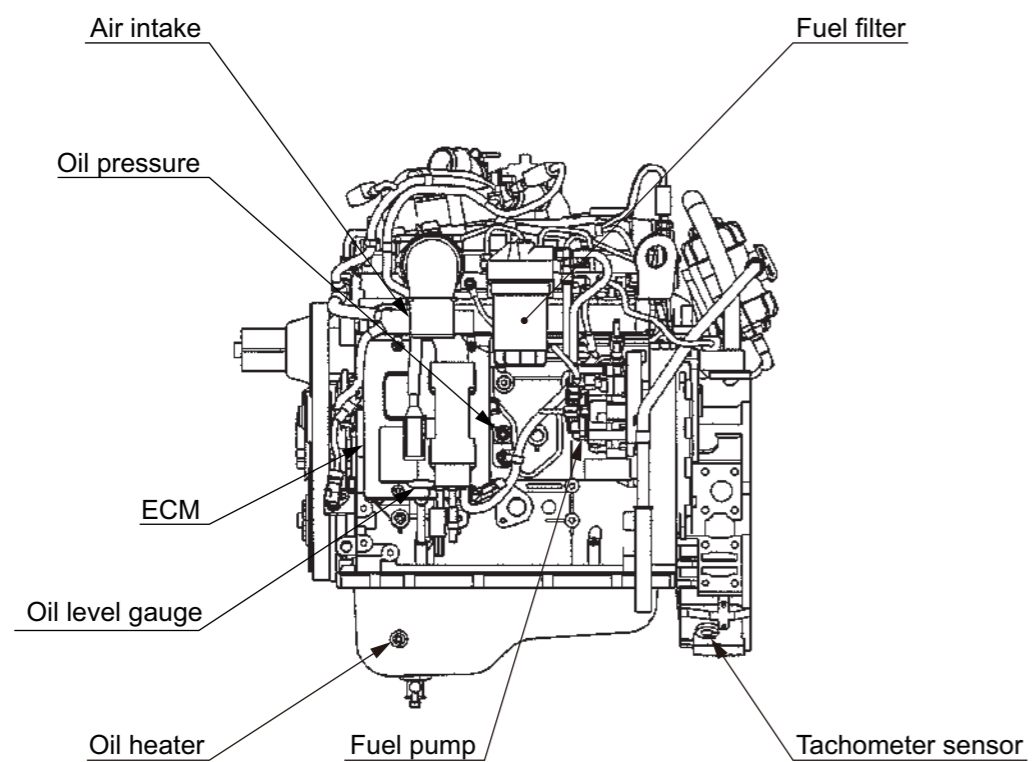


- | | |
|------------------------------------------|-------------------------------------------|
| (3) Bolt M16×40 : 265 N·m (195 lbf-ft) | (14) Bolt M16×40 : 265 N·m (195 lbf-ft) |
| (4) Bolt M12×30 : 108 N·m (80 lbf-ft) | (15) Bolt M12×40 : 108 N·m (80 lbf-ft) |
| (9) Nut M12 : 108 N·m (80 lbf-ft) | (16) Bolt M16×50 : 265 N·m (195 lbf-ft) |
| (11) Bolt M 8×20 : 31 N·m (23 lbf-ft) | (17) Bolt M12×25 : 108 N·m (80 lbf-ft) |

1-2. Engine Exterior

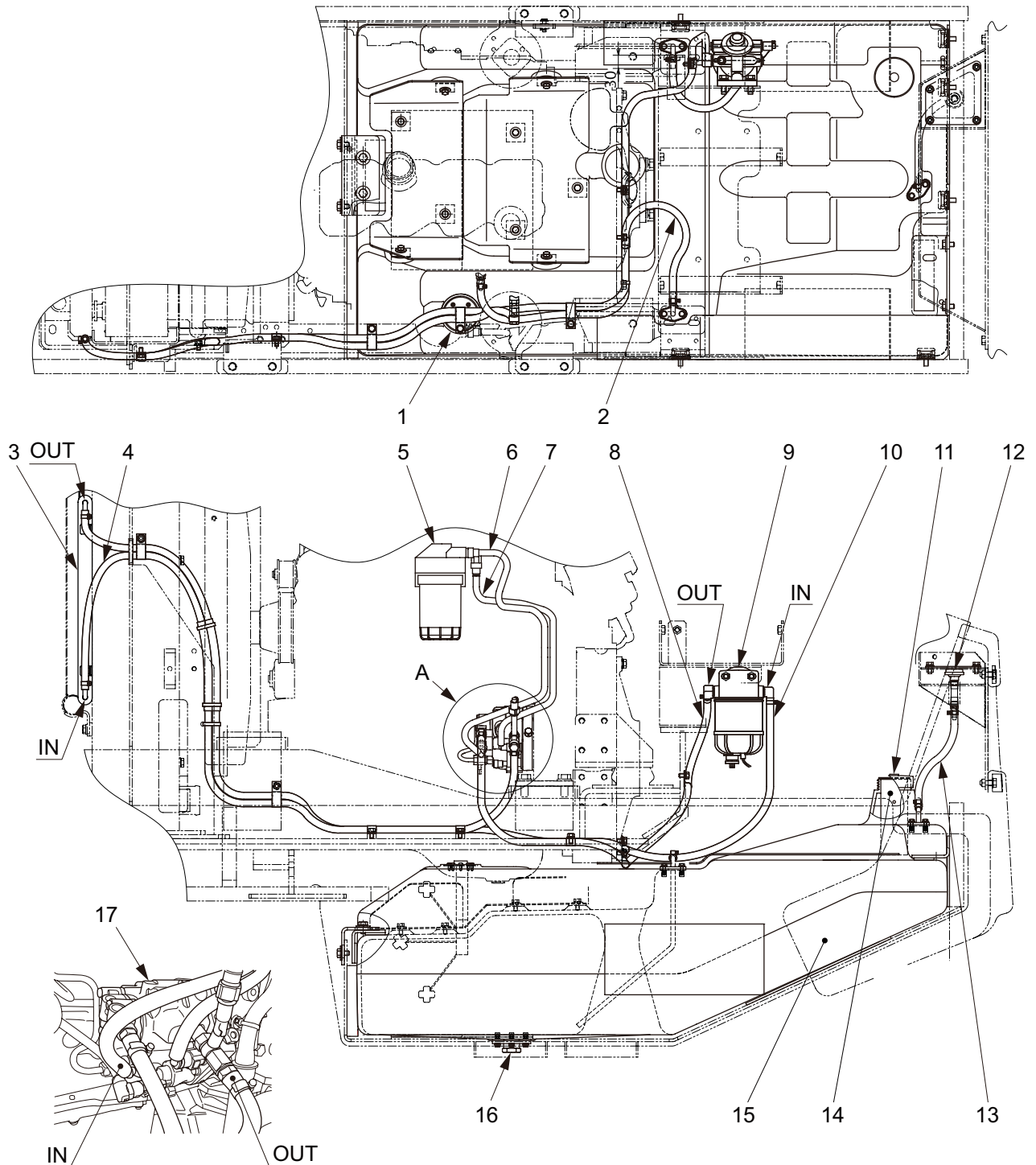


VIEW A



* The actual equipment may differ from that shown above.

2. FUEL SYSTEM



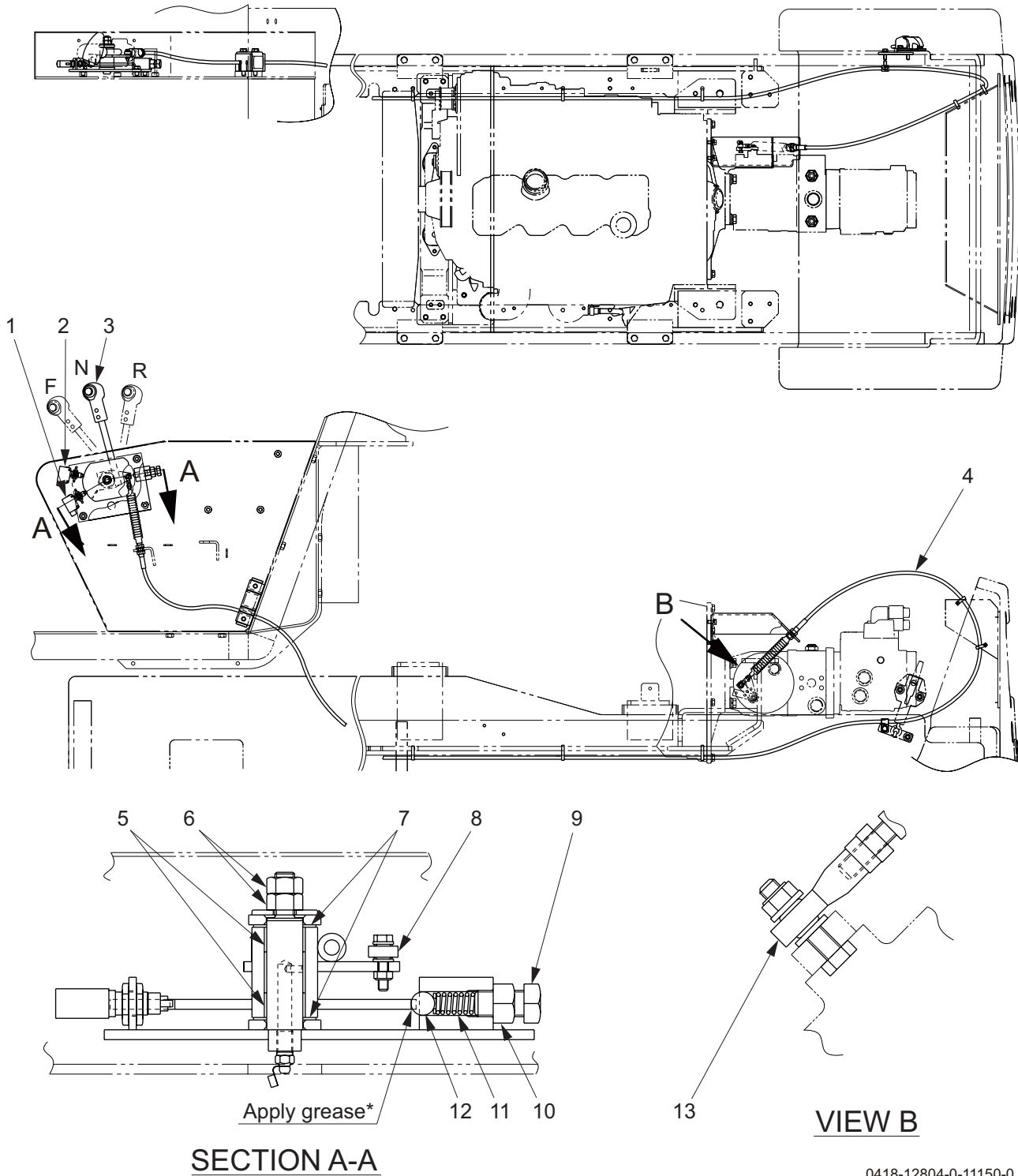
DETAIL A

0418-02805-0-10899-B

- | | |
|---------------------------------------------|-----------------------------------------|
| (1) Fuel unit | (10) Hose (Fuel tank → Fuel pre-filter) |
| (2) Hose (Fuel cooler OUT → Tank) | (11) Cap |
| (3) Fuel cooler | (12) Breather |
| (4) Hose (Fuel gear pump → Fuel cooler IN) | (13) Hose (Breather → Tank) |
| (5) Fuel filter | (14) Strainer |
| (6) Hose (Fuel gear pump → Fuel filter) | (15) Fuel tank |
| (7) Hose (Fuel filter → Fuel gear pump) | (16) Plug |
| (8) Hose (Fuel pre-filter → Fuel gear pump) | (17) Fuel gear pump |
| (9) Fuel pre-filter | |

3. CONTROL SYSTEM

3-1. Forward-reverse Control

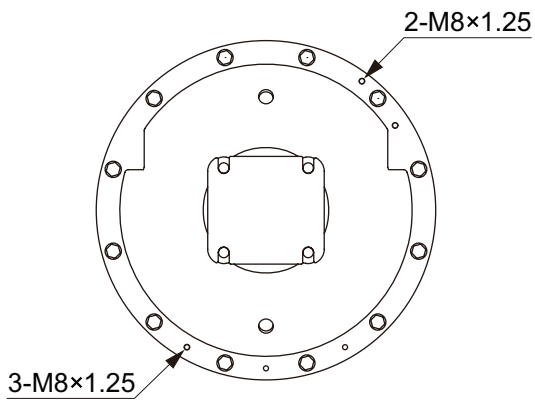
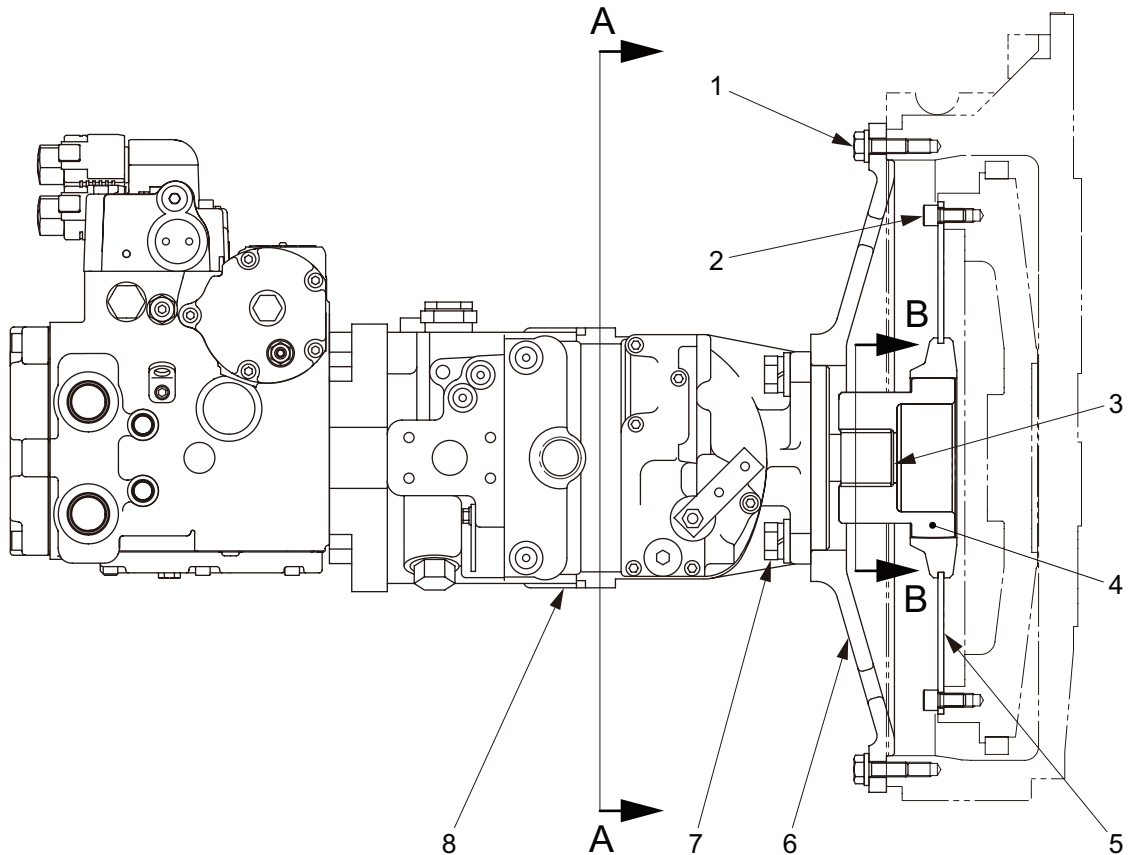


- | | | | |
|--------------------------|-----------------------------|----------|------------------------------|
| (1) F-R lever switch | (6) Nut | : M12 | (11) Spring (Fill grease*) |
| (2) Backup buzzer switch | (7) Washer (Apply grease*) | | (12) Steel ball |
| (3) F-R lever | (8) Rod end (Apply grease*) | | (13) Rod end (Apply grease*) |
| (4) Control cable | (9) Bolt | : M16×30 | |
| (5) Bush (Apply grease*) | (10) Nut | : M16 | |

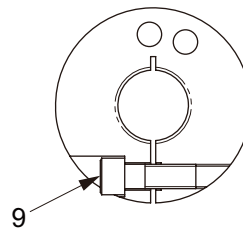
*: Lithium-based grease

4. PUMP MOUNT

4-1. Pump Mount



SECTION A-A



SECTION B-B

0418-36814-0-20909-0

- | | | | | |
|--------------------|---|--------------|-------------|----------|
| (1) Bolt | : | M10×30 | (6) Housing | |
| (2) Bolt | : | 3/8-16UNC×22 | (7) Bolt | : M14×45 |
| (3) Retaining ring | | | (8) Pump | |
| (4) Hub | | | (9) Bolt | : M12×35 |
| (5) Flange | | | | |



- | | | | | | |
|----------|--------------|------------------------|----------|--------|--------------------------|
| (1) Bolt | M10×30 | : 59 N·m (44 lbf·ft) | (7) Bolt | M14×45 | : 167 N·m (123 lbf·ft) |
| (2) Bolt | 3/8-16UNC×22 | : 69 N·m (51 lbf·ft) | (9) Bolt | M12×35 | : 86 N·m (63 lbf·ft) |

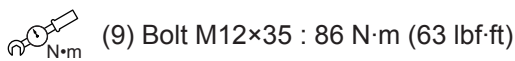
4-1-1. Installation of pump

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

- ① Apply adequate amount of grease to pump (8) and hub (4) splines.
- ② Install retaining ring (3) of hub (4) to pump (8) and set to the specified dimension.

★ Specified dimension a: 44 mm (1.73 in.)

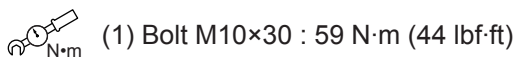
- ③ Secure hub (4) with bolt (9).



- ④ Secure flange (5) to engine flywheel with eight bolts (2).



- ⑤ Position housing (6) as shown in the figure, and secure to engine flywheel housing with twelve bolts (1) and washers.



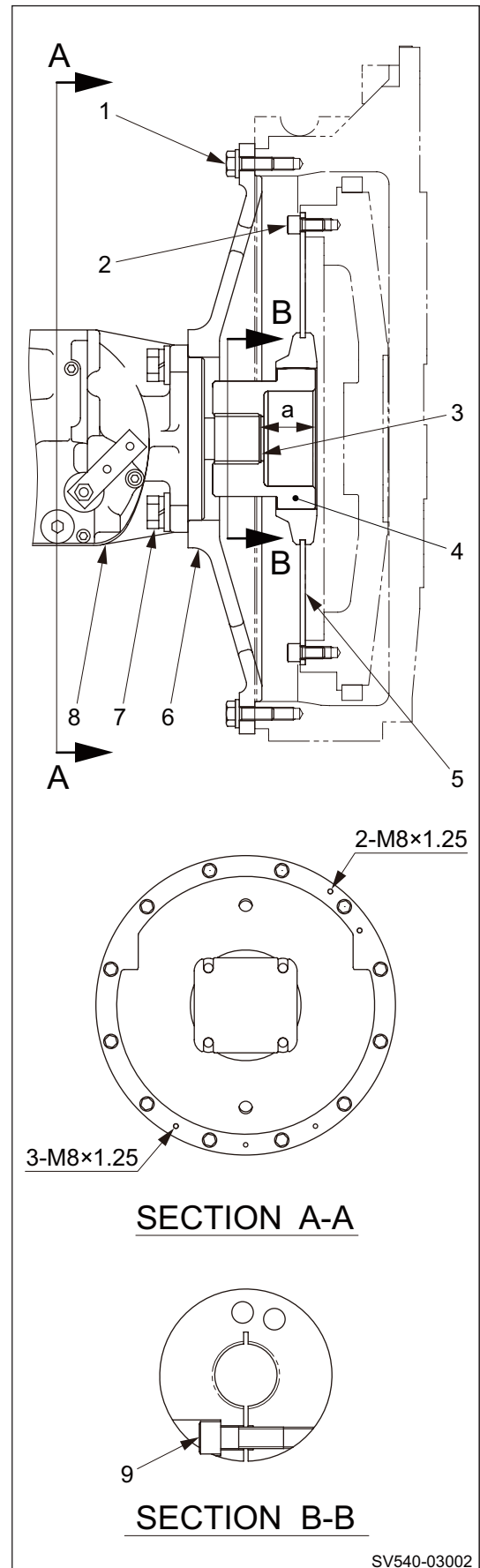
- ⑥ Engage hub (4) with flange (5).

- ⑦ Secure pump (8) to housing (6) with four bolts (7), spring washers and washers.



(NOTICE)

- Bolt (2) is treated with thread-locking fluid. Use new thread-locking fluid treated bolt for installation.



HYDRAULIC SYSTEMS

1. SYSTEM CIRCUIT DIAGRAM

1-1. Graphic Symbols for Hydraulic Circuits

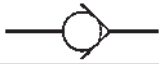

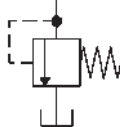

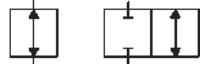
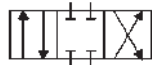

Basic Symbols

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.	


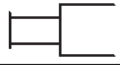

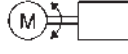
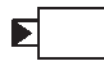

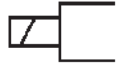


Pump, Motors and Cylinders

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	

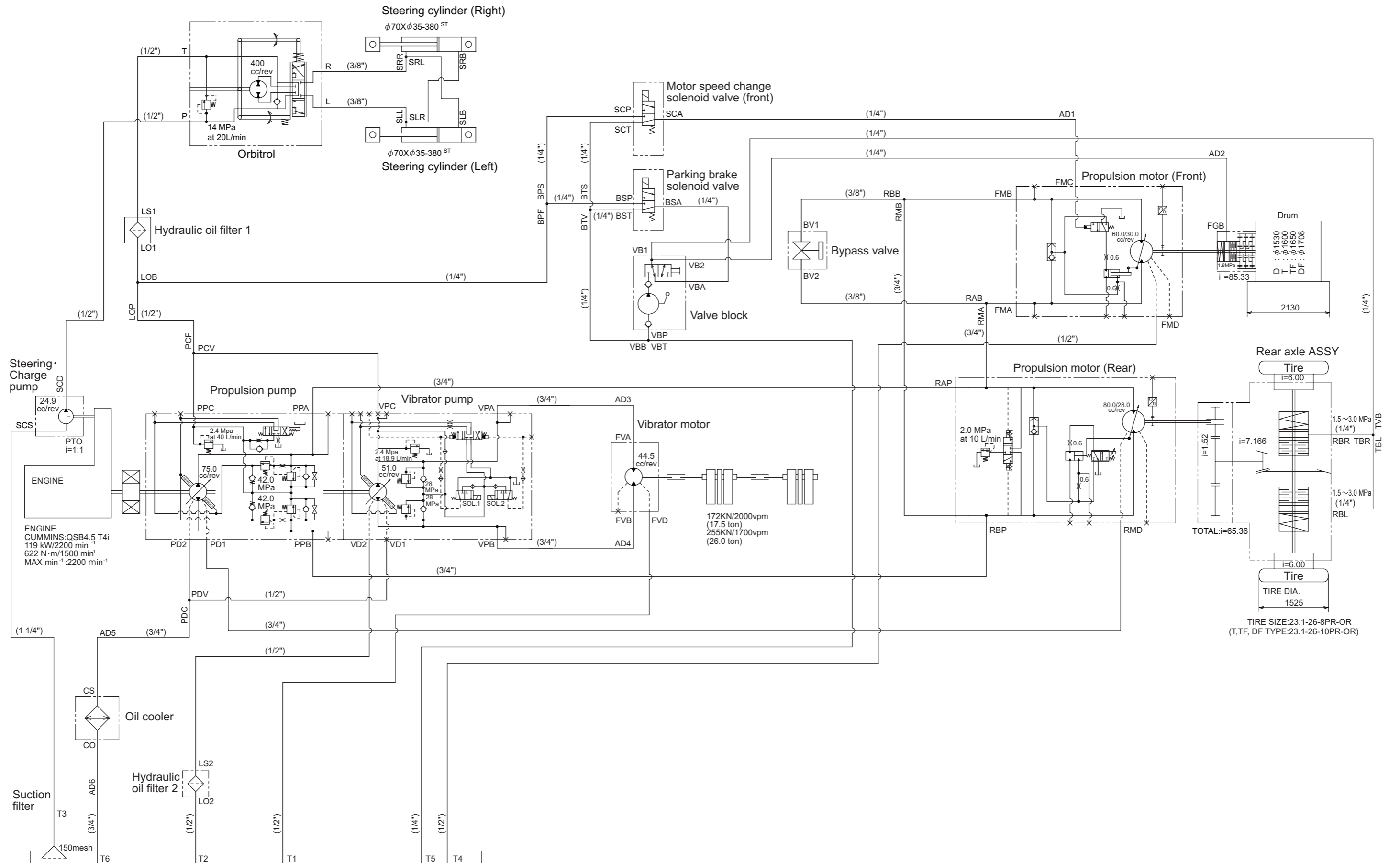
Valves

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.	

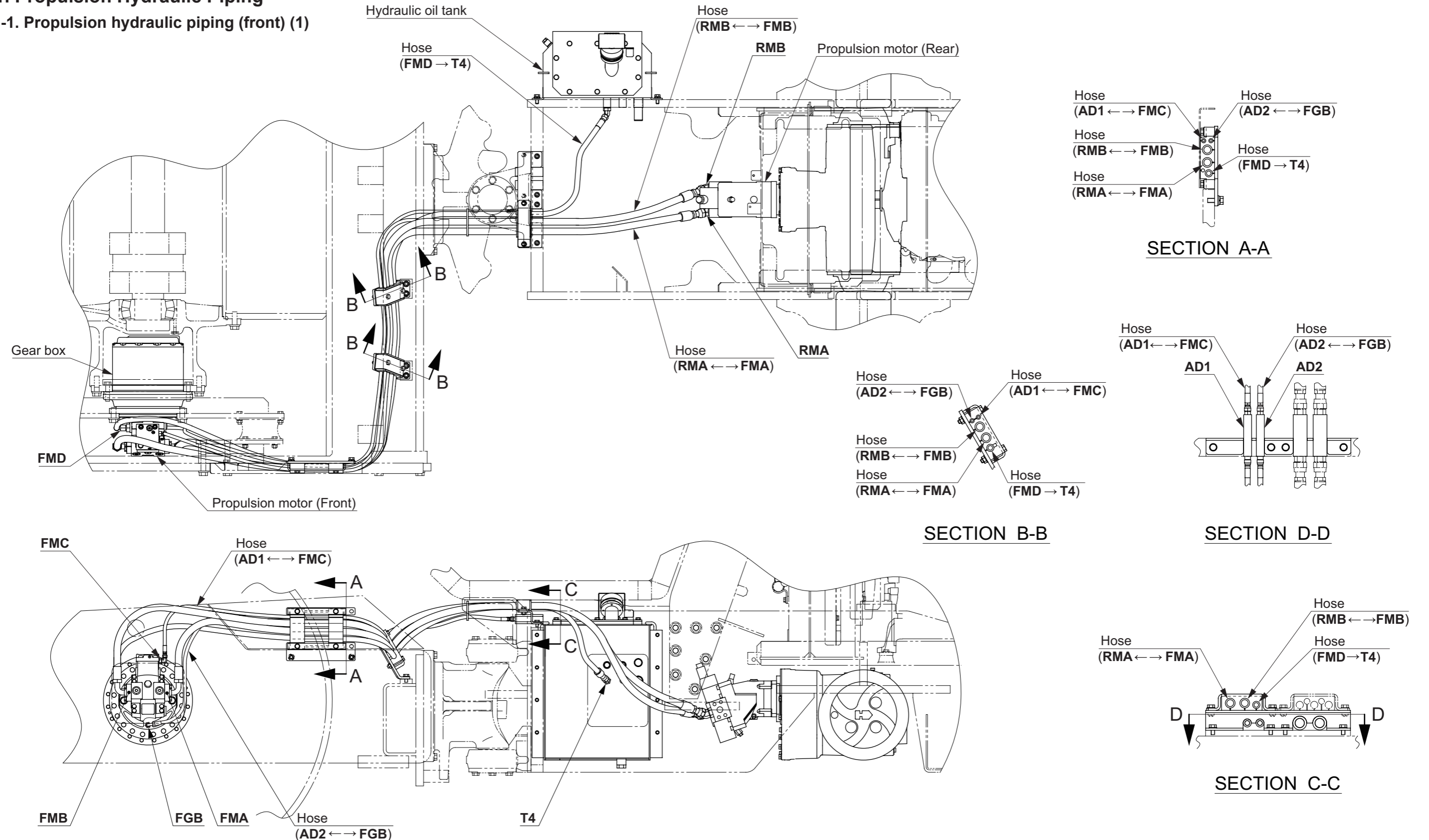
1-2. Hydraulic Circuit Diagram



2. PROPULSION HYDRAULIC SYSTEM

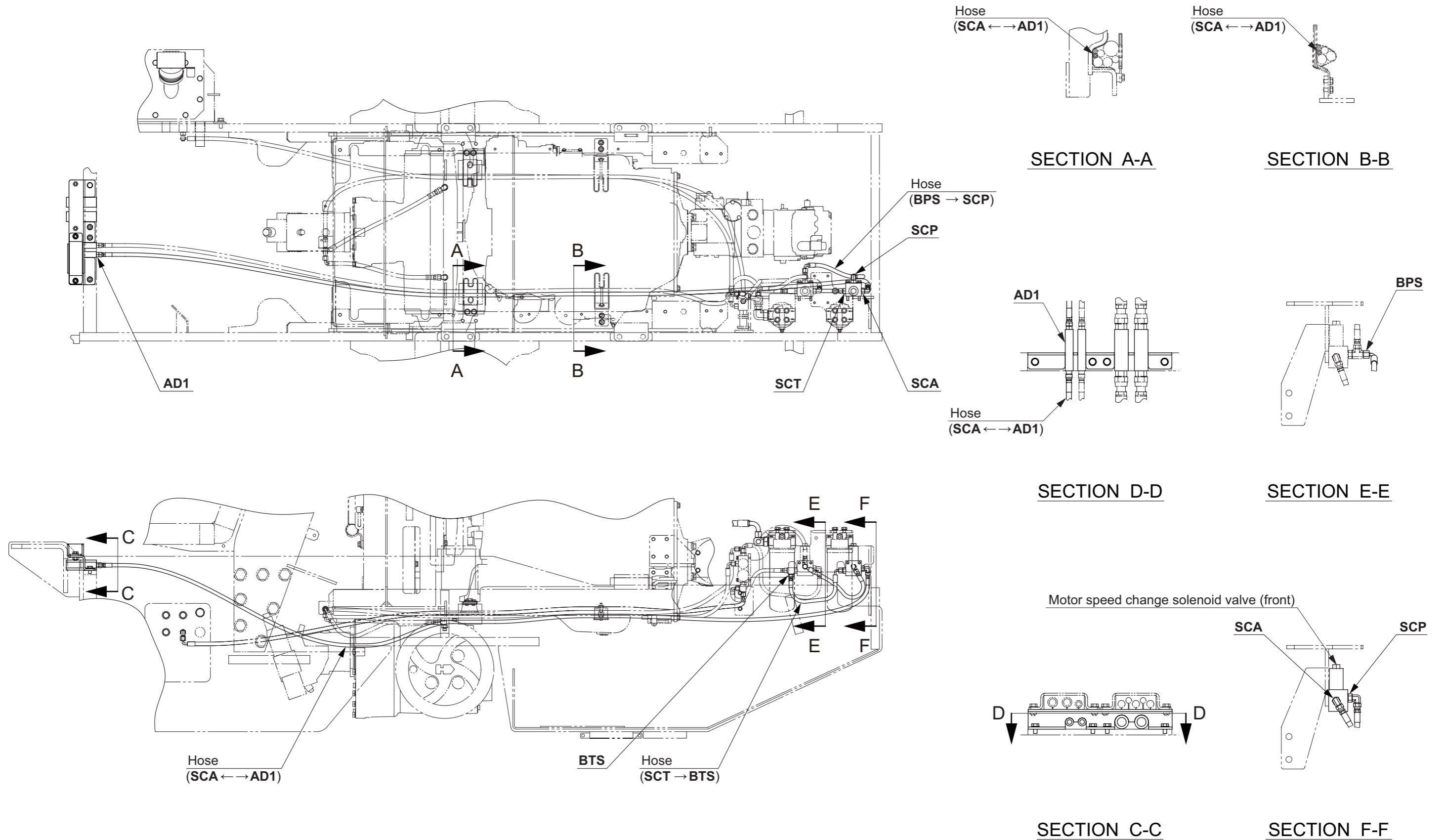
2-1. Propulsion Hydraulic Piping

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



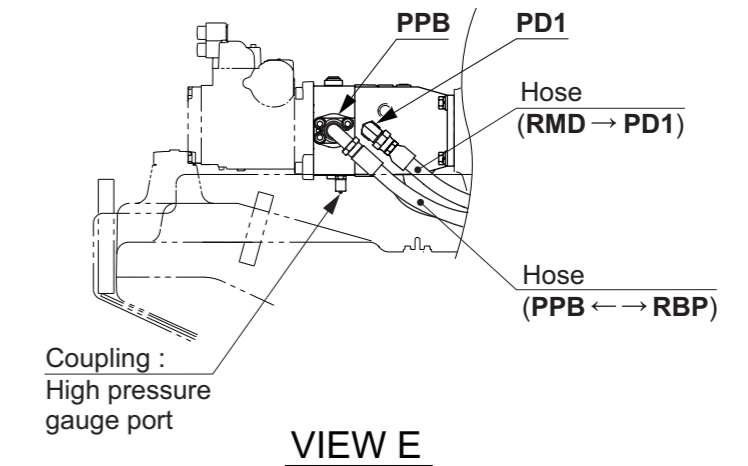
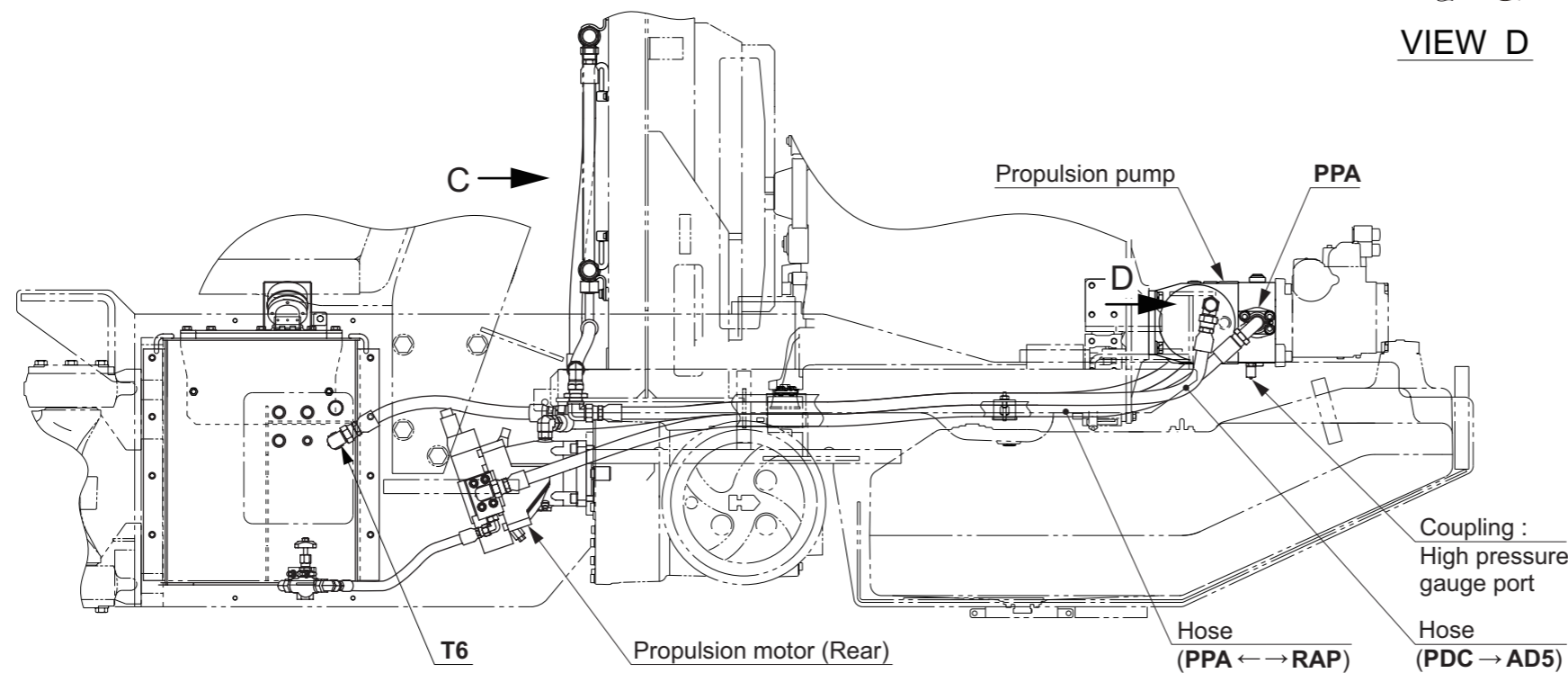
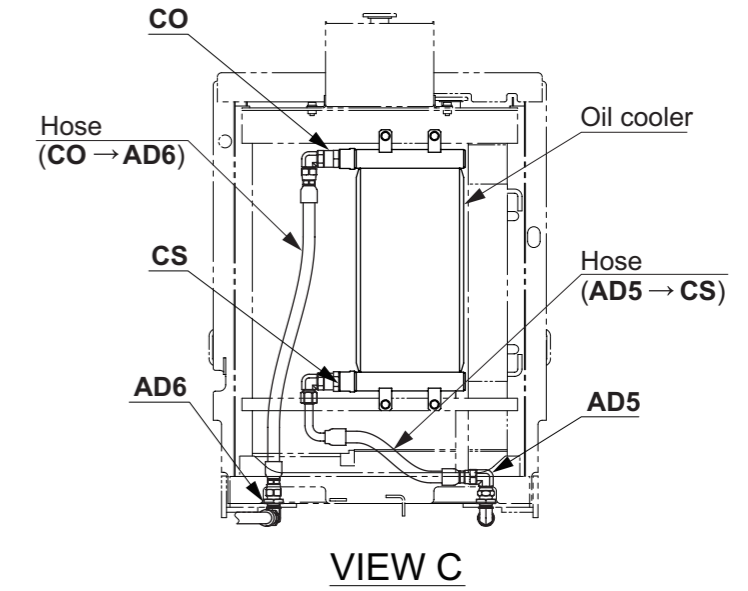
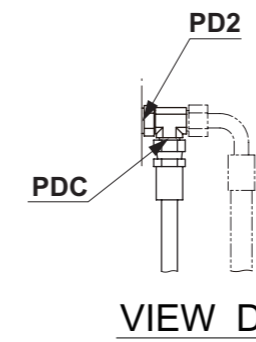
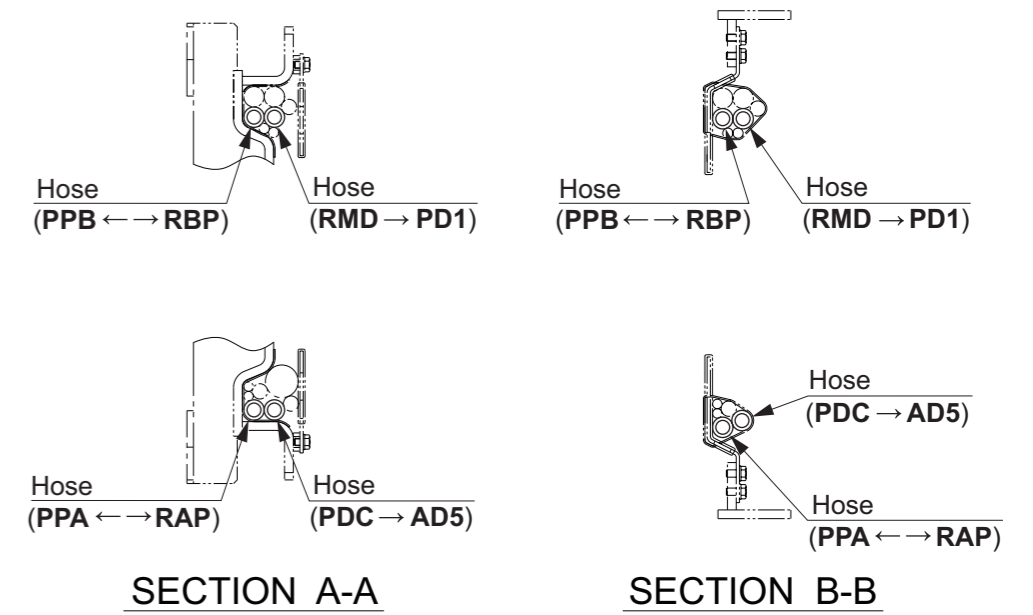
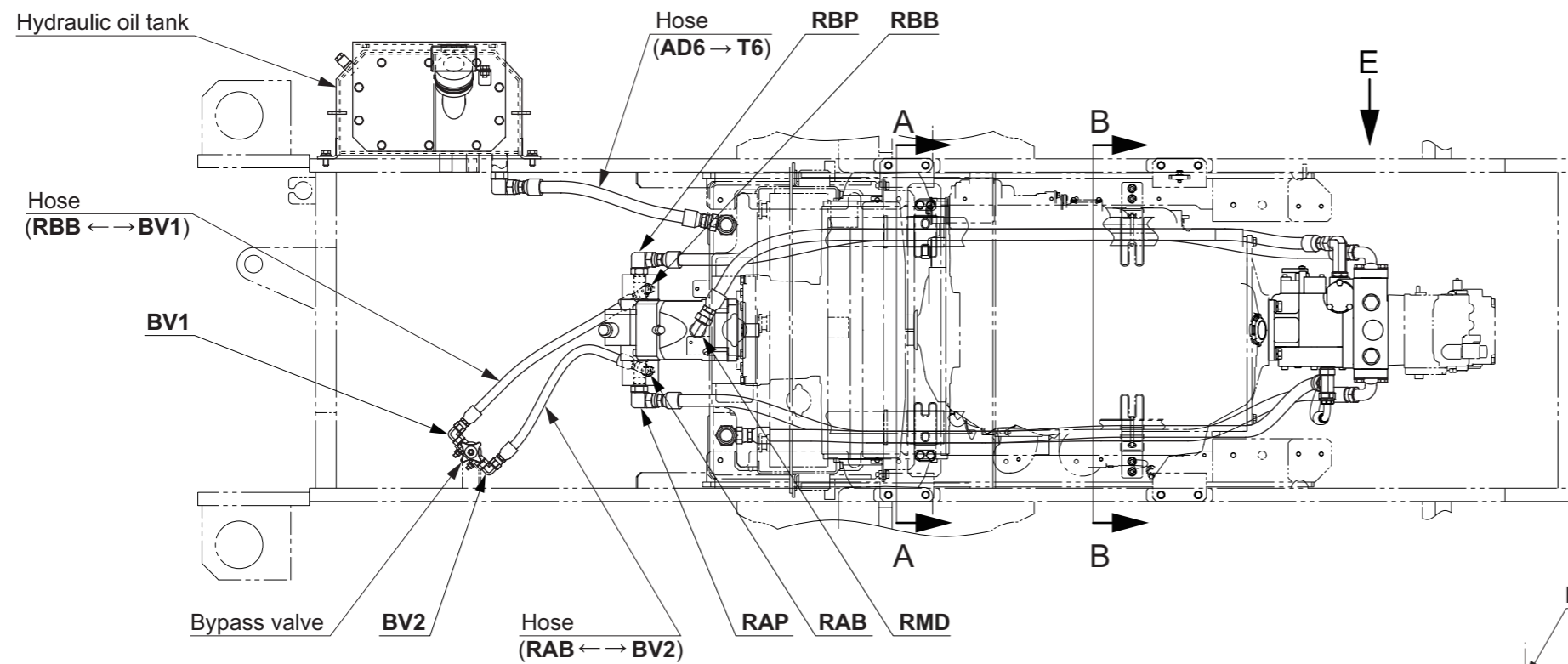
• The letters and figures (such as AD2 and FGB) show each port and the arrow (↔; →) symbols show the hose connection and the direction of the flow of the oil.

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



• The letters and figures (such as SCA and AD1) show each port and the arrow (↔; →) symbols show the hose connection and the direction of the flow of the oil.

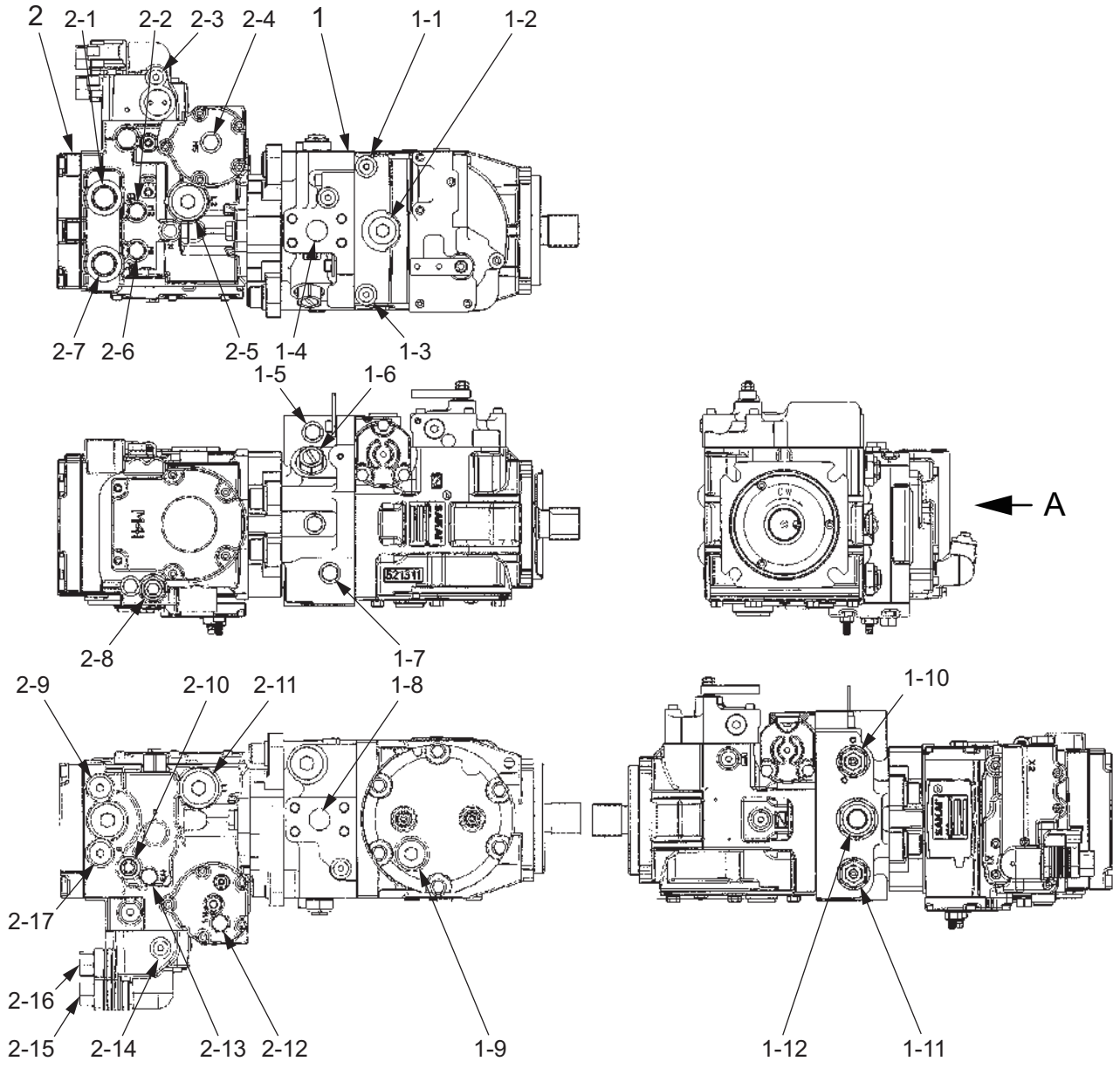
2-1-3. Propulsion hydraulic piping (rear)



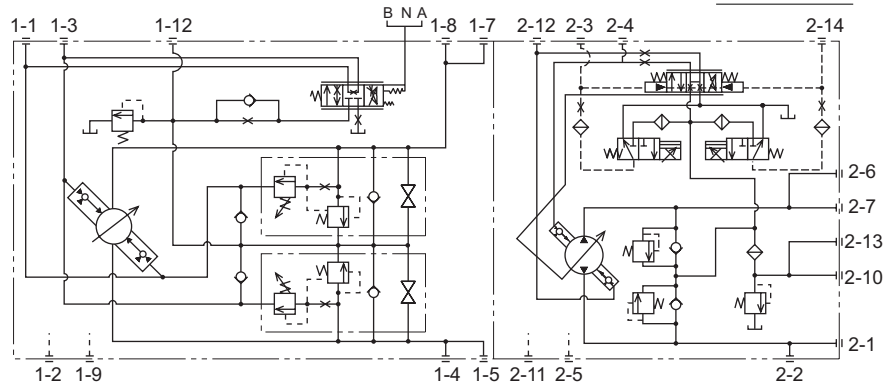
• The letters and figures (such as PPA and RAP) show each port and the arrow (↔; →) symbols show the hose connection and the direction of the flow of the oil.

2-2. Hydraulic Component Specifications

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



VIEW A



Pump circuit diagram

SV520-04001

(1) Propulsion pump

(1-1) Servo pressure gauge port	:	9/16-18UNF
(1-2) Drain port	[PD1]	: 1 1/16-12UN
(1-3) Servo pressure gauge port	:	9/16-18UNF
(1-4) Port B1 (Reverse)	[PPB]	: SAE 1"
(1-5) High pressure gauge port (For Port B1)	:	9/16-18UNF
(1-6) Charge relief valve		
(1-7) High pressure gauge port (For Port A1)	:	9/16-18UNF
(1-8) Port A1 (Forward)	[PPA]	: SAE 1"
(1-9) Drain port	[PD2]	: 1 1/16-12UN
(1-10) Multifunction valve (Port B1)		
(1-11) Multifunction valve (Port A1)		
(1-12) Charge supply port	[PPC]	: 7/ 8-14UNF

Specifications

- Displacement : 75 cm³/rev (4.58 cu.in./rev)
- High pressure relief valve pressure setting : 42 MPa (6,090 psi) (at 1,800 min⁻¹)
- Charge relief valve pressure setting : 2.4 MPa (348 psi) (at 40 L/min)

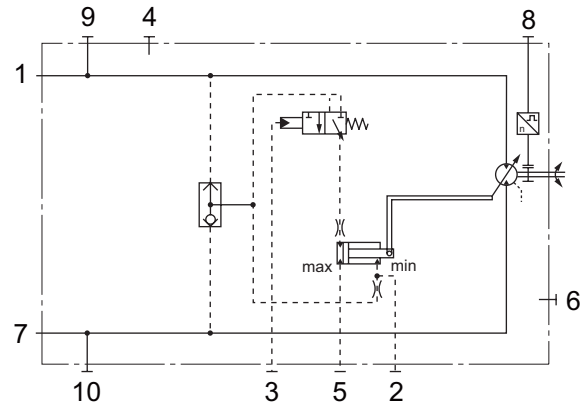
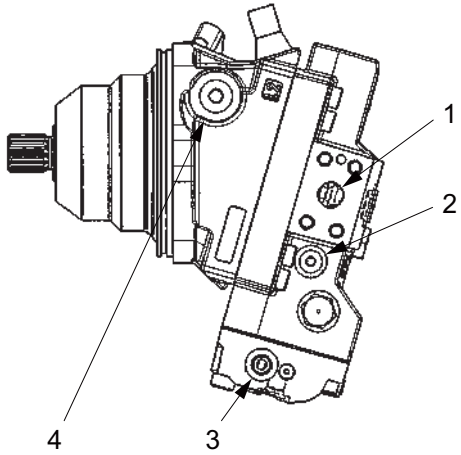
(2) Vibrator pump

(2-1) Port B2 (High amplitude)	[VPB]	: 1 1/16-12UN
(2-2) High pressure gauge port (For Port B2)	:	9/16-18UNF
(2-3) Control pressure gauge port	:	9/16-18UNF
(2-4) Servo pressure gauge port	:	9/16-18UNF
(2-5) Drain port	[VD1]	: 1 5/16-12UN
(2-6) High pressure gauge port (For Port A2)	:	9/16-18UNF
(2-7) Port A2 (Low amplitude)	[VPA]	: 1 1/16-12UN
(2-8) Charge relief valve		
(2-9) High pressure check relief valve port (For Port A2)		
(2-10) Charge supply port	[VPC]	: 3/ 4-16UNF
(2-11) Drain port	[VD2]	: 1 5/16-12UN
(2-12) Servo pressure gauge port	:	9/16-18UNF
(2-13) Charge pressure gauge port	:	9/16-18UNF
(2-14) Control pressure gauge port	:	9/16-18UNF
(2-15) Solenoid valve 1 (Low amplitude)		
(2-16) Solenoid valve 2 (High amplitude)		
(2-17) High pressure check relief valve port (For Port B2)		

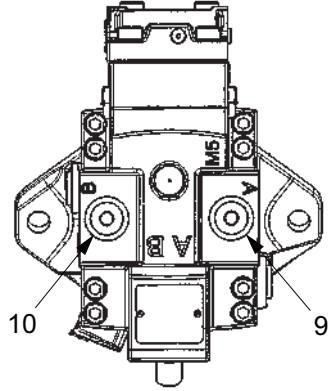
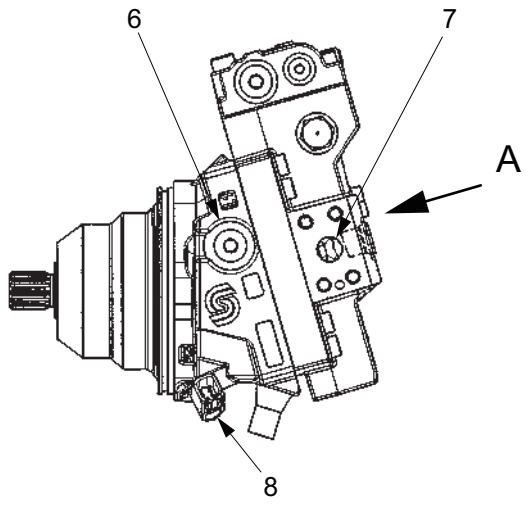
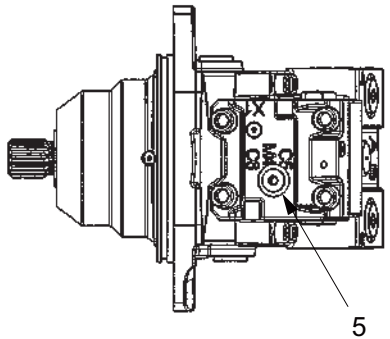
Specifications

- Displacement (Low amplitude) : 51.0 cm³/rev (3.1 cu.in./rev)
- Displacement (High amplitude) : 44.9 cm³/rev (2.7 cu.in./rev)
- High pressure relief valve pressure setting : 28.0 MPa (4,060 psi) (at 3.8 to 5.6 L/min)
- Charge relief valve pressure setting : 2.4 MPa (348 psi) (at 18.9 L/min)
- Allowable pump case pressure : 0.3 MPa (43.5 psi) or less
- Pump assembly weight : 100 kg (220 lbs.)

2-2-2. Propulsion hydraulic motor (front)



Motor circuit diagram



VIEW A

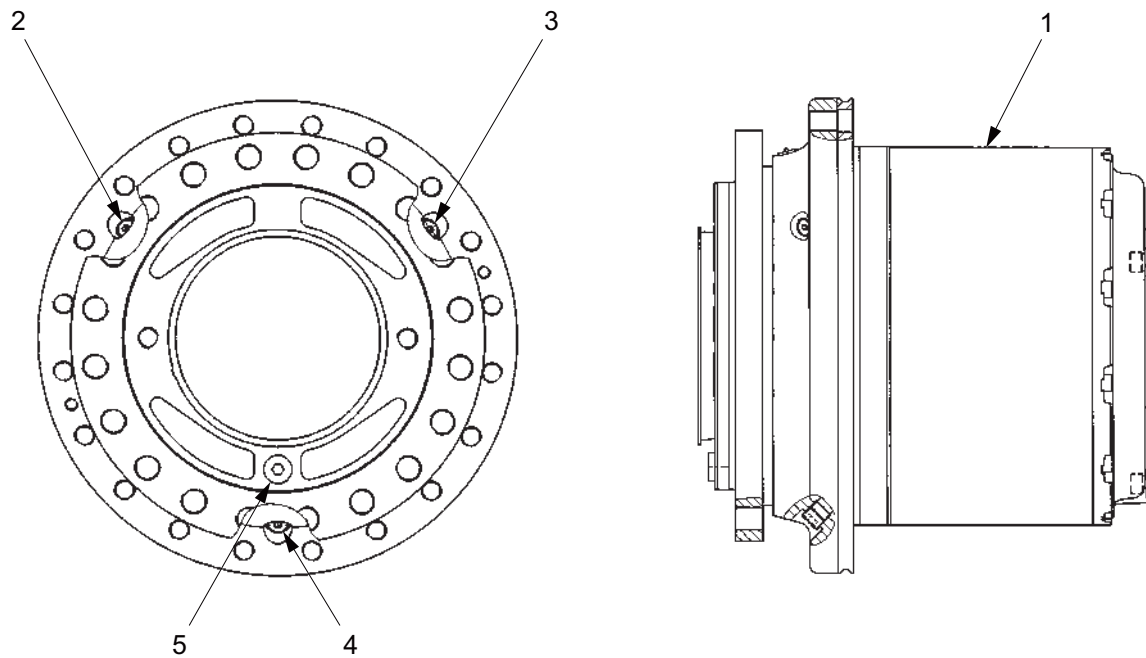
SV540-04001

- | | | | |
|--------------------------------------|----------------------------|------------------------------|----------------------------|
| (1) Port A (Forward) | [FMA] : 3/4" (DN19) | (6) Drain port | [FMD] : 7/8-14UNF |
| (2) Servo pressure gauge port (min.) | : 9/16-18UNF | (7) Port B (Reverse) | [FMB] : 3/4" (DN19) |
| (3) Control pressure port | [FMC] : 9/16-18UNF | (8) Speed sensor | |
| (4) Drain port | : 7/ 8-14UNF | (9) Gauge port (For Port A) | : 7/8-12 |
| (5) Servo pressure gauge port (max.) | : 9/16-18UNF | (10) Gauge port (For Port B) | : 7/8-12 |

Motor specifications

- Displacement (max.) : 60.0 cm³/rev (3.66 cu.in./rev)
- (min.) : 30.0 cm³/rev (1.83 cu.in./rev)
- Allowable motor case pressure : 0.3 MPa (43.5 psi) or less
- Weight : 27.4 kg (60.4 lbs.)

2-2-3. Gear box



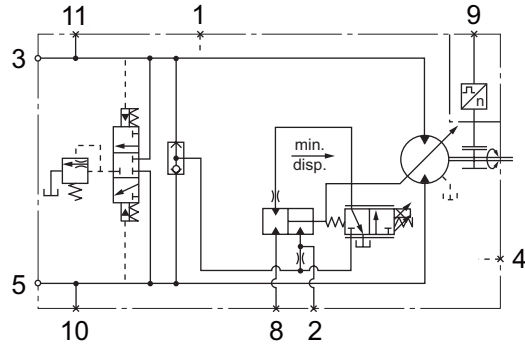
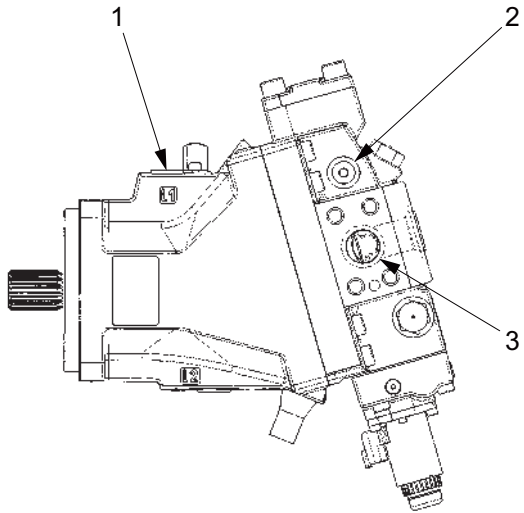
SV540-04002

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|------------------------------------------------------|----------------|--------------------------|
| (1) Gear box | (4) Drain port | : M16 P=1.5 |
| (2) Oil filler port/Oil level check port : M16 P=1.5 | (5) Brake port | [FGB] : M16 P=1.5 |
| (3) Oil filler port/Oil level check port : M16 P=1.5 | | |

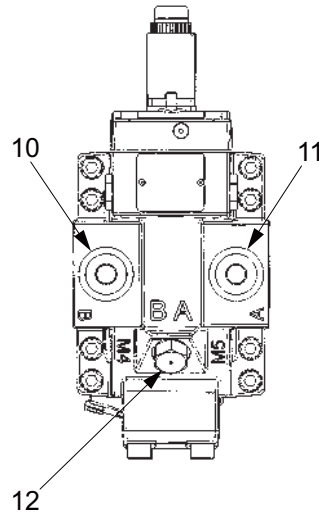
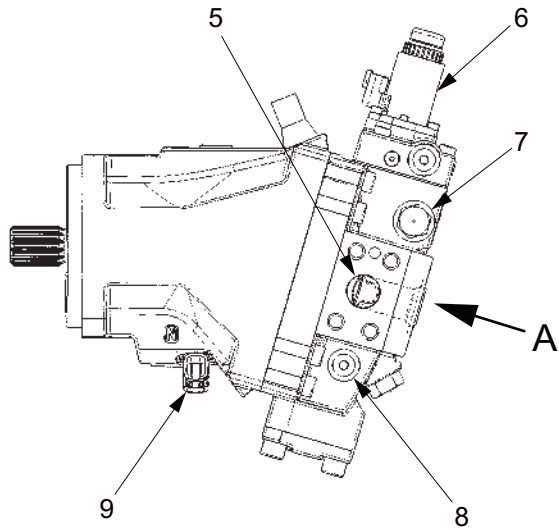
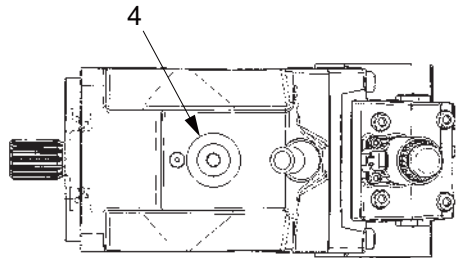
Specifications

- Reduction ratio : 1/85.33
- Brake release pressure : 1.8 MPa (261 psi) or more
- Oil capacity : 4.5 L (1.19 gal.)
- Weight : 121.1 kg (267 lbs.)

2-2-4. Propulsion hydraulic motor (rear)



Motor circuit diagram



VIEW A

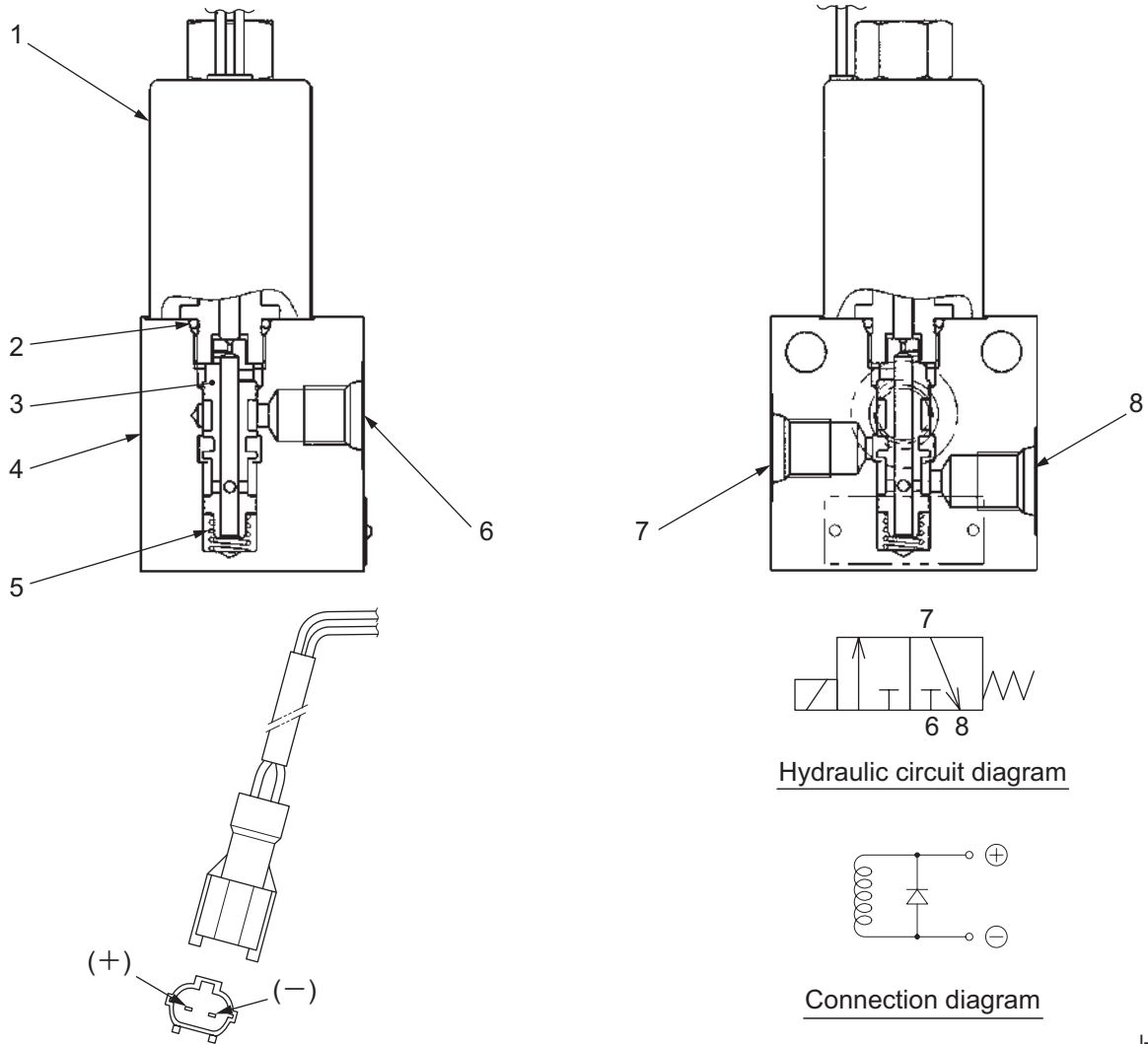
SV540-04003

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|--------------------------------------|---------------------------|--------------------------------------|----------------------------|
| (1) Drain port | : 7/ 8-14UNF | (7) Loop flushing shuttle valve | |
| (2) Servo pressure gauge port (min.) | : 9/16-18UNF | (8) Servo pressure gauge port (max.) | : 9/16-18UNF |
| (3) Port A (Forward) | [RPA] : 1" (DN25) | (9) Speed sensor | |
| (4) Drain port | [RMD] : 7/ 8-14UNF | (10) Gauge port (For Port B) | [RMB] : 1 1/16-12UN |
| (5) Port B (Reverse) | [RPB] : 1" (DN25) | (11) Gauge port (For Port A) | [RMA] : 1 1/16-12UN |
| (6) Solenoid valve (speed change) | | (12) Charge pressure relief valve | |

Motor specifications

- Displacement (max.) : 80.0 cm³/rev (4.88 cu.in./rev)
- Displacement (min.) : 28.0 cm³/rev (1.71 cu.in./rev)
- Charge relief valve pressure setting : 2.0 MPa (290 psi)
- Allowable motor case pressure : 0.3 MPa (43.5 psi) or less
- Weight : 34.8 kg (76.7 lbs.)

2-2-5. Motor speed change solenoid valve (front)



- (1) Solenoid
- (2) O-ring (1B P14)
- (3) Spool (J)
- (4) Body
- (5) Spring
- (6) Port P **[SCP]** : 9/16-18UNF-2B
- (7) Port A **[SCA]** : 9/16-18UNF-2B
- (8) Port T **[SCT]** : 9/16-18UNF-2B

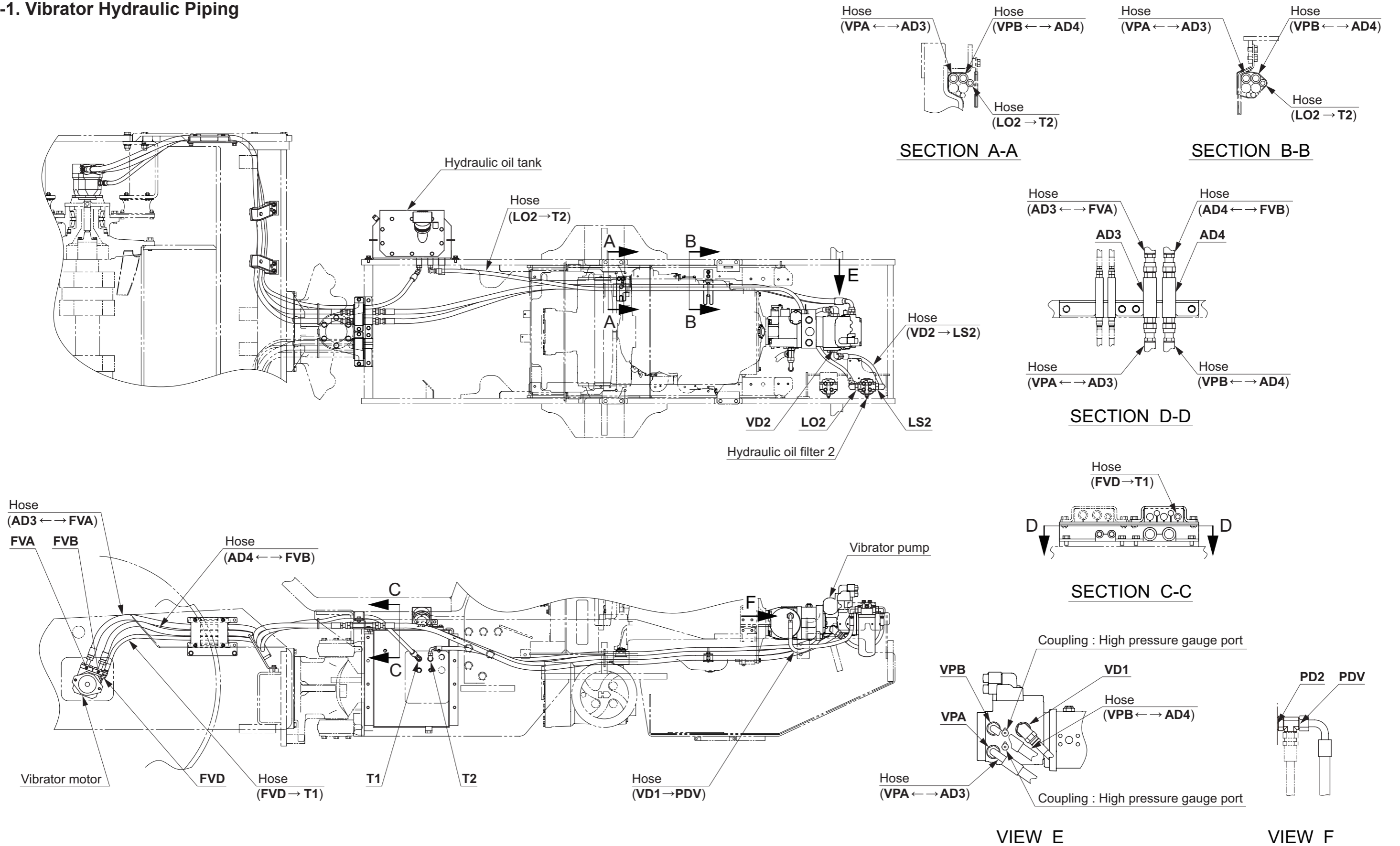
Specifications

- Rated pressure : 4.9 MPa (710 psi) (6, 7)
- : 0.5 MPa (72.5 psi) (8)
- Rated flow : 30 L/min (7.9 gal./min)
- Weight : 1.5 kg (3.3 lbs.)

J-40146

3. VIBRATOR HYDRAULIC SYSTEM

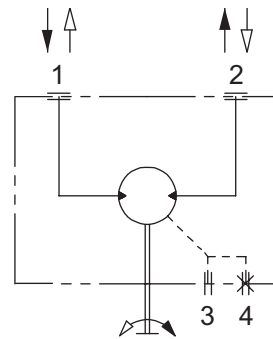
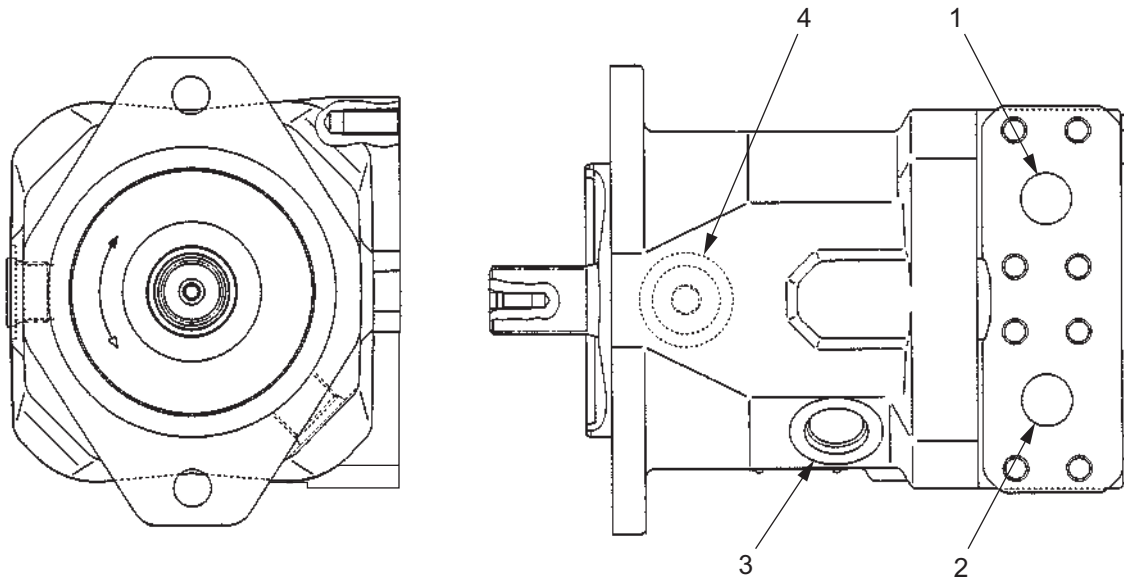
3-1. Vibrator Hydraulic Piping



• The letters and figures (such as FVD and T1) show each port and the arrow (←→; →) symbols show the hose connection and the direction of the flow of the oil.

3-2. Hydraulic Component Specifications

3-2-1. Vibrator hydraulic motor



Hydraulic circuit diagram

Flow of oil

- 1→2 Clockwise rotation
- 2→1 Counterclockwise rotation

- | | |
|---------------------|--------------------------|
| (1) Port A | [FVA] : SAE 3/4" |
| (2) Port B | [FVB] : SAE 3/4" |
| (3) Drain port (L) | [FVD] : 7/8-14UNF |
| (4) Drain port (L1) | : 7/8-14UNF |

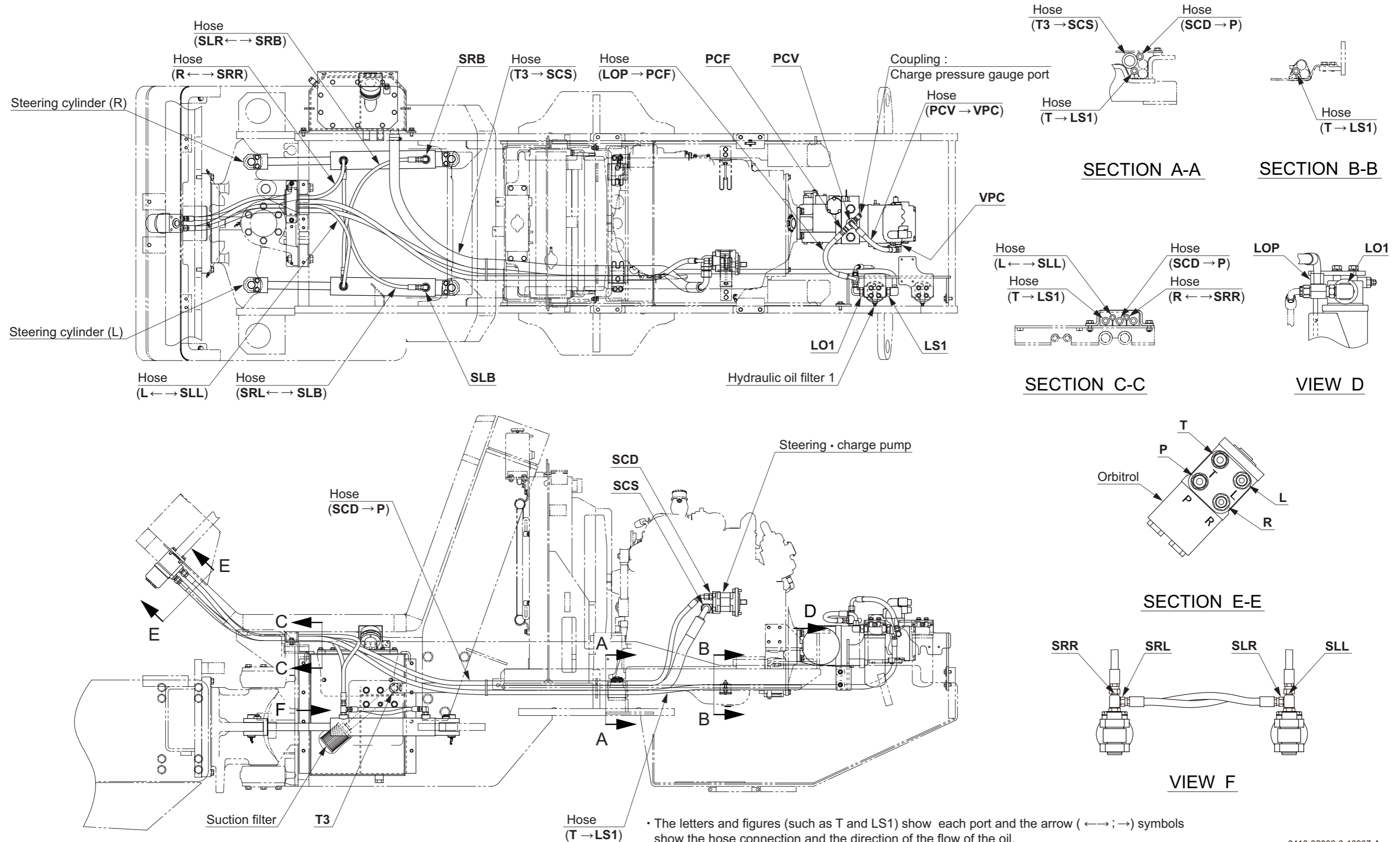
Specifications

- Displacement : 44.5 cm³/rev (2.72 cu.in./rev)
- Working pressure : 28 MPa (4,060 psi)
- Allowable pump case pressure : 0.2 MPa (29 psi)
- Weight : 17 kg (37 lbs.)

SV510-III-04008

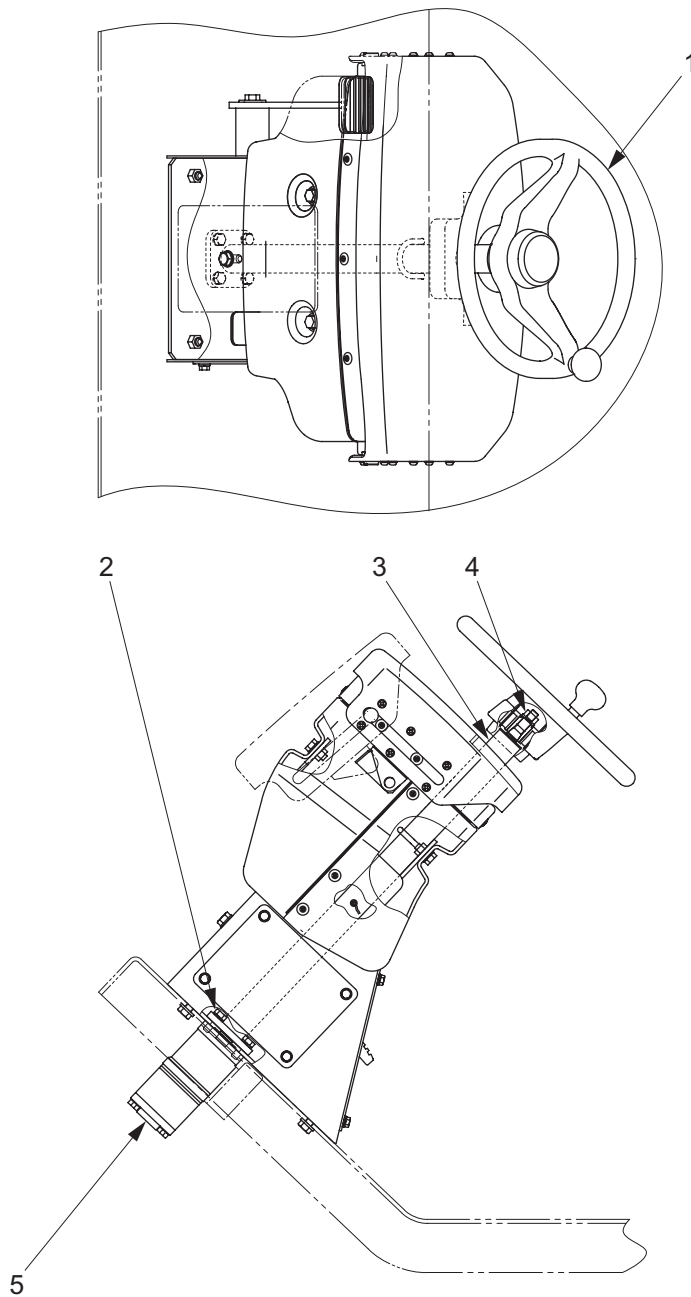
4. STEERING SYSTEM

4-1. Steering Hydraulic Piping



• The letters and figures (such as T and LS1) show each port and the arrow (↔ ; →) symbols show the hose connection and the direction of the flow of the oil.

4-2. Steering Wheel



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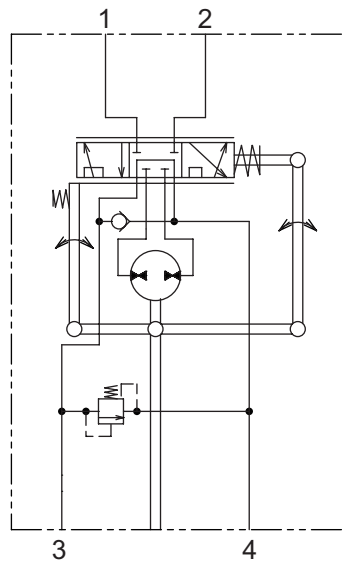
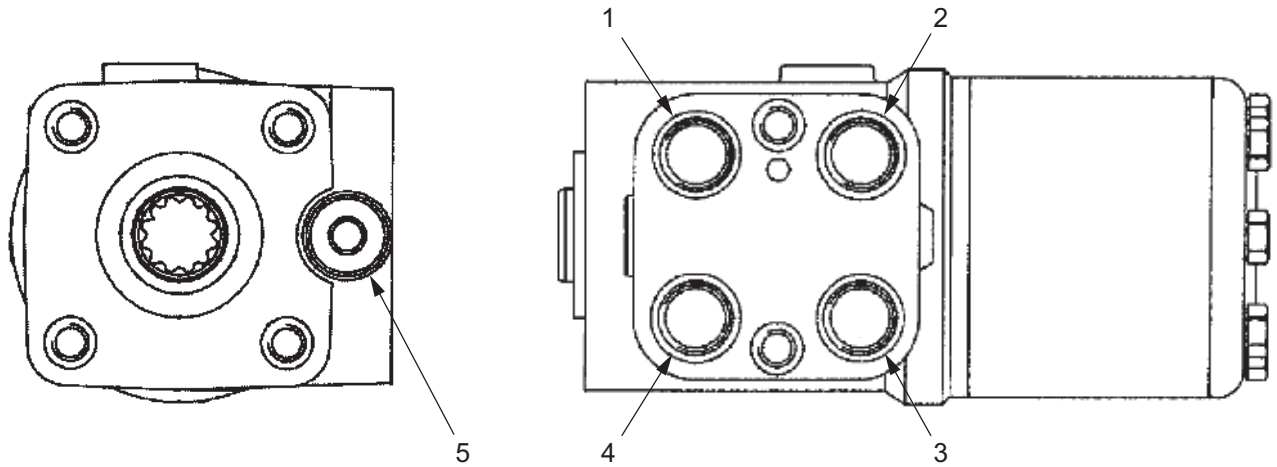
- | | |
|--------------------|----------------------|
| (1) Steering wheel | (4) Nut : M12 P=1.25 |
| (2) Bolt : M10×30 | (5) Orbitrol |
| (3) Column shaft | |



- | | |
|--------------------|------------------------|
| (2) Bolt M10×30 | : 49 N·m (36 lbf·ft) |
| (4) Nut M12 P=1.25 | : 35 N·m (26 lbf·ft) |

4-3. Hydraulic Component Specifications

4-3-1. Orbitrol



Hydraulic circuit diagram

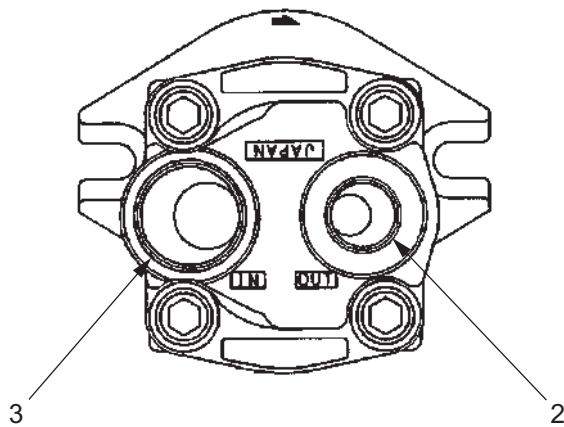
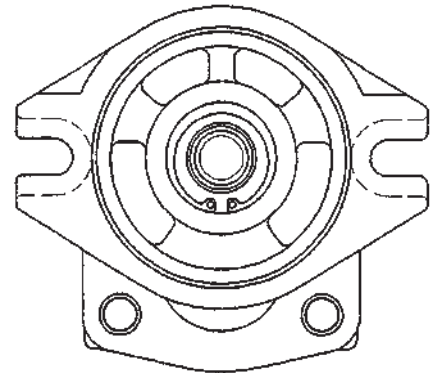
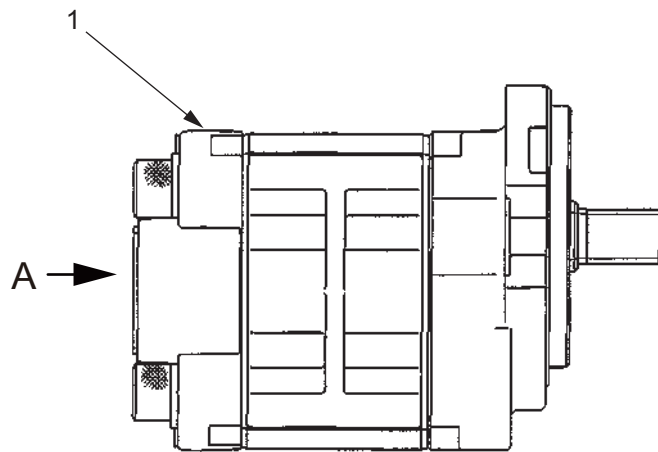
SV510-III-04010

- | | | | |
|------------|------------------------|------------------|------------------------|
| (1) Port L | [L] : 3/4-16UNF | (4) Port T | [T] : 3/4-16UNF |
| (2) Port R | [R] : 3/4-16UNF | (5) Relief valve | |
| (3) Port P | [P] : 3/4-16UNF | | |

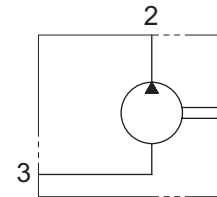
Specifications

- Displacement : 400 cm³/rev (24.4 cu.in./rev)
- Relief valve pressure setting : 15.0 MPa (2,175 psi)
- Weight : 7 kg (15 lbs.)

4-3-2. Steering • charge pump



VIEW A



Hydraulic circuit diagram

- (1) Pump
- (2) Outlet port **[SCD]** : 7/ 8-14UNF
- (3) Inlet port **[SCS]** : 1 5/16-12UN

Specifications

- Displacement : 24.9 cm³/rev (1.5 cu.in./rev)
- Rated pressure : 20.6 MPa (2,987 psi)
- Weight : 3.8 kg (8.4 lbs.)

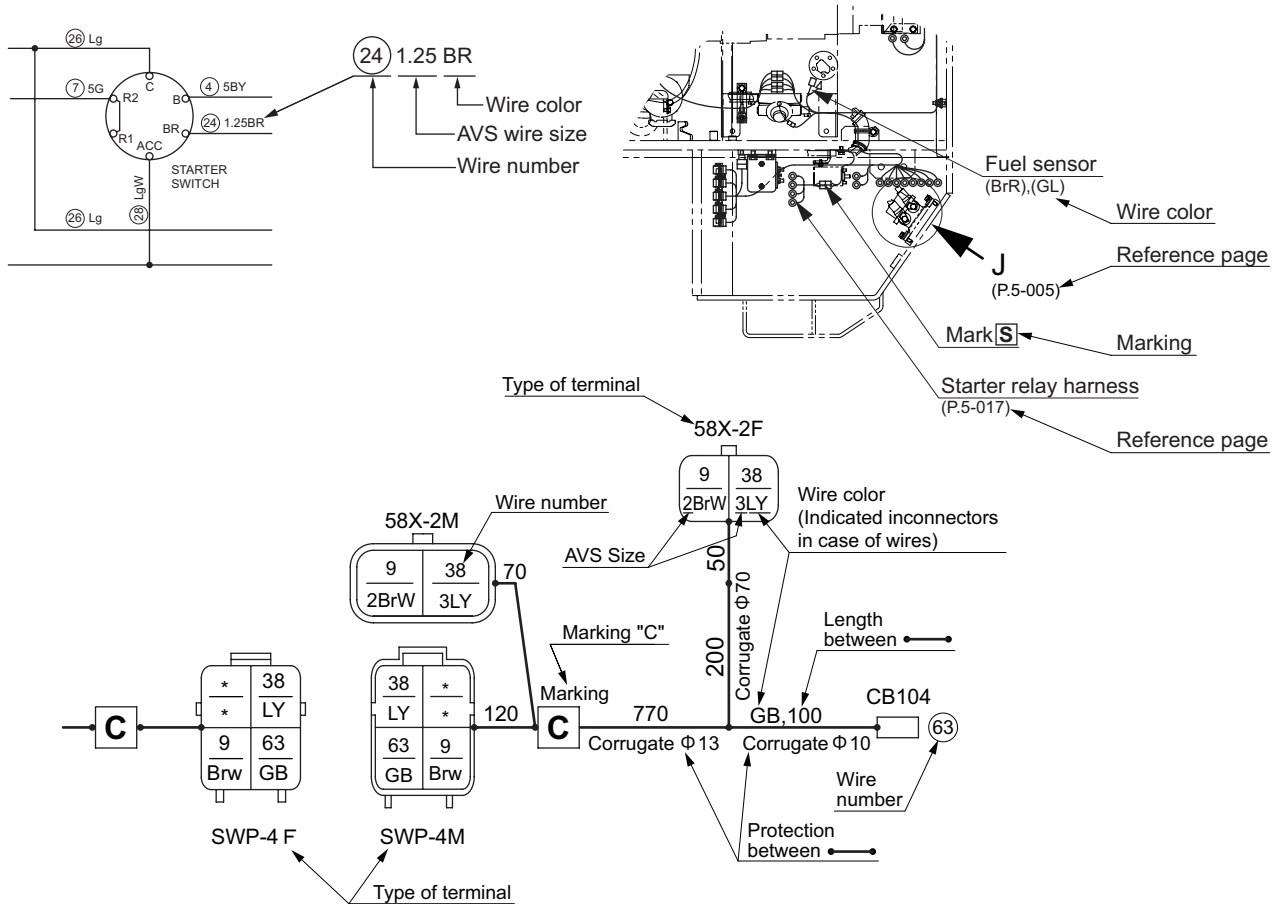
SV540-04004

ELECTRICAL SYSTEM

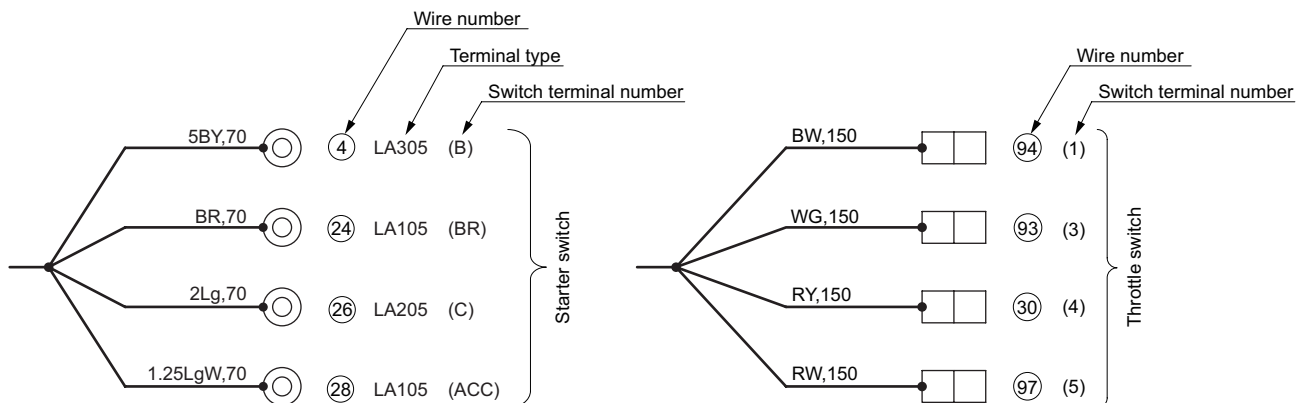
1. PRECAUTIONS FOR WORK

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

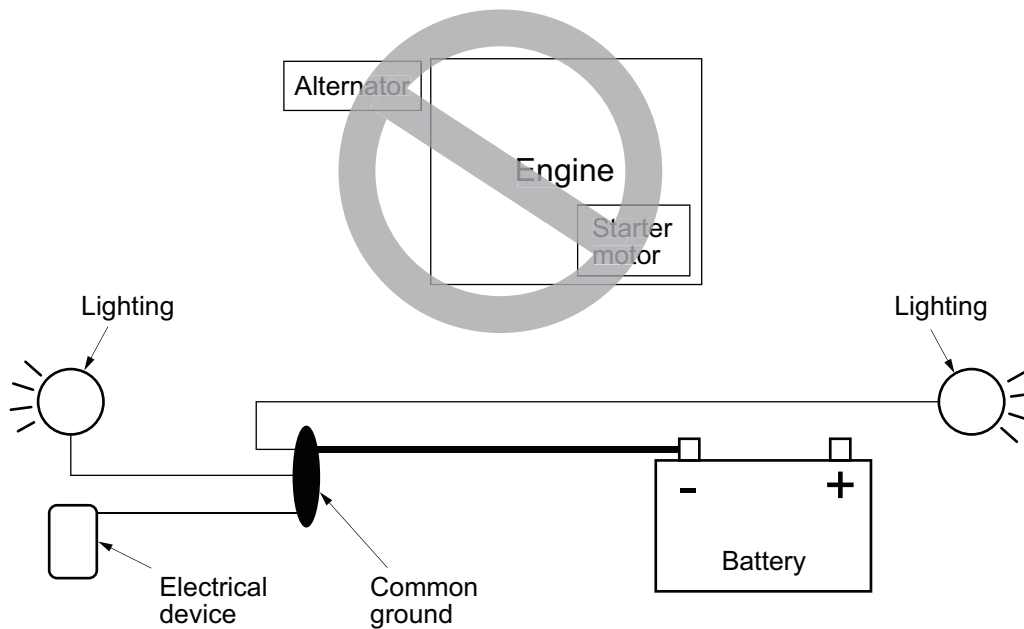
- Wire color code chart

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

1-2. Electrical Equipment Installation

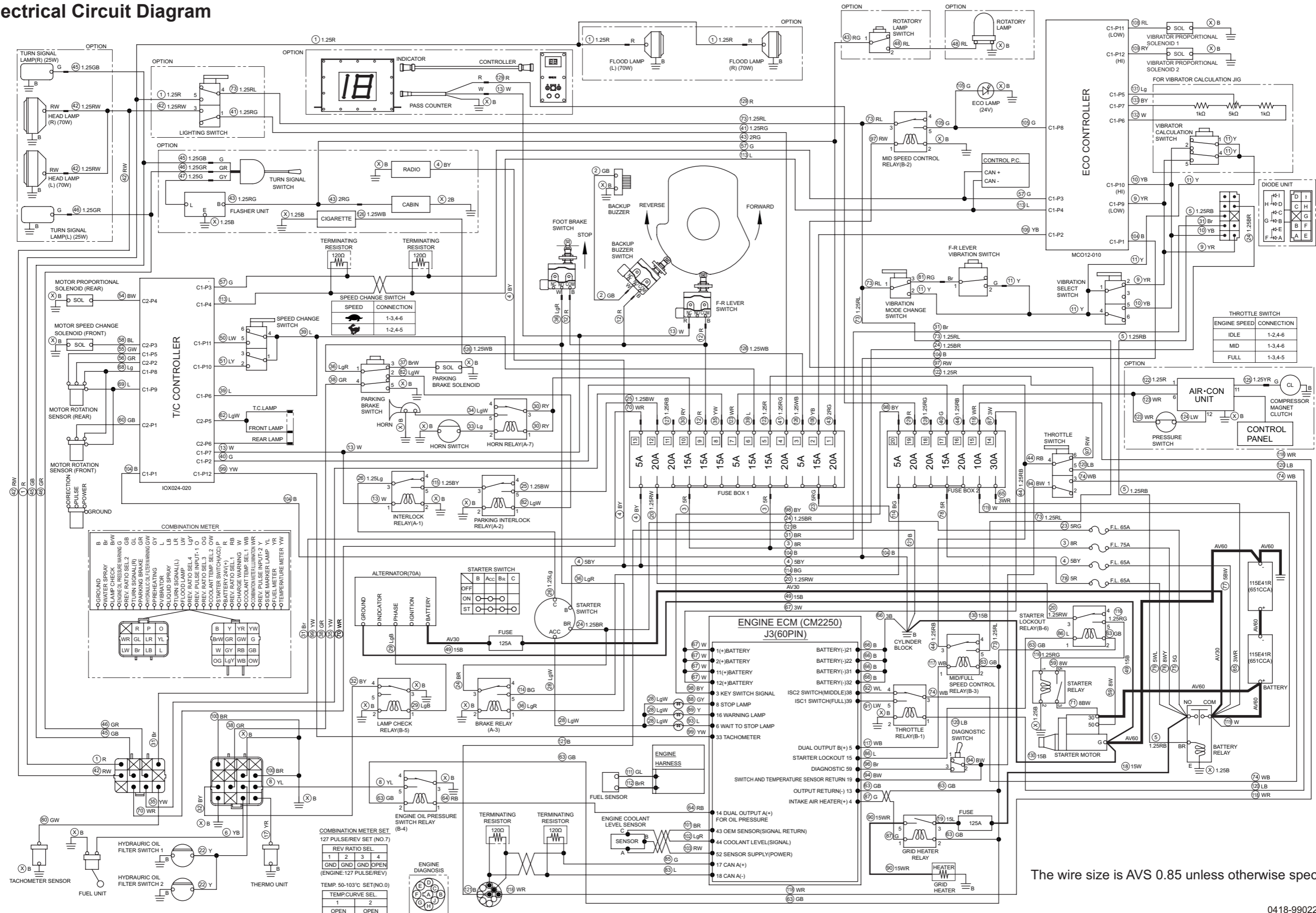
When wiring electrical components to this machine (for example, additional lighting or electrical devices), connect all grounds to a common ground location and then return to the negative side of the battery. Do not wire to the engine block, starter or alternator terminals. Reference picture is below.

Attention! Do NOT wire to engine, alternator or starter motor.



2. SYSTEM CIRCUIT DIAGRAM

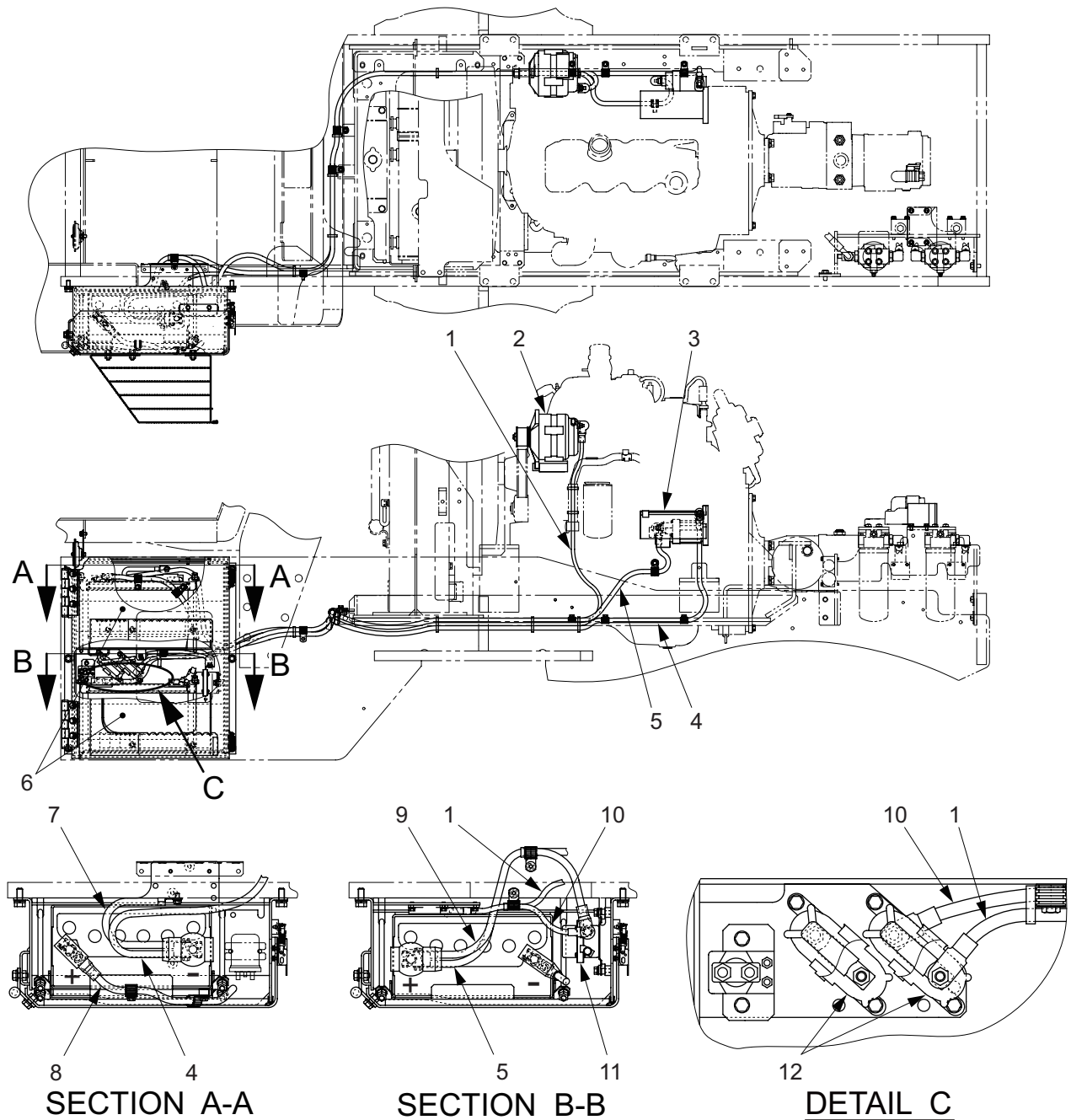
2-1. Electrical Circuit Diagram



The wire size is AVS 0.85 unless otherwise specified.

3. ELECTRICAL COMPONENTS

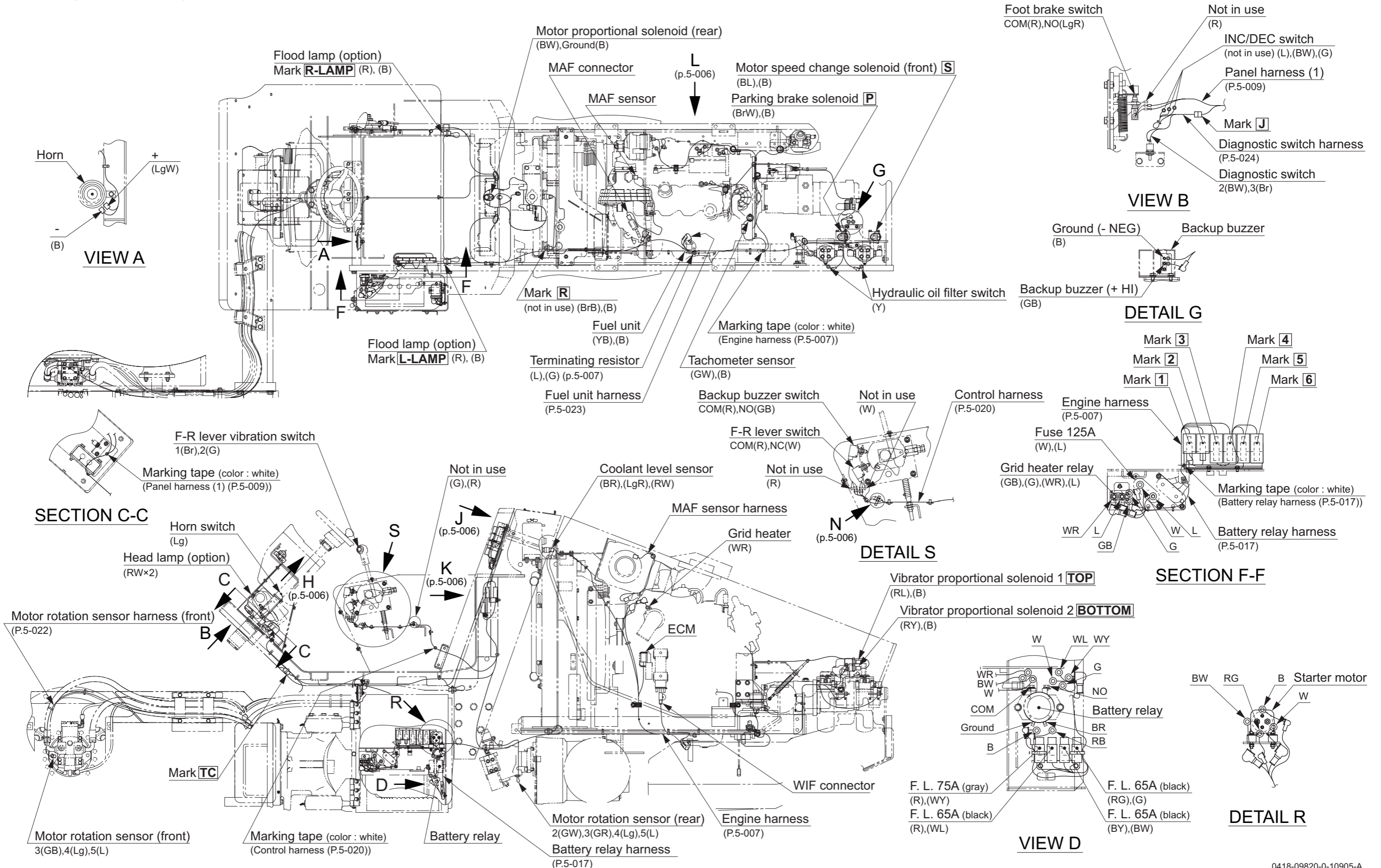
3-1. Battery Layout



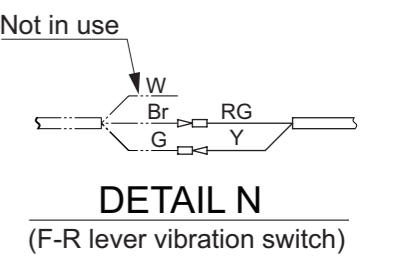
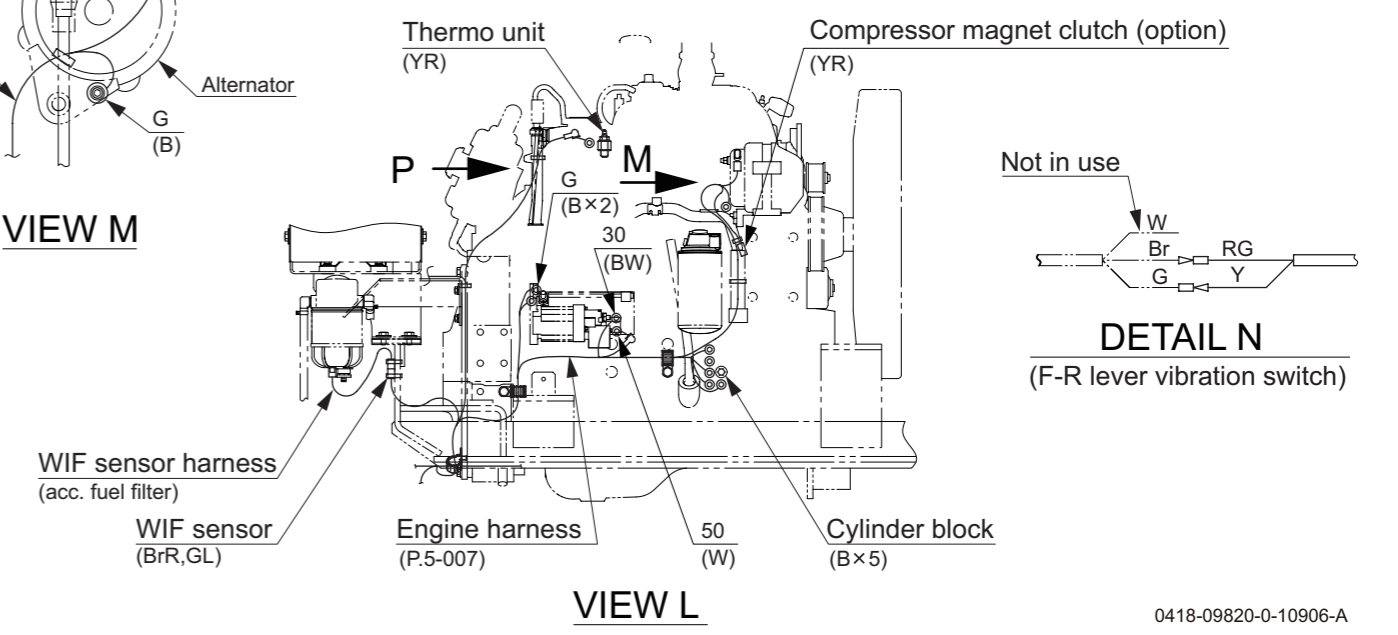
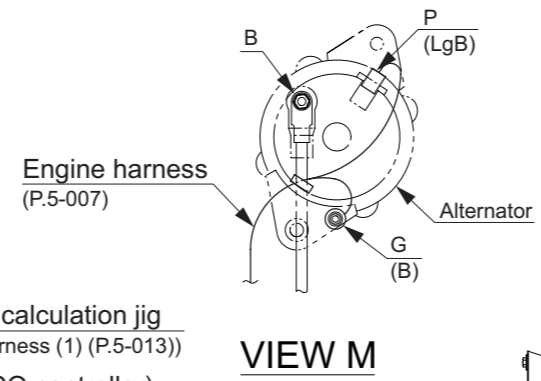
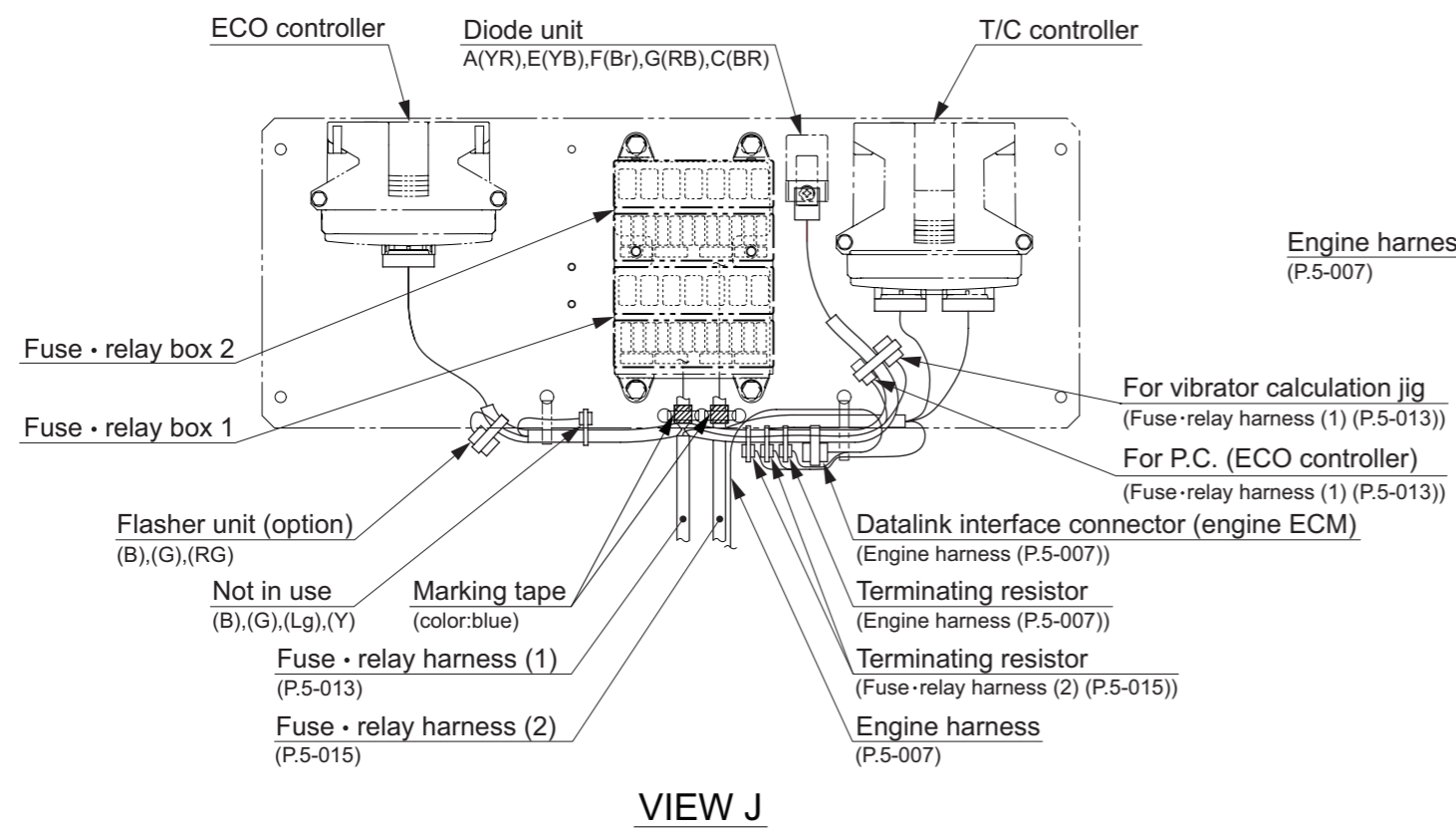
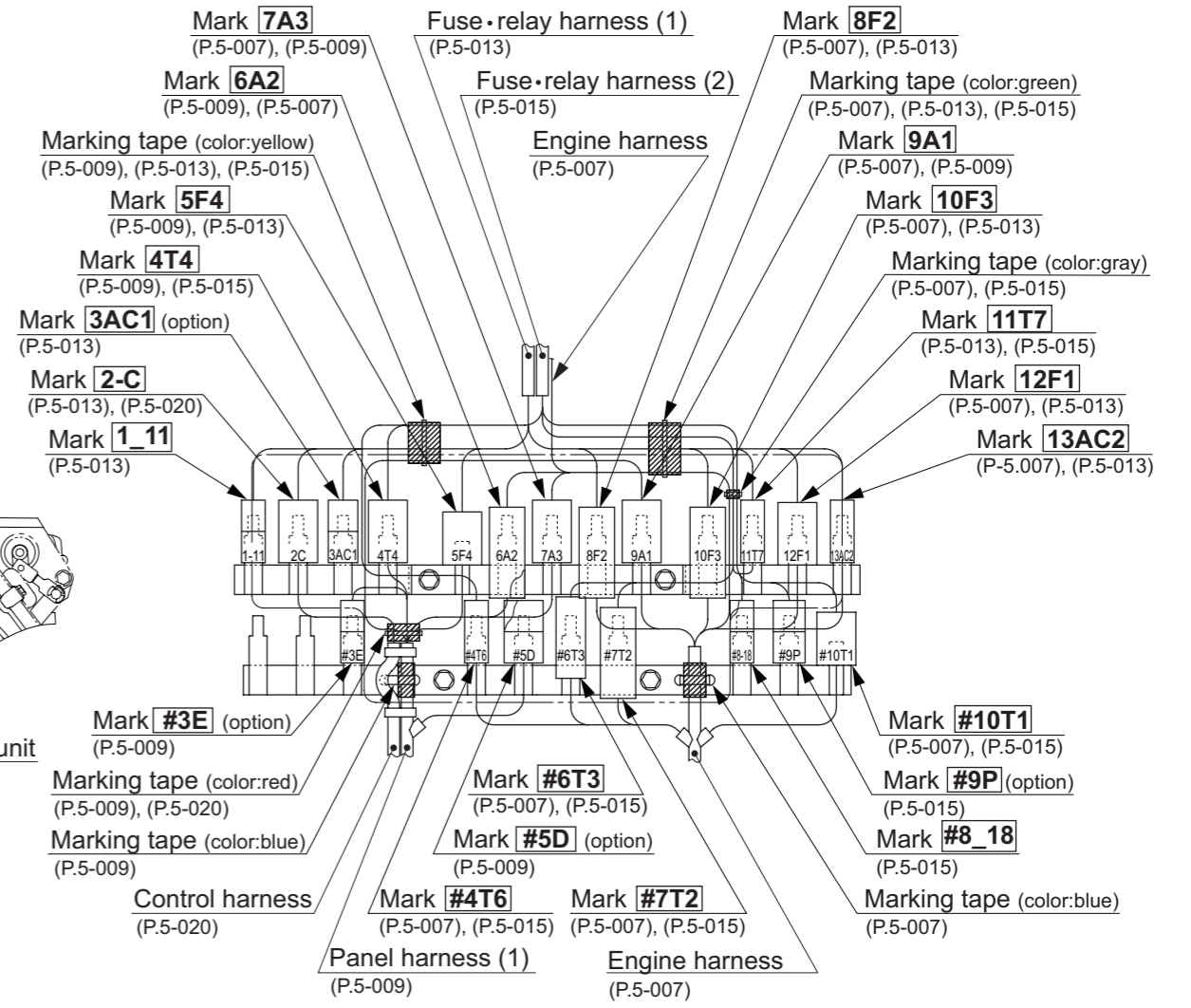
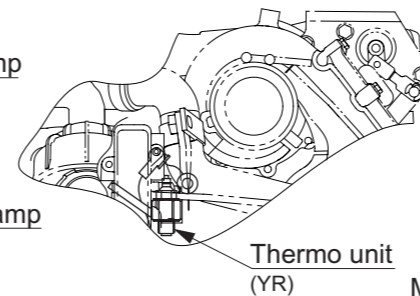
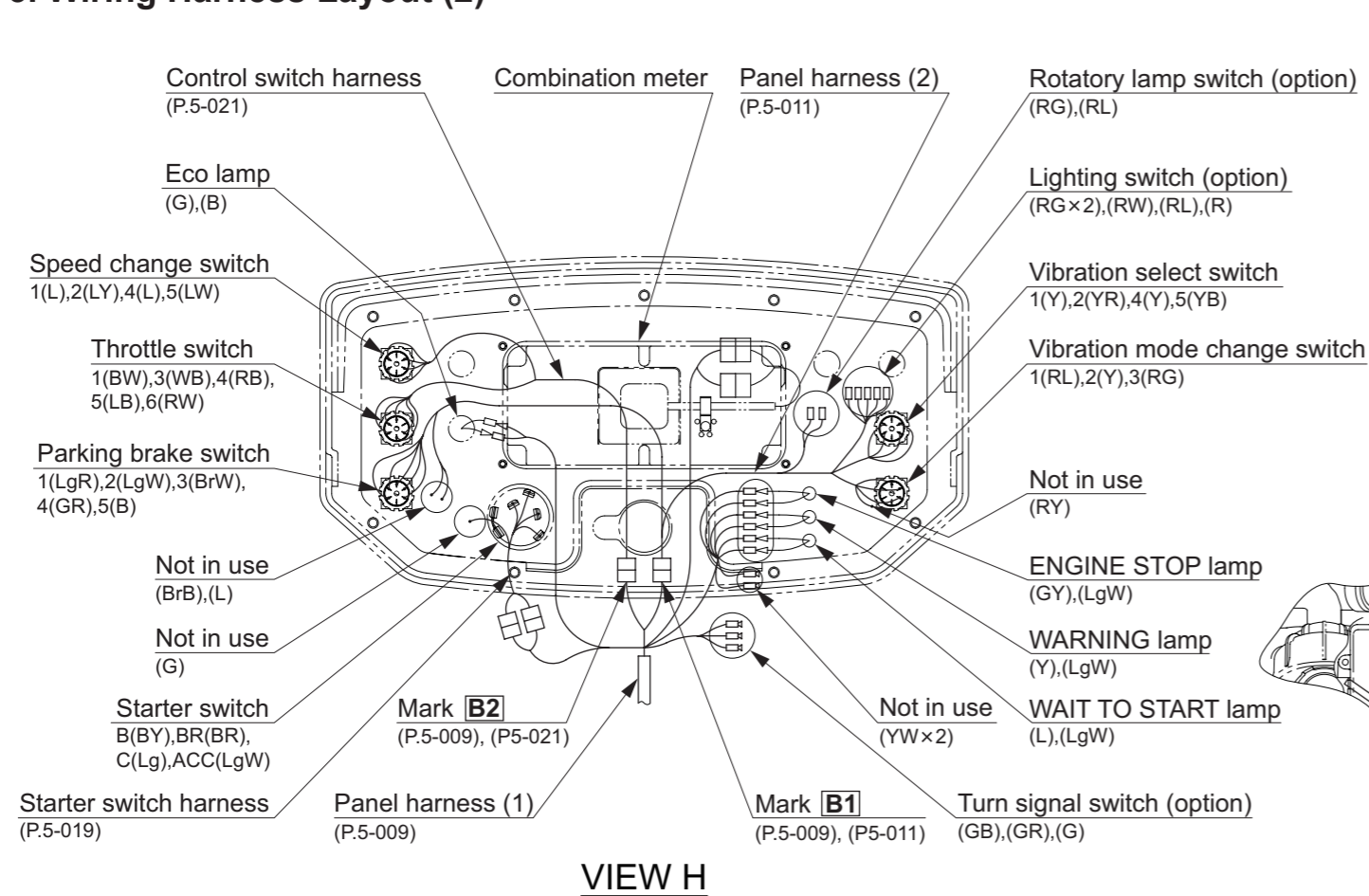
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- | | |
|------------------------------------------------------|----------------------------------------------|
| (1) Cord (Fuse – Alternator) | (7) Cord (Battery (-) – Ground) |
| (2) Alternator | (8) Cord (Battery (+) – Battery (-)) |
| (3) Starter motor | (9) Cord (Battery (+) – Battery relay (COM)) |
| (4) Cord (Starter motor (terminal G) – Battery (-)) | (10) Cord (Battery relay (COM) – Fuse) |
| (5) Cord (Battery (+) – Starter motor (terminal 30)) | (11) Battery relay |
| (6) Battery | (12) Fuse (125A) |

3-2. Wiring Harness Layout (1)

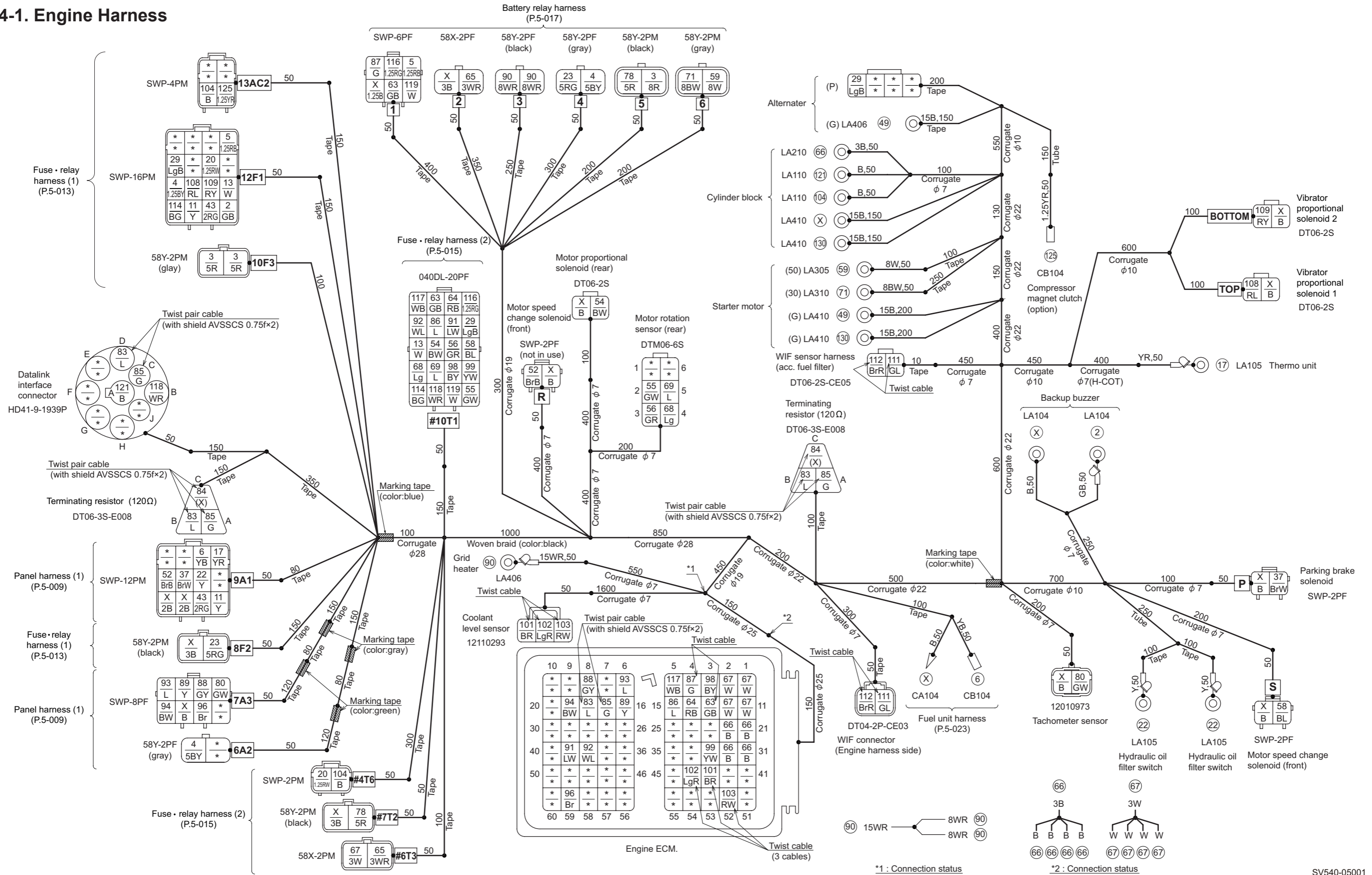


3-3. Wiring Harness Layout (2)



4. WIRING HARNESSSES

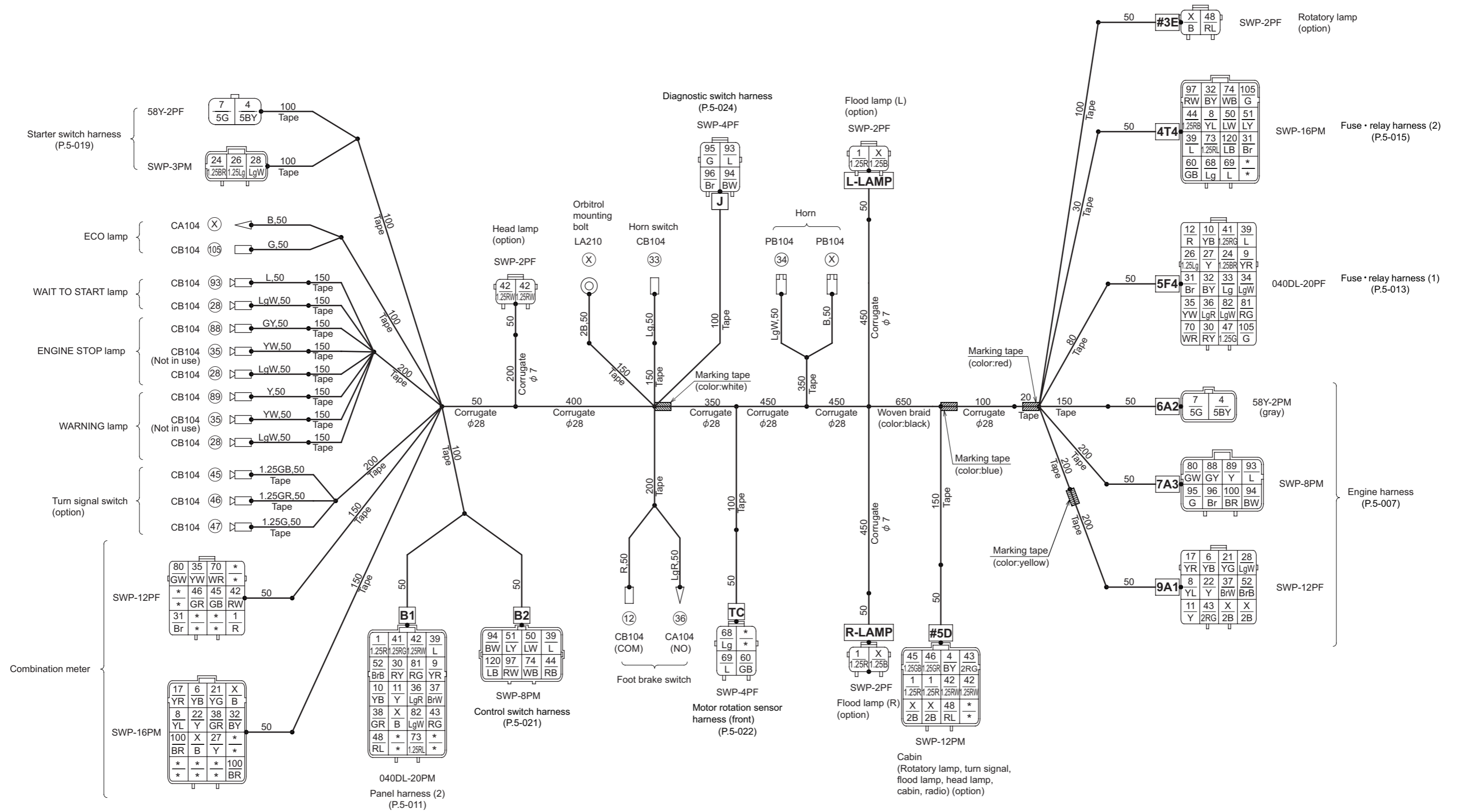
4-1. Engine Harness



NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
ⓧ	B, 1.25B, 2B, 3B, 15B	17	1 , 2 , 7A3 , 8F2 , 9A1 × 2, #7T2 , BOTTOM , P , S , TOP , Backup buzzer, Cylinder block, Fuel unit harness, Motor proportional solenoid (rear), Tachometer sensor, R (not in use)
②	GB	2	12F1 , Backup buzzer
③	5R, 8R	3	5 , 10F3 × 2
④	1.25BY, 5BY	3	4 , 6A2 , 12F1
⑤	1.25RB	2	1 , 12F1
⑥	YB	2	9A1 , Fuel unit harness
⑪	Y	2	9A1 , 12F1
⑬	W	2	12F1 , #10T1
⑰	YR	2	9A1 , Thermo unit
⑳	1.25RW	2	12F1 , #4T6
㉒	Y	3	9A1 , Hydraulic oil filter switch × 2
㉓	5RG	2	4 , 8F2
㉙	LgB	3	12F1 , #10T1 , Alternater-P
㉛	BrW	2	9A1 , P
④③	2RG	2	9A1 , 12F1
④⑨	15B	2	Alternater-G, Starter motor-G
⑤②	BrB	2	9A1 , R (not in use)
⑤④	BW	2	#10T1 , Motor proportional solenoid (rear)
⑤⑤	GW	2	#10T1 , Motor rotation sensor (rear)
⑤⑥	GR	2	#10T1 , Motor rotation sensor (rear)
⑤⑧	BL	2	#10T1 , S
⑤⑨	8W	2	6 , Starter motor-50
⑥③	GB	3	1 , #10T1 , Engine ECM-13
⑥④	RB	2	#10T1 , Engine ECM-14
⑥⑤	3WR	2	2 , #6T3
⑥⑥	B, 3B	5	Cylinder block, Engine ECM-21, 22, 31, 32
⑥⑦	W, 3W	5	#6T3 , Engine ECM-1, 2, 11, 12
⑥⑧	Lg	2	#10T1 , Motor rotation sensor (rear)
⑥⑨	L	2	#10T1 , Motor rotation sensor (rear)
⑦①	8BW	2	6 , Starter motor-30
⑦⑧	5R	2	5 , #7T2
⑧①	GW	2	7A3 , Tachometer sensor

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
⑧③	L	4	Datalink interface connector-D, Engine ECM-18, Terminating resistor (120Ω) -B × 2
⑧④	X	2	Terminating resistor (120Ω) -C × 2
⑧⑤	G	4	Datalink interface connector-C, Engine ECM-17, Terminating resistor (120Ω) -A × 2
⑧⑥	L	2	#10T1 , Engine ECM-15
⑧⑦	G	2	1 , Engine ECM-4
⑧⑧	GY	2	7A3 , Engine ECM-8
⑧⑨	Y	2	7A3 , Engine ECM-16
⑨①	8WR, 15WR	2	3 × 2, Grid heater
⑨②	LW	2	#10T1 , Engine ECM-39
⑨③	WL	2	#10T1 , Engine ECM-38
⑨④	L	2	7A3 , Engine ECM-6
⑨⑥	BW	2	7A3 , Engine ECM-19
⑨⑧	Br	2	7A3 , Engine ECM-59
⑨⑨	BY	2	#10T1 , Engine ECM-3
⑩①	YW	2	#10T1 , Engine ECM-33
⑩②	BR	2	Engine coolant level sensor, Engine ECM-43
⑩③	LgR	2	Engine coolant level sensor, Engine ECM-44
⑩④	RW	2	Engine coolant level sensor, Engine ECM-52
⑩⑥	B	3	13AC2 , #4T6 , Cylinder block
⑩⑧	RL	2	12F1 , TOP
⑩⑨	RY	2	12F1 , BOTTOM
⑪①	GL	2	WIF connector, WIF sensor harness (acc. fuel filter)
⑪②	BrR	2	WIF connector, WIF sensor harness (acc. fuel filter)
⑪④	BG	2	12F1 , #10T1
⑪⑥	1.25RG	2	1 , #10T1
⑪⑦	WB	2	#10T1 , Engine ECM-5
⑪⑧	WR	2	#10T1 , Datalink interface connector-B
⑪⑨	W	2	1 , #10T1
⑫①	B	2	Cylinder block, Datalink interface connector-A
⑫⑤	1.25YR	2	13AC2 , Compressor magnet clutch (option)
⑬①	15B	2	Cylinder block, Starter motor-G

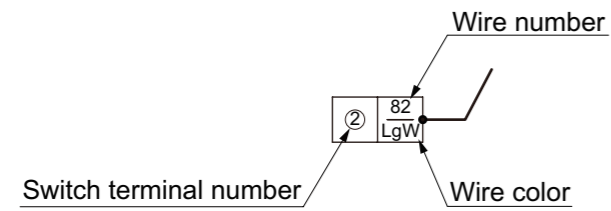
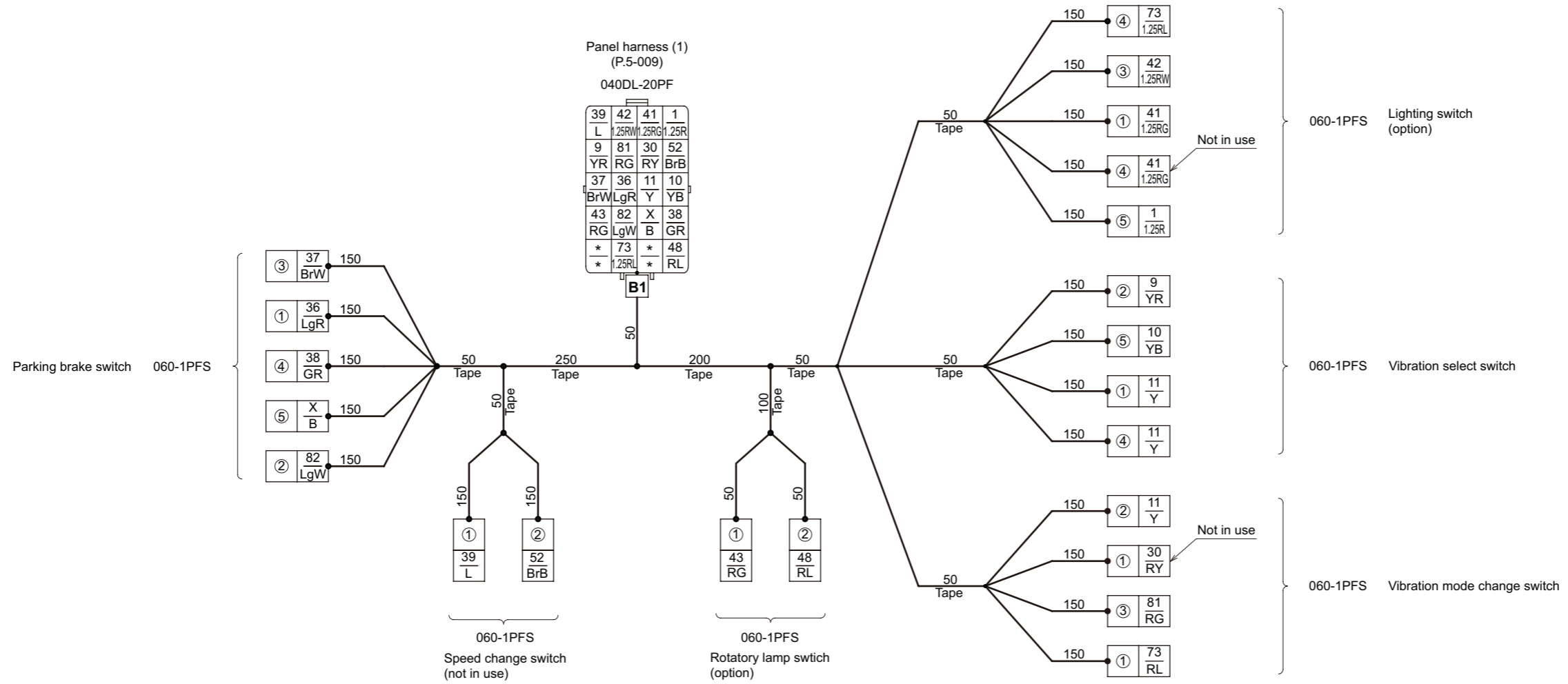
4-2. Panel Harness (1)



NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
⊗	B, 1.25B, 2B	13	9A1 × 2, Combination meter (16PF) × 2, ECO lamp, Horn, Orbitrol mounting bolt, #3E (option), #5D × 2 (option), B1 , L-LAMP (option), R-LAMP (option)
①	R, 1.25R	6	B1 , Combination meter (12PF), #5D × 2 (option), L-LAMP (option), R-LAMP (option),
④	BY, 5BY	3	6A2 , Starter switch harness, #5D (option)
⑥	YB	2	9A1 , Combination meter (16PF)
⑦	5G	2	6A2 , Starter switch harness
⑧	YL	3	4T4 , 9A1 , Combination meter (16PF)
⑨	YR	2	5F4 , B1
⑩	YB	2	5F4 , B1
⑪	Y	2	9A1 , B1
⑫	R	2	5F4 , Foot brake switch
⑰	YR	2	9A1 , Combination meter (16PF)
⑳	YG	2	9A1 , Combination meter (16PF)
㉑	Y	2	9A1 , Combination meter (16PF)
㉔	1.25BR	2	5F4 , Starter switch harness
㉖	1.25Lg	2	5F4 , Starter switch harness
㉗	Y	2	5F4 , Combination meter (16PF)
㉘	LgW	5	9A1 , ENGINE STOP lamp, Starter switch harness, WAIT TO START lamp, WARNING lamp
③⑩	RY	2	5F4 , B1
③①	Br	3	4T4 , 5F4 , Combination meter (12PF)
③②	BY	3	4T4 , 5F4 , Combination meter (16PF)
③③	Lg	2	5F4 , Horn switch
③④	LgW	2	5F4 , Horn
③⑤	YW	4	5F4 , Combination meter (12PF), ENGINE STOP lamp (not in use), WARNING lamp (not in use)
③⑥	LgR	3	5F4 , B1 , Foot brake switch
③⑦	BrW	2	9A1 , B1
③⑧	GR	2	B1 , Combination meter (16PF)
③⑨	L	4	4T4 , 5F4 , B1 , B2

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
④①	1.25RG	2	5F4 , B1
④②	RW, 1.25RW	6	B1 , Combination meter (12PF), #5D × 2 (option), Head lamp (option) × 2
④③	RG, 2RG	3	9A1 , B1 , #5D (option)
④④	RB, 1.25RB	2	4T4 , B2
④⑤	GB, 1.25GB	3	Combination meter (12PF), #5D (option), Turn signal switch (option)
④⑥	GR, 1.25GR	3	Combination meter (12PF), #5D (option), Turn signal switch (option)
④⑦	1.25G	2	5F4 , Turn signal switch (option)
④⑧	RL	3	B1 , #3E (option), #5D (option)
⑤⑩	LW	2	4T4 , B2
⑤①	LY	2	4T4 , B2
⑤②	BrB	2	9A1 , B1
⑥⑩	GB	2	4T4 , TC
⑥⑧	Lg	2	4T4 , TC
⑥⑨	L	2	4T4 , TC
⑦⑩	WR	2	5F4 , Combination meter (12PF)
⑦③	1.25RL	2	4T4 , B1
⑦④	WB	2	4T4 , B2
⑧⑩	GW	2	7A3 , Combination meter (12PF)
⑧①	RG	2	5F4 , B1
⑧②	LgW	2	5F4 , B1
⑧⑧	GY	2	7A3 , ENGINE STOP lamp
⑧⑨	Y	2	7A3 , WARNING lamp
⑨③	L	3	7A3 , J , WAIT TO START lamp
⑨④	BW	3	7A3 , B2 , J
⑨⑤	G	2	7A3 , J
⑨⑥	Br	2	7A3 , J
⑨⑦	RW	2	4T4 , B2
⑩⑩	BR	3	7A3 , Combination meter (16PF) × 2
⑩⑤	G	3	4T4 , 5F4 , ECO lamp
⑩⑩	LB	2	4T4 , B2

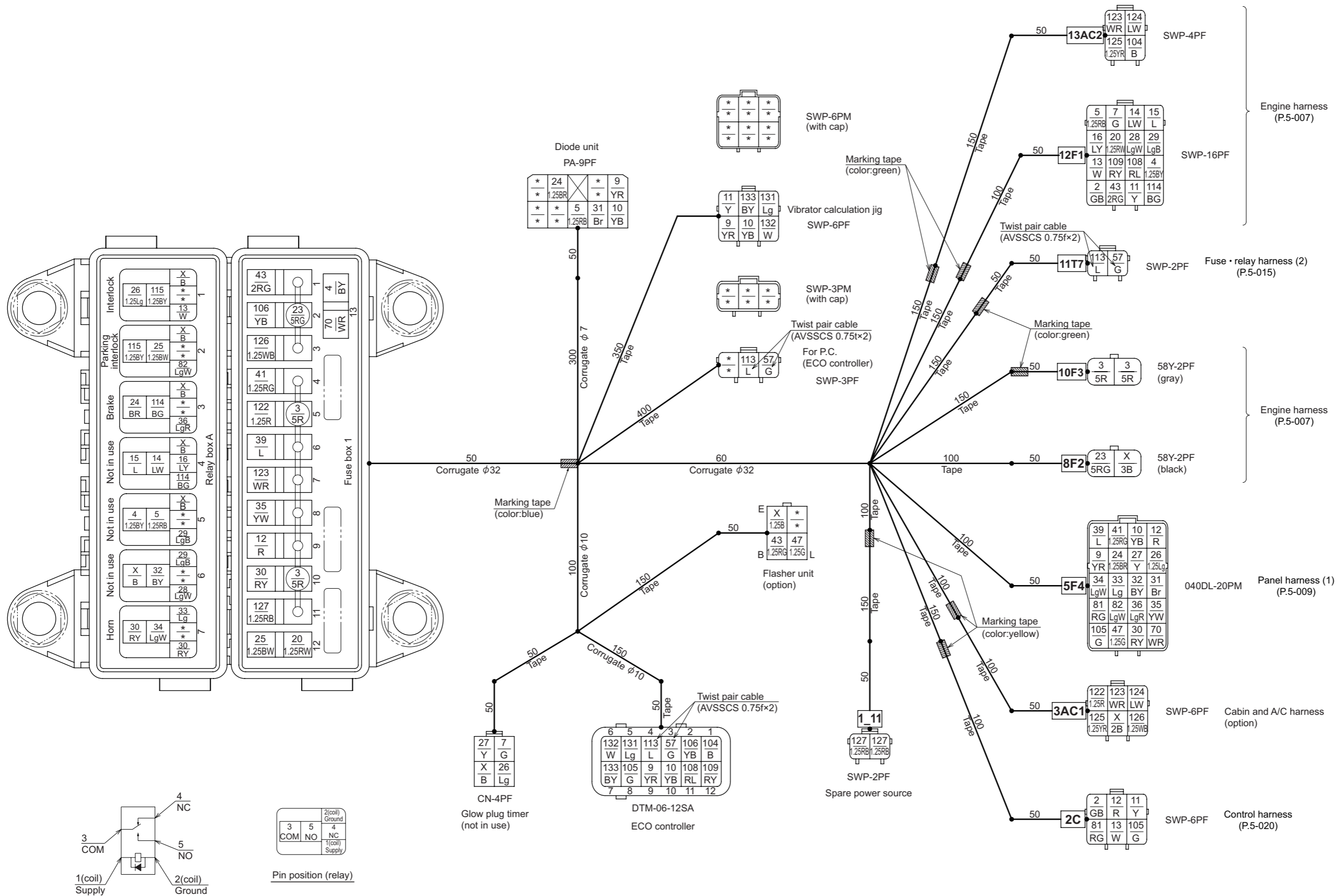
4-3. Panel Harness (2)



NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
ⓧ	B	2	B1 , Parking brake switch-5
①	1.25R	2	B1 , Lighting switch-5 (option)
⑨	YR	2	B1 , Vibration select switch-2
⑩	YB	2	B1 , Vibration select switch-5
⑪	Y	4	B1 , Vibration mode change switch-2, Vibration select switch-1, 4
⑩	RY	2	B1 , Vibration mode change switch-1
⑩	LgR	2	B1 , Parking brake switch-1
⑩	BrW	2	B1 , Parking brake switch-3
⑩	GR	2	B1 , Parking brake switch-4

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
⑩	L	2	B1 , Speed change switch-1 (not in use)
⑩	1.25RG	3	B1 , Lighting switch-1 (option), Lighting switch-4 (not in use)
⑩	1.25RW	2	B1 , Lighting switch-3 (option)
⑩	RG	2	B1 , Rotatory lamp switch-1 (option)
⑩	RL	2	B1 , Rotatory lamp switch-2 (option)
⑩	BrB	2	B1 , Speed change switch-2 (not in use)
⑩	RL, 1.25RL	3	B1 , Vibration mode change switch-1, Lighting switch-4 (option)
⑩	RG	2	B1 , Vibration mode change switch-3
⑩	LgW	2	B1 , Parking brake switch-2

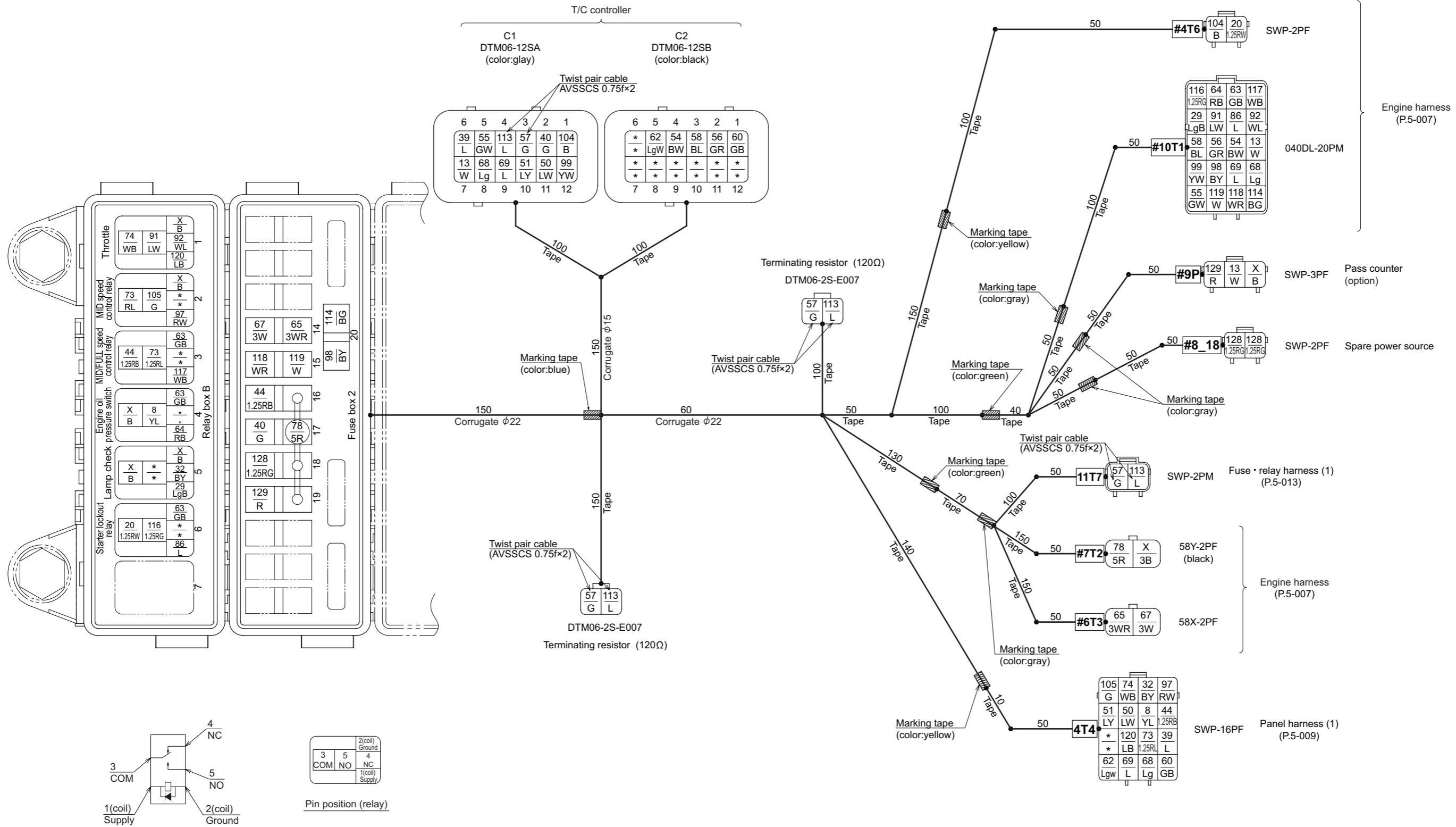
4-4. Fuse • Relay Harness (1)



NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
ⓧ	B, 1.25B, 2B, 3B	10	3AC1 , 8F2 , Relay box A-1, 2, 3, 4, 5, 6, Flasher unit (option), Glow plug timer (not in use)
②	GB	2	2C , 12F1
③	5R	4	10F3 × 2, Fuse box 1-5, 10
④	BY, 1.25BY	3	12F1 , Fuse box 1-13, Relay box A-5
⑤	1.25RB	3	12F1 , Diode unit, Relay box A-5
⑦	G	2	12F1 , Glow plug timer (not in use)
⑨	YR	4	5F4 , ECO controller-9, Diode unit, Vibrator calculation jig
⑩	YB	4	5F4 , ECO controller-10, Diode unit, Vibrator calculation jig
⑪	Y	3	2C , 12F1 , Vibrator calculation jig
⑫	R	3	2C , 5F4 , Fuse box 1-9
⑬	W	3	2C , 12F1 , Relay box A-1
⑭	LW	2	12F1 , Relay box A-4
⑮	L	2	12F1 , Relay box A-4
⑯	LY	2	12F1 , Relay box A-4
⑳	1.25RW	2	12F1 , Fuse box 1-12
㉓	5RG	2	8F2 , Fuse box 1-2
㉔	BR, 1.25BR	3	5F4 , Diode unit, Relay box A-3
㉕	1.25BW	2	Fuse box 1-12, Relay box A-2
㉖	Lg, 1.25Lg	3	5F4 , Relay box A-1, Glow plug timer (not in use)
㉗	Y	2	5F4 , Glow plug timer (not in use)
㉘	LgW	2	12F1 , Relay box A-6
㉙	LgB	3	12F1 , Relay box A-5, 6
⑳	RY	4	5F4 , Fuse box 1-10, Relay box A-7 × 2
㉑	Br	2	5F4 , Diode unit
㉒	BY	2	5F4 , Relay box A-6
㉓	Lg	2	5F4 , Relay box A-7
㉔	LgW	2	5F4 , Relay box A-7

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
⑳	YW	2	5F4 , Fuse box 1-8
㉑	LgR	2	5F4 , Relay box A-3
㉒	L	2	5F4 , Fuse box 1-6
㉓	1.25RG	2	5F4 , Fuse box 1-4
㉔	1.25RG, 2RG	3	12F1 , Fuse box 1-1, Flasher unit (option)
㉕	1.25G	2	5F4 , Flasher unit (option)
㉖	G	3	11T7 , ECO controller-3, For P.C. (ECO controller)
㉗	WR	2	5F4 , Fuse box 1-13
㉘	RG	2	2C , 5F4
㉙	LgW	2	5F4 , Relay box A-2
㉚	B	2	13AC2 , ECO controller-1
㉛	G	3	2C , 5F4 , ECO controller-8
㉜	YB	2	Fuse box 1-2, ECO controller-2
㉝	RL	2	12F1 , ECO controller-11
㉞	RY	2	12F1 , ECO controller-12
㉟	L	3	11T7 , ECO controller-4, For P.C. (ECO controller)
㊱	BG	3	12F1 , Relay box A-3, 4
㊲	1.25BY	2	Relay box A-1, 2
㊳	1.25R	2	3AC1 , Fuse box 1-5
㊴	WR	3	3AC1 , 13AC2 , Fuse box 1-7
㊵	LW	2	3AC1 , 13AC2
㊶	1.25YR	2	3AC1 , 13AC2
㊷	1.25WB	2	3AC1 , Fuse box 1-3
㊸	1.25RB	3	1_11 × 2, Fuse box 1-11
㊹	Lg	2	ECO controller-5, Vibrator calculation jig
㊺	W	2	ECO controller-6, Vibrator calculation jig
㊻	BY	2	ECO controller-7, Vibrator calculation jig

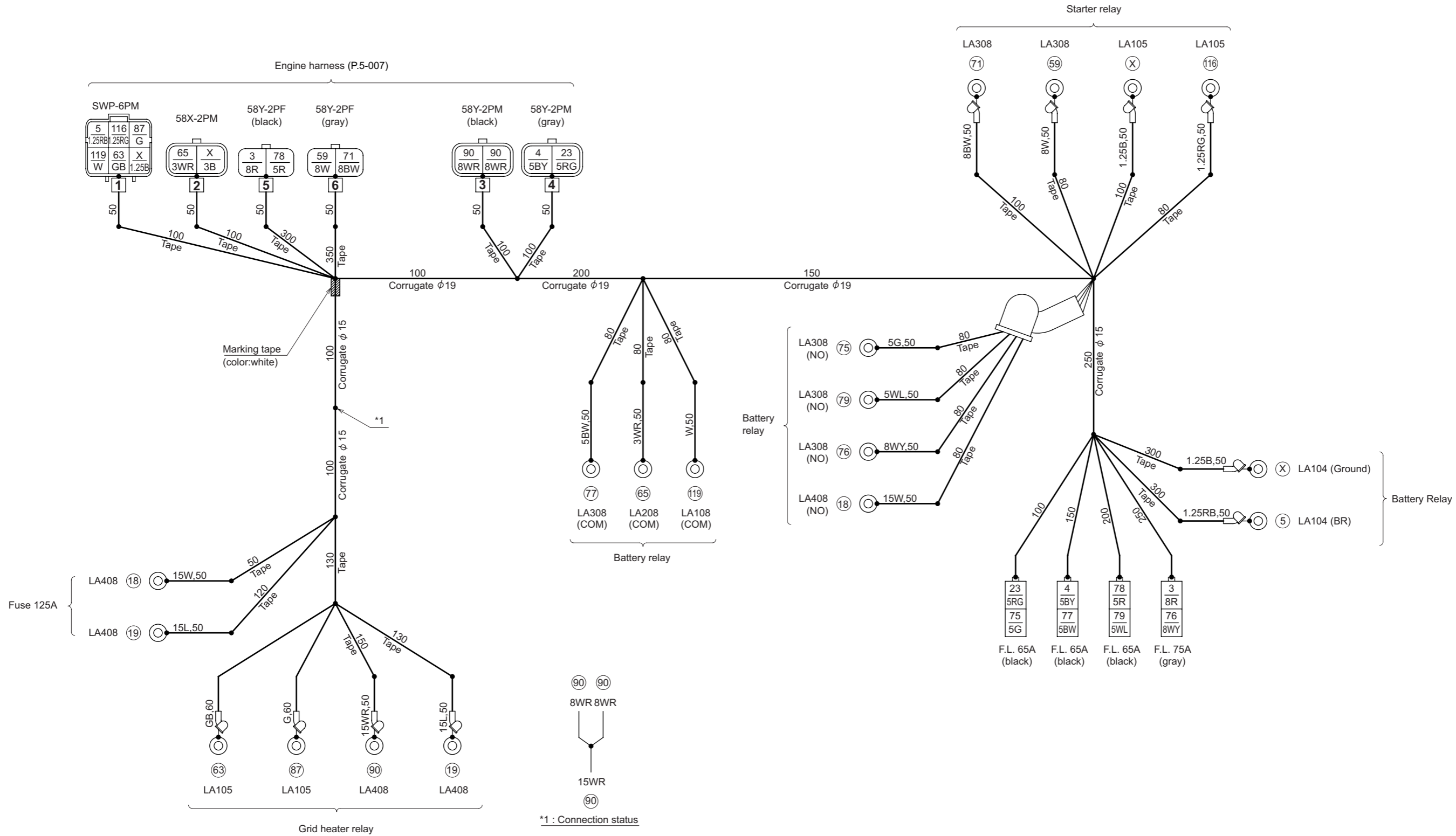
4-5. Fuse • Relay Harness (2)



NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
ⓧ	B, 3B	7	#7T2, Relay box B-1, 2, 4, 5 × 2, #9P (option)
⑧	YL	2	4T4, Relay box B-4
⑬	W	3	#10T1, T/C controller C1-7, #9P (option)
⑳	1.25RW	2	#4T6, Relay box B-6
㉑	LgB	2	#10T1, Relay box B-5
㉓	BY	2	4T4, Relay box B-5
㉙	L	2	4T4, T/C controller C1-6
④⑩	G	2	T/C controller C1-2, Fuse box 2-17
④④	1.25RB	3	4T4, Fuse box 2-16, Relay box B-3
⑤⑩	LW	2	4T4, T/C controller C1-11
⑤①	LY	2	4T4, T/C controller C1-10
⑤④	BW	2	#10T1, T/C controller C2-4
⑤⑤	GW	2	#10T1, T/C controller C1-5
⑤⑥	GR	2	#10T1, T/C controller C2-2
⑤⑦	G	4	11T7, T/C controller C1-3, Terminating resistor × 2
⑤⑧	BL	2	#10T1, T/C controller C2-3
⑥⑩	GB	2	4T4, T/C controller C2-1
⑥②	LgW	2	4T4, T/C controller C2-5
⑥③	GB	4	#10T1, Relay box B-3, 4, 6
⑥④	RB	2	#10T1, Relay box B-4
⑥⑤	3WR	2	#6T3, Fuse box 2-14
⑥⑦	3W	2	#6T3, Fuse box 2-14

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
⑥⑧	Lg	3	4T4, #10T1, T/C controller C1-8
⑥⑨	L	3	4T4, #10T1, T/C controller C1-9
⑦③	RL, 1.25RL	3	4T4, Relay box B-2, 3
⑦④	WB	2	4T4, Relay box B-1
⑦⑧	5R	2	#7T2, Fuse box 2-17
⑧⑥	L	2	#10T1, Relay box B-6
⑨①	LW	2	#10T1, Relay box B-1
⑨②	WL	2	#10T1, Relay box B-1
⑨⑦	RW	2	4T4, Relay box B-2
⑨⑧	BY	2	#10T1, Fuse box 2-20
⑨⑨	YW	2	#10T1, T/C controller C1-12
⑩④	B	2	#4T6, T/C controller C1-1
⑩⑤	G	2	4T4, Relay box B-2
⑪③	L	4	11T7, T/C controller C1-4, Terminating resistor × 2
⑪④	BG	2	#10T1, Fuse box 2-20
⑪⑥	1.25RG	2	#10T1, Relay box B-6
⑪⑦	WB	2	#10T1, Relay box B-3
⑪⑧	WR	2	#10T1, Fuse box 2-15
⑪⑨	W	2	#10T1, Fuse box 2-15
⑫⑩	LB	2	4T4, Relay box B-1
⑫⑧	1.25RG	3	#8_18 × 2, Fuse box 2-18
⑫⑨	R	2	Fuse box 2-19, #9P (option)

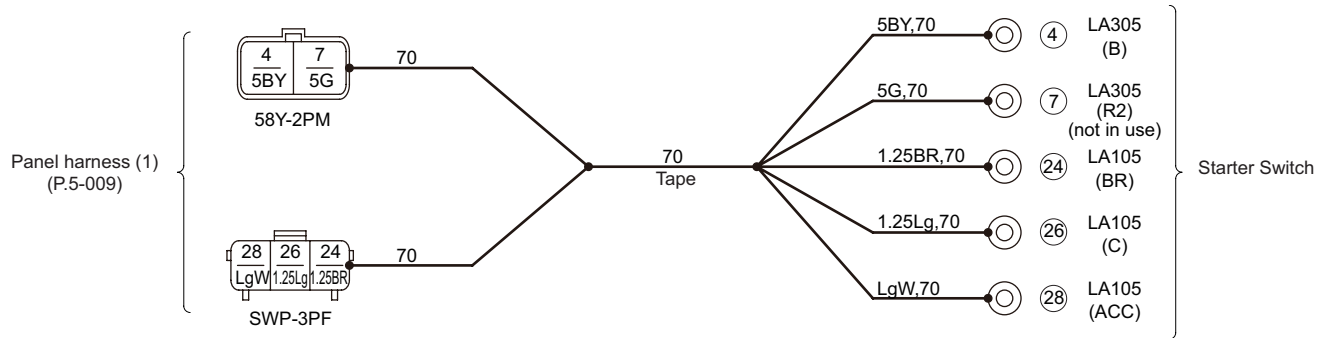
4-6. Battery Relay Harness



NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
ⓧ	1.25B, 3B	4	1, 2, Battery relay-Ground, Starter relay
③	8R	2	5, F.L. 75A
④	5BY	2	4, F.L. 65A
⑤	1.25RB	2	1, Battery relay-BR
⑱	15W	2	Battery relay-NO, Fuse 125A
⑲	15L	2	Fuse 125A, Grid heater relay
⑳	5RG	2	4, F.L. 65A
⑤⑨	8W	2	6, Starter relay
⑥③	GB	2	1, Grid heater relay
⑥⑤	3WR	2	2, Battery relay-COM

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
⑦①	8BW	2	6, Starter relay
⑦⑤	5G	2	Battery relay-NO, F.L. 65A
⑦⑥	8WY	2	Battery relay-NO, F.L. 75A
⑦⑦	5BW	2	Battery relay-COM, F.L. 65A
⑦⑧	5R	2	5, F.L. 65A
⑦⑨	5WL	2	Battery relay-NO, F.L. 65A
⑧⑦	G	2	1, Grid heater relay
⑨⑩	8WR, 15WR	3	3 × 2, Grid heater relay
⑪⑥	1.25RG	2	1, Starter relay
⑪⑨	W	2	1, Battery relay-COM

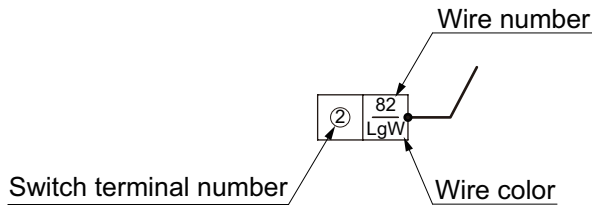
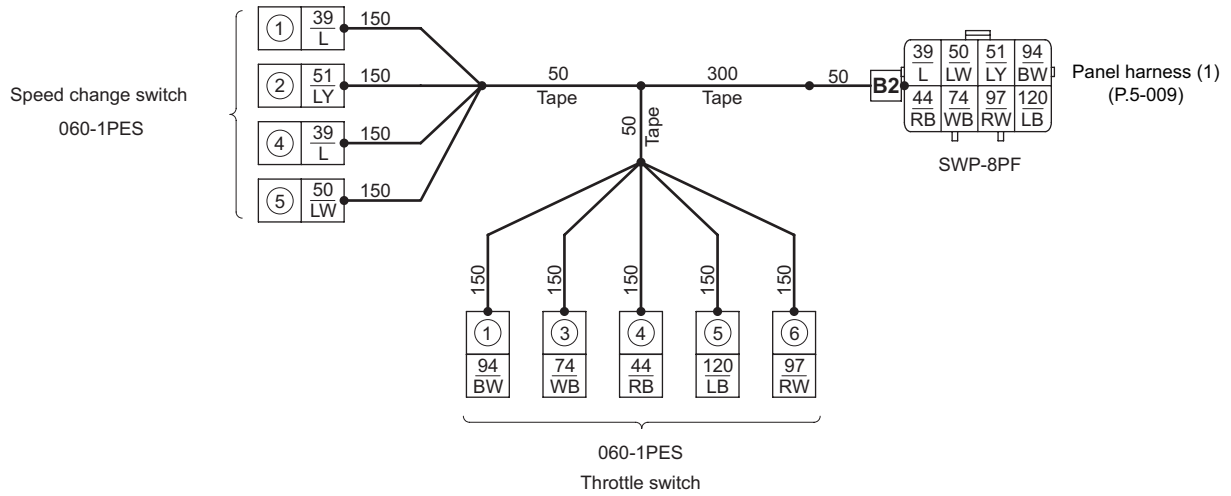
4-7. Starter Switch Harness



SV540-05007

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
④	5BY	2	Panel harness (1), Starter switch-B
⑦	5G	2	Panel harness (1), Starter switch-R2
②④	1.25BR	2	Panel harness (1), Starter switch-BR
②⑥	1.25Lg	2	Panel harness (1), Starter switch-C
②⑧	LgW	2	Panel harness (1), Starter switch-ACC

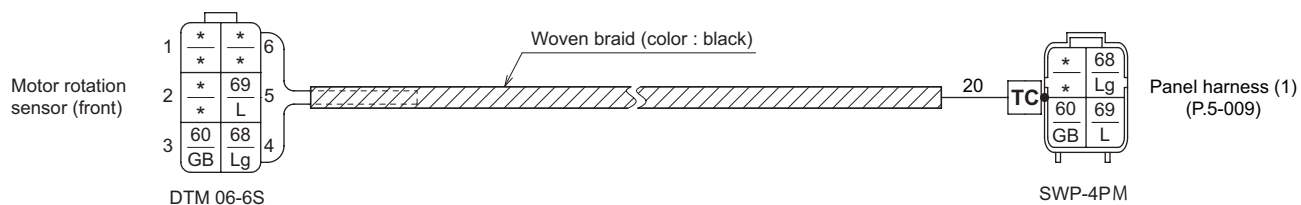
4-9. Control Switch Harness



SV540-05009

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
③⑨	L	3	B2 , Speed change switch-1, Speed change switch-4
④④	RB	2	B2 , Throttle switch-4
⑤⑩	LW	2	B2 , Speed change switch-5
⑤①	LY	2	B2 , Speed change switch-2
⑦④	WB	2	B2 , Throttle switch-3
⑨④	BW	2	B2 , Throttle switch-1
⑨⑦	RW	2	B2 , Throttle switch-6
⑫⑩	LB	2	B2 , Throttle switch-5

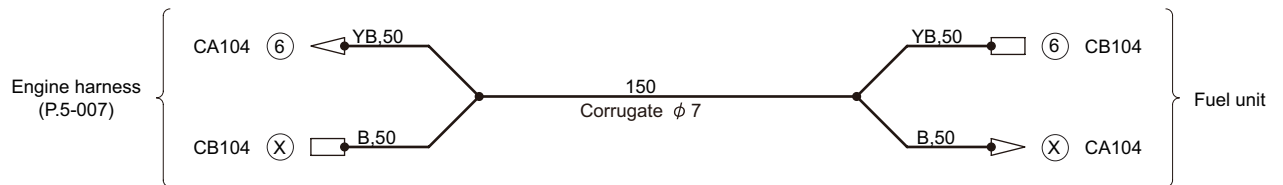
4-10. Motor Rotation Sensor Harness (front)



SV540-05010

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
⑥0	GB	2	TC , Motor rotation sensor (front)
⑥8	Lg	2	TC , Motor rotation sensor (front)
⑥9	L	2	TC , Motor rotation sensor (front)

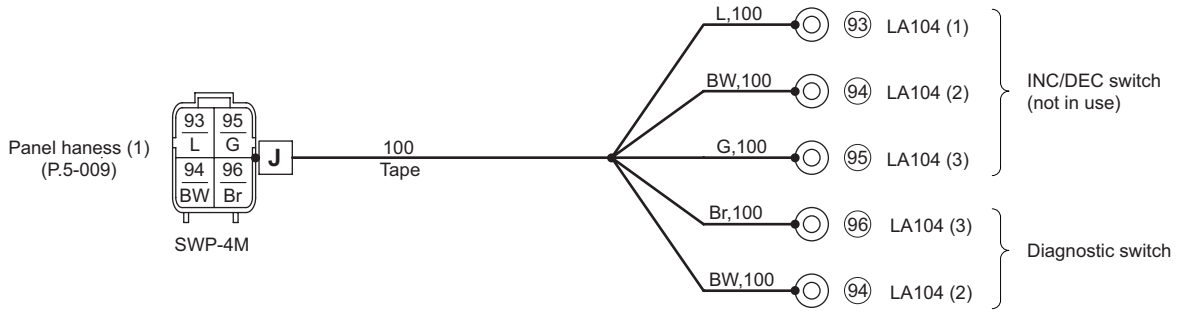
4-11. Fuel Unit Harness



SV540-05011

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
⊗	B	2	Engine harness, Fuel unit
⊕	YB	2	Engine harness, Fuel unit

4-12. Diagnostic Switch Harness

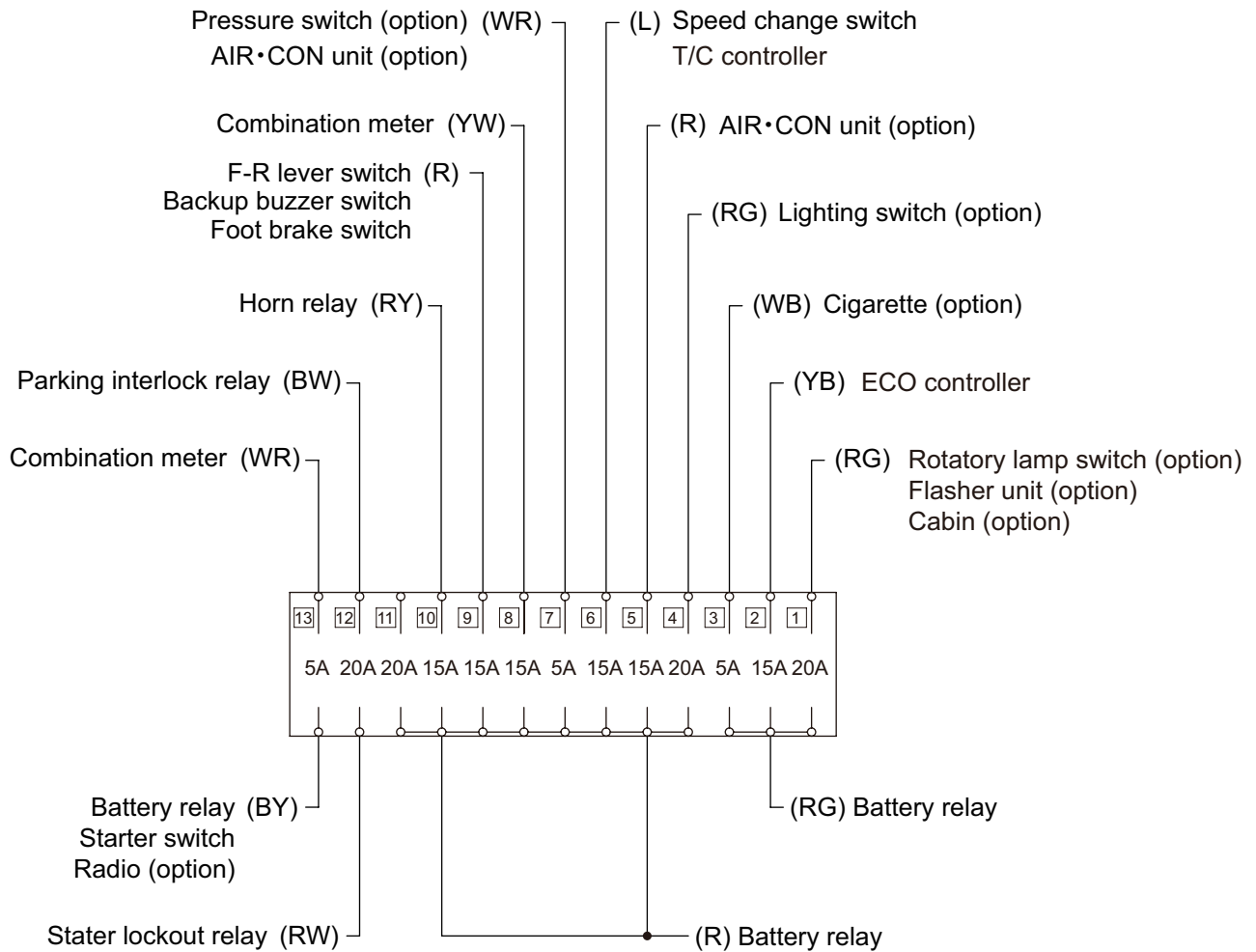


SV540-05012

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
⑨③	L	2	J , INC/DEC switch-1 (not in use)
⑨④	BW	3	J , Diagnostic switch-2, INC/DEC switch-2 (not in use)
⑨⑤	G	2	J , INC/DEC switch-3 (not in use)
⑨⑥	Br	2	J , Diagnostic switch-3

5. ELECTRICAL COMPONENT SPECIFICATIONS

5-1. Fuse Box (1)

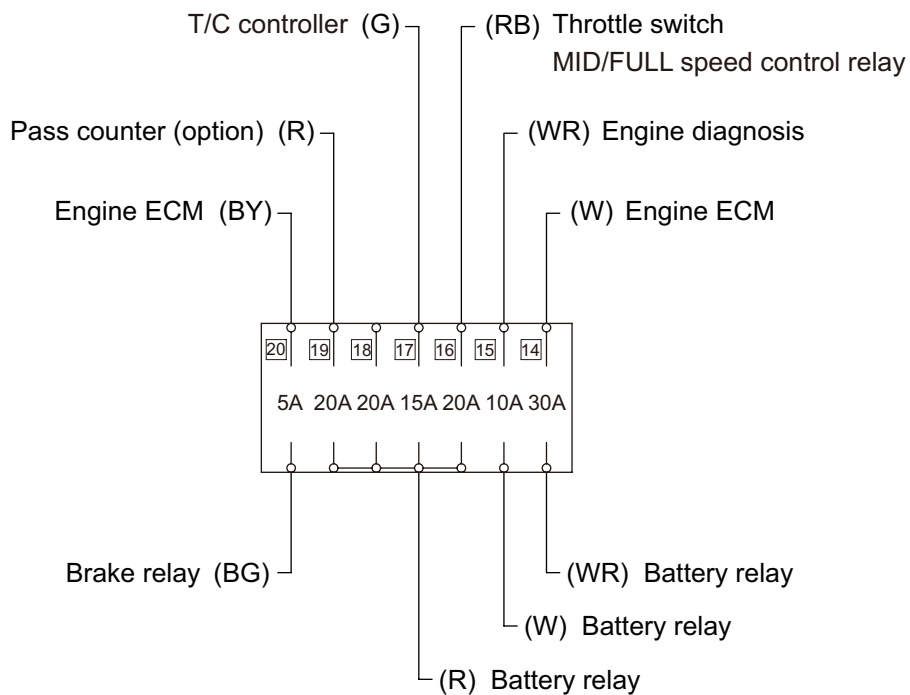


SV540-05013

Harness color codes

- | | |
|--------------------------|--------------------------|
| R : Red | RW : Red/White stripe |
| L : Blue | RY : Red/Yellow stripe |
| BW : Black/White stripe | RG : Red/Green stripe |
| BY : Black/Yellow stripe | YB : Yellow/Black stripe |
| WR : White/Red stripe | YW : Yellow/White stripe |
| WB : White/Black stripe | |

5-2. Fuse Box (2)

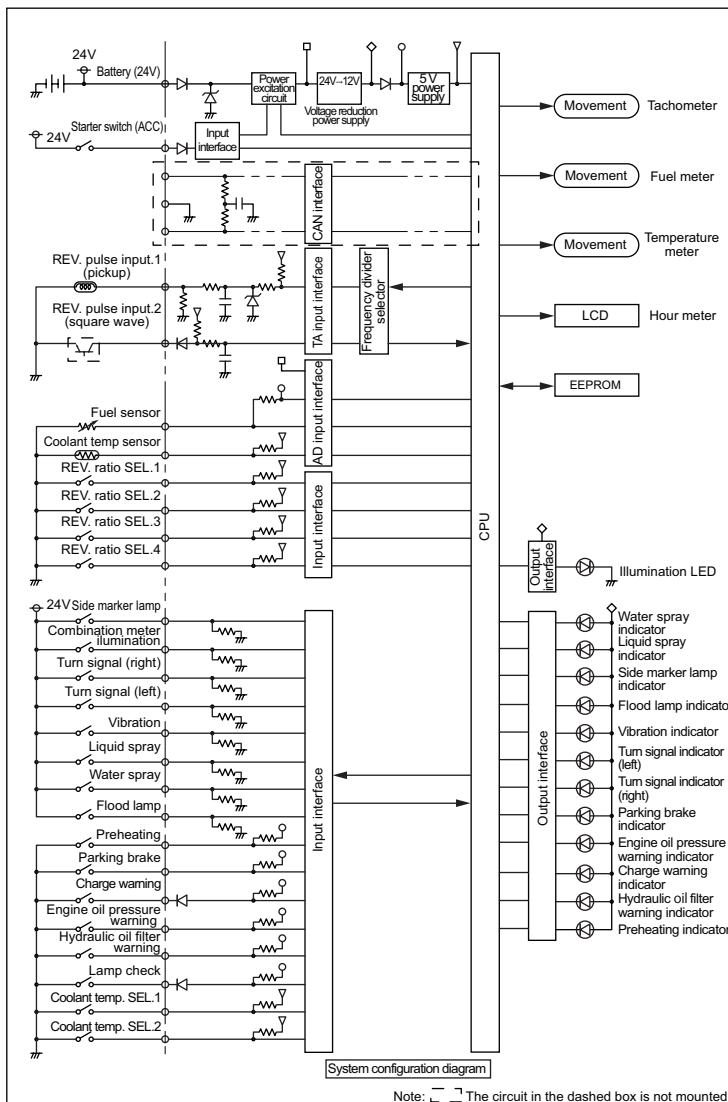
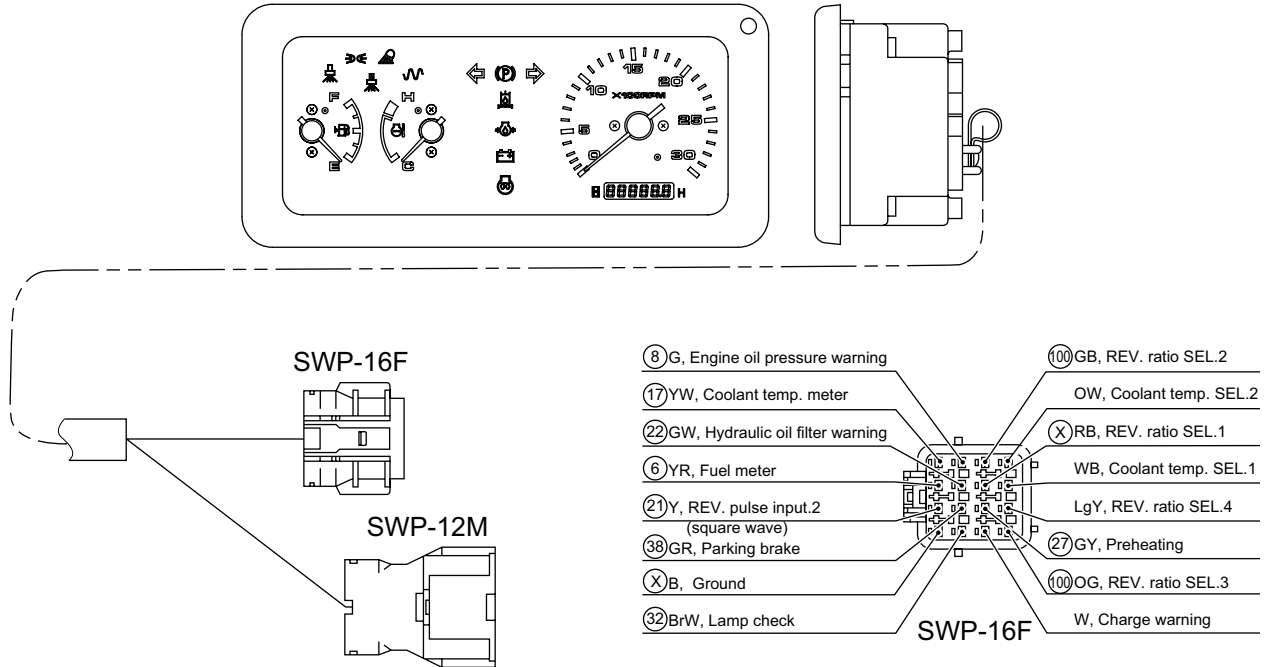


SV540-05014

Harness color codes

W : White	BG : Black/Green stripe
R : Red	WR : White/Red stripe
G : Green	RB : Red/Black stripe
BY : Black/Yellow stripe	

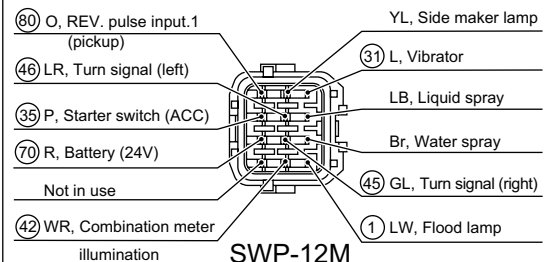
5-3. Combination Meter



Harness side

X	32	*	100
B	BY	*	BR
21	38	27	*
YG	GR	Y	*
6	22	X	*
YB	Y	B	*
17	8	100	*
YR	YL	BR	*

SWP-16PM



SWP-12M

Harness side

*	42	1
*	RW	R
70	45	*
WR	GB	*
35	46	*
YW	GR	*
80	*	31
GW	*	Br

SWP-12PF

VIBRATORY DRUM • REAR AXLE

1. PRECAUTIONS FOR DISASSEMBLY AND REASSEMBLY

- When removing, installing, disassembling or reassembling the unit, observe the general precautions described below.
- 1) Precautions for removal work
 - Coolant that contains antifreeze should be treated as a chemical, and must not be drained carelessly on the ground.
 - To prevent dust from getting into disconnected hoses and tubes, cover them with a plug or similar means.
 - When draining oil, use a receptacle with sufficient capacity to receive it.
 - Before proceeding with the work, look for matchmarks that show the installation location. For reassembly, place matchmarks in the required locations to prevent errors. Then remove.
 - When disconnecting wiring connectors, hold the connector components so that unreasonable force is not applied to the wires.
 - Label wires and hoses to ensure correct installation location.
 - Confirm the number and thickness of shims prior to storage.
 - When lifting parts, use lifting equipment of sufficient capacity.
 - When separating parts by using pull bolts, tighten the bolts alternately.
 - Before removing a unit, clean its surrounding area. Then after removal, cover it to prevent dust and other substances from getting in.
 - Before removing piping for hydraulic oil or coolant, or removing related parts, satisfactorily release internal pressure.
 - 2) Precautions for installation work
 - Tighten bolts and nuts (sleeve nuts) to the specified torque (screw tightening torque table).
 - When installing hoses, do not twist them or allow them to interfere with other parts.
 - Replace gaskets, O-rings, split cotter pins, and lock plates with new parts.
 - Properly bend split cotter pins and lock plates.
 - When applying an adhesive, first clean and remove oil/grease from the surfaces properly. Then apply two or three drops to the threaded areas.
 - When applying a liquid gasket, first clean and remove oil/grease from the application surface properly, and confirm that the surface is free of dust and damage. Then apply the product evenly.
 - Clean parts well. Repair scratches, dents, burrs, rust, etc.
 - Apply gear oil to rotating and sliding components.
 - Apply grease to the surfaces of press-fit parts.
 - After installing snap rings, confirm that they are properly seated in the grooves.
 - Connect wiring connectors securely after cleaning off adhering oil, dust and water.
 - Use lifting bolts that are not fatigued or deformed. Screw them in fully.
 - When tightening a split flange, tighten screws alternately to prevent uneven tightening.
 - Before installing hydraulic parts, confirm that they are free of damage and dust, etc.

3) Precautions when work is completed

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

2. VIBRATORY DRUM

2-1. Removal and Installation of Vibratory Drum

2-1-1. Removal of vibratory drum

- 1) Joint front frame and rear frame with lock pin (1).

⚠ WARNING

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) Lift rear frame with a crane.
 - Firmly secure machine body by placing support stands and/or wooden blocks at rear end of rear frame.

(NOTICE)

- Do not allow rear wheel tires to leave the ground. (The tires must support the machine's body weight, too.)

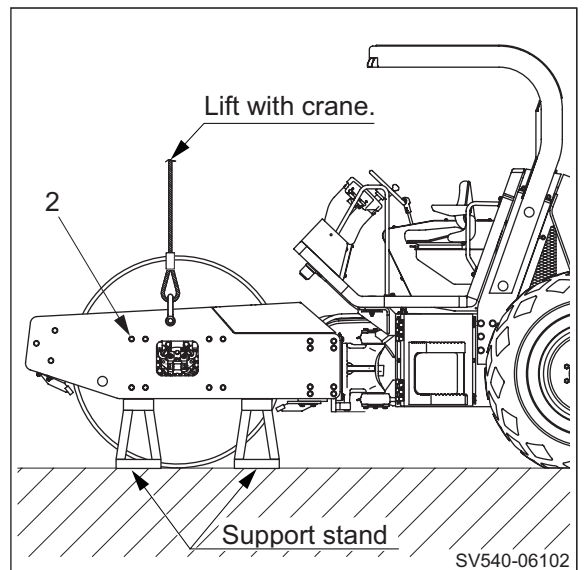
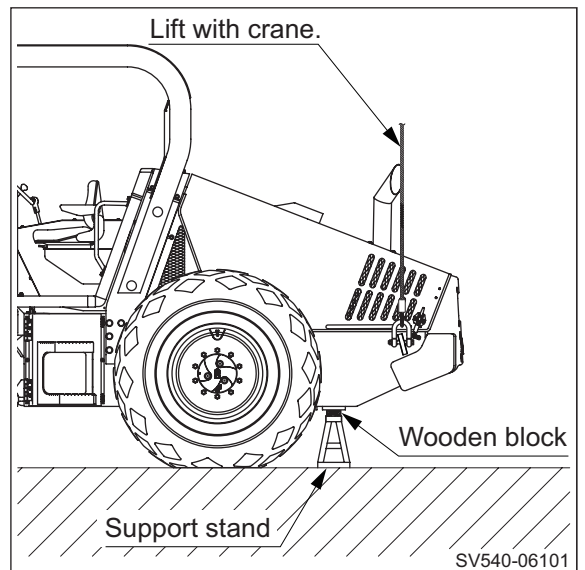
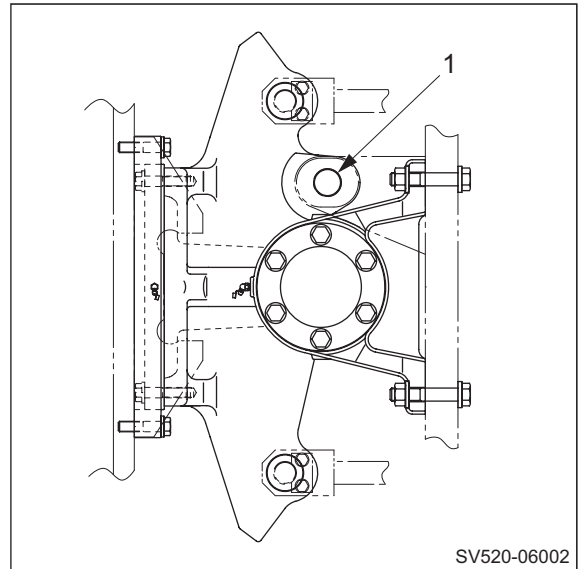
\int_{kg} Rear axle weight

SV540D	: 5,240 kg (11,550 lbs.)
SV540T	: 5,235 kg (11,540 lbs.)
SV540TF	: 5,230 kg (11,530 lbs.)
SV540DF	: 5,170 kg (11,400 lbs.)
SV640D	: 6,000 kg (13,230 lbs.)
SV640T	: 6,040 kg (13,320 lbs.)

- 3) Lift front frame with a crane.
 - Ensuring that no load is applied to eight bolts (2) (left and right sides), place support stands at right and left sides of front frame. Firmly secure machine body.

\int_{kg} Front axle weight

SV540D	: 5,470 kg (12,060 lbs.)
SV540T	: 5,855 kg (12,910 lbs.)
SV540TF	: 8,120 kg (17,900 lbs.)
SV540DF	: 7,215 kg (15,905 lbs.)
SV640D	: 7,150 kg (15,760 lbs.)
SV640T	: 7,485 kg (16,500 lbs.)



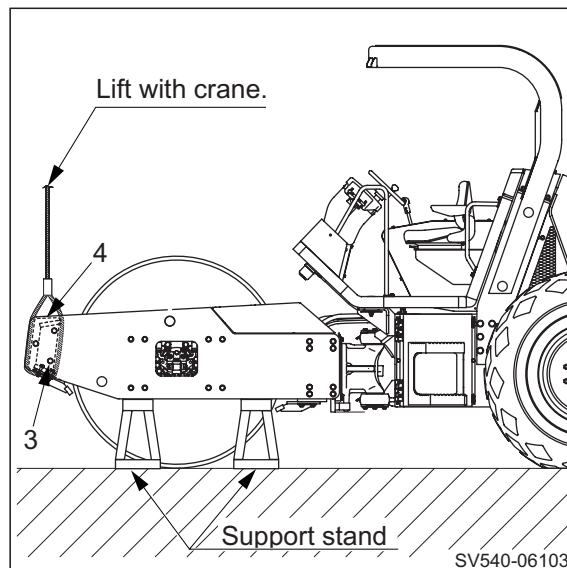
VIBRATORY DRUM • REAR AXLE

- 4) Lift cross member (4) with a crane and hold it.
 - Remove two bolts (3) (left and right sides).
 - Lift cross member (4) and remove it from frame.



Cross member

SV540D	: 285 kg (628 lbs.)
SV540T	: 385 kg (849 lbs.)
SV540TF	: 430 kg (948 lbs.)
SV540DF	: 455 kg (1,003 lbs.)
SV640D	: 1,345 kg (2,965 lbs.)
SV640T	: 1,440 kg (3,175 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.

5) Disconnecting piping

5-1) Propulsion motor piping

- Disconnect hydraulic hoses (5), (6), (7), (8) and (9) connecting to propulsion motor.

(NOTICE)

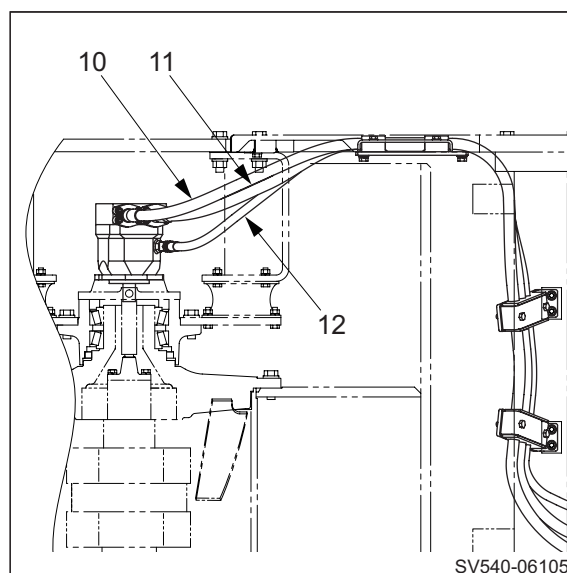
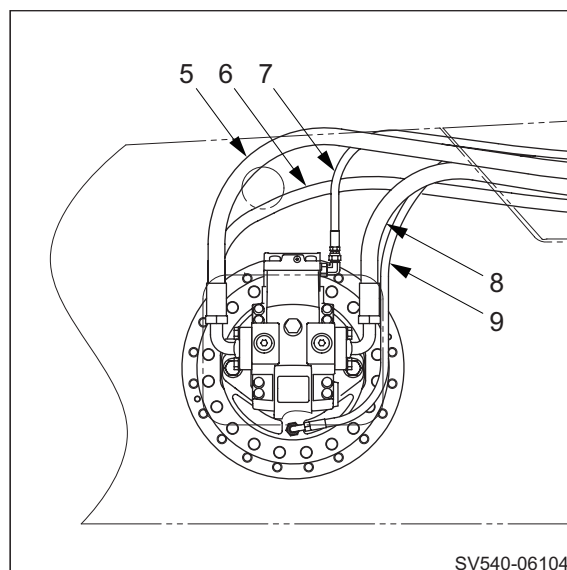
- Plug both ends of the disconnected hoses or implement other actions to prevent entry of foreign matter.

5-2) Vibrator motor piping

- Disconnect hydraulic hoses (10), (11) and (12) connecting to vibrator motor.

(NOTICE)

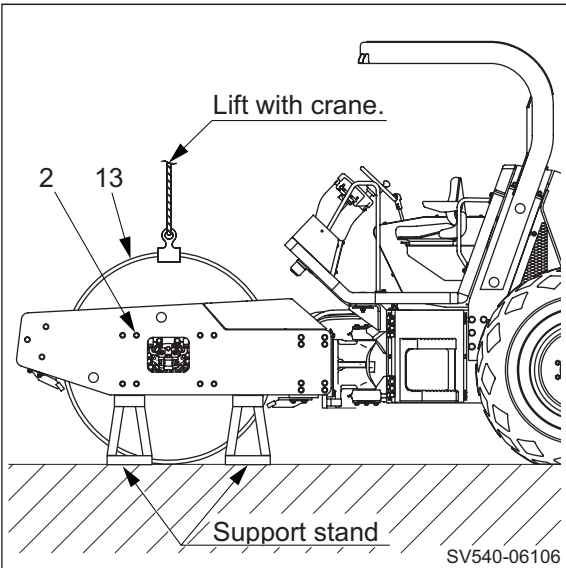
- Plug both ends of the disconnected hoses or implement other actions to prevent entry of foreign matter.



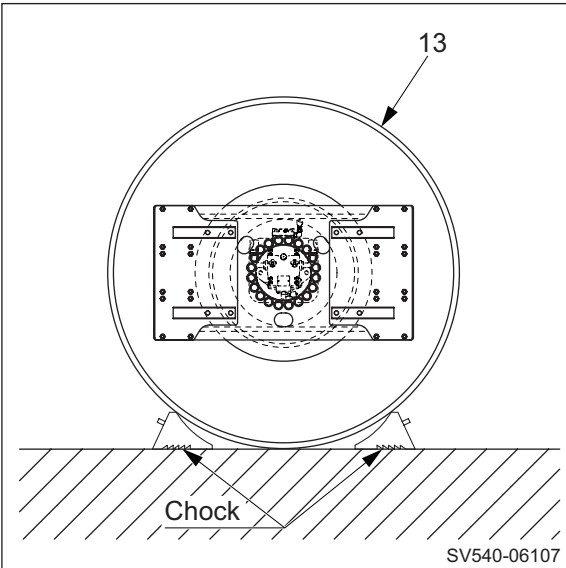
- 6) Remove eight bolts (2) (left and right sides).
 - Lift off vibratory drum (13) from frame.

\mathfrak{J}_{kg} Vibratory drum assembly

SV540D	: 4,460 kg (9,833 lbs.)
SV540T	: 4,785 kg (10,549 lbs.)
SV540TF	: 7,190 kg (15,851 lbs.)
SV540DF	: 6,145 kg (13,547 lbs.)
SV640D	: 4,505 kg (9,932 lbs.)
SV640T	: 4,835 kg (10,659 lbs.)



- 7) Put chocks or the like under removed drum (13) to prevent it from moving.



2-1-2. Installation of vibratory drum

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



Vibratory drum

- (2) Bolts (propulsion motor side)
M20×120 : 539 N·m (398 lbf·ft)
- Bolts (vibrator motor side)
M20× 90 : 539 N·m (398 lbf·ft)

Cross member

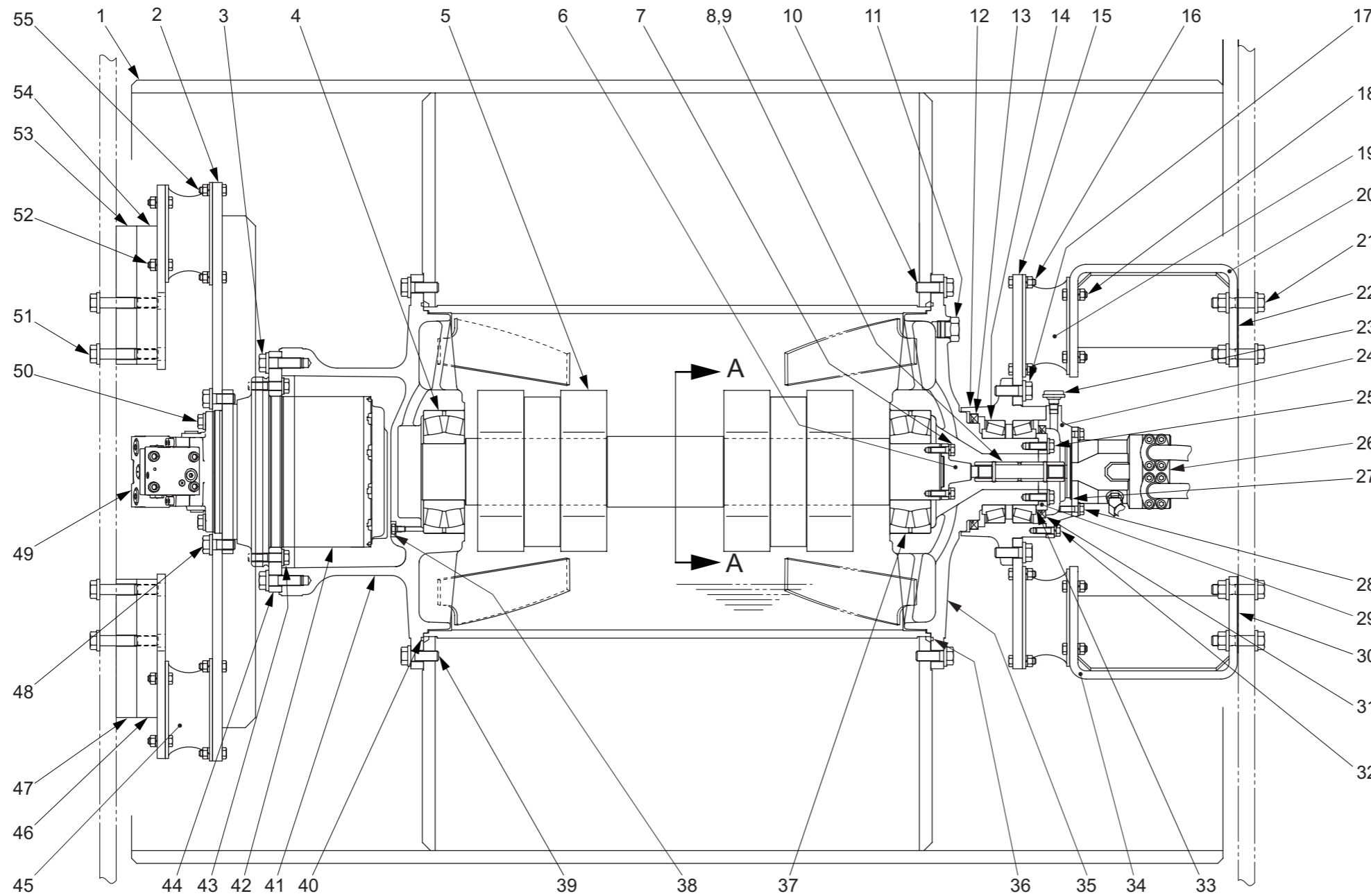
- (3) Bolts M20×100 : 539 N·m (398 lbf·ft)

- 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 the oil is at specified level.

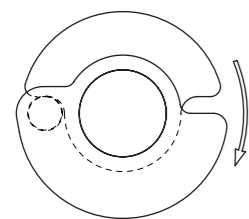
(NOTICE)

- **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.**

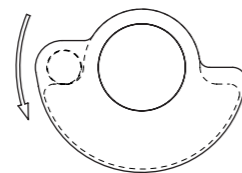
2-2. Vibratory Drum Assembly



- (1) Drum
- (2) Disc
- (3) Bolt : M20×70
- (4) Vibrator bearing
- (5) Eccentric shaft
- (6) Shaft
- (7) Bolt : M12×40
- (8) Sleeve
- (9) Spring pin
- (10) Bolt : M20×60
- (11) Plug
- (12) Housing
- (13) Oil seal
- (14) Roller bearing
- (15) Disc
- (16) Bolt : M12×45
- (17) Bolt : M20×60
- (18) Bolt : M12×40
- (19) Damper
- (20) Holder
- (21) Bolt : M20×90
- (22) Plate
- (23) Breather
- (24) Cover
- (25) Bolt : M14×40
- (26) Vibrator motor
- (27) O-ring
- (28) Bolt : M12×40
- (29) Cover
- (30) Plate
- (31) Oil seal
- (32) Bolt : M12×40
- (33) Shim
- (34) Holder
- (35) Axle shaft
- (36) O-ring
- (37) Vibrator bearing
- (38) Bolt : M10×20
- (39) Bolt : M20×60
- (40) O-ring
- (41) Axle shaft
- (42) Gear box
- (43) Bolt : M16×70 P=1.5
- (44) Ring
- (45) Damper
- (46) Holder
- (47) Spacer
- (48) Bolt : M20×50 P=1.5
- (49) Propulsion motor
- (50) Bolts : M16× 40
- (51) Bolt : M20×120
- (52) Bolt : M12× 40
- (53) Spacer
- (54) Holder
- (55) Bolt : M12×45

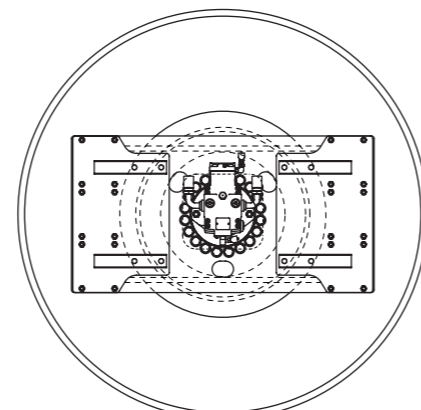


Vibration mode: Low
Motor clockwise rotation

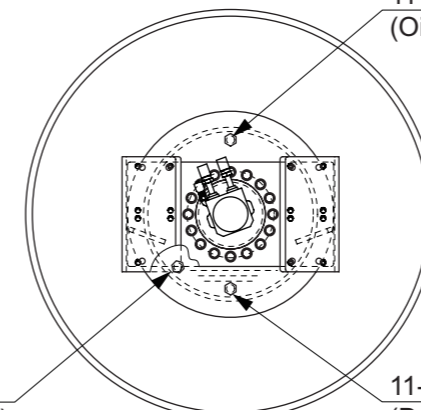


Vibration mode: High
Motor counterclockwise rotation

SECTION A-A



Propulsion motor side



11-3
(Level plug)

11-2
(Drain plug)

Vibrator motor side

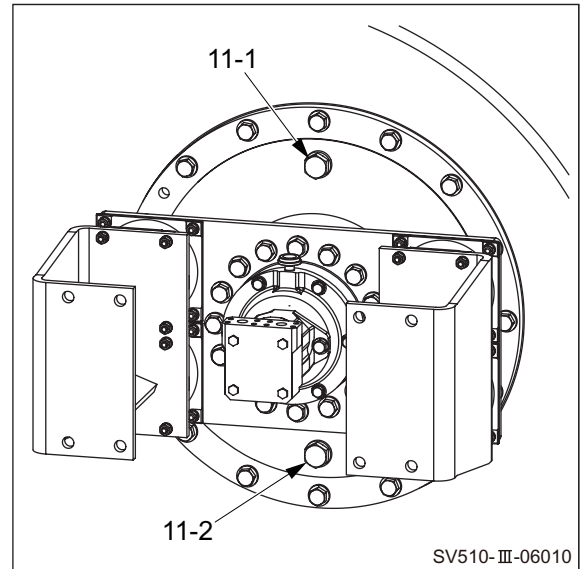
0418-43819-0-19013-0

2-3. 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.

2-3-1. Disassembly of vibratory drum

- 1) Remove plugs (11-1) and (11-2).
 - Drain gear oil in vibrator case.
 - Quantity of gear oil : 34 L (9.0 gal.)

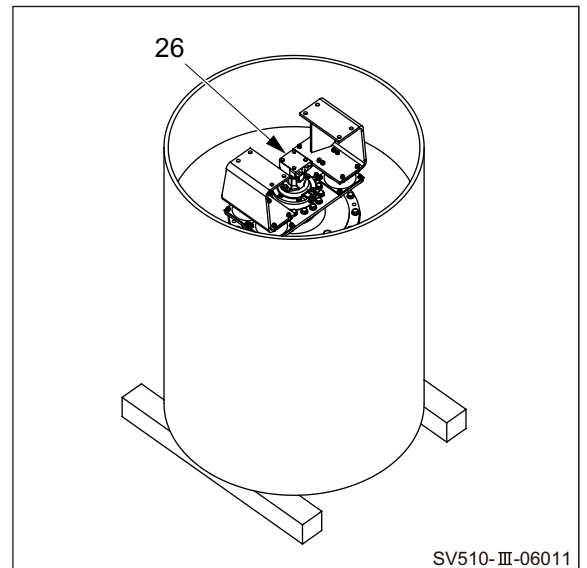


! WARNING

- 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.

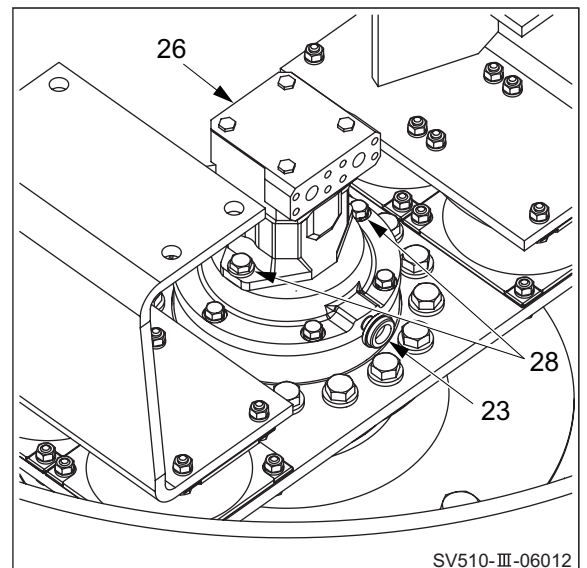
- 2) Lift vibratory drum with a crane and stand it with its vibrator motor (26) side facing up as shown on the right.

\mathfrak{J}_{kg}	Vibratory drum assembly
	SV540D : 4,425 kg (9,755 lbs.)
	SV540T : 4,750 kg (10,472 lbs.)
	SV540TF : 7,155 kg (15,774 lbs.)
	SV540DF : 6,110 kg (13,470 lbs.)
	SV640D : 4,475 kg (9,866 lbs.)
SV640T : 4,805 kg (10,593 lbs.)	



- 3) Remove two bolts (28).
 - Remove vibrator motor (26).
 - Remove breather (23).

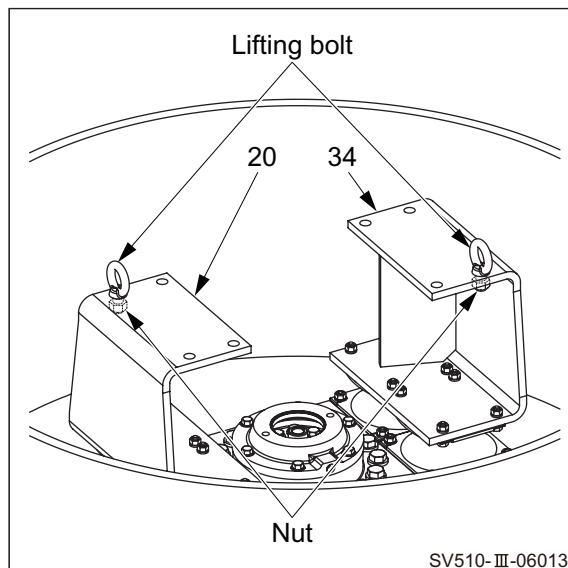
\mathfrak{J}_{kg}	(26) Vibrator motor : 20 kg (44 lbs.)
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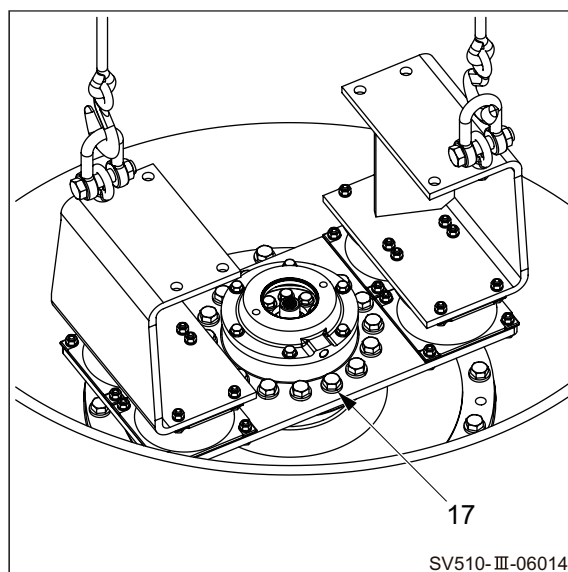
⚠ WARNING

When installing lifting bolts, secure them with nuts.


- 4) Install lifting bolts and nuts (M20) to holders (20) and (34).

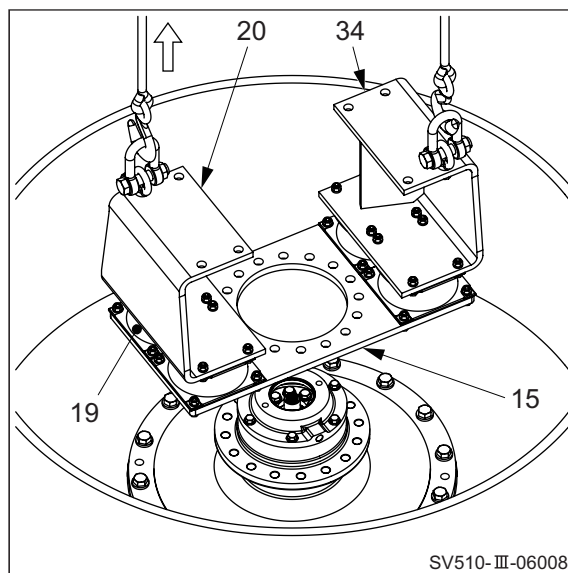


- 5) Remove sixteen bolts (17).

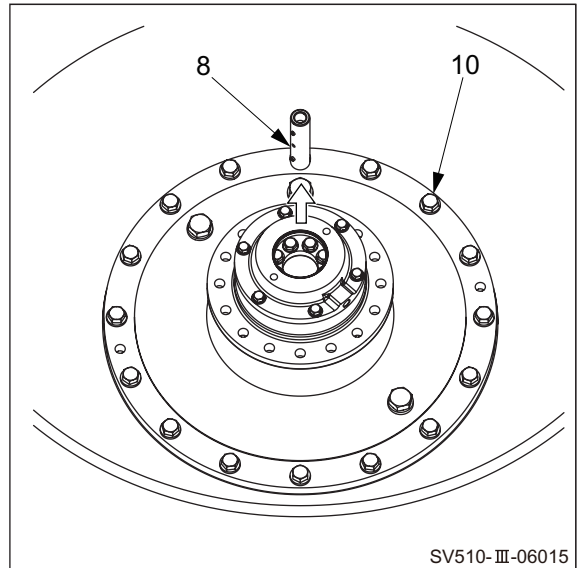


- 6) Lift holders (20), (34), dampers (19) and disc (15) together with a crane and remove them.

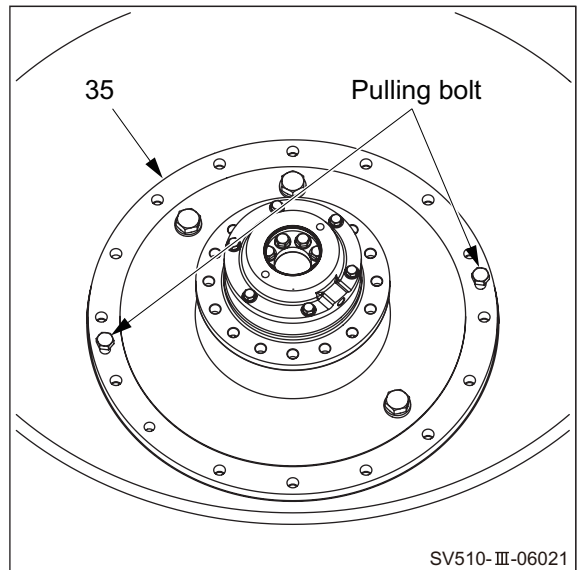
 Total weight of parts to be lifted
 SV540D, T, TF, DF : 155 kg (342 lbs.)
 SV640D, T : 205 kg (452 lbs.)



- 7) Pull out sleeve (8).
 - Remove sixteen bolts (10).



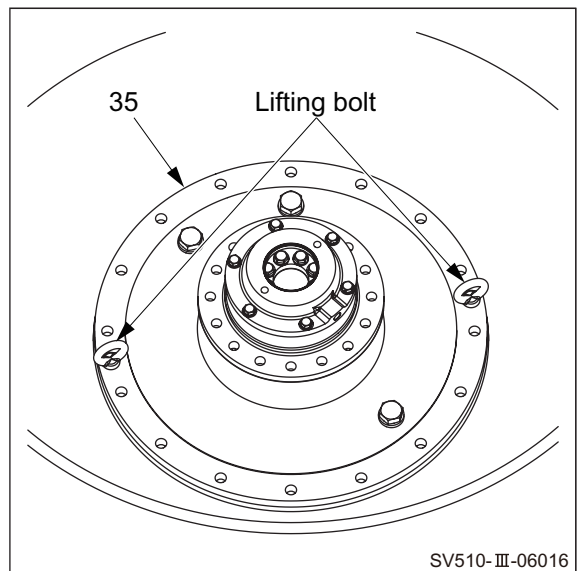
- 8) Lift axle shaft (35) using two pulling bolts (M20×60).



⚠ WARNING

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

- 9) Install lifting bolts (M20) to axle shaft subassembly (35).




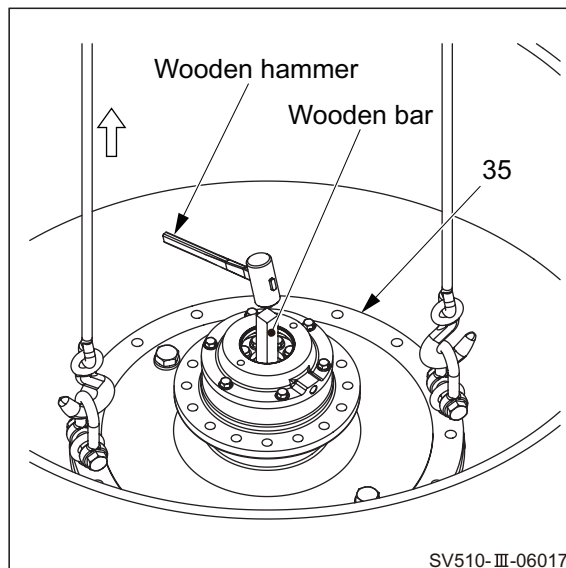
VIBRATORY DRUM • REAR AXLE

10) Slowly lift axle shaft subassembly (35) with a crane and remove it.

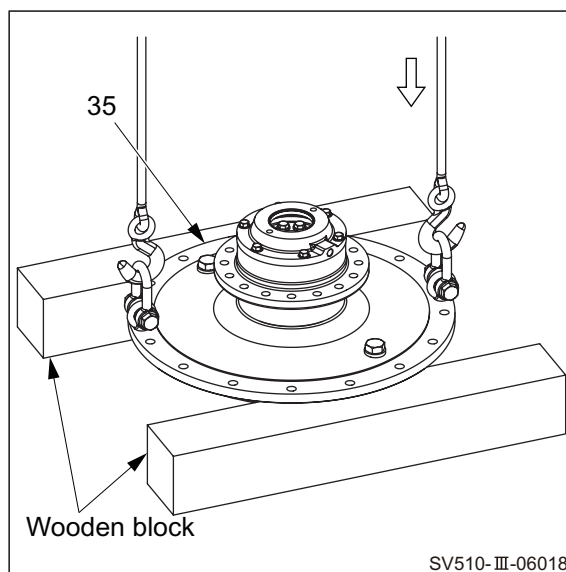
(NOTICE)

- In order not to lift eccentric shaft (5) together with axle shaft subassembly (35), tap on the eccentric shaft end with a wooden hammer via a wooden bar during lifting.

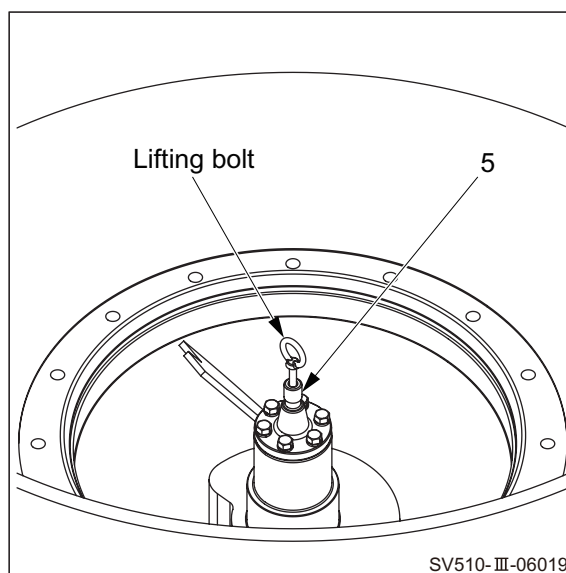
 (35) Axle shaft subassembly : 240 kg (529 lbs.)



11) Put removed axle shaft subassembly (35) on wooden blocks.




12) Install a lifting bolt (M10) to the end of eccentric shaft subassembly (5).

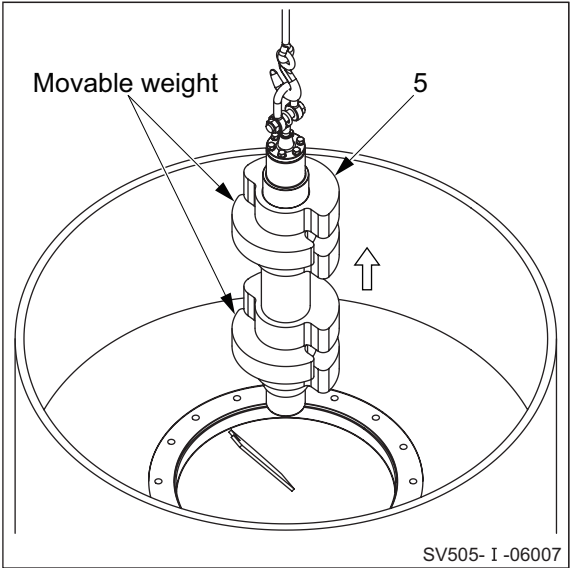


13) Lift eccentric shaft subassembly (5) with a crane and remove it.

(NOTICE)

- When lifting the eccentric shaft, put the movable weights at their outmost position.


 (5) Eccentric shaft subassembly : 280 kg (617 lbs.)



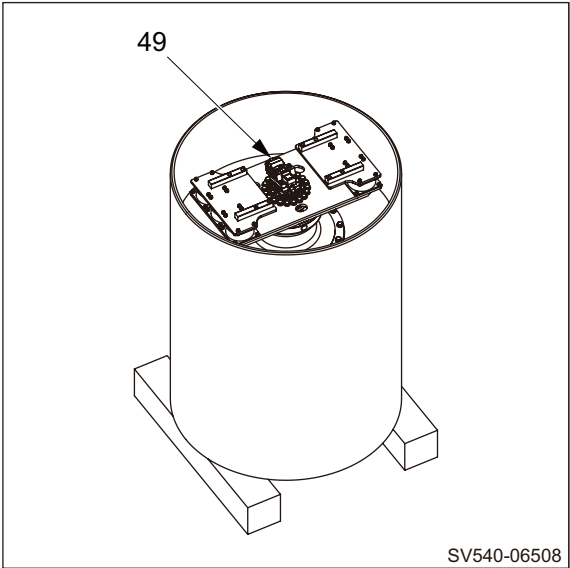
WARNING

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

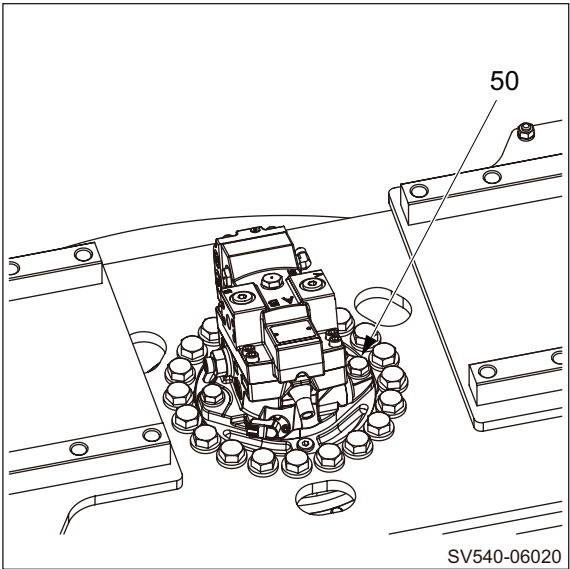
14) Lift vibratory drum with a crane and reverse it. Then, stand drum with its propulsion motor (49) side facing up.

 Total weight of parts to be lifted

SV540D	: 3,720 kg (8,201 lbs.)
SV540T	: 4,045 kg (8,918 lbs.)
SV540TF	: 6,450 kg (14,220 lbs.)
SV540DF	: 5,400 kg (11,905 lbs.)
SV640D	: 3,720 kg (8,201 lbs.)
SV640T	: 4,045 kg (8,918 lbs.)

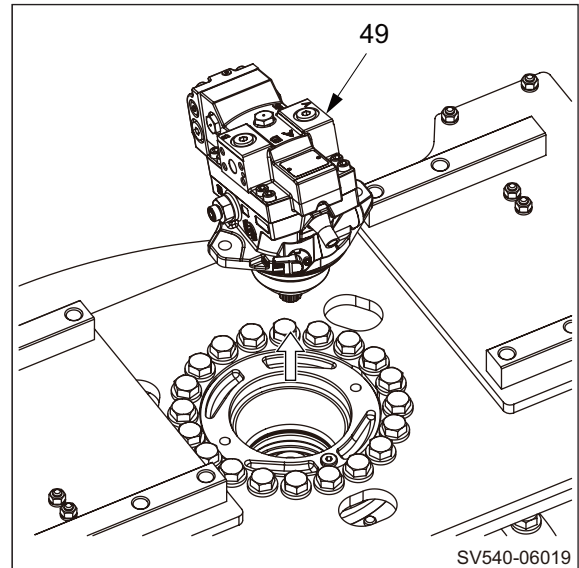


15) Remove two bolts (50).

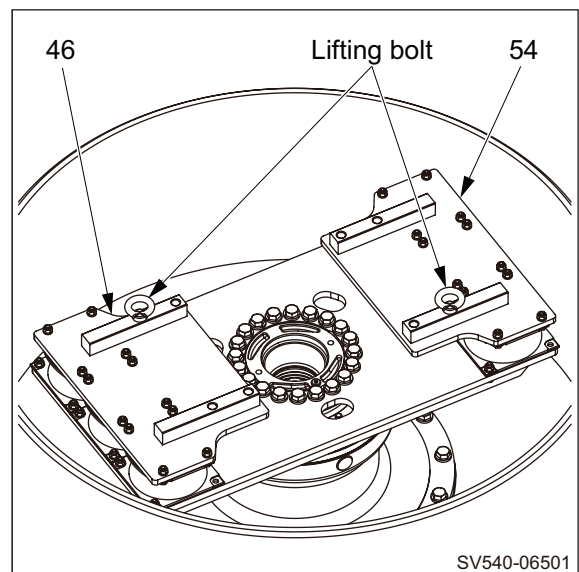


VIBRATORY DRUM • REAR AXLE

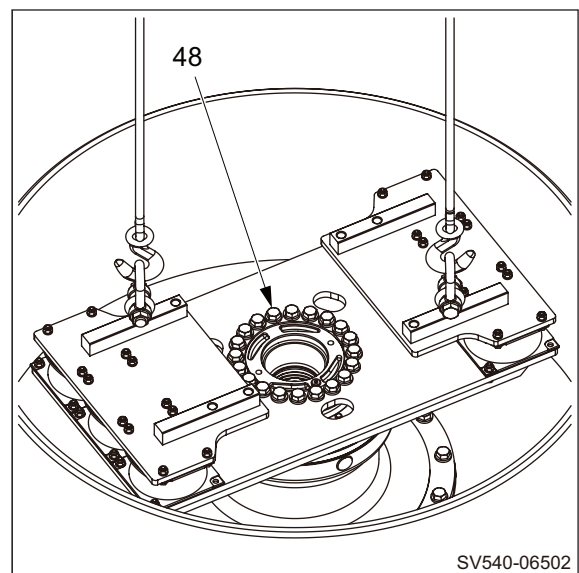
16) Remove propulsion motor (49).



17) Install lifting bolts (M20) to holders (46) and (54).

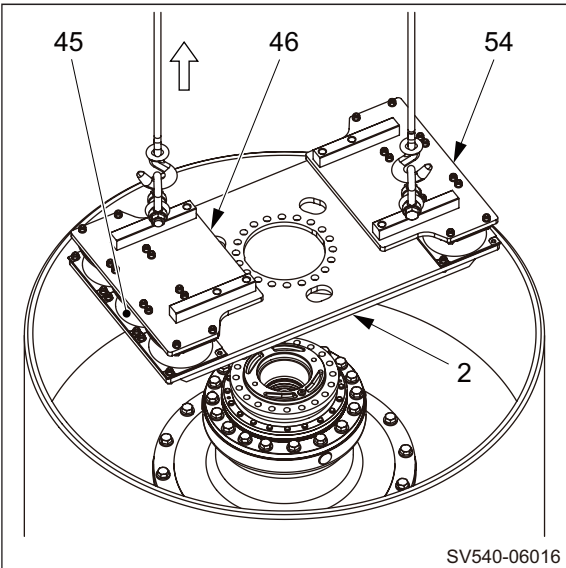


18) Remove twenty bolts (48).



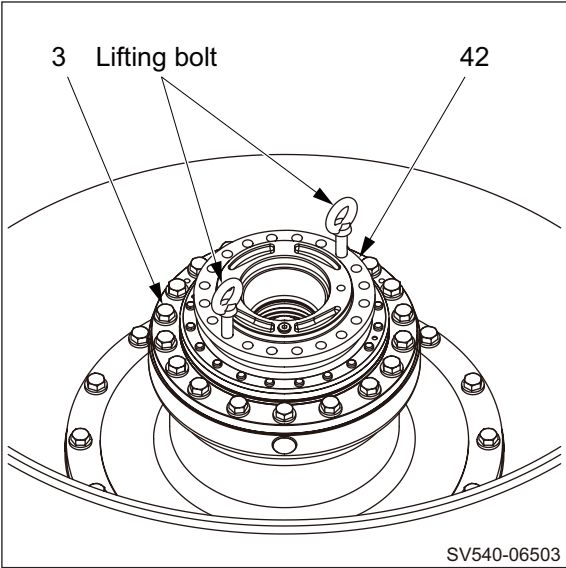
19) Lift holders (46), (54), dampers (45) and disc (2) together with a crane and remove them.

\int_{kg} Total weight of parts to be lifted : 220 kg (485 lbs.)



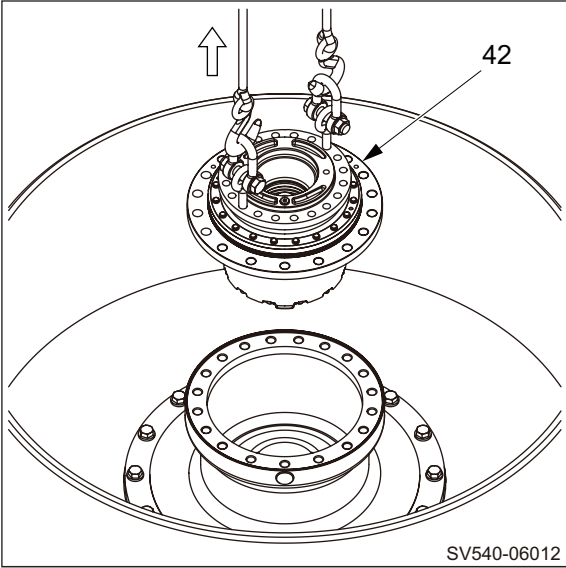
20) Install lifting bolts (M20) to gear box (42).

- Remove nineteen bolts (3).



21) Lift gear box subassembly (42) with a crane and remove it.

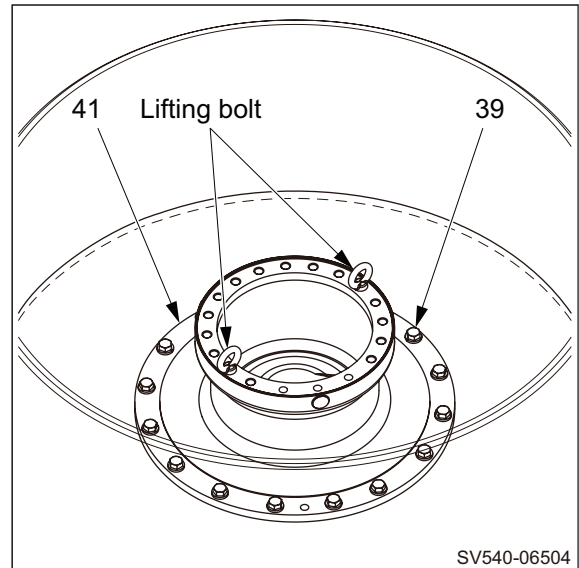
\int_{kg} (42) Gear box subassembly : 190 kg (419 lbs.)



VIBRATORY DRUM • REAR AXLE

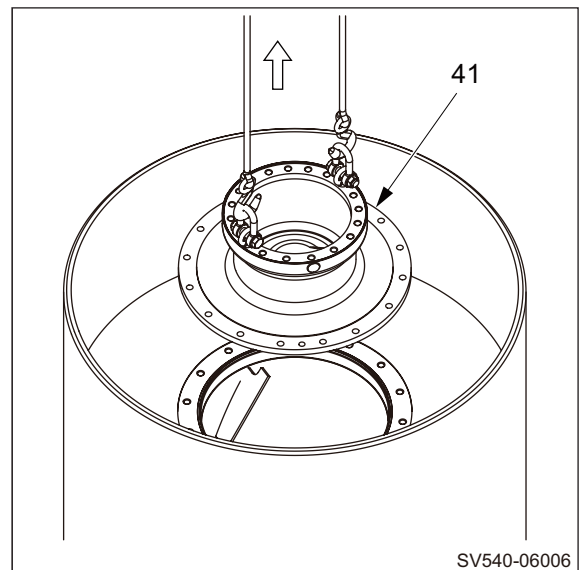
22) Install lifting bolts (M20) on axle shaft (41).

- Remove sixteen bolts (39).

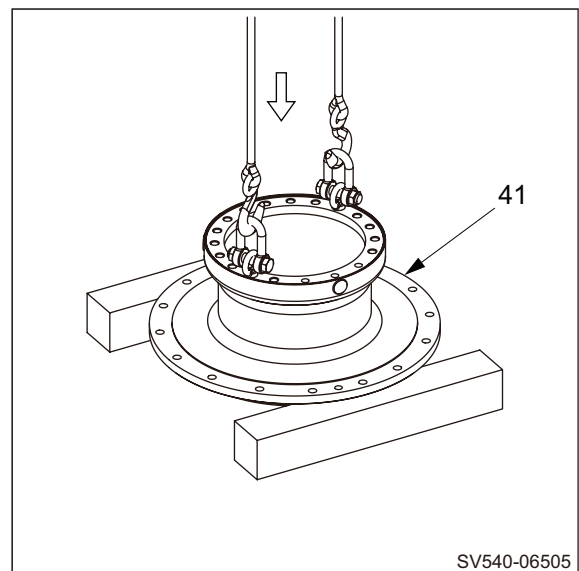


23) Lift axle shaft (41) with a crane and remove it.

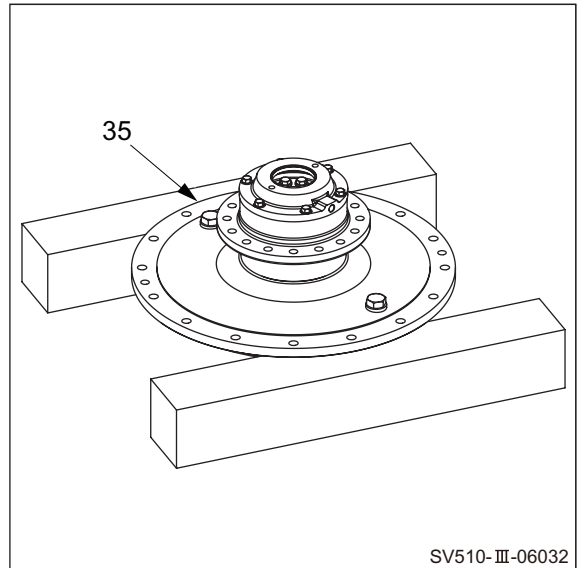
\mathfrak{J}_{kg} (41) Axle shaft : 230 kg (507 lbs.)



24) Put removed axle shaft (41) on wooden blocks.



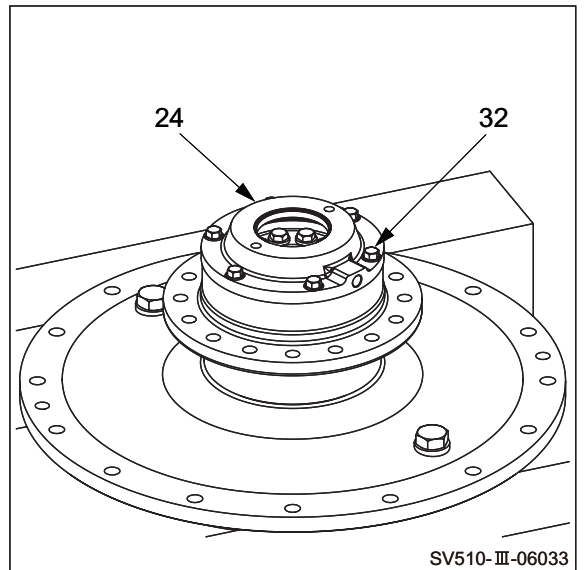
25) The right illustration shows axle shaft subassembly (35) removed from vibratory drum.



26) Remove six bolts (32).

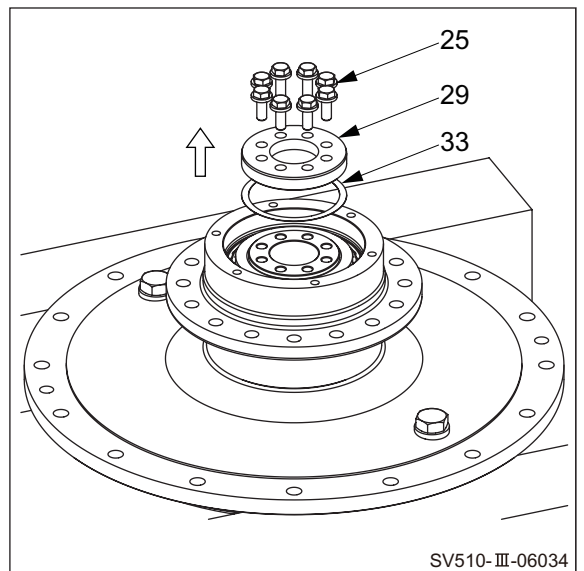
- Remove cover (24).

\mathfrak{J}_{kg} (24) Cover : 10 kg (22 lbs.)



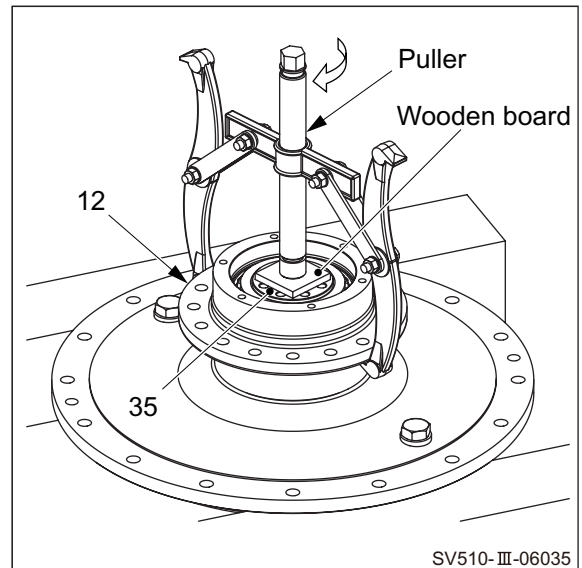
27) Remove eight bolts (25).

- Remove cover (29).
- Remove shim (33).

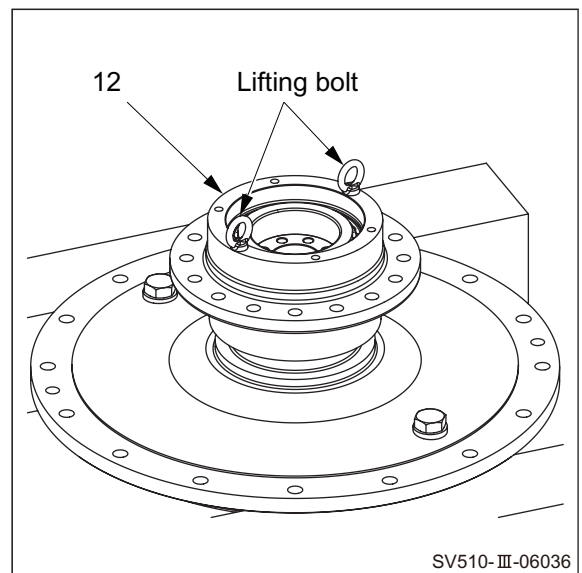


VIBRATORY DRUM • REAR AXLE

- 28) Put a piece of wooden board on the end of axle shaft (35) and set a puller on housing (12).
- Separate housing (12) together with roller bearing from axle shaft (35).

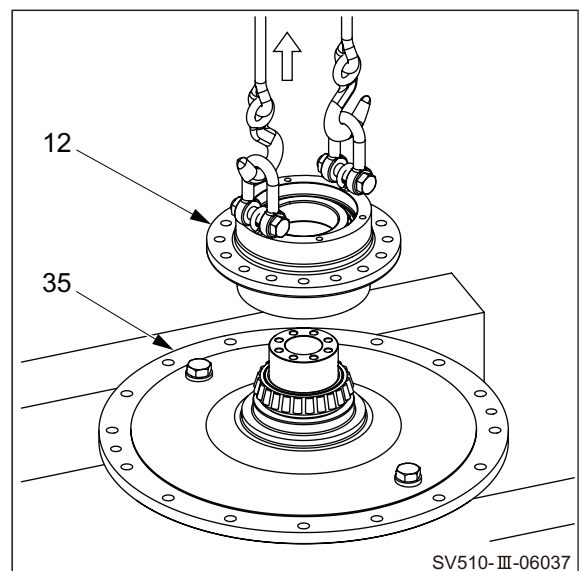


- 29) Install lifting bolts (M12) to housing (12).

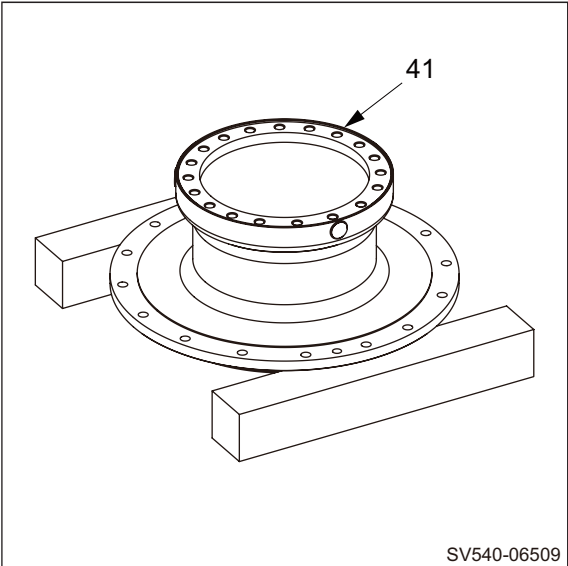


- 30) Lift housing subassembly (12) with a crane and separate it from axle shaft (35).

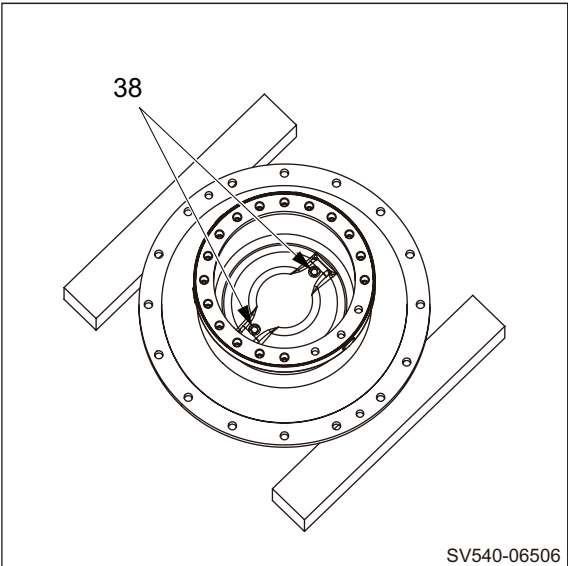
J_{kg} (12) Housing subassembly : 45 kg (99 lbs.)



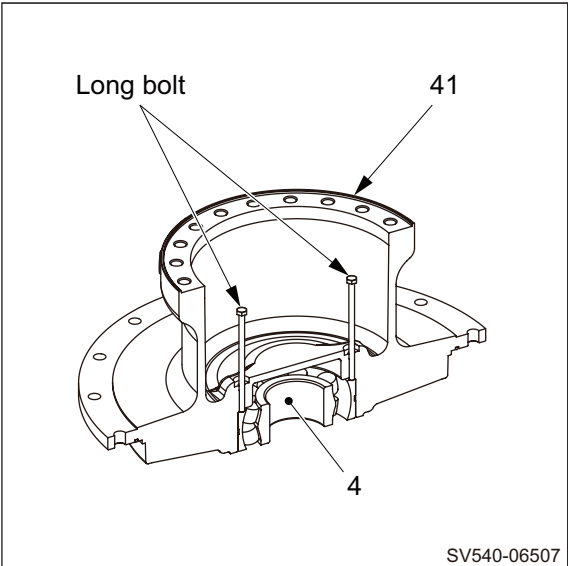
31) The right illustration shown axle shaft (41) removed from vibratory drum.



32) Remove bolt (38).



33) Remove vibrator bearing (4) from axle shaft (41) using long bolts (M10).



2-3-2. Reassembly of vibratory drum

- Before reassembling, clean disassembled parts well and check that there is no abnormality.
- When removed bolts threaded with thread sealant, replace new bolts.

⚠ WARNING

When standing the vibratory drum, use wooden blocks of sufficient strength to securely support the drum.

- 1) Lift vibratory drum (1) with a crane and put it in an upright position.



(1) Vibratory drum

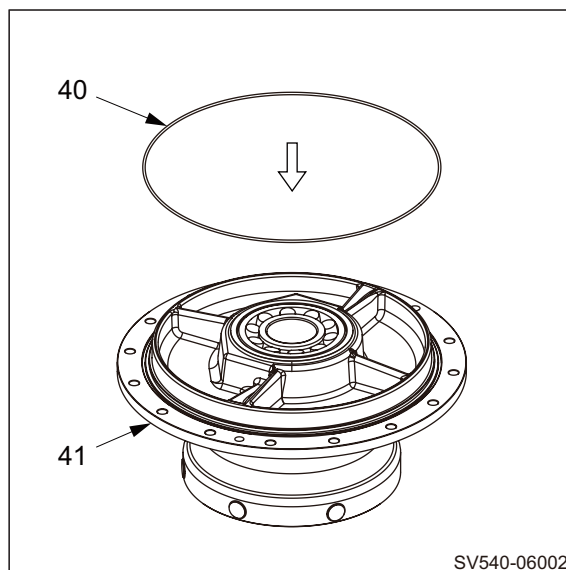
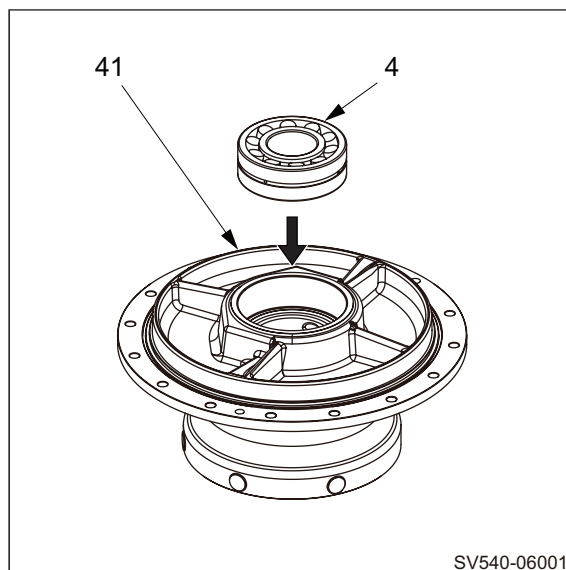
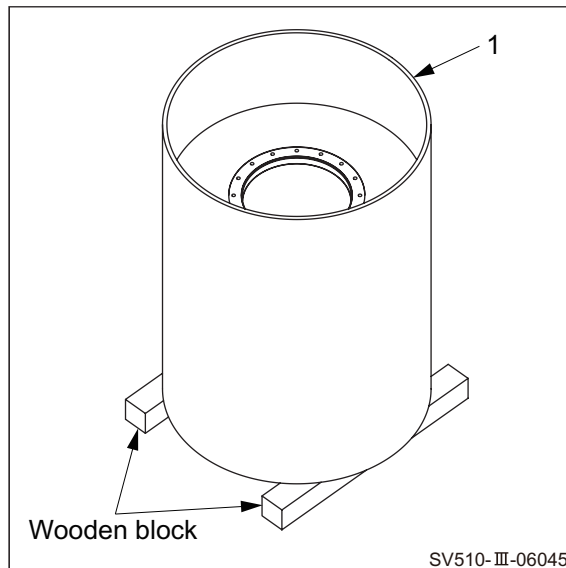
SV540D	: 3,060 kg (6,746 lbs.)
SV540T	: 3,385 kg (7,463 lbs.)
SV540TF	: 5,790 kg (12,765 lbs.)
SV540DF	: 4,740 kg (10,450 lbs.)
SV640D	: 3,060 kg (6,746 lbs.)
SV640T	: 3,385 kg (7,463 lbs.)

- 2) Apply a thin coat of gear oil to axle shaft (41) on its surface where vibrator bearing (4) will be press-fitted.
 - Drive in vibrator bearing (4).

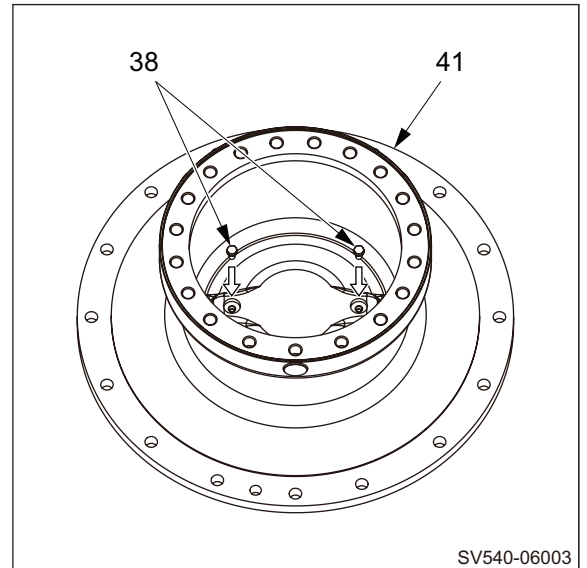
(NOTICE)

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

- 3) Apply grease to entire periphery of O-ring (40).
 - Install O-ring (40) on axle shaft subassembly (41)



4) Install bolts (38) and seal washers to axle shaft (41).



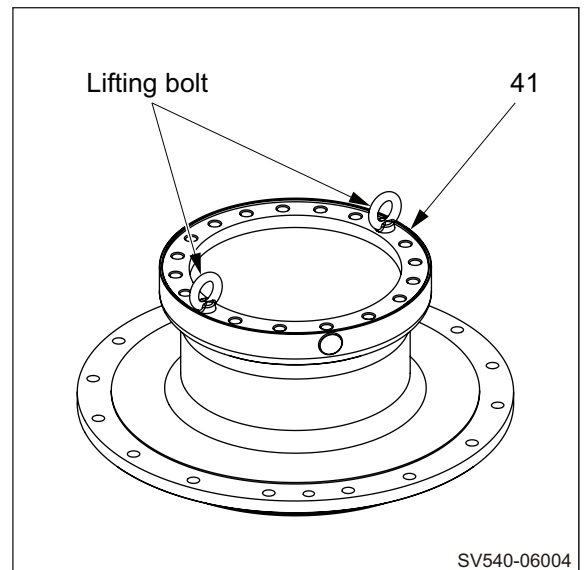
⚠ WARNING

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

5) Lift axle shaft (41) with a crane and reverse it.

\mathfrak{J}_{kg} (41) Axle shaft : 230 kg (507 lbs.)

- Install lifting bolts (M20) to axle shaft (41).

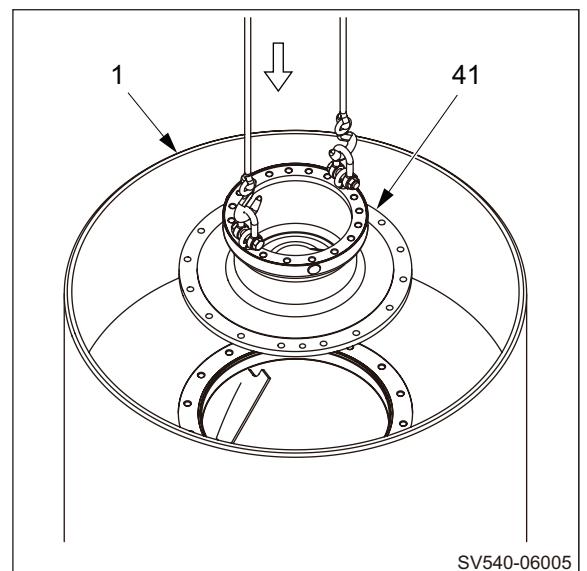


6) Lift axle shaft (41) with a crane and lower it on mounting surface of vibratory drum (1).

\mathfrak{J}_{kg} (41) Axle shaft : 230 kg (507 lbs.)

(NOTICE)

- When installing axle shaft, take care not to allow the O-ring to protrude from the fitting groove.

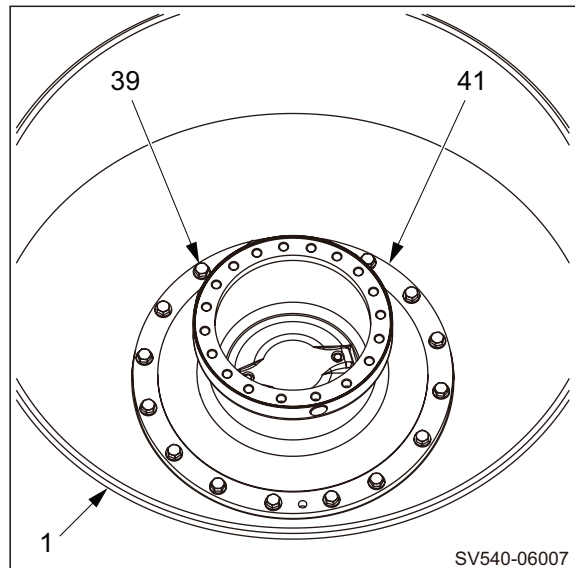


VIBRATORY DRUM • REAR AXLE

- 7) Secure axle shaft (41) to vibratory drum (1) with sixteen bolts (39) and washers.



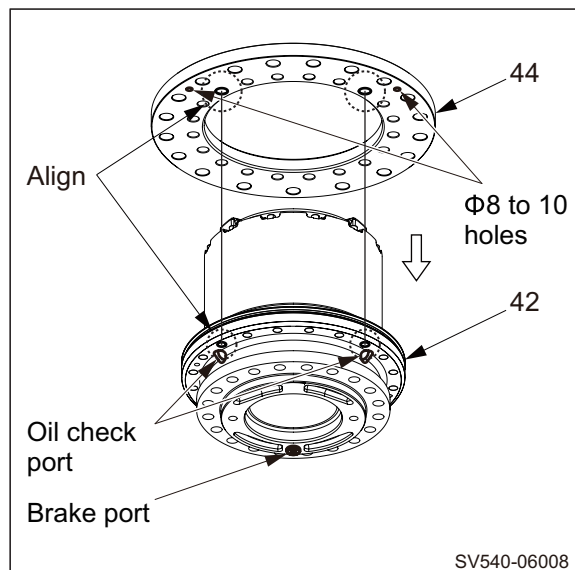
(39) Bolts M20×60 : 539 N·m (398 lbf-ft)



- 8) Install ring (44) to mounting surface of gear box (42).

(NOTICE)

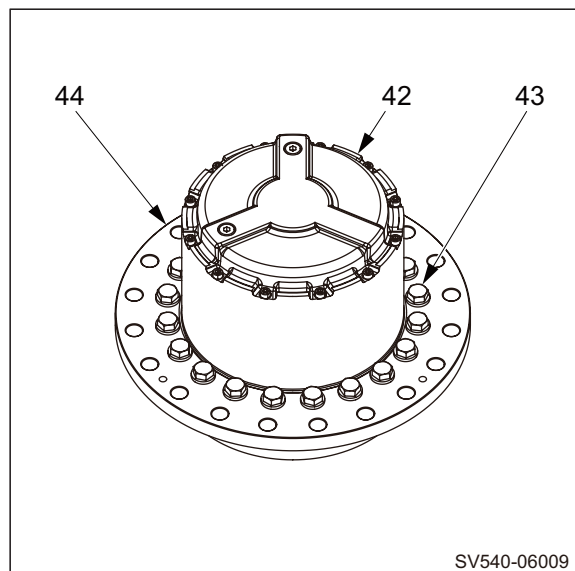
- Align $\Phi 8$ to 10 holes with oil check port as shown.



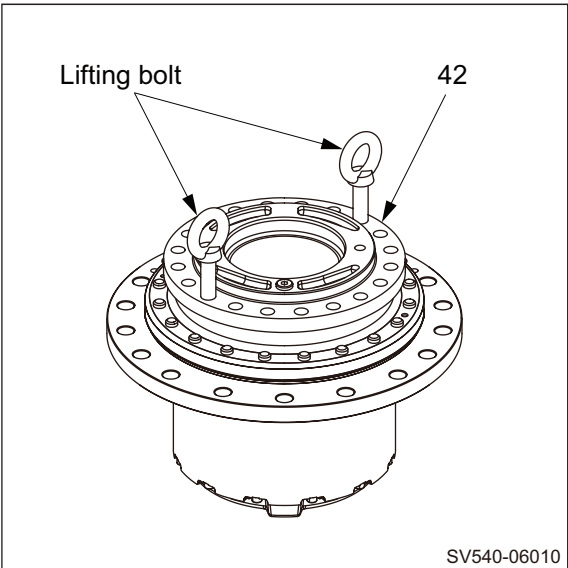
- 9) Secure ring (44) to gear box (42) with twenty bolts (43) and washers.



(43) Bolt M16×70 P=1.5 : 284 N·m (209 lbf-ft)

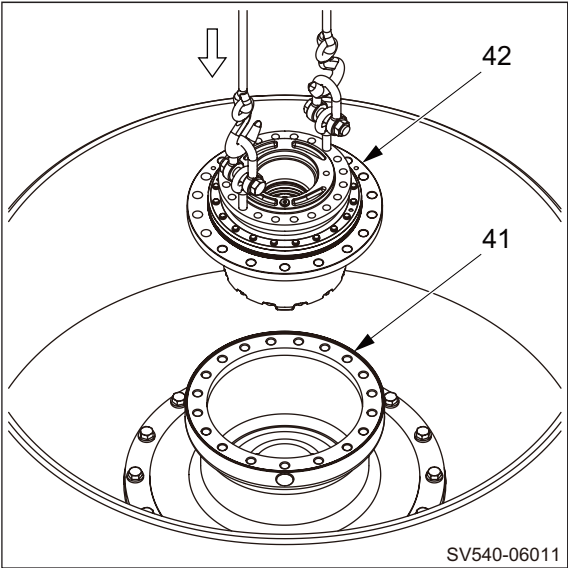


10) Install lifting bolts (M20) to gear box subassembly (42).



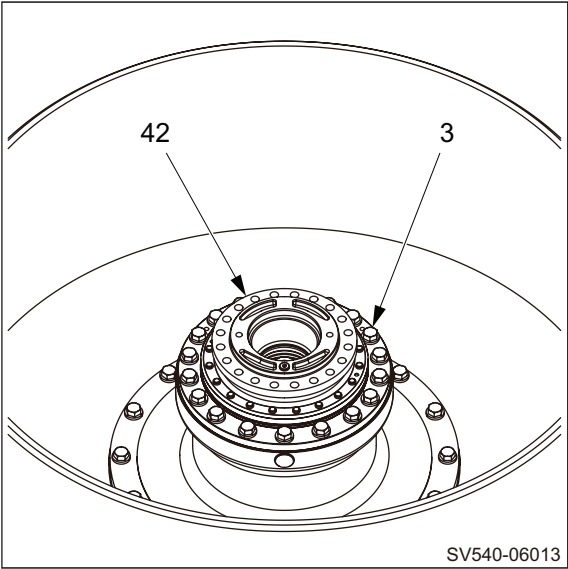
11) Lift gear box subassembly (42) with a crane and lower it on the mounting surface of axle shaft (41).

\mathfrak{J}_{kg} (42) Gear box subassembly : 155 kg (342 lbs.)



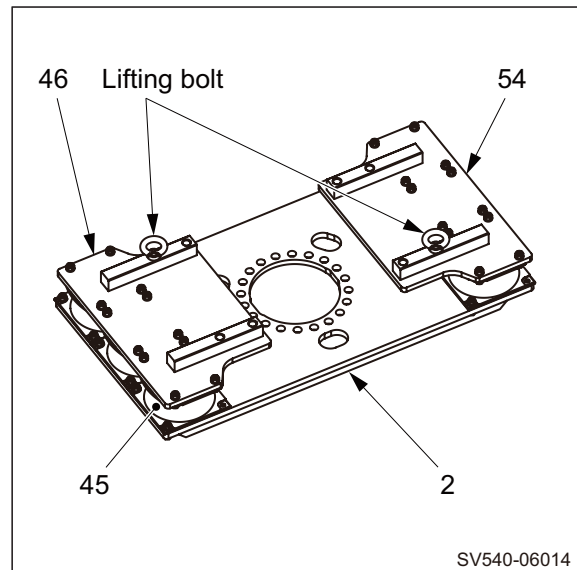
12) Secure gear box subassembly (42) with nineteen bolts (3) and washers.

$\mathfrak{N}\cdot\text{m}$ (3) Bolts M20×70 : 539 N·m (398 lbf·ft)



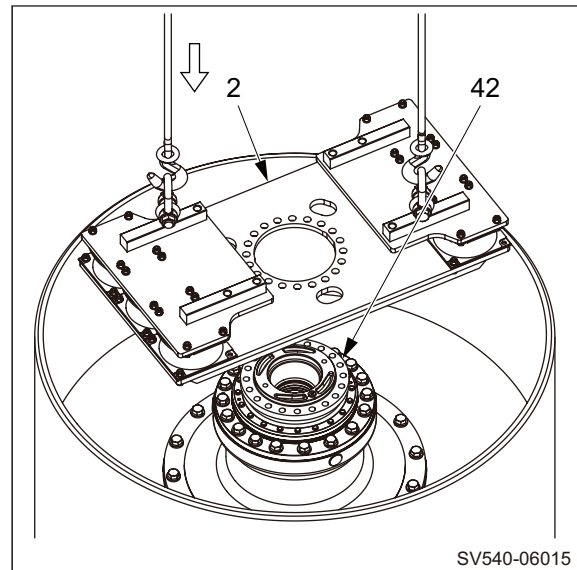
VIBRATORY DRUM • REAR AXLE

13) Install lifting bolts and nuts (M20) on a subassembly of holders (46), (54), dampers (45) and disc (2) as shown on the right.

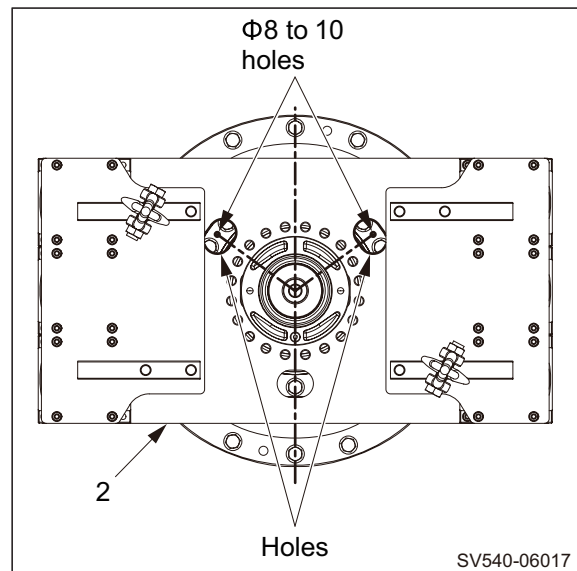


14) Lift disc subassembly (2) with a crane and lower it on mounting surface of gear box (42).

\mathfrak{J}_{kg} (2) Disc subassembly : 220 kg (485 lbs.)



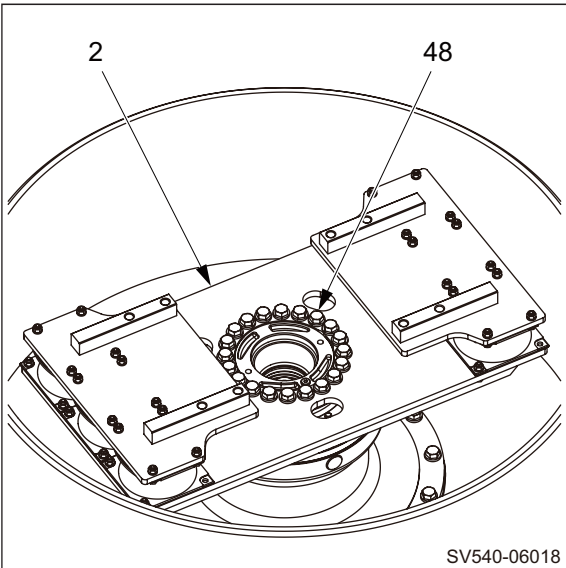
15) Position disc subassembly (2) as shown right.



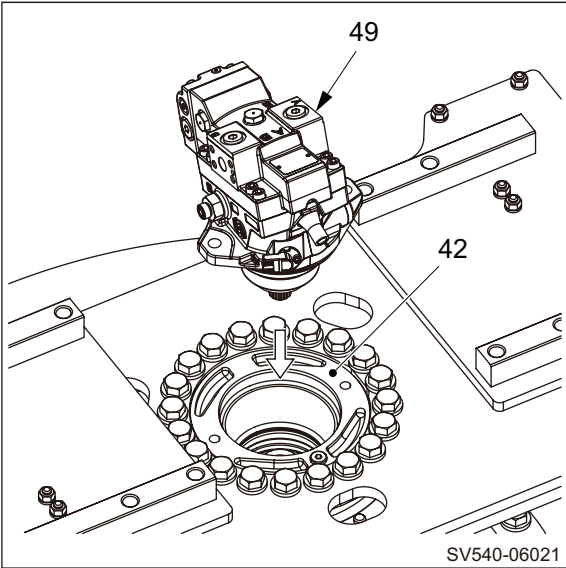
16) Secure disc subassembly (2) with twenty bolts (48) and washers.



(44) Bolts M20×50 P=1.5 : 588 N·m (434 lbf·ft)



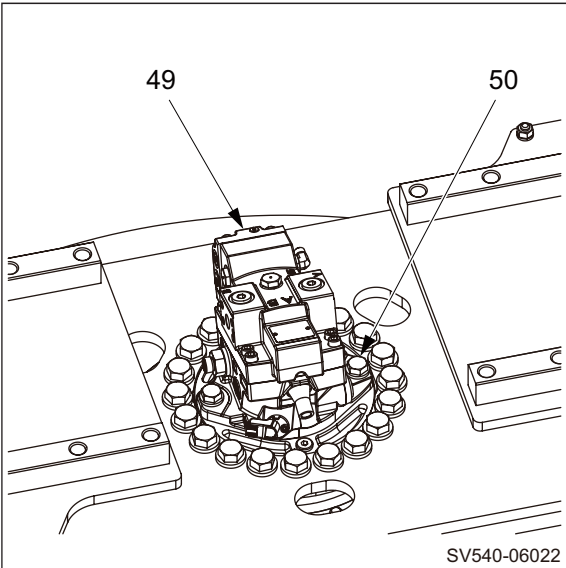
17) Install propulsion motor (49) to gear box (42).



18) Secure propulsion motor (49) with two bolts (50) and washers.



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



⚠ WARNING

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

- 19) Lift vibratory drum subassembly (1) with a crane and reverse it. Then, stand drum with its propulsion motor side facing down.



(1) Vibratory drum

SV540D : 3,720 kg (8,201 lbs.)

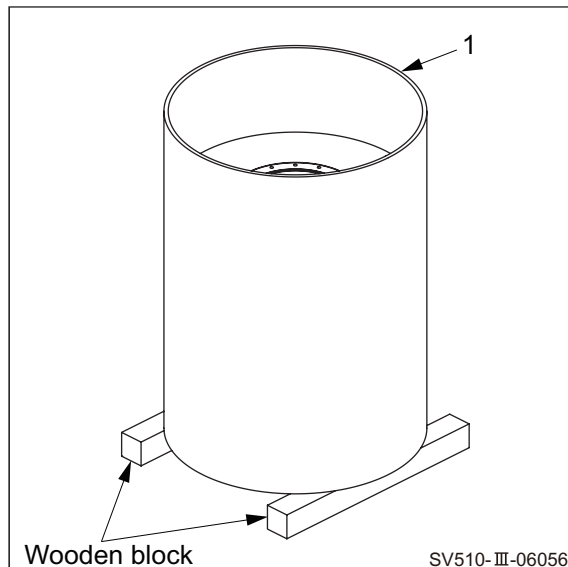
SV540T : 4,045 kg (8,918 lbs.)

SV540TF : 6,450 kg (14,220 lbs.)

SV540DF : 5,400 kg (11,905 lbs.)

SV640D : 3,720 kg (8,201 lbs.)

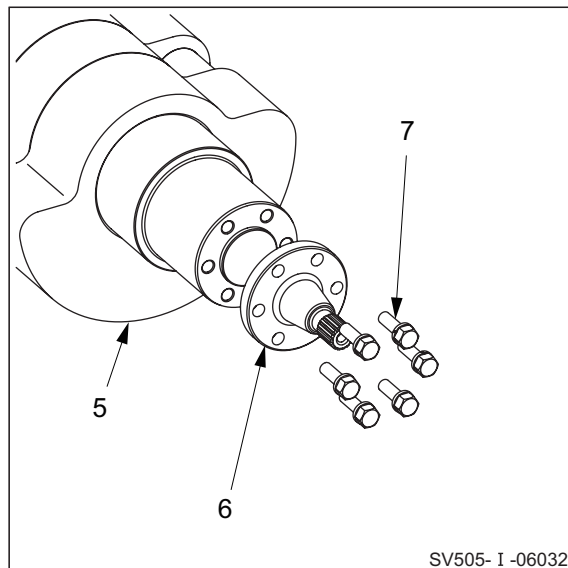
SV640T : 4,045 kg (8,918 lbs.)



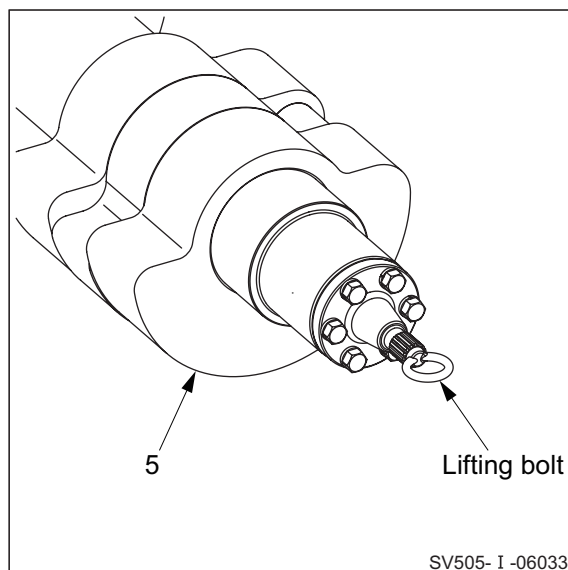
- 20) Secure shaft (6) to eccentric shaft (5) with six bolts (7) and spring washers.



(7) Bolts M12×40 : 108 N·m (80 lbf-ft)



- 21) Install a lifting bolt (M10) to the end of eccentric shaft subassembly (5).

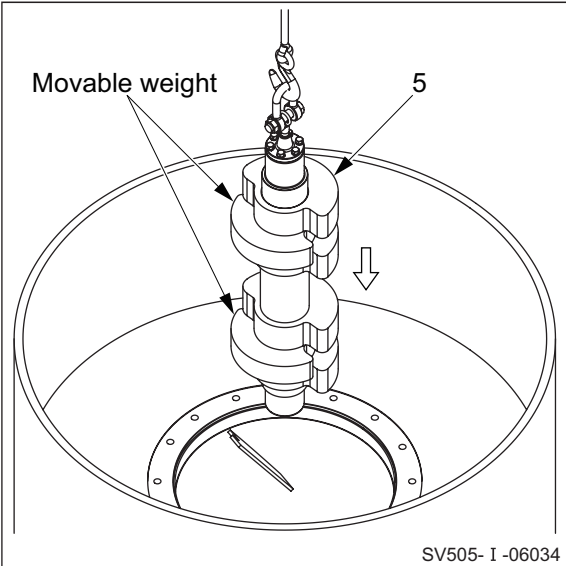


- 22) Apply a coat of gear oil to eccentric shaft subassembly (5) at where bearing will be installed.
- Lift eccentric shaft subassembly (5) with a crane and install it on vibratory drum slowly.

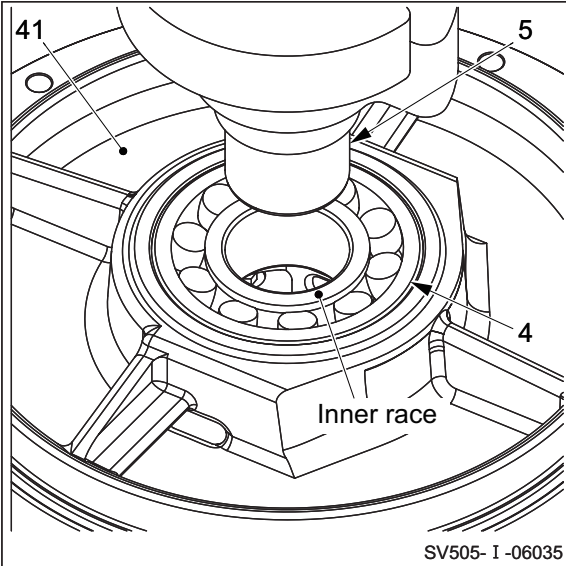
\mathfrak{J}_{kg} (5) Eccentric shaft subassembly : 280 kg (617 lbs.)

(NOTICE)

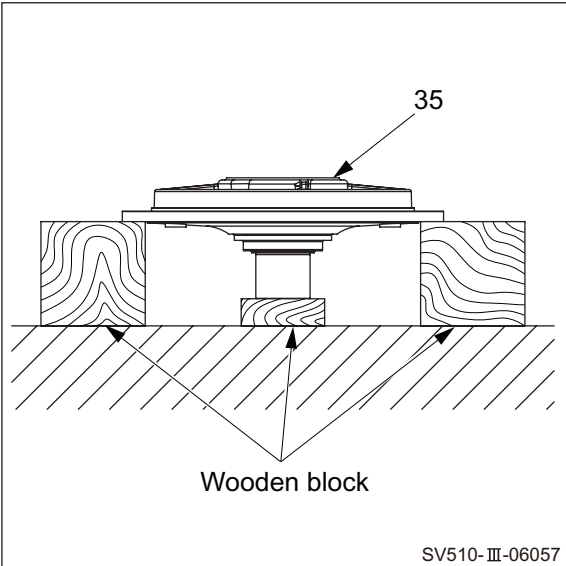
- **When lifting the eccentric shaft, put the movable weights at their outmost position.**



- 23) Insert eccentric shaft subassembly (5) into vibrator bearing (4) while taking care not to tilt vibrator bearing inner race installed on axle shaft (41).



- 24) Reassembly of axle shaft subassembly (35)
24-1) Fix axle shaft (35) with wooden blocks.



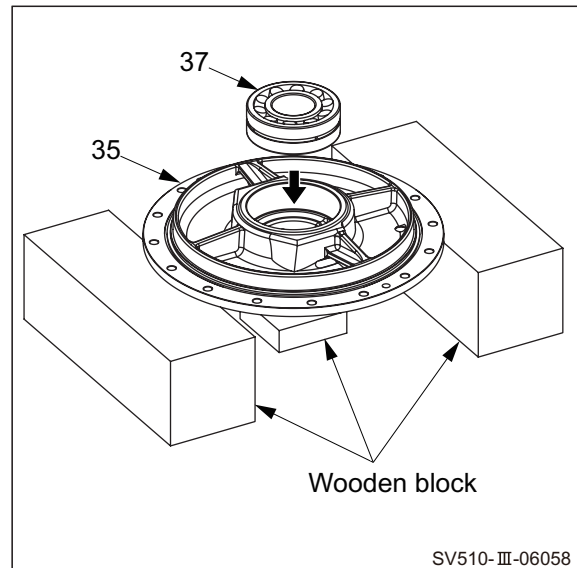
VIBRATORY DRUM • REAR AXLE

24-2) Apply a thin coat of gear oil to axle shaft (35) on its surface where vibrator bearing (37) will be press-fitted.

- Drive in vibrator bearing (37).

(NOTICE)

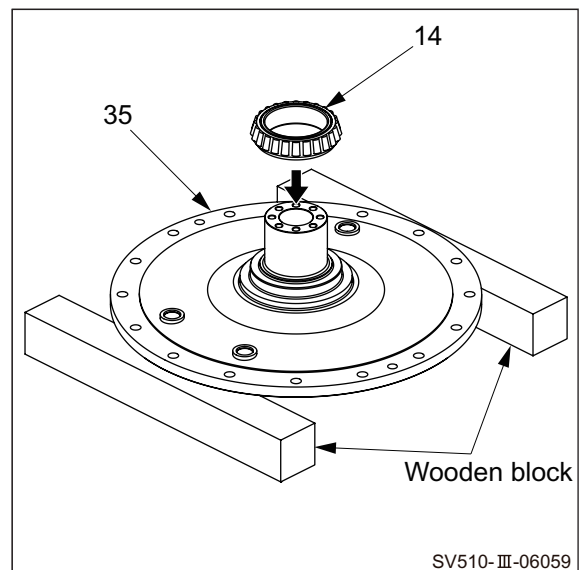
- Take care not to damage the bearing when installing it.



24-3) Lift axle shaft (35) with a crane and reverse it.

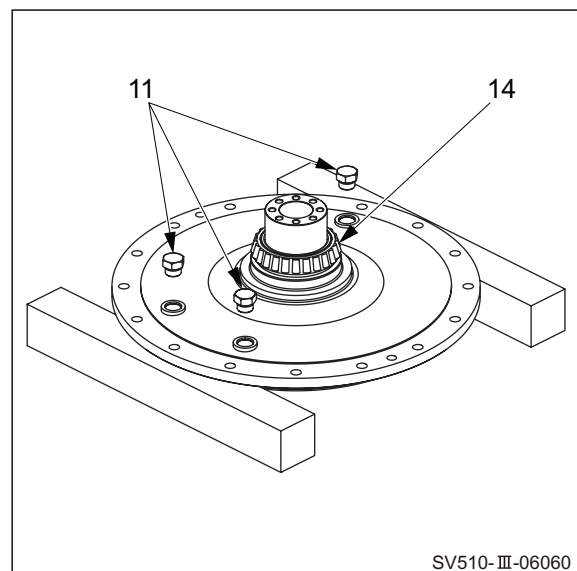
kg (35) Axle shaft : 180 kg (397 lbs.)

- Apply a thin coat of gear oil to roller bearing (14) inner race on its surface to be press-fitted.
- Press fit roller bearing (14) inner race.



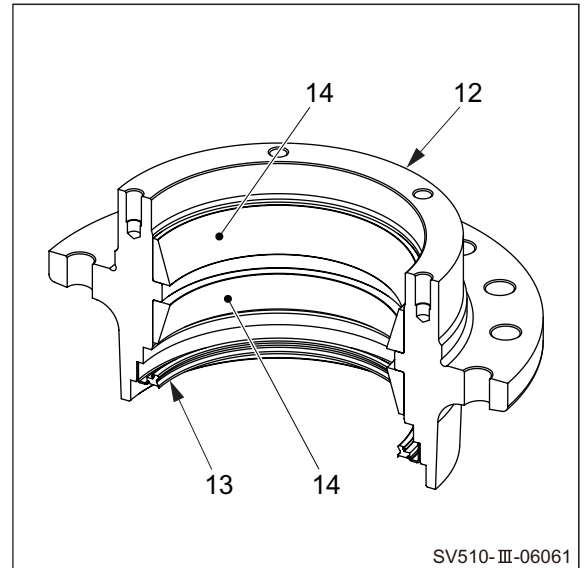
24-4) Apply grease to O-rings for plugs (11).

- Install three plugs (11).
- Apply sufficient amount of lithium-based grease to rollers of roller bearing (14) inner race.

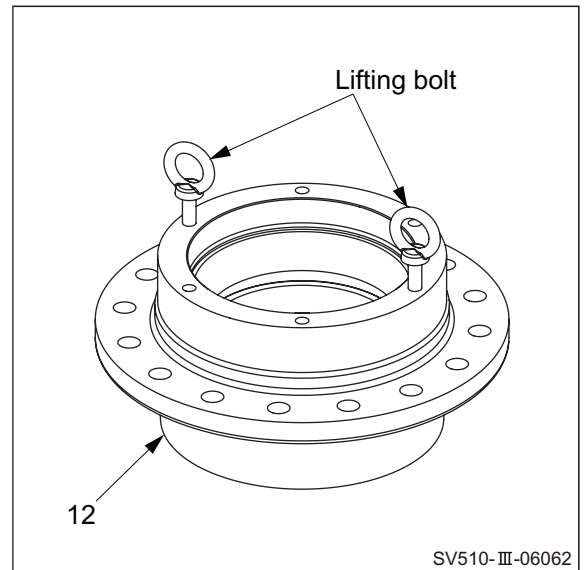


24-5) Apply a thin coat of gear oil to roller bearing (14) outer race on its surface to be press-fitted.

- Drive outer race of roller bearing (14) into housing (12).
- Install oil seal (13).
- Apply a thin coat of grease to lip of oil seal (13).

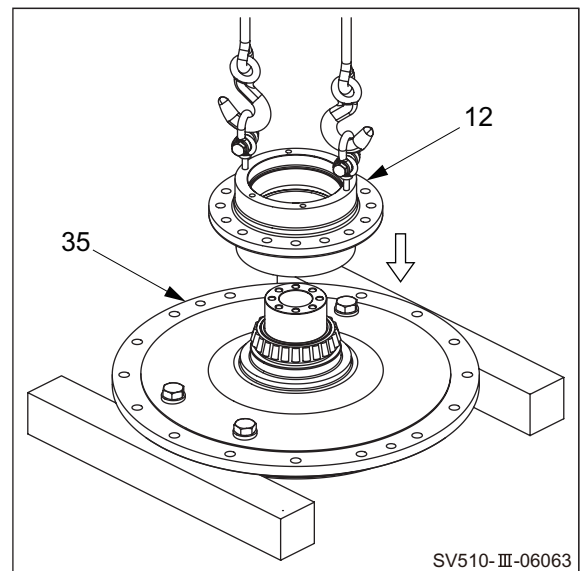


24-6) Install lifting bolts (M12) to housing subassembly (12).



24-7) Lift housing subassembly (12) with a crane and install it on axle shaft subassembly (35).

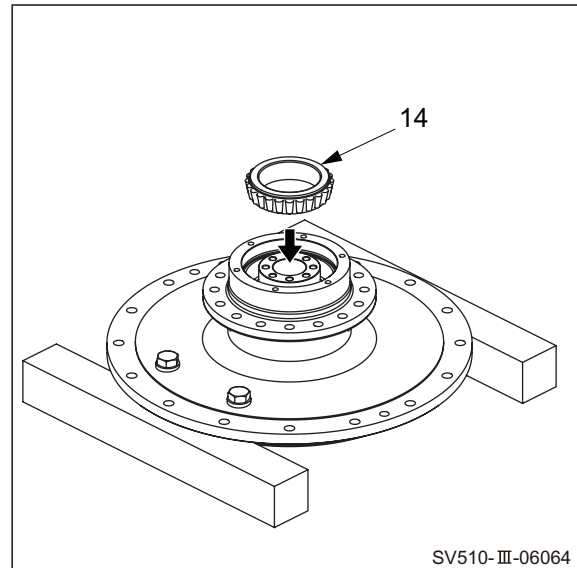
\mathfrak{J}_{kg} (12) Housing subassembly : 40 kg (88 lbs.)



VIBRATORY DRUM • REAR AXLE

24-8) Apply sufficient amount of lithium-based grease to rollers of roller bearing (14) inner race.

- Drive in roller bearing (14) inner race until rollers come in contact with outer race.



24-9) Preload adjustment of roller bearing

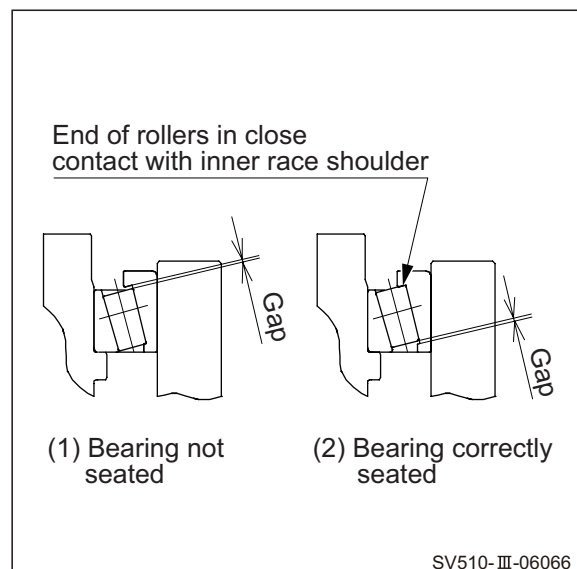
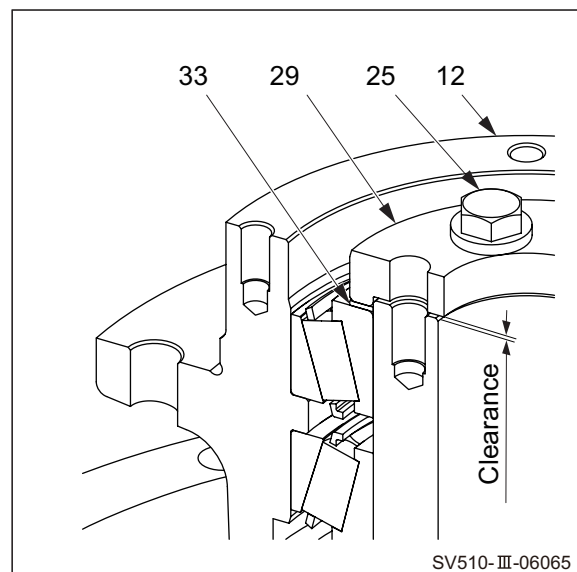
- ① Install a shim (33) of about 1 mm (0.04 in.) on axle shaft and install cover (29). The shim provides a clearance between end face of axle shaft and inner surface of cover (29).
- Tighten four bolts (25) with washers to a torque of 108 N·m (80 lbf·ft).
- Give housing (12) two to three turns and tighten bolts to a torque of 108 N·m (80 lbf·ft) again.
- Repeat this work several times until tightening torque of bolts no longer fluctuates.

(NOTICE)

- Tighten four of the eight bolts (25) alternately in the diagonal directions.

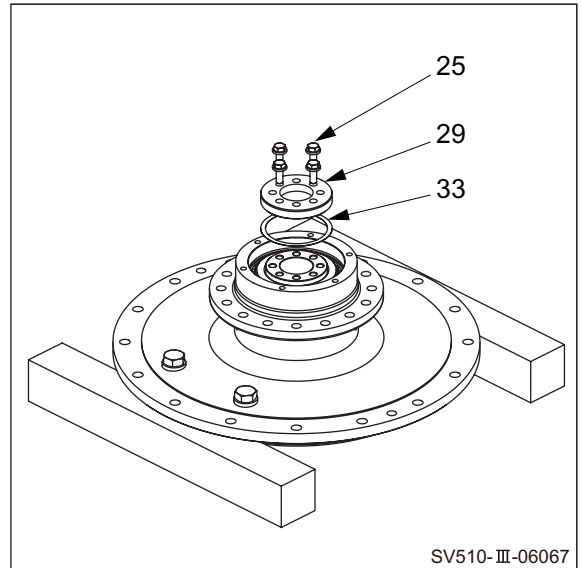
(NOTICE)

- 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.



② Remove four bolts (25).

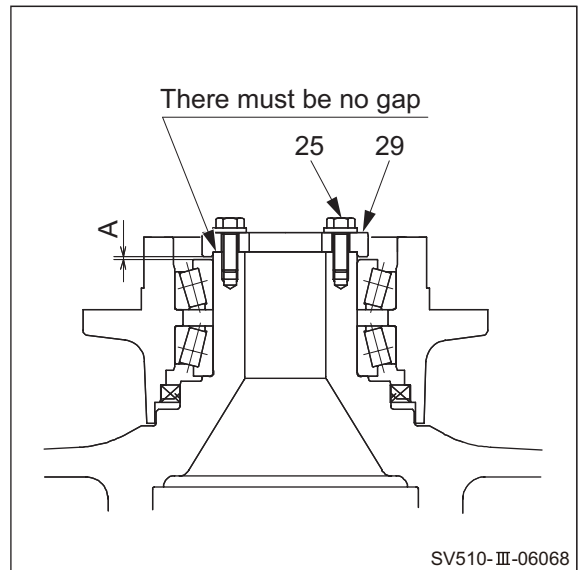
- Remove cover (29).
- Remove shim (33).



③ Without inserting shim, install cover (29).


- Install washers to four bolts (25) and tighten.
- Using a thickness gauge, measure the gap at dimension “A”.

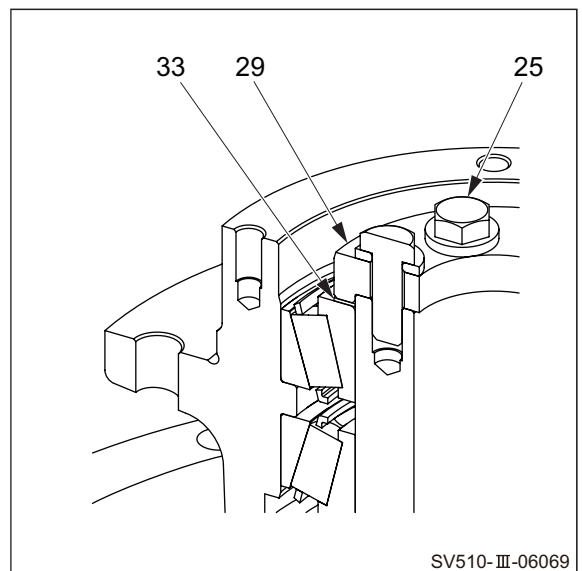
★ Preload adjusting shim thickness = $A + 0.1 \text{ mm (0.04 in.)}$



④ Remove four bolts (25).

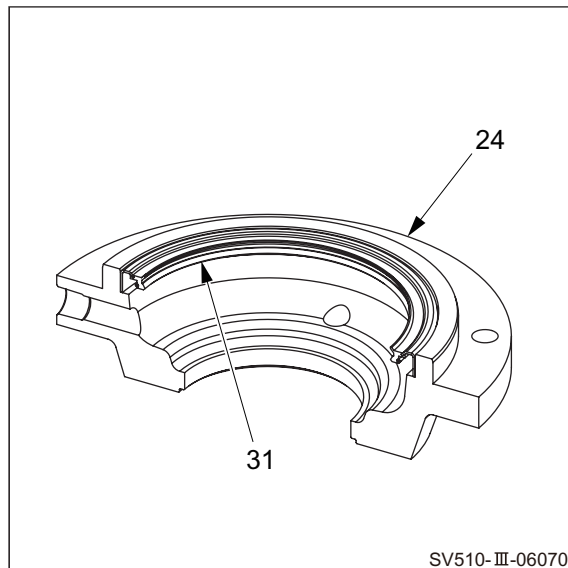
- Remove cover (29).
- Install a shim of preload adjusting shim (33) thickness “A + 0.1 mm” and reinstall cover (29). Then, secure cover with eight bolts (25) and washers.

 (25) Bolts M14×40 : 170 N·m (125 lbf·ft)



VIBRATORY DRUM • REAR AXLE

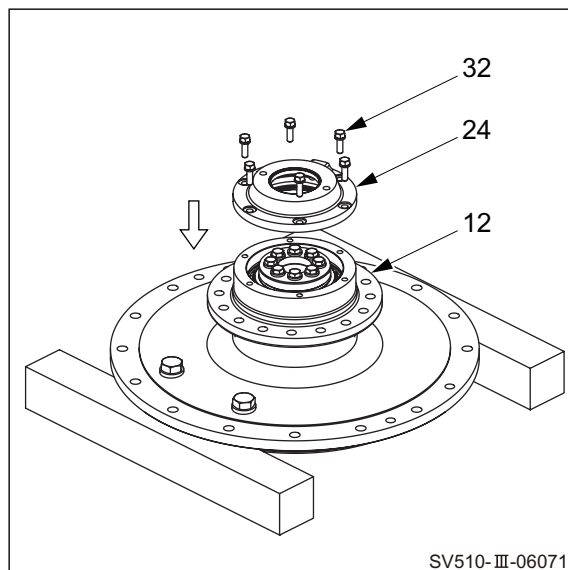
- ⑤ Install oil seal (31) on cover (24).
- Apply a thin coat of grease to lip of oil seal (31).
 - Apply liquid packing to mounting surface.



- ⑥ Secure cover (24) to housing subassembly (12) with six bolts (32) and spring washers.

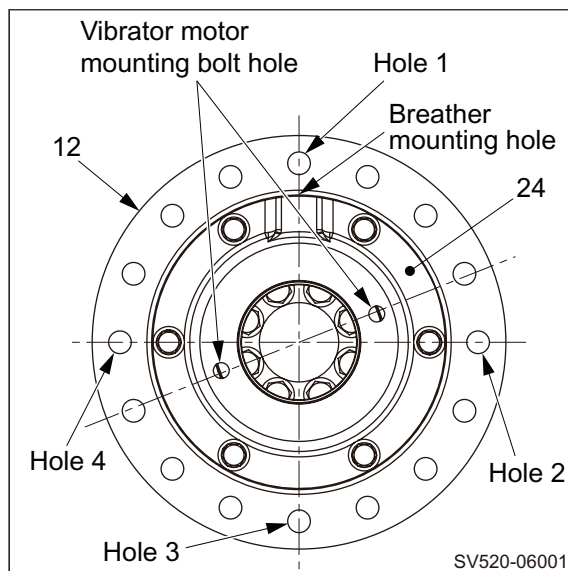


(32) Bolts M12×40 : 108 N·m (80 lbf·ft)

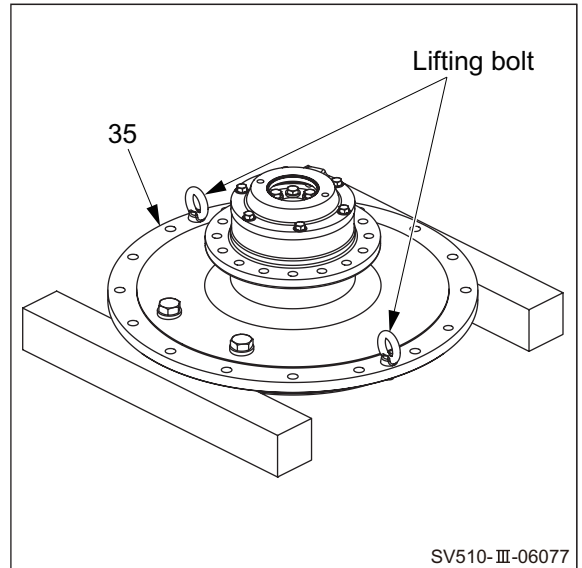


(NOTICE)

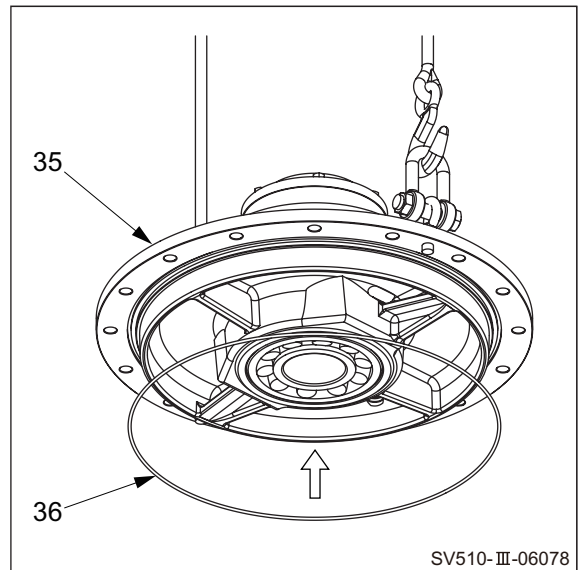
- The four holes in housing (12), breather mounting hole in cover (24), and vibrator motor mounting bolt holes must be arranged as shown on the right.



25) Install lifting bolts (M20) to axle shaft subassembly (35).



26) Apply grease to entire periphery of O-ring (36).
 • Install O-ring (36) on axle shaft subassembly (35).

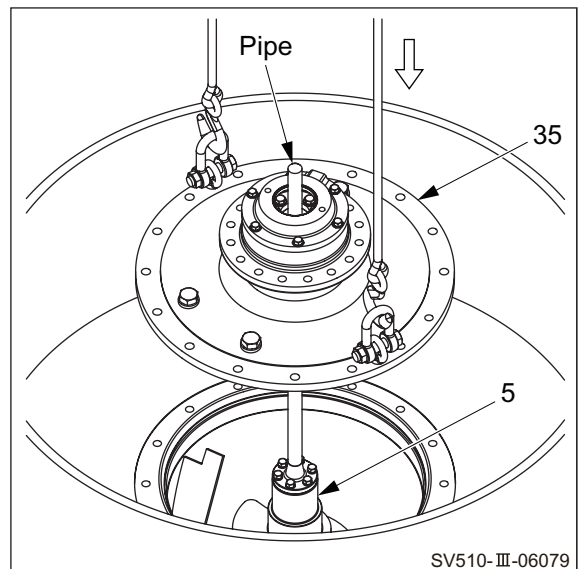


27) Lift axle shaft subassembly (35) with a crane and lower it slowly.
 • Supporting eccentric shaft subassembly (5) with a pipe or the like, align center of vibrator bearing inner race to that of shaft.

\mathfrak{J}_{kg} (35) Axle shaft subassembly : 240 kg (529 lbs.)

(NOTICE)

- Install the axle shaft taking care not to tilt the vibrator bearing.
- When installing the axle shaft, take care not to allow the O-ring to protrude from the fitting groove.

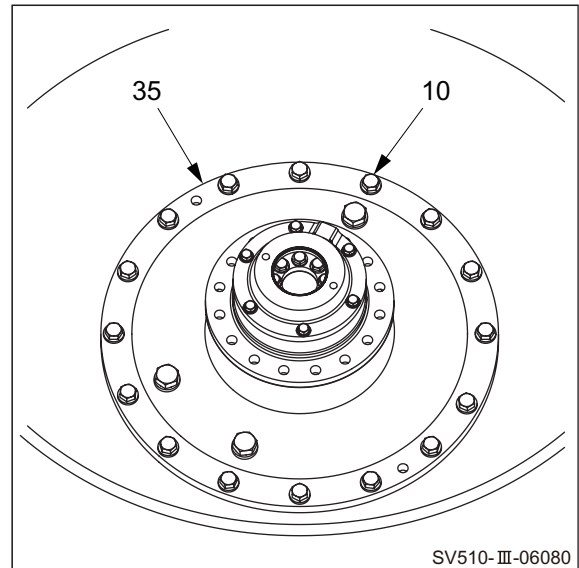


VIBRATORY DRUM • REAR AXLE

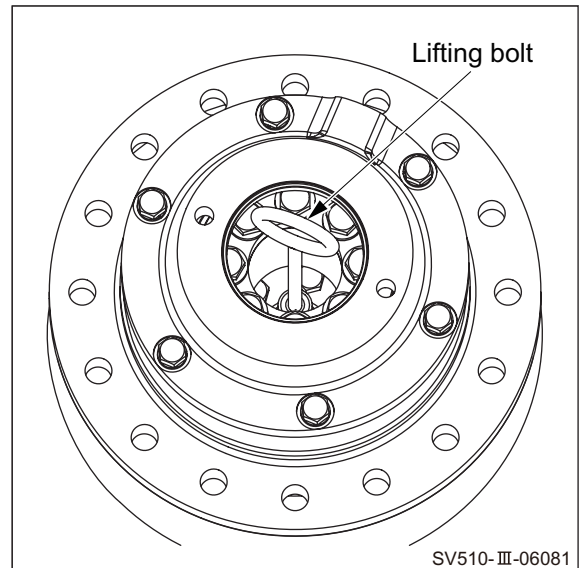
28) Secure axle shaft subassembly (35) to drum with sixteen bolts (10).



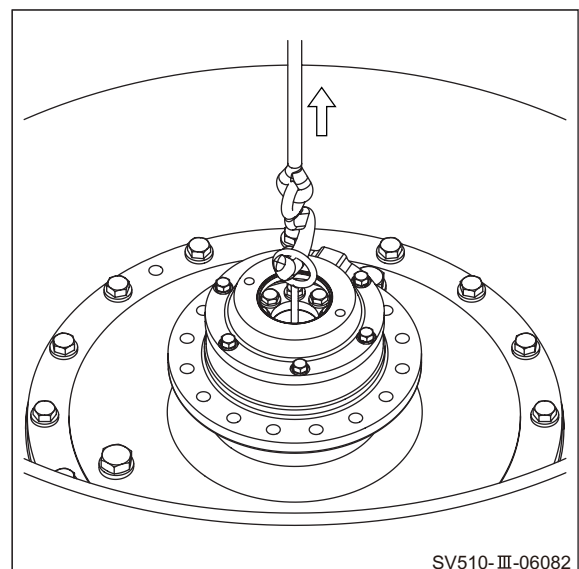
(10) Bolts M20×60 : 539 N·m (398 lbf-ft)



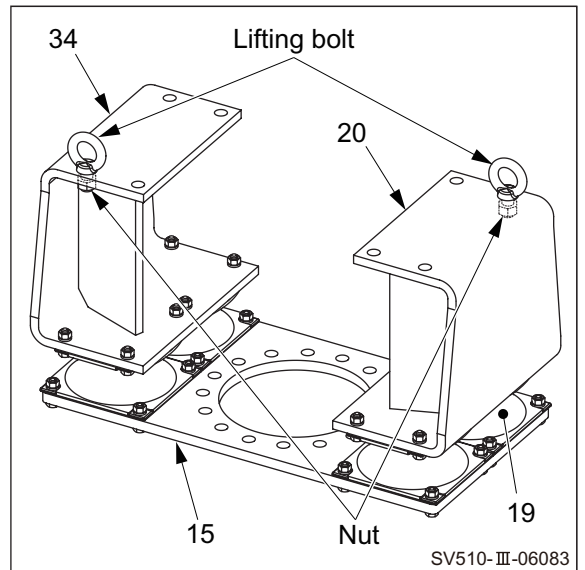
29) Install a lifting bolt (M8) on shaft end of eccentric shaft (5).



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

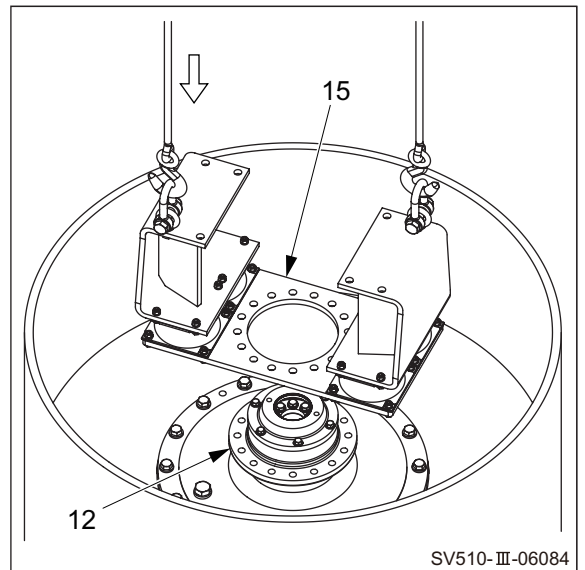


31) Install lifting bolts and nuts (M20) on a subassembly of holders (20), (34), dampers (19) and disc (15) as shown on the right.




32) Lift disc subassembly (15) with a crane and lower it on mounting surface of housing (12).

\mathfrak{J}_{kg} (15) Disc subassembly
 SV540D, T, TF, DF : 155 kg (342 lbs.)
 SV640D, T : 205 kg (452 lbs.)

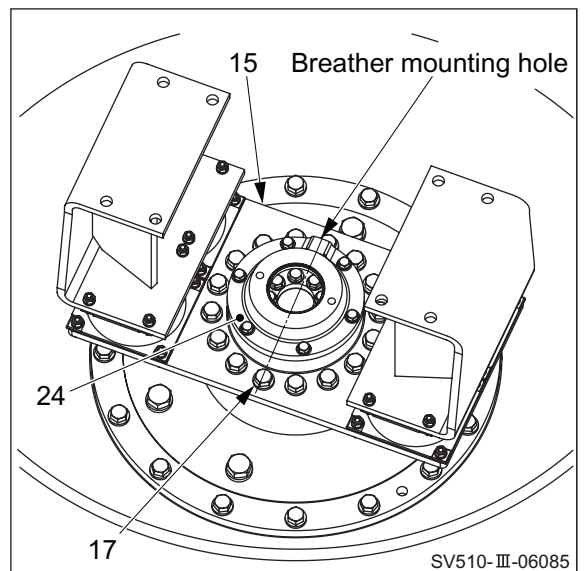


33) Secure disc subassembly (15) with sixteen bolts (17) and washers.

 (17) Bolts M20×60 : 539 N·m (398 lbf·ft)

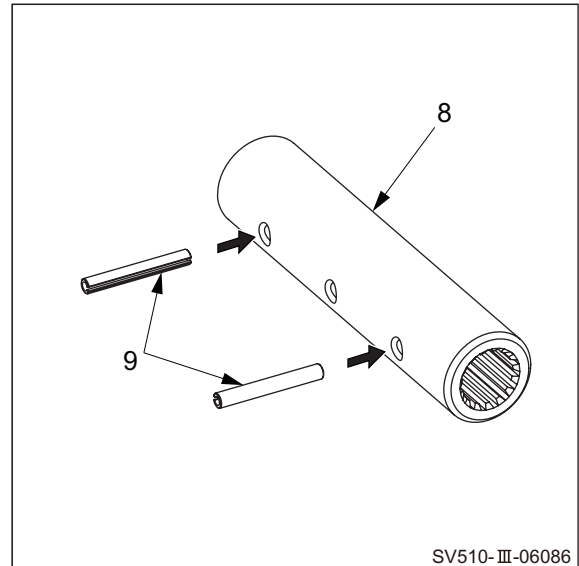
(NOTICE)

- When installing the disc subassembly, the breather mounting hole in cover (24) must be perpendicular to the longer edge of the disc.



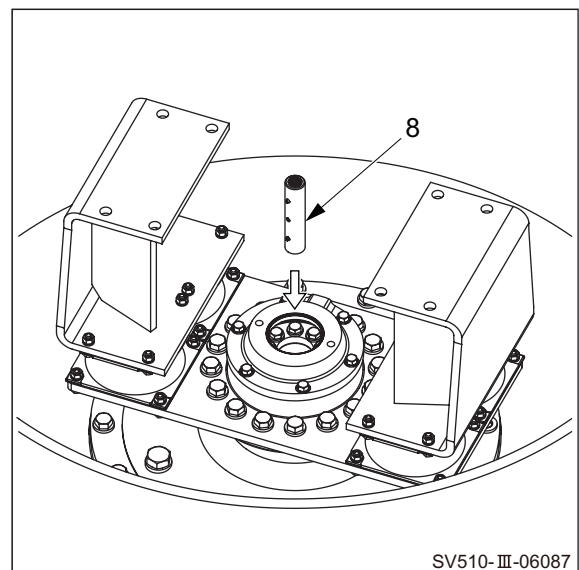
VIBRATORY DRUM • REAR AXLE

34) Drive two spring pins (9) into sleeve (8).



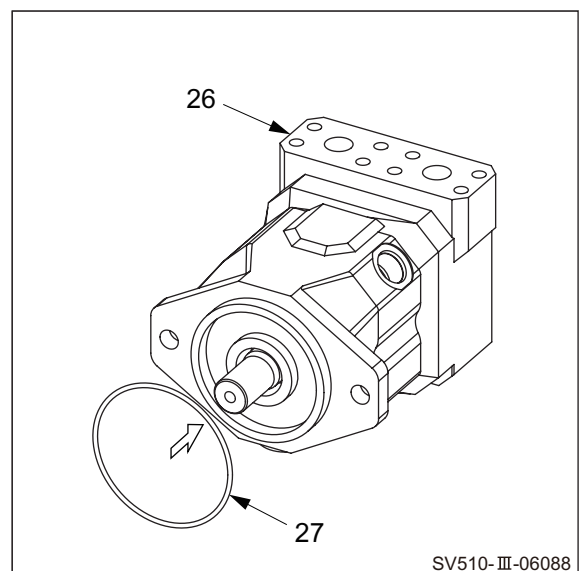
35) Apply molybdenum-based grease to splined portion of sleeve (8).

- Fit sleeve (8) to splined shaft on eccentric shaft end.





36) Apply grease to O-ring (27).

- Install O-ring (27) to vibrator motor (26).



37) Secure vibrator motor (26) to cover (24) with two new thread sealant bolts (28) and washers.

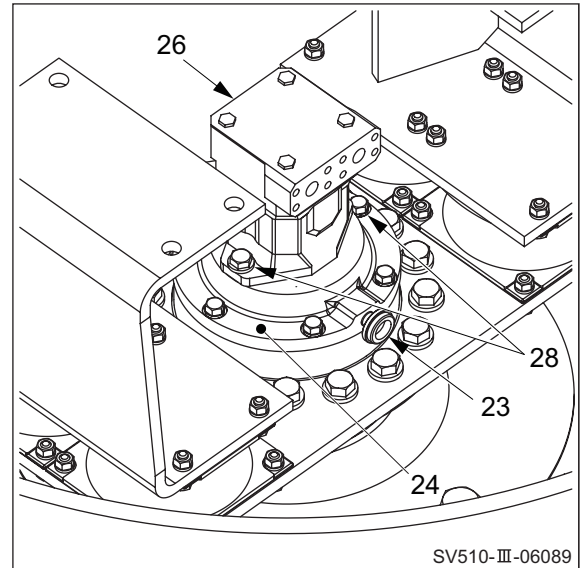
 (26) Vibrator motor : 20 kg (44 lbs.)

 (28) Bolts M14×40 : 108 N·m (80 lbf·ft)

- Wind seal tape around the threaded portion of breather (23).
- Install breather (23).


(NOTICE)

- **When installing the vibrator motor, take care not to allow the O-ring to protrude from the fitting groove.**



38) Lift vibratory drum assembly with a crane and lay it with plugs positioned as shown on the right.

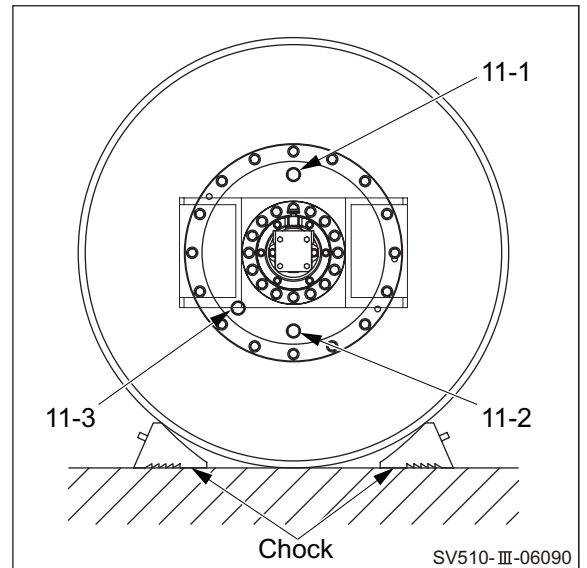
- Hold with chocks.

 Vibratory drum assembly

SV540D	: 4,425 kg (9,755 lbs.)
SV540T	: 4,750 kg (10,472 lbs.)
SV540TF	: 7,155 kg (15,774 lbs.)
SV540DF	: 6,110 kg (13,470 lbs.)
SV640D	: 4,475 kg (9,866 lbs.)
SV640T	: 4,805 kg (10,593 lbs.)

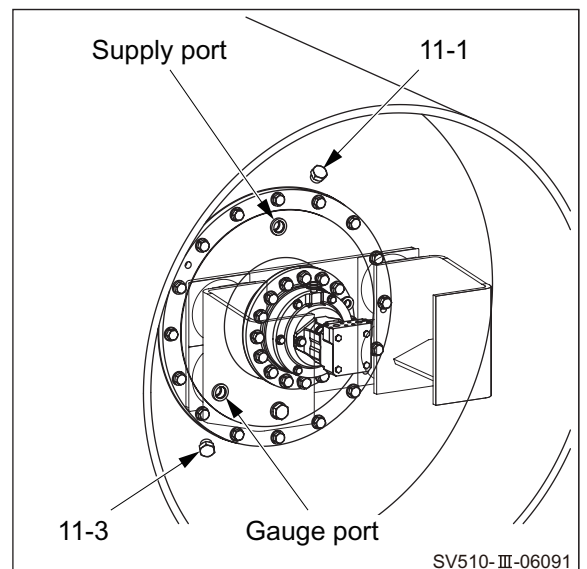
(NOTICE)

- **Make sure that the drum is placed on level ground.**



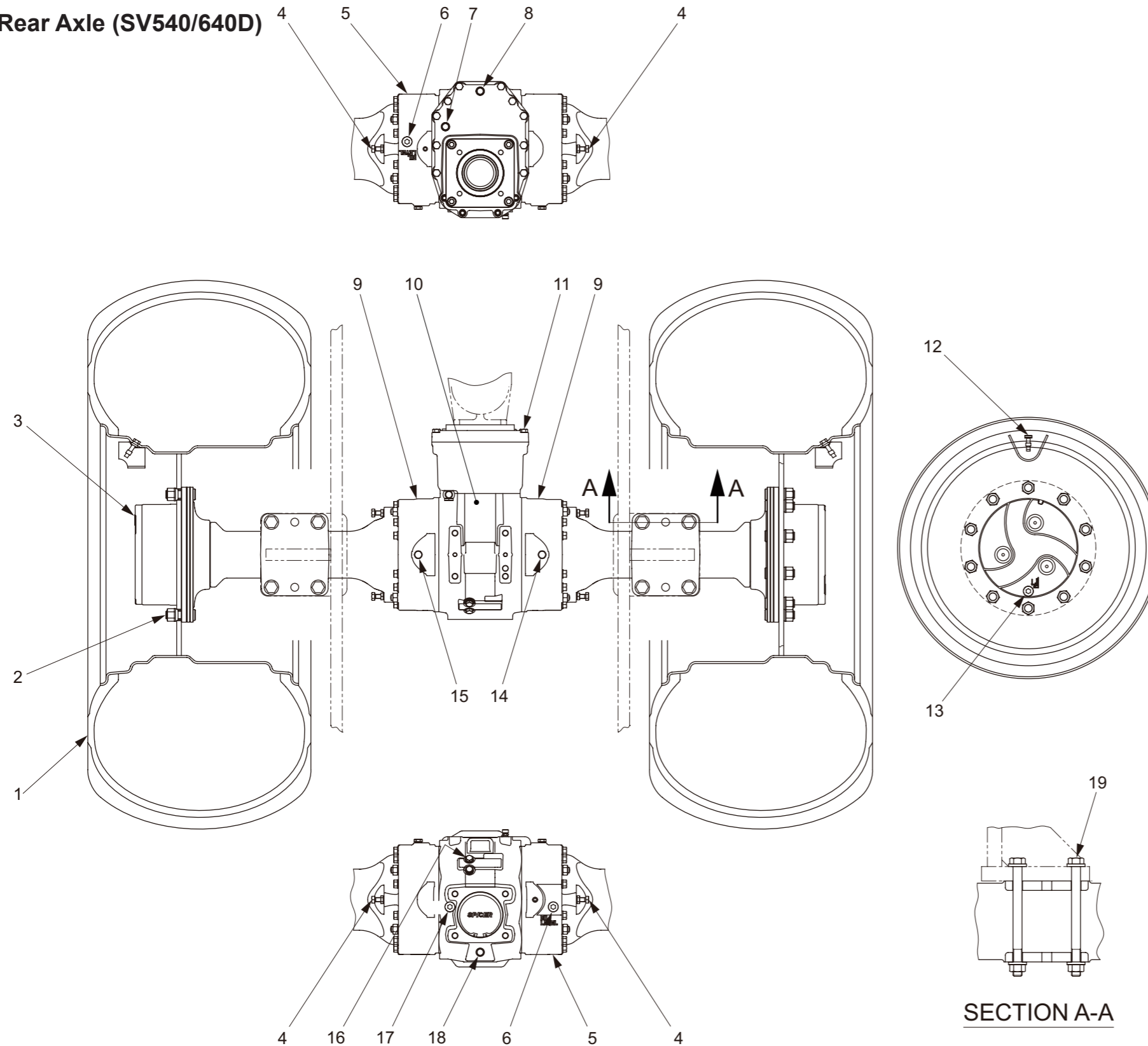
39) Remove plugs (11-1) and (11-3).

- Supply gear oil from oil supply port.
- Check that oil drips from gauge port.
 - Quantity of gear oil : 34 L (9.0 gal.)
- Reinstall plugs (11-1) and (11-3).





3. REAR AXLE

3-1. Rear Axle (SV540/640D)



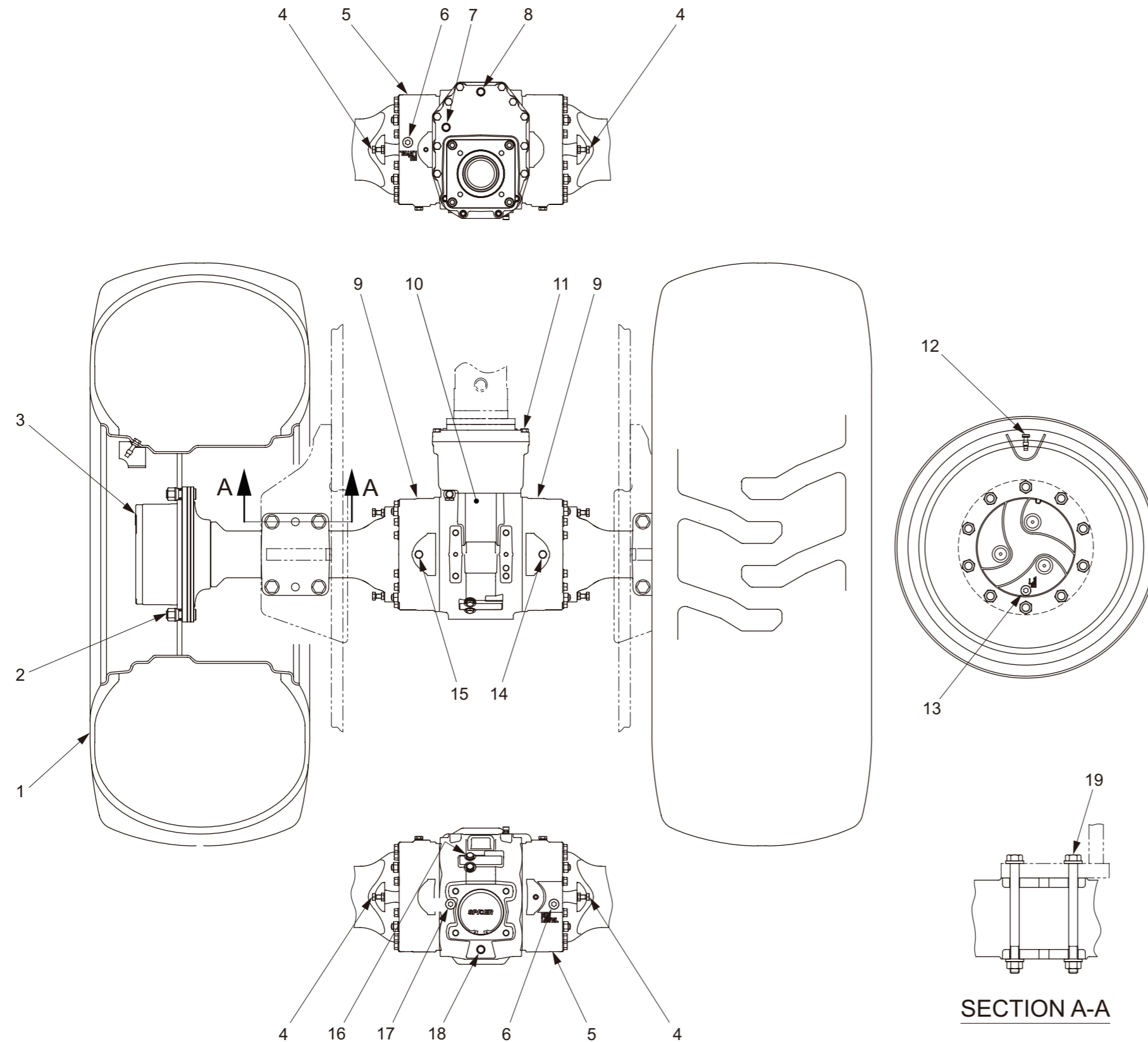
- (1) Tire
- (2) Nut : M22 P=1.5
- (3) Hub reduction gear
- (4) Bolt (brake release)
- (5) Plug (brake drain)
- (6) Plug (brake filler and level gauge)
- (7) Plug (gear box filler and level gauge)
- (8) Plug (gear box drain)
- (9) Brake
- (10) Differential
- (11) Gear box
- (12) Valve
- (13) Plug (hub reduction gear filler, level gauge and drain)
- (14) Parking brake release port **[RBR]** : G1/4
- (15) Parking brake release port **[RBL]** : G1/4
- (16) Plug (differential filler)
- (17) Plug (differential filler and level gauge)
- (18) Plug (differential drain)
- (19) Bolt : M20×250

-  (2) Nut M22 P=1.5 : 785 N·m (579 lbf-ft)
-  (19) Bolt M20×250 : 540 N·m (398 lbf-ft)


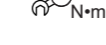
Specifications

- Tire inflation pressure : 137.5 kPa (20 psi)
- Tire assembly weight : 206 kg (454 lbs.)
- Rear axle assembly weight : 1,080 kg (2,381 lbs.)

3-2. Rear Axle (SV540/640T, TF, DF)



- (1) Tire
- (2) Nut : M22 P=1.5
- (3) Hub reduction gear
- (4) Bolt (brake release)
- (5) Plug (brake drain)
- (6) Plug (brake filler and level gauge)
- (7) Plug (gear box filler and level gauge)
- (8) Plug (gear box drain)
- (9) Brake
- (10) Differential
- (11) Gear box
- (12) Valve
- (13) Plug (hub reduction gear filler, level gauge and drain)
- (14) Parking brake release port [RBR] : G1/4
- (15) Parking brake release port [RBL] : G1/4
- (16) Plug (differential filler)
- (17) Plug (differential filler and level gauge)
- (18) Plug (differential drain)
- (19) Bolt : M20×250

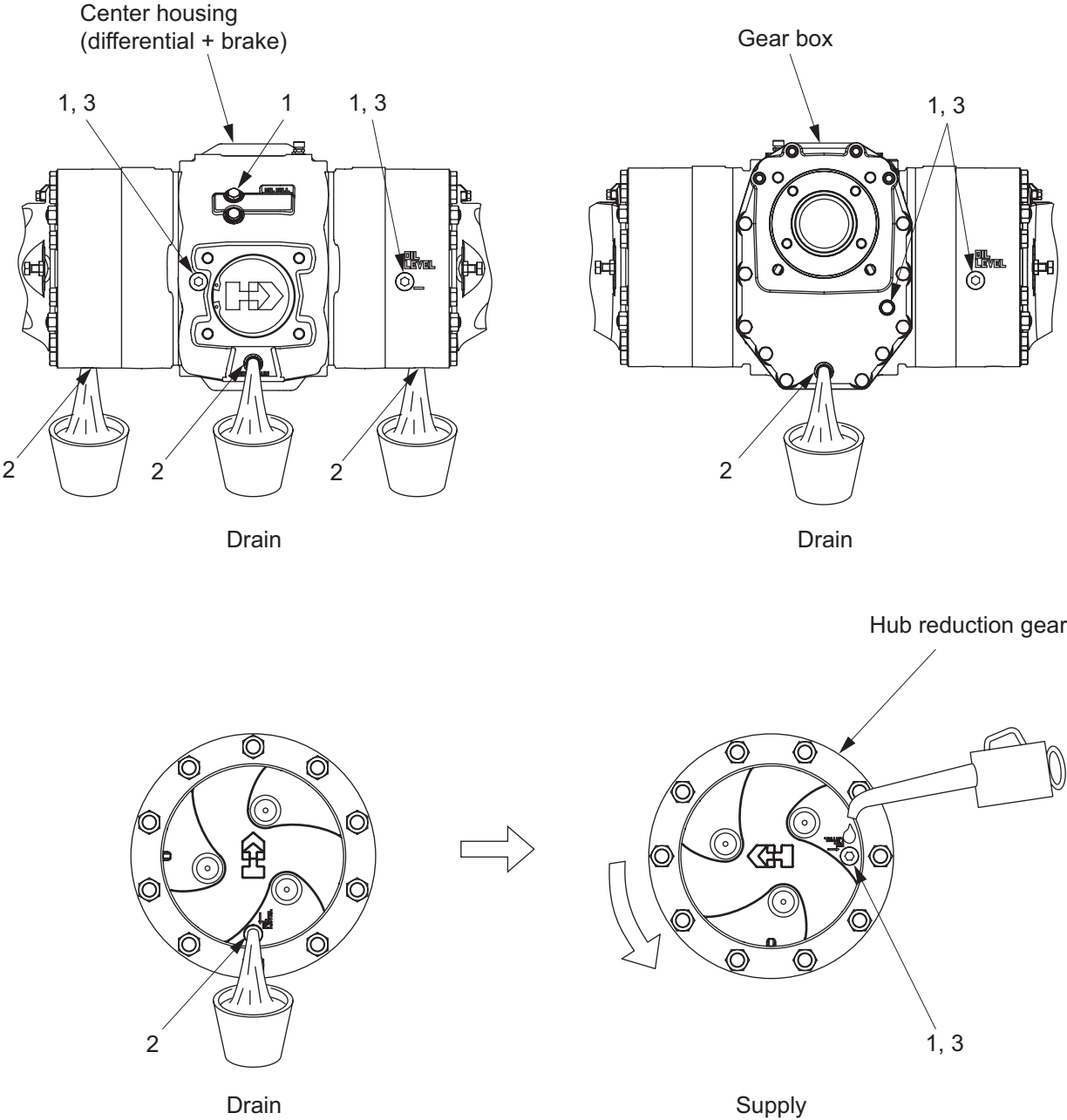
-  (2) Nut M22 P=1.5 : 785 N·m (579 lbf·ft)
-  (19) Bolt M20×250 : 540 N·m (398 lbf·ft)

Specifications

- Tire inflation pressure : 137.5 kPa (20 psi)
- Tire assembly weight : 245 kg (540 lbs.)
- Rear axle assembly weight : 1,120 kg (2,469 lbs.)

SECTION A-A

3-3. Rear Axle Lubrication



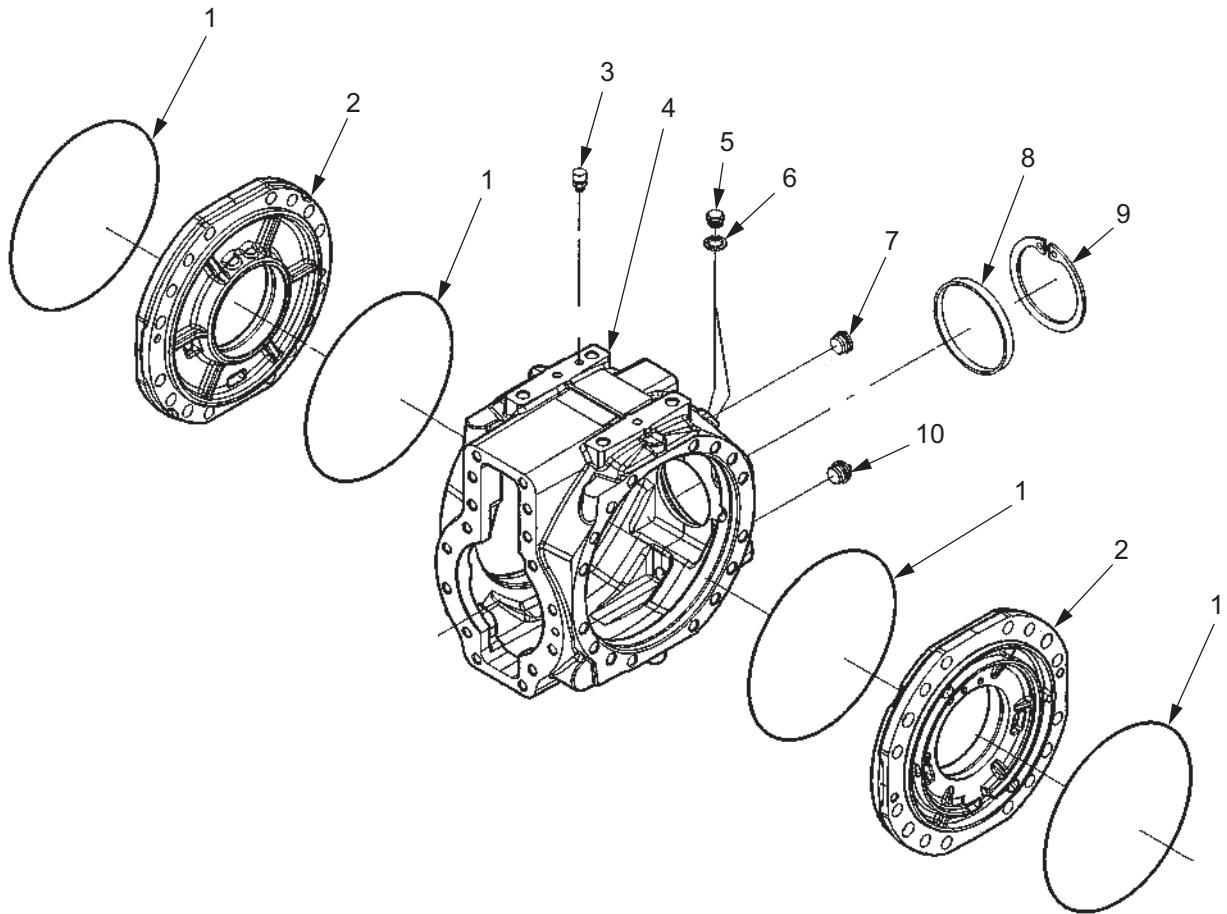
SV510-III-06100

- (1) Filler port
- (2) Drain port
- (3) Level gauge

- Change oil : Gear oil API-grade GL5 SAE90 (See recommended lubrication.)
- Change oil quantity
 - Gear box : 2.0 L (0.53 gal.)
 - Center housing : 11.0 L (2.90 gal.)
 - Hub reduction gear : 1.75 L×2 (0.46 gal.×2)

3-4. Rear Axle Structure

3-4-1. Center housing



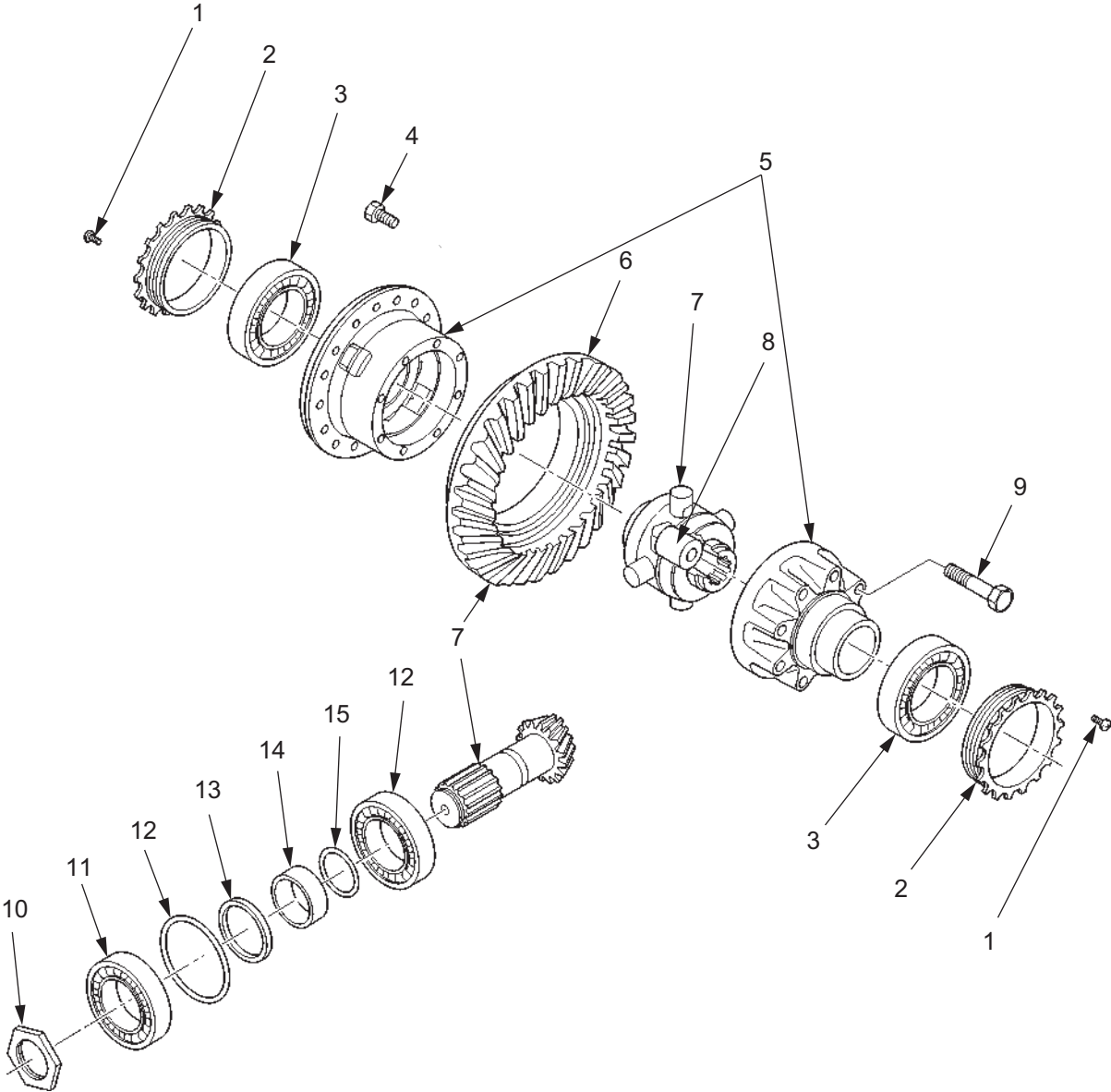
SV510-III-06093

- (1) O-ring
- (2) Cover
- (3) Vent
- (4) Housing

- (5) Bolt
- (6) Seal washer
- (7) Plug
- (8) Cover

- (9) Snap ring
- (10) Magnet plug

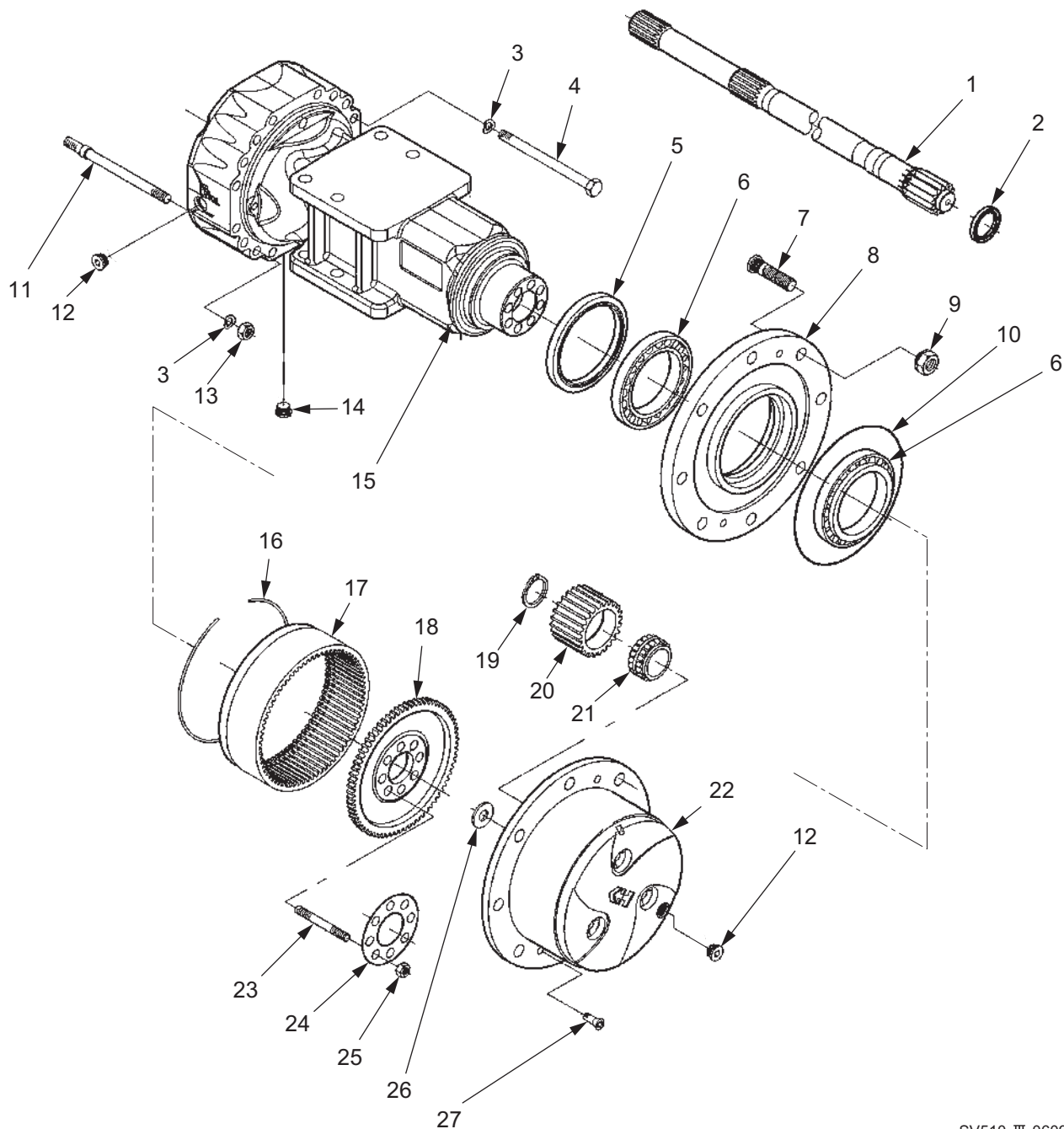
3-4-2. Differential



SV510-III-06101

- (1) Bolt
- (2) Ring nut
- (3) Taper roller bearing
- (4) Bolt
- (5) Differential carrier
- (6) Bevel gear set
- (7) Nospin differential
- (8) Spacer
- (9) Bolt
- (10) Ring nut
- (11) Taper roller bearing
- (12) Shim
- (13) Seal
- (14) Spacer
- (15) Shim

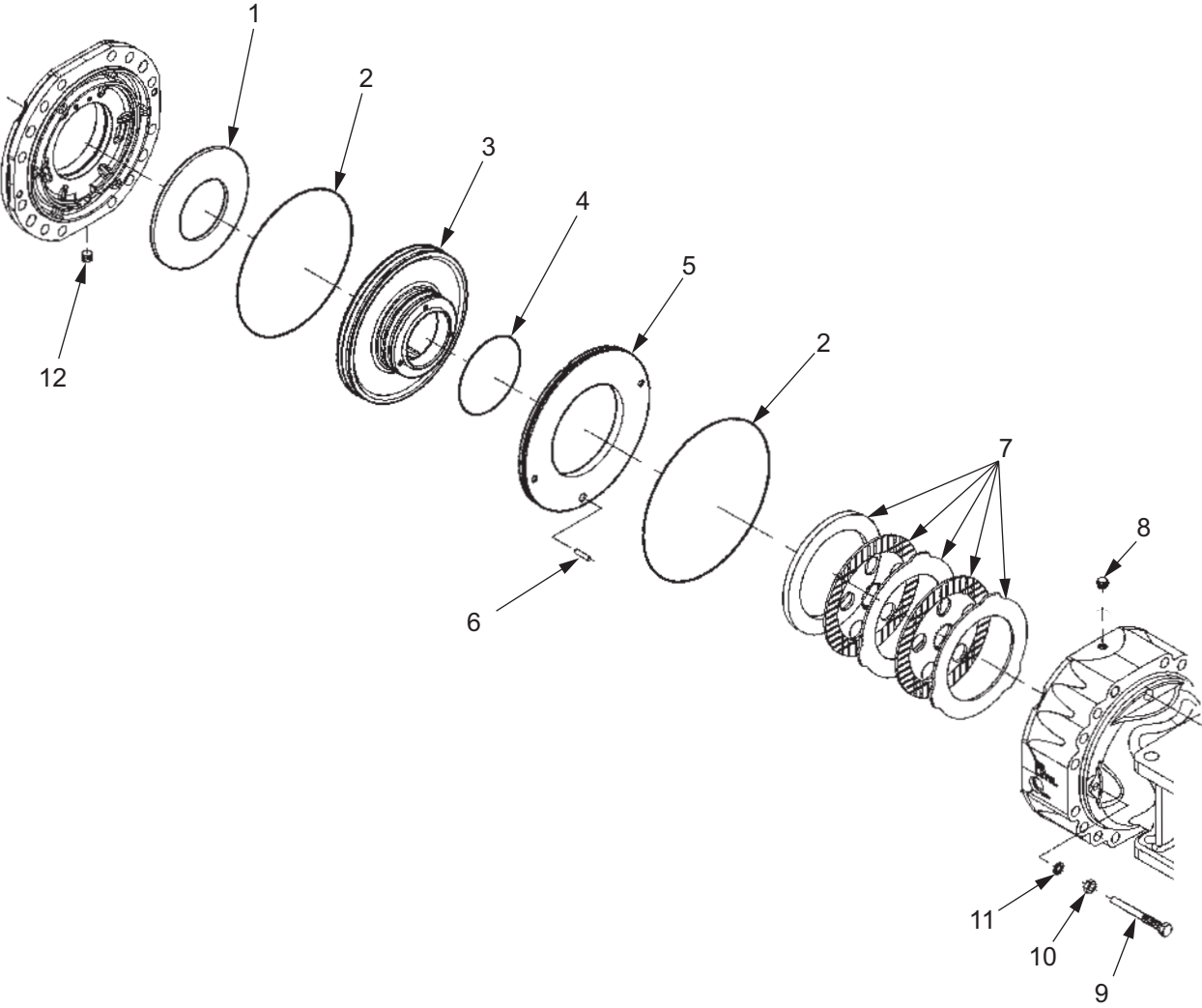
3-4-3. Hub reduction gear



SV510-III-06095

- | | | |
|-------------------|------------------------|--------------------------|
| (1) Half shaft | (10) O-ring | (19) Snap ring |
| (2) Seal | (11) Stud | (20) Planet gear |
| (3) Spring washer | (12) Plug | (21) Bearing |
| (4) Bolt | (13) Nut | (22) Planet gear carrier |
| (5) Seal | (14) Magnet plug | (23) Stud |
| (6) Bearing | (15) Axle case | (24) Locking plate |
| (7) Wheel stud | (16) Circlip | (25) Nut |
| (8) Wheel hub | (17) Ring gear | (26) Friction washer |
| (9) Wheel nut | (18) Ring gear support | (27) Countersunk bolt |

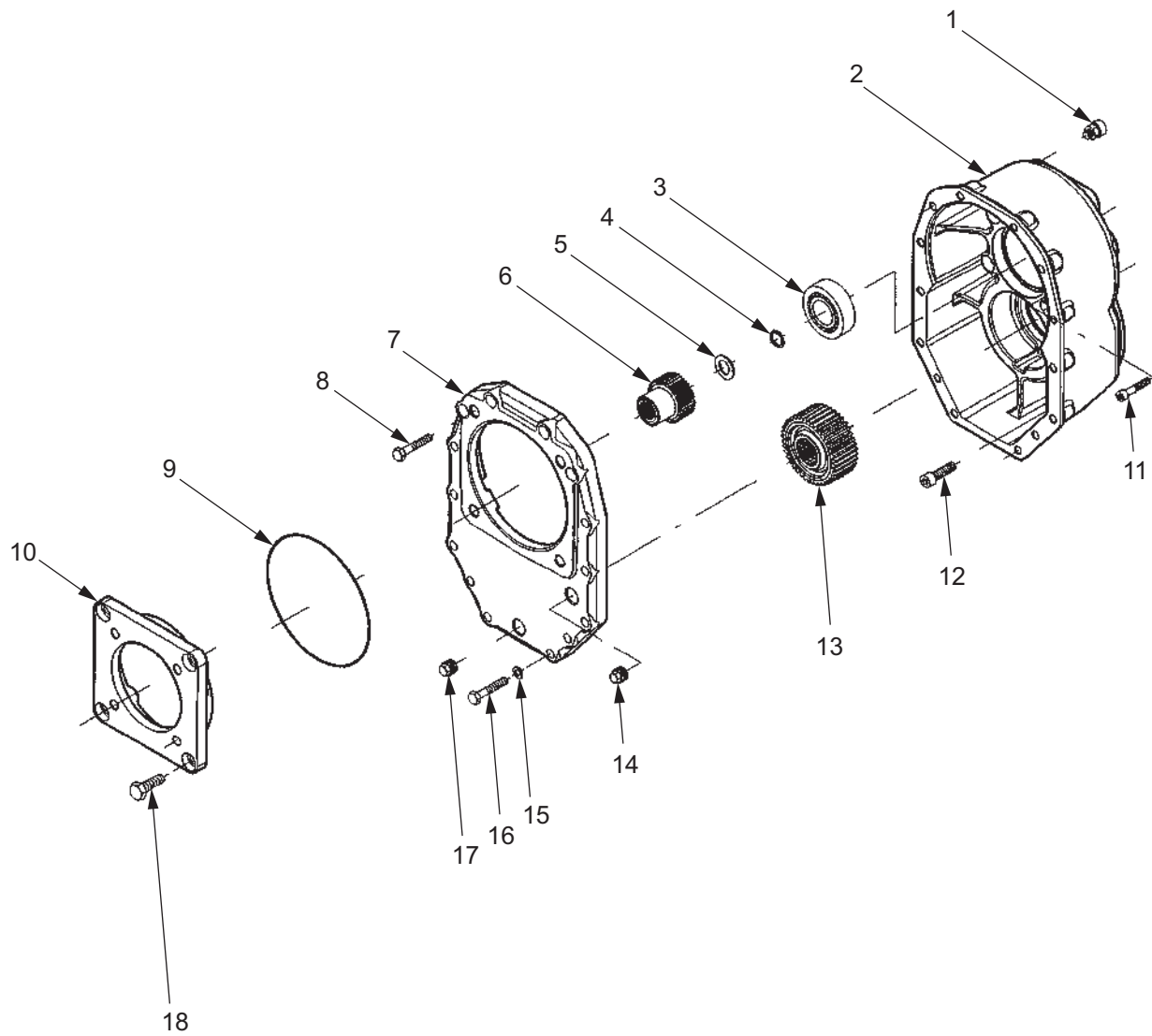
3-4-4. Brake



SV700-06094

- (1) Spring
- (2) O-ring
- (3) Piston
- (4) O-ring
- (5) Ring
- (6) Dowel
- (7) Brake disc
- (8) Plug
- (9) Bolt
- (10) Nut
- (11) Lock washer
- (12) Plug

3-4-5. Gear box

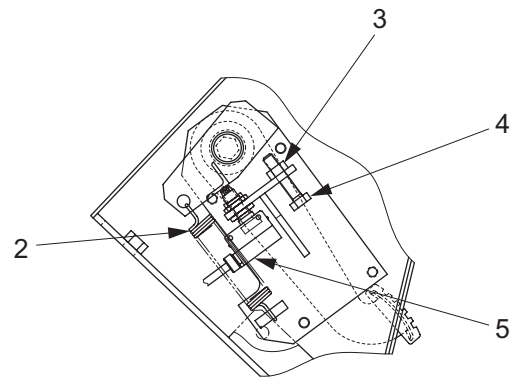
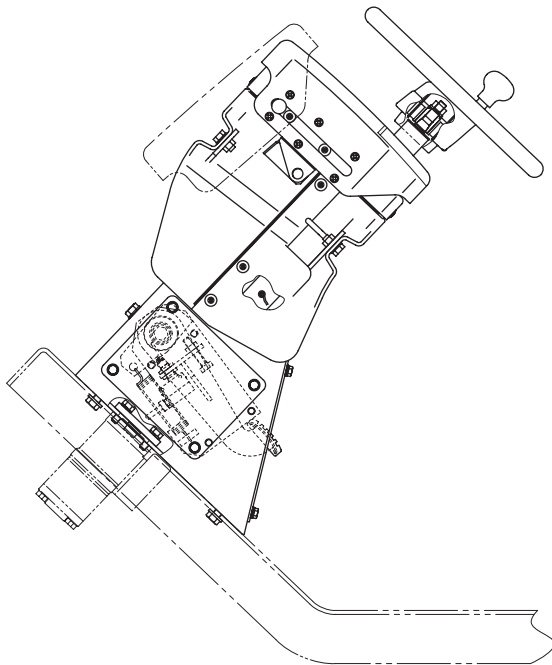
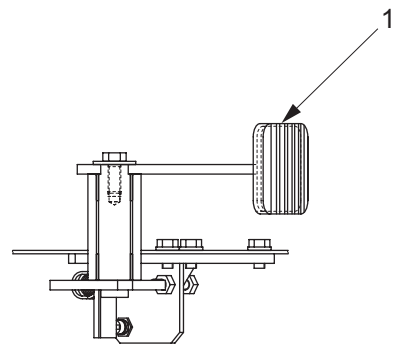
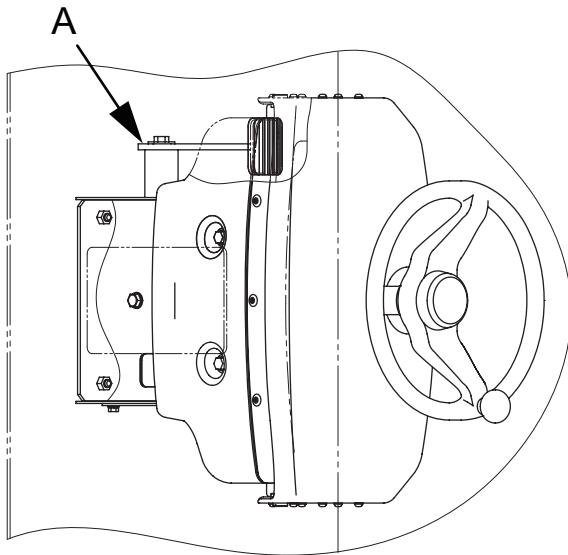


SV510-III-06097

- | | | |
|------------------|-------------------------|--------------------|
| (1) Vent | (7) Cover | (13) Gear |
| (2) Housing | (8) Cylinder bolt | (14) Plug |
| (3) Ball bearing | (9) O-ring | (15) Spring washer |
| (4) Circlip | (10) Intermediate cover | (16) Bolt |
| (5) Spacer | (11) Cylinder bolt | (17) Magnet plug |
| (6) Gear | (12) Bolt | (18) Cylinder bolt |

BRAKE

1. BRAKE PEDAL



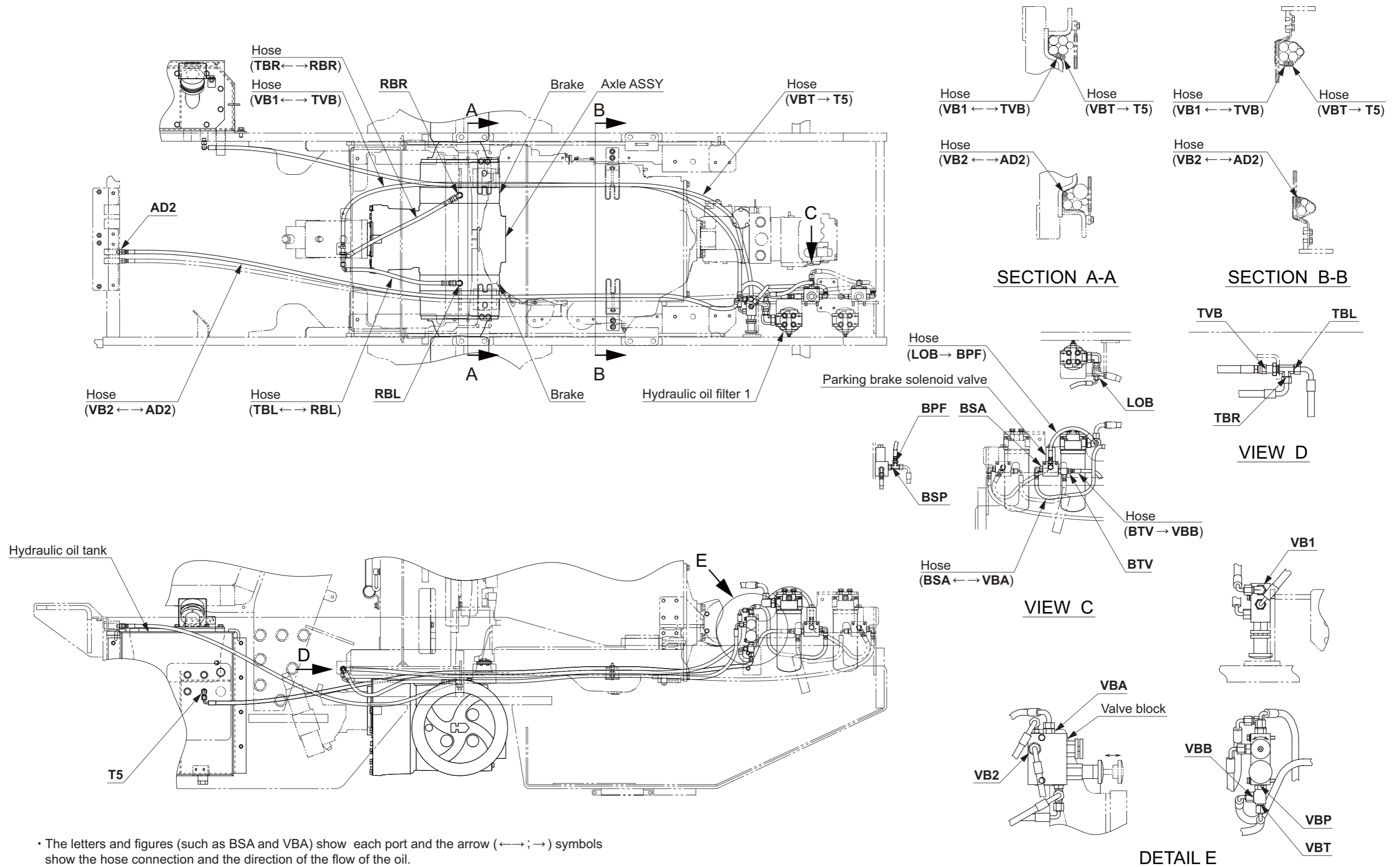
DETAIL A

0418-62801-0-10174-C

- (1) Brake pedal
- (2) Return spring
- (3) Nut : M10

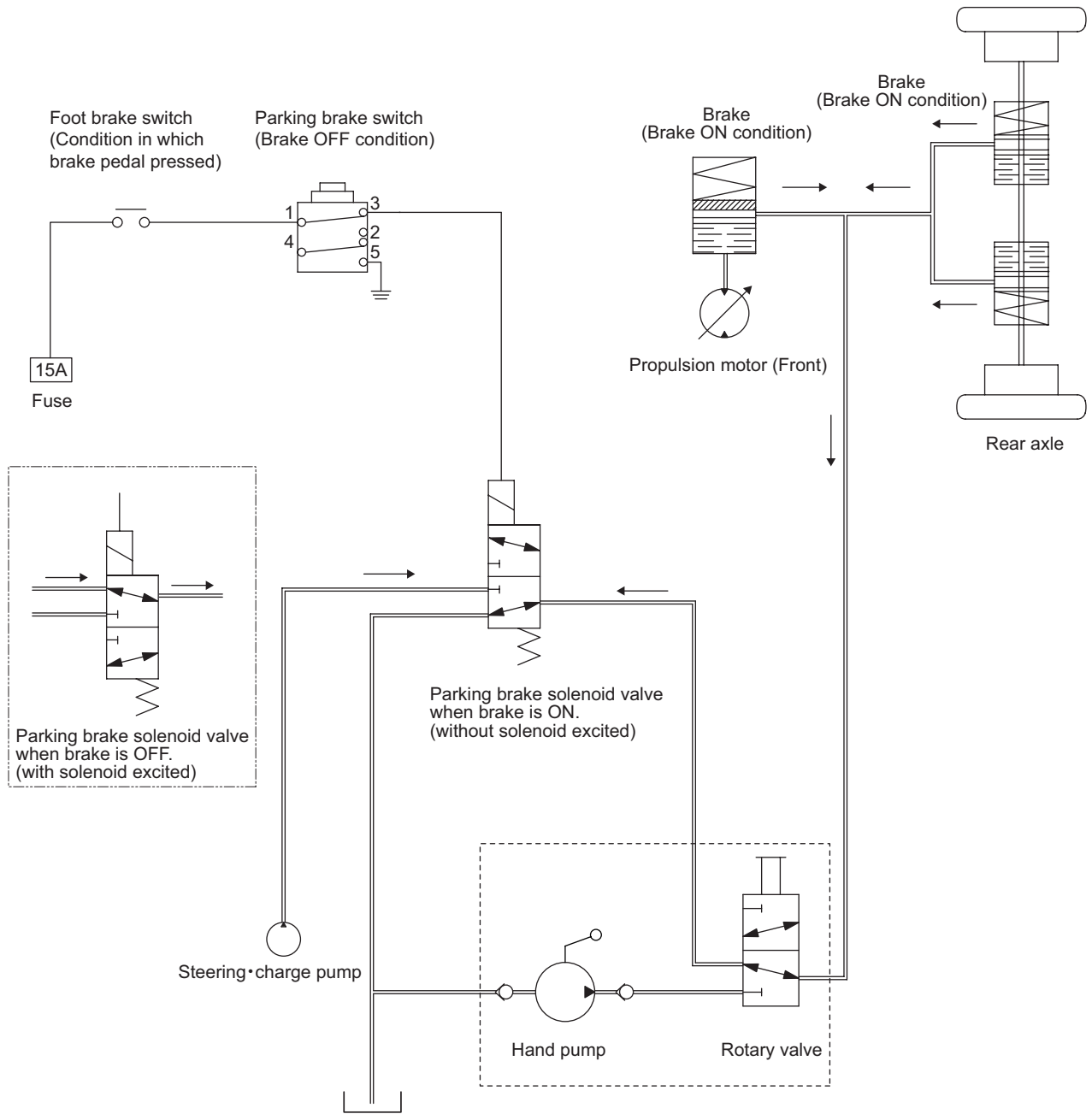
- (4) Stopper bolt : M10×50
- (5) Foot brake switch

2. BRAKE HYDRAULIC PIPING



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

3. BRAKE SYSTEM

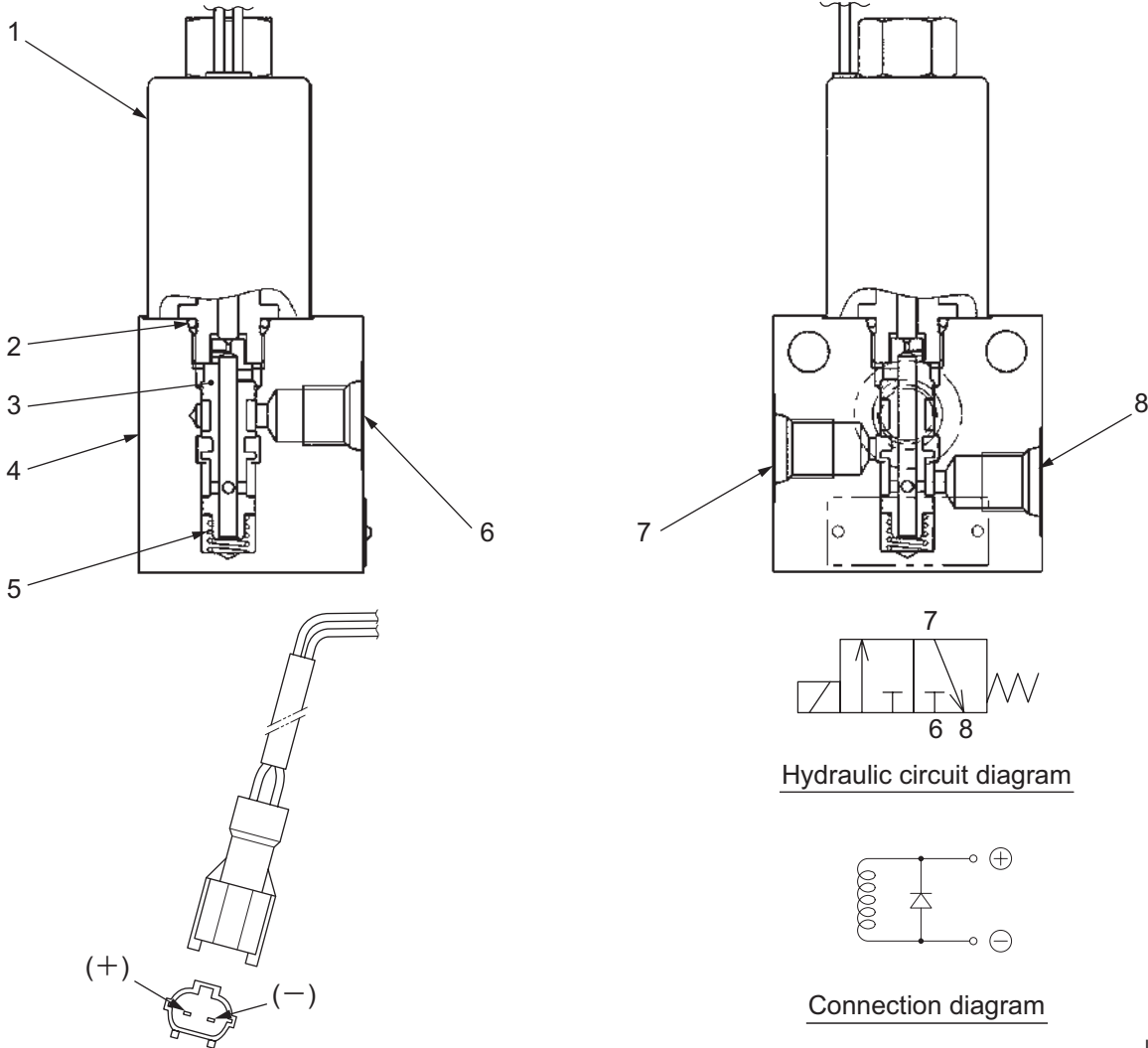


• The arrow (→) symbol shows the direction of the hydraulic oil flow.

SV540-07001

4. HYDRAULIC COMPONENT SPECIFICATIONS

4-1. Brake Solenoid Valve

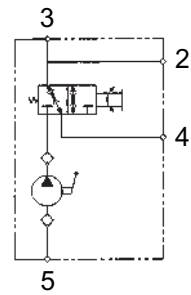
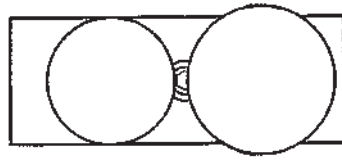


- (1) Solenoid
- (2) O-ring (1B P14)
- (3) Spool (J)
- (4) Body
- (5) Spring
- (6) Port P **[BSP]** : 9/16-18UNF-2B
- (7) Port A **[BSA]** : 9/16-18UNF-2B
- (8) Port T **[BST]** : 9/16-18UNF-2B

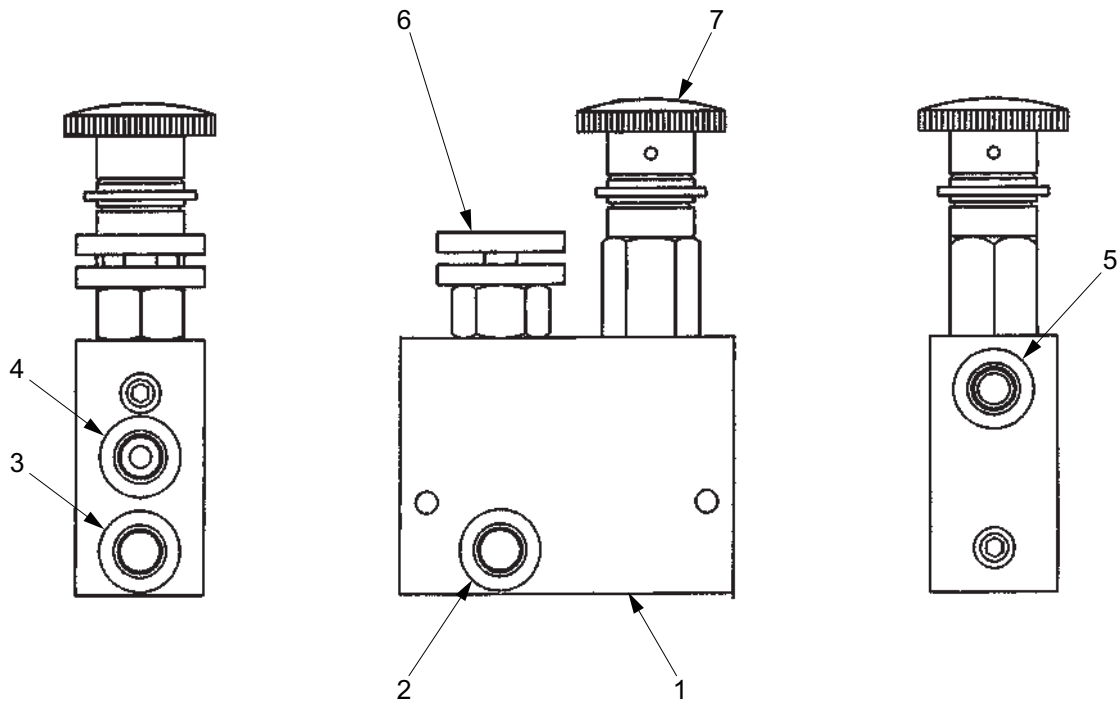
Specifications

- Rated pressure : 4.9 MPa (710 psi) (6, 7)
- : 0.5 MPa (72.5 psi) (8)
- Rated flow : 30 L/min (7.9 gal./min)
- Weight : 1.5 kg (3.3 lbs.)

4-2. Valve Block



Hydraulic circuit diagram



GW750-2-04011

(1) System block

(2) Port B2 **[VB2]** : 9/16-18UNF

(3) Port B1 **[VB1]** : 9/16-18UNF

(4) Port A **[VBA]** : 9/16-18UNF

(5) Port P **[VBP]** : 9/16-18UNF



(6) Rotary valve : 70 N·m (51.6 lbf-ft)

(7) Hand pump : 70 N·m (51.6 lbf-ft)

Specifications

- Maximum working pressure : 1.8 MPa (261 psi)
- Maximum flow : 5 L/min (1.3 gal./min)
- Hand pump displacement : 5.7 mL/stroke (0.0015 gal./stroke)

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 ADJUSTMENT OF PROPULSION CIRCUIT PRESSURE

2-1. Measurement

⚠ WARNING

Confirm that the parking brake works properly before measurement.

- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)

① Remove plugs from couplings (1) and (2) of propulsion pump. 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
- High pressure gauge port (Forward) : (2)
- High pressure gauge port (Reverse) : (1)
- Pressure gauge : 0 to 50 MPa
(0 to 7,250 psi)

② Set propulsion speed change switch to “”.

③ Start the engine and set throttle switch to “FULL”.

④ Establish a condition in which machine propulsion load becomes maximum.

(Pressure does not build up unless propulsion load is applied.)

⑤ With propulsion load at maximum, slowly move F-R lever to the side to be measured.

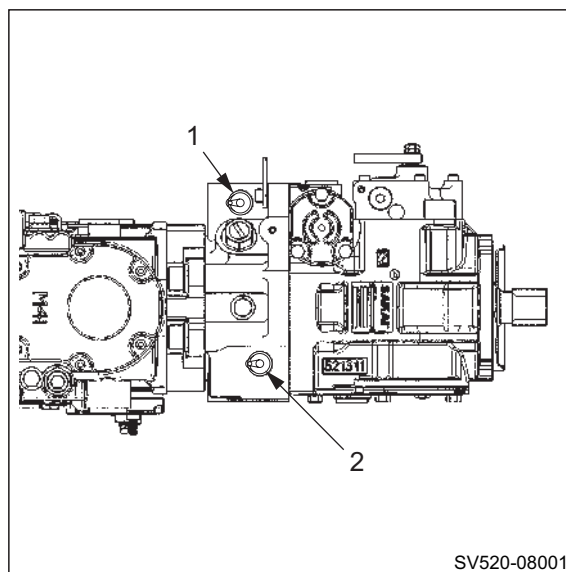
- Then, read pressure indicated by pressure gauge.

⑥ After measuring, promptly return F-R lever to “N”.

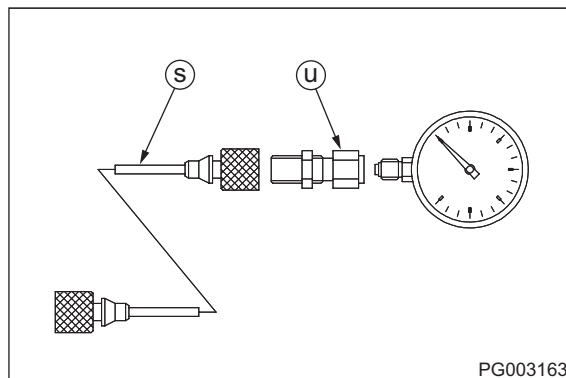
★ Maximum circuit pressure

(high pressure relief valve setting)

: 42.0 ± 1.0 MPa ($6,090 \pm 145$ psi)



SV520-08001



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2-2. Adjustment


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

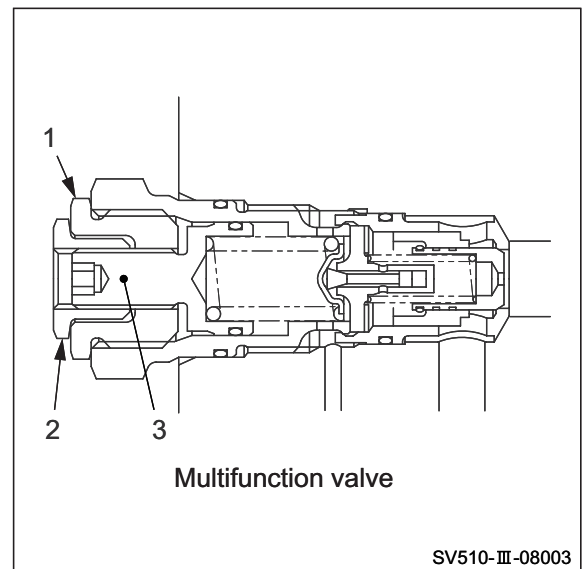
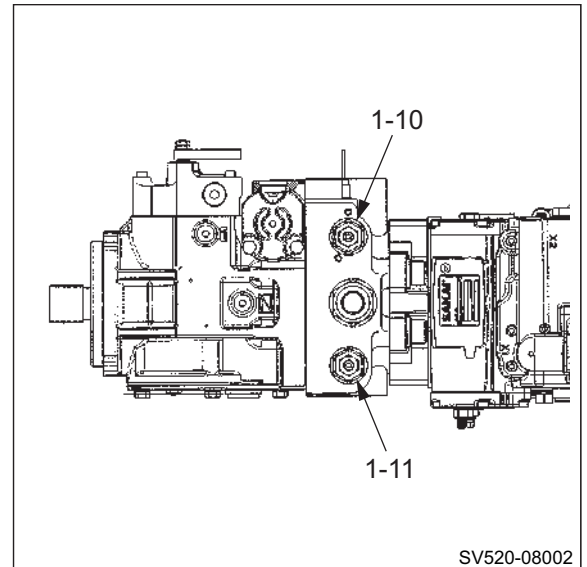
- ① Check nut (2) of multifunction valve (1-10) or (1-11) for evidence of having loosened.
 - Multifunction valve (Forward) : (1-11)
 - Multifunction valve (Reverse) : (1-10)
- ② If there is evidence of nut having loosened, adjust multifunction valve so that pressure becomes within maximum circuit pressure range while watching pressure gauge.
 - To adjust pressure, loosen nut and turn adjustment screw (3).

Adjustment screw turned clockwise
: Pressure rise

Adjustment screw turned counterclockwise
: Pressure drop

Pressure change rate : 9 MPa/turn (1,305 psi/turn)
- ③ If there is no evidence of nut having loosened, remove multifunction valve.
- ④ Check removed multifunction valve for trapped dirt and scratches on its seat.
- ⑤ If trapped dirt is present, disassemble and clean multifunction valve.
- ⑥ If a scratch is found on seat, replace multifunction valve.
- ⑦ After adjustment, measure pressure again and check that pressure reaches maximum circuit pressure range.

	(1)	Nut	: 41 N·m (30 lbf·ft)
	(2)	Nut	: 20 N·m (16 lbf·ft)
	(1-10)	Multifunction valve	: 89 N·m (66 lbf·ft)
	(1-11)	Multifunction valve	: 89 N·m (66 lbf·ft)



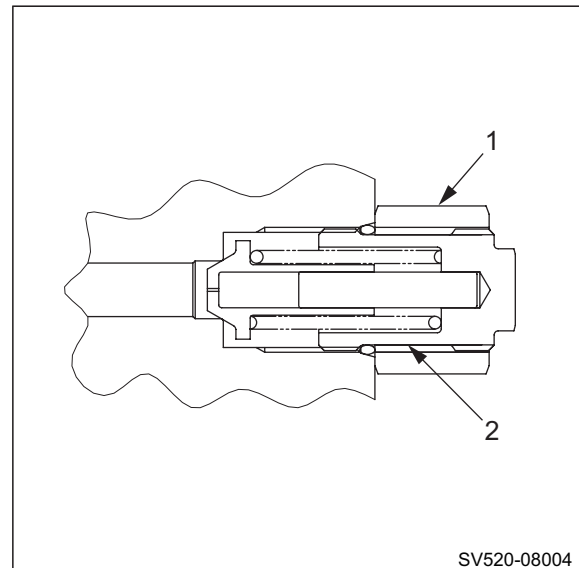
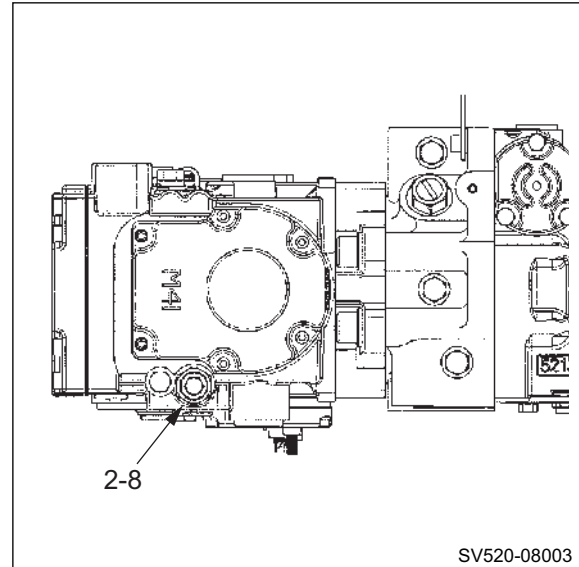
(NOTICE)

- **Carefully disassemble and reassemble after taking steps to prevent foreign material from getting in.**
- The numbers “1-10” and “1-11” appearing in above illustrations are consistent with lead line numbers shown in illustration of propulsion pump in “2-2. Hydraulic Component Specifications” (page 4-007).

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.
- Propulsion charge circuits and vibration charge circuits consist of parallel circuits. Thus, in order to measure whether vibrator charge circuit pressure is within standard value, use following operation to ensure that oil does not escape to the charge relief valve on vibrator pump side.

- ① Loosen nut (1) from charge relief valve (2-8) on vibrator pump side.
- ② Tighten adjustment screw (2) by two complete turns.
 - Adjustment screw turned clockwise : Pressure rise
 - Adjustment screw turned counterclockwise : Pressure drop
 - Pressure change rate : 0.56 MPa/turn (81.2 psi/turn)



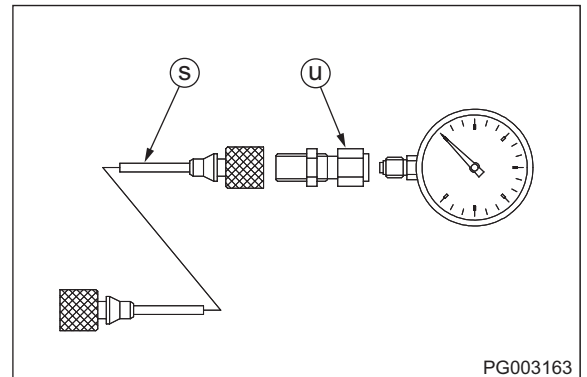
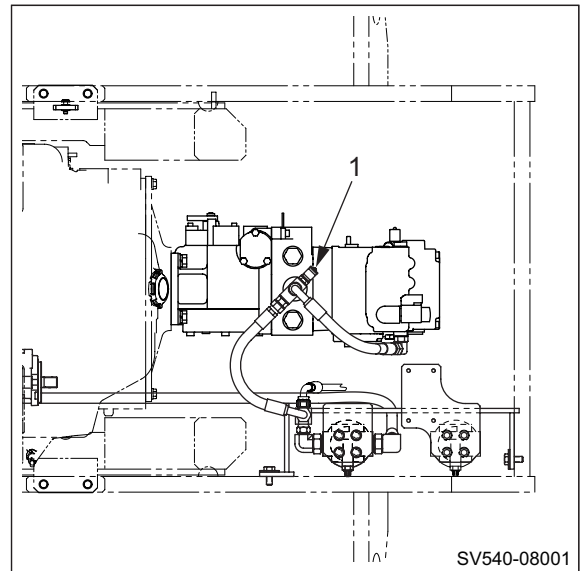
- The number “2-8” appearing in above illustrations is consistent with lead line numbers shown in illustration of vibrator pump in “2-2. Hydraulic Component Specifications” (page 4-007).

3-1. Measurement

- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)
- ① Remove plug from coupling (1) of propulsion pump.
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 5 MPa
(0 to 725 psi)
- ② Apply parking brake by pressing parking brake switch button.
- ③ Start the engine and set throttle switch to "FULL".
 - Then, read pressure indicated by pressure gauge.

★ **Standard charge relief valve setting**

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



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 (2) of charge relief valve (1-6) 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 (3).

Adjustment screw turned clockwise

: Pressure rise

Adjustment screw turned counterclockwise

: Pressure drop

Pressure change rate : 0.39 MPa/turn (57 psi/turn)

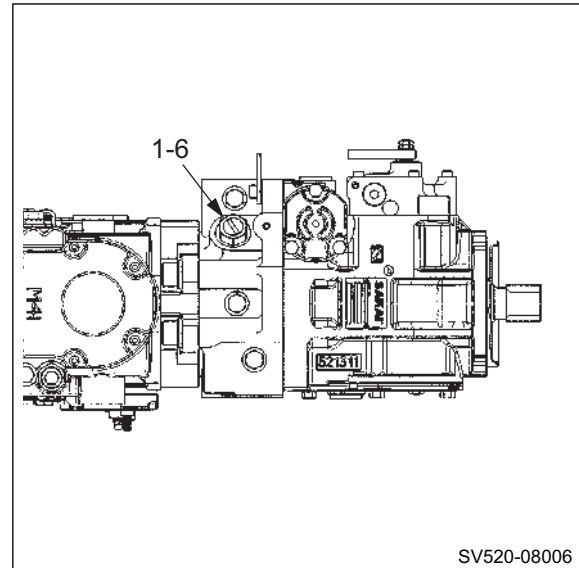
- ③ If there is no evidence of nut having loosened, remove charge relief valve.
- ④ Check removed charge relief valve for trapped dirt and scratches on its seat.
- ⑤ If trapped dirt is present, disassemble and clean charge relief valve.
- ⑥ If a scratch is found on seat, replace charge relief valve.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



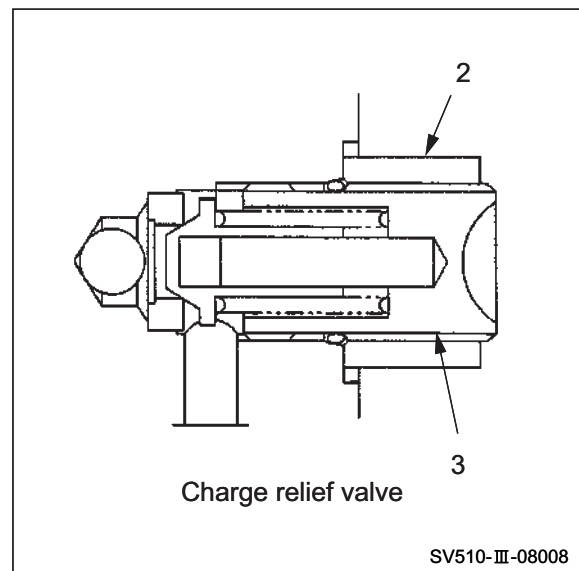
(2) Nut : 52 N·m (38 lbf·ft)

(NOTICE)

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



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- The number "1-6" appearing in above illustrations is consistent with lead line numbers shown in illustration of propulsion pump in "2-2. Hydraulic Component Specifications" (page 4-007).

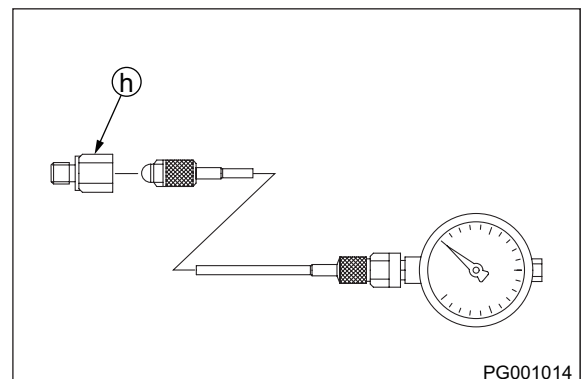
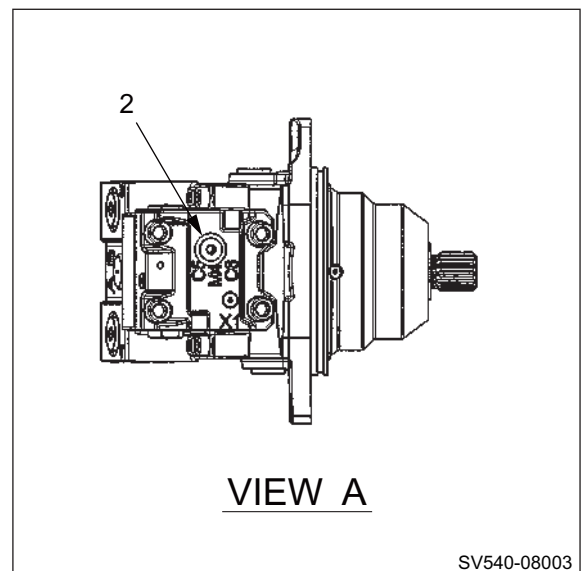
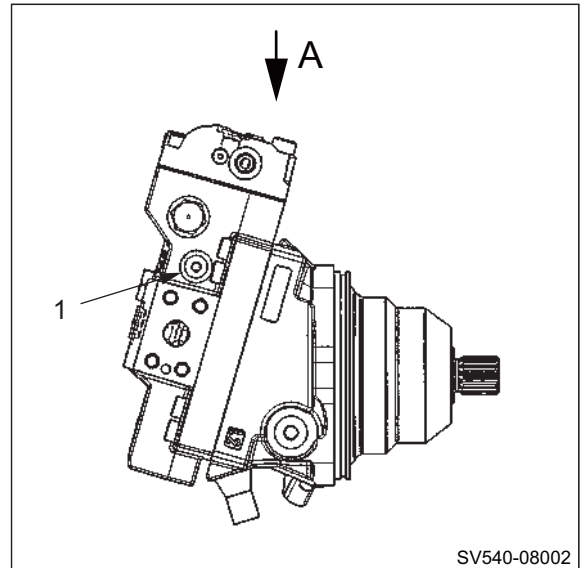
4. MEASUREMENT OF MACHINE HIGH/LOW SPEED CHANGE CIRCUIT PRESSURE

4-1. Measurement of Propulsion Motor (front)

- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)
- ① Remove plugs from front propulsion motor gauge ports (1) and (2). Attach pressure gauge with the adapter (h) .
 - Adapter (h) : 9/16-18UNF
 - Servo pressure gauge port (Low) : (1)
 - Servo pressure gauge port (High) : (2)
 - Pressure gauge : 0 to 5 MPa
(0 to 725 psi)
- ② Apply parking brake by pressing parking brake switch button.
- ③ Set propulsion speed change switch to “” or “”.
- ④ Start the engine and set throttle switch to “FULL”.
 - Then, read pressure indicated by pressure gauge.

★ **Standard charge relief valve setting**

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





4-2. Measurement of Propulsion Motor (rear)

- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)

① Remove plugs from front propulsion motor gauge ports (1) and (2). Attach pressure gauge with the adapter (h).

- Adapter (h) : 9/16-18UNF
- Servo pressure gauge port (Low) : (1)
- Servo pressure gauge port (High) : (2)
- Pressure gauge : 0 to 5 MPa
(0 to 725 psi)

② Apply parking brake by pressing parking brake switch button.

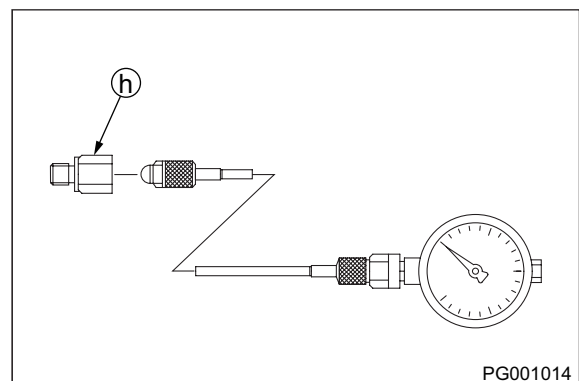
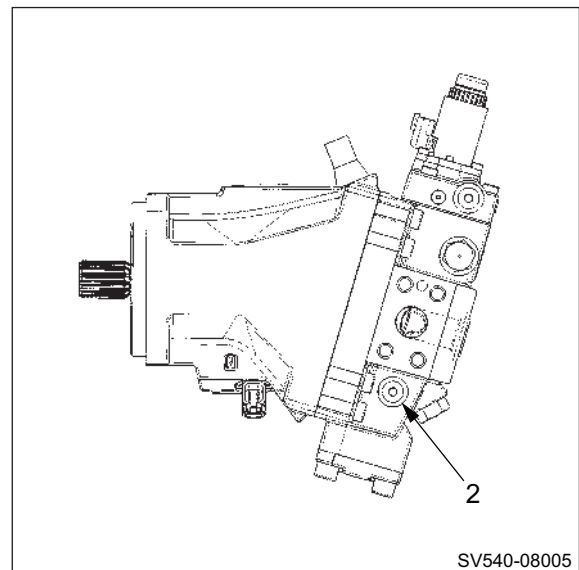
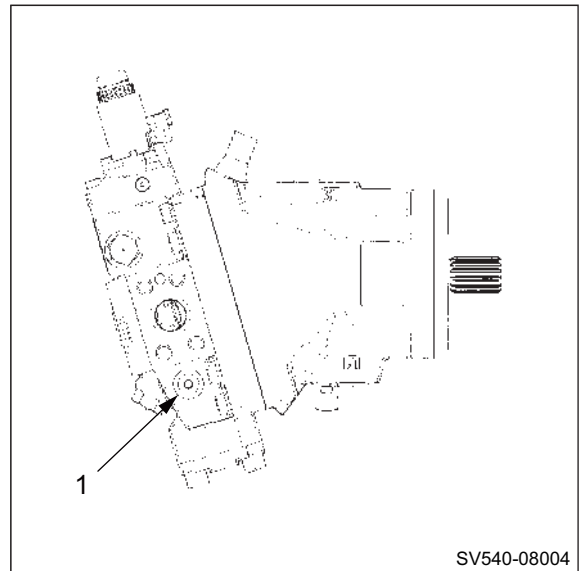
③ Set propulsion speed change switch to “” or “”.

④ Start the engine and set throttle switch to “FULL”.

- Then, read pressure indicated by pressure gauge.

★ Standard charge relief valve setting

: 2.0 ± 0.2 MPa (290 ± 29 psi)

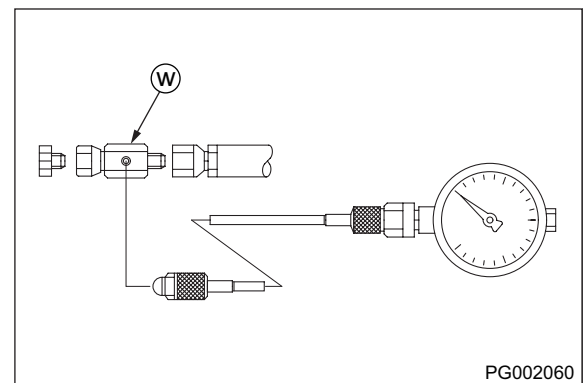
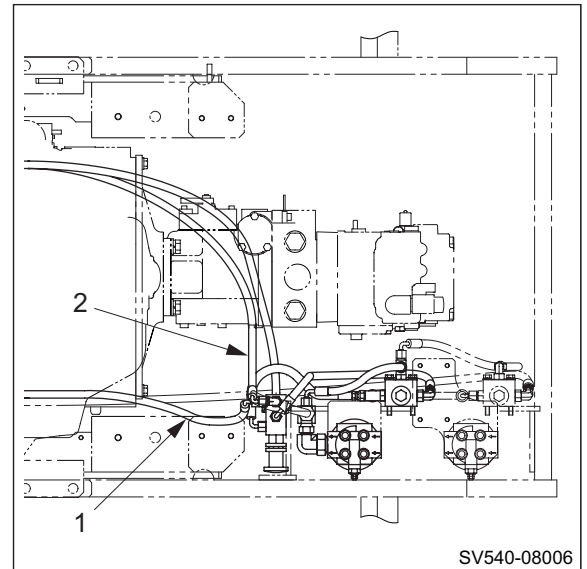


5. MEASUREMENT OF PARKING BRAKE RELEASE PRESSURE

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

5-1. Measurement

- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)
- ① Disconnect hoses (1) and (2) from valve block. Attach pressure gauge through adapter (W) .
 - Hose (1) : Gear box
 - Hose (2) : Rear axle
 - Adapter (W) : 4-4LOHL6G5TP (Parker part number)
 - Pressure gauge : 0 to 5 MPa (0 to 725 psi)
- ② Confirm that F-R lever is "N" properly.
- ③ Apply parking brake by pressing parking brake switch button.
- ④ Start the engine and set throttle switch to "FULL".
- ⑤ Release parking brake by pressing parking brake switch button.
 - Then, read brake release pressure indicated by pressure gauge.



★ Brake release pressure

Gear box : 1.8 MPa (261 psi) or more


Rear axle : 1.5 to 3.0 MPa (218 to 435 psi)

6. MEASUREMENT AND INSPECTION OF VIBRATOR CIRCUIT PRESSURE

6-1. Measurement

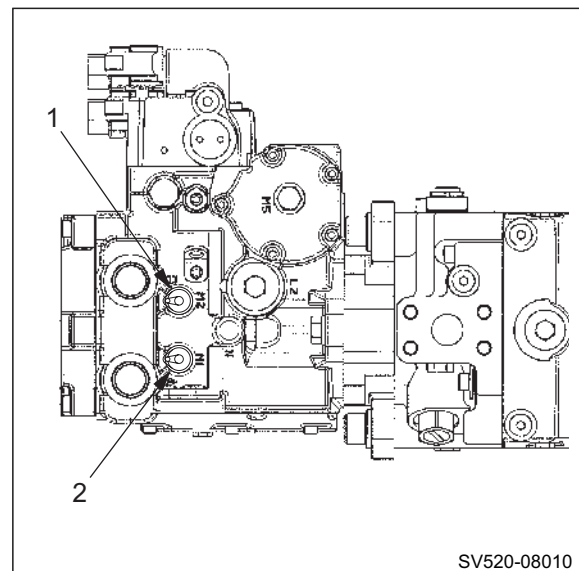
CAUTION

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.

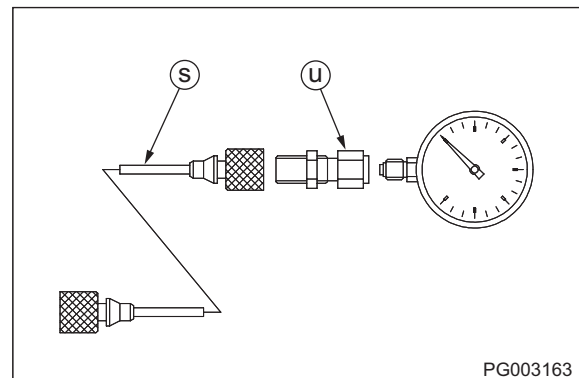
- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)
- ① Remove plugs from couplings (1) and (2) of vibrator pump. Attach pressure gauge with hose (S) and connector (U).
- Coupling : 9/16-18UNF×M16
- Adapter for hose (S) : M16 P=2.0
- Pressure gauge connector (U) : M16×G3/8
- High pressure gauge port : (2)
(Low amplitude)
- High pressure gauge port : (1)
(High amplitude)
- Pressure gauge : 0 to 50 MPa
(0 to 7,250 psi)
- ② Apply parking brake by pressing parking brake switch button.
- ③ Set vibration mode change switch to “”.
- ④ Start the engine and set throttle switch to “FULL”.
- ⑤ Press F-R lever vibration switch ON.
 - Then, read pressure gauge for maximum value of vibrator circuit pressure.
- ⑥ Press F-R lever vibration switch OFF as soon as measurement is finished.

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

: 28.0 ± 1.0 MPa ($4,060 \pm 145$ psi)



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


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6-2. Inspection

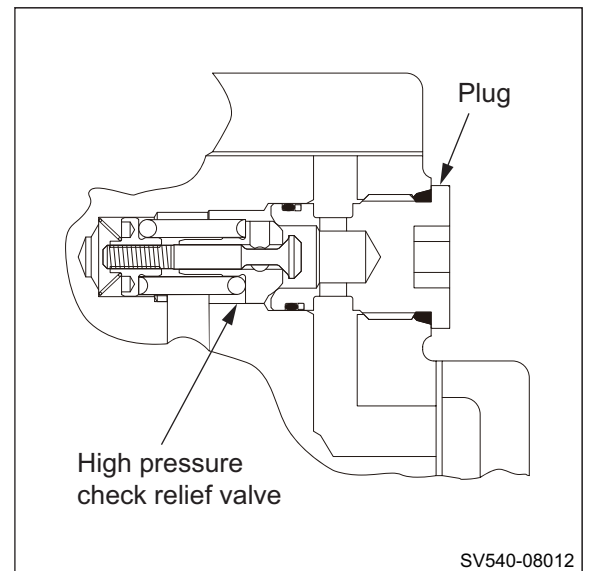
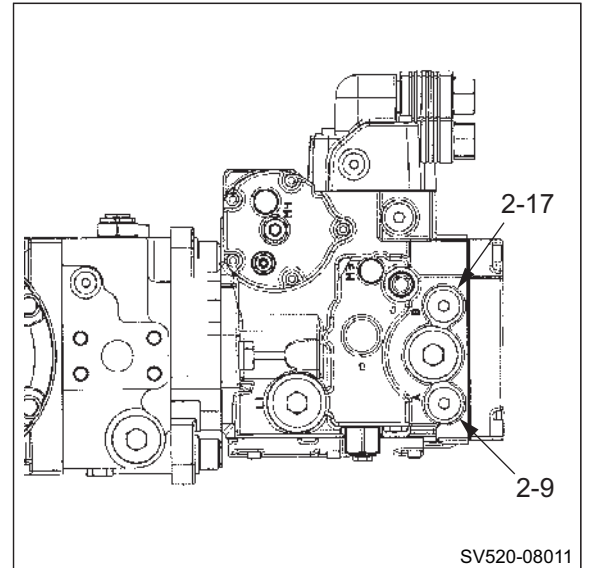
- If measurement results indicate the pressure deviating from maximum circuit pressure range, make an inspection in accordance with procedure described below.

- ① Remove plug and high pressure check relief valve (2-9) or (2-17) of vibrator pump.
 - High pressure check relief valve (Low amplitude) : (2-9)
 - High pressure check relief valve (High amplitude) : (2-17)
- ② Check removed high pressure check relief valve for trapped dirt and other abnormalities.
- ③ If trapped dirt is present, disassemble and clean high pressure check relief valve.
- ④ If pressure still deviates from maximum circuit pressure range after valve is disassembled and cleaned, replace high pressure check 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.**

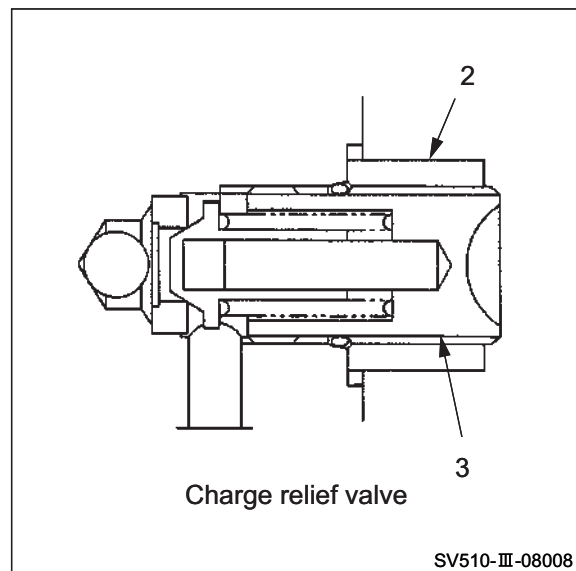
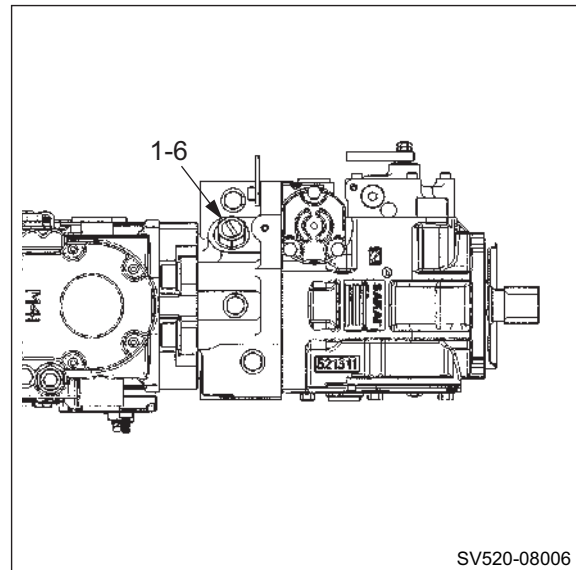


- The numbers “2-9” and “2-17” appearing in above illustrations are consistent with lead line numbers shown in illustration of vibrator pump in “2-2. Hydraulic Component Specifications” (page 4-007).

7. MEASUREMENT AND ADJUSTMENT OF VIBRATOR CHARGE CIRCUIT PRESSURE

- Since oil in charge circuit is supplied from steering circuit, confirm that steering operation is normal before measurement.
- Propulsion charge circuits and vibration charge circuits consist of parallel circuits. Thus, in order to measure whether vibrator charge circuit pressure is within standard value, use following operation to ensure that oil does not escape to the charge relief valve on propulsion pump side.

- ① Loosen nut (2) from charge relief valve (1-6) on propulsion pump side.
- ② Tighten adjustment screw (3) by two complete turns.
 - Adjustment screw turned clockwise : Pressure rise
 - Adjustment screw turned counterclockwise : Pressure drop
 - Pressure change rate : 0.39 MPa/turn (57 psi/turn)



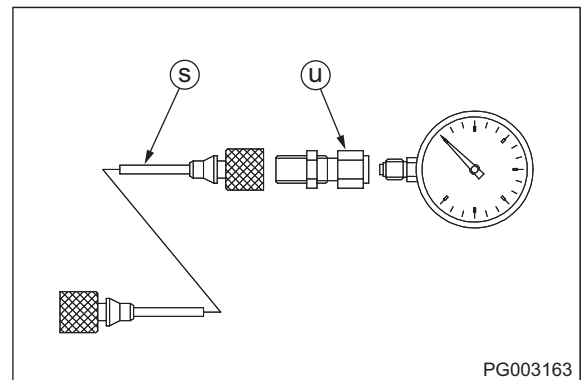
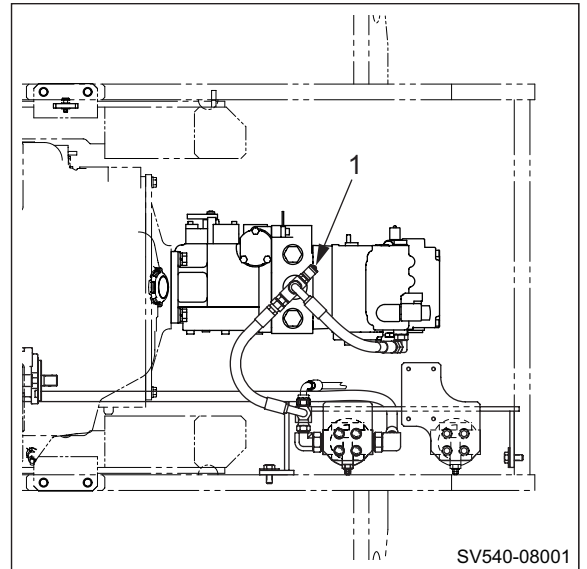
- The number “1-6” appearing in above illustrations is consistent with lead line numbers shown in illustration of vibrator pump in “2-2. Hydraulic Component Specifications” (page 4-007).

7-1. Measurement

- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)
- ① Remove plug from coupling (1) of propulsion pump.
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 5 MPa (0 to 725 psi)
- ② Apply parking brake by pressing parking brake switch button.
- ③ Start the engine and set throttle switch to "FULL".
 - Then, read pressure indicated by pressure gauge.

★ Standard charge relief valve setting

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



7-2. 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 (2-8) 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 : 0.56 MPa/turn (81.2 psi/turn)

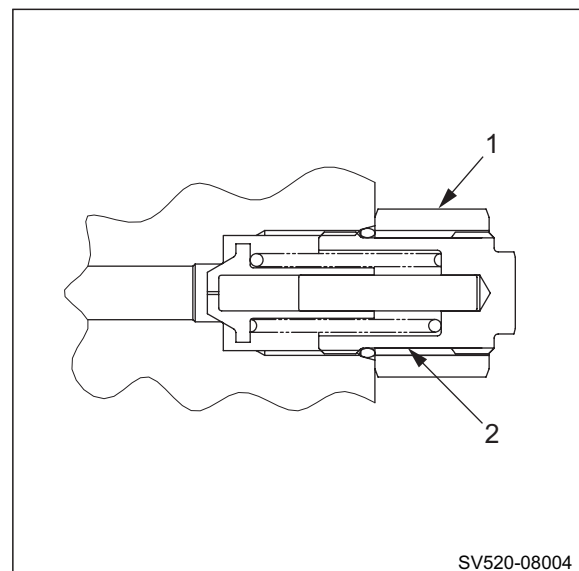
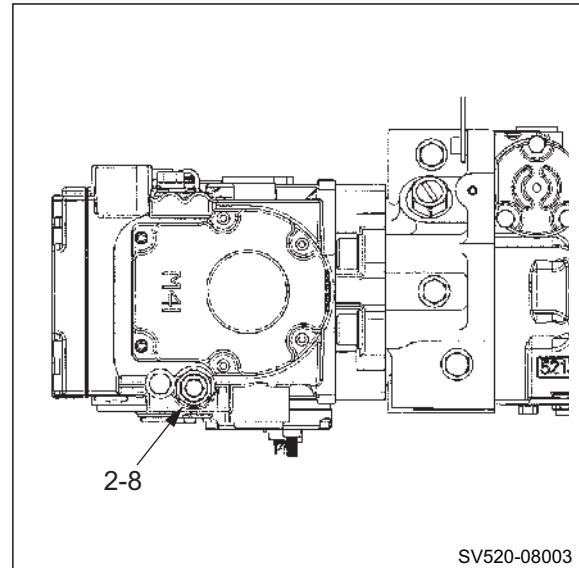
- ③ If there is no evidence of nut having loosened, remove charge relief valve.
- ④ Check removed charge relief valve for trapped dirt and scratches on its seat.
- ⑤ If trapped dirt is present, disassemble and clean charge relief valve.
- ⑥ If a scratch is found on seat, replace charge relief valve.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



(1) Nut : 40 N·m (30 lbf·ft)

(NOTICE)

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



- The number “2-8” appearing in above illustrations is consistent with lead line numbers shown in illustration of propulsion pump in “2-2. Hydraulic Component Specifications” (page 4-007).

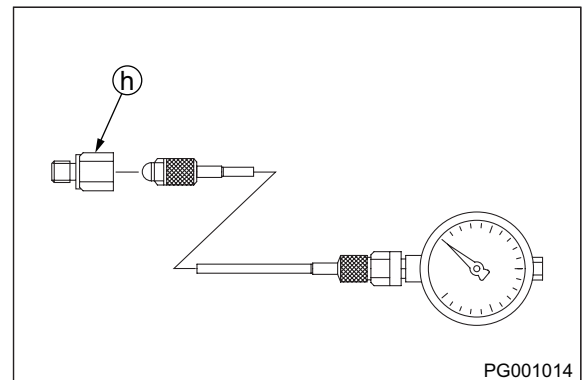
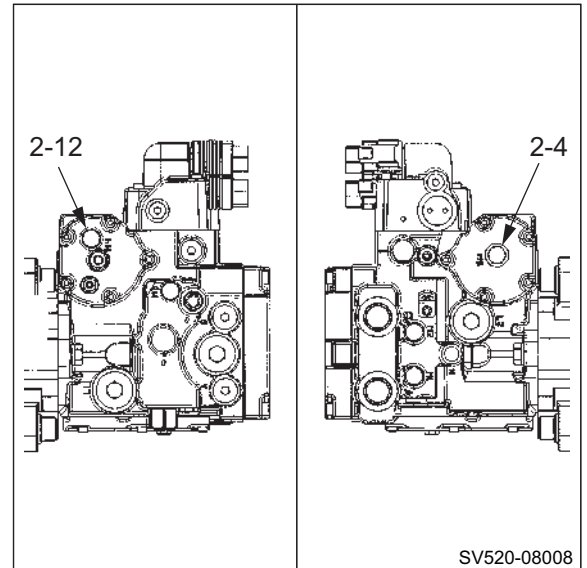
8. MEASUREMENT OF VIBRATOR HIGH/LOW CHANGE CIRCUIT PRESSURE

8-1. Measurement

- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)
- ① Remove plugs from servo pressure gauge ports (2-4) and (2-12). Attach pressure gauge with the adapter (h) .
 - Adapter (h) : 9/16-18UNF
 - Servo pressure gauge port (High) : (2-12)
 - Servo pressure gauge port (Low) : (2-4)
 - Pressure gauge : 0 to 5 MPa (0 to 725 psi)
- ② Apply parking brake by pressing parking brake switch button.
- ③ Start the engine and set throttle switch to "FULL".
- ④ Set vibration select switch and then read pressure indicated by pressure gauge.
 - With vibration select switch is in "○", measured pressures of (2-4) and (2-12) are same.
 - With vibration select switch is in "∩" or "∪", measured pressures of (2-4) and (2-12) are different.

★ **Standard charge relief valve setting**

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



- The number "2-4" and "2-12" appearing in above illustrations is consistent with lead line numbers shown in illustration of propulsion pump in "2-2. Hydraulic Component Specifications" (page 4-007).

9. MEASUREMENT AND INSPECTION OF STEERING CIRCUIT PRESSURE

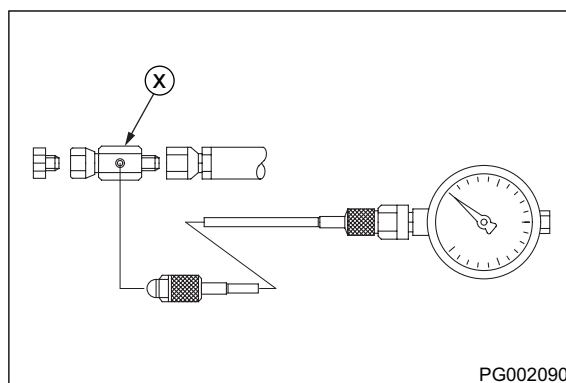
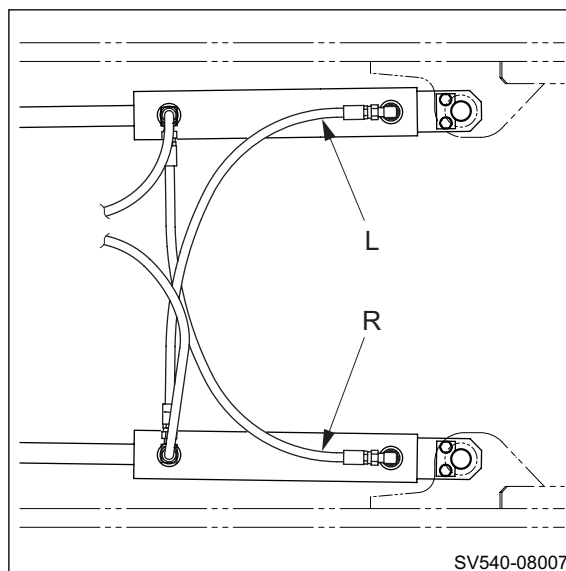
9-1. Measurement

⚠ 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 Disconnect the hose (L) or (R) from steering cylinder.
Attach pressure gauge through adapter (X) .
 - Adapter (X) : 6-4LOHL6G5TP (Parker part number)
 - Pressure gauge : 0 to 25 MPa (0 to 3,625 psi)
- ② Confirm that F-R lever is "N" properly.
- ③ Start the engine and set throttle switch to "FULL".
- ④ Turn steering wheel to operate relief valve.
 - Then, read pressure indicated by pressure gauge.

★ **Standard maximum circuit pressure**
(orbitroll relief pressure + charge relief pressure)
: 16.4 ± 1.0 MPa ($2,378 \pm 145$ psi)

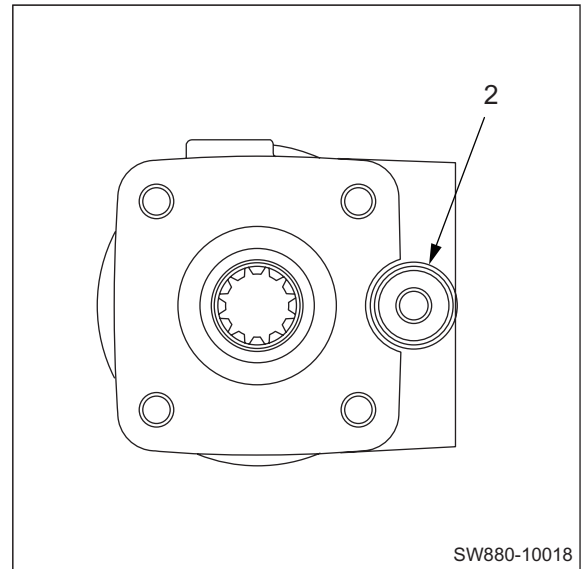


9-2. Inspection

- If measurement results indicate the pressure deviating from standard maximum circuit pressure range, make an inspection 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.**



10. MEASUREMENT OF HYDRAULIC PUMP CASE PRESSURE


PRESSURE

10-1. 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 (K) .



- Adapter (K) : 12-4LOHL6G5TF
(Parker part number)
- Pressure gauge : 0 to 5 MPa (0 to 725 psi)

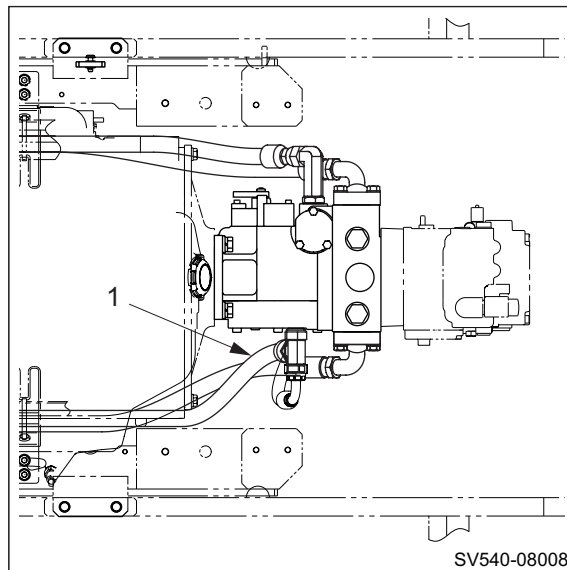
② Set propulsion speed change switch to “”.

③ Start the engine and set throttle switch to “FULL”.

④ Establish a condition in which machine propulsion load becomes maximum.

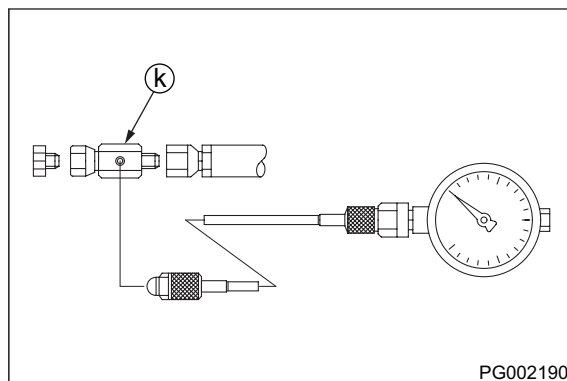
(Pressure does not build up unless propulsion load is applied.)

⑤ With propulsion load at maximum, measure pressure when speed change switch is in “” and “” and F-R lever is in “N”, “F”, and “R”, respectively.



★ Allowable pump case pressure


: 0.3 MPa (43.5 psi) or less



10-2. Measurement of Vibrator Pump Case Pressure

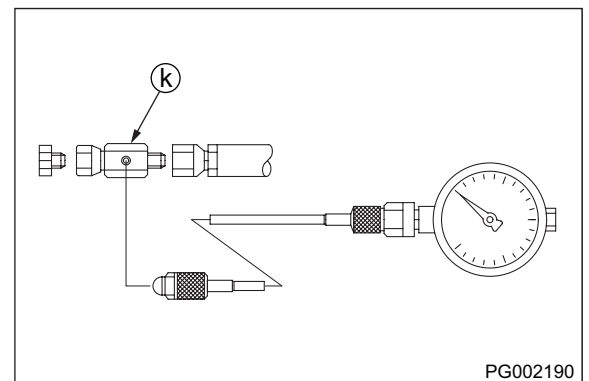
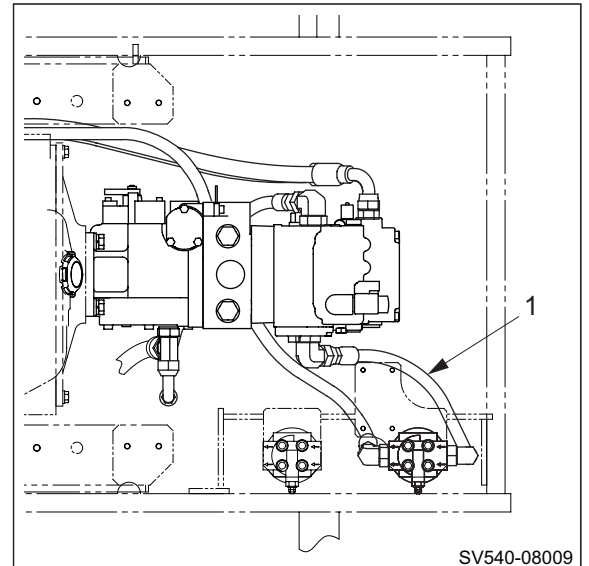
⚠ CAUTION

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

- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)
- ① Disconnect hose (1) from vibrator pump. Attach pressure gauge through adapter (k) .
 - Adapter (k) : 12-4LOHL6G5TF
(Parker part number)
 - Pressure gauge : 0 to 5 MPa (0 to 725 psi)
- ② Apply parking brake by pressing parking brake switch button.
- ③ Set vibration mode change switch to “

★ Allowable pump case pressure

: 0.3 MPa (43.5 psi) or less




11. MEASUREMENT OF PROPULSION MOTOR CASE PRESSURE

11-1. Measurement of Propulsion Motor (front)

- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)

① Remove plug from drain port (1). Attach pressure gauge and adapter ① .



- Adapter ① : 7/8-14UNF
- Pressure gauge : 0 to 5 MPa (0 to 725 psi)

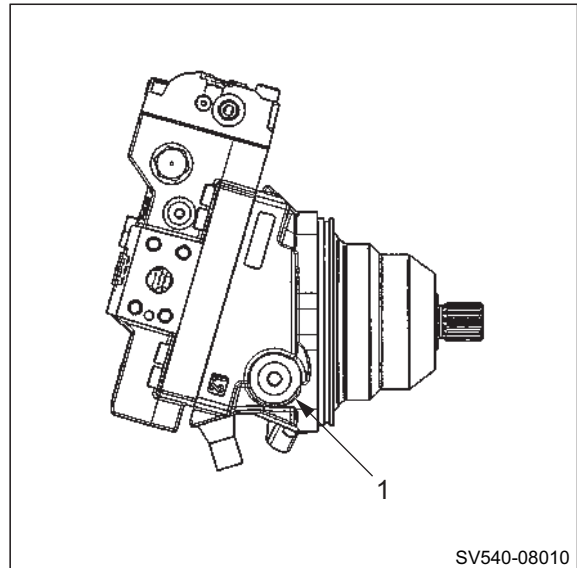
② Set propulsion speed change switch to “”.

③ Start the engine and set throttle switch to “FULL”.

④ Establish a condition in which machine propulsion load becomes maximum.

(Pressure does not build up unless propulsion load is applied.)

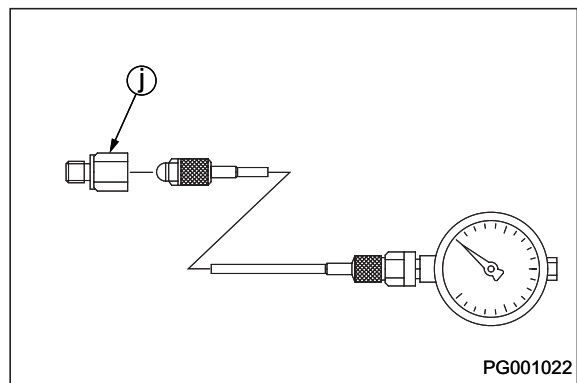
⑤ With propulsion load at maximum, measure pressure when speed change switch is in “” and “” and F-R lever is in “N”, “F”, and “R”, respectively.



SV540-08010




★ Allowable motor case pressure

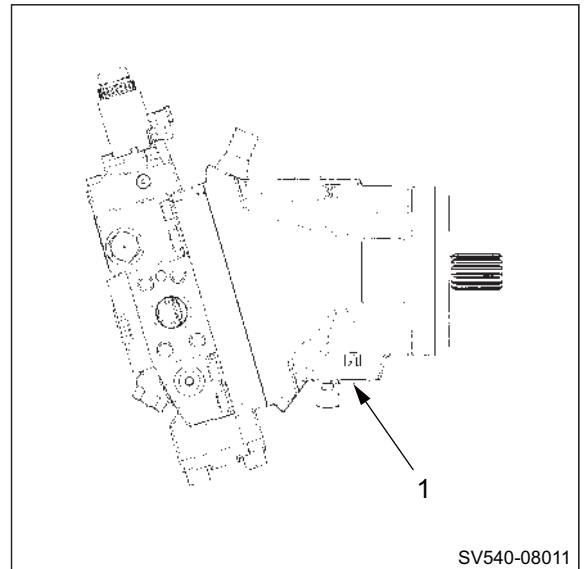
: 0.3 MPa (43.5 psi) or less



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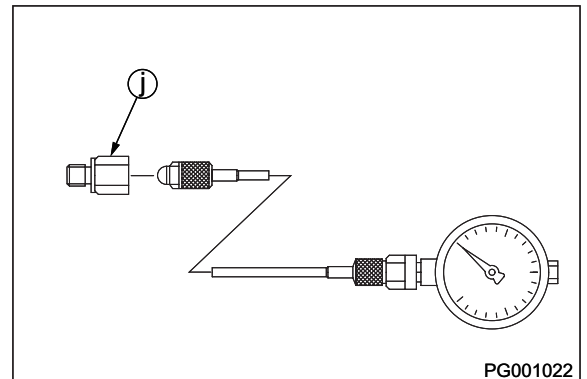
11-2. Measurement of Propulsion Motor (rear)

- Oil temperature during measurement : $50 \pm 5^{\circ}\text{C}$ ($122 \pm 9^{\circ}\text{F}$)
- ① Remove plug from drain port (1). Attach pressure gauge and adapter ① .
 - Adapter ① : 7/8-14UNF
 - Pressure gauge : 0 to 5 MPa (0 to 725 psi)
- ② Set propulsion speed change switch to “”.
- ③ Start the engine and set throttle switch to “FULL”.
- ④ Establish a condition in which machine propulsion load becomes maximum.
(Pressure does not build up unless propulsion load is applied.)
- ⑤ With propulsion load at maximum, measure pressure when speed change switch is in “” and “” and F-R lever is in “N”, “F”, and “R”, respectively.



★ Allowable motor case pressure

: 0.3 MPa (43.5 psi) or less






12. MEASUREMENT OF VIBRATOR MOTOR CASE PRESSURE

12-1. Measurement

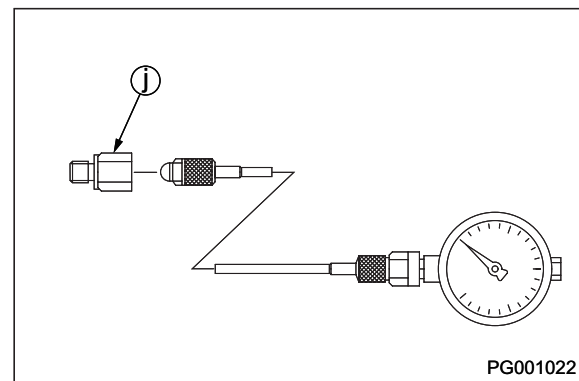
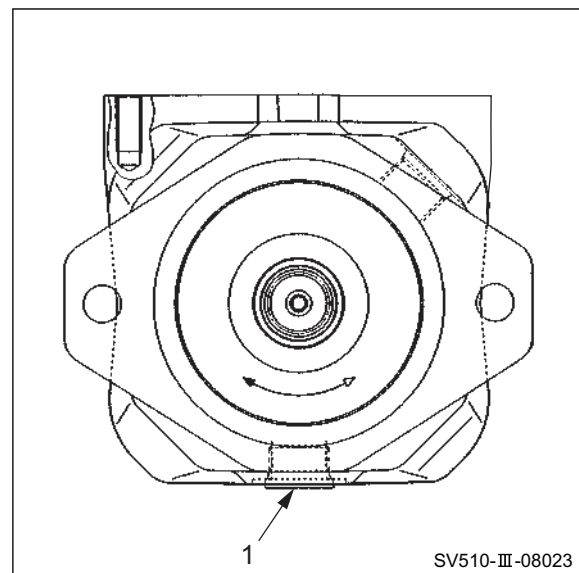
⚠ CAUTION

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 Remove plug from drain port (1). Attach pressure gauge with adapter ① .
 - Adapter ① : 7/8-14UNF
 - Pressure gauge : 0 to 5 MPa (0 to 725 psi)
- ② Apply parking brake by pressing parking brake switch button.
- ③ Set vibration mode change switch to “”.
- ④ Start the engine and set throttle switch to “FULL”.
- ⑤ Press F-R lever vibration switch ON.
- ⑥ Measure pressure when vibration select switch is in “” and “”, respectively.
- ⑦ Press F-R lever vibration switch OFF as soon as measurement is finished.

★ Allowable motor case pressure

: 0.2 MPa (29 psi) or less



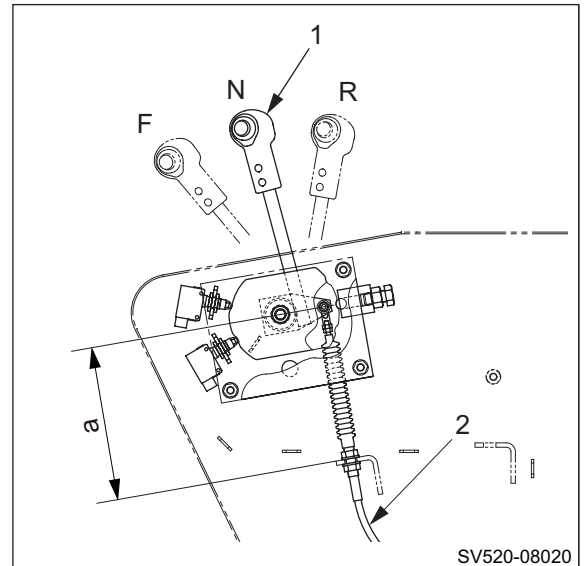
13. ADJUSTMENT OF F-R LEVER LINKAGE

13-1. Adjustment

- In cases such as propulsion hydraulic 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 both ends of control cable (2).

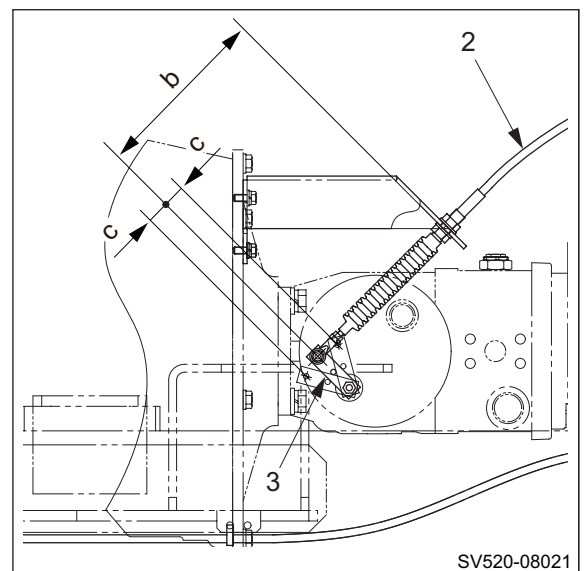
★ Specified dimension a : 210 mm (8.27 in.)



★ Specified dimension b : 205 mm (8.07 in.)

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

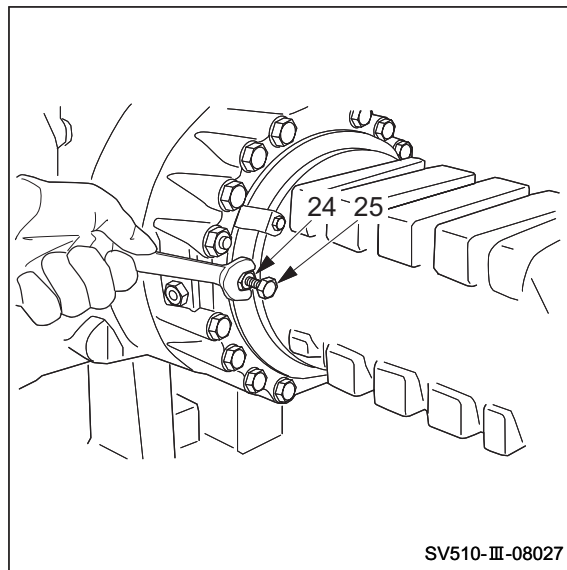
★ Specified dimension c : 25 mm (1.0 in.)



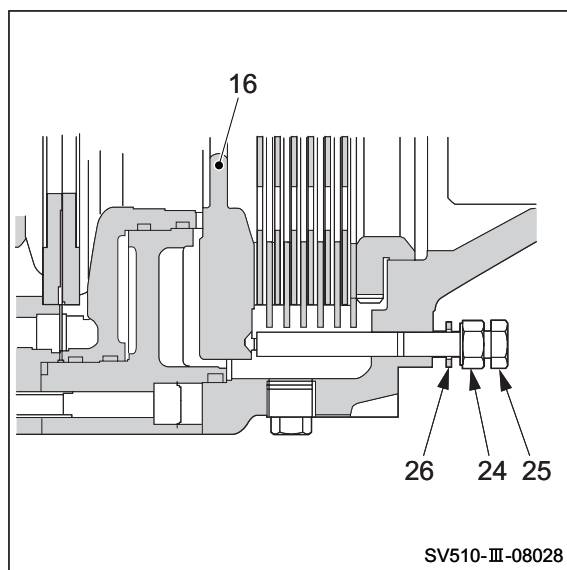
14. BRAKE ADJUSTMENT

14-1. Manually Releasing the Brake

- 1) Loosen nut (24) of bolt (25).
 - Loosen nut on the opposite side.

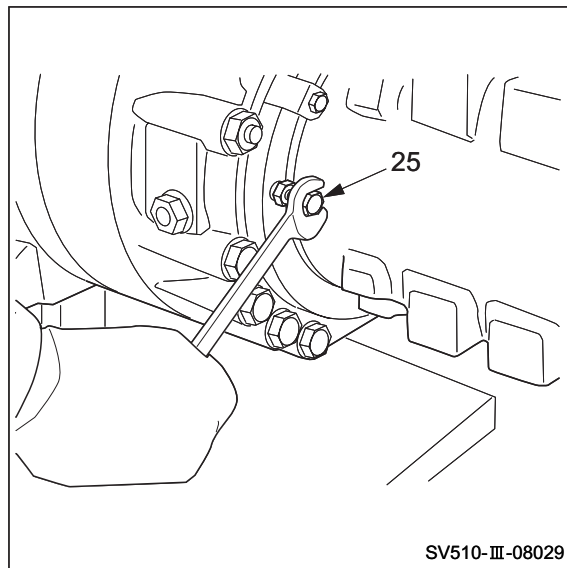


- 2) Tighten bolt (25), and press it into disc (16).
 - Do the same with bolt on the opposite side.



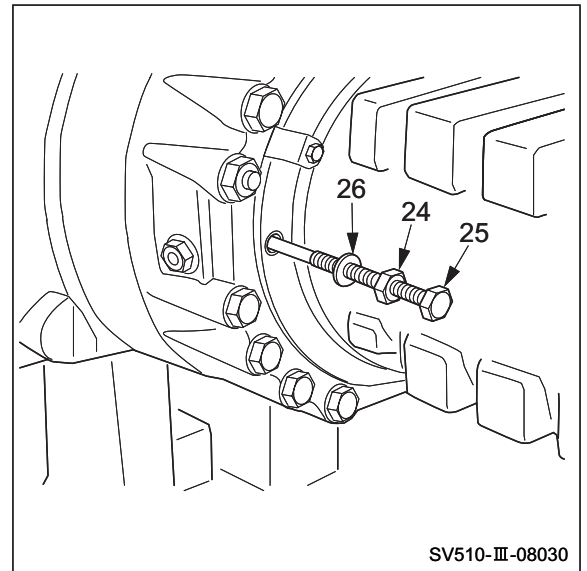
- 3) Alternately tighten bolts (25) 1/4 turn each, and release brake disc.

★ After bolt end makes contact with disc (16), strictly observe not tightening bolt (25) more than one complete turn.



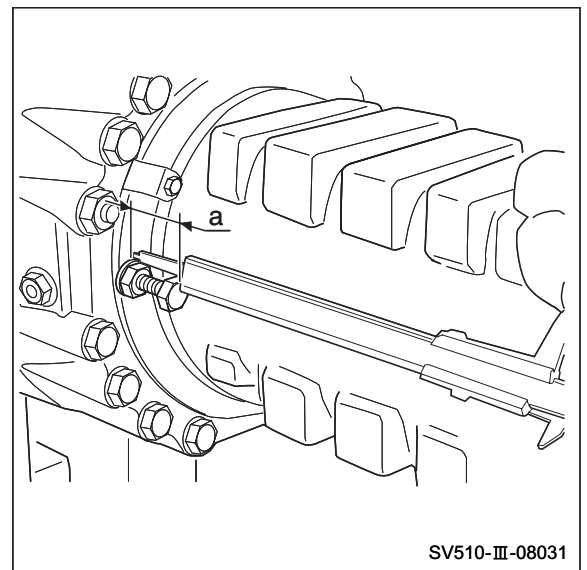
14-2. Adjustment after Manual Release of Brake

- ① Remove bolt (25), nut (24), and seal washer (26).
- ② Replace seal washer (26) with a new one.
- ③ Apply grease to bolt (25) threads.
- ④ As shown on the right, install bolt (25), nut (24), and seal washer (26).



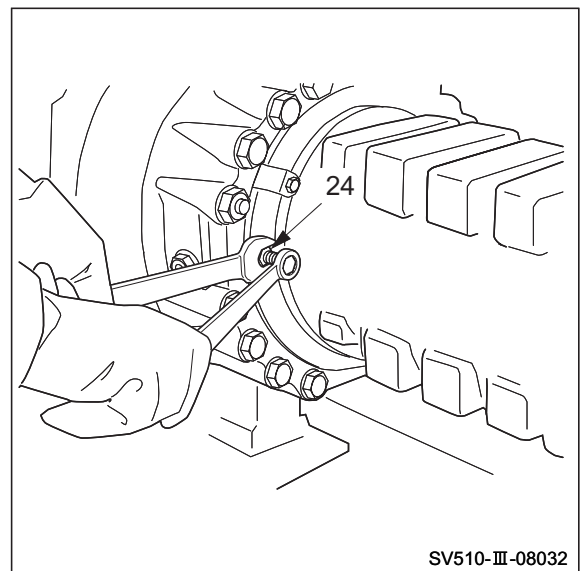
- ⑤ Adjust bolt (25) to the dimensions as shown on the right.
 - Similarly, adjust the bolt on the opposite side.

★ Specified dimension a: $34^{+0.5}_0$ mm ($1.34^{+0.02}_0$ in.)



- ⑥ Tighten nut (24), and firmly secure bolt (25).

★ When tightening nut (24), make sure that bolt (25) does not move. After securing bolt, check the dimensions of bolt again.



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.

1-4. Wire Number and Color Code

Refer to "1-1. Wire Numbers, Wire Sizes, Wire Colors and Connectors Shown in Electrical Circuit Diagram, Wiring Harness Layout and Wiring Harnesses" of ELECTRICAL SYSTEM.

2. ELECTRICAL SYSTEM TROUBLESHOOTING

2-1. When Performing Electrical System Fault Diagnosis

⚠ WARNING

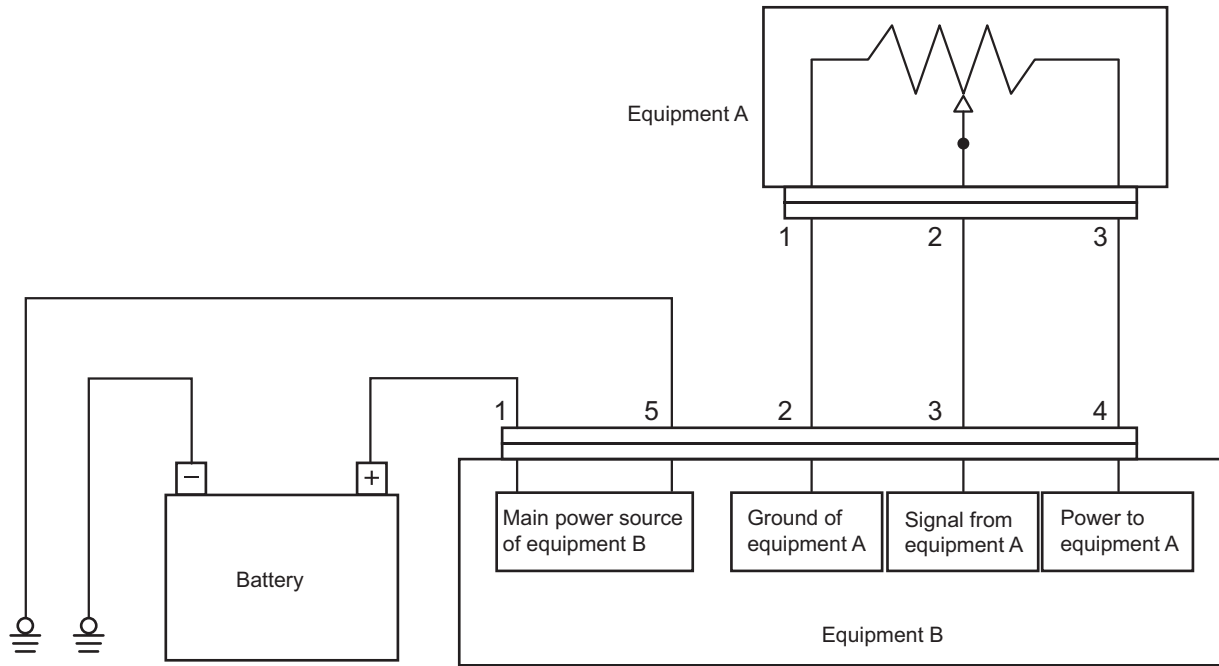
Be very careful because equipment can return to normal during an inspection and suddenly operate properly when a failure occurs due to a faulty contact or other such cause.

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

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

2-1-2. Inspection procedures using a tester

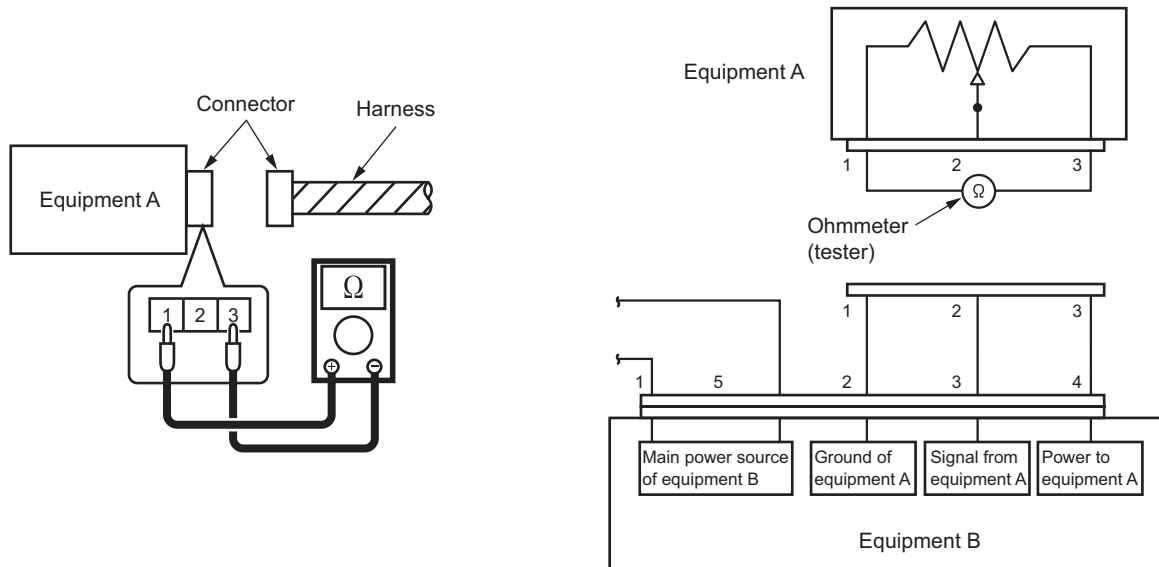
Some of the various inspection procedures are presented here for reference, using a sample circuit below.



GW750-2-10003

1) Measuring resistance using tester

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

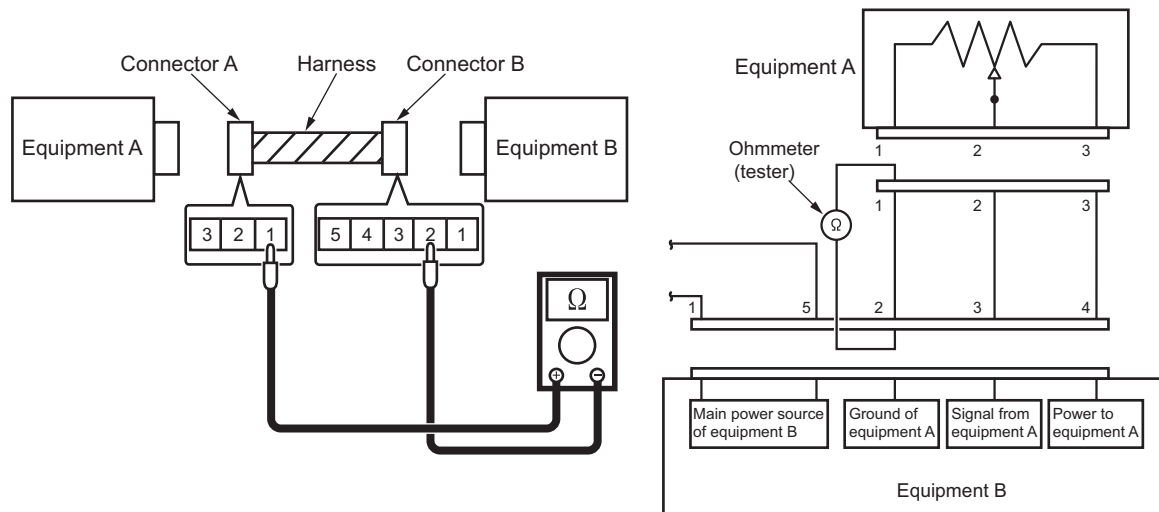


GW750-2-10004

Inspection procedure

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

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



GW750-2-10005

Inspection procedure

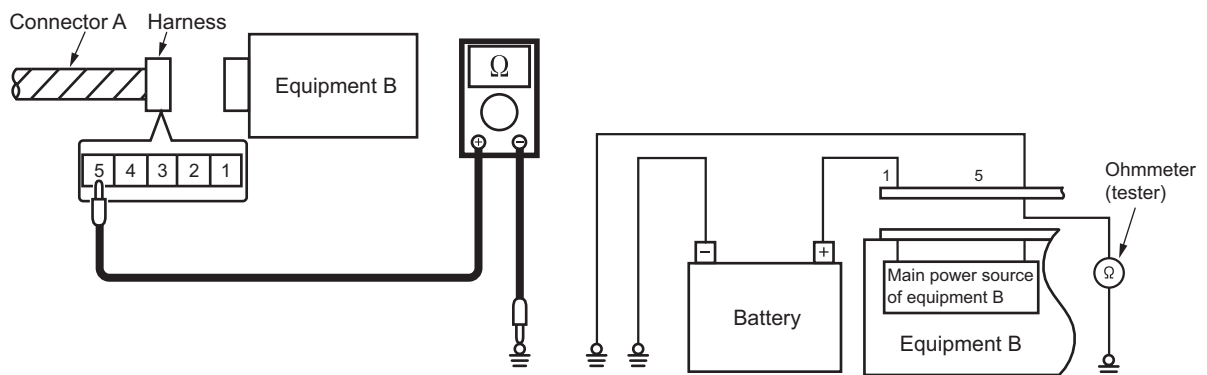
- ① Disconnect the connectors of equipment A and equipment B.
- ② Connect the test probe (+) to connector terminal 1 of equipment A and the test probe (-) to connector terminal 2 of equipment B and measure the resistance. At this time, reversing the connector terminals between the probes (+) and (-)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

Criteria for harness defects

When there is no abnormality in the harness: Less than 10 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)



GW750-2-10006

Inspection procedure

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

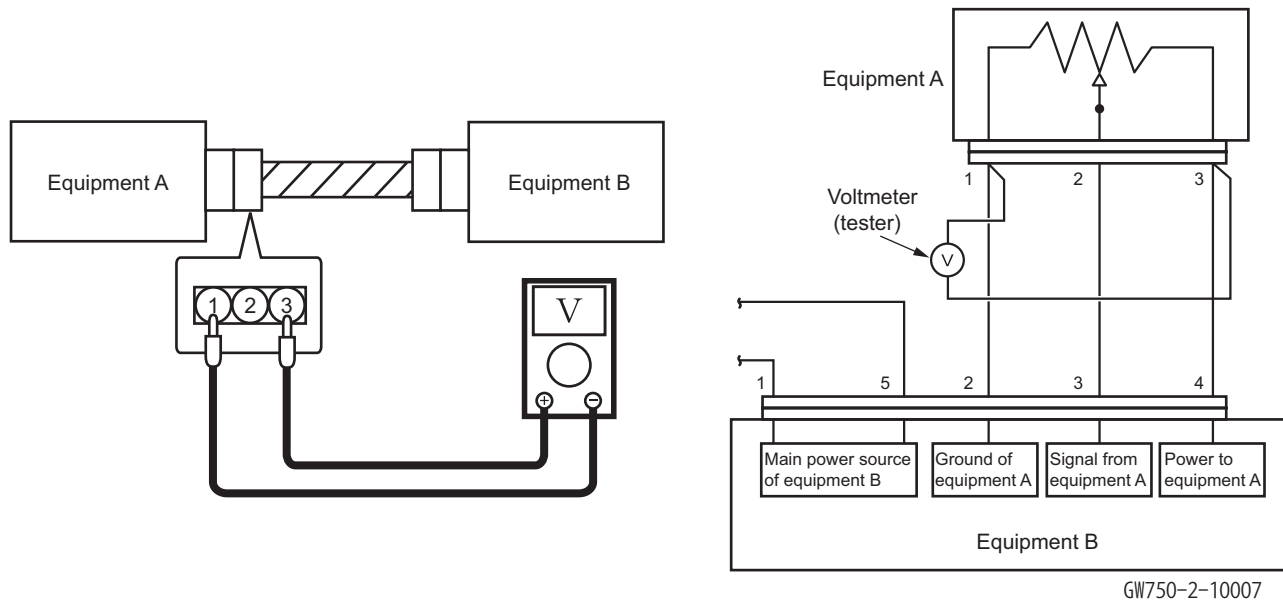
(NOTICE)

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

TROUBLESHOOTING

2) Measuring voltage and current flowing using tester

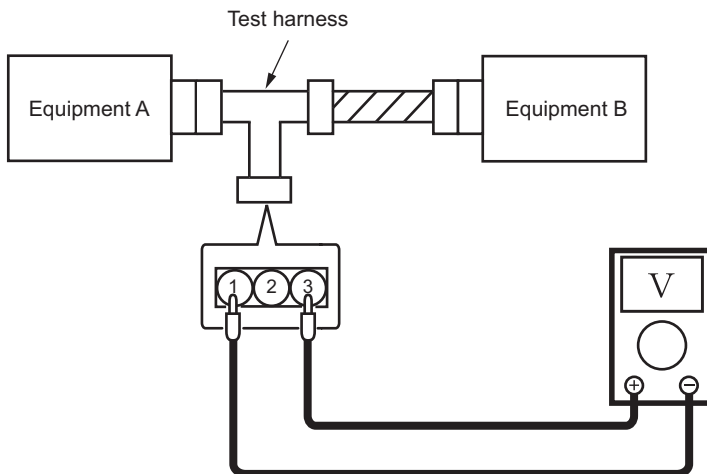
2-1) Measuring voltage of equipment A (measuring voltage between terminals 1 and 3)



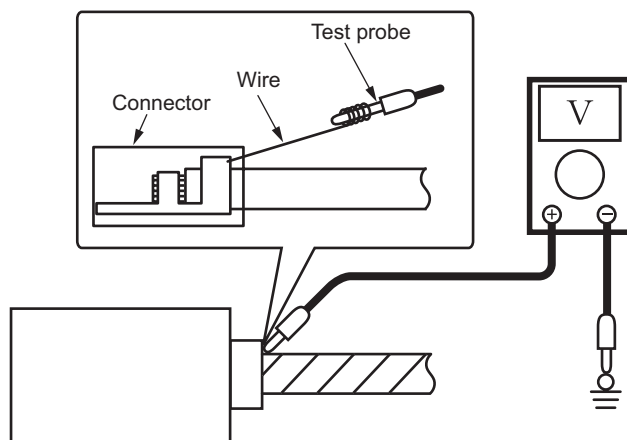
Inspection procedure

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

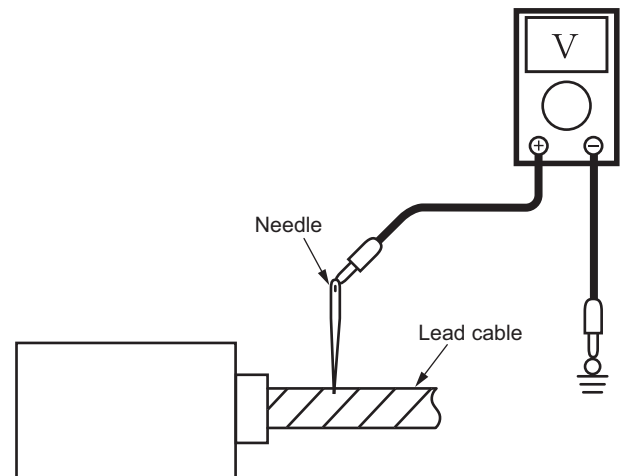
- Measurement using a test harness



- Measurement from the backside of connector



- Measurement on a lead cable



GW750-2-10002

Measurement method

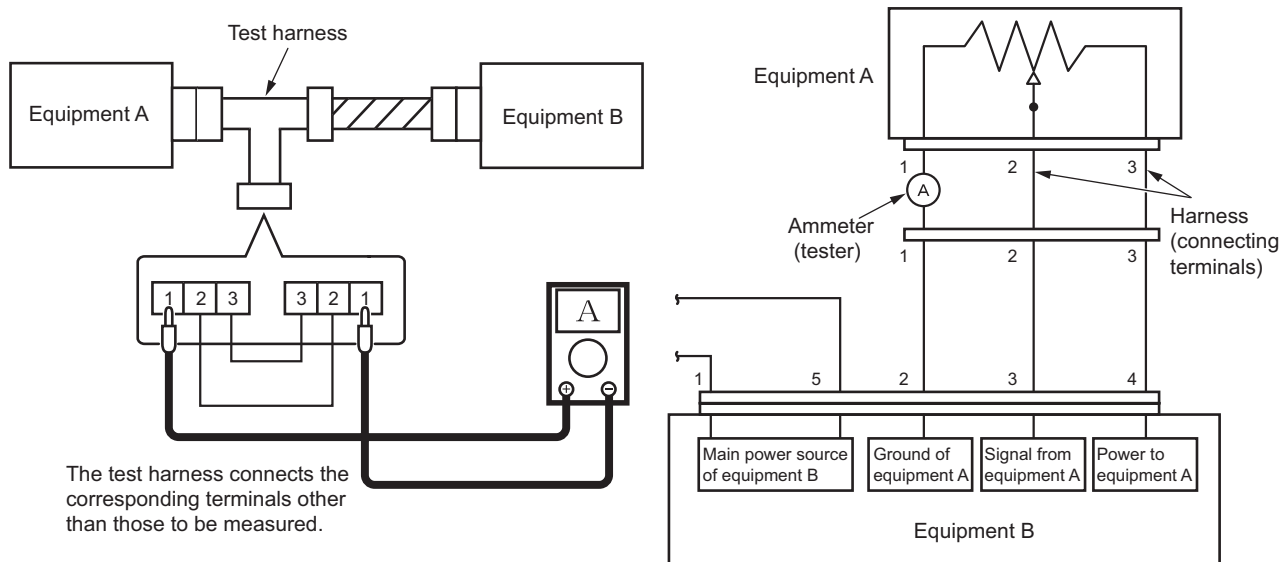
For measurement of voltage, connect the tester probes in parallel to the portion to be measured. Because the voltage can be measured only when the connector is connected in position, contact the tester probes to the terminals without disconnecting the connector. The following methods are available:

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

(NOTICE)

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

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



GW750-2-10008

Inspection procedure

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

Measurement method

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

2-1-3. Inspection of electrical system

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

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

1) Ground inspection

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

2) Fuse inspection

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

2-2) If a fuse is blown

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

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

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

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

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

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

3) Connector inspection

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

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

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

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

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

Sound heard : A relay failure occurred.

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

Sound heard : A relay failure occurred.

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

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

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

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

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

Sound heard : The electrical system is normal.

No sound heard : Check with a tester.

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

: ② Is the solenoid valve coil burnt?

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

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

If YES : Replace the valve.

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

6) Harness check

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

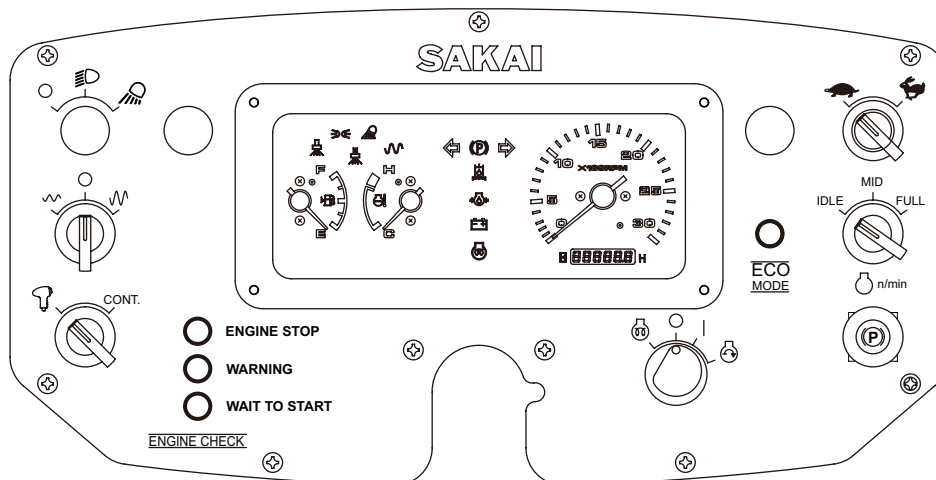
2-2. Fault Codes

2-2-1. Fault detection

- Faults are detected while the starter switch is on, during the operation of the machine itself. If a fault becomes active (currently detected) at this time, a fault is logged in memory and a snapshot of engine parameters is logged. In addition, certain faults may illuminate the warning lamp (orange) or the stop lamp (red).

2-2-2. Fault lamps

- The controller systems use 3 indicator lamps: the “ENGINE STOP”, “WARNING” and “WAIT TO START”. If the starter switch is turned on but the diagnostic switch remains off, the indicator lamps will illuminate for approximately two seconds and then go off, one after the other, to verify they are working and wired correctly. They all go on and then go off one at a time, at an interval of approximately 0.5 seconds each.
- “ENGINE STOP” Lamp - The “ENGINE STOP” lamp provides critical operator messages. These messages require immediate and decisive operator response. The “ENGINE STOP” lamp is also used to flash out diagnostic fault codes.
- “WARNING” Lamp - The “WARNING” lamp provides important operator messages. These messages require timely operator attention. The “WARNING” lamp is also used to delineate diagnostics fault codes.
- “WAIT TO START” Lamp - The “WAIT TO START” lamp indicates that the pre-start intake manifold heater warm-up sequence is active. A Cummins supplied grid heater will automatically heat the intake manifold based on the Intake Manifold Temperature when needed prior to engine starting. Intake manifold heating improves engine starting in cold temperatures and reduces white smoke.



SV540-09007

2-2-3. Flash out of fault codes

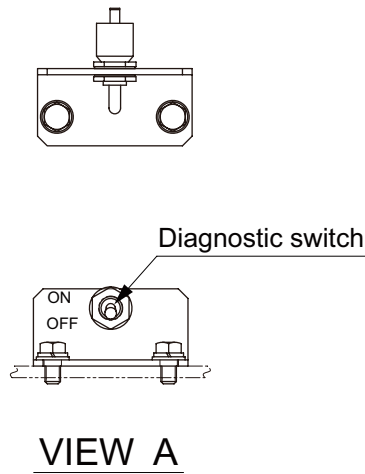
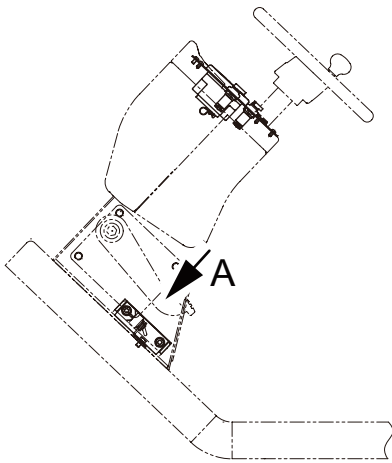
- Fault codes can be accessed in at least two different ways; using the electronic service tool or fault code flash out.
- Fault flash out mode can be entered through the use of a diagnostic switch. The diagnostic switch may also be multiplexed on the J1939 datalink.

Entering diagnostic mode:

- 1) To enter the fault flash out, the starter switch must be ON with the engine not running.
- 2) When a diagnostic switch is used to enter the mode, the ECM will automatically flash the first fault code after the switch is turned on. Each active fault shall flash out twice, wrapping around to the first fault code at the end.

Flashing of fault codes:

- The diagram below depicts the pattern of the fault code flash out scheme as indicated by the “ENGINE STOP” lamp. A blink is equivalent to the “ENGINE STOP” lamp being on for 0.5 seconds, and off for 0.5 seconds. A pause between fault code digits has duration of 2 seconds.



SV540-09008

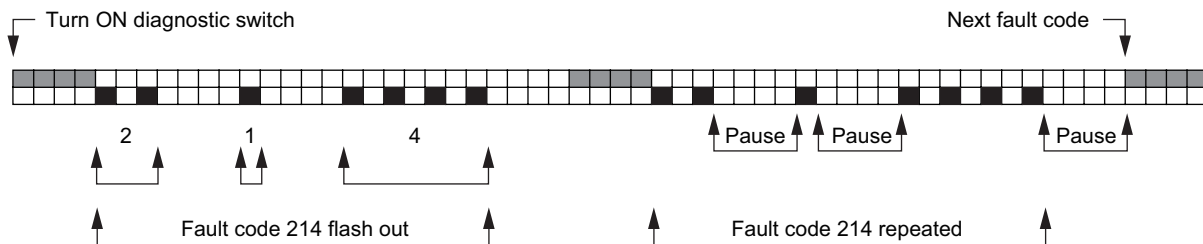
Example Fault Code Sequence

Fault Code 214 :

Each block represents 0.5 seconds

■ = “WARNING” lamp ON

■ = “ENGINE STOP” lamp ON



SV412-09012

2-2-4. Fault code list

Fault code (Lamp)	Reason	Effect
111 (Red)	Engine control module critical internal failure • Bad intelligent device or component.	Engine may not start.
115 (Red)	Engine magnetic crankshaft speed/position lost both of two signals • Data erratic, intermittent, or incorrect.	Fueling to the injectors is disabled and the engine cannot be started.
122 (Orange)	Intake manifold 1 pressure sensor circuit • Voltage above normal or shorted to high source.	Derate in power output of the engine.
123 (Orange)	Intake manifold 1 pressure sensor circuit • Voltage below normal or shorted to low source.	Derate in power output of the engine.
131 (Red)	Accelerator pedal or lever position sensor 1 circuit • Voltage above normal or shorted to high source.	Severe derate in power output of the engine. Limp home power only.
132 (Red)	Accelerator pedal or lever position sensor 1 circuit • Voltage below normal or shorted to low source.	Severe derate in power output of the engine. Limp home power only.
133 (Red)	Remote accelerator pedal or lever position sensor circuit • Voltage above normal or shorted to high source.	Remote accelerator will not operate. Remote accelerator position will be set to zero percent.
134 (Red)	Remote accelerator pedal or lever position sensor circuit • Voltage below normal or shorted to low source.	Remote accelerator will not operate. Remote accelerator position will be set to zero percent.
135 (Orange)	Engine oil rifle pressure 1 sensor circuit • Voltage above normal or shorted to high source.	None on performance. No engine protection for oil pressure.
141 (Orange)	Engine oil rifle pressure 1 sensor circuit • Voltage below normal or shorted to low source.	None on performance. No engine protection for oil pressure.
143 (Orange)	Engine oil rifle pressure • Data valid but below normal operation range. • Moderately severe level.	None on performance.
144 (Orange)	Engine coolant temperature 1 sensor circuit • Voltage above normal or shorted to high source.	Possible white smoke. Fan will stay ON if controlled by ECM No engine protection for engine coolant temperature.
145 (Orange)	Engine coolant temperature 1 sensor circuit • Voltage below normal or shorted to low source.	Possible white smoke. Fan will stay ON if controlled by ECM No engine protection for engine coolant temperature.
146 (Orange)	Engine coolant temperature • Data valid but above normal operation range. • Moderately severe level.	Progressive power derate increasing in severity from time of alert.
147 (Red)	Accelerator pedal or lever position 1 sensor circuit frequency • Data valid but below normal operational range. • Most severe level.	Severe derate in power output of the engine. Limp home power only.

TROUBLESHOOTING

Fault code (Lamp)	Reason	Effect
148 (Red)	Accelerator pedal or lever position sensor 1 <ul style="list-style-type: none"> • Data valid but above normal operational range. • Most severe level. 	Severe derate in power output of the engine. Limp home power only.
151 (Red)	Engine coolant temperature <ul style="list-style-type: none"> • Data valid but above normal operation range. • Most severe level. 	Progressive power derate increasing in severity from time of alert. If engine protection shutdown feature is enabled, engine will shut down 30 seconds after red stop lamp starts flashing.
153 (Orange)	Intake manifold 1 temperature sensor circuit <ul style="list-style-type: none"> • Voltage above normal or shorted to high source. 	Possible white smoke. Fan will stay ON if controlled by ECM No engine protection for intake manifold air temperature.
154 (Orange)	Intake manifold 1 temperature sensor circuit <ul style="list-style-type: none"> • Voltage below normal or shorted to low source. 	Possible white smoke. Fan will stay ON if controlled by ECM No engine protection for intake manifold air temperature.
155 (Red)	Intake manifold 1 temperature <ul style="list-style-type: none"> • Data valid but above normal operation range. • Most severe level. 	Progressive power derate increasing in severity from time of alert. If engine protection shutdown feature is enabled, engine will shut down 30 seconds after red stop lamp starts flashing.
187 (Orange)	Sensor supply 2 circuit <ul style="list-style-type: none"> • Voltage below normal or shorted to low source. 	Engine power derate.
195 (Orange)	Coolant level sensor 1 circuit <ul style="list-style-type: none"> • Voltage above normal or shorted to high source. 	None on performance.
196 (Orange)	Coolant level sensor 1 circuit <ul style="list-style-type: none"> • Voltage below normal or shorted to low source. 	None on performance.
197 (Orange)	Coolant level <ul style="list-style-type: none"> • Data valid but below normal operation range. • Moderately severe level. 	None on performance.
221 (Orange)	Barometric pressure sensor circuit <ul style="list-style-type: none"> • Voltage above normal or shorted to high source. 	Engine power derate.
222 (Orange)	Barometric pressure sensor circuit <ul style="list-style-type: none"> • Voltage below normal or shorted to low source. 	Engine power derate.
227 (Orange)	Sensor supply 2 circuit <ul style="list-style-type: none"> • Voltage above normal or shorted to high source. 	Engine power derate.
234 (Red)	Engine Crankshaft speed/position <ul style="list-style-type: none"> • Data valid but above normal operation range. • Most severe level. 	Fuel injection disabled until engine speed falls below the overspeed limit.
235 (Red)	Coolant level <ul style="list-style-type: none"> • Data valid but below normal operation range. • Most severe level. 	Progressive power derate increasing in severity from time of alert. If engine protection shutdown feature is enabled, engine will shut down 30 seconds after red stop lamp starts flashing.
237 (Orange)	External speed input (Multiple unit synchronization) <ul style="list-style-type: none"> • Data erratic, intermittent or incorrect. 	Primary or secondary engine may stop running.
238 (Orange)	Sensor supply 3 circuit <ul style="list-style-type: none"> • Voltage below normal or shorted to low source. 	Possible hard starting and rough running.

Fault code (Lamp)	Reason	Effect
239 (Orange)	Sensor supply 3 circuit • Voltage above normal or shorted to high source.	Possible hard starting and rough running.
241 (Orange)	Wheel based machine speed • Data erratic, intermittent or incorrect.	Engine speed limited to maximum engine speed without VSS parameter value. Cruise control, gear down protection and road speed governor will not work.
245 (Orange)	Fan control circuit • Voltage below normal or shorted to low source.	The fan can possibly stay on continuously or not run at all.
271 (Orange)	Fuel pump pressurizing assembly 1 circuit • Voltage below normal or shorted to low source.	Engine will run poorly at idle. Engine will have low power. Fuel pressure will be higher than commanded.
272 (Orange)	Fuel pump pressurizing assembly 1 circuit • Voltage above normal or shorted to high source.	Engine will not run or engine will run poorly.
285 (Orange)	SAE J1939 multiplexing PGN timeout error • Abnormal update rate.	One or more multiplexed devices will not operate properly. One or more symptoms will occur.
286 (Orange)	SAE J1939 multiplexing configuration error • Out of calibration.	At least one multiplexed device will not operate properly.
288 (Red)	SAE J1939 multiplexing remote accelerator pedal or lever position sensor circuit • Received network data in error.	The engine will not respond to the remote throttle. Engine may only idle. The primary or cab accelerator may be able to be used.
292 (Red)	Auxiliary temperature sensor input 1 • Special instructions.	Possible engine derate.
293 (Orange)	Auxiliary temperature sensor input #1 circuit • Voltage above normal or shorted to high source.	None on performance.
294 (Orange)	Auxiliary temperature sensor input #1 circuit • Voltage below normal or shorted to low source.	None on performance.
295 (Orange)	Barometric pressure • Data erratic, intermittent or incorrect.	Engine power derate.
296 (Red)	Auxiliary pressure sensor input 1 • Special instructions	Possible engine power derate.
297 (Orange)	Auxiliary pressure sensor input #2 circuit • Voltage above normal or shorted to high source.	None on performance.
298 (Orange)	Auxiliary pressure sensor input #2 circuit • Voltage below normal or shorted to low source.	None on performance.
322 (Orange)	Injector solenoid driver cylinder 1 circuit • Current below normal or open circuit.	Engine can misfire or possibly run rough.
324 (Orange)	Injector solenoid driver cylinder 3 circuit • Current below normal or open circuit.	Engine can misfire or possibly run rough.
331 (Orange)	Injector solenoid driver cylinder 2 circuit • Current below normal or open circuit.	Engine can misfire or possibly run rough.
332 (Orange)	Injector solenoid driver cylinder 4 circuit • Current below normal or open circuit.	Engine can misfire or possibly run rough.

TROUBLESHOOTING

Fault code (Lamp)	Reason	Effect
343 (Orange)	Electronic control module warning internal hardware failure <ul style="list-style-type: none"> • Bad intelligent device or component. 	Possible no noticeable performance effects, engine dying or hard starting. Fault information, trip information and maintenance monitor data can be inaccurate.
349 (Orange)	Transmission output shaft speed <ul style="list-style-type: none"> • Data valid but above normal operational range. • Moderately severe level. 	Engine will run off of a default auxiliary speed.
351 (Orange)	Injector power supply <ul style="list-style-type: none"> • Bad intelligent device or component. 	Possible low power, engine misfire and/or engine will not start.
352 (Orange)	Sensor supply 1 circuit <ul style="list-style-type: none"> • Voltage below normal or shorted to low source. 	Engine power derate.
386 (Orange)	Sensor supply 1 circuit <ul style="list-style-type: none"> • Voltage above normal or shorted to high source. 	Engine power derate.
415 (Red)	Engine oil rifle pressure <ul style="list-style-type: none"> • Data valid but below normal operation range. • Most severe level. 	Progressive power derate increasing in severity from time if alert. If engine protection shutdown feature is enabled, engine will shut down 30 seconds after red engine stop lamp starts flashing.
418 (Orange/ Blinking)	Water in fuel indicator <ul style="list-style-type: none"> • Data valid but above normal operation range. • Least severe level. 	Possible white smoke, loss of power, or hard starting.
428 (Orange)	Water in fuel indicator sensor circuit <ul style="list-style-type: none"> • Voltage above normal or shorted to high source. 	None on performance. No water in fuel warning available.
429 (Orange)	Water in fuel indicator sensor circuit <ul style="list-style-type: none"> • Voltage below normal or shorted to low source. 	None on performance. No water in fuel warning available.
431 (Orange)	Accelerator pedal or lever idle validation switch <ul style="list-style-type: none"> • Data erratic, intermittent or incorrect. 	Engine will only idle.
432 (Red)	Accelerator pedal or lever idle validation switch circuit <ul style="list-style-type: none"> • Out of calibration. 	Engine will only idle.
435 (Orange)	Engine oil rifle pressure <ul style="list-style-type: none"> • Data erratic, intermittent or incorrect. 	None on performance. No engine protection for oil pressure.
441 (Orange)	Battery 1 voltage <ul style="list-style-type: none"> • Data valid but below normal operation range. • Moderately severe level. 	Engine may stop running or be difficult to start.
442 (Orange)	Battery 1 voltage <ul style="list-style-type: none"> • Data valid but above normal operation range. • Moderately severe level. 	Possible electrical damage to all electrical components.
449 (Red)	Injector metering rail 1 pressure <ul style="list-style-type: none"> • Data valid but above normal operation range. • Most severe level. 	None or possible engine noise associated with higher injection pressures (especially at idle or light load). Engine power is reduced.
451 (Orange)	Injector metering rail 1 pressure sensor circuit <ul style="list-style-type: none"> • Voltage above normal or shorted to high source. 	Power and/or speed derate.
452 (Orange)	Injector metering rail 1 pressure sensor circuit <ul style="list-style-type: none"> • Voltage below normal or shorted to low source. 	Power and/or speed derate.

Fault code (Lamp)	Reason	Effect
488 (Orange)	Intake manifold 1 temperature <ul style="list-style-type: none"> • Data valid but above normal operation range. • Moderately severe level. 	Progressive power derate increasing in severity from time of alert.
489 (Orange)	Transmission output shaft speed <ul style="list-style-type: none"> • Data valid but below normal operational range. • Moderately severe level. 	ECM changes engine speed to a calibration dependent set point.
497 (Orange)	Multiple unit synchronization switch circuit <ul style="list-style-type: none"> • Data erratic, intermittent or incorrect. 	Synchronization function of multiple unit is disabled.
515 (Orange)	Sensor supply 6 circuit <ul style="list-style-type: none"> • Voltage above normal or shorted to high source. 	Possible reduced performance.
516 (Orange)	Sensor supply 6 circuit <ul style="list-style-type: none"> • Voltage below normal or shorted to low source. 	Possible reduced performance.
523 (Orange)	Intermediate (P.T.O) speed switch validation <ul style="list-style-type: none"> • Data erratic, intermittent or incorrect. 	Intermediate speed control switch may not operate correctly.
527 (Orange)	Auxiliary input/output 2 circuit <ul style="list-style-type: none"> • Voltage above normal or shorted to high source. 	None on performance.
528 (Orange)	Auxiliary alternate torque validation switch <ul style="list-style-type: none"> • Data erratic, intermittent or incorrect. 	Torque curve setting defaults to default curve.
529 (Orange)	Auxiliary input/output 3 circuit <ul style="list-style-type: none"> • Voltage above normal or shorted to high source. 	None on performance.
553 (Orange)	Injector metering rail 1 pressure <ul style="list-style-type: none"> • Data valid but above normal operation range. • Moderately severe level. 	None or possible engine noise associated with higher injection pressures (especially at idle or light load). Engine power is reduced.
555 (Orange)	Crankcase pressure <ul style="list-style-type: none"> • Data valid but above normal operating range. • Moderately severe level. 	None on performance.
556 (Red)	Crankcase pressure <ul style="list-style-type: none"> • Data valid but above normal operational range. • Most severe level. 	Engine power derate.
559 (Orange)	Injector metering rail 1 pressure <ul style="list-style-type: none"> • Data valid but below normal operation range. • Moderately severe level. 	Possibly hard to start, low power or engine smoke. Engine could possibly not start.
584 (Orange)	Starter relay driver circuit <ul style="list-style-type: none"> • Voltage above normal or shorted to high source. 	Either the engine will not start or the engine will not have starter lockout protection.
585 (Orange)	Starter relay driver circuit <ul style="list-style-type: none"> • Voltage below normal or shorted to low source. 	The engine will not have starter lockout protection.
595 (Orange)	Turbocharger 1 speed <ul style="list-style-type: none"> • Data valid but above normal operating range. • Moderately severe level. 	No effect on engine performance.
599 (Red)	Auxiliary commanded dual output shutdown <ul style="list-style-type: none"> • Special instructions. 	Engine will shutdown.
649 (Orange/ Blinking)	Change lubricating oil and filter <ul style="list-style-type: none"> • Condition exists. 	Maintenance reminder only.

TROUBLESHOOTING

Fault code (Lamp)	Reason	Effect
687 (Orange)	Turbocharger 1 speed <ul style="list-style-type: none"> • Data valid but below normal operating range. • Moderately severe level. 	Engine power derate. The ECM uses an estimated turbocharger speed.
689 (Orange)	Engine crankshaft speed/position <ul style="list-style-type: none"> • Data erratic, intermittent or incorrect. 	Engine power derate.
691 (Orange)	Turbocharger 1 compression intake temperature circuit <ul style="list-style-type: none"> • Voltage above normal or shorted to high source. 	Engine power derate.
692 (Orange)	Turbocharger 1 compression intake temperature circuit <ul style="list-style-type: none"> • Voltage below normal or shorted to low source. 	Engine power derate.
731 (Orange)	Engine speed/position camshaft and crankshaft misalignment <ul style="list-style-type: none"> • Mechanical system not responding or out of adjustment. 	Engine will run derated. Hard start and rough idle possible.
778 (Orange)	Engine camshaft speed/position sensor <ul style="list-style-type: none"> • Data erratic, intermittent or incorrect. 	Engine can run rough. Possibly poor starting capability. Engine runs using primary engine position sensor.
1117 (None)	Power supply lost with starter switch ON <ul style="list-style-type: none"> • Data erratic, intermittent or incorrect. 	Possible no noticeable performance effects, engine dying or hard starting. Fault information, trip information and maintenance monitor data can be inaccurate.
1239 (Orange)	Accelerator pedal or lever position sensor 2 circuit <ul style="list-style-type: none"> • Voltage above normal or shorted to high source. 	Severe derate in power output of the engine. Limp home power only.
1241 (Orange)	Accelerator pedal or lever position sensor 2 circuit <ul style="list-style-type: none"> • Voltage below normal or shorted to low source. 	Severe derate in power output of the engine. Limp home power only.
1242 (Red)	Accelerator pedal or lever position sensor 1 <ul style="list-style-type: none"> • Data erratic, intermittent or incorrect. 	The engine will only idle.
1515 (Red)	SAE J1939 multiplexed accelerator pedal or lever sensor system <ul style="list-style-type: none"> • Received network data in error. 	The engine will only idle.
1539 (Orange)	Auxiliary pressure sensor input 1 circuit <ul style="list-style-type: none"> • Voltage above normal or shorted to high source. 	None on performance.
1621 (Orange)	Auxiliary pressure sensor input 1 circuit <ul style="list-style-type: none"> • Voltage below normal or shorted to low source. 	None on performance.
1695 (Orange)	Sensor supply 5 <ul style="list-style-type: none"> • Voltage above normal or shorted to high source. 	Severe derate in power output of the engine. Limp home power only.
1696 (Orange)	Sensor supply 5 <ul style="list-style-type: none"> • Voltage below normal or shorted to low source. 	Severe derate in power output of the engine. Limp home power only.
1843 (Orange)	Crankcase pressure circuit <ul style="list-style-type: none"> • Voltage above normal or shorted to high source. 	No engine protection for high crankcase pressure.

Fault code (Lamp)	Reason	Effect
1844 (Orange)	Crankcase pressure circuit • Voltage below normal or shorted to low source.	No engine protection for high crankcase pressure.
1896 (Orange)	EGR valve controller • Out of calibration	EGR valve actuation will be disabled.
1898 (Orange)	VGT actuator controller • Out of calibration	Low intake manifold pressure. The VGT will be in the open position.
1911 (Orange)	Injector metering rail 1 pressure • Data valid but above normal operation range • Most severe level.	None or possible engine noise associated with higher injection pressure (especially at idle or light load) or possible power interruption associated with dump valve reset.
1938 (Orange)	ECU power output supply voltage 1 • Data valid but below normal operating range. • Moderately severe level.	None on performance.
1942 (Orange)	Crankcase pressure • Data erratic, intermittent or incorrect.	None on performance.
1961 (Orange)	EGR valve control circuit over temperature • Data valid but above normal operating range. • Least severe level.	EGR valve operation will be disabled.
1974 (Orange/ Blinking)	Crankcase pressure • Data valid but above normal operating range. • Least severe level.	None on performance.
2182 (Orange)	Engine brake actuator driver 1 circuit • Voltage above normal or shorted to high source.	Engine brake on cylinders 1, 2 and 3 can not be activated.
2183 (Orange)	Engine brake actuator driver 1 circuit • Voltage below normal or shorted to low source.	Engine brake on cylinders 1, 2 and 3 can not be activated.
2185 (Orange)	Sensor supply 4 circuit • Voltage above normal or shorted to high source.	Engine will only idle.
2186 (Orange)	Sensor supply 4 circuit • Voltage below normal or shorted to low source.	Engine will only idle.
2195 (Red)	Auxiliary equipment sensor input 3 engine protection critical • Special instructions.	Engine may shutdown.
2272 (Orange)	EGR valve position circuit • Voltage below normal or shorted to low source.	EGR valve actuation will be disabled.
2288 (None)	Turbocharger 1 speed • Data valid but above normal operating range. • Least severe level.	Engine power derate to lower the turbocharger speed.
2311 (Orange)	Electronic fuel injection control valve circuit • Condition exists.	Possible low power.
2321 (None)	Engine crankshaft speed/position • Data erratic, intermittent or incorrect.	Engine may exhibit misfire as control switches from the primary to the backup speed sensor. Engine power is reduced while the engine operates on the backup speed sensor.
2322 (None)	Engine camshaft speed/position sensor • Data erratic, intermittent or incorrect.	None on performance.

TROUBLESHOOTING

Fault code (Lamp)	Reason	Effect
2349 (Orange)	EGR valve control circuit • Current below normal or open circuit.	EGR valve actuation will be disabled.
2353 (Orange)	EGR valve control circuit • Current above normal or grounded circuit.	EGR valve actuation will be disabled.
2357 (Orange)	EGR valve control circuit • Mechanical system not responding or out of adjustment.	EGR valve actuation will be disabled.
2363 (Orange)	Engine brake actuator driver output 2 circuit • Voltage below normal or shorted to low source.	Engine brake on cylinders 4, 5 and 6 can not be activated.
2367 (Orange)	Engine brake actuator driver output 2 circuit • Voltage above normal or shorted to high source.	Engine brake on cylinders 4, 5 and 6 can not be activated.
2372 (Orange)	Fuel filter differential pressure • Data valid but above normal operating range. • Moderately severe level.	Engine can possibly have low power.
2373 (Orange)	Exhaust gas pressure sensor circuit • Voltage above normal or shorted to high source.	None on performance.
2374 (Orange)	Exhaust gas pressure sensor circuit • Voltage below normal or shorted to low source.	None on performance.
2375 (Orange)	Exhaust gas recirculation temperature sensor circuit • Voltage above normal or shorted to high source.	EGR valve actuation will be disabled.
2376 (Orange)	Exhaust gas recirculation temperature sensor circuit • Voltage below normal or shorted to low source.	EGR valve actuation will be disabled.
2377 (Orange)	Fan control circuit • Voltage above normal or shorted to high source.	The fan may stay on continuously or not run at all.
2448 (Orange/ Blinking)	Coolant level • Data valid but below normal operating range. • Least severe level.	None on performance.
2554 (Orange)	Exhaust gas pressure • Data erratic, intermittent or incorrect.	The ECM will estimate the exhaust gas pressure.
2555 (Orange)	Engine intake air heater 1 circuit • Voltage above normal or shorted to high source.	The intake air heats may be ON or OFF at all the time.
2556 (Orange)	Engine intake air heater 1 circuit • Voltage below normal or shorted to low source.	The intake air heats may be ON or OFF at all the time.
2557 (Orange)	Auxiliary PWM driver #1 • Voltage above normal or shorted to high source.	Can not control transmission.
2558 (Orange)	Auxiliary PWM driver #1 • Voltage below normal or shorted to low source.	Can not control transmission.

Fault code (Lamp)	Reason	Effect
2646 (Orange)	Engine coolant temperature • Condition exists.	EGR valve actuation will be disabled.
2765 (None)	Engine injector bank 1 barcodes • Out of calibration.	None on performance.
2961 (None)	Exhaust gas recirculation temperature • Data valid but above normal operating range. • Least severe level.	Slight fueling derate to bring EGR temperature under the maximum limit.
2973 (Orange)	Intake manifold 1 pressure • Data erratic, intermittent or incorrect.	Engine power derate.
3186 (Orange)	Tachograph output shaft speed • Abnormal update rate.	None on performance.
3213 (Orange)	Tachograph output shaft speed • Received network data in error.	None on performance.
3326 (Red)	SAE J1939 multiplexed accelerator pedal or lever sensor system • Abnormal update rate.	Engine will only idle.
3328 (Orange)	Transmission output shaft speed • Abnormal update rate.	None on performance.
3418 (Orange)	Transmission output shaft speed • Received network data in error.	None on performance.
3525 (Orange)	Wheel-based vehicle speed • Received network data in error.	None on performance.
3526 (Orange)	Wheel-based vehicle speed • Abnormal update rate.	None on performance.
3527 (Red)	Accelerator pedal or lever idle validation switch • Received network data in error.	Engine will only idle.
3528 (Red)	Accelerator pedal or lever idle validation switch • Abnormal update rate.	Engine will only idle.
3616 (None)	Engine VGT nozzle position • Mechanical system not responding or out of adjustment.	Engine power may be derated.
3697 (Red)	Engine control module calibration memory • Bad intelligent device or component.	Engine may not start.
3724 (Orange)	Battery 1 voltage • Data valid but below normal operating range. • Least severe level.	EGR valve actuation will be disabled.
3727 (None)	High pressure common rail fuel pressure relief valve • Mechanical system not responding or out of adjustment.	Possible low power or power interruption associated with relief valve reset.
3737 (None)	Engine starter mode overcrank protection • Condition exists.	Starter operation is prohibited until the starter motor has adequately cooled.
3741 (Orange)	High pressure common rail fuel pressure relief valve • Data valid but above normal operational range. • Most severe level.	Engine may run rough, may stop running, may not start or may be difficult to start.
3765 (Orange)	Auxiliary temperature sensor input 2 circuit • Voltage above normal or shorted to high source.	None on performance.

TROUBLESHOOTING

Fault code (Lamp)	Reason	Effect
3766 (Orange)	Auxiliary temperature sensor input 2 circuit • Voltage below normal or shorted to low source.	None on performance.

(NOTICE)

- For details, refer to “Service information” of engine manufacturer.

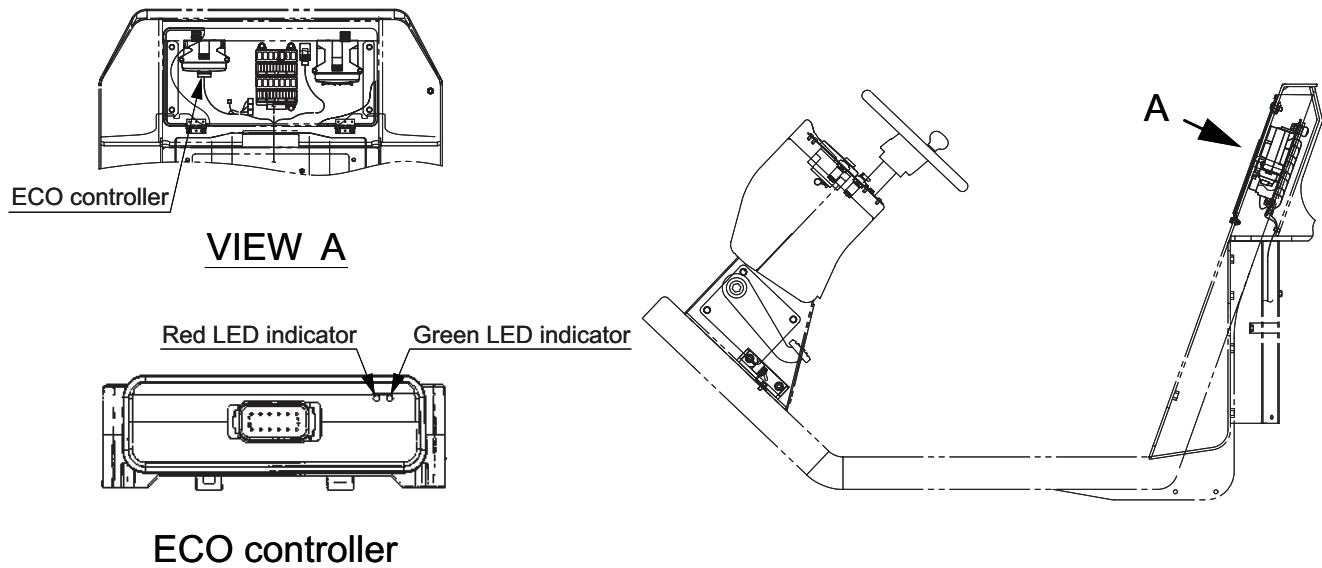
2-3. Error Codes

The ECO controller processes signals from the vibration select switch and the throttle switch to control the discharge rate and direction of the vibrator pump. The ECO controller monitors the state of the motor rotation sensors (front and rear) that are connected to the T/C controller via CAN, in order to control the torque in accordance with the road surface condition. (Anti-spin control)

The ECO controller has safeguard features (error detection, error display and error bypass action) and displays each status with LED indicators.

Normal : Red LED OFF, green LED ON

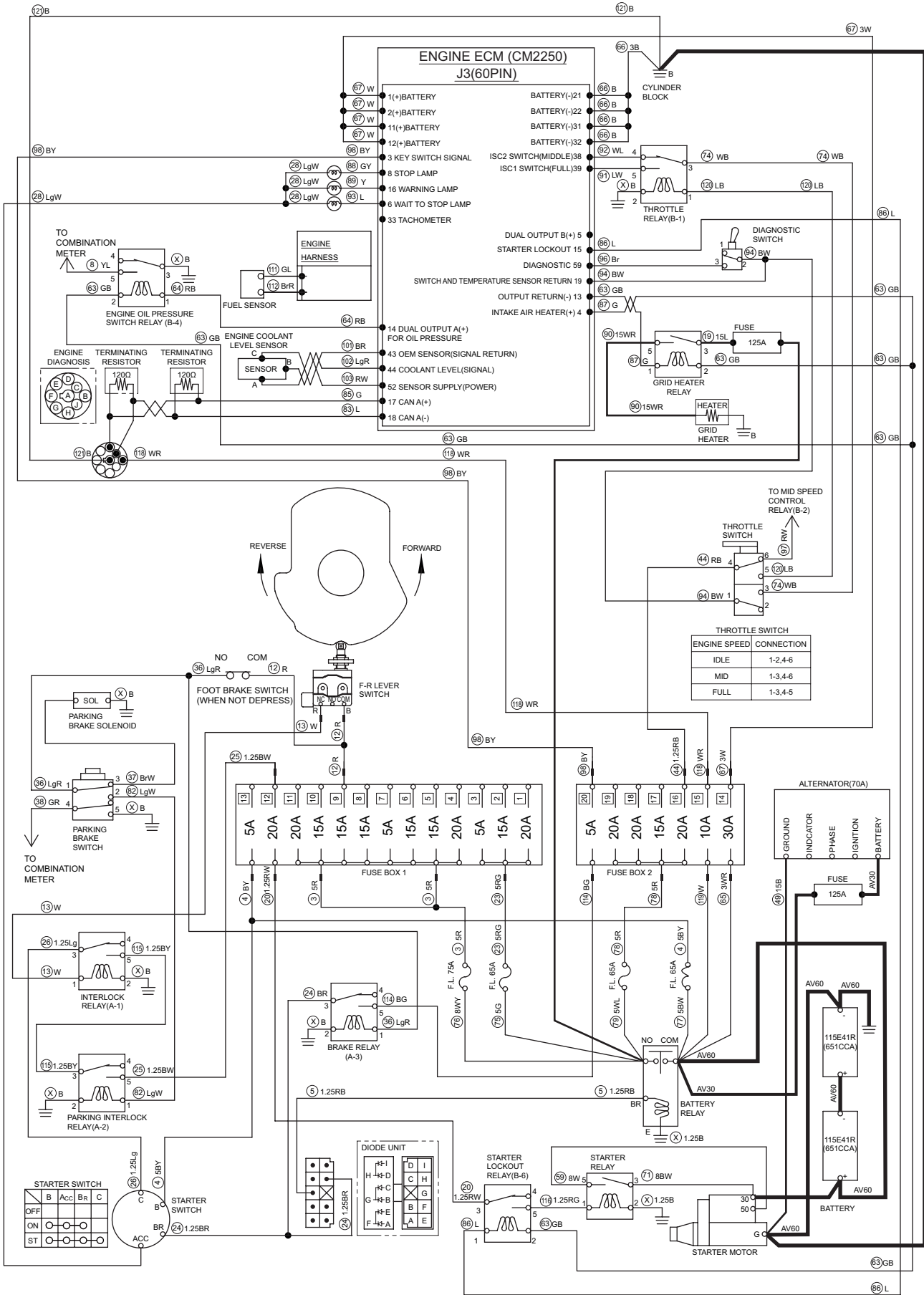
Abnormal : An error code depending on the error type is indicated by a combination of long and short red LED blinks. (Error code can be viewed when using service tool) If more than one error occur at the same time, the sum of the error codes is output.



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Number of red LED blinks	Error occurred at	Description	Error code	Error bypass action
1 long, 1 short	Motor proportional solenoid (rear)	Signal wire short-circuit	1	Speed is changed to 1st (low speed) immediately.
1 long, 2 short		Signal wire open-circuit	2	
1 long, 3 short	Motor speed change solenoid (front)	Signal wire short-circuit	1	
1 long, 4 short		Signal wire open-circuit	2	
1 long, 5 short	Motor rotation sensor (rear)	Shortage of power supply voltage	1	Speed is changed to 1st (low speed) immediately.
		Over voltage of power supply voltage	2	
		Signal frequency is below threshold limit values for measurement	4	
		Signal frequency is over threshold limit values for measurement	8	
		Shortage of signal voltage	16	
		Over voltage of signal voltage	32	
		Signal wire open-circuit	64	
		Ground wire open-circuit	128	
		Power supply voltage wire open-circuit	256	
1 long, 6 short	Motor rotation sensor (front)	Shortage of power supply voltage	1	
		Over voltage of power supply voltage	2	
		Signal frequency is below threshold limit values for measurement	4	
		Signal frequency is over threshold	8	
		Shortage of signal voltage (not in use)	16	
		Over voltage of signal voltage (not in use)	32	
		Signal wire open-circuit	64	
		Ground wire open-circuit	128	
		Power supply voltage wire open-circuit	256	
1 long, 7 short	ECU tachometer sensor	Engine rotation speed is lowered	–	
2 long, 1 short	Vibrator proportional solenoid 1 for low amplitude	Signal wire short-circuit	1	Both solenoids 1 and 2 stop the current output immediately.
2 long, 2 short		Signal wire open-circuit	2	
2 long, 3 short	Vibrator proportional solenoid 2 for high amplitude	Signal wire short-circuit	1	
2 long, 4 short		Signal wire open-circuit	2	

Fig.: 2-4-1



The wire size is AVS 0.85 unless otherwise specified.

2-4. 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.
- Engine check lamp must not be lighting. If engine check lamp lights, refer to “Service information” of engine manufacturer.

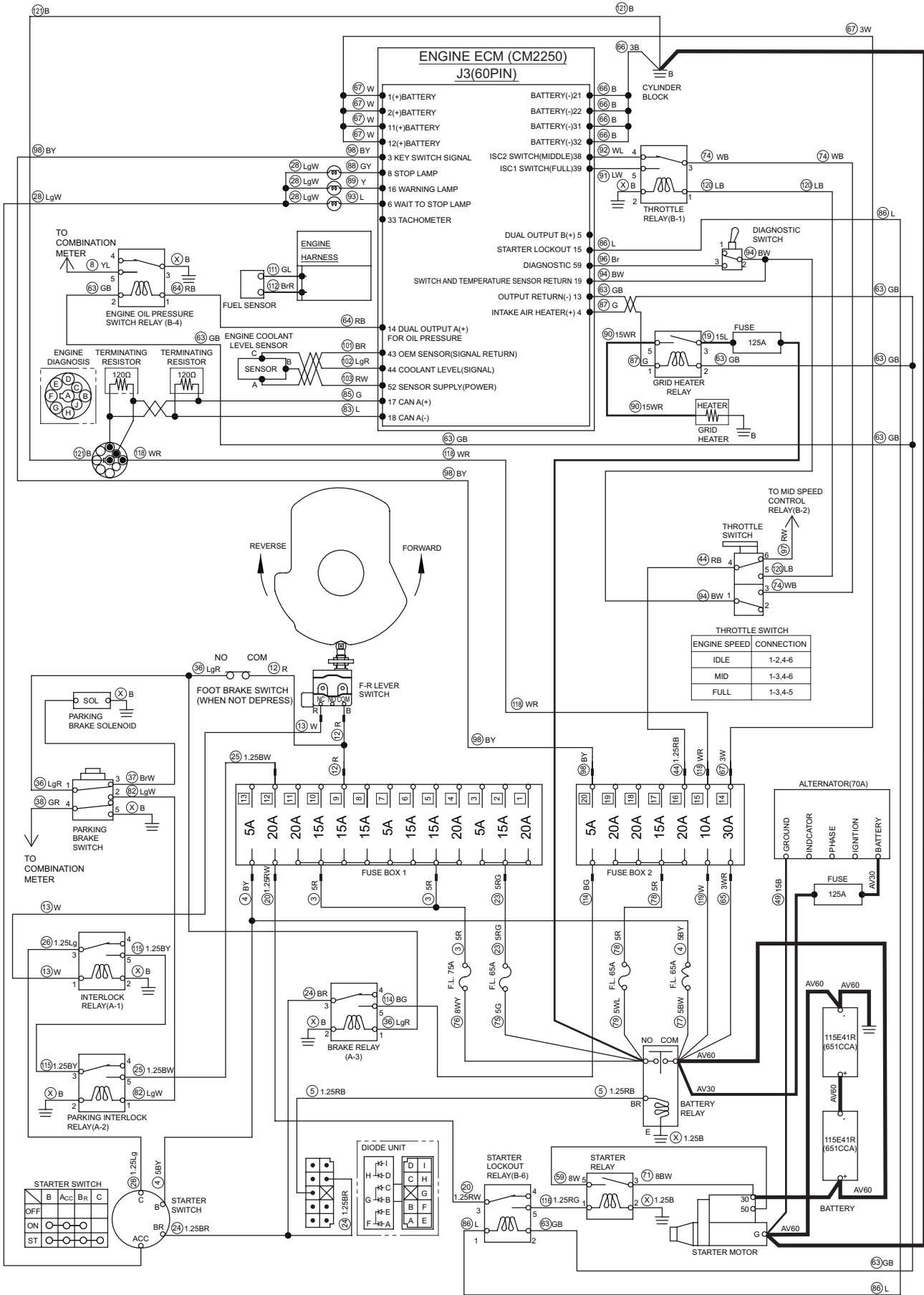
2-4-1. Engine will not start (Starter motor does not run) 1/4

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

Reference Fig.: 2-4-1

Check point	Check/Cause	Action
1. Battery	<ul style="list-style-type: none"> • Measure battery voltage or specific gravity. Standard voltage : 24 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	<p>(1) When starter switch is ON, measure voltage between starter motor terminal 30 and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is START, measure voltage between starter motor terminal 50 and chassis ground. Standard voltage : 24 V or more</p> <ul style="list-style-type: none"> • If starter motor does not run even though above items (1) and (2) are OK, starter motor is faulty. 	Replace starter motor.
4. Diode Unit	<p>(1) When starter switch is ON, measure voltage between diode unit terminal C inlet wire BR and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, measure voltage between diode unit terminal G outlet wire RB and chassis ground. Standard voltage : 24 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, diode unit is faulty. 	Replace diode unit.
5. Battery Relay	<p>(1) When starter switch is OFF, measure voltage between battery relay primary terminal COM and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, measure voltage between battery relay coil terminal BR inlet wire RB and coil ground terminal E. Standard voltage : 24 V or more</p> <p>(3) When starter switch is ON, measure voltage between battery relay secondary terminal NO and chassis ground. Standard voltage : 24 V or more</p> <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.

Fig.: 2-4-1



The wire size is AVS 0.85 unless otherwise specified.

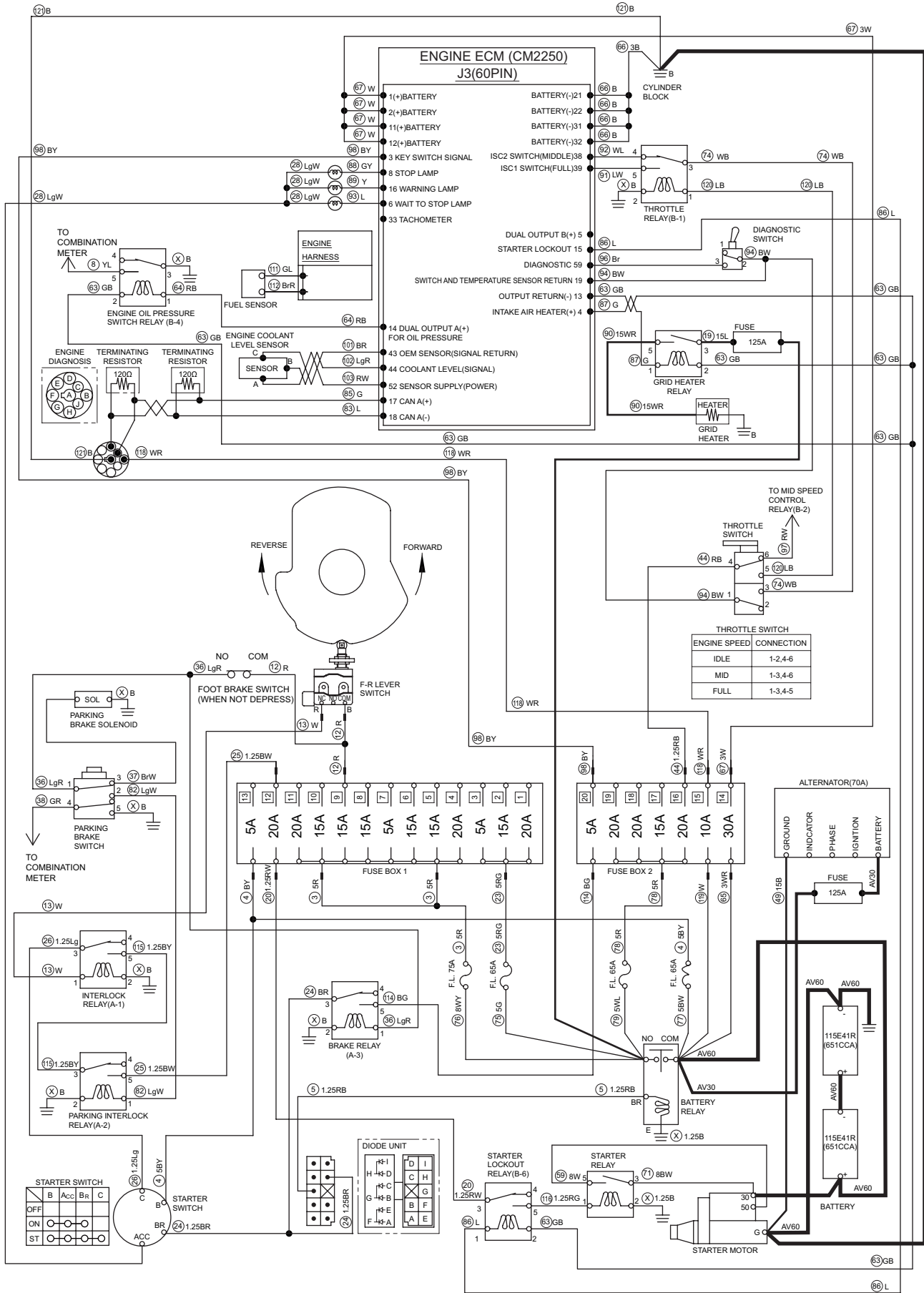
2-4-1. Engine will not start (Starter motor does not run) 2/4

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

Reference Fig.: 2-4-1

Check point	Check/Cause	Action
6. Starter Lockout Relay (B-6)	<p>(1) When starter switch is ON, measure voltage between starter lockout relay (B-6) terminal 1 inlet wire L and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is START, measure voltage between starter lockout relay (B-6) terminal 3 inlet wire RW and chassis ground. Standard voltage : 24 V or more</p> <p>(3) When starter switch is START, measure voltage between starter lockout relay (B-6) terminal 5 outlet wire RG and chassis ground. Standard voltage : 24 V or more</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and item (3) is NG, starter lockout relay (B-6) is faulty. 	Replace starter lockout relay (B-6).
7. Starter Relay	<p>(1) When starter switch is START, measure voltage between starter relay terminal 1 inlet wire RG and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, measure voltage between starter relay terminal 3 inlet wire BW and chassis ground. Standard voltage : 24 V or more</p> <p>(3) When starter switch is START, measure voltage between starter relay terminal 5 outlet wire W and chassis ground. Standard voltage : 24 V or more</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and item (3) is NG, starter relay is faulty. 	Replace starter relay.
8. F-R Lever Switch	<p>(1) When starter switch is ON, measure voltage between F-R lever switch terminal COM inlet wire R and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, measure voltage between F-R lever switch terminal NC outlet wire W and chassis ground. Standard voltage : 24 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.
9. Foot Brake Switch	<p>(1) When starter switch is ON, measure voltage between foot brake switch terminal COM inlet wire R and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, measure voltage between foot brake switch terminal NO outlet wire LgR and chassis ground. Standard voltage : 24 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.: 2-4-1



The wire size is AVS 0.85 unless otherwise specified.

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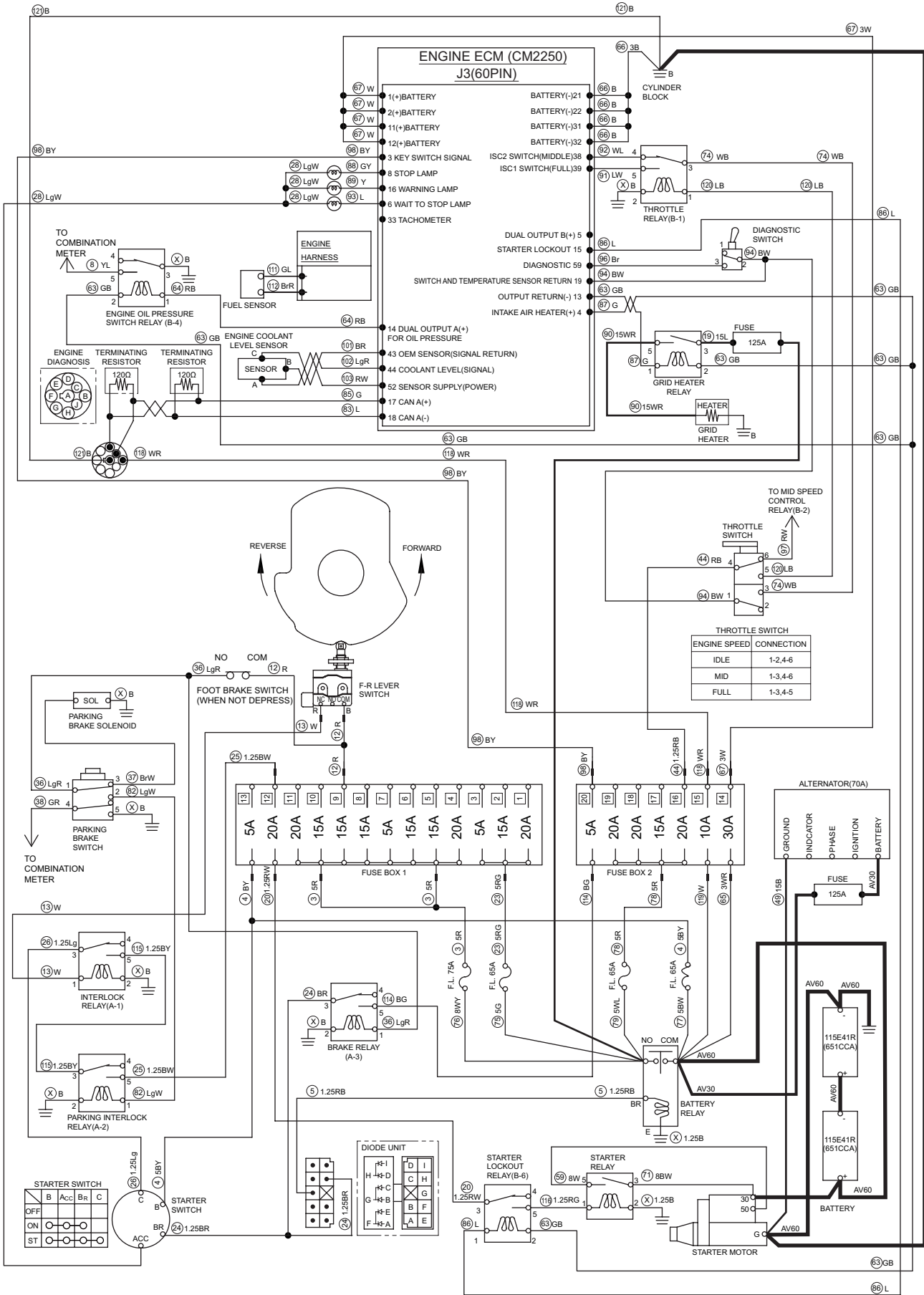
2-4-1. Engine will not start (Starter motor does not run) 3/4

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

Reference Fig.: 2-4-1

Check point	Check/Cause	Action
10. Parking Brake Switch	<p>(1) When starter switch is ON, measure voltage between parking brake switch terminal 1 inlet wire LgR and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, measure voltage between parking brake switch terminal 2 outlet wire LgW and chassis ground. Standard voltage : 24 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.
11. Interlock Relay (A-1)	<p>(1) When starter switch is ON, measure voltage between interlock relay (A-1) terminal 1 inlet wire W and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is START, measure voltage between interlock relay (A-1) terminal 3 inlet wire Lg and chassis ground. Standard voltage : 24 V or more</p> <p>(3) When starter switch is START, measure voltage between interlock relay (A-1) terminal 5 outlet wire BY and chassis ground. Standard voltage : 24 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 (A-1) is faulty. 	Replace interlock relay (A-1).
12. Parking Interlock Relay (A-2)	<p>(1) When starter switch is ON, measure voltage between parking interlock relay (A-2) terminal 1 inlet wire LgW and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is START, measure voltage between parking interlock relay (A-2) terminal 3 inlet wire BY and chassis ground. Standard voltage : 24 V or more</p> <p>(3) When starter switch is START, measure voltage between parking interlock relay (A-2) terminal 5 outlet wire BW and chassis ground. Standard voltage : 24 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 (A-2) is faulty. 	Replace parking interlock relay (A-2).

Fig.: 2-4-1



The wire size is AVS 0.85 unless otherwise specified.

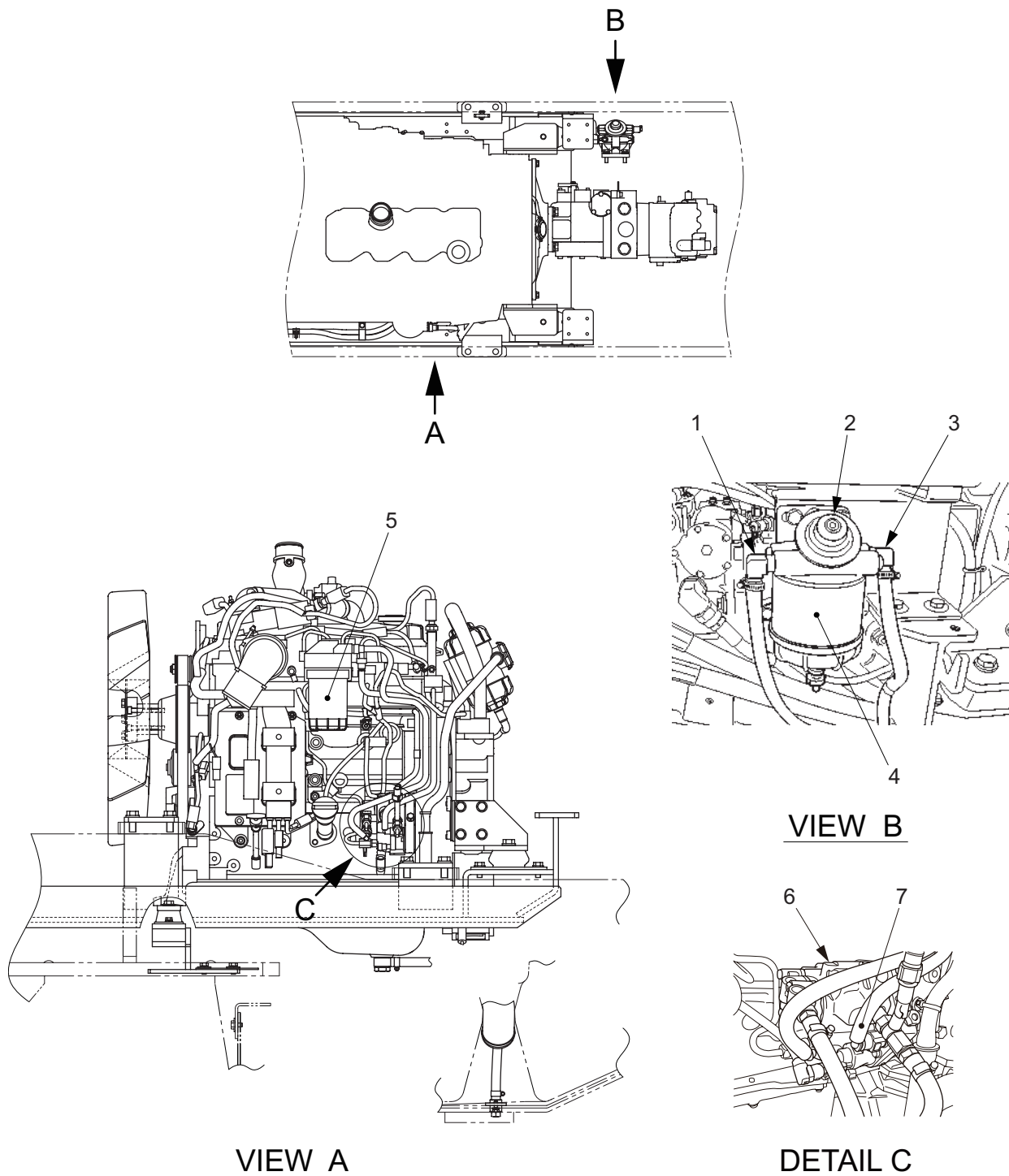
2-4-1. Engine will not start (Starter motor does not run) 4/4

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

Reference Fig.: 2-4-1

Check point	Check/Cause	Action
13. Brake Relay (A-3)	<p>(1) When starter switch is ON, measure voltage between brake relay (A-3) terminal 1 inlet wire LgR and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, measure voltage between brake relay (A-3) terminal 3 inlet wire BR and chassis ground. Standard voltage : 24 V or more</p> <p>(3) When starter switch is ON, measure voltage between brake relay (A-3) terminal 5 outlet wire BG and chassis ground. Standard voltage : 24 V or more</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and item (3) is NG, brake relay (A-3) is faulty. 	Replace brake relay (A-3).
14. 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.: 2-4-2



- (1) Fuel from supply tank
- (2) Priming pump
- (3) Fuel to fuel filter
- (4) Fuel pre-filter

- (5) Fuel filter
- (6) Fuel gear pump
- (7) Fuel supply to pump

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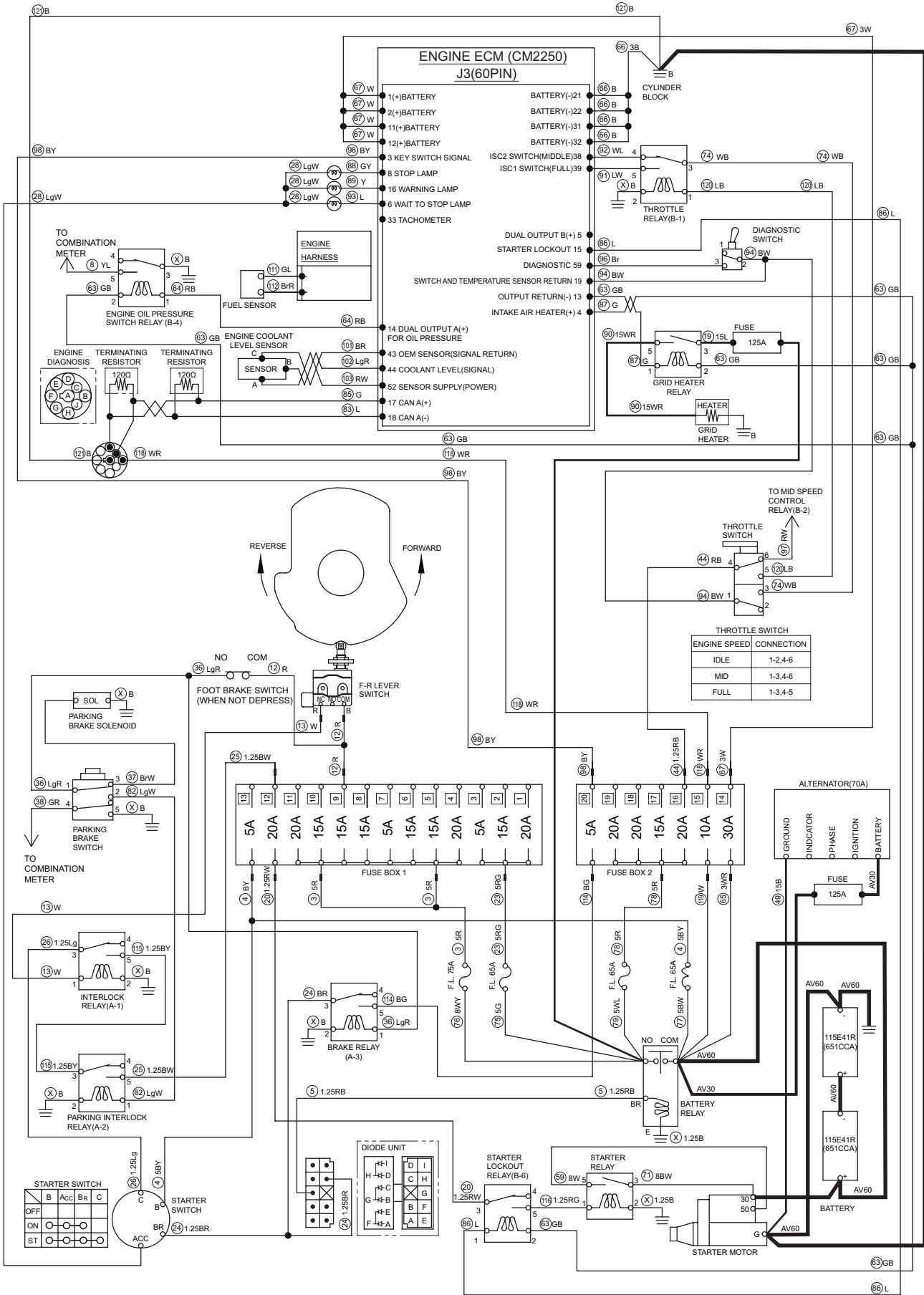
2-4-2. Engine will not start (But starter motor runs)

- 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 gear pump.

Reference Fig.: 2-4-2

Check point	Check/Cause	Action
1. Fuel Tank	<ul style="list-style-type: none"> • Check that fuel tank is filled with diesel oil. • If quantity is low, fuel is not delivered to fuel system. 	Fill tank with fuel.
	<ul style="list-style-type: none"> • Check that there is no water has entered fuel tank. • If water has entered tank, engine does not start. 	Drain water from tank.
	<ul style="list-style-type: none"> • Check that quality of diesel oil is sufficient. • If oil does not meet standard, engine may fail. 	Replace fuel in tank with an appropriate one.
2. Water/ Fuel Pre-Filter/ Fuel Filter (Pressure Side)	<ul style="list-style-type: none"> • Check that water does not cover water-in-fuel (WIF) sensor in contaminant collection bowl. • If water covers the sensor, engine may not start. 	Drain water.
	<ul style="list-style-type: none"> • Check filter for clogging. • Insufficient supply of proper fuel due to clogging of filter. <p>(NOTICE)</p> <ul style="list-style-type: none"> • Air bleeding should be performed whenever filter is replaced. 	<ul style="list-style-type: none"> • Replace filter. • Bleed filter.
3. Fuel Gear Pump	<ul style="list-style-type: none"> • Disconnect hose connecting to fuel gear pump and check that fuel flows out of pump. • If fuel does not flow out of pump, it is not delivered to fuel system. <p>(NOTICE)</p> <ul style="list-style-type: none"> • Air bleeding should be performed whenever fuel gear pump is replaced. 	<ul style="list-style-type: none"> • Replace fuel gear pump. • Bleed pump.
4. Hoses Connecting Between Parts	<ul style="list-style-type: none"> • Check hoses for fuel leakage and clogging. • Hose failure due to deterioration. <p>(NOTICE)</p> <ul style="list-style-type: none"> • Air bleeding should be performed whenever fuel hose is replaced. 	Replace hose.

Fig.: 2-4-1



The wire size is AVS 0.85 unless otherwise specified.

2-4-3. No charging

Reference Fig.: 2-4-1

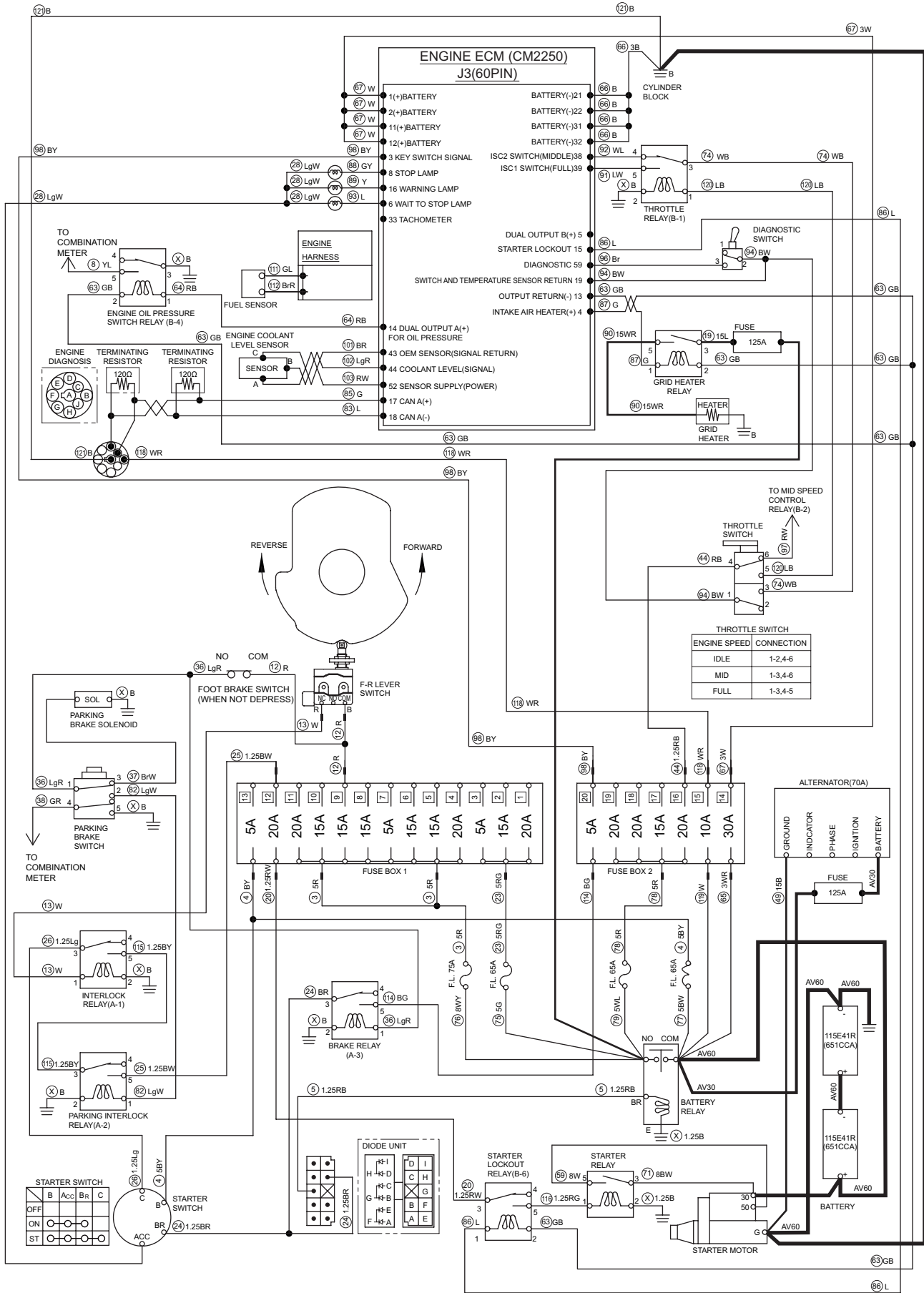
Check point	Check/Cause	Action
1. Alternator	<ul style="list-style-type: none"> • After starting engine, measure voltage between alternator terminal BATTERY wire and chassis ground. Standard voltage : At least intermediate engine speed, 27 to 29 V or more • If voltage is lower than standard, alternator is faulty. • If voltage is normal and battery is not charged, battery is faulty. 	Replace alternator or battery.

2-4-4. Grid heater does not work (Engine starting performance is bad in cold weather)

Reference Fig. : 2-4-1

Check point	Check/Cause	Action
1. Grid Heater	<ul style="list-style-type: none"> • When starter switch is ON, measure voltage between grid heater inlet wire WR and chassis ground. Standard voltage : 24 V or more • If voltage is normal, grid heater is faulty. 	Replace grid heater.
2. Grid Heater Relay	<p>(1) When starter switch is ON, measure voltage between grid heater relay terminal 2 inlet wire GB and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, measure voltage between grid heater relay terminal 3 inlet wire L and chassis ground. Standard voltage : 24 V or more</p> <p>(3) When starter switch is ON, measure voltage between grid heater relay terminal 5 outlet wire WR and chassis ground. Standard voltage : 24 V or more</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and item (3) is NG, grid heater relay is faulty. 	Replace grid heater relay.
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. <p>(NOTICE)</p> <ul style="list-style-type: none"> • If any abnormality is found in shielded twisted wires, repair is not approved. Be sure to replace them. 	Repair or replace harness.

Fig.: 2-4-1



The wire size is AVS 0.85 unless otherwise specified.

2-4-5. Starter motor runs even when F-R lever is not at “N” and parking brake is not applied

Reference Fig.: 2-4-1

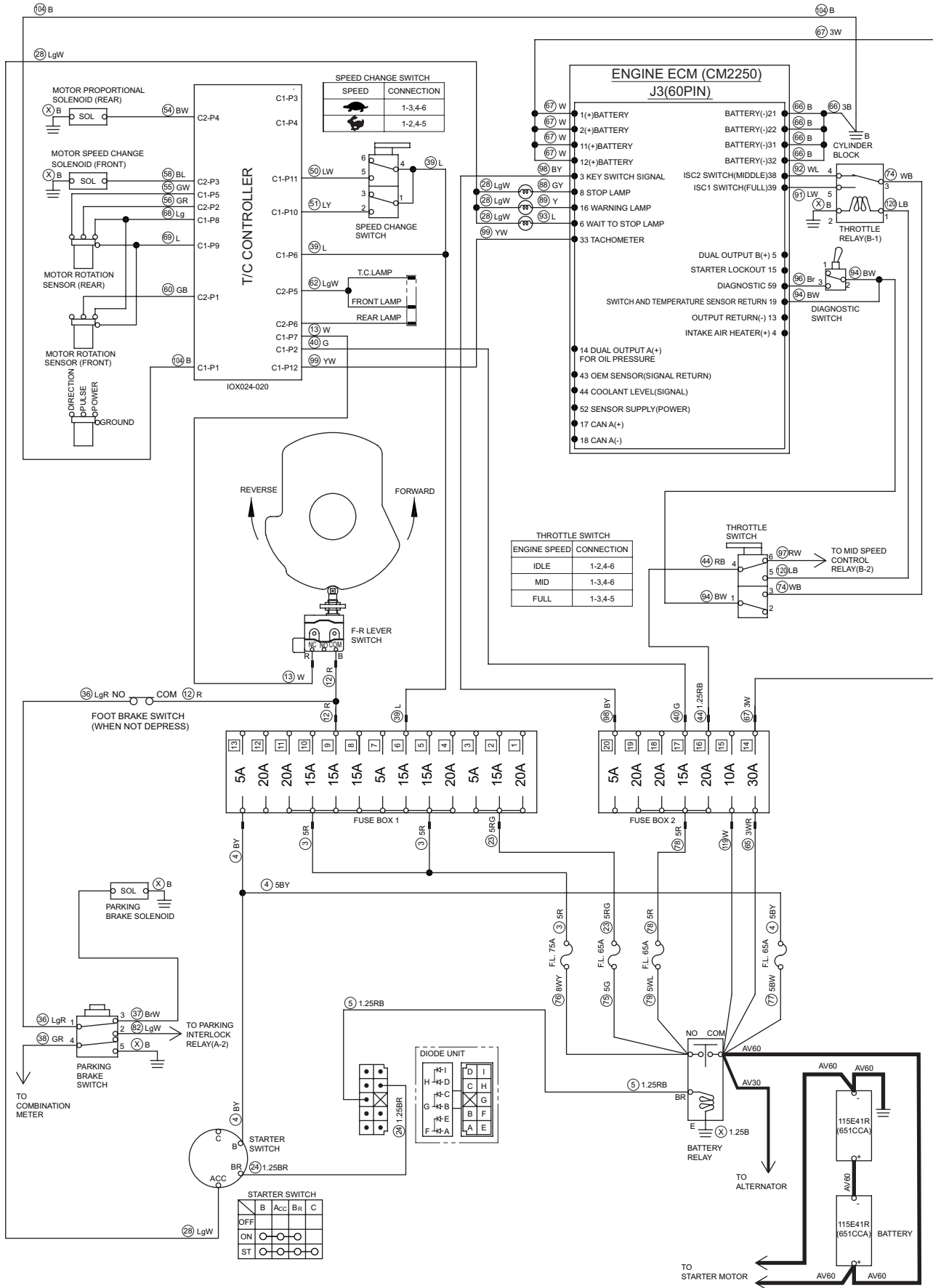
Check point	Check/Cause	Action
1. F-R Lever Switch	<ul style="list-style-type: none"> When starter switch is OFF and F-R lever is “F” or “R”, check continuity between F-R lever switch terminal COM and terminal NC. There is no continuity in normal condition. If there is continuity, F-R lever switch is faulty. 	Replace F-R lever switch.
2. Parking Brake Switch	<ul style="list-style-type: none"> When starter switch is OFF and parking brake switch is released position, check continuity between parking brake switch terminal 1 and 2. There is no continuity in normal condition. If there is continuity, parking brake switch is faulty. 	Replace parking brake switch.

2-4-6. Engine speed cannot be switched

Reference Fig. : 2-4-1

Check point	Check/Cause	Action
1. Throttle Switch	<ol style="list-style-type: none"> When throttle switch is “IDLE”, check continuity between throttle switch terminals 1 and 2, 4 and 6. There is continuity in normal condition. When throttle switch is “MID”, check continuity between throttle switch terminals 1 and 3, 4 and 6. There is continuity in normal condition. When throttle switch is “FULL”, check continuity between throttle switch terminals 1 and 3, 4 and 5. There is continuity in normal condition. <ul style="list-style-type: none"> If above item (1), (2) or (3) is NG, throttle switch is faulty. 	Replace throttle switch.
2. Throttle Relay (B-1)	<ol style="list-style-type: none"> When starter switch is ON and throttle switch is “FULL”, measure voltage between throttle relay (B-1) terminal 1 inlet wire LB and chassis ground. Standard voltage : 24 V or more When starter switch is ON and throttle switch is “FULL”, measure voltage between throttle relay (B-1) terminal 5 outlet wire LW and chassis ground. There is electricity in normal condition. When starter switch is ON and throttle switch is “MID”, measure voltage between throttle relay (B-1) terminal 4 outlet wire WL and chassis ground. There is electricity in normal condition. <ul style="list-style-type: none"> If above item (1) is OK and item (2) or (3) is NG, throttle relay (B-1) is faulty. 	Replace throttle relay (B-1).
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



The wire size is AVS 0.85 unless otherwise specified.

2-5. 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.9-006 to P.9-008).
- Check any ground circuit which belongs to components to be checked.

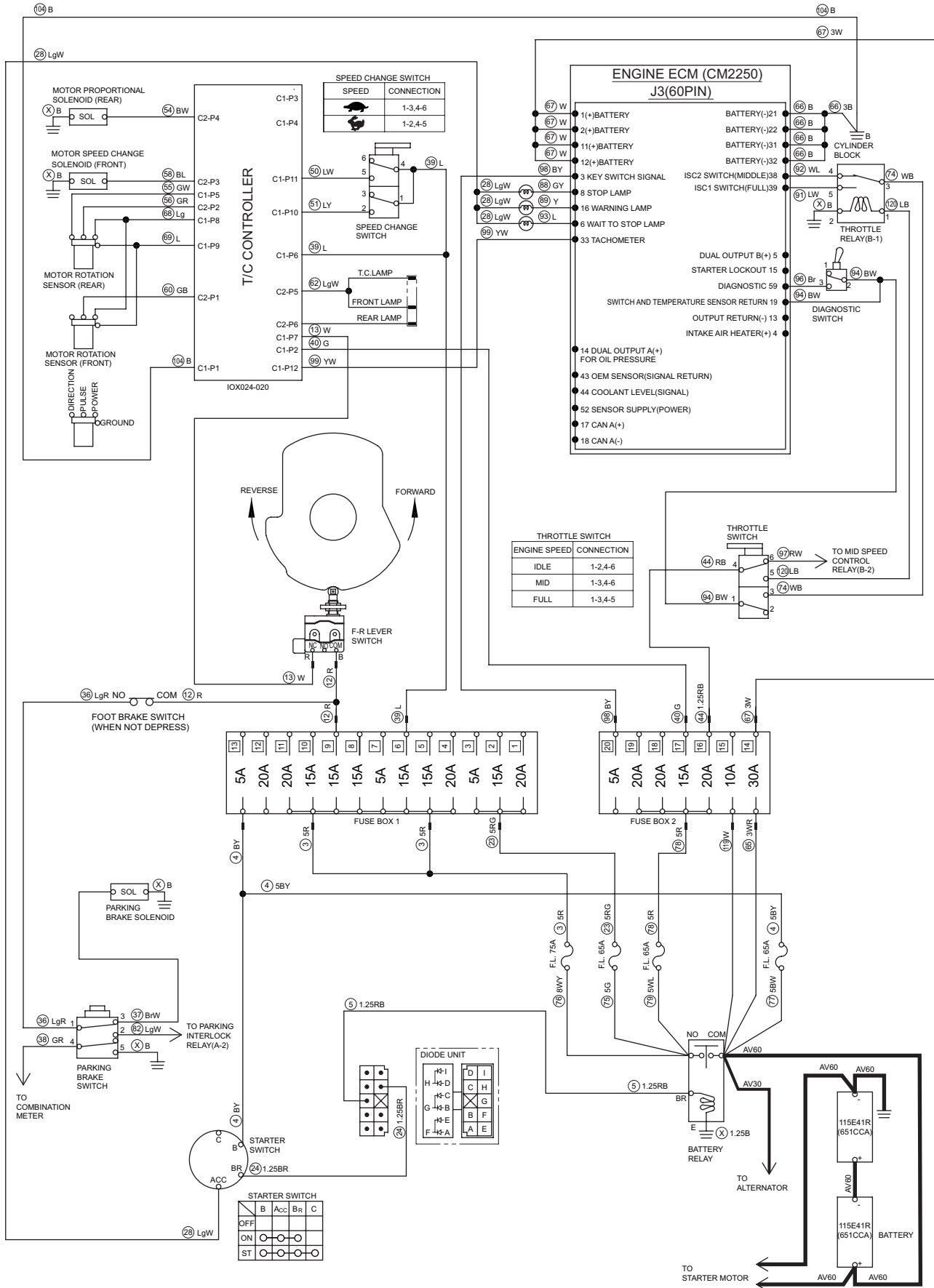
2-5-1. Machine moves neither forward nor backward

- Parking brake switch must be released.
- Foot brake switch must be ON (Brake pedal is not depressed).

Reference Fig.: 2-5-1

Check point	Check/Cause	Action
1. Parking Brake Solenoid	<ul style="list-style-type: none"> • Disconnect harness and measure resistance of coil. Standard resistance : $45 \pm 4.5 \Omega$ • If measured resistance is abnormal, parking brake solenoid is faulty. 	Replace parking brake solenoid.
2. Foot Brake Switch	<p>(1) When starter switch is ON, measure voltage between foot brake switch terminal COM inlet wire R and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, measure voltage between foot brake switch terminal NO outlet wire LgR and chassis ground. Standard voltage : 24 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. Parking Brake Switch	<p>(1) When starter switch is ON, measure voltage between parking brake switch terminal 1 inlet wire LgR and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, measure voltage between parking brake switch terminal 3 outlet wire BrW and chassis ground. Standard voltage : 24 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.
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.: 2-5-1



The wire size is AVS 0.85 unless otherwise specified.

2-5-2. Machine speed cannot be changed 1/5

- Engine check lamp must not be lighting. If engine check lamp lights, refer to “Service information” of engine manufacturer.
- Check whether ECO controller red LED shows any blink.

1) When red LED shows no blink.

Reference Fig.: 2-5-1


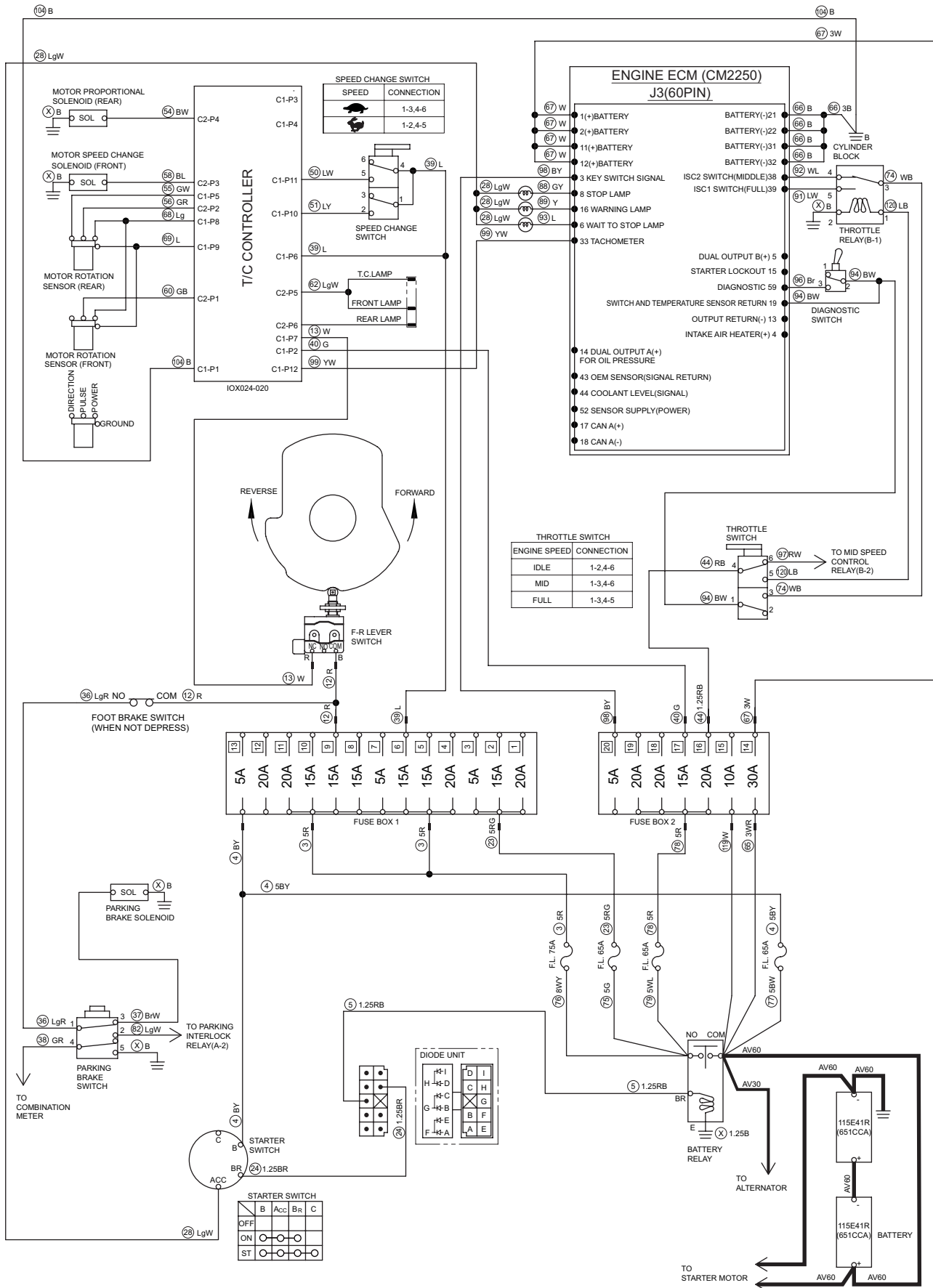
Check point	Check/Cause	Action
1. Motor Speed Change Solenoid (Front)	<ul style="list-style-type: none"> • Disconnect harness and measure resistances of coil. Standard resistance : $45 \pm 4.5 \Omega$ • If resistance is abnormal, motor speed change solenoid (front) is faulty. 	Replace motor speed change solenoid (front).
2. Motor Proportional Solenoid (Rear)	<ul style="list-style-type: none"> • Disconnect harness and measure resistances of coil. Standard resistance : 14.2Ω • If resistance is abnormal, motor proportional solenoid (rear) is faulty. 	Replace motor proportional solenoid (rear).
3.Speed Change Switch	<p>(1) When starter switch is ON, measure voltage between speed change switch terminal 1 inlet wire L, terminal 4 inlet wire L and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON and speed change switch is “”, measure voltage between speed change switch terminal wires and chassis ground.</p> <ul style="list-style-type: none"> • Speed change switch terminal 2 outlet wire LY and chassis ground. • Speed change switch terminal 5 outlet wire LW and chassis ground. <p>Standard voltage : 24 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.

Fig.: 2-5-1



The wire size is AVS 0.85 unless otherwise specified.

2-5-2. Machine speed cannot be changed 2/5

- Engine check lamp must not be lighting. If engine check lamp lights, refer to “Service information” of engine manufacturer.
- Check whether ECO controller red LED shows any blink.

1) When red LED shows no blink.

Reference Fig.: 2-5-1






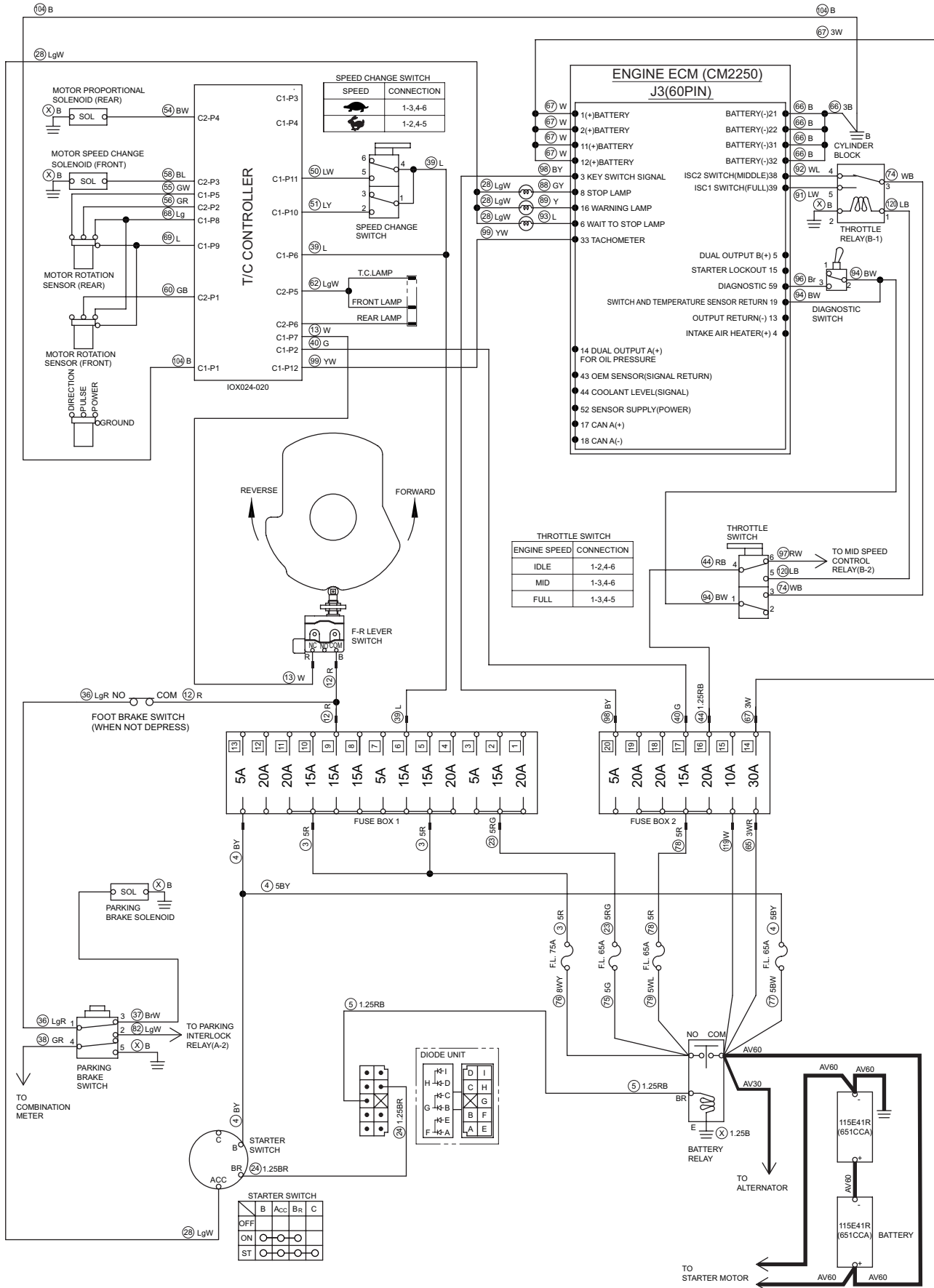
Check point	Check/Cause	Action
4. T/C Controller	<p>(1) When starter switch is ON, measure voltage between T/C controller terminal C1-P2 inlet wire G and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, measure voltage between T/C controller terminal C1-P6 inlet wire L and chassis ground. Standard voltage : 24 V or more</p> <p>(3) When starter switch is ON, measure voltage between T/C controller terminal C1-P7 inlet wire W and chassis ground. Standard voltage : 24 V or more (When F-R lever is “F” or “R”) : 0 V (When F-R lever is “N”)</p> <p>(4) When starter switch is ON and F-R lever is “F” or “R”, measure voltage between T/C controller terminal C1-P7 inlet wire W and chassis ground. There is no electricity in normal condition.</p> <p>(5) Check that T/C controller terminal C1-P1 wire B is grounded.</p> <p>(6) When starter switch is ON, measure current between T/C controller and chassis ground. Front motor side : • T/C controller terminal C2-P3 outlet wire BL and chassis ground. Standard current : 0 mA (When speed change switch is  and F-R lever is “R”) : 600 mA (Except when speed change switch is  and F-R lever is “R”)</p> <p>Rear motor side : • T/C controller terminal C2-P4 outlet wire BW and chassis ground. Standard current : 230 mA (When speed change switch is  and F-R lever is “F”) : 430 mA (When speed change switch is  and F-R lever is “N” or “R”) : 690 mA (When speed change switch is  and F-R lever is “F” or “R”)</p> <p>• If above items (1), (2), (3), (4) and (5) are OK and item (6) is NG, T/C controller is faulty.</p> <p>(NOTICE) • Since current value is output in PWM, standard value shown above represent maximum instaneous value.</p>	Replace T/C controller.
5. Repair or replace harness	<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. 	Harness connecting between terminals.

Fig.: 2-5-1



The wire size is AVS 0.85 unless otherwise specified.

2-5-2. Machine speed cannot be changed 3/5

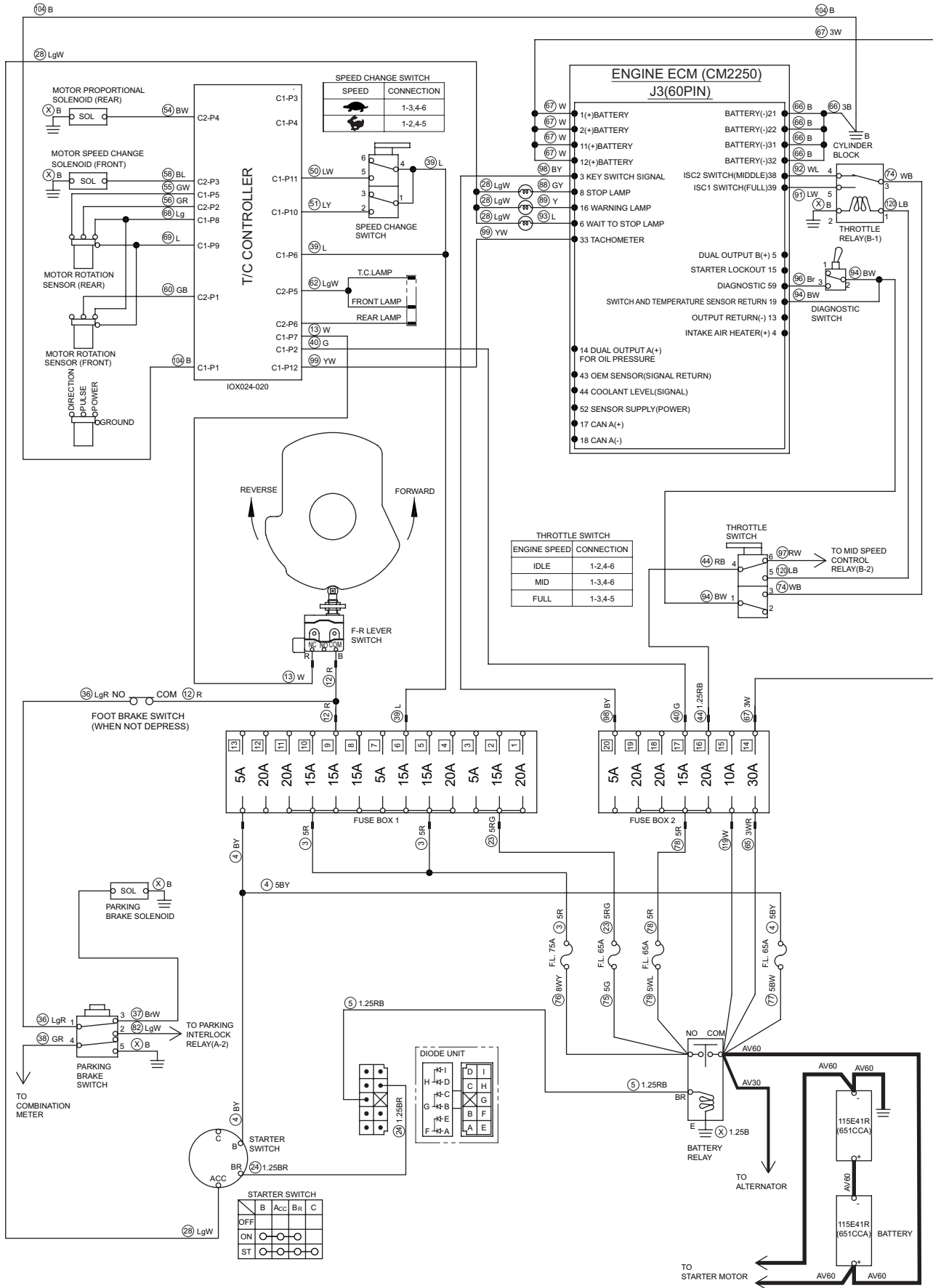
- Engine check lamp must not be lighting. If engine check lamp lights, refer to “Service information” of engine manufacturer.
- Check whether ECO controller red LED shows any blink.

2) When red LED shows any blink.

Reference Fig.: 2-5-1

Number of red LED blinks	Check point	Check/Cause	Action
1 long, 1 short or 1 long, 2 short	1. Connector	<ul style="list-style-type: none"> • Check motor proportional solenoid (rear) connector and T/C controller (terminal C2-P4) for corrosion, breakage, bending and looseness. • If any abnormality is found, connector is faulty. 	Replace connector or terminal.
	2. Harness	<ul style="list-style-type: none"> • Measure resistances between motor proportional solenoid (rear) terminal wire BW and T/C controller terminal C2-P4 wire BW. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.
1 long, 3 short or 1 long, 4 short	1. Connector	<ul style="list-style-type: none"> • Check motor speed change solenoid (front) connector and T/C controller (terminal C2-P3) for corrosion, breakage, bending and looseness. • If any abnormality is found, connector is faulty. 	Replace connector or terminal.
	2. Harness	<ul style="list-style-type: none"> • Measure resistances between motor speed change solenoid (front) terminal wire BL and T/C controller terminal C2-P3 wire BL. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

Fig.: 2-5-1



The wire size is AVS 0.85 unless otherwise specified.

2-5-2. Machine speed cannot be changed 4/5

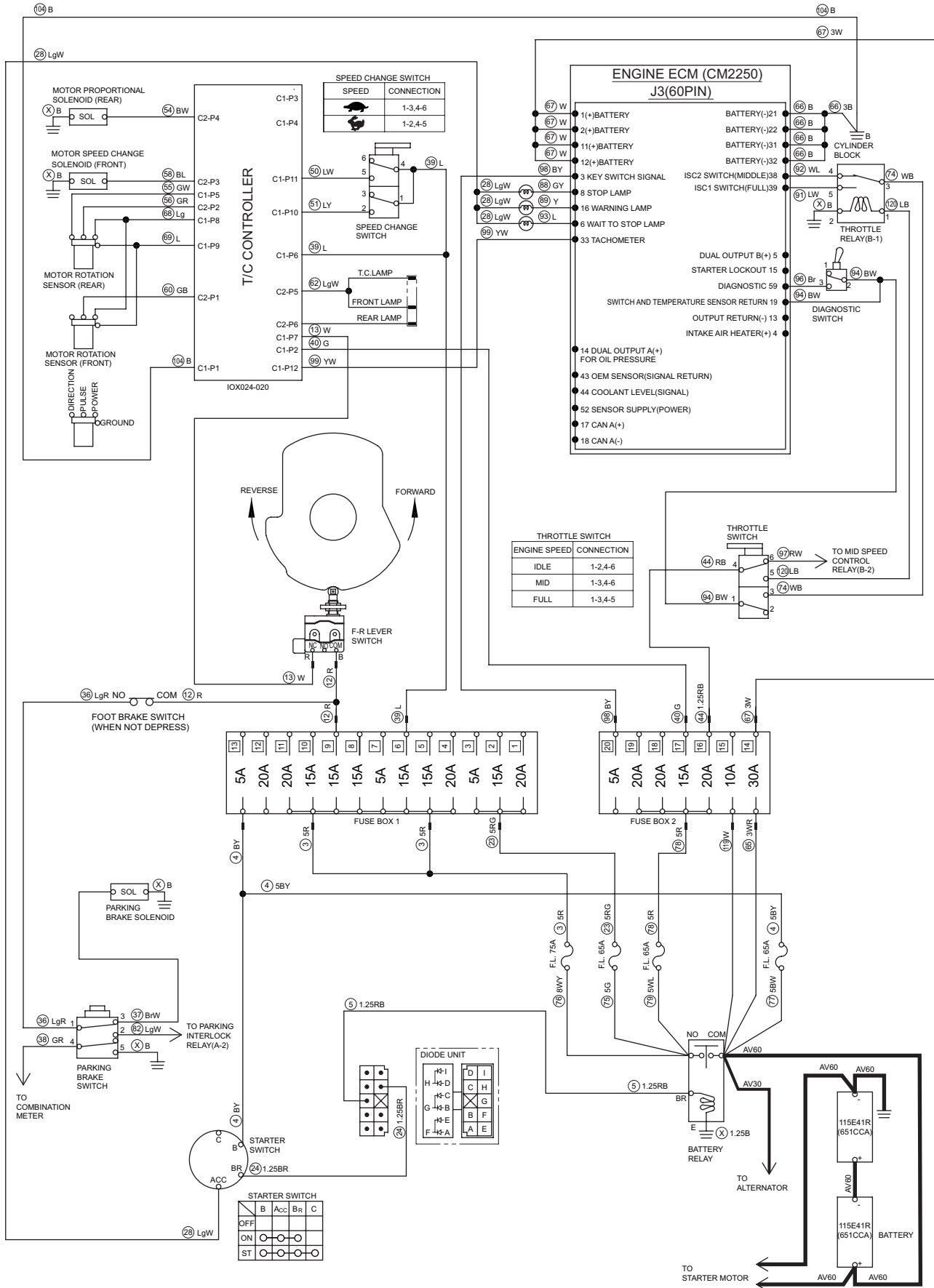
- Engine check lamp must not be lighting. If engine check lamp lights, refer to “Service information” of engine manufacturer.
- Check whether ECO controller red LED shows any blink.

2) When red LED shows any blink.

Reference Fig.: 2-5-1

Number of red LED blinks	Check point	Check/Cause	Action
1 long, 5 short	1. Connector	<ul style="list-style-type: none"> • Check motor rotation sensor (rear) connector and T/C controller (terminal C1-P5, C1-P8, C1-P9 and C2-P2) for corrosion, breakage, bending and looseness. • If any abnormality is found, connector is faulty. 	Replace connector or terminal.
	2. Harness	<ul style="list-style-type: none"> • Measure resistances between motor rotation sensor (rear) and T/C controller terminal wires. <ul style="list-style-type: none"> • Motor rotation sensor (rear) terminal DIRECTION wire GW and T/C controller terminal C1-P5 wire GW. • Motor rotation sensor (rear) terminal POWER wire Lg and T/C controller terminal C1-P8 wire Lg. • Motor rotation sensor (rear) terminal PULSE wire GR and T/C controller terminal C2-P2 wire GR. • Motor rotation sensor (rear) terminal GROUND wire L and T/C controller terminal C1-P9 wire L. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.
	3. Motor Rotation Sensor (Rear)	<ol style="list-style-type: none"> (1) When starter switch is ON, measure voltage between motor rotation sensor (rear) terminal POWER inlet wire Lg and chassis ground. Standard voltage : 5.0 ± 0.25 V (2) Check that motor rotation sensor terminal (rear) GROUND wire L is grounded. (3) Start engine and rotate wheels. Measure pulse between motor rotation sensor (rear) terminal PULSE outlet wire GR and chassis ground. Standard pulse : 78 pulses/rotation (4) When starter switch is ON, measure voltage between motor rotation sensor (rear) terminal DIRECTION outlet wire GW and chassis ground. Standard voltage : 0.2 to 0.6 V (when forward) : 4.2 to 5.0 V (when reverse) <ul style="list-style-type: none"> • If above items (1) and (2) are OK and item (3) or (4) is NG, motor rotation sensor (rear) is faulty. 	Replace motor rotation sensor (rear)

Fig.: 2-5-1



The wire size is AVS 0.85 unless otherwise specified.

2-5-2. Machine speed cannot be changed 5/5

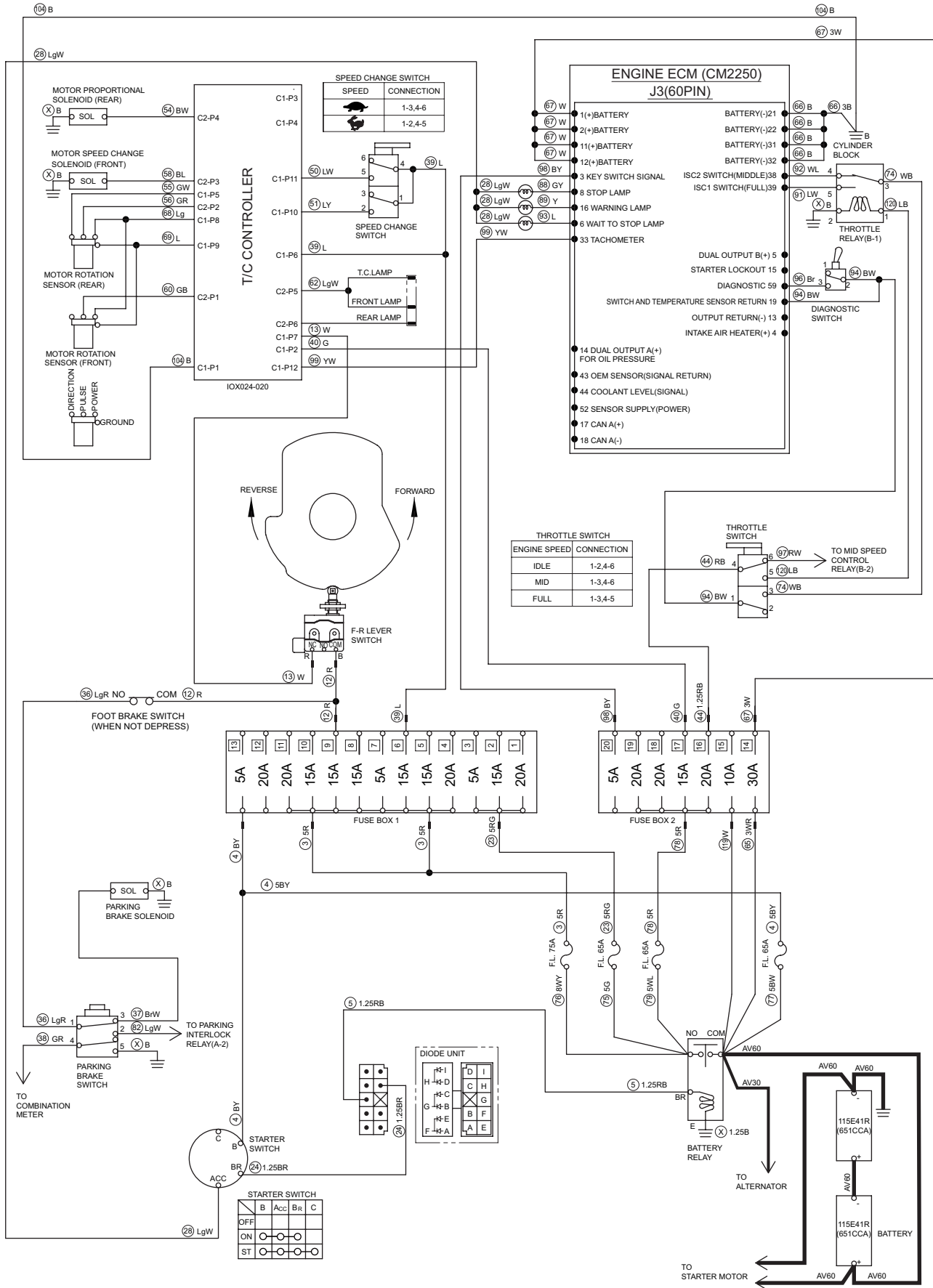
- Engine check lamp must not be lighting. If engine check lamp lights, refer to “Service information” of engine manufacturer.
- Check whether ECO controller red LED shows any blink.

2) When red LED shows any blink.

Reference Fig.: 2-5-1

Number of red LED blinks	Check point	Check/Cause	Action
1 long, 6 short	1. Connector	<ul style="list-style-type: none"> • Check motor rotation sensor (front) connector and T/C controller (terminal C1-P8, C1-P9 and C2-P1) for corrosion, breakage, bending and looseness. • If any abnormality is found, connector is faulty. 	Replace connector or terminal.
	2. Harness	<ul style="list-style-type: none"> • Measure resistances between motor rotation sensor (front) and T/C controller terminal wires. • Motor rotation sensor (front) terminal POWER wire Lg and T/C controller terminal C1-P8 wire Lg. • Motor rotation sensor (front) terminal PULSE wire GB and T/C controller terminal C2-P1 wire GB. • Motor rotation sensor (front) terminal GROUND wire L and T/C controller terminal C1-P9 wire L. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.
	3. Motor Rotation Sensor (Front)	<p>(1) When starter switch is ON, measure voltage between motor rotation sensor (front) terminal POWER inlet wire Lg and chassis ground. Standard voltage : 5.0 ± 0.25 V</p> <p>(2) Check that motor rotation sensor (front) terminal GROUND wire L is grounded.</p> <p>(3) Start engine and rotate drum. Measure pulse between motor rotation sensor (front) terminal PULSE outlet wire GB and chassis ground. Standard pulse : 71 pulses/rotation</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and item (3) is NG, motor rotation sensor (front) is faulty. 	Replace front motor rotation sensor.
1 long, 7 short	1. Connector	<ul style="list-style-type: none"> • Check engine ECM (terminal 33) and T/C controller (terminal C1-P12) for corrosion, breakage, bending and looseness. • If any abnormality is found, connector is faulty. 	Replace connector or terminal.
	2. Harness	<ul style="list-style-type: none"> • Measure resistances between engine ECM terminal 33 wire YW and T/C controller terminal C1-P12 wire YW. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.
	3. T/C controller	<ul style="list-style-type: none"> • After starting engine and throttle switch is “IDLE”, measure pulse between T/C controller terminal C1-P12 engine rotation speed pulse inlet wire YW and chassis ground. Standard pulse : 2 pulses/rotation • If pulses are normal, but machine speed does not change, T/C controller is faulty. 	Replace T/C controller.

Fig.: 2-5-1



The wire size is AVS 0.85 unless otherwise specified.

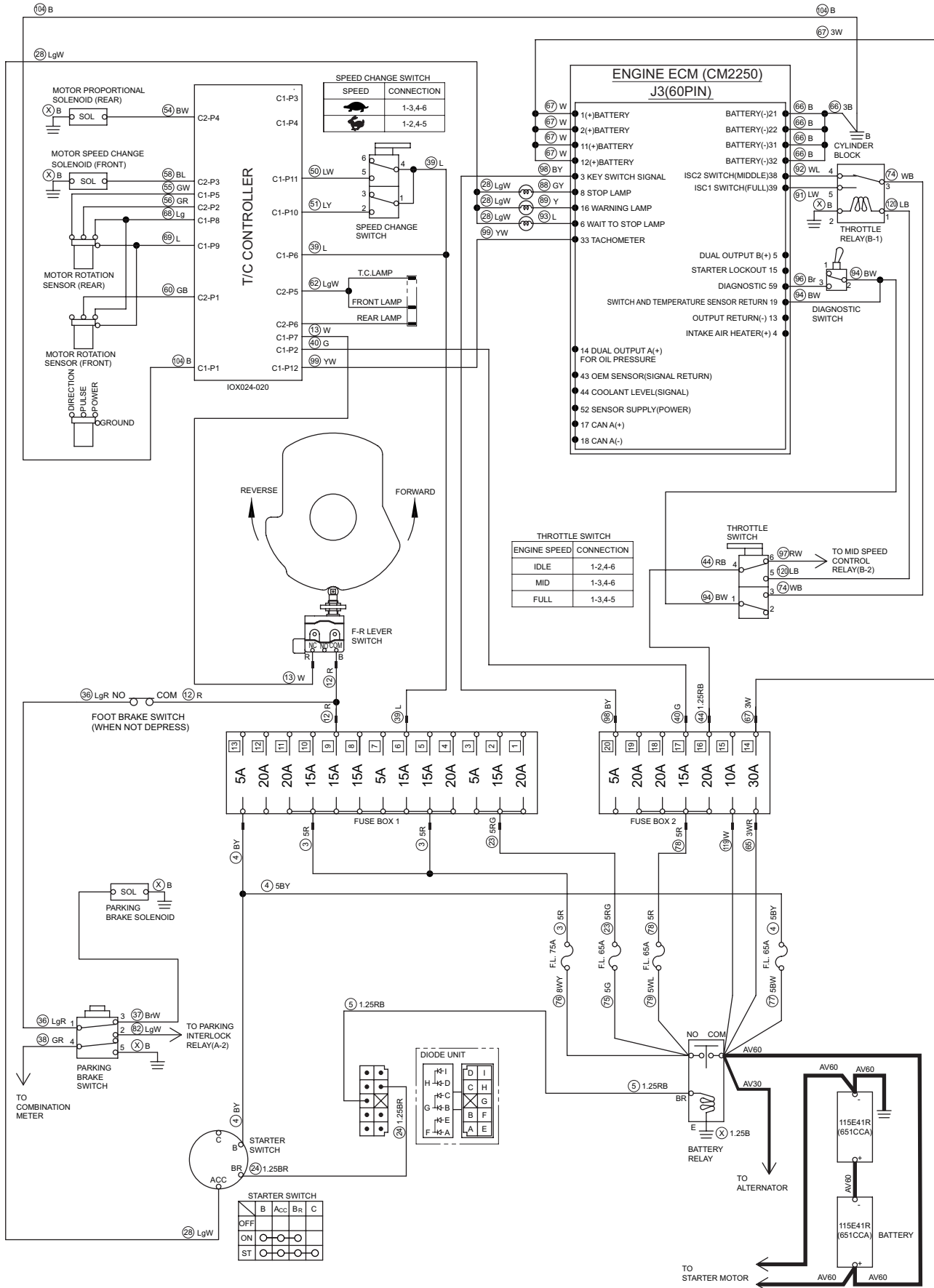
2-5-3. Brake cannot be released

- Parking brake switch must be released.
- Foot brake switch must be ON (Brake pedal is not depressed).

Reference Fig.: 2-5-1

Check point	Check/Cause	Action
1. Parking Brake Solenoid	<ul style="list-style-type: none"> • Disconnect harness and measure resistance of coil. Standard voltage : $45 \pm 4.5 \Omega$ • If measured resistance is abnormal, parking brake solenoid is faulty. 	Replace parking brake solenoid.
2. Foot Brake Switch	<p>(1) When starter switch is ON, measure voltage between foot brake switch terminal COM inlet wire R and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, measure voltage between foot brake switch terminal NO outlet wire LgR and chassis ground. Standard voltage : 24 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. Parking Brake Switch	<p>(1) When starter switch is ON, measure voltage between parking brake switch terminal 1 inlet wire LgR and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, measure voltage between parking brake switch terminal 3 outlet wire BrW and chassis ground. Standard voltage : 24 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.
4. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

Fig.: 2-5-1



The wire size is AVS 0.85 unless otherwise specified.

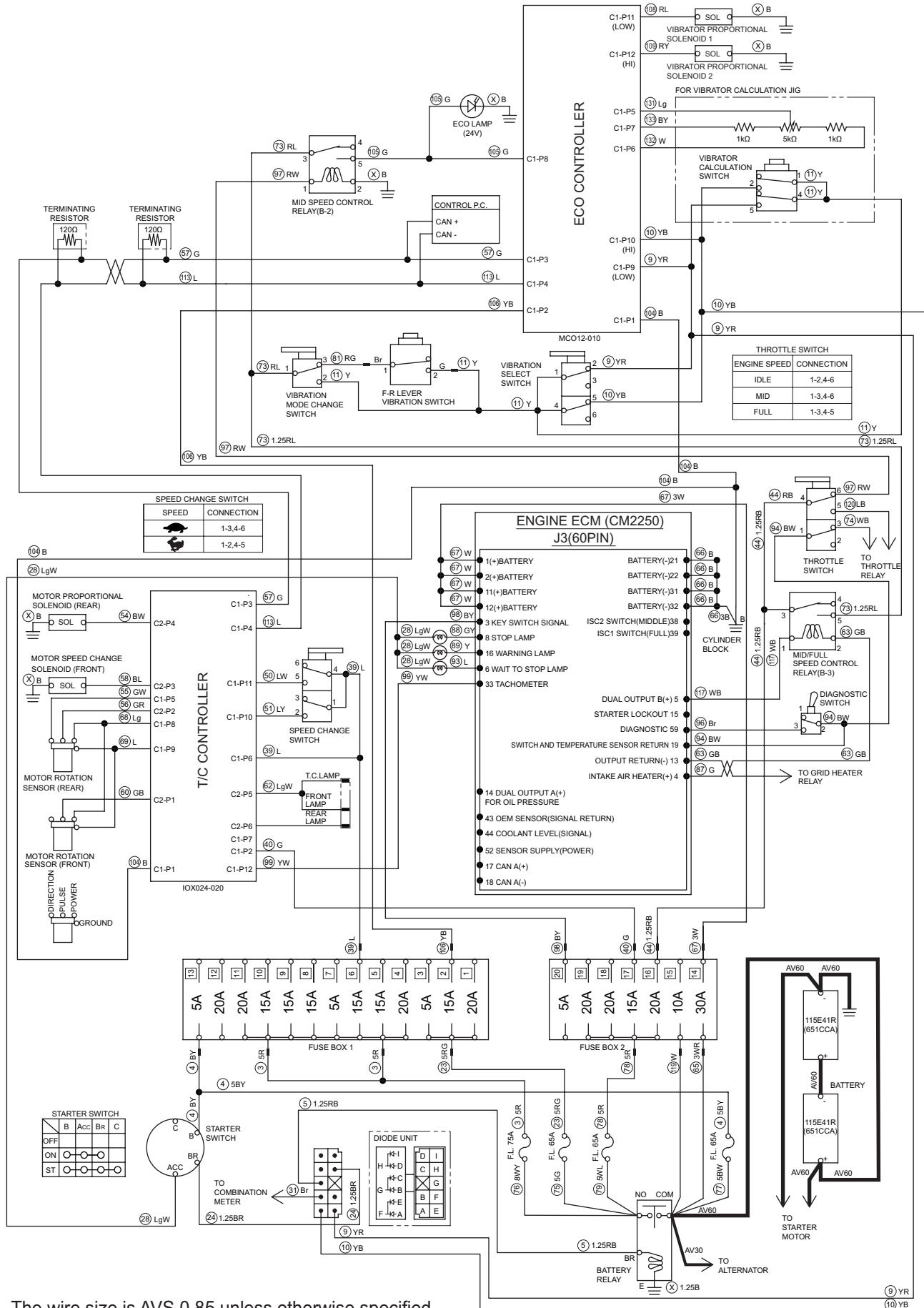
2-5-4. Brake does not work

- Parking brake switch must be applied.
- Foot brake switch must be OFF (Brake pedal is depressed).

Reference Fig.: 2-5-1

Check point	Check/Cause	Action
1. Parking Brake Solenoid	<ul style="list-style-type: none"> • Disconnect harness and measure resistance of coil. Standard resistance : $45 \pm 4.5 \Omega$ • 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 BrW and chassis ground. There is no electricity in normal condition. • If electricity flows, 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 NO outlet wire LgR and chassis ground. There is no electricity in normal condition. • If electricity flows, 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 : 10Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

Fig.: 2-6-1



The wire size is AVS 0.85 unless otherwise specified.

2-6. Vibration

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.9-006 to P.9-008).
- Check any ground circuit which belongs to components to be checked.
- Engine check lamp must not be lighting. If engine check lamp lights, refer to “Service information” of engine manufacturer.
- Throttle switch to “MID” or “FULL”.

2-6-1. No vibration occurs 1/3

- Vibration mode change switch must be “CONT” (continuous mode).
- Vibration select switch must not be “○”.
- Check whether ECO controller red LED shows any blink.

1) When red LED shows no blink.

Reference Fig.: 2-6-1



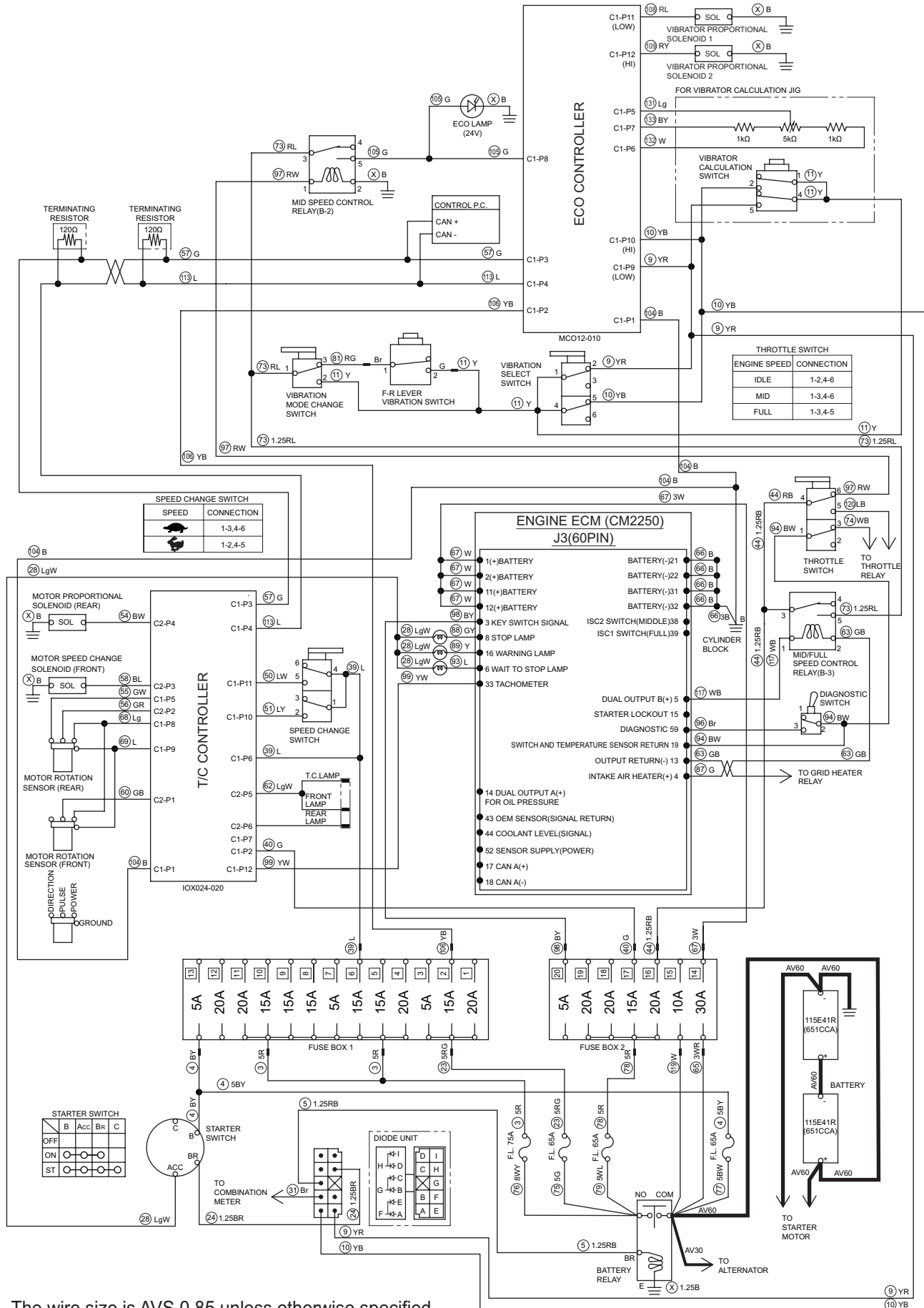
Check point	Check/Cause	Action
1. Vibrator Proportional Solenoid 1	<ul style="list-style-type: none"> • Disconnect harness and measure resistance of coil. Standard resistance : 36 Ω • If resistance is abnormal, vibrator proportional solenoid 1 is faulty. 	Replace vibrator proportional solenoid 1.
2. Vibrator Proportional Solenoid 2	<ul style="list-style-type: none"> • Disconnect harness and measure resistance of coil. Standard resistance : 36 Ω • If resistance is abnormal, vibrator proportional solenoid 2 is faulty. 	Replace vibrator proportional solenoid 2.
3. Vibration Select Switch	<p>(1) When starter switch is ON, measure voltage between vibration select switch terminal 1 inlet wire Y, terminal 4 inlet wire Y and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON and vibration select switch is “”, measure voltage between vibration select switch terminal 2 outlet wire YR and chassis ground. Standard voltage : 24 V or more</p> <p>(3) When starter switch is ON and vibration select switch is “”, measure voltage between vibration select switch terminal 5 outlet wire YB and chassis ground. Standard voltage : 24 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) or (3) is NG, vibration select switch is faulty. 	Replace vibration select switch.
4. Vibration Mode Change Switch	<p>(1) When starter switch is ON, measure voltage between vibration mode change switch terminal 1 inlet wire RL and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, measure voltage between vibration mode change switch terminal 2 outlet wire Y and chassis ground. Standard voltage : 24 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, vibration mode change switch is faulty. 	Replace vibration mode change switch.

Fig.: 2-6-1



The wire size is AVS 0.85 unless otherwise specified.

2-6-1. No vibration occurs 2/3

- Vibration mode change switch must be “CONT” (continuous mode).
- Vibration select switch must not be “○”.
- Check whether ECO controller red LED shows any blink.

1) When red LED shows no blink.

Reference Fig.: 2-6-1









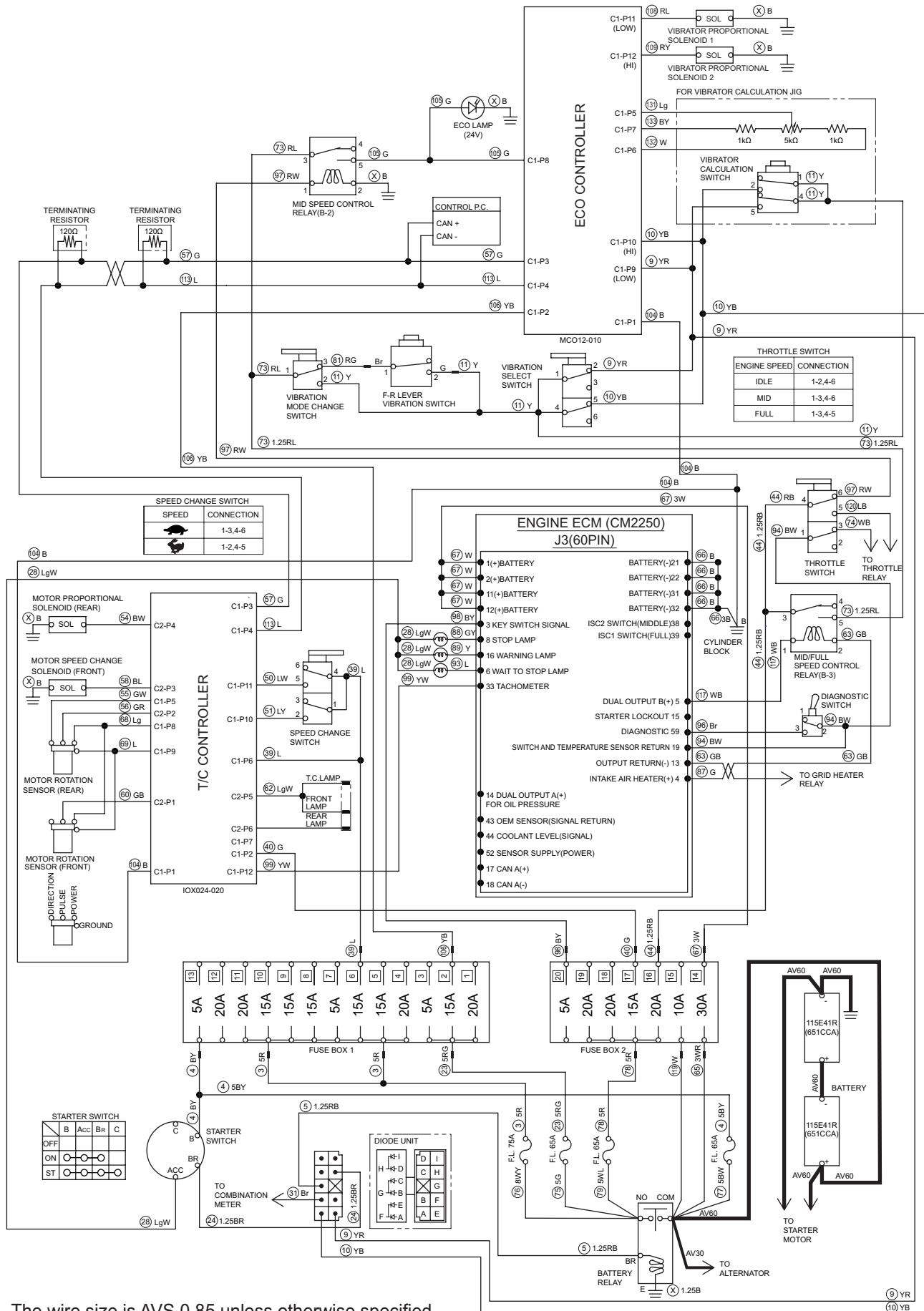
Check point	Check/Cause	Action
5. MID/FULL Speed Control Relay (B-3)	<p>(1) When starter switch is ON, measure voltage between MID/FULL speed control relay (B-3) terminal 1 inlet wire WB and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, measure voltage between MID/FULL speed control relay (B-3) terminal 3 inlet wire RB and chassis ground. Standard voltage : 24 V or more</p> <p>(3) When starter switch is ON and throttle switch is “MID”, measure voltage between MID/FULL speed control relay (B-3) terminal 5 outlet wire RL and chassis ground. Standard voltage : 24 V or more</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and item (3) is NG, MID/FULL speed control relay (B-3) is faulty. 	Replace MID/FULL speed control relay (B-3).
6. ECO controller	<p>(1) When starter switch is ON, measure voltage between ECO controller terminal C1-P2 inlet wire YB and chassis ground. Standard voltage : 24 V</p> <p>(2) When starter switch is ON and vibration select switch is “” or “”, measure voltage between ECO controller terminal wires and chassis ground. “” : ECO controller terminal C1-P9 inlet wire YR and chassis ground. “” : ECO controller terminal C1-P10 inlet wire YB and chassis ground. Standard voltage : 24 V</p> <p>(3) Check ECO controller terminal C1-P1 wire B is grounded.</p> <p>(4) After starting engine and vibration select switch is “” or “”, measure current between ECO controller terminal wires and chassis ground. “” : ECO controller terminal C1-P11 outlet wire RL and chassis ground. Standard current : 450 mA (at throttle switch is “MID”) : 340 mA (at throttle switch is “FULL”) “” : ECO controller terminal C1-P12 outlet wire RY and chassis ground. Standard current : 450 mA (at throttle switch is “MID”) : 330 mA (at throttle switch is “FULL”)</p> <ul style="list-style-type: none"> • If above items (1), (2) and (3) are OK and item (4) is NG, ECO controller is faulty. <p>(NOTICE)</p> <ul style="list-style-type: none"> • Since current value is output in PWM, standard value shown above represent a maximum instaneous value. 	Replace ECO controller.

Fig.: 2-6-1



The wire size is AVS 0.85 unless otherwise specified.

2-6-1. No vibration occurs 3/3

- Vibration mode change switch must be “CONT” (continuous mode).
- Vibration select switch must not be “○”.
- Check whether ECO controller red LED shows any blink.

1) When red LED shows no blink.

Reference Fig.: 2-6-1

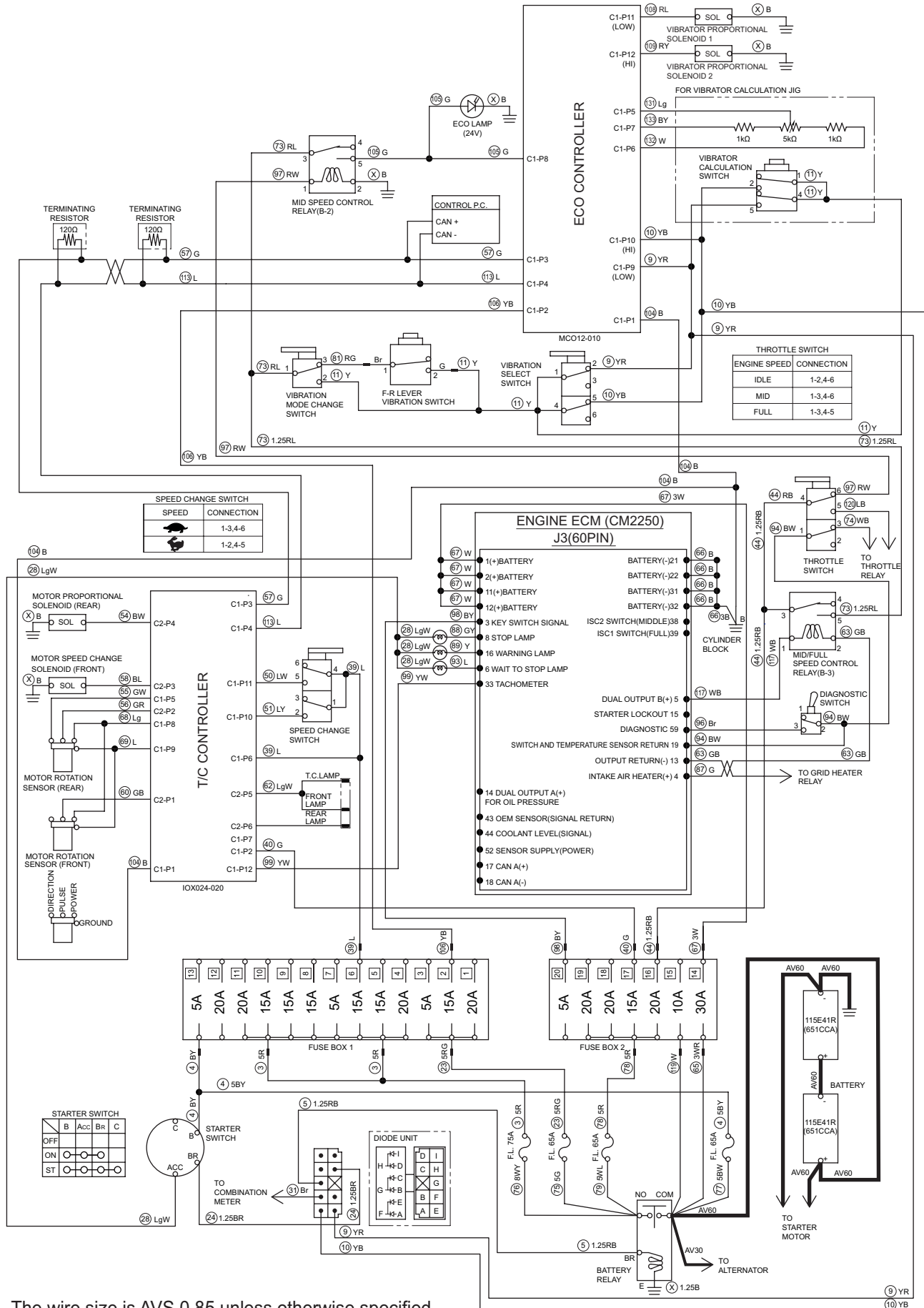
Check point	Check/Cause	Action
7. Harness Connecting Between Terminals	<ul style="list-style-type: none"> • Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

2) When red LED shows any blink.

Reference Fig.: 2-6-1

Number of red LED blinks	Check point	Check/Cause	Action
2 long, 1 short or 2 long, 2 short	1. Connector	<ul style="list-style-type: none"> • Check vibrator proportional solenoid 1 connector and ECO controller (terminal C1-P11) for corrosion, breakage, bending and looseness. • If any abnormality is found, connector is faulty. 	Replace connector or terminal.
	2. Harness	<ul style="list-style-type: none"> • Measure resistances between vibrator proportional solenoid 1 terminal wire RL and ECO controller terminal C1-P11 wire RL. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.
2 long, 3 short or 2 long, 4 short	1. Connector	<ul style="list-style-type: none"> • Check vibrator proportional solenoid 2 connector and ECO controller (terminal C1-P12) for corrosion, breakage, bending and looseness. • If any abnormality is found, connector is faulty. 	Replace connector or terminal.
	2. Harness	<ul style="list-style-type: none"> • Measure resistances between vibrator proportional solenoid 2 terminal wire RY and ECO controller terminal C1-P12 wire RY. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.

Fig.: 2-6-1



The wire size is AVS 0.85 unless otherwise specified.

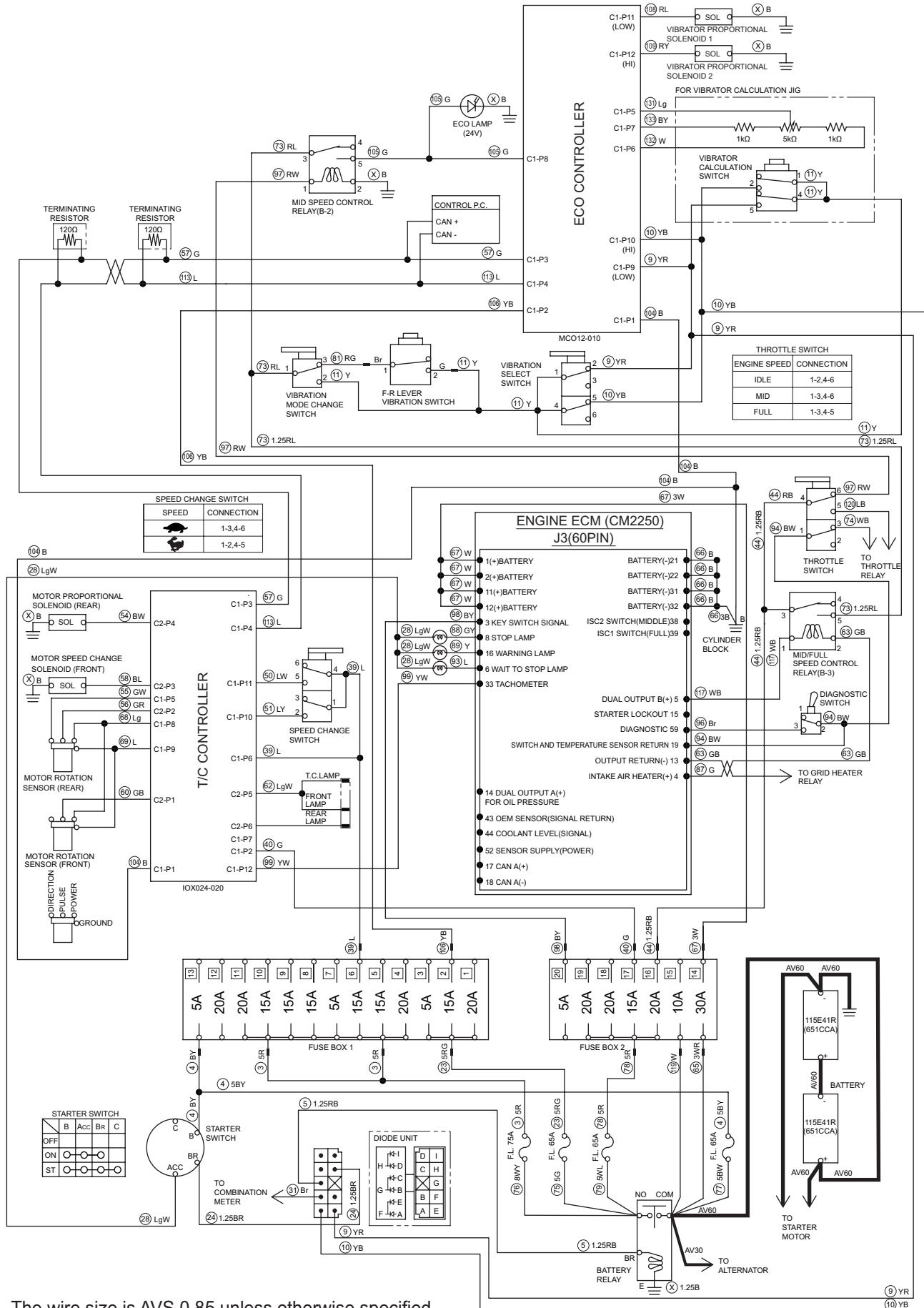
2-6-2. Amplitude does not change (Remains either low or high) 1/3

- Vibration mode change switch must be "CONT" (continuous mode).
- Vibration switch must not be "○".

Reference Fig. : 2-6-1

Check point	Check/Cause	Action
1. Vibrator Proportional Solenoid 1	<ul style="list-style-type: none"> • Disconnect harness and measure resistance of coil. Standard resistance : 36 Ω • If resistance is abnormal, vibrator solenoid 1 is faulty. 	Replace vibrator proportional solenoid 1.
2. Vibrator Proportional Solenoid 2	<ul style="list-style-type: none"> • Disconnect harness and measure resistance of coil. Standard resistance : 36 Ω • If resistance is abnormal, vibrator solenoid 2 is faulty. 	Replace vibrator proportional solenoid 2.
3. Vibration Select Switch	<p>(1) When starter switch is ON, measure voltage between vibration select switch terminal 1 inlet wire Y, terminal 4 inlet wire Y and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON and vibration select switch is "○", measure voltage vibration select switch terminal wires and chassis ground.</p> <ul style="list-style-type: none"> • Vibration select switch terminal 2 outlet wire YR and chassis ground. • Vibration select switch terminal 5 outlet wire YB and chassis ground. <p>There is no electricity in normal condition.</p> <p>(3) When starter switch is ON and vibration select switch is "√", measure voltage between vibration select switch terminal 2 outlet wire YR and chassis ground. Standard voltage : 24 V or more.</p> <p>(4) When starter switch is ON and vibration select switch is "√", measure voltage between vibration select switch terminal 5 outlet wire YB and chassis ground. Standard voltage : 24 V or more.</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2), (3) or (4) is NG, vibration select switch is faulty. 	Replace vibration select switch.

Fig.: 2-6-1



The wire size is AVS 0.85 unless otherwise specified.

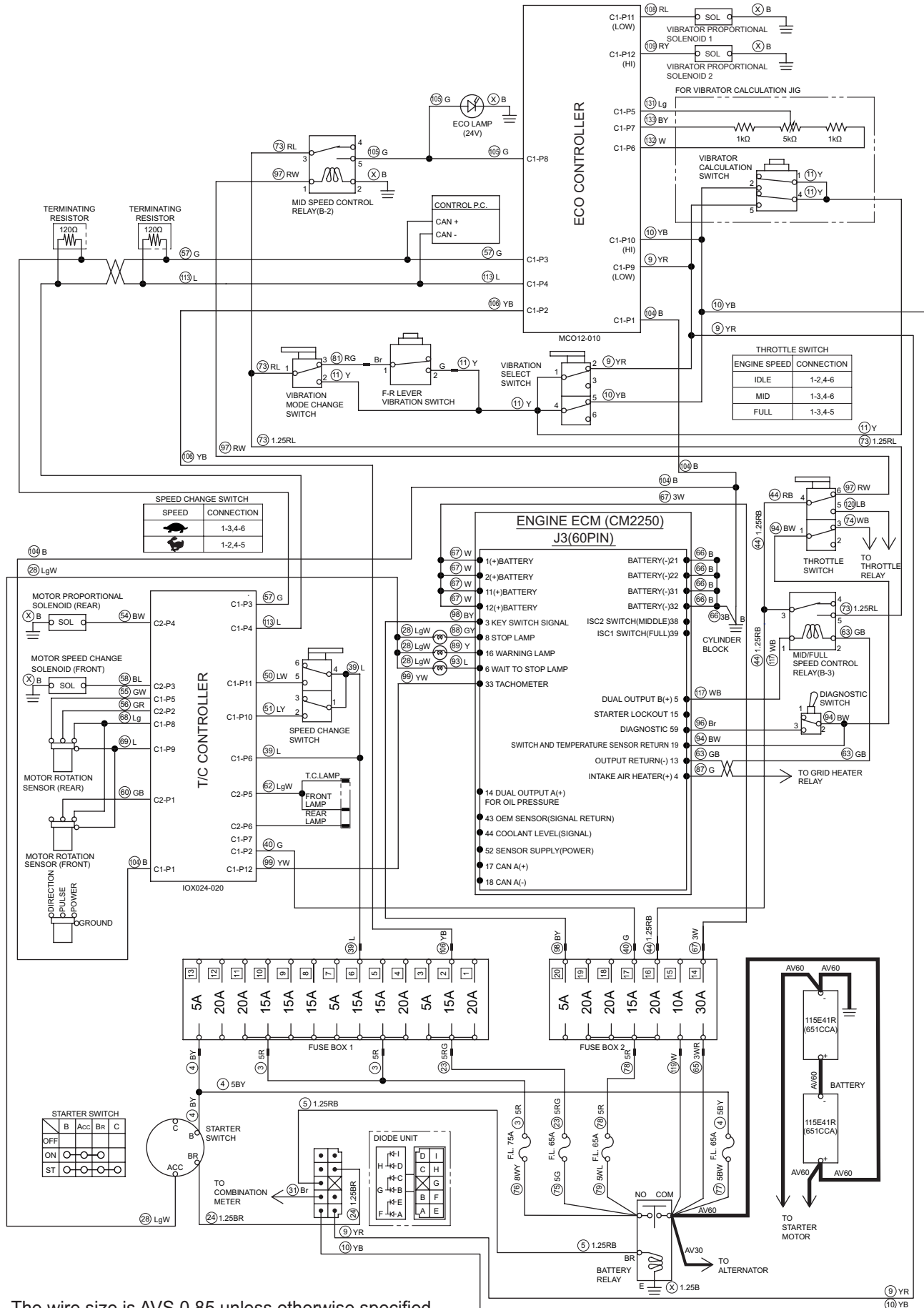
2-6-2. Amplitude does not change (Remains either low or high) 2/3

- Vibration mode change switch must be “CONT” (continuous mode).
- Vibration select switch must not be “○”.

Reference Fig. : 2-6-1

Check point	Check/Cause	Action
4. Throttle switch	<p>(1) When starter switch is ON, measure voltage between throttle switch terminal 1 inlet wire BW, terminal 4 inlet wire RB and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON and throttle switch is “MID”, measure voltage between throttle switch terminal 3 outlet wire WB, terminal 6 outlet wire RW and chassis ground. Standard voltage : 24 V or more</p> <p>(3) When starter switch is ON and throttle switch is “FULL”, measure voltage between throttle switch terminal 3 outlet wire WB, terminal 5 outlet wire LB and chassis ground. Standard voltage : 24 V or more</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and item (3) is NG, throttle switch is faulty. 	Replace throttle switch.
5. MID speed control relay (B-2)	<p>(1) When starter switch is ON and throttle switch is “MID”, measure voltage between MID speed control relay (B-2) terminal 1 inlet wire RW and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON and throttle switch is “MID”, measure voltage between MID speed control relay (B-2) terminal 3 inlet wire RL and chassis ground. Standard voltage : 24 V or more</p> <p>(3) When starter switch is ON and throttle switch is “MID”, measure voltage between MID speed control relay (B-2) terminal 5 outlet wire G and chassis ground. Standard voltage : 24 V or more</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and item (3) is NG, MID speed control relay (B-2) is faulty. 	Replace MID speed control relay (B-2).

Fig.: 2-6-1



The wire size is AVS 0.85 unless otherwise specified.

2-6-2. Amplitude does not change (Remains either low or high) 3/3

- Vibration mode change switch must be “CONT” (continuous mode).
- Vibration select switch must not be “○”.

Reference Fig. : 2-6-1









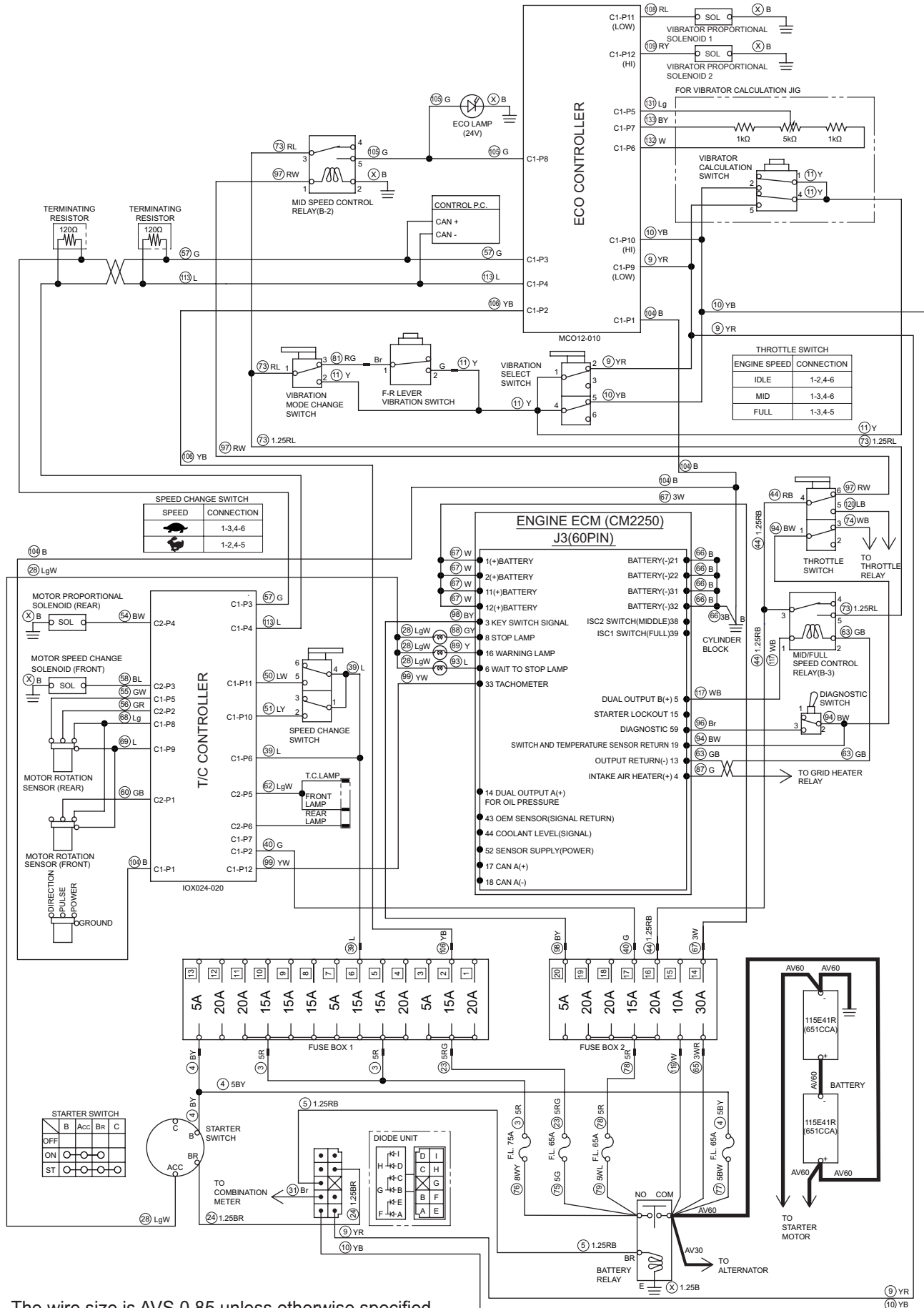


Check point	Check/Cause	Action
6. ECO controller	<p>(1) When starter switch is ON, measure voltage between ECO controller terminal C1-P2 inlet wire YB and chassis ground. Standard voltage : 24 V</p> <p>(2) When starter switch is ON and vibration select switch is “” or “”, measure voltage between ECO controller terminal wires and chassis ground. “” : ECO controller terminal C1-P9 inlet wire YR and chassis ground. “” : ECO controller terminal C1-P10 inlet wire YB and chassis ground. Standard voltage : 24 V</p> <p>(3) Check ECO controller terminal C1-P1 wire B is grounded.</p> <p>(4) When starter switch is ON and throttle switch is “MID”, voltage between ECO controller terminal C1-P8 inlet wire G and chassis ground. Standard voltage : 24 V</p> <p>(5) After starting engine and vibration select switch is “” or “”, measure current between ECO controller terminal wires and chassis ground. “” : ECO controller terminal C1-P11 outlet wire RL and chassis ground. Standard current : 450 mA (at throttle switch is “MID”) : 340 mA (at throttle switch is “FULL”) “” : ECO controller terminal C1-P12 outlet wire RY and chassis ground. Standard current : 450 mA (at throttle switch is “MID”) : 330 mA (at throttle switch is “FULL”)</p> <ul style="list-style-type: none"> • If above items (1), (2), (3) and (4) are OK and item (5) is NG, ECO controller is faulty. <p>(NOTICE)</p> <ul style="list-style-type: none"> • Since current value is output in PWM, standard value shown above represent a maximum instaneous value. 	Replace ECO controller.
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.

Fig.: 2-6-1



The wire size is AVS 0.85 unless otherwise specified.

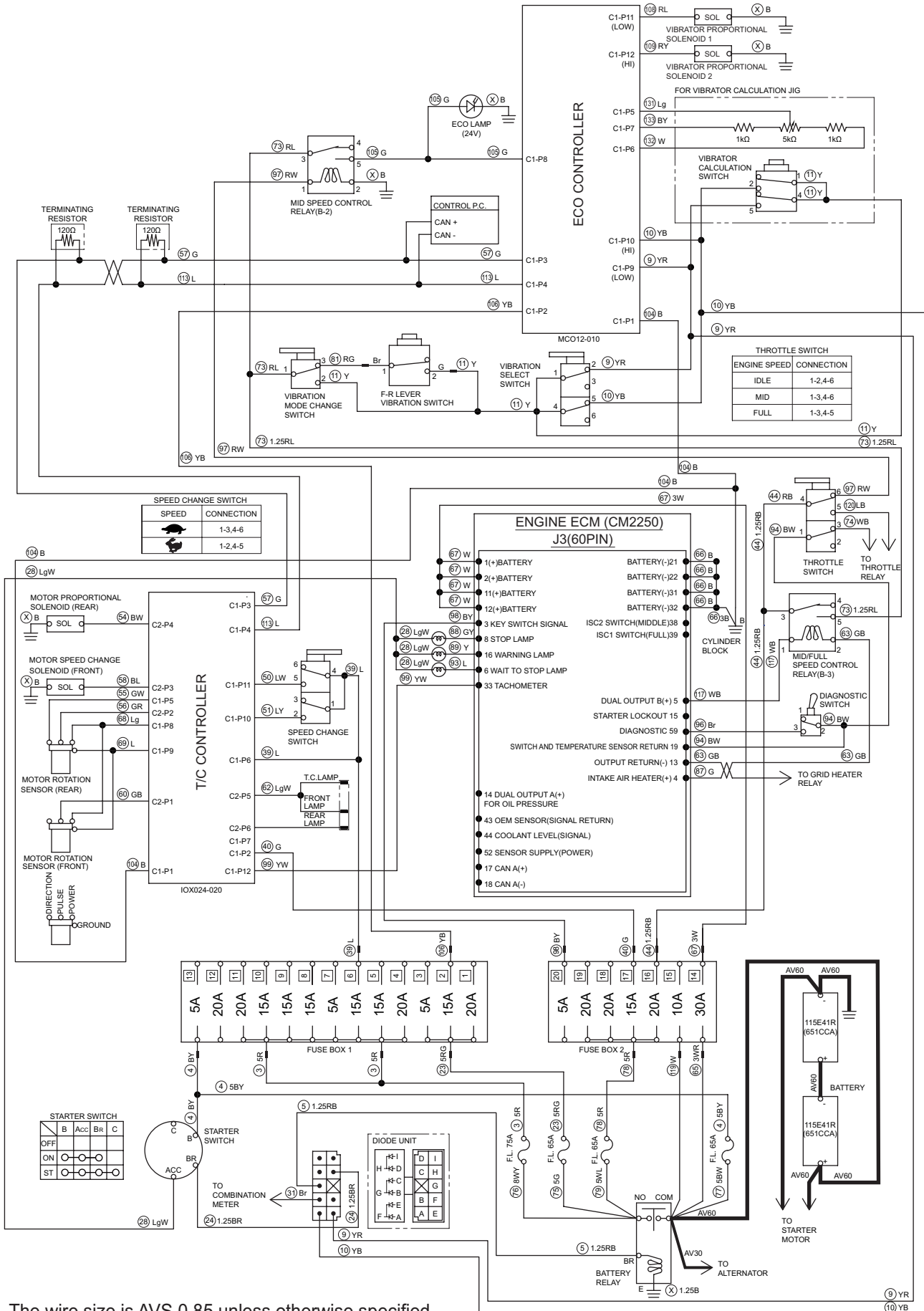
2-6-3. Vibration mode cannot be switched (F-R lever vibration switch does not work)

- Vibration mode change switch must be “” (manual mode).
- Vibration select switch must not be “”.

Reference Fig. : 2-6-1

Check point	Check/Cause	Action
1. MID/FULL Speed Control Relay (B-3)	<p>(1) When starter switch is ON, measure voltage between MID/FULL speed control relay (B-3) terminal 1 inlet wire WB and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, measure voltage between MID/FULL speed control relay (B-3) terminal 3 inlet wire RB and chassis ground. Standard voltage : 24 V or more</p> <p>(3) When starter switch is ON and throttle switch is “MID”, measure voltage between MID/FULL speed control relay (B-3) terminal 5 outlet wire RL and chassis ground. Standard voltage : 24 V or more</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and item (3) is NG, MID/FULL speed control relay (B-3) is faulty. 	Replace MID/FULL speed control relay (B-3).
2. Vibration Mode Change Switch	<p>(1) When starter switch is ON, measure voltage between vibration mode change switch terminal 1 inlet wire RL and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, measure voltage between vibration mode change switch terminal 3 outlet wire RG and chassis ground. Standard voltage : 24 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, vibration mode change switch is faulty. 	Replace vibration mode change switch.
3. F-R Lever Vibration Switch	<p>(1) When starter switch is ON, measure voltage between F-R lever vibration switch terminal 1 inlet wire Br and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON and F-R lever vibration switch is pressed once, measure voltage between F-R lever vibration switch terminal 2 outlet wire G and chassis ground. Standard voltage : 24 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, F-R lever vibration switch is faulty. 	Replace F-R lever vibration 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



The wire size is AVS 0.85 unless otherwise specified.

2-6-4. Vibrator force is low in ECO mode

- Vibration mode change switch must be “CONT” (continuous mode).
- Vibration select switch must not be “○”.
- Throttle switch must be “MID”.
- ECO lamp is ON.

Reference Fig. : 2-6-1









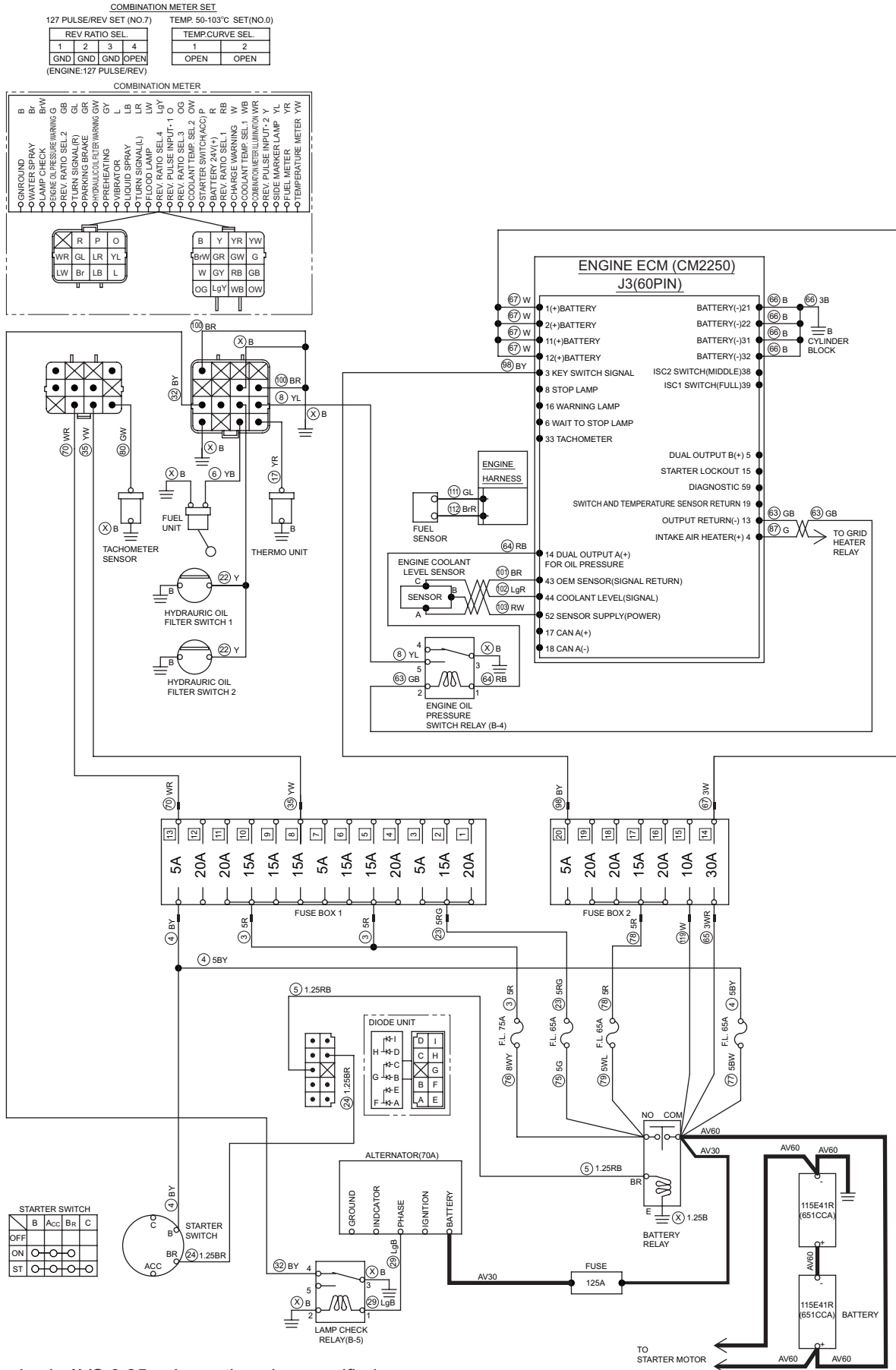
Check point	Check/Cause	Action
1. Connector	<ul style="list-style-type: none"> • Check MID speed control relay (B-2) (terminal 5) connector and ECO controller (terminal C1-P8) for corrosion, breakage, bending and looseness. • If any abnormality is found, connector is faulty. 	Replace connector or terminal.
2. Harness	<ul style="list-style-type: none"> • Measure resistances between MID speed control relay (B-2) terminal 5 wire G and ECO controller terminal C1-P8 wire G. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. 	Repair or replace harness.
3. ECO Controller	<p>(1) When starter switch is ON, measure voltage between ECO controller terminal C1-P2 inlet wire YB and chassis ground. Standard voltage : 24 V</p> <p>(2) When starter switch is ON and vibration select switch is “” or “”, measure voltage between ECO controller terminal wires and chassis ground. “” : ECO controller terminal C1-P9 inlet wire YR and chassis ground. “” : ECO controller terminal C1-P10 inlet wire YB and chassis ground. Standard voltage : 24 V</p> <p>(3) Check ECO controller terminal C1-P1 wire B is grounded.</p> <p>(4) When starter switch is ON and throttle switch is “MID”, voltage between ECO controller terminal C1-P8 inlet wire G and chassis ground. Standard voltage : 24V</p> <p>(5) After starting engine and vibration select switch is “” or “”, measure current between ECO controller terminal wires and chassis ground. “” : ECO controller terminal C1-P11 outlet wire RL and chassis ground. Standard current : 450 mA (at throttle switch is “MID”) : 340 mA (at throttle switch is “FULL”) “” : ECO controller terminal C1-P12 outlet wire RY and chassis ground. Standard current : 450 mA (at throttle switch is “MID”) : 330 mA (at throttle switch is “FULL”)</p> <ul style="list-style-type: none"> • If above items (1), (2), (3) and (4) are OK and item (5) is NG, ECO controller is faulty. <p>(NOTICE)</p> <ul style="list-style-type: none"> • Since current value is output in PWM, standard value shown above represent a maximum instaneous value. 	Replace ECO controller.

Fig.: 2-7-1



The wire size is AVS 0.85 unless otherwise specified.

2-7. Lighting

Check following items before troubleshooting.

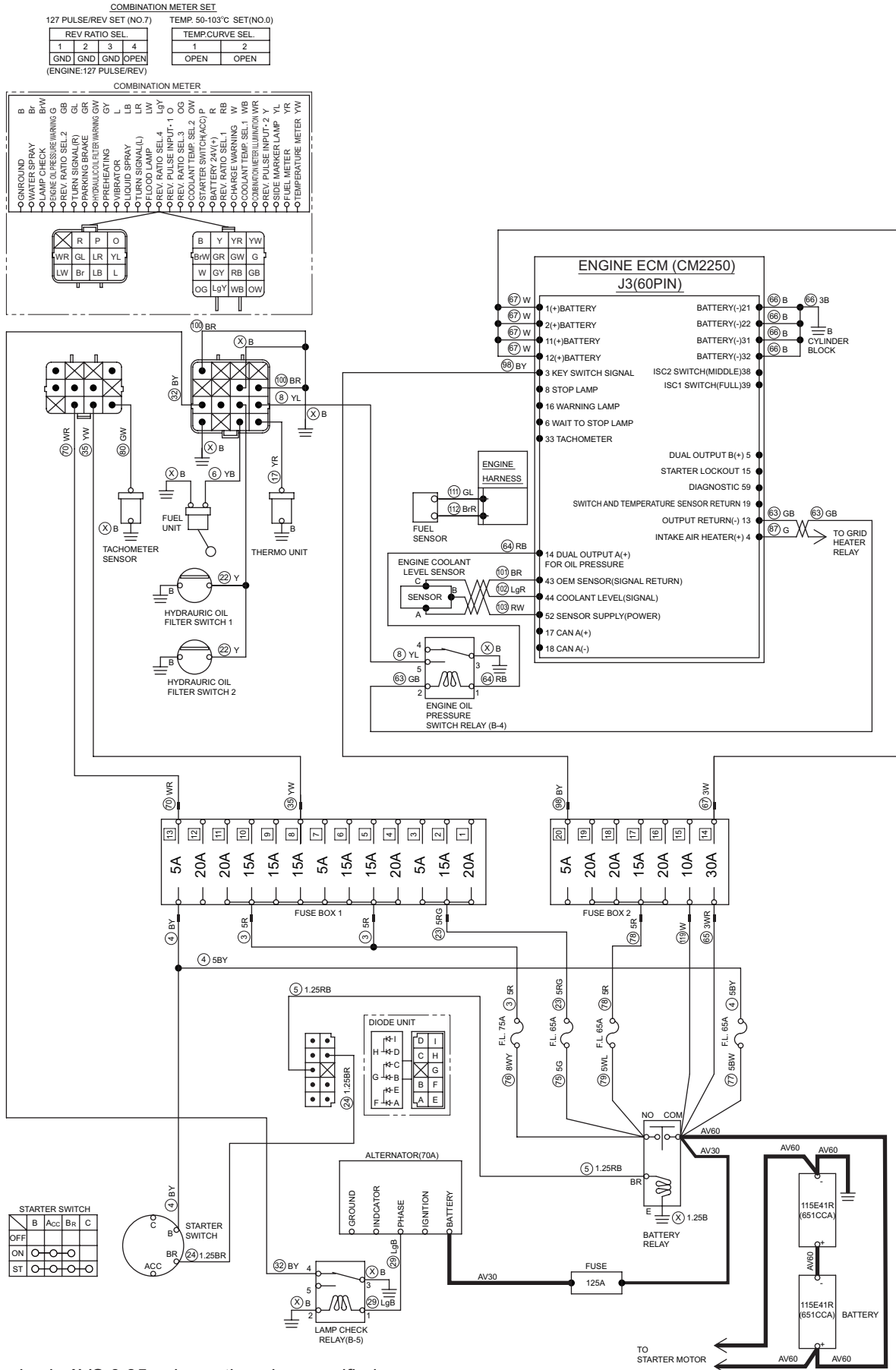
- No blown fuse and power is applied up to fuses.
- When measuring voltage and current without disconnecting connectors, refer to “measuring voltage and current following using tester” (P. 9-006 to P. 9-008).
- Check any ground circuit which belongs to components to be checked.

2-7-1. Combination meter warning lamp or indicator lamp is abnormal

Reference Fig. : 2-7-1

Check point	Check/Cause	Action
1. Harness	<ul style="list-style-type: none"> • Disconnect connectors between combination meter and lamp check relay (B-5). • Measure resistance between terminals and chassis ground. <ul style="list-style-type: none"> • Combination meter connector terminal wire No. 32 wire BY and chassis ground • Lamp check relay (B-5) terminal 4 wire BY and chassis ground Standard resistance: 100 kΩ or more • If resistance is abnormal, harness is faulty. 	Repair or replace harness.
2. Lamp Check Relay (B-5)	<ol style="list-style-type: none"> (1) After starting engine, measure voltage between lamp check relay (B-5) terminal 1 inlet wire LgB and chassis ground. Standard voltage : 24 V or more (2) After starting engine, measure voltage between lamp check relay (B-5) terminal 3 outlet wire B and chassis ground. There is no electricity in normal condition. (3) When starter switch is ON, measure voltage between lamp check relay (B-5) terminal 3 outlet wire B and chassis ground. Standard voltage : 24 V or more <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, lamp check relay (B-5) is faulty. • If above item (3) is OK and item (1) is NG, alternator is faulty. 	Repair or replace lamp check relay (B-5) or alternator.
3. Combination Meter (Lamp check)	<ol style="list-style-type: none"> (1) When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire. <ul style="list-style-type: none"> • Battery terminal wire No. 70 inlet wire WR and ground terminal wire B • Starter switch terminal wire No. 35 inlet wire YW and ground terminal wire B Standard voltage : 24 V or more (2) When starter switch is ON, check that parking brake indicator lamp, hydraulic oil filter warning lamp, engine oil pressure warning lamp and electrical charge warning lamp illuminate and then go out after starting engine. <ul style="list-style-type: none"> • If above item (1) is OK and the 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 and F-R lever is “N”, parking brake indicator lamp does not go out even after starting engine. 	Replace combination meter.

Fig.: 2-7-1



2-7-2. Tachometer reading is abnormal

Reference Fig. : 2-7-1

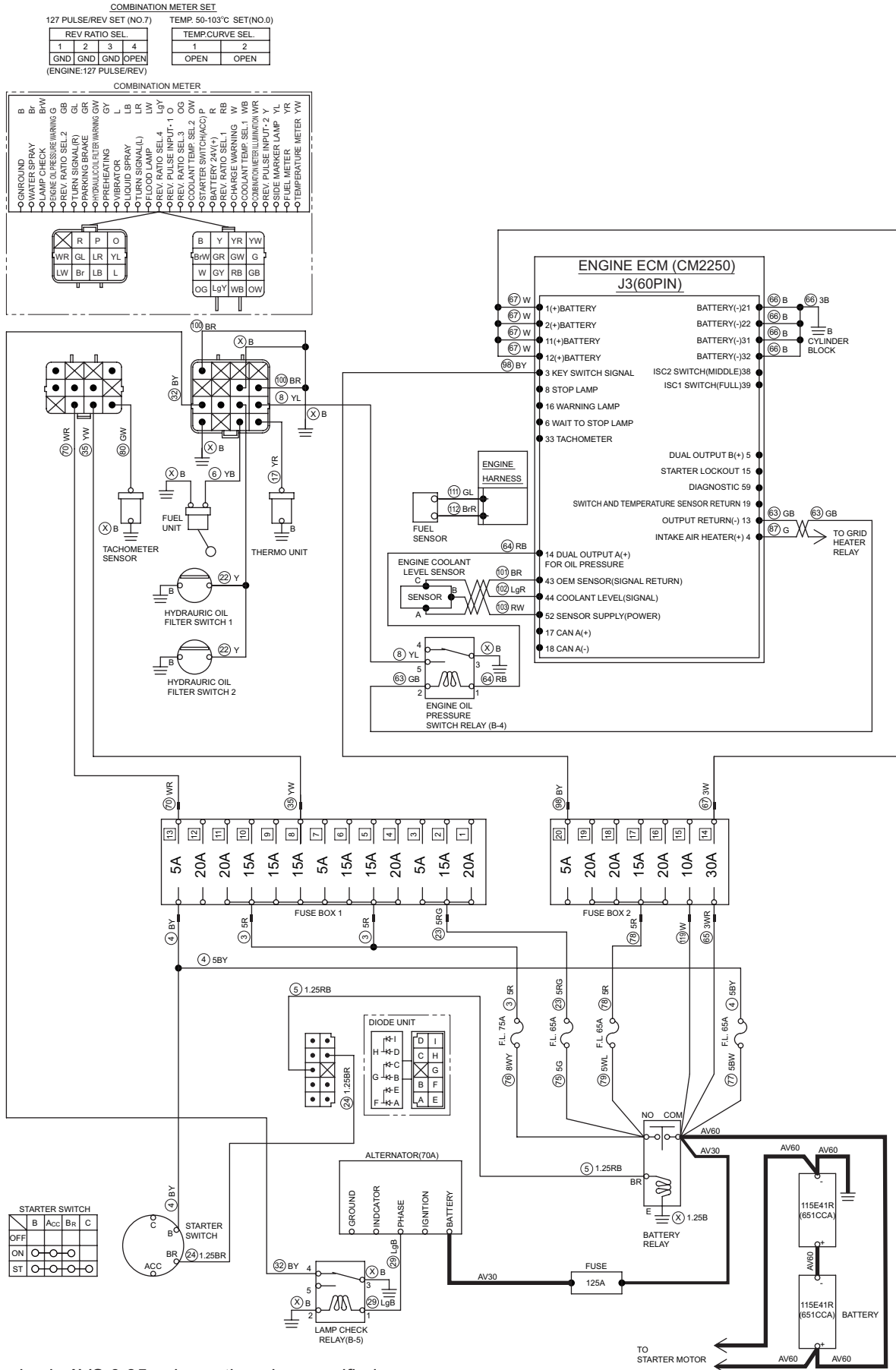
Check point	Check/Cause	Action
1. Combination Meter (Tachometer)	<p>(1) When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire.</p> <ul style="list-style-type: none"> • Battery terminal wire No. 70 inlet wire WR and ground terminal wire B • Starter switch terminal wire No. 35 inlet wire YW and ground terminal wire B <p>Standard voltage : 24 V or more</p> <p>(2) Check that combination meter terminal wire B (rev. ratio 1) wires BR (rev. ratio 2, 3) are grounded.</p> <p>(3) Start engine and measure pulse between combination meter rev. pulse input. 1 terminal wire No. 80 inlet wire GW and chassis ground.</p> <p>Standard pulse : 127 pulses/rotation of engine</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and pulse 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.

2-7-3. Hour meter is abnormal

Reference Fig. : 2-7-1

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. • Battery terminal wire No. 70 inlet wire WR and ground terminal wire B • Starter switch terminal wire No. 35 inlet wire YW and ground terminal wire B <p>Standard voltage : 24 V or more</p> <ul style="list-style-type: none"> • If no abnormality is found, combination meter is faulty. 	Replace combination meter.

Fig.: 2-7-1



The wire size is AVS 0.85 unless otherwise specified.

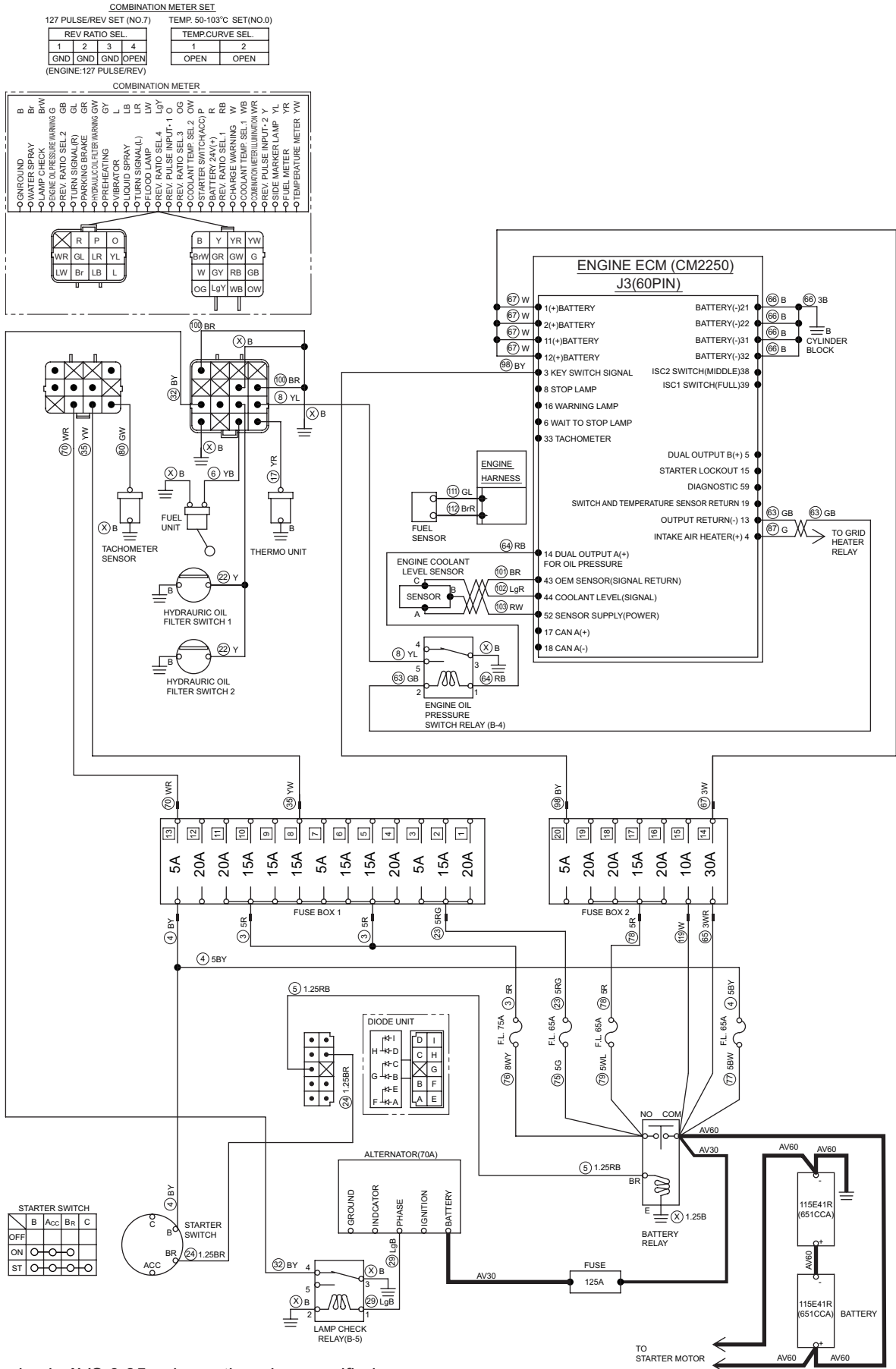
2-7-4. Temperature meter is abnormal**Reference Fig. : 2-7-1**

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 (122°F))] 26.44 Ω [(at unit temperature of 103°C (217°F))] • 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 terminal wire No. 70 inlet wire WR and ground terminal wire B • Starter switch terminal wire No. 35 inlet wire YW and ground terminal wire B Standard voltage : 24 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.

2-7-5. Fuel meter is abnormal**Reference Fig. : 2-7-1**

Check point	Check/Cause	Action
1. Fuel Unit	<ul style="list-style-type: none"> • Disconnect harness and measure resistance of fuel unit. Standard resistance : 13.5 Ω (with float in "F") 80.0 Ω (with float in "E") • If resistance is abnormal, fuel unit is faulty. 	Replace fuel 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 terminal wire No. 70 inlet wire WR and ground terminal wire B • Starter switch terminal wire No. 35 inlet wire YW and ground terminal wire B Standard voltage : 24 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.: 2-7-1



The wire size is AVS 0.85 unless otherwise specified.

2-7-6. Hydraulic oil filter warning lamp remains ON

Reference Fig. : 2-7-1

Check point	Check/Cause	Action
1. Harness	<ul style="list-style-type: none"> • Disconnect connectors between hydraulic oil filter switch 1, 2 and combination meter. • Measure resistance between terminal and chassis ground. <ul style="list-style-type: none"> • Hydraulic oil filter switch 1 or 2 terminal wire Y and chassis ground. • Combination meter connector terminal wire No. 22 wire Y and chassis ground. <p style="margin-left: 40px;">Standard resistance : 100 kΩ or more</p> • If resistance is abnormal, harness is faulty. 	Repair or replace harness.
2. Hydraulic Oil Filter Switch 1 or 2	<ul style="list-style-type: none"> • When starter switch is OFF, check continuity between hydraulic oil filter switch 1 or 2 inlet terminal and chassis ground. <p style="margin-left: 20px;">There is no continuity in normal condition.</p> • If there is continuity, hydraulic oil filter switch 1 or 2 is faulty. 	Replace hydraulic oil filter switch 1 or 2.
3. Combination Meter (Hydraulic oil filter 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 terminal inlet wire No. 70 inlet wire WR and ground terminal wire B. • Starter switch terminal inlet wire No. 35 inlet wire YW and ground terminal wire B. <p style="margin-left: 40px;">Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, measure voltage between combination meter hydraulic oil filter warning terminal outlet wire Y and chassis ground.</p> <p style="margin-left: 20px;">There is no electricity in normal condition.</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and no abnormality is found in hydraulic oil filter switch 1 or 2 but hydraulic oil filter warning lamp remains on after starting engine, combination meter is faulty. 	Replace combination meter.

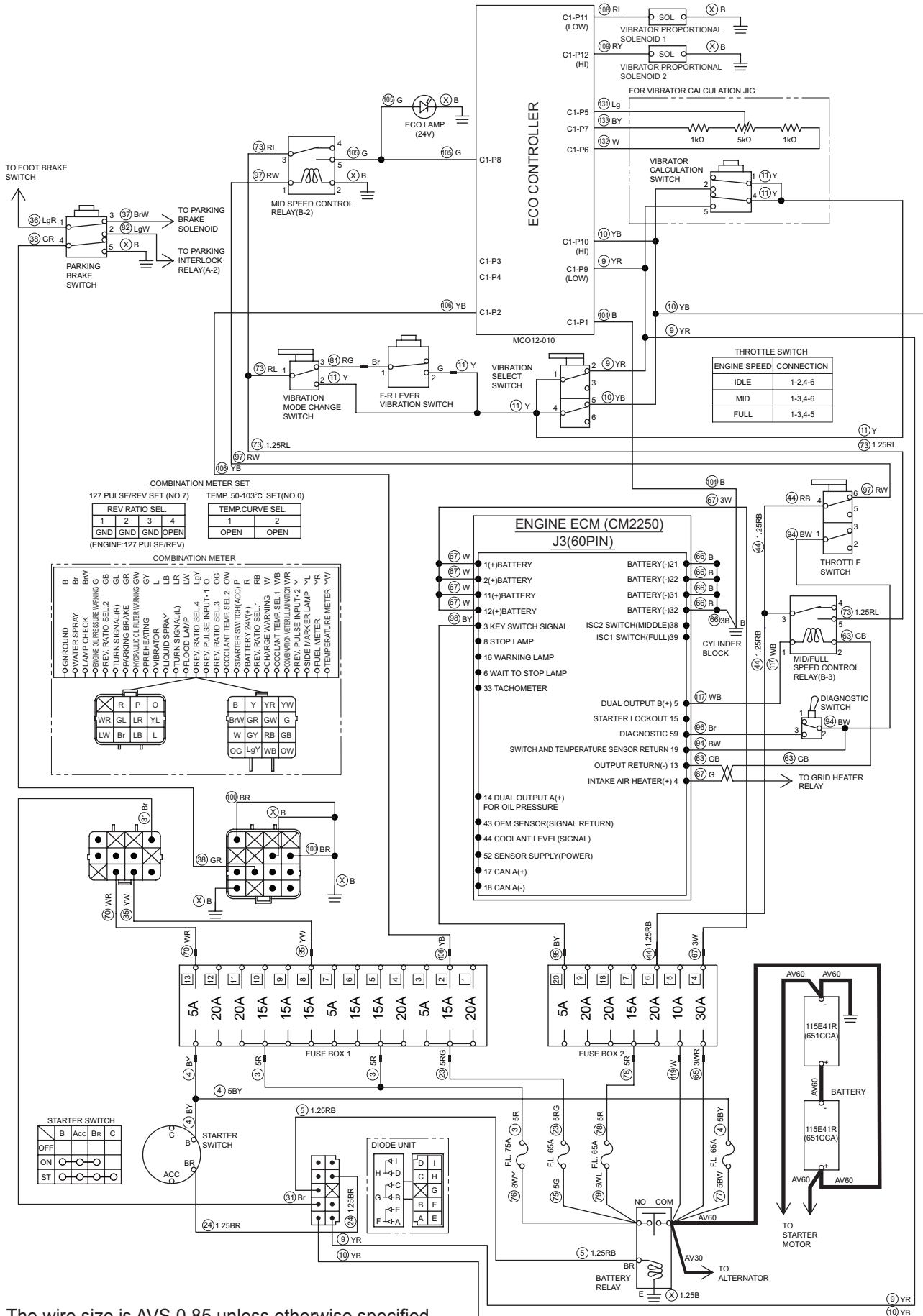
2-7-7. Engine oil pressure warning lamp remains ON

- Check whether engine check lamps show no fault code.

Reference Fig. : 2-7-1

Check point	Check/Cause	Action
1. Harness	<ul style="list-style-type: none"> • Disconnect connectors between engine ECM, engine oil pressure switch relay (B-4) and combination meter. • Measure resistance between terminals and chassis ground. <ul style="list-style-type: none"> • Engine ECM output return (-) terminal 13 wire GB and chassis ground. • Engine oil pressure switch relay (B-4) terminal 2 wire GB and chassis ground. • Engine ECM dual output A (+) for oil pressure terminal 14 wire RB and chassis ground. • Engine oil pressure switch relay (B-4) terminal 1 wire RB and chassis ground. • Combination meter connector terminal wire No. 8 wire YL and chassis ground. • Engine oil pressure switch relay (B-4) terminal 4 wire YL and chassis ground. Standard resistance : 100 kΩ or more • If resistance is abnormal, harness is faulty. <p>(NOTICE)</p> <ul style="list-style-type: none"> • If any abnormality is found in shielded twisted wires, repair is not approved. Be sure to replace them. 	Repair or replace harness.
2. Engine Oil Pressure Switch Relay (B-4)	<p>(1) When starter switch is ON, measure voltage between engine oil pressure switch relay (B-4) terminal 1 inlet wire RB and chassis ground. There is no electricity in normal condition.</p> <p>(2) When starter switch is ON, measure voltage between engine oil pressure switch relay (B-4) terminal 3 outlet wire B and chassis ground. There is no electricity in normal condition.</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, engine oil pressure switch relay (B-4) is faulty. 	Replace engine oil pressure switch relay (B-4).
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 terminal inlet wire No. 70 inlet wire WR and ground terminal wire B. • Starter switch terminal inlet wire No. 35 inlet wire YW and ground terminal wire B. <p>Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, measure voltage between combination meter engine oil pressure warning terminal outlet wire No. 8 wire YL 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 no fault code is shown but engine oil pressure warning lamp remains on after starting engine, combination meter is faulty. 	Replace combination meter.

Fig.: 2-7-2



The wire size is AVS 0.85 unless otherwise specified.

2-7-8. Vibration indicator lamp does not light

- Check that vibrator can be operated.

Reference Fig. : 2-7-2





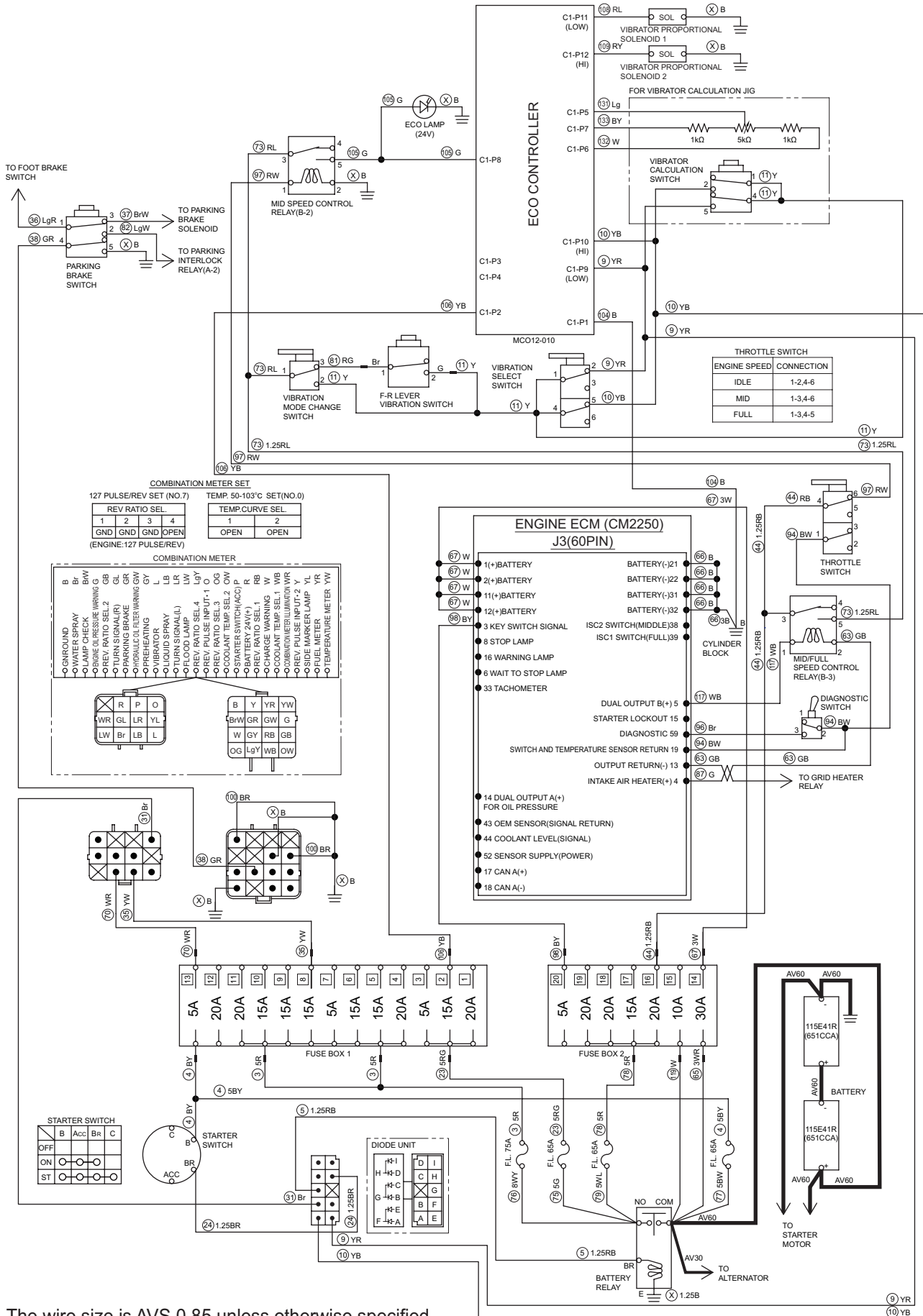
Check point	Check/Cause	Action
1. Harness	<p>(1) Measure resistance between vibration select switch terminal 5 wire YB and diode unit terminal E wire YB. Standard resistance : 10 Ω or less</p> <p>(2) Measure resistance between vibration select switch terminal 2 wire YR and diode unit terminal A wire YR. Standard resistance : 10 Ω or less</p> <p>(3) Measure resistance between diode unit terminal F wire Br and combination meter connector terminal wire No. 31 wire Br. Standard resistance : 10 Ω or less</p> <ul style="list-style-type: none"> • If above item (1), (2) or (3) is NG, harness is faulty. 	Repair or replace harness.
2. Diode Unit	<p>(1) When starter switch is ON and vibration select switch is “”, measure voltage between diode unit terminal A inlet wire YR and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON and vibration select switch is “”, measure voltage between diode unit terminal E inlet wire YB and chassis ground. Standard voltage : 24 V or more</p> <p>(3) When starter switch is ON, measure voltage between diode unit terminal F outlet wire Br and chassis ground. Standard voltage : 24 V or more</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and item (3) is NG, diode unit is faulty. 	Replace diode unit.
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 terminal wire No. 70 inlet wire WR and ground terminal wire B • Starter switch terminal wire No. 35 inlet wire YW and ground terminal wire B <p>Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, vibration mode change switch is “CONT” and vibration select switch is “” or “”, measure voltage between combination meter vibration terminal wire No. 31 inlet wire Br and chassis ground. Standard voltage : 24 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.: 2-7-2



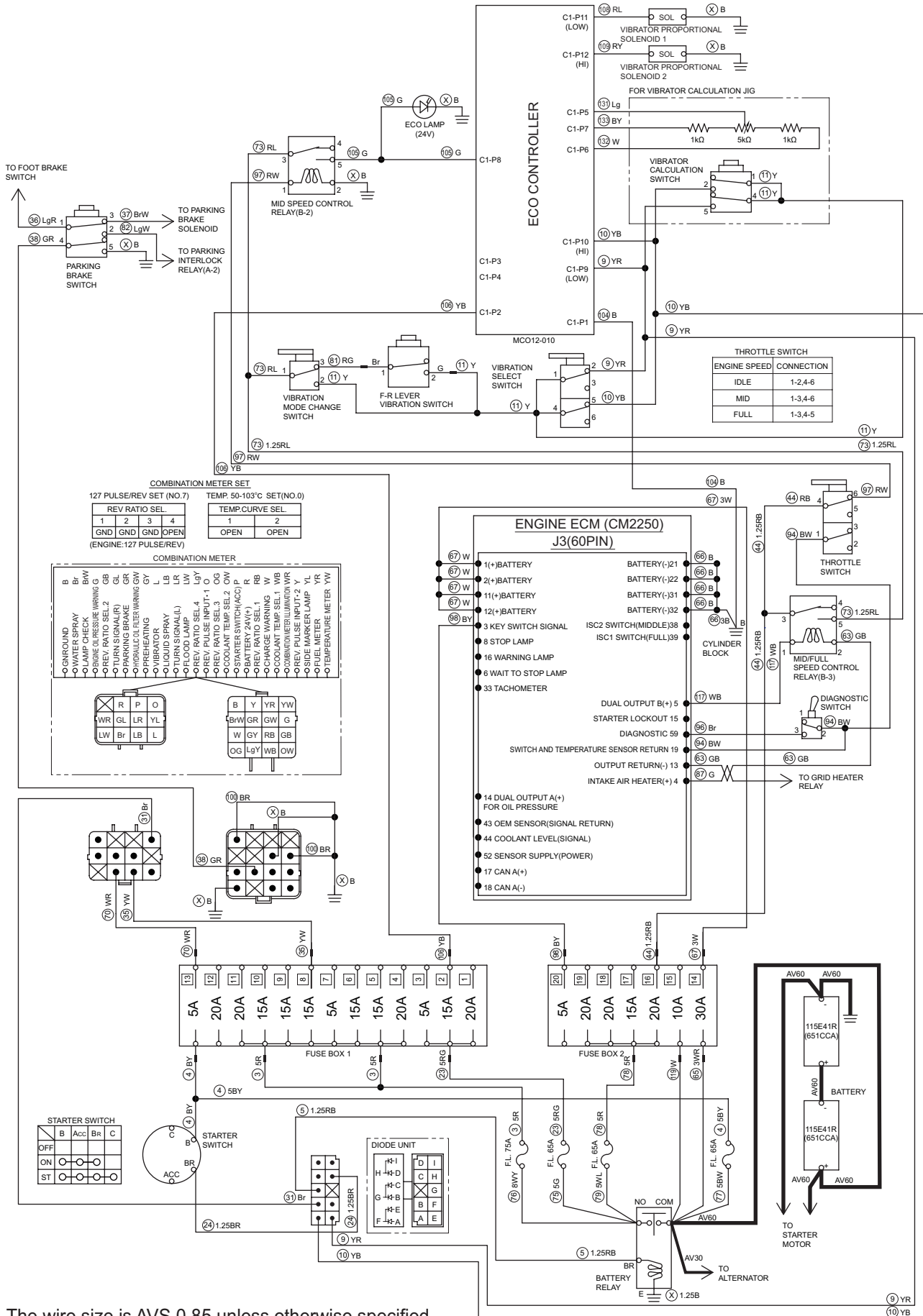
The wire size is AVS 0.85 unless otherwise specified.

2-7-9. Parking brake indicator lamp does not light

Reference Fig. : 2-7-2

Check point	Check/Cause	Action
1. Harness	<ul style="list-style-type: none"> • Measure resistance between parking brake switch terminal 4 wire GR and combination meter connector terminal wire No. 38 wire GR. 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 is applied, check continuity between parking brake switch terminal 4 and 5. 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 terminal wire No. 70 inlet wire WR and ground terminal wire B • Starter switch terminal wire No. 35 inlet wire YW and ground terminal wire B <p>Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON and parking brake is applied, measure voltage between combination meter parking brake terminal wire No. 38 outlet wire GR and chassis ground.</p> <p>Standard voltage : 24 V or more</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.: 2-7-2



The wire size is AVS 0.85 unless otherwise specified.

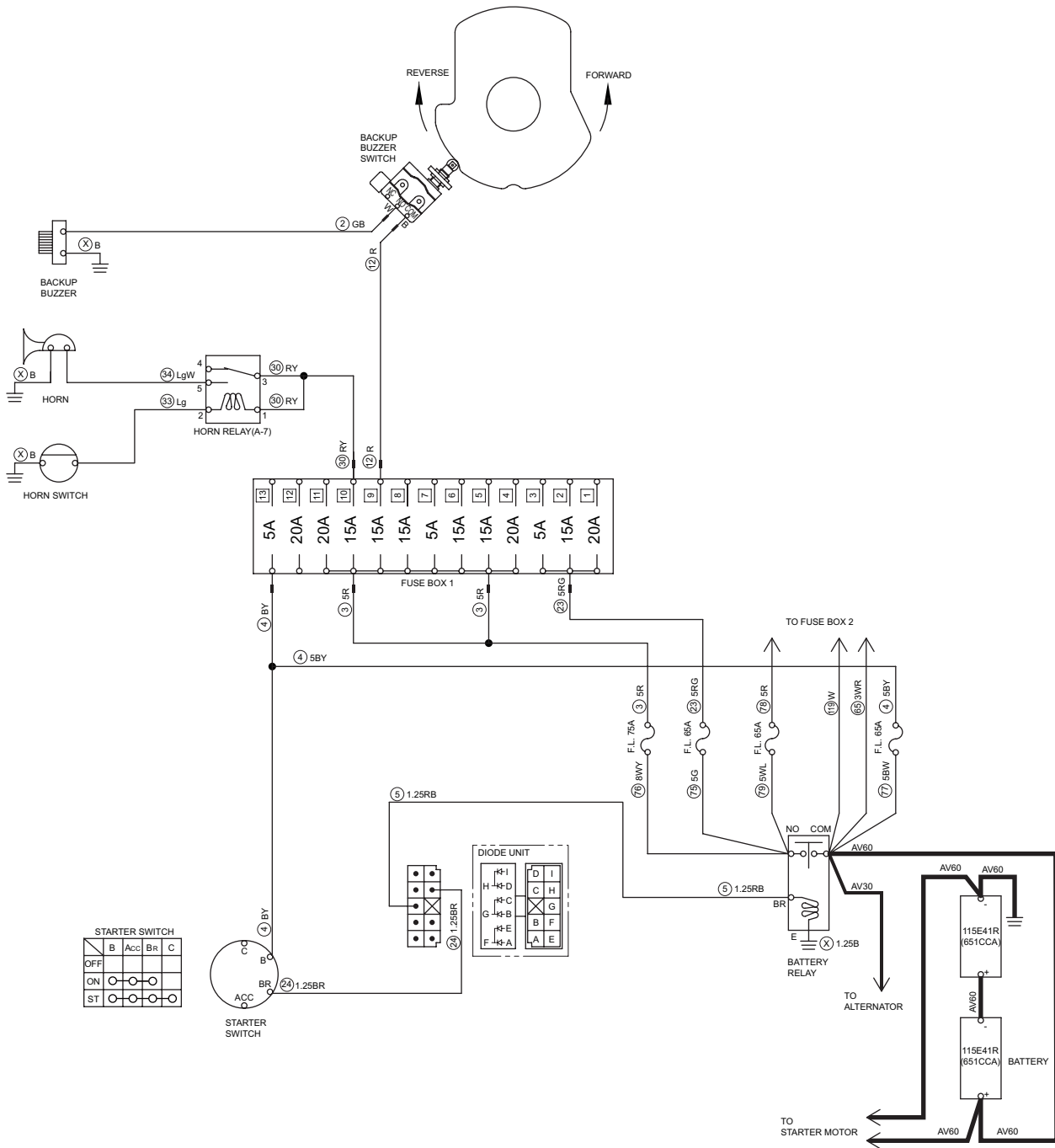
2-7-10. ECO mode indicator lamp does not light

- Throttle switch must be “MID”.
- Vibration select switch must not be “○”.

Reference Fig. : 2-7-2

Check point	Check/Cause	Action
1. MID/FULL Speed Control Relay (B-3)	<p>(1) When starter switch is ON, measure voltage between MID/FULL speed control relay (B-3) terminal 1 inlet wire WB and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, measure voltage between MID/FULL speed control relay (B-3) terminal 3 inlet wire RB and chassis ground. Standard voltage : 24 V or more</p> <p>(3) When starter switch is ON and throttle switch is “MID”, measure voltage between MID/FULL speed control relay (B-3) terminal 5 outlet wire RL and chassis ground. Standard voltage : 24 V or more</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and item (3) is NG, MID/FULL speed control relay (B-3) is faulty. 	Replace MID/FULL speed control relay (B-3).
2. Throttle Switch	<p>(1) When starter switch is ON, measure voltage between throttle switch terminal 4 inlet wire RB and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, measure voltage between throttle switch terminal 6 outlet wire RW and chassis ground. Standard voltage : 24 V or more</p> <ul style="list-style-type: none"> • If above items (1) is OK and item (2) is NG, throttle switch is faulty. 	Replace throttle switch.
3. MID Speed Control Relay (B-2)	<p>(1) When starter switch is ON, measure voltage between MID speed control relay (B-2) terminal 1 inlet wire RW and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON, measure voltage between MID speed control relay (B-2) terminal 3 inlet wire RL and chassis ground. Standard voltage : 24 V or more</p> <p>(3) When starter switch is ON, measure voltage between MID speed control relay (B-2) terminal 5 outlet wire G and chassis ground. Standard voltage : 24 V or more</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK and item (3) is NG, MID speed control relay (B-2) is faulty. 	Replace MID speed control relay (B-2).
4. ECO Lamp	<p>(1) When starter switch is ON, measure voltage between ECO lamp terminal inlet wire G (anode side) and chassis ground. Standard voltage : 24 V or more</p> <p>(2) Check ECO lamp terminal wire B (cathode side) is grounded.</p> <ul style="list-style-type: none"> • If above items (1) and (2) are OK but ECO lamp does not light, ECO lamp is faulty. 	Replace ECO lamp.

Fig.: 2-7-3



The wire size is AVS 0.85 unless otherwise specified.

2-7-11. Horn does not sound

Reference Fig. : 2-7-3

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 LgW side and negative terminal to horn terminal wire B side. • If horn does not sound, horn is faulty. 	Replace horn.
2. Horn Relay (A-7)	<p>(1) When starter switch is ON and horn switch is pressed, measure voltage between horn relay (A-7) terminal 2 outlet wire Lg and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON and horn switch is pressed, measure voltage between horn relay (A-7) terminal 5 outlet wire LgW and chassis ground. Standard voltage : 24 V or more</p> <ul style="list-style-type: none"> • If above item (1) is OK and item (2) is NG, horn relay (A-7) is faulty. 	Replace horn relay (A-7).
3. Horn Switch	<ul style="list-style-type: none"> • When horn switch is OFF, measure resistance between horn switch terminals. Standard resistance : 100 kΩ or more • If resistance is abnormal, 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.

2-7-12. Backup buzzer does not sound

Reference Fig. : 2-7-3

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 GB 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 COM inlet wire R and chassis ground. Standard voltage : 24 V or more</p> <p>(2) When starter switch is ON and F-R lever is "R", measure voltage between backup buzzer switch terminal NO outlet wire GB and chassis ground. Standard voltage : 24 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 multifunction valve or replace it if necessary.
7. Propulsion Motor	Propulsion circuit pressure is not held in propulsion motor case.	If pressure in propulsion motor case is not within allowable range, repair propulsion motor or replace it if necessary.
	Internal leakage of propulsion motor.	<ul style="list-style-type: none"> • Measure drain quantity from propulsion motor. • If drain quantity is larger than standard value, repair propulsion motor or replace it if necessary.
8. Gear Box (front)	Sticking of brake discs causes brakes to remain applied.	Replace brake discs.

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

Check point	Cause	Check/Action
9. Propulsion Pump	Discharge flow rate is insufficient due to efficiency degradation of propulsion pump.	<ul style="list-style-type: none"> • 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.	If pressure in propulsion pump case is not within allowable range, repair propulsion pump or replace it if necessary.
	Sticking of brake discs causes brakes to remain applied.	Replace brake discs.
10. Parking Brake Solenoid Valve	Brake remains applied because spool of parking brake solenoid valve does not shift.	Repair parking brake solenoid valve or replace it if necessary.
11. Brake Inlet Pressure	Brake cannot be released because brake inlet pressure is low.	<ul style="list-style-type: none"> • Measure brake release pressure. • If low, repair or replace propulsion motor.
12. Rear Axle	Sticking of brake discs causes brakes to remain applied.	<ul style="list-style-type: none"> • Replace brake discs.
13. Flange	Drive torque is not transmitted to pump due to faulty flange.	Replace flange.

3-2-2. Machine moves in one direction only (forward or backward)

Check point	Cause	Check/Action
1. F-R Lever Linkage	F-R lever linkage is faulty.	Check and adjust F-R lever linkage or replace it if necessary.
2. Multifunction Valve	Low circuit pressure due to incorrect high pressure relief setting or internal leakage of multifunction valve.	<ul style="list-style-type: none"> • Interchange two multifunction valves. • If faulty condition is accordingly reversed, check and adjust multifunction 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 multifunction valve or replace it if necessary.
	Propulsion circuit pressure is not held in propulsion motor case.	If pressure in propulsion motor case is not within allowable range, repair propulsion motor or replace it if necessary.
	Output of propulsion motor decreases and number of revolutions decreases due to internal leakage of propulsion motor.	<ul style="list-style-type: none"> • 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.	If pressure in propulsion pump case is not within allowable range, repair propulsion pump or replace it if necessary.

3-2-4. Machine speed cannot be switched

Check point	Cause	Check/Action
1. Speed Change Solenoid Valve	Machine speed does not change because spool of speed change solenoid valve does not change.	Repair speed change solenoid valve or replace it if necessary.
2. Propulsion Motor Swash Plate Stroke Cylinder	Faulty propulsion motor swash plate stroke cylinder.	Repair propulsion motor or replace it if necessary.

3-2-5. Machine does not stop completely with F-R lever in “N”

Check point	Cause	Check/Action
1. F-R lever Linkage	F-R lever linkage is faulty.	Check and adjust F-R lever linkage or replace it if necessary.
2. Servo Control Valve	Servo control valve neutral position adjustment failure.	Check and adjust servo control valve or replace it if necessary.
3. Servo Cylinder	Faulty servo cylinder or faulty pump swash plate setting.	Repair propulsion pump or replace it if necessary.

3-2-6. Propulsion system is overheating

Check point	Cause	Check/Action
1. Oil Level of Hydraulic Oil Tank	Oil level in hydraulic oil tank is low.	Fill tank until correct oil level is obtained.
2. Oil Cooler	Cooling efficiency is reduced due to clogged oil cooler fins.	Clean oil cooler fins.
3. Flushing Valve (only rear propulsion motor)	Hydraulic oil in propulsion closed circuit is insufficiently cooled due to flushing valve shuttle spool sticking.	Repair flushing valve or replace it if necessary.
	Hydraulic oil in propulsion closed circuit is insufficiently cooled because flushing valve relief setting pressure is excessively high.	Check dust or damage in flushing relief valve and replace it if necessary.
	Hydraulic oil in propulsion closed circuit is insufficiently cooled due to flushing valve relief valve poppet sticking.	Clean flushing relief valve or replace it if necessary.
4. Propulsion Circuit Pressure	If circuit pressure setting is excessively low, relief valve opens, causing temperature of hydraulic oil in circuit to rise.	<ul style="list-style-type: none"> • 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 1	Charge circuit pressure increases due to clogged filter.	Clean hydraulic oil filter 1 or replace it if necessary.

3-2-7. Abnormal noise from propulsion system

Check point	Cause	Check/Action
1. Axle Bearings	Axle bearings supporting front and rear drums are damaged.	Replace axle bearings.
2. Gear Box	Reduction gear of gear box is damaged.	Replace reduction gear.
3. Rear Axle	Rear axle gear is damaged.	Replace rear axle gear.
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 Steering • Charge Pump	Cavitation is occurring in steering • charge pump due to clogged filter.	Clean suction filter or replace it if necessary.
6. 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.
7. 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. Charge Circuit Pressure	Vibrator pump does not discharge oil due to low charge pressure.	<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.
3. Vibrator proportional solenoid valve	Vibrator pump cannot discharge oil because proportional pressure reducing valve does not shift.	Repair vibrator proportional solenoid valve or replace them if necessary.
4. Suction Filter for Steering • Charge Pump	Steering • charge pump flow is reduced due to clogged filler.	Clean suction filter or replace it if necessary.
5. Vibrator Circuit Pressure	Circuit does not obtain required pressure because setting pressure of high pressure check relief is low.	<ul style="list-style-type: none"> • Measure vibrator circuit pressure. • If low, check and clean high pressure check relief valve or replace it if necessary.
6. Vibrator Motor	Vibrator circuit pressure is not held in vibrator motor case.	If pressure in vibrator motor case is not within allowable range, repair vibrator motor or replace it if necessary.
	Internal leakage of vibrator motor.	<ul style="list-style-type: none"> • 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.
	Vibrator circuit pressure is not held in vibrator pump case.	If pressure in vibrator pump case is not within allowable range, repair vibrator pump or replace it if necessary.

3-3-2. Vibrator frequency is too low

Check point	Cause	Check/Action
1. Oil Level of Hydraulic Oil Tank	Oil level in hydraulic oil tank is low.	Fill tank until correct oil level is obtained.
2. Charge Circuit Pressure	Stroke of vibrator pump swash plate is small because charge pressure is low, decreasing discharge rate of vibrator pump.	<ul style="list-style-type: none"> • 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.
3. Suction Filter for Steering • Charge Pump	Steering • charge pump flow is reduced due to clogged filter.	Clean suction filter or replace it if necessary.
4. Vibrator Motor	Vibrator motor inlet pressure is low.	<ul style="list-style-type: none"> • Measure vibrator motor inlet pressure. • If low, check and clean high pressure check relief valve or replace it if necessary.
	Vibrator circuit pressure is not held in vibrator motor case.	If pressure in vibrator motor case is not within allowable range, repair vibrator motor or replace it if necessary.
	Decrease in vibrator motor rpm due to internal leakage in vibrator motor.	<ul style="list-style-type: none"> • Measure drain quantity from vibrator motor. • If drain quantity is larger than standard value, repair vibrator motor or replace it if necessary.
5. 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.
	Vibrator circuit pressure is not held in vibrator pump case.	If pressure in vibrator pump case is not within allowable range, repair vibrator pump or replace it if necessary.

3-3-3. Amplitude does not switch between high and low

Check point	Cause	Check/Action
1. Vibrator Proportional Solenoid Valve	Only high or low side proportional pressure reducing valve works.	Repair vibrator proportional solenoid valve or replace them if necessary.
2. Servo Control Valve	Servo control valve spool shifts only in one direction.	Repair servo control valve spool or replace it if necessary.

3-3-4. Vibrator does not stop

Check point	Cause	Check/Action
1. Servo Control Valve	Servo control valve spool does not return to neutral position.	<ul style="list-style-type: none"> • Measure vibrator high/low circuit pressure. • If not equal, check and adjust servo control valve or replace it if necessary.
2. Vibrator Pump	Vibrator pump swash plate does not return to neutral position.	Repair vibrator pump or replace it if necessary.

3-3-5. 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, check and clean relief valve or replace it if necessary.
	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 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.
5. Hydraulic Oil Filter 1	Charge circuit pressure increases due to clogged filter.	Clean hydraulic oil filter 1 or replace it if necessary.

3-3-6. Abnormal noise from vibrator system

Check point	Cause	Check/Action
1. Vibrator Bearings	Vibrator bearings supporting eccentric shaft are damaged.	Replace vibrator bearings.
2. Hydraulic Hose Clamp	Vibrator sound of hydraulic hose is generated because clamp securing hydraulic hose is loose.	Tighten bolts of loose hydraulic hose clamp to specified torque.
3. Suction Filter for Steering • Charge Pump	Cavitation is occurring in steering • charge pump due to clogged filter.	Clean suction filter or replace it if necessary.
4. Vibrator Motor	Internal bearing of vibrator motor is damaged.	Repair vibrator motor or replace it if necessary.

3-4. Steering System

If a problem occurs in the steering systems such as the steering pump and orbitrol, determine the cause and carry out action as required, according to the following general troubleshooting items.

(NOTICE)

- When checking whether or not the pressure is correct, refer to the pressure standard value for each hydraulic circuit.

3-4-1. Steering wheel is hard to turn

Check point	Cause	Check/Action
1. Oil Level of Hydraulic Oil Tank	Oil level in hydraulic oil tank is low.	Fill tank until correct oil level is obtained.
2. Orbitrol	Relief valve is open or setting pressure is low.	<ul style="list-style-type: none"> • 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 oil filter 1.	Clean hydraulic oil filter 1 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 adjust 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.

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