R2-4

SHOP MANUAL

SAKAI®

3498-6634A-1

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.

CONTENTS

1. SAFETY

1. GENERAL SAFETY

1-1. Understanding the Safety Symbols and Words ····· 1-001
1-2. General ····· 1-001
1-3. Qualifications of Operators and Maintenance Personnel ····· 1-002
1-4. Safety Practices and Policies····· 1-002
1-5. Pre Start Inspection····· 1-003
1-6. Safety Instructions ····· 1-003
1-7. Starting····· 1-004
1-8. Operating····· 1-004
1-9. Stopping ····· 1-004
1-10. Maintenance····· 1-005
1-11. Transporting the Machine····· 1-007

2. SPECIFICATIONS

1. SPECIFICATION DATA

1-1. R2-4····· 2-001
1-2. R2-4 ROPS····· 2-004
1-3. R2H-4 ····· 2-007
1-4. R2H-4 ROPS ····· 2-010

2. TABLE OF STANDARD VALUES

2-1. Engine····· 2-013
2-2. Propulsion····· 2-013
2-3. Hydraulic System····· 2-013
2-4. Steering····· 2-014
2-5. Brakes····· 2-014
2-6. Capacities····· 2-014

3. FUEL AND LUBRICANTS SPECIFICATION

3-1. Rating ····· 2-015
3-2. Recommended Lubricants ····· 2-015

4. TIGHTENING TORQUE CHART····· 2-016

3. ENGINE AND CONTROLS

1. ENGINE
1-1. Engine Mount ····· 3-001
1-2. Engine Exterior ····· 3-002
2. CONTROL SYSTEMS
2-1. Throttle Control ····· 3-003
2-2. Forward-reverse Control ····· 3-004
3. PUMP MOUNT
3-1. Pump Mount ····· 3-005
3-1-1. Installation of pump ····· 3-006

4. HYDRAULIC SYSTEMS

1. SYSTEM CIRCUIT DIAGRAM
1-1. Graphic Symbols for Hydraulic Circuits ····· 4-001
1-2. Hydraulic Circuit Diagram ····· 4-003
2. PROPULSION HYDRAULIC SYSTEM
2-1. Propulsion Hydraulic Piping ····· 4-004
2-1-1. Propulsion hydraulic piping (1) ····· 4-004
2-1-2. Propulsion hydraulic piping (2) ····· 4-005
2-1-3. Propulsion hydraulic piping (3) ····· 4-006
① 2-1-4. Propulsion hydraulic piping (R) ····· 4-007
2-2. Hydraulic Component Specifications ····· 4-008
2-2-1. Hydraulic pump assembly (propulsion + steering • charge) ····· 4-008
2-2-2. Propulsion hydraulic motor (F) ····· 4-010
2-2-3. Propulsion hydraulic motor (R) ····· 4-012
2-2-4. Valve ····· 4-014
2-2-5. Block A ····· 4-015
2-2-6. Block B ····· 4-016
3. STEERING SYSTEM
① 3-1. Steering Hydraulic Piping ····· 4-017
3-2. Steering Wheel ····· 4-018
3-3. Hydraulic Component Specifications ····· 4-019
3-3-1. Orbitrol ····· 4-019
3-3-2. Valve ····· 4-020

5. 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 ··· 5-001

2. SYSTEM CIRCUIT DIAGRAM

2-1. Electrical Circuit Diagram ····· 5-003

① 2-1. Electrical Circuit Diagram *:a ····· 5-003a

2-1. Electrical Circuit Diagram *:g (From 70379) ····· 5-003g

2-1. Electrical Circuit Diagram *:h (From 70442) ····· 5-003h

3. ELECTRICAL COMPONENTS

3-1. Wiring Harness Layout (1) ····· 5-004

① 3-1. Wiring Harness Layout (1) *:a ····· 5-004a

3-1. Wiring Harness Layout (1) *:b (From 70218) ····· 5-004b

3-1. Wiring Harness Layout (1) *:c (From 70234) ····· 5-004c

3-1. Wiring Harness Layout (1) *:g (From 70379) ····· 5-004g

3-2. Wiring Harness Layout (2) ····· 5-005

① 3-2. Wiring Harness Layout (2) *:e (From 70273) ····· 5-005e

3-2. Wiring Harness Layout (2) *:g (From 70379) ····· 5-005g

3-2. Wiring Harness Layout (2) *:h (From 70442) ····· 5-005h

4. WIRING HARNESSES

4-1. Main Harness (1) ····· 5-006

① 4-1. Main Harness (1) *:a ····· 5-006a

4-1. Main Harness (1) *:b (From 70218) ····· 5-006b

4-1. Main Harness (1) *:d (From 70253) ····· 5-006d

4-1. Main Harness (1) *:g (From 70379) ····· 5-006g

4-2. Main Harness (2) ····· 5-008

① 4-2. Main Harness (2) *:a ····· 5-008a

4-2. Main Harness (2) *:b (From 70218) ····· 5-008b

4-2. Main Harness (2) *:g (From 70379) ····· 5-008g

4-3. Main Harness (3) ····· 5-010

① 4-3. Main Harness (3) *:b (From 70218) ····· 5-010b

4-4. Frame Harness (F) ····· 5-012

4-5. Frame Harness (R) ····· 5-014

4-6. Floor Board Harness ····· 5-016

4-7. Engine Harness ····· 5-018

① 4-7. Engine Harness *:c (From 70234) ····· 5-018c

4-7. Engine Harness *:f (From 70343) ····· 5-018f

4-8. Starter Switch Harness ····· 5-019

4-9. Control Switch Harness ····· 5-020

4-10. Lighting Switch Harness ····· 5-021
4-11. Hazard Switch Harness ····· 5-022
4-12. F-R Lever Switch Harness ····· 5-023
4-13. Backup Buzzer Switch Harness ····· 5-024
4-14. Foot Brake Switch Harness ····· 5-025
4-15. ENGINE WARNING Lamp Harness ····· 5-026
4-16. DPF Harness ····· 5-027
4-17. Water Spray Harness ····· 5-028
4-18. Combination Lamp Harness (F,L) ····· 5-029
4-19. Combination Lamp Harness (F,R) ····· 5-030
4-20. Sub Power Harness ····· 5-031
5. ELECTRICAL COMPONENT SPECIFICATIONS
5-1. Fuse Box ····· 5-032
① 5-1. Fuse Box *:h (From 70442) ····· 5-032h
5-2. Combination Meter ····· 5-033

6. DRUM

1. PRECAUTIONS FOR DISASSEMBLY AND REASSEMBLY ····· 6-001
2. DRUM
2-1. Drum (F) (R2-4) ····· 6-003
2-2. Drum (F) (R2H-4) ····· 6-004
2-3. Drum (R) (R2-4) ····· 6-005
2-4. Drum (R) (R2H-4) ····· 6-006

7. BRAKE

1. BRAKE PEDAL ····· 7-001
2. BRAKE SYSTEM ····· 7-002

8. WATER SPRAY SYSTEM

1. WATER SPRAY PIPING ····· 8-001

9. INSPECTION AND ADJUSTMENT

1. INSPECTION AND ADJUSTMENT
1-1. Safety Precautions for Inspection and Adjustment ····· 9-001
1-2. Preparation for Inspection and Adjustment ····· 9-001
1-3. Precautions for Inspection and Adjustment ····· 9-001
1-4. Warm-up ····· 9-001
1-5. Inspection and Adjustment of Engine Related Items ····· 9-001

2. MEASUREMENT AND ADJUSTMENT OF PROPULSION CIRCUIT PRESSURE
2-1. Measurement ····· 9-002
2-2. Adjustment ····· 9-003
3. MEASUREMENT AND ADJUSTMENT OF PROPULSION CHARGE CIRCUIT PRESSURE
3-1. Measurement ····· 9-004
3-2. Adjustment ····· 9-005
4. MEASUREMENT OF PROPULSION SERVO CIRCUIT PRESSURE
4-1. Measurement ····· 9-006
5. MEASUREMENT OF MACHINE HIGH/LOW SPEED CHANGE CIRCUIT PRESSURE
5-1. Measurement ····· 9-007
6. MEASUREMENT OF PARKING BRAKE RELEASE PRESSURE
6-1. Measurement of propulsion motor (F) ····· 9-008
6-2. Measurement of propulsion motor (R) ····· 9-009
7. MEASUREMENT AND INSPECTION OF STEERING CIRCUIT PRESSURE
7-1. Measurement ····· 9-010
7-2. Inspection ····· 9-011
8. MEASUREMENT OF HYDRAULIC PUMP CASE PRESSURE
8-1. Measurement of Propulsion Pump Case Pressure ····· 9-012
9. MEASUREMENT OF PROPULSION MOTOR CASE PRESSURE
9-1. Measurement of Propulsion Motor (F) ····· 9-013
9-2. Measurement of Propulsion Motor (R) ····· 9-014
10. ADJUSTMENT OF THROTTLE LEVER
10-1. Adjustment of Potentiometer ····· 9-015
10-2. Adjustment of Operating Force ····· 9-017
11. ADJUSTMENT OF F-R LEVER LINKAGE
11-1. Adjustment ····· 9-018

10. TROUBLESHOOTING

1. TROUBLESHOOTING
1-1. Safety Precautions for Troubleshooting ····· 10-001
1-2. Important Information for Troubleshooting ····· 10-001
1-3. Before Starting ····· 10-002
2. ELECTRICAL SYSTEM TROUBLESHOOTING
2-1. When Performing Electrical System Fault Diagnosis ····· 10-003
2-1-1. Precautions to take during electrical circuit fault diagnosis ····· 10-003
2-1-2. Inspection procedures using a tester ····· 10-004
2-1-3. Inspection of electrical system ····· 10-009

2-2. Engine Diagnosis Trouble Code····· 10-011
2-2-1. Description of diagnostic trouble code (DTC) ····· 10-011
2-2-2. Table of the diagnostic trouble code (DTC)····· 10-012
2-3. Engine····· 10-019
2-3-1. Engine will not start (Starter motor does not run) 1/2····· 10-019
2-3-1. Engine will not start (Starter motor does not run) 2/2····· 10-021
2-3-2. Engine will not start (But starter motor runs) ····· 10-023
2-3-3. No charging····· 10-023
2-3-4. Glow plug is not heated
(Engine starting performance is bad in cold weather) ····· 10-025
2-3-5. Starter motor runs even when F-R lever is not at “N”
and parking brake is not applied ····· 10-025
2-3-6. Engine speed does not change when operating throttle lever····· 10-027
2-4. Propulsion System ····· 10-029
2-4-1. Machine moves neither forward nor backward 1/2 ····· 10-029
2-4-1. Machine moves neither forward nor backward 2/2 ····· 10-031
2-4-2. Brake cannot be released····· 10-031
2-4-3. Brake does not work 1/2····· 10-031
2-4-3. Brake does not work 2/2····· 10-033
2-4-4. Speed cannot be changed····· 10-033
2-5. Water Spray ····· 10-035
2-5-1. Continuous water spray does not operate····· 10-035
2-5-2. Continuous water spray works, but intermittent water spray
does not operate ····· 10-037
2-6. Lighting····· 10-039
2-6-1. Head lamp, side marker lamp, tail lamp and license lamp
do not light 1/2 ····· 10-039
2-6-1. Head lamp, side marker lamp, tail lamp and license lamp
do not light 2/2 ····· 10-041
2-6-2. Flood lamp does not light 1/2 ····· 10-041
2-6-2. Flood lamp does not light 2/2 ····· 10-043
2-6-3. High-beam of head lamp does not light ····· 10-043
2-6-4. Turn signal lamp does not blink····· 10-045
2-6-5. Hazard lamp does not light (Turn signal blinks) ····· 10-047
2-6-6. Backup lamp does not light····· 10-047
2-6-7. Stop lamp does not light····· 10-049
2-6-8. Illumination of combination meter does not light ····· 10-051
2-6-9. Combination meter warning lamp or indicator lamp is abnormal ····· 10-051
2-6-10. Tachometer reading is abnormal ····· 10-053
2-6-11. Hour meter is abnormal····· 10-053

2-6-12. Temperature meter is abnormal ····· 10-055
2-6-13. Fuel meter is abnormal····· 10-055
2-6-14. Charge warning lamp remains ON····· 10-057
2-6-15. Water spray indicator lamp does not light ····· 10-057
2-6-16. Flood lamp indicator lamp does not light····· 10-059
2-6-17. Side marker lamp indicator lamp does not light····· 10-059
2-6-18. Parking brake indicator lamp does not light····· 10-061
2-6-19. Turn signal indicator lamp does not light····· 10-063
2-6-20. Horn does not sound····· 10-065
2-6-21. Backup buzzer does not sound ····· 10-065
3. HYDRAULIC SYSTEM TROUBLESHOOTING
3-1. When Performing Hydraulic System Troubleshooting ····· 10-066
3-2. Propulsion System ····· 10-067
3-2-1. Machine moves neither forward nor backward 1/2 ····· 10-067
3-2-1. Machine moves neither forward nor backward 2/2 ····· 10-068
3-2-2. Machine moves in one direction only (forward or backward) ····· 10-068
3-2-3. Slow machine speed or small drive force 1/2 ····· 10-068
3-2-3. Slow machine speed or small drive force 2/2 ····· 10-069
3-2-4. Machine speed cannot be switched ····· 10-069
3-2-5. Machine does not stop completely with F-R lever in “N” ····· 10-069
3-2-6. Propulsion system is overheating ····· 10-070
3-2-7. Abnormal noise from propulsion system····· 10-070
3-3. Steering System ····· 10-071
3-3-1. Steering wheel is hard to turn ····· 10-071
3-3-2. Steering response is slow····· 10-071
3-3-3. Steering wheel backlash or play is large····· 10-072
3-3-4. Steering system is overheating ····· 10-072
3-3-5. Abnormal noise from steering system ····· 10-072

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.

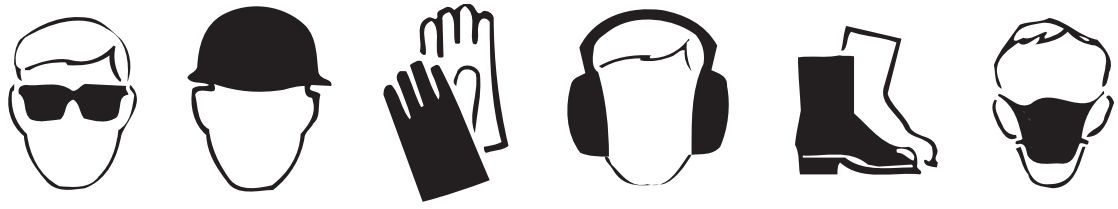
- The machine is designed specifically for the compaction of asphalt or soil road construction materials. Use of the machine for other purposes such as towing other equipment is considered contrary to the designated use. The manufacturer cannot be responsible or held liable for any damage resulting from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

- 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.

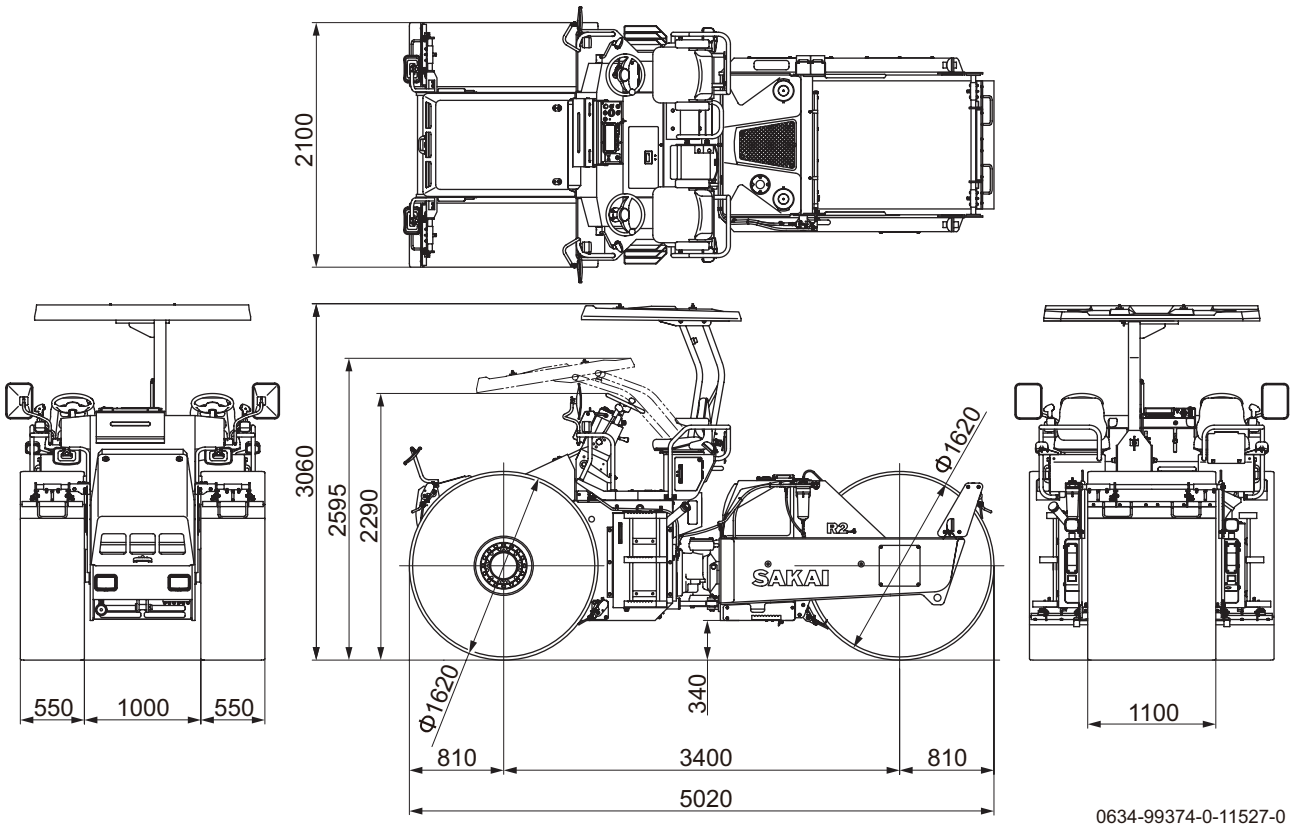
1-11. Transporting the Machine

- 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. R2-4

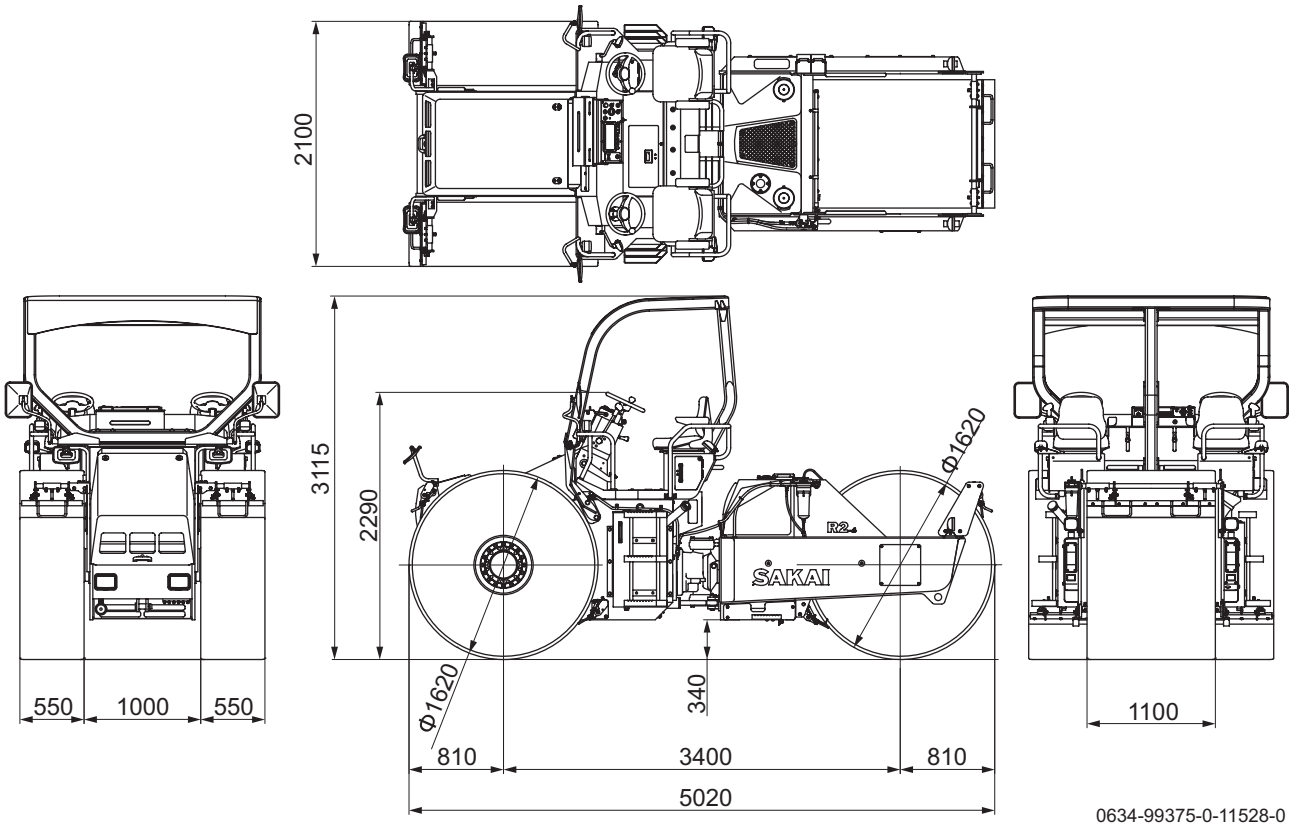


Model & Type	Model		SAKAI R2-4 with AWNING
	Type		STATIC THREE-WHEEL ROLLER
Weight	Operating weight	without ballast	9,800 kg (21,605 lbs.)
		with ballast	N/A kg (N/A lbs.)
	Maximum weight		10,180 kg (22,445 lbs.)
	Shipping weight	with AWNING	9,340 kg (20,590 lbs.)
		without AWNING	9,240 kg (20,370 lbs.)
	Load on front axle with operating weight		4,850 kg (10,690 lbs.)
	Load on rear axle with operating weight		4,950 kg (10,915 lbs.)
Dimensions	Overall length		5,020 mm (198 in.)
	Overall width		2,100 mm (83 in.)
	Overall height	with AWNING	3,060 mm (120 in.)
		without AWNING	2,290 mm (90 in.)
	Wheelbase		3,400 mm (134 in.)
	Compaction width		2,100 mm (83 in.)
	Front drum	width × dia. × thickness	550 mm × 1,620 mm × 28 mm (22 in. × 64 in. × 1.1 in.)
	Rear drum	width × dia. × thickness	1,100 mm × 1,620 mm × 28 mm (43 in. × 64 in. × 1.1 in.)
	Ground clearance		340 mm (13 in.)
	Kerb clearance	Right	∞ mm (∞ in.)
		Left	∞ mm (∞ in.)
	Side clearance	Right	0 mm (0 in.)
		Left	0 mm (0 in.)
	Leveling blade width		N/A mm (N/A in.)

Performance	Vibrator system	Front	Centrifugal force	Low amplitude		N/A kN (N/A lbf.)
				High amplitude		N/A kN (N/A lbf.)
			Frequency	Low amplitude		N/A Hz (N/A vpm)
				High amplitude		N/A Hz (N/A vpm)
			Amplitude	Low amplitude		N/A mm (N/A in.)
				High amplitude		N/A mm (N/A in.)
		Rear	Centrifugal force	Low amplitude		N/A kN (N/A lbf.)
				High amplitude		N/A kN (N/A lbf.)
			Frequency	Low amplitude		N/A Hz (N/A vpm)
				High amplitude		N/A Hz (N/A vpm)
			Amplitude	Low amplitude		N/A mm (N/A in.)
				High amplitude		N/A mm (N/A in.)
	Linear pressure	Static linear pressure	Front drum	Operating weight		432 N/cm (245 lbf./in.)
			Rear drum	Operating weight		441 N/cm (250 lbf./in.)
		Dynamic linear pressure	Front drum	Operating weight	Low amplitude	N/A N/cm (N/A lbf./in.)
					High amplitude	N/A N/cm (N/A lbf./in.)
			Rear drum	Operating weight	Low amplitude	N/A N/cm (N/A lbf./in.)
					High amplitude	N/A N/cm (N/A lbf./in.)
	Traveling speed	Number of speed shift				2 speed
		Speed range		1st		0 to 8 km/h (0 to 5.0 mph)
				2nd		0 to 16 km/h (0 to 9.9 mph)
	Gradeability					47 % (25 °)
	Turning radius	Machine clearance radius inside				4.2 m (166 in.)
		Machine clearance radius outside				6.5 m (256 in.)
		Turning radius inside compacted surface				4.2 m (166 in.)
		Turning radius outside compacted surface				6.3 m (249 in.)
	Steering / Oscillating angle					± 36 ° / ± 5.3 °

Engine	Model		KUBOTA V3307-CR-T-EF05 (Diesel, EPA-Tier4)
	Type		4-cycle, water-cooled, 4-cylinder in-line, overhead valve, direct injection type, with turbo charger
	Cylinders - Bore × Stroke		94 mm × 120 mm (3.701 in. × 4.724 in.)
	Displacement		3.331 L (203.3 cu.in.)
	Performance	Rated speed	2,200 min^{-1}
		Rated output	54.6 kW (73 HP)
		Max. torque	261 N·m (193 lbf·ft) at 1,500 min^{-1}
		Fuel consumption rate	229 g/kW·h (0.376 lb/HP·h) at 2,200 min^{-1}
		Fuel consumption	15 L/h (4.0 gal.) with full load
	Fuel system	Fuel	Diesel (ASTM D975-2D)
		Fuel injection pump	High pressure common rail
		Fuel injection time regulator	Electric speed control
	Lubrication system	Lubrication type	Full forced pressure feed
		Oil filter type	Full flow plastic fiber element
		Oil cooler type	Intergrated water cooled
	Air intake system	Air cleaner type	Dry
	Cooling system	Cooling type	Pressurized water forced circulation
		Cooling fan type	Inhale
	Electrical system	Alternator	12 V 90 A
		Starter	12 V 3.0 kW
		Battery	12 V (72 Ah, CCA750) × 1 pc. (12 V)
	Dry weight		311 kg (686 lbs.)
Drive system	Transmission	Type	Hydrostatic
		Speed	2 speed shifts
	Reverser		Switching the direction of flow delivered from the variable pump
	Differential type	Front	N/A
		Rear	N/A
	Final drive	Front	Planetary gear
		Rear	Planetary gear
Vibration system	Power transmission type		N/A
	Vibrator type		N/A
Brake system	Service brake		Dynamic brake through hydrostatic drive system (F-N-R lever)
	Secondary brake (Emergency brake)		Hydrostatic + spring applied hydraulically released type (Brake pedal)
	Parking brake		Spring applied hydraulically released type (Panel button)
Steering system	Power transmission type		Hydraulic
	Steering type		Articulated
Drum and tyres	Use	Front	Steel drum / Drive / 2pcs.
		Rear	Steel drum / Drive / 1pc.
	Suspension type	Front	Rigid
		Rear	Rigid
Sprinkler system	Water spray type		Pressurized
	Liquid spray type		Pressurized
Ballast	Steel		N/A kg (N/A lbs.)
	Water		N/A kg (N/A lbs.)
Others	ECO mode		Standard

1-2. R2-4 ROPS

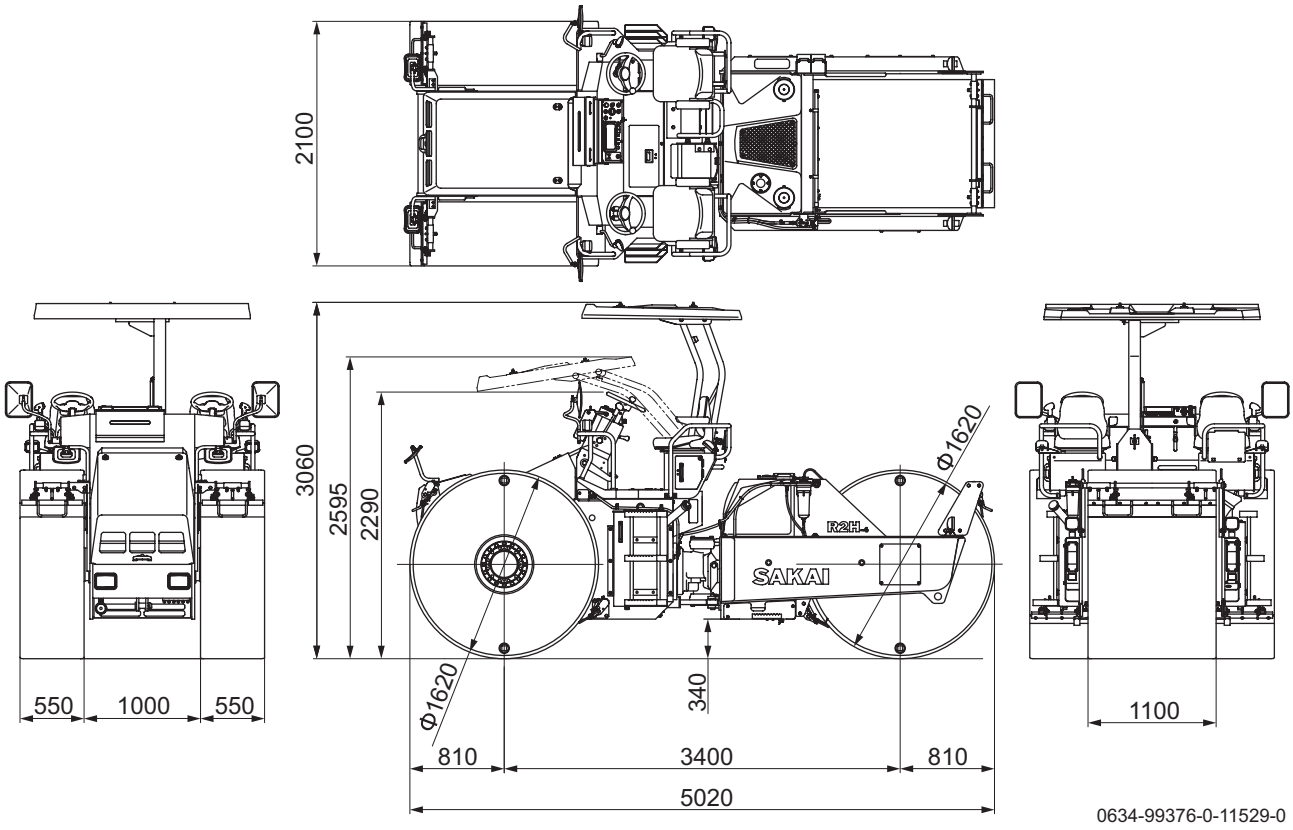


Model & Type	Model		SAKAI R2-4 with ROPS
	Type		STATIC THREE-WHEEL ROLLER
Weight	Operating weight	without ballast	10,060 kg (22,180 lbs.)
		with ballast	N/A kg (N/A lbs.)
	Maximum weight		10,520 kg (23,190 lbs.)
	Shipping weight	with ROPS	9,720 kg (21,430 lbs.)
		without ROPS	9,330 kg (20,570 lbs.)
	Load on front axle with operating weight		5,060 kg (11,155 lbs.)
	Load on rear axle with operating weight		5,000 kg (11,025 lbs.)
Dimensions	Overall length		5,020 mm (198 in.)
	Overall width		2,100 mm (83 in.)
	Overall height	with ROPS	3,115 mm (123 in.)
		without ROPS	2,290 mm (90 in.)
	Wheelbase		3,400 mm (134 in.)
	Compaction width		2,100 mm (83 in.)
	Front drum	width × dia. × thickness	550 mm × 1,620 mm × 28 mm (22 in. × 64 in. × 1.1 in.)
	Rear drum	width × dia. × thickness	1,100 mm × 1,620 mm × 28 mm (43 in. × 64 in. × 1.1 in.)
	Ground clearance		340 mm (13 in.)
	Kerb clearance	Right	∞ mm (∞ in.)
		Left	∞ mm (∞ in.)
	Side clearance	Right	0 mm (0 in.)
		Left	0 mm (0 in.)
	Leveling blade width		N/A mm (N/A in.)

Performance	Vibrator system	Front	Centrifugal force	Low amplitude		N/A kN (N/A lbf.)
				High amplitude		N/A kN (N/A lbf.)
			Frequency	Low amplitude		N/A Hz (N/A vpm)
				High amplitude		N/A Hz (N/A vpm)
			Amplitude	Low amplitude		N/A mm (N/A in.)
				High amplitude		N/A mm (N/A in.)
		Rear	Centrifugal force	Low amplitude		N/A kN (N/A lbf.)
				High amplitude		N/A kN (N/A lbf.)
			Frequency	Low amplitude		N/A Hz (N/A vpm)
				High amplitude		N/A Hz (N/A vpm)
			Amplitude	Low amplitude		N/A mm (N/A in.)
				High amplitude		N/A mm (N/A in.)
	Linear pressure	Static linear pressure	Front drum	Operating weight		451 N/cm (260 lbf./in.)
			Rear drum	Operating weight		445 N/cm (255 lbf./in.)
		Dynamic linear pressure	Front drum	Operating weight	Low amplitude	N/A N/cm (N/A lbf./in.)
					High amplitude	N/A N/cm (N/A lbf./in.)
			Rear drum	Operating weight	Low amplitude	N/A N/cm (N/A lbf./in.)
					High amplitude	N/A N/cm (N/A lbf./in.)
	Traveling speed	Number of speed shift				2 speed
		Speed range		1st		0 to 8 km/h (0 to 5.0 mph)
				2nd		0 to 16 km/h (0 to 9.9 mph)
	Gradeability					45 % (24 °)
	Turning radius	Machine clearance radius inside				4.2 m (166 in.)
		Machine clearance radius outside				6.5 m (256 in.)
		Turning radius inside compacted surface				4.2 m (166 in.)
		Turning radius outside compacted surface				6.3 m (249 in.)
	Steering / Oscillating angle					± 36 ° / ± 5.3 °

Engine	Model		KUBOTA V3307-CR-T-EF05 (Diesel, EPA-Tier4)
	Type		4-cycle, water-cooled, 4-cylinder in-line, overhead valve, direct injection type, with turbo charger
	Cylinders - Bore × Stroke		94 mm × 120 mm (3.701 in. × 4.724 in.)
	Displacement		3.331 L (203.3 cu.in.)
	Performance	Rated speed	2,200 min^{-1}
		Rated output	54.6 kW (73 HP)
		Max. torque	261 N·m (193 lbf·ft)
			at 1,500 min^{-1}
		Fuel consumption rate	229 g/kW·h (0.376 lb/HP·h)
			at 2,200 min^{-1}
		Fuel consumption	15 L/h (4.0 gal.)
			with full load
	Fuel system	Fuel	Diesel (ASTM D975-2D)
		Fuel injection pump	High pressure common rail
		Fuel injection time regulator	Electric speed control
	Lubrication system	Lubrication type	Full forced pressure feed
		Oil filter type	Full flow plastic fiber element
		Oil cooler type	Intergrated water cooled
	Air intake system	Air cleaner type	Dry
	Cooling system	Cooling type	Pressurized water forced circulation
		Cooling fan type	Inhale
	Electrical system	Alternator	12 V 90 A
		Starter	12 V 3.0 kW
		Battery	12 V (72 Ah, CCA750) × 1 pc. (12 V)
	Dry weight		311 kg (686 lbs.)
Drive system	Transmission	Type	Hydrostatic
		Speed	2 speed shifts
	Reverser		Switching the direction of flow delivered from the variable pump
	Differential type	Front	N/A
		Rear	N/A
	Final drive	Front	Planetary gear
		Rear	Planetary gear
Vibration system	Power transmission type		N/A
	Vibrator type		N/A
Brake system	Service brake		Dynamic brake through hydrostatic drive system (F-N-R lever)
	Secondary brake (Emergency brake)		Hydrostatic + spring applied hydraulically released type (Brake pedal)
	Parking brake		Spring applied hydraulically released type (Panel button)
Steering system	Power transmission type		Hydraulic
	Steering type		Articulated
Drum and tyres	Use	Front	Steel drum / Drive / 2pcs.
		Rear	Steel drum / Drive / 1pc.
	Suspension type	Front	Rigid
		Rear	Rigid
Sprinkler system	Water spray type		Pressurized
	Liquid spray type		Pressurized
Ballast	Steel		N/A kg (N/A lbs.)
	Water		N/A kg (N/A lbs.)
Others	ECO mode		Standard

1-3. R2H-4



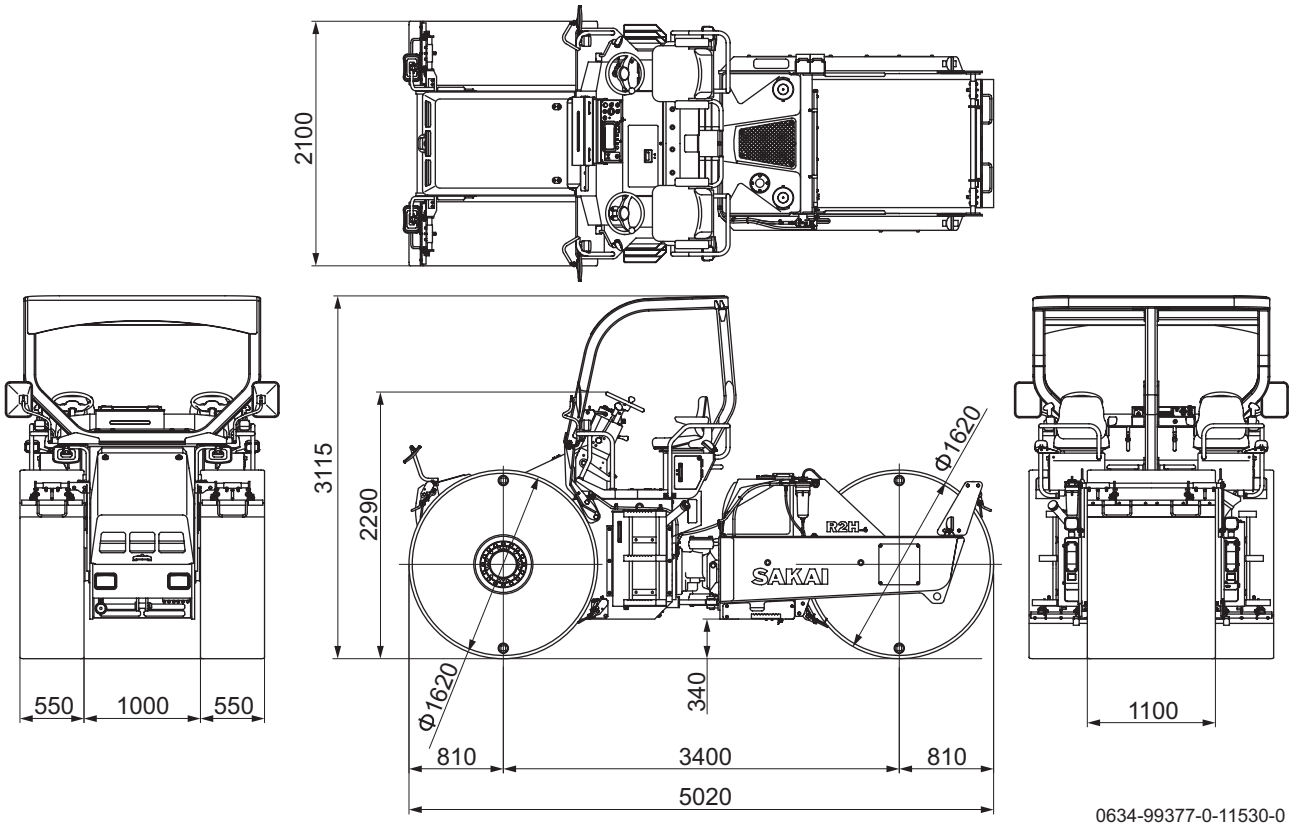
0634-99376-0-11529-0

Model & Type	Model		SAKAI R2H-4 with AWNING
	Type		STATIC THREE-WHEEL ROLLER
Weight	Operating weight	without ballast	10,560 kg (23,280 lbs.)
		with ballast	13,700 kg (30,205 lbs.)
	Maximum weight		14,080 kg (31,040 lbs.)
	Shipping weight	with AWNING	10,110 kg (22,290 lbs.)
		without AWNING	10,000 kg (22,045 lbs.)
	Load on front axle with operating weight		6,760 kg (14,905 lbs.)
	Load on rear axle with operating weight		6,940 kg (15,300 lbs.)
Dimensions	Overall length		5,020 mm (198 in.)
	Overall width		2,100 mm (83 in.)
	Overall height	with AWNING	3,060 mm (120 in.)
		without AWNING	2,290 mm (90 in.)
	Wheelbase		3,400 mm (134 in.)
	Compaction width		2,100 mm (83 in.)
	Front drum	width × dia. × thickness	550 mm × 1,620 mm × 28 mm (22 in. × 64 in. × 1.1 in.)
	Rear drum	width × dia. × thickness	1,100 mm × 1,620 mm × 28 mm (43 in. × 64 in. × 1.1 in.)
	Ground clearance		340 mm (13 in.)
	Kerb clearance	Right	∞ mm (∞ in.)
		Left	∞ mm (∞ in.)
	Side clearance	Right	0 mm (0 in.)
		Left	0 mm (0 in.)
	Leveling blade width		N/A mm (N/A in.)

Performance	Vibrator system	Front	Centrifugal force	Low amplitude		N/A kN (N/A lbf.)
				High amplitude		N/A kN (N/A lbf.)
			Frequency	Low amplitude		N/A Hz (N/A vpm)
				High amplitude		N/A Hz (N/A vpm)
			Amplitude	Low amplitude		N/A mm (N/A in.)
				High amplitude		N/A mm (N/A in.)
		Rear	Centrifugal force	Low amplitude		N/A kN (N/A lbf.)
				High amplitude		N/A kN (N/A lbf.)
			Frequency	Low amplitude		N/A Hz (N/A vpm)
				High amplitude		N/A Hz (N/A vpm)
			Amplitude	Low amplitude		N/A mm (N/A in.)
				High amplitude		N/A mm (N/A in.)
	Linear pressure	Static linear pressure	Front drum	Operating weight		602 N/cm (345 lbf./in.)
			Rear drum	Operating weight		618 N/cm (355 lbf./in.)
		Dynamic linear pressure	Front drum	Operating weight	Low amplitude	N/A N/cm (N/A lbf./in.)
					High amplitude	N/A N/cm (N/A lbf./in.)
			Rear drum	Operating weight	Low amplitude	N/A N/cm (N/A lbf./in.)
					High amplitude	N/A N/cm (N/A lbf./in.)
	Traveling speed	Number of speed shift				2 speed
		Speed range		1st		0 to 8 km/h (0 to 5.0 mph)
				2nd		0 to 16 km/h (0 to 9.9 mph)
	Gradeability					31 % (17 °)
	Turning radius	Machine clearance radius inside				4.2 m (166 in.)
		Machine clearance radius outside				6.5 m (256 in.)
		Turning radius inside compacted surface				4.2 m (166 in.)
		Turning radius outside compacted surface				6.3 m (249 in.)
	Steering / Oscillating angle					± 36 ° / ± 5.3 °

Engine	Model		KUBOTA V3307-CR-T-EF05 (Diesel, EPA-Tier4)
	Type		4-cycle, water-cooled, 4-cylinder in-line, overhead valve, direct injection type, with turbo charger
	Cylinders - Bore × Stroke		94 mm × 120 mm (3.701 in. × 4.724 in.)
	Displacement		3.331 L (203.3 cu.in.)
	Performance	Rated speed	2,200 min^{-1}
		Rated output	54.6 kW (73 HP)
		Max. torque	261 N·m (193 lbf·ft)
			at 1,500 min^{-1}
		Fuel consumption rate	229 g/kW·h (0.376 lb/HP·h)
			at 2,200 min^{-1}
		Fuel consumption	15 L/h (4.0 gal.)
			with full load
	Fuel system	Fuel	Diesel (ASTM D975-2D)
		Fuel injection pump	High pressure common rail
		Fuel injection time regulator	Electric speed control
	Lubrication system	Lubrication type	Full forced pressure feed
		Oil filter type	Full flow plastic fiber element
		Oil cooler type	Intergrated water cooled
	Air intake system	Air cleaner type	Dry
	Cooling system	Cooling type	Pressurized water forced circulation
		Cooling fan type	Inhale
	Electrical system	Alternator	12 V 90 A
		Starter	12 V 3.0 kW
		Battery	12 V (72 Ah, CCA750) × 1 pc. (12 V)
	Dry weight		311 kg (686 lbs.)
Drive system	Transmission	Type	Hydrostatic
		Speed	2 speed shifts
	Reverser		Switching the direction of flow delivered from the variable pump
	Differential type	Front	N/A
		Rear	N/A
	Final drive	Front	Planetary gear
		Rear	Planetary gear
Vibration system	Power transmission type		N/A
	Vibrator type		N/A
Brake system	Service brake		Dynamic brake through hydrostatic drive system (F-N-R lever)
	Secondary brake (Emergency brake)		Hydrostatic + spring applied hydraulically released type (Brake pedal)
	Parking brake		Spring applied hydraulically released type (Panel button)
Steering system	Power transmission type		Hydraulic
	Steering type		Articulated
Drum and tyres	Use	Front	Steel drum / Drive / 2pcs.
		Rear	Steel drum / Drive / 1pc.
	Suspension type	Front	Rigid
		Rear	Rigid
Sprinkler system	Water spray type		Pressurized
	Liquid spray type		Pressurized
Ballast	Steel		835 kg (1,845 lbs.)
	Water		3,140 kg (6,925 lbs.)
Others	ECO mode		Standard

1-4. R2H-4 ROPS



Model & Type	Model		SAKAI R2H-4 with ROPS
	Type		STATIC THREE-WHEEL ROLLER
Weight	Operating weight	without ballast	10,900 kg (24,030 lbs.)
		with ballast	14,040 kg (30,955 lbs.)
	Maximum weight		14,420 kg (31,790 lbs.)
	Shipping weight	with ROPS	10,450 kg (23,040 lbs.)
		without ROPS	10,060 kg (22,180 lbs.)
	Load on front axle with operating weight		7,010 kg (15,455 lbs.)
	Load on rear axle with operating weight		7,030 kg (15,500 lbs.)
Dimensions	Overall length		5,020 mm (198 in.)
	Overall width		2,100 mm (83 in.)
	Overall height	with ROPS	3,115 mm (123 in.)
		without ROPS	2,290 mm (90 in.)
	Wheelbase		3,400 mm (134 in.)
	Compaction width		2,100 mm (83 in.)
	Front drum	width × dia. × thickness	550 mm × 1,620 mm × 28 mm (22 in. × 64 in. × 1.1 in.)
	Rear drum	width × dia. × thickness	1,100 mm × 1,620 mm × 28 mm (43 in. × 64 in. × 1.1 in.)
	Ground clearance		340 mm (13 in.)
	Kerb clearance	Right	∞ mm (∞ in.)
		Left	∞ mm (∞ in.)
	Side clearance	Right	0 mm (0 in.)
		Left	0 mm (0 in.)
	Leveling blade width		N/A mm (N/A in.)

Performance	Vibrator system	Front	Centrifugal force	Low amplitude		N/A kN (N/A lbf.)
				High amplitude		N/A kN (N/A lbf.)
			Frequency	Low amplitude		N/A Hz (N/A vpm)
				High amplitude		N/A Hz (N/A vpm)
			Amplitude	Low amplitude		N/A mm (N/A in.)
				High amplitude		N/A mm (N/A in.)
		Rear	Centrifugal force	Low amplitude		N/A kN (N/A lbf.)
				High amplitude		N/A kN (N/A lbf.)
			Frequency	Low amplitude		N/A Hz (N/A vpm)
				High amplitude		N/A Hz (N/A vpm)
			Amplitude	Low amplitude		N/A mm (N/A in.)
				High amplitude		N/A mm (N/A in.)
	Linear pressure	Static linear pressure	Front drum	Operating weight		625 N/cm (355 lbf./in.)
			Rear drum	Operating weight		626 N/cm (355 lbf./in.)
		Dynamic linear pressure	Front drum	Operating weight	Low amplitude	N/A N/cm (N/A lbf./in.)
					High amplitude	N/A N/cm (N/A lbf./in.)
			Rear drum	Operating weight	Low amplitude	N/A N/cm (N/A lbf./in.)
					High amplitude	N/A N/cm (N/A lbf./in.)
	Traveling speed	Number of speed shift				2 speed
		Speed range		1st		0 to 8 km/h (0 to 5.0 mph)
				2nd		0 to 16 km/h (0 to 9.9 mph)
	Gradeability					31 % (17 °)
	Turning radius	Machine clearance radius inside				4.2 m (166 in.)
		Machine clearance radius outside				6.5 m (256 in.)
		Turning radius inside compacted surface				4.2 m (166 in.)
		Turning radius outside compacted surface				6.3 m (249 in.)
	Steering / Oscillating angle					± 36 ° / ± 5.3 °

Engine	Model		KUBOTA V3307-CR-T-EF05 (Diesel, EPA-Tier4)
	Type		4-cycle, water-cooled, 4-cylinder in-line, overhead valve, direct injection type, with turbo charger
	Cylinders - Bore × Stroke		94 mm × 120 mm (3.701 in. × 4.724 in.)
	Displacement		3.331 L (203.3 cu.in.)
	Performance	Rated speed	2,200 min^{-1}
		Rated output	54.6 kW (73 HP)
		Max. torque	261 N·m (193 lbf·ft)
			at 1,500 min^{-1}
		Fuel consumption rate	229 g/kW·h (0.376 lb/HP·h)
			at 2,200 min^{-1}
		Fuel consumption	15 L/h (4.0 gal.)
			with full load
	Fuel system	Fuel	Diesel (ASTM D975-2D)
		Fuel injection pump	High pressure common rail
		Fuel injection time regulator	Electric speed control
	Lubrication system	Lubrication type	Full forced pressure feed
		Oil filter type	Full flow plastic fiber element
		Oil cooler type	Intergrated water cooled
	Air intake system	Air cleaner type	Dry
	Cooling system	Cooling type	Pressurized water forced circulation
		Cooling fan type	Inhale
	Electrical system	Alternator	12 V 90 A
		Starter	12 V 3.0 kW
		Battery	12 V (72 Ah, CCA750) × 1 pc. (12 V)
	Dry weight		311 kg (686 lbs.)
Drive system	Transmission	Type	Hydrostatic
		Speed	2 speed shifts
	Reverser		Switching the direction of flow delivered from the variable pump
	Differential type	Front	N/A
		Rear	N/A
	Final drive	Front	Planetary gear
		Rear	Planetary gear
Vibration system	Power transmission type		N/A
	Vibrator type		N/A
Brake system	Service brake		Dynamic brake through hydrostatic drive system (F-N-R lever)
	Secondary brake (Emergency brake)		Hydrostatic + spring applied hydraulically released type (Brake pedal)
	Parking brake		Spring applied hydraulically released type (Panel button)
Steering system	Power transmission type		Hydraulic
	Steering type		Articulated
Drum and tyres	Use	Front	Steel drum / Drive / 2pcs.
		Rear	Steel drum / Drive / 1pc.
	Suspension type	Front	Rigid
		Rear	Rigid
Sprinkler system	Water spray type		Pressurized
	Liquid spray type		Pressurized
Ballast	Steel		835 kg (1,845 lbs.)
	Water		3,140 kg (6,925 lbs.)
Others	ECO mode		Standard

2. TABLE OF STANDARD VALUES

2-1. Engine

Item		Standard value	Remarks
Engine model		KUBOTA V3307-CR-T-EF05 Diesel Engine with turbocharger	
Rated output		66.5 ± 3 kW (89.2 ± 4 HP)	
Max. no-load rotational speed		2,200 min^{-1}	
Min. no-load rotational speed		900 min^{-1}	
Cylinder head tightening torque		187 to 196 N·m (137.9 to 144.6 lbf·ft)	
Intake manifold tightening torque		18 to 20 N·m (13 to 15 lbf·ft)	
Exhaust manifold tightening torque		30 to 34 N·m (22 to 25 lbf·ft)	
Fan belt tension		10 to 12 mm (0.4 to 0.5 in.)	When midpoint of belt pressed at 98 N (22 lbf)
Valve clearance	Intake	0.13 to 0.17 mm (0.005 to 0.007 in.)	
	Exhaust	0.13 to 0.17 mm (0.005 to 0.007 in.)	
Compression pressure		3.92 MPa (569 psi)	250 min^{-1}

2-2. Propulsion

Item		Standard value	Remarks
Travel speed (Forward/reverse)	1st	0 to 8 km/h (0 to 5.0 mph)	
	2nd	0 to 16 km/h (0 to 9.9 mph)	

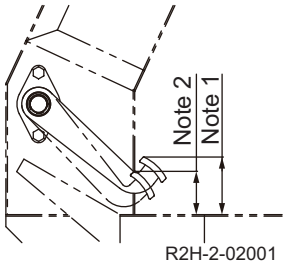
2-3. Hydraulic System

Item			Standard value	Remarks
Propulsion	High pressure relief valve setting		41.8 ± 1.0 MPa (6,061 ± 145 psi)	at 1,800 min^{-1}
	Charge relief valve setting		2.4 ± 0.2 MPa (348 ± 29 psi)	
	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	Front motor	1.3 to 1.7 MPa (189 to 247 psi)	
		Rear motor	1.3 to 1.6 MPa (189 to 232 psi)	
		Rear axle	—	
	Motor drainage	Front motor	4.8 L/min (1.3 gal./min)	
		Rear motor	5.7 L/min (1.5 gal./min)	
Steering oil pressure			17.6 ± 1.0 MPa (2,552 ± 145 psi)	(orbitroll relief pressure + charge relief pressure)

2-4. Steering

Item	Standard value	Remarks
Play in steering wheel	5 to 10 mm (0.2 to 0.4 in.)	Steering wheel circumference
	0.5 mm (0.02 in.) or less	Steering column shaft direction
Steering chain tension	25 to 30 mm (1.0 to 1.2 in.)	When midpoint of chain at 19.6 N (4.4 lbf)

2-5. Brakes

Item	Standard value	Remarks
Clearance between brake pedal and floorboard (as released)	120 mm (4.7 in.) Note 1 : See dimensions	
Clearance between brake pedal and floorboard (when pressed down)	90 mm (3.5 in.) Note 2 : See dimensions	

2-6. Capacities

Item	Standard value	Remarks
Engine oil pan	11 L (2.9 gal.)	
Fuel tank	100 L (26 gal.)	
Coolant	9.0 L (2.4 gal.)	
Gear box (front)	3.2 L × 2 (0.8 gal. × 2)	
Gear box (rear)	3.6 L (1.0 gal.)	
Hydraulic oil tank	85 L (22.5 gal.)	
Water spray tank	680 L (180 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-CJ-4 or JASO DH-2	SAE10W-30	SAE10W-30	SAE10W-30	—
Gear oil	API grade GL5	SAE80W-90	SAE90	SAE140	MIL-L-2105
Hydraulic oil	Wear resisting	ISO-VG32 Over VI 140	ISO-VG46 Over VI 140	ISO-VG68 Over VI 110	ISO-3448
Grease	Lithium type extreme-pressure grease				NLGI-2
Fuel	Diesel oil				ASTM-D975-2D

3-2. Recommended Lubricants

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

4. TIGHTENING TORQUE CHART

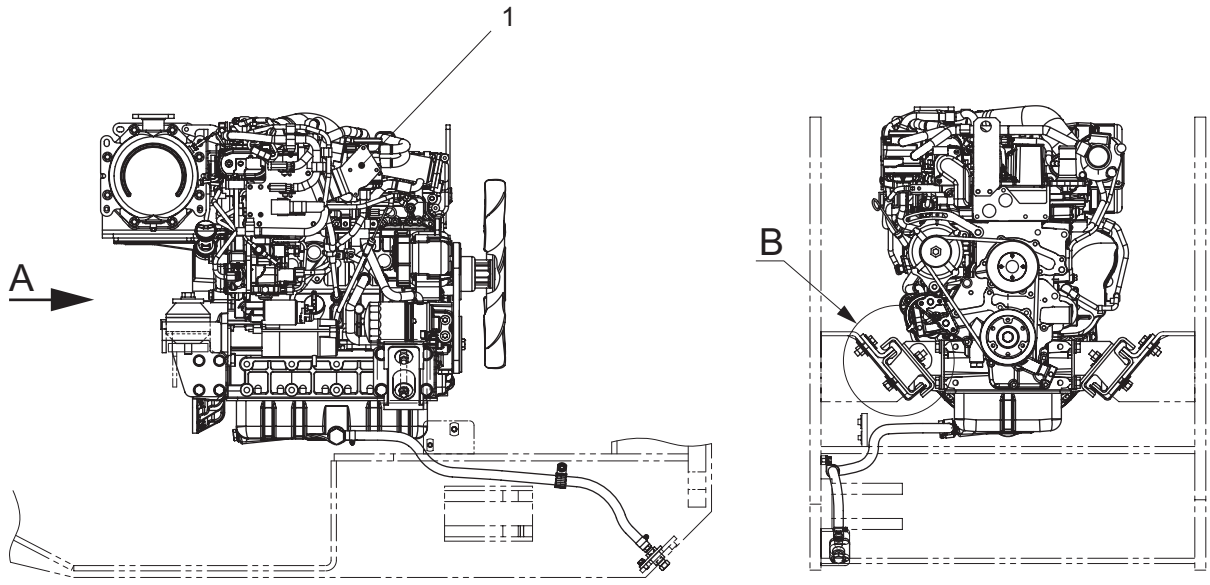
N·m	(lbf·ft)

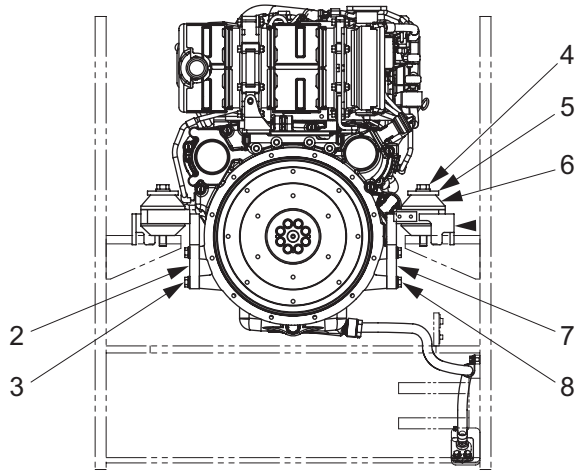
	Nominal Dia.	Pitch	Strength Classification							
			6.8		8.8		10.9		12.9	
Metric coarse screw	5	0.8	4.9	(3.6)	5.9	(4.4)	7.8	(5.8)	7.8	(5.8)
	6	1.0	7.8	(5.8)	9.8	(7.2)	13	(9.6)	13	(9.6)
	8	1.25	17	(13)	23	(17)	31	(23)	31	(23)
	10	1.5	39	(29)	49	(36)	59	(44)	59	(44)
	12	1.75	69	(51)	78	(58)	108	(80)	108	(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

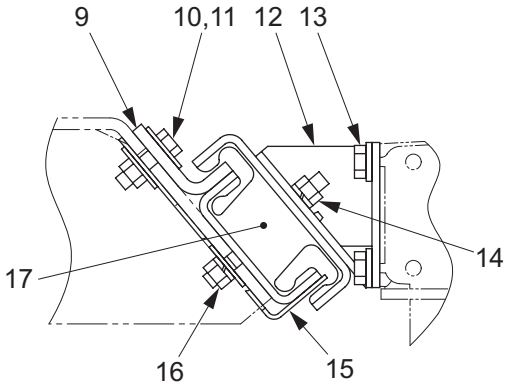
1. ENGINE

1-1. Engine Mount





VIEW A



DETAIL B

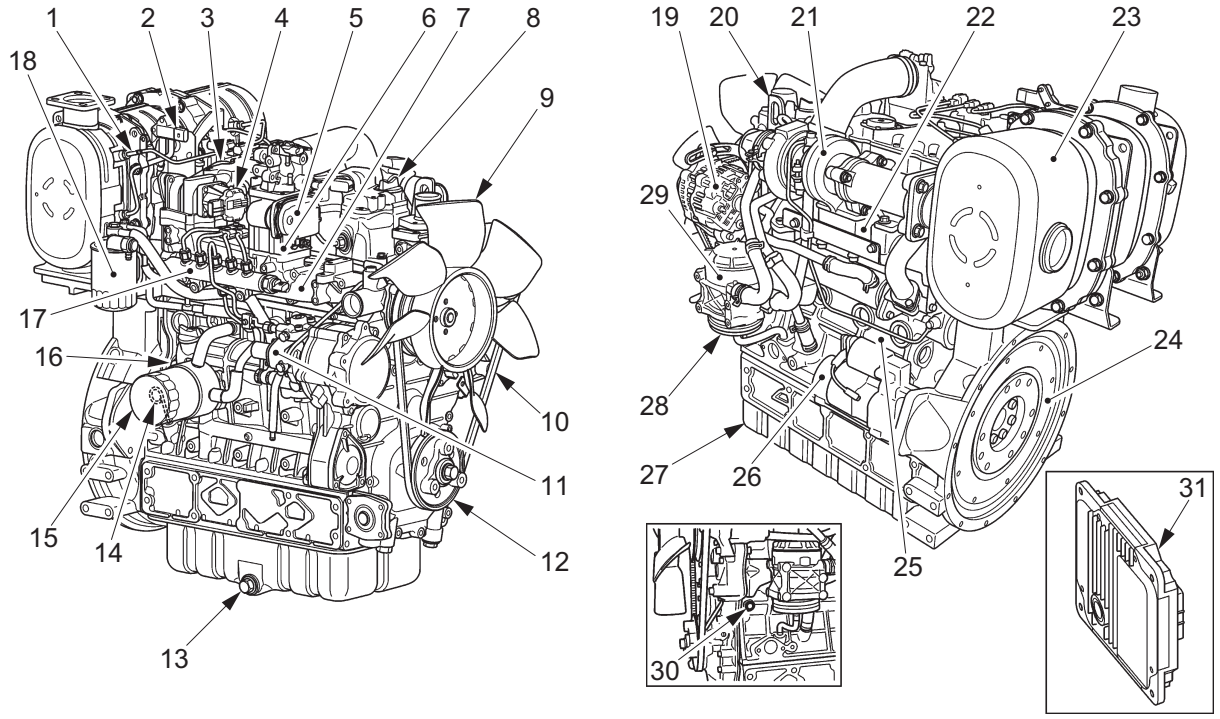
0634-01808-0-11231-B

(1) Engine
(2) Bracket
(3) Bolt : M12× 40 P=1.25
(4) Bolt : M16×130
(5) Plate
(6) Damper
(7) Bracket
(8) Bolt : M12×40 P=1.25
(9) Stopper
(10) Bolt : M12×45
(11) Nut : M12
(12) Bracket
(13) Bolt : M14×30 P=1.5
(14) Nut : M12 P=1.25
(15) Stopper
(16) Nut : M12 P=1.25
(17) Damper

N•m

(3) Bolt M16×130 : 265 N·m (195 lbf·ft)
(7) Bolt M12× 40 P=1.25 : 118 N·m (87 lbf·ft)
(12) Bolt M14× 30 P=1.5 : 186 N·m (137 lbf·ft)
(13) Nut M12 P=1.25 : 88 N·m (65 lbf·ft)
(15) Nut M12 P=1.25 : 88 N·m (65 lbf·ft)

1-2. Engine Exterior



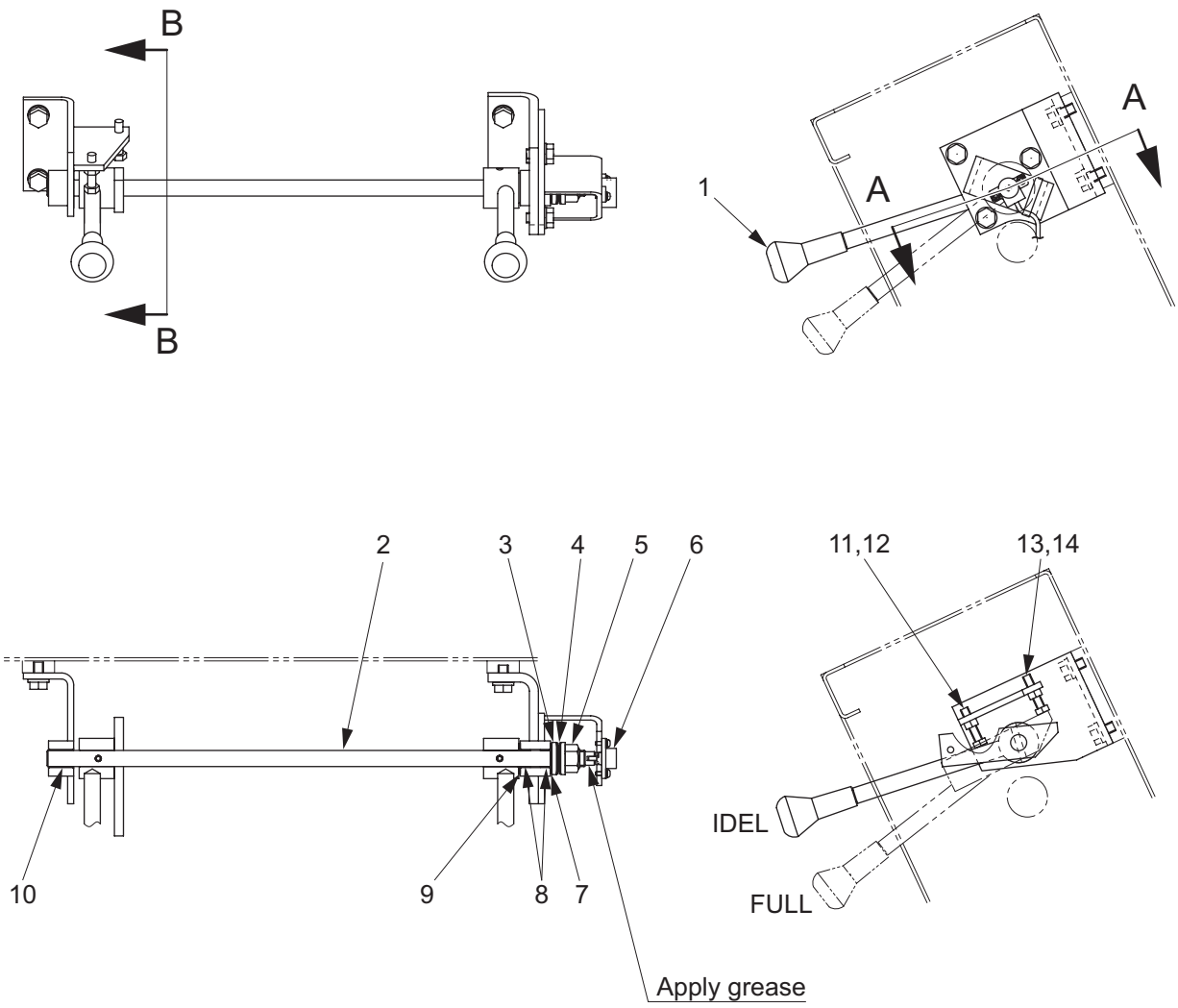
* The actual equipment may differ from that shown above.

TZ703-03003

(1) Temperature sensor
(2) Differential pressure sensor
(3) EGR pipe
(4) EGR valve
(5) Air intake throttle
(6) Air intake heater
(7) Inlet manifold
(8) Oil filler plug
(9) Cooling fan
(10) Fan belt
(11) Feed pump
(12) Fan drive pulley
(13) Oil drain plug
(14) Oil level gauge
(15) Oil filter cartridge
(16) Water drain plug
(17) Rail
(18) Fuel filter cartridge
(19) Alternator
(20) Steel lifting bracket
(21) Turbocharger
(22) Exhaust manifold
(23) DPF
(24) Flywheel
(25) EGR cooler
(26) Starter motor
(27) Oil pan
(28) PCV valve
(29) Oil separator
(30) Oil switch
(31) ECU

2. CONTROL SYSTEMS

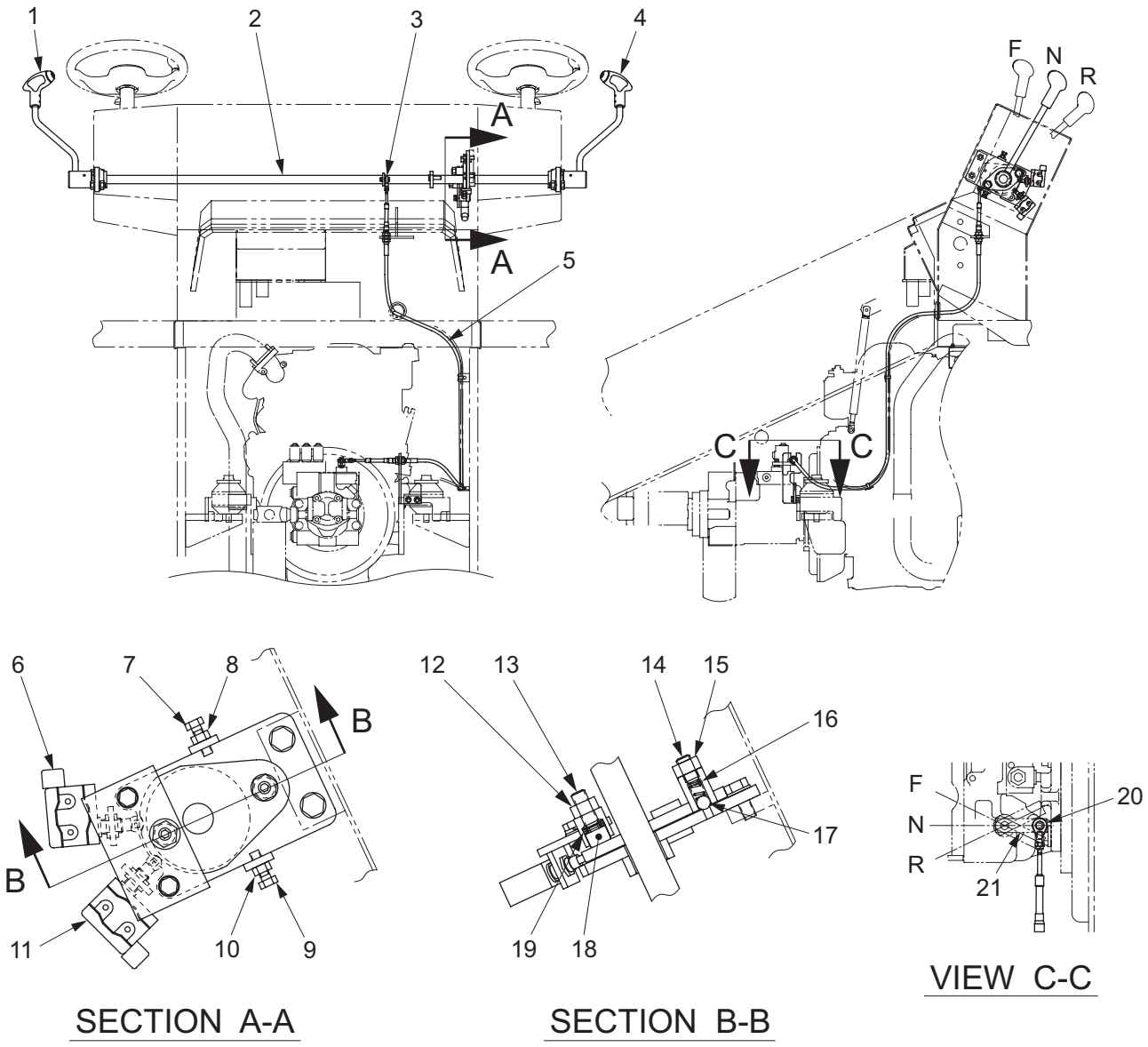
2-1. Throttle Control



0634-12810-0-11239-A

(1) Throttle lever
(2) Shaft
(3) Washer
(4) Coned disc spring (Do not apply grease)
(5) Nut : M16
(6) Potentiometer
(7) Washer (Apply grease)
(8) Bush (Apply grease)
(9) Washer (Apply grease)
(10) Bush (Apply grease)
(11) Lock nut : M8
(12) Stopper bolt (IDLE) : M8×60
(13) Lock nut : M8
(14) Stopper bolt (FULL) : M8×60

2-2. Forward-reverse Control

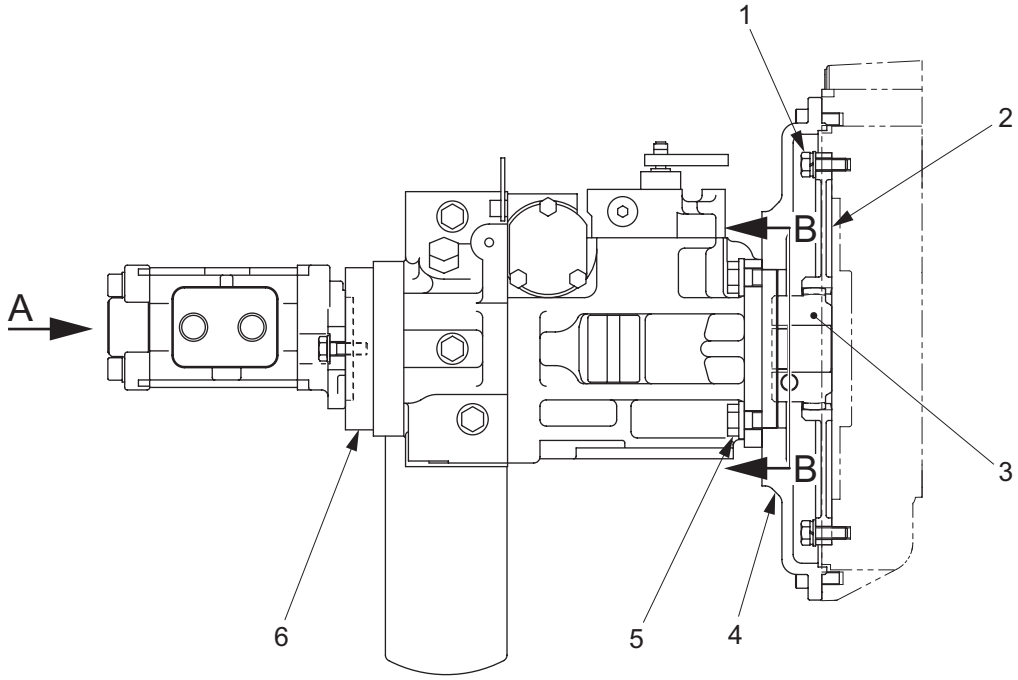


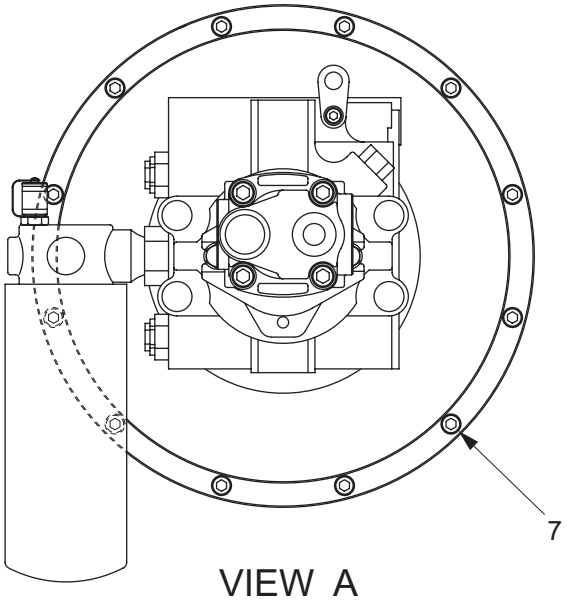
0634-12809-0-11084-C

(1)	F-R lever (right)	(8)	Lock nut : M8	(15)	Lock nut : M12
(2)	Shaft	(9)	Stopper bolt (forward) : M8×25	(16)	Spring (Fill grease)
(3)	Rod end	(10)	Lock nut : M8	(17)	Steel ball
(4)	F-R lever (left)	(11)	Backup buzzer switch	(18)	Holder
(5)	Control cable	(12)	Lock nut : M12	(19)	Coned disc spring (Apply grease)
(6)	F-R lever switch	(13)	Set screw : M12×30	(20)	Rod end
(7)	Stopper bolt (reverse) : M8×25	(14)	Set screw : M12×30	(21)	Pump lever

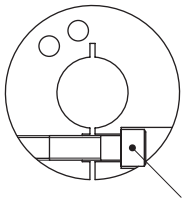
3. PUMP MOUNT

3-1. Pump Mount





VIEW A



SECTION B-B

0634-36815-0-11241-B

(1) Bolt : M10×30 P=1.25
(2) Flange
(3) Hub
(4) Housing
(5) Bolt : M14×40
(6) Pump
(7) Bolt : M10×25 P=1.25
(8) Bolt : M12×35

N•m

(1) Bolt M10×30 P=1.25 : 49 N·m (36 lbf·ft)
(5) Bolt M14×40 : 167 N·m (123 lbf·ft)
(7) Bolt M10×25 P=1.25 : 69 N·m (51 lbf·ft)
(8) Bolt M12×35 : 86 N·m (63 lbf·ft)

3-1-1. Installation of pump

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

① Apply adequate amount of lithium-based grease to pump (6) and hub (3) splines.
② Attach hub (3) to pump (6) aligning it with end surface of pump shaft.
③ Secure hub (3) with bolt (8).

N•m (8) Bolt M12×35 : 86 N·m (63 lbf·ft)

④ Secure flange (2) to engine flywheel with eight bolts (1) and spring washers and washers.

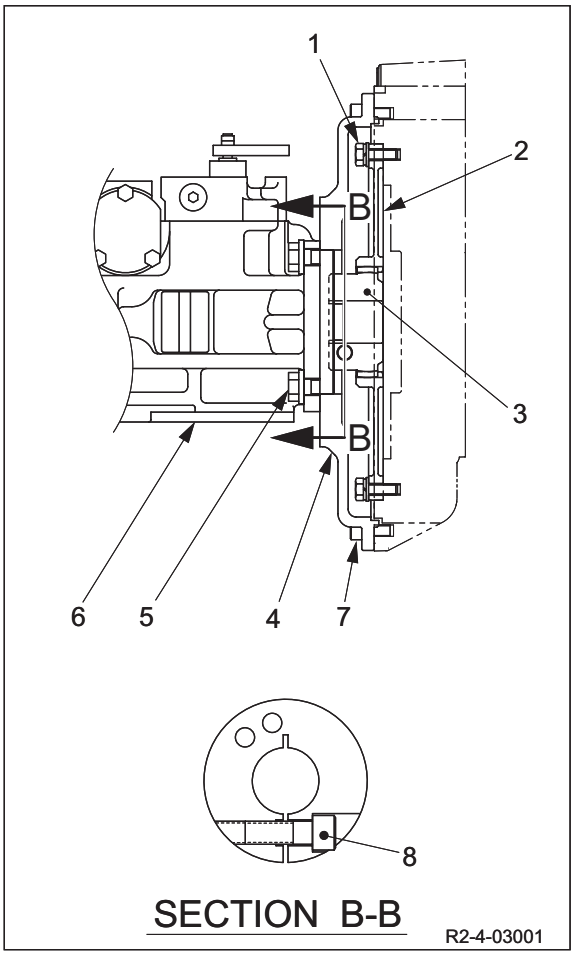
N•m (1) Bolt M10×30 P=1.25 : 49 N·m (36 lbf·ft)

⑤ Secure housing (4) to engine flywheel housing with twelve bolts (7).

N•m (7) Bolt M10×25 P=1.25 : 69 N·m (51 lbf·ft)

⑥ Engage hub (3) with flange (2).
⑦ Secure pump (6) to housing (4) with four bolts (5) and washers.

N•m (5) Bolt M14×40 : 167 N·m (123 lbf·ft)



(NOTICE)

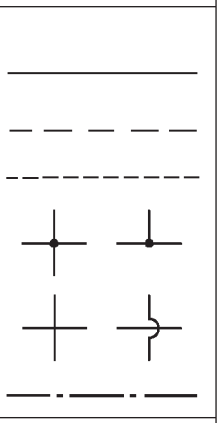
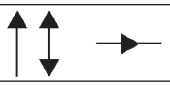
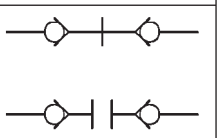
- **Bolt (1) is treated with thread-locking fluid. Use new thread-locking fluid treated bolt for installation.**

HYDRAULIC SYSTEMS

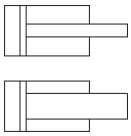
1. SYSTEM CIRCUIT DIAGRAM

1-1. Graphic Symbols for Hydraulic Circuits

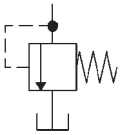
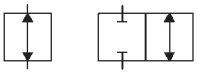
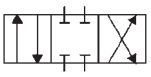
Basic Symbols

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.	

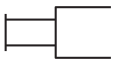
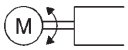
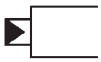
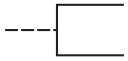
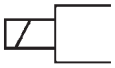
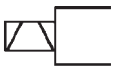
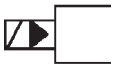
Pump, Motors and Cylinders

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	

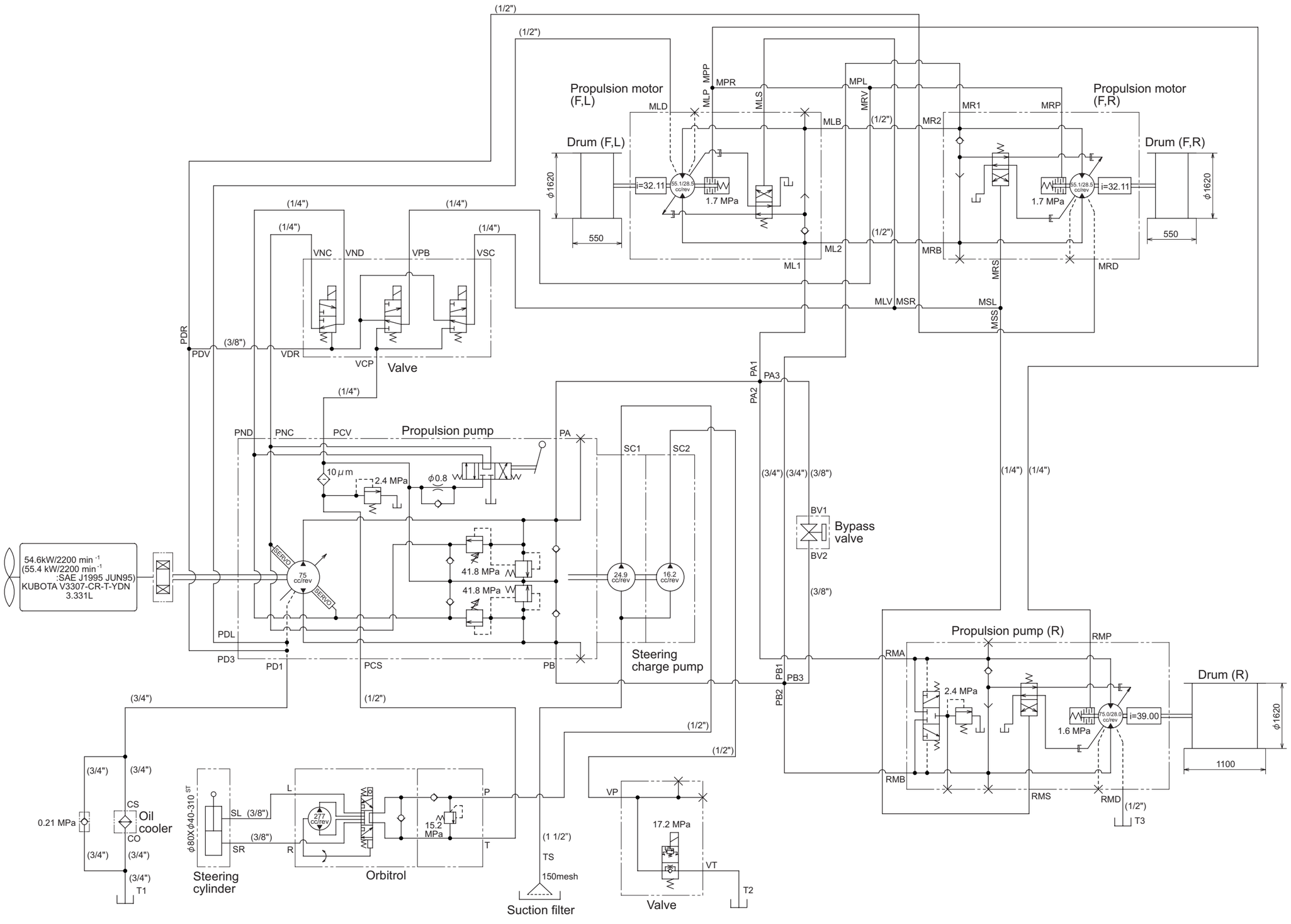
Valves

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

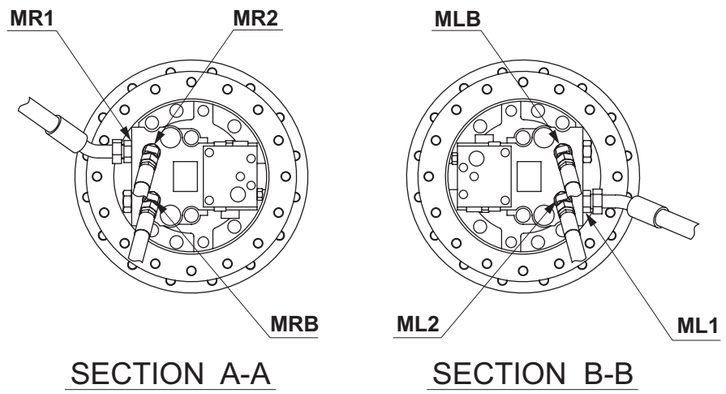


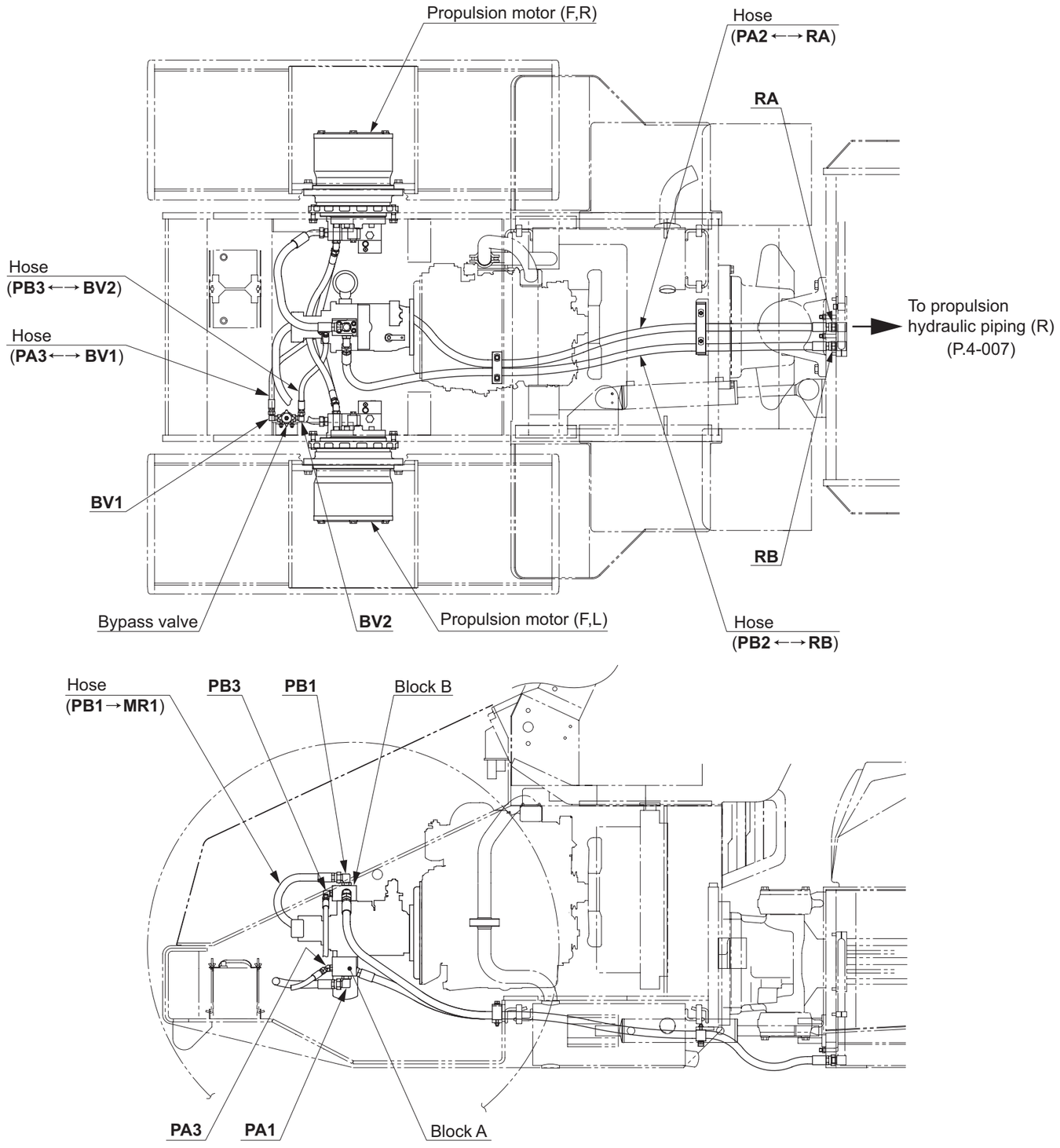
0634-99371-0-11505-0

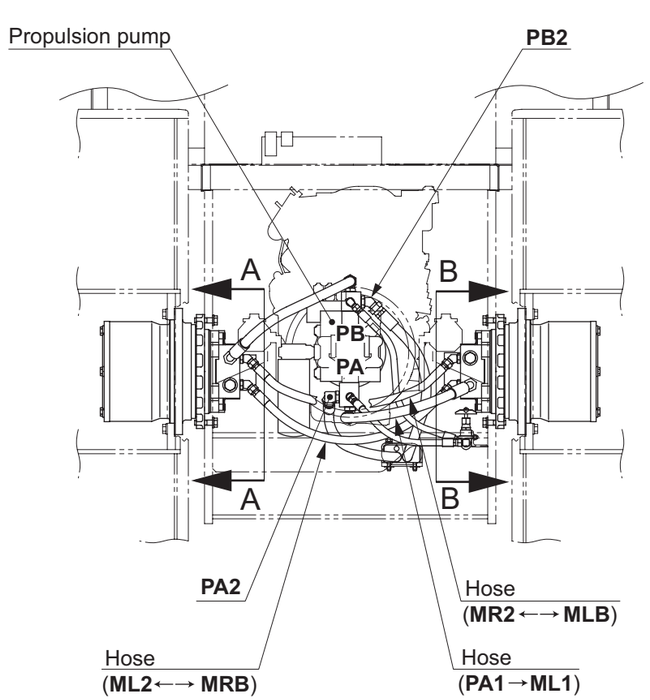
2. PROPULSION HYDRAULIC SYSTEM

2-1. Propulsion Hydraulic Piping

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

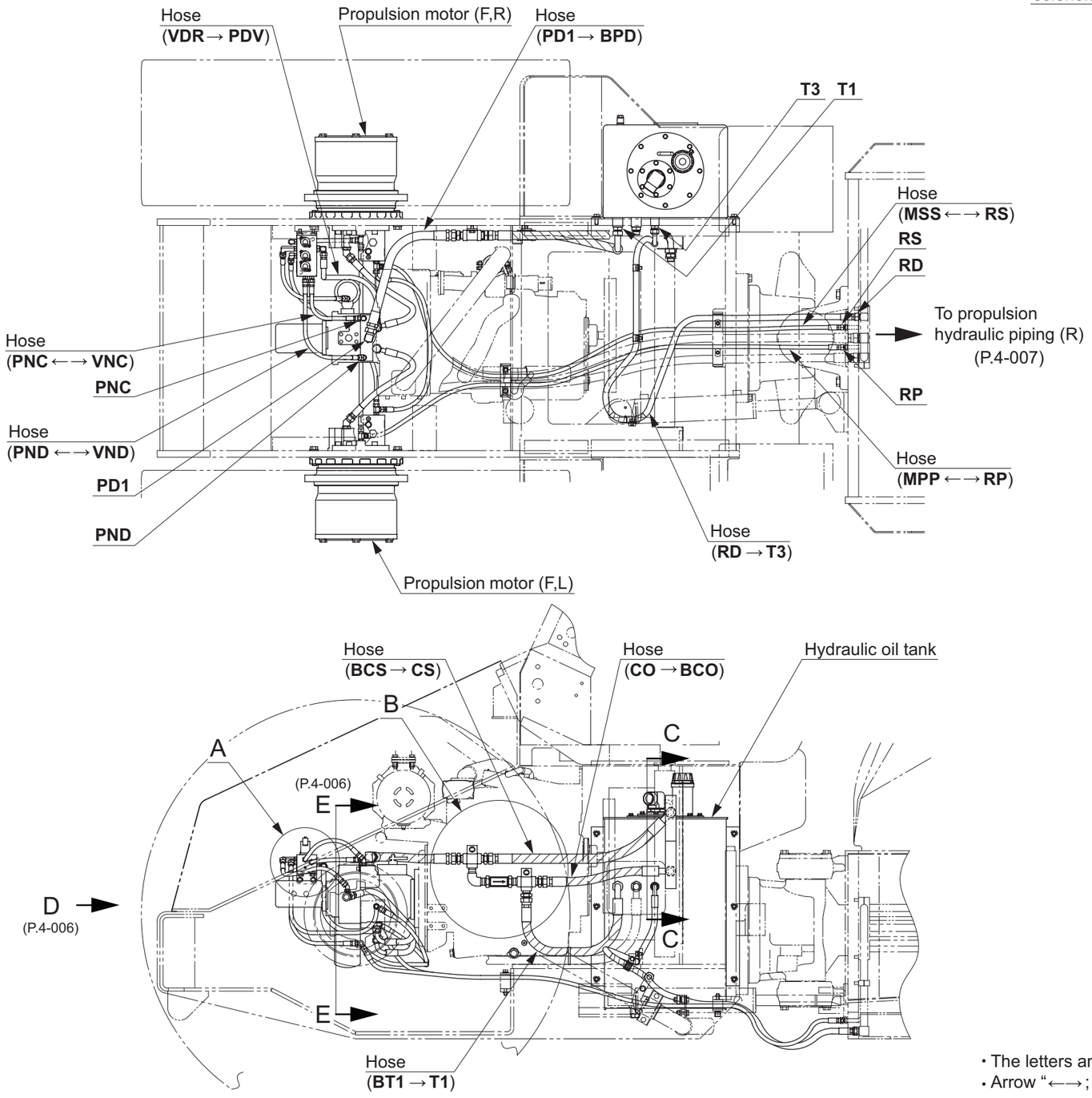


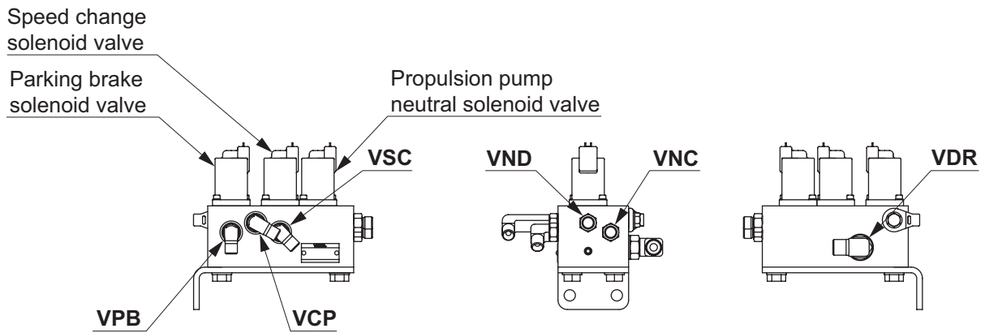




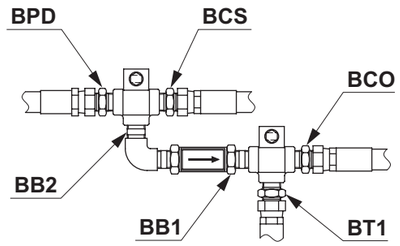
- The letters and numbers in the figure such as “PB1” and “MR1” show each port.
- Arrow “ ⟷ ; → ” symbols show the hose connection and the direction of the flow of the oil.

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

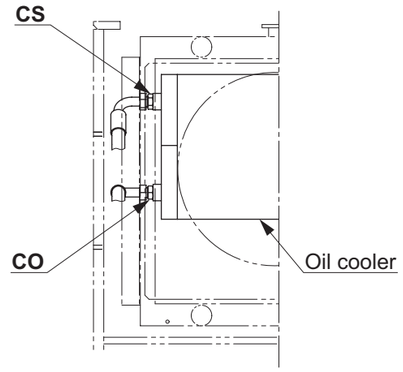




DETAIL A



DETAIL B

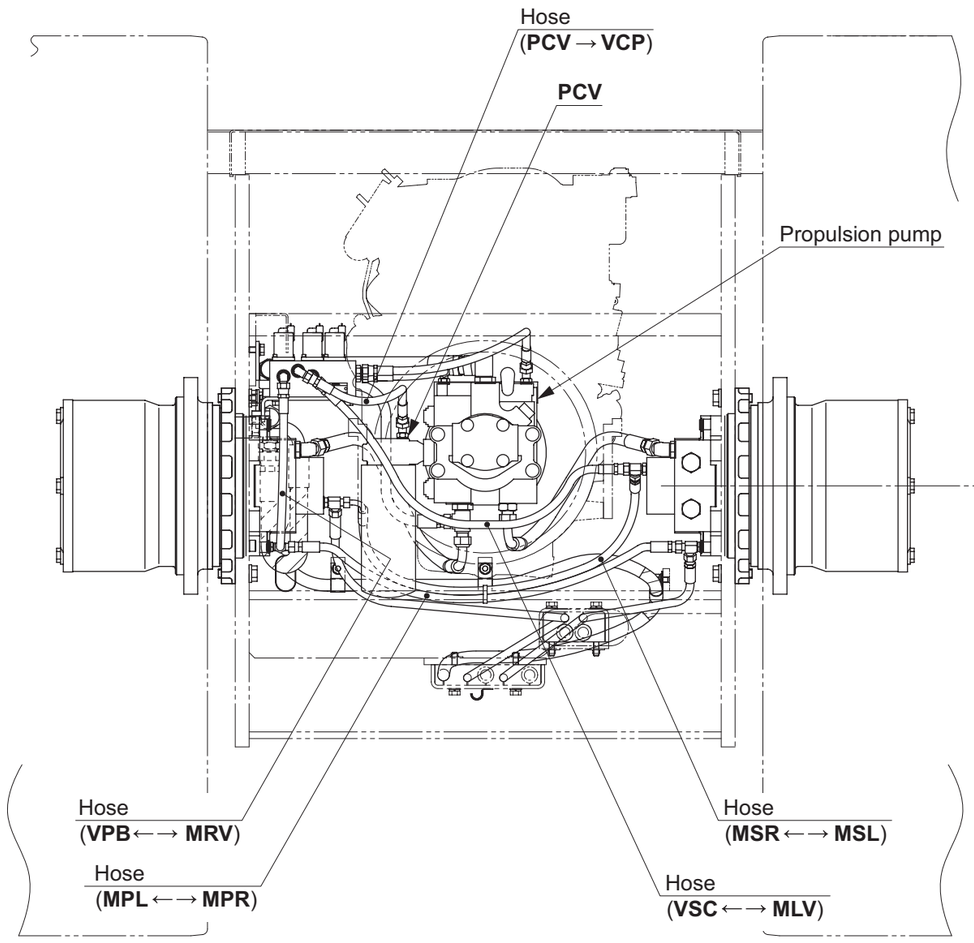


SECTION C-C

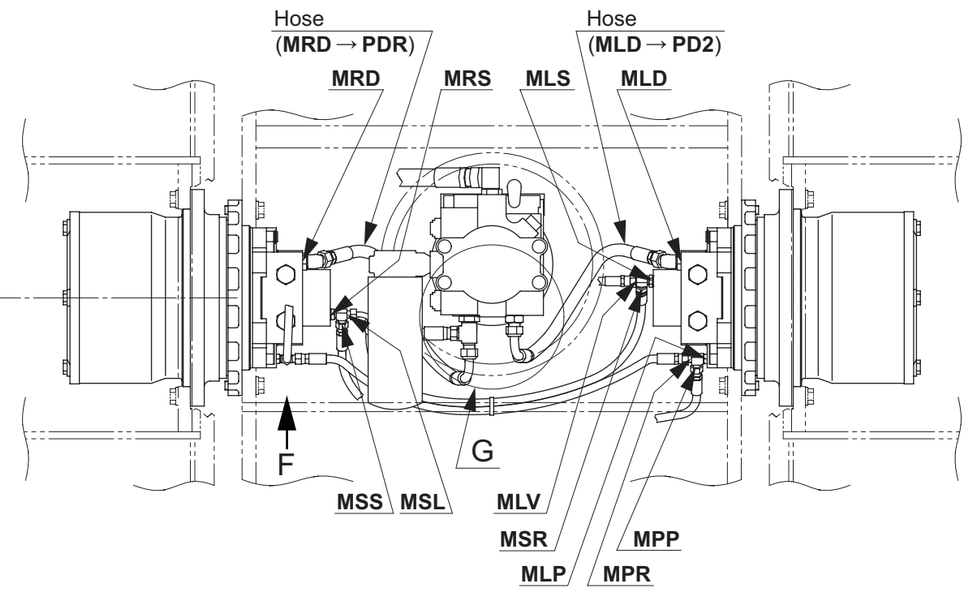
• The letters and numbers in the figure such as “BT1” and “T1” show each port.
• Arrow “←→; →” symbols show the hose connection and the direction of the flow of the oil.

0634-36816-0-11242-C

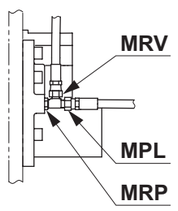
2-1-3. Propulsion hydraulic piping (3)



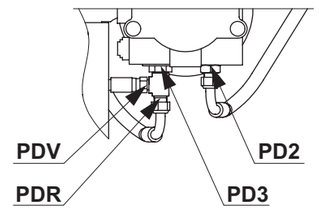
VIEW D



SECTION E-E



VIEW F

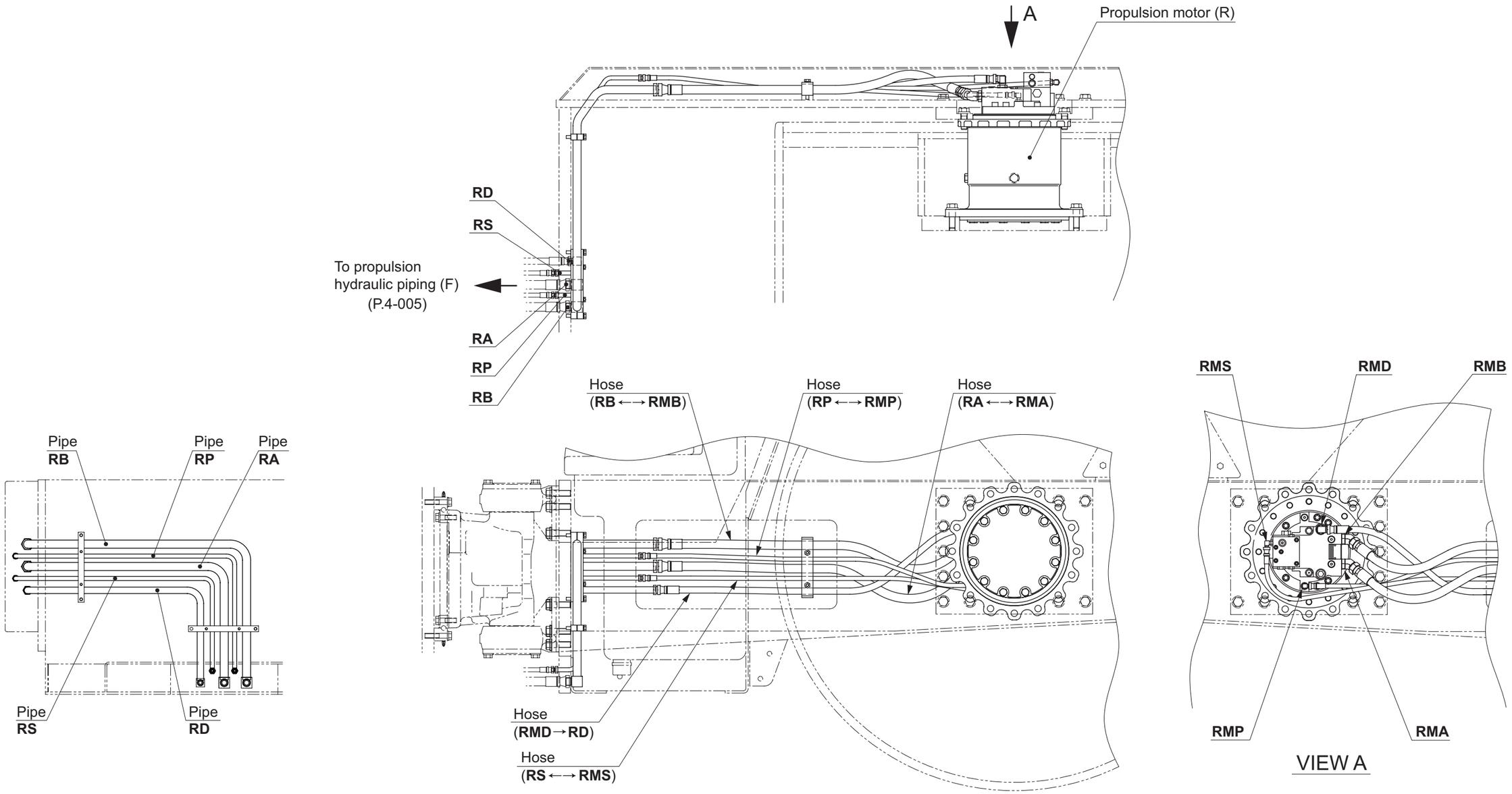


DETAIL G

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

0634-36816-0-11242-C

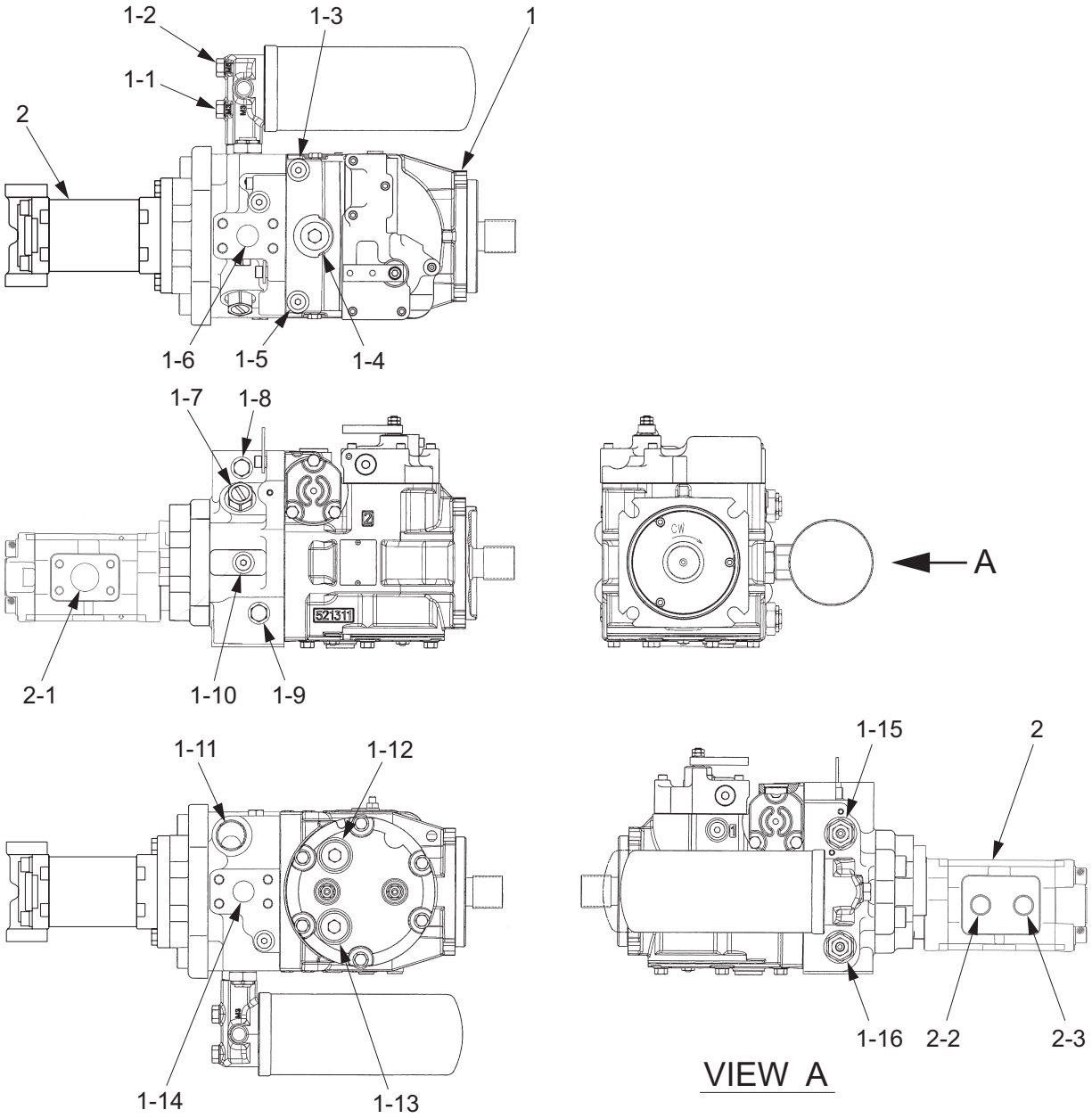
2-1-4. Propulsion hydraulic piping (R)

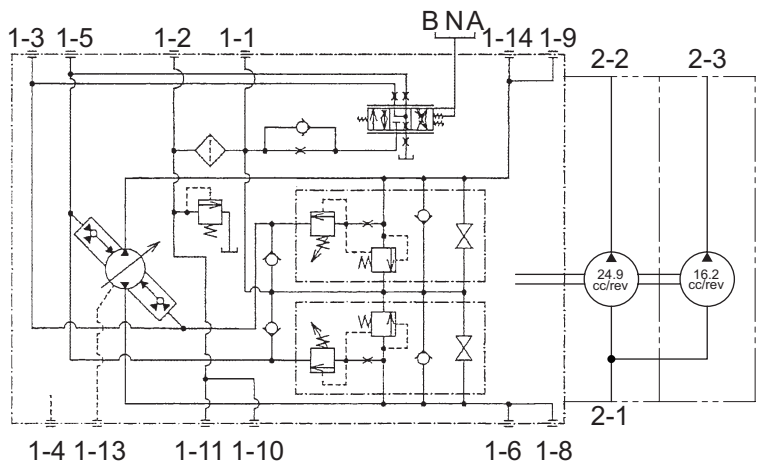


• The letters and numbers in the figure such as “RMB” and “RB” show each port.
• Arrow “ ⟷ ; → ” symbols show the hose connection and the direction of the flow of the oil.

2-2. Hydraulic Component Specifications

2-2-1. Hydraulic pump assembly (propulsion + steering · charge)





Pump circuit diagram

R2-4-04001

(1) Propulsion pump

(1-1)	Charge pressure gauge port (After oil filter)	**[PCV]**	: 9/16-18UNF
(1-2)	Charge pressure gauge port (Before oil filter)		: 9/16-18UNF
(1-3)	Servo pressure gauge port	**[PNC]**	: 9/16-18UNF
(1-4)	Drain port	**[PD1]**	: 1 1/16-12UN
(1-5)	Servo pressure gauge port	**[PND]**	: 9/16-18UNF
(1-6)	Port B (Reverse)	**[PB]**	: SAE 1″
(1-7)	Charge relief valve		
(1-8)	High pressure gauge port (For Port B)		: 9/16-18UNF
(1-9)	High pressure gauge port (For Port A)		: 9/16-18UNF
(1-10)	Charge pressure gauge port		: 9/16-18UNF
(1-11)	Charge supply port	**[PCS]**	: 1 5/16-12UN
(1-12)	Drain port	**[PD3]**	: 1 1/16-12UN
(1-13)	Drain port	**[PD2]**	: 1 1/16-12UN
(1-14)	Port A (Forward)	**[PA]**	: SAE 1″
(1-15)	Multi function valve (Port B)		
(1-16)	Multi function valve (Port A)		

Specifications

- Displacement : 75 cm^3/rev (4.58 cu.in./rev)
- Pressure limit pressure setting : 41.8 MPa (6,061 psi) (at 1,800 min^{-1})
- Charge relief valve pressure setting : 2.4 MPa (348 psi) (at 1,800 min^{-1})

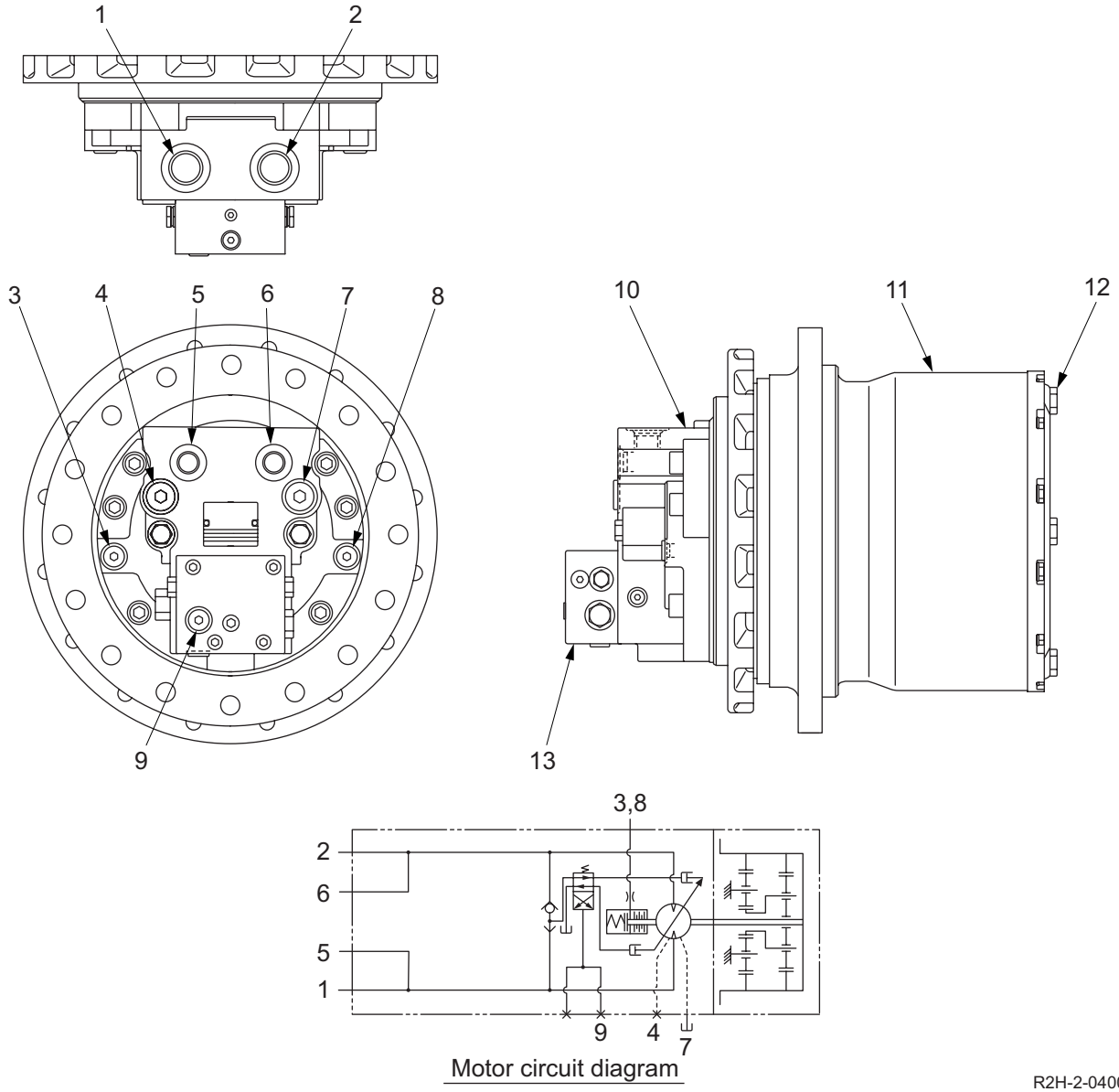
(2) Steering • Charge pump

(2-1)	Discharge port	**[SCS]**	: ϕ 32
(2-2)	Suction port	**[SC1]**	: G1/2
(2-3)	Suction port	**[SC2]**	: G1/2

Specifications

- Displacement (No. 1 pump) : 24.9 cm^3/rev (1.52 cu.in./rev)
  (No. 2 pump) : 16.2 cm^3/rev (0.99 cu.in./rev)
- Allowable pump case pressure : 0.3 MPa (44 psi) or less
- Pump assembly weight : 61.5 kg (136 lbs.)

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



Motor circuit diagram

R2H-2-04002

(1)	Port B1		: G3/4	(8)	Parking brake pilot port	**[MLP]**	: G1/4
(2)	Port A1	**[ML1] [MR1]**	: G3/4	(9)	Speed change port	**[MLS] [MRS]**	: 9/16-18UNF
(3)	Parking brake pilot port	**[MRP]**	: G1/4	(10)	Motor		
(4)	Drain port	**[MLD]**	: G1/2	(11)	Reduction gear		
(5)	Port B2	**[MLB] [MRB]**	: G1/2	(12)	Filler cap		: PF 3/8
(6)	Port A2	**[ML2] [MR2]**	: G1/2	(13)	Shift valve assembly		
(7)	Drain port	**[MRD]**	: G1/2				

Motor specifications

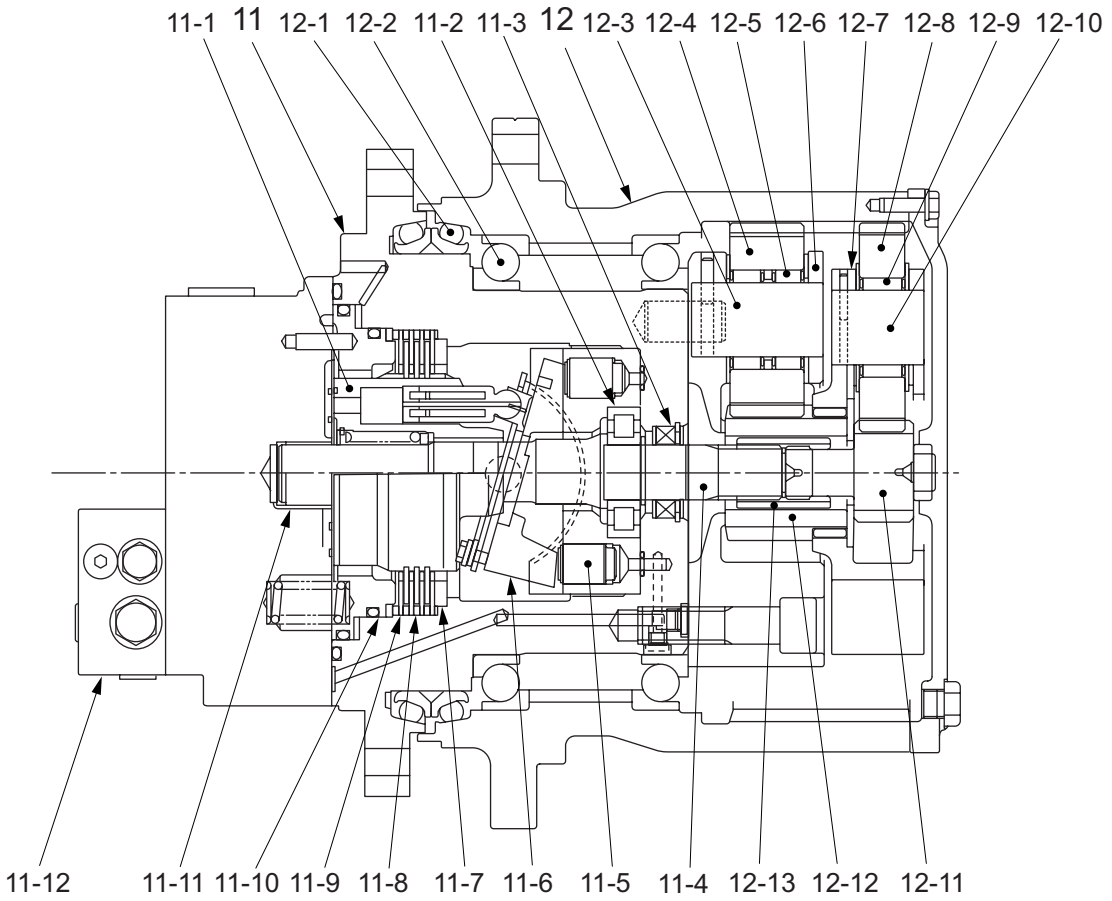
- Displacement (max.) : 55.1 cm^3/rev (3.36 cu.in./rev)
  (min.) : 28.5 cm^3/rev (1.74 cu.in./rev)
- Brake release pressure : 1.3 to 1.7 MPa (189 to 247 psi)
- Allowable motor case pressure : 0.3 MPa (44 psi) or less

Reduction gear specifications

- Reduction ratio : 1:32.11

- Weight : 162 kg (357 lbs.)

1) Internal structure of propulsion hydraulic motor (F)

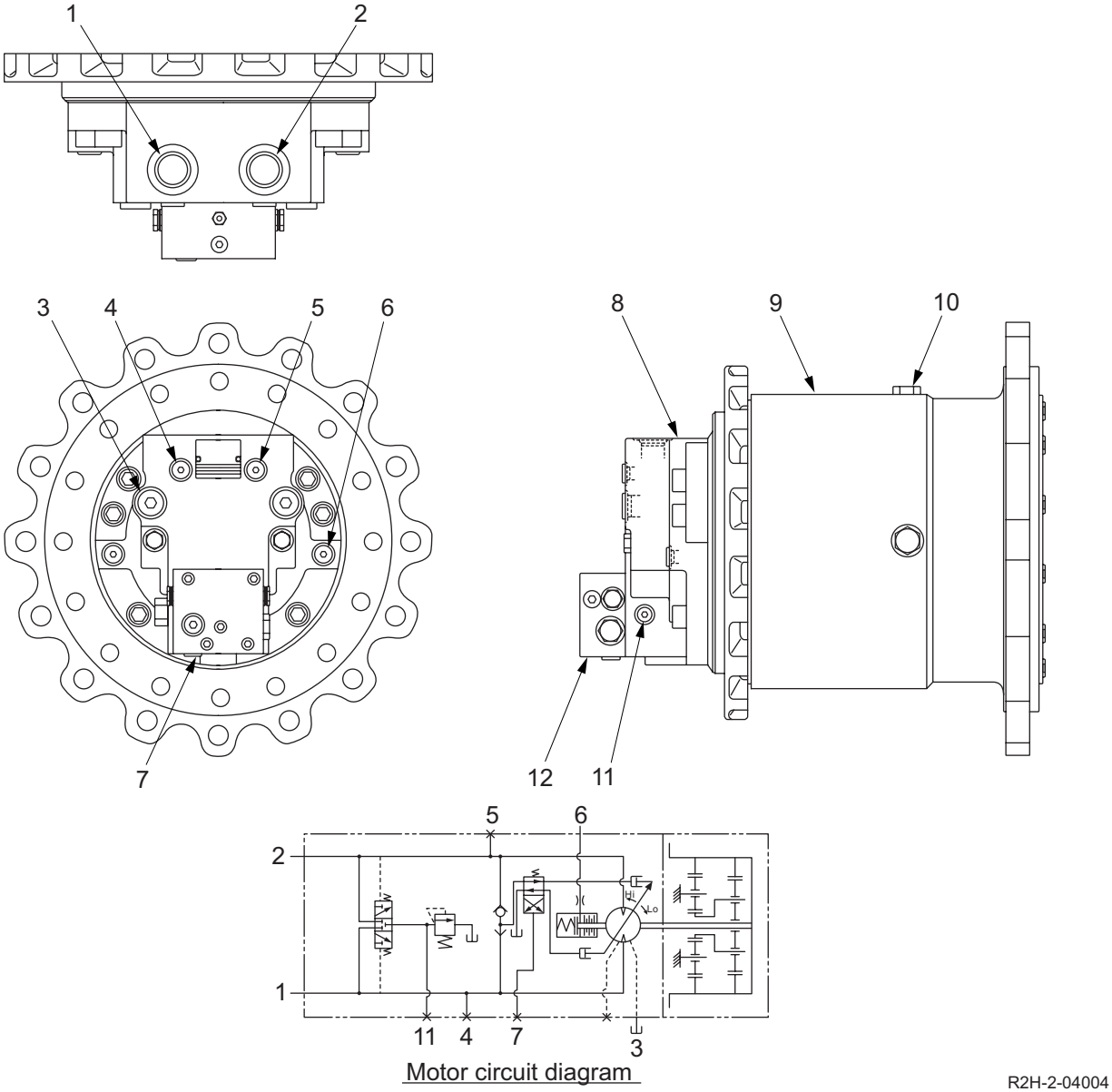


R2H-2-04003

(11) Motor
- (11-1) Cylinder block kit
- (11-2) Roller bearing
- (11-3) Oil seal
- (11-4) Shaft
- (11-5) Control piston
- (11-6) Swash plate assembly
- (11-7) Brake stopper
- (11-8) Friction plate
- (11-9) Separate plate
- (11-10) Piston brake
- (11-11) Journal bearing
- (11-12) Shift valve assembly

(12) Reduction gear
- (12-1) Floating seal kit
- (12-2) Angular bearing
- (12-3) Shaft B
- (12-4) Planetary gear B
- (12-5) Needle roller
- (12-6) Carrier B
- (12-7) Carrier A
- (12-8) Planetary gear A
- (12-9) Needle roller
- (12-10) Shaft A
- (12-11) Sun gear A
- (12-12) Sun gear B
- (12-13) Coupling

2-2-3. Propulsion hydraulic motor (R)



Motor circuit diagram

R2H-2-04004

(1) Port B (Reverse)	**[RMB]** : G3/4	(7) Speed change port	**[RMS]** : G1/4
(2) Port A (Forward)	**[RMA]** : G3/4	(8) Motor	
(3) Drain port	**[RMD]** : G1/2	(9) Reduction gear	
(4) High pressure gauge port (For port B)	: G1/4	(10) Filler cap	: 7/8-14UNF
(5) High pressure gauge port (For port A)	: G1/4	(11) Charge pressure gauge port	: G1/8
(6) Parking brake pilot port	**[RMP]** : G1/4	(12) Shift valve assembly	

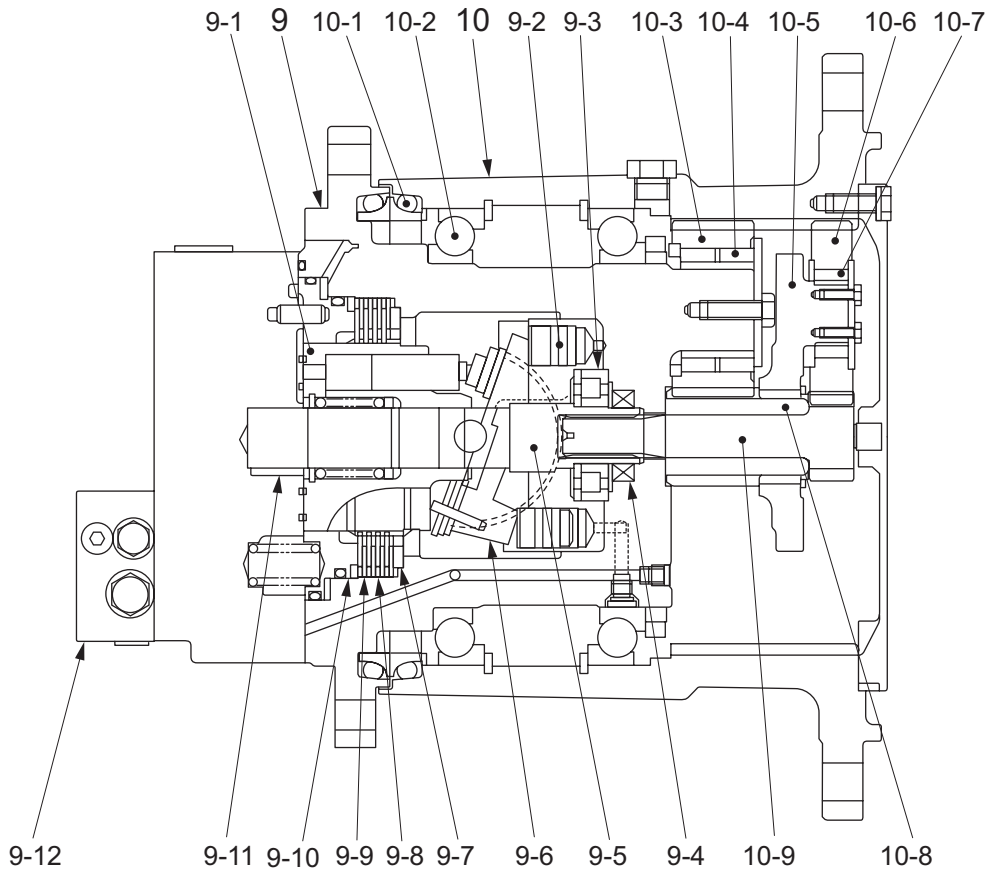
Motor specifications

- Displacement (max.) : 75.0 cm^3/rev (4.58 cu.in./rev)
  (min.) : 28.0 cm^3/rev (1.71 cu.in./rev)
- Charge relief valve pressure setting : 2.4 MPa (348 psi)
- Brake release pressure : 1.3 to 1.7 MPa (189 to 247 psi)
- Allowable motor case pressure : 0.3 MPa (44 psi) or less

Reduction gear specifications

- Reduction ratio : 1:39.000
- Weight : 193 kg (425 lbs.)

1) Internal structure of propulsion hydraulic motor (R)

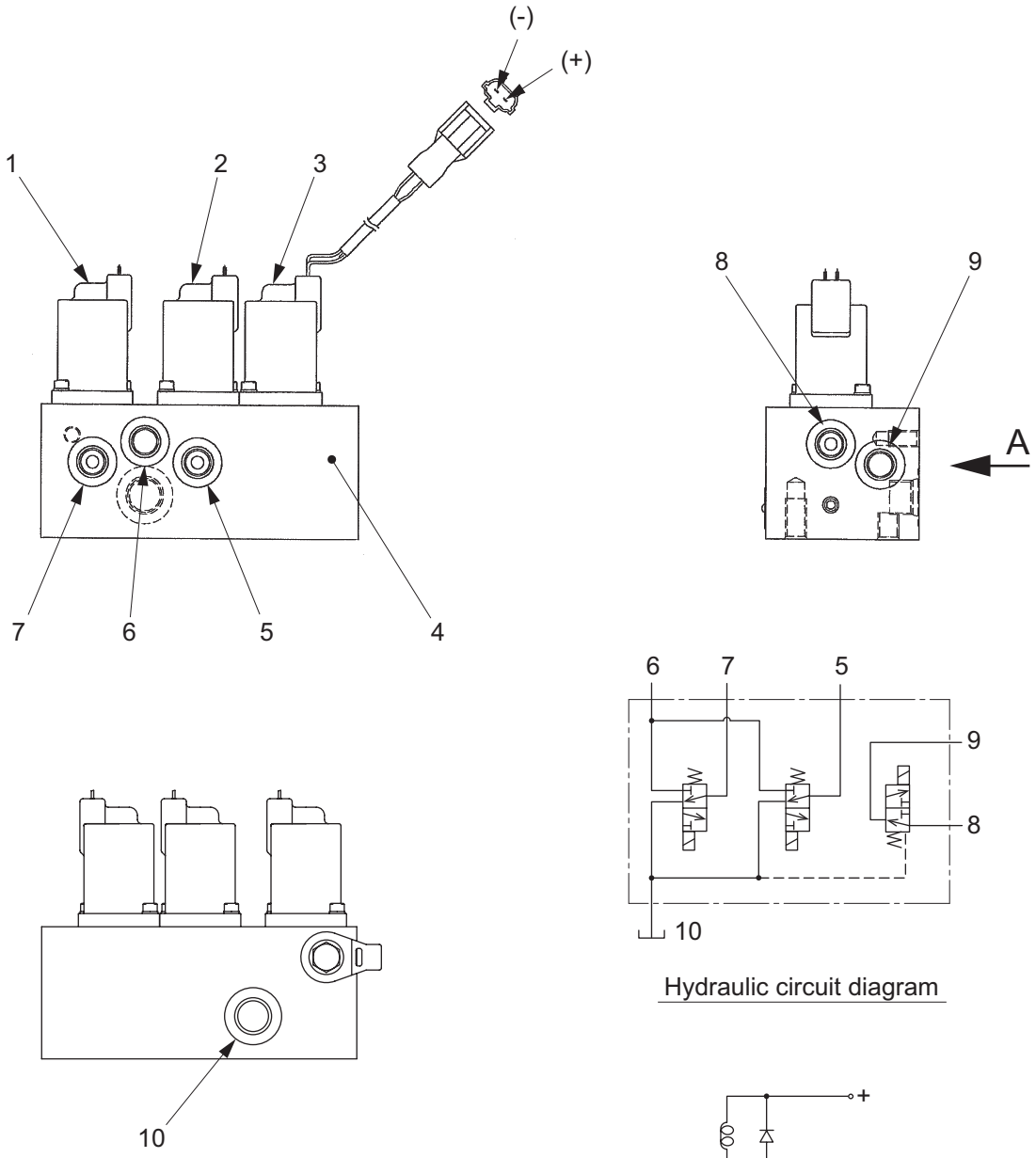


R2H-2-04005

(9) Motor
- (9-1) Cylinder block kit
- (9-2) Control piston
- (9-3) Bearing
- (9-4) Oil seal
- (9-5) Shaft
- (9-6) Swash plate assembly
- (9-7) Brake stopper
- (9-8) Friction plate
- (9-9) Separate plate
- (9-10) Piston brake
- (9-11) Journal bearing
- (9-12) Shift valve assembly

(10) Reduction gear
- (10-1) Floating seal kit
- (10-2) Angular bearing
- (10-3) Planetary gear 2nd
- (10-4) Needle roller
- (10-5) Carrier
- (10-6) Planetary gear 1st
- (10-7) Needle roller
- (10-8) Sun gear 2nd
- (10-9) Sun gear 1st

2-2-4. Valve

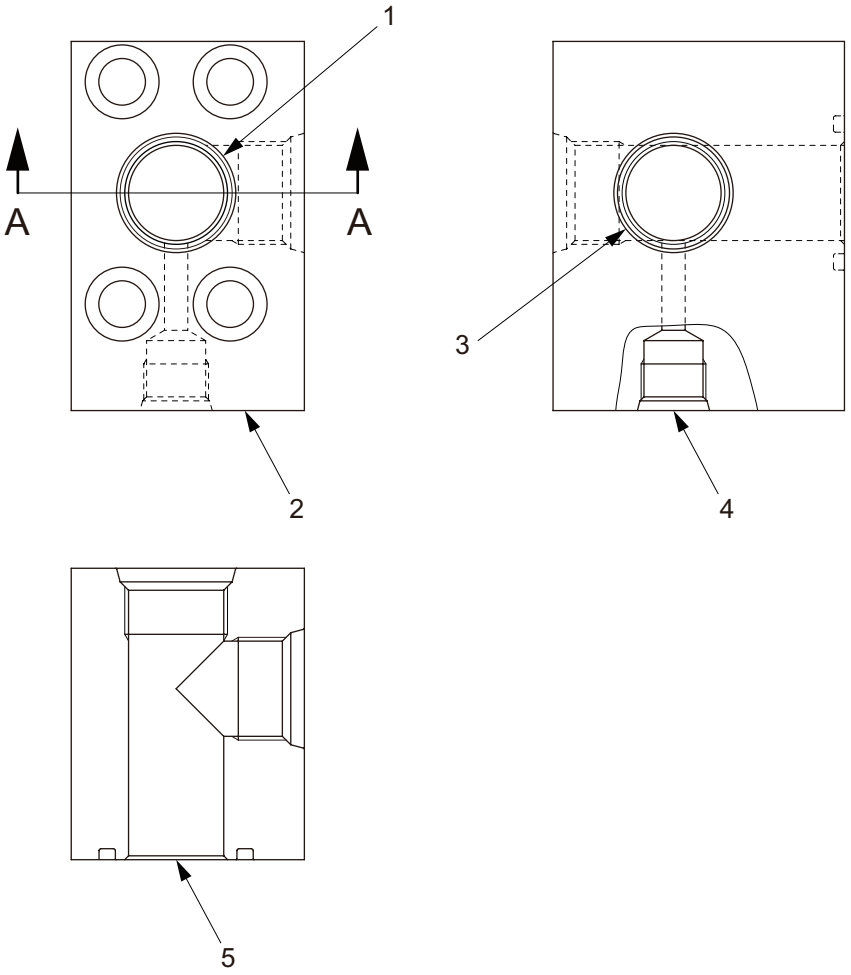


R2-4-04004

(1) Parking brake solenoid valve
(2) Speed change solenoid valve
(3) Propulsion pump neutral solenoid valve
(4) Block
(5) Port B **[VSC]** : G1/4
(6) Port P **[VCP]** : G1/4
(7) Port A **[VPB]** : G1/4
(8) Port D **[VND]** : G1/4
(9) Port C **[VNC]** : G1/4
(10) Port T **[VDR]** : G3/8

Specifications
- Maximum flow : 10 L/min (2.6 gal./min)
- Rated pressure : 3.5 MPa (506 psi)
- Weight : 7.1 kg (15.7 lbs.)

2-2-5. Block A

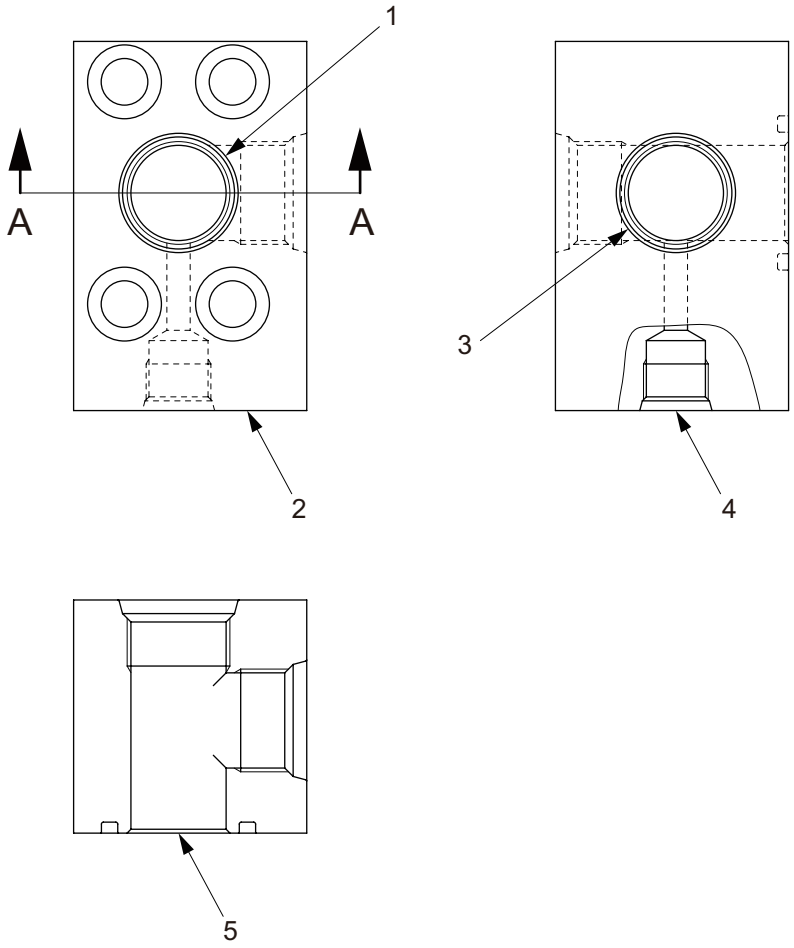


SECTION A-A

R2-4-04005

(1) To propulsion motor (F,L) port A1 **[PA1]** : G3/4
(2) Body
(3) To pipe **[PA2]** : G3/4
(4) To bypass valve **[PA3]** : G3/8
(5) From propulsion pump port A : ϕ 24.5

2-2-6. Block B



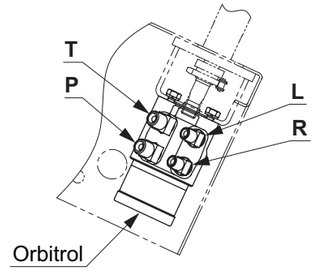
SECTION A-A

R2-4-04006

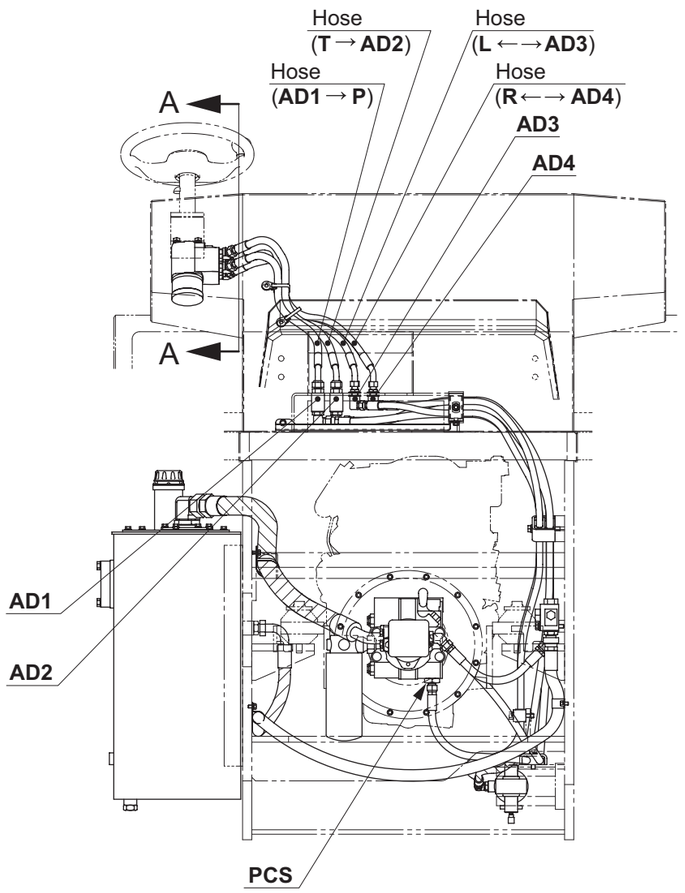
(1) To propulsion motor (F,R) port A1 **[PB1]** : G3/4
(2) Body
(3) To pipe **[PB2]** : G3/4
(4) To bypass valve **[PB3]** : G3/8
(5) From propulsion pump port B : ϕ 24.5

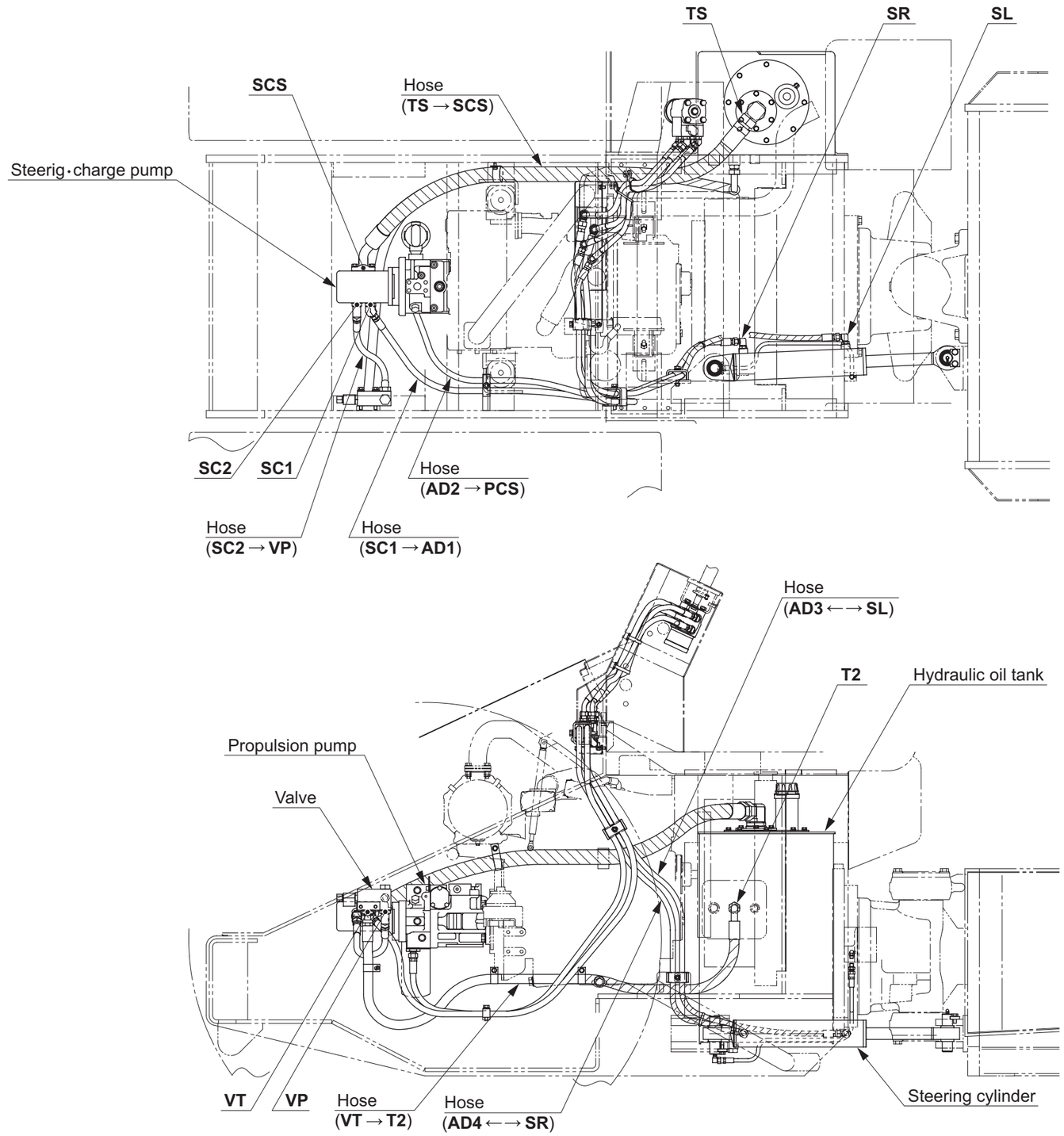
3. STEERING SYSTEM

3-1. Steering Hydraulic Piping



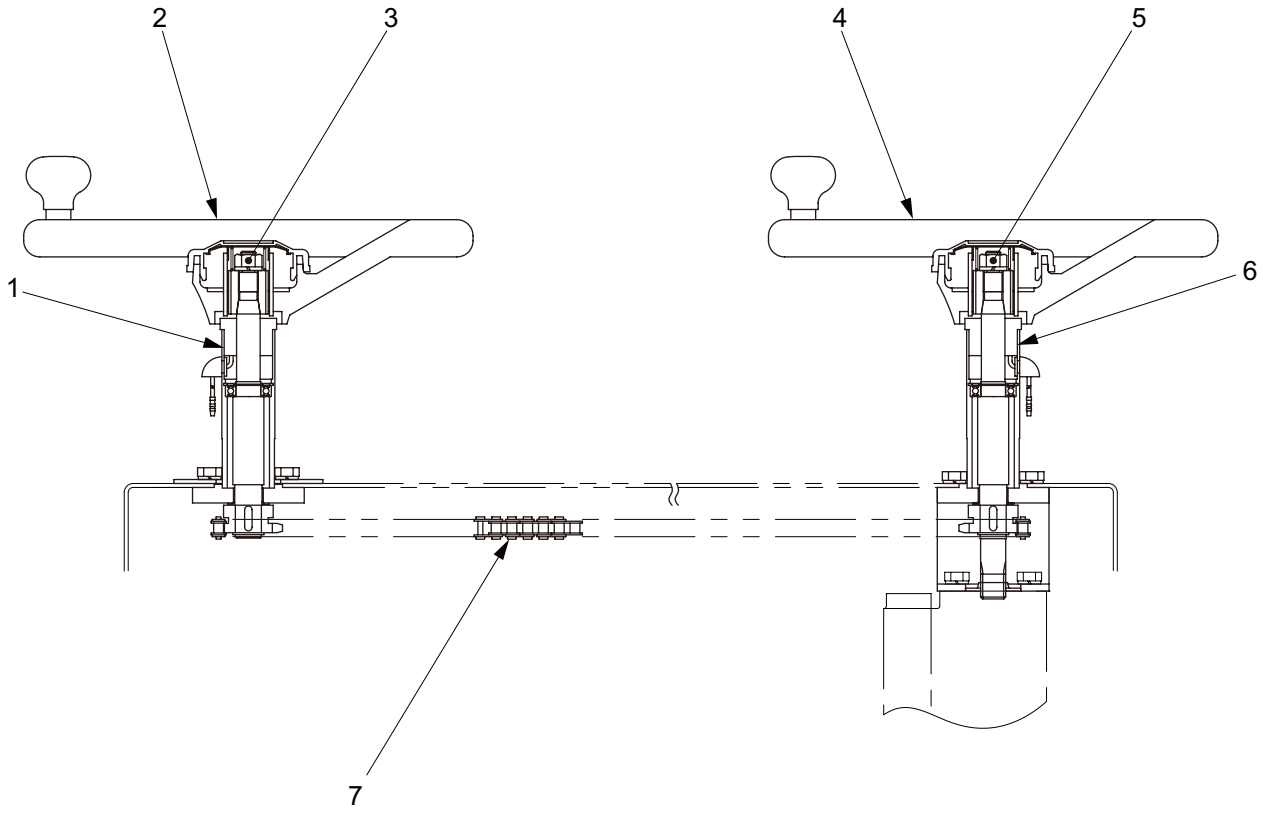
SECTION A-A





• The letters and numbers in the figure such as “AD4” and “SR” show each port.
• Arrow “←→; →” symbols show the hose connection and the direction of the flow of the oil.

3-2. Steering Wheel



0634-32802-0-20337-A

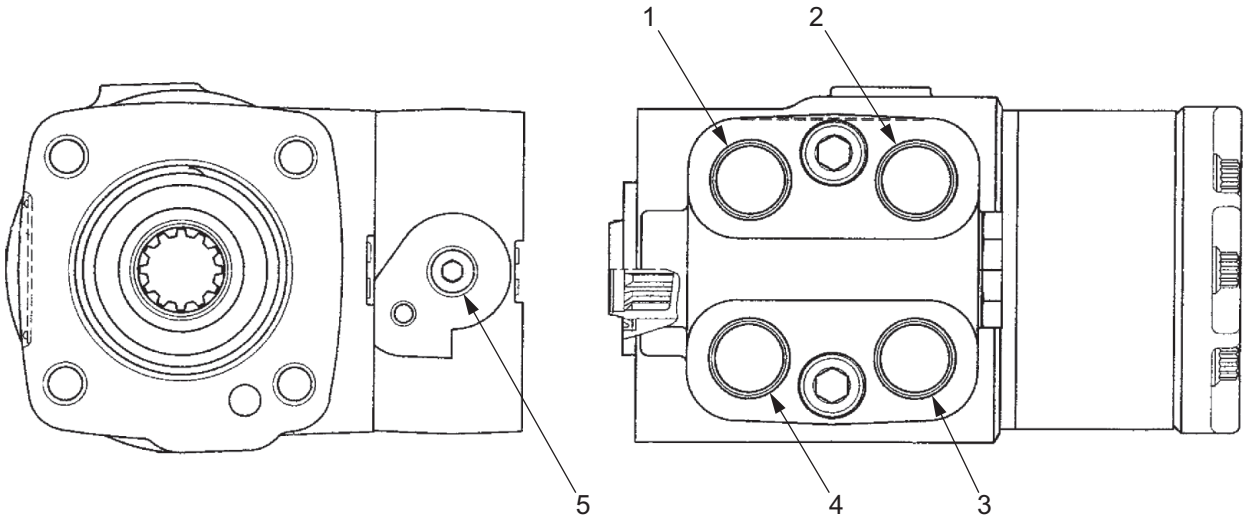
(1) Column shaft
(2) Steering wheel
(3) Nut : M12 P=1.25
(4) Steering wheel
(5) Nut : M12 P=1.25
(6) Column shaft
(7) Roller chain

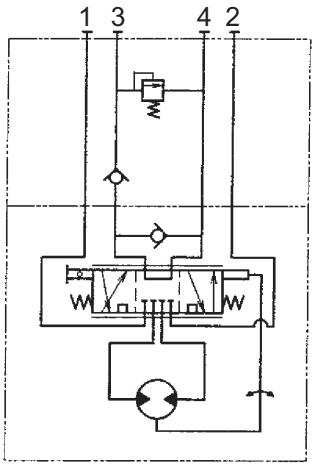
N•m

(3) Nut M12 P=1.25 : 64 N·m (47 lbf·ft)
(5) Nut M12 P=1.25 : 64 N·m (47 lbf·ft)

3-3. Hydraulic Component Specifications

3-3-1. Orbitrol





Hydraulic circuit diagram

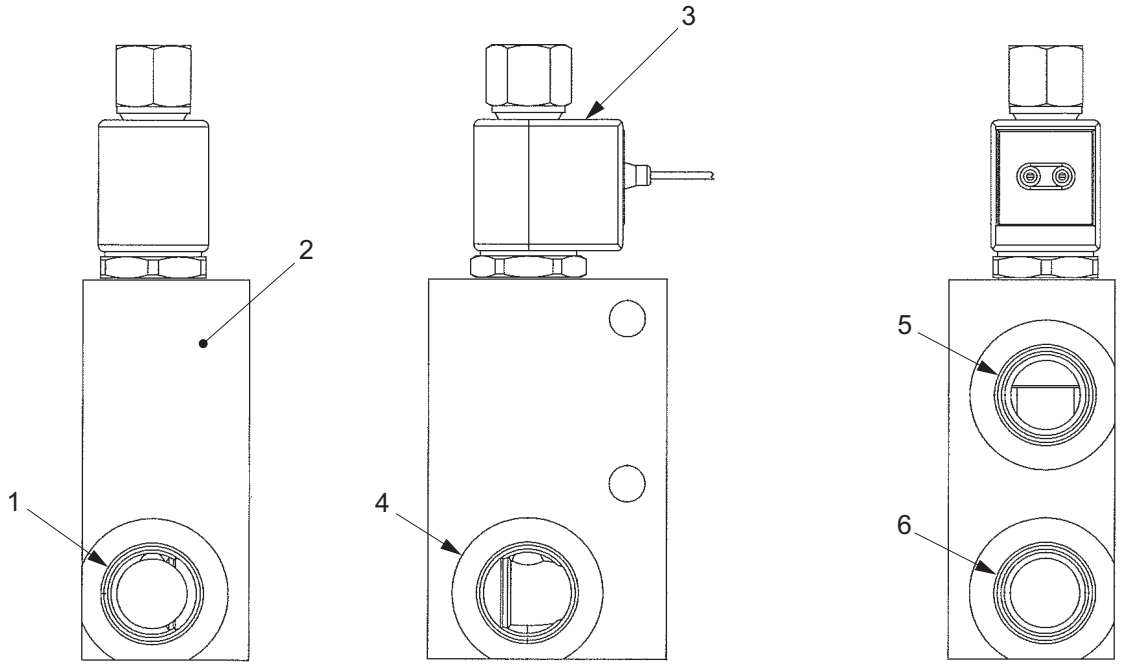
R2-4-04002

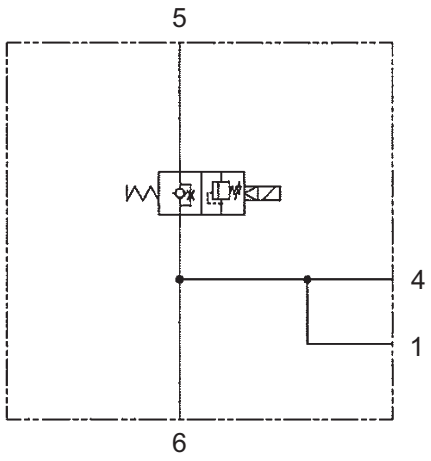
(1) Port L **[L]** : 3/4-16UNF
(2) Port R **[R]** : 3/4-16UNF
(3) Port P **[P]** : 3/4-16UNF
(4) Port T **[T]** : 3/4-16UNF
(5) Relief valve

Specifications

- Displacement : 277 cm^3/rev (16.9 cu.in./rev)
- Relief valve pressure setting : 15.2 MPa (2,204 psi)
- Weight : 7.3 kg (16.1 lbs.)

3-3-2. Valve





Hydraulic circuit diagram

R2-4-04003

(1) Port B : G3/4
(2) Block
(3) Solenoid valve
(4) Port A : G3/4
(5) Port T **[VT]** : G3/4
(6) Port P **[VP]** : G3/4

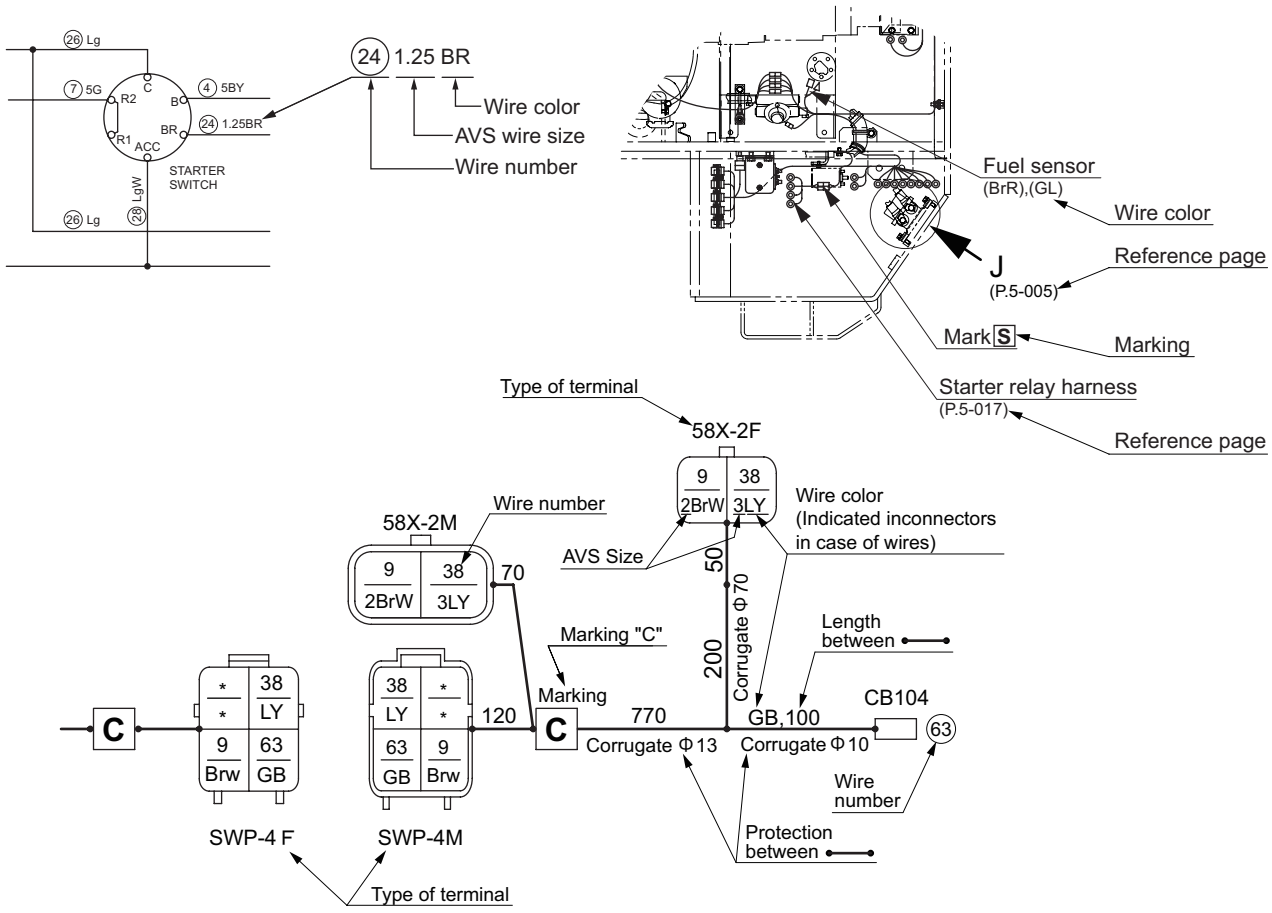
Specifications
- Maximum flow : 75 L/min (19.8 gal./min)
- Maximum pressure : 19.5 MPa (2,828 psi)
- Weight : 1.26 kg (2.8 lbs.)

ELECTRICAL SYSTEM

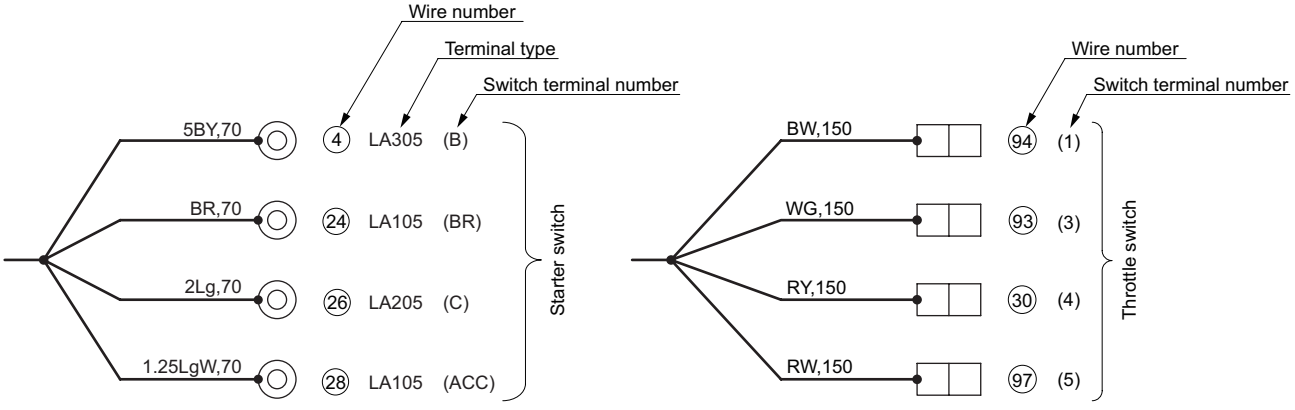
1. PRECAUTIONS FOR WORK

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

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



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



- 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 (Gr)	Gray	GyR	Gray/ Red stripe
Y	Yellow	YR	Yellow/ Red stripe	YB	Yellow/ Black stripe	YG	Yellow/ Green stripe	YL	Yellow/ Blue stripe	YW	Yellow/ White stripe					GyL	Gray/ Blue stripe
Br	Brown	BrW	Brown/ White stripe	BrR	Brown/ Red stripe	BrY	Brown/ Yellow stripe	BrB	Brown/ Black stripe	BrG	Brown/ Green stripe	BrL	Brown/ Blue stripe	Sb	Sky blue		
L	Blue	LW	Blue/ White stripe	LR	Blue/ Red stripe	LY	Blue/ Yellow stripe	LB	Blue/ Black stripe	LG	Blue/ Green stripe			P	Pink	PB	Pink/ Black stripe
Lg	Light green	LgR	Light green/ Red stripe	LgY	Light green/ Yellow stripe	LgB	Light green/ Black stripe	LgW	Light green/ White stripe	LgL	Light green/ Blue stripe			Pu	Purple		

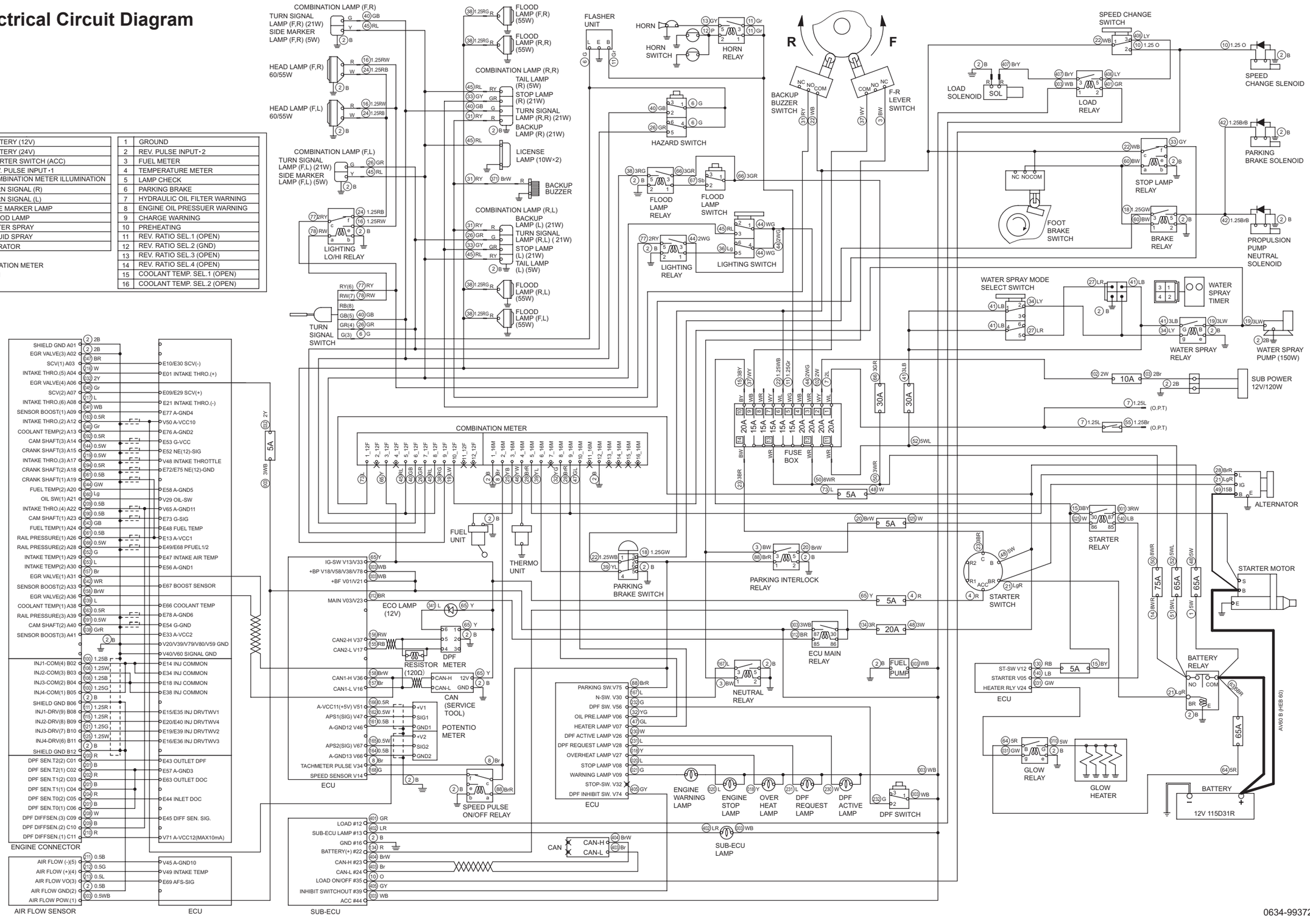
2. SYSTEM CIRCUIT DIAGRAM

2-1. Electrical Circuit Diagram

1	BATTERY (12V)
2	BATTERY (24V)
3	STARTER SWITCH (ACC)
4	REV. PULSE INPUT•1
5	COMBINATION METER ILLUMINATION
6	TURN SIGNAL (R)
7	TURN SIGNAL (L)
8	SIDE MARKER LAMP
9	FLOOD LAMP
10	WATER SPRAY
11	LIQUID SPRAY
12	VIBRATOR

1	GROUND
2	REV. PULSE INPUT•2
3	FUEL METER
4	TEMPERATURE METER
5	LAMP CHECK
6	PARKING BRAKE
7	HYDRAULIC OIL FILTER WARNING
8	ENGINE OIL PRESSUER WARNING
9	CHARGE WARNING
10	PREHEATING
11	REV. RATIO SEL.1 (OPEN)
12	REV. RATIO SEL.2 (GND)
13	REV. RATIO SEL.3 (OPEN)
14	REV. RATIO SEL.4 (OPEN)
15	COOLANT TEMP. SEL.1 (OPEN)
16	COOLANT TEMP. SEL.2 (OPEN)

COMBINATION METER
SWP12M
SWP16F



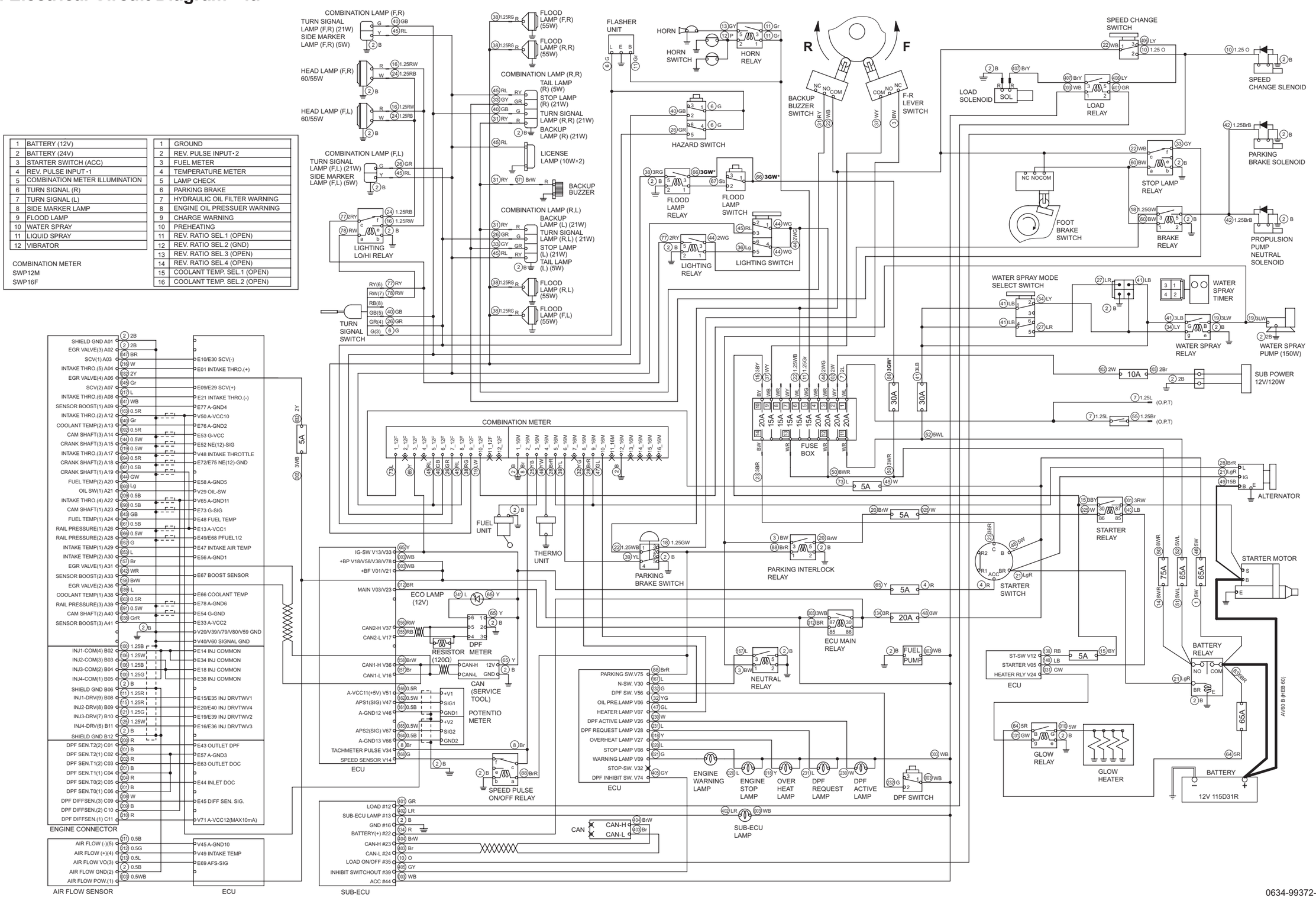
0634-99372-0-11506-A

2-1. Electrical Circuit Diagram *:a

1	BATTERY (12V)
2	BATTERY (24V)
3	STARTER SWITCH (ACC)
4	REV. PULSE INPUT･1
5	COMBINATION METER ILLUMINATION
6	TURN SIGNAL (R)
7	TURN SIGNAL (L)
8	SIDE MARKER LAMP
9	FLOOD LAMP
10	WATER SPRAY
11	LIQUID SPRAY
12	VIBRATOR

1	GROUND
2	REV. PULSE INPUT･2
3	FUEL METER
4	TEMPERATURE METER
5	LAMP CHECK
6	PARKING BRAKE
7	HYDRAULIC OIL FILTER WARNING
8	ENGINE OIL PRESSUER WARNING
9	CHARGE WARNING
10	PREHEATING
11	REV. RATIO SEL.1 (OPEN)
12	REV. RATIO SEL.2 (GND)
13	REV. RATIO SEL.3 (OPEN)
14	REV. RATIO SEL.4 (OPEN)
15	COOLANT TEMP. SEL.1 (OPEN)
16	COOLANT TEMP. SEL.2 (OPEN)

COMBINATION METER
SWP12M
SWP16F

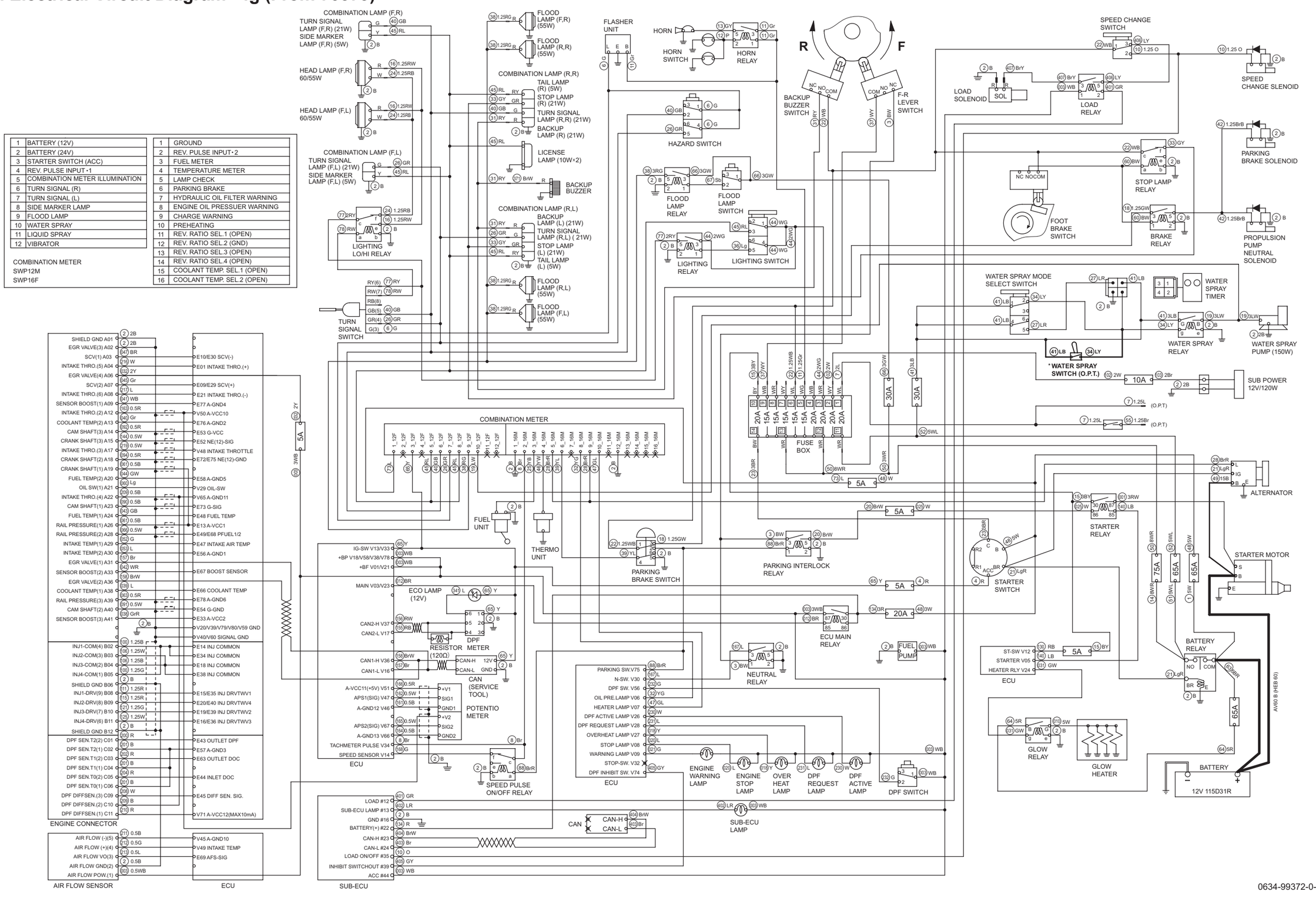


0634-99372-0-11506-B

2-1. Electrical Circuit Diagram *:g (From 70379)

1	BATTERY (12V)	1	GROUND
2	BATTERY (24V)	2	REV. PULSE INPUT•2
3	STARTER SWITCH (ACC)	3	FUEL METER
4	REV. PULSE INPUT•1	4	TEMPERATURE METER
5	COMBINATION METER ILLUMINATION	5	LAMP CHECK
6	TURN SIGNAL (R)	6	PARKING BRAKE
7	TURN SIGNAL (L)	7	HYDRAULIC OIL FILTER WARNING
8	SIDE MARKER LAMP	8	ENGINE OIL PRESSUER WARNING
9	FLOOD LAMP	9	CHARGE WARNING
10	WATER SPRAY	10	PREHEATING
11	LIQUID SPRAY	11	REV. RATIO SEL.1 (OPEN)
12	VIBRATOR	12	REV. RATIO SEL.2 (GND)
		13	REV. RATIO SEL.3 (OPEN)
		14	REV. RATIO SEL.4 (OPEN)
		15	COOLANT TEMP. SEL.1 (OPEN)
		16	COOLANT TEMP. SEL.2 (OPEN)

COMBINATION METER
SWP12M
SWP16F



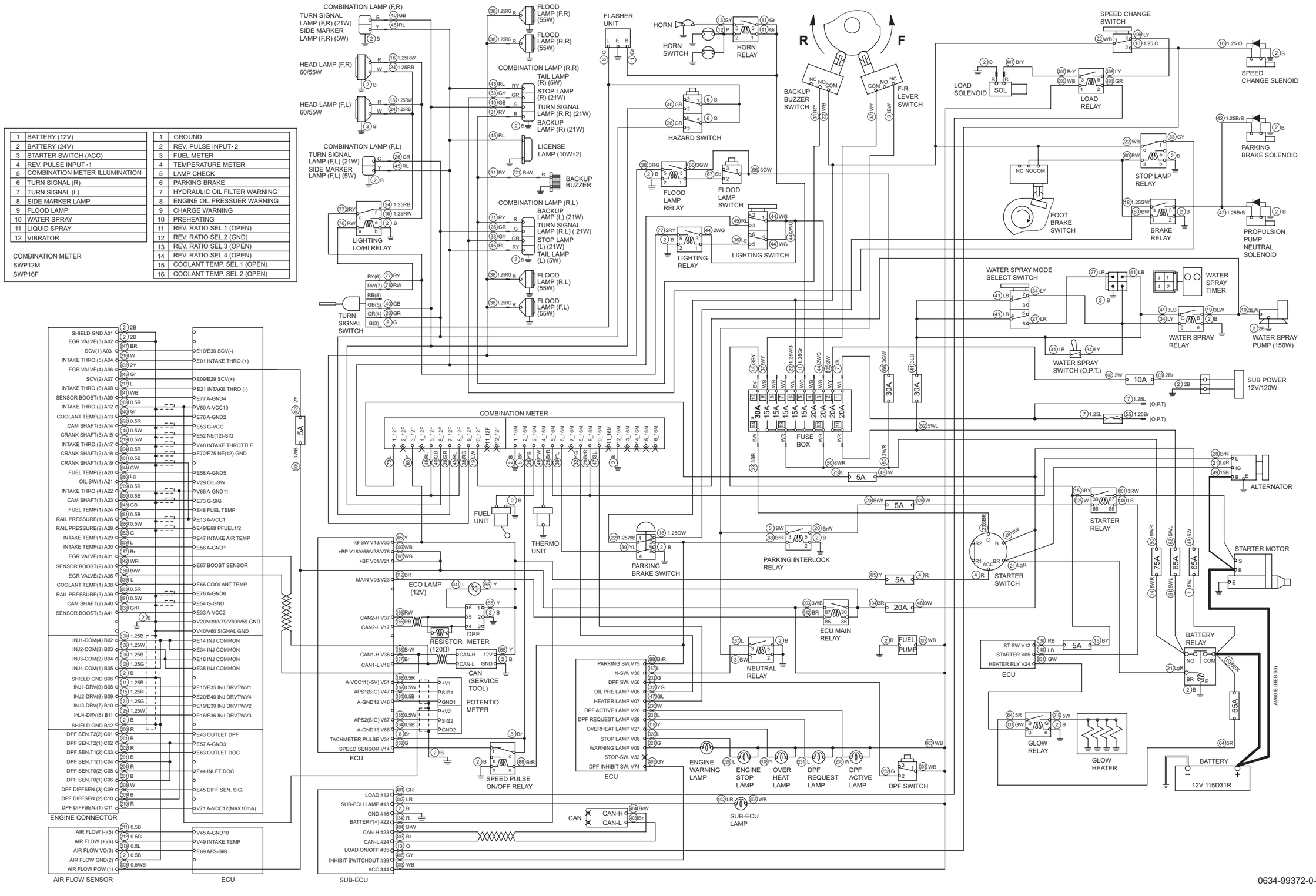
0634-99372-0-11506-C

2-1. Electrical Circuit Diagram *:h (From 70442)

1	BATTERY (12V)
2	BATTERY (24V)
3	STARTER SWITCH (ACC)
4	REV. PULSE INPUT*1
5	COMBINATION METER ILLUMINATION
6	TURN SIGNAL (R)
7	TURN SIGNAL (L)
8	SIDE MARKER LAMP
9	FLOOD LAMP
10	WATER SPRAY
11	LIQUID SPRAY
12	VIBRATOR

1	GROUND
2	REV. PULSE INPUT*2
3	FUEL METER
4	TEMPERATURE METER
5	LAMP CHECK
6	PARKING BRAKE
7	HYDRAULIC OIL FILTER WARNING
8	ENGINE OIL PRESSUER WARNING
9	CHARGE WARNING
10	PREHEATING
11	REV. RATIO SEL.1 (OPEN)
12	REV. RATIO SEL.2 (GND)
13	REV. RATIO SEL.3 (OPEN)
14	REV. RATIO SEL.4 (OPEN)
15	COOLANT TEMP. SEL.1 (OPEN)
16	COOLANT TEMP. SEL.2 (OPEN)

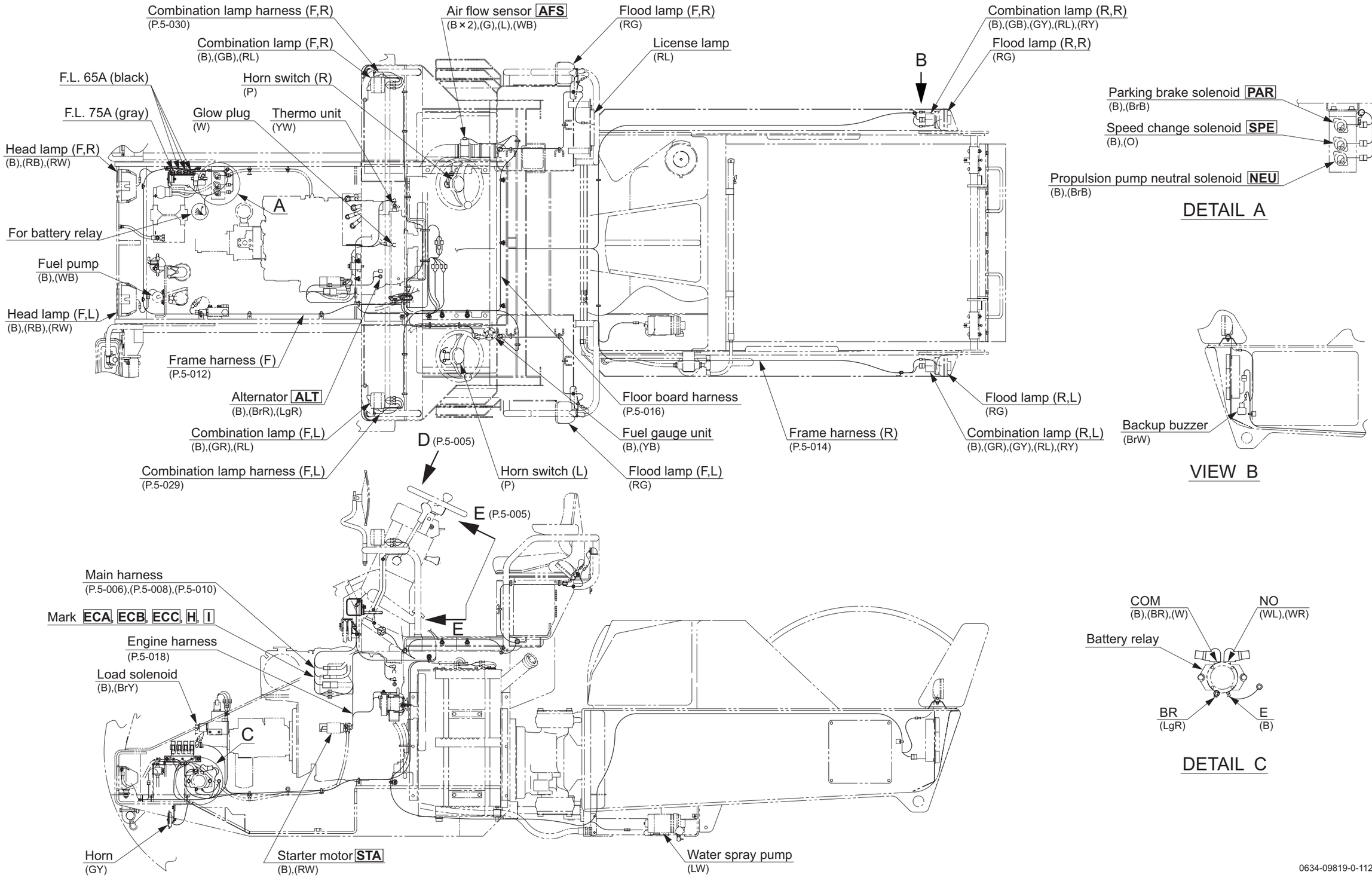
COMBINATION METER
SWP12M
SWP16F



0634-99372-0-11506-D

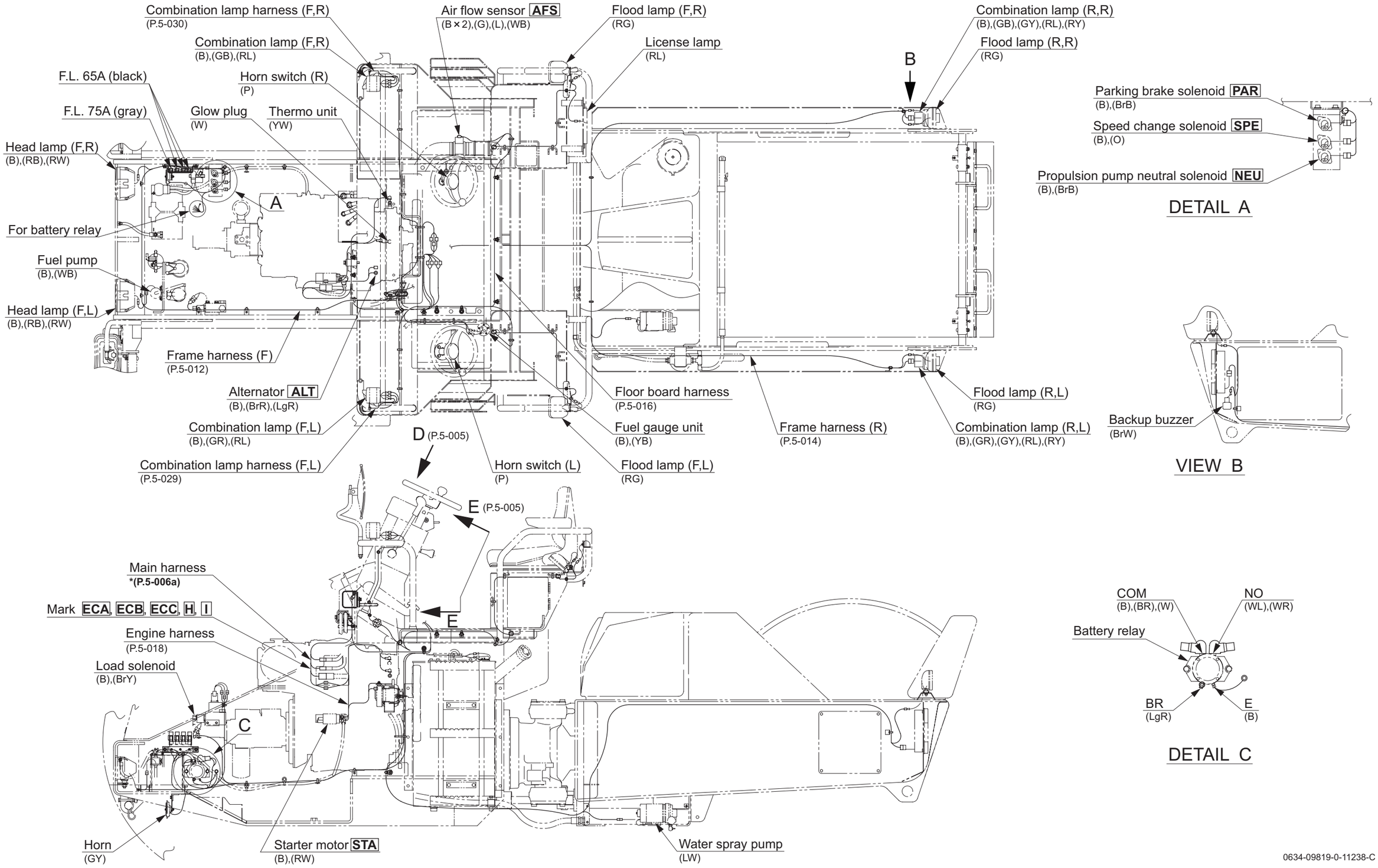
3. ELECTRICAL COMPONENTS

3-1. Wiring Harness Layout (1)

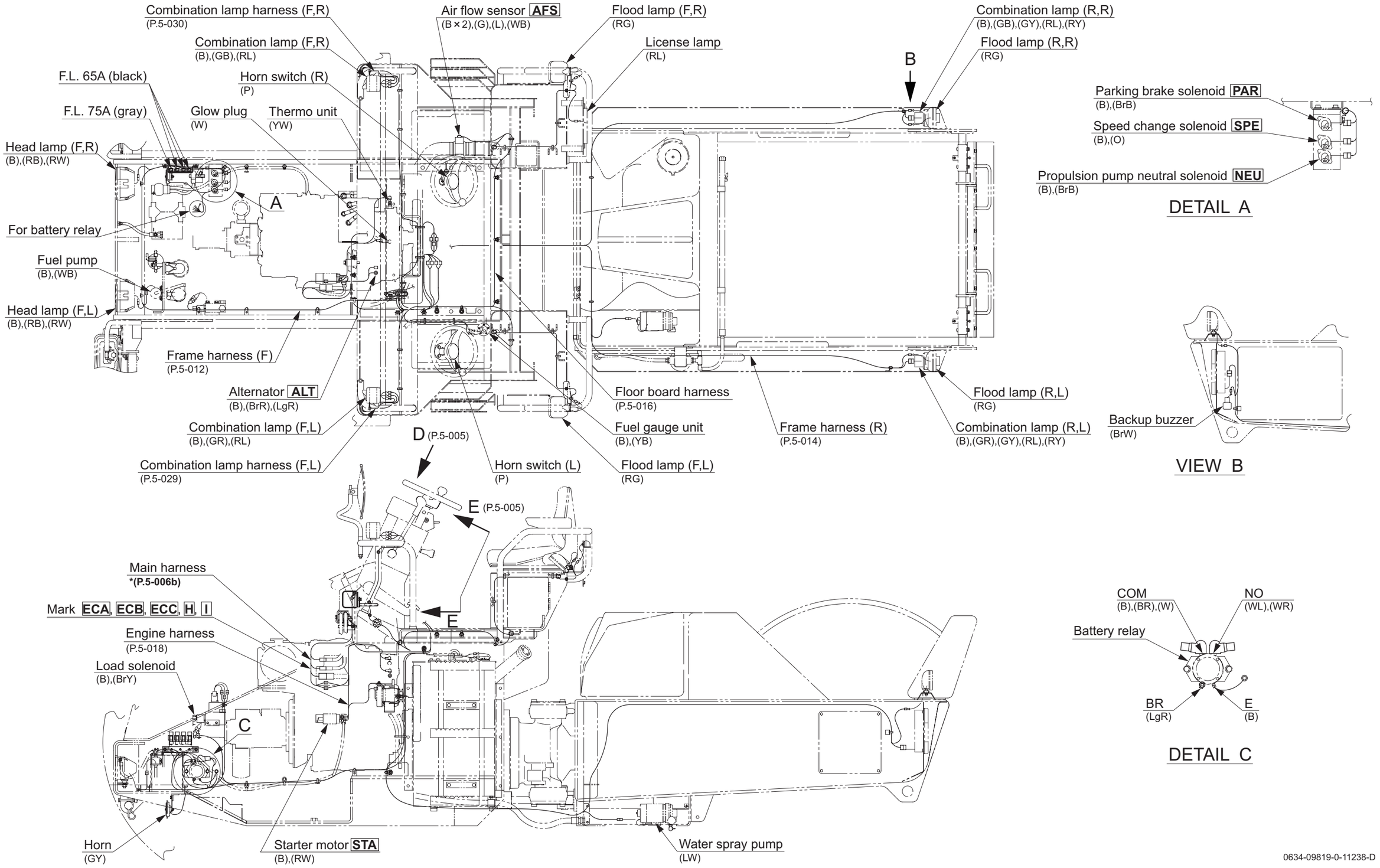


0634-09819-0-11238-B

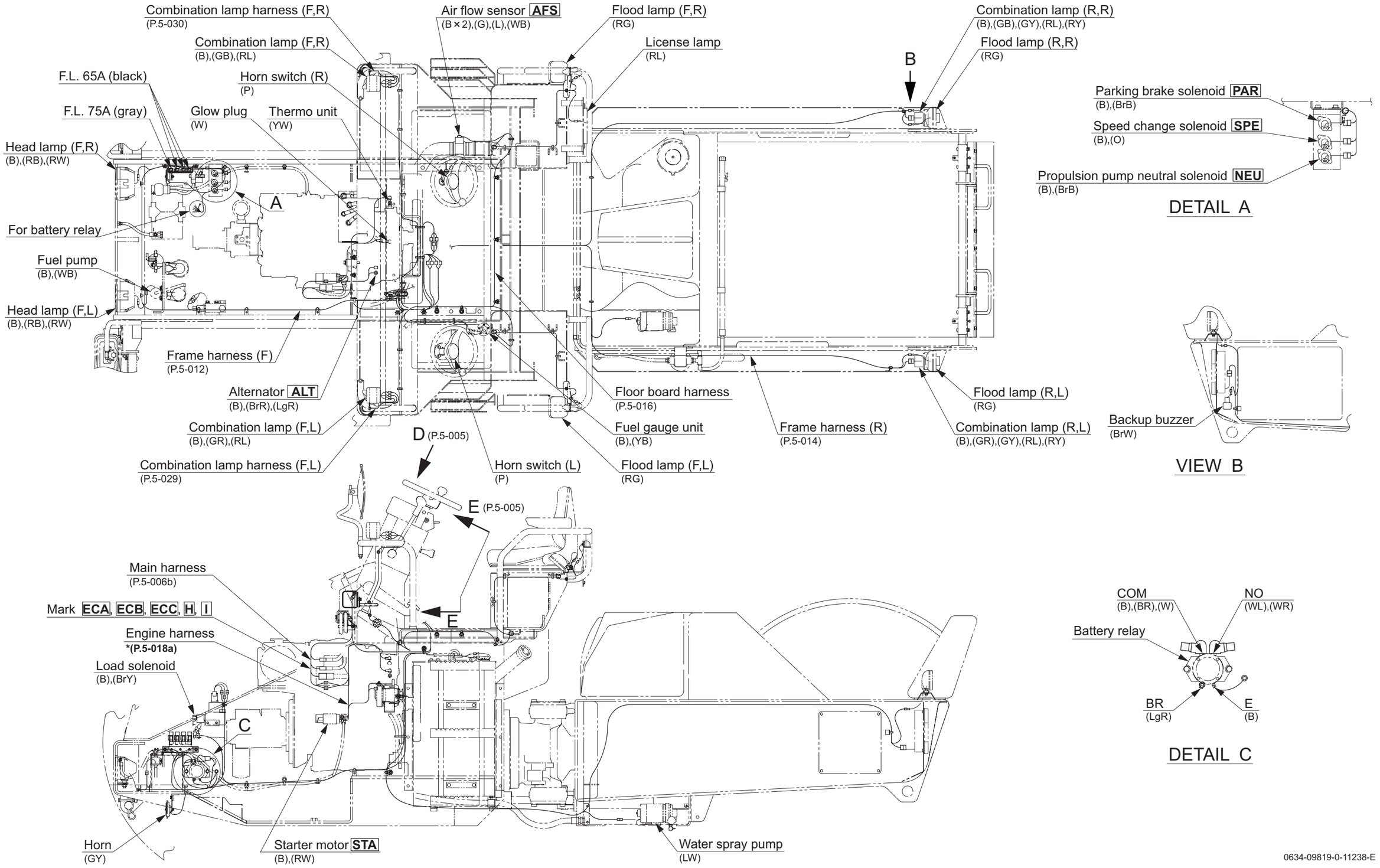
3-1. Wiring Harness Layout (1) *:a



3-1. Wiring Harness Layout (1) *:b (From 70218)



3-1. Wiring Harness Layout (1) *:c (From 70234)



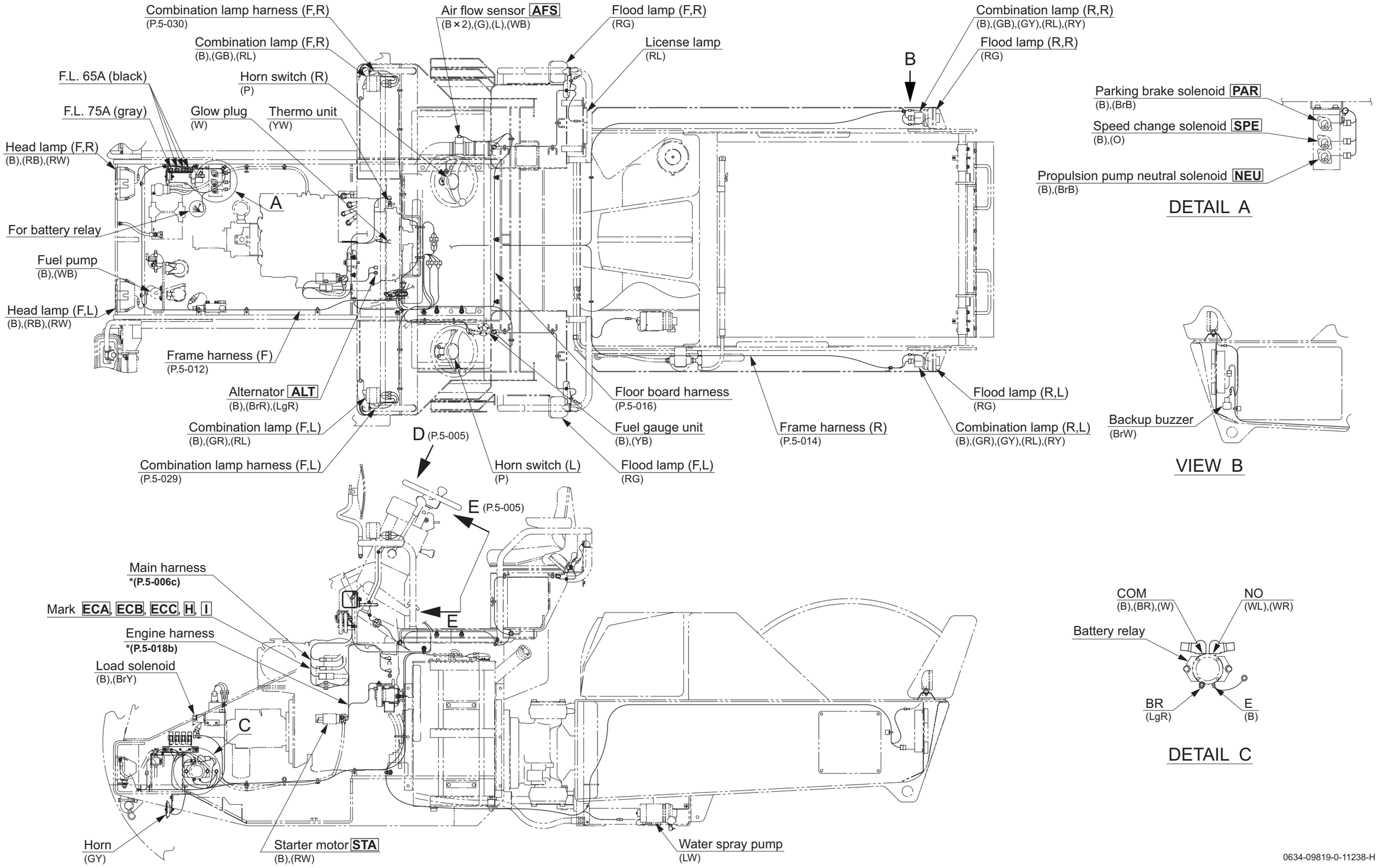
DETAIL A

VIEW B

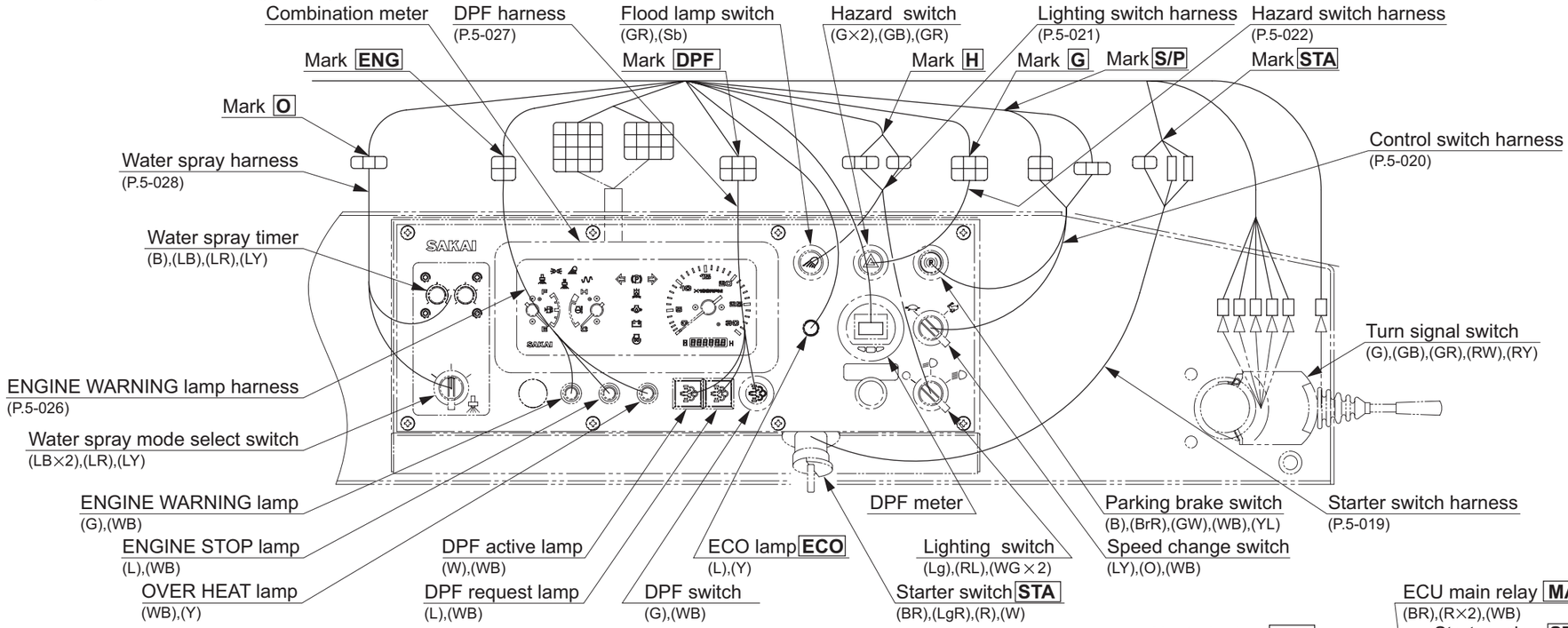
DETAIL C

0634-09819-0-11238-E

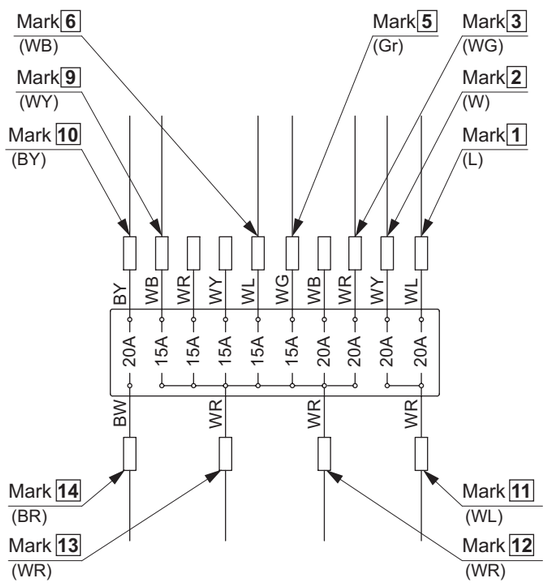
3-1. Wiring Harness Layout (1) *:g (From 70379)



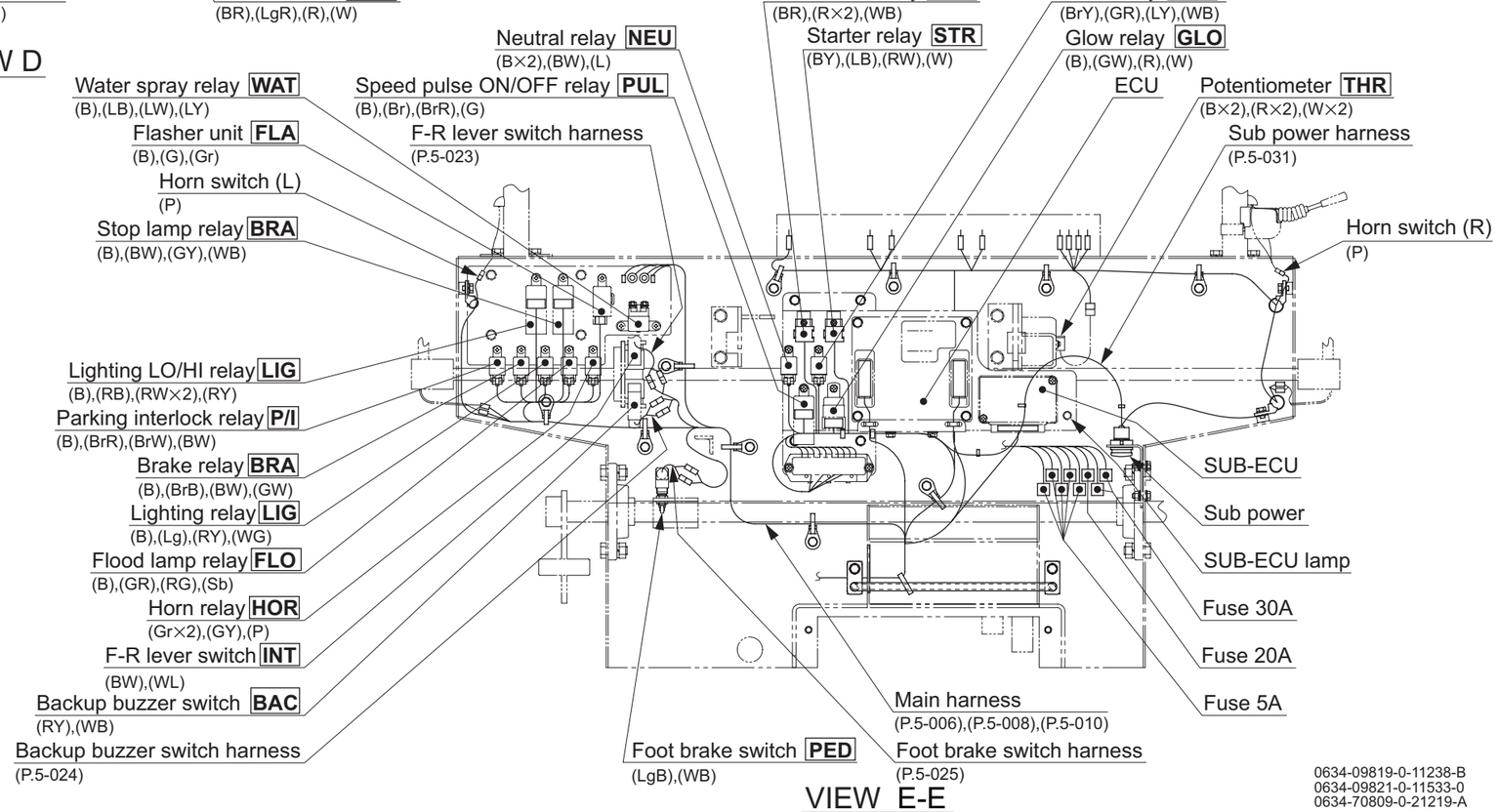
3-2. Wiring Harness Layout (2)



VIEW D



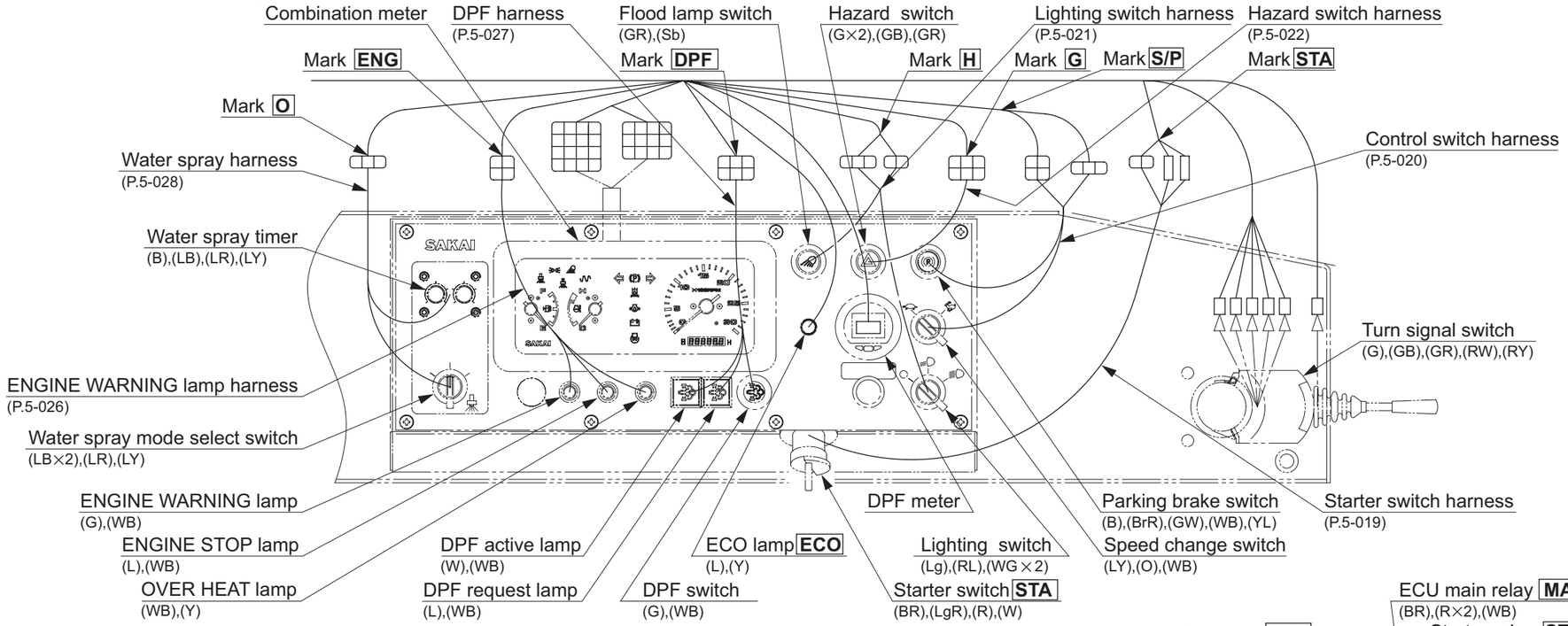
DETAIL Fuse box



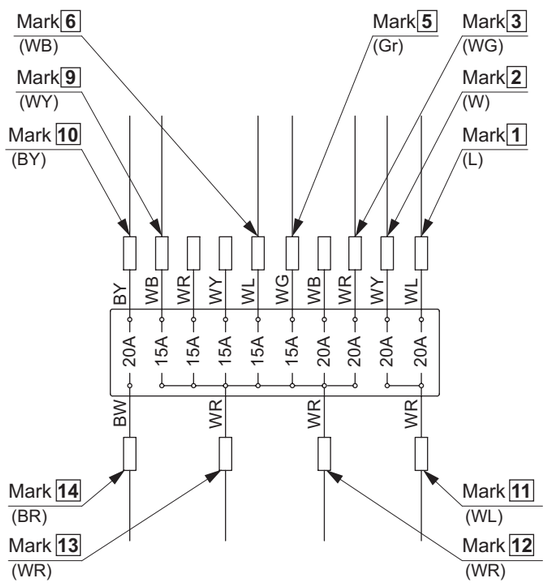
VIEW E-E

0634-09819-0-11238-B
0634-09821-0-11533-0
0634-70809-0-21219-A

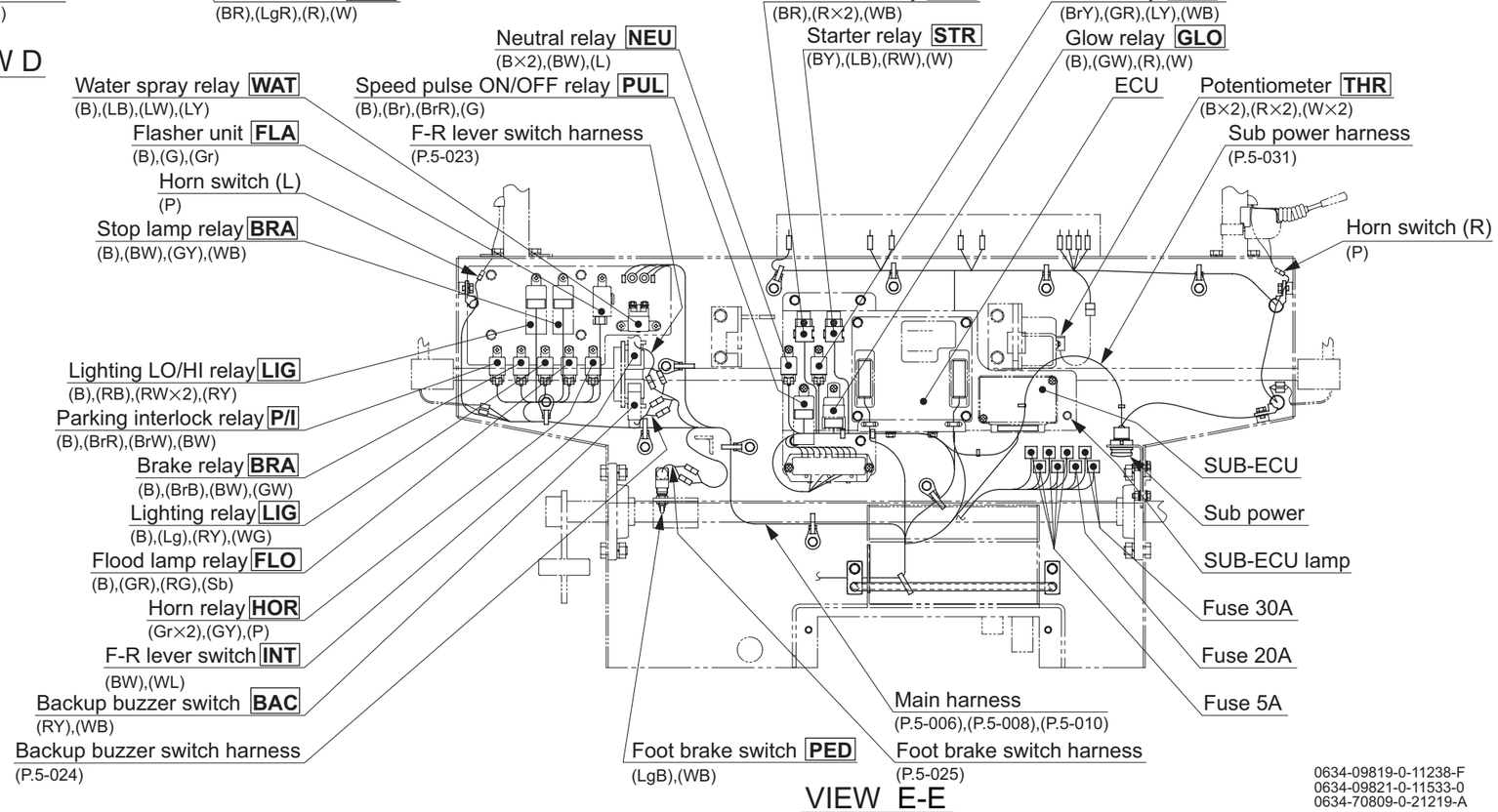
3-2. Wiring Harness Layout (2) *:e (From 70273)



VIEW D



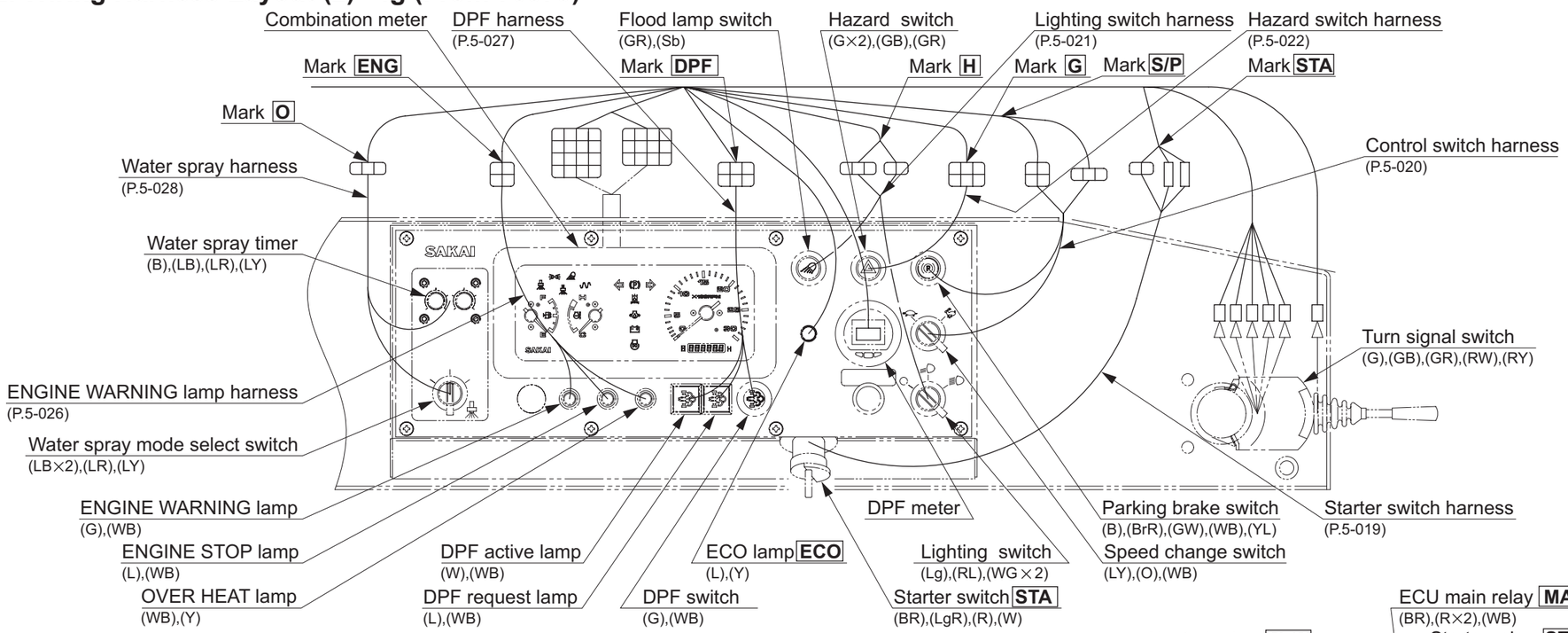
DETAIL Fuse box



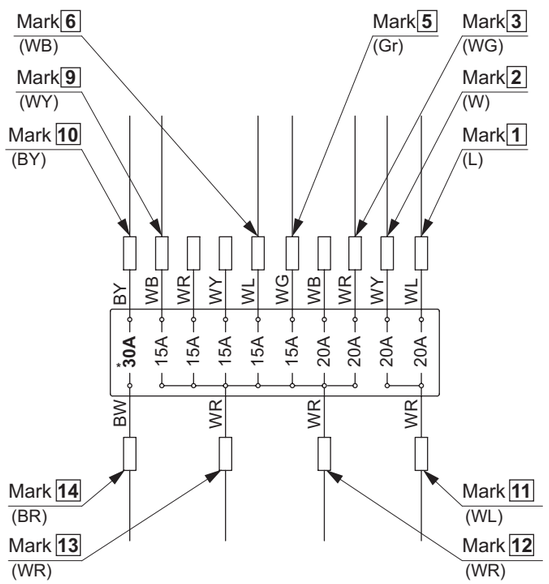
VIEW E-E

0634-09819-0-11238-F
0634-09821-0-11533-0
0634-70809-0-21219-A

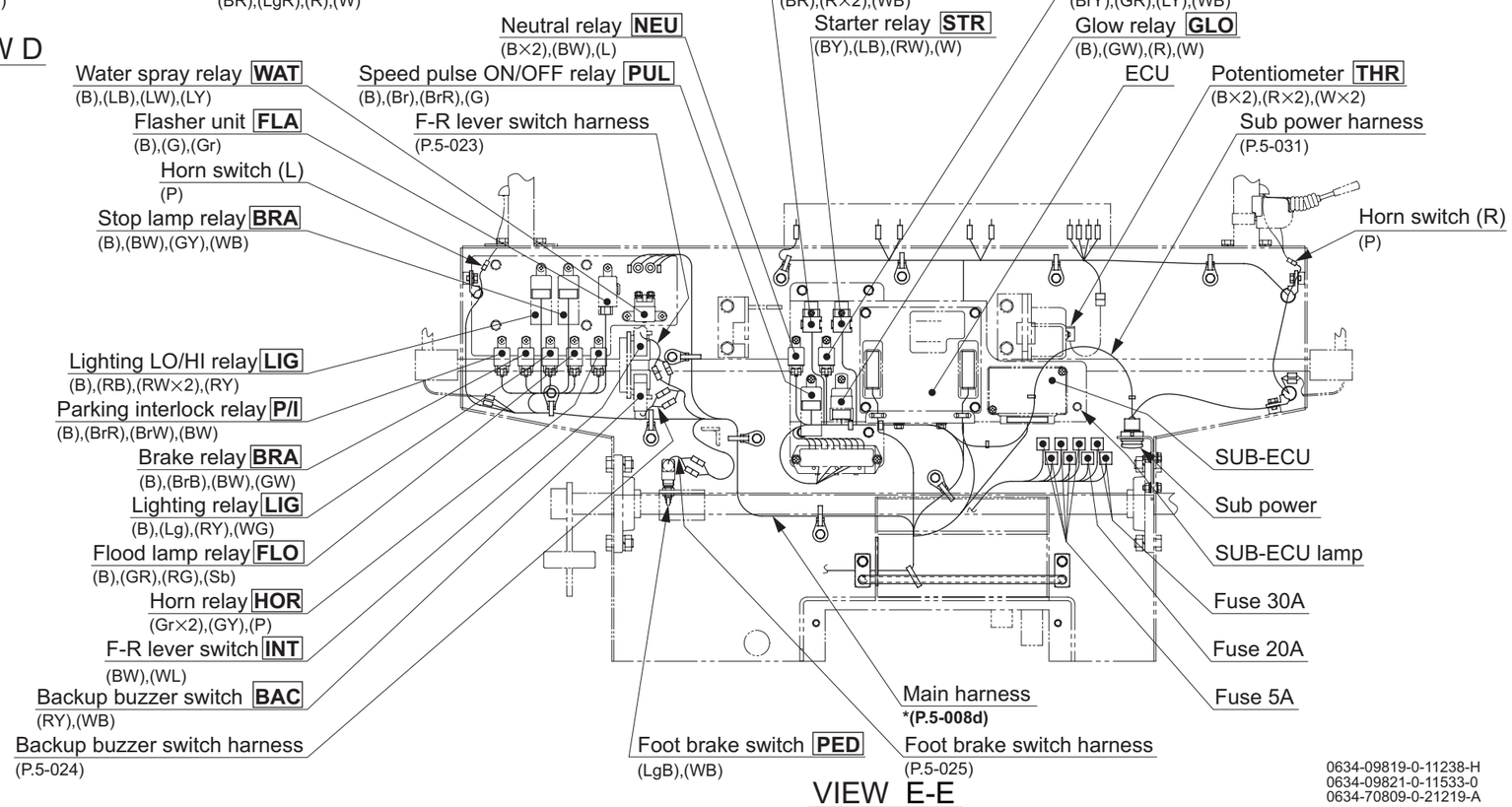
3-2. Wiring Harness Layout (2) *:g (From 70379)



VIEW D



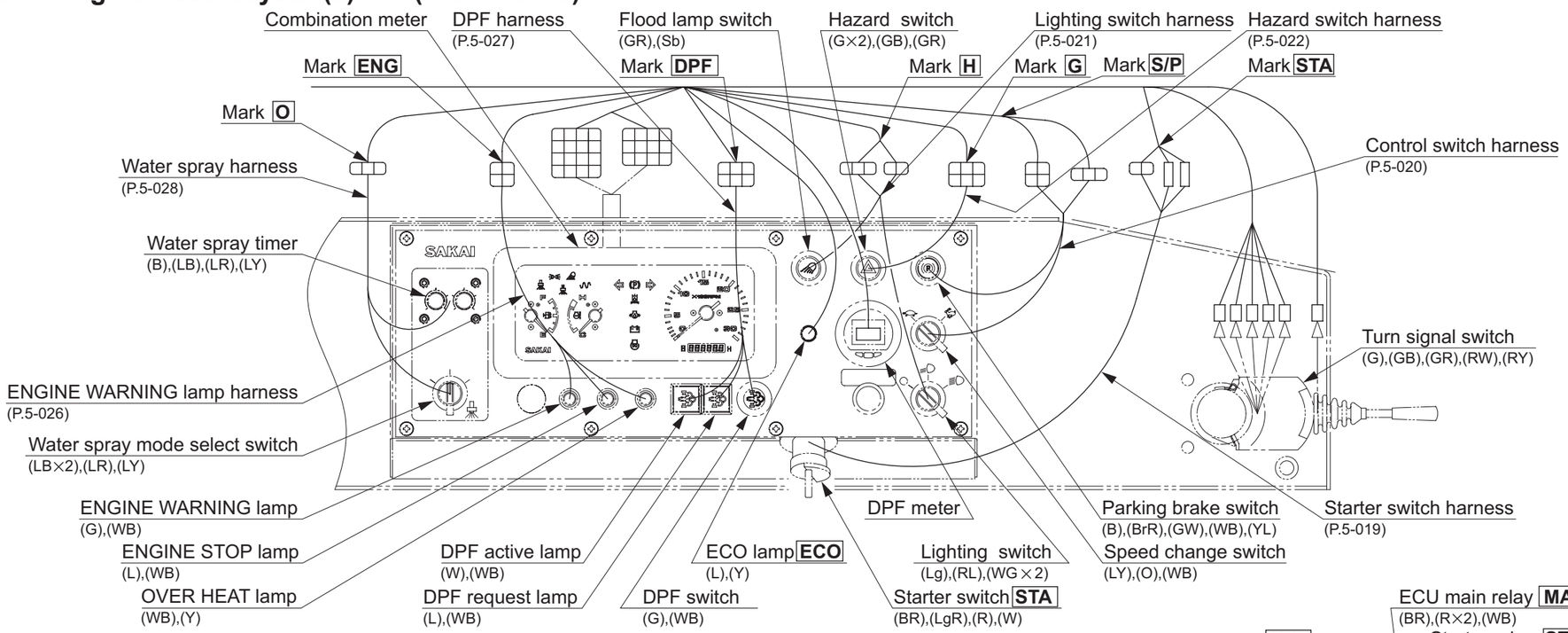
DETAIL Fuse box



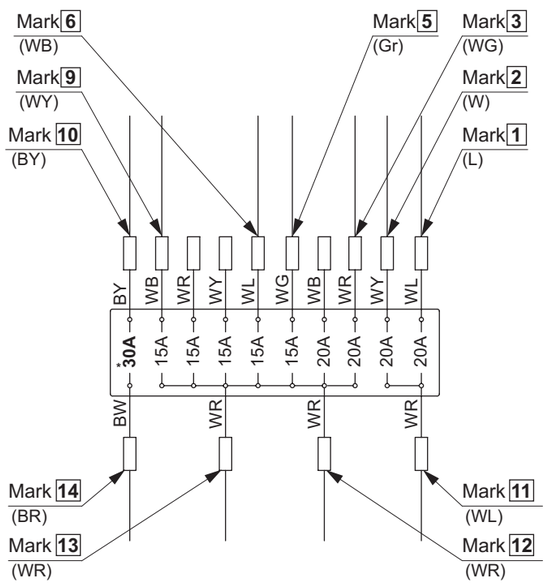
VIEW E-E

0634-09819-0-11238-H
0634-09821-0-11533-0
0634-70809-0-21219-A

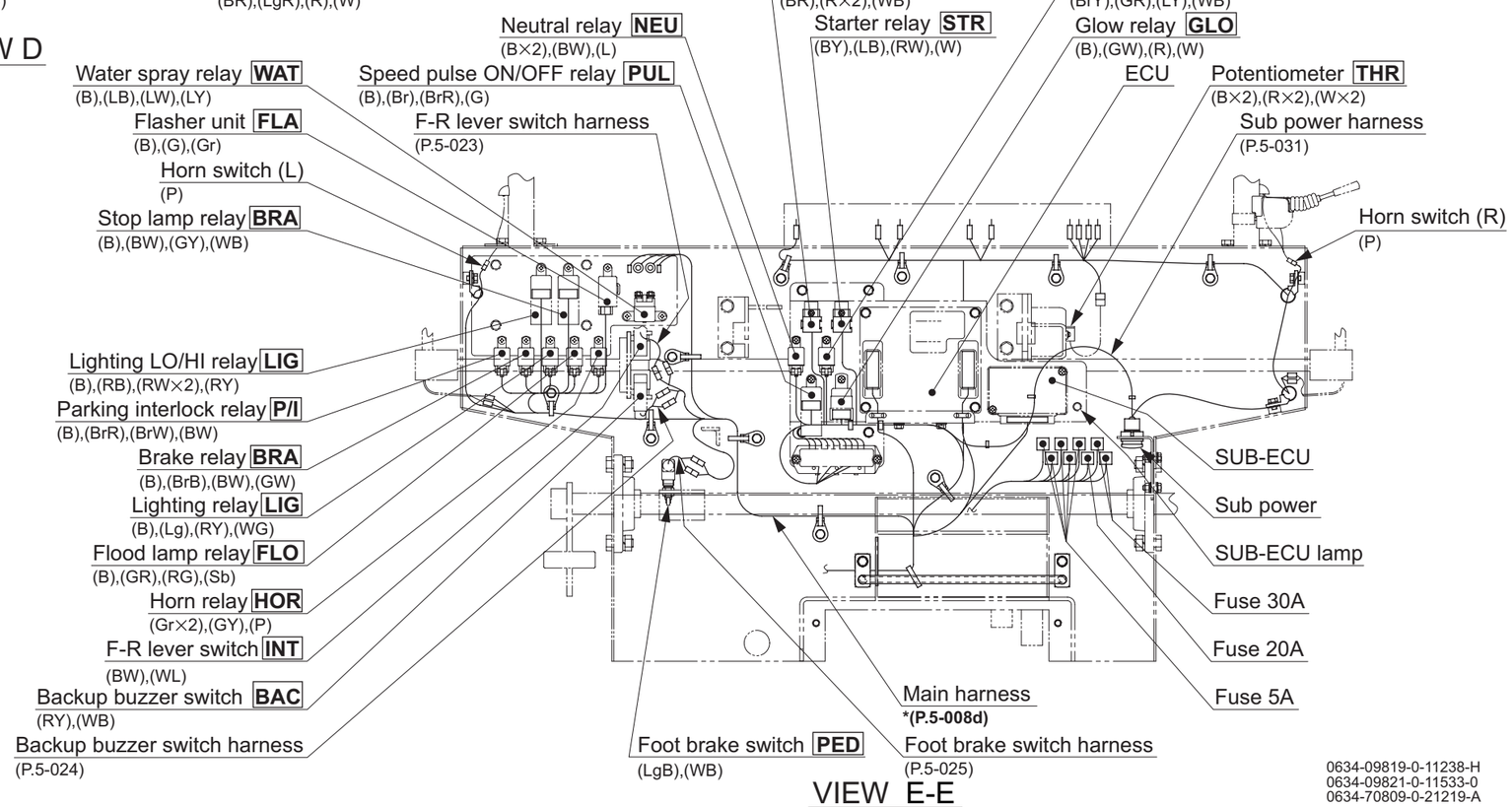
3-2. Wiring Harness Layout (2) *:h (From 70442)



VIEW D



DETAIL Fuse box

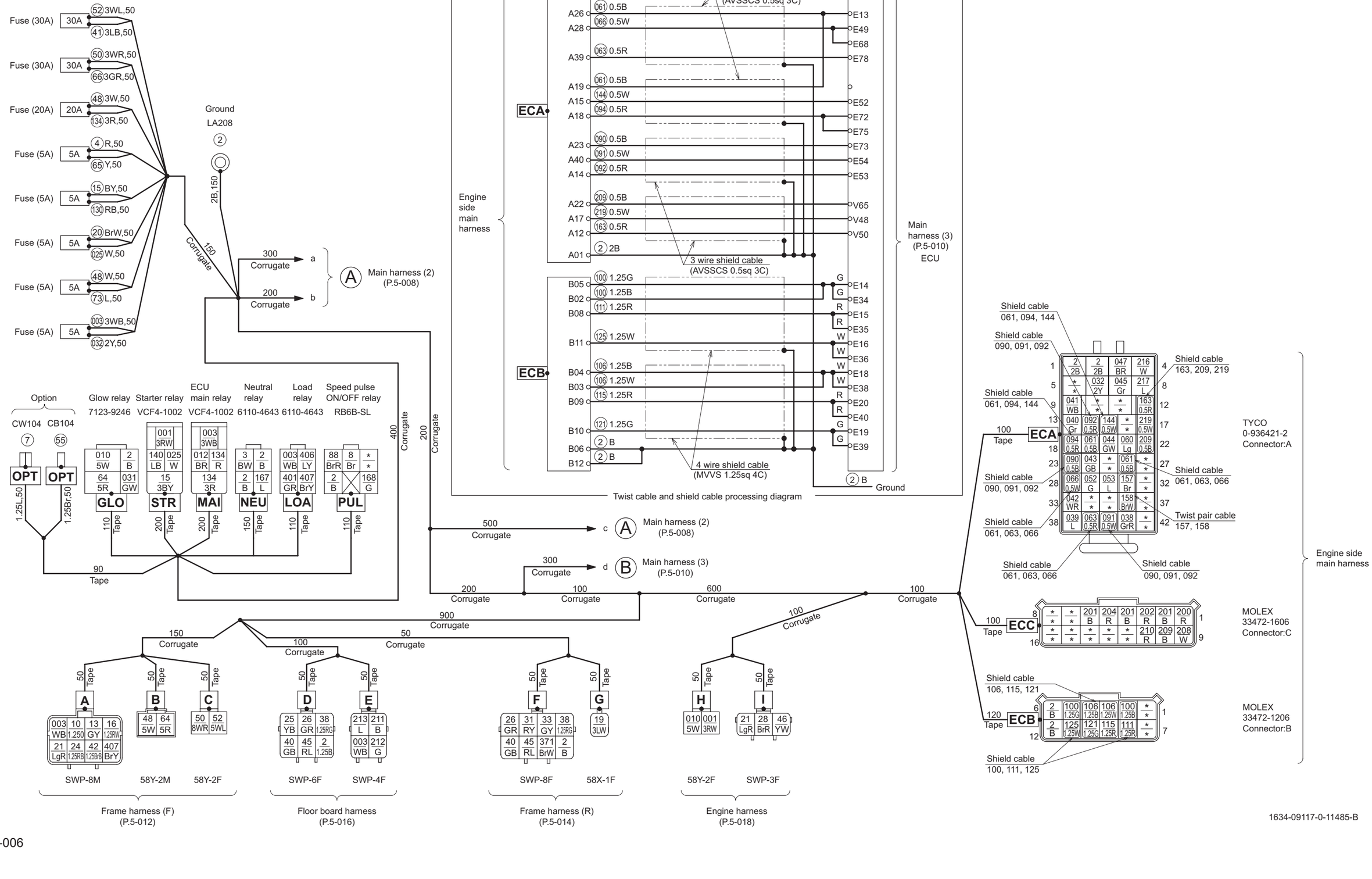


VIEW E-E

0634-09819-0-11238-H
0634-09821-0-11533-0
0634-70809-0-21219-A

4. WIRING HARNESSES

4-1. Main Harness (1)



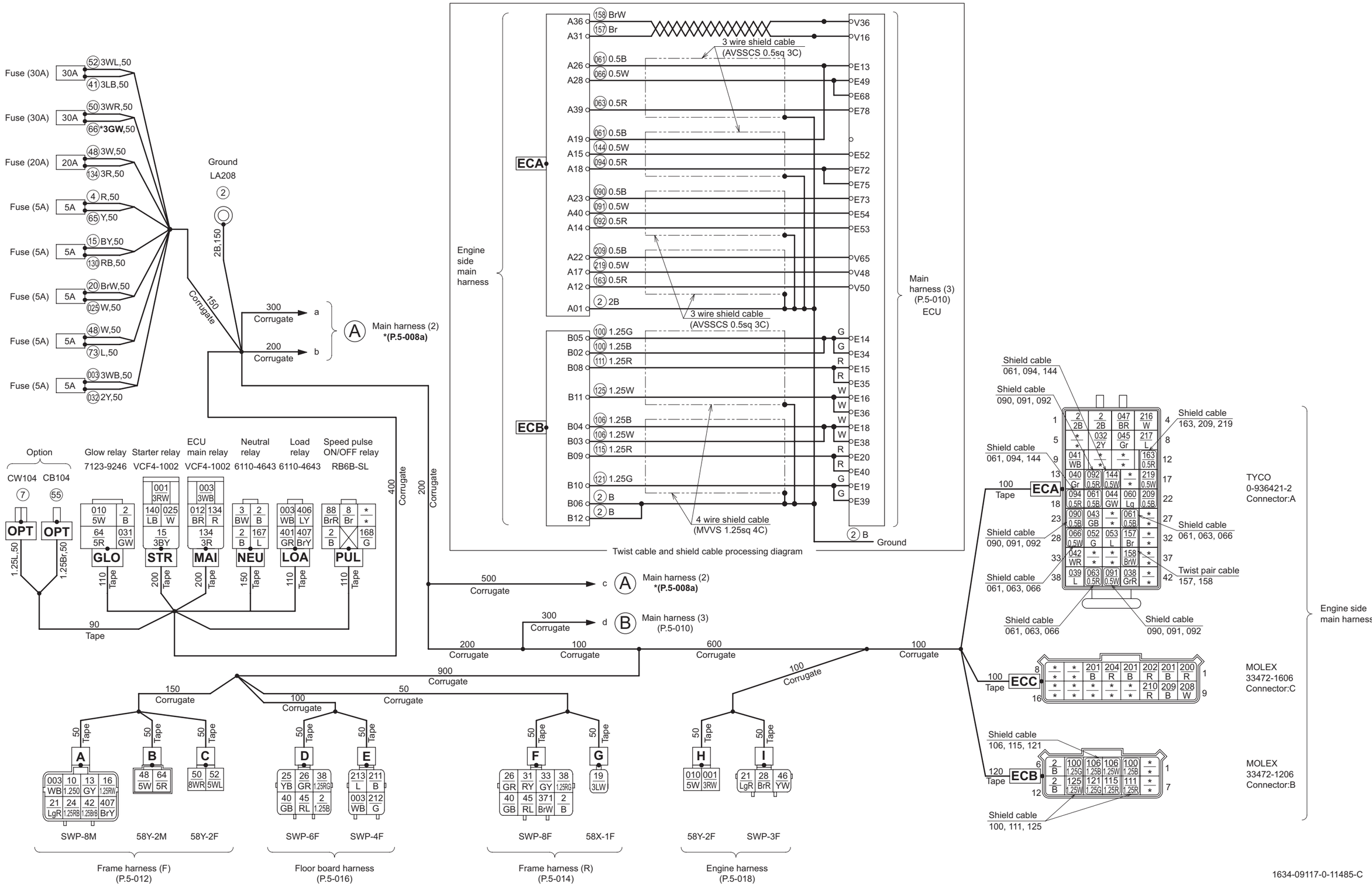
1634-09117-0-11485-B

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			Main harness (1)		(2)	(3)
②	B, 1.25B, 2B	33	D, ECA × 2, ECB × 2, F, GLO, NEU × 2, PUL, Ground	11	13	9
③	BW	3	NEU	1	2	
④	R	2	Fuse 5A	1	1	
⑦	1.25L	3	OPT	1	2	
⑧	Br	3	PUL	1	1	1
⑩	1.25O	3	A	1	1	1
⑬	GY	2	A	1	1	
⑮	BY, 3BY	3	STR, Fuse 5A	2	1	
⑯	1.25RW	2	A	1	1	
⑲	3LW	3	G	1	2	
⑳	BrW	2	Fuse 5A	1	1	
㉑	LgR	3	A, I	2	1	
㉔	1.25RB	2	A	1	1	
㉕	YB	2	D	1	1	
㉖	GR	5	D, F	2	3	
㉘	BrR	3	I	1	2	
㉛	RY	3	F	1	2	
㉝	GY	2	F	1	1	
㉞	1.25RG	4	D, F	2	2	
㊵	GB	5	D, F	2	3	
㊶	3LB	3	Fuse 30A	1	2	
㊷	1.25BrB	2	A	1	1	
㊺	RL	5	D, F	2	3	
㊻	YW	2	I	1	1	
㊽	W, 3W, 5W	4	B, Fuse 5A, 20A	3	1	
㊿	3WR, 8WR	4	C, Fuse 30A	2	2	
(52)	3WL, 5WL	3	C, Fuse 30A	2	1	
(55)	1.25Br	2	OPT	1	1	
(64)	5R	2	B, GLO	2		
(65)	Y	7	Fuse 5A	1	3	3

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			Main harness (1)		(2)	(3)
(66)	3GR	3	Fuse 30A	1	2	
(73)	L	2	Fuse 5A	1	1	
(88)	BrR	4	PUL	1	2	1
(001)	3RW	2	H, STR	2		
(003)	WB, 3WB	15	A, E, LOA, MAI, Fuse 5A	5	2	8
(010)	5W	2	GLO, H	2		
(012)	BR	3	MAI	1		2
(025)	W	2	STR, Fuse 5A	2		
(031)	GW	2	GLO	1		1
(032)	2Y	2	ECA, Fuse 5A	2		
(038)	GrR	2	ECA	1		1
(039)	L	2	ECA	1		1
(040)	Gr	2	ECA	1		1
(041)	WB	2	ECA	1		1
(042)	WR	2	ECA	1		1
(043)	GB	2	ECA	1		1
(044)	GW	2	ECA	1		1
(045)	Gr	3	ECA	1		2
(047)	BR	3	ECA	1		2
(052)	G	2	ECA	1		1
(053)	L	2	ECA	1		1
(060)	Lg	2	ECA	1		1
(061)	0.5B	3	ECA × 2	2		1
(063)	0.5R	2	ECA	1		1
(066)	0.5W	3	ECA	1		2
(090)	0.5B	2	ECA	1		1
(091)	0.5W	2	ECA	1		1
(092)	0.5R	2	ECA	1		1
(094)	0.5R	3	ECA	1		2
(100)	1.25G, (1.25B)	4	ECB × 2	2		2
(106)	1.25W, (1.25B)	4	ECB × 2	2		2

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			Main harness (1)		(2)	(3)
(111)	1.25R	3	ECB	1		2
(115)	1.25R	3	ECB	1		2
(121)	1.25G	3	ECB	1		2
(125)	1.25W	3	ECB	1		2
(130)	RB	2	Fuse 5A	1		1
(134)	R, 3R	4	MAI × 2, Fuse 20A	3		1
(140)	LB	2	STR	1		1
(144)	0.5W	2	ECA	1		1
(157)	Br	3	ECA	1		2
(158)	BrW	3	ECA	1		2
(163)	0.5R	3	ECA	1	1	1
(167)	L	2	NEU	1		1
(168)	G	2	PUL	1		1
(200)	R	2	ECC	1		1
(201)	B	4	ECC × 3	3		1
(202)	R	2	ECC	1		1
(204)	R	2	ECC	1		1
(208)	W	2	ECC	1		1
(209)	0.5B, B	3	ECA, ECC	2		1
(210)	R	2	ECC	1		1
(211)	B	2	E	1		1
(212)	G	2	E	1		1
(213)	L	2	E	1		1
(216)	W	2	ECA	1		1
(217)	L	2	ECA	1		1
(219)	0.5W	2	ECA	1		1
(371)	BrW	2	F	1	1	
(401)	GR	2	LOA	1		1
(406)	LY	2	LOA	1	1	
(407)	BrY	2	A, LOA	2		

4-1. Main Harness (1) *:a



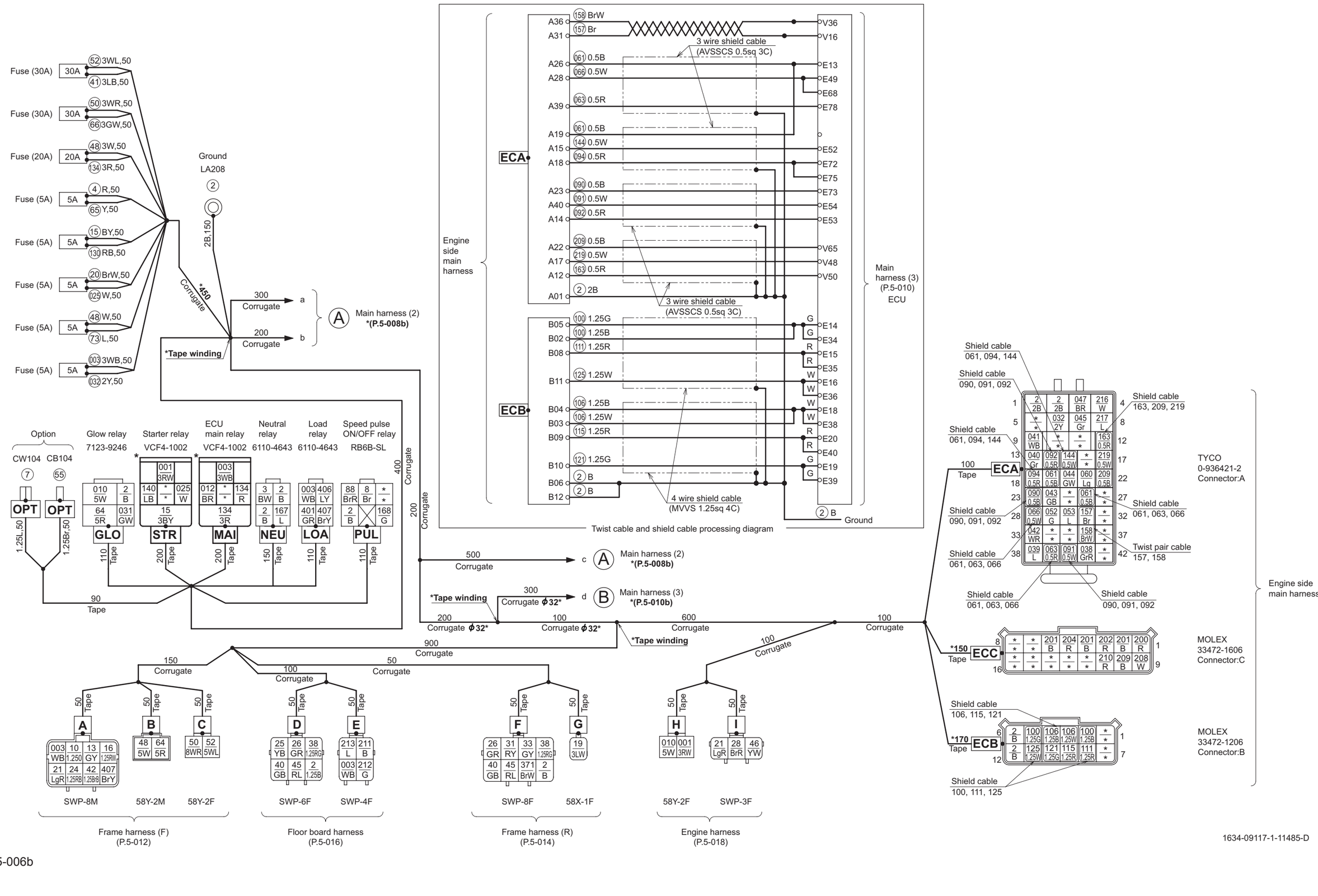
1634-09117-0-11485-C

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			Main harness (1)		(2)	(3)
②	B, 1.25B, 2B	33	D, ECA × 2, ECB × 2, F, GLO, NEU × 2, PUL, Ground	11	13	9
③	BW	3	NEU	1	2	
④	R	2	Fuse 5A	1	1	
⑦	1.25L	3	OPT	1	2	
⑧	Br	3	PUL	1	1	1
⑩	1.25O	3	A	1	1	1
⑬	GY	2	A	1	1	
⑮	BY, 3BY	3	STR, Fuse 5A	2	1	
⑯	1.25RW	2	A	1	1	
⑲	3LW	3	G	1	2	
⑳	BrW	2	Fuse 5A	1	1	
㉑	LgR	3	A, I	2	1	
㉔	1.25RB	2	A	1	1	
㉕	YB	2	D	1	1	
㉖	GR	5	D, F	2	3	
㉘	BrR	3	I	1	2	
㉛	RY	3	F	1	2	
㉝	GY	2	F	1	1	
㉞	1.25RG	4	D, F	2	2	
㊵	GB	5	D, F	2	3	
㊶	3LB	3	Fuse 30A	1	2	
㊷	1.25BrB	2	A	1	1	
㊺	RL	5	D, F	2	3	
㊻	YW	2	I	1	1	
㊽	W, 3W, 5W	4	B, Fuse 5A, 20A	3	1	
㊿	3WR, 8WR	4	C, Fuse 30A	2	2	
(52)	3WL, 5WL	3	C, Fuse 30A	2	1	
(55)	1.25Br	2	OPT	1	1	
(64)	5R	2	B, GLO	2		
(65)	Y	7	Fuse 5A	1	3	3

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			Main harness (1)		(2)	(3)
(66)	*3GW	3	Fuse 30A	1	2	
(73)	L	2	Fuse 5A	1	1	
(88)	BrR	4	PUL	1	2	1
(001)	3RW	2	H, STR	2		
(003)	WB, 3WB	15	A, E, LOA, MAI, Fuse 5A	5	2	8
(010)	5W	2	GLO, H	2		
(012)	BR	3	MAI	1		2
(025)	W	2	STR, Fuse 5A	2		
(031)	GW	2	GLO	1		1
(032)	2Y	2	ECA, Fuse 5A	2		
(038)	GrR	2	ECA	1		1
(039)	L	2	ECA	1		1
(040)	Gr	2	ECA	1		1
(041)	WB	2	ECA	1		1
(042)	WR	2	ECA	1		1
(043)	GB	2	ECA	1		1
(044)	GW	2	ECA	1		1
(045)	Gr	3	ECA	1		2
(047)	BR	3	ECA	1		2
(052)	G	2	ECA	1		1
(053)	L	2	ECA	1		1
(060)	Lg	2	ECA	1		1
(061)	0.5B	3	ECA × 2	2		1
(063)	0.5R	2	ECA	1		1
(066)	0.5W	3	ECA	1		2
(090)	0.5B	2	ECA	1		1
(091)	0.5W	2	ECA	1		1
(092)	0.5R	2	ECA	1		1
(094)	0.5R	3	ECA	1		2
(100)	1.25G, (1.25B)	4	ECB × 2	2		2
(106)	1.25W, (1.25B)	4	ECB × 2	2		2

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			Main harness (1)		(2)	(3)
(111)	1.25R	3	ECB	1		2
(115)	1.25R	3	ECB	1		2
(121)	1.25G	3	ECB	1		2
(125)	1.25W	3	ECB	1		2
(130)	RB	2	Fuse 5A	1		1
(134)	R, 3R	4	MAI × 2, Fuse 20A	3		1
(140)	LB	2	STR	1		1
(144)	0.5W	2	ECA	1		1
(157)	Br	3	ECA	1		2
(158)	BrW	3	ECA	1		2
(163)	0.5R	3	ECA	1	1	1
(167)	L	2	NEU	1		1
(168)	G	2	PUL	1		1
(200)	R	2	ECC	1		1
(201)	B	4	ECC × 3	3		1
(202)	R	2	ECC	1		1
(204)	R	2	ECC	1		1
(208)	W	2	ECC	1		1
(209)	0.5B, B	3	ECA, ECC	2		1
(210)	R	2	ECC	1		1
(211)	B	2	E	1		1
(212)	G	2	E	1		1
(213)	L	2	E	1		1
(216)	W	2	ECA	1		1
(217)	L	2	ECA	1		1
(219)	0.5W	2	ECA	1		1
(371)	BrW	2	F	1	1	
(401)	GR	2	LOA	1		1
(406)	LY	2	LOA	1	1	
(407)	BrY	2	A, LOA	2		

4-1. Main Harness (1) *:b (From 70218)



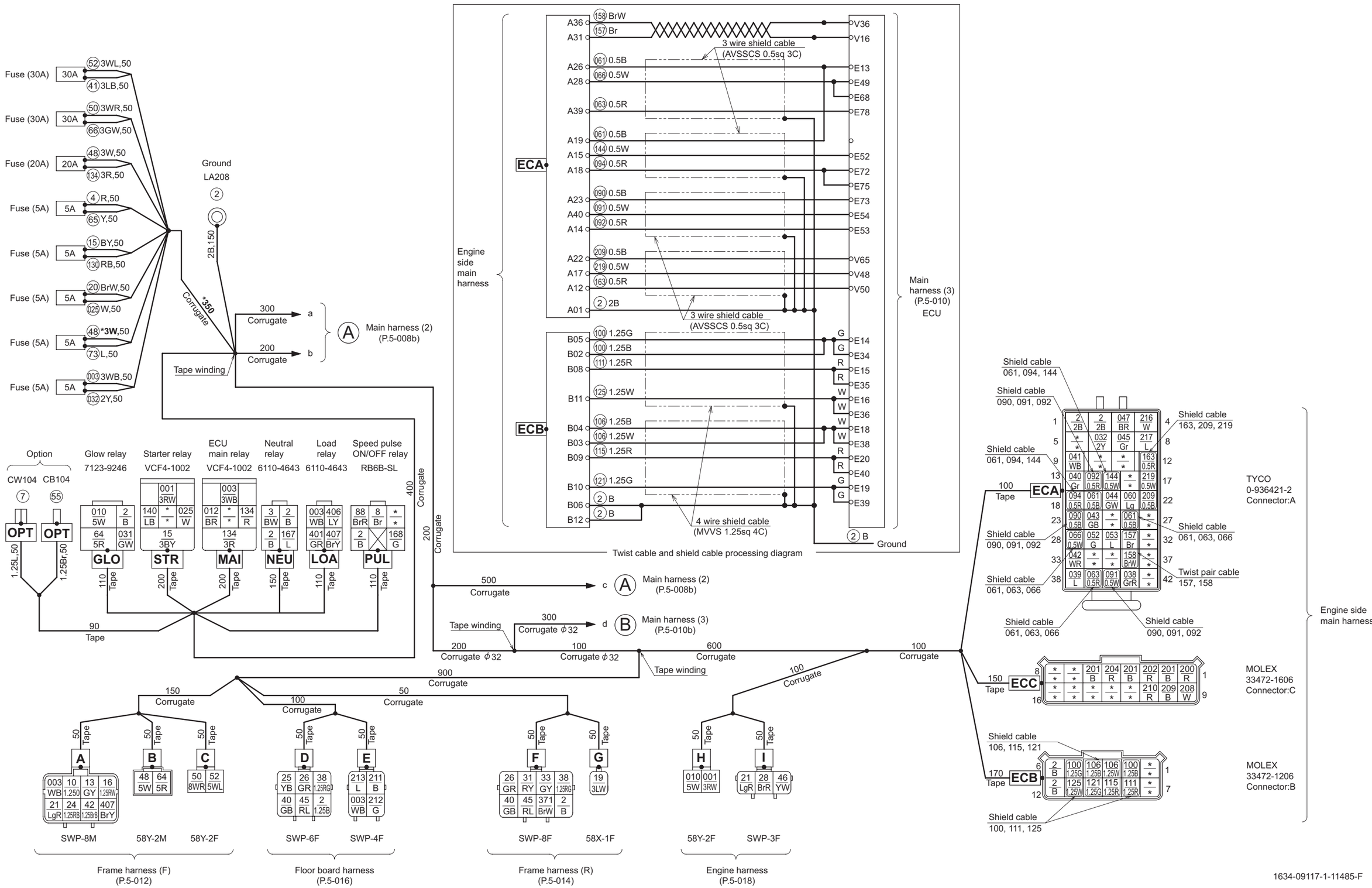
1634-09117-1-11485-D

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			Main harness (1)		(2)	(3)
②	B, 1.25B, 2B	33	D, ECA × 2, ECB × 2, F, GLO, NEU × 2, PUL, Ground	11	13	9
③	BW	3	NEU	1	2	
④	R	2	Fuse 5A	1	1	
⑦	1.25L	3	OPT	1	2	
⑧	Br	3	PUL	1	1	1
⑩	1.25O	3	A	1	1	1
⑬	GY	2	A	1	1	
⑮	BY, 3BY	3	STR, Fuse 5A	2	1	
⑯	1.25RW	2	A	1	1	
⑲	3LW	3	G	1	2	
⑳	BrW	2	Fuse 5A	1	1	
㉑	LgR	3	A, I	2	1	
㉔	1.25RB	2	A	1	1	
㉕	YB	2	D	1	1	
㉖	GR	5	D, F	2	3	
㉘	BrR	3	I	1	2	
㉛	RY	3	F	1	2	
㉝	GY	2	F	1	1	
㉞	1.25RG	4	D, F	2	2	
㊵	GB	5	D, F	2	3	
㊶	3LB	3	Fuse 30A	1	2	
㊷	1.25BrB	2	A	1	1	
㊺	RL	5	D, F	2	3	
㊻	YW	2	I	1	1	
㊽	W, 3W, 5W	4	B, Fuse 5A, 20A	3	1	
㊿	3WR, 8WR	4	C, Fuse 30A	2	2	
(52)	3WL, 5WL	3	C, Fuse 30A	2	1	
(55)	1.25Br	2	OPT	1	1	
(64)	5R	2	B, GLO	2		
(65)	Y	7	Fuse 5A	1	3	3

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			Main harness (1)		(2)	(3)
(66)	3GW	3	Fuse 30A	1	2	
(73)	L	2	Fuse 5A	1	1	
(88)	BrR	4	PUL	1	2	1
(001)	3RW	2	H, STR	2		
(003)	WB, 3WB	15	A, E, LOA, MAI, Fuse 5A	5	2	8
(010)	5W	2	GLO, H	2		
(012)	BR	3	MAI	1		2
(025)	W	2	STR, Fuse 5A	2		
(031)	GW	2	GLO	1		1
(032)	2Y	2	ECA, Fuse 5A	2		
(038)	GrR	2	ECA	1		1
(039)	L	2	ECA	1		1
(040)	Gr	2	ECA	1		1
(041)	WB	2	ECA	1		1
(042)	WR	2	ECA	1		1
(043)	GB	2	ECA	1		1
(044)	GW	2	ECA	1		1
(045)	Gr	3	ECA	1		2
(047)	BR	3	ECA	1		2
(052)	G	2	ECA	1		1
(053)	L	2	ECA	1		1
(060)	Lg	2	ECA	1		1
(061)	0.5B	3	ECA × 2	2		1
(063)	0.5R	2	ECA	1		1
(066)	0.5W	3	ECA	1		2
(090)	0.5B	2	ECA	1		1
(091)	0.5W	2	ECA	1		1
(092)	0.5R	2	ECA	1		1
(094)	0.5R	3	ECA	1		2
(100)	1.25G, (1.25B)	4	ECB × 2	2		2
(106)	1.25W, (1.25B)	4	ECB × 2	2		2

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			Main harness (1)		(2)	(3)
(111)	1.25R	3	ECB	1		2
(115)	1.25R	3	ECB	1		2
(121)	1.25G	3	ECB	1		2
(125)	1.25W	3	ECB	1		2
(130)	RB	2	Fuse 5A	1		1
(134)	R, 3R	4	MAI × 2, Fuse 20A	3		1
(140)	LB	2	STR	1		1
(144)	0.5W	2	ECA	1		1
(157)	Br	3	ECA	1		2
(158)	BrW	3	ECA	1		2
(163)	0.5R	3	ECA	1	1	1
(167)	L	2	NEU	1		1
(168)	G	2	PUL	1		1
(200)	R	2	ECC	1		1
(201)	B	4	ECC × 3	3		1
(202)	R	2	ECC	1		1
(204)	R	2	ECC	1		1
(208)	W	2	ECC	1		1
(209)	0.5B, B	3	ECA, ECC	2		1
(210)	R	2	ECC	1		1
(211)	B	2	E	1		1
(212)	G	2	E	1		1
(213)	L	2	E	1		1
(216)	W	2	ECA	1		1
(217)	L	2	ECA	1		1
(219)	0.5W	2	ECA	1		1
(371)	BrW	2	F	1	1	
(401)	GR	2	LOA	1		1
(406)	LY	2	LOA	1	1	
(407)	BrY	2	A, LOA	2		

4-1. Main Harness (1) *:d (From 70253)



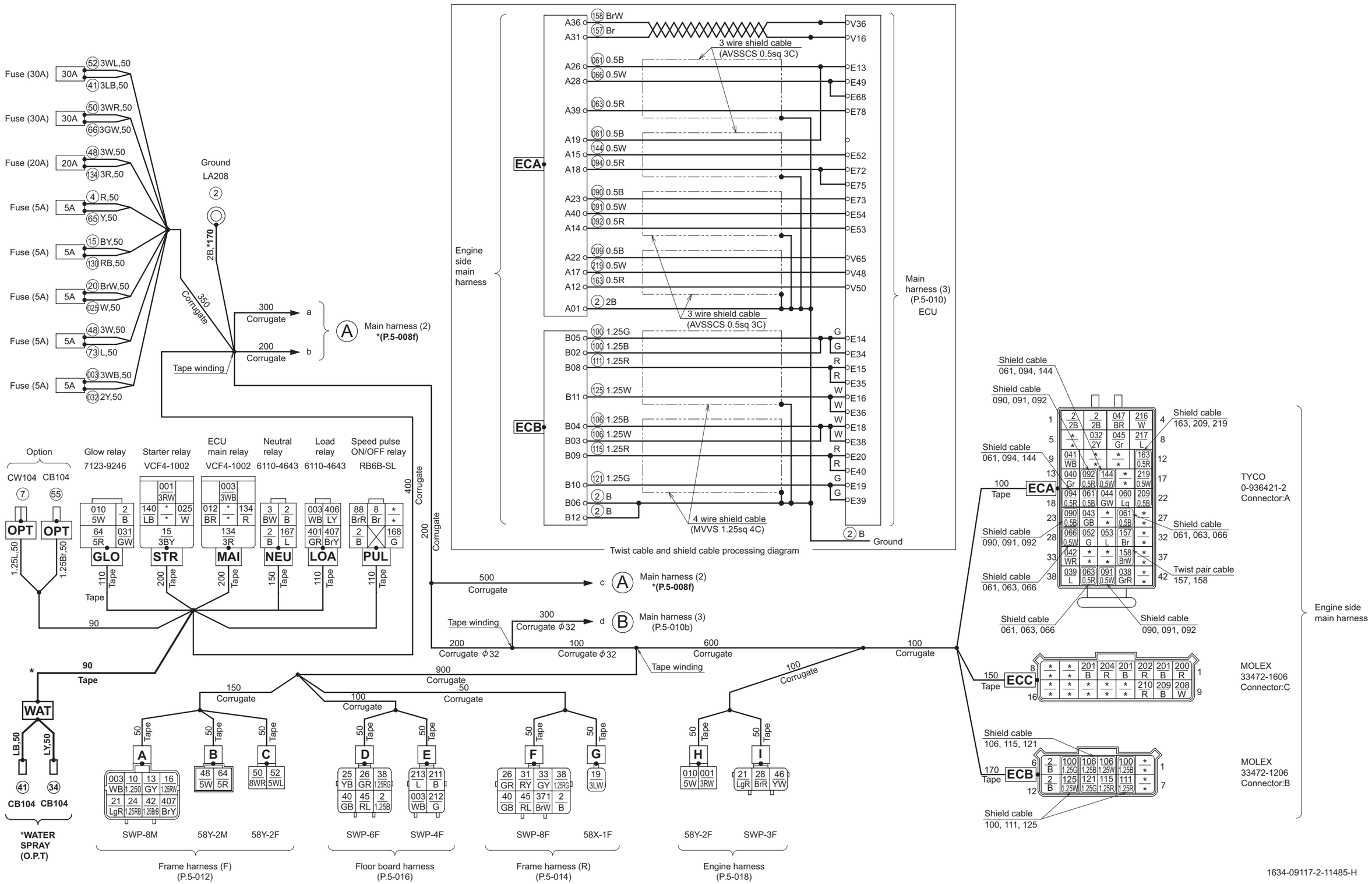
1634-09117-1-11485-F

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			Main harness (1)		(2)	(3)
②	B, 1.25B, 2B	33	D, ECA × 2, ECB × 2, F, GLO, NEU × 2, PUL, Ground	11	13	9
③	BW	3	NEU	1	2	
④	R	2	Fuse 5A	1	1	
⑦	1.25L	3	OPT	1	2	
⑧	Br	3	PUL	1	1	1
⑩	1.25O	3	A	1	1	1
⑬	GY	2	A	1	1	
⑮	BY, 3BY	3	STR, Fuse 5A	2	1	
⑯	1.25RW	2	A	1	1	
⑲	3LW	3	G	1	2	
⑳	BrW	2	Fuse 5A	1	1	
㉑	LgR	3	A, I	2	1	
㉔	1.25RB	2	A	1	1	
㉕	YB	2	D	1	1	
㉖	GR	5	D, F	2	3	
㉘	BrR	3	I	1	2	
㉛	RY	3	F	1	2	
㉝	GY	2	F	1	1	
㉞	1.25RG	4	D, F	2	2	
㊵	GB	5	D, F	2	3	
㊶	3LB	3	Fuse 30A	1	2	
㊷	1.25BrB	2	A	1	1	
㊺	RL	5	D, F	2	3	
㊻	YW	2	I	1	1	
㊽	* 3W, 5W	4	B, Fuse 5A, 20A	3	1	
㊿	3WR, 8WR	4	C, Fuse 30A	2	2	
(52)	3WL, 5WL	3	C, Fuse 30A	2	1	
(55)	1.25Br	2	OPT	1	1	
(64)	5R	2	B, GLO	2		
(65)	Y	7	Fuse 5A	1	3	3

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			Main harness (1)		(2)	(3)
(66)	3GW	3	Fuse 30A	1	2	
(73)	L	2	Fuse 5A	1	1	
(88)	BrR	4	PUL	1	2	1
(001)	3RW	2	H, STR	2		
(003)	WB, 3WB	15	A, E, LOA, MAI, Fuse 5A	5	2	8
(010)	5W	2	GLO, H	2		
(012)	BR	3	MAI	1		2
(025)	W	2	STR, Fuse 5A	2		
(031)	GW	2	GLO	1		1
(032)	2Y	2	ECA, Fuse 5A	2		
(038)	GrR	2	ECA	1		1
(039)	L	2	ECA	1		1
(040)	Gr	2	ECA	1		1
(041)	WB	2	ECA	1		1
(042)	WR	2	ECA	1		1
(043)	GB	2	ECA	1		1
(044)	GW	2	ECA	1		1
(045)	Gr	3	ECA	1		2
(047)	BR	3	ECA	1		2
(052)	G	2	ECA	1		1
(053)	L	2	ECA	1		1
(060)	Lg	2	ECA	1		1
(061)	0.5B	3	ECA × 2	2		1
(063)	0.5R	2	ECA	1		1
(066)	0.5W	3	ECA	1		2
(090)	0.5B	2	ECA	1		1
(091)	0.5W	2	ECA	1		1
(092)	0.5R	2	ECA	1		1
(094)	0.5R	3	ECA	1		2
(100)	1.25G, (1.25B)	4	ECB × 2	2		2
(106)	1.25W, (1.25B)	4	ECB × 2	2		2

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			Main harness (1)		(2)	(3)
(111)	1.25R	3	ECB	1		2
(115)	1.25R	3	ECB	1		2
(121)	1.25G	3	ECB	1		2
(125)	1.25W	3	ECB	1		2
(130)	RB	2	Fuse 5A	1		1
(134)	R, 3R	4	MAI × 2, Fuse 20A	3		1
(140)	LB	2	STR	1		1
(144)	0.5W	2	ECA	1		1
(157)	Br	3	ECA	1		2
(158)	BrW	3	ECA	1		2
(163)	0.5R	3	ECA	1	1	1
(167)	L	2	NEU	1		1
(168)	G	2	PUL	1		1
(200)	R	2	ECC	1		1
(201)	B	4	ECC × 3	3		1
(202)	R	2	ECC	1		1
(204)	R	2	ECC	1		1
(208)	W	2	ECC	1		1
(209)	0.5B, B	3	ECA, ECC	2		1
(210)	R	2	ECC	1		1
(211)	B	2	E	1		1
(212)	G	2	E	1		1
(213)	L	2	E	1		1
(216)	W	2	ECA	1		1
(217)	L	2	ECA	1		1
(219)	0.5W	2	ECA	1		1
(371)	BrW	2	F	1	1	
(401)	GR	2	LOA	1		1
(406)	LY	2	LOA	1	1	
(407)	BrY	2	A, LOA	2		

4-1. Main Harness (1) *:g (From 70379)

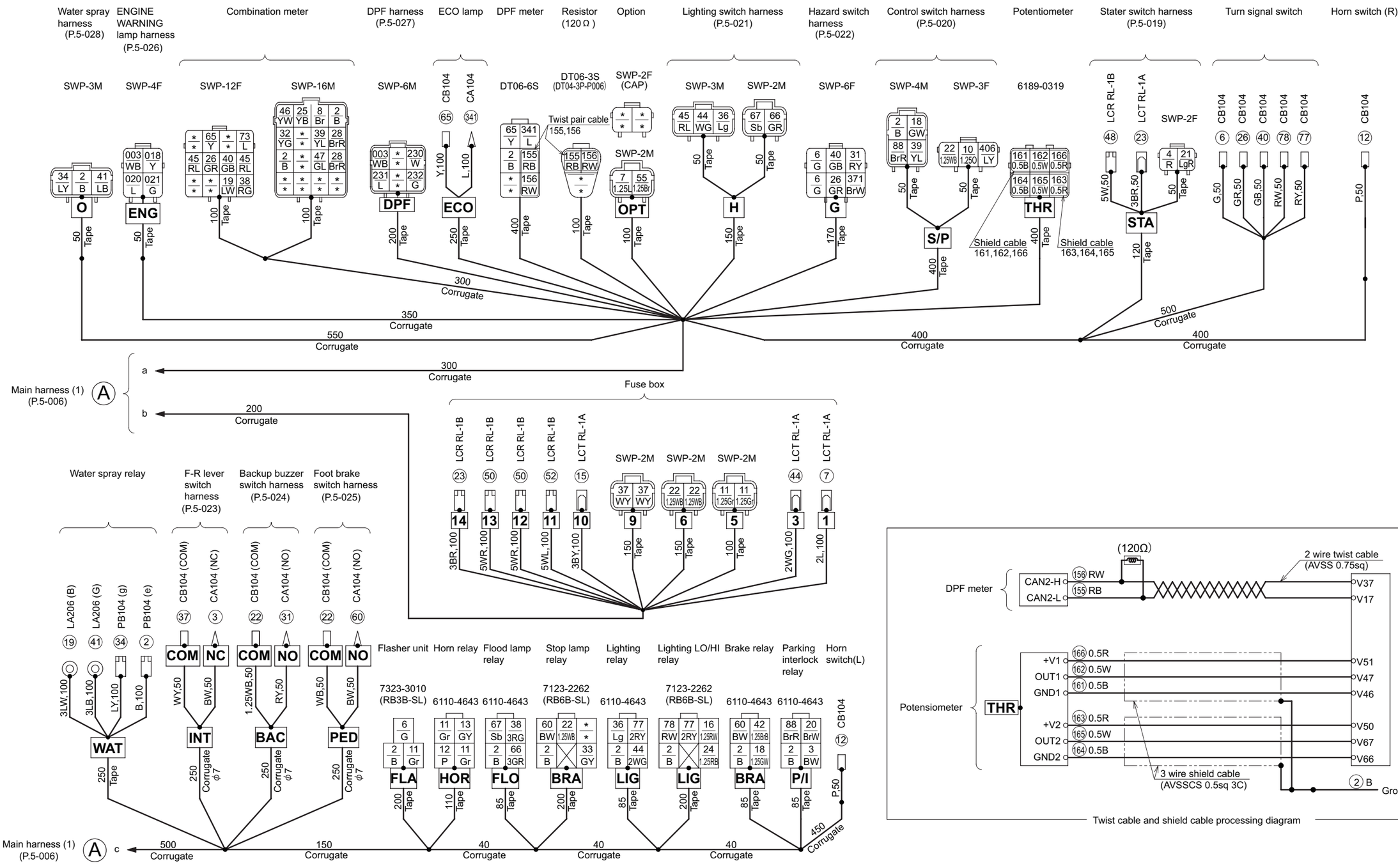


	NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
				Main harness (1)		(2)	(3)
	②	B, 1.25B, 2B	33	D, ECA × 2, ECB × 2, F, GLO, NEU × 2, PUL, Ground	11	13	9
	③	BW	3	NEU	1	2	
	④	R	2	Fuse 5A	1	1	
	⑦	1.25L	3	OPT	1	2	
	⑧	Br	3	PUL	1	1	1
	⑩	1.25O	3	A	1	1	1
	⑬	GY	2	A	1	1	
	⑮	BY, 3BY	3	STR, Fuse 5A	2	1	
	⑯	1.25RW	2	A	1	1	
	⑲	3LW	3	G	1	2	
	⑳	BrW	2	Fuse 5A	1	1	
	㉑	LgR	3	A, I	2	1	
	㉔	1.25RB	2	A	1	1	
	㉕	YB	2	D	1	1	
	㉖	GR	5	D, F	2	3	
	㉘	BrR	3	I	1	2	
	㉛	RY	3	F	1	2	
	㉝	GY	2	F	1	1	
*	**㉞**	**LY**	**3**	**WAT (OPT)**	**1**	**2**	
	㊳	1.25RG	4	D, F	2	2	
	㊵	GB	5	D, F	2	3	
*	㊶	LB, 3LB	4	Fuse 30A, WAT (OPT)	2	2	
	㊷	1.25BrB	2	A	1	1	
	㊺	RL	5	D, F	2	3	
	㊻	YW	2	I	1	1	
	㊽	3W, 5W	4	B, Fuse 5A, 20A	3	1	
	㊿	3WR, 8WR	4	C, Fuse 30A	2	2	
	㊷	3WL, 5WL	3	C, Fuse 30A	2	1	
	㊺	1.25Br	2	OPT	1	1	
	㊹	5R	2	B, GLO	2		

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			Main harness (1)		(2)	(3)
㊺	Y	7	Fuse 5A	1	3	3
㊻	3GR	3	Fuse 30A	1	2	
㊸	L	2	Fuse 5A	1	1	
㊽	BrR	4	PUL	1	2	1
001	3RW	2	H, STR	2		
003	WB, 3WB	15	A, E, LOA, MAI, Fuse 5A	5	2	8
010	5W	2	GLO, H	2		
012	BR	3	MAI	1		2
025	W	2	STR, Fuse 5A	2		
031	GW	2	GLO	1		1
032	2Y	2	ECA, Fuse 5A	2		
038	GrR	2	ECA	1		1
039	L	2	ECA	1		1
040	Gr	2	ECA	1		1
041	WB	2	ECA	1		1
042	WR	2	ECA	1		1
043	GB	2	ECA	1		1
044	GW	2	ECA	1		1
045	Gr	3	ECA	1		2
047	BR	3	ECA	1		2
052	G	2	ECA	1		1
053	L	2	ECA	1		1
060	Lg	2	ECA	1		1
061	0.5B	3	ECA × 2	2		1
063	0.5R	2	ECA	1		1
066	0.5W	3	ECA	1		2
090	0.5B	2	ECA	1		1
091	0.5W	2	ECA	1		1
092	0.5R	2	ECA	1		1
094	0.5R	3	ECA	1		2
100	1.25G, (1.25B)	4	ECB × 2	2		2

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			Main harness (1)		(2)	(3)
106	1.25W, (1.25B)	4	ECB × 2	2		2
111	1.25R	3	ECB	1		2
115	1.25R	3	ECB	1		2
121	1.25G	3	ECB	1		2
125	1.25W	3	ECB	1		2
130	RB	2	Fuse 5A	1		1
134	R, 3R	4	MAI × 2, Fuse 20A	3		1
140	LB	2	STR	1		1
144	0.5W	2	ECA	1		1
157	Br	3	ECA	1		2
158	BrW	3	ECA	1		2
163	0.5R	3	ECA	1	1	1
167	L	2	NEU	1		1
168	G	2	PUL	1		1
200	R	2	ECC	1		1
201	B	4	ECC × 3	3		1
202	R	2	ECC	1		1
204	R	2	ECC	1		1
208	W	2	ECC	1		1
209	0.5B, B	3	ECA, ECC	2		1
210	R	2	ECC	1		1
211	B	2	E	1		1
212	G	2	E	1		1
213	L	2	E	1		1
216	W	2	ECA	1		1
217	L	2	ECA	1		1
219	0.5W	2	ECA	1		1
371	BrW	2	F	1	1	
401	GR	2	LOA	1		1
406	LY	2	LOA	1	1	
407	BrY	2	A, LOA	2		

4-2. Main Harness (2)



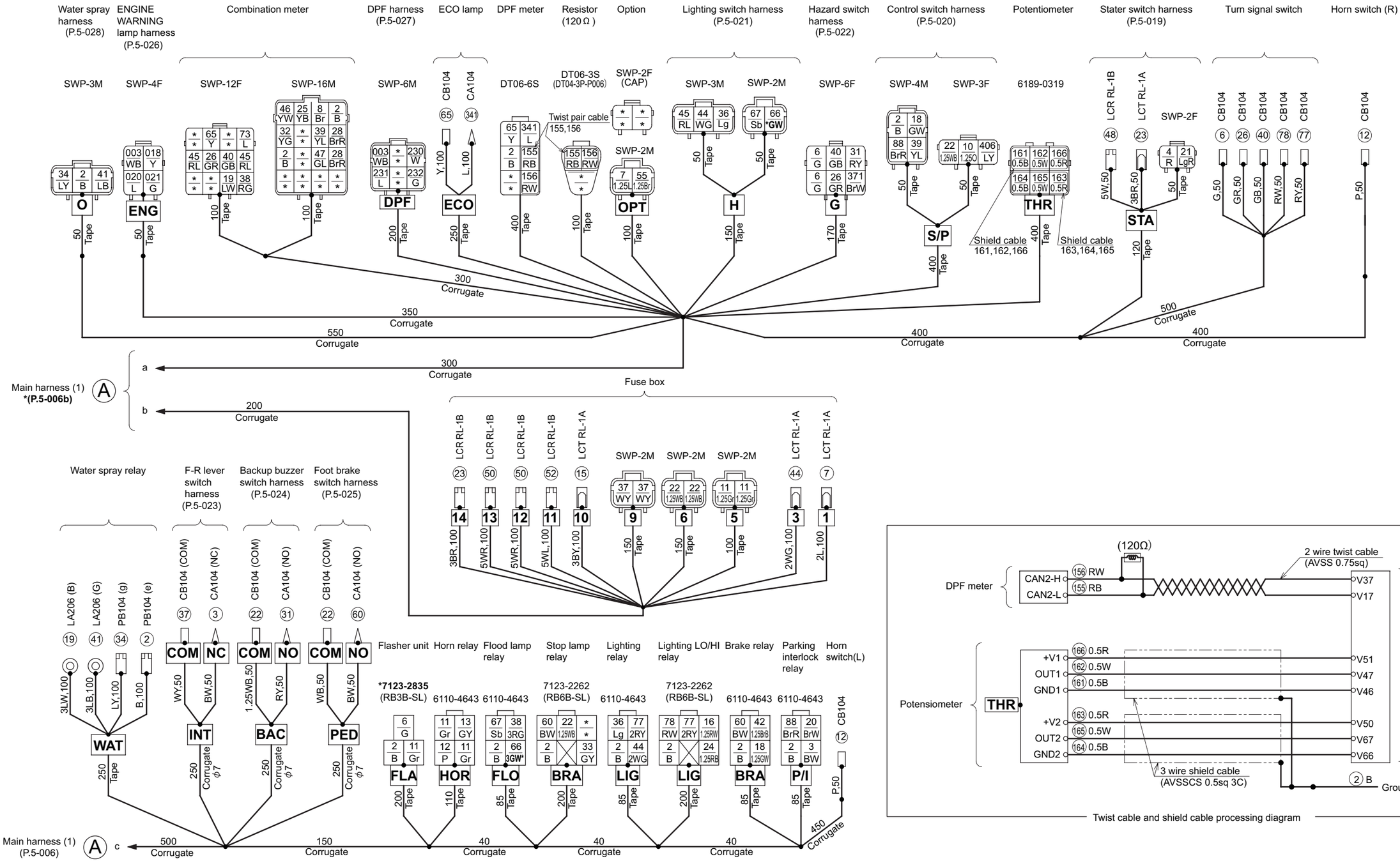
1634-09117-0-11485-B

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			(1)	Main harness (2)		(3)
②	B	33	11	BRA-2262, 4643, FLA, FLO, LIG-2262, 4643, O, P/I, S/P, WAT, Combination meter-16M × 2, DPF meter	13	9
③	BW	3	1	INT-NC, P/I	2	
④	R	2	1	STA	1	
⑥	G	4		FLA, G × 2, Turn signal switch	4	
⑦	1.25L, 2L	3	1	1, OPT	2	
⑧	Br	3	1	Combination meter-16M	1	1
⑩	1.25O	3	1	S/P	1	1
⑪	Gr, 1.25Gr	5		5 × 2, FLA, HOR × 2	5	
⑫	P	3		HOR, Horn switch (L), (R)	3	
⑬	GY	2	1	HOR	1	
⑮	3BY	3	2	10	1	
⑯	1.25RW	2	1	LIG-2262	1	
⑱	GW, 1.25GW	2		BRA-4643, S/P	2	
⑲	LW, 3LW	3	1	WAT, Combination meter-12F	2	
⑳	BrW	2	1	P/I	1	
㉑	LgR	3	2	STA	1	
㉒	WB, 1.25WB	6		6 × 2, BAC-COM, BRA-2262, PED-COM, S/P	6	
㉓	3BR	2		14, STA	2	
㉔	1.25RB	2	1	LIG-2262	1	
㉕	YB	2	1	Combination meter-16M	1	
㉖	GR	5	2	G, Combination meter-12F, Turn signal switch	3	

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			(1)	Main harness (2)		(3)
㉘	BrR	3	1	Combination meter-16M × 2	2	
㉛	RY	3	1	BAC-NO, G	2	
㉜	YG	2		Combination meter-16M	1	1
㉝	GY	2	1	BRA-2262	1	
㉞	LY	2		O, WAT	2	
㊱	Lg	2		H, LIG-4643	2	
㊲	WY	3		9 × 2, INT-COM	3	
㊳	RG, 3RG	4	2	FLO, Combination meter-12F	2	
㊴	YL	2		S/P, Combination meter-16M	2	
㊵	GB	5	2	G, Combination meter-12F, Turn signal switch	3	
㊶	LB, 3LB	3	1	O, WAT	2	
㊷	1.25BrB	2	1	BRA-4643	1	
㊹	WG, 2WG	3		3, H, LIG-4643	3	
㊺	RL	5	2	H, Combination meter-12F × 2	3	
㊻	YW	2	1	Combination meter-16M	1	
㊼	GL	2		Combination meter-16M	1	1
㊽	5W	4	3	STA	1	
㊿	5WR	4	2	12, 13	2	
(52)	5WL	3	2	11	1	
(55)	1.25Br	2	1	OPT	1	
(60)	BW	3		BRA-2262, 4643, PED-NO	3	
(65)	Y	7	1	ECO, Combination meter-12F, DPF meter	3	3
(66)	GR, 3GR	3	1	FLO, H	2	

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			(1)	Main harness (2)		(3)
(67)	Sb	2		FLO, H	2	
(73)	L	2	1	Combination meter-12F	1	
(77)	RY, 2RY	3		LIG-2262, 4643, Turn signal switch	3	
(78)	RW	2		LIG-2262, Turn signal switch	2	
(88)	BrR	4	1	P/I, S/P	2	1
(003)	WB	15	5	DPF, ENG	2	8
(018)	Y	2		ENG	1	1
(020)	L	2		ENG	1	1
(021)	G	2		ENG	1	1
(155)	RB	3		DPF meter, Resistor (120 Ω)	2	1
(156)	RW	3		DPF meter, Resistor (120 Ω)	2	1
(161)	0.5B	2		THR	1	1
(162)	0.5W	2		THR	1	1
(163)	0.5R	3	1	THR	1	1
(164)	0.5B	2		THR	1	1
(165)	0.5W	2		THR	1	1
(166)	0.5R	2		THR	1	1
(230)	W	2		DPF	1	1
(231)	L	2		DPF	1	1
(232)	G	2		DPF	1	1
(341)	L	2		ECO, DPF meter	2	
(371)	BrW	2	1	G	1	
(406)	LY	2	1	S/P	1	

4-2. Main Harness (2) *:a



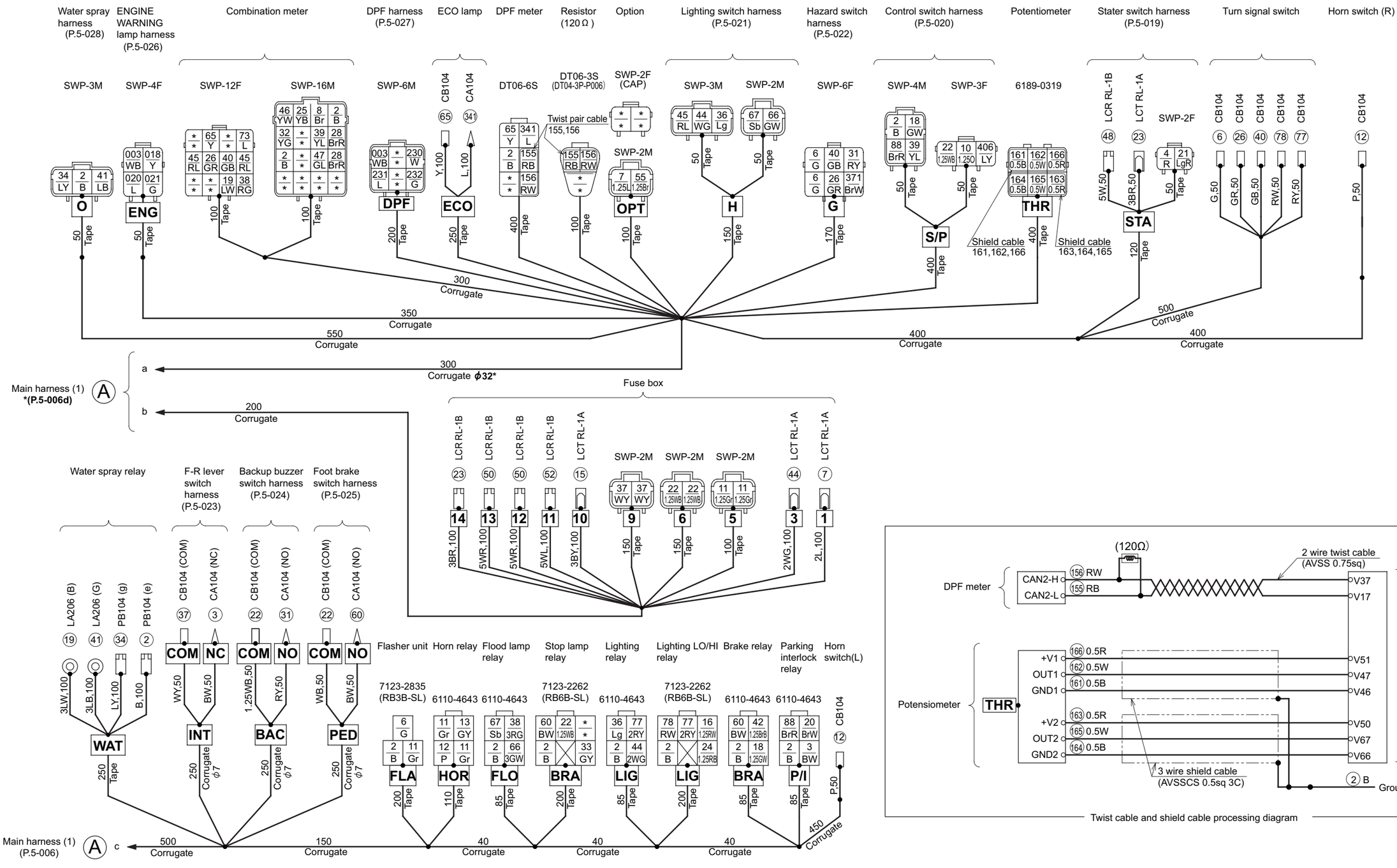
1634-09117-0-11485-C

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			(1)	Main harness (2)		(3)
②	B	33	11	BRA-2262, 4643, FLA, FLO, LIG-2262, 4643, O, P/I, S/P, WAT, Combination meter-16M × 2, DPF meter	13	9
③	BW	3	1	INT-NC, P/I	2	
④	R	2	1	STA	1	
⑥	G	4		FLA, G × 2, Turn signal switch	4	
⑦	1.25L, 2L	3	1	1, OPT	2	
⑧	Br	3	1	Combination meter-16M	1	1
⑩	1.25O	3	1	S/P	1	1
⑪	Gr, 1.25Gr	5		5 × 2, FLA, HOR × 2	5	
⑫	P	3		HOR, Horn switch (L), (R)	3	
⑬	GY	2	1	HOR	1	
⑮	3BY	3	2	10	1	
⑯	1.25RW	2	1	LIG-2262	1	
⑱	GW, 1.25GW	2		BRA-4643, S/P	2	
⑲	LW, 3LW	3	1	WAT, Combination meter-12F	2	
⑳	BrW	2	1	P/I	1	
㉑	LgR	3	2	STA	1	
㉒	WB, 1.25WB	6		6 × 2, BAC-COM, BRA-2262, PED-COM, S/P	6	
㉓	3BR	2		14, STA	2	
㉔	1.25RB	2	1	LIG-2262	1	
㉕	YB	2	1	Combination meter-16M	1	
㉖	GR	5	2	G, Combination meter-12F, Turn signal switch	3	

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			(1)	Main harness (2)		(3)
㉘	BrR	3	1	Combination meter-16M × 2	2	
㉛	RY	3	1	BAC-NO, G	2	
㉜	YG	2		Combination meter-16M	1	1
㉝	GY	2	1	BRA-2262	1	
㉞	LY	2		O, WAT	2	
㊱	Lg	2		H, LIG-4643	2	
㊲	WY	3		9 × 2, INT-COM	3	
㊳	RG, 3RG	4	2	FLO, Combination meter-12F	2	
㊴	YL	2		S/P, Combination meter-16M	2	
㊵	GB	5	2	G, Combination meter-12F, Turn signal switch	3	
㊶	LB, 3LB	3	1	O, WAT	2	
㊷	1.25BrB	2	1	BRA-4643	1	
㊹	WG, 2WG	3		3, H, LIG-4643	3	
㊺	RL	5	2	H, Combination meter-12F × 2	3	
㊻	YW	2	1	Combination meter-16M	1	
㊼	GL	2		Combination meter-16M	1	1
㊽	5W	4	3	STA	1	
㊿	5WR	4	2	12, 13	2	
(52)	5WL	3	2	11	1	
(55)	1.25Br	2	1	OPT	1	
(60)	BW	3		BRA-2262, 4643, PED-NO	3	
(65)	Y	7	1	ECO, Combination meter-12F, DPF meter	3	3
(66)	* GW, 3GW	3	1	FLO, H	2	

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			(1)	Main harness (2)		(3)
(67)	Sb	2		FLO, H	2	
(73)	L	2	1	Combination meter-12F	1	
(77)	RY, 2RY	3		LIG-2262, 4643, Turn signal switch	3	
(78)	RW	2		LIG-2262, Turn signal switch	2	
(88)	BrR	4	1	P/I, S/P	2	1
(003)	WB	15	5	DPF, ENG	2	8
(018)	Y	2		ENG	1	1
(020)	L	2		ENG	1	1
(021)	G	2		ENG	1	1
(155)	RB	3		DPF meter, Resistor (120 Ω)	2	1
(156)	RW	3		DPF meter, Resistor (120 Ω)	2	1
(161)	0.5B	2		THR	1	1
(162)	0.5W	2		THR	1	1
(163)	0.5R	3	1	THR	1	1
(164)	0.5B	2		THR	1	1
(165)	0.5W	2		THR	1	1
(166)	0.5R	2		THR	1	1
(230)	W	2		DPF	1	1
(231)	L	2		DPF	1	1
(232)	G	2		DPF	1	1
(341)	L	2		ECO, DPF meter	2	
(371)	BrW	2	1	G	1	
(406)	LY	2	1	S/P	1	

4-2. Main Harness (2) *:b (From 70218)



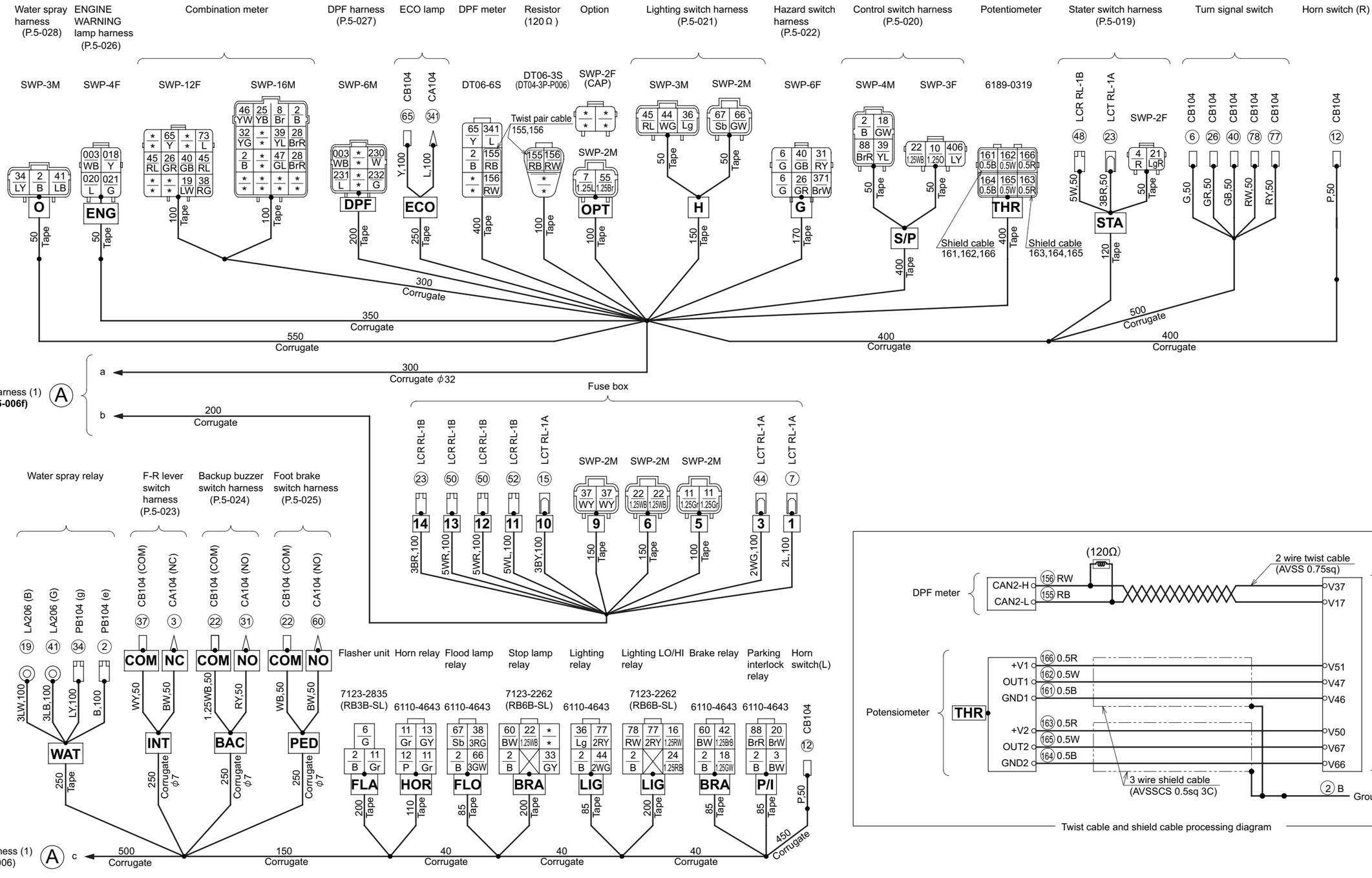
1634-09117-1-11485-D

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			(1)	Main harness (2)		(3)
②	B	33	11	BRA-2262, 4643, FLA, FLO, LIG-2262, 4643, O, P/I, S/P, WAT, Combination meter-16M × 2, DPF meter	13	9
③	BW	3	1	INT-NC, P/I	2	
④	R	2	1	STA	1	
⑥	G	4		FLA, G × 2, Turn signal switch	4	
⑦	1.25L, 2L	3	1	1, OPT	2	
⑧	Br	3	1	Combination meter-16M	1	1
⑩	1.25O	3	1	S/P	1	1
⑪	Gr, 1.25Gr	5		5 × 2, FLA, HOR × 2	5	
⑫	P	3		HOR, Horn switch (L), (R)	3	
⑬	GY	2	1	HOR	1	
⑮	3BY	3	2	10	1	
⑯	1.25RW	2	1	LIG-2262	1	
⑱	GW, 1.25GW	2		BRA-4643, S/P	2	
⑲	LW, 3LW	3	1	WAT, Combination meter-12F	2	
⑳	BrW	2	1	P/I	1	
㉑	LgR	3	2	STA	1	
㉒	WB, 1.25WB	6		6 × 2, BAC-COM, BRA-2262, PED-COM, S/P	6	
㉓	3BR	2		14, STA	2	
㉔	1.25RB	2	1	LIG-2262	1	
㉕	YB	2	1	Combination meter-16M	1	
㉖	GR	5	2	G, Combination meter-12F, Turn signal switch	3	

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			(1)	Main harness (2)		(3)
㉘	BrR	3	1	Combination meter-16M × 2	2	
㉛	RY	3	1	BAC-NO, G	2	
㉜	YG	2		Combination meter-16M	1	1
㉝	GY	2	1	BRA-2262	1	
㉞	LY	2		O, WAT	2	
㊱	Lg	2		H, LIG-4643	2	
㊲	WY	3		9 × 2, INT-COM	3	
㊳	RG, 3RG	4	2	FLO, Combination meter-12F	2	
㊴	YL	2		S/P, Combination meter-16M	2	
㊵	GB	5	2	G, Combination meter-12F, Turn signal switch	3	
㊶	LB, 3LB	3	1	O, WAT	2	
㊷	1.25BrB	2	1	BRA-4643	1	
㊹	WG, 2WG	3		3, H, LIG-4643	3	
㊺	RL	5	2	H, Combination meter-12F × 2	3	
㊻	YW	2	1	Combination meter-16M	1	
㊼	GL	2		Combination meter-16M	1	1
㊽	5W	4	3	STA	1	
㊿	5WR	4	2	12, 13	2	
㊷	5WL	3	2	11	1	
㊺	1.25Br	2	1	OPT	1	
㊿	BW	3		BRA-2262, 4643, PED-NO	3	
㊺	Y	7	1	ECO, Combination meter-12F, DPF meter	3	3
㊻	GW, 3GW	3	1	FLO, H	2	

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			(1)	Main harness (2)		(3)
㊼	Sb	2		FLO, H	2	
㊸	L	2	1	Combination meter-12F	1	
㊼	RY, 2RY	3		LIG-2262, 4643, Turn signal switch	3	
㊽	RW	2		LIG-2262, Turn signal switch	2	
㊽	BrR	4	1	P/I, S/P	2	1
⑶	WB	15	5	DPF, ENG	2	8
⑱	Y	2		ENG	1	1
⑳	L	2		ENG	1	1
㉑	G	2		ENG	1	1
㉟	RB	3		DPF meter, Resistor (120 Ω)	2	1
㊱	RW	3		DPF meter, Resistor (120 Ω)	2	1
㊶	0.5B	2		THR	1	1
㊷	0.5W	2		THR	1	1
㊸	0.5R	3	1	THR	1	1
㊹	0.5B	2		THR	1	1
㊺	0.5W	2		THR	1	1
㊻	0.5R	2		THR	1	1
㉚	W	2		DPF	1	1
㉛	L	2		DPF	1	1
㉜	G	2		DPF	1	1
㉛	L	2		ECO, DPF meter	2	
㊶	BrW	2	1	G	1	
㊻	LY	2	1	S/P	1	

4-2. Main Harness (2) *:g (From 70379)



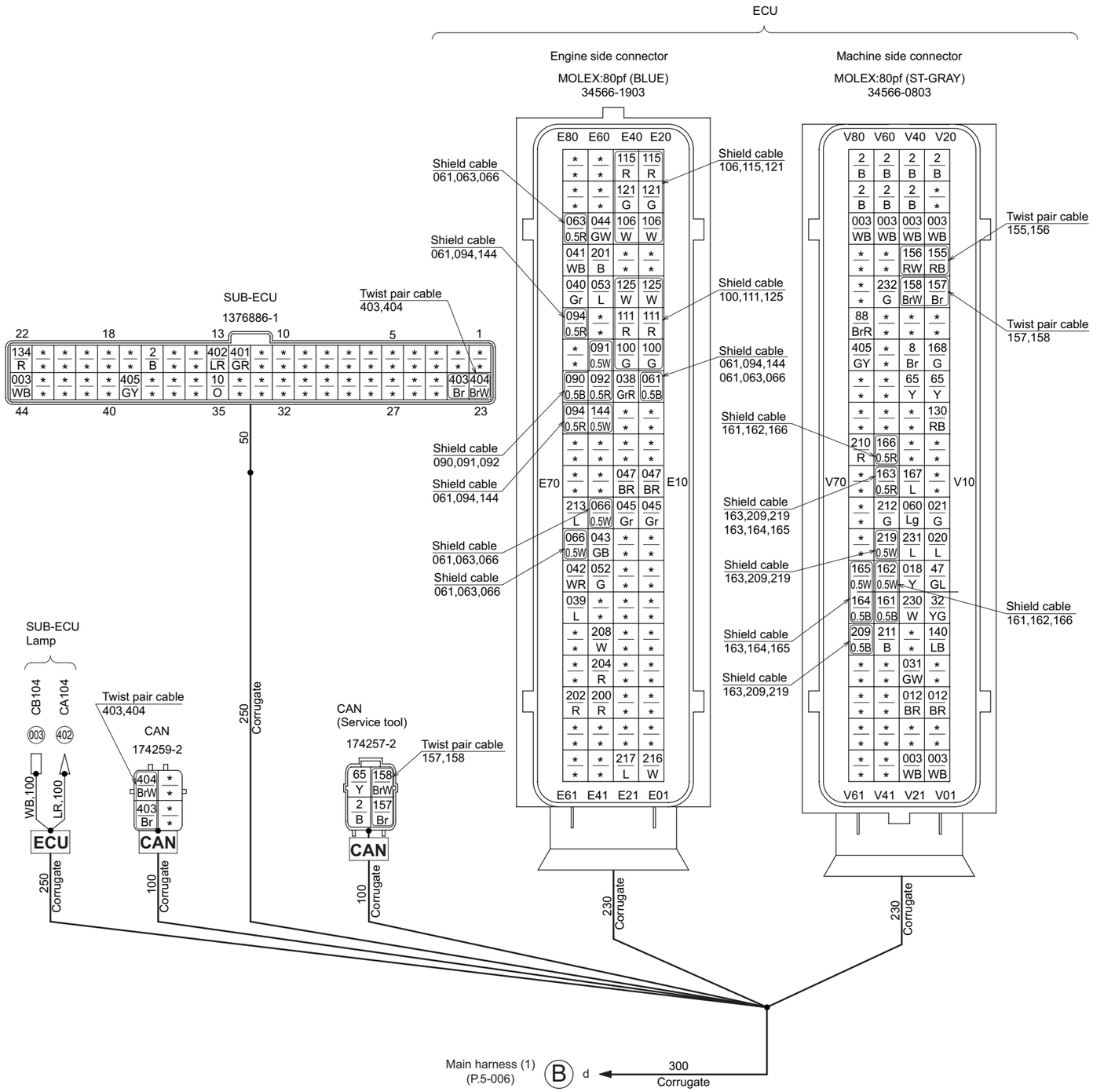
1634-09117-2-11485-H

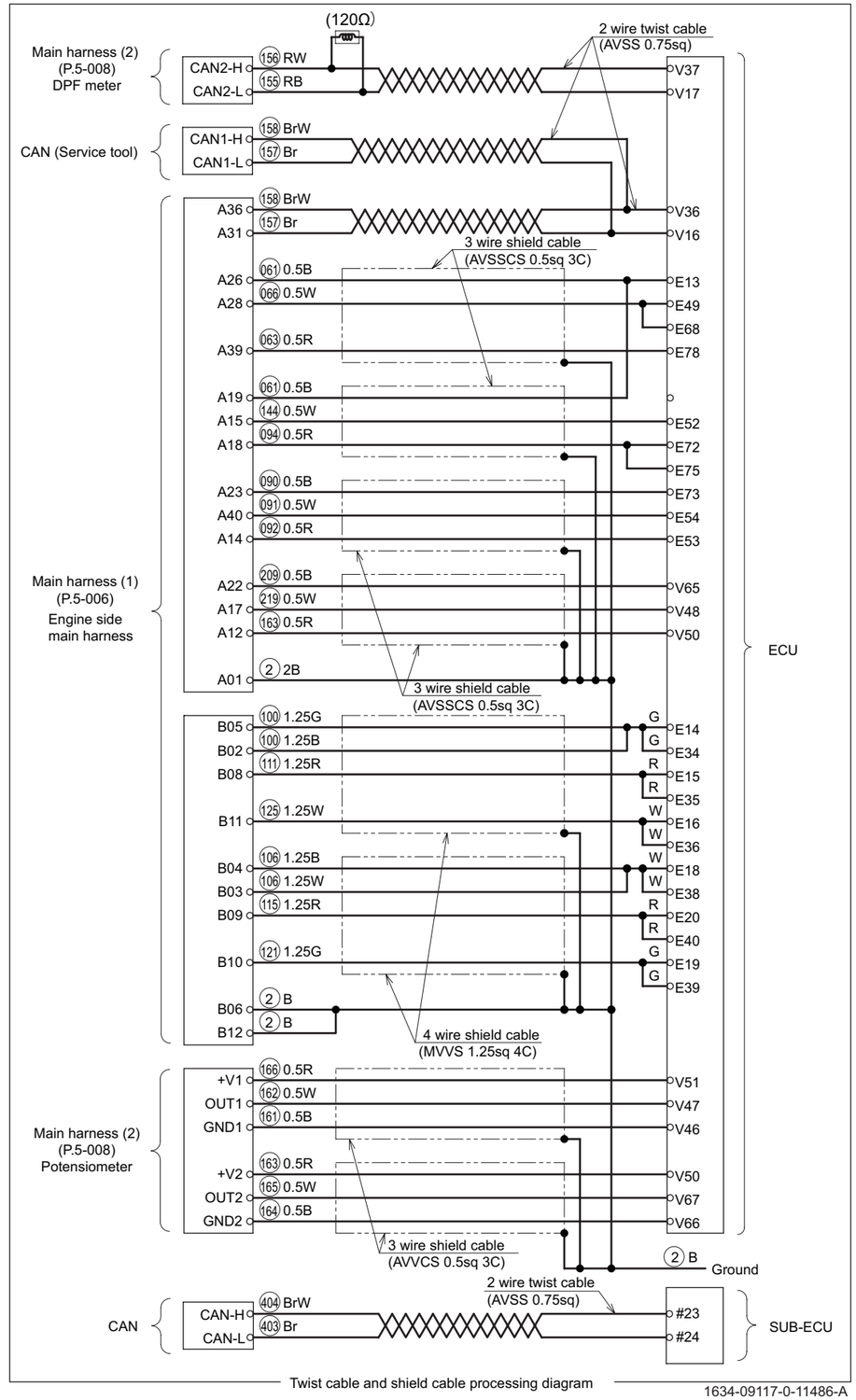
NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			(1)	Main harness (2)		(3)
②	B	33	11	BRA-2262, 4643, FLA, FLO, LIG-2262, 4643, O, P/I, S/P, WAT, Combination meter-16M × 2, DPF meter	13	9
③	BW	3	1	INT-NC, P/I	2	
④	R	2	1	STA	1	
⑥	G	4		FLA, G × 2, Turn signal switch	4	
⑦	1.25L, 2L	3	1	1, OPT	2	
⑧	Br	3	1	Combination meter-16M	1	1
⑩	1.25O	3	1	S/P	1	1
⑪	Gr, 1.25Gr	5		5 × 2, FLA, HOR × 2	5	
⑫	P	3		HOR, Horn switch (L), (R)	3	
⑬	GY	2	1	HOR	1	
⑮	3BY	3	2	10	1	
⑯	1.25RW	2	1	LIG-2262	1	
⑱	GW, 1.25GW	2		BRA-4643, S/P	2	
⑲	LW, 3LW	3	1	WAT, Combination meter-12F	2	
⑳	BrW	2	1	P/I	1	
㉑	LgR	3	2	STA	1	
㉒	WB, 1.25WB	6		6 × 2, BAC-COM, BRA-2262, PED-COM, S/P	6	
㉓	3BR	2		14, STA	2	
㉔	1.25RB	2	1	LIG-2262	1	
㉕	YB	2	1	Combination meter-16M	1	
㉖	GR	5	2	G, Combination meter-12F, Turn signal switch	3	

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			(1)	Main harness (2)		(3)
㉘	BrR	3	1	Combination meter-16M × 2	2	
㉛	RY	3	1	BAC-NO, G	2	
㉜	YG	2		Combination meter-16M	1	1
㉝	GY	2	1	BRA-2262	1	
㉞	LY	*3	1	O, WAT	2	
㊱	Lg	2		H, LIG-4643	2	
㊲	WY	3		9 × 2, INT-COM	3	
㊳	RG, 3RG	4	2	FLO, Combination meter-12F	2	
㊴	YL	2		S/P, Combination meter-16M	2	
㊵	GB	5	2	G, Combination meter-12F, Turn signal switch	3	
㊶	LB, 3LB	*4	2	O, WAT	2	
㊷	1.25BrB	2	1	BRA-4643	1	
㊹	WG, 2WG	3		3, H, LIG-4643	3	
㊺	RL	5	2	H, Combination meter-12F × 2	3	
㊻	YW	2	1	Combination meter-16M	1	
㊼	GL	2		Combination meter-16M	1	1
㊽	5W	4	3	STA	1	
㊿	5WR	4	2	12, 13	2	
㊷	5WL	3	2	11	1	
㊺	1.25Br	2	1	OPT	1	
㊿	BW	3		BRA-2262, 4643, PED-NO	3	
㊺	Y	7	1	ECO, Combination meter-12F, DPF meter	3	3
㊻	GW, 3GW	3	1	FLO, H	2	

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			(1)	Main harness (2)		(3)
㊼	Sb	2		FLO, H	2	
㊸	L	2	1	Combination meter-12F	1	
㊼	RY, 2RY	3		LIG-2262, 4643, Turn signal switch	3	
㊽	RW	2		LIG-2262, Turn signal switch	2	
㊽	BrR	4	1	P/I, S/P	2	1
003	WB	15	5	DPF, ENG	2	8
018	Y	2		ENG	1	1
020	L	2		ENG	1	1
021	G	2		ENG	1	1
㉟	RB	3		DPF meter, Resistor (120 Ω)	2	1
㊱	RW	3		DPF meter, Resistor (120 Ω)	2	1
㊶	0.5B	2		THR	1	1
㊷	0.5W	2		THR	1	1
㊸	0.5R	3	1	THR	1	1
㊹	0.5B	2		THR	1	1
㊺	0.5W	2		THR	1	1
㊻	0.5R	2		THR	1	1
㉚	W	2		DPF	1	1
㉛	L	2		DPF	1	1
㉜	G	2		DPF	1	1
㉛	L	2		ECO, DPF meter	2	
㊶	BrW	2	1	G	1	
㊻	LY	2	1	S/P	1	

4-3. Main Harness (3)





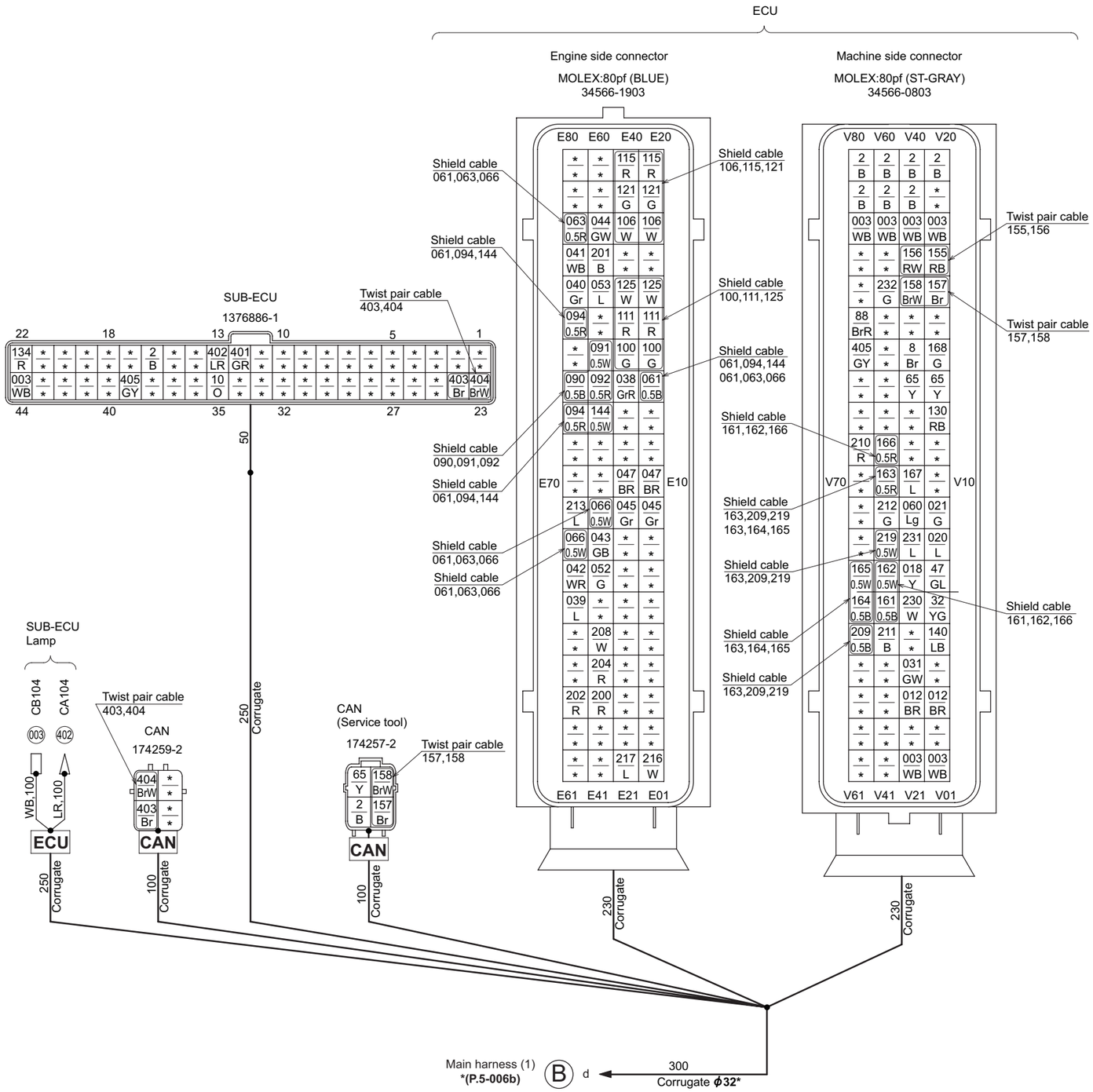
1634-09117-0-11486-A

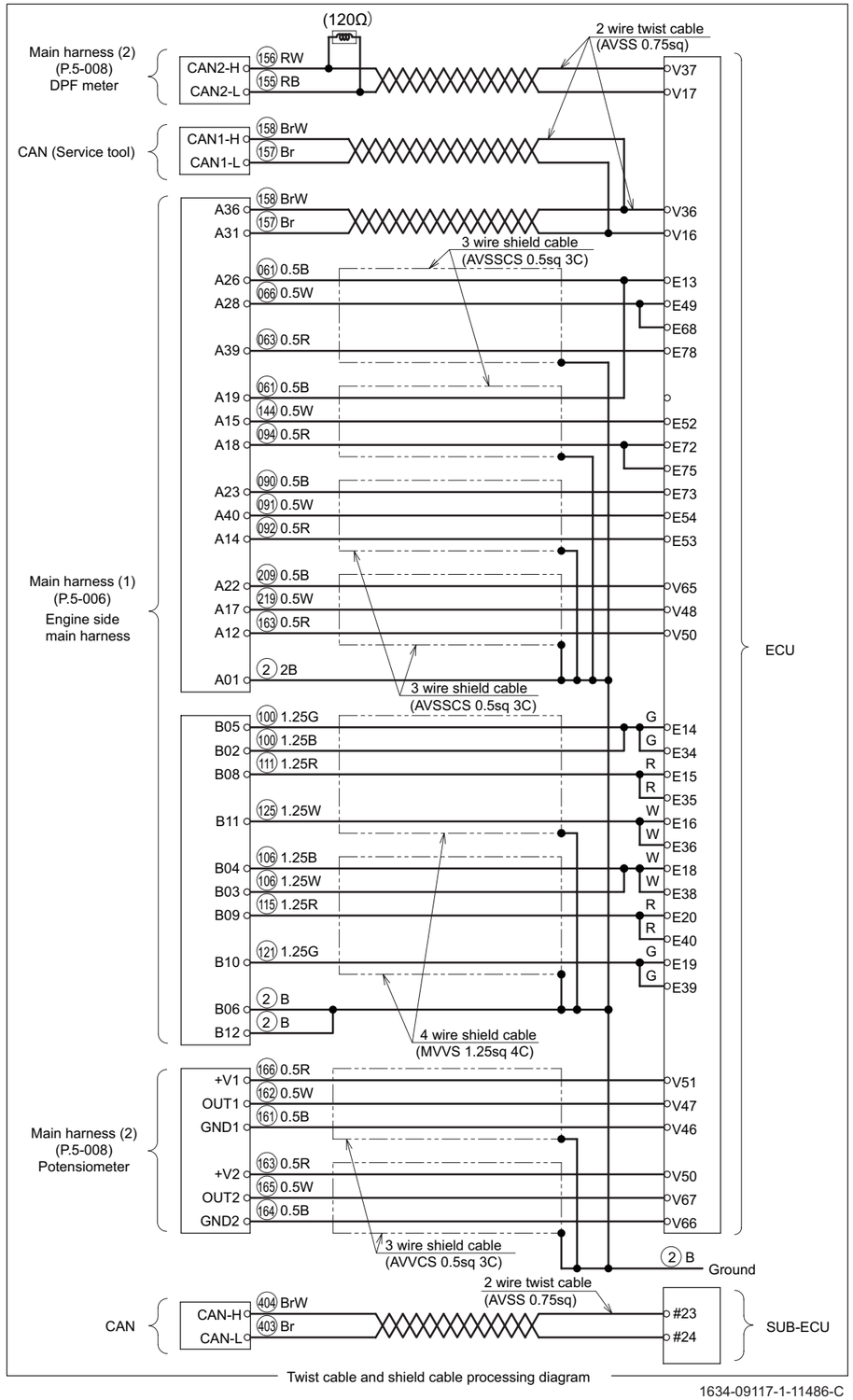
NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			(1)	(2)	Main harness (3)	
②	B	33	11	13	CAN-174257, ECU-V20, V39, V40, V59, V60, V79, V80, SUB-ECU-16	9
⑧	Br	3	1	1	ECU-V34	1
⑩	O	3	1	1	SUB-ECU-35	1
㉜	YG	2		1	ECU-V06	1
㊼	GL	2		1	ECU-V07	1
㊺	Y	7	1	3	CAN-174257, ECU-V13, V33	3
㊽	BrR	4	1	2	ECU-V75	1
003	WB	15	5	2	ECU, ECU-V01, V18, V21, V38, V58, V78, SUB-ECU-44	8
012	BR	3	1		ECU-V03, V23	2
018	Y	2		1	ECU-V27	1
020	L	2		1	ECU-V08	1
021	G	2		1	ECU-V09	1
031	GW	2	1		ECU-V24	1
038	GrR	2	1		ECU-E33	1
039	L	2	1		ECU-E66	1
040	Gr	2	1		ECU-E76	1
041	WB	2	1		ECU-E77	1
042	WR	2	1		ECU-E67	1
043	GB	2	1		ECU-E48	1
044	GW	2	1		ECU-E58	1
045	Gr	3	1		ECU-E09, E29	2
047	BR	3	1		ECU-E10, E30	2
052	G	2	1		ECU-E47	1
053	L	2	1		ECU-E56	1

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			(1)	(2)	Main harness (3)	
060	Lg	2	1		ECU-V29	1
061	0.5B	3	2		ECU-E13	1
063	0.5R	2	1		ECU-E78	1
066	0.5W	3	1		ECU-E49, E68	2
090	0.5B	2	1		ECU-E73	1
091	0.5W	2	1		ECU-E54	1
092	0.5R	2	1		ECU-E53	1
094	0.5R	3	1		ECU- E72, E75	2
100	G	4	2		ECU-E14, E34	2
106	W	4	2		ECU-E18, E38	2
111	R	3	1		ECU-E15, E35	2
115	R	3	1		ECU-E20, E40	2
121	G	3	1		ECU-E19, E39	2
125	W	3	1		ECU-E16, E36	2
130	RB	2	1		ECU-V12	1
134	R	4	3		SUB-ECU-22	1
140	LB	2	1		ECU-V05	1
144	0.5W	2	1		ECU-E52	1
155	RB	3		2	ECU-V17	1
156	RW	3		2	ECU-V37	1
157	Br	3	1		CAN-174257, ECU-V16	2
158	BrW	3	1		CAN-174257, ECU-V36	2
161	0.5B	2		1	ECU-V46	1
162	0.5W	2		1	ECU-V47	1
163	0.5R	3	1	1	ECU-V50	1
164	0.5B	2		1	ECU-V66	1

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			(1)	(2)	Main harness (3)	
165	0.5W	2		1	ECU-V67	1
166	0.5R	2		1	ECU-V51	1
167	L	2	1		ECU-V30	1
168	G	2	1		ECU-V14	1
200	R	2	1		ECU-E43	1
201	B	4	3		ECU-E57	1
202	R	2	1		ECU-E63	1
204	R	2	1		ECU-E44	1
208	W	2	1		ECU-E45	1
209	0.5B	3	2		ECU-V65	1
210	R	2	1		ECU-V71	1
211	B	2	1		ECU-V45	1
212	G	2	1		ECU-V49	1
213	L	2	1		ECU-E69	1
216	W	2	1		ECU-E01	1
217	L	2	1		ECU-E21	1
219	0.5W	2	1		ECU-V48	1
230	W	2		1	ECU-V26	1
231	L	2		1	ECU-V28	1
232	G	2		1	ECU-V56	1
401	GR	2	1		SUB-ECU-12	1
402	LR	2			ECU, SUB-ECU-13	2
403	Br	2			CAN-174259, SUB-ECU-24	2
404	BrW	2			CAN-174259, SUB-ECU-23	2
405	GY	2			ECU-V74, SUB-ECU-39	2

4-3. Main Harness (3) *:b (From 70218)





Twist cable and shield cable processing diagram

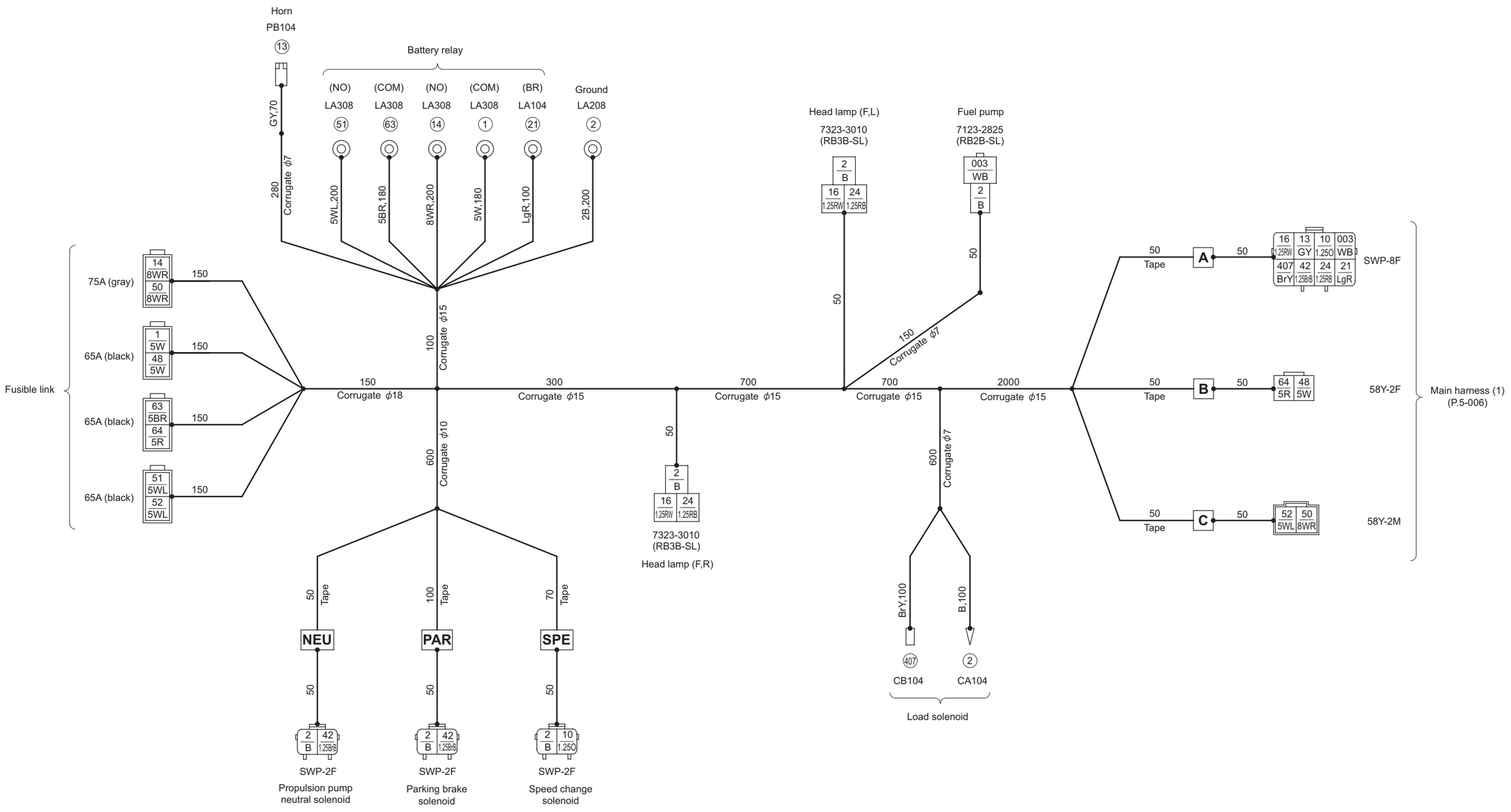
1634-09117-1-11486-C

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			(1)	(2)	Main harness (3)	
②	B	33	11	13	CAN-174257, ECU-V20, V39, V40, V59, V60, V79, V80, SUB-ECU-16	9
⑧	Br	3	1	1	ECU-V34	1
⑩	O	3	1	1	SUB-ECU-35	1
㉜	YG	2		1	ECU-V06	1
㊼	GL	2		1	ECU-V07	1
㊺	Y	7	1	3	CAN-174257, ECU-V13, V33	3
㊽	BrR	4	1	2	ECU-V75	1
003	WB	15	5	2	ECU, ECU-V01, V18, V21, V38, V58, V78, SUB-ECU-44	8
012	BR	3	1		ECU-V03, V23	2
018	Y	2		1	ECU-V27	1
020	L	2		1	ECU-V08	1
021	G	2		1	ECU-V09	1
031	GW	2	1		ECU-V24	1
038	GrR	2	1		ECU-E33	1
039	L	2	1		ECU-E66	1
040	Gr	2	1		ECU-E76	1
041	WB	2	1		ECU-E77	1
042	WR	2	1		ECU-E67	1
043	GB	2	1		ECU-E48	1
044	GW	2	1		ECU-E58	1
045	Gr	3	1		ECU-E09, E29	2
047	BR	3	1		ECU-E10, E30	2
052	G	2	1		ECU-E47	1
053	L	2	1		ECU-E56	1

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			(1)	(2)	Main harness (3)	
060	Lg	2	1		ECU-V29	1
061	0.5B	3	2		ECU-E13	1
063	0.5R	2	1		ECU-E78	1
066	0.5W	3	1		ECU-E49, E68	2
090	0.5B	2	1		ECU-E73	1
091	0.5W	2	1		ECU-E54	1
092	0.5R	2	1		ECU-E53	1
094	0.5R	3	1		ECU- E72, E75	2
100	G	4	2		ECU-E14, E34	2
106	W	4	2		ECU-E18, E38	2
111	R	3	1		ECU-E15, E35	2
115	R	3	1		ECU-E20, E40	2
121	G	3	1		ECU-E19, E39	2
125	W	3	1		ECU-E16, E36	2
130	RB	2	1		ECU-V12	1
134	R	4	3		SUB-ECU-22	1
140	LB	2	1		ECU-V05	1
144	0.5W	2	1		ECU-E52	1
155	RB	3		2	ECU-V17	1
156	RW	3		2	ECU-V37	1
157	Br	3	1		CAN-174257, ECU-V16	2
158	BrW	3	1		CAN-174257, ECU-V36	2
161	0.5B	2		1	ECU-V46	1
162	0.5W	2		1	ECU-V47	1
163	0.5R	3	1	1	ECU-V50	1
164	0.5B	2		1	ECU-V66	1

NO.	SIZE, COLOR	CONTACT POINTS TOTAL	CONNECTION and NUMBER OF CONTACT POINTS			
			(1)	(2)	Main harness (3)	
165	0.5W	2		1	ECU-V67	1
166	0.5R	2		1	ECU-V51	1
167	L	2	1		ECU-V30	1
168	G	2	1		ECU-V14	1
200	R	2	1		ECU-E43	1
201	B	4	3		ECU-E57	1
202	R	2	1		ECU-E63	1
204	R	2	1		ECU-E44	1
208	W	2	1		ECU-E45	1
209	0.5B	3	2		ECU-V65	1
210	R	2	1		ECU-V71	1
211	B	2	1		ECU-V45	1
212	G	2	1		ECU-V49	1
213	L	2	1		ECU-E69	1
216	W	2	1		ECU-E01	1
217	L	2	1		ECU-E21	1
219	0.5W	2	1		ECU-V48	1
230	W	2		1	ECU-V26	1
231	L	2		1	ECU-V28	1
232	G	2		1	ECU-V56	1
401	GR	2	1		SUB-ECU-12	1
402	LR	2			ECU, SUB-ECU-13	2
403	Br	2			CAN-174259, SUB-ECU-24	2
404	BrW	2			CAN-174259, SUB-ECU-23	2
405	GY	2			ECU-V74, SUB-ECU-39	2

4-4. Frame Harness (F)

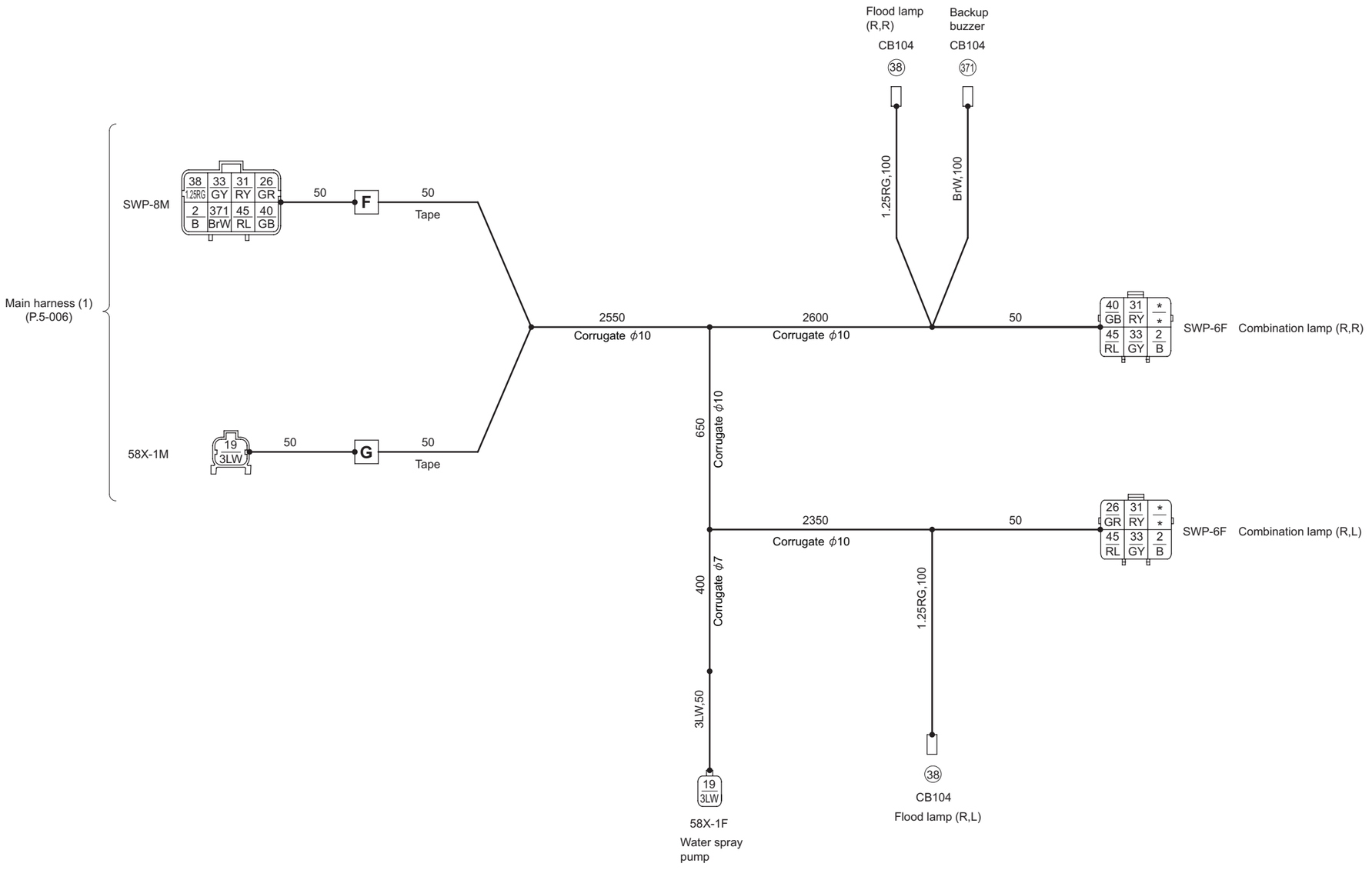


1634-09118-0-11488-0

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
①	5W	2	Battery relay-COM, Fusible link 65A
②	B, 2B	8	**NEU**, **PAR**, **SPE**, Fuel pump, Ground, Head lamp (F,L), (F,R), Load solenoid
⑩	1.25O	2	**A**, **SPE**
⑬	GY	2	**A**, Horn
⑭	8WR	2	Battery relay-NO, Fusible link 75A
⑯	1.25RW	3	**A**, Head lamp (F,L), (F,R)
㉑	LgR	2	**A**, Battery relay-BR
㉔	1.25RB	3	**A**, Head lamp (F,L), (F,R)
㊷	1.25BrB	3	**A**, **NEU**, **PAR**

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
㊽	5W	2	**B**, Fusible link 65A
㊿	8WR	2	**C**, Fusible link 75A
(51)	5WL	2	Battery relay-NO, Fusible link 65A
(52)	5WL	2	**C**, Fusible link 65A
(63)	5BR	2	Battery relay-COM, Fusible link 65A
(64)	5R	2	**B**, Fusible link 65A
(003)	WB	2	**A**, Fuel pump
(407)	BrY	2	**A**, Load solenoid

4-5. Frame Harness (R)

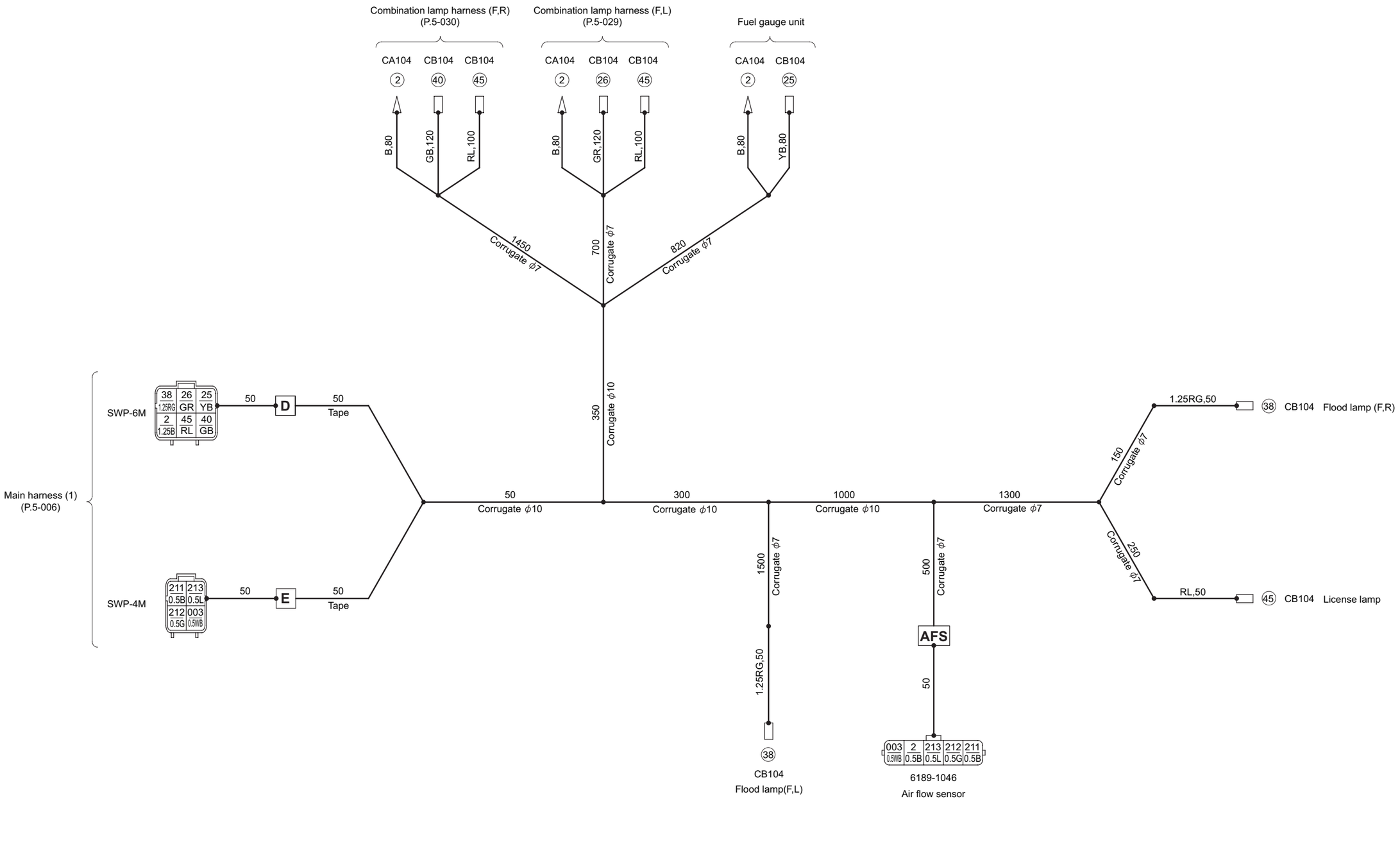


1634-09121-0-21491-A

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
②	B	3	F, Combination lamp (R,L), (R,R)
⑲	3LW	2	G, Water spray pump
㉖	GR	2	F, Combination lamp (R,L)
㉛	RY	3	F, Combination lamp (R,L), (R,R)
㉝	GY	3	F, Combination lamp (R,L), (R,R)

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
㉝	1.25RG	3	F, Flood lamp (R,L), (R,R)
㊵	GB	2	F, Combination lamp (R,R)
㊺	RL	3	F, Combination lamp (R,L), (R,R)
㊶	BrW	2	F, Backup buzzer

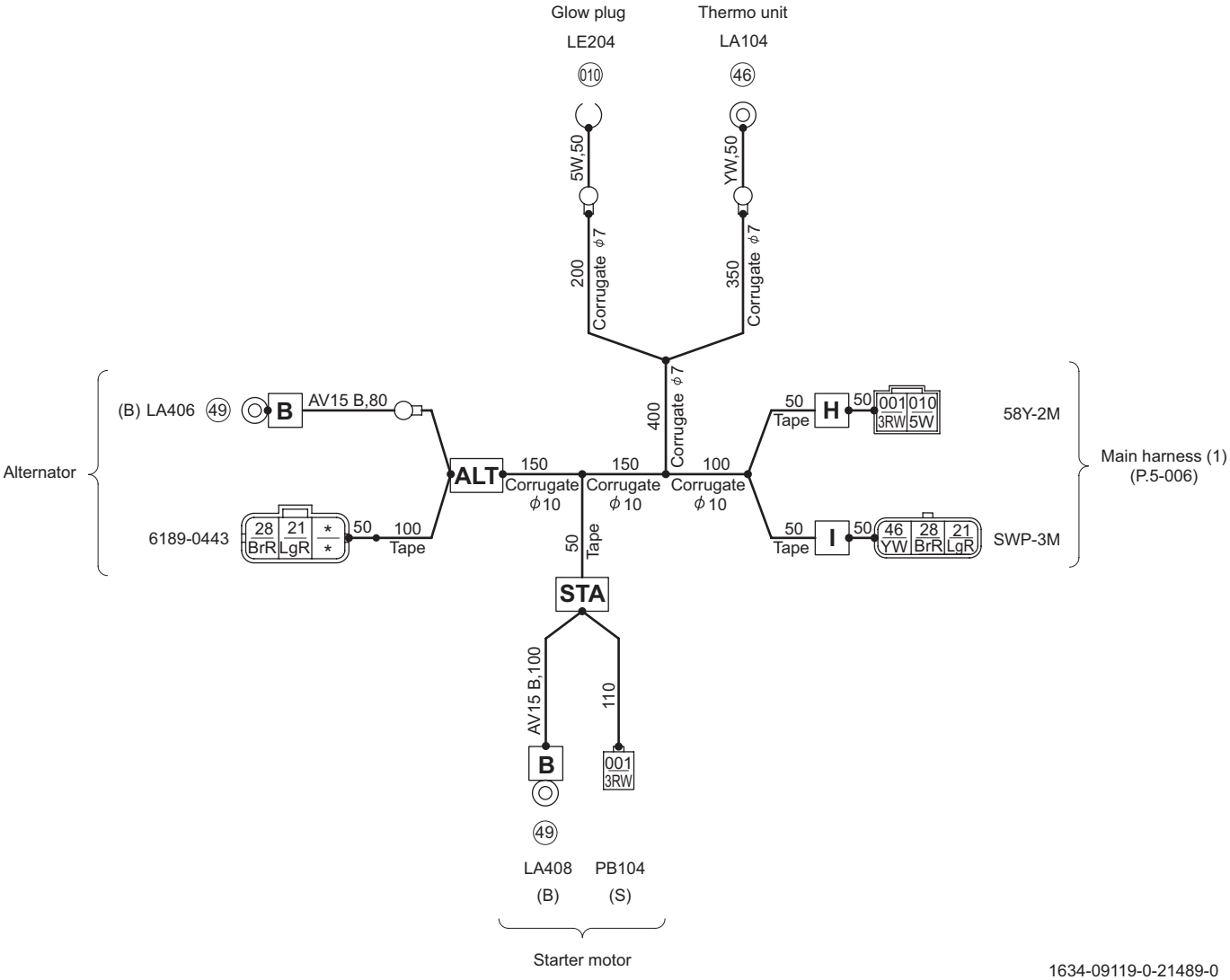
4-6. Floor Board Harness



1634-09120-0-21490-0

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
②	0.5B, B, 1.25B	5	**AFS**, **D**, Combination lamp harness (F,L), (F,R), Fuel gauge unit
㉕	YB	2	**D**, Fuel gauge unit
㉖	GR	2	**D**, Combination lamp harness (F,L)
㊳	1.25RG	3	**D**, Flood lamp (F,L), (F,R)
㊵	GB	2	**D**, Combination lamp harness (F,R)
㊺	RL	4	**D**, Combination lamp harness (F,L), (F,R), License lamp
⑩③	0.5WB	2	**AFS**, **E**
②⑪	0.5B	2	**AFS**, **E**
②⑫	0.5G	2	**AFS**, **E**
②⑬	0.5L	2	**AFS**, **E**

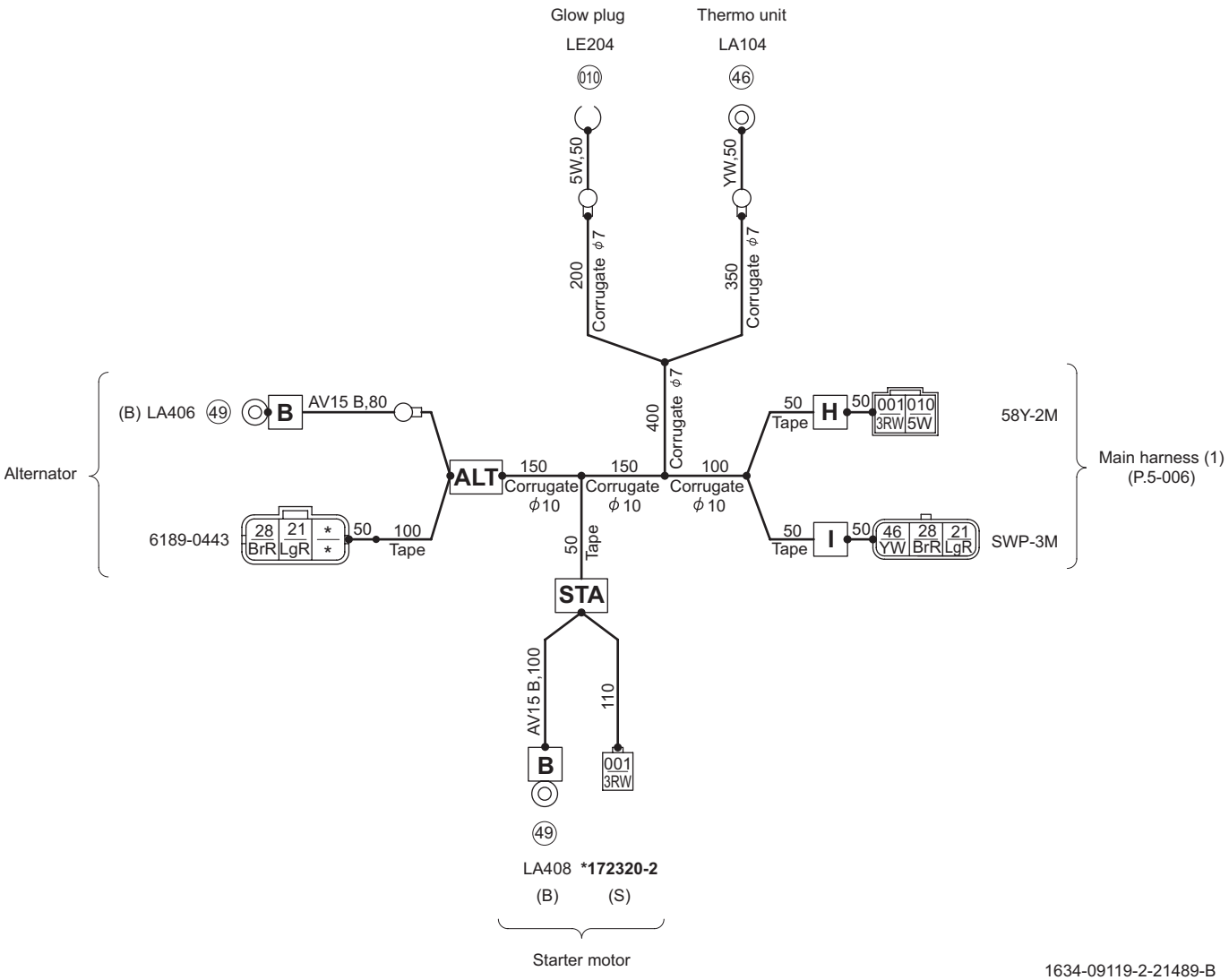
4-7. Engine Harness



1634-09119-0-21489-0

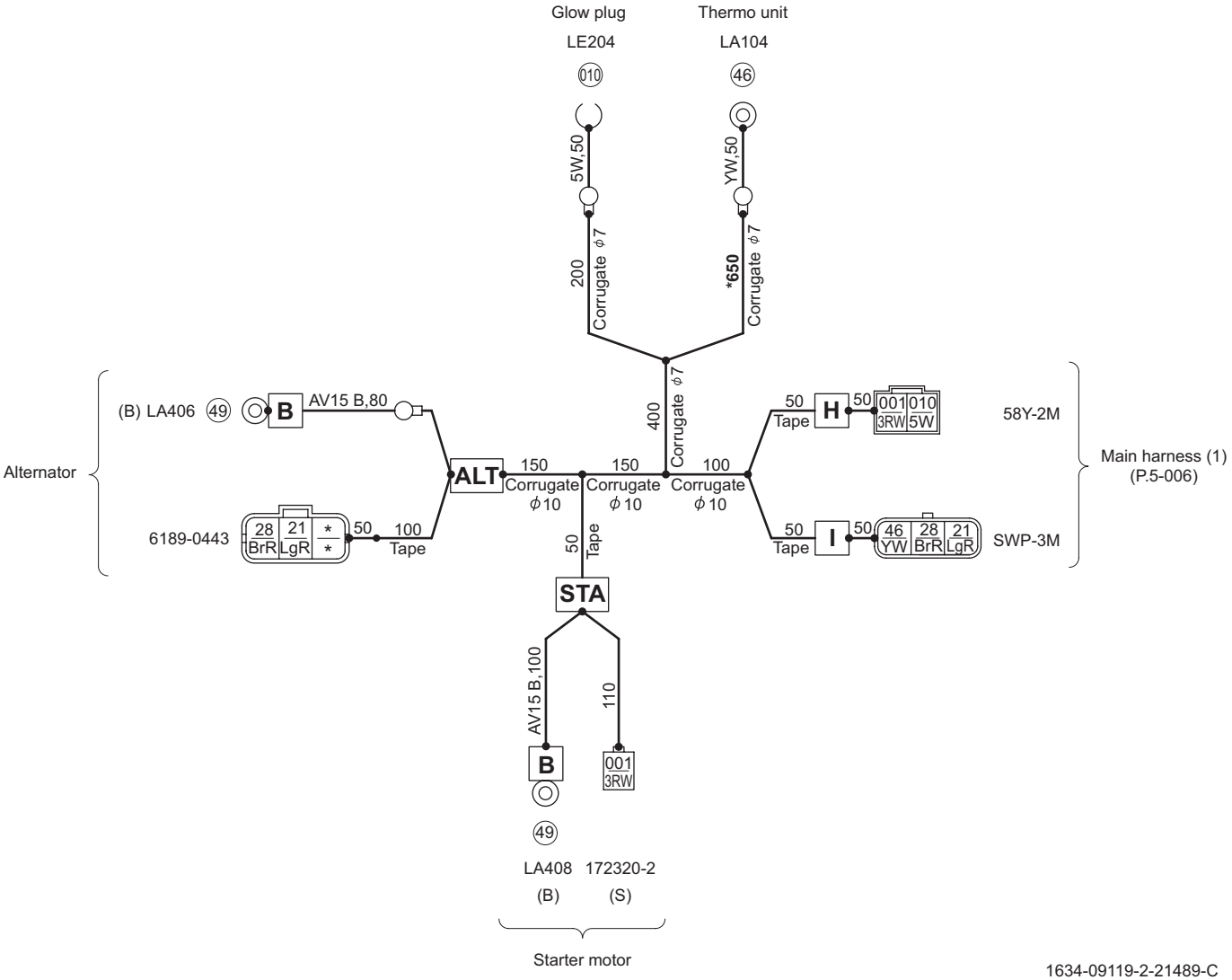
NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
㉑	LgR	2	**ALT**, **I**
㉘	BrR	2	**ALT**, **I**
㊻	YW	2	**I**, Thermo unit
㊾	15B	2	**ALT**-**B**, **STA**-**B**
⑴	3RW	2	**H**, **STA**
⑩	5W	2	**H**, Glow plug

4-7. Engine Harness *:c (From 70234)



NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
㉑	LgR	2	**ALT**, **I**
㉘	BrR	2	**ALT**, **I**
㊻	YW	2	**I**, Thermo unit
㊾	15B	2	**ALT**-**B**, **STA**-**B**
⑪	3RW	2	**H**, **STA**
⑩	5W	2	**H**, Glow plug

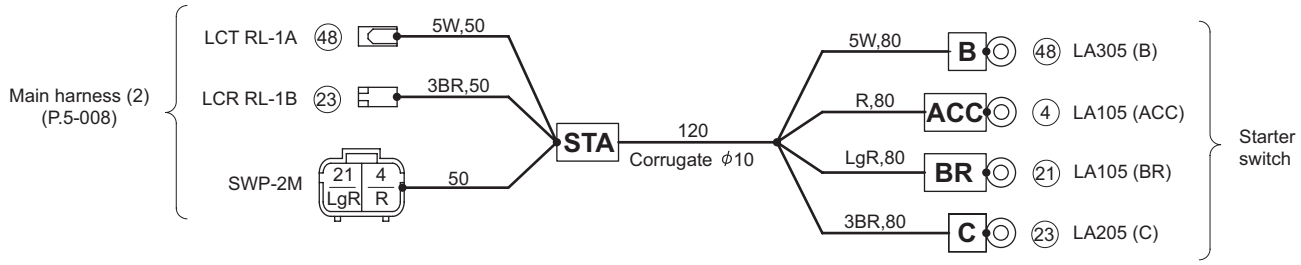
4-7. Engine Harness *:f (From 70343)



1634-09119-2-21489-C

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
㉑	LgR	2	**ALT**, **I**
㉘	BrR	2	**ALT**, **I**
㊻	YW	2	**I**, Thermo unit
㊾	15B	2	**ALT**-**B**, **STA**-**B**
㉀㉑	3RW	2	**H**, **STA**
㉀㉒	5W	2	**H**, Glow plug

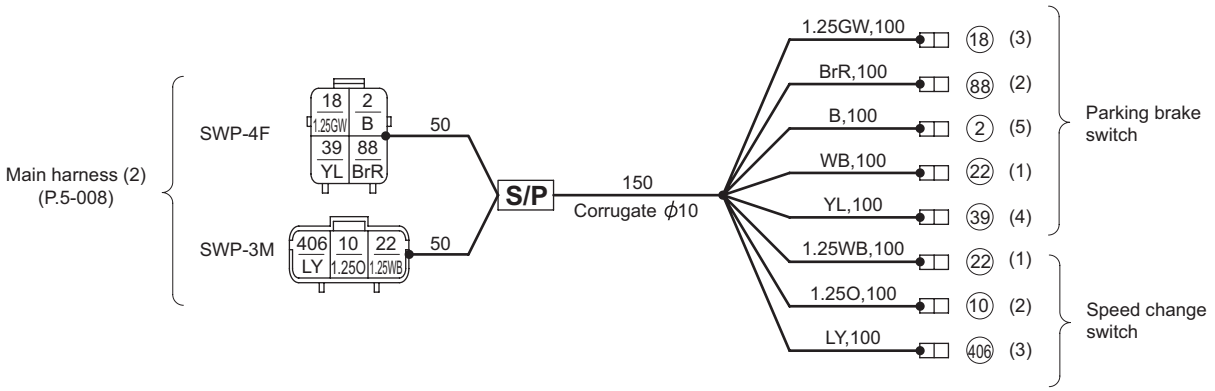
4-8. Starter Switch Harness



1310-09006-0-30165-0

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
④	R	2	STA, ACC
㉑	LgR	2	STA, BR
㉓	3BR	2	STA, C
㊽	5W	2	STA, B

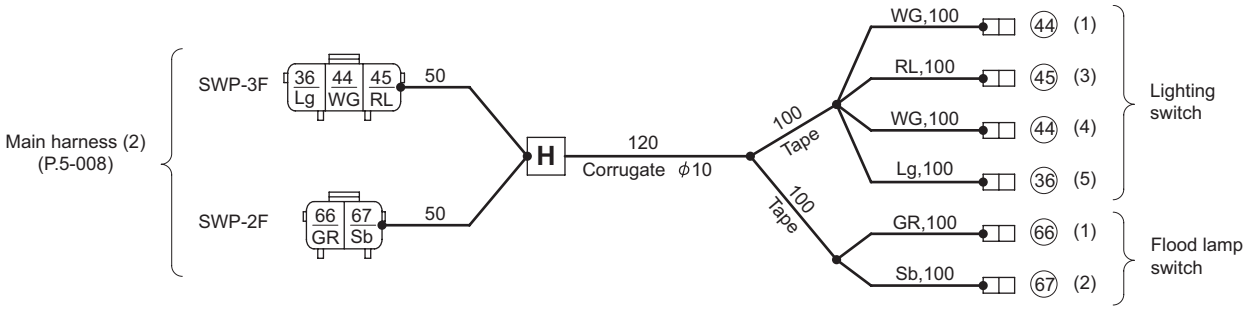
4-9. Control Switch Harness



1634-09125-0-31495-0

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
②	B	2	**S/P**, Parking brake switch-5
⑩	1.25O	2	**S/P**, Speed change switch-2
⑱	1.25GW	2	**S/P**, Parking brake switch-3
㉒	WB, 1.25WB	3	**S/P**, Parking brake switch-1, Speed change switch-1
㊴	YL	2	**S/P**, Parking brake switch-4
⑧⑧	BrR	2	**S/P**, Parking brake switch-2
㊻	LY	2	**S/P**, Speed change switch-3

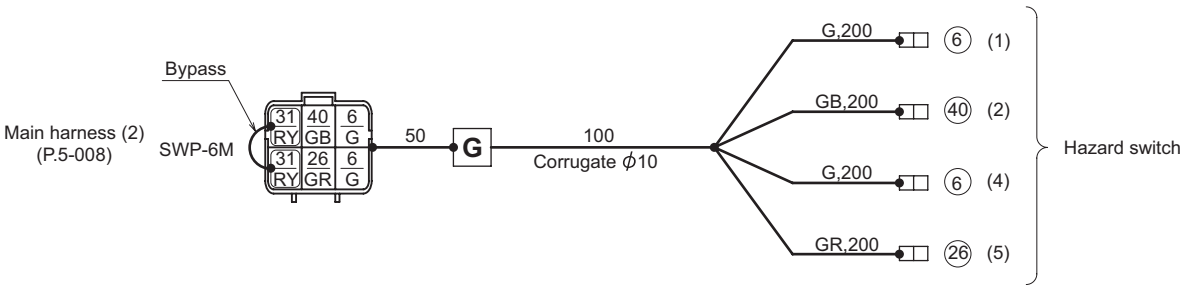
4-10. Lighting Switch Harness



1634-09122-0-31492-A

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
㊱	Lg	2	H, Lighting switch-5
㊹	WG	3	H, Lighting switch-1, -4
㊺	RL	2	H, Lighting switch-3
㊻	GR	2	H, Flood lamp switch-1
㊼	Sb	2	H, Flood lamp switch-2

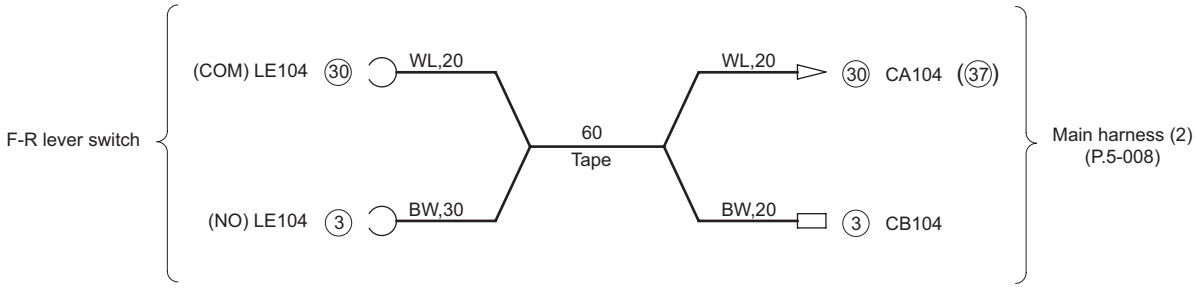
4-11. Hazard Switch Harness



1634-09127-0-31534-0

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
⑥	G	4	G × 2, Hazard switch-1, -4
㉖	GR	2	G, Hazard switch-5
㉛	RY	2	G × 2
㊵	GB	2	G, Hazard switch-2

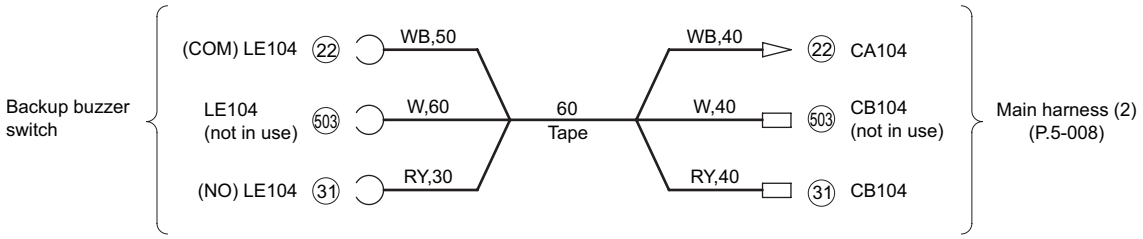
4-12. F-R Lever Switch Harness



1634-09027-0-40466-A

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
③	BW	2	F-R lever switch-NO, Main harness (2)
㉚	WL	2	F-R lever switch-COM, Main harness (2) - ㊲

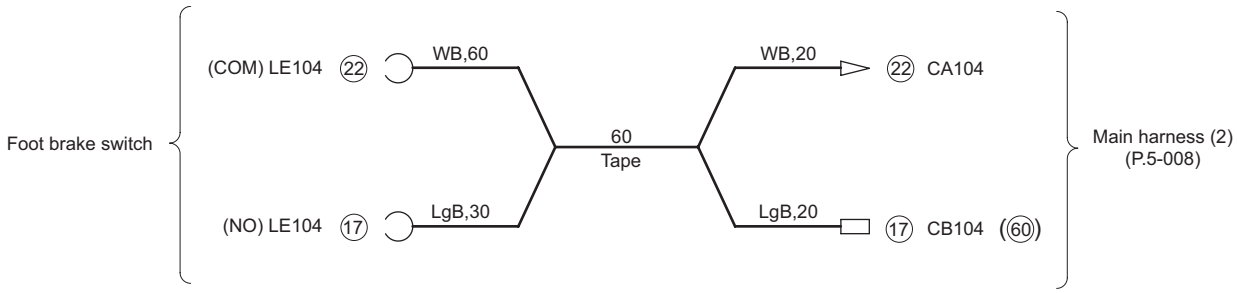
4-13. Backup Buzzer Switch Harness



1634-09132-0-41540-A

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
㉒	WB	2	Backup buzzer switch-COM, Main harness (2)
㉛	RY	2	Backup buzzer switch-NO, Main harness (2)
⑤⓪③	W	2	Not in use

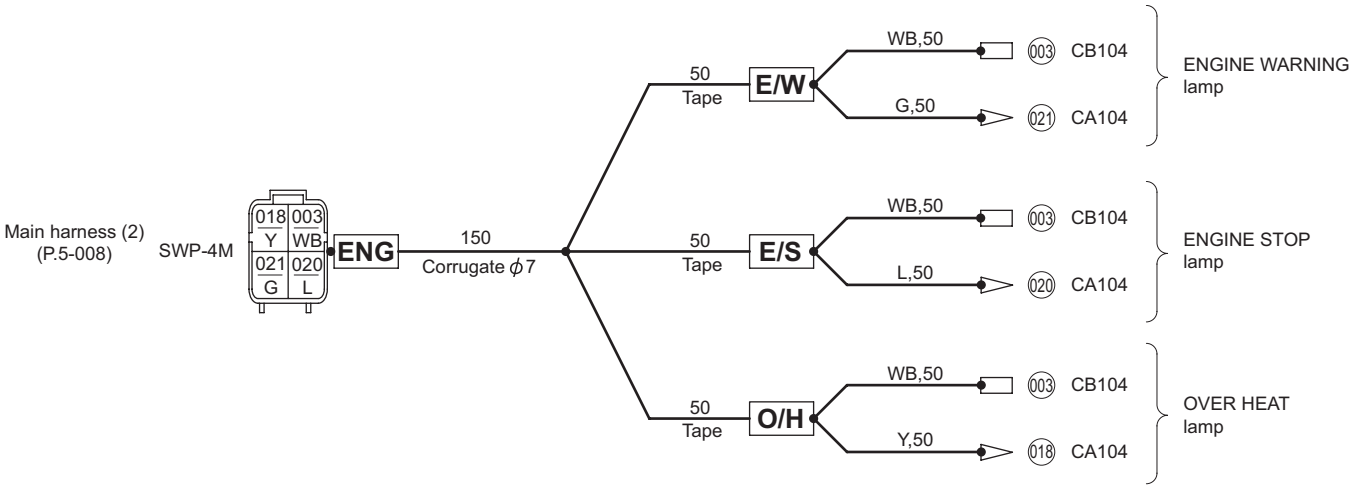
4-14. Foot Brake Switch Harness



1634-09028-0-40467-0

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
⑰	LgB	2	Footbrake switch-NO, Main harness (2) - ⑥⓪
㉒	WB	2	Footbrake switch-COM, Main harness (2)

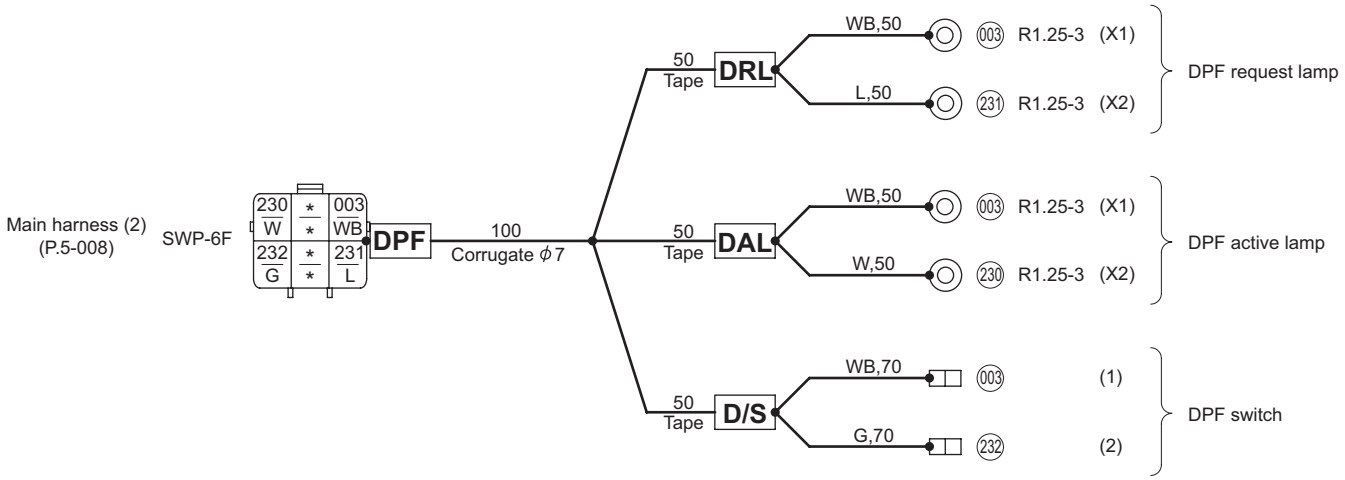
4-15. ENGINE WARNING Lamp Harness



1634-09123-0-31493-A

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
⑬	WB	4	**ENG**, **E/W**, **E/S**, **O/H**
⑱	Y	2	**ENG**, **O/H**
⑳	L	2	**ENG**, **E/S**
㉑	G	2	**ENG**, **E/W**

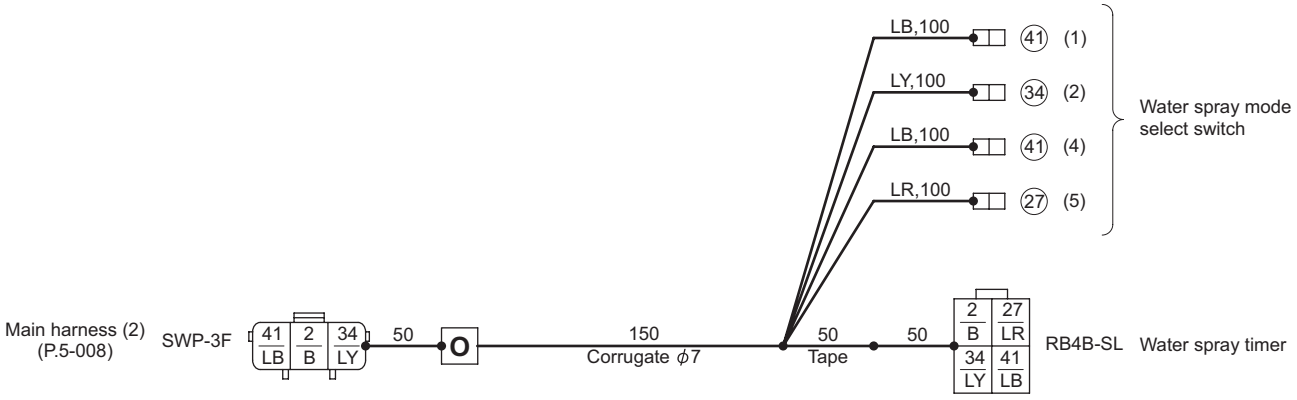
4-16. DPF Harness



1310-09008-0-30167-A

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
⑬	WB	4	**DPF**, **DRL**-X1, **DAL**-X1, **D/S**-1
⑳	W	2	**DPF**, **DAL**-X2
㉛	L	2	**DPF**, **DRL**-X2
㉜	G	2	**DPF**, **D/S**-2

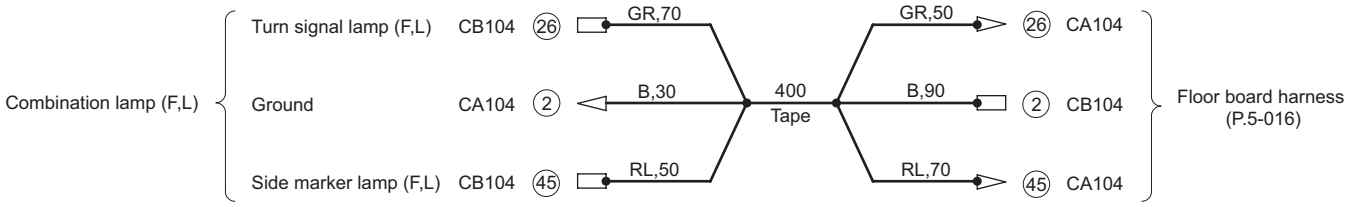
4-17. Water Spray Harness



1308-09023-0-30388-A

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
②	B	2	O, Water spray timer
㉗	LR	2	Water spray mode select switch-5, Water spray timer
㉞	LY	3	O, Water spray mode select switch-2, Water spray timer
㊶	LB	4	O, Water spray mode select switch-1,-4, Water spray timer

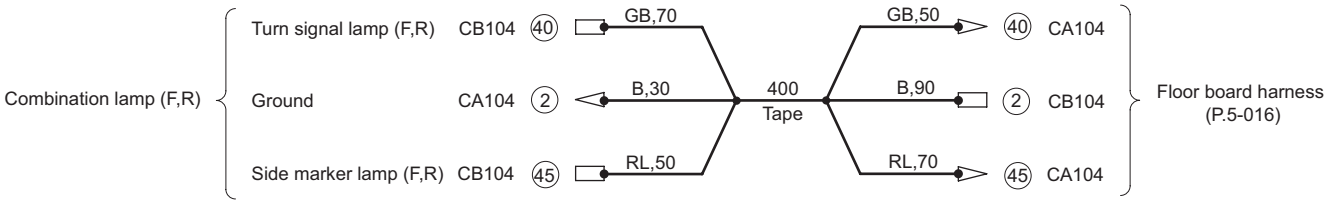
4-18. Combination Lamp Harness (F,L)



1634-09047-0-40883-0

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
②	B	2	Combination lamp (F,L), Floor board harness
㉖	GR	2	Combination lamp (F,L), Floor board harness
㊺	RL	2	Combination lamp (F,L), Floor board harness

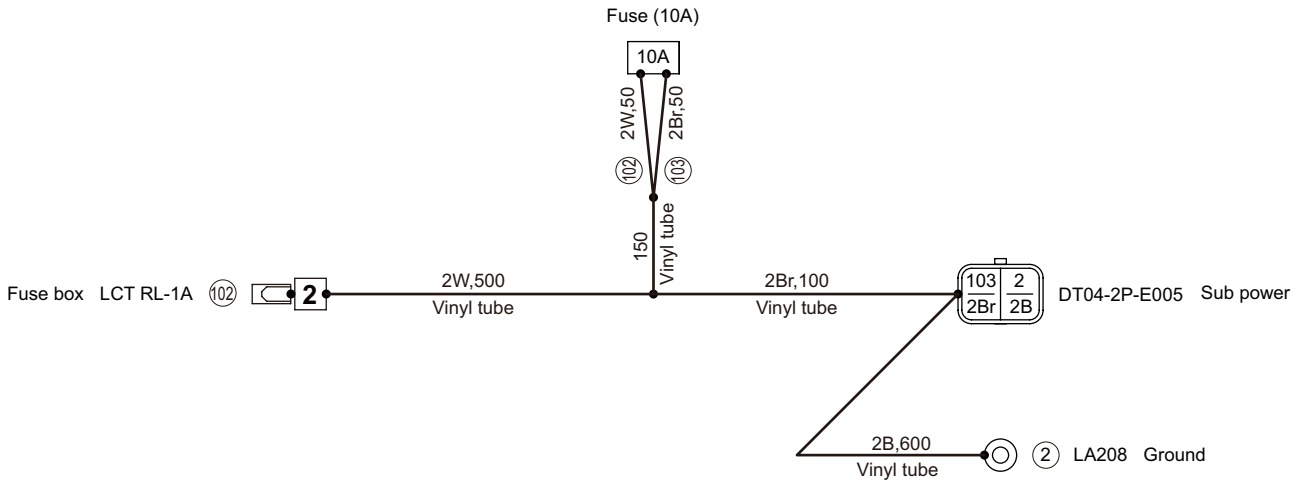
4-19. Combination Lamp Harness (F,R)



1634-09048-0-40884-0

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
②	B	2	Combination lamp (F,R), Floor board harness
⑩	GB	2	Combination lamp (F,R), Floor board harness
㊺	RL	2	Combination lamp (F,R), Floor board harness

4-20. Sub Power Harness

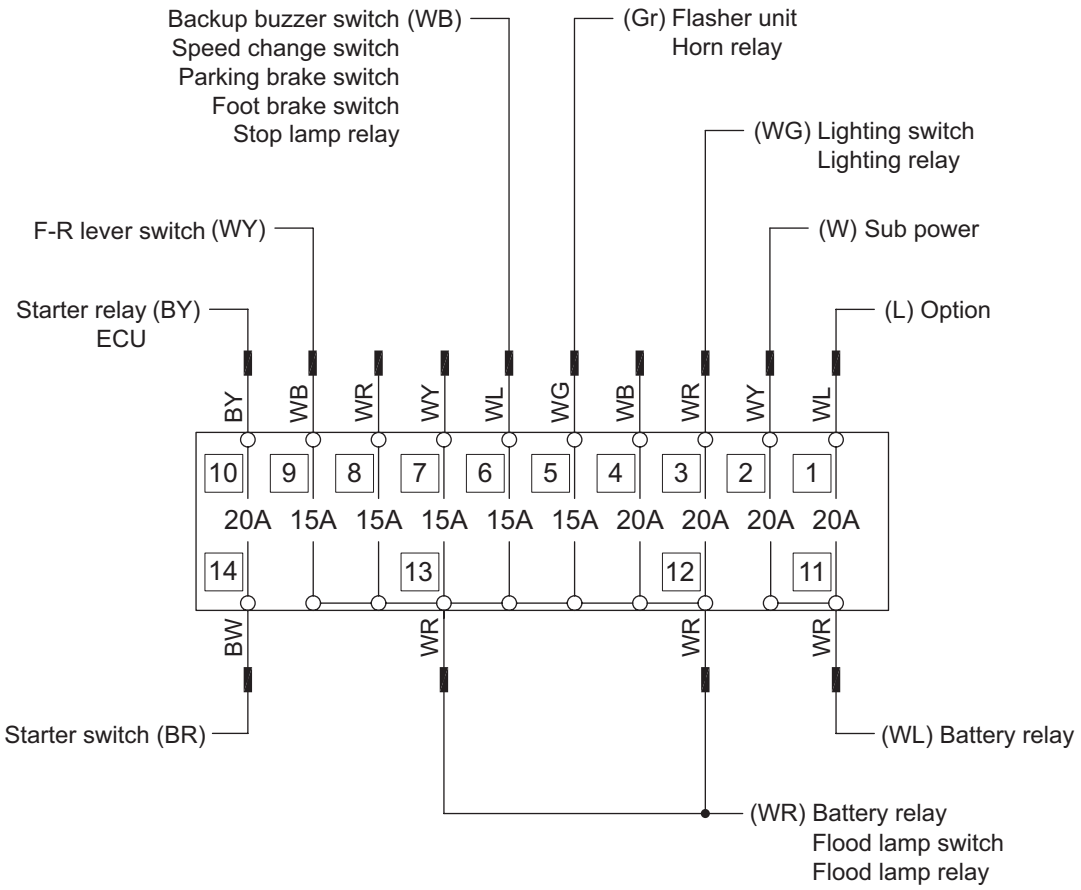


1634-70053-0-31218-A

NO.	SIZE, COLOR	CONTACT POINTS	CONNECTION
②	2B	2	Sub power, Ground
⑩②	2W	2	**2**, Fuse 10A
⑩③	2Br	2	Sub power, Fuse 10A

5. ELECTRICAL COMPONENT SPECIFICATIONS

5-1. Fuse Box

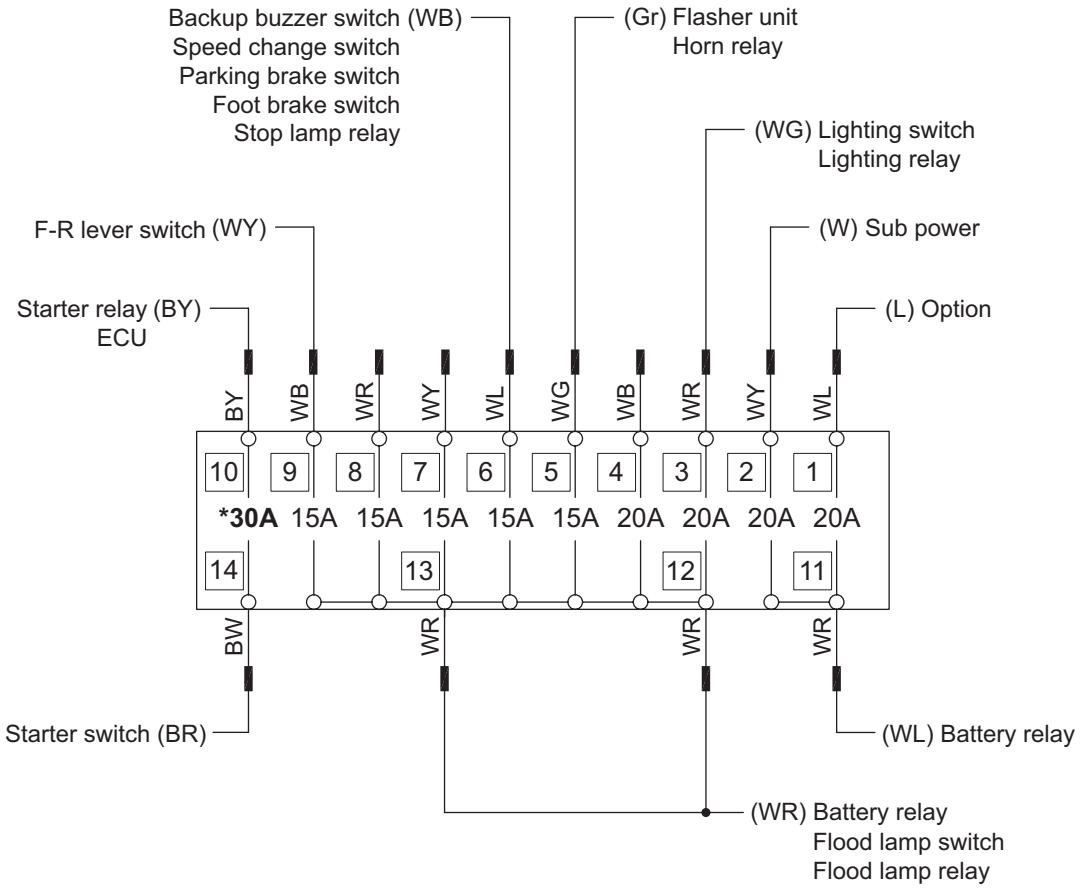


R2-4-05001

Harness color codes

W	: White	WB	: White/Black stripe
L	: Blue	WL	: White/Blue stripe
BY	: Black/Yellow stripe	WY	: White/Yellow stripe
BR	: Black/Red stripe	WG	: White/Green stripe
WR	: White/Red stripe	Gr	: Gray

5-1. Fuse Box *:h (From 70442)

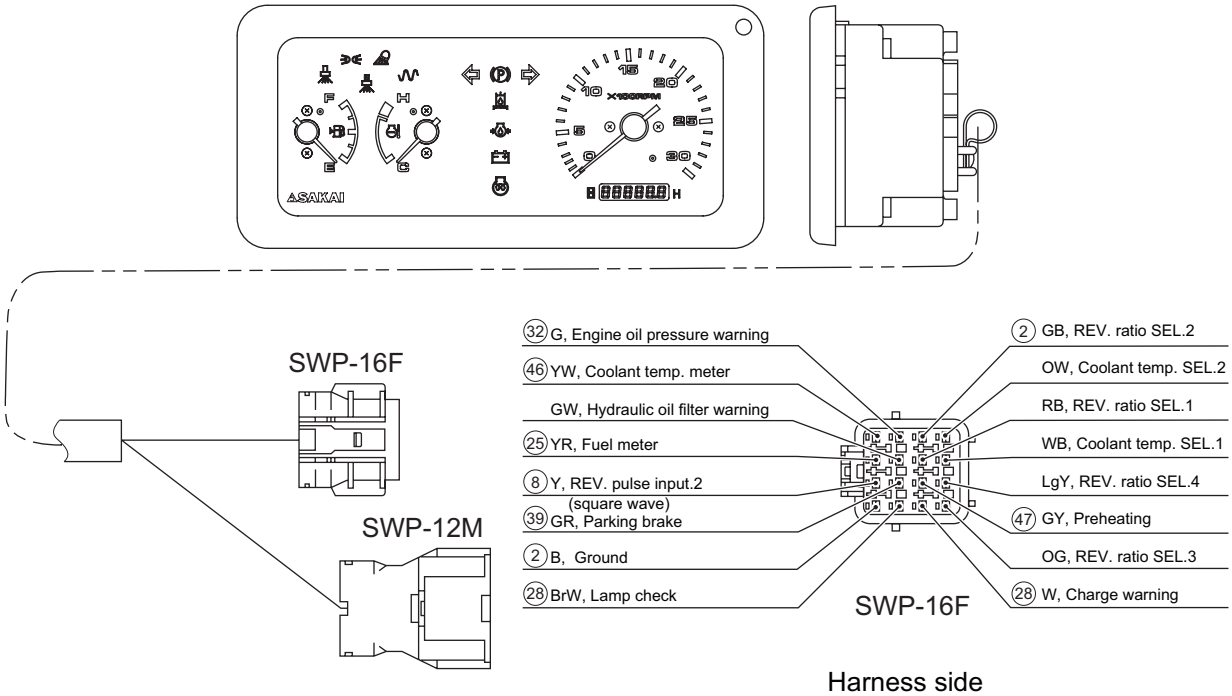


R2-4-05001

Harness color codes

W	: White	WB	: White/Black stripe
L	: Blue	WL	: White/Blue stripe
BY	: Black/Yellow stripe	WY	: White/Yellow stripe
BR	: Black/Red stripe	WG	: White/Green stripe
WR	: White/Red stripe	Gr	: Gray

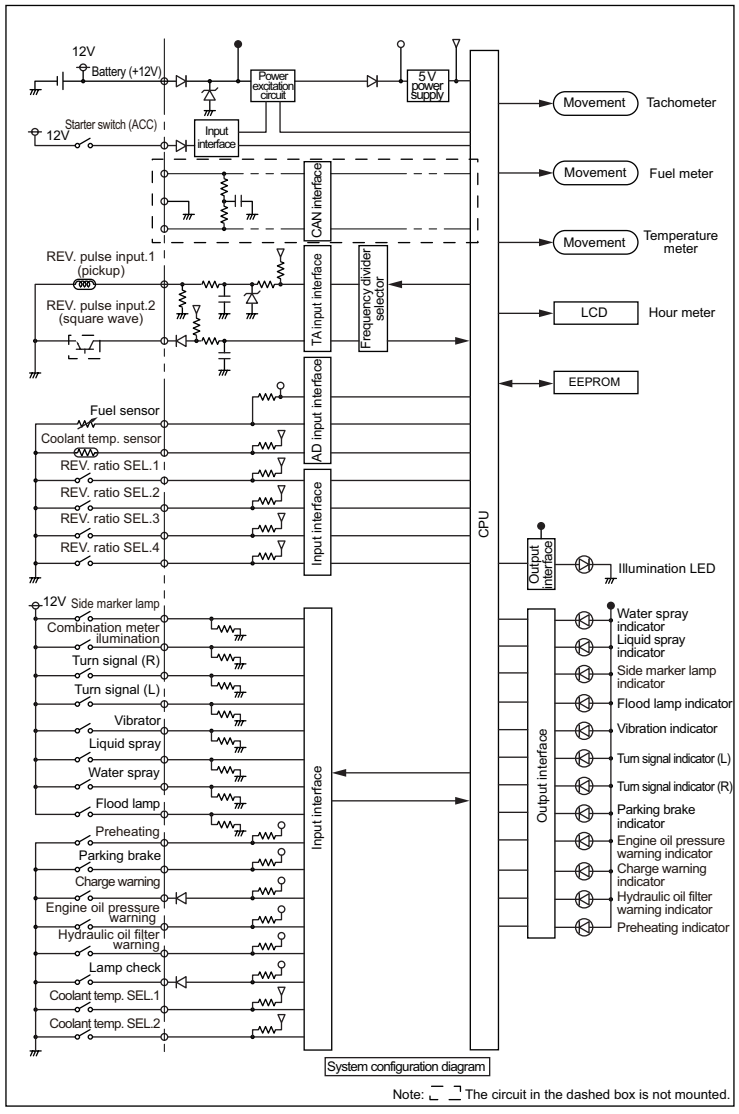
5-2. Combination Meter

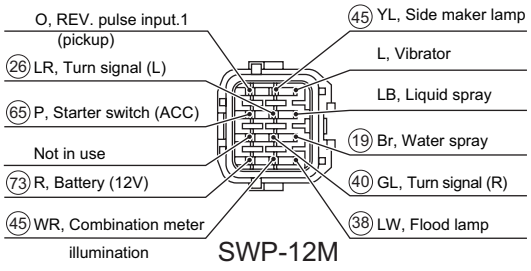


Harness side

2 B	28 BrR	28 BrR	* *
8 Br	39 YL	47 GL	* *
25 YB	* *	* *	* *
46 YW	32 YG	2 B	* *

SWP-16M





Harness side

73 L	45 RL	38 RG
* *	40 GB	19 LW
65 Y	26 GR	* *
* *	45 RL	* *

SWP-12F

R2-4-05002

DRUM

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.

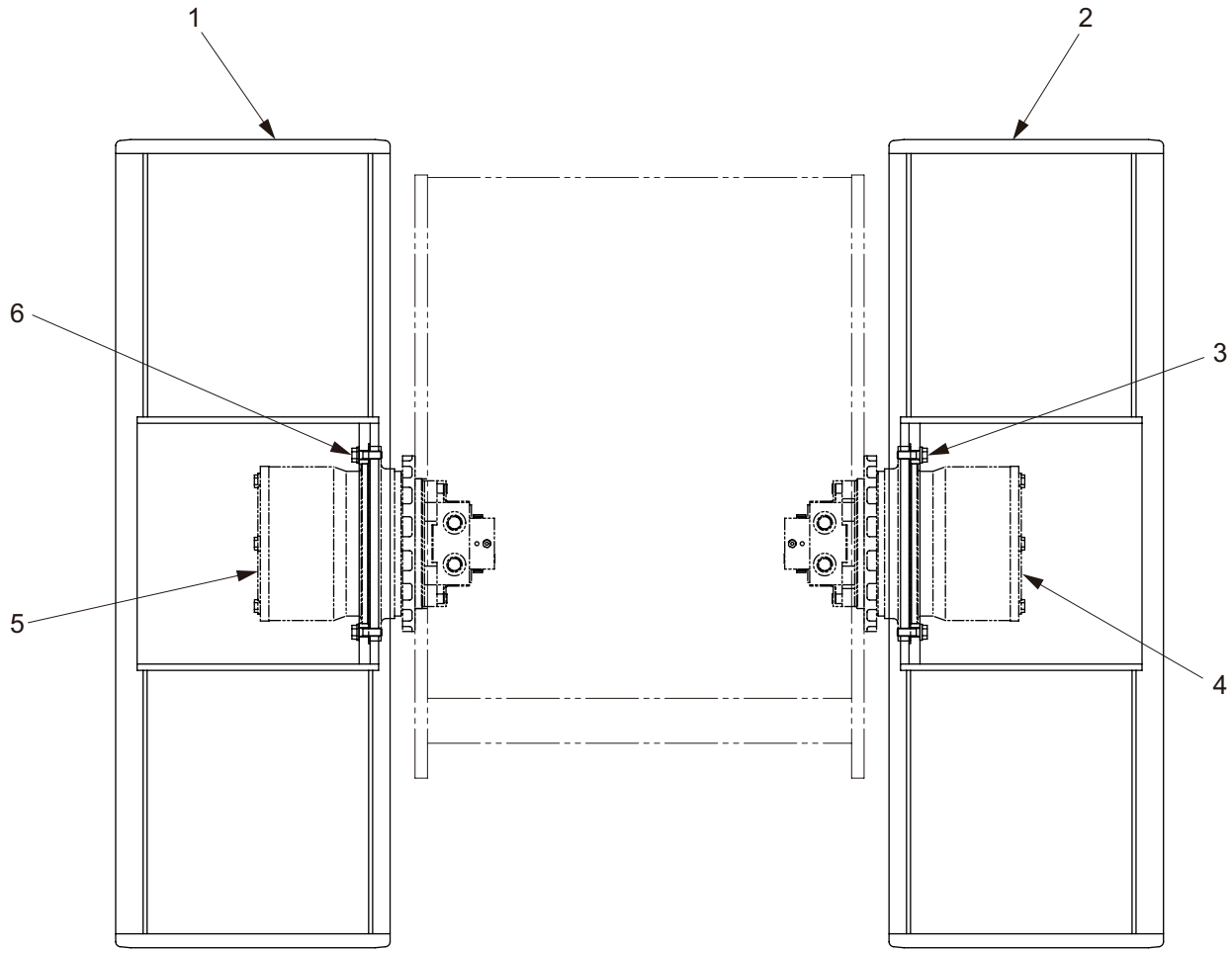
2) Precautions for installation work
- Tighten bolts and nuts (sleeve nuts) to the specified torque (screw tightening torque table).
- When installing hoses, do not twist them or allow them to interfere with other parts.
- Replace gaskets, O-rings, split cotter pins, and lock plates with new parts.
- 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 grease to rotating and sliding components.
- Apply gear oil to the surfaces of press-fit parts.
- After installing snap rings, confirm that they are properly seated in the grooves.
- Connect wiring connectors securely after cleaning off adhering oil, dust and water.
- Use lifting bolts that are not fatigued or deformed. Screw them in fully.
- When tightening a split flange, tighten screws alternately to prevent uneven tightening.
- Before installing hydraulic parts, confirm that they are free of damage and dust, etc.

3) Precautions when work is completed

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

2. DRUM

2-1. Drum (F) (R2-4)



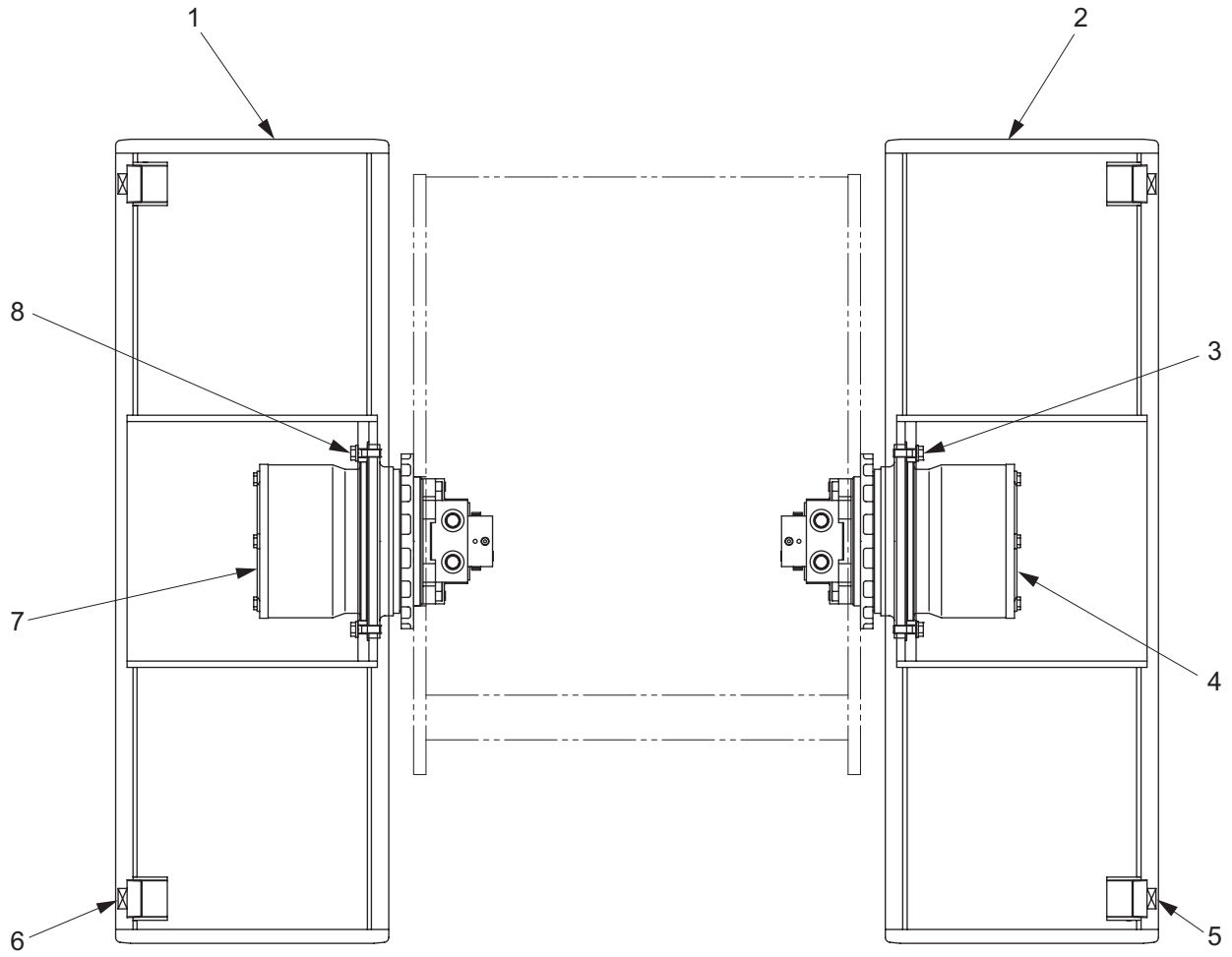
0634-24803-0-11400-0

(1) Drum (F,R)
(2) Drum (F,L)
(3) Bolt : M16×50
(4) Propulsion motor (F,L)
(5) Propulsion motor (F,R)
(6) Bolt : M16×50

N•m

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

2-2. Drum (F) (R2H-4)



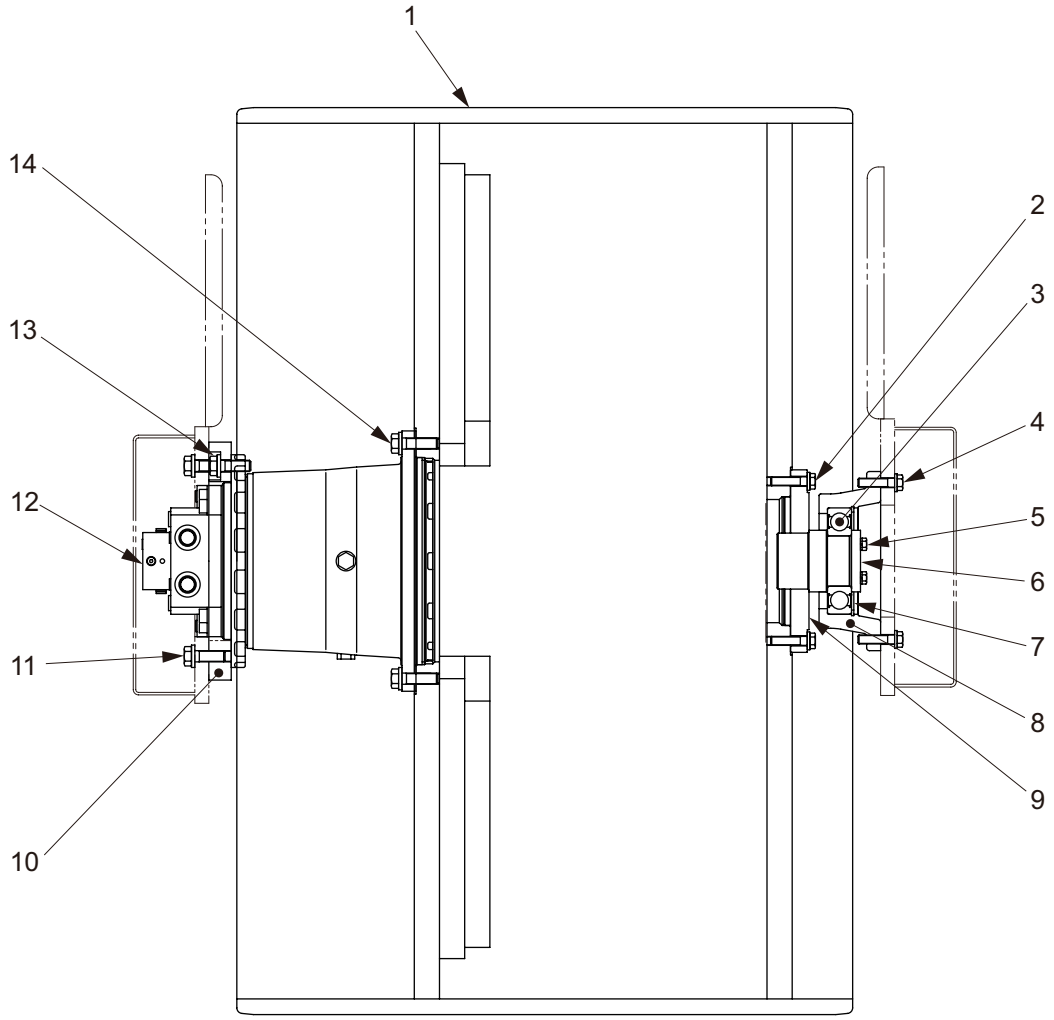
0634-24804-0-11502-0

(1) Drum (F,R)
(2) Drum (F,L)
(3) Bolt : M16×50
(4) Propulsion motor (F,L)
(5) Plug
(6) Plug
(7) Propulsion motor (F,R)
(8) Bolt : M16×50

N•m

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

2-3. Drum (R) (R2-4)



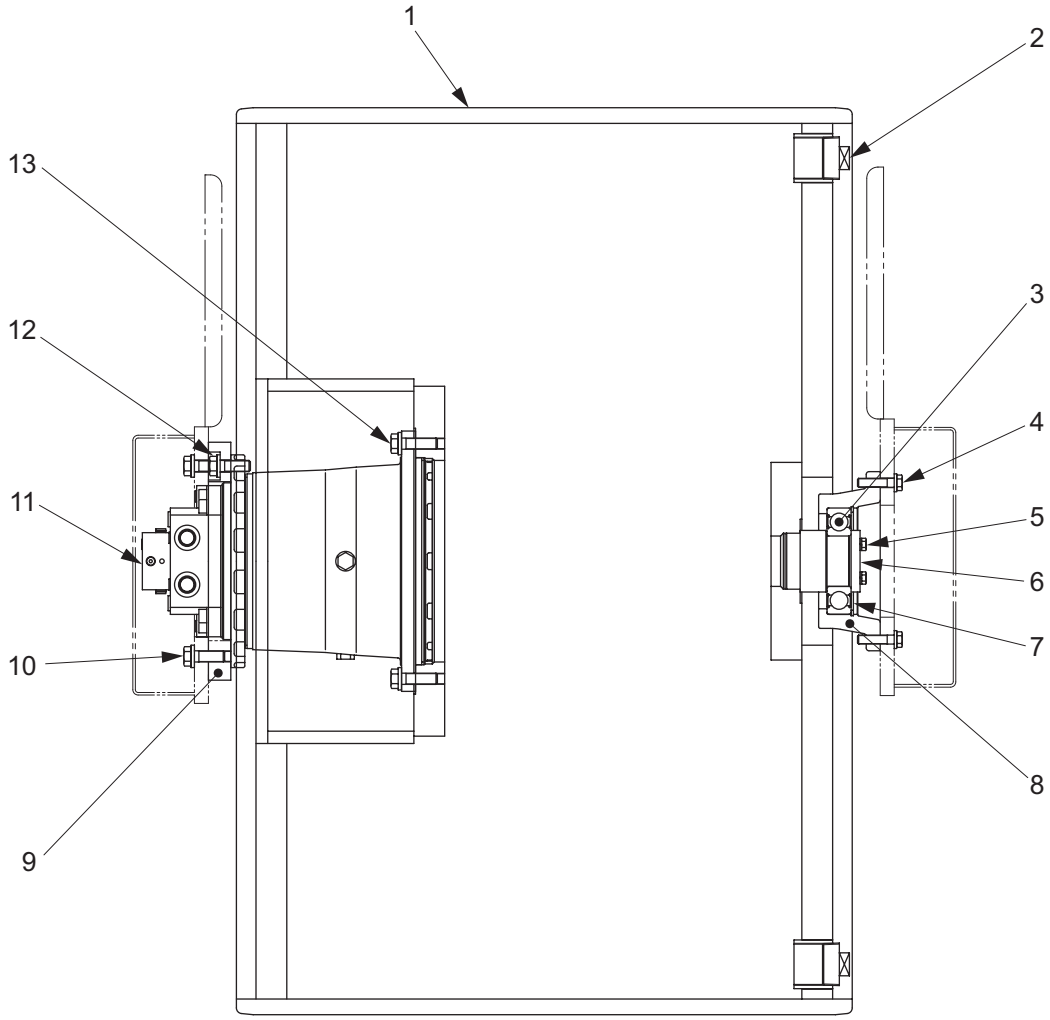
0634-27802-0-11401-0

(1) Drum (R)
(2) Bolt : M16×70
(3) Ball bearing
(4) Bolt : M16×60
(5) Bolt : M12×40
(6) End plate
(7) Retaining ring
(8) Case
(9) Flange
(10) Plate
(11) Bolt : M20×60
(12) Propulsion motor (R)
(13) Bolt : M20×60
(14) Bolt : M20×70

N•m

(2) Bolt M16×70 : 265 N·m (195 lbf·ft)
(4) Bolt M16×60 : 265 N·m (195 lbf·ft)
(11) Bolt M20×60 : 539 N·m (398 lbf·ft)
(13) Bolt M20×60 : 539 N·m (398 lbf·ft)
(14) Bolt M20×70 : 539 N·m (398 lbf·ft)

2-4. Drum (R) (R2H-4)



0634-27803-0-11503-0

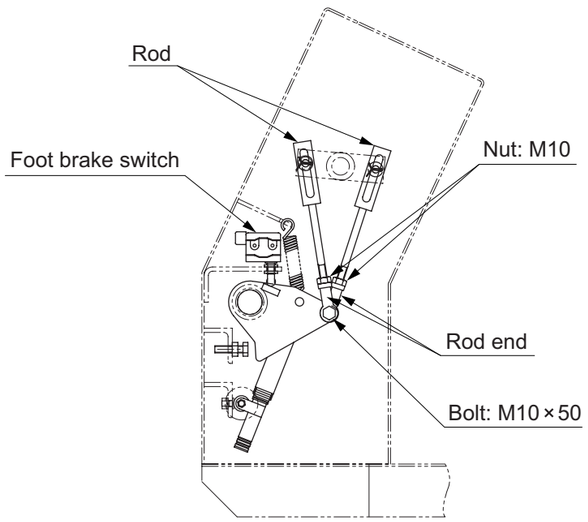
(1) Drum (R)
(2) Plug
(3) Ball bearing
(4) Bolt : M16×60
(5) Bolt : M12×40
(6) End plate
(7) Retaining ring
(8) Case
(9) Plate
(10) Bolt : M20×60
(11) Propulsion motor (R)
(12) Bolt : M20×60
(13) Bolt : M20×70
(Apply liquid sealant to the threaded area)

N•m

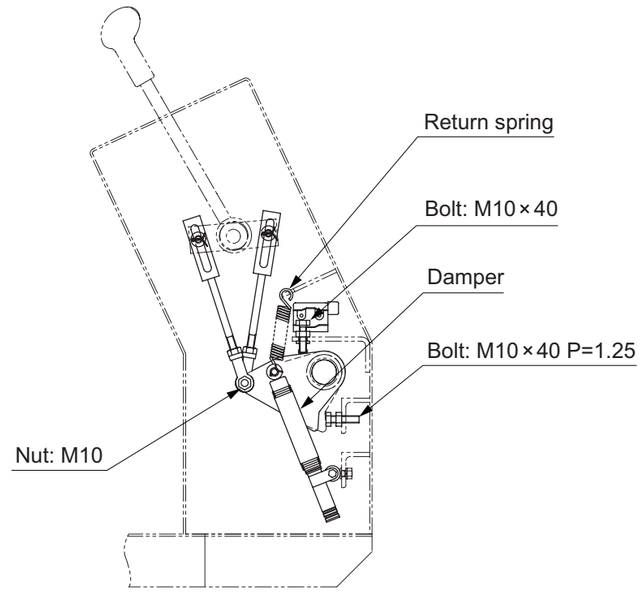
(4) Bolt M16×60 : 265 N·m (195 lbf·ft)
(10) Bolt M20×60 : 539 N·m (398 lbf·ft)
(12) Bolt M20×60 : 539 N·m (398 lbf·ft)
(13) Bolt M20×70 : 539 N·m (398 lbf·ft)

BRAKE

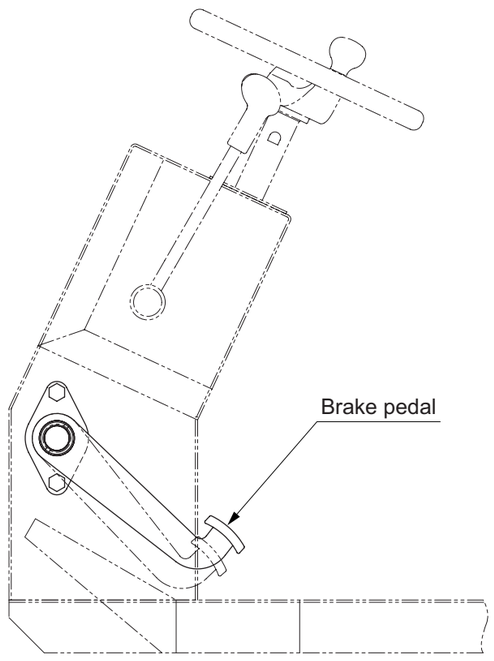
1. BRAKE PEDAL

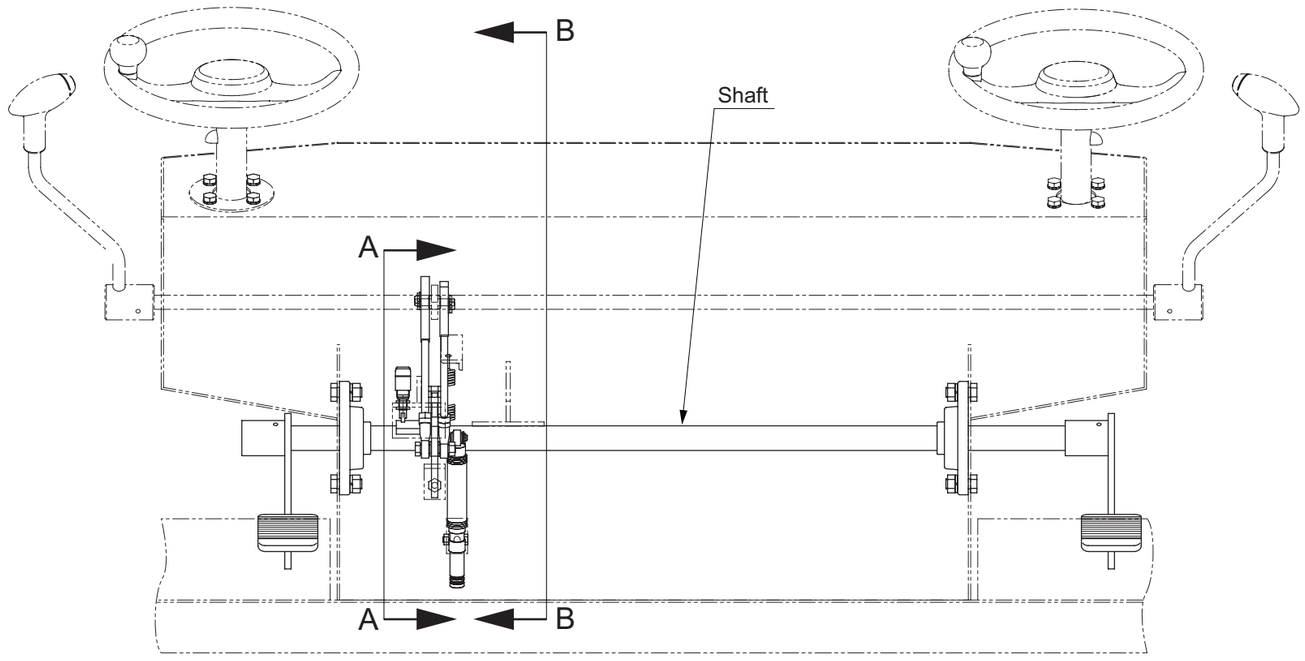


SECTION A-A

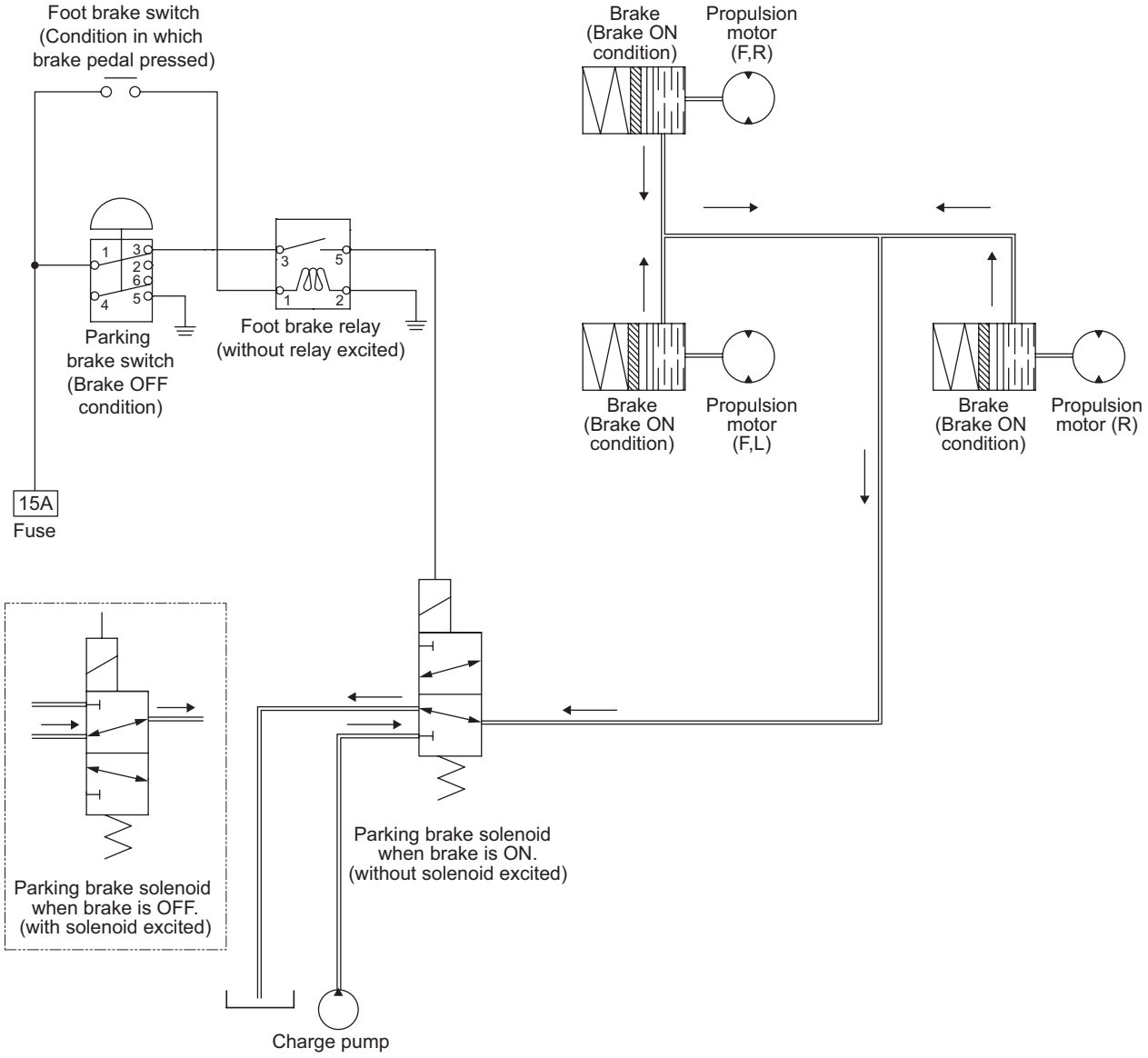


SECTION B-B





2. BRAKE SYSTEM

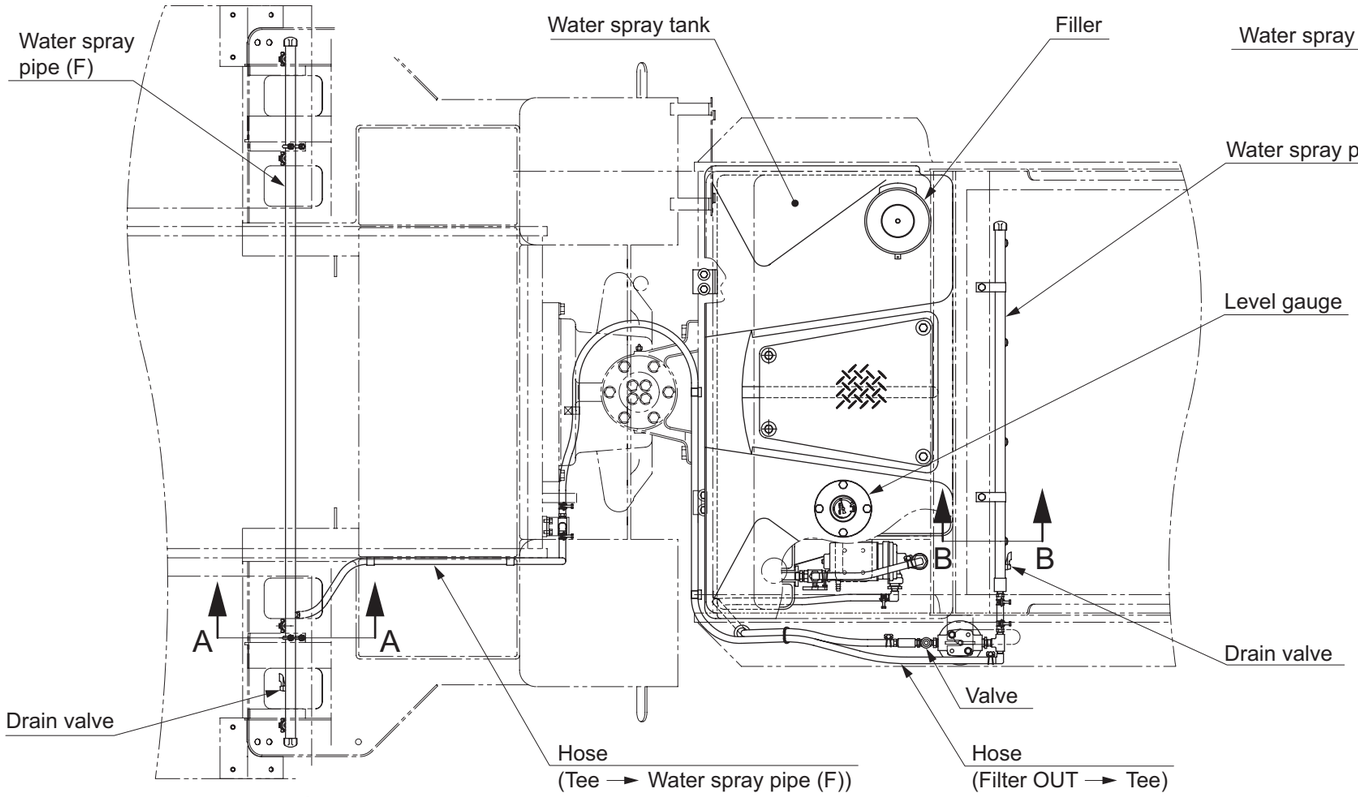


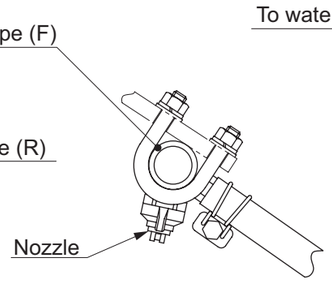
- The arrow (⟶) symbol shows the direction of the hydraulic oil flow.

R2H-2-07001

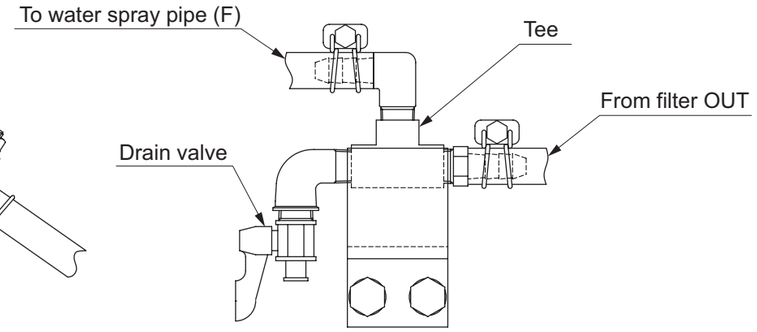
WATER SPRAY SYSTEM

1. WATER SPRAY PIPING

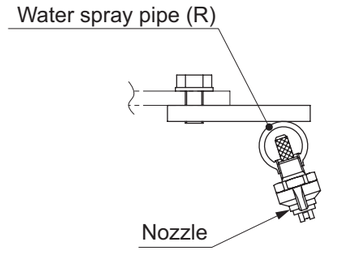




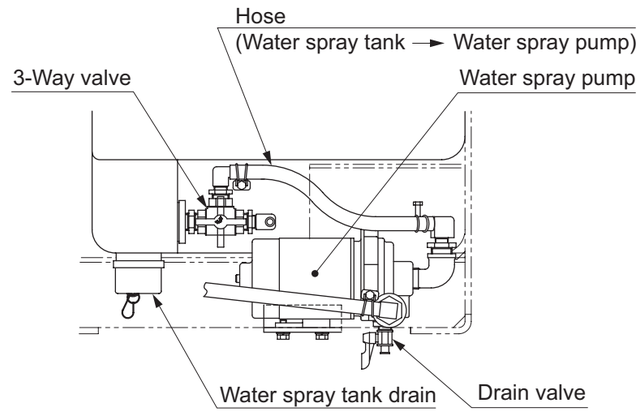
SECTION A-A



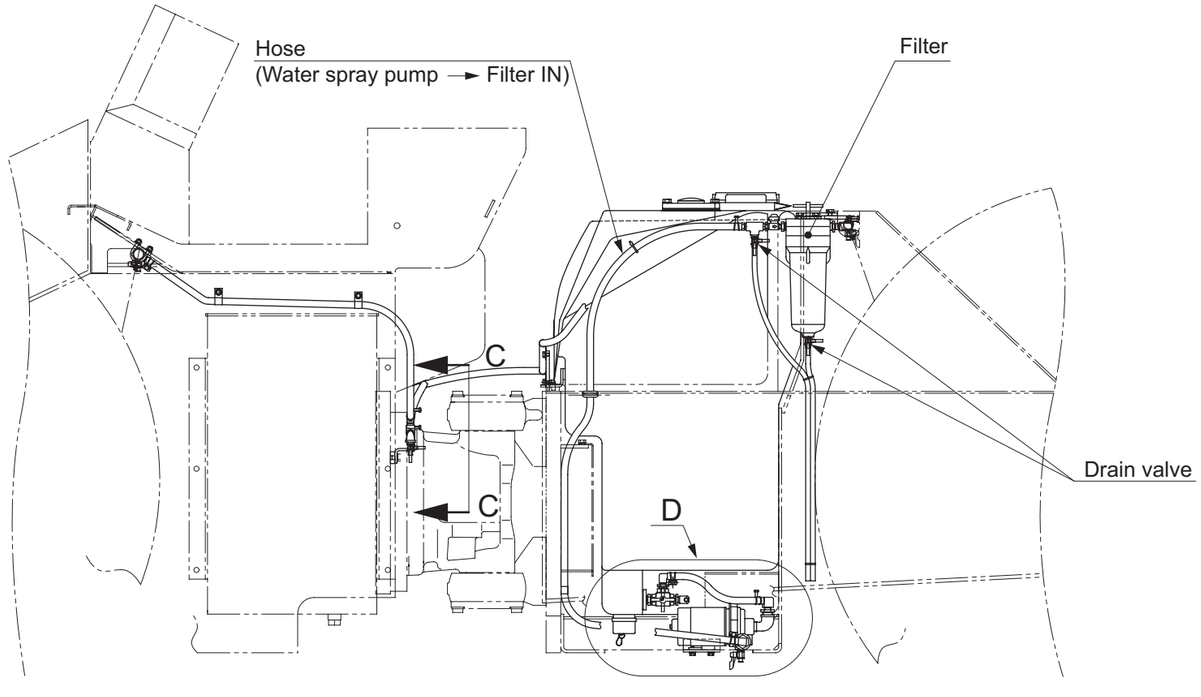
VIEW C-C

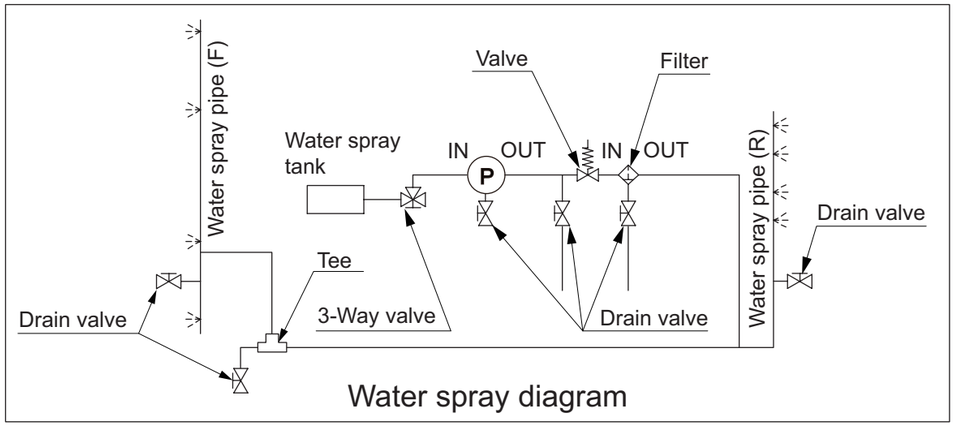


SECTION B-B



DETAIL D





Water spray diagram

• The letters and numbers in the figure such as “Water spray pump” and “Filter IN” show each port.
• Arrow symbols “ → ” show the hose connection and the direction of the flow of the water.

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 ± 5°C (122 ± 9°F)

① Remove plugs from high pressure gauge port (1-8) and (1-9) of propulsion pump. Attach pressure gauge with the adapter ⓗ .
- Adapter : 9/16-18UNF
- High pressure gauge port (Reverse) : (1-8)
- High pressure gauge port (Forward) : (1-9)
- Pressure gauge : 0 to 50 MPa (0 to 7,250 psi)

② Confirm that F-R lever is “N”.

③ Apply parking brake by pressing parking brake switch button.

④ Set speed change switch to “ 🐢 ”.

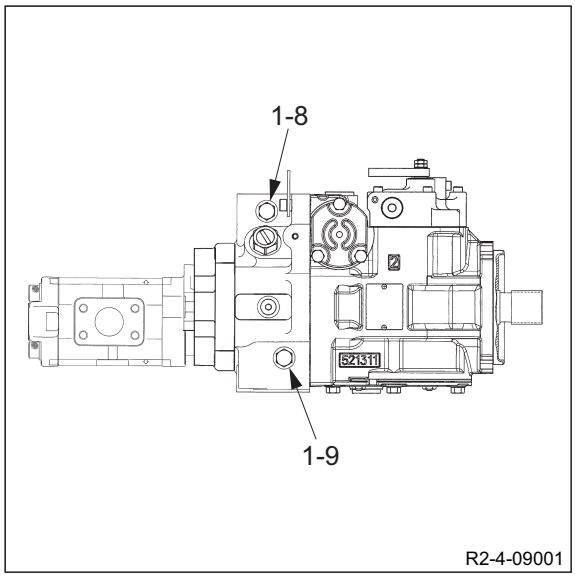
⑤ Start the engine and set throttle lever to “FULL”.

⑥ Establish a condition in which machine propulsion load becomes maximum. (Pressure does not build up unless propulsion load is applied.)

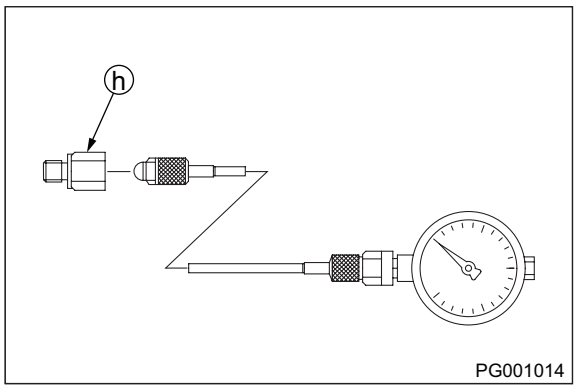
⑦ With propulsion load at maximum, slowly move F-R lever to the side to be measured.

⑧ Read pressure indicated by pressure gauge.

⑨ After measuring, promptly return F-R lever to “N”.



R2-4-09001



PG001014

★ Maximum circuit pressure
(high pressure relief valve setting)
: 41.8 ± 1.0 MPa (6,061 ± 145 psi)

- The numbers “1-8” and “1-9” appearing in above illustrations are consistent with lead line numbers shown in illustration of propulsion pump in “2-2. Hydraulic Component Specifications” (page 4-008).

2-2. Adjustment

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

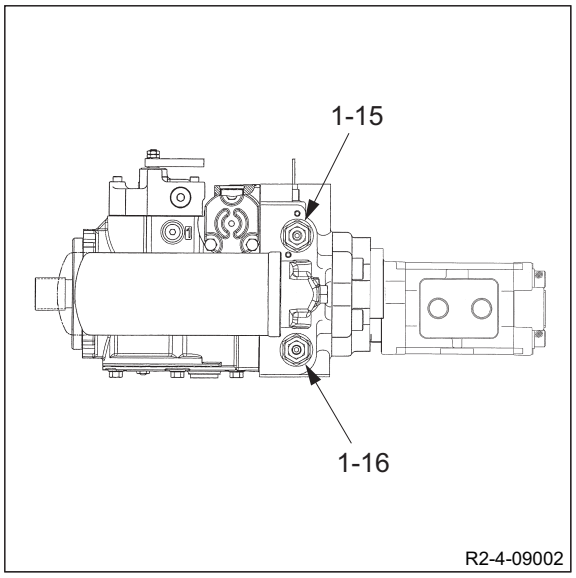
① Check nut (2) of multifunction valve (1-15) or (1-16) for evidence of having loosened.
- Multifunction valve (Reverse) : (1-15)
- Multifunction valve (Forward) : (1-16)

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).

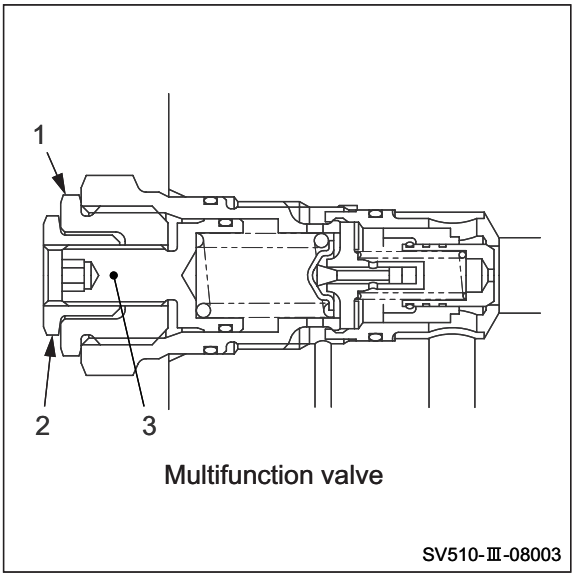
Adjustment screw turned clockwise
: Pressure rise
Adjustment screw turned counterclockwise
: Pressure drop
Pressure change rate : 9 MPa/turn (1,305 psi/turn)

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 (15 lbf·ft)
(1-15) (1-16)	Multifunction valve	: 89 N·m (66 lbf·ft)



R2-4-09002



Multifunction valve
SV510-Ⅲ-08003

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

- The numbers “1-15” and “1-16” appearing in above illustrations are consistent with lead line numbers shown in illustration of propulsion pump in “2-2. Hydraulic Component Specifications” (page 4-008).

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.

3-1. Measurement

- Oil temperature during measurement : 50 ± 5°C (122 ± 9°F)

① Remove plug from coupling (1) of propulsion pump. Attach pressure gauge with hose ⓢ and connector ⓤ .
- Coupling : 9/16-18UNF×M16
- Adapter for hose ⓢ : M16 P=2.0
- Pressure gauge connector ⓤ : M16×G3/8
- Pressure gauge : 0 to 5 MPa (0 to 725 psi)

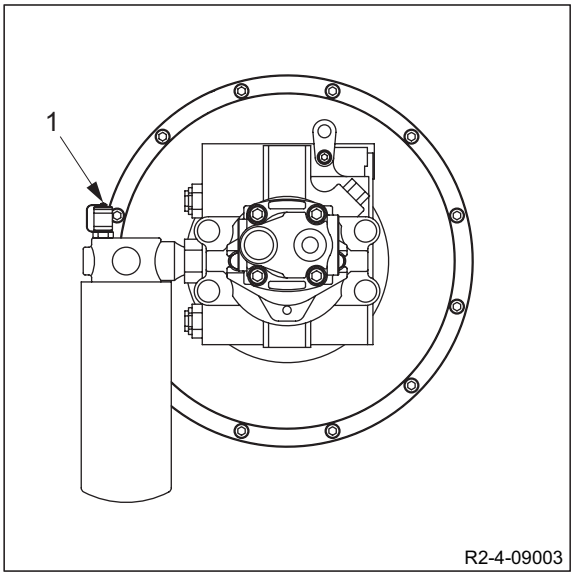
② Confirm that F-R lever is “N”.

③ Apply parking brake by pressing parking brake switch button.

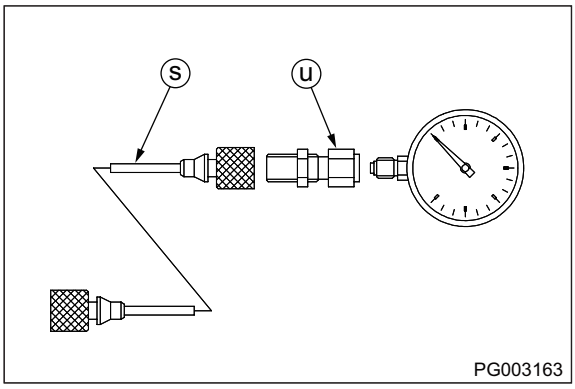
④ Start the engine and set throttle lever to “FULL”.

⑤ Read pressure indicated by pressure gauge.

★ Standard charge relief valve setting
: 2.4 ± 0.2 MPa (348 ± 29 psi)



R2-4-09003



PG003163

3-2. Adjustment

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

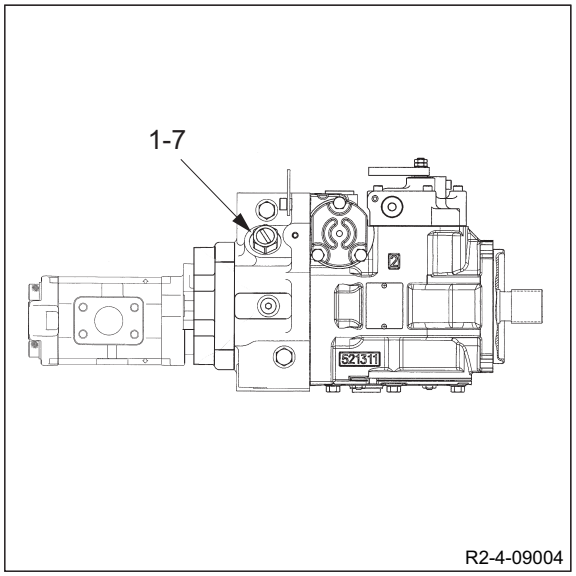
① Check nut (2) of charge relief valve (1-7) for evidence of having loosened.
② If there is evidence of nut having loosened, adjust charge relief valve so that pressure becomes within standard charge relief valve pressure setting range while watching pressure gauge.
- To adjust pressure, loosen nut and 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)

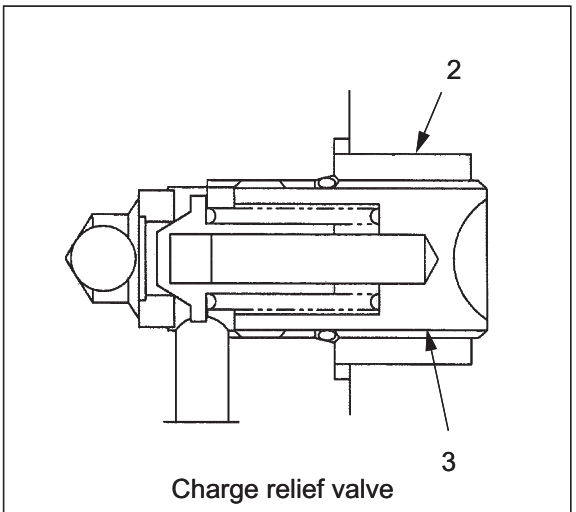
③ If there is no evidence of nut having loosened, remove charge relief valve.
④ Check removed charge relief valve for trapped dirt and scratches on its seat.
⑤ If trapped dirt is present, disassemble and clean charge relief valve.
⑥ If a scratch is found on seat, replace charge relief valve.
⑦ After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

N•m (2) Nut : 52 N·m (38 lbf·ft)

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



R2-4-09004



Charge relief valve
SV510-Ⅲ-08008

- The number “1-7” appearing in above illustrations is consistent with lead line numbers shown in illustration of propulsion pump in “2-2. Hydraulic Component Specifications” (page 4-008).

4. MEASUREMENT OF PROPULSION SERVO CIRCUIT PRESSURE

4-1. Measurement

- Oil temperature during measurement : 50 ± 5°C (122 ± 9°F)

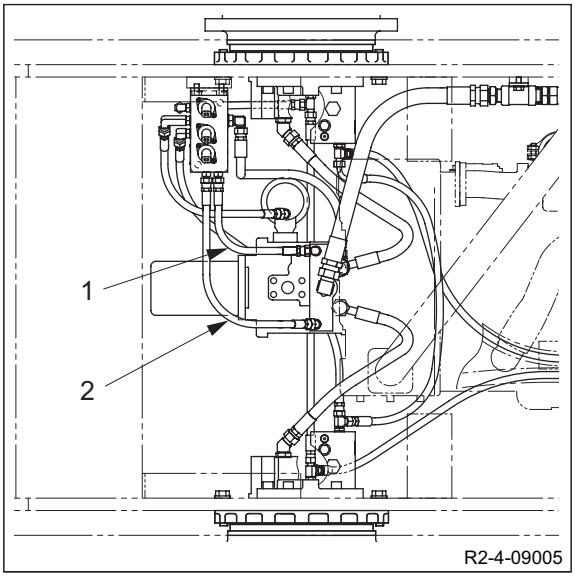
① Disconnect hoses (1) and (2) from propulsion pump. Attach pressure gauge through adapter ⓜ .
- Adapter ⓜ : G1/4
- Pressure gauge : 0 to 5 MPa (0 to 725 psi)

② Confirm that F-R lever is “N”.

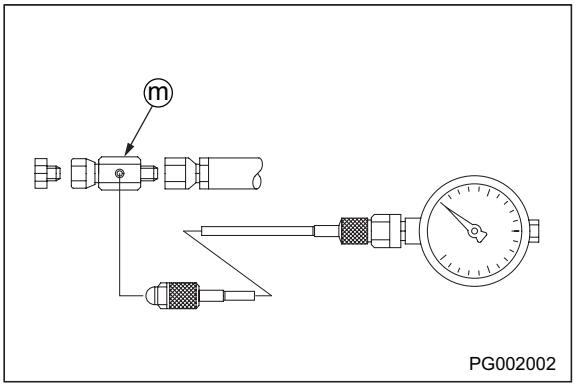
③ Apply parking brake by pressing parking brake switch button.

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

⑤ Operate F-R lever and then read pressure indicated by pressure gauge.
- With parking brake applied (ON), measured pressures of (1) and (2) are same.
- With parking brake released (OFF), measured pressures of (1) and (2) are different.



★ Standard charge relief pressure setting
: 2.4 ± 0.2 MPa (348 ± 29 psi)



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

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

5-1. Measurement

- Oil temperature during measurement : 50 ± 5°C (122 ± 9°F)

① Disconnect hose (1) from valve. Attach pressure gauge through adapter ⓜ .
- Adapter ⓜ : G1/4
- Pressure gauge : 0 to 5 MPa (0 to 725 psi)

② Confirm that F-R lever is “N”.

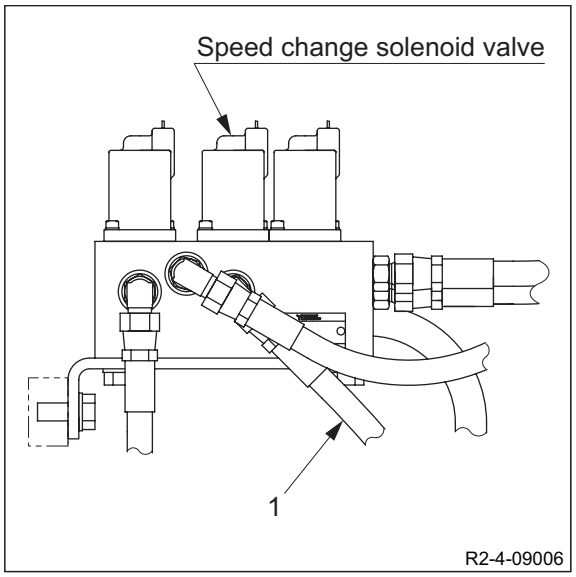
③ Apply parking brake by pressing parking brake switch button.

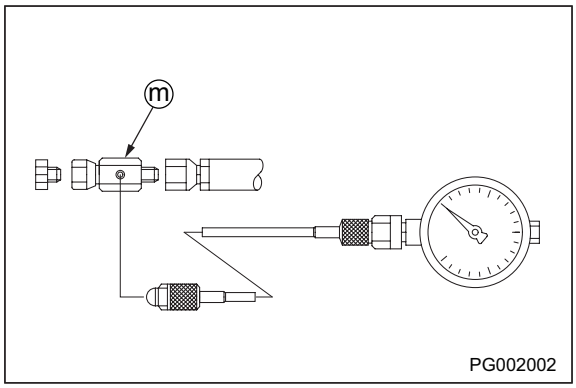
④ Set speed change switch to “ ”.

⑤ Start the engine and set throttle lever to “FULL”.

⑥ Read pressure indicated by pressure gauge.

★ Standard charge relief valve setting
: 2.4 ± 0.2 MPa (348 ± 29 psi)





6. MEASUREMENT OF PARKING BRAKE RELEASE PRESSURE

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

6-1. Measurement of propulsion motor (F)

- Oil temperature during measurement : 50 ± 5°C (122 ± 9°F)

① Disconnect hose (1) from valve. Attach pressure gauge through adapter ⓜ .
- Adapter ⓜ : G1/4
- Pressure gauge : 0 to 5 MPa (0 to 725 psi)

② Confirm that F-R lever is “N”.

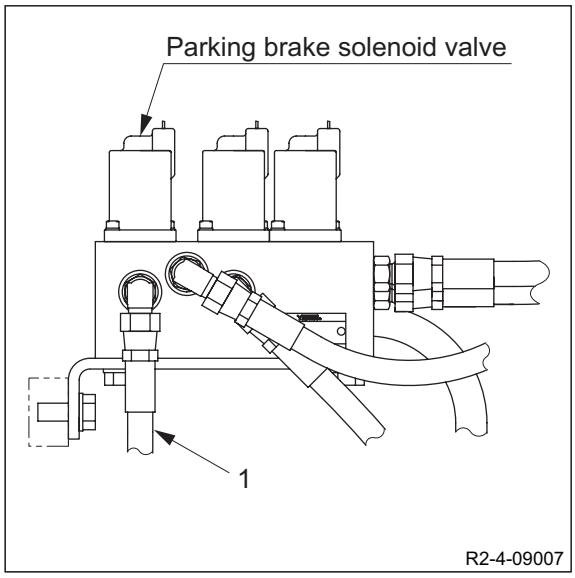
③ Apply parking brake by pressing parking brake switch button.

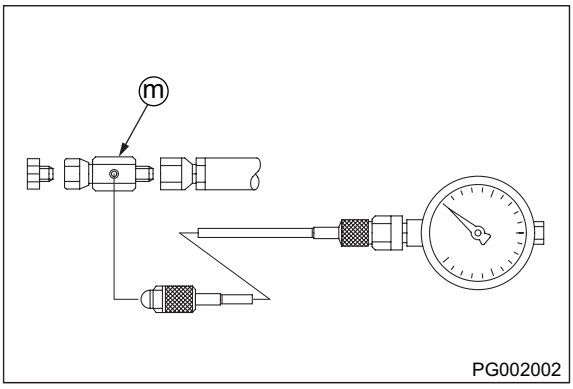
④ Start the engine and set throttle lever to “FULL”.

⑤ Release parking brake by pressing parking brake switch button.

⑥ Read brake release pressure indicated by pressure gauge.

★ Brake release pressure
: 1.3 to 1.7 MPa (189 to 247 psi)





6-2. Measurement of propulsion motor (R)

- Oil temperature during measurement : 50 ± 5°C (122 ± 9°F)

① Remove plug from parking brake pilot port (1). Attach pressure gauge with adapter ⓑ .
- Adapter ⓑ : G1/4
- Pressure gauge : 0 to 5 MPa (0 to 725 psi)

② Confirm that F-R lever is “N”.

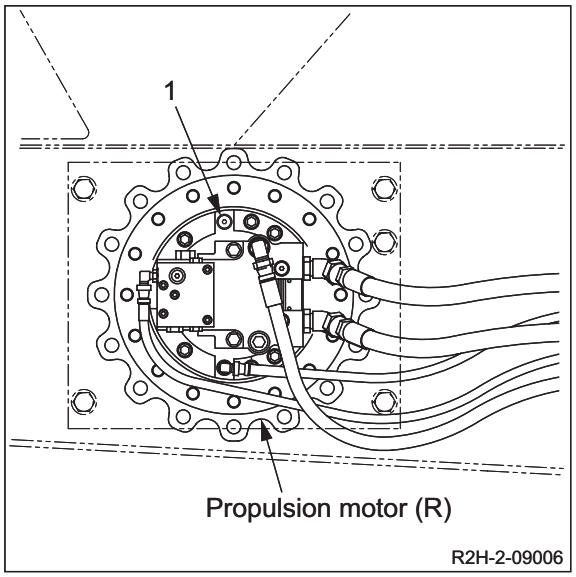
③ Apply parking brake by pressing parking brake switch button.

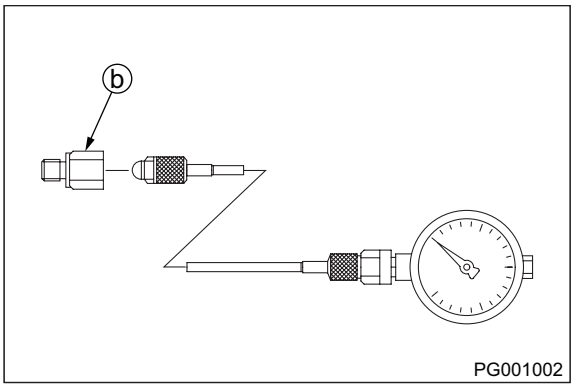
④ Start the engine and set throttle lever to “FULL”.

⑤ Release parking brake by pressing parking brake switch button.

⑥ Read brake release pressure indicated by pressure gauge.

★ Brake release pressure
: 1.3 to 1.6 MPa (189 to 232 psi)





7. MEASUREMENT AND INSPECTION OF STEERING CIRCUIT PRESSURE

7-1. Measurement

⚠WARNING

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

- Oil temperature during measurement : 50 ± 5°C (122 ± 9°F)

① Disconnect hose (1) from steering·charge pump. Attach pressure gauge through adapter Ⓟ .
- Adapter Ⓟ : G1/2
- Pressure gauge : 0 to 25 MPa (0 to 3,625 psi)

② Confirm that F-R lever is “N”.

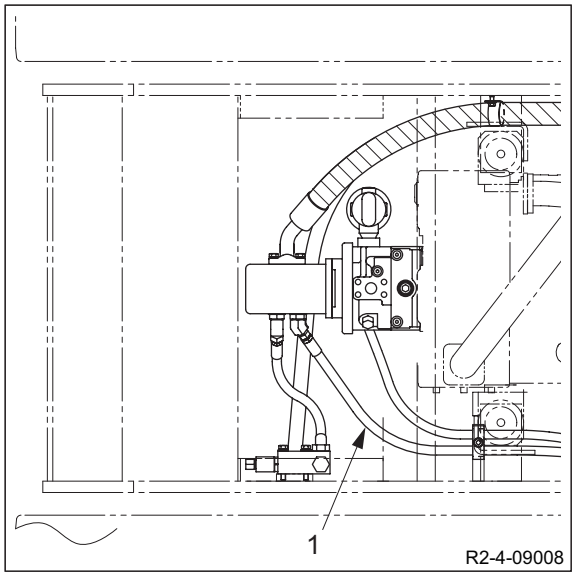
③ Apply parking brake by pressing parking brake switch button.

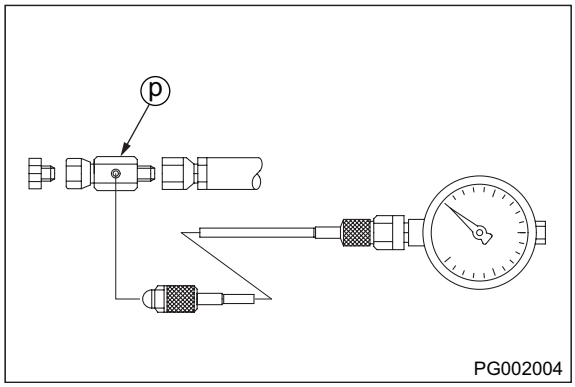
④ Start the engine and set throttle lever to “FULL”.

⑤ Turn steering wheel to operate relief valve.

⑥ Read pressure indicated by pressure gauge.

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

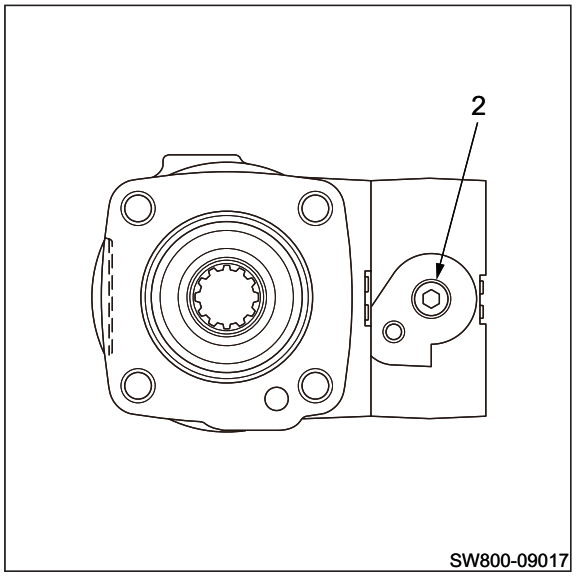




7-2. Inspection

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

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



(NOTICE)

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

8. MEASUREMENT OF HYDRAULIC PUMP CASE PRESSURE

8-1. Measurement of Propulsion Pump Case Pressure

- Oil temperature during measurement : 50 ± 5°C (122 ± 9°F)

① Disconnect hose (1) from propulsion pump. Attach pressure gauge through adapter ⓠ .
- Adapter ⓠ : G 3/4
- Pressure gauge : 0 to 5 MPa (0 to 725 psi)

② Confirm that F-R lever is “N”.

③ Apply parking brake by pressing parking brake switch button.

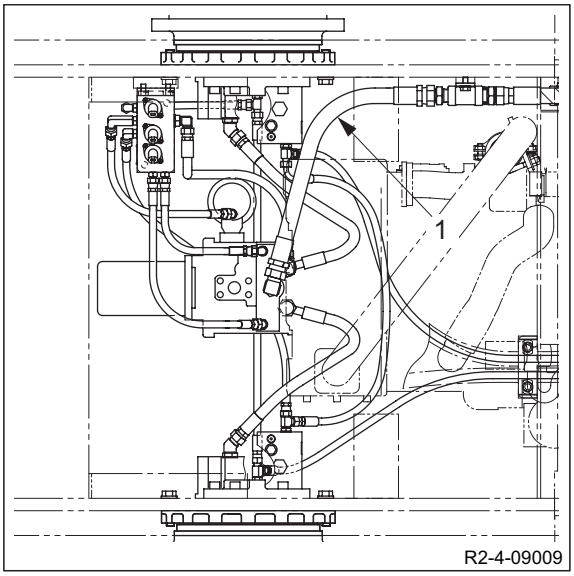
④ Set speed change switch to “  ”.

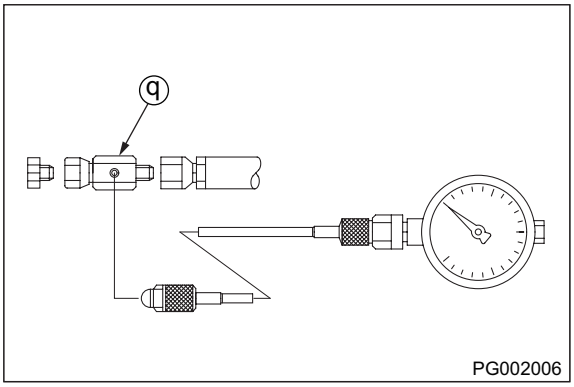
⑤ Start the engine and set throttle lever to “FULL”.

⑥ Establish a condition in which machine propulsion load becomes maximum. (Pressure does not build up unless propulsion load is applied.)

⑦ With propulsion load at maximum, measure pressure when speed change switch is “  ” and “  ” and F-R lever is “N”, “F”, and “R”, respectively.

★ Allowable pump case pressure
: 0.3 MPa (43.5 psi) or less





9. MEASUREMENT OF PROPULSION MOTOR CASE PRESSURE

9-1. Measurement of Propulsion Motor (F)

- Oil temperature during measurement : 50 ± 5°C (122 ± 9°F)

① Disconnect hose (1) and (2) from propulsion motor. Attach pressure gauge through adapter Ⓟ .
- Hose (1) : Propulsion motor (F,R)
- Hose (2) : Propulsion motor (F,L)
- Adapter Ⓟ : G1/2
- Pressure gauge : 0 to 5 MPa (0 to 725 psi)

② Confirm that F-R lever is “N”.

③ Apply parking brake by pressing parking brake switch button.

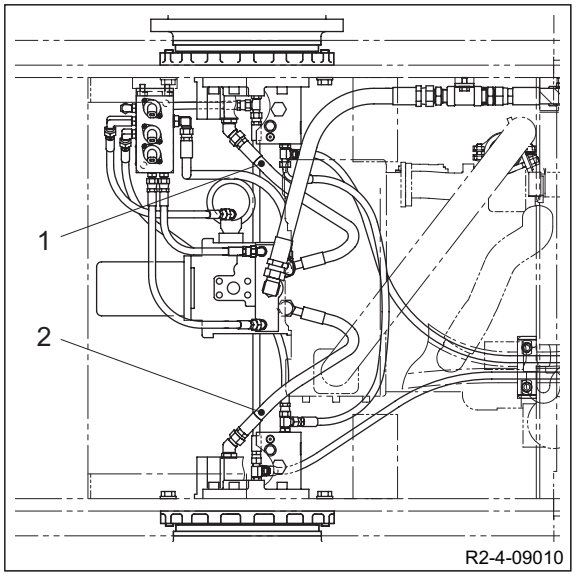
④ Set speed change switch to “ 🐢 ”.

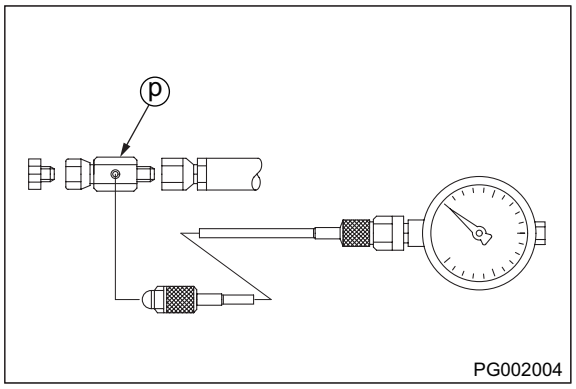
⑤ Start the engine and set throttle lever to “FULL”.

⑥ Establish a condition in which machine propulsion load becomes maximum. (Pressure does not build up unless propulsion load is applied.)

⑦ With propulsion load at maximum, measure pressure when speed change switch is “ 🐢 ” and “ 🐇 ” and F-R lever is “N”, “F”, and “R”, respectively.

★ Allowable motor case pressure
: 0.3 MPa (43.5 psi) or less





9-2. Measurement of Propulsion Motor (R)

- Oil temperature during measurement : 50 ± 5°C (122 ± 9°F)

① Remove plug from propulsion motor drain port (3). Attach pressure gauge with adapter ⓓ .
- Adapter ⓓ : G1/2
- Pressure gauge : 0 to 5 MPa (0 to 725 psi)

② Confirm that F-R lever is “N”.

③ Apply parking brake by pressing parking brake switch button.

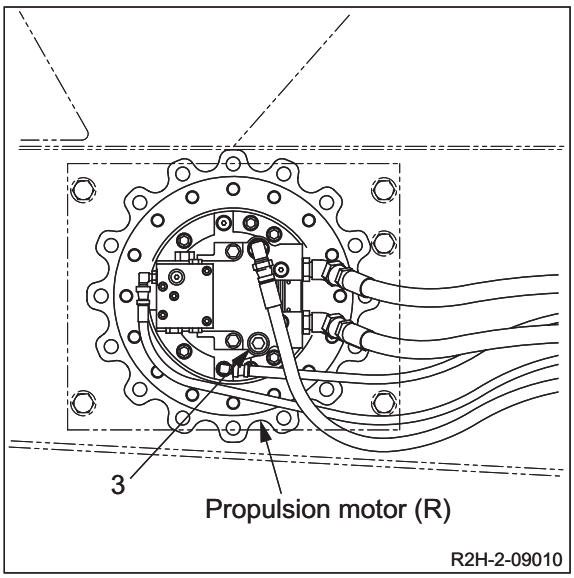
④ Set speed change switch to “  ”.

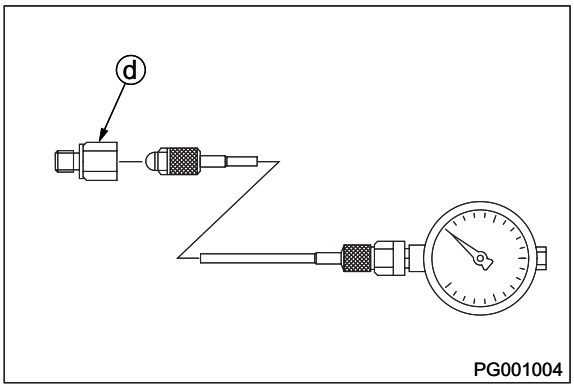
⑤ Start the engine and set throttle lever to “FULL”.

⑥ Establish a condition in which machine propulsion load becomes maximum. (Pressure does not build up unless propulsion load is applied.)

⑦ With propulsion load at maximum, measure pressure when speed change switch is “  ” and “  ” and F-R lever is “N”, “F”, and “R”, respectively.

★ Allowable motor case pressure
: 0.3 MPa (43.5 psi) or less

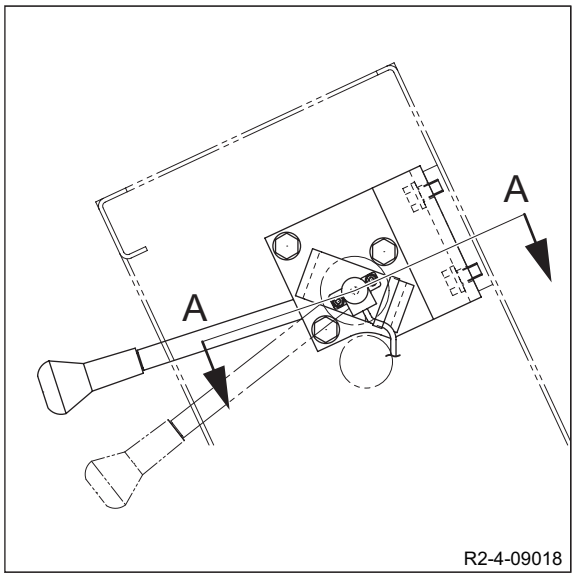




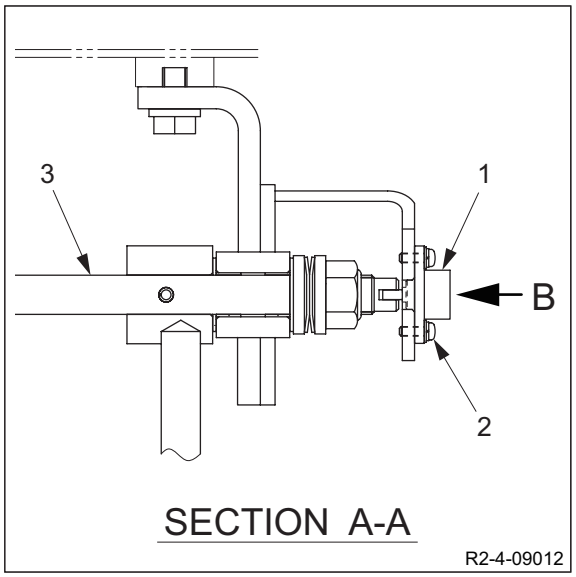
10. ADJUSTMENT OF THROTTLE LEVER

10-1. Adjustment of Potentiometer

- When the potentiometer is replaced, make an adjustment in accordance with procedure described below.
- Make the adjustment after amply warming up engine.
- Oil temperature during measurement: 50 ± 5°C (122 ± 9°F)

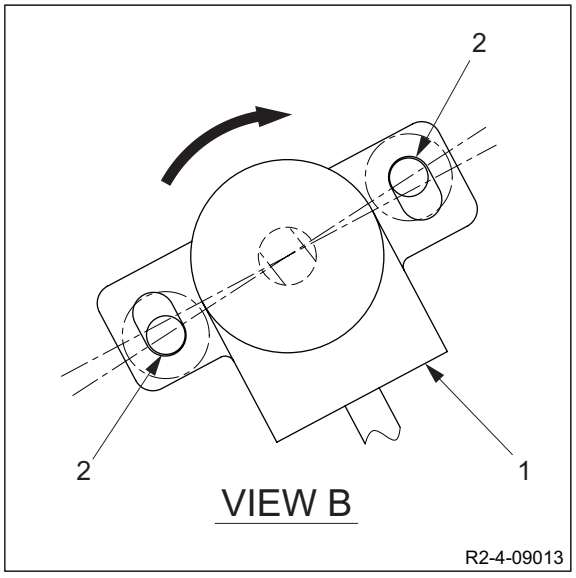


① Apply grease to shaft of potentiometer (1).
② Insert potentiometer shaft to the groove on shaft (3), and fix it with two screws (2).



(NOTICE)

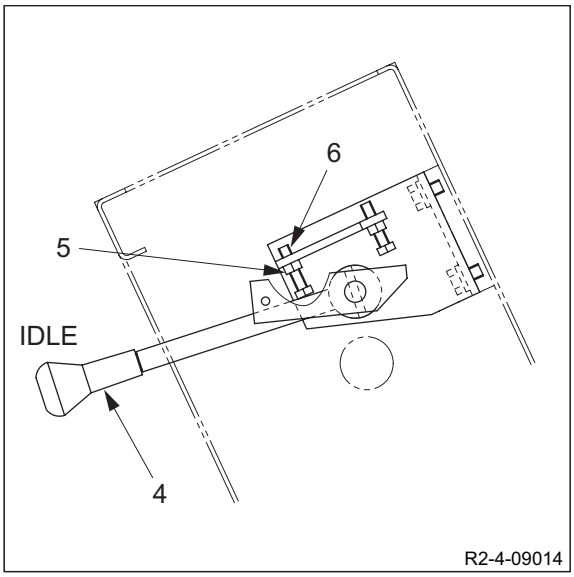
- **When fixing potentiometer (1), turn potentiometer clockwise till it is stopped by screws (2) and tighten screws.**
- **Apply thread-locked liquid to screws (2).**



③ Confirm that F-R lever is “N”.
④ Apply parking brake by pressing parking brake switch button.
⑤ Start the engine and set throttle lever (4) to “IDLE”.
⑥ Loosen locknut (5), and adjust engine rotational speed to standard value with stopper bolt (6).

★ Engine rotational speed : 975 ± 25 min^{-1}

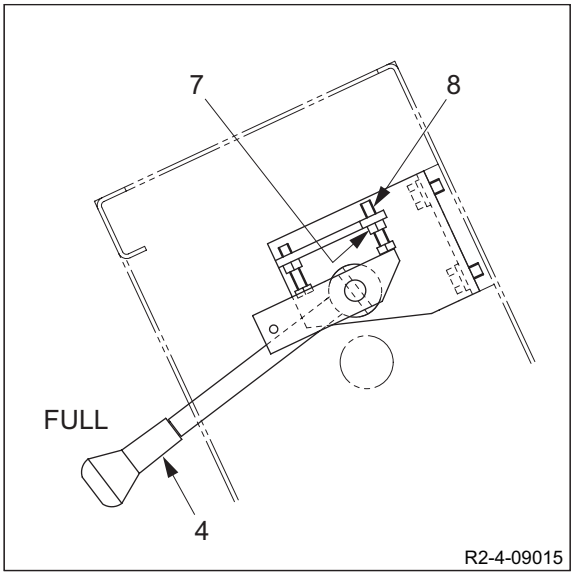
• After adjustment, fix stopper bolt (6) with locknut (5).



⑦ Set throttle lever (4) to “FULL”.
⑧ Loosen locknut (7), and adjust engine rotational speed to standard value with stopper bolt (8).

★ Engine rotational speed : 2,400 ± 50 min^{-1}

• After adjustment, fix stopper bolt (8) with locknut (7).



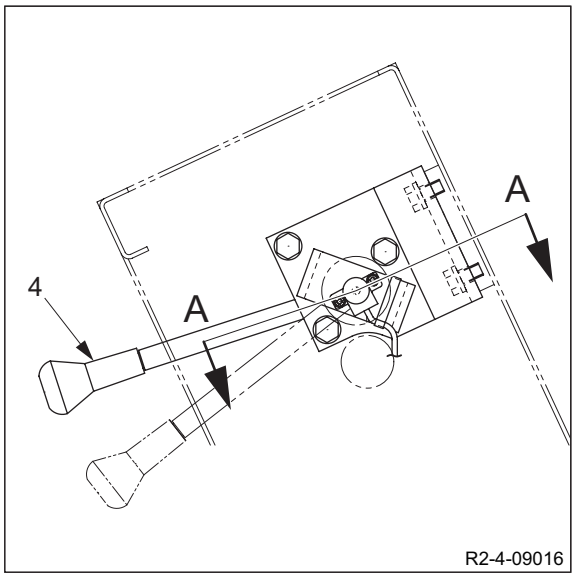
10-2. Adjustment of Operating Force

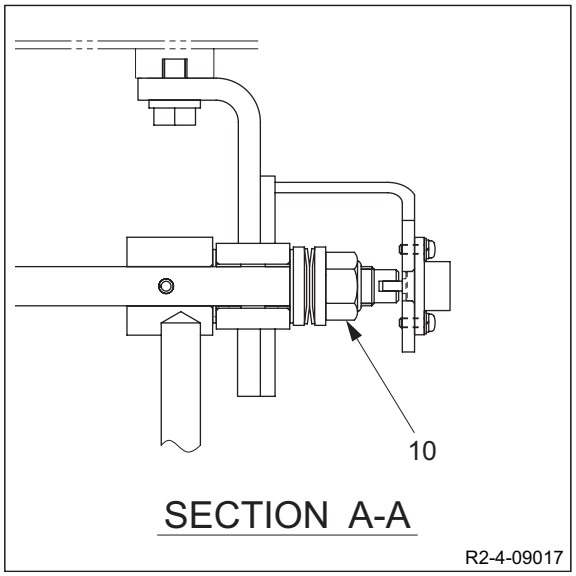
① Tighten nut (10) and set operating force at center of throttle lever (4) knob to standard operating force. Do not turn nut to the loosening direction.

★ Standard operating force : 45 N (10 lbf)

(NOTICE)

- **In case of loosen nut (10), replace it with a new one.**

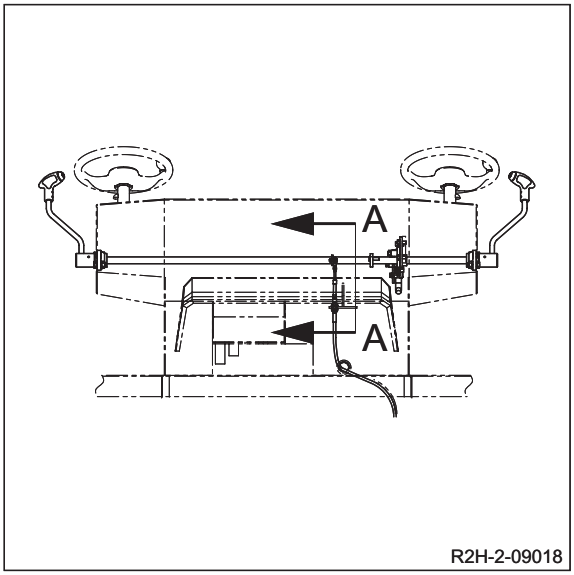




11. ADJUSTMENT OF F-R LEVER LINKAGE

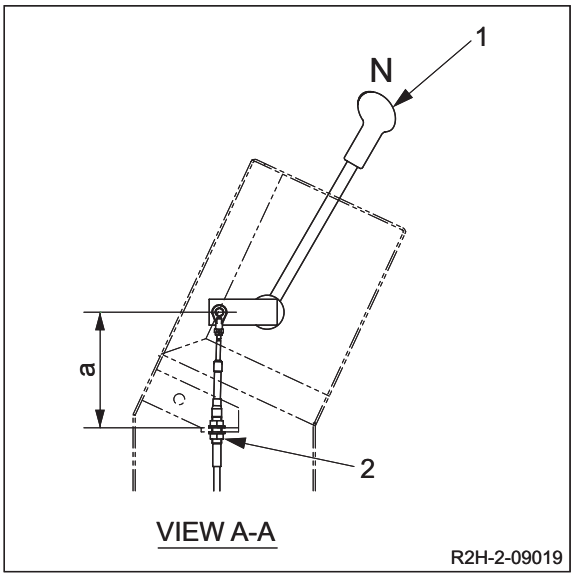
11-1. Adjustment

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



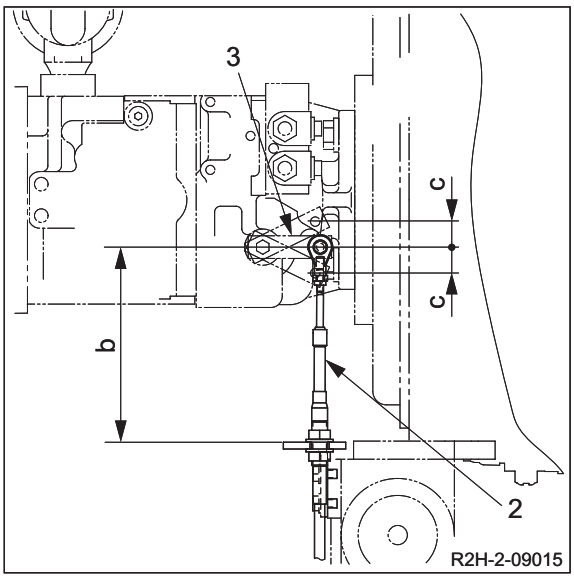
① Set F-R lever in “N”.
② Attach both ends of control cable (2).

★ **Specified dimension a : 170 mm (6.69 in.)**



★ **Specified dimension b : 172 mm (6.77 in.)**

③ Confirm the strokes of propulsion pump control lever (3).
★ **Specified dimension c : 22 mm (0.9 in.)**



TROUBLESHOOTING

1. TROUBLESHOOTING

1-1. Safety Precautions for Troubleshooting

⚠ WARNING

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

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

⚠ CAUTION

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

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

⚠ WARNING

Inadvertent starting the engine may cause a serious accident.

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

⚠ CAUTION

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

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

1-2. Important Information for Troubleshooting

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

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

1-3. Before Starting

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

The following steps are recommended:

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

2. ELECTRICAL SYSTEM TROUBLESHOOTING

2-1. When Performing Electrical System Fault Diagnosis

⚠ WARNING

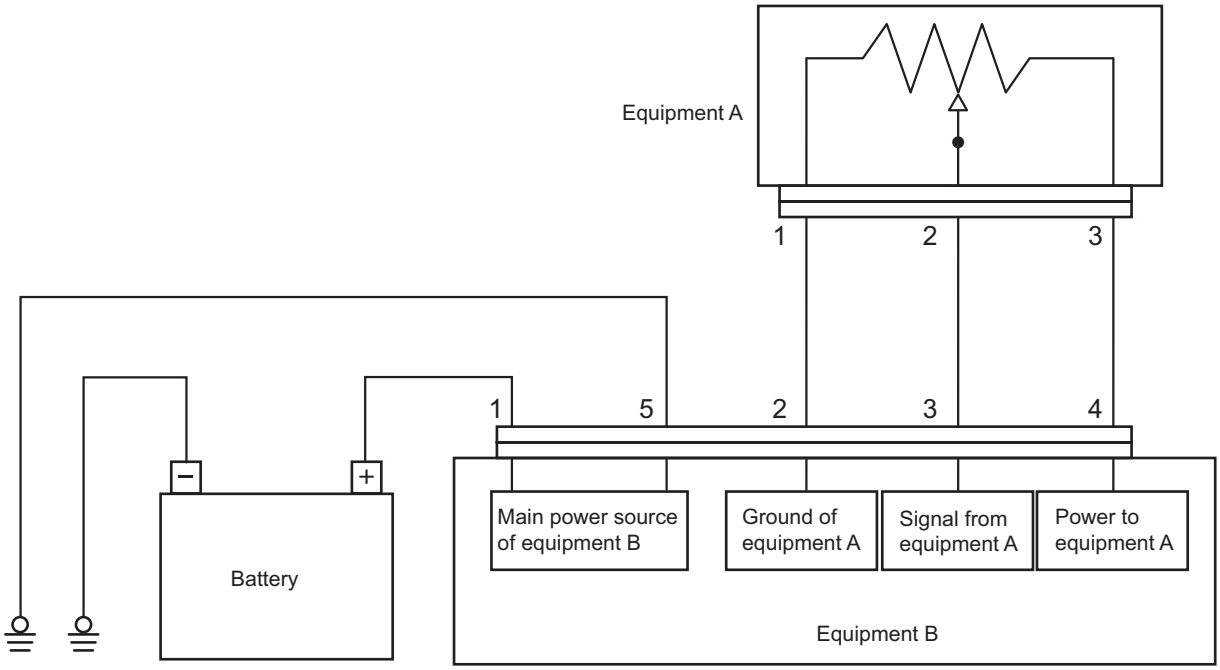
Be very careful because equipment can return to normal during an inspection and suddenly operate properly when a failure occurs due to a faulty contact or other such cause.

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

- When disconnecting or connecting a connector, be sure to turn the power supply OFF. (Electronic control parts such as the engine control unit, in particular, could be damaged internally.)
- Since connectors are not numbered, be sure to affix alignment marks so that you can restore them to their original condition.
- Before making a diagnosis, check related connectors for faulty connections. (Check by disconnecting and reconnecting related connectors several times.)
- Before proceeding to the next step, be sure to return the disconnected connectors to their original condition.
- When diagnosing a circuit (measuring the voltage, resistance, continuity and current), move related wiring and connectors several times, and check whether the tester’s numerical values change. (If values change, faulty contact in the circuit is possible.)
- Do not ground the circuit of the control unit or apply voltage to it unless otherwise specified.
- For information of wire number, wire size, and wire color used in the sample circuit diagrams, refer to "1-1. Wire Numbers, Wire Sizes, Wire Colors and Connectors Shown in Electrical Circuit Diagram, Wiring Harness Layout and Wiring Harnesses" (P.5-001).

2-1-2. Inspection procedures using a tester

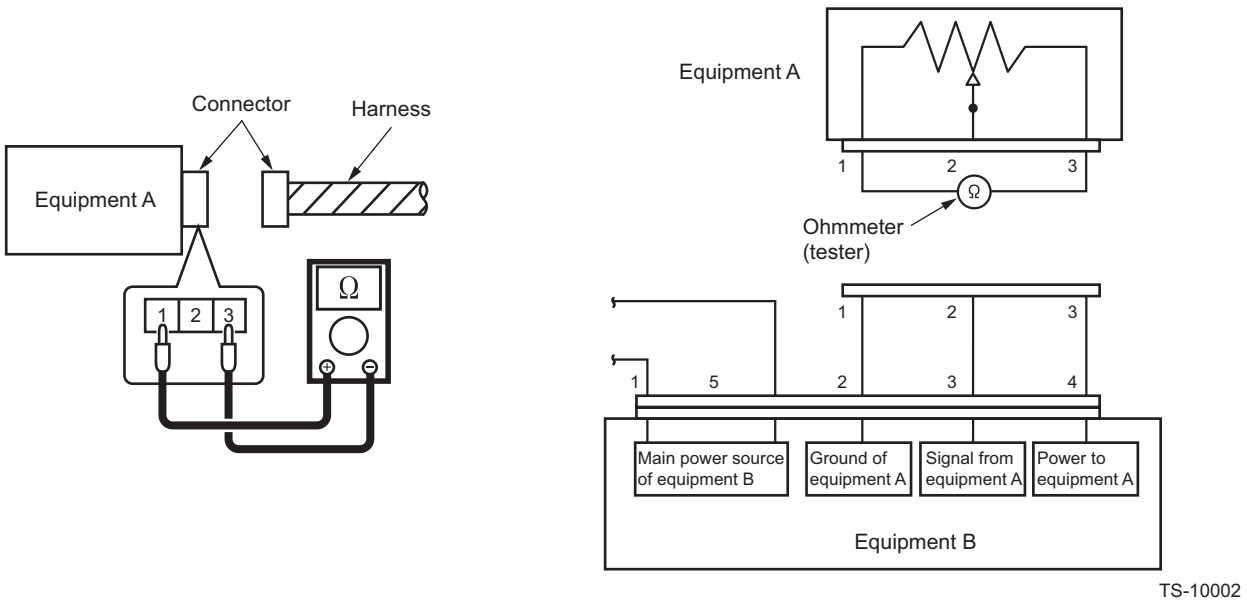
Some of the various inspection procedures are presented here for reference, using a sample circuit below.



TS-10001

1) Measuring resistance using tester

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



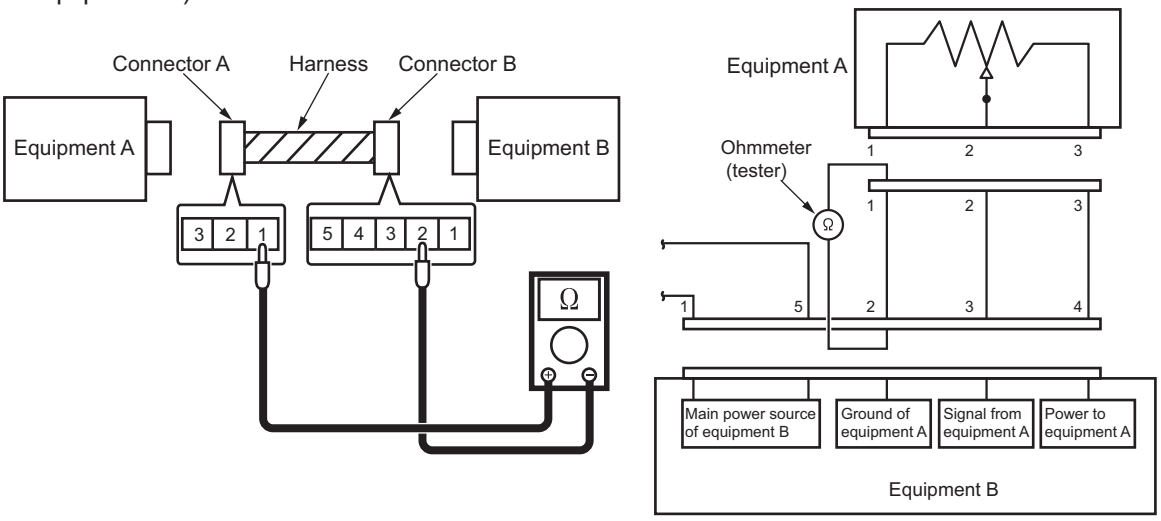
TS-10002

Inspection procedure

① Disconnect the connector of equipment A.

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

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



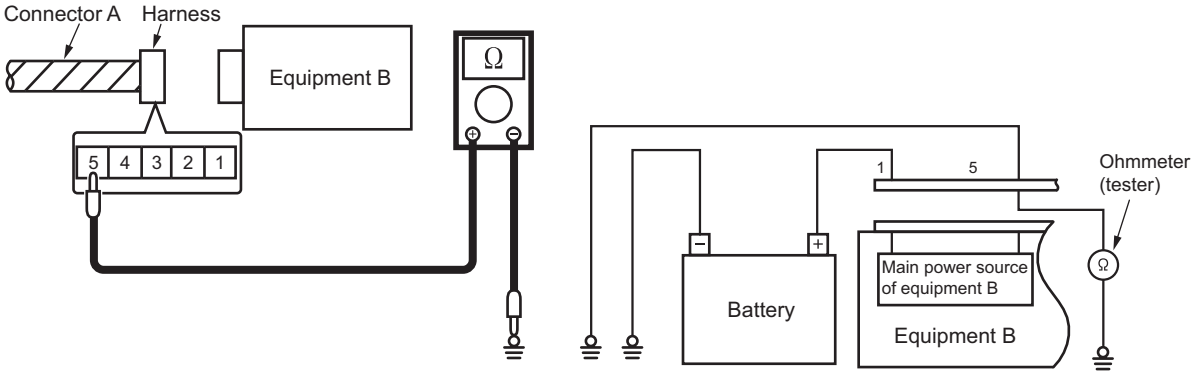
TS-10003

Inspection procedure

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

Criteria for harness defects
When there is no abnormality in the harness: Less than 10 Ω (measured value)
If there is any abnormality in the harness such as broken wire: 10 Ω or higher (measured value)

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



TS-10004

Inspection procedure

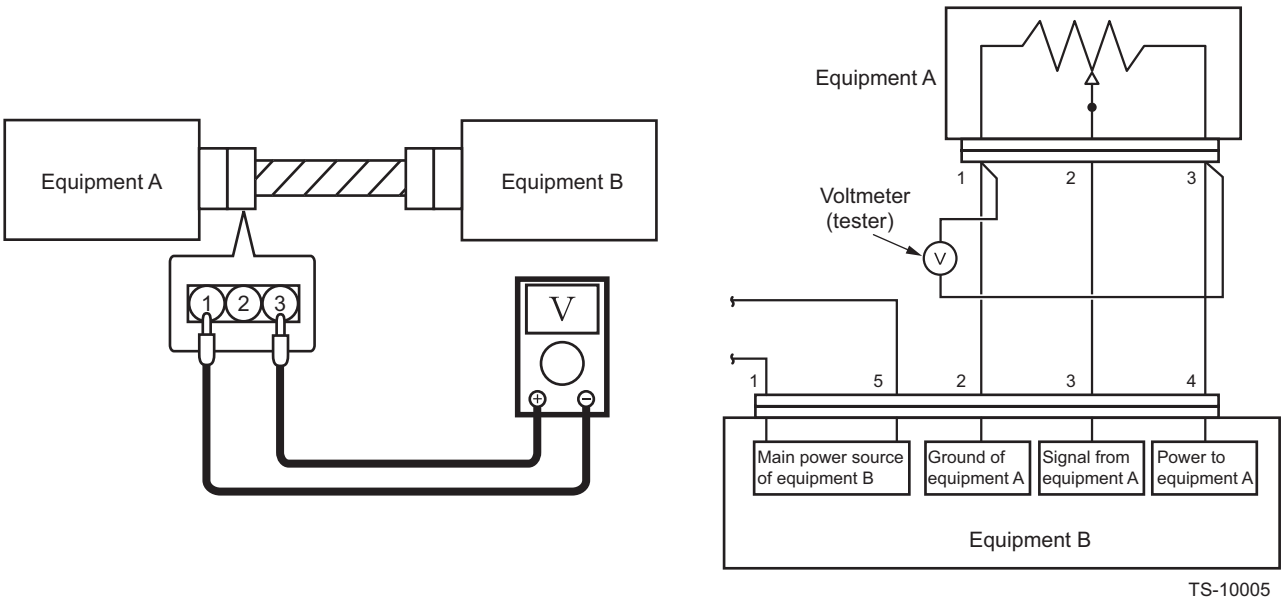
① Disconnect the connector of equipment B.
② Connect the test probe (+) to connector terminal 5 of equipment B and the test probe (-) to a machine ground point (the bolt fastening the ground terminal or an unpainted portion on the body) and measure the resistance. At this time, reversing the connector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

(NOTICE)

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

2) Measuring voltage and current flowing using tester

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

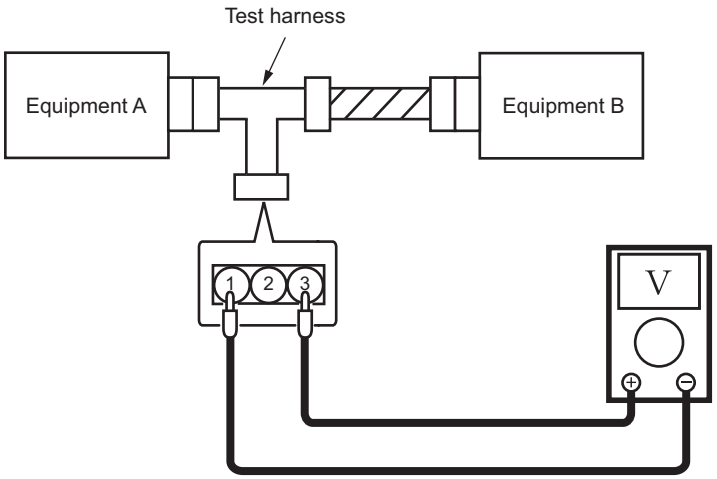


Inspection procedure

① Connect the connectors of equipment A and that of equipment B.

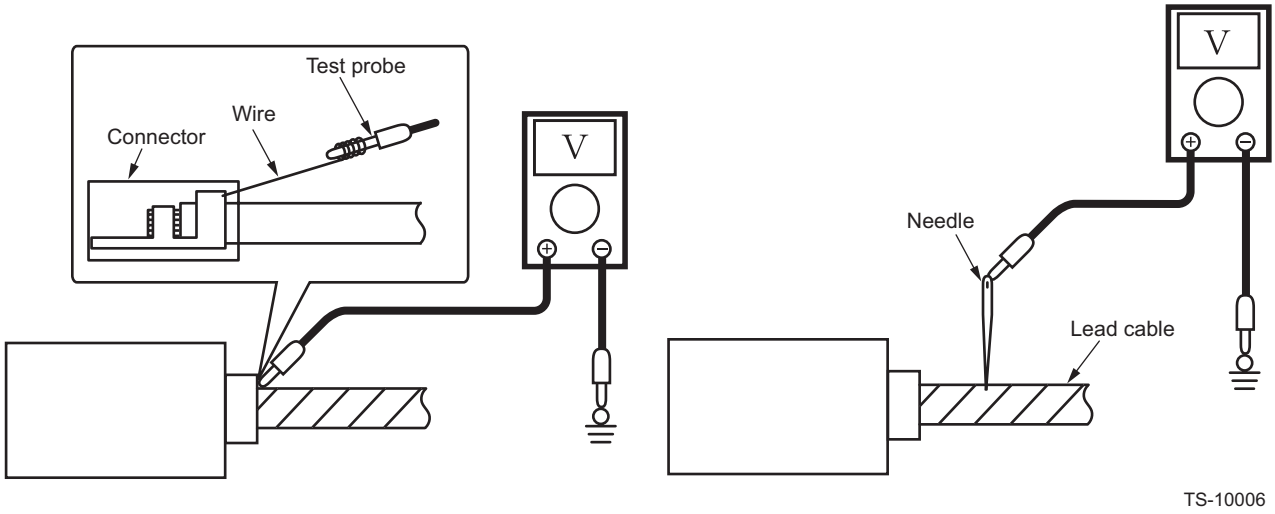
② Connect the test probe (+) to connector terminal 3 of equipment A and the test probe (-) to connector terminal 1 of equipment A and measure the voltage. Note that reversing the connector terminals between the probes (+) and (-) changes the result of the measurement. Be sure to connect the probe (+)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



Measurement method

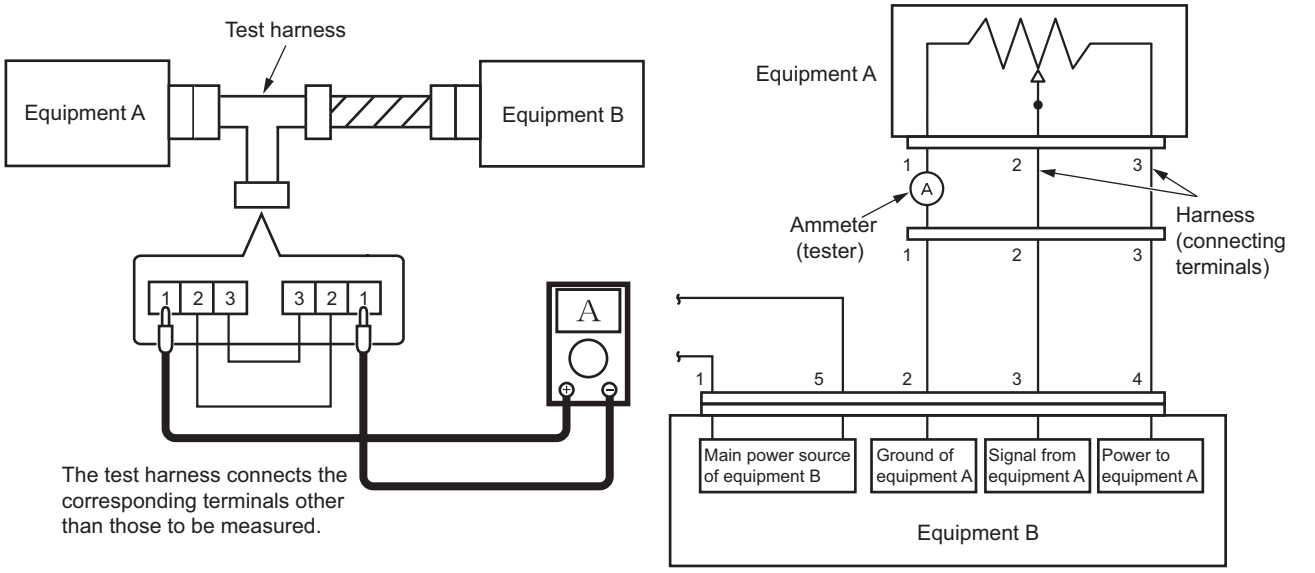
For measurement of voltage, connect the tester probes in parallel to the portion to be measured. Because the voltage can be measured only when the connector is connected in position, contact the tester probes to the terminals without disconnecting the connector. The following methods are available:

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

(NOTICE)

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

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



TS-10007

Inspection procedure

① Disconnect the connector of equipment A and connect the test harness.

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

Measurement method

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

2-1-3. Inspection of electrical system

Operate the applicable switches and turn the relays ON and OFF. Ultimately, if the solenoid valve operates (makes a sound) and the pump runs, the electrical system is OK.
If there is a failure (fault), narrow the range of the inspection to the six broad steps described below.

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

2) Fuse inspection

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

2-2) If a fuse is blown
Check whether a pump or valve (that is supposed to be protected by a blown fuse) burned, and whether there is a burning odor.
Especially if the pump and valve are not burned, check the harness for signs of burning. If it is burned, replace it.
If a fuse is blown and a relay along the pathway has failed, replace it. And if there is a timer, replace the timer, too. If a switch visually appears to be unsatisfactory (burned, melted, etc.) even though it operates, replace it.
- Simply replacing a fuse may not eliminate the true cause of a problem, and over current may flow again. Also, if over current secondarily causes an electrical path to fail (such as a wiring meltdown inside a solenoid valve), current will not flow. Thus, a fuse may not be blown out, but it also will not operate. If you do not know the location of burning or of an odor, investigate as described follows.

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

3) Connector inspection
- Is a connector disconnected or loose?
- Check that pins are not snapped or corroded.
- If faulty contact is suspected
  Turn the starter switch OFF. Then disconnect and check the connectors (including relay and switch sockets).
  If the terminal has no luster, faulty contact due to oxidation can be suspected. Therefore, polish the terminal by inserting and removing the connector (relay, switch) repeatedly at least five times. (Luster will return.)

4) Relay inspection (Check ON/OFF operation by sound.)
- Conduct without running the engine. (If you run the engine, you cannot hear the sound of operation.)
  Sound heard : A relay failure occurred.
  No sound heard : Using a tester, check the harness.
  Sound heard : A relay failure occurred.
  Still no sound : Using a tester, check the harness.
  Continuity : Turn the starter switch OFF temporarily, disconnect the relay and check for continuity between the harness-side grounding terminal (color: black) and vehicle body ground. (If there is none, replace the harness.)
  Voltage : With the relay disconnected, turn the starter switch ON and turn the operating switch ON. 24 V (or 12 V) (between vehicle body ground) should not reach the relay coil input terminal. Confirm this. Identify the location (section) to which 24 V (or 12 V) reaches. Then replace the harness or take other action.

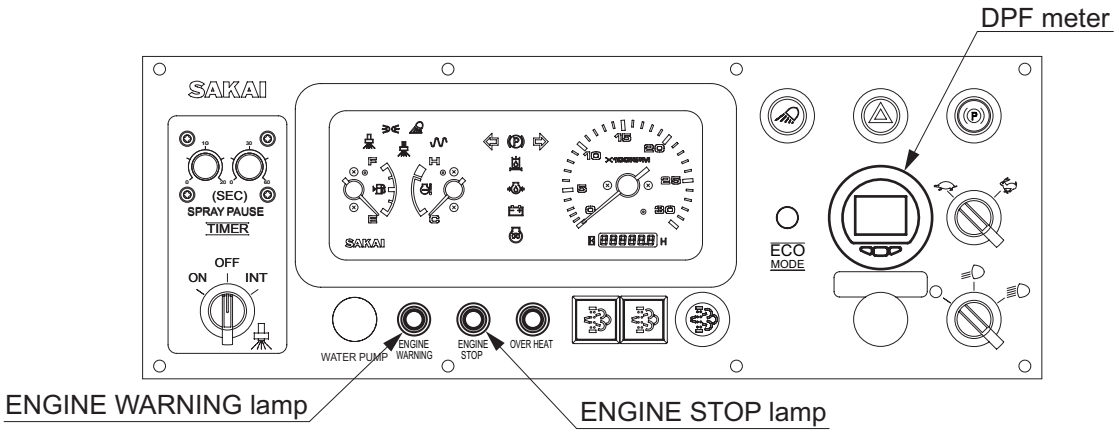
5) Solenoid valve inspection (Check ON/OFF operation by sound.)
- Conduct without running the engine. (If you run the engine, you cannot hear the sound of operation.)
  Sound heard : The electrical system is normal.
  No sound heard : Check with a tester.
  Continuity : ① Turn the starter switch OFF temporarily, disconnect the connector and check for continuity between the harness-side grounding terminal (color: black) and vehicle body ground. (If there is none, replace the harness.)
  : ② Is the solenoid valve coil burnt?
  (Turn the starter switch OFF, disconnect the connector and check the resistance between the solenoid valve terminals.)
  Voltage : With the connector disconnected, turn the starter switch ON and check whether 24 V (or 12 V) exists between the harness-side connector and vehicle body ground.
  If YES : Replace the valve.
  If NO : Investigate and identify the location (section) to which 24 V (or 12 V) reaches. Then replace the harness or take other action.

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

2-2. Engine Diagnosis Trouble Code

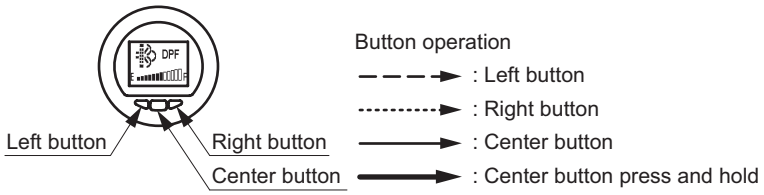
2-2-1. Description of diagnostic trouble code (DTC)

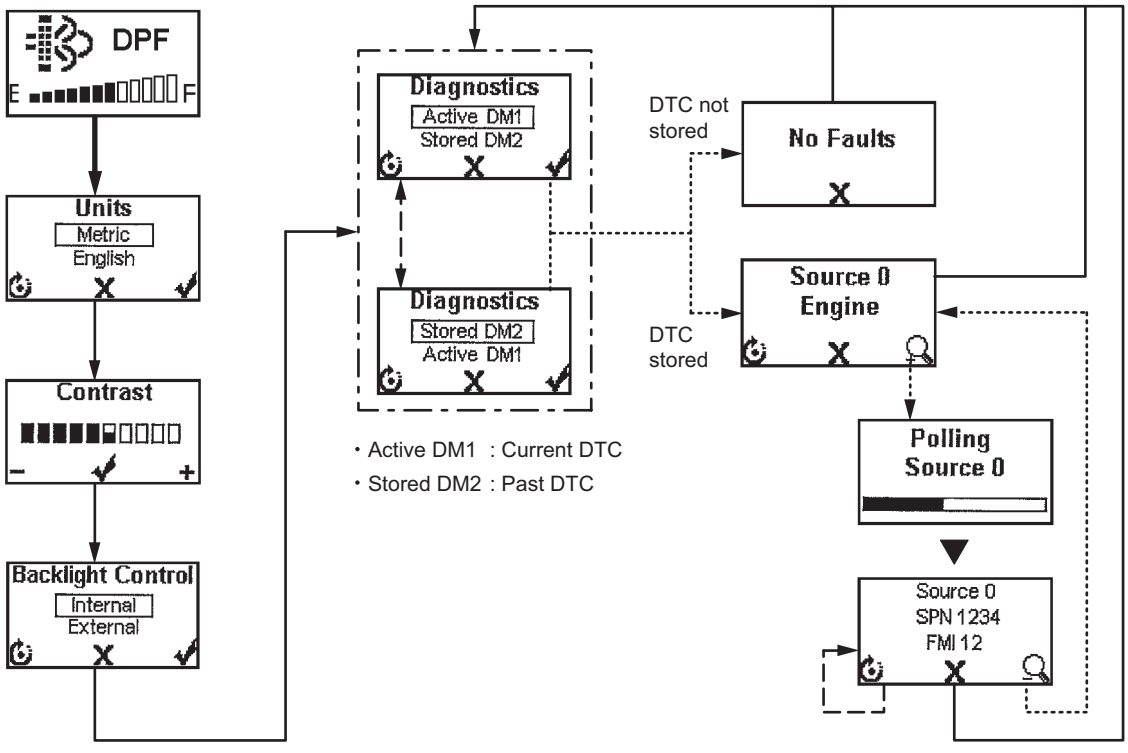
- When the ENGINE WARNING lamp or ENGINE STOP lamp illuminates, the DPF meter is used to display a DTC (diagnostic trouble code).



R2-4-10001

1) DTC display procedure using the DPF meter
   - A current or past DTC stored in the engine control unit (ECU) is displayed on the DPF meter by switching its display as described in the diagram below.





*Pressing and holding the center button returns any display back to the DPF meter.

TZ703-10021

2-2-2. Table of the diagnostic trouble code (DTC)

J1939-73		Description	DTC Description	Diagnosis
SPN	FMI			
29	3	Accelerator pedal or lever position sensor-2 abnormal	Accelerator sensor-2 High	• Short circuit in sensor/harness power supply
	4		Accelerator sensor-2 Low	• Open circuit in sensor/harness, ground fault
91	2	Accelerator pedal or lever position sensor property abnormal	Accelerator pedal sensor property abnormal	• Sensor output of two systems excessively different
	3	Accelerator pedal or lever position sensor-1 abnormal	Accelerator sensor-1 High	• Short circuit in sensor/harness power supply
	4		Accelerator sensor-1 Low	• Open circuit in sensor/harness, ground fault
100	1	Oil pressure decrease	Engine oil pressure decrease	• Engine oil pressure switch activated
102	3	Boost pressure sensor abnormal	Boost pressure sensor High	• Open circuit in sensor/harness, +B short-circuited • Sensor failure
	4		Boost pressure sensor Low	• Short circuit in sensor/harness ground • Sensor failure
108	3	Atmospheric pressure sensor abnormal	Atmospheric pressure sensor High	• Short circuit in sensor/ECU internal circuit +B
	4		Atmospheric pressure sensor Low	• Short circuit in sensor/ECU internal circuit ground
110	0	Overheat	Engine overheat	• Engine water temperature abnormally high
	3	Water temperature sensor abnormal	Water temperature sensor High	• Open circuit in sensor/harness, +B short-circuited
	4		Water temperature sensor Low	• Short circuit in sensor/harness ground
132	1	Intake air shortage (Turbo blower IN hose disconnected)	Intake air shortage (Turbo blower IN hose disconnected)	• Intake air shortage (Turbo blower IN hose disconnected)
	3	Mass air flow (MAF) sensor abnormal	Mass air flow (MAF) sensor High	• Short circuit in sensor/harness +B
	4		Mass air flow (MAF) sensor Low	• Open circuit in sensor/harness, ground fault
	15	Turbo boost increase insufficient (Blow out: Hose between intake flanges disconnected)	Turbo boost increase insufficient (Blow out: Hose between intake flanges disconnected)	• Turbo blow out: Hose between intake flanges disconnected (abnormal)
157	0	Rail pressure abnormally high	Rail pressure abnormally high	• Actual pressure exceeds command pressure. (When detected high pressure exceeding specified pressure range)
	3	Rail pressure sensor abnormal	Rail pressure sensor High	• Open circuit in sensor/harness, +B short-circuited • Sensor failure
	4		Rail pressure sensor Low	• Short circuit in sensor/harness ground • Sensor failure

J1939-73		Description	DTC Description	Diagnosis
SPN	FMI			
168	3	Battery voltage abnormal	Battery voltage High	• Open circuit, short circuit, or breakage in harness • Battery abnormal
	4		Battery voltage Low	• Open circuit, short circuit, or breakage in harness • Battery abnormal
171	3	Intake air temperature sensor (with built-in mass air flow sensor) abnormal	Intake air temperature sensor (with built-in mass air flow sensor) High	• Open circuit in sensor/harness, +B short-circuited
	4		Intake air temperature sensor (with built-in mass air flow sensor) Low	• Short circuit in sensor/harness ground
172	0	Intake air temperature abnormally high (Intercooler model only)	Intake air temperature abnormally high	• Intake air temperature abnormally high
	3	Intake air temperature sensor abnormal	Intake air temperature sensor High	• Open circuit in sensor/harness, +B short-circuited
	4		Intake air temperature sensor Low	• Short circuit in sensor/harness ground
174	0	Fuel temperature abnormally high	Fuel temperature abnormally high	• Fuel temperature abnormally high
	3	Fuel temperature sensor abnormal	Fuel temperature sensor High	• Open circuit in sensor/harness, +B short-circuited
	4		Fuel temperature sensor Low	• Short circuit in sensor/harness ground
190	0	Overrun	Engine overrun	• Engine speed exceeds specified speed
628	2	ECU flash ROM and CPU abnormal	ECU flash ROM abnormal	• Monitoring of unauthorized alteration of internal flash ROM
633	7	Pressure limiter valve opening abnormal	Pressure limiter valve opening abnormal	• Pressure limiter valve opening abnormal
636	2	Crankshaft position sensor (NE sensor) abnormal	NE sensor pulse count abnormal	• Open circuit in sensor/harness, short-circuited • Sensor failure
	7	NE-G phase shift	NE-G phase shift failure	• Phase shift between NE pulse and G pulse excessive
	8	Crankshaft position sensor (NE sensor) abnormal	NE sensor pulse not inputted	• Open circuit in sensor/harness, short-circuited • Sensor failure
651	3	Open circuit in TWV driving system	Injector of 1st engine cylinder (TWV1): Open circuit in harness/coil	• Open circuit in harness • Open circuit in injector coil
652	3		Injector of 2nd engine cylinder (TWV4): Open circuit in harness/coil	
653	3		Injector of 3rd engine cylinder (TWV2): Open circuit in harness/coil	
654	3		Injector of 4th engine cylinder (TWV3): Open circuit in harness/coil	

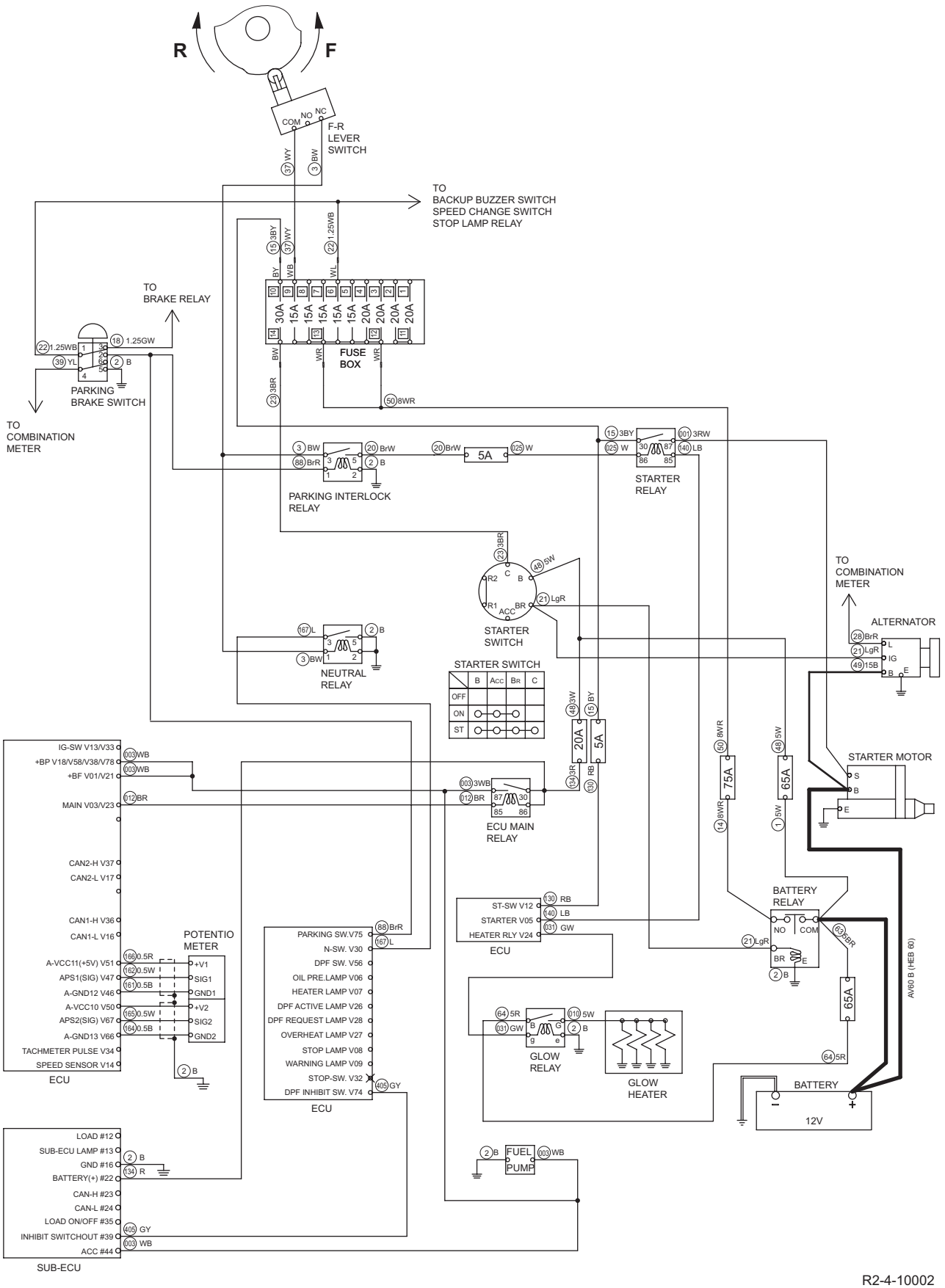
J1939-73		Description	DTC Description	Diagnosis
SPN	FMI			
723	2	Camshaft position sensor (G sensor) abnormal	G sensor pulse count abnormal	• Open circuit in sensor/harness, short-circuited • Sensor failure
	8		G sensor pulse not inputted	
1077	2	ECU flash ROM and CPU abnormal	ECU CPU abnormal (main IC abnormal)	• CPU failure
1239	1	Fuel leakage (high pressure fuel system)	Fuel leakage (high pressure fuel system)	• Fuel leakage from high pressure fuel system (when detected excessive fuel consumption, calculating from difference of fuel rail pressure before and after fuel injection)
1347	3	SCV abnormal	SCV +B short-circuit	• Short circuit in SCV +B
	4		SCV driving system abnormal	• Open circuit in SCV, ground fault
	7	SCV sticking	SCV sticking diagnosis	• SCV sticks while open (when detected condition that actual rail pressure constantly exceeds command rail pressure)
1485	2	Main relay abnormal	Main relay abnormal	• Main relay failure
3242	0	Exhaust temperature rise abnormal T1	Exhaust temperature rise abnormal T1	• DPF inlet temperature (T1) abnormally high
	3	Exhaust temperature sensor 1 (T1: DOC outlet) abnormal	Exhaust temperature sensor 1 (T1: DOC outlet) High	• Open circuit in sensor/harness, +B short-circuited
	4		Exhaust temperature sensor 1 (T1: DOC outlet) Low	• Short circuit in sensor/harness ground
3246	0	Exhaust temperature rise abnormal T2	Exhaust temperature rise abnormal T2	• DPF outlet temperature (T2) abnormally high
	3	Exhaust temperature sensor 2 (T2: DPF outlet) abnormal	Exhaust temperature sensor 2 (T2: DPF outlet) High	• Open circuit in sensor/harness, +B short-circuited
	4		Exhaust temperature sensor 2 (T2: DPF outlet) Low	• Short circuit in sensor/harness ground
3251	3	Differential pressure sensor abnormal	Differential pressure sensor abnormal High	• Open circuit in sensor/harness, +B short-circuited
	4		Differential pressure sensor abnormal Low	• Short circuit in sensor/harness ground
3252	0	DOC reaction abnormal (exhaust gas abnormal)	DOC reaction abnormal (exhaust gas abnormal)	• DOC temperature abnormally high due to unburned gas
3509	3	Sensor voltage 1 abnormal	Sensor supply voltage 1 High	• Sensor supply voltage 1 abnormal or recognition abnormal
	4		Sensor supply voltage 1 Low	
3510	3	Sensor supply voltage 2 abnormal	Sensor supply voltage 2 High	• Sensor supply voltage 2 abnormal or recognition abnormal
	4		Sensor supply voltage 2 Low	
3701	0	PM accumulation abnormal level 5	PM accumulation abnormal level 5	• PM (estimated) accumulation quantity excessive level 5
	15	PM accumulation abnormal level 3	PM accumulation abnormal level 3	• PM (estimated) accumulation quantity excessive level 3
	16	PM accumulation abnormal level 4	PM accumulation abnormal level 4	• PM (estimated) accumulation quantity excessive level 4

J1939-73		Description	DTC Description	Diagnosis
SPN	FMI			
4765	0	Exhaust temperature rise abnormal T0	Exhaust temperature rise abnormal T0	• DOC inlet temperature (T0) abnormally high
	3	Exhaust temperature sensor 0 (T0 : DOC inlet) abnormal	Exhaust temperature sensor 0 (T0 : DOC inlet) High	• Open circuit in sensor/harness, +B short-circuited
	4		Exhaust temperature sensor 0 (T0 : DOC inlet) Low	• Short circuit in sensor/harness ground
523523	2	Open circuit in common 1 system	Open circuit in injector driving circuit: Common 1 system, or TWV 1 and 3 (1st and 4th cylinders) simultaneously	• Open circuit in harness
	3	Short circuit in common 1 TWV driving system	Short circuit in battery: Injector driving circuit at ECU side (Common 1 system), or 1st and 4th cylinders at INJ side simultaneously	• Short circuit in harness +B
	4		Short circuit in GND: Injector driving circuit at ECU side (Common 1 system), or 1st and 4th cylinders at INJ side simultaneously	• Short circuit in harness ground
523524	2	Open circuit in common 2 system	Open circuit in injector driving circuit: Common 2 system, or TWV 2 and 4 (3rd and 2nd cylinders) simultaneously	• Open circuit in harness
	3	Short circuit in common 2 TWV driving system	Short circuit in battery: Injector driving circuit at ECU side (Common 2 system), or 2nd and 3rd cylinders at INJ side simultaneously	• Short circuit in harness +B
	4		Short circuit in GND: Injector driving circuit at ECU side (Common 2 system), or 2nd and 3rd cylinders at INJ side simultaneously	• Short circuit in harness ground
523525	1	Injector charge voltage abnormal	ECU injector charge voltage insufficient	• Injector charge voltage insufficient • ECU charge circuit failure
523527	2	ECU flash ROM and CPU abnormal	ECU CPU abnormal (watching IC abnormal)	• CPU-watching IC failure
523535	0	Overcharge	ECU injector charge voltage excessively high	• ECU injector charge voltage excessively high (ECU charge circuit failure)
523538	2	QR abnormal	QR data abnormal	• QR code correction data abnormal
	7		QR data writing abnormal	• QR code correction data unwritten
523539	2	Pump seizure	Pump seizure 1	• Pressure abnormally high 1
523540	2		Pump seizure 2	• Pressure abnormally high 2
523543	2	Accelerator pedal or lever position sensor abnormal (via CAN)	Accelerator sensor at machine body abnormal	• Abnormal message from machine body received

J1939-73		Description	DTC Description	Diagnosis
SPN	FMI			
523544	3	Air heater relay drive abnormal	Short circuit in air heater relay driving circuit +B	• Short circuit in air heater relay driving circuit +B
	4		Short circuit in air heater relay driving circuit GND	• Open circuit in air heater relay driving circuit, ground fault
523547	2	CAN2 bus off	CAN2 bus off	• Short circuit in CAN2 +B/GND or traffic abnormally high
523548	2	Open circuit in CAN2 frame	Open circuit in CAN_KBT original frame	• Open circuit in CAN_KBT original frame
523572	4	EGR motor abnormal	EGR position sensor abnormal	• EGR position sensor abnormal
523574	3		Open circuit in EGR motor	• Open circuit in EGR motor coil
	4		Short circuit in EGR motor	• Short circuit in EGR motor coil
523575	7	EGR (DC motor) abnormal	EGR valve sticking (FB abnormal)	• EGR valve sticking
523576	2		EGR motor ambient temperature abnormal	• EGR motor temperature abnormally high
523577	2		EGR thermistor sensor with built-in valve abnormal	• EGR motor temperature sensor abnormal
523578	2	Open circuit in CAN_ EGR control line	Disconnection (open circuit) in EGR control line communication	• CAN communication with EGR
523580	2	Intake throttle FB (feed back) abnormal	Intake throttle FB (feed back) abnormal	• Intake throttle DC motor feed back abnormal
523582	3	Intake throttle lift sensor abnormal	Intake throttle lift sensor abnormal (High)	• Intake throttle lift sensor High
	4		Intake throttle lift sensor abnormal (Low)	• Intake throttle lift sensor Low
523589	17	Water temperature rise during manual regeneration insufficient	Water temperature rise during manual regeneration insufficient	• While regenerating, conditions required for warming up the engine not established (Insufficient water temperature rise)
523590	16	Manual regeneration process time-up abnormal	Manual regeneration process time-up abnormal	• Regeneration process not end due to insufficient DPF temperature rise (Regeneration time)
523591	2	Open circuit in CAN2 frame	CAN_CCVS communication disruption	• CAN_CCVS communication disruption
523592	2		CAN_CM1 communication disruption	• CAN_CM1 communication disruption
523593	2		CAN_DDC1 communication disruption	• CAN_DDC1 communication disruption
523594	2		CAN_ETC2 communication disruption	• CAN_ETC2 communication disruption
523595	2		CAN_ETC5 communication disruption	• CAN_ETC5 communication disruption
523596	2		CAN_TSC1 communication disruption	• CAN_TSC1 communication disruption
523598	2		CAN_EBC1 communication disruption	• CAN_EBC1 communication disruption

J1939-73		Description	DTC Description	Diagnosis
SPN	FMI			
523599	0	Simultaneous open circuit in all exhaust temperature sensors	Simultaneous open circuit in all exhaust temperature sensors	• Simultaneous open circuit in all exhaust temperature sensors
523600	0	Warning on incomplete learning of individual difference of pumps	Warning on incomplete learning of individual difference of pumps	• Pump learning history
523601	0	Exhaust temperature continuously abnormal (Starter relay drive prohibit warning)	Exhaust temperature continuously abnormal (Starter relay drive prohibit warning)	• Exhaust temperature when abnormally high temperature generated
523602	0	Regeneration frequency abnormally high	Regeneration frequency abnormally high	• Abnormal interval between end of regeneration process and trigger for next regeneration
523603	15	Warning on High. Temp_AECD operation	Warning on High.Temp_AECD operation	• High Temperature AECD_EGR valve limiting state warning
523604	2	CAN1 bus off	CAN1 bus off	• Short circuit in CAN1 +B/GND or traffic abnormally high
523700	13	EEPROM checksum not coincident	KBT area EEPROM checksum not coincident	• KBT area EEPROM checksum not coincident
523701	13		DST1 area EEPROM checksum not coincident	• DST1 area EEPROM checksum not coincident
523702	13		DST2 area EEPROM checksum not coincident	• DST2 area EEPROM checksum not coincident

Fig.: 2-3-1


R
F
COM NO NC
F-R LEVER SWITCH
TO BACKUP BUZZER SWITCH SPEED CHANGE SWITCH STOP LAMP RELAY
TO BRAKE RELAY
FUSE BOX
30A 15A 15A 15A 15A 15A 20A 20A 20A 20A
PARKING BRAKE SWITCH
TO COMBINATION METER
PARKING INTERLOCK RELAY
5A
STARTER RELAY
STARTER SWITCH
NEUTRAL RELAY
STARTER SWITCH
B Acc Br C
OFF
ON
ST
20A
5A
ALTERNATOR
STARTER MOTOR
75A
65A
ECU MAIN RELAY
BATTERY RELAY
ST-SW V12
STARTER V05
HEATER RLY V24
ECU
GLOW RELAY
GLOW HEATER
BATTERY
12V
FUEL PUMP
IG-SW V13/V33
+BP V18/V58/V38/V78
+BF V01/V21
MAIN V03/V23
CAN2-H V37
CAN2-L V17
CAN1-H V36
CAN1-L V16
POTENTIO METER
A-VCC11(+5V) V51
APS1(SIG) V47
A-GND12 V46
A-VCC10 V50
APS2(SIG) V67
A-GND13 V66
TACHMETER PULSE V34
SPEED SENSOR V14
ECU
PARKING SW.V75
N-SW. V30
DPF SW. V56
OIL PRE.LAMP V06
HEATER LAMP V07
DPF ACTIVE LAMP V26
DPF REQUEST LAMP V28
OVERHEAT LAMP V27
STOP LAMP V08
WARNING LAMP V09
STOP-SW. V32
DPF INHIBIT SW. V74
ECU
LOAD #12
SUB-ECU LAMP #13
GND #16
BATTERY(+) #22
CAN-H #23
CAN-L #24
LOAD ON/OFF #35
INHIBIT SWITCHOUT #39
ACC #44
SUB-ECU
AV60 B (HEB 60)
R2-4-10002

2-3. 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 WARNING lamp or ENGINE STOP lamp must not be lighting. If ENGINE WARNING lamp or ENGINE STOP lamp lights, refer to troubleshooting of engine manufacturer.

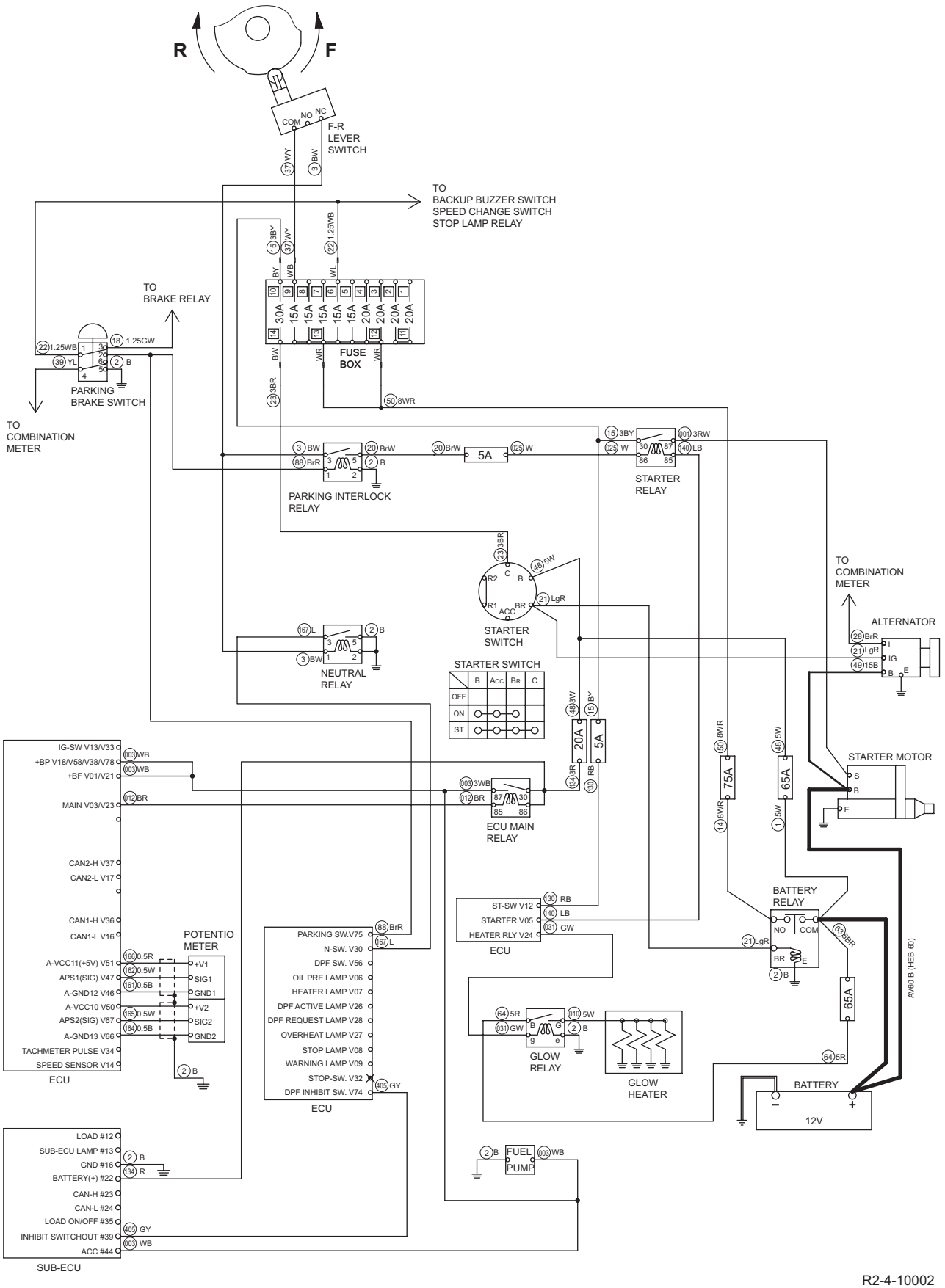
2-3-1. Engine will not start (Starter motor does not run) 1/2

- F-R lever must be in “N”.
- Parking brake switch must be applied.

Reference Fig.: 2-3-1

Check point	Check/Cause	Action
1. Battery	• Measure battery voltage or specific gravity. Standard voltage : 12 V or more Standard gravity : 1.26 or more • If value is below standard, battery capacity is insufficient.	Charge or replace battery.
2. Starter Switch	• 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	(1) When starter switch is ON, measure voltage between starter motor terminal B and chassis ground. Standard voltage : 12 V or more (2) When starter switch is START, measure voltage between starter motor terminal S and chassis ground. Standard voltage : 12 V or more • If above items (1) and (2) are OK and starter motor does not run, starter motor is faulty.	Replace starter motor.
4. Starter Relay	(1) When starter switch is START, measure voltage between starter relay terminal 86 inlet wire W and chassis ground. Standard voltage : 12 V or more (2) When starter switch is START, measure voltage between starter relay terminal 30 inlet wire BY and chassis ground. Standard voltage : 12 V or more (3) When starter switch is START, measure voltage between starter relay terminal 87 outlet wire RW and chassis ground. Standard voltage : 12 V or more • If above items (1) and (2) are OK and item (3) is NG, starter relay is faulty.	Replace starter relay.

Fig.: 2-3-1



R2-4-10002

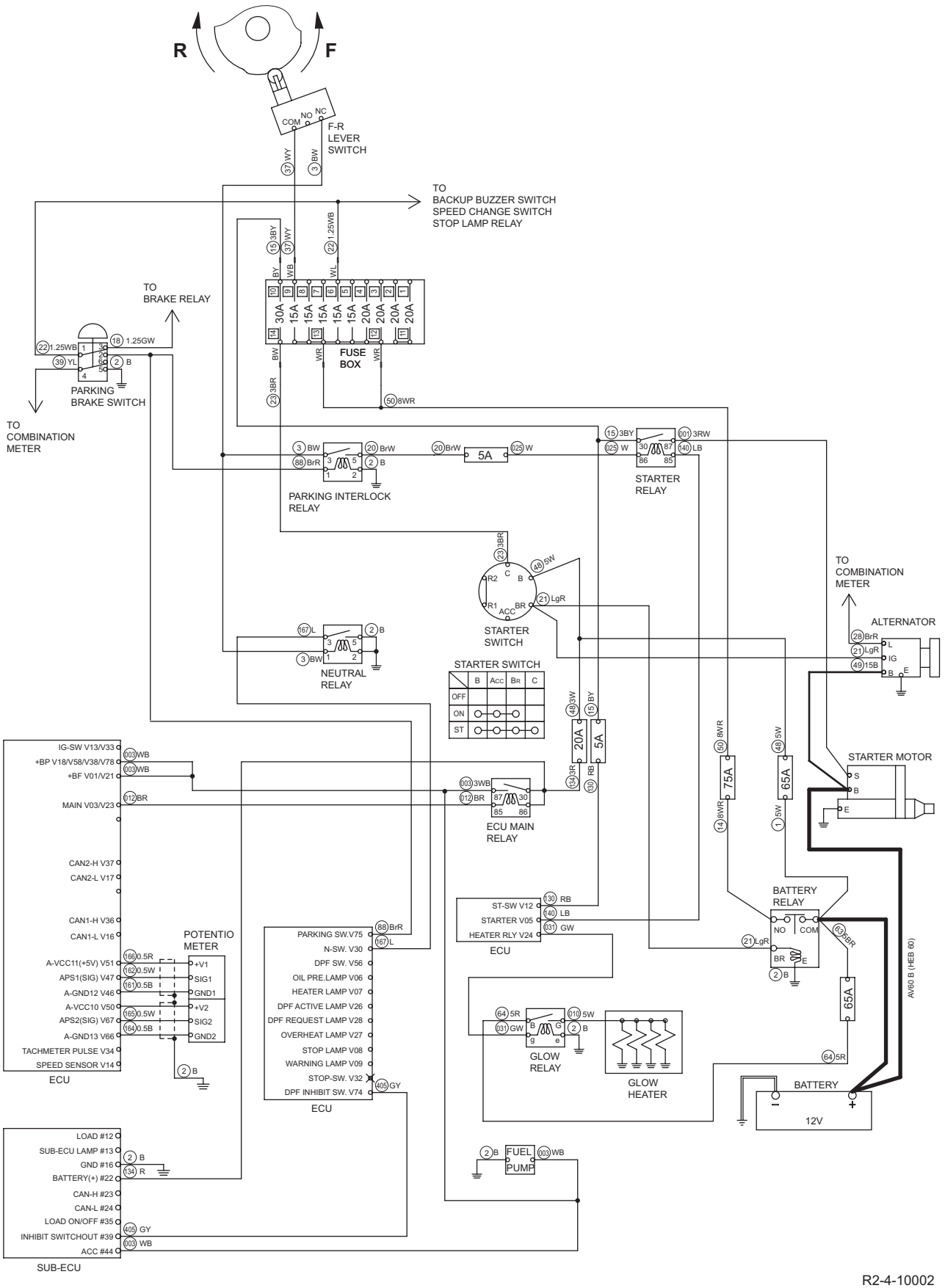
2-3-1. Engine will not start (Starter motor does not run) 2/2

- F-R lever must be in “N”.
- Parking brake switch must be applied.

Reference Fig.: 2-3-1

Check point	Check/Cause	Action
5. Battery Relay	(1) When starter switch is OFF, measure voltage between battery relay primary terminal COM and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON, measure voltage between battery relay coil terminal BR inlet wire LgR and coil ground terminal E. Standard voltage : 12 V or more (3) When starter switch is ON, measure voltage between battery relay secondary terminal NO and chassis ground. Standard voltage : 12 V or more • If above items (1) and (2) are OK and item (3) is NG, battery relay is faulty.	Replace battery relay.
6. F-R Lever Switch	(1) When starter switch is ON, measure voltage between F-R lever switch terminal COM inlet wire WY and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON, measure voltage between F-R lever switch terminal NC outlet wire BW and chassis ground. Standard voltage : 12 V or more • If above item (1) is OK and item (2) is NG, F-R lever switch is faulty.	Replace F-R lever switch.
7. Parking Interlock Relay	(1) When starter switch is ON, measure voltage between parking interlock relay terminal 1 inlet wire BrR and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON, measure voltage between parking interlock relay terminal 3 inlet wire BW and chassis ground. Standard voltage : 12 V or more (3) When starter switch is ON, measure voltage between parking interlock relay terminal 5 outlet wire BrW and chassis ground. Standard voltage : 12 V or more • If above items (1) and (2) are OK and item (3) is NG, parking interlock relay is faulty.	Replace parking interlock relay.
8. Parking Brake Switch	(1) When starter switch is ON, measure voltage between parking brake switch terminal 1 inlet wire WB and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON, measure voltage between parking brake switch terminal 2 outlet wire BrR and chassis ground. Standard voltage : 12 V or more • If above item (1) is OK and item (2) is NG, parking brake switch is faulty.	Replace parking brake switch.
9. Harness Connecting Between Terminals	• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.

Fig.: 2-3-1


R
F
F-R LEVER SWITCH
TO BACKUP BUZZER SWITCH SPEED CHANGE SWITCH STOP LAMP RELAY
TO BRAKE RELAY
FUSE BOX
PARKING BRAKE SWITCH
TO COMBINATION METER
PARKING INTERLOCK RELAY
STARTER RELAY
STARTER SWITCH
NEUTRAL RELAY
ALTERNATOR
STARTER MOTOR
ECU MAIN RELAY
BATTERY RELAY
GLOW RELAY
GLOW HEATER
BATTERY
12V
FUEL PUMP
POTENTIO METER
ECU
SUB-ECU
R2-4-10002

2-3-2. Engine will not start (But starter motor runs)

- **In case of engine will not start while starter motor runs, generally trouble is caused by that fuel is not supplied, supply amount of fuel is extremely low, or selection of fuel is not appropriate.**
- Check that fuel is supplied to inlet of fuel pump.

Reference Fig.: 2-3-1

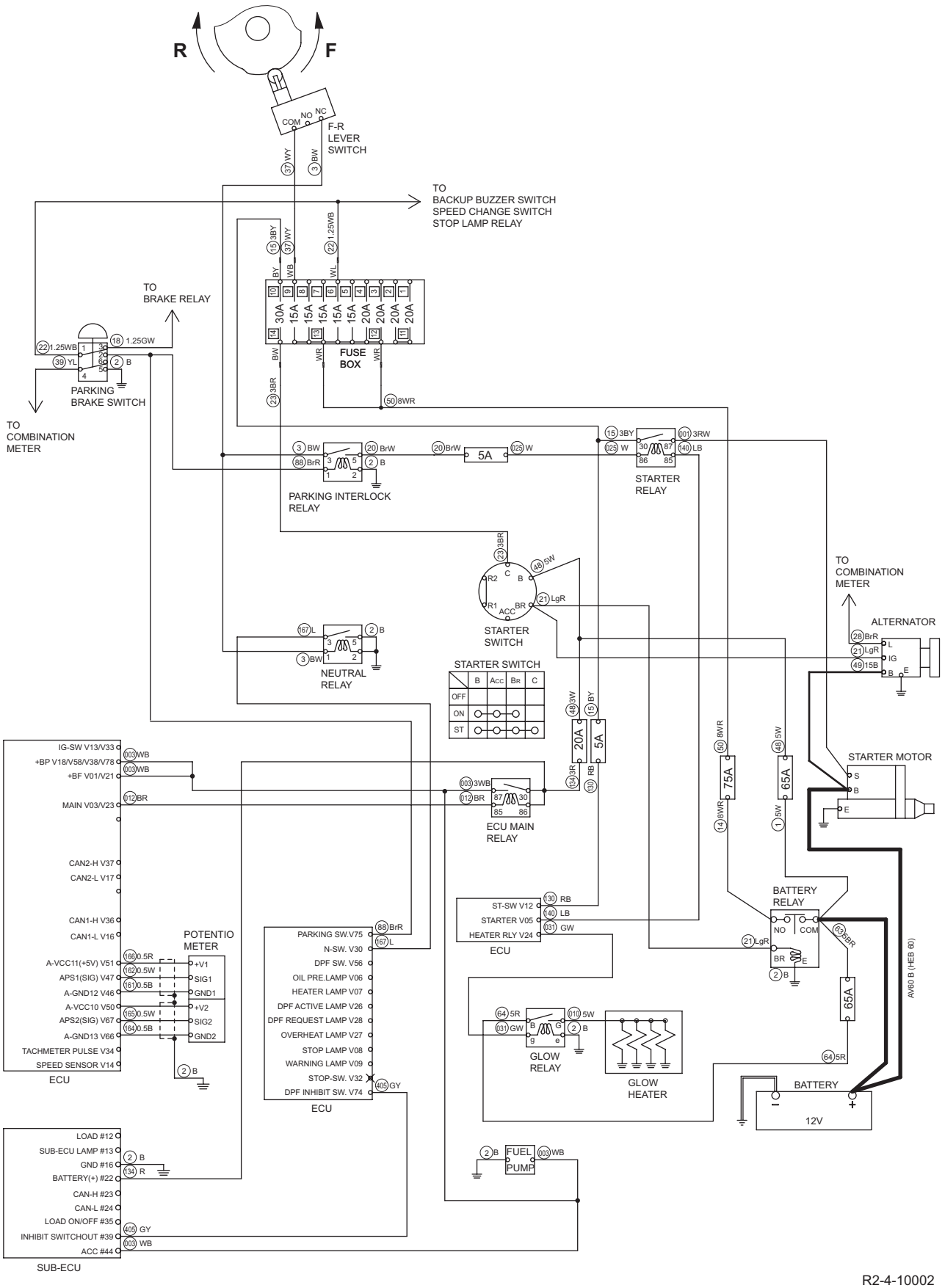
Check point	Check/Cause	Action
1. Fuel Pump	• When starter switch is ON, measure voltage between fuel pump terminal inlet wire WB and chassis ground. Standard voltage : 12 V or more • If above item is OK and fuel pump does not operate, fuel pump is faulty.	Repair or replace fuel pump.
2. ECU Main Relay	(1) Measure voltage between ECU main relay terminal 86 inlet wire R and chassis ground. Standard voltage : 12 V or more (2) Measure voltage between ECU main relay terminal 30 inlet wire R and chassis ground. Standard voltage : 12 V or more (3) When starter switch is ON, measure voltage between ECU main relay terminal 87 outlet wire WB and chassis ground. Standard voltage : 12 V or more • If above items (1) and (2) are OK and item (3) is NG, ECU main relay is faulty.	Replace ECU main relay.
3. Harness Connecting Between Terminals	• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.

2-3-3. No charging

Reference Fig.: 2-3-1

Check point	Check/Cause	Action
1. Alternator	• After starting engine, measure voltage between alternator terminal B wire B and chassis ground. Standard voltage : At least intermediate engine speed, 14 V or more • If voltage is lower than standard, alternator is faulty. • If voltage is normal and battery is not charged, battery is faulty.	Replace alternator or battery.

Fig.: 2-3-1



R2-4-10002

2-3-4. Glow plug is not heated (Engine starting performance is bad in cold weather)

Reference Fig.: 2-3-1

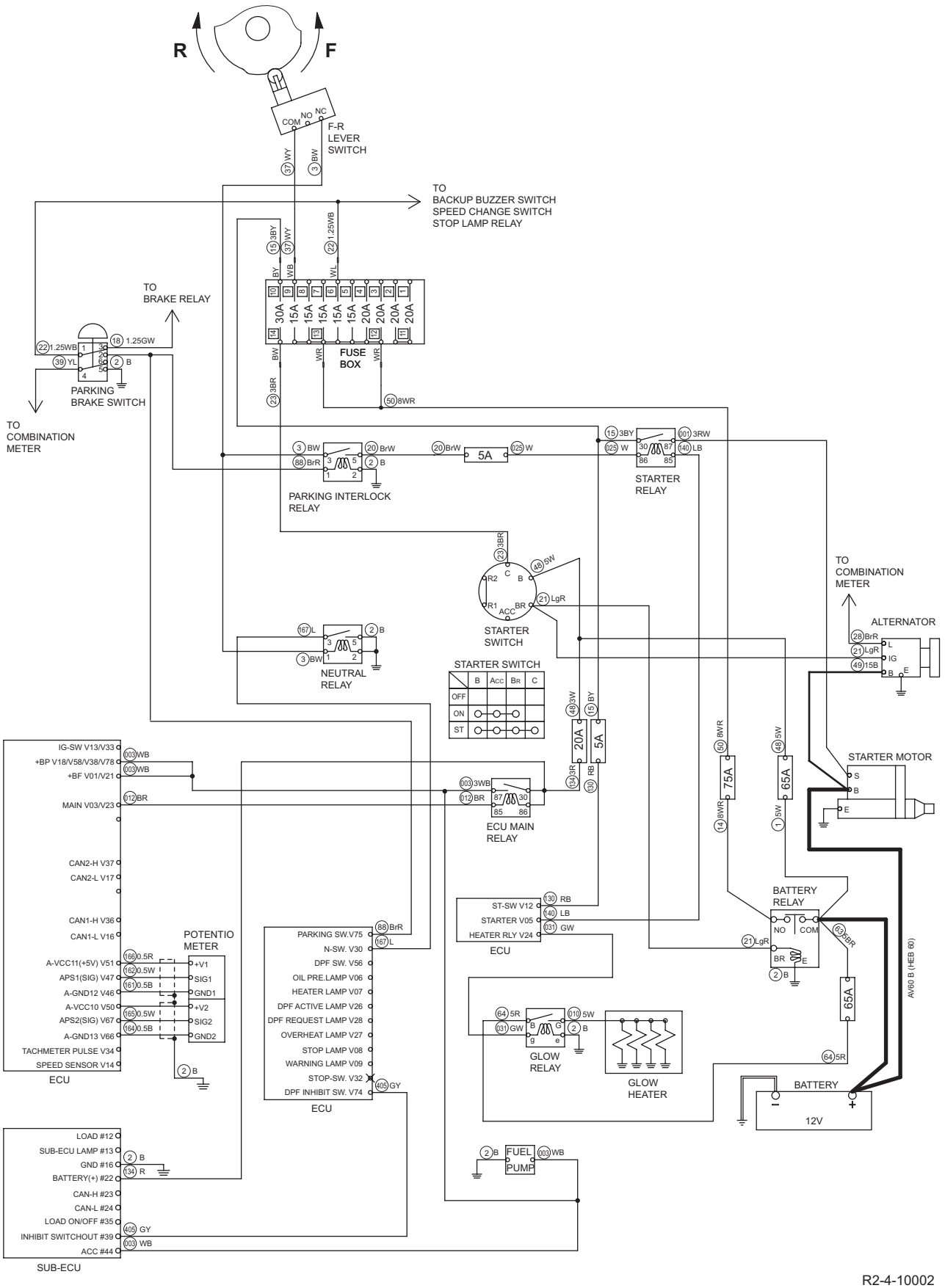
Check point	Check/Cause	Action
1. Glow Heater	• When starter switch is ON, measure voltage between glow heater terminal inlet wire W and chassis ground. Standard voltage : 12 V or more • If voltage is OK and fuel pump does not operate, glow heater is faulty.	Replace glow heater.
2. Glow Relay	(1) When starter switch is ON, measure voltage between glow relay terminal g inlet wire GW and chassis ground. Standard voltage : 12 V or more (2) Measure voltage between glow relay terminal B inlet wire R and chassis ground. Standard voltage : 12 V or more (3) When starter switch is ON, measure voltage between glow relay terminal G outlet wire W and chassis ground. Standard voltage : 12 V or more • If above items (1) and (2) are OK and item (3) is NG, glow relay is faulty.	Replace glow relay.
3. Harness Connecting Between Terminals	• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.

2-3-5. Starter motor runs even when F-R lever is not at “N” and parking brake is not applied

Reference Fig.: 2-3-1

Check point	Check/Cause	Action
1. F-R Lever Switch	• When starter switch is OFF and F-R lever is “F” or “R”, check continuity between F-R lever switch terminal COM wire WY and terminal NC wire BW. 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	• 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.

Fig.: 2-3-1



R2-4-10002

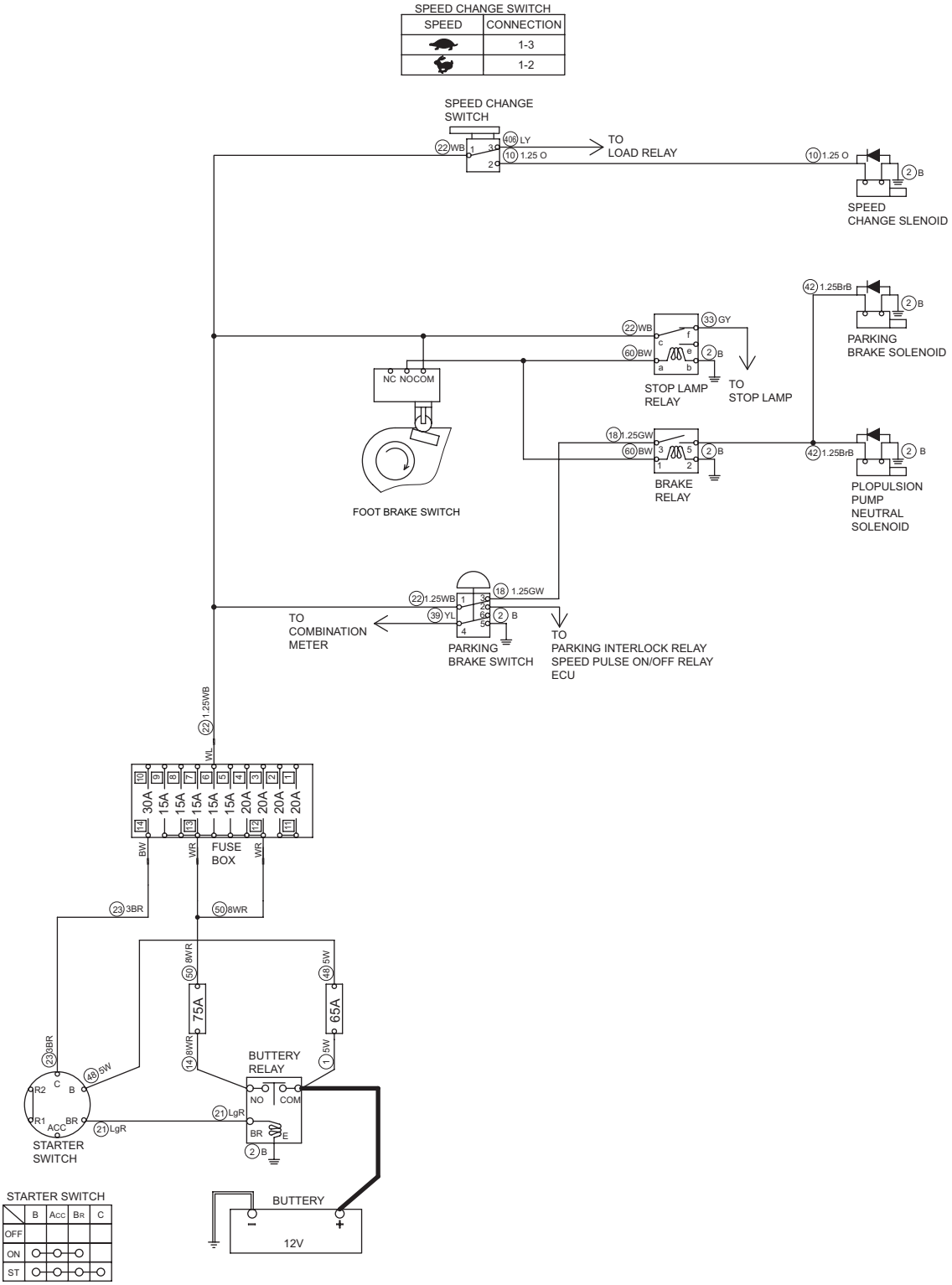
2-3-6. Engine speed does not change when operating throttle lever

- ENGINE WARNING lamp must not be lighting.
- Refer to voltage measurement method when voltage is to be measured without disconnecting connector.

Reference Fig. : 2-3-1

Check point	Check/Cause	Action
1. Connector	• Check for corrosion, break, bend, or loosening on potentiometer connector terminals. • If there are any above mentioned abnormalities, the connector is faulty.	Replace connector or terminal.
2. Potentiometer	(1) When starter switch is ON, measure voltage between potentiometer terminal +V1 wire R and potentiometer terminal GND1 wire B. Standard voltage : 5 ± 0.5 V (2) When starter switch is ON, measure voltage between potentiometer terminal +V2 wire R and potentiometer terminal GND2 wire B. Standard voltage : 5 ± 0.5 V (3) When starter switch is ON, measure voltage between potentiometer terminal SIG1 wire W and potentiometer terminal GND1 wire B. ①When throttle lever is at IDLE position Standard voltage : 0.5 to 1.0 V ②When throttle lever is at FULL position Standard voltage : 4.0 to 4.5 V (4) When starter switch is ON, measure voltage between potentiometer terminal SIG2 wire W and potentiometer terminal GND2 wire B. ①When throttle lever is at IDLE position Standard voltage : 4.0 to 4.5 V ②When throttle lever is at FULL position Standard voltage : 0.5 to 1.0 V • If above items (1) and (2) are OK and item (3) or (4) is NG, potentiometer is faulty.	Replace potentiometer.
3. Harness Connecting Between Terminals	• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty. **(NOTICE)** **• Because three-wire shield cable is used between potentiometer and ECU, it is impossible to repair it. It must be replaced.**	Repair or replace harness.

Fig.: 2-4-1



R2-4-10003

2-4. Propulsion System

Check following items before troubleshooting.

- No blown fuses and power is applied up to fuses.
- When measuring voltage and current without disconnecting connectors, refer to “Measuring voltage and current flowing using tester” (P.10-006 to P.10-008).
- Check any ground circuit which belongs to components to be checked.

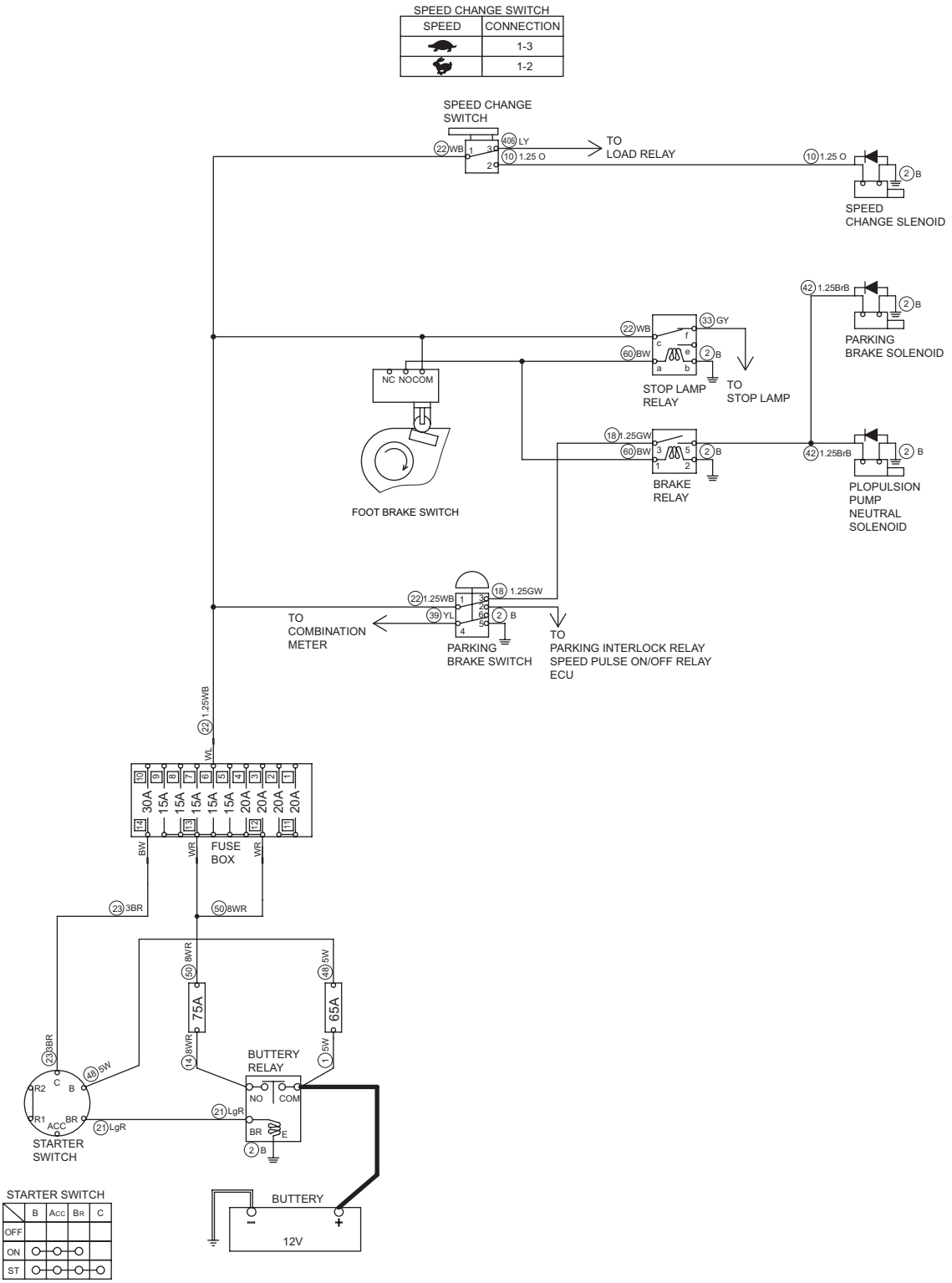
2-4-1. Machine moves neither forward nor backward 1/2

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

Reference Fig.: 2-4-1

Check point	Check/Cause	Action
1. Parking Brake Solenoid	• Disconnect harness and measure resistance of coil. Standard resistance : 8.5 Ω • If measured resistance is abnormal, parking brake solenoid is faulty.	Replace parking brake solenoid.
2. Propulsion Pump Neutral Solenoid	• Disconnect harness and measure resistance of coil. Standard resistance : 8.5 Ω • If measured resistance is abnormal, propulsion pump neutral solenoid is faulty.	Replace propulsion pump neutral solenoid.
3. Brake Relay	(1) When starter switch is ON, measure voltage between brake relay terminal 1 inlet wire BW and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON, measure voltage between brake relay terminal 3 inlet wire GW and chassis ground. Standard voltage : 12 V or more (3) When starter switch is ON, measure voltage between brake relay terminal 5 outlet wire BrB and chassis ground. Standard voltage : 12 V or more • If above items (1) and (2) are OK and item (3) is NG, brake relay is faulty.	Replace brake relay.
4. Foot Brake Switch	(1) When starter switch is ON, measure voltage between foot brake switch terminal COM inlet wire WB and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON, measure voltage between foot brake switch terminal NO outlet wire BW and chassis ground. Standard voltage : 12 V or more • If above item (1) is OK and item (2) is NG, foot brake switch is faulty.	Replace foot brake switch.
5. Parking Brake Switch	(1) When starter switch is ON, measure voltage between parking brake switch terminal 1 inlet wire WB and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON, measure voltage between parking brake switch terminal 3 outlet wire GW and chassis ground. Standard voltage : 12 V or more • If above item (1) is OK and item (2) is NG, parking brake switch is faulty.	Replace parking brake switch.

Fig.: 2-4-1



R2-4-10003

2-4-1. Machine moves neither forward nor backward 2/2

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

Reference Fig.: 2-4-1

Check point	Check/Cause	Action
6. Harness Connecting Between Terminals	• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.

2-4-2. Brake cannot be released

- Parking brake switch must be released.

Reference Fig.: 2-4-1

Check point	Check/Cause	Action
1. Parking Brake Solenoid	• Disconnect harness and measure resistance of coil. Standard voltage : 8.5 Ω • If measured resistance is abnormal, parking brake solenoid is faulty.	Replace parking brake solenoid.
2. Parking Brake Switch	(1) When starter switch is ON, measure voltage between parking brake switch terminal 1 inlet wire WB and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON, measure voltage between parking brake switch terminal 3 outlet wire GW and chassis ground. Standard voltage : 12 V or more • If above item (1) is OK and item (2) is NG, parking brake switch is faulty.	Replace parking brake switch.
3. Harness Connecting Between Terminals	• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.

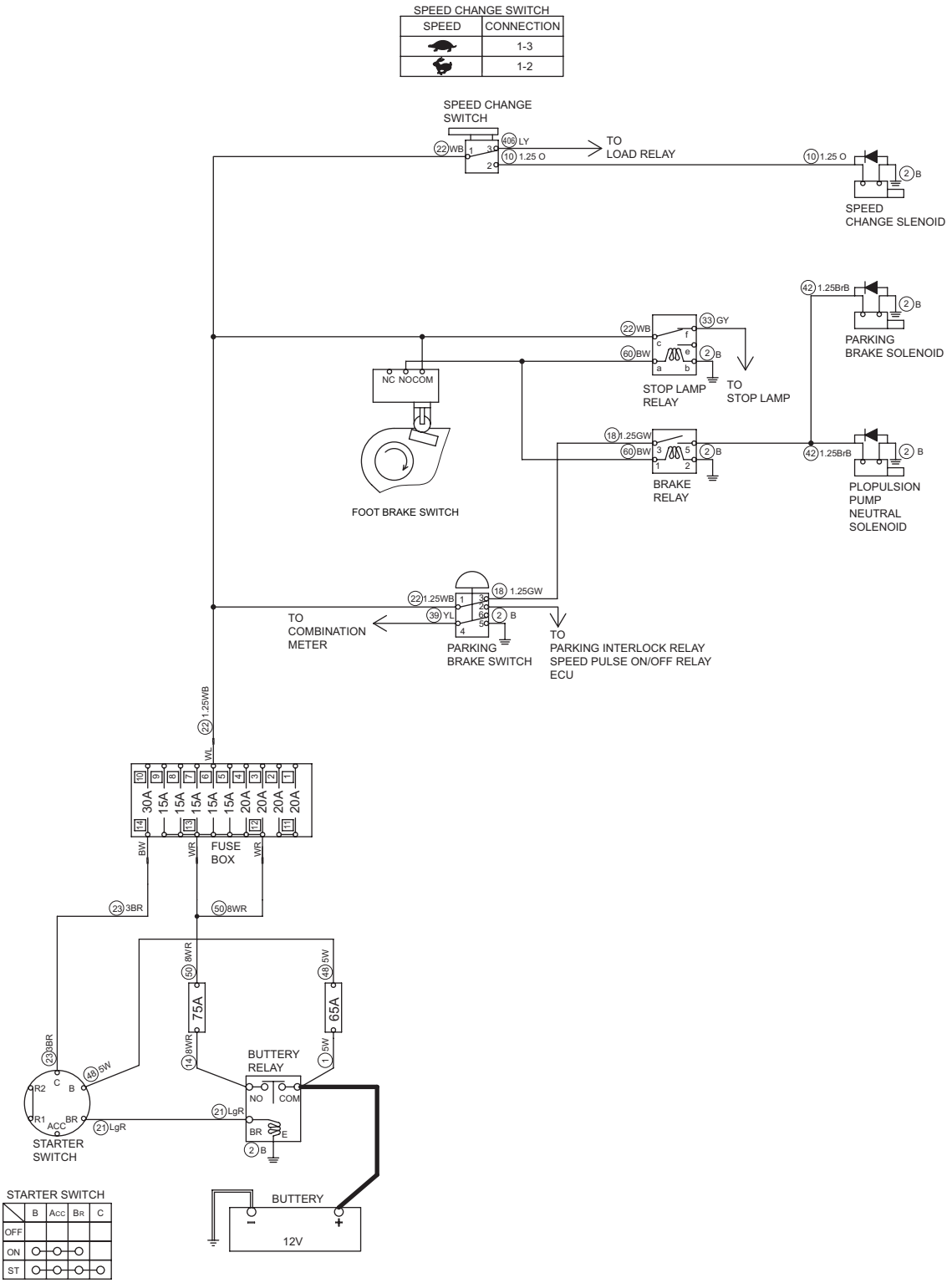
2-4-3. Brake does not work 1/2

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

Reference Fig.: 2-4-1

Check point	Check/Cause	Action
1. Parking Brake Solenoid	• Disconnect harness and measure resistance of coil. Standard voltage : 8.5 Ω • If measured resistance is abnormal, parking brake solenoid is faulty.	Replace parking brake solenoid.
2. Brake Relay	(1) When starter switch is ON, measure voltage between brake relay terminal 1 inlet wire BW and chassis ground. There is no electricity in normal condition. (2) When starter switch is ON, measure voltage between brake relay terminal 5 outlet wire BrB and chassis ground. There is no electricity in normal condition. • If above item (1) is OK and item (2) is NG, brake relay is faulty.	Replace brake relay.

Fig.: 2-4-1



R2-4-10003

2-4-3. Brake does not work 2/2

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

Reference Fig.: 2-4-1

Check point	Check/Cause	Action
3. Parking Brake Switch	(1) When starter switch is ON, measure voltage between parking brake switch terminal 1 inlet wire WB and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON, measure voltage between parking brake switch terminal 3 outlet wire GW and chassis ground. There is no electricity in normal condition. • If above item (1) is OK and item (2) is NG, parking brake switch is faulty.	Replace parking brake switch.
4. Foot Brake Switch	• When starter switch is ON, measure voltage between foot brake switch terminal NO outlet wire BW and chassis ground. There is no electricity in normal condition. • If there is electricity, foot brake switch is faulty.	Replace foot brake switch.
5. Harness Connecting Between Terminals	• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.

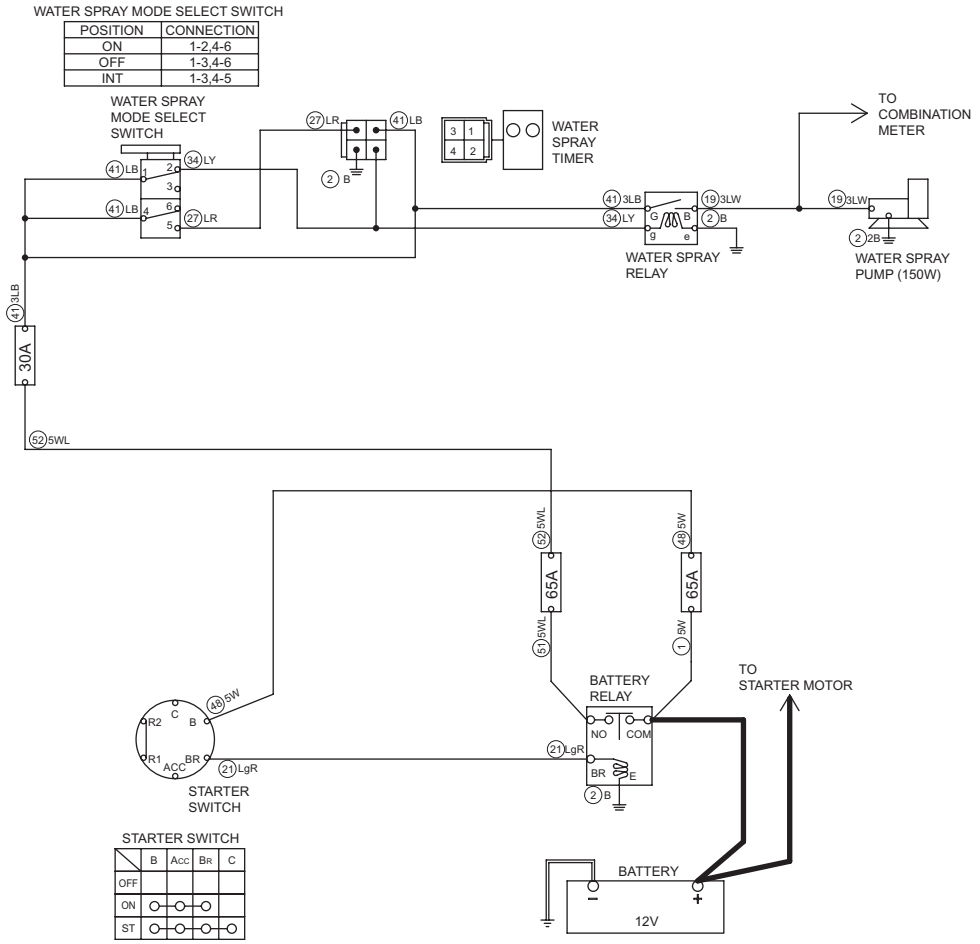
2-4-4. Speed cannot be changed

- Speed change switch must be "  ".

Reference Fig.: 2-4-1

Check point	Check/Cause	Action
1. Speed Change Solenoid	• Disconnect harness and measure resistance of coil. Standard voltage : 8.5 Ω • If measured resistance is abnormal, speed change solenoid is faulty.	Replace speed change solenoid.
2. Speed Change Switch	(1) When starter switch is ON, measure voltage between speed change switch terminal 1 inlet wire WB and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON, measure voltage between speed change switch terminal 2 outlet wire O and chassis ground. Standard voltage : 12 V or more • If above item (1) is OK and item (2) is NG, speed change switch is faulty.	Replace speed change switch.
3. Harness Connecting Between Terminals	• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.

Fig.: 2-5-1



R2-4-10004

2-5. Water Spray

Check following items before troubleshooting.

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

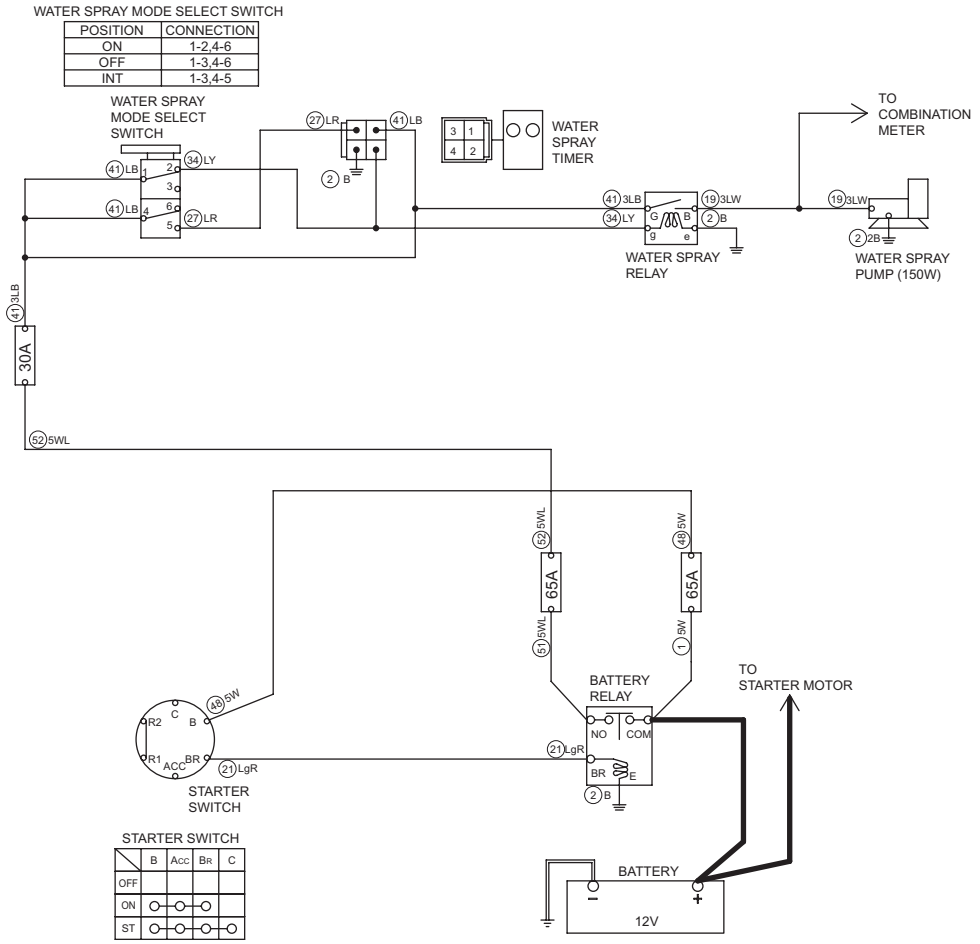
2-5-1. Continuous water spray does not operate

- Water spray mode select switch must be ON.

Reference Fig.: 2-5-1

Check point	Check/Cause	Action
1. Battery	• Measure battery voltage or specific gravity. Standard voltage : 12 V or more Standard gravity : 1.26 or more • If value is below standard, battery capacity is insufficient.	Charge or replace battery.
2. Water Spray Pump	• When starter switch is ON, measure voltage between water spray pump terminal inlet wire LW and chassis ground. Standard voltage : 12 V or more • If above item is OK and water spray pump does not operate, water spray pump is faulty.	Replace water spray pump.
3. Water Spray Relay	(1) When starter switch is ON, measure voltage between water spray relay terminal g inlet wire LY and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON, measure voltage between water spray relay terminal G inlet wire LB and chassis ground. Standard voltage : 12 V or more (3) When starter switch is ON, measure voltage between water spray relay terminal B outlet wire LW and chassis ground. Standard voltage : 12 V or more • If above items (1) and (2) are OK and item (3) is NG, water spray relay is faulty.	Replace water spray relay.
4. Water Spray Mode Select Switch	(1) When starter switch is ON, measure voltage between water spray mode select switch terminal 1 inlet wire LB and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON, measure voltage between water spray mode select switch terminal 2 outlet wire LY and chassis ground. Standard voltage : 12 V or more • If above item (1) is OK and item (2) is NG, water spray mode select switch is faulty.	Replace water spray mode select switch.
5. Harness Connecting Between Terminals	• 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



R2-4-10004

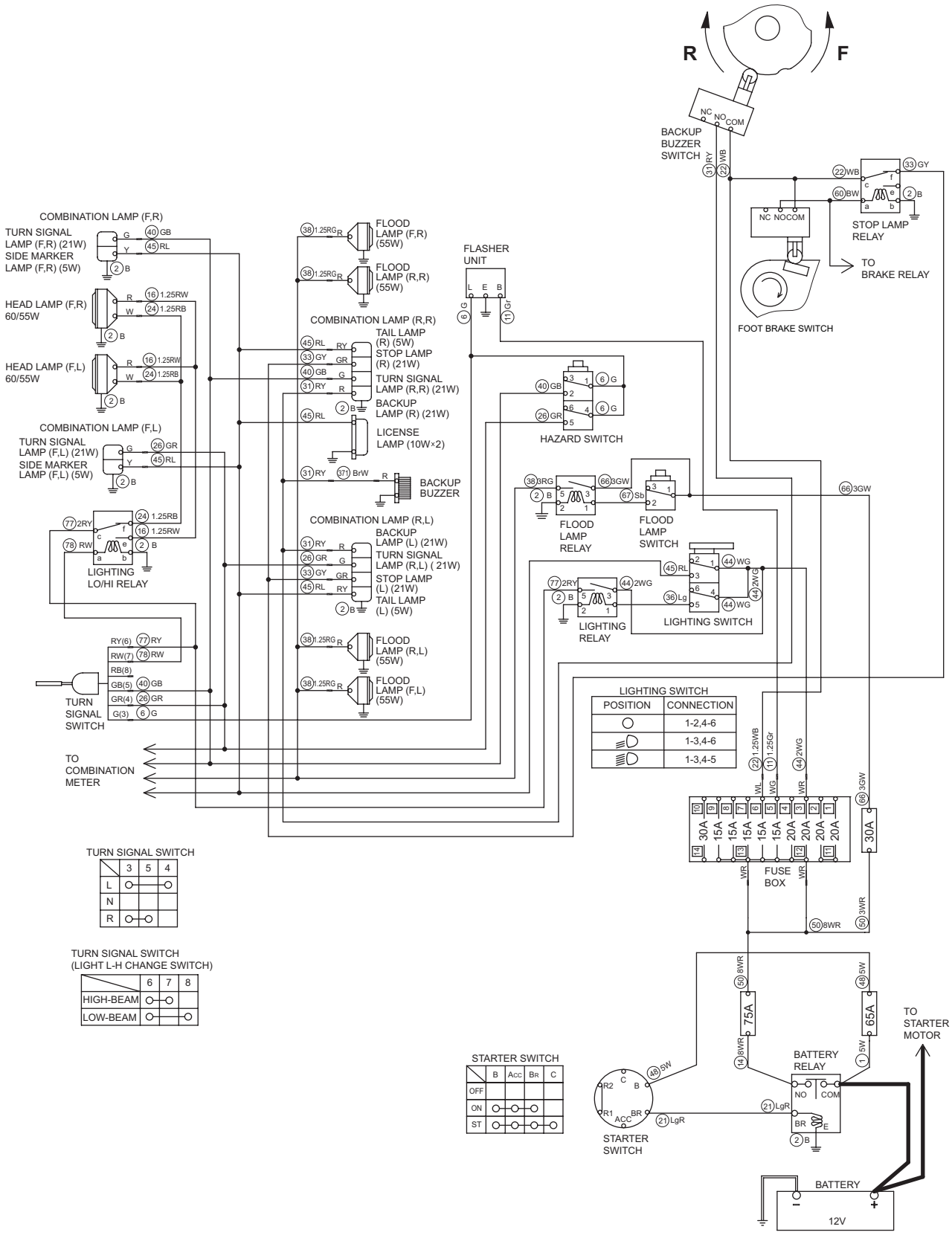
2-5-2. Continuous water spray works, but intermittent water spray does not operate

• Water spray mode select switch must be “INT”.

Reference Fig.: 2-5-1

Check point	Check/Cause	Action
1. Water Spray Timer	(1) When starter switch is ON, measure voltage between water spray timer terminal 1 inlet wire LR and terminal 3 inlet wire LB and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON, measure voltage between water spray timer terminal 4 outlet wire LY and chassis ground. Standard voltage : 12 V or more with constant intervals • If above item (1) is OK and item (2) is NG, water spray timer is faulty.	Replace water spray timer.
2. Water Spray Mode Select Switch	(1) When starter switch is ON, measure voltage between water spray mode select switch terminal 4 inlet wire LB and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON, measure voltage between water spray mode select switch terminal 5 outlet wire LR and chassis ground. Standard voltage : 12 V or more • If above item (1) is OK and item (2) is NG, water spray mode select switch is faulty.	Replace water spray mode select switch.
3. Harness Connecting Between Terminals	• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.

Fig.: 2-6-1



R2-4-10005

2-6. Lighting

Check following items before troubleshooting.

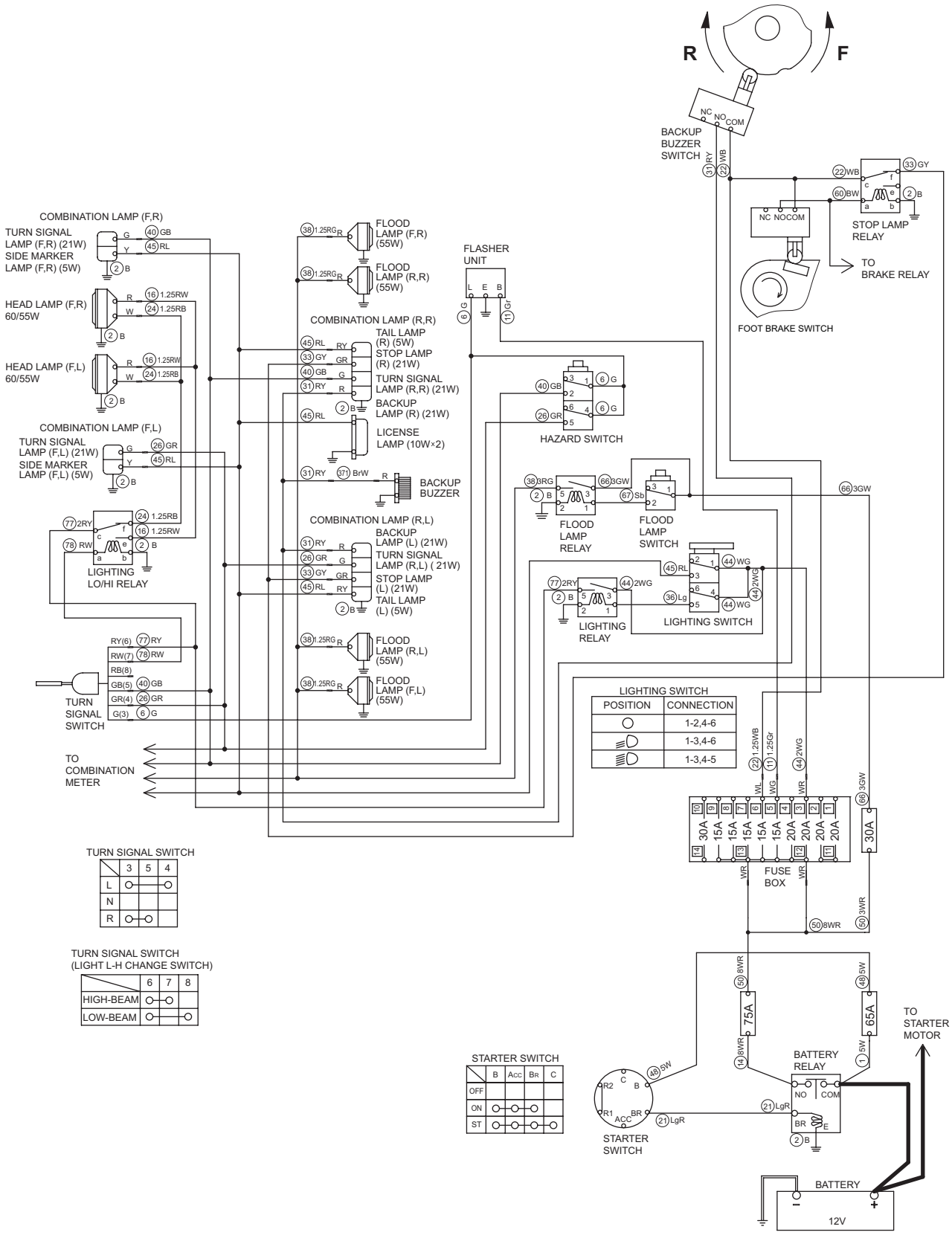
- No blown fuse and power is applied up to fuses.

2-6-1. Head lamp, side marker lamp, tail lamp and license lamp do not light 1/2

Reference Fig.: 2-6-1

Check point	Check/Cause	Action
1. Battery	• Measure battery voltage or specific gravity. Standard voltage : 12 V or more Standard gravity : 1.26 or more • If value is below standard, battery capacity is insufficient.	Charge or replace battery.
2. Each Bulb	• Check that none of lamp bulbs is burned out or has a contact failure. • Bulb is faulty or poorly connected.	Replace each bulb.
3. Lighting Switch	(1) When starter switch is ON, measure voltage between lighting switch terminal 1 and 4 inlet wire WG and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON and lighting switch is “ ≡D ”, measure voltage between lighting switch terminal 3 outlet wire RL and chassis ground. Standard voltage : 12 V or more (3) When starter switch is ON and lighting switch is “ ≡D ”, measure voltage between lighting switch terminal 5 outlet wire Lg and chassis ground. Standard voltage : 12 V or more • If above item (1) is OK and item (2) or (3) is NG, lighting switch is faulty.	Replace lighting switch.
4. Lighting Relay	(1) When starter switch is ON and lighting switch is “ ≡D ”, measure voltage between lighting relay terminal 1 inlet wire Lg and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON and lighting switch is “ ≡D ”, measure voltage between lighting relay terminal 3 inlet wire WG and chassis ground. Standard voltage : 12 V or more (3) When starter switch is ON and lighting switch is “ ≡D ”, measure voltage between lighting relay terminal 5 outlet wire RY and chassis ground. Standard voltage : 12 V or more • If above items (1) and (2) are OK and item (3) is NG, lighting relay is faulty.	Replace lighting relay.

Fig.: 2-6-1



R2-4-10005

2-6-1. Head lamp, side marker lamp, tail lamp and license lamp do not light 2/2

Reference Fig.: 2-6-1

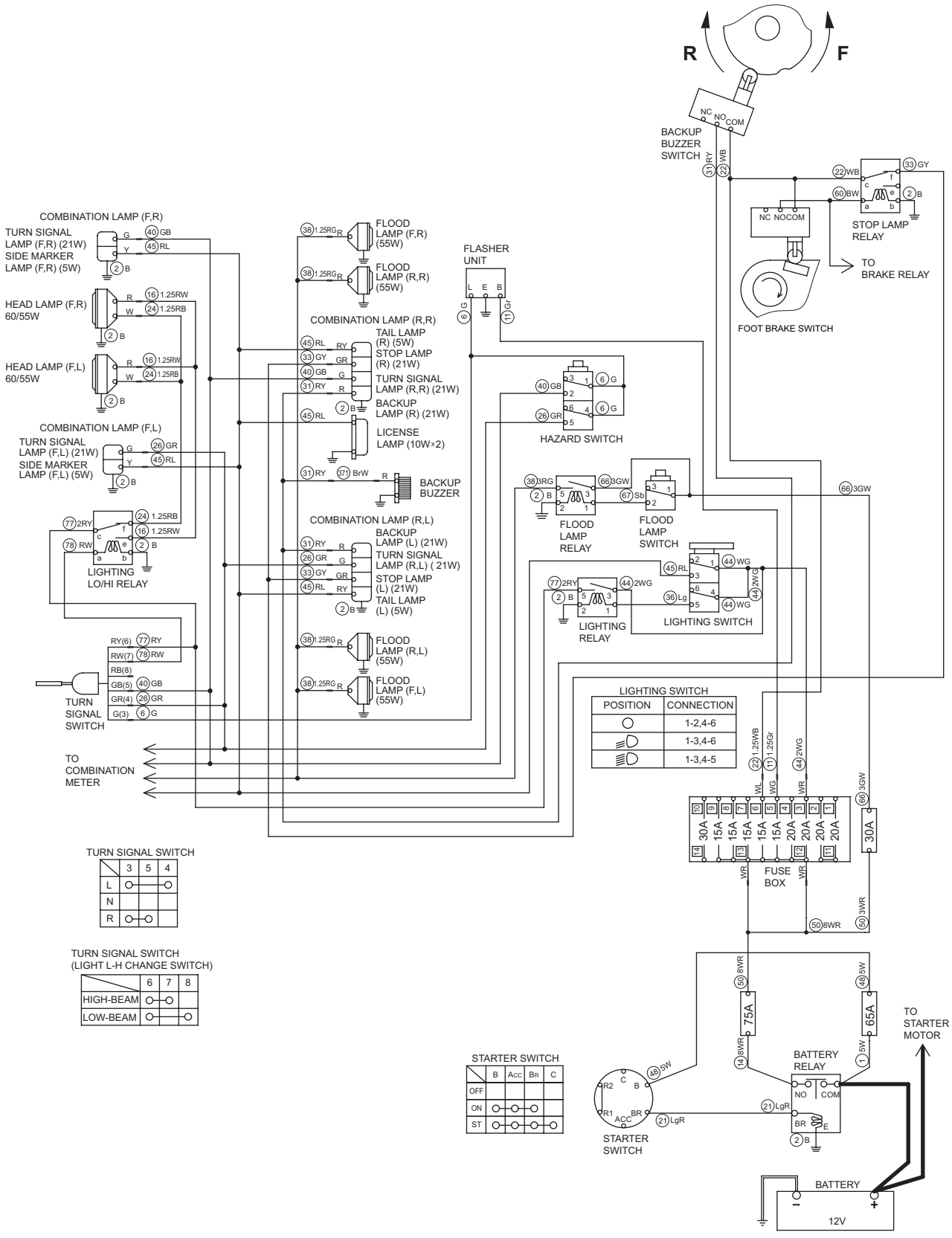
Check point	Check/Cause	Action
5. Lighting LO/HI Relay	(1) When starter switch is ON, lighting switch is " ≣D " and turn signal switch is "Low-beam", measure voltage between lighting LO/HI relay terminal a inlet wire RW and chassis ground. There is no electricity in normal condition. (2) When starter switch is ON and lighting switch is " ≣D ", measure voltage between lighting LO/HI relay terminal c inlet wire RY and chassis ground. Standard voltage : 12 V or more (3) When starter switch is ON, lighting switch is " ≣D " and turn signal switch is "Low-beam", measure voltage between lighting LO/HI relay terminal f outlet wire RB and chassis ground. Standard voltage : 12 V or more • If above items (1) and (2) are OK and item (3) is NG, lighting LO/HI relay is faulty.	Replace lighting LO/HI relay.
6. Harness Connecting Between Terminals	• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.

2-6-2. Flood lamp does not light 1/2

Reference Fig.: 2-6-1

Check point	Check/Cause	Action
1. Each Bulb	• Check that none of lamp bulbs is burned out or has a contact failure. • Bulb is faulty or poorly connected.	Replace each bulb.
2. Flood Lamp Switch	(1) When starter switch is ON, measure voltage between flood lamp switch terminal 1 inlet wire GW and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON and flood lamp switch is ON, measure voltage between flood lamp switch terminal 2 outlet wire Sb and chassis ground. Standard voltage : 12 V or more • If above item (1) is OK and item (2) is NG, flood lamp switch is faulty.	Replace flood lamp switch.
3. Flood Lamp Relay	(1) When starter switch is ON and flood lamp switch is ON, measure voltage between flood lamp relay terminal 1 inlet wire Sb and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON and flood lamp switch is ON, measure voltage between flood lamp relay terminal 3 inlet wire GW and chassis ground. Standard voltage : 12 V or more (3) When starter switch is ON and flood lamp switch is ON, measure voltage between flood lamp relay terminal 5 outlet wire RG and chassis ground. Standard voltage : 12 V or more • If above items (1) and (2) are OK and item (3) is NG, flood lamp relay is faulty.	Replace flood lamp relay.

Fig.: 2-6-1



R2-4-10005

2-6-2. Flood lamp does not light 2/2

Reference Fig.: 2-6-1

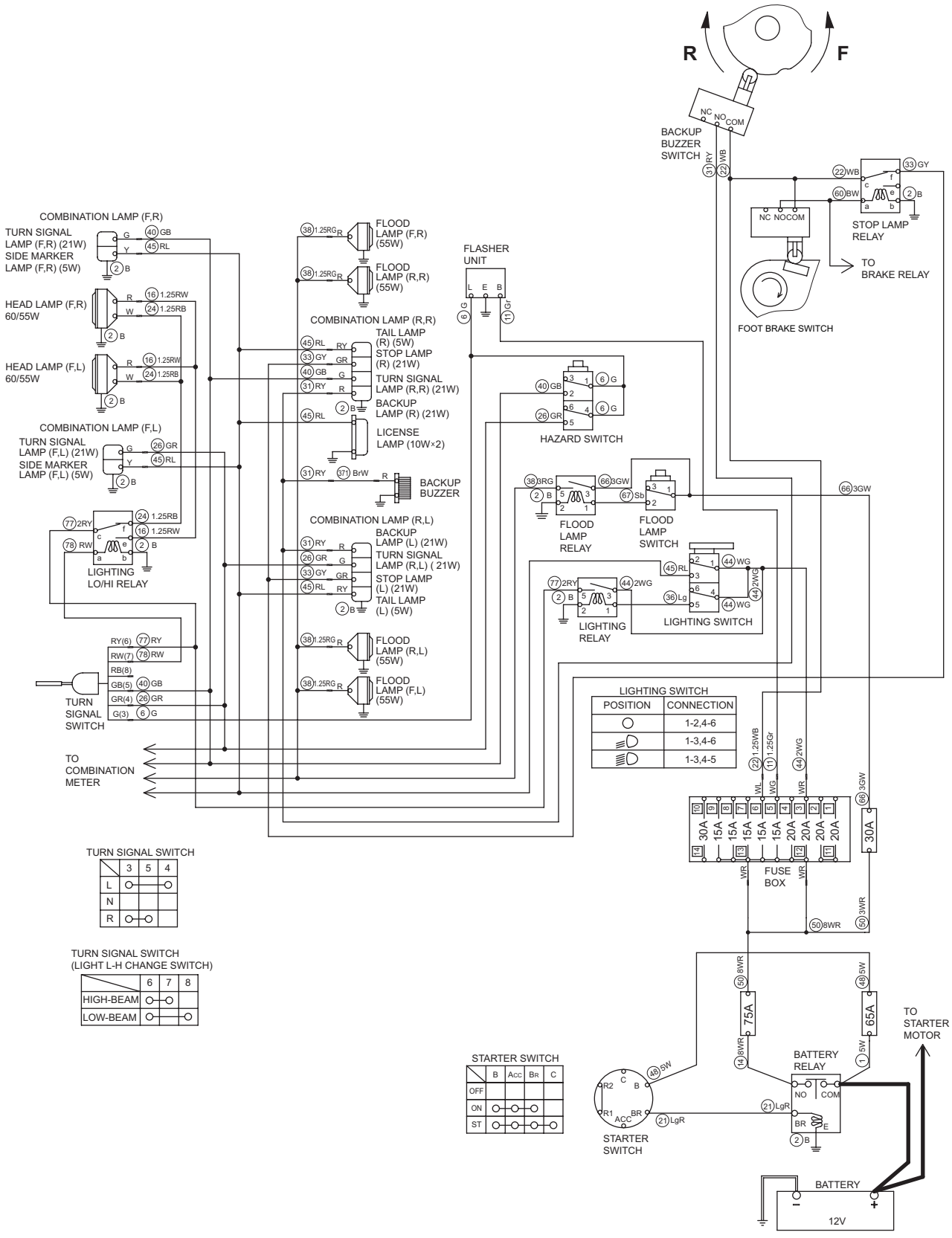
Check point	Check/Cause	Action
4. Harness Connecting Between Terminals	• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.

2-6-3. High-beam of head lamp does not light

Reference Fig.: 2-6-1

Check point	Check/Cause	Action
1. Each Bulb	• Check that none of lamp bulbs is burned out or has a contact failure. • Bulb is faulty or poorly connected.	Replace each bulb.
2. Turn Signal Switch (Light L-H Change Switch)	(1) When starter switch is ON and lighting switch is “ ≣D ”, measure voltage between turn signal switch terminal inlet wire RY and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON, lighting switch is “ ≣D ” and turn signal switch is “High-beam”, measure voltage between turn signal switch terminal outlet wire RW and chassis ground. Standard voltage : 12 V or more • If above item (1) is OK and item (2) is NG, turn signal switch is faulty.	Replace turn signal switch.
3. Lighting LO/HI Relay	(1) When starter switch is ON, lighting switch is “ ≣D ”and turn signal switch is “High-beam”, measure voltage between lighting LO/HI relay terminal a inlet wire RW and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON, lighting switch is “ ≣D ” and turn signal switch is “High-beam”, measure voltage between lighting LO/HI relay terminal c inlet wire RY and chassis ground. Standard voltage : 12 V or more (3) When starter switch is ON, lighting switch is “ ≣D ” and turn signal switch is “High-beam”, measure voltage between lighting LO/HI relay terminal e outlet wire RW and chassis ground. Standard voltage : 12 V or more • If above items (1) and (2) are OK and item (3) is NG, lighting LO/HI relay is faulty.	Replace lighting LO/HI relay.
4. Harness Connecting Between Terminals	• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.

Fig.: 2-6-1



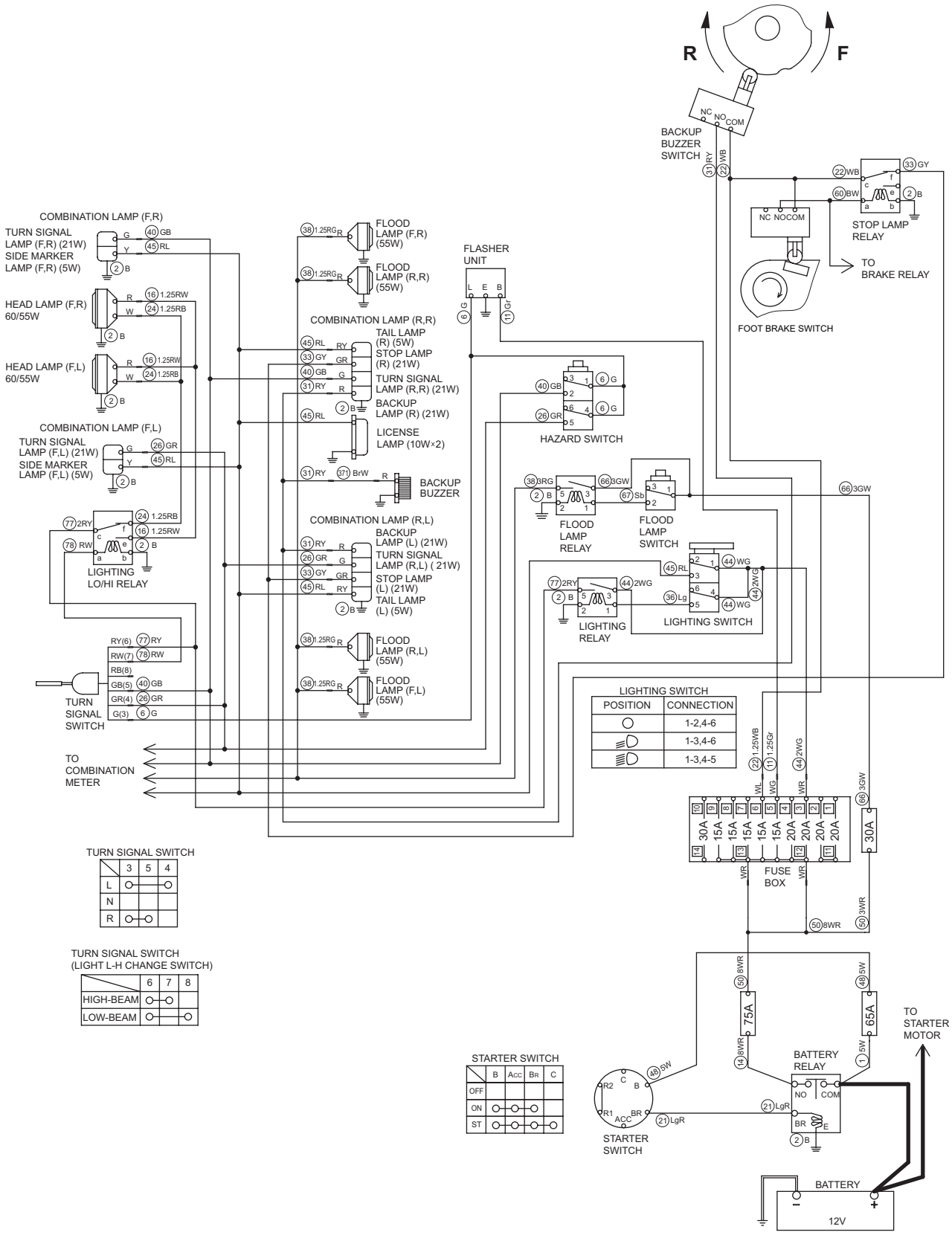
R2-4-10005

2-6-4. Turn signal lamp does not blink

Reference Fig.: 2-6-1

Check point	Check/Cause	Action
1. Each Bulb	• Check that none of lamp bulbs is burned out or has a contact failure. • Bulb is faulty or poorly connected.	Replace each bulb.
2. Flasher Unit	(1) When starter switch is ON, measure voltage between flasher unit terminal B inlet wire Gr and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON and turn signal switch lever is moved, measure voltage between flasher unit terminal L outlet wire G and chassis ground. Standard voltage : 12 V or more with constant intervals • If above item (1) is OK and item (2) is NG, flasher unit is faulty.	Replace flasher unit.
3. Turn Signal Switch	(1) When starter switch is ON and turn signal switch lever is moved, measure voltage between turn signal switch terminal inlet wire G and chassis ground. Standard voltage : 12 V or more with constant intervals (2) When starter switch is ON and turn signal switch lever is moved, measure voltage between turn signal switch terminals and chassis ground. Turn signal (L) : Outlet wire GR Turn signal (R) : Outlet wire GB Standard voltage : 12 V or more with constant intervals • If above item (1) is OK and item (2) is NG, turn signal switch is faulty.	Replace turn signal switch.
4. Harness Connecting Between Terminals	• 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



R2-4-10005

2-6-5. Hazard lamp does not light (Turn signal blinks)

• Hazard switch must be ON.

Reference Fig.: 2-6-1

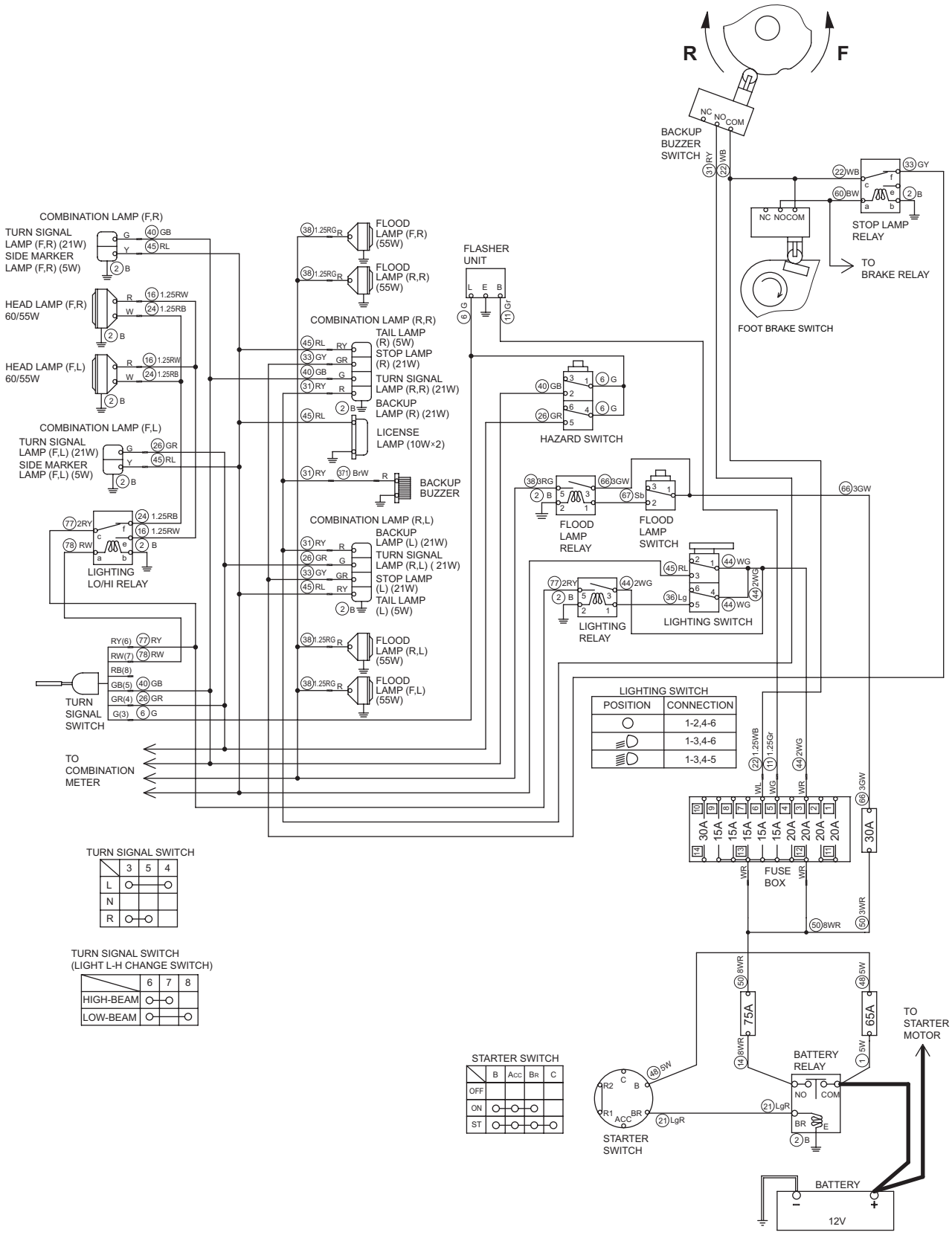
Check point	Check/Cause	Action
1. Each Bulb	• Check that none of lamp bulbs is burned out or has a contact failure. • Bulb is faulty or poorly connected.	Replace each bulb.
2. Hazard Switch	(1) When starter switch is ON, measure voltage between hazard switch terminal 1 and 4 inlet wire G and chassis ground. Standard voltage : 12 V or more with constant intervals (2) When starter switch is ON, measure voltage between hazard switch terminal 2 outlet wire GB and chassis ground. Standard voltage : 12 V or more with constant intervals (3) When starter switch is ON, measure voltage between hazard switch terminal 5 outlet wire GR and chassis ground. Standard voltage : 12 V or more with constant intervals • If above item (1) is OK and item (2) or (3) is NG, hazard switch is faulty.	Replace hazard switch.
3. Harness Connecting Between Terminals	• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.

2-6-6. Backup lamp does not light

Reference Fig.: 2-6-1

Check point	Check/Cause	Action
1. Each Bulb	• Check that none of lamp bulbs is burned out or has a contact failure. • Bulb is faulty or poorly connected.	Replace each bulb.
2. Backup Buzzer Switch	(1) When starter switch is ON, measure voltage between backup buzzer switch terminal COM inlet wire WB and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON and F-R lever is “R”, measure voltage between backup buzzer switch terminal NO outlet wire RY and chassis ground. Standard voltage : 12 V or more • 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	• 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



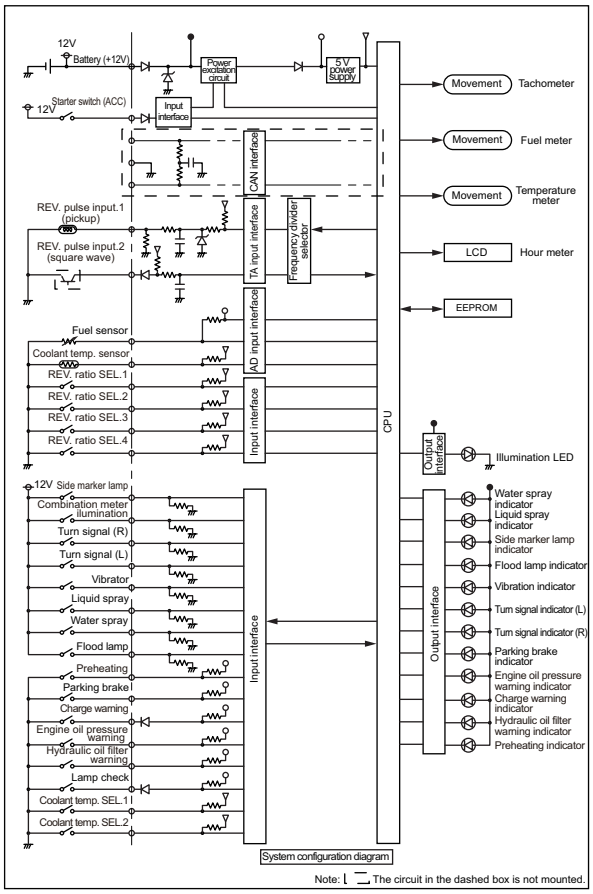
R2-4-10005

2-6-7. Stop lamp does not light

Reference Fig.: 2-6-1

Check point	Check/Cause	Action
1. Each Bulb	• Check that none of lamp bulbs is burned out or has a contact failure. • Bulb is faulty or poorly connected.	Replace each bulb.
2. Foot Brake Switch	(1) When starter switch is ON, measure voltage between foot brake switch terminal COM inlet wire WB and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON while foot brake is depressed, measure voltage between foot brake switch terminal NO outlet wire BW and chassis ground. There is no electricity in normal condition. • If above item (1) is OK and item (2) is NG, foot brake switch is faulty.	Replace foot brake switch.
3. Stop Lamp Relay	(1) When starter switch is ON while foot brake is depressed, measure voltage between stop lamp relay terminal a inlet wire BW and chassis ground. There is no electricity in normal condition. (2) When starter switch is ON while foot brake is depressed, measure voltage between stop lamp relay terminal c inlet wire WB and chassis ground. Standard voltage : 12 V or more (3) When starter switch is ON while foot brake is depressed, measure voltage between stop lamp relay terminal f outlet wire GY and chassis ground. Standard voltage : 12 V or more • If above items (1) and (2) are OK and item (3) is NG, stop lamp relay is faulty.	Replace stop lamp relay.
4. Harness Connecting Between Terminals	• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.

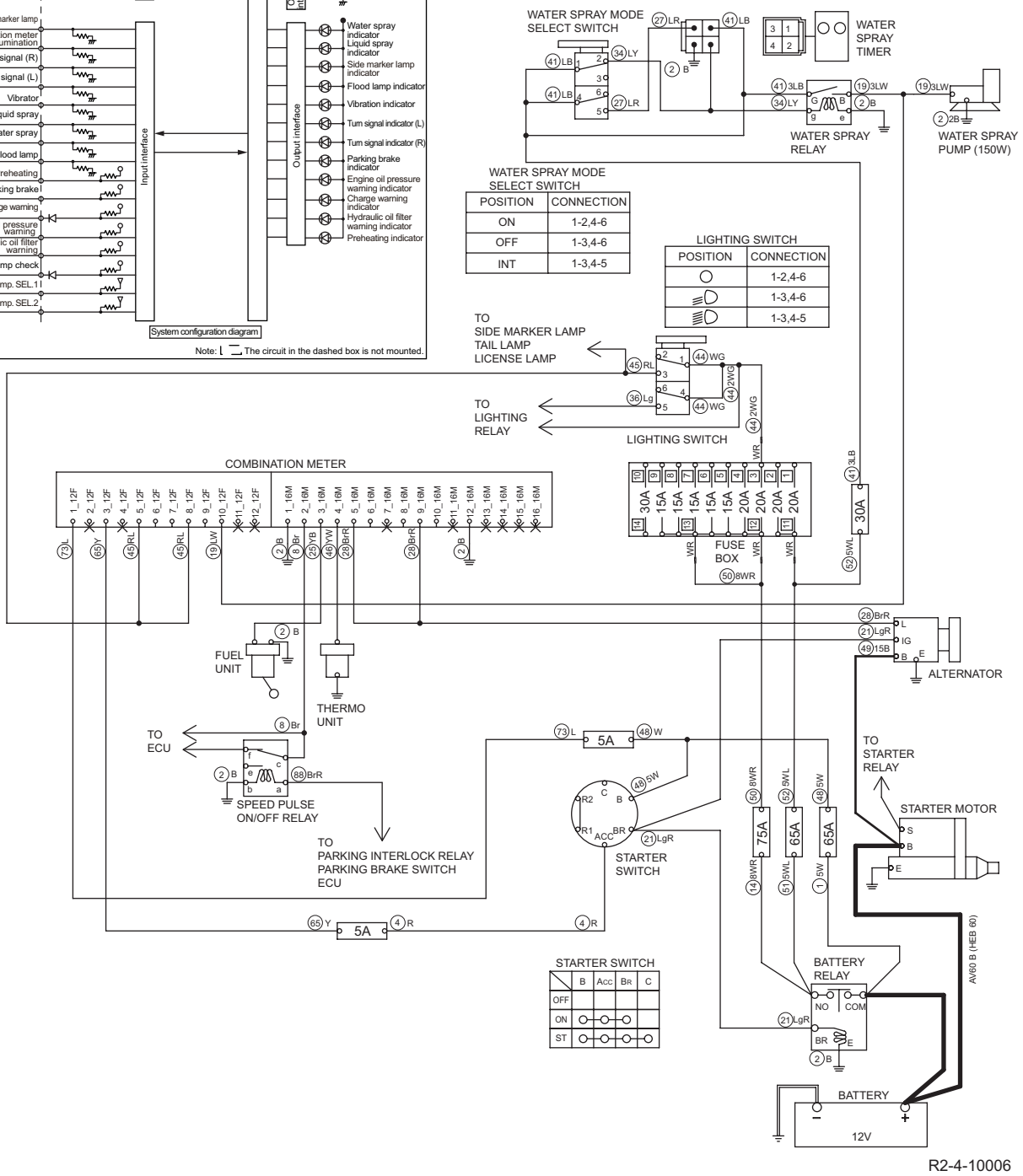
Fig.: 2-6-2



1	BATTERY (12V)
2	BATTERY (24V)
3	STARTER SWITCH (ACC)
4	REV. PULSE INPUT•1
5	COMBINATION METER ILLUMINATION
6	TURN SIGNAL (R)
7	TURN SIGNAL (L)
8	SIDE MARKER LAMP
9	FLOOD LAMP
10	WATER SPRAY
11	LIQUID SPRAY
12	VIBRATOR

COMBINATION METER
SWP12M
SWP16F

1	GROUND
2	REV. PULSE INPUT•2
3	FUEL METER
4	TEMPERATURE METER
5	LAMP CHECK
6	PARKING BRAKE
7	HYDRAULIC OIL FILTER WARNING
8	ENGINE OIL PRESSUER WARNING
9	CHARGE WARNING
10	PREHEATING
11	REV. RATIO SEL.1 (OPEN)
12	REV. RATIO SEL.2 (GND)
13	REV. RATIO SEL.3 (OPEN)
14	REV. RATIO SEL.4 (OPEN)
15	COOLANT TEMP. SEL.1 (OPEN)
16	COOLANT TEMP. SEL.2 (OPEN)



R2-4-10006

2-6-8. Illumination of combination meter does not light

Reference Fig.: 2-6-2

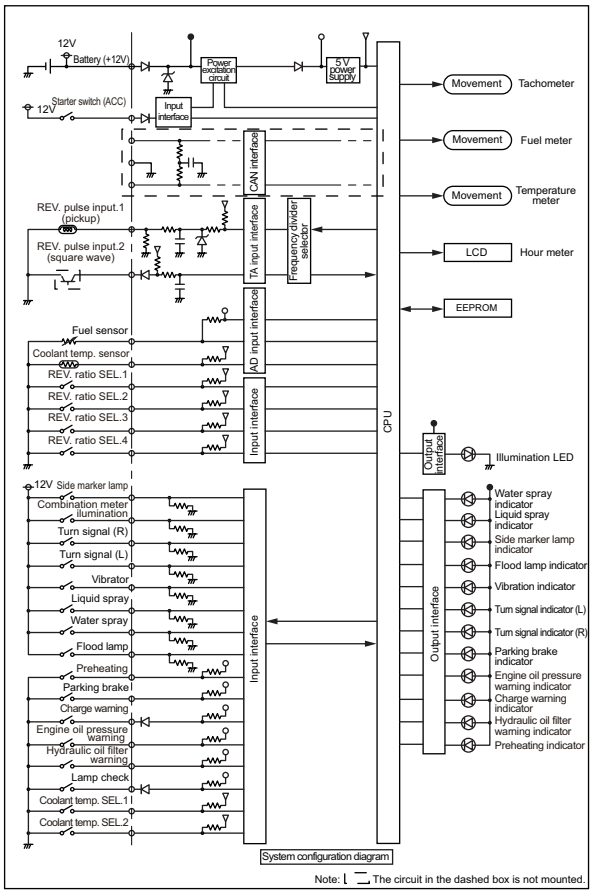
Check point	Check/Cause	Action
1. Harness	• Measure resistance between lighting switch terminal 3 wire RL and combination meter connector terminal wire No.45 wire RL. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.
2. Combination Meter (Combination meter illumination)	(1) When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire. • Battery (12 V) terminal wire No.73 inlet wire L and ground terminal wire No.2 wire B • Starter switch (ACC) terminal wire No.65 inlet wire Y and ground terminal wire No.2 wire B Standard voltage : 12 V or more (2) When starter switch is ON and lighting switch is "≡D", measure voltage between combination meter illumination terminal wire No.45 inlet wire RL and chassis ground. Standard voltage : 12 V or more • If above items (1) and (2) are OK and combination meter does not turn on, combination meter is faulty.	Replace combination meter.

2-6-9. Combination meter warning lamp or indicator lamp is abnormal

Reference Fig.: 2-6-2

Check point	Check/Cause	Action
1. Combination Meter (Lamp check)	(1) When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire. • Battery (12 V) terminal wire No.73 inlet wire L and ground terminal wire No.2 wire B • Starter switch (ACC) terminal wire No.65 inlet wire Y and ground terminal wire No.2 wire B Standard voltage : 12 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 charge warning lamp, illuminate and then go out after starting engine. • If above item (1) is OK and item (2) is NG, combination meter is faulty. **(NOTICE)** **• Since engine cannot start unless parking brake switch is applied, parking brake indicator lamp does not go out even after starting engine.**	Replace combination meter.

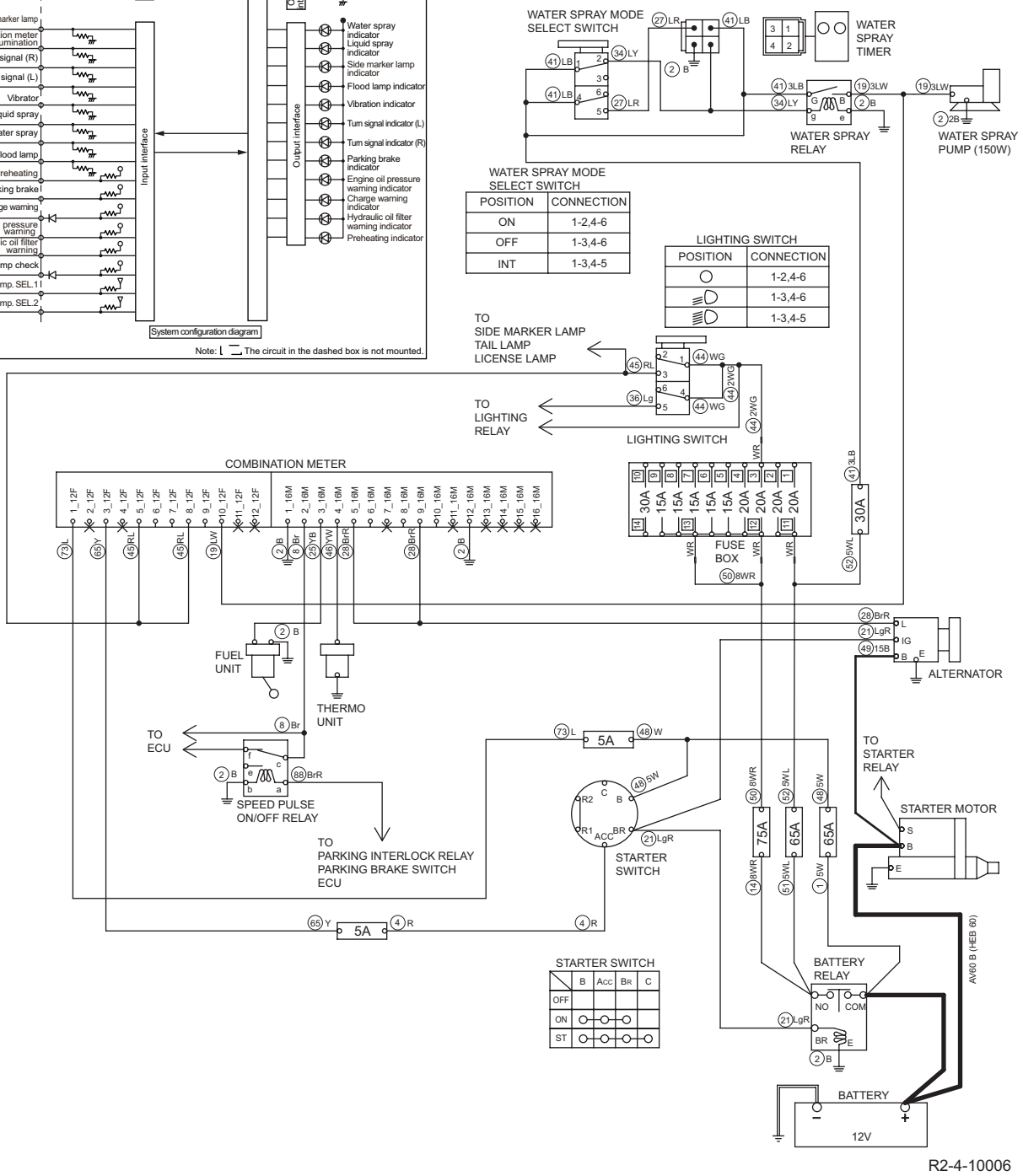
Fig.: 2-6-2



1	BATTERY (12V)
2	BATTERY (24V)
3	STARTER SWITCH (ACC)
4	REV. PULSE INPUT•1
5	COMBINATION METER ILLUMINATION
6	TURN SIGNAL (R)
7	TURN SIGNAL (L)
8	SIDE MARKER LAMP
9	FLOOD LAMP
10	WATER SPRAY
11	LIQUID SPRAY
12	VIBRATOR

COMBINATION METER
SWP12M
SWP16F

1	GROUND
2	REV. PULSE INPUT•2
3	FUEL METER
4	TEMPERATURE METER
5	LAMP CHECK
6	PARKING BRAKE
7	HYDRAULIC OIL FILTER WARNING
8	ENGINE OIL PRESSUER WARNING
9	CHARGE WARNING
10	PREHEATING
11	REV. RATIO SEL.1 (OPEN)
12	REV. RATIO SEL.2 (GND)
13	REV. RATIO SEL.3 (OPEN)
14	REV. RATIO SEL.4 (OPEN)
15	COOLANT TEMP. SEL.1 (OPEN)
16	COOLANT TEMP. SEL.2 (OPEN)



R2-4-10006

2-6-10. Tachometer reading is abnormal

Reference Fig.: 2-6-2

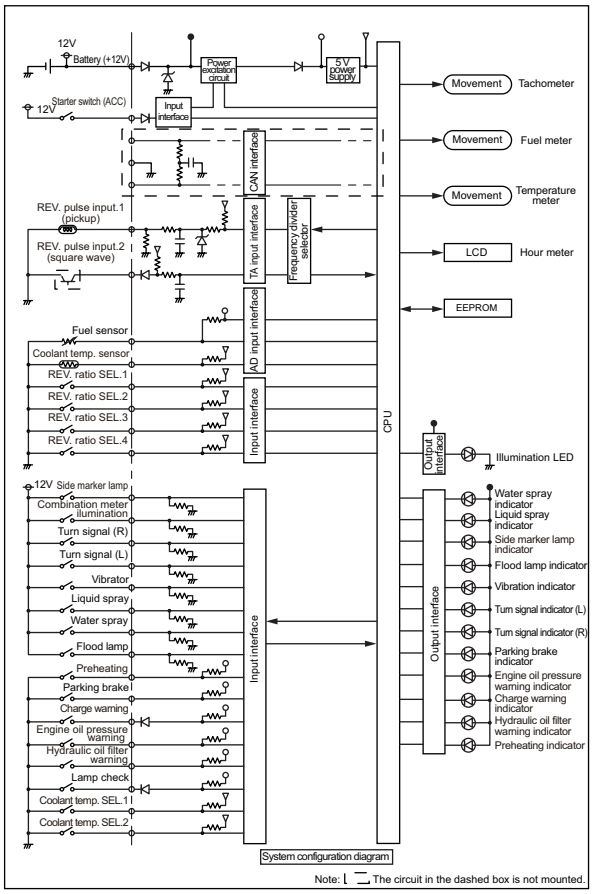
Check point	Check/Cause	Action
1. Combination Meter (Tachometer)	(1) When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire. • Battery (12 V) terminal wire No.73 inlet wire L and ground terminal wire No.2 wire B • Starter switch (ACC) terminal wire No.65 inlet wire Y and ground terminal wire No.2 wire B Standard voltage : 12 V or more (2) Check that combination meter rev. ratio SEL.2 terminal wire No.2 wire B is grounded. (3) Start engine and measure pulse between combination meter rev. pulse input • 2 terminal wire No.8 wire Br and chassis ground. Standard pulse : 3 pulses/rotation of engine • If above item is OK and tachometer reading is NG, combination meter is faulty.	Replace combination meter.
2. Harness Connecting Between Terminals	• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.

2-6-11. Hour meter is abnormal

Reference Fig.: 2-6-2

Check point	Check/Cause	Action
1. Combination Meter (Hour meter)	• When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire. • Battery (12 V) terminal wire No.73 inlet wire L and ground terminal wire No.2 wire B • Starter switch (ACC) terminal wire No.65 inlet wire Y and ground terminal wire No.2 wire B Standard voltage : 12 V or more • If no abnormality is found, combination meter is faulty.	Replace combination meter.

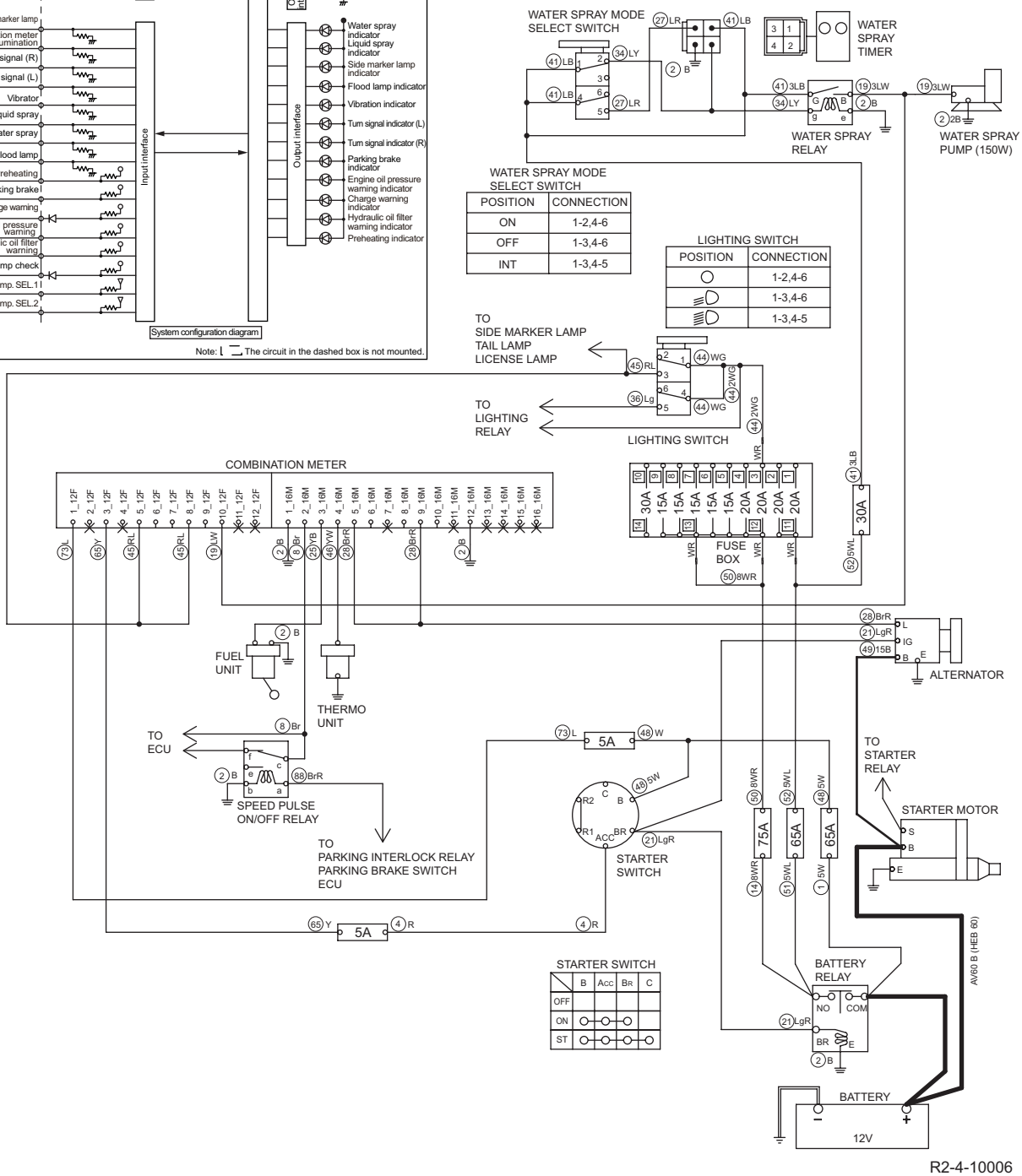
Fig.: 2-6-2



1	BATTERY (12V)
2	BATTERY (24V)
3	STARTER SWITCH (ACC)
4	REV. PULSE INPUT•1
5	COMBINATION METER ILLUMINATION
6	TURN SIGNAL (R)
7	TURN SIGNAL (L)
8	SIDE MARKER LAMP
9	FLOOD LAMP
10	WATER SPRAY
11	LIQUID SPRAY
12	VIBRATOR

COMBINATION METER
SWP12M
SWP16F

1	GROUND
2	REV. PULSE INPUT•2
3	FUEL METER
4	TEMPERATURE METER
5	LAMP CHECK
6	PARKING BRAKE
7	HYDRAULIC OIL FILTER WARNING
8	ENGINE OIL PRESSUER WARNING
9	CHARGE WARNING
10	PREHEATING
11	REV. RATIO SEL.1 (OPEN)
12	REV. RATIO SEL.2 (GND)
13	REV. RATIO SEL.3 (OPEN)
14	REV. RATIO SEL.4 (OPEN)
15	COOLANT TEMP. SEL.1 (OPEN)
16	COOLANT TEMP. SEL.2 (OPEN)



R2-4-10006

2-6-12. Temperature meter is abnormal

Reference Fig.: 2-6-2

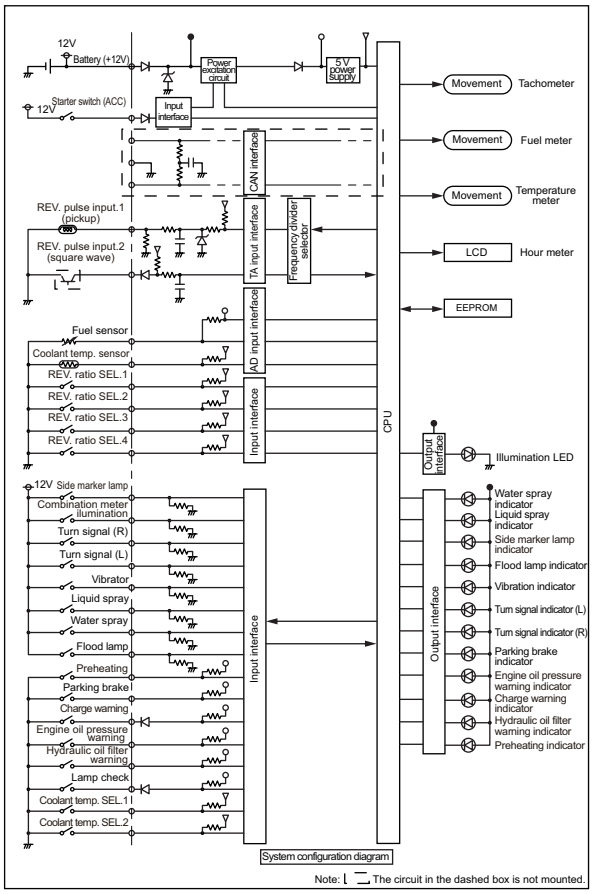
Check point	Check/Cause	Action
1. Thermo Unit	• Disconnect harness and measure resistance of thermo unit. Standard resistance : 164.6 Ω (at unit temperature of 50°C) 26.44 Ω (at unit temperature of 103°C) • If resistance is abnormal, thermo unit is faulty.	Replace thermo unit.
2. Combination Meter (Temperature meter)	• When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire. • Battery (12 V) terminal wire No.73 inlet wire L and ground terminal wire No.2 wire B • Starter switch (ACC) terminal wire No.65 inlet wire Y and ground terminal wire No.2 wire B Standard voltage : 12 V or more • If no abnormality is found, combination meter is faulty.	Replace combination meter.
3. Harness Connecting Between Terminals	• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.

2-6-13. Fuel meter is abnormal

Reference Fig.: 2-6-2

Check point	Check/Cause	Action
1. Fuel Unit	• 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)	• When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire. • Battery (12 V) terminal wire No.73 inlet wire L and ground terminal wire No.2 wire B • Starter switch (ACC) terminal wire No.65 inlet wire Y and ground terminal wire No.2 wire B Standard voltage : 12 V or more • If no abnormality is found, combination meter is faulty.	Replace combination meter.
3. Harness Connecting Between Terminals	• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.

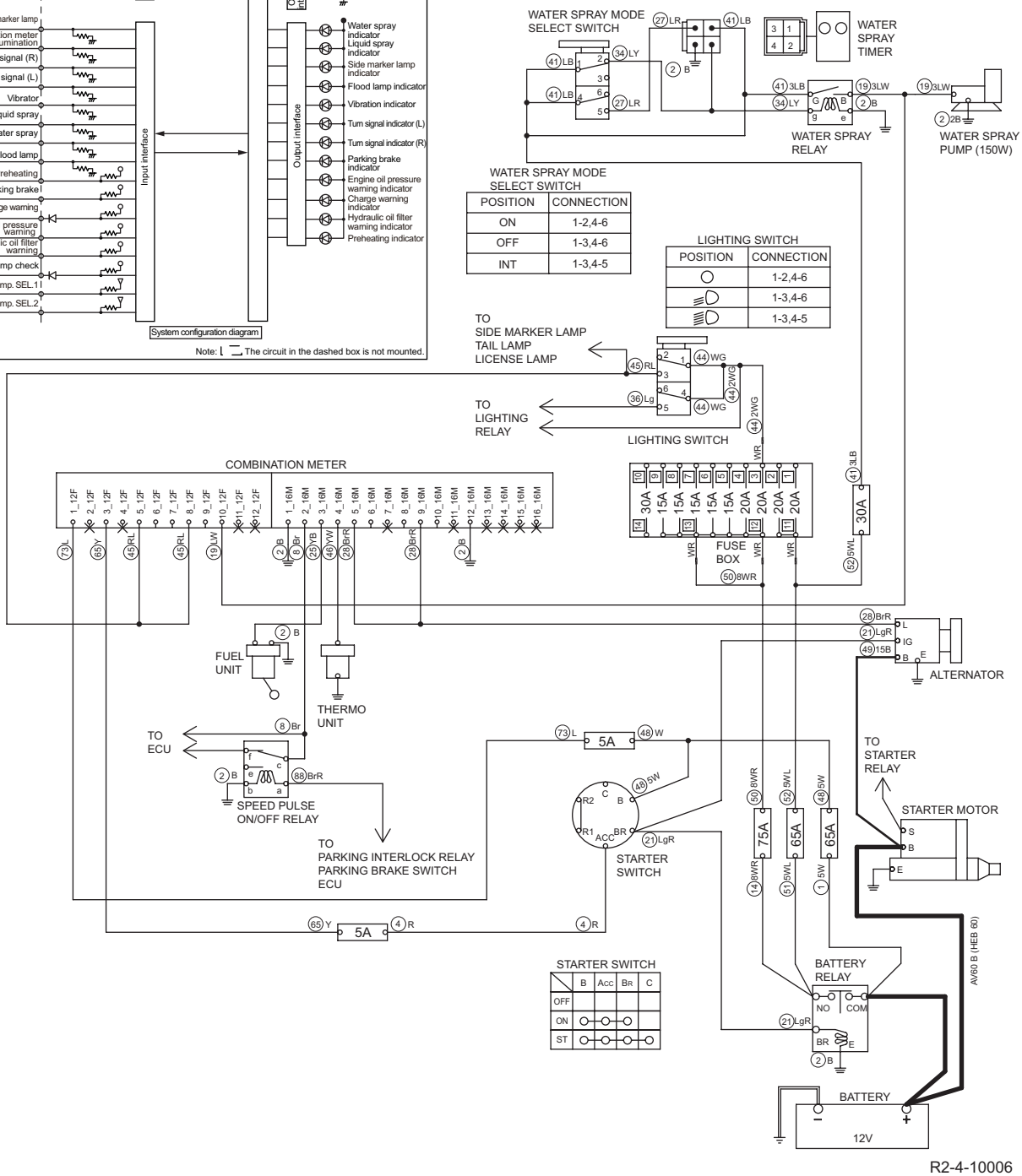
Fig.: 2-6-2



1	BATTERY (12V)
2	BATTERY (24V)
3	STARTER SWITCH (ACC)
4	REV. PULSE INPUT•1
5	COMBINATION METER ILLUMINATION
6	TURN SIGNAL (R)
7	TURN SIGNAL (L)
8	SIDE MARKER LAMP
9	FLOOD LAMP
10	WATER SPRAY
11	LIQUID SPRAY
12	VIBRATOR

COMBINATION METER
SWP12M
SWP16F

1	GROUND
2	REV. PULSE INPUT•2
3	FUEL METER
4	TEMPERATURE METER
5	LAMP CHECK
6	PARKING BRAKE
7	HYDRAULIC OIL FILTER WARNING
8	ENGINE OIL PRESSUER WARNING
9	CHARGE WARNING
10	PREHEATING
11	REV. RATIO SEL.1 (OPEN)
12	REV. RATIO SEL.2 (GND)
13	REV. RATIO SEL.3 (OPEN)
14	REV. RATIO SEL.4 (OPEN)
15	COOLANT TEMP. SEL.1 (OPEN)
16	COOLANT TEMP. SEL.2 (OPEN)



R2-4-10006

2-6-14. Charge warning lamp remains ON

• Check with engine running.

Reference Fig.: 2-6-2

Check point	Check/Cause	Action
1. Harness	• Disconnect connectors between combination meter and alternator terminal L. • Measure resistance between terminals and chassis ground. • Combination meter connector terminal wire No.28 wire BrR and chassis ground. • Alternator terminal L wire BrR and chassis ground Standard resistance : 100 kΩ or more • If resistance is abnormal, harness is faulty.	Repair or replace harness.
2. Combination Meter (Charge warning lamp)	• Measure voltage between combination meter charge warning terminal wire No.28 outlet wire BrR and chassis ground. Standard voltage : 12 V or more • If no abnormality is found, combination meter is faulty.	Replace combination meter.

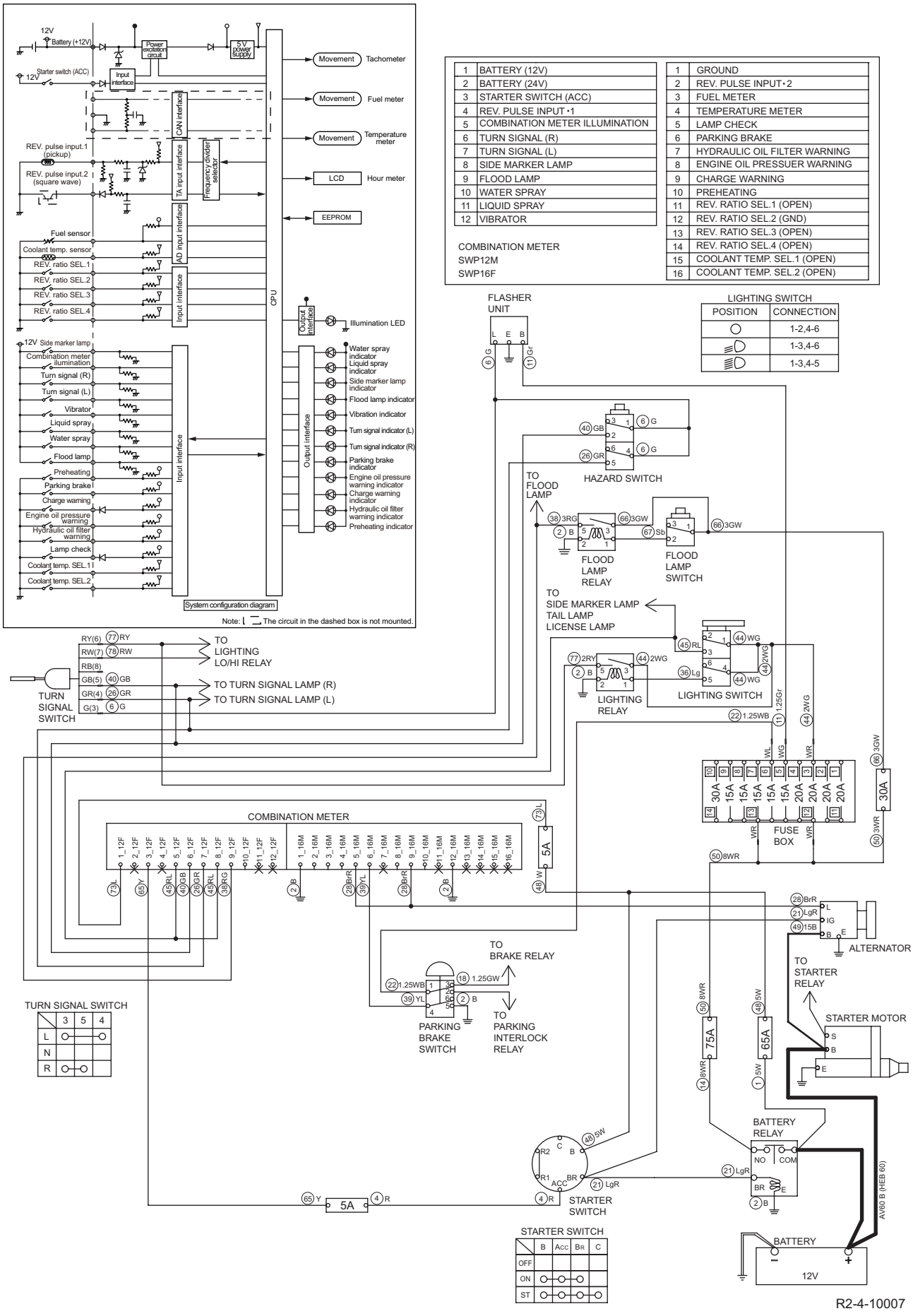
2-6-15. Water spray indicator lamp does not light

• Check that water spray pump can be activated.

Reference Fig.: 2-6-2

Check point	Check/Cause	Action
1. Harness	• Measure resistance between water spray relay terminal B wire LW and combination meter connector terminal wire No.19 wire LW. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.
2. Combination Meter (Water spray indicator lamp)	(1) When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire. • Battery (12 V) terminal wire No.73 inlet wire L and ground terminal wire No.2 wire B • Starter switch (ACC) terminal wire No.65 inlet wire Y and ground terminal wire No.2 wire B Standard voltage : 12 V or more (2) When starter switch is ON and water spray mode select switch is ON, measure voltage between combination meter water spray terminal wire No.19 inlet wire LW and chassis ground. Standard voltage : 12 V or more • If above items (1) and (2) are OK and water spray indicator lamp does not light, combination meter is faulty.	Replace combination meter.

Fig.: 2-6-3



1	BATTERY (12V)
2	BATTERY (24V)
3	STARTER SWITCH (ACC)
4	REV. PULSE INPUT•1
5	COMBINATION METER ILLUMINATION
6	TURN SIGNAL (R)
7	TURN SIGNAL (L)
8	SIDE MARKER LAMP
9	FLOOD LAMP
10	WATER SPRAY
11	LIQUID SPRAY
12	VIBRATOR

COMBINATION METER
SWP12M
SWP16F

1	GROUND
2	REV. PULSE INPUT•2
3	FUEL METER
4	TEMPERATURE METER
5	LAMP CHECK
6	PARKING BRAKE
7	HYDRAULIC OIL FILTER WARNING
8	ENGINE OIL PRESSUER WARNING
9	CHARGE WARNING
10	PREHEATING
11	REV. RATIO SEL.1 (OPEN)
12	REV. RATIO SEL.2 (GND)
13	REV. RATIO SEL.3 (OPEN)
14	REV. RATIO SEL.4 (OPEN)
15	COOLANT TEMP. SEL.1 (OPEN)
16	COOLANT TEMP. SEL.2 (OPEN)

LIGHTING SWITCH

POSITION	CONNECTION
○	1-2,4-6
	1-3,4-6
	1-3,4-5

TURN SIGNAL SWITCH

	3	5	4
L	○		○
N			
R	○		○

STARTER SWITCH

	B	ACC	BR	C
OFF				
ON	○	○		
ST	○	○	○	

R2-4-10007

2-6-16. Flood lamp indicator lamp does not light

• Check that flood lamp lights.

Reference Fig.: 2-6-3

Check point	Check/Cause	Action
1. Harness	• Measure resistance between flood lamp relay terminal 5 wire RG and combination meter connector terminal wire No.38 wire RG. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.
2. Combination Meter (Flood lamp indicator lamp)	(1) When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire. • Battery (12 V) terminal wire No.73 inlet wire L and ground terminal wire No.2 wire B • Starter switch (ACC) terminal wire No.65 inlet wire Y and ground terminal wire No.2 wire B Standard voltage : 12 V or more (2) When starter switch is ON and flood lamp switch is ON, measure voltage between combination meter flood lamp terminal wire No.38 inlet wire RG and chassis ground. Standard voltage : 12 V or more • If above items (1) and (2) are OK and flood lamp indicator lamp does not light, combination meter is faulty.	Replace combination meter.

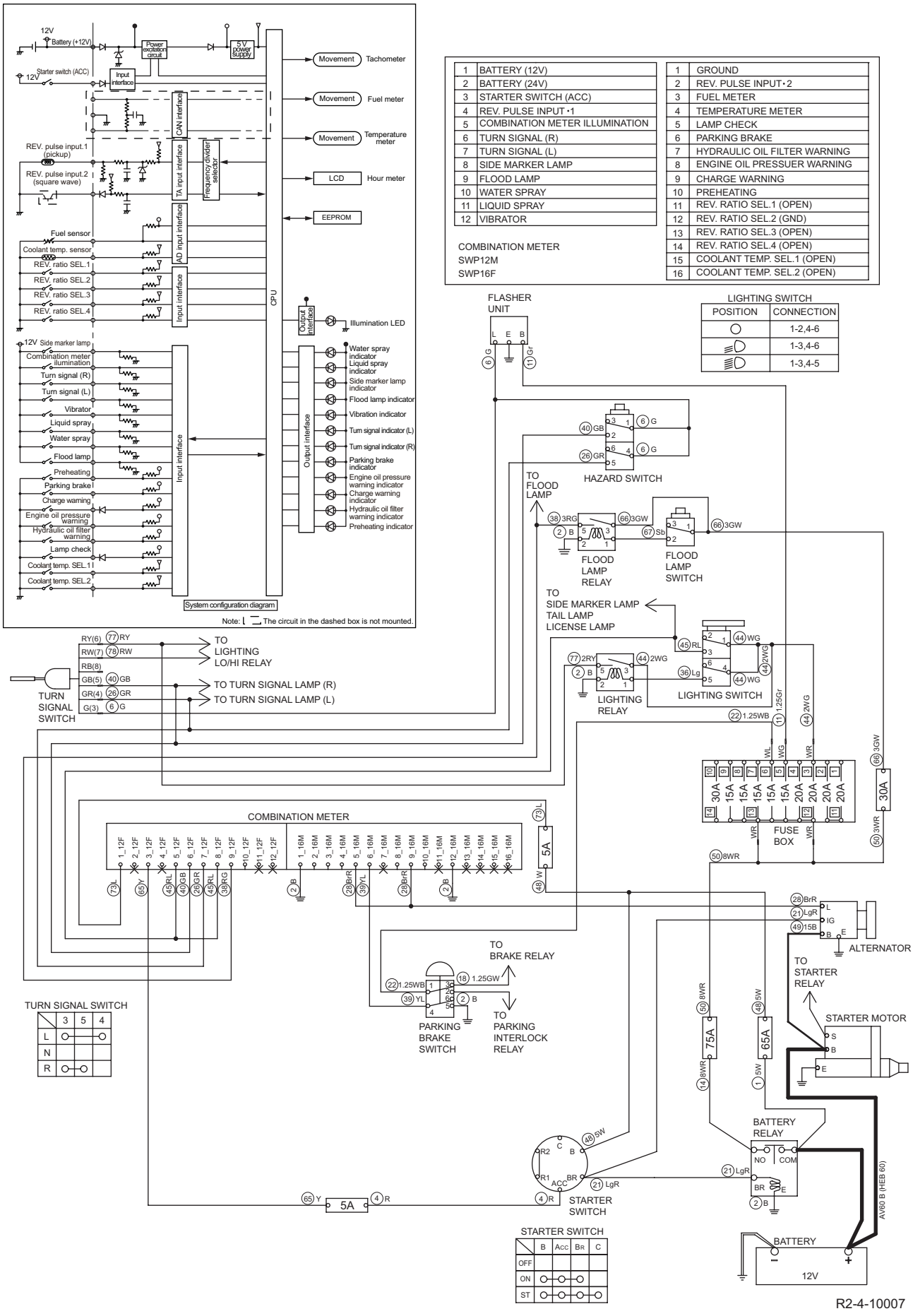
2-6-17. Side marker lamp indicator lamp does not light

• Check that side marker lamp, tail lamp and license lamp light.

Reference Fig.: 2-6-3

Check point	Check/Cause	Action
1. Harness	• Measure resistance between lighting switch terminal 3 wire RL and combination meter connector terminal wire No.45 wire RL. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.
2. Combination Meter (Side marker lamp indicator lamp)	(1) When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire. • Battery (12 V) terminal wire No.73 inlet wire L and ground terminal wire No.2 wire B • Starter switch (ACC) terminal wire No.65 inlet wire Y and ground terminal wire No.2 wire B Standard voltage : 12 V or more (2) When starter switch is ON and lighting switch is " ≡D ", measure voltage between combination meter side marker lamp terminal wire No.45 inlet wire RL and chassis ground. Standard voltage : 12 V or more • If above items (1) and (2) are OK and side marker lamp indicator lamp does not light, combination meter is faulty.	Replace combination meter.

Fig.: 2-6-3

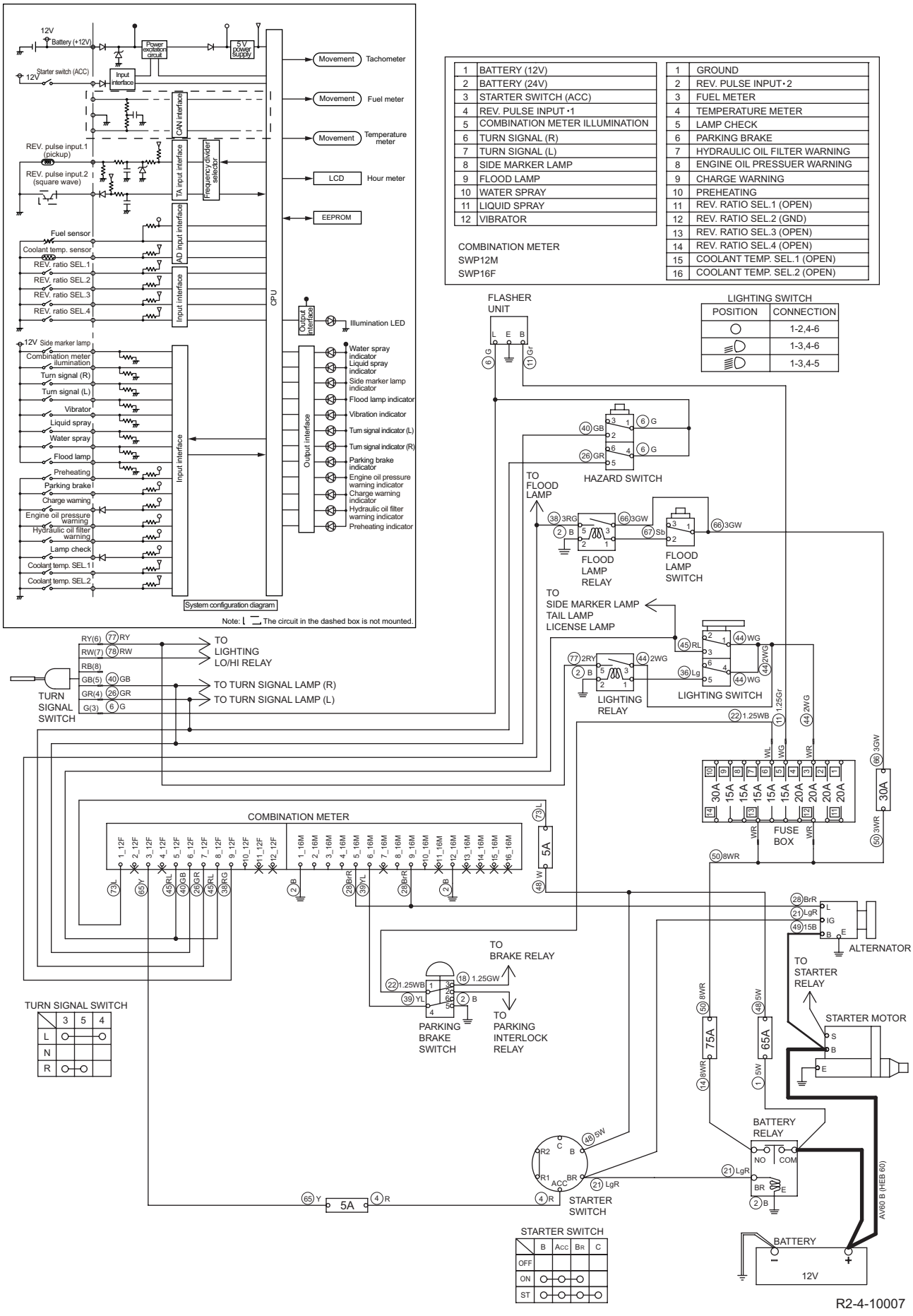

12V
Battery (+12V)
Power excitation circuit
5 V power supply
Starter switch (ACC)
Input interface
CAN interface
TA input interface
Frequency divider selector
AD input interface
Input interface
CPU
Output interface
Movement
Tachometer
Fuel meter
Temperature meter
Hour meter
LCD
EEPROM
REV. pulse input.1 (pickup)
REV. pulse input.2 (square wave)
Fuel sensor
Coolant temp. sensor
REV. ratio SEL.1
REV. ratio SEL.2
REV. ratio SEL.3
REV. ratio SEL.4
Side marker lamp
Combination meter illumination
Turn signal (R)
Turn signal (L)
Vibrator
Liquid spray
Water spray
Flood lamp
Preheating
Parking brake
Charge warning
Engine oil pressure warning
Hydraulic oil filter warning
Lamp check
Coolant temp. SEL.1
Coolant temp. SEL.2
Illumination LED
Water spray indicator
Liquid spray indicator
Side marker lamp indicator
Flood lamp indicator
Vibration indicator
Turn signal indicator (L)
Turn signal indicator (R)
Parking brake indicator
Engine oil pressure warning indicator
Charge warning indicator
Hydraulic oil filter warning indicator
Preheating indicator
System configuration diagram
Note: The circuit in the dashed box is not mounted.
COMBINATION METER
SWP12M
SWP16F
1 BATTERY (12V)
2 BATTERY (24V)
3 STARTER SWITCH (ACC)
4 REV. PULSE INPUT•1
5 COMBINATION METER ILLUMINATION
6 TURN SIGNAL (R)
7 TURN SIGNAL (L)
8 SIDE MARKER LAMP
9 FLOOD LAMP
10 WATER SPRAY
11 LIQUID SPRAY
12 VIBRATOR
1 GROUND
2 REV. PULSE INPUT•2
3 FUEL METER
4 TEMPERATURE METER
5 LAMP CHECK
6 PARKING BRAKE
7 HYDRAULIC OIL FILTER WARNING
8 ENGINE OIL PRESSUER WARNING
9 CHARGE WARNING
10 PREHEATING
11 REV. RATIO SEL.1 (OPEN)
12 REV. RATIO SEL.2 (GND)
13 REV. RATIO SEL.3 (OPEN)
14 REV. RATIO SEL.4 (OPEN)
15 COOLANT TEMP. SEL.1 (OPEN)
16 COOLANT TEMP. SEL.2 (OPEN)
FLASHER UNIT
LIGHTING SWITCH
POSITION CONNECTION
1-2,4-6
1-3,4-6
1-3,4-5
HAZARD SWITCH
TO FLOOD LAMP
FLOOD LAMP RELAY
FLOOD LAMP SWITCH
TO SIDE MARKER LAMP TAIL LAMP LICENSE LAMP
TURN SIGNAL SWITCH
TO LIGHTING LO/HI RELAY
TO TURN SIGNAL LAMP (R)
TO TURN SIGNAL LAMP (L)
LIGHTING RELAY
LIGHTING SWITCH
FUSE BOX
COMBINATION METER
TO BRAKE RELAY
PARKING BRAKE SWITCH
TO PARKING INTERLOCK RELAY
ALTERNATOR
TO STARTER RELAY
STARTER MOTOR
BATTERY RELAY
STARTER SWITCH
BATTERY
12V
AV60 B (HEB 60)
TURN SIGNAL SWITCH
STARTER SWITCH
R2-4-10007

2-6-18. Parking brake indicator lamp does not light

Reference Fig.: 2-6-3

Check point	Check/Cause	Action
1. Harness	• Measure resistance between parking brake switch terminal 4 wire YL and combination meter connector terminal wire No.39 wire YL. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.
2. Parking Brake Switch	• When parking brake switch is applied, check continuity between parking brake switch terminal 4 wire YL and terminal 5 wire B. There is continuity in normal condition. • If there is no continuity, parking brake switch is faulty.	Replace parking brake switch.
3. Combination Meter (Parking brake indicator lamp)	(1) When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire. • Battery (12 V) terminal wire No.73 inlet wire L and ground terminal wire No.2 wire B • Starter switch (ACC) terminal wire No.65 inlet wire Y and ground terminal wire No.2 wire B Standard voltage : 12 V or more (2) When parking brake switch is applied and starter switch is ON, check continuity between combination meter parking brake terminal wire No.39 inlet wire YL and chassis ground. There is continuity in normal condition. • If above items (1) and (2) are OK and parking brake indicator lamp does not light, combination meter is faulty.	Replace combination meter.

Fig.: 2-6-3



1	BATTERY (12V)
2	BATTERY (24V)
3	STARTER SWITCH (ACC)
4	REV. PULSE INPUT•1
5	COMBINATION METER ILLUMINATION
6	TURN SIGNAL (R)
7	TURN SIGNAL (L)
8	SIDE MARKER LAMP
9	FLOOD LAMP
10	WATER SPRAY
11	LIQUID SPRAY
12	VIBRATOR

COMBINATION METER
SWP12M
SWP16F

1	GROUND
2	REV. PULSE INPUT•2
3	FUEL METER
4	TEMPERATURE METER
5	LAMP CHECK
6	PARKING BRAKE
7	HYDRAULIC OIL FILTER WARNING
8	ENGINE OIL PRESSUER WARNING
9	CHARGE WARNING
10	PREHEATING
11	REV. RATIO SEL.1 (OPEN)
12	REV. RATIO SEL.2 (GND)
13	REV. RATIO SEL.3 (OPEN)
14	REV. RATIO SEL.4 (OPEN)
15	COOLANT TEMP. SEL.1 (OPEN)
16	COOLANT TEMP. SEL.2 (OPEN)

LIGHTING SWITCH

POSITION	CONNECTION
○	1-2,4-6
	1-3,4-6
	1-3,4-5

TURN SIGNAL SWITCH

	3	5	4
L	○		○
N			
R	○		○

STARTER SWITCH

	B	ACC	BR	C
OFF				
ON	○	○		
ST	○	○	○	○

R2-4-10007

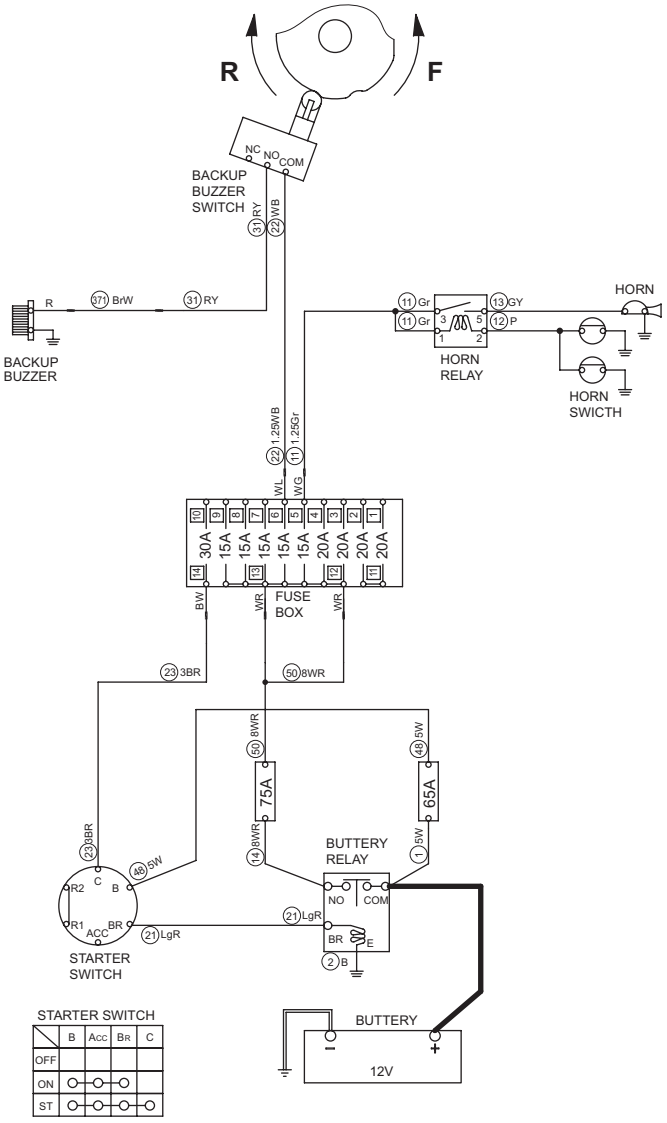
2-6-19. Turn signal indicator lamp does not light

• Check that turn signal lamp blinks.

Reference Fig.: 2-6-3

Check point	Check/Cause	Action
1. Harness	(1) Measure resistance between turn signal switch terminal wire GR (left-hand side) and combination meter connector terminal wire No.26 wire GR. Standard resistance : 10 Ω or less (2) Measure resistance between turn signal switch terminal wire GB (right-hand side) and combination meter connector terminal wire No.40 wire GB. Standard resistance : 10 Ω or less • If above item (1) or (2) is NG, harness is faulty.	Repair or replace harness.
2. Turn Signal Switch	• When turn signal switch lever is moved, check continuity between turn signal switch terminals. Turn signal (L) : Between wire G and wire GR Turn signal (R) : Between wire G and wire GB There is continuity in normal condition. • If there is no continuity, turn signal switch is faulty.	Replace turn signal switch.
3. Combination Meter (Turn signal indicator lamp)	(1) When starter switch is ON, measure voltage between combination meter terminal wires and ground terminal wire. • Battery (12 V) terminal wire No.73 inlet wire L and ground terminal wire No.2 wire B • Starter switch (ACC) terminal wire No.65 inlet wire Y and ground terminal wire No.2 wire B Standard voltage : 12 V or more (2) When starter switch is ON and turn signal switch is moved, measure voltage between combination meter terminal wires and chassis ground. • Turn signal (L) terminal wire No.26 inlet wire GR and chassis ground • Turn signal (R) terminal wire No.40 inlet wire GB and chassis ground Standard voltage : 12 V or more with constant intervals • If above items (1) and (2) are OK and turn signal indicator lamp does not light, combination meter is faulty.	Replace combination meter.

Fig.: 2-6-4



R2-4-10008

2-6-20. Horn does not sound

Reference Fig.: 2-6-4

Check point	Check/Cause	Action
1. Horn	• Disconnect horn and directly connect battery positive terminal to horn terminal wire GY side and negative terminal to horn terminal chassis ground side. • If horn does not sound, horn is faulty.	Replace horn.
2. Horn Relay	(1) When starter switch is ON, measure voltage between horn relay terminal 1 inlet wire Gr and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON, measure voltage between horn relay terminal 3 inlet wire Gr and chassis ground. Standard voltage : 12 V or more (3) When starter switch is ON and horn switch pressed, measure voltage between horn relay terminal 5 outlet wire GY and chassis ground. Standard voltage : 12 V or more • If above items (1) and (2) are OK and item (3) is NG, horn relay is faulty.	Replace horn relay.
3. Horn Switch	• When horn switch is ON, check continuity between horn switch terminals. There is continuity in normal condition. • If there is no continuity, horn switch is faulty.	Replace horn switch.
4. Harness Connecting Between Terminals	• Measure resistance of harness connecting between terminals. Standard resistance : 10 Ω or less • If resistance is abnormal, harness is faulty.	Repair or replace harness.

2-6-21. Backup buzzer does not sound

Reference Fig.: 2-6-4

Check point	Check/Cause	Action
1. Backup Buzzer	• Disconnect backup buzzer and directly connect battery positive terminal to backup buzzer terminal wire RY side and negative terminal to backup buzzer terminal chassis ground side. • If backup buzzer does not sound, backup buzzer is faulty.	Replace backup buzzer.
2. Backup Buzzer Switch	(1) When starter switch is ON, measure voltage between backup buzzer switch terminal COM inlet wire WB and chassis ground. Standard voltage : 12 V or more (2) When starter switch is ON and F-R lever is “R”, measure voltage between backup buzzer switch terminal NO outlet wire RY and chassis ground. Standard voltage : 12 V or more • 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	• 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.	• 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. • Parking brake solenoid valve • Speed change solenoid valve	• 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. Plopulsion Pump Neutral Solenoid Valve	Swash plate is not switched from neutral position because spool of plopulsion pump neutral solenoid valve is stuck.	If valve spool does not move, repair or replace plopulsion pump neutral solenoid valve.
6. Suction Filter for Steering • Charge Pump	Steering • charge pump flow is reduced due to clogged filter.	Clean suction filter or replace it if necessary.
7. Propulsion Circuit Pressure	Circuit does not obtain required pressure because setting pressure of high pressure relief is low.	• Measure propulsion circuit pressure. • If low, check and adjust multifunction valve or replace it if necessary.
8. Propulsion Motor	Propulsion circuit pressure is not held in propulsion motor case.	If pressure in propulsion motor case is not within allowable range, repair propulsion motor or replace it if necessary.
	Internal leakage of propulsion motor.	• Measure drain quantity from propulsion motor. • If drain quantity is larger than standard value, repair propulsion motor or replace it if necessary.
	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.	• 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.
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.	• Measure brake release pressure. • If low, repair or replace propulsion motor.
12. Flange	Drive torque is not transmitted to pump due to faulty flange.	Replace flange.

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

Check point	Cause	Check/Action
1. F-R Lever Linkage	F-R lever linkage is faulty.	Check and adjust F-R lever linkage or replace it if necessary.
2. Multifunction Valve	Low circuit pressure due to incorrect high pressure relief setting or internal leakage of multifunction valve.	• 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.	• 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. • Parking brake solenoid valve • Speed change solenoid valve	• 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.	• 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.	• 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.	• 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. Propulsion Pump Servo Cylinder	Faulty propulsion pump servo cylinder or faulty pump swash plate setting.	Repair propulsion pump or replace it if necessary.

3-2-6. Propulsion system is overheating

Check point	Cause	Check/Action
1. Oil Level of Hydraulic Oil Tank	Oil level in hydraulic oil tank is low.	Fill tank until correct oil level is obtained.
2. Oil Cooler	Cooling efficiency is reduced due to clogged oil cooler fins.	Clean oil cooler fins.
3. Flushing Valve	Hydraulic oil in propulsion closed circuit is insufficiently cooled due to flushing valve shuttle spool sticking.	Repair flushing valve or replace it if necessary.
	Hydraulic oil in propulsion closed circuit is insufficiently cooled because flushing valve relief setting pressure is excessively high.	Check dust or damage in flushing relief valve and replace it if necessary.
	Hydraulic oil in propulsion closed circuit is insufficiently cooled due to flushing valve relief valve poppet sticking.	Clean flushing relief valve or replace it if necessary.
4. Propulsion Circuit Pressure	If circuit pressure setting is excessively low, relief valve opens, causing temperature of hydraulic oil in circuit to rise.	• 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.	• Measure propulsion circuit pressure. • If high, decrease propulsion load.
5. Suction Filter for Steering • Charge Pump	Load of steering • charge pump increases due to clogged filter, causing temperature of hydraulic oil in circuit to rise.	Clean suction filter or replace it if necessary.
6. Hydraulic Oil Filter	Charge circuit pressure increases due to clogged filter.	Clean hydraulic oil filter or replace it if necessary.

3-2-7. Abnormal noise from propulsion system

Check point	Cause	Check/Action
1. Ball Bearing	Ball bearing supporting rear drum is damaged.	Replace ball bearing.
2. Hydraulic Hose Clamp	Vibrator sound of hydraulic hose is generated because clamp securing hydraulic hose is loose.	Tighten bolts of loose hydraulic hose clamp to specified torque.
3. Suction Filter for Steering • Charge Pump	Cavitation is occurring in steering • charge pump due to clogged filter.	Clean suction filter or replace it if necessary.
4. Charge Circuit Pressure	If charge pressure is low, brake cannot be released completely, which causes brake drag.	• Measure charge pressure. • If low, check and adjust charge relief valve or replace it if necessary.
5. Propulsion Motor	Internal bearing of propulsion motor is damaged.	Repair propulsion motor or replace it if necessary.

3-3. Steering System

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

(NOTICE)

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

3-3-1. 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.	• 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.	Clean hydraulic oil filter or replace it if necessary.
4. Steering Cylinder	Cylinder thrust decreases due to internal leakage of steering cylinder.	Repair steering cylinder or replace it if necessary.
5. Suction Filter for Steering • Charge Pump	Steering • charge pump discharge rate decreases due to clogged filter.	Clean suction filter or replace it if necessary.
6. Steering • Charge Pump	Discharging pressure is insufficient due to efficiency degradation of steering • charge pump.	• 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.

3-3-2. 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.	• 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.	• Measure steering circuit pressure. • If low, replace steering • charge pump.

3-3-3. 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. Roller Chain	Roller chain is faulty.	Replace roller chain.

3-3-4. 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.	• 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.	• 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.

3-3-5. 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.

R2-4

SHOP MANUAL

SAKAI HEAVY INDUSTRIES, LTD.

Head office: Seiwa Bldg., 4-8, Shibadaimon 1-chome, Minato-ku, Tokyo, Japan

Telephone: +81-3-3434-3401

Global Service Division: 2500 Takayanagi, Kuki-shi, Saitama, Japan

Telephone: +81-480-52-1111

Printed in Japan 2016.03 50 ⓪ H.S
0634-99373-0-31526-A

Printed in Japan 2020.04 0 ① H.S
0634-99373-0-31526-B