PART NO. TT4GC-E-00

HITACHI

Technical Manual

Troubleshooting

ZW

220
250

Wheel Loader

Service Manual consists of the following separate Part No.

Technical Manual (Operational Principle)	: Vol. No.TO4GC-E
Technical Manual (Troubleshooting)	: Vol. No.TT4GC-E
Workshop Manual	: Vol. No.W4GC-E

INTRODUCTION

TO THE READER

- This manual is written for an experienced technician to provide technical information needed to maintain and repair this machine.

  ・Be sure to thoroughly read this manual for correct product information and service procedures.

・If you have any questions or comments, at if you found any errors regarding the contents of this manual, please contact using “Service Manual Revision Request Form” at the end of this manual.
(Note: Do not tear off the form. Copy it for usage.):

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ADDITIONAL REFERENCES

- Please refer to the materials listed below in addition to this manual.

  ・The Operator’s Manual
  ・The Parts Catalog

・The Engine Manual
・Parts Catalog of the Engine
・Hitachi Training Material

MANUAL COMPOSITION

- This manual consists of three portions: the Technical Manual (Operational Principle), the Technical Manual (Troubleshooting) and the Workshop Manual.

  ・Information included in the Technical Manual (Operational Principle):
  technical information needed for redelivery and delivery, operation and activation of all devices and systems.

・Information included in the Technical Manual (Troubleshooting):
technical information needed for operational performance tests, and troubleshooting procedures.

・Information included in the Workshop Manual:
technical information needed for maintenance and repair of the machine, tools and devices needed for maintenance and repair, maintenance standards, and removal/installation and assemble/disassemble procedures.

PAGE NUMBER

- Each page has a number, located on the center lower part of the page, and each number contains the following information:

Example : T 1-3-5

5 → Consecutive Page Number for Each Group
3 → Group Number
1 → Section Number
T → T: Technical Manual W: Workshop Manual

SAFETY ALERT SYMBOL AND HEADLINE NOTATIONS

In this manual, the following safety alert symbol and signal words are used to alert the reader to the potential for personal injury of machine damage.

⚠ This is the safety alert symbol. When you see this symbol, be alert to the potential for personal injury.
Never fail to follow the safety instructions prescribed along with the safety alert symbol.
The safety alert symbol is also used to draw attention to component/part weights.
To avoid injury and damage, be sure to use appropriate lifting techniques and equipment when lifting heavy parts.

- ⚠ **CAUTION:**
  Indicated potentially hazardous situation which could, if not avoided, result in personal injury or death.

- **IMPORTANT:**
  Indicates a situation which, if not conformed to the instructions, could result in damage to the machine.

- *NOTE:*
  Indicates supplementary technical information or know-how.

UNITS USED

- SI Units (International System of Units) are used in this manual.
  MKSA system units and English units are also indicated in parenthheses just behind SI units.

Example : 24.5 MPa (250 kgf/cm^2, 3560 psi)

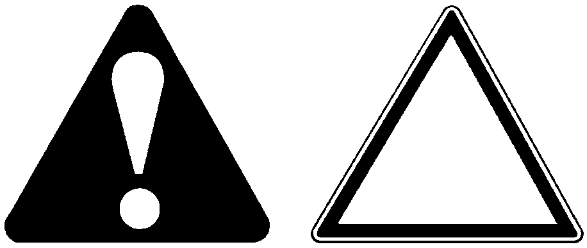
A table for conversion from SI units to other system units is shown below for reference purposees.

Quantity	To Convert From	Into	Multiply By	Quantity	To Convert From	Into	Multiply By
Length	mm	in	0.03937	Pressure	MPa	kgf/cm^2	10.197
	mm	ft	0.003281		MPa	psi	145.0
Volume	L	US gal	0.2642	Power	kW	PS	1.360
	L	US qt	1.057		kW	HP	1.341
	m^3	yd^3	1.308	Temperature	°C	°F	°C×1.8+32
Weight	kg	lb	2.205	Velocity	km/h	mph	0.6214
Force	N	kgf	0.10197		min^{-1}	rpm	1.0
	N	lbf	0.2248	Flow rate	L/min	US gpm	0.2642
Torque	N·m	kgf·m	1.0197		mL/rev	cc/rev	1.0
	N·m	lbf·ft	0.7375				

RECOGNIZE SAFETY INFORMATION

- These are the **SAFETY ALERT SYMBOLS**.
  - When you see these symbols on your machine or in operator`s manual, be alert to the potential for personal injury.
  - Follow recommended precautions and safe operating practices.

001-E01A-0001



SA-688

UNDERSTAND SIGNAL WORDS

- On machine safety signs, signal words designating the degree or level of hazard - DANGER, WARNING, or CAUTION - are used with the safety alert symbol.
  - **DANGER** indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
  - **WARNING** indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
  - **CAUTION** indicates a potentially hazardous situation
  - which, if not avoided, may result in minor or moderate injury.
  - **DANGER or WARNING safety signs** are located near specific hazards. General precautions are listed on **CAUTION safety signs**.
  - Some safety signs don't use any of the designated signal words above after the safety alert symbol are occasionally used on this machine.

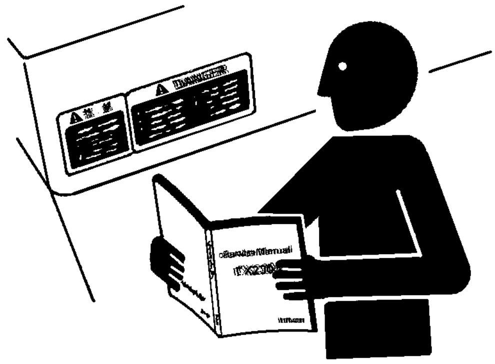
  - To avoid confusing machine protection with personal safety messages, a signal word **IMPORTANT** indicates a situation which, if not avoided, could result in damage to the machine.

  - ***NOTE*** indicates an additional explanation for an element of information.

002-E01A-1223

SA-1223

FOLLOW SAFETY INSTRUCTIONS



SA-003

- Carefully read and follow all safety signs on the machine and all safety messages in operator`s manual.
- Safety signs should be installed, maintained and replaced when necessary.
  - If a safety sign or operator`s manual is damaged or missing, order a replacement from your authorized dealer in the same way you order other replacement parts (be sure to state machine model and serial number when ordering).
- Learn how to operate the machine and its controls correctly and safely.
- Allow only trained, qualified, authorized personnel to operate the machine.
- Keep your machine in proper working condition.
  - Unauthorized modifications of the machine may impair its function and/or safety and affect machine life.
  - Do not modify any machine parts without authorization.
    Failure to do so may deteriorate the part safety, function, and/or service life. In addition, personal accident, machine trouble, and/or damage to material caused by unauthorized modifications will void Hitachi Warranty Policy.
  - Do not use attachments and/or optional parts or equipment not authorized by Hitachi. Failure to do so may deteriorate the safety, function, and/or service life of the machine. In addition, personal accident, machine trouble, and/or damage to material caused by using unauthorized attachments and/or optional parts or equipment will void Hitachi Warranty Policy.
- The safety messages in this SAFETY chapter are intended to illustrate basic safety procedures of machines. However it is impossible for these safety messages to cover every hazardous situation you may encounter. If you have any questions, you should first consult your supervisor and/or your authorized dealer before operating or performing maintenance work on the machine.

003-E01B-0003

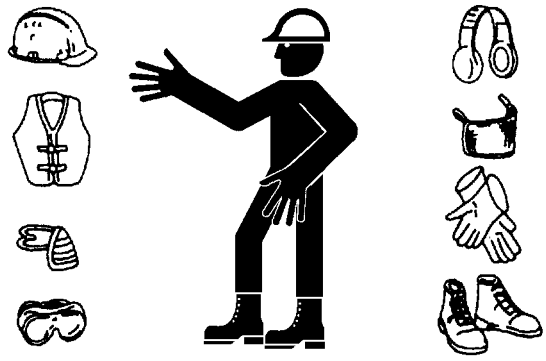
PREPARE FOR EMERGENCIES

- Be prepared if a fire starts or if an accident occurs.
  - Keep a first aid kit and fire extinguisher on hand.
  - Thoroughly read and understand the label attached on the fire extinguisher to use it properly.
  - To ensure that a fire-extinguisher can be always used when necessary, check and service the fire-extinguisher at the recommended intervals as specified in the fire-extinguisher manual.
  - Establish emergency procedure guidelines to cope with fires and accidents.
  - Keep emergency numbers for doctors, ambulance service, hospital, and fire department posted near your telephone.

SA-437

004-E01A-0437

WEAR PROTECTIVE CLOTHING



SA-438

- Wear close fitting clothing and safety equipment appropriate to the job.

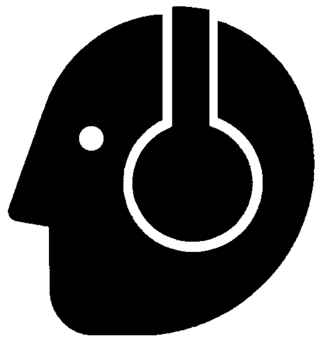
  You may need:
  A hard hat
  Safety shoes
  Safety glasses, goggles, or face shield
  Heavy gloves
  Hearing protection
  Reflective clothing
  Wet weather gear
  Respirator or filter mask.
  Be sure to wear the correct equipment and clothing for the job. Do not take any chances.

  - Avoid wearing loose clothing, jewelry, or other items that can catch on control levers or other parts of the machine.

- Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating the machine.

005-E01A-0438

PROTECT AGAINST NOISE



- Prolonged exposure to loud noise can cause impairment or loss of hearing.
  - Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortably loud noises.

006-E01A-0434

SA-434

NSPECT MACHINE

- Inspect your machine carefully each day or shift by walking around it before you start it to avoid personal injury.
  - In the walk-around inspection be sure to cover all points described in the “PRE-START INSPECTION” chapter in the operator’s manual.

007-E01A-0435

SA-435

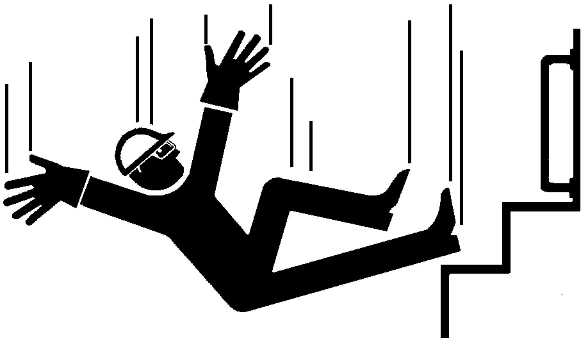
GENERAL PRECAUTIONS FOR CAB

- Before entering the cab, thoroughly remove all dirt and/or oil from the soles of your work boots. If any controls such as a pedal is operated while with dirt and/or oil on the soles of the operator's work boots the operator's foot may slip off the pedal, possibly resulting in a personal accident.
- Do not leave parts and/or tools lying around the operator's seat. Store them in their specified locations.
- Avoid storing transparent bottles in the cab. Do not attach any transparent type window decorations on the windowpanes as they may focus sunlight, possibly starting a fire.
- Refrain from listening to the radio, or using music headphones or mobile telephones in the cab while operating the machine.
- Keep all flammable objects and/or explosives away from the machine.
- After using the ashtray, always cover it to extinguish the match and/or tobacco.
- Do not leave cigarette lighters in the cab. When the temperature in the cab increases, the lighter may explode.

524-E01A-0000

USE HANDHOLDS AND STEPS

- Falling is one of the major causes of personal injury.
  - When you get on and off the machine, always face the machine and maintain a three-point contact with the steps and handrails.
  - Do not use any controls as hand-holds.
  - Never jump on or off the machine. Never mount or dismount a moving machine.
  - Be careful of slippery conditions on platforms, steps, and handrails when leaving the machine.



SA-439

008-E01A-0439

ADJUST THE OPERATOR'S SEAT

- A poorly adjusted seat for either the operator or for the work at hand may quickly fatigue the operator leading to misoperations.
  - The seat should be adjusted whenever changing the operator for the machine.
  - The operator should be able to fully depress the pedals and to correctly operate the control levers with his back against the seat back.
  - If not, move the seat forward or backward, and check again.
  - Adjust the rear view mirror position so that the best rear visibility is obtained from the operator's seat. If the mirror is broken, immediately replace it with a new one.

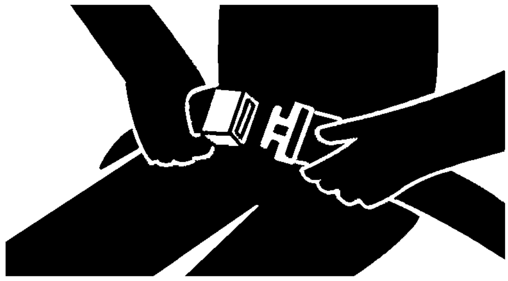
SA-462

009-E01A-0462

ENSURE SAFETY BEFORE RISING FROM OR LEAVING OPERATOR'S SEAT

- Before rising from the operator's seat to open/close either side window or to adjust the seat position, be sure to first lower the front attachment to the ground and then move the pilot control shut-off lever to the LOCK position. Failure to do so may allow the machine to unexpectedly move when a body part unintentionally comes in contact with a control lever, possibly resulting in serious personal injury or death.
  - Before leaving the machine, be sure to first lower the front attachment to the ground and then move the pilot control shut-off lever to the LOCK position. Turn the key switch OFF to stop the engine.
  - Before leaving the machine, close all windows, doors, and access covers and lock them up.

FASTEN YOUR SEAT BELT

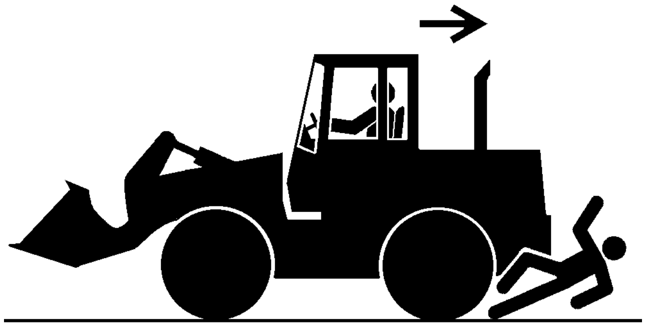


SA-237

- If the machine should overturn, the operator may become injured and/or thrown from the cab. Additionally the operator may be crushed by the overturning machine, resulting in serious injury or death.
  - Prior to operating the machine, thoroughly examine webbing, buckle and attaching hardware. If any item is damaged or worn, replace the seat belt or component before operating the machine.
  - Be sure to remain seated with the seat belt securely fastened at all times when the machine is in operation to minimize the chance of injury from an accident.
  - We recommend that the seat belt be replaced every three years regardless of its apparent condition.

010-E01A-0237

MOVE AND OPERATE MACHINE SAFELY



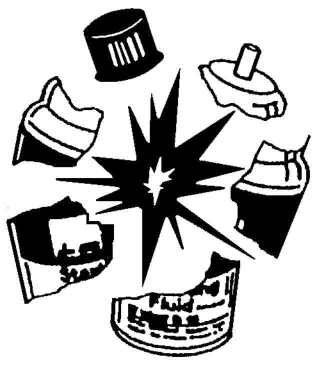
SA-398

- Bystanders can be run over.
  - Take extra care not to run over bystanders. Confirm the location of bystanders before moving, or operating the machine.
  - Always keep the travel alarm and horn in working condition (if equipped). It warns people when the machine starts to move.
  - Use a signal person when moving, swinging, or operating the machine in congested areas. Coordinate hand signals before starting the machine.
  - Use appropriate illumination. Check that all lights are operable before operating the machine. If any faulty illumination is present, immediately repair it.

011-E01A-0398

HANDLE STARTING AIDS SAFELY

Starting fluid:



SA-293

- Starting fluid is highly flammable.
  - Keep all sparks and flame away when using it.
  - Keep starting fluid well away from batteries and cables.
  - Remove container from machine if engine does not need starting fluid.
  - To prevent accidental discharge when storing a pressurized container, keep the cap on the container, and store it in a cool, well-protected location.
  - Do not incinerate or puncture a starting fluid container.

036-E01A-0293-3

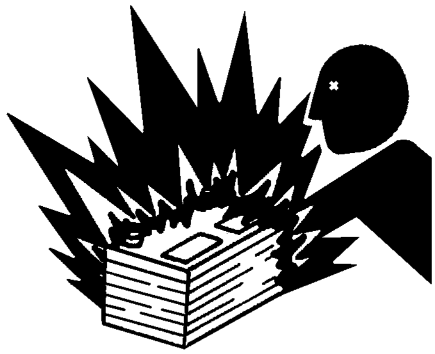
OPERATE ONLY FROM OPERATOR'S SEAT

SA-431

- Inappropriate engine starting procedures may cause the machine to runaway, possibly resulting in serious injury or death.
  - Start the engine only when seated in the operator's seat.
  - NEVER start the engine while standing on the track or on ground.
  - Do not start engine by shorting across starter terminals.
  - Before starting the engine, confirm that all control levers are in neutral.
  - Before starting the engine, confirm the safety around the machine and sound the horn to alert bystanders.

012-E01B-0431

JUMP STARTING



SA-032

- Battery gas can explode, resulting in serious injury.
  - If the engine must be jump started, be sure to follow the instructions shown in the “OPERATING THE ENGINE” chapter in the operator’s manual.
  - The operator must be in the operator’s seat so that the machine will be under control when the engine starts.
  - Jump starting is a two-person operation.
  - Never use a frozen battery.
  - Failure to follow correct jump starting procedures could result in a battery explosion or a runaway machine.

S013-E01A-0032 SA-032

INVESTIGATE JOB SITE BEFOREHAND

- When working at the edge of an excavation or on a road shoulder, the machine could tip over, possibly resulting in serious injury or death.
  - Investigate the configuration and ground conditions of the job site beforehand to prevent the machine from falling and to prevent the ground, stockpiles, or banks from collapsing.
  - Make a work plan. Use machines appropriate to the work and job site.
  - Reinforce ground, edges, and road shoulders as necessary. Keep the machine well back from the edges of excavations and road shoulders.
  - When working on an incline or on a road shoulder, employ a signal person as required.
  - Confirm that your machine is equipped a FOPS cab before working in areas where the possibility of falling stones or debris exist.
  - When the footing is weak, reinforce the ground before starting work.
  - When working on frozen ground, be extremely alert. As ambient temperatures rise, footing becomes loose and slippery.
  - Beware the possibility of fire when operating the machine near flammable objects such as dry grass.

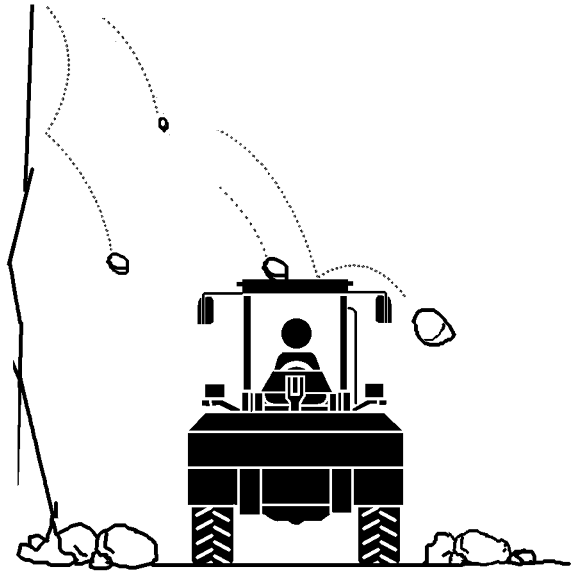
SA-447

015-E01B-0447

EQUIPMENT OF HEAD GUARD, ROPS, FOPS

In case the machine is operated in areas where the possibility of falling stones or debris exist, equip a head guard, ROPS, or FOPS according to the potential hazardous conditions. (The standard cab for this machine corresponds to ROPS and FOPS.)

ROPS: Roll-Over Protective Structure
FOPS: Falling Object Protective Structure



SA-521

PROVIDE SIGNALS FOR JOBS INVOLVING MULTIPLE NUMBERS OF MACHINES

- For jobs involving multiple numbers of machines, provide signals commonly known by all personnel involved. Also, appoint a signal person to coordinate the job site. Make sure that all personnel obey the signal person's directions.

018-E01A-0481

SA-481

KEEP RIDERS OFF MACHINE

- Riders on machine are subject to injury such as being struck by foreign objects and being thrown off the machine.
  - Only the operator should be on the machine. Keep riders off.
  - Riders also obstruct the operator’s view, resulting in the machine being operated in an unsafe manner.

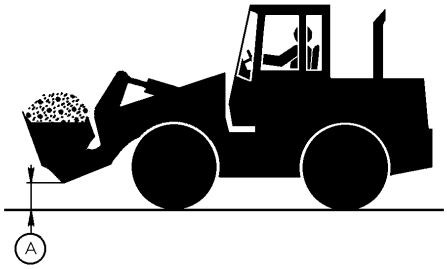
014-E01B-0427

SA-427

DRIVE SAFELY

- Beware of the possibility of slipping and/or turning over the machine when driving on a slope.
  - When driving on level ground, hold the bucket at mark (A) 400 to 500 mm above the ground as illustrated.
  - Avoid driving over any obstacles.
  - Drive the machine slowly when driving on rough terrain.
  - Avoid quick direction changes. Failure to do so may cause the machine to turn over.
  - If the engine stops while driving, the steering function becomes inoperative. Immediately stop the machine by applying the bake to prevent personal accident.

019-E07A-0448



SA-448

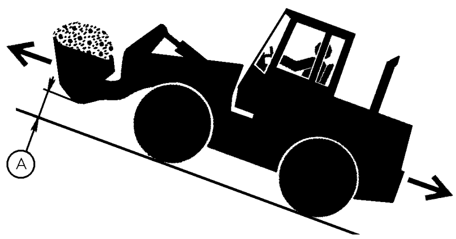
DRIVE MACHINE SAFELY (WORK SITE)

- Before driving the machine, always confirm that the steering wheel/F-N-R lever direction corresponds to the direction you wish to drive.
  - Be sure to detour around any obstructions.

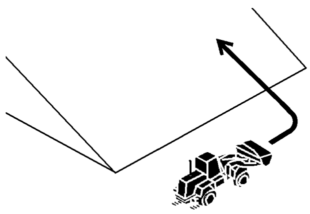
- Driving on a slope may cause the machine to slip or overturn, possibly resulting in serious injury or death.
  - When driving up or down a slope, keep the bucket facing the direction of travel, approximately 200 to 300 mm (approximately 8 to 12 in) (A) above the ground.
  - If the machine starts to skid or becomes unstable, immediately lower the bucket to the ground and stop.

- Driving across the face of a slope or steering on a slope may cause the machine to skid or overturn. If the direction must be changed, move the machine to level ground, then, change the direction to ensure safe operation.

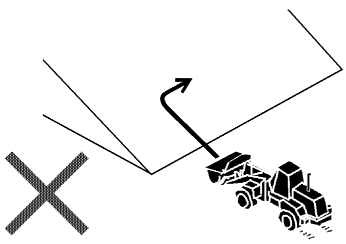
019-E05B-0515



SA-449



SA-450

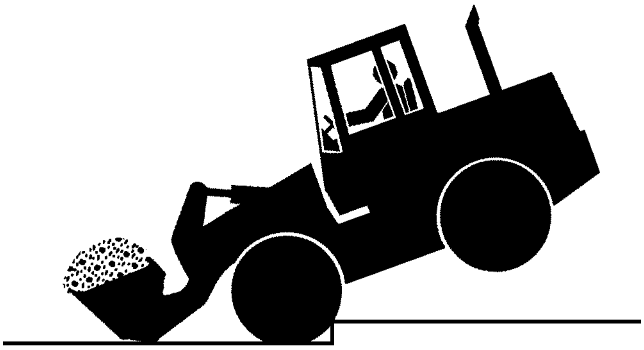


SA-451

DRIVE SAFELY WITH BUCKET LOADED

- If the machine is incorrectly operated while driving with the bucket loaded, turning over of the machine may result. Be sure to follow all the instructions indicated below.
  - When driving the machine on a job site with the bucket loaded, hold the bucket as low as possible to keep the machine balanced and to have good visibility.
  - Do not exceed the rated load capacity. Always operate the machine within the rated load capacity.
  - Avoid fast starts, stops, and quick turns. Failure to do so may result in personal injury and/or death.
  - Avoid rapid drive direction changes which could possibly cause personal injury and/or death.

051-E02A-0400

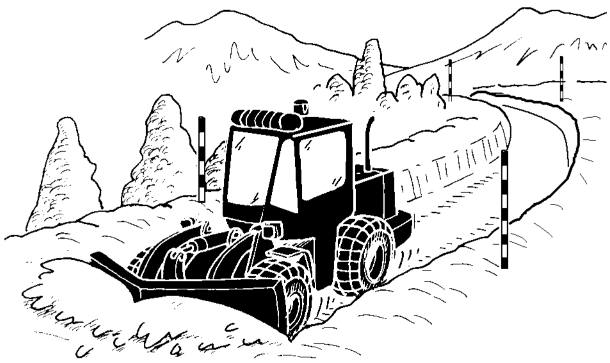


SA-400

DRIVE ON SNOW SAFELY

- Beware of the possibility of slipping or turning over the machine when driving on frozen snow surfaces.
  - The machine may slip more easily than expected on frozen snow surfaces even if the inclination is small. Reduce speed when driving. Avoid fast starts, stops and quick turns.
  - Road shoulder and/or set-up utilities covered with snow are difficult to locate. Be sure where they are before removing snow.
  - Be sure to use tire chains when driving on snow.
  - Avoid applying the brake for quick stops on snow. If a quick stop is required, lower the bucket to the ground.

052-E02A-0452

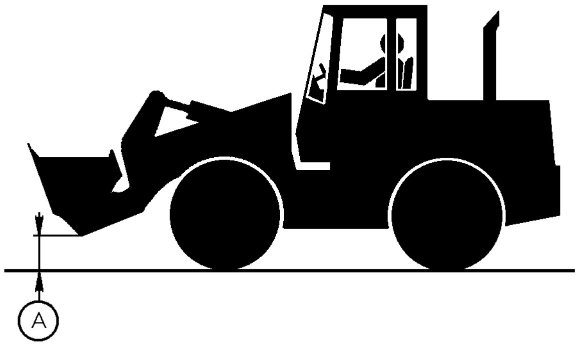


SA-452

TRAVEL ON PUBLIC ROADS SAFELY

- This machine is not allowed to drive on public loads with the bucket loaded.
  - Be sure to empty the bucket.
  - Hold the bucket at mark (A) 400 to 500 mm above the road surface as illustrated.

053-E02A-0453



SA-453

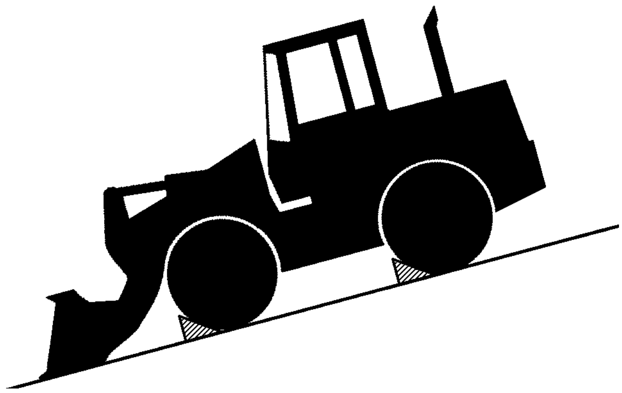
AVOID INJURY FROM ROLLAWAY ACCIDENTS

- Death or serious injury may result if you attempt to mount or stop a moving machine.

  To avoid rollaways:
  - Select level ground when possible to park machine.
  - Do not park the machine on a grade.
  - Lower the bucket to the ground.
  - Place the F-N-R lever in neutral, and put the park brake switch in the ON (parking brake) position.
  - Run the engine at slow idle speed without load for 5 minutes to cool down the engine.
  - Stop the engine and remove the key from the key switch.
  - Pull the lock lever to LOCK position.
  - Block both tires and lower the bucket to the ground.
  - Position the machine to prevent rolling.
  - Park a reasonable distance from other machines.

020-E02A-0516

SA-457

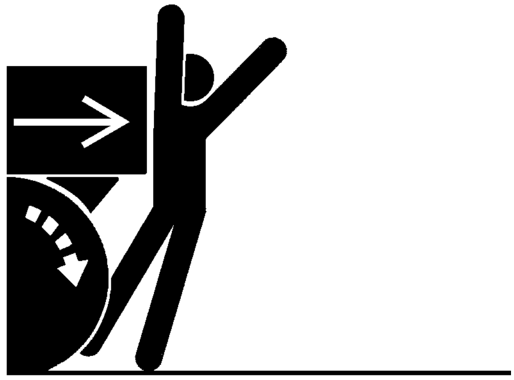


SA-458

AVOID ACCIDENTS FROM BACKING UP AND TURNING

- Make sure no one is working under or close to the machine before backing up or turning the machine to avoid personal injury and/or death by being run over or entangled in the machine.
  - Keep all personnel away from the machine by sounding the horn and/or using hand signals. Use extra care to be sure no one is in from the articulation area before turning the machine.
  - Keep windows, mirrors, and lights in good condition.
  - Reduce travel speed when dust, heavy rain, fog, etc., reduce the visibility.
  - In case good visibility is not obtained, use a signal person to guide you.

021-E02A-0517



SA-383

SA-312

AVOID POSITIONING BUCKET OVER ANYONE

- Never allow the bucket to pass over co-workers and/or the dump truck operator’s cab. Falling soil from the bucket or contact with bucket may cause serious personal accidents and/or damage to the machine.
  - Avoid carrying the bucket over the co-workers to ensure safe operation.

023-E02A-0518

SA-518

AVOID TIPPING

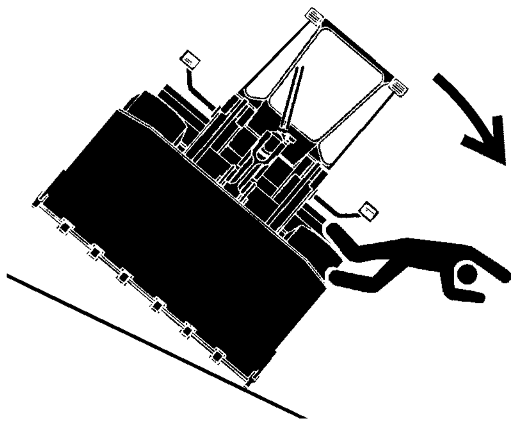
DO NOT ATTEMPT TO JUMP CLEAR OF TIPPING MACHINE. MACHINE WILL TIP OVER FASTER THAN YOU CAN JUMP FREE, POSSIBLY RESULTING IN SERIOUS PERSONAL INJURY OR DEATH. IF TIPPING OVER OF THE MACHINE IS PREDICTED, SECURELY HOLD THE STEERING WHEEL TO PREVENT YOUR BODY FROM BEING THROWN OUT OF THE MACHINE.

MACHINE WILL TIP OVER FASTER THAN YOU CAN JUMP FREE

FASTEN YOUR SEAT BELT

- The danger of tipping is always present when operating on a grade, possibly resulting in serious injury or death.
  To avoid tipping:
- Be extra careful before operating on a grade.
  - Prepare machine operating area flat.
  - Keep the bucket low to the ground and close to the machine.
  - Reduce operating speeds to avoid tipping or slipping.
  - Avoid changing direction when traveling on grades.
  - NEVER attempt to travel across a grade steeper than 5 degrees if crossing the grade is unavoidable.
  - Reduce swing speed as necessary when swinging loads.

- Be careful when working on frozen ground.
  - Temperature increases will cause the ground to become soft and make ground travel unstable.

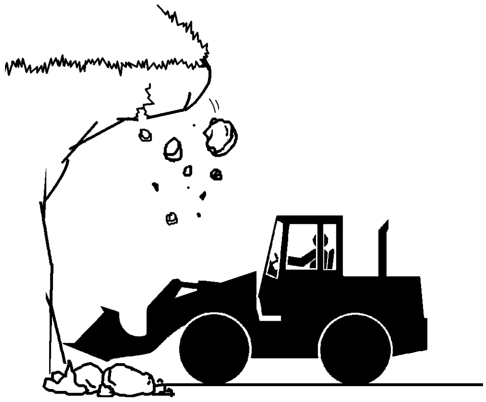


SA-463

NEVER UNDERCUT A HIGH BANK

- The edges could collapse or a land slide could occur causing serious injury or death.

026-E01A-0519

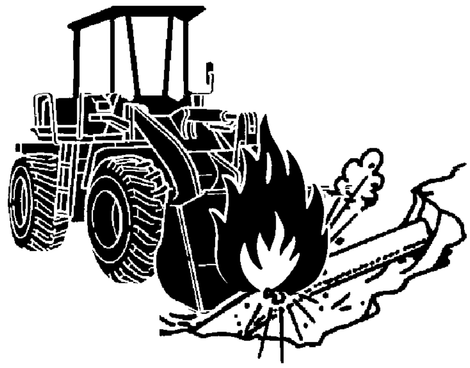


SA-519

DIG WITH CAUTION

Before digging, check the location of cables, gas lines, and water lines.

027-E01A-0396

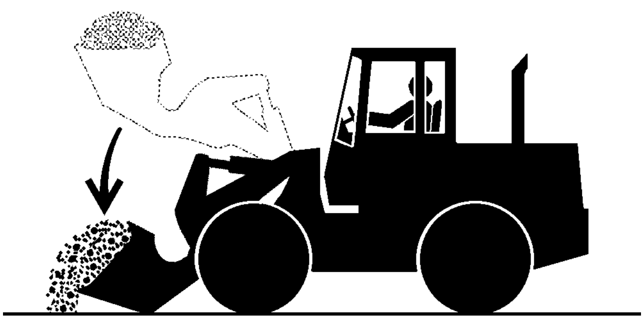


SA-396

PERFORM TRUCK LOADING SAFELY

- Do not operate the machine involuntarily. Unexpected machine movement may cause personal injury and/or death.
  - Do not lower the bucket with the loader control lever in the FLOAT position. The bucket may free fall, possibly causing personal injury and/or death.
  - Always select a level surface for truck loading.

028-E01A-397



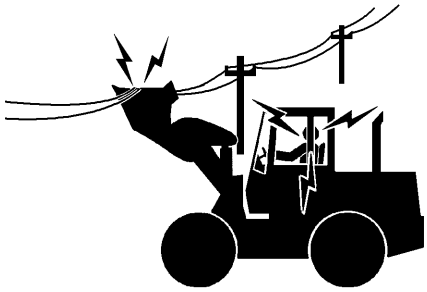
SA-397

AVOID POWER LINES

Serious injury or death can result from contact with electric lines.

Never move any part of the machine or load closer to any electric line than 3 m (10 ft) plus twice the line insulator length.

29-E01A-0455



SA-455

PRECAUTIONS FOR OPERATION

- If the front attachment or any part of the machine comes in contact with an overhead obstacle, both the machine and the overhead obstacle may become damaged, and personal injury may result.
  - Take care to avoid coming in contact with overhead obstacles with the bucket or arm during operation.

PRECAUTIONS FOR LIGHTENING

- The machine is vulnerable to lighting strikes.
  - In the event of an electrical storm, immediately stop operation, and lower the bucket to the ground. Evacuate to a safe place far away from the machine.
  - After the electrical storm has passed, check all of the machine safety devices for any failure. If any failed safety devices are found, operate the machine only after repairing them.

OBJECT HANDLING

- If a lifted load should fall, any person nearby may be struck by the falling load or may be crushed underneath it, resulting in serious injury or death.
  - When using the machine for craning operations, be sure to comply with all local regulations.
  - Do not use damaged chains or frayed cables, sables, slings, or ropes.
  - Before craning, position the upperstructure with the position of the bucket support located on the chassis at the front.
  - Move the load slowly and carefully. Never move it suddenly.
  - Keep all persons well away from the load.
  - Never move a load over a person's head.
  - Do not allow anyone to approach the load until it is safely and securely situated on supporting blocks or on the ground.
  - Never attach a sling or chain to the bucket teeth. They may come off, causing the load to fall.

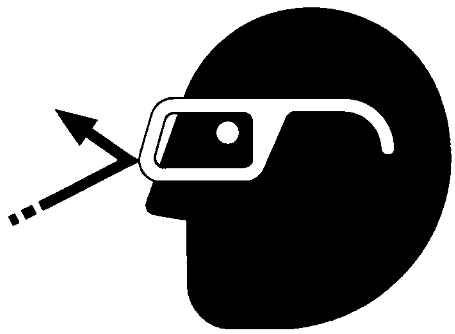
032-E01A-0132

SA-132

PROTECT AGAINST FLYING DEBRIS

- If flying debris hit eyes or any other part of the body, serious injury may result.
  - Guard against injury from flying pieces of metal or debris; wear goggles or safety glasses.
  - Keep bystanders away from the working area before striking any object.

031-E01A-0432

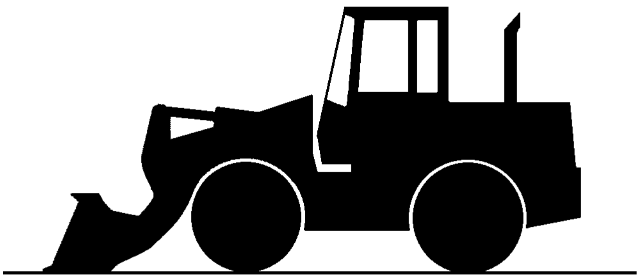


SA-432

PARK MACHINE SAFELY

To avoid accidents:

- Park machine on a firm, level surface.
- Lower bucket to the ground.
- Place the F-N-R lever in neutral, and put the park brake switch in the ON (parking brake) position.
- Run engine at slow idle speed without load for 5 minutes.
- Turn key switch to OFF to stop engine.
- Remove the key from the key switch.
- Lower the lock lever to the LOCK position.
- Close windows, roof vent, and cab door.
- Lock all access doors and compartments.



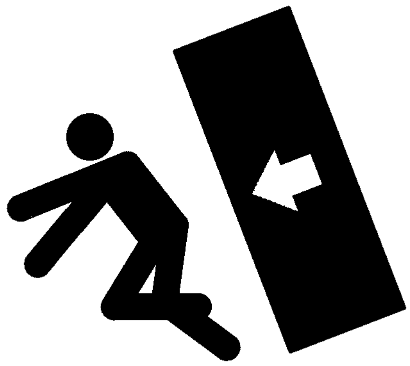
SA-456

033-E07B-0456

STORE ATTACHMENTS SAFELY

- Stored attachments such as buckets, hydraulic hammers, and blades can fall and cause serious injury or death.
  - Securely store attachments and implements to prevent falling. Keep children and bystanders away from storage areas.

504-E01A-0034



SA-034

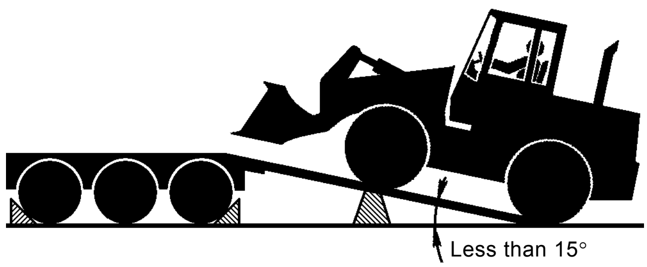
TRANSPORT SAFELY

- Take care the machine may turn over when loading or unloading the machine onto or off of a truck or trailer.
  - Observe the related regulations and rules for safe transportation.
  - Select an appropriate truck or trailer for the machine to be transported.
  - Be sure to use a signal person.
  - Always follow the following precautions for loading or unloading:

1. Select solid and level ground.
2. Always use a ramp or deck strong enough to support the machine weight.
3. Use the low speed gear.
4. Never steer the machine while on the ramp. If the traveling direction must be changed while the ramp, unload the machine from the ramp, reposition the machine on the ground, then try loading again.
5. After loading, install the lock bar to securely hold the articulation mechanism.
6. Wedge the front and rear of tires. Securely hold the machine to the truck or trailer deck with wire ropes.

Be sure to further follow the details described in the TRANSPORTING section.

035-E07A-0454



SA-454

HANDLE FLUIDS SAFELY-AVOID FIRES

SA-018

- Handle fuel with care; it is highly flammable. If fuel ignites, an explosion and/or a fire may occur, possibly resulting in serious injury or death.
  - Do not refuel the machine while smoking or when near open flame or sparks.
  - Always stop the engine before refueling the machine.
  - Fill the fuel tank outdoors.

- All fuels, most lubricants, and some coolants are flammable.
  - Store flammable fluids well away from fire hazards.
  - Do not incinerate or puncture pressurized containers.
  - Do not store oily rags; they can ignite and burn spontaneously.
  - Securely tighten the fuel and oil filler cap.

034-E01A-0496

SA-019

PRACTICE SAFE MAINTENANCE

To avoid accidents:

- Understand service procedures before starting work.
- Keep the work area clean and dry.
- Do not spray water or steam inside cab.
- Never lubricate or service the machine while it is moving.
- Keep hands, feet and clothing away from power-driven parts.

Before servicing the machine:

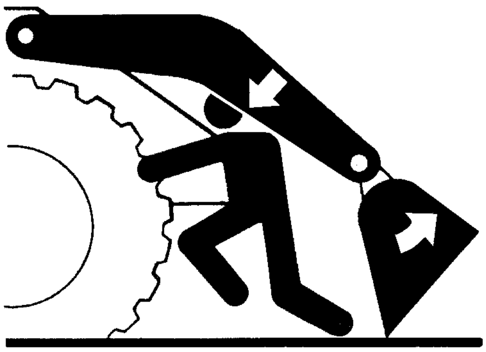
1. Park the machine on a level surface.
2. Lower the bucket to the ground.
3. Turn the auto-idle switch off.
4. Run the engine at slow idle speed without load for 5 minutes.
5. Turn the key switch to OFF to stop engine.
6. Relieve the pressure in the hydraulic system by moving the control levers several times.
7. Remove the key from the switch.
8. Attach a “Do Not Operate” tag on the control lever.
9. Lower the lock lever to the LOCK position.
10. Lock bar connects the front and rear frames.
11. Allow the engine to cool.

- If a maintenance procedure must be performed with the engine running, do not leave machine unattended.
- Never work under a machine raised by the lift arm.
- Inspect certain parts periodically and repair or replace as necessary. Refer to the section discussing that part in the “MAINTENANCE” chapter of operator`s manual.
- Keep all parts in good condition and properly installed.
- Fix damage immediately. Replace worn or broken parts. Remove any buildup of grease, oil, or debris.
- When cleaning parts, always use nonflammable detergent oil. Never use highly flammable oil such as fuel oil and gasoline to clean parts or surfaces.
- Disconnect battery ground cable (-) before making adjustments to electrical systems or before performing welding on the machine.

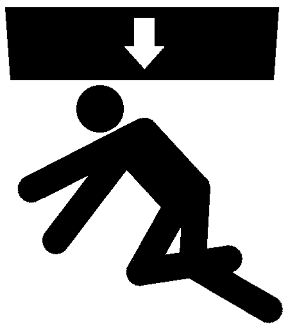
500-E02C-0520

SA-028

SA-312

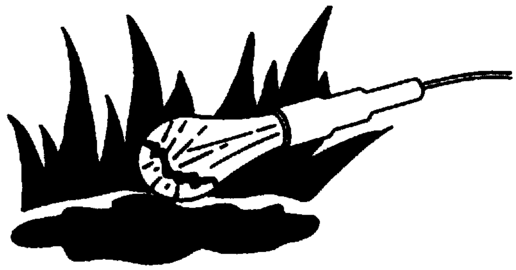


SA-134



SA-527

- Sufficiently illuminate the work site. Use a maintenance work light when working under or inside the machine.
- Always use a work light protected with a guard. In case the light bulb is broken, spilled fuel, oil, antifreeze fluid, or window washer fluid may catch fire.

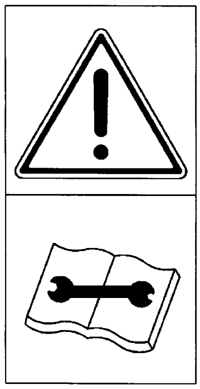


SA-037

WARN OTHERS OF SERVICE WORK

- Unexpected machine movement can cause serious injury.
  - Before performing any work on the machine, attach a "Do Not Operate" tag on the control lever. This tag is available from your authorized dealer.

501-E01A-0287

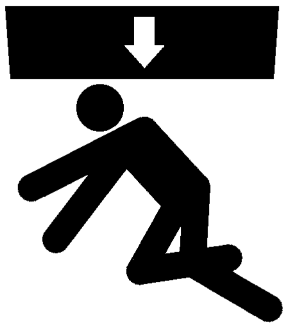


SS2045102

SUPPORT MACHINE PROPERLY

- Never attempt to work on the machine without securing the machine first.
  - Always lower the attachment to the ground before you work on the machine.
  - If you must work on a lifted machine or attachment, securely support the machine or attachment. Do not support the machine on cinder blocks, hollow tires, or props that may crumble under continuous load. Do not work under a machine that is supported solely by a jack.

519-E01A-0527

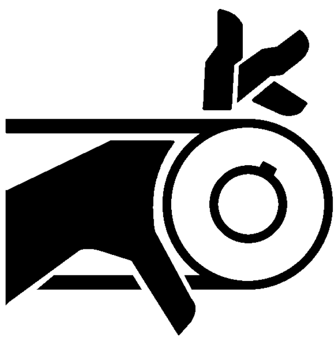


SA-527

STAY CLEAR OF MOVING PARTS

- Entanglement in moving parts can cause serious injury.
  - To prevent accidents, care should be taken to ensure that hands, feet, clothing, jewelry and hair do not become entangled when working around rotating parts.

502-E01A-0026

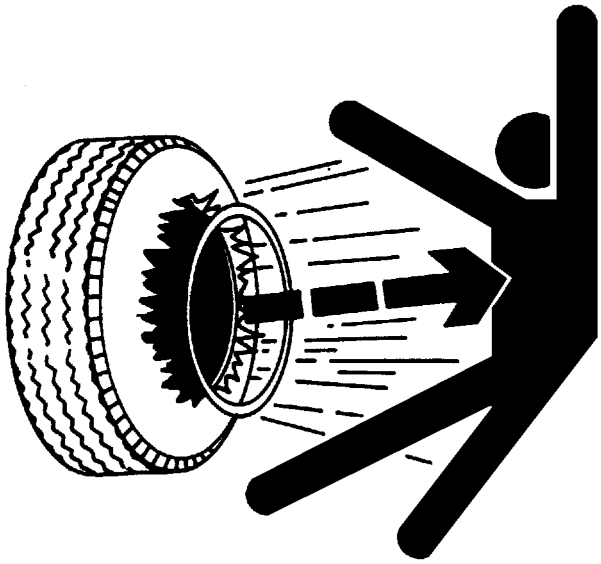


SA-026

SUPPORT MAINTENANCE PROPERLY

- Explosive separation of a tire and rim parts can cause serious injury or death.
  - Do not attempt to mount a tire unless you have the proper equipment and experience to perform the job. Have it done by your authorized dealer or a qualified repair service.
  - Always maintain the correct tire pressure. DO NOT inflate tire above the recommended pressure.
  - When inflating tires, use a chip-on chuck and extension hose long enough to allow you to stand to one side and not in front of or over the tire assembly. Use a safety cage it available.
  - Inspect tires and wheels daily. Do not operate with low pressure, cuts bubbles, damaged rims, or missing lug bolts and nuts.
  - Never cut or weld on an inflated tire or rim assembly. Heat from welding could cause an increase in pressure and may result in tire explosion.

521-E02A-0249

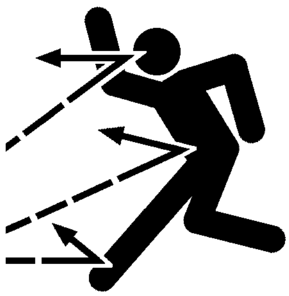


SA-249

PREVENT PARTS FROM FLYING

- Travel reduction gears are under pressure.
  - As pieces may fly off, be sure to keep body and face away from AIR RELEASE PLUG to avoid injury.
  - GEAR OIL is hot. Wait for GEAR OIL to cool, then gradually loosen AIR RELEASE PLUG to release pressure.

503-E03A-0344



SA-344

PREVENT BURNS

Hot spraying fluids:

- After operation, engine coolant is hot and under pressure. Hot water or steam is contained in the engine, radiator and heater lines.
  Skin contact with escaping hot water or steam can cause severe burns.
  - To avoid possible injury from hot spraying water. DO NOT remove the radiator cap until the engine is cool. When opening, turn the cap slowly to the stop. Allow all pressure to be released before removing the cap.
  - The hydraulic oil tank is pressurized. Again, be sure to release all pressure before removing the cap.


SA-039

Hot fluids and surfaces:

- Engine oil, gear oil and hydraulic oil also become hot during operation.
  The engine, hoses, lines and other parts become hot as well.

  - Wait for the oil and components to cool before starting any maintenance or inspection work.


SA-225

505-E01B-0498

REPLACE RUBBER HOSES PERIODICALLY

- Rubber hoses that contain flammable fluids under pressure may break due to aging, fatigue, and abrasion. It is very difficult to gauge the extent of deterioration due to aging, fatigue, and abrasion of rubber hoses by inspection alone.

  - Periodically replace the rubber hoses. (See the page of “Periodic replacement of parts” in the operator’s manual.)

- Failure to periodically replace rubber hoses may cause a fire, fluid injection into skin, or the front attachment to fall on a person nearby, which may result in severe burns, gangrene, or otherwise serious injury or death.

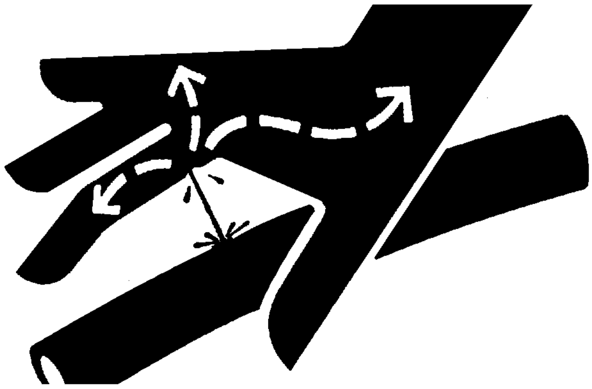

SA-019

S506-E01A-0019

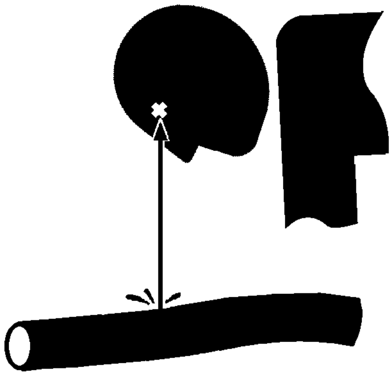
AVOID HIGH-PRESSURE FLUIDS

- Fluids such as diesel fuel or hydraulic oil under pressure can penetrate the skin or eyes causing serious injury, blindness or death.
  - Avoid this hazard by relieving pressure before disconnecting hydraulic or other lines.
  - Tighten all connections before applying pressure.
  - Search for leaks with a piece of cardboard; take care to protect hands and body from high-pressure fluids. Wear a face shield or goggles for eye protection.
  - If an accident occurs, see a doctor familiar with this type of injury immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.

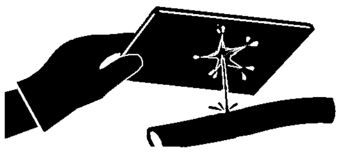
507-E03A-0499



SA-031



SA-292



SA-044

PREVENT FIRES

Check for Oil Leaks:
- Fuel, hydraulic oil and lubricant leaks can lead to fires.
  - Check for oil leaks due to missing or loose clamps, kinked hoses, lines or hoses that rub against each other, damage to the oil-cooler, and loose oil-cooler flange bolts.
  - Tighten, repair or replace any missing, loose or damaged clamps, lines, hoses, oil-cooler and oil-cooler flange bolts.
  - Do not bend or strike high-pressure lines.
  - Never install bent or damaged lines, pipes, or hoses.


SA-019

Check for Shorts:
- Short circuits can cause fires.
  - Clean and tighten all electrical connections.
  - Check before each shift or after eight(8) to ten(10) hours operation for loose, kinked, hardened or frayed electrical cables and wires.
  - Check before each shift or after eight(8) to ten(10) hours operation for missing or damaged terminal caps.
  - DO NOT OPERATE MACHINE if cable or wires are loose, kinked, etc..

Clean up Flammables:
- Spilled fuel and oil, and trash, grease, debris, accumulated coal dust, and other flammables may cause fires.
  - Prevent fires by inspecting and cleaning the machine daily and by removing spilled or accumulated flammables immediately.

Check Key Switch:
- If a fire breaks out, failure to stop the engine will escalate the fire, hampering fire fighting.
  Always check key switch function before operating the machine every day:
  1. Start the engine and run it at slow idle.
  2. Turn the key switch to the OFF position to confirm that the engine stops.
  - If any abnormalities are found, be sure to repair them before operating the machine.

508-E02B-0019

Check Heat Shields:
- Damaged or missing heat shields may lead to fires.
  - Damaged or missing heat shields must be repaired or replaced before operating the machine.

508-E02A-0393

EVACUATING IN CASE OF FIRE

- If a fire breaks out, evacuate the machine in the following way:
  - Stop the engine by turning the key switch to the OFF position if there is time.
  - Use a fire extinguisher if there is time.
  - Exit the machine.

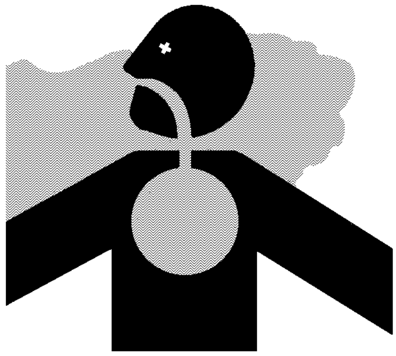
518-E01A-0393

SA-393

BEWARE OF EXHAUST FUMES

- Prevent asphyxiation. Engine exhaust fumes can cause sickness or death.
  - If you must operate in a building, be sure there is adequate ventilation. Either use an exhaust pipe extension to remove the exhaust fumes or open doors and windows to bring enough outside air into the area.

509-E01A-0016

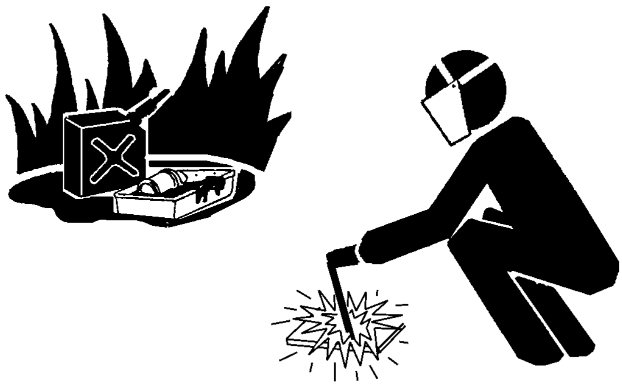


SA-016

PRECAUTIONS FOR WELDING AND GRINDING

- Welding may generate gas and/or small fires.
  - Be sure to perform welding in a well ventilated and prepared area. Store flammable objects in a safe place before starting welding.
  - Only qualified personnel should perform welding. Never allow an unqualified person to perform welding.
- Grinding on the machine may create fire hazards. Store flammable objects in a safe place before starting grinding.
- After finishing welding and grinding, recheck that there are no abnormalities such as the area surrounding the welded area still smoldering.

523-E01A-0818



SA-818

AVOID HEATING NEAR PRESSURIZED FLUID LINES

- Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders.
  - Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials.
  - Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area. Install temporary fireresistant guards to protect hoses or other materials before engaging in welding, soldering, etc..

SA-030

AVOID APPLYING HEAT TO LINES CONTAINING FLAMMABLE FLUIDS

- Do not weld or flame cut pipes or tubes that contain flammable fluids.
- Clean them thoroughly with nonflammable solvent before welding or flame cutting them.

510-E01B-0030

REMOVE PAINT BEFORE WELDING OR HEATING

- Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch. If inhaled, these fumes may cause sickness.
  - Avoid potentially toxic fumes and dust.
  - Do all such work outside or in a well-ventilated area. Dispose of paint and solvent properly.
  - Remove paint before welding or heating:

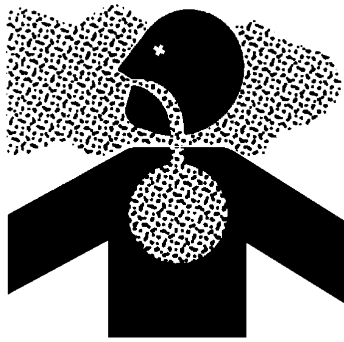
1. If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.
2. If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

SA-029

511-E01A-0029

BEWARE OF ASBESTOS DUST

- Take care not to inhale dust produced in the work site. Inhalation of asbestos fibers may be the cause of lung cancer.
  - Depending on the wok site conditions, the risk of inhaling asbestos fiber may exist. Spray water to prevent asbestos from becoming airborne. Do not use compressed air.
  - When operating the machine in a work site where asbestos might be present, be sure to operate the machine from the upwind side and wear a mask rated to prevent the inhalation of asbestos.
  - Keep bystanders out of the work site during operation.
  - Asbestos might be present in imitation parts. Use only genuine Hitachi Parts.



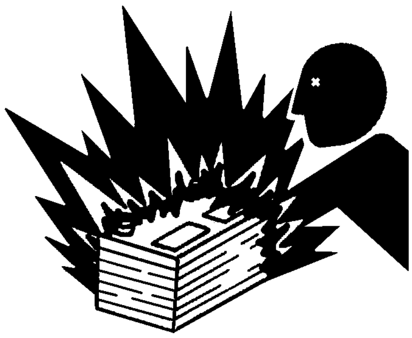
SA-029

PREVENT BATTERY EXPLOSIONS

- Battery gas can explode.
  - Keep sparks, lighted matches, and flame away from the top of battery.
  - Never check battery charge by placing a metal object across the posts. Use a voltmeter or hydrometer.
  - Do not charge a frozen battery; it may explode. Warm the battery to 16 °C (60 °F) first.
  - Do not continue to use or charge the battery when electrolyte level is lower than specified. Explosion of the battery may result.
  - Loose terminals may produce sparks. Securely tighten all terminals.

- Battery electrolyte is poisonous. If the battery should explode, battery electrolyte may be splashed into eyes, possibly resulting in blindness.
  - Be sure to wear eye protection when checking electrolyte specific gravity.

512-E01B-0032



SA-032

SERVICE AIR CONDITIONING SYSTEM SAFELY

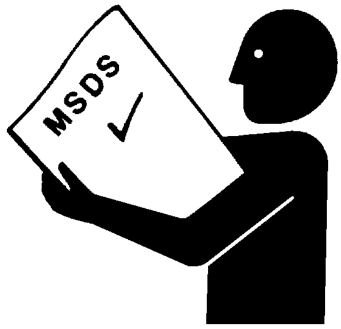
- If spilled onto skin, refrigerant may cause a cold contact burn.
  - Refer to the instructions described on the container for proper use when handling the refrigerant.
  - Use a recovery and recycling system to avoid leaking refrigerant into the atmosphere.
  - Never touch the refrigerant.

513-E01A-0405

SA-405

HANDLE CHEMICAL PRODUCTS SAFELY

- Direct exposure to hazardous chemicals can cause serious injury. Potentially hazardous chemicals used with your machine include such items as lubricants, coolants, paints, and adhesives.
  - A Material Safety Data Sheet (MSDS) provides specific details on chemical products: physical and health hazards, safety procedures, and emergency response techniques.
  - Check the MSDS before you start any job using a hazardous chemical. That way you will know exactly what the risks are and how to do the job safely. Then follow procedures and use recommended equipment.
  - See your authorized dealer for MSDS's (available only in English) on chemical products used with your machine.

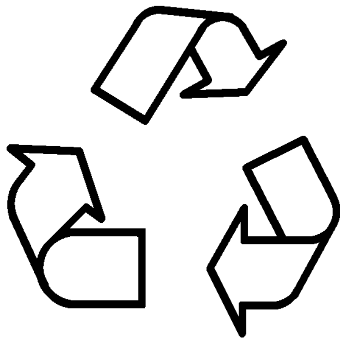


SA-309

515-E01A-0309

DISPOSE OF WASTE PROPERLY

- Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with HITACHI equipment includes such items as oil, fuel, coolant, brake fluid, filters, and batteries.
  - Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.
  - Do not pour waste onto the ground, down a drain, or into any water source.
  - Air conditioning refrigerants escaping into the air can
  - damage the Earth's atmosphere. Government regulations may require a certified air conditioning service center to recover and recycle used air conditioning refrigerants.
  - Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your authorized dealer.



SA-226

516-E01A-0226

BEFORE RETURNING THE MACHINE TO THE CUSTOMER

- After maintenance or repair work is complete, confirm that:
  - ・The machine is functioning properly, especially the safety systems.
  - ・Worn or damaged parts have been repaired or replaced.

S517-E01A-0435

SA-435

SECTION AND GROUP CONTENTS

TECHNICAL MANUAL

(Troubleshooting)

All information, illustrations and specifications in this manual are based on the latest product information available at the time of publication. The right is reserved to make changes at any time without notice.

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Group 4 Wheel Loader Test
Group 5 Component Test
Group 6 Adjustment

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Group 2 Tightening Torque
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OPERATIONAL PERFORMANCE TEST

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OPERATIONAL PERFORMANCE TESTS

Use operational performance test procedure to quantitatively check all system and functions on the machine.

Purpose of Performance Tests

1. To comprehensively evaluate each operational function by comparing the performance test data with the standard values.
2. According to the evaluation results, repair, adjust, or replace parts or components as necessary to restore the machine's performance to the desired standard.
3. To economically operate the machine under optimal conditions.

Kinds of Tests

1. Base machine performance test is to check the operational performance of each system such as engine, travel, swing, and hydraulic cylinders.
2. Hydraulic component unit test is to check the operational performance of each component such as hydraulic pump, motor, and various kinds of valves.

Performance Standards

"Performance Standard" is shown in tables to evaluate the performance test data.

Precautions for Evaluation of Test Data

1. To evaluate not only that the test data are correct, but also in what range the test data are.
2. Be sure to evaluate the test data based on the machine operation hours, kinds and state of work loads, and machine maintenance conditions.

The machine performance does not always deteriorate as the working hours increase. However, the machine performance is normally considered to reduce in proportion to the increase of the operation hours. Accordingly, restoring the machine performance by repair, adjustment, or replacement shall consider the number of the machine's working hours.

Definition of "Performance Standard"

1. Operation speed values and dimensions of the new machine.
2. Operational performance of new components adjusted to specifications. Allowable errors will be indicated as necessary.

PREPARATION FOR PERFORMANCE TESTS

Observe the following rules in order to carry out performance tests accurately and safely.

THE MACHINE

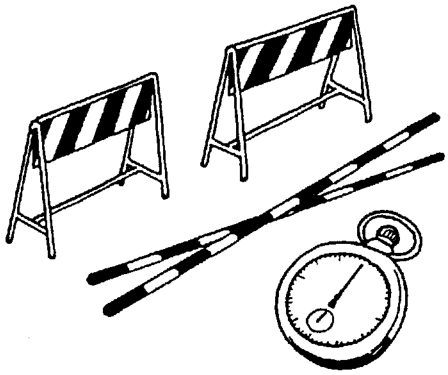
1. Repair any defects and damage found, such as oil or water leaks, loose bolts, cracks and so on, before starting to test.

TEST AREA

1. Select a hard and flat surface.
2. Secure enough space to allow the machine to run straight more than 200 m (656 ft 2 in), and to operate steering.
3. If required, rope off the test area and provide signboards to keep unauthorized personnel away.

PRECAUTIONS

1. Before starting to test, agree upon the signals to be employed for communication among coworkers. Once the test is started, be sure to communicate with each other using these signals, and to follow them without fail.
2. Operate the machine carefully and always give first priority to safety.
3. While testing, always take care to avoid accidents due to landslides or contact with high-voltage power lines. Always confirm that there is sufficient space for full swings.
4. Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.



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MAKE PRECISE MEASUREMENT

1. Accurately calibrate test instruments in advance to obtain correct data.
2. Carry out tests under the exact test conditions prescribed for each test item.
3. Repeat the same test and confirm that the test data obtained can be produced repeatedly. Use mean values of measurements if necessary.

OPERATIONAL PERFORMANCE STANDARD TABLE

- ZW220

The standard performance values are listed in the table below. Refer to the Group T4-3 or later for performance test procedures.

The following switch positions shall be selected and the hydraulic oil temperature shall be maintained as indicated below as the preconditions of performance tests unless otherwise instructed in each performance test procedure:

Acceletor Pedal : Full Stroke
Driving Mode Switch : H Mode
Work Mode Switch : N Mode
Hydraulic Oil Temperature : 50±5 °C (122±41 °F)

NOTE: 1 mm=0.03937 in

PERFORMANCE TEST DESIGNATION	Performance Standard	Remarks	Reference Page
ENGINE SPEED (FAN SPEED min/max) min^{-1}			T4-3-1
Slow Idle Speed (without load)	840±25	Value indicated on Dr. ZX	
Fast Idle Speed (without load)	2230/2220±25	↑	
Fast Idle Speed (with engine stalled)	1990/1900±50	↑	
Fast Idle Speed (with engine stalled and relieved)	1760/1750±50	↑	
ENGINE COMPRESSION PRESSURE MPa (kgf/cm^2, psi)	3.04 (31.0, 442)	Engine speed: 200min^{-1}	T4-3-3
VALVE CLEARANCE (IN, EX) mm	0.4	With the engine cold	T4-3-4
LUBRICANT CONSUMPTION (Rated output) mL/h	45 or less	Hour meter: 2000 hours or less	T4-3-7
DRIVE BELT BEND mm	6 to 8		T4-6-8
RADIATOR CAP OPENING PRESSURE kPa (kgf/cm^2, psi)	49 (0.5, 7)		-

OPERATIONAL PERFORMANCE TEST / Standard

PERFORMANCE TEST DESIGNATION	Performance Standard	Remarks	Reference Page
TRAVEL SPEED km/h			T4-4-1
First Gear (Forward/Reverse)	7.0/7.1±0.7	Value indicated on Dr. ZX	
Second Gear (Forward/Reverse)	12.3/12.3±1.2	↑	
Third Gear (Forward/Reverse)	22.0/22.0±2.2	↑	
Fourth (Forward/Reverse)	34.5/34.5±3.6	↑	
SERVICE BRAKE CAPACITY m	5.0 or less		T4-4-2
SERVICE BRAKE WEAR mm			T4-4-3
Brake Disc	6.2	Allowable Limit: 5.3	
Brake Ring (t=15)	15.0	Allowable Limit: 13.5	
Brake Ring (t=5)	5.0	Allowable Limit: 4.3	
PARKING BRAKE CAPACITY mm/5 min	0		T4-4-4
PARKING BRAKE WEAR mm			-
Brake Disc	2.2	Allowable Limit: 1.9	
Brake Ring	2.4	Allowable Limit: 2.2	
BUCKET STOPPER CLEARANCE mm	0		T4-4-6
BELL CRANK STOPPER CLEARANCE mm	2		T4-4-6
FRONT PIN WEAR mm (to new pin outer diameter)	-	Allowable Limit: -1.0	-
FRONT BUSHING WEAR mm (to new pin outer diameter)	-	Allowable Limit: -1.5	-
CLEARANCE BETWEEN FRONT PIN AND BUSHING mm	0.3		-
BUCKET BUMP mm	14		T4-4-11
HYDRAULIC CYLINDER CYCLE TIME sec			T4-4-8
Lift Arm Raise	5.3±0.3		
Lift Arm Lower (Float)	2.9±0.3		
Bucket Roll-Out	1.2±0.3		
Steering (engine: neutral)	2.8±0.3		
Steering (engine: full)	2.5±0.3		
DIG FUNCTION DRIFT CHECK mm/15 min			T4-4-10
Lift Arm Cylinder	45 or less		
Bucket Cylinder	15 or less		
Bucket Bottom	150 or less		

PERFORMANCE TEST DESIGNATION	Performance Standard	Remarks	Reference Page
CONTROL LEVER OPERATING FORCE N (kgf, lbf)			T4-4-12
Lift Arm Raise (STD/MF)	11 (1.1, 2.5)/ 19 (1.9, 4.3) or less		
Lift Arm Raise Detent (STD/MF)	17 (1.7, 3.8)/ 30 (3.1, 6.8) or less		
Lift Arm Raise Detent Release (STD/MF)	40 (4.1, 9)/ 20(2.0, 4.5) or less		
Lift Arm Lower (STD/MF)	11 (1.1, 2.5)/ 19 (1.9, 4.3) or less		
Lift Arm Lower Float (STD/MF)	17 (1.7, 3.8)/ 30 (3.1, 6.8) or less		
Lift Arm Lower Float Release (STD/MF)	40 (4.1, 9)/ 20 (2.0, 4.5) or less		
Bucket Lever Tilt (STD/MF)	12 (1.2, 2.7)/ 22 (2.2, 5) or less		
Bucket Lever Tilt Detent (STD/MF)	18 (1.8, 4)/ 33 (3.3, 7.4) or less		
Bucket Lever Tilt Detent Release (STD/MF)	40 (4.1, 9)/ 20 (2.0, 4.5) or less		
Bucket Lever Dump (STD/MF)	17(1.7, 3.8)/ 28 (2.9, 6.3) or less		
Steering Wheel (Right/Left)	17 (1.7, 3.8)/ 17 (1.7, 3.8) or less		
Forward/Reverse Lever	11.8^{+1}_{-2} ($1.2^{+0.1}_{-0.2}$, $2.7^{+0.2}_{-0.5}$)/ 11.8^{+1}_{-2} ($1.2^{+0.1}_{-0.2}$, $2.7^{+0.2}_{-0.5}$)		
Accelerator Pedal	25.0 ± 3.5 (3.6 ± 0.4, 5.6 ± 0.8)		
Brake Pedal Right	318^{+65}_{-45} ($32.4^{+6.6}_{-4.6}$, $71.6^{+14.6}_{-10.1}$)		
Inching Pedal Left	288^{+80}_{-30} ($29.4^{+8.2}_{-3.1}$, $64.8^{+18}_{-6.8}$)		

NOTE: STD: Standard Lever (Two-Lever)
MF: Multi-Function Lever (Joystick Lever)

PERFORMANCE TEST DESIGNATION	Performance Standard	Remarks	Reference Page
CONTROL LEVER STROKE mm			T4-4-13
Lift Arm Raise Position (STD/MF)	34±5/63±10		
Lift Arm Raise Detent Position (STD/MF)	54±5/80±10		
Lift Arm Lower Position (STD/MF)	34±5/63±10		
Lift Arm Lower Float Position (STD/MF)	54±5/80±10		
Bucket Lever Tilt Position (STD/MF)	34±5/63±10		
Bucket Lever Tilt Detent Position (STD/MF)	54±5/80±10		
Bucket Lever Dump Position (STD/MF)	54±5/80±10		
Steering Wheel Rotation (Right Max. to Left Max.)	3.5 to 4.0		
Forward/Reverse Lever (F/R)	50±5/50±5		
Accelerator Pedal Depressing Angle (without play)	18.0°±1.5		
Brake Pedal (Right) Depressing Angle (without play)	18.4°±1.0		
Inching Pedal (Left) Depressing Angle (without play)	17.4°±1.0		
Steering Wheel Play	5 to 15		
Brake Pedal Play	12 to 20		
ELECTROLYTE DENSITY (Specification at 20 °C)	1.26	Allowable Limit: 1.16	-
TIRE INFLATION kPa (kgf/cm^2, psi)	375 (3.83, 55)		-

NOTE: STD: Standard Lever (Two-Lever)
MF: Multi-Function Lever (Joystick Lever)

PERFORMANCE TEST DESIGNATION	Performance Standard	Remarks	Reference Page
PRIMARY PILOT PRESSURE MPa (kgf/cm^2, psi)	$4.0^{+1.0}_{-0.5}$ (41^{+10}_{-5}, 580^{+142}_{-71})		T4-5-1
SECONDARY PILOT PRESSURE MPa (kgf/cm^2, psi)	$3.7^{+0.5}_{-0.3}$ (38^{+5}_{-3}, 538^{+73}_{-64})		T4-5-3
SOLENOID VALVE SET PRESSURE MPa (kgf/cm^2, psi)			
Solenoid Valve Unit Set Pressure	Value indicated on Dr. ZX±0.2 (2, 28)	Value indicated on Dr. ZX	T4-5-4
MAIN PUMP DELIVERY PRESSURE MPa (kgf/cm^2, psi)	$2.0^{+1.0}_{-0.5}$ (20^{+10}_{-5}, 100^{+142}_{-71})	In neutral, Value indicated on Dr. ZX	T4-5-6
MAIN RELIEF VALVE PRESSURE MPa (kgf/cm^2, psi)			T4-5-8
Lift Arm (Relief operation)	$27.4^{+2.0}_{-0.5}$ (280^{+20}_{-5}, 3983^{+284}_{-71})	Value indicated on Dr. ZX	
Bucket (Relief operation)	$27.4^{+2.0}_{-0.5}$ (280^{+20}_{-5}, 3983^{+284}_{-71})	Value indicated on Dr. ZX	
OVERLOAD RELIEF PRESSURE MPa (kgf/cm^2, psi)	(Reference values at 50 L/min)		T4-5-14
Lift Arm Raise	$34.3^{+1.0}_{-0}$ (350^{+10}_{-0}, 4987^{+142}_{-0})		
Bucket Roll-In	$30.4^{+1.0}_{-0}$ (310^{+10}_{-0}, 4420^{+142}_{-0})		
Bucket Roll-Out	$30.4^{+1.0}_{-0}$ (310^{+10}_{-0}, 4420^{+142}_{-0})		
MAIN PUMP FLOW RATE (L/min)	-		T4-5-16
STEERING RELIEF PRESSURE MPa (kgf/cm^2, psi)	$27.4^{+2.0}_{-0.5}$ (280^{+20}_{-5}, 3983^{+291}_{-73})	Value indicated on Dr. ZX	T4-5-12
SERVICE BRAKE PRESSURE (Forward/Reverse) MPa (kgf/cm^2, psi)	4.18±0.85 (42.7±8.7, 608±124)	at Brake Pedal (Right)	T4-5-22
PARKING BRAKE PRESSURE MPa (kgf/cm^2, psi)	$3.7^{+0.5}_{-0.3}$ (38^{+5}_{-3}, 538^{+73}_{-44})		T4-5-24
BRAKE ACCUMULATOR PRESSURE MPa (kgf/cm^2, psi)			T4-5-26
Service Brake	14.7±1.0 (150±10, 2137±145)		
Parking Brake	$3.7^{+0.5}_{-0.3}$ (38^{+5}_{-3}, 538^{+73}_{-44})		
BRAKE WARNING PRESSURE (Pressure-Decreasing) MPa (kgf/cm^2, psi)	8±0.5 (82±5, 1163±73)		T4-5-28
BRAKE WARNING PRESSURE (Pressure-Increasing) MPa (kgf/cm^2, psi)	10±0.5 (102±5, 1454±73)		T4-5-30
TRANSMISSION CLUTCH PRESSURE MPa (kgf/cm^2, psi)	2.2 to 2.4 (22 to 24, 320 to 349)		T4-5-32
TORQUE CONVERTER PRESSURE (Inlet/Outlet) MPa (kgf/cm^2, psi)	0.84 to 0.94 (8.6 to 9.6, 122 to 137)/ 0.32 to 0.42 (3.3 to 4.3, 47 to 61)		T4-5-33

- ZW250

The standard performance values are listed in the table below. Refer to the Group T4-3 or later for performance test procedures.

The following switch positions shall be selected and the hydraulic oil temperature shall be maintained as indicated below as the preconditions of performance tests unless otherwise instructed in each performance test procedure:

Acceletor Pedal : Full Stroke
Driving Mode Switch : H Mode
Work Mode Switch : N Mode
Hydraulic Oil Temperature : 50±5 °C (122±41 °F)

NOTE: 1 mm=0.03937 in

PERFORMANCE TEST DESIGNATION	Performance Standard	Remarks	Reference Page
ENGINE SPEED (FAN SPEED min/max) min^{-1}			T4-3-1
Slow Idle Speed (without load)	840±25	Value indicated on Dr. ZX	
Fast Idle Speed (without load)	2300/2290±25	↑	
Fast Idle Speed (with engine stalled)	2040/1960±50	↑	
Fast Idle Speed (with engine stalled and relieved)	1790/1770±50	↑	
ENGINE COMPRESSION PRESSURE MPa (kgf/cm^2, psi)	3.04 (31.0, 442)	Engine speed: 200min^{-1}	T4-3-3
VALVE CLEARANCE (IN, EX) mm	0.4	With the engine cold	T4-3-4
LUBRICANT CONSUMPTION (Rated output) mL/h	45 or less	Hour meter: 2000 hours or less	T4-3-7
DRIVE BELT BEND mm	6 to 8		T4-6-8
RADIATOR CAP OPENING PRESSURE kPa (kgf/cm^2, psi)	49 (0.5, 7)		-

PERFORMANCE TEST DESIGNATION	Performance Standard	Remarks	Reference Page
TRAVEL SPEED km/h			T4-4-1
First Gear (Forward/Reverse)	7.1/7.1±0.7	Value indicated on Dr. ZX	
Second Gear (Forward/Reverse)	12.3/12.3±1.2	↑	
Third Gear (Forward/Reverse)	21.9/21.9±2.2	↑	
Fourth (Forward/Reverse)	34.5/34.5±3.5	↑	
SERVICE BRAKE CAPACITY m	5.0 or less		T4-4-2
SERVICE BRAKE WEAR mm			T4-4-3
Brake Disc	6.2	Allowable Limit: 5.3	
Brake Ring (t=15)	15.0	Allowable Limit: 13.5	
Brake Ring (t=5)	5.0	Allowable Limit: 4.5	
PARKING BRAKE CAPACITY mm/5 min	0		T4-4-4
PARKING BRAKE WEAR mm			-
Brake Disc	2.2	Allowable Limit: 1.9	
Brake Ring	2.4	Allowable Limit: 2.2	
BUCKET STOPPER CLEARANCE mm	0		T4-4-6
BELL CRANK STOPPER CLEARANCE mm	2		T4-4-6
FRONT PIN WEAR mm (to new pin outer diameter)	-	Allowable Limit: -1.0	-
FRONT BUSHING WEAR mm (to new pin outer diameter)	-	Allowable Limit: -1.5	-
CLEARANCE BETWEEN FRONT PIN AND BUSHING mm	0.3		-
BUCKET BUMP mm	14		T4-4-11
HYDRAULIC CYLINDER CYCLE TIME sec			T4-4-8
Lift Arm Raise	5.3±0.3		
Lift Arm Lower (Float)	2.9±0.3		
Bucket Roll-Out	1.1±0.3		
Steering (engine: neutral)	2.8±0.3		
Steering (engine: full)	2.5±0.3		
DIG FUNCTION DRIFT CHECK mm/15 min			T4-4-10
Lift Arm Cylinder	45 or less		
Bucket Cylinder	15 or less		
Bucket Bottom	150 or less		

PERFORMANCE TEST DESIGNATION	Performance Standard	Remarks	Reference Page
CONTROL LEVER OPERATING FORCE N (kgf, lbf)			T4-4-12
Lift Arm Raise (STD/MF)	11 (1.1, 2.5)/ 19 (1.9, 4.3) or less		
Lift Arm Raise Detent (STD/MF)	17 (1.7, 3.8)/ 30 (3.1, 6.8) or less		
Lift Arm Raise Detent Release (STD/MF)	40 (4.1, 9)/ 20(2.0, 4.5) or less		
Lift Arm Lower (STD/MF)	11 (1.1, 2.5)/ 19 (1.9, 4.3) or less		
Lift Arm Lower Float (STD/MF)	17 (1.7, 3.8)/ 30 (3.1, 6.8) or less		
Lift Arm Lower Float Release (STD/MF)	40 (4.1, 9)/ 20 (2.0, 4.5) or less		
Bucket Lever Tilt (STD/MF)	12 (1.2, 2.7)/ 22 (2.2, 5) or less		
Bucket Lever Tilt Detent (STD/MF)	18 (1.8, 4)/ 33 (3.3, 7.4) or less		
Bucket Lever Tilt Detent Release (STD/MF)	40 (4.1, 9)/ 20 (2.0, 4.5) or less		
Bucket Lever Dump (STD/MF)	17(1.7, 3.8)/ 28 (2.9, 6.3) or less		
Steering Wheel (Right/Left)	17 (1.7, 3.8)/ 17 (1.7, 3.8) or less		
Forward/Reverse Lever	11.8^{+1}_{-2} ($1.2^{+0.1}_{-0.2}$, $2.7^{+0.2}_{-0.5}$)/ 11.8^{+1}_{-2} ($1.2^{+0.1}_{-0.2}$, $2.7^{+0.2}_{-0.5}$)		
Accelerator Pedal	25.0 ± 3.5 (3. 6 ± 0.4, 5.6 ± 0.8)		
Brake Pedal Right	318^{+65}_{-45} ($32.4^{+6.6}_{-4.6}$, $71.6^{+14.6}_{-10.1}$)		
Inching Pedal Left	288^{+80}_{-30} ($29.4^{+8.2}_{-3.1}$, $64.8^{+18}_{-6.8}$)		

NOTE: STD: Standard Lever (Two-Lever)
MF: Multi-Function Lever (Joystick Lever)

PERFORMANCE TEST DESIGNATION	Performance Standard	Remarks	Reference Page
CONTROL LEVER STROKE mm			T4-4-13
Lift Arm Raise Position (STD/MF)	34±5/63±10		
Lift Arm Raise Detent Position (STD/MF)	54±5/80±10		
Lift Arm Lower Position (STD/MF)	34±5/63±10		
Lift Arm Lower Float Position (STD/MF)	54±5/80±10		
Bucket Lever Tilt Position (STD/MF)	34±5/63±10		
Bucket Lever Tilt Detent Position (STD/MF)	54±5/80±10		
Bucket Lever Dump Position (STD/MF)	54±5/80±10		
Steering Wheel Rotation (Right Max. to Left Max.)	3.5 to 4.0		
Forward/Reverse Lever (F/R)	50±5/50±5		
Accelerator Pedal Depressing Angle (without play)	18.0°±1.5		
Brake Pedal (Right) Depressing Angle (without play)	18.4°±1.0		
Inching Pedal (Left) Depressing Angle (without play)	17.4°±1.0		
Steering Wheel Play	5 to 15		
Brake Pedal Play	12 to 20		
ELECTROLYTE DENSITY (Specification at 20 °C)	1.26	Allowable Limit: 1.16	-
TIRE INFLATION kPa (kgf/cm^2, psi)	375 (3.75, 47.3)		-

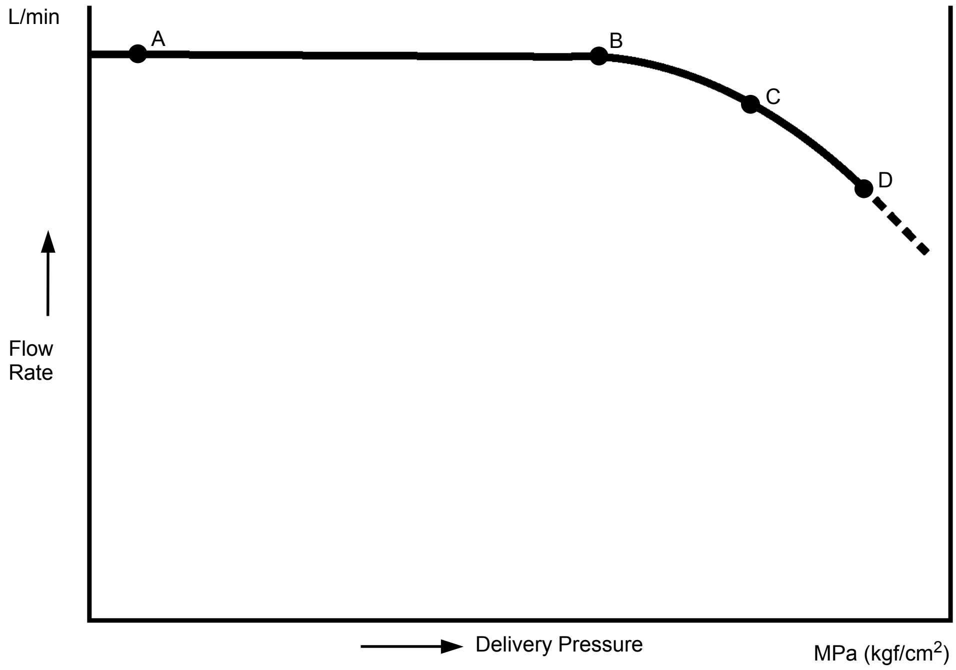
NOTE: STD: Standard Lever (Two-Lever)
MF: Multi-Function Lever (Joystick Lever)

PERFORMANCE TEST DESIGNATION	Performance Standard	Remarks	Reference Page
PRIMARY PILOT PRESSURE MPa (kgf/cm^2, psi)	$4.0^{+1.0}_{-0.5}$ (41^{+10}_{-5}, 580^{+142}_{-71})		T4-5-1
SECONDARY PILOT PRESSURE MPa (kgf/cm^2, psi)	$3.7^{+0.5}_{-0.3}$ (38^{+5}_{-3}, 538^{+73}_{-64})		T4-5-3
SOLENOID VALVE SET PRESSURE MPa (kgf/cm^2, psi)			
Solenoid Valve Unit Set Pressure	Value indicated on Dr. ZX±0.2 (2, 28)	Value indicated on Dr. ZX	T4-5-4
MAIN PUMP DELIVERY PRESSURE MPa (kgf/cm^2, psi)	$2.0^{+1.0}_{-0.5}$ (20^{+10}_{-5}, 100^{+142}_{-71})	In neutral, Value indicated on Dr. ZX	T4-5-6
MAIN RELIEF VALVE PRESSURE MPa (kgf/cm^2, psi)			T4-5-8
Lift Arm (Relief operation)	$29.4^{+2.0}_{-0.5}$ (300^{+20}_{-5}, 4274^{+284}_{-71})	Value indicated on Dr. ZX	
Bucket (Relief operation)	$29.4^{+2.0}_{-0.5}$ (300^{+20}_{-5}, 4274^{+284}_{-71})	Value indicated on Dr. ZX	
OVERLOAD RELIEF PRESSURE MPa (kgf/cm^2, psi)	(Reference values at 50 L/min)		T4-5-14
Lift Arm Raise	$36.8^{+1.0}_{-0}$ (375^{+10}_{-0}, 5350^{+142}_{-0})		
Bucket Roll-In	$32.5^{+1.0}_{-0}$ (332^{+10}_{-0}, 4725^{+142}_{-0})		
Bucket Roll-Out	$32.5^{+1.0}_{-0}$ (332^{+10}_{-0}, 4725^{+142}_{-0})		
MAIN PUMP FLOW RATE (L/min)	-		T4-5-16
STEERING RELIEF PRESSURE MPa (kgf/cm^2, psi)	$29.4^{+2.0}_{-0.5}$ (300^{+20}_{-5}, 4274^{+291}_{-73})	Value indicated on Dr. ZX	T4-5-12
SERVICE BRAKE PRESSURE (Forward/Reverse) MPa (kgf/cm^2, psi)	4.18±0.85 (42.7±8.7, 608±124)	at Brake Pedal (Right)	T4-5-22
PARKING BRAKE PRESSURE MPa (kgf/cm^2, psi)	$3.7^{+0.5}_{-0.3}$ (38^{+5}_{-3}, 538^{+73}_{-44})		T4-5-24
BRAKE ACCUMULATOR PRESSURE MPa (kgf/cm^2, psi)			T4-5-26
Service Brake	14.7±1.0 (150±10, 2137±145)		
Parking Brake	$3.7^{+0.5}_{-0.3}$ (38^{+5}_{-3}, 538^{+73}_{-44})		
BRAKE WARNING PRESSURE (Pressure-Decreasing) MPa (kgf/cm^2, psi)	8±0.5 (82±5, 1163±73)		T4-5-28
BRAKE WARNING PRESSURE (Pressure-Increasing) MPa (kgf/cm^2, psi)	10±0.5 (102±5, 1454±73)		T4-5-30
TRANSMISSION CLUTCH PRESSURE MPa (kgf/cm^2, psi)	2.2 to 2.4 (22 to 24, 320 to 349)		T4-5-32
TORQUE CONVERTER PRESSURE (Inlet/Outlet) MPa (kgf/cm^2, psi)	0.94 to 1.04 (9.6 to 10.6, 137 to 151)/ 0.34 to 0.44 (3.5 to 4.5, 49 to 64)		T4-5-33

MAIN PUMP P-Q CURVE

P-Q Control (Torque Control)
(REFERENCE: Measured at Test Stand)

- Rated Pump Speed:
  ZW220: 2170 min^{-1} (rpm)
  ZW250: 2240 min^{-1} (rpm)
- Hydraulic Oil Temperature: 50±5 °C (122±41 °F)

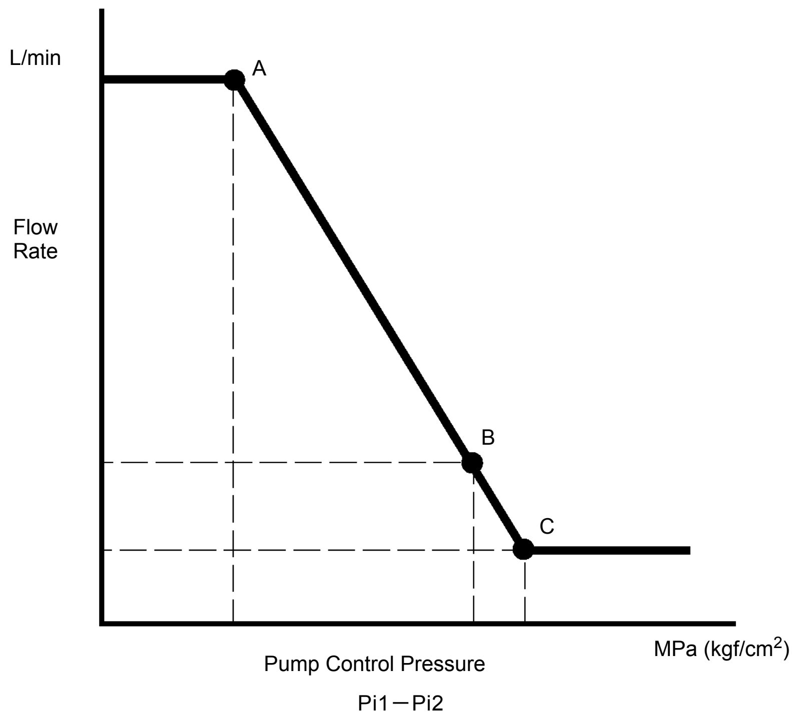


T4GB-04-02-001

	ZW220		ZW250	
	Delivery Pressure MPa (kgf/cm^2, psi)	Flow Rate L/min (gpm)	Delivery Pressure MPa (kgf/cm^2, psi)	Flow Rate L/min (gpm)
A	4.9 (50, 712)	271±3 (72±0.8)	4.9 (50, 712)	291±3 (77±0.8)
B	19.6 (200, 2849)	270±3 (71±0.8)	19.6 (200, 2849)	290±3 (77±0.8)
C	24.5 (250, 3562)	240±6 (63±1.6)	25.5 (260, 3707)	275±6 (73±1.6)
D	27.4 (280, 3983)	210±6 (55±1.6)	29.4 (300, 4274)	225±6 (59±1.6)

P-Q Control by Pump Control Pilot Pressure Signal
(REFERENCE: Measured at Test Stand)

- Rated Pump Speed:
  ZW220: 2170 min^{-1} (rpm)
  ZW250: 2240 min^{-1} (rpm)
- Hydraulic Oil Temperature: 50±5 °C (122±41 °F)



T4GB-04-02-002

	ZW220		ZW250	
	Pump Control Pressure (Pi1－Pi2) MPa (kgf/cm², psi)	Flow Rate L/min (gpm)	Pump Control Pressure (Pi1－Pi2) MPa (kgf/cm², psi)	Flow Rate L/min (gpm)
A	$0.39^{+0.01}_{-0}$ ($4^{+0.1}_{-0}$, $57^{+1.5}_{-0}$)	271±3 (172±0.8)	$0.49^{+0.01}_{-0}$ ($5^{+0.1}_{-0}$, $71^{+1.5}_{-0}$)	291±3 (77±0.8)
B	1.47±0.05 (15±0.5, 214±7)	80±2 (21±0.5)	1.47±0.05 (15±0.5, 214±7)	100±2 (26±0.5)
C	$1.67^{+0.01}_{-0}$ ($17^{+0.1}_{-0}$, $243^{+1.5}_{-0}$)	36±3 (10±0.8)	$1.67^{+0.01}_{-0}$ ($17^{+0.1}_{-0}$, $243^{+1.5}_{-0}$)	55±3 (15±0.8)

SENSOR ACTIVATING RANGE

1. Checking Method
- Hydraulic Oil Temperature: 50 ± 5 °C (122±41 °F)
- Unless specified:

Engine Speed	Work Mode Switch
Fast Idle	N

- Monitor each sensor by using Dr. ZX.

2. Sensor Activating Range
- ZW220

Item	Operation	Specification MPa (kgf/cm^2, psi)
Pump Delivery Pressure	Neutral	1.2 to 2.6 (12 to 27, 174 to 378)
	Relieved	26.7 to 30.0 (272 to 306, 3882 to 4361)
Implement Pressure	Neutral	1.2 to 2.6 (12 to 27, 174 to 378)
	Implement Lever: Relieved	26.7 to 30.0 (272 to 306, 3882 to 4361)
Parking Brake Pressure	Parking Brake Switch: ON	0 to 0.1 (0 to 1, 0 to 15)
	Parking Brake Switch: OFF	3.6 to 4.3 (37 to 44, 523 to 625)
Service Brake Pressure	Brake Pedal: Neutral	0 to 0.1 (0 to 1, 0 to 15)
	Brake Pedal: Fully Depressed	3.3 to 5.0 (34 to 51, 480 to 727)

- ZW250

Item	Operation	Specification MPa (kgf/cm^2, psi)
Pump Delivery Pressure	Neutral	1.2 to 2.6 (12 to 27, 174 to 378)
	Relieved	28.7 to 32.0 (293 to 327, 4172 to 4652)
Implement Pressure	Neutral	1.2 to 2.6 (12 to 27, 174 to 378)
	Implement Lever: Relieved	28.7 to 32.0 (293 to 327, 4172 to 4652)
Parking Brake Pressure	Parking Brake Switch: ON	0 to 0.1 (0 to 1, 0 to 15)
	Parking Brake Switch: OFF	3.6 to 4.3 (37 to 44, 523 to 625)
Service Brake Pressure	Brake Pedal: Neutral	0 to 0.1 (0 to 1, 0 to 15)
	Brake Pedal: Fully Depressed	3.3 to 5.0 (34 to 51, 480 to 727)

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ENGINE SPEED

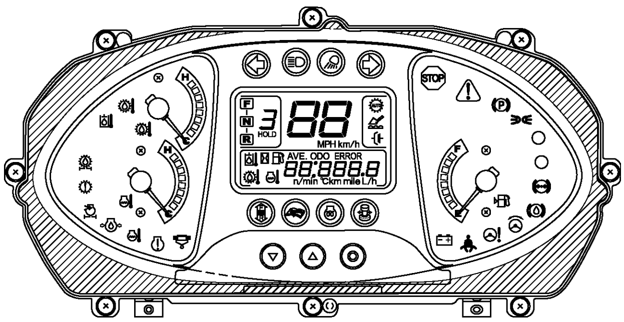
Summary

1. Measure the engine speed by using the monitor unit or Dr. ZX.
2. Measure the engine speeds in each mode.

NOTE: If the engine speed is not adjusted correctly, all other performance data will be unreliable. Consequently, measure the engine speed before performing all other tests in order to check that the engine speed meets specification.

Preparation:

1. Select the monitor which is started on the service mode or Engine Actual Speed on the MC screen by Dr.ZX.
2. Warm up the machine until coolant temperature reaches 50 °C (122 °F) or more, hydraulic oil temperature is 50±5 °C (122±41 °F) and Transmission oil temperature is 85±5 °C (185±41 °F).



M4GB-01-039

Measurement:

1. Measure the items as followings: slow idle with no load), fast idle (with no load), fast idle (when engine stalls) and fast idle (when engine stalls and is relieved).
2. When measuring, set the switch and test condition as shown in the table below in response to the engine speed to be measured.

	Forward/Reverse Lever	Accelerator Pedal	Travel Mode Switch	Work Mode Switch
Slow Idle (with no load)	N	No depression	M	N
Fast Idle (with no load)	Forward third/fourth gear	Full depression	M	N
Fast Idle (when engine stalls)	N	Full depression	M	N
Fast Idle (when engine stalls and is relieved)	Forward third/fourth gear	Full depression	M	N

	Clutch Cut Position Switch	Brake Pedal	Parking Brake Switch	Control Lever (Bucket)
Slow Idle (with no load)	-	-	ON	Transporting position No control lever operation
Fast Idle (with no load)	S	Full depression	ON	Transporting position No control lever operation
Fast Idle (when engine stalls)	OFF	Full depression	OFF	Transporting position No control lever operation
Fast Idle (when engine stalls and is relieved)	OFF	Full depression	OFF	Transporting position Bucket is raised and relieved.

Evaluation:
Refer to Operational Performance Standard in Group T4-2.

Remedy:
Refer to Troubleshooting in Section T5.

ENGINE COMPRESSION PRESSURE

Summary:

1. Measure compression pressure in the cylinders and check for a decline in engine power.
2. Check exhaust gas color. Keep track of engine oil consumption.
3. Check for abnormalities in the intake system, including the air filter.

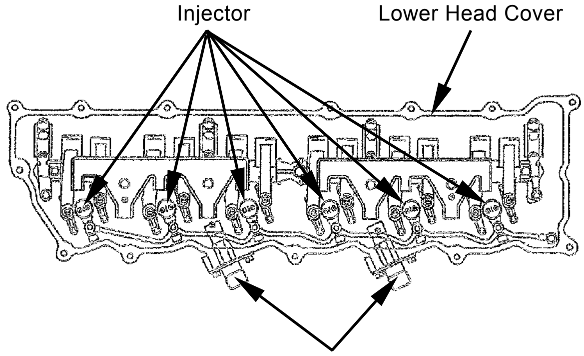
Preparation:

1. Confirm that valve clearances are correct.
2. Confirm that the batteries are charged properly.
3. Run the engine until the coolant temperature gauge reaches the operating range.
4. Remove all the glow plugs from each cylinder.

   : 20 N·m (2.0 kgf·m, 14.8 lbf·ft)

IMPORTANT: **If disconnecting the connector of injector, fuel cannot be jetted. Therefore, ECM judges that the fuel system is faulty and the fault code is displayed. After measurement, delete the displayed fault code.**

5. Disconnect the connector of injector which is installed to the lower head cover.
6. Install the negative terminal of battery.
7. Turn the starter. Exhaust foreign subjects from the cylinder.
8. Install a pressure gauge and an adaptor (Isuzu EN-46722) to the glow plug mounting part. (Sufficiently install them in order to prevent air leakage.)



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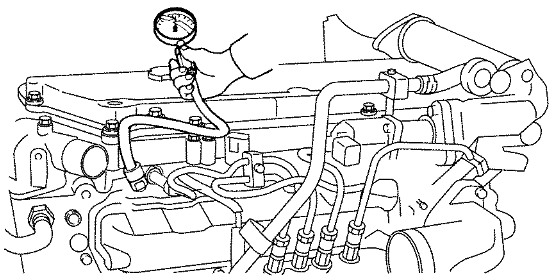


T1V1-04-03-005

Measurement:

1. Turn the starter and measure compression pressure of each cylinder.
2. Repeat the measurement three times and calculate the mean values.

Evaluation:

Refer to Operational Performance Standard in Group T4-2.

Remedy:

Refer to the engine shop manual.

VALVE CLEARANCE

Summary:
1. Perform the measurement when the engine is cold.
2. Before starting any work, clean the head cover mounting area and avoid contamination in the engine.

Preparation:
1. Remove the head cover.
2. Remove the terminal nut which secures the harness to the injector.

   : 2 N·m (0.2 kgf·m, 1.5 lbf·ft)
3. Remove the harness assembly from the injector.
4. Remove the leak off pipe.

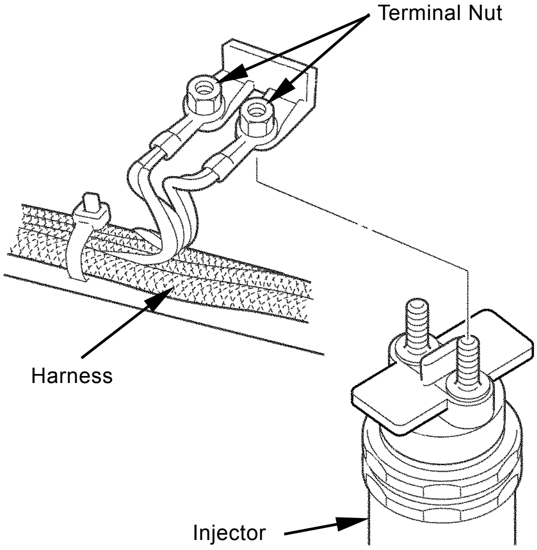
   : 12 N·m (1.2 kgf·m, 8.9 lbf·ft)
5. Rotate the crank pulley. Align the top dead center (TDC) mark on crank pulley with the top mark located on timing gear case.

NOTE: *When rotating the crank pulley, remove the fan guard. Then, rotate the fan while holding the fan belt. If it is difficult to rotate, remove all glow plugs and release compression pressure.*

6. Check if piston No.1 (or piston No.4) is now positioned at the TDC in the compression stroke.

NOTE: *Move push rods for the intake and exhaust valves on the No.1 cylinder up and down by hand. If any clearances on the both ends of the push rods are found, piston No.1 is positioned at TDC in the compression stroke. (If the exhaust valve of cylinder No.1 is pushed down, piston No.4 is positioned at TDC in the compression stroke.*

7. Start measurement from the cylinder (No.1 or No.6) positioned at TDC in the compression stroke.



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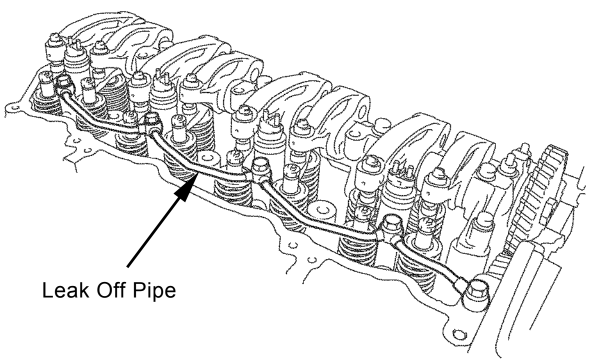

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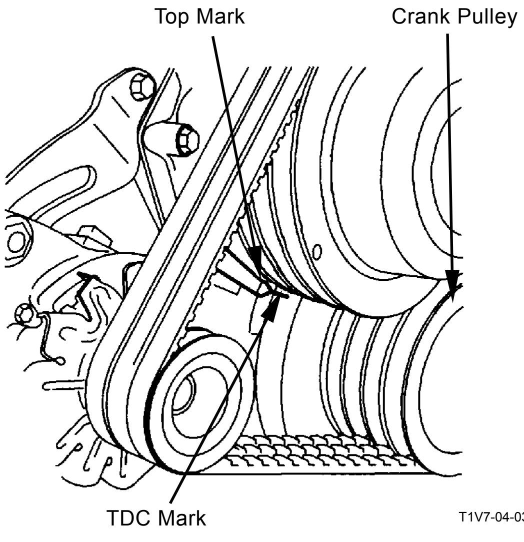
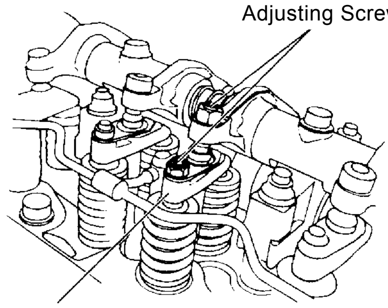


T1V7-04-03-001

Measurement:

1. Insert a thickness gauge into the clearance between rocker arm and bridge cap end and measure the valve clearance.



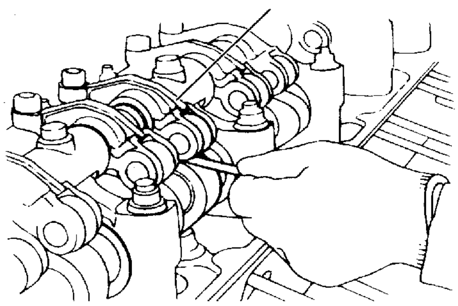
T4GB-04-03-003

NOTE: The cylinders are aligned from No.1 to No.6 in that order, as viewed from the fan side. Injection Order: 1-5-3-6-2-4

2. When measurement is started from No.1 cylinder, perform the same measurement to all valves indicated with the mark "○" in the table below. (When measurement is started from No.6 cylinder, perform the measurement in the valves shown with mark "×".)

Cylinder No.	No.1		No.2		No.3		No.4		No.5		No.6	
Valve locations	I	E	I	E	I	E	I	E	I	E	I	E
When the measurement is started from No.1 cylinder	○	○	○			○	○			○		
When the measurement is started from No.6 cylinder				×	×			×	×		×	×

3. Rotate the crankshaft 360°. Align the TDC mark with the pointer. Continue measurement of other valves in the same way.



T4GB-04-03-004

Evaluation:

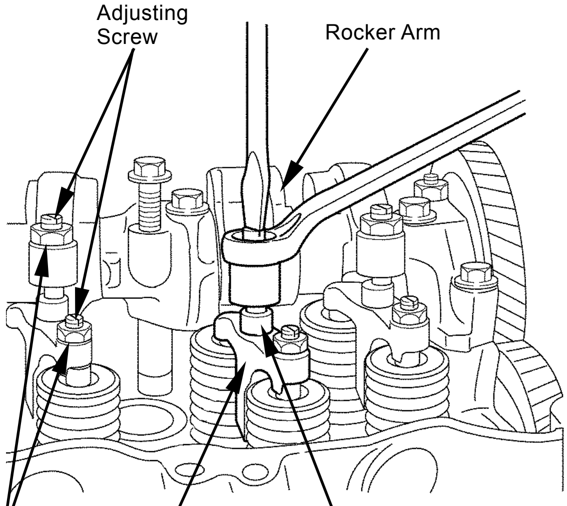
Refer to Operational Performance Standard in Group T4-2.

Adjustment:

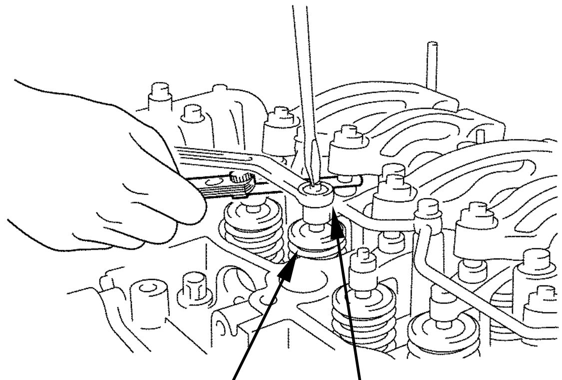
If the measurement results are out of specification, adjust the valve clearance in the same order of measurement.

IMPORTANT: Touch the bridge to the end of valve heads (2 used) horizontally and adjust the valve clearance carefully.

1. Loosen the lock nuts (12 used) and adjusting screws (12 used), which secure the bridge and rocker arm.
2. Insert a thickness gauge into the clearance between rocker arm and bridge cap.
3. Tighten the adjusting screw of rocker arm until condition for the thickness gauge is proper.
4. Tighten the lock nut of rocker arm.
   : 22 N·m (2.2 kgf·m, 16.2 lbf·ft)
5. Tighten the adjusting screw of bridge until the bridge comes in contact with the valve head.
6. Tighten the lock nut of bridge.
   : 22 N·m (2.2 kgf·m, 16.2 lbf·ft)
7. Check the valve clearance after the lock nuts are tightened.



T1V1-04-03-002



T1V1-04-03-003

LUBRICANT CONSUMPTION

Measuring Method

1. Place the machine on level firm ground and leave the machine for at least one hour in order to let the lubricant lower to the oil pan when the engine stops.
   At this time, confirm that the machine is level by using a leveler.
2. Record read-out A (unit: hour) of the hour meter.
3. Replenish the lubricant up to the high-level gauge.
4. Operate the machine for at least 100 hours or until the oil level lowers to the low-level gauge.

IMPORTANT: Keep the machine-leaving time in Step 1 above.

5. Place the machine on level firm ground and leave the machine for at least one hour in order to let the lubricant lower to the oil pan when the engine stops.
   At this time, confirm that the machine is level by using a leveler.
6. Record read-out B (unit: hour) of the hour meter.
7. Replenish the lubricant up to the high-level gauge while measuring the oil-replenishing volume C.

NOTE: When measuring, use a high-precision measuring cylinder or the like.

8. Determine lubricant consumption from the following equation:
   Oil replenishing volume (C) [mL] / Operating hours (B-A) [hr]

Evaluation:

Refer to Operational Performance Standard in Group T4-2.

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TRAVEL SPEED

Summary:
1. The overall performance of the travel drive system (torque converter through transmission) is judged by measuring the time necessary for traveling 50 m (164 ft).

Preparation:
1. Adjust air pressure of the tires evenly in advance. Air pressure:375 kPa (3.83 kgf/cm^2, 55 psi)
2. On a firm level and uniform supporting surface, prepare a 50 m (164 ft) straight travel course, and 70 m (230 ft) forward and backward runways. (For measurement at Speed 4, a forward runway of 300 m (984 ft) is needed.)
3. Empty the bucket, and hold the lift arm afloat 0.4 to 0.5 m (1 ft 4 in to 1 ft 8 in) above the ground.
4. Keep the hydraulic oil temperature at 50±5 °C (122±41 °F). Warm the axle oil satisfactorily by repeating travel and brake operations.
   Make a warm up operation so that the indicators of the engine water temperature monitor and the torque converter oil temperature monitor rise above the horizontal positions.

Measurement

CAUTION: Avoid measurement at reverse for fear of dangers involved.

1. Make measurement for each mode (Speeds 1 to 4).
2. Select the switches as follows.

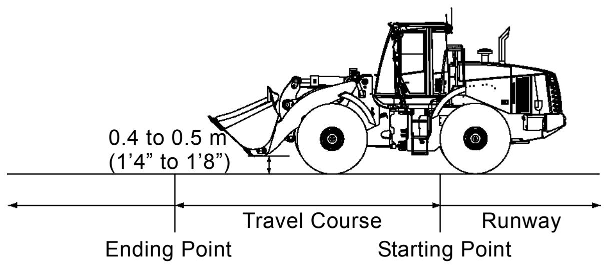
	Shift Switch	Parking Brake Switch	Accelerator Pedal	Travel Mode Switch	Work Mode Switch
Speed 1	Speed 1	OFF	Full depression	H	N
Speed 2	Speed 2	OFF	Full depression	H	N
Speed 3	Speed 3	OFF	Full depression	H	N
Speed 4	Speed 4	OFF	Full depression	H	N

3. Put the forward-reverse lever at the F (Forward) position. From the runway, travel by depression the accelerator pedal to the stroke end.
4. Measure the travel speed (sec) of each travel mode.
5. Make measurement three times, and determine the measurement value by obtaining their mean values.
6. Convert the measurement value to be expressed in km/h.
   Measurement value (seconds) = S (sec)
   Converted value (hourly speed) = A (km/h)

$$A = \frac{50 \times 600}{S \times 1000}$$

Evaluation:
Refer to the Performance Standard Table in Group T4-2.

Remedy:
Refer to the Trouble Shooting in Section T5.



T4GB-04-04-001

SERVICE BRAKE FUNCTION CHECK

Summary:

1. The overall performance of the service brake is judged.
2. The braking capability of the brake is an item of safety control. Be sure to conduct the performance test.

Preparation:

1. Adjust air pressure of the tires evenly in advance. Air pressure: 375 kPa (3.83 kgf/cm^2, 55 psi)
2. On a paved dry road, prepare a 100 m (328 ft) straight travel course (a 50 m (164 ft) of runway and a 50 m (164 ft) of measurement road), and set the brake starting point.
3. Empty the bucket, and hold the lift arm afloat 0.4 to 0.5 m (1 ft 4 in to 1 ft 8 in) above the ground.
4. Keep the hydraulic oil temperature at 50±5 °C (122±41 °F). Warm the axle oil satisfactorily by repeating travel and brake operations.
   Make a warm up operation so that the indicators of the engine water temperature monitor and the torque converter oil temperature monitor rise above the horizontal positions.

Measurement

CAUTION: Avoid measurement at reverse for fear of dangers involved. (Forward-reverse lever: F)

1. Make measurement for high-speed mode.
2. Select the switches as follows.

Shift Switch	Parking Brake Switch	Accelerator Pedal	Travel Mode Switch	Work Mode Switch	Clutch Cut Position Switch
Speed 4	OFF	Full depression	H	N	OFF

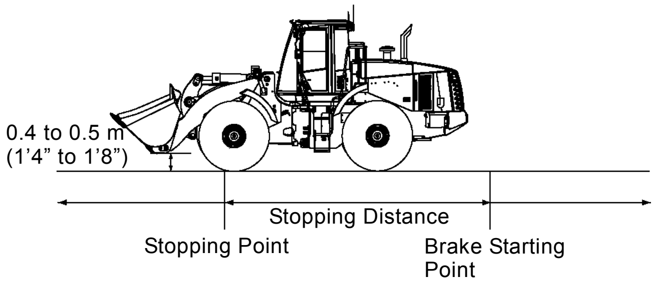
3. Put the forward-reverse lever at the F (Forward) position. From the runway, travel at 20 km/h (12 mph) by depression the accelerator pedal to the stroke end.
4. Depression the brake at the brake starting point, and completely stop the vehicle. (Right Service Brake Pedal)
5. Measure the distance from the brake starting point to the point where the front tire is contacting.
6. Make measurement three times, and determine the measurement value by obtaining their mean values.

Evaluation:

Refer to the Performance Standard Table in Group T4-2.

Remedy:

Refer to the Trouble Shooting in Section T5.

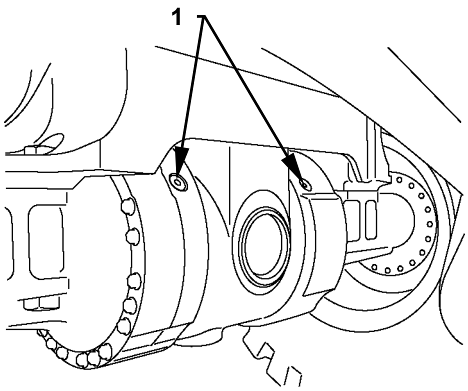


T4GB-04-04-002

SERVICE BRAKE WEAR AMOUNT

Summary:

The extent of wear of the brake disc at the service brake of the axle is judged by the wear gauge.



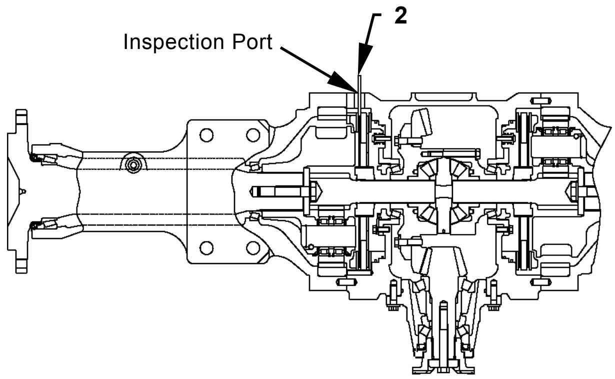
T4GB-04-04-004

Preparation:

1. Clean the inspection plug (1) of the axle, and loosen it.
2. In the case of the rear axle, the inspection plug (1) is located below the center line of the differential, so loosen the inspection plug (1) after draining the axle oil.

Measurement:

1. Operate the service brake by depression the brake pedal.
2. Insert the wear gauge (2) into the inspection port until it contacts the brake disc (6) between the brake ring (3) and the brake ring (4).



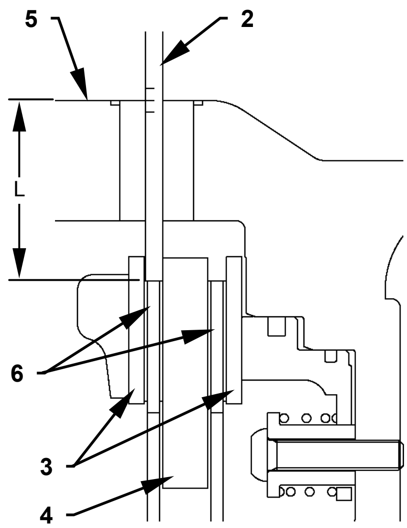
T4GB-04-04-005

Evaluation:

1. In case the wear gauge (2) has entered between the brake rings (3 and 4), and the model scale of the wear gauge (2) and the housing face (5) have coincided, the wear amount of the brake disc (6) is not reached the maximum allowable limit of use.
   In case the wear gauge (2) has not entered between the brake rings (3 and 4), and the model scale is sticking above the housing face (5), the brake disc (6) is worn in excess of the maximum allowable limit of use.
2. In the method above, in case the maximum allowable limit of use has not reached, or in case the service brake portion has been assembled, refer to the Performance Standard Table in Group T4-2.

   Distance between Housing Face (5) and Brake Disc (6)

Model	Dimensions (L) mm
ZW220	52
ZW250	54



T4GB-04-04-006

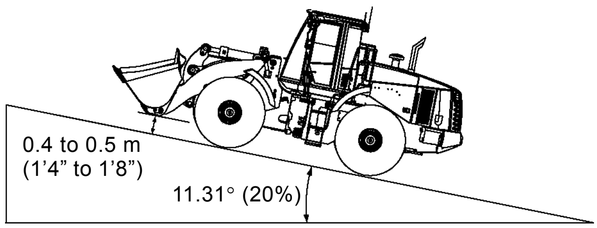
PARKING BRAKE FUNCTION CHECK

Summary:

1. The function of the parking brake on a determined slope is measured.
2. The braking capability of the brake is an item of safety control. Be sure to conduct the performance test.

Preparation:

1. Make measurement on a plane slope of 11.31 ° (20 %).
2. Empty the bucket, and hold the lift arm afloat 0.4 to 0.5 m (1’4” to 1’8”) above the ground.
3. Keep the hydraulic oil temperature at 50±5 °C (122±41 °F).
4. Warm the axle oil satisfactorily by repeating travel and brake operations.
   Make a warm up operation so that the indicators of the engine water temperature monitor and the torque converter oil temperature monitor rise above the horizontal positions.



T4GB-04-04-003

Measurement:

1. Travel up the slope, and put the parking brake switch at the P position.
2. Stop the engine.
3. After the body has stopped, put a mark (white line) on the tire and the ground surface respectively.
4. After Five minutes have passed, measure the amount of movement of the white line of the tire from that of the ground surface.
5. Make measurement three times, and determine the measurement value by obtaining their mean values.

Evaluation:

Refer to the Performance Standard Table in Group T4-2.

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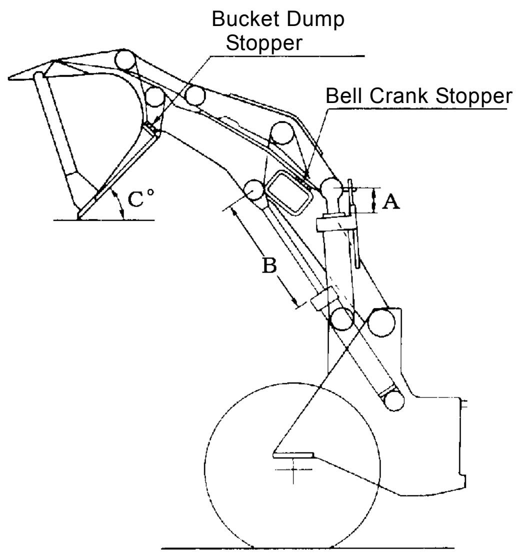
BUCKET STOPPER AND BELL CRANK CLEARANCE

Summary;
Wear and deformation conditions of the bucket stopper (dump end and crowd end) and the clearance between the bell crank stopper and the cross tube are measured.

Preparation:
Stop the vehicle on a plane road surface, and operate the parking brake.

Measurement:
1. Bucket dump stopper
1-1. Raise the lift arm to the highest lifting position, and stop the engine.
1-2. At stop of the engine, dump calmly until the buket contacts the dump stopper. At this time, measure the Strokes (A and B) of the bucket cylinder and the lift arm and the dump angle (C) of the bucket. In addition, measure the clearance between the bell crank stopper and the cross tube.
1-3. At the same time, make measurement of the contact conditions of the bucket dump stoppers (left and right).
2. Bucket crowd stopper
1-1. Raise the lift arm until the lift arm cylinder stroke (E) becomes the length of the standard dimension.
1-2. Set the engine at idling speed, and make crowding operation until the bucket calmly contacts the bucket crowd stopper.
1-3. At this time, measure the strokes (D and E) of the bucket cylinder and the lift arm cylinder and the crowd angle (F) of the bucket. In addition, measure the height (G) from the ground to the bucket lowest portion.
1-4. Also measure the contact conditions of the bucket crowd stoppers (left and right).



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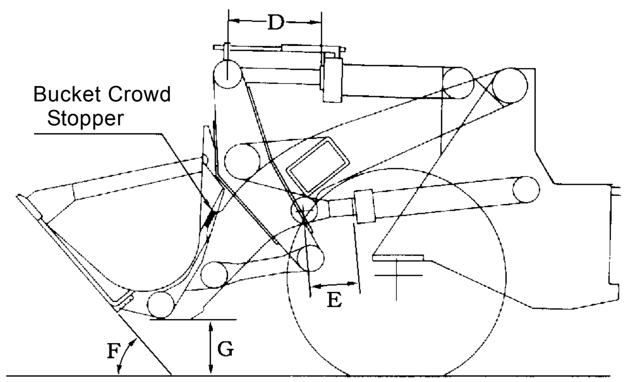


T4GB-04-04-010

Evaluation:

1. Bucket Dumper Stopper

1-1. Cylinder Stroke Strokes A and B

Model	Bucket Cylinder A (mm)	Lift Arm Cylinder B (mm)
ZW220	362±1.5	1120±2
ZW250	373±1.5	1180±2

1-2. Bucket Dump Angle C

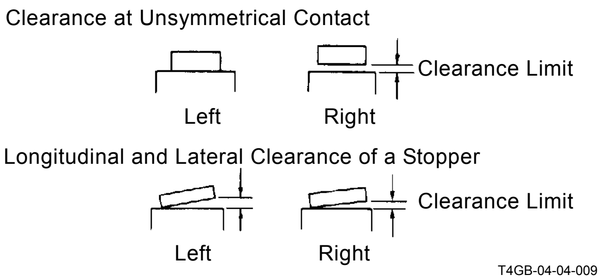
Model	C (°)
ZW220	50±2
ZW250	50±2

1-3. Clearance between Bell Crank Stopper and Cross Tube

Model		Clearance between Bell Crank Stopper and Cross Tube (mm)
ZW220	Standard	2.0
	Limit	-
ZW250	Standard	2.0
	Limit	

1-4. Clearance between Bucket Dump Stopper and Lift Arm

Model		Clearance at Unsymmetrical Contact (mm)	Longitudinal and Lateral Clearance of a Stopper (mm)
ZW220	Standard	0	0
	Limit	0.5	1.0
ZW250	Standard	0	0
	Limit	0.5	1.0



2. Bucket Crowd Stopper

2-1. Cylinder Strokes D and E

Model	Bucket Cylinder D (mm)	Lift Arm Cylinder E (mm)
ZW220	690	360
ZW250	719	371

2-2. Bucket Crowd Angle (F)

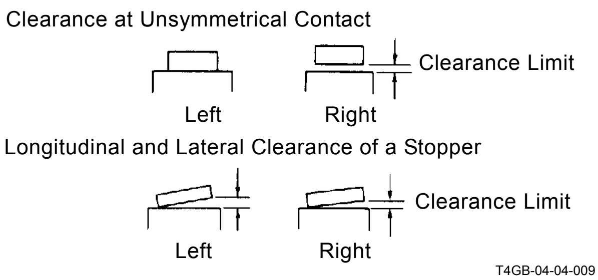
Model	F (°)
ZW220	50
ZW250	50

2-3. Height from Ground to Bucket Lowest Portion (G)

Model	G (mm)
ZW220	450
ZW250	425

2-4. Clearance between Bucket Dump Stopper and Lift Arm

Model		Clearance at Unsymmetrical Contact (mm)	Longitudinal and Lateral Clearance of a Stopper (mm)
ZW220	Standard	0	0
	Limit	0.5	1.0
ZW250	Standard	0	0
	Limit	0.5	1.0



NOTE: Standard dimensions indicate those of a new tire at the designated air pressure.

HYDRAULIC CYLINDER CYCLE TIME

Summary:

1. The overall performance of the cylinders drive system (main pump through each cylinder) is judged by measuring the operating time of the cylinders for the lift arm, bucket, and steeering.
2. The bucket is made empty in advance.

Preparation:

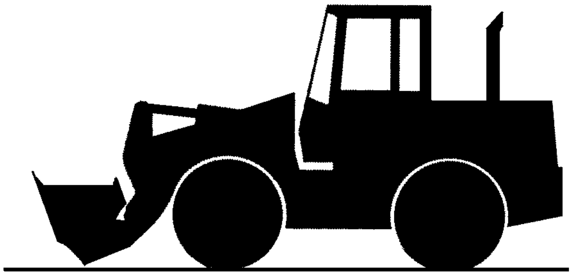
1. Measurement is made for the following positions.
   1-1. Measurement of Lift Arm Cylinder (for Liftig)
   Fully crowd the bucket, and lower the lift arm.
   1-2. Measurement of Lift Arm Cylinder (for Lowering)
   Lower the lift arm until the bucket bottom face touches the ground horizontally.
   1-3. Measurement of Bucket Cylinder
   Lift the lift arm to the highest position.
   1-4. Measurement of Steering Cylinder
   Empty the bucket, and take the travel forward position.

2. Keep the hydraulic oil temperature at 50±5 °C (122±41 °F).

CAUTION: Select ground filled with sand or something so that the bucket contacts the ground with buffer.

Lift Arm Cylinder:

(for Lifting)



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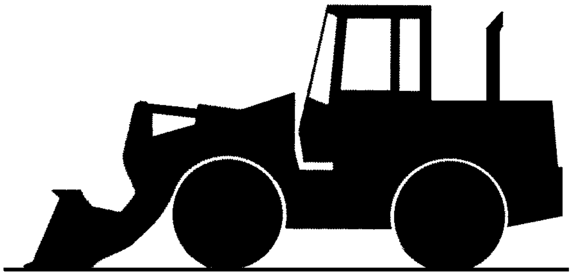
(for Lowering)

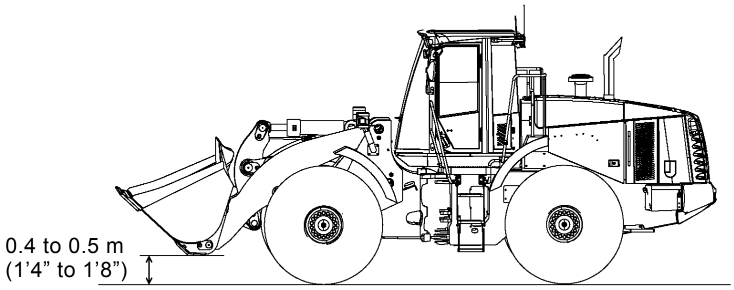


T487-04-03-005

Bucket Cylinder:

T487-04-03-006

Travel Position



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Measurement:

1. Select the pedal, switches, and forward-reverse lever as follows.

	Accelerator Pedal	Parking Brake Switch	Forward-reverse Lever	Work Mode Switch
Lift Arm (for Lifting)	Full Stroke (Engine Maximum Speed)	ON	N	N
Lift Arm (for Lowering)	Neutral (Engine Minimum Speed)	ON	N	N
Bucket	Full Stroke (Engine Maximum Speed)	ON	N	N
Steering	Neutral (Engine Minimum Speed)	OFF	N	N
Steering	Full Stroke (Engine Maximum Speed)	OFF	N	N

2. Make measurement operation as follows. (including the buffer range)

2-1. Measurement of Lift Arm Cylinder (for Lifting)
Operate the lift arm lever to the stroke end, and measure the time of movement of the lift arm from the lowest position to the highest position.

2-2. Measurement of Lift Arm Cylinder (for Lowering)
Lower the bucket to the ground in the horizontal position, and lift the lift arm to the highest position.
Keep the lift arm lever at the afloat position, and measure the time of movement of the bucket reaching the ground.

2-3. Measurement of Bucket Cylinder
Operate the bucket lever to the stroke end, and measure the time of movement of the bucket from the full crowd position to the full dump position.

2-4. Measurement of Steering Cylinder
Operate the steering wheel to the stroke end, and measure the time of movement of the steering wheel from the right to the left end, and from the left to the right end.

CAUTION: Before measurement, confimr that there are no human beings or obstacles in the steering range.

3. Make measurement three times, and determine the measurement value by obtaining their mean values.

Evaluation:

Refer to the Performance Standard Table in Group T4-2.

Remedy:

Refer to the Trouble Shooting in Section T5.

CYLINDER DRIFT CHECK

Summary:

1. Internal leakage of the lift arm, bucket cylinders, and control valves when the buket is loaded with load equivalent to the standard load is judged by the settlement (shrinkage) of the cylinder rod.
2. Measurement is made in the standard front condition (standard bucket).
3. In case measurement is made immediately after the cylinder replacement, conduct air venting of the cylinder before measurement by operating the cylinders slowly to the stroke ends several times.

Preparation:

1. Load the bucket with weight or sand equivalent to the standard load
   ZW220: 5085 kg (11210 lb)
   ZW250: 5600 kg (12346 lb)
2. In the front position, extend the lift arm to the maximum reach, and hold the bucket at an agle of about 5° declined forward from full crowding.

CAUTION: Never allow any personnel to be under the bucket.

1. Keep the hydraulic oil temperature at 50±5 °C (122±41 °F).

Measurement:

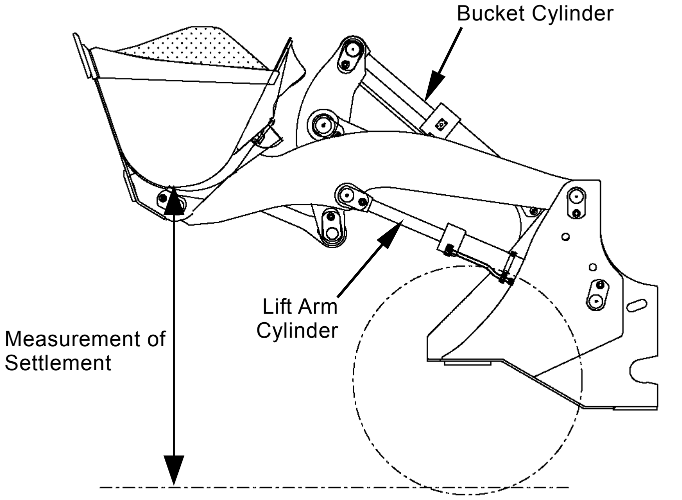
1. Stop the engine.
2. After 15 minutes have passed, measure the shrinkage of the lift arm cylinder, shrinkage of the bucket cylinder, and the settlement of the bucket bottom respectively.
3. Make measurement three times, and determine the measurement value by obtaining their mean values.

Evaluation:

Refer to the Performance Standard Table in Group T4-2.

Remedy:

Refer to the Trouble Shooting in Section T5.



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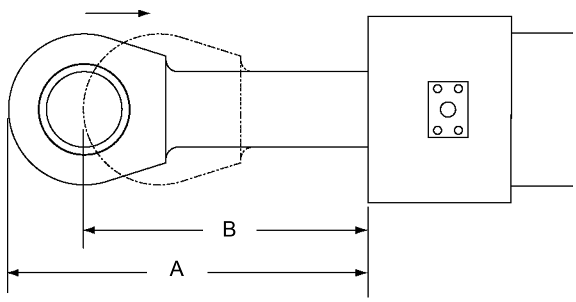

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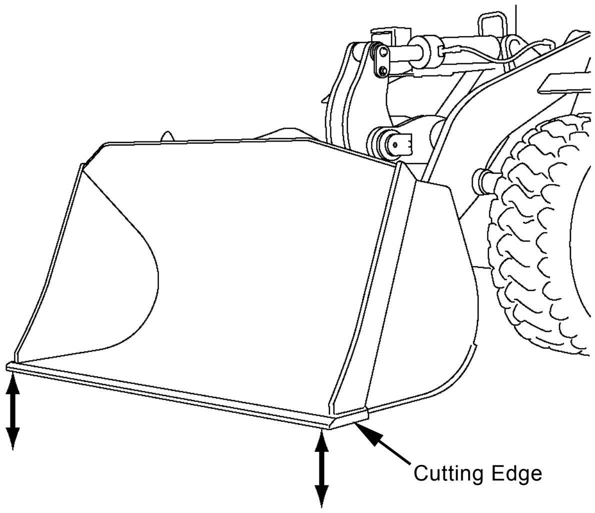
BUCKET LEVELNESS

Summary:
Left and right inclinations of the bucket are checked in order to prevent uneven wear of the cutting edge of the bucket.



T4GB-04-04-011

Preparation:
1. Place the unloaded base machine on a horizontal bed on rhe ground. (In case a bed is not available, place it on a horizontal flat concrete on the ground. Deal with the measurement values as guide lines.)
2. Adjust the tire air pressure to the designated value.
3. Have the bucket bottom contact the ground horizontally.

Measurement:
1. Have the bucket bottom float slightly above the bed.
2. Measure the vertical distance from the bed and the bottom face of the cutting edge on the left and right ends, and confirm the difference.
3. Make measurement three times, and determine the measurement value by obtaining their mean values.

CAUTION: Never put hands, feet, and measuring instruments under the bucket.

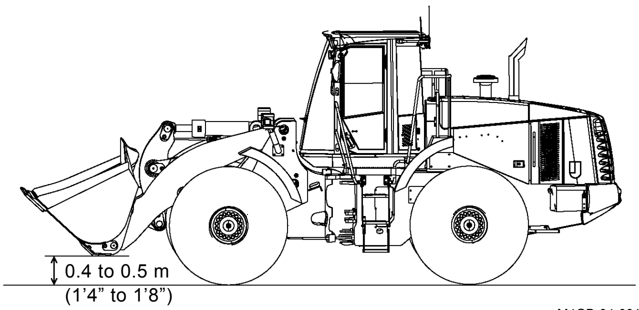
Evaluation:
Refer to the Performance Standard Table in Group T4-2.

CONTROL LEVER OPERATING FORCE

Summary

1. Operating conditions of the levers, pedals, and steering wheel are confirmed, and their operating force are measured.
2. Maximum operating force of the levers, pedals, and steering wheel are measured.
3. Measurement of each of the operating levers is made at the center of the grip.
   Measurement of each of the pedals is made at 150 mm (6 in) from the pedal support.

Travel Position



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Preparation:

1. In the front position, empty the bucket in advance.
2. Keep the hydraulic oil temperature at 50±5 °C (122±41 °F).

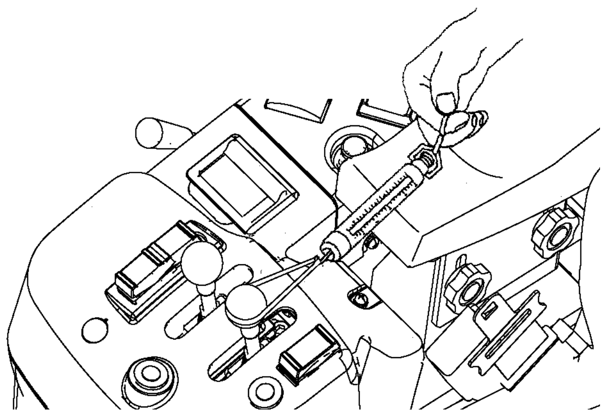
Measurement

1. Make measurement for each of the operating levers, pedals, and steering wheel.
2. Select the pedal, switches, and forward-reverse lever as follows.

Accelerator Pedal	Parking Brake Switch	Forward-reverse Lever
Neutral (Engine Minimum Speed)	ON	N

CAUTION: Before measurement, confimr that there are no human beings or obstacles in the steering range.

3. Apply a spring balance scale (tension type) to each of the lift arm, bucket, and froward-reverse lever, and measure their maximum operating efforts by operating them to the stroke end.
4. In the case of the pedals, apply a spring balance scale (compression type) or a load cell to them, and measure their operating efforts when they are stepped slightly.
5. For the steering wheel, apply a spring balance scale (tension type) to the knob, and measure the maximum operating effort when it is moved.
6. Make measurement three times, and determine the measurement value by obtaining their mean values.



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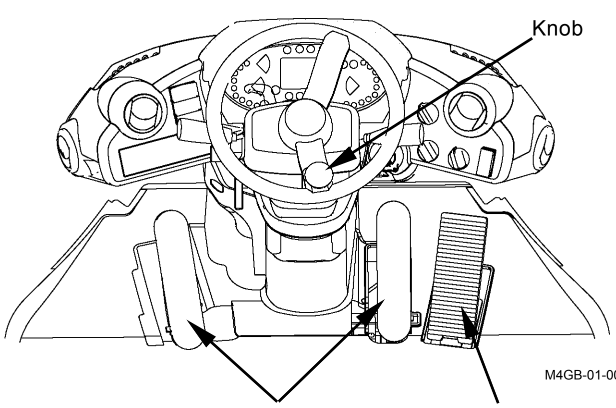

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Evaluation:

Refer to the Performance Standard Table in Group T4-2.

CONTROL LEVER STROKE

Summary:

1. Plays and operating conditions of operating levers, pedals, and steering wheel are confirmed, and their strokes are measured.
2. Measurement of each of the operating levers is made at the tip of the grip.
   Measurement of each of the pedals is made at the top of the pedal.
3. In the case of existence of play at neutral, make measurement by dividing it on both sides evenly.

Preparation:

1. Keep the hydraulic oil temperature at 50±5 °C (122±40 °F).

Measurement:

1. Measurement of Operating Lever
1-1. Have the bucket bottom contact the ground.
1-2. Stop the engine.
1-3. Measure the stroke from the neutral position to the stroke end of each of the lift arm, bucket, and forward-reverse operating levers at the top center of the grip.
2. Measurement of Pedal
2-1. Have the bucket contact the ground.
2-2. Stop the engine.
2-3. Measure the stroke from the neutral position to the stroke end of the pedal at the top of the pedal.
3. Measurement of Steering Wheel
3-1. Start the engine. (Low idling)
3-2. Have the bucket float slightly above the ground.
3-3. Measure the number of times of rotation required for reaching the left stroke end from the right, and vice versa of the steering wheel.
4. make measurement corresponding to a straight line.
5. Make measurement three times, and determine the measurement value by obtaining their mean values.

Evaluation:

Refer to the Performance Standard Table in Group T4-2.

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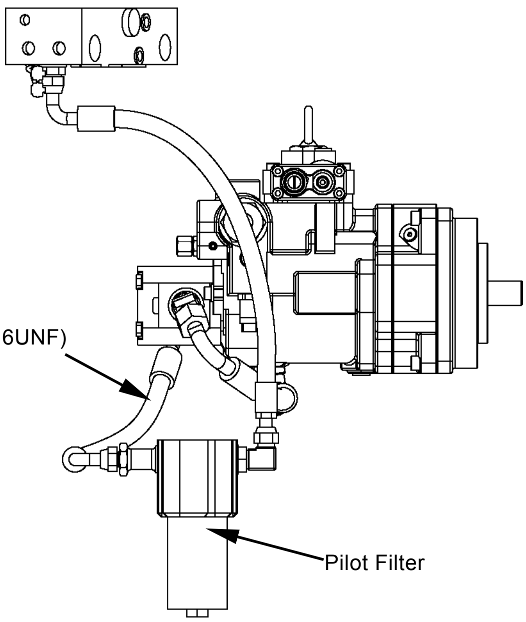
PRIMARY PILOT PRESSURE

(Including Brake Circuit)

CAUTION: If air is mixed in the brake system, the brake function is reduced, and serious hazard may occur. Bleed air from the brake system after removing and installing the pipe lines and replacing hydraulic oil.
Refer to Troubleshooting B in Group T5-6.

IMPORTANT: Primary pilot pressure circuit shuts off a circuit connecting to pilot relief valve if pressure in the accumulator is insufficient, and delivers primary pilot pressure to accumulator circuit. At this time, primary pilot pressure reaches 15 MPa (153 kgf/cm², 2180 psi) or high, so use a pressure gauge capable of measuring 15 MPa (153 kgf/cm², 2180 psi) or higher.



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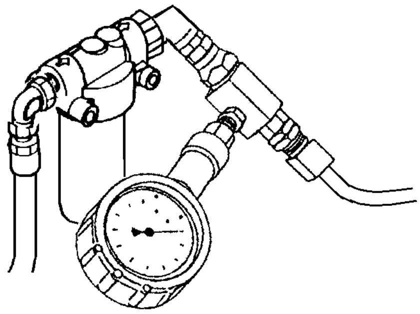
Preparation:

1. Stop the engine.
2. Push the air bleed valve on top of the hydraulic oil tank and release any remaining pressure.
3. Remove the hose end from the pilot filter inlet or outlet port. Install adapter (13/16-16UNF), nipple, pressure gauge and coupling.
   : 22 mm, 24 mm, 27 mm
4. Start the engine. Check for any oil leaks at the pressure gauge connection.
5. Maintain the hydraulic oil temperature at 50±5 °C (122±41 °F).



T1F3-04-05-001

Measurement:

1. Set engine speed at fast idle. Depress the accelerator pedal fully.
2. Measure pilot pressure without load by using a pressure gauge.
3. Repeat the measurement three times and calculate the average values.

Evaluation:

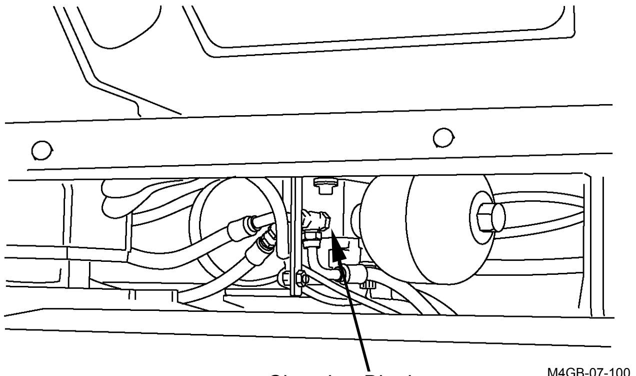
Refer to the Performance Standard Table in Group T4-2.

NOTE: When pressure in the service brake accumulator is reduced during measurement of primary pilot pressure, the measured valve is increased to 15 MPa (153 kgf/cm², 2180 psi) for several seconds.

Primary Pilot Pressure Adjustment Procedure

Adjustment:

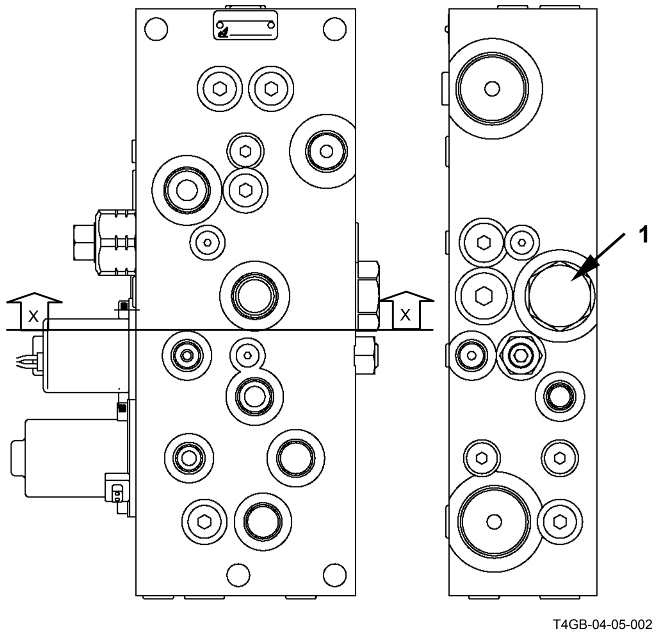
Adjust the relief valve set-pressure in charging block as necessary.

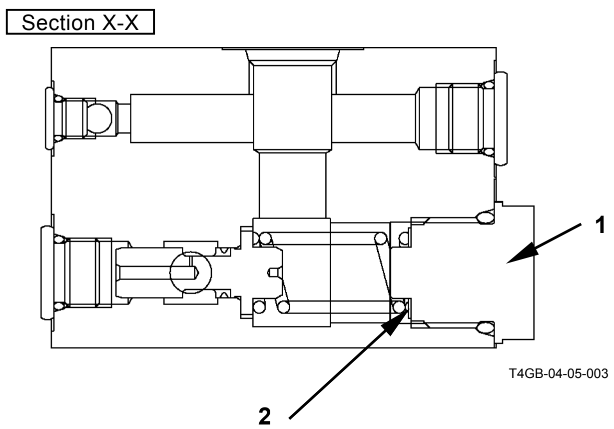


1. Remove plug (1) from the relief valve.
   : 30 mm
2. Remove shim (2) from the relief valve.
3. Install the estimated number of shim (2).
4. Install shim (2) to the relief valve.
   Tighten plug (1).
   : 98.0±9.8 N·m
   (960±95 kgf·m, 710±71 lbf·ft)
5. Check the set-relief pressure.

NOTE: Standard Change in Pressure (Reference)
Set the thickness of shims at less than 1.5 mm.

Shim Thickness	Change in Pressure		
(mm)	kPa	(kgf/cm^2)	(psi)
0.2	61.8	(0.63)	(9)
0.4	124.6	(1.27)	(18)
0.8	249.2	(2.54)	(36)

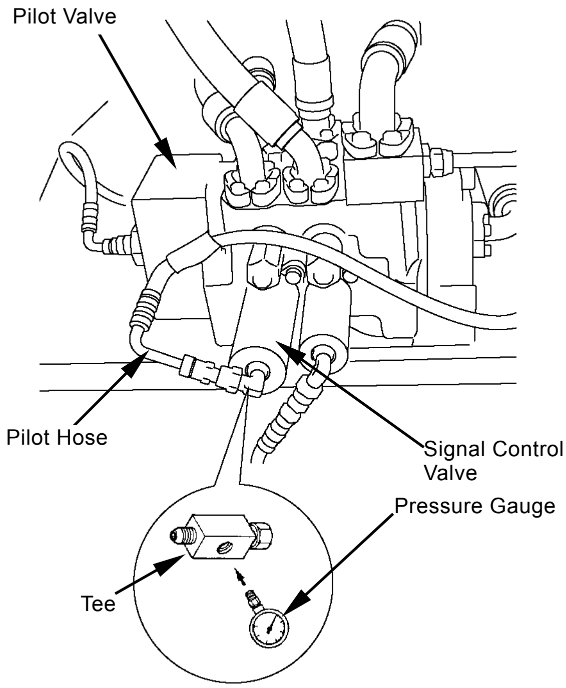




SECONDARY PILOT PRESSURE

Preparation:

1. Stop the engine.
2. Push the air bleed valve on top of the hydraulic oil tank and release any remaining pressure.
3. Measure pressure at the location between pilot valve and main valve.
   Remove the pilot hose to be measured. Install the hose (9/16-18UNF length: approx. 400 mm) to the signal control valve side. Install a tee and a pressure gauge between the hoses.
   : 17 mm, 19 mm, 22 mm
4. Start the engine. Check for any oil leaks at the pressure gauge connection.
5. Maintain the hydraulic oil temperature at 50±5 °C (122±41 °F).



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Measurement:

1. Set engine speed at fast idle. Depress the accelerator pedal fully.
2. Measure pilot pressure by using a pressure gauge with the corresponding control lever operated full stroke.
3. Repeat the measurement three times and calculate the average values.

Evaluation:

Refer to the Performance Standard Table in Group T4-2.

Remedy:

Refer to Troubleshooting in Section T5.

SOLENOID VALVE SET PRESSURE

Measure solenoid valve set pressure by using both Dr. ZX and the pressure gauge.

Preparation:

1. Stop the engine.
2. Push the air bleed valve on top of the hydraulic oil tank and release any remaining pressure.
3. Remove the line from port X in the charging block. Install a tee, a hose and adapter (ST 6461). Install pressure gauge (ST 6942).
   : 17 mm, 19 mm, 22 mm

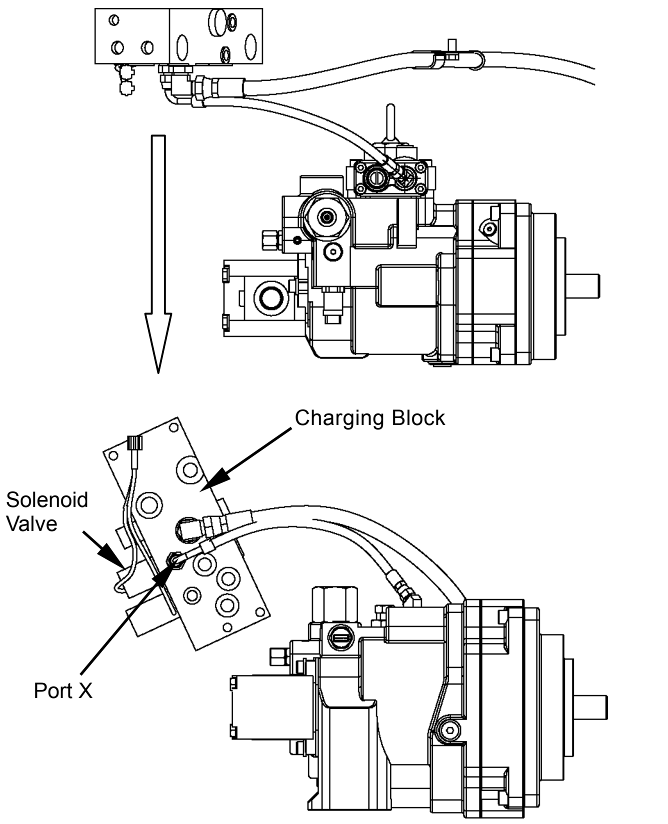
   Install Dr. ZX and select the monitoring function.
4. Start the engine. Check for any oil leaks at the pressure gauge connection.
5. Maintain the hydraulic oil temperature at 50±5 °C (122±41 °F).

Measurement:

1. Set engine speed at fast idle.
2. Measure without depressing the accelerator pedal.
   Measure with the accelerator pedal fully depressed.
3. Read the values on both Dr. ZX and the pressure gauge.
4. Repeat the measurement three times and calculate the average values.

Evaluation:

Refer to the performance Standard Table in Group T4-2.



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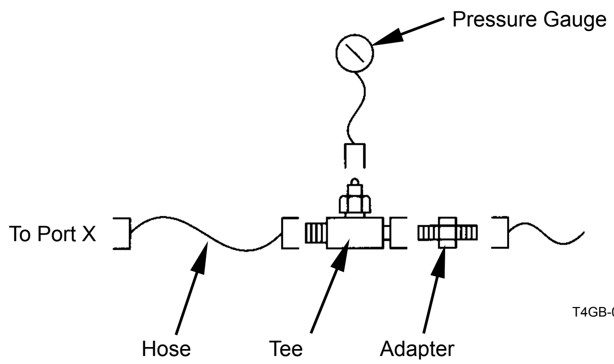

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Solenoid Valve Set Pressure Adjustment Procedure

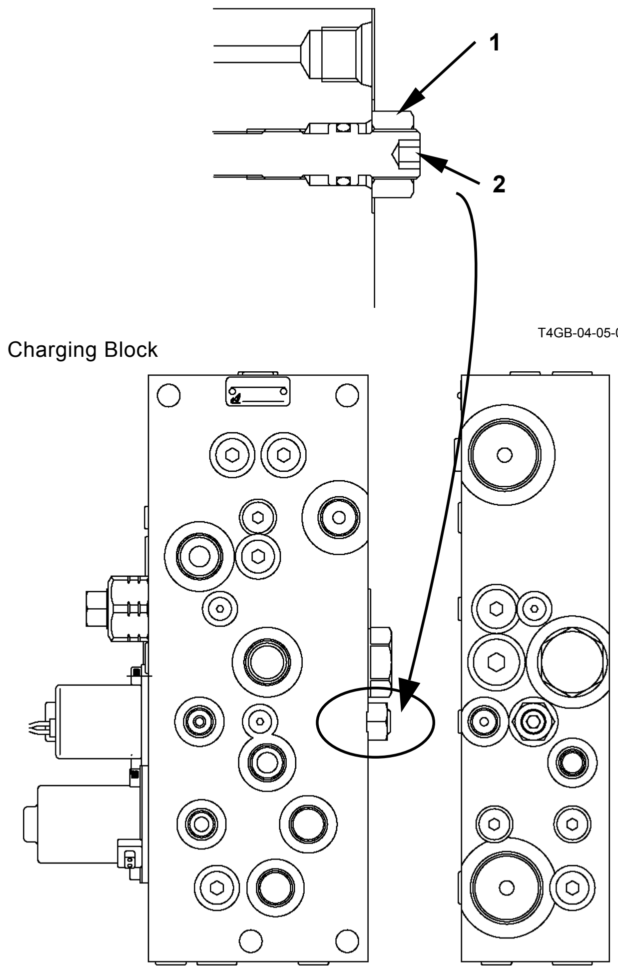
IMPORTANT: O-ring on the threads may come off the sealing surface and oil leak may occur. Do not loosen and tighten the adjusting screw excessively.
Do not loosen the adjusting screw more than 1.2 turns. Do not tighten the adjusting screw more than 2 turns.

1. Loosen lock nut (1). Turn adjusting screw (2) and adjust set pressure of the solenoid valve.
2. Retighten lock nut (1).
   : 18 mm
   : 19.6 N·m (2 kgf·m, 14 lbf·ft)
   : 6 mm

3. Check the set pressure of solenoid valve.

NOTE: Standard Change in Pressure (Reference)

Adjusting Screw Turns		1/4	1/2	3/4	1
Change in Pressure	kPa	39.2	80.4	120	160
	(kgf/cm^2)	(0.4)	(0.82)	(1.22)	(1.63)
	(psi)	(6)	(12)	(17)	(23)



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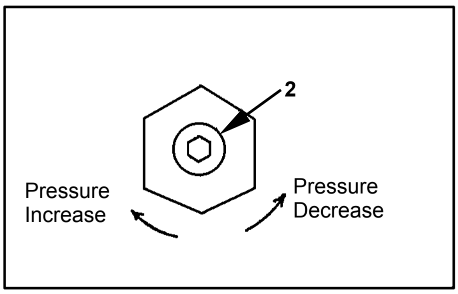

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MAIN PUMP DELIVERY PRESSURE

The main pump delivery pressure can also be measured by using Dr. ZX.

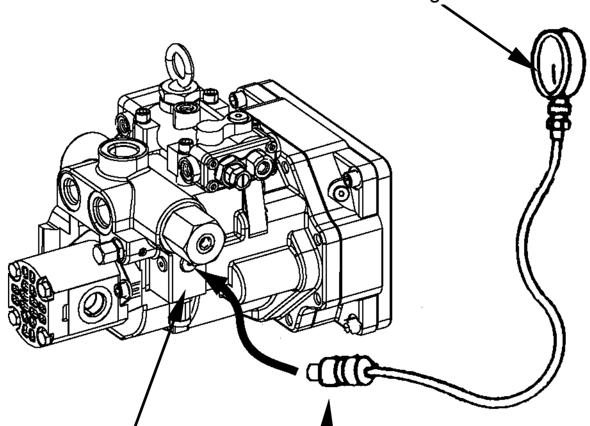
Summary:
Measure the main pump delivery pressure in order to check performance of the main pump.

Preparation:
1. Stop the engine.
2. Push the air bleed valve on top of the hydraulic oil tank and release any remaining pressure.
3. Remove the plug from the main pump delivery port. Install an adapter, a hose and a pressure gauge.
   : 6 mm
   (If Dr. ZX is used, install Dr. ZX and select the controller function diagnosing.)
4. Start the engine. Check for any leaks at the pressure gauge connection.
5. Maintain the hydraulic oil temperature at 50±5 °C (122±41 °F).

Measurement:
1. Set engine speed at fast idle. Depress the accelerator pedal fully.
2. Measure pressure without load (with the control levers in neutral).
3. Repeat the measurement three times and calculate the average values.

Evaluation:
Refer to the Performance Standard Table in Group T4-2.

Remedy:
Refer to Troubleshooting in Section T5.



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MAIN RELIEF PRESSURE

The main relief pressure can also be measured by using Dr. ZX.

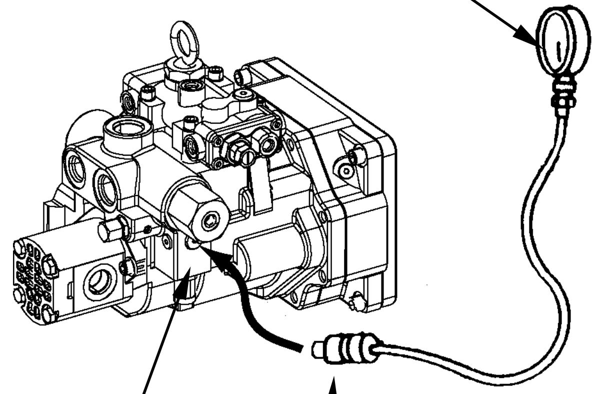
Summary:
Measure the main relief valve set pressure at the main pump delivery port in order to check performance of the main relief valve.

Preparation:
1. Stop the engine.
2. Push the air bleed valve on top of the hydraulic oil tank and release any remaining pressure.
3. Remove the plug from the main pump delivery port. Install an adapter, a hose and a pressure gauge.
   : 6 mm
   (If Dr. ZX is used, install Dr. ZX and select the controller function diagnosing.)
4. Start the engine. Check for any oil leaks at the pressure gauge connection.
5. Maintain the hydraulic oil temperature at 50±5 °C (122±41 °F).

Measurement:

1. Set engine speed at fast idle. Depress the accelerator pedal fully.
2. Slowly operate the lift arm or bucket control levers to the stroke end (extend or retract) and relieve each function.
3. Repeat the measurement three times and calculate the average values.

Evaluation:
Refer to the Performance Standard Table in Group T4-2.



T4GB-04-05-008

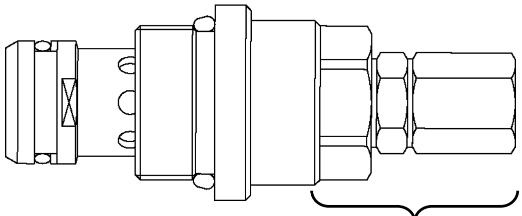
Main Relief Valve Pressure Adjustment Procedure

•ZW220

1. Secure lock nut (1). Remove nut (3).
   : 17 mm
2. Secure adjusting screw (2). Loosen lock nut (1).
   : 17 mm
3. Turn adjusting screw (2) and adjust the relief pressure to the specification.
4. Secure adjusting screw (2). Tighten lock nut (1).
   : 19.5 N·m (2 kgf·m, 14 lbf·ft)
5. Secure lock nut (1). Tighten nut (3).
6. Check the relief set pressure.

NOTE: Standard Change in Pressure (Reference)

Adjusting Screw Turns		1/4	1/2	3/4	1
Change in Pressure	MPa	2.79	5.59	8.36	11.2
	(kgf/cm^2)	(28.5)	(57)	(85.2)	(114)
	(psi)	(406)	(813)	(1215)	(1628)



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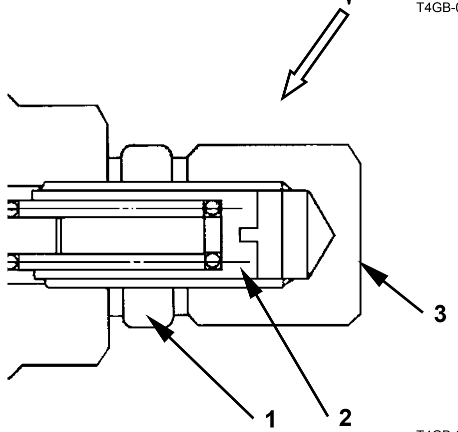

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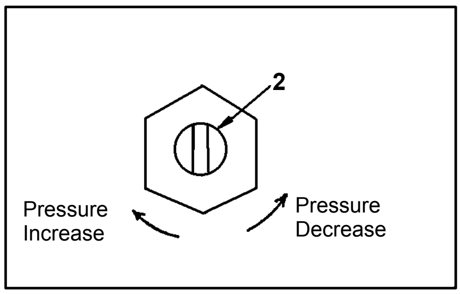
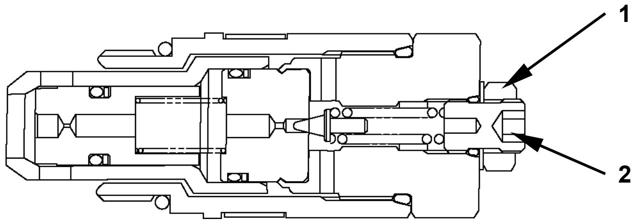


T105-06-05-002

•ZW250

1. Loosen lock nut (1).
   : 17 mm
2. Turn adjusting screw (2) and adjust the relief pressure to the specification.
   : 6 mm
3. Tighten lock nut (1).
   : 29.4 N·m (3 kgf·m, 22 lbf·ft)
4. Check the relief set pressure.



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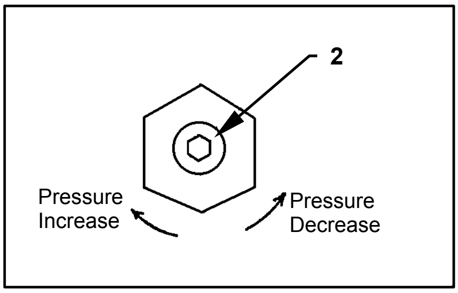
NOTE: Standard Change in Pressure (Reference)

Adjusting Screw Turns		1/4	1/2	3/4	1
Change in Pressure	MPa	4.5	8.9	13.4	17.8
	(kgf/cm^2)	(46)	(91)	(137)	(182)
	(psi)	(654)	(1294)	(1948)	(2588)



W107-02-05-129

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STEERING RELIEF PRESSURE

The steering relief pressure can also be measured by using Dr. ZX.

Summary:

Measure the steering relief valve set pressure at the main pump delivery port in order to check performance of the steering relief valve.

Preparation:

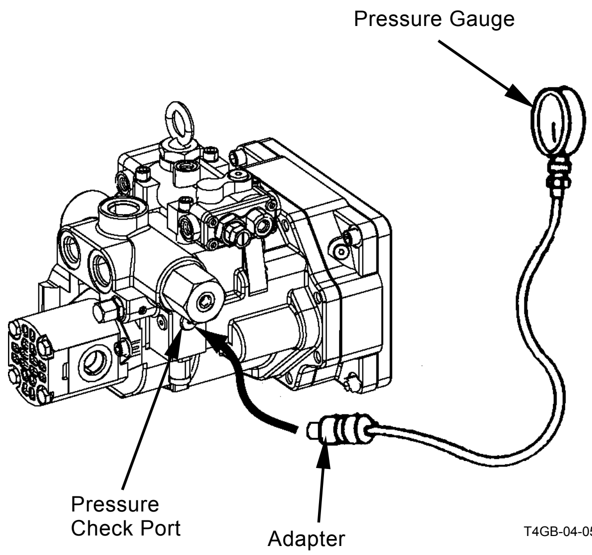
1. Stop the engine.
2. Pusht the air bleed valve on top of the hydraulic oil tank and release any remaining pressure.
3. Remove the plug from the main pump delivery port. Install an adapter, a hose and a pressure gauge.
   : 6 mm
   (If Dr.ZX is used, install Dr.ZX and select the controller function diagnosing.)
4. Start the engine. Check for any oil leaks at the pressure gauge connection.
5. Maintain the hydraulic oil temperature at 50±5 °C (122±41 °F).

Measurement:

1. Set engine speed at fast idle. Depress the accelerator pedal fully.
2. Install the articulation lock bar. Slowly operate the steering handle and relieve the steering.
3. Repeat the measurement three times and calculate the average values.

Evaluation:

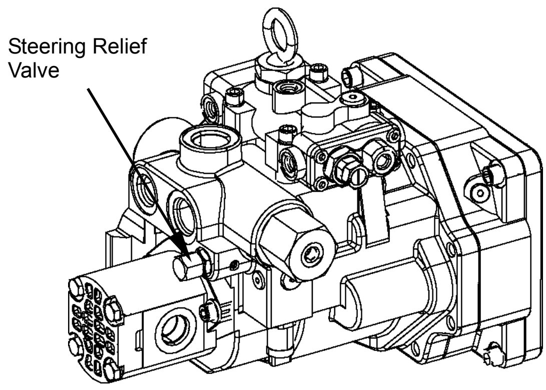
Refer to the Performance Standard Table in Group T4-2.



T4GB-04-05-008

Steering Relief Valve Pressure Adjustment Procedure

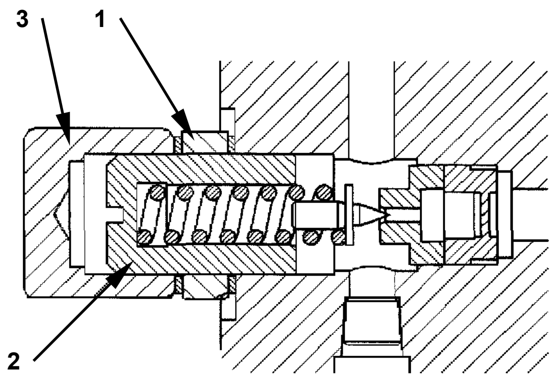
1. Secure lock nut (1). Remove nut (3).
   : 24 mm
2. Secure adjusting screw (2). Loosen lock nut (1).
   : 24 mm
3. Turn adjusting screw (2) and adjust the relief pressure to the specification.
4. Secure adjusting screw (2). Tighten lock nut (1).
   : 37 N·m(3.8 kgf·m, 27 lbf·ft)
5. Secure lock nut (1). Tighten nut (3).
   : 37 N·m(3.8 kgf·m, 27 lbf·ft)
6. Check the relief set pressure.



T4GB-04-05-012

NOTE: Standard Change in Pressure (Reference)

Adjusting Screw Turns		1/4	1/2	3/4	1
Change in Pressure	MPa	3.8	7.5	11.3	15.0
	(kgf/cm^2)	(39)	(77)	(155)	(153)
	(psi)	(552)	(1050)	(1643)	(2181)



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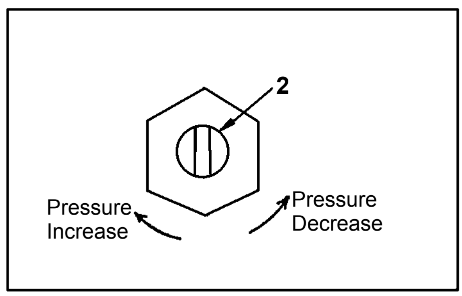


T105-06-05-002

OVERLOAD RELIEF VALVE SET PRESSURE

Summary:

1. The circuit pressure must be increased by applying an external force while blocking the return circuit from the control valve. This measuring method is hazardous and the results obtained with this method are unreliable.
2. The oil flow rate used to set the overload relief pressure is far less than that used to set the main relief pressure. Therefore, measuring the overload pressure in the main circuit by increasing the main relief set-pressure more than the overload valve set-pressure is not a proper method. In addition, in case a main relief valve designed to leak a small quantity of oil before reliving is used, its pre-leaking start pressure must be increased more than the overload relief valve set-pressure. However, the pre-leaking start pressure is not always increased more than the overload relief valve set-pressure as the adjustable upper limit of the main relief valve set-pressure is provided. Accordingly, the overload relief valve assembly should be removed from the machine and checked on a specified test stand at a correct oil flow rate. Some overload relief valves come in contact with the control valve body to block the oil passage. When this type of overload relief valve is checked, the control valve body must be precisely finished as the test unit. Provide one control valve other than that on the machine as a test kit.

3. If the overload relief valve performance must be checked on the machine, however, measure the main relief pressure while releasing each front function respective to the measuring overload relief valve. And, assume that the overload relief valve is functioning correctly if the obtained main relief pressure is within the specified value range.
   Measure the main pressure of the front functions by using Dr. ZX.

Preparation:

1. Stop the engine.
2. Push the air bleed valve on top of the hydraulic oil tank and release any remaining pressure.
3. Remove the plug from the main pump delivery port. Install an adapter, a hose and a pressure gauge.
   : 6 mm
4. Install Dr. ZX and select the monitoring function. Start the engine. Check for any oil leaks at the pressure gauge connection.

5. Maintain the hydraulic oil temperature at 50±5 °C (122±41 °F).

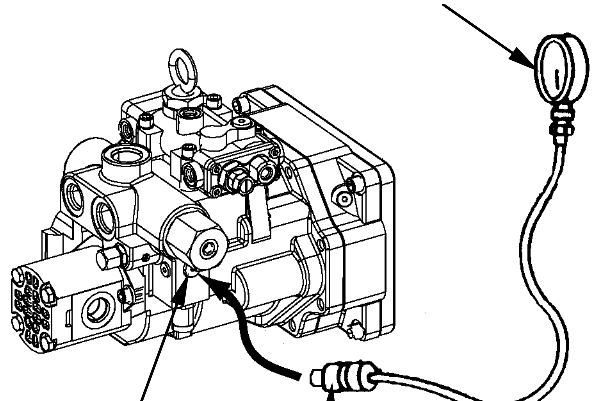
Measurement:

1. Set engine speed at fast idle. Depress the accelerator pedal fully.
2. Slowly operate the control levers (lift arm or bucket) corresponding to the overload relief valve to be measured to the stroke ends (extend and retract) and relieve each function.
3. Read the pressures on the pressure gauge at this time.
4. Repeat the measurement three times and calculate the average values.

Evaluation:

Performance of the overload relief valves are normal if the measured main relief pressures are within the specified value range.

Refer to the Performance Standard Table in Group T4-2.



Overload Relief Valve Pressure Adjusting Procedure

NOTE: *In principle, adjust the overload relief valve pressure on a test stand.*

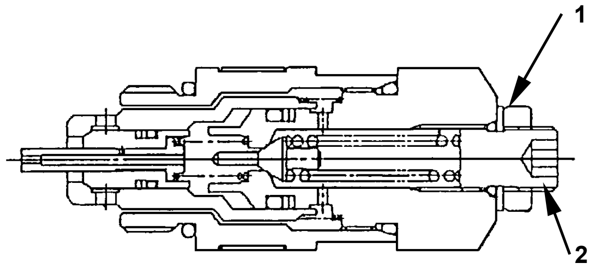
Adjust the pressure setting of the overload relief valve with adjusting screw (2) after loosening lock nut (1).

1. Loosen lock nut (1).
   : 17 mm

2. Turn adjusting screw (2) and adjust the pressure.
   : 6 mm

3. Tighten lock nut (1).
   : 17 mm
   : 29.5 N·m (3.0 kgf·m, 22 lbf·ft)

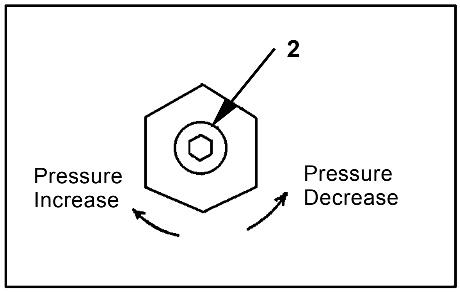
4. Check the set pressure.



W107-02-05-128

NOTE: *Standard Change in Pressure (Reference)*

Adjusting Screw Turns		1/4	1/2	3/4	1
Change in Pressure	MPa	5.2	10.6	15.9	21.1
	(kgf/cm^2)	(54)	(108)	(162)	(216)
	(psi)	(770)	(1540)	(2300)	(3070)



W107-02-05-129

MAIN PUMP FLOW RATE

- P-Q Control (Torque Control)

Summary:

Main pump performance is checked by measuring the pump flow rate by using a hydraulic tester installed at the main pump delivery port to be measured. Use Dr. ZX and a pressure gauge at the same time.

IMPORTANT: This measurement procedure is a simple method. The measured data will be lower by approx. 5 % than the accurately measured value. In order to measure accurately, disconnect the return circuit from the control valve and connect it to the hydraulic oil tank.

Preparation:

1. Stop the engine. Push the air bleed valve and release any remaining pressure. Install a vacuum pump to the oil filler port.

NOTE: Operate the vacuum pump while connecting the pump flow rate test line.

2. Remove the delivery hose from the main pump. Install pipe (1) to split flange (8) in the removed hose with the bolt.
   : 41 mm
   : 10 mm
3. Connect pipe (1) to hydraulic tester (4) with test hose (2) and adapter (3). Install adapter (5), joint (6) and flange (7).
   : 41 mm
   : 10 mm
4. Connect flange (7) to the delivery hose with split flange (8) and bolt (9).
   : 10 mm
5. Install a pressure gauge to the main pump. (Refer to the page on Main Pump Relief Pressure.)
   : 6 mm
6. Remove hose (11) from the regulator. Install plug (G1/4) to the hole on hose (11).
   : 17 mm
7. Remove the vacuum pump. Loosen plug (10) on top of the pump casing. Bleed air from the pump casing until oil only comes out of the plug clearance.
8. Fully open the loading valve of hydraulic tester.
9. Start the engine. Check for any oil leaks at the pressure gauge connection. Install Dr. ZX and select the monitor display function of MC.

Measurement:

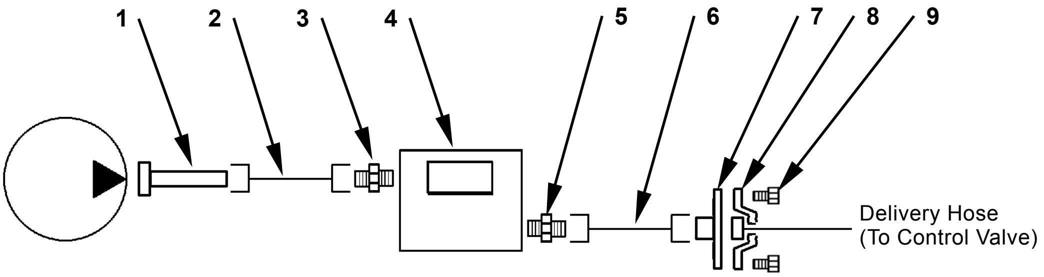
1. Maintain the hydraulic oil temperature at 50±5 °C (122±41 °F).
2. Measure the maximum flow rate.
3. Set engine speed at fast idle. Depress the accelerator pedal fully.
4. Adjust the main relief valve set pressure in the control valve to each pressure point specified along the main pump P-Q curve. (Refer to T4-2.) Slowly close the loading valve of the hydraulic tester while relieving the pressure in the bucket crowd circuit. Measure the flow rates and engine speeds at the pressure points specified in the P-Q curve.
5. Repeat the measurement three times and calculate the average values.

Evaluation:

1. Convert the measured flow rates to those at the specified pump speed by using the following formulas:
2. Standard Flow Rate
   Refer to the Performance Standard Table in Group T4-2.

$Qc = (Ns \times Q) / Ne$

Qc : Converted Flow Rate
Q : Measured Flow Rate
Ns : Specified Engine Speed: ZW220: 2170 min^{-1}
ZW250: 2240 min^{-1}
Ne : Measured Engine Speed:
Value by Dr. ZX



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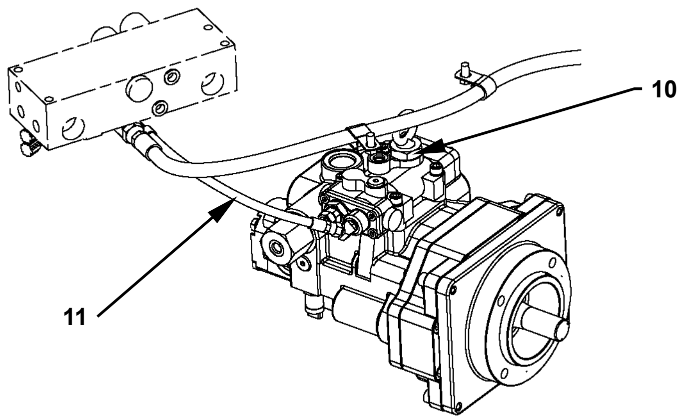


T4GB-04-05-014

1 - Pipe
2 - Test Hose
3 - Adapter (PF1× UNF1-7/8)
4 - Hydraulic Tester
5 - Adapter (PF1×UNF1-7/8)
6 - Joint
7 - Flange
8 - Split Flange
9 - Bolt (4 Used)
10 - Plug
11 - Hose

- Pilot Characteristics

Summary:
Main pump performance is checked by measuring the pump flow rate by using a hydraulic tester installed at the main pump delivery port to be measured. Use Dr. ZX and a pressure gauge at the same time.

IMPORTANT: This measurement procedure is a simple method. The measured data will be lower by approx. 5 % than the accurately measured value. In order to measure accurately, disconnect the return circuit from the control valve and connect it to the hydraulic oil tank.

Preparation:
1. Refer to steps 1 to 4 on page T4-5-16. Install a hydraulic tester to the main pump.
2. Remove the hose from regulator port Pi1 of the pump. Install a plug to the removed hose.
   : 19 mm
3. Install adapters (13) (3 used) to pressure reducing valve (14). Remove the hose from port P of the orbit roll. Insert tee (10), adapter (11) and hose (12) between orbit roll and charging block.
   Install hose (12) to port P1 on reducing valve (14).
   : 19 mm
4. Install tee (15) to port P2 on pressure reducing valve (14). Install pressure gauge (16) and hose (12) to tee (15). Install hose (12) to regulator port Pi1.
   : 19 mm
5. Install hose (12) and adapter (13) to port T on pressure reducing valve (14). Remove plug L from the return pipe. Install hose (12).
   : 19 mm
6. Connect regulator port Pi2 to the hydraulic oil tank. As for the emergency steering, install tee (17), adapter (18) and hose (19) to port E in the emergency steering block. Install hose (19) to regulator port Pi2.
7. Remove the vacuum pump. Loosen the plug on top of the pump casing. Bleed air from the pump casing until oil only comes out of the plug clearance.
8. Fully open the loading valve of the hydraulic tester.
9. Start the engine. Check for any oil leaks at the pipe connection.

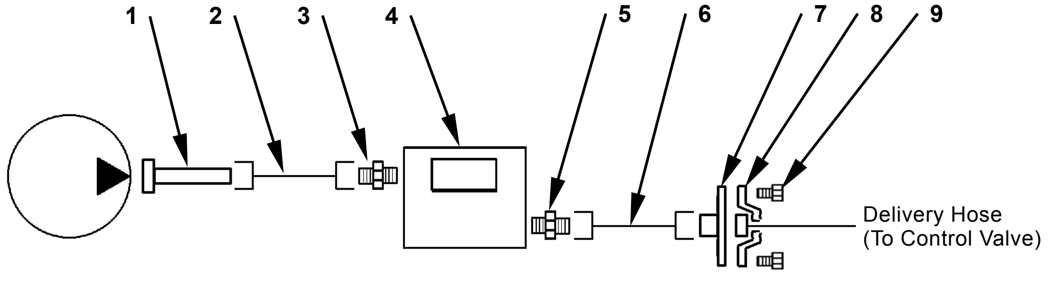
Measurement:
1. Maintain the hydraulic oil temperature at 50±5 °C (122±41 °F)
2. The pump flow rate in response to the external command pilot pressure is measured.
3. Set engine speed at fast idle. Depress the accelerator pedal fully
4. Adjust the pressure reducing valve set pressure to each pressure point specified along the main pump P-Q curve. (Pilot Characteristics) (Refer to T4-2.) Measure the flow rates and engine speeds at the pressure points specified in the P-Q curve.
5. Repeat the measurement three times and calculate the average values.

Evaluation:
1. Convert the measured flow rates to those at the specified pump speed by using the following formulas:

$$Qc = (Ns \times Q) / Ne$$

Qc : Converted Flow Rate
Q : Measured Flow Rate
Ns : Specified Engine Speed : ZW220: 2170 min^{-1}
ZW250: 2240 min^{-1}
Ne : Measured Engine Speed Value by Dr. ZX

2. Standard Flow Rate
   Refer to the Performance Standard Table in Group T4-2.



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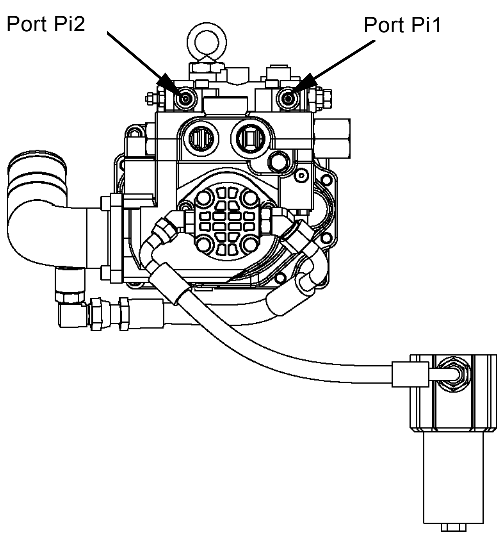
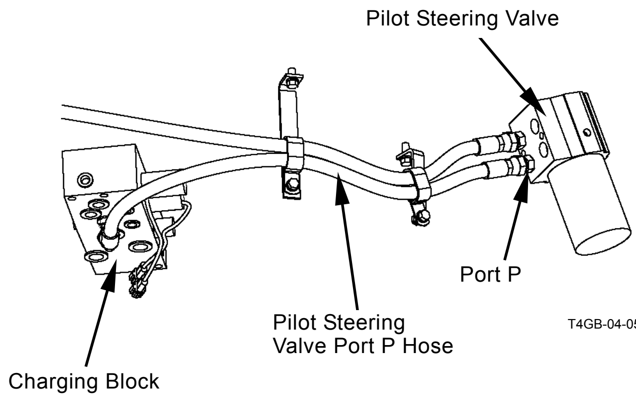
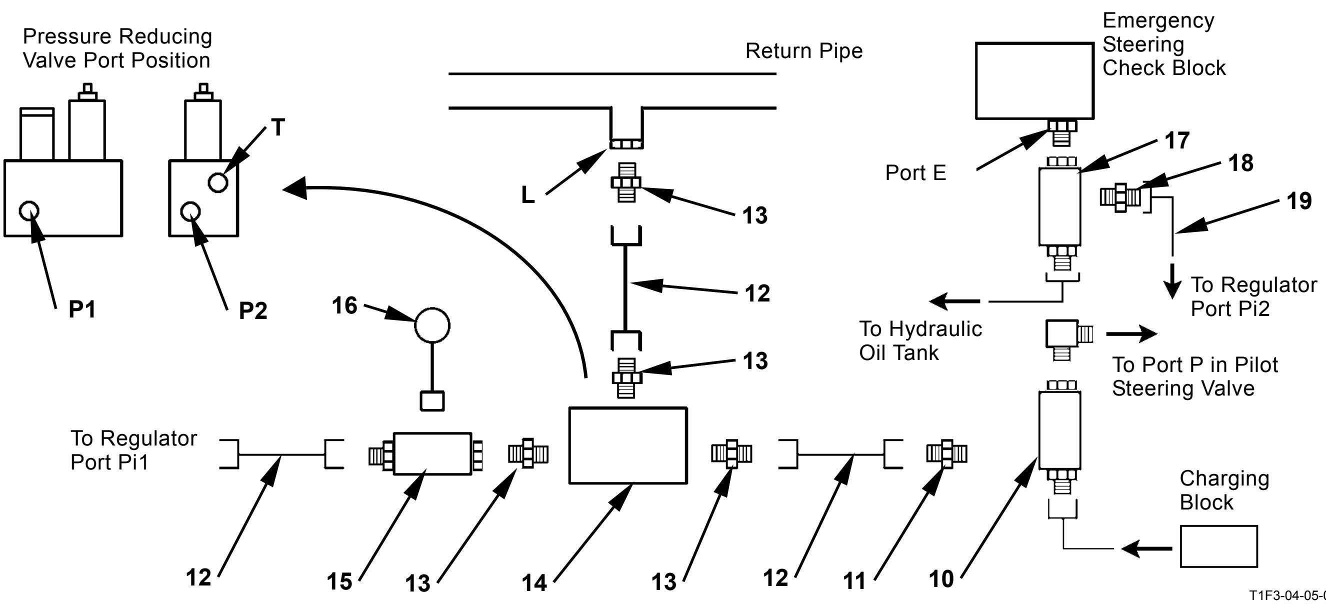


T4GB-04-05-026



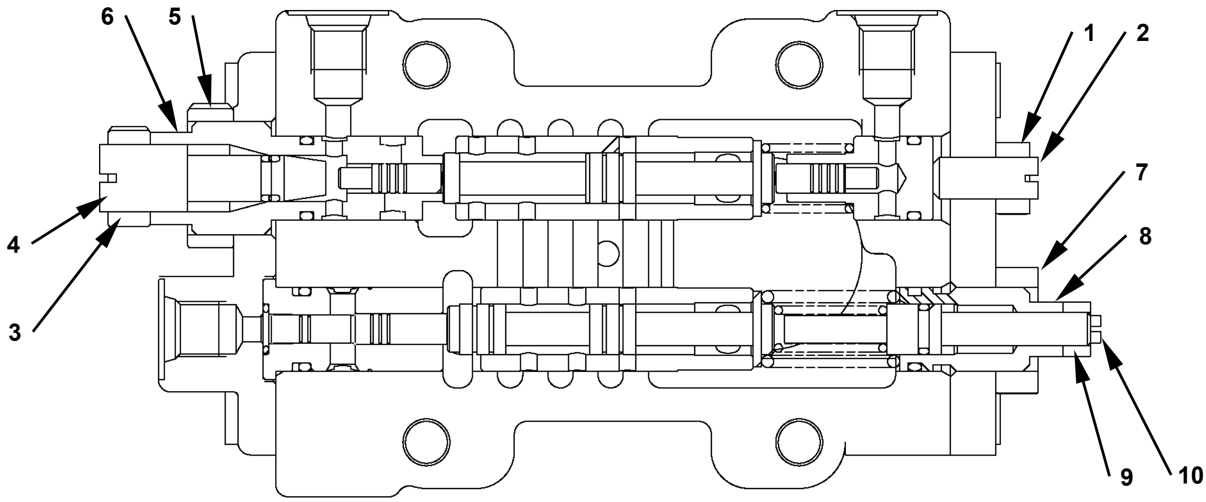
T4GB-04-05-025



T1F3-04-05-009

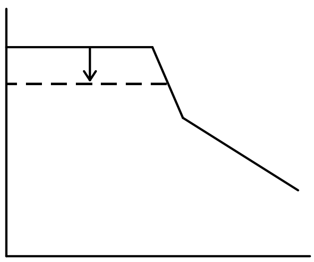
1 - Pipe	6 - Test Hose	11 - Adapter (9/16 UNF x G1/4) (A852123)	16 - Pressure Gauge
2 - Test Hose	7 - Flange	12 - Hose (9/16 UNF) (4304905)	17 - Tee
3 - Adapter (G1 × UNF1-7/8) (ST 6146)	8 - Split Flange (4085560)	13 - Adapter (9/16 UNF x G3/8) (A852133)	18 - Adapter
4 - Hydraulic Tester	9 - Bolt (J781240) (4 Used)	14 - Pressure Reducing Valve (4325439)	19 - Hose
5 - Adapter (G1 × UNF1-7/8) (ST 6146)	10 - Tee 7/16-20UNF x G1/4	15 - Tee (9/16 UNF x G1/4)	

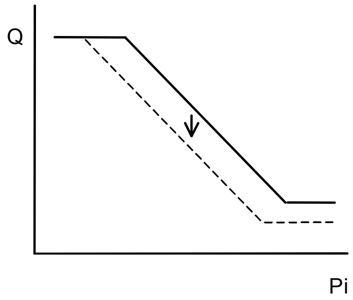
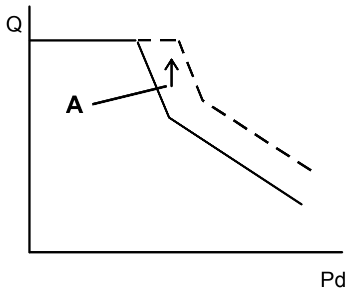
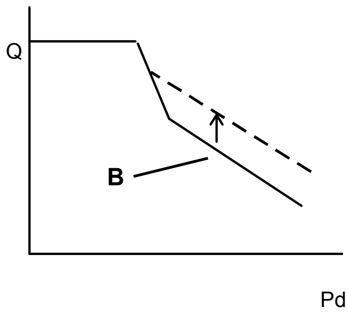
REGULATOR ADJUSTMENT



T4GB-04-05-016

1 - Lock Nut (For Minimum Flow Rate)
2 - Adjusting Screw (For Minimum Flow Rate)
3 - Lock Nut (For Maximum Flow Rate)
4 - Adjusting Screw (For Maximum Flow Rate)
5 - Lock Nut (For Pilot Pressure Characteristic)
6 - Adjusting Screw (For Pilot Pressure Characteristic)
7 - Lock Nut (For P-Q Control)
8 - Adjusting Screw (For P-Q Control)
9 - Lock Nut (For P-Q Control)
10 - Adjusting Screw (For P-Q Control)

Adjustment Item	Adjustment Procedure	Remarks
1. Maximum Flow Rate 	ZW220 Loosen lock nut (5) and turn adjusting screw (6). Rotate adjusting screw (6) 1/4 a turn clockwise and the maximum pump flow rate decreases by 11.26 cm^3/rev. (0.69 in^3/rev). : 32 mm : 40 N·m (4.1 kgf·m, 30 lbf·ft)	1) Do not turn adjusting screw (6) more than two turns. 2) Do not increase the maximum flow rate. In other words, do not turn adjusting screw (6) counterclockwise. 3) Secure tighten lock nut (5) after the adjustment.
	ZW250 Loosen lock nut (3) and turn adjusting screw (4). Rotating adjusting screw (4) 1/4 a turn clockwise and maximum pump flow rate decreases by 12.58 cm^3/rev. (0.77 in^3/rev). : 22 mm : 20 N·m (2 kgf·m, 15 lbf·ft)	1) Do not turn the adjusting screw (4) more than two turns. 2) Do not increase the maximum flow rate. In other words, do not turn adjusting screw (4) counterclockwise. 3) Securely retighten lock nut (3) after the adjustment.

Adjustment Item	Adjustment Procedure	Remarks
2. Pilot Pressure Characteristics  	Loosen lock nut (1) and turn adjusting screw (2). Rotate adjusting screw (2) 1/4 a turn clockwise and the pump flow rate decreases by X cm^3/rev. (X in^3/rev). ZW220: X=8.08 (0.49) ZW250: X=9.22 (0.56) : 17 mm : 20 N·m (2 kgf·m, 15 lbf·ft)	1) Do not turn the adjusting screw (2) more than one turn. 2) Securely tighten lock nut (1) after the adjustment.
3. P-Q Control (Torque Adjustment)   	A: Loosen lock nut (7) and turn adjusting screw (8). Rotating adjusting screw (8) 1/4 a turn clockwise increases and the pump flow rate increase by Y cm^3/rev. (Y in^3/rev.). ZW220: Y=13.6 (0.83) ZW250: Y=15.5 (0.95) : 30 mm : 30 N·m (3.1 kgf·m, 22 lbf·ft) B: Loosen lock nut (9) and turn adjusting screw (10). Rotating adjusting screw (10) 1/4 a turn clockwise and the pump flow rate increases by Z cm^3/rev. (Z in^3/rev). ZW220: Z=3.9 (0.24) ZW250: Z=4.2 (0.26) : 13 mm : 10 N·m (1 kgf·m, 7.5 lbf·ft)	1) Do not turn the adjusting screws (8, 10) more than one turn. 2) Rotate the adjusting screws (8, 10) while watching the engine performance. 3) Securely tighten lock nuts (7, 9) after the adjustment.

SERVICE BRAKE PRESSURE (FRONT AND REAR)

(The pressure can be measured by using Dr. ZX.)

CAUTION: If air is mixed in the brake system, the brake function is reduced and serious hazard may occur. Bleed air from the brake system after removing and installing the pipe lines and replacing hydraulic oil.
Refer to Troubleshooting B in Group T5-6.

Summary:

Measure the pressure at the brake valve pressure check port when the brake pedal is depressed.

Preparation:

CAUTION: Set the block onto the front and rear tires in order not to move the machine. Keep away from the machine.

1. Stop the engine.
2. Push the air bleed valve on top of the hydraulic oil tank and release any remaining pressure.
3. Depress the brake at least 50 strokes in order to reduce the accumulated pressure left in the brake circuit.
4. Install the measuring devices to the front and rear wheel brake circuits.

4-1. Front wheel brake circuit pressure: Remove plug (1) from the pressure check port in brake valve. Install a nipple and a pressure gauge to the pressure check port.

: 19 mm, 22 mm

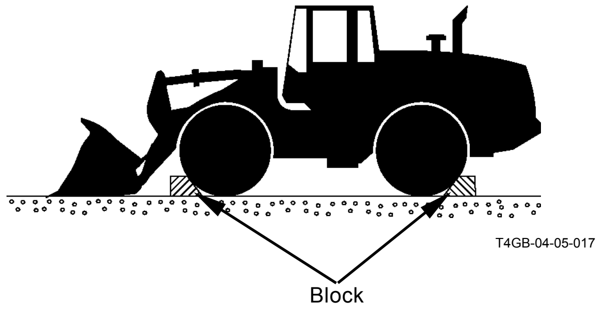
: 6 mm

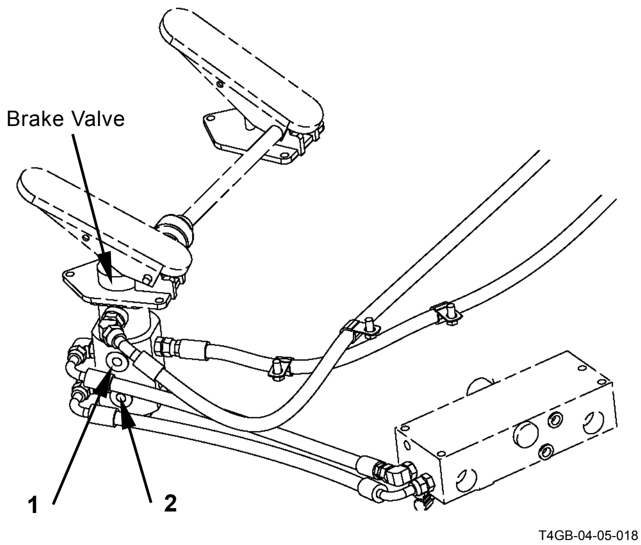
4-2. Rear wheel brake circuit pressure: Remove plug (2) from the pressure check port in brake valve. Install a nipple and a pressure gauge to the pressure check port.

: 19 mm, 22 mm

: 6 mm

5. Start the engine. Check for any oil leaks at the pressure gauge connection.
6. Maintain the hydraulic oil temperature at 50±5 °C (122±41 °F).





Conditions for Measurement:

1. Set engine speed at fast idle.
2. Depress the accelerator pedal fully.

Measurement:

1. Measure the pressure when fully depressing the brake pedal at left side to the floor.
2. Repeat the measurement three times and calculate the average values.

Evaluation:

Refer to the Performance Standard Table in Group T4-2.

Remedy:

Refer to Troubleshooting B in Group T5-6.
Normally, the front and rear wheel brake pressures become equal. If not, malfunction of the brake valve and dirt caught in the valve are suspected.

PARKING BRAKE PRESSURE

CAUTION: If air is mixed in the brake system, the brake function is reduced and serious hazard may occur. Bleed air from the brake system after removing and installing the pipe lines and replacing hydraulic oil.
Refer to Troubleshooting B in Group T5-6.

Summary:
1. Measure the parking brake release pressure in the parking brake release circuit.

Preparation:

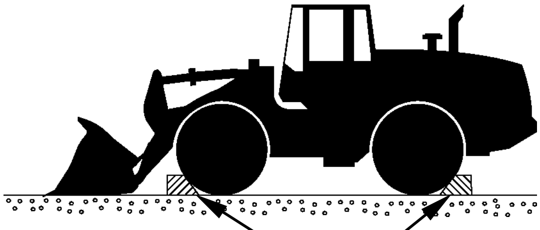
CAUTION: Set the block onto the front and rear tires in order not to move the machine. Keep away from the machine.
1. Stop the engine.
2. Push the air bleed valve on top of the hydraulic oil tank and release any remaining pressure.
3. Remove brake hose (1) from the parking brake side. Install a pressure gauge to the removed hose.
   : 19 mm, 22 mm
4. Start the engine. Check for any oil leaks at the pressure gauge connection.
5. Maintain the hydraulic oil temperature at 50±5 °C (122±41 °F).

Conditions for Measurement:
1. Set engine speed at fast idle.
2. Depress the accelerator pedal fully.

Measurment:
1. Release the parking brake and measure the pressure at this time.
2. Repeat the measurement three times and calculate the average values.

Evaluation:
Refer to the Performance Standard Table in Group T4-2.

Remedy:
Refer to Troubleshooting B in Group T5-6.



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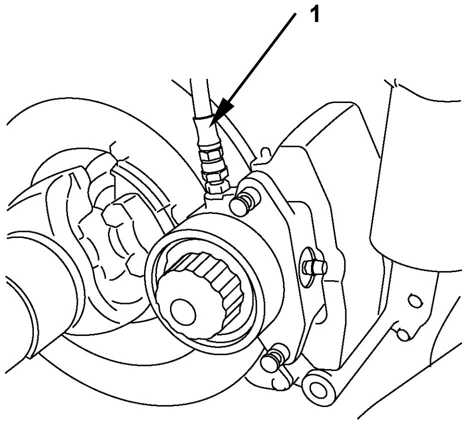

M4GB-06-004

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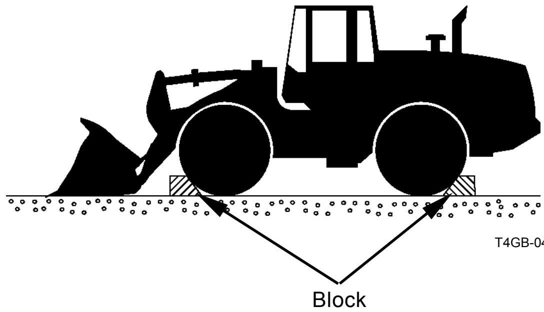
BRAKE ACCUMLATED PRESSURE

(The pressure can be measured by using Dr. ZX.)

CAUTION: If air is mixed in the brake system, the brake function is reduced serious hazard may occur. Bleed air from the brake system after removing and installing the pipe lines and replacing hydraulic oil.
Refer to the Troubleshooting B in Group T5-6.

Summary:

The accumulated brake pressure is measured at output port of the accumulator. The accumulated brake pressure varies according to operation of the brake. Record the maximum value.

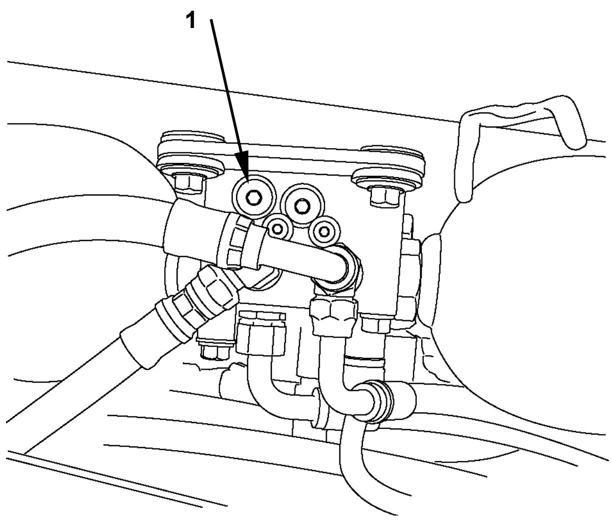


T4GB-04-05-017

Preparation:

CAUTION: Set the block onto the front and rear tires in order not to move machine. Keep away from the machine.

1. Stop the engine.
2. Push the air bleed valve on top of the hydraulic oil tank and release any remaining pressure.
3. Depress the brake at least 50 strokes in order to reduce the accumulated pressure left in the brake circuit.
4. Remove plug (1) from the pressure check port of charging block in bottom of the cab.
   Install a nipple and a pressure gauge to the pressure check port.
   : 19 mm, 22 mm
   : 6 mm
5. Start the engine. Check for any oil leaks at the pressure gauge connection.
6. Maintain the hydraulic oil temperature at 50±5 °C (122±41 °F).



T4GB-04-05-019

Conditions for Measurement:
1. Set engine speed at fast idle.
2. Depress the accelerator pedal fully.

Measurement:
1. Measure maximum pressure when depressing the brake pedal slowly several times.
2. Repeat the measurement three times and calculate the average values.

Evaluation:
Refer to the Performance Standard Table in Group T4-2.

Remedy:
Refer to Troubleshooting B in Group T5-6.

BRAKE WARNING SET PRESSURE (DECREASE)

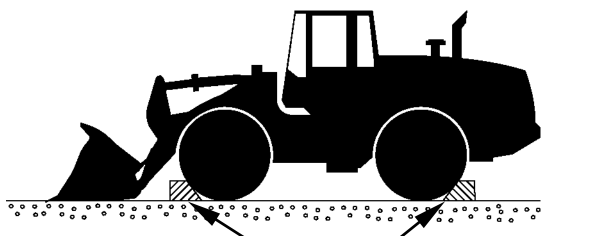
(The pressure can be measured by using Dr. ZX.)

CAUTION: If air is mixed in the brake system, the brake function is reduced serious hazard may occur. Bleed air from the brake system after removing and installing the pipe lines and replacing hydraulic oil.
Refer to the Troubleshooting B in Group T5-6.

Summary:
When the warning buzzer sounds by reducing the accumulated brake pressure, measure the pressure at the output port of accumulator.

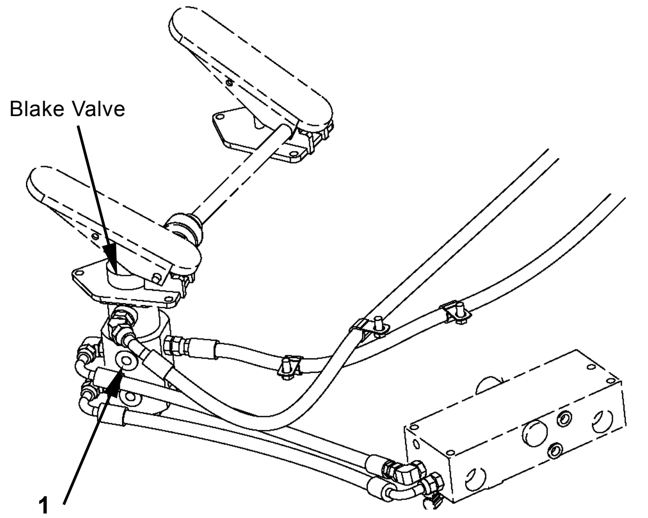
Preparation:

CAUTION: Set the block onto he front and rear tires in order not to move the machine. Keep away from the machine.



T4GB-04-05-017

1. Stop the engine.
2. Push the air bleed valve on top of the hydraulic oil tank and release any remaining pressure.
3. Depress the brake at least 50 strokes in order to reduce the accumulated pressure left in the brake circuit.
4. Remove plug (1) from the charged pressure check port in brake valve. Install a nipple and a pressure gauge to the pressure check port.
   : 19 mm, 22 mm
   : 6 mm
5. Start the engine. Check for any oil leaks at the pressure gauge connection.
6. Maintain the hydraulic oil temperature at 50±5 °C (122±41 °F).



T4GB-04-05-018

Conditions for Measurement:

1. Select the following switch positions.

Forward/Reverse Lever	Parking Brake Switch
N	P (Parking)

Measurement:

1. Stop the engine. Turn the key switch to ON position.
2. Measure the pressure when warning buzzer sounds by slowly depressing the brake pedal several times.
3. Repeat the measurement three times and calculate the average values.

Evaluation:

Refer to the Performance Standard Table in Group T4-2.

Remedy:

Refer to Troubleshooting B in Group T5-6.

BRAKE WARNING SET PRESSURE (INCREASE)

(The pressure can be measured by using Dr. ZX.)

CAUTION: If air is mixed in the brake system, the brake function is reduced serious hazard may occur. Bleed air from the brake system after removing and installing the pipe lines and replacing hydraulic oil.
Refer to the Troubleshooting B in Group T5-6.

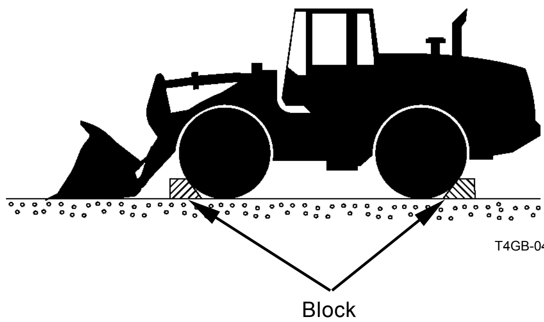
Summary:

When sounding of the warning buzzer stops by increasing the accumulated brake pressure, measure the pressure at the output port of accumulator.

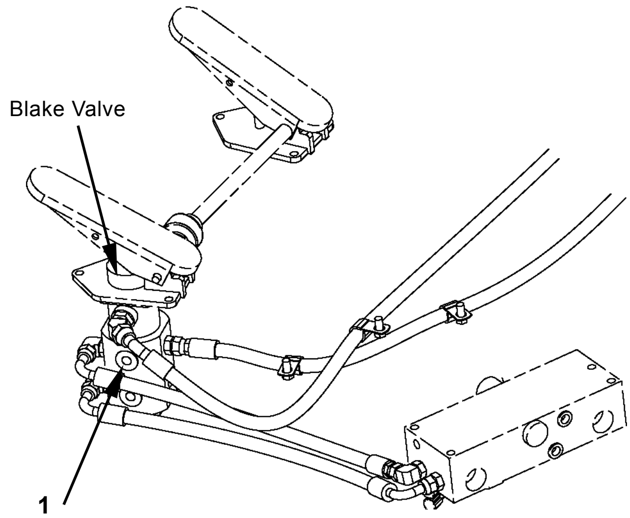
Preparation:

CAUTION: Set the block onto the front and rear tires in order not to move machine. Keep away from the machine.

4. Stop the engine.
5. Push the air bleed valve on top of the hydraulic oil tank and release any remaining pressure.
6. Depress the brake at least 50 strokes in order to reduce the accumulated pressure left in the brake circuit.
5. Remove plug (1) from the charged pressure check port in brake valve. Install a nipple and a pressure gauge to the pressure check port.
   : 19 mm, 22 mm
   : 6 mm
6. Start the engine. Check for any oil leaks at the pressure gauge connection.
5. Maintain the hydraulic oil temperature at 50±5 °C (122±41 °F).



T4GB-04-05-017



T4GB-04-05-018

Conditions for Measurement:

1. Select the following switch positions.

Forward/Reverse Lever	Parking Brake Switch
N	ON

Measurement:

1. Stop the engine. Turn the key switch to ON position.
2. Set the engine control dial to slow idle.
3. Depress the brake pedal several times and make the warning buzzer sound.
4. Start the engine. Measure the pressure when sounding of the warning buzzer stops. Notice that it is difficult to read the gauge as the pressure increases rapidly.
5. Repeat the measurement three times and calculate the average values.

Evaluation:

Refer to the Performance Standard Table in Group T4-2.

Remedy:

Refer to Troubleshooting B in Group T5-6.

TRANSMISSION CLUTCH PRESSURE

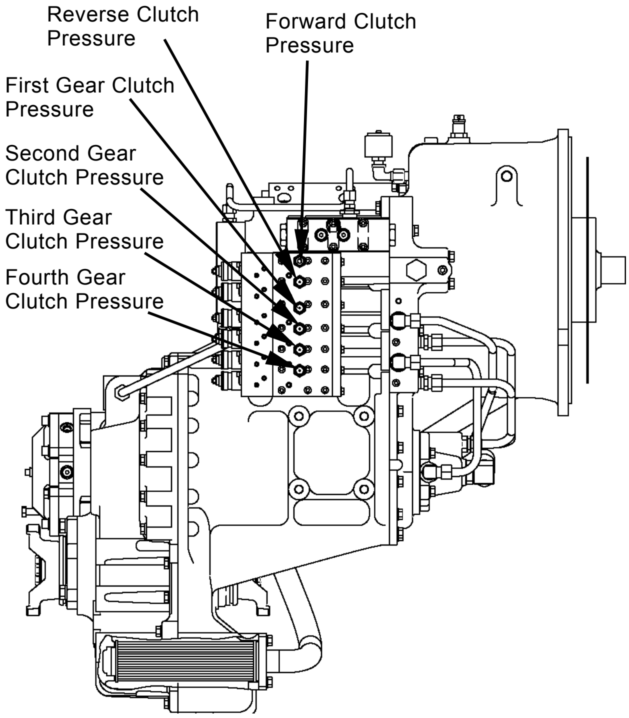
Summary:
Measure each operating pressure of the tansmission clutch at each port of the transmission control valve.

Preparation:
1. Stop the engine.
2. Remove the plug from the port. Install a hose, an adapter and a pressure gauge.
   : 8 mm
   : 21 mm
3. Start the engine. Check for any oil leaks at the pressure gauge connection.
4. Maintain the torque converter oil temperature at 60 to 80 °C (140 to 176 °F).

Measurement:

CAUTION: Set the block onto the front and rear tires in order not to move machine. Keep away from the machine.

1. Select the following switch positions.



T4GB-04-05-023

Accelerator Pedal	Brake Pedal	Travel Mode	Clutch Cut-Off Position Switch	Parking Brake Switch
Fully Depressed	Fully Depressed	M	OFF	OFF

2. Operate the forward/reverse lever and the shift switch. Measure each clutch pressure.

		F	R	1st	2nd	3rd	4th
Travel Switch	Forward/Reverse Lever	F	R	N	N	N	N
	Shift Switch	4	4	1	2	3	4

3. Repeat the measurement three times and calculate the average values.

Evaluation:
Refer to the Performance Standard Table in Group T4-2.

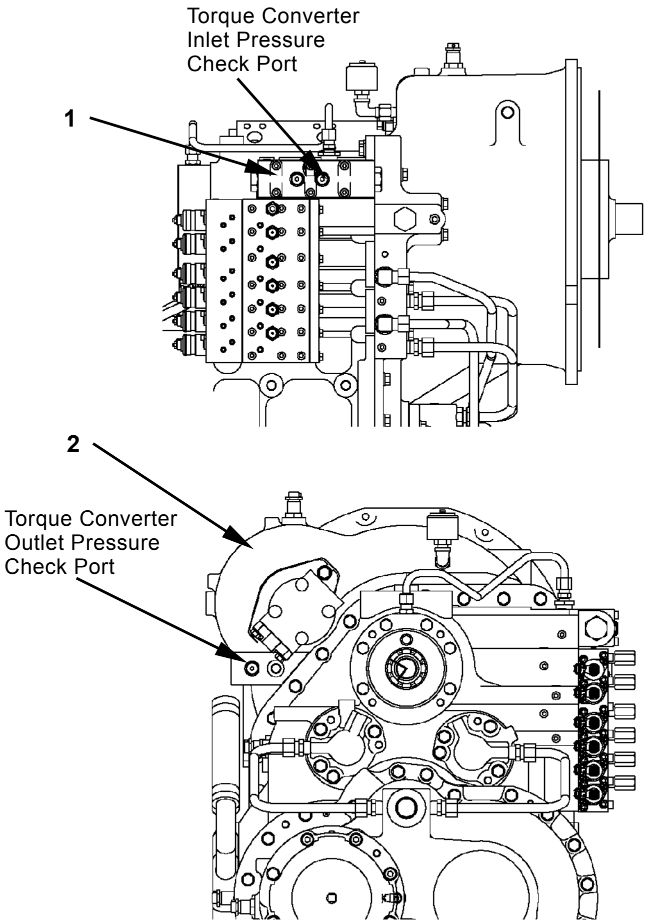
TORQUE CONVERTER PRESSURE (INLET AND OUTLET)

Summary:

Measure inlet pressure and outlet pressure of the torque converter pressure at the port of torque converter housing.

Preparation:

1. Stop the engine.
2. Inlet pressure:
   Remove the plug from the port of regulator valve (1). Install a hose, an adapter and a pressure gauge to the open part.
   : 6 mm
   Outlet pressure:
   Remove the plug from the port of torque converter housing (2). Install a hose, an adapter and a pressure gauge to the open part.
   : 6 mm
3. Start the engine. Check for any oil leaks at the pressure gauge connection.
4. Maintain the torque converter oil temperature at 60 to 80 °C (140 to 176 °F).

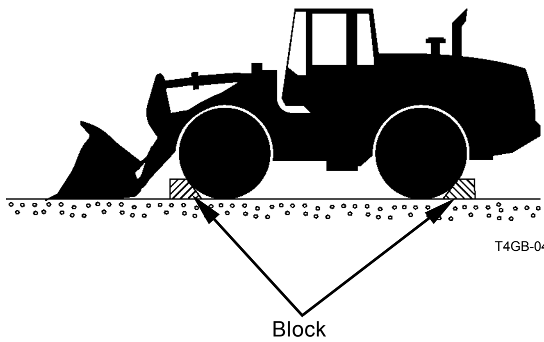


T4GB-04-05-024

Measurement:

CAUTION: Set the block onto the front and rear tires in order not to move the machine. Keep away from the machine.

1. Select the following switch positions:



T4GB-04-05-017

Accelerator Pedal	Brake Pedal	Travel Mode	Clutch Cut-Off Position Switch	Parking Brake Switch
Fully Depressed	Fully Depressed	M	OFF	OFF

2. Set the front/reverse lever to “F” (Forward) and the shift switch to “4” (Fourth Gear). Measure the pressure.
3. Repeat the measurement three times and calculate the average values.

Evaluation:

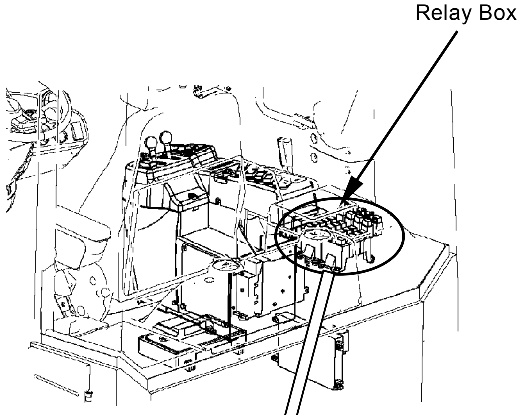
Refer to the Performance Standard Table in Group T4-2.

(Blank)

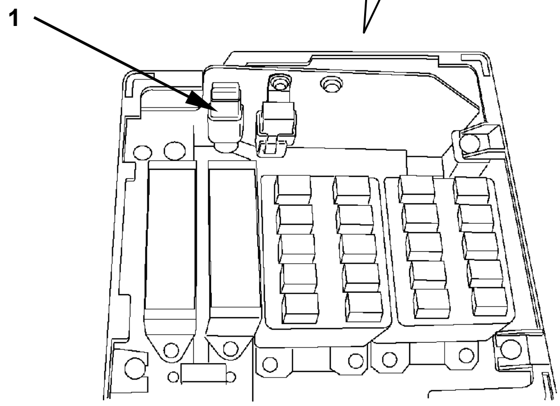
TRANSMISSION LEARNING

After removing and/or replacing the components as described below for repair, perform the transmission learning (calibration).

- Replacement or repair of the transmission assembly, transmission control valve or clutch pack
- Replacement or repair of MC (Main Controller)



T4GB-04-06-007



T4GB-04-06-001

Preparation:

1. Start the service mode in monitor. Start the engine. (Refer to T5-1-6.)
2. Select the transmission oil temperature on the monitor. (Refer to T5-1-7.)
3. Heat transmission oil.

3-1. Disconnect connector (1) (6-pole, gray) in the relay box from dummy connector.

3-2. Select or operate the switches from the left item in the table below.

Clutch Cut-Off Position Switch	Shift Switch	Parking Brake Switch	Brake Pedal	Accelerator pedal	Forward/Reverse Lever
OFF	Second Gear	OFF	Fully Depressed	Fully Depressed	F

3-3. Stall the transmission and heat transmission oil to 90 °C (194 °F).

3-4. When transmission oil temperature on the monitor reaches 90 °C (194 °F), return the forward/reverse lever to neutral (N) and stop the engine.

Learning

1. Install the calibration switch to the connector (6-pole, gray) in relay box in 10 seconds after turning the key switch OFF (the battery relay is tuned OFF). At this time, return the calibration start switch to neutral.

IMPORTANT: If the battery relay is not turned OFF, calibration cannot be performed. It takes 10 seconds to turn the battery relay OFF after turning the key switch OFF.

2. Start the service mode in monitor. Start the engine. Set engine speed at idling speed. (Refer to T5-1-6.)

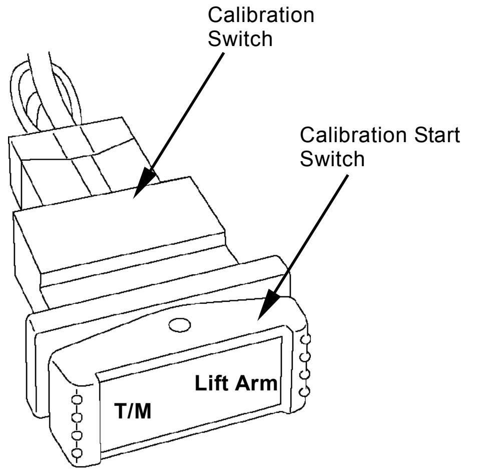
3. Select the transmission oil temperature on the monitor. (Refer to T5-1-7.)

IMPORTANT: Do not operate each switch and lever until calibration finishes.

4. When transmission oil temperature reaches 75 °C (167 °F), push T/M in the calibration start switch. The start of learning display as illustrated in the right is selected on the monitor.

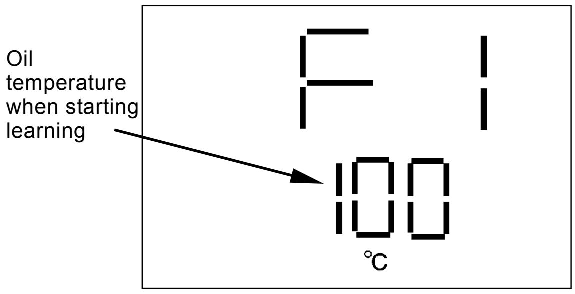
5. When learning finishes, the end of learning display as illusrated in the right is selected on the monitor. Return the calibration start switch to neutral.

6. Remove the calibration switch from the connector and stop the engine.



T4GB-04-06-003

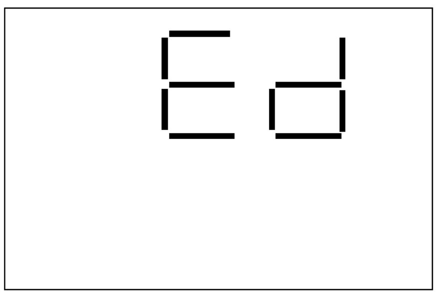
Start of Learning



T4GB-04-06-004

The speed stage during learning is displayed on the monitor.
11 to 13: First Gear, 21 to23: Second Gear,
31 to 33: Third Gear, 41 to 43: Fourth Gear,
F1 to F3: Forward, A1 to A3: Reverse

End of Learning



T4GB-04-06-006

Error Display

When calibration fails, the error is displayed on the monitor.
The error consists of two types; when start of calibration fails, when calibration is aborted during calibration.

- Error display when start of calibration fails
  If the error display as figure 1 is displayed before starting calibration, calibration cannot be continued. After the trouble correspoding to error No. is solved, start calibration again.

Error No.	Error
2	The forward/reverse lever is not in “N”.
3	The parking brake is not in “ON”.
4	The machine is driving.
5	T/M temperature is lower than specification. *1
6	T/M temperature is higher than specification. *1
7	Engine speed is lower than specification. *2
8	Engine speed is higher than specification. *2

*1: Error No. and T/M temperature at this time (figure 2) are displayed alternately.
*2: Error No. and engine speed at this time (figure 3) are displayed alternately.

NOTE: If error No. 2, 3 or 4 is displayed, set the switch and lever corresponding to this error to the correct position so that SR is displayed on the monitor.
If error No. 6 is displayed, wait until transmission oil temperature reaches specification so that SR is displayed on the monitor.
When SR is displayed, push the calibration start switch again and start calibration.

Figure 1

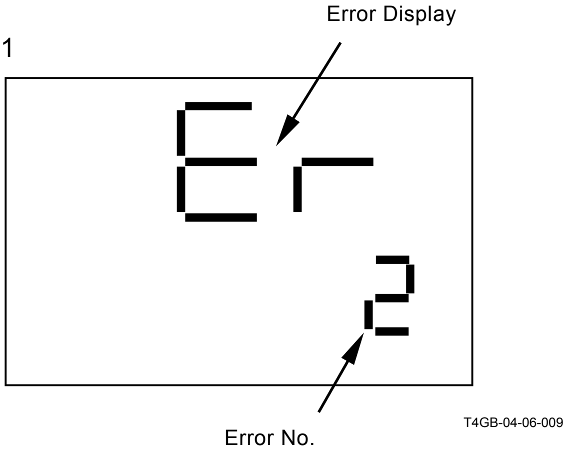


Figure 2

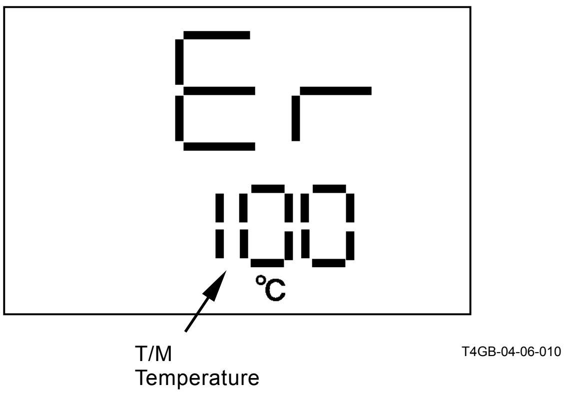
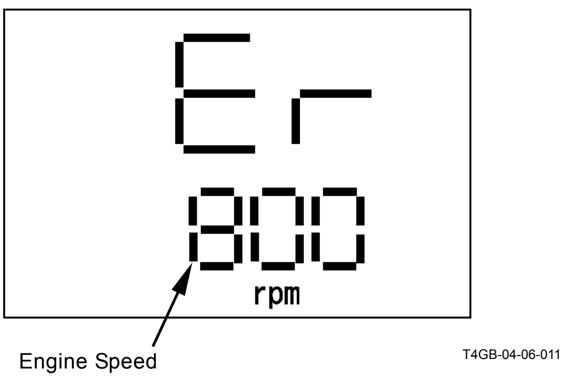


Figure 3



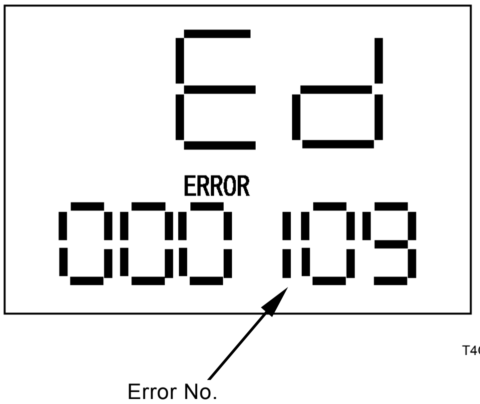
NOTE: If error No. 5, 7 or 8 is displayed, stop the engine. Remove the calibration switch from the connector and solve the trouble. Then, start calibration again.

- Error display when calibration is aborted during calibration

When calibration is aborted during calibration, the error display as illustrated in the right is selected.
After the trouble is solved, start calibration again.

Error No.	Error
000108	The key is turned into OFF.
000208	Engine speed is out of specification.
000308	The parking brake is turned into OFF.
000408	The machine starts traveling.
000508	The forward/reverse lever is operated.
000109 000209 000309	Failure of learning at first gear.
000110 000210 000310	Failure of learning at second gear.
000111 000211 000311	Failure of learning at third gear.
000112 000212 000312	Failure of learning at fourth gear.
000113 000213 000313	Failure of learning at forward.
000114 000214 000314	Failure of learning at reverse.

NOTE: *Cause of the error No. display on failure of learning (from first gear to reverse): The clutch at the speed when the error occurs may be out of correctable range (malfunction of drive unit parts) or the transmission oil temperature may be beyond the specification.*



T4GB-04-06-013

LIFT ARM ANGLE SENSOR LEARNING (OPTIONAL)

After removing and/or replacing the components as described below for repair, perform the left arm angle learning (calibration).

- Removal and installation of angle sensor, Replacement of angle sensor
- Replacement or repair of MC (Main Controller)

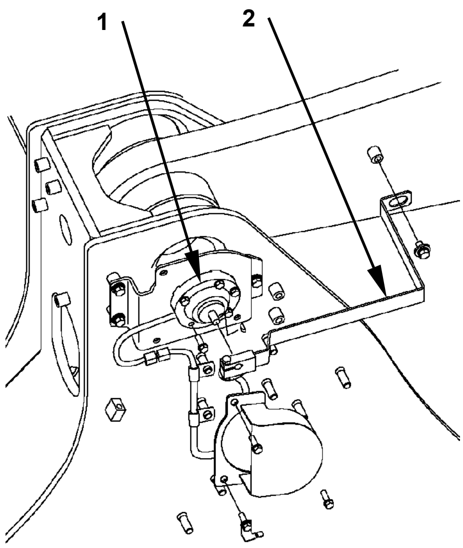
Preparation:

1. Install Dr. ZX and start the engine.
   Select Boom Anlge and Angle Sensor Learning Status on the main controller screen in Dr. ZX.

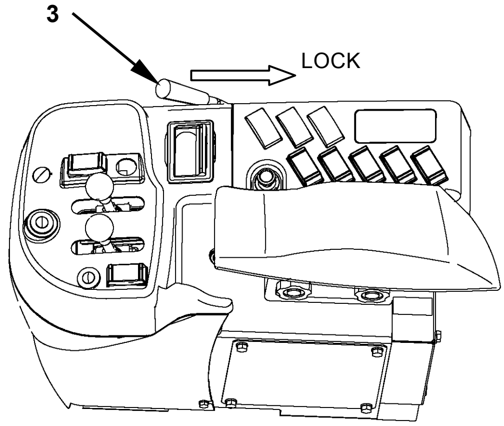
2. Raise the lift arm to the highest position.
   At this time, check if voltage at Boom Angle on the display in Dr. ZX is 3.78±0.5 V.

3. If voltage 3.78±0.5 V is not displayed, the followings may be caused. Conduct the remedy.
   - The rotation shaft in angle sensor (1) turns with sensor lever (2) together.
   - Angle sensor (1) failure

4. Set control lever lock (3) to LOCK position and stop the engine.



T4GB-04-06-008



M4GB-01-050

5. Install calibration switch (5) to connector (4) (6-pole, gray) in relay box in 10 seconds after turning the key switch OFF (the battery relay is tuned OFF). At this time, return calibration start switch (6) to neutral.

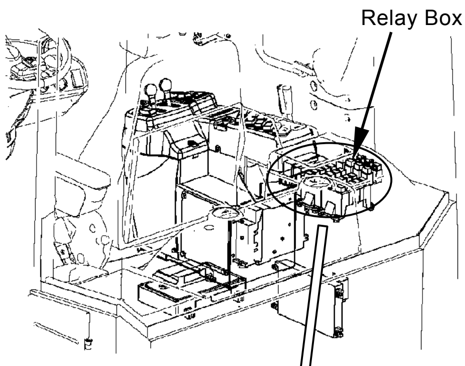
IMPORTANT: If the battery relay is not turned OFF, calibration cannot be performed. It takes 10 seconds to turn the battery relay OFF after turning the key switch OFF.

6. Lay down calibration start switch (6) to the lift arm side. Start the engine at idling speed.

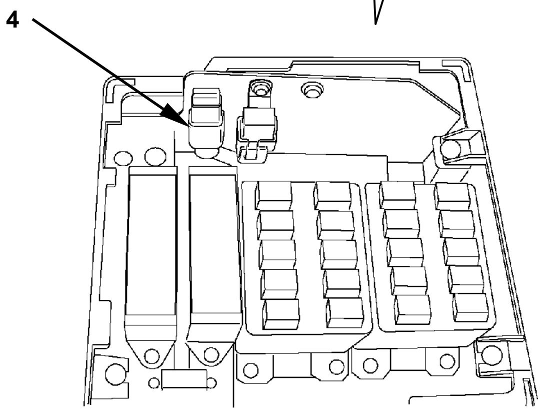
7. If “Finish” in Angle Sensor Learning Status on Dr. ZX is turned into black, learning finishes. Return calibration start switch (6) to OFF (neutral).
   If “Failed” or “Not Learn” in Angle Sensor Learning Status on Dr. ZX is turned into black, repeat the procedures from step 1.

8. Return the control lever lock to UNLOCK. Lower the lift arm onto the ground. Stop the engine.

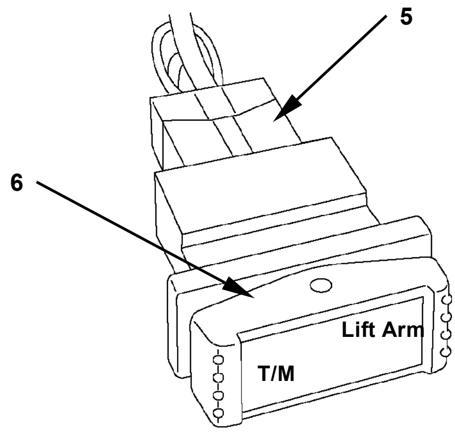
9. After learning of the lift arm angle sensor, set the stop position of lift arm. (Refer to the Operator’s Manual.)



T4GB-04-06-007



T4GB-04-06-001



T4GB-04-06-003

DRIVE BELT TENSION ADJUSTMENT

Summary:

If the drive belt is loosened, the charge is defective of the battery or wear-out at early stage of drive belt occurs.

If the drive belt is too tense, the water pump and the bearing of alternator are damaged.

Adjust the drive belt within specification.

Measurement:

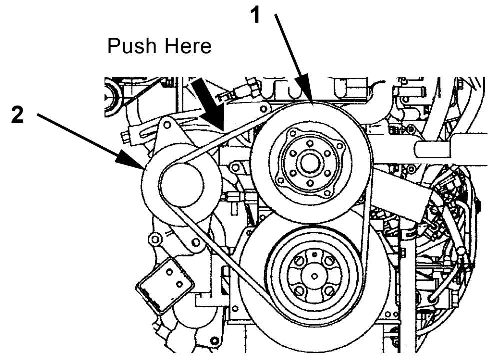
Push the drive belt between water pump (1) and alternator (2) pulley by finger. Measure slack of the drive belt.

Pushing force: Approx. 98 N (10 kgf, 72 lbf)

CAUTION: As soon as the machine is operated, the engine is too hot. When measureing, take a good care.

Evaluation:

Slack of drive belt: 6 to 8 mm (0.24 to 0.31 in)

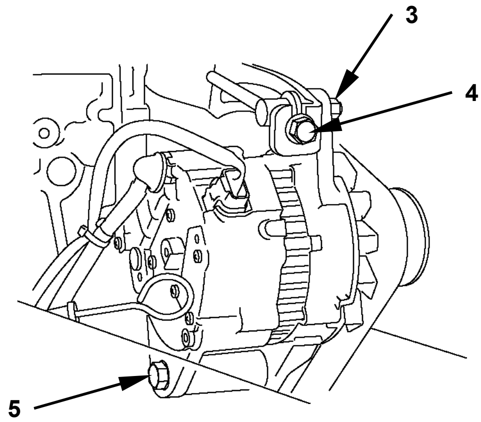


M4GB-07-082

Adjustment:

1. Loosen nut (3) and bolt (5).
2. Adjust tension of the drive belt to specification with bolt (4).
3. Tighten nut (3) and bolt (5).
   After tightening, check slack of the drive belt.

NOTE: When the drive belt is replaced with the new one, the drive belt does not fit first. After the engine is running at slow idle for 3 to 5 minutes, check slack of the drive belt.



T4GB-04-03-001

MEMO

MEMO

SECTION 5
TROUBLESHOOTING

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INTRODUCTION

Refer to the inspection and troubleshooting procedures after any machine trouble has occurred. The inspection and troubleshooting procedures are presented in an orderly fashion in this section to quickly find the cause of the machine trouble and solution.

The troubleshooting section in this manual consists of 8 groups; Diagnosing Procedure, Dr. ZX, e-Wheel, Component Layout, Troubleshooting A (base machine diagnosis by using fault codes), Troubleshooting B (base machine diagnosis starting with inspection of abnormal operational status), Troubleshooting C (monitor diagnosis) and Electrical System Inspection.

- Dr. ZX
  This group contains the operating procedures for Dr. ZX.

- e-Wheel
  Refer to these procedures if any fault codes are displayed when ICF (information controller) and satellite communication controller are diagnosed by using Dr. ZX. (ICF and satellite communication controller self-diagnosing functions retain a record of the electrical signal system malfunction in the form of fault codes. At the same time, as the satellite communication controller sends information onto CAN, the fault code of satellite communication controller can be checked by using ICF.)
  This group contains as follows.
  Download data from ICF and Upload
  Various setting procedures when starting satellite communication, when installing the satellite communication controller and when replacing ICF
  Explanation for the satellite communication system

- Component Layout
  Refer to this group when required to check where the components and inner parts are located.

- Troubleshooting A (base machine diagnosis by using fault codes)
  Refer to these procedures if any fault codes are displayed when each controller of ICF (information controller) is diagnosed by using Dr. ZX (or the service mode of monitor).

IMPORTANT: Each controller self-diagnosing function retains a record of the electrical signal system malfunction in the form of fault codes. At the same time, as each controller sends information onto CAN, the fault code of all controllers can be checked by using ICF.)
ICF records the fault code of each controller and the date when the malfunction occurs.

- Troubleshooting B (base machine diagnosis starting with inspection of abnormal operational status)
  Refer to these procedures when no fault codes are displayed after diagnosing the machine with Dr. ZX (or the service mode of monitor).

- Troubleshooting C (monitor diagnosis)
  Refer to these procedures when gauges and/or indicators are malfunctioning.

- Electrical System Inspection
  Refer to this group when required to obtain precautions and/or information for the electrical system inspection.

DIAGNOSING PROCEDURE

These six basic steps are essential for efficient troubleshooting:

1. Study the System
   Study the machine's technical manuals. Know the system and how it works, and what the construction, functions and specifications of the system components are.

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2. Ask the operator
   Before inspecting, get the full story of malfunctions from the operator below.

   (a) How is the machine being used? (Find out if the machine is being operated correctly)

   (b) When was the trouble noticed, and what types of work the machine doing at that time?

   (c) What are the details of the trouble? Is the trouble getting worse, or did it appear suddenly for the first time?

   (d) Did the machine have any other troubles previously? If so, which parts were repaired before?

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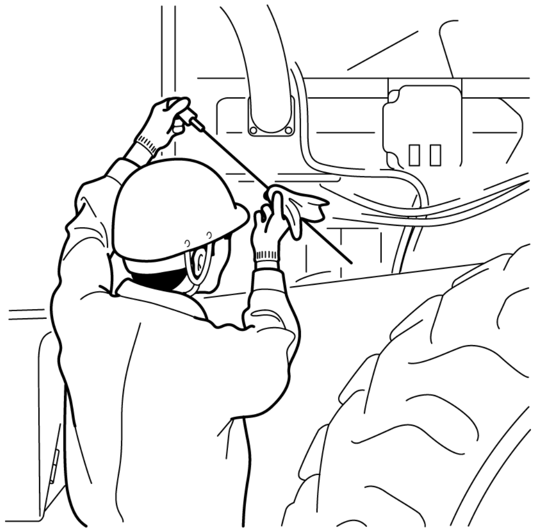
3. Inspect the machine
   Before starting the troubleshooting procedure, check the machine's daily maintenance points, as shown in the operator's manual.

   Also, check the electrical system, including the batteries, as troubles in the electrical system such as low battery voltage, loose connections and blown fuses will result in malfunction of the controllers, causing total operational failure of the machine.
   If troubleshooting is started without checking for blown fuses, a wrong diagnosis may result, wasting time. Check for blown fuses before troubleshooting. Even if a fuse looks normal by visual inspection, a fine crack is difficult to find. Always use a tester when checking the fuses.



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4. Operate the machine yourself
   Try to identify the trouble by operating the machine yourself.
   If the trouble cannot be confirmed (this states are repeated that the trouble is resolved later altough the trouble sometimes occurs), stop the engine and obtain further details of the malfunction from the operator.
   Also, check for any incomplete connections of the wire harnesses correponding to the trouble.

NOTE: It should take time to required to find the malfunction according to the trouble during the troubleshooting. The malfunction may occur due to up and down of hydraulic temperature, weather and under the special condition including expansion by heat and shorted harness by moisture. The informations of weather when the mulfunction occurs, time from the engine start to the trouble occurrence are also important.

5. Perform troubleshooting

CAUTION: Do not disconnect harnesses or hydraulic lines while the engine is running. The machine may malfunction or pressurized oil may spout, possibly resulting in personal injury. Stop the engine before disconnecting harnesses or hydraulic lines.

Perform diagnosis by connecting Dr. ZX to the machine or by using the service mode of monitor. In case any fault code has been displayed by diagnosis by using Dr. ZX or the service mode of monitor, check the cause of the trouble by referring to Troubleshooting A in this section. In case any fault code has been displayed by diagnosis by using Dr. ZX or the service mode of monitor, write the fault code. Delete the fault code once and retry self-diagnosis again. If the fault code is displayed again, check the cause of the trouble by referring to Troubleshooting A in this section. After the machine trouble has been corrected, the fault code (displayed by the service mode of monitor) will be deleted. Therefore, in case problems which are not easily re-predicable are encountered (this states are repeated that the trouble is resolved later altough the troubole sometimes occurs), check the fault code by using Dr. ZX.

NOTE: As for teach controller, the fault code and date when the trouble occurred, which are recorded by ICF, are effective in order to resolve the problem which are not easily re-predicable. (Refer to e-Wheel in this section.)

In case the fault code is not displayed, check operating condition of each component by referring to Troubleshooting B in this section and by using Dr.ZX or the service mode of monitor.

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T4GB-05-01-005

T4GB-05-01-006

Note that the fault codes displayed do not necessarily indicate machine trouble. The controller stores even temporary electrical malfunctions, such as a drop in battery output voltage or disconnections of the switches, sensors, etc., for inspections.
For this reason, the “RETRIAL” is required to erase the accumulated fault codes from the controller memory and to confirm if any fault codes are indicated after the “RETRIAL”.

6. Trace possible causes
   Before reaching a conclusion, check the most likely causes again. Try to identify the actual cause of the trouble.
   Based on your conclusion, make a plan for appropriate repairs to avoid consequent malfunctions.

HOW TO OPERATE SERVICE MODE OF MONITOR

In case the engine starts in normal, the monitor is started in normal mode and only the items, which can be displayed in normal mode, are displayed on the liquid crystal display (LCD). (Refer to the next page.)

When the monitor is started in service mode according to the following procedures, the items which can be displayed in normal mode, the fault code and one part of monitor items can be displayed. (Refer to the next page.)

How to Start Monitor in Service Mode

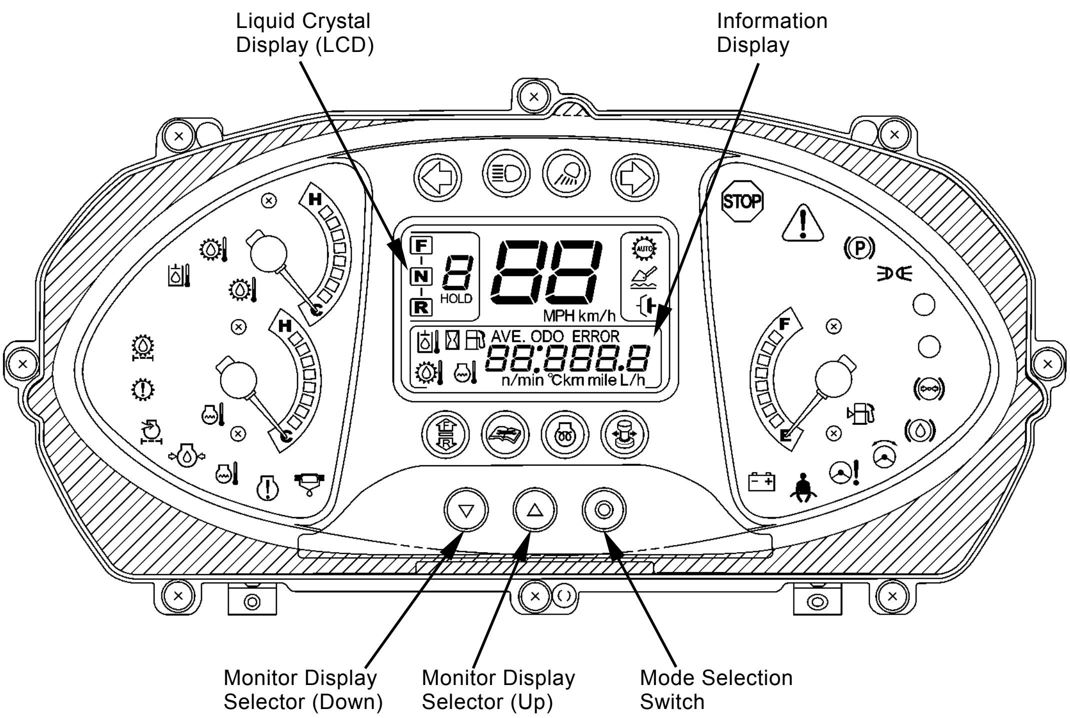
1. Push the monitor display selector (up) and (down) in the monitor at the same time and the key switch is turned ON.

NOTE: The engine can start in normal.

How to Used Monitor in Service Mode

1. Whenever pushing the monitor display selector (up) in the monitor, the display in information display is changed.

NOTE: The fault code is indicated in the display order 11. All fault codes can be indicated. In case more than one fault code is indicated, they will be displayed with an interval of 1 second in order. After the machine malfunction has been repaired, the fault codes are automatically deleted. Accordingly, if any trouble, which is not reproducible, is encountered (this states are repeated that the trouble is resolved later altough the troubole sometimes occurs), it is recommended to use Dr. ZX in order to check the fault code history.



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DISPLAY LIST OF MONITOR SERVICE MODE

Display Order	Description	Monitored Result	Unit	Remark
1	Model	○○○○○○	-	Service Mode
2	Clock (24 hour)	○○:○○	hh:mm	Normal Mode
3	Hour Meter	○○○○○.○ h	hour	Normal Mode
4	Fuel Consumption Amount	○○○○○.○	L/h	Normal Mode
4-1	Average Fuel Consumption Amount	○○○○○.○	L/h	Normal Mode (Displayed when pushing the monitor display selector (down) with “4” displayed, Re-set when pushing the mode selection switch)
5	Other Information	InFo	-	Normal Mode
5-1	Remainder Time when Hydraulic Oil can be used	○○○○○.○	hour	Normal Mode (Displayed when pushing the monitor display selector down) with “5” displayed)
5-2	Remainder Time when Hydraulic Oil Filter can be used	○○○○○.○	hour	Normal Mode (Displayed when pushing the monitor display selector (down) with “5-1” displayed)
5-3	Remainder Time when Transmission Oil can be used	○○○○○.○	hour	Normal Mode (Displayed when pushing the monitor display selector (down) with “5-2” displayed)
5-4	Remainder Time when Transmission Oil Filter can be used	○○○○○.○	hour	Normal Mode (Displayed when pushing the monitor display selector (down) with “5-3” displayed)
5-5	Remainder Time when Engine Oil can be used	○○○○○.○	hour	Normal Mode (Displayed when pushing the monitor display selector (down) with “5-4” displayed)
5-6	Remainder Time when Engine Oil Filter can be used	○○○○○.○	hour	Normal Mode (Displayed when pushing the monitor display selector (down) with “5-5” displayed)
5-7	Remainder Time when Fuel Filter can be used	○○○○○.○	hour	Normal Mode (Displayed when pushing the monitor display selector (down) with “5-6” displayed)
6	Odometer	○○○○○○	km or mile	Service Mode (“Mile” is displayed when pushing the mode selection switch.)
7	Engine Speed	○○○○○	min^{-1}	Service Mode
8	Coolant Temperature	○○○○○	°C	Service Mode
9	Transmission Oil Temperature	○○○○○	°C	Service Mode
10	Hydraulic Oil Temperature	○○○○○	°C	Service Mode
11	Fault Code	○○○○○○	ERROR	Service Mode

(Blank)

OUTLINE

Dr. ZX is used for diagnosis of electrical system including MC (main controller), ECM (engine control module), ICF (information controller) and monitor unit.
Dr. ZX is connected to ICF and failure of each controller and each sensor is displayed as a fault code. (Self-Diagnostic Result)

Dr. ZX displays the input status of sensors and switches connected to each controller and the output status to actuator including solenoid valve from controller with the machine operated in real time. (Controller Diagnosis)

Operation

1. Connect Palm (Dr. ZX) to the diagnosing connector in the cab by using the Hot Sync cable and connecting harness.
2. Turn the key switch ON or start the engine.
3. When turning Palm ON, the following screen is displayed on the display of Palm.

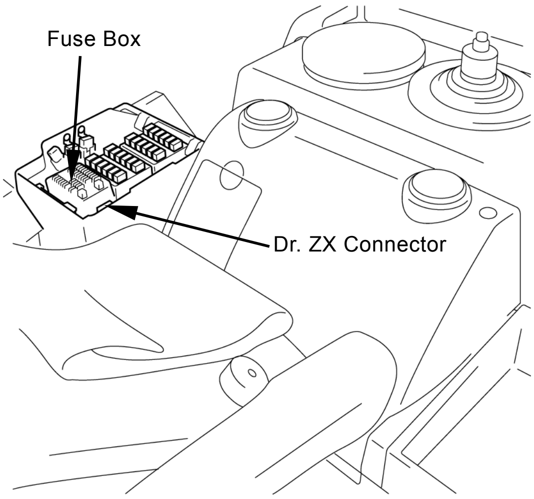
1-1. Initial Screen
Select Dr. ZX icon.

1-2. Password Setup Screen (When the password has unset)
Set the password.

1-3. Service Software Selection Screen
+ Select ZX-3 Mid.

1-4. Function Selection Screen
+ Self-Diagnostic Result
+ Select Controller

4. Select Self-Diagnostic Result and operate according to the instruction under display screen.



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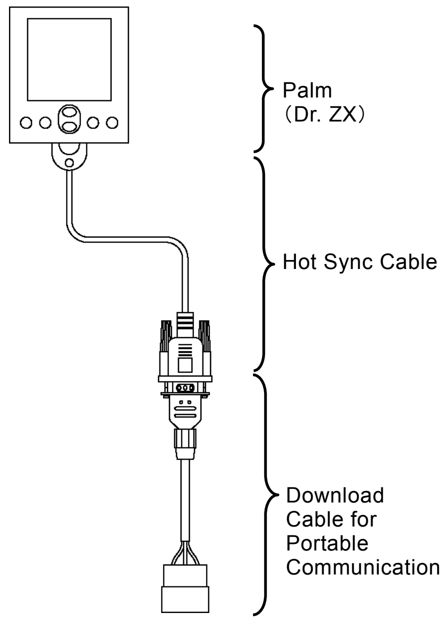

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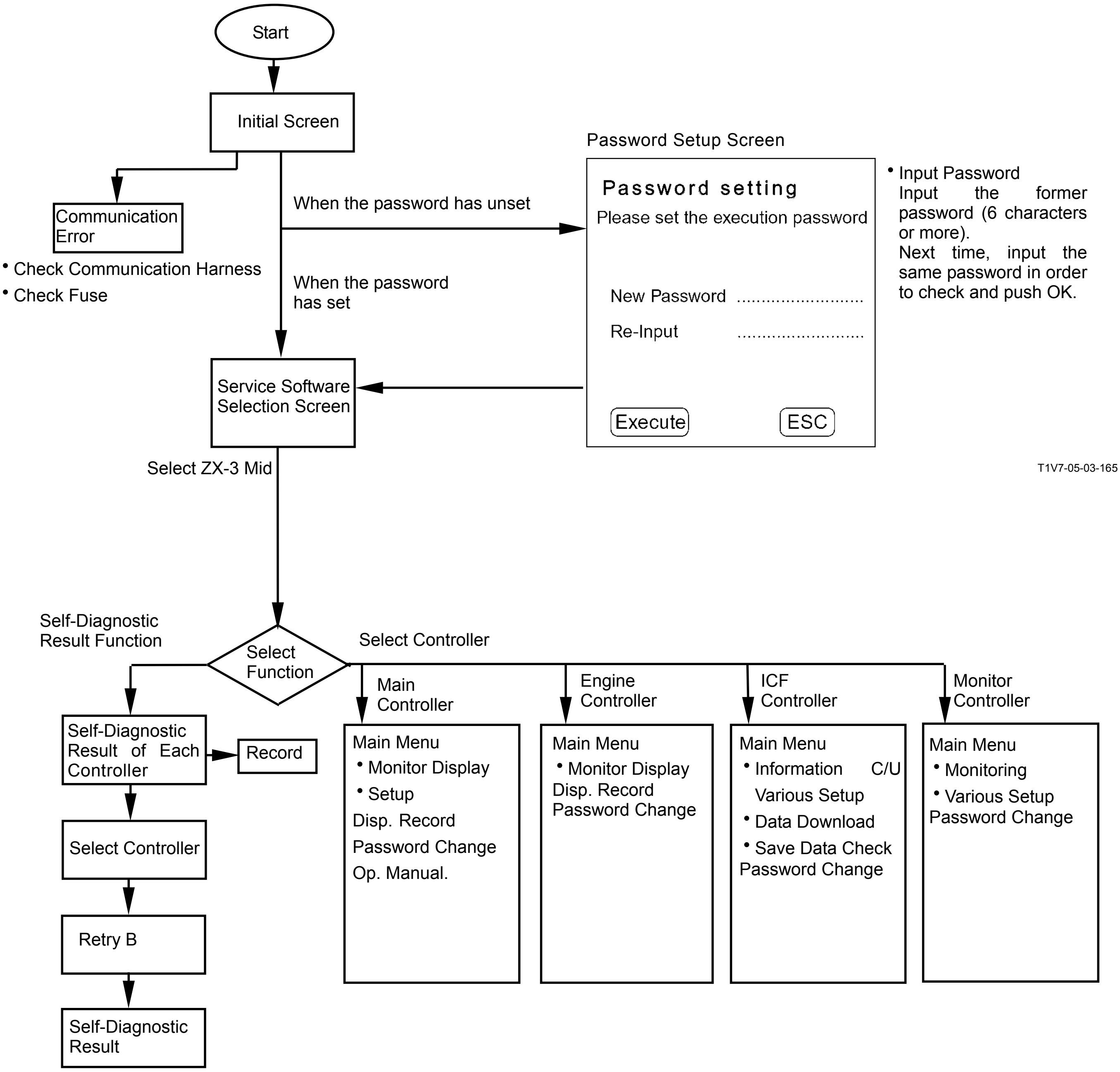
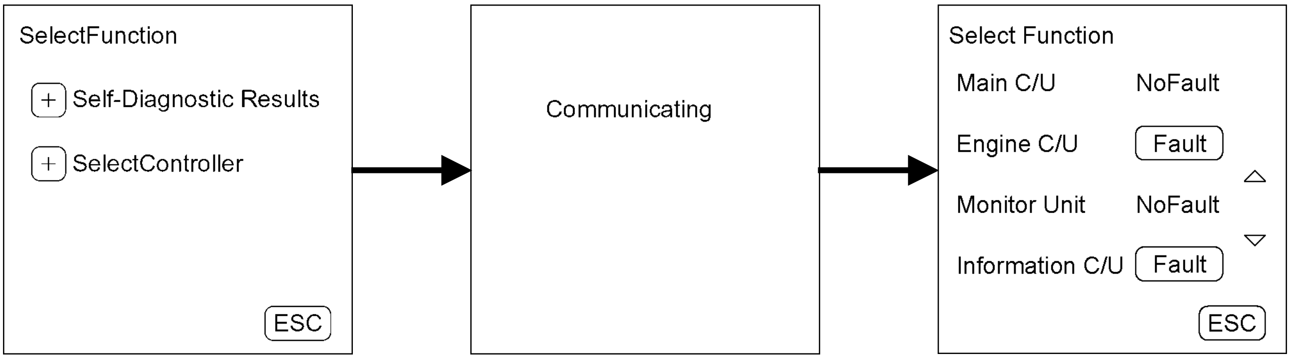


T1V7-05-03-165

Self-Diagnostic Result

The self-diagnostic result of each controller is displayed.
After starting Dr. ZX, push Self-Diagnostic Result.



Function Selection Screen T1V7-05-03-001

T1V7-05-03-008

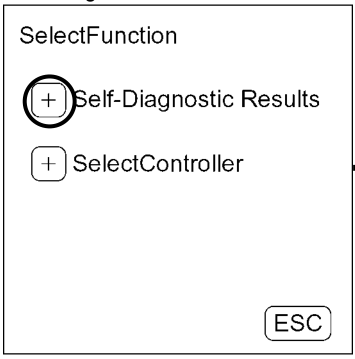
T4GB-05-02-052
Controller Self- Diagnosis Screen

NOTE: Main C/U: MC
Engine C/U: ECM
Monitor Unit: Monitor Unit
Information C/U: ICF

NOTE: Self-diagnosis of ICF controller is done on the next page.

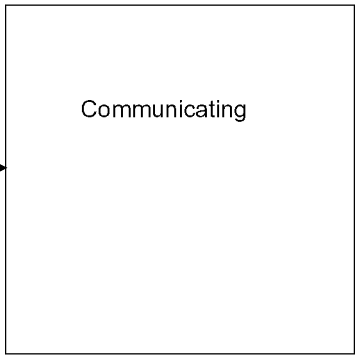
Self-Diagnosis

After starting Dr. ZX, push Self-Diagnostic Result.



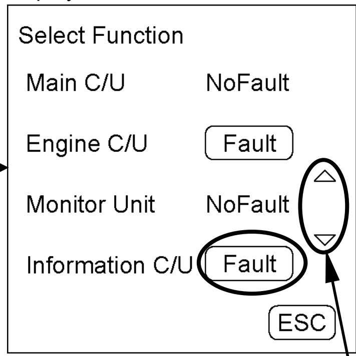
T1V7-05-03-001

Function Selection Screen



T1V7-05-03-008

Push Fault of ICF Controller. In case of no faulty, No Fault is displayed.



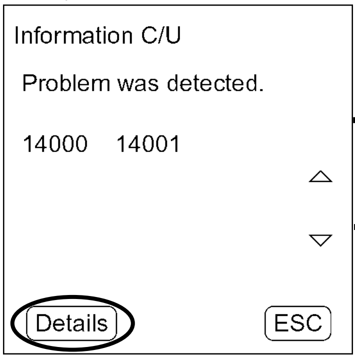
To the lower

T4GB-05-02-052

Controller Self- Diagnosis Screen

By changing the page, the forward or backward controller is displayed.

Push Details, and Details of the fault code and Corrective Action are displayed.
Push ESC and Retry B Screen is displayed.



T1V7-05-03-003

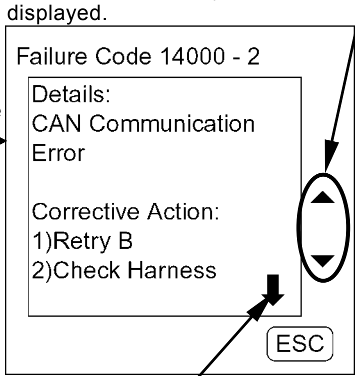
Fault Code Screen

Trouble

ESC

By changing the page, the forward or backward fault code is displayed.

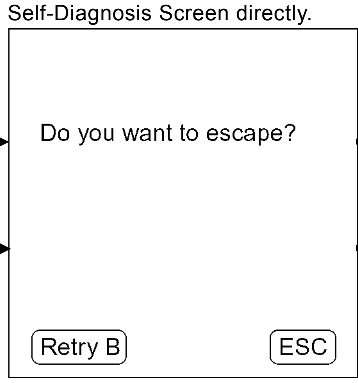
Push ESC and Retry B Screen is displayed.



T1V7-05-03-005

If the message of Details is long, push the arrow and change the screen.

Push Retry B and return to Controller Self-Diagnosis Screen after executing Retry B.
Push ESC and return to Controller Self-Diagnosis Screen directly.



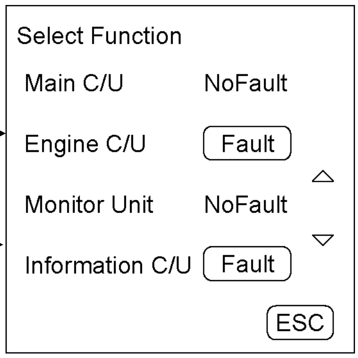
Retry B

ESC

T1V7-05-03-007

Retry B Screen

ESC



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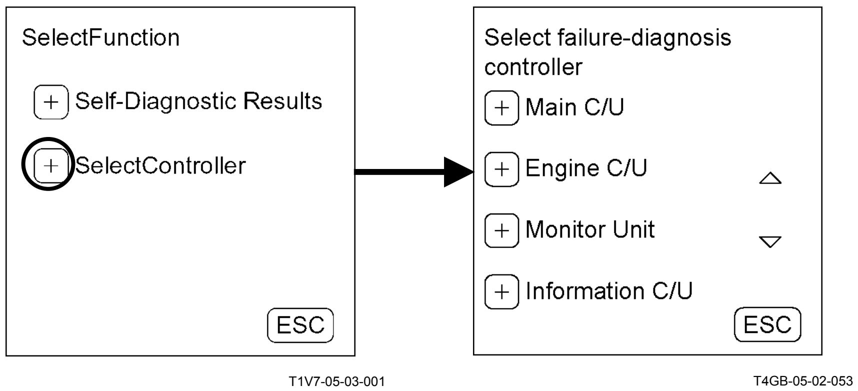
Controller Self- Diagnosis Screen

SELECT CONTROLLER

Select the failure-diagnosis controller.
After starting Dr. ZX, push Select Controller.



Function Selection Screen   Controller Selection Screen

NOTE: Main C/U: MC
Engine C/U: ECM
Monitor Unit: Monitor Unit
Information C/U: ICF

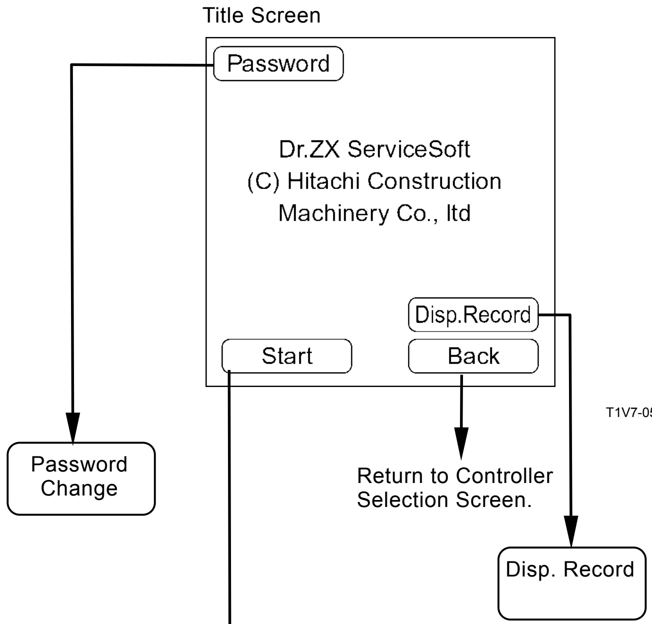
MAIN CONTROLLER

Main Menu

- Monitor Display
  Displays the control signals of MC and the input signals from each switch and sensor.
- Setup
  Adjusts target engine idling speed, engine warming-up speed and so on.

Recorded Data
Displays data recorded in MC by one day by using Dr. ZX.

Password Change
Changes the password input when setting.



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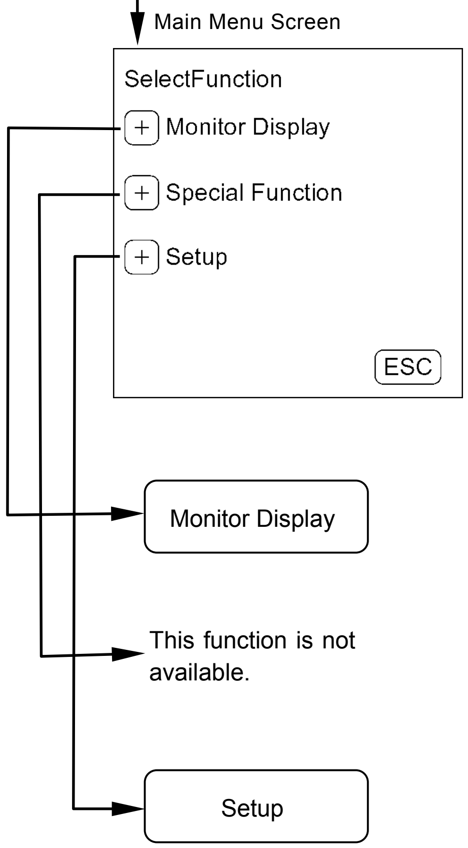


T1V7-05-03-012

MAIN MENU MONITOR DISPLAY

Dr. ZX displays the input signals from switches and sensors and the control signals from MC.

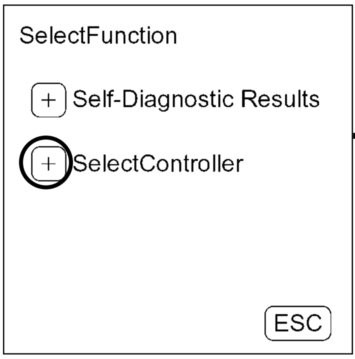
MC List of Monitor Item

Item	Data	Unit
Required Engine Speed	Control instruction value of engine speed to ECM	min^{-1}
Hydraulic Fan Target Speed	Control instruction value to fan flow rate control valve	min^{-1}
Actual Engine Speed	Detected valve of torque converter input speed sensor	min^{-1}
Torque Converter Output Speed	Detected valve of torque converter output speed sensor	min^{-1}
Medium Gear Speed	Detected valve of transmission medium shaft sensor	min^{-1}
Transmission Output speed	Detected valve of travel speed sensor	min^{-1}
Engine Speed Deviation	Difference between required engine speed and actual engine speed	min^{-1}
Torque Converter Speed Ratio	Ratio of the detected value of torque converter output rotation sensor in that of torque converter input rotation sensor	No unit
Travel Speed	Value converted the detected value of travel speed sensor into speed per hour	Km/h
Pump Pressure	Detected value to main pump delivery pressure sensor	MPa
Pump Displacement Proportional Valve Output	Control instruction value to pump displacement proportional solenoid valve	MPa
Hydraulic Drive Fan Proportional Valve	Control instruction value to hydraulic drive fan flow rate control solenoid valve	mA
Ride Control Proportional Valve Output (Optional)	Control instruction value to ride control solenoid valve	MPa
Pump Displacement Proportional Valve FB	Feedback value from pump displacement proportional solenoid valve	mA
Hydraulic Drive Fan Proportional Valve FB	Feedback value from hydraulic drive fan flow rate control solenoid valve	mA
Ride Control Proportional Valve Output FB (Optional)	Feedback value from ride control solenoid valve	mA
Accelerator Pedal	Output value of accelerator pedal	V
Parking Brake Pressure	Detected value of parking brake pressure sensor	MPa
Pedal Brake Pressure (Low)	Detected value of service brake pressure sensor	MPa
Lift Cylinder Bottom Pressure (Optional)	Detected value of lift arm cylinder bottom pressure sensor	MPa
Lift Cylinder Rod Pressure (Optional)	Detected value of lift arm cylinder rod pressure sensor	MPa
Implement Pressure	Detected value of implement pressure sensor	MPa
Boom Angle (Optional)	Output valve of lift arm angle sensor	V
Key Switch	Key ON signal from key switch to each controller	ON OFF
Ride Control Switch (Optional)	Continuity status in ride control switch	ON OFF
A/C Clutch SW	Continuity status in air conditioner switch	ON OFF
Fan Reversing SW	Continuity status in hydraulic drive fan reversing switch	ON OFF
FNR SW	Selected status of forward/reverse lever	N F R Err N
Speed Gear SW	Selected status of shift switch	1 2 3 4
Implement FNR SW	Selected status of forward/reverse switch	N F R Err N
Implement FNR Selector SW	Continuity status in forward/reverse selector switch	ON OFF
USS SW	Continuity status in up-shift switch	ON OFF
DSS SW	Continuity status in down-shift switch	ON OFF
Speed Gear Hold SW	Continuity status in hold switch	ON OFF
Selected Speed Gear	Selected speed gear	R4 R3 R2 R1 N F1 F2 F3 F4
Actual Speed Gear	Actual speed gear	R4 R3 R2 R1 N F1 F2 F3 F4
Boom Height Kickout SW (Optional)	Continuity status in lift arm auto leveler switch (raise)	ON OFF
Boom Height Kickout Setup SW (Optional)	Continuity status in lift arm auto leveler switch (raise) set switch	ON OFF
Ground Stop SW (Optional)	Continuity status in lift arm auto leveler switch (lower)	ON OFF
Ground Stop Setup SW (Optional)	Continuity status in lift arm auto leveler switch (lower) set switch	ON OFF

Item	Data	Unit
Engine Torque Selection	Instruction signal of engine torque selection to ECM	1 2 3 4
Pump Torque Selection	Selection status of work mode selection switch	LD/Cry Normal Power
Hold Mode	Enabled/disabled status of hold mode	ON OFF
Option FNR Mode	Enabled/disabled status of forward/reverse switch use mode	Acr NotAct
Auto/Manual Selection	Selected status (auto/manual) of travel mode selector switch	Manual Auto
Auto Gear Shifting Mode	Selected status (gear shifting timing) of travel mode selector switch	Low Normal High
Clutch Cut-Off Switch	Selected status (ON/OFF) of clutch cut-off position switch	ON OFF
Clutch Cut-Off Mode	Selected status (clutch cut-off position) of clutch cut-off position switch	Low Medium High
T/M Clutch Forward Proportional Valve Output	Instruction value of forward proportional solenoid valve output	mA
T/M Clutch Reverse Proportional Valve Output	Instruction value of reverse proportional solenoid valve output	mA
T/M Clutch First Gear Proportional Valve Output	Instruction value of first gear proportional solenoid valve output	mA
T/M Clutch Second Gear Proportional Valve Output	Instruction value of second gear proportional solenoid valve output	mA
T/M Clutch Third Gear Proportional Valve Output	Instruction value of third gear proportional solenoid valve output	mA
T/M Clutch Fourth Gear Proportional Valve Output	Instruction value of fourth gear proportional solenoid valve output	mA
T/M Clutch Forward Proportional Valve FB	Feedback value of forward proportional solenoid valve output	mA
T/M Clutch Reverse Proportional Valve FB	Feedback value of reverse proportional solenoid valve output	mA
T/M Clutch First Gear Proportional Valve FB	Feedback value of first gear proportional solenoid valve output	mA
T/M Clutch Second Gear Proportional Valve FB	Feedback value of second gear proportional solenoid valve output	mA
T/M Clutch Third Gear Proportional Valve FB	Feedback value of third gear proportional solenoid valve output	mA
T/M Clutch Fourth Gear Proportional Valve FB	Feedback value of fourth gear proportional solenoid valve output	mA
Hydraulic Drive Fan Reversing Valve	Instruction signal to hydraulic drive fan reversing solenoid valve	ON OFF
Implement FNR Operating Light	Continuity status to enabled indicator in forward/reverse switch	ON OFF
Back Alarm	Excited condition of reverse relay in MC	ON OFF
Boom Height Kickout (Optional)	Excited Status of solenoid valve at lift arm raise side in pilot valve	ON OFF
Ground Stop System (Optional)	Excited Status of solenoid valve at lift arm lower side in pilot valve	ON OFF
Neutral Signal	Forward/reverse neutral signal status	ON OFF
Parking brake Light	Excited status of parking brake relay 1 and continuity status to parking brake indicator	ON OFF
T/M Warning Light	Continuity status to transmission warning indicator	ON OFF
Ambient Temperature	Detected value of ambient temperature sensor	°C
Hydraulic Oil Temperature	Detected value of hydraulic oil temperature sensor	°C
AEB Status (Main Code)	Transmission learning process status code	Normal Other
AEB Status (Sub Code)	Transmission learning failure position code	Enabled Learning Other
Learning Step	Learning detail position of transmission learning process status each code	1 2 3
Learning Warning Step	Learning failure detail position of transmission learning failure position code	1 2 3
Learning Warning Crash	Crash grounds of transmission learning	Ky Eng Pbrk Spd FNR
Angle Sensor Learning Status	Lift arm angle sensor learning status	Not Learn Finish Failure

Monitor Display

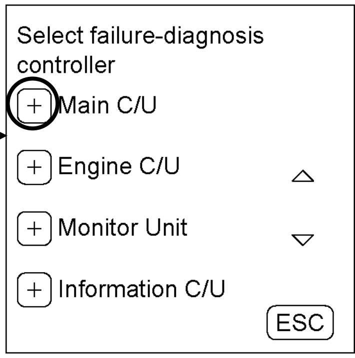
After starting Dr. ZX, push Select Controller.



T1V7-05-03-001

Function Selection Screen

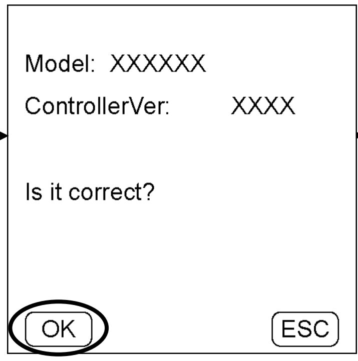
Push Main C/U.



T4GB-05-02-053

Controller Selection Screen

Push OK.

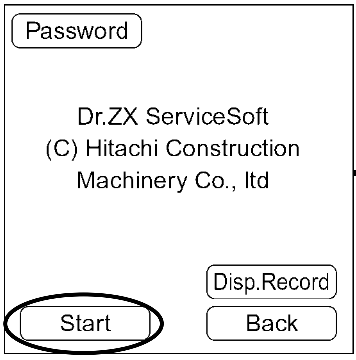


T4GB-05-02-004

Main Controller Screen

To the lower

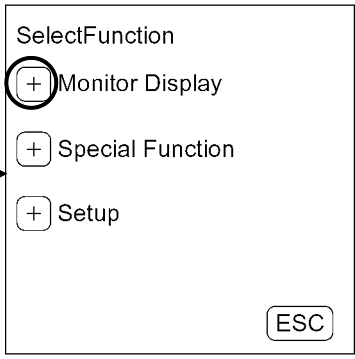
Push Start.



T1V7-05-03-011

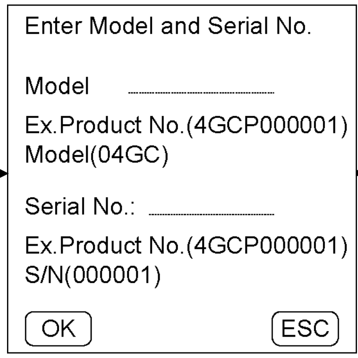
Title Screen

Push Monitor Display.



T1V7-05-03-012

Main Menu Screen

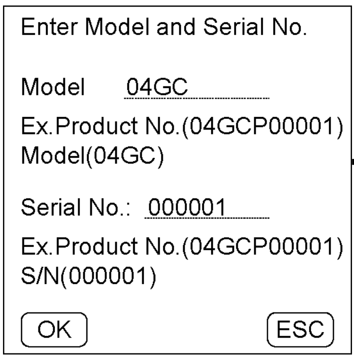


T4GB-05-02-054

Enter Model and Serial No. Screen

To the lower

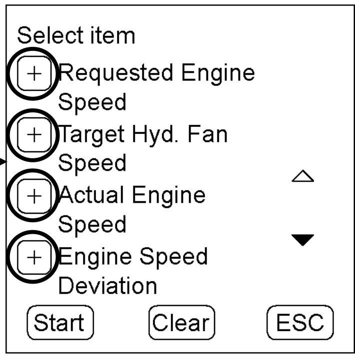
Input the model code and serial No. and push OK. If this procedure is not done, monitor data cannot recorded. Push ESC and return to Main Menu Screen.



T4GB-05-02-055

Enter Model and Serial No. Screen

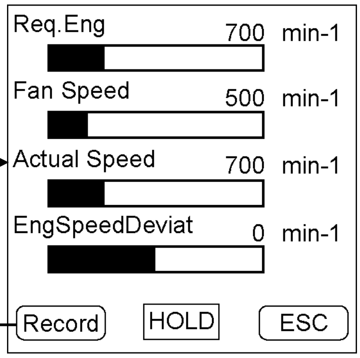
Push the item for Monitor Display and push OK. Refer to T5-2-8, 9 as for the monitor item. Push ESC and return to Main Menu Screen.



T4GB-05-02-007

Display Item Selection Screen

Push Hold and the monitor are stopped temporarily. When the monitor is started again, push Hold again. Push ESC and return to Display Item Selection Screen.

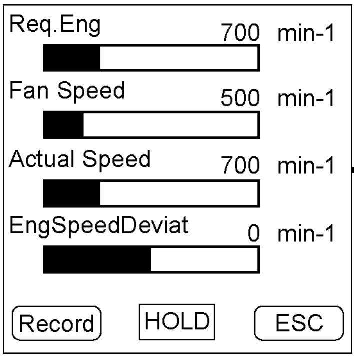


T4GB-05-02-008

Monitor Screen

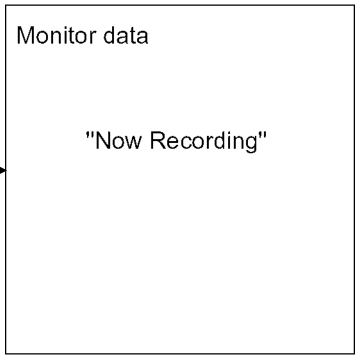
To the next page

Push Record.



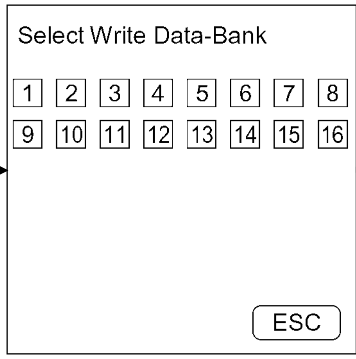
T4GB-05-02-008

Monitor Screen



T1V7-05-03-096

Push Rec. No. and the recording screen for Rec. No. is made.

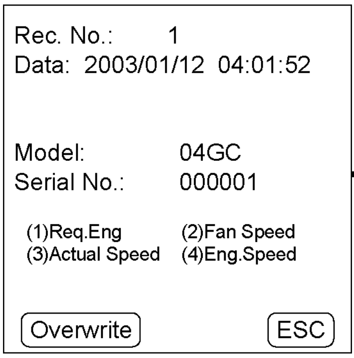


To the lower

T1V7-05-03-097

Select Write Data-Bank Screen

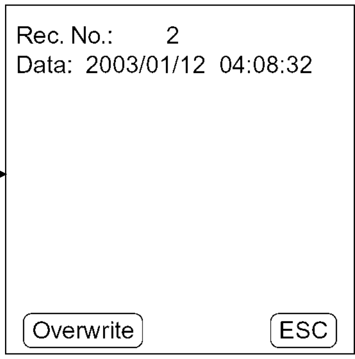
If Rec. No. has already been recorded and push Over Write, data is overwritten. Push ESC and return to Main Menu Screen.



T4GB-05-02-056

Recording Screen

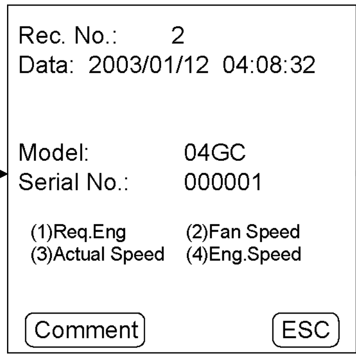
If Rec. No. has not been recorded yet and push Write, data is written to the recording screen. Push ESC and return to Main Menu Screen.



T1V7-05-03-100

Recording Screen

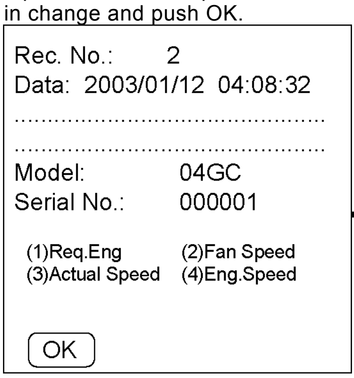
Push Comment.
Push ESC and return to Main Menu Screen.



To the lower

T4GB-05-02-057

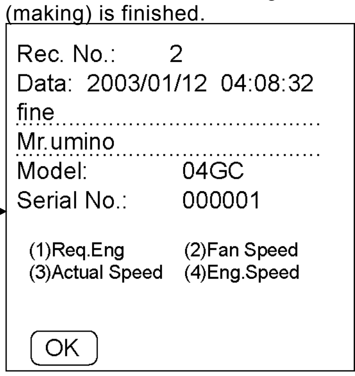
Input weather and person's name in change and push OK.



T4GB-05-02-058

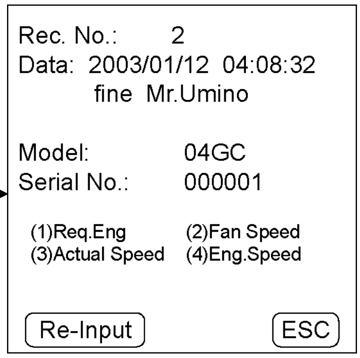
Recording Screen (Comment Input)

Push OK and the recording screen (making) is finished.



T4GB-05-02-059

Push Re-Input and return to Recording Screen (Comment Input).
Push ESC and return to Monitor Screen.



T4GB-05-02-060

SETTING

Target engine idling speed, engine warming-up speed and so on can be adjusted.

MC List of Parameter Change Item

Item	Unit	Data
Request Speed Ⅰ Calibration	min^{-1}	Adjustment of engine idling speed
Warning Up Speed Calibration	min^{-1}	Adjustment of engine warming-up speed
Warming Up Control Deactivation Flag	ON, OFF	Selection (enable/ disable) of engine warming-up control
Set Torque Calibration	N·m	Adjustment of main pump target torque

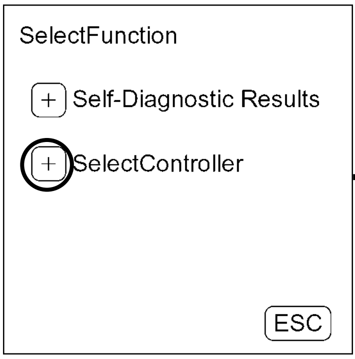
MC List of Adjustment Data

Data	Adjustment Minimum Unit	Adjustable Range	Adjustment Value When Delivering	Remark
Request Speed Ⅰ Calibration	1 min^{-1}	0 to 200	0 min^{-1}	
Warning Up Speed Calibration	1 min^{-1}	-200 to 200	0 min^{-1}	
Warming Up Control Deactivation Flag	-	ON or OFF	ON	
Set Torque Calibration	3 N·m	-45 to 45	0 N·m	

Setting

・ Parameter Change

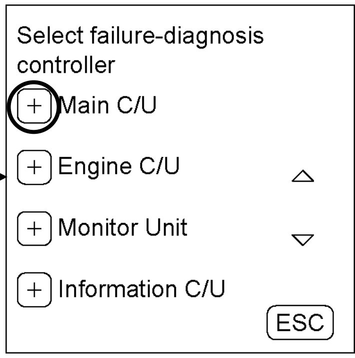
After starting Dr. ZX, push Select Controller.



T1V7-05-03-001

Function Selection Screen

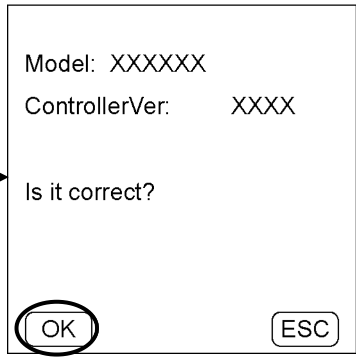
Push Main C/U.



T4GB-05-02-053

Controller Selection Screen

Push OK.

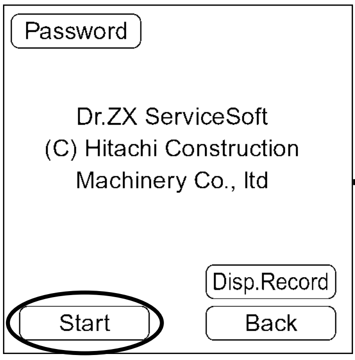


To the lower

T4GB-05-02-004

Main Controller Screen

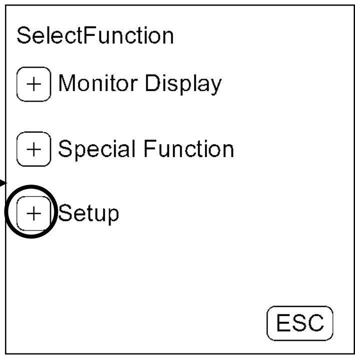
Push Start.



T1V7-05-03-011

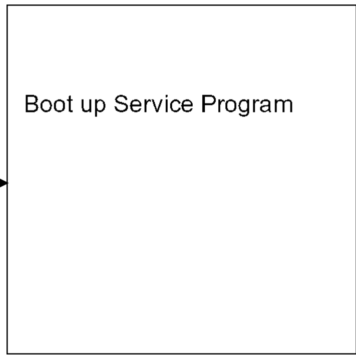
Title Screen

Push Setup.



T1V7-05-03-012

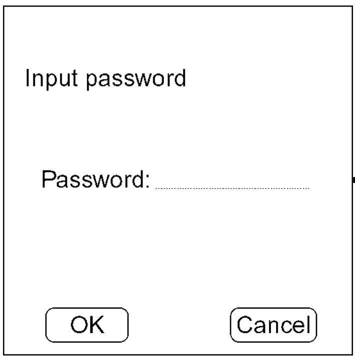
Main Menu Screen



To the lower

T1V7-05-03-016

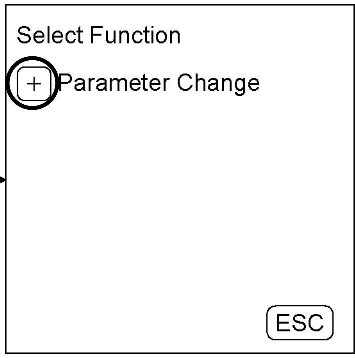
Input the password and push OK. Push Cancel and return to Main Menu Screen.



T1V7-05-03-022

Setup Password Input Screen

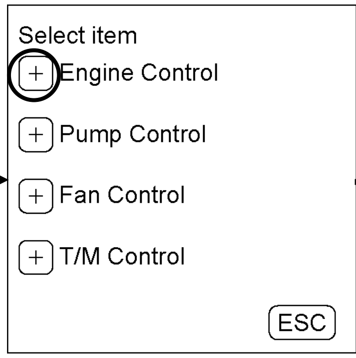
Push Parameter Change. Push ESC and return to Main Menu Screen.



T4GB-05-02-014

Setup Item Selection Screen

Refer to T5-2-12 as for the item of Parameter Change. Push Engine Control.



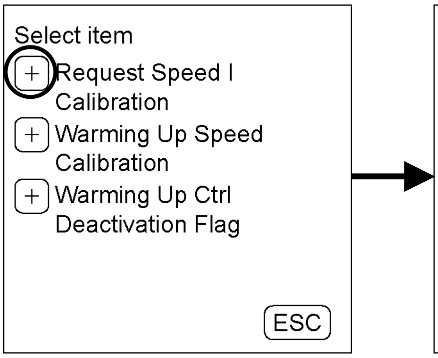
To the Next Page

T4GB-05-02-015

Parameter Change Selection Screen

Parameter Input
Example: Engine Control Target Speed I Correction
Input Value = Normal Value

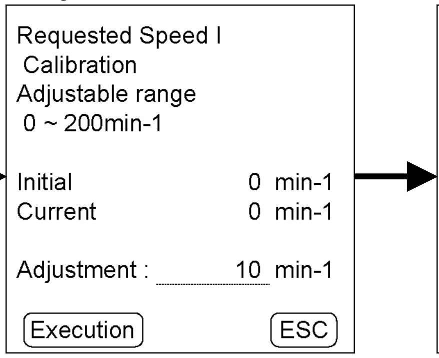
Push Request Speed I Calibration..



T4GB-05-02-016

Parameter Change Selection Screen

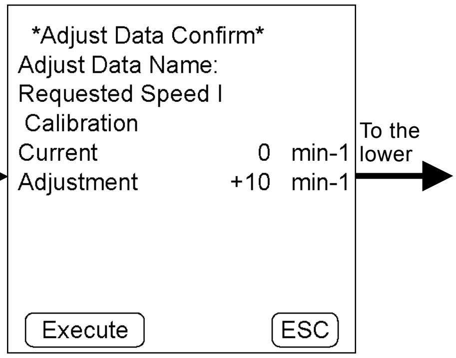
Input the value and push Exec. Push ESC and return to Parameter Change Selection Screen.



T4GB-05-02-017

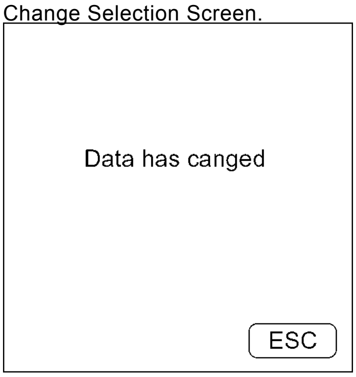
Parameter Input Screen

Check Adjustment and push Exec. Push ESC and return to Parameter Change Selection Screen.



T4GB-05-02-018

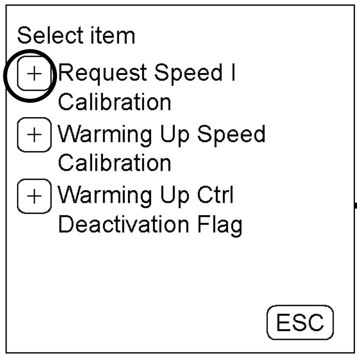
Push ESC and return to Parameter Change Selection Screen.



T1V7-05-03-107

Input Value = Current Value

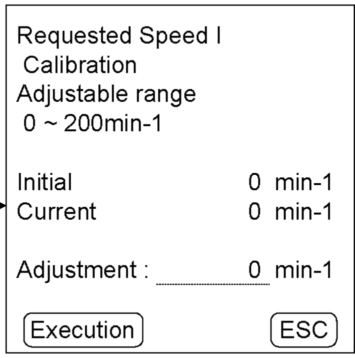
Push Request Speed I Calibration.



T4GB-05-02-016

Parameter Change Selection Screen

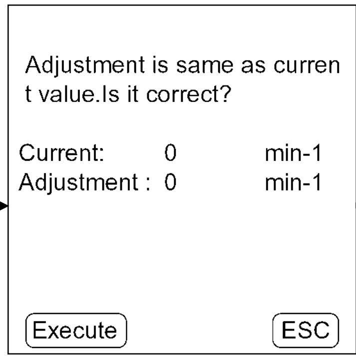
Input the value and push Exec. Push ESC and return to Parameter Change Selection Screen.



T4GB-05-02-019

Parameter Input Screen

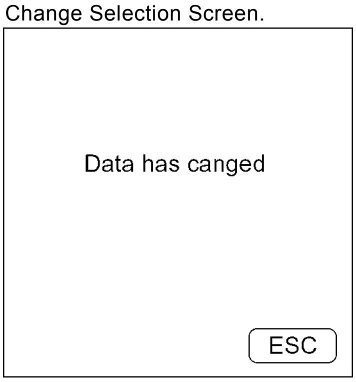
Push Exec. Push ESC and return to Parameter Change Selection Screen.



To the lower

T1V7-05-03-108

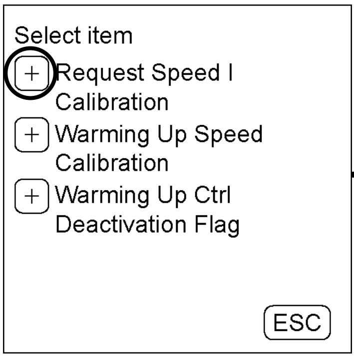
Push ESC and return to Parameter Change Selection Screen.



T1V7-05-03-107

Input Value > Maximum Value
(Input Value < Minimum Value)

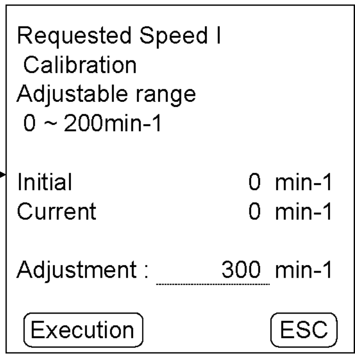
Push Request Speed I Calibration.



T4GB-05-02-016

Parameter Change Selection Screen

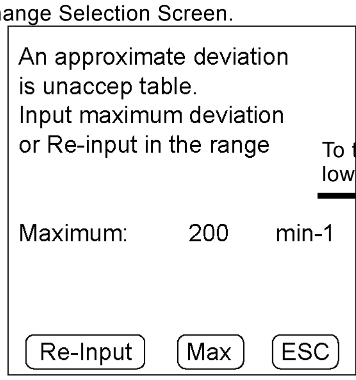
Input the value and push Exec. Push ESC and return to Parameter Change Selection Screen.



T4GB-05-02-020

Parameter Input Screen

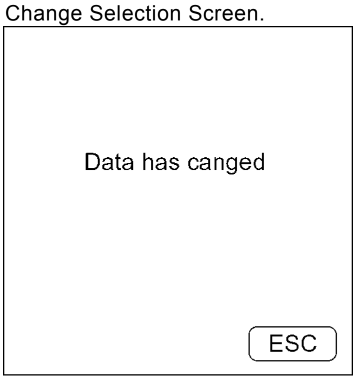
Push Re-Input and return to Parameter Input Screen. Push Max and the maximum value is input. Push ESC and return to Parameter Change Selection Screen.



To the lower

T4GB-05-02-021

Push ESC and return to Parameter Change Selection Screen.



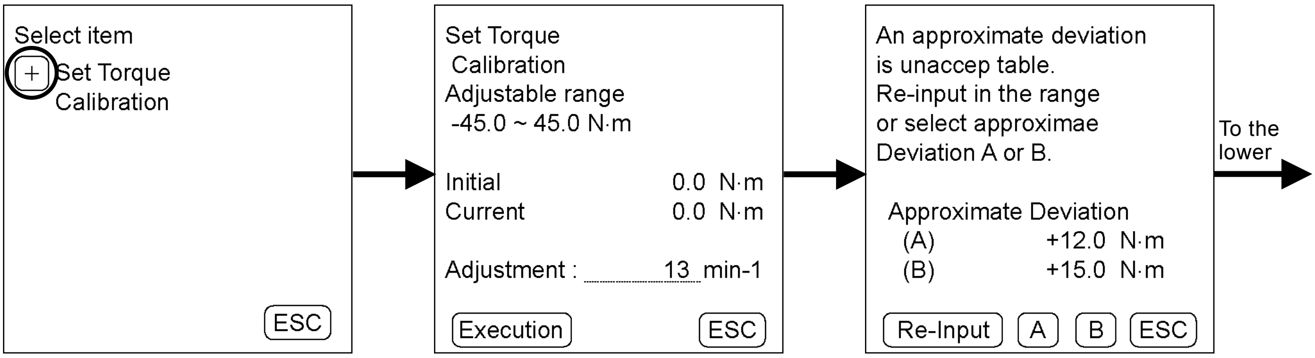
T1V7-05-03-107

When the input value cannot be divided
Example: Pump Control Set Torque Calibration

Push Set Torque Calibration.

Input the value and push Exec. Push ESC and return to Parameter Change Selection Screen.

Push Re-Input and return to Parameter Input Screen. Push A or B and the value of A or B is input. Push ESC and return to Parameter Change Selection Screen.

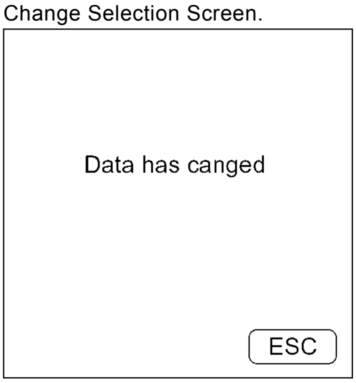


T4GB-05-02-022 T4GB-05-02-023 T4GB-05-02-024

Parameter Change Selection Screen

Parameter Input Screen

Push ESC and return to Parameter Change Selection Screen.



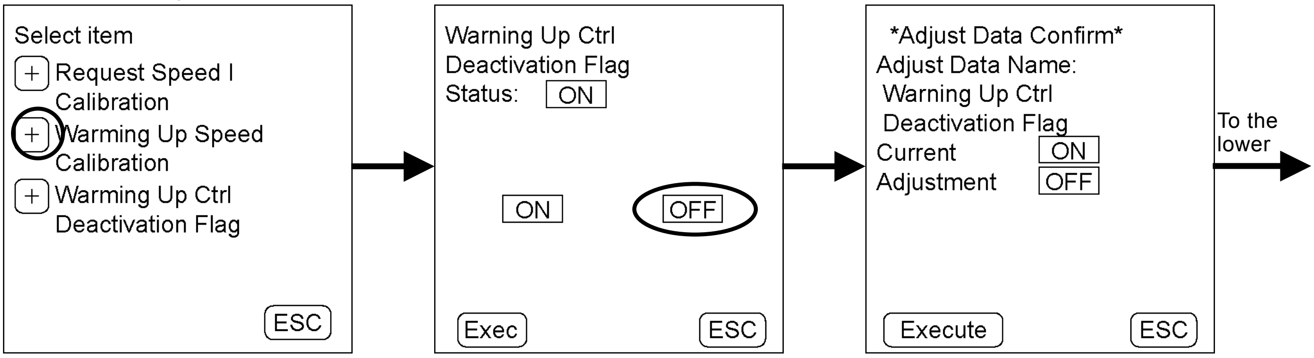
T1V7-05-03-107

Status Selection
Example: Engine Control Warming Up Control Deactivation Flag

Push Warming Up Ctrl Deactivation Flag.

Push OFF and push Exec. Push ESC and return to Parameter Change Selection Screen.

Check contents and push Exec. Push ESC and return to Parameter Change Selection Screen.

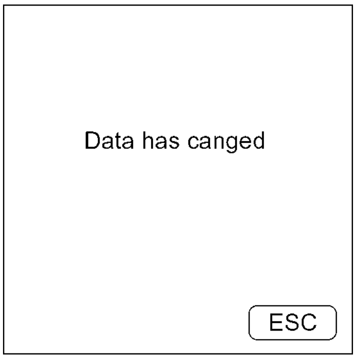


T4GB-05-02-016 T4GB-05-02-025 T4GB-05-02-026

Parameter Change Selection Screen

Status Selection Screen

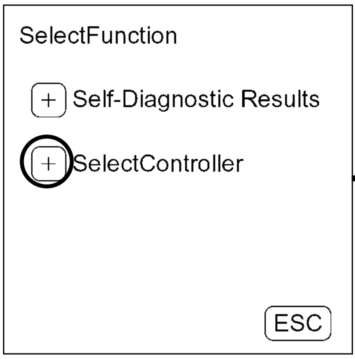
Push ESC and return to Parameter Change Selection Screen.



T1V7-05-03-107

Recorded Data Display

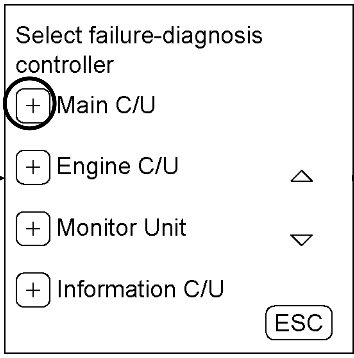
After starting Dr. ZX, push Select Controller.



T1V7-05-03-001

Function Selection Screen

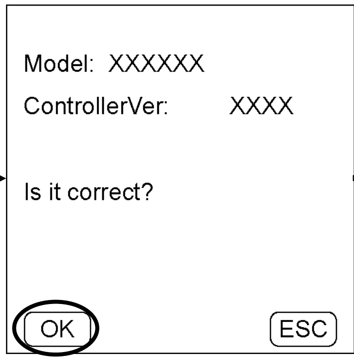
Push Main C/U.



T4GB-05-02-053

Controller Selection Screen

Push OK.

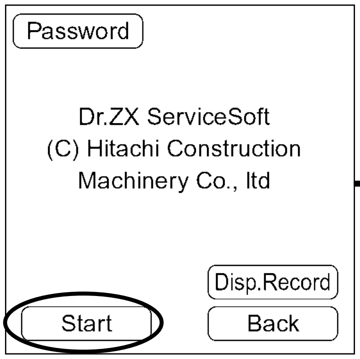


To the lower

T4GB-05-02-004

Main Controller Screen

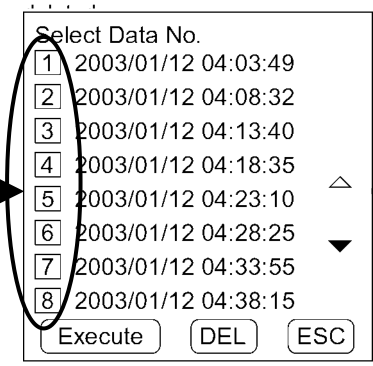
Push Start to record.



T1V7-05-03-011

Title Screen

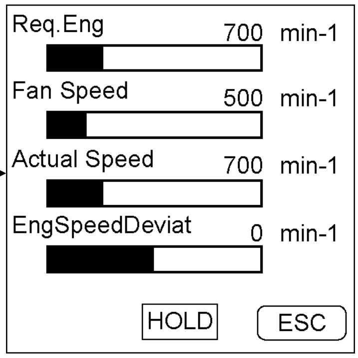
Push and select No. Push Regeneration and the recorded data are regenerated.Push DEL and data of selected No. is



T1V7-05-03-124

Recorded Data Selection Screen

Push Hold and the monitor are stopped temporarily. Push Hold again and restart regeneration. Push ESC and Recorded Data Selection Screen is displayed.

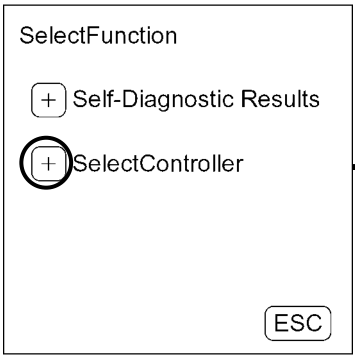


T4GB-05-02-027

Recorded Data Regeneration Screen

PASSWORD CHANGE

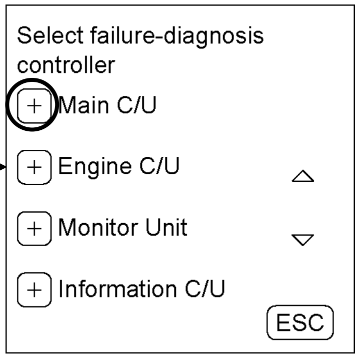
After starting Dr. ZX, push Select Controller.



T1V7-05-03-001

Function Selection Screen

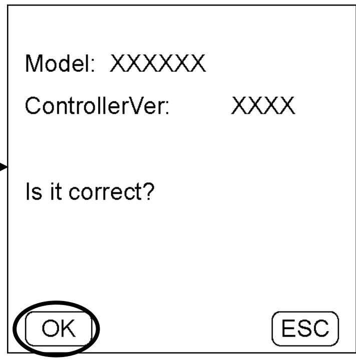
Push Main C/U.



T4GB-05-02-053

Controller Selection Screen

Push OK.



To the lower

T4GB-05-02-004

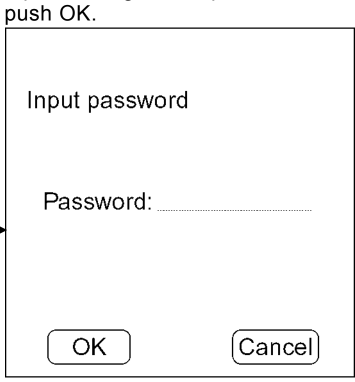
Main Controller Screen

Push Password.

T1V7-05-03-011

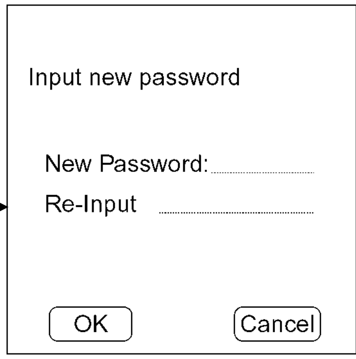
Title Screen

Input the registered password and push OK.



T1V7-05-03-126

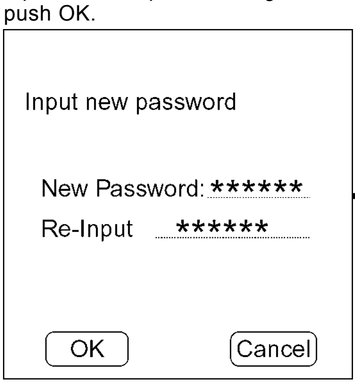
Input the new password and push OK.



To the lower

T1V7-05-03-127

Input the new password again and push OK.



T1V7-05-03-169

Push OK and return to Title Screen.

T1V7-05-03-128

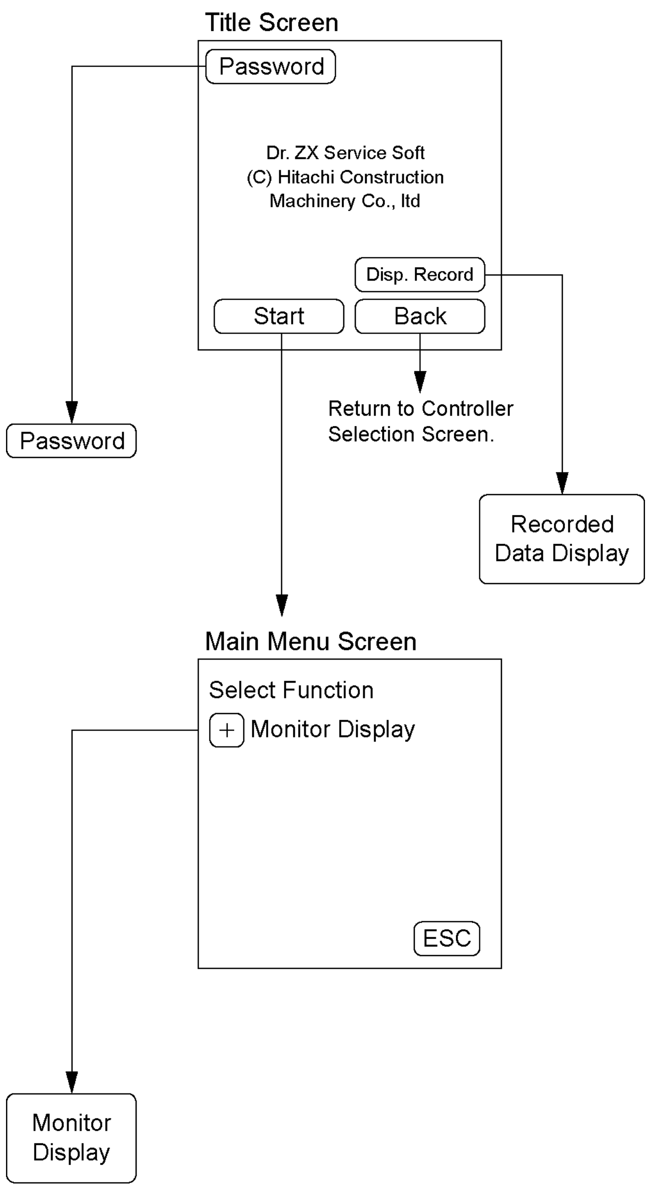
ENGINE CONTROLLER

Main Menu

- Monitor Display
  Dr. ZX displays the input signals from sensors and the control signals of ECM.

- Recorded Data Display
  Data recorded in ECM is displayed by one day by using Dr. ZX.

Password
The password can be changed.



T1V7-05-03-079

MONITOR DISPLAY

ECM List of Monitor Item

Item		Unit	Data
Selecting	Monitoring		
Engine Torque	Engine Torque	%	Input signal from ECM
Actual Engine Speed (Engine Speed)	Actual Engine Speed	min^{-1}	Input signal from crank speed sensor and cam angle sensor
Target Engine Speed	Target Engine Speed	min^{-1}	Input signal from accelerator pedal
Glow Signal	Glow Signal	OFF, ON	Glow relay ON/OFF status
Coolant Temperature (Engine Coolant Temperature)	Coolant Temperature (E)	°C	Input signal from coolant temperature sensor
Fuel Temperature	Fuel Temperature	°C	Input signal from fuel sensor
Engine Oil Pressure	Engine Oil Pressure	kPa	Input signal from engine oil pressure sensor
Fuel Flow Rate	Fuel Flow	L/h	Input signal from ECM
Atmospheric Pressure	Barometric Pressure	kPa	Input signal from atmospheric pressure sensor
Suction Temperature (Intake Air Temperature)	Intake Air Temperature	°C	Input signal from intake-air temperature sensor
Boost Pressure	Boost Pressure	kPa	Input signal from boost pressure sensor
Boost Temperature	Boost Temperature	°C	Input signal from boost temperature sensor
Battery Voltage	Battery Voltage	V	Input signal from ECM
Total Amount of Fuel Use	Total Used Fuel	L	Input signal from ECM

(Blank)

Monitor Display

After starting Dr. ZX, push Select Controller.

SelectFunction
+ Self-Diagnostic Results
+ SelectController
ESC

T1V7-05-03-001

Function Selection Screen

Push Engine C/U.

Select failure-diagnosis controller
+ Main C/U
+ Engine C/U
+ Monitor Unit
+ Information C/U
ESC

T4GB-05-02-053

Controller Selection Screen

Push OK.

Model: XXXXXX
ControllerVer: XXXX
Is it correct?
OK ESC

To the lower

T4GB-05-02-004

Engine Controller Screen

Push Start.

Password
Dr.ZX ServiceSoft
(C) Hitachi Construction Machinery Co., ltd
Disp.Record
Start Back

T1V7-05-03-011

Title Screen

Push Monitor Display.

SelectFunction
+ Monitor Display
ESC

T4GB-05-02-028

Main Menu Screen

Enter Model and Serial No.
Model
Ex.Product No.(4GCP000001) Model(04GC)
Serial No.:
Ex.Product No.(4GCP000001) S/N(000001)
OK ESC

To the lower

T4GB-05-02-061

Enter Model and Serial No. Screen

Input the model code and serial No. and push OK. If this procedure is not done, monitor data cannot recorded. Push ESC and return to Main Menu Screen.

Enter Model and Serial No.
Model 04GC
Ex.Product No.(04GCP00001) Model(04GC)
Serial No.: 000001
Ex.Product No.(04GCP00001) S/N(000001)
OK ESC

T4GB-05-02-062

Enter Model and Serial No. Screen

Push the item for Monitor Display and push OK. Refer to T5-2-22 as for the monitor item.
Push ESC and return to Main Menu Screen.

Select item
+ Engine Torque
+ Actual Engine Speed (Engine Speed)
+ Target Engine Speed
+ Glow Signal
Start Clear ESC

T1V7-05-03-132

Display Item Selection Screen

Push Hold and the monitor are stopped temporarily. When the monitor is started again, push Hold again. Push ESC and return to Display Item Selection Screen.

Engine Torque 0 min-1
Act.Eng Speed 0 min-1
Tar.Eng Speed 800.0 min-1
Glow Signal
OFF ON
Record HOLD ESC

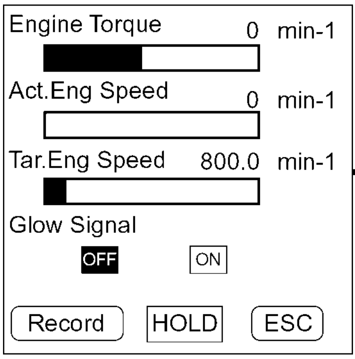
Start recoding.

To the next page

T1V7-05-03-133

Monitor Screen

Push Record.

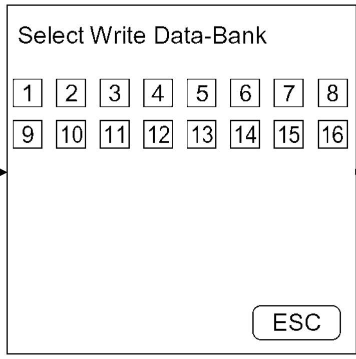


T1V7-05-03-133

Monitor Screen

T1V7-05-03-134

Push Rec. No. and the recording screen for Rec. No. is made.

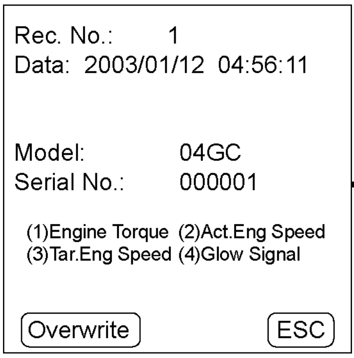


To the lower

T1V7-05-03-135

Select Write Data-Bank Screen

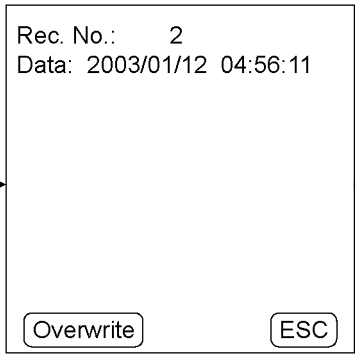
If Rec. No. has already been recorded and push Over Write, data is overwritten.
Push ESC and return to Main Menu Screen.



T4GB-05-02-063

Recording Screen

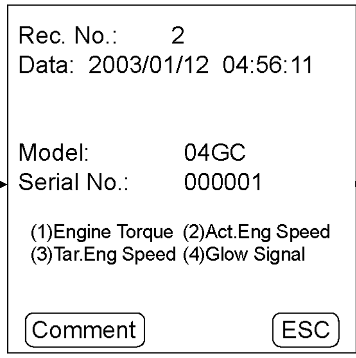
If Rec. No. has not been recorded yet and push Write, data is written to the recording screen.
Push ESC and return to Main Menu Screen.



T4GB-05-02-030

Recording Screen

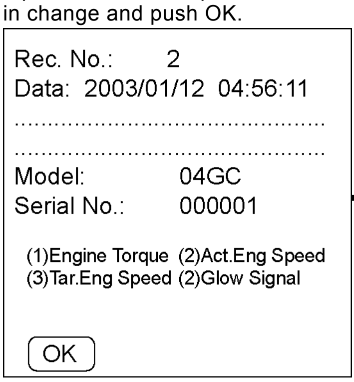
Push Comment.
Push ESC and return to Main Menu Screen.



To the lower

T4GB-05-02-064

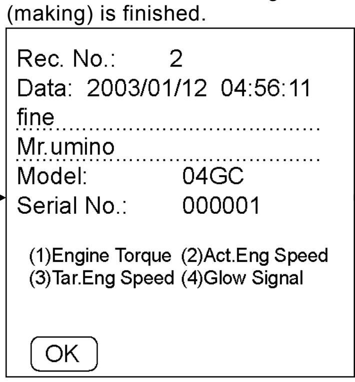
Input weather and person's name in change and push OK.



T4GB-05-02-065

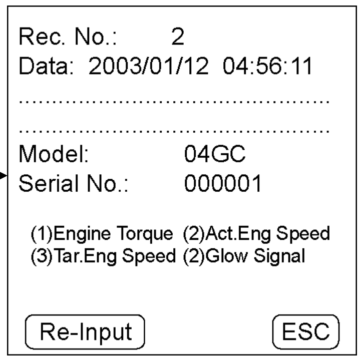
Recording Screen (Comment Input)

Push OK and the recording screen (making) is finished.



T4GB-05-02-066

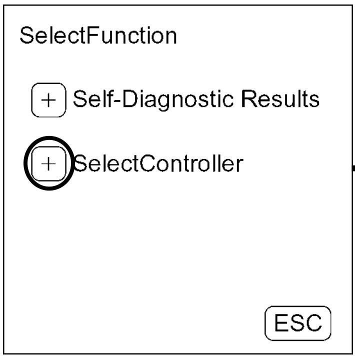
Push Re-Input and return to Recording Screen (Comment Input).
Push ESC and return to Main Menu Screen.



T4GB-05-02-067

RECORDED DATA DISPLAY

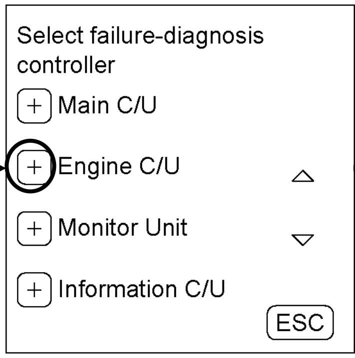
After starting Dr. ZX, push Select Controller.



T1V7-05-03-001

Function Selection Screen

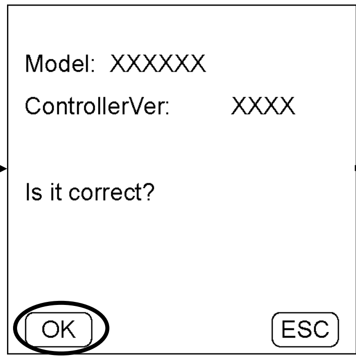
Push Engine C/U.



T4GB-05-02-053

Controller Selection Screen

Push OK.

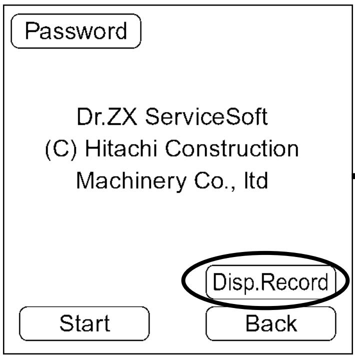


To the lower

T4GB-05-02-004

Engine Controller Screen

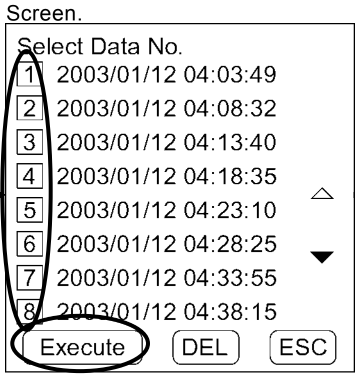
Push Disp. Record.



T1V7-05-03-011

Title Screen

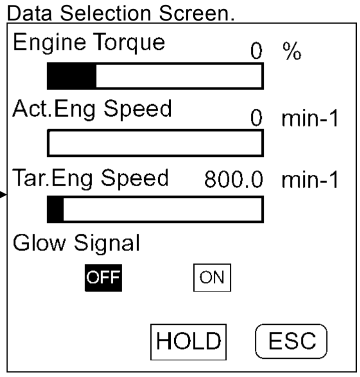
Push and select No. Push Regeneration and the recorded data is regenerated. Push DEL and data of selected No. is deleted.
Push ESC and return to Title Screen.



T1V7-05-03-124

Recorded Data Selection Screen

Push Hold and the monitor is stopped temporarily
When the monitor is started again, push Hold again.
Push ESC and return to Recored Data Selection Screen.

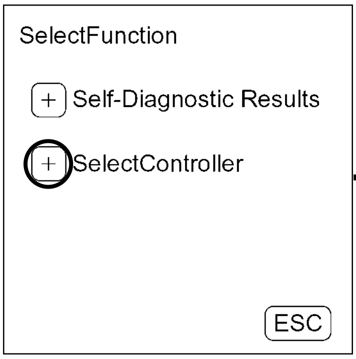


T1V7-05-03-141

Recorded Data Regeneration Screen

PASSWORD CHANGE

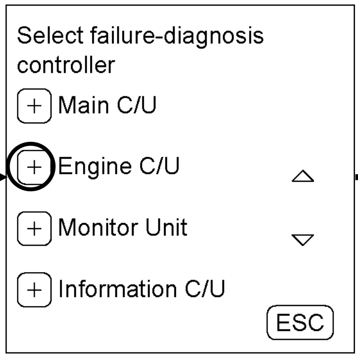
After starting Dr. ZX, push Select Controller.



T1V7-05-03-001

Function Selection Screen

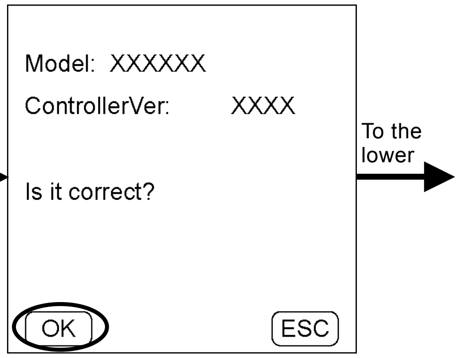
Push Engine C/U.



T4GB-05-02-053

Controller Selection Screen

Push OK.



T4GB-05-02-004

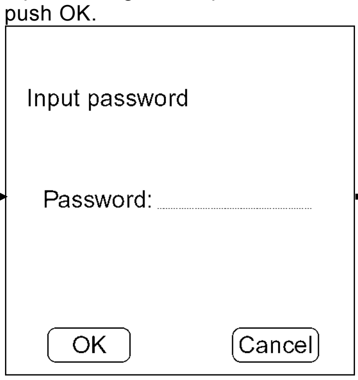
Engine Controller Screen

Push Password.

T1V7-05-03-011

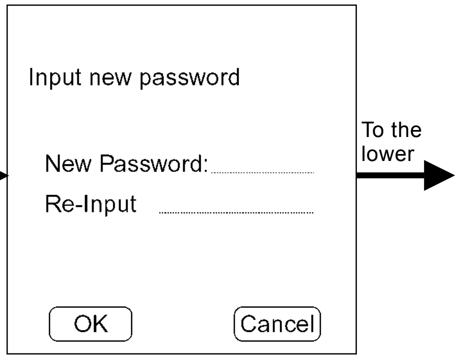
Title Screen

Input the registered password and push OK.



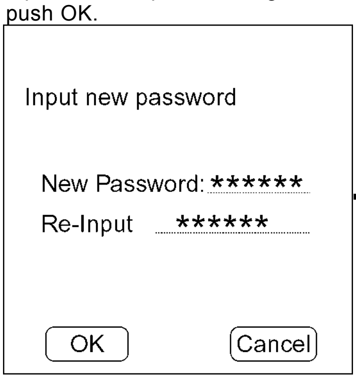
T1V7-05-03-126

Input the new password and push OK.



T1V7-05-03-127

Input the new password again and push OK.



T1V7-05-03-169

Push OK and return to Title Screen.

T1V7-05-03-128

(Blank)

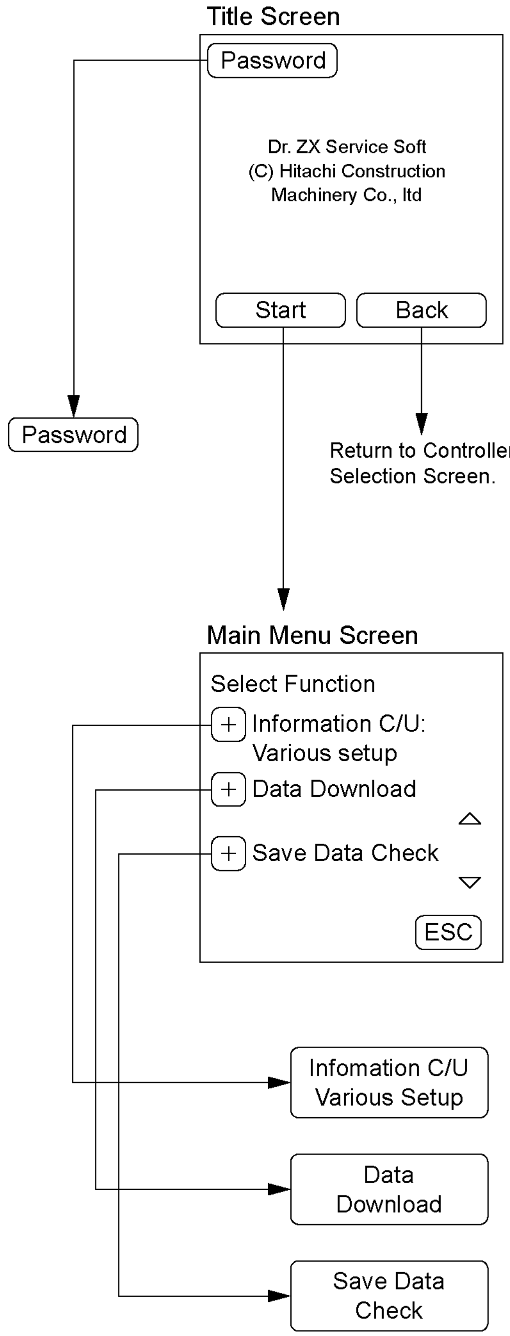
ICF CONTROLLER

Main Menu

- Information C/U Various Setup
  Initialization of information C/U, setting of model, serial No. and time, and initialization of control data can be done.
- Data Download
  Daily report data, frequency distribution data, total operating hours, alarm and fault code, which are recorded in ICF, can be downloaded to Dr. ZX.
- Save Data Check
  Daily report data, frequency distribution data, total operating hours, alarm and fault code, which are saved in ICF, can be checked by using Dr. ZX.

Password

The password can be changed.



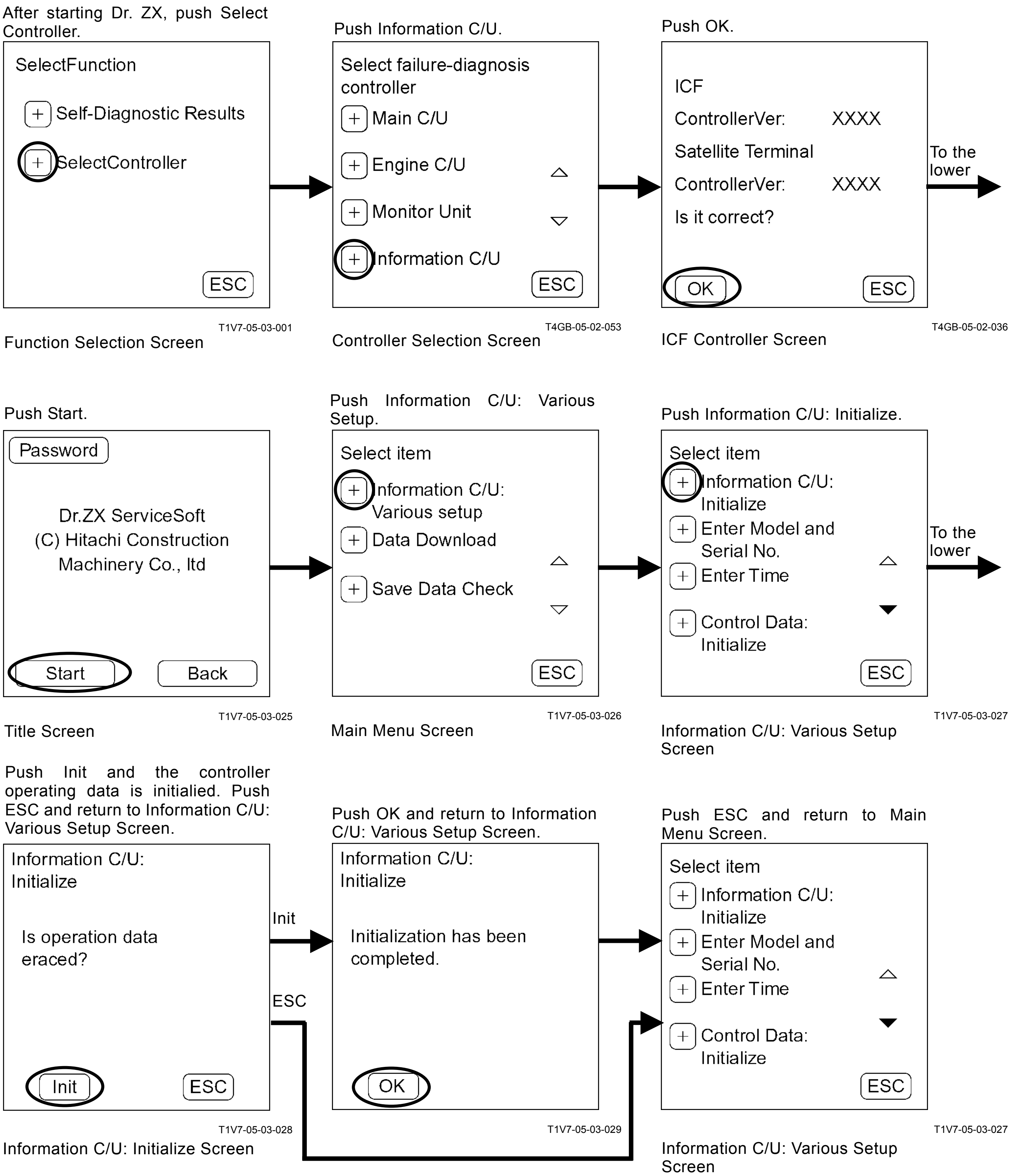
T1V7-05-03-166

INFORMATION C/U VARIOUS SETUP

ICF List of Controller Data Setting Item

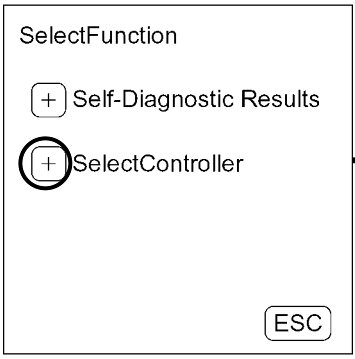
Item			Range of Data
Information C/U: Initialize			Initialize/ESC
Enter Model and Serial No.	Model		ASCII (4 characters) 0 to 9, A to Z
	Serial No.		000000 to 999999
Enter Date and Time	Date	YY	2000 to 2100
		MM	1 to 12
		DD	1 to 31
	Time	HH	0 to 23
		MM	0 to 59
Control Data: Initialize			Initialize/ESC
Satellite Terminal: Initialize			DEL/ESC
Satellite Terminal No. Confirmation			12 digits: 0 to 9, A to Z
Communicating State Check	ICF < = > Satellite Terminal	Connect	Conn/UnConn
		Comm.	OK/NG
	Satellite Terminal	Power	ON/OFF
		Comm.	Enable/Stop
	Rod Aerial		OK/NG
	GPS Aerial		OK/NG
	Wave State		ON/OFF
	Un-Transmit Data Number		0～99
	Last Transmitting Time		YYYY/MM/DD hh: mm: ss
Enter Satellite Comm. Start/Stop			Start/Stop

INFORMATION C/U: INITIALIZE



ENTER MODEL AND SERIAL No.

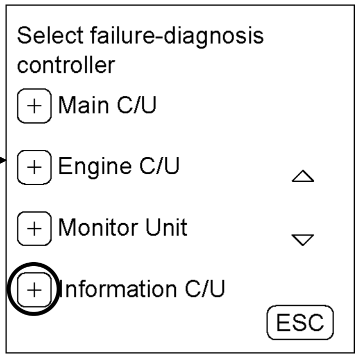
After starting Dr. ZX, push Select Controller.



T1V7-05-03-001

Function Selection Screen

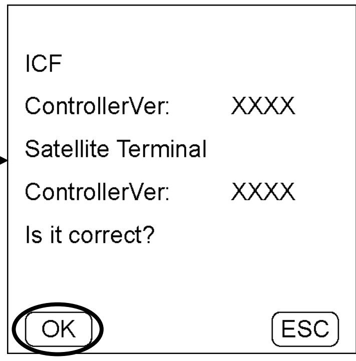
Push Information C/U.



T4GB-05-02-053

Controller Selection Screen

Push OK.



T4GB-05-02-036

ICF Controller Screen

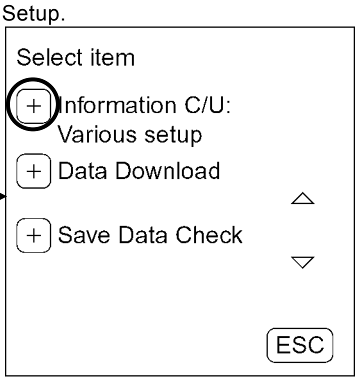
To the lower

Push Start.

T1V7-05-03-025

Title Screen

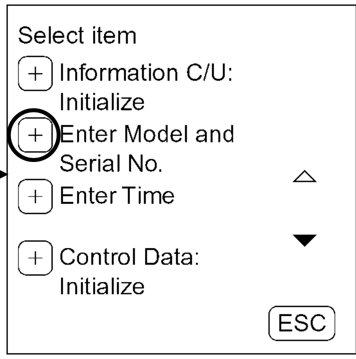
Push Information C/U: Various Setup.



T1V7-05-03-026

Main Menu Screen

Push Enter Model and Serial No.

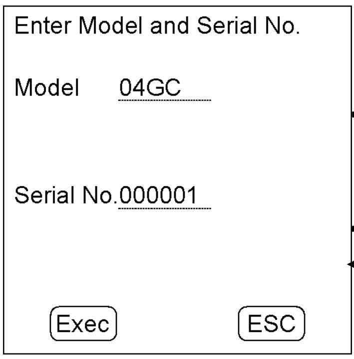


T1V7-05-03-027

Information C/U: Various Setup Screen

To the lower

Push Exec and model and serial No. can be input.
Push ESC and return to Information C/U: Various Setup Screen.



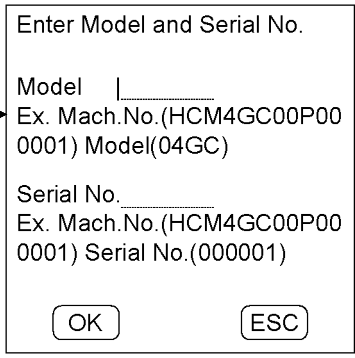
T4GB-05-02-068

Enter Model and Serial No. Screen

Exec

ESC

Push OK after inputting model and serial No. and return to Enter Model and Serial No. Screen.
Push ESC and return to Information C/U: Various Setup Screen.

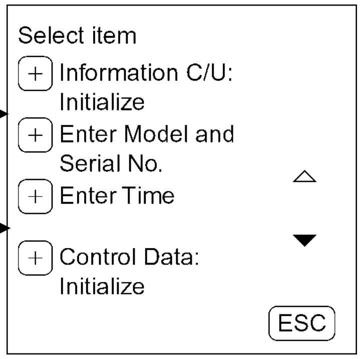


T4GB-05-02-069

ESC

OK

Push ESC and return to Main Menu Screen.

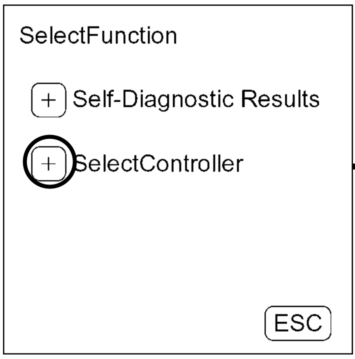


T1V7-05-03-027

Information C/U: Various Setup Screen

ENTER DATE AND TIME

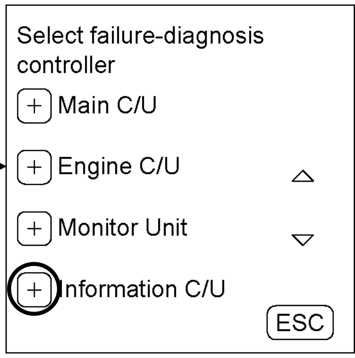
After starting Dr. ZX, push Select Controller.



T1V7-05-03-001

Function Selection Screen

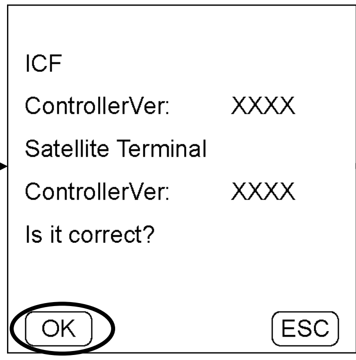
Push Information C/U.



T4GB-05-02-053

Controller Selection Screen

Push OK.



T4GB-05-02-036

ICF Controller Screen

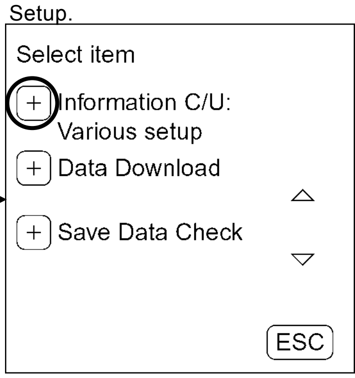
To the lower

Push Start.

T1V7-05-03-025

Title Screen

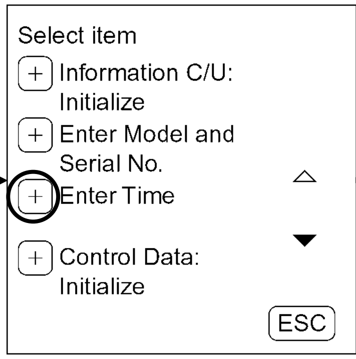
Push Information C/U: Various Setup.



T1V7-05-03-026

Main Menu Screen

Push Enter Date and Time.

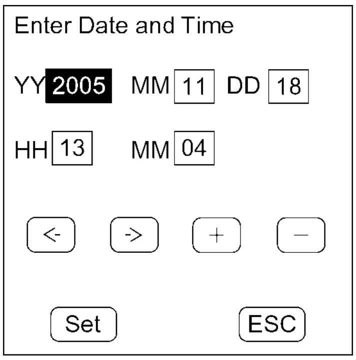


T1V7-05-03-027

Information C/U: Various Setup Screen

To the lower

Push Set and the focused item is YY. Push ESC and return to Information C/U: Various Setup Screen.



T1V7-05-03-032

Enter Date and Time Screen

YY, MM, DD, HH and MM
The focused item is displayed reversely.
At first, the focused item is YY.

<- ->

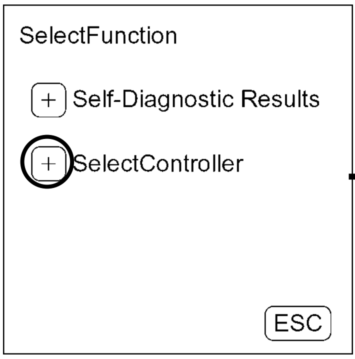
YY, MM, DD, HH and MM
Move the focused item.
No repeat input.

− +

YY, MM, DD, HH and MM
Value of the focused item is increased or decreased one by one.
In case value is beyond maximum one: Change value into the minimum one
In case value is below minimum one: Change value into the maximum one
No repeat input.

CONTROL DATA: INITIALIZE

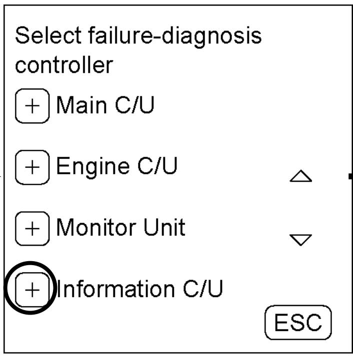
After starting Dr. ZX, push Select Controller.



T1V7-05-03-001

Function Selection Screen

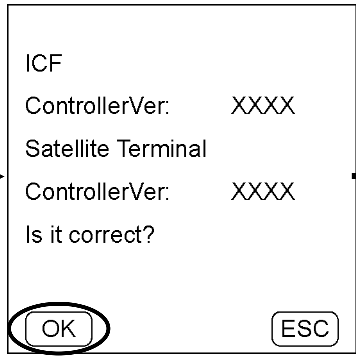
Push Information C/U.



T4GB-05-02-053

Controller Selection Screen

Push OK.

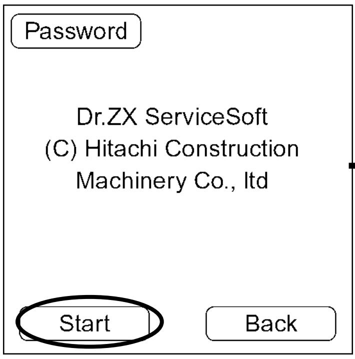


To the lower

T4GB-05-02-036

ICF Controller Screen

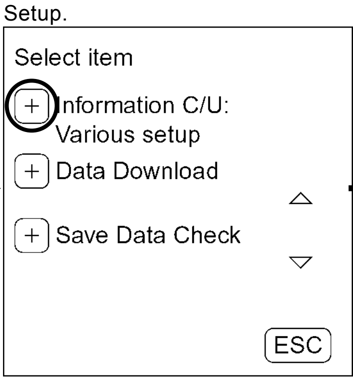
Push Start.



T1V7-05-03-025

Title Screen

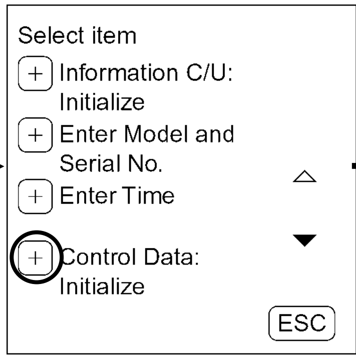
Push Information C/U: Various Setup.



T1V7-05-03-026

Main Menu Screen

Push Control Data: Initialize.

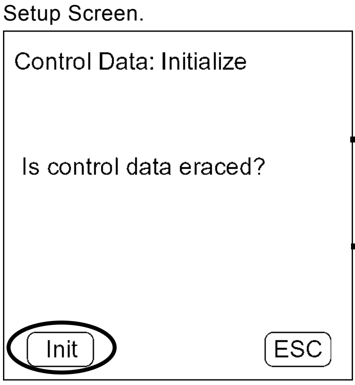


To the lower

T1V7-05-03-027

Information C/U: Various Setup Screen

Push Init and the controller control data is initialied. Push ESC and return to Information C/U: Various Setup Screen.



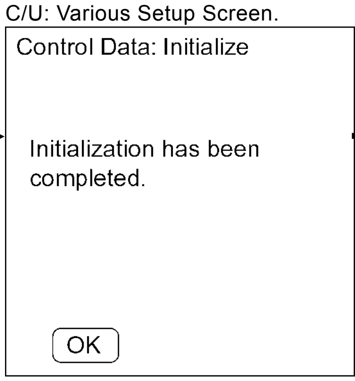
Init

ESC

T1V7-05-03-033

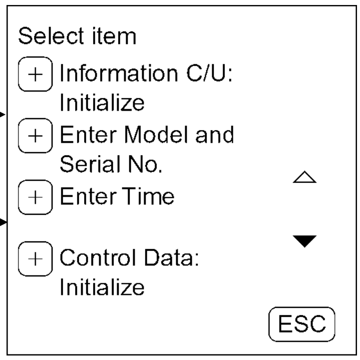
Control Data: Initialize Screen

Push OK and return to Information C/U: Various Setup Screen.



T1V7-05-03-034

Push ESC and return to Main Menu Screen.

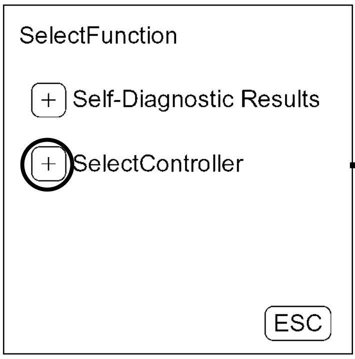


T1V7-05-03-027

Information C/U: Various Setup Screen

SATELLITE TERMINAL: INITIALIZE

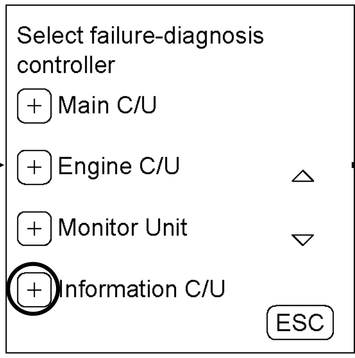
After starting Dr. ZX, push Select Controller.



T1V7-05-03-001

Function Selection Screen

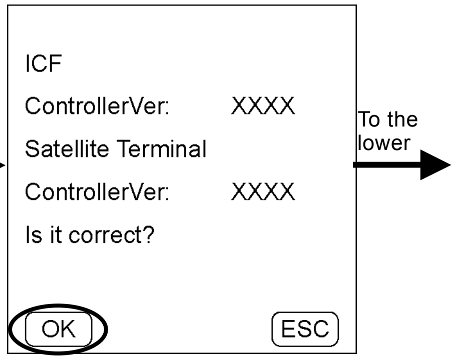
Push Information C/U.



T4GB-05-02-053

Controller Selection Screen

Push OK.



T4GB-05-02-036

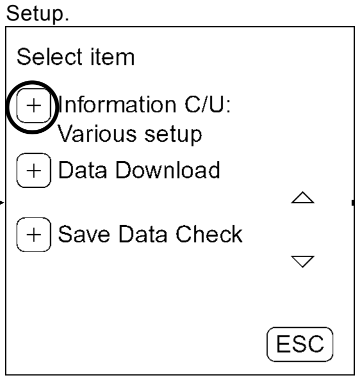
ICF Controller Screen

Push Start.

T1V7-05-03-025

Title Screen

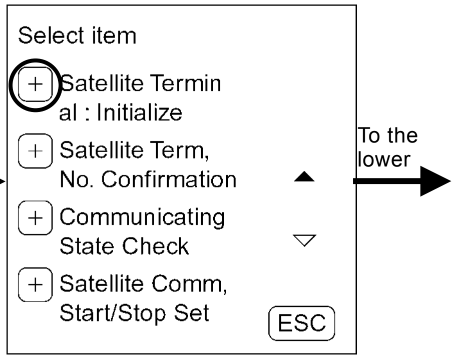
Push Information C/U: Various Setup.



T1V7-05-03-026

Main Menu Screen

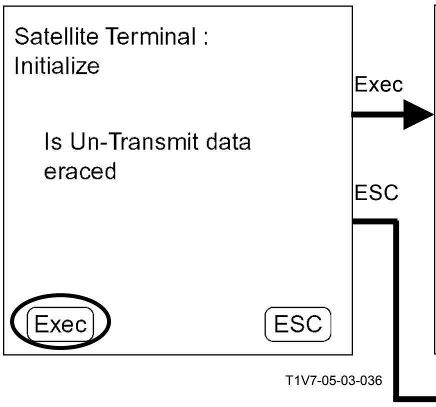
Push ▼ and move to the next screen of Information C/U: Various Setup Screen. Push Satellite Terminal: Initialize.



T1V7-05-03-035

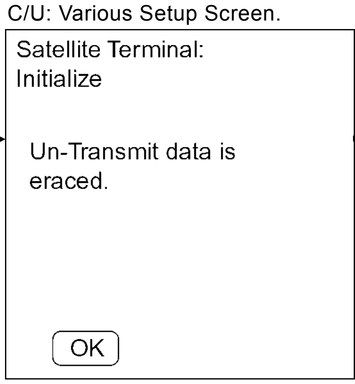
Information C/U: Various Setup Screen

Push Exec.
Push ESC and return to Information C/U: Various Setup Screen.

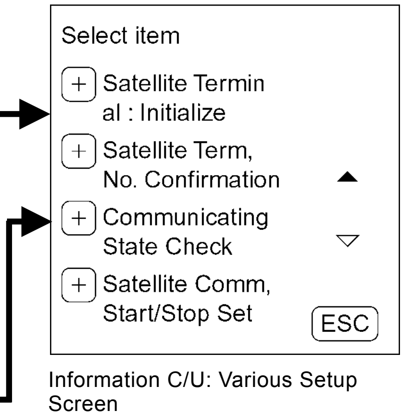


T1V7-05-03-036

Push OK and return to Information C/U: Various Setup Screen.



T1V7-05-03-145

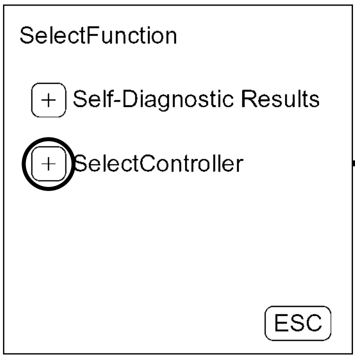


Information C/U: Various Setup Screen

T1V7-05-03-035

SATELLITE TERMINAL No. CONFIRMATION

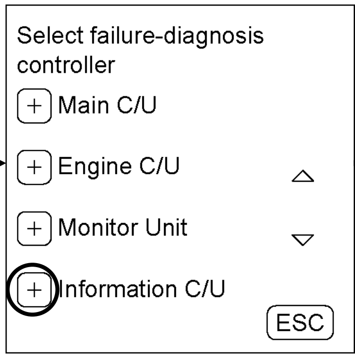
After starting Dr. ZX, push Select Controller.



T1V7-05-03-001

Function Selection Screen

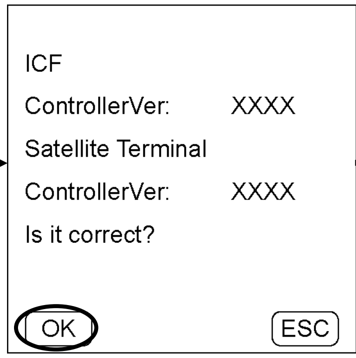
Push Information C/U.



T4GB-05-02-053

Controller Selection Screen

Push OK.

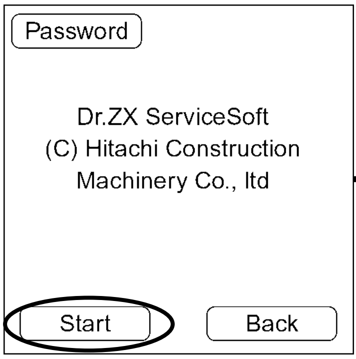


T4GB-05-02-036

ICF Controller Screen

To the lower

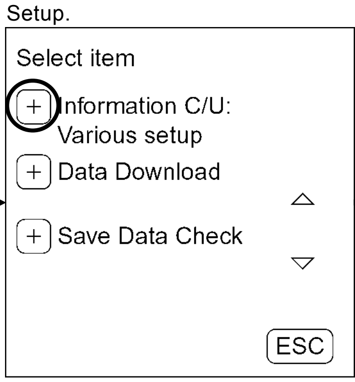
Push Start.



T1V7-05-03-025

Title Screen

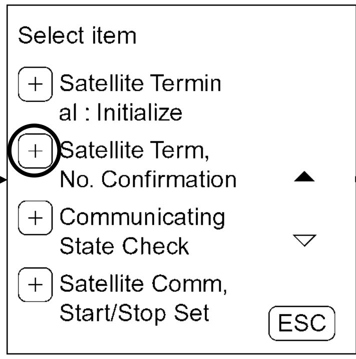
Push Information C/U: Various Setup.



T1V7-05-03-026

Main Menu Screen

Push ▼ and move to the next screen of Information C/U: Various Setup Screen. Push Satellite Terminal No. Confirmation.

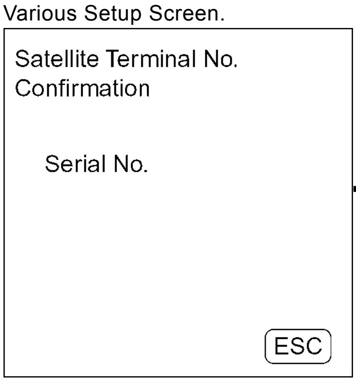


T1V7-05-03-035

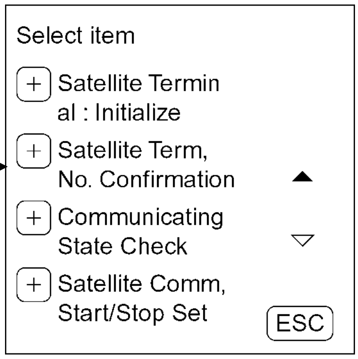
Information C/U: Various Setup Screen

To the lower

Confirm serial No. (12 digits). Push ESC and return to Information C/U: Various Setup Screen.



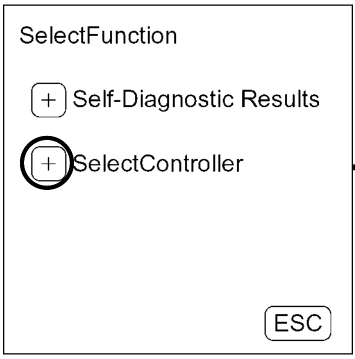
T1V7-05-03-037



T1V7-05-03-035

COMMUNICATING STATE CHECK

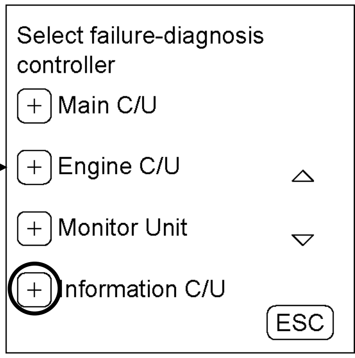
After starting Dr. ZX, push Select Controller.



T1V7-05-03-001

Function Selection Screen

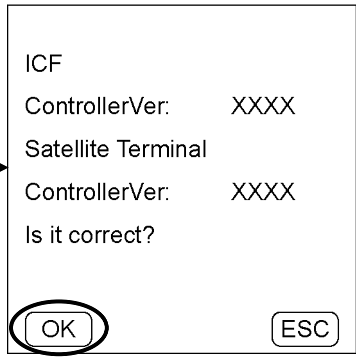
Push Information C/U.



T4GB-05-02-053

Controller Selection Screen

Push OK.



To the lower

T4GB-05-02-036

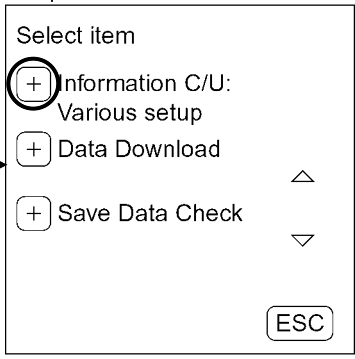
ICF Controller Screen

Push Start.

T1V7-05-03-025

Title Screen

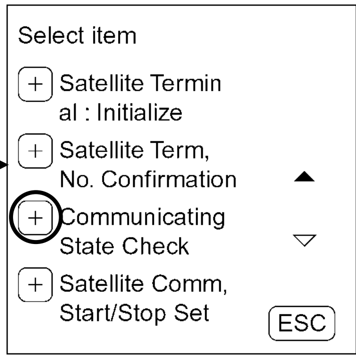
Push Information C/U: Various Setup.



T1V7-05-03-026

Main Menu Screen

Push ▼ and move to the next screen of Information C/U: Various Setup Screen. Push Communicating State Check.

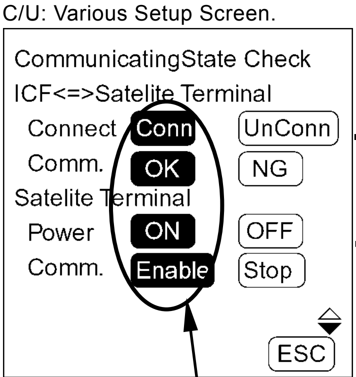


To the lower

T1V7-05-03-035

Information C/U: Various Setup Screen

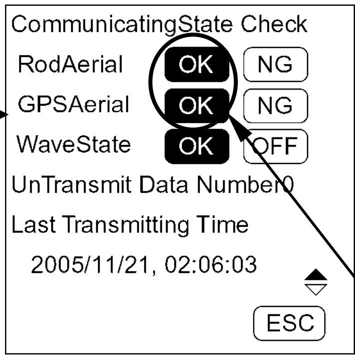
Check communicating state.
Unconn: Faulty harness
NG: Faulty harness for Comm.
OFF: Faulty harness, Faulty controller
Stop: Enter Satellite Comm. Start/Stop
Push ESC and return to Information C/U: Various Setup Screen.



T1V7-05-03-142

Check the enclosed state.

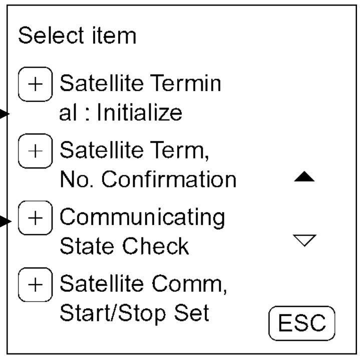
Push ▼ and move to the next screen. Check communicating state of Rod Aerial and GPS Aerial. Push ESC and return to Information C/U: Various Setup Screen.



ESC

T1V7-05-03-143

Push ESC and return to Main Menu Screen.



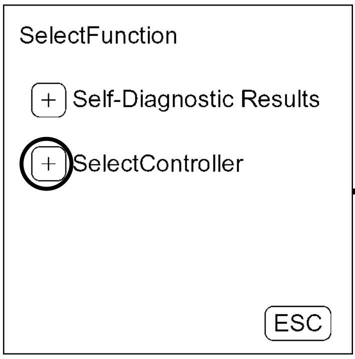
T1V7-05-03-035

When electrical wave of the satellite is caught, the items are turned into OK.

IMPORTANT: Check this with the key of machine ON in outdoor. According to state of electrical wave, it may take a little longer time.

ENTER SATELLITE COMM. START / STOP

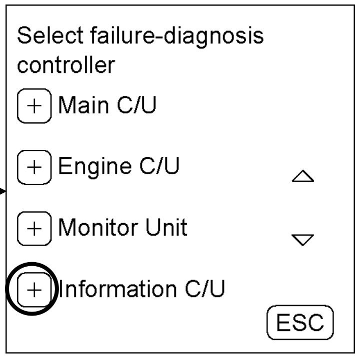
After starting Dr. ZX, push Select Controller.



T1V7-05-03-001

Function Selection Screen

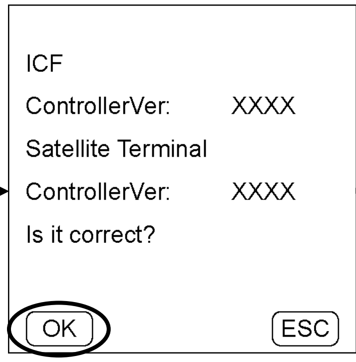
Push Information C/U.



T4GB-05-02-053

Controller Selection Screen

Push OK.



To the lower

T4GB-05-02-036

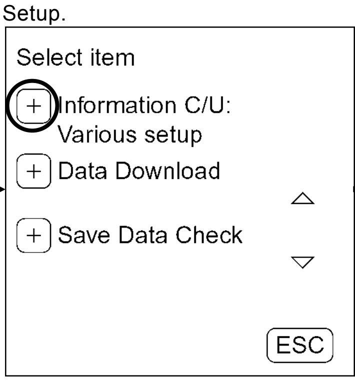
ICF Controller Screen

Push Start.

T1V7-05-03-025

Title Screen

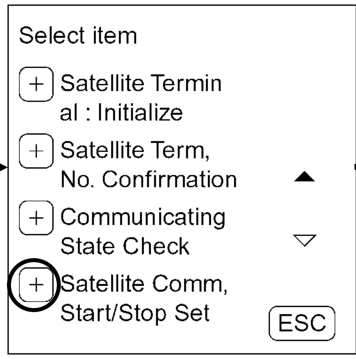
Push Information C/U: Various Setup.



T1V7-05-03-026

Main Menu Screen

Push ▼ and move to the next screen of Information C/U: Various Setup Screen. Push Enter Satellite Comm. Start/Stop.

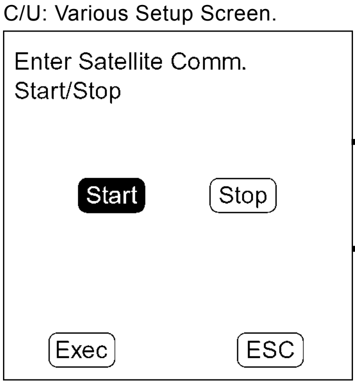


To the lower

T1V7-05-03-035

Information C/U: Various Setup Screen

When starting Satellite Comm., push Start and push Exec. When stopping Satellite Comm., push Stop and push Exec.
Push ESC and return to Information C/U: Various Setup Screen.

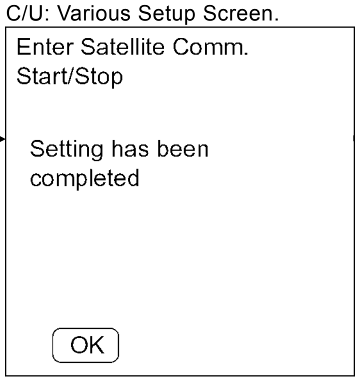


Exec

ESC

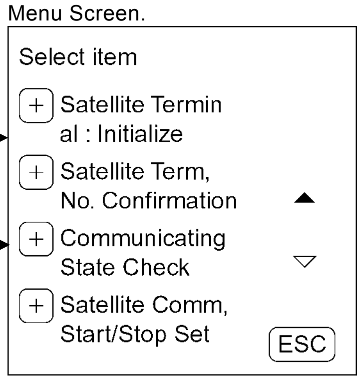
T1V7-05-03-146

Push OK and return to Information C/U: Various Setup Screen.



T1V7-05-03-147

Push ESC and return to Main Menu Screen.

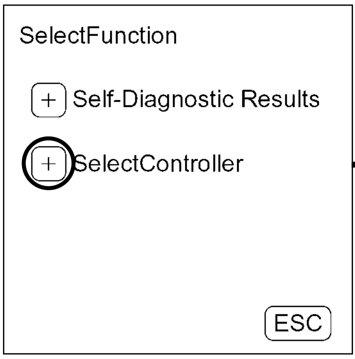


T1V7-05-03-035

Information C/U: Various Setup Screen

DATA DOWNLOAD

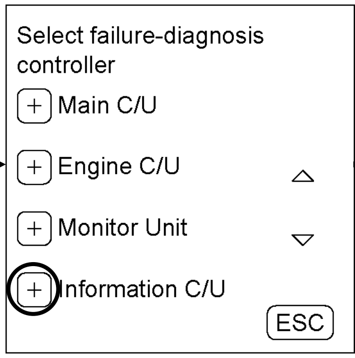
After starting Dr. ZX, push Select Controller.



T1V7-05-03-001

Function Selection Screen

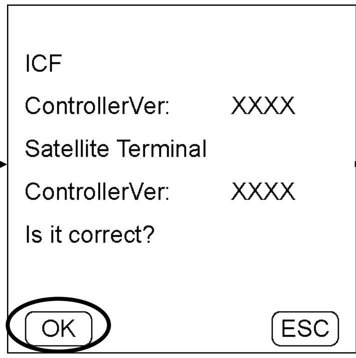
Push Information C/U.



T4GB-05-02-053

Controller Selection Screen

Push OK.



To the lower

T4GB-05-02-036

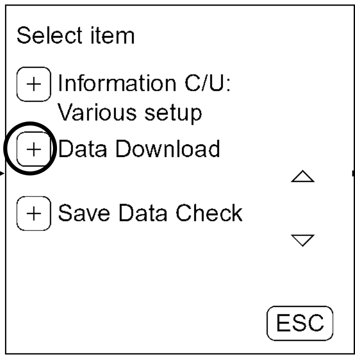
ICF Controller Screen

Push Start.

T1V7-05-03-025

Title Screen

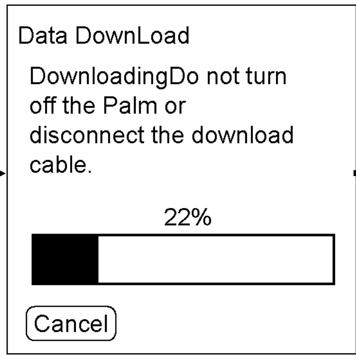
Push Data Download.



T1V7-05-03-026

Main Menu Screen

While downloading data, Download Screen is displayed.

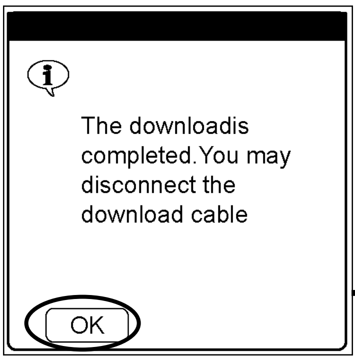


To the lower

T1V7-05-03-038

Data Download Screen

When downloading is completed normally, Normal End Screen is displayed. Push OK and return to Main Menu Screen.



T1V7-05-03-039

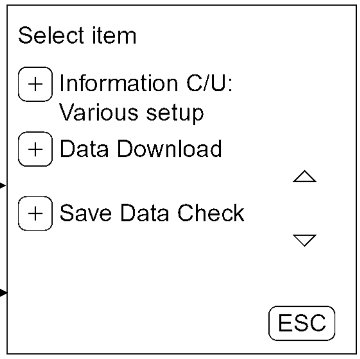
Normal End Screen

If pushing Cancel on Data Download Screen, Alarm Screen is displayed. Push OK and return to Main Menu Screen.

T1V7-05-03-148

Alarm Screen

Push ESC and return to Title Screen.

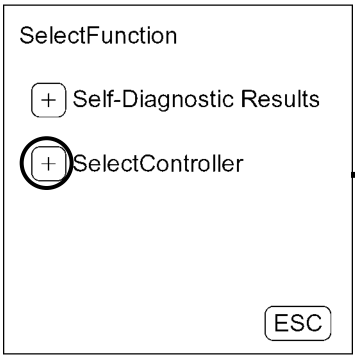


T1V7-05-03-026

Main Menu Screen

SAVE DATA CHECK

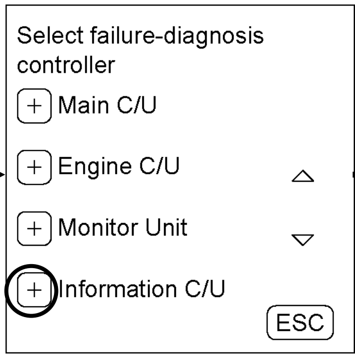
After starting Dr. ZX, push Select Controller.



T1V7-05-03-001

Function Selection Screen

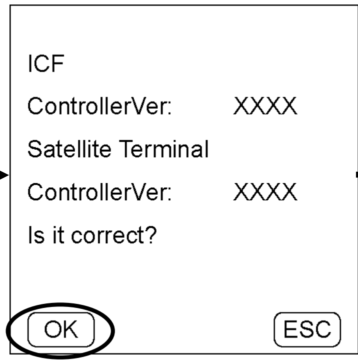
Push Information C/U.



T4GB-05-02-053

Controller Selection Screen

Push OK.



To the lower

T4GB-05-02-036

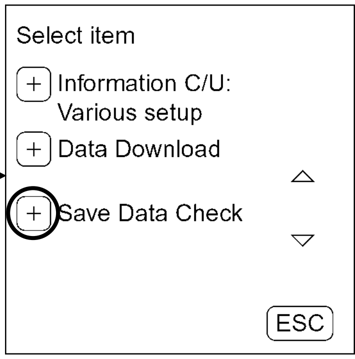
ICF Controller Screen

Push Start.

T1V7-05-03-025

Title Screen

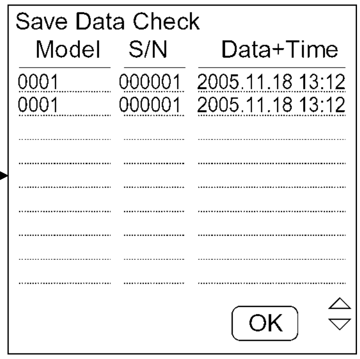
Push Save Data Check.



T1V7-05-03-026

Main Menu Screen

Data saved in ICF is displayed. Push OK and return to Main Menu Screen.

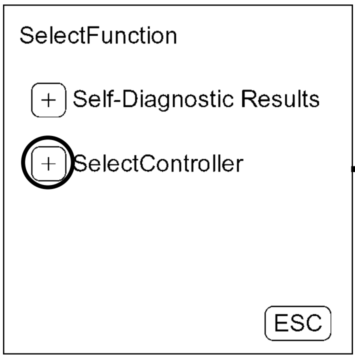


T1V7-05-03-040

Save Data Check Screen

PASSWORD CHANGE

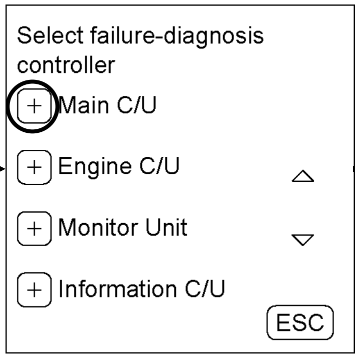
After starting Dr. ZX, push Select Controller.



T1V7-05-03-001

Function Selection Screen

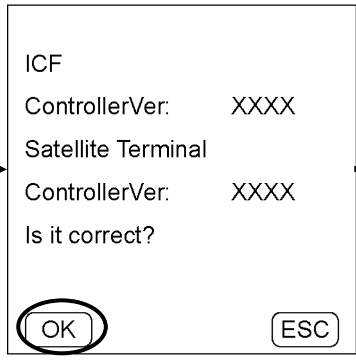
Push Information C/U.



T4GB-05-02-053

Controller Selection Screen

Push OK.



To the lower

T4GB-05-02-036

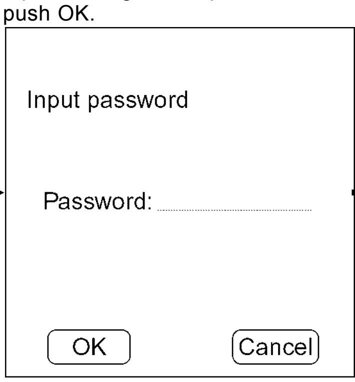
ICF Controller Screen

Push Password.

T1V7-05-03-025

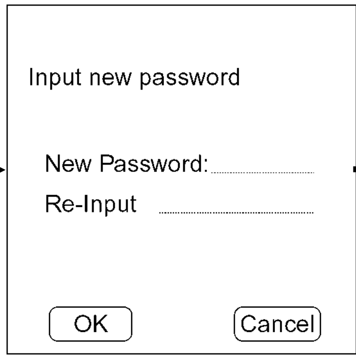
Title Screen

Input the registered password and push OK.



T1V7-05-03-126

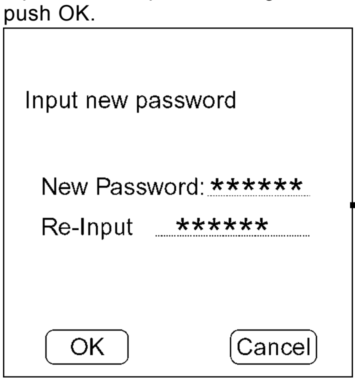
Input the new password and push OK.



To the lower

T1V7-05-03-127

Input the new password again and push OK.



T1V7-05-03-169

Push OK and return to Title Screen.

T1V7-05-03-128

(Blank)

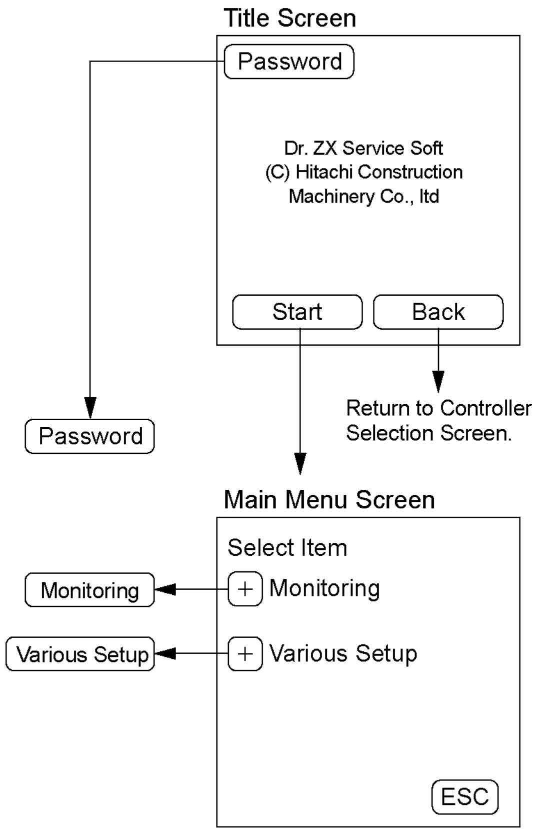
MONITOR UNIT

Main Menu

- Monitoring
  Dr. ZX displays the input signals from each sensor and switch.
- Various Settings
  Dr. ZX can set inner hour meter synchronization.

Password

The password can be changed.



T4GB-05-02-039

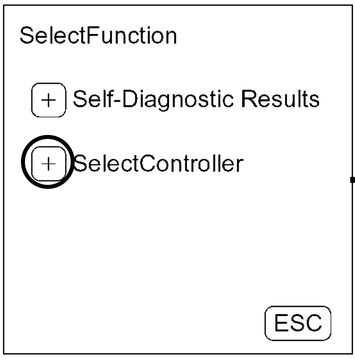
MONITORING

List of Monitoring Item

Item	Data	Unit
Radiator Coolant Temperature	Signal to coolant temperature gauge	°C
Fuel Level	Signal to fuel gauge	%
T/M Torque Converter Oil Temperature	Signal to transmission oil temperature gauge	°C
Steering Pressure	Continuity status in emergency steering pressure switch	ON OFF
Brake Oil Level Switch of Service Brake	Continuity status to brake oil level indicator	ON OFF
Emergency Steering Pump Pressure Switch	Continuity status in emergency steering pump delivery pressure switch	ON OFF
Service Brake Pressure	Detected value in brake primary pressure sensor	MPa
Overheat Switch	Continuity status to overheat indicator	ON OFF
Engine Oil Pressure Switch	Continuity status to engine oil pressure indicator	ON OFF
Air Filter Restriction	Continuity status to air filter restriction indicator	ON OFF
Heated Window Switch (Optional)	Continuity status in heated window switch (optional)	ON OFF
Emergency Steering Operation Check Switch	Continuity status in emergency steering check switch	ON OFF
Front Wiper Switch	Continuity status in front wiper switch	ON OFF
Engine Warning Switch	Continuity status to engine warning indicator	ON OFF
Engine STOP Switch	Continuity status to stop indicator	ON OFF
Model Selector Switch 1	Switch 1 OFF, switch 2 OFF: ZW220/250 Switch 1 ON, switch 2 OFF: ZW310	ON OFF
Model Selector Switch 2		ON OFF
Glow Switch	Continuity status to glow signal	ON OFF
T/M Warning Switch	Continuity status to transmission warning indicator	ON OFF
Buzzer Output	Continuity status to buzzer	ON OFF
Load Dump Relay Output	Excited status in load dump relay	ON OFF
Emergency Steering Relay Output	Excited status in emergency steering relay	ON OFF
Front Wiper Relay Output	Excited status in front wiper relay	ON OFF
Heated Window Relay Output	Excited status in heated window relay	ON OFF
Parking Brake Signal Output	Sending status of parking brake operating signal to TCU	ON OFF
Parking Brake Pressure Switch	Continuity status in parking brake pressure switch	ON OFF
Neutral Signal	Excited status in neutral relay	ON OFF
Axle Oil Temperature	Detected value in axle oil temperature sensor	°C

Monitoring

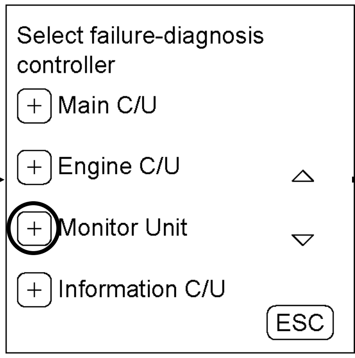
After starting Dr. ZX, push Select Controller.



T1V7-05-03-001

Function Selection Screen

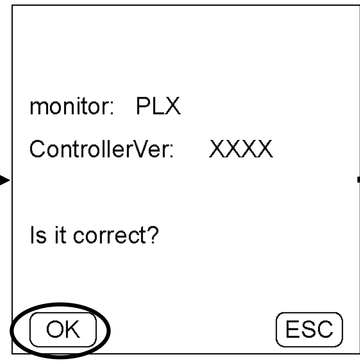
Push Monitor Unit.



T4GB-05-02-053

Controller Selection Screen

Push OK.

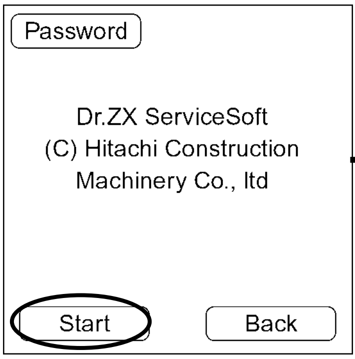


To the lower

T4GB-05-02-040

Monitor Controller Screen

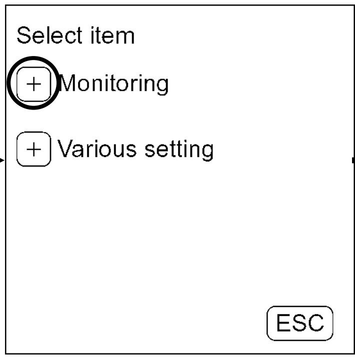
Push Start.



T1V7-05-03-025

Title Screen

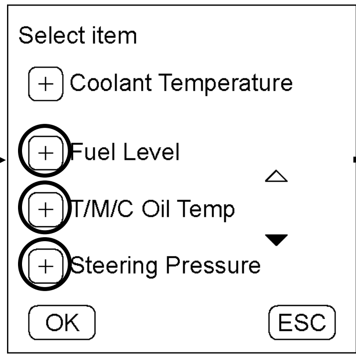
Push Monitoring.



T1V7-05-03-042

Main Menu Screen

Push item for monitoring and push OK. Refer to T5-2-44 as for the monitoring item.
Push ESC and return to Main Menu Screen.

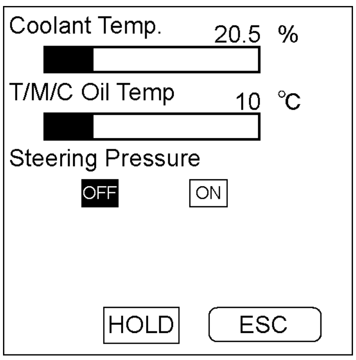


To the lower

T4GB-05-02-041

Monitoring Item Selection Screen

When pushing Hold, the monitor is stopped temporarily.
When re-starting the monitor, push Hold again. Push ESC and return to Monitoring Item Selection Screen.



T4GB-05-02-042

Monitoring Screen

VARIOUS SETTINGS

Monitor Unit List of Setup Item

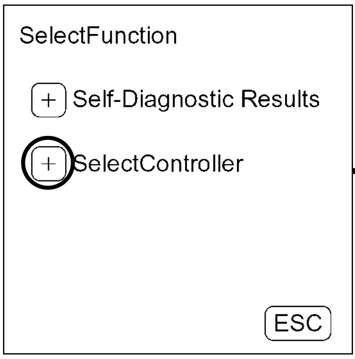
Item	Data
Internal Hour Meter Sync.	Synchronization of hour meter data in both monitor unit and ICF

MC List of Adjustment Data

Data	Adjustment Minimum Unit	Adjustable Range	Adjustment Minimum Unit	Remark
Internal Hour Meter Sync.	-	ON only	-	

INTERNAL HOUR METER SYNCHRONIZATION

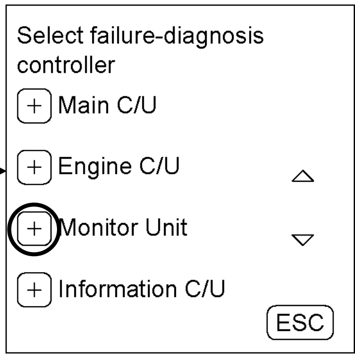
After starting Dr. ZX, push Select Controller.



T1V7-05-03-001

Function Selection Screen

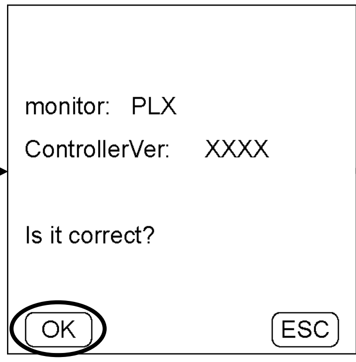
Push Monitor Unit.



T4GB-05-02-053

Controller Selection Screen

Push OK.



To the lower

T4GB-05-02-040

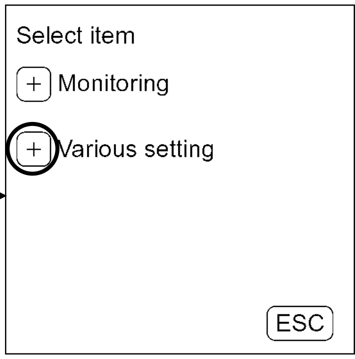
Monitor Controller Screen

Push Start.

T1V7-05-03-025

Title Screen

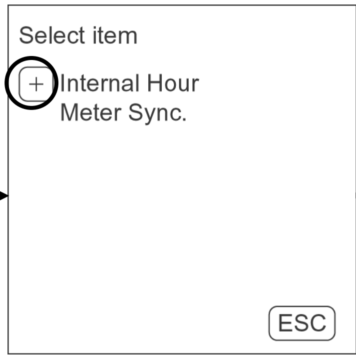
Push Various setting.



T1V7-05-03-042

Main Menu Screen

Push Internal Hour Meter Sync.

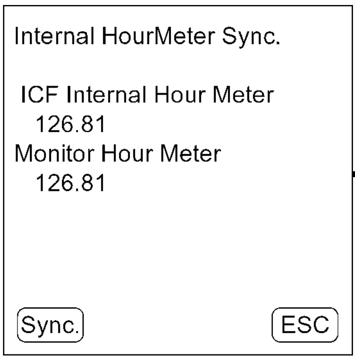


To the lower

T4GB-05-02-043

Various Setup Item Screen

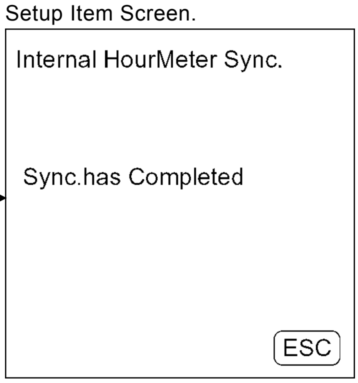
Push Sync. Push ESC and return to the former screen.



T1V7-05-03-085

Maintenance Set Item Screen

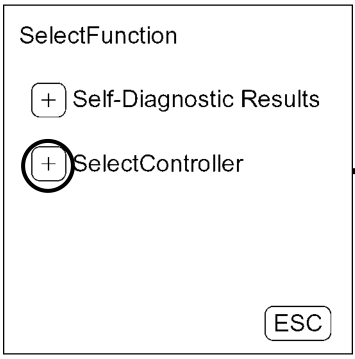
Push ESC and return to Various Setup Item Screen.



T1V7-05-03-086

PASSWORD CHANGE

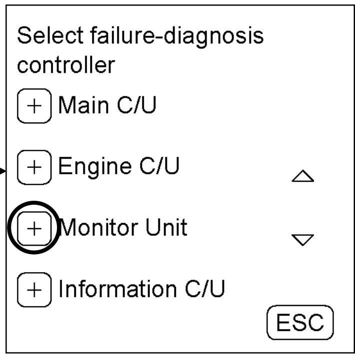
After starting Dr. ZX, push Select Controller.



T1V7-05-03-001

Function Selection Screen

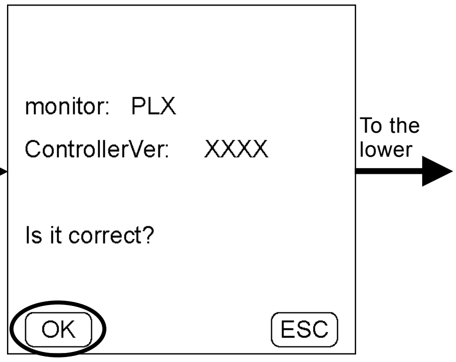
Push Monitor Unit.



T4GB-05-02-053

Controller Selection Screen

Push OK.



T4GB-05-02-040

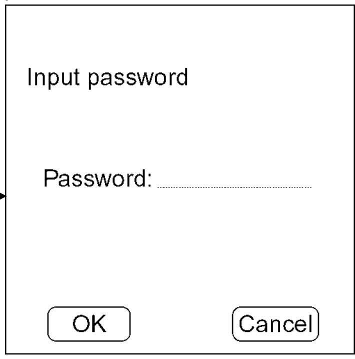
Monitor Controller Screen

Push Password.

T1V7-05-03-025

Title Screen

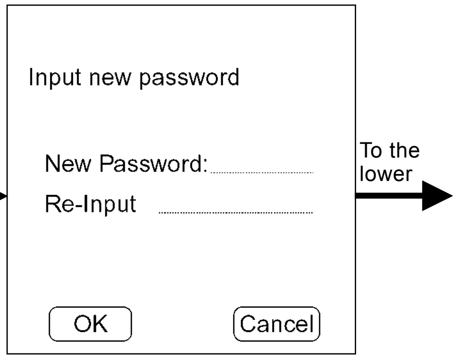
Input the registered password and push OK.



T1V7-05-03-126

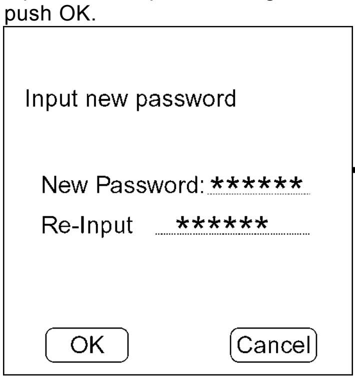
Main Menu Screen

Input the new password and push OK.



T1V7-05-03-127

Input the new password again and push OK.



T1V7-05-03-169

Push OK and return to Title Screen.

T1V7-05-03-128

OUTLINE

ICF (Information Controller) saves the input signals from various sensors and switches of the machine as data by using CAN bus line from each controller.
Various input signals are recorded as “list of daily report data”, “list of frequency distribution data”, “list of total operating hours”, “list of alarm” and “list of failure” in ICF.

The recorded data is downloaded to the personal computer and is uploaded to the center server via LAN, so that the data can be used as “e-Service”.
The machine equipped with the optional satellite communication terminal can send the data to center server by using satellite communication. (As for the satellite communication system, refer to T5-3-24.

LIST OF DAILY REPORT DATA

	Item	Details
1.	Date	Date of daily report data
2.	Fuel Level	The value of the final remained fuel during a day when the engine stops
3.	Fuel Usage Amount	The value of fuel used during a day
4.	Machine Hour Meter	Hour meter cumulative hours
5.	Engine Operating Hours	Total engine operating hours during a day
6.	Operating Distance	Traveling distance during a day
7.	Manual Transmission Operating Hours	Total manual transmission operating hours during a day
8.	Automatic Transmission Operating Hours	Total automatic transmission operating hours during a day
9.	L Mode Operating Hours	Total hours operating L mode of work mode selection switch during a day
10.	N mode Operating Hours	Total hours operating N mode of work mode selection switch during a day
11.	P mode Operating Hours	Total hours operating P mode of work mode selection switch during a day
12.	Radiator Coolant Temperature	The highest radiator coolant temperature during a day
13.	Hydraulic Oil Temperature	The highest hydraulic oil temperature during a day
14.	Intake Air Temperature	The highest intake air temperature during a day
15.	Fuel Temperature	The highest fuel temperature during a day
16.	Torque Converter Oil Temperature	The highest torque converter oil temperature during a day
17.	Engine Operating Hour Distribution	Engine operating hour distribution during a day (Operating hours are recorded only when alternator output signal is continuously delivered for more than 10 minutes.)

NOTE: The daily operation in this table is equivalent to the hours between 0:00 and 23:59:59 counted by the ICX built-in clock. In case the engine is kept operated beyond 0:00, such data are recorded as those for the following day.

LIST OF FREQUENCY DISTRIBUTION DATA

	Item	Details
1.	Fuel Temperature Distribution	Frequency distribution of fuel temperature
2.	Pump Load Distribution	Frequency distribution of main pump delivery pressure
3.	Travel Load Distribution	Frequency distribution of travel torque
4.	Radiator Coolant Temperature Distribution	Frequency distribution of coolant temperature
5.	Hydraulic Oil Temperature Distribution	Frequency distribution of hydraulic oil temperature
6.	Torque converter oil Temperature Distribution	Frequency distribution of torque converter oil temperature
7.	Brake Pressure Distribution	Frequency distribution of secondary brake pressure
8.	Radiator Coolant Temperature - Intake Air Temperature Distribution	Frequency distribution on temperature in which intake air temperature is pulled from coolant temperature
9.	Hydraulic Oil Temperature - Intake Air Temperature	Frequency distribution on temperature in which intake air temperature is pulled from hydraulic oil temperature
10.	Torque Converter Oil Temperature - Intake Air Temperature Distribution i	Frequency distribution on temperature in which intake air temperature is pulled from torque converter oil temperature
11.	Radiator Coolant Temperature/Intake Air Temperature	Frequency distribution of coolant temperature and intake air temperature
12.	Hydraulic Oil Temperature/Intake Air Temperature	Frequency distribution of hydraulic oil temperature and intake air temperature
13.	Torque Converter Oil Temperature / Intake Air Temperature	Frequency distribution of torque converter oil temperature and intake air temperature
14.	Manual Transmission Speed Distribution	Frequency distribution of speed in manual transmission
15.	Automatic Transmission Speed Distribution	Frequency distribution of speed in automatic transmission
16.	Engine Load Rate	Frequency distribution of engine spood and engine torque

LIST OF TOTAL OPERATING HOURS

	Item	Details
1.	Hour Meter (ICF)	Hour meter's value accumulated inside ICF
2.	Hour Meter (Monitor Unit)	Hour meter's value accumulated in monitor unit
3.	Engine Operating Hour	Total engine operating hours
4.	Traveling Distance	Total traveling Distance
5.	Manual Transmission Operating Hours	Total manual transmission operating hours
6.	Automatic Transmission Operating Hours	Total automatic transmission operating hours
7.	L mode Operating Hours	Total hours operating L mode of work mode selection switch
8.	N mode Operating Hours	Total hours operating N mode of work mode selection switch
9.	P mode Operating Hours	Total hours operating P mode of work mode selection switch

LIST OF ALARM

	Item	Details
1.	Overheat Alarm	Date when the overheat indicator lights
2.	Engine Warning Alarm	Date when the engine warning indicator lights
3.	Engine Oil Pressure Alarm	Date when the engine oil pressure indicator lights
4.	Alternator Indicator Alarm	Date when the alternator indicator lights
5.	Air Filter Restriction Alarm	Date when the air filter restriction indicator lights
6.	Water Separator Alarm	Date when the water separator indicator lights
7.	Service Brake Oil Level Alarm	Date when the service brake oil level indicator lights
8.	Service Brake Oil Pressure Alarm	Date when the service brake oil pressure indicator lights
9.	Emergency Steering Operation Alarm	Date when the emergency steering operation indicator lights
10.	Steering Oil Pressure Alarm	Date when the steering oil pressure indicator lights
11.	Transmission Oil Temperature Alarm	Date when the transmission oil temperature indicator lights
12.	Hydraulic Oil Temperature Alarm	Date when the hydraulic oil temperature indicator lights
13.	Transmission Filter Restriction Alarm	Date when the transmission filter restriction indicator lights
14.	Transmission Failure Alarm	Date when the transmission failure indicator lights

NOTE: When the alarm above is recorded, check each item.
If the monitor is faulty, refer to Troubleshooting C.

LIST OF FAILURE

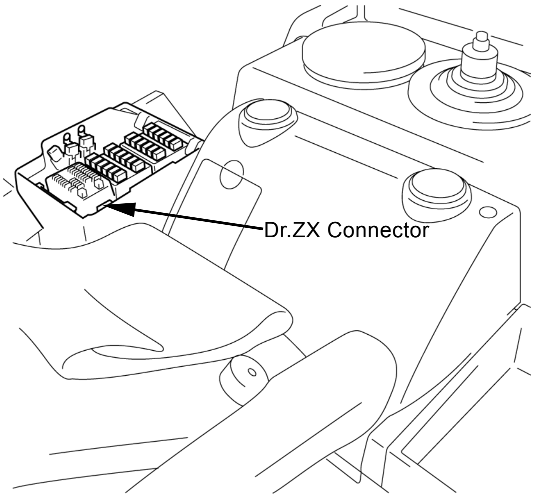
When the fault code occurs, ICF records the fault code and the date.

Use the list of failure when the malfunction, which is difficult to identify, occurs as the remedy information.
Refer to Troubleshooting A.

If the machine is operated properly with the fault code recorded, the machine can continue to be operated.

HOW TO DOWNLOAD AND UPLOAD DATA OF ICF

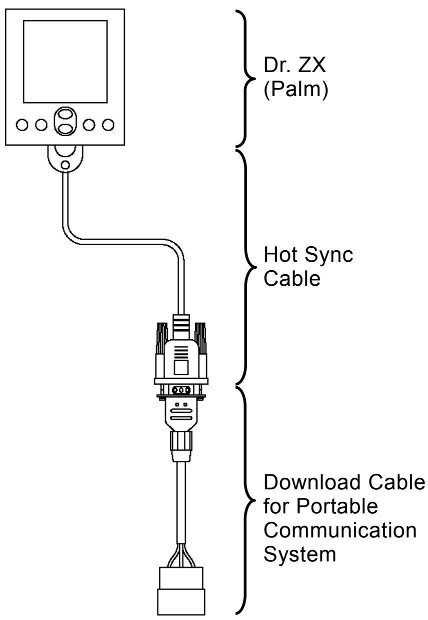
After the data saved in ICF is downloaded to Dr. ZX, is uploaded to the personal Computer, and is uploaded to the center server by using LAN, the data can be used as “e-Service”.



T4GB-05-01-007

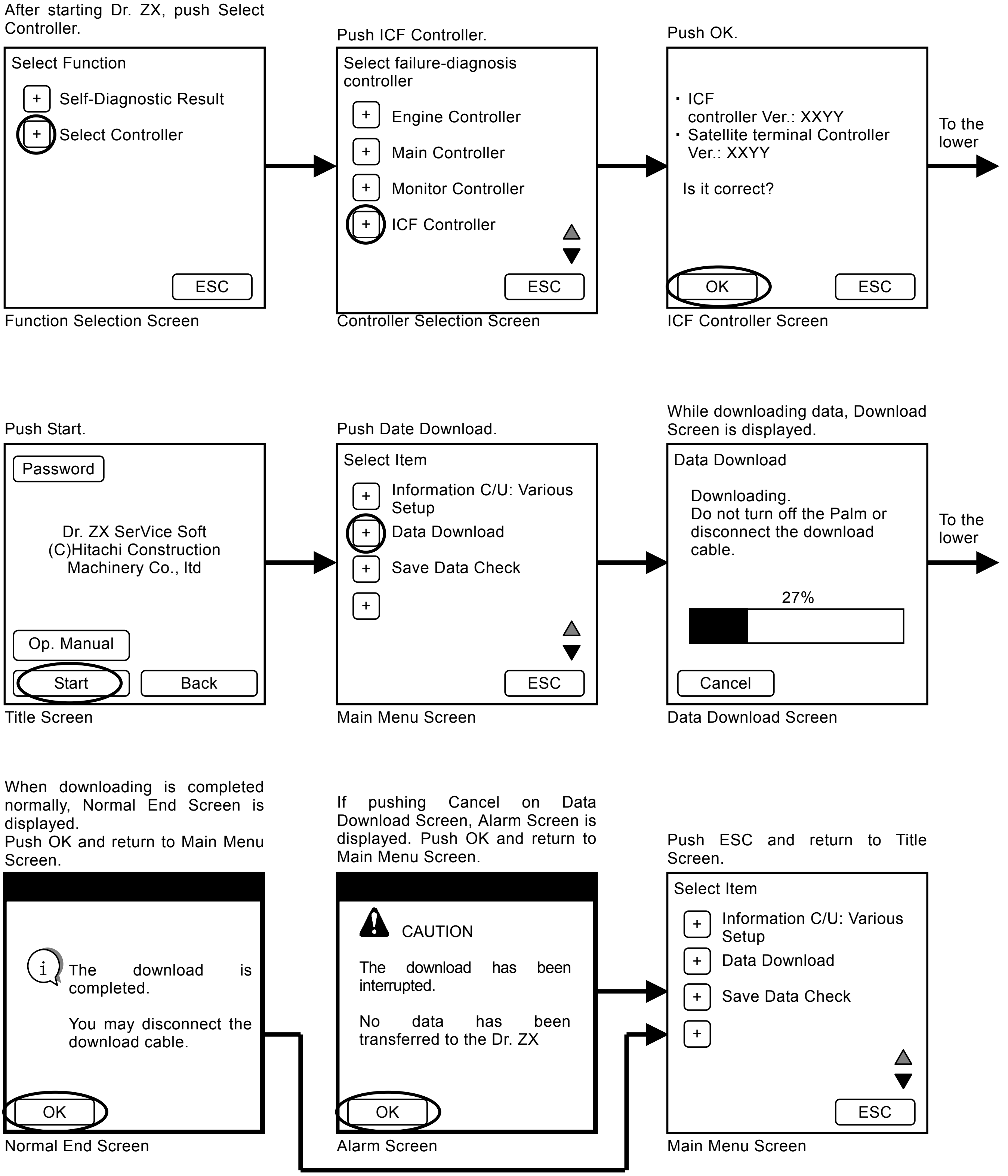
How to Download Data from Machine to Dr. ZX

1. Connect Dr. ZX to the machine by using the Hot Sync cable and download cable for portable communication system.
2. Turn Dr. ZX ON and start downloading the data. (Refer to the next page.)



T1V1-05-07-002

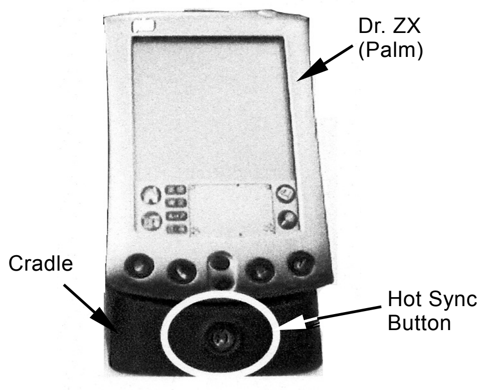
Data Download



How to Upload Data from Dr. ZX (Palm) to Personal Computer

1. Set Dr. ZX (Palm) to the cradle. Connect the USB cable to the personal computer.
2. Push the Hot Sync button.

NOTE: When pushing the Hot Sync button and uploading the data to the personal computer, the Palm Desktop software attached with Dr. ZX (Palm) need to be installed.

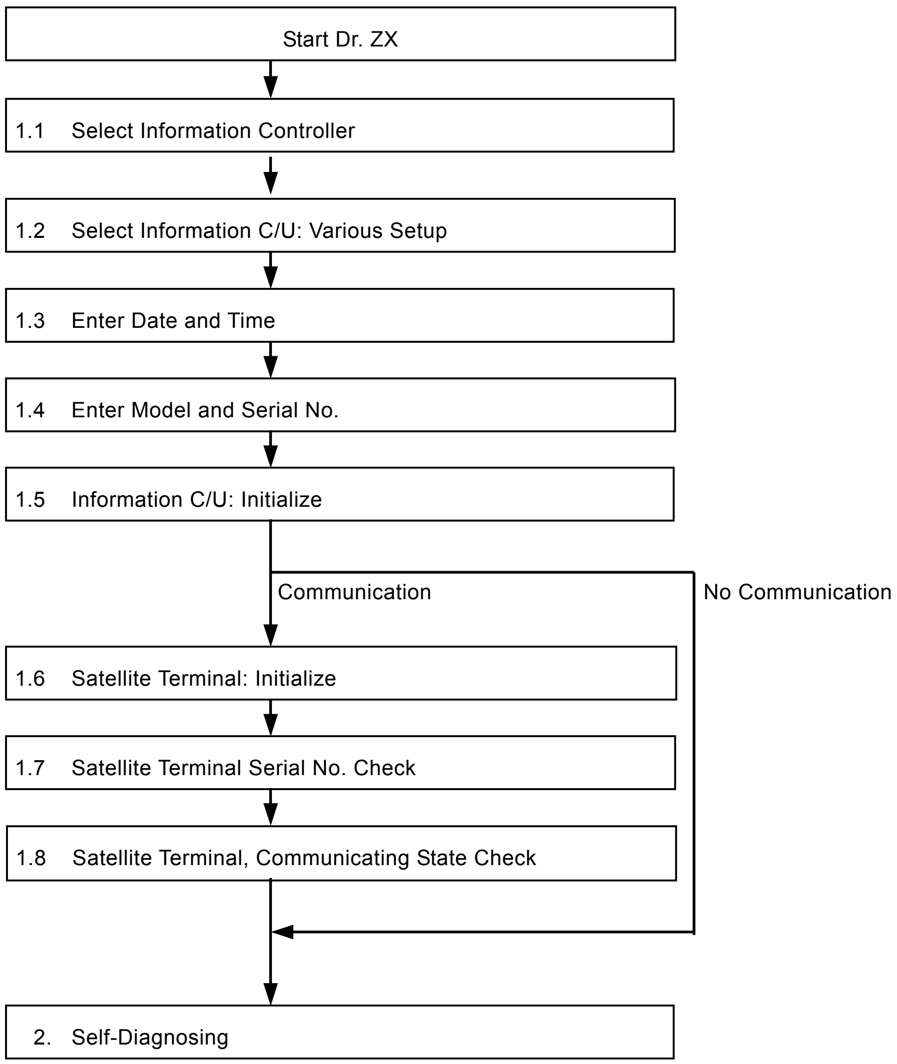


T178-05-07-033

VARIOUS SETUP OF ICF AND SATELLITE COMMUNICATION TERMINAL BY USING Dr. ZX

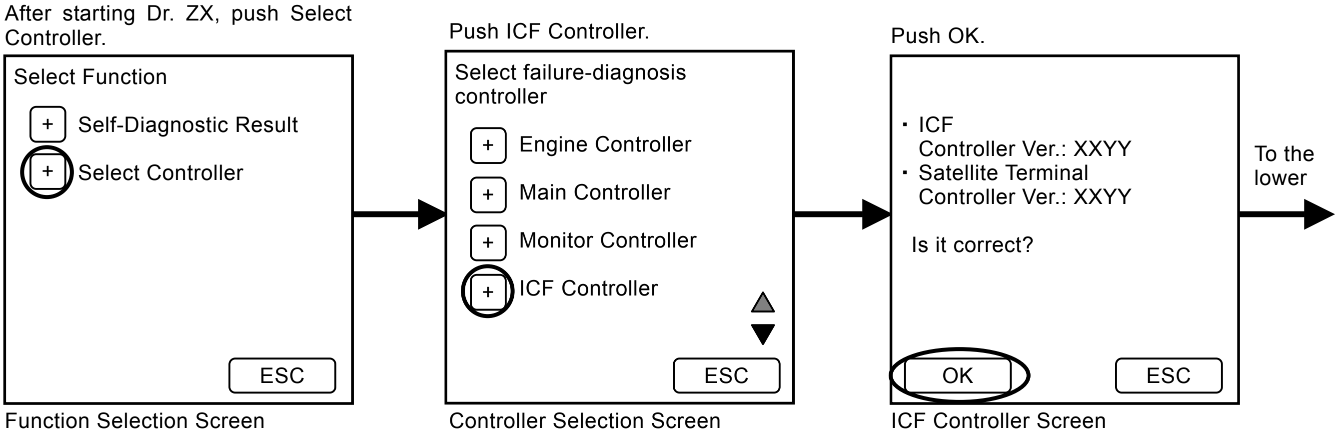
Before starting satellite communication, installing the satellite communication terminal and replacing ICF, perform the following procedures by using Dr. ZX.

ICF Setup Procedures

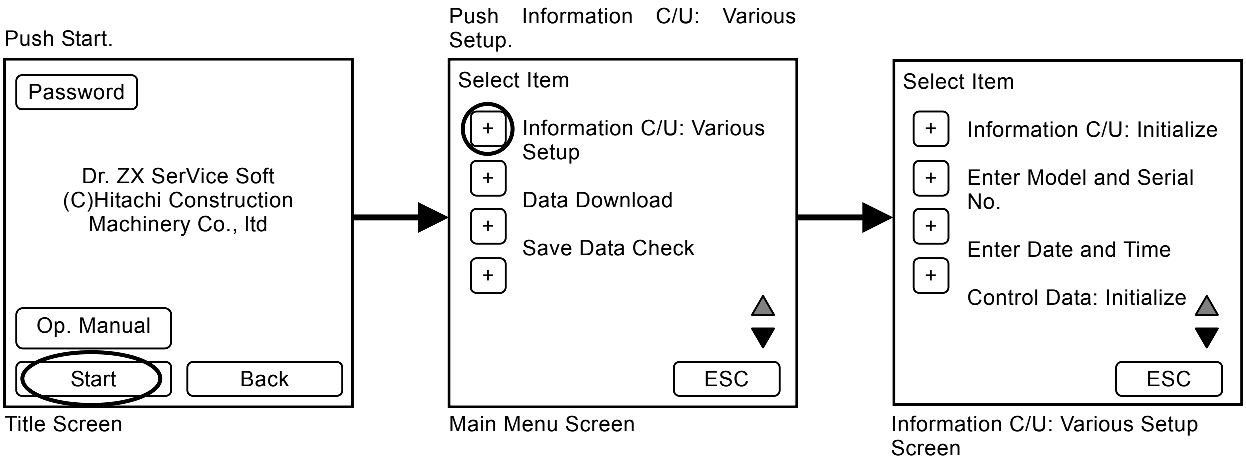


1.1 Select Information Controller
1.2 Select Information C/U: Various Setup

1.1 Select Information Controller

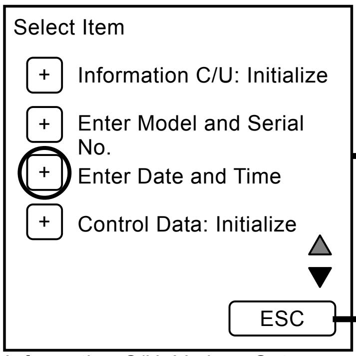


1.2 Select Information C/U: Various Setup



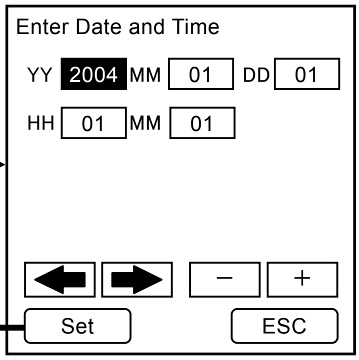
1.3 Enter Date and Time

Push Enter Date and Time.
Push ESC and return to Main Menu Screen.



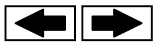
Information C/U: Various Setup Screen

Push Set and the focused item is YY.
Push ESC and return to Information C/U: Various Setup Screen.

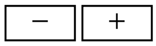


Enter Date and Time Screen

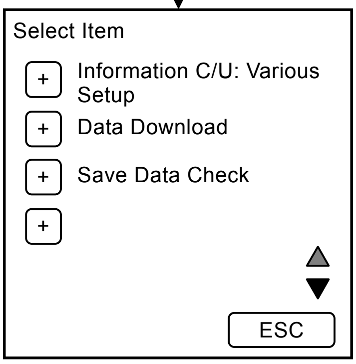
YY, MM, DD, HH and MM
The focused item is displayed reversely.
At first, the focused item is YY.



YY, MM, DD, HH and MM
Move the focused item.
No repeat input.



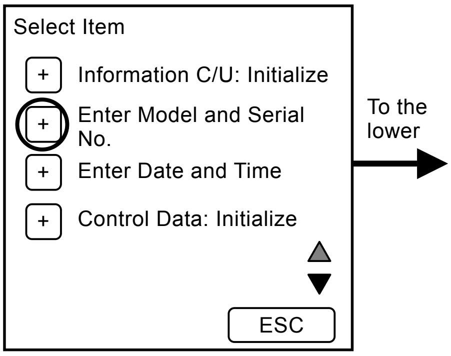
YY, MM, DD, HH and MM
Value of the focused item is increased or decreased one by one.
In case value is beyond maximum one: Change value into the minimum one
In case value is below minimum one: Change value into the maximum one
No repeat input.



Main Menu Screen

1.4 Enter Model and Serial No.

Push Enter Model and Serial No.

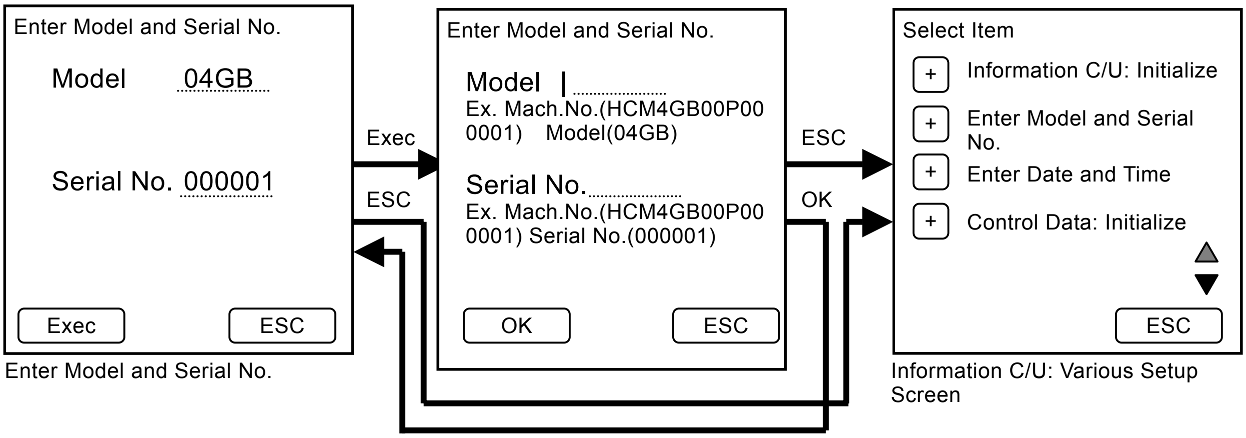


Information C/U: Various Setup Screen

Push Exec, and model and serial No. can be input.
Push ESC and return to Information C/U: Various Setup Screen.

After inputting model and serial No., push OK and return to Enter Model and Serial No. Screen.
Push ESC and return to Information C/U: Various Setup Screen.

Push ESC and return to Main Menu Screen.

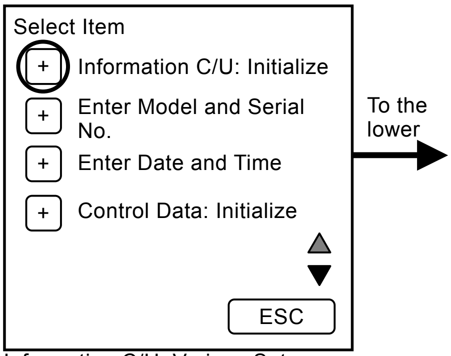


Enter Model and Serial No.

Information C/U: Various Setup Screen

1.5 Information C/U: Initialize

Push Information C/U: Initialize.

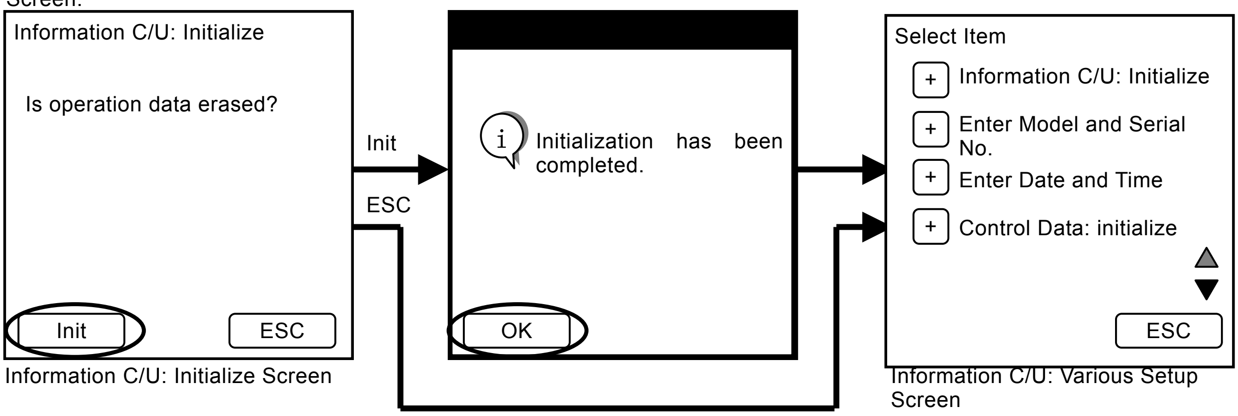


Information C/U: Various Setup Screen

Push Init and the controller operating data is initialized.
Push ESC and return to Information C/U: Various Setup Screen.

Push OK and return to Information C/U: Various Setup Screen.

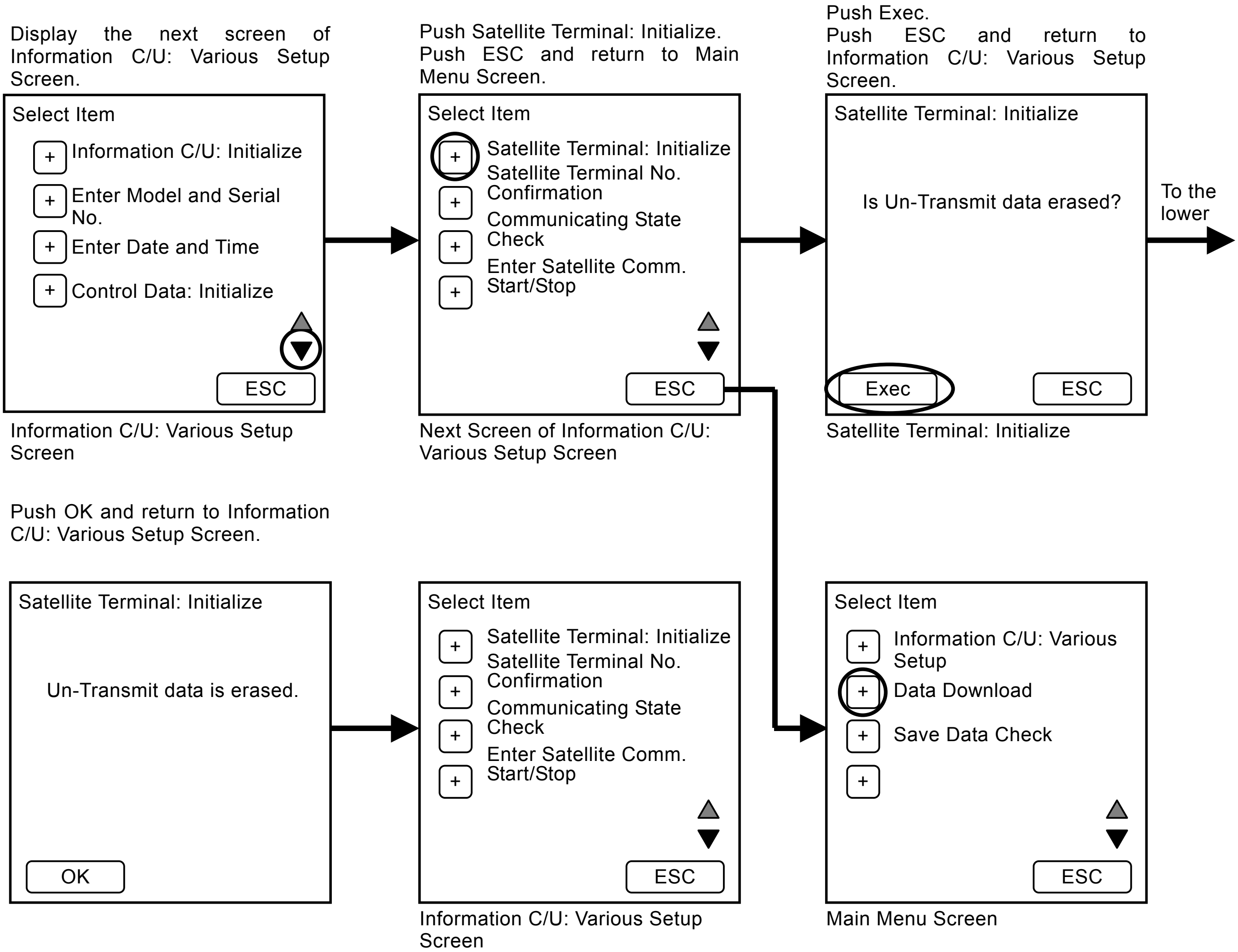
Push ESC and return to Main Menu Screen.



Information C/U: Initialize Screen

Information C/U: Various Setup Screen

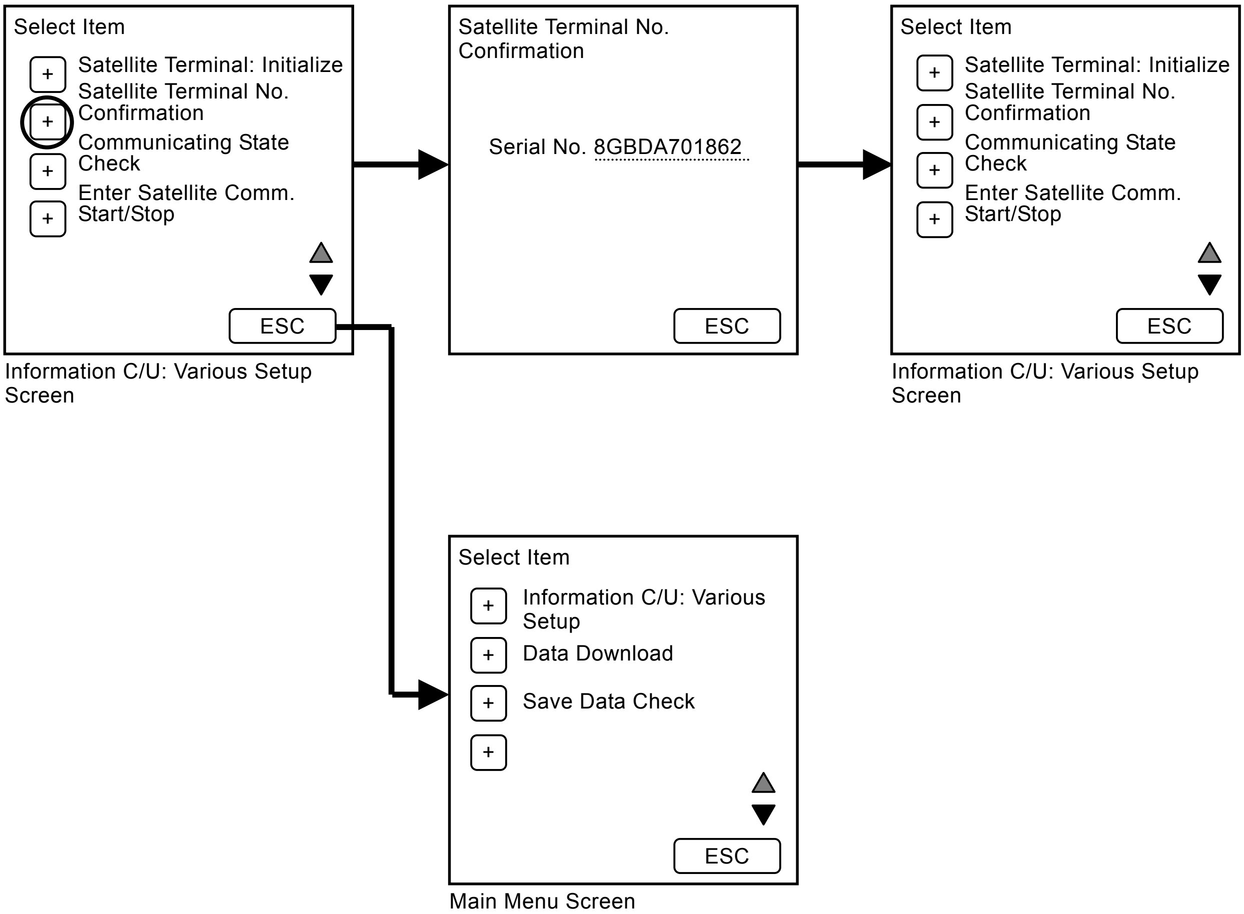
1.6 Satellite Terminal: Initialize



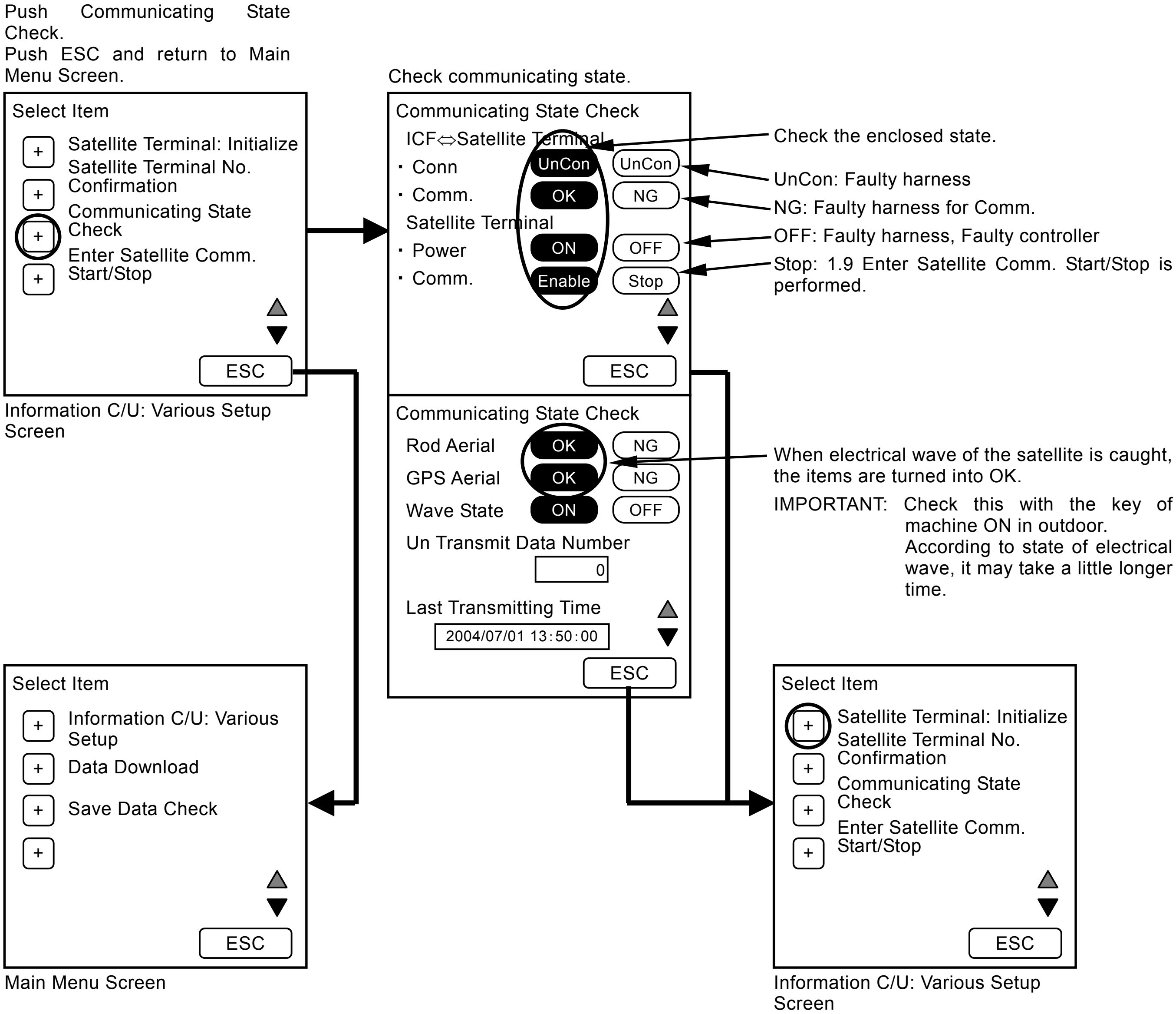
1.7 Satellite Terminal Serial No. Check

Push Satellite Terminal No. Confirmation.
Push ESC and return to Main Menu Screen.

Confirm serial no. (12 digits). Push ESC and return to Information C/U: Various Setup Screen.

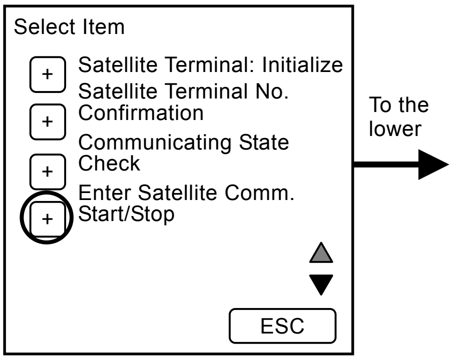


1.8 Satellite Terminal, Communicating State Check



1.9 Enter Satellite Comm. Start/Stop

Push ▼ and move to the next screen of Information C/U: Various Setup Screen.
Push Enter Satellite Comm. Start/Stop.

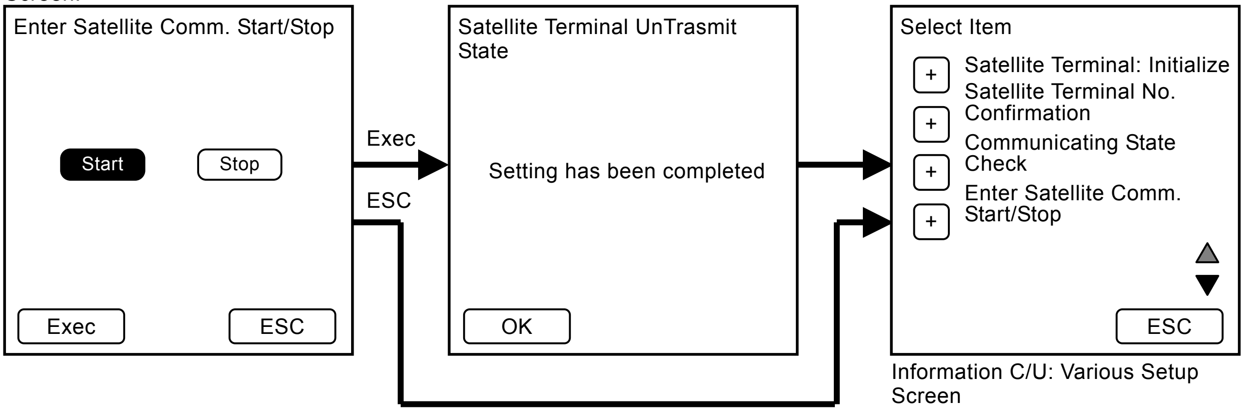


Information C/U: Various Setup Screen

In normal, Start is selected. When stopping Satellite Comm., due to some reasons, push Stop and push Exec.
Push ESC and return to Information C/U: Various Setup Screen.

Push OK and return to Information C/U: Various Setup Screen.

Push ESC and return to Main Menu Screen.

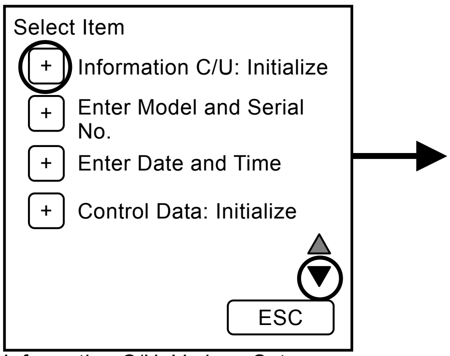


Information C/U: Various Setup Screen

CAUTION: This procedure need not be done in normal.

1.10 Control Data: Initialize

Push Control Data: Initialize.

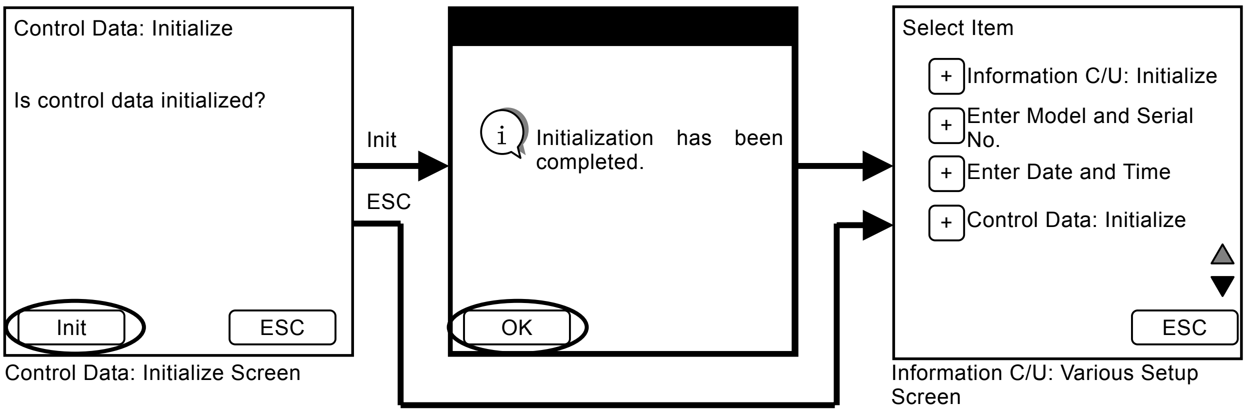


Information C/U: Various Setup Screen

Push Init and the controller operating data is initialized.
Push ESC and return to Information C/U: Various Setup Screen.

Push OK and return to Information C/U: Various Setup Screen.

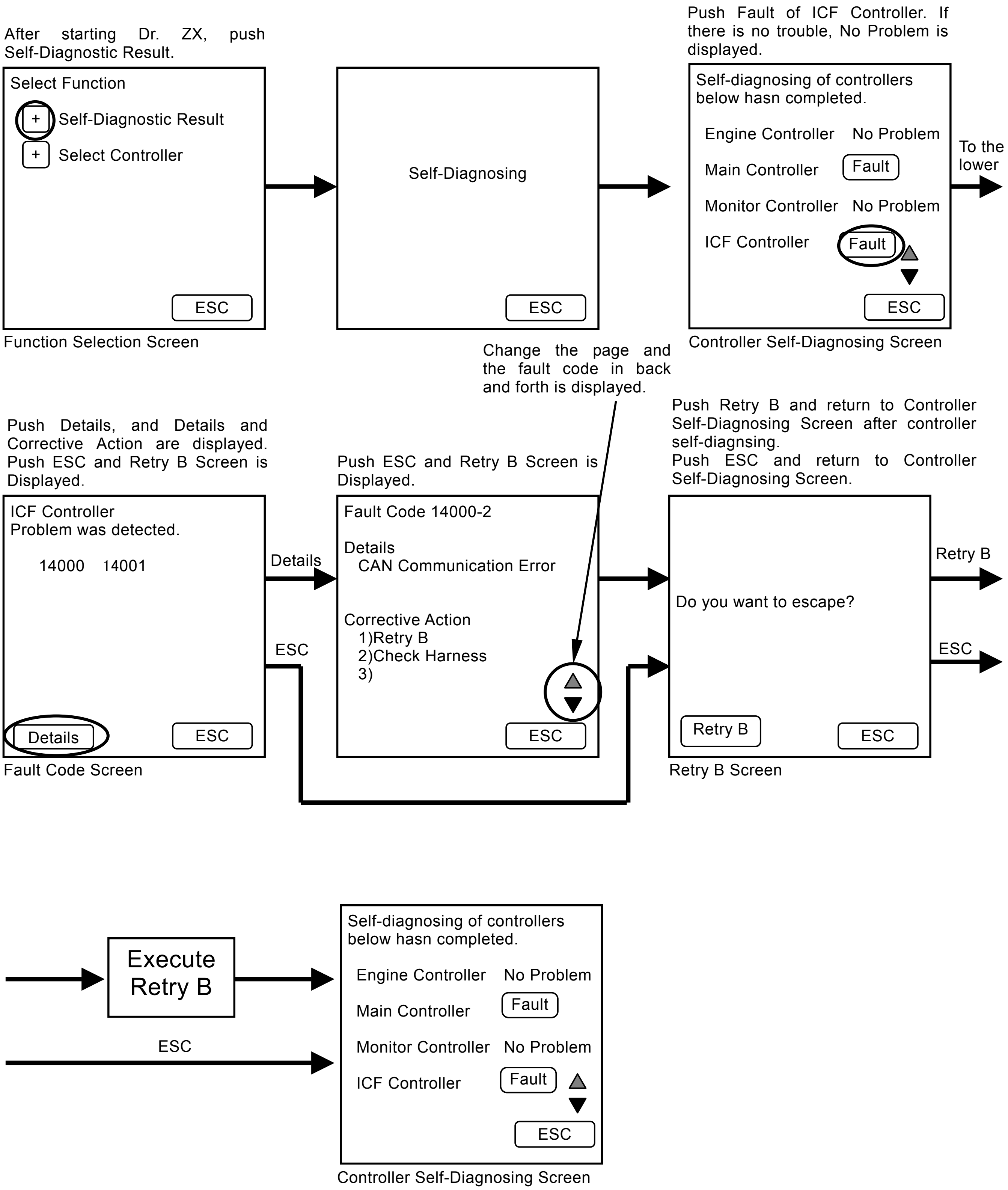
Push ESC and return to Main Menu Screen.



Control Data: Initialize Screen

Information C/U: Various Setup Screen

2. Self-Diagnosing



(Blank)

LIST OF ICF FAULT CODE

Fault Code	Details	Remedy
14000-2	Abnormal CAN Communication CAN Communication Error	Execute retry B in self-diagnosing. If this error code is displayed after re-try, check the following item. ・Check the CAN communication line (check the
14001-2	Abnormal Flash Memory Read / Write Error	Execute retry B in self-diagnosing and execute the following item. ・Execute 1.5 Information C/U: Initialize (T5-3-14).
14002-2	Abnormal External RAM Read / Write Error	
14003-2	Abnormal EEPROM Sum Check Error	Execute retry B in self-diagnosing. If this error code is displayed after re-try, check the following item. 1. Execute 1.4 Enter Model and Serial No. (T5-3-13). 2. Execute 1.10 Control Data: Initialize (T5-3-19). Then, execute self-diagnosing and execute retry B.
14006-2	Communication Error Impossible to communicate with MC	Execute retry B in self-diagnosing. If this error code is displayed after re-try, check the following item. ・Check the communication line. ・Check the power source line of satellite terminal. ・Check the fuse. Then, execute self-diagnosing and execute retry B.
14008-2	Abnormal RAM Road / Write Error	Execute retry B in self-diagnosing. If this error code is displayed after re-try, replace the controller.

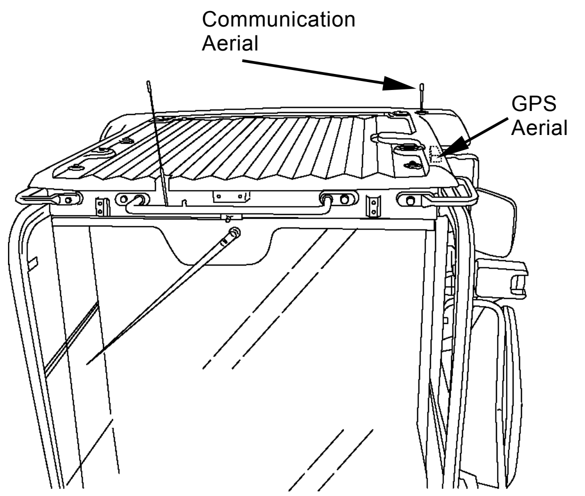
LIST OF FAULT CODE OF SATELLITE COMMUNICATION TERMINAL

Fault Code	Details	Remedy
14100-2	Inside Error Abnormal EEPROM	Execute retry B in self-diagnosing. If this error code is displayed after re-try, replace the controller.
14101-2	Inside Error Abnormal IB/OB Queue	
14102-2	Inside Error Abnormal Local Loup Back	
14103-2	Communication Error The satellite is not found.	
14104-2	Inside Error Fail 1 of Remote Loup Back	
14105-2	Communication Error Fail 2 of Remote Loup Back	
14106-2	Abnormal Harness Sending and receiving data are unmatched.	

SATELLITE COMMUNICATION SYSTEM

The satellite communication system is used for maintenance of the machine, “e-Service” by transmitting various data of the machine regularly via a low earth orbit satellite.

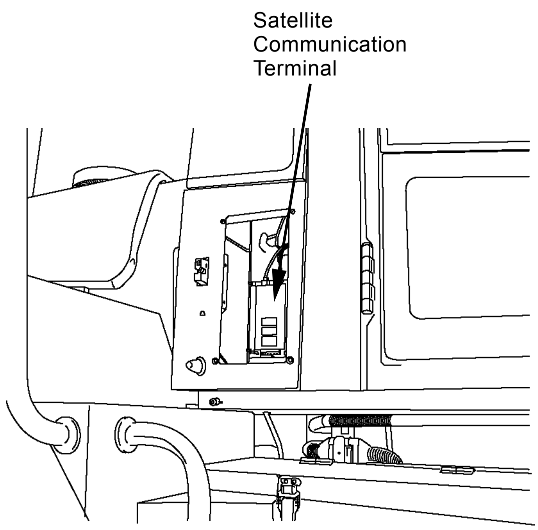
NOTE: Depending on the circumstances of the machine (ex. in the constructions, in the tunnel, affected by the surrounding building and affected of noise), the data transfer rate may become slower, or the communication might not be established.
The satellite communication system using a low earth orbit satellite transmits digital data through the radio wave. If there is excessively noise or use of electrical equipment which causes noise near the machine, they cause reduces data transfer rate or communication might not be established at worst.



T4GB-05-07-001

The satellite communication system consists of satellite communication terminal, GPS aerial and communication aerial.
The functions of each equipment are:

- Satellite Communication Terminal
  Receives the data from ICF and GPS aerial, and sends the data to the communication aerial.
- GPS Aerial
  Receives location information of the machine from a low earth orbit satellite.
- Communication Aerial
  Communicates the data with a low earth orbit satellite.



T4GB-05-07-002

On the machine equipped with the satellite communication system, the data are sent according to the condition as follows:

Kinds of data sent from the machine by using satellite communication:

Items	Kinds of Data	Condition
Periodical Transmission	Daily Report Data, Latest Location Information, Fuel Level	The data are sent once a day. In order to avoid congested traffic in the communication line, the data is sent randomly between 0:00 and 02:00.
Transmitting Data at Engine Start	Latest Location Information	The data is sent only when the machine is moved more than 5 km from the place where it is recorded lastly.
Emergency Transmission	Alarm and Error Information	The transmission starts immediately when the alarm and error occurs.
Hour Meter 100 Hours Transmission	Frequency Distribution Information	The data is sent when the hour meter exceeds every 100 hours.

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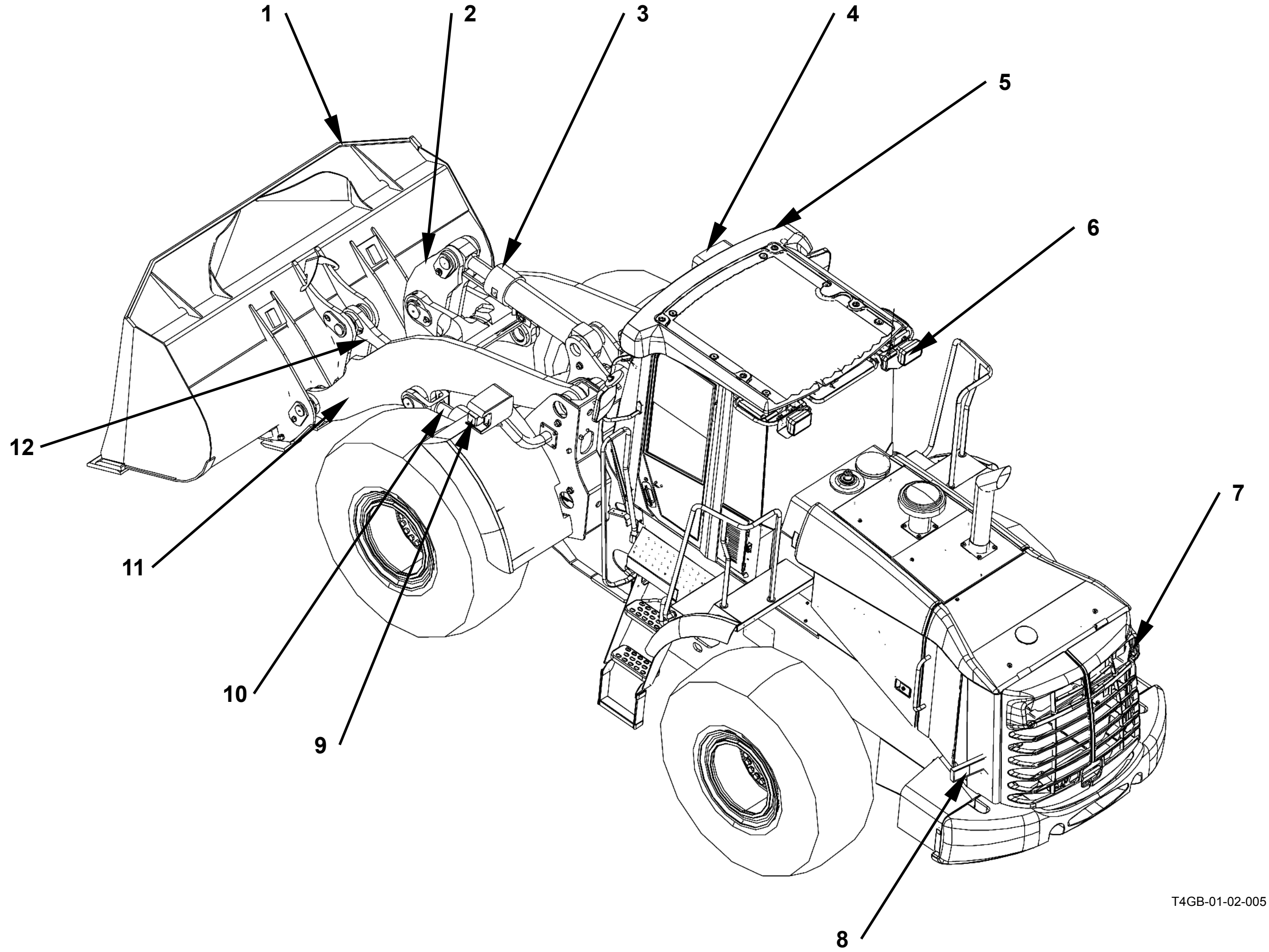
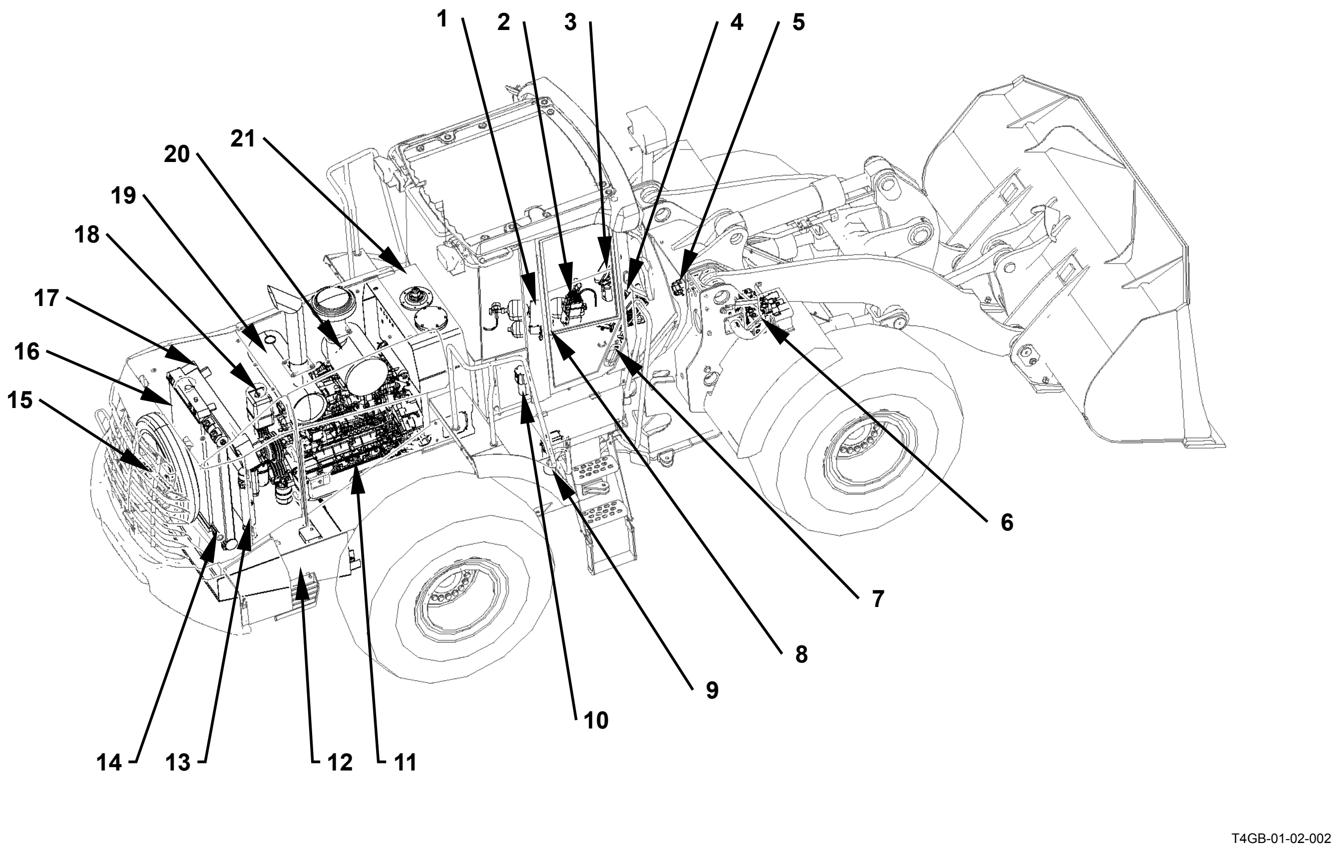
MAIN COMPONENT LAYOUT (OVERVIEW)



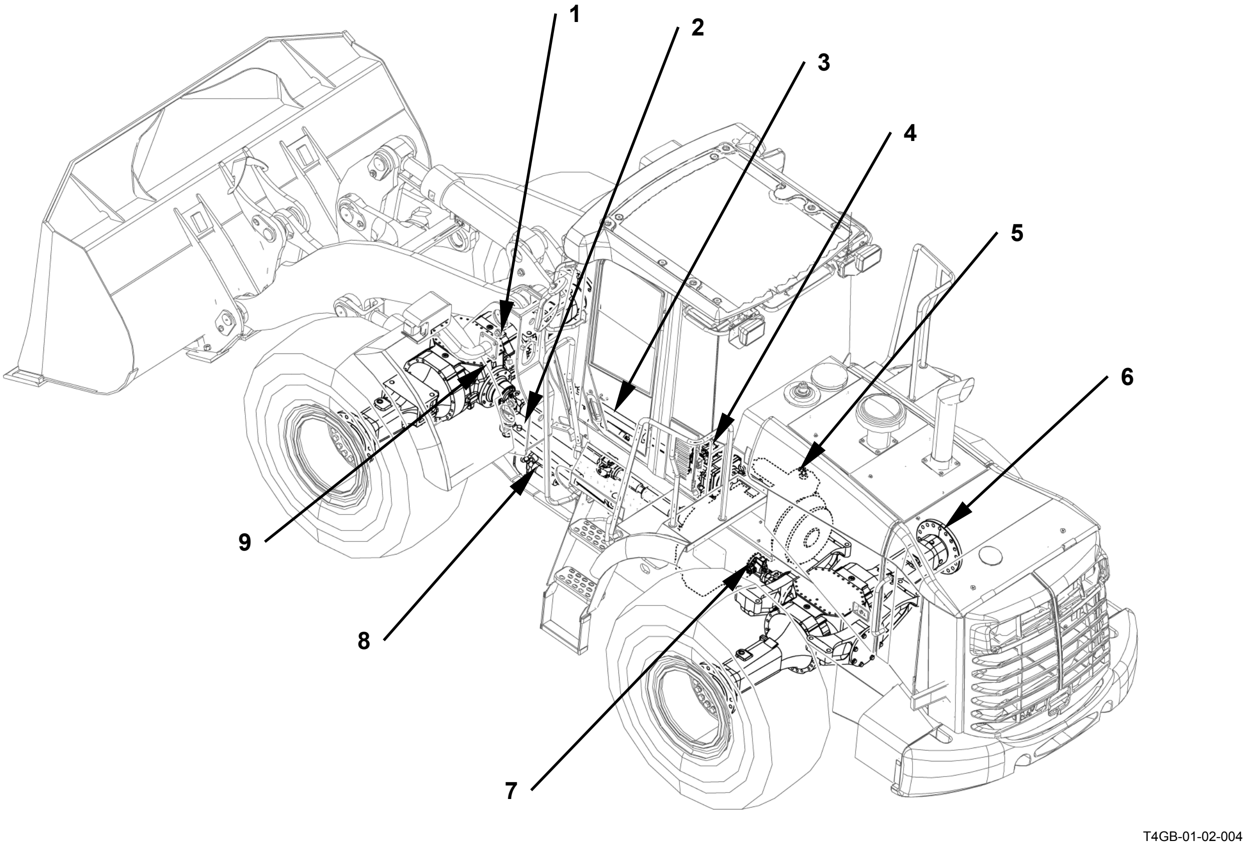
1 - Bucket	4 - Head Light	7 - Rear Working Light	10 - Lift Arm Cylinder
2 - Bell Crank	5 - Front Working Light	8 - Rear Combination Light (Turn Signal, Hazard Light Clearance Light and Brake Light)	11 - Lift Arm
3 - Bucket Cylinder	6 - Rear Working Light (Optional)	9 - Turn Signal, Hazard Light and Clearance Light	12 - Bucket Link

MAIN COMPONENT LAYOUT (UPPERSTRUCTURE)



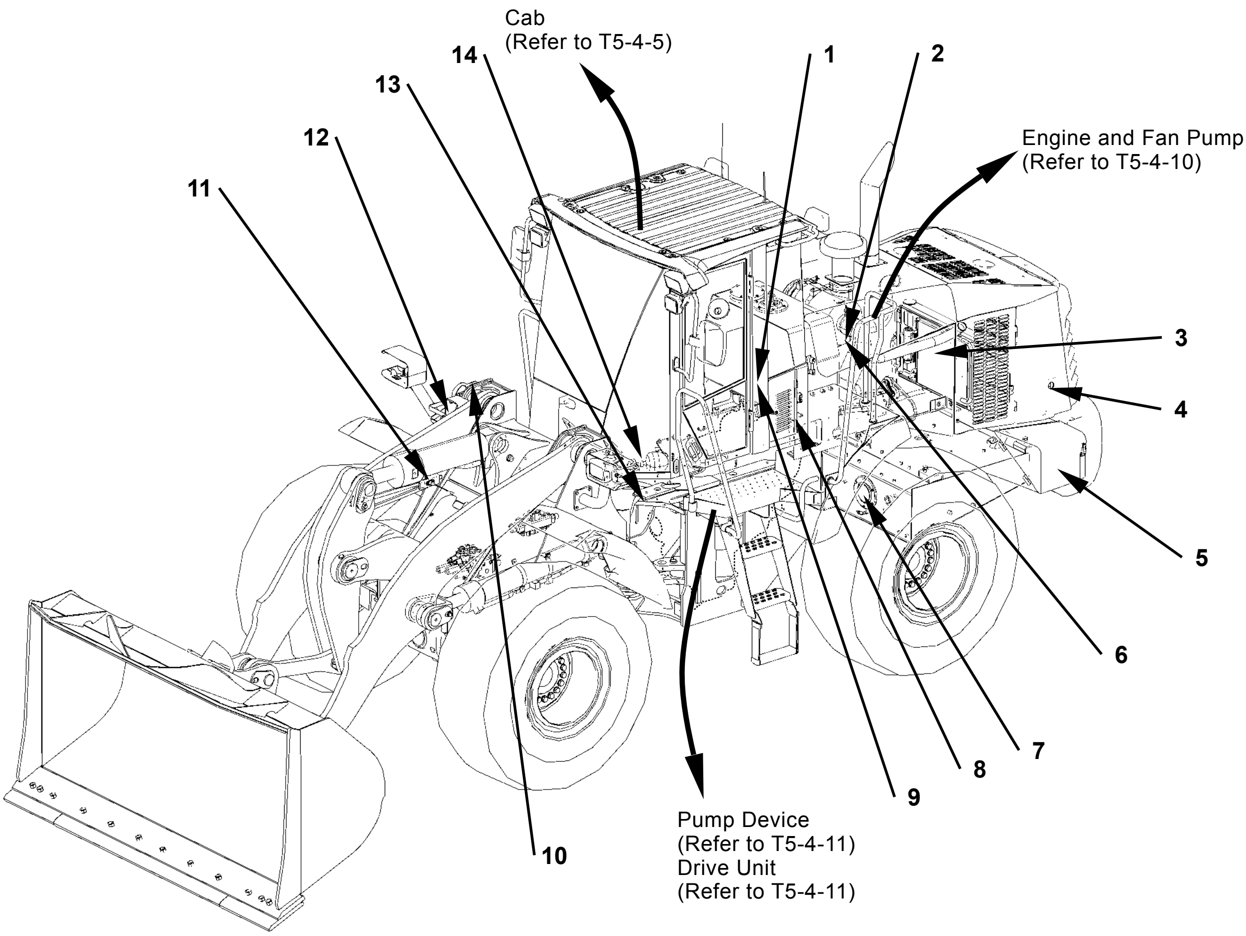
1 - Charging Block
2 - Pilot Valve
3 - Brake Valve
4 - Steering Pilot Valve
5 - Steering Valve
6 - Control Valve
7 - Stop Valve
8 - Pilot Shutoff Valve
9 - Engine Oil Filter
10 - Pilot Filter
11 - Engine
12 - Fuel Tank
13 - Torque Converter Cooler
14 - Oil Cooler
15 - Fan Motor
16 - Radiator
17 - Inter Cooler
18 - Reserve Tank
19 - Muffler
20 - Air Cleaner
21 - Hydraulic Tank

MAIN COMPONENT LAYOUT (TRAVEL SYSTEM)



1 - Front Axle	4 - Pump Device	5 - Rear Axle	7 - Steering Accumulator
2 - Propeller Shaft (Front)	5 - Transmission	6 - Propeller Shaft (Rear)	8 - Brake Pressure Sensor
3 - Steering Cylinder			

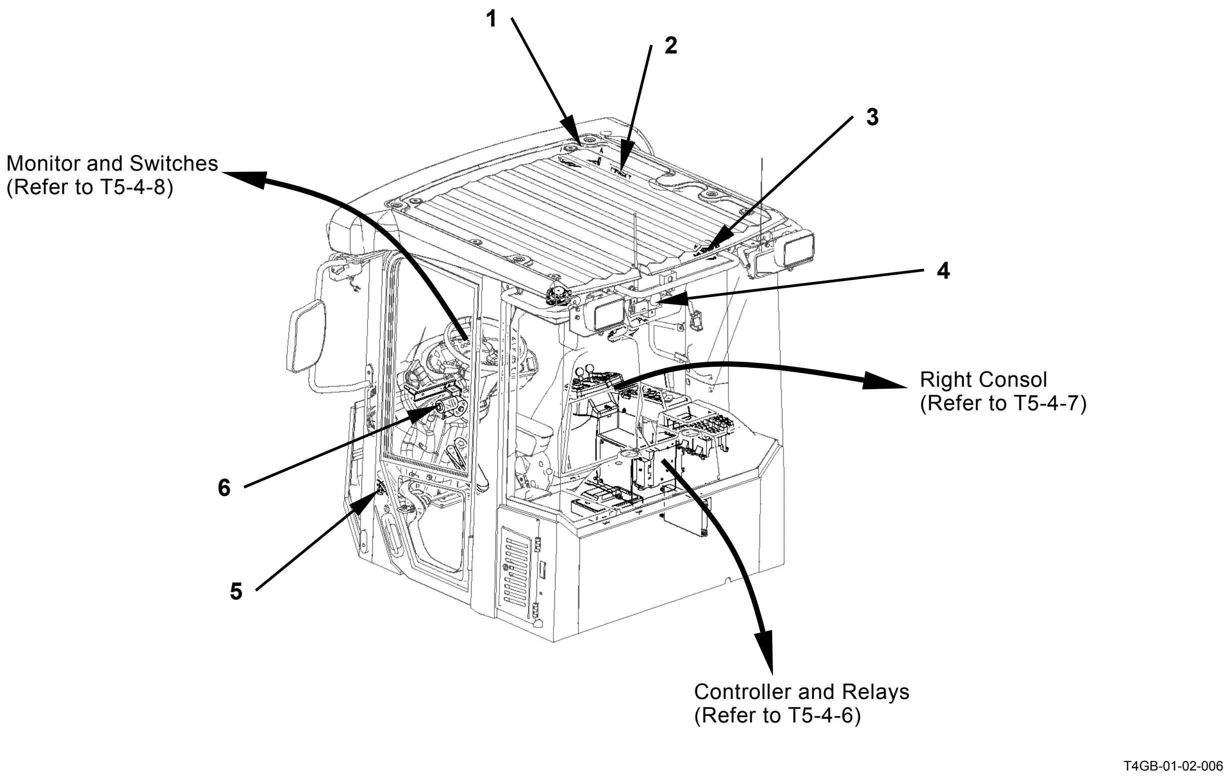
ELECTRIC COMPONENT LAYOUT (OVERVIEW)



T4GB-01-02-019

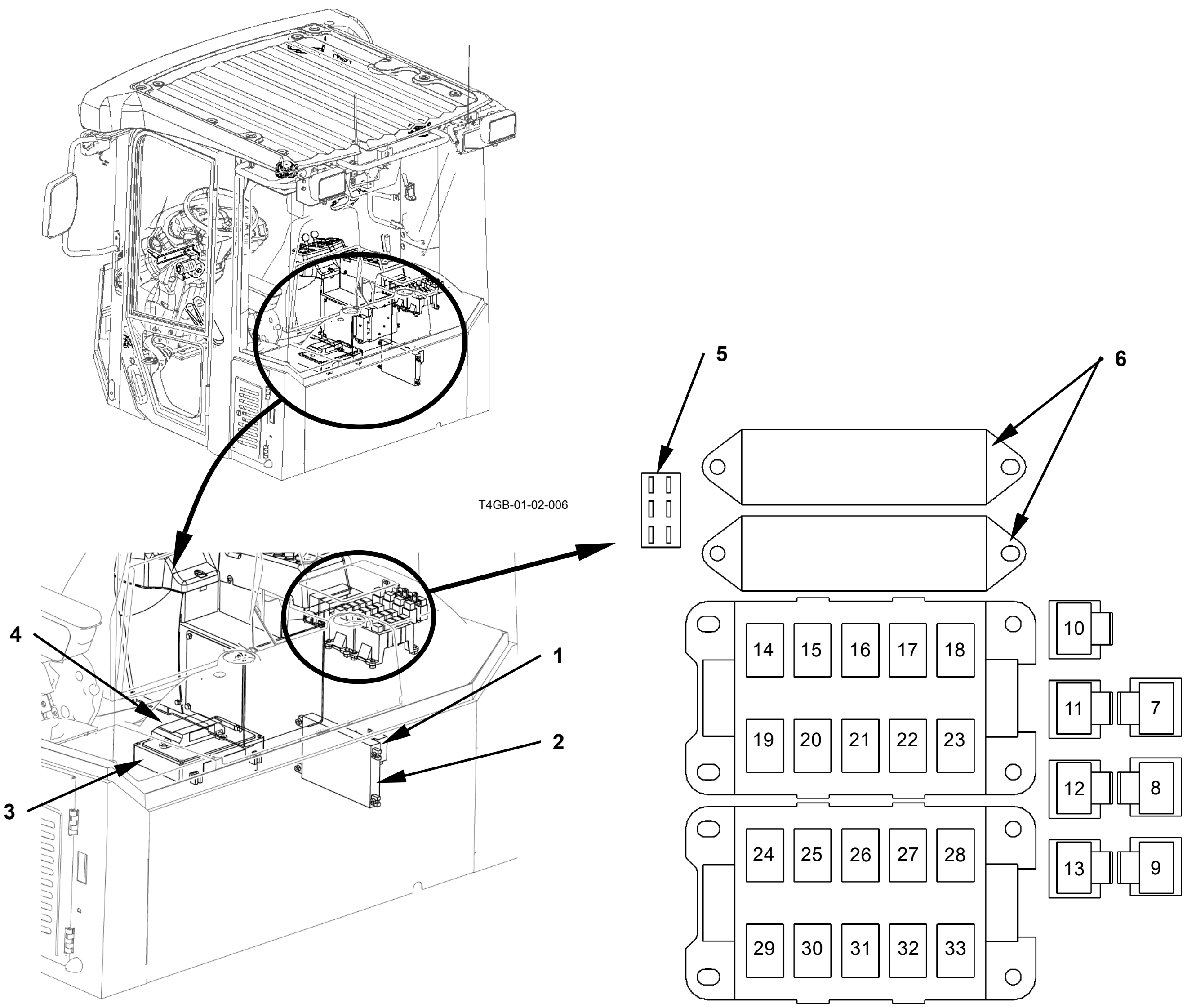
1 - Hydraulic Oil Level Switch
2 - Air Filter Restriction Switch
3 - ECM
4 - Reverse Buzzer
5 - Battery
6 - Boost Pressure Sensor
7 - Fuel Level Sensor
8 - Hydraulic Oil Temperature Sensor
7 - Emergency Steering Pump Delivery Pressure Switch
8 - Lift Arm Angle Sensor (Optional)
9 - Bucket Proximity Switch
10 - Lift Arm Proximity Switch
11 - Implement Pressure Sensor
12 - Out Side Temperature Sensor

ELECTRICAL SYSTEM (CAB)



1 - Radio
2 - Auxiliary Switch Panel (Optional)
3 - Speaker
4 - Rear Wiper Motor
5 - Brake Lamp Switch
6 - Front Wiper Motor

Controller and Relays



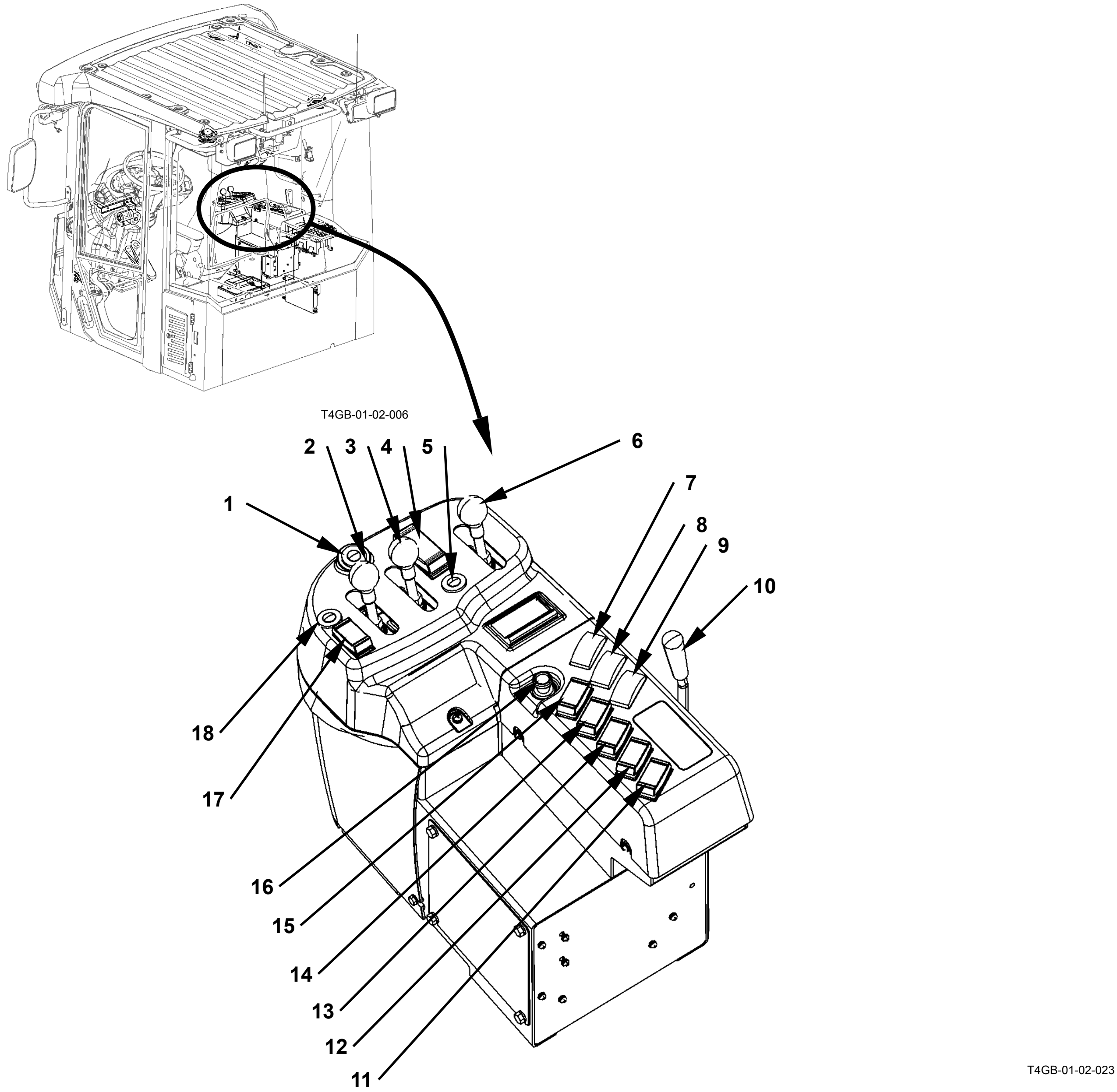
T4GB-01-02-006

T4GC-01-02-002

T4GB-01-02-022

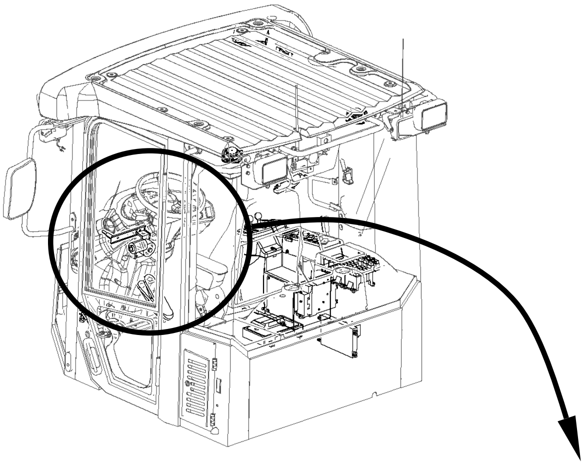
1 - Flasher Relay
2 - Option Controller (Optional)
3 - MCF
4 - ICF
5 - Dr.ZX Connector
6 - Fuse Box
7 - Fog Light Relay (Optional)
8 - Auxiliary
9 - Front Window Heater Relay
10 - Neutral Relay
11 - Rear Window Heater Relay
12 - Wiper Relay (Left)
13 - Wiper Relay (Right)
14 - Reverse Light Relay (A-R5)
15 - Brake Light Relay (A-R4)
16 - High Beam Relay (A-R3)
17 - Head Light Relay (Right) (A-R2)
18 - Head Light Relay (Left) (A-R1)
19 - Emergency Steering Relay (A-R10)
20 - Hone Relay (A-R9)
21 - Turn Signal Relay (Right) (A-R8)
22 - Working Light Relay (Rear) (A-R7)
23 - Working Light Relay (Front) (A-R8)
24 - Front Wiper Relay (B-R5)
25 - Neutral Relay (B-R4)
26 - Load Dump Relay (B-R3)
27 - Parking Brake Relay (B-R2)
28 - Parking Brake Relay (B-R1)
29 - Fuel Pump Relay (B-R10)
30 - Main Relay (B-R9)
31 - Rear Washer Relay (B-R8)
32 - Turn Signal Relay (Left) (B-R7)
33 - Rear Wiper Relay (B-R6)

Right Console

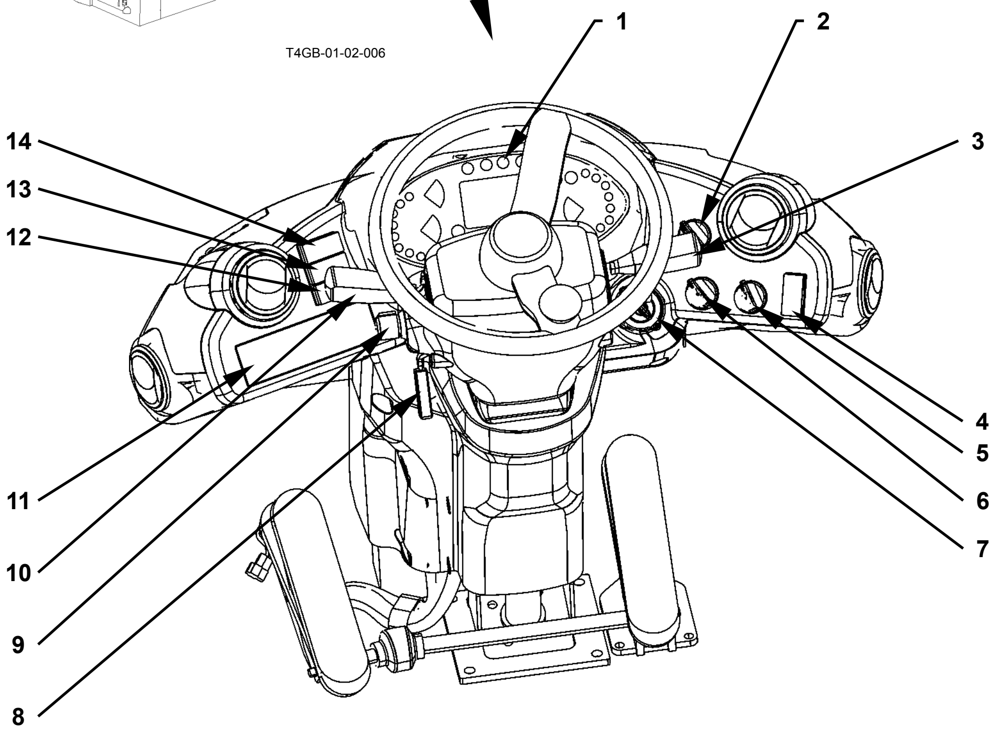


1 - Down Shift Switch	6 - Auxiliary Control Lever (Optional)	11 - Emergency Steering Check Switch	15 - Forward/Reverse Selector Switch
2 - Bucket Control Lever	7 - Quick Coupler Switch (Optional)	12 - Fan Reversing Switch	16 - Cigar Lighter
3 - Lift Arm Control Lever	8 - Lift Arm Auto Leveler Downward Set Switch (Optional)	13 - Fog Light Switch (Optional)	17 - Up-shift/Down-shift Switch
4 - Forward/Reverse Switch	9 - Lift Arm Auto Leveler Upward Set Switch (Optional)	14 - Ride Control Switch (Optional)	18 - Hold Switch
5 - Hone Switch	10 - Front Control Lock Lever		

Monitor and Switchs



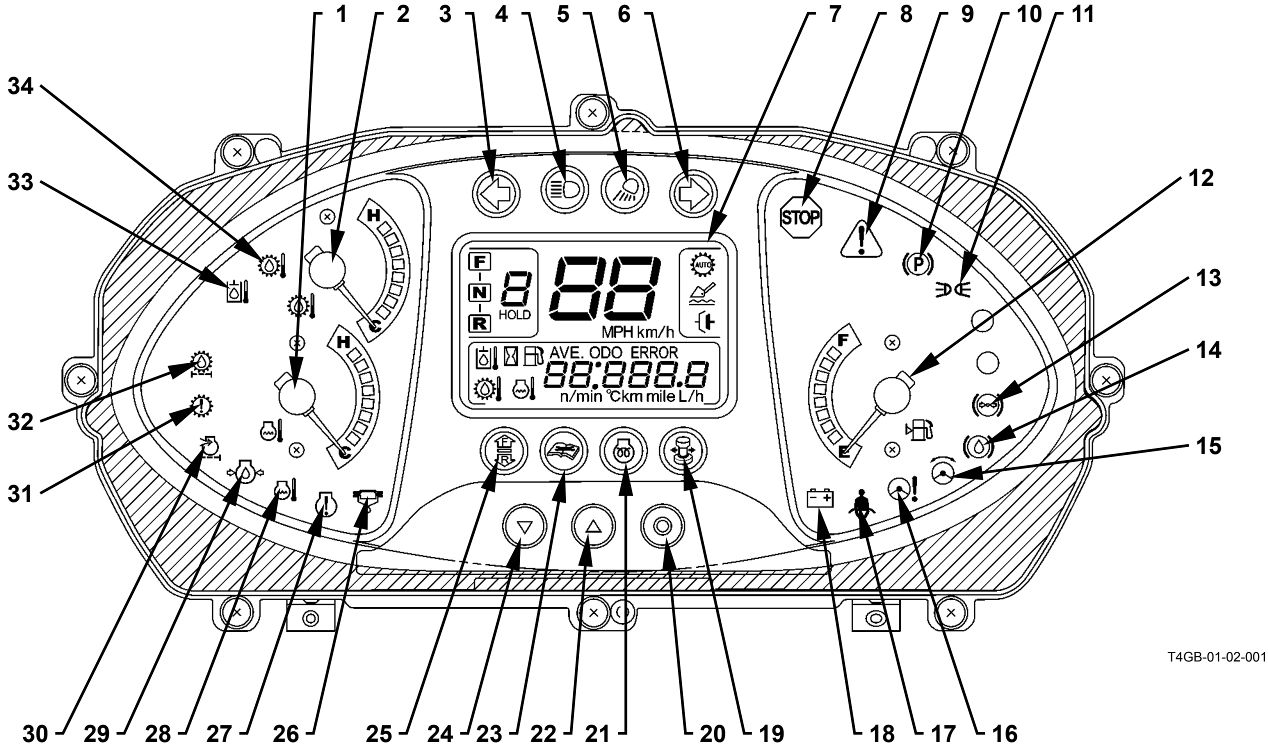
T4GB-01-02-006



T4GB-01-02-024

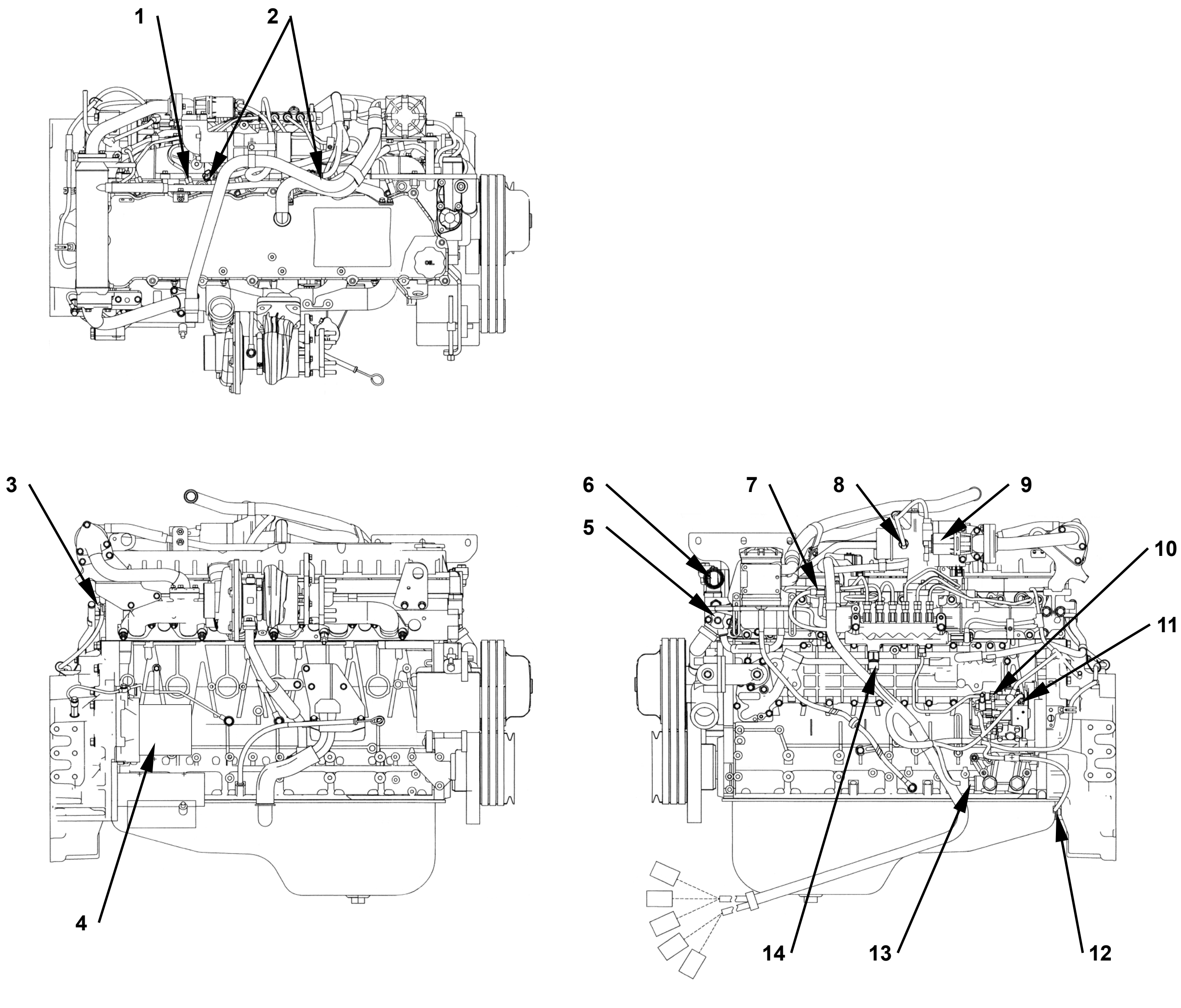
1 - Monitor Panel (Refer to T5-4-9)
2 - Driving Mode Switch
3 - Turn Signal Lever /Head Light Switch/Dimmer Switch
4 - Parking Brake Switch
5 - Work Mode Selector Switch
6 - Clutch Cat Position Switch
7 - Key Switch
8 - Steering Column Tilt /Telescopic Lever
9 - Front Wiper Switch
10 - Forward/Reverse Lever and Shift Switch
11 - Air Conditioner Switch Panel
12 - Rear Wiper Switch
13 - Working Light Switch
14 - Hazard Light Switch

Monitor Panel



1 - Coolant Temperature Gauge
2 - Transmission Oil Temperature Gauge
3 - Turn Signal Indicator (Left)
4 - High Beam Indicator
5 - Working Light Indicator
6 - Turn Signal Indicator (Right)
7 - Monitor Display
8 - Stop Indicator
9 - Service Indicator
10 - Parking Brake Indicator
11 - Clearance Light Indicator
12 - Fuel Gauge
13 - Brake Low Oil Pressure Indicator
14 - Brake Low Oil Level Indicator
15 - Emergency Steering Indicator (Optional)
16 - Low Steering Oil Pressure Indicator
17 - Seat Belt Indicator
18 - Discharge Warning Indicator
19 - Lever Steering Indicator (Optional)
20 - Monitor Mode Selector
21 - Glow Signal
22 - Monitor Display Selector (Up)
23 - Maintenance Indicator
24 - Monitor Display selector (Down)
25 - Forward/Reverse Switch Indicator
26 - Water Separator Indicator
27 - Engine Warning Indicator
28 - Overheat Indicator
29 - Engine Low Oil Pressure Indicator
30 - Air Filter Restriction Indicator
31 - Transmission Warning Indicator
32 - Transmission Oil Filter Restriction Indicator
33 - Hydraulic Oil Temperature Indicator
34 - Transmission Oil Temperature Indicator

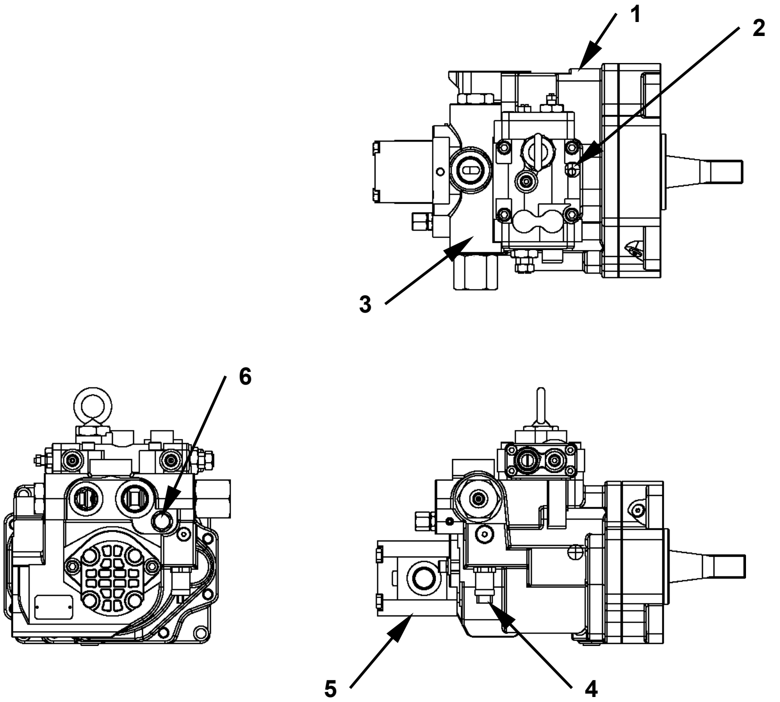
ENGINE AND FAN PUMP



T4GB-01-02-025

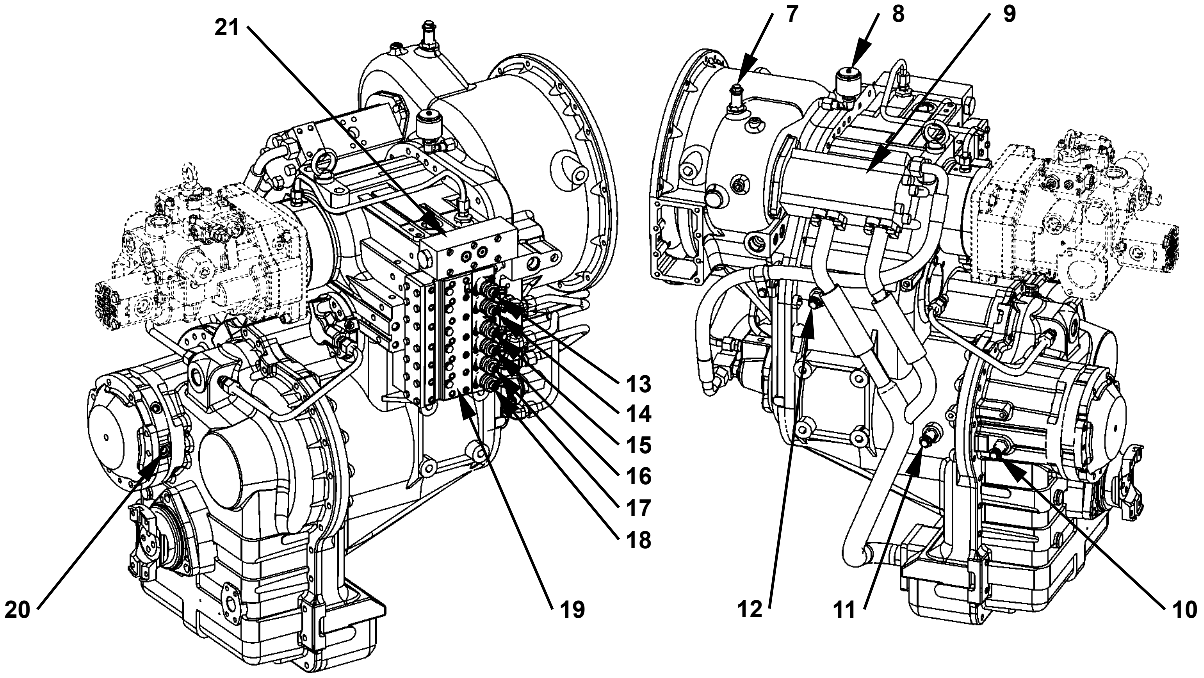
1 - Glow Plug
2 - Injector
3 - Cam Angle Sensor
4 - Fan Pump
5 - Coolant Temperature Sensor
6 - Overheat Switch
7 - Boost Pressure Sensor
8 - Boost Temperature Sensor
9 - EGR Valve
10 - Supply Pump
11 - Fuel Temperature Sensor
12 - Crank Revolution Sensor
13 - Engine Oil Pressure Sensor
14 - Common Rail Pressure Sensor

PUMP DEVICE



T4GB-01-02-009

DRIVE UNIT

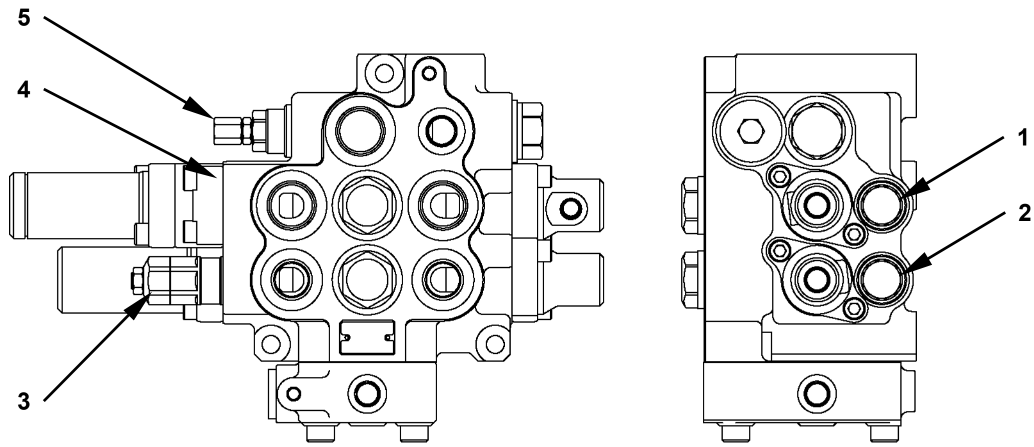


T4GC-01-02-001

1 - Main Pump
2 - Regulator
3 - Priority Valve
4 - Pump Delivery Pressure Switch
5 - Pilot Pump
6 - Steering Relief Valve
7 - Torque Converter Input Speed Sensor
8 - Air Breather
9 - Charge Pump
10 - Vehicle Speed Sensor
11 - Transmission Output Speed Sensor
12 - Transmission Middle Shaft Sensor
13 - Forward Clutch Solenoid Valve
14 - Reverse Clutch Solenoid Valve
15 - 1st Clutch Solenoid Valve
16 - 2nd Clutch Solenoid Valve
17 - 3rd Clutch Solenoid Valve
18 - 4th Clutch Solenoid Valve
19 - Transmission Control Valve
20 - Parking Brake Pressure Switch
21 - Regulator Valve

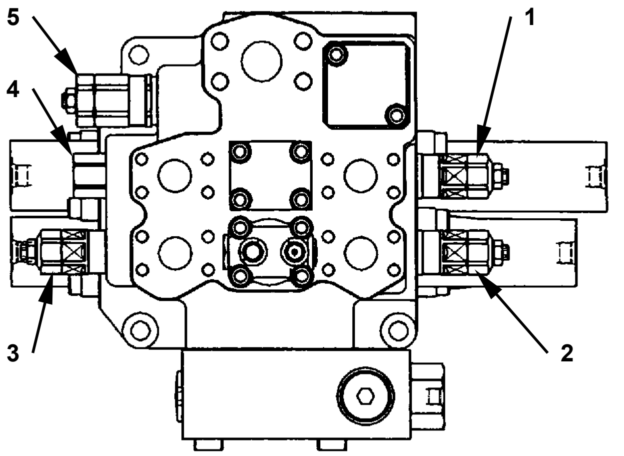
CONTROL VALVE

ZW220



T4GB-01-02-027

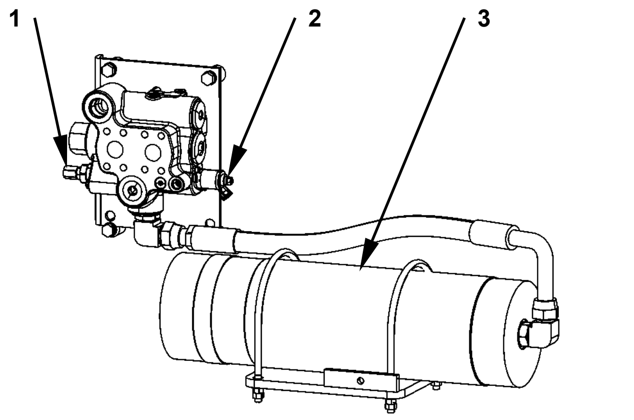
ZW250



T4GB-03-02-002

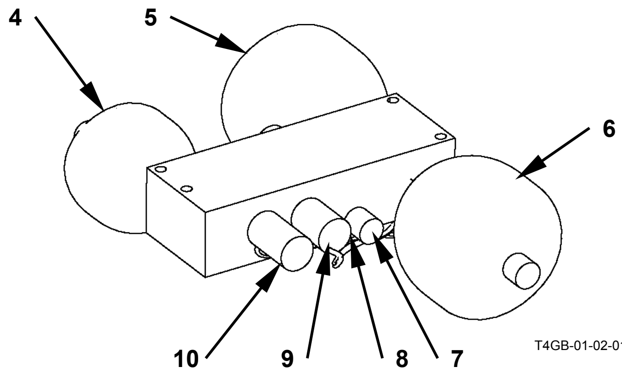
1 - Over Load Relief Valve (Lift Arm: Bottom)
2 - Over Load Relief Valve (Bucket: Bottom)
3 - Over Load Relief Valve (Bucket: Rod)
4 - Make-up Valve (Lift Arm: Rod)
5 - Main Relief Valve

RIDE CONTROL VALVE



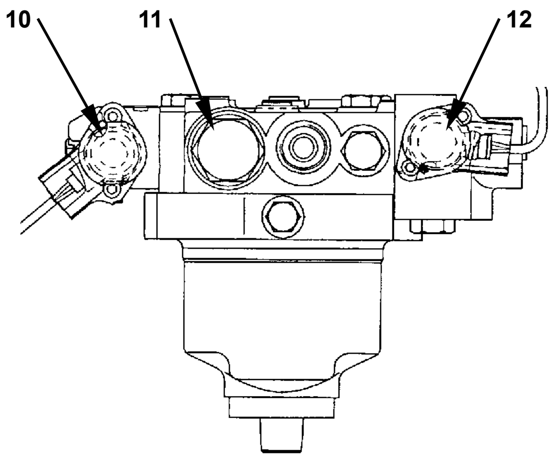
T4GB-01-02-014

CHARGING BLOCK



T4GB-01-02-013

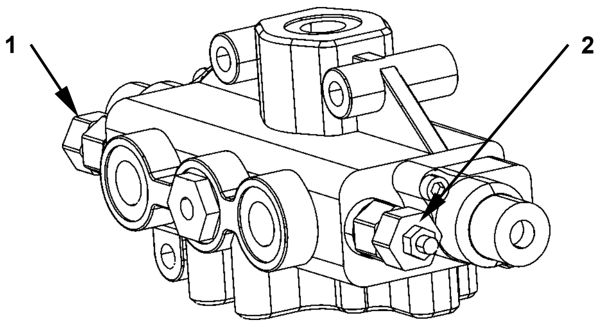
FAN MOTOR



T4GB-01-02-012

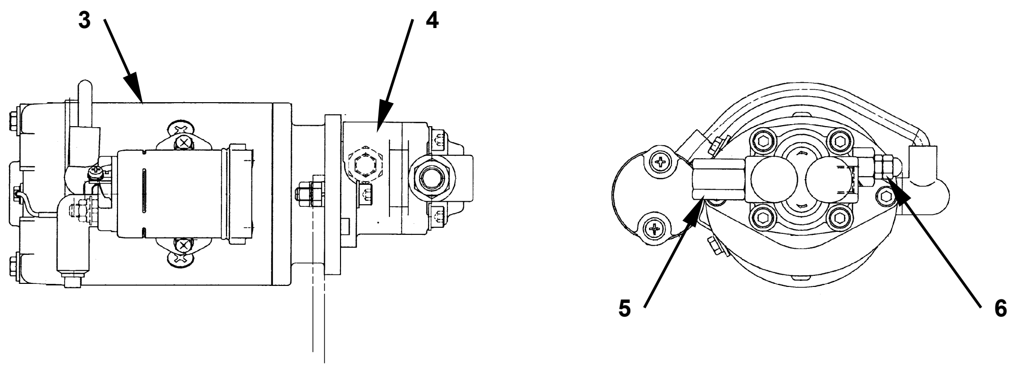
1 - Overload Relief Valve
2 - Ride Control Solenoid Valve
3 - Ride Control Accumulator
4 - Pilot Accumulator
5 - Service Brake Accumulator (Front)
6 - Service Brake Accumulator (Rear)
7 - Relief Valve
8 - Pilot Relief Valve
9 - Pump Torque Control Solenoid Valve
10 - Parking Brake Solenoid Valve
11 - Reverse Control Solenoid Valve
12 - Relief Valve
13 - Flow Control Solenoid Valve

STEERING VALVE



T4GB-01-02-020

EMERGENCY STEERING PUMP (OPTIONAL)



T4GB-01-02-010

1 - Overload Relief Valve
2 - Overload Relief Valve
3 - Electric Motor
4 - Gear Pump
5 - Check Valve
6 - Relief Valve

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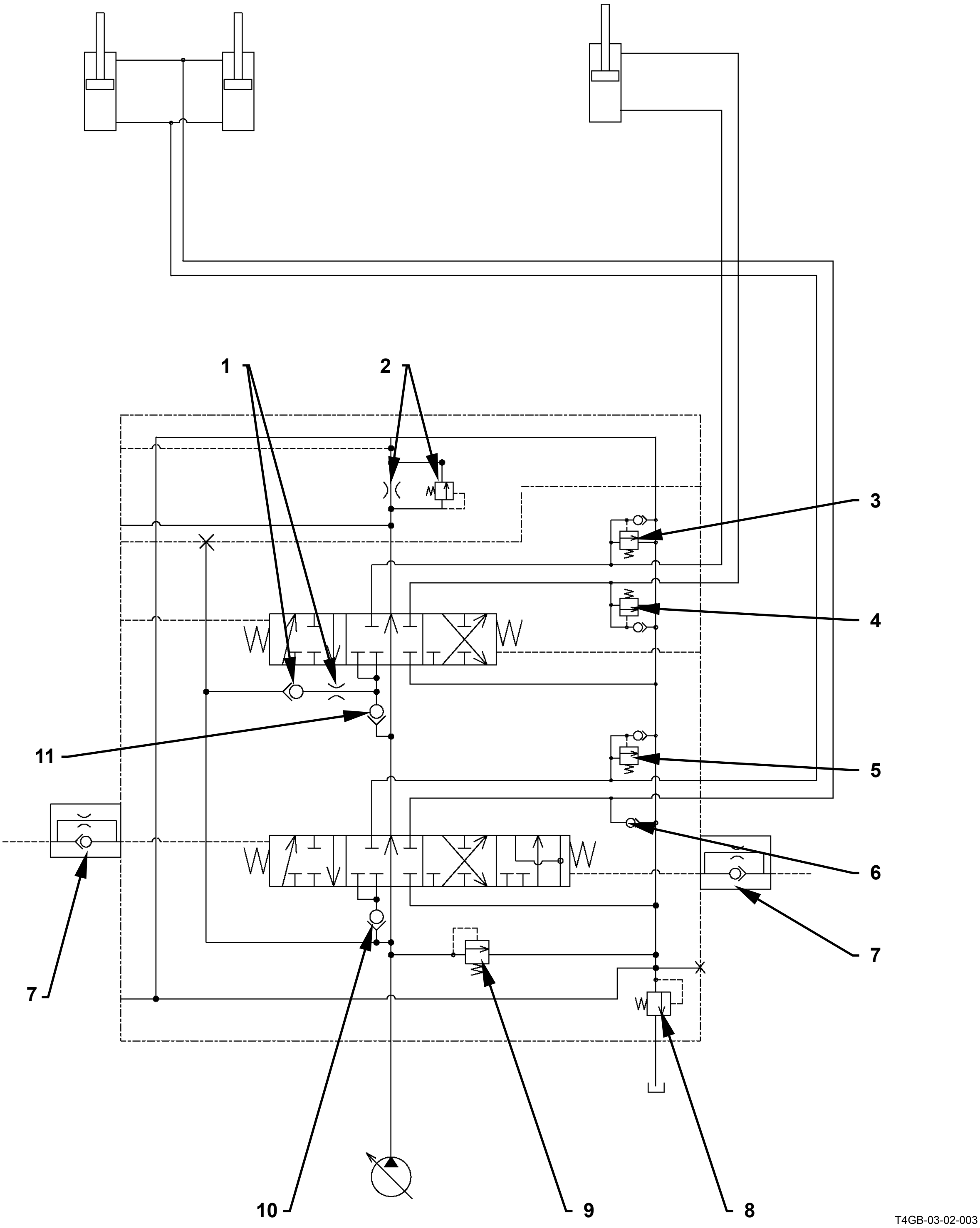
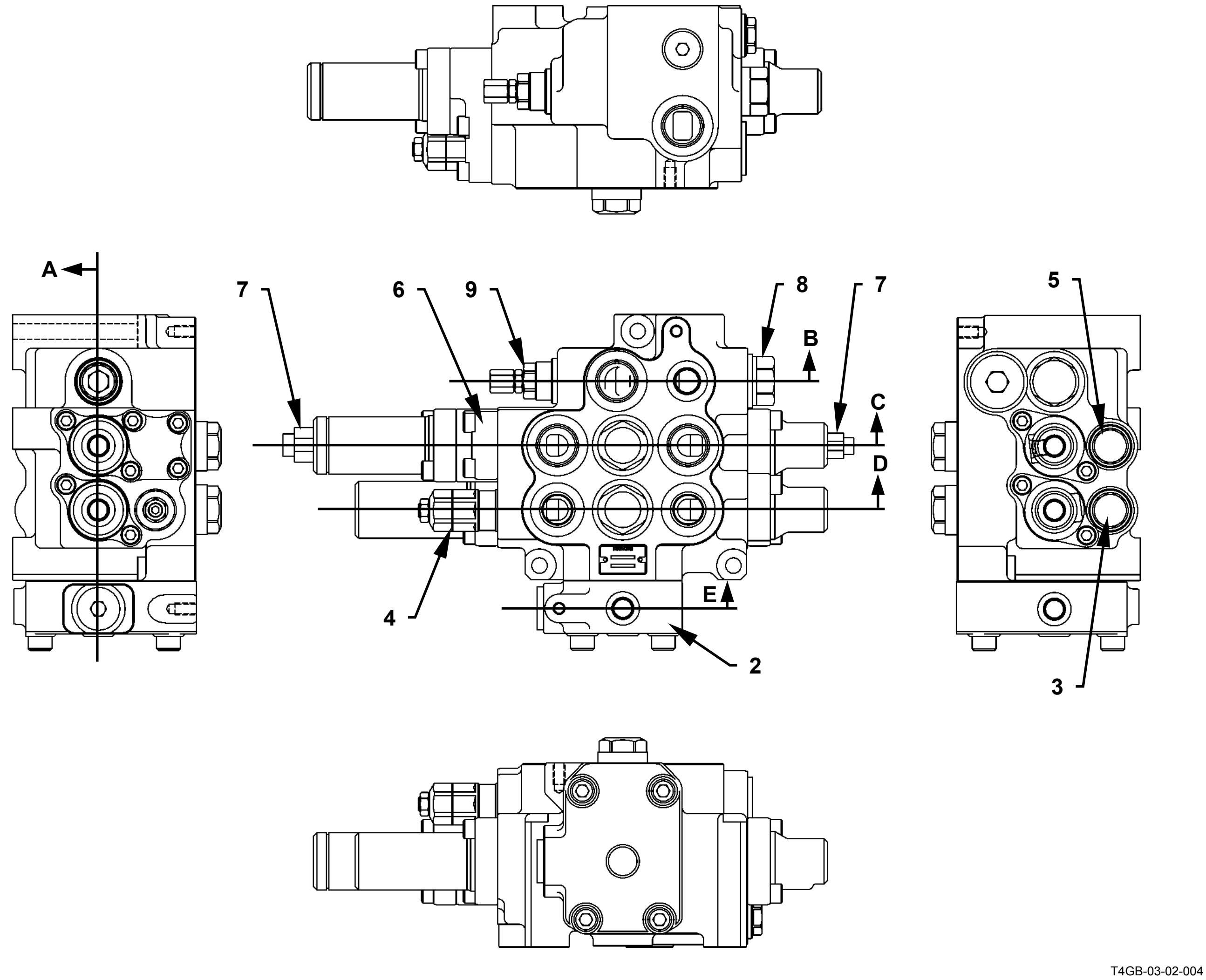
COMPONENTS IN CONTROL VALVE

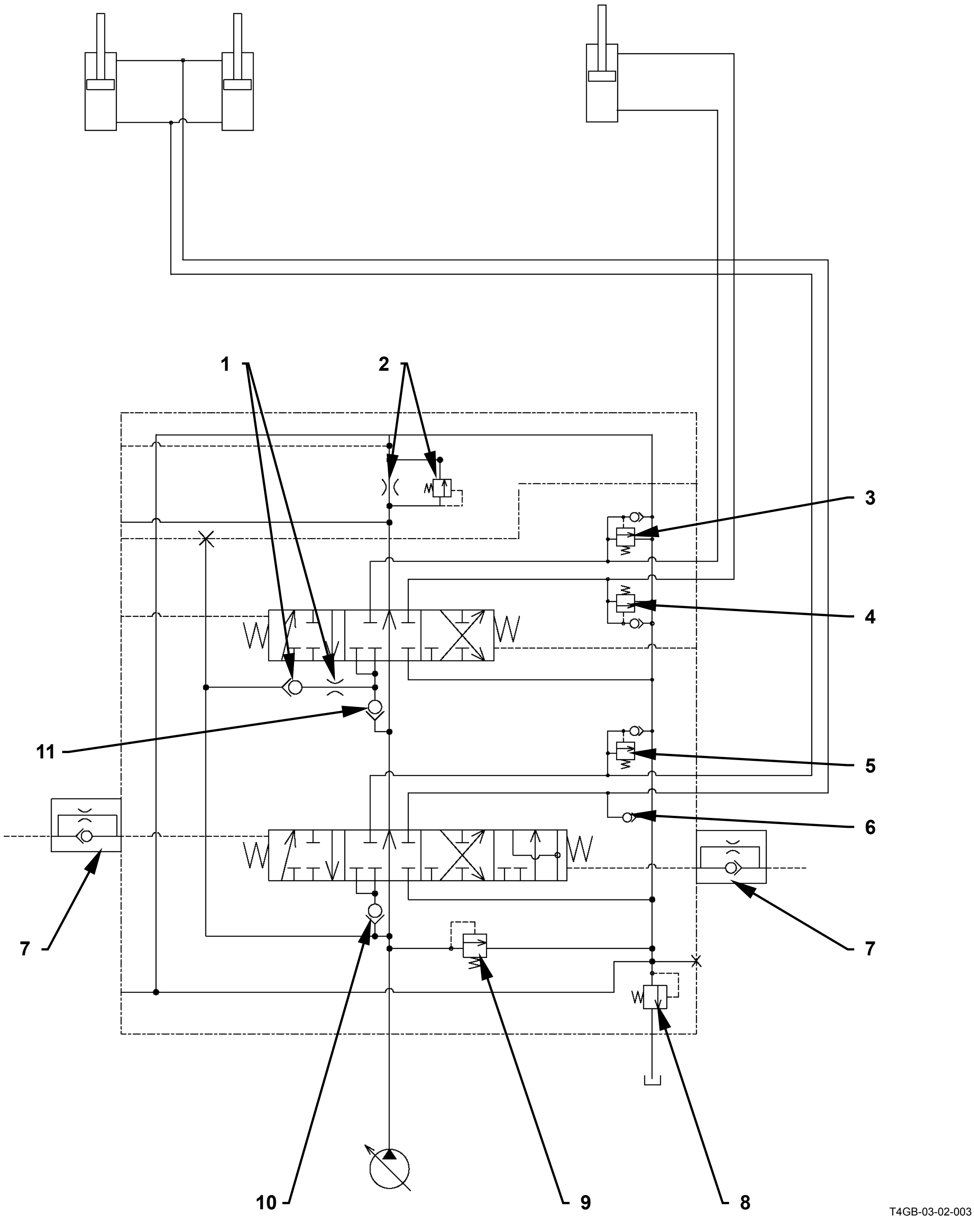
ZW220





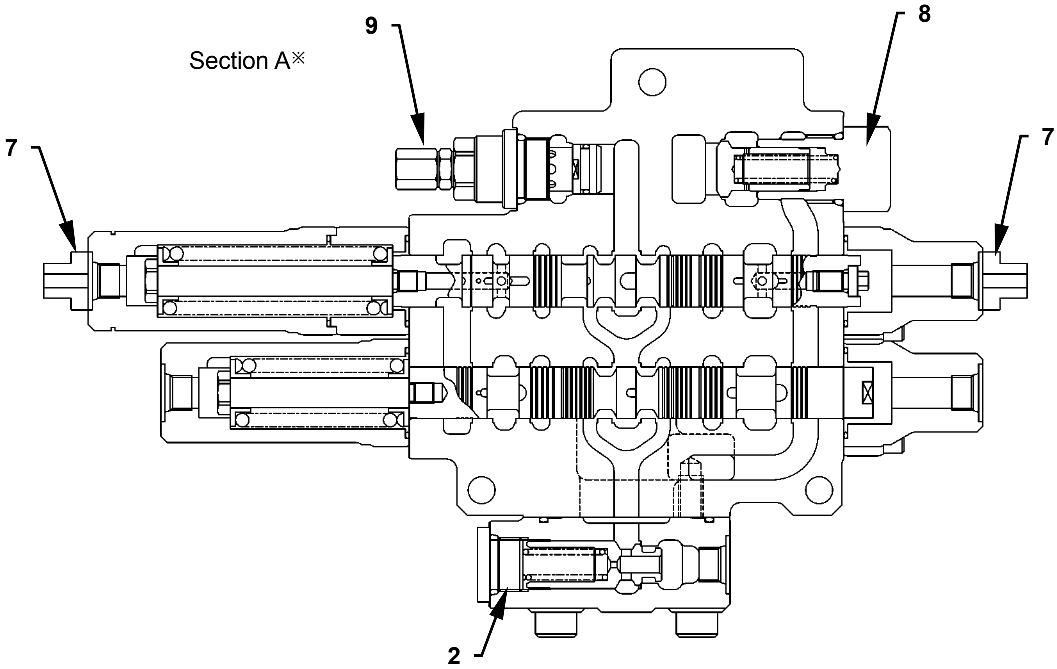
1 - Bucket Flow Control Valve	4 - Overload Relief Valve (Bucket: Rod End)	7 - Restriction Valve	10 - Load Check Valve (Arm Lift Circuit)
2 - Negative Control Valve	5 - Overload Relief Valve (Lift Arm: Bottom End)	8 - Low-pressure Relief Valve	11 - Load Check Valve (Bucket Circuit)
3 - Overload Relief Valve (Bucket: Bottom End)	6 - Make-up Valve (Lift Arm: Rod End)	9 - Main Relief Valve	

ZW220



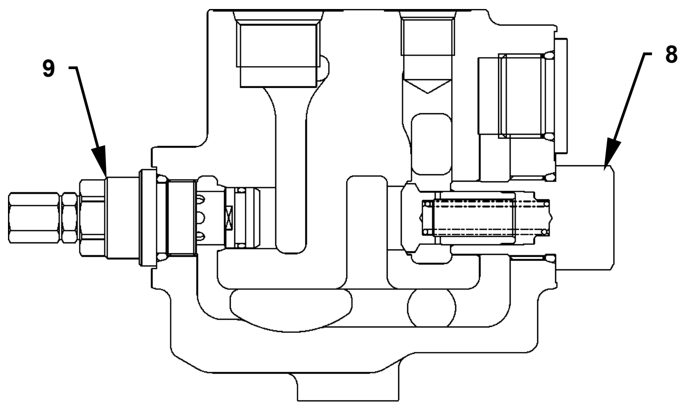
ZW220

Section A※



T4GB-03-02-005

Section B※

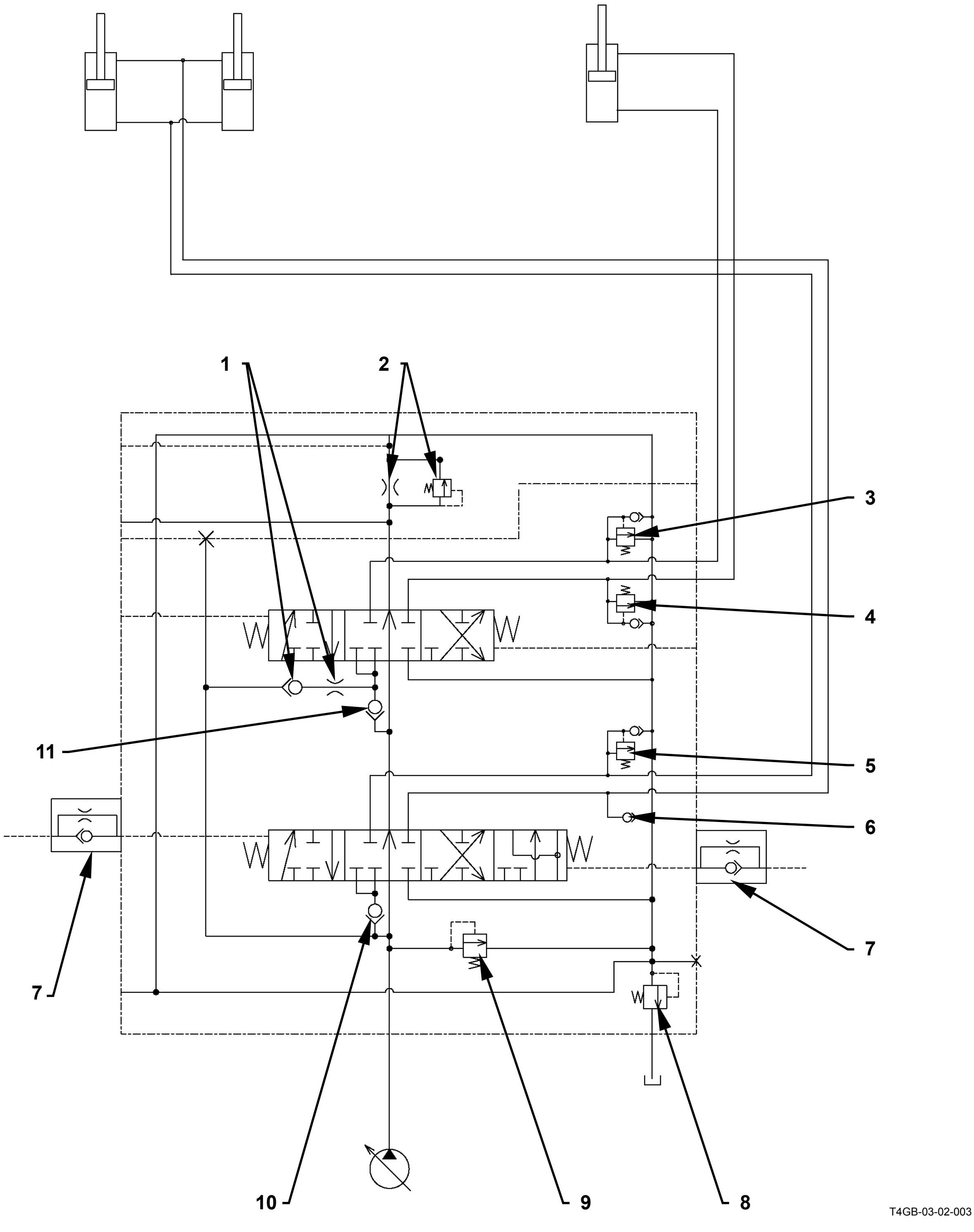


T4GB-03-02-006

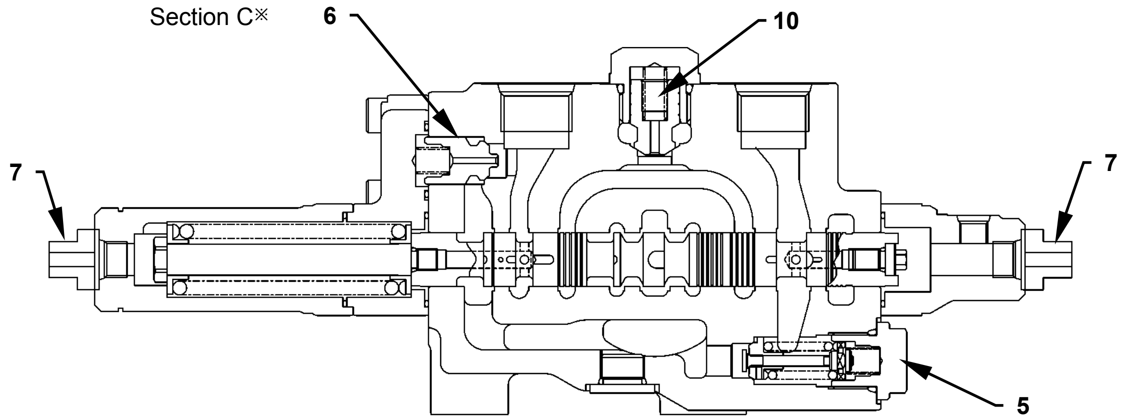
1 - Bucket Flow Control Valve
2 - Negative Control Valve
3 - Overload Relief Valve (Bucket: Bottom End)
4 - Overload Relief Valve (Bucket: Rod End)
5 - Overload Relief Valve (Lift Arm: Bottom End)
6 - Make-up Valve (Lift Arm: Rod End)
7 - Restriction Valve
8 - Low-pressure Relief Valve
9 - Main Relief Valve
10 - Load Check Valve (Arm Lift Circuit)
11 - Load Check Valve (Bucket Circuit)

※ Refer to T5-4-17.

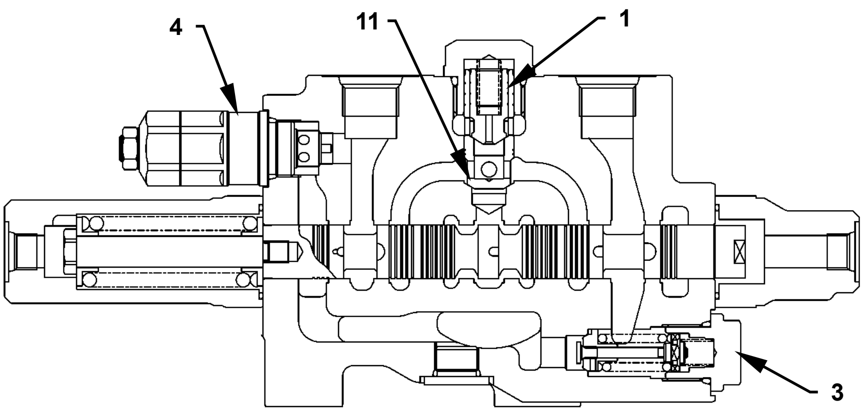
ZW220



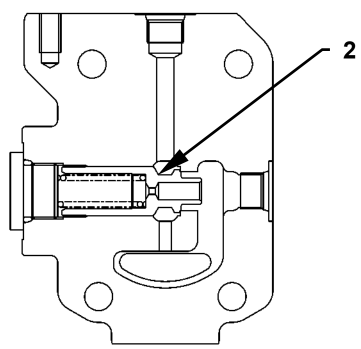
Section C※



Section D※



Section E※

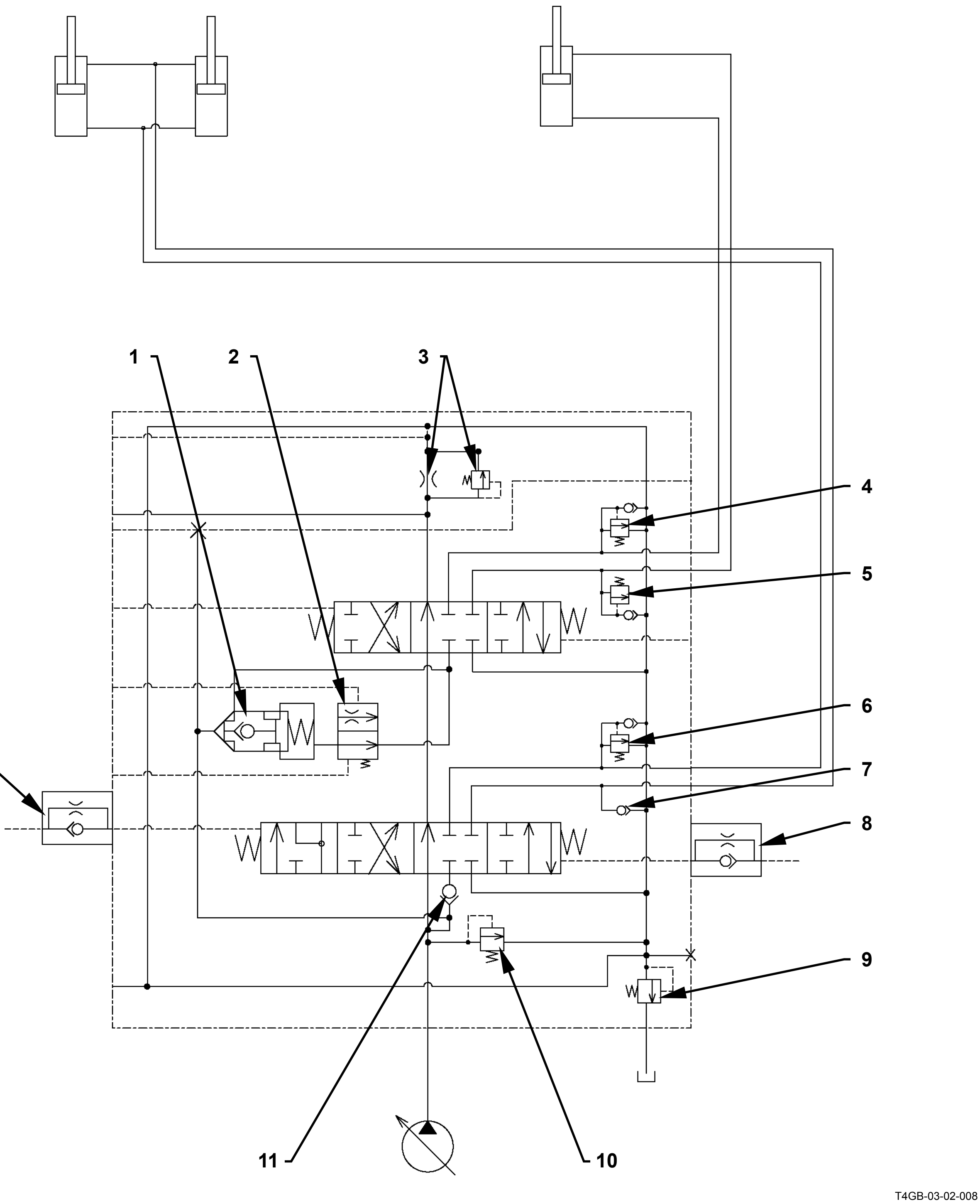


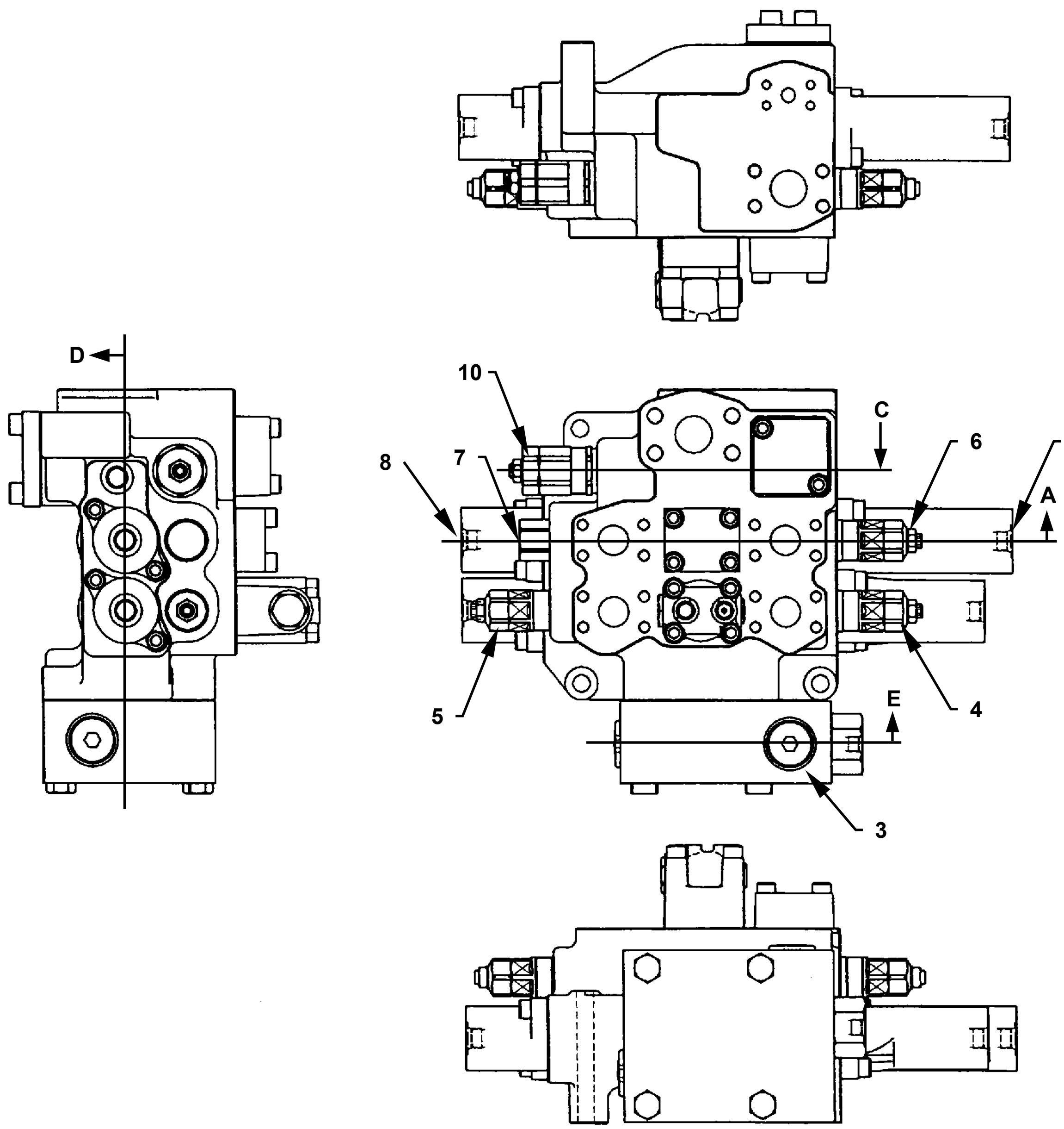
T4GB-03-02-007

1 - Bucket Flow Control Valve
2 - Negative Control Valve
3 - Overload Relief Valve (Bucket: Bottom End)
4 - Overload Relief Valve (Bucket: Rod End)
5 - Overload Relief Valve (Lift Arm: Bottom End)
6 - Make-up Valve (Lift Arm: Rod End)
7 - Restriction Valve
8 - Low-pressure Relief Valve
9 - Main Relief Valve
10 - Load Check Valve (Arm Lift Circuit)
11 - Load Check Valve (Bucket Circuit)

※ Refer to T5-4-17

ZW250

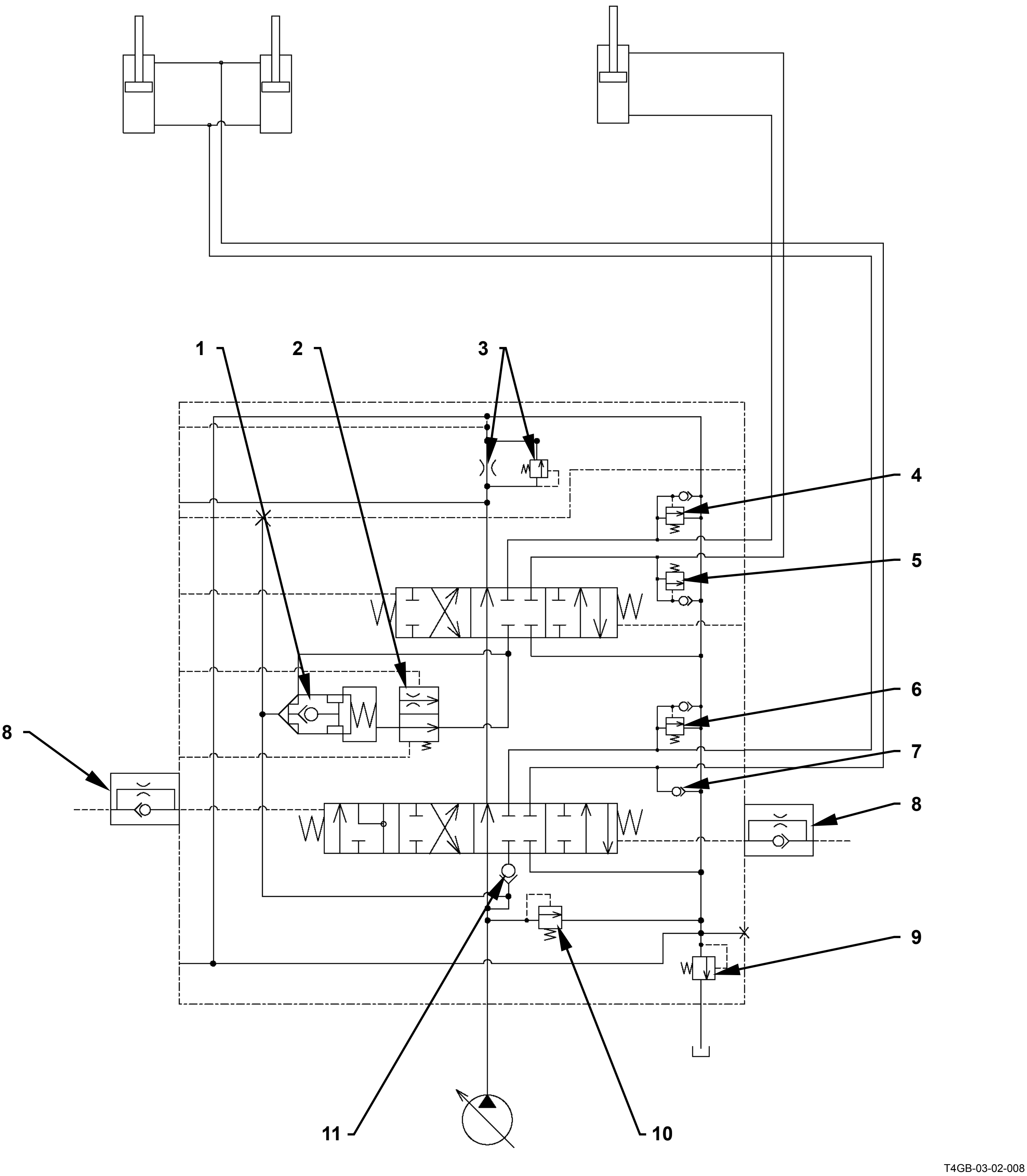


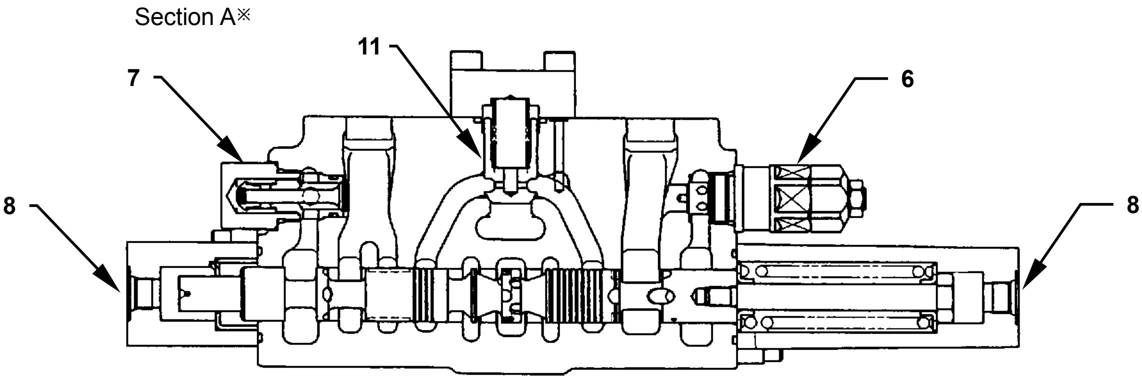


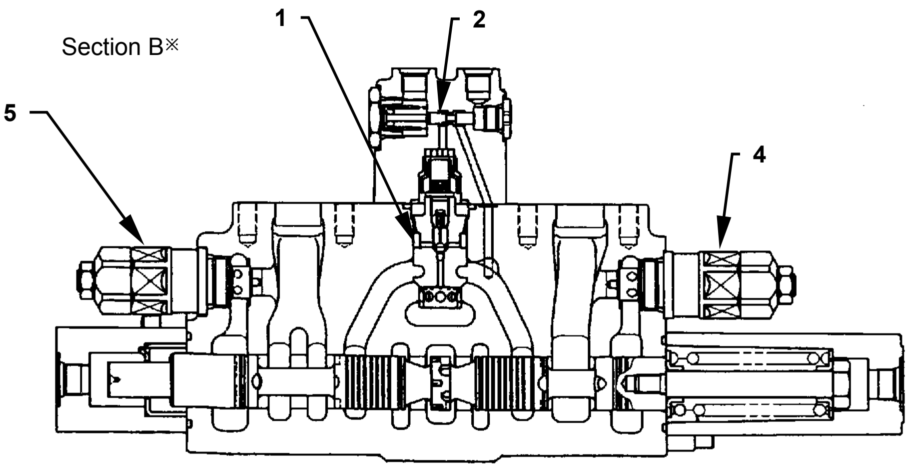
T4GB-03-02-009

1 - Flow Control Valve (Poppet)
2 - Flow Control Valve (Changeover Valve)
3 - Negative Control Valve
4 - Overload Relief Valve (Bucket: Bottom End)
5 - Overload Relief Valve (Bucket: Rod End)
6 - Overload Relief Valve (Lift Arm: Bottom End)
7 - Make-up Valve (Lift Arm: for Rod)
8 - Restriction Valve
9 - Low-pressure Relief Valve
10 - Main Relief Valve
11 - Load Check Valve (Lift Arm Circuit)

ZW250







T4GB-03-02-010

1 - Flow Control Valve (Poppet)
2 - Flow Control Valve (Changeover Valve)
3 - Negative Control Valve
4 - Overload Relief Valve (Bucket: Bottom End)
5 - Overload Relief Valve (Bucket: Rod End)
6 - Overload Relief Valve (Lift Arm: Bottom End)
7 - Make-up Valve (Lift Arm: for Rod)
8 - Restriction Valve
9 - Low-pressure Relief Valve
10 - Main Relief Valve
11 - Load Check Valve (Lift Arm Circuit)

※ Refer to T5-4-23

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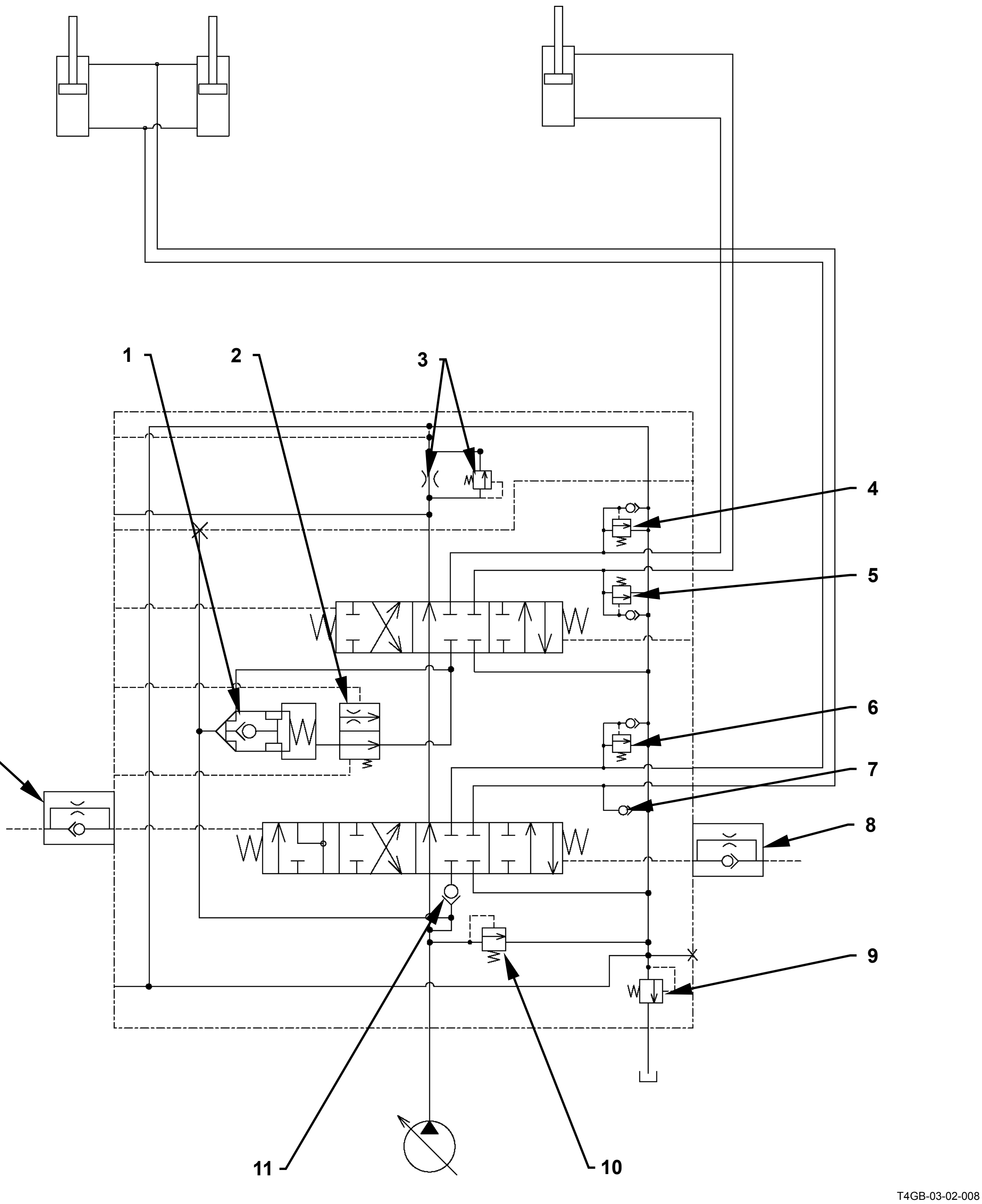
ZW250



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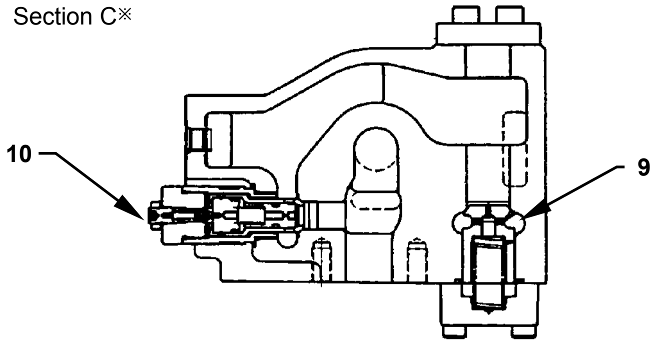

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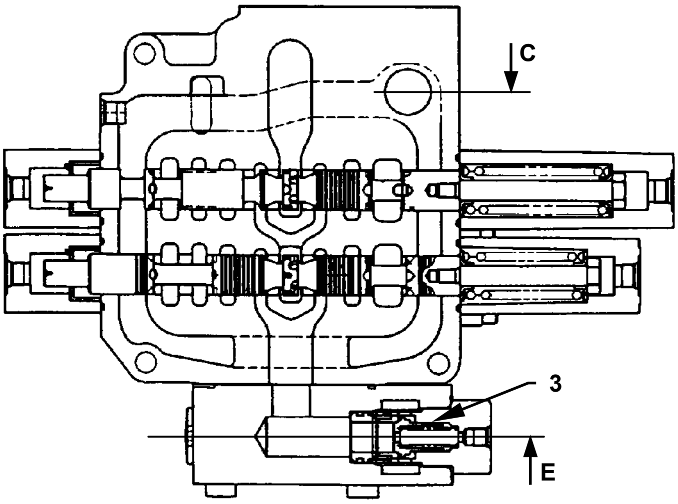
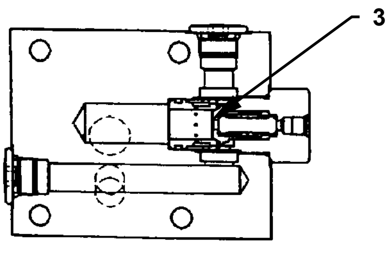


Section E※

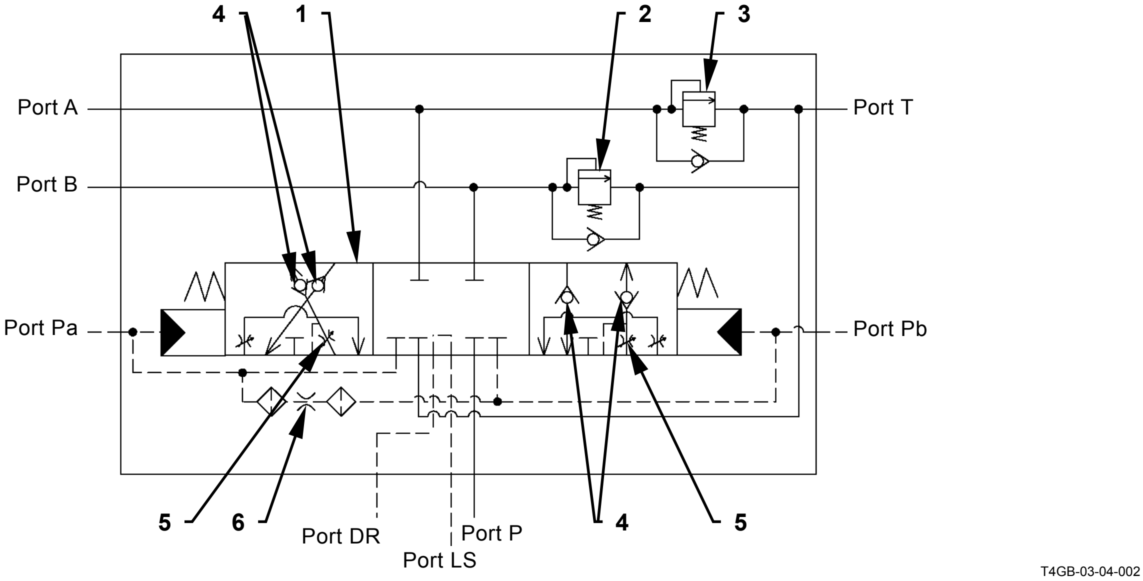


T4GB-03-02-011

1 - Flow Control Valve (Poppet)
2 - Flow Control Valve (Changeover Valve)
3 - Negative Control Valve
4 - Overload Relief Valve (Bucket: Bottom End)
5 - Overload Relief Valve (Bucket: Rod End)
6 - Overload Relief Valve (Lift Arm: Bottom End)
7 - Make-up Valve (Lift Arm: for Rod)
8 - Restriction Valve
9 - Low-pressure Relief Valve
10 - Main Relief Valve
11 - Load Check Valve (Lift Arm Circuit)

※ Refer to T5-4-23.

COMPONENTS IN STEERING VALVE

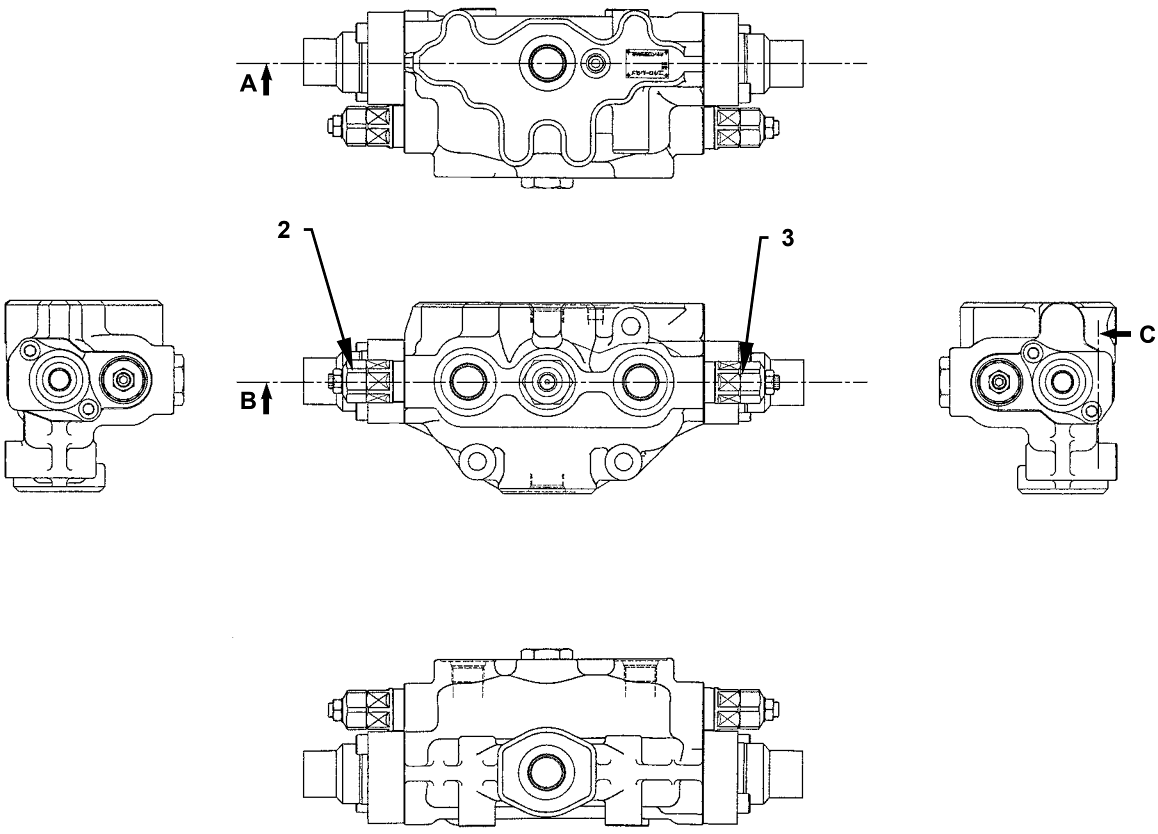


Port A: Pressure for Steering Right
Port P: From Main Pump

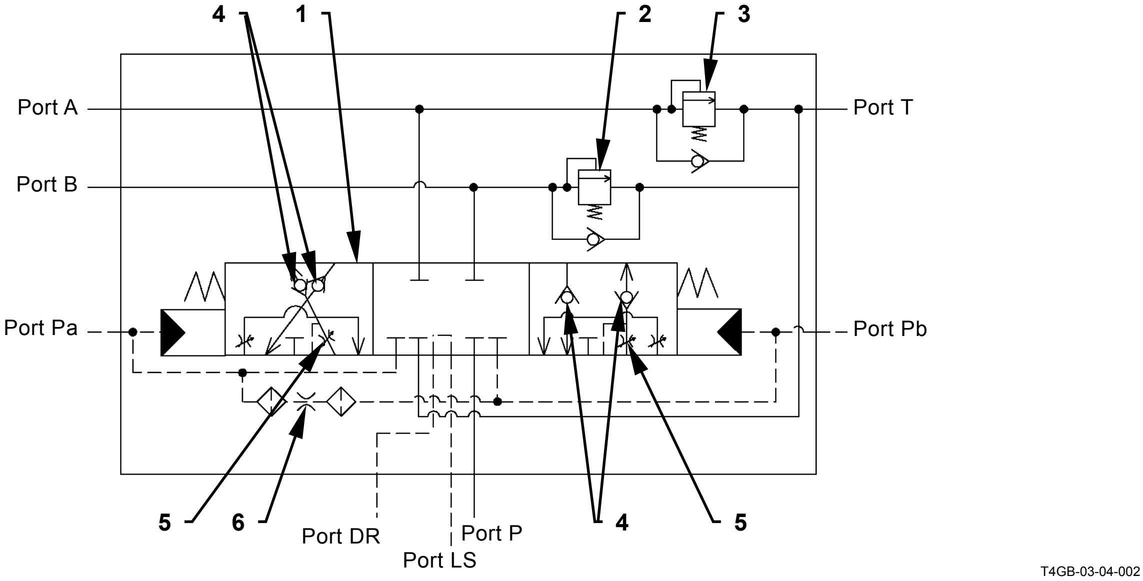
Port B: Pressure for Steering Left
Port T: Return to Hydraulic Oil Tank

Port Pa: Pilot Pressure for Steering Right
Port LS: To Port LS of Priority Valve

Port Pb: Pilot Pressure for Steering Left
Port DR: Return to Hydraulic Oil Tank



1 - Spool
2 - Overload Relief Valve
3 - Overload Relief Valve
4 - Lord Check Valve
5 - Variable Orifice
6 - Fixed Orifice

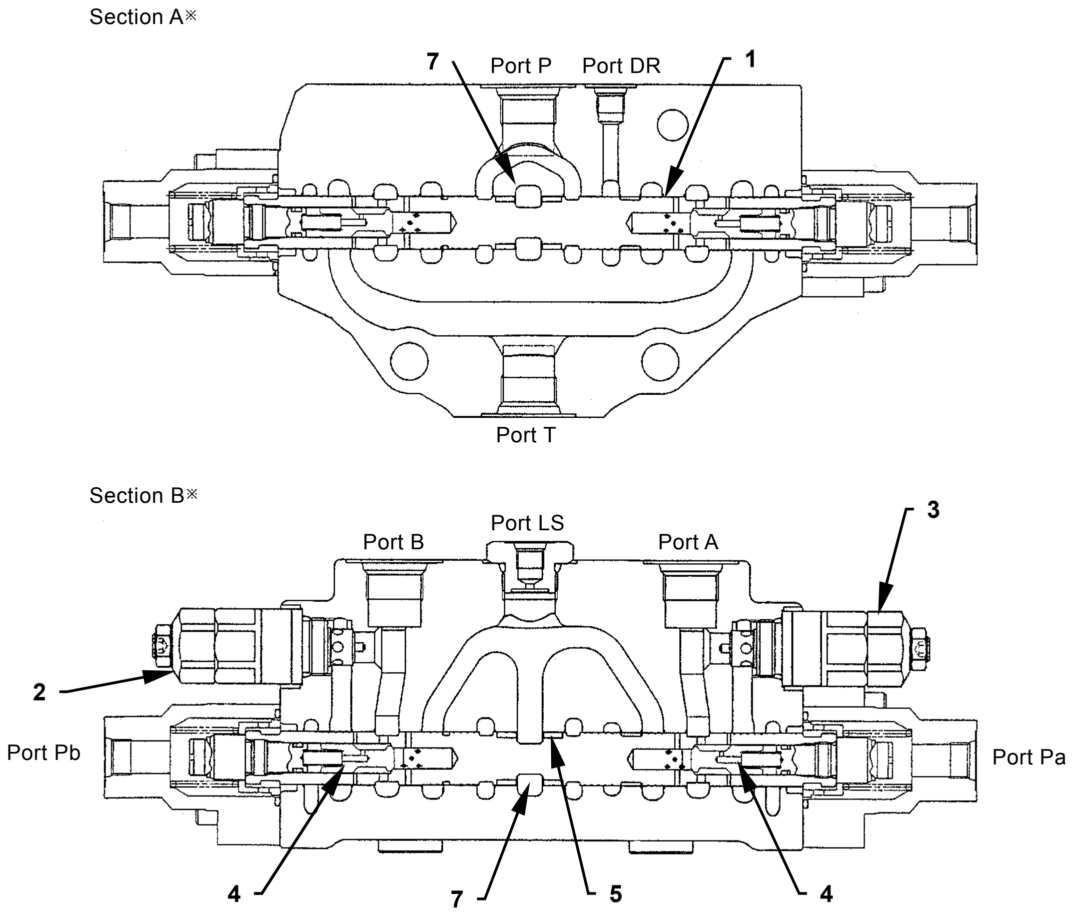


Port A: Pressure for Steering Right
Port P: From Main Pump

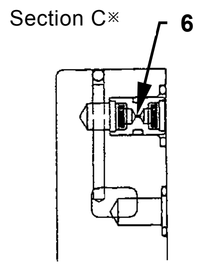
Port B: Pressure for Steering Left
Port T: Return to Hydraulic Oil Tank

Port Pa: Pilot Pressure for Steering Right
Port LS: To Port LS of Priority Valve

Port Pb: Pilot Pressure for Steering Left
Port DR: Return to Hydraulic Oil Tank



T4GB-03-04-003

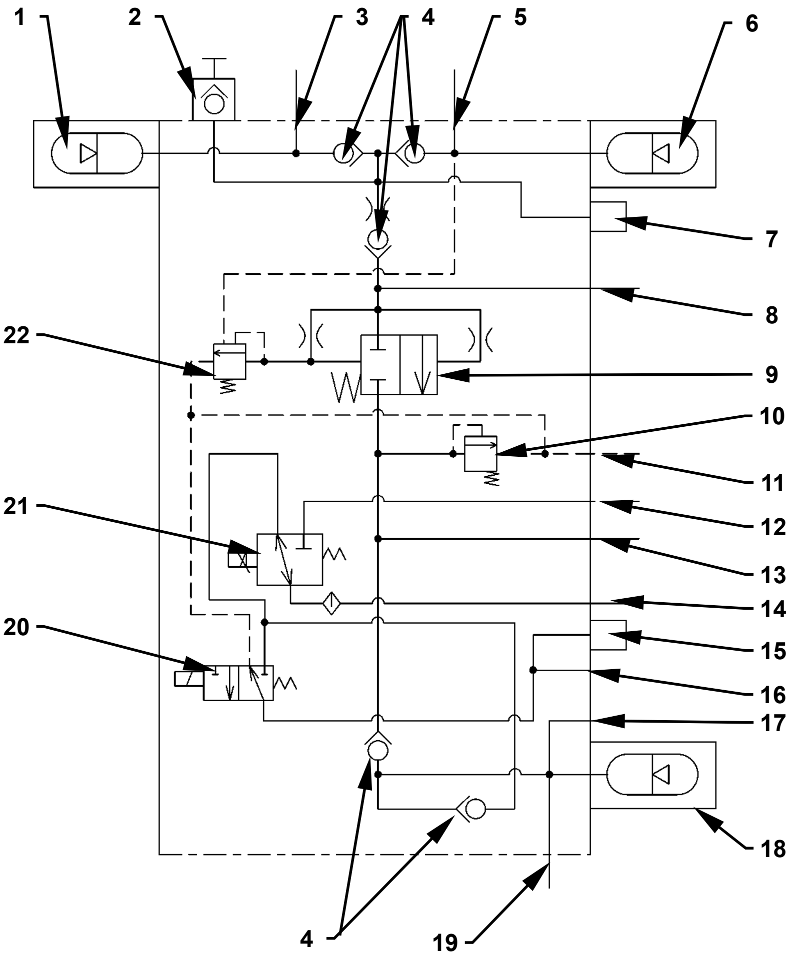


T4GB-03-04-006

1 - Spool
2 - Overload Relief Valve
3 - Overload Relief Valve
4 - Lord Check Valve
5 - Variable Orifice
6 - Fixed Orifice
7 - Passage A

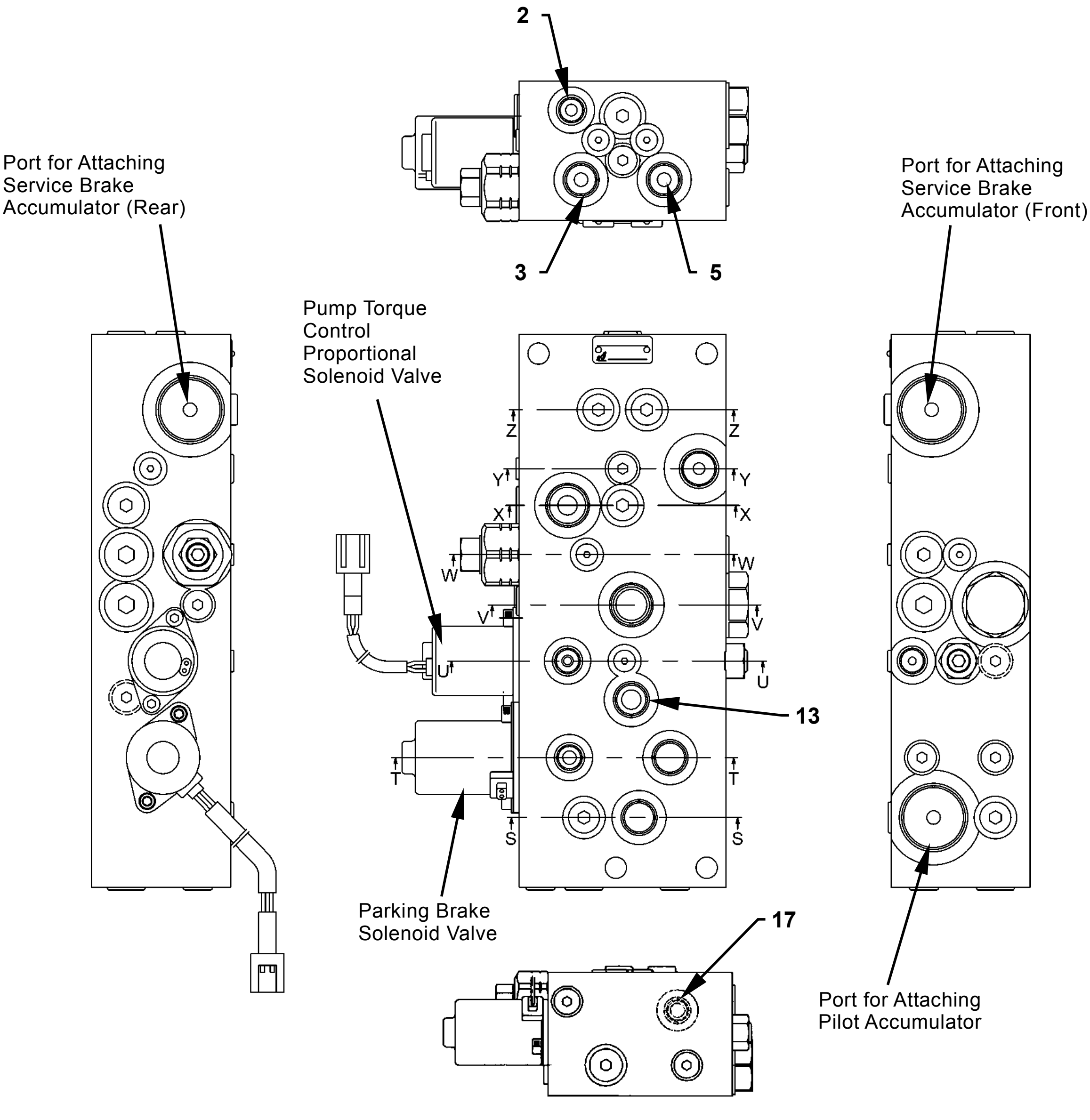
※: Refer to T5-4-29.

COMPONENTS IN CHARGING BLOCK

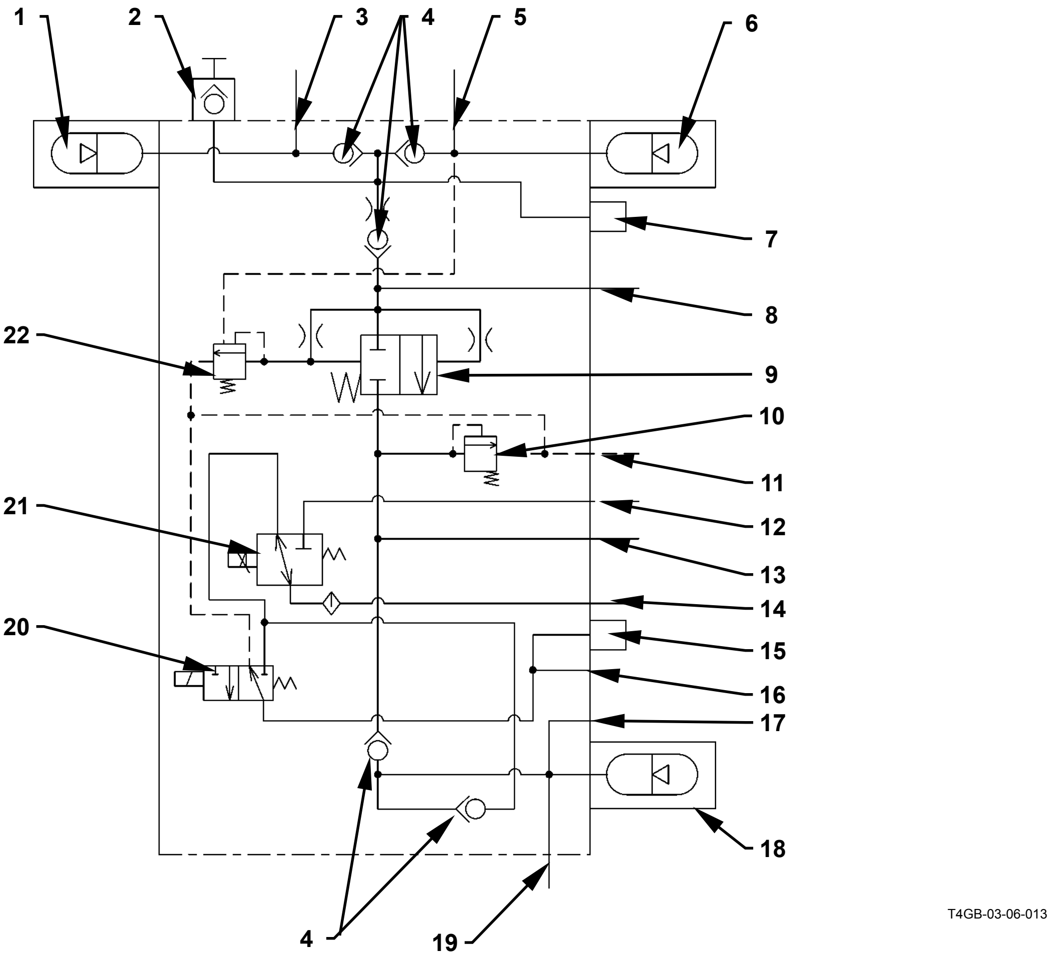


T4GB-03-06-013

1 - Service Brake Accumulator (Rear)
2 - Adaptor
3 - Port M2 (To Rear End of Brake Valve)
4 - Check Valve
5 - Port M1 (To Front End of Brake Valve)
6 - Service Brake Accumulator (Front)
7 - Service Brake Pressure Sensor
8 - Port P (from Pilot Pump)
9 - Priority Valve
10 - Pilot Relief Valve
11 - Port DR (To Hydraulic Oil Tank)
12 - Port DR2 (To Hydraulic Oil Tank)
13 - Port PS1 (To Steering Pilot Valve)
14 - Port X (To Main Pump Regulator)
15 - Parking Brake Pressure Sensor
16 - Port BR3 (To Parking Brake)
17 - Port PS2 (To Main Pump Regulator and Ride Control Valve (Optional))
18 - Pilot Accumulator
19 - Port PP (To Pilot Shutoff Valve)
20 - Parking Brake Solenoid Valve
21 - Pump Torque Control Proportional Solenoid Valve
22 - Relief Valve

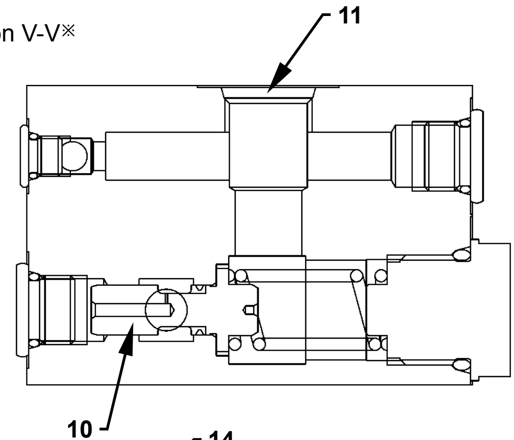


T4GB-03-06-001

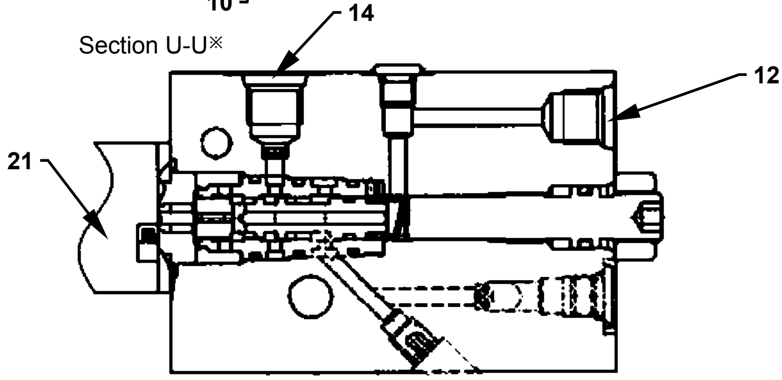


1 - Service Brake Accumulator (Rear)
2 - Adaptor
3 - Port M2 (To Rear End of Brake Valve)
4 - Check Valve
5 - Port M1 (To Front End of Brake Valve)
6 - Service Brake Accumulator (Front)
7 - Service Brake Pressure Sensor
8 - Port P (from Pilot Pump)
9 - Priority Valve
10 - Pilot Relief Valve
11 - Port DR (To Hydraulic Oil Tank)
12 - Port DR2 (To Hydraulic Oil Tank)
13 - Port PS1 (To Steering Pilot Valve)
14 - Port X （To Main Pump Regulator）
15 - Parking Brake Pressure Sensor
16 - Port BR3（To Parking Brake）
17 - Port PS2 (To Main Pump Regulator and Ride Control Valve (Optional))
18 - Pilot Accumulator
19 - Port PP（To Pilot Shutoff Valve）
20 - Parking Brake Solenoid Valve
21 - Pump Torque Control Proportional Solenoid Valve
22 - Relief Valve

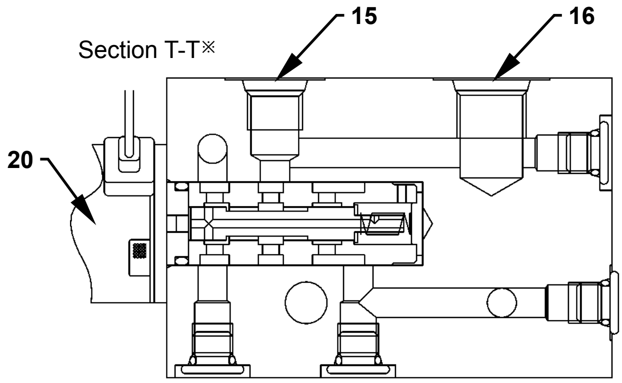
Section V-V※



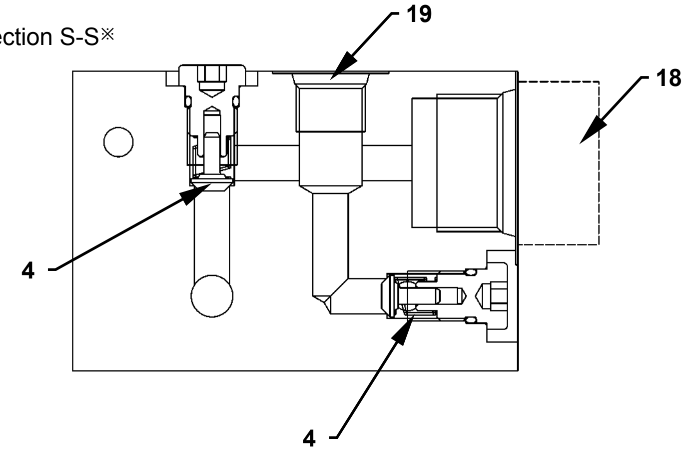
Section U-U※



Section T-T※

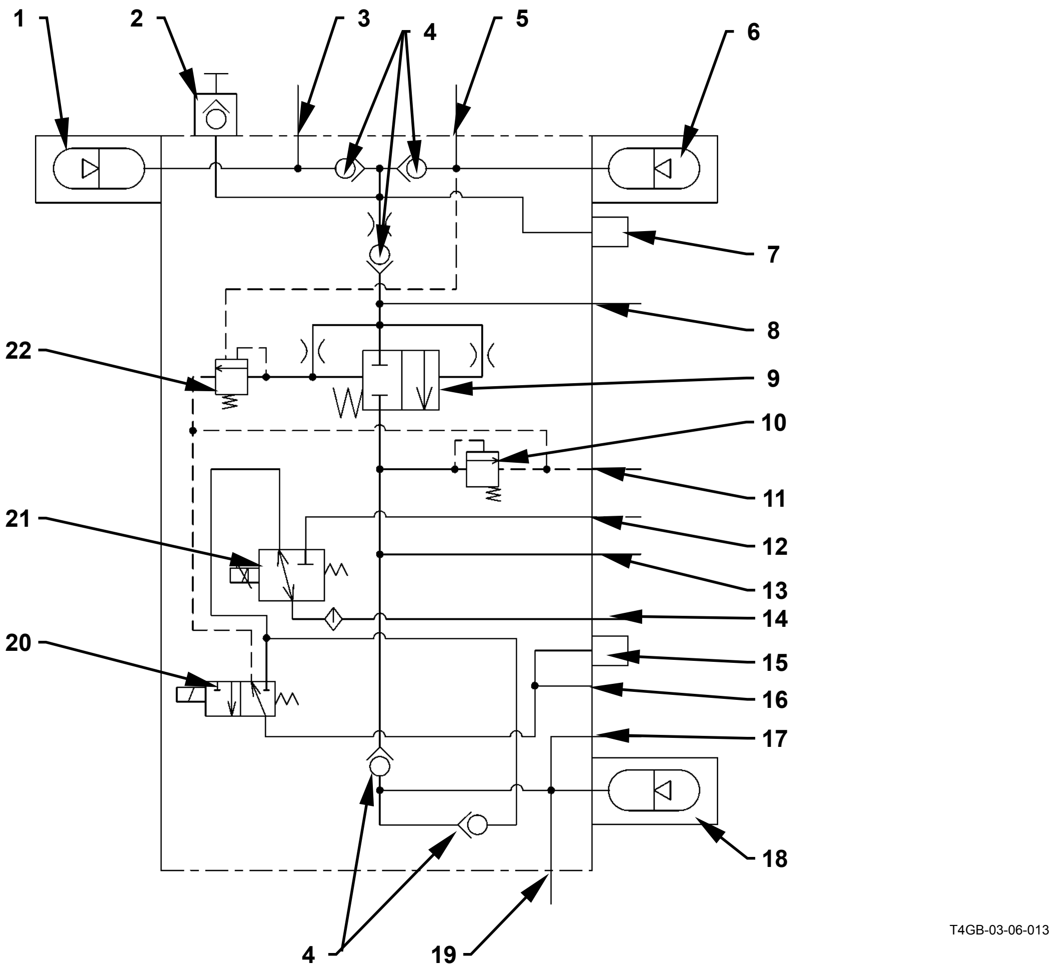


Section S-S※



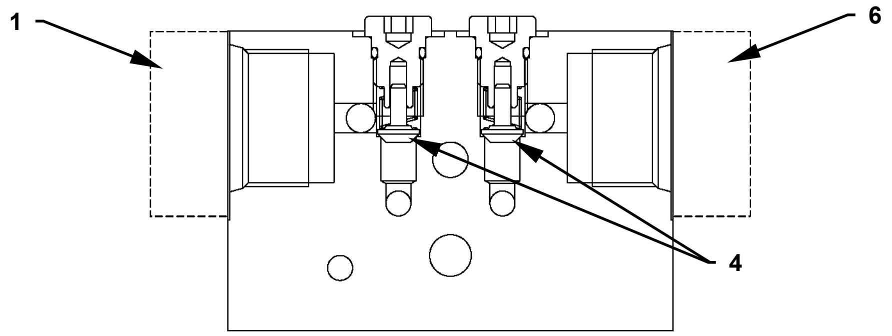
T4GB-03-06-003

※Refer to T5-4-33.

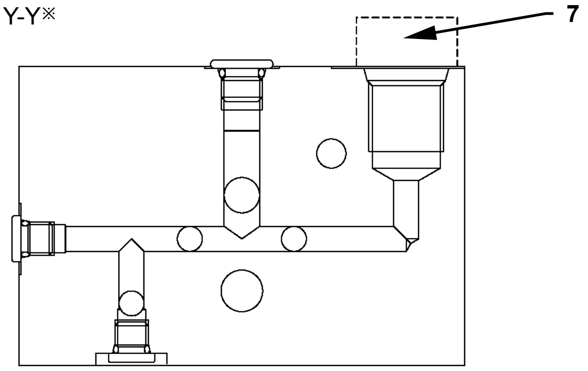


1 - Service Brake Accumulator (Rear)
2 - Adaptor
3 - Port M2 (To Rear End of Brake Valve)
4 - Check Valve
5 - Port M1 (To Front End of Brake Valve)
6 - Service Brake Accumulator (Front)
7 - Service Brake Pressure Sensor
8 - Port P (From Pilot Pump)
9 - Priority Valve
10 - Pilot Relief Valve
11 - Port DR (To Hydraulic Oil Tank)
12 - Port DR2 (To Hydraulic Oil Tank)
13 - Port PS1 (To Steering Pilot Valve)
14 - Port X (To Main Pump Regulator)
15 - Parking Brake Pressure Sensor
16 - Port BR3 (To Parking Brake)
17 - Port PS2 (To Main Pump Regulator and Ride Control Valve (Optional))
18 - Pilot Accumulator
19 - Port PP (To Pilot Shutoff Valve)
20 - Parking Brake Solenoid Valve
21 - Pump Torque Control Proportional Solenoid Valve
22 - Relief Valve

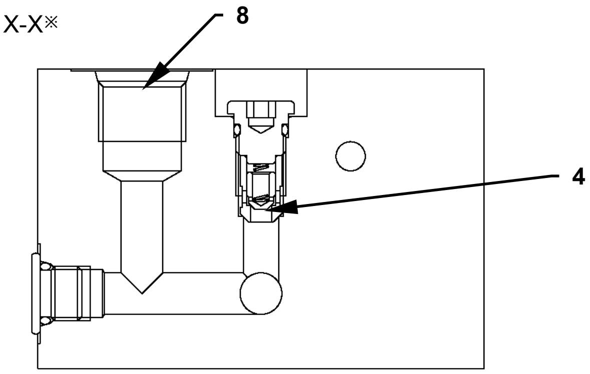
Section Z-Z※



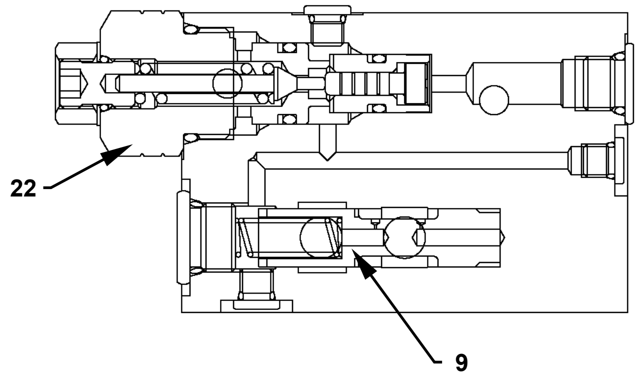
Section Y-Y※



Section X-X※



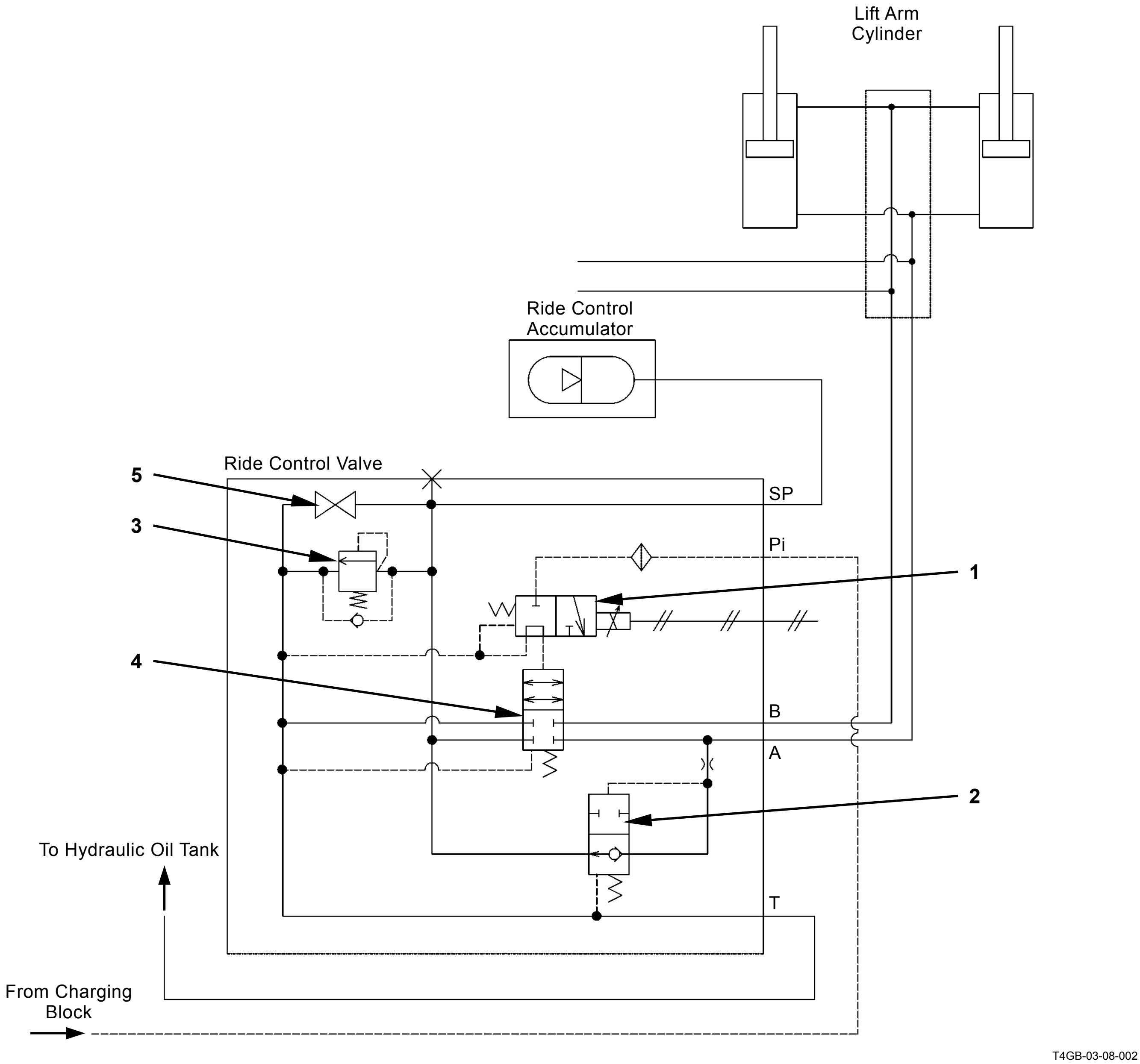
Section W-W※



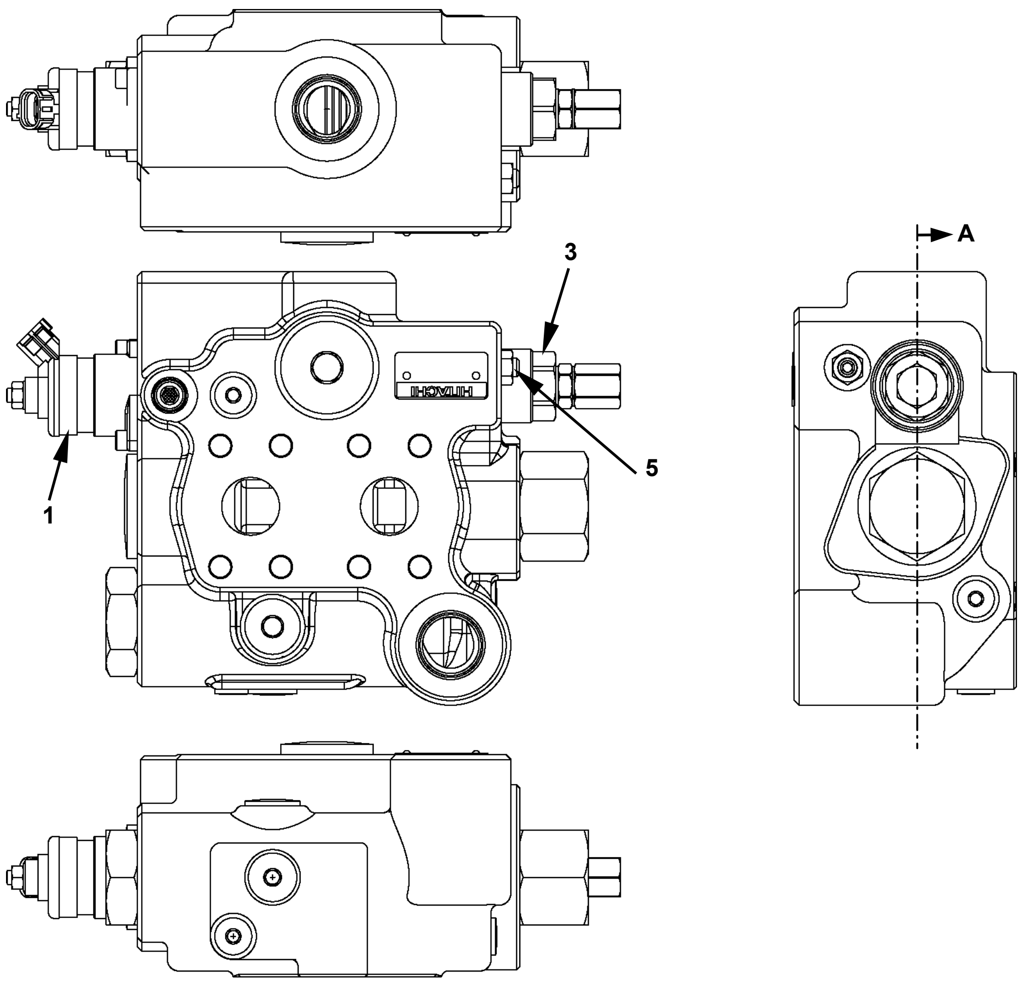
T4GB-03-06-004

※Refer to T5-4-33

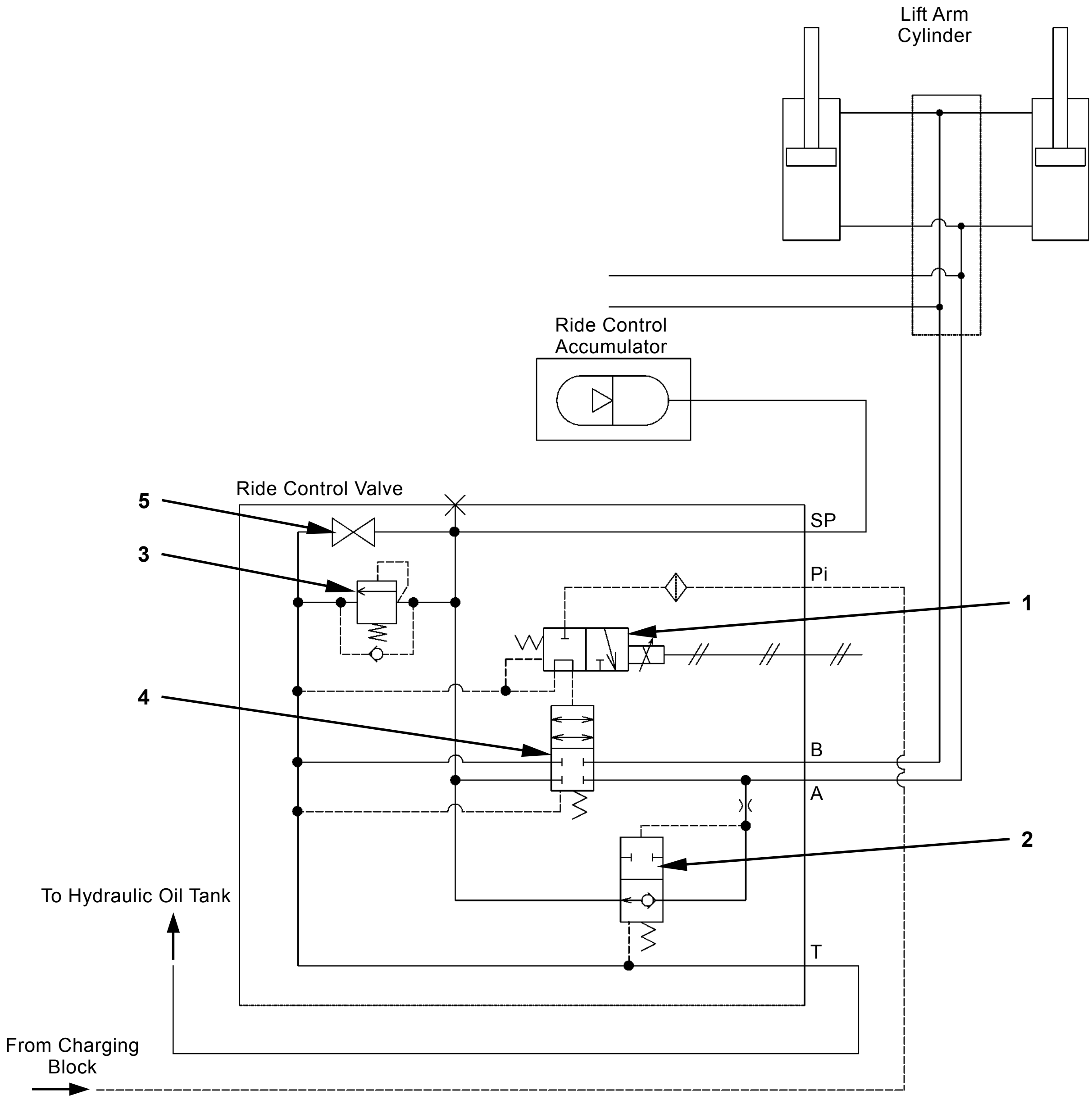
COMPONENTS IN RIDE CONTROL VALVE



1 - Ride Control Solenoid Valve
2 - Charge-cut Spool
3 - Overload Relief Valve
4 - Spool
5 - Drain Plug



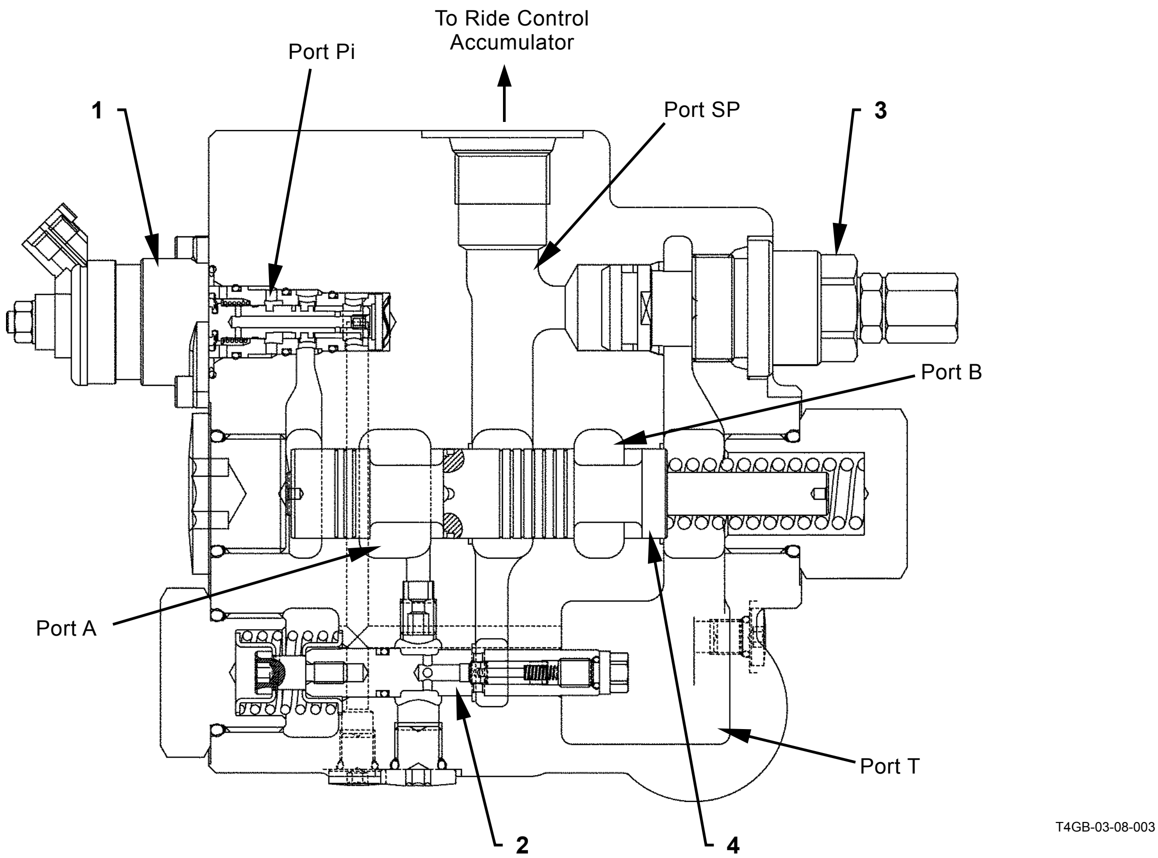
T4GB-03-08-001



T4GB-03-08-002

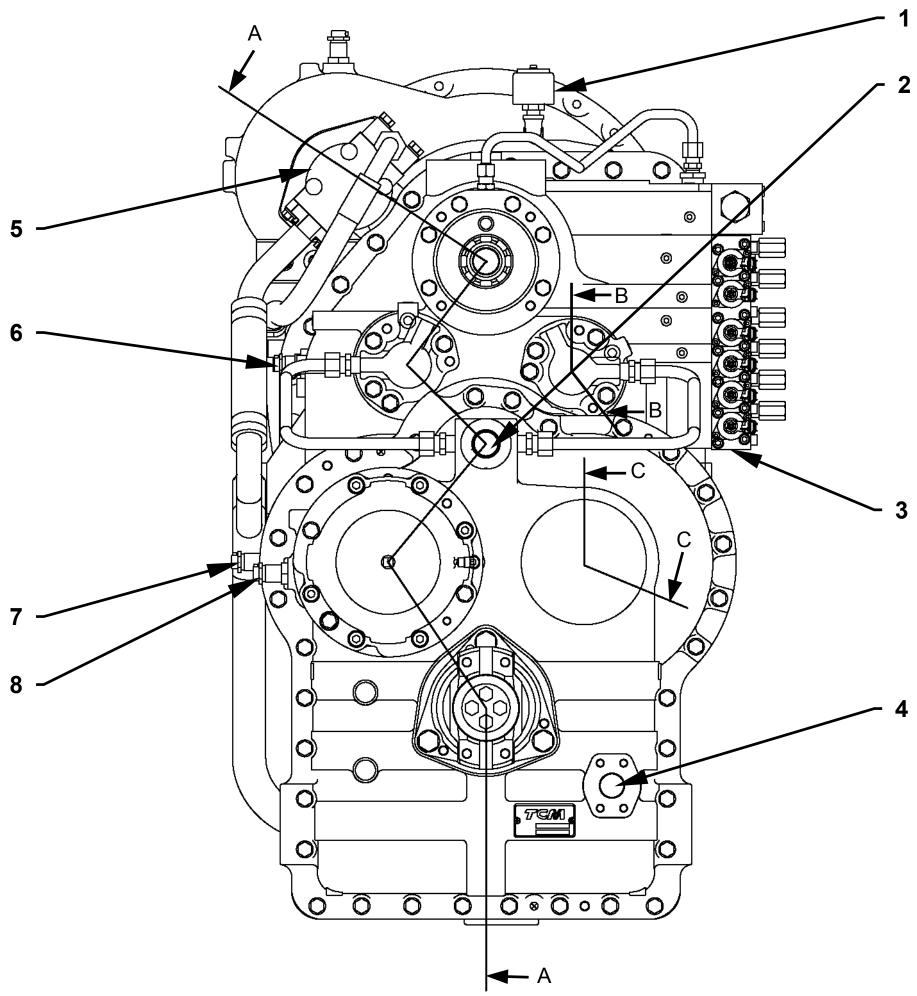
1 - Ride Control Solenoid Valve
2 - Charge-cut Spool
3 - Overload Relief Valve
4 - Spool
5 - Drain Plug

Section A※



※Refer to T5-4-39

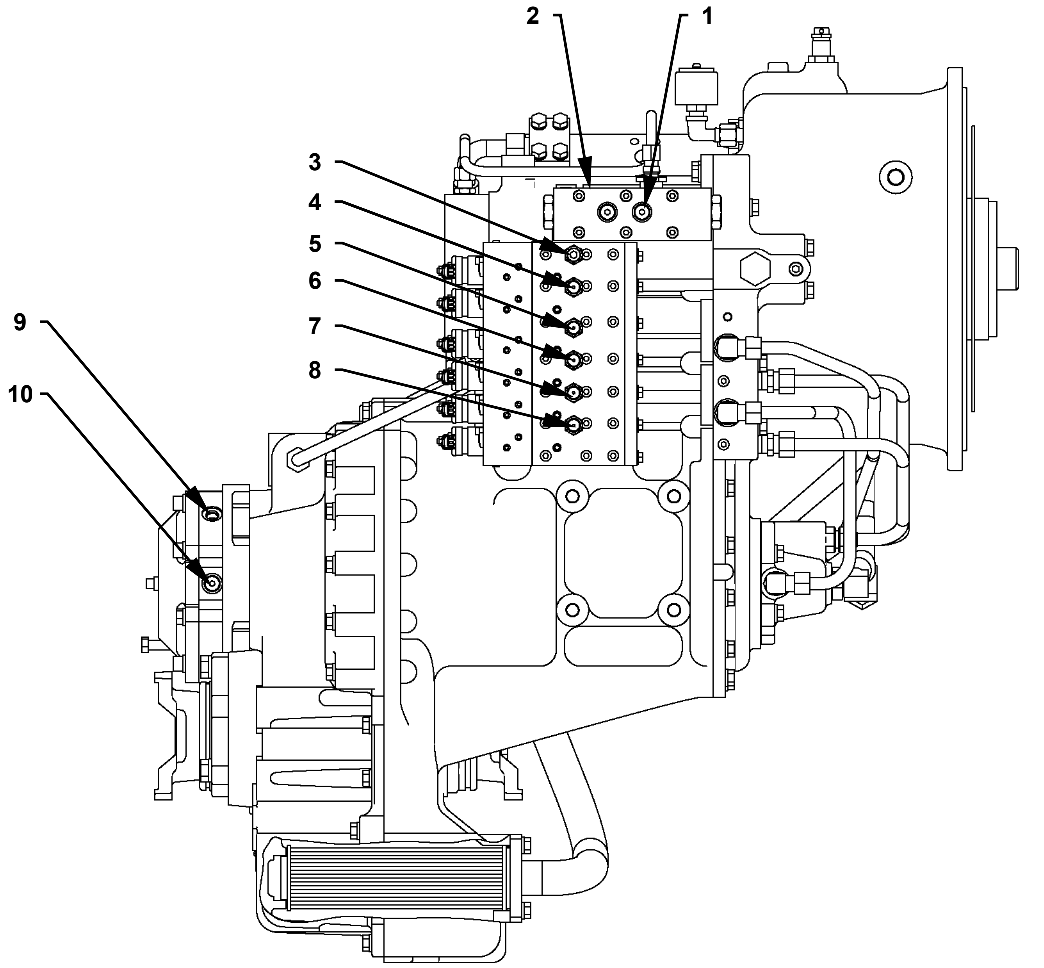
FRONT VIEW OF TRANSMISSION



T4GC-03-09-003

1 - Breather	3 - Control Valve	5 - Charging Pump	7 - Rotation Sensor (B)
2 - From Oil Cooler	4 - Oil Feed Port	6 - Rotation Sensor (A)	8 - Vehicle Speed Sensor

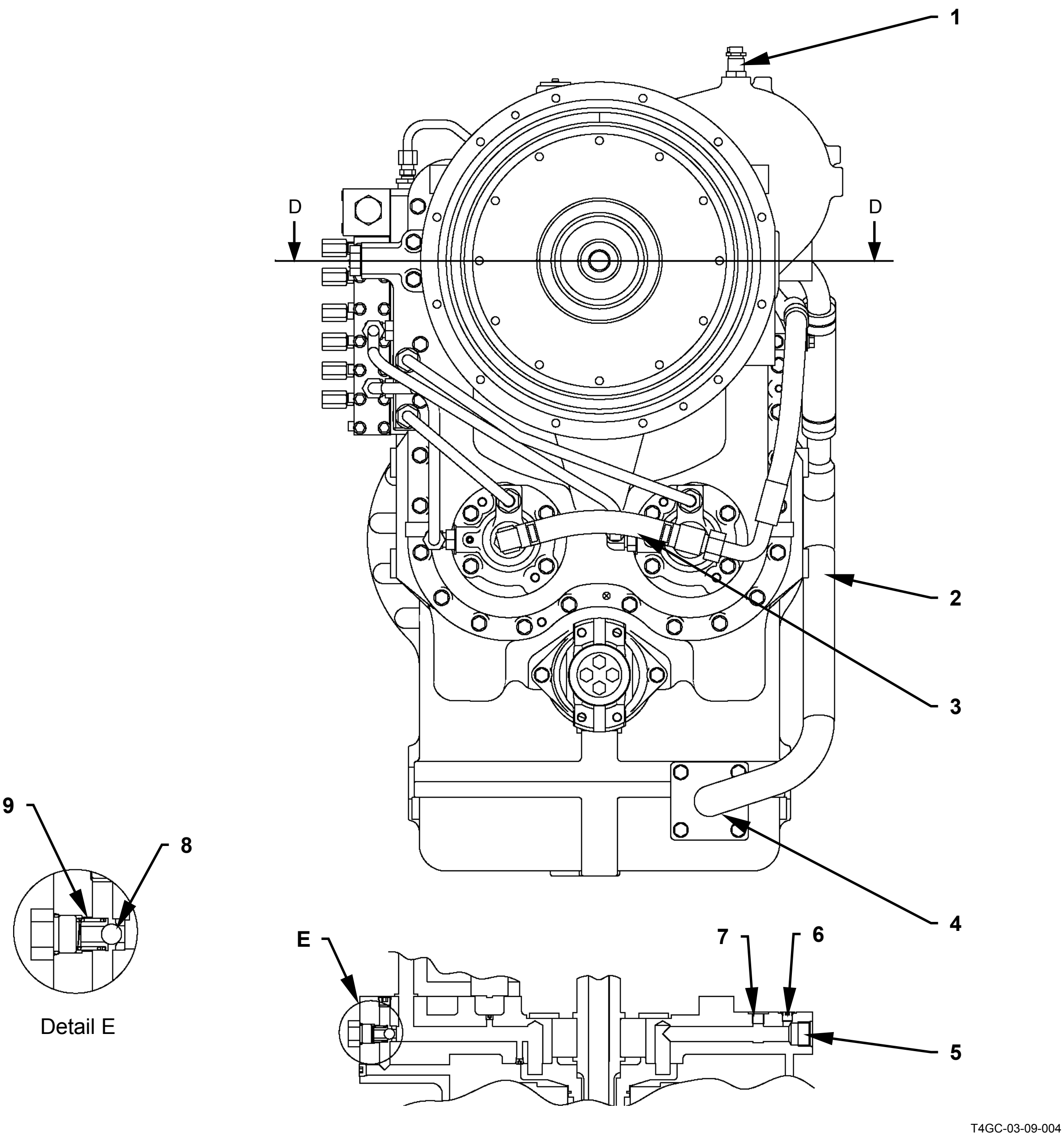
SIDE VIEW OF TRANSMISSION



T4GC-03-09-005

1 - Converter Inlet Pressure Port
2 - Regulator Valve
3 - Forward Clutch Pressure Port
4 - Reverse Clutch Pressure Port
5 - 1st Speed Clutch Pressure Port
6 - 2nd Speed Clutch Pressure Port
7 - 3rd Speed Clutch Pressure Port
8 - 4th Speed Clutch Pressure Port
9 - Parking Brake Release Pressure Inlet
10 - Parking Brake Pressure Switch Port

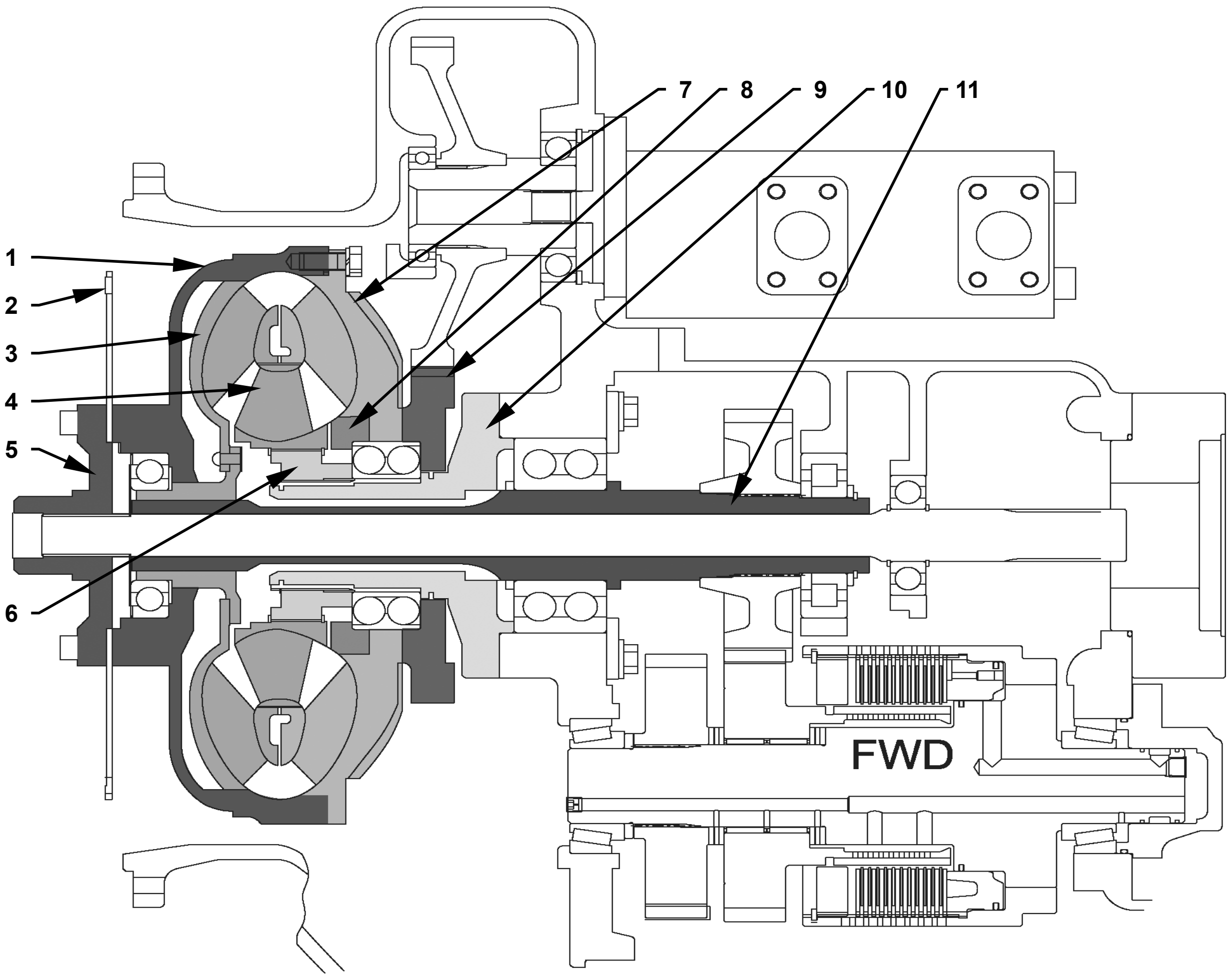
REAR VIEW OF TRANSMISSION



Section DD

1 - Engine Speed Sensor
2 - Suction Tube
3 - Hose
4 - Strainer
5 - To Oil Cooler
6 - Converter Outlet Boss
7 - Oil Pressure Gauge Port
8 - Safety Valve
9 - Spring

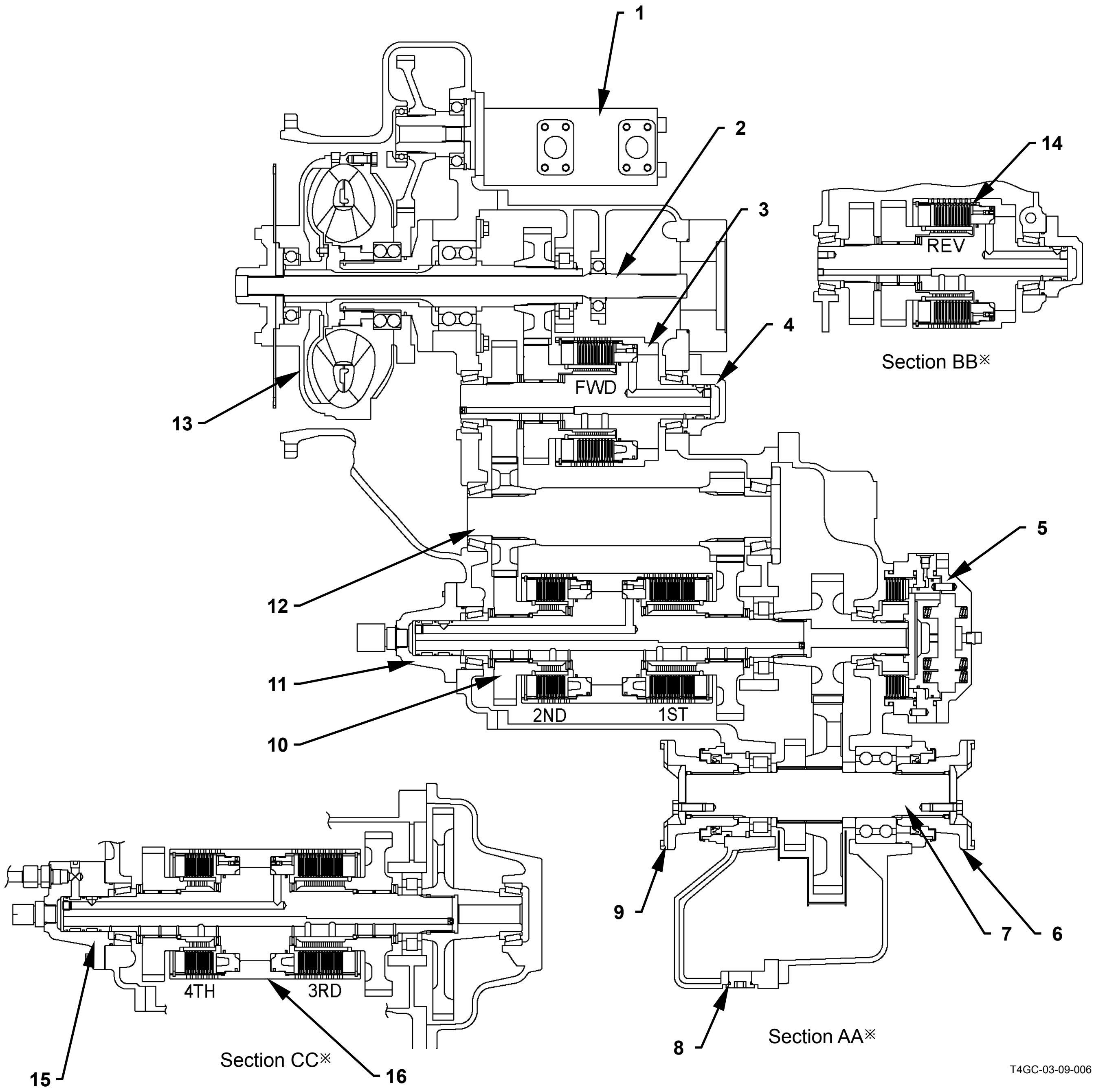
CROSS-SECTIONAL DRAWING OF TORQUE CONVERTER



T4GC-03-09-001

1 - Cover Wheel	4 - Stator	7 - Impeller	10 - Guide Carrier
2 - Input Plate	5 - Input Guide	8 - Impeller Hub	11 - Turbine Shaft
3 - Turbine	6 - Stator Hub	9 - Pump Drive Gear	

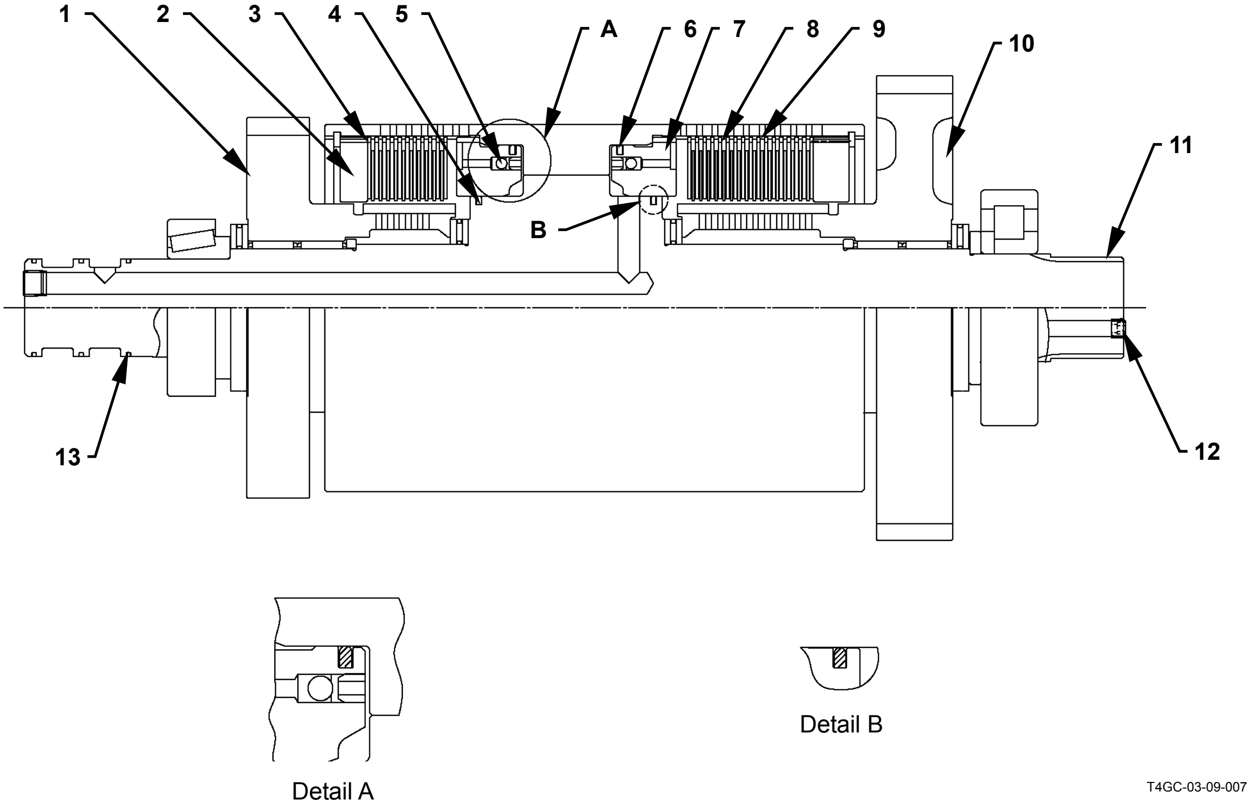
CROSS-SECTIONAL DRAWING OF TRANSMISSION



1 - Charging Pump	5 - Parking Brake	9 - Rear Output Flange	13 - Torque Converter
2 - Pump Drive Shaft	6 - Front Output Flange	10 - 1st & 2nd Speeds Clutch	14 - Reverse Clutch
3 - Forward Clutch	7 - Output Shaft	11 - Distributor Cap	15 - Distributor Cap
4 - Distributor Cap	8 - Drain Plug	12 - Idler Shaft	16 - 3rd & 4th Speeds Clutch

※Refer to T5-4-42

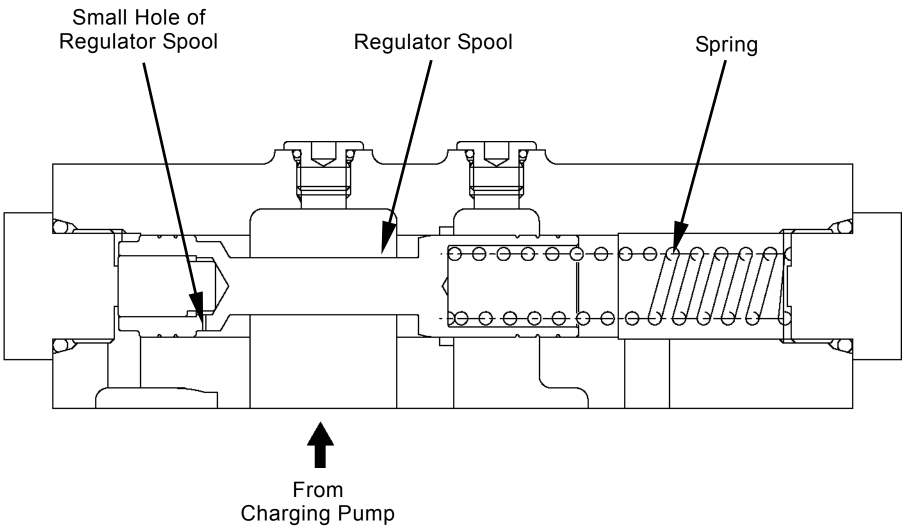
CROSS-SECTIONAL DRAWING OF CLUTCH SHAFT



1 - Hub Gear	5 - Bleed Valve	8 - Disk	11 - Shaft
2 - End Plate	6 - Seal Ring (Outer)	9 - Plate	12 - Plug
3 - Return Spring	7 - Piston	10 - Hub Gear	13 - Seal Ring
4 - Seal Ring (Inner)			

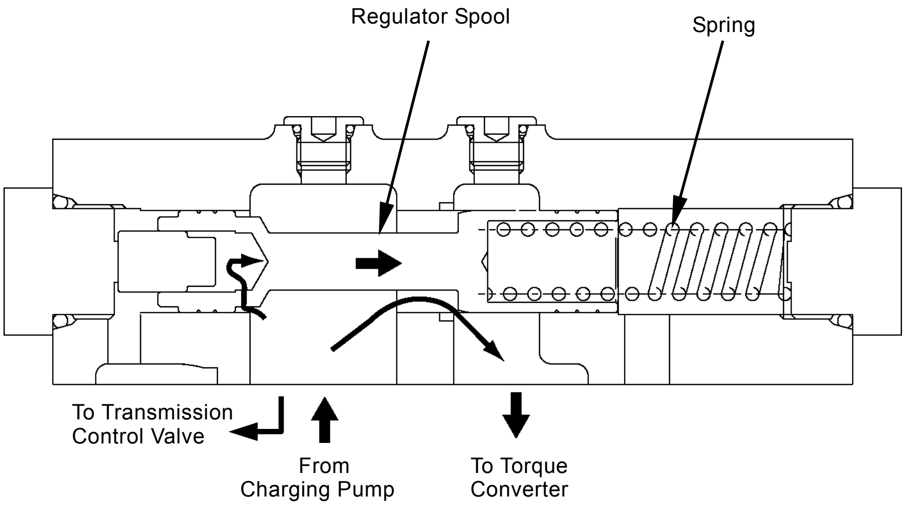
CROSS-SECTIONAL DRAWING OF TRANSMISSION REGULATOR VALVE

Normally



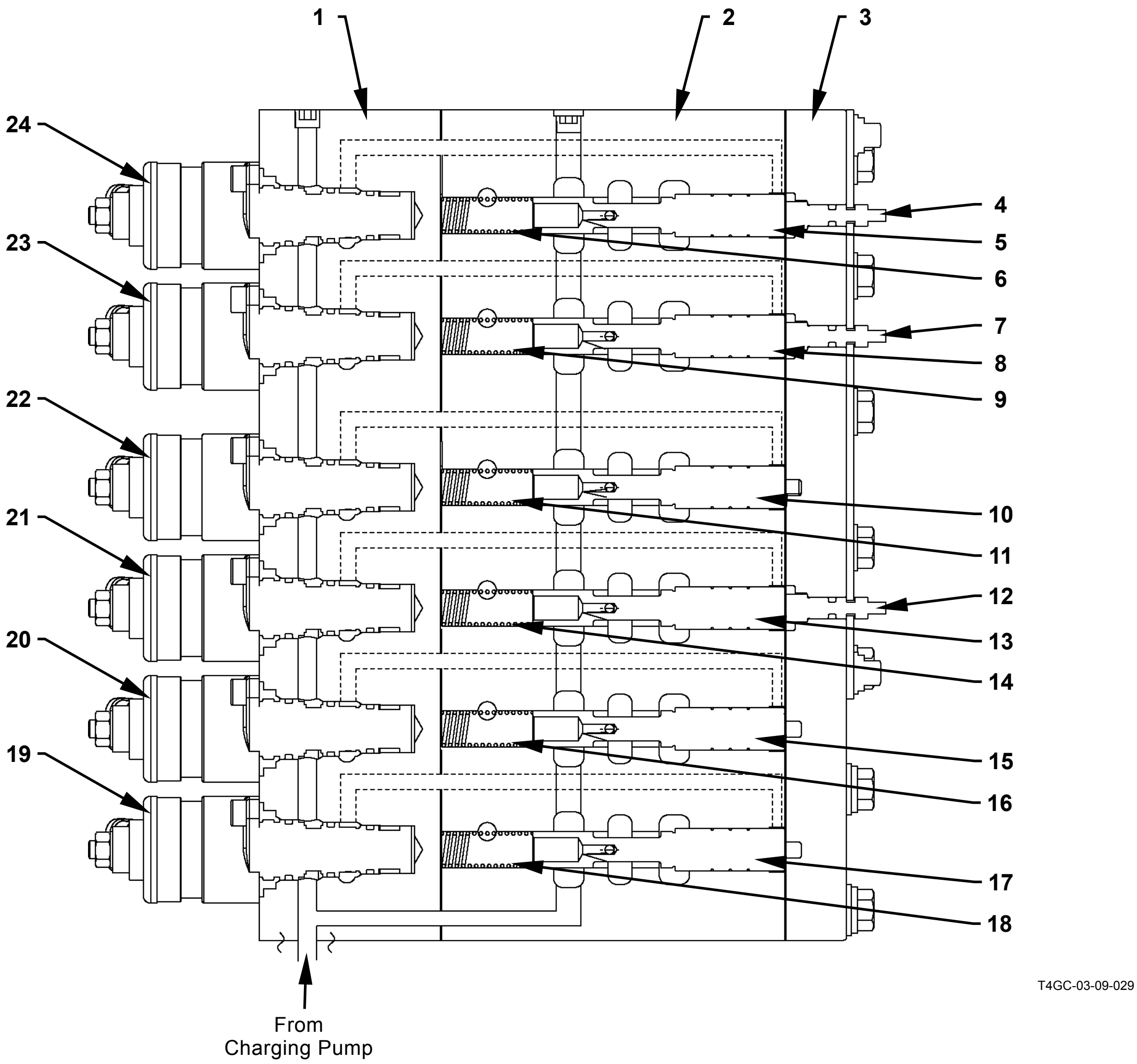
T4GC-03-09-025

When overflowing



T4GC-03-09-026

CROSS-SECTIONAL DRAWING OF TRANSMISSION CONTROL VALVE



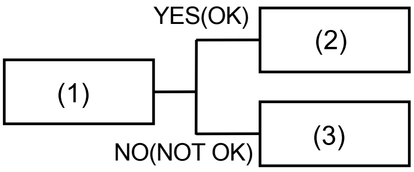
1 - Solenoid Body
2 - Valve Body
3 - Cover
4 - Emergency Forward Spool
5 - Forward Modulation Spool
6 - Forward Modulation Spring
7 - Emergency Reverse Spool
8 - Reverse Modulation Spool
9 - Reverse Modulation Spring
10 - 1st Speed Modulation Spool
11 - 1st Speed Modulation Spring
12 - Emergency 2nd Speed Spool
13 - 2nd Speed Modulation Spool
14 - 2nd Speed Modulation Spring
15 - 3rd Speed Modulation Spool
16 - 3rd Speed Modulation Spring
17 - 4th Speed Modulation Spool
18 - 4th Speed Modulation Spring
19 - 4th Speed Proportional Solenoid Valve
20 - 3rd Speed Proportional Solenoid Valve
21 - 2nd Speed Proportional Solenoid Valve
22 - 1st Speed Proportional Solenoid Valve
23 - Reverse Proportional Solenoid Valve
24 - Forward Proportional Solenoid Valve

(Blank)

TROUBLESHOOTING A PROCEDURE

Refer to troubleshooting A procedure in case any fault codes are displayed after diagnosing by using Dr. ZX or the service mode of monitor unit.

- How to Read Troubleshooting Flow Charts

- 

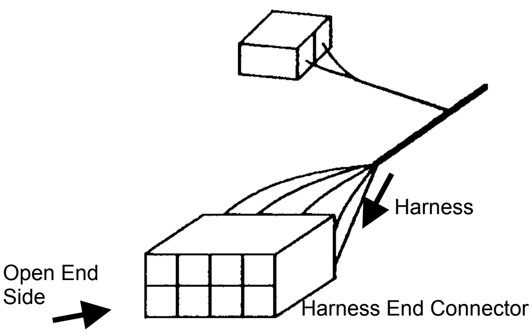
After completing the checking and/or measuring procedures in box (1), select YES (OK) or NO (NOT OK) and proceed to box (2) or (3).

- 
· Key switch: ON
Instructions, reference, and/or inspection methods and/or measurements are occasionally described under the box. If incorrectly checked or measured, not only will troubleshooting be unsuccessful but also damage to the components may result.

- 
Use Dr. ZX for descriptions in the double-line box.

- 
Causes of machine problems are stated in the thick-line box. Scanning quickly through the thick-line boxes allows you to estimate the possible causes before actually following the flow chart.

NOTE: *Harness end connector viewed from the open end side by the all connectors image shown in this section.*



T158-05-03-001

MC FAULT CODE LIST

Controller Hardware Failure

Fault Code	Trouble	Cause	Influenced Control
11000-2	Abnormal EEPROM	Faulty MC	All Control
11001-2	Abnormal RAM	Faulty MC	All Control
11002-2	Abnormal A/D (Analog to Digital) Converter	Faulty MC	All Control
11003-3	Abnormal Sensor Voltage	Faulty sensor because of shorted circuit in harness Faulty MC	All Control
11004-2	CAN Communication Error	Faulty sensor because of shorted circuit in harness Faulty MC	All Pump Control All Transmission Control All Engine Control Hydraulic Drive Fan Cooling Control Ride Control CAN Cycle Data Communication

Symptoms in Machine Operation When Trouble Occurs	Remark
There is something wrong with machine operation.	Retrial B Replace MC
There is something wrong with machine operation.	Retrial B Replace MC
As the latest, normal value AD (analog to digital) is enabled, the machine may be operated incorrectly or slowly.	Retrial B Replace MC
Inputs from all sensors are uncertain.	Retrial B Check Harness Replace MC
As engine speed is kept at 1000 min^{-1} (1000 rpm), the work may be inoperable.	Retrial B Check CAN Harness Replace MC

Engine Failure

Fault Code	Trouble	Cause	Influenced Control
11103-3	Abnormal Accelerator Pedal High Voltage	Voltage: 4.75 V or higher	Pump Torque Decrease Control Engine Accelerator Pedal Control
11103-4	Abnormal Accelerator Pedal Low Voltage	Voltage: Less than 0.25 V	Pump Torque Decrease Control Engine Accelerator Pedal Control
11105-3	Abnormal Torque Converter Input Shaft Sensor	Engine speed=0 min^{-1} ECM engine speed>500 min^{-1}	Hydraulic Drive Fan Cooling Control

Symptoms in Machine Operation When Trouble Occurs	Remedy
The accelerator pedal is inoperable. Engine speed kept at 1000 min^{-1} (1000 rpm), the work may be inoperable.	Retrial B Check Harness Replace Accelerator Pedal Replace MC
The accelerator pedal is inoperable. Engine speed kept at 1000 min^{-1} (1000 rpm), the work may be inoperable.	Retrial B Check Harness Replace Accelerator Pedal Replace MC
As fan speed is controlled by temperature only, when oil and coolant temperature are high, the machine starts slowly. Fuel consumption becomes bad.	Retrial B Check Harness Replace Torque Converter Input Shaft Sensor Replace MC

Pump Failure

Fault Code	Trouble	Cause	Influenced Control
11204-3	Abnormal Pump Delivery Pressure Sensor High Voltage	Output voltage: 4.75 V or higher	Disable Pump Torque Decrease Control
11204-4	Abnormal Pump Delivery Pressure Sensor Low Voltage	Output voltage: Less than 0.25 V	Disable Pump Torque Decrease Control
11209-3	Abnormal Implement Pressure Sensor High Voltage	Output voltage: 4.75 V or higher	Disable Pump Torque Decrease Control
11209-4	Abnormal Implement Pressure Sensor Low Voltage	Output voltage: Less than 0.25 V	Disable Pump Torque Decrease Control

Symptoms in Machine Operation When Trouble Occurs	Remedy
As the pump is controlled by pump standard torque control, work efficiency of the front attachment becomes low. Fuel consumption becomes bad.	Retrial B Check Harness Replace Pump Delivery Pressure Sensor Replace MC
As the pump is controlled by pump standard torque control, work efficiency of the front attachment becomes low. Fuel consumption becomes bad.	Retrial B Check Harness Replace Pump Delivery Pressure Sensor Replace MC
As the pump is controlled by pump standard torque control, work efficiency of the front attachment becomes low. Fuel consumption becomes bad.	Retrial B Check Harness Replace Implement Pressure Sensor Replace MC
As the pump is controlled by pump standard torque control, work efficiency of the front attachment becomes low. Fuel consumption becomes bad.	Retrial B Check Harness Replace Implement Pressure Sensor Replace MC

Pilot Failure

Fault Code	Trouble	Cause	Influenced Control
11312-3	Abnormal Brake Pedal Pressure Sensor High Voltage	Voltage: 4.75 V or higher	Clutch Cut-Off Control
11312-4	Abnormal Brake Pedal Pressure Sensor Low Voltage	Voltage: Less than 0.25 V	Clutch Cut-Off Control
11313-3	Abnormal Parking Brake Pressure Sensor High Voltage	Output voltage: 4.75 V or higher	Parking Brake Indicator Control
11313-4	Abnormal Parking Brake Pressure Sensor Low Voltage	Output voltage: Less than 0.25 V	Parking Brake Indicator Control

Symptoms in Machine Operation When Trouble Occurs	Remedy
As clutch cut-off control is disabled, the clutch cut-off is inoperable. Fuel consumption becomes bad.	Retrial B Check Harness Replace Brake Pedal Pressure Sensor Replace MC
As clutch cut-off control is disabled, the clutch cut-off is inoperable. Fuel consumption becomes bad.	Retrial B Check Harness Replace Brake Pedal Pressure Sensor Replace MC
As the parking brake is forcibly released, the machine can travel with the parking brake switch ON.	Retrial B Check Harness Replace Parking Brake Pressure Sensor Replace MC
As the parking brake is forcibly released, the machine can travel with the parking brake switch ON.	Retrial B Check Harness Replace Parking Brake Pressure Sensor Replace MC

Proportional Solenoid Valve Failure

Fault Code	Trouble	Cause	Influenced Control
11412-2	Abnormal Feedback of Hydraulic Drive Fan Flow Rate Control Solenoid Valve	The feedback current to MC becomes the uncertain value	Hydraulic Drive Fan Cooling Control
11412-3	Abnormal Feedback High Current of Hydraulic Drive Fan Flow Rate Control Solenoid Valve	The feedback current to MC exceeds the upper limit	Hydraulic Drive Fan Cooling Control
11412-4	Abnormal Feedback Low Current of Hydraulic Drive Fan Flow Rate Control Solenoid Valve	While the command from MC is output, the feedback current to MC is 56 mA or less	Hydraulic Drive Fan Cooling Control
11413-2	Abnormal Feedback of Pump Torque Control Solenoid Valve	The feedback current to MC becomes the uncertain value	Pump Standard Torque Control
11413-3	Abnormal Feedback High Current of Pump Torque Control Solenoid Valve	The feedback current to MC exceeds the upper limit	Pump Standard Torque Control
11413-4	Abnormal Feedback Low Current of Pump Torque Control Solenoid Valve	While the command from MC is output, the feedback current to MC is 56 mA or less	Pump Standard Torque Control
11414-2	Abnormal Feedback of Transmission Clutch First Gear Proportional Solenoid Valve	The feedback current to MC becomes the uncertain value	All Transmission Control
11414-3	Abnormal Feedback High Current of Transmission Clutch First Gear Proportional Solenoid Valve	The feedback current to MC exceeds the upper limit	All Transmission Control

Symptoms in Machine Operation When Trouble Occurs	Remedy
As the fan rotation is kept at maximum, the machine starts slowly. Fuel consumption becomes bad.	Retrial B Check Harness (Feedback line from the flow rate control solenoid valve to MC) Replace Hydraulic Drive Fan Flow Rate Control Solenoid Valve Replace MC
As the fan rotation is kept at maximum, the machine starts slowly. Fuel consumption becomes bad.	Retrial B Check Harness (Feedback line from the flow rate control solenoid valve to MC) Replace Hydraulic Drive Fan Flow Rate Control Solenoid Valve Replace MC
As the fan rotation is kept at maximum, the machine starts slowly. Fuel consumption becomes bad.	Retrial B Check Harness (Feedback line from the flow rate control solenoid valve to MC) Replace Hydraulic Drive Fan Flow Rate Control Solenoid Valve Replace MC
As the pump is kept at minimum displacement, work efficiency of the front attachment becomes low.	Retrial B Check Harness (Feedback line from the torque control solenoid valve to MC) Replace Pump Torque Control Solenoid Valve Replace MC
As the pump is kept at minimum displacement, work efficiency of the front attachment becomes low.	Retrial B Check Harness (Feedback line from the torque control solenoid valve to MC) Replace Pump Torque Control Solenoid Valve Replace MC
As the pump is kept at minimum displacement, work efficiency of the front attachment becomes low.	Retrial B Check Harness (Feedback line from the torque control solenoid valve to MC) Replace Pump Torque Control Solenoid Valve Replace MC
As speed is kept at second gear in spite of the shift switch, there is some influence on the work.	Retrial B Check Harness (Feedback line from first gear proportional solenoid valve output to MC) Replace First Gear Proportional Solenoid Valve Replace MC
As speed is kept at second gear in spite of the shift switch, there is some influence on the work.	Retrial B Check Harness (Feedback line from first gear proportional solenoid valve output to MC) Replace First Gear Proportional Solenoid Valve Replace MC

Fault Code	Trouble	Cause	Influenced Control
11414-4	Abnormal Feedback Low Current of Transmission Clutch First Gear Proportional Solenoid Valve	The feedback current to MC is 20 mA or less	All Transmission Control
11415-2	Abnormal Feedback of Transmission Clutch Second Gear Proportional Solenoid Valve	The feedback current to MC becomes the uncertain value	All Transmission Control
11415-3	Abnormal Feedback High Current of Transmission Clutch Second Gear Proportional Solenoid Valve	The feedback current to MC exceeds the upper limit	All Transmission Control
11415-4	Abnormal Feedback Low Current of Transmission Clutch Second Gear Proportional Solenoid Valve	The feedback current to MC is 20 mA or less	All Transmission Control
11416-2	Abnormal Feedback of Transmission Clutch Third Gear Proportional Solenoid Valve	The feedback current to MC becomes the uncertain value	All Transmission Control
11416-3	Abnormal Feedback High Current of Transmission Clutch Third Gear Proportional Solenoid Valve	The feedback current to MC exceeds the upper limit	All Transmission Control
11416-4	Abnormal Feedback Low Current of Transmission Clutch Third Gear Proportional Solenoid Valve	The feedback current to MC is 20 mA or less	All Transmission Control
11417-2	Abnormal Feedback of Transmission Clutch Fourth Gear Proportional Solenoid Valve	The feedback current to MC becomes the uncertain value	All Transmission Control

Symptoms in Machine Operation When Trouble Occurs	Remedy
As speed is kept at second gear in spite of the shift switch, there is some influence on the work.	Retrial B Check Harness (Feedback line from first gear proportional solenoid valve output to MC) Replace First Gear Proportional Solenoid Valve Replace MC
As speed is kept at first gear in spite of the shift switch, there is some influence on the work.	Retrial B Check Harness (Feedback line from second gear proportional solenoid valve output to MC) Replace Second Gear Proportional Solenoid Valve Replace MC
As speed is kept at first gear in spite of the shift switch, there is some influence on the work.	Retrial B Check Harness (Feedback line from second gear proportional solenoid valve output to MC) Replace Second Gear Proportional Solenoid Valve Replace MC
As speed is kept at first gear in spite of the shift switch, there is some influence on the work.	Retrial B Check Harness (Feedback line from second gear proportional solenoid valve output to MC) Replace Second Gear Proportional Solenoid Valve Replace MC
As speed is kept at second gear in spite of the shift switch, there is some influence on the work.	Retrial B Check Harness (Feedback line from third gear proportional solenoid valve output to MC) Replace Third Gear Proportional Solenoid Valve Replace MC
As speed is kept at second gear in spite of the shift switch, there is some influence on the work.	Retrial B Check Harness (Feedback line from third gear proportional solenoid valve output to MC) Replace Third Gear Proportional Solenoid Valve Replace MC
As speed is kept at second gear in spite of the shift switch, there is some influence on the work.	Retrial B Check Harness (Feedback line from third gear proportional solenoid valve output to MC) Replace Third Gear Proportional Solenoid Valve Replace MC
As speed is kept at second gear in spite of the shift switch, there is some influence on the work.	Retrial B Check Harness (Feedback line from fourth gear proportional solenoid valve output to MC) Replace Fourth Gear Proportional Solenoid Valve Replace MC

Fault Code	Trouble	Cause	Influenced Control
11417-3	Abnormal Feedback High Current of Transmission Clutch Fourth Gear Proportional Solenoid Valve	The feedback current to MC exceeds the upper limit	All Transmission Control
11417-4	Abnormal Feedback Low Current of Transmission Clutch Fourth Gear Proportional Solenoid Valve	The feedback current to MC is 20 mA or less	All Transmission Control
11418-2	Abnormal Feedback of Transmission Clutch Forward Proportional Solenoid Valve	The feedback current to MC becomes the uncertain value	All Transmission Control
11418-3	Abnormal Feedback High Current of Transmission Clutch Forward Proportional Solenoid Valve	The feedback current to MC exceeds the upper limit	All Transmission Control
11418-4	Abnormal Feedback Low Current of Transmission Clutch Forward Proportional Solenoid Valve	The feedback current to MC is 20 mA or less	All Transmission Control
11419-2	Abnormal Feedback of Transmission Clutch Reverse Proportional Solenoid Valve	The feedback current to MC becomes the uncertain value	All Transmission Control
11419-3	Abnormal Feedback High Current of Transmission Clutch Reverse Proportional Solenoid Valve	The feedback current to MC exceeds the upper limit	All Transmission Control
11419-4	Abnormal Feedback Low Current of Transmission Clutch Reverse Proportional Solenoid Valve	The feedback current to MC is 20 mA or less	All Transmission Control

Symptoms in Machine Operation When Trouble Occurs	Remedy
As speed is kept at second gear in spite of the shift switch, there is some influence on the work.	Retrial B Check Harness (Feedback line from fourth gear proportional solenoid valve output to MC) Replace Fourth Gear Proportional Solenoid Valve Replace MC
As speed is kept at second gear in spite of the shift switch, there is some influence on the work.	Retrial B Check Harness (Feedback line from fourth gear proportional solenoid valve output to MC) Replace Fourth Gear Proportional Solenoid Valve Replace MC
As speed is kept at second gear in spite of the shift switch, there is some influence on the work.	Retrial B Check Harness (Feedback line from forward proportional solenoid valve output to MC) Replace Forward Proportional Solenoid Valve Replace MC
As speed is kept at second gear in spite of the shift switch, there is some influence on the work.	Retrial B Check Harness (Feedback line from forward proportional solenoid valve output to MC) Replace Forward Proportional Solenoid Valve Replace MC
As speed is kept at second gear in spite of the shift switch, there is some influence on the work.	Retrial B Check Harness (Feedback line from forward proportional solenoid valve output to MC) Replace Forward Proportional Solenoid Valve Replace MC
As speed is kept at second gear in spite of the shift switch, there is some influence on the work.	Retrial B Check Harness (Feedback line from reverse proportional solenoid valve output to MC) Replace Reverse Proportional Solenoid Valve Replace MC
As speed is kept at second gear in spite of the shift switch, there is some influence on the work.	Retrial B Check Harness (Feedback line from reverse proportional solenoid valve output to MC) Replace Reverse Proportional Solenoid Valve Replace MC
As speed is kept at second gear in spite of the shift switch, there is some influence on the work.	Retrial B Check Harness (Feedback line from reverse proportional solenoid valve output to MC) Replace Reverse Proportional Solenoid Valve Replace MC

Transmission Failure

Fault Code	Trouble	Cause	Influenced Control
11600-3	Abnormal Travel Speed Sensor	The abnormal value below is detected with the clutch connected. • Travel speed sensor=0 min^{-1} • Middle shaft sensor>300 min^{-1} • Torque converter output speed sensor>500 min^{-1} • Detected voltage under the open circuit with key ON: 4.5 V or higher	All Transmission Control
11600-4	Abnormal Low Voltage of Travel Speed Sensor	Detected voltage under the shorted circuit with key ON: Less than 1.5 V	All Transmission Control
11601-3	Abnormal Torque Converter Output Speed Sensor	The abnormal value below is detected with the clutch connected. • Torque converter output speed sensor=0 min^{-1} • Middle shaft sensor>300 min^{-1} • Travel speed sensor>300 min^{-1}	Pump Torque Decrease Control
11602-3	Abnormal Transmission Middle Shaft Sensor	The abnormal value below is detected with the clutch connected. • Middle shaft sensor =0 min^{-1} • Travel speed sensor>500 min^{-1} • Torque converter output speed sensor>500 min^{-1}	All Transmission Control
11904-2	Abnormal Forward/Reverse Lever	The forward/reverse signals are turned ON for 80 ms or longer at the same time.	All Transmission Control
11905-2	Abnormal Forward/Reverse Switch	The forward/reverse signals are turned ON for 80 ms or longer at the same time.	All Transmission Control

Symptoms in Machine Operation When Trouble Occurs	Remedy
As travel speed is calculated at the middle shaft sensor, there is no influence on the machine. Travel speed moves over about 2 km/h when shifting the gears.	Retrial B Check Harness Replace Travel Speed Sensor Replace MC
As travel speed is calculated at the middle shaft sensor, there is no influence on the machine. Travel speed moves over about 2 km/h when shifting the gears.	Retrial B Check Harness Replace Travel Speed Sensor
As travel speed rate becomes 0, torque decrease control is disabled and base torque control is operable. Work efficiency and fuel consumption may become bad. There may be some shock when shifting the gears.	Retrial B Check Harness Replace Torque Converter Output Speed Sensor Replace MC
As backup travel speed calculation is disabled, travel speed is not displayed in case of the abnormal travel speed sensor.	Retrial B Check Harness Replace Transmission Middle Shaft Sensor Replace MC
As the forward/reverse lever is forcibly turned to neutral in case of the abnormal forward/reverse lever, the machine cannot start.	Retrial B Check Harness Replace Forward/Reverse Lever Replace MC
The forward/reverse lever only is operable in case of the abnormal forward/reverse switch.	Retrial B Check Harness Replace Forward/Reverse Switch Replace MC

CAN Data Reception Failure

Fault Code	Trouble	Cause	Influenced Control
11910-2	Actual Engine Speed Receive Error Received from ECM	Faulty Harness Faulty ECM	Transmission Control (Error judgment of engine pulse sensor)
11914-2	Radiator Coolant Temperature Receive Error Received from Monitor Unit	Faulty Harness Faulty Monitor Unit	Hydraulic Drive Fan Cooling Control
11920-2	Fuel Flow Rate Receive Error Received from ECM	Faulty Harness Faulty ECM	

Symptoms in Machine Operation When Trouble Occurs	Remedy
Error of the torque converter input speed sensor cannot be judged.	Retrial B Check CAN Communication Line Replace Engine Speed Sensor Replace MC
As the fan rotation is always kept at maximum, the machine starts slowly. Fuel consumption becomes bad.	Retrial B Check CAN Communication Line Replace Monitor Unit Replace MC
The fuel consumption is not displayed on the monitor.	Retrial B Check CAN Communication Line Replace ECM Replace MC

Other Failures

Fault Code	Trouble	Cause	Influenced Control
11901-3	Hydraulic Oil Temperature Sensor High Voltage	Voltage: 4.52 V or higher	Auto-Warming Up Control Hydraulic Drive Fan Cooling Control
11901-4	Hydraulic Oil Temperature Sensor Low Voltage	Voltage: Less than 0.23 V	Auto-Warming Up Control Hydraulic Drive Fan Cooling Control

Symptoms in Machine Operation When Trouble Occurs	Remedy
When temperature is low (hydraulic oil temperature is 0 °C (32 °F) or less), the auto-warming up control is inoperable. Fuel consumption becomes bad. The hydraulic oil temperature calculating part is kept at maximum.	Retrial B Check Harness Replace Hydraulic Oil Temperature Sensor Replace MC
When temperature is low (hydraulic oil temperature is 0 °C (32 °F) or less), the auto-warming up control is inoperable. Fuel consumption becomes bad. The hydraulic oil temperature calculating part is kept at maximum.	Retrial B Check Harness Replace Hydraulic Oil Temperature Sensor Replace MC

ECM FAULT CODE LIST

Sensor System

Fault Code	Trouble	Cause
636-2	Abnormal Cam Angle Sensor (No Signal)	Although the crank signal is present, the cam signal is not present.
636-2	Abnormal Cam Angle Sensor (Abnormal Signal)	The pulse of cam signal is not matched.
723-2	Abnormal Crank Speed Sensor (No Signal)	Although the cam signal is present, the crank signal is not present.
723-2	Abnormal Crank Speed Sensor (Abnormal Signal)	The pulse of crank signal is not matched.
636-7	Phase Mismatch of Cam Angle Sensor	The right cam pulse is not present at the gap in the crank.
172-3	Abnormal Intake-Air Temperature Sensor (Abnormal High Voltage)	Voltage at the intake-air temperature sensor is beyond 4.95 V in 3 minutes after the engine starts.
172-4	Abnormal Intake-Air Temperature Sensor (Abnormal Low Voltage)	Voltage at the intake-air temperature sensor is below 0.1 V.
110-3	Abnormal Coolant Temperature Sensor (Abnormal High Voltage)	Voltage at the coolant temperature sensor is beyond 4.85 V in 3 minutes after the engine starts.
110-4	Abnormal Coolant Temperature Sensor (Abnormal Low Voltage)	Voltage at the coolant temperature sensor is below 0.1 V.
102-4	Abnormal Boost Pressure Sensor (Abnormal High Voltage)	Voltage at the boost pressure sensor is beyond 4.9 V.
102-3	Abnormal Boost Pressure Sensor (Abnormal Low Voltage)	Voltage at the boost pressure sensor is below 0.1 V
10001-3	Abnormal EGR Position (Brushless spec.)	The condition which the output signal of EGR position cannot be present in.
108-4	Abnormal Atmospheric Pressure Sensor (Abnormal High Voltage)	Voltage at the atmospheric pressure sensor is beyond 3.8 V.
108-3	Abnormal Atmospheric Pressure Sensor (Abnormal Low Voltage)	Voltage at the atmospheric pressure sensor is below 0.5 V.
174-3	Abnormal Fuel Temperature Sensor (Abnormal High Voltage)	Voltage at the fuel temperature sensor is beyond 4.85 V in 3 minutes after the engine starts.
174-4	Abnormal Fuel Temperature Sensor (Abnormal Low Voltage)	Voltage at the fuel temperature sensor is below 0.1 V.

Presumptive Symptoms in Real Machine Operation	Assumptive Conditions at Backup	Fault Code (Tech 2)
While the engine runs, there is nothing abnormal with machine operation. After the engine is stalled, the re-start is impossible.	While the engine runs, operate according to standard of the crank sensor. When the engine stops, the start is impossible (in order to prevent the engine from damaging).	P0340 P0341
The output power may decrease, white smoke may occur and vibration may occur. The engine may be stalled. (If the cam senor is normal, the engine can re-start.)	Operate according to standard of the cam sensor.	P0335 P0336
While the engine runs, there is nothing abnormal with machine operation. After the engine is stalled, the re-start is impossible.	The timing chain and the belt does not turn smoothly but turn in reverse.	P1345
Nothing special	When starting: -10 °C (14 °F) (Start the engine although what state.) When operating: 25 °C (77 °F) (Operate normally.)	P0113 P0112
Normal temperature: When starting, dark smoke may occur and engine combustion sound may become loud. While warming up with fresh air in low temperature: Rough idle, engine stall or while smoke may occur.	When starting: -20 °C (-4 °F) (Start the engine although what state.) When operating: 80 °C (176 °F) (Operate normally.)	P0118 P0117
Dark smoke occurs.	Boost pressure cannot be corrected.	P0238 P0237
There is influence to exhaust gas.	As the sensor input is not certain, it cannot be controlled. Exhaust gas becomes bad. Operate the engine with EGR valve fully close.	P0487
Dark smoke occurs at high altitude.	Atmospheric pressure 80 kPa (0.8 kgf/cm^2, 12 psi) (2000 m above the sea)	P0108 O0107
Nothing special	When starting: -20 °C (-4 °F) (Start the engine although what state.) When operating: 70 °C (158 °F) (Operate normally.)	P0183 P0182

Fault Code	Trouble	Cause
157-3	Abnormal Common Rail Pressure Sensor (Abnormal High Voltage)	Voltage at the common rail pressure sensor is beyond 4.5 V.
157-4	Abnormal Common Rail Pressure Sensor (Abnormal Low Voltage)	Voltage at the common rail pressure sensor is below 0.7 V.
100-4	Abnormal Engine Oil Pressure Sensor (Abnormal High Voltage)	Voltage at the engine oil pressure sensor is beyond 4.85 V.
100-3	Abnormal Engine Oil Pressure Sensor (Abnormal Low Voltage)	Voltage at the engine oil pressure sensor is below 0.1 V.
105-3	Abnormal Boost Temperature Sensor (Abnormal High Voltage)	Voltage at the boost temperature sensor is beyond 4.95 V over 5 minutes after the engine starts or when coolant temperature is beyond 50 °C (122 °F).
105-4	Abnormal Boost Temperature Sensor (Abnormal Low Voltage)	Voltage at the boost temperature sensor is below 0.1 V.

Presumptive Symptoms in Real Machine Operation	Assumptive Conditions at Backup	Fault Code (Tech 2)
The engine may be stalled. The output power decreases.	The supply pump can not be controlled.	P0193
		P0192
There is no influence when operating the machine.	Nothing special	P0523
		P0522
There is no influence when operating the machine.	Nothing special	P1113
		P1112

Fault Code	Trouble	Influence to Engine Performance (Presumption)	Operating Rank (Current State)				Remark
			A	B	C	D	
636-2	Abnormal Cam Angle Sensor (No Signal)	No influence during operation After stopping, the re-start is impossible.	○			○	
636-2	Abnormal Cam Angle Sensor (Abnormal Signal)		○			○	
723-2	Abnormal Crank Speed Sensor (No Signal)	No output power decrease	○				
723-2	Abnormal Crank Speed Sensor (Abnormal Signal)		○				
636-7	Phase Mismatch of Cam Angle Sensor	No influence during operation After stopping, the re-start is impossible.	○			○	
172-3	Abnormal Intake-Air Temperature Sensor (Abnormal High Voltage)	No output power decrease	○				
172-4	Abnormal Intake-Air Temperature Sensor (Abnormal Low Voltage)		○				
110-3	Abnormal Coolant Temperature Sensor (Abnormal High Voltage)	No output power decrease	○				
110-4	Abnormal Coolant Temperature Sensor (Abnormal Low Voltage)		○				
102-4	Abnormal Boost Pressure Sensor (Abnormal High Voltage)	No output power decrease	○				
102-3	Abnormal Boost Pressure Sensor (Abnormal Low Voltage)		○				
10001-3	Abnormal EGR Position (Brushless spec.)	No output power change	○				
108-4	Abnormal Atmospheric Pressure Sensor (Abnormal High Voltage)	No output power decrease	○				
108-3	Abnormal Atmospheric Pressure Sensor (Abnormal Low Voltage)		○				
174-3	Abnormal Fuel Temperature Sensor (Abnormal High Voltage)	No output power decrease	○				
174-4	Abnormal Fuel Temperature Sensor (Abnormal Low Voltage)		○				
157-3	Abnormal Common Rail Pressure Sensor (Abnormal High Voltage)	Output power decrease: 70%			○		
157-4	Abnormal Common Rail Pressure Sensor (Abnormal Low Voltage)				○		

Fault Code	Trouble	Influence to Engine Performance (Presumption)	Operating Rank (Current State)				Remark
			A	B	C	D	
100-4	Abnormal Engine Oil Pressure Sensor (Abnormal High Voltage)	No output power change	○				
100-3	Abnormal Engine Oil Pressure Sensor (Abnormal Low Voltage)		○				
105-3	Abnormal Boost Temperature Sensor (Abnormal High Voltage)		○				
105-4	Abnormal Boost Temperature Sensor (Abnormal Low Voltage)		○				

Operating Rank
A: Digging and travel are operable. (A few performance decreases may occur.)
B: Machine can travel on flat and downward slope.
C: The engine can stop / start.
D: The engine cannot stop / start.

IMPORTANT: When fault code 723-2 (abnormal crank speed sensor) is displayed and the engine does not start, the cam angle sensor is faulty although fault codes 636-2 (abnormal cam angle sensor) and 636-7 (phase mismatch of cam angle sensor) are not displayed.

External Device System

Fault Code	Trouble	Cause
10002-2	Abnormal EGR valve control	Difference between the target valve lift and actual position is beyond 20%.
1347-0	Open circuit in suction control valve drive system, Shorted circuit in + B or GND	The suction control valve drive current is beyond 2400 mA or below 50 mA. Or, difference between the tartget current and actual current is 1000 mA or more.
651-3	Open circuit in injection nozzle ＃1 drive system	No monitor input signal of injector 1.
652-3	Open circuit in injection nozzle ＃2 drive system	No monitor input signal of injector 2.
653-3	Open circuit in injection nozzle ＃3 drive system	No monitor input signal of injector 3.
654-3	Open circuit in injection nozzle #4 drive system	No monitor input signal of injector 4.
655-3	Open circuit in injection nozzle ＃5 drive system	No monitor input signal of injector 5.
656-3	Open circuit in injection nozzle ＃6 drive system	No monitor input signal of injector 6.
987-3	Abnormal check engine lamp	No monitor signal of the check engine lamp
1485-2	Abnormal main relay system	Voltage in the main relay system is 1 V or less with the main relay coil output ON.
		Although the main relay coil output is turned OFF, the main relay is kept ON.

Presumptive Symptoms in Real Machine Operation	Assumptive Conditions at Backup	Fault Code (Tech 2)
There is influence to exhaust gas.	EGR cannot be controlled. As exhaust gas becomes bad, EGR stops.	P0488
The engine may be stalled and the rotation speed increases automatically and abnormally according to open or shorted circuitc ondition. Dark smoke occurs. Output power is too large.	The supply pump cannot be controlled. → Prevent the engine from increasing the rotation speed automatically and abnormally (Protect the engine).	P0090
Vibration of the engine is large, Rough idle, output power decrease, faulty increasing of rotation speed, output power decrease	#1 injector cannot be controlled. → Stop drive pulse output of #1 injector.	P0201
	#2 injector cannot be controlled. → Stop drive pulse output of #2 injector.	P0202
	#3 injector cannot be controlled. → Stop drive pulse output of #3 injector.	P0203
	#4 injector cannot be controlled. → Stop drive pulse output of #4 injector.	P0204
	#5 injector cannot be controlled. → Stop drive pulse output of #5 injector.	P0205
	#6 injector cannot be controlled. → Stop drive pulse output of #6 injector.	P0206
There is no influence when operating the machine.	Nothing special	P0650
The engine cannot start.	Nothing	P1625
Electrical power is kept supplying to the machine.	Nothing	

Fuel System

Fault Code	Trouble	Cause
157-0	Abnormal common rail pressure (First stage)	Common rail pressure is beyond 185 Mpa (1887 kgf/cm^2, 26895 psi).
157-0	Abnormal commo rail pressure (Second stage)	The first stage “Abnormal common rail presure” is approve and common rail pressure is beyond 190 Mpa (1938 kgf/cm^2, 27622 psi)..
157-2	Abnormal common rail pressure (Pump over-pressure)	When DUTY to the suction control valve is 40 % or more, or target pressure to the suction control valve is 90 mm^3/sec or less, actual rail pressure is 40 MPa (410 kgf/cm^2, 5820 psi) higher than the target rail pressure.
633-7	Pressure limiter open	The pressure limiter is open.
1239-1	No pressure to pump (Fuel leakage)	When pressure to the suction control valve is 900 min^{-1} (900 rpm) or more, actual rail pressure is 15Mpa (150 kgf/cm^2, 2180 psi) or less.

Presumptive Symptoms in Real Machine Operation	Assumptive Conditions at Backup	Fault Code (Tech 2)
Vibration of the engine may be large, Rough idle, output power decrease may occur, faulty increasing of rotation speed, dark smoke may occur, output power may be too large.	Prevention the injection system (pump) from damage (Protect the RP sensor by over-pressure)	P0088
Vibration of the engine may be large, Rough idle, output power decrease may occur, faulty increasing of rotation speed, dark smoke may occur, output power may be too large.	Prevention the injection system from damage (Pressure is too much as PR is clogged.)	P0088
Vibration of the engine may be large, Rough idle, output power decrease may occur, faulty increasing of rotation speed, dark smoke may occur, output power may be too large.	Prevention the injection system (pump) from damage (Protect the RP sensor by over-pressure)	P0089
Output power decrease	Rial pressure is beyond the allowable pressure.	P1095
Vibration of the engine may be large, Rough idle, output power decrease may occur, faulty increasing of rotation speed, dark smoke may occur, output power may be too large.	Fuel leakage is too much. Actual rail pressure does not increase to the required pressure.	P0087 P1093

Fault Code	Trouble	Influence to Engine Performance (Presumption)	Operating Rank (Current)				Remark
			A	B	C	D	
10002-2	Abnormal EGR valve control	No output power change	○				
1347-0	Open circuit in suction control valve drive system, Shorted circuit in + B or GND Open circuit in PCV1 drive system, shorted circuit in GND	Output power decrease: 50%		○			
651-3	Open circuit in injection nozzle ＃1 drive system	Output power decrease: 15% (Five cylinders drive.)		○			
652-3	Open circuit in injection nozzle ＃2 drive system			○			
653-3	Open circuit in injection nozzle ＃3 drive system			○			
654-3	Open circuit in injection nozzle ＃4 drive system			○			
655-3	Open circuit in injection nozzle ＃5 drive system			○			
656-3	Open circuit in injection nozzle ＃6 drive system			○			
987-3	Abnormal check engine lamp	No output power change	○				
1485-2	Abnormal main relay system	The engine stops.				○	
		Nothing (The engine cannot re-start according to battery voltage.)	○			○	

Fault Code	Trouble	Influence to Engine Performance (Presumption)	Operating Rank (Current)				Remark
			A	B	C	D	
157-0	Abnormal common rail pressure (First stage)	Output power decrease: 50%		○			
157-0	Abnormal common rail pressure (Second stage)	Output power decrease: 50%		○			
157-2	Abnormal common rail pressure (Pump over-pressure)	Output power decrease: 50%		○			
633-7	Pressure limiter open	Output power decrease: 50%		○			
1239-1	No pressure to pump (Fuel leakage)			○			

Operating Rank
A: Digging and travel are operable. (A few performance decreases may occur.)
B: Machine can travel on flat and downward slope.
C: The engine can stop / start.
D: The engine cannot stop / start.

(Blank)

Engine Protection System

Fault Code	Trouble	Cause
110-0	Overheating	Coolant temperature is beyond 120 °C (248 °F) when operating the engine.
190-0	Overrunning	In case the engine speed is beyond 2500 min^{-1} (2500 rpm)

Presumptive Symptoms in Real Machine Operation	Assumptive Conditions at Backup	Fault Code (Tech 2)
There is no influence when operating the machine.	Nothing special (The history of overheating is recorded.)	P1173
Engine speed of the wheel loader may not increase 2500 min^{-1} (2500 rpm) or more.	Mistake of gear change, etc.	P0219

Fault Code	Trouble	Influence to Engine Performance (Presumption)	Operating Ranke (Current)				Remark
			A	B	C	D	
110-0	Overheating	No output power change	○				
190-0	Overrunning	No output power decrease	○				

Operating Rank
A: Digging and travel are operable. (A few performance decreases may occur.)
B: Machine can travel on flat and downward slope.
C: The engine can stop / start.
D: The engine cannot stop / start.

(Blank)

Internal Circuit System

Fault Code	Trouble	Cause
10005-1	Abnormal Charge Circuit (Bank 1)	In case voltage at bank 1 of charge circuit in ECM is low
10006-1	Abnormal Charge Circuit (Bank 2)	In case voltage at bank 2 of charge circuit in ECM is low
10008-2	Abnormal A/D Converter (Analog to Digital)	A/D conversion (analog to digital) cannot be done.
10007-2	Abnormal CPU	Within 100 msec after the key switch is turned ON, failure of main CPU is detected by sub CPU. (Sub CPU resets CPU.)→CPU is recovered.
		Within 100 msec after the key switch is turned ON, failure of main CPU is detected by sub CPU. (Sub CPU resets CPU.)→CPU is not recovered.
1077-2	Abnormal IC for CPU Watching	No change of RUN-SUB pulse in 20 msec
628-2	Abnormal ROM	ROM is broken.
10013-2	Abnormal EEPROM	EEPROM is broken.
1079-2	Abnormal 5 V Power Source 1 Voltage	When battery voltage is between 16 V and 32 V, voltage of IGKEY power source is 5.5 V or more or 4.5 V or less.
1080-2	Abnormal 5 V Power Source 2 Voltage	When battery voltage is between 16 V and 32 V, voltage of IGKEY power source is 5.5 V or more or 4.5 V or less.
10009-2	Abnormal 5 V Power Source 3 Voltage	When battery voltage is between 16 V and 32 V, voltage of IGKEY power source is 5.5 V or more or 4.5 V or less.
10010-2	Abnormal 5 V Power Source 4 Voltage	When battery voltage is between 16 V and 32 V, voltage of IGKEY power source is 5.5 V or more or 4.5 V or less.
10011-2	Abnormal 5 V Power Source 5 Voltage	When battery voltage is between 16 V and 32 V, voltage of IGKEY power source is 5.5 V or more or 4.5 V or less.
10003-2	Abnormal Injection Nozzle Common 1 Drive System	No monitor input signals of injectors 1, 3, 5
10004-2	Abnormal Injection Nozzle Common 2 Drive System	No monitor input signals of injectors 2, 4, 6

Presumptive Symptoms in Real Machine Operation	Assumptive Conditions at Backup	Fault Code (Tech 2)
Vibration of the engine may be large, Rough idle, output power decrease may occur, faulty increasing of rotation speed may occur, the engine may be stalled.	The injector cannot be controlled. → Stop output of drive signal at broken common side (Protect the engine from damage)	P0611 P0612
Output power decrease, dark smoke occurs.	All analogue sensor cannot be used.	P1630
Output power decrease	CPU is broken.	P0606
The engine cannot start.		P0606
Output power decrease	Sub CPU is broken.	P0606
The engine stops.	Data of ROM cannot be read.	P1601
There is no influence when operating the machine.	Data cannot be written to EEPROM.	P1603
Same as Abnormal accelerator sensor	←	P1631
Same as Abnomal atmospheric and in-take temperature sensors	←	P1632
Same as Abnomal coolant temperature, fuel temperature and hydraulic oil pressure sensors	←	P1633
Same as Abnomal boost pressure and boost temperature sensors	←	P1634
Same as Abnomal rail pressure and EGR position sensors	←	P1635
Vibration of the engine may be large, Rough idle, output power decrease may occur, faulty increasing of rotation speed may occur, the engine may be stalled.	The injector cannot be controlled. → Stop output of drive signal at broken common side (Protect the engine from damage)	P1261 P1262

Fault Code	Trouble	Influence to Engine Performance (Presumption)	Operating Rank (Current)				Remark
			A	B	C	D	
10005-1	Abnormal Charge Circuit (Bank 1)	Output power decrease: 60% (Three cylinders drive.)		○	○		
10006-1	Abnormal Charge Circuit (Bank 2)			○	○		
10008-2	Abnormal A/D Converter	Output power decrease: 50%		○			
10007-2	Abnormal CPU	Output power decrease: 50%		○			
		The engine cannot start.				○	
1077-2	Abnormal IC for CPU watching	Output power decrease: 50%		○			
628-2	Abnormal ROM	The engine stops.				○	
10013-2	Abnormal EEPROM	No output power decrease	○				
1079-2	Abnormal 5 V Power Source 1 Voltage	Idle speed operation	○				
1080-2	Abnormal 5 V Power Source 2 Voltage	No output power decrease	○				
10009-2	Abnormal 5 V Power Source 3 Voltage	No output power change	○				
10010-2	Abnormal 5 V Power Source 4 Voltage	No output power decrease	○				
10011-2	Abnormal 5 V Power Source 5 Voltage	Output power decrease: 50%		○	○		
10003-2	Abnormal Injection Nozzle Common 1 Drive System	Output power decrease: 60% (Three cylinders drive.)		○	○		
10004-2	Abnormal Injection Nozzle Common 2 Drive System			○	○		

Operating Rank
A: Digging and travel are operable. (A few performance decreases may occur.)
B: Machine can travel on flat and downward slope.
C: The engine can stop / start.
D: The engine cannot stop / start.

(Blank)

Communication System

Fault Code	Trouble	Cause
639-2	Abnormal CAN Bus Line	Detect the bus line off.
639-3	Abnormal CAN Time Out	In case the CAN data reception is not approved in prescribedtime

Presumptive Symptoms in Real Machine Operation	Assumptive Conditions at Backup	Fault Code (Tech 2)
Speed is turnd into idle speed.	CAN communication is inoperable.	U2104
		U2106

Fault Code	Trouble	Influence to Engine Performance (Presumption)	Operating Rank (Current)				Remark
			A	B	C	D	
639-2	Abnormal CAN Bus Line	Idle speed	○				
639-3	Abnormal CAN Time Out		○				

Operating Rank

A: Digging and travel are operable. (A few performance decreases may occur.)

B: Machine can travel on flat and downward slope.

C: The engine can stop / start.

D: The engine cannot stop / start.

(Blank)

ICF FAULT CODE LIST

Fault Code	Trouble	Cause
14000-2	Abnormal CAN Communication	Data cannot be received due to the noise on the CAN bus line.
14001-2	ICF: Flash Memory: Read / Write Error	In case the internal memory is abnormal when the key is turned ON
14002-2	ICF: External RAM: Read / Write Error	In case the internal memory is abnormal when the key is turned ON
14003-2	ICF: EEPROM: Sum Check Error	In case the internal memory is abnormal when the key is turned ON
14006-2	ICF: Satellite Communication Terminal: Communication Error	In case communication to the satellite terminal cannot be done over 30 seconds.
14008-2	ICF: Abnormal Internal RAM	In case the internal memory is abnormal when the key is turned ON

Remedy
If trouble is not resolved after retrial B, check for CAN communication bus line.
After initializing the information C/U by using Dr. ZX, re-try in the troubleshooting. If the error code is displayed after re-try, ICF may be broken. Replace ICF. *NOTE: When initialising the information C/U, all stored data is deleted.*
After initializing the information C/U by using Dr. ZX, re-try in the troubleshooting. If the error code is displayed after re-try, ICF may be broken. Replace ICF. *NOTE: When initialising the information C/U, all stored data is deleted.*
If trouble is not resolved after retrial B, ICF may be broken. Replace ICF.
Check for the items below. 1. Retrial B. 2. Check if the communication line is abnormal. 3. Check if the electrical power source of communication terminal is abnormal. ・Electrical power source ・Fuses 3. Check if the satellite terminal is broken.
Re-try in the troubleshooting by using Dr.ZX. If the error code is displayed after re-try, ICF may be broken. Replace ICF.

SATELLITE TERMINAL FAULT CODE LIST

Fault Code	Trouble	Cause
14100-2	Satellite Communication Terminal: Abnormal EEPROM	In case internal memory is abnormal
14101-2	Satellite Communication Terminal: Abnormal IB/OB Queue	In case internal memory is abnormal
14102-2	Satellite Communication Terminal: Abnormal Local Loup Back	In case data cannot be received from the satellite terminal
14103-2	Satellite Communication Terminal: The satellite is not found.	In case the satellite terminal cannot be acquired
14104-2	Satellite Communication Terminal: Fail 1 of Remote Loup Back	In case communication to the satellite terminal base cannot be done
14105-2	Satellite Communication Terminal: Fail 2 of Remote Loup Back	In case communication to the satellite terminal base cannot be done
14106-2	Satellite Communication Terminal: Sending and receiving data are unmatched.	In case sending and receiving data are unmatched

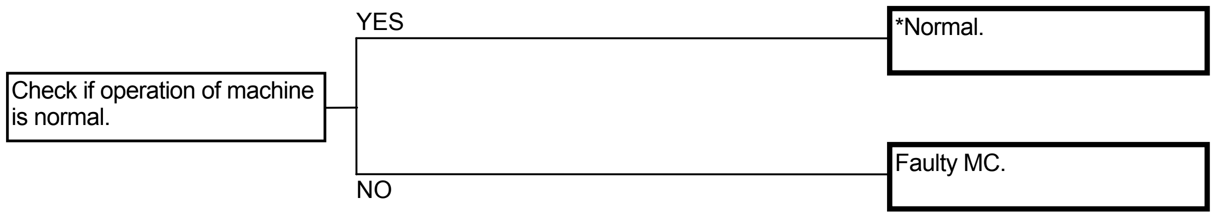
Remedy
Retrial B. Replace the ICF controller.
Retrial B. Replace the ICF controller.
Retrial B. Check the communication aerial. Replace the ICF controller.
Retrial B. Check the communication aerial. Replace the ICF controller.
Retrial B. Replace the ICF controller.
Retrial B. Replace the ICF controller.
Retrial B. Replace the ICF controller.

MONITOR UNIT FAULT CODE LIST

Fault Code	Trouble	Cause
13306-2	Abnormal EEPROM	When failure reading EEPROM occurs
13308-2	Abnormal CAN Communication	Bus off occurs beyond five times
13312-2	Abnormal Transmission Oil Temperature Sensor	Shorted ground circuit in the transmission oil temperature sensor
13314-3	Service Brake Pressure Sensor High Voltage	Voltage at the signal line in service brake pressure sensor: 4.75 V or higher
13314-4	Service Brake Pressure Sensor Low Voltage	Voltage at the signal line in service brake pressure sensor: 0.25 or less

CONTROLLER HARDWARE FAILURE
MC FAULT CODES 11000 to 11002

Fault Code	Trouble	Cause	Influenced Control
11000-2	Abnormal EEPROM	Faulty MC	All Control
11001-2	Abnormal RAM	Faulty MC	All Control
11002-2	Abnormal A/D Converter	Faulty MC	All Control



* When the fault code is displayed in the result of retrial and If operation of engine or machine is normal, the machine can be used.

MC FAULT CODE 11003

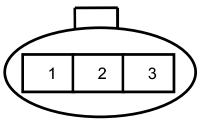
Fault Code	Trouble	Cause	Influenced Control
11003-3	Abnormal Sensor Voltage	Shorted circuit in harness Faulty sensor Faulty MC	All Control

Disconnect connectors of all sensors corresponding to the displayed fault code and connector monitor-1B in monitor unit. Retry. Check if fault code 11003-3 disappears.

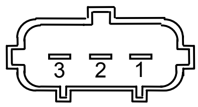
- YES → Faulty any sensors.
- NO → Disconnect all connectors at MC end. Check for continuity between terminals #1 and #3 of harness end connector of each sensor to MC, terminal #1 and vehicle frame. Check for continuity between terminals #27 and #32 of connector monitor-1B in monitor unit, each terminal #27, #28, #29, #30 or #31 and vehicle frame.
  · Key switch: OFF
  - YES → Shorted circuit in harness with continuity.
  - NO → Faulty MC or faulty monitor unit.

Connector (Harness end of connector viewed from the open end side)

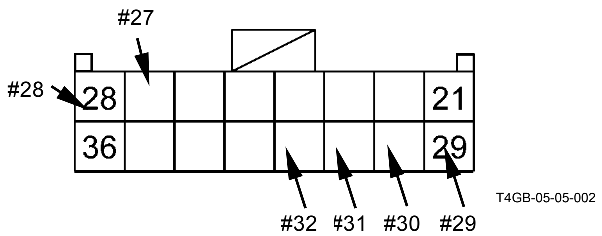
- Parking Brake Pressure Sensor



- Pump Delivery Pressure Sensor
- Implement Pressure Sensor

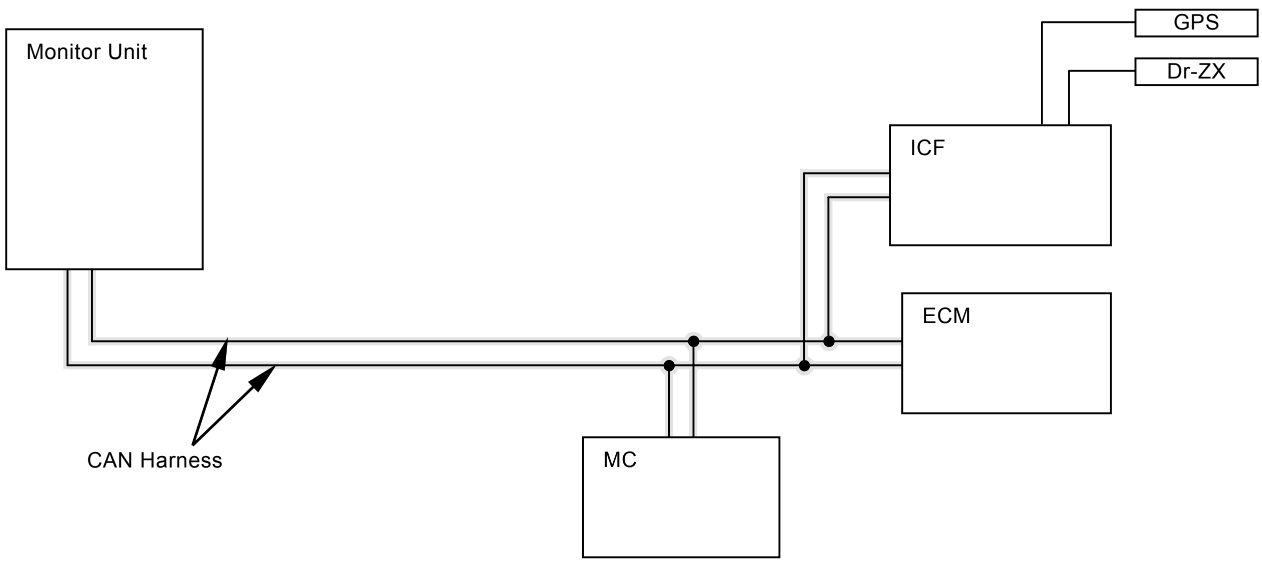


Monitor Unit
Connector Monitor-1B
(Harness end)



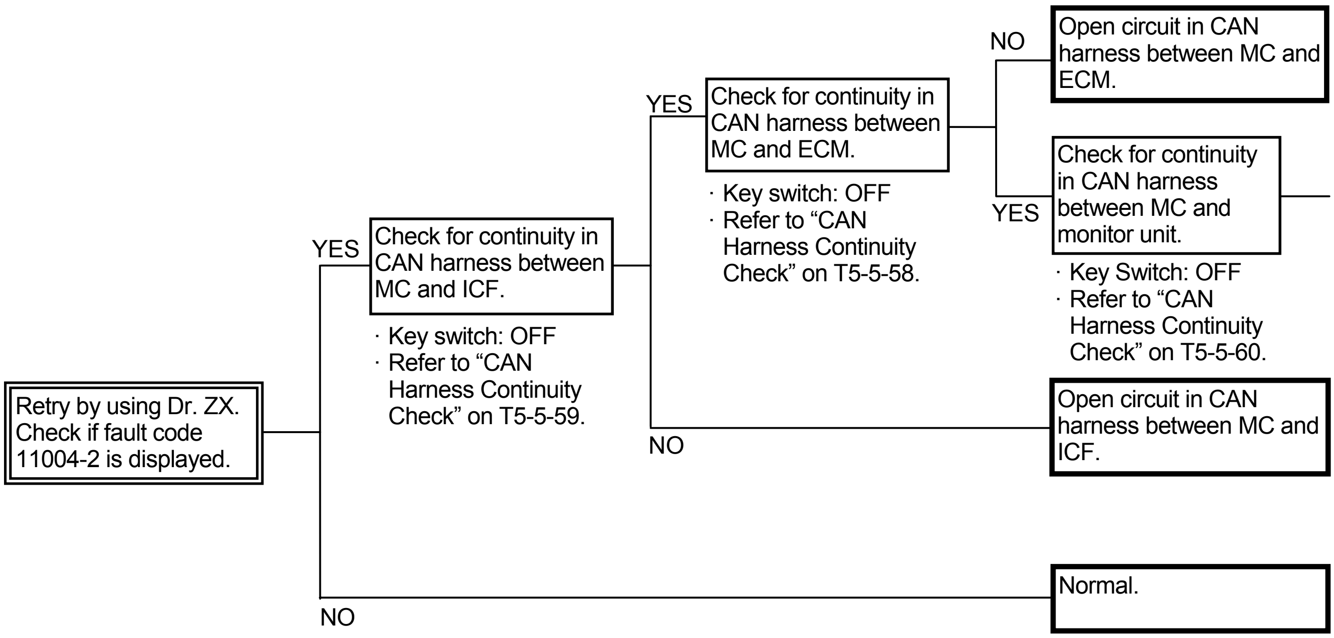
MC FAULT CODE 11004

Fault Code	Trouble	Cause	Influenced Control
11004-2	Abnormal CAN Communication	Shorted circuit in harness Faulty MC	• All Pump Control • All Transmission Control • All Engine Control • Hydraulic Drive Fan Cooling Control • Ride Control • CAN Cycle Data Communication

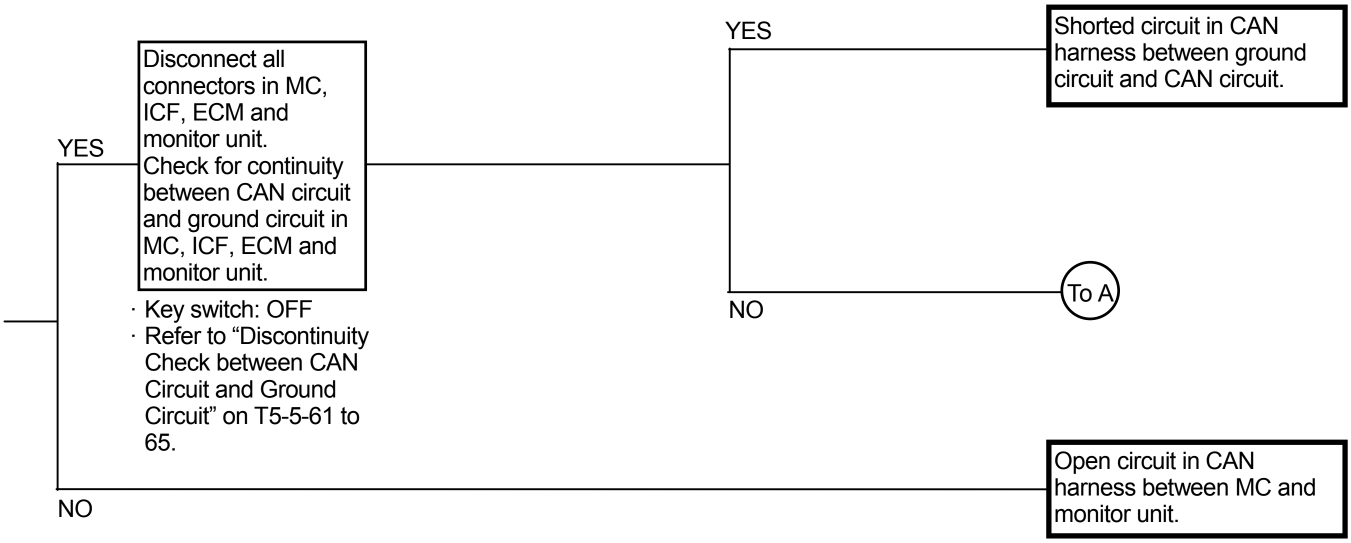


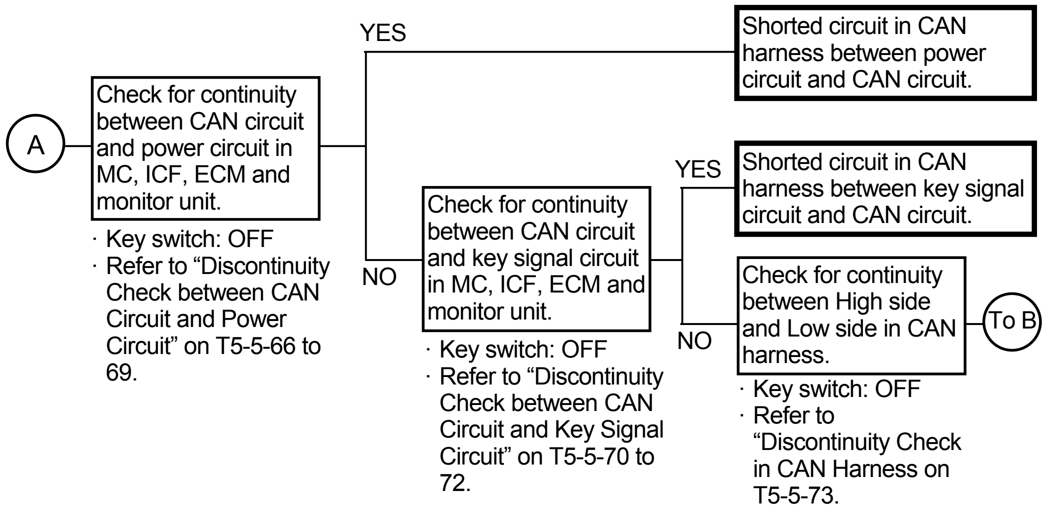
CAN HARNESS CHECK

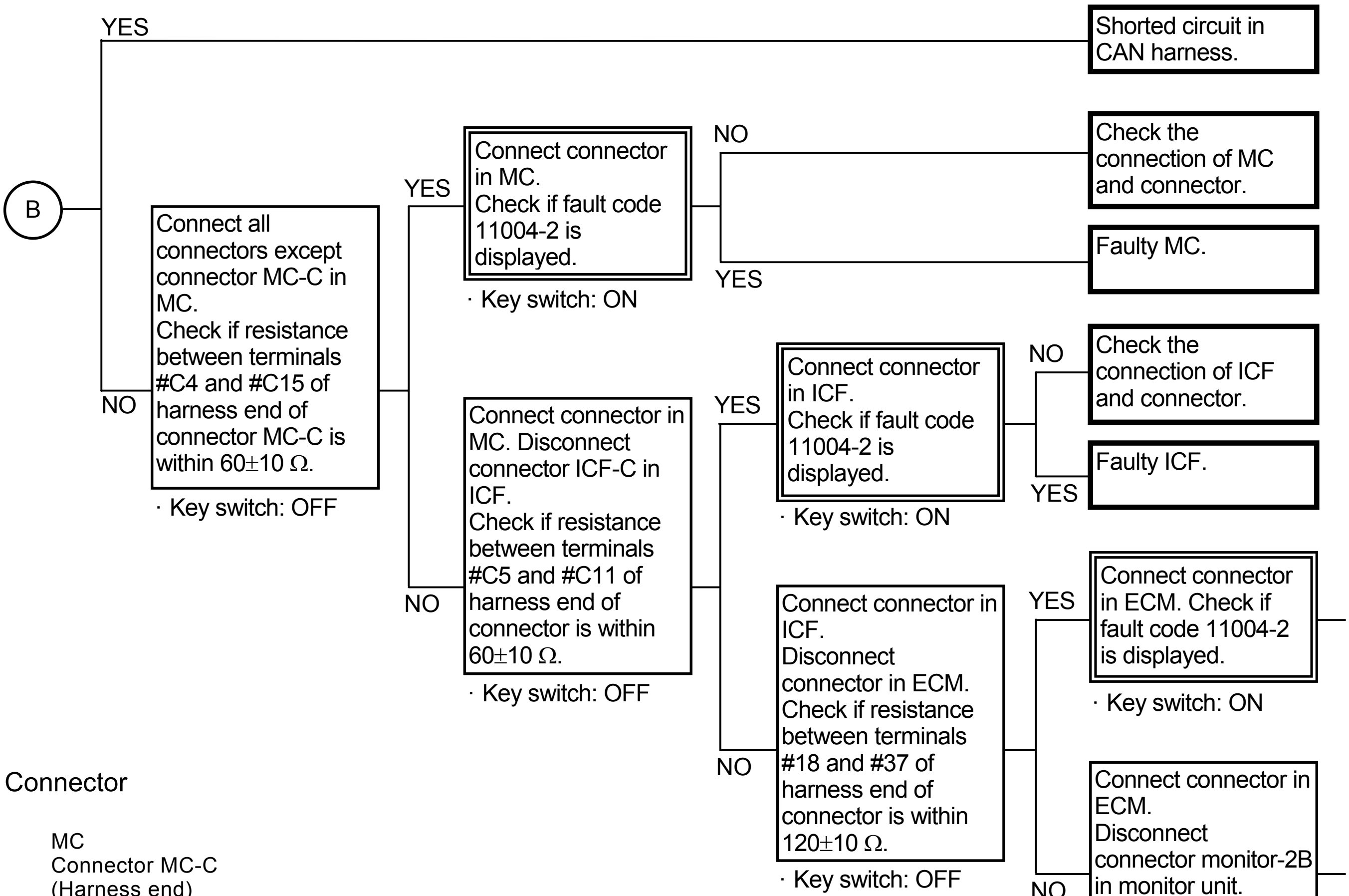
- Check the wiring connections first.



IMPORTANT: If the CAN harness is completely opened in circuit, the controller name is not displayed on the diagnosing screen on Dr. ZX (refer to T5-2-4).

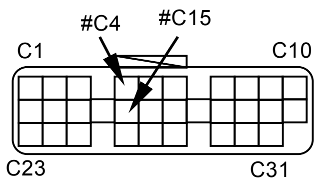

YES
Disconnect all connectors in MC, ICF, ECM and monitor unit. Check for continuity between CAN circuit and ground circuit in MC, ICF, ECM and monitor unit.
· Key switch: OFF
· Refer to "Discontinuity Check between CAN Circuit and Ground Circuit" on T5-5-61 to 65.
YES
Shorted circuit in CAN harness between ground circuit and CAN circuit.
NO
To A
NO
Open circuit in CAN harness between MC and monitor unit.


A
Check for continuity between CAN circuit and power circuit in MC, ICF, ECM and monitor unit.
· Key switch: OFF
· Refer to "Discontinuity Check between CAN Circuit and Power Circuit" on T5-5-66 to 69.
YES
Shorted circuit in CAN harness between power circuit and CAN circuit.
NO
Check for continuity between CAN circuit and key signal circuit in MC, ICF, ECM and monitor unit.
· Key switch: OFF
· Refer to "Discontinuity Check between CAN Circuit and Key Signal Circuit" on T5-5-70 to 72.
YES
Shorted circuit in CAN harness between key signal circuit and CAN circuit.
NO
Check for continuity between High side and Low side in CAN harness.
· Key switch: OFF
· Refer to "Discontinuity Check in CAN Harness on T5-5-73.
To B

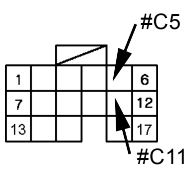


Connector

MC
Connector MC-C
(Harness end)

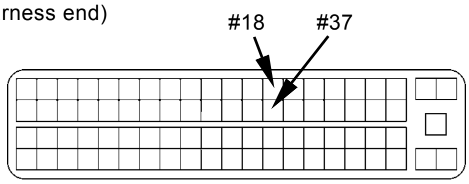


ICF
Connector ICF-C
(Harness end)



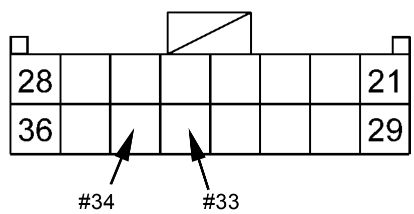
T1V1-05-04-002

ECM
Connector
(Harness end)

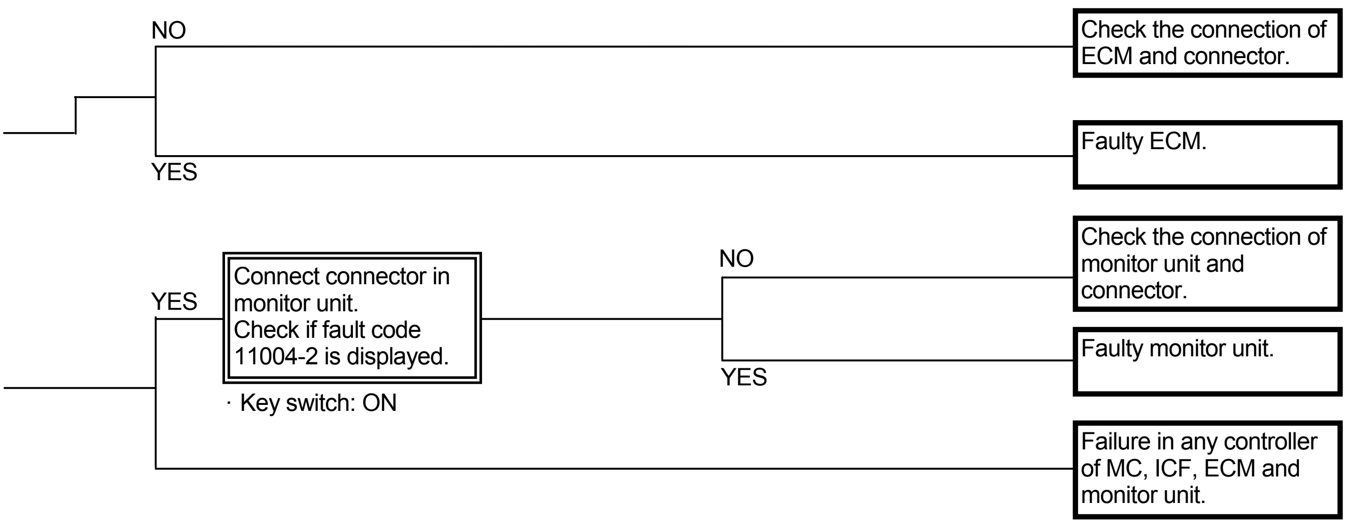


T1GR-05-04-002

Monitor Unit
Connector Monitor-2B
(Harness end)



T4GB-05-05-002


NO
Check the connection of ECM and connector.
Faulty ECM.
YES
Check the connection of monitor unit and connector.
NO
YES
Connect connector in monitor unit.
Check if fault code 11004-2 is displayed.
· Key switch: ON
Faulty monitor unit.
YES
Failure in any controller of MC, ICF, ECM and monitor unit.

Continuity Check in CAN Harness

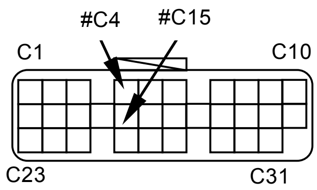
IMPORTANT: Before continuity check, turn the key switch OFF.

- Between MC and ECM
  CAN Harness (High Side)
  Check for continuity between terminal #C4 of harness end of connector MC-C in MC and terminal #18 of harness end of connector in ECM.

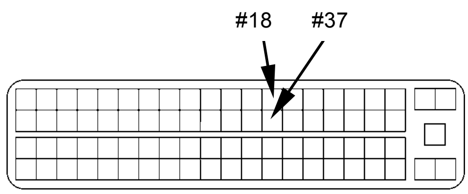
  CAN Harness (Low Side)
  Check for continuity between terminal #C15 of harness end of connector MC-C in MC and terminal #37 of harness end of connector in ECM.

Connector

MC
Connector MC-C
(Harness end)



ECM
Connector
(Harness end)

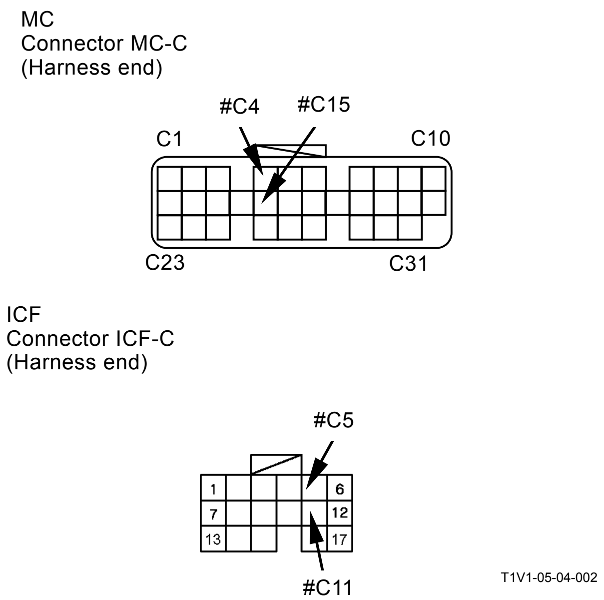


T1GR-05-04-002

- Between MC and ICF
  CAN Harness (High Side)
  Check for continuity between terminal #C4 of harness end of connector MC-C in MC and terminal #C5 of harness end of connector ICF-C in ICF.

  CAN Harness (Low Side)
  Check for continuity between terminal #C15 of harness end of connector MC-C in MC and terminal #C11 of harness end of connector ICF-C in ICF.

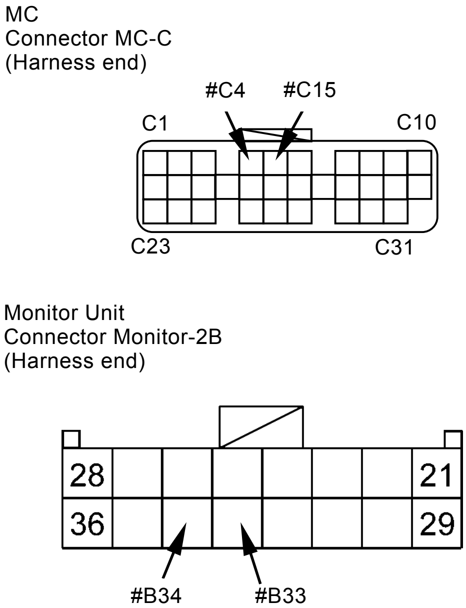
Connector



- Between MC and Monitor Unit
  CAN Harness (High Side)
  Check for continuity between terminal #C4 of harness end of connector MC-C in MC and terminal #B33 of harness end of connector monitor-2B in the monitor unit.

  CAN Harness (Low Side)
  Check for continuity between terminal #C15 of harness end of connector MC-C in MC and terminal #B34 of harness end of connector monitor-2B in the monitor unit.

Connector



T4GB-05-05-002

Discontinuity Check between CAN Circuit and Ground Circuit

IMPORTANT: Before continuity check, turn the key switch OFF.
- **In case of continuity, the circuit between CAN circuit and ground circuit is shorted.**
- **In case of discontinuity, the circuit is normal.**

- MC
  Between CAN Circuit (High Side) and Ground Circuit
  Check for continuity between terminal #C4 of harness end of connector MC-C and terminal #A2 of harness end of connector in MC-A.

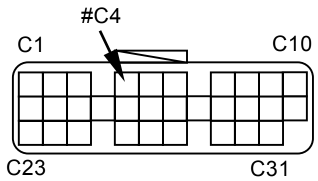
  Check for continuity between terminal #C4 of harness end of connector MC-C and terminal #A13 of harness end of connector in MC-A.

  Check for continuity between terminal #C4 of harness end of connector MC-C and terminal #B8 of harness end of connector in MC-B.

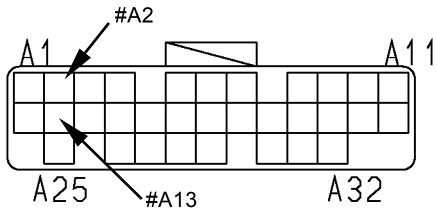
  Check for continuity between terminal #C4 of harness end of connector MC-C and terminal #B18 of harness end of connector in MC-B.

Connector

Connector MC-C
(Harness end)

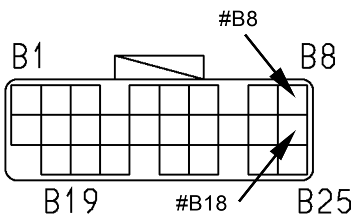


Connector MC-A
(Harness end)



T183-05-04-008

Connector MC-B
(Harness end)



T183-05-04-021

Between CAN Circuit (Low Side) and Ground Circuit

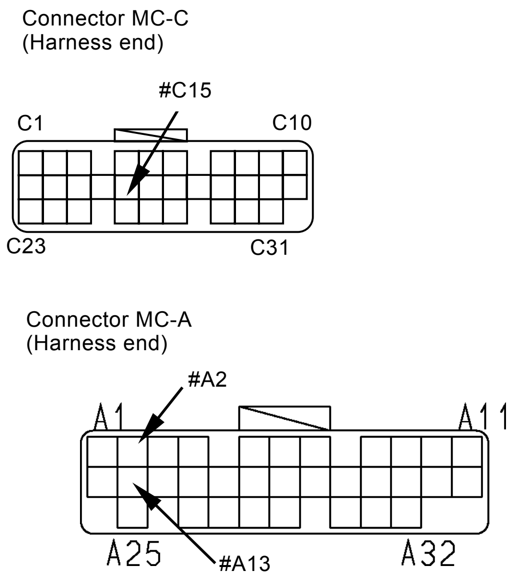
Check for continuity between terminal #C15 of harness end of connector MC-C and terminal #A2 of harness end of connector in MC-A.

Check for continuity between terminal #C15 of harness end of connector MC-C and terminal #A13 of harness end of connector in MC-A.

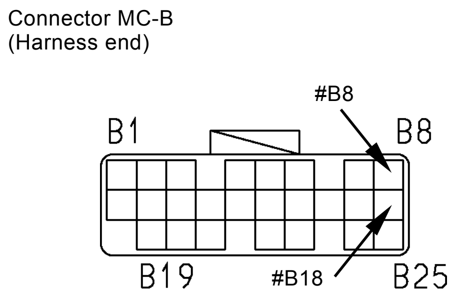
Check for continuity between terminal #C15 of harness end of connector MC-C and terminal #B8 of harness end of connector in MC-B.

Check for continuity between terminal #C15 of harness end of connector MC-C and terminal #B18 of harness end of connector in MC-B.

Connector



T183-05-04-008



T183-05-04-021

- ECM

  Between CAN Circuit (High Side) and Ground Circuit
  Check for continuity between terminals #18 and #1 of harness end of connector.

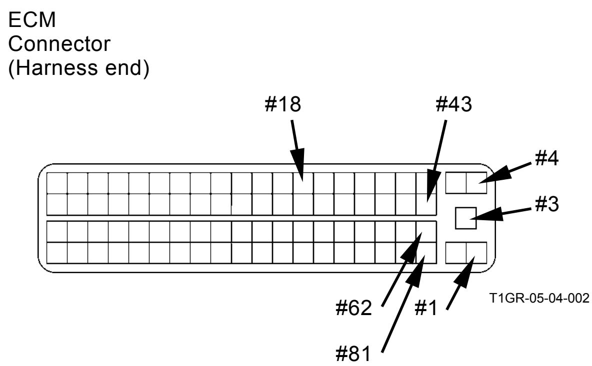
  Check for continuity between terminals #18 and #3 of harness end of connector.

  Check for continuity between terminals #18 and #4 of harness end of connector.

  Check for continuity between terminals #18 and #43 of harness end of connector.

  Check for continuity between terminals #18 and #62 of harness end of connector.

  Check for continuity between terminals #18 and #81 of harness end of connector.



Between CAN Circuit (Low Side) and Ground Circuit
Check for continuity between terminals #37 and #1 of harness end of connector.

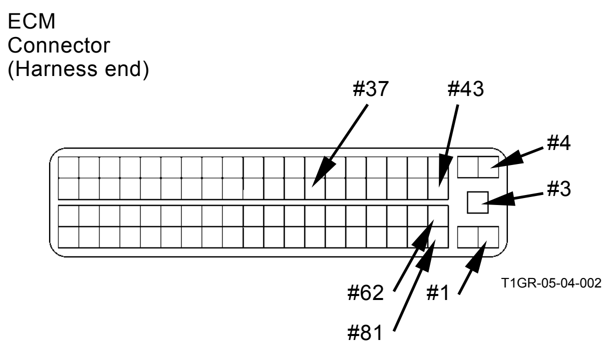
Check for continuity between terminals #37 and #3 of harness end of connector.

Check for continuity between terminals #37 and #4 of harness end of connector.

Check for continuity between terminals #37 and #43 of harness end of connector.

Check for continuity between terminals #37 and #62 of harness end of connector.

Check for continuity between terminals #37 and #81 of harness end of connector.



- ICF

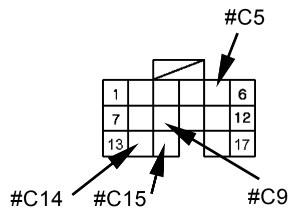
  Between CAN Circuit (High Side) and Ground Circuit

  Check for continuity between terminals #C5 and #C9 of harness end of connector ICF-C.

  Check for continuity between terminals #C5 and #C14 of harness end of connector ICF-C.

  Check for continuity between terminals #C5 and #C15 of harness end of connector ICF-C.

ICF
Connector ICF-C
(Harness end)



T1V1-05-04-002

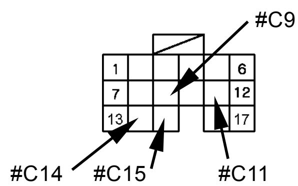
Between CAN Circuit (Low Side) and Ground Circuit

Check for continuity between terminals #C11 and #C9 of harness end of connector ICF-C.

Check for continuity between terminals #C11 and #C14 of harness end of connector ICF-C.

Check for continuity between terminals #C11 and #C15 of harness end of connector ICF-C.

ICF
Connector ICF-C
(Harness end)

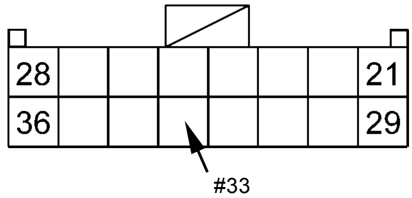


T1V1-05-04-002

- Monitor Unit
  Between CAN Circuit (High Side) and Ground Circuit
  Check for continuity between terminal #33 of harness end of connector monitor-2B and terminal #19 of harness end of connector monitor-2A in the monitor unit.

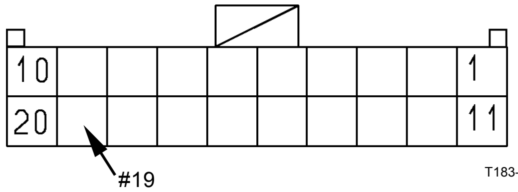
  Check for continuity between terminal #33 of harness end of connector monitor-2B and terminal #4 of harness end of connector monitor-1A in the monitor unit.

Monitor Unit
Connector Monitor-2B
(Harness end)



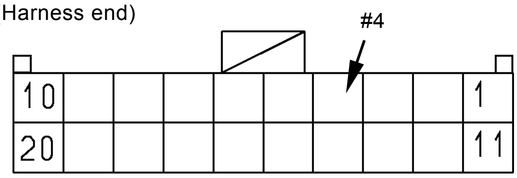
T4GB-05-05-002

Monitor Unit
Connector Monitor-2A
(Harness end)



T183-05-04-013

Monitor Unit
Connector Monitor-1A
(Harness end)

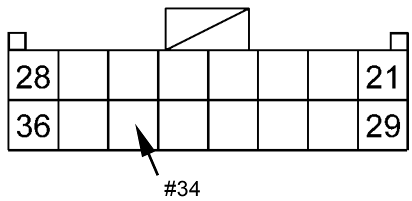


T183-05-04-013

Between CAN Circuit (Low Side) and Ground Circuit
Check for continuity between terminal #34 of harness end of connector monitor-2B and terminal #19 of harness end of connector monitor-2A in the monitor unit.

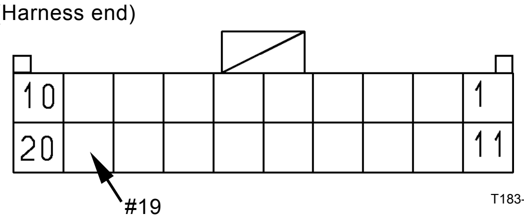
Check for continuity between terminal #34 of harness end of connector monitor-2B and terminal #4 of harness end of connector monitor-1A in the monitor unit.

Monitor Unit
Connector Monitor-2B
(Harness end)



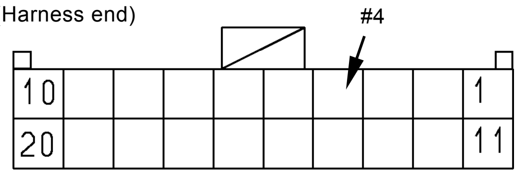
T4GB-05-05-002

Monitor Unit
Connector Monitor-2A
(Harness end)



T183-05-04-013

Monitor Unit
Connector Monitor-1A
(Harness end)



T183-05-04-013

Discontinuity Check between CAN Circuit and Power Circuit

IMPORTANT: Before continuity check, turn the key switch OFF.

- **In case of continuity, the circuit between CAN circuit and power circuit is shorted.**
- **In case of discontinuity, the circuit is normal.**

- MC

  Between CAN Circuit (High Side) and Power Circuit

  Check for continuity between terminal #C4 of harness end of connector MC-C and terminal #A1 of harness end connector MC-A.

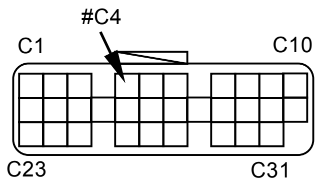
  Check for continuity between terminal #C4 of harness end of connector MC-C and terminal #A12 of harness end connector MC-A.

  Check for continuity between terminal #C4 of harness end of connector MC-C and terminal #B7 of harness end connector MC-B.

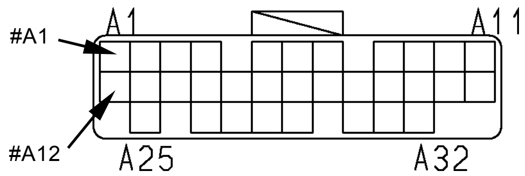
  Check for continuity between terminal #C4 of harness end of connector MC-C and terminal #B17 of harness end connector MC-B.

Connector

Connector MC-C
(Harness end)

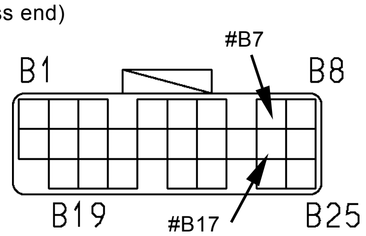


Connector MC-A
(Harness end)



T183-05-04-008

Connector MC-B
(Harness end)



T183-05-04-021

Between CAN Circuit (Low Side) and Power Circuit
Check for continuity between terminal #C15 of harness end of connector MC-C and terminal #A2 of harness end connector MC-A.

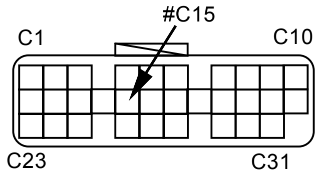
Check for continuity between terminal #C15 of harness end of connector MC-C and terminal #A12 of harness end connector MC-A.

Check for continuity between terminal #C15 of harness end of connector MC-C and terminal #B7 of harness end connector MC-B.

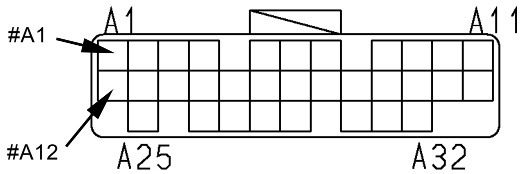
Check for continuity between terminal #C15 of harness end of connector MC-C and terminal #B17 of harness end connector MC-B.

Connector

Connector MC-C
(Harness end)

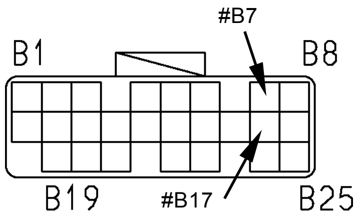


Connector MC-A
(Harness end)



T183-05-04-008

Connector MC-B
(Harness end)

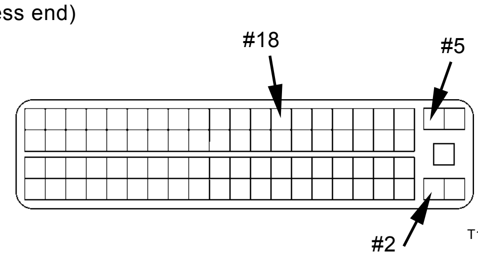


T183-05-04-021

- ECM
  Between CAN Circuit (High Side) and Power Circuit
  Check for continuity between terminals #18 and #2 of harness end of connector.

  Check for continuity between terminals #18 and #5 of harness end of connector.

ECM
Connector
(Harness end)

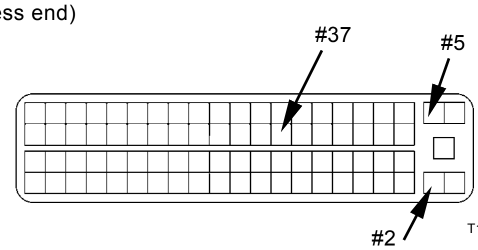


T1GR-05-04-002

  Between CAN Circuit (Low Side) and Power Circuit
  Check for continuity between terminals #37 and #2 of harness end of connector.

  Check for continuity between terminals #37 and #5 of harness end of connector.

ECM
Connector
(Harness end)

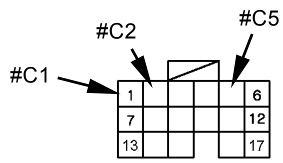


T1GR-05-04-002

- ICF
  Between CAN Circuit (High Side) and Power Circuit
  Check for continuity between terminals #C5 and #C1 of harness end of connector ICF-C.

  Check for continuity between terminals #C5 and #C2 of harness end of connector ICF-C.

ICF
Connector ICF-C
(Harness end)

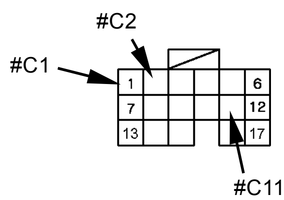


T1V1-05-04-002

  Between CAN Circuit (Low Side) and Power Circuit
  Check for continuity between terminals #C11 and #C1 of harness end of connector ICF-C.

  Check for continuity between terminals #C11 and #C2 of harness end of connector ICF-C.

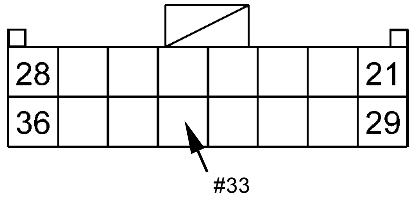
ICF
Connector ICF-C
(Harness end)



T1V1-05-04-002

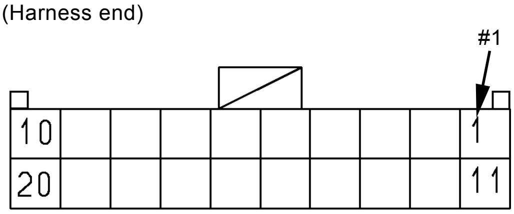
- Monitor Unit
  Between CAN Circuit (High Side) and Power Circuit
  Check for continuity between terminal #33 of harness end of connector monitor–2B in the monitor unit and terminal #1 of harness end of connector monitor–1A in the monitor unit.

Monitor Unit
Connector Monitor-2B
(Harness end)



T4GB-05-05-002

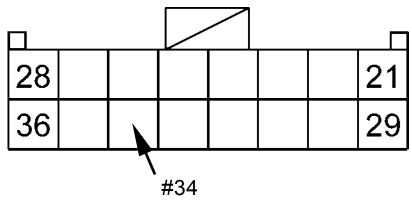
Monitor Unit
Connector Monitor-1A
(Harness end)



T183-05-04-013

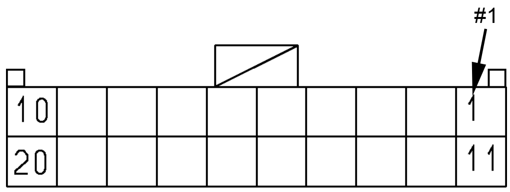
Between CAN Circuit (Low Side) and Power Circuit
Check for continuity between terminal #34 of harness end of connector monitor–2B in the monitor unit and terminal #1 of harness end of connector monitor–1A in the monitor unit.

Monitor Unit
Connector Monitor-2B
(Harness end)



T4GB-05-05-002

Monitor Unit
Connector Monitor-1A
(Harness end)



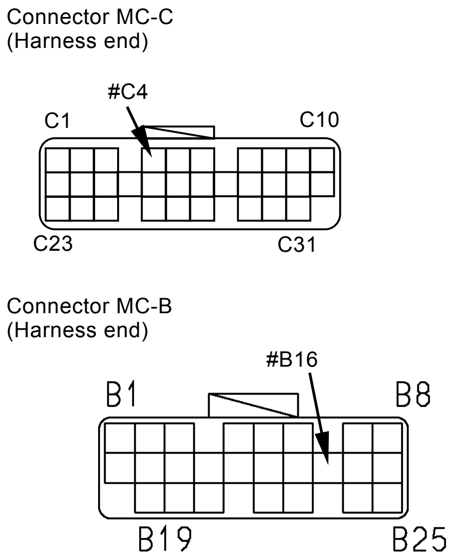
T183-05-04-013

Discontinuity Check between CAN Circuit and Key Signal Circuit

IMPORTANT: Before continuity check, turn the key switch OFF.
- **In case of continuity, the circuit between CAN circuit and key signal circuit is shorted.**
- **In case of discontinuity, the circuit is normal.**

- MC
  Between CAN Circuit (High Side) and Key Signal Circuit
  Check for continuity between terminal #C4 of harness end of connector MC-C and terminal #B16 of harness end of connector MC-B.

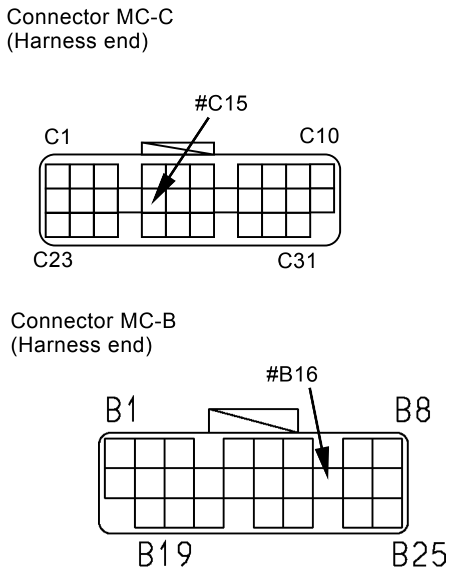
Connector



T183-05-04-021

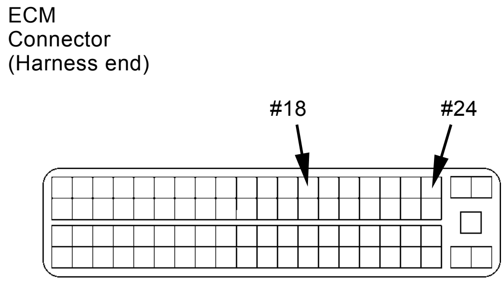
  Between CAN Circuit (Low Side) and Key Signal Circuit
  Check for continuity between terminal #C15 of harness end of connector MC-C and terminal #B16 of harness end of connector MC-B.

Connector



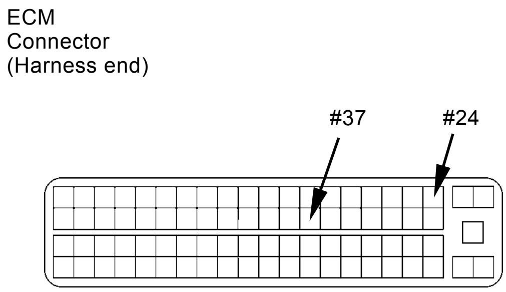
T183-05-04-021

- ECM
  Between CAN Circuit (High Side) and Key Signal Circuit
  Check for continuity between terminals #18 and #24 of harness end of connector.



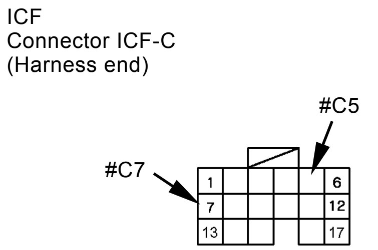
T1GR-05-04-002

Between CAN Circuit (Low Side) and Key Signal Circuit
Check for continuity between terminals #37 and #24 of harness end of connector.



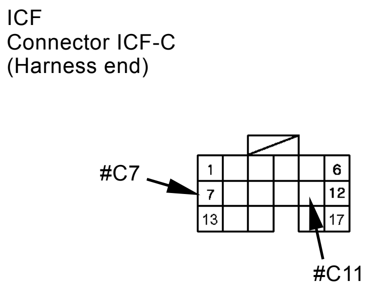
T1GR-05-04-002

- ICF
  Between CAN Circuit (High Side) and Key Signal Circuit
  Check for continuity between terminals #C5 and #C7 of harness end of connector ICF-C.



T1V1-05-04-002

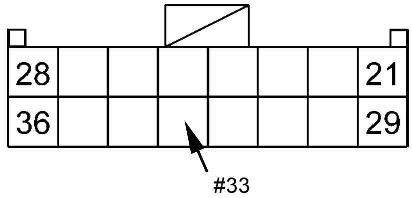
Between CAN Circuit (Low Side) and Key Signal Circuit
Check for continuity between terminals #C11 and #C7 of harness end of connector ICF-C.



T1V1-05-04-002

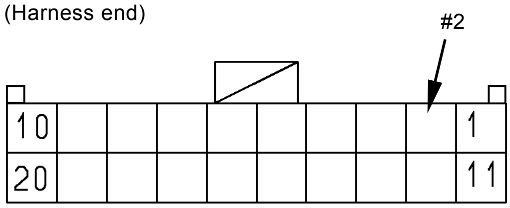
- Monitor Unit
  Between CAN Circuit (High Side) and Key Signal Circuit
  Check for continuity between terminal #33 of harness end of connector monitor–2B in the monitor unit and terminal #2 of harness end of connector monitor–1A in the monitor unit.

Monitor Unit
Connector Monitor-2B
(Harness end)



T4GB-05-05-002

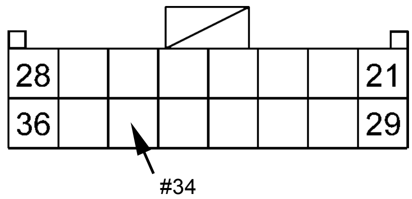
Monitor Unit
Connector Monitor-1A
(Harness end)



T183-05-04-013

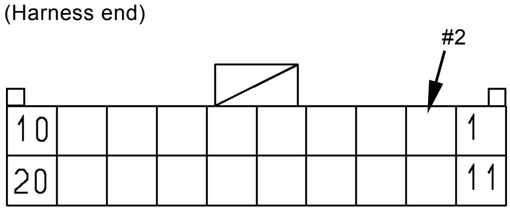
Between CAN Circuit (Low Side) and Key Signal Circuit
Check for continuity between terminal #34 of harness end of connector monitor–2B in the monitor unit and terminal #2 of harness end of connector monitor–1A in the monitor unit.

Monitor Unit
Connector Monitor-2B
(Harness end)



T4GB-05-05-002

Monitor Unit
Connector Monitor-1A
(Harness end)



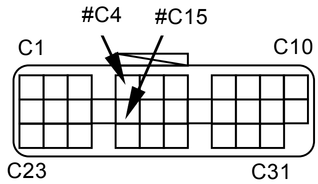
T183-05-04-013

Discontinuity Check in CAN Harness

IMPORTANT: Before continuity check, turn the key switch OFF.
- **In case of continuity, the circuit between CAN (high side) circuit and CAN (low side) circuit is shorted.**
- **In case of discontinuity, the circuit is normal.**

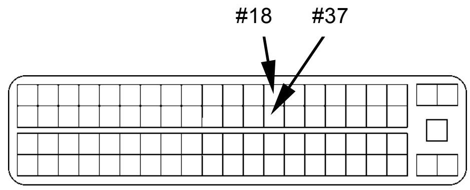
- Connector MC-C
  Check for continuity between terminals #C4 and #C15 of harness end of connector MC-C in MC.

MC
Connector MC-C
(Harness end)



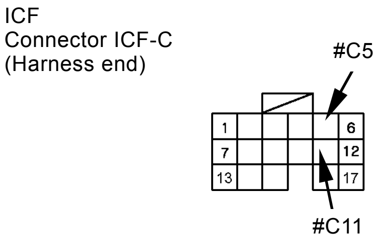
- Connector ECM
  Check for continuity between terminals #18 and #37 of harness end of connector in ECM.

ECM
Connector
(Harness end)



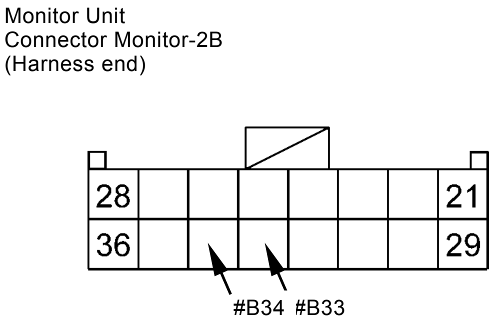
T1GR-05-04-002

- Connector ICF-C
  Check for continuity between terminals #C5 and #C11 of harness end of connector ICF-C in ICF.



T1V1-05-04-002

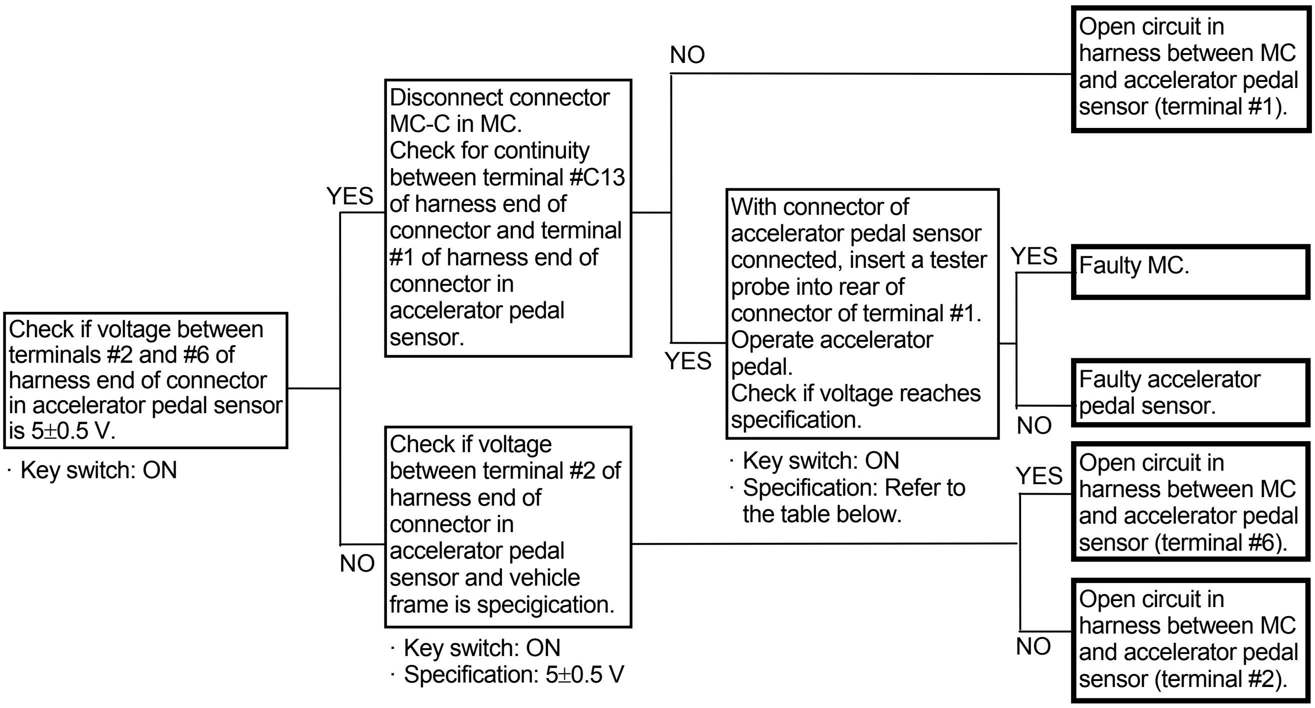
- Connector Monitor-2B in Monitor Unit
  Check for continuity between terminals #B33 and #B34 of harness end of connector monitor-2B in the monitor unit.



T4GB-05-05-002

ENGINE FAILURE
MC FAULT CODE 11103

Fault Code	Trouble	Cause	Influenced Control
11103-3	Abnormal Accelerator Pedal High Voltage	Voltage: 4.75 V or higher	Pump Torque Decrease Control Engine Accelerator Pedal Control
11103-4	Abnormal Accelerator Pedal Low Voltage	Voltage: Less than 0.25 V	Pump Torque Decrease Control Engine Accelerator Pedal Control

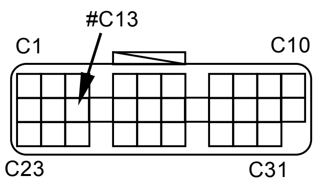


Specification of Accelerator Pedal Sensor

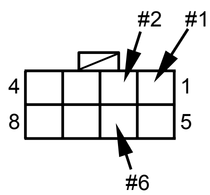
Slow Idle	0.5 to 0.65 V
Fast Idle	4.35 to 4.5 V

Connector (Harness end of connector viewed from the open end side)

MC
Connector MC-C

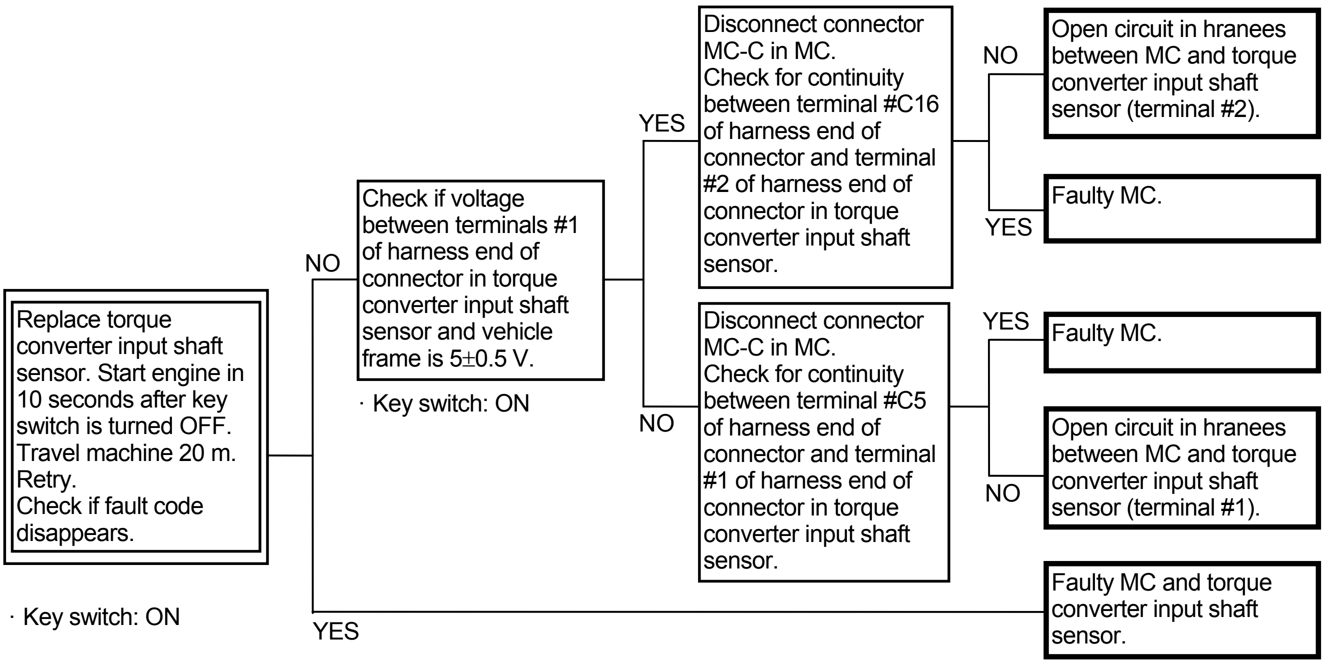


Accelerator Pedal Sensor Connector

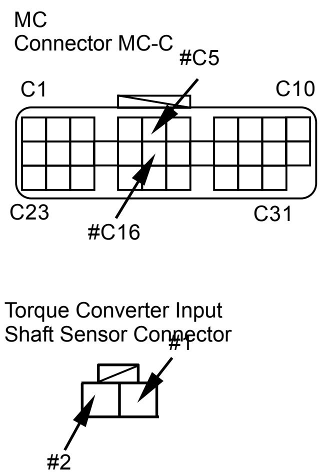


MC FAULT CODE 11105

Fault Code	Trouble	Cause	Influenced Control
11105-3	Abnormal Torque Converter Input Shaft Sensor	Engine speed=0 min^{-1} ECM engine speed>500 min^{-1}	• Hydraulic rive Fan Cooling Control

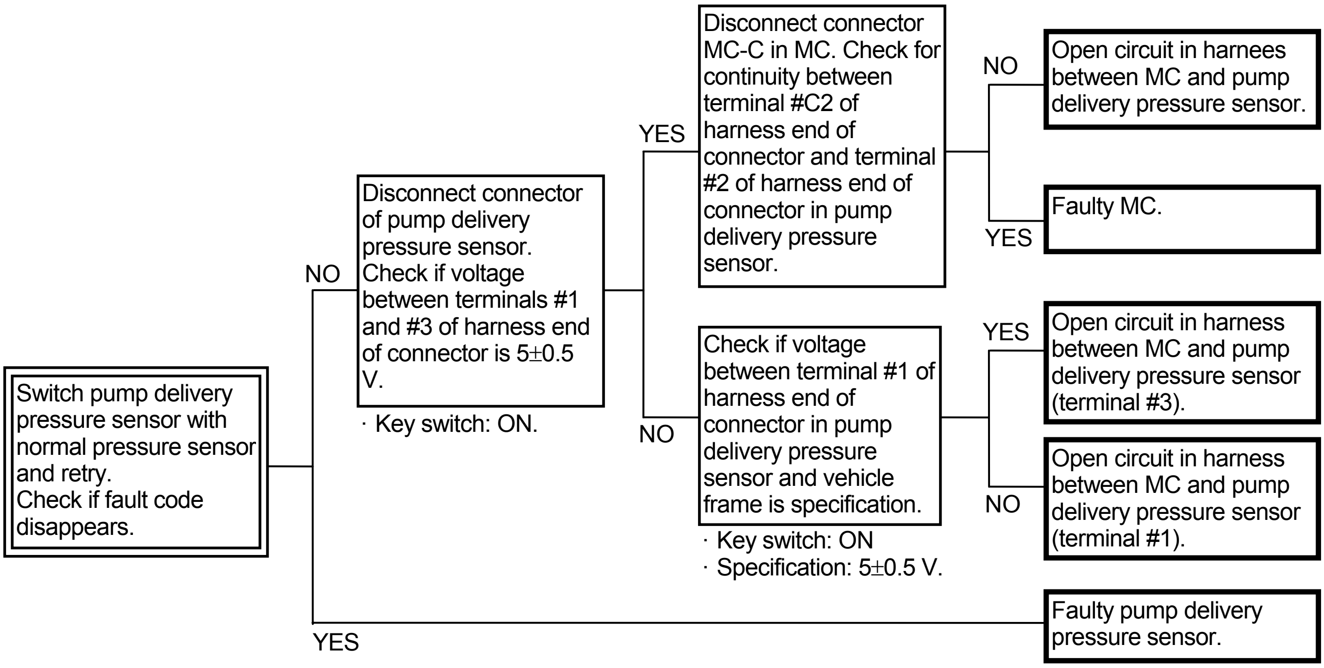


Connector (Harness end of connector viewed from the open end side)



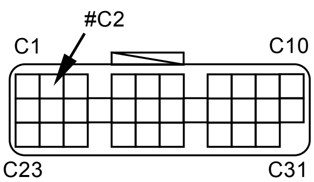
PUMP FAILURE
MC FAULT CODE 11204

Fault Code	Trouble	Cause	Influenced Control
11204-3	Abnormal Pump Delivery Pressure Sensor High Voltage	Output voltage: 4.75 V or higher	• Pump Torque Decrease Control: Disabled
11204-4	Abnormal Pump Delivery Pressure Sensor Low Voltage	Output voltage: Less than 0.25 V	• Pump Torque Decrease Control: Disabled

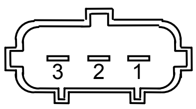


Connector (Harness end of connector viewed from the open end side)

MC
Connector MC-C

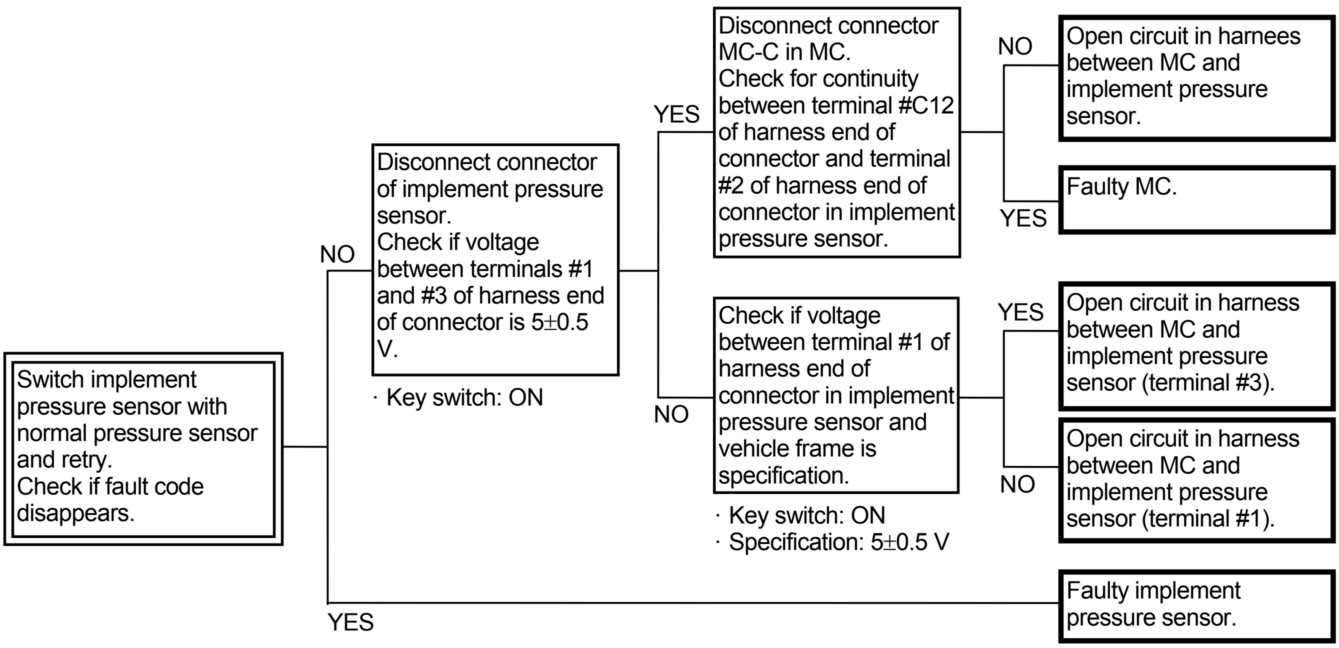


Pump Delivery
Pressure Sensor



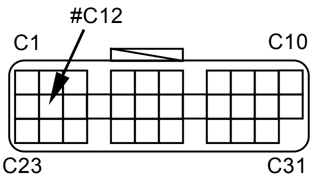
MC FAULT CODE 11209

Fault Code	Trouble	Cause	Influenced Control
11209-3	Abnormal Implement Pressure Sensor High Voltage	Output voltage: 4.75 V or higher	• Pump Torque Decrease Control: Disabled
11209-4	Abnormal Implement Pressure Sensor Low Voltage	Output voltage: Less than 0.25 V	• Pump Torque Decrease Control: Disabled

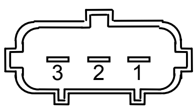


Connector (Harness end of connector viewed from the open end side)

MC
Connector MC-C

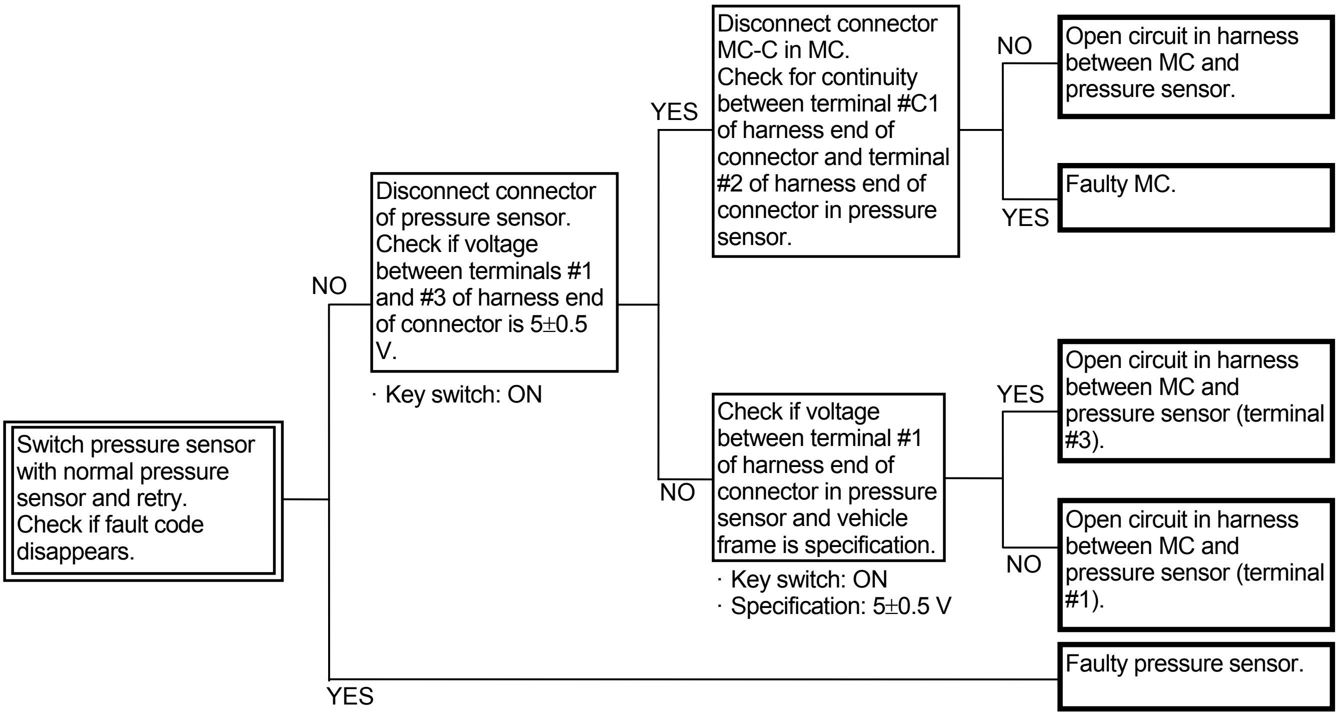


Implement
Pressure Sensor Connector

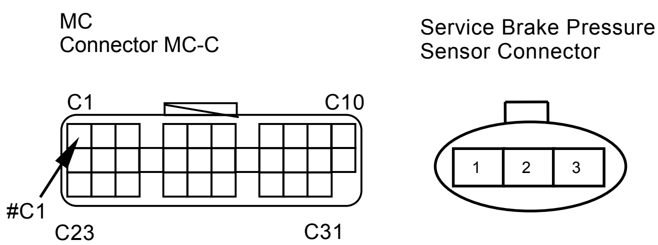


PILOT FAILURE
MC FAULT CODE 11312

Fault Code	Trouble	Cause	Influenced Control
11312-3	Abnormal Brake Pedal Pressure Sensor (Service Brake Pressure Sensor) High Voltage	Voltage: 4.75 V or higher	• Clutch Cut-Off Control
11312-4	Abnormal Brake Pedal Pressure Sensor (Service Brake Pressure Sensor) Low Voltage	Voltage: Less than 0.25 V	• Clutch Cut-Off Control

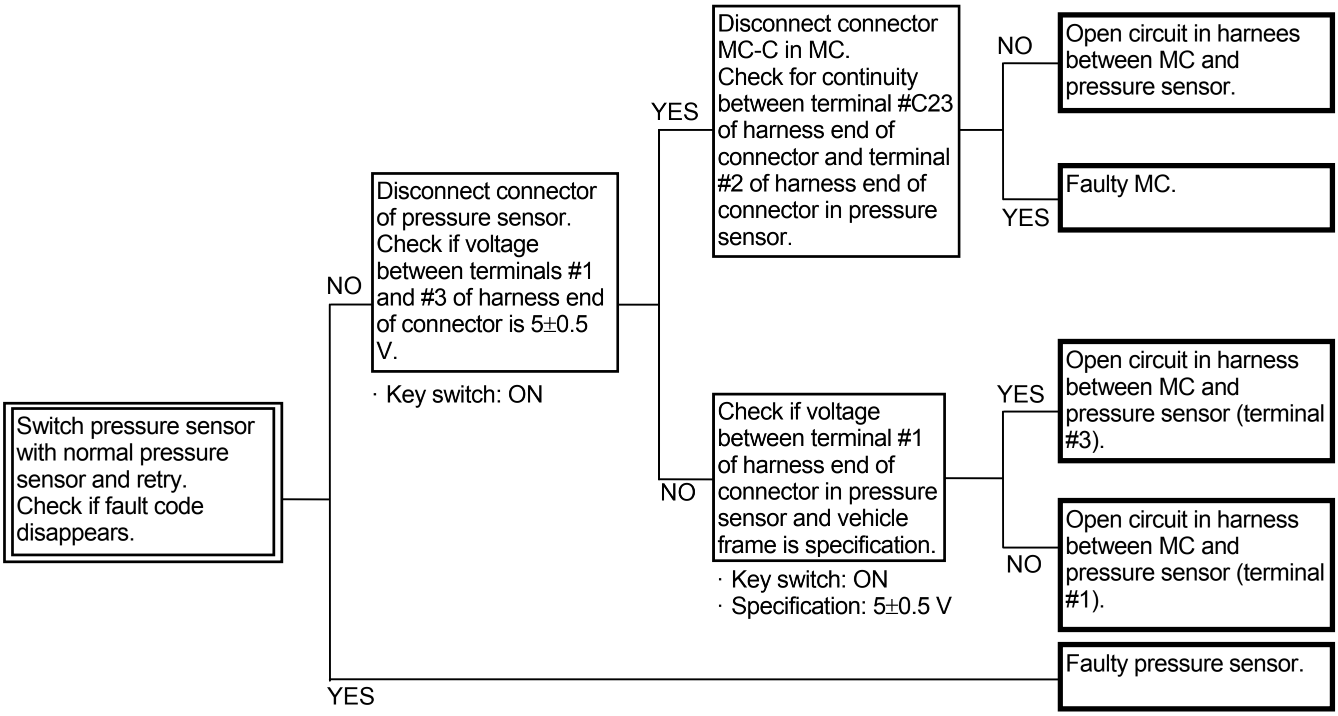


Connector (Harness end of connector viewed from the open end side)

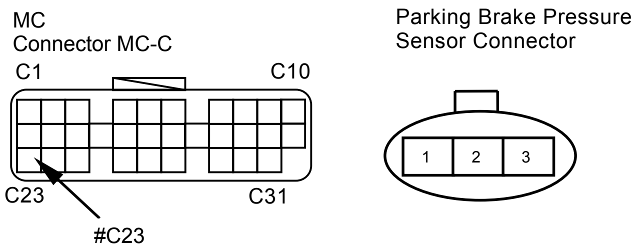


MC FAULT CODE 11313

Fault Code	Trouble	Cause	Influenced Control
11313-3	Abnormal Parking Brake Pressure Sensor High Voltage	Output voltage: 4.75 V or higher	• Parking Brake Indicator Control
11313-4	Abnormal Parking Brake Pressure Sensor Low Voltage	Output voltage: Less than 0.25 V	• Parking Brake Indicator Control

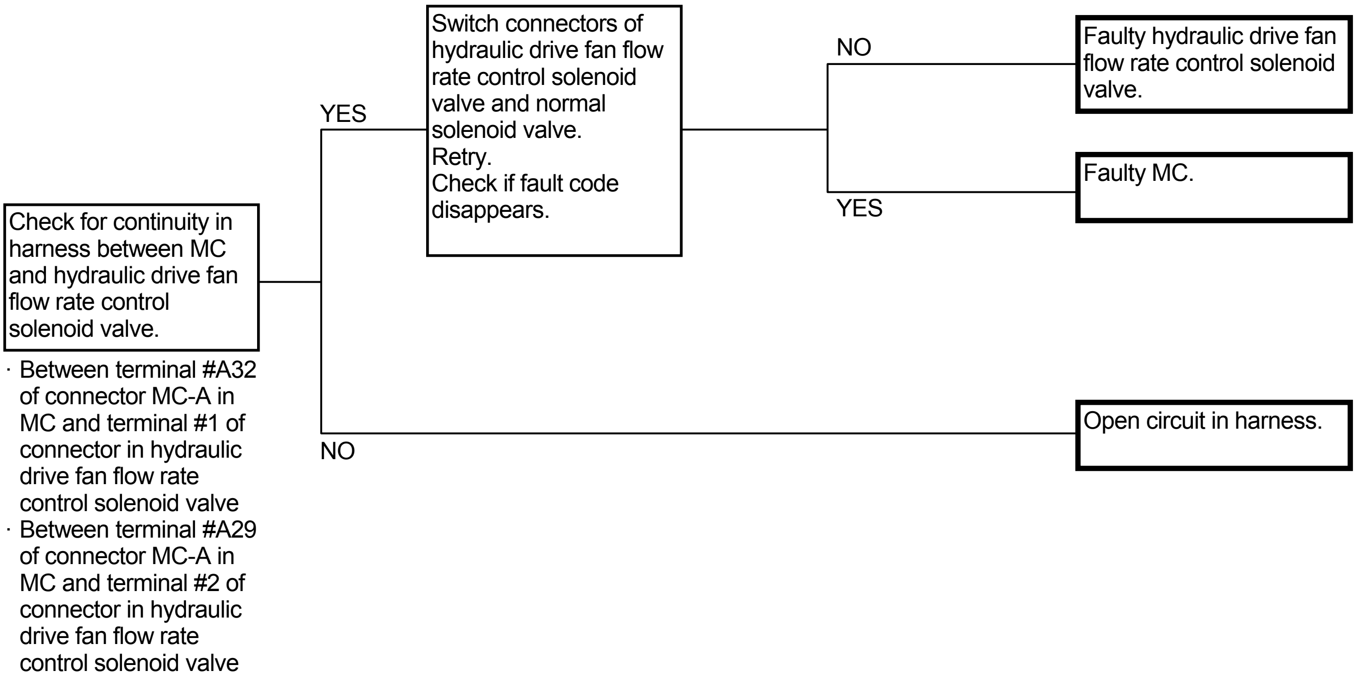


Connector (Harness end of connector viewed from the open end side)



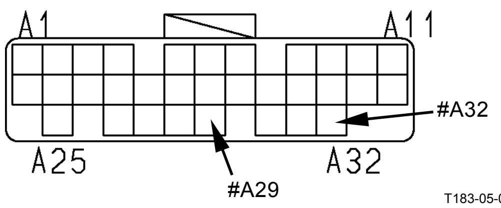
PROPORTIONAL SOLENOID VALVE FAILURE
MC FAULT CODE 11412

Fault Code	Trouble	Cause	Influenced Control
11412-2	Abnormal Feedback of Hydraulic Drive Fan Flow Rate Control Solenoid Valve	The feedback current to MC becomes the uncertain value.	Hydraulic Drive Fan Cooling Control
11412-3	Abnormal Feedback High Current of Hydraulic Drive Fan Flow Rate Control Solenoid Valve	The feedback current to MC is beyond the upper limit.	Hydraulic Drive Fan Cooling Control
11412-4	Abnormal Feedback Low Current of Hydraulic Drive Fan Flow Rate Control Solenoid Valve	While the command from MC is output, the feedback current to MC is 56 mA or less.	Hydraulic Drive Fan Cooling Control



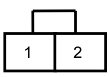
Connector (Harness end of connector viewed from the open end side)

MC
Connector MC-A



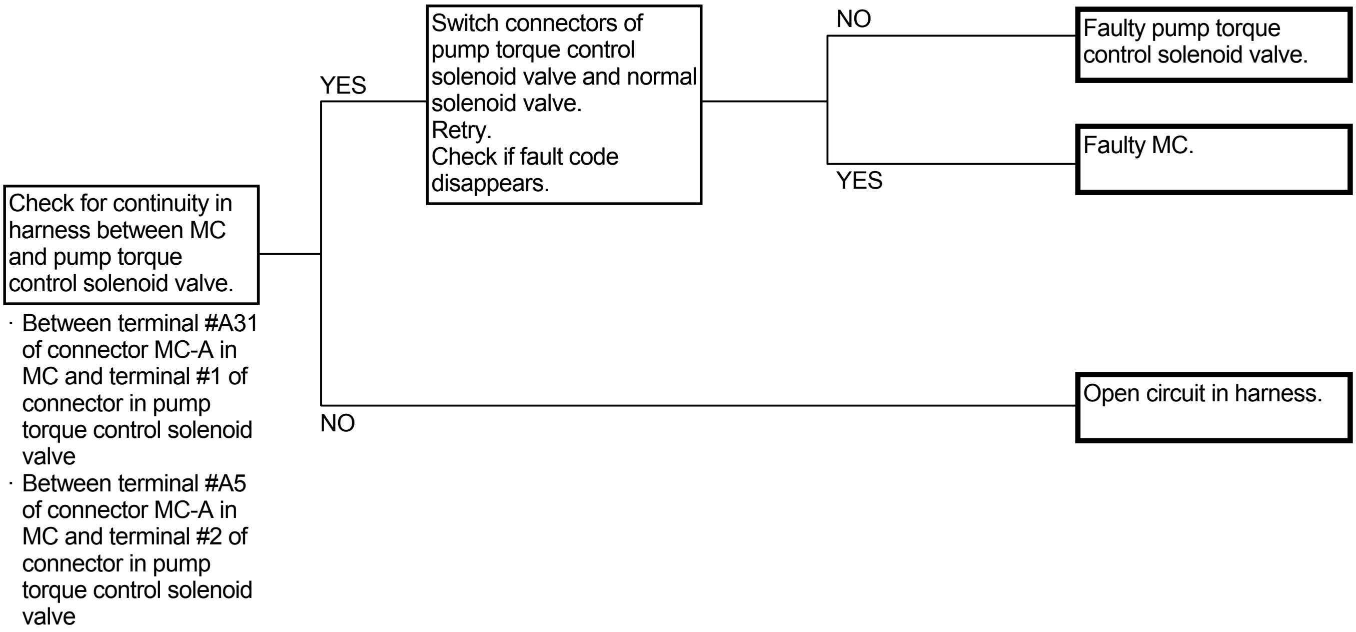
T183-05-04-008

Hydraulic Drive Fan Flow Rate
Control Solenoid Valve Connector



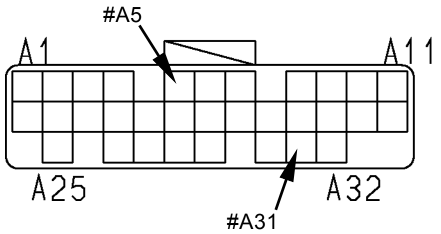
MC FAULT CODE 11413

Fault Code	Trouble	Cause	Influenced Control
11413-2	Abnormal Feedback of Pump Torque Control Solenoid Valve	The feedback current to MC becomes the uncertain value.	• Pump Standard Torque Control
11413-3	Abnormal Feedback High Current of Pump Torque Control Solenoid Valve	The feedback current to MC is beyond the upper limit.	• Pump Standard Torque Control
11413-4	Abnormal Feedback Low Current of Pump Torque Control Solenoid Valve	While the command from MC is output, the feedback current to MC is 56 mA or less.	• Pump Standard Torque Control



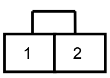
Connector (Harness end of connector viewed from the open end side)

MC
Connector MC-A



T183-05-04-008

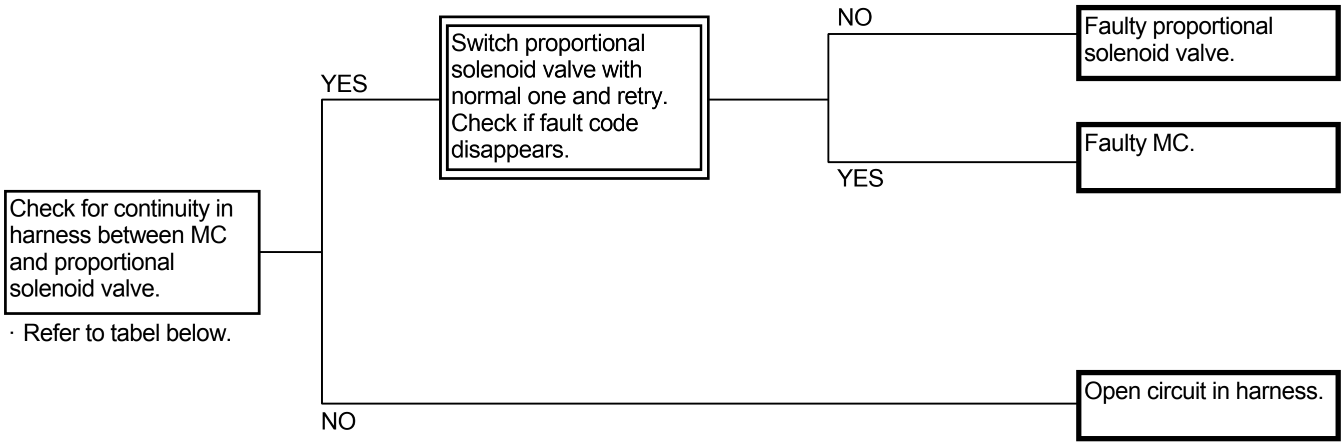
Pump Torque Control Solenoid Valve



MC FAULT CODES 11414, 11415, 11416, 11417, 11418, 11419

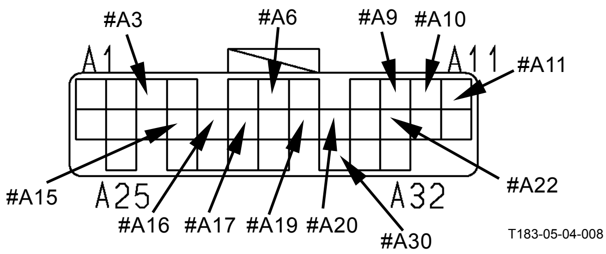
Fault Code	Trouble	Cause	Influenced Control
11414-2	Abnormal Feedback of Transmission Clutch First Gear Proportional Solenoid Valve	The feedback current to MC becomes the uncertain value	• All Transmission Control
11414-3	Abnormal Feedback High Current of Transmission Clutch First Gear Proportional Solenoid Valve	The feedback current to MC exceeds the upper limit	• All Transmission Control
11414-4	Abnormal Feedback Low Current of Transmission Clutch First Gear Proportional Solenoid Valve	The feedback current to MC is 20 mA or less	• All Transmission Control
11415-2	Abnormal Feedback of Transmission Clutch Second Gear Proportional Solenoid Valve	The feedback current to MC becomes the uncertain value	• All Transmission Control
11415-3	Abnormal Feedback High Current of Transmission Clutch Second Gear Proportional Solenoid Valve	The feedback current to MC exceeds the upper limit	• All Transmission Control
11415-4	Abnormal Feedback Low Current of Transmission Clutch Second Gear Proportional Solenoid Valve	The feedback current to MC is 20 mA or less	• All Transmission Control
11416-2	Abnormal Feedback of Transmission Clutch Third Gear Proportional Solenoid Valve	The feedback current to MC becomes the uncertain value	• All Transmission Control
11416-3	Abnormal Feedback High Current of Transmission Clutch Third Gear Proportional Solenoid Valve	The feedback current to MC exceeds the upper limit	• All Transmission Control
11416-4	Abnormal Feedback Low Current of Transmission Clutch Third Gear Proportional Solenoid Valve	The feedback current to MC is 20 mA or less	• All Transmission Control
11417-2	Abnormal Feedback of Transmission Clutch Fourth Gear Proportional Solenoid Valve	The feedback current to MC becomes the uncertain value	• All Transmission Control
11417-3	Abnormal Feedback High Current of Transmission Clutch Fourth Gear Proportional Solenoid Valve	The feedback current to MC exceeds the upper limit	• All Transmission Control
11417-4	Abnormal Feedback Low Current of Transmission Clutch Fourth Gear Proportional Solenoid Valve	The feedback current to MC is 20 mA or less	• All Transmission Control

Fault Code	Trouble	Cause	Influenced Control
11418-2	Abnormal Feedback of Transmission Clutch Forward Proportional Solenoid Valve	The feedback current to MC becomes the uncertain value	• All Transmission Control
11418-3	Abnormal Feedback High Current of Transmission Clutch Forward Proportional Solenoid Valve	The feedback current to MC exceeds the upper limit	• All Transmission Control
11418-4	Abnormal Feedback Low Current of Transmission Clutch Forward Proportional Solenoid Valve	The feedback current to MC is 20 mA or less	• All Transmission Control
11419-2	Abnormal Feedback of Transmission Clutch Reverse Proportional Solenoid Valve	The feedback current to MC becomes the uncertain value	• All Transmission Control
11419-3	Abnormal Feedback High Current of Transmission Clutch Reverse Proportional Solenoid Valve	The feedback current to MC exceeds the upper limit	• All Transmission Control
11419-4	Abnormal Feedback Low Current of Transmission Clutch Reverse Proportional Solenoid Valve	The feedback current to MC is 20 mA or less	• All Transmission Control

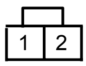


Connector (Harness end of connector viewed from the open end side)

MC
Connector MC-A



Proportional Solenoid Valve Connector

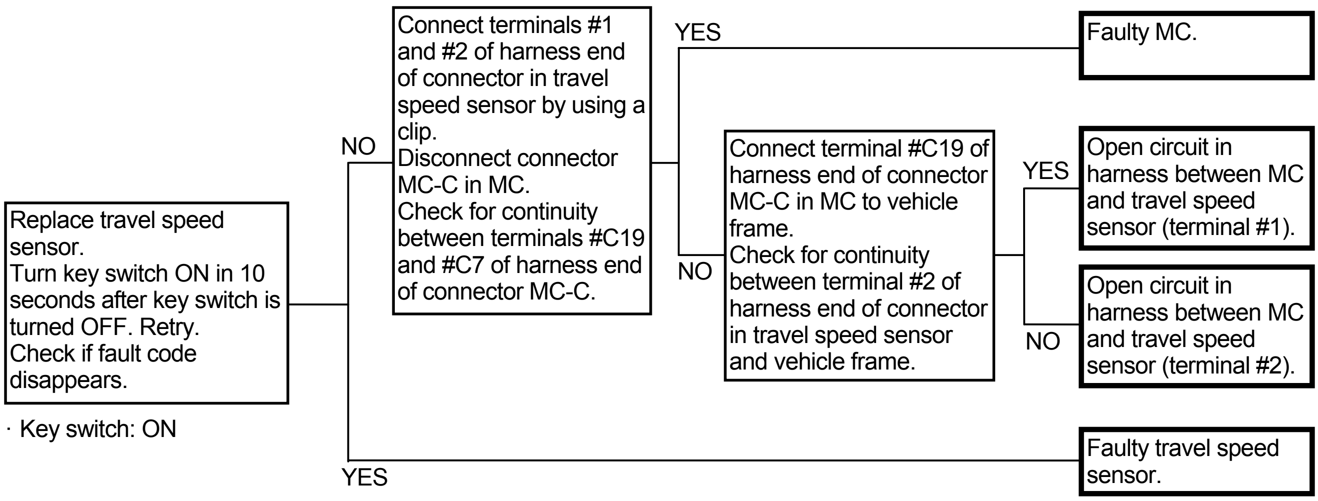


List of connection relationship between each proportional solenoid valve connector terminal and connector MC-A terminal

	First Gear Proportional Solenoid Valve Connector		Second Gear Proportional Solenoid Valve Connector		Third Gear Proportional Solenoid Valve Connector		Fourth Gear Proportional Solenoid Valve Connector		Forward Proportional Solenoid Valve Connector		Reverse Proportional Solenoid Valve Connector	
	#1	#2	#1	#2	#1	#2	#1	#2	#1	#2	#1	#2
Connector MC-A	#A10	#A6	#A22	#A16	#A20	#A3	#A11	#A17	#A30	#A19	#A9	#A15

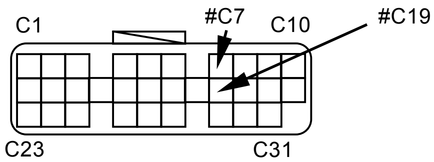
TRANSMISSION FAILURE
MC FAULT CODE 11600

Fault Code	Trouble	Cause	Influenced Control
11600-3	Abnormal Travel Speed Sensor	The abnormal value below is detected with the clutch connected. • Travel speed sensor=0 min^{-1} • Middle shaft sensor>300 min^{-1} • Torque converter output speed sensor>500 min^{-1} • Detected voltage under the shorted circuit with key ON: 4.5 V or higher	All Transmission Control
11600-4	Abnormal Low Voltage of Travel Speed Sensor	Detected voltage under the shorted circuit with key ON: Less than 1.5 V	All Transmission Control

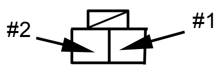


Connector (Harness end of connector viewed from the open end side)

MC
Connector MC-C

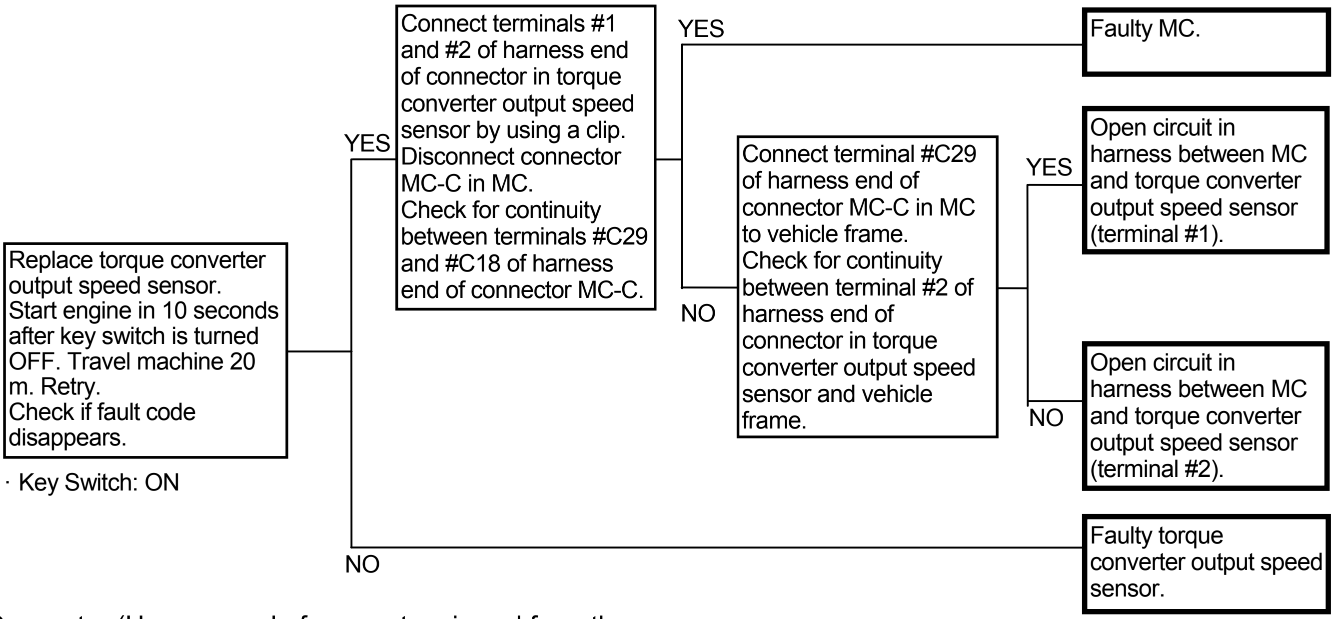


Travel Speed Sensor Connector



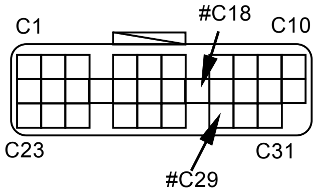
MC FAULT CODE 11601

Fault Code	Trouble	Cause	Influenced Control
11601-3	Abnormal Torque Converter Output Speed Sensor	The abnormal value below is detected with the clutch connected. • Torque converter output speed sensor=0 min^{-1} • Middle shaft sensor>300 min^{-1} • Travel speed sensor>300 min^{-1}	• Pump Torque Decrease Control

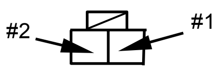


Connector (Harness end of connector viewed from the open end side)

MC
Connector MC-C

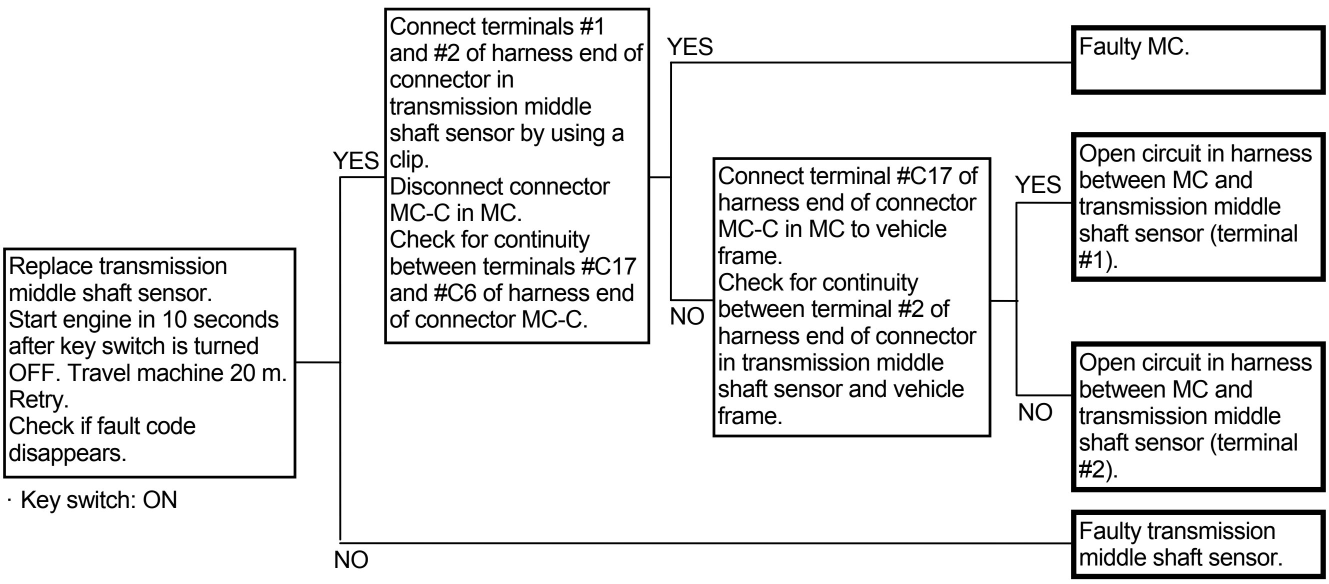


Torque Converter Output Speed Sensor Connector

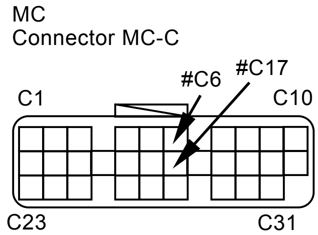


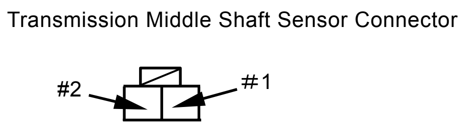
MC FAULT CODE 11602

Fault Code	Trouble	Cause	Influenced Control
11602-3	Abnormal Transmission Middle Shaft Sensor	The abnormal value below is detected with the clutch connected. • Middle shaft sensor =0 min^{-1} • Travel speed sensor>500 min^{-1} • Torque converter output speed sensor>500 min^{-1}	• All Transmission Control



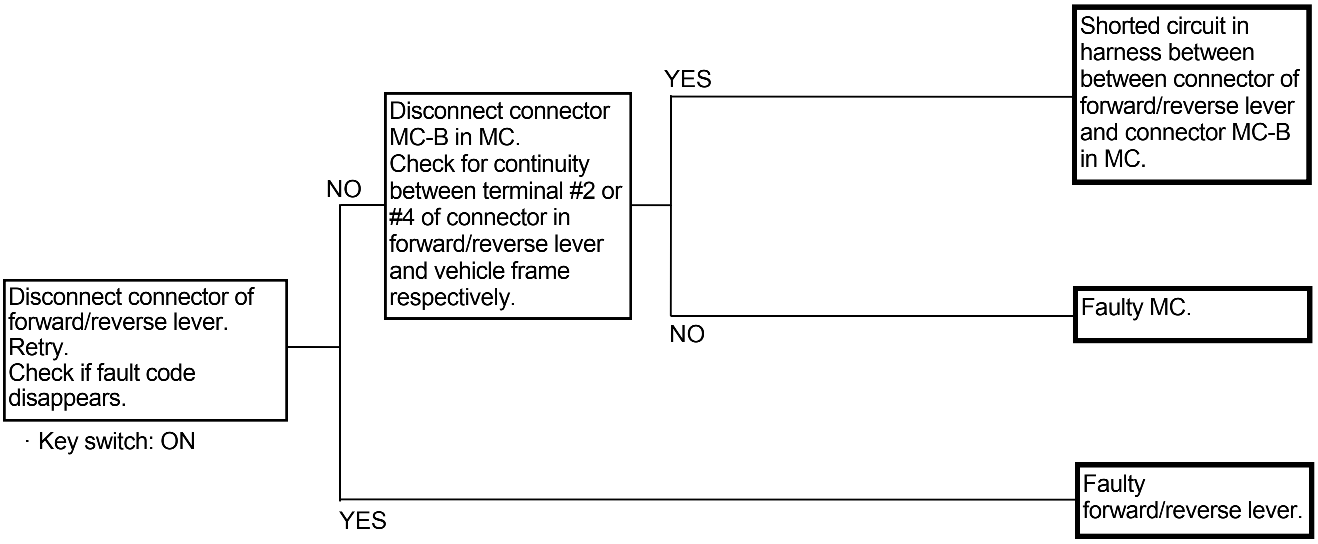
Connector (Harness end of connector viewed from the open end side)





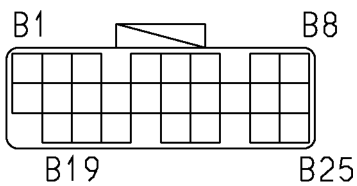
MC FAULT CODE 11904

Fault Code	Trouble	Cause	Influenced Control
11904-2	Abnormal Forward/Reverse Lever	The forward/reverse signals are turned ON for 80 ms or longer at the same time.	All Transmission Control



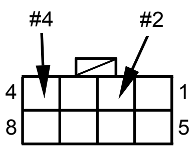
Connector (Harness end of connector viewed from the open end side)

MC
Connector MC-C



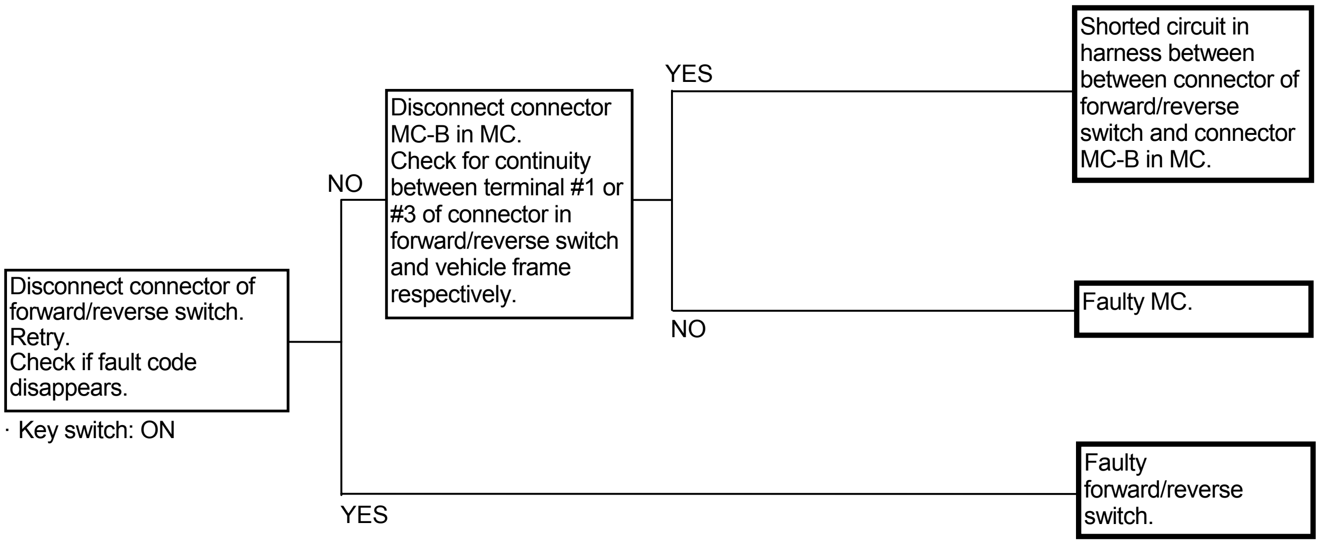
T183-05-04-021

Forward/Reverse Lever Connector



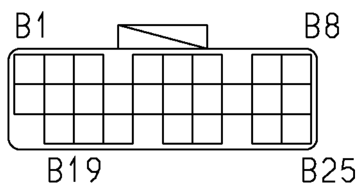
MC FAULT CODE 11905

Fault Code	Trouble	Cause	Influenced Control
11905-2	Abnormal Forward/Reverse Switch	The forward/reverse signals are turned ON for 80 ms or longer at the same time.	All Transmission Control



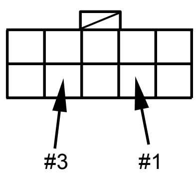
Connector (Harness end of connector viewed from the open end side)

MC
Connector MC-B



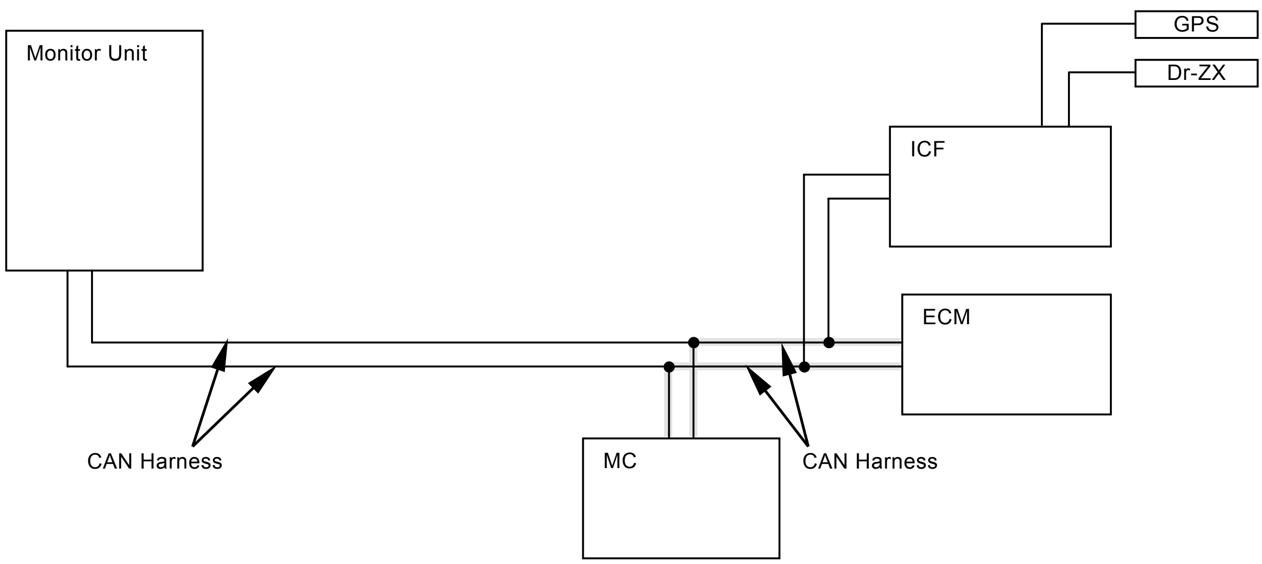
T183-05-04-021

Forward/Reverse Switch Connector



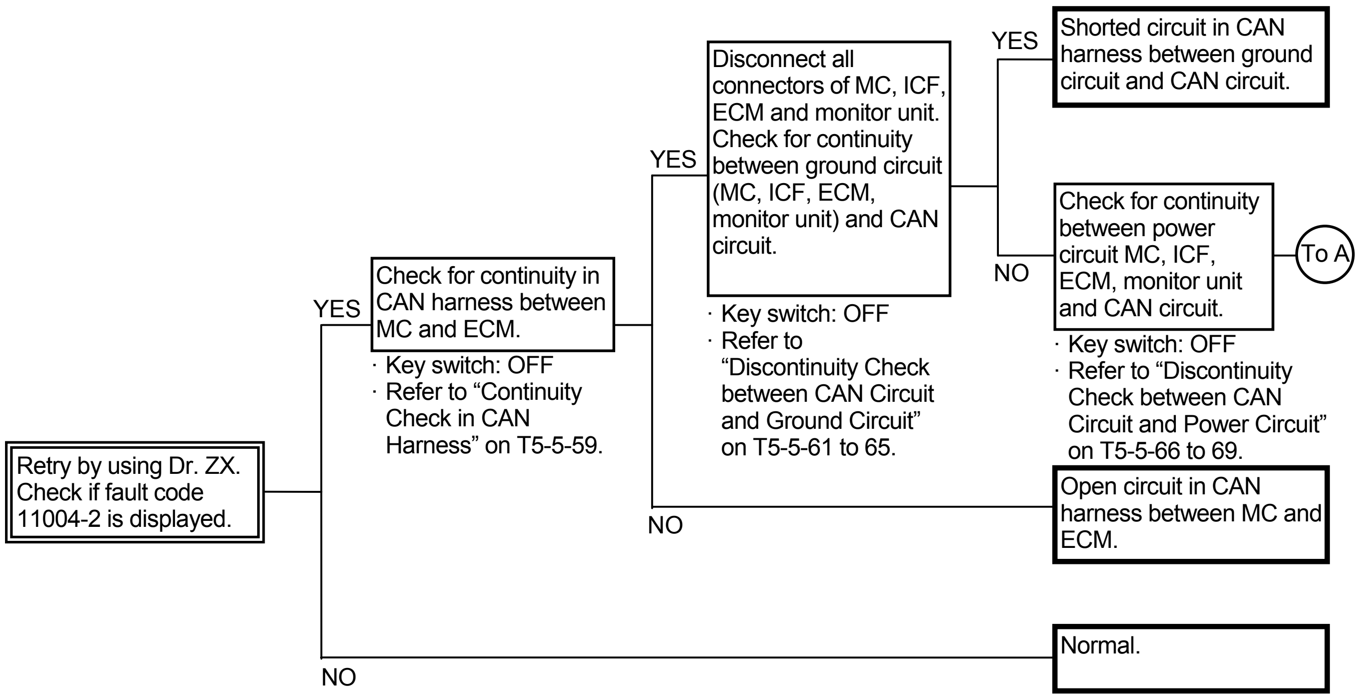
CAN DATA RECEPTION FAILURE
MC FAULT CODES 11910, 11920

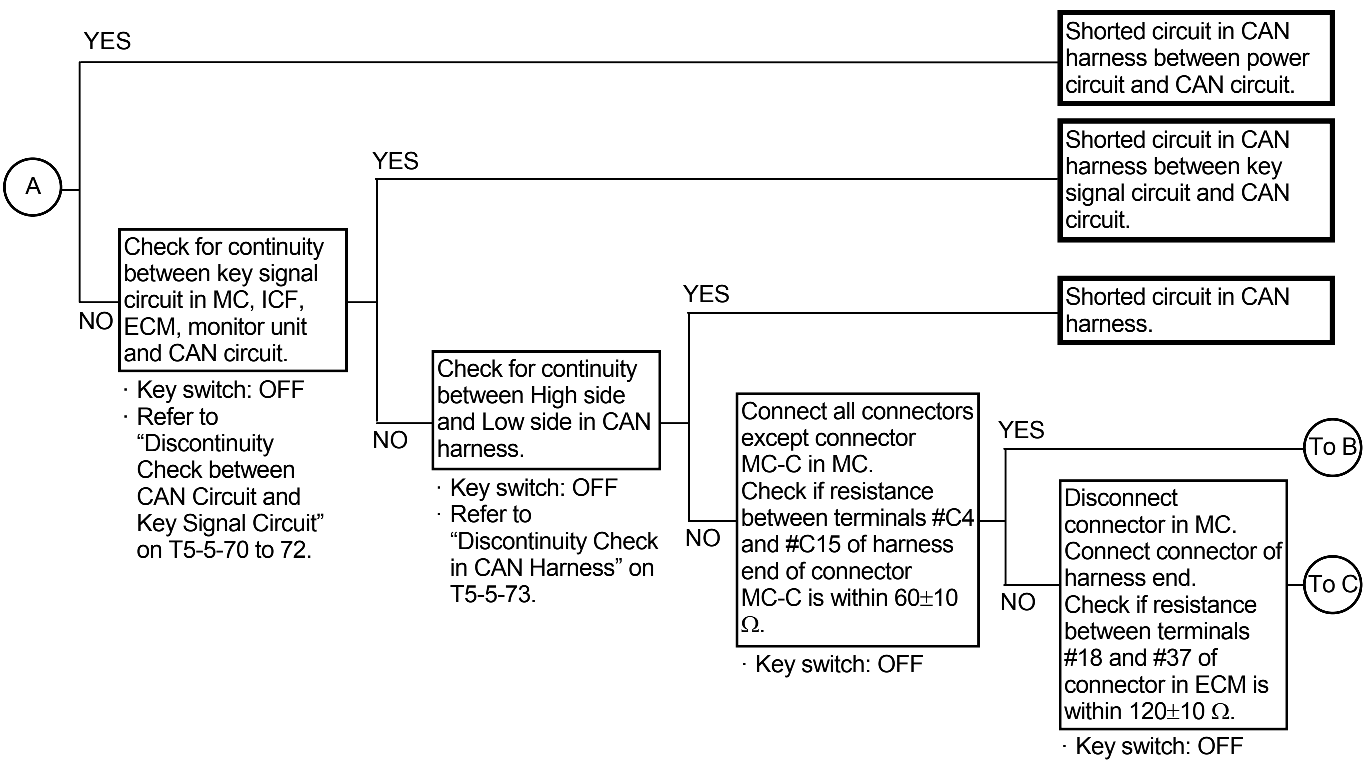
Fault Code	Trouble	Cause	Influenced Control
11910-2	Actual Engine Speed Receive Error Received from ECM	Faulty Harness Faulty ECM	• Pump Torque Decrease Control • Hydraulic Drive Fan Cooling Control
11920-2	Fuel Flow Rate Receive Error Received from ECM	Faulty Harness Faulty ECM	• Engine Speed Decrease Control

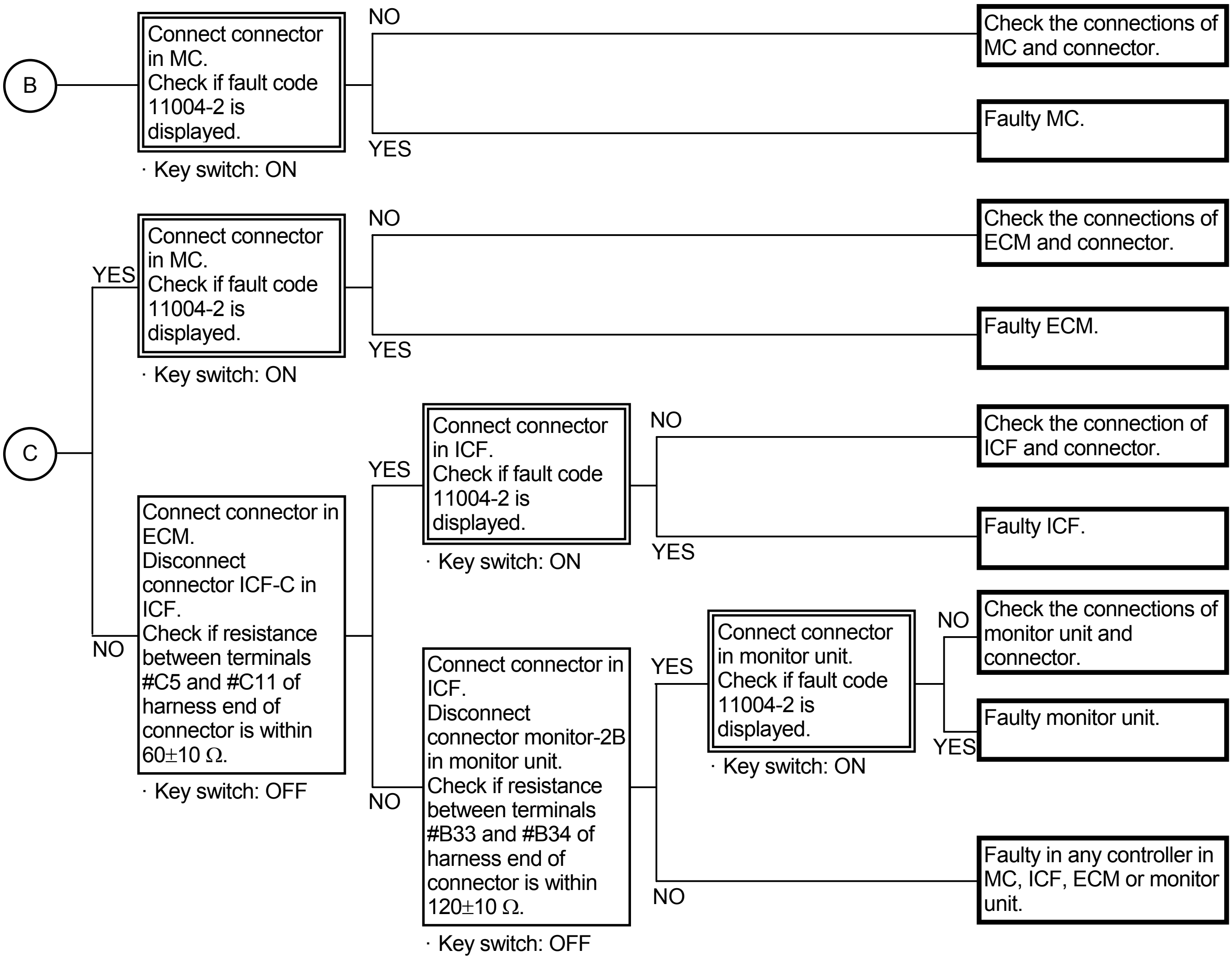


CAN HARNESS CHECK
MC FAULT CODES 11910, 11920

- Check the wiring connections first.

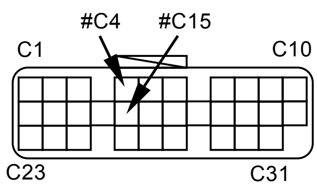




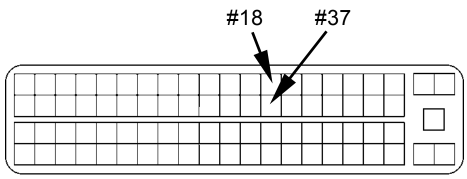


Connector

MC
Connector MC-C
(Harness end)

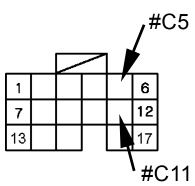


ECM
Connector
(Harness end)



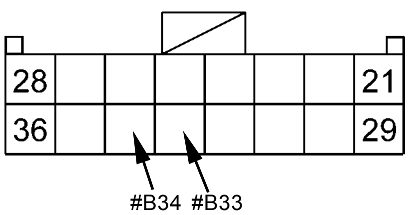
T1GR-05-04-002

ICF
Connector ICF
(Harness end)



T1V1-05-04-002

Monitor Unit
Connector Monitor-2B
(Harness end)



T4GB-05-05-002

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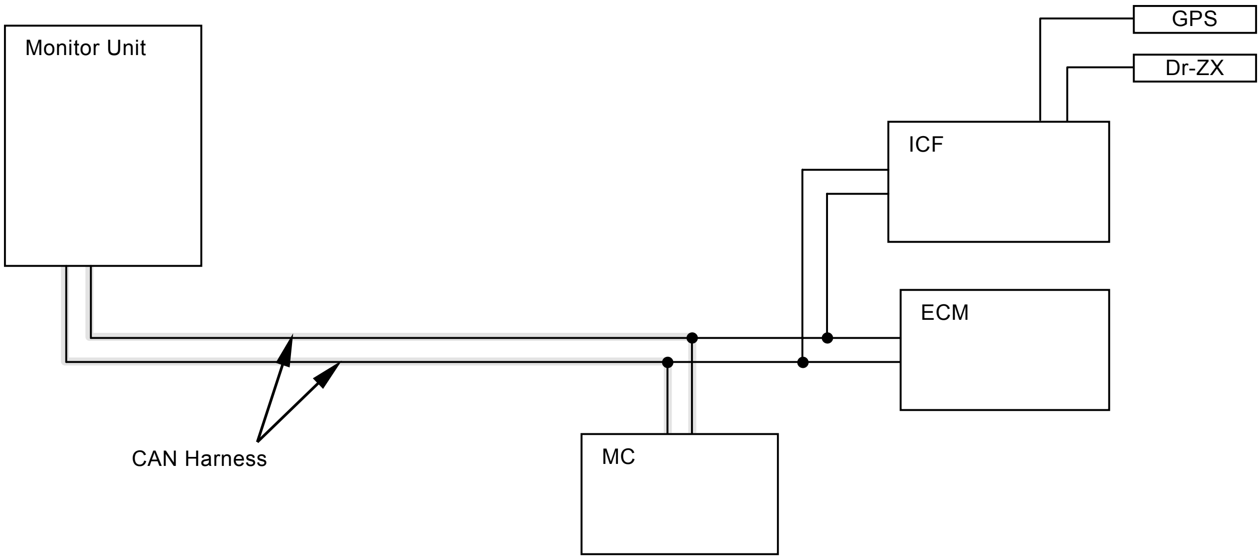
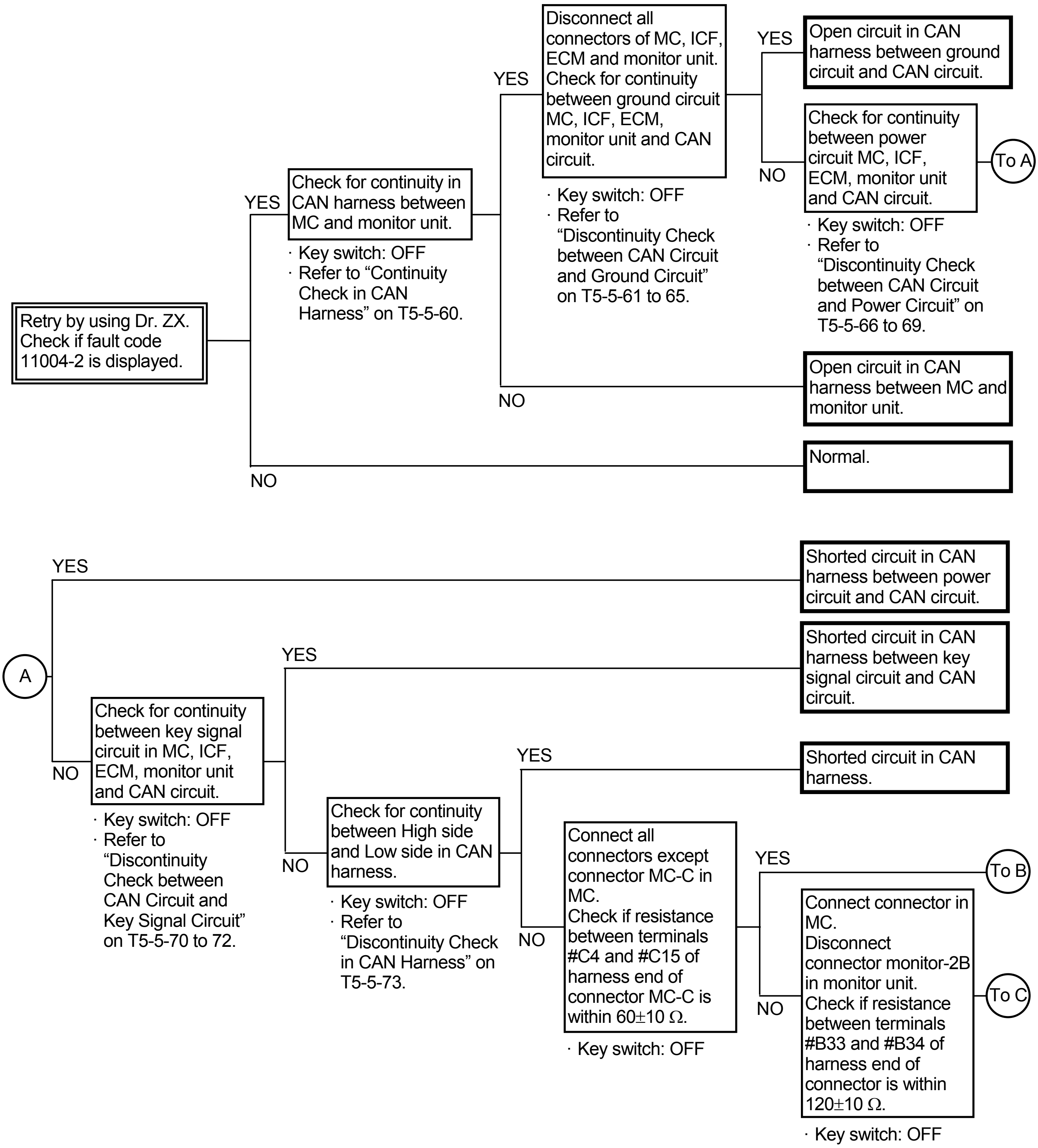
MC FAULT CODE 11914

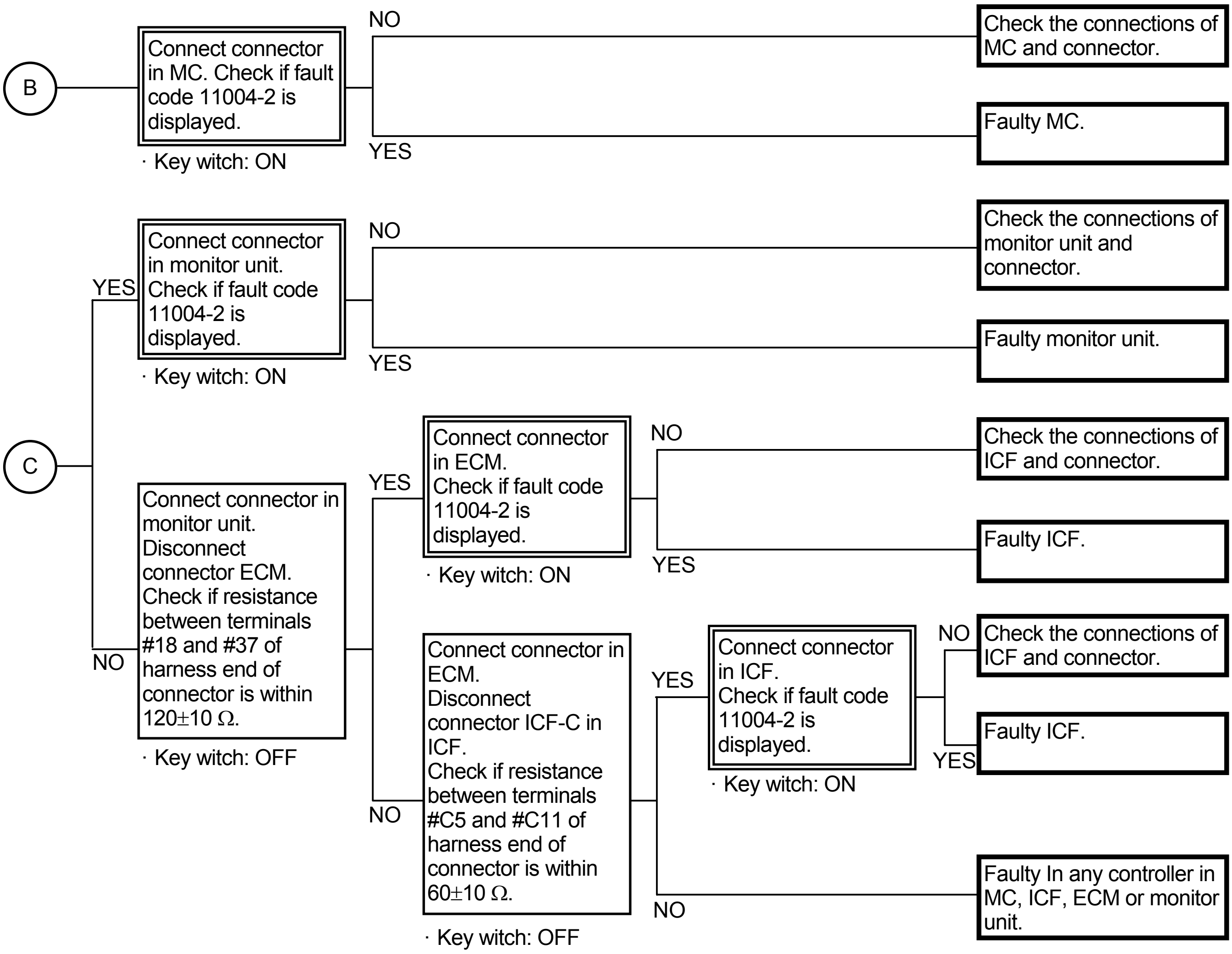
Fault Code	Trouble	Cause	Influenced Control
11914-2	Radiator Coolant Temperature Receive Error Received from Monitor Unit	Faulty Harness Faulty Monitor Unit	• Hydraulic Drive Fan Cooling Control



CAN HARNESS CHECK
FAULT CODE 11914

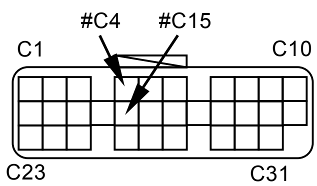
- Check the wiring connections first.



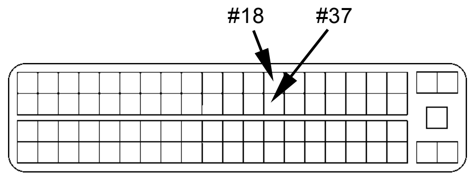


Connector

MC
Connector MC-C
(Harness end)

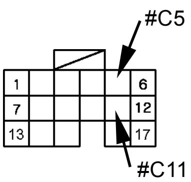


ECM
Connector
(Harness end)



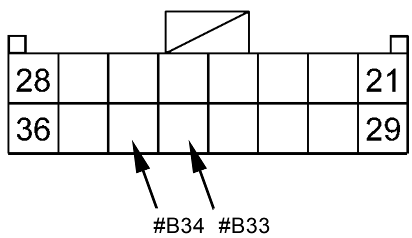
T1GR-05-04-002

ICF
Connector ICF-C
(Harness end)



T1V1-05-04-002

Monitor Unit
Connector Monitor-2B
(Harness end)



T4GB-05-05-002

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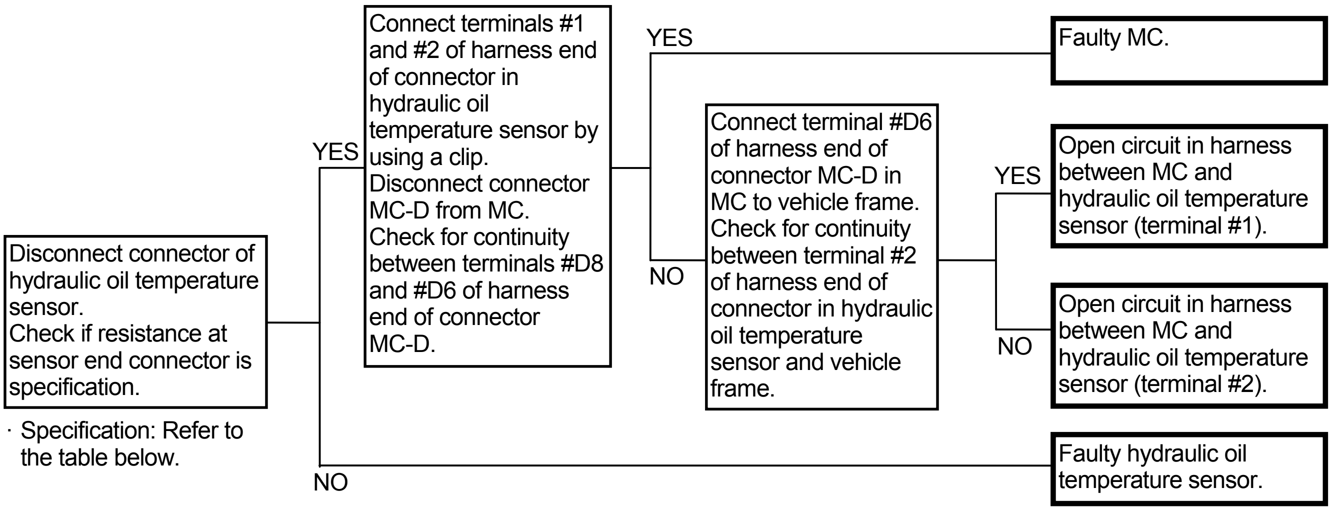
OTHER FAILURES
MC FAULT CODE 11901

Fault Code	Trouble	Cause	Influenced Control
11901-3	Hydraulic Oil Temperature Sensor High Voltage	Voltage: 4.52 V or higher	• Auto Warning-Up Control • Hydraulic Drive Fan Cooling Control
11901-4	Hydraulic Oil Temperature Sensor Low Voltage	Voltage: Less than 0.23 V	• Auto Warning-Up Control • Hydraulic Drive Fan Cooling Control



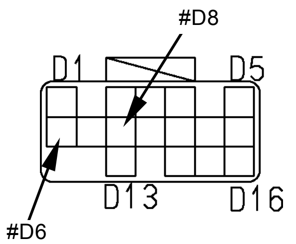
Specification of Hydraulic Oil Temperature Sensor

Hydraulic Oil Temperature (°C, °F)	Resistance (kΩ)
-20, -4	16.2±1.6
0, 32	(5.88)
20, 68	2.45±0.24
40, 104	(1.14)
60, 140	(0.534)
80, 176	0.322

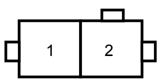
NOTE: *If fault code 11901-4 is not displayed and hydraulic oil temperature "-30°C" is displayed on the monitor by using Dr. ZX, the circuit in hydraulic oil temperature sensor may be opened.*

Connector (Harness end of connector viewed from the open end side)

MC
Connector MC-D



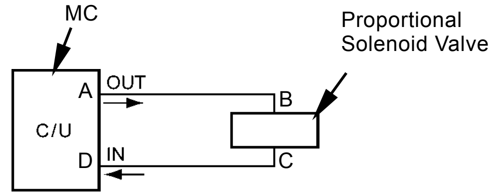
Hydraulic Oil Temperature
Sensor Connector



T183-05-04-009

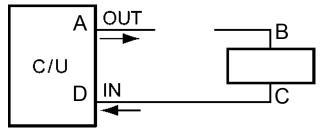
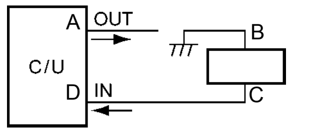
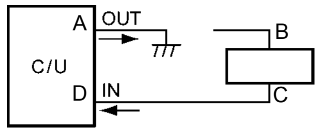
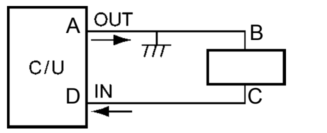
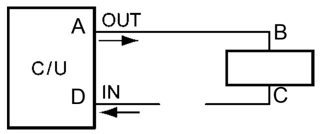
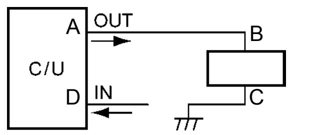
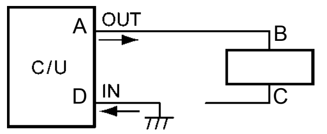
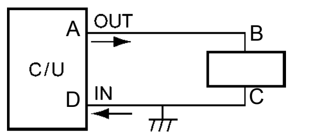
PROPORTIONAL SOLENOID VALVE TROUBLE CHECK

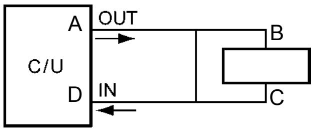
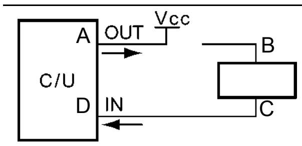
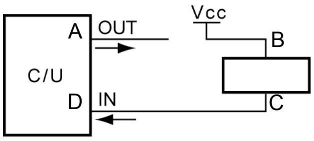
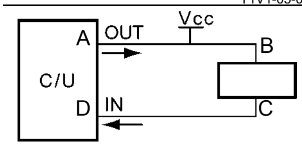
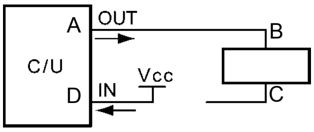
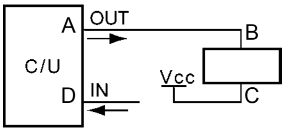
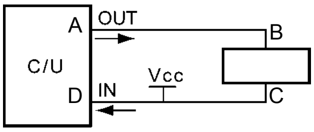
When the harness in proportional solenoid valve is faulty, the fault code may be not detected. If the trouble is related to the proportional solenoid valve, disconnect the connectors in MC and proportional solenoid valve. Then check for continuity.



T1V1-05-06-008

○: Fault code can be detected.
△: Fault code can be detected according to trouble.
×: Fault code cannot be detected.

Circuit Condition in Trouble	Trouble	Fault Code	Damaged Parts in MC
 T1V1-05-06-006	Open circuit in A-B	△	None
 T1V1-05-06-007	• Open circuit in A-B • Harness in side B is shorted to the ground.	○	None
 T1V1-05-06-009	• Open circuit in A-B • Harness in side A is shorted to the ground.	△	FET
 T1V1-05-06-010	Shorted circuit in A-B	○	FET
 T1V1-05-06-011	Open circuit in C-D	△	None
 T1V1-05-06-012	• Open circuit in C-D • Harness in side C is shorted to the ground.	△	None
 T1V1-05-06-013	• Open circuit in C-D • Harness in side D is shorted to the ground.	○	None
 T1V1-05-06-014	Shorted circuit in C-D	△	None

Circuit Condition in Trouble	Trouble	Fault Code	Damaged Parts in MC
 T1V1-05-06-015	Shorted circuit in harness between A-B and C-D	×	Resistance
 T1V1-05-06-016	• Open circuit in A- B • Harness in side A is shorted to the power source.	△	None
 T1V1-05-06-017	• Open circuit in A- B • Harness in side B is shorted to the power source.	○	None
 T1V1-05-06-018	Harness in A-B is shorted to the power source.	○	None
 T1V1-05-06-019	• Open circuit in C-D • Harness in side D is shorted to the power source.	○	Resistance
 T1V1-05-06-020	• Open circuit in C-D • Harness in side C is shorted to the power source.	△	None
 T1V1-05-06-021	Harness in C-D is shorted to the power source.	○	Resistance

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ECM, SENSOR SYSTEM
ECM FAULT CODES 100, 102, 105, 108, 110, 157, 172

Fault Code	Trouble	Fault Code (Tech 2)	Reference Page on 4HK1/6HK1 Engine Manual Troubleshooting
100-3	Abnormal Engine Oil Pressure Sensor (Abnormal Low Voltage)	P0522	1E-403
100-4	Abnormal Engine Oil Pressure Sensor (Abnormal High Voltage)	P0523	1E-409
102-3	Abnormal Boost Pressure Sensor (Abnormal Low Voltage)	P0237	1E-341
102-4	Abnormal Boost Pressure Sensor (Abnormal High Voltage)	P0238	1E-348
105-3	Abnormal Boost Temperature Sensor (Abnormal High Voltage)	P1113	1E-460
105-4	Abnormal Boost Temperature Sensor (Abnormal Low Voltage)	P1112	1E-452
108-3	Abnormal Atmospheric Pressure Sensor (Abnormal Low Voltage)	P0107	1E-231
108-4	Abnormal Atmospheric Pressure Sensor (Abnormal High Voltage)	P0108	1E-238
110-3	Abnormal Coolant Temperature Sensor (Abnormal High Voltage)	P0118	1E-266
110-4	Abnormal Coolant Temperature Sensor (Abnormal Low Voltage)	P0117	1E-259
157-3	Abnormal Common Rail Pressure Sensor (Abnormal High Voltage)	P0193	1E-294
157-4	Abnormal Common Rail Pressure Sensor (Abnormal Low Voltage)	P0192	1E-288
172-3	Abnormal Intake-Air Temperature Sensor (Abnormal High Voltage)	P0113	1E-251
172-4	Abnormal Intake-Air Temperature Sensor (Abnormal Low Voltage)	P0112	1E-245

ECM FAULT CODES 174, 636, 723, 10001

Fault Code	Trouble	Fault Code (Tech 2)	Reference Page on 4HK1/6HK1 Engine Manual Troubleshooting
174-3	Abnormal Fuel Temperature Sensor (Abnormal High Voltage)	P0183	1E-280
174-4	Abnormal Fuel Temperature Sensor (Abnormal Low Voltage)	P0182	1E-274
636-2	Abnormal Cam Angle Sensor (No Signal)	P0340	1E-368
636-2	Abnormal Cam Angle Sensor (Abnormal Signal)	P0341	1E-375
636-7	Phase Mismatch of Cam Angle Sensor	P1345	1E-524
723-2	Abnormal Crank Speed Sensor (No Signal)	P0335	1E-355
723-2	Abnormal Crank Speed Sensor (Abnormal Signal)	P0336	1E-362
10001-3	Abnormal EGR Position (Brushless spec.)	P0487	1E-391

IMPORTANT: When fault code 723-2 (abnormal crank speed sensor) is displayed and the engine does not start, the cam angle sensor is faulty although fault codes 636-2 (abnormal cam angle sensor) and 636-7 (phase mismatch of cam angle sensor) are not displayed.

ECM, EXTERNAL DEVICE SYSTEM
ECM FAULT CODES 651, 652, 653, 654, 655, 656, 1347, 10002

Fault Code	Trouble	Fault Code (Tech 2)	Reference Page on 4HK1/6HK1 Engine Manual Troubleshooting
651-3	Open Circuit in Injection Nozzle #1 Drive System	P0201	1E-301
652-3	Open Circuit in Injection Nozzle #2 Drive System	P0202	1E-308
653-3	Open Circuit in Injection Nozzle #3 Drive System	P0203	1E-315
654-3	Open Circuit in Injection Nozzle #4 Drive System	P0204	1E-322
655-3	Open Circuit in Injection Nozzle #5 Drive System	P0205	1E-329
656-3	Open Circuit in Injection Nozzle #6 Drive System	P0206	1E-334
1347-0	Open Circuit in Suction Control Valve Drive System, Shorted Circuit in + B or GND	P0090	1E-225
10002-2	Abnormal EGR Valve Control	P0488	1E-397

ECM, FUEL SYSTEM
ECM FAULT CODES 157, 633, 1239, 1240

Fault Code	Trouble	Fault Code (Tech 2)	Reference Page on 4HK1/6HK1 Engine Manual Troubleshooting
157-0	Abnormal Common Rail Pressure (First Stage)	P0088	1E-215
157-0	Abnormal Common Rail Pressure (Second Stage)	P0088	1E-215
157-2	Abnormal Common Rail Pressure (Pump Over-Pressure)	P0089	1E-220
633-7	Pressure Limiter Open	P1095	1E-443
1239-1	No Pressure to Pump (Fuel Leakage)	P0087	1E-207
		P1093	1E-434

ECM, ENGINE PROTECTION
ECM FAULT CODES 110, 190

Fault Code	Trouble	Fault Code (Tech 2)	Reference Page on 4HK1/6HK1 Engine Manual Troubleshooting
110-0	Overheating	P1173	1E-466
190-0	Overrunning	P0219	1E-339

ECM, EXTERNAL CIRCUIT SYSTEM
ECM FAULT CODES 987, 1485

Fault Code	Trouble	Fault Code (Tech 2)	Reference Page on 4HK1/6HK1 Engine Manual Troubleshooting
987-3	Abnormal Check Engine Lamp	P0650	1E-429
1485-2	Abnormal Main Relay System (None)	P1625	1E-529

ECM, INTERNAL CIRCUIT SYSTEM
ECM FAULT CODES 628, 1077, 1079, 1080, 10003, 10004, 10005

Fault Code	Trouble	Fault Code (Tech 2)	Reference Page on 4HK1/6HK1 Engine Manual Troubleshooting
628-2	Abnormal ROM	P0601	1E-417
1077-2	Abnormal IC for CPU Watching	P0606	1E-421
1079-2	Abnormal 5 V Power Source 1 Voltage	P1631	1E-538
1080-2	Abnormal 5 V Power Source 2 Voltage	P1632	1E-541
10003-2	Abnormal Injection Nozzle Common 1 Drive System	P1261	1E-476
10004-2	Abnormal Injection Nozzle Common 2 Drive System	P1262	1E-487
10005-1	Abnormal Charge Circuit (Bank 1)	P0611	1E-423

ECM FAULT CODES 10006, 10007, 10008, 10009, 10010, 10011, 10013

Fault Code	Trouble	Fault Code (Tech 2)	Reference Page on 4HK1/6HK1 Engine Manual Troubleshooting
10006-1	Abnormal Charge Circuit (Bank 2)	P0612	1E-426
10007-2	Abnormal CPU	P0606	1E-421
10008-2	Abnormal A/D Converter	P1630	1E-536
10009-2	Abnormal 5 V Power Source 3 Voltage	P1633	1E-544
10010-2	Abnormal 5 V Power Source 4 Voltage	P1634	1E-547
10011-2	Abnormal 5 V Power Source 5 Voltage	P1635	1E-550
10013-2	Abnormal EEPROM	P0603	1E-419

ECM, COMMUNICATION SYSETEM
ECM FAULT CODE 639

Fault Code	Trouble	Fault Code (Tech 2)	Reference Page on 4HK1/6HK1 Engine Manual Troubleshooting
639-2	Abnormal CAN Bus Line	U2104	1E-553
639-3	Abnormal CAN Time Out	U2106	1E-558

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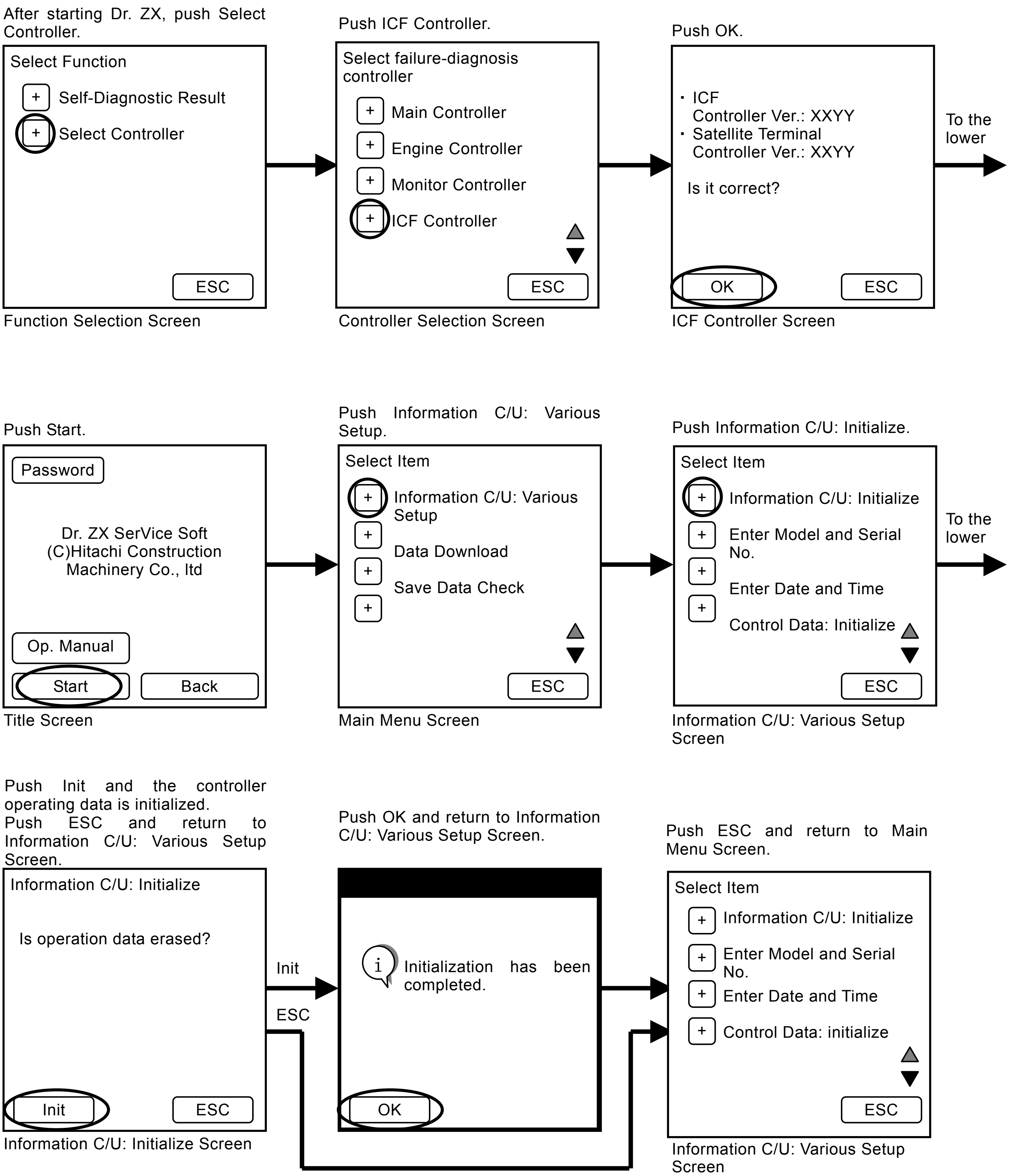
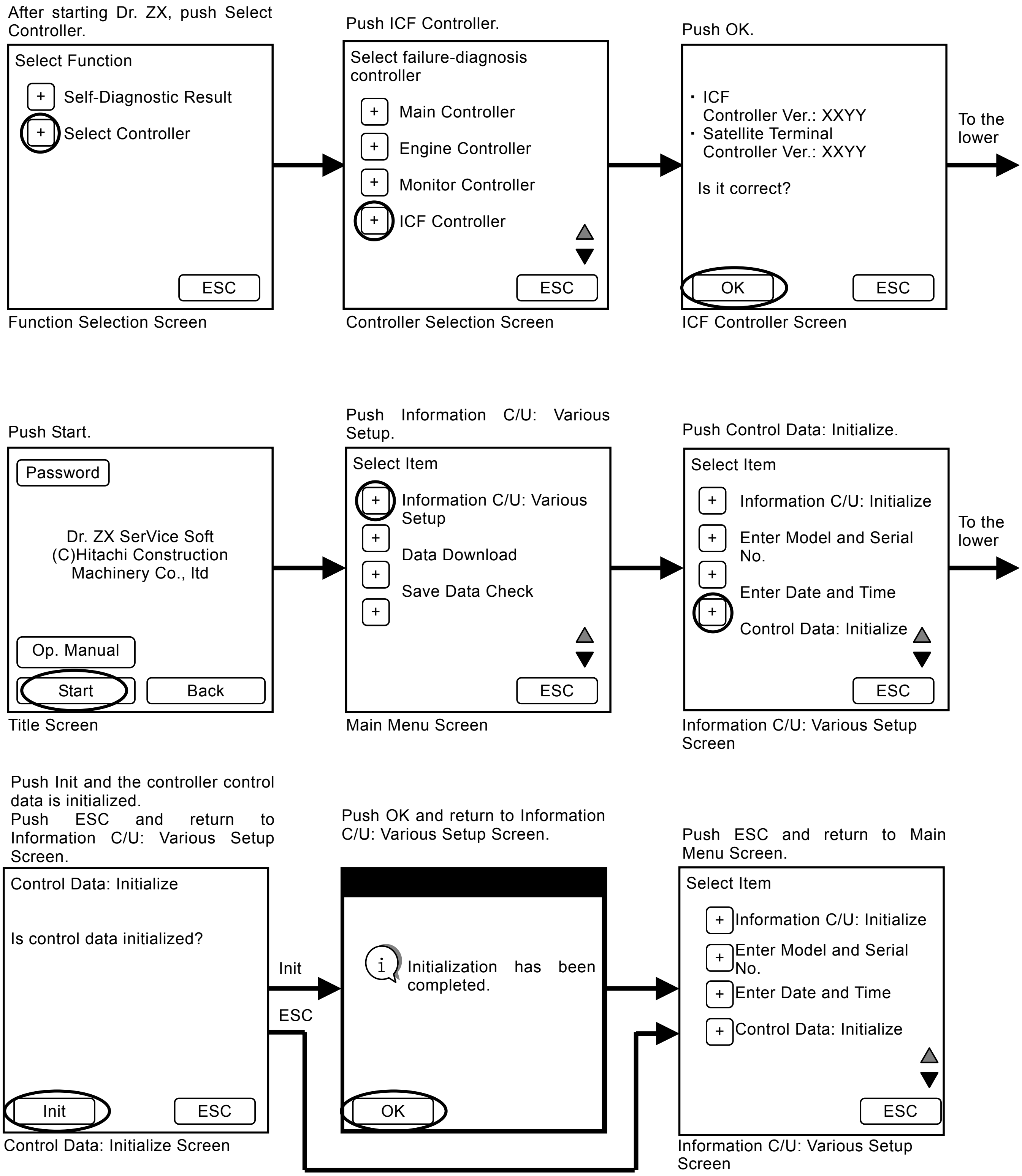
ICF, SATELLITE TERMINAL FAULT CODES 14000 to 14003

Fault Code	Trouble	Remedy
14000-2	Abnormal CAN Communication	Execute retry B in self-diagnosing. If this error code is displayed after re-try, check the following item. • Check the CAN communication line (harness).
14001-2	ICF: Flash Memory Read / Write Error	Execute retry B in self-diagnosing and execute the following item. • Execute “Information C/U: Initialize”.
14002-2	ICF: External RAM Read Error	
14003-2	ICF: EEPROM Sum Check Error	Execute retry B in self-diagnosing. If this error code is displayed after re-try, check the following item. • Execute “Control Data: Initialize”. • Execute “Enter Model and Serial No.”. Then, execute self-diagnosing and execute retry B.

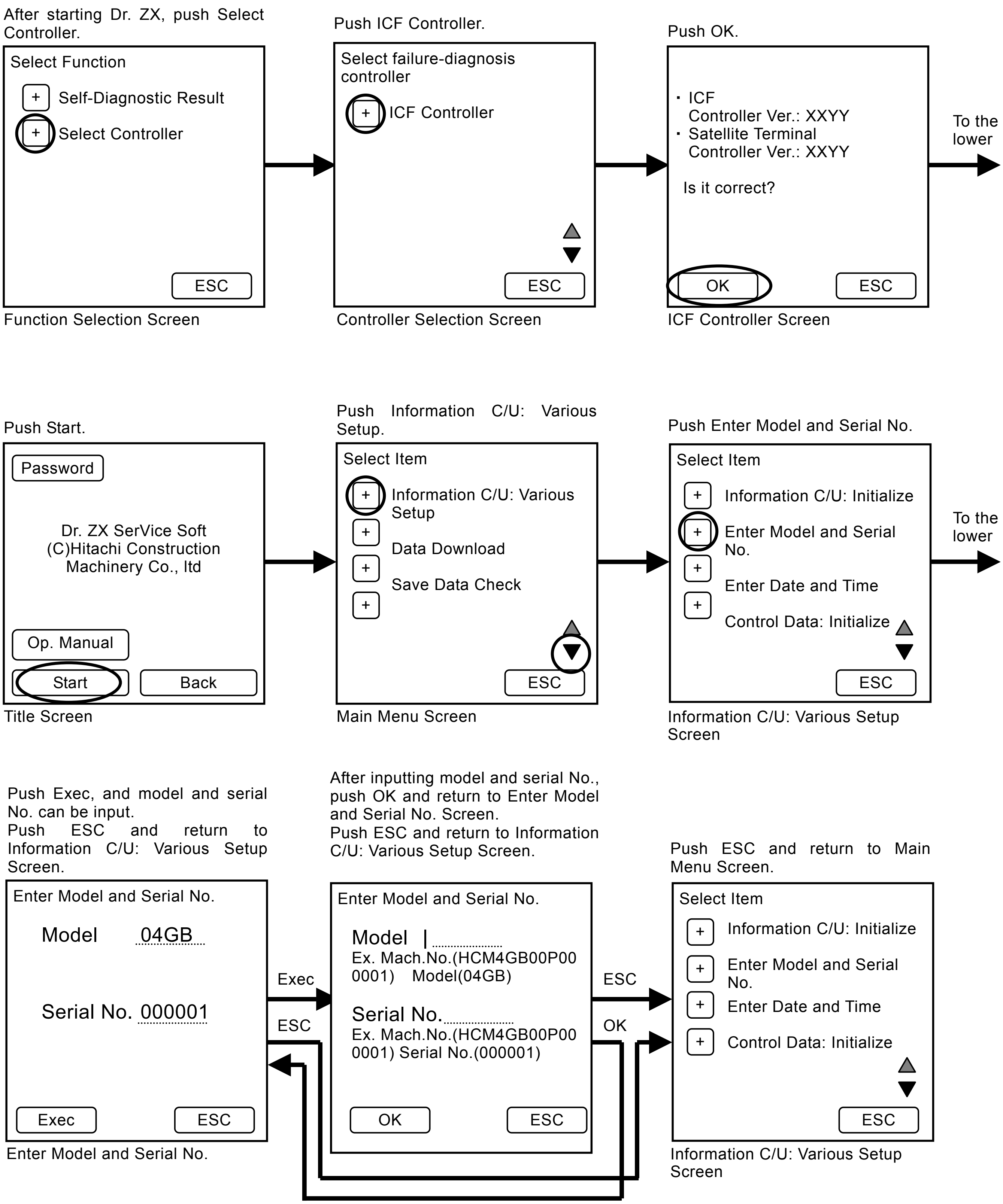
Information C/U: Initialize



Control Data: Initialize



Enter Model and Serial No.



ICF, SATELLITE TERMINAL FAULT CODES 14006, 14008, 14100 to 14106

Fault Code	Trouble	Remedy
14006-2	ICF: Satellite Communication Terminal Communication Error	Execute retry B in self-diagnosing. If this error code is displayed after re-try, check the following item. ・Check the communication line. ・Check the power source line of satellite terminal. ・Check the fuse. Then, execute self-diagnosing and execute retry B.
14008-2	ICF: Abnormal Internal RAM	Execute retry B in self-diagnosing. If this error code is displayed after re-try, replace the controller.
14100-2	Satellite Communication Terminal: Abnormal EEPROM	
14101-2	Satellite Communication Terminal: Abnormal IB/OB Queue	
14102-2	Satellite Communication Terminal: Abnormal Local Loup Back	Check the communication aerial of satellite terminal. (Refer to T5-5-115.)
14103-2	Satellite Communication Terminal: The satellite is not found.	
14104-2	Satellite Communication Terminal: Fail 1 of Remote Loup Back	Execute retry B in self-diagnosing. If this error code is displayed after re-try, replace the controller.
14105-2	Satellite Communication Terminal: Fail 2 of Remote Loup Back	
14106-2	Satellite Communication Terminal: Sending and receiving data are mismatched.	

Fault Code 14006-2

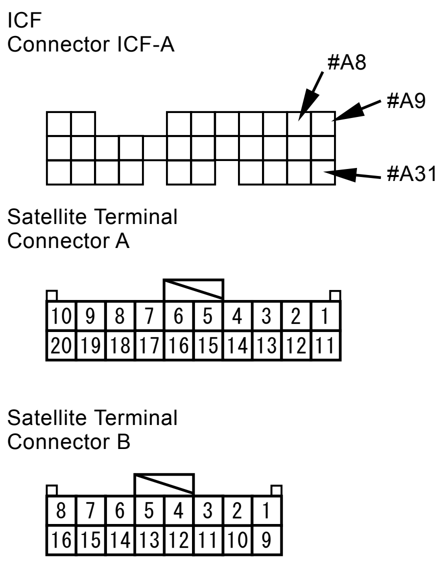
・Check the communication line

1. Check for continuity between terminal #A8 of harness end of connector ICF-A in ICF and terminal #10 of harness end of connector A in satellite terminal.
2. Check for continuity between terminal #A9 of harness end of connector ICF-A in ICF and terminal #20 of harness end of connector A in satellite terminal.
3. Check for continuity between terminal #A31 of harness end of connector ICF-A in ICF and terminal #2 of harness end of connector B in satellite terminal.

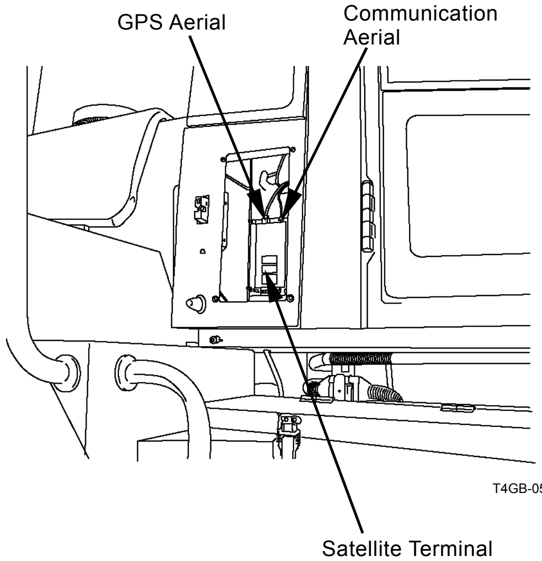
・Check the power source line of satellite terminal

1. Check the battery power
   Check if voltage between terminal #2 of harness end of connector A in satellite terminal and vehicle frame is 24 V.
2. Check the main power
   With the key switch ON, check if voltage between terminal #1 of harness end of connector A in satellite terminal and vehicle frame is 24 V.
3. Check the ground circuit
   Check for continuity between terminals #11 and #12 of harness end of connector A in satellite terminal.

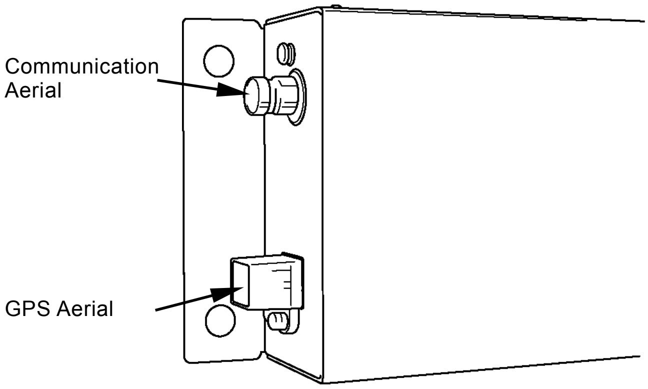
Connector (Harness end of connector viewed from the open end side)



Fault Codes 14102-2, 14103-2



T4GB-05-07-002



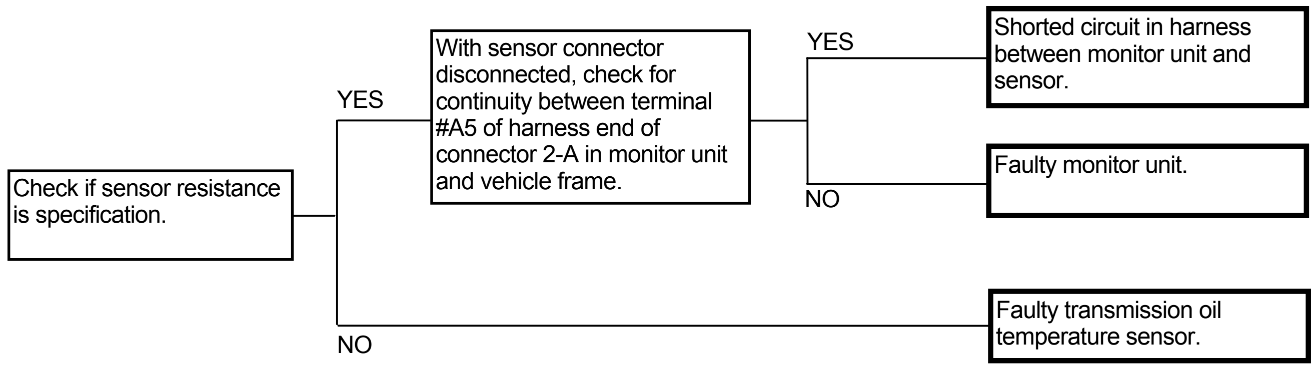
T1V1-05-06-004

MONITOR UNIT FAULT CODES 13306, 13308

Fault Code	Trouble	Remedy
13306-2	Abnormal EEPROM	If this error code is displayed after re-try, replace the monitor unit.
13308-2	Abnormal CAN Communication	Refer to “Check CAN Harness” (T5-5-58).

MONITOR UNIT FAULT CODE 13312

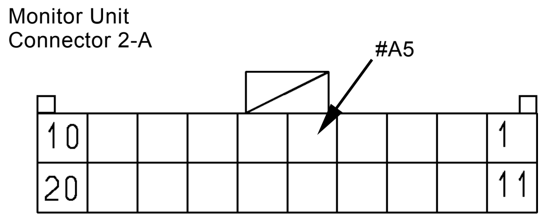
Fault Code	Trouble	Remedy
13312-2	Abnormal Transmission Oil Temperature Sensor	Execute re-try. Check the transmission oil temperature sensor and harness.



Transmission Oil Temperature Sensor

Coolant Temperature (°C, °F)	Resistance (kΩ)
25, 77	7.6±0.76
40, 104	4.0±0.35
50, 122	2.7±0.22
80, 176	0.92±0.07
95, 203	0.56±0.04
105, 221	0.42±0.03
120, 248	0.28±0.01

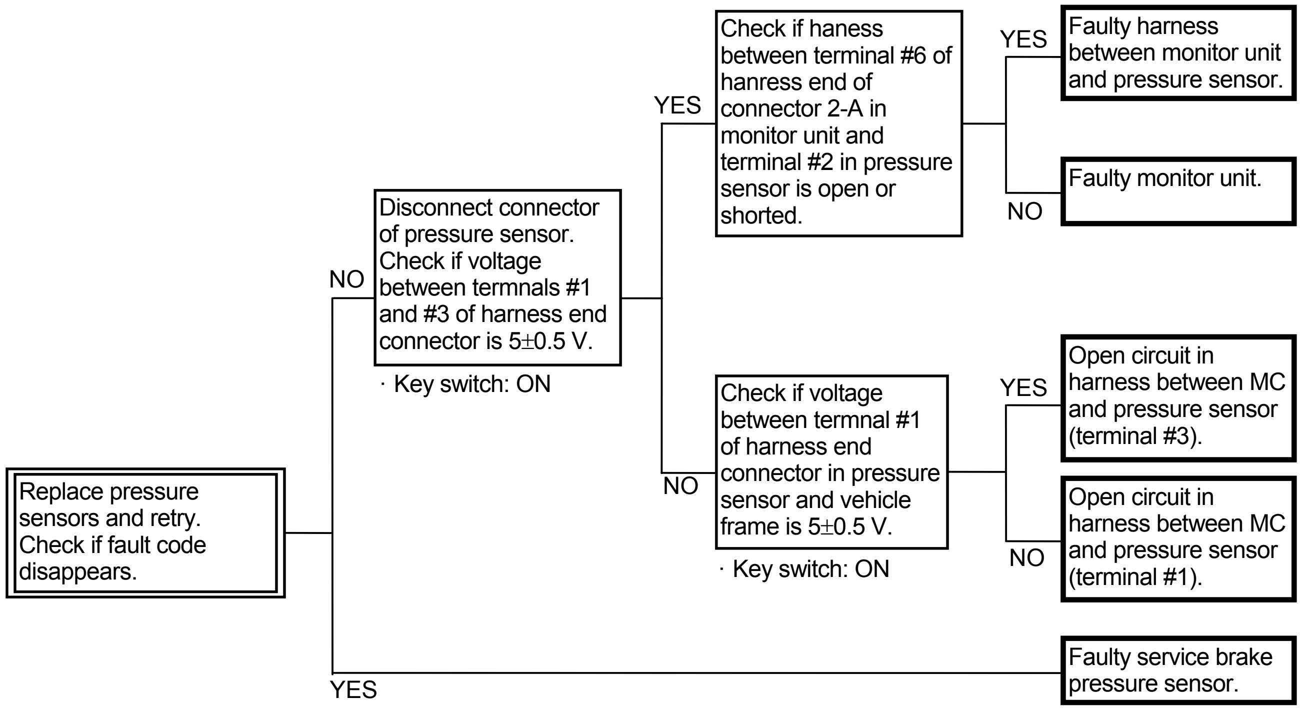
Connector (Harness end of connector viewed from the open end side)



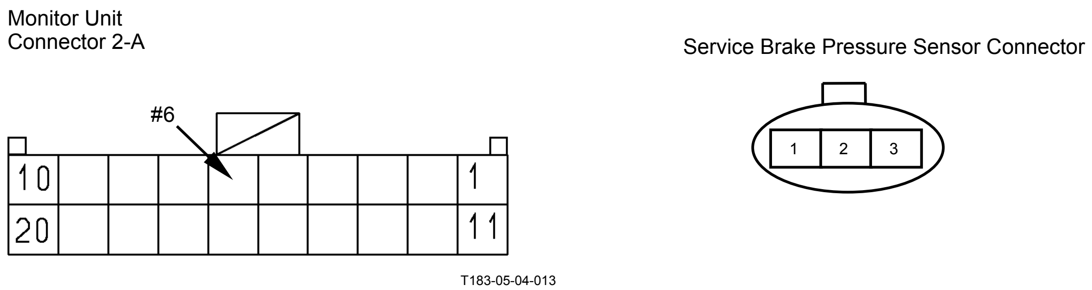
T183-05-04-013

MONITOR UNIT FAULT CODE 13314

Fault Code	Trouble	Remedy
13314-3	Service Brake Pressure Sensor High Voltage	Execute re-try. Check the service brake pressure sensor and harness.
13314-4	Service Brake Pressure Sensor Low Voltage	Execute re-try. Check the service brake pressure sensor and harness.



Connector (Harness end of connector viewed from the open end side)



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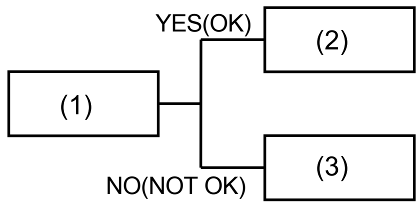
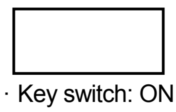
TROUBLESHOOTING B PROCEDURE

Apply troubleshooting B procedure when no fault code is displayed on the service mode (built-in diagnosing system) in monitor and Dr.ZX although the machine operation is abnormal.
On the front section pages of this group are the tables indicating the relationship between machine trouble symptoms and related parts which may cause such trouble if failed.
Start the troubleshooting with more probable causes selected by referring to these tables.

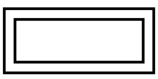
- How to Read the Troubleshoting Flow Charts



- After checking or measuring item (1), select either YES (OK) or NO (NOT OK) and proceed to item (2) or (3), as appropriate.



- Special instructions or reference item are indicated in the spaces under the box. Incorrect measuring or checking methods will render troubleshooting impossible, and may damage components as well.



- Use the service mode in monitor and the diagnosing system/controller diagnosing system in Dr.ZX.

- Causes are stated in a thick-line box. Scanning through thick-line boxes, possible causes can be seen without going through the flow chart.

RELATIONSHIP BETWEEN MACHINE TROUBLE SYMPTOMS AND RELATED PARTS

This table indicates the relationship between machine trouble symptoms and the potential problem parts, which may cause trouble if failed, and the evaluation methods of these components.

Parts	Function	Symptoms in control system when trouble occurs.	Symptoms in machine operation when trouble occurs.
Forward/Reverse Lever	• Sends the command signal on Forward/Reverse to MC. • Sends the signal on forward/reverse to the neutral relay.	• Keeps MC in neutral when traveling.	• Although the forward/reverse lever is operated, the machine does not travel. • Although the forward/reverse lever is in Reverse, the backlight and back buzzer are not operated.
Shift Switch	• Sends the command signal on speed gear to MC.	• Particular speed gear only can be operated according to condition of the shorted or open circuit.	• When the travel mode switch is manually operated, the machine can travel at particular speed gear only. • When the travel mode switch is automatically operated, speed can be shifted to particular speed gear only.
Parking Brake Switch	• Releases/applies the parking brake.	• The parking brake cannot be released or applied.	• Although the parking brake switch is OFF, the machine cannot operate in the forward or reverse direction. • Although the parking brake switch is ON on the slope, the machine moves.
Travel Mode Selector Switch	• Sends the command signal on travel mode to MC.	• MC makes only the travel mode in manual gear shifting operable.	• When the automatic gear shifting is selected, the machine can travel in the travel mode in manual gear shifting only.
Work Mode Selector Switch	• Sends the command siganl on work mode to MC.	• MC keeps the work mode selector switch in Normal mode.	• Although mode L has been used, fuel consumption suddenly increases after certain week or month. • Machine operation may be normal according to the switch by which engine output is controlled to low at low speed gear.
Clutch Cut-Off Position Switch	• Sends the command siganl on clutch cut-off to MC.	• MC makes the clutch cut-off mode disabled.	• Although mode S,N or D in the clutch cut-off mode switch is selected and the brake pedal is depressed, the clutch cut-off is not operated.
Down-Shift Switch Down-Shift/Up-Shift Switch	• Sends the command signal on down-shift/up-shift switch to MC. (The circuit in down-shift switch is connected to that at down-shift side in down-shift/up-shift switch.)	• MC makes down-shift/up-shift switch control disabled.	• Although the down-shift/up-shift switch is pushed, down-shift/up-shift is not operated. • Although the down-shift switch is pushed, down-shift is not operated.
Hold Switch	• Sends the command signal on hold switch to MC.	• MC makes hold switch control disabled.	• Although the auto spped gear shifting is selected and the hold switch is pushed, travel speed gear is not fixed.

Evaluation by Fault Code	Evaluation by Monitor Function	NOTE	Descriptions of Control (Operational Principle Section in T/M)
MC: 11904	MC Monitor Item: FNR switch, Selected speed gear, Actual speed gear, Backward alarm, Neutral signal	-	T2-1, T2-4
-	MC Monitor Item: Selected speed gear, Actual speed gear, Speed gear	-	T2-1, T2-4
-	-	• The parking brake is the spool regulated pump control circtuit (The parking brake is released with the parking brake switch OFF). • If the parking brake pressure sensor is faulty, the parking brake indicator does not light with the parking brake switch ON.	T2-1, T2-3, T2-4
-	MC Monitor Item: Auto/manual selection, auto speed gear shifting mode	-	T2-1
-	MC Monitor Item: Engine torque control, Pump torque control	-	T2-1
-	MC Monitor Item: Clutch cut-off switch, Clutch cut-off mode	-	T2-1
-	MC Monitor Item: DSS switch, USS switch	• Altough other levers and switches corresponding to travel are operated and the down-shift/up-shift switch control is disabled, this contition is normal.	T2-1
-	MC Monitor Item: Speed gear hold switch, Hold mode	• Altough other levers and switches corresponding to travel are operated and the hold switch control is disabled, this contition is normal.	T2-1

Parts	Function	Symptoms in control system when trouble occurs.	Symptoms in machine operation when trouble occurs.
Forward/Reverse Switch	• Sends the command signal on forward/reverse to MC. • When the machine travels forward, the signal on forward is sent to the neutral relay in forward/reverse switch.	• MC makes forward/reverse switch control disabled during the work.	• The machine cannot travel forward/reverse by using the forward/reverse switch during the work. • Although the forward/reverse selector switch is turned ON and the forward/reverse switch indicator on monitor lights during the work, the machine does not travel forward/reverse.
Forward/Reverse Selector Switch	• Sends the command signal that the forward/reverse switch is enabled during the work to MC.	• The machine cannot travel forward/reverse by using the forward/reverse switch.	• The machine cannot travel forward/reverse by using the forward/reverse switch during the work. • Although the forward/reverse selector switch is turned ON, the forward/reverse switch indicator on monitor does not light during the work.
Fan Reversing Switch	• Sends the command signal that the fan motor rotates reverse to MC.	• The hydraulic drive fan cleaning control cannot be selected or released.	• Although the switch is turned ON, the cooling fan does not rotate reverse. • Although the switch is turned OFF, the cooling fan does not rotate forward. • If the switch is turned OFF and the forward/reverse switch is operated, engine speed does not increase.
Ride Control Switch	• Sends the command signal on ride control to MC.	• Ride control cannot be stopped or operated.	• Altough the ride control switch is turned ON, ride control is not operated. (Travel speed: 7 km/h) • Although the ride control switch is turned OFF, ride control is not stopped.
Emergency Steering Check Switch	• Sends the operating command signal on emergency steering pump unit to the monitor unit.	• The command signal is not sent to the monitor unit. • The command signal continues to be sent to the monitor unit.	• Emergency steering check operation cannot be operated. • Whenever the engine strats, the emergency steering pump unit is operated for 30 seconds.
Lift Arm Auto Leveler Set Switch (Optional)	• Sends the operating command signal on lift arm auto level to MC. • Sends the setting signal on lift arm stop position to MC.	• The lift arm auto level cannot be operated or stopped. • The lift arm stop position cannot be set randomly.	• Although the switch is turned ON, the lift arm does not stop at the set position. • Although the switch is turned OFF, the lift arm stops at the set position.

Evaluation by Fault Code	Evaluation by Monitor Function	NOTE	Descriptions of Control (Operational Principle Section in T/M)
MC: 11905	MC Monitor Item: Implement FNR switch, Selected speed gear, Actual speed gear, Backward alarm, Neutral signal	• Although the forward/reverse lever is operated and the forward/reverse switch operation is disabled during the work, this contition is normal.	T2-1
-	MC Monitor Item: Implement FNR selector switch, Implement FNR mode, Implement FNR operating light	• Although the forward/reverse lever is operated and the command signal from forward/reverse selector switch is disabled during the work, this contition is normal.	T2-1
-	MC Monitor Item: Fan reversing switch	• If the switch is turned ON under the certaion conditions, the fan reversing control cannot be operated. • If the key switch is turned OFF and the fan reversing switch is turned OFF, turn the key ON in 10 seconds. If not, the fan reversing control is operated on the logic in MC. When the switches cprresponding to travel are operated, engine speed is fixed to the idling speed. This condition is normal.	T2-1, T2-3
-	MC Monitor Item: Ride control switch	• If the travel speed sensor is faulty, ride control is disabled.	T2-1, T2-3
-	Monitor Unit Monitor Item: Emergency steering operation check switch	• When the engine starts, the emergency steering pump unit is operated for 2 seconds. This condition is normal.	T2-1, T2-4
-	MC Monitor Item: Boom height kickout switch, Boom height kickout setup switch, Ground stop switch, Ground stop setup switch	• The lift arm auto leveler upward set switch and lift arm auto leveler downward set switch are installed. • Each lift arm auto leveler set switch consists of the auto leveler ON/OFF switch and lift arm stop position setup switch. • The lift arm stop position cannot be set without learning the angle sensor. (Refer to T4-6.)	T2-1

Parts	Function	Symptoms in control system when trouble occurs.	Symptoms in machine operation when trouble occurs.
Accelerator Pedal Sensor	• Sends the command signal on accelerator depressing to MC.	• MC fixes engine speed to 1000 min^{-1}.	• As the accelerator pedal is depressed and engine speed does not increase, the machine moves slowly.
Coolant Temperature Sensor	• Sends the signal on coolant temperature to the monitor unit.	• Coolant temperature cannot be detected.	• Auto warming-up control is operated abnormally. • The coolant temperature gauge is operated abnormally.
Hydraulic Oil Level Sensor	• Sends the signal on hydrauli oil level to the monitor unit.	• Hydraulic oil level cannot be detected.	• The brake oil indicator is operated abnormally.
Air Filter Restriction Switch	• Sends the signal on air filter in-take pressure to the monitor unit.	• Air filter in-take pressure cannot be detected.	• The air filter restriction indicator is operated abnormally.
Fuel Level Sensor	• Sends the signal on fuel level to the monitor unit.	• Fuel level cannot be detected.	• The fuel gauge is operated abnormally.
Hydraulic Oil Temperature Sensor	• Sends the signal on hydraulic oil temperature to MC.	• Hydraulic oil temperature cannot be detected. • MC fixes the cooling fan to the maximum speed. • Engine auto warming-up control cannot be operated. • Altough outside air temperature is high, auto warming-up control is operated.	• Hydraulic drive fan cooling control cannot be operated. (Cooling fan: Maximum speed) • The hydraulic oil temperature indicator is operated abnormally.
Bucket Proximity Switch	• Uses for bucket auto leveler control. • ON: While the bar is passed in front, OFF: When the bar is out of front	• The bar cannot be detected.	• The bucket auto leveler cannot be used.
Lift Arm Proximity Switch	• Uses for lift arm height kickout control. • ON: While the plate is passed in front, OFF: When the plate is out of front	• The plate cannot be detected.	• The lift arm height kickout cannot be used.
Lift Arm Angle Sensor (Optional)	• Uses for lift arm auto leveler control (optional). • Sends the signal on lift arm operating angle to MC.	• Lift arm operating angle cannot be detected.	• The lift arm auto leveler control (optional) cannot be used.
Torque Converter Oil Temperature Sensor (Torque Converter Cooler Piping Upper)	• Sends the signal on torque converter oil temperature to the monitor unit.	• Torque converter oil temperature cannot be detected.	• Hydraulic drive fan cooling control cannot be operated. (Cooling fan: Maximum speed) • The transmission oil temperature gauge is operated abnormally.
Outside Air Temperature Sensor (for Air Conditioner)	• Sends the signal on air temperature to the air conditioner controller.	• Auto temperature control in the air conditioner cannot be operated.	• The cab inside becomes cold or hot rapidly.

Evaluation by Fault Code	Evaluation by Monitor Function	NOTE	Descriptions of Control (Operational Principle Section in T/M)
MC: 11103	MC Monitor Item: Required engine speed deviation, Engine speed deviation, Accelerator pedal, ECM Monitor Item: Actual engine speed, Target engine speed	• If MC malfunctions, ECM set engine speed to 1000min-1. In this case, if the accelerator dedal wiring is connected to ECM directly, engine speed control becomes possible.	T2-1
ECM: 110	ECM Monitor Item: Coolant temperature Monitor Unit Monitor Item: Radiator coolant temperature (possible to be displayed by using the service mode on monitor)	• The harnesses from same sensors are connected to ECM and the monitor unit respectively. If both temperature displays are abnormal, the sensor may be faulty. If one temperature display is abnormal, the controller including the abnormal harness may be faulty.	T2-1
-	MC Monitor Item: Service brake oil level switch	-	-
-	Monitor Unit Monitor Item: Air filter restriction	-	-
-	Monitor Unit Monitor Item: Fuel level	• If the circuit is opened or shorted, the fuel gauge pointes to ”E”.	-
MC: 11901	MC Monitor Item: Hydraulic oil temperature (possible to be displayed by using the service mode on monitor)	-	T2-1, T2-3
-	-	-	T2-1
-	-	-	T2-1
-	MC Monitor Item: Boom angle, Angle sensor learning status	• If the angle sensor learning is not completed, the lift arm stop position cannot be set. (Refer to T4-6.)	T2-1
-	-	-	T2-1, T2-3, T3-12
-	-	-	-

Parts	Function	Symptoms in control system when trouble occurs.	Symptoms in machine operation when trouble occurs.
Outside Air Temperature Sensor (for MC)	• Sends the signal on air temperature to MC.	• Air temperature cannot be detected.	• Just after the engine starts, the air conditioning is weak with the air conditioner switch ON. (No cooled wind blows.)
Torque Converter Input Speed Sensor	• Sends the signal on torque converter inlet speed to MC.	• Torque converter inlet speed cannot be detected.	• As torque decrese control cannot be operated, the engine has a load during combined operation of travel and front attachment. • Gear shifting shock may become big when traveling.
Torque Converter Output Speed Sensor	• Sends the signal on torque converter outlet speed to MC.	• Torque converter outlet speed cannot be detected.	• As torque decrese control cannot be operated, the engine has a load during combined operation of travel and front attachment. • Gear shifting shock may become big when traveling
Transmission Control Valve	• Is installed to the transmission. • Decreases oil presssure from the drive unit pump and supplies clutch connection pressure. • The spool moves according to the transmission proportional solenoid valve and clutch connection pressure is supplied to the certain clutch pack.	• Speed gear cannot be shifted normally.	• The following troubles may occur according to malfunction. As the serious accident including the transmission break occurs, judge the trouble carefully. • Although the forward/reverse lever is in Neutral, the machine moves. • Although the accelerator pedal is depressed, the machine moves slowly or does not move at all. At this time, although engine speed increases, the engine has a heavy load.
Transmission Proportional Solenoid Valve	• Is installed to the transmission control valve. • Consists of 6 solenoid valves for forward, reverse, first gear, second gear, third gear and fourth gear. Is operated by the command signal from MC and shifts the spool in transmission control valve.	• Speed gear cannot be shifted normally. • Travel speed is fixed to first gear or second gear due to the abnormal proportional solenoid valve.	• Big shock occurs when speed gear is shifted. • Speed gear is fixed to first gear or second gear.
Transmission Oil Temperature Sensor	• Is installed to the transmission. • Sends the signal on oil temperature to MC.	• Transmission oil temperature cannot be detected.	• Transmission oil temperature is not displayed on Dr. ZX and the monitor. • Transmission learning cannot be performed.

Evaluation by Fault Code	Evaluation by Monitor Function	NOTE	Descriptions of Control (Operational Principle Section in T/M)
-	MC Monitor Item: Outside air temperature	• The cooling fan rotates slowly just after the engine starts. At this time, if the air conditoner switch is turned ON, the air conditioning becomes weak. When air temperature is high and hydraulic oil and coolant temeprature are low, if the air conditoner switch is turned ON, MC increases target fan speed.	-
MC: 11105	MC Monitor Item: Actual engine speed, Engine speed deviation, Torque converter speed ratio (possible to be displayed by using the service mode on monitor)	-	T2-1, T3-9
MC: 11601	MC Monitor Item: Torque converter output speed, Torque converter speed ratio	-	T2-1, T3-9
-	-	-	T3-9
MC: 11414, 11415, 11416, 11417, 11418, 11419	MC monitor Item: T/M clutch proportional solenoid valve, T/M clutch proportional solenoid valve FB (for each for forward, reverse, first gear, second gear, third gear and fourth gear)	• If the travel mode siwtch is in Auto, only speed gear which is selected by using the shift switch can be operated. This condition is normal.	T2-1, T3-9
Monitor Unit: 13312	Monitor Unit Monitor Item: T/M torque converter (possible to be displayed by using the service mode on monitor)	• If the circuit is shorted, overheating is displayed. (red zone)	T3-9

Parts	Function	Symptoms in control system when trouble occurs.	Symptoms in machine operation when trouble occurs.
Transmission Middle Shaft Sensor	• Sends the signal on trasmission middle shaft speed to MC.	• MC cannot calculate travel speed.	• If the travel speed sensor malfunctions, travel speed is not displayed on the monitor.
Travel Speed Sensor	• Sends the signal on trasmission output shaft speed to MC.	• MC cannot calculate travel speed.	• Auto gear shifting cannot be operated.
Axle Oil Temperature Sensor	• Is installed to the axle upper. • Sends the siganl on axle oil temperature to the monitor unit.	• Axle oil temperature cannot be detected.	• Although axle oil temperature is over 120 °C, the service indicator does not light. • Altough axle oil temperature is less than 120°C, the service indicator lights.
Service Brake Pressure Sensor	• Is installed to the service brake pressure outlet port in front axle. • Sends the signal on pressure to MC.	• MC makes clutch cut-off control disabled.	• Although S, N or D in the clutch cut-off mode switch is selected, clutch cut-off is not operated when the brake pedal is depressed.
Priority Valve (Main Pump)	• Divides main pump delivery pressure oil into the steering valve and the control valve effectively.	• Division of main pump delievery pressure oil becomes less efficient.	• The steering or front attahment is operated slowy according to malfunction.
Main Pump Delivery Pressure Sensor	• Sends the signal on main pump delivery pressure to MC.	• Main pump delivery pressure cannot be detected. • MC makes torque decrease control disabled.	• Although engine torque control cannot be operated properly, clear malfunction may not occur except bad fuel consumption. • As torque decrease control cannot be operated, the engine has a load during combined operation of travel and front attachment.
Steering Relief Valve	• Is installed to the priority valve (main pump) side on main pump upper. • Is operated when steering circuit pressure exceeds the specification in order to protect the steering circuit.	• If the valve is kept open, the priority valve (main pump) is operated abnormally.	• If the valve is kept open, the priority valve (main pump) spool stops and pressure oil is supplied to the control valve. Then, steering is operated slowly. • If the valve is kept closed, the steering circuit may be damaged.

Evaluation by Fault Code	Evaluation by Monitor Function	NOTE	Descriptions of Control (Operational Principle Section in T/M)
MC: 5160, 5660, 5665, 5670, 5675, 5680, 5685	MC Monitor Item: Middle gear speed	-	T2-1, T3-9
MC: 11602	MC Monitor Item: Travel speed, Transmission output speed	-	T2-1, T3-9
Monitor Unit: 13318	Monitor Unit Monitor Item: Axle oil temperature	-	-
MC: 11312	MC Monitor Item: Pedal brake pressure	-	T2-1
-	-	-	T2-3, T3-1
MC: 11204	MC Monitor Item: Pump pressure	-	T2-1, T2-3, T3-1
-	-	-	T2-3, T3-1

Parts	Function	Symptoms in control system when trouble occurs.	Symptoms in machine operation when trouble occurs.
Implement Pressure Sensor	• Is installed to piping upper between main pump and control valve. • Sends the signal on pressure to control valve from main pump to MC.	• Pressure cannot be detected. • MC makes torque decrease control disabled.	• Although engine torque control cannot be operated properly, clear malfunction may not occur except bad fuel consumption. • As torque decrease control cannot be operated, the engine has a load during combined operation of travel and front attachment. • When travel load is heavy and the front attachment is operated, the engine may be stalled.
Negative Control Valve in Control Valve	• Supplies front/rear pressures at the orifice in neutral circuit in control valve to the main pump regulator. • As pressure difference becomes large with the front attachment in neutral, the main pump regulator decreases main pump delivery flow rate.	• Main pump delivery flow rate cannot be controlled properly.	• If pressure difference becomes small, there is no efficiency to the machine operation. In the long and medium terms, fuel consumption may become bad. • If pressure difference becomes large, the front attachment and steering are operated slowly.
Bucket Flow Rate Control Valve in Control Valve (ZW220)	• Controls pressure oil flow rate to the bucket cylinder during combined operation of bucket and lift arm in order to operate combined operation smoothly.	• Pressure oil flow rate to the bucket cylinder cannot be controlled properly.	• Speed ratio during combined operation of front attachment changes.
Flow Rate Control Poppet Valve in Control Valve (ZW250)	• Controls pressure oil flow rate to the bucket cylinder during combined operation of bucket and lift arm in order to operate combined operation smoothly.	• Pressure oil flow rate to the bucket cylinder cannot be controlled properly.	• Speed ratio during combined operation of front attachment changes. • Bucket single operation may become slow.
Flow Rate Control Selector Valve in Control Valve (ZW250)	• Reduces pressure oil flow rate to the bucket cylinder during combined operation of bucket and lift arm raise in order to operate combined operation smoothly.	• Pressure oil flow rate to the bucket cylinder cannot be controlled properly.	• Speed ratio during combined operation of front attachment changes. • Bucket single operation may become slow.
Steering Valve	• Controls pressure oil flow rate to the steering cylinder.	• The steering cylinder cannot be controlled.	• According to malfunction, the troubles may occur including the steering is operated slowly, the steering is operated without operating the steering hadle, and so on. • When the steering is operated, hunting may occur.
Steering Accumulator	• Absorbs pulsation in the steering circuit.	• Pulsation in the steering circuit cannot be absorbed.	• When the steering is operated, hunting occurs easily.
Stop Valve	• Stops supplying pressure oil to the steering valve from the steering pilot valve when the steering is operated to the stroke end, comes in contact with the frame and closes the valve.	• Pressure oil flow rate to the steering valve from the steering pilot valve cannot be controlled.	• When the valve is kept open, although the steering is operated to the stroke end, the steering handle can be operated. • When the valve is kept closed, the steering handle is operated hardly or cannot be operated.

Evaluation by Fault Code	Evaluation by Monitor Function	NOTE	Descriptions of Control (Operational Principle Section in T/M)
MC: 11209	MC Monitor Item: Implement pressure	-	-
-	-	If pressure becomes small, pump delivery pressure becomes over 2 Mpa (20kgf/cm^2) when the engine speed is at fast idle in neutral.	T2-3, T3-2
-	-	-	T2-3, T3-2
-	-	-	T2-3, T3-2
-	-	-	T2-3, T3-2
-	-	-	T2-3, T3-5
-	-	-	T2-3
-	-	-	T2-3

Parts	Function	Symptoms in control system when trouble occurs.	Symptoms in machine operation when trouble occurs.
Steering Pilot Valve	• Controls pilot pressure oil flow rate and direction to the steering valve spool end according to steering handle operating speed and direction.	• Pilot pressure oil flow rate cannot be controlled properly.	• According to malfunction, the troubles may occur including; although the steering handle is operataed fast, the steering is operated slowly, although the steering handle is operataed slowly, the steering is operated fast, and so on.
Ride Control Valve	• Supplies lift arm cylinder bottom pressure to the accumulator through the chage cut-off spool with the ride control switch OFF. • Closes the charge cut-off spool and blocks the circuit to lift arm cylinder bottom side when accmulated pressure in the accumulator exceeds the specification. • Operates the solenoid valve by the command signal from MC, moves the main spool and connects the circuits between lift arm cylinder bottom side and accumulator, between lift arm rod side and hydraulic oil tank when travel speed reaches 7km/h or faster with the ride control switch ON.	• Pressure cannot be accumulated in the accumulator. • The solenoid valve and main spool cannot be controlled.	• Ride control is not operated. (Shock when traveling is continued.) • Ride control does not stop. (Shock when traveling is always reduced.)
Emergency Steering Pressure Switch	• Is installed to emergency steering block in circuit upper between main pump and steering valve. • Sends the signal on steering circuit pressure to the monitor unit.	• Steering circuit pressure cannot be detected.	• Although there is no trouble in the steering circuit, the emergency steering pump is operated.
Emergency Steering Pump Delivery Pressure Switch	• Is installed to between emergency steering pump and emergency steering block. • When pressure oil beyond specification from the emergency steering pump is supplied, the connection is broken and the monitor unit judges that the emergency steering switch is operated correctly.	• The normal signal on pressure occurrence is not sent to the monitor unit.	• Although the emergency steering pump auto check circuit is operated when the engine starts, the emergency steering pump indicator blinks.
Hydraulic Fan Motor	• Operates the flow rate adjustment solenoid valve by the command signal from MC. Controls pressure oil flow rate to the fan motor by operating the flow rate control valve. Increases or decreases cooling fan speed. • Operates the reverse control solenoid valve by the command signal from MC. Shifts the outlet port for pressure oil to the fan motor by operating the reverse control valve. Switches the cooling fan in reverse rotation.	• The flow rate control valve cannot be controlled. • The reverse control valve cannot be controlled.	• Cooling fan speed cannot be controlled. • Cooling fan reverse control cannot be operated.

Evaluation by Fault Code	Evaluation by Monitor Function	NOTE	Descriptions of Control (Operational Principle Section in T/M)
-	-	-	T2-3, T3-4
-	MC Monitor Item: Ride control proportional valve output, Ride control proportional valve output FB	• If the travel speed sensor malfunctions, MC makes ride control disabled.	T2-1, T2-3, T3-8
Monitor Unit: 13313	Monitor Unit Monitor Item: Steering pressure	• Altough the emergency steering pump is operated for 2 seconds when the engine starts, this condition is normal.	T2-3, T2-4, T3-12
-	Monitor Unit Monitor Item: Emergency steering pump pressure switch	-	T2-3, T2-4
MC: 11412	MC Monitor Item: Hydraulic fan target speed, Hydraulic drive fan proportional valve, Hydraulic drive fan proportional valve FB, Hydraulic drive fan reverse valve	-	T2-1, T2-3, T3-3

Parts	Function	Symptoms in control system when trouble occurs.	Symptoms in machine operation when trouble occurs.
Charging Block	• Divides pilot pump pressure oil into the brake circuit and the pilot circuit effectively. • Accumulates pressure at outlets of brake circuit and pilot circuit and supplies stable pressure to both circuits.	• Stable pressure cannot be supplied to the brake circuit or the pilot circuit.	• The brake oil pressure indicator lights. • The parking brake cannot be released. • The front attachment/ steering are cylinders operated slowly.
Priority Valve (Charging Block)	• Is installed in the charging block. Divides pilot pump pressure oil into the brake circuit and the pilot circuit effectively.	• Stable pressure cannot be supplied to the brake circuit or the pilot circuit.	• The brake oil pressure indicator lights. • The parking brake cannot be released.
Primary Brake Pressure Sensor	• Is installed in the charging block. Monitors accumulated pressure in the service brake accumulator.	• Accumulated pressure in the the service brake accumulator cannot be detected.	• The brake oil pressure indicator on monitor always lights. • Although the trouble in the service brake circuit due to pressure decrease, the brake oil pressure indicator on monitor does not light.
Service Brake Relief Valve	• Is installed in the charging block. Is operated when accumulated pressure in the service brake accumulator exceeds the specification. • Supplies pilot pump delivery oil to the pilot circuit after the priority valve (charging block) is open.	• Accumulated pressure in the the service brake accumulator cannot be controlled.	• According to malfunction, the service brake efficinecy becomes bad or the parts in service brake circuit are damaged. • According to malfunction, the parking brake is completery not released or the parts in parking brake circuit are damaged.
Pump Torque Control Proportional Solenoid Valve	• Is installed in the charging block. Is operated by the command signal from MC. • Supplies pilot pressure for pump delivery flow rate control to the main pump regulator.	• Pilot pressure to the main pump regulator cannot be controlled and supplied.	• According to malfunction, the troubles may occur including the front attachment/steering are operated slowly, the engine stalled during combined operation of front attachment and travel or engine idling, and so on.
Parking Brake Solenoid Valve	• Controls that the parking brake is applied or released.	• The parking brake cannot be controlled to apply or release.	• According to malfunction, the parking brake cannot be applied or released.
Parking Brake Pressure Sensor	• Sends the signal on parking brake circuit pressure to MC.	• Parking brake circuit pressure cannot be detected. • MC makes the parking brake indicator go off forcibly. • MC makes forward/reverse operation disabled when the parking brake is applied.	• The machine cannot travel forwad/reverse. • The parking brake indicator does not light with the parking brake switch OFF. • Although the parking brake is applied, the machine can travel.
Electromagnet in Pilot Valve	• Fixes the control lever by the magnetic force when the electromagnet in pilot valve is magnetized and the control lever in pilot valve is moved to the detent position.	• The control lever in pilot valve is not fixed in the detent position.	• Although the electromagnet in pilot valve is magnetized, the control lever is not fixed.
Brake Valve	• Supplies pilot pressure according to brake pedal depression from the outlet port and operates the service brake.	• Pilot pressure cannot be controlled.	• The service brake does not function.

Evaluation by Fault Code	Evaluation by Monitor Function	NOTE	Descriptions of Control (Operational Principle Section in T/M)
-	-	-	T2-3, T3-7
-	-	-	T2-3, T3-7
Monitor Unit: 13314	Monitor Unit Monitor Item: Service brake pressure	-	T2-3, T3-7
-	-	-	T2-3, T3-7
MC: 11413	MC Monitor Item: Pump displacement proportional valve output, Pump displacement proportional valve output FB	-	T2-1, T2-3, T3-7
-	-	-	T2-1, T2-3, T2-4, T3-12
MC: 11313	MC Monitor Item: Parking brake pressure Monitor Unit Monitor Item: Parking brake signal, Parking brake pressure switch	• The parking brake body circuit is separated from the parking brake operation monitoring circuit. Therefore, although the parking brake operation monitoring circuit malfunctions, if the parking brake body circuit is normal, the parking brake can be operated.	T2-1, T2-3, T2-4, T3-12
-	MC Monitor Item: Boom height kickout, Ground stop system	-	T2-1, T3-6
-	-	-	T2-1, T2-3, T3-11

CORRELATION BETWEEN TROUBLE SYMPTOMS AND PART FAILURES

This table indicates the relationship between machine troubles and parts contributing to the cause of the trouble if failed.

● : Related, required to check
○ : Related. However, in case this component fails, other trouble symptom will be more noticeable so that this component will not be the direct cause of the trouble concerned.

Engine System Troubleshooting

Trouble Symptom / Parts	E-1	E-2	E-3
	Starter does not rotate.	Even if starter rotates, engine does not start.	Engine is difficult to start at low temperature.
Battery Relay	●		
Glow Relay			●
Safety Relay	●		
Neutral Relay	●		
Main Relay for ECM		●	
MC			
ECM		●	●
Key Switch	●		
Forward/Reverse Lever	●		
Forward/Reverse Switch	●		
Fan Reverse Switch			
Accelerator Pedal Sensor			
Main Pump Regulator			
Fuel Pump		●	○
Pump Delivery Pressure Sensor			
Implement Pressure Sensor			
Pump Torque Control Proportional Solenoid Valve			
Engine Unit		●	●
Engine Electrical Equipment	●	●	●
Remarks	Check fuse and battery.	Check intake and fuel system. (filter, piping)	Check fuse and battery.

NOTE: The trouble symptoms in this table are described provided that each trouble occurs independently.

In case more than one trouble occurs at the same time, find out all faulty components while checking all suspected components in each trouble symptom.

E-4	E-5	E-6
Even if accelerator pedal is depressed, engine speed remains unchanged.	Even if key switch is turned OFF, engine does not stop.	Engine stalls during operation under adverse condition such as at high altitude.
●		●
●	●	
	○	
●		
●		
		●
		●
		●
		●
●		○
●		●
Check wiring of accelerator pedal sensor.		Check fuse and battery.

Front Attachment System Troubleshooting

Parts \ Trouble Symptom	F-1 All front attachments does not move.	F-2 All front attachment operations are slow/ weak.	F-3 Certain front attachment is slow/ weak.
MC		●	
ECM		○	
Shift Switch			
Work Mode Selector Switch			
Accelerator Pedal Sensor		○	
Lift Arm Proximity Switch			
Torque Converter Input Speed Sensor			
Torque Converter Output Speed Sensor			
Main Pump		●	
Main Pump Regulator		○	
Priority Valve (Main Pump)		●	
Main Pump Delivery Pressure Sensor		●	
Steering Relief Valve		●	
Pilot Pump	○	●	
Implement Pressure Sensor		○	
Control Valve Spool		○	●
Main Relief Valve in Control Valve		○	○
Overload Relief Valve in Control Valve			●
Load Check Valve in Control Valve			●
Make-Up Valve in Control Valve			●
Restriction Valve in Control Valve			●
Bucket Flow Rate Control Valve in Control Valve (ZW220)			●
Flow Rate Control Poppet Valve in Control Valve (ZW250)			●
Flow Rate Control Selector Valve in Control Valve (ZW250)			●
Cylinder			●
Steering Valve		○	
Steering Pilot Valve		○	
Charging Block		●	
Priority Valve (Charging Block)		●	
Service Brake Relief Valve		●	
Pilot Relief Valve	○	●	
Pump Torque Control Proportional Solenoid Valve		●	
Pilot Valve			●
Electromagnet in Pilot Valve			
Pilot Shut-Off Valve	●	●	
Engine Unit		●	
Engine Electrical Equipment		●	
Remarks		Check fuse and battery.	

NOTE: The trouble symptoms in this table are described provided that each trouble occurs independently. In case more than one trouble occurs at the same time, find out all faulty components while checking all suspected components in each trouble symptom.

F-4	F-5	F-6	F-7	F-8
Front attachment moves with lever in neutral.	Front attachment drifts remarkably.	Bucket is slow during combined operation.	Work mode is not effective.	Lift arm height kickout is not operated.
			●	
			●	
			●	
			●	
				●
			●	
			●	
			●	
			●	
●	●			
	●			
		●		
		●		
		●		
	●			
			○	
●	●			
				●
	When the engine stops.			

● : Related, required to check
○ : Related. However, in case this component fails, other trouble symptom will be more noticeable so that this component will not be the direct cause of the trouble concerned.

NOTE: The trouble symptoms in this table are described provided that each trouble occurs independently.

In case more than one trouble occurs at the same time, find out all faulty components while checking all suspected components in each trouble symptom.

Trouble Symptom / Parts	F-9 Lift arm float is not operated.	F-10 Bucket auto leveler is not operated.	F-11 Lift arm auto lever is not operated. (optional)	F-12 Lift arm auto lever stop position cannot be set. (optional)	F-13 Ride Control is not effective.
MC			●	●	●
Ride Control Switch					●
Lift Arm Auto Leveler Set Switch (Optional)			●	●	
Bucket Proximity Switch		●			
Lift Arm Angle Sensor (Optional)			●	●	
Travel Speed Sensor					●
Control Valve Spool					○
Overload Relief Valve in Control Valve					○
Cylinder					○
Ride Control Valve					●
Charging Block					○
Priority Valve (Charging Block)					○
Service Brake Relief Valve					○
Pilot Relief Valve					○
Electromagnet in Pilot Valve	●	●	●		
Remarks			When the lift arm angle sensor does not learn and the stop position is not set, lift arm auto leveler is not operated.		

● : Related, required to check

○ : Related. However, in case this component fails, other trouble symptom will be more noticeable so that this component will not be the direct cause of the trouble concerned.

(Blank)

Travel System Troubleshooting

Trouble Symptom / Parts	T-1	T-2	T-3	T-4
	Machine does not travel forward/reverse.	Machine does not travel forward or reverse.	Machine moves with lever in neutral.	Even if travel speed is turned up or down, travel speed gear is not changed.
MC (Main Controller)	●	●	●	●
Forward/Reverse Lever	●	●	●	
Shift Switch				●
Travel Mode Selector Switch				
Down-Shift Switch				
Down-Shift/Up-Shift Switch				
Hold Switch				
Forward/Reverse Switch	●	●	●	
Forward/Reverse Selector Switch	●			
Drive Unit Charging Pump	●			
Torque Converter	●			
Transmission Control Valve	●	●	●	●
Transmission Proportional Solenoid Valve		●	●	●
Transmission		●	●	●
Travel Speed Sensor				●
Axle	○			
Service Brake	○			
Service Brake Pressure Sensor	●			
Propeller Shaft	○			
Parking Brake Pressure Sensor	●			
Brake Valve	●			
Engine Unit	○			
Engine Electrical Equipment	○			
Remarks				

NOTE: The trouble symptoms in this table are described provided that each trouble occurs independently.

In case more than one trouble occurs at the same time, find out all faulty components while checking all suspected components in each trouble symptom.

T-5	T-6	T-7
Even if up-shift switch is pushed, travel speed gear is not turned up.	Even if down-shift switch is pushed, travel speed gear is not turned down.	Even if hold switch is pushed, travel speed gear is not fixed.
●	●	●
○		
●	●	
		●
	●	
●	●	
		●
●	●	●
●	●	
	●	

● : Related, required to check
○ : Related. However, in case this component fails, other trouble symptom will be more noticeable so that this component will not be the direct cause of the trouble concerned.

NOTE: The trouble symptoms in this table are described provided that each trouble occurs independently.

In case more than one trouble occurs at the same time, find out all faulty components while checking all suspected components in each trouble symptom.

Trouble Symptom / Parts	T-8 Travel mode is not shifted.	T-9 Clutch cut-off is not operated.
MC (Main Controller)	●	●
Monitor Unit	●	●
Travel Mode Selector Switch	●	
Clutch Cut-off Position Switch		●
Torque Converter Input Speed Sensor	○	
Torque Converter Output Speed Sensor	○	
Travel Speed Sensor	○	
Service Brake Pressure Sensor		●
Remarks		

● : Related, required to check

○ : Related. However, in case this component fails, other trouble symptom will be more noticeable so that this component will not be the direct cause of the trouble concerned.

(Blank)

Brake System Troubleshooting

Parts \ Trouble Symptom	B-1 Parking brake is not released.	B-2 Parking brake is not locked.	B-3 Service brake efficiency is bad or low.
Parking Brake Relay 1	●		
Parking Brake Relay 2	●	●	
Monitor Unit	●		
Parking Brake Relay Switch	●	●	
Parking Brake	●	●	
Service Brake			●
Pilot Pump	○		○
Charging Block	○		
Priority Valve (Charging Block)	○		
Service Brake Relief Valve	○		
Pilot Relief Valve			●
Parking Brake Solenoid Valve	●	●	
Brake Valve			●
Engine Electrical Equipment	○		
Remarks			

● : Related, required to check
○ : Related. However, in case this component fails, other trouble symptom will be more noticeable so that this component will not be the direct cause of the trouble concerned.

NOTE: The trouble symptoms in this table are described provided that each trouble occurs independently.
In case more than one trouble occurs at the same time, find out all faulty components while checking all suspected components in each trouble symptom.

(Blank)

Steering/Other System Troubleshooting

Parts \ Trouble Symptom	H-1 Steering cylinder operation is slow or does not move.	O-1 Air conditioner operation malfunctions.
Main Pump	○	
Main Pump Regulator	○	
Priority Valve (Main Pump)	●	
Steering Relief Valve	●	
Pilot Pump	○	
Cylinder	●	
Steering Valve	●	
Steering Overload Relief Valve	●	
Stop Valve	●	
Steering Pilot Valve	●	
Charging Block	○	
Priority Valve (Charging Block)	○	
Pilot Relief Valve	○	
Other Electrical Equipment		●
Remarks	Check if the steering shaft is normal.	

● : Related, required to check
○ : Related. However, in case this component fails, other trouble symptom will be more noticeable so that this component will not be the direct cause of the trouble concerned.

NOTE: The trouble symptoms in this table are described provided that each trouble occurs independently.
In case more than one trouble occurs at the same time, find out all faulty components while checking all suspected components in each trouble symptom.

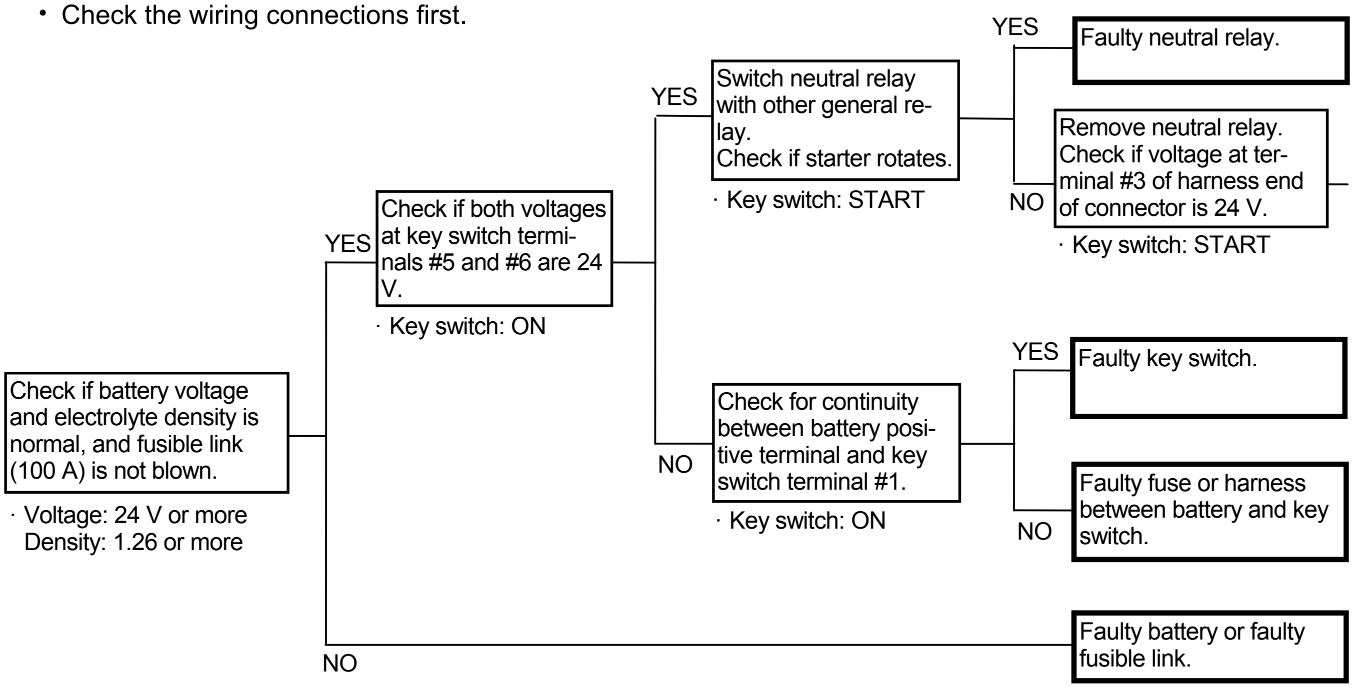
(Blank)

ENGINE SYSTEM TROUBLESHOOTING

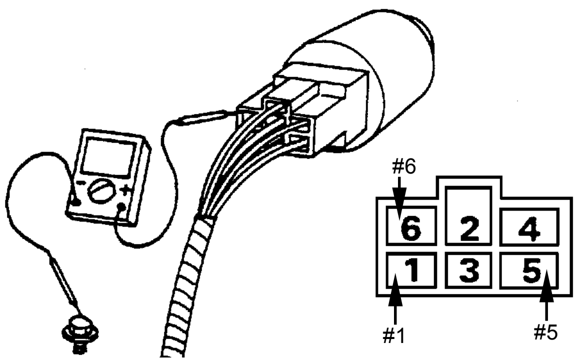
E-1 Starter does not rotate.

IMPORTANT: As electric current from the key switch is not routed to safety relay with the forward/reverse lever or forward/reverse switch in Forward or Reverse position, the starter does not rotate. (Refer to "Electrical System / SYSTEM".)

- This trouble has nothing to do with the electronic control system such as MC.
- Check the wiring connections first.

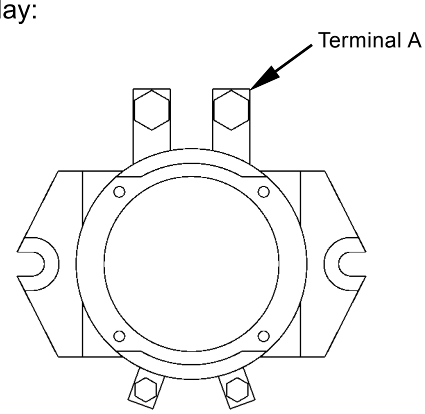


Key Switch:

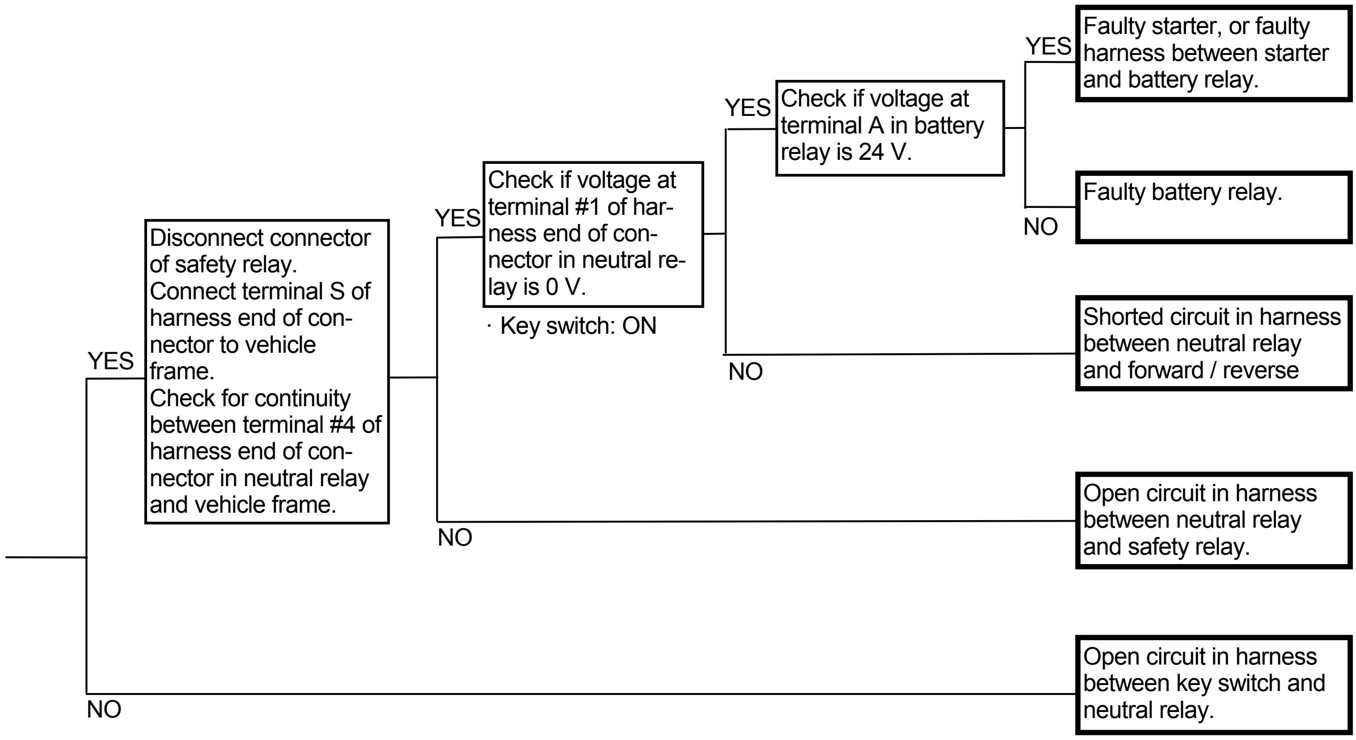


T105-07-04-002

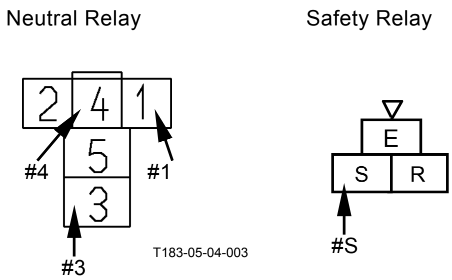
Battery Relay:



T178-05-04-001



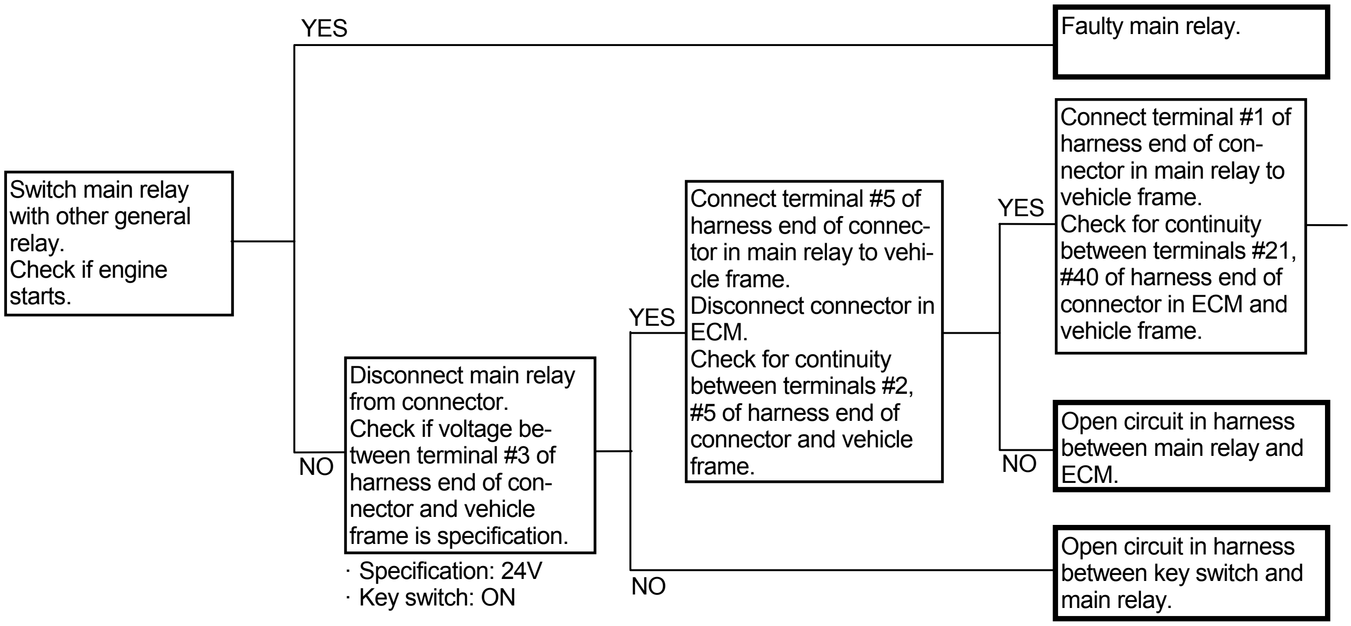
Connector (Harness end of connector viewed from the open end side)



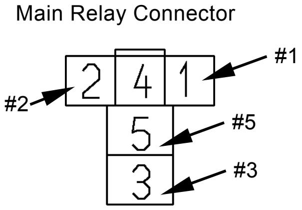
E-2 Even if starter rotates, engine does not start.

Related MC Fault Code: None

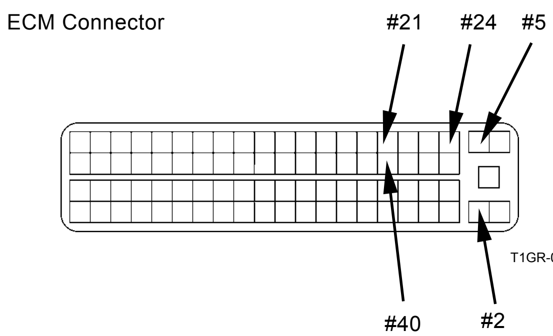
- Check the wiring connections first.
- Check if fuel system malfunctions, the fuel filter is clogged or the fuel pump is properly operated with the key ON.



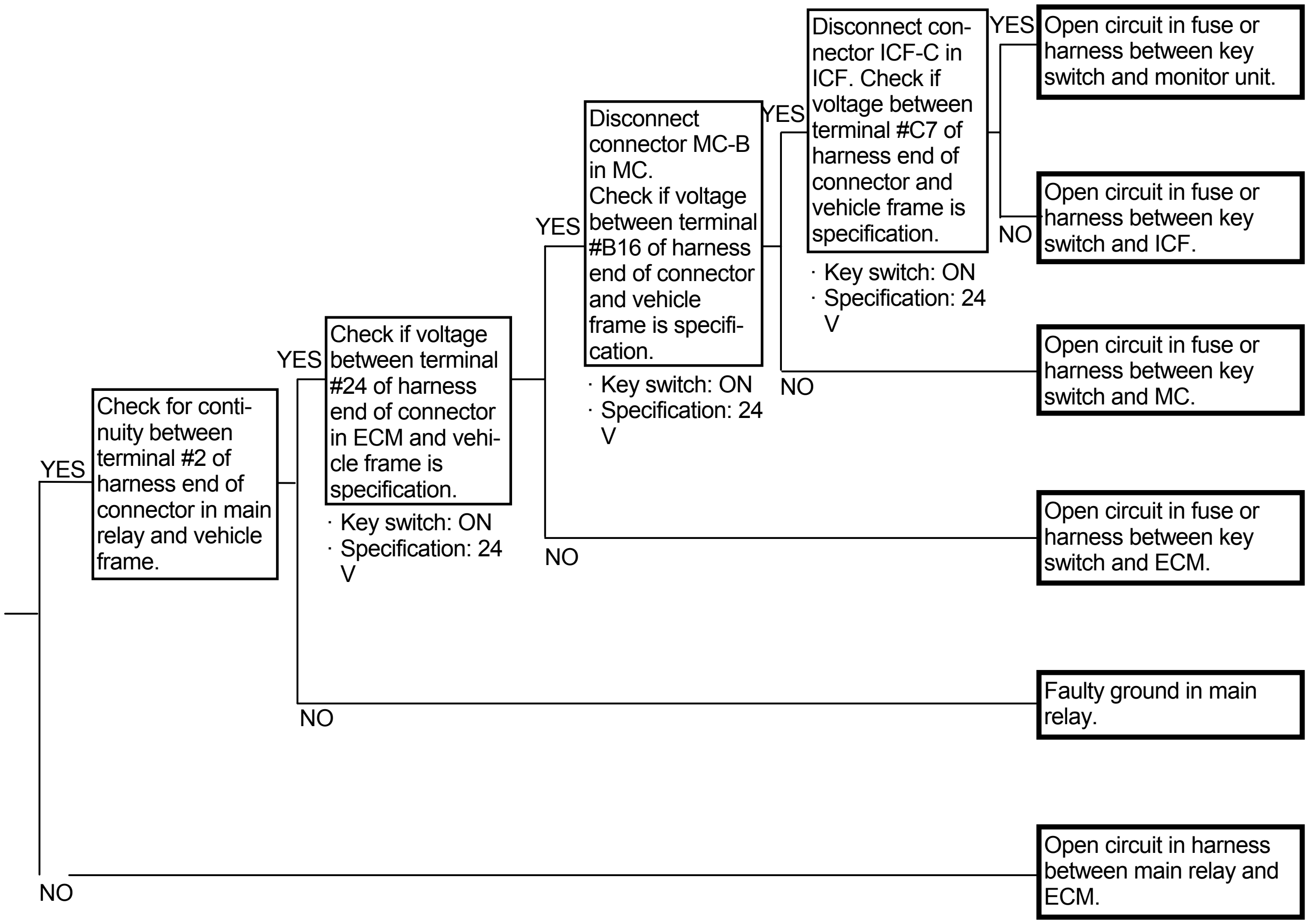
Connector (Harness end of connector viewed from the open end side)



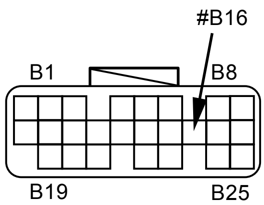
T183-05-04-003



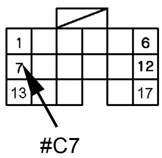
T1GR-05-04-002



Connector MC-B



Connector ICF-C



T1V1-05-04-002

E-3 Engine is difficult to start at low temperature. (During cold weather or in cold districts, engine is difficult to start or does not start even if pre-heated.)

- Check if electricity is routed to the glow plugs. Check the glow plugs for any abnormality.
- Check the battery.
- Check the wiring connections first.

NOTE: If there is no malfunction on the followings and the engine is difficult to start with the engine cold, the fuel pump performance may become bad.

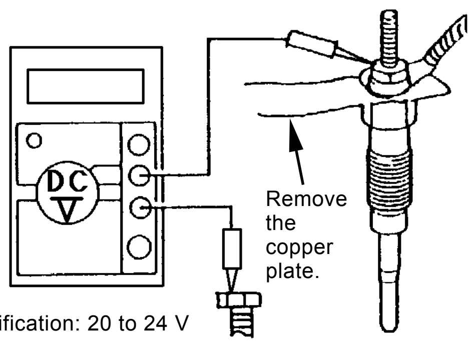
Disconnect connector of coolant temperature sensor. Check if voltage at glow plug is 20 to 24 V.

· Key switch: ON

- YES → Faulty coolant temperature sensor.
- NO → Connect terminal #10 in ECM to vehicle frame. Check if problem is corrected.
  · Connect to machine from the back of connector by using a clip with the connector connected.
  - YES → Faulty ECM.
  - NO → Measure each glow plug resistance.
    · Key switch: OFF
    · Before measuring, remove copper plates connecting each glow plug.

- Measurement of Glow Plug Voltage and Resistance

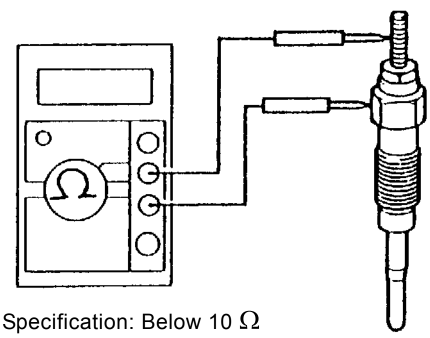
Voltage Check



Specification: 20 to 24 V

T105-07-04-006

Resistance Check



Specification: Below 10 Ω

T105-07-04-007

10 Ω or higher

Faulty glow plug.

Less than 10 Ω

Disconnect connector in glow relay.
Check if voltages at terminals #1 and #3 of harness end of connector in glow relay are 20 to 24 V.

· Key switch: ON

YES

Connect connector in glow relay.
Connect terminal #4 of harness end of connector to vehicle frame.
Check if voltage at glow plug is 20 to 24 V.

· Key switch: ON

NO

Faulty glow relay, or faulty harness between glow relay and glow plug.

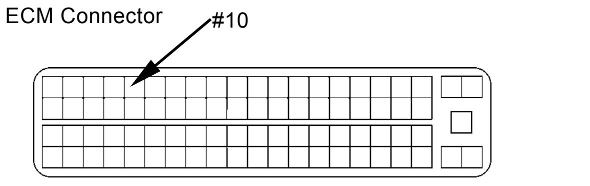
YES

Open circuit in harness between glow relay and ECM.

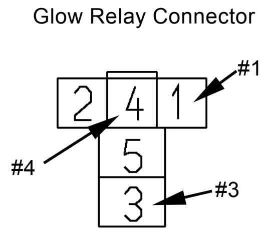
NO

If terminal #1 is 0 V, open circuit in 100A fuse or harness between glow relay and battery. If terminal #3 is 0 V, open circuit in fuse or harness between glow relay and terminal M in key switch.

Connector (Harness end of connector viewed from the open end side)



T1GR-05-04-002

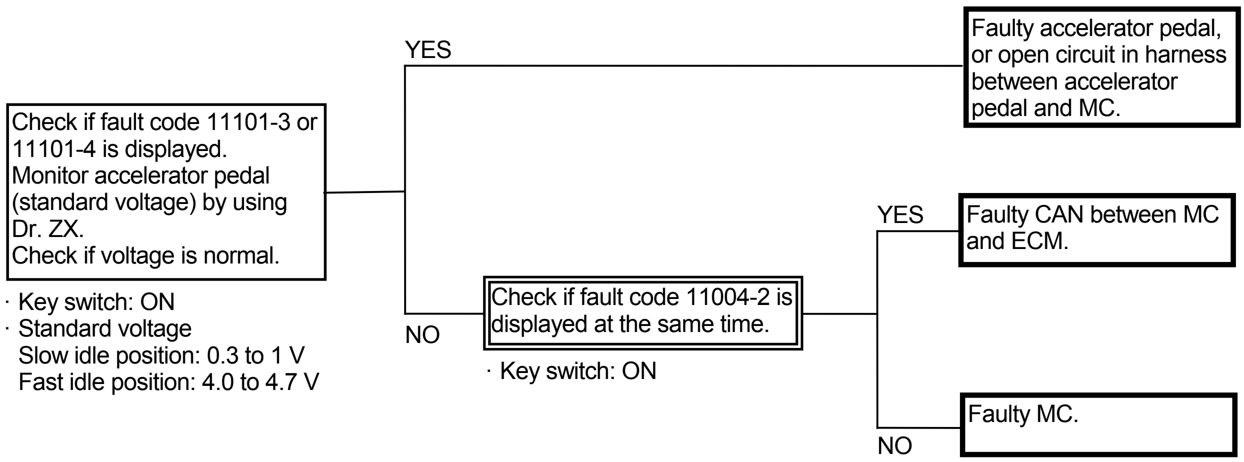


T183-05-04-003

E-4 Even if accelerator pedal is depressed, engine speed remains unchanged.

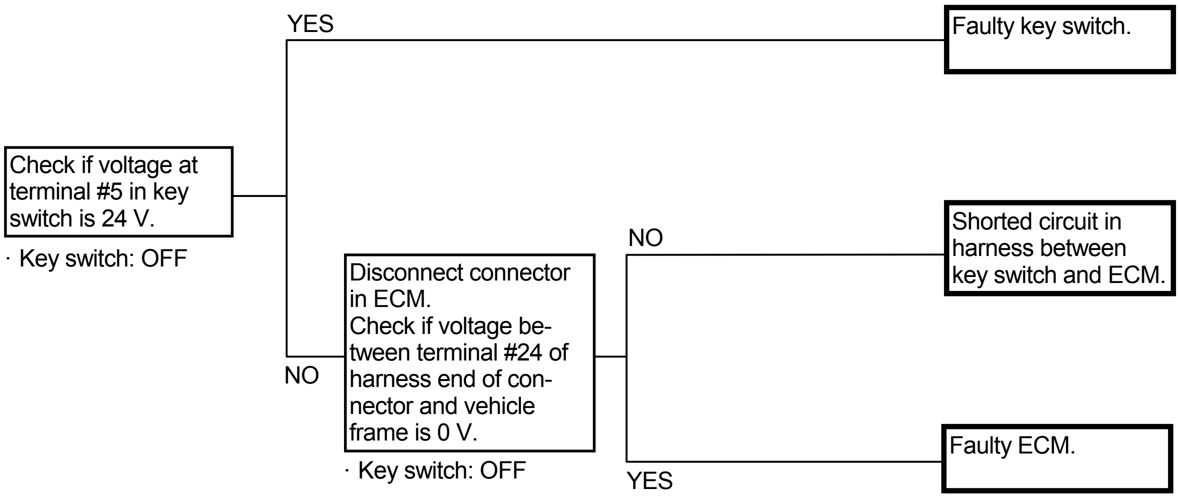
Related MC Fault Code: 11004-2, 11101-3, 11101-4

- Check the wiring connections first.
- Turn the key switch OFF with the fan reversing switch ON. Turn the fan reversing switch OFF within 10 seconds and start the engine. When the machine travels, engine speed is fixed to idling speed. This condition is normal. Although the fan reversing switch is OFF, if the same trouble occurs, harness to the fan reversing switch or MC may be shorted.

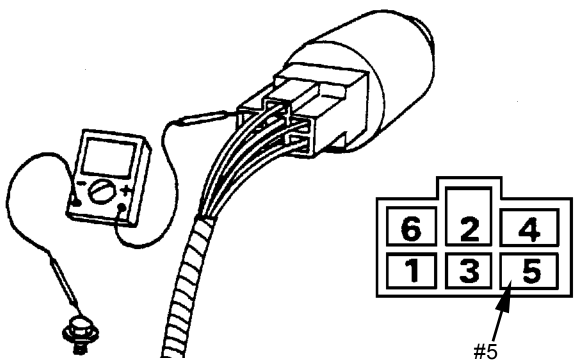


E-5 Even if key switch is turned OFF, engine does not stop.

- Check the wiring connections first.
- The trouble that even if accelerator pedal is depressed, engine speed remains unchanged may occur. Execute the troubleshooting procedures on this trouble.

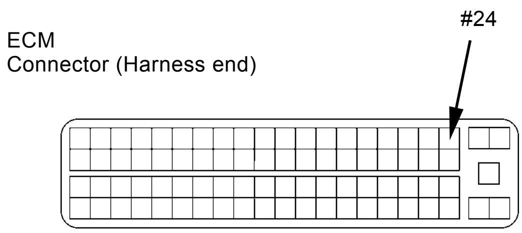


Key Switch:



T105-07-04-002

Connector (Harness end of connector viewed from the open end side)

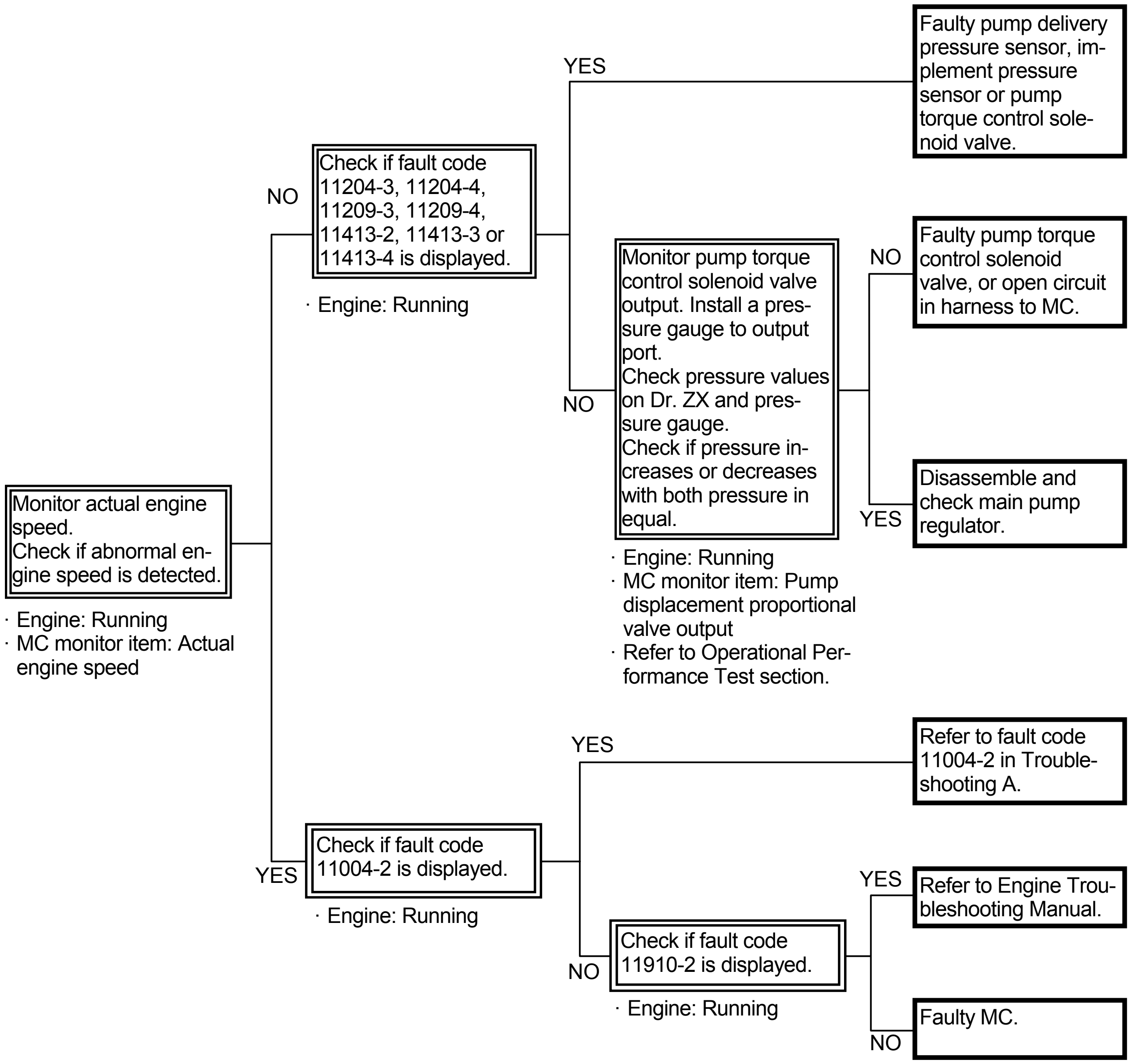


T1GR-05-04-002

E-6 Engine stalls during operation under adverse condition such as at high altitude.

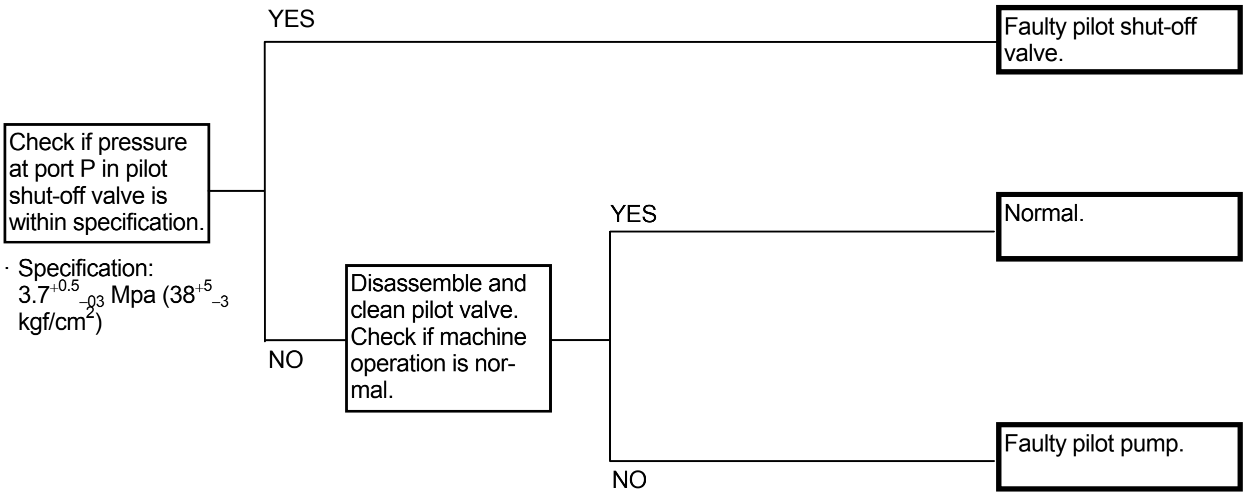
Related MC Fault Code: 11004-2, 11910-2, 11209-3, 11209-4,11413-2, 11413-3,11413-4

- Check the wiring connections first.
- Check if fuel system malfunctions, the fuel filter is clogged or the fuel pump is properly operated with the key ON.



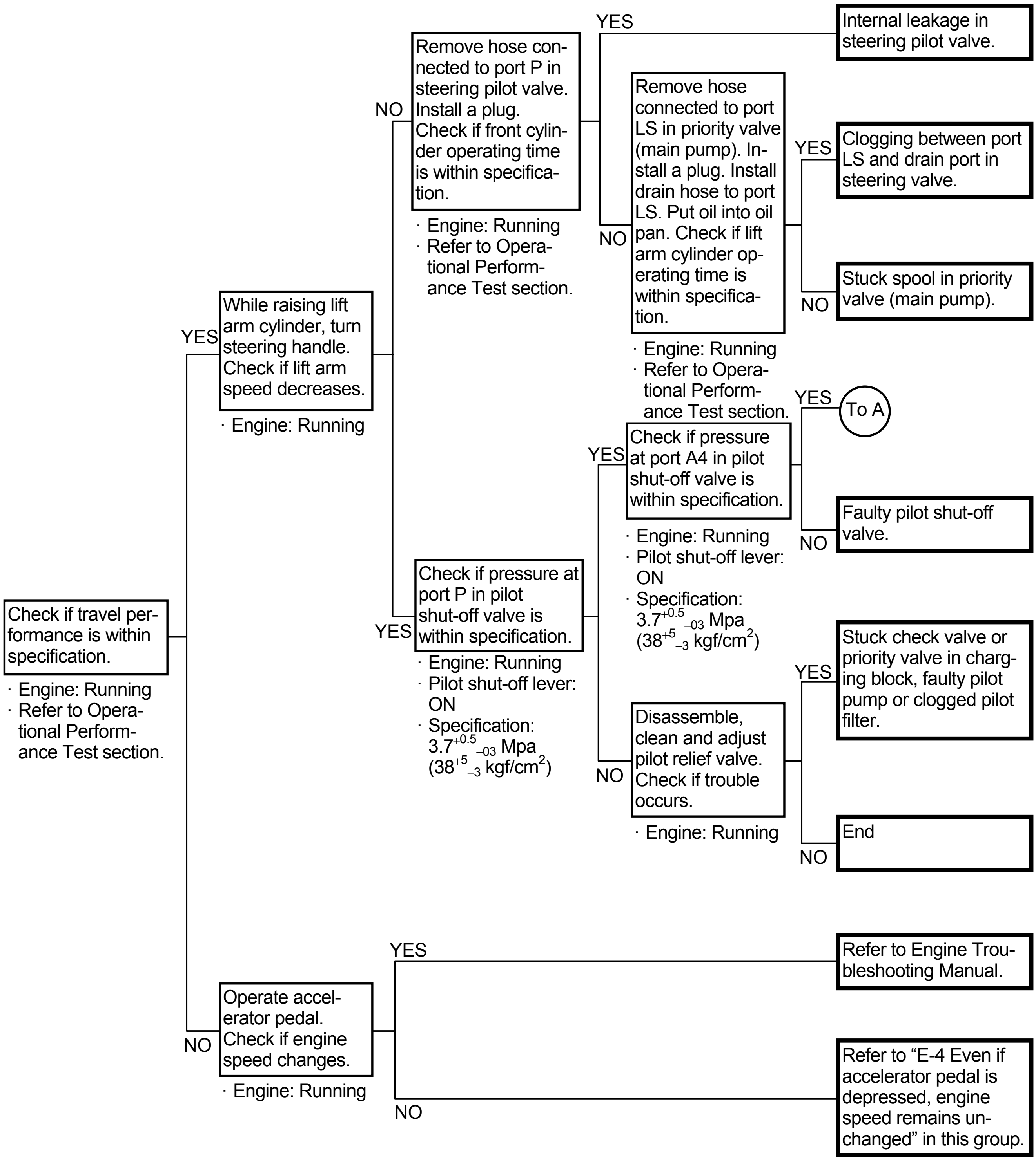
FRONT ATTACHMENT SYSTEM TROUBLESHOOTING

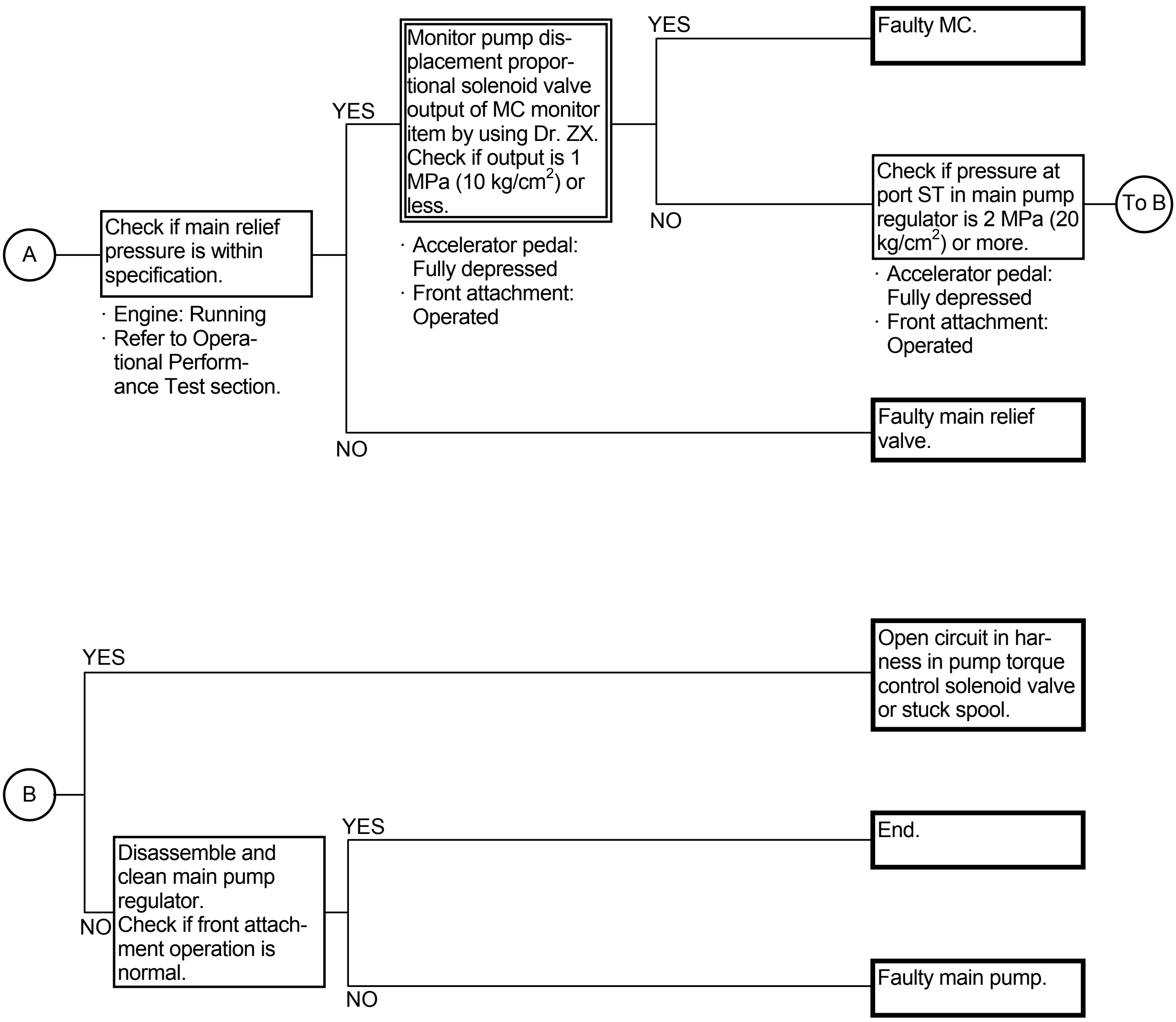
F-1 All front attachments do not move.



F-2 All front attachment operations are slow / weak.

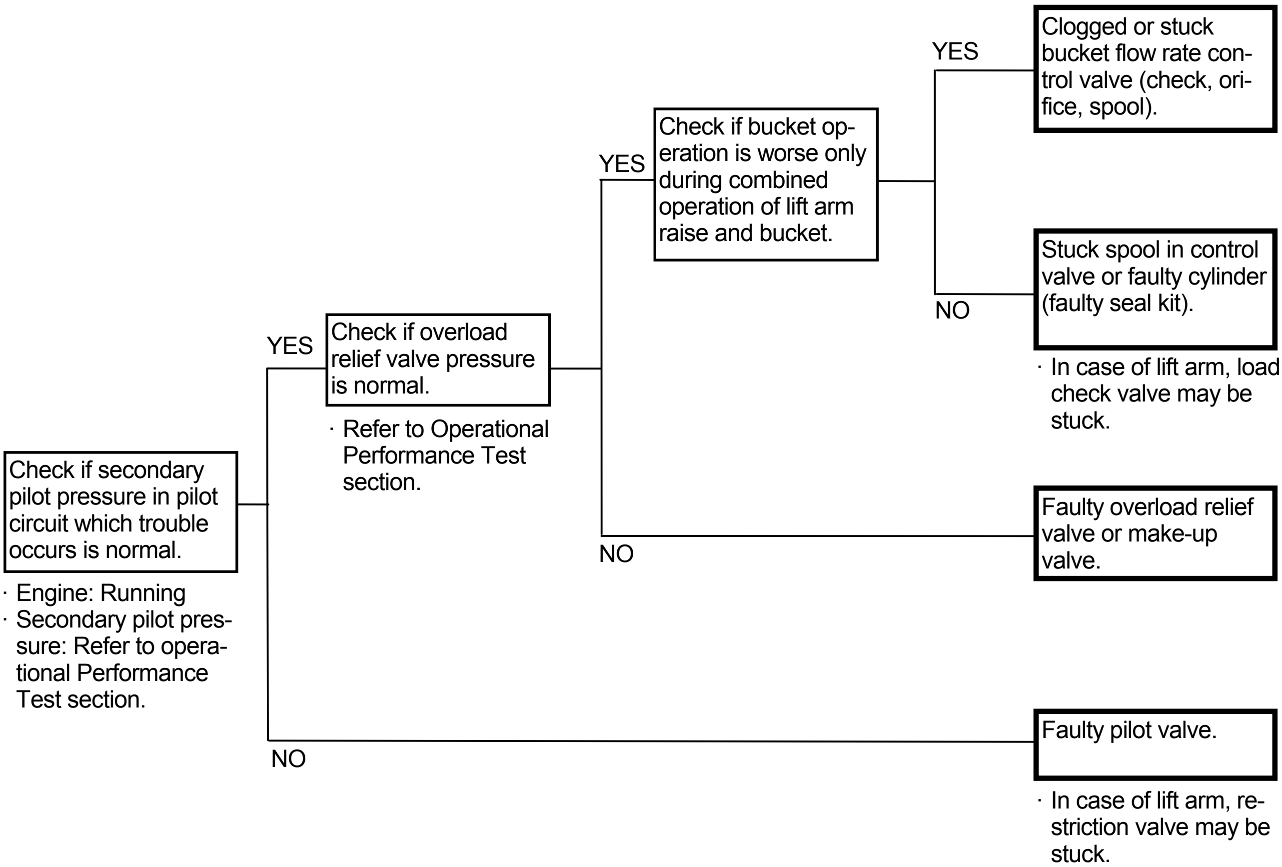
- When the service brake valve is kept closed, trouble may occur. In this case, as the pilot hose or pilot filter is damaged, this is not included here.




A
Check if main relief pressure is within specification.
· Engine: Running
· Refer to Operational Performance Test section.
YES
Monitor pump displacement proportional solenoid valve output of MC monitor item by using Dr. ZX. Check if output is 1 MPa (10 kg/cm^2) or less.
· Accelerator pedal: Fully depressed
· Front attachment: Operated
YES
Faulty MC.
NO
Check if pressure at port ST in main pump regulator is 2 MPa (20 kg/cm^2) or more.
· Accelerator pedal: Fully depressed
· Front attachment: Operated
To B
NO
Faulty main relief valve.
B
YES
Open circuit in harness in pump torque control solenoid valve or stuck spool.
NO
Disassemble and clean main pump regulator. Check if front attachment operation is normal.
YES
End.
NO
Faulty main pump.

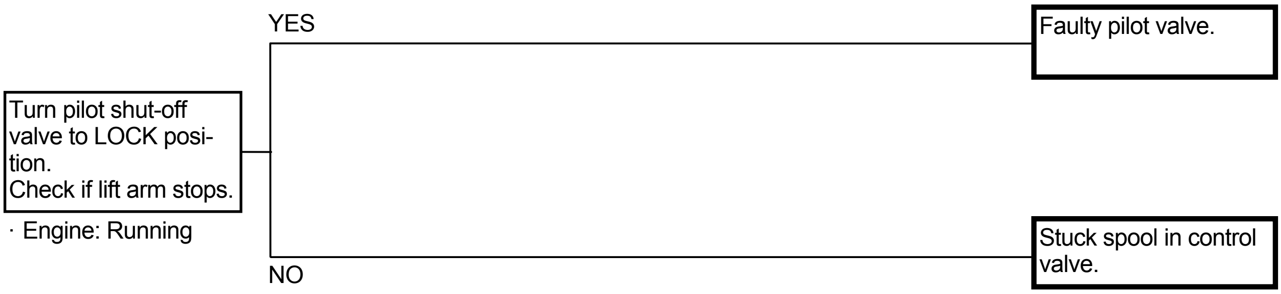
F-3 Certain front attachment is slow / weak.

- If the lift arm or the bucket is normal, the pilot pump (primary pilot pressure) should be normal.
- If there is malfunction in the pilot poppet valve in main relief valve, operating speed with light load may be normal.

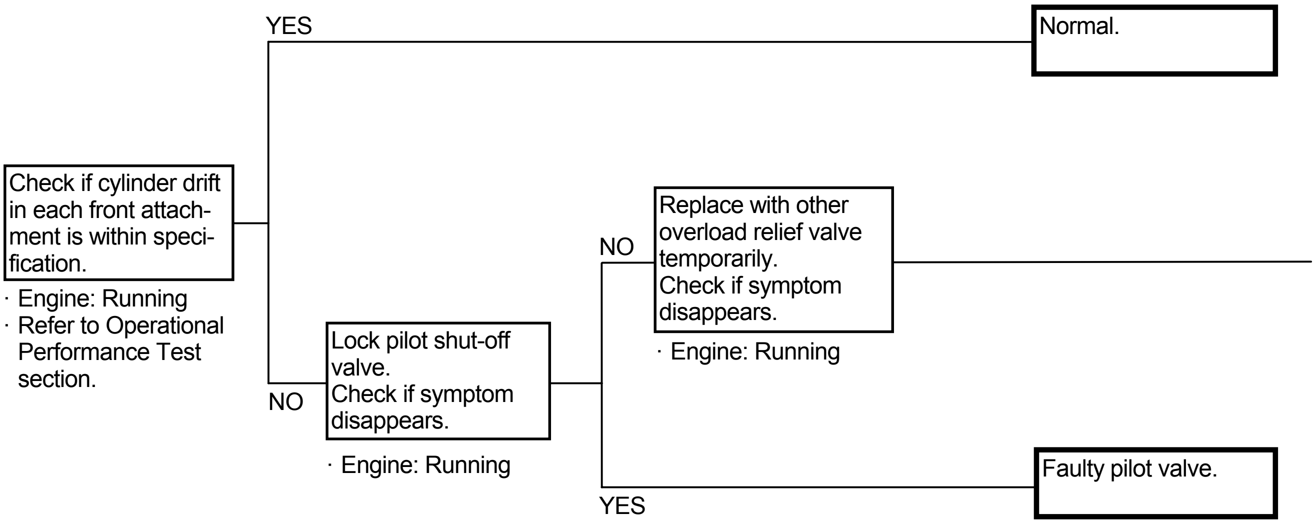


F-4 Front attachment moves with lever in neutral.

- Although the lever is released just after the lift arm is operated, the lift arm is kept moving. In this case, the restriction valve may be clogged.



F-5 Front attachment drifts remarkably.

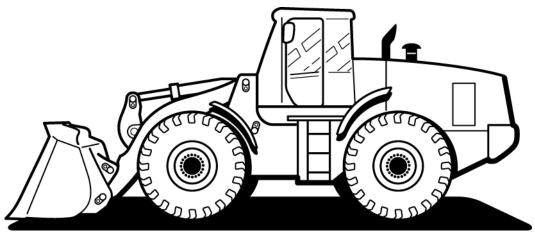


- Lift Arm Cylinder Internal Leakage Check

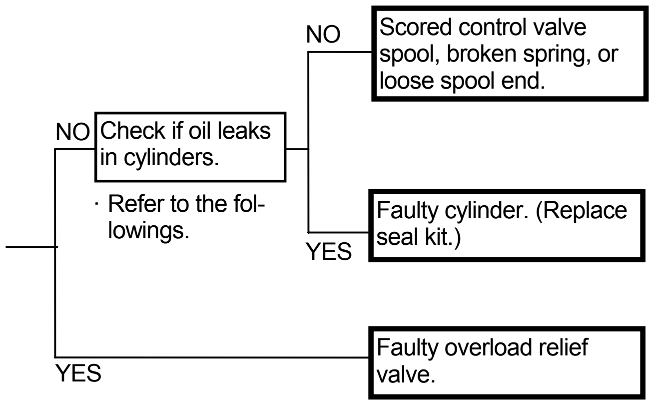
1. With the bucket cylinder slightly extended from the fully retracted position, lower the bucket tooth tips onto the ground.

2. Remove the hoses from the lift arm cylinder rod side. Drain oil from the hoses and cylinders. (Plug the remove hose ends.)

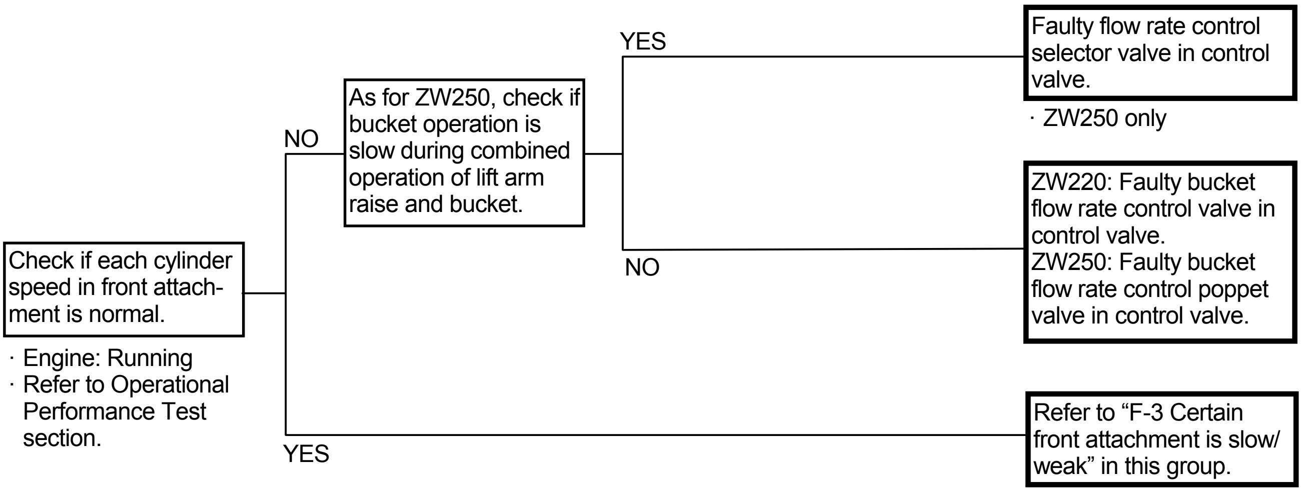
3. Retract the bucket cylinder rod and lift the bucket off the ground. If oil flows out of the hose removed pipe ends and the lift arm cylinders are retracted at this time, oil leaks in the lift arm cylinders. In case no oil flows out of the hose removed pipe ends but the lift arm cylinders are retracted, oil leaks in the control valve.



T4GB-05-04-001


NO
Scored control valve spool, broken spring, or loose spool end.
NO
Check if oil leaks in cylinders.
· Refer to the fol-lowings.
Faulty cylinder. (Replace seal kit.)
YES
Faulty overload relief valve.
YES

F-6 Bucket is slow during combined operation.



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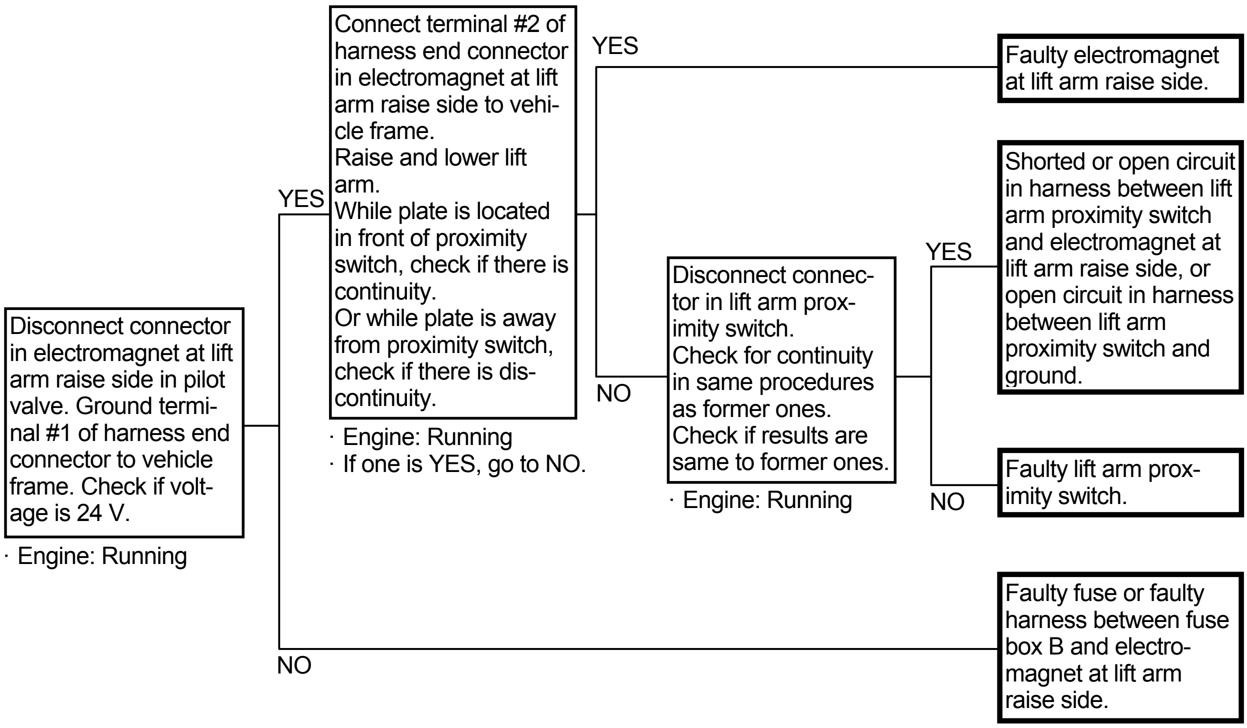
F-7 Work mode is not effective.

- Check the corresponding wiring and connectors in electrical parts.
- When the work mode switch malfunctions, the remarkable trouble does not occur. As fuel consumption becomes bad, this trouble may come out.
- When the work mode selector switch is shifted, engine torque control (refer to the Control System group/SYSTEM.) is executed. If the parts corresponding to this control malfunction, the fault code is displayed. Execute the remedy according to troubleshooting A.
- Although the fault code is not displayed and fuel consumption becomes bad, refer to Engine Troubleshooting Manual and inspect the engine.

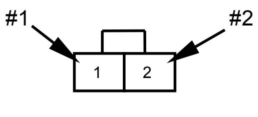
F-8 Lift arm height kickout is not operated.

- Check the wiring connections first.



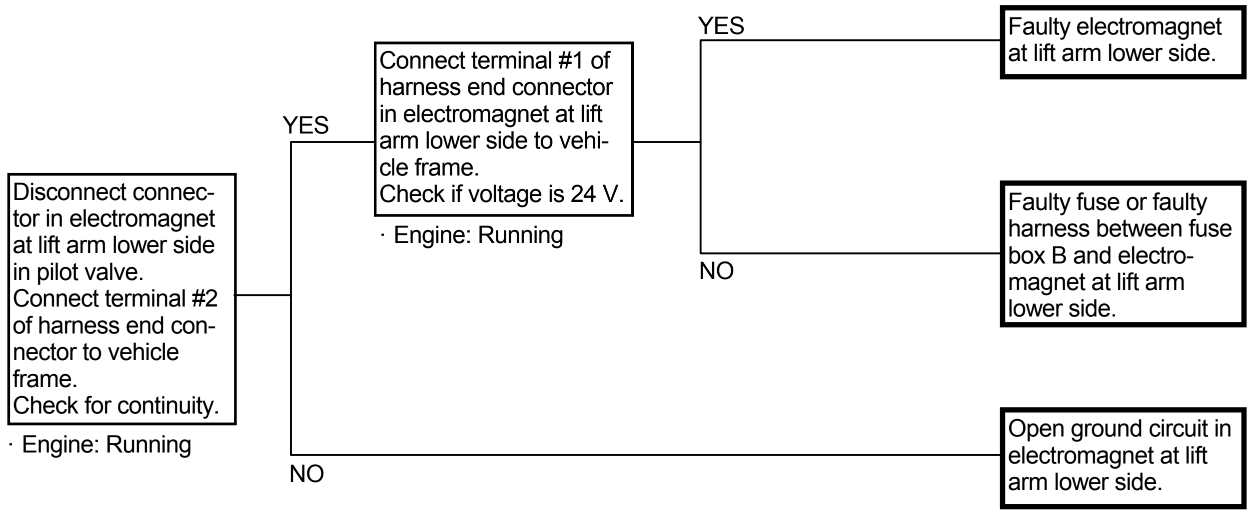
Connector (Harness end of connector viewed from the open end side)

Electromagnet Connector at Lift Arm Raise Side



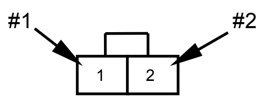
F-9 Lift arm float is not operated.

- Check the wiring connections first.



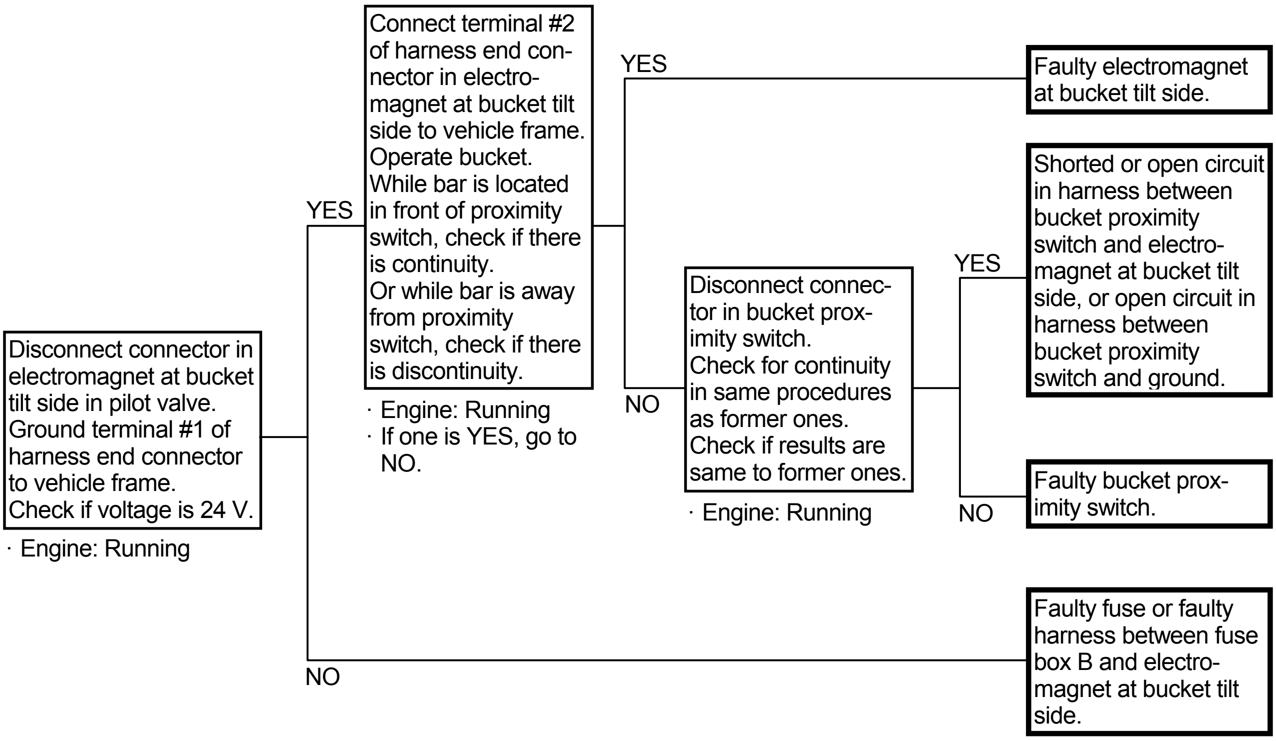
Connector (Harness end of connector viewed from the open end side)

Electromagnet Connector at Lift Arm Lower Side



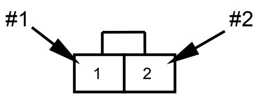
F-10 Bucket auto leveler is not operated.

- Check the wiring connections first.



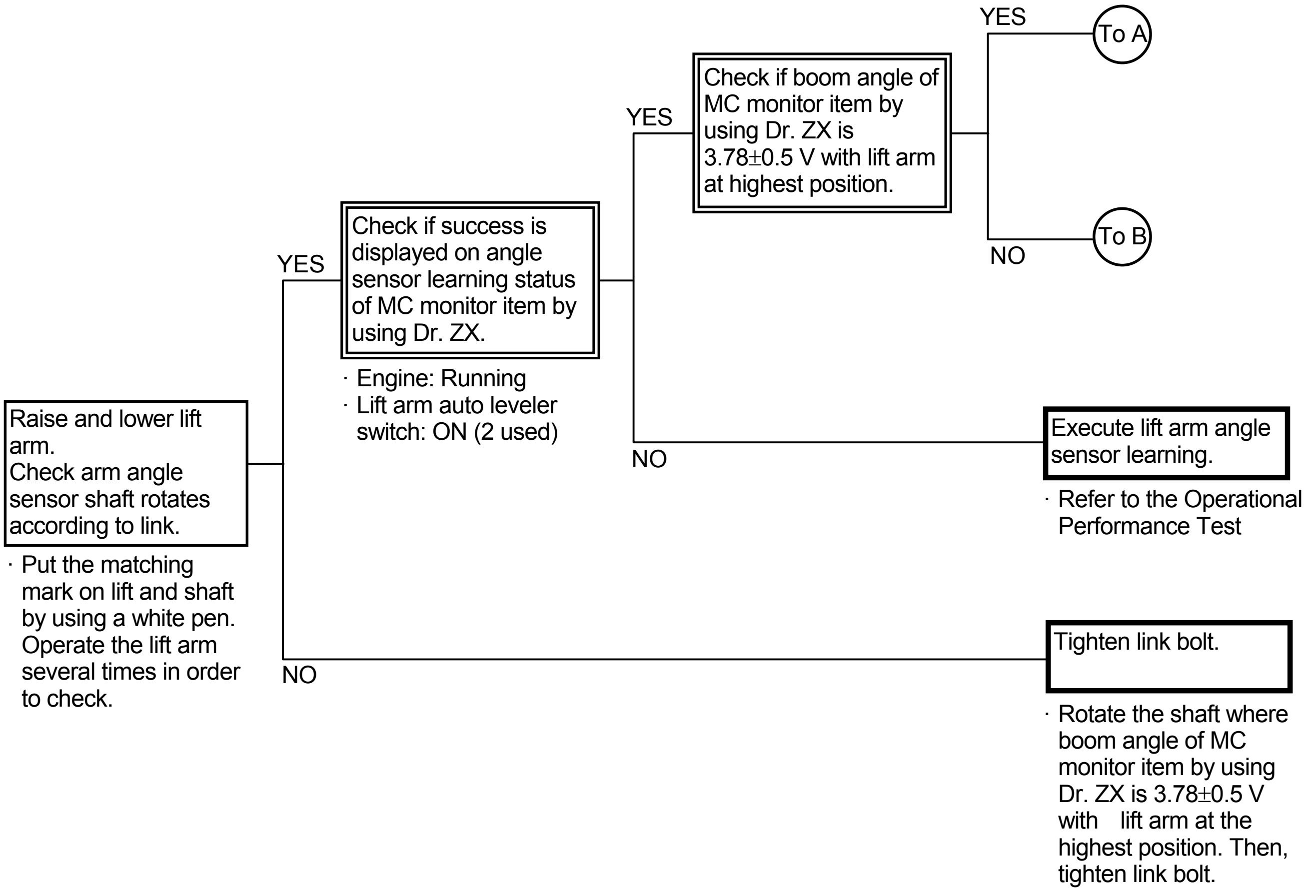
Connector (Harness end of connector viewed from the open end side)

Electromagnet Connector at Bucket Tilt Side

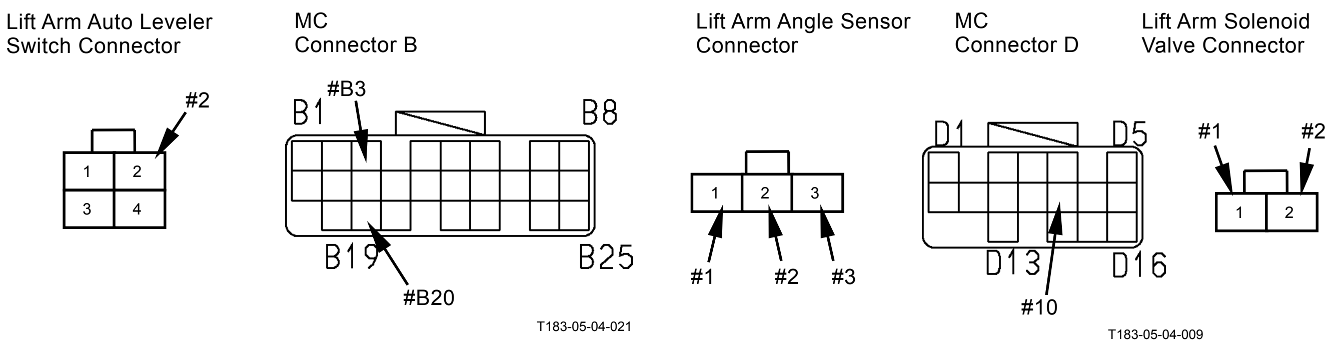


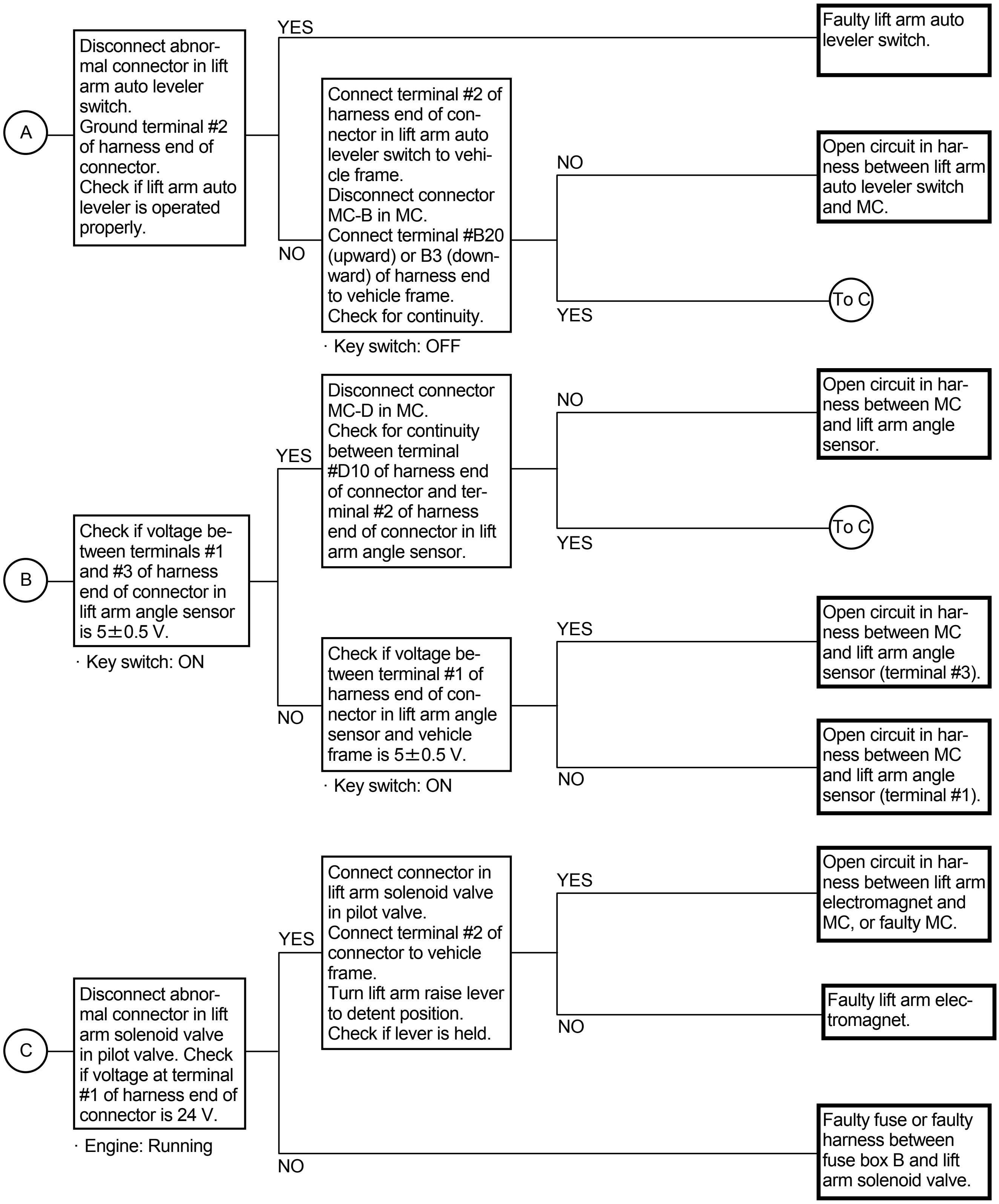
F-11 Lift arm auto leveler is not operated. (Optional)

- Check the wiring connections first.



Connector (Harness end of connector viewed from the open end side)




A
Disconnect abnormal connector in lift arm auto leveler switch.
Ground terminal #2 of harness end of connector.
Check if lift arm auto leveler is operated properly.
YES
Faulty lift arm auto leveler switch.
NO
Connect terminal #2 of harness end of connector in lift arm auto leveler switch to vehicle frame.
Disconnect connector MC-B in MC.
Connect terminal #B20 (upward) or B3 (downward) of harness end to vehicle frame.
Check for continuity.
· Key switch: OFF
NO
Open circuit in harness between lift arm auto leveler switch and MC.
YES
To C
B
Check if voltage between terminals #1 and #3 of harness end of connector in lift arm angle sensor is 5±0.5 V.
· Key switch: ON
YES
Disconnect connector MC-D in MC.
Check for continuity between terminal #D10 of harness end of connector and terminal #2 of harness end of connector in lift arm angle sensor.
NO
Open circuit in harness between MC and lift arm angle sensor.
YES
To C
NO
Check if voltage between terminal #1 of harness end of connector in lift arm angle sensor and vehicle frame is 5±0.5 V.
· Key switch: ON
YES
Open circuit in harness between MC and lift arm angle sensor (terminal #3).
NO
Open circuit in harness between MC and lift arm angle sensor (terminal #1).
C
Disconnect abnormal connector in lift arm solenoid valve in pilot valve. Check if voltage at terminal #1 of harness end of connector is 24 V.
· Engine: Running
YES
Connect connector in lift arm solenoid valve in pilot valve.
Connect terminal #2 of connector to vehicle frame.
Turn lift arm raise lever to detent position.
Check if lever is held.
YES
Open circuit in harness between lift arm electromagnet and MC, or faulty MC.
NO
Faulty lift arm electromagnet.
NO
Faulty fuse or faulty harness between fuse box B and lift arm solenoid valve.

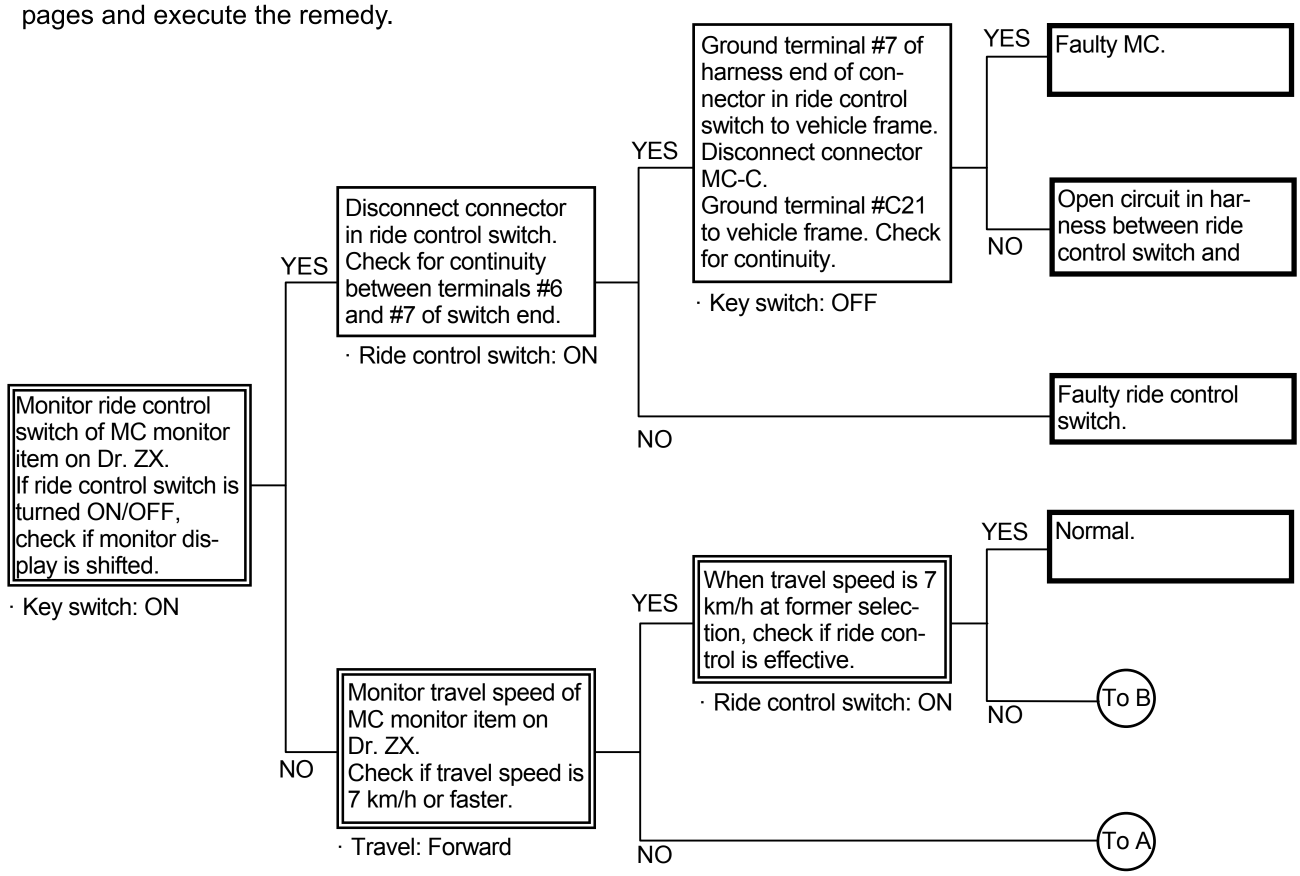
F-12 Lift arm auto leveler stop position cannot be set. (Optional)

- If the lift arm auto leveler stop position cannot be set as for both upward and downward, lift arm angle sensor learning has not been completed or lift arm angle sensor, MC or harness may malfunction.
- If the lift arm auto leveler stop position cannot be set as for either upward or downward, lift arm auto leveler set switch, MC or harness may malfunction.
- Refer to “F-11 Lift arm auto leveler is not operated” and execute the remedy.

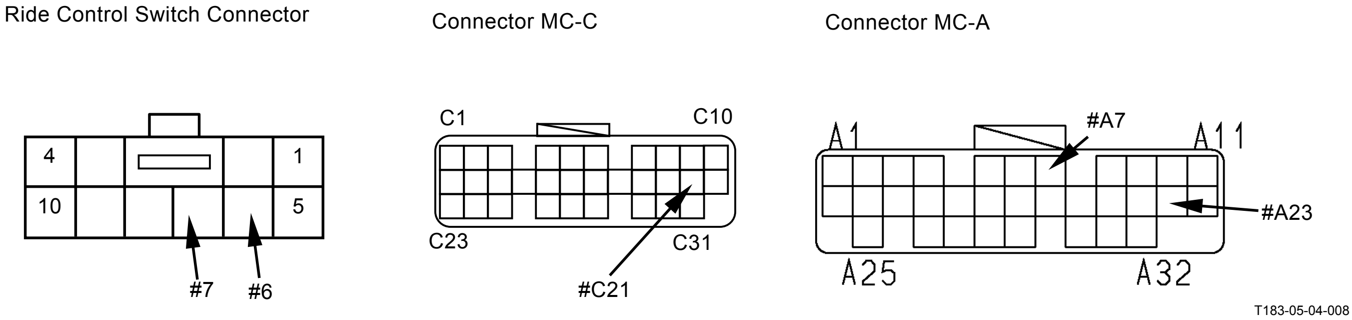
(Blank)

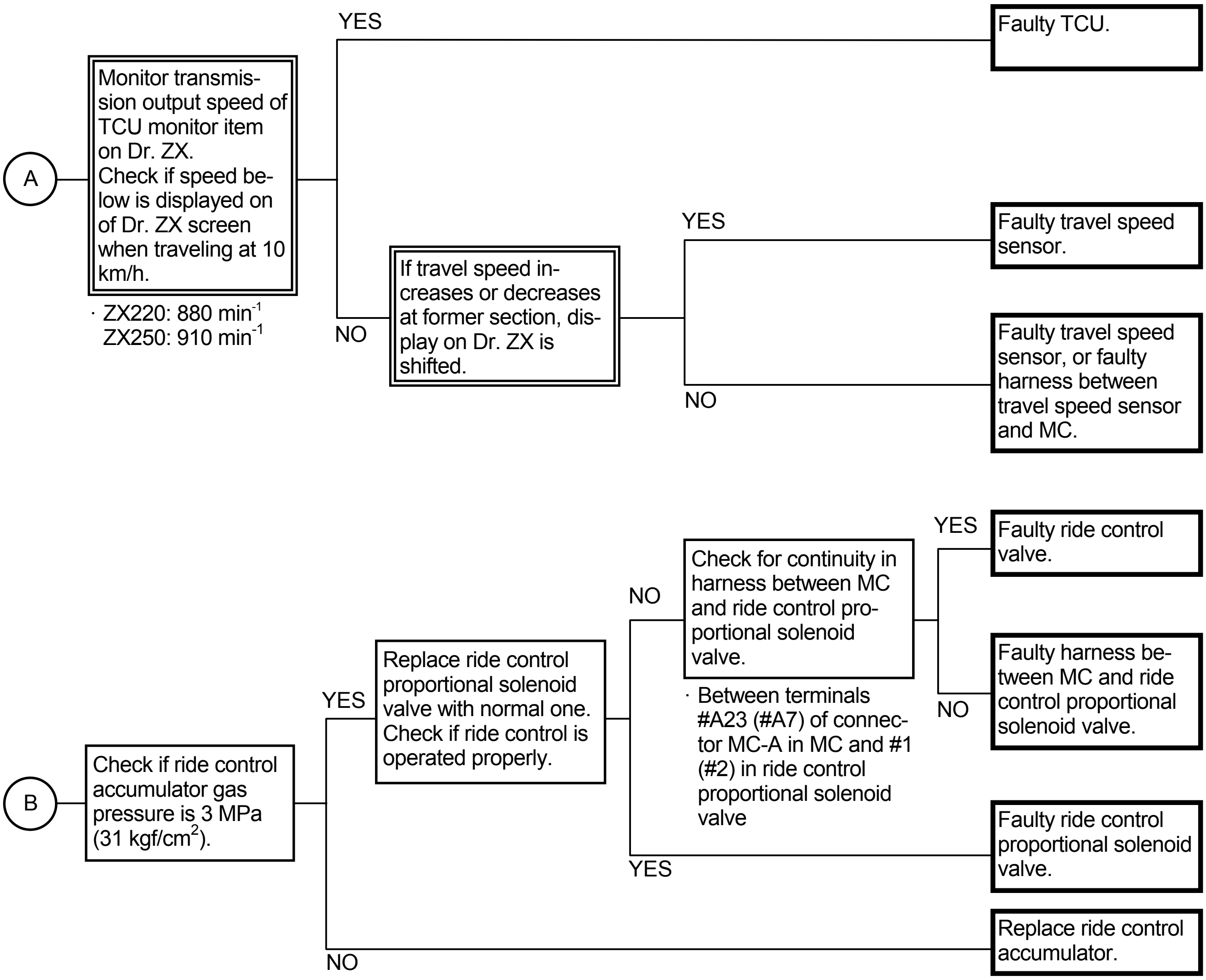
F-13 Ride control is not effective.

- Check the wiring connections first.
- When there is trouble with main circuit system and system pilot oil in the lift arm cylinder, this trouble may occur. As the front attachment operation malfunction together, refer to the related pages and execute the remedy.

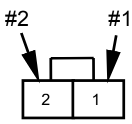


Connector (Harness end of connector viewed from the open end side)





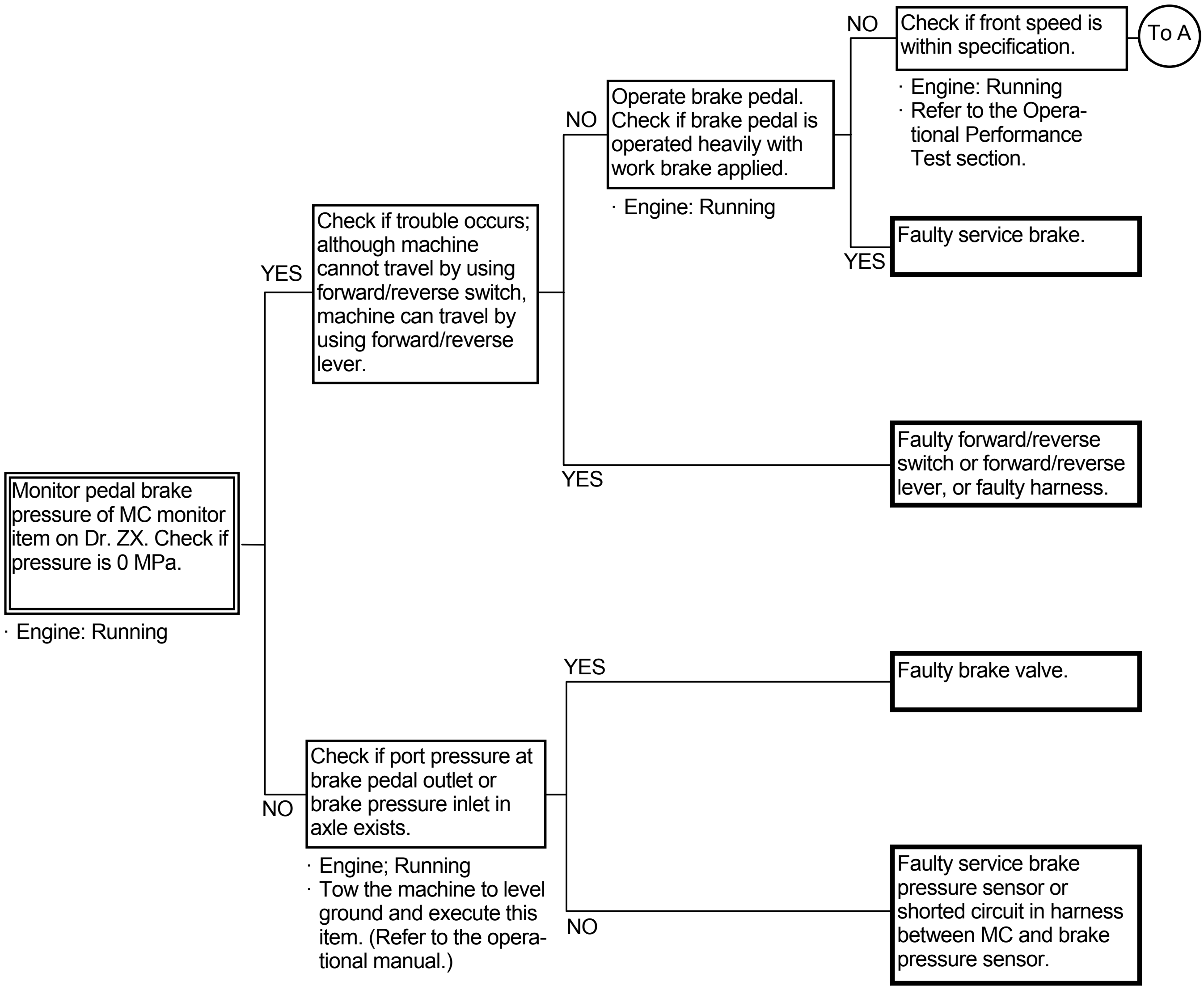
Proportional Solenoid Valve Connector

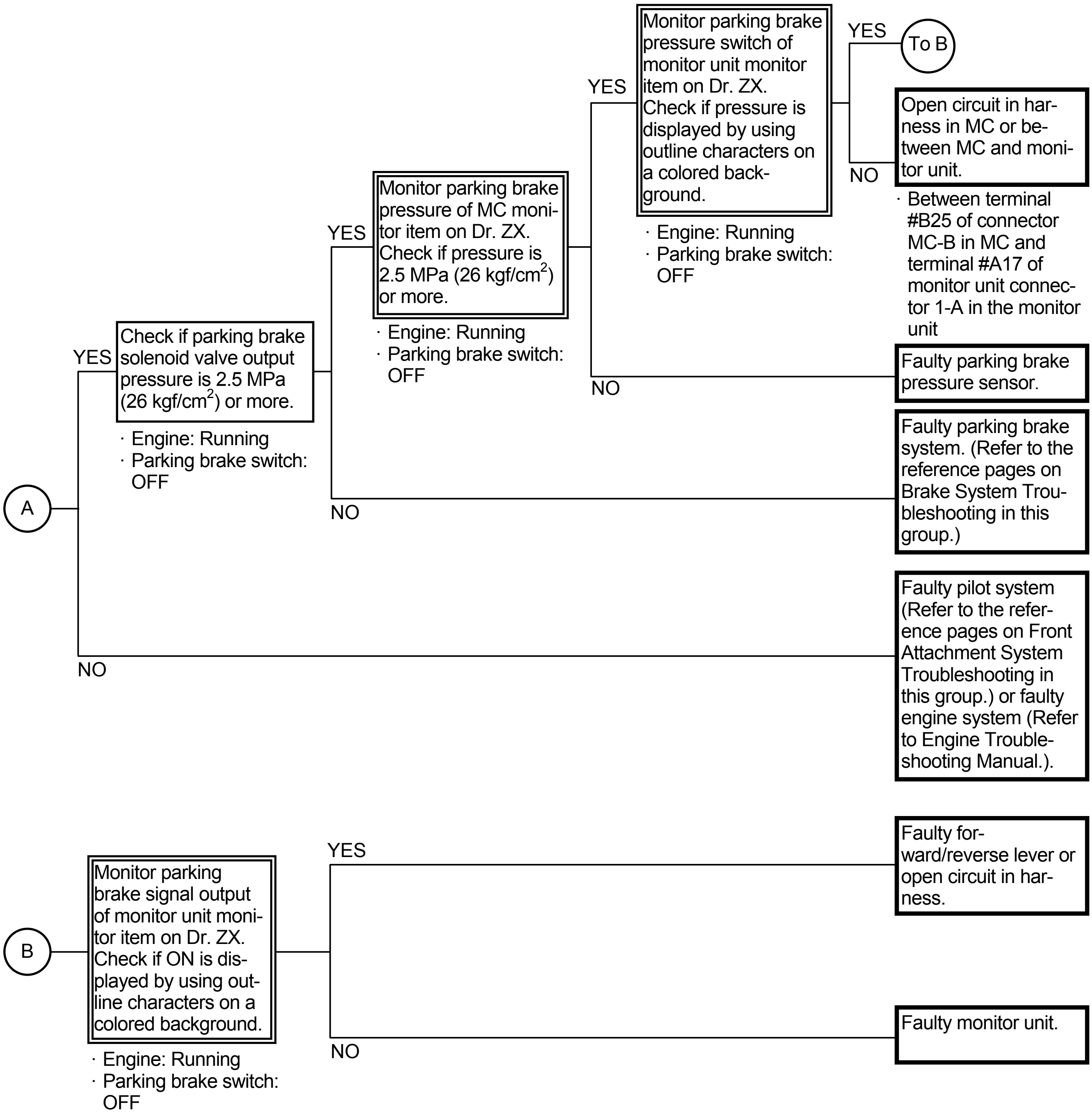


TRAVEL SYSTEM TROUBLESHOOTING

T-1 Machine does not travel forward/ reverse.

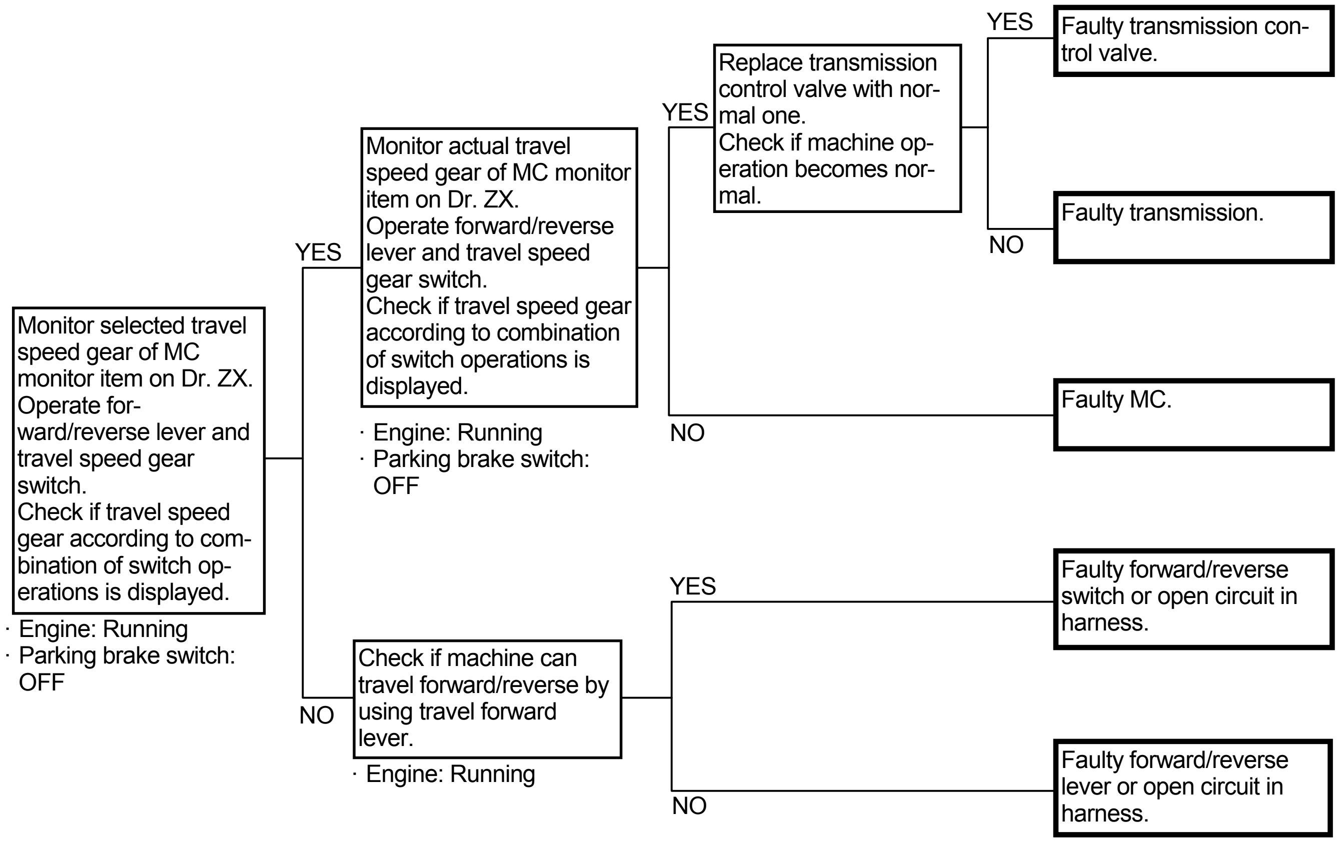
- Machine can travel only when the following conditions are present.
  Forward/Reverse Lever: F or R
  Parking Brake Switch: OFF
- If the front attachment operation is normal, the engine system and the pilot oil supply system may be normal.
- Check the wiring connections first.
- If the followings are normal, the transmission and axles (front, rear) may be faulty. Check for abnormal sound at each part.



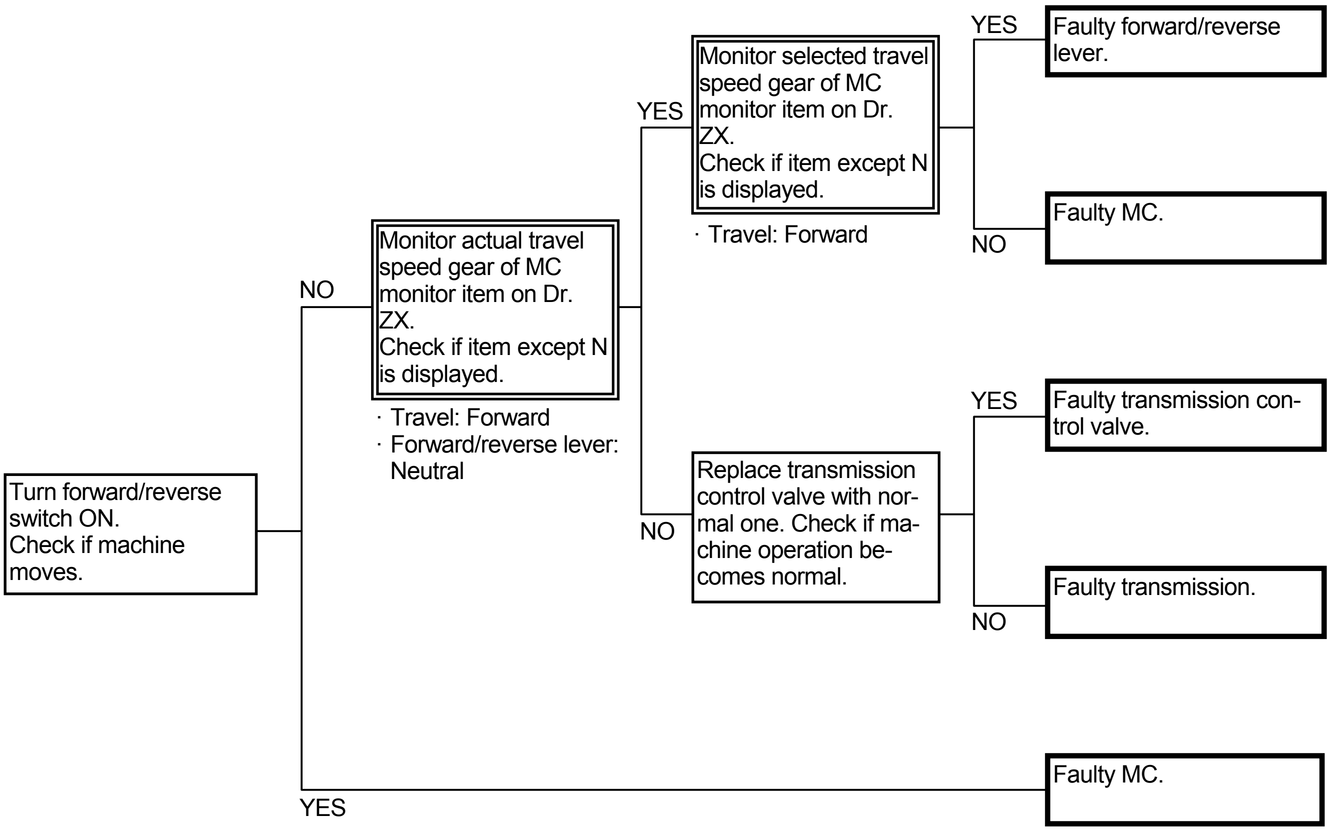

A
YES
Check if parking brake solenoid valve output pressure is 2.5 MPa (26 kgf/cm2) or more.
· Engine: Running
· Parking brake switch: OFF
YES
Monitor parking brake pressure of MC monitor item on Dr. ZX. Check if pressure is 2.5 MPa (26 kgf/cm2) or more.
· Engine: Running
· Parking brake switch: OFF
YES
Monitor parking brake pressure switch of monitor unit monitor item on Dr. ZX. Check if pressure is displayed by using outline characters on a colored background.
· Engine: Running
· Parking brake switch: OFF
YES
To B
NO
Open circuit in harness in MC or between MC and monitor unit.
· Between terminal #B25 of connector MC-B in MC and terminal #A17 of monitor unit connector 1-A in the monitor unit
NO
Faulty parking brake pressure sensor.
NO
Faulty parking brake system. (Refer to the reference pages on Brake System Troubleshooting in this group.)
NO
Faulty pilot system (Refer to the reference pages on Front Attachment System Troubleshooting in this group.) or faulty engine system (Refer to Engine Troubleshooting Manual.).
B
Monitor parking brake signal output of monitor unit monitor item on Dr. ZX. Check if ON is displayed by using outline characters on a colored background.
· Engine: Running
· Parking brake switch: OFF
YES
Faulty forward/reverse lever or open circuit in harness.
NO
Faulty monitor unit.

T-2 Machine does not travel forward or reverse.

- The transmission and axles (front, rear) may be faulty. Check for abnormal sound at each part.
- If other operations of front attachment and swing are normal, the pilot pump, pilot filter and pilot relief valve may be normal.
- Check the wiring connections first.

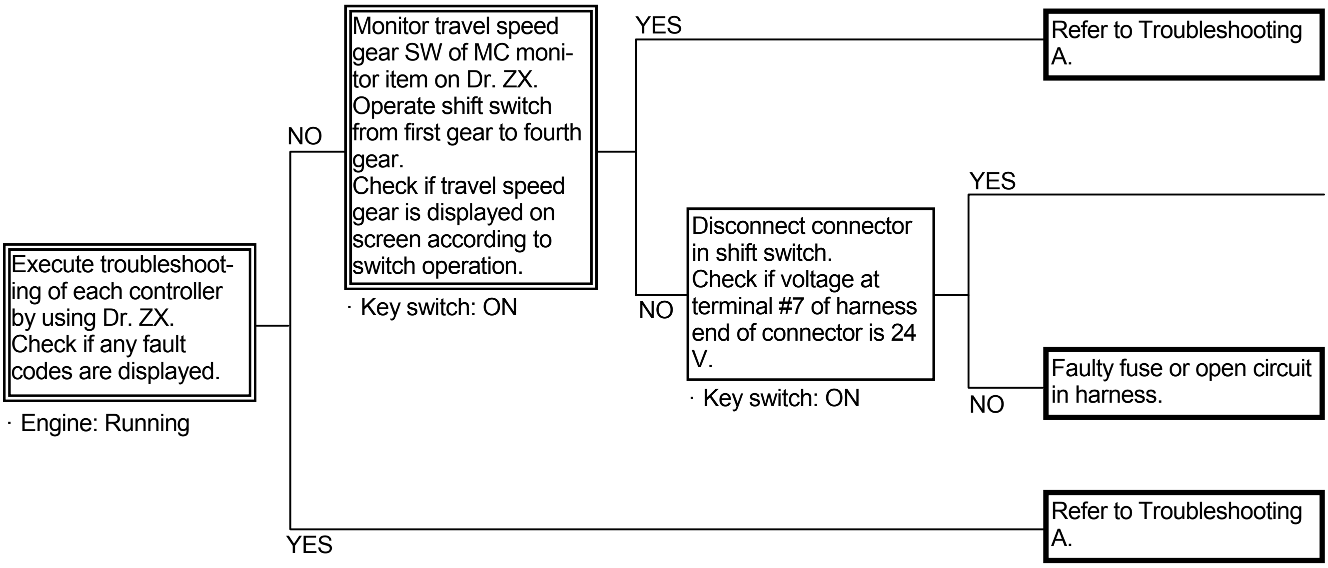


T-3 Machine moves with lever in neutral.



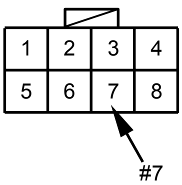
T-4 Even if travel speed is turned up or down, travel speed gear is not changed.

- Check the wiring connections first.
- Refer to T2-1-28 to 31 in the Control System group/ SYSTEM section.
- If the travel speed sensor malfunctions or if two wirings in the shift switch are opened, travel speed is fixed to second gear. When the travel speed sensor malfunctions, the fault code is displayed on MC.

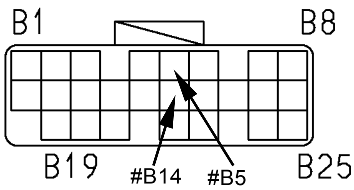


Connector (Harness end of connector viewed from the open end side)

Shift Switch Connector



Connector MC-B



T183-05-04-021

Connect connector in shift switch.
Set travel speed to fourth gear.
Disconnect connector MC-B in MC.
Check for continuity between terminals #B5 and #B14 of harness end of connector.

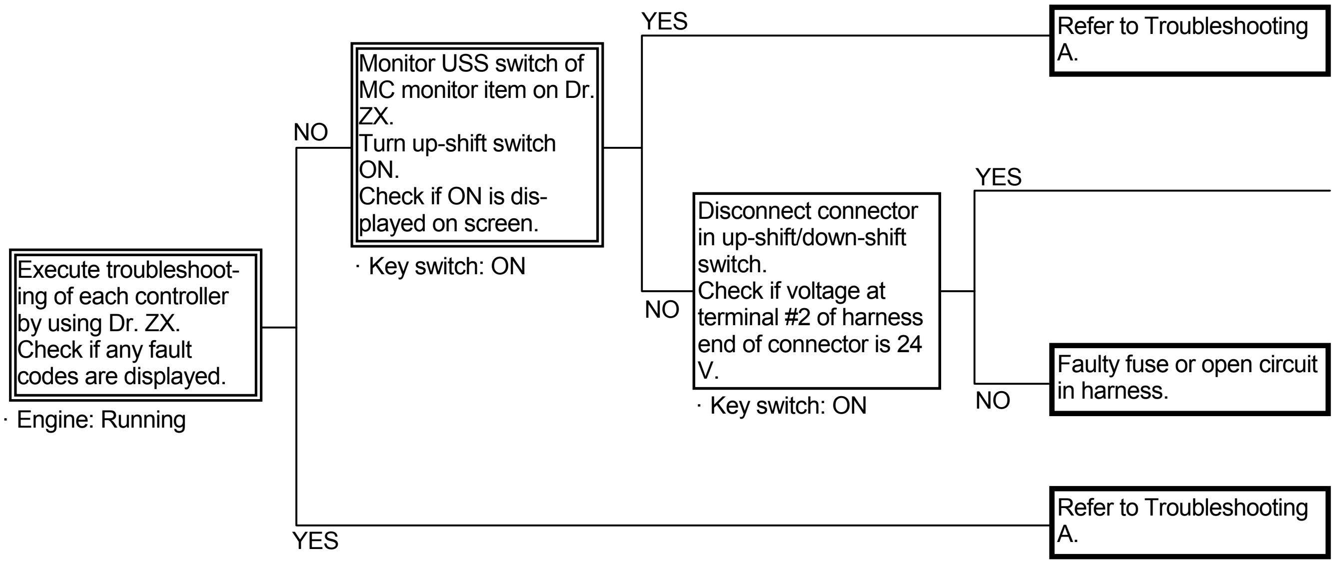
· Key switch: OFF

YES → Faulty MC.

NO → Faulty shift switch or open circuit in harness.

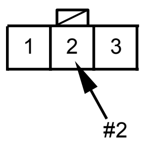
T-5 Even if up-shift switch is pushed, travel speed gear is not turned up.

- Refer to T2-1-34 to 35 in the Control System group/ SYSTEM section.
- When auto L, N or H in the travel mode selector switch is selected, if the hold switch is pushed, up-shift control is not operated.
- Travel speed gear cannot be turned up by the up-shift switch beyond travel speed gear selected by the shift switch.
- Check the wiring connections first.

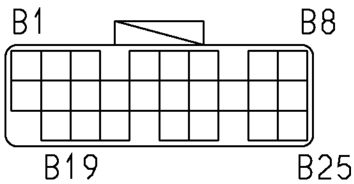


Connector (Harness end of connector viewed from the open end side)

Up-Shift/Down-Shift Switch Connector



Connector MC-B



T183-05-04-021

Connect connector in up-shift/down-shift switch.
Disconnect connector in MC-B in MC.
Turn up-shift switch ON.
Check for continuity between terminal #B2 of harness end of connector and vehicle frame.

· Key switch: OFF

YES → Faulty MC.

NO → Faulty up-shift/down-shift switch or open circuit in harness.

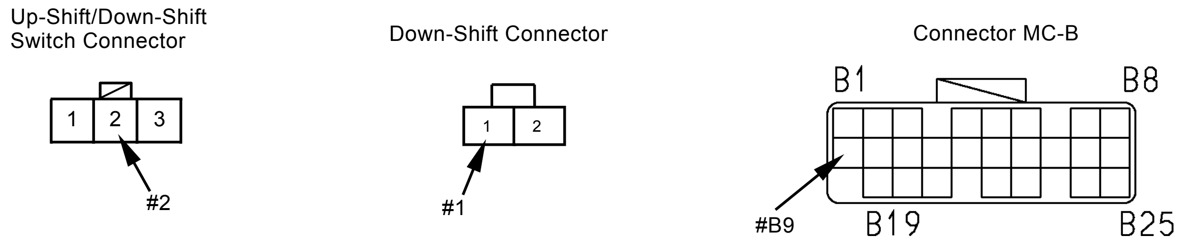
T-6 Even if down-shift switch is pushed, travel speed gear is not turned down.

- Refer to T2-1-32 to 33 in the Control System group/ SYSTEM section.
- When machine travels at faster than travel speed gear, which can decrease, although the down-shift switch is pushed, travel speed gear cannot be turned down.
- When auto L, N or H in the travel mode selector switch is selected, if the hold switch is pushed, down-shift control is not operated.
- Check the wiring connections first.

Execute troubleshooting of each controller by using Dr. ZX. Check if any fault codes are displayed.
· Key switch: ON

- YES → Refer to Troubleshooting A.
- NO → **Monitor DSS switch of MC monitor item on Dr.ZX. Turn down-shift switch ON. Check if ON is displayed on screen.**
  · Key switch: ON
  - YES → Refer to Troubleshooting A.
  - NO → **Disconnect connector in up-shift/down-shift switch. Check if voltage at terminal #2 or #1 of each harness end of connector is 24 V.**
    · Key switch: ON
    - YES → (continued)
    - NO → Faulty fuse or open circuit in harness.

Connector (Harness end of connector viewed from the open end side)



T183-05-04-021

Connect connector in up-shift/down-shift switch.
Disconnect connector in MC-B in MC.
Turn down-shift side in up-shift/down-shift switch and down-shift switch ON alternately.
Check for continuity between terminal #B9 of harness end of connector and vehicle frame.

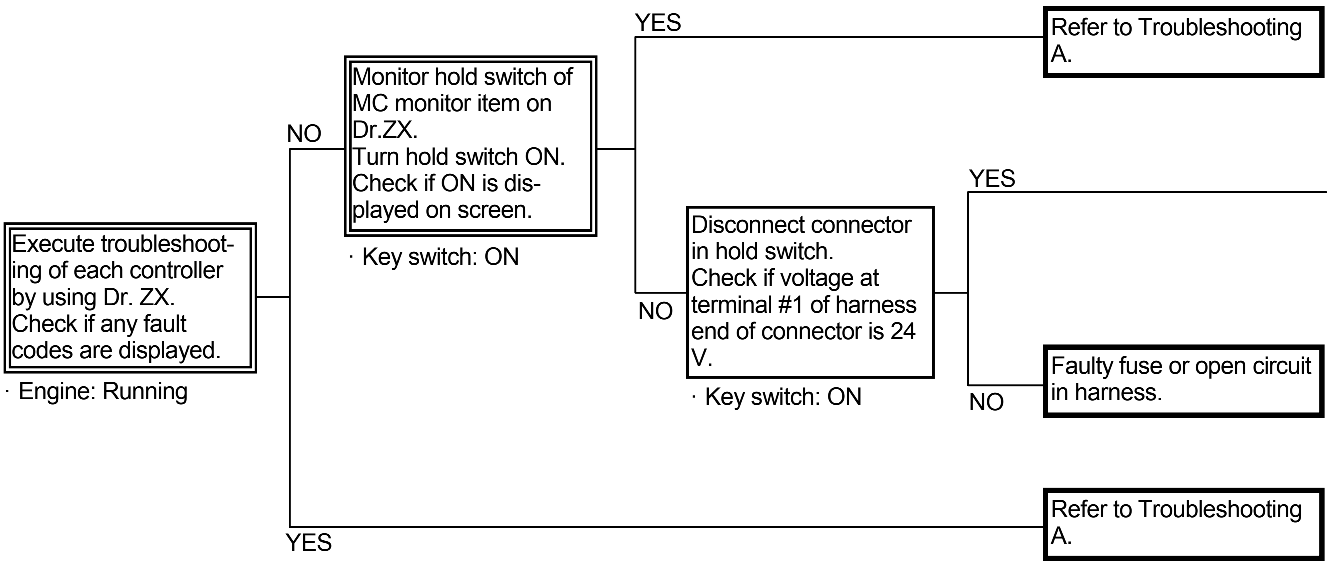
· Key switch: OFF

YES → Faulty MC.

NO → Faulty switch without continuity or open circuit in harness.

T-7 Even if hold switch is pushed, travel speed gear is not fixed.

- Refer to T2-1-38 to 39 in the Control System group/ SYSTEM section.
- When auto L, N or H in the travel mode selector switch is selected, hold control is not operated.
- Check the wiring connections first.



Connector (Harness end of connector viewed from the open end side)

T183-05-04-021

Connect connector in hold switch.
Disconnect connector MC-B in MC.
Turn hold switch ON.
Check for continuity between terminal #B4 of harness end of connector and vehicle frame.

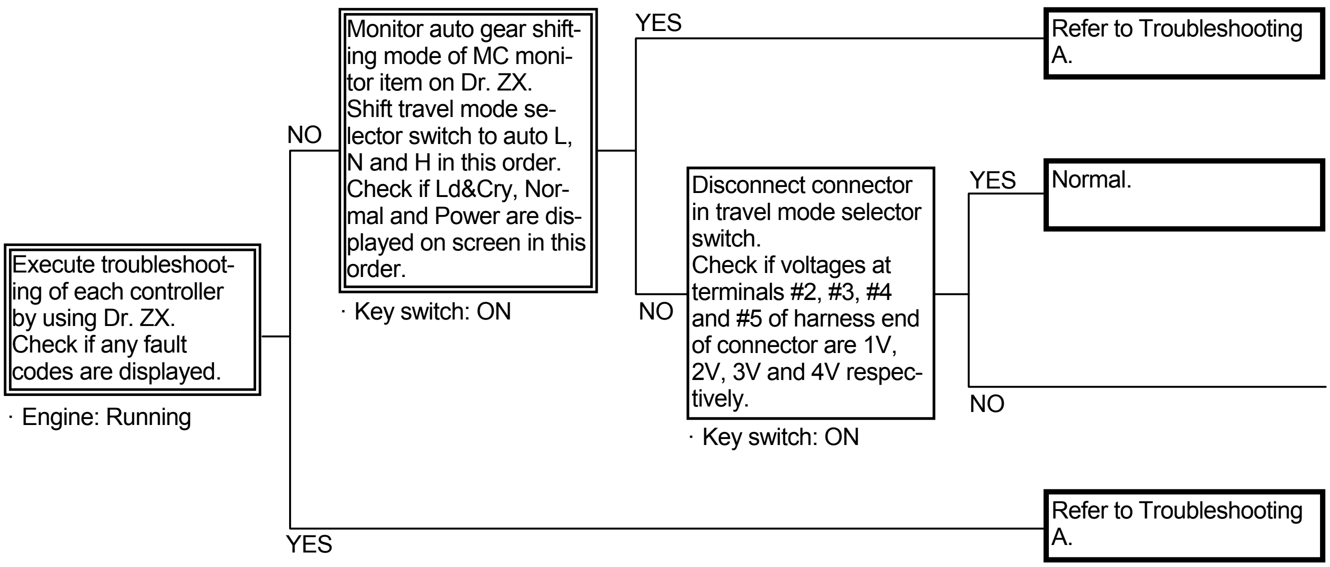
· Key switch: OFF

YES → Faulty MC.

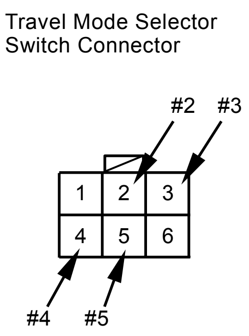
NO → Faulty hold switch or open circuit in harness.

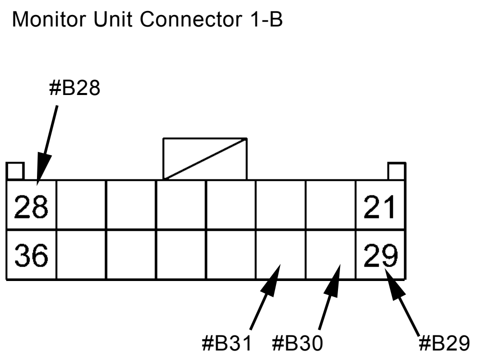
T-8 Travel mode is not shifted.

- Check the wiring connections first.
- Refer to T2-1-30 to 31 in the Control System group/ SYSTEM section.



Connector (Harness end of connector viewed from the open end side)





T4GB-05-05-002

Connect connector in travel mode selector switch.
Disconnect monitor unit connector 1-B in monitor unit.
Check if voltages at terminals #B28, #B29, #B30 and #B31 of harness end of connector are 4V, 3V, 2V and 1V respectively.

· Key switch: ON

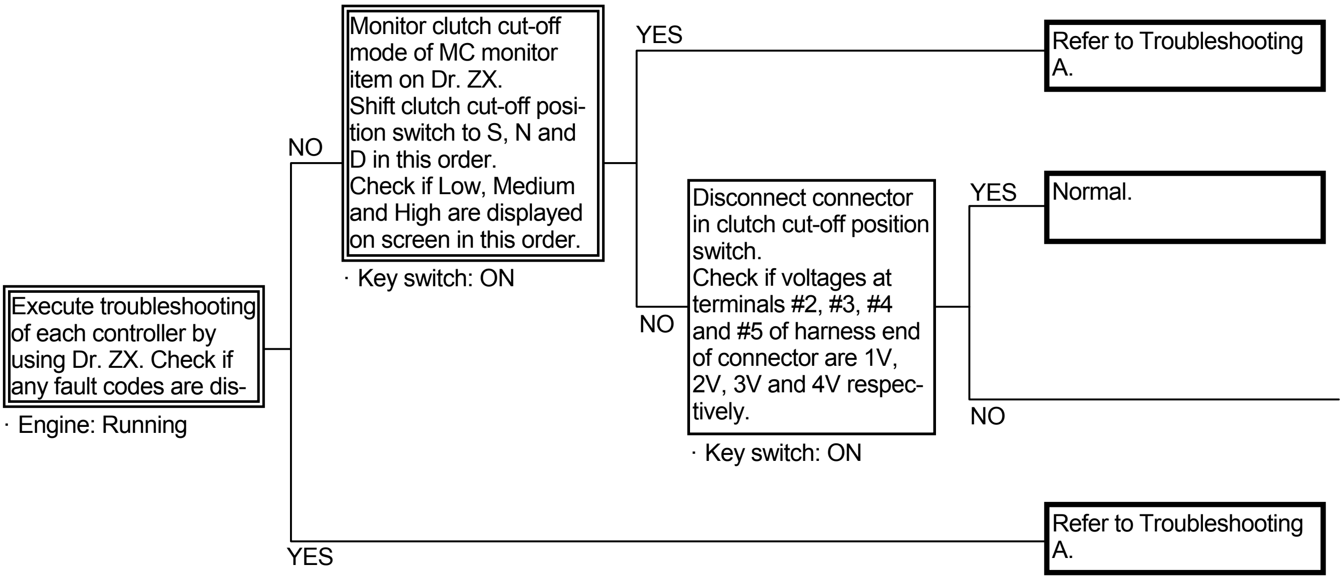
YES → Faulty travel mode selector switch or faulty harness.

· As for the harness in travel mode selector switch, the harness which correct current does not flow through is faulty.

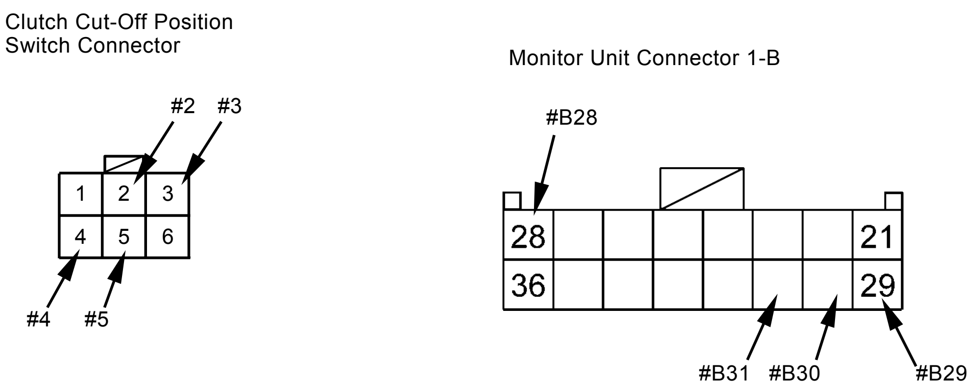
NO → Faulty monitor unit.

T-9 Clutch cut-off is not operated.

- Check the wiring connections first.
- Refer to T2-1-36 to 37 in the Control System group/ SYSTEM section.



Connector (Harness end of connector viewed from the open end side)



T4GB-05-05-002

Connect connector in clutch cut-off position switch.
Disconnect monitor unit connector 1-B in monitor unit.
Check if voltages at terminals #B28, #B29, #B30 and #B31 of harness end of connector are 4V, 3V, 2V and 1V respectively.

· Key switch: ON

YES

Faulty clutch cut-off position switch or faulty harness.

· As for the harness in clutch cut-off position switch, the harness which correct current does not flow through is faulty.

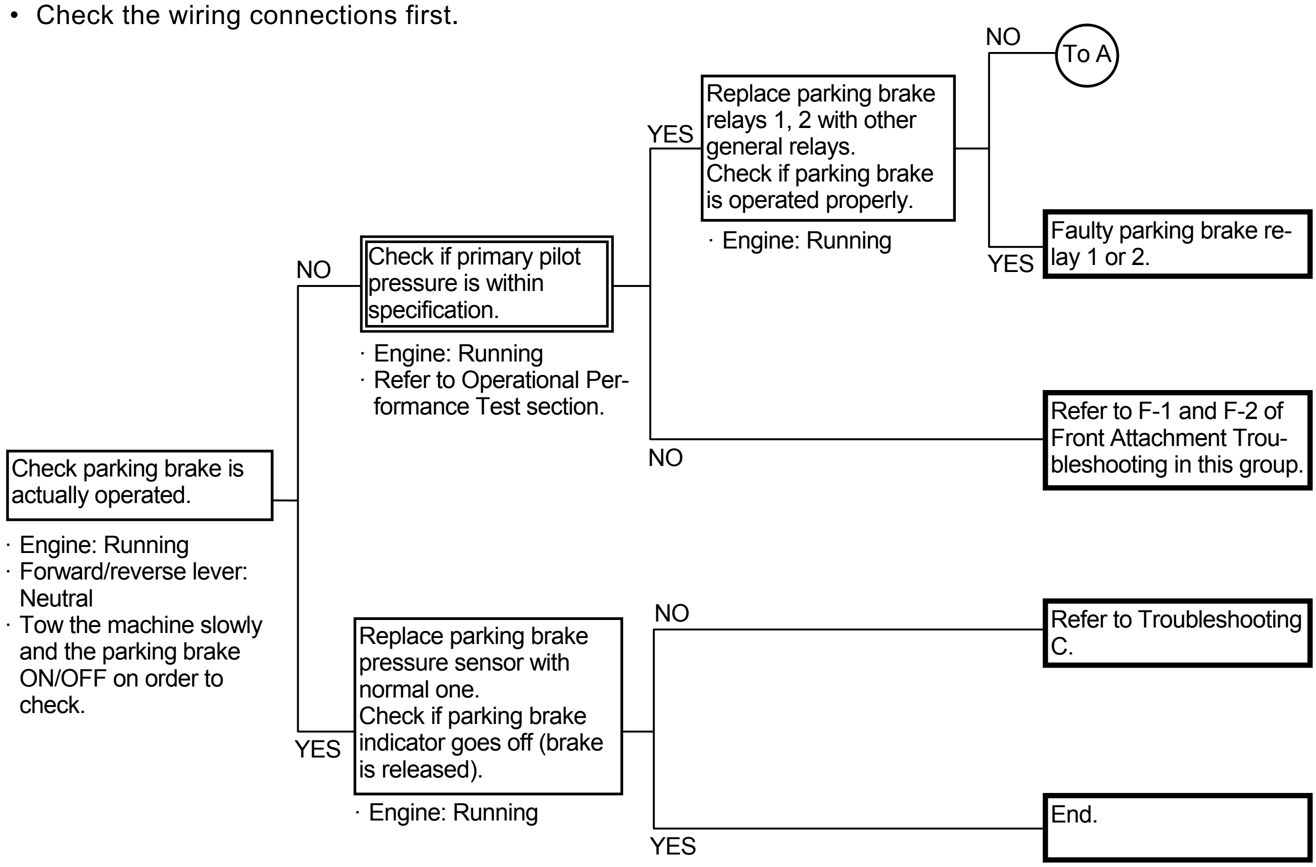
NO

Faulty monitor unit.

BRAKE SYSTEM TROUBLESHOOTING

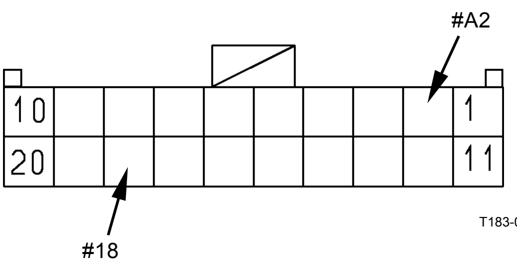
B-1 Parking brake is not released.

- Check the wiring connections first.



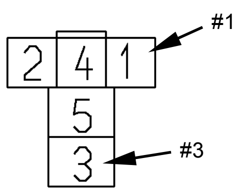
Connector (Harness end of connector viewed from the open end side)

Monitor Unit Connector A



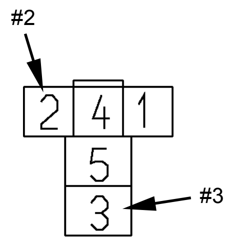
T183-05-04-013

Parking Brake Relay 1 Connector

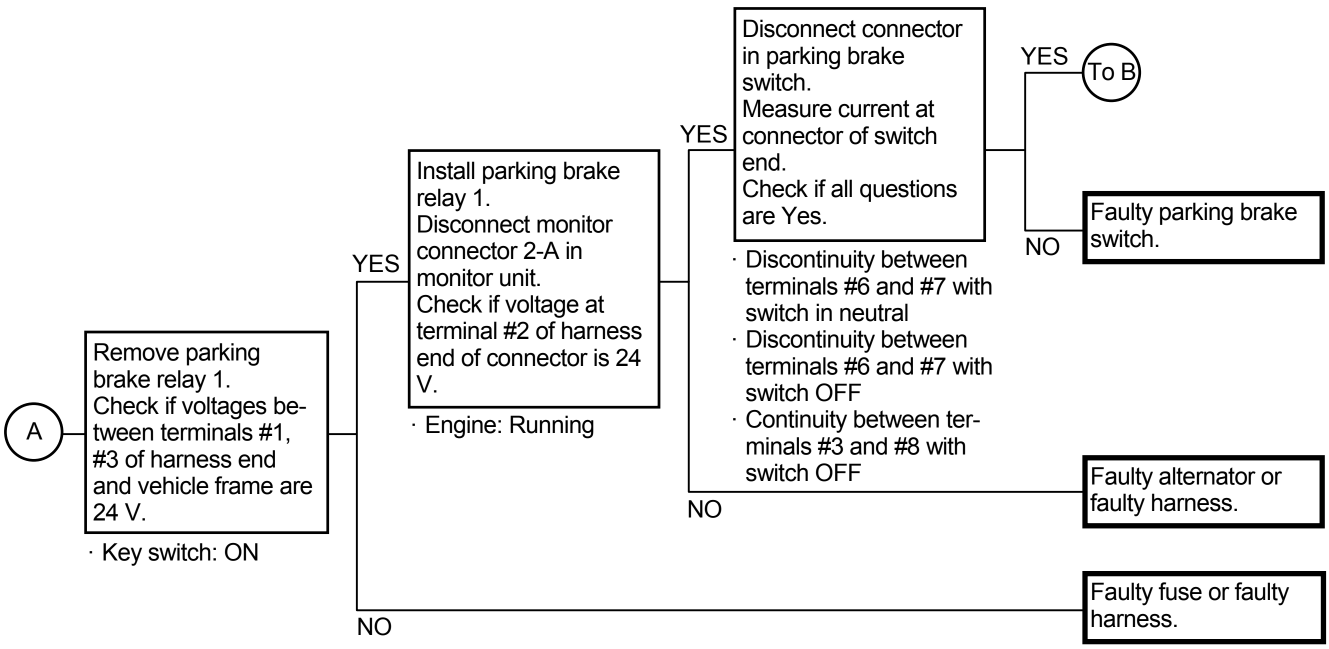


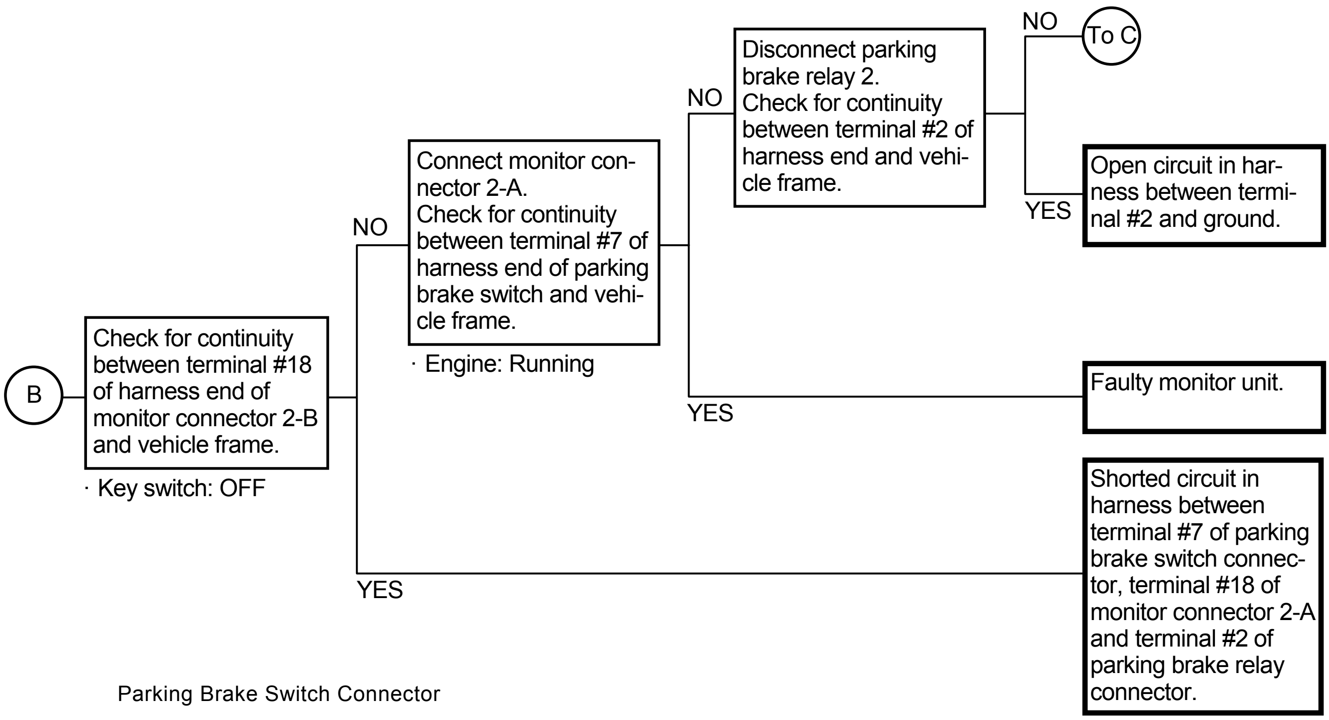
T183-05-04-003

Parking Brake Relay 2 Connector

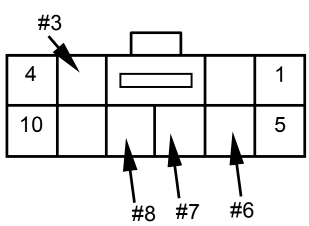


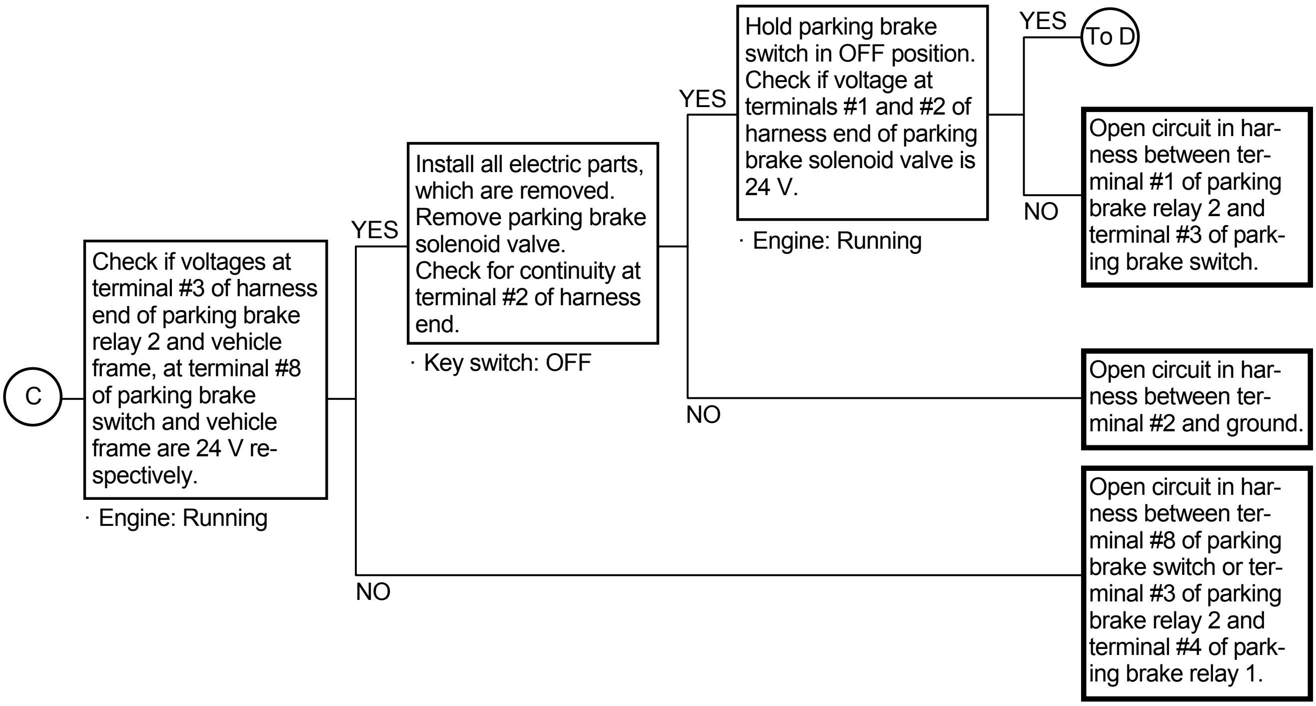
T183-05-04-003

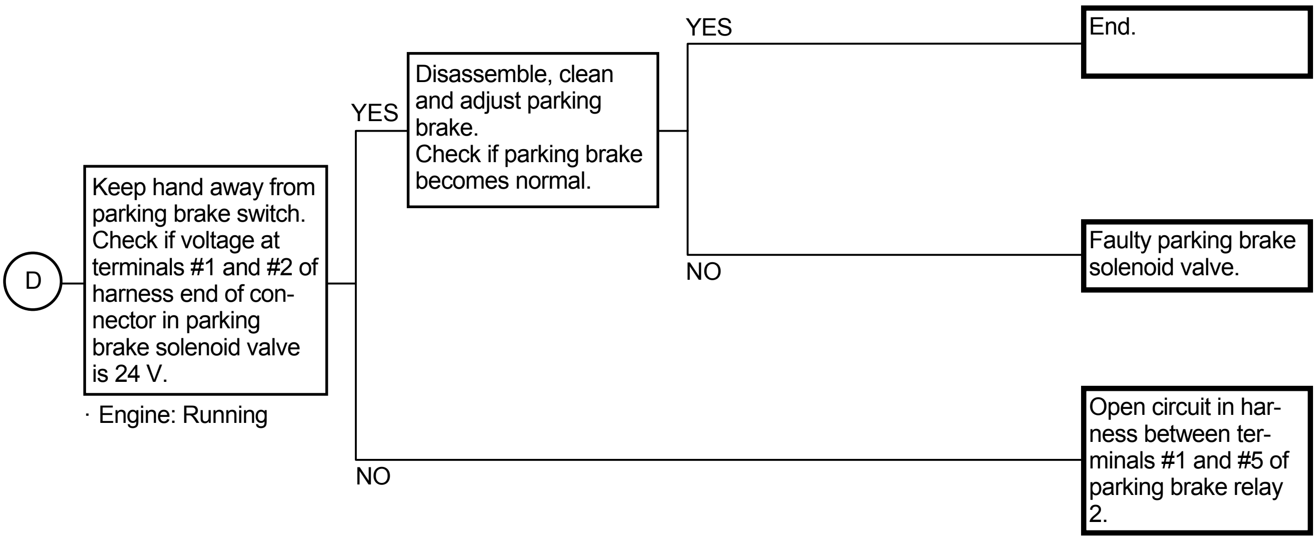




Parking Brake Switch Connector

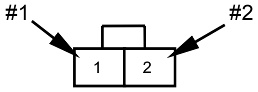






Connector (Harness end of connector viewed from the open end side)

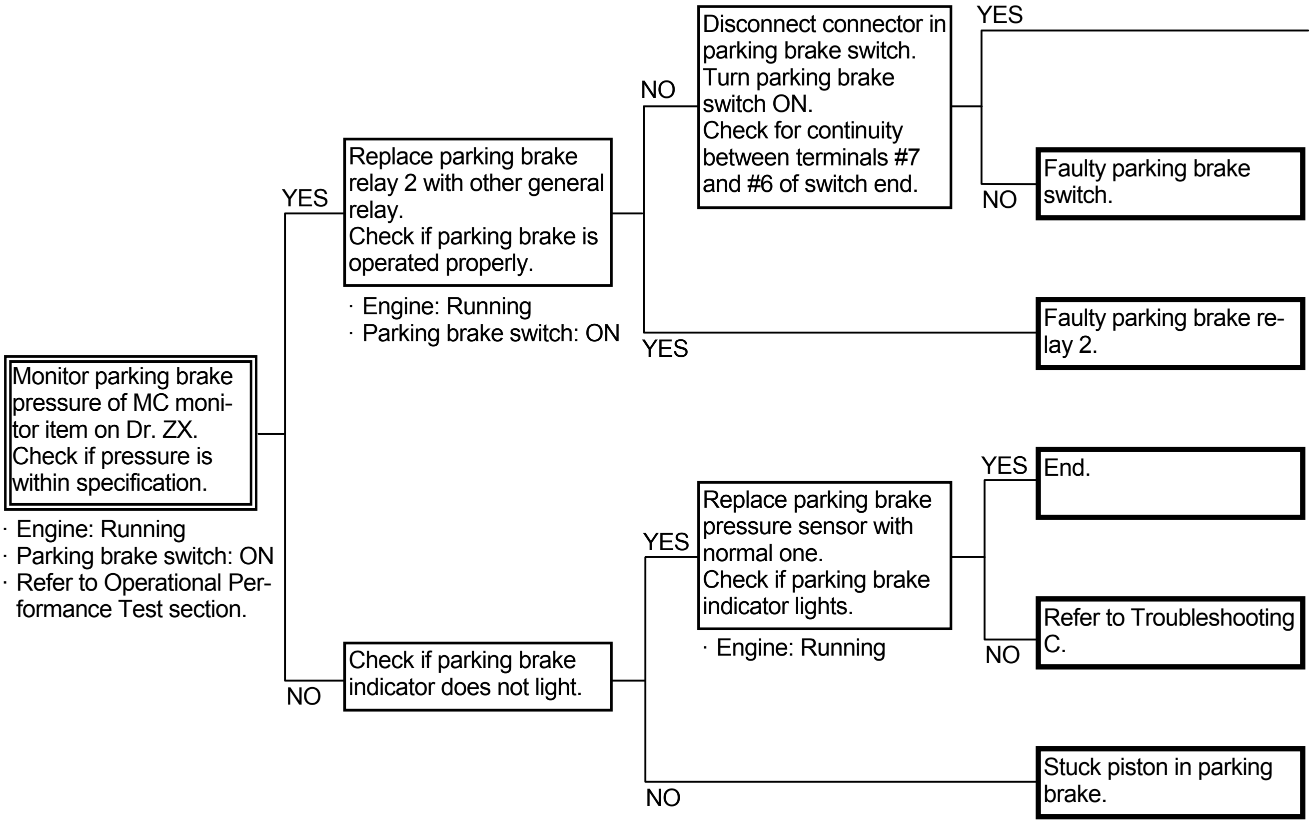
Parking Brake Solenoid Valve Connector



(Blank)

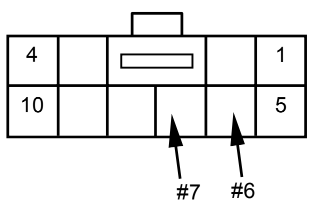
B-2 Parking brake is not locked.

- Check the wiring connections first.

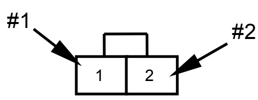


Connector (Harness end of connector viewed from the open end side)

Parking Brake Switch Connector



Parking Brake Solenoid Valve Connector



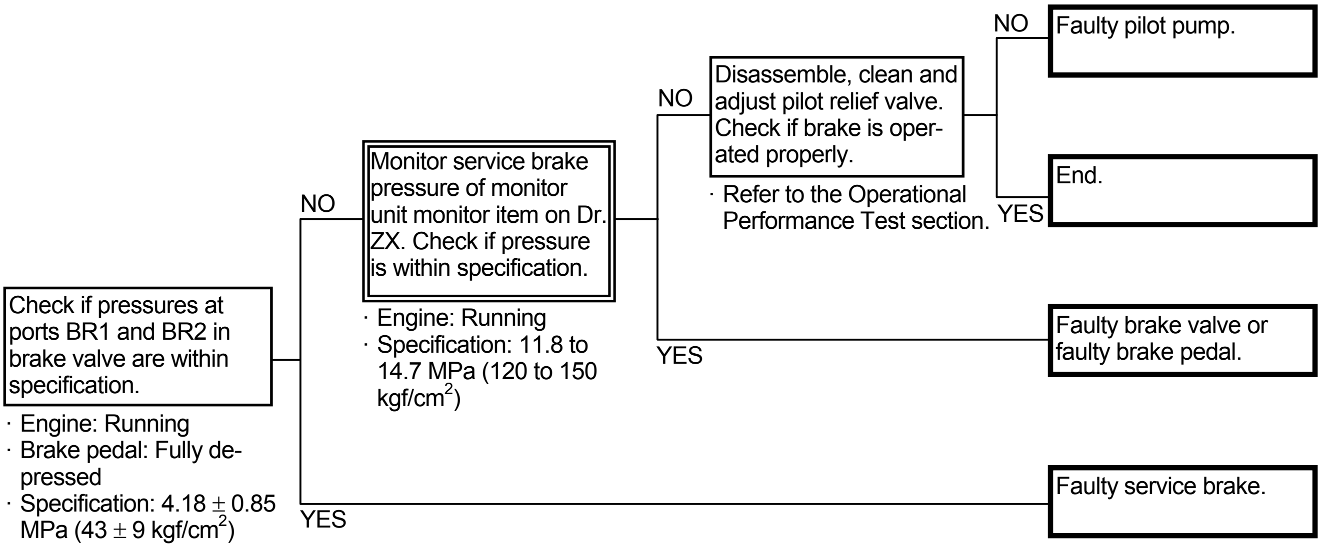
Disconnect connector in parking brake solenoid valve.
Check if voltage between terminals #1 and #2 of harness end is 24 V.

· Engine: Running
· Parking brake switch: ON

YES → Shorted power circuit.

NO → Stuck spool in parking brake solenoid valve.

B-3 Service brake efficiency is bad or low.

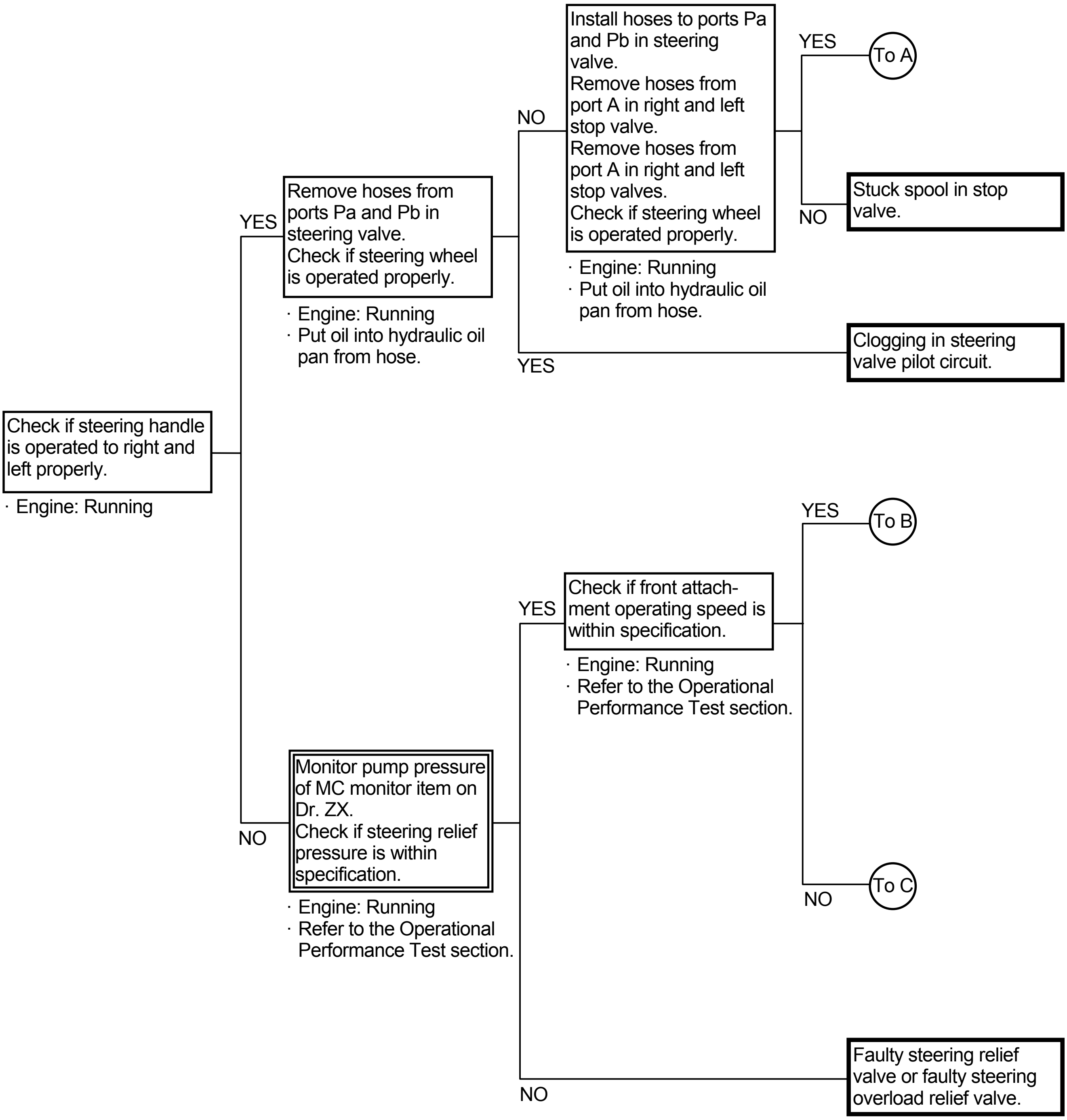


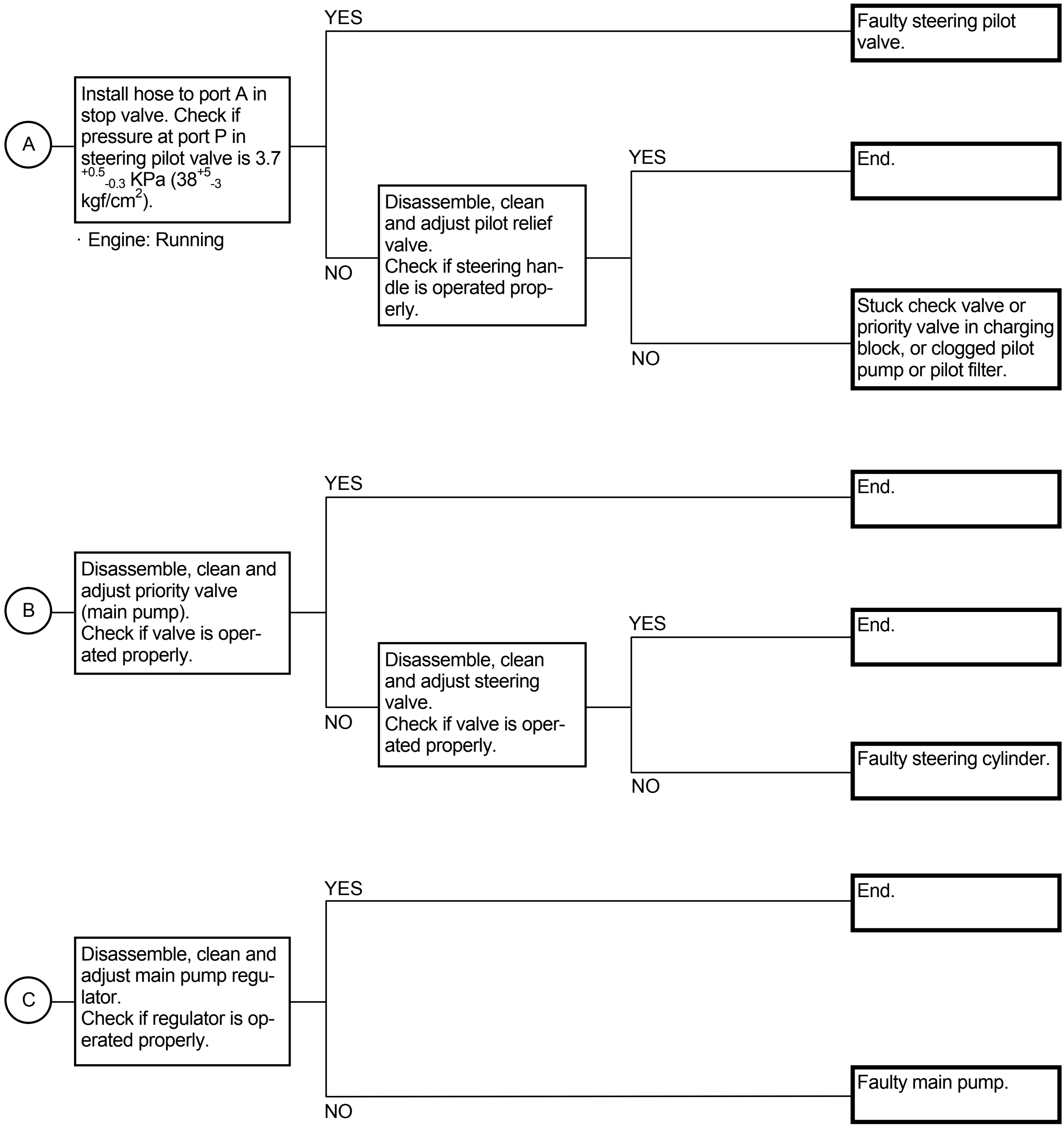
(Blank)

STEERING SYSTEM TROUBLESHOOTING

H-1 Steering cylinder operation is slow or does not move.

- Check if the steering shaft is deformed or stuck.




A
Install hose to port A in stop valve. Check if pressure at port P in steering pilot valve is $3.7^{+0.5}_{-0.3}$ KPa (38^{+5}_{-3} kgf/cm^2).
· Engine: Running
YES
Faulty steering pilot valve.
NO
Disassemble, clean and adjust pilot relief valve.
Check if steering handle is operated properly.
YES
End.
NO
Stuck check valve or priority valve in charging block, or clogged pilot pump or pilot filter.
B
Disassemble, clean and adjust priority valve (main pump).
Check if valve is operated properly.
YES
End.
NO
Disassemble, clean and adjust steering valve.
Check if valve is operated properly.
YES
End.
NO
Faulty steering cylinder.
C
Disassemble, clean and adjust main pump regulator.
Check if regulator is operated properly.
YES
End.
NO
Faulty main pump.

(Blank)

OTHER SYSTEM TROUBLESHOOTING

O-1 Air conditioner malfunction

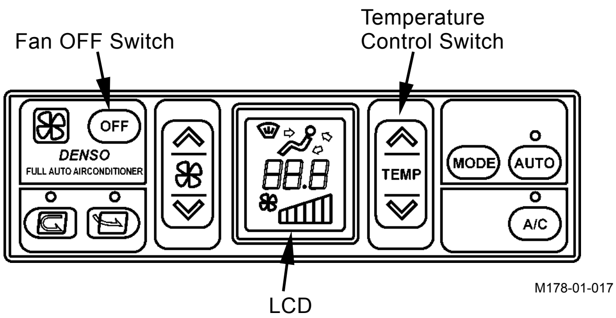
The air conditioner has a self-diagnosis function. The self-diagnosis functions to:
1) Display Fault Codes
2) Change Displayed Fault Codes
3) Delete Fault Code
4) End Fault Code Display

- Display Fault Code
1. Push the fan OFF switch and turn the fan OFF.
2. Push and hold both upper and lower sides of the temperature control switch on the air conditioner control panel at the same time for more than 3 seconds with the key switch ON.

NOTE: After operation has been performed, the buzzer will sound.

3. If any fault codes are found, the LCD displays the fault codes as「EOO」.

NOTE: If more than one fault code is found, the lower number fault code will be displayed first.

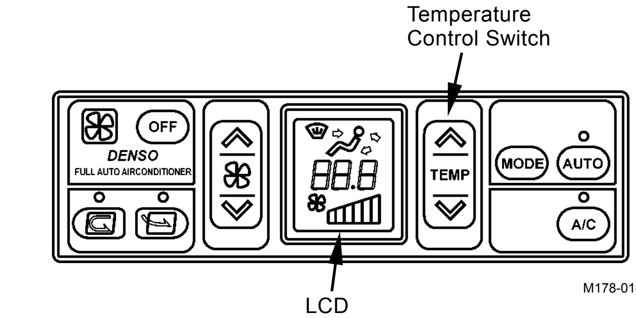


Fault Code List

Location in Trouble	Fault Code	Cause	Symptom
Abnormal circulation air sensor	E11	Open circuit in air circulation sensor	Value Y (air flow-in temperature) in response to the set-temperature is fixed.
	E12	Shorted circuit in air circulation sensor	
Abnormal fresh air sensor	E13	Open circuit in fresh air sensor	Operation is controlled under such circumstance as no fresh air sensor is provided.
	E14	Shorted circuit in fresh air sensor	
Abnormal coolant temperature sensor	E15	Open circuit in coolant temperature sensor	Operation is controlled under such circumstance as the water temperature is set to 60 °C (140 °F). (Warm-up control is not performed.)
	E16	Shorted circuit in coolant temperature sensor	
Abnormal air vent sensor	E21	Open circuit in air vent sensor	Operation is controlled under such circumstance as air flow-in temperature 0 °C (32 °F).
	E22	Shorted circuit in air vent sensor	
Abnormal damper	E43	Abnormal air vent damper	Corresponding damper servo becomes inoperable.
	E44	Abnormal air mix damper	
Abnormal refrigerant	E51	Abnormal high/low refrigerant pressure	The compressor clutch is disengaged. (The compressor stops.)

- Change Displayed Fault Code
  1. When displaying more than one fault code, push either upper or bottom side of the temperature control switch. The following fault code is displayed.

NOTE: Each time the displayed fault code is changed, the buzzer sounds. In case only one fault code exists, the displayed fault code remains unchanged.

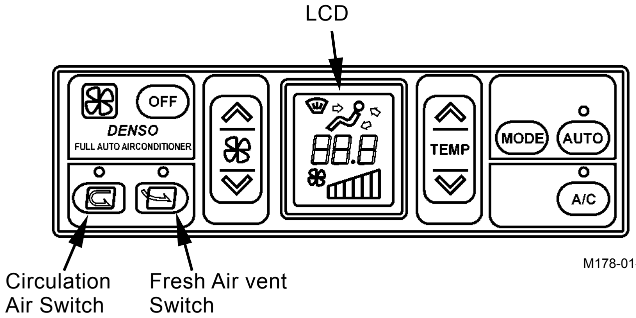


M178-01-017

- Delete Fault Code
  1. Push, and hold both the circulation air switch and the fresh air vent switch for more than 3 seconds at the same time and the fault code is deleted.

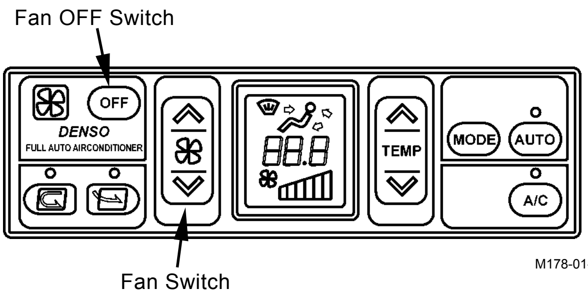
NOTE: After the fault code is deleted, the buzzer sounds.

  2. After the fault code has been deleted, the LCD displays「E○○」.



M178-01-017

- End Fault Code Display
  1. Push the fan OFF switch, and turn the fan ON. The self-diagnostic mode is completed.



M178-01-017

∗ Please fill in all sections and return this AIR CONDITIONER TROUBLE REPORT to Hitachi Tsuchiura Works Quality Assurance Dept. after experiencing a problem with your machine's air conditioning system.

< Air Conditioner Trouble Report > File No.

Checked by:

(1) What

Model	(Serial No.)		
Operation Type	Manual	Semi-Auto	Full-Auto
Delivery Date	Year Month		

(2) When

Date	Year	Month	Day	Operating Hour (h)
Time	Morning	Daytime	Evening	Night
Frequency	Every Day	Once a Week	Once a Month	Times per

(3) Where

Job Site Address	State	County	Town
Access Road Condition	Paved	Not Paved (Gravel Sand Soil)	

(4) How (Operating Conditions)

Weather		Fine	Cloudy	Rain	Snow
Atmospheric Temperature		Very Hot	Hot	Cold	Very Cold
Operating Conditions		Parking	Traveling	Working	
Control Panel	Temperature Control	Paint blanks equal to red indicators. / Fill in set-temperature when full-auto operation			
	A/C	ON		OFF	
	Air Induction	Re-Circulation		Fresh Air Circulation	
	AUTO	ON	OFF	Not Available	
	Fill following items when operated in manual mode or when manual control type unit is used.				
	Vent Position	Front / Front / Rear / Foot / Front / Rear and Foot			
	Fan	First / Second / Third / Fourth / Fifth / Sixth			

(5) How (Problem Symptom)

Abnormal Compressor Operation	
Symptom	Not turned ON
	Not turned OFF
	Others
Uncontrollable air temperature	
Symptom	No cool air
	No warm air
	Others
Uncontrollable air volume	
Symptom	Air flows in Hi mode only
	No air flows
	Small air volume
	Others
Uncontrollable vent hole	
Symptom	Vent hole isn't selected
	Others
Abnormal panel indication	
Faulty Indicator	Vent Hole
	A/C
	AUTO
	Fresh Air Circulation
	Fan OFF
	Fan (Lo • •• Hi)
	Temperature Control
Symptom	Stays OFF
	Stays ON
	Blinks
	Others

<Check Result>

(1) Is problem reproducible ?

Reproducible
Not reproducible

(2) Pressure (To be measured at gauge manifold)

Low Pressure
High Pressure

(3) Which parts have been replaced ?

1
2

∗ Before replacing the control amplifier, be sure to check that the connectors are correctly connected while repeatedly disconnecting and reconnecting connectors.

Cooling Circuit

- Insufficient Cooling Power
  - Refrigerant pressure in both high and low-pressure sides is low.
    - Bubbles can be seen in sight glass.
      - Piping and/or parts are stained with oil, respond to gas detector.
      - No oil stain is found or gas detector does not respond. Refrigerant has not been refilled for longer than one season.
    - No bubbles are seen in sight glass.
      - After cooling at fast speed continuously, cooling power is reduced. Air flow volume remains unchanged.
      - Air flow volume is reduced.
  - Refrigerant pressure in low-pressure side is high.
    - Bubbles can be seen in sight glass.
      - Compressor cylinder is extremely hot, emitting a smell.
    - Refrigerant pressure in high-pressure side is low.
      - Compressor cylinder is extremely hot, emitting a smell.
    - Heater unit emits hot air.
  - Refrigerant pressure in high-pressure side is high.
    - Bubbles can be seen in sight glass.
      - Refrigerant pressure in low-pressure side is low.
    - Condenser is stained and clogged.
    - Even if condenser is sprayed with water, few bubbles appear. Receiver dryer temperature is low.
  - After cooling at fast speed continuously, cooling power is reduced. Air flow volume is reduced.
    - Frost forms.
      - Thermistor does not cool.
      - Thermistor cools.

Gas leaks from pipe joints and/or parts.	Re-tighten or replace parts.
Normal leakage of refrigerant from hoses.	Refill refrigerant.
Improper adjustment (excessive restriction) of expansion valve.	Readjust or replace expansion valve.
Clogged expansion valve.	Remove clog, or replace receiver and/or expansion valve.
Clogged low-pressure circuit and/or evaporator.	Remove clog, or replace parts.
Frozen expansion valve or water in circuit.	After evacuation, refill refrigerant and/or replace receiver dryer.
Gas leaks from case.	Seal gaps by using vinyl tape or packing compound.
Poor contact of expansion valve temperature sensing cylinder.	Make good contact. Replace temperature sensing stay.
Improper adjustment (excessive open) of expansion valve.	Readjust or replace.
Insufficient compressor discharge (faulty gasket and/or valve).	Replace.
Improper water stop valve wire adjustment and/or faulty stop valve.	Check and readjust or replace.
Poor airtight fitting of outside air damper (outside air induction type).	Repair.
Clogged high-pressure circuit before receiver dryer.	Remove clog, or replace parts.
	Clean Condenser.
Excessive refrigerant.	Remove excessive refrigerant to proper level.
Air is mixed in system.	After evacuation, refill refrigerant and/or replace receiver dryer.
Incorrect thermistor location.	Correct thermistor location.
Gas leaks from case.	Seal gaps by using vinyl tape or packing compound.
Faulty thermistor (stays ON).	Disconnected thermistor cord.
Even if function and performance are normal, when air-conditioner is kept operated for a long time with thermistor in max. cooling position and air flow in M or L mode, frost may form.	Instruct user on correct air-conditioner operation. (Reset thermistor to either minimum or middle cooling position or increase air flow.)

Cooling Circuit

- Noise
  - Case connection.
    - Louver resonance.
  - Blower fan connection.
    - Fan contacts case, or foreign matter enters case.
    - Brush friction noise, metal and/or thrust washer contact noise.
  - Gas blowing sound (roaring).
    - Gas vibration noise (compressor discharge and/or suction gas noise).
  - Expansion valve connection, whistle sound, gas blowing sound.
    - Abnormal noise from expansion valve (Expansion valve is normally functioning.).
  - Clutch disengaging sound.
    - Faulty clutch bearing, and/or idle pulley bearing.
    - Contact of clutch amature due to resonance, or loose belt and/or screws.
  - Compressor rotating sound.
    - Noisy compressor.
    - Vibration and/or loose screws due to excessive drive belt looseness.
- Others
  - Water leak and/or splash.
    - Broken heater core and/or hose.
    - Clogged case drain port and/or drain hose.
  - Abnormal smell.
    - Absorbed cigarette and dust smell on evaporator fins.

Repair or replace.

Remove foreign matter. Readjust fan motor location.

Slight noise is unavoidable.
Replace if loud.

No functional problem exists.
Provide silencer if intolerable.

Replace expansion valve if whistle sound is heard. Gas flow noise can be slightly heard.

Replace.

Repair or replace clutch. Re-tighten screws.

Repair or replace.

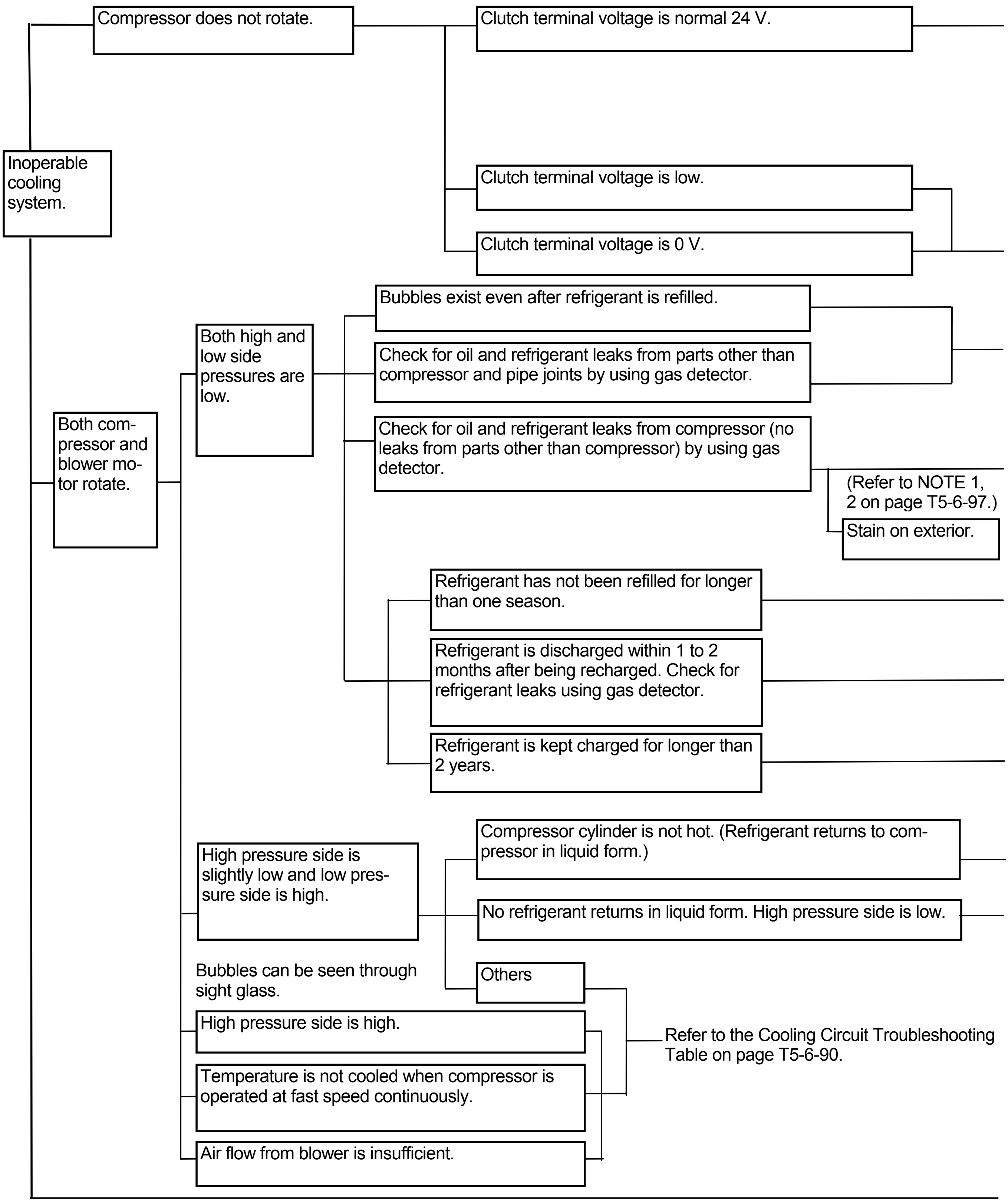
Re-adjust drive belt.

Replace.

Clean.

Clean evaporator. When humidity is high, open door. While rotating fan at approx. 1500 min^{-1} in L mode for more than 10 minutes, flush smell out by condensed water.

Compressor


Inoperable cooling system.
Compressor does not rotate.
Clutch terminal voltage is normal 24 V.
Clutch terminal voltage is low.
Clutch terminal voltage is 0 V.
Both compressor and blower motor rotate.
Both high and low side pressures are low.
Bubbles exist even after refrigerant is refilled.
Check for oil and refrigerant leaks from parts other than compressor and pipe joints by using gas detector.
Check for oil and refrigerant leaks from compressor (no leaks from parts other than compressor) by using gas detector.
(Refer to NOTE 1, 2 on page T5-6-97.)
Stain on exterior.
Refrigerant has not been refilled for longer than one season.
Refrigerant is discharged within 1 to 2 months after being recharged. Check for refrigerant leaks using gas detector.
Refrigerant is kept charged for longer than 2 years.
High pressure side is slightly low and low pressure side is high.
Compressor cylinder is not hot. (Refrigerant returns to compressor in liquid form.)
No refrigerant returns in liquid form. High pressure side is low.
Others
Bubbles can be seen through sight glass.
High pressure side is high.
Temperature is not cooled when compressor is operated at fast speed continuously.
Air flow from blower is insufficient.
Refer to the Cooling Circuit Troubleshooting Table on page T5-6-90.

Seized clutch. — Replace.

Improper gap between amature and rotor (improper air gap). — Replace.

Open or shorted circuit in core cable. — Replace.

Shaft does not rotate (internally locked). — Replace.

Faulty Electrical System.

Faulty Electrical System.

Oil leaks from mechanical seal, gasket, and/or charge valve. — Replace.

Oil leaks from oil plug. — Replace.

Oil and refrigerant leaks from front housing, and/or cylinder block joint. — Replace.

Normal leaks from hoses. — Charge refrigerant.

No leaks (normal).

Refer to the Cooling Circuit Troubleshooting Table on page T5-6-90.

Broken valve (See NOTE 3 on page T5-6-97.) — Replace.

Blown gasket (See NOTE 3 on page T5-6-97.) — Replace.

Excessive oil. — Check and adjust oil level.

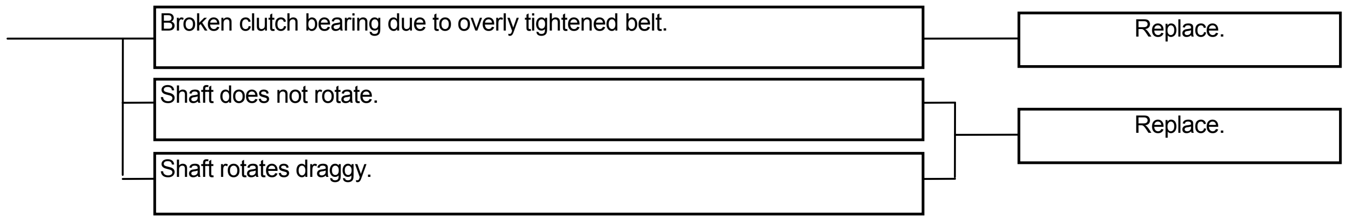
Compressor

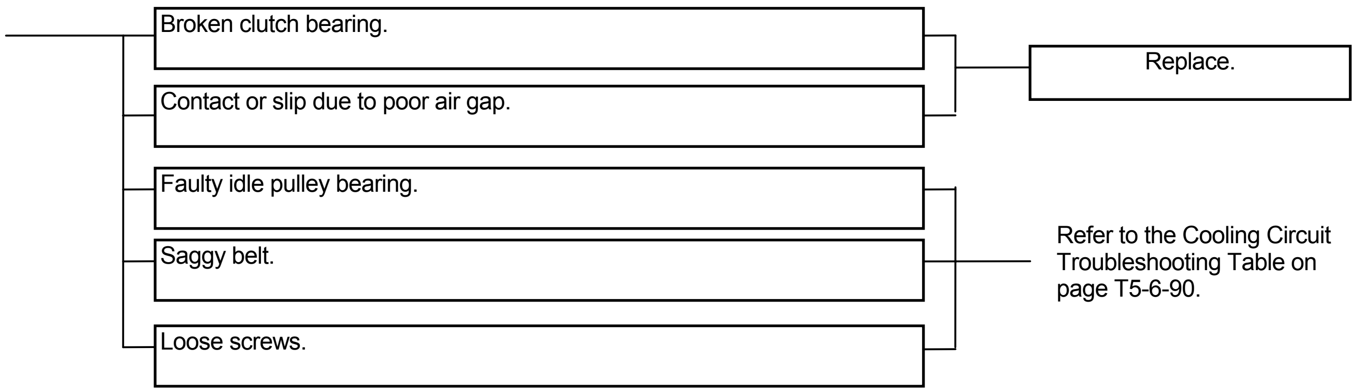
Overheating is susceptible to occur.

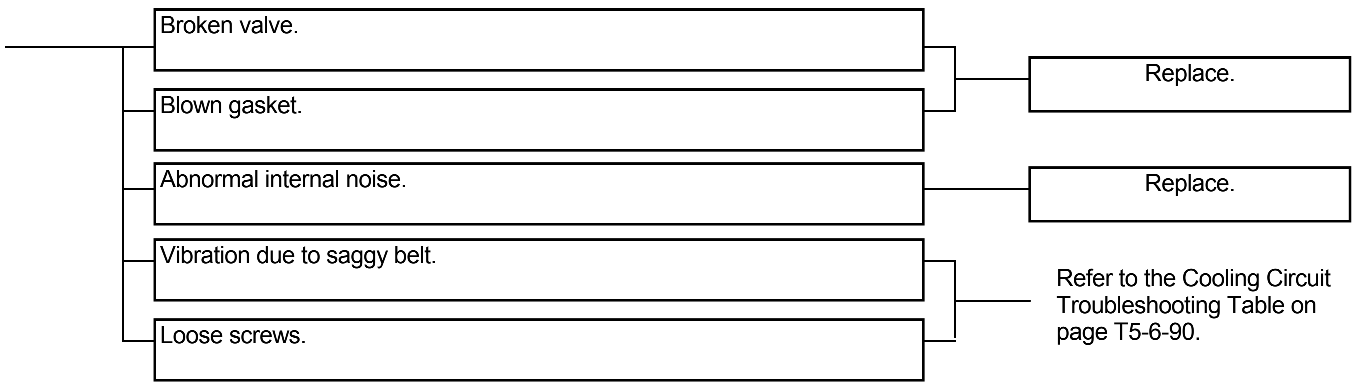
- Compressor rotation is abnormally draggy.
- Trouble other than compressor.
  - Refer to the Cooling Circuit Troubleshooting Table on page T5-6-90.

Abnormal noise

- Noise is heard when clutch is OFF.
- Noise is heard when clutch is ON.







NOTE:

1. *Do not quickly decide that oil is leaking when a stain around the clutch and/or gasket is found. A slight oil seepage will appear due to the seal construction. However, this oil seepage will not cause malfunction. Accurately check whether oil is leaking or seeping only.*
2. *When gas detector is used in the high sensitivity range, normal gas leaks from rubber hose surface may be detected. As long as the specified rubber hoses are used, the problem should not occur. (In case a large leaks is detected, the hose may be broken.)*
3. *After allowing the compressor to idle for 10 to 15 minutes, normal pressure difference between high-pressure side and low-pressure side is 0.5 MPa (5 kgf/cm^2) or less. When the clutch is turned OFF, the pressure difference between high-pressure side and low-pressure side will disappear within about 10 seconds.*

WORK AFTER REPLACING COMPONENTS

The following work is required after replacing compressor, high pressure hose, low pressure hose, condenser, receiver tank, liquid hose and air conditioner unit.
The same work is required when gas leakage is found.

1. Add compressor oil
   Oil amount: 160 cm^3 (0.17 qt)

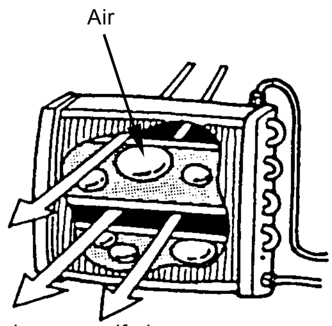
2. Charge air conditioner with refrigerant
   - Purging
   - Charge air conditioner with refrigerant
   - Warm-up operation
   - Inspection

CHARGE AIR CONDITIONER WITH REFRIGERANT

Necessity of Purging

Make sure to purge the air conditioner circuit with a vacuum before charging with refrigerant (R134a) because the following problems can arise if air or other gases remain in the A/C circuit.

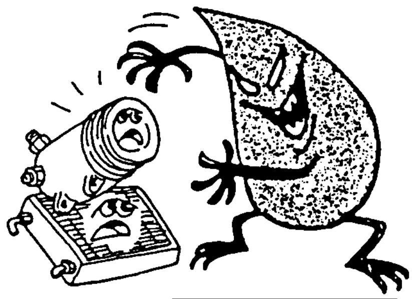
1. Pressure rise in the high pressure side:
   If air remains in the air conditioner circuit, this disturbs the heat exchange between refrigerant and air in the condenser, causing pressure to rise in the high pressure side (compressor side). Usually, refrigerant gas is easily liquefied, however, air cannot be liquefied and remains as a gas in the condenser because the temperature at which air liquefies is extremely low. That is, liquidation of the refrigerant gas in the condenser decreases by the amount of air in the circuit, and the gas pressure in the high pressure side increases accordingly.



Pressure increases if air remains in the air conditioner circuit.

W115-02-10-001

2. Metal corrosion:
   If air remains in the air conditioner circuit, a chemical reaction between refrigerant and moisture in the air takes place, and as a result, hydrochloric acid, that corrodes metals such as aluminum, copper and iron, is produced.



Hydrochloric acid corrodes metals if moisture exists.

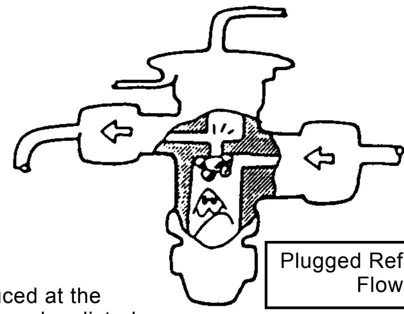
Hydrochloric Acid

⇩

Metal Corrosion

W115-02-10-002

3. Plugging of the expansion valve by moisture:
   When high pressure refrigerant gas passes through the expansion valve, gas pressure decreases and temperature drops. Moisture included in high pressure refrigerant gas in the air conditioner circuit freezes at the expansion valve orifice, plugging refrigerant flow. Operation of the air conditioner becomes unstable and cooling efficiency lowers.



Ice produced at the expansion valve disturbs refrigerant flow, lowering cooling efficiency.

Plugged Refrigerant Flow

⇩

Low Cooling Efficiency

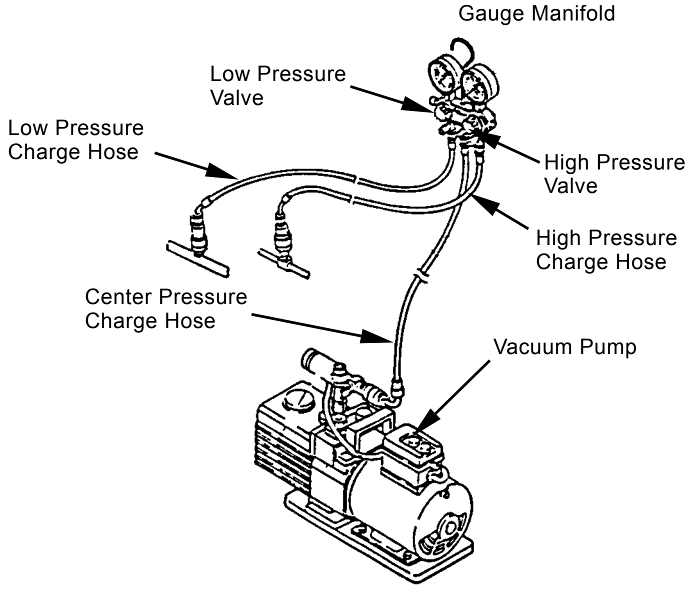
W115-02-10-003

Purging Procedure

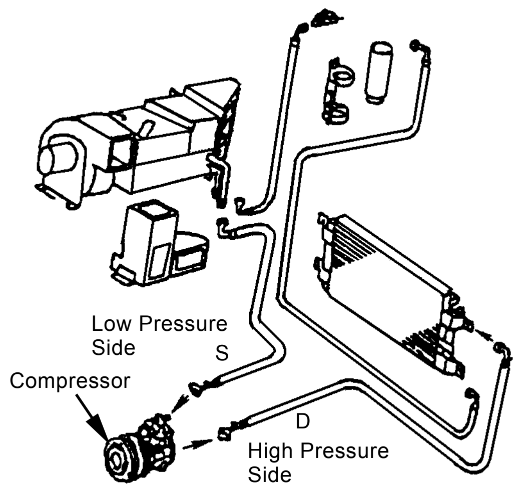
IMPORTANT: Never mistake the charge hose connections.

1. Close the high and low pressure valves on the gauge manifold (Parts Number 4360564).
   Connect the high-pressure-side charge hose and the low-pressure-side charge hoses to the high-pressure-side charge valve ("D" marked) and to the low-pressure-side charge valve ("S" marked) located on the compressor, respectively.
   Connect the charge hose located on the center of the manifold bottom to the vacuum pump (Parts Number 4360565).

NOTE: Vacuum Pump Joint Adapter (Parts Number 4360566).

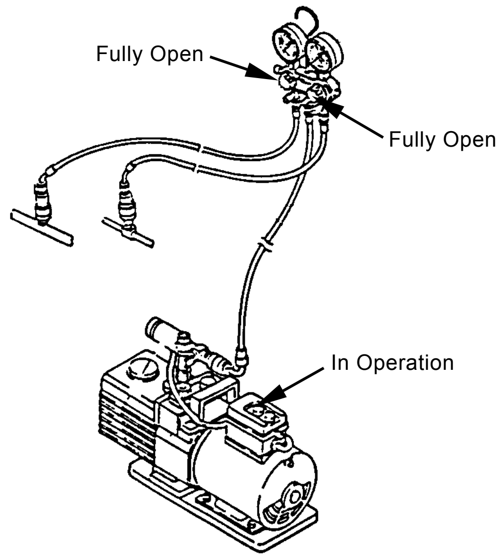


W115-02-10-005



T142-02-05-018

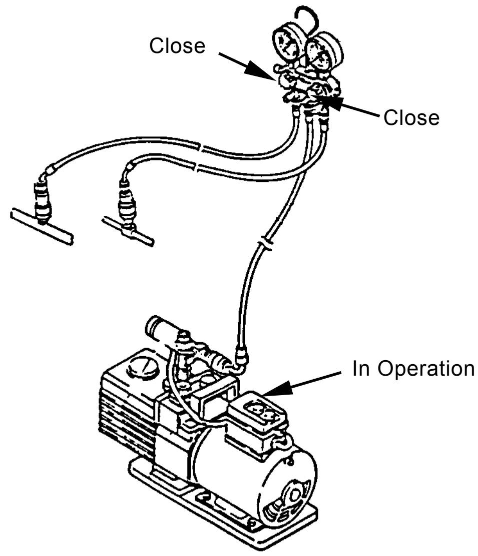
2. Fully open the high pressure and low pressure valves in the gauge manifold. Perform purging for 10 minutes or more by operating the vacuum pump.



W115-02-10-005

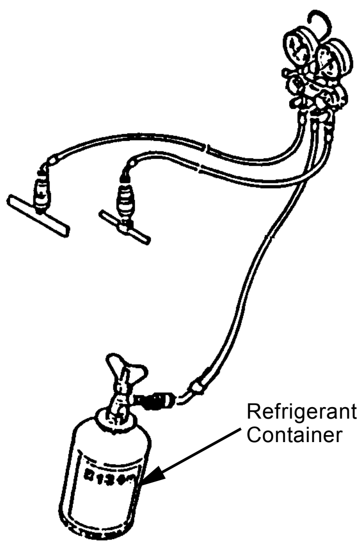
IMPORTANT: If the pointer returns to 0, retighten the line connections and perform purging again.

3. When the low pressure gauge reading falls below -100 kPa (-755 mmHg), stop the vacuum pump and close the high and low pressure valves. Wait for approximately five minutes and confirm that the pointer does not return to 0.



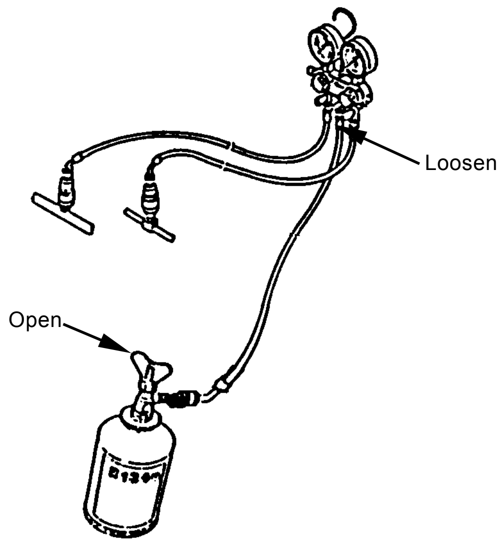
W115-02-10-005

4. With the high pressure and low pressure valves of the gauge manifold closed, connect the charge hose to the refrigerant container (Parts Number 4347644).



W115-02-10-007

5. Loosen the charge hose connection to the gauge manifold and open the refrigerant container valve to purge air in the charge hose with the refrigerant pressure.

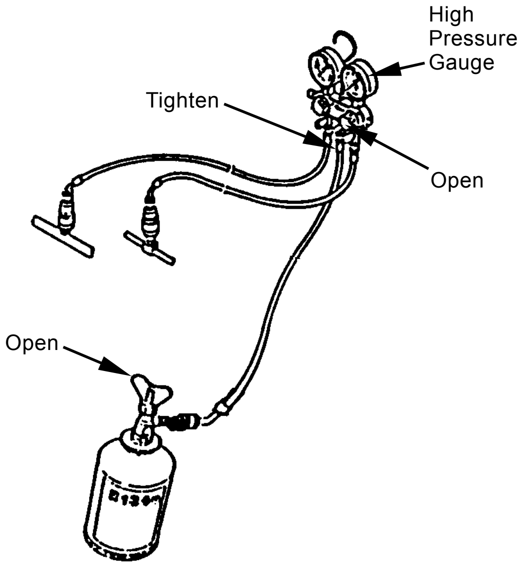


W115-02-10-007

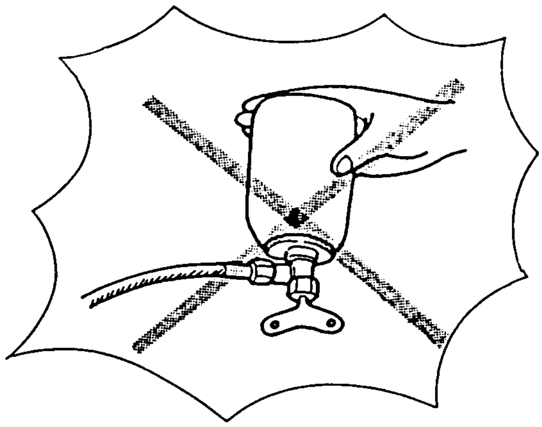
IMPORTANT: Always stop the engine when charging the air conditioner with refrigerant. Do not position the refrigerant container upside down during charging operation. When changing the refrigerant container during charging operation, purge air from the charge hose, as shown in step 10. Charge the low pressure side hose first.

6. Fully tighten the charge hose connection to the gauge manifold. Open the high pressure valve and refrigerant container valve to charge with refrigerant (R134a).
   Close the high pressure valve and refrigerant container valve when the high pressure gauge reading reaches 98 kPa (1 kgf/cm^2, 14 psi).

NOTE: Use warm water of 40 °C (104 °F) or less to warm the refrigerant container to aid in charging operation.



W115-02-10-007



W115-02-10-008

IMPORTANT: Use the leak tester for R134a.

7. After charging, check the line connections for gas leaks by using leak tester (Parts Number 4360567).

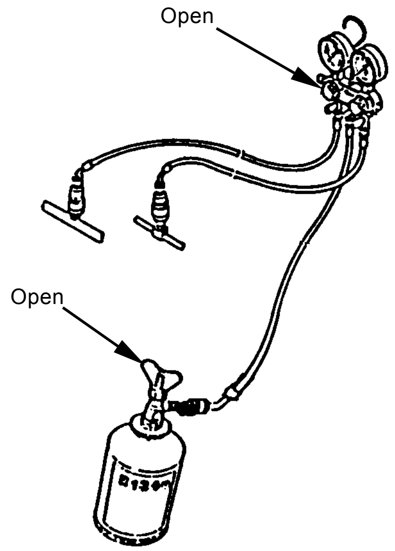
8. Confirm that the high pressure and low pressure valves in the gauge manifold and the refrigerant container valve are closed.
   Start the engine and operate the air conditioner.

   Operating Conditions of the Air Conditioner:
   Engine Speed : Slow Idle
   Cab Window : Fully Open
   Cooler Switch : ON
   Airflow Volume : Maximum
   Thermo Switch : Maximum

IMPORTANT: Do not open the high pressure valve in the gauge manifold.

9. Open the low pressure valve in the gauge manifold and the refrigerant container valve to charge with refrigerant until the bubbles seen in the receiver tank sight glass disappear.

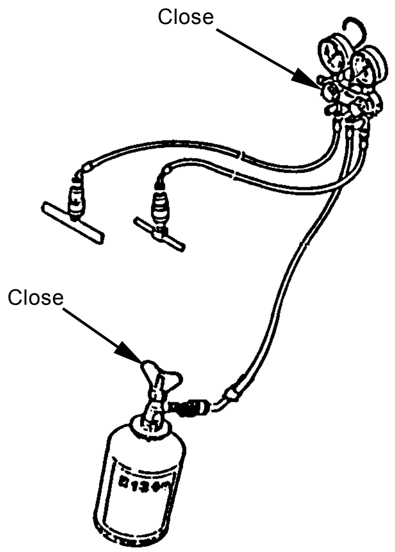
NOTE: The required refrigerant quantity is 1050 g (2.31 lb).



W115-02-10-007

10. If the refrigerant container becomes empty during the charging work, replace it with a new refrigerant container as follows:
    - Close the high pressure and low pressure valves on the manifold gauge.
    - Replace the empty container with a new one.
    - Tighten, then slightly loosen the refrigerant container joint.
    - Slightly open the low pressure valve on the manifold gauge.
    - When the refrigerant container joint starts to leak, immediately tighten the refrigerant container joint and close the low pressure valve on the manifold gauge.

11. After charging, close the low pressure valve in the gauge manifold and the refrigerant container valve.
    Stop the engine.

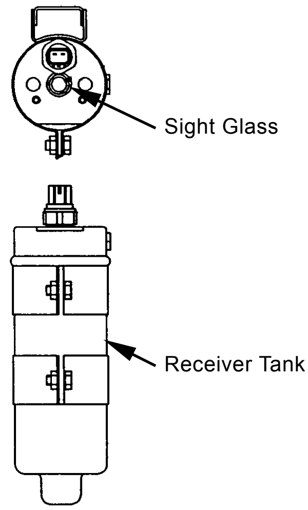


W115-02-10-007

IMPORTANT: If the air conditioner is operated with very low refrigerant, a bad load will be exerted on the compressor. If the air conditioner is overcharged with refrigerant, cooling efficiency will lower and abnormal high pressure will arise in the air conditioner circuit, causing danger.

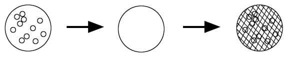
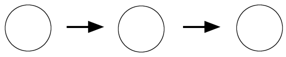
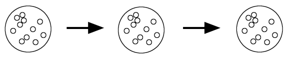
12. Start the engine and operate the air-conditioner again.
    Observe the sight glass of the receiver tank and check refrigerant quantity.
    Operating Conditions of the Air Conditioner:
    Engine Speed : Slow Idle
    Cab Window : Fully Open
    Cooler Switch : ON
    Airflow Volume : Maximum
    Thermo Switch : Maximum

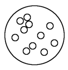
NOTE: As the bubbles in the sight glass vary depending on the ambient temperature, check refrigerant quantity confirming the changes in pressure .
Checking procedures: Stop the air conditioner and wait until refrigerant returns to the balanced pressure. Then, start the air conditioner again.



W115-02-10-009

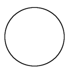
Relation between Refrigerant Quantity and Refrigerant Flow in Sight Glass:

Refrigerant Quantity	Refrigerant Flow in Sight Glass (approx. 1 min. after air conditioner switch is turned ON)	Explanation for Refrigerant Flow in Sight Glass
Adequate	(immediately after) (approx. 1 mm after)  W115-02-10-016	Immediately after the air conditioner is turned ON, few bubbles are seen. Then the flow becomes transparent and shows thin milk white color.
Overcharged	 W115-02-10-017	No bubbles are seen after the air conditioner is turned ON.
Not Enough	 W115-02-10-018	Bubbles are seen continuously after the air conditioner is turned ON.



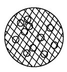
W115-02-10-019

Bubbles exist: Bubbles are seen in refrigerant flow as both liquid refrigerant and refrigerant gas exist, being mixed.



W115-02-10-020

Transparent: Refrigerant flow is transparent as only liquid refrigerant exists.



115-02-10-021

Milk white: Refrigerant flow shows thin milk white as oil and refrigerant are separated.

CAUTION: Wait until the high-pressure-side pressure drops to less than 980 kPa (10 kgf/cm^2, 142 psi) before attempting to disconnect the high-pressure-side charge hose. Otherwise, refrigerant and compressor oil may spout.

13. After checking refrigerant quantity, disconnect the low-pressure-side charge hose first. Wait for the high-pressure-side pressure to drop to less than 980 kPa (10 kgf/cm^2, 142 psi). Disconnect the high-pressure-side charge hose.

Warm-up Operation

After charting the air conditioner, carry out warm-up operation five minute to lubricate system with compressor oil.

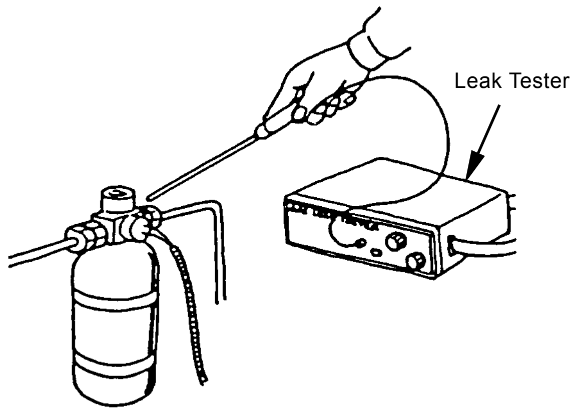
Operating Conditions of the Air Conditioner:
Engine Speed : Slow Idle
Cab Window : Fully Open
Cooler Switch : ON
Airflow Volume : Maximum
Thermo Switch : Maximum

Inspection

After warm-up operation, carry out gas leak check and performance check.

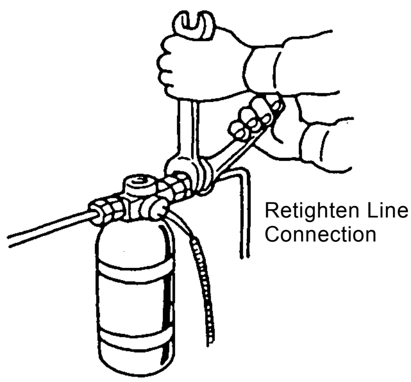
CAUTION: Refrigerant will produce poisonous material if exposed to heat of 1000 °C (1800 °F) or more. Never bring refrigerant close to a fire.

1. Check the air conditioner for gas leaks by using a leak tester.
   - Perform checking under well-ventilated conditions.
   - Thoroughly wipe off dust from the charge hose connections of the compressor.
   - Pay special attention to check the line connections.
   - If any gas leaks are found, retighten the line connections.



W115-02-10-013

2. Performance Check
   Carry out performance check of the air conditioner after checking each air conditioner component.
   - Check each component for abnormalities.
   - Carry out ON-OFF check of the compressor clutch.
   - Check compressor fan belt tension.
   - Check coolant level in the radiator.
   - Operate the air conditioner and check the performance.



W115-02-10-014

3. The checklist before the summer season is as follows:
   - Check each air conditioner component for abnormalities.
   - Check the line connections for oil leaks.
   - Check refrigerant quantity.
   - Check the engine cooling circuit.
   - Check V-belts for wear. Replace if necessary.

4. Off-Season Maintenance
   - During off-season, operate the idler pulley and compressor at least once a month for a short time in order to check for any abnormal sounds.
   - Do not remove the compressor belts during off-season. Operate the compressor occasionally at slow speed for 5 to 10 minutes with the belt slightly loosened in order to lubricate the machine parts.

(Blank)

EXCHANGE INSPECTION

Exchange inspection method is a troubleshooting method to find the trouble location by exchanging the suspected part / component with another part /component having identical characteristics.

Many sensors and solenoid valves used on this machine are identical. Therefore, by using this switch-check method, faulty part /component, and/or harness can be easily found.

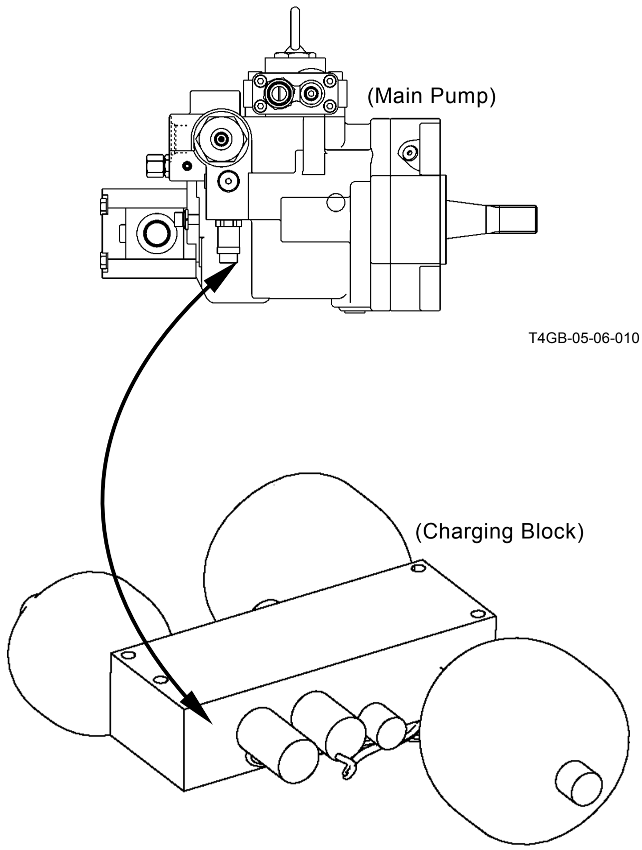
Example: Abnormal pump delivery pressure sensor high voltage (MC fault code: 11204-3)

Check Method:

1. Stop the engine. Release remained pressure in the hydraulic oil tank. (Purge the hydraulic oil tank if possible.)
2. Replace two pressure sensors as illustrated.

CAUTION: If the sensors are removed, hydraulic oil may gush out. Take a good care and use the oil pan.

3. Start the engine. Retry troubleshooting.



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T4GB-01-02-013

Result:
In case abnormal parking brake pressure sensor high voltage is displayed (MC fault code 11313-3), the pressure sensor is considered to be faulty.

In case abnormal pump delivery pressure sensor high voltage is displayed (MC fault code 11204-3), the pump delivery pressure sensor harness is considered to be faulty.

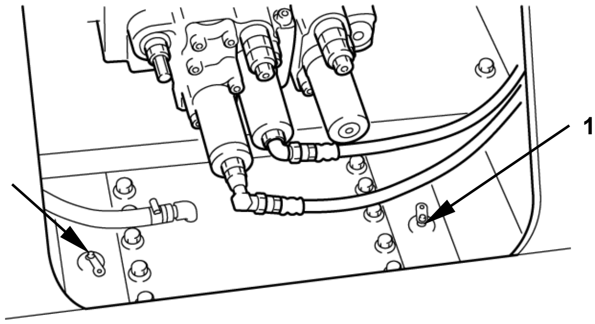
Applicability of Switch-Check Method

Fault Code	Trouble	Applicability
11204-3	Abnormal Pump Delivery Pressure Sensor High Voltage	Applicable (Sensor only)
11204-4	Abnormal Pump Delivery Pressure Sensor Low Voltage	Applicable (Sensor only)
11209-3	Abnormal Implement Pressure Sensor High Voltage	Applicable (Sensor only)
11209-4	Abnormal Implement Pressure Sensor Low Voltage	Applicable (Sensor only)
11313-3	Abnormal Parking Brake Pressure Sensor High Voltage	Applicable (Sensor only)
11313-4	Abnormal Parking Brake Pressure Sensor Low Voltage	Applicable (Sensor only)
13314-3	Service Brake Pressure Switch High Voltage	Applicable (Sensor only)
13314-4	Service Brake Pressure Switch High Voltage	Applicable (Sensor only)
11414-2	Abnormal Operation of Transmission Clutch First Gear Proportional Solenoid Valve Feedback	Applicable (Sensor only)
11414-3	High Current of Transmission Clutch First Gear Proportional Solenoid Valve Feedback	Applicable (Sensor only)
11414-4	Low Current of Transmission Clutch First Gear Proportional Solenoid Valve Feedback	Applicable (Sensor only)
11415-2	Abnormal Operation of Transmission Clutch Second Gear Proportional Solenoid Valve Feedback	Applicable (Sensor only)
11415-3	High Current of Transmission Clutch Second Gear Proportional Solenoid Valve Feedback	Applicable (Sensor only)
11415-4	Low Current of Transmission Clutch Second Gear Proportional Solenoid Valve Feedback	Applicable (Sensor only)
11416-2	Abnormal Operation of Transmission Clutch Third Gear Proportional Solenoid Valve Feedback	Applicable (Sensor only)
11416-3	High Current of Transmission Clutch Third Gear Proportional Solenoid Valve Feedback	Applicable (Sensor only)
11416-4	Low Current of Transmission Clutch Third Gear Proportional Solenoid Valve Feedback	Applicable (Sensor only)
11417-2	Abnormal Operation of Transmission Clutch Fourth Gear Proportional Solenoid Valve Feedback	Applicable (Sensor only)
11417-3	High Current of Transmission Clutch Fourth Gear Proportional Solenoid Valve Feedback	Applicable (Sensor only)
11417-4	Low Current of Transmission Clutch Fourth Gear Proportional Solenoid Valve Feedback	Applicable (Sensor only)
11418-2	Abnormal Operation of Transmission Clutch Forward Proportional Solenoid Valve Feedback	Applicable (Sensor only)
11418-3	High Current of Transmission Clutch Forward Proportional Solenoid Valve Feedback	Applicable (Sensor only)
11418-4	Low Current of Transmission Clutch Forward Proportional Solenoid Valve Feedback	Applicable (Sensor only)
11419-2	Abnormal Operation of Transmission Clutch Reverse Proportional Solenoid Valve Feedback	Applicable (Sensor only)
11419-3	High Current of Transmission Clutch Reverse Proportional Solenoid Valve Feedback	Applicable (Sensor only)
11419-4	Low Current of Transmission Clutch Reverse Proportional Solenoid Valve Feedback	Applicable (Sensor only)

BLEEDING AIR FROM BRAKE (AXLE)

IMPORTANT: If air is contained in the brake, brake efficiency is low so that the serious accident may occur. When the brake pipe is installed/ removed or hydraulic oil is replaced, release any pressure in the brake. Until hydraulic oil (0.5 L) comes out from each wheel (4 places) after bubbles stops, continue to release any pressure.

NOTE: Two or more workers should do this work at each wheel (4 places). Air bleed plug (1) is located near the center of front/ rear axle upper.



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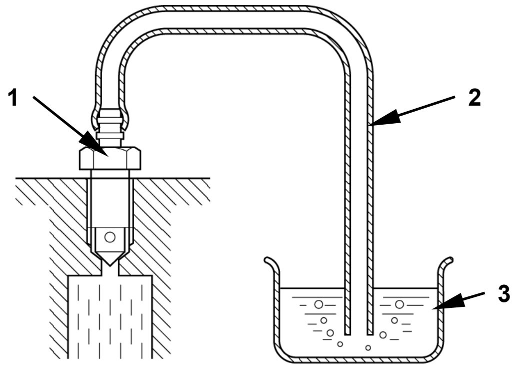
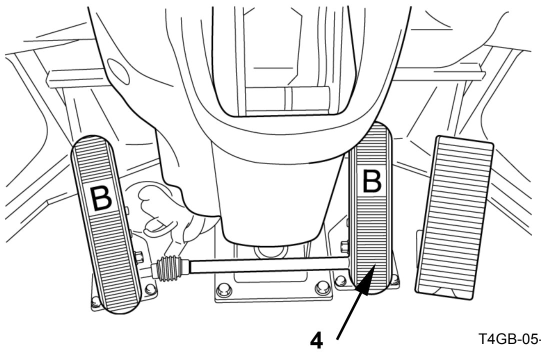
1. Turn the parking brake switch in front console to P. Start the engine. Increase service brake oil pressure.
2. Attach clear vinyl tube (2) onto end of air bleed plug (1). Insert other of clear vinyl tube (2) into clear container (3) filled with hydraulic oil.
3. Depress brake pedal (4) several times. Then, depress and hold brake pedal (4) to the stroke end.
4. Loosen air bleed plug (1) under condition in step 3 and drain hydraulic oil and air for several seconds.
5. Tighten air bleed plug (1).
6. Drain hydraulic oil after bubbles stops in steps 3 to 5 repeatedly.



T4GB-05-04-005

NOTE: When hydraulic oil (0.5 L) comes out, air may be remained. In this case, repeat steps 3 to 5.

7. Release any pressure at other 3 places in the same procedures as steps 3 to 5.



T4GB-05-04-006

IMPORTANT: After air bleeding work is completed at 4 places, release any pressure at 4 places again. Release any pressure in the same procedures as steps 3 to 5 twice and check if no remained pressure inside.

ONE PART OF DATA, "DAILY REPORT DATA", "DISTRIBUTION DATA", "TOTAL OPERATING HOURS" AND "ALARM" IS NOT RECORDED

- The required signal for data may not be sent to ICF. As each signal is used for some data, check the corresponding signal system according to the table below.

Daily Report Data

	Data	Input Signal
1	Date	Date of daily report data (Year/ Month/ Day)
2	Fuel level	Fuel level when the engine stops at last in one day
3	Fuel used amount	Fuel used amount in one day
4	Machine hour meter	Total hours of hour meter
5	Engine operating hours	Engine operating hours in one day
6	Travel operating distance	Traveling distance in one day
7	Manual gear shifting operating hours	Manual gear shifting operating hours in one day
8	Automatic gear shifting operating hours	Automatic gear shifting operating hours in one day
9	L mode operating hours	L mode in work mode selector switch operating hours in one day
10	N mode operating hours	N mode in work mode selector switch operating hours in one day
11	P mode operating hours	P mode in work mode selector switch operating hours in one day
12	Radiator coolant temperature	Highest radiator coolant temperature in one day
13	Hydraulic oil temperature	Highest hydraulic oil temperature in one day
14	Intake-air temperature	Highest intake-air temperature in one day
15	Fuel temperature	Highest fuel temperature in one day
16	Torque converter oil temperature	Highest torque converter oil temperature in one day
17	Engine operating hours distribution	Engine operating hours distribution in one day (Data is recorded only when alternator output signal is received for 10 minutes or longer.)

IMPORTANT: If the trouble occurs between each controller and sensor, the data corresponding to this trouble is not recorded in ICF.

Although the machine is normal (The fault code is not displayed as for all controllers, the monitor display and the machine operation are normal) and the required data is not recorded in ICX, execute this inspection.

Generated/Detected Data Position	Controller sending data on CAN	*Inspected Position
Internal clock circuit in MC	ICF	-
Fuel level sensor	Monitor unit	Communication line between monitor unit and ICF (CAN line)
Circuit calculating fuel used amount in ECM	ECM	Communication line between ECM and ICF (CAN line)
Hour meter circuit in monitor unit	Monitor unit	Communication line between monitor unit and ICF (CAN line)
Alternator	• Alternator • ECM	• Wiring between alternator and ICF • Communication line between ECM and ICF (CAN line)
Travel speed sensor	MC	Communication line between MC and ICF (CAN line)
M mode in travel mode selector switch	MC	Communication line between MC and ICF (CAN line)
• L mode in travel mode selector switch • N mode in travel mode selector switch • H mode in travel mode selector switch	MC	Communication line between MC and ICF (CAN line)
L mode in work mode selector switch	MC	Communication line between MC and ICF (CAN line)
N mode in work mode selector switch	MC	Communication line between MC and ICF (CAN line)
P mode in work mode selector switch	MC	Communication line between MC and ICF (CAN line)
Coolant temperature sensor	Monitor unit	Communication line between monitor unit and ICF (CAN line)
Hydraulic oil temperature sensor	MC	Communication line between MC and ICF (CAN line)
Intake-air temperature sensor	ECM	Communication line between ECM and ICF (CAN line)
Fuel temperature sensor	ECM	Communication line between ECM and ICF (CAN line)
Torque converter oil temperature sensor	Monitor unit	Communication line between monitor unit and ICF (CAN line)
Alternator	• Alternator • ECM	• Wiring between alternator and ICF • Communication line between ECM and ICF (CAN line)

As for inspection method of the CAN line, refer to Troubleshooting A group in TROUBLESHOOTING section.

Daily Report Data

	Data	Input Signal
1	Date	Replace ICF
2	Fuel level	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit
3	Fuel used amount	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #18, #37 of connector in ECM
4	Machine hour meter	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit
5	Engine operating hours	Check terminal #8 of connector ICF-C in ICF, terminal L in alternator Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #18, #37 of connector in ECM
6	Travel operating distance	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #4, #15 of connector MC-C in MC
7	Manual gear shifting operating hours	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #4, #15 of connector MC-C in MC
8	Automatic gear shifting operating hours	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #4, #15 of connector MC-C in MC
9	L mode operating hours	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #4, #15 of connector MC-C in MC
10	N mode operating hours	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #4, #15 of connector MC-C in MC
11	P mode operating hours	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #4, #15 of connector MC-C in MC
12	Radiator coolant temperature	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit
13	Hydraulic oil temperature	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #4, #15 of connector MC-C in MC
14	Intake-air temperature	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #18, #37 of connector in ECM
15	Fuel temperature	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #18, #37 of connector in ECM
16	Torque converter oil temperature	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit
17	Engine operating hours distribution	Check terminal #8 of connector ICF-C in ICF, terminal L in alternator Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #18, #37 of connector in ECM

As for inspection method of the CAN line, refer to Troubleshooting A group in TROUBLESHOOTING section.

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Distribution Data

	Data	Input Signal
1	Fuel temperature distribution	Distribution of fuel temperature
2	Pump load distribution	Distribution of main pump delivery pressure
3	Travel load distribution	Distribution of travel torque
4	Radiator coolant temperature distribution	Distribution of coolant temperature
5	Hydraulic oil temperature distribution	Distribution of hydraulic oil temperature
6	Torque converter oil temperature distribution	Distribution of torque converter oil temperature
7	Brake pressure distribution	Distribution of secondary brake pressure
8	Radiator coolant temperature - Intake-air temperature distribution	Distribution of temperature that intake-air temperature is taken from coolant temperature
9	Hydraulic oil temperature - Intake-air temperature distribution	Distribution of temperature that intake-air temperature is taken from hydraulic oil temperature
10	Torque converter oil temperature - Intake-air temperature distribution	Distribution of temperature that intake-air temperature is taken from torque converter oil temperature
11	Radiator coolant temperature / Intake-air temperature	Distribution of coolant temperature and intake-air temperature
12	Hydraulic oil temperature / Intake-air temperature	Distribution of hydraulic oil temperature and intake-air temperature
13	Torque converter oil temperature / Intake-air temperature	Distribution of torque converter oil temperature and intake-air temperature
14	Travel speed gear distribution during manual gear shifting	Distribution of travel speed gear during manual gear shifting
15	Travel speed gear distribution during automatic gear shifting	Distribution of travel speed gear during automatic gear shifting
16	Engine load rate	Distribution of engine speed and engine torque

IMPORTANT: If the trouble occurs between each controller and sensor, the data corresponding to this trouble is not recorded in ICF.
Although the machine is normal (The fault code is not displayed as for all controllers, the monitor display and the machine operation are normal) and the required data is not recorded in ICX, execute this inspection.

Generated/Detected Data Position	Controller sending data on CAN	Inspected Position
Fuel temperature sensor	ECM	Communication line between ECM and ICF (CAN line)
Pump delivery pressure sensor	MC	Communication line between MC and ICF (CAN line)
• Torque converter input shaft sensor • Torque converter output shaft sensor	MC	Communication line between MC and ICF (CAN line)
Coolant temperature sensor	Monitor unit	Communication line between monitor unit and ICF (CAN line)
Hydraulic oil temperature sensor	MC	Communication line between MC and ICF (CAN line)
Torque converter oil temperature sensor	Monitor unit	Communication line between monitor unit and ICF (CAN line)
Service brake pressure sensor	MC	Communication line between MC and ICF (CAN line)
• Coolant temperature sensor • Intake-air temperature sensor	• Monitor unit • ECM	Communication line between monitor unit and ICF (CAN line) Communication line between ECM and ICF (CAN line)
• Hydraulic oil temperature sensor • Intake-air temperature sensor	• MC • ECM	• Communication line between MC and ICF (CAN line) • Communication line between ECM and ICF (CAN line)
• Torque converter oil temperature sensor • Intake-air temperature sensor	• Monitor unit • ECM	• Communication line between monitor unit and ICF (CAN line) • Communication line between ECM and ICF (CAN line)
• Coolant temperature sensor • Intake-air temperature sensor	• Monitor unit • ECM	• Communication line between monitor unit and ICF (CAN line) • Communication line between ECM and ICF (CAN line)
• Hydraulic oil temperature sensor • Intake-air temperature sensor	• MC • ECM	• Communication line between MC and ICF (CAN line) • Communication line between ECM and ICF (CAN line)
• Torque converter oil temperature sensor • Intake-air temperature sensor	• Monitor unit • ECM	• Communication line between monitor unit and ICF (CAN line) • Communication line between ECM and ICF (CAN line)
• M mode in travel mode selector switch • Shift switch	• MC	• Communication line between MC and ICF (CAN line)
• L mode in travel mode selector switch • N mode in travel mode selector switch • H mode in travel mode selector switch • Shift switch	MC	Communication line between MC and ICF (CAN line)
• Engine torque curve control circuit in ECM • Engine speed sensor	ECM	Communication line between ECM and ICF (CAN line)

As for inspection method of the CAN line, refer to Troubleshooting A group in TROUBLESHOOTING section.

Distribution Data

	Data	Input Signal
1	Fuel temperature distribution	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #18, #37 of connector in ECM
2	Pump load distribution	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #4, #15 of connector MC-C in MC
3	Travel load distribution	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #4, #15 of connector MC-C in MC
4	Radiator coolant temperature distribution	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit
5	Hydraulic oil temperature distribution	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #4, #15 of connector MC-C in MC
6	Brake pressure distribution	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit
7	Torque converter oil temperature distribution	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit
8	Radiator coolant temperature – Intake-air temperature distribution	• Check terminal #8 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit • Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #18, #37 of connector in ECM
9	Hydraulic oil temperature - Intake-air temperature distribution	• Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #4, #15 of connector MC-C in MC • Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #18, #37 of connector in ECM
10	Torque converter oil temperature - Intake-air temperature distribution	• Check terminal #8 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit • Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #18, #37 of connector in ECM
11	Radiator coolant temperature / Intake-air temperature	• Check terminal #8 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit • Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #18, #37 of connector in ECM
12	Hydraulic oil temperature /Intake-air temperature	• Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #4, #15 of connector MC-C in MC • Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #18, #37 of connector in ECM
13	Torque converter oil temperature / Intake-air temperature	• Check terminal #8 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit • Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #18, #37 of connector in ECM
14	Travel speed gear distribution during manual gear shifting	• Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #4, #15 of connector MC-C in MC
15	Travel speed gear distribution during automatic gear shifting	• Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #4, #15 of connector MC-C in MC
16	Engine load rate	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #18, #37 of connector in ECM

As for inspection method of the CAN line, refer to Troubleshooting A group in TROUBLESHOOTING section.

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Total Operating Hours Data

	Data	Input Signal
1	Hour meter (ICF)	Hour meter value calculated in ICF
2	Hour meter (monitor unit)	Hour meter value calculated in monitor unit
3	Engine operating hours	Total engine operating
4	Traveling distance	Total traveling distance
5	Manual gear shifting operating hours	Total manual gear shifting operating hours
6	Automatic gear shifting operating hours	Total automatic gear shifting operating hours
7	L mode operating hours	Total L mode in work mode selector switch operating hours
8	N mode operating hours	Total N mode in work mode selector switch operating hours
9	P mode operating hours	Total P mode in work mode selector switch operating hours

IMPORTANT: If the trouble occurs between each controller and sensor, the data corresponding to this trouble is not recorded in ICF.
Although the machine is normal (The fault code is not displayed as for all controllers, the monitor display and the machine operation are normal) and the required data is not recorded in ICX, execute this inspection.

Generated/Detected Data Position	Controller sending data on CAN	Inspected Position
Hour meter circuit in ICF	ICF	-
Hour meter circuit in monitor unit	Monitor unit	Communication line between monitor unit and ICF (CAN line)
Alternator	• Alternator • ECM	• Wiring between alternator and ICF • Communication line between ECM and ICF (CAN line)
Travel speed sensor	MC	Communication line between MC and ICF (CAN line)
M mode in travel mode selector switch	MC	Communication line between MC and ICF (CAN line)
• L mode in travel mode selector switch • N mode in travel mode selector switch • H mode in travel mode selector switch	MC	Communication line between MC and ICF (CAN line)
L mode in work mode selector switch	MC	Communication line between MC and ICF (CAN line)
N mode in work mode selector switch	MC	Communication line between MC and ICF (CAN line)
P mode in work mode selector switch	MC	Communication line between MC and ICF (CAN line)

As for inspection method of the CAN line, refer to Troubleshooting A group in TROUBLESHOOTING section.

Total Operating Hours Data

	Data	Input Signal
1	Hour meter (ICF)	Replace ICF
2	Hour meter (monitor unit)	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit
3	Engine operating hours	Check terminal #8 of connector ICF-C in ICF, terminal L in alternator Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #18, #37 of connector in ECM
4	Traveling distance	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #4, #15 of connector MC-C in MC
5	Manual gear shifting operating hours	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #4, #15 of connector MC-C in MC
6	Automatic gear shifting operating hours	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #4, #15 of connector MC-C in MC
7	L mode operating hours	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #4, #15 of connector MC-C in MC
8	N mode operating hours	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #4, #15 of connector MC-C in MC
9	P mode operating hours	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #4, #15 of connector MC-C in MC

As for inspection method of the CAN line, refer to Troubleshooting A group in TROUBLESHOOTING section.

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Alarm Data

	Data	Input Signal
1	Overheat alarm	Data when overheat indicator lights
2	Engine warning alarm	Data when engine warning indicator lights
3	Engine oil pressure alarm	Data when engine oil pressure indicator lights
4	Alternator indicator alarm	Data when alternator indicator lights
5	Air cleaner restriction alarm	Data when air cleaner restriction indicator lights
6	Water separator alarm	Data when water separator indicator lights
7	Service brake oil level alarm	Data when air cleaner restriction indicator lights
8	Service brake oil pressure alarm	Data when brake oil lever indicator lights
9	Emergency steering operation alarm	Data when emergency steering operation indicator lights
10	Steering oil pressure alarm	Data when steering oil pressure indicator lights
11	Transmission oil temperature alarm	Data when transmission oil temperature indicator lights
12	Hydraulic oil temperature alarm	Data when hydraulic oil temperature indicator lights
13	Transmission filter restriction alarm	Data when transmission filter restriction indicator lights
14	Transmission malfunction alarm	Data when transmission malfunction indicator lights

IMPORTANT: If the trouble occurs between each controller and sensor, the data corresponding to this trouble is not recorded in ICF.
Although the machine is normal (The fault code is not displayed as for all controllers, the monitor display and the machine operation are normal) and the required data is not recorded in ICX, execute this inspection.

Generated/Detected Data Position	Controller sending data on CAN	Inspected Position
Overheat switch	Monitor unit	Communication line between monitor unit and ICF (CAN line)
ECM	Monitor unit	Communication line between monitor unit and ICF (CAN line)
Engine oil pressure switch	Monitor unit	Communication line between monitor unit and ICF (CAN line)
Alternator	Monitor unit	Communication line between monitor unit and ICF (CAN line)
Air cleaner restriction switch	Monitor unit	Communication line between monitor unit and ICF (CAN line)
Water separator level sensor	Monitor unit	Communication line between monitor unit and ICF (CAN line)
Air cleaner restriction switch	Monitor unit	Communication line between monitor unit and ICF (CAN line)
Hydraulic oil level switch	Monitor unit	Communication line between monitor unit and ICF (CAN line)
Emergency steering sensor	Monitor unit	Communication line between monitor unit and ICF (CAN line)
Main pump delivery pressure sensor	Monitor unit	Communication line between monitor unit and ICF (CAN line)
Transmission oil temperature sensor	Monitor unit	Communication line between monitor unit and ICF (CAN line)
Hydraulic oil temperature sensor	Monitor unit	Communication line between monitor unit and ICF (CAN line)
• Transmission filter restriction switch	Monitor unit	Communication line between monitor unit and ICF (CAN line)
• Torque converter input speed sensor • Torque converter output speed sensor • Transmission medium shaft sensor • Travel speed sensor • Forward/reverse lever • Forward/reverse switch • Brake pressure sensor	Monitor unit	Communication line between monitor unit and ICF (CAN line)

As for inspection method of the CAN line, refer to Troubleshooting A group in TROUBLESHOOTING section.

Alarm Data

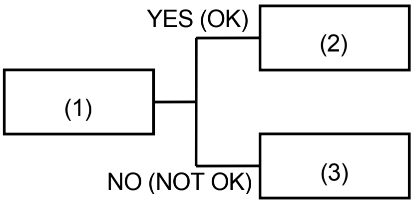
	Data	Input Signal
1	Overheat alarm	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit
2	Engine warning alarm	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit
3	Engine oil pressure alarm	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit
4	Alternator indicator alarm	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit
5	Air cleaner restriction alarm	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit
6	Water separator alarm	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit
7	Service brake oil level alarm	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit
8	Service brake oil pressure alarm	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit
9	Emergency steering operation alarm	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit
10	Steering oil pressure alarm	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit
11	Transmission oil temperature alarm	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit
12	Hydraulic oil temperature alarm	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit
13	Transmission filter restriction alarm	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit
14	Transmission malfunction alarm	Check terminals #C5, #C11 of connector ICF-C in ICF, terminals #33, #34 of connector monitor-2 in monitor unit

As for inspection method of the CAN line, refer to Troubleshooting A group in TROUBLESHOOTING section.

TROUBLESHOOTING C (TROUBLE-SHOOTING FOR MONITOR) PROCEDURE

Use troubleshooting C when any monitors, such as gauges or indicators malfunction.

- How to Read Troubleshooting Flow Charts

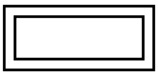
▪ 

After completing the checking and/or measuring procedures in box (1), select YES (OK) or NO (NOT OK) and proceed to box (2) or (3).

▪ 

· Key switch: ON

Instructions, reference, and/or instruction methods on inspection and/or measurements are occasionally described under the box. If incorrectly checked or measured, not only will troubleshooting be unsuccessful but also damage to components may result.

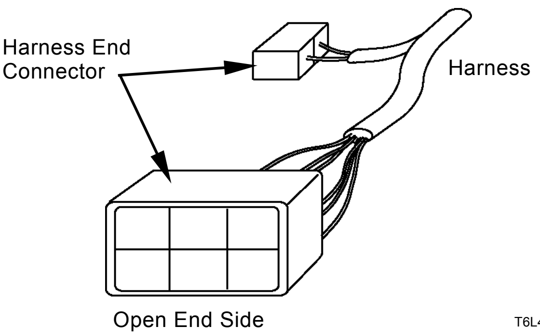
▪ 

Use the service mode in monitor and the diagnosing system / controller diagnosing system in Dr. ZX.

▪ 

Causes of machine problems are stated in the thick-line box. Scanning quickly through the thick-line boxes, allows you to estimate the possible causes before actually following the flow chart.

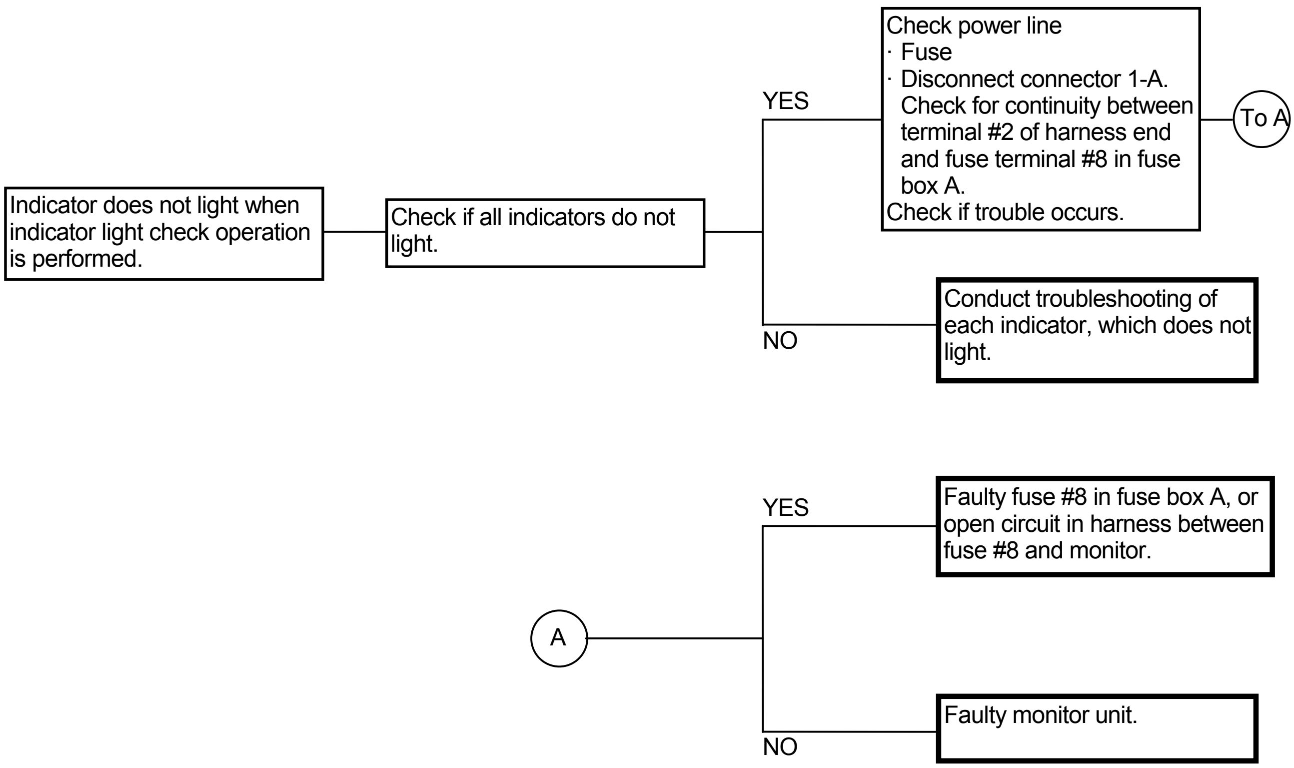
NOTE: All harness end connector are seen from the open-end side.



T6L4-05-03-001

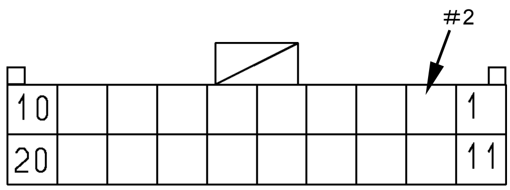
MALFUNCTION OF INDICATOR LIGHT CHECK SYSTEM

- Check the wiring connections first.



Connector (Harness end of connector viewed from the open end side)

Monitor Unit
Connector 1-A



T183-05-04-013

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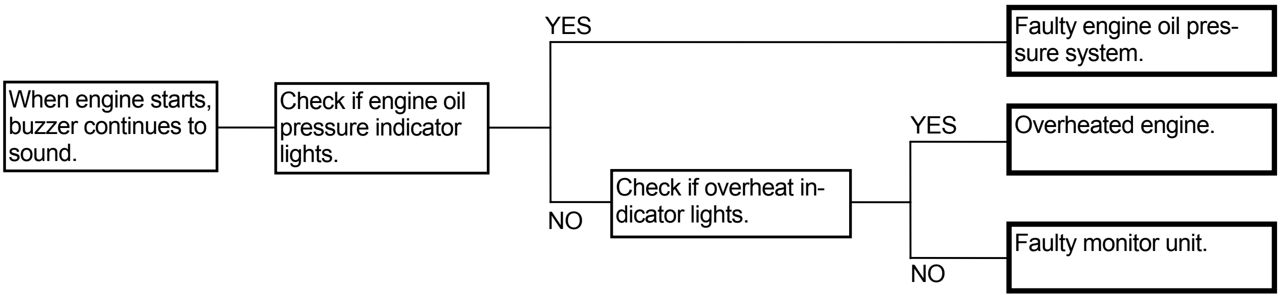
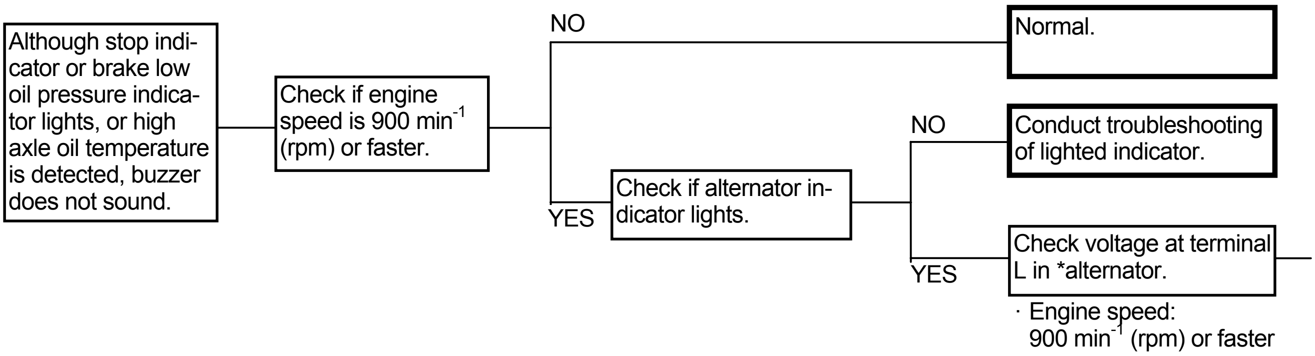
MALFUNCTION OF BUZZER IN MONITOR

- Check the wiring connections first.

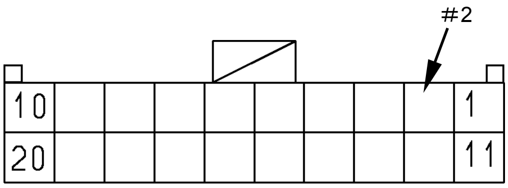
*NOTE: * Terminals L in the alternator are water-resistant type connectors so that it is not practical to measure voltage at these terminals. Measure voltage at terminal R in safety relay. Check for continuity between terminal R in safety relay and terminal L in the alternator first.*



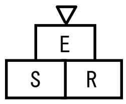


Connector (Harness end of connector viewed from the open end side)

Monitor Unit
Connector 2-A



Safety Relay
Connector A



T183-05-04-013

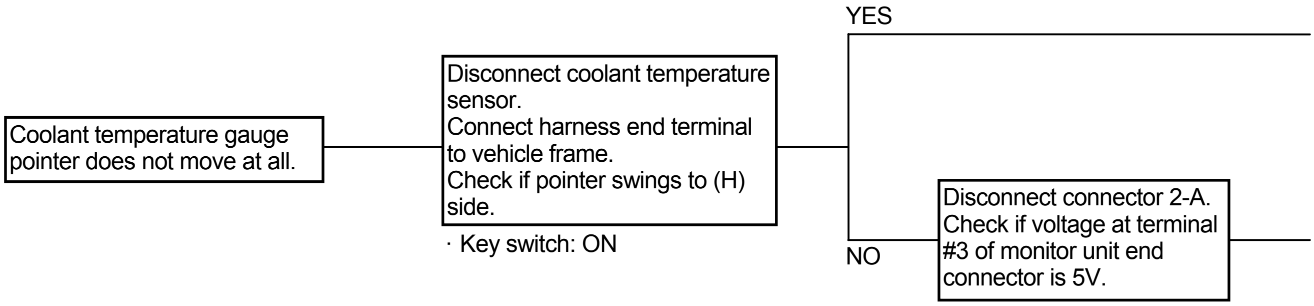
Less than 12 V or 35 V or higher → **Faulty regulator or faulty alternator.**

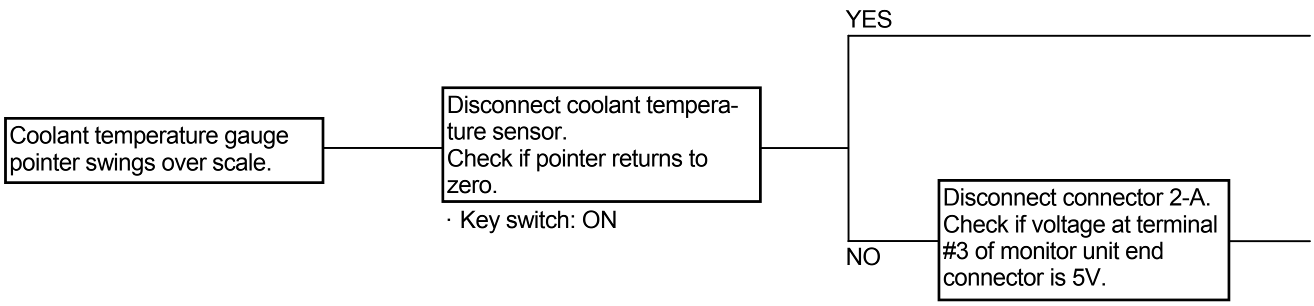
Between 12 V and 35 V → Check voltage at terminal #2 on connector 2-A in monitor unit.
· Engine speed 900 min^{-1} (rpm) or faster

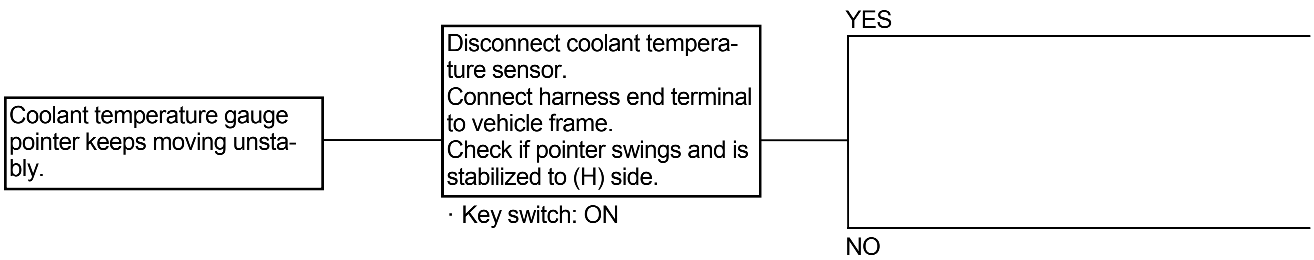
- Less than 12 V or 35 V or higher → **Open circuit in harness between terminal L in alternator and monitor unit.**
- Between 12 V and 35 V → **Faulty monitor unit.**

MALFUNCTION OF COOLANT TEMPERATURE GAUGE

- Check the wiring connections first.







Faulty coolant temperature sensor.

YES

Open circuit in harness between monitor unit and sensor.

Faulty monitor unit.

NO

Faulty coolant temperature sensor.

YES

Shorted circuit in harness between monitor unit and sensor.

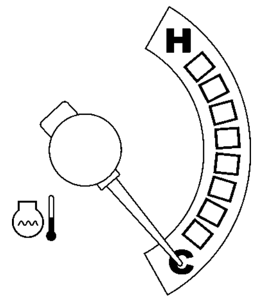
Faulty monitor unit.

NO

Faulty coolant temperature sensor.

Faulty monitor unit.

Coolant Temperature Gauge

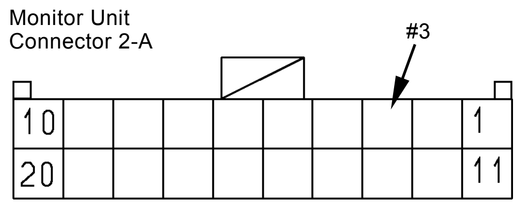


T4GB-05-07-005

Coolant Temperature Sensor

Coolant Temperature °C (°F)	Resistance (kΩ)
25 (77)	7.6±0.76
40 (104)	4.0±0.35
50 (122)	2.7±0.22
80 (176)	0.92±0.07
95 (203)	0.56±0.04
105 (221)	0.42±0.03
120 (248)	0.28±0.01

Connector (Harness end of connector viewed from the open end side)



T183-05-04-013

MALFUNCTION OF TRANSMISSION OIL TEMPERATURE GAUGE

- Check the wiring connections first.

Transmission oil temperature gauge pointer does not move at all.

Disconnect oil temperature sensor.
Connect harness end terminal to vehicle frame.
Check if pointer swings to (H) side.

· Key switch: ON

YES

NO

Disconnect connector 2-A in monitor unit.
Check if voltage at terminal #5 of monitor unit end connector is 5V.

Transmission oil temperature gauge pointer swings over scale.

Disconnect oil temperature sensor.
Check if pointer returns to zero.

· Key switch: ON

YES

NO

Disconnect connector 2-A in monitor unit.
Check if voltage at terminal #5 of monitor unit end connector is 5 V.

Transmission oil temperature gauge pointer keeps moving unstably.

Disconnect oil temperature sensor.
Connect harness end terminal to vehicle frame.
Check if pointer swings and is stabilized to (H) side.

· Key switch: ON

YES

NO

Faulty transmission oil temperature sensor.

YES — Open circuit in harness between monitor unit and sensor.

NO — Faulty monitor unit.

Faulty transmission oil temperature sensor.

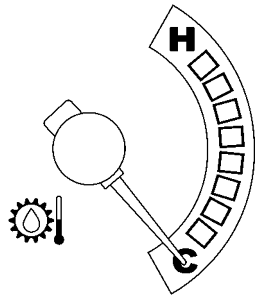
YES — Shorted circuit in harness between monitor unit and sensor.

NO — Faulty monitor unit.

Faulty transmission oil temperature sensor.

Faulty monitor unit.

Transmission Oil Temperature Gauge



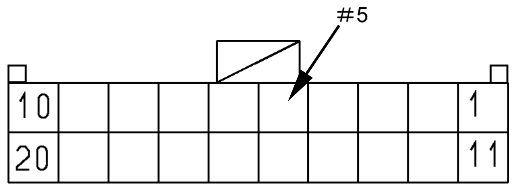
T4GB-05-07-006

Transmission Oil Temperature Sensor

Oil Temperature °C (°F)	Resistance (kΩ)
25 (77)	7.6±0.76
40 (104)	4.0±0.35
50 (122)	2.7±0.22
80 (176)	0.92±0.07
95 (203)	0.56±0.04
105 (221)	0.42±0.03
120 (248)	0.28±0.01

Connector (Harness end of connector viewed from the open end side)

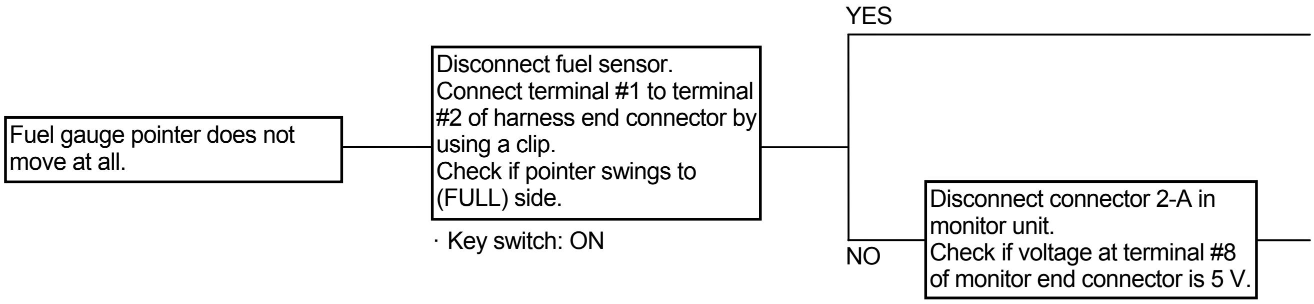
Monitor Unit
Connector 2-A

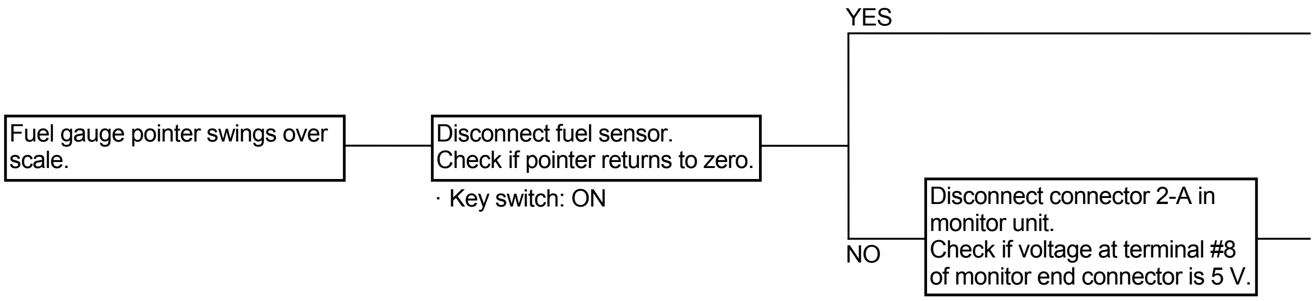


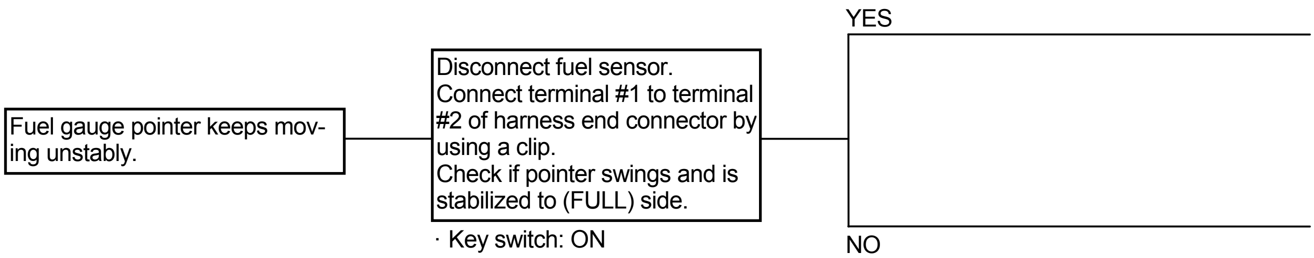
T183-05-04-013

MALFUNCTION OF FUEL GAUGE

- Check the wiring connections first.







Faulty fuel sensor.

YES — Open circuit in harness between monitor unit and sensor.

NO — Faulty monitor unit.

Faulty fuel sensor.

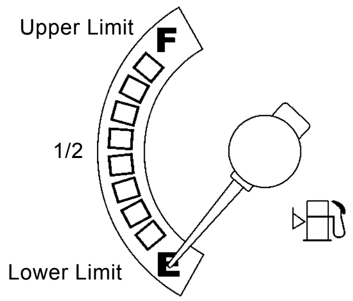
YES — Shorted circuit in harness between monitor unit and sensor.

NO — Faulty monitor unit.

Faulty fuel sensor.

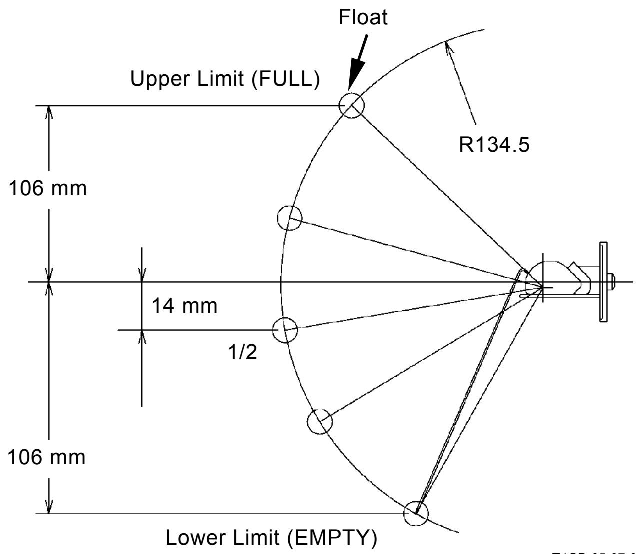
Faulty monitor unit.

Fuel Gauge



T4GB-05-07-007

Fuel Sensor



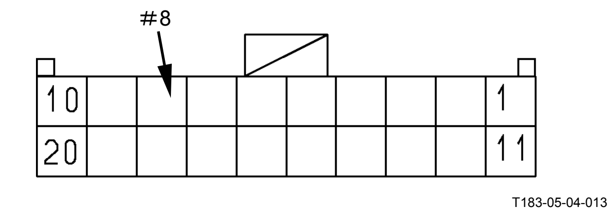
T4GB-05-07-008

NOTE: 1 mm = 0.03937 in

Float Position	Resistance (Ω)
Upper Limit (FULL)	10^{+0}_{-4}
1/2	38 ± 5
Warning Level	77 ± 3
Lower Limit (EMPTY)	90^{+10}_{-0}

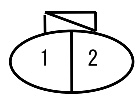
Connector (Harness end of connector viewed from the open end side)

Monitor Unit Connector 2-A



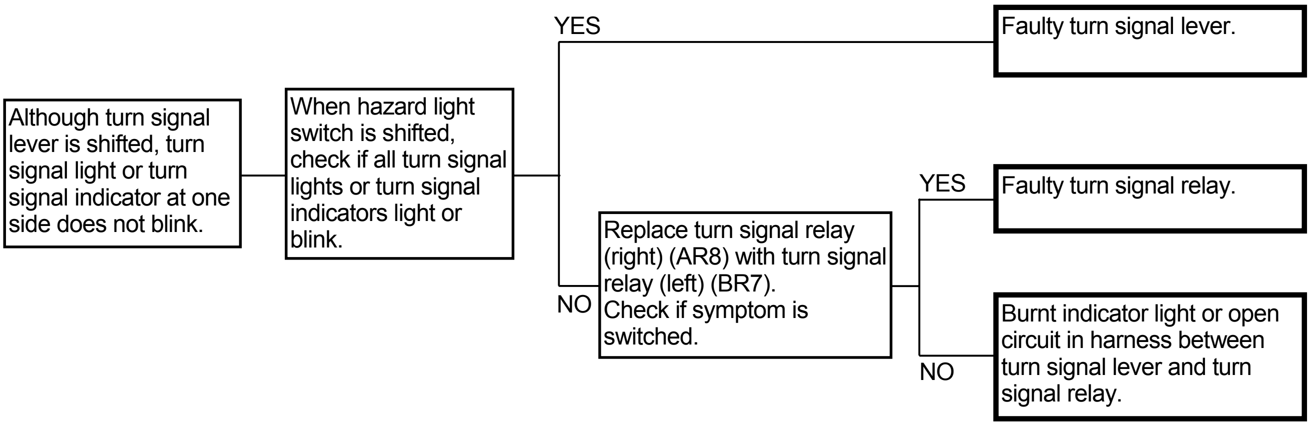
T183-05-04-013

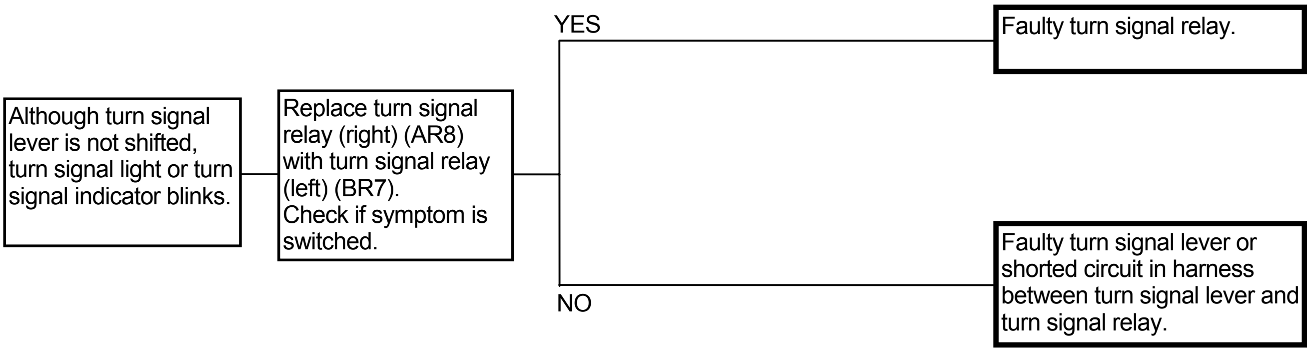
Fuel Sensor



MALFUNCTION OF TURN SIGNAL INDICATORS (LEFT AND RIGHT)

- Check the wiring connections first.
- If the turn signal indicators (left and right) do not blink, the flasher relay may be faulty.



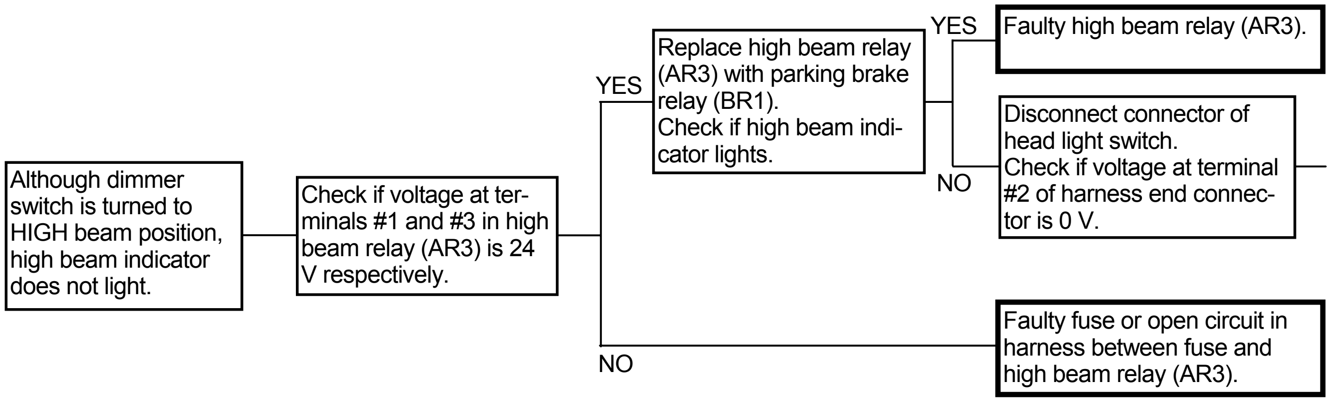


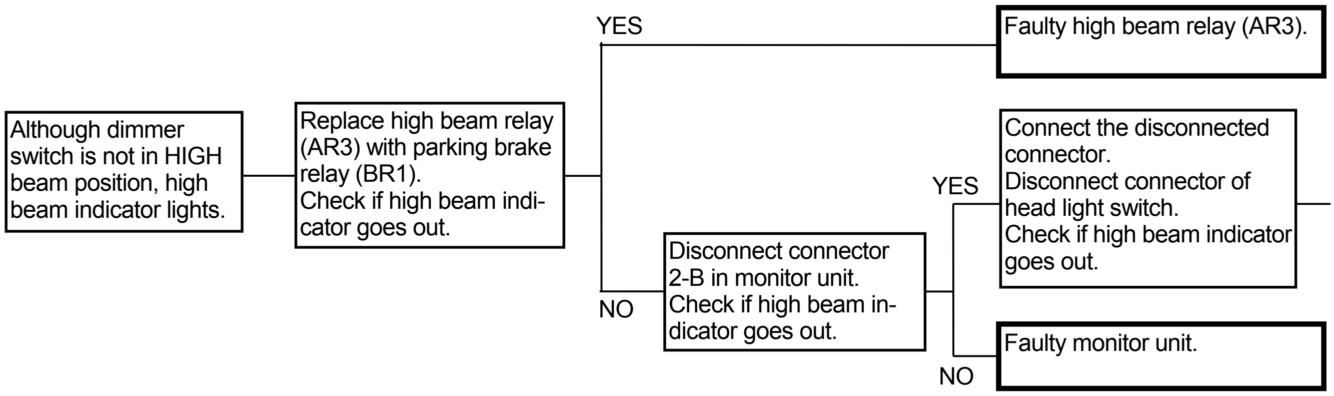
MALFUNCTION OF HAZARD LIGHT INDICATOR

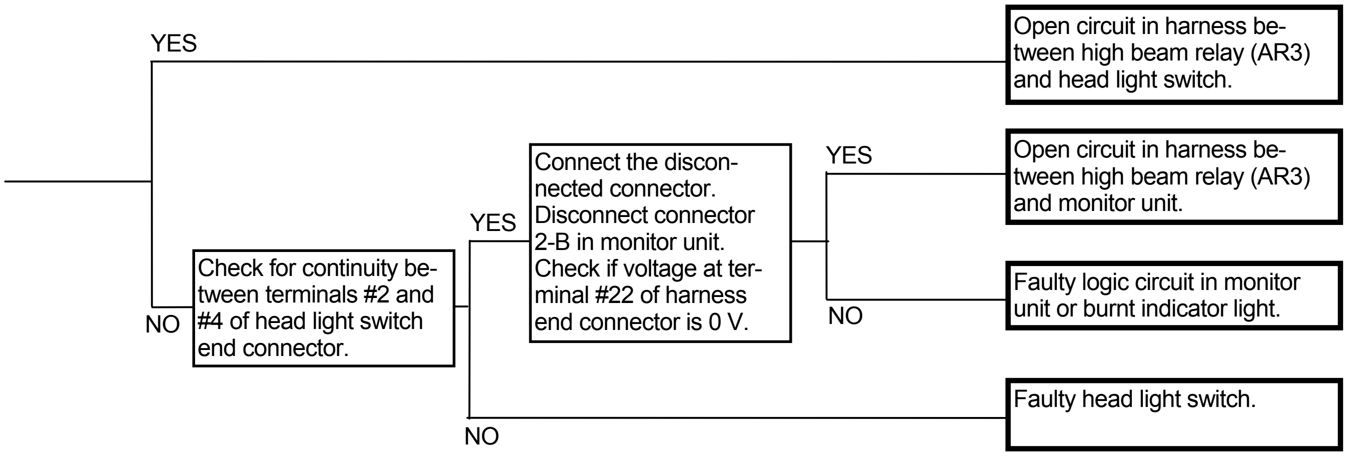
- The hazard light indicator lights when the signal of turn signal relay in left and right enters into the hazard light switch. Therefore, although both turn signal indicator light or blink and if the hazard light indicator does not light, the harness between turn signal relay and monitor unit may be faulty or the monitor unit may be faulty. If the turn signal indicator at one side does not light or blink, refer to troubleshooting that harness between turn signal relay and hazard light switch may be faulty or the turn signals (left and right) may be faulty in order to conduct the remedy.
- Check the wiring connections first.

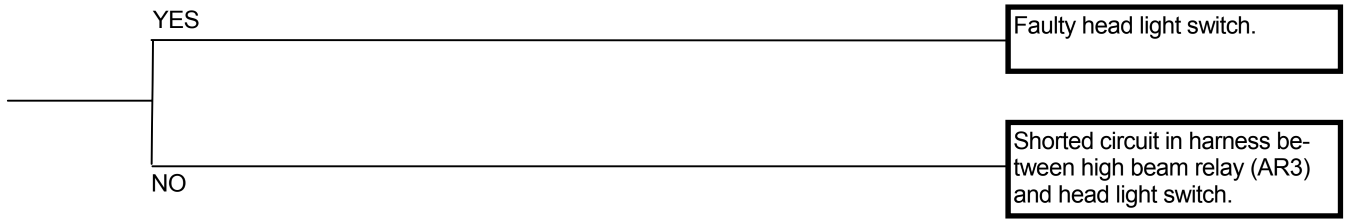
MALFUNCTION OF HIGH BEAM INDICATOR

- Check the wiring connections first.

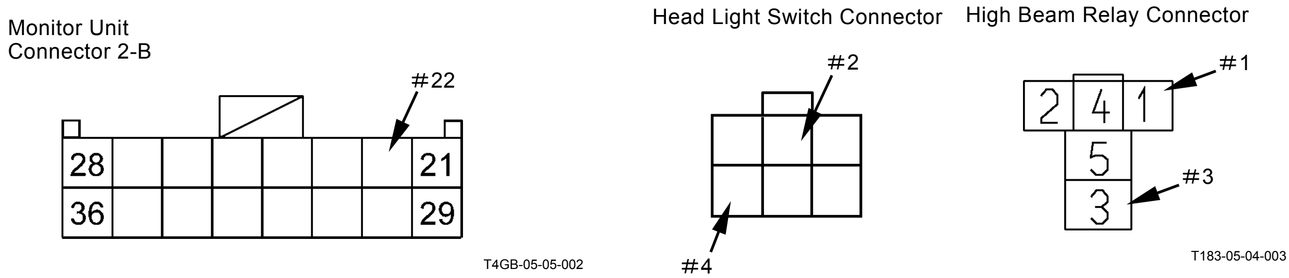






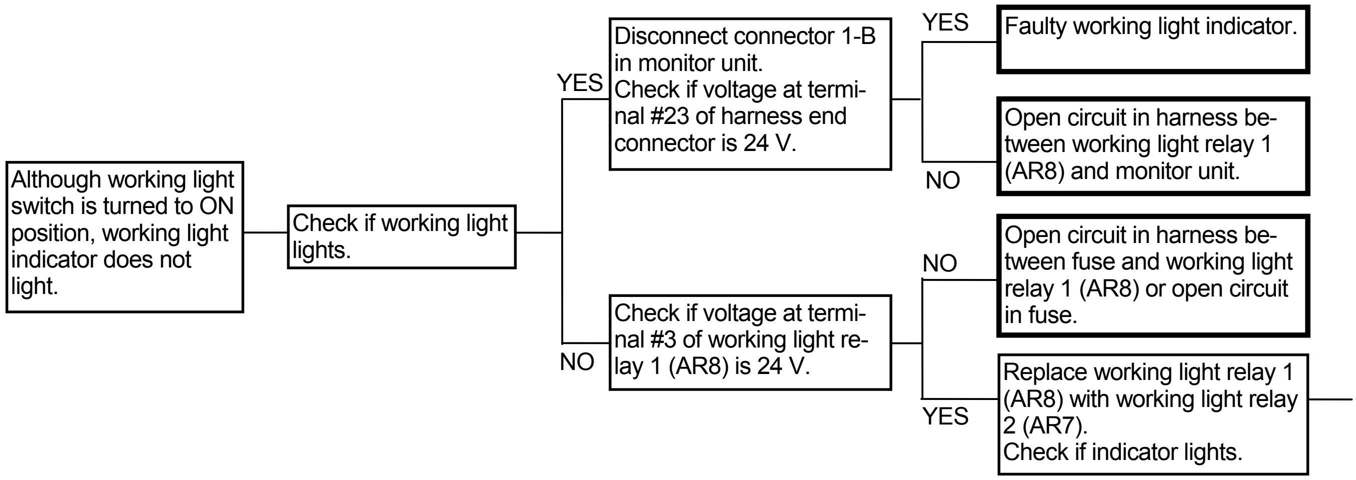


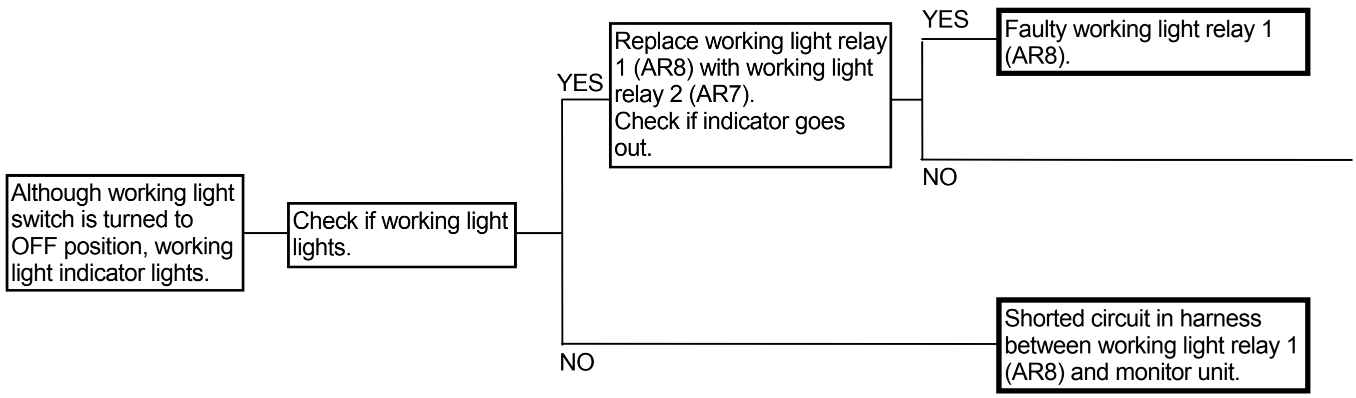
Connector (Harness end of connector viewed from the open end side)

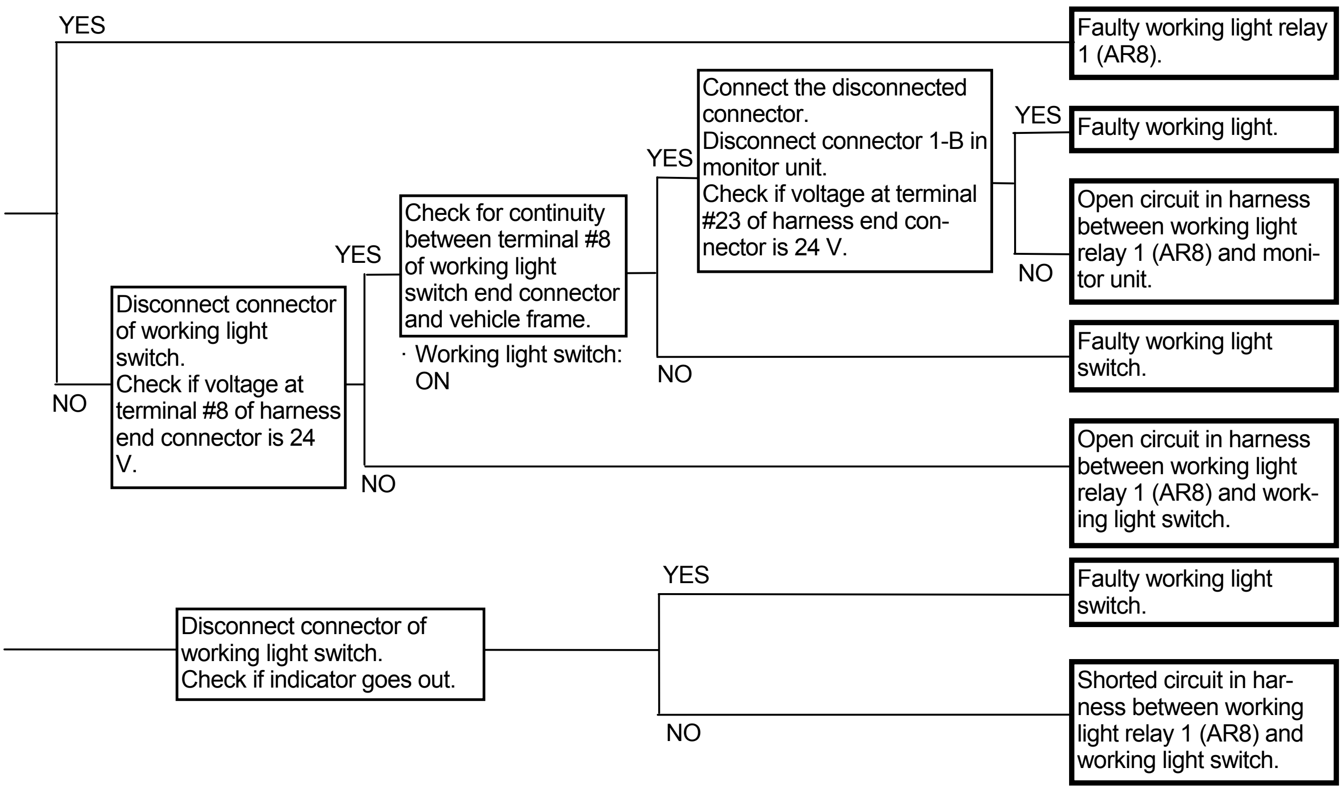


MALFUNCTION OF WORKING LIGHT INDICATOR

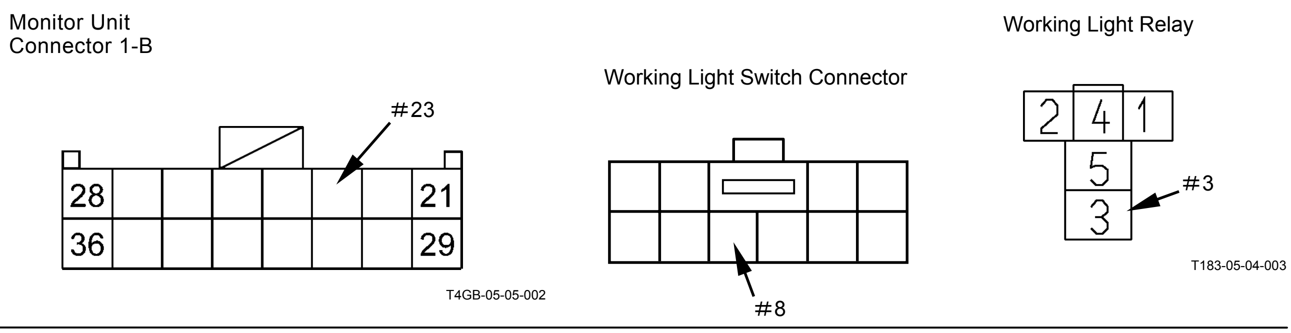
- Check if the working light switch and head light switch are in the ON position.
- If the clearance light indicator also does not light, the common circuit for clearance light indicator and working light indicator may be faulty. Refer to the Malfunction of Clearance Light Indicator section.
- Check the wiring connections first.





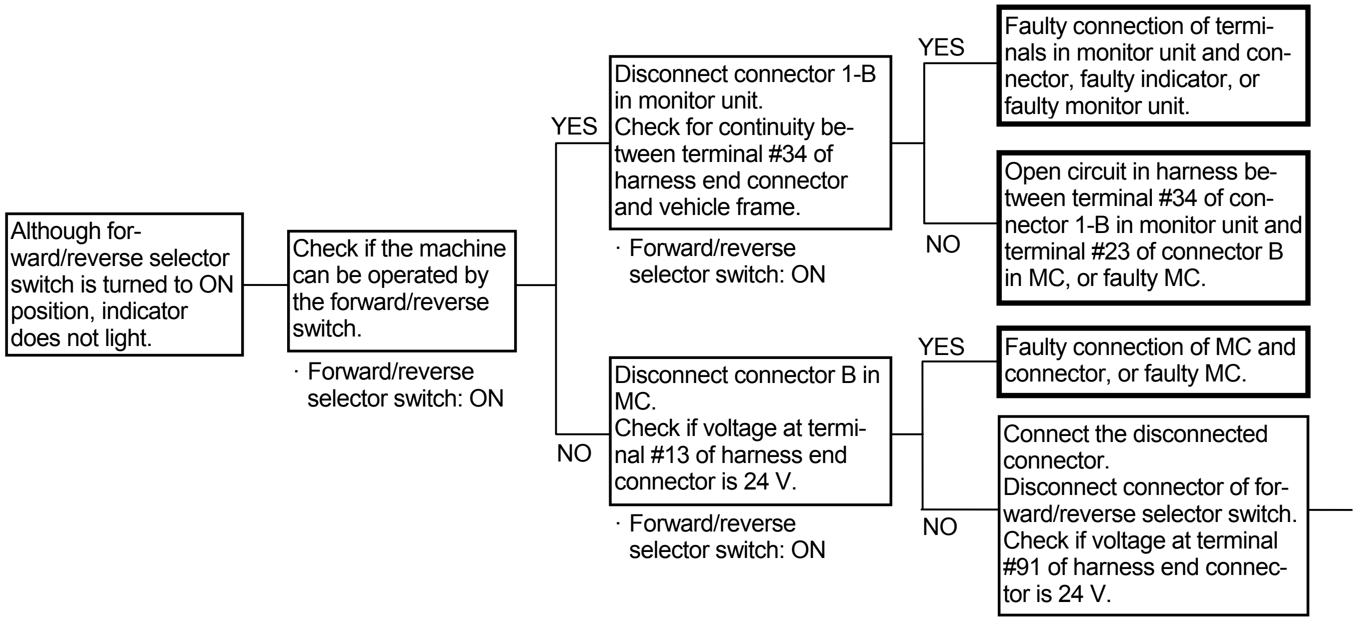


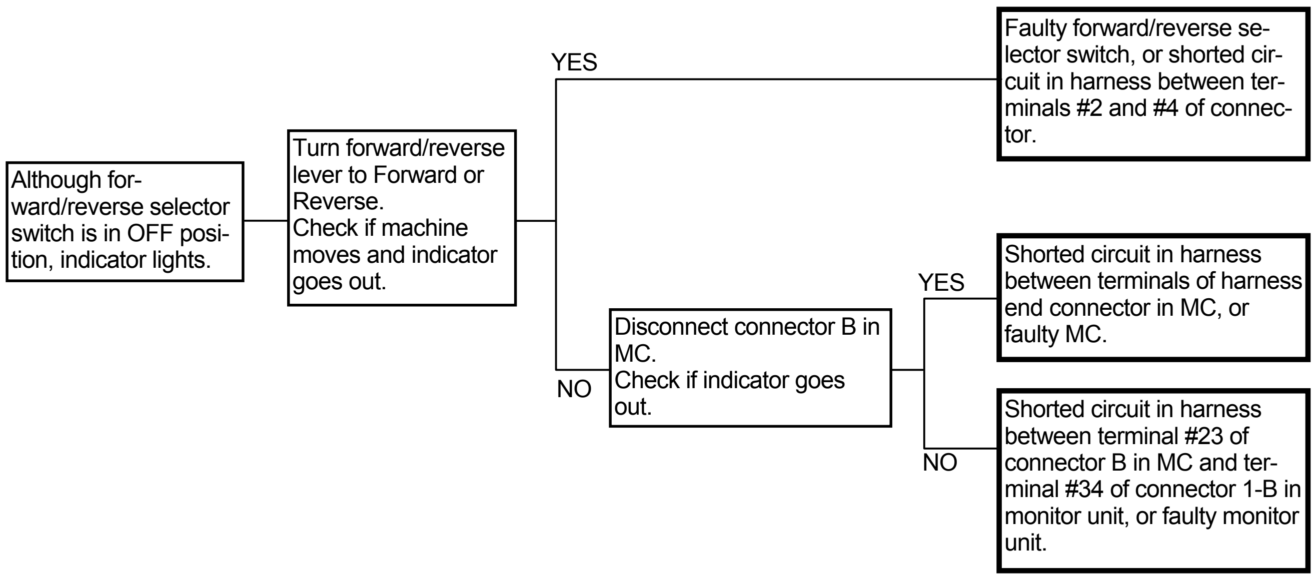
Connector (Harness end of connector viewed from the open end side)

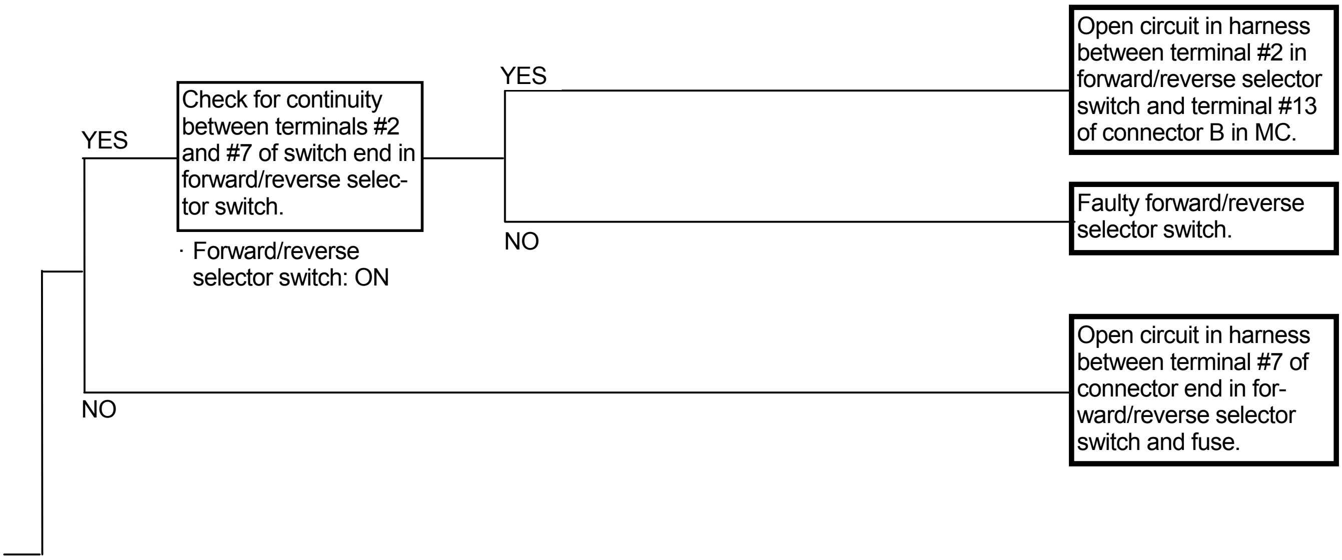


MALFUNCTION OF FORWARD/REVERSE SWITCH INDICATOR

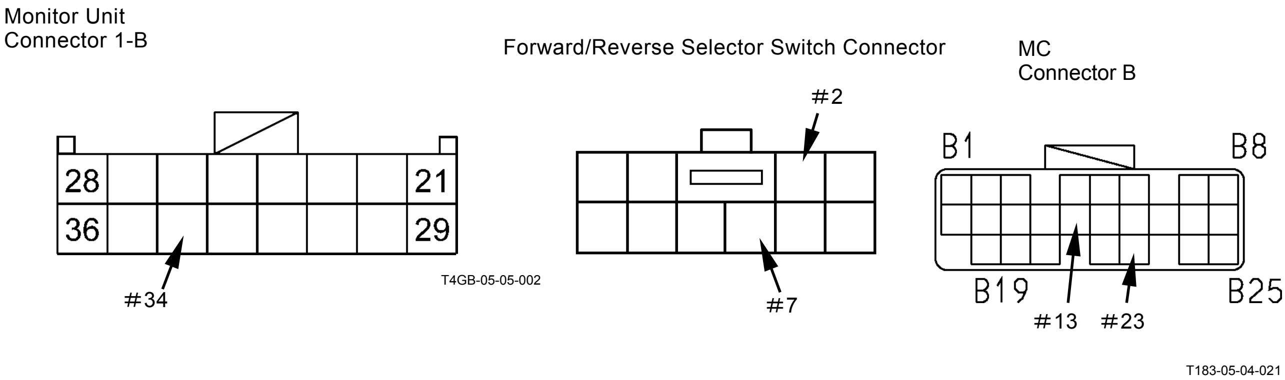
CAUTION: Turn the forward/reverse lever and the forward/reverse switch to neutral and turn the forward/reverse selector switch to the ON position. If not, the indicator does not light and the machine cannot be operated by the forward/reverse switch.







Connector (Harness end of connector viewed from the open end side)

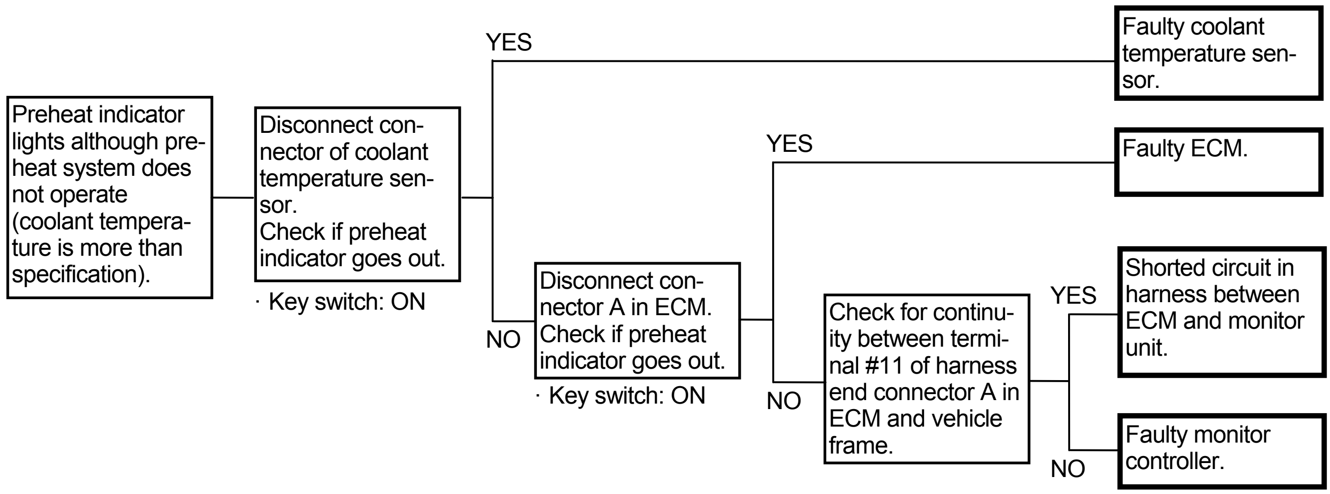


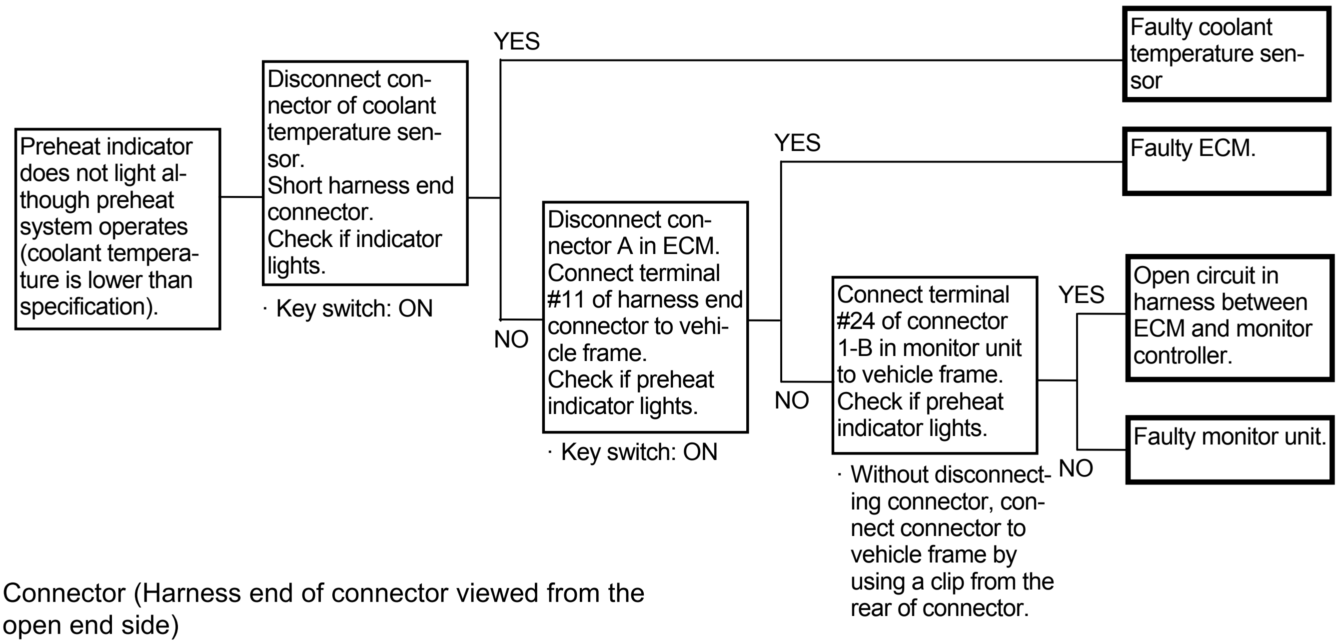
MALFUNCTION OF MAINTENANCE INDICATOR

- The maintenance indicator lights when the hour meter reaches the set replacement interval for lubrication system and filter. (Refer to the operation manual.) The maintenance indicator lighting is controlled in the logic circuit of monitor unit. If the maintenance indicator lights during the time when the maintenance indicator must go out, the monitor unit may be faulty. If the maintenance indicator does not light during the time when the maintenance indicator must light, the light or the monitor unit may be faulty.

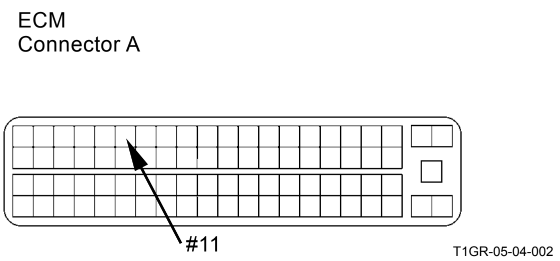
MALFUNCTION OF PREHEAT INDICATOR

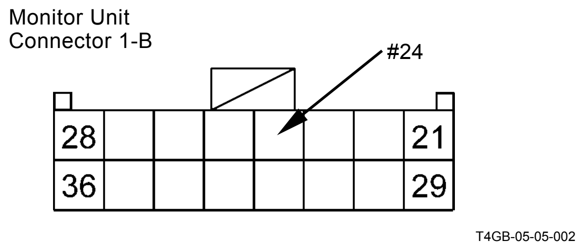
- The preheat system operates only when coolant temperature is below the specification. (Refer to the SYSTEM / Electrical Circuit group.)
- In case the preheat system malfunctions, refer to Troubleshooting B.
- Check the wiring connections first.





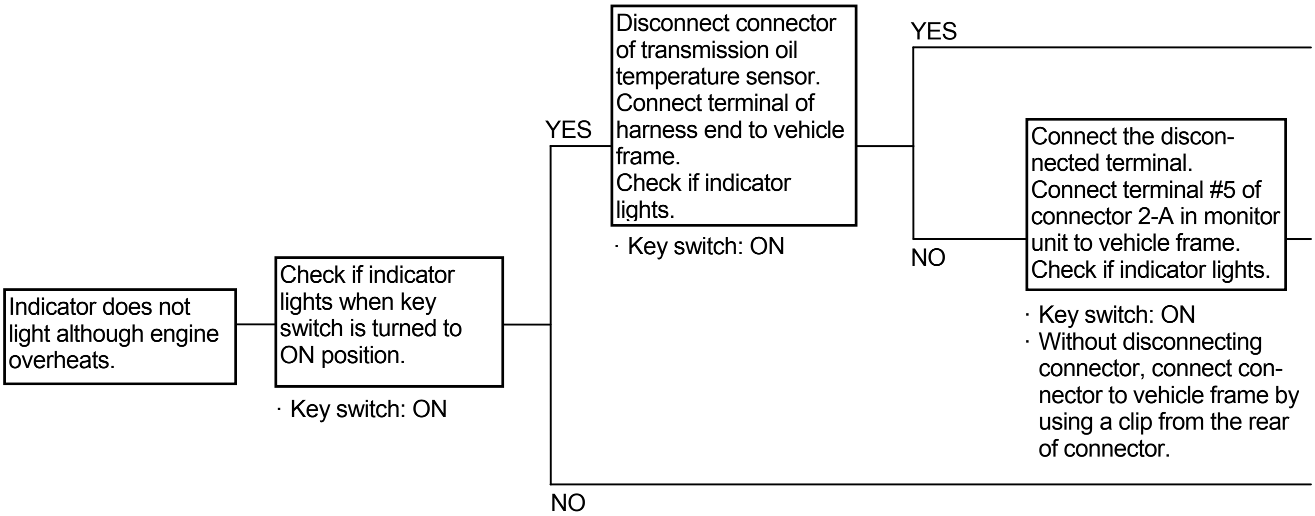
Connector (Harness end of connector viewed from the open end side)

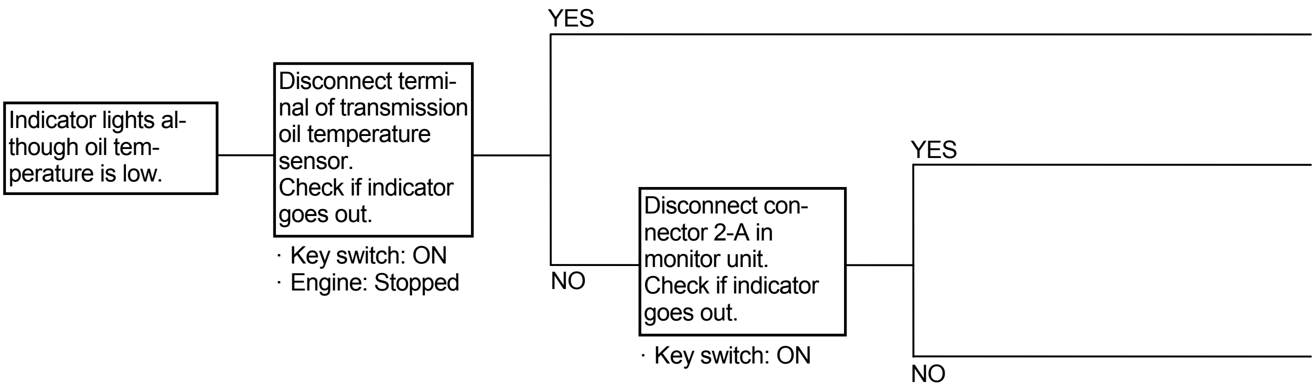




MALFUNCTION OF TRANSMISSION OIL TEMPERATURE

- Check the wiring connections first.





Faulty transmission oil temperature sensor.

YES

Open circuit in harness between monitor unit and transmission oil temperature sensor.

NO

Faulty monitor unit.

Faulty monitor unit, or burnt indicator light.

Faulty transmission oil temperature sensor.

Shorted circuit in harness between monitor unit and transmission oil temperature sensor.

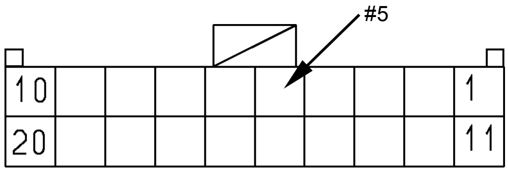
Faulty monitor unit.

Transmission Oil Temperature Indicator

Oil Temperature	Operation
Less than 110 °C (230 °F)	OFF
120 °C (248 °F) or higher	ON

Connector (Harness end of connector viewed from the open end side)

Monitor Unit
Connector 2-A



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MALFUNCTION OF HYDRAULIC OIL TEMPERATURE INDICATOR

- The hydraulic oil temperature indicator is not turned on by the signal directly input from the sensors. The signal data which inputs to other controllers from the sensors once is input to the monitor unit by using the CAN communication and is proceeded in the logic circuit of monitor unit.
- When this trouble occurs, refer to Troubleshooting A and remedy the trouble on fault code.
- Although the fault code is not displayed and if the trouble occurs after re-trial, the connection between monitor unit and terminal #33 or #34 of connector 2-B in monitor unit may be faulty, or the monitor unit may be faulty.

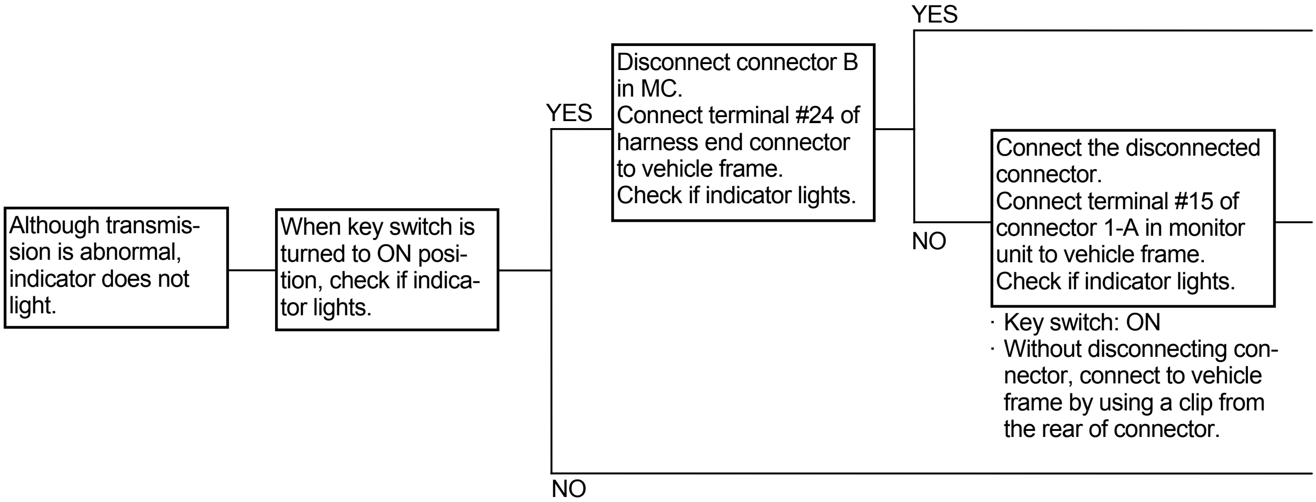
Hydraulic Oil Temperature Indicator

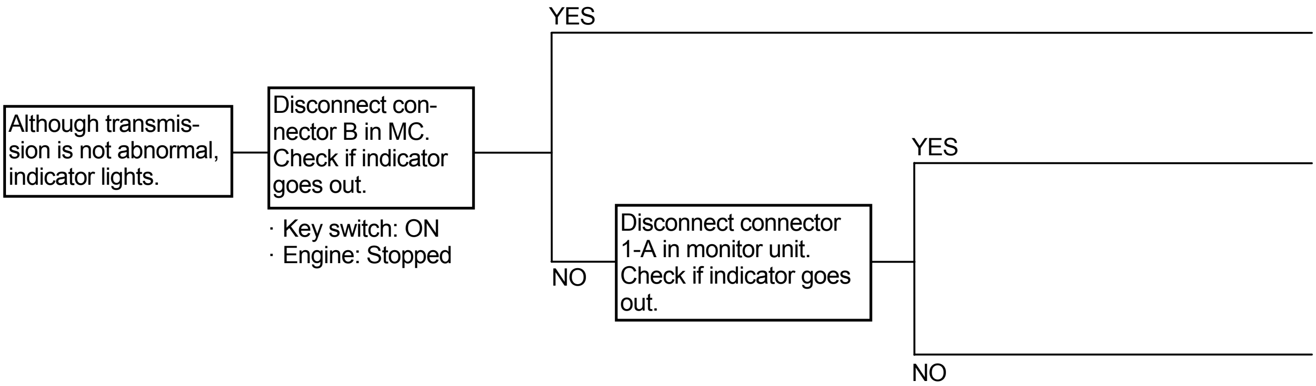
Oil Temperature	Operation
Less than 95 °C (203 °F)	OFF
105 °C (221 °F) or higher	ON

(Blank)

MALFUNCTION OF TRANSMISSION WARNING INDICATOR

- Although the fault code is not displayed in MC and if the trouble occurs, conduct this remedy.
- Check the wiring connections first.





Faulty MC.

YES — Open circuit in harness between monitor unit and MC.

NO — Faulty monitor unit.

Faulty monitor unit, or burnt indicator light.

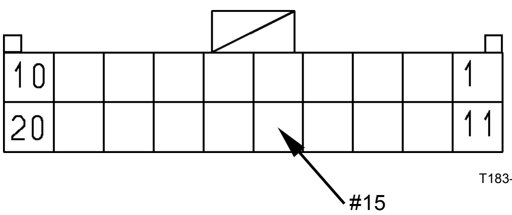
Faulty MC.

Shorted circuit in harness between monitor unit and MC.

Faulty monitor unit.

Connector (Harness end of connector viewed from the open end side)

Monitor Unit
Connector 1-A



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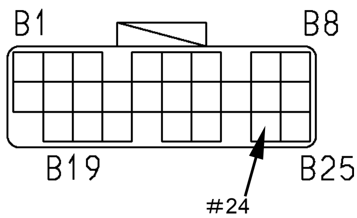
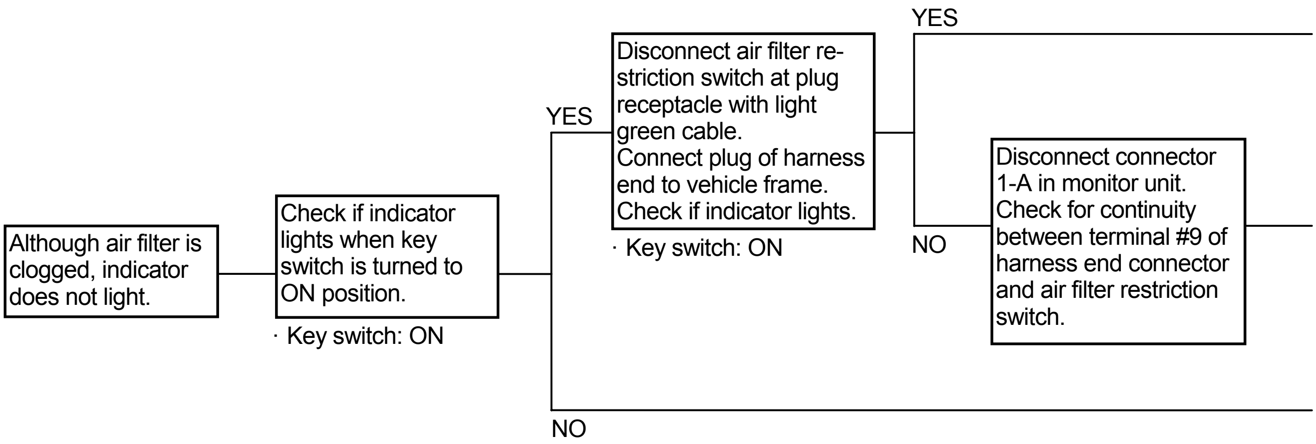
MC
Connector B

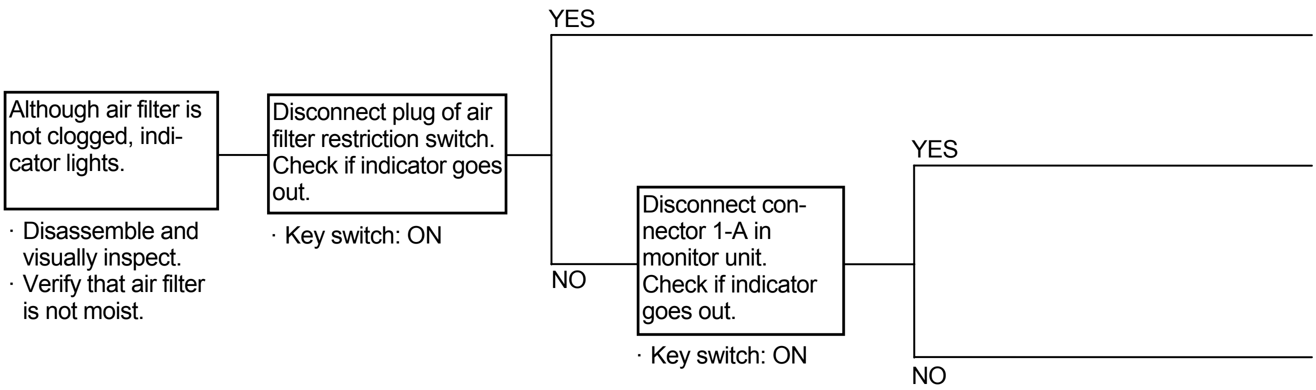


T183-05-04-021

MALFUNCTION OF AIR FILTER RESTRICTION INDICATOR

- Check the wiring connections first.





Air Filter Restriction Switch Operational Resistance: 6.2±0.6 kPa (635±58 mmH_2O)

Faulty air filter restriction switch.

YES

Faulty monitor unit.

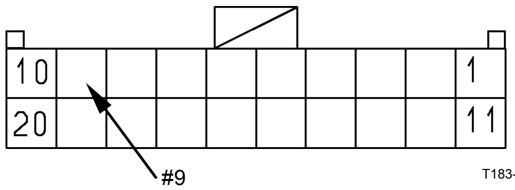
NO

Open circuit in harness between monitor unit and air filter restriction switch.

Faulty monitor unit, or burnt indicator light.

Connector (Harness end of connector viewed from the open end side)

Monitor Unit
Connector 1-A



T183-05-04-013

Faulty air filter restriction switch.

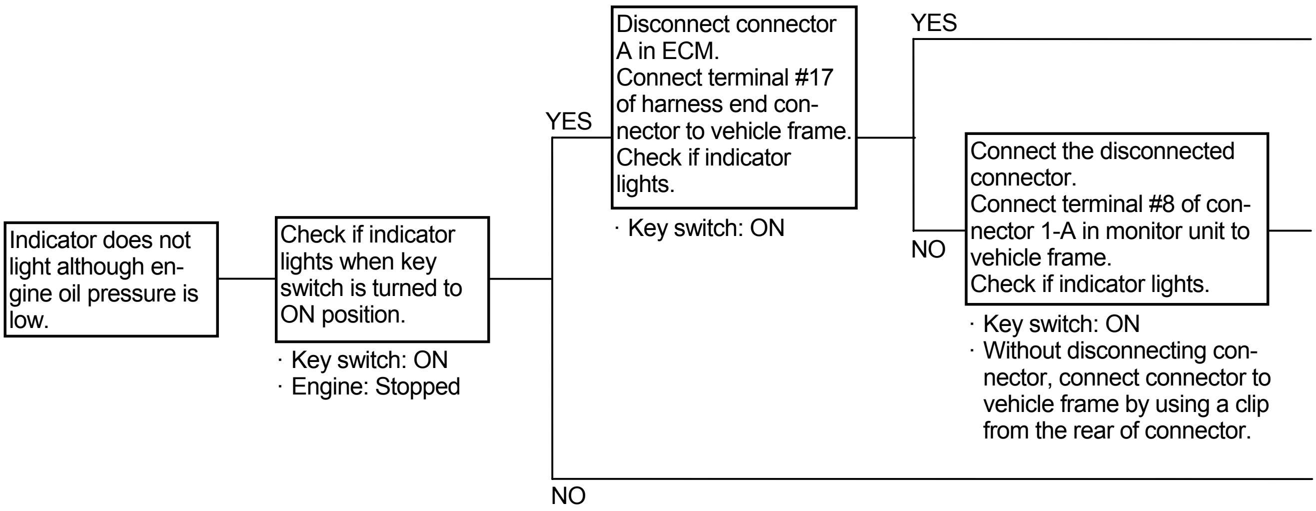
Shorted circuit in harness between monitor unit and air filter restriction switch.

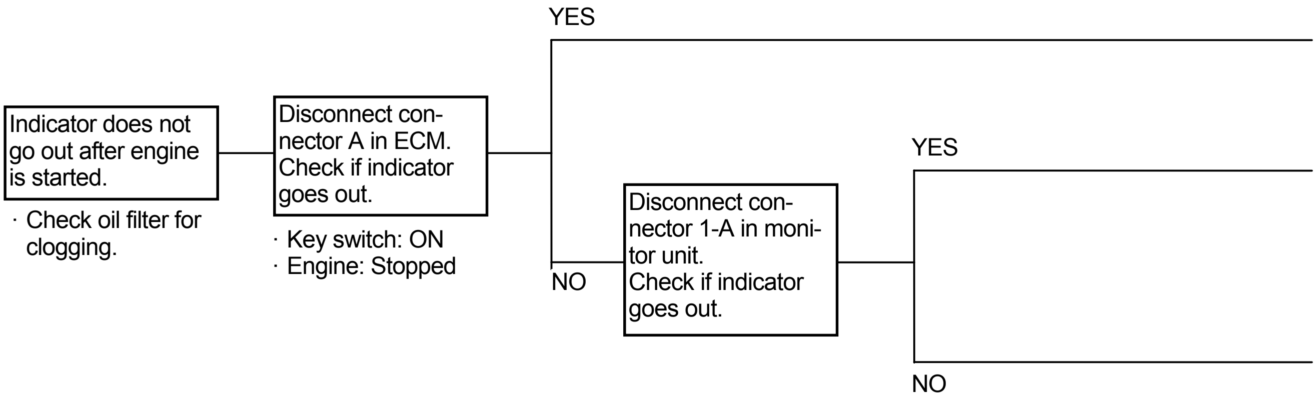
Faulty monitor unit.

MALFUNCTION OF ENGINE OIL PRESSURE INDICATOR

- Although the fault code is not displayed in ECM and if the trouble occurs, conduct this remedy.

NOTE: *After the engine stops in 1 to 2 minutes, pressure may remain inside. When the engine re-starts under this condition, the indicator may not light.*





Faulty ECM.

YES — Open circuit in harness between monitor unit and ECM.

NO — Faulty monitor unit.

Faulty monitor unit, or burnt indicator light.

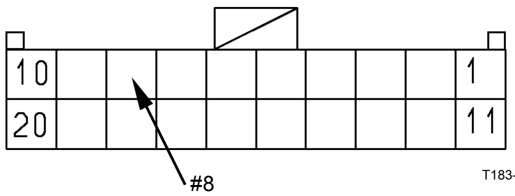
Faulty oil system of ECM and engine, or clogged oil filter.

Shorted circuit in harness between monitor unit and ECM.

Faulty monitor unit.

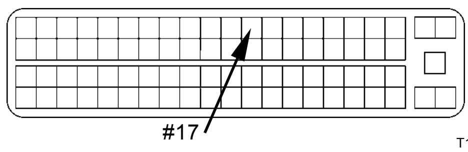
Connector (Harness end of connector viewed from the open end side)

Monitor Unit
Connector 1-A



T183-05-04-013

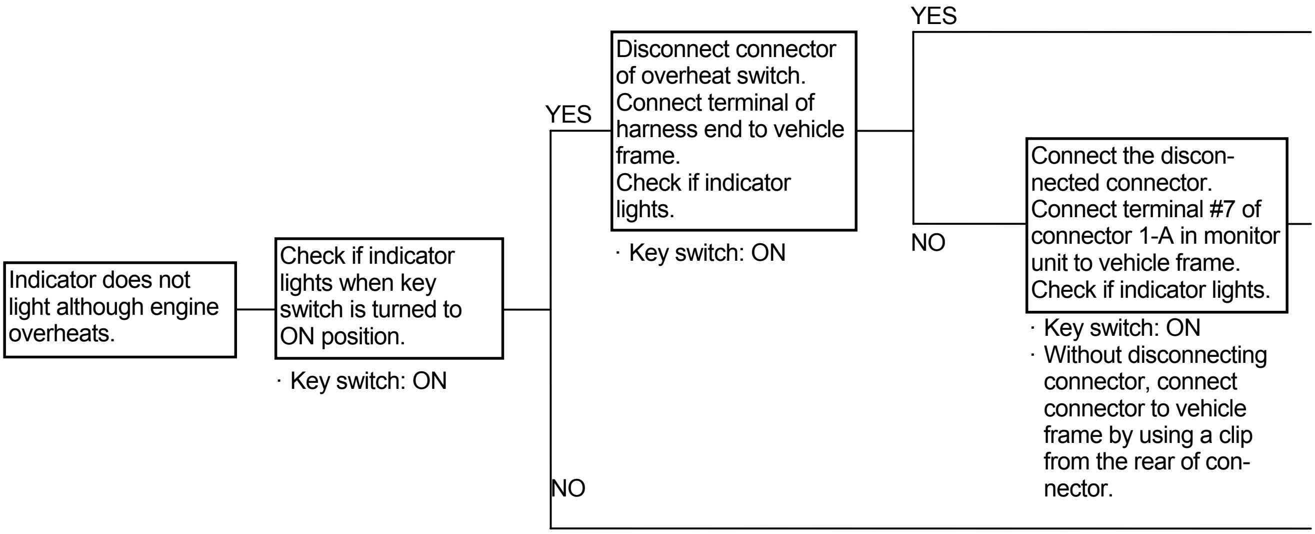
ECM
Connector A

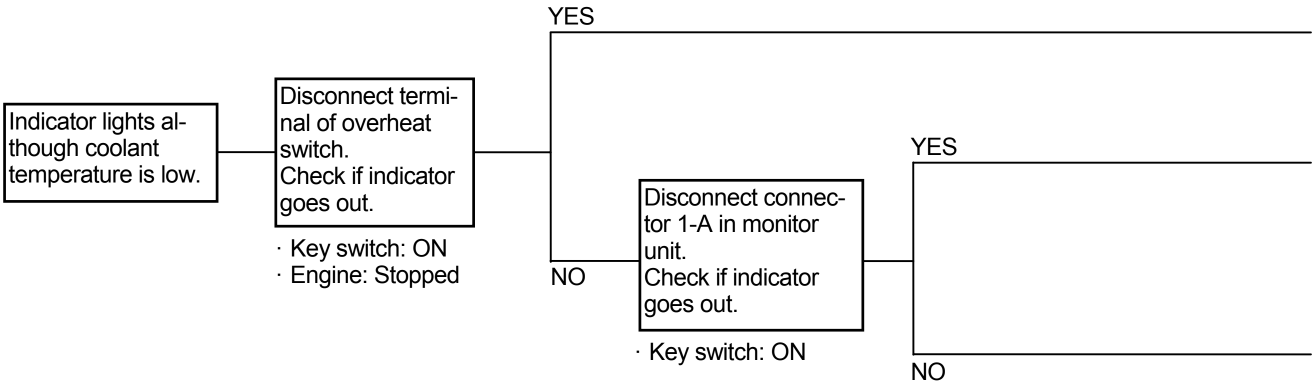


T1GR-05-04-002

MALFUNCTION OF OVERHEAT INDICATOR

- Check the wiring connections first.





Faulty overheat switch.

YES

Open circuit in harness between monitor unit and overheat switch.

Faulty monitor unit.

NO

Faulty monitor unit or burnt indicator light.

Faulty overheat switch.

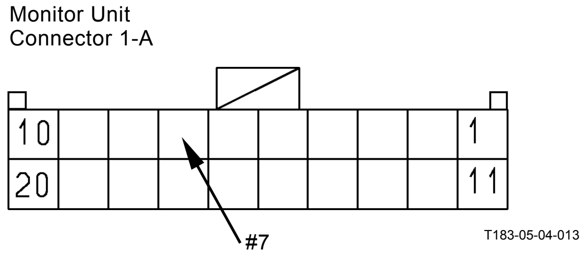
Shorted circuit in harness between monitor unit and overheat switch.

Faulty monitor unit.

Overheat Switch

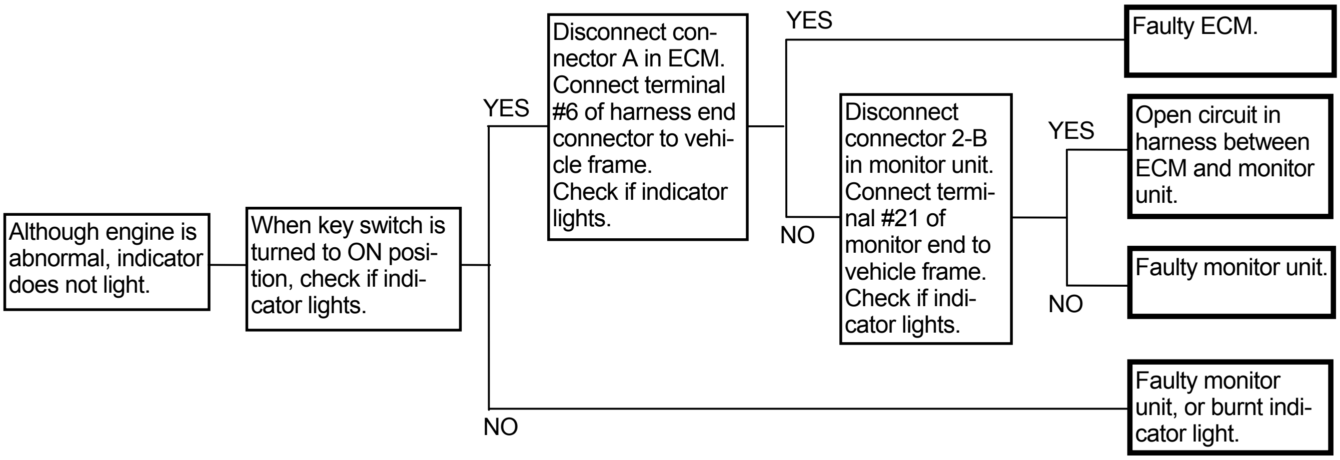
Coolant Temperature	Operation
Lower than 107±3 °C (225±6°F)	OFF
107±3 °C (225±6 °F) or higher	ON

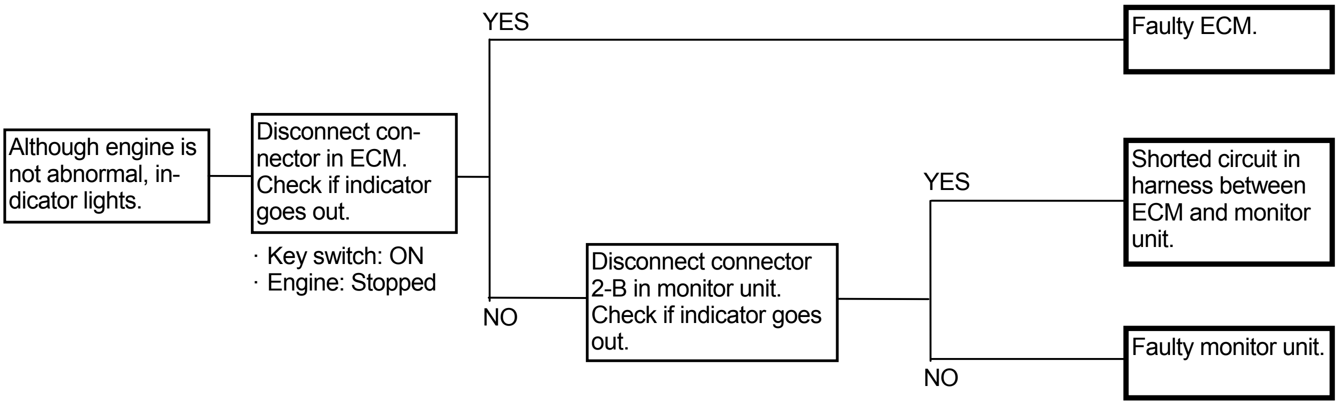
Connector (Harness end of connector viewed from the open end side)



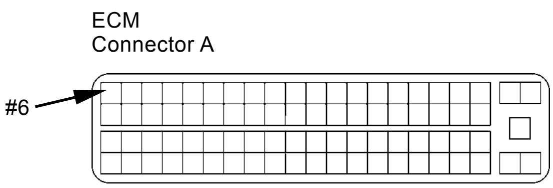
MALFUNCTION OF ENGINE WARNING INDICATOR

Although the fault code is not displayed in ECM and if the trouble occurs, conduct this remedy.

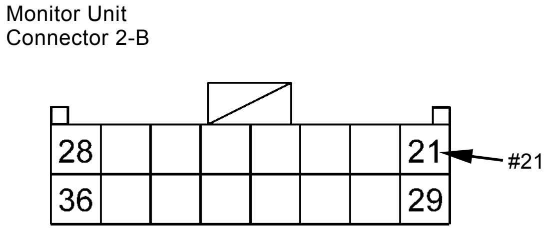




Connector (Harness end of connector viewed from the open end side)



T1GR-05-04-002



T4GB-05-05-002

MALFUNCTION OF STOP INDICATOR

- When the following troubles occur, the stop indicator lights in order to announce the trouble to the operator, stop the machine and repair the machine.
- Although the machine is repaired and if the stop indicator does not go out, other indicator on monitor must light. Refer to the pages corresponding to the indicator in this group or conduct the remedy according to Troubleshooting A.
- Although there is no trouble and if the stop indicator does not go out, the logic circuit in monitor unit may be faulty.

(When the abnormal value is detected, the stop indicator lights;)

- Low engine oil pressure
- Overheat of the engine (high temperature of engine coolant)
- Low level of service brake oil (low level of hydraulic oil tank)
- Low service oil pressure
- High temperature of transmission oil
- Low steering oil pressure
- High temperature of hydraulic oil

MALFUNCTION OF SERVICE INDICATOR

- When the following troubles occur, the service indicator lights in order to announce the trouble to the operator, stop the machine and maintain the machine.
- Although the machine is maintained and if the service indicator does not go out, other indicator on monitor must light. Refer to the pages corresponding to the indicator in this group or conduct the remedy according to Troubleshooting A.
- Although there is no trouble and if the service indicator does not go out, the logic circuit in monitor unit may be faulty.

(When the abnormal value is detected, the service indicator lights;)

- Faulty generation of the alternator
- Clogged air cleaner
- Emergency steering operation
- Lighting the engine warning indicator
- Lighting the transmission warning indicator
- Lighting the maintenance indicator
- High temperature of axle oil

(Blank)

MALFUNCTION OF PARKING BRAKE INDICATOR

- Although the fault code is not displayed in MC and if the trouble occurs, conduct this remedy.

Although brake switch is not turned to Parking position, indicator lights.

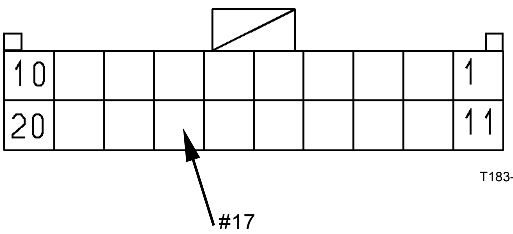
- Disconnect connector B in MC. Check if indicator goes out.
  - YES
  - NO: Disconnect connector 1-A in monitor unit. Check if indicator goes out.
    - YES
    - NO

Although brake switch is in Parking position, indicator does not light.

- When key switch is turned to ON position, check if indicator lights.
  · Key switch: ON
  · Engine: Stopped
  - YES: Disconnect connector B in MC. Connect harness end connector to vehicle frame. Check if indicator lights.
    · Key switch: ON
    - YES
    - NO
  - NO

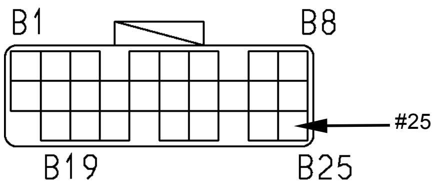
Connector (Harness end of connector viewed from the open end side)

Monitor Unit
Connector 1-A



T183-05-04-013

MC
Connector B



T183-05-04-021

Faulty MC.

Shorted circuit in harness between monitor unit and MC.

Faulty monitor unit.

Faulty MC.

Connect the disconnected connector. Connect terminal #17 of connector 1-A in monitor unit to vehicle frame. Check if indicator lights.

· Key switch: ON
· Without disconnecting connector, connect to vehicle frame by using a clip from the rear of connector.

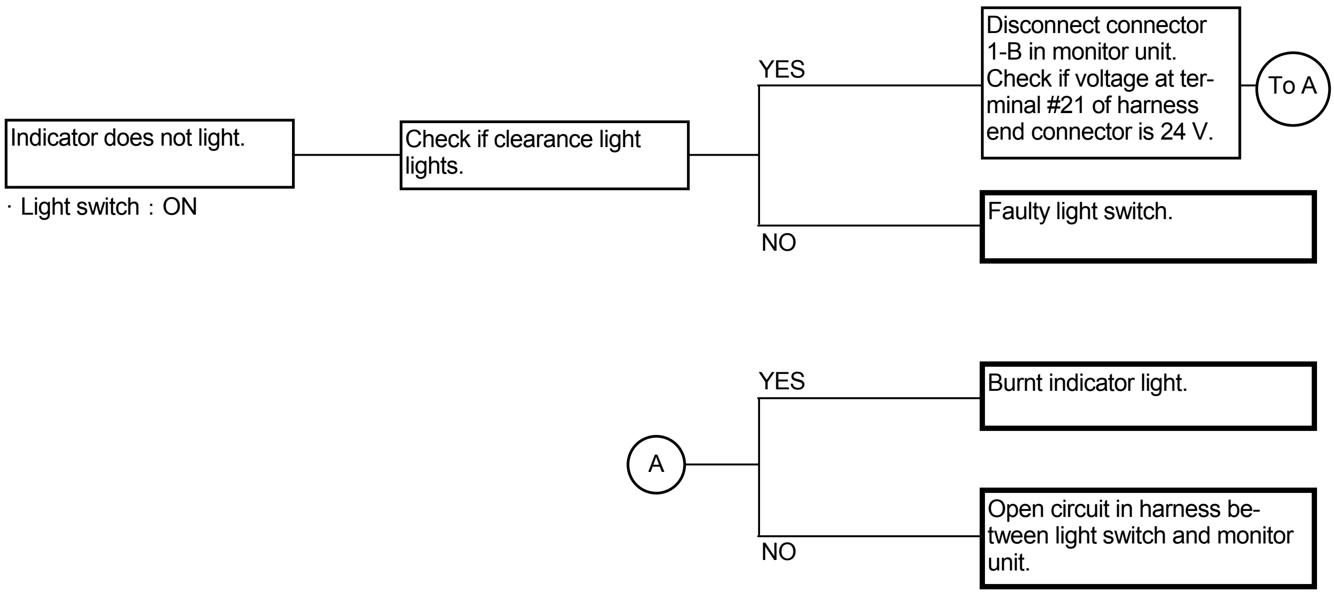
YES → Open circuit in harness between monitor unit and MC.

NO → Faulty monitor unit.

Faulty monitor unit, or burnt indicator light.

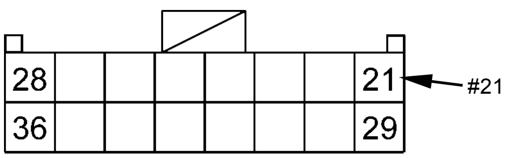
MALFUNCTION OF CLEARANCE LIGHT INDICATOR

- If the light is OFF and the clearance light and indicator light, the light switch may be faulty or the harness between light switch and clearance light or monitor unit may be shorted.
- Check the wiring connections first.



Connector (Harness end of connector viewed from the open end side)

Monitor Unit
Connector 1-B



T4GB-05-05-002

MALFUNCTION OF BRAKE LOW OIL PRESSURE INDICATOR

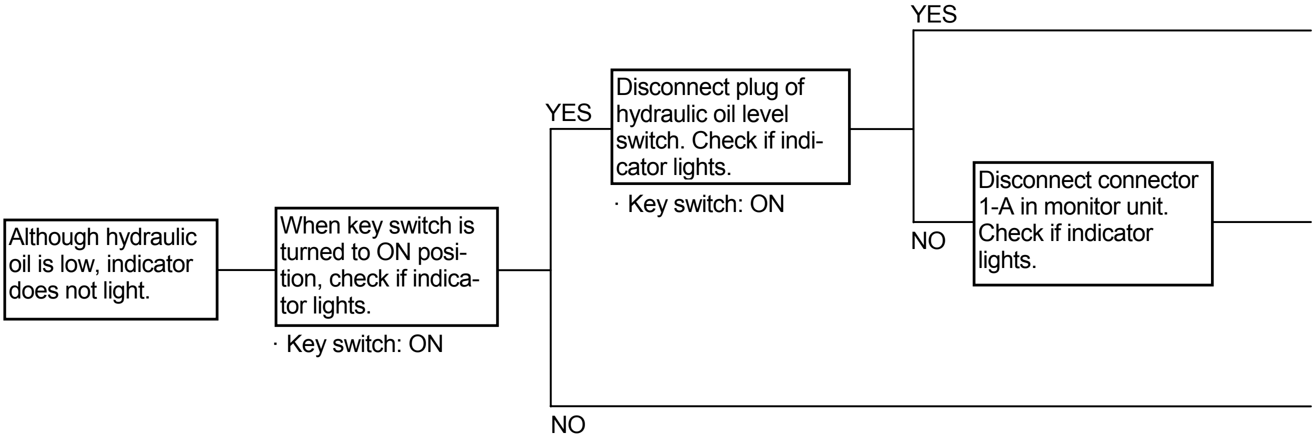
- When this trouble occurs, the fault code corresponding to the service brake pressure switch in monitor unit must be displayed. Refer to Troubleshooting A and conduct the remedy for this trouble.
- Although the fault cold is not displayed and if the trouble occurs, the monitor unit may be faulty.

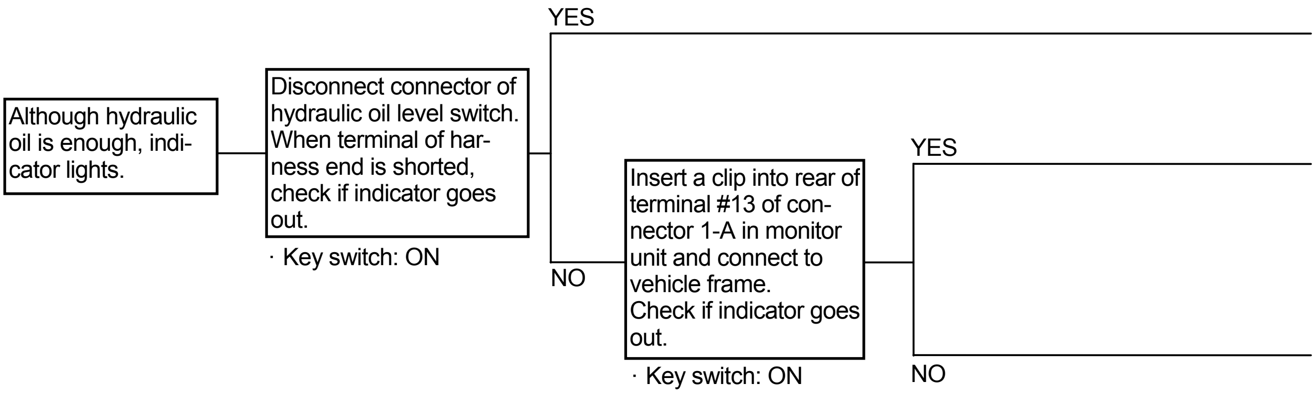
Service Brake Pressure Switch

Pressure	Voltage	Operation
10 Mpa (82 kgf/cm^2) or higher	1.32 V or higher	OFF
Less than 8 Mpa (102 kgf/cm^2)	Less than 1.15 V	ON

MALFUNCTION OF BRAKE LOW OIL LEVEL INDICATOR

- Check the wiring connections first.





Faulty hydraulic oil level switch.

YES

Shorted circuit in harness between monitor unit and hydraulic oil level switch.

NO

Faulty monitor unit.

Faulty monitor unit, or burnt indicator light.

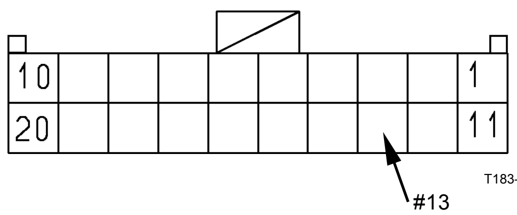
Faulty hydraulic oil level switch.

Open circuit in harness between monitor unit and hydraulic oil level switch.

Faulty monitor unit.

Connector (Harness end of connector viewed from the open end side)

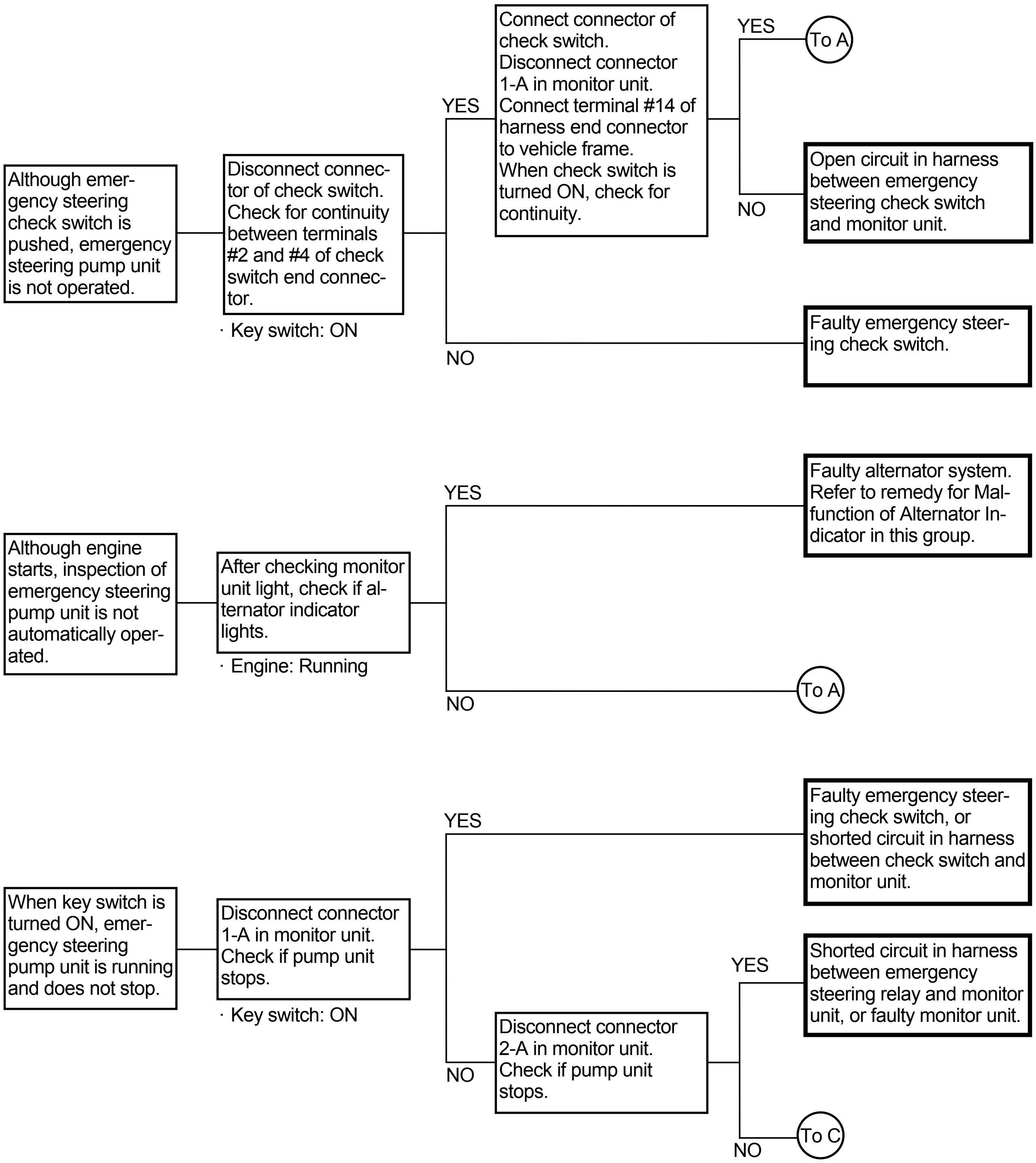
Monitor Unit
Connector 1-A

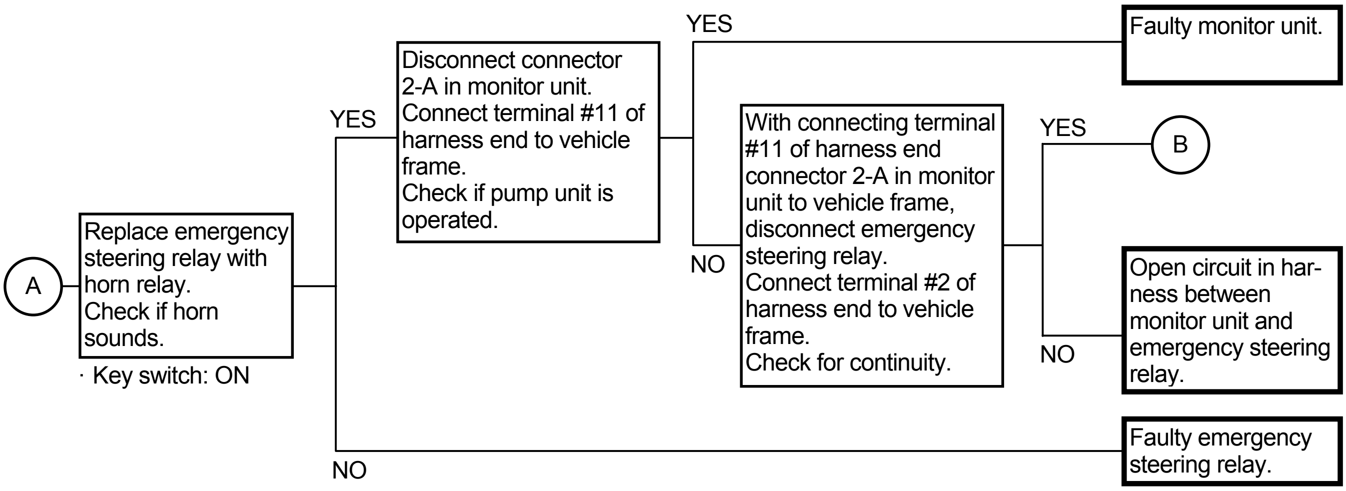


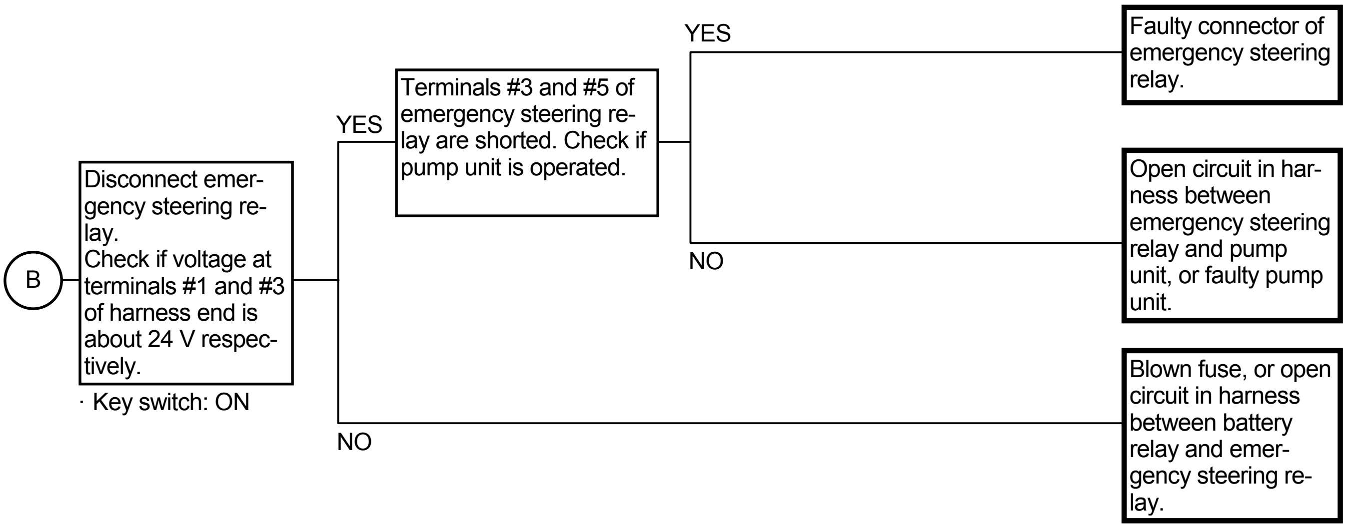
T183-05-04-013

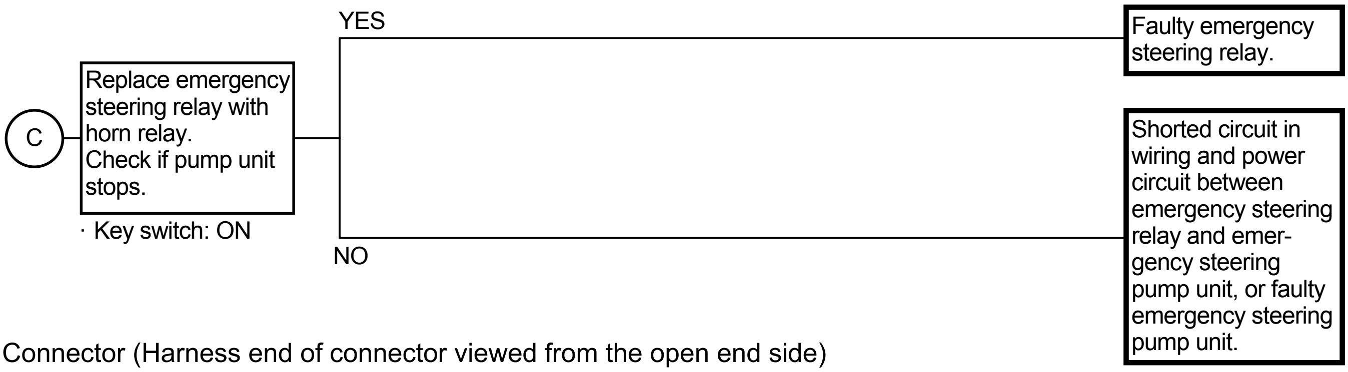
MALFUNCTION OF EMERGENCY STEERING INDICATOR (Optional)

- After checking if the fault code is not displayed on Troubleshooting by Dr. ZX, conduct this remedy.

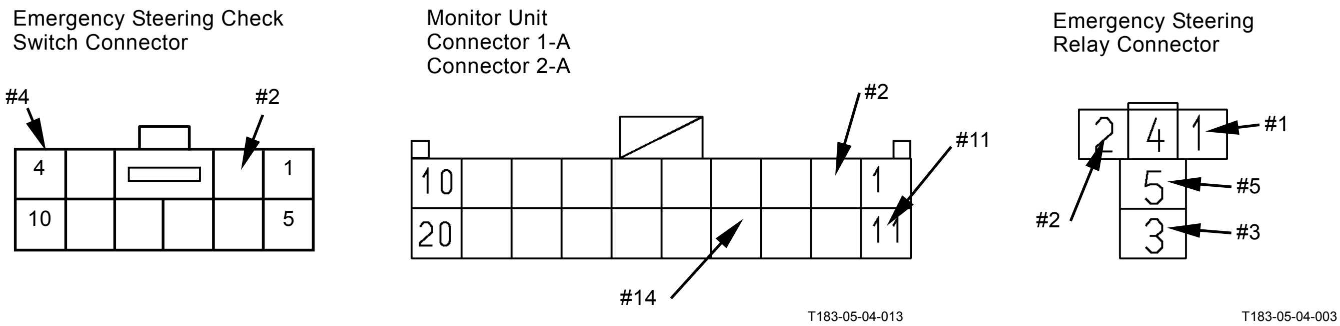








Connector (Harness end of connector viewed from the open end side)



MALFUNCTION OF LOW STEERING OIL PRESSURE INDICATOR (Optional)

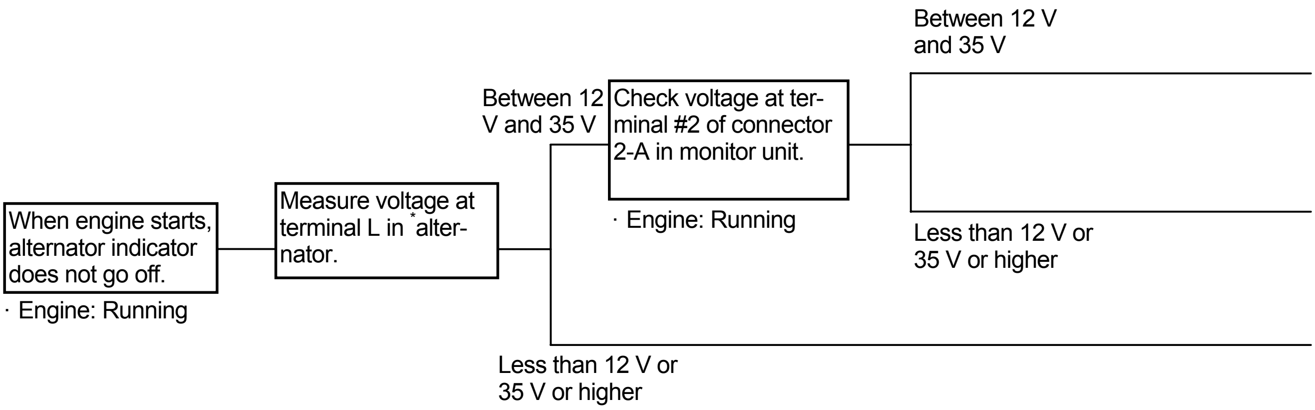
- When this trouble occurs, the fault code corresponding to the emergency steering pressure switch in monitor unit must be displayed. Refer to Troubleshooting A and conduct the remedy.
- Although the fault cold is not displayed and if the trouble occurs, the monitor unit may be faulty.

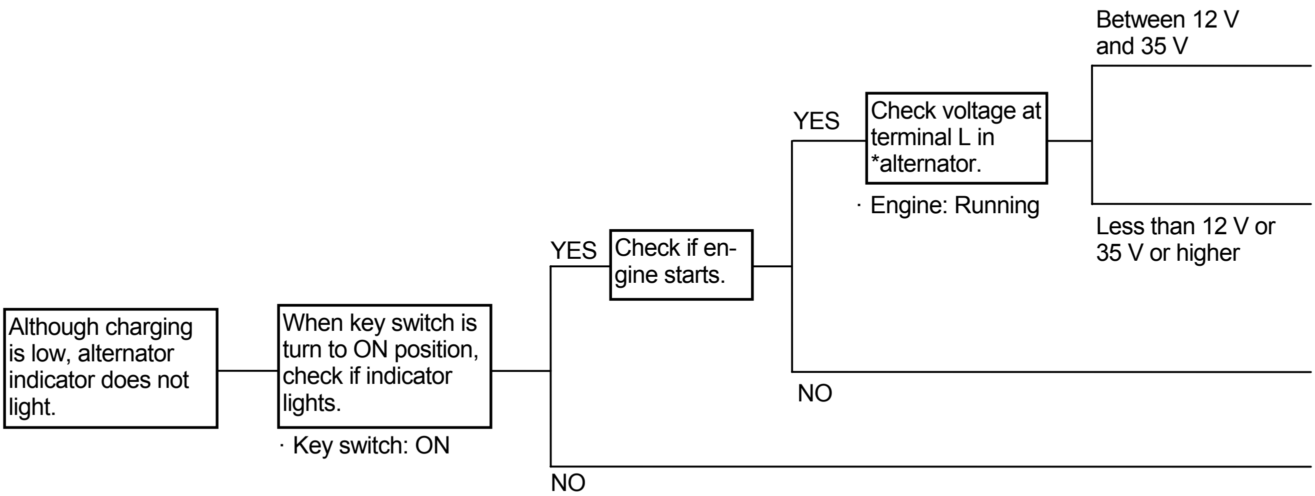
(Blank)

MALFUNCTION OF DISCHARGE WARNING INDICATOR

- Check the wiring connections first.

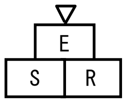
*NOTE: *Terminals L in the alternator are water-resistant type connectors so that it is not practical to measure voltage at these terminals. Measure voltage at terminal R in safety relay. Check for continuity between terminal R in safety relay and terminal L in the alternator first.*



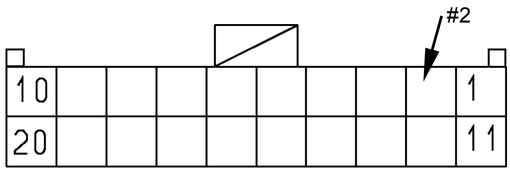


Connector (Harness end of connector viewed from the open end side)

Safety Relay
Connector A



Monitor Unit
Connector 2-A



T183-05-04-013

Faulty monitor unit.

Faulty harness between terminal L in alternator and monitor unit.

Faulty regulator, or faulty alternator.

Check voltage at terminal #2 of connector 2-A in monitor unit.
· Engine: Running

- Between 12 V and 35 V → Faulty monitor unit.
- Less than 12 V or 35 V or higher → Faulty harness between terminal L in alternator and monitor unit.

Faulty alternator.

Refer to Engine System Troubleshooting in Troubleshooting B.

Faulty monitor unit, or faulty alternator indicator.

MALFUNCTION OF MONITOR DISPLAY

- The data on monitor display is not displayed by the signal directly input from the sensors except one part. The signal data which inputs to other controllers from the sensors once is input to the monitor unit by using the CAN communication and is proceeded in the logic circuit of monitor unit. Therefore, check if the CAN communication is normal first and check if the sensors corresponding to the trouble are normal.

Description			Cause of Trouble
Data on liquid crystal display	Neutral indicator		If the data of monitoring function can be displayed on Dr. ZX, CAN communication between monitor unit and other controllers is faulty. If the data cannot be displayed on Dr. ZX, the sensor system detecting the related signal is faulty. (As for the machine, some trouble must occur. Refer to Troubleshooting A and conduct the remedy.)
	Forward/reverse indicator		
	Driving mode indicator		
	Hold indicator		
	Speedometer		
	Automatic mode indicator		
	Clutch cut-off indicator		
	Ride control indicator		Refer to T5-7-51.
Data on data display	Model	Displayed on service mode when starting only	If the data of monitoring function can be displayed on Dr. ZX, CAN communication between monitor unit and other controllers is faulty. If the data cannot be displayed on Dr. ZX, the sensor system detecting the related signal is faulty. (As for the machine, some trouble must occur. Refer to Troubleshooting A and conduct the remedy.)
	Clock (24 hours)		
	Fuel consumption amount		
	Average fuel consumption amount		
	Odometer	Displayed on service mode when starting only	
	Engine speed	Displayed on service mode when starting only	
	Hydraulic oil temperature	Displayed on service mode when starting only	
	Fault code	Displayed on service mode when starting only	
	Transmission oil temperature	Displayed on service mode when starting only	
	Other data	Displayed on normal mode when starting only	As for these troubles, the liquid crystal display in monitor unit may be faulty or the logic circuit may be faulty.
	• Remainder time that hydraulic oil can be used		
	• Remainder time that hydraulic oil filter can be used		
	• Remainder time that transmission oil can be used		
	• Remainder time that transmission oil filter can be used		
	Remainder time that engine oil can be used		
	Remainder time that engine oil filter can be used		
	Remainder time that fuel filter can be used		
	Hour meter		The alternator is faulty, the harness between terminal L in the alternator and terminal #2 of connector 2-A in monitor unit is faulty, or the clock circuit in monitor unit may is faulty.
	Coolant temperature	Displayed on service mode when starting only	Refer to T5-7-52.

MALFUNCTION OF RIDE CONTROL INDICATOR

- Check the wiring connections first.

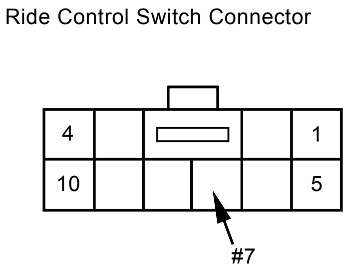
When ride control switch is turned ON, indicator does not light.

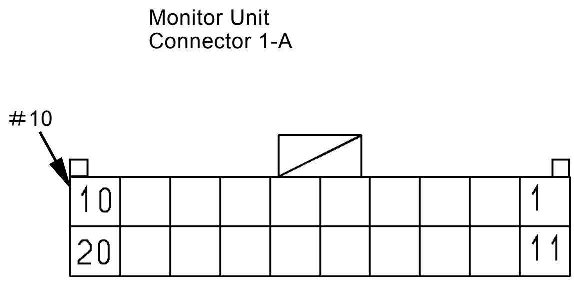
- Check if ride control is operated correctly.
  - YES: Disconnect connector 1-A in monitor unit. Connect terminal #10 of harness end to vehicle frame. Check for continuity.
    · Ride control switch: ON
    - YES: Faulty monitor unit.
    - NO: Faulty harness between ride control switch and monitor unit.
  - NO: Disconnect connector of ride control switch. Connect terminal #7 of harness end to vehicle frame. Check if indicator lights.
    - YES: Faulty ride control switch.
    - NO: Faulty harness between terminal #7 of ride control switch and monitor unit.

When ride control switch is turned OFF, indicator does not go out.

- Check if ride control is operated.
  - YES: Faulty ride control switch.
  - NO: Disconnect connector 1-A in monitor unit. Check if indicator goes out.
    - YES: Shorted circuit in harness between ride control switch and monitor unit.
    - NO: Faulty monitor unit.

Connector (Harness end of connector viewed from the open end side)





T183-05-04-013

MALFUNCTION OF ENGINE COOLANT TEMPERATURE DISPLAY

- This trouble on coolant temperature operation and data on monitor display is displayed according to the signal from the same coolant temperature sensors. Therefore, when this trouble occurs, the coolant temperature operation must be faulty. Refer to the remedy for Malfunction Coolant Temperature Operation in this group and remedy this trouble first. Although the coolant temperature operation is not faulty and if this trouble occurs, the monitor unit is faulty.

PRECAUTIONS FOR INSPECTION AND MAINTENANCE

1. Disconnect the power source.
   Remove the harness from the negative terminal side in battery first when taking wire harnesses and connectors off for repair or replacement work. Failure to do so can result in damage to the wire harnesses, fuses and fusible links and, in some cases, cause fire due to short circuiting.
2. Color coding of wire harnesses.
   As for the color codes of wire harnesses in the electrical system, refer to the table below.
   In cases on the design sheet where two colors are indicated for one wire, the left initial stands for base color, while the right initial stands for marking color.

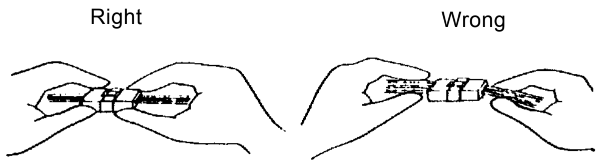
Code	Color	Code	Color
R	Red	W	White
L	Blue	G	Green
Or	Orange	Lg	Light green
Y	Yellow	B	Black
Br	Brown	P	Pink
Gr	Gray	V	Violet

NOTE: 1) Code BW indicates a black base wire with white fine-line marking.

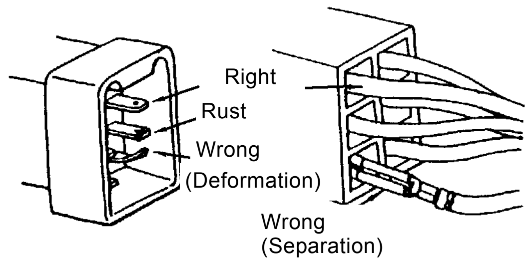
2) Initials “O” and “Or” both stand for the color orange.

3) Wires with longitudinal stripes printed on them are not color coded. Do not confuse them with color coded wires.

3. Precautions for connecting and disconnecting terminal connectors.
   1) When disconnecting the harnesses, grasp them by their connectors. Do not pull on the wire itself. Release the lock first before attempting to separate connectors, if a lock is provided. (Refer to "Instructions for Disconnecting Connector" on page T5-8-3.)
   2) The water-resistant connectors keep water out. If water enters them, water will not easily drain from them. When checking the water-resistant connectors, take extra care not to allow water to enter the connectors. In case water should enter the connectors, reconnect only after the connectors are thoroughly dried.
   3) Before connecting terminal connectors, check that no terminals are bent or coming off. In addition, as most connectors are made of brass, check that no terminals are rusting.
   4) When connecting terminal connectors provided with a lock, insert them together until the lock "clicks."
   5) Pull the harness near the connector in order to check if it is correctly connected.

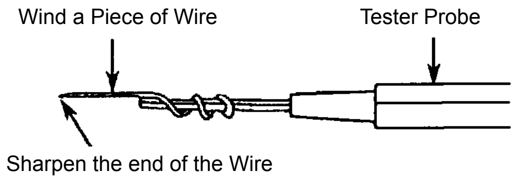


T107-07-06-001



T107-07-06-002

4. Precaution for using a circuit tester.
   1) Before using a circuit tester, refer to the instructions in the circuit tester manual.
      Then, set the circuit tester to meet the object to be measured, voltage range and current polarity.
   2) Before starting the connector test, always check the connector terminal numbers, referring to the circuit diagram.
      When the connector size is very small, and the standard probe size is too large to be used for testing, wind a fine piece of sharpened wire or a pin around the probe to make the test easier.
   3) When checking the connector by using a tester, insert a tester probe from the harness end of connector in order not to damage the terminal inside connector.



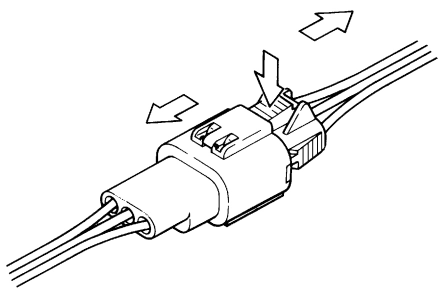
T107-07-06-003

INSTRUCTIONS FOR DISCONNECTING CONNECTORS

- Push, Unlock and Separate Type

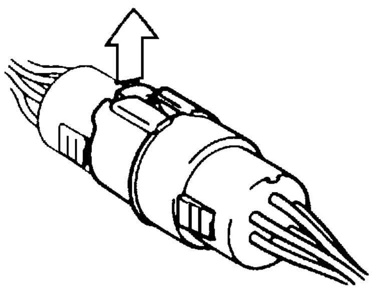
NOTE: Connectors will not be easily separated even if the lock is pushed while being pulled. Push the lock first before pulling the connectors.

The lock is located on female side connector (harness end side).

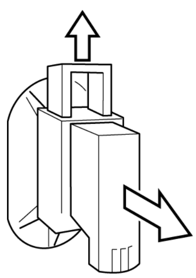


T107-04-05-002

- Raise Lock, Pull and Separate Type

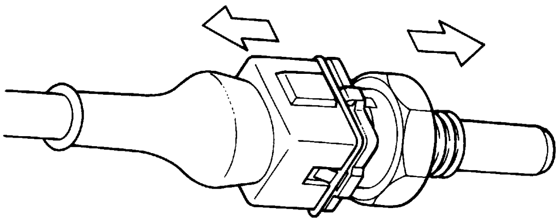


T107-04-05-003



T4GB-05-06-003

- Pull and Separate Type

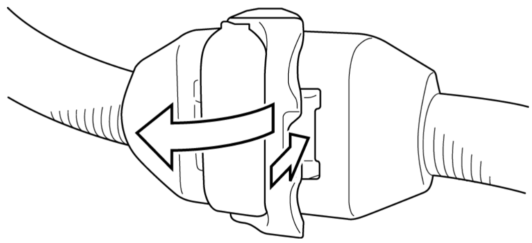


T107-04-05-004

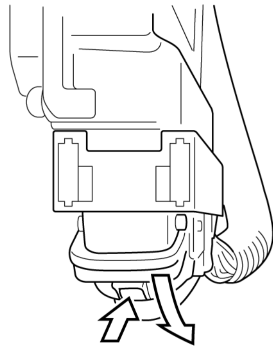
IMPORTANT: Before pulling and separating, release the lock of connector in the solenoid valve by using a pair of pincers.

- Unlock, Move the Lever and Pull Type

NOTE: When unlocking, release the lock by one hand, slowly pull the lever by another hand, and separate the connector.



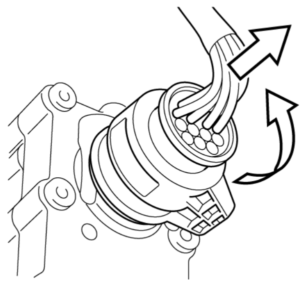
T4GB-05-06-001



T4GB-05-06-002

- Rotate the Lock and Pull Type

NOTE: Pinch the harness end connector, rotate the projection part counterclockwise while pushing, and separate the connector.



T4GB-05-06-007

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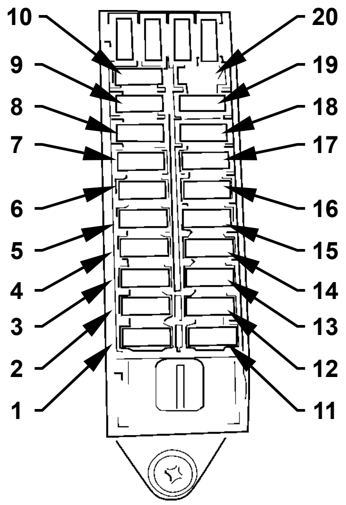
FUSE INSPECTION

Cracks in a fuse are so fine that it is very difficult or impossible to find by visual inspection. Use a tester in order to correctly inspect fuse continuity. Inspect the fuse by following the instructions described below.

1. Turn Key Switch ON
   When the key switch is turned ON, current from terminal M of key switch activates the battery relay so that electric power is supplied to all circuits. (Refer to the circuit diagram.)
2. Remove the fuse box cover. Set the tester voltage in order to meet the circuit specification to be measured.
   (Measurement Range: 0 to 30 V)
3. Ground the negative probe of the tester to the machine. Touch the terminals located away from the center of the fuse box with the positive probe of tester one at a time. When normal continuity of a fuse is intact, the tester will indicate 20 to 25 V (battery voltage).

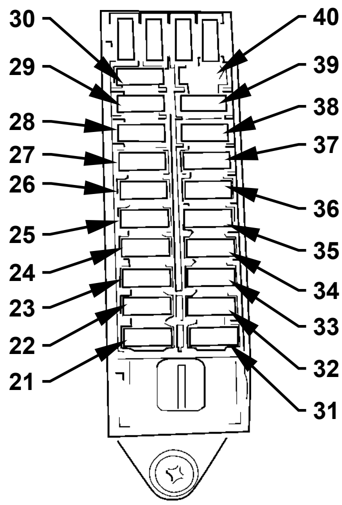
NOTE: All terminals located along the lengthwise centerline of the fuse box are connected to the power source, while terminals located away from the center of the fuse box are connected to loads (accessories). Therefore, test all fuses in the same method except for the glow plug relay circuit fuse. Check the glow plug relay circuit fuse with the key switch turned ON according to the procedure in step 3.

(Fuse Box A)



M178-07-034

(Fuse Box B)



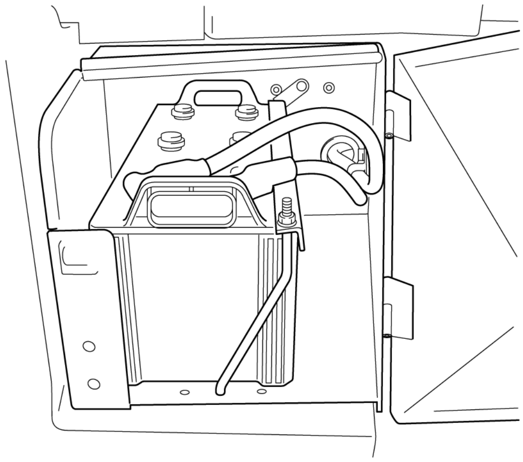
M178-07-034

Fuse NO.	Capacity	Connected to
1	10 A	Option (Seta Heater)
2	10 A	12V Converter
3	-	Option 1
4	15 A	Wiper (Front)
5	5 A	Head Light (Right)
6	10 A	Cigar Lighter
7	-	Spare 1
8	10 A	Controller Power Source
9	5 A	Parking Brake Relay
10	-	Option 2
11	5 A	Reverse Light
12	10 A	Brake Lamp Relay
13	20 A	Working Light (Front)
14	10 A	Horn
15	5 A	Head Light (Left)
16	15 A	Option (Side Wiper 1)
17	15 A	Option (Side Wiper 2)
18	15 A	Option (Window Heater (Front))
19	15 A	Option (Window Heater (Side))
20	10 A	Option (Window Heater (Rear))
21	10A	Option (Fog Lamp)
22	20A	Working Light (Rear)
23	5A	Air Conditioner 1
24	20A	Air Conditioner 2
25	10A	Wiper (Rear)
26	10A	Emergency Steering Pump Unit
27	20A	Ignition
28	15A	Flusher
29	5A	Load Damp Relay
30	5A	Radio
31	10A	Option (Beacon Light)
32	10A	High Beam
33	10A	Controller (Key: ON)
34	-	Spare 2
35	30A	ECM (Key: ON)
36	5A	Clearance Lamp 1
37	5A	Clearance Lamp 2
38	10A	MC (Key: ON)
39	10A	Option (Control Unit Power Source)
40	5A	Monitor Unit

FUSIBLE LINK INSPECTION

Inspection

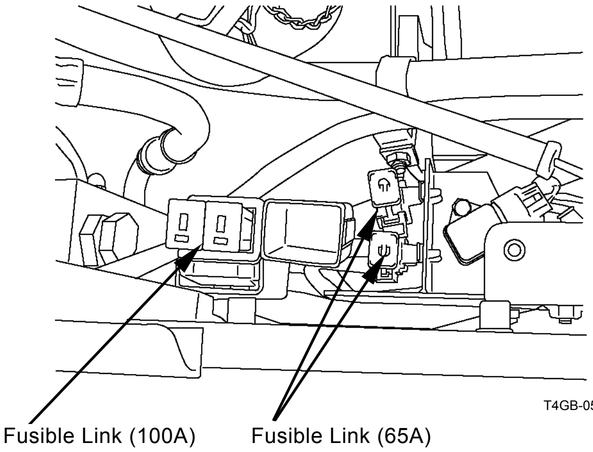
1. Open either battery box cover from left and right of the machine. Remove the negative cable from the battery.
2. Open the engine cover on left side of the machine with the front attachment side forward.
3. Remove bolts (M10) (2 used) from the L type cover. Remove the cover. There are fusible links (65A) (2 used).
4. Open the black box. There are fusible links (50A) (2 used) (100A in total).
5. Visually inspect the fusible link.
6. Install the negative cable to the battery.



T4GB-05-06-004

Replacement

1. Check if the negative cable is removed from either battery box from left and right of the machine.
2. Open the engine cover on left side of the machine with the front attachment side forward.
3. Remove bolts (M10) (2 used) from the L type cover. Remove the cover. There are fusible links (65A) (2 used).
4. Open the black box. There are fusible links (50A) (2 used) (100A in total).
5. Pull out and replace the fusible link.
6. Install the negative cable to the battery.



T4GB-05-06-008

BATTERY VOLTAGE CHECK

1. Turn the key switch OFF.
2. Open the battery box cover on left side of the machine with the front attachment side forward.
3. Check voltage between the battery positive terminal and the vehicle frame (ground).

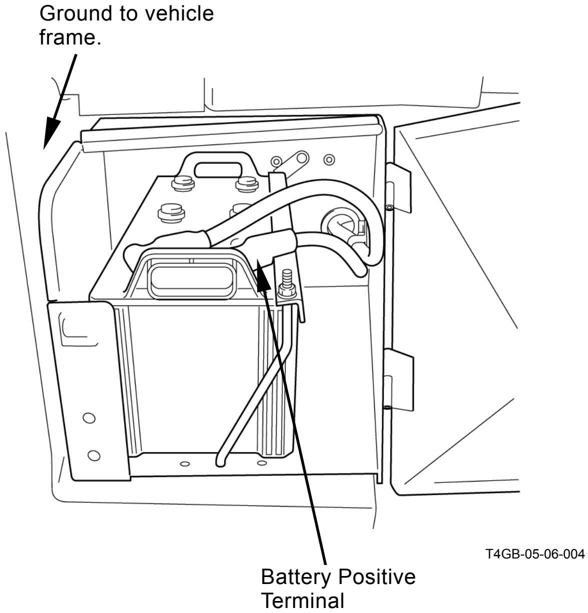
   Normal Voltage: 24 V

NOTE: If voltage is abnormal, recharge or replace the battery.

4. Start the engine. Check voltage between the battery positive terminal and the vehicle frame (ground).

   Normal Voltage: 26 to 28 V

NOTE: If voltage is abnormal, check the charging system.

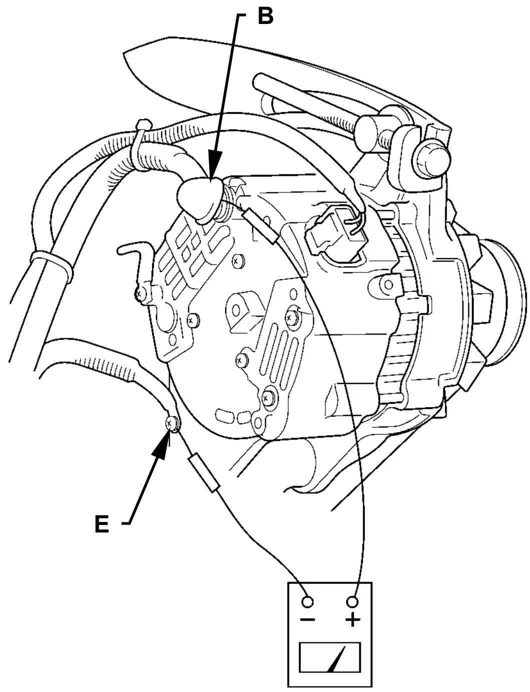


ALTERNATOR CHECK

In general, the alternator indicator remains off when the alternator is generating power.
If the alternator indicator comes on while the engine is running, the alternator may be faulty.

How to Check Alternator

1. Turn the key switch to the ON position. Confirm that the alternator indicator comes on.
2. Measure voltage between terminals B and E of the alternator.
   If the measured voltage is around 24 V, the alternator circuit can be considered normal.
   If the measured voltage is low, a shortage in battery capacity or looseness of the wire connectors of alternator circuit might be cause of the malfunction.
   When voltage is 0 V, the wiring between fuse box and alternator or the ground line to alternator might be open circuit.
3. Next, start the engine and measure voltage generated while as the alternator rotates.
   As described above, measure voltage between terminals B and E on the end of alternator.
   If voltage is around 28 V, the alternator is operating normally.
   If the measured voltage is equal to battery voltage (around 24V), there is some trouble with the alternator or the regulator.



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CONTINUITY CHECK

Single-line continuity check

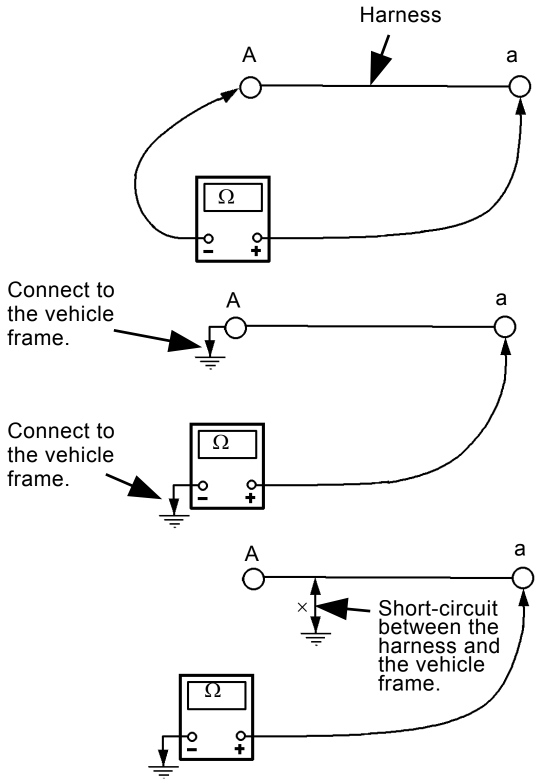
Disconnect both end connectors of the harness and check continuity between both ends:
If the ohm-meter reading is: 0 Ω = Continuity
∞ Ω = Discontinuity

NOTE: When the one end connector is far apart from the other, connect one end of connector (A) to the machine chassis using a clip. Then, check continuity of the harness through the vehicle frame as illustrated.

If the ohm-meter reading is: 0 Ω = Continuity
∞ Ω = Discontinuity

Single-line short-circuit check

Disconnect both end connectors of the harness and check continuity between one end connector of the harness and the vehicle frame:
If the ohm-meter reading is:
0 Ω = Short circuit is present.
∞ Ω = No short circuit is present.



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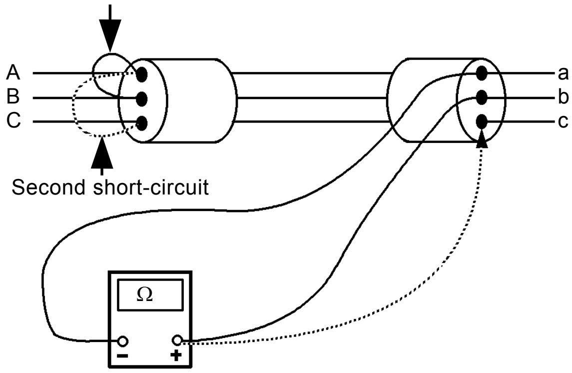
Multi-line continuity check

Disconnect both end connectors of the harness, and short-circuit two terminals, (A) and (B), at one end connector, as illustrated. Then, check continuity between terminals (a) and (b) at the other connector. If the ohm-meter reading is ∞ Ω, either line (A) - (a), or (B) - (b) is in discontinuity. To find out which line is discontinued, conduct the single line continuity check on both lines individually, or, after changing the short-circuit terminals from (A) - (B) to (A) - (C), check continuity once more between terminals (a) and (c).



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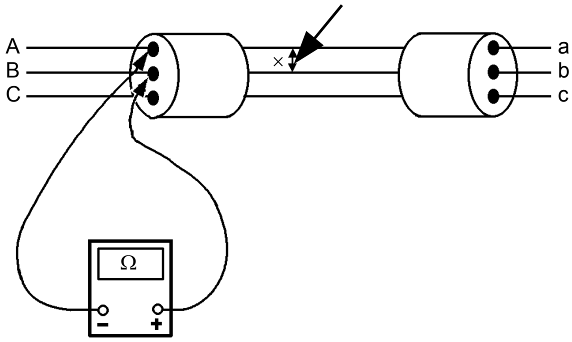
NOTE: By conducting the multi-line continuity check twice, it is possible to find out which line is discontinued. With terminals (A) and (C) short-circuited, check continuity between terminals (a) and (c).

If the ohm-meter reading is:
0 Ω = Line (B) - (b) has discontinuity.
∞ Ω = Line (A) - (a) has discontinuity.

Multi-line short-circuit check

Disconnect both end connectors of the harness, and check continuity between terminals (A) and (B) or (C).
If the ohm-meter reading is:
0 Ω = Short-circuit exists between the lines.
∞ Ω = No short-circuit exists between the lines.



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VOLTAGE AND CURRENT MEASUREMENT

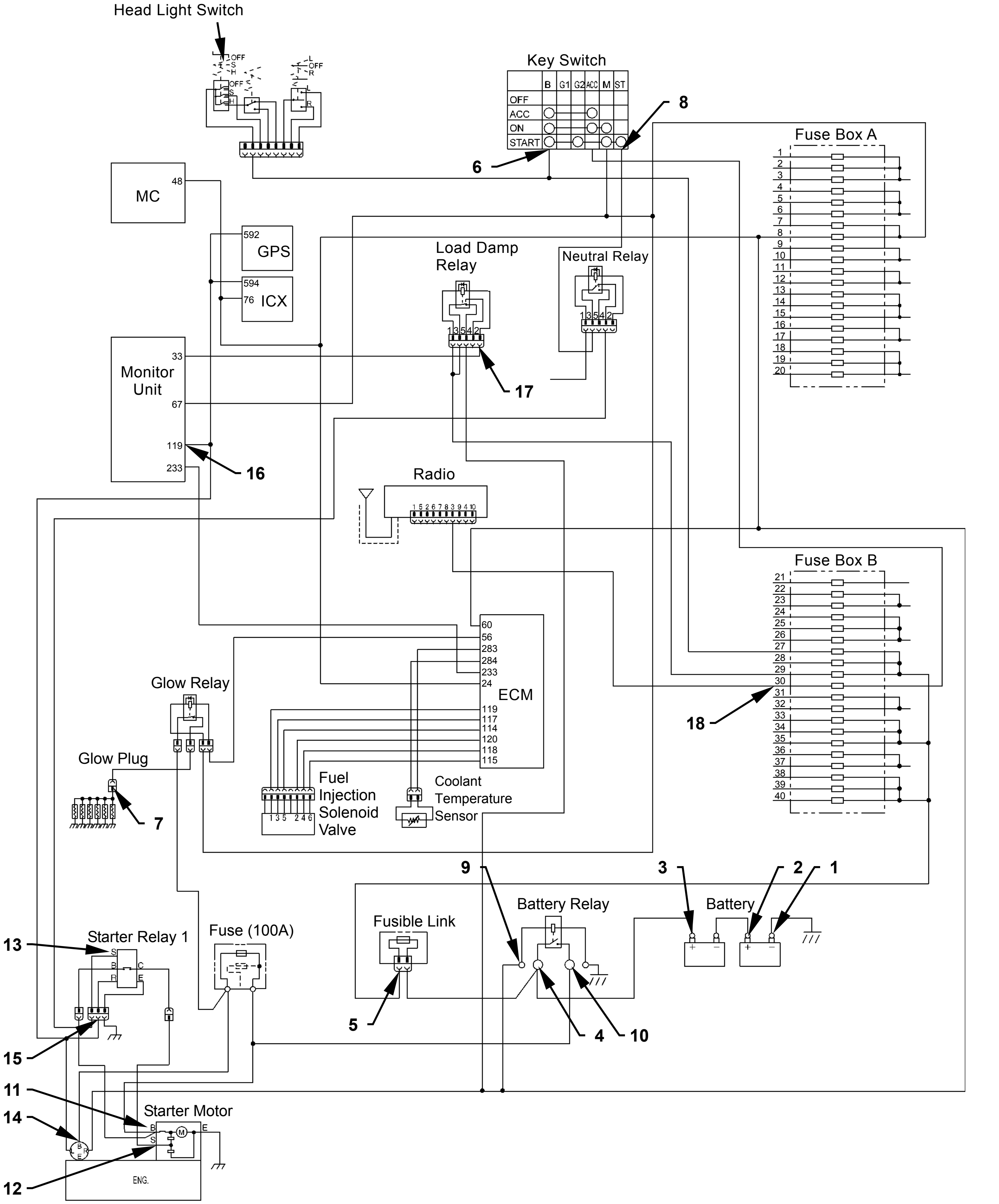
Turn key switch ON so that the specified voltage (current) is supplied to the location to be measured. Judge if the circuit is normal by evaluating whether the measured voltage (current) matches the specification.

24-Volt Circuit
Start checking the circuit in order up to the location to be measured from either power source or actuator side. Thereby, the faulty location in the circuit will be found.

Black Probe (Negative) of Tester:
To ground to the vehicle frame
Red Probe (Positive) of Tester:
To touch the location to be measured

Engine	Key Switch	Location to be Measured	Specification
Power Source Circuit			
Stopped	OFF	Between (2) and (1): One Battery	10 to 12.5 V
Stopped	OFF	Between (3) and (2): One Battery	10 to 12.5 V
Stopped	OFF	Between (3) and (1): Two Batteries	20 to 25 V
Stopped	OFF	Between (4) and Ground: Battery Power	20 to 25 V
Stopped	OFF	Between (5) and Ground: Fusible Link	20 to 25 V
Stopped	OFF	Between (1) and Ground: Backup Current*	6 mA
Preheat Circuit			
Started	START	Between (6) and Ground: Key Switch	20 to 25 V
Started	START	Between (7) and Ground: Glow Plug	20 to 25 V
Starting Circuit			
Started	START	Between (8) and Ground: Key Switch	20 to 25 V
Started	START	Between (9) and Ground: Battery Relay (Coil)	20 to 25 V
Started	START	Between (10) and Ground: Battery Relay (Switch)	20 to 25 V
Started	START	Between (11) and Ground: Starter (B)	20 to 25 V
Started	START	Between (12) and Ground: Starter (S)	20 to 25 V
Started	START	Between (13) and Ground: Starter Relay 2 (S)	20 to 25 V
Charging Circuit			
Fast Speed	ON	Between (14) and Ground: Alternator (B) / Generating Voltage	26 to 30 V
Fast Speed	ON	Between (10) and Ground: Battery Relay / Generating Voltage	26 to 30 V
Fast Speed	ON	Between (15) and Ground: Generating Voltage	13 to 30 V
Fast Speed	ON	Between (16) and Ground: Monitor	13 to 30 V
Surge Voltage Prevention Circuit			
Idle Speed	ON→OFF	Between (14) and Ground: Alternator (B)	26 to 30 V
Idle Speed	ON→OFF	Between (15) and Ground: Starter Relay 1 (R)	13 to 30 V
Idle Speed	ON→OFF	Between (17) and Ground: Load Damp Relay	26 to 30 V
Idle Speed	ON→OFF	Between (10) and Ground: Battery Relay	26 to 30 V
Accessory Circuit			
Stopped	ON	Between (18) and Ground: Radio	20 to 25 V

*NOTE: *Measure after disconnecting the negative cable from the battery.*



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5-V Circuit

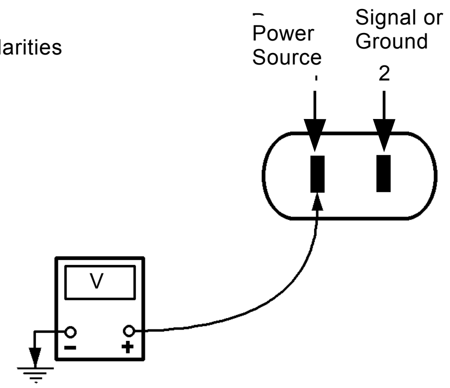
- **Voltage between terminal #1 and the vehicle frame**
  With the key switch turned OFF, disconnect the connector.
  Measure voltage between the terminal of 5V power source on machine harness end connector and the vehicle frame (ground).

  - Key switch: ON
  - Tester black probe (negative):
    Vehicle frame (ground)
  - Tester red probe (positive):
    Terminal of 5V power source

  Evaluation:
  If the measured voltage is within 5±0.5 V, the circuit up to terminal of 5V power source is normal.

IMPORTANT: Altough terminal #1 is the teminal of power source on the illustlation, all the terminals are not terminals of power source. Before measurement, check the electrical circuit diagram for the connector to be measured.

Two Polarities



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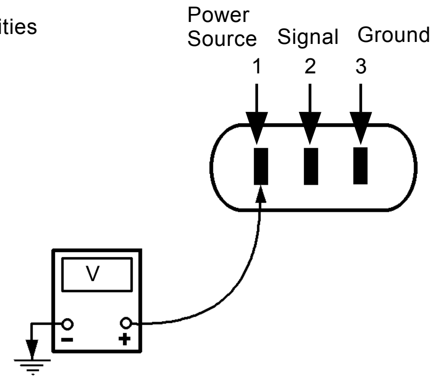
Three Polarities



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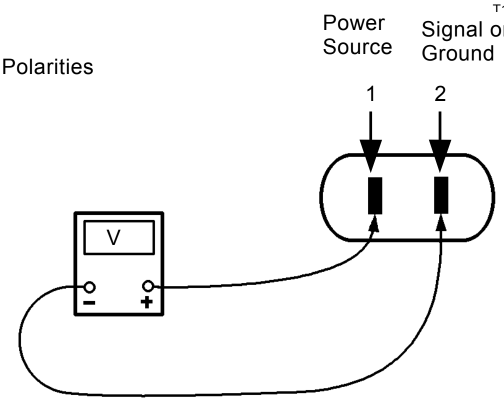
- **Voltage between terminal #1 and the ground terminal**
  With the key switch turned OFF, disconnect the sensor connector.
  Measure voltage between the terminal of 5V power source on machine harness end connector and the ground terminal.

  - Key switch: ON
  - Tester black probe:
    Ground terminal
    (terminal #2 or #3)
  - Tester red probe:
    Terminal of 5V power source

  Evaluation:
  If the measured voltage is within 5±0.5 V, the circuits up to terminal of 5V power source and ground terminal are normal.

IMPORTANT: Altough terminal #1 is the teminal of power source, terminal #2 is the signal and #3 is the ground terminal respectively on the illustlation, all the connectors are not arranged similarly. Before measurement, check the electrical circuit diagram for the connector to be measured.

Two Polarities



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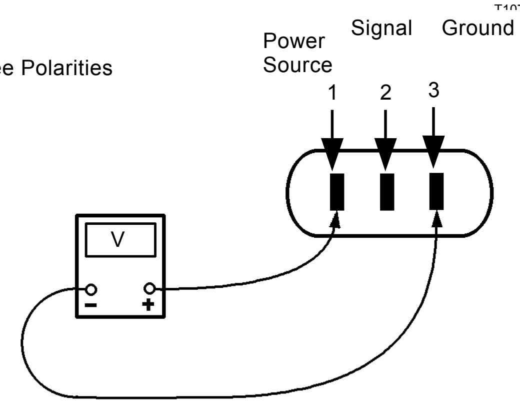
Three Polarities



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CHECK BY FALSE SIGNAL

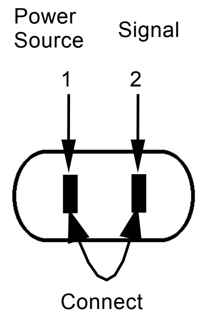
Turn the key switch OFF and disconnect the sensor connector. Turn the key switch ON. Connect terminal of power source and signal terminal on machine harness end connector. (Power voltage is used as a false signal.)
Check this state by using the monitor function of Dr. ZX. If the displayed value is the maximum value, the circuits up to MC and machine harness end connector are normal. If “ON” is displayed, the pressure switch circuits are normal.

IMPORTANT: Altough terminal #1 is the teminal of power source, terminal #2 is the signal and #3 is the ground terminal respectively on the illustlation, all the connectors are not arranged similarly. Before measurement, check the electrical circuit diagram for the connector to be measured.

IMPORTANT: Do not connect terminal of power source and signal terminal to ground terminal or to the vehicle frame (ground) when checking a three-polarity connector.

NOTE: Some kinds of sensors can be monitored by using the service mode of monitor. (Refer to the TROUBLESHOOTING / Diagnosing Procedure group.)

Two Polarities



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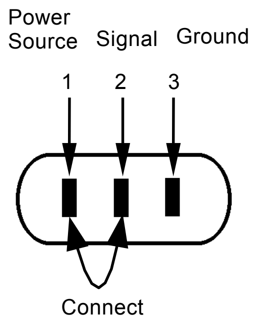
Three Polarities



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THE ATTACHED DIAGRAM LIST

(The following diagrams are attached to this manual.)

ZW220/250 ELECTRIC CIRCUIT DIAGRAM 1 (GENERAL STANDARD) (INCOMPLETION)

ZW220/250 ELECTRIC CIRCUIT DIAGRAM 2 (GENERAL STANDARD) (INCOMPLETION)

ZW220/250 LIFT ARM PROXIMITY SWITCH HARNESS (EU STANDARD, GENERAL STANDARD)
ZW310 LIFT ARM PROXIMITY SWITCH HARNESS

ZW220/250 LIFT ARM ANGLE SENSOR HARNESS (EU STANDARD, GENERAL STANDARD) (OPTIONAL)
ZW310 LIFT ARM ANGLE SENSOR HARNESS (OPTIONAL)

ZW220/250 FRONT LIGHT HARNESS (EU STANDARD, GENERAL STANDARD)
ZW310 FRONT LIGHT HARNESS

ZW220/250 FRONT HARNESS (EU STANDARD, GENERAL STANDARD)
ZW310 FRONT HARNESS

ZW220/250 CENTER HARNESS (EU STANDARD, GENERAL STANDARD)
ZW310 CENTER HARNESS

ZW220/250 FRONT CONSOLE HARNESS 1 (EU STANDARD, GENERAL STANDARD)
ZW310 FRONT CONSOLE HARNESS 1

ZW220/250 FRONT CONSOLE HARNESS 2 (EU STANDARD, GENERAL STANDARD)
ZW310 FRONT CONSOLE HARNESS 2

ZW220/250 SIDE CONSOLE HARNESS 1 (EU STANDARD, GENERAL STANDARD)
ZW310 SIDE CONSOLE HARNESS 1

ZW220/250 SIDE CONSOLE HARNESS 2 (EU STANDARD, GENERAL STANDARD) (FOR STANDARD TWO LEVER PILOT VALVE)
ZW310 SIDE CONSOLE HARNESS 2 (FOR STANDARD TWO LEVER PILOT VALVE)

ZW220/250 SIDE CONSOLE HARNESS 3 (EU STANDARD, GENERAL STANDARD) (FOR OPTIONAL JOY STICK LEVER PILOT VALVE)
ZW310 SIDE CONSOLE HARNESS 3 (FOR OPTIONAL JOY STICK LEVER PILOT VALVE)

ZW220/250 REAR CONSOLE HARNESS (GENERAL STANDARD)

ZW220/250 TRANSMISSION HARNESS (GENERAL STANDARD)
ZW310 TRANSMISSION HARNESS

ZW220/250 REAR FRAME HARNESS (EU STANDARD, GENERAL STANDARD)

ZW220/250 ENGINE HARNESS (EU STANDARD, GENERAL STANDARD)

ZW220 HYDRAULIC CIRCUIT DIAGRAM (GENERAL STANDARD)

ZW250 HYDRAULIC CIRCUIT DIAGRAM (GENERAL STANDARD)