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Safety, Specification and Systems Operation

Dozer Maintenance Safety

Safety Instructions

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments repairs or service. Untrained operators and failure to follow instructions can cause death or serious injury.

General

Safe Operation is Operator's Responsibility

Only trained and authorized personnel should operate and maintain the machine.

Follow all safety rules, regulations and instructions when operating or performing maintenance on machine.

- Do not operate machine if you are under the influence of drugs or alcohol. An operator who is taking prescription drugs must get medical advice to determine if he or she can safely operate a machine.
- When working with other personnel on a work site, be sure that all personnel know nature of work and understand all hand signals that are to be used.
- Be sure that all guards and shields are installed in their proper location. Have guards and shields repaired or replaced immediately if damaged.
- Be sure that you understand the use and maintenance of all safety features such as safety lever and seat belt. Use them properly.
- Never remove, modify or disable any safety features. Always keep them in good operating condition.
- Always check for and know the location of underground and overhead utility lines before excavating.
- Failure to use and maintain safety features according to instructions in this manual, Safety Manual and Shop Manual can result in death or serious injury.

Know Your Machine

Know how to operate your machine. Know the purpose of all controls, gauges, signals, indicators and monitor displays. Know the rated load capacity, speed range, braking and steering characteristics, turning radius and operating clearances. Keep in mind that rain, snow, ice, loose gravel, soft ground, slopes etc., can change operating capabilities of your machine.

Proper Work Tools and Attachments

Only use work tools and attachments that are recommended be dealer for use on machines. When installing and using optional attachments, read instruction manual for attachment, and general information related to attachments in this manual. Because HD HYUNDAI CONSTRUCTION EQUIPMENT cannot anticipate, identify or test all attachments that owners may want to install

on their machines, contact HD HYUNDAI CONSTRUCTION EQUIPMENT for written authorization and approval of attachments, and their compatibility with optional kits.

Attachments and attachment control systems that are compatible with the machine are required for safe and reliable machine operation. Do not exceed maximum operating weight.

Make sure that all guards and shields are in place on machine and on work tool. Depending on type or combination of work equipment, there is a potential that work equipment could interfere with the cabin or other parts of machine. Before using unfamiliar work equipment, check if there is any potential of interference, and operate with caution.

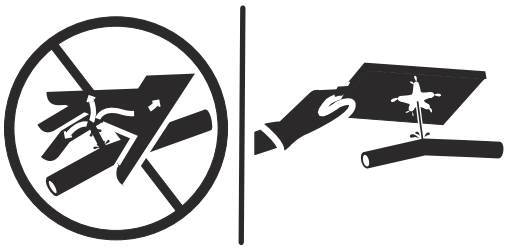
While you are performing any maintenance, testing, or adjustments to attachments, stay clear of the following areas: cutting edges, pinch points, and crushing surfaces.

Never use attachment as a work platform or man-lift.

Contact your HD HYUNDAI CONSTRUCTION EQUIPMENT distributor about auxiliary hydraulic kits for attachments installation. If you are in doubt about compatibility of a particular attachment with a machine, consult your distributor.

Pressurized Fluids

Figure 1



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Pressurized air or fluids can cause debris and/or fluids to be blown out. This could result in death or serious injury.

Immediately after operations are stopped, coolant, engine oil, and hydraulic oil are at their highest temperatures and the radiator and hydraulic tank are still under pressure. Always wait for temperature to cool down. Follow specified procedures when attempting to remove caps, drain oil or coolant, or replacing filters. Always wait for temperature to cool down, and follow specified procedures when performing these operations. Failure to do so can result in death or serious injury.

When pressurized air and/or pressurized water is used for cleaning, wear protective clothing, protective shoes, and eye protection. Eye protection includes goggles or a protective face shield.

Pressure can be trapped in a hydraulic system and must be relieved before maintenance is started.

Releasing trapped pressure can cause sudden machine movement or attachment movement. Use caution if you disconnect hydraulic lines or fittings.

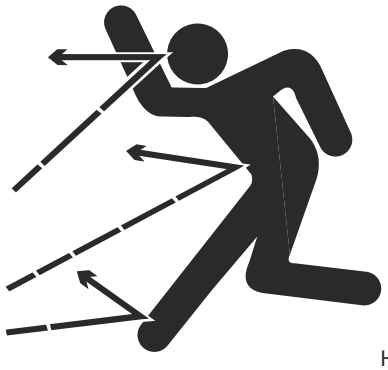
High-pressure oil that is released can cause a hose to whip or oil to spray. Fluid penetration can result in death or serious injury. If fluid enters skin or eyes, get immediate medical attention from a physician familiar with this injury.

Obey all local laws and regulations for disposal of liquids.

To prevent hot coolant from spraying out, stop engine and wait for coolant to cool. Using gloves, slowly loosen cap to relieve pressure.

Flying or Falling Objects

Figure 2



HAOA110L

On work sites where there is a potential hazard that flying or falling objects can hit operator's cabin, select and use a guard to match operating conditions for additional operator protection.

Working in mines, tunnels, deep pits, and loose or wet surfaces, could produce hazard of falling rocks or flying objects. Contact your distributor for information on available protective guards.

To prevent personnel from being struck by flying objects, keep personnel out of work area.

Figure 3

HAOA100L

Personal Protective Equipment (PPE)

Figure 4

HAOA020L

Do not wear loose clothing and accessories. Secure long hair. These items can snag on controls or on other parts of equipment.

Do not wear oily clothes. They are highly flammable.

Do not forget that some risks to your health may not be immediately apparent. Exhaust gases and noise pollution may not be visible, but these hazards can cause disabling or permanent injuries. Breathing masks and/or ear protection may be required.

Wear a hard hat, safety shoes, safety goggles, mask, leather gloves, earplugs and other protective equipment, as required.

While working on machine, never use inadequate tools. They could break or slip, or they may not adequately perform intended functions.

Correction of Machine Problems

If any machine problems are found during operation and maintenance (noise, vibration, smell, incorrect gauges, smoke, oil leakage, etc.), or if any abnormal warning alerts are displayed on display monitor, stop the machine and take the necessary corrective actions. Do not operate machine until problem has been corrected.

Crushing and Cutting

Figure 5

HDO1010L

Keep objects away from moving fan blades. Fan blades can throw and cut objects.

Do not use a wire rope that is kinked or frayed, or a wire rope with any loss of diameter. Wear leather gloves when handling a wire rope.

When striking a loose retainer pin, it can fly out and can cause a serious injury. Make sure that area is clear of personnel when striking a retainer pin. To avoid injury to your eyes, wear safety goggles when striking a retainer pin.

Do not put your hand, arm or any other part of your body between movable parts. If going between movable parts is necessary, always position and secure work equipment so it cannot move. Properly support equipment before performing any work or maintenance under raised equipment.

If control levers are operated, clearance between machine and work equipment will change and this may lead to serious damage or can result in death or serious injury. Stay clear of areas that may have a sudden change in clearance with machine movement or equipment movement. Stay clear of all rotating and moving parts. Unless instructed, never attempt adjustments while machine is moving or while engine is running.

Do not depend on hydraulic cylinders to support raised equipment. Equipment can fall if a control is moved, or if a hydraulic line breaks, is loosened or disconnected.

If it is necessary to remove guards to perform maintenance, always install guards after maintenance is completed.

Hot Coolant and Oils - Burn Prevention

Figure 6

FG019095

Do not touch any part of an operating engine. Immediately after operations are stopped, coolant, engine oil, and hydraulic oil are at their highest temperatures. The radiator and hydraulic tank are still under pressure. Always wait for temperature to cool down. Attempting to remove caps, drain oil or coolant, or replacing filters may lead to serious burns, if done when hot. Relieve all pressure in air system, hydraulic oil system, lubrication system, fuel system, and cooling system, before any lines, fittings or related items are disconnected.

To prevent hot oil or coolant from spraying out, stop engine, wait for oil and coolant to cool. Using gloves, slowly loosen cap to relieve pressure.

Figure 7

FG019096

Fire and Explosion Prevention

Figure 8

H D O 1 0

All fuels, most lubricants and some coolant mixtures are flammable and can cause a fire resulting in death or serious injury, and property damage. Flammable fluids that are leaking or spilled onto hot surfaces or onto electrical components can cause fire.

Inspect for and remove all flammable materials such as spilled fuel and oil, and debris from machine. Do not allow any flammable materials to accumulate on machine.

Always observe the following:

- Add fuel, oil, antifreeze and hydraulic fluid to machine only in a well ventilated area. Machine must be parked with controls, lights and switches turned "OFF". Engine must be "OFF" and any flames, glowing embers, auxiliary heating units or spark causing equipment must be extinguished, or turned "OFF" and kept well clear of machine.
- Dust that is generated from repairing or grinding nonmetallic hoods or nonmetallic fenders can be toxic, flammable and explosive. Repair these components in a well ventilated area away from flames or sparks and wear dust mask when grinding painted parts.
  Figure 9

FG018458

Maintenance

The machine and some attachments have components that are at high temperatures under normal operating conditions. The primary source of high temperatures are the engine and exhaust system. If damaged or incorrectly maintained, the electrical system can be a source of arcs or sparks.

Flammable debris (leaves, straw, etc.) must be removed regularly. If flammable debris is allowed to accumulate, it can cause a fire hazard. Clean machine often to avoid this accumulation. Flammable debris in an engine compartment is a potential fire hazard.

The operator's area, engine compartment and engine cooling system must be inspected every day and cleaned. This is necessary to prevent fire hazards and overheating.

Operation

Do not use machine where exhaust, arcs, sparks or hot components can contact flammable material, explosive dust or gases.

Do not operate machine near any flame.

Exhaust shields (if equipped) protect hot exhaust components from oil spray or fuel spray in case of a break in a line, hose, or seal. Exhaust shields must be correctly installed.

Electrical

Check all electrical wiring and connections for damage daily.

Keep battery terminals clean and tight. Repair or replace any damaged part or wires that are loose or frayed. Clean all electrical connections and tighten all electrical connections.

Never check battery charge by placing a metal object across terminal posts. Use a voltmeter or a hydrometer.

Battery gas can explode and can result in death or serious injury. Follow procedures in this manual for connecting battery and for jump-starting. Do not jump-start or charge a frozen or damaged battery. Keep any flames or sparks away from batteries. Do not smoke in battery charging area.

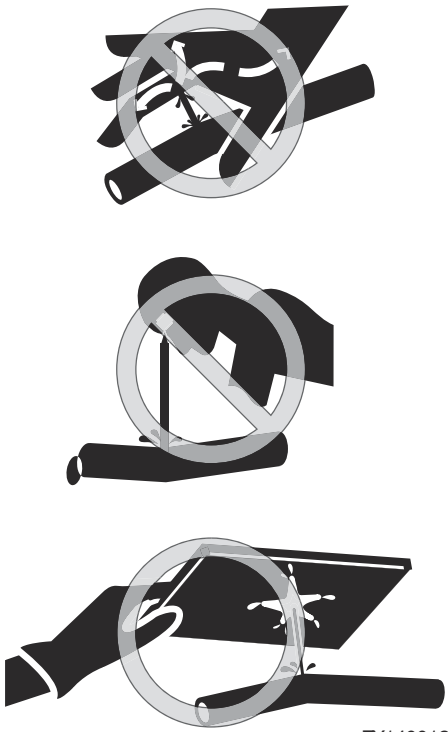
Improper jumper cable connections can cause an explosion that can result in death or serious injury. Refer to Operation and Maintenance Manual.

Do not charge a frozen battery. This can cause an explosion.

After market radios or other electric operated equipment in cabin must have a fuse in the electrical circuit.

Hydraulic System

Figure 10



EX1400129

Check hydraulic tubes, hoses and fittings for damage, wear or for leaks. Hydraulic lines and hoses must be properly routed and have adequate support and secure clamps. Leaks can cause fires. Never use a flame or bare skin to check for leaks.

Tighten or replace any parts that show leakage.

Check that all hose and tube clamps, guards, and cushions are securely attached. If they are loose, they can vibrate during operation and rub against other parts. This can cause damage to hoses and cause high-pressure oil to spray on hot surfaces, causing a fire and death or serious injury.

Always clean fluid spills. Do not use gasoline or diesel fuel for cleaning parts. Use commercial nonflammable solvents.

Fueling

Figure 11

EX1400130

Use caution when you are refueling a machine.

Fuel is flammable and can catch fire if it is brought close to a flame.

Stop engine and let it cool before adding fuel. Do not smoke while you are refueling a machine. Do not refuel a machine near flames or sparks. Fill fuel tank outdoors.

Keep fuel and other fluid reservoir caps tight and do not start engine until caps have been secured.

Store fuels and lubricants in properly marked containers away from unauthorized personnel. Store oily rags and any flammable materials in protective containers.

Static electricity can produce dangerous sparks at fuel filling nozzle. In very cold, dry weather or other conditions that could produce a static discharge, keep tip of fuel nozzle in constant contact with neck of fuel filling nozzle, to provide a ground.

Always place plastic fuel containers on the ground before filling.

Never Use Ether Starting Aids

Figure 12

FG018458

Do not use ether or starting fluids on any engine that has glow plugs, or an electric grid type manifold heater. These starting aids can cause an explosion and result in death or serious injury.

Use procedures in this manual for connecting battery and for jump-starting.

Welding and Grinding

Always clean machine and attachment, set battery disconnect switch to "OFF" position, and disconnect wiring from electronic controllers before welding. Cover rubber hoses, battery and all other flammable parts. Keep a fire extinguisher near machine when welding.

Toxic dust or gas can be produced when grinding or welding painted parts. Grinding or welding painted parts must be done in a well ventilated area. Wear dust mask when grinding painted parts.

Dust generated from repairing nonmetallic parts such as hoods, fenders or covers can be flammable or explosive.

Repair such components in a well ventilated area away from flames or sparks.

Do not weld on lines or on tanks that contain flammable fluids. Do not flame cut lines or tanks that contain flammable fluid. Clean any such lines or tanks thoroughly with a nonflammable solvent before welding or flame cutting.

If a Fire Occurs

Figure 13

FG018459

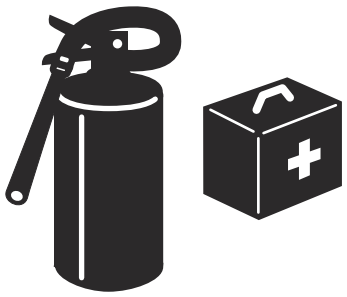
If a fire occurs:

- Do not attempt to move machine or continue operations.
- Turn starter switch to "O" (OFF) position to stop engine.
- Use handrails, guardrails and steps to get off machine.
- Immediately call for help or fire station.
- When using a fire extinguisher, always aim extinguisher at base of fire.
- If an optional fire extinguishing system is in place, be familiar with its operating procedures.

NOTE: *Depending on job conditions, other procedures could be necessary if a fire occurs.*

Fire Extinguisher and First-aid Kit (Emergency Medical Kit)

Figure 14



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To be prepared in the event of a fire:

- Make sure fire extinguishers are always available and read labels to know how to use them. It is recommended that an appropriately sized (2.27 kg [5 lb) or larger) multipurpose A/B/C fire extinguisher be mounted in cabin. Check and service fire extinguisher at regular intervals and make sure that all work site crew members are adequately trained in its use.
- Inspect fire extinguisher and service fire extinguisher regularly.
- Follow instructions on extinguisher instruction plate.
- Keep a first aid kit in storage compartment and keep another kit at work site. Check kit periodically and keep it properly supplied.
- Keep emergency numbers for doctor, ambulance service, hospital and fire department readily available.

Electrical System and Electrical Shock

Never short across starter terminals or across batteries. Shorting could damage electrical system and engine neutral start system.

When engine is running or immediately after it has stopped, high voltage is generated at injector terminal and inside engine controller, so there is a potential for an electrical shock. Never touch injector terminal or inside of engine controller.

NOTE: *If it is necessary to touch injector terminal or inside engine controller, contact your distributor.*

Roll-over Protective Structure (ROPS)

The operator's cabin is a ROPS certified structure for protecting the seat-belted operator. It absorbs the impact energy of a roll-over impact. Do not allow machine weight (mass) to exceed certified

value on certification plate. If weight is exceeded, the ROPS structure will not be able to fulfill its safety function.

Do not increase machine weight beyond certified value by modifying machine or by installing attachments on machine. If weight limit of protective equipment is exceeded, protective equipment will not be able to protect operator, and this can result in death or serious injury. Always observe the following:

- This machine is equipped with a protective structure. Do not remove protective structure and perform operations without it.
- Never modify the operator's cabin by welding, grinding, drilling holes or adding attachments without the dealer's approval. Changes to the cabin can cause loss of operator protection from roll-over and falling objects, and result in death or serious injury.
- When protective structure is damaged or deformed by falling objects or by rolling over, its strength will be reduced and it will not be able to adequately protect the operator. Contact your distributor if you have any questions about the ROPS. Never repair a damaged ROPS cabin.
- Always wear your seat belt when operating machine.

ROPS Certification

This HD HYUNDAI CONSTRUCTION EQUIPMENT dozer has an operator's cabin that meets ROPS requirements. The seat belt must be worn for roll-over protection.

The ROPS certification plate is found on the left side of the cabin on most models. It may vary slightly in its location on some models.

Check the ROPS cabin, mounting, and hardware for damage.

Never modify the ROPS cabin. Replace the cabin and hardware if damaged. See your HD HYUNDAI CONSTRUCTION EQUIPMENT distributor for parts.

ROPS – Roll-over Protective Structure complies with

ISO 12117-2:2008, EN13531:2001.

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Never modify the operator cabin by welding, grinding, drilling holes or adding attachments unless instructed in writing by HD HYUNDAI CONSTRUCTION EQUIPMENT. Changes to the cabin can cause loss of operator protection from rollover and falling objects, and can result in death or serious injury.

Long Term Storage

When a machine is taken out of service and stored for a time exceeding 30 days, steps must be taken to protect the machine. Leaving equipment outdoors exposed to the elements will shorten its life.

An enclosure will protect the machine from rapid temperature changes and lessen the amount of condensation that forms in hydraulic components, engine, fuel tank, etc. If it is not possible to put the machine in an enclosure, cover it with a tarpaulin.

Check that storage site is not subject to flooding or other natural disasters.

After the machine has been positioned for storage and the engine stopped, perform the following operations:

Before Storage

Keep the dozer in the position shown in #id20CLGOTD0UI/id20CSB100C5Z to prevent rust of the hydraulic piston rods.

- Inspect for damaged, loose or missing parts.
- Repaint necessary areas to prevent oxidation.
- Wash and clean all parts of machine.
- Store the machine in an indoor, stable place. If stored outside, cover with a waterproof tarp.
- Perform lubrication procedures on all grease points.
- Apply a coating of light oil to the exposed plated metal surfaces (such as hydraulic cylinder rods, etc.) and to all the control linkage and control cylinders. (Control valve spools, etc.)
- Remove battery from the dozer to be fully charged and stored.
- Inspect the coolant recovery tank and radiator to make sure the antifreeze level in the system is correct. Make sure that antifreeze concentration is enough for the lowest temperature anticipated during storage.
- Seal all external openings (i.e. engine exhaust outlet, crankcase and hydraulic breather, fuel vent line, etc.) with tape wide enough to cover the opening, regardless of size.

  NOTE: *When sealing with tape, be sure to extend tape approximately one inch (25 mm) beyond opening to insure a good seal.*

  NOTE: *Keep in mind that theft and burglary risk can be minimized by:*

  - Removing starter key when the machine is left unattended.
  - Locking doors and covers after working hours.
  - Turning off electrical current with battery disconnect switch.
  - Park machine where risk of theft, burglary and damage is minimized.
  - Removing valuables from cabin such as cellular phone, computer, radio and bags.

During Storage

- Once a month, start the engine and follow the “Hydraulic Oil Warm-up” procedures listed in this manual.
- Operate hydraulic functions for traveling, swing and digging two or three times for lubrication after “Hydraulic Oil Warm-up”. Coat all the moving parts and surfaces of the components with a new oil film after operating. At the same time, charge the battery. Rotate track to prevent track seizing”.
- Every 90 days, use a hydrometer to measure the protection of the coolant. Refer to the antifreeze/coolant protection chart to determine protection of the cooling system. Add coolant as required.

After Storage

- Before operating the work equipment, remove all grease from the hydraulic cylinder rods.
- Add grease and oil at all lubrication points.
- Adjust fan and alternator belt tension.
- Connect the charged battery.
- Check condition of all hoses and connections.
- Check the levels of engine oil, fuel, coolant and hydraulic circuit oil. If there is water in the oil, change all the oil.
- Change all filters.

- Inspect for signs of nests. (i.e. birds, rodents, etc.)
- When starting the engine after long-term storage, follow the “Hydraulic Oil Warm-up” procedures listed in this manual.

Maintenance

Improper operation and maintenance can result in death or serious injury. Read manual and safety decals before operating or maintaining the machine. Follow all instructions and safety messages.

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

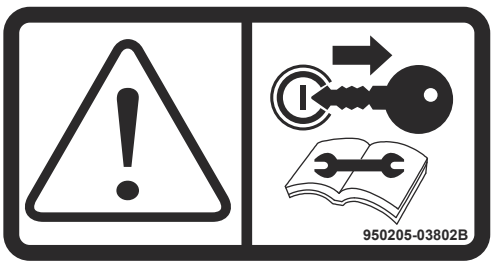
Follow instructions before operating or servicing machine. Read and understand the Operation & Maintenance Manual and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments, repairs or service. Untrained operators and failure to follow instructions can result in death or serious injury.

- Never service equipment without instructions.
- Always lower bucket and blade to ground before doing any maintenance.
- Use correct procedure to lift and support dozer.
- Cleaning and maintenance are required daily.
- Welding or grinding painted parts must be done in well ventilated areas.
- Wear a dust mask when grinding painted parts. Toxic dust and gas can be produced.
- Vent exhaust to outside when engine must be running for service.
- Exhaust system must be tightly sealed. Exhaust fumes are hazardous and can cause death or serious injury.
- Stop and allow engine to cool and clean engine of flammable materials before checking fluids.
- Never service or adjust machine with engine running unless instructed to do so in this manual.
- Avoid contact with leaking hydraulic fluid or diesel fuel under pressure. It can penetrate skin or eyes.
- Never fill fuel tank while engine running, while smoking, or when near open flame.
- Keep body, jewelry and clothing away from moving parts, electrical contact, hot parts and exhaust.
- Wear eye protection to guard from battery acid, compressed springs, fluids under pressure and flying debris when engines are running or tools are used. Use eye protection approved for welding.
- Lead-acid batteries produce flammable and explosive gases.
- Keep arcs, sparks, flames and lighted tobacco away from batteries.
- Batteries contain acid which burns eyes or skin on contact.
- Wear protective clothing. If acid contacts body, flush well with water. For eye contact flush well and get immediate medical attention from a physician familiar with this injury.
- The maintenance procedures which are given in this manual can be performed by the owner or operator without any specific technical training. Maintenance procedures which are not in this manual must be performed ONLY BY QUALIFIED SERVICE PERSONNEL. Always use genuine genuine parts.

- Only authorized personnel should service and repair the machine. Do not allow unauthorized personnel into work area.
- Lower work equipment and stop engine before performing maintenance.
- Park machine on firm and level ground.
- Turn starter switch to "ON' position and keep safety lever in "UNLOCK" position. Cycle work levers (joysticks) back and forth, left and right at full stroke 2 to 3 times to eliminate remaining internal pressure in hydraulic circuit. Then move safety lever to "LOCK" position.
- Check that battery relay is "OFF" and main power is shut off. (Wait for approximately one minute after turning "OFF" engine starter switch key and press horn switch. If horn does not sound, the main power is shut off.)
- Put blocks under track to prevent the machine from moving.
- To prevent injury, do not perform maintenance with engine running. If maintenance must be done with engine running, perform maintenance with at least two workers and do the following:
  - One worker must always sit in the operator's seat and be ready to stop engine at any time. All workers must maintain contact with other workers.
  - When maintenance operations are near fan, fan belt, or other rotating parts, there is a potential hazard of being caught in rotating parts. Keep hands and tools away.
- Never drop or insert tools or other objects into rotating fan or fan belt. Parts can break off and hit someone.
- Do not touch any control levers or control pedals. If any control levers or control pedals must be operated, always give a signal to other workers and instruct them to move away.
- When performing maintenance of engine and you are exposed to engine noise for long periods of time, wear hearing protection while working.
- If noise from the machine is too loud, it can cause temporary or permanent hearing problems.
- Do not smoke when you service an air conditioner or if refrigerant gas is present.
- Inhaling fumes either from a flame or gas from a cigarette that has contacted air conditioner refrigerant can cause death or serious injury.
- Never put maintenance fluids into glass containers. Drain all liquids into a suitable containers.
- Unless instructed otherwise, perform maintenance with equipment in servicing position. Refer to this manual for procedure for placing equipment in servicing position.

Warning Tag

Figure 15



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Alert others that service or maintenance is being performed by attaching a "DO NOT OPERATE" warning tag to the operator's cabin controls – and other machine areas, if required. Use of a chain or cable to keep the safety lever in the fully lowered "LOCK" position, complies with OSHA's lockout requirements.

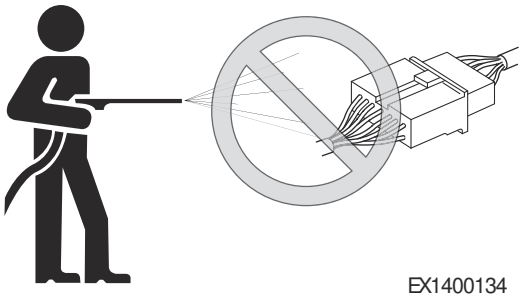
"DO NOT OPERATE" warning tags, are available from your distributor.

- Always attach "DO NOT OPERATE" warning tag to work equipment control lever in the operator's cabin to alert others that you are performing service or maintenance on the machine. Attach additional warning tags on the machine, if necessary.
- Keep warning tags in tool box while it is not used. If there is not tool box or in the owner manual storage pocket.
- If any other person starts engine, and operates control levers or control pedals while you are performing service or maintenance, it can result in death or serious injury.

Attach a "DO NOT OPERATE" warning tag to starter switch or to controls before servicing or repairing equipment. Warning tags are available from your distributor.

Cleaning

Figure 16



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Clean machine before performing inspection and maintenance.

If inspection and maintenance are done when machine is dirty, it will become more difficult to locate problems, and you could slip on steps and work platform areas and injure yourself.

When washing machine, do the following:

- Wear shoes with nonslip soles to prevent slipping and falling.
- Wear safety goggles and protective clothing when washing machine with high-pressure steam or water.
- Do not spray water directly on electrical components (sensors, connectors). If water gets into electrical system, it can cause operation problems.
- Pick up any tools or hammers that are laying in workplace. Wipe up any grease or oil to prevent slippery substances, that can cause tripping or slipping.
- When cleaning cabin top window which is made of polycarbonate material, use tap water. Avoid use of organic solvents for cleaning, such as benzene, toluene or methanol. These solvents can cause a chemical reaction that will dissolve and damage the window.

Proper Tools and Clothing

Only use tools that are intended for the type of service to be done. Metal pieces from low quality or damaged tools, such as chisels or hammers, can break off and hit a service person in the eyes or face causing serious injury.

Disassembling Precautions

When using a hammer to remove pins, pins can fly out or metal particles may break off. Always do the following:

- Hitting hard metal pins, bucket teeth, cutting edges or bearings with a hammer, can cause metal pieces to break or fly off resulting in serious injury. Always wear safety goggles and leather gloves. Keep other personnel away.

Use of Lighting

When checking fuel, oil, battery electrolyte, window washer fluid, or coolant, always use proper lighting equipment to prevent arcs or sparks that could cause a fire or explosion resulting in death or serious injury.

Fire and Explosion Prevention

Figure 17

HDO1C

Fuels, most lubricants and some coolant mixtures are flammable. Flammable fluids that are leaking or spilled onto hot surfaces or onto electrical components can cause a fire resulting in property damage or death or serious injury.

Store all fuels and all lubricants in properly marked and approved containers and keep away from all unauthorized personnel.

Store oily rags and other flammable material in a protective container.

Tighten all fuel and oil caps.

Figure 18

FG018458

Do not smoke while you refuel machine or while you are in a refueling area.

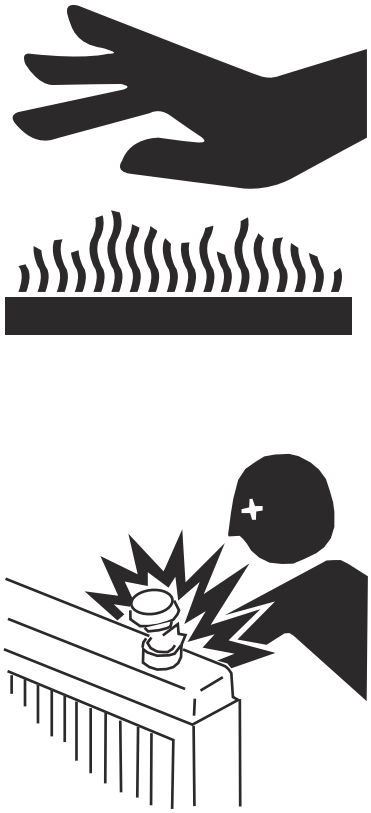
Do not smoke in battery charging areas or in areas that contain flammable material.

Clean all electrical connections and tighten all electrical connections. Check electrical wires daily for wires that are loose or frayed. Tighten all loose, and repair or replace all frayed, electrical wires before operating machine.

Remove all flammable materials and debris from the engine compartment, exhaust system components and hydraulic lines.

Burn Prevention

Figure 19



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When checking radiator coolant level, stop engine, let engine and radiator cool down, then check coolant recovery tank. If coolant level in coolant recovery tank is near upper limit, there is enough coolant in radiator.

Using gloves, loosen radiator cap slowly to release internal pressure before removing radiator cap.

If coolant level in coolant recovery tank is below lower limit, add coolant.

Cooling system conditioner contains alkali which can cause personal injury. Do not allow alkali to contact skin, eyes, or mouth.

Allow cooling system components to cool before draining cooling system.

Hot oil and hot components can cause personal injury. Do not allow hot oil or hot components to contact skin.

Vent hydraulic tank only after engine has been stopped and hydraulic tank is cool. Using gloves, slowly tilt hydraulic tank air breather to relieve pressure.

Relieve all pressure in hydraulic oil system, in fuel system, or in cooling system before disconnecting any lines, hoses, fittings, or related components.

Batteries give off flammable fumes that can explode and start a fire.

Do not smoke while you are checking battery electrolyte level.

Electrolyte is an acid. Electrolyte can cause personal injury. Do not allow electrolyte to contact skin or eyes.

Always wear safety goggles and face protection when working with batteries.

Rubber That Contains Fluorides

Observe extra great care when it is suspected that you may have to handle rubber that contains fluorides.

Certain seals which have to withstand high operating temperatures (e.g. in engines, transmissions, axles, hydraulic motors and pumps) may be made from rubber that contains fluorides, which, when exposed to high heat (fire), forms hydrogen fluoride and hydrofluoric acid. This acid is very corrosive and cannot be rinsed or washed off from the skin. It causes very severe burns which take a long time to heal.

It usually means that damaged tissue must be surgically removed. Several hours may pass after contact with the acid, before any symptoms appear and therefore one is not given any immediate warning. The acid may remain on the machine parts for several years after a fire.

If swelling, redness or a stinging feeling appears and one suspects that cause may be contact with heated rubber that contains fluorides, contact a medical doctor immediately. If a machine, or part of a machine, has been exposed to fire or severe heat, it must be handled by specially trained personnel. In all handling of machines after a fire, thick rubber gloves and protective goggles must be used.

The area around a part which has been very hot and which may be made of rubber that contains fluorides must be decontaminated by thorough and ample washing with lime water (a solution or suspension of calcium hydroxide, i.e. slaked lime in water). After the work has been completed, the gloves must be washed in lime water and then discarded.

Rubber and Plastics

Polymer materials when heated, can form compounds that create a health hazard and can harm the environment. Scrapped rubber and plastics must never be burned. Extra precautions must be taken when servicing machines that have been in a fire or exposed to extreme heat.

If gas cutting or welding is to be done near such materials, the following safety instructions must be followed:

- Protect the material from heat.
- Use protective gloves, protective goggles and an approved respirator.

Waste Hazardous to the Environment

Painted parts or parts made of plastic or rubber which are to be scrapped must never be burned, but must be taken care of by an approved refuse handling plant.

Batteries, plastic objects and anything else which is suspected of being dangerous to the environment must be taken care of in an environmentally safe way.

Check List After Fire

When handling a machine which has been damaged by fire or been exposed to intense heat, the following protective measures must under all circumstances be followed:

Use thick, gloves made of rubber and wear goggles which are certain to protect your eyes.

Never touch burned components with your bare hands, as there is a risk that you may come into contact with melted polymer materials. First wash thoroughly with plenty of lime water (a solution or suspension of calcium hydroxide, i.e. slaked lime in water).

As a precaution, seals (O-rings and other oil seals) should always be handled as if they were made of rubber that contains fluorides.

Treat skin, which is suspected of having touched burned rubber that contains fluorides, with Hydrofluoric Acid Burn Jelly or something similar. Seek medical advice. Symptom may not appear until several hours afterwards.

Discard gloves, rags etc. which are suspected of having touched burned rubber that contains fluorides.

Welding Repairs

NOTICE

When disconnecting or connecting connectors between ECU and engine, or connector between ECU and the machine, always disconnect the battery to prevent damage to ECU.
If you do not follow this procedure, the ECU will be damaged and/or the engine will not operate properly.

NOTE: *Disconnect battery only when LED light is OFF after engine is turned OFF.*

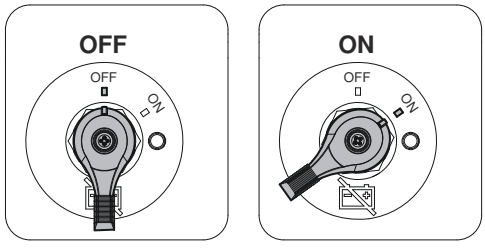
When performing welding repairs, perform welding in a properly equipped place.Repairs must be performed by a qualified welder. Welding operations, can create potential hazards, including generation of gas, fire, or electric shock. Never let an unqualified welder do welding.

A qualified welder must do the following:

- To prevent battery explosion, turn battery disconnect switch to "OFF" position.
- Disconnect the connector between ECU and machine, and the connector between ECU and engine.
- Disconnect the negative (-) cable of battery.
- To prevent generation of gas, remove paint from location of the weld.
- If hydraulic equipment, piping or component ports close to them are heated, a flammable gas or mist could result in an explosion or fire. To prevent this, protect and insulate components from excessive heat.
- Do not weld on pipes or on tubes that contain flammable fluids. Do not flame cut pipes or tubes that contain flammable fluids. Before welding on pipes or tubes, or before flaming cut pipes or tubes, clean them thoroughly with a nonflammable solvent. Make sure pressure inside pipes or tubes does not cause a rupture of the component parts.
- If heat is applied directly to rubber hoses or piping under pressure, they may suddenly break, so cover and insulate them with a fireproof covering.
- Wear protective clothing.
- Make sure there is good ventilation.
- Remove all flammable objects and make sure a fire extinguisher is available.

Preparation for Electrical Welding On Body Structure

Figure 20



EX1500481

To prevent damage to ECU by electrical welding, observe the following procedures:

1. Turn battery disconnect switch to "OFF" position.
2. Disconnect the connector between ECU and machine, and the connector between ECU and engine.

3. Disconnect the negative (-) cable of battery.
4. Proceed with welding.
5. After welding, connect the connector between ECU and machine, and the connector between ECU and engine.
6. Connect the negative (-) cable of battery.
7. Clean battery compartment.
8. Turn battery disconnect switch to "ON" position.
9. Close battery compartment door.

Lock Inspection Covers

When performing maintenance with inspection cover open, use lock bar to secure cover and prevent accidental lowering of the cover caused by wind or movement of the machine.

Working on Machine

Figure 21

ARO1380L

When performing maintenance operations on machine, prevent tripping and falling by keeping area around your feet clean and free of objects and debris. Always do the following:

- Do not spill oil or grease.
- Do not leave tools laying around.
- Watch your step when walking.
- Never jump down from machine. When getting on or off machine, use steps and handrails, and maintain a three-point contact (both feet and one hand or both hands and one foot) to support yourself.
- If job requires it, wear protective clothing.
- To prevent injury from slipping or falling, when working on hood or covers, never stand or walk on areas except areas equipped with nonslip pads.
- If it is necessary to work under raised equipment or the machine, support work equipment and machine securely with blocks and stands strong enough to support weight of work equipment and machine.
- Do not work under the machine if track shoes are lifted off ground and the machine is supported only with work equipment. If any control levers are moved, or there is damage to hydraulic system, work equipment or the machine will suddenly drop causing death or serious injury.

Accumulator

Figure 22

EX1400135

The pilot control system is equipped with an accumulator. For a short period of time after engine has been stopped, accumulator will store a pressure charge that allow hydraulic controls to be activated. Activation of any controls will allow selected functions to operate under force of gravity.

When performing maintenance on pilot control system, release hydraulic pressure in system as described in Operation and Maintenance Manual.

The accumulator is charged with high-pressure nitrogen gas. If it is improperly handled it can explode causing death or serious injury. Always observe the following precautions:

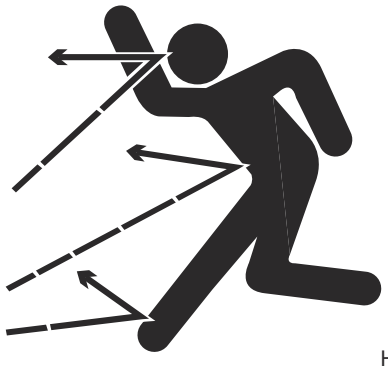
- Do not drill or punch holes in accumulator or expose it to any flames, fire or external heat source.
- Do not weld on accumulator.
- When performing disassembly or maintenance of accumulator, or when disposing of accumulator, charged nitrogen gas must be properly released. Contact your distributor for assistance.
- Wear safety goggles and leather gloves when working on an accumulator. Hydraulic oil under pressure can penetrate skin and result in death or serious injury. If fluid enters skin or eyes, get immediate medical attention from a physician familiar with this injury.

Compressed Air

- When cleaning filters, radiator or other components with compressed air, there is a hazard of flying particles that can result in serious injury.
- Always wear safety goggles, dust mask, leather gloves, and other protective devices.

Track Tension Adjustments

Figure 23



HAOA110L

Track adjusting systems use grease under high-pressure to keep track under tension. Grease under high-pressure can penetrate body and result in death or serious injury. Watch track or track spring to see if track is being loosened.

NEVER LOOSEN track tension grease valve. To release pressure from crawler frame track tension assembly, you should NEVER attempt to disassemble track adjuster or attempt to remove track tension grease valve assembly.

Keep your face and body away from grease valve. Refer to Operation or Shop Manual.

Supports and Blocking for Work Equipment

Figure 24

HDO1042L

Do not allow weight or equipment loads to remain suspended and unsupported.

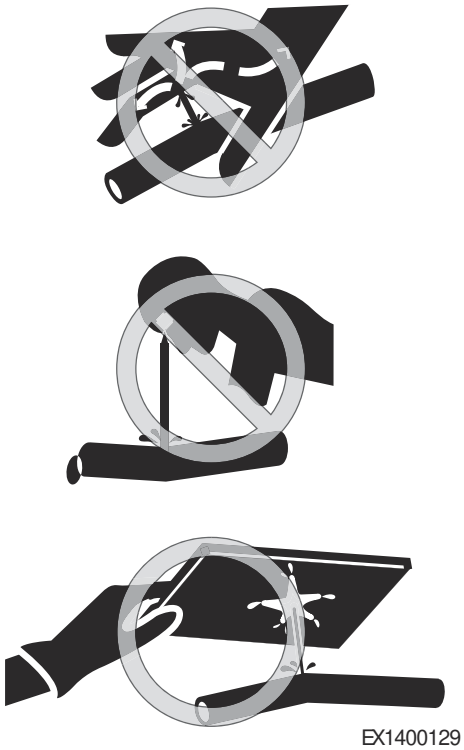
Lower work group to ground before leaving operator's seat.

Do not use hollow, cracked or unsteady wobbling supports.

Do not work under any equipment supported only by a lifting jack.

High-pressure Lines, Tubes and Hoses

Figure 25



EX1400129

When inspecting or replacing high-pressure piping or hoses, check to verify that pressure has been released from circuit. Failure to release pressure can result in death or serious injury. Release pressure as described in Operation and Maintenance Manual. Always do the following:

- Wear eye protection and leather gloves.
- Fluid leaks from hydraulic hoses or pressurized components can be difficult to see but has enough force to pierce skin and can result in death or serious injury. Always use a piece of wood or cardboard to check for suspected hydraulic leaks. Never use your hands or expose your fingers. Wear safety goggles.
- Do not bend high-pressure lines. Do not strike high-pressure lines. Do not install lines, tubes or hoses that are bent or damaged.
- Make sure that all clamps, guards and heat shields are correctly installed to prevent vibration, rubbing against other parts, and excessive heat during operation.
- Replace hose or components if any of the following problems are found:
  - Damage or leakage from hose end fitting.
  - Wear, damage, cutting of hose covering, or wire braiding is exposed on any hose.
  - Cover portion is swollen in any section.
  - The hose is twisted or crushed.
  - Foreign material is embedded in hose covering.
  - Hose end is deformed.
  - Connection fittings are damaged or leaking.

NOTE: *Refer to Operation and Maintenance Manual, for additional European regulations.*

High-pressure is generated inside engine fuel lines when engine is running. Before performing inspection or maintenance of fuel line system, wait for at least thirty seconds after stopping engine to let internal pressure drop and tip breather cap up to release residual pressure.

Oil or fuel leaks from high-pressure hoses can cause fire or improper operation, which can result in death or serious injury. If any loose bolts are found, stop work and tighten to specified torque. If any damaged hoses are found, stop operations immediately and contact your distributor for replacement parts.

Battery

Battery Hazard Prevention

Figure 26

EX1400136

Battery electrolyte contains diluted sulfuric acid and generates hydrogen gas. Hydrogen gas is highly explosive, and improper handling can cause death or serious injury, or fire. Always observe the following precautions.

- Do not smoke or bring any flame near battery.
- When cleaning top surface of battery, wipe it with a clean, damp cloth. Never use gasoline, thinner, or any other organic solvent or detergent.
- Tighten battery caps.
- If battery electrolyte is frozen, do not charge battery or start engine with power from another source. This could cause the battery to explode and start a fire.
- When charging battery or starting with power from another source, let battery electrolyte thaw and check that there is no leakage of battery electrolyte before starting operation.
- Always remove battery from machine before charging.
- Before maintaining or working with batteries, turn starter switch to "O" (OFF) position.

Since there is a potential hazard that sparks could be generated, always do the following:

- Do not let tools, rings or other metal objects make any contact between battery terminals. Do not leave tools or other metal objects lying near battery.
- When disconnecting battery terminals, wait for approximately one minute after turning engine starter switch key to "O" (OFF) position, and be sure to disconnect grounding terminal; negative (-) terminal first. Conversely, when connecting them, begin with positive (+) terminal and then grounding (-) terminal, Make sure that all terminals are connected securely.
- Flammable hydrogen gas is generated when battery is charged. Remove battery from machine, take it to a well ventilated place, and remove battery caps, before charging it.
- After charging, tighten battery caps securely.
- After charging, secure battery back in machine.

When repairing or welding electrical system, wait for approximately one minute after turning engine starter switch key "OFF". Then disconnect negative (-) terminal of battery to stop flow of electricity.

Environment and Circumstances

Work Site Areas Requiring Extra Caution

- Do not operate too close to edge of a quay, ramp, etc.
- Do not operate too close to edge of a steep slope or drop-off. Take care when working in a place where machine may tip over.
- Do not operate on soft ground or near riverbanks that could collapse or where ground may not support weight of dozer.
- Observe changes in ground and traction conditions after a rain or other changes in weather.

Digging Under an Overhang

Do not dig work face under an overhang. This can cause overhang to collapse and fall on top of the machine.

- Do not perform overhead demolition work. This can cause broken objects and debris to fall on top of machine causing death or serious injury, or property damage.

Deep Digging

Do not perform deep digging under front of machine. The ground under machine may collapse and cause machine to fall resulting in death or serious injury.

Working heavy loads on loose, soft or uneven ground, can cause side load conditions resulting in a tip over and injury. Traveling without a load or a balanced load may also be hazardous.

Never rely on lift jacks or other inadequate supports when work is being done. Block tracks fore and aft to prevent any movement.

Use machine only for its intended purpose. Using it for other purposes will cause failures.

- Do not perform demolition work under machine. There is a hazard that the machine may become unstable and tip over.
- When working on or from top of buildings or other structures, check if structure can support weight of machine and attachment. If a building structure collapses, this can cause death or serious injury.

Drop-off or Edge

When working at edge of an excavation or near a drop-off, the machine could tip over, which can result in death or serious injury. Always fasten your seat belt. Check ground conditions of work site before operating to prevent the machine from falling or roll-over, and to prevent ground, stockpiles, or banks from collapsing.

Do not travel too close to edge of a drop-off.

Poor Visibility

For good visibility, always do the following:

- When working in dark areas, attach working lights and front lights to the machine. If necessary, set up additional lighting at work site.
- Stop operations when visibility is poor, such as in fog, mist, snow, and rain. Wait for visibility to improve before starting operation.

To avoid hitting work equipment and damaging other property, always do the following:

- When working in tunnels, on bridges, under electrical wires, or when parking the machine or performing other operations in places with limited height, be careful not to hit and damage other equipment or property.
- To prevent hitting objects, operate machine at a slow speed when working in confined spaces, indoors, or in crowded areas.
- Do not swing bucket over the top of personnel or over operator's cabin of dump truck.

Loose or Soft Ground

Do not operate on soft ground or near edge of drop-offs, overhangs, and deep ditches. The ground can collapse because of the weight of the machine causing the machine to fall or roll-over.

Check ground conditions before beginning work with the machine. If ground is soft, reposition the machine before operating.

The excavated material must not be dumped too close to edge. How far away from edge of trench excavated material must be dumped depends on soil type and moisture content. If loose clay is being excavated, place it at least 5 m (16 ft) away from edge.

If excavated material is dumped too close to edge, its weight can cause a landslide.

Thawing of frozen ground, rain, traffic, piling and blasting are other factors which increase risk of landslide. The risk also increases on sloping ground. If it is not possible to dig a trench and adequately slope its sides, always install shoring equipment.

Loose ground may easily give way under weight of the machine.

When working on loose or unstable ground, it is important not to dig too deep and to carefully reposition the machine. Do not panic and do not raise bucket, if ground should begin to collapse. Lower work equipment to improve stability of machine.

Never dig under machine, if there is a potential of causing a landslide.

High-voltage Cables

Do not travel or operate machine near electrical cables or overhead power lines. There is a hazard of electric shock, which can cause property damage and result in death or serious injury. The bucket or other attachment does not have to make physical contact with power lines for current to cause an electrocution.

Use a spotter and hand signals to stay away from power lines not clearly visible to operator. On work sites where machine may operate close to electrical cables, always do the following:

- Remember that electrical voltage determines what the minimum distance is to stay away from the power line. See the following table for minimum distances when working near electrical power lines. Electrical flash over can occur and damage machine and cause death or serious injury.

Voltage	Minimum Distance
6.6 kV	3 m (9' 10")
33.0 kV	4 m (13' 1")

Voltage	Minimum Distance
66.0 kV	5 m (16' 5")
154.0 kV	8 m (26' 3")
275.0 kV	10 m (32' 10")

- Always contact the power company responsible before beginning work near high voltage power lines.

Underground Operation

If excavation is in an underground location or in a building, make sure there is adequate overhead clearance, and adequate ventilation.

Special equipment and engines may be required in some countries. Contact your distributor for more information.

Check that there is sufficient room for machine and load.

Move slowly.

Make sure that authorities or companies responsible for underground cables, utilities, and electrical lines have been contacted and that their instructions are followed. Also check which rules apply to ground personnel regarding exposing cables, utilities and electrical lines.

Consider all electrical cables as live.

Working in Water

NOTICE

Do not exceed maximum permissible water depth. The water level must not reach higher than centerline of upper track roller(s) (1).

After working in water, lubricate all lubrication points on undercarriage, which have been underwater so water is removed. Check that no water has entered travel gearboxes and undercarriage components.

Working in Contaminated Environment

When working within area which is contaminated or where there is a health risk, check local regulations and contact your distributor for assistance with identifying what additional safety precautions need to be taken.

Operation in Extreme Conditions

Operation In Extreme Cold

In extremely cold weather, avoid sudden travel movements and stay away from even slight slopes. The machine could slide down the slope.

Snow accumulation could hide potential hazards and slippery surfaces.

Warming up engine for a short period may be necessary to avoid operating with sluggish or reduced working capacity. The jolting shocks and impact loads caused by bumping or bottoming boom or attachment could cause severe stress in very cold temperatures. Reducing work cycle rate and workload may be necessary.

If machine is to be operated in extremely cold weather temperatures, certain precautions must be taken. The following paragraphs detail checks to be made to be certain machine is capable of operating at these temperatures.

1. Keep batteries fully charged to prevent freezing. If distilled water is added to batteries, run engine at least one hour to mix electrolyte solution. When temperature drops below -10°C, efficacy of the battery is reduced accordingly. Insulation of the battery prevents reduction of efficacy, and supports improvement of starting power of the starter.

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Explosion of the battery can cause death or serious injury.Never attempt to directly heat the battery with open fire.

2. Keep engine in good mechanical condition for easy starting and good performance during adverse weather.
3. Use engine oil with proper specifications for expected temperatures. Refer to Operation and Shop Manual for details.
4. Always keep the fuel tank fully filled after completion of the operation. Always drain water from the fuel tank before and after the operation. In addition, check the water separator, and drain it if required. The fuel filter, if frozen, may interrupt the flow of fuel. Periodically remove water from the fuel tank, drain water from the filter, and replace the filter upon regular basis. To prevent fuel from being clogged because of formation of wax in fuel, make sure that wax formation point of fuel is lower than atmospheric temperature.

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Explosion of the battery can cause death or serious injury.Never attempt to directly heat the battery with open fire.

5. Lubricate entire machine according to Operation and Maintenance Manual or lubrication chart on machine.
6. Start engine and allow it to reach normal operating temperature before operating.
   - If mud and ice collects and freezes on any of moving parts while machine is idle, apply heat to thaw frozen material before attempting to operate machine.
   - Operate hydraulic units with care until they have reached a temperature which enable them to operate normally.
   - Check all machine controls and functions to be sure they are operating correctly.
7. An extra outer air filter must be kept in operator's cabin to replace element that could become iced and cause restricted airflow to engine.
8. Clean off all mud, snow and ice to prevent freezing. Cover machine with a tarp if possible, keep ends of tarp from freezing to ground.

Operation in Extreme Heat

Continuous operation of machine in high temperatures can cause machine to overheat. Monitor engine and hydraulic system temperatures and stop machine to let it cool, when necessary.

1. Make frequent inspections and services of fan and radiator. Check coolant level in radiator. Check grilles and radiator fins for accumulation of dirt, debris and insects which could block cooling passages.

- Formation of scale and rust in cooling system occurs more rapidly in extremely high temperatures. Change antifreeze each year to keep corrosion inhibitor at full strength.
- If necessary, flush cooling system periodically to keep passages clear. Avoid use of water with a high alkali content which increases scale and rust formation.

2. Batteries self-discharge at a higher rate if left standing for long periods at high temperatures. If machine is to stand for several days, remove batteries and store in a cool place.

NOTICE

Do not store acid type storage batteries near stacks of tires. Acid fumes can damage rubber.

3. Service fuel system as directed in Operation and Maintenance Manual. Check for water content before filling fuel tank. High temperatures and cooling off cause condensation in storage drums.
4. Lubricate as specified in Operation and Maintenance Manual or Lubrication Decal on machine.
5. Do not park machine in sun for long periods of time. If possible, park machine under cover to protect it from sun, dirt and dust.
   A. Cover machine if no suitable shelter is available. Protect engine compartment and hydraulics from dirt and debris.
   B. In hot, damp climates, corrosion will occur on all parts of machine and will be accelerated during rainy season. Rust and paint blisters will appear on metal surfaces and fungus growth on other surfaces.
   C. Protect all unfinished, exposed surfaces with a film of preservative lubricating oil. Protect cables and terminals with ignition insulation compound. Apply paint or suitable rust preventive to damaged surfaces to protect them from rust and corrosion.

Operation In Dusty and Sandy Areas

Operation of machine can cause dust in almost any area. However, when in predominantly dusty or sandy areas, additional precautions must be taken.

1. Keep cooling system fins and cooling areas clean. Blow out with compressed air, if possible, as often as necessary.

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Wear goggles when using compressed air to prevent face or eye injury.

2. Use care when servicing fuel system to prevent dust and sand from entering tank.
3. Service air cleaner at frequent intervals, check air restriction indicator daily and keep dust cup and dust valve clean. Prevent dust and sand from entering engine parts and compartments as much as possible.
4. Lubricate and perform services outlined on current lubrication chart on machine and Operation and Maintenance Manual. Clean all lubrication fittings before applying lubricant. Sand mixed with lubricant becomes very abrasive and accelerates wear on parts.
5. Protect machine from dust and sand as much as possible. Park machine under cover to keep dust and sand from damaging unit.

Operation in Rainy or Humid Conditions

Operation under rainy or humid conditions is similar to that as in extreme heat procedures previously listed.

1. Keep all exposed surfaces coated with preservative lubricating oil. Pay particular attention to damaged or unpainted surfaces. Cover all paint cracks and chip marks as soon as possible to prevent corrosive effects.

Operation in Saltwater Areas

Saltwater and saltwater spray is very corrosive. When operating in saltwater areas, or in or around snow, observe the following precautions:

1. When exposed to saltwater, dry machine thoroughly and rinse with freshwater, as soon as possible.
2. Keep all exposed surfaces coated with preservative lubricating oil. Pay attention to damaged paint surfaces.
3. Keep all painted surfaces in good repair.
4. Lubricate machine as prescribed on lubrication chart on machine or Operation and Maintenance Manual. Shorten lubricating intervals for parts exposed to salt water.
5. Check operating controls to ensure proper functionality and that they return to “NEUTRAL” when released.

Operation at High Altitudes

Operation instructions at high altitudes are the same as those provided for extreme cold. Before operating at high altitudes, engine fuel and air mixture may have to be adjusted according to appropriate engine manual.

1. Check engine operating temperature for evidence of overheating. The radiator cap must make a perfect seal to maintain coolant pressure in cooling system.
    - Perform warming-up operation thoroughly. If machine is not thoroughly warmed up before control levers or control pedals are operated, reaction of machine will be slow.
    - If battery electrolyte is frozen, do not charge battery or start engine with a different power source. There is a potential hazard that could cause a battery explosion or fire.
    - Before charging or starting engine with a different power source, thaw battery electrolyte and check for any leakage of electrolyte before starting.

Operation During Electrical Storms

During electrical storms, do not enter or exit machine.

- If you are off machine, keep away from machine until storm passes.
- If you are in cabin, remain seated with machine stationary until storm passes. Do not touch controls or anything metal.

Exhaust Ventilation

Figure 27

ARO1770L

Engine exhaust gases can cause unconsciousness, loss of alertness, judgment and motor control. This can result in death or serious injury.

Make sure there is adequate ventilation before starting engine in any enclosed area.

Check for and be aware of any open windows, doors or ductwork where exhaust may be carried, or blown by wind, exposing others to hazardous exhaust gases.

Ventilation for Enclosed Area

If it is necessary to start engine within an enclosed area, or when handling fuel, flushing oil, or paint; open doors and windows to ensure that adequate ventilation is provided to prevent gas poisoning.

Diesel engine exhaust contains products of combustion which can be harmful to your health.

Always run engine in a well ventilated area. If you are in an enclosed area, vent exhaust to outside.

Asbestos Information

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Avoid exposure to dust containing asbestos as it can cause death or serious injury to the lungs and other organs (mesothelioma, lung and other cancers, and asbestoses).

Asbestos dust can be HAZARDOUS to your health if it is inhaled. Materials containing asbestos fiber can be present on work sites. Breathing air that contains asbestos fiber can ultimately cause serious or fatal lung damage or diseases such as mesothelioma, lung and other cancers, and asbestoses. To prevent lung damage from asbestos fiber, observe the following precautions:

- Use an approved respirator that is approved for use in an asbestos-laden atmosphere.
- Use water for cleaning to keep down dust.
- Always observe any regulations related to work site and working environment.
- Avoid brushing or grinding materials that contain asbestos.
- A vacuum cleaner that is equipped with a high efficiency particulate air filter can also be used.
- Comply with applicable laws and regulations for workplace.
- Stay away from areas that might have asbestos particles in air.

Silica Dust Information

⚠ WARNING

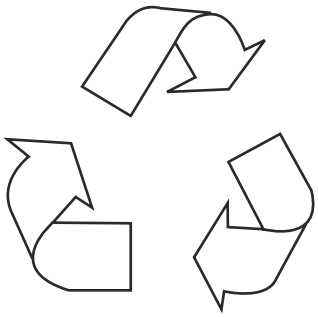
AVOID DEATH OR SERIOUS INJURY

Avoid exposure to dust containing crystalline silica particles as it can cause serious injury to the lungs (silicosis).

Cutting or drilling concrete containing sand or rock containing quartz can result in exposure to silica dust. Do not exceed Permissible Exposure Limits (PEL) to silica dust as determined by OSHA or other work site rules, laws and regulations. Use a respirator, water spray or other means to control dust. Silica dust can cause lung disease and is known to the state of California to cause cancer.

Disposal of Hazardous Materials

Figure 28



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Physical contact with used motor oil or gear oil could create a health risk. Wipe oil from your hands promptly and wash off any remaining residue.

Used motor oil or gear oil is an environmental contaminant and should only be disposed of at approved collection facilities. To prevent pollution of environment, always do the following:

- Never dump waste oil in a sewer system, rivers, etc.
- Always put drained oil from your machine in approved, leak proof containers. Never drain oil directly onto ground.
- Obey appropriate laws and regulations when disposing of harmful materials such as oil, fuel, solvent, filters, and batteries.

Improperly disposing of waste can threaten environment. Potentially harmful fluids must be disposed of according to local regulations.

Use all cleaning solutions with care. Report all necessary repairs.

Sound

Sound Level Information: Hearing protection may be required when machine is operated with an open operator station for extended periods or in a noisy environment.

Vibration Information

NOTE: *The level of vibration is influenced by many different parameters such as operator training, job site organization, weather, material, environment, machine type, machine and seat suspension system, attachments, and condition of the machine.*

Measurements are obtained on a representative machine, using measuring procedures as described in the following standards: ISO 2631/1, ISO 5349, and SAE J1166.

Vibration levels were given consideration in accordance with uncertainty (K) determined to manufacturer.

Hand/Arm Vibration Level

The vibration total value to which the hand-arm system is subjected, is less than 2.5 m/s^2.

Whole Body Vibration Level

The highest root mean square value of weighted acceleration to which the whole body is subjected, is more than 0.5 m/s^2 (less than 1.15 m/s^2).

Guidelines for Use and Working Conditions of Earth-moving Machinery to Reduce Vibration Levels (ISO/TR 25398 Annex E)

Properly adjusting and maintaining machines, operating machines smoothly, and maintaining the terrain conditions can reduce whole-body vibrations. The following can help the users of earth-moving machinery reduce whole-body vibration levels.

1. Use the right type and size of machine, equipment, and attachments.
2. Maintain machines according to the manufacturer's recommendations: (for wheeled machine)
   - Tire pressure;
   - Brake and steering systems;
   - Controls, hydraulic system and linkages.
3. Keep the terrain where the machine is working and traveling in good condition:
   - Remove any large rocks or obstacles;
   - Fill any ditches and holes;
   - Provide machines and schedule time to maintain terrain conditions.
4. Use a seat in conformance with ISO 7096 and keep the seat maintained and adjusted:
   - Adjust the seat and suspension for the weight and size of the operator;
   - Inspect and maintain the seat suspension and adjustment mechanisms.
5. Steer, brake, accelerate, shift gears, and move the attachments smoothly. (for wheeled machine)
6. Adjust the machine speed and travel path to minimize the vibration level:
   - Drive around obstacles and rough terrain conditions;
   - Slow down when it is necessary to go over rough terrain.
7. Minimize vibrations for long work cycle or long distance traveling: (for wheeled machine)
   - Use machines equipped with suspension systems;
   - Use lift arm suspensions;
   - If no suspension system is available, reduce speed to prevent bouncing;
   - Haul machines long distances between work sites.
8. Back pain associated with whole-body vibrations can be caused by other risk factors. To minimize the risk of back pain:
   - Adjust the seat and controls to achieve good posture;
   - Adjust the mirrors to minimize twisted posture;
   - Provide breaks to reduce long periods of sitting;
   - Avoid jumping down from the cab or access system;
   - Minimize repeated handling and lifting of loads;

- Minimize any shocks and jolts during sports and leisure activities.

General Specifications

Safety Instructions

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments repairs or service. Untrained operators and failure to follow instructions can cause death or serious injury.

General

The dozer has three main component sections:

- The Upper Structure
- The Lower Undercarriage and Track Frames
- The Front-end Attachment

Standard Specification

ITEMS		UNIT	STD.	OPT. 1	OPT. 2
OPERATING WEIGHT		ton	15.3	14.5	16
ENGINE	RATED POWER (Gross)	kW/rpm	117/2200		
	MAX. TORQUE	N.m/ rpm	710/1400		
SYSTEM PRESSURE		bar 250			
TRAVEL SPEED		km/h 9			
GROUND PRESSURE		kg/cm 2	0.33	0.43	0.35
TRANSPORTATION DIMENSION	OVERALL LENGTH	mm	5035	5035	6030
	OVERALL WIDTH	mm	3655	3105	3655
	OVERALL HEIGHT	mm	3130	3130	3130
	GROUND CLEARANCE (W/O Grouser)	mm	355	355	355
	TRACK LENGTH (With Grouser)	mm	3690	3690	3690
	GROUSER HEIGHT	mm	57	57	57
	TRACK GAUGE	mm	2000	1770	2000

	BLADE HEIGHT	mm	1085	1085	1085
OPTION ATTACHMENT	Blade	mm	LGP, XL		
	Rear Attachment	mm	RIPPER, TOWING DRAWBAR		
	SHOE	mm	760(LGP), 560(XL)		
Spec. Combination Criteria	STD	LGP BLADE, LGP SHOE, NON-REAR ATTACHMENT			
	OPTION 1	XL BLADE, XL SHOE, NON-REAR ATTACHMENT			
	OPTION 2	LGP BLADE, LGP SHOE, RIPPER			

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 test data is correct, but also in what range the test data is.
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 to perform performance tests accurately and safely.

The Machine

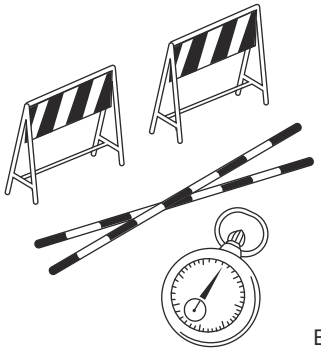
1. Repair any defects and damage found, such as oil or water leaks, loose bolts, cracks etc, before starting to test.

Test Area

1. Select a hard and flat surface.
2. Secure enough space to allow the machine to run straight more than 20 m (65 ft 7 in), and to make a full swing with the front attachment extended.
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.
   Figure 29



   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 because of landslides or contact with high voltage power lines. Always confirm 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.

Make Precise Measurement

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

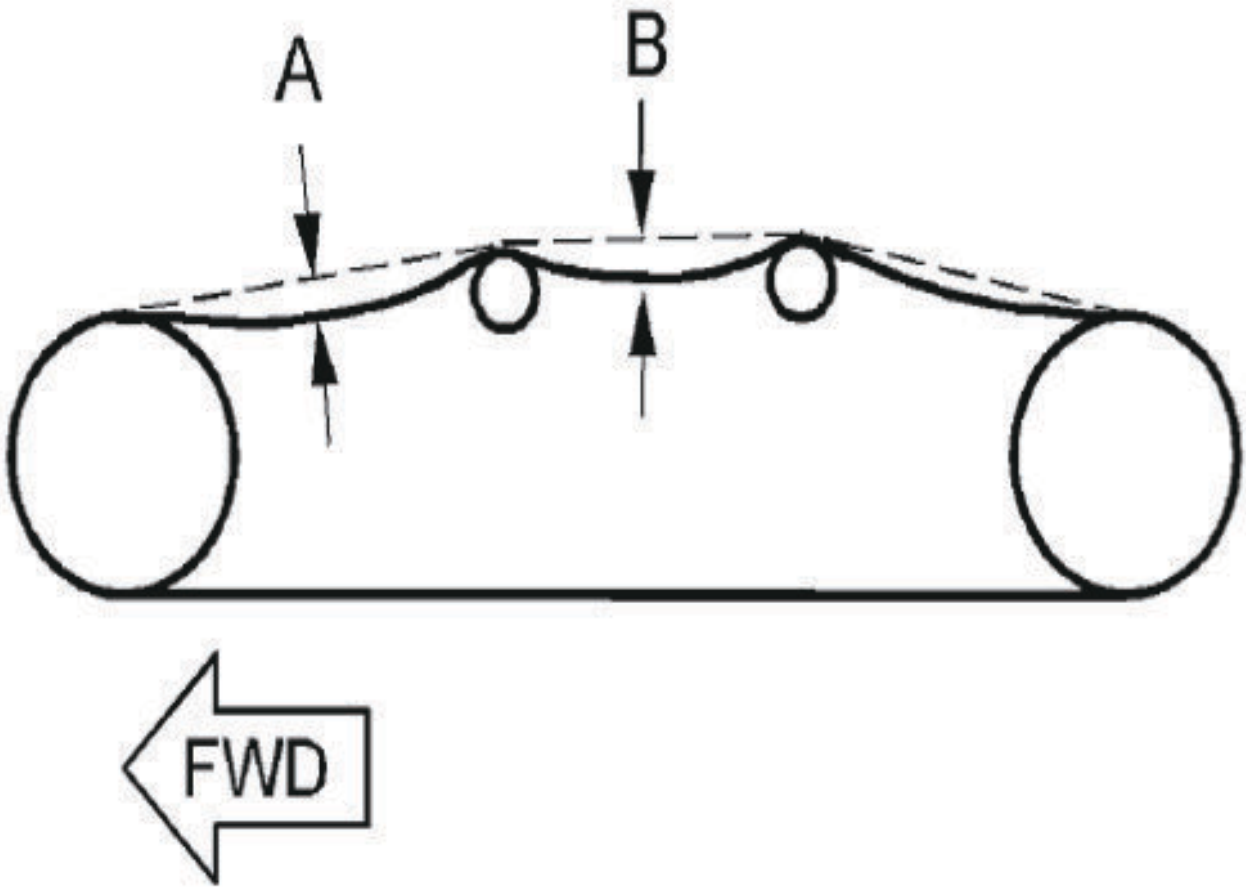
Operational Performance Standard Table

Item			Unit	Performance Standard	Value	Clearance
Engine	Non Load	Low Idle	rpm	Dial Max.	800	±20

Item			Unit	Performance Standard	Value	Clearance
		Auto Idle	rpm	Dial Min.	800	±20
		High Idle	rpm	Auto Idle activated	2,180	±50
	Load	Front Relief	rpm	-	2,180	±50
	Engine Stops	Front Relief + Blade Up	-	Blade Angle Relief, Blade Up Sudden Command	Not Stop Engine	-100 Above
Pressure Set	Main Pump	Pump Relief Pressure	bar	-	-	±10
		LS Relief Pressure	bar	Front Relief Status	236	±10
	Pilot Supply Valve	Parking Brake Release	bar	-	32	-0 +2
Cylinder Speed	Lift Cylinder	Up	sec	*Standard, Sudden Command. * Max. Stroke	2.7	±0.2
		Down	sec		2.3	±0.2
	Tilt Cylinder	Right	sec	* Sudden Command, Max. Blade Lift Up	1.1	±0.1
		Left	sec		0.8	±0.1
	Angle Cylinder	Right	sec		3.0	±0.2
		Left	sec		3.0	±0.2
	Ripper Cylinder	Up	sec	*Standard, Sudden Command.	2.5	±0.2
		Down	sec		2.8	±0.2
Travel Speed	Forward	0.5	km/hr	Power Mode, Dial Max, Operating Joystick Forward	1.1	±0.5
		2nd			3.8	±0.5
		3rd			5.0	±0.5
		4th			6.4	±0.5
		5th			8.5	±0.5
	Backward	0.5		Power Mode, Dial Max, Operating Joystick Backward	1.1	±0.5
		3rd			5.0	±0.5
		5th			8.5	±0.5
	ECO Mode	Engine Speed	rpm		1,950	±50
		0.5	km/hr	Power Mode, Dial Max.	1.0	±0.5
		5th			7.0	±0.5
	Inching Pedal	-	-	Inching Pedal Max.	Do Not Operate Machine	
Cooling Fan	Max. Performance	Min. Current	mA	Dial Min., Forced Drive	200	-
		Max. Fan Speed	rpm		2,400	±50

Item			Unit	Performance Standard	Value	Clearance
	Min. Performance	Max. Current	mA	Forced Drive	360	-
		Min. Fan Speed	rpm		550	Above
Cylinder Creeping	Lift Cylinder	Creeping	mm/5 min	Max. Blade Lift Up	5	Below
	Ripper Cylinder	Creeping	mm/5 min	Max. Ripper Up	5	Below
Track Sag			mm	A. Sagging between idler and No. 1 carrier roller	23-32	-
			mm	B. Sagging between No. 1 Carrier roller and No. 2 Carrier roller	26-36.5	-

Figure 30



DS2300981

* Conditions: P mode, Engine Dial Max., A/C Off, Hydraulic oil 45±5°C, Coolant 80 +5°C

Engine Specifications

Safety Instructions

⚠ WARNING

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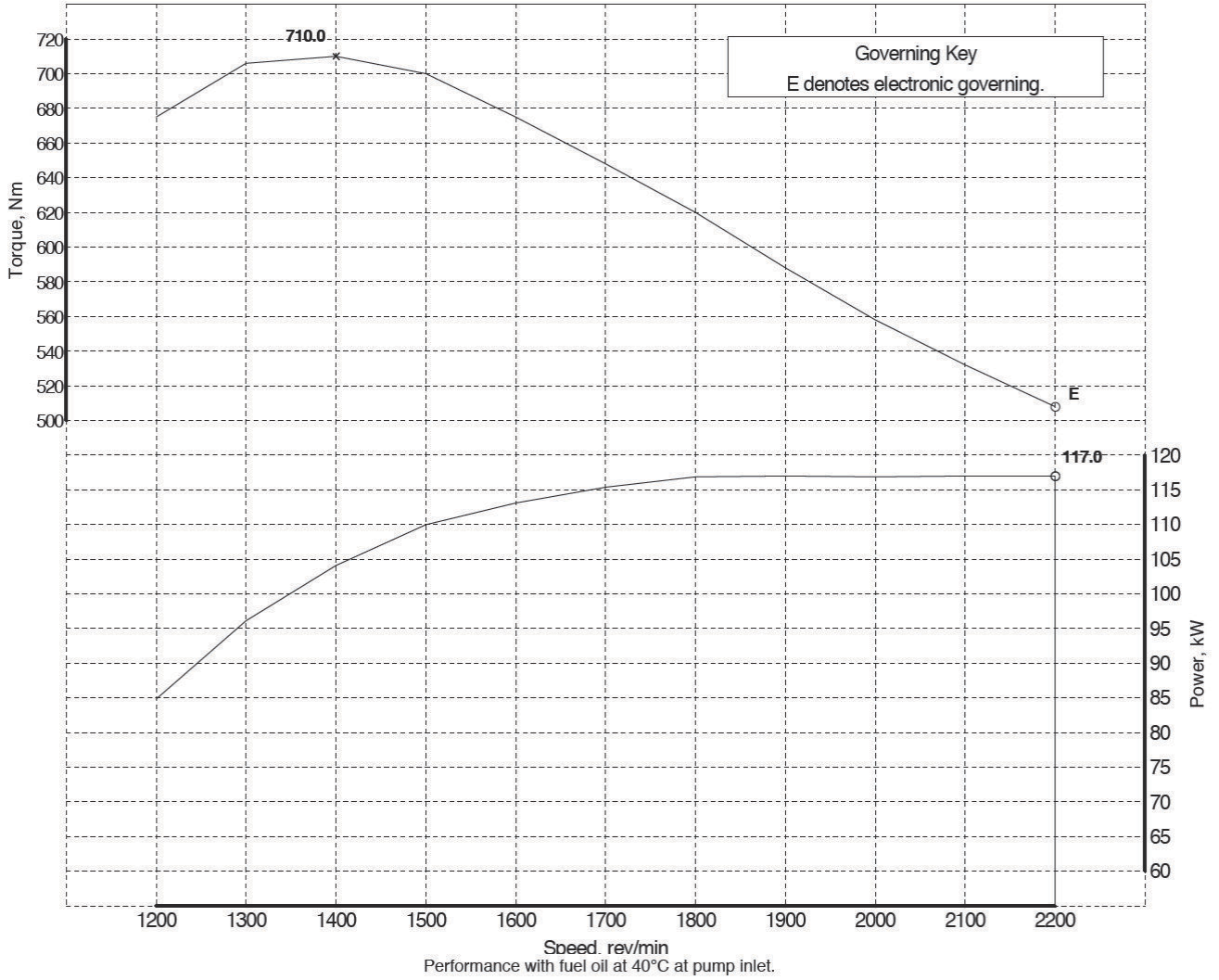
Engine Specification

Items		Specification
Engine	Type	4-Cycle water-cooled, Variable Geometry Turbocharged (2 stage), Common Rail Direct Injection
	Emission	Stage V
	Model	1204J
	Gross Power	117 kW (156.9 HP) @ 2,200 rpm (SAE J1995)
Number of Cylinders		4
After-treatment		DOC + SCR + DPF
Displacement		4,400 cc
Compression Ratio		16.5 : 1
Low Idle Speed		800 ± 10 rpm
High Idle Speed		2,200 ± 25 rpm
Weight, without Coolant and Oil		534 kg (1,177 lb)
Alternator		24 V, 100 A
Battery		12 V * 2, 100 AH
Start Motor		24 V, 7.8 kW

Engine Performance Curves

Figure 31



DS2300982

Performance Condition	ISO 14396: 2002
Emission	Stage V
Power Output (Rated)	117 kW @ 2,200 rpm
Max. Torque	710 N.m @ 1,400 rpm
Fuel Consumption (Rated)	214 g/kW.hr

NOTE: *Barometric Pressure: 760 mm (30") Mercury*

Temperature: 20°C (68°F)

W/O Cooling Fan

Alternator: Installed

Exhaust System: Complete, Installed

Air Cleaner, Installed

Tightening Torques

Normal Tightening Torque

The specifications in the tables below show the normal tightening torque for screws, nuts and unions. The values are to be used unless other values are specified in the inspection information. Always check whether there are special tightening torques given in the descriptions for the respective areas in the inspection information before using the general values for normal and special tightening torques respectively.

The following conditions apply:

- A tolerance of ±15 % applies to all values unless otherwise specified.
- All contact surfaces are to be clean and free of paint.
- Bolts and nuts are normally not lubricated regardless of surface treatment. All exceptions are specified in the inspection information.

Union Assemblies

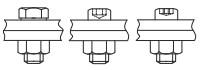
The specified values apply with a tolerance of ±5 %. The values apply to tightening with a counter hold.

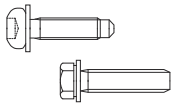
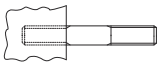
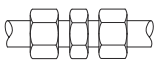
Thread Inserts

The specified tightening torques also apply to bolted joints with a thread insert (Heli-Coil).

Thread inserts often provide greater strength compared to a directly screwed thread. This generates a stronger bolted joint in aluminum or the like.

NOTE: *When a damaged thread is repaired with a thread insert, the normal screw and prescribed tightening torque are to be maintained. Install the thread insert as instructed in the inspection information.*

Hexagonal Screws, Hexagon Socket Screws, Six-point Socket Screws, Hexagon Nuts (Metric Thread, Course Pitch)		
Thread	Strength Class 8.8/8 Tightening Torque (Nm)	 FG020238
M4	2.4	
M5	5	
M6	8	
M8	20	
M10	39	
M12	70	
M14	112	
M16	180	
M18	240	
M20	350	
M22	490	
M24	600	
Flange Screws with Hexagonal Head and Hexagonal Flange Nuts (Metric Thread, Course Pitch)		
Thread	Strength Class 8.8/8 Tightening Torque (Nm)	 FG020239
M5	5.4	
M6	8.6	

M8	22			
M10	42			
M12	77			
M14	123			
M16	184			
Thread Forming Six-point Socket Screws and Hexagon Screws with Captive Washer (Modified Metric Thread, Course Pitch)				
Thread	Class 8	Class 10		 FG020240
	Tightening Torque (Nm)			
M4	2.9	-		
M6	9.4	11		
M8	24	26		
M10	47	49		
M12	80	85		
Thread Forming Six-point Socket Screws ST Thread				
Thread	Tightening Torque (Nm)			 FG020241
ST2.9	1.1			
ST3.5	1.9			
ST4.2	3.1			
ST4.8	4.5			
ST5.5	7.1			
ST6.3	9.7			
Stud Tap End in Threaded Hole, Strength Class 8.8/8 (Metric Thread, Course Pitch)				
Tightening the stud tap end in the threaded hole must be done so the stud does not come loose when undoing the nut. To tighten the stud in the threaded hole, the torque must just overcome the friction in the thread and generate a preload. The torque for locking is 50% of the normal torque for hexagonal screws, hexagon socket screws, six-point socket screws, hexagon nuts.				 FG020242
Union Nuts for Ferrule				
Thread	Thread Tighteninue (±15% Nm)			 FG020243
	For Pipe Diameter	Steel Pipe with Greased Steel Nut	Plastic Pipe with Steel Ferrule and Brass or Steel Nut	Plastic Pipe with Brass Ferrule and Nut with Rubber Seal
M10x1	5	15	10	-
M12x1.5	6	20	10	-
M14x1.5	8	30	20	-
M16x1.5	10	40	25	15
M18x1.5	12	50	30	20
M20x1.5	12	55	35	-

M24x1.5	16	60	50	40	
M130x2	22	120	-	-	
Nuts for Lead-in Union					
Thread	Thread Tightening Torque (±15% Nm)				 FG020244
M12x1.5	20				
M14x1.5	25				
M16x1.5	35				
M18x1.5	50				
M24x1.5	70				
M130x2	80				
Unions with Tapered Thread for Port Connection					
Thread	Thread Tightening Torque (±15% Nm)		Tightening Torque (Nm)		
	Straight Unions		Elbow Unions		
M10x1k	10		8		
M12x1.5k	10		8		
M14x1.5k	15		10		
M16x1.5k	15		10		
M18x1.5k	20		15		
M20x1.5k	25		20		
M22x1.5k	25		20		
M26x1.5k	45		40		
Unions, Plugs and Banjo Screws with Cylindrical Threads for Seal with Flat Copper Gasket					
Thread	Thread Tightening Torque (±15% Nm)				
M8x1	10				
M10x1	20				
M12x1.5	20				
M14x1.5	25				
M16x1.5	30				
M18x1.5	35				
M20x1.5	45				
M22x1.5	50				
M24x1.5	60				
M26x1.5	70				
M28x1.5	80				
M30x1.5	110				
M30x2	115				
M32x1.5	115				

M36x1.5	160	
M38x1.5	170	
M45x1.5	270	
Plugs with Tapered Thread		
Thread	Thread Tightening Torque (±15% Nm)	 FG020247
M10x1k	15	
M12x1.5k	20	
M14x1.5k	20	
M16x1.5k	25	
M18x1.5k	40	
M20x1.5k	40	
M22x1.5k	40	
M26x1.5k	60	
Insert Connections for Port Connection		
Thread	Thread Tightening Torque (±15% Nm)	 FG020248
M10x1k	18	
M12x1.5k	24	
M14x1.5k	28	
M16x1.5k	35	
M22x1.5k	40	
Insert Connections for Union Connection		
Thread	For pipe Diameter	Thread Tightening Torque (±15% Nm)
M14x1.5k	4-8	10
M18x1.5k	12	15
M24x1.5k	16	25


FG020249

Hydraulic Systems And Structure Specifications

Safety Instructions

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

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Hydraulic System

Main Pump

Type	Variable Displacement Axial Piston Pump
Displacement	60 cc/rev (3.7 cu.in/rev)
Pump Cut-Off Pressure	265 bar
Max. Flow Rate	132 L/min (34.9 gal/min)

Fan Pump

Type	Gear
Max. Flow	66.8 liter/min (17.6 gal/min)
Displacement	30.3 cc/rev (1.8 cu.in/rev)

Main Control Valve

Control Type	Closed-Center (LS) Hydraulic System, Electric Control with Float Spool
Spool Arrangement	Lift, Tilt, Angle, Ripper
Relief Valve Pressure	236 bar (LS)
Port Relief Pressure	270 bar (Lift), 350 bar (Angle, Ripper)

Fan Motor (Oil Cooler Fan)

Control Type	Gear
Displacement	19 cc/rev (1.2 cu.in/rev)
Max. Operating Pressure	205 bar
Direction of Rotation	Reversible

Solenoid Valve

Type	DC 24 V, 4 Solenoid Valve
Function	Safety Cut Off, HST Cut Off L/R, Parking

Accumulator

Charge Pressure	Volume
10 bar (142 psi) (10 kg/cm^2)	0.32 Liter (0.08 gal)

By Pass Valve, C1

Size	Cracking Pressure
1 inch	3 bar (3.1 kgf/cm2) @ 105 Liter/min

By Pass Valve, C2

Size	Cracking Pressure
3/4 inch	1.5 bar (1.5 kgf/cm2) @ 5 Liter/min

Travel System

HST Pump

Type	Swash Plate, Axial Piston
Displacement	2 * 71 cc/rev
Max. Flow Rate	2 * 156 Liter/min (2 * 41.2 gal/min)

HST Motor

Type	Swash Plate, Axial Piston
Displacement	2 * 160 cc/rev
Max. Flow Rate	2 * 312 Liter/min (2 * 82.4 gal/min)

Reduction Gear

Drive Type	2-Stage Planetary Gear
Reduction Ratio	50.6
Max. Output Speed	21.8 / 39.3 rpm
Max. Output Torque	6,398 / 3,543 kgf.m (62.7 / 34.7 kN.m)
Weight (Included Motor)	395 kg (870 lb)

Sprocket

Sprocket P.C.D.	Ø 823.88 mm (32.4 inches)
Track Link Pitch	190 mm (7.5 inches)
No. Of Teeth	27
Weight	50 kg (181 lb)

Traveling Performance

Traveling Speed (Theoretical)	9 km/hr (5.6 mile/hr)
Max. Traction Force	22 ton

Parking Brake

Control Type	Main Pressure, Mechanical
Brake Torque	142.8 kgf.m (1,400 N.m)
Brake Release Pressure	18 ± 1.5 bar (18.4 ±1.5 kgf/cm^2)

Figure 32

General Maintenance Instructions

Safety Instructions

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

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Welding Precautions and Instructions

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

To avoid accidents, personal injury and the possibility of causing damage to the machine or to components, welding must only be performed by properly trained and qualified personnel, who possess the correct certification (when required) for the specific welding fabrication or specialized repair being performed.

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Structural elements of the machine may be built from a variety of steels. These could contain unique alloys or may have been heat-treated to obtain particular strength characteristics. It is extremely important that welding repairs on these types of steel are performed with the proper procedures and equipment. If repairs are performed incorrectly, structural weakening or other damage to the machine (that is not always readily visible) could result. Always consult with your dealer before welding on integral components of the machine. It is possible that some types of structurally critical repairs may require Magnetic Particle or Liquid Penetrant testing, to make sure there are no hidden cracks or damage before the machine can be returned to service.

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Always perform welding procedures with proper safety equipment and adequate ventilation in a dry work area. Keep a fire extinguisher near and wear personal protective equipment.

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Observe the following safety instructions:

1. Use adequate safety shielding and keep away from fuel and oil tanks, batteries, hydraulic piping lines or other fire hazards when welding.
2. Never weld when the engine is running. Battery cables must be disconnected before the welding procedure is started.
3. Never weld on a wet or damp surface. The presence of moisture causes hydrogen embrittlement and structural weakening of the weld.
4. If welding procedures are being performed near cylinder rods then, operator's cabin window areas or any other assemblies could be damaged by weld spatters. Use adequate shielding protection in front of the assembly.
5. During welding equipment setup, always attach ground cables directly to the area or component being welded to prevent arcing through bearings, bushings, or spacers.
6. Always use correct welding rods for the type of weld being performed and observe recommended precautions and time constraints. AWS Class E7018 welding rods for low alloy to medium carbon steel must be used within two hours after removal from a freshly opened container. Class E11018G welding rods for T-1 and other higher strength steel must be used within 1/2 hour of removal from a freshly opened container.

Hydraulic System - General Precautions

Always maintain oil level in the system at recommended levels. Assemblies that operate under heavy loads, at high-speed, with extremely precise tolerances between moving parts (e.g. pistons and cylinders, or shoes and swash plates), can be severely damaged if oil supply runs dry.

Assemblies can be run dry and damaged severely in a very short time when piping or hoses are disconnected to repair leaks and/or replace damaged components. Hoses that are inadvertently switched during disassembly (inlet for outlet and vice versa), air introduced into the system or assemblies that are low on oil because of neglect or careless maintenance, could all produce sufficient fluid loss to cause damage or improper operation.

When starting the engine (particularly after long layoff or storage intervals), make sure that all hydraulic controls and operating circuits are in neutral, or “OFF”. That will prevent pumps or other components that may be temporarily oil starved from being run under a load.

Replacement of any hydraulic system component could require thorough cleaning, flushing, and some amount of refilling with fresh, clean oil if the protective seal on replacement parts has obviously been broken or if seal integrity may have been compromised. When protective seals are removed before installation and reassembly, inspect all replacement parts carefully before they are installed. If the replacement part shows no trace of factory pre-lube or has been contaminated by dirt or by questionable oils, flushing and refilling with clean hydraulic fluid is recommended.

Vibration, irregular or difficult movement or unusual noise from any part of the hydraulic system could be an indication of air in the system (and many other types of problems). As a general precaution (and to help lessen the risk of potential long-term damage), allow the engine to run at no-load idle speed immediately after initial start-up. Hydraulic fluid will circulate, releasing any air that may have been trapped in the system before load demands are imposed.

Before starting the machine, a daily walk-around safety inspection, including a quick visual inspection for any exterior evidence of leaking hydraulic fluid, can help extend the service life of system components.

NOTICE

Hydraulic system operating conditions (repetitive cycling, heavy workloads, fluid circulating under high-pressure) make it extremely critical that dust, grit or any other contamination be kept out of the system. Observe fluid and filter change maintenance interval recommendations and always pre-clean any exterior surface of the system before it is exposed to air. For example, the reservoir fill cap and neck area, hoses that have to be disassembled, and the covers and external surfaces of filter canisters should all be cleaned before disassembly.

Maintenance Service and Repair Procedure

General Precautions

Fluid level and condition should always be checked whenever any other maintenance service or repair is being performed.

NOTE: *If the unit is being used in an extreme temperature environment (in subfreezing climates or in high temperature, high humidity tropical conditions), frequent purging of moisture condensation from the hydraulic reservoir drain tap must be a regular and frequent part of the operating routine. In more moderate, temperate climates, draining reservoir sediment and moisture may not be required more than once or twice every few months.*

Inspect drained oil and used filters for signs of abnormal coloring or visible fluid contamination at every oil change. Abrasive grit or dust particles will cause discoloration and darkening of the fluid. Visible accumulations of dirt or grit could be an indication that filters are overloaded (and will require more frequent replacement) or that disintegrating bearings or other component failures in the hydraulic circuit may be imminent or have already occurred. Open the drain plugs on the main pump casings and check and compare drain oil in the pumps. Look for evidence of grit or metallic particles.

Vibration or unusual noise during operation could be an indication of air leaking into the circuit (Refer to the appropriate Troubleshooting section for component or unit for procedures.), or it may be evidence of a defective pump. The gear type pilot pump could be defective, causing low pilot pressure, or a main pump broken shoe or piston could be responsible.

NOTE: *If equipped, indicated operating pressure, as shown on the multi-display digital gauge on the Instrument Panel ("F-Pump" and "R-Pump") will be reduced because of a mechanical problem inside the pump. However, pressure loss could also be because of cavitation or air leakage, or other faults in the hydraulic system.*

Check the outer case's oil drain line in the main pumps. If no metallic particles are found, make sure there is no air in the system. Unbolt and remove the tank return drain line from the top part of the swing motor, both travel motors, and each main pump. If there is air in any one of the drain lines, carefully prefill the assembly before bolting together the drain line piping connections. Run the system at low rpm.

Hydraulic System Cleanliness and Oil Leaks

Maintenance Precautions for Hydraulic System Service

Whenever maintenance, repairs or any other troubleshooting or service is being performed, it's important to remember that hydraulic system - including both the interior and exterior surfaces of assemblies, and every drop of operating fluid - must be protected from contamination.

Dust and other foreign contaminants are major contributors to premature wear in hydraulic circuits. The narrow tolerances, rapidly moving parts and high operating pressures of the system require that fluid be kept as clean as possible. The performance and dependability of the machine (and the service life of individual components) can be noticeably reduced if proper precautions are not observed:

- Use a noncombustible, evaporative type, low residue solvent and thoroughly clean exterior surfaces of assemblies before any part of the circuit is opened or disassembled.

  NOTE: *It's just as important to clean the cap and reservoir top before routine fluid changes or quick checks as it is before major repairs. (Accumulated dirt attracts moisture, oil and other fluids - and more dirt.)*

- Keep dismantled parts covered during disassembly. Use clean caps, plugs or tape to protect the disconnected openings of flanges, manifolds and piping.
- Do not allow cleaning solvents or other fluids to mix with the oil in the system. Use clean oil to flush any traces of solvent or other residue before reassembly.
- If metal or rubber fragments are found in the system, flush and replace all fluid in the system and troubleshoot the circuit to identify the source of contamination.

NOTICE

Make sure that cleaning solvents will be compatible with rubber materials used in the hydraulic system. Many petroleum based compounds can cause swelling, softening, or other deterioration of system sealing elements, such as O-rings, caps and other seals.

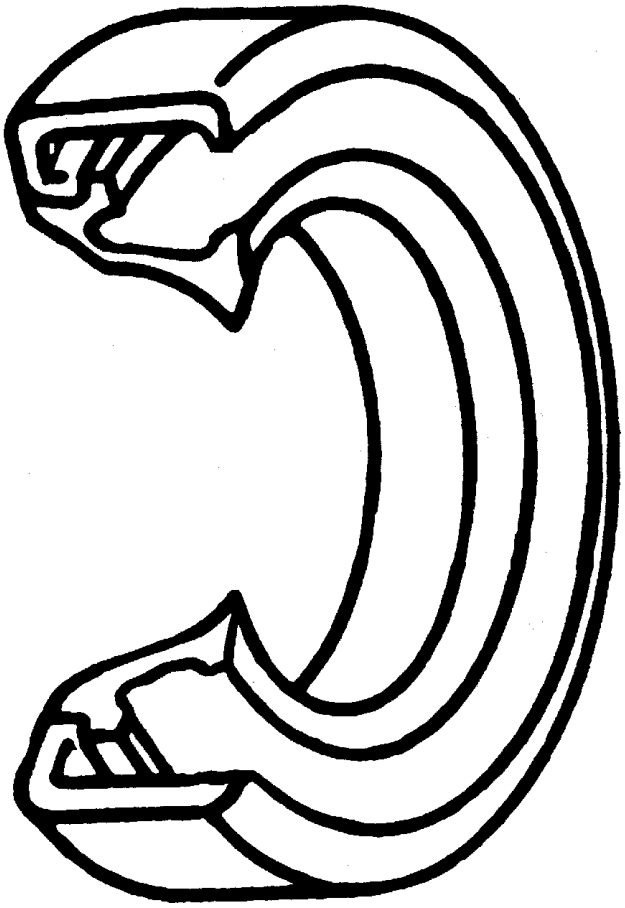
Oil Leakage Precautions

Oil that is visibly seeping from joints or seals should always serve as a "red flag" alarm.

Leaks must alert the machine operator and maintenance crew that air, water and dirt have an open, free passageway through which to enter the circuit. Corrosive salt air, freezing and thawing condensation cycles and working environments that are full of fine dust are especially hazardous. Clogging of valve spools or external piping (especially pilot circuit piping) can gradually diminish or suddenly put a stop to normal hydraulic function. You can prevent having to make these types of repairs by the following recommended assembly procedures:

1. Use new O-rings and oil seals whenever hydraulic assemblies are rebuilt.
2. Prepare joint surfaces before assembly by checking alignment and flatness. Clean and repair corrosion or any other damage.

3. Follow bolt torque recommendations and all other assembly requirements.
   Figure 33



0565A

NOTE: *Grease lip seals before assembly.*

Cleaning and Inspection

General Instructions

All parts must be clean to permit an effective inspection. During assembly, it is very important that no dirt or foreign material enters unit being assembled. Even minute particles can cause malfunction of close installed parts such as thrust bearing, matched parts, etc.

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Do not inhale vapors or allow solvent type cleaners to contact skin. Keep solvent away from open flame, arcs or sparks or other sources of ignition that could start a fire.

1. Clean all metal parts thoroughly using a suitable cleaning fluid. It is recommended that parts be immersed in cleaning fluid and moved up and down slowly until all oils, lubricants, and/or foreign materials are dissolved and parts are thoroughly clean.
2. For bearings that can be removed, soak them in a suitable cleaning fluid for a minute or two, then remove bearings from cleaning fluid and strike flat against a block of wood to dislodge solidified particles of lubricant. Immerse again in cleaning fluid to flush out particles. Repeat above operation until bearings are thoroughly clean. To dry bearings, use moisture-free compressed air. Be careful to direct air stream across bearing to avoid spinning bearings that are not lubricated.

DO NOT SPIN BEARINGS WHEN DRYING; bearings may be rotated slowly by hand to facilitate drying process.

3. Carefully inspect all bearing rollers, cages, and cups for wear, chipping, or nicks to determine condition. Do not replace a bearing cone or cup individually without replacing the mating cup or cone simultaneously. After inspection, dip bearings in lightweight oil and wrap them in clean lintless cloth or paper to protect them until installation.
   For those bearings that are to be inspected in place; inspect bearings for roughness of rotation, scoring, pitting, cracked or chipped races. If any of these defects are found, replace bearings. Also, inspect defective bearing housing and/or shaft for grooved, galled or burred conditions that indicate bearing has been turning in its housing or on its shaft.
4. It is more economical to replace oil seals, O-rings, sealing rings, gaskets and retaining rings when unit is disassembled than waiting for premature failures; refer to latest Micro Fiche and/or Parts Book for replacement items. Be careful when installing sealing members, to avoid cutting or scratching. Curling under of any seal lip will seriously impair its efficiency. Apply a thin coat of Loctite #120 to outer diameter of metal casing and on oil seals to assure an oil tight install into retainer. Use extreme care not to get Loctite on lips of oil seals. If this happens, that portion of the seal will become brittle and allow leakage.

   When replacing lip type seals, make sure spring loaded side is towards oil to be sealed.
5. If available, use Magna-flux or a similar process for checking for cracks that are not visible. Examine teeth on all gears carefully for wear, pitting, chipping, nicks, cracks, or scores. Replace all gears showing cracks or spots where case-hardening has worn through. Minor nicks may be removed with suitable hone. Inspect shafts and quills to make certain they have not been sprung, bent, or no twisted splines, and that shafts are in normal condition.

   NOTE: *Spline wear is not considered detrimental except where it affects tightness of splined parts.*

   Inspect thrust washers for distortion, scores, burs, and wear. Replace thrust washer if defective or worn.
6. Inspect bores and bearing surfaces of cast parts and machined surfaces for scratches, wear, grooves and dirt. Remove any scratches and burrs with crocus cloth. Remove foreign material. Replace any parts that are deeply grooved or scratched which would affect their operation.

Bearing Inspection

The conditions of the bearing are vital to the smooth and efficient operation of the machinery. When any component containing bearings is disassembled, always carefully examine the condition of the bearings and all of its components for wear and damage.

Once the bearing is removed, clean all parts thoroughly using a suitable cleaning solution. If the bearing is excessively dirty, soak the bearing assembly in a light solution and move the bearing around until all lubricants and/or foreign materials are dissolved and the parts are thoroughly clean.

When drying bearings, moisture free compressed air can be used. Be careful not to direct the air in a direction which will force the bearing to dry spin while not being properly lubricated.

After the bearings have been cleaned and dried, carefully inspect all bearing rollers, cages and cups for wear, chipping or nicks. If the bearing cannot be removed and is to be inspected in place, check for roughness of rotation, scoring, pitting, cracked or chipped races. If any of these defects are found replace the whole bearing assembly. NEVER replace the bearing alone without replacing the mating cup or the cone at the same time.

After inspection lightly coat the bearing and related parts with oil and wrap in a clean lintless cloth or paper and protect them from moisture and other foreign materials until installation.

It is also important to inspect the bearing housing and/or shaft for grooved, galled or burred conditions that indicate the bearing has been turning in its housing or on its shaft.

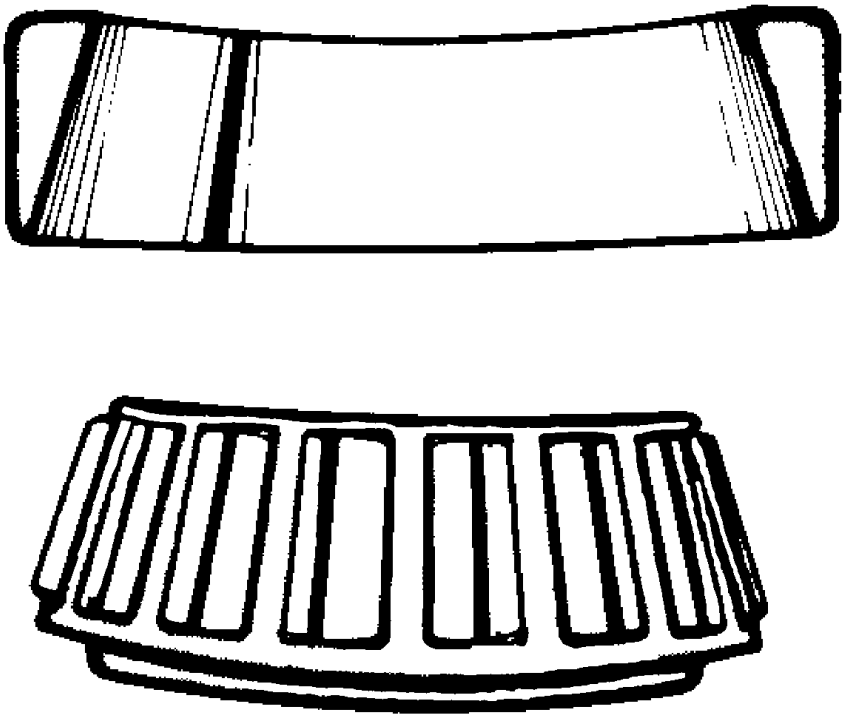
If available, use Magna-flux or similar process for checking for cracks that are not visible.

The following illustrations will aid in identifying and diagnosing some of the bearing related problems.

NOTE: *The illustrations will only show tapered roller bearings, but the principles of identifying, diagnosing and remedying the defects are common to all styles and types of bearings.*

Normal Bearing

Figure 34

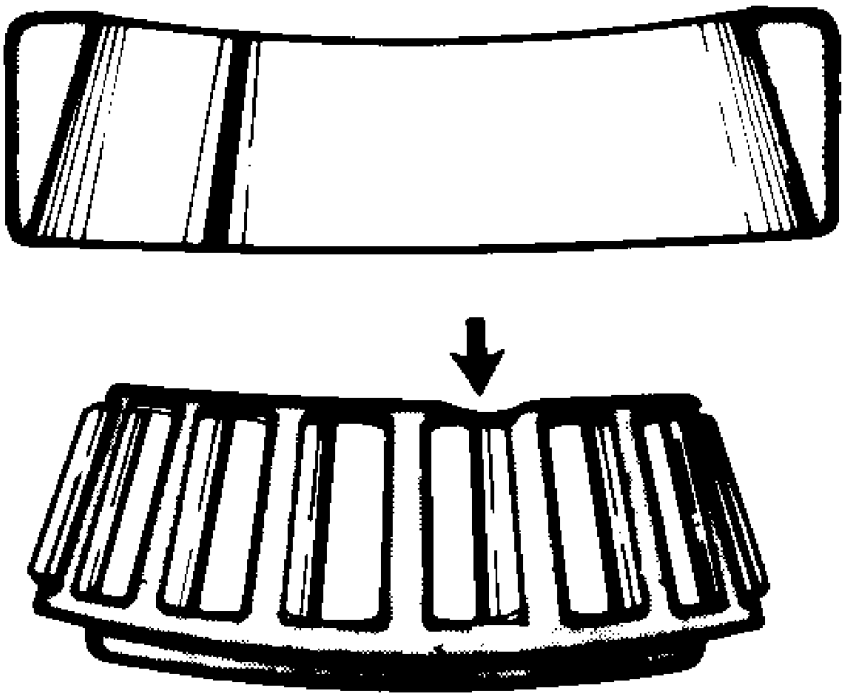


HASA620S

Smooth even surfaces with no discoloration or marks.

Bent Cage

Figure 35



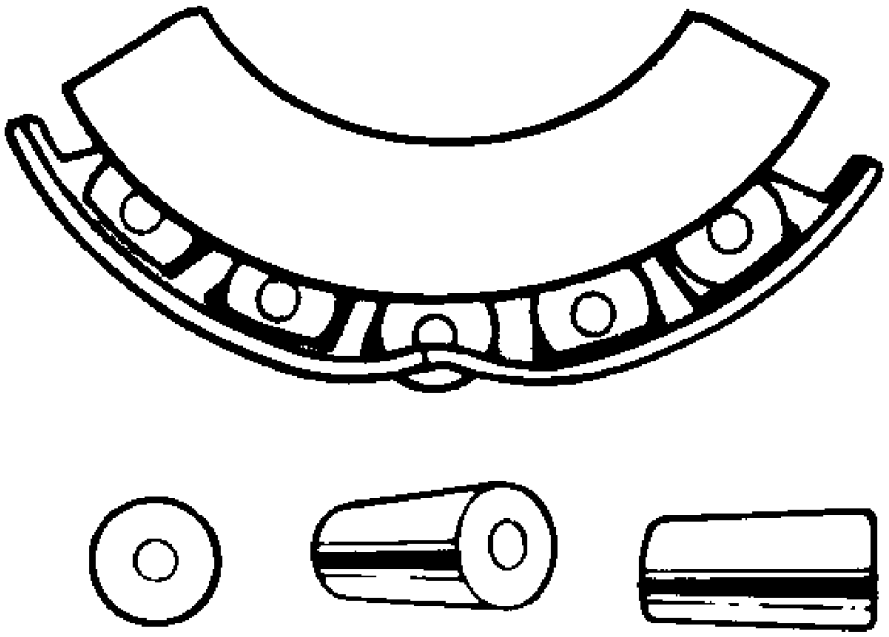
HASA460S

Cage damage because of improper handling or tool usage.

Replace bearing.

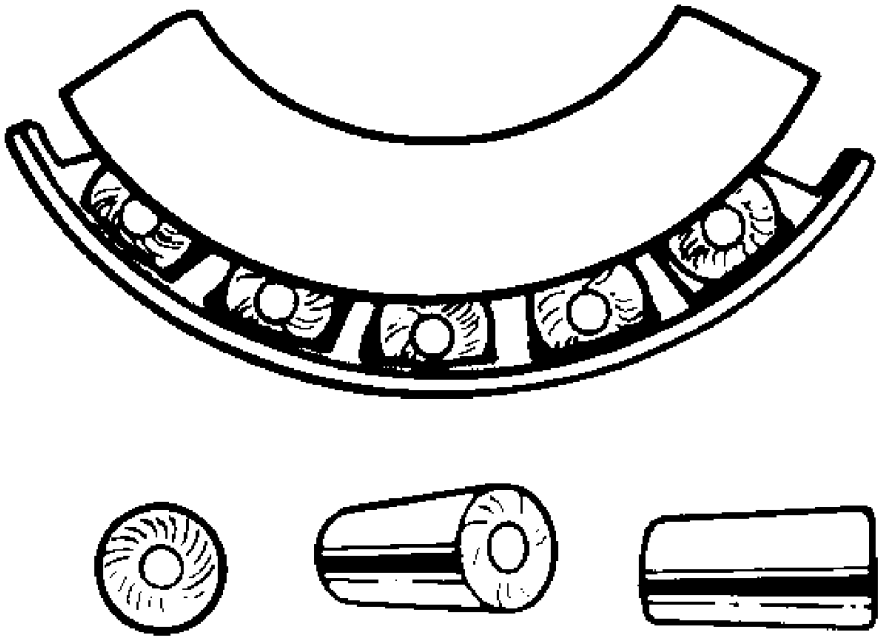
Galling

Figure 36



HASA470S

Figure 37



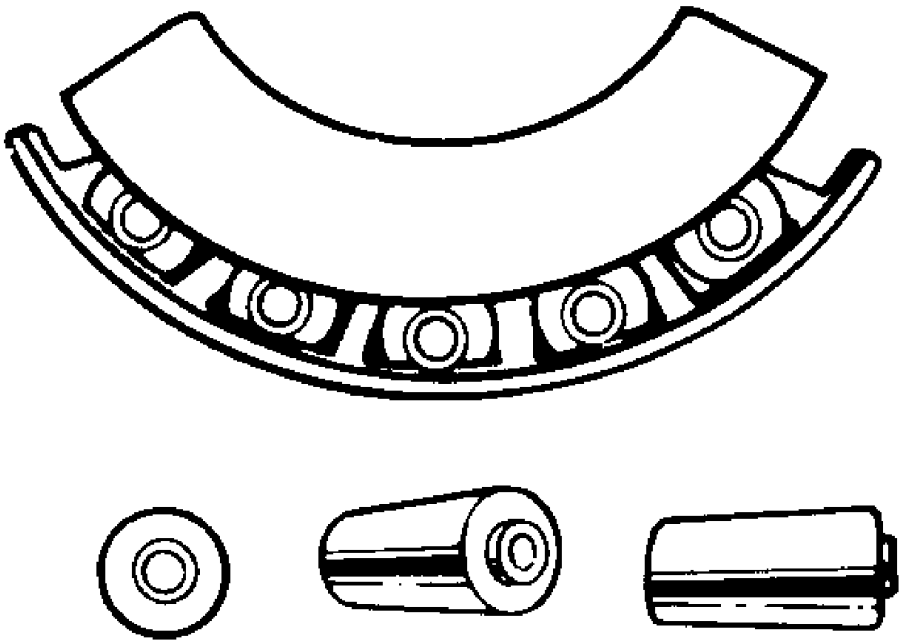
HASA480S

Metal smears on roller ends because of overheat, lubricant failure or overload.

Replace bearing - check seals and check for proper lubrication.

Abrasive Step Wear

Figure 38



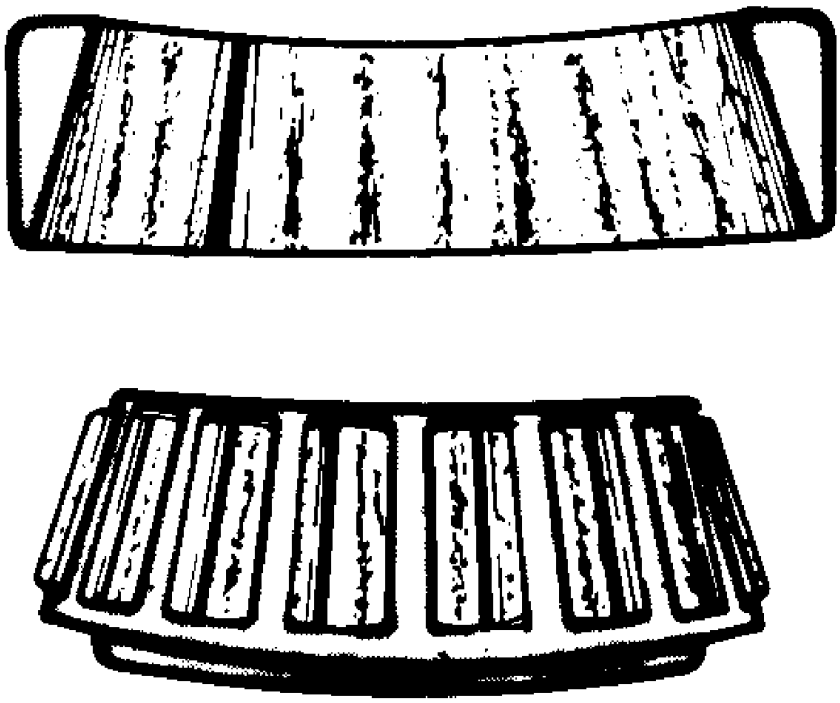
HASA490S

Pattern on roller ends caused by fine abrasives.

Clean all parts and housings, check all parts and housings, check seals and bearings and replace if leaking, rough or noisy.

Etching

Figure 39



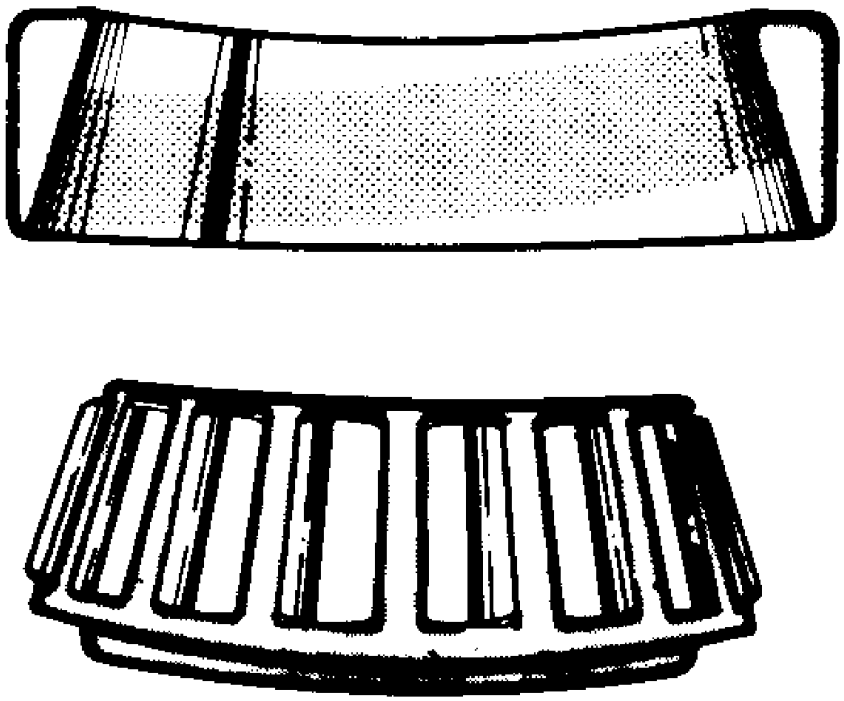
HASA500S

Bearing surfaces appear gray or grayish black in color with related etching away of material usually at roller spacing.

Replace bearings - check seals and check for proper lubrication.

Misalignment

Figure 40



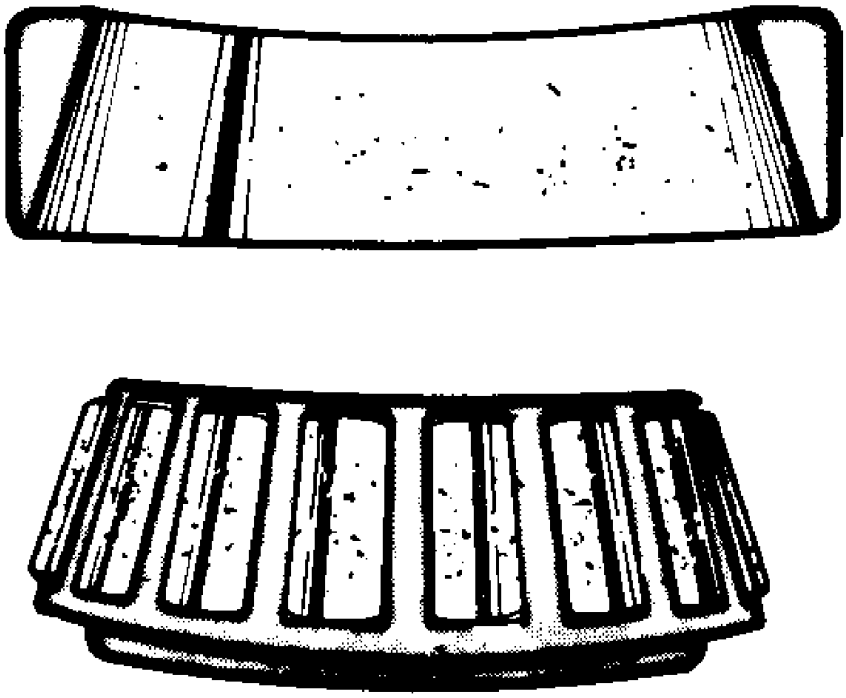
HASA510S

Outer race misalignment because of foreign object.

Clean related parts and replace bearing. Make sure races are properly seated.

Indentations

Figure 41

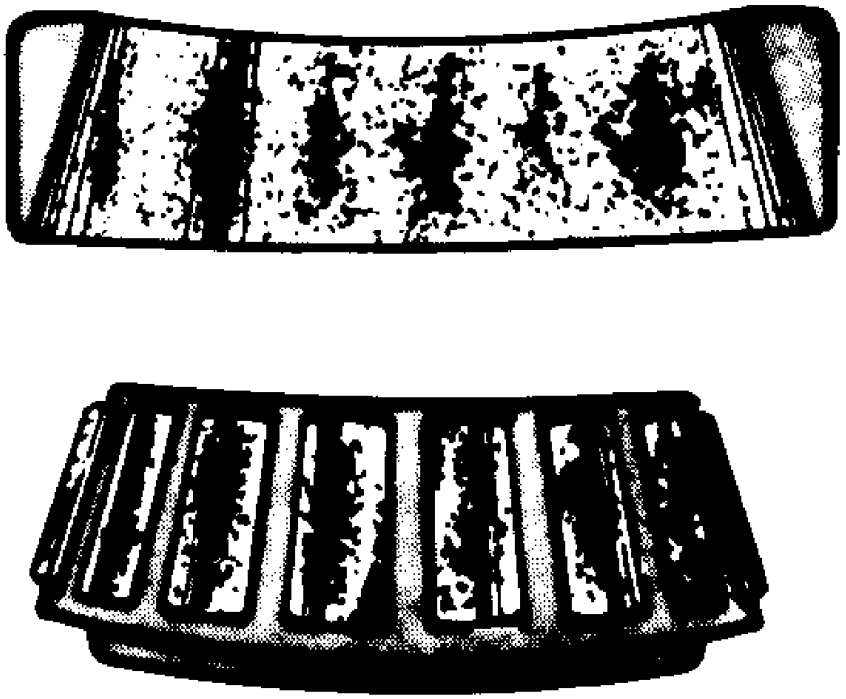


HASA520S

Surface depressions on race and rollers caused by hard particles of foreign materials.
Clean all parts and housings, check seals and replace bearings if rough or noisy.

Fatigue Spalling

Figure 42



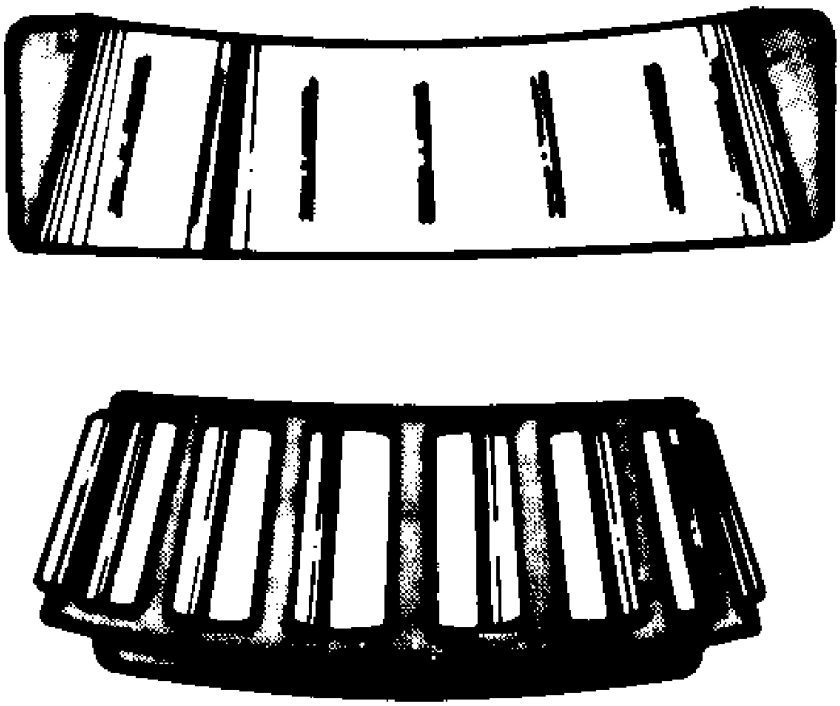
HASA530S

Flaking of surface metal resulting from fatigue.

Replace bearing - clean all related parts.

Brinelling

Figure 43



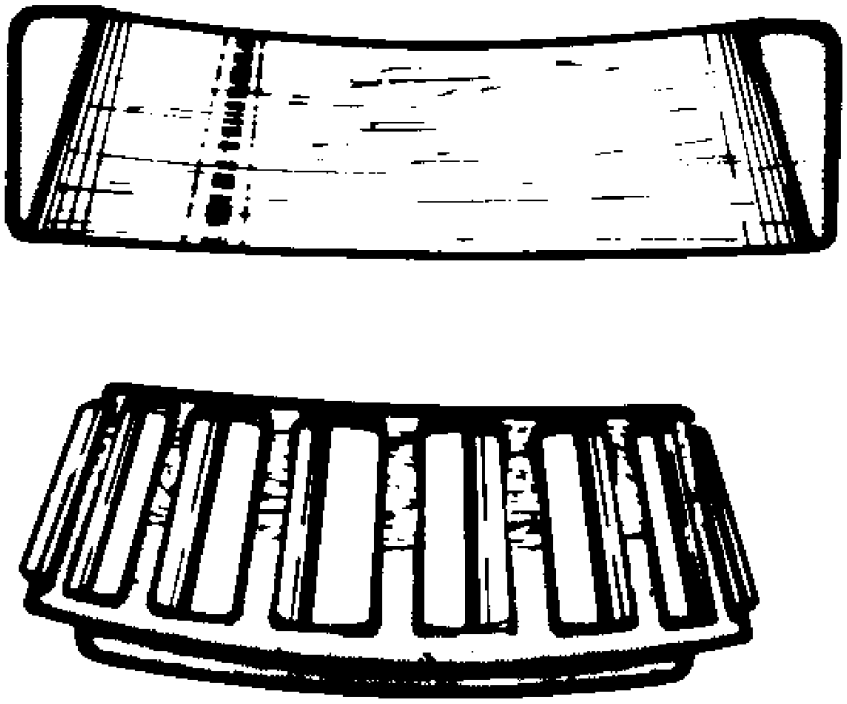
HASA540S

Surface indentations in raceway caused by rollers either under impact loading or vibration while the bearing is not rotating.

Replace bearing if rough or noisy.

Cage Wear

Figure 44



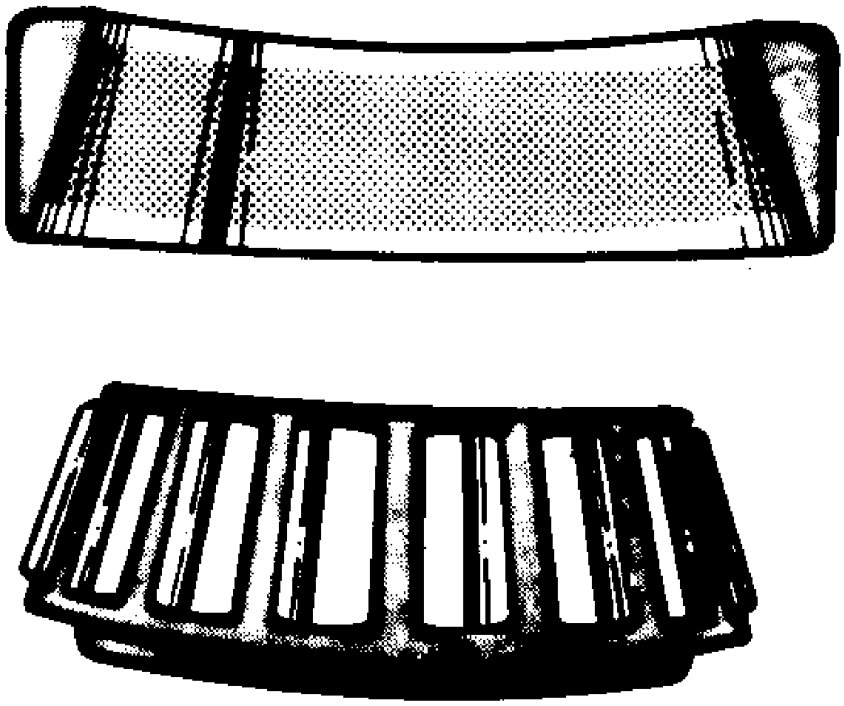
HASA550S

Wear around outside diameter of cage and roller pockets caused by abrasive material and inefficient lubrication.

Replace bearings - check seals.

Abrasive Roller Wear

Figure 45



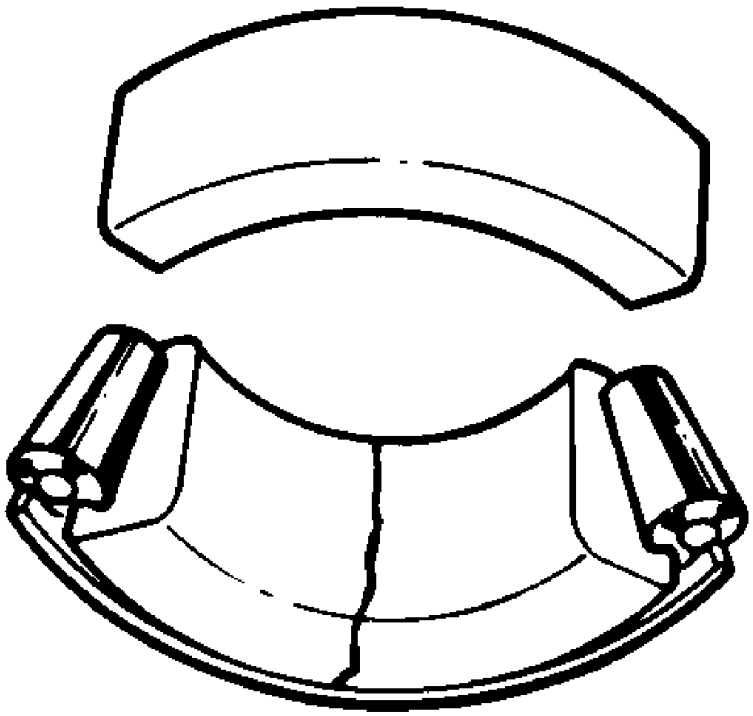
HASA560S

Pattern on races and rollers caused by fine abrasives.

Clean all parts and housings, check seals and bearings and replace if leaking, rough or noisy.

Cracked Inner Race

Figure 46

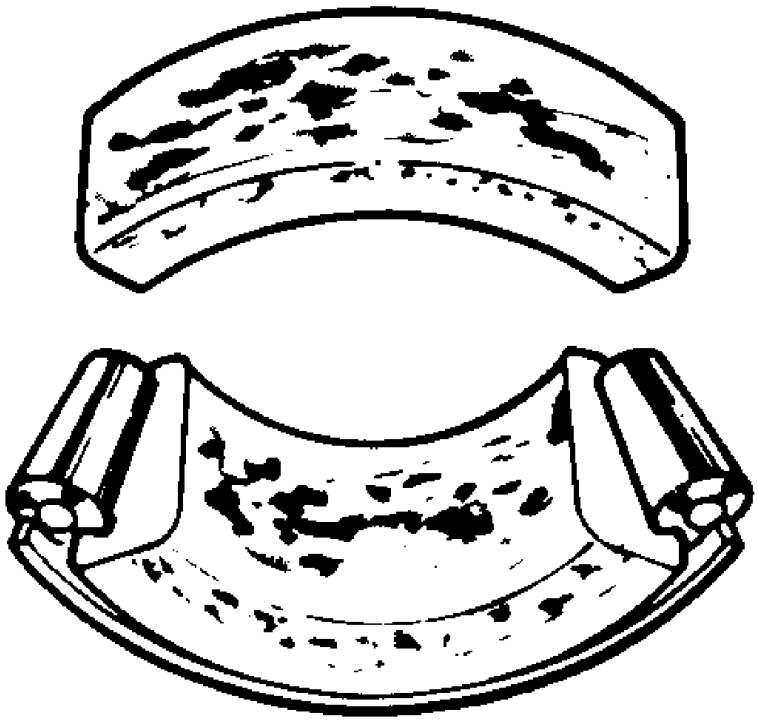


HASA570S

Race cracked because of improper installation, cocking or poor bearing seat.
Replace all parts and housings, check seals and bearings and replace if leaking.

Smears

Figure 47



HASA580S

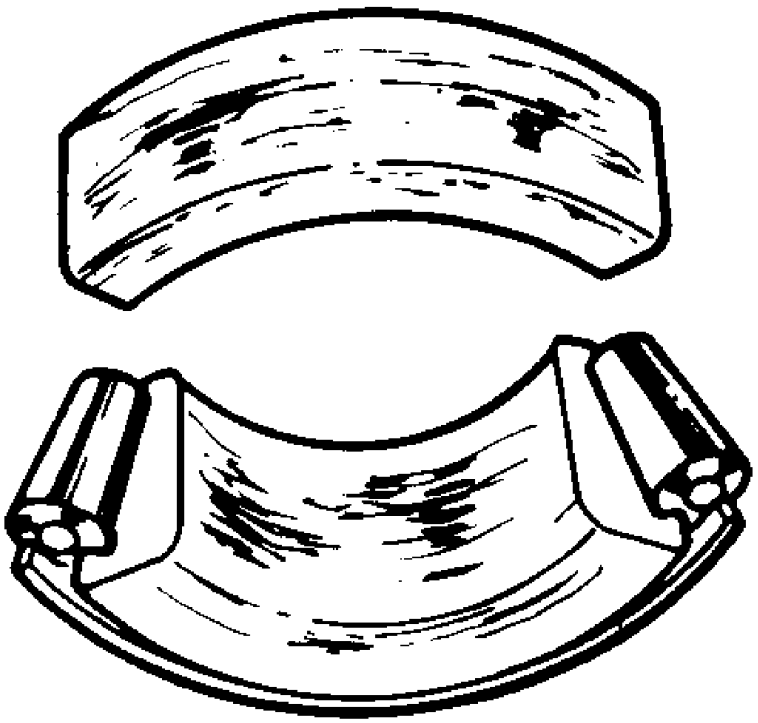
Smearing of metal because of slippage caused by poor installation, lubrication, overheating, overloads or handling damage.

Replace bearings, clean related parts and check for proper installation and lubrication.

Replace shaft if damaged.

Frettage

Figure 48



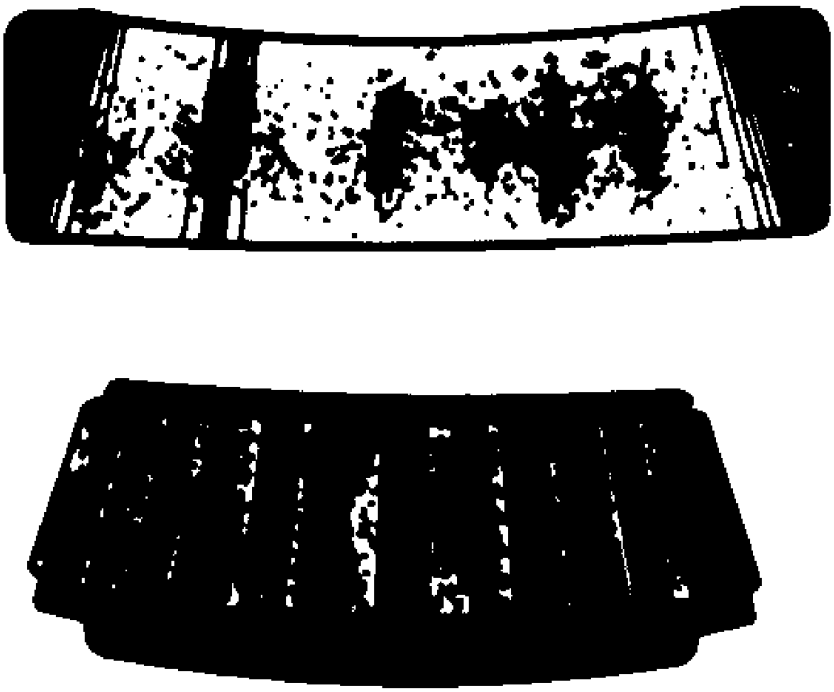
HASA590S

Corrosion set up by small relative movement of parts with no lubrication.

Replace bearing. Clean all related parts. Check seals and check for proper lubrication.

Heat Discoloration

Figure 49



HASA600S

Heat discoloration can range from faint yellow to dark blue resulting from overload or incorrect lubrication.

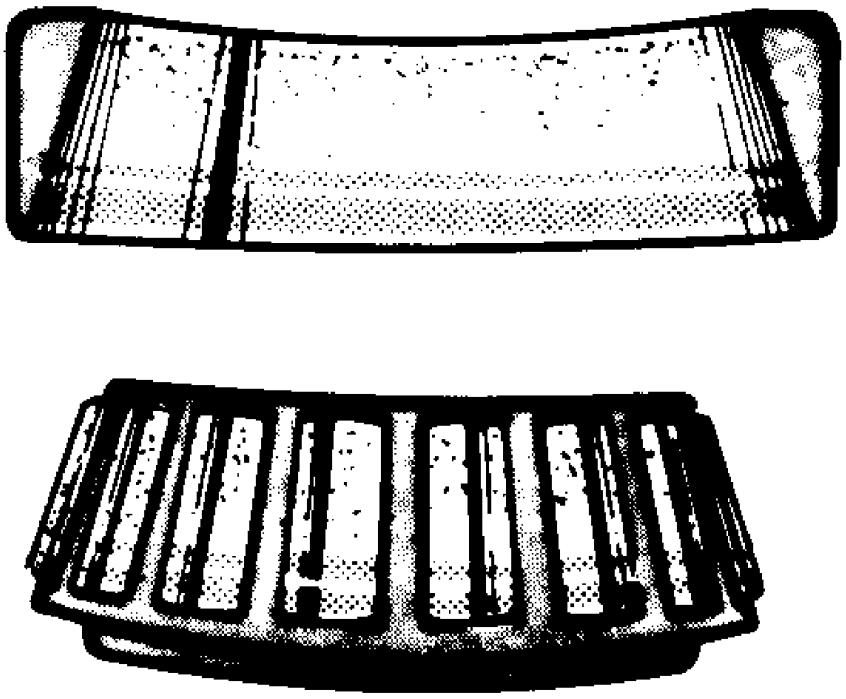
Excessive heat can cause softening of races or rollers.

To check for loss of temper on races or rollers, a simple file test may be made. A file drawn over a tempered part will grab and cut metal, whereas a file drawn over a hard part will glide readily with no metal cutting.

Replace bearing if overheating damage is indicated. Check seals and other related parts for damage.

Stain Discoloration

Figure 50



HASA610S

Discoloration can range from light brown to black caused by incorrect lubrication or moisture.

If the stain can be removed by light polishing or if no evidence of overheating is visible, the bearing can be reused.

Check seals and other related parts for damage.

Standard Torques

Safety Instructions

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments repairs or service. Untrained operators and failure to follow instructions can cause death or serious injury.

Torque Values for Standard U.S. Fasteners

Type	SAE Grade	Description	Bolt Head Marking
1	1 or 2	WILL HAVE NO MARKINGS IN THE CENTER OF THE HEAD. Low or Medium Carbon Steel Not Heat-treated.	
5	5	WILL HAVE THREE RADIAL LINES. Quenched and Tempered Medium Carbon Steel.	
8	8	WILL HAVE 6 RADIAL LINES. Quenched and Tempered Special Carbon or Alloy Steel.	

Recommended torque, in foot-pounds, for all Standard Application Nuts and Bolts, provided:

1. All thread surfaces are clean and lubricated with SAE-30 engine oil. (See Note.)
2. Joints are rigid, that is, no gaskets or compressible materials are used.
3. When reusing nuts or bolts, use minimum torque values.

   NOTE: *Multiply the standard torque by:*

   0.65 When finished jam nuts are used.

   0.70 When Molykote, white lead or similar mixtures are used as lubricants.

   0.75 When Parkerized bolts or nuts are used.

   0.85 When cadmium plated bolts or nuts and zinc bolts w/waxed zinc nuts are used.

   0.9 When hardened surfaces are used under the nut or bolt head.

   NOTE: *When reusing bolts and nuts in service, use minimum torque values.*

The following General Torque Values must be used where SPECIAL TORQUE VALUES are not given.

NOTE: *Torque values listed throughout this manual are lubricated (wet) threads; values must be increased 1/3 for non lubricated (dry) threads.*				
Thread Size	Heat-treated Material Grade 5 and Grade 8			
	Grade 5 (3 Radial Dashes on Head)		Grade 8 (6 Radial Dashes on Head)	
	Foot pounds (ft lb)	Newton Meter (Nm)	Foot pounds (ft lb)	Newton Meter (Nm)
1/4" - 20	6	8	9	12

NOTE: *Torque values listed throughout this manual are lubricated (wet) threads; values must be increased 1/3 for non lubricated (dry) threads.*				
Thread Size	Heat-treated Material Grade 5 and Grade 8			
	Grade 5 (3 Radial Dashes on Head)		Grade 8 (6 Radial Dashes on Head)	
	Foot pounds (ft lb)	Newton Meter (Nm)	Foot pounds (ft lb)	Newton Meter (Nm)
1/4" - 28	7	9	11	15
5/16" - 18	13	18	18	24
5/16" - 24	15	20	21	28
3/8" - 16	24	33	34	46
3/8" - 24	27	37	38	52
7/16" - 14	38	52	54	73
7/16" - 20	42	57	60	81
1/2" - 13	58	79	82	111
1/2" - 20	65	88	90	122
9/16" - 12	84	114	120	163
9/16" - 18	93	126	132	179
5/8" - 11	115	156	165	224
5/8" - 18	130	176	185	251
3/4" - 10	205	278	290	393
3/4" - 16	240	312	320	434
7/8" - 9	305	414	455	617
7/8" - 14	334	454	515	698
1" - 8	455	617	695	942
1" - 14	510	691	785	1064
1 1/8" - 7	610	827	990	1342
1 1/8" - 12	685	929	1110	1505
1 1/4" - 7	860	1166	1400	1898
1 1/4" - 12	955	1295	1550	2102
1 3/8" - 6	1130	1532	1830	2481
1 3/8" - 12	1290	1749	2085	2827
1 1/2" - 6	1400	2034	2430	3295
1 1/2" - 12	1690	2291	2730	3701
1 3/4" - 5	2370	3213	3810	5166
2" - 4 1/2	3550	4813	5760	7810

NOTE: *If any bolts and nuts are found loose or at values less than what the chart states, it is recommended that loose bolt and/or nut be replaced with a new one.*

Type 8 Phosphate Coated Hardware

This chart provides tightening torque for general purpose applications using original equipment standard hardware as listed in the Parts Manual for the machine involved. DO NOT SUBSTITUTE. In most cases, original equipment standard hardware is defined as Type 8, coarse thread bolts, nuts and through hardened flat washers (Rockwell "C" 38 - 45), all phosphate coated and assembled without supplemental lubrication (as received) condition.

The torques shown below also apply to the following:

1. Phosphate coated bolts used in tapped holes in steel or gray iron.
2. Phosphate coated bolts used with phosphate coated prevailing torque nuts. (nuts with distorted threads or plastic inserts).
3. Phosphate coated bolts used with copper plated weld nuts.

Markings on bolt heads or nuts indicate material grade ONLY and are NOT to be used to determine required torque.

Nominal Thread Diameter	Standard Torque ±10%	
	Kilogram.meter (kg.m)	Foot pounds (ft lb)
1/4"	1.1	8
5/16"	2.2	16
3/8"	3.9	28
7/16"	6.2	45
1/2"	9.7	70
9/16"	13.8	100
5/8"	19.4	140
3/4"	33.2	240
7/8"	53.9	390
1"	80.2	580
1 - 1/8"	113.4	820
1 - 1/4"	160.4	1160
1 - 3/8"	210.2	1520
1 - 1/2"	279.4	2020
1 - 3/4"	347.1	2510
2"	522.8	3780

Torque Values for Hose Clamps

The following chart provides the tightening torques for hose clamps used in all rubber applications (radiator, air cleaner, operating lever boots, hydraulic system, etc.).

Clamp Type and Size	Torque			
	Radiator, Air Cleaner, Boots, Etc.		Hydraulic System	
	Kilogram.meter (kg.m)	Inch Pounds (in lb)	Kilogram.meter (kg.m)	Inch Pounds (in lb)
"T" Bolt (Any Diameter)	0.68 - 0.72	59 - 63	-------	-------
Worm Drive - Under 44 mm (1-3/4 in) Open Diameter	0.2 - 0.3	20 - 30	0.5 - 0.6	40 - 50
Worm Drive - Over 44 mm (1-3/4 in) Open Diameter	0.5 - 0.6	40 - 50	-------	-------
Worm Drive - All "Ultra-Tite"	0.6 - 0.7	50 - 60	0.5 - 0.6	40 - 50

ORFS Swivel Nut Recommended Torque

Dash Size	Hose I.D.	Thread Size	Torque (kg.m) Recommended
4	1/4"	9/16"	2.4 - 2.6
6	3/8"	11/16"	3.3 - 3.9
8	1/2"	13/16"	5.1 - 5.7
12	3/4"	1 3/16"	11.7 - 12.7
16	1"	1 7/16"	15.3 - 17.3
20	1 1/4"	1 11/16"	18.0 - 20.0

Torque Values for Split Flanges

The following chart provides the tightening torques for split flange connections used in hydraulic systems. Split flanges and shoulders should install squarely. Install all bolts, finger tight and then torque evenly.

NOTE: *Over torquing bolts will damage the flanges and/or bolts, which can cause leakage.*

Flange Size (*)	Bolt Size	Bolt Torque	
		Kilogram.meter (kg.m)	Foot-pounds (ft lb)
1/2"	5/16"	2.1 - 2.5	15 - 18
3/4"	3/8"	3.0 - 3.7	22 - 27
1"	3/8"	3.7 - 4.8	27 - 35
1 - 1/4"	7/16"	4.8 - 6.2	35 - 45
1 - 1/2"	1/2"	6.4 - 8.0	46 - 58
2"	1/2"	7.6 - 9.0	55 - 65
2 - 1/2"	1/2"	10.9 - 12.6	79 - 91
3"	5/8"	19.1 - 20.7	138 - 150
3 - 1/2"	5/8"	16.2 - 18.4	117 - 133

(*) - Inside diameter of flange on end of hydraulic tube or hose fitting.

NOTE: *Values stated in chart are for Standard Pressure Series (Code 61) Split Flanges.*

Torque Wrench Extension Tools

Very large diameter, high-grade fasteners (nuts, bolts, cap screws, etc.) require a great deal of turning force to achieve recommended tightening torque values.

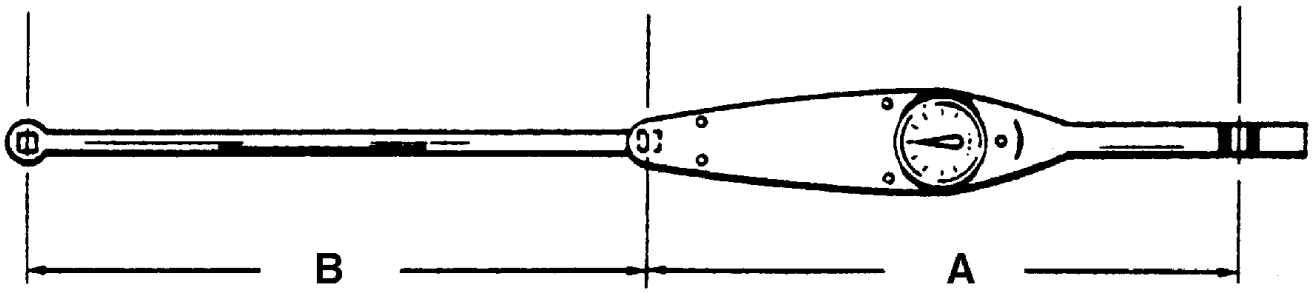
Common problems that could occur as a result are:

- Recommended torque exceeds the measuring capacity of the torque wrench.
- Specialized sockets do not fit the adapter on the front end (nose) of the torque wrench.
- Generating adequate force on the back end (handle) of the wrench is difficult or impossible.
- Restricted access or an obstruction may make use of the torque wrench impossible.
- A unique application requires fabrication of an adapter or other special extension.

Most standard torque wrenches can be adapted to suit any one of the proceeding needs or situations, if the right extension tool is used or fabricated.

Torque Multiplication

Figure 51



0552A

A wrench extension tool can be used to increase the tightening force on a high capacity nut or bolt.

For example, doubling the distance between the bolt and the back (handle) end of the torque wrench doubles the tightening force on the bolt. It also halves the indicated reading on the scale or dial of the torque wrench. To accurately adjust or convert indicated scale or dial readings, use the following formula:

I = A x T/A + B where:

I = Indicated force shown on the torque wrench scale or dial.

T = Tightening force applied to the nut or bolt (actual Torque).

A = Length of the torque wrench (between the center of the nut or bolt and the center of the handle).

B = Length of the extension.

As an example, if a 12" extension is added to a 12" torque wrench, and the indicated torque on the dial reads “150 ft lb”, the real force applied to the bolt is 300 ft lb:

I =	A x T A + B	=	12 x 300 12 + 12	=	3600 24	=	150

NOTE: *The formula assumes there is no added deflection or “give” in the joint between the extension and torque wrench. Readings may also be inaccurate:*

- If the extension itself absorbs some of the tightening force and starts to bend or bow out.
- If an extension has to be fabricated that is not perfectly straight (for example, an extension made to go around an obstruction, to allow access to a difficult to tighten fastener), the materials and methods used must be solid enough to transmit full tightening torque.

Other Uses for Torque Wrench Extension Tools

Torque wrench extensions are sometimes made up for reasons other than increasing leverage on a fastener.

For example, a torque wrench and extension can be used to measure adjustment “tightness” of a linkage or assembly. Specially fabricated extensions can be used to make very precise checks of the force required to engage or disengage a clutch mechanism, release a spring-applied brake assembly, or “take up” free play in most any movable linkage.

Once the value of the adjustment force is established, repeated checks at regular intervals can help to monitor and maintain peak operating efficiency. These types of adjustment checks are especially useful if physical measurements of linkage travel are difficult to make or will not provide the needed degree of precision and accuracy.

To allow the assembly or mechanism to accept a torque wrench, welding a nut or other adapter on the end of a linkage shaft or other leverage point will allow turning the shaft or assembly manually.

Loctite Applications

Tightening Torque Specifications (Metric)

(For coated threads, pre-lubricated assemblies.)

NOTICE

Disassembly, overhaul and replacement of components on the machine, installation of new or replacement parts and/or other service-related maintenance may require the use of thread or flange sealing assembly compound.
Use the information on this page as a general guide in selecting specific formulas that will meet the particular requirements of individual assembly installations. We, Machine Producer, do not specifically approve a specific manufacturer or brand name, but the following table of "Loctite" applications is included for which cross-references to other manufacturer's products should also be widely available.

NOTICE

Use primer "T" or "N" for all cold weather assembly of fastener adhesives, with Thread locker sealers 222, 242/243,262, 271, 272, or 277.

I. "Loctite" Fastener Adhesives

Product	Application	Color	Removal	Breakaway Cure Strength (in lb) of Sealer Alone
222	Low strength for 6 mm (1/4") or smaller fasteners.	Purple	Hand tools	45
242 or 243	Medium strength for 6 mm (1/4") and larger fasteners.	Blue	Hand tools	80
262	High strength for high-grade fasteners subject to shock, stress and vibration.	Red	Heat/260°C (500°F) Remove HOT (NO solvent)	160
271	Extra high strength for fine thread fasteners up to 25 mm (1") diameter.	Red	Heat/260°C (500°F) Remove HOT	160
272	High temperature/high strength for hostile environments to 232°C (450°F).	Red	Heat/316°C (600°F) Remove HOT	180
277	Extra high strength for coarse thread fasteners 25 mm (1") diameter and larger.	Red	Heat/260°C (500°F) Remove HOT	210

II. "Loctite" Pipe Thread Sealant

Product	Application	Color	Removal	Required Setup
545	"No filler/non clog" formula for high-pressure hydraulic systems. Over application will not restrict or foul system components.	Purple	Hand tools	4 Hours (or 1/2 hour with Locquic "T" Primer)
656	Solvent resistant, higher viscosity tapered thread sealer.	White	Hand tools	4 Hours (or 1/2 hour with Locquic "T" Primer)

III. "Loctite" gasket/flange sealer

Product	Application	Color	Notes
518	Gasket eliminator specifically made for aluminum flanges/ surfaces. For hydraulic systems to 34,475 kPa (5,000 psi).	Red	Use Locquic "N" primer for fast (1/2 - 4 hours) setup. Unprimed setup 4 - 24 hours.
504	Low-pressure/wide-gap gasket eliminator compound. Fills gaps to 0.762 mm (0.030"), cures to rigid seal.	Orange	Use Locquic "N" primer for faster (1/2 - 4 hours) setup. Unprimed setup 4 - 24 hours.
515	General purpose, fast setup, flexible-cure gasket eliminator. For	Purple	Use Locquic "N" primer for faster (1/4 - 2 hours) setup. Unprimed setup 1 - 12 hours.

Product	Application	Color	Notes
	nonrigid assemblies subject to shock, vibration or deflection.		

IV. "Loctite" retaining compounds

Product	Application	Color	Notes
609	For bushings, sleeves, press fit bearings, splines and collars. For gaps to 0.0002 mm (0.005"), temperatures to 121°C (250°F).	Green	Use Locquic "N" primer for increased bond strength and all cold temperature applications.
620	For high temperatures to 232°C (450°F).	Green	Same as 609, above.
680	For high strength bonds and tight clearance gaps, to 0.00008 mm (0.002").	Green	Same as 609, above.

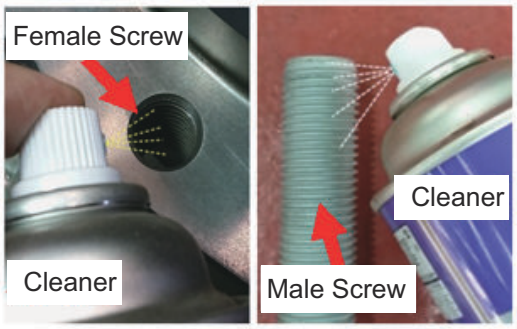
V. "Loctite" Adhesives

Product	Application	Color	Notes
380	Black Max instant adhesive for shock and vibration-resistant bonds.	Black	May take 120 hours to reach full cure strength.
454	Adhesive for porous surfaces.	Clear	Full strength in 24 hours.
480	Increased strength (+50%), shock and vibration-resistant.	Black	Full strength in 24 hours.

Tips for using thread locker

Instructions for use

1. Figure 52



DS2301334

Removal of foreign substances in the fastening area

If there is oil or foreign matter on the screw thread, clean it off with a cleaning solution.

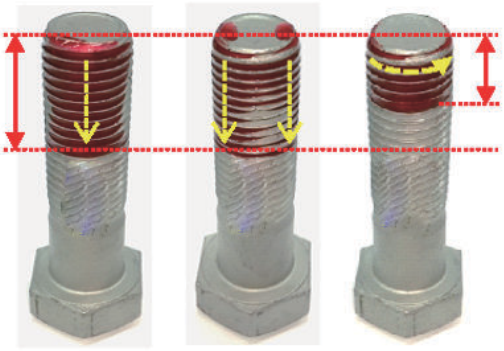
2. Figure 53

DS2301335

Application of screw locking agent

Apply evenly from the tip of the bolt to the screw thread.

3. Figure 54



DS2301336

Appearance of finished application

One line: bolted length = spread length

Double row or round: at least half the bolted length

If you do not know the length of your physique, apply about 1/3 or more of the bolt part.

The application form is less than M20 => one application, more than w22 => two lines or circular application.

If the bolts are assembled, completely remove them within 30 minutes.

NOTE: *Fastening Depth: The total length of engagement between the female thread and the male thread when tightening*

Precautions

1. To manage the cleanliness of the screw locker, keep it sealed when not in use, and do not apply it to the bolt in advance, but apply it before the bolt installation work.
2. The bolts must be fully torqued within 30 minutes after temporary assembly.

   However, if the work cannot be done within 30 minutes, do not do the temporary assembly, and proceed with the assembly when the complete torque work is possible within 30 minutes.
3. If more than 30 minutes have elapsed after the provisional fastening, unscrew the bolts, cleanly remove the screw fixing agent, reapply and then fasten.

   At this time, the hardened screw fixing agent on the female screw is cleaned with a cleaning solution.

4. If it is difficult to remove the bolts coated with the screw fixing agent, heat them over 260 degrees in Celsius to melt the screw fixing agent before removing it.

   The thread locker does not harden even when left in the air. (It hardens when it is blocked from air and comes into contact with metal - anaerobic property)

Engine

Safety Instructions

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments repairs or service. Untrained operators and failure to follow instructions can cause death or serious injury.

Due to the high fuel pressure, leakage can cause jets of fuel that penetrates through the skin! Always consider the high pressure part of the system (accumulator and high pressure lines) as pressurized. The pressure could be as high as 30,450 psi (2,100 bar). This applies also to an engine that is not running!

Before working on any of the fuel system components: Depressurized the system with SDP3 and then loosen the cylinder high pressure line nut at the accumulator of the cylinder you are going to work on. Cover the nut with a cloth during the operation. Use safety glasses and gloves.

Avoid standing closer than 3 feet (1 m) to an engine at first start up after fuel system work has been conducted. Fuel jets will diverge within this distance from the source and become less harmful.

General Information

General Description

This manual provides the most efficient methods for engine maintenance as well as quick, efficient methods to determine the cause of engine faults to ensure that any actions taken by professionally certified maintenance technicians are done in the most efficient and efficient way possible. If maintenance is performed by unskilled technicians, or maintenance without the specified tools and facilities, serious bodily injury or critical faults in engine performance may occur. Regular inspection and maintenance are required to maintain long-term optimal engine conditions and best performance. In the event that a part must be replaced, only genuine parts as defined by the parts the list (Parts Book) should be used. It shall not be held liable for any critical damage or faults which may be caused by the use of unauthorized or remanufactured parts. The maintenance methods stated in this Operation and Maintenance Manual are the most efficient and safest work procedures. Some work procedures require special tools.

For questions about genuine parts and special tools, please contact us.

This manual includes 'Danger', 'Warning', and 'Caution' in order to reduce possible injuries and engine faults which may occur while performing maintenance. If workers do not follow the instructions, critical faults in engine performance and operation or serious bodily injury may occurred. 'Danger', 'Warning', and 'Caution' instructions must be followed. However, we inform you that it is not possible to describe all possible and unexpected dangers which may arise while performing engine maintenance.

Cautions for Starting the Engine

1. Before starting the engine, please read this manual carefully and fully understand 'Danger', 'Warning', and 'Caution'. If you cannot fully understand it or have any question, please contact us.
2. For safety reasons, attach “Warning” signs around engines in operation to keep people other than workers from accessing the engines. Let engine operators know that they are responsible for the safety of the engine room.

3. Only authorized people may start and operate engines. Unauthorized people should not be allowed to handle engines.
4. Do not access running or rotating parts while the engine is in operation.
5. Be careful not to touch or contact the engine during operation since it becomes hot during operation.
6. Exhaust gas is poisonous. Fully ventilate before starting engine. If the space is airtight, ensure that it is well ventilated.

Cautions for Inspection and Repair

1. Inspection and repair of engine should be performed only when the engine is stopped. Otherwise, burns or safety accidents may occur, so do not perform inspection or repair while the engine is running.
2. If it is absolutely necessary to perform inspection or repair on the operating engine, do not get close to the rotating parts.

⚠ DANGER

AVOID DEATH
When accessories such as necklaces, rings, watches, or gloves become stuck in rotating parts while the engine is running, serious bodily injury may occur.

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY
Do not exchange or disassemble a pipe or horse (from the engine fuel circuit, engine oil circuit, coolant circuit, or compressed air circuit) while the engine is running. The leaked liquid may cause bodily injuries.

3. Use an engine oil drain container that is large enough to prevent the overflow of engine oil while draining engine oil.
4. Open the engine coolant cap after fully cooling the engine to exchange or replenish coolant.

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY
If the coolant cap is opened while the engine is still hot, hot water will spurt out and may cause burns. Open the engine coolant cap after fully cooling the engine.

5. Fuel is highly flammable. Smoking or use of fire around an engine may cause fire.

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY
Only refuel when the engine is stopped.

6. Mark and separately manage the containers for storing coolant from beverage containers for avoiding confusion. See a doctor immediately in case of drinking coolant.
7. Follow the instructions provided by the battery manufacturer when checking or handling batteries.

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Battery fluid is corrosive and dangerous because of its explosiveness and toxicity. Therefore, it should only be handled by a skilled technician who specializes in battery fluid.

8. Only certified professional technicians should repair and maintain engines.
9. Only appropriate tools should be used. If the jaws of a wrench are worn out, the wrench might slip during use, causing safety accidents.
10. Do not allow other persons to stay or pass under an engine when lifting the engine with a crane. Before lifting the engine, ensure that there is no one around the engine and reserve enough safety space.
11. Before inspecting or replacing the electrical apparatus, disconnect the battery ground wire first. Connect the battery ground wire after completing all required work for checking or replacing the electrical apparatus in order to prevent a short circuit.
12. Before performing electric welding works, turn off engine, block the power supply to the engine, and remove the wire harness connector connected to the engine control unit (ECU).
13. Do not give any electric or mechanical shocks or perform welding works on the electrical apparatus or the ECU.

General Repair

1. Wait until the engine is properly cooled down before starting work, since you may get burned by the heated engine.

   Before performing fuel line work, check the common rail pressure and engine temperature by using the failure diagnosis device.
2. Disconnect the battery ground wire from to prevent damage of wires and sensors caused by a short circuit.
3. Engine oil and coolant may damage paint and should be stored in a separate container and marked for safe management.
4. Store the disassembled parts in a specified space to avoid damage or pollution.
5. Use specified and special tools for efficient and safe repair.
6. If parts need to be replaced, use only genuine parts for replacement. Using unauthorized or remanufactured parts may cause critical damage and faults in engine performance.
7. Replace parts such as cotter pins, gaskets, O-rings, seal rings, oil seals, and washers with new ones during repairs. Reuse of parts may be the cause of engine faults and engine may not operate properly.
8. Group and store disassembled parts in disassembling order. The strength, shape, and screw torque of bolts and nuts are different according to their assembly position. Please divide and store them accordingly to these characteristics.
9. Clean disassembled parts to remove foreign substances before inspecting or reassembling parts. Use compressed air to clean the oil holes or holes.
10. Thinly spread oil or grease on rotating parts or parts requiring lubrication, before assembling them.
11. If required, use a specified adhesive to assemble gaskets to prevent water or oil from leaking.

12. Assemble bolts and nuts with the specified tightening torque.
13. After completing repairs, conduct a final inspection and perform a test operation to check if all works have been successfully completed.

Other Safety Instructions and Environmental Pollution

Observe the following instructions to protect workers from danger and to prevent the environmental pollution while performing engine repairs.

1. Good ventilation and low humidity should be maintained in the work space.
2. The workspace should be clean, in good order, and no flammables are allowed in the workshop.
3. Smoking is strictly forbidden in the workshop.
4. Workers should wear working clothes, protective goggles, and safety shoes.
5. Workers are not allowed to wear accessories such as necklaces, rings, watches, and earrings.
6. Start the engine in a well-ventilated space and fully ventilate the space before starting engine to prevent carbon monoxide poisoning.
7. Wait until the engine is properly cooled down before starting work, since you may get burned by the heated engine.
8. Do Not work on rotating or running parts once the engine has been started.
9. Discard oil according to the regulations set forth by the relevant authorities.
10. If engine oil or fuel leaks on the floor or is improperly discharged, serious environmental pollution of sea, river or underground water may occur.
11. Discard the undiluted anticorrosive agent, antifreeze, filter elements, and cartridges as special wastes.
12. Discard coolant and special waste according to the regulations of the appropriate authorities.

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Failure to observe the regulations of the relevant authorities violates environmental pollution regulations and may be subject to legal penalties.

Use of Genuine Parts

An engine consists of many parts which are mechanically harmonized. To prevent engine faults in advance and use engines with best performance for a long period, maintenance and replacement of expendable parts should be conducted regularly.

Use of genuine parts is recommended. Using unauthorized or remanufactured parts may cause critical damage and faults to engine for which HD HYUNDAI CONSTRUCTION EQUIPMENT shall not be held liable.

Engine Maintenance

Prevention of Damage and Abrasion

Using an engine for any purposes other than the designed purpose may cause critical faults in engine performance for which HD HYUNDAI CONSTRUCTION EQUIPMENT shall not be held liable. For details concerning the usage and purpose of the engine, please direct questions to our Sales Team. Do not adjust, convert, or change the ECU without our authorization.

If a problem is found in an engine, figure out and solve the cause to prevent the critical faults in advance. Use of genuine parts is recommended. Using unauthorized or remanufactured parts may

cause critical damage and faults to engine for which HD HYUNDAI CONSTRUCTION EQUIPMENT shall not be held liable.

Consider the following while managing engines.

1. Use clean, specified, and qualified fuel only. Use fuel recommended in this Operation and Maintenance Manual.

⚠ CAUTION

AVOID INJURY

Using inappropriate or unspecified fuel may cause critical damage and faults in engine performance.

2. Do not operate an engine without lubrication oil or coolant. Use only the products (engine oil, cooling water, anticorrosive agent, and etc) recommended by HD HYUNDAI CONSTRUCTION EQUIPMENT.
3. Always keep surroundings of the engine clean.
4. Use fuel recommended in this Operation and Maintenance manual.
5. Conduct inspections and exchanges regularly according to the regular inspection table.
6. If the engine is overheated, do not stop it immediately, but operate it at idle status for five minutes or more to lower the engine temperature to the proper level.

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

If the radiator cap is opened while the engine is still hot, hot water will spurt out and may cause burns.

7. Check the engine oil level on a flat surface. Do not exceed the maximum on the oil level gauge.

⚠ CAUTION

AVOID INJURY

Immediately replenish engine oil when the engine oil level is below the lower limit of the engine oil gauge.

8. If there are gauges for battery, oil pressure and coolant and temperature, check if they indicate a normal status.
9. Do not operate engine without coolant.

⚠ CAUTION

AVOID INJURY

Always use coolant mixed with antifreeze. If coolant without antifreeze is used, the coolant may freeze causing the coolant passage in the cylinder block to freeze and damaging the engine.

Prevention of Pollution

Consider the following to manage engine without causing environmental pollution.

1. Discharge oil and coolant using collection containers.
2. Discard oil and coolant according to the regulations of the relevant authorities.

3. Be careful not to let discharged oil and cooling water flow into the ground or the sewer. Otherwise, serious pollution of the drinking water source may occur.
4. Classify the oil, filters, and filter cartridges as environmental pollution wastes and discards them according to regulations.
5. Classify the antifreeze, cooling water, and anticorrosive agent as hazardous wastes and discards them according to the regulations.

Handling of Engine Oil

Prolonged and repeated contact of skin with engine oil may cause skin to dry out and contract, causing dermatitis. Engine oil includes substances toxic to the human body. Handle engine oil by observing the following safety rules:

1. Do not expose skin to new engine oil for a long time.
2. Always wear working clothes and gloves.
3. If skin comes in contact with engine oil, immediately wipe it off with water, soap or hand cleaners.
4. Do not clean skin with gasoline, fuel, thinner, or solvent.
5. Apply a skin protective cream after cleaning from oil.
6. Do not put oil-stained gloves or cloth in ones pocket.

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Discard oil according to the regulations set forth by the relevant authorities. Disposing of discharged oil into the ground, sewers, drains, rivers, or the sea will cause serious environmental pollution. Violation of regulations regarding discard of engine oil without observing the handling regulations, will be punished.

Inspection and Repair of the Engine

Checking Engine Parts after Prolonged Operation

Wear, corrosion, or degradation of engine elements and assemblies may occur, causing lowered performance of engine parts. To maintain high engine performance, check the engine after prolonged operation to enhance the durability of the engine.

Unexpected faults may occur in some weak engine parts after normal operation of the engine, when operation time is prolonged. In this case, it is difficult to maintain high engine performance by simply repairing some parts. We recommend the entire part be replaced or repaired in order to find out the causes more accurately and maintain high engine performance.

To prevent engine failure in advance and use the engine safely for a long period, perform periodic replacements and inspections.

It is recommended to perform engine adjustments and preventive inspections during spring after the engine was exposed to winter or cold weather. This allows economic, long-term use of the engine without faults. As the following parts affect the engine output and performance, these parts should be regularly checked and inspected.

1. Parts affecting intake and exhaust
   - Air filter
   - Intercooler
   - Turbocharger, muffler
   - Other parts
2. Parts affecting lubrication and cooling

- Air filter
- Oil filter
- Antifreeze
- Other parts

Inspection and Repair of Turbocharger

As performance of supercharger significantly affects the engine performance, regular inspections and repairs should be performed and inspection and maintenance regulations should be observed.

Intake Unit

Be careful when handling the air filter in the intake unit. If oil level of the wet air filter is below the specified level, filtering performance is degraded. On the other hand, if the oil level is higher, oil may flow into the case, and it may become polluted. In regards to the dry air filter, intake resistance should be small to ensure the smooth intake of air.

Exhaust Unit

If exhaust emission is leaked from the part connecting the exhaust tube and the turbocharger, the supercharger efficiency is lowered, causing degraded engine output and, if serious, burning of related parts. As parts related to exhaust and turbocharger are used at high temperature, be careful not to mix the bolts and nuts with other parts when performing repair.

Lubrication System

Inspection and replacement of the lubrication system should be performed according to the replacement schedule of oil and oil filter. Overheated engine oil can affect not only the engine itself, but also the engine performance.

Tightening Torque

Tightening Torque of Main Parts

Major parts		Screw (Diameter x pitch)	Strength (Grade)	Tightening torque (kgf.m)
Cylinder block & Bed plate	Main bearing cap bolt (D18, D24)	M12 x 1.5	10.9T	Initial 5.5 ±0.28 + angle 90° ±4° + angle 90° ±4°
	Main bearing cap bolt (D34)	M12 x 1.5	12.9T	Initial 5.5 ±0.28 + angle 90° ±4° + angle 90° ±4°
	Bed plate bolt	M8 x 1.25	8.8T	2.2 ±0.22
	Plug, screw (PT)	PT 3/8	-	6.5 ±0.5
	Plug, screw Water drain plug (D18, D24)	M12 x 1.5	-	3.0 ±0.3
	Plug, screw Water drain plug (D34)	M12 x 1.5	-	5.0 ±0.5
Oil spray nozzle valve		M10 x 1.25	-	2 ±0.2
Flywheel housing, bolt		M10 x 1.5	10.9T	6.2 ±0.62
CRS V pulley, bolt		M14 x 1.5	10.9T	26 ±1
Connecting rod bolt (for		M8 x 1.0	10.9T	1st: 2.0 ±0.1 / 2nd: 90° ±4°

D18, D24)			
Connecting rod bolt (for D34)	M9 x 1.0	10.9T	1st: 3.0 ±0.15 / 2nd: 90° ±4°
MBS bolt (for D34, option)	M10 x 1.5	10.9T	Initial 6.0 ±0.3 + angle 90° ±4°
			+ angle 90° ±4°
Flywheel bolt (25 mm, option) for flat type flywheel	M12 x 1.5	12.9T	17 ±0.85
Flywheel bolt (43 mm, option)	M12 x 1.5	10.9T	1st: 7 ±0.35 / 2nd: 45° ±4°
Head bolt (D18, D24)	M11 x 1.25	9T	Initial 4.0 ±0.2 + angle 90° ±4° + angle 90° ±4° + angle 90° ±4°
Head bolt (D34)	M12 x 1.25	9T	Initial 4.5 ±0.23 + angle 90° ±4° + angle 90° ±4°
Head cover bolt (LH, RH)	M6 x 1.0	8.8T	1 ±0.1
Head cover bolt (Main)	M6 x 1.0	8.8T	1 ±0.1
EX manifold bolts	M8 x 1.25 (60mm)	10.9T	3.4 ±0.3
Injector fixture bolts	M8 x 1.25	12.9T	4.4 ±0.4
HP pump drive gear nut	M18 x 1.5	-	8.2 ±0.5
HP pump MTG nut	M8 x 1.25	-	2.2 ±0.22
HP pipe nut - injector to rail	Union nut	-	3.0 ±0.3
HP pipe nut - rail to pump	Union nut	-	3.0 ±0.3
Thermostat MTG space bolt	M8 x 1.25	8.8T	2.2 ±0.22
Thermostat plug	UNF 3/4 - 16	-	1.75 ±0.25
Oil pan drain plug	UNF 3/4 - 16	-	3 ±0.3
Glow plug body	M8 x 1.0	-	1.05 ±0.15
Glow plug terminal	M4 x 0.7	-	0.165 ±0.035
Turbocharger hollow screw	M10 x 1.0	-	1.9 ±0.1
Turbocharger MTG nut	M8 x 1.25	-	2.2 ±0.22
Water pump MTG nut	M8 x 1.25	-	2.2 ±0.22
Rocker arm adjusting hex nut	M8 x 1.0	-	1.5 ±0.15
Camshaft thrust washer bolt	M8 x 1.25	8.8T	2.2 ±0.22
Idle gear shaft bolt	M10 x 1.5	8.8T	4.4 ±0.44
Rocker arm bracket bolt	M8 x 1.25	8.8T	2.2 ±0.22
PTO housing bolt	M10 x 1.5	12.9T	4.4 ±0.44
PTO (D34)	M10 x 1.5	12.9T	1st: 4.4 ±0.44
Alternator nut	M8 x 1.25	-	2.2 ±0.22
Alternator bolt	M8 x 1.25	8.8T	2.2 ±0.22

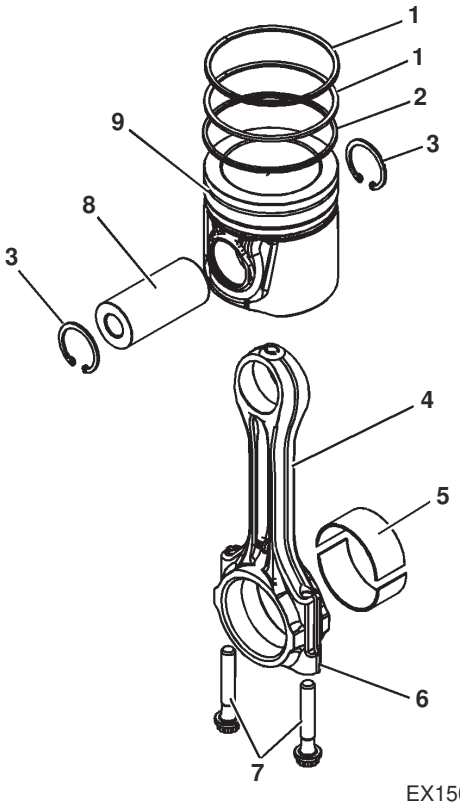
Starter nut	M10 x 1.5	-	4.4 ±0.44
Idle pulley assembly bolt	M10 x 1.5	-	4.5 ±0.5
Extension hose bracket bolt (Fuel)	M12 x 1.75	8.8T	5.5 ±0.55
Worm drive type clamp	-	-	0.525 ±0.03
Band clamp (DOC & SCR)	-	-	1.4 ±0.1
V-clamp (Exhaust pipe)	-	-	1.0 ±0.1
Oil pressure sensor	M14 x 1.5	-	1.0 ±0.1
EGT sensor*	M14 x 1.5	-	4.0 ±0.5
Water temp. sensor	M12 x 1.5	-	2.5 ±0.3

Actuating System

Pistons, Rings, and Connecting Rods

Overview

Figure 55



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The pistons have a quiescent or a re-entrant combustion chamber in the top of the piston in order to provide an efficient mix of fuel and air. The piston pin is off-center in order to reduce the noise level.

The position pin is retained in the correct position by two clips.

The pistons have two compression rings and an oil control ring. The groove for the top ring has a hard metal insert in order to reduce wear of the groove. The piston skirt has a low friction coating in order to reduce the risk of seizure when the engine is new.

The correct piston height is important in order to ensure that the piston does not contact the cylinder head.

The correct piston height also ensures the efficient combustion of fuel which is necessary in order to conform to requirements for emissions.

The connecting rods are machined from forged steel. The connecting rods have bearing caps (that are fracture split.

Two connecting rod bearings are installed between the connecting rod and the bearing cap.

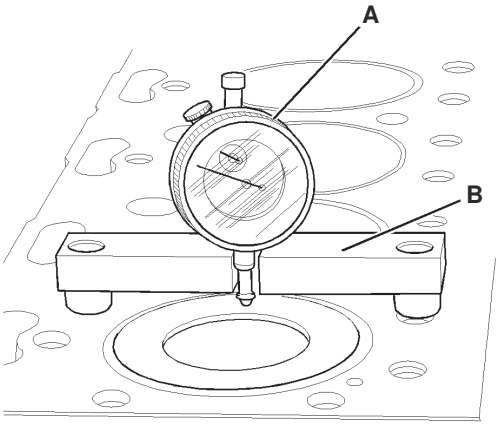
The bearing caps on fracture split connecting rods are retained with Torx bolts.

Connecting rods with bearing caps that are fracture split have the following characteristics:

- The splitting produces an accurately matched surface on each side of the fracture for improved strength.
- The correct connecting rod must be installed with the correct bearing cap for the connecting rod and bearing cap must match.

Piston Height - Inspect

Figure 56



EX1500866

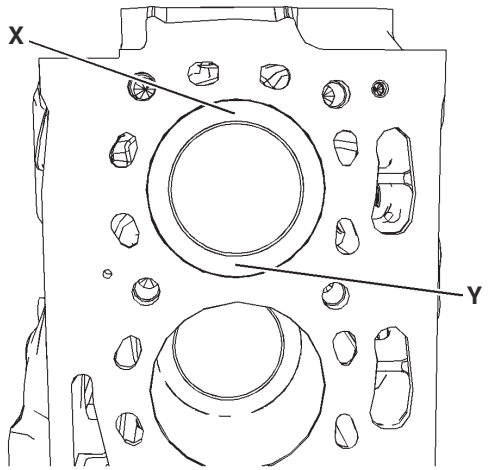
If the height of the piston above the cylinder block is not within the tolerance that is given in "Piston and Rings", the bearing for the piston pin must be checked. Refer to "Connecting Rod - Inspect". If any of the following components are replaced or remachined, the piston height above the cylinder block must be measured:

- Crankshaft
- Cylinder head
- Connecting rod
- Bearing for the piston pin

The correct piston height must be maintained in order to ensure that the engine conforms to the standards for emissions.

NOTE: *The top of the piston should not be machined. If the original piston is installed, be sure that the original piston is assembled to the correct connecting rod and installed in the original cylinder.*

1. Use dial gauge and dial gauge holder in order to measure the piston height above the cylinder block. Use the cylinder block face to zero dial gauge.
   Figure 57



EX1500867

2. Rotate the crankshaft until the piston is at the approximate top center.
3. Position dial gauge hold and dial gauge in order to measure the piston height above the cylinder block. The piston height must be measured at positions (X) or (Y). Slowly rotate the crankshaft in order to determine when the piston is at the highest position. Record this dimension. Compare this dimension with the dimensions that are given in "Piston and Rings".

Connecting Rod - Inspect

NOTE: *If the crankshaft or the cylinder block are replaced, the piston height for all cylinders must be measured.*

New piston pin bearings must be bored after installation in the original connecting rods. Refer to "Connecting Rod Bearings - Install".

NOTE: *When the piston pin is installed, always install new retaining rings on each end of the piston pin. If the piston pin cannot be removed by hand, heat the piston to a temperature of 45 °C (113°F) in order to aid the removal of the piston pin. Heating the piston to this temperature may also aid the installation of the piston pin.*

Crankshaft

Overview

The crankshaft has five main journals. Thrust washers are installed on both sides of number 3 main bearing in order to control the end play of the crankshaft.

The crankshaft changes the linear energy of the pistons and connecting rods into rotary torque in order to power external equipment.

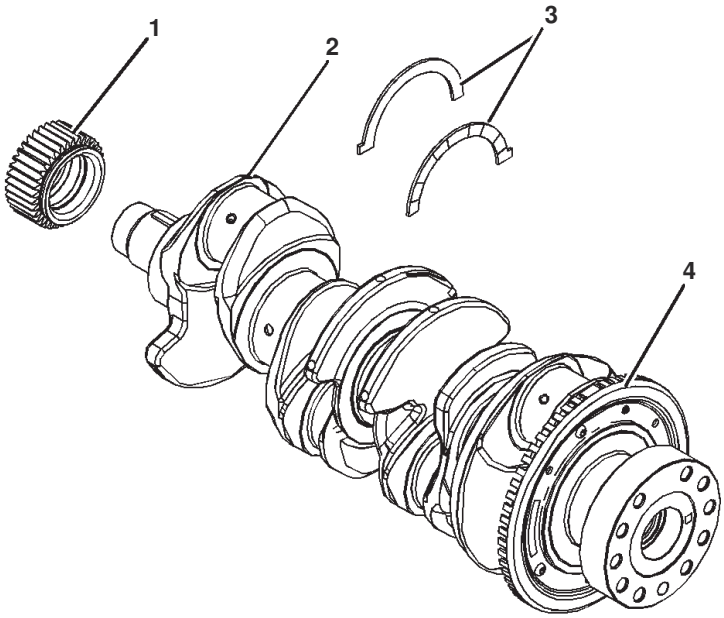
A gear at the front of the crankshaft drives the timing gears. The crankshaft gear turns the idler gear which then turns the following gears:

- Camshaft gear
- Fuel injection pump and fuel transfer pump
- The idler gear is driven by the crankshaft gear

Which turns the gear of the lubricating oil pump. Lip type seals are used on both the front of the crankshaft and the rear of the crankshaft.

A timing ring is installed to the crankshaft. The timing ring is used by the ECM in order to measure the engine speed and the engine position.

Figure 58

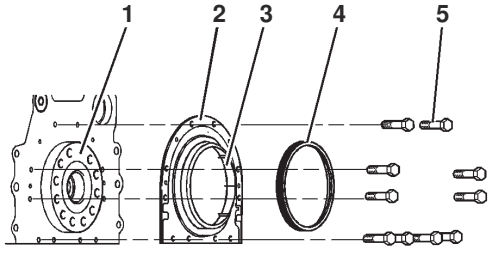


EX1500868

Reference Number	Description
1	Crankshaft Gear
2	Crankshaft
3	Crankshaft Thrust Washers
4	Crankshaft Timing Ring

Crankshaft Seals - Specificaition

Figure 59



EX1500871

Reference Number	Description
1	Crankshaft
2	Crankshaft Seal
3	Plastic Sleeve

Reference Number	Description
4	Alignment Tool
5	Bolt

Bearing Clearance - Check

NOTICE

Keep all parts clean from contaminants.
Contaminants may cause rapid wear and shortened component life.

NOTE: *We as the Machine Producer do not recommend the checking of the actual clearances of the bearing shells particularly on small engines. Checking of the actual clearances of the bearing shells is because of the possibility of obtaining inaccurate results and of damaging the bearing shell or the journal surfaces. Each bearing shell is quality checked for specific wall thickness.*

NOTE: *The measurements must be within specifications and the correct bearings must be used. If the crankshaft journals and the bores for the block and the rods were measured during disassembly, no further checks are necessary. However, if the technician still wants to measure the bearing clearances, a suitable tool is an acceptable method.*

NOTICE

Lead wire, shim stock or a dial bore gauge can damage the bearing surfaces.

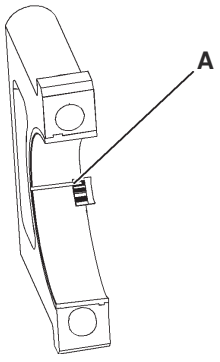
The technician must use tools correctly. The following points must be remembered:

- Ensure that the backs of the bearings and the bores are clean and dry.
- Ensure that the bearing locking tabs are properly seated in the tab grooves.
- The crankshaft must be free of oil at the contact points of tools.

1. Put a piece of tool on the crown of the bearing that is in the cap.

   NOTE: *Do not allow tool to extend over the edge of the bearing.*

2. Use the correct torque-turn specifications in order to install the bearing cap. Do not use an impact wrench. Be careful not to dislodge the bearing when the cap is installed.
   Figure 60



EX1500987

   NOTE: *Do not turn the crankshaft when a tool is installed.*

3. Carefully remove cap, but do not remove tool. Measure the width of tool while it is in the bearing cap or on the crankshaft journal. Refer to Figure 53.
4. Remove all of tool before you install the bearing cap.

NOTE: *When tool is used, the readings can sometimes be unclear. For example, all parts of tools are not the same width. Measure the major width in order to ensure that the parts are within the specification range. Refer to "Connecting Rod Bearing Journal" and Specifications Manual, "Main Bearing Journal" for the correct clearances.*

Crankshaft Pulley - Check

The crankshaft pulley is installed on the front of the crankshaft.

Replace the crankshaft pulley if any of the following conditions exist:

- There is movement of the crankshaft pulley.
- There is a large amount of gear train wear that is not caused by lack of oil.
- Analysis of the engine oil has revealed that the front main bearing is badly worn.
- The engine has had a failure because of a broken crankshaft.

Check the areas around the holes for the bolts in the crankshaft pulley for cracks or for wear and for damage.

Use the following steps in order to check the alignment and the run out of the crankshaft pulley:

1. Remove any debris from the front face of the crankshaft pulley. Remove any debris from the circumference of the crankshaft pulley.
2. Mount the dial indicator on the front cover. Use the dial indicator to measure the outer face of the crankshaft pulley. Set the dial indicator to read 0.00 mm (0.00 inch).
3. Rotate the crankshaft at intervals of 45 degrees and read the dial indicator.
4. The difference between the lower measurements and the higher measurements that are read on the dial indicator at all four points must not be more than 0.18 mm (0.007 inch). If the reading on the dial indicator is more than 0.18 mm (0.007 inch), inspect the pulley for damage. If the pulley is damaged, use new parts for replacement.
5. Move the dial indicator so that the dial indicator will measure the circumference of the crankshaft pulley. Set the dial indicator to read 0.00 mm (0.00 inch).
6. Slowly rotate the crankshaft in order to measure the run out of the circumference of the crankshaft pulley. Use the highest reading and the lowest reading on the dial indicator. The maximum and the minimum readings on the dial indicator should not vary more than 0.12 mm (0.005 inch). If the reading on the dial indicator is more than 0.12 mm (0.005 inch), inspect the pulley for damage. If the pulley is damaged, use new parts for replacement.

Gears and Timing Gear Case

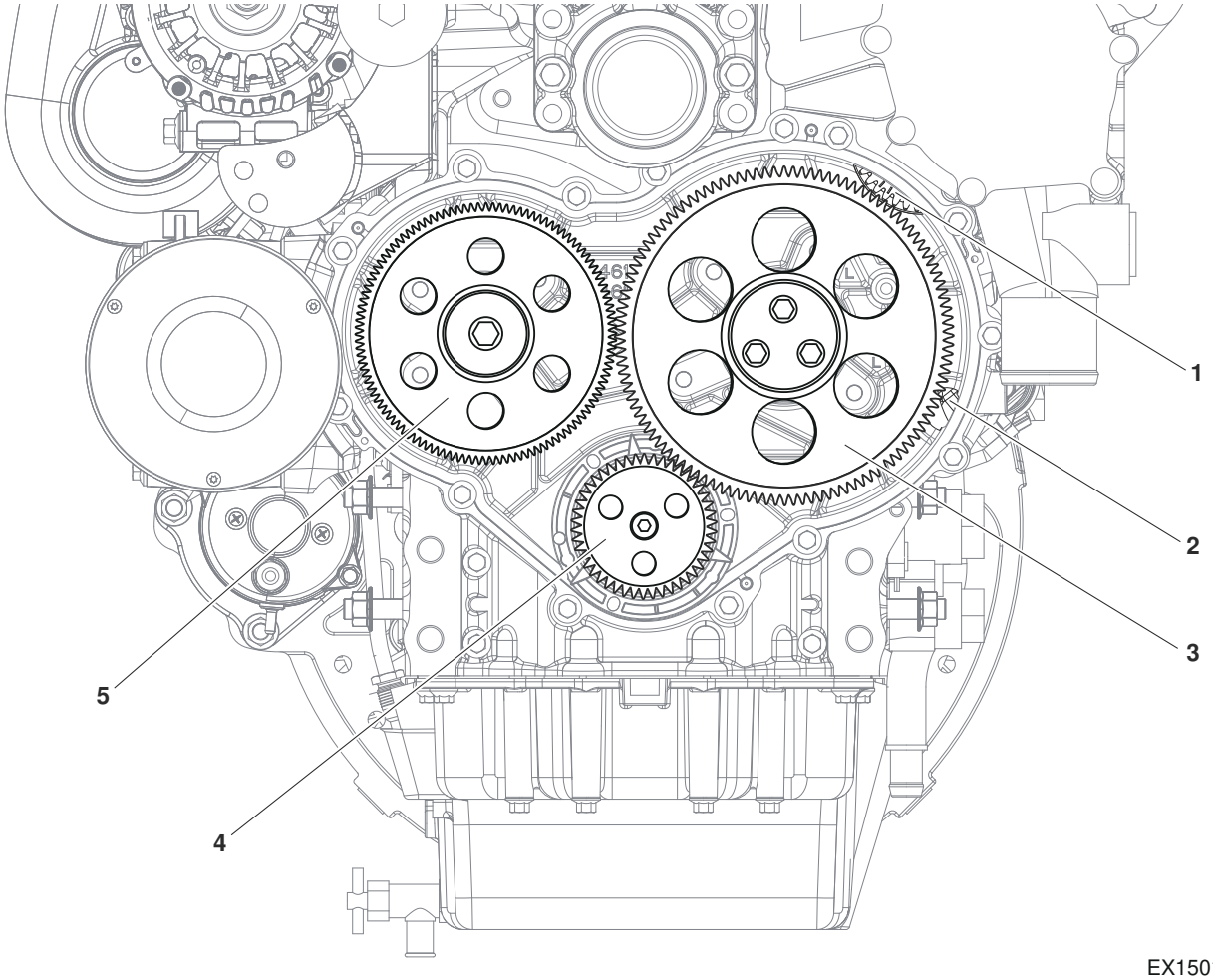
Overview

The crankshaft oil seal is mounted in the cover of the timing case. The timing case cover is made from sound-deadened steel or cast iron. The timing gears are made of steel.

The crankshaft gear drives an upper idler gear and a lower idler gear. The upper idler gear drives the camshaft gear and the fuel injection pump gear. The lower idler gear drives the oil pump. The water pump drive gear is driven by the fuel injection pump gear.

The camshaft rotates at half the engine speed. The fuel injection pump rotates at engine speed.

Figure 61



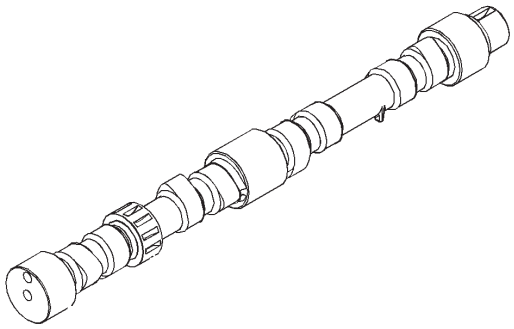
EX1501283

Reference Number	Description
1	Fuel Injection Pump Gear
2	Position of the Accessory Drive Gear
3	Idler Gear
4	Crankshaft Gear
5	Camshaft Gear

Camshaft

Overview

Figure 62



EX1501021

The engine has a single camshaft. The camshaft is made of cast iron. The camshaft lobes are chill hardened.

The camshaft is driven at the front end. As the camshaft turns, the camshaft lobes move the valve system components. The valve system components move the cylinder valves.

The camshaft gear must be timed to the crankshaft gear. The relationship between the lobes and the camshaft gear causes the valves in each cylinder to open at the correct time. The relationship between the lobes and the camshaft gear also causes the valves in each cylinder to close at the correct time.

Lubricant System

Overview

Lubricating oil from the oil pan flows through a strainer and a pipe to the suction side of the engine oil pump. Engine oil pressure for the lubrication system is supplied by the oil pump. The crankshaft gear drives a lower idler gear. The lower idler gear drives the oil pump gear.

The pump has an inner rotor and an outer rotor. The axis of the inner rotor is off-center to the outer rotor.

There is an interference fit between the inner rotor and the drive shaft.

The inner rotor has six lobes which mesh with the seven lobes of the outer rotor. When the pump rotates, the distance increases between the lobes of the outer rotor and the lobes of the inner rotor in order to create suction. When the distance decreases between the lobes, pressure is created, forcing oil into the lubricating system.

The lubricating oil flows from the outlet side of the oil pump through a passage to the plate type oil cooler.

The oil cooler is located on the left side of the cylinder block. The oil then flows from the oil cooler through a passage to the oil filter head. Under normal conditions, the oil then flows from the oil filter head to the oil filter.

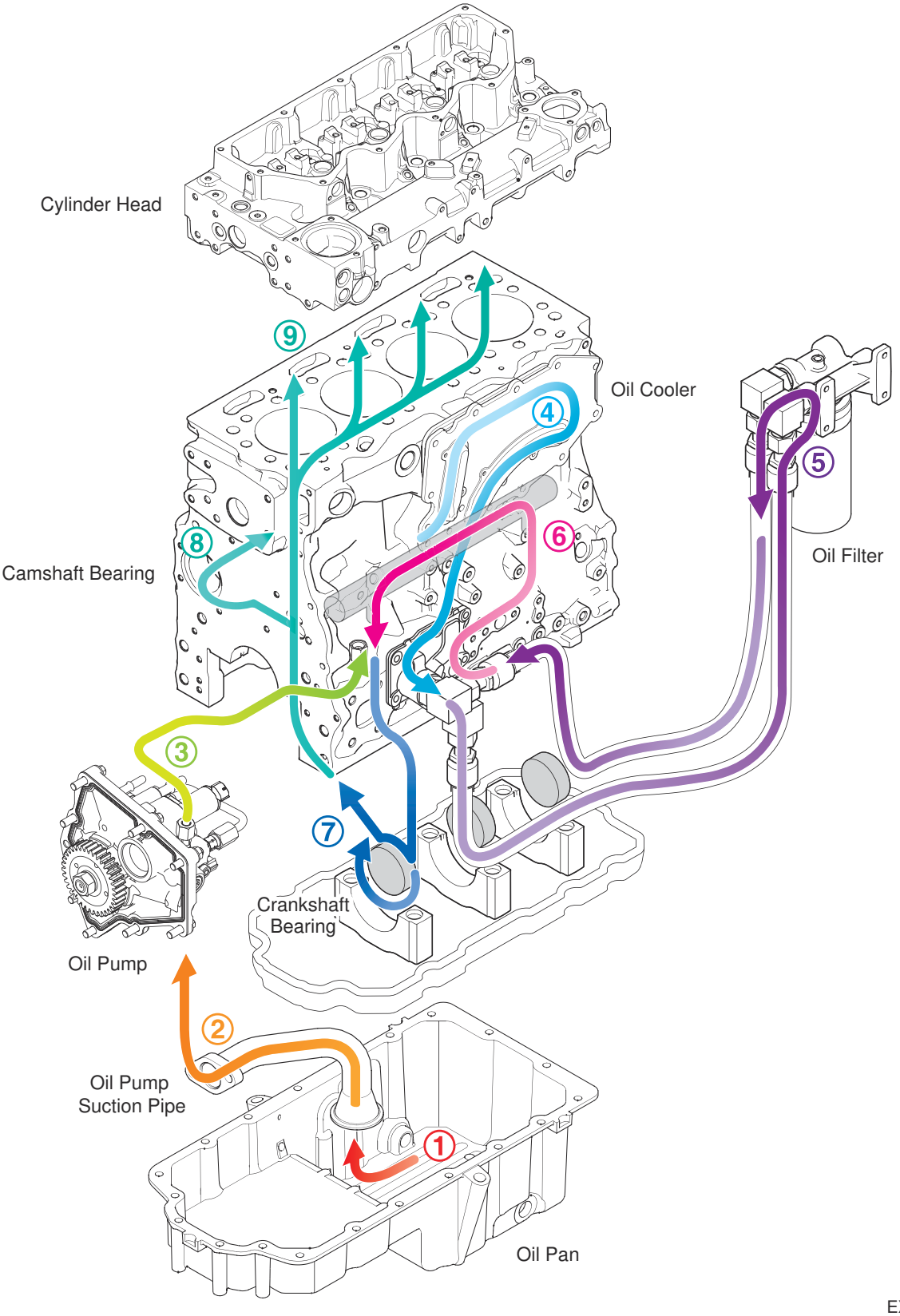
The oil may flow through a bypass valve that permits the lubrication system to function if the oil filter becomes blocked.

The oil flows from the oil filter through a passage that is drilled across the cylinder block to the oil gallery.

The oil gallery is drilled through the total length of the left side of the cylinder block. If the oil filter is on the right side of the engine, the oil flows through a passage that is drilled across the cylinder block to the pressure gallery.

Lubrication oil from the oil gallery flows through high pressure passages to the connecting rod bearing journals. The pistons and the cylinder bores are lubricated by the splash of oil and the oil mist. Engines have piston cooling jets that are supplied with oil from the oil gallery. The piston cooling jets spray lubricating oil on the underside of the pistons in order to cool the pistons. Lubricating oil from the main bearings flows through passages in the cylinder block to the journals of the camshaft. Then, the oil flows from the front journal of the camshaft at a reduced pressure to the cylinder head. The oil then flows through the center of the rocker shaft to the rocker arm levers. The valve stems, the valve springs and the valve lifters are lubricated by the splash and the oil mist. The hub of the idler gear is lubricated by oil from the oil gallery. The timing gears are lubricated by the splash from the oil. Lubrication oil from the oil filter flows through a passage in the cylinder block to an external feed connection for the turbocharger. The feed connection supplies lubricating connection supplies lubricating oil to the center housing of the turbocharger. Lubricating oil then flows from the drain for the turbocharger to the engine crankcase.

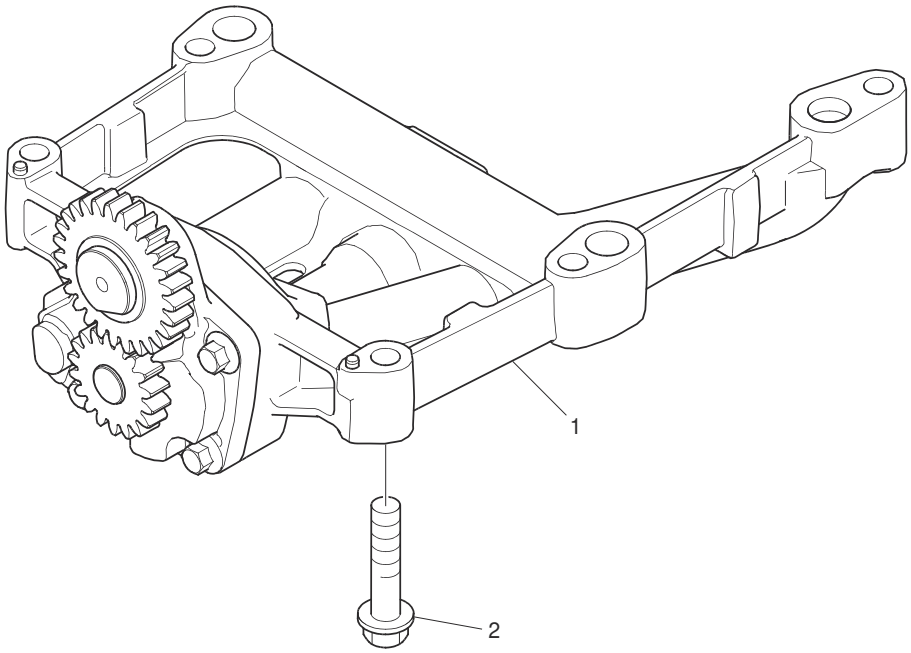
Figure 63



EX1501432

Engine Oil Pump

Figure 64



EX1501047

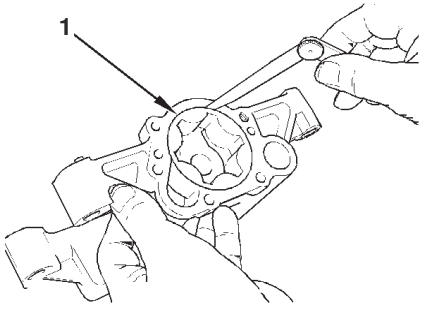
Reference Number	Description
1	Pump Assembly, Oil
2	Screw

Engine Oil Pump - Inspect

If any part of the oil pump is worn enough in order to affect the performance of the oil pump, the oil pump must be replaced.

Perform the following procedures in order to inspect the oil pump. Refer to "Engine Oil Pump - Specifications" for clearances and torques.

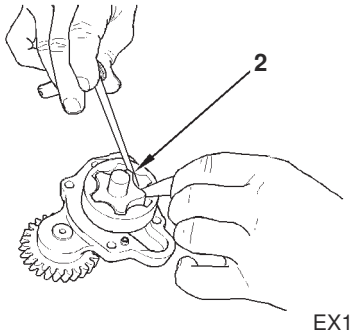
1. Remove oil pump from the engine. Remove cover of the oil pump.
2. Figure 65



EX1501050

Remove outer rotor (1). Clean all of the parts. Look for cracks in the metal or other damage.

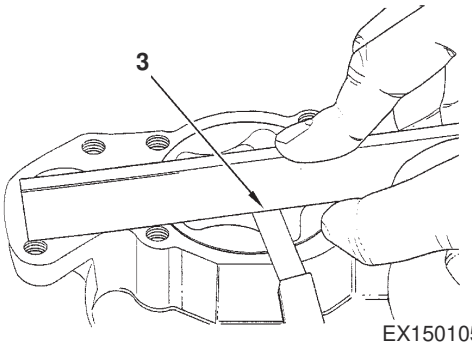
3. Install the outer rotor. Measure the clearance of the outer rotor to the body .
4. Figure 66



EX1501051

Measure the clearance of the inner rotor to the outer rotor (2).

5. Figure 67



EX1501052

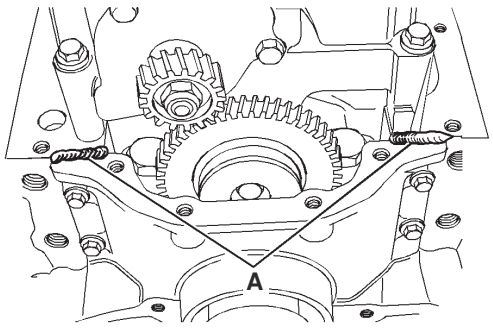
Measure the end play of the outer rotor with a straight edge and a feeler gauge (3).

6. Clean the top face of the oil pump and the bottom face of the cover. Install the cover on the oil pump. Install the oil pump on the engine.

Engine Oil Pan

Engine Oil Pan - Specification

Figure 68

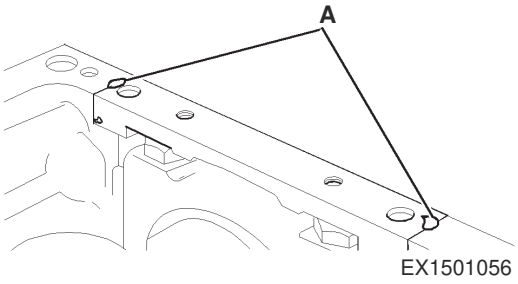


EX1501052

Front Sealant

NOTE: *Apply a sealant bead of 3.5 mm (0.1378 inch) that is shown in Figure 16.*

Figure 69

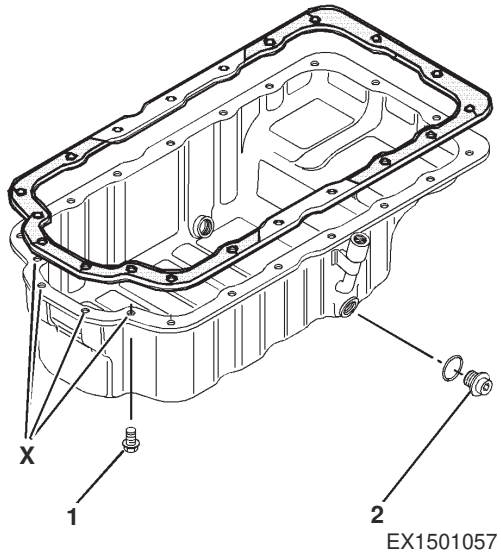


Rear Sealant

NOTE: *Install the rear oil seal before sealant is applied to the bridge.*

Apply a suitable tool to the bridge. The sealant must not protrude more than 5 mm (0.1969 inch) above the bridge.

1. Figure 70



   Tighten the four front bolts in position (X) to the following torque (1): 22 N.m (2.2 kg.m, 16.2 ft lb)

   - Tighten the remaining bolts to the following torque: 22 N.m (2.2 kg.m, 16.2 ft lb)

2. Drain plug (2)

   - Tighten the drain plug for the engine oil pan to the following torque: 34 N.m (3.5 kg.m, 25 ft lb)

Engine Oil Pressure - Test

Low Oil Pressure

The following conditions will cause low oil pressure.

- The oil level is low in the crankcase.
- A restriction exists on the oil suction screen.
- Connections in the oil lines are leaking.
- The connecting rod or the main bearings are worn.
- The rotors in the oil pump are worn.
- The oil pressure relief valve is operating incorrectly.

A worn oil pressure relief valve can allow oil to leak through the valve which lowers the oil pressure.

The minimum oil pressure at a maximum engine speed of 2,200 rpm and at normal operating temperature is 2.8 bar (40 psi). A lower pressure is normal at low idle.

A suitable pressure gauge can be used in order to test the pressure of the lubrication system.

High Oil Pressure

High oil pressure can be caused by the following conditions.

- The spring for the oil pressure relief valve is installed incorrectly.
- The plunger for the oil pressure relief valve becomes jammed in the closed position.
- Excessive sludge exists in the oil which makes the viscosity of the oil too high.

Excessive Bearing Wear - Inspect

When some components of the engine show bearing wear in a short time, the cause can be a restriction in an oil passage.

An engine oil pressure indicator may show that there is enough oil pressure, but a component is worn due to a lack of lubrication. In such a case, look at the passage for the oil supply to the component. A restriction in an oil supply passage will not allow enough lubrication to reach a component. Early wear will result.

Refer to Specifications for more information regarding component wear limits.

Excessive Engine Oil Consumption - Inspect

Engine Oil Leaks on the Outside of the Engine

Check for leakage at the seals at each end of the crankshaft. Look for leakage at the gasket for the engine oil pan and all lubrication system connections.

Look for any engine oil that may be leaking from the crankcase breather. This can be caused by combustion gas leakage around the pistons. A dirty crankcase breather will cause high-pressure in the crankcase. A dirty crankcase breather will cause the gaskets and the seals to leak.

Engine Oil Leaks into the Combustion Area of the Cylinders

Engine oil that is leaking into the combustion area of the cylinders can be the cause of blue smoke. There are several possible ways for engine oil to leak into the combustion area of the cylinders:

- Failed valve stem seals
- Leaks between worn valve guides and valve stems
- Worn components or damaged components (pistons, piston rings, or dirty return holes for the engine oil)
- Incorrect installation of the compression ring and/or the intermediate ring

- Leaks past the seal rings in the turbocharger shaft
- Overfilling of the crankcase
- Wrong dipstick or guide tube
- Sustained operation at light loads

Excessive consumption of engine oil can also result if engine oil with the wrong viscosity is used. Engine oil with a thin viscosity can be caused by fuel leakage into the crankcase or by increased engine temperature.

Increased Engine Oil Temperature - Inspect

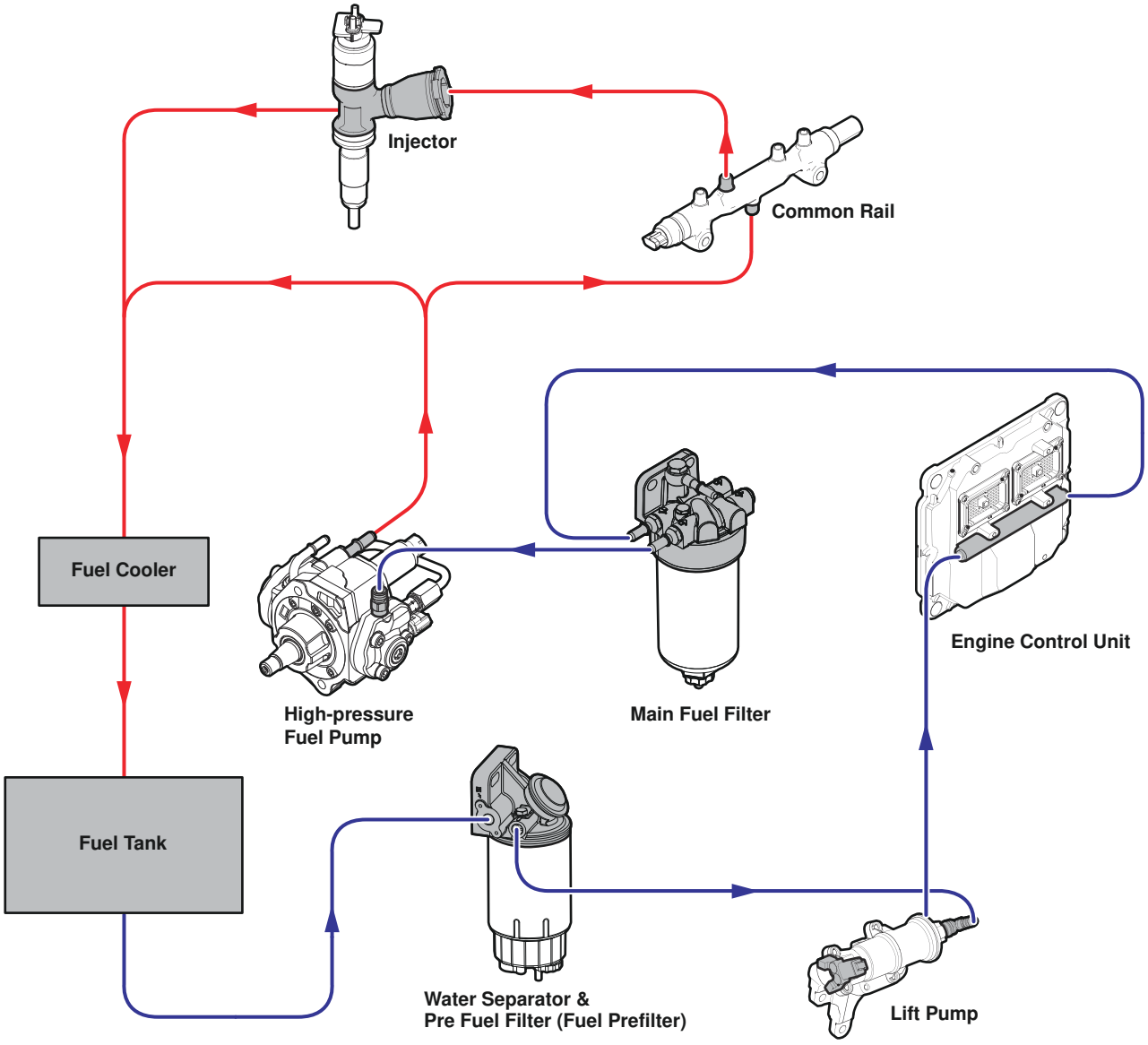
Look for a restriction in the oil passages of the oil cooler. The oil temperature may be higher than normal when the engine is operating. In such a case, the oil cooler may have a restriction.

Fuel System

Overview

Fuel is drawn from the fuel tank through a fuel cooler and an in-line fuel filter to an external electric transfer pump. The fuel may flow to a fuel cooled ECM. The fuel then flows to a water separator. The fuel flows from water separator to a main fuel filter. The fuel flows from main fuel filter to a pressure regulator. A pressure regulator that is installed in the low-pressure fuel system controls the fuel pressure to the fuel injection pump. The pressure regulator regulates the fuel at a pressure of 1.5 bar (22 psi) when the engine is at idle speed. From the pressure regulator, the fuel flows to the fuel injection pump. The fuel is pumped at an increased pressure of 2000 bar (29,000 psi) to the fuel manifold (rail). Fuel that has too high a pressure from the fuel manifold (rail) returns through the pressure relief valve to the return line fuel that is leak off from the electronic unit injectors flows to the return line. The fuel may then flow to the fuel tank.

Figure 71



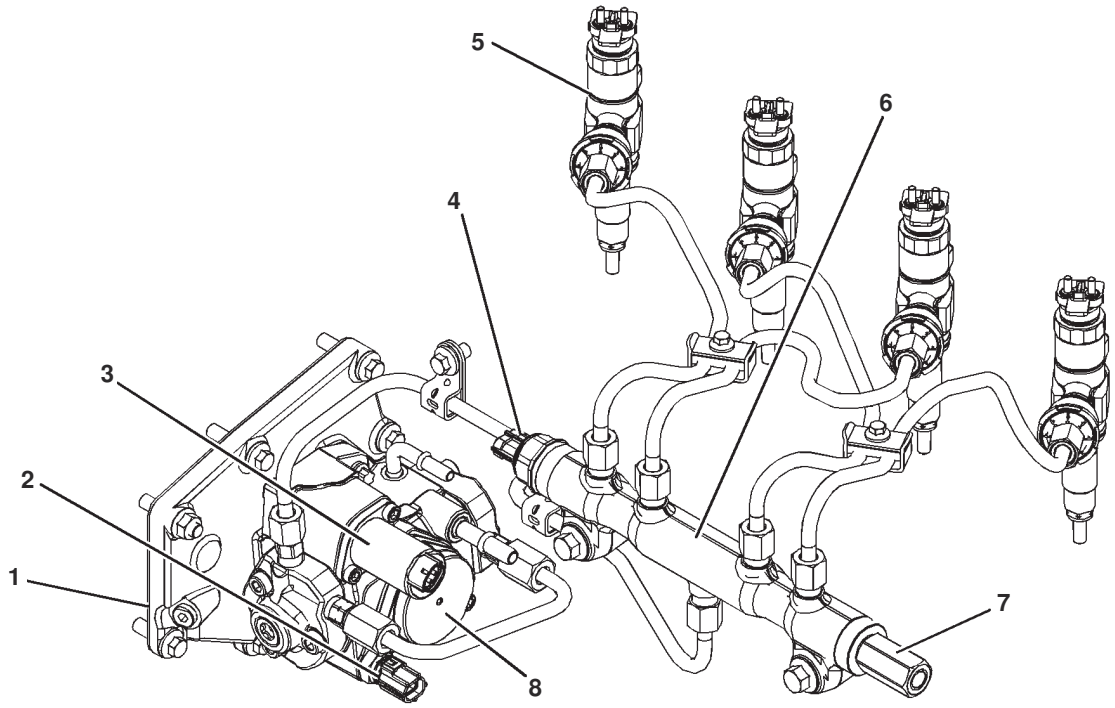
DS1602865

High-pressure Fuel System

The fuel injection pump feeds fuel to the high-pressure fuel manifold (rail). The fuel is at a pressure of 2,000 bar (29,000 psi). A pressure sensor in the high-pressure fuel manifold (rail) monitors the fuel pressure in the high-pressure fuel manifold (rail). The ECM controls a suction control valve in the fuel injection pump in order to maintain the actual pressure in the high-pressure fuel manifold at the desired level. The high-pressure fuel is continuously available at each injector.

The ECM determines the correct time for activation of the correct electronic unit injector which allows fuel to be injected into the cylinder. The leak off fuel from each injector passes into a drilling which runs along the inside of the cylinder head. A pipe is connected to the rear of the cylinder head in order to return the leak off fuel to the fuel tank.

Figure 72



EX1501091

Reference Number	Description
1	Fuel Injection Pump
2	Fuel Temperature Sensor
3	Suction Control Valve for the Fuel Injection Pump
4	Fuel Pressure Sensor
5	Electronic Unit Injector
6	Fuel Manifold (Rail)
7	Pressure Relief Valve
8	Fuel Transfer Pump

Components of the Fuel Injection System

The fuel injection system has the following mechanical components:

- Water separator
- Electric transfer pump
- Fuel transfer pump
- Main fuel filter
- Fuel injection pump
- Fuel injectors
- Fuel manifold
- Pressure relief valve
- Fuel pressure sensor

- Fuel temperature sensor

The following list contains examples of both service and repairs when you must prime the system:

- A fuel filter is changed.
- A low-pressure fuel line is replaced
- The fuel injection pump is replaced.
- The ECM is replaced.

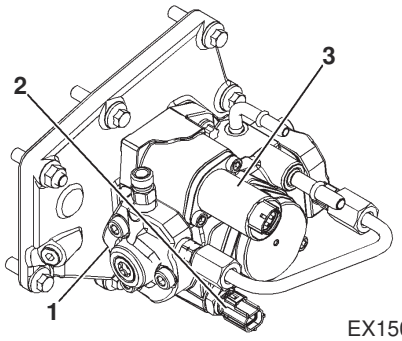
For the correct procedure to prime the fuel system, refer to "Fuel System - Prime".

Fuel Injection Pump

Overview

The fuel pump assembly consists of a low-pressure transfer pump and a high-pressure fuel injection pump.

Figure 73



EX1501094

The pump assembly is driven from a gear in the front timing case at engine speed. The fuel injection pump has two plungers that are driven by a camshaft. The fuel injection pump delivers a volume of fuel two times for each revolution.

The stroke of the plungers are fixed. The injector will use only part of the fuel that is delivered by each stroke of the pistons in the pump. The suction control valve for the fuel injection pump is controlled by the ECM. This maintains the fuel pressure in the fuel manifold (rail) at the correct level.

A feature of the fuel injection pump allows fuel to return to the tank continuously.

The fuel temperature sensor measures the temperature of the fuel. The ECM receives the signal from the fuel temperature sensor. The ECM calculates the volume of fuel.

The fuel injection pump has the following operation:

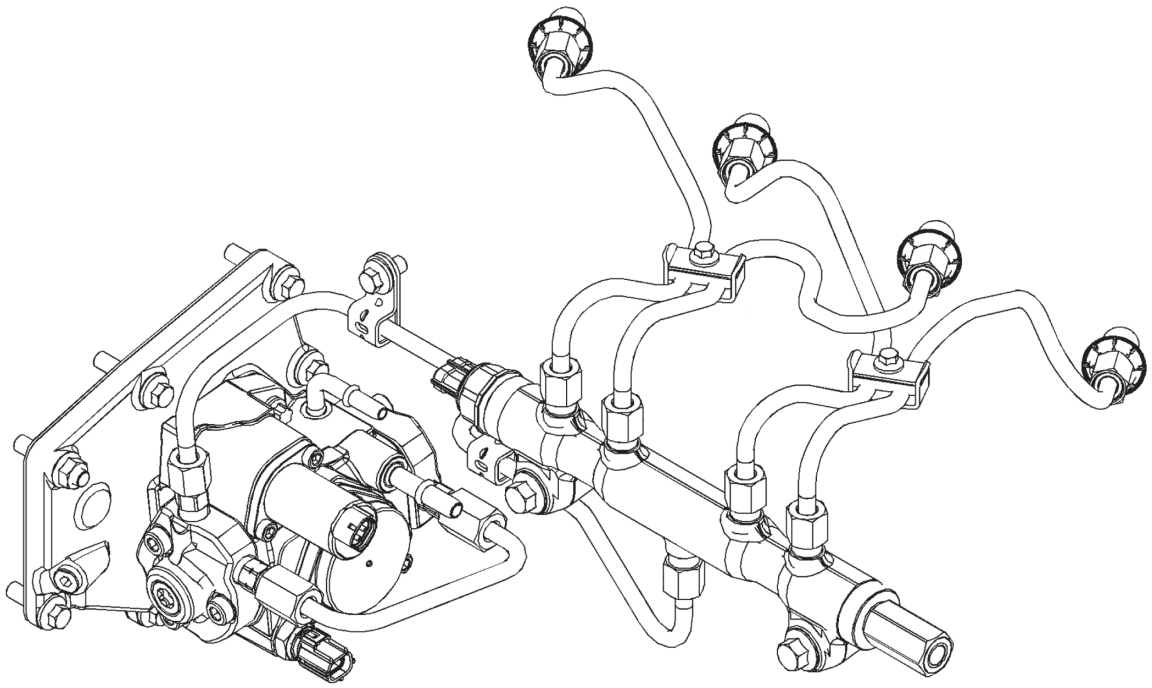
- Generation of high-pressure fuel

The fuel output of the fuel injection pump is controlled by the ECM in response to changes in the demand of fuel pressure.

Fuel Injection Lines

Overview

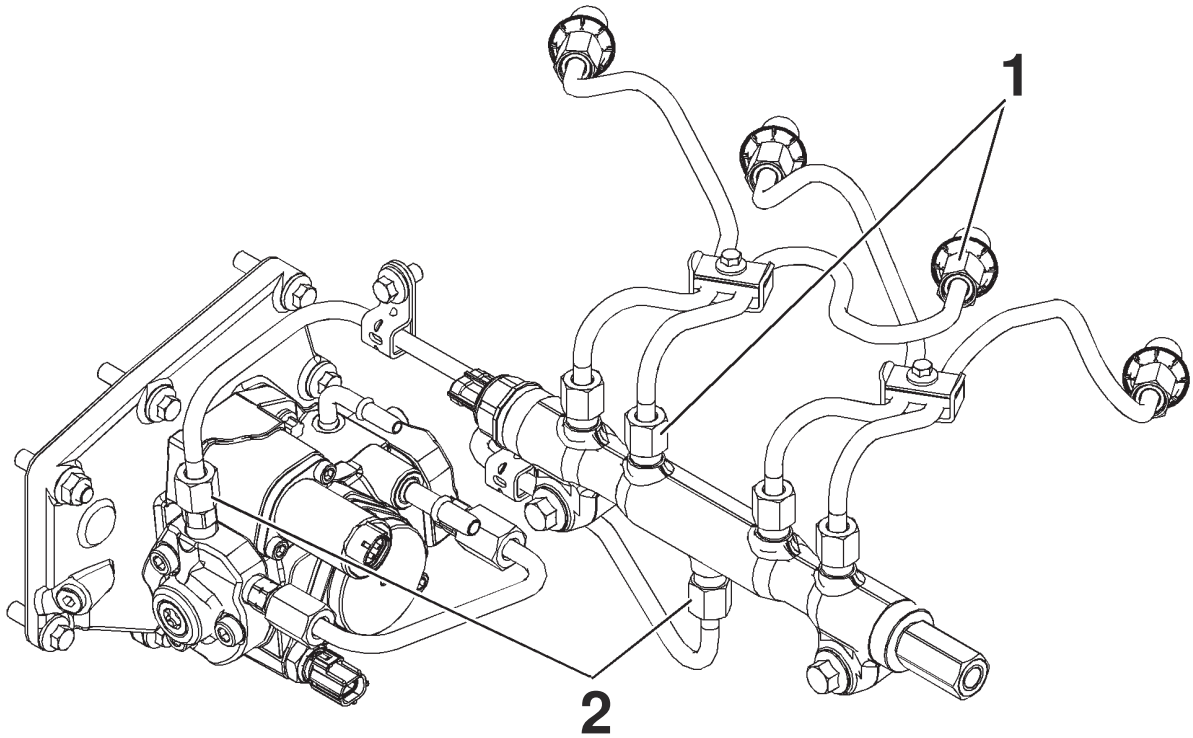
Figure 74



EX1501103

Fuel Injection Lines - Specification

- Torque for the nuts on the high-pressure fuel lines (1 and 2): 55 N.m (5.6 kg.m, 41 ft lb)
  Figure 75



EX1501101

Electric Control

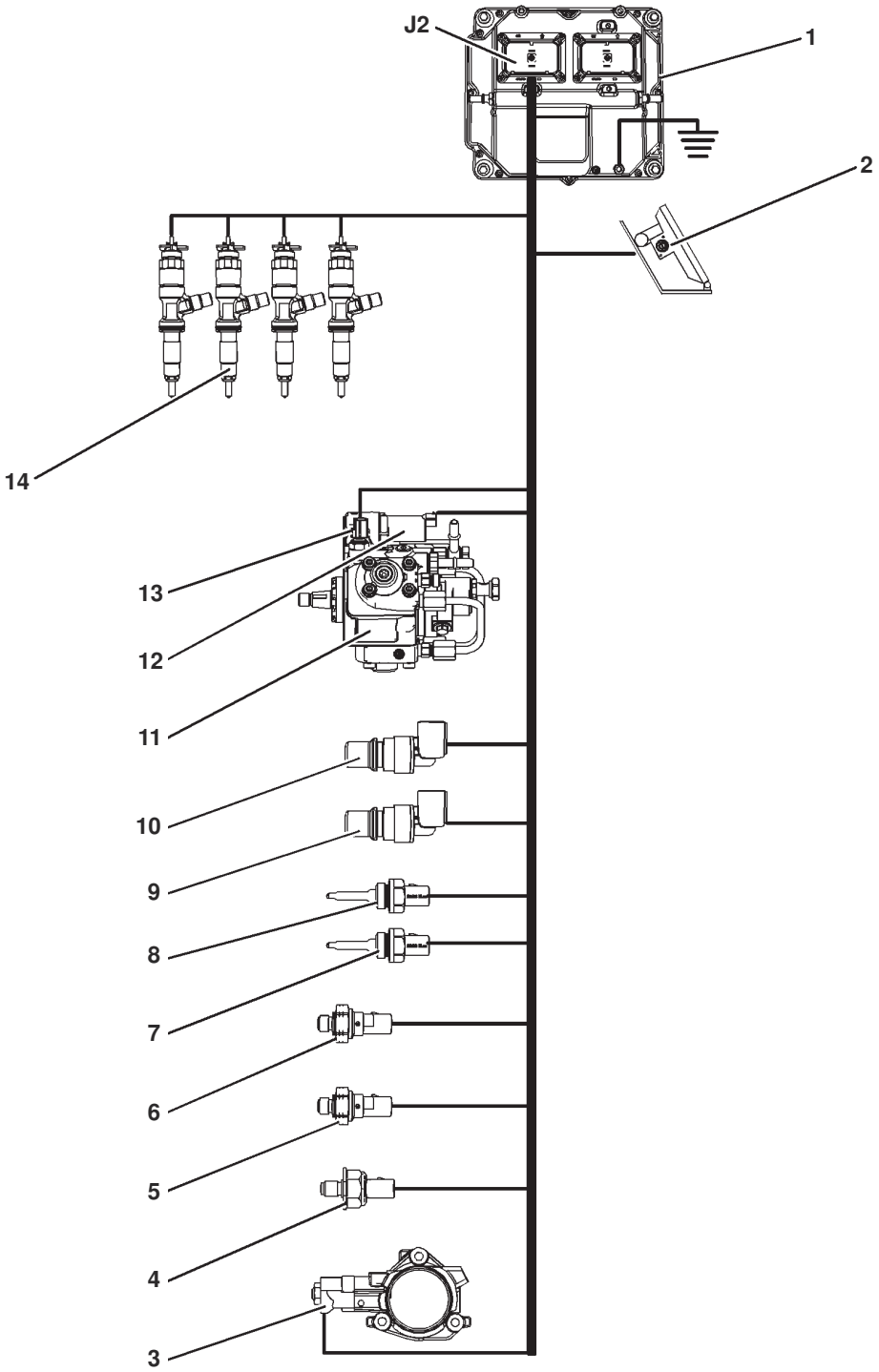
The ECM determines the quantity, timing, and pressure of the fuel in order to be injected into the fuel injector.

The ECM uses input from the sensors on the engine. These sensors include the speed/timing sensors and the pressure sensors. The ECM controls the timing and the flow of fuel by actuating the injector solenoid.

The amount of fuel is proportional to the duration of the signal to the injector solenoid.

The ECM controls the fuel pressure by increasing or decreasing the flow of fuel from the fuel injection pump.

Figure 76

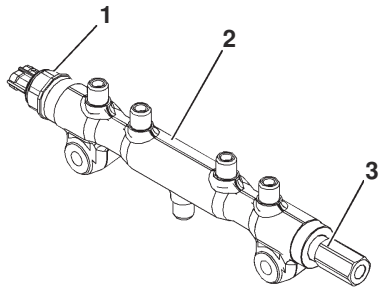


Reference Number	Description
1	Electronic Control Module (ECM)
2	Throttle Position Sensor
3	Wastegate Regulator
4	Fuel Rail Pressure Sensor
5	Inlet Manifold Pressure Sensor
6	Atmospheric Pressure Sensor
7	Coolant Temperature Sensor
8	Inlet Manifold Air Temperature Sensor
9	Secondary Speed/Timing Sensor
10	Primary Speed/Timing Sensor
11	Fuel Injection Pump
12	Suction Control Valve for the Fuel Injection Pump
13	Fuel Temperature Sensor
14	Electronic Unit Injectors

Fuel Manifold

Overview

Figure 77



EX1501110

The fuel manifold stores high-pressure fuel from the fuel injection pump. The high-pressure fuel will flow to the injectors.

The fuel pressure sensor measures the fuel pressure in the fuel manifold.

The pressure relief valve will prevent the fuel pressure from getting too high.

The fuel pressure sensor must be replaced with the fuel manifold (rail). The pressure relief valve can be serviced as a separate component.

Fuel Injectors

Overview

NOTE: *If a replacement electronic unit injector is installed, the correct injector code must be programmed into the electronic control module. The code that is required is located at position (X). Record code (X) before the electronic unit injector is installed.*

The fuel injectors contain no serviceable parts apart from the O-ring seal and the combustion washer. The clamp and setscrew are serviced separately. The pressurized fuel from the fuel manifold is injected into the combustion chamber by the electronic unit injector. The desired injection timing,

injection quantity and injection pattern are controlled by the ECM depending on engine operating conditions.

The injection process is controlled using a two-way valve. The supply of electrical current to the solenoid controls the two-way valve. When the two-way valveis not energized the out orifice is closed and there is no fuel leak. In this condition the pressure in the control chamber and the pressure at the nozzle needle are the same. In this condition the spring pressure on the command piston keeps the needle closed.

When an injection of fuel is required, the electrical current from the ECM charges the solenoid, which in turn energizes the two-way valve and lifts the valve.

When the valve lifts the valve uncovers the out orifice. The fuel starts to flow and reduces the pressure in the control chamber. When the pressure difference at the nozzle needle exceeds the combined pressure of the control chamber pressure and the spring pressure, the nozzle lifts to start the injection process. The fuel coming out of the nozzle is atomized and injected as a very fine spray.

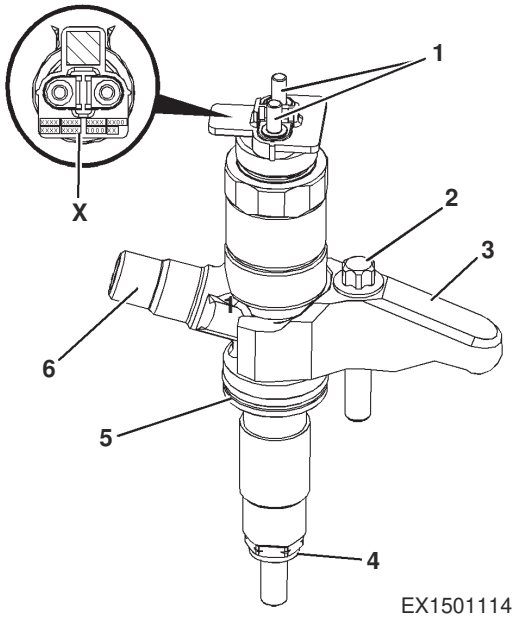
When the injection needs to be stopped the electrical current to the solenoid is cut off and the pressure difference in the control chamber starts increasing. The increased pressure difference stops the injection process when the combined pressure exceeds the nozzle pressure.

The electronic unit injectors can be instructed to inject fuel multiple times during the combustion process.

A close pilot injection occurs before the main injection.

The close pilot injection helps to reduce NOx and noise. The main injection period helps to increase the torque of the engine. The after injection period helps to reduce the amount of smoke that is produced.

Figure 78



EX1501114

Reference Number	Description
1	Electrical Connections
2	Bolt
3	Clamp
4	Combustion Washer
5	O-ring
6	Fuel Inlet

NOTICE

Ensure that all adjustments and repairs that are carried out to the fuel system are performed by authorized personnel that have the correct training.
Before beginning ANY work on the fuel system, refer to "General Hazard Information and High-pressure Fuel Lines" for safety information.
Refer to "Cleanliness of Fuel System" for detailed information on the standards of cleanliness that must be observed during ALL work on the fuel system.

A problem with the components that transport fuel to the engine can cause low fuel pressure. This can decrease engine performance.

1. Check the fuel level in the fuel tank. Ensure that the vent in the fuel cap is not filled with dirt.
2. Check that the valve in the fuel return line is open before the engine is started.
3. Check all low-pressure fuel lines for fuel leakage. The fuel lines must be free from restrictions and faulty bends. Verify that the fuel return line is not collapsed.
4. Install new fuel filters.
5. Cut the old filter open with a suitable filter cutter. Inspect the filter for excess contamination. Determine the source of the contamination. Make the necessary repairs.

Cooling System

Overview

The coolant flows from the bottom of the radiator to the centrifugal water pump. The water pump is installed on the front of the timing case. The water pump is driven by a gear. The gear of the fuel injection pump drives the water pump gear. The water pump contains a rotary seal that uses the engine coolant as a lubricating medium. This will ensure that an adequate sealing film is created. The sealing film is maintained in order to reduce heat generation. Heat that is generated by the rotating sealing faces under normal operating conditions causes a small flow of coolant to be emitted into a chamber. The water pump pumps the coolant through a passage in the timing case to the front of the cylinder block.

The coolant enters a passage in the left side of the cylinder block. Some coolant enters the cylinder block.

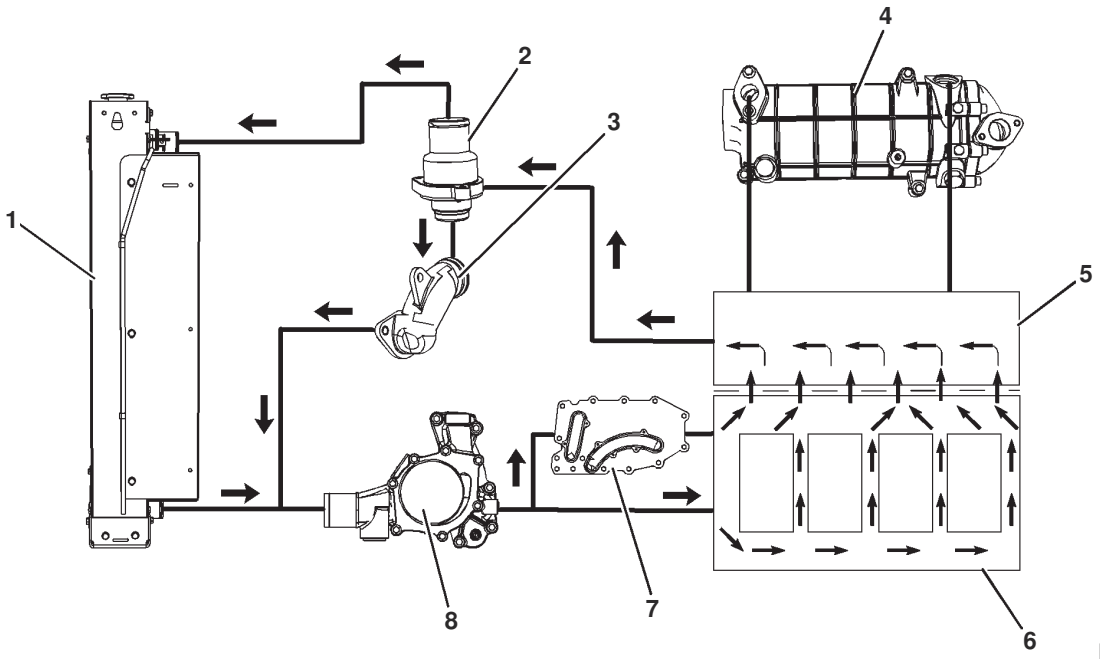
Some coolant passes over the element of the oil cooler. The coolant then enters the block.

Coolant flows around the outside of the cylinders then flows from the cylinder block into the cylinder head cylinder head. Some coolant is diverted into the exhaust gas cooler by a coolant pipe in the rear of the cylinder head. The coolant then flows out of the exhaust gas cooler to the cavity in the cylinder head.

The coolant then flows into the housing of the water temperature regulator. If the water temperature regulator is closed, the coolant goes directly through a bypass to the inlet side of the water pump.

If the water temperature regulator is open, and the bypass is closed then the coolant flows to the top of the radiator.

Figure 79



Reference Number	Description
1	Radiator
2	Water Temperature Regulator and Housing
3	Bypass for the Water Temperature Regulator
4	Exhaust Gas Cooler (NRS)
5	Cylinder Head
6	Cylinder Block
7	Engine Oil Cooler
8	Water Pump

Cooling and Lubrication

The cooling system and lubrication system consists of the following components:

- Gear-driven centrifugal water pump
- Water temperature regulator which regulates the engine coolant temperature
- Gear-driven rotor type oil pump
- Oil cooler

The engine lubricating oil is supplied by a rotor type oil pump. The engine lubricating oil is cooled and the engine lubricating oil is filtered. The bypass valve can provide unrestricted flow of lubrication oil to the engine if the oil filter element should become plugged.

Engine efficiency, efficiency of emission controls, and engine performance depend on adherence to proper operation and maintenance recommendations. Engine performance and efficiency also depend on the use of recommended fuels, lubrication oils, and coolants.

Cooling and Purging of the DEF lines

After key-off, the DEF pump will circulate the DEF fluid for a given time. Also, the DEF pump will purge the DEF system of fluid to protect the system from freeze of the DEF fluid in cold conditions.

Allow at least 2 minutes for the cooling and purging of DEF lines.

Air Inlet and Exhaust System

Exhaust System

Overview

The components of the air inlet and exhaust system control the quality of air and the amount of air that is available for combustion. The air inlet and exhaust system consists of the following components:

- Air cleaner
- NOx Reduction System (NRS)
- Turbocharger
- after cooler
- Inlet manifold
- Cylinder head, injectors, and glow plugs
- Valves and valve system components
- Piston and cylinder
- Exhaust manifold
- Clean Emissions Module (CEM)

Air is drawn in through the air cleaner into the air inlet of the turbocharger by the turbocharger compressor wheel.

Cooling of the inlet air assists the combustion efficiency of the engine. Increased combustion efficiency helps achieve the following benefits:

- Lower fuel consumption
- Increased power output
- Reduced NOx emission
- Reduced particulate emission

There are two inlet valves and two exhaust valves for each cylinder. The inlet valves open when the piston moves down on the intake stroke. When the inlet valves open, cooled compressed air from the inlet port is forced into the cylinder. The complete cycle consists of four strokes:

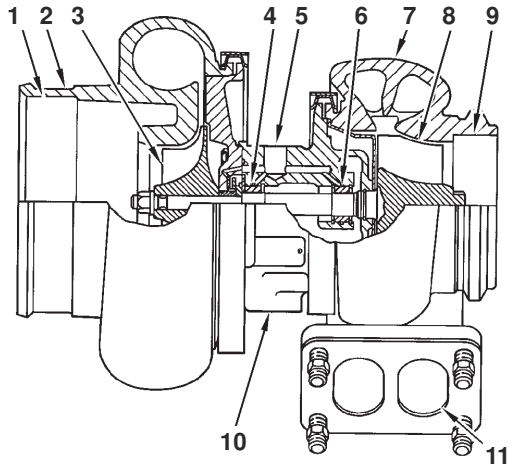
- Inlet
- Compression
- Power
- Exhaust

On the compression stroke, the piston moves back up the cylinder and the inlet valves close. The cool compressed air is compressed further. This additional compression generates more heat.

NOTE: *If the cold starting system is operating, the glow plugs will also heat the air in the cylinder.*

Turbocharger

Figure 80



EX1501185

Figure 3 is a typical example of cross section of turbocharger

Reference Number	Description
1	Air Intake
2	Compressor Housing
3	Compressor Wheel
4	Compressor Wheel
5	Oil Inlet Port
6	Bearing
7	Turbine Housing
8	Turbine Wheel
9	Exhaust Outlet
10	Oil Outlet Port
11	Exhaust Inlet

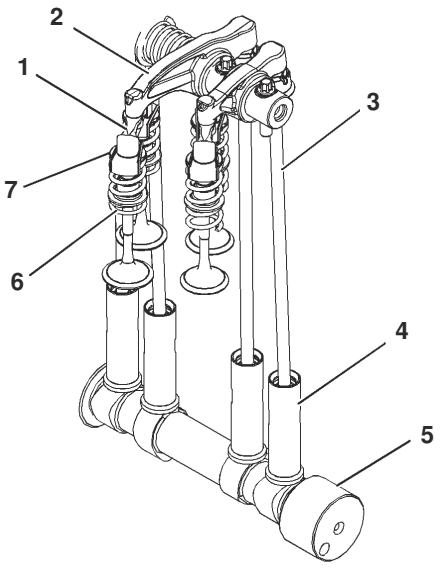
The turbocharger is mounted on the outlet of the exhaust manifold. The exhaust gas from the exhaust manifold enters the exhaust inlet and passes through the turbine housing of the turbocharger.

Energy from the exhaust gas causes the turbine wheel to rotate. The turbine wheel is connected by a shaft to the compressor wheel.

As the turbine wheel rotates, the compressor wheel is rotated. The rotation of the compressor wheel causes the intake air to be pressurized through the compressor housing of the turbocharger.

Valve System Components

Figure 81



EX1501186

Reference Number	Description
1	Bridge
2	Rocker Arm
3	Pushrod
4	Lifter
5	Camshaft
6	Spring
7	Valve

The valve system components control the flow of inlet air into the cylinders during engine operation. The valve system components also control the flow of exhaust gases out of the cylinders during engine operation.

The crankshaft gear drives the camshaft gear through an idler gear. The camshaft must be timed to the crankshaft in order to get the correct relation between the piston movement and the valve movement.

The camshaft has two camshaft lobes for each cylinder. The lobes operate either a pair of inlet valves or a pair of exhaust valves. As the camshaft turns, lobes on the camshaft cause the lifter to move the push rod up and down.

The lifter incorporates a hydraulic lash adjuster which removes valve lash from the valve mechanism.

The lifter uses engine lubricating oil to compensate for wear of system components so that no service adjustment of valve lash is needed.

The engine lubricating oil enters the lifter through a non-return valve. The engine lubricating oil increases the length of the lifter until all valve lash is removed. If the engine is stationary for a prolonged period the valve springs will cause the lifter to shorten so that when the engine is started engine valve lash is present for the first few seconds.

After cranking restores oil pressure the lifter increases in length and removes the valve lash.

When load is removed from a lifter during service work by the removal of the rocker shaft the lifter increases in length to the maximum extent. Refer to “Position the Valve Mechanism Before Maintenance Procedures” for the correct procedure.

During reassembly of the rocker shaft the engine must be put into a safe position to avoid engine damage. After load is imposed on the lifters by reassembling the rocker assembly, the engine must be left in safe position for a safe period until the lifters have reduced to the correct length. Refer to “Rocker Shaft and Push rod - Install” for the correct procedure.

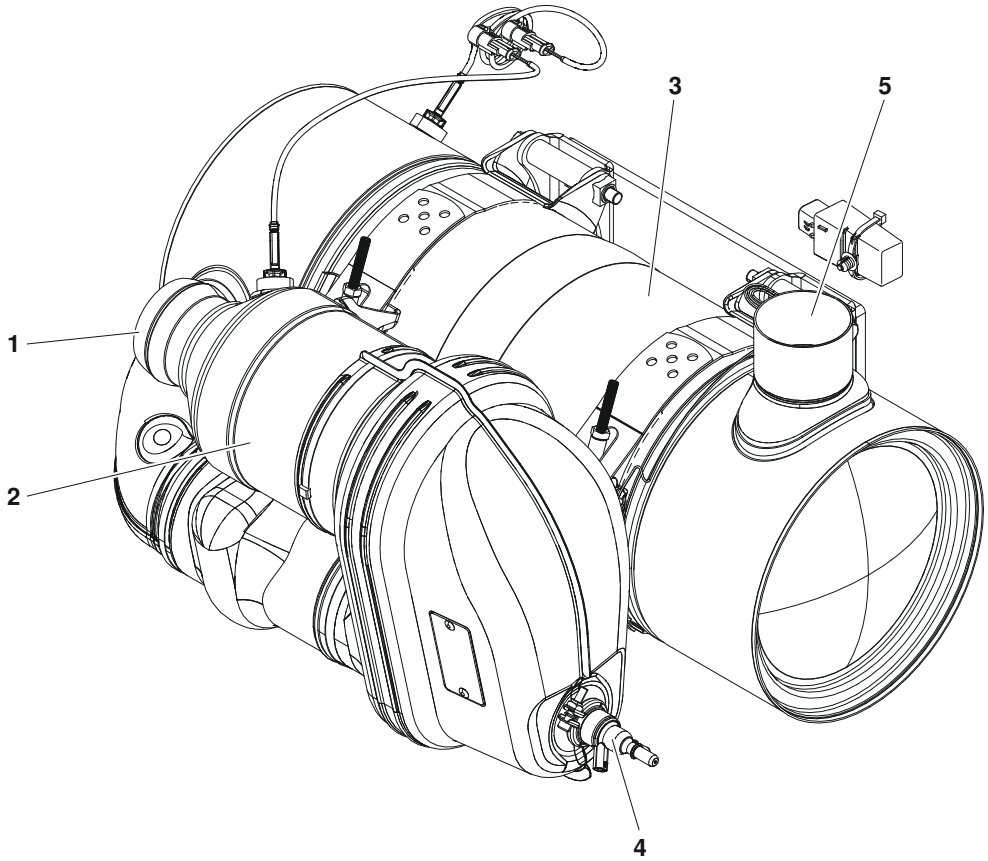
Upward movement of the push rod against rocker arm results in a downward movement that acts on the valve bridge. This action opens a pair of valves which compresses the valve springs. When the camshaft has rotated to the peak of the lobe, the valves are fully open. When the camshaft rotates further, the two valve springs under compression start to expand. The valve stems are under tension of the springs. The stems are pushed upward in order to maintain contact with the valve bridge. The continued rotation of the camshaft causes the rocker arm, the push rods and the lifters to move downward until the lifter reaches the bottom of the lobe. The valves are now closed. The cycle is repeated for all the valves on each cylinder.

Clean Emissions Module (Diesel Oxidation Catalyst (DOC) and Selective Catalytic Reduction (SCR) System)

Overview

NOTE: *To meet current emissions legislation requirements, a small amount of certain chemical compounds that are emitted by the engine must not be allowed to enter the atmosphere.*

Figure 82



EX1501433

Reference Number	Description
1	Exhaust Outlet Connection
2	Diesel Oxidation Catalyst (DOC)
3	Selective Catalytic Reduction (SCR) System

Reference Number	Description
4	Diesel Exhaust Fluid (DEF) Injector
5	Exhaust Intake Connection

The Clean Emissions Module (CEM) for the engine consists of the following components.

- Diesel Oxidation Catalyst (DOC)
- Selective Catalytic Reduction (SCR) system

The DOC oxidizes the carbon monoxide and the hydrocarbons that are not burnt in the exhaust gas into carbon dioxide and water. The DOC also acts on the oxides of nitrogen to increase the nitrogen dioxide fraction for improved efficiency of the SCR system.

The DOC is a through flow device that will continue to operate during all normal engine operating conditions.

A flexible exhaust pipe connects the engine to the Clean Emissions Module (CEM). Refer to Disassembly and Assembly for the correct procedure to install the flexible exhaust pipe.

After the DOC, the exhaust gases are injected with a Diesel Exhaust Fluid (DEF) by a Diesel Exhaust Fluid (DEF) injector. The exhaust gases and the DEF are mixed in a mixing chamber. The mixture decomposes to form ammonia and carbon dioxide. The mixture passes to the main Selective Catalytic Reduction (SCR) reaction chamber.

Exhaust gases and an atomized mist of ammonia and carbon dioxide enter the SCR reaction chamber.

Together with the SCR catalyst inside the chamber, the mixture undergoes a chemical reaction that produces nitrogen gas and water vapor.

There is an oxidation catalyst after the SCR catalyst.

The oxidation catalyst reacts with the excess ammonia to produce oxides of nitrogen and water vapor.

Refer to "DEF Dosing Control System" for more information on the DEF system.

Electrical System

Electrical Control System

Overview

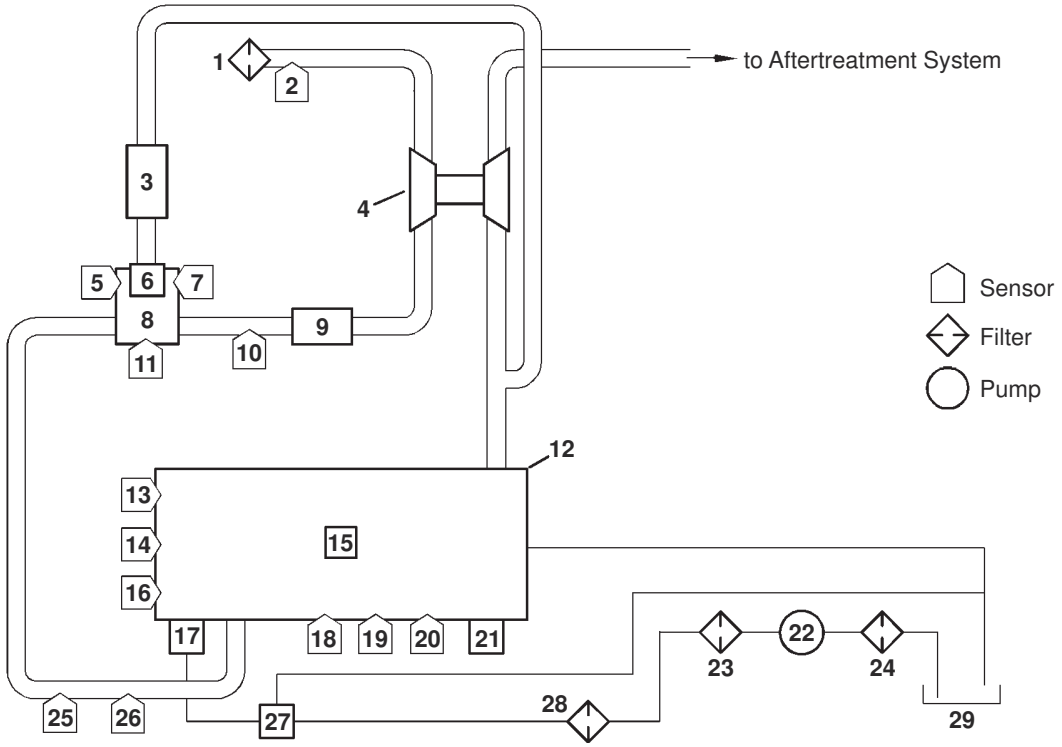
The engine is designed for electronic control. The engine has an Electronic Control Module (ECM), a fuel injection pump and electronic unit injectors. All of these items are electronically controlled. There are also a number of engine sensors. The engine is equipped with an electronically controlled wastegate system for the turbocharger. The ECM controls the engine operating parameters through the software within the ECM and the inputs from the various sensors.

The software contains parameters that control the engine operation. The parameters include all of the operating maps and customer-selected parameters.

The electronic control system has the following components:

Engines with a Turbocharger

Figure 83



EX1501132

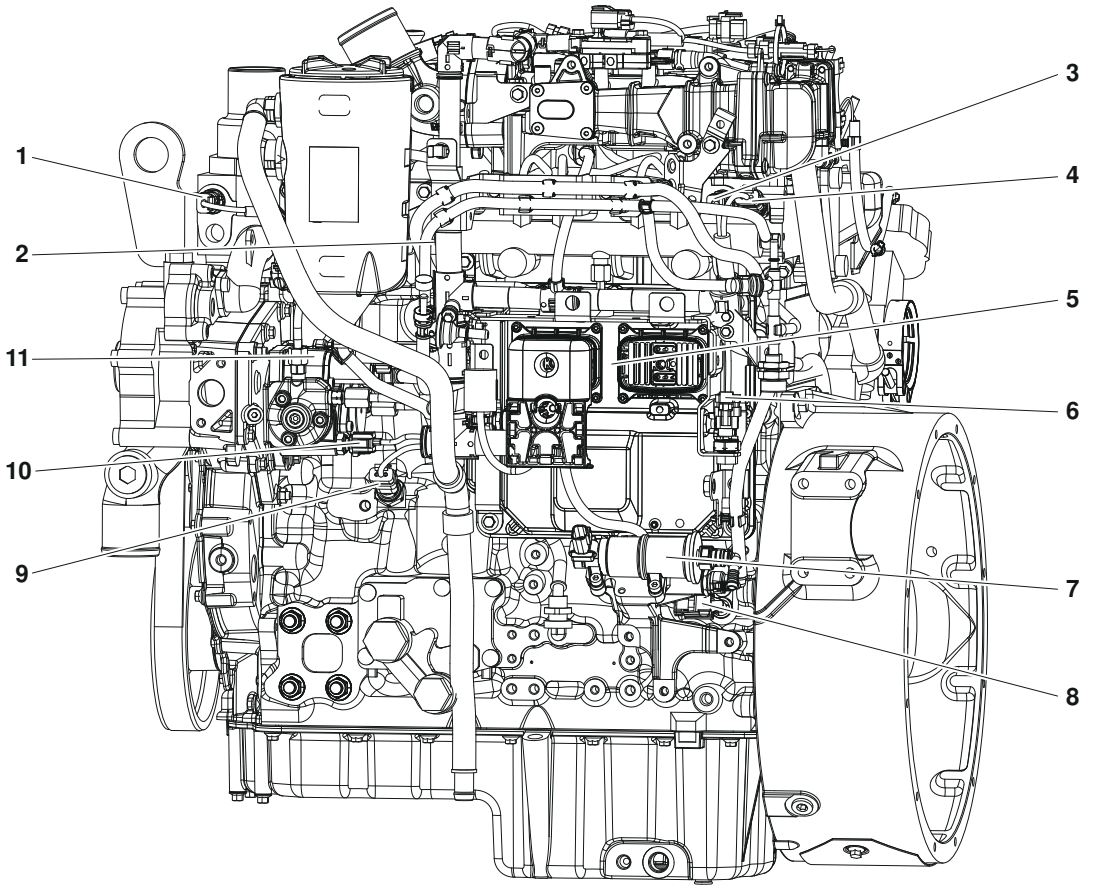
Reference Number	Description
1	Air Cleaner
2	Air Inlet Temperature Sensor
3	Exhaust Gas Cooler (NRS)
4	Turbocharger
5	NRS Temperature Sensor
6	Exhaust Gas Valve for the NOx Reduction System (NRS)
7	NRS Inlet Pressure Sensor
8	Exhaust Gas Valve (NRS)
9	Air-to-air after cooler
10	Wastegate Regulator
11	NRS Differential Pressure Sensor
12	Engine
13	Coolant Temperature Sensor
14	Crankshaft Speed/Timing Sensor
15	Electronic Unit Injectors
16	Camshaft Speed/Timing Sensor
17	Fuel Injection Pump and Fuel Temperature Sensor

Reference Number	Description
18	Fuel Pressure Sensor
19	Oil Pressure Sensor
20	Atmospheric Pressure Sensor
21	ECM
22	Fuel Transfer Pump
23	Main Fuel Filter
24	In-line Fuel Filter
25	Boost Pressure Sensor
26	Inlet Manifold Air Temperature Sensor
27	Transfer Pump Inlet Regulator
28	Main Fuel Filter
29	Fuel Tank

Sensor Locations for the Engine

The figures in this section show the typical locations of the sensors for the industrial engine. Specific engines may appear different from the illustration due to differences in applications.

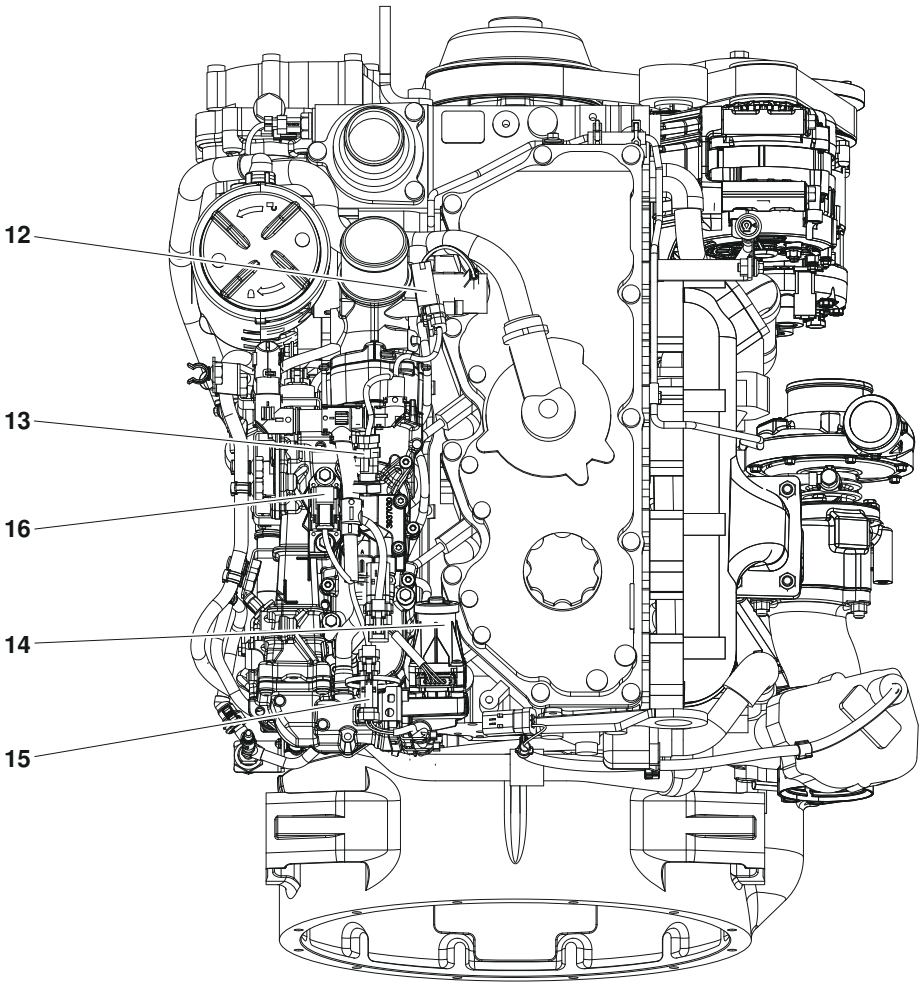
Figure 84



EX1501134

Reference Number	Description
1	Coolant Temperature Sensor
2	Fuel Pressure Sensor
3	Inlet Manifold Temperature Sensor
4	Boost Pressure Sensor
5	Electronic Control Module (ECM)
6	Atmospheric Pressure Sensor
7	Electric Fuel Transfer Pump
8	Crankshaft Speed/Timing Sensor
9	Engine Oil Pressure Sensor
10	Fuel Temperature Sensor
11	Suction Control Valve for the Fuel Injection Pump

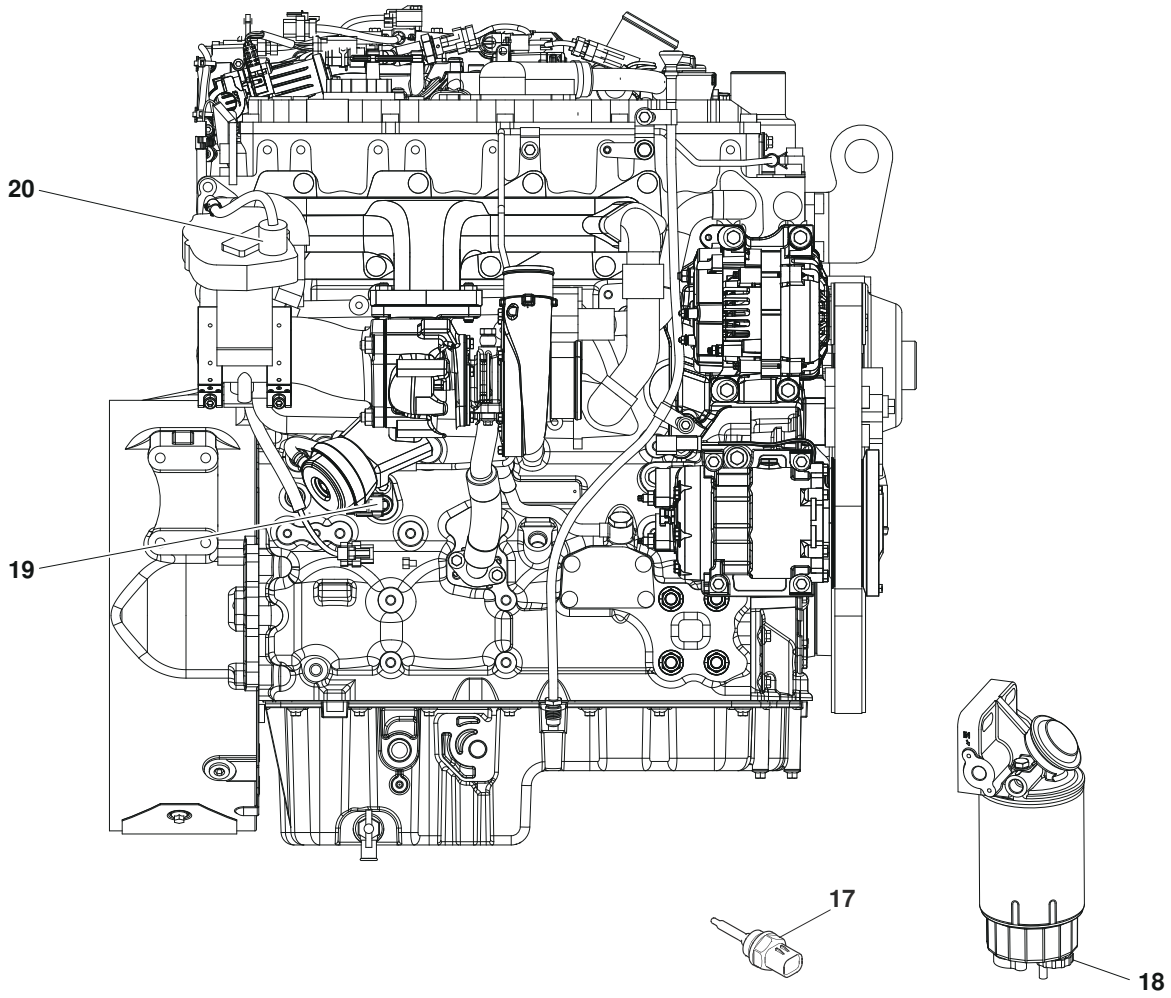
Figure 85



EX1501135

Reference Number	Description
12	Wastegate Regulator
13	Inlet Pressure Sensor for the NOx Reduction System (NRS)
14	Exhaust Gas Valve for the NOx Reduction System (NRS)
15	Temperature Sensor for the NOx Reduction System (NRS)
16	Differential Pressure Sensor for the NOx Reduction System (NRS)

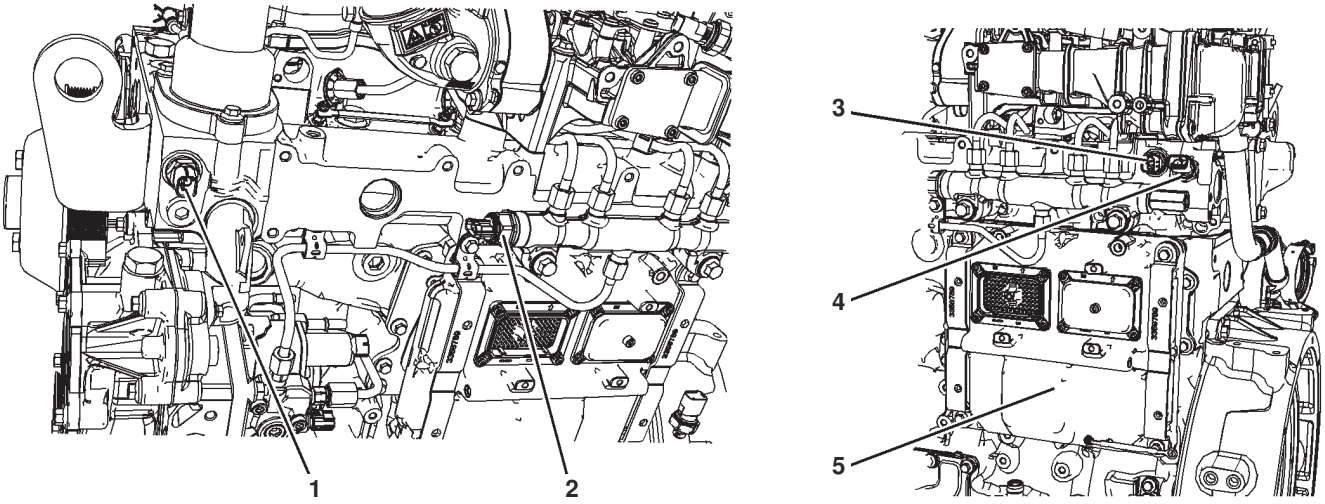
Figure 86



EX1501137

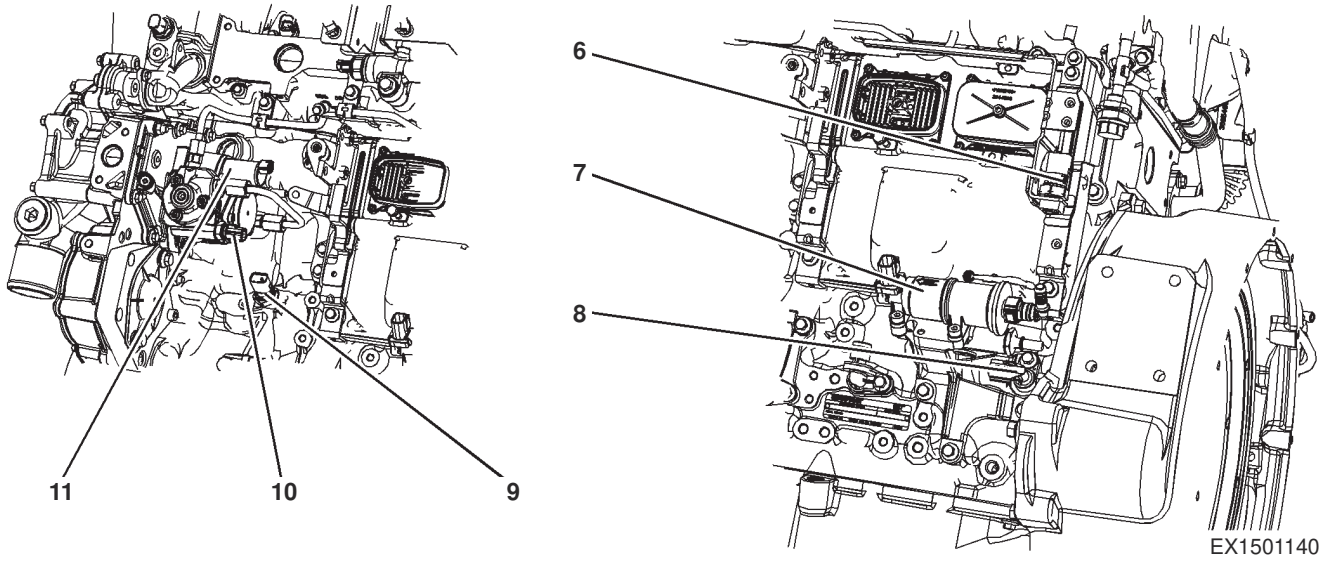
Reference Number	Description
17	Inlet Air Temperature Sensor
18	Water in Fuel Switch
19	Camshaft Speed/Timing Sensor
20	Exhaust Back Pressure Valve

Figure 87



Reference Number	Description
1	Coolant Temperature Sensor
2	Fuel Pressure Sensor
3	Inlet Manifold Temperature Sensor
4	Boost Pressure Sensor
5	Electronic Control Module (ECM)

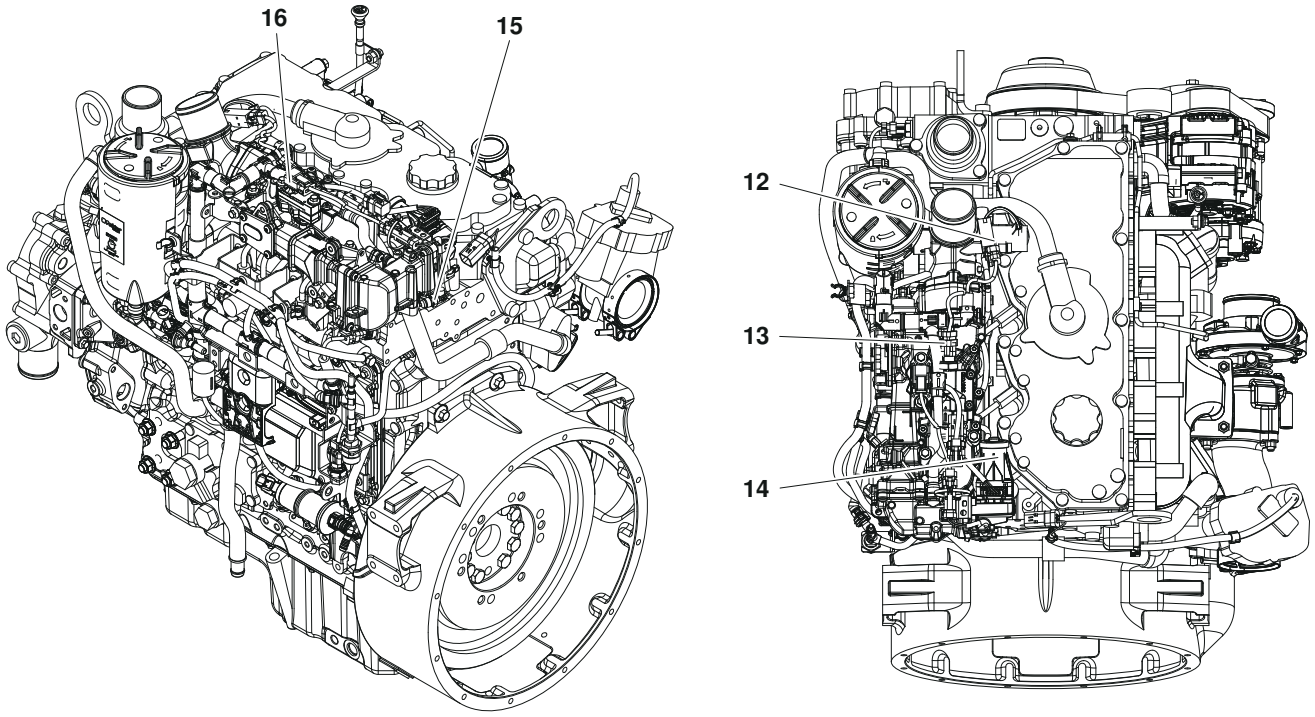
Figure 88



Reference Number	Description
6	Atmospheric Pressure Sensor
7	Electric Fuel Transfer Pump
8	Crankshaft Speed/Timing Sensor
9	Engine Oil Pressure Sensor

Reference Number	Description
10	Fuel Temperature Sensor
11	Suction Control Valve for the Fuel Injection Pump

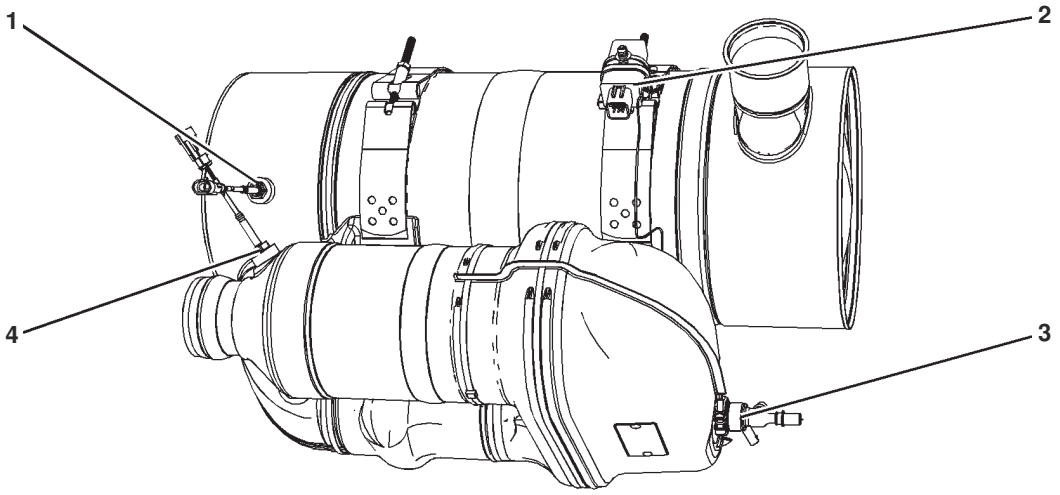
Figure 89



Reference Number	Description
12	Wastegate Regulator
13	Inlet Pressure Sensor for the NOx Reduction System (NRS)
14	Exhaust Gas Valve for the NOx Reduction System (NRS)
15	Temperature Sensor for the NOx Reduction System (NRS)
16	Differential Pressure Sensor for the NOx Reduction System (NRS)

Sensor Locations for the Clean Emissions Module

Figure 90

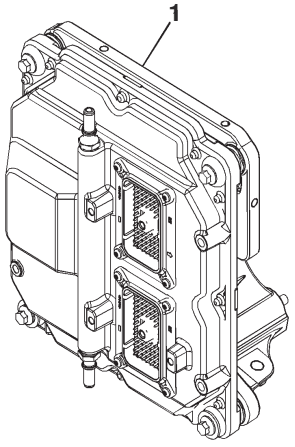


EX1501141

Reference Number	Description
1	SCR Temperature Sensor
2	Identification Module
3	DEF Injector
4	DOC Temperature Sensor

Electronic Control Module (ECM)

Figure 91



EX1501142

The Electronic Control Module (ECM) (1) functions as a governor and a computer for the fuel system. The ECM receives signals from the sensors in order to control the timing and the engine speed.

The electronic system consists of the ECM, the engine sensors, and inputs from the parent machine.

The ECM is the computer. The personality module is the software for the computer. The personality module contains the operating maps. The operating maps define the following characteristics of the engine:

- Engine rating
- Torque curves

- High and low idle speed (rpm)
- Emissions
- Injection timing

The factory passwords restrict changes to authorized personnel. Factory passwords are required to clear any event code. Refer to "Factory Passwords" for more information on the passwords.

The ECM has an excellent record of reliability. Any problems in the system are most likely to be the connectors and the wiring harness. The ECM must be the last item in troubleshooting the engine.

The programmable software contains all the fuel setting information. The information determines the engine performance.

Flash programming is the method of programming or updating the programmable software. Refer to "Flash Programming" for the instructions on the flash programming of the programmable software.

The ECM is sealed and the ECM needs no routine adjustment or maintenance.

Engine Speed

The electronic controls determine the injection timing, the amount of fuel that is delivered to the cylinders and the intake manifold pressure if an electronically controlled wastegate is installed. These decisions are based on the actual conditions and the desired conditions at any given time.

The ECM has software that compares the desired engine speed to the actual engine speed. The actual engine speed is determined through the crankshaft speed/timing sensor and the camshaft speed/timing sensor. If the desired engine speed is greater than the actual engine speed, the ECM will instruct the electronic unit injector to inject more fuel in order to increase engine speed.

Timing Considerations

Once the ECM has determined the amount of fuel that is required, the software must determine the timing of the fuel injection. Fuel injection timing is determined by the ECM after considering input from the following components:

- Engine coolant temperature sensor
- The sensor for the intake manifold air temperature
- The sensor for the intake manifold pressure

At start-up, the ECM determines the TOP CENTER position of the number 1 cylinder from the secondary speed/timing sensor on the camshaft. The ECM decides when fuel injection should occur relative to the TOP CENTER position. The ECM optimizes engine performance by control of each of the electronic unit injectors so that the required amount of fuel is injected at the precise point of the engine's cycle. The electronic unit injectors are supplied high-pressure fuel from the fuel manifold. The ECM also provides the signal to the solenoid in the fuel injection pump. The solenoid in the fuel injection pump controls a valve in the fuel injection pump.

Controls the volume of fuel that enters the plungers.

By controlling the volume of fuel that enters the plungers, this controls the pressure in the fuel manifold. Fuel that is not required for the engine is diverted away from the fuel injection pump back to the fuel tank.

The ECM adjusts injection timing and fuel pressure for the best engine performance, the best fuel economy, and the best control of exhaust emissions.

Fuel Injection

The programmable software inside the ECM sets certain limits on the amount of fuel that can be injected.

The FRC Limit is a limit that is based on intake manifold air pressure and engine rpm. The FRC Limit is used to control the air/fuel ratio in order to control the engine's exhaust emissions. When the ECM senses a higher intake manifold air pressure, the ECM increases the FRC Limit. A higher intake manifold air pressure indicates that there is more air in the cylinder. When the ECM increases the FRC Limit, the ECM allows more fuel into the cylinder.

The Rated Fuel Limit is a limit that is based on the power rating of the engine and on the engine rpm.

The Rated Fuel Limit enables the engine power and torque outputs to conform to the power and torque curves of a specific engine model.

These limits are in the programmable software and these limits cannot be changed.

The ECM controls the following characteristics:

- Boost pressure
- Operation of the NOx reduction system

Diagnostic Codes

When the ECM detects an electronic system problem, the ECM generates a diagnostic code. Also, the ECM logs the diagnostic code in order to indicate the time of the problems occurrence. The ECM also logs the number of occurrences of the problem.

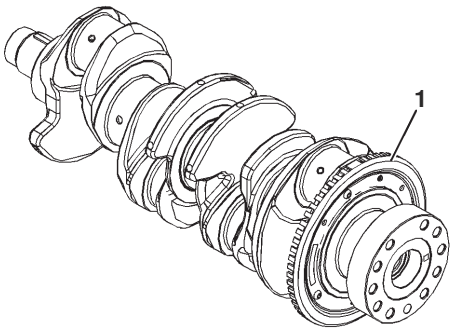
Diagnostic codes are provided in order to indicate that the ECM has detected an electrical problem or an electronic problem with the engine control system.

In some cases, the engine performance can be affected when the condition that is causing the code exists.

If the operator indicates that a performance problem occurs, the diagnostic code may indicate the cause of the problem. Use a laptop computer to access the diagnostic codes. The problem should then be corrected.

Event Codes

Figure 92



detected an abnormal engine operating condition.

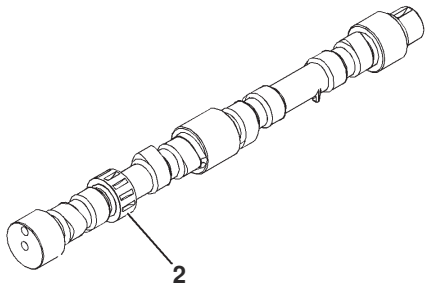
The ECM will log the occurrence of the event code.

This does not indicate an electrical malfunction or an electronic malfunction. If the temperature of the coolant in the engine is higher than the permitted limit, then the ECM will detect the condition. The ECM will then log an event code for the condition.

Speed/Timing Sensors

The primary speed/timing sensor is located on the left-hand side of the cylinder block close to the flywheel housing. The primary speed/timing sensor generates a signal by detecting the movement of the teeth that are located on the crankshaft timing ring (1). The signal that is generated by the speed/timing sensor is transmitted to the ECM. The ECM uses the signal from the speed/timing sensor to calculate the position of the crankshaft. The signal is also used to determine the engine speed.

Figure 93



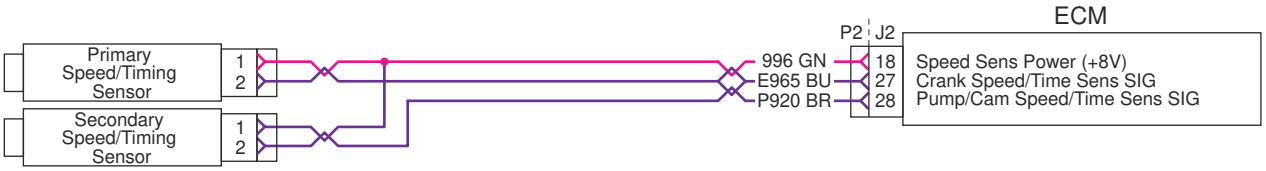
EX1501144

The secondary speed/timing sensor is located on the right-hand side of the cylinder block toward the rear of the engine. The secondary speed/timing sensor generates a signal that is related to the camshaft position. The secondary speed/timing sensor detects the movement of the teeth on the timing ring (2) for the camshaft. The signal that is generated by the speed/timing sensor is transmitted to the ECM. The ECM calculates the speed and the rotational position of the engine by using the signal. The secondary speed/timing sensor is required for starting purposes.

When the engine is cranking, the ECM uses the signal from the speed/timing sensor on the camshaft.

When the engine is running the ECM uses the signal from the speed/timing sensor on the crankshaft. This speed/timing sensor is the primary source of the engine position.

Figure 94



EX1501145

Components Operation, Description And Inspection

Safety Instructions

⚠ WARNING

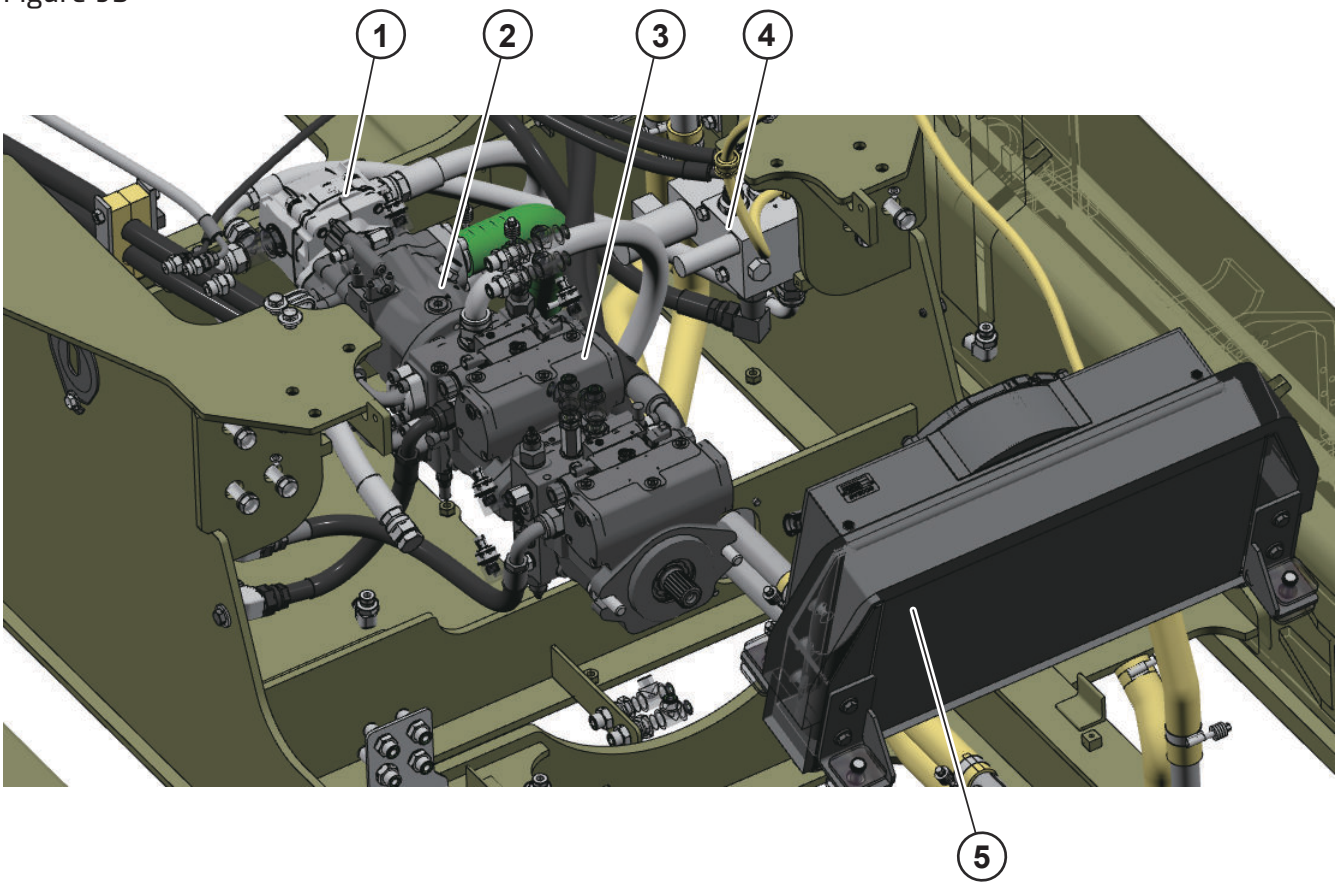
AVOID DEATH OR SERIOUS INJURY

Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments repairs or service. Untrained operators and failure to follow instructions can cause death or serious injury.

Overview

Around Main Pump

Figure 95

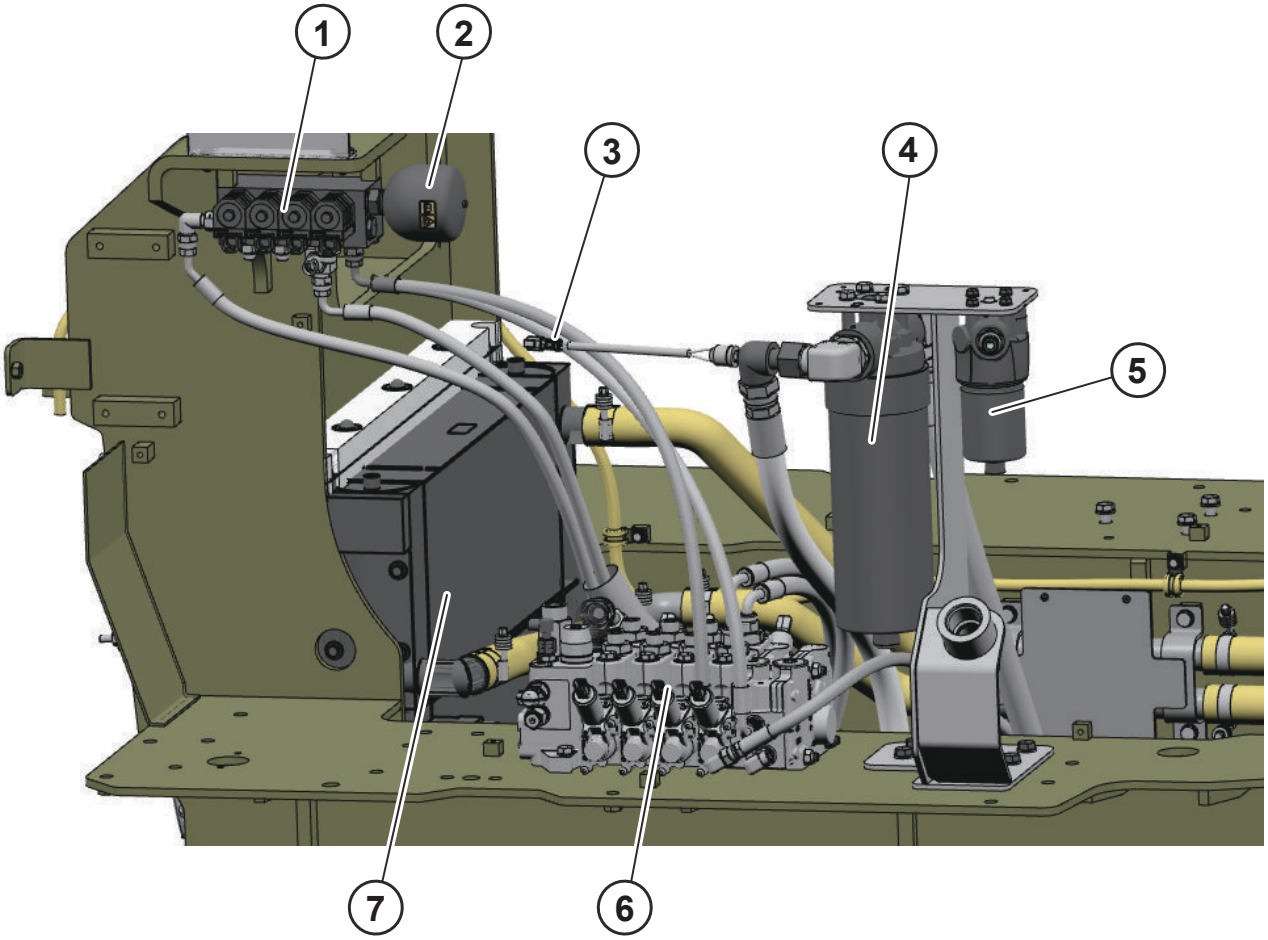


DS2201304

1	Gear Pump	4	Fan Motor Supply Valve
2	Main Pump	5	CAC (Charged Air Cooler) Assembly
3	HST Pump	-	-

Around MCV

Figure 96

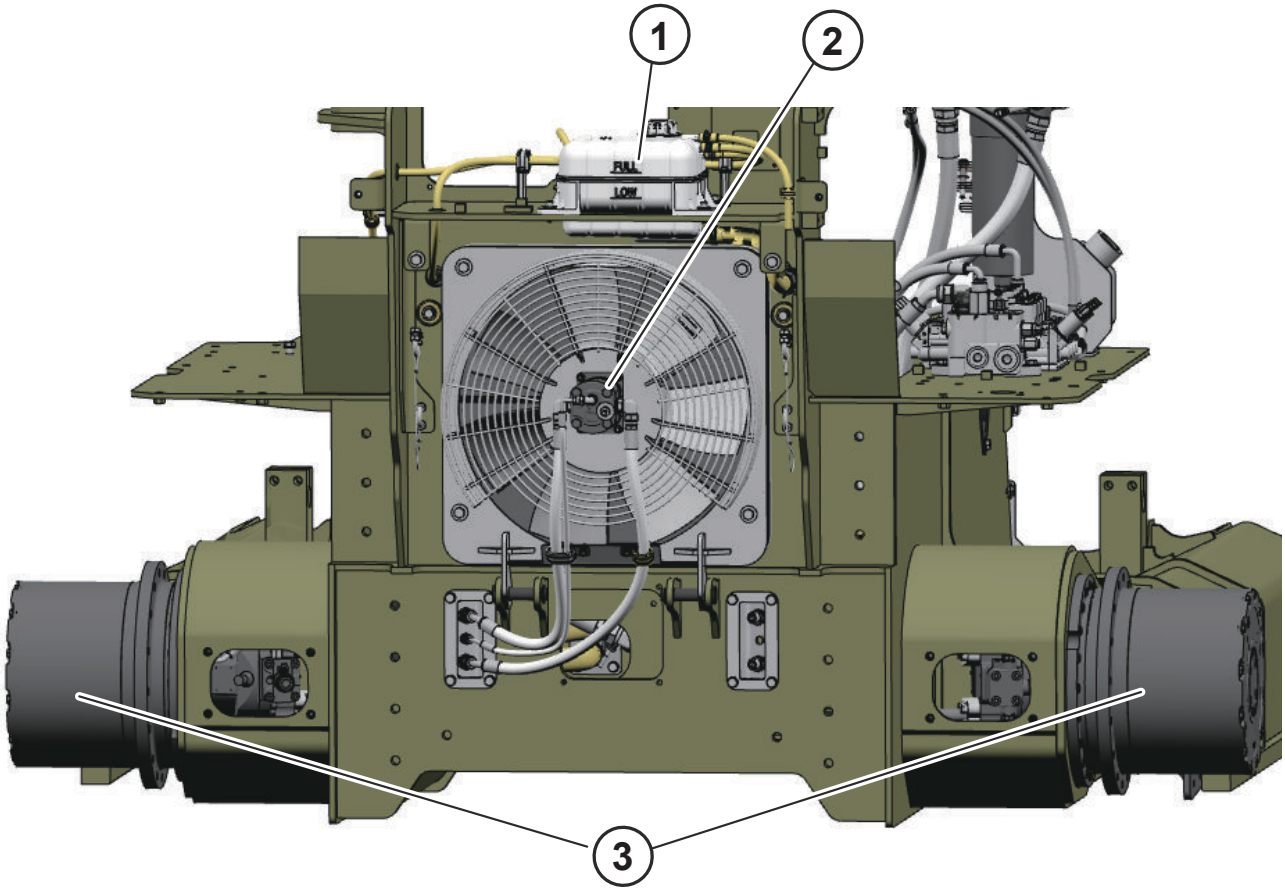


DS2201305

1	Solenoid Valves	5	Brake Filter
2	Accumulator	6	Main Control Valve
3	Oil Pressure Switch	7	Radiator Assembly
4	Return Filter	-	-

Around Fan Assembly

Figure 97



DS2201306

1	Surge Tank	3	HST Travel Device
2	Fan Motor	-	-

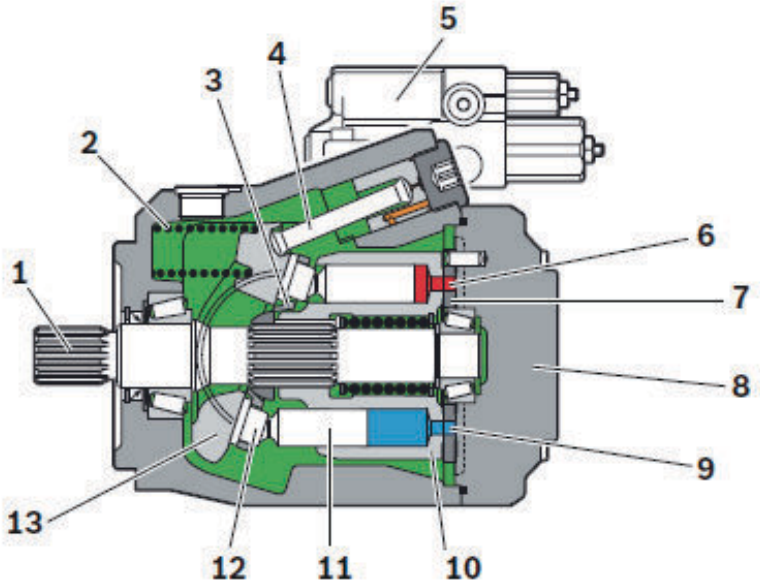
Main Pump

General Description

The axial piston variable pump generates, controls, and regulates a hydraulic-fluid flow. It is a variable pump with an axial piston rotary group in a swash-plate design for a hydrostatic drive in an open circuit. Flow is proportional to drive speed and displacement. The flow can be steplessly changed by controlling the cradle. For axial piston units with a swash plate design, the pistons are arranged axially to the drive shaft. In an open circuit, the hydraulic fluid flows from the reservoir to the hydraulic pump from where it is fed to the consumer, e.g. hydraulic motor. The hydraulic fluid flows directly back to the reservoir.

Axial Piston Layout

Figure 98



DS2201307

1	Drive Shaft	6	High-Pressure Side	11	Piston
2	Spring	7	Control Plate (Distributor Plate)	12	Slipper Pad
3	Retaining Plate	8	Connection Plate	13	Cradle
4	Stroking Piston	9	Suction Side	-	-
5	Control Valve	10	Cylinder	-	-

Pump

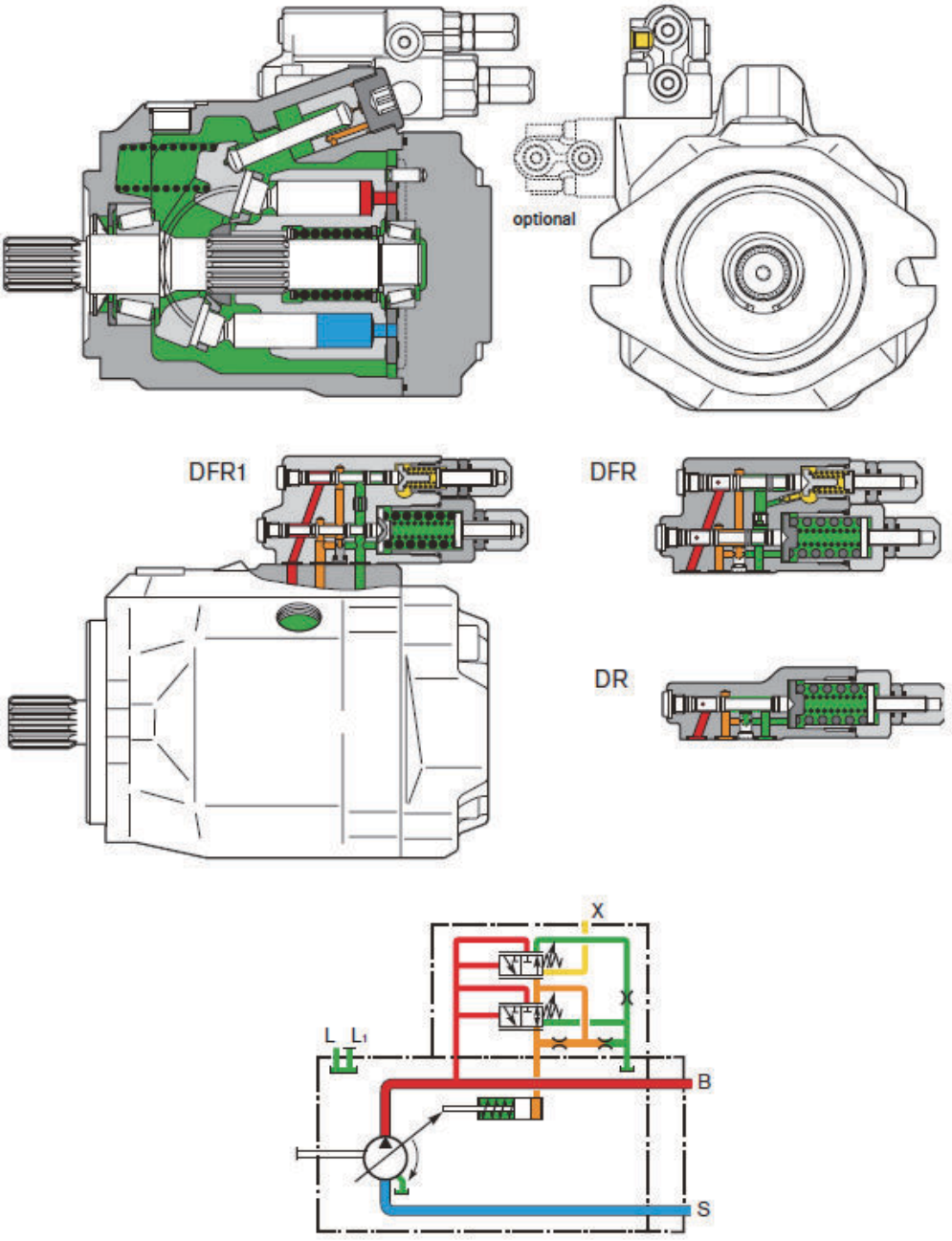
A drive motor applies torque and rotational speed to the drive shaft. The cylinder is picked up and turned by the splines of the drive shaft.With every revolution, the pistons complete a stroke in the cylinder bores, the size of which depends on the pitch of the cradle. The slipper pads are held on with the pistons and guided along the glide surface of the cradle by the retaining plate. The cradle setting during a rotation causes each piston to move over the bottom and top dead centers and back to its initial position. During this sequence, hydraulic fluid is fed in and drained out through the two control slots in the control plate according to displacement. The hydraulic fluid flows into the piston chamber as the piston recedes on the suction side. At the same time, on the high-pressure side, the hydraulic fluid is pushed out of the cylinder chamber into the hydraulic system by the pistons.

Control

The swivel angle of the cradle is continuously adjustable. Adjusting the swivel angle changes the piston stroke and, with it, the displacement. The swivel angle is controlled hydraulically by means of the stroking piston. The cradle is mounted for effortless motion in swivel bearings. When pressurized, the cradle is held in balance by the swiveling forces of the rotary group, which are generated by the eccentrically mounted swash plate and by the control pressure. When depressurized, the spring presses the cradle to a maximum swivel angle. Increasing the swivel angle increases the displacement; reducing the angle reduces displacement accordingly.

Section View

Figure 99



DS2201308

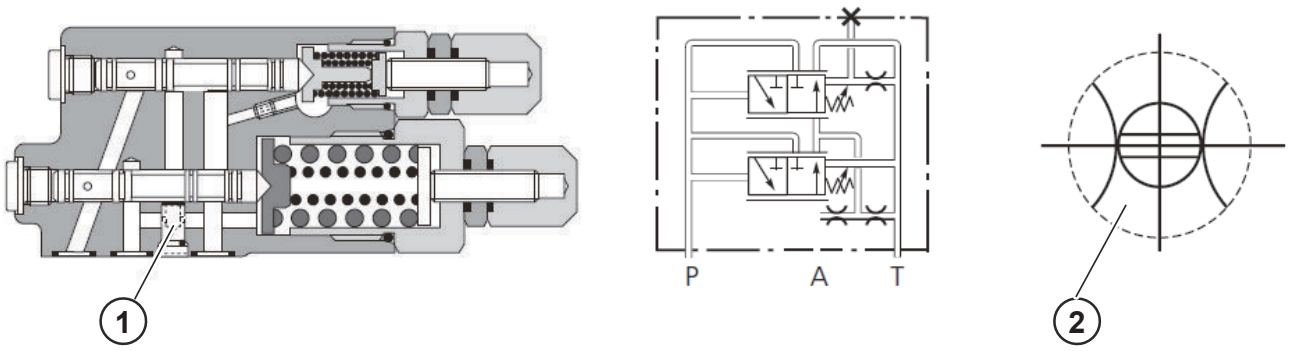
Control valve: Guidelines for DR, DFR, DFR1

All of the valves shown above have the orifice shown in its open condition.

DR control valve

Both X-ports are plugged. Flow controller is blocked.

Figure 100



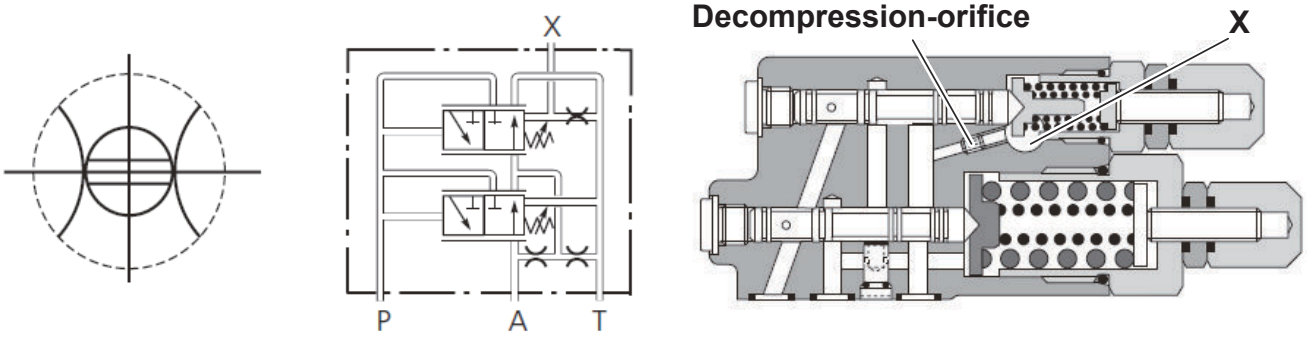
DS2201309

1	Orifice 0.6 mm	2	Position of the orifice Φ 0.6

DFR control valve

One X-port is plugged.

Figure 101

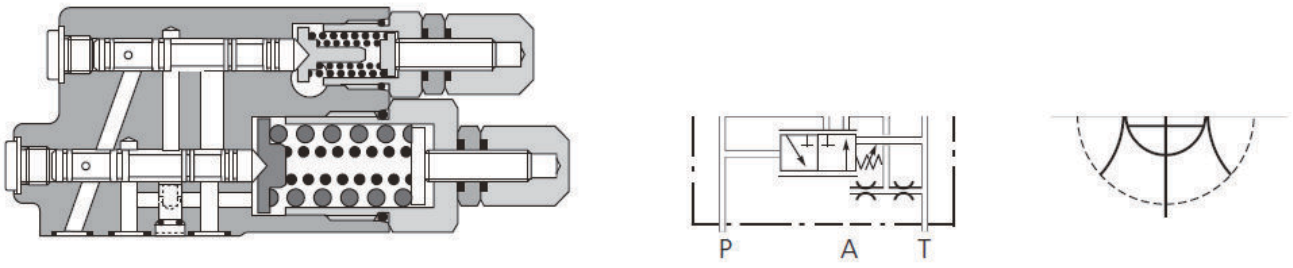


DS2201310

DFR1 control valve

One X-port is plugged.
Bypass orifice X-T is closed using a plug.

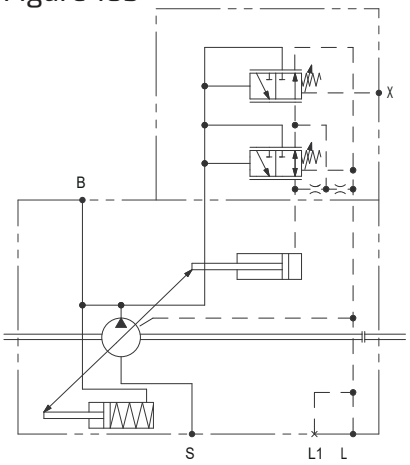
Figure 102



DS2201311

Port Connections

Figure 103



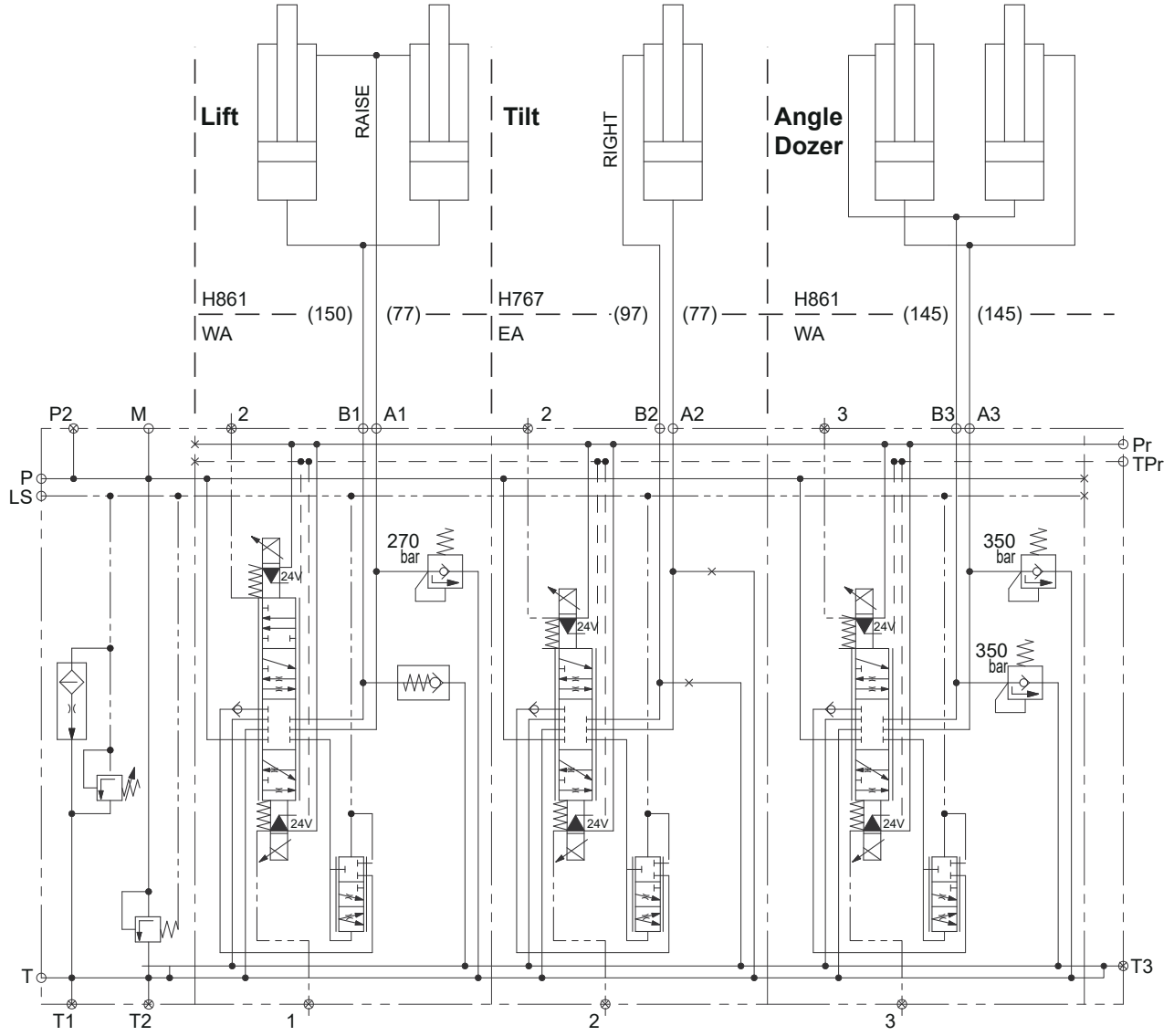
DS2201312

B	Pressure Port	SAE 1”
S	Suction Port	SAE 1 1/2”
L, L1	Case Drain Port	7/8-14 UNF-2B
X	Pilot Pressure Port	7/16-20 UNF-2B

Main Control Valve

Circuit

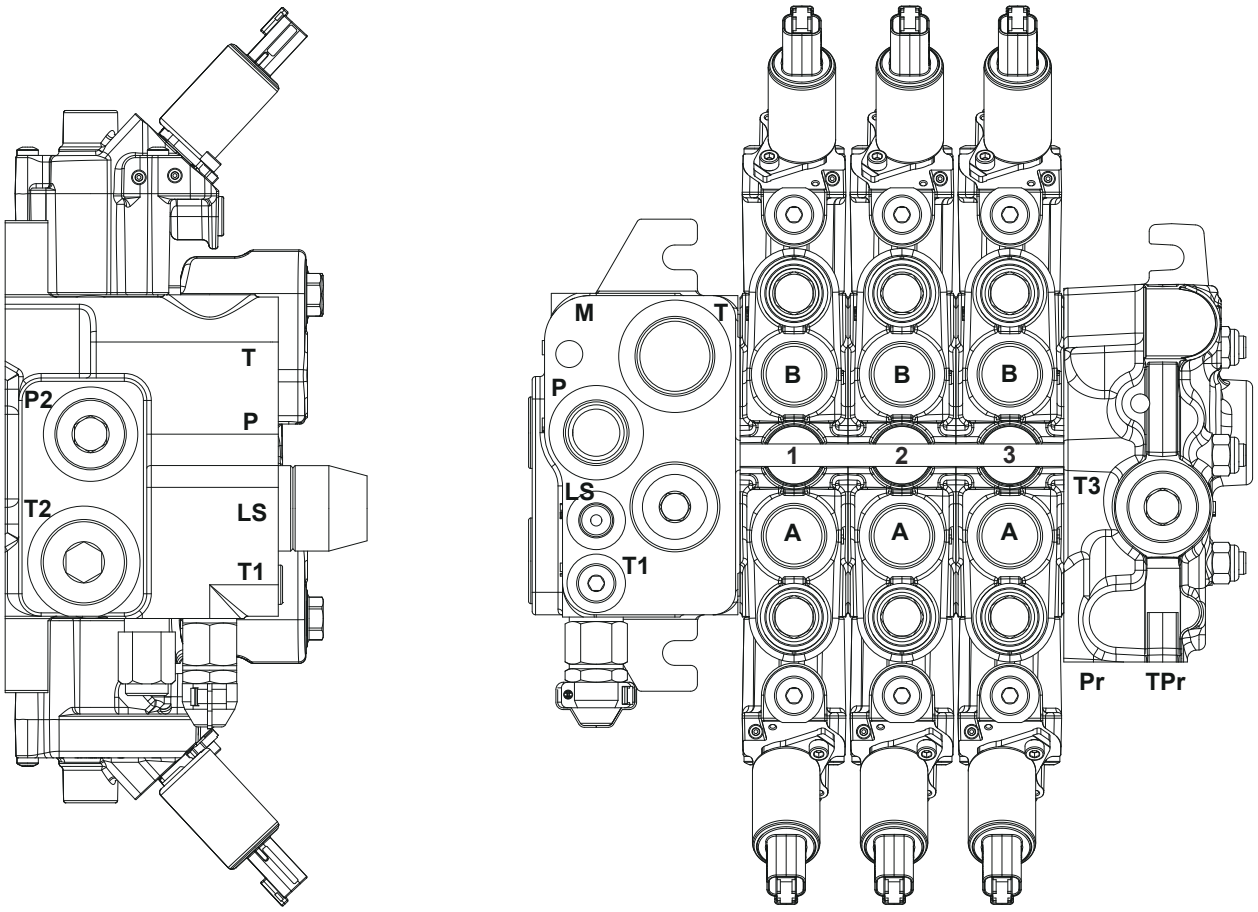
Figure 104



DS2201313

Spools

Figure 105- View from Top side



DS2201314

Port	Relief Valve Setting Pressure
A1	Lift Raise: 270 bar at 15 L/min
B1	Lift Lower: Check valve
A2	Tilt Right: N/A
B2	Tilt Left: N/A
A3	Angle: 350 bar at 15 L/min
B3	Angle: 350 bar at 15 L/min

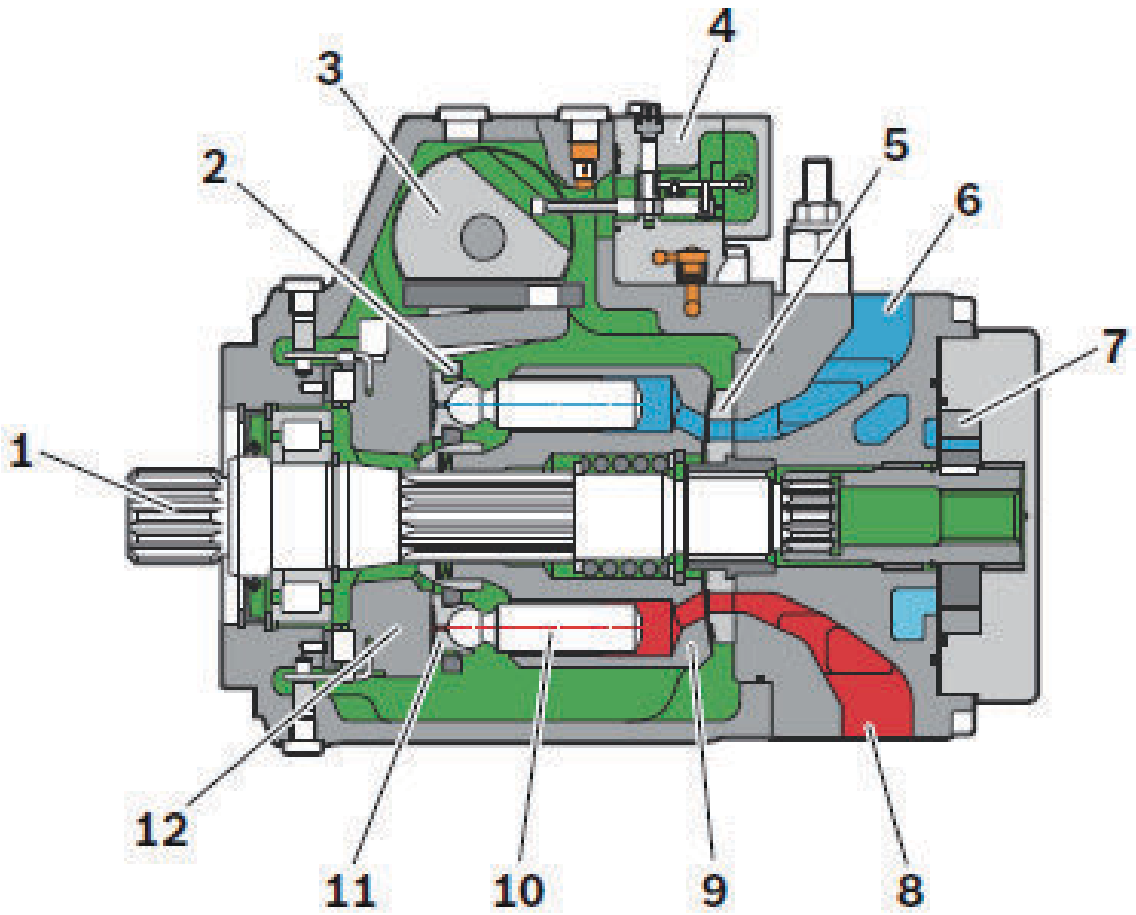
HST Pump

Overview

HST stands for Hydrostatic Transmission and is used in a travel system to connect the hydraulic pump with the motor in a closed enabling continuous speed change from forwarding to stop/Neutral and Reverse or vice versa. HST is smoother in operation and smaller than mechanical transmissions installed on the machine.

The axial piston variable pump generates, controls and regulates a hydraulic fluid flow. It is designed for mobile applications such as construction machinery.

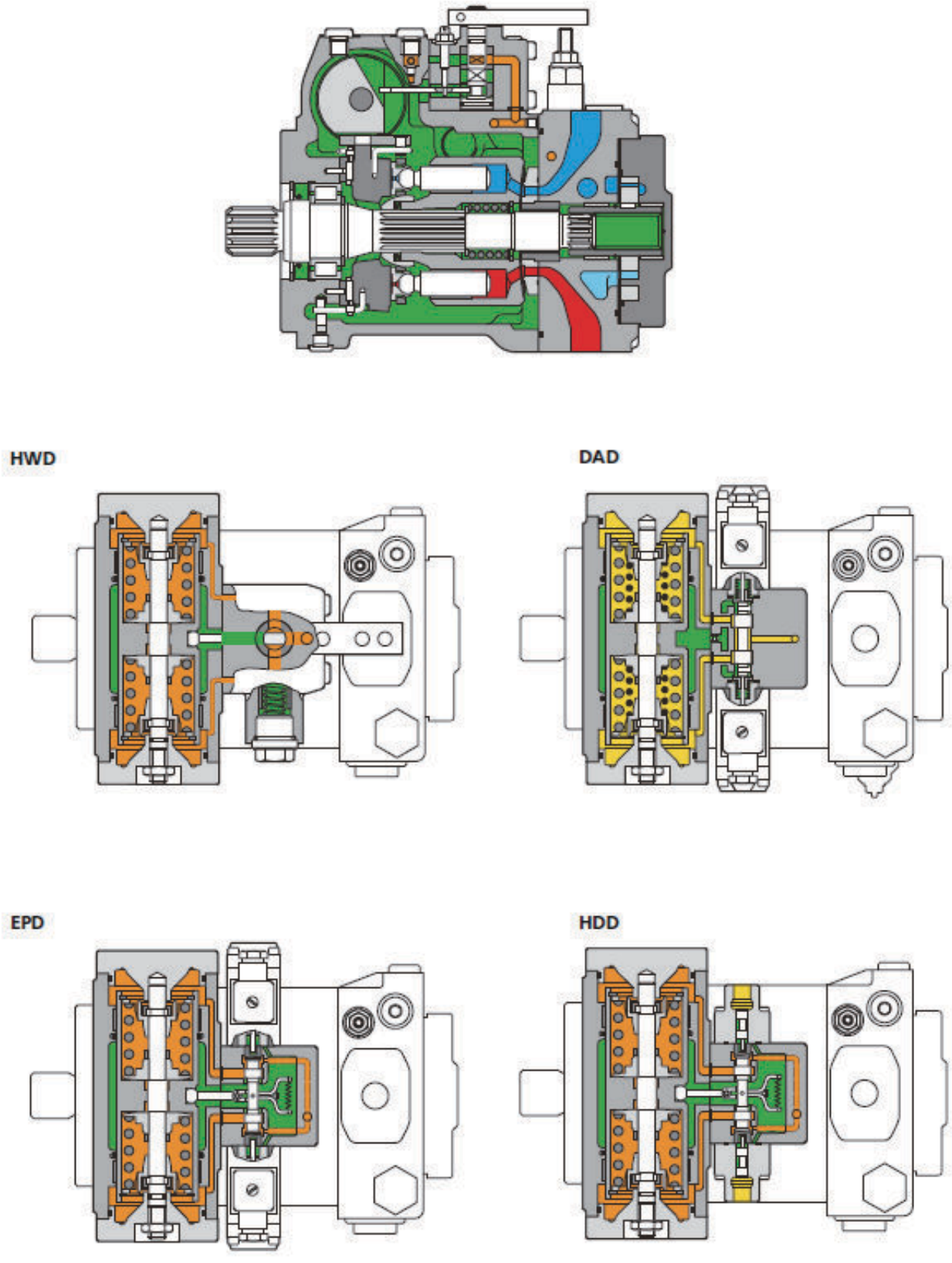
Figure 106



DS2201431

1	Drive Shaft	2	Retainer Plate
3	Stroking Piston	4	Control Unit
5	Control Plate	6	Low-Pressure Side
7	Boost Pump	8	High-Pressure Side
9	Cylinder	10	Piston
11	Slipper Pad	12	Cradle

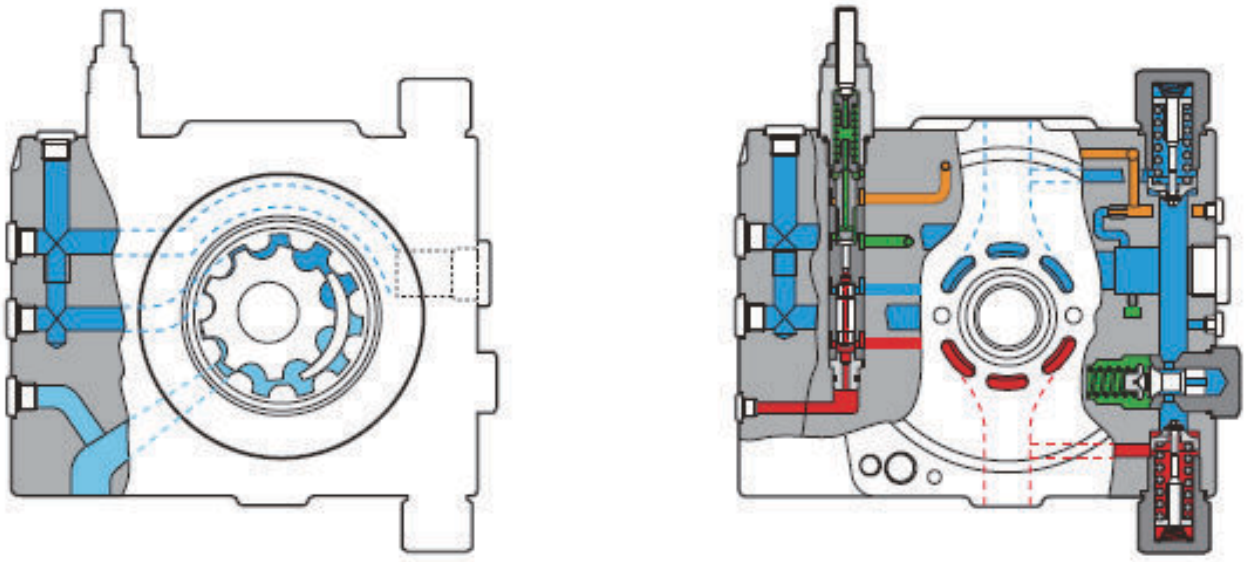
Figure 107



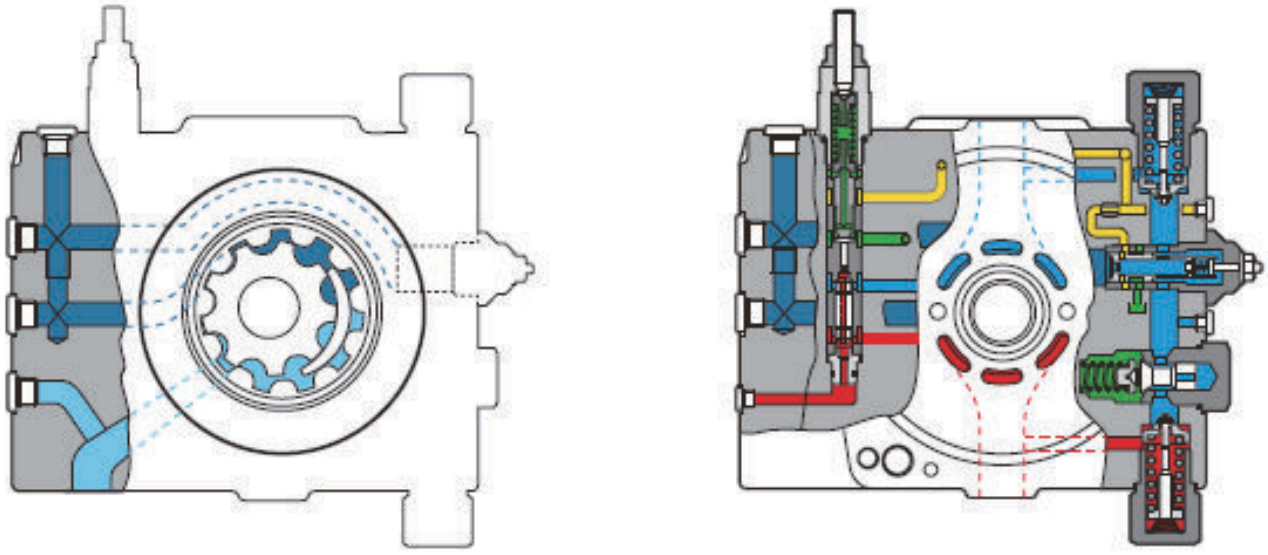
DS2201429

Figure 108

HWD / EPD / HDD



DAD



DS2201430

This is an axial piston variable pump with a swash plate design for hydrostatic drives in closed circuits. The flow is proportional to the drive speed and displacement. The flow can be steplessly changed by controlling the cradle. For axial piston units with a swash plate design, the pistons are arranged axially relative to the drive shaft. In the closed circuit, the hydraulic fluid flows from the hydraulic pump to the consumer, e.g. hydraulic motor, and from there directly back to the hydraulic

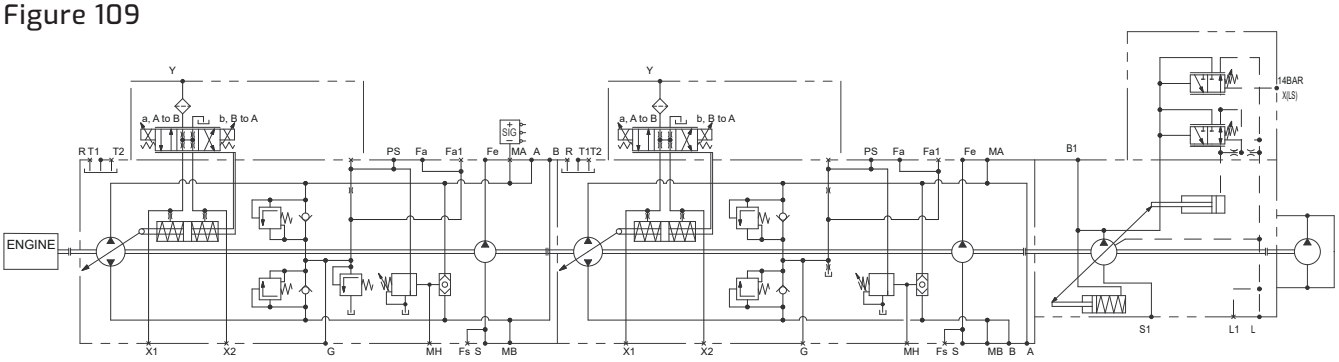
pump. There is a high-pressure side and a low-pressure side which alternate depending on which side is under load.

Function Description

- Pump Function - Torque and rotational speed are applied to the drive shaft by a drive motor. The drive shaft is connected by splines to the cylinder to set this in motion. With every revolution, the pistons execute a stroke in the cylinder bores, the size of which depends on the pitch of the cradle. The slipper pads are held on with the pistons and guided along the glide surface of the cradle by the retaining plate. The pitch of the swash plate during a rotation causes each piston to move over the bottom and top dead centers and back to its initial position.Here, hydraulic fluid is fed in and drained out through the two control slots in the control plate according to the stroke displacement. On the high-pressure side, the hydraulic fluid is pushed out of the cylinder chamber and into the hydraulic system by the pistons. On the low-pressure side, hydraulic fluid simultaneously flows into the enlarging piston chamber – in a closed circuit this is supported by the return and boost pressures.
- Pressure Cut-Off - The working pressure is limited by the pressure cut-off. The pressure cut-off corresponds to a pressure control which reduces the pump capacity once the set specified pressure command value is reached so that the set pressure is maintained but not exceeded.
- High-Pressure Safeguard - The two high-pressure relief valves protect the hydrostatic transmission (pump and motor) from overloading. They limit the maximum pressure in the respective high-pressure line and serve simultaneously as boost valves. High-pressure relief valves are not working valves and are only suitable for pressure peaks or high rates of pressure change.
- Stroking Chamber Bypass (optional) - The optional stroking chamber bypass connects both of the stroking chambers to enable pressure equalization. The springs in the stroking chambers move the stroking piston towards the central position (neutral position). The reset function is influenced by the current working pressure and speed. A bypass circuit for the two stroking chambers does not ensure that the pump goes to the central position (neutral position).
- Sequence Valve (optional) - The optional sequence valve interrupts the active control pressure. The springs in the stroking chambers move the stroking piston towards the central position (neutral position). The reset function is influenced by the current working pressure and speed.Switching off the control pressure does not ensure that the pump goes to the central position (neutral position).
- Control - The swivel angle of the cradle is infinitely variable. Adjusting the swivel angle changes the piston stroke and therefore, the displacement. Controlling the cradle through the neutral position will change the direction of flow (making reversing operation possible). The swivel angle is controlled hydraulically by means of the stroking piston. The cradle is mounted for smooth operation and the neutral position is spring-centered. Increasing the swivel angle increases the displacement; reducing the angle results in a corresponding reduction in displacement.

Hydraulic Circuit

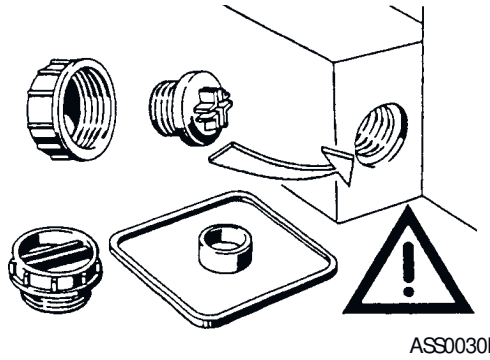
Figure 109



DS2201315

Maintenance Guidelines

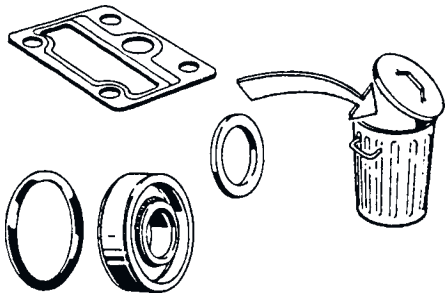
1. Figure 110



ASS0030L

Close off all openings of hydraulic unit.

2. Figure 111

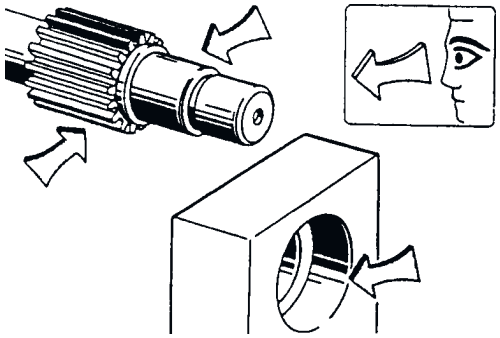


ASS0040L

Replace all seals.

Use only original replacement parts

3. Figure 112

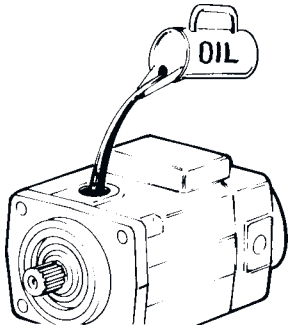


ASS0050L

Check all sealing and sliding surfaces for wear.

NOTE: *Do not rework sliding surfaces using crocus cloth or other similar materials. It can damage the surface.*

4. Figure 113



ASS0060L

Fill hydraulic unit with clean hydraulic oil before putting into operation.

HST Motor

Overview

An Axial piston variable motor converts hydrostatic flow into mechanical rotation and controls or regulates this. The A6VM is a variable motor with an axial piston rotary group of bent-axis design, for hydrostatic drives in open and closed circuits. For axial piston units with a bent-axis design, the pistons are arranged at an angle to the drive shaft. The pistons rest directly on the drive shaft where they generate torque depending on the pressure and swivel angle. The specific torque and displacement can be changed by adjusting the bent axis.

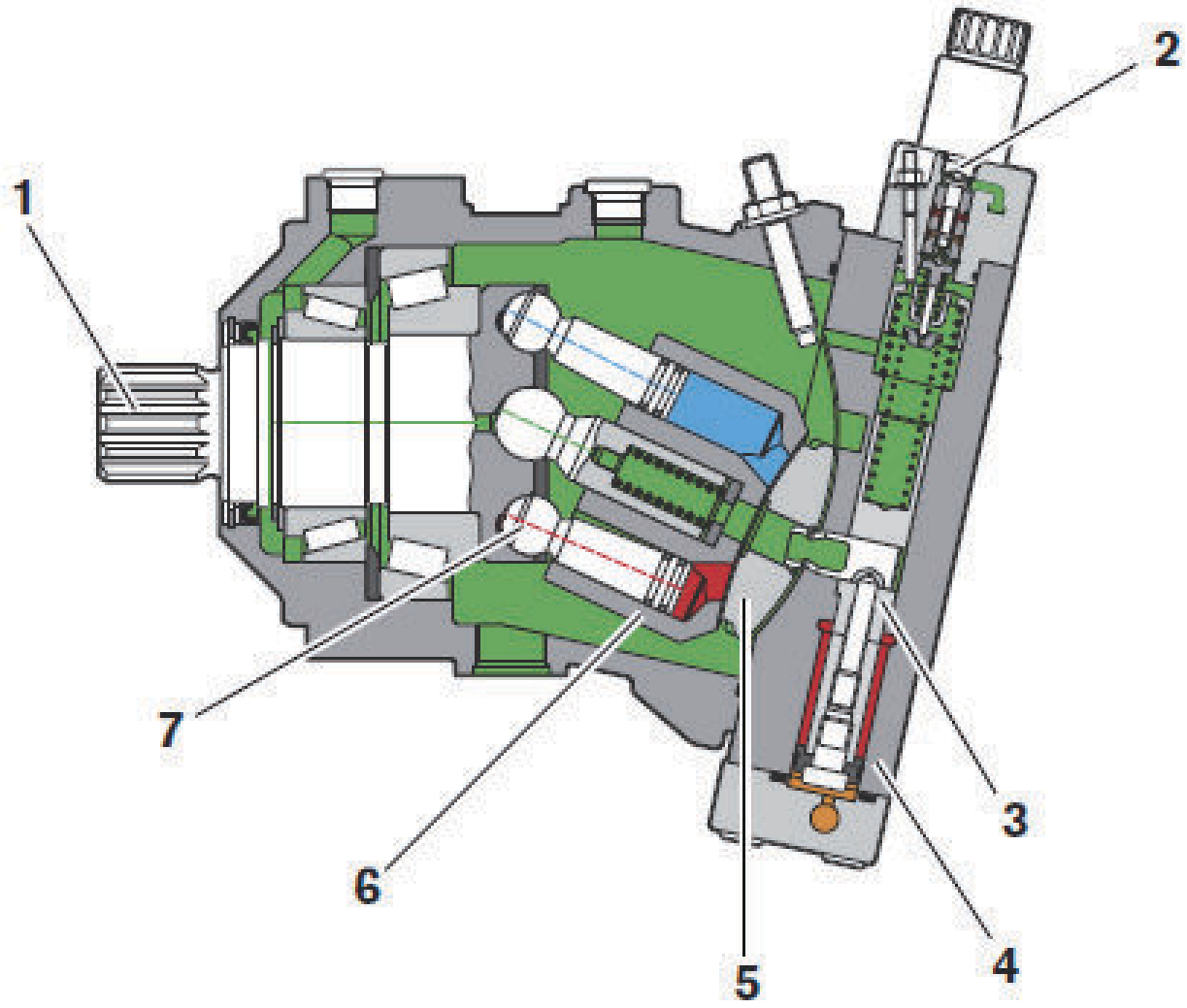
An Axial piston variable motor converts hydrostatic flow into mechanical rotation and controls or regulates this. The A6VM is a variable motor with an axial piston rotary group of bent-axis design, for hydrostatic drives in open and closed circuits. For axial piston units with a bent-axis design, the pistons are arranged at an angle to the drive shaft. The pistons rest directly on the drive shaft where they generate torque depending on the pressure and swivel angle. The specific torque and displacement can be changed by adjusting the bent axis.

- Open Circuit - In the open circuit, the hydraulic fluid flows from the reservoir to the hydraulic pump from where it is transported to the hydraulic motor. From the hydraulic motor, the hydraulic fluid flows directly back to the reservoir. The output direction of rotation of the hydraulic motor can be changed, e.g. by a directional valve.
- Closed Circuit - In the open circuit, the hydraulic fluid flows from the reservoir to the hydraulic pump from where it is transported to the hydraulic motor. From the hydraulic motor, the hydraulic

fluid flows directly back to the reservoir. The output direction of rotation of the hydraulic motor can be changed, e.g. by a directional valve.

The axial piston variable pump generates, controls and regulates a hydraulic fluid flow. It is designed for mobile applications such as construction machinery.

Figure 114



DS2201432

1	Drive Shaft	2	Control Piston
3	Stroke Piston	4	Port Plate
5	Lens Plate	6	Cylinder
7	Piston	-	-

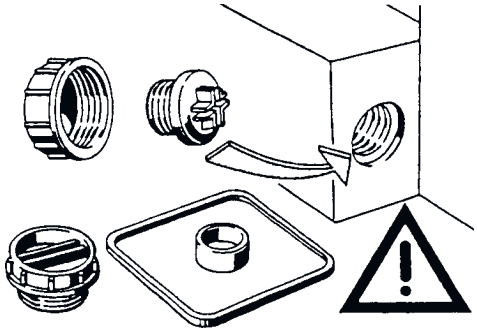
Function Description

- Motor Function - A hydraulic motor converts hydrostatic energy into mechanical energy. Hydraulic fluid is directed via the port plate and the lens plate to the cylinder bores. The pistons in the cylinder bores execute a stroke that is converted into rotary motion by the piston on the driveshaft flange. During this process, the pistons move the cylinder and generate an output torque at the drive shaft. The output torque increases with the pressure difference between the high- and low-pressure sides and increasing displacement. The output speed is proportional to the inward flow and inversely proportional to the displacement of the hydraulic motor.

- Flushing and Boost Pressure Valve (optional) - The flushing and boost pressure valve is used to remove heat from the hydraulic circuit. In an open circuit, it is used exclusively for flushing the case. In a closed circuit, it ensures a minimum boost pressure level in addition to the case flushing.Hydraulic fluid is directed from the respective low-pressure side into the motor case. This is then fed into the reservoir, together with the case drain fluid. The hydraulic fluid removed from the closed-circuit must be replaced by cooled hydraulic fluid from the boost pump.
- Control - The swivel angle of the bent-axis rotary group is steplessly variable. With two-point control (HZ, EZ), the swivel angle can be switched from maximum to minimum angle. Control of the swivel angle of the bent-axis rotary group changes the piston stroke and therefore the displacement. The swivel angle is changed hydraulically via the stroke piston. Here, the cylinder is swiveled including the pistons and lens plate. The lens plate is mounted for easy motion in a guideway. Increasing the swivel angle results in an increase in the displacement and specific torque; decreasing the swivel angle results in a corresponding decrease in these values. The output speed is dependent on the input flow and the displacement of the hydraulic motor.

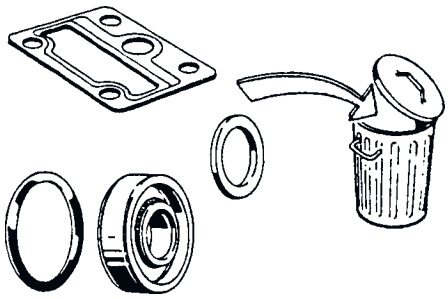
Maintenance Guidelines

1. Figure 115



   Close off all openings of hydraulic unit.

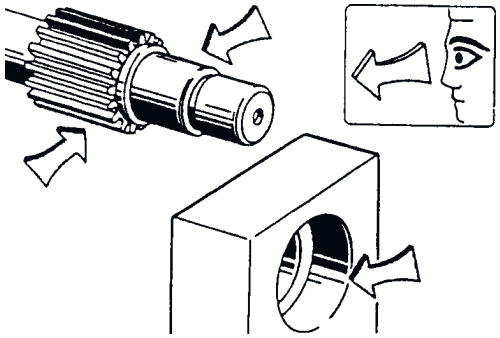
2. Figure 116



   Replace all seals.

   Use only original replacement parts

3. Figure 117

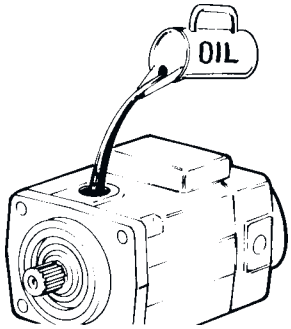


ASS0050L

Check all sealing and sliding surfaces for wear.

NOTE: *Do not rework sliding surfaces using crocus cloth or other similar materials. It can damage the surface.*

4. Figure 118



ASS0060L

Fill hydraulic unit with clean hydraulic oil before putting into operation.

Fan Pump

Overview

Fan pump is a piston type pump of variable displacement, discharging flow is controlled by EPPR current value with EPOS.

The low temperature of the cooling system the discharging flow is decreasing to low flow amount, and high temperature of the cooling system the discharging flow is increased to high flow amount.

Discharging flow depends on the angle of the swash plate even the pump shaft rotating speed is low or high.

Figure 119

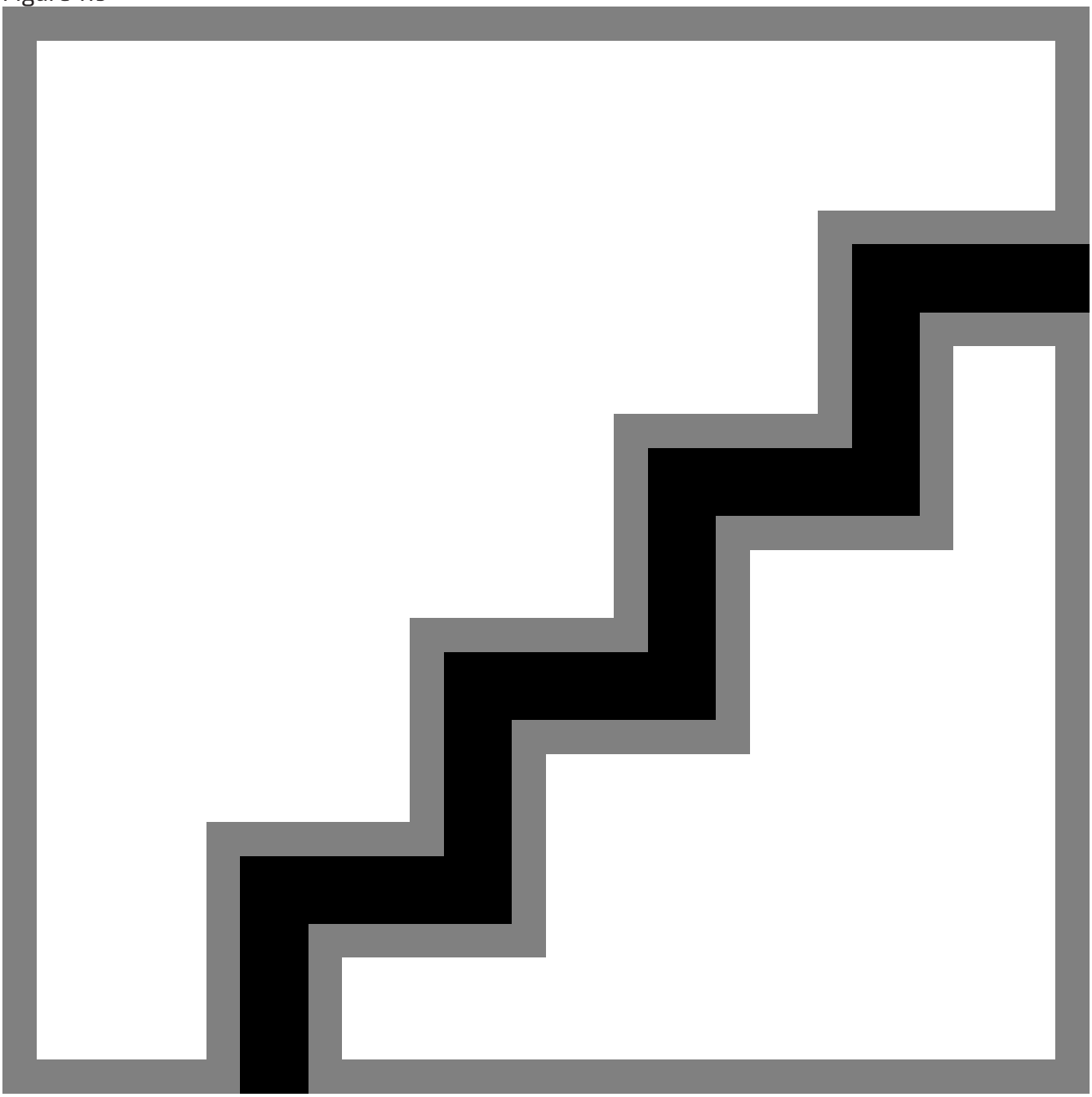
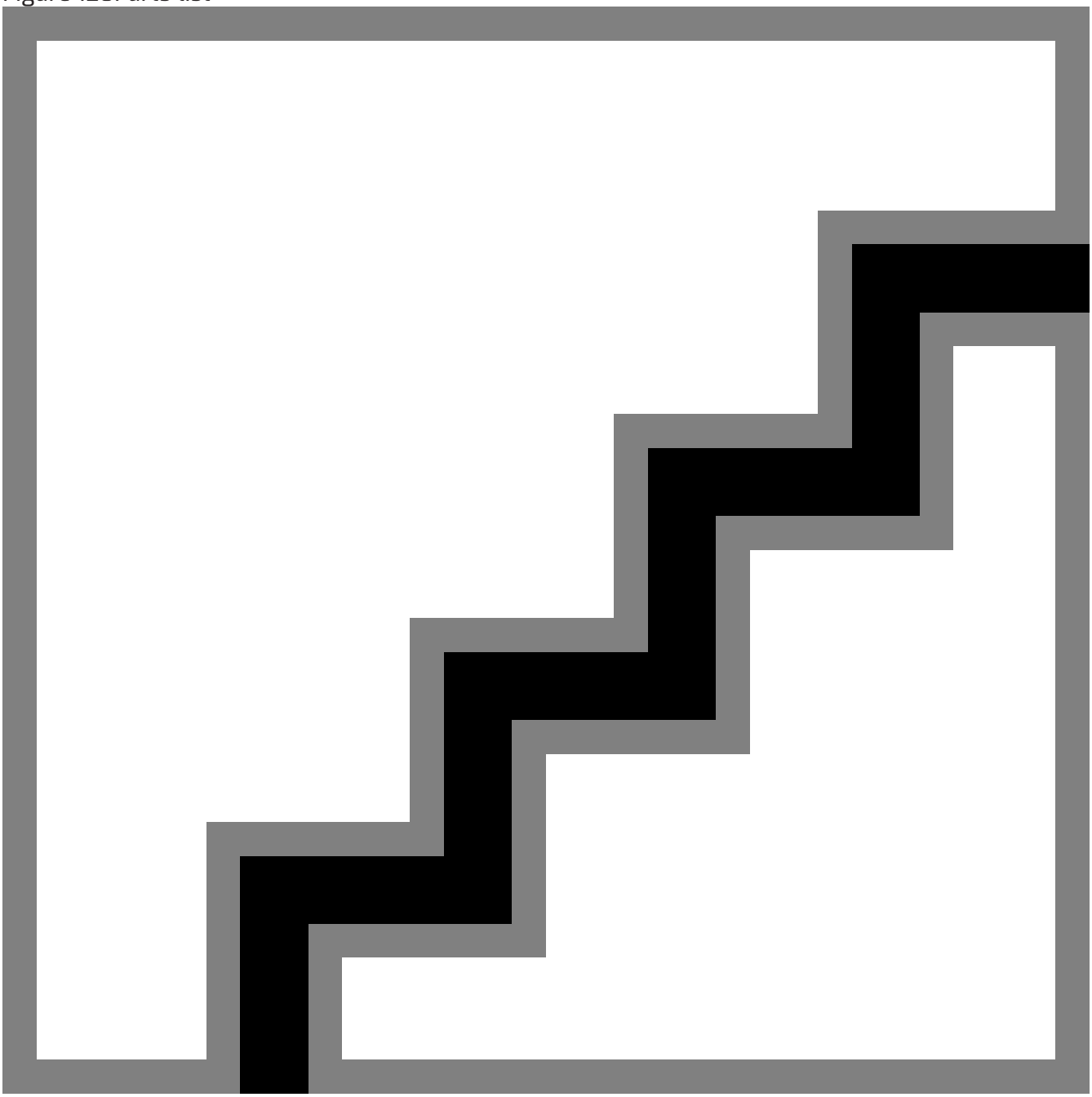


Figure 120Parts list



Reference Number	Description	Reference Number	Description
1	Front Cover	9	Seal
2	Thrust Plate	10	Shaft Seal
3	Drive Shaft	11	Snap Ring
4	Driven Gear	12	Ring
5	Socket Bolt	13	Bush
6	Plug	14	Bush
7	Washer	15	Body
8	Seal		

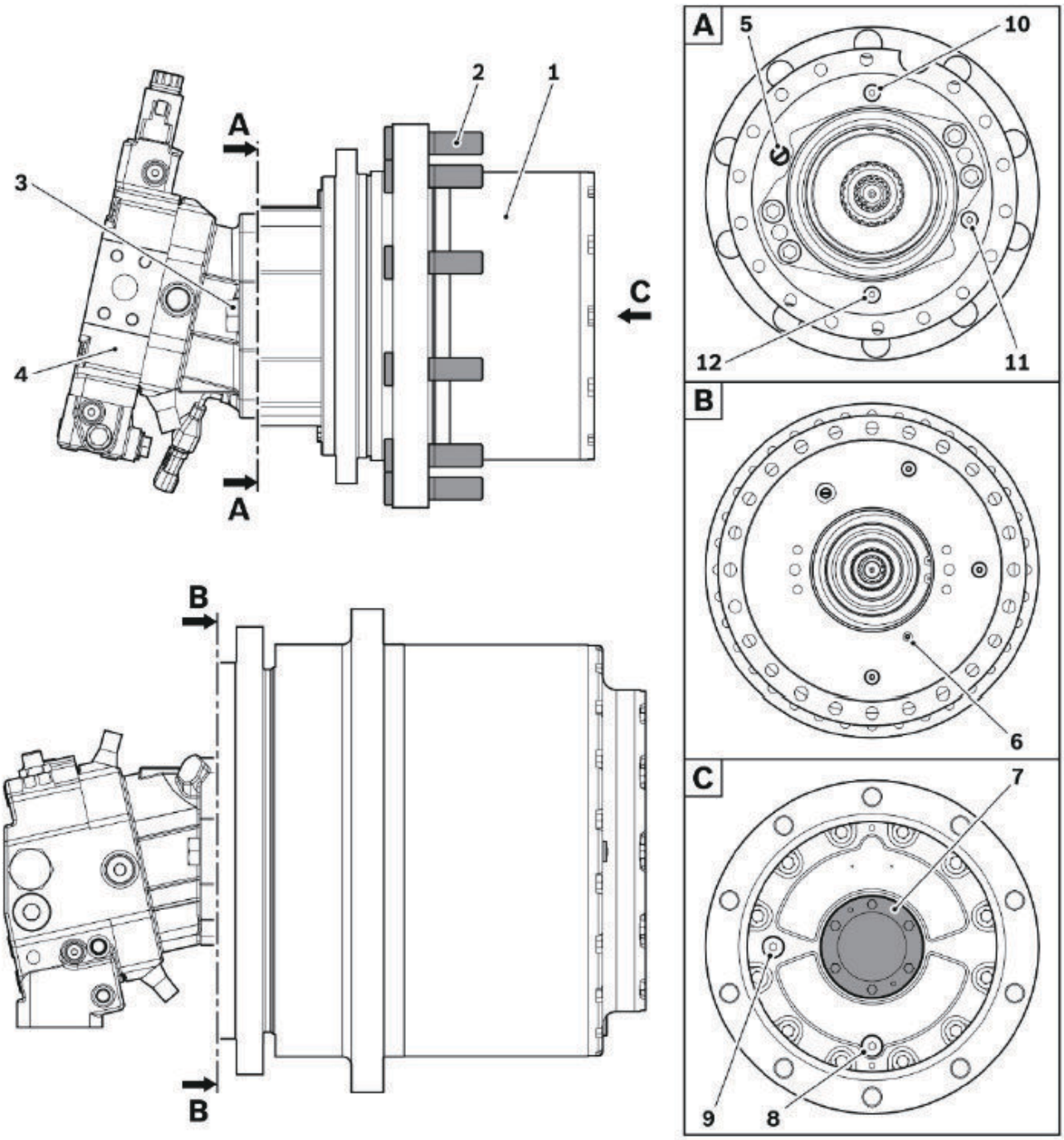
Travel Device

Overview

The hydrostatic drive is a planetary gearbox. The entire planetary gearbox, which is mounted in rolling bearings, is equipped with a splash oil lubrication. The externally toothed planet gears are case-hardened. A special output seal ensures optimum protection against dust and dirt in the output bearing.Drive and output have opposite directions of rotation.

Brake - Depending on the scope of supply, the planetary gearbox is equipped with a wet-running, integrated static multiple-disk brake (multiple-disk parking brake). The multiple-disk brake is a hydraulically released brake. The multiple-disk brake is used as a parking brake as standard. The parking brake (static multiple-disk parking brake) is applied via the brake release connection. The static multiple-disk parking brake acts negatively, i.e. it is released by means of pressure fluid and applied by spring action when pressure-less.

Figure 121



DS2201433

1	Planetary Gearbox	2	Wheel Stud (optional)
3	Motor Attachment Screws	4	Axial-Piston Motor
5	External Brake Release Connection	6	Internal Brake Release Connection
7	Disconnect Mechanism (optional)	8	for Discharging the Lubricating Oil
9	for Oil Level checking	10	for Filling the Lubricating Oil
11	for Checking the Lubricating Oil	12	for Discharging the Lubricating Oil

The indicated gear type is an example.

- Position and type of the connections

- Position of the oil filler opening
- Position of the oil level control system
- Position of the oil drain opening
- Position and type of mounting parts
- Optional wheel stud
- Optional disconnect mechanisms (deactivation)

Systems Operation And Description

Safety Instructions

⚠ WARNING

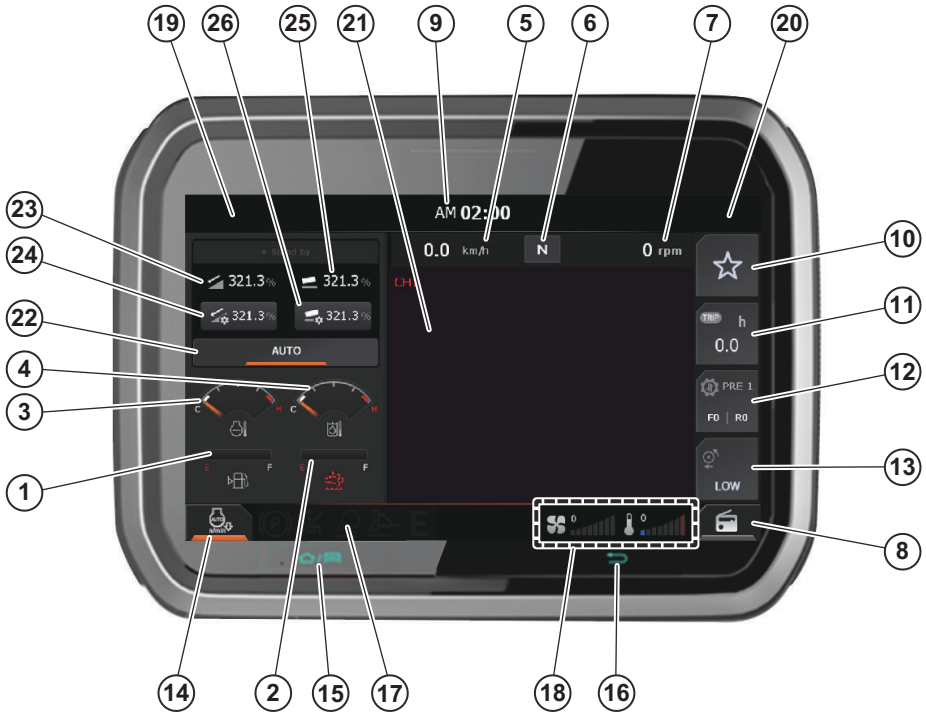
AVOID DEATH OR SERIOUS INJURY

Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments repairs or service. Untrained operators and failure to follow instructions can cause death or serious injury.

Gauge Panel system

Display Monitor

Figure 122



DS2201227

Reference Number	Description	Reference Number	Description
1	Fuel Gauge	14	Auto Idle Selector Button
2	DEF Level Gauge	15	Menu Selector Button
3	Engine Coolant Temperature Gauge	16	Back Button
4	Hydraulic Oil Temperature Gauge	17	Mode Symbol Display
5	Travel Speed Display	18	HVAC Display
6	FNR Display	19	Display Warning Symbols

Reference Number	Description	Reference Number	Description
7	RPM Display	20	Indicator Display
8	Audio Display	21	Camera Display
9	Digital Clock	22	Dozing Assist Control Auto Button
10	Favorites Button	23	Blade Lift Angle Display
11	Main Information Selector Button	24	Blade Lift Angle Control Button
12	Travel Speed Management	25	Blade Tilt Angle Display
13	Traction Mode Selector Button	26	Blade Tilt Angle Control Button

NOTE: *The information, illustrations, and menu can change at any time without prior notice.*

Service Menu

Overview

In this menu, many types of operating conditions and functions can be accessed and displayed.

This menu is mainly used for machine testing and fault diagnostics.

Various sub menus can be selected by turning the jog switch and clicking on the jog switch to select the menu.

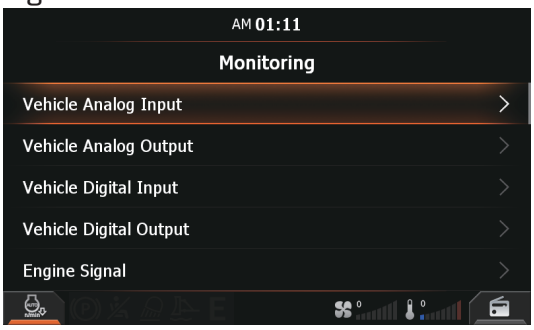
Press the ESC button to return to the previous screen.

Menu Description				
1st	2nd	3rd	4th	5th
Service Menu	Monitoring	Vehicle Analog Input		
		Vehicle Analog Output		
		Vehicle Digital Input		
		Vehicle Digital Output		
		Engine Signal		
		TCU Analog		
		TCU Digital		
		User Selection Signal		
		TMS Information	GPS Information	
			Network Information	
			Terminal Information	
	Graph	Graph Data Monitoring		
		Set Graph Data		

	Failure Information	Real Time Failure Information		
		Failure Log Information		
	Operating Hour Information			
	Machine Configuration	Option Configuration	Set Machine Option	Ripper
				Travel / Swing Alarm
				DAAC
			Set General Option	TMS
				DAB
		Calibration	Brake Pedal Calibration	
			Body Level Sensor Calibration	
			R2 Length	
			LC Length	
		Set Camera		
		SW Update		
		Enter Serial Number		
		Reset	Failure Log Reset	
			Operation Hour Reset	
			Gauge Panel Configuration Reset	
		Version Information		
		Permanent Security Unlock		
		Enter Vehicle Name		
		Gauge Panel Monitoring		

Monitoring

1. Figure 123

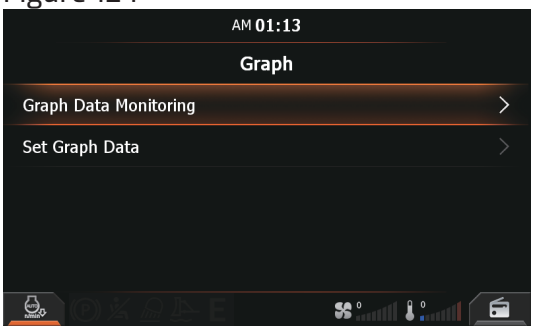


DS2201501

Entering sub-menus: When cursor is located on “Monitoring” of special menu screen, press the jog switch and the “Monitoring” will be displayed.

2. The following menus can be accessed: Vehicle Analog Input, Vehicle Analog Output, Vehicle Digital Input, Vehicle Digital Output, Engine Signal, TCU Analog, TCU Digital, User Selection Signal, and TMS Information.

Figure 124

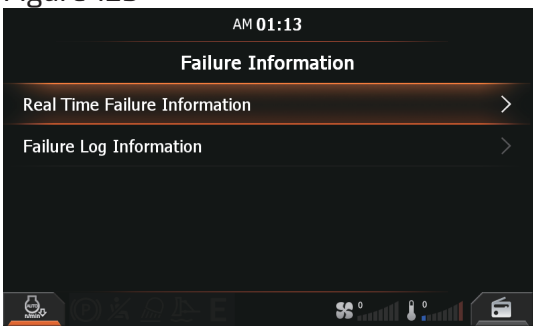


DS2201502

Graph

The following menus can be accessed: Graph Data Monitoring and Set Graph Data.

Figure 125

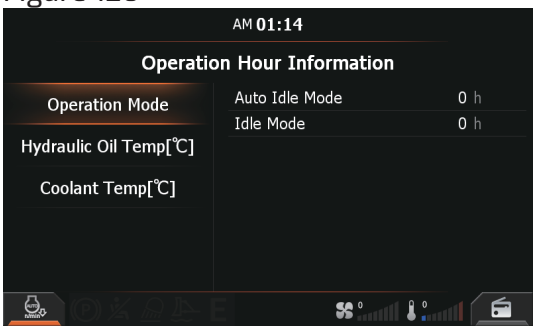


DS2201503

Failure Information

The following menus can be accessed: Real Time Failure Information and Failure Log Information.

Figure 126

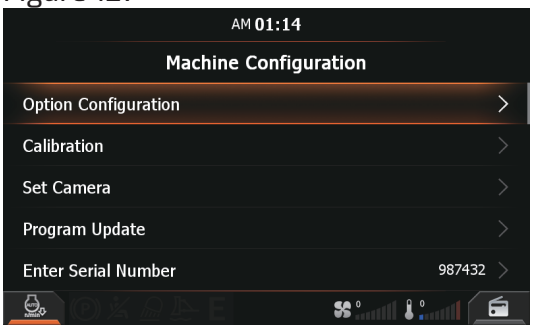


DS2201504

Operation Hour Information

In this screen, Operation Mode, Hydraulic Oil Temp and Coolant Temp can be monitored.

Figure 127



DS2201505

Machine Configuration

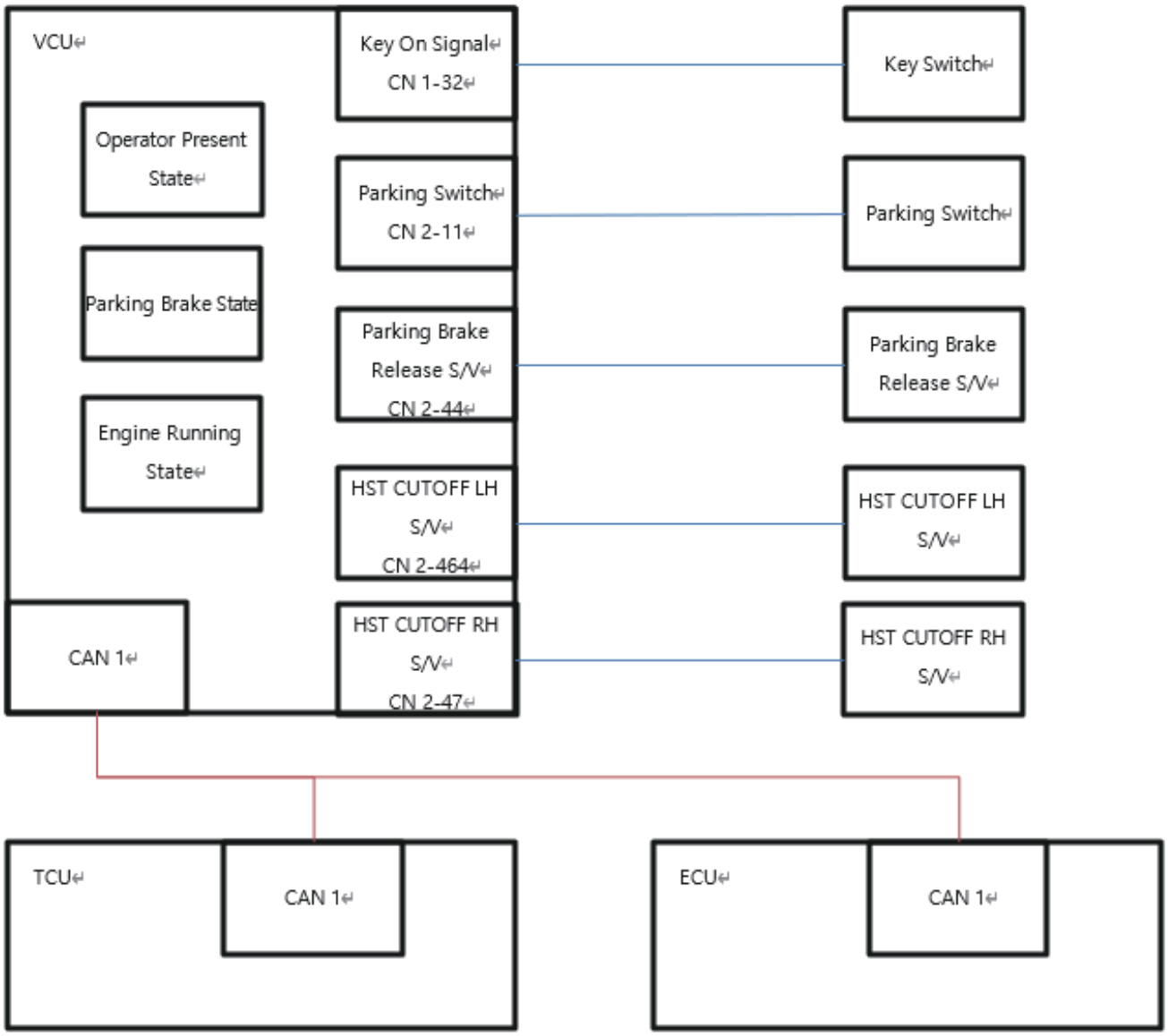
In this screen, Option Configuration, Calibration, Set Camera, Program Update, Enter Serial Number, Reset, Version Information, Permanent Security Unlock, Enter Vehicle Name, and Gauge Panel Monitoring can be monitored.

EPOS Function Description

Parking Brake Control

Purpose - To prevent unintended operation due to erroneous operation when equipment is not in operation

Figure 128

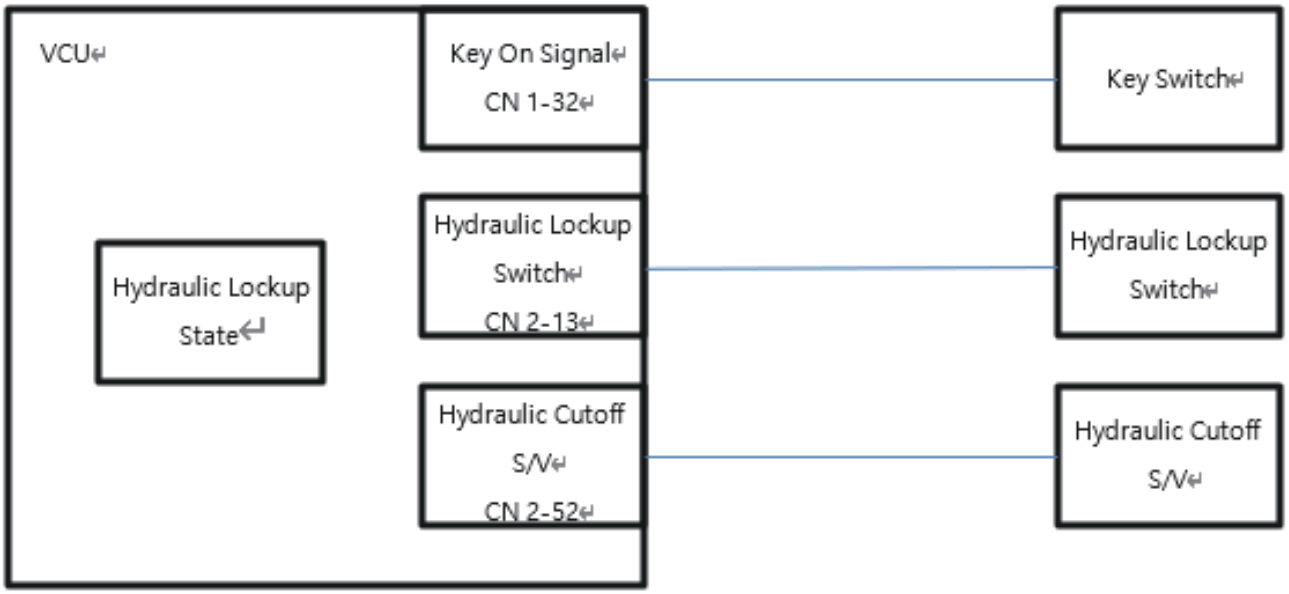


DS2201438

Hydraulic Lockup Control

Purpose - To prevent unintended operation due to erroneous operation when equipment is not in operation

Figure 129

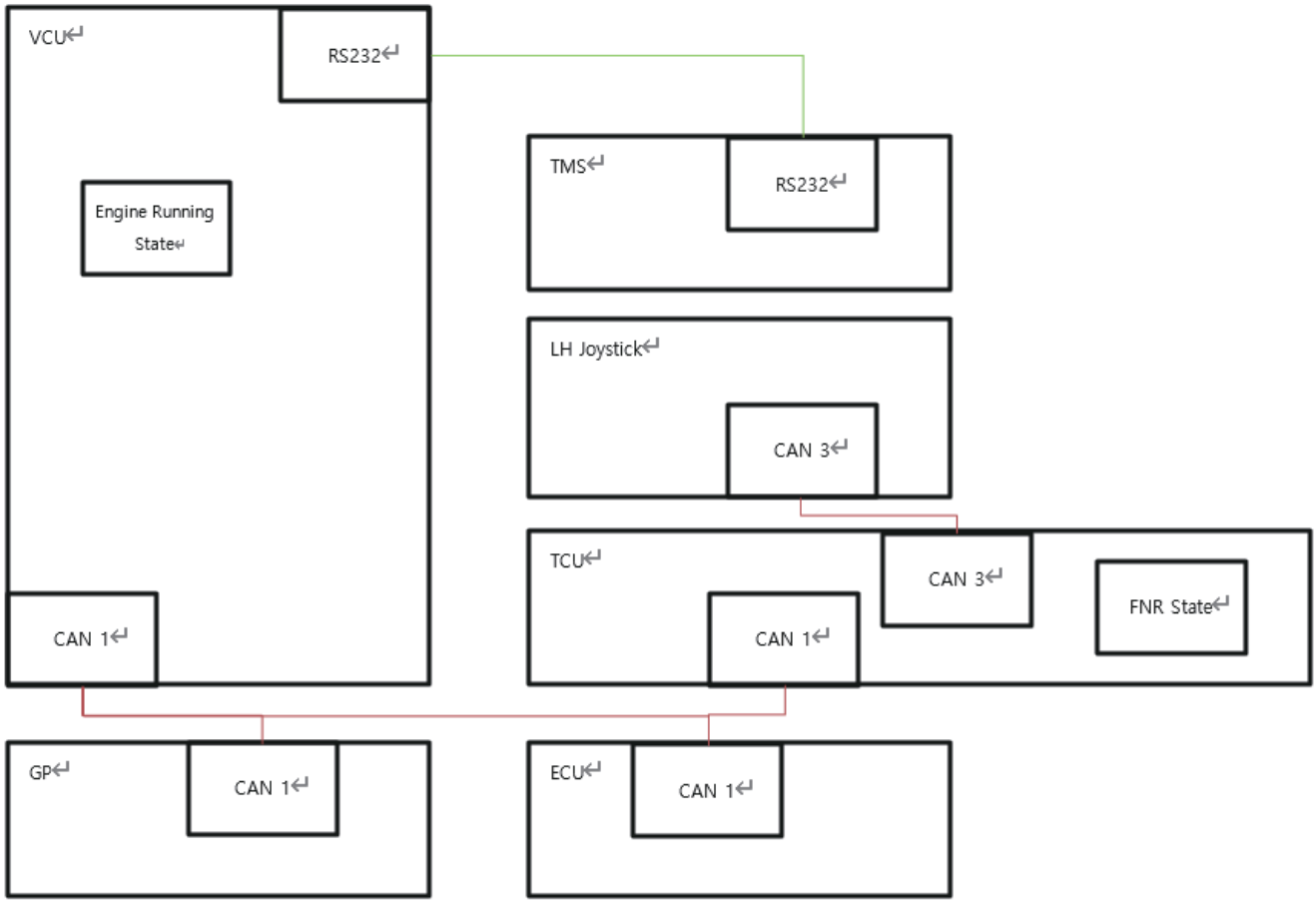


DS2201439

Starter Control

Purpose - This is to limit the use of equipment in conditions not intended by operators or equipment owners, such as unnoticeable safety risks, equipment theft, or equipment claims impossible to recover

Figure 130

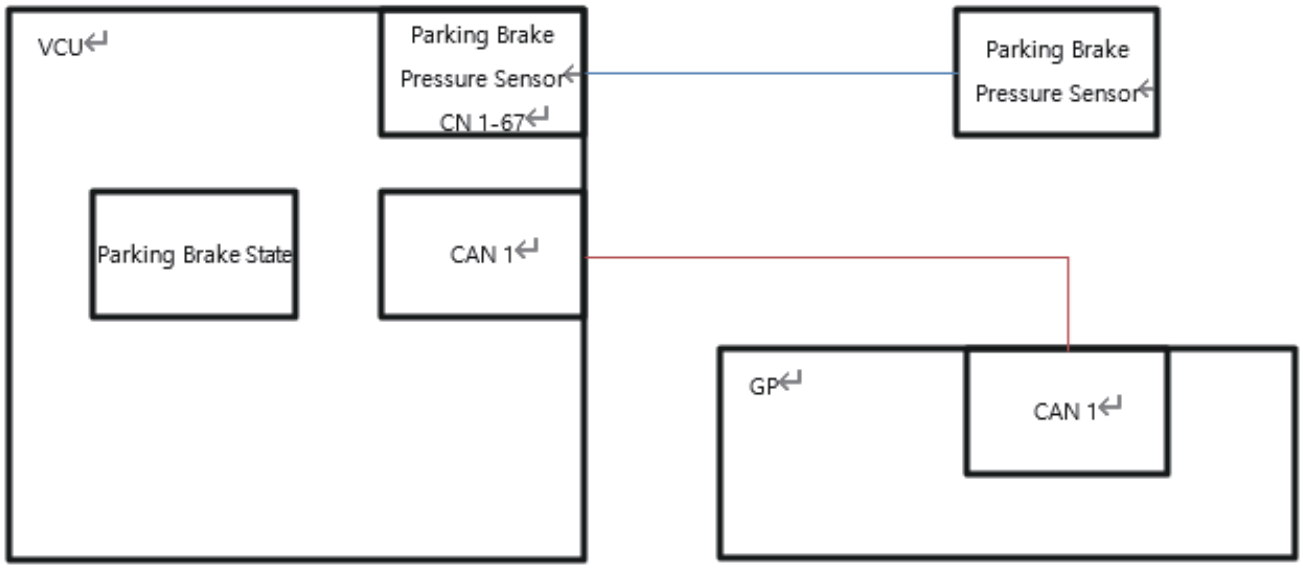


DS2201440

Parking Brake Pressure Warning

Purpose - Warns of abnormal parking brake pressure on the machine

Figure 131

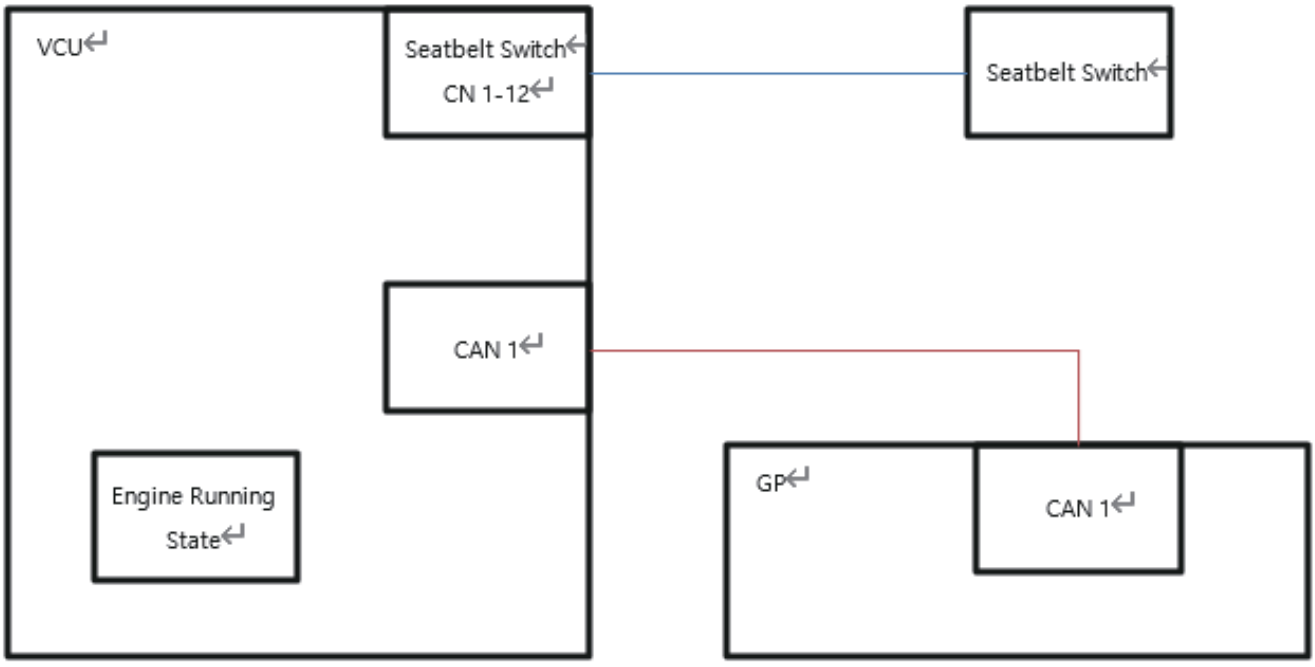


DS2201441

Seatbelt Warning

Purpose - Warns if seatbelt is not installed while engine is running

Figure 132

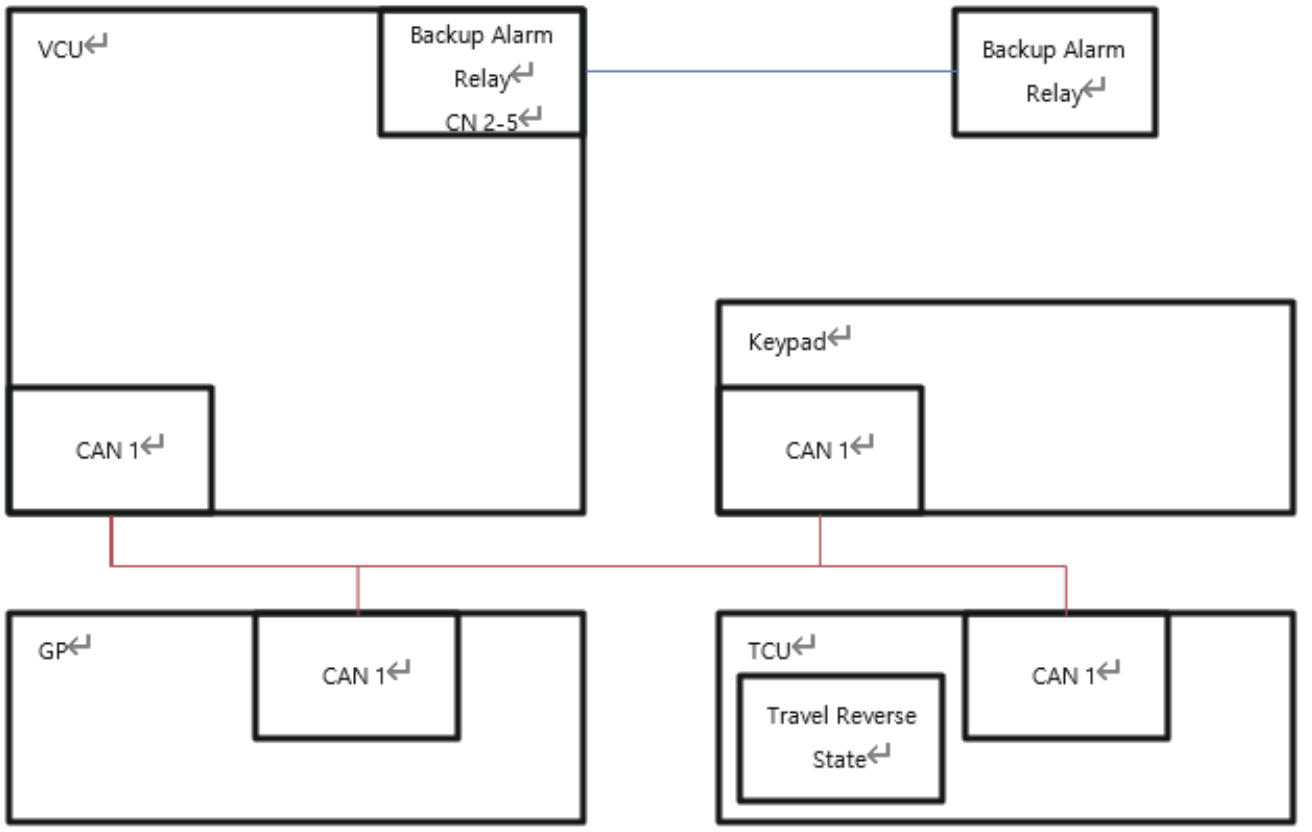


DS2201442

Reverse Warning

Purpose - When reversing the machine, warn nearby workers of reversing the machine

Figure 133

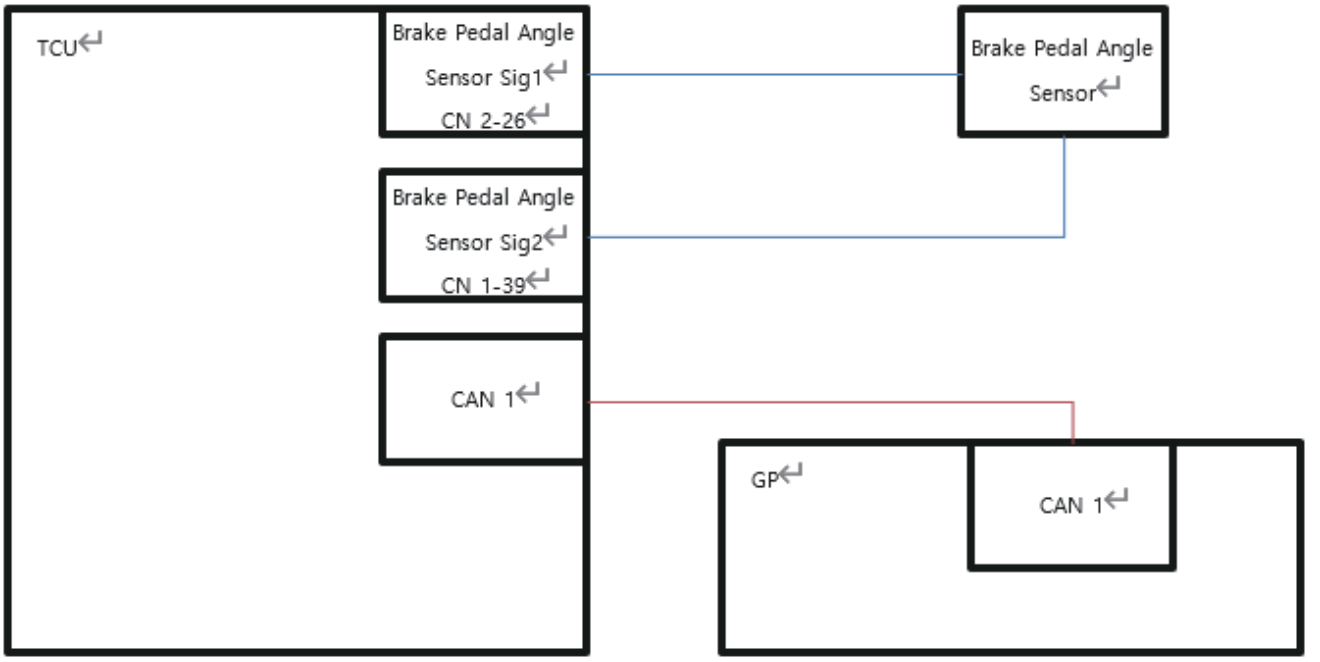


DS2201443

Brake Pedal Angle Sensor Calibration

Purpose - Calibrates the maximum and minimum values of the Brake Pedal connected to the TCU

Figure 134

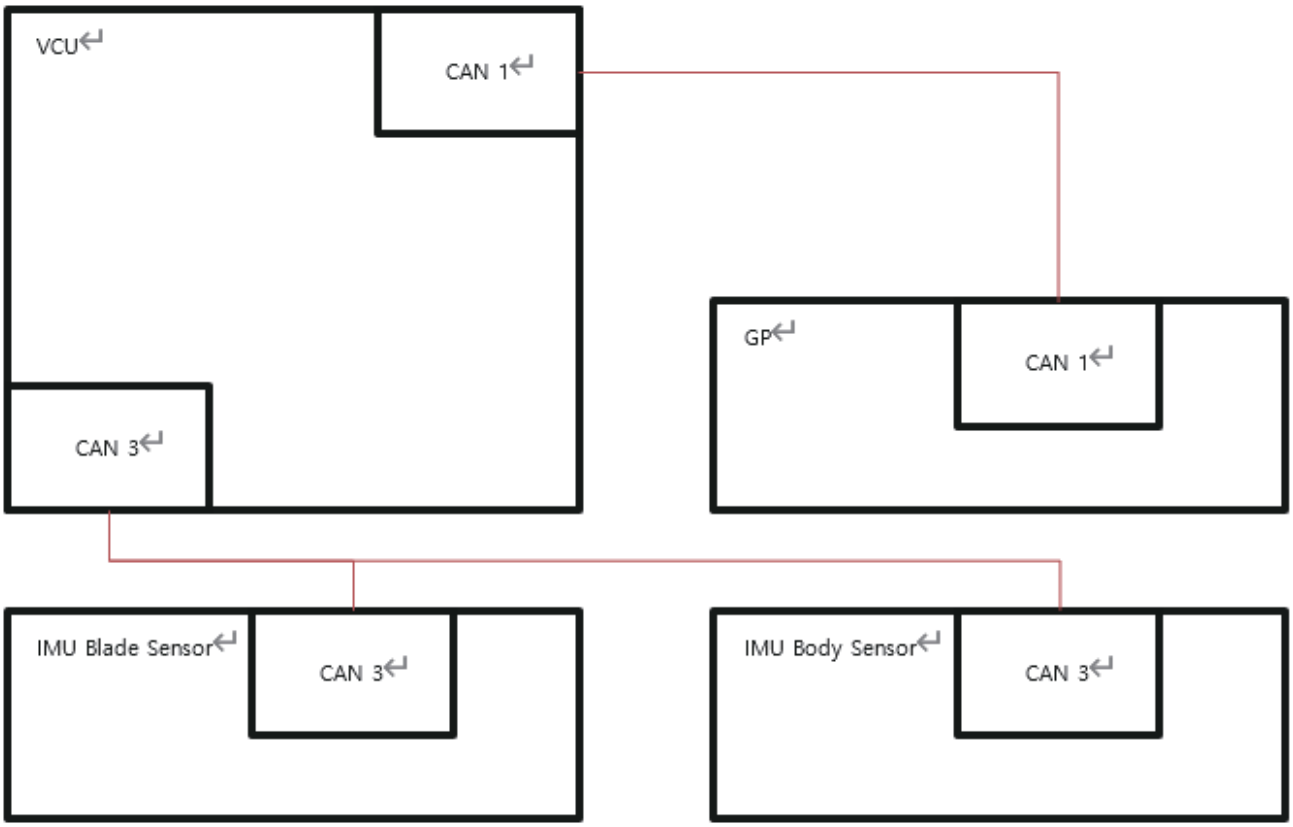


DS2201444

IMU Sensor Calibration

Purpose - Calibrate the IMU sensor connected to the VCU

Figure 135



DS2201445

Consumables Management

Purpose - To manage the replacement time of equipment filters and oil consumables

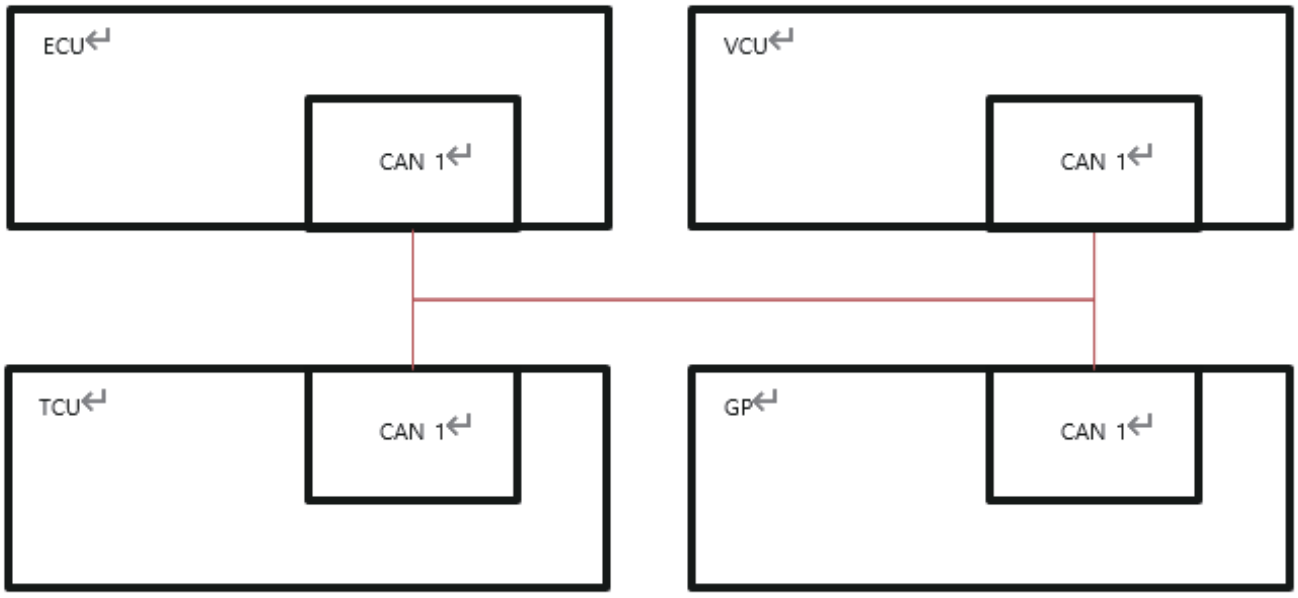
Figure 136

DS2201446

Version Information Management

Purpose - For convenience when checking the equipment by displaying the version information of the control device in the equipment on the instrument panel

Figure 137

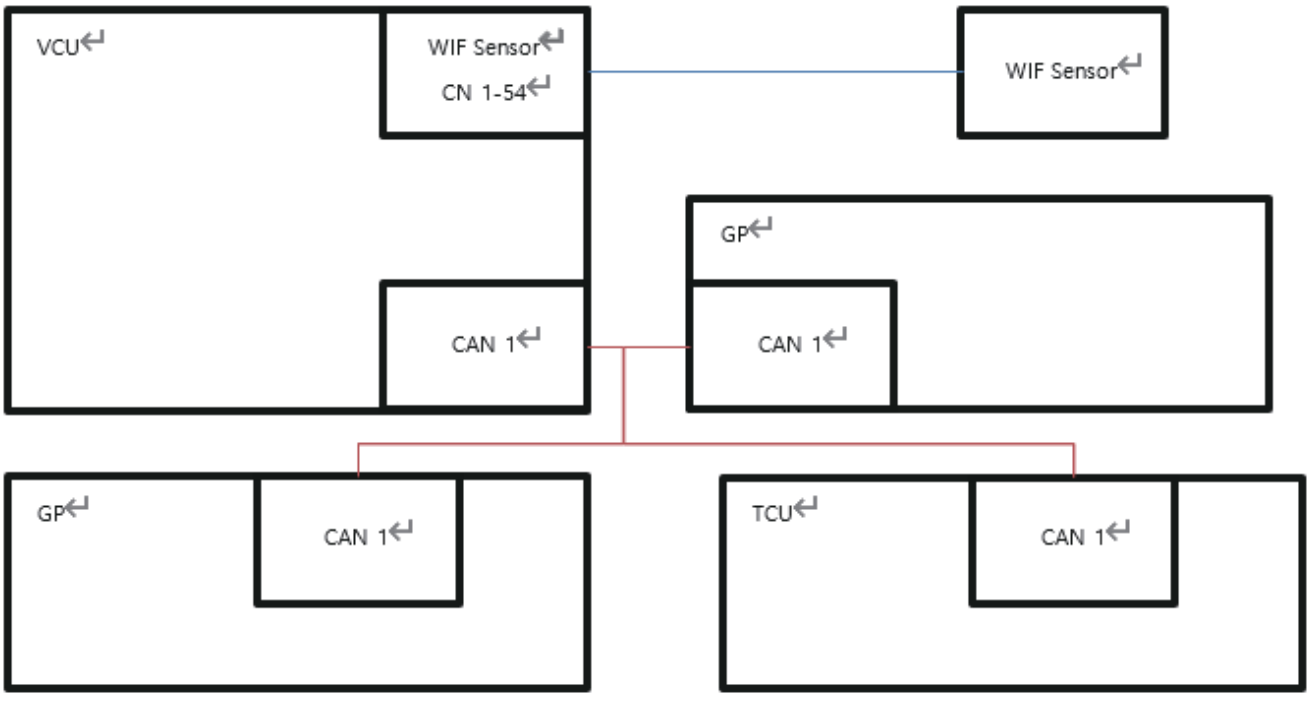


DS2201447

WIF (Water In Fuel) Warning

Purpose - To detect and warn of moisture in the fuel of the equipment

Figure 138

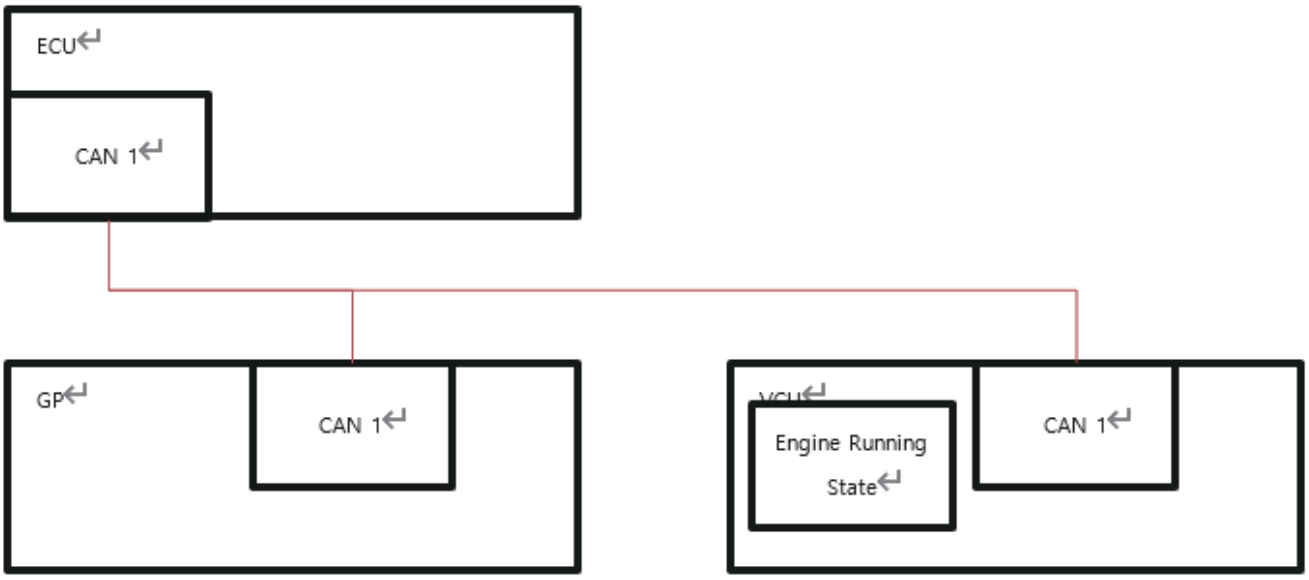


DS2201448

Engine Oil Pressure Warning

Purpose - To detect and warn of engine oil abnormalities

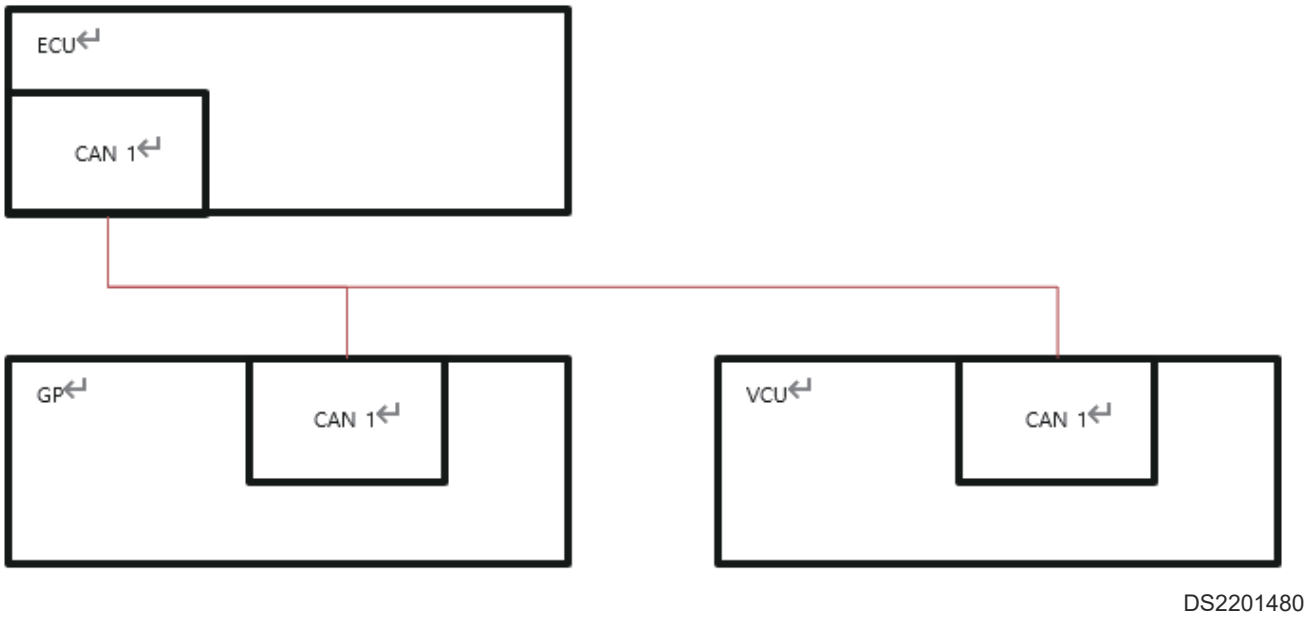
Figure 139



Coolant Overheat Warning

Purpose - To detect and warn of engine coolant overheating condition

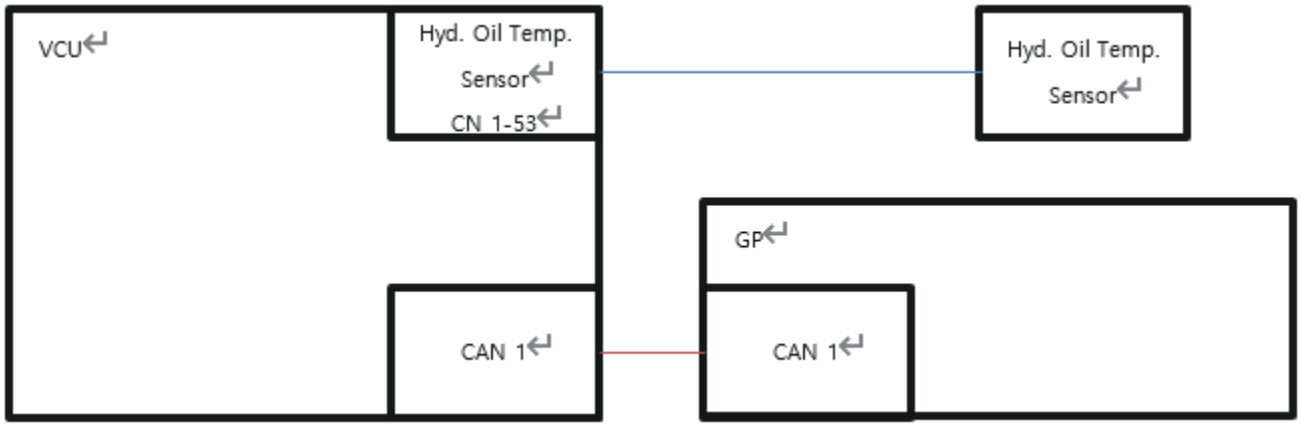
Figure 140



Hydraulic Oil Overheat Warning

Purpose - To detect and warn of overheating condition of hydraulic oil in equipment

Figure 141

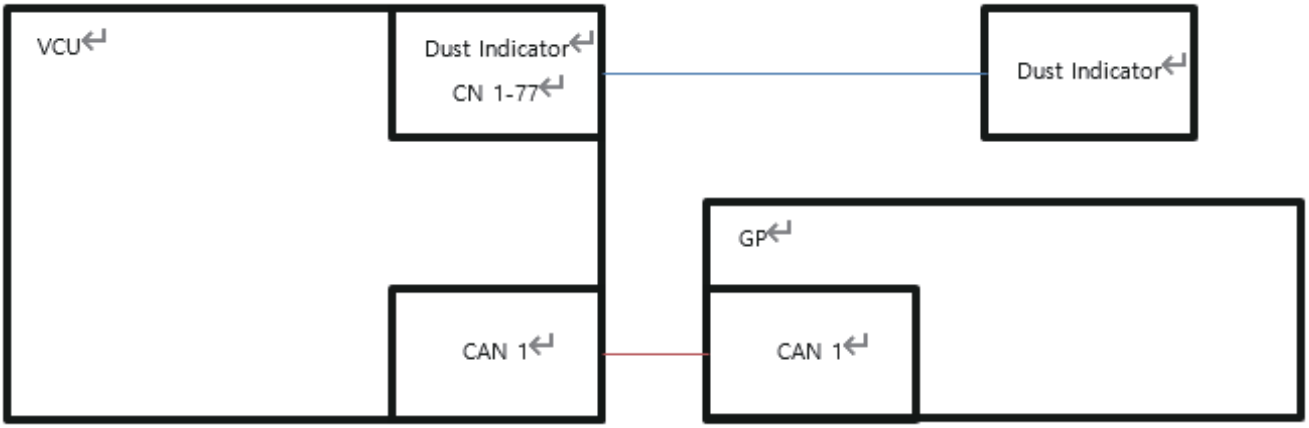


DS2201481

Air Cleaner Clogging Warning

Purpose - To warn the operator of clogged air cleaner

Figure 142

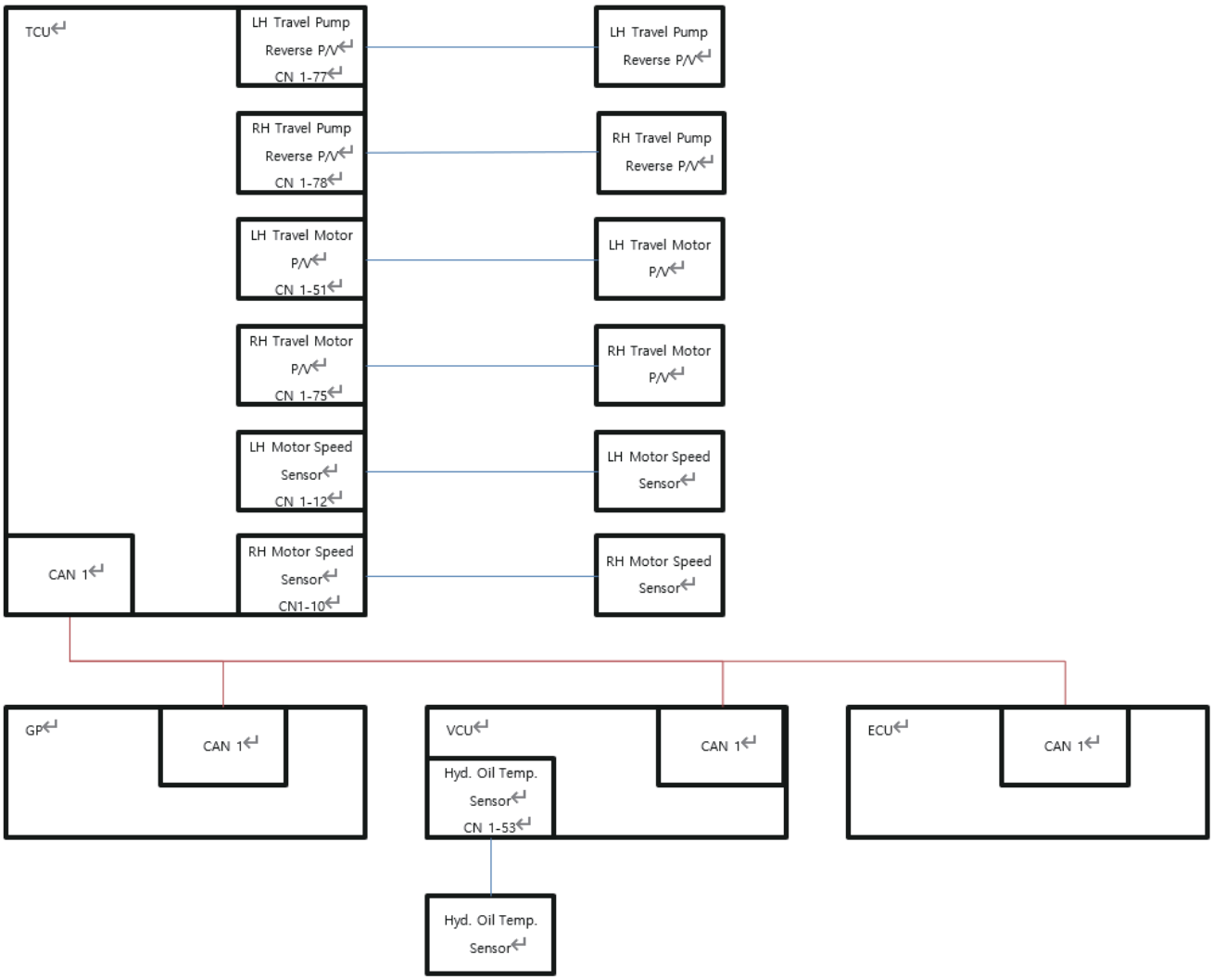


DS2201482

Overheat Protection Control

Purpose - Limits the maximum output of the travel pump to prevent overheating of the machine

Figure 143

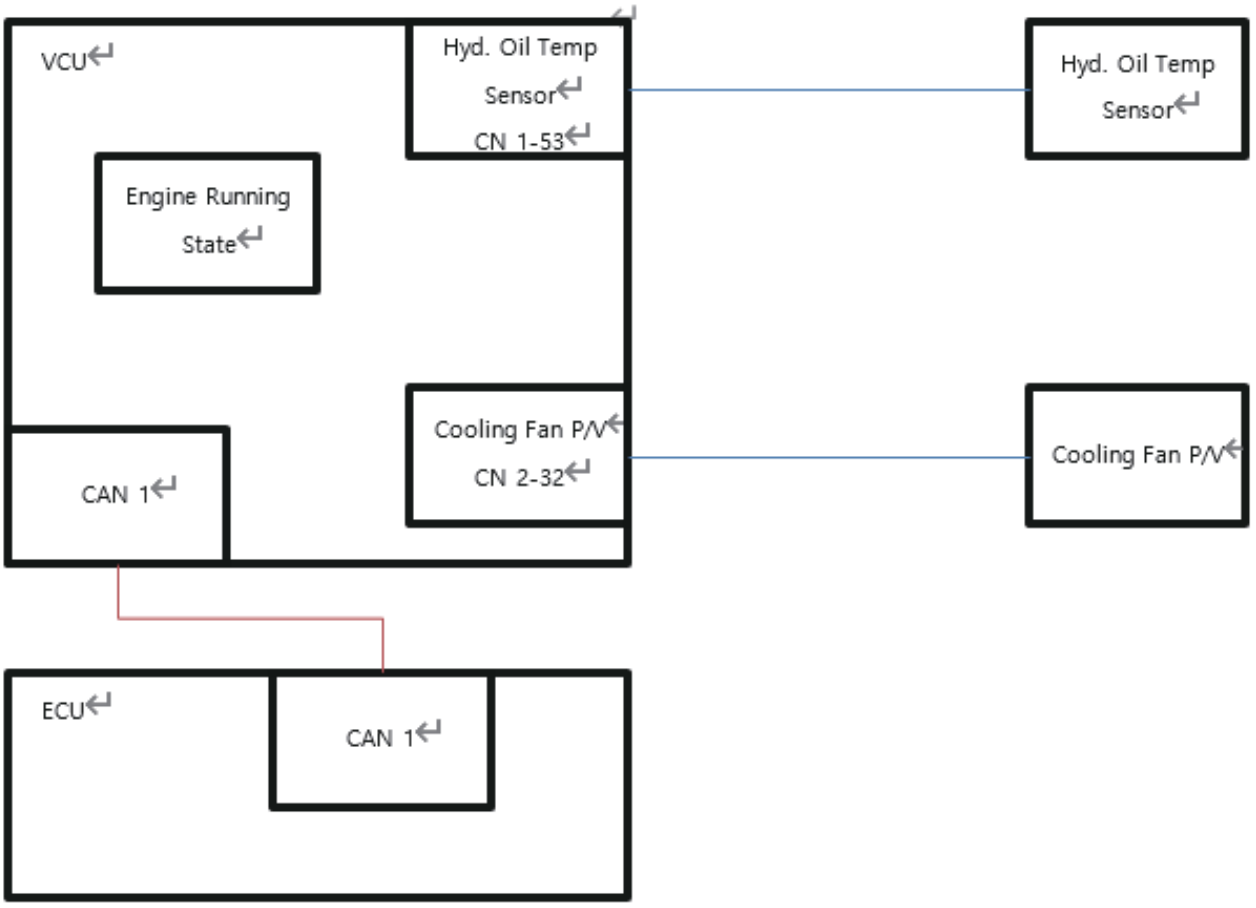


DS2201483

Cooling Fan Control

Purpose - Controls the cooling fan EPPR V/V based on the coolant and hydraulic oil temperature to prevent overheating

Figure 144

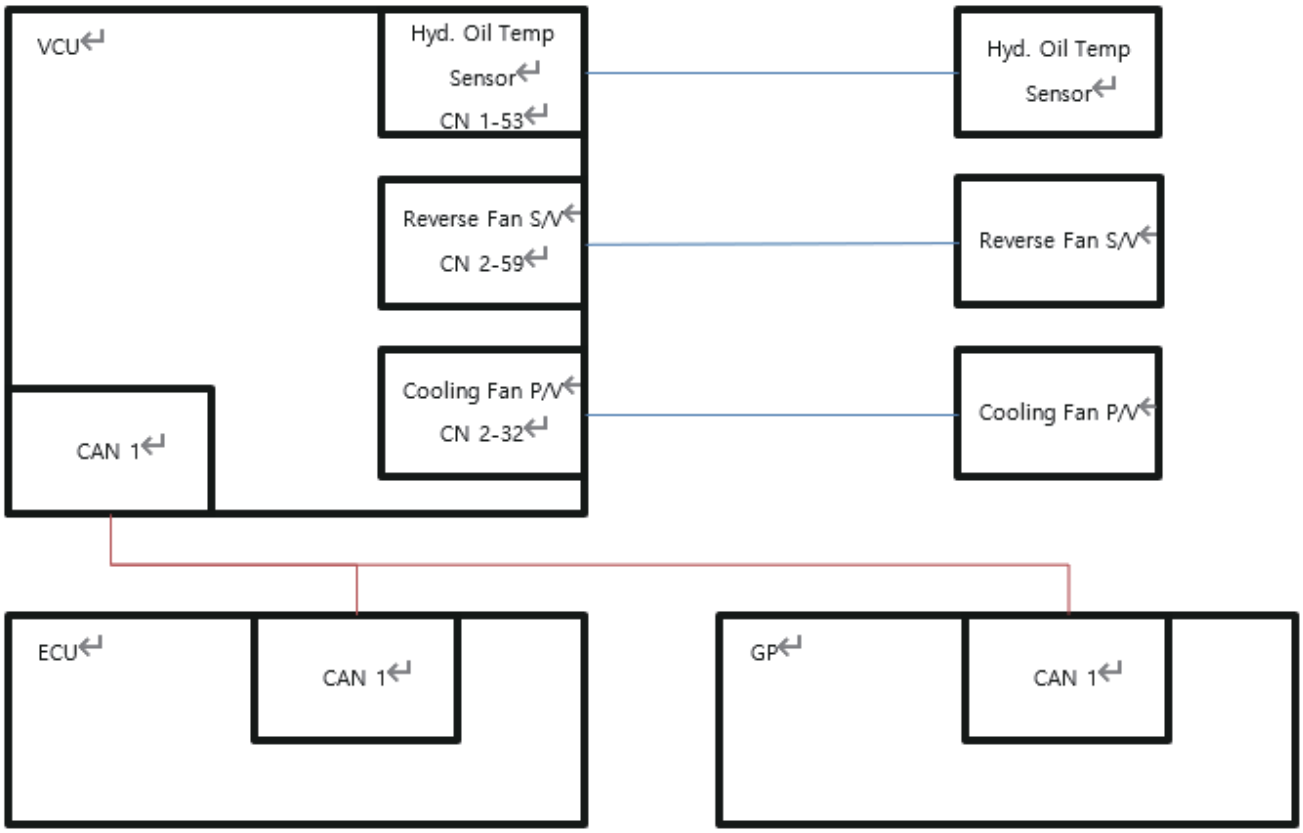


DS2201484

Cooling Fan Reverse Control

Purpose - Controls the cooling fan EPPR V/V based on the coolant and hydraulic oil temperature to prevent overheating

Figure 145

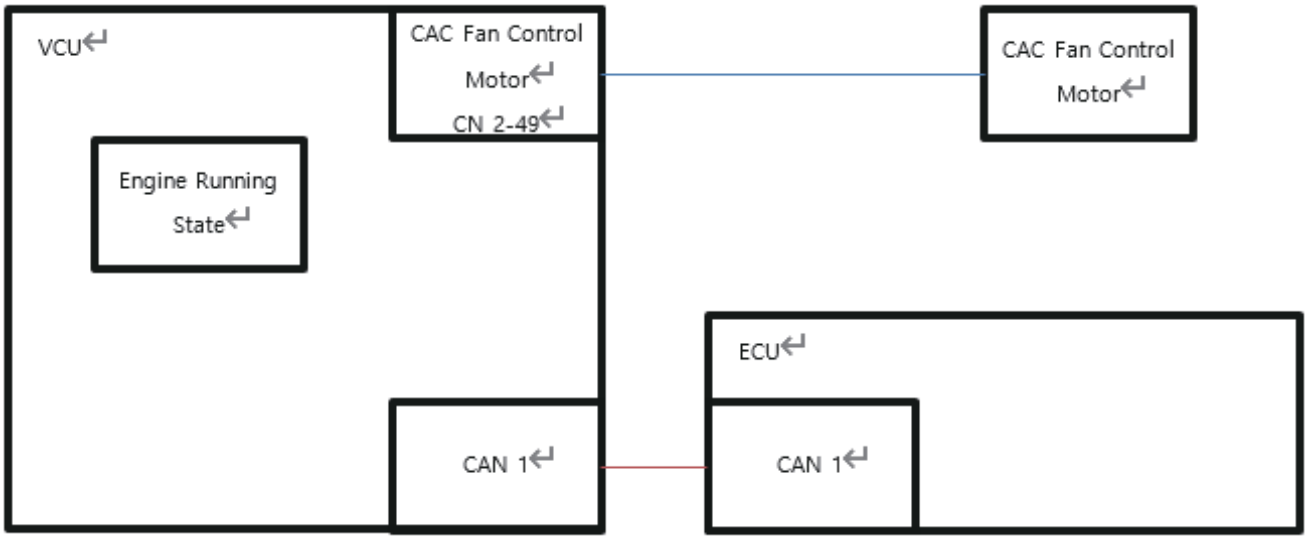


DS2201485

CAC Fan Control

Purpose - Controls CAC Fan Motor based on CAC temperature to prevent overheating

Figure 146

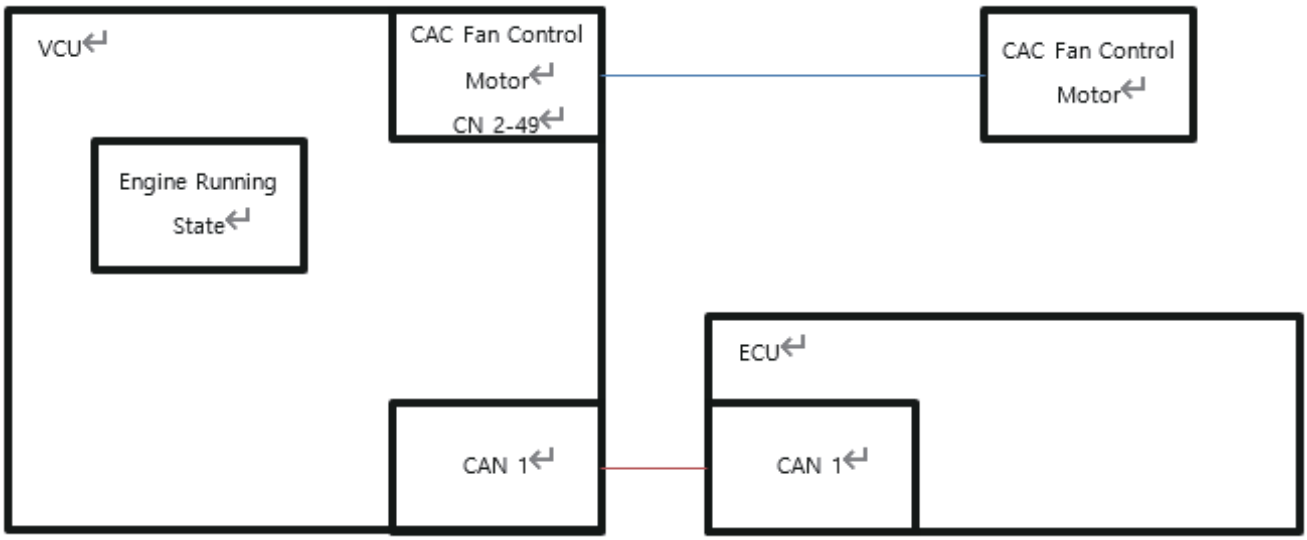


DS2201486

CAC Fan Reverse Control

Purpose - Convenience of cleaning by rotating CAC Fan Motor in reverse

Figure 147

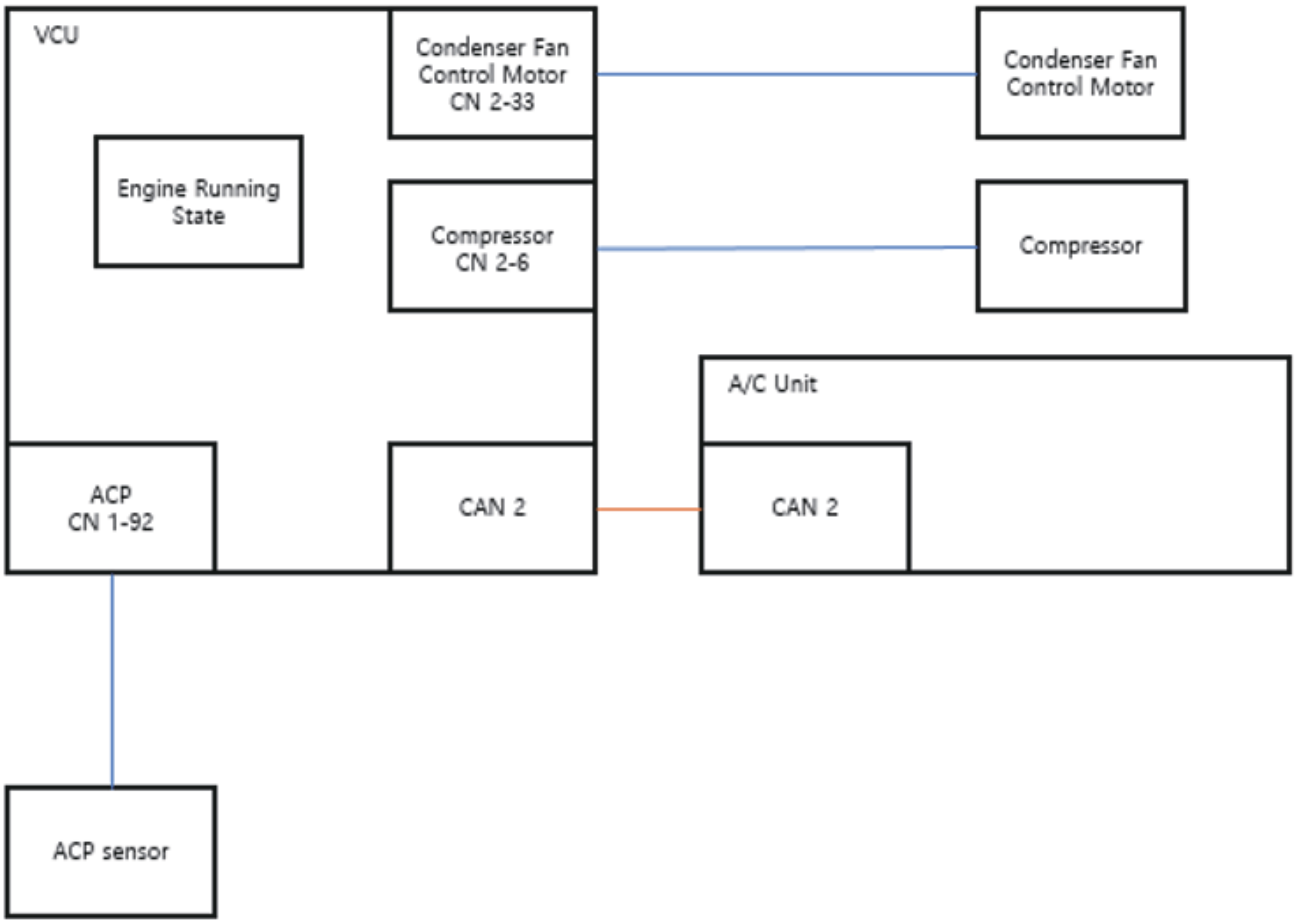


DS2201486

Condenser Fan Control

Purpose - Controls the condenser fan motor based on the compressor operation and A/C operation

Figure 148

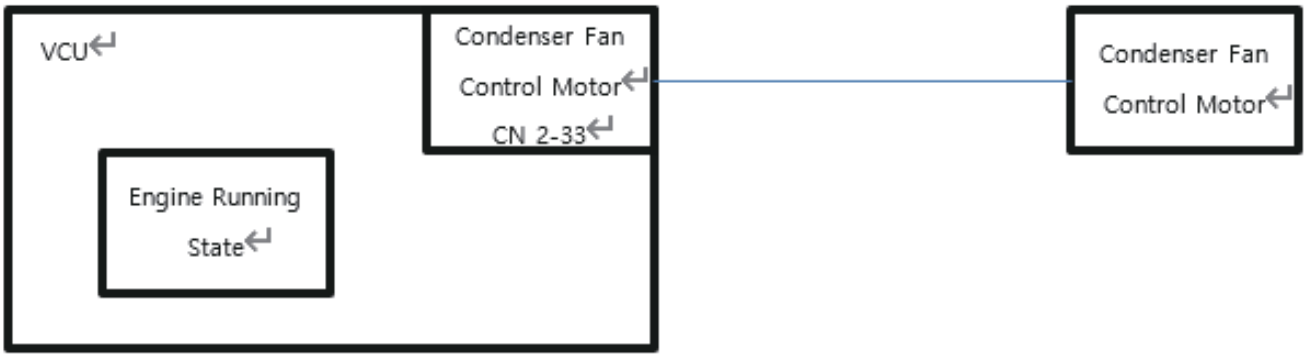


DS2201487

Condenser Fan Reverse Control

Purpose - Condenser Fan Motor is rotated in reverse to provide convenience when cleaning

Figure 149

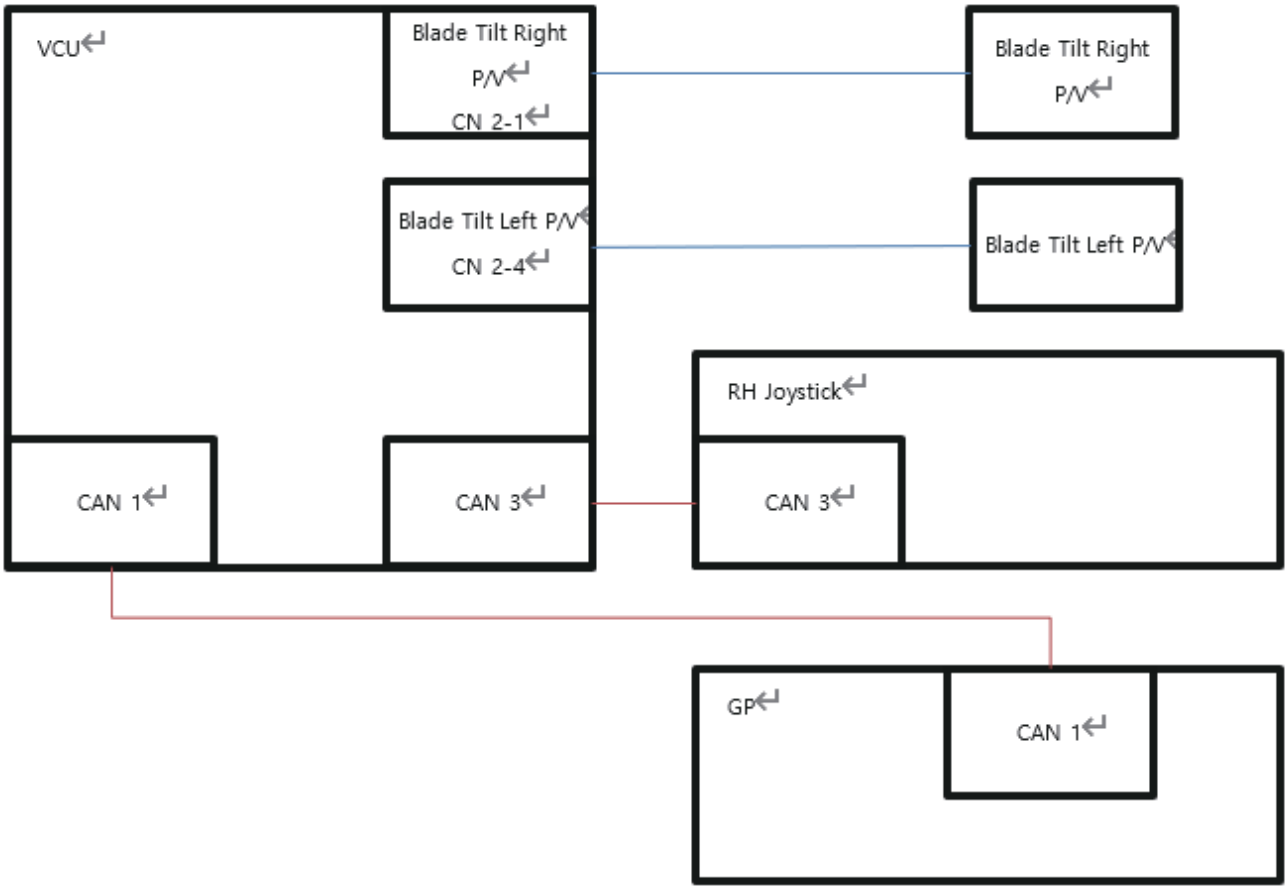


DS2201488

Blade Tilt Control

Purpose - Controls Blade Tilt operation according to joystick operation

Figure 150

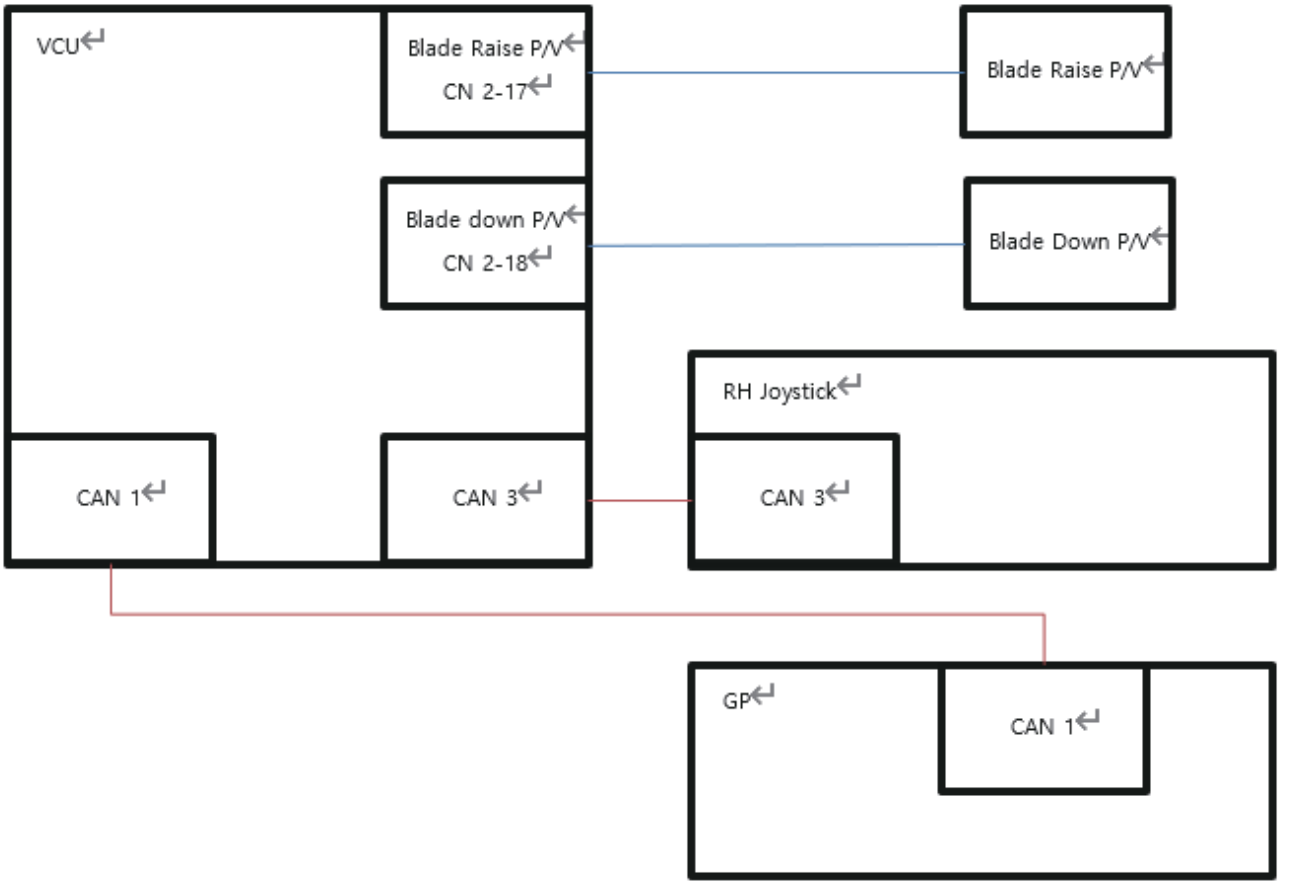


DS2201489

Blade Raise Down Control

Purpose - Controls Blade Raise Down operation according to joystick operation

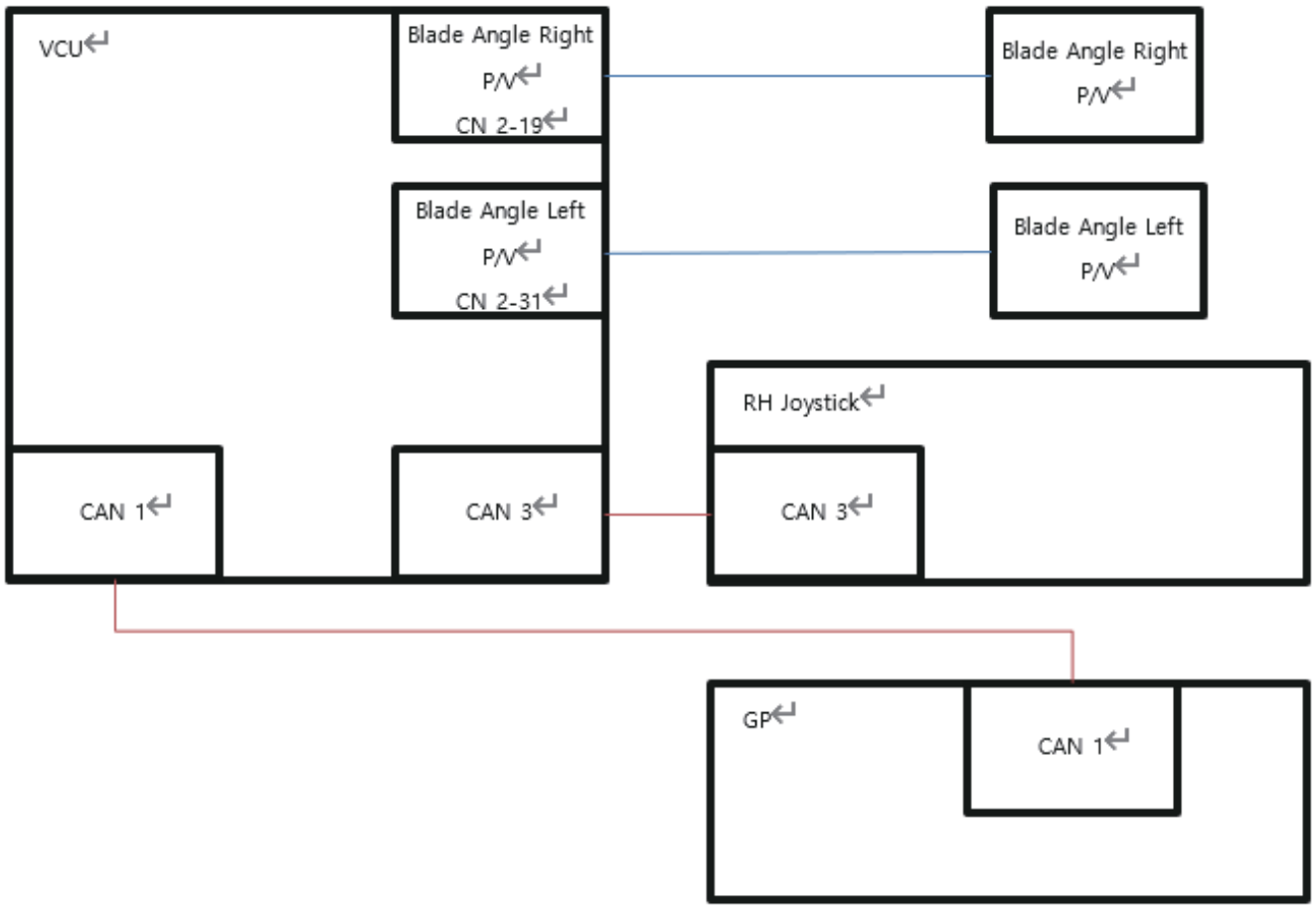
Figure 151



Blade Angle Control

Purpose - Controls Blade Angle operation according to joystick operation

Figure 152

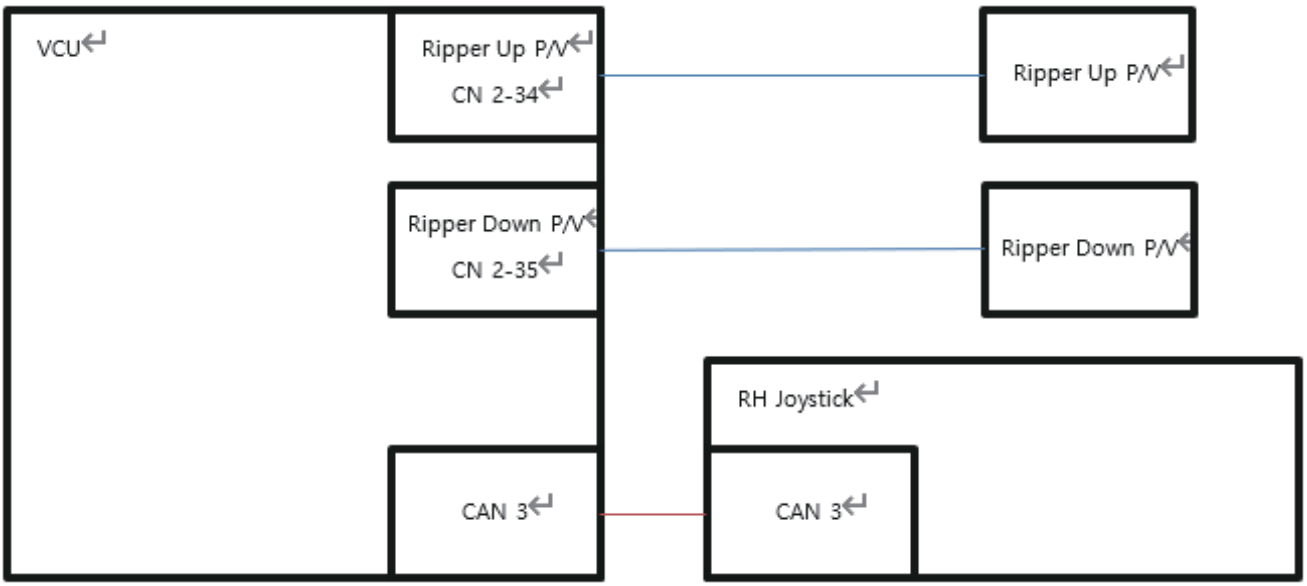


DS2201491

Blade Angle Control

Purpose - Controls Ripper operation according to Joystick operation

Figure 153

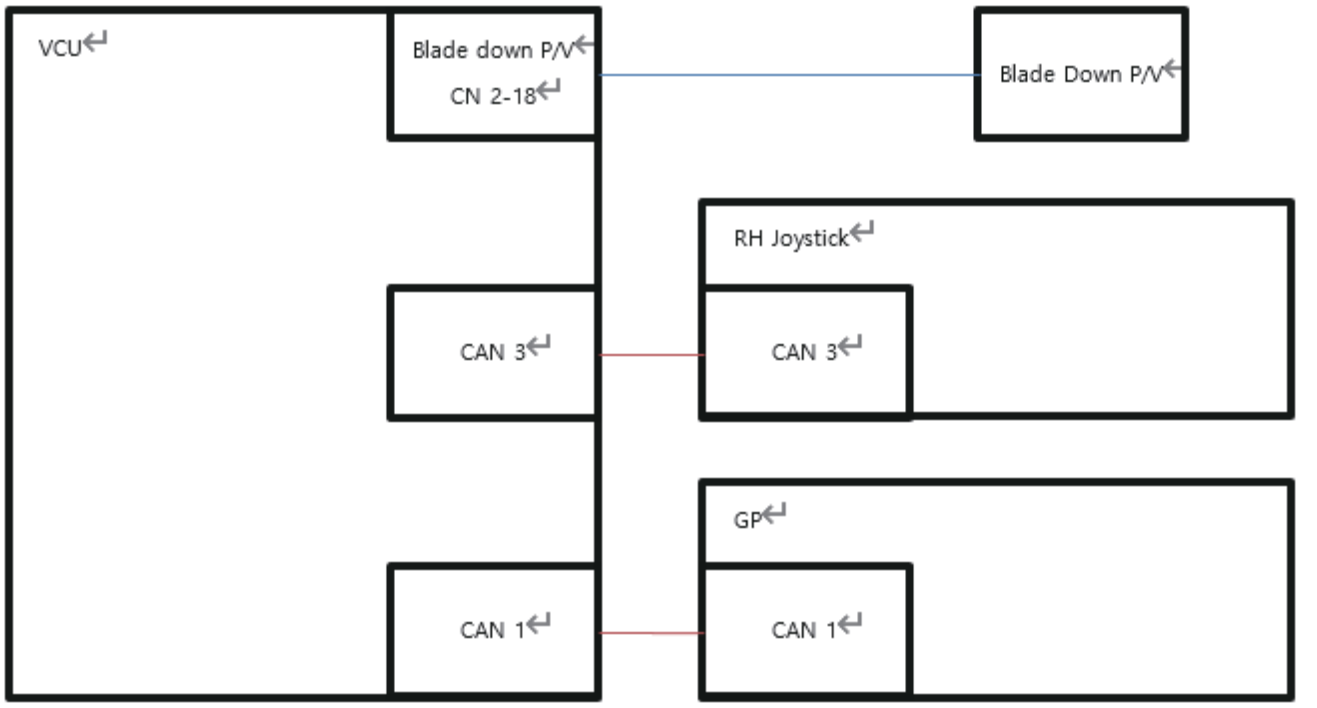


DS2201492

Blade Float Control

Purpose - Controls Blade Float operation according to Joystick operation

Figure 154

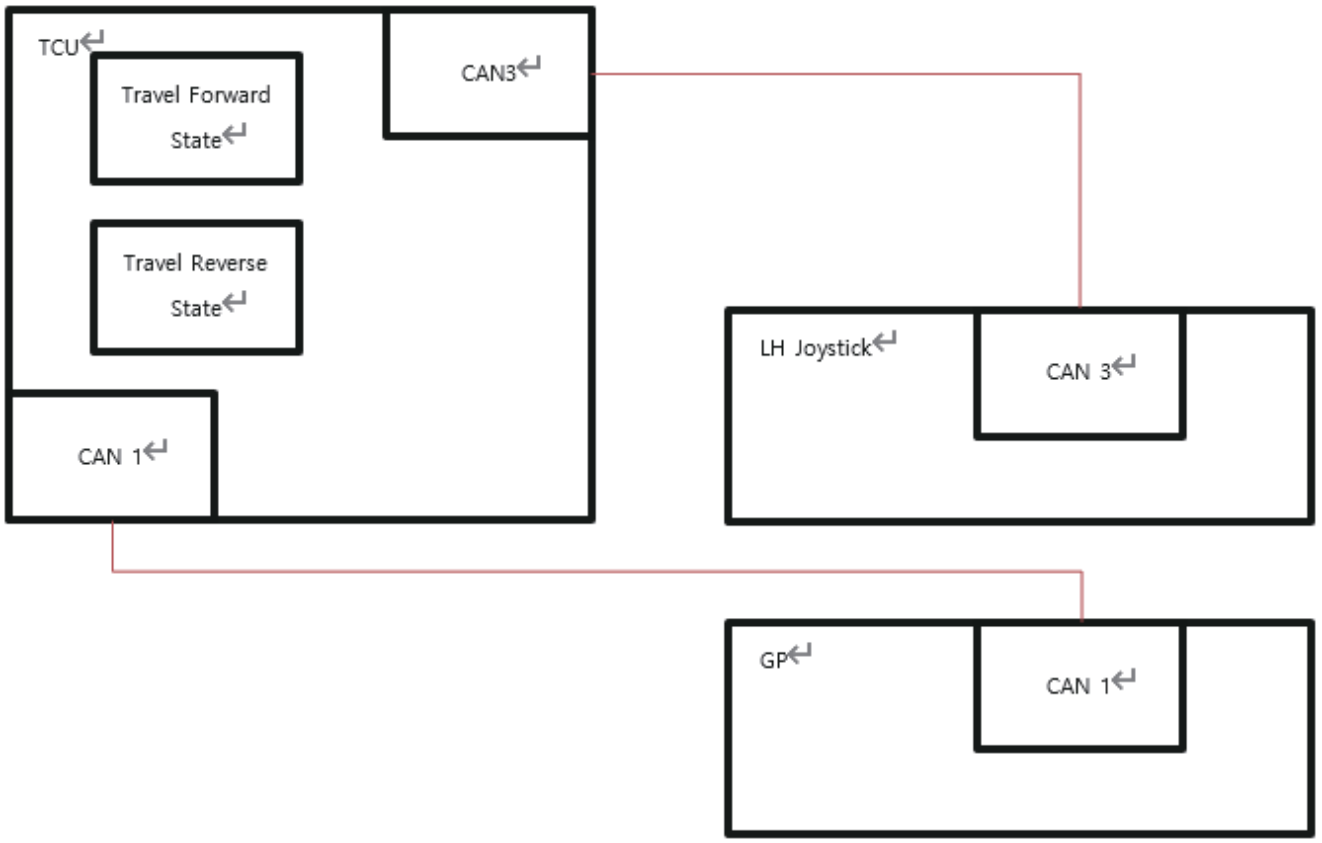


DS2201493

Travel Max. Speed Control

Purpose - Controls the maximum speed during forward and reverse according to the operator's input from the instrument panel and joystick

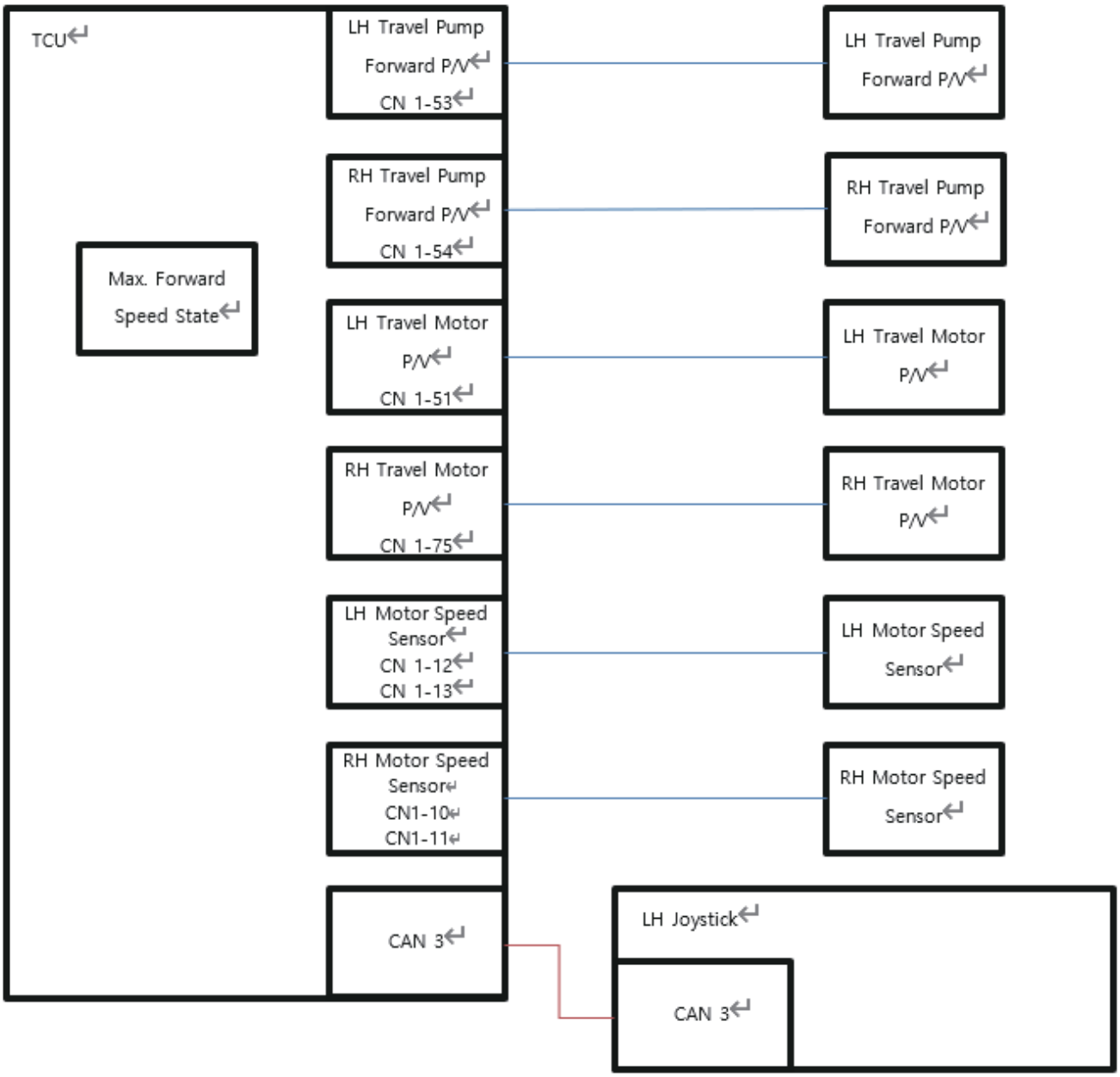
Figure 155



Travel Forward Control

Purpose - Controls the forward motion according to the joystick operation

Figure 156

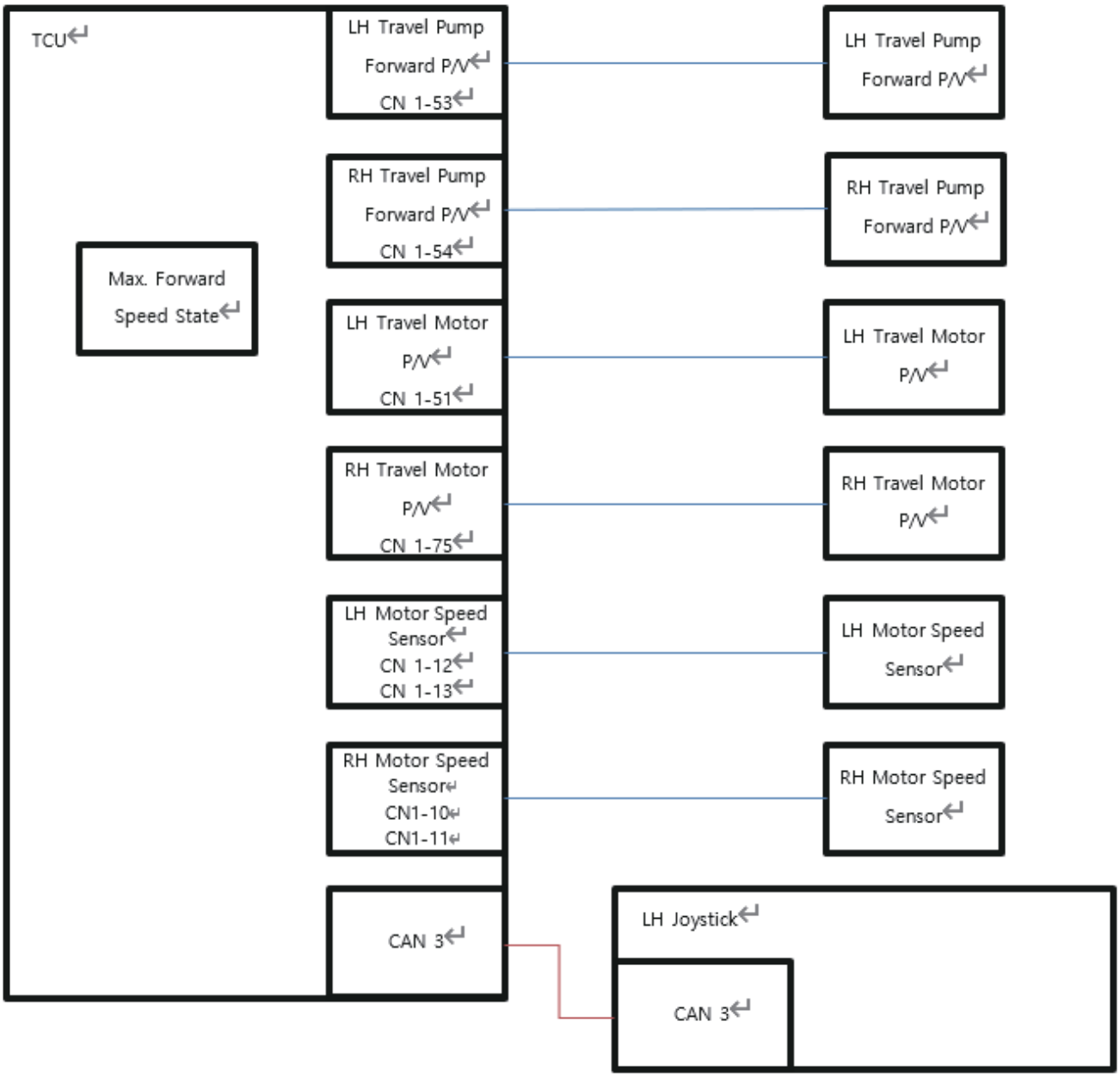


DS2201495

Travel Forward Control

Purpose - Controls the forward motion according to the joystick operation

Figure 157

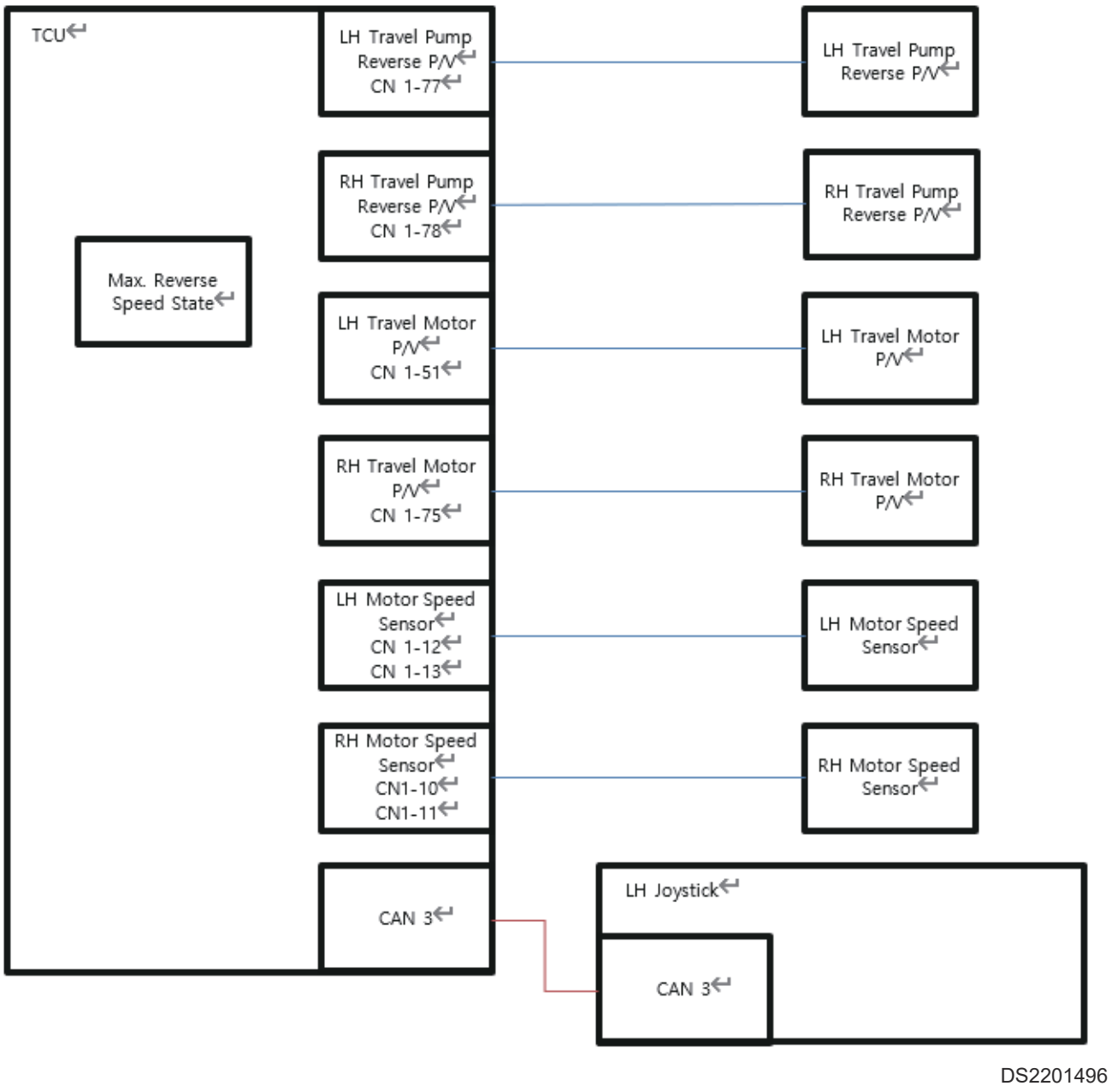


DS2201495

Travel Backward Control

Purpose - Controls the backward motion according to the joystick operation

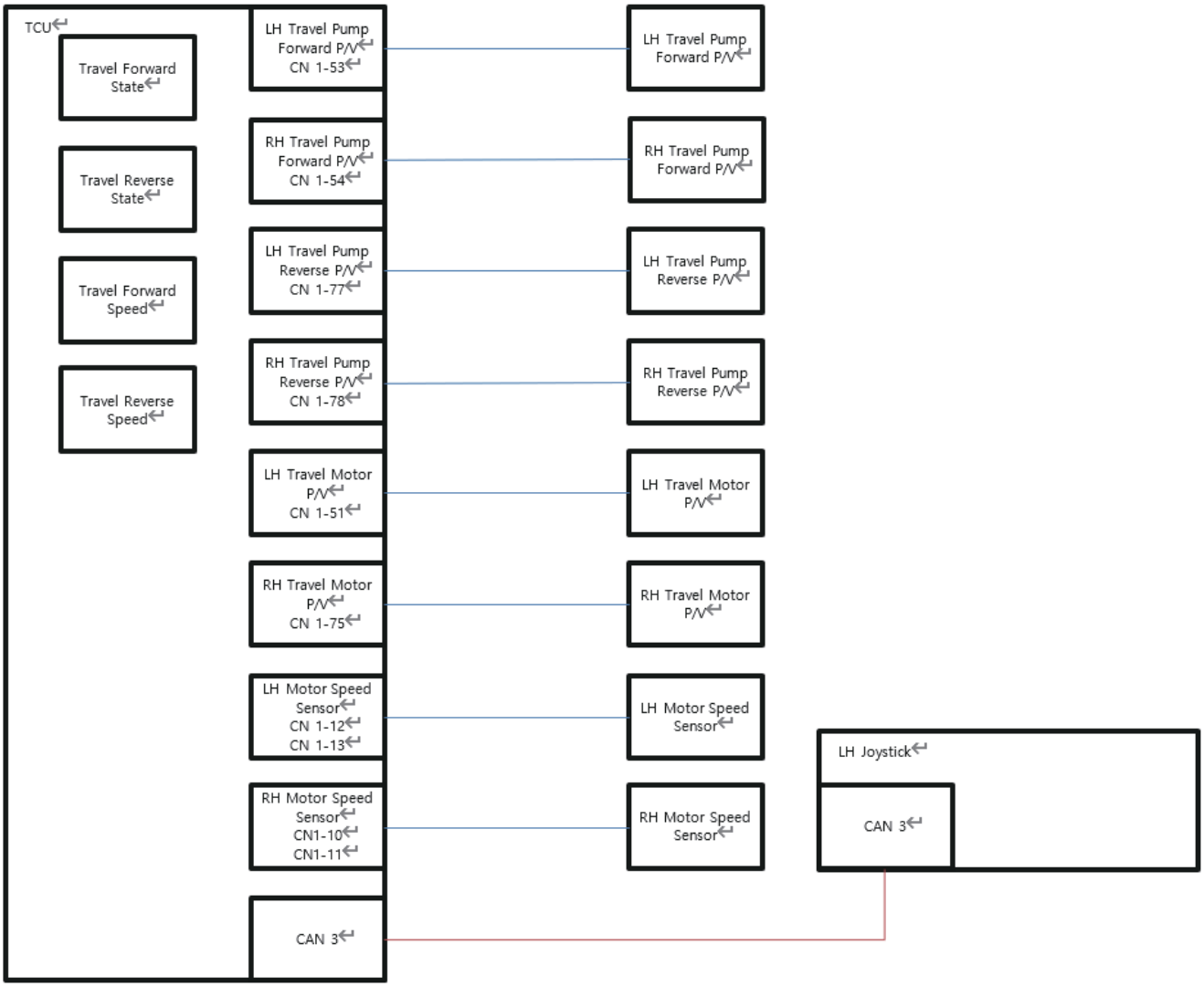
Figure 158



Left Turn Control

Purpose - Controls the Left Turn motion according to the joystick operation

Figure 159

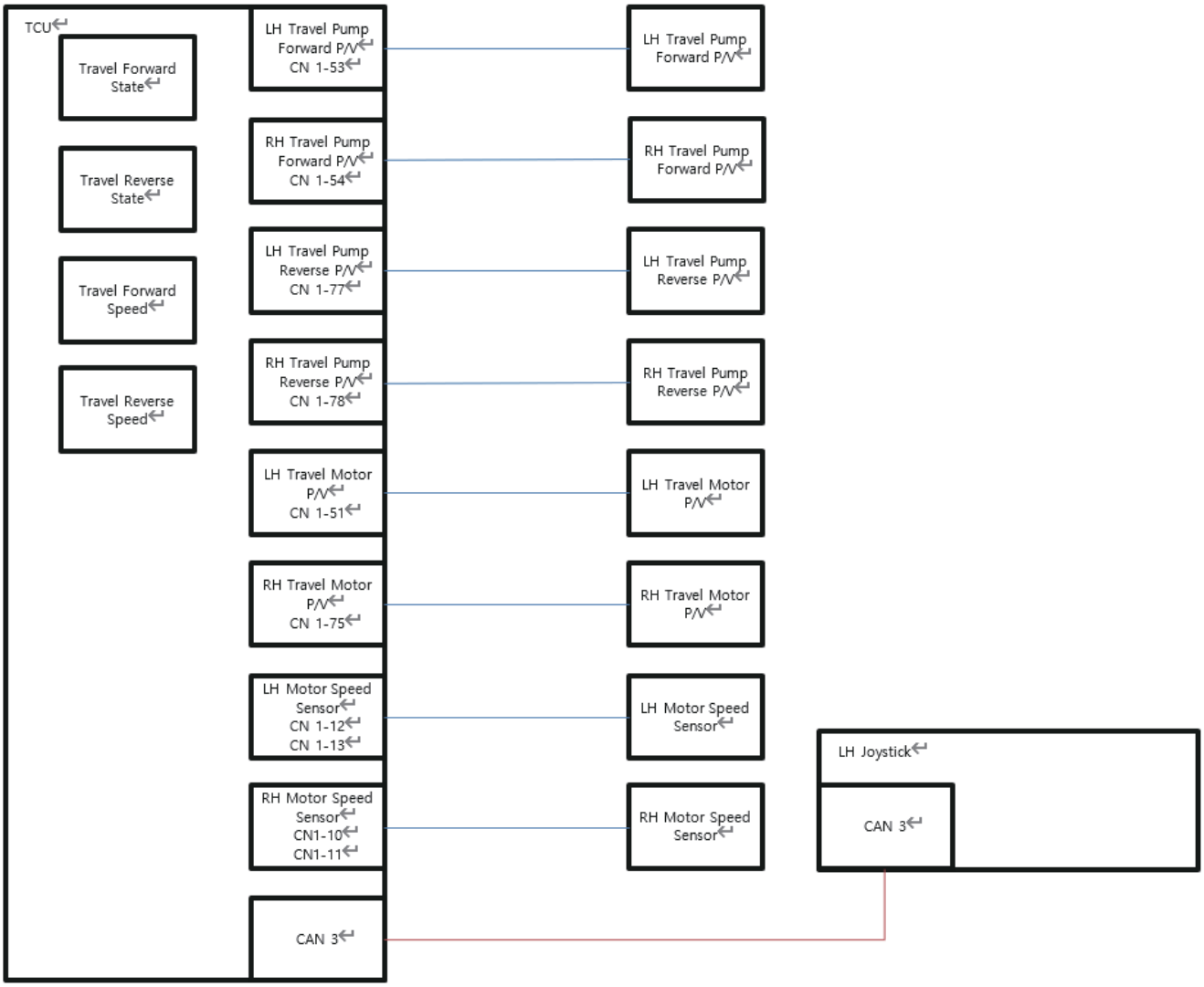


DS2201497

Right Turn Control

Purpose - Controls the Right Turn motion according to the joystick operation

Figure 160

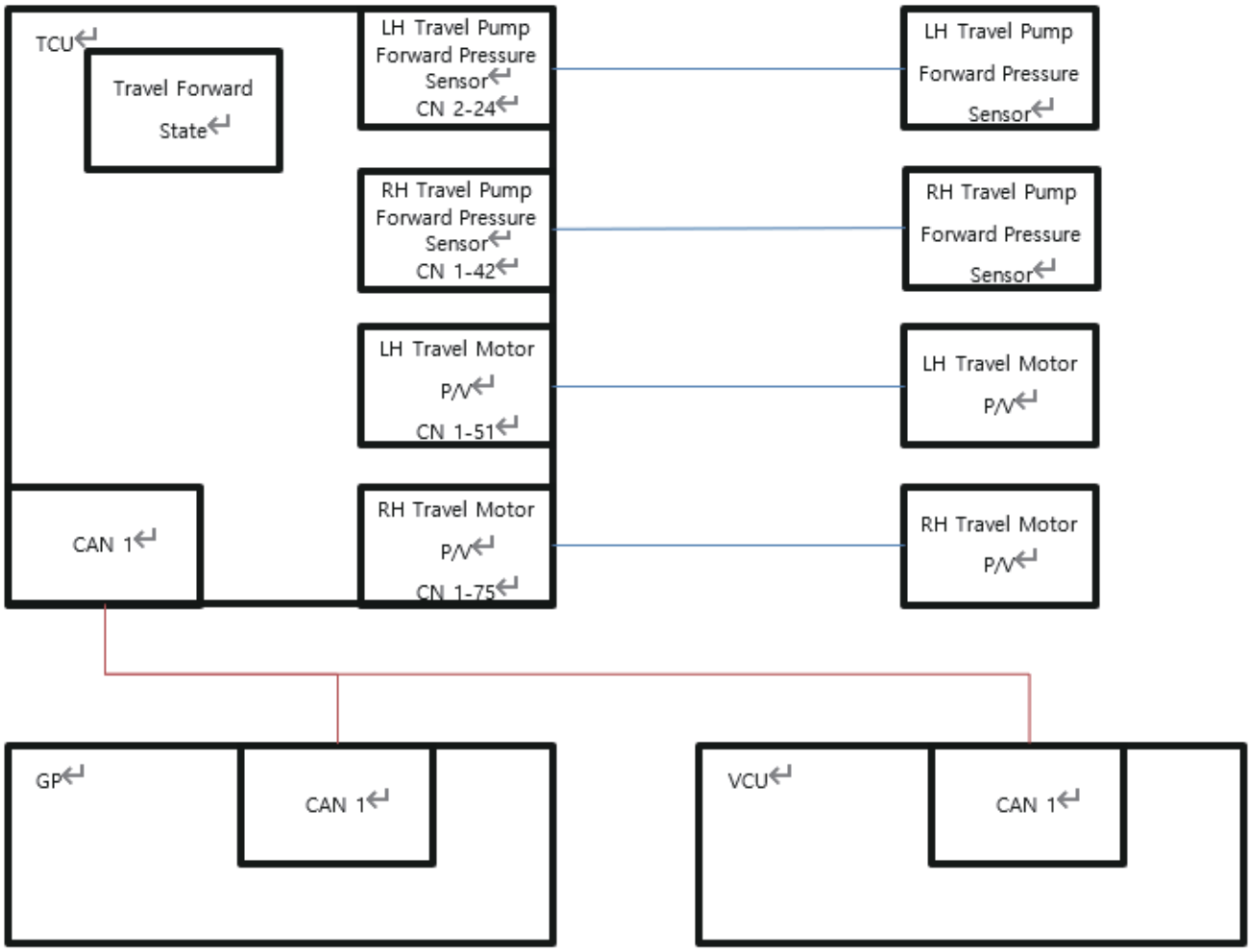


DS2201497

Traction Control

Purpose - Controls the maximum traction torque when moving forward according to the GP input

Figure 161

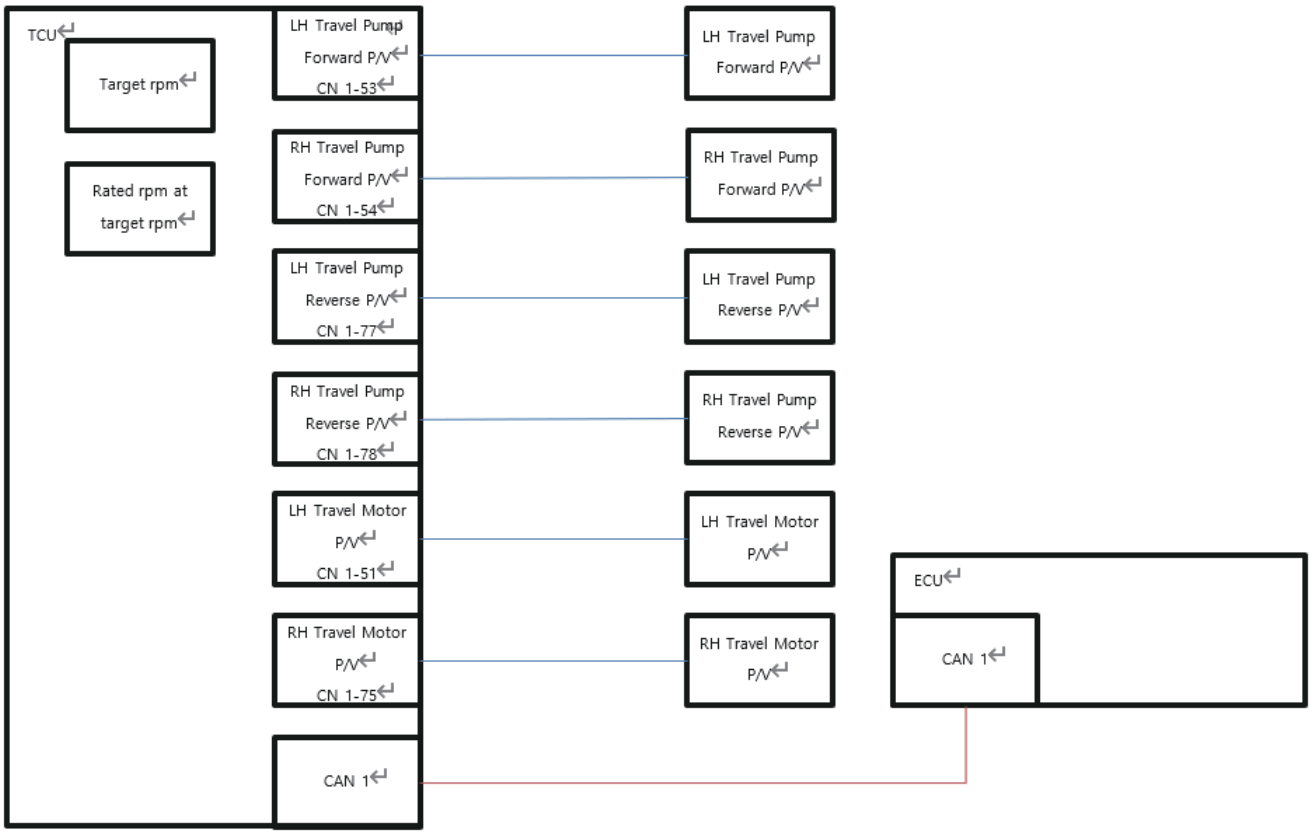


DS2201498

Travel Load Limit Control

Purpose - To prevent the engine from turning off while driving

Figure 162

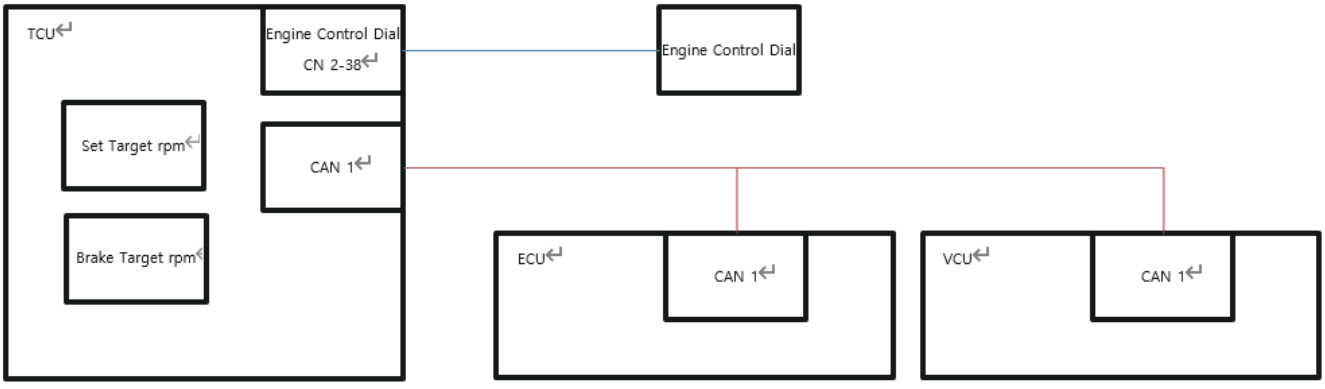


DS2201499

Engine RPM Control

Purpose - Controls engine rpm according to dial input

Figure 163



DS2201500

2D MC Calibration

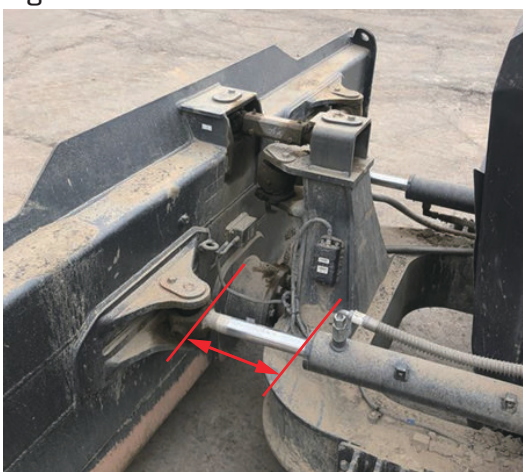
A. Equipment Posture

1. Figure 164

DS2202338

Position the machine on even, firm and level ground.

2. Figure 165



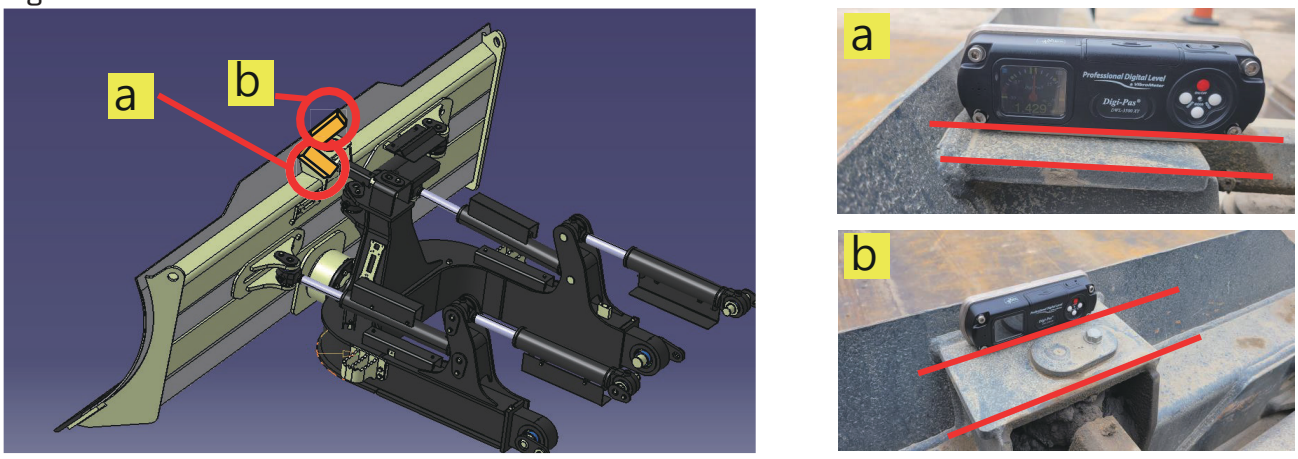
DS2202339

Position the left and right cylinder lengths equally. (Left and Right Horizontal)

3. Equipment posture: Engine off, Key on (No ACC), Blade touching the ground, and No jack-up
4. It must remain in the initial state until the entire calibration is completed.

B. Blade level measurement

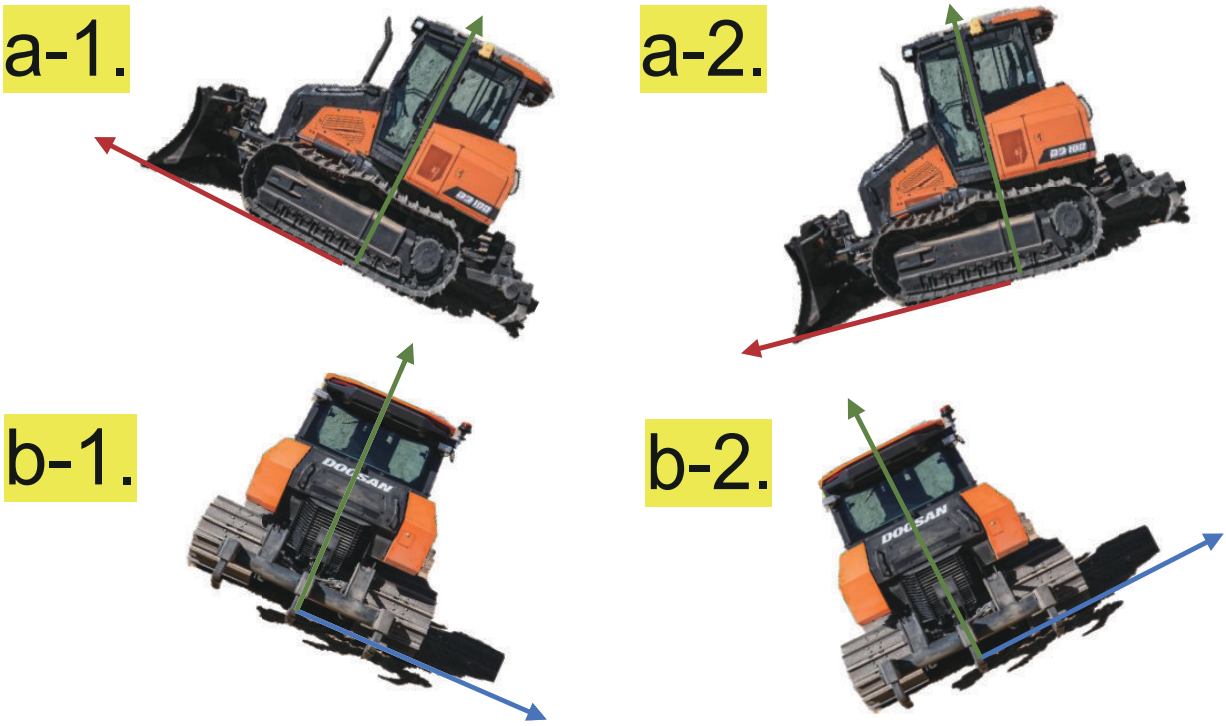
1. Position the leveler in that position. “a” is pitch angle measurement, “b” is the position for roll angle measurement.
   Figure 166



DS2202340

2. Position the leveler so that the leveler and the blade marking line are parallel. The unit of measurement for an electronic leveler is the deg.
3. Blade pitch angle sign
   - + sign when the horizontal display angle is in the direction of rotation as shown in the figure.
   - - sign when the horizontal display angle is in the direction of rotation as shown in the figure.

   Figure 167



DS2202341

4. Blade roll angle sign
   - + sign when the horizontal display angle is in the direction of rotation as shown in the figure.
   - - sign when the horizontal display angle is in the direction of rotation as shown in the figure.

C. Enter measured values of Blade level

1. When the leveler is placed like “a”, if the direction of the arrow is the same as “a-1”, write the angle value of the + sign in the memo. If the direction of the arrow is the same as "a-2", write the angle value of the - sign in the memo.

   Figure 168

DS2202342

2. When the leveler is set as “b”, if the direction of the arrow is the same as “b-1”, the angle value of the + sign is written in the memo. If the direction of the arrow is the same as “b-2”, write the angle value of the - sign in the memo.

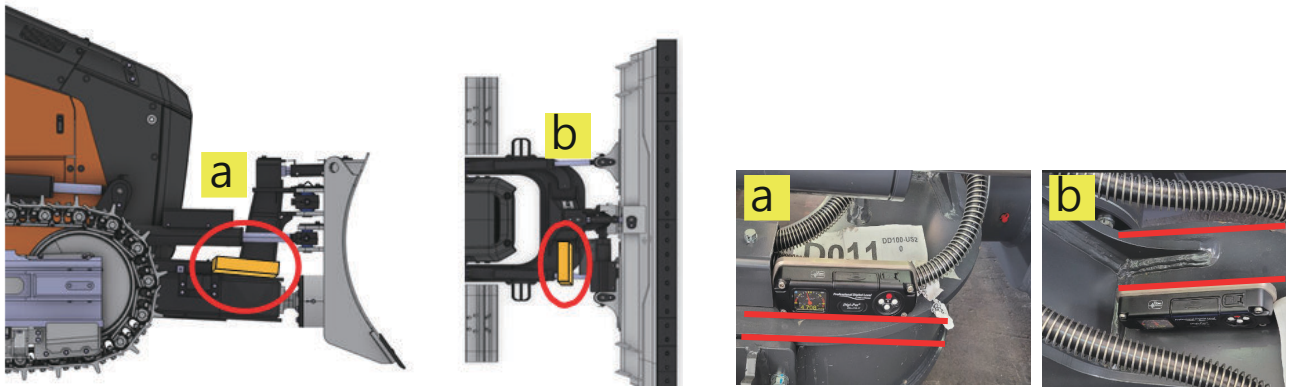
Figure 169

DS2202343

D. CFrame level measurement

1. Position the leveler in that position. “a” is pitch angle measurement, “b” is the position for roll angle measurement.

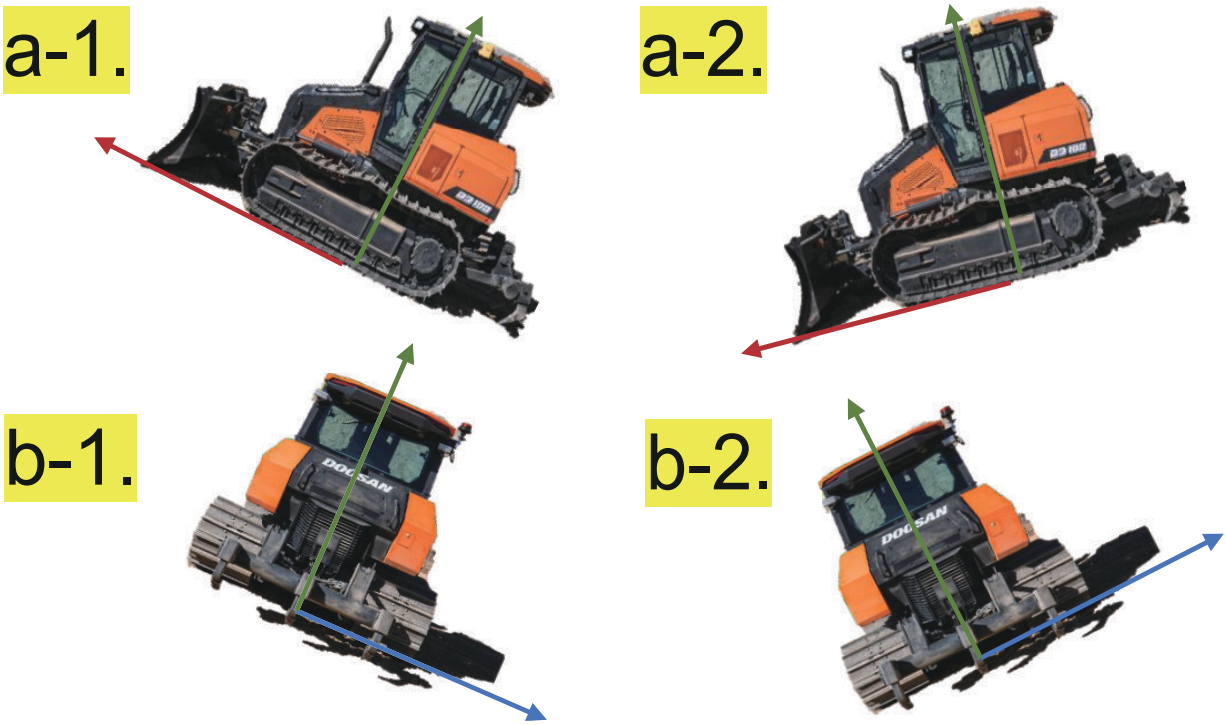
Figure 170



DS2202344

2. Position the leveler so that the leveler and the CFrame marking line are parallel. The unit of measurement for an electronic leveler is the deg.
3. CFrame pitch angle sign
   - + sign when the horizontal display angle is in the direction of rotation as shown in the figure.
   - - sign when the horizontal display angle is in the direction of rotation as shown in the figure.

Figure 171



DS2202341

4. CFrame roll angle sign
   - + sign when the horizontal display angle is in the direction of rotation as shown in the figure.
   - - sign when the horizontal display angle is in the direction of rotation as shown in the figure.

E. Enter measured values of CFrame level

1. When the leveler is placed like “a”, if the direction of the arrow is the same as “a-1”, write the angle value of the + sign in the memo. If the direction of the arrow is the same as "a-2", write the angle value of the - sign in the memo.

   NOTE: *Note the pitch direction*

   Figure 172

DS2202345

2. When the leveler is set as “b”, if the direction of the arrow is the same as “b-1”, the angle value of the + sign is written in the memo. If the direction of the arrow is the same as “b-2”, write the angle value of the - sign in the memo.

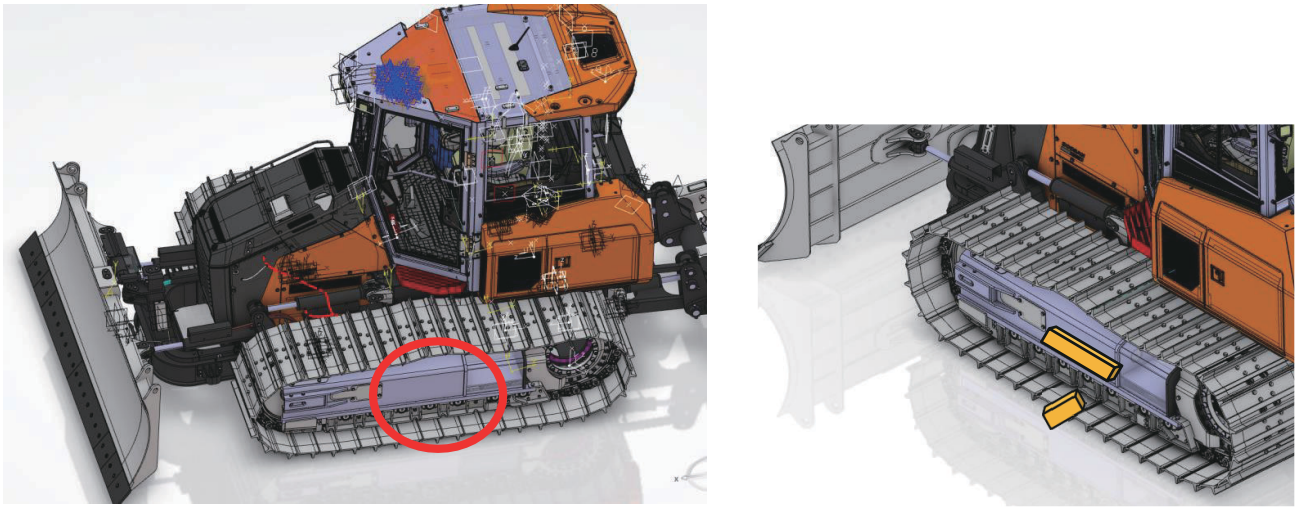
Figure 173

DS2202346

F. Body level measurement

1. Position the leveler in the appropriate position. Place it on the left track cover (Pitch) and the top of the track (Roll). Proceed in the same way for the right side.

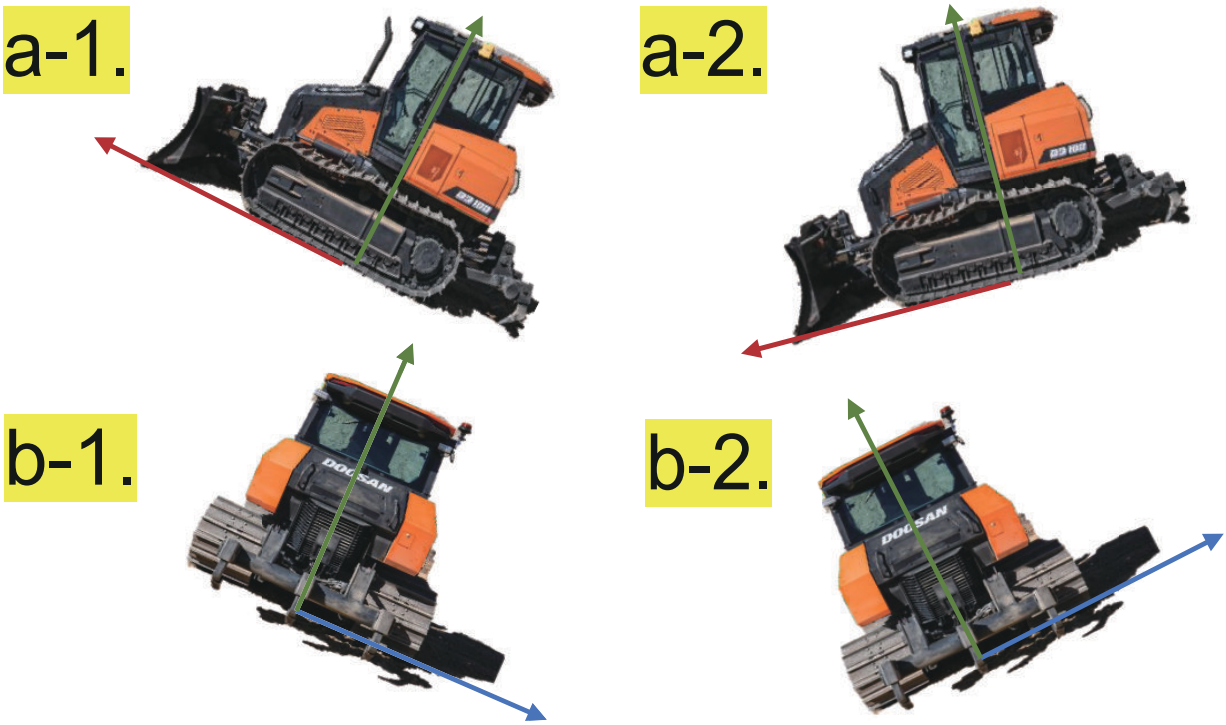
Figure 174



DS2202348

2. Position the leveler so that the leveler and the body marking line are paralle. The unit of measurement for an electronic leveler is the deg.
3. Body pitch angle sign
   - + sign when the horizontal display angle is in the direction of rotation as shown in the figure.
   - - sign when the horizontal display angle is in the direction of rotation as shown in the figure.

Figure 175



DS2202341

4. Body roll angle sign
   - + sign when the horizontal display angle is in the direction of rotation as shown in the figure.
   - - sign when the horizontal display angle is in the direction of rotation as shown in the figure.

G. Enter measured values of Body level for left & right side each

1. When the leveler is placed like “a”, if the direction of the arrow is the same as “a-1”, write the angle value of the + sign in the memo. If the direction of the arrow is the same as "a-2", write the angle value of the - sign in the memo.

Figure 176

DS2202349

2. When the leveler is set as “b”, if the direction of the arrow is the same as “b-1”, the angle value of the + sign is written in the memo. If the direction of the arrow is the same as “b-2”, write the angle value of the - sign in the memo.

Figure 177

DS2202346

3. Proceed the same for another side.

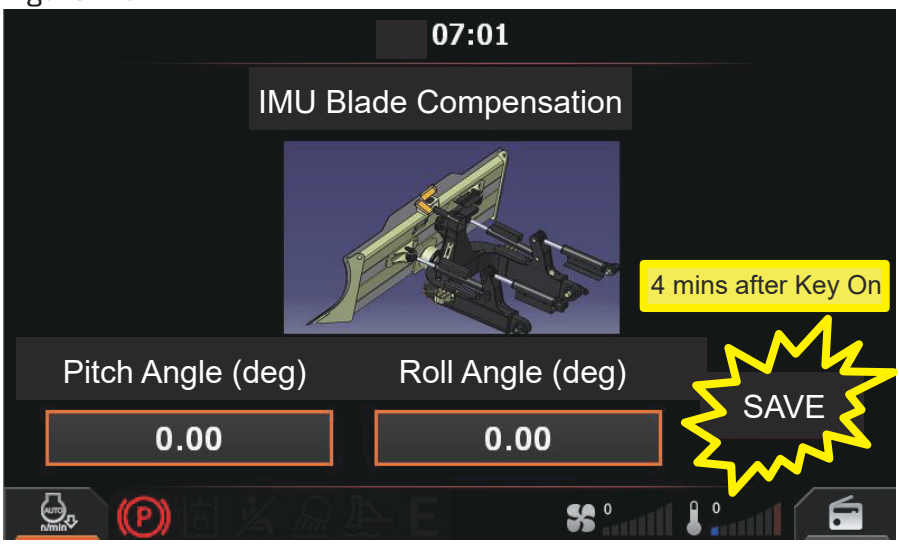
H. Please refer to the Operation & Maintenance Manual for Blade tip length compensation, Blade angle compensation, and Crawler tip calibration.

I. Enter the lever values in the Gauge Panel.

NOTE: *Be sure to enter the angle value after 4 minutes of Key On.*

1. The angle value entered in Memo is rounded to two decimal places. (ex. 3.056 -> 3.06)

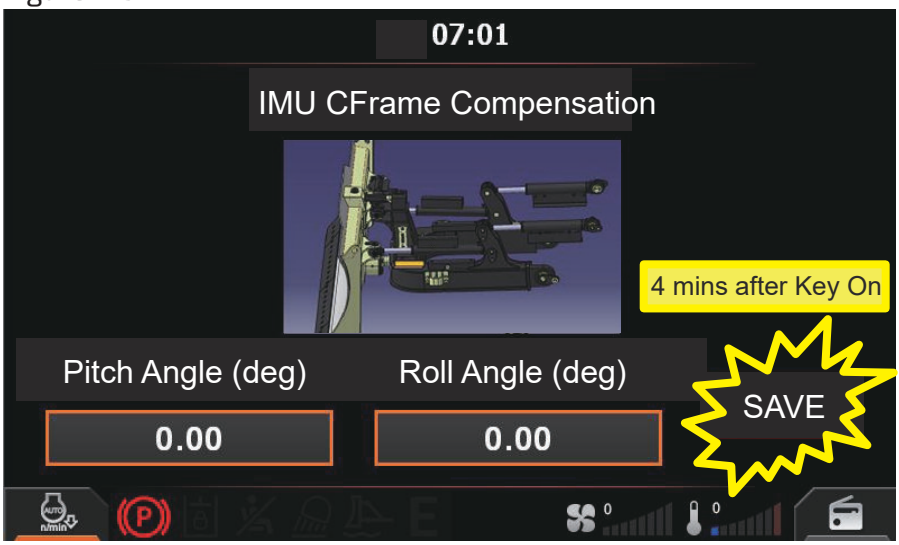
Figure 178



DS2202350

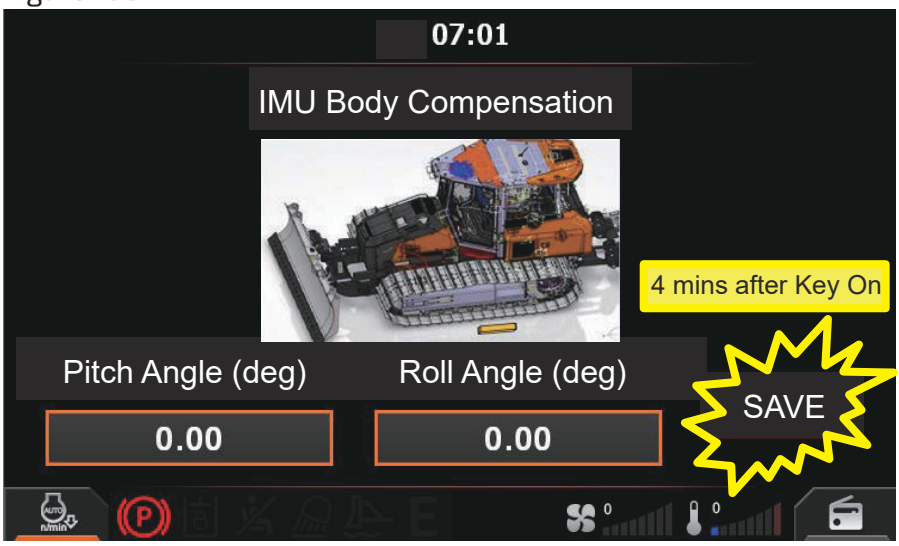
2. After inputting the Blade pitch and Blade roll angle rounded to two decimal places, save it.

3. The angle value entered in Memo is rounded to two decimal places. (ex. 3.056 -> 3.06)
   Figure 179



DS2202351

4. After inputting the CFrame pitch and CFrame roll angle rounded to two decimal places, save it.
5. The angle value entered in Memo is rounded to two decimal places. (ex. 3.056 -> 3.06)
   Figure 180



DS2202352

6. After inputting the Body pitch and Body roll angle rounded to two decimal places, save it.

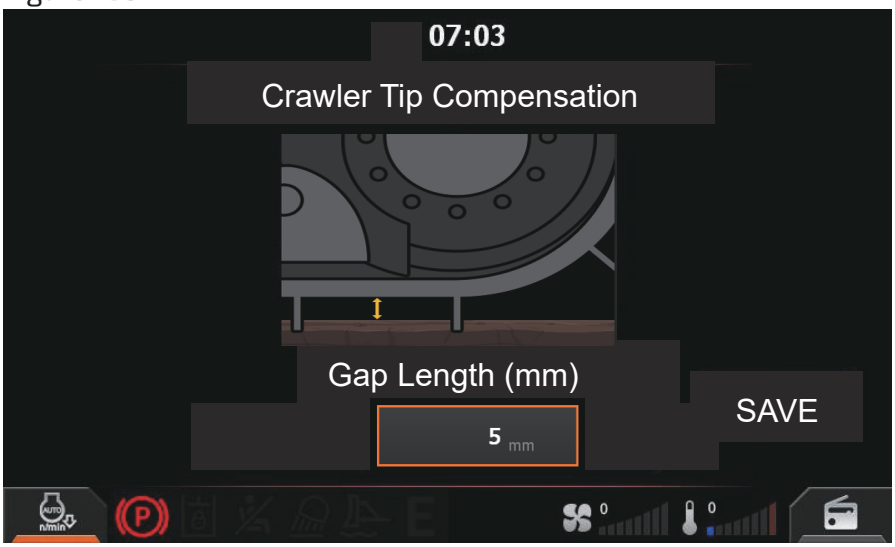
7. After inputting the Blade tip measurement length written in Memo, save it.
Figure 181

DS2202353

8. After inputting the Blade Joint measurement length written in Memo, save it.
Figure 182

DS2202354

9. After inputting the Crawler Tip measurement length written in Memo, save it.
Figure 183

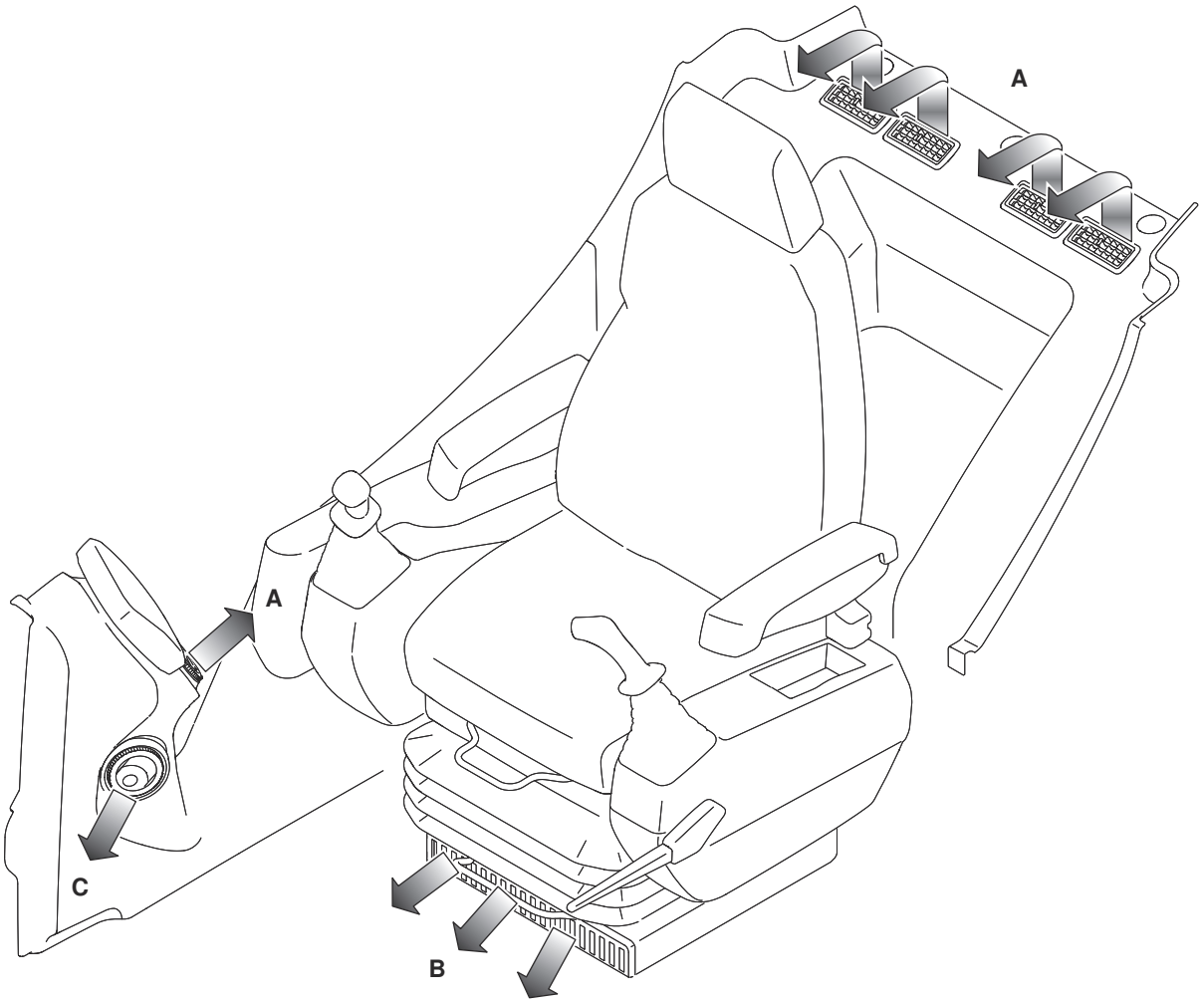


DS2202355

Air Conditioner System

Outline

Figure 184



EX1301100

Solid-type heater and air conditioner are installed in the cover behind the operator's seat.

Temperature of the operator's cabin is adjusted automatically to the temperature set by operator.

(Please refer to the Operation & Maintenance Manual for detailed full automatic control.

Vent mode selects the direction of discharged air.

Outlets by vent modes

Modes				
Outlets	A	A+B	B	B+C

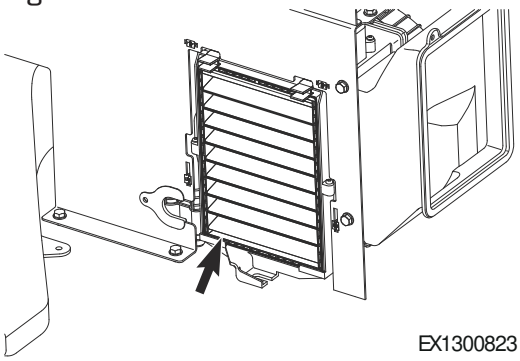
Internal and External Filters

Internal and external air purification filters are installed for the operator's room.

If machine operates in an excessively contaminated environment, filters must be cleaned more frequently and if necessary, replaced with new ones.

How to Check Internal Air Filter

1. Figure 185



EX1300823

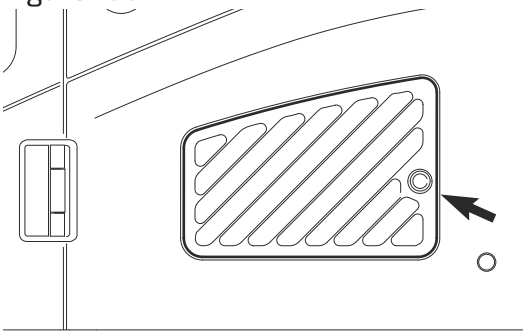
Remove cover by pulling knob outward on top of the left and right of the filter which is inside the left rear part of the cabin.

2. Remove inner filter by pulling knob outward while pressing the upper part and lower part of the filter handle.
3. Replace with new one.
4. Reassemble filter in reverse order.

How to Check External Air Filter

NOTE: *All right and left call outs are based on the operator being seated in the operator's seat facing the front.*

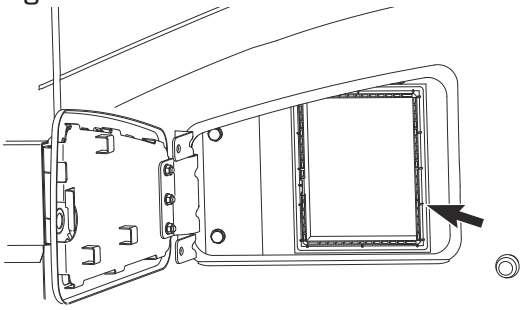
1. Figure 186



EX1300825

Open the cover by using the starter KEY in the left side of the cabin.

2. Figure 187



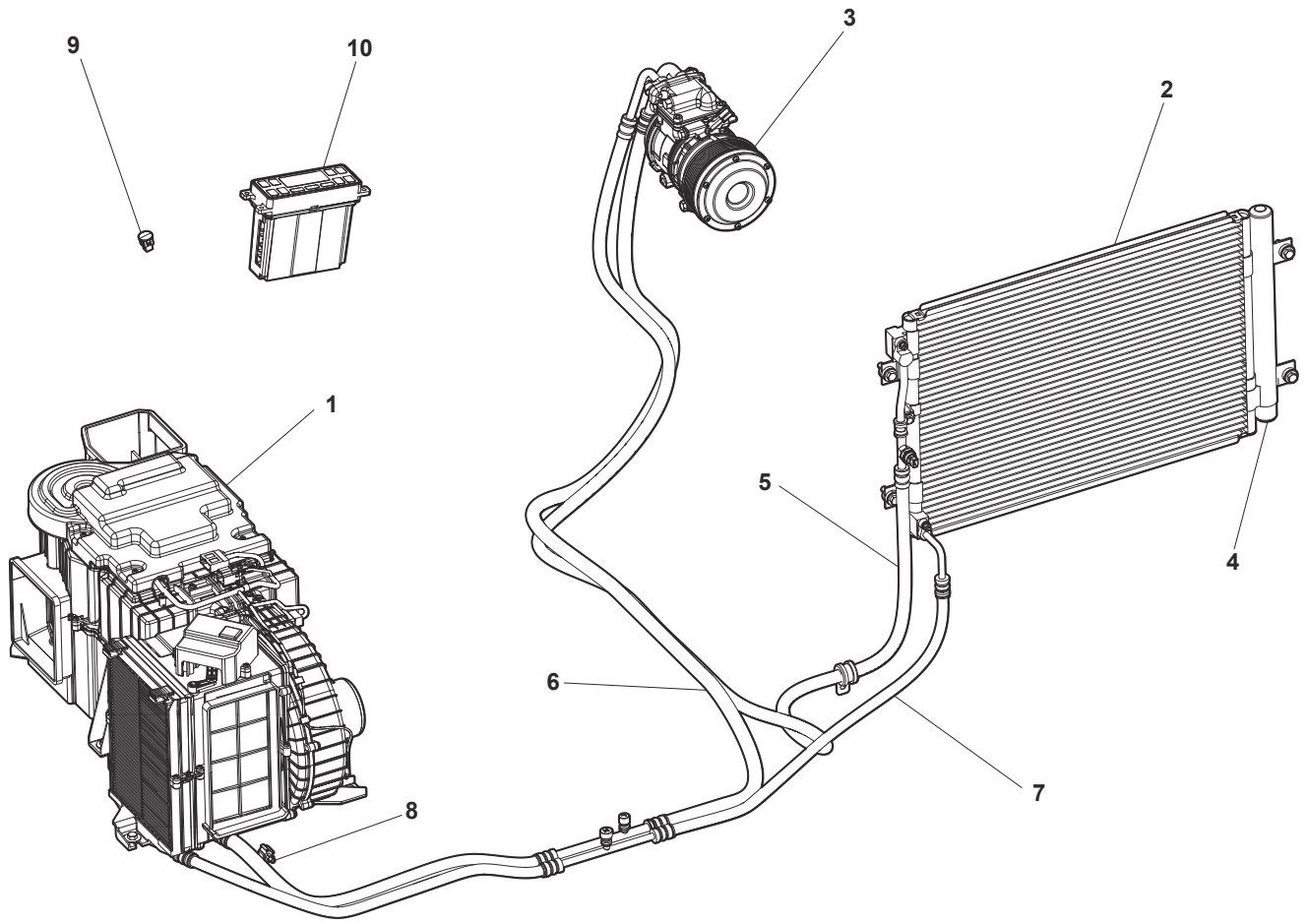
EX1403389

Remove filter and replace with new one.

3. Reassemble in reverse order.

Air-Conditioning System Layout

Figure 188

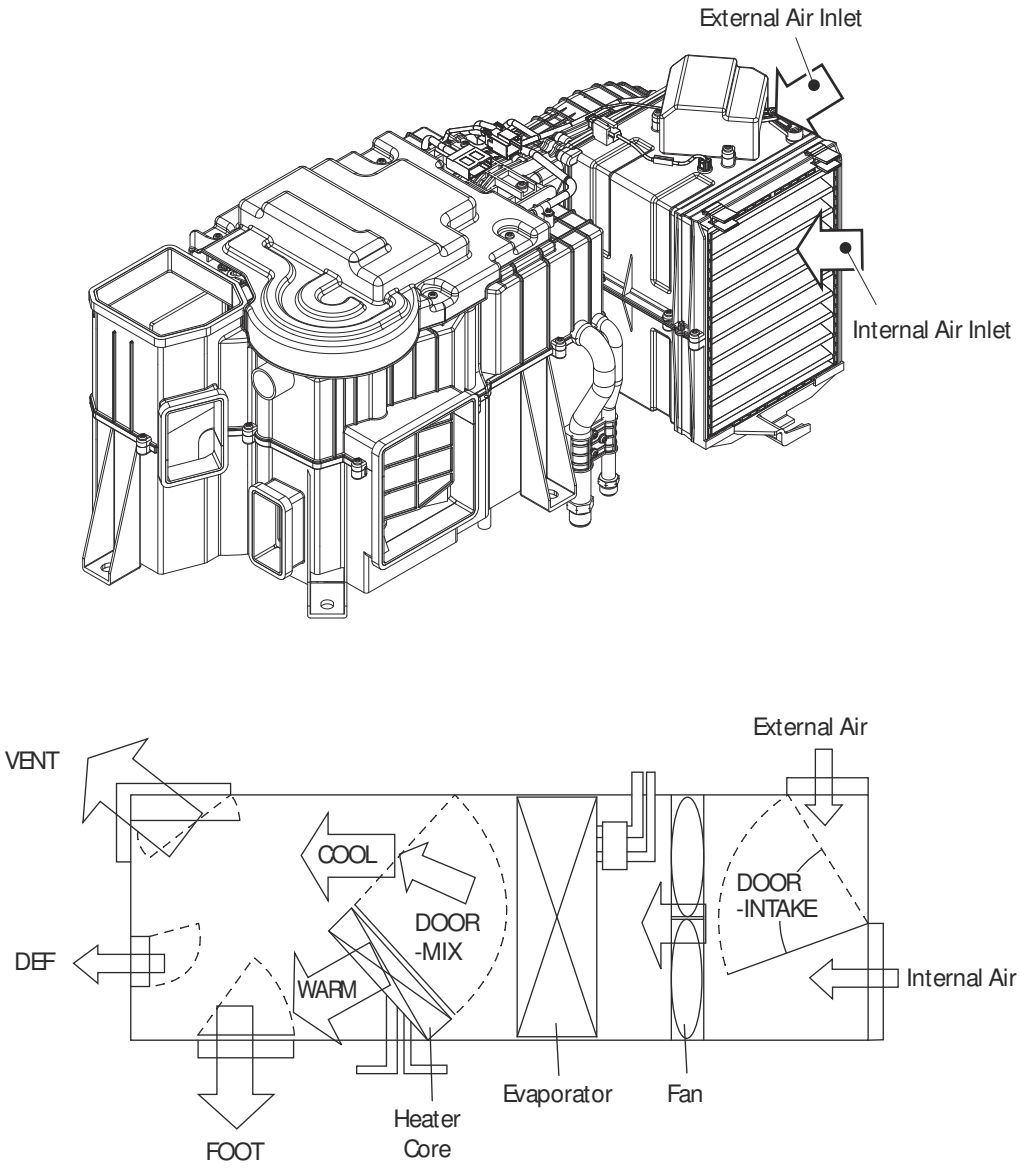


Reference Number	Description
1	Air Conditioner/heater Unit
2	Condenser
3	Compressor
4	Receiver Dryer
5	Discharge Hose
6	Suction Hose
7	Liquid Hose
8	In-car Sensor
9	Photo Sensor
10	Control Panel

Air Conditioner/Heater Unit

Airflow Diagram

Figure 189

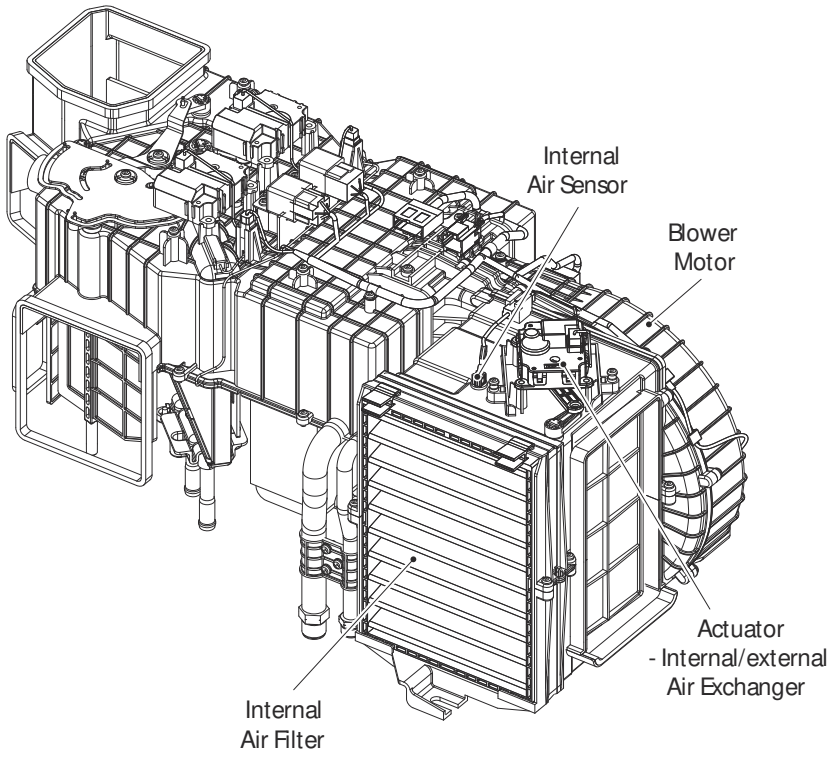


Door Open by Vent Modes

Door	Mode				
	Vent	Bi-level	Foot	Def/foot	Def
Vent	100	70	0	0	0
Foot	0	30	100	85	65
Def	0	0	0	15	35

Main Components

Figure 190



FG016943

Actuator - Airflow Direction Control

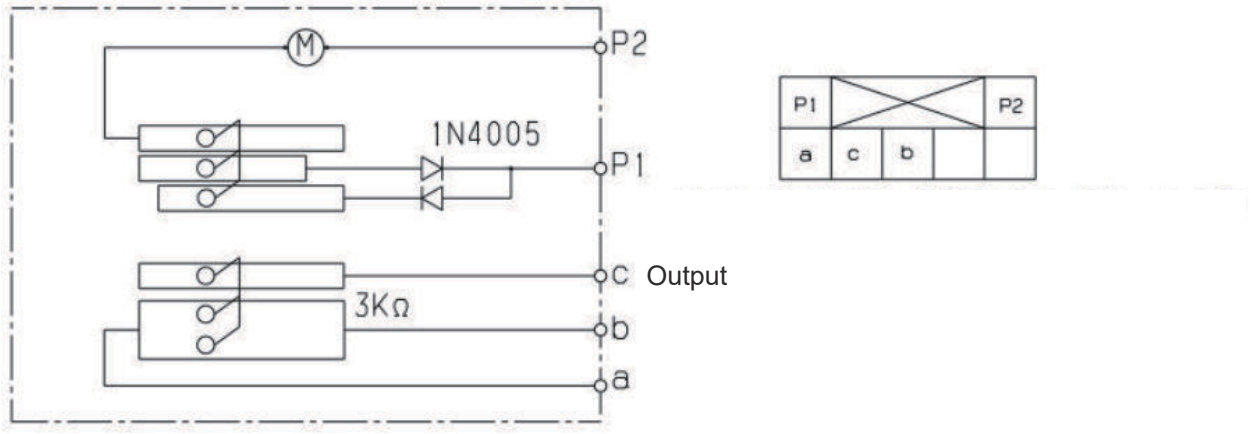
Change of discharged airflow according to selected airflow direction mode

Change of airflow direction: Direction changes in the order of VENT→ BI-LEVEL → FOOT → FOOT/DEF → VENT.

Actuator - Temperature Control

Change of discharged air temperature by controlling the position of temperature control door.

Figure 191



DS2301082

Actuator - Airflow Direction Control

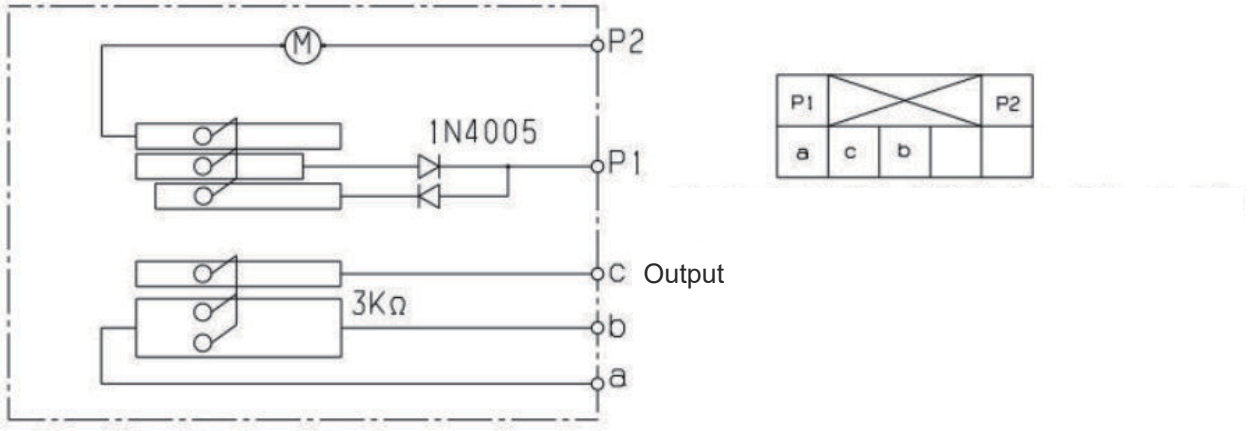
Position	Feedback (V)
Vent/Recirculation	0.53
Vent/Recirculation/Foot	1.2

Position	Feedback (V)
Foot	2.4
Mix	3.5
Defrost	4.6

When Vent/Rear mode is converted to Vent/Rear/Foot mode, after controlling the motor as much as the target feedback +0.5 V, the target feedback voltage is restored.

Actuator - Internal/External Air Exchange

Figure 192



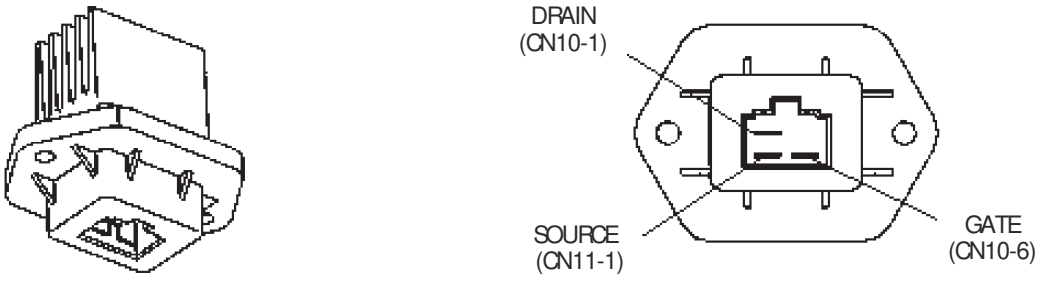
DS2301082

Mode	Output Terminal	Output
Intake	P1 (+), P2 (-)	Moving of exchange door by selecting intake.
Recirculate	P1 (-), P2 (+)	Moving of exchange door by selecting recirculate.

Airflow Control Module

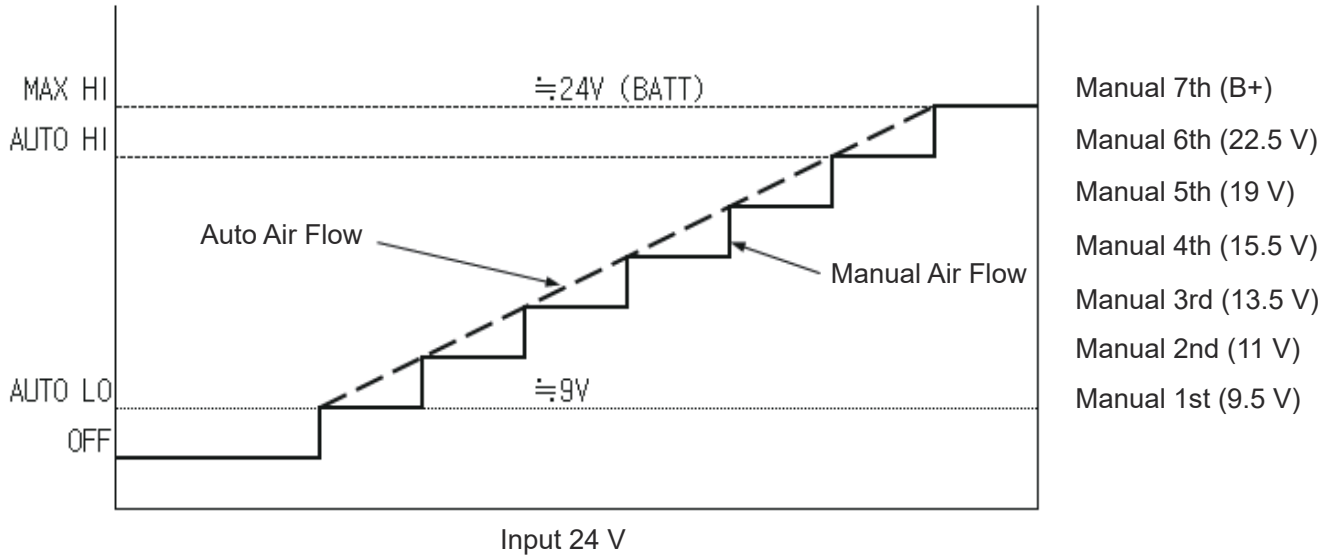
Airflow is controlled through the control of voltage between GATE and SOURCE.

Figure 193



FG001056

Figure 194

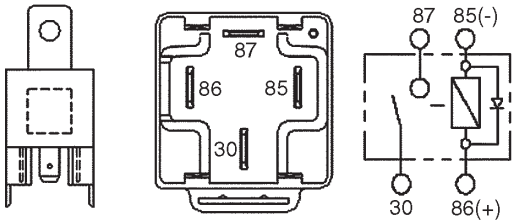


DS2301083

The airflow is based on manual set.

Relay - Blower: Power is supplied to the blower motor when the system is turned "ON".

Figure 195

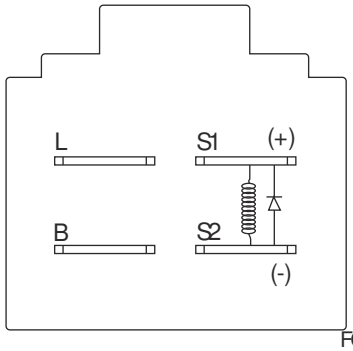


FG001057

Specifications	
Rated voltage	24V
Rated current	20A

Relay - A/C: Power is supplied to the magnetic clutch of the compressor.

Figure 196



FG001058

Specifications	
Rated voltage	24V
Rated current	10A

Duct Sensor: It is inserted in the core of the evaporator to prevent freezing of the evaporator.

Figure 197

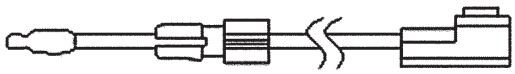
FG001059

The sensor consist of negative characteristic thermistor that resistant value increases and decreases when the temperature rises and falls, respectively.

Temperature (°C)	Resistance (KΩ)
0	11.36 ±0.1
2	10.39 ±0.2
2.5	10.17 ±0.2
3	9.95 ±0.2
3.5	9.73 ±0.2
4	9.52 ±0.2
5	9.12 ±0.2
10	7.36 ±0.15
25	4.02 ±0.08
30	3.33 ±0.07

Internal Air Temperature Sensor:Built in the internal air filter, it senses the internal temperature.

Figure 198

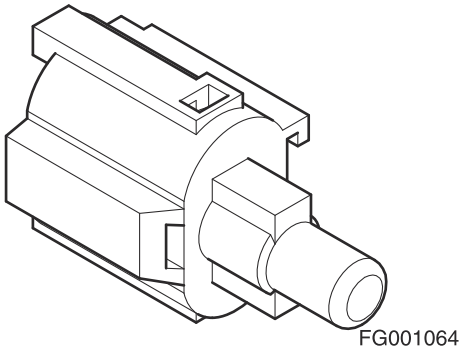


FG001061

Temperature (°C)	Resistance (KΩ)
-15	218.2 ±7.5

Temperature (°C)	Resistance (KΩ)
0	97.83 ±0.9
15	47.12 ±0.7
25	30.0 ±0.36
35	19.60 ±0.3

Figure 199



Ambient Air Temperature Sensor

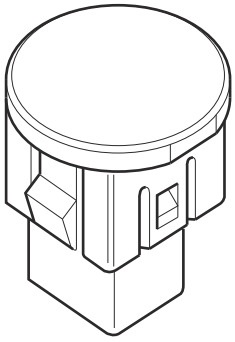
Built at the bottom of the cockpit, it senses the temperature of external air.

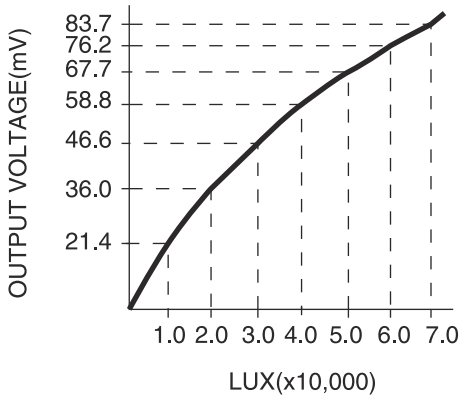
Temperature (°C)	Resistance (KΩ)
-10	163 ±4.9
0	96.9 ±2.9
10	59.4 ± 1.8
20	37.4 ±1.1
25	30 ±0.9
30	24.2 ±0.7

Photo Sensor

Built beside the socket of spare power, it senses the quantity of the sun radiation to regulate discharge temperature and airflow as set by operator.

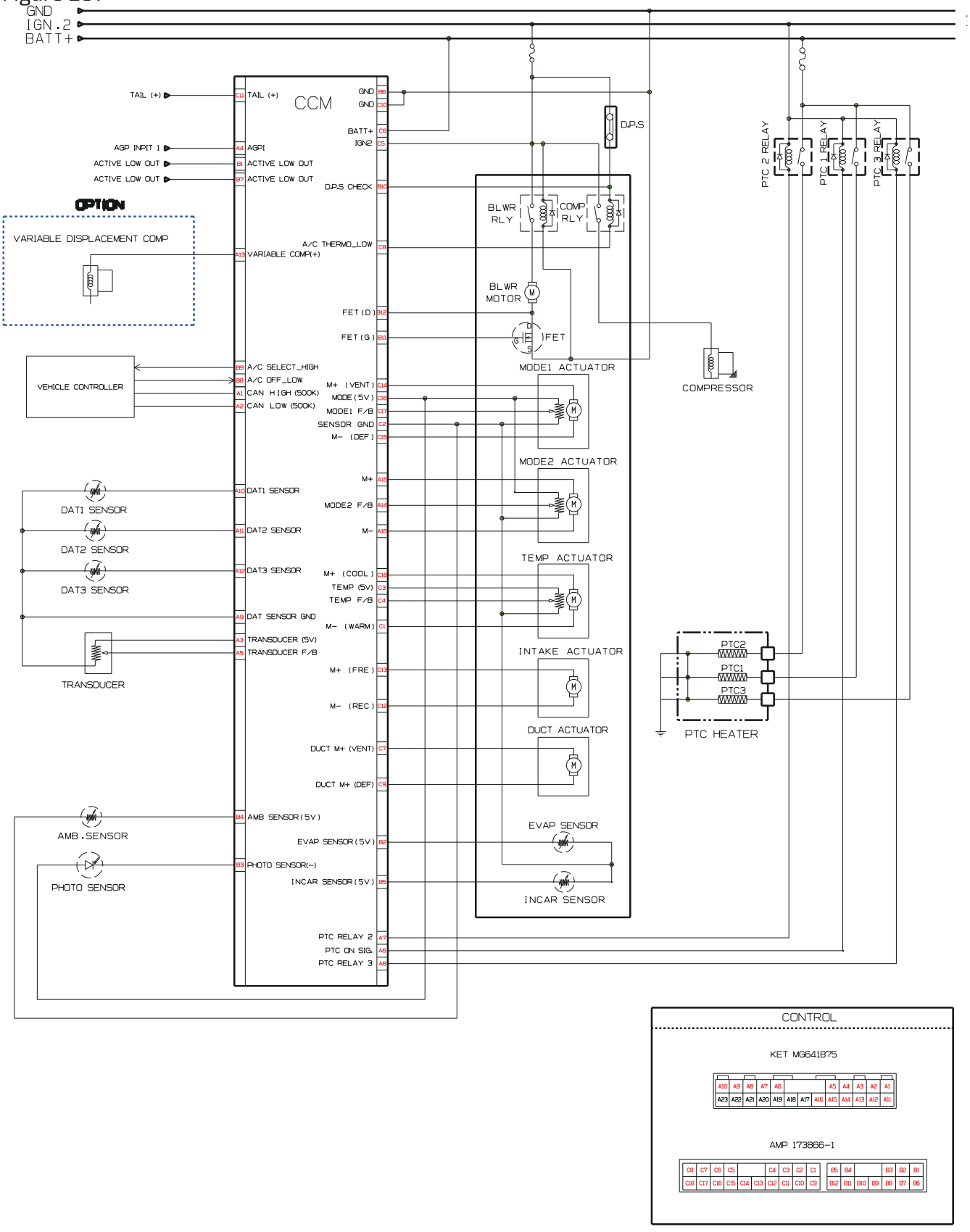
Figure 200





Air Conditioner/Heater Circuit Diagram

Figure 201

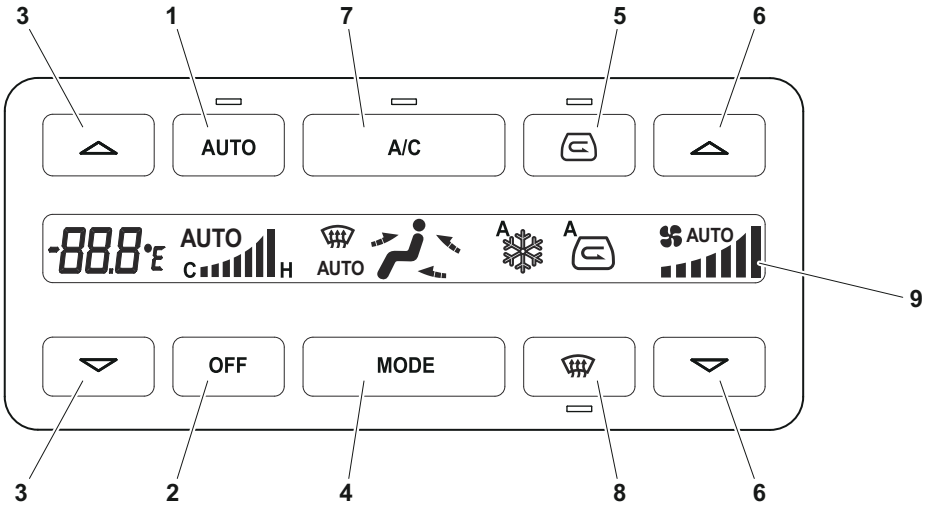


DS2301081

Control Panel

Appearance and Terminal Arrangement

Figure 202



DS2104888

1	Automatic Temperature Control Button	6	Fan Speed Selector Button
2	Off Button	7	Air Conditioner Button
3	Temperature Control Button	8	Defroster Button
4	Air Outlet Selector Button	9	LCD Display
5	Air Inlet Selector Button	-	-

Refer to "Air Conditioner and Heater" of operation manual.

Control Connector

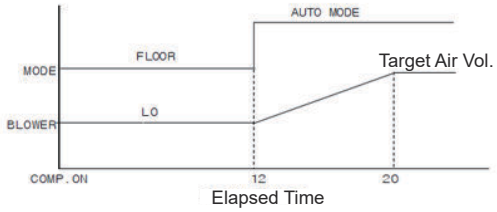
	Pin No.	Description		Pin No.	Description
Connector A	1	CAN High	Connector B	1	Active Low Out
	2	CAN Low		2	Evaporator Sensor
	3	Transducer 5V Out		3	Photo Sensor
	4	AGP Input 1		4	Ambient Sensor
	5	Transducer Feedback		5	In-car Sensor
	6	PTC 1 (Active Low Out)		6	GND
	7	PTC 2 (Active Low Out)		7	Active Low Out
	8	PTC 3 (Active Low Out)		8	Compressor Off Signal_Low
	9	DAT Sensor GND		9	A/C Select Signal_High
	10	DAT Sensor 1		10	DPS Check
	11	DAT Sensor 2		11	FET (G)_Blower Control
	12	DAT Sensor 3		12	FET (D)_Blower Feedback
	13	Variable Compressor (+)		-	-
	14	Mode 2 Feedback		-	-
	15	Mode 2 Actuator (+)		-	-

	16	Mode 2 Actuator (-)	-	-

Connector C	Pin No.	Description
	1	Temperature Actuator (Warm)
	2	Sensor GND
	3	Temperature 5V Out
	4	Temperature Feedback
	5	IGN +
	6	B +
	7	Duct Actuator (Vent)
	8	A/C Thermo Signal_Low
	9	Duct Actuator (Vent)
	10	GDN
	11	ILL +
	12	Intake Actuator (-)
	13	Intake Actuator (+)
	14	Mode Actuator (Vent)
	15	Mode Actuator (Defrost)
	16	Mode 5V Out
	17	Mode Feedback
	18	Temperature Actuator (Cool)

Control Logic

Categories	Inputs	System Operation
Auto	Set temperature Internal air temperature sensor Ambient air temperature sensor Sun sensor	1. Automatically adjust room temperature as set and then next items. 2. Auto mode is released when manually setting any switch except, Temperature Control switch in Auto mode. 3. Upon the releasing of Auto mode, all of functions except selected switch are controlled automatically.
Sensor compensation	Set temperature Internal air temperature sensor Ambient air temperature sensor	1. In case of sensor fault, the following defaults are applied: Temperature control actuator: - Set Temperature 17 - 24.5°C: Max cooling, Set Temperature 25 - 32°C: Max heating Airflow direction mode actuator - VENT: VENT fix, modes other than VENT: Fixed to DEF

<table>
<tr><th>Categories</th><th>Inputs</th><th>System Operation</th></tr>
<tr><td></td><td></td><td>* Sun sensor is not compensated.</td></tr>
<tr><td>Max cooling/ heating control</td><td>Auto Setting</td><td>1.
<table>
<tr><td></td><td colspan="2">Temperature</td></tr>
<tr><td>System</td><td>Low (Max. Cool)</td><td>High (Max. Hot)</td></tr>
<tr><td>Mode</td><td>Vent/Rear</td><td>Foot</td></tr>
<tr><td>Temp.</td><td>Max. Cool</td><td>Max. Warm</td></tr>
<tr><td>Intake</td><td>Recirculation</td><td>Fresh Air</td></tr>
<tr><td>Blower Speed</td><td>7th</td><td>6th</td></tr>
<tr><td>A/C</td><td>On</td><td>Off</td></tr>
</table>
DS2301085
When the set temperature is set to the maximum (Low or High), the automatically controlled functions are forcibly fixed and controlled as follows.
2. Returns to the previous mode when the function is canceled due to the change in the set temperature.</td></tr>
<tr><td>Starting Control of Cooling</td><td>Auto mode
Duct sensor</td><td>When Ignition Switch is ON, blower speed and wind direction are controlled to prevent unpleasant feeling due to rapid discharge of hot air right before A/C is turned on.
1. Start condition (AND condition): Ignition Off → On & A/C On, Blower Auto, Evaporator senses over 30°C
2. Control condition
 

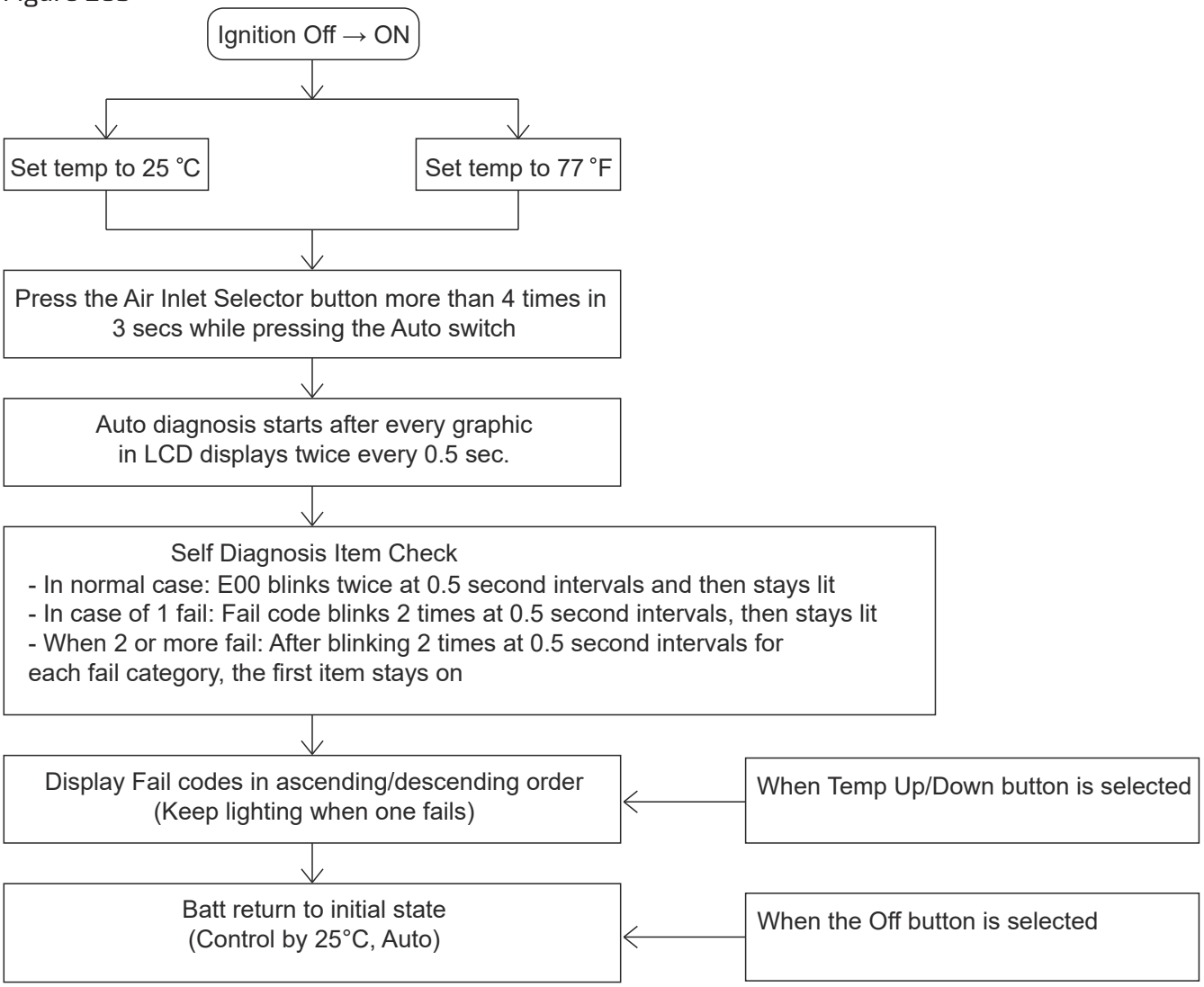
DS2301086
3. Release Conditions (OR condition): Blower Manual Selection, A/C Off, Pressing Defrost switch
4. Priority is given to starting air volume control over the maximum cooling control function based on the set temperature.</td></tr>
<tr><td>Starting control of heating</td><td>Internal air temperature sensor
Auto mode
Set Temperature</td><td>1. Start condition (AND condition for A, B, and C), (OR condition for D and E)
A. Ignition Off (After 1 hour later) → Ignition On
B. Outdoor Temperature: Below 5°C
C. System On
D. When Mode is Floor by Auto
E. For Blower Auto</td></tr>
</table>

<table>
<tr><th>Categories</th><th>Inputs</th><th>System Operation</th></tr>
<tr><td></td><td></td><td>2.
<table>
<tr><th>Outdoor Temperature (℃)</th><th>Control Time (min.)</th></tr>
<tr><td>Below -15</td><td>8</td></tr>
<tr><td>-15 ~ -10</td><td>6</td></tr>
<tr><td>-9.5 ~ -1</td><td>4</td></tr>
<tr><td>-0.5 ~ 5</td><td>2</td></tr>
</table>
DS2301087
Control condition
• During manual selection during heating control, the selected function is manually controlled and heating control is maintained.
• When Auto is selected in the manual control state, it operates as a heating control.
• When defrost on heating control, the switch indicator turns off.
• Max. Priority is given to heating control over the hot function.
• Max. Heating control is performed when the heating control entry condition is reached when cool is released.</td></tr>
<tr><td rowspan="2">Compressor control</td><td>Evaporator sensor</td><td>1. Function: Magnetic clutch of compressor is turned "ON/OFF" depending on temperature of the duct sensor to prevent the freezing of the evaporator with A/C being "ON".
2. Control pattern.  </td></tr>
<tr><td>External temperature sensor</td><td>1. Function: Prevention of compressor in winter.
2. Control pattern.  </td></tr>
</table>

Self-diagnosis

How to start self-diagnosis

Figure 203



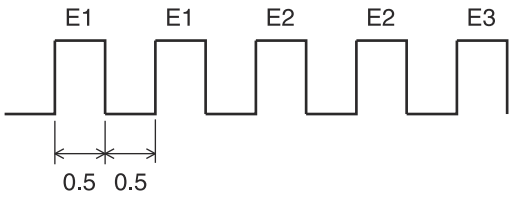
DS2301090

Error codes

Code	Description	Failure Judgment Condition
E0	Normal	-
E1	In-car sensor short	When In-car Feedback ≤ 0.1 V
E2	In-car sensor open	When In-car Feedback ≥ 4.9 V
E3	Ambient air temperature sensor short	When Ambient air temp. sensor Feedback ≤ 0.1 V
E4	Ambient air temperature sensor open	When Ambient air temp. sensor Feedback ≥ 4.9 V
E5	Evaporator sensor short	Evaporator sensor Feedback ≤ 0.1 V
E6	Evaporator sensor open	Evaporator sensor Feedback ≥ 4.9 V
E7	-	-
E8	Photo sensor open	Photo sensor Feedback ≤ 0.05 V
E9	-	-

Code	Description	Failure Judgment Condition
E10	-	-
E11	D.P.S open	D.P.S input is open
E12	Bad Mode actuator drive system	When the actuator does not reach the target position within 10 seconds
E13	Bad Temp. actuator drive system	When the actuator does not reach the target position within 10 seconds
E14	Mode actuator open or short	When Mode Feedback ≤ 0.1 V or Mode Feedback ≥ 4.9 V
E15	Temp. actuator open or short	When Temp. Feedback ≤ 0.1 V or Mode Feedback ≥ 4.9 V

Figure 204



FG001067

NOTE: *The position error means that it fails to move to designated place in 40 seconds.*

NOTE: *Sun sensor displays E8 in case of no sunlight.*

NOTE: *2 and more fails: Codes concerned blinks twice at a time.*

Ambient Temperature Display

Selection of both the SEL and MODE switch for more than 3 seconds indicates the ambient temperature in the set temperature display department.

- Range of temperature display: -40 - +60°C

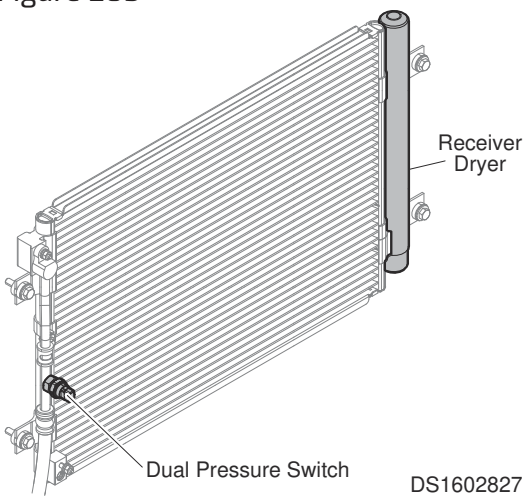
NOTE: *Display of ambient temperature may be released in the same way for its entry way.*

NOTE: *It returns automatically to default mode 5 seconds after entering the ambient air temperature display mode.*

Receiver Dryer

The receiver dryer reserves refrigerant enough to ensure smooth freezing cycle responding immediately to the change of level in the freezing cycle.

Figure 205

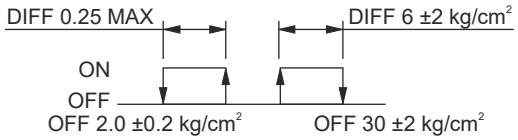


As liquid refrigerant from the condenser may contain refrigerant gas with bubbles whose presence in the expansion valve decreases the freezing power excessively, it separates liquid and gas and sends liquid only to the expansion valve.

Water in refrigerant shall be eliminated with dryer and through filter.

During refrigerant recovery and refilling, the desiccant and filter must be replaced.

- Figure 206



Refrigerant System Repairs

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Always wear safety goggles and gloves when handling refrigerant. If refrigerant comes in contact with the skin or eyes, immediately flush with clean, running water and consult a physician.
Select a clean and well ventilated area to work.
The refrigerant container is under high-pressure and must be stored below 40°C (104°F). Be careful not to drop the container from a high location.
The contents are under high-pressure and should not be used with compressed air or near an open flame.

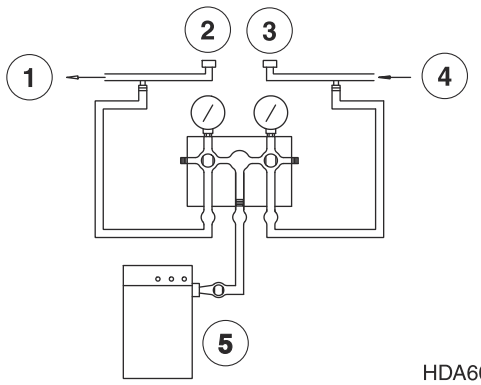
The "vacuum operation" consists of eliminating moisture in the air conditioner circuit.
If there is any moisture left inside the air conditioner circuit, various problems may occur during operation such as freezing in the small hole of the expansion valve causing the circuit to clog and rust developing in the circuit.

Refrigerant Safe Handling Procedures

The following procedures must be observed for safe handling of refrigerant during vacuum and charging process.

1. Use an approved recovery/charging device which can safely perform vacuum and charge work simultaneously.
2. When charging the refrigerant, be careful to ensure that the prescribed amount of refrigerant is filled.
3. Do not over tighten connections when working on refrigerant system.
4. The new refrigerant system standards require new tools, equipment and parts. DO NOT attempt to use equipment use in servicing the old refrigerant system.
5. The new refrigerant oil (PAG type) has a high moisture absorption characteristic. When the refrigerant system vacuum seal has been broken, immediately plug up all openings to prevent moisture from entering the system.
6. When installing flanges that use O-ring seals, apply refrigerant oil lightly to the O-ring. Be careful not to get refrigerant oil on the threaded part of the nut.
7. Be certain the O-rings are seated properly on the refrigerant line lip. Always use new O-rings when reassembling parts. Do not reuse old O-rings.
8. Refer to the refrigerant recovery and filling method for repair and replacement procedures.

Figure 207



HDA6067L

Refrigerant Recovery

Reference Number	Description
1	To Compressor
2	Low-pressure Side
3	High-pressure Side
4	To Receiver drier

Reference Number	Description
5	Refrigerant Recovery Tank

1. Attach the manifold gauge and the refrigerant recovery unit to the refrigerant lines as shown.

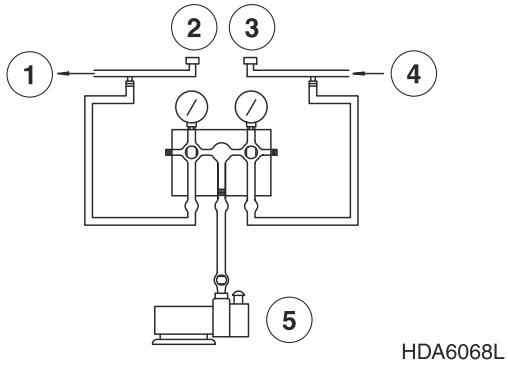
   NOTE: *Be careful not to switch the connections for the low and high-pressure valves.*

2. Open the high-pressure valve slowly to release the refrigerant to the recovery unit.

   NOTE: *Open the valve slowly, while checking to see that refrigerant is not leaking out.*

3. When the manifold gauge dial falls below 3.5 bar (50 psi), slowly open the low-pressure valve.
4. Open both the high and low-pressure valves slowly until manifold gauge dials indicates 0 bar (0 psi).

Figure 208



Vacuuming Refrigerant System

Reference Number	Description
1	To Compressor
2	Low-pressure Side
3	High-pressure Side
4	From Receiver drier
5	Vacuum Pump

1. Vacuuming Procedure

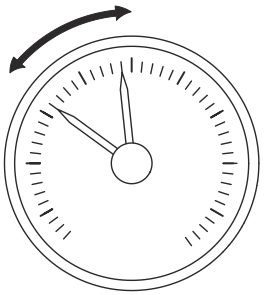
   NOTE: *When the A/C system has been exposed to the air, it must be vacuumed out. Perform vacuum process for 30 minutes for complete moisture and air evacuation.*

   A. Attach the manifold gauge and vacuum pump to the refrigerant system as shown.

   B. Turn on the vacuum pump and open both valves.

   C. After running the vacuum pump for 5 minutes, when the low pressure side gauge indicates -712~-750 mmHg (-0.95~-1 bar, -13.8~-14.5 psi), close both valves and stop the vacuum pump.

2. Figure 209



HDA6069L

Check system for vacuum leak.

Allow system to sit for 10 minutes and check whether the system is holding the pressure. If the pressure has dropped, it must be repaired before proceeding to the next step.

3. Vacuuming Procedure

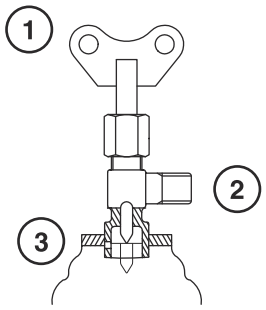
If the pressure in the unit does not fall below -675 mmHg (-0.9 bar, -13.1 psi) in 10 minutes, vacuum the system for 20 minutes.

A. Turn on the vacuum pump and slowly open both valves.

B. Run the vacuum pump for additional 20 minutes.

C. Close both valves and stop the vacuum pump.

4. Figure 210



HDA6070L

Installation of Refrigerant Container

Reference Number	Description
1	Handle
2	Hose Connection
3	Mounting Disk

A. Before mounting valve on the container, make sure the handle is in the counterclockwise most position, with the puncture pin retracted and the mounting disk is in the raised position.

B. Attach the manifold gauge center hose to the valve assembly.

C. Turn the disk in the clockwise direction and securely mount valve onto refrigerant container.

D. Turn the valve handle in the clockwise direction and puncture the container seal with the pin.

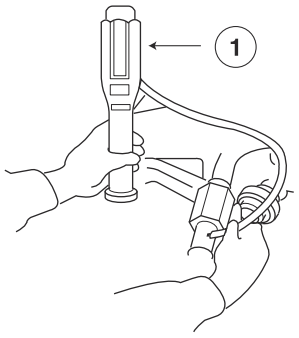
E. Once the can has been punctured, turn the handle in the counterclockwise direction so the refrigerant can flow into the manifold gauge center hose. Now, do not open the low and high-pressure valves of the manifold gauge.

F. Press the manifold gauge low side valve to eliminate the trapped air in the hose.

Leakage Check

NOTE: *Perform the leakage check after completing vacuuming process.*

1. After attaching the manifold gauge, open the high side valve.
2. Charge system until low side gauge dial indicates a pressure of 1 bar (14 psi) and close the high side valve.
3. Figure 211



HDA6071L

Using a refrigerant leak detector or soapy water check each joint for leakage.

Reference Number	Description
1	Refrigerant Leak Detection Device

4. If a leak is detected, check for O-ring damage or correct tightening torque and replace or repair as necessary.
5. If no leaks are detected, proceed with the charging process.

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

For accurate refrigerant leak detection, perform leak detection procedure in a well ventilated area.

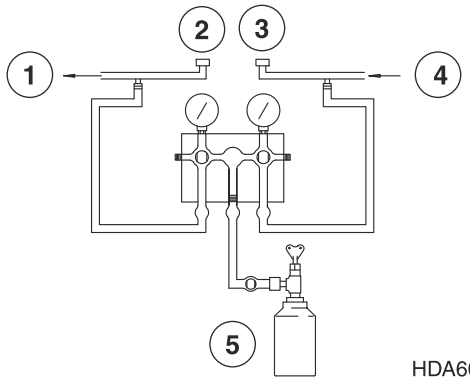
Refrigerant Charging

1. Perform the vacuuming procedure, vacuum holding and leaking tests as described in the proceeding headings.

   NOTE: *First charge the refrigerant system with 100g (3.5 ounces) of refrigerant with the engine off. Then using the manifold gauge as a guide fully charge the system with the engine running.*

NOTE: *When exchanging refrigerant containers, press the manifold gauge low side valve to eliminate air from the charging hose.*

Figure 212



HDA6072L

Reference Number	Description
1	To Compressor
2	Low-pressure Side
3	High-pressure Side
4	To Receiver drier
5	Refrigerant Supply Container

2. Charge the system by opening the manifold gauge low side valve.

   Initial charge amount: 100 g (3.5 ounces).

3. If the refrigerant does not enter well, turn the refrigerant container upside down to inject the refrigerant.While the refrigerant is being injected, measure the weight of the refrigerant container using a scale to check if the proper amount is entered.

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

When charging refrigerant system with the engine running:

- **Always keep refrigerant supply container in the upright position.**
- **Never open the high side pressure valve.**

4. Open the manifold gauge low side valve and charge system to standard capacity.

   NOTE: *Appropriate pressure at an outside temperature of 30 - 35 °C is at High pressure: about 15 - 17 kg/cm^2, Low pressure: about 1.3 - 2.0 kg/cm^2*

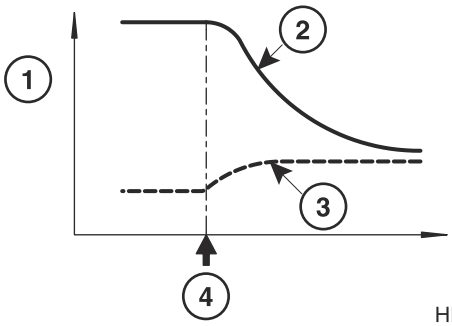
Ambient Temp. (°C)	High Pressure (PSI)	High Pressure (kg/cm^2)	Low Pressure (PSI)	Low Pressure (kg/cm^2)
21	120 - 190	8.4 - 13.3	7 - 15	0.5 - 1
27	140 - 210	9.8 - 14.7	7 - 20	0.5 - 1.4
32	170 - 240	12 - 16.8	7 - 20	0.5 - 1.4
38	190 - 270	13.3 - 19	10 - 30	0.7 - 2.1
43	210 - 300	14.7 - 21.1	10 - 30	0.7 - 2.1

NOTICE

- When outside temperature is low, warm the refrigerant supply container with warm water not exceeding 40°C (104°F). Do not allow water to come in contact with the charging adapter valve handle.
- When outside temperature is high, cool off refrigerant supply container and condenser to aid the refrigerant charging process.

5. Close low-pressure side valve.
6. Shut off engine and close refrigerant supply container adapter valve. Disconnect manifold gauge hoses from machine.

Figure 213



HDA6073L

Inspecting System For Leakage

After completing charging procedures, clean all joints and connections with a clean dry cloth. Using a refrigerant leak detecting device or soapy water, inspect system for leaks starting from the high-pressure side.

NOTE: *When the refrigerant circulation has been stopped the high-pressure will start to decrease and the low-pressure will start to increase until they are equalized. Starting the inspection from the high side will result in an accurate test.*

Reference Number	Description
1	Pressure
2	High-pressure
3	Low-pressure
4	Compressor Stop

Inspection Procedure

1. High-pressure Side

   Compressor outlet → condenser inlet → receiver dryer inlet → air conditioner unit inlet.

2. Low-pressure side

   Compressor inlet → air conditioner unit outlet.

3. Compressor

   Compressor shaft area, bolt hole area and magnetic clutch area.

4. Receiver dryer

   Pressure switch and plug area.

5. Connection valve area

   Inspect all valve areas.

   Verify all valves are capped to prevent leaking.

   Check for foreign material inside of valve cap.

6. Interior of air-conditioning unit.

   After stopping engine, insert detector probe into drain hose. (Leave inserted for 10 seconds minimum.)

   NOTE: *When inspecting leakage from the air-conditioning unit, perform the inspection in a well ventilated area.*

Approximate Refill Capacities

When removing and installing the parts of Air Conditioning, check the each component's refrigerant oil quantity.

Each component contains the appropriate oil.The oil quantity being low will cause compressor seizing and a reduction in durability. The oil quantity being high will cause a reduction in cooling capabilities.Make sure to check the oil quantity and adjust if needed.Measure the oil quantity of the removed parts. Only this oil quantity is necessary, so subtract this quantity to determine the amount by which the oil quantity of the new parts should be reduced.Example)If the remaining oil quantity of the removed compressor is 40 g: Remove 150 g - 40 g = 110 g from the new compressor to be installed.

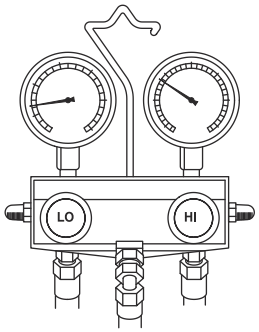
- Volume of refrigerant: R-134a, 700g
- Refrigerant Oil: PAG SP-A2, Refer to the below table for specific oil quantity.

Containing Refrigerant Oil Quantity					
Compressor	Condenser	HVAC (EVA)	Discharge Hose	Suction Hose	Liquid Hose
150 g	37 g	88 g	28 g	40 g	26 g

Troubleshooting

Refrigerant Pressure Check

1. Figure 214



HDA6074L

   Open all doors and windows.

2. Install manifold gauge set.
3. Start engine and maintain engine speed at 1,800 - 2,000 rpm.
4. Check high/low-pressure of refrigerant.

1	High-pressure: 8.0 - 10.0 bar (114 - 142 psi) Low-pressure: Approximately 1.0 bar(14 psi)		
Possible Cause: Low Refrigerant Level			
Step	Inspection Item		Remedy
1	Check for traces of refrigerant oil.	Yes	Reassemble using correct tightening torque.
		No	Go to next step.
2	Using a leak detection device or soapy water check for refrigerant leakage at all major components and joints.	Yes	Repair leaking component.
		No	Recharge system to correct pressure.

2	High-pressure: Over 23 bar (327 psi) Low-pressure: Approximately 2.5 - 3.0 bar(36 - 43 psi)		
Possible Cause: Overcharge, Frost on condenser			
Step	Inspection Item		Remedy
1	Check for condenser pin damage or contamination.	Yes	Clean, repair or replace condenser.
		No	Refrigerant overcharge.

3	High-pressure: Approximately 20 - 25 bar (285 - 356 psi) Low-pressure: Approximately 2.5 - 3.5 bar (36 - 50 psi)
Possible Cause: Air in system.	
A. Recover any remaining refrigerant. B. Vacuum out system. C. Recharge system. **NOTE:** *During refrigerant recovery and refilling, the desiccant and filter must be replaced.*	

4	High-pressure: Over 6 bar (85 psi) Low-pressure: Approximately 760 mmHg (Negative Pressure)		
Possible Cause: Refrigerant does not circulate			
Step	Inspection Item		Remedy
1	A. Connect manifold gauge and start engine. B. Turn on air conditioner. C. Set blower switch to HIGH position. D. Turn air conditioner OFF and wait 10 minutes.	Yes	Moisture in system, replace receiver dryer.
		No	Contaminated system, replace expansion valve. (Replace evaporator core assembly.)

4	High-pressure: Over 6 bar (85 psi) Low-pressure: Approximately 760 mmHg (Negative Pressure)		
	E. Recheck high/ low-pressure readings. Low-pressure: 1.5 - 3.3 bar (21.3 - 46.9 psi)		

5	High-pressure: Over 6 - 18 bar (85 - 256 psi) Low-pressure: 500 mmHg (Negative Pressure) - Dial indicator needle unstable.
Possible Cause: Moisture in system has iced up the expansion valve. NOTE: *When the absorbed moisture freezes the pressure readings may look normal. Careful readings must be made to determine whether pressure is in normal range.*	
A. Recover any remaining refrigerant. B. Vacuum out system. C. Recharge system. NOTE: *During refrigerant recovery and refilling, the desiccant and filter must be replaced.*	

6	High-pressure: Over 22.0 - 23 bar (313 - 327 psi) Low-pressure: 2.5 bar(36 psi)		
Possible Cause: Refrigerant pressure problem because of defective expansion valve or temperature sensor.			
Step	Inspection Item		Remedy
1	Inspect whether the temperature sensor is installed properly.	Yes	Replace expansion valve.
		No	Exchange duct sensor.

7	High-pressure: Over 7.0 - 11.0 bar (100 - 156 psi) Low-pressure: 4.0 - 6.0 bar(57 - 85 psi)
Possible Cause: Low refrigerant pressure because of poor compressor compression.	
Inspect and replace compressor if necessary.	

Removal and Installation

Engine

Safety Instructions

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Instructions are necessary before operating or servicingmachine. Read and understand the Operation & Maintenance Manual and signs (decals) on machine. Followwarnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correctfunction after adjustments repairs or service. Untrainedoperators and failure to follow instructions can cause deathor serious injury.

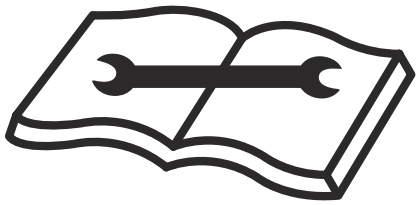
Before Removing and Installing

Preparatory Work

1. Park the machine on level ground. And lower front attachment to the ground.
2. Set parking brake switch to the parking position and then stop the engine.
3. Turn battery disconnect switch to "OFF" position.
4. Release the remaining pressure in the hydraulic circuit.
5. Cool down the hydraulic system and engine.
6. Attach a maintenance warning tag on controls.

General Precaution

1. Always read the safety section before removing and Installing.
   Figure 1



DS1901903

2. Mark the location of the bolts before removing.
3. Keep in the mind the order for tightening bolts.
4. Tighten bolts by hands, then using the tool.
5. If reusing the bolts, clean threads and apply thread locker to threads prior to installation.
6. Mark the location of wire harness connectors and hoses before disconnecting.
7. Be careful not to damage all components.
8. Do not reused gaskets, O-ring and adhesive bolts.

Completing Work

1. Check oil, coolant and fuel leak from the machine.
2. Check all oil level and if necessary, add oil.
3. Fill up the fuel tank to the standard level.
4. Apply grease to all lubrication points.
5. When fuel component has been disconnected, air must be bled from circuit.
   For details, see the Operation and Maintenance Manual.
6. When hydraulic component has been disconnected, air must be bled from circuit.
   For details, see the Operation and Maintenance Manual.
7. Start the engine and run at low idle for about 5 minutes.
8. Perform the machine performance test.

ECU (Engine Control Unit)

Repair Procedure Quick Guide

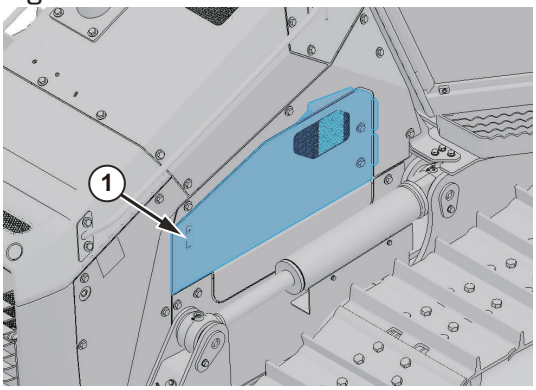
Step-A. Open left side covers
Step-B. Disconnect wiring harness
Step-C. Remove ECU assembly

Removal

1. Turn OFF the battery disconnect switch.

Left Side Covers

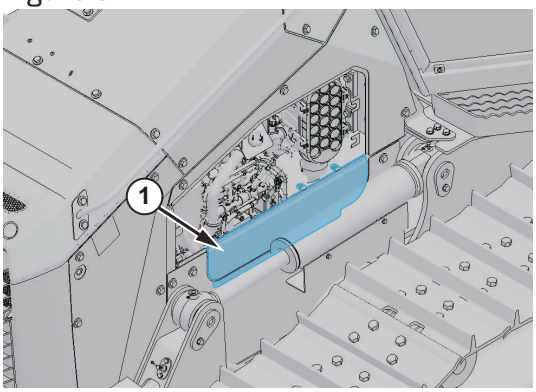
1. Open left side cover (1).
   Figure 2



DS2201847

2. Remove side cover (1).

Figure 3



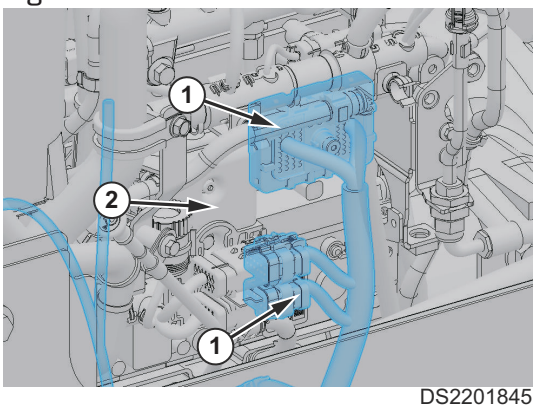
DS2201848

3. Remove side cover.

Wiring Harness

1. Disconnect ECU harness connector (1) from ECU assembly.

Figure 4



DS2201845

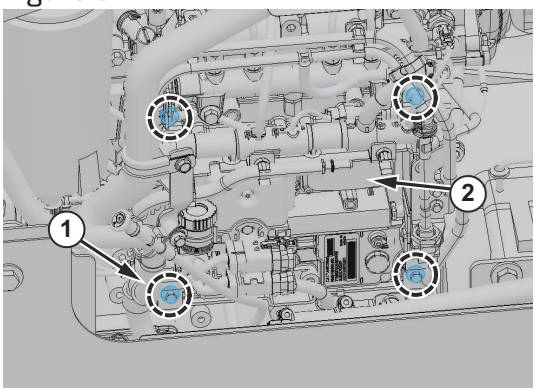
NOTE: *Check the location of the connectors before disconnecting. Be careful not to let water get into electrical components. If water gets into electrical system, this will cause an electrical short circuit and result in improper machine operation.*

2. Disconnect any additional connections as necessary.

ECU Assembly

1. Remove mounting bolts (1) and ECU assembly (2) from bracket.

Figure 5



DS2201846

NOTE: *Do not tighten the fasteners too hard when installing.*

Installation

1. Perform installation in the reverse order to removal.

V-Belt

Repair Procedure Quick Guide

Step-A. Remove engine side cover

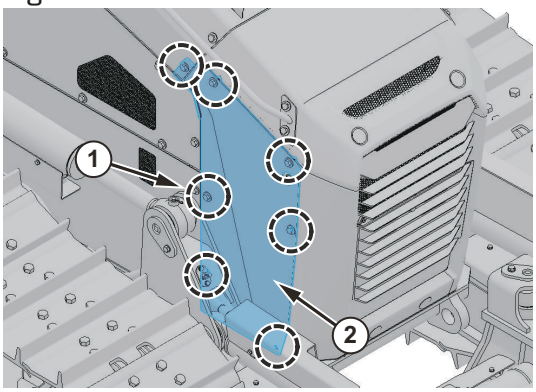
Step-B. Remove V-belt

Removal

1. Open the left side door.
2. Turn OFF the battery disconnect switch.

Engine Side Cover

1. Remove bolts (1) from engine side cover (2).
   Figure 6



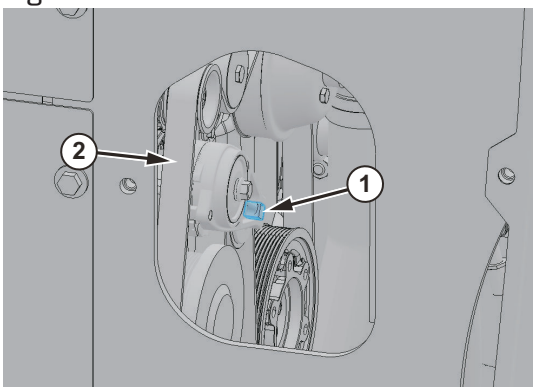
DS2201840

   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
2. Remove engine side cover.

V-belt

1. Insert the tool into the auto tensioner service hole (1).

   NOTE: *Before removing the belt, check the belt layout.*
   Figure 7



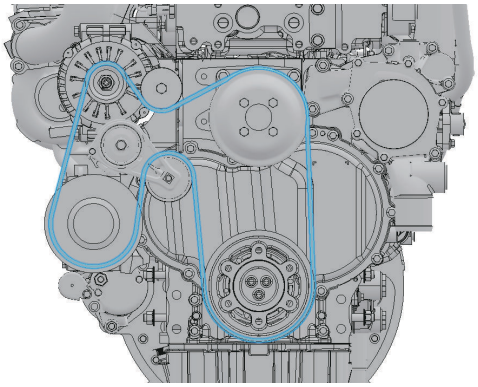
DS2201841

2. Turn the auto tensioner with tool clockwise to loosen and put away the V-belt (2).

NOTE: *If reusing V-belt, mark the rotation direction on the belt.*

3. Carefully release the tension.
4. Remove tool from auto tensioner service hole.

Figure 8



DS2201842

NOTE: *If equipped air conditioner compressor, please refer to V-belts layout.*

Installation

1. Perform installation in the reverse order to removal.
2. Check that V-belt is installed to the all pulley grooves.
3. Start engine.

Alternator

Repair Procedure Quick Guide

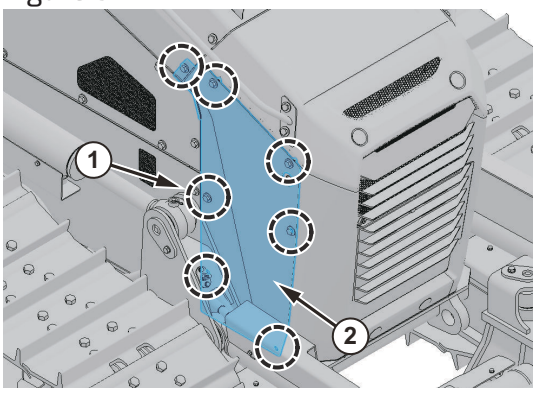
Step-A. Remove engine side cover
Step-B. Remove V-belt
Step-C. Open right side covers
Step-D. Disconnect wiring harness
Step-E. Remove alternator assembly

Removal

1. Open the left side door.
2. Turn OFF the battery disconnect switch.

Engine Side Cover

1. Remove bolts (1) from engine side cover (2).
   Figure 9



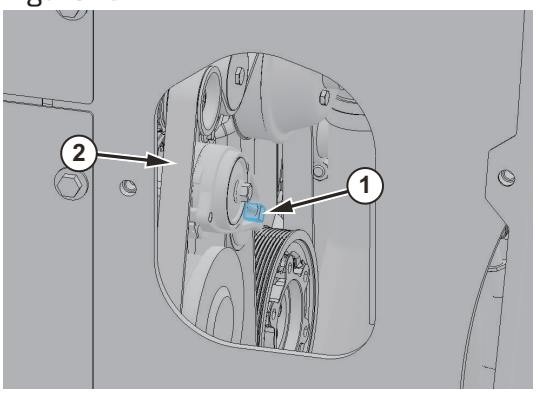
DS2201840

   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
2. Remove engine side cover.

V-belt

1. Insert the tool into the auto tensioner service hole (1).

   NOTE: *Before removing the belt, check the belt layout.*
   Figure 10

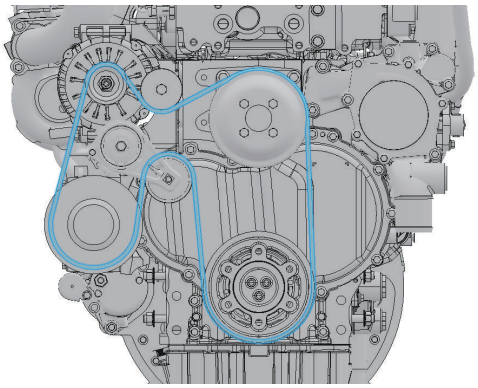


DS2201841

2. Turn the auto tensioner with tool clockwise to loosen and put away the V-belt (2).

   NOTE: *If reusing V-belt, mark the rotation direction on the belt.*
3. Carefully release the tension.

4. Remove tool from auto tensioner service hole.
   Figure 11

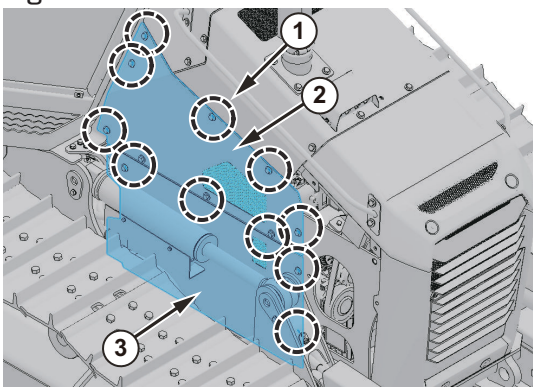


DS2201842

NOTE: *If equipped air conditioner compressor, please refer to V-belts layout.*

Right Side Covers

1. Remove bolts (1) from side cover (2, 3).
   Figure 12

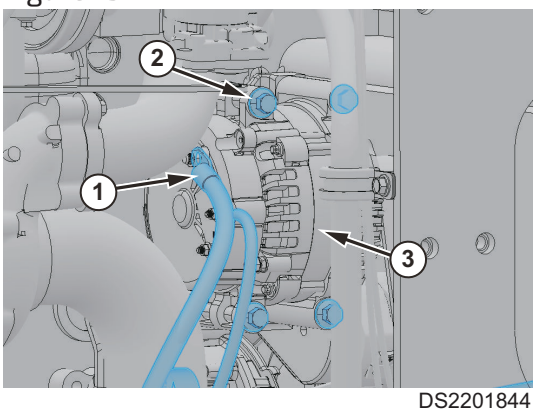


DS2201843

   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
2. Remove side cover (2, 3).

Wiring Harness

1. Disconnect wire harnesses (1) from alternator (3).
   Figure 13



DS2201844

Alternator Assembly

1. Remove the mounting bolts (2) from alternator.

2. Remove the alternator (3) from engine.

Installation

1. Perform installation in the reverse order to removal.
2. Start engine.

Starter Motor

Repair Procedure Quick Guide

Step-A. Remove engine side cover

Step-B. Disconnect cable

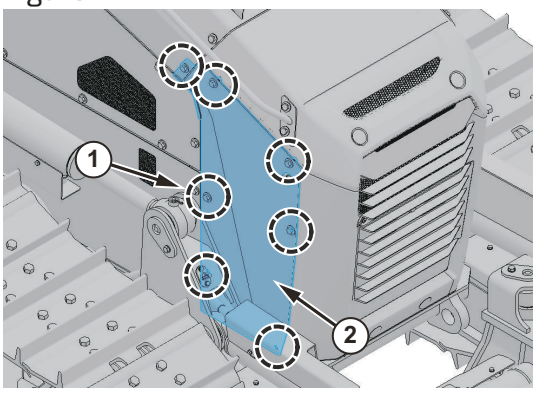
Step-C. Remove starter motor

Removal

1. Turn OFF the battery disconnect switch.

Engine Side Cover

1. Remove bolts (1) from engine side cover (2).
   Figure 14

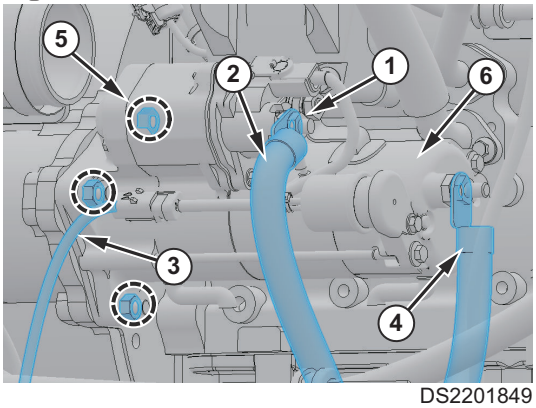


DS2201840

   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
2. Remove engine side cover.

Cable

1. Remove nut (1) from starter motor.
   Figure 15



DS2201849

2. Disconnect the positive cable (2) from starter motor.
3. Disconnect the wiring harness (3) from starter relay.
4. Remove mounting bolt and ground cable (4).

Starter Motor

1. Remove mounting bolts (5) from starter motor.
2. Remove starter motor (6).

Installation

1. Perform installation in the reverse order to removal.
2. Start engine.

DEF (adblue®) Quality Sensor

Repair Procedure Quick Guide

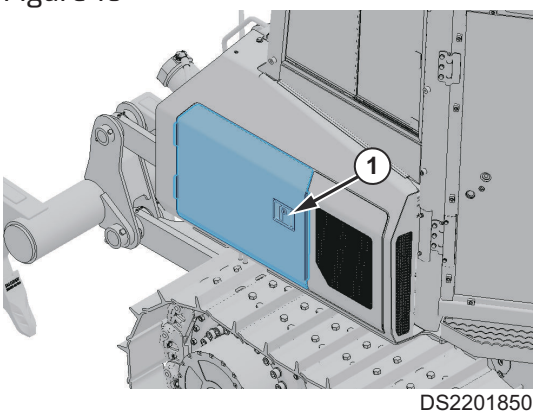
Step-A. Open the right side doors
Step-B. Drain of DEF (AdBlue®)
Step-C. Disconnect wiring harness and hoses
Step-D. Remove DEF (AdBlue®) tank
Step-D. Remove engine sensors - DEF (AdBlue®) quality sensor

Removal

1. Open the left side door.
2. Turn OFF the battery disconnect switch.

Right Side Doors

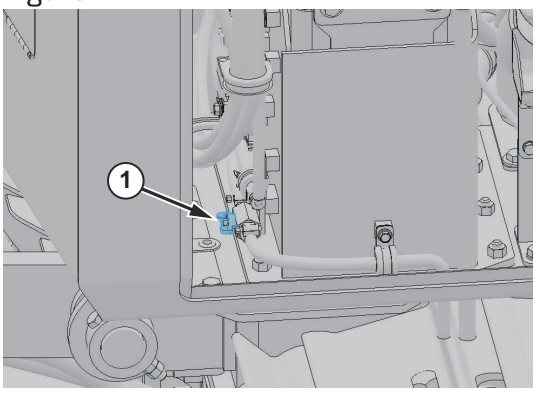
1. Open the right side doors (1).
   Figure 16



DS2201850

Draining of DEF (AdBlue®)

1. Position a small container under drain port.
   Figure 17

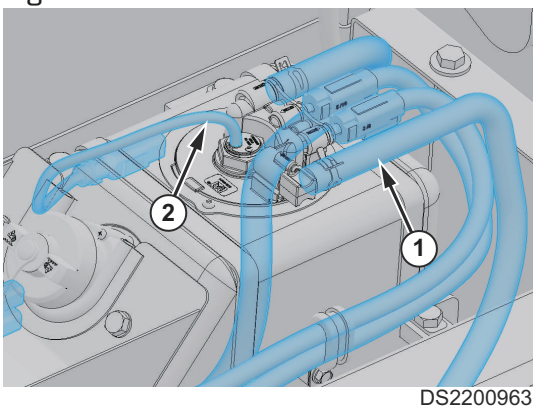


DS2300036

2. Open DEF (AdBlue®) cock valve (1) from tank.
3. Drain the DEF (AdBlue®).
   - NOTE: *Be sure to use vinyl gloves.*

Wiring Harness and Hoses

1. Disconnect hoses (1) from tank.
   Figure 18

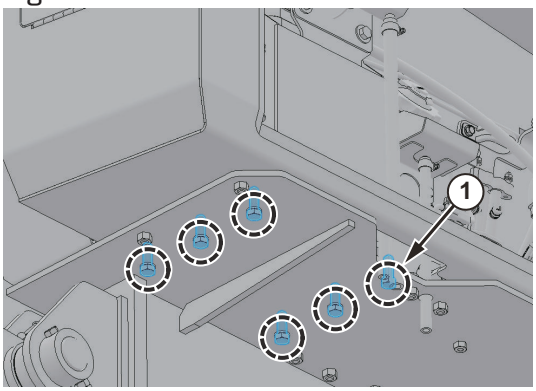


DS2200963

2. Disconnect wire harnesses (2) from tank.
3. NOTE: *Check the location of the connectors before disconnecting.*

Remove DEF (AdBlue®) Tank

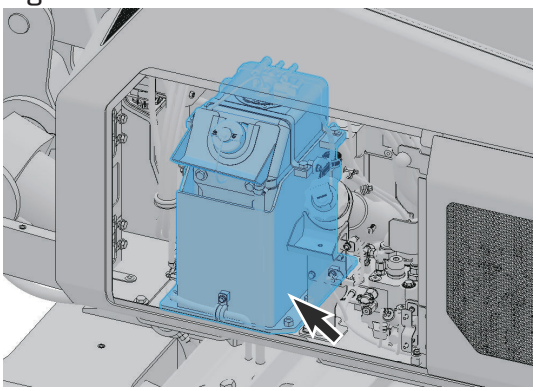
1. Remove bolts (1) from frame.
   Figure 19



DS2300037

- Tool: 19 mm ( )
- Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)

2. Remove DEF (AdBlue®) tank from frame.
   Figure 20

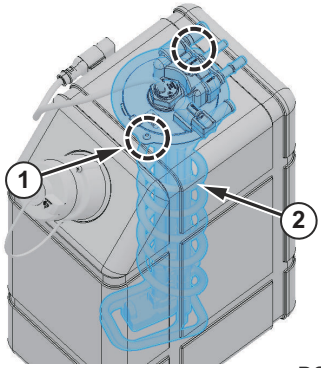


DS2300038

- NOTE: *Apply adhesive (Loctite #262) to the mounting bolt.*

DEF (AdBlue®) Quality Sensor

1. Remove mounting bolts (1) from DEF (AdBlue®) tank.
   Figure 21



DS2300039

2. Remove DEF (AdBlue®) quality sensor (2) from tank.

   NOTE: *Be sure to use vinyl gloves.*

Installation

1. Perform installation in the reverse order to removal.

Sensors - After Treatment

Repair Procedure Quick Guide

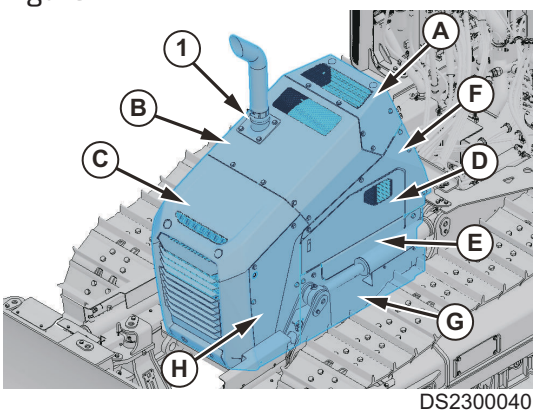
Step-A. Remove front cover

Step-B. Remove engine sensors

Removal

Front Cover

1. Remove V-clamp and muffler pipe.
   Figure 22

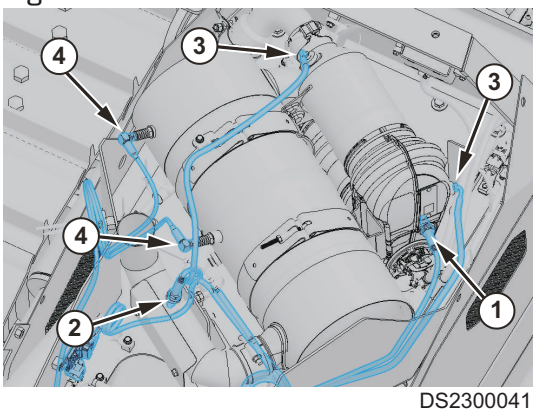


DS2300040

2. Remove the muffler cover (1).
   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
   - Weight: about 4 kg (8.8 lb)
3. Remove bolts from all left side front cover.
   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
   - (A) Cover Weight: about 9 kg (19.8 lb)
   - (B) Cover Weight: about 22 kg (48.5 lb)
   - (C) Cover Weight: about 35 kg (77.2 lb)

Engine Sensors - After Treatment System

1. Disconnect NOx upstream sensor (1).
   Figure 23



DS2300041

   - Torque: 49.0 N.m (5 kg.m, 36.2 ft lb)
2. Disconnect NOx downstream sensor (2).
   - Torque: 49.0 N.m (5 kg.m, 36.2 ft lb)
3. Disconnect temperature sensor (3).

- Torque: 19.6 N.m (2 kg.m, 14.5 ft lb)

4. Disconnect soot sensor (4).
   - Torque: 1.2 N.m (0.12 kg.m, 0.9 ft lb)
5. Disconnect wiring harness.
6. Disconnect any additional electrical connections as necessary.

   NOTE: *Be careful not to let water get into electrical components (sensor, connectors). If water gets into electrical system, this will cause an electrical short circuit and result in improper machine operation.*

Installation

1. Perform installation in the reverse order to removal.

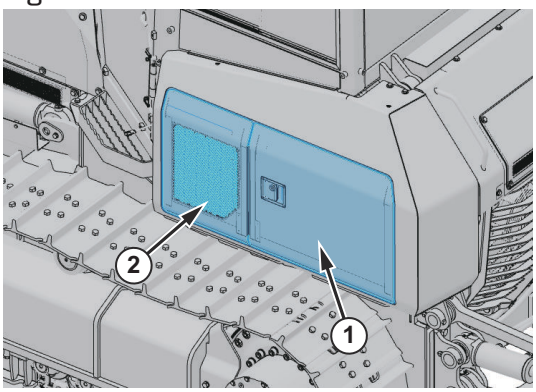
Engine Assembly

Repair Procedure Quick Guide

Step-A. Tilt the cabin
Step-B. Remove hoses under the cabin
Step-C. Remove window washer tank
Step-D. Remove cabin tilting cylinder
Step-E. Disconnect wiring harness connectors
Step-F. Remove the cabin
Step-G. Drain coolant
Step-H. Drain hydraulic oil
Step-I. Remove fan pump
Step-J. Remove main pump
Step-K. Remove support
Step-L. Remove HST pump
Step-M. Remove front cover
Step-N. Remove front radiator
Step-O. Remove muffler assembly
Step-P. Remove oil filter
Step-Q. Remove air cleaner and support
Step-R. Remove V-belt
Step-S. Remove alternator assembly
Step-T. Remove start motor
Step-U. Disconnect wiring connectors and cables
Step-V. Separate air conditioner compressor
Step-W. Remove engine mount
Step-X. Remove engine assembly

Removal

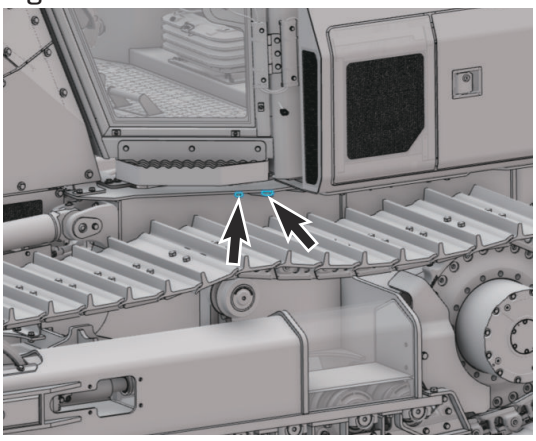
1. Open the left side door (1, 2).
   Figure 24



DS2200849

Tilt the Cabin

1. To operate cabin tilting system, remove bolts and nuts under the cabin.
   Figure 25

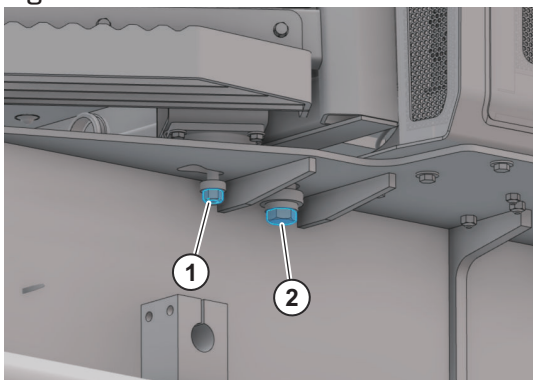


DS2201285

NOTE: *Both the left/right bolts of the cabin must be removed.*

NOTE: *Failure to remove bolts can cause serious damage to the machine.*

2. Remove nuts (1).
   Figure 26



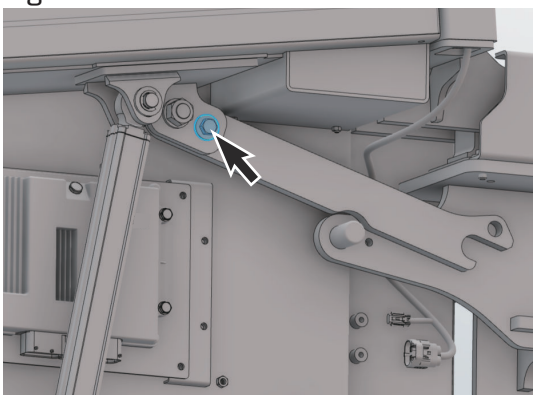
DS2201286

- Tool: 24 mm ( )
- Torque: 215.7 N.m (22 kg.m, 159 ft lb)

3. Remove bolts (2).

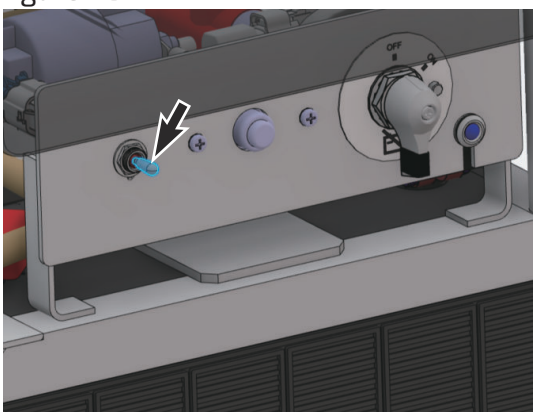
- Tool: 36mm ( )
- Torque: 127.4 N.m (13 kg.m, 94 ft lb)

4. Remove the bolts and washer on the safety bar. Safety bar is located in left side door.
   Figure 27



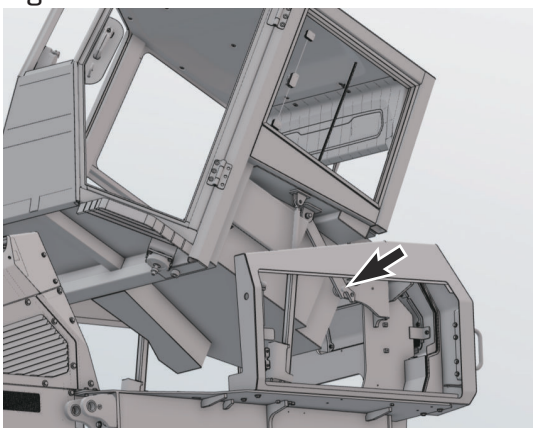
DS2201290

5. Turn cabin tilting switch to "ON" position.
   Figure 28



DS2201287

6. When the cabin tilting is completed, make sure the safety bar is fully engaged to the end and tighten the bolts and washers that were removed in step 4.
   Figure 29



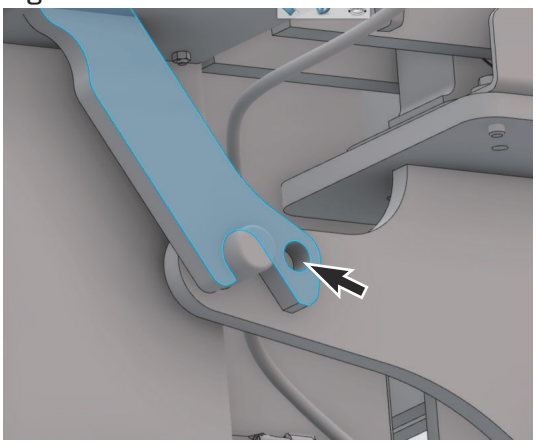
DS2201288

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Always check the installation of the safety bar during tilt operation.
It can cause death or serious injury.

Figure 30

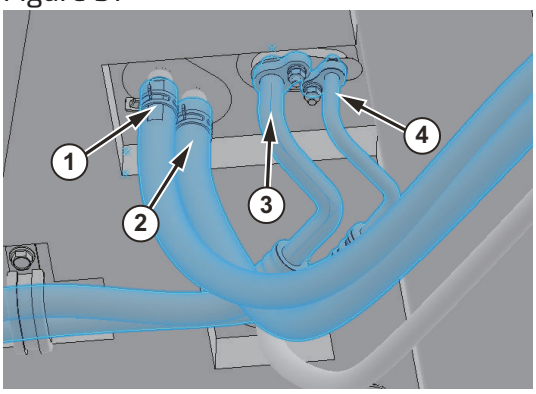


DS2201289

Hoses

1. Remove the heater hose (1).

Figure 31

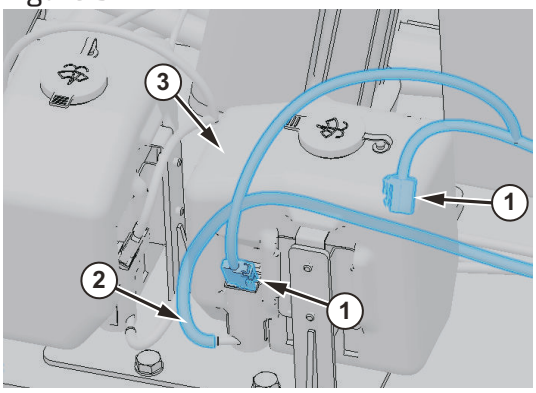


DS2200907

2. Remove the water hose (2).
3. Remove the air conditioner suction hose (3).
4. Remove the air conditioner liquid hose (4).
5. Return the tilted cabin to its original position.
6. Turn OFF the battery disconnect switch.

Window Washer Tank

1. Disconnect wiring harness (1) from window washer tank.
   Figure 32

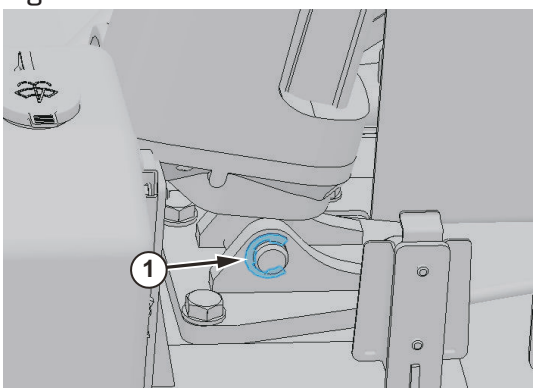


DS2200886

2. Remove water hose (2) from window washer tank.
3. Remove window washer tank (3).

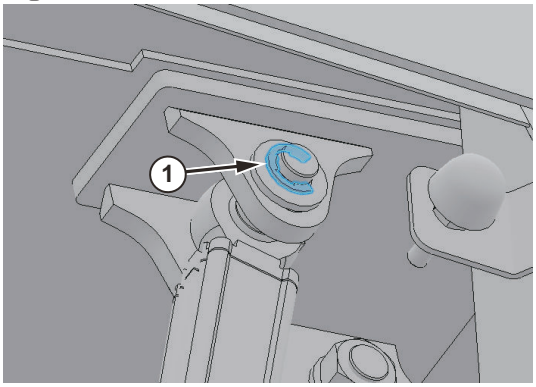
Cabin Tilting Cylinder

1. Remove the retaining ring (1) at the bottom of the cylinder.
   Figure 33



DS2200887

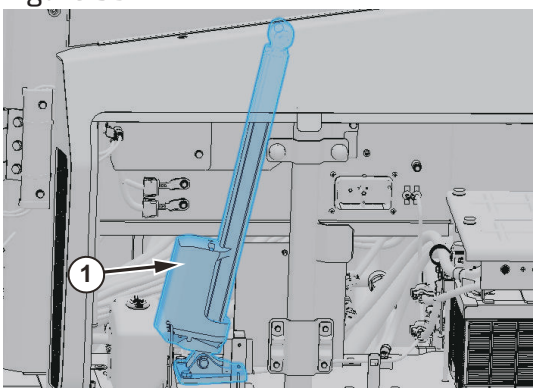
2. Remove the cylinder pin.
3. Remove the retaining ring (1) at the top of the cylinder.
   Figure 34



DS2200888

4. Remove the cylinder pin.

5. Remove the cabin tilting cylinder (1).
   Figure 35

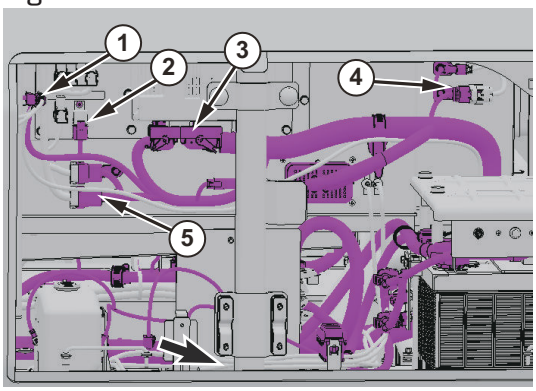


DS2200889

- Cabin tilting cylinder weight: about 10 kg (22.0 lb)

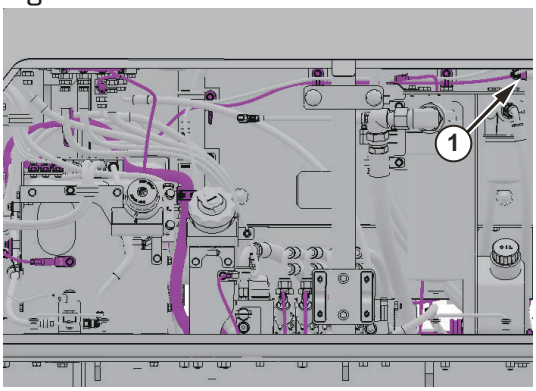
Wiring Harness Connectors

1. Disconnect wiper motor connector (1).
   Figure 36



DS2200905

2. Disconnect relay connector (2).
3. Disconnect EPOS connector (3).
4. Disconnect fan motor connector (4).
5. Disconnect wiper motor connector (1).
   Figure 37

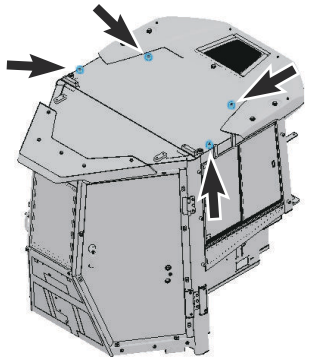


DS2200906

6. Disconnect any additional electrical connections as necessary.

Cabin

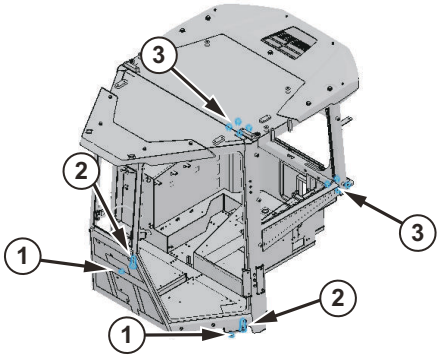
1. Using a suitable lifting device, attach slings to four lift points on top of cabin.
   Figure 38



DS2200908

   - Cabin weight: about 700 kg (1,543 lb)

2. Remove mounting nuts (1) (2 ea).
   Figure 39



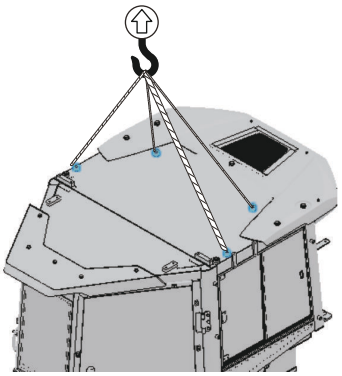
DS2200909

   - Tool: 24 mm ( )
   - Torque: 205.9 N.m (21 kg.m, 151.9 ft lb)

3. Remove mounting bolts (2) (2 ea) from cabin floor.
   - Tool: 36 mm ( )
   - Torque: 127.5 N.m (13 kg.m, 94.0 ft lb))

4. Remove hinge bolts (3) (8 ea).
   - Tool: 19 mm ( )
   - Torque: 88.3 N.m (9 kg.m, 65.1 ft lb)

5. Lift cabin approximately 25 - 50 mm (1" - 2") above deck.
   Figure 40



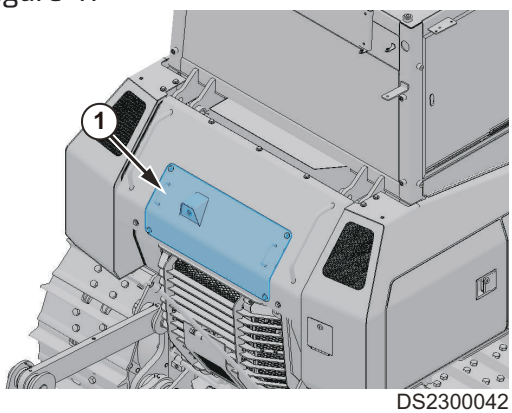
DS2200910

6. Check that all electrical connections have been disconnected and all other items unbolted.

   NOTE: *Lift operator's cabin slowly to prevent damaging.*

Coolant

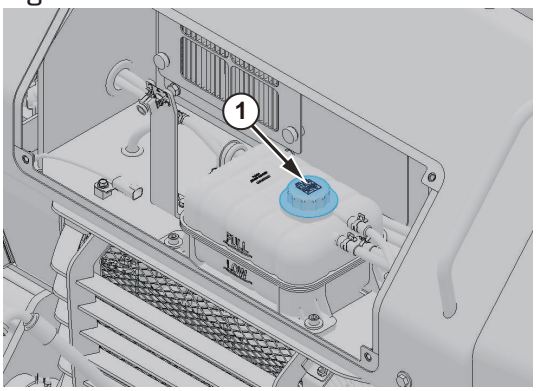
1. Remove mounting bolts and rear cover (1).
   Figure 41



DS2300042

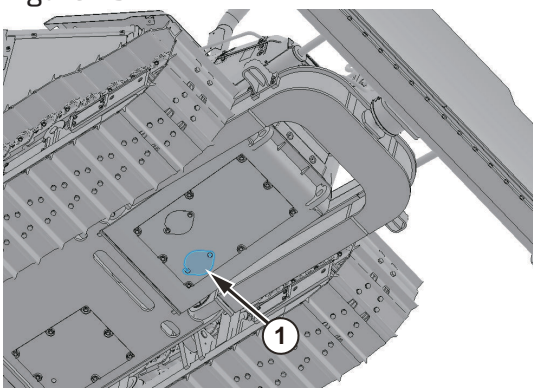
   - Tool: 17 mm ( )
   - Torque: 63.7 N.m (6.5 kg.m, 47.0 ft lb)

2. Slowly open surge tank cap (1) to allow any pressure to escape.
   Figure 42



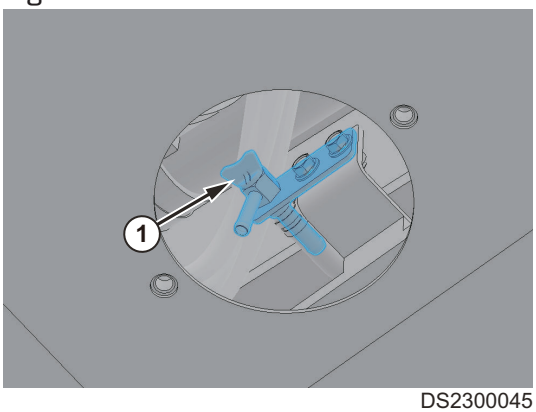
DS2300043

3. Remove mounting bolts and under cover (1) from frame.
   Figure 43



DS2300044

4. Place a container under valve and open the drain valve (1).
   Figure 44



DS2300045

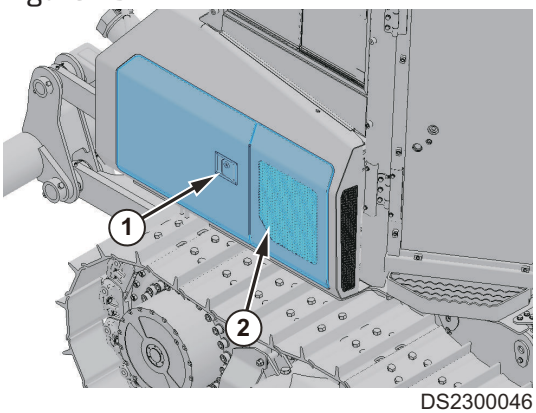
   - Coolant volume: 44.6 L (11.8 U.S. gal)

     NOTE: *Dispose of drained fluids according to local applicable environmental laws and regulations.*

     For details, refer to Change Radiator Coolant of Operation Manual

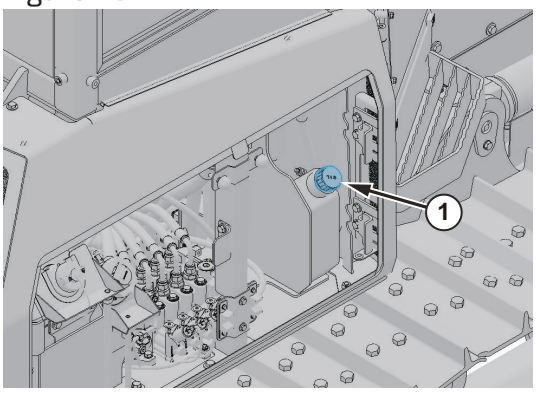
Hydraulic Oil

1. Open right side doors (1, 2).
   Figure 45



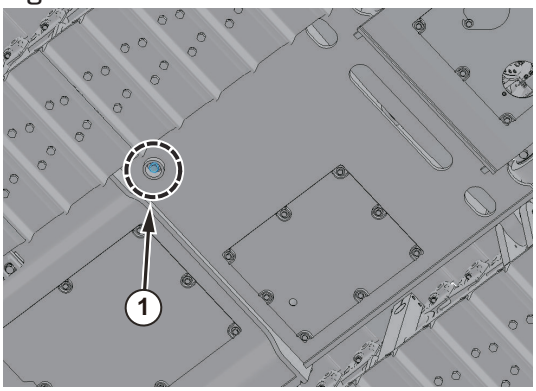
DS2300046

2. Remove hydraulic oil fill cap (1) from tank.
   Figure 46



DS2300047

3. Position a container under hydraulic tank drain plug.
   Figure 47



DS2300048

4. Remove hydraulic oil drain plug (1) from oil tank.
5. Drain hydraulic oil.
   - Hydraulic tank level: 74 L (19.5 U.S. gal)

     NOTE: *Dispose of drained fluids according to local applicable environmental laws and regulations.*

     For details, refer to Hydraulic Oil Tank - Removal and Installation.

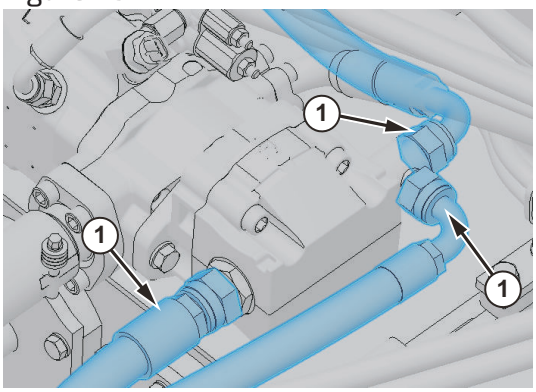
Hydraulic Hoses and Fittings

1. When disconnecting the hose, oil left in the hose may flow out. Therefore, place the end of the hose into a suitable container to prevent contamination of the ground and environment.
   Figure 48

EX1504170

2. Disconnect the hoses and adapters from fan pump.

Figure 49



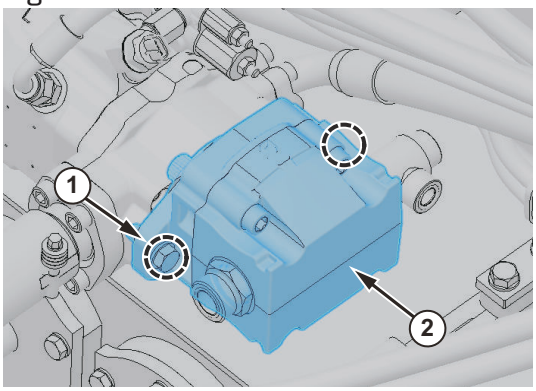
DS2200890

NOTE: *Attach identification tags to the removed hoses for reassembling. After disconnecting hoses from fan pump, plug them to prevent dirt or dust from entering. Disconnect the hoses from the bottom to top of fan pump.*

Fan Pump

1. Tie pump with rope to lift it.

Figure 50

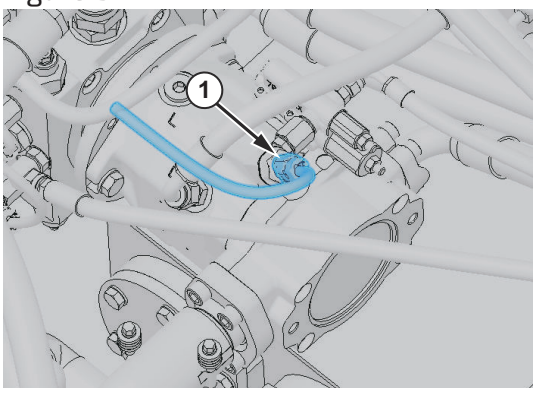


DS2200891

2. Remove mounting bolts (1) and fan pump (2) from main pump.
   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
   - Fan pump weight: about 15 kg (33 lb)

Wiring Harness

1. Turn Off the battery disconnect switch.
   Figure 51



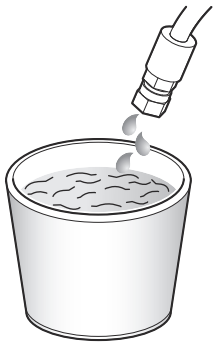
DS2200911

2. Disconnect harness connectors (1) from main pump.

   NOTE: *Check the location of the connectors before disconnecting. Be careful not to let water get into electrical components. If water gets into electrical system, this will cause an electrical short circuit and result in improper machine operation.*

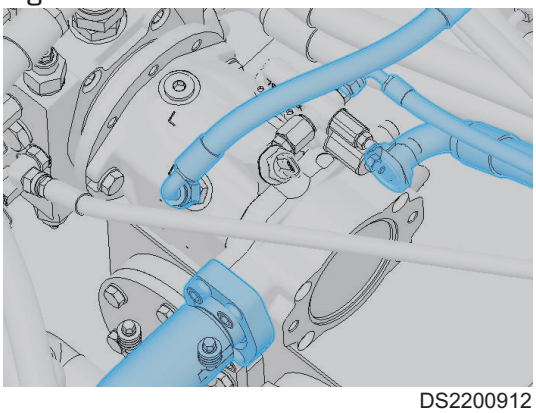
Hydraulic Hoses and Fittings

1. When disconnecting the hose, oil left in the hose may flow out. Therefore, place the end of the hose into a suitable container to prevent contamination of the ground and environment.
   Figure 52



EX1504170

2. Disconnect the hoses and adapters from main pump.
   Figure 53

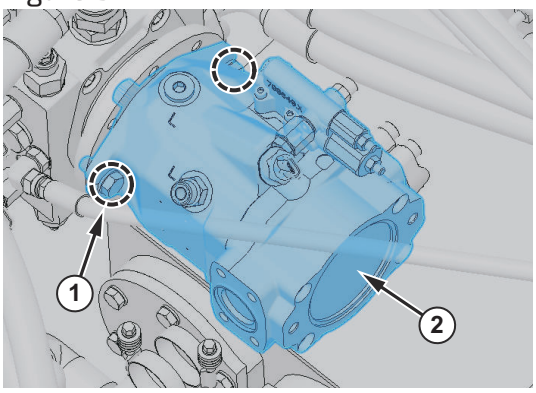


DS2200912

   NOTE: *Attach identification tags to the removed hoses for reassembling. After disconnecting hoses from main pump, plug them to prevent dirt or dust from entering. Disconnect the hoses from the bottom to top of main pump.*

Main Pump

1. Tie pump with rope to lift it.
   Figure 54

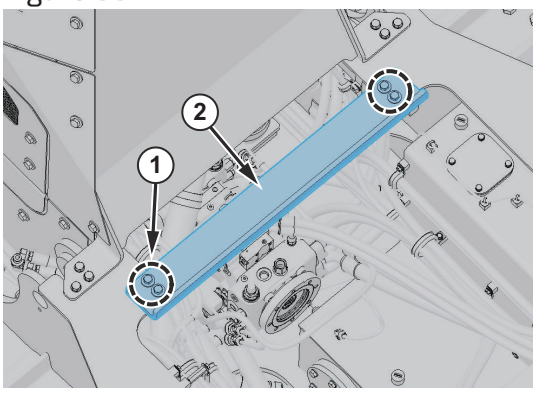


DS2200913

2. Remove mounting bolts (1) and main pump (2) from HST pump.
   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
   - Main pump weight: about 28 kg (61.7 lb)

Support

1. Remove bolts (1) from support (2).
   Figure 55

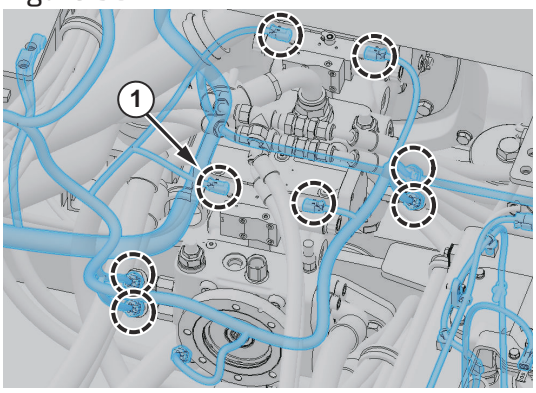


DS2201831

   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
2. Remove support (2).

Wiring Harness

1. Disconnect harness connectors (1) from HST pump.
   Figure 56



DS2201832

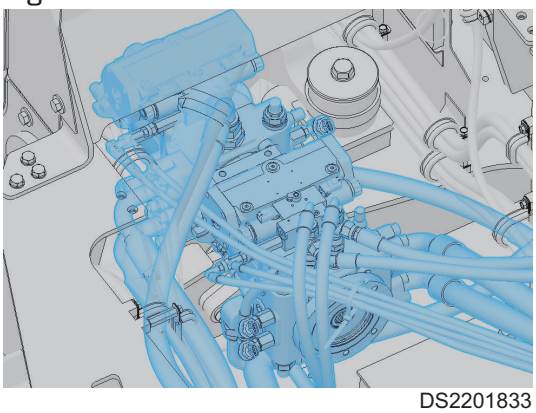
NOTE: *Check the location of the connectors before disconnecting. Be careful not to let water get into electrical components. If water gets into electrical system, this will cause an electrical short circuit and result in improper machine operation.*

Hydraulic Hoses and Fittings

1. When disconnecting the hose, oil left in the hose may flow out. Therefore, place the end of the hose into a suitable container to prevent contamination of the ground and environment.
   Figure 57

EX1504170

2. Disconnect the hoses and adapters from HST pump.
   Figure 58

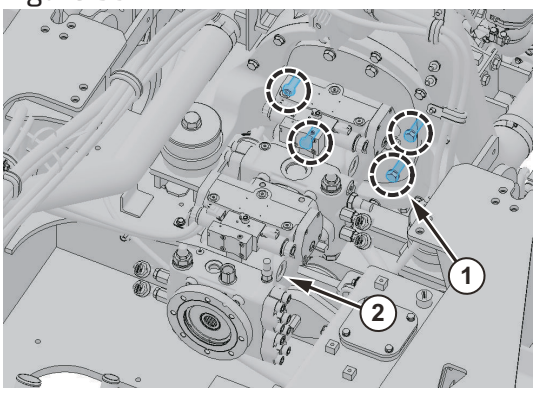


DS2201833

NOTE: *Attach identification tags to the removed hoses for reassembling. After disconnecting hoses from HST pump, plug them to prevent dirt or dust from entering. Disconnect the hoses from the bottom to top of HST pump.*

HST Pump

1. Remove bolts (1) (4 ea) of pump without top bolts (2) (2 ea).
   Figure 59

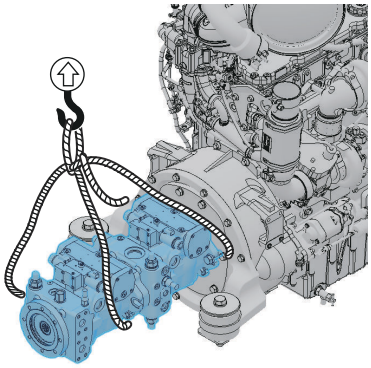


DS2201834

   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)

     NOTE: *Apply adhesive (Loctite #262) to the mounting bolt.*

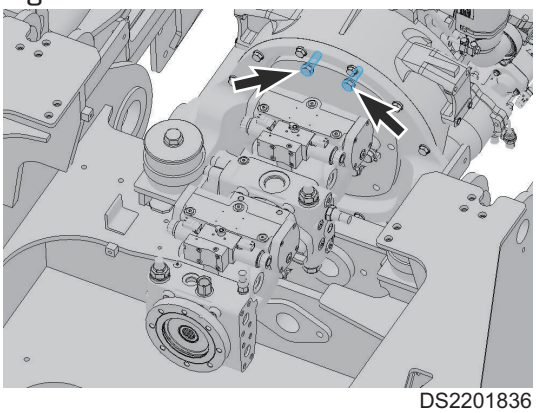
2. Attach a lifting device around pump. Raise the lifting device until the pump is supported prior to removing remaining bolts (2 ea).
   Figure 60



DS2201835

   - Weight: about 110 kg (242.5 lb)

3. Remove remaining bolts (2 ea).
   Figure 61



DS2201836

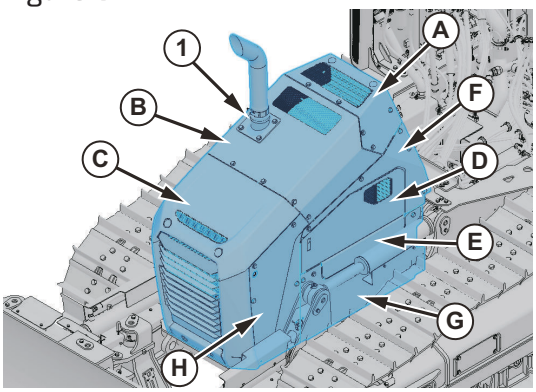
   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)

NOTE: *Apply adhesive (Loctite #262) to the mounting bolt.*

4. Lift the pump from engine slowly and carefully.

Front Cover

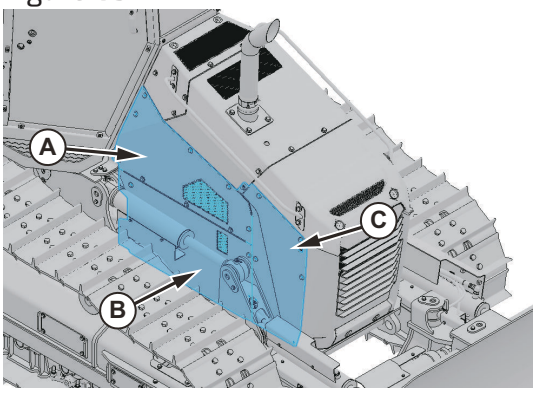
1. Remove V-clamp and muffler pipe.
   Figure 62



DS2300040

2. Remove the muffler cover (1).
   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
   - Weight: about 4 kg (8.8 lb)
3. Remove bolts from all left side front cover.
   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
   - (A) Cover Weight: about 9 kg (19.8 lb)
   - (B) Cover Weight: about 22 kg (48.5 lb)
   - (C) Cover Weight: about 35 kg (77.2 lb)
   - (D) Cover Weight: about 10 kg (22.0 lb)
   - (E) Cover Weight: about 3 kg (6.6 lb)
   - (F) Cover Weight: about 3 kg (6.6 lb)
   - (G) Cover Weight: about 12 kg (26.5 lb)
   - (H) Cover Weight: about 7 kg (15.4 lb)

4. Remove bolts from all right side front cover.
   Figure 63

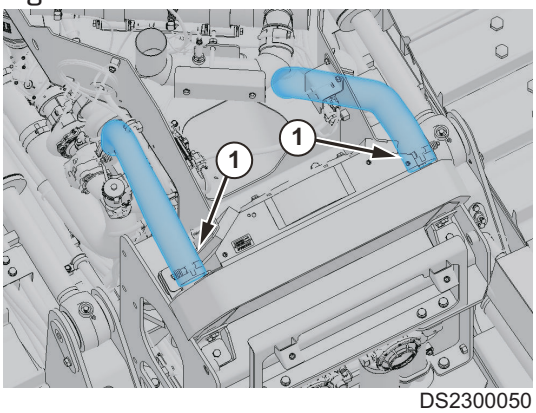


DS2300049

- Tool: 19 mm ( )
- Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
- (A) Cover Weight: about 8 kg (17.6 lb)
- (B) Cover Weight: about 13 kg (28.7 lb)
- (C) Cover Weight: about 7 kg (15.4 lb)

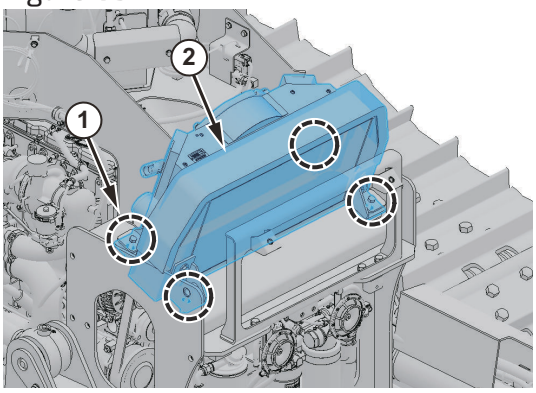
Front Radiator

1. Remove V-clamp and CAC hose (1).
   Figure 64



DS2300050

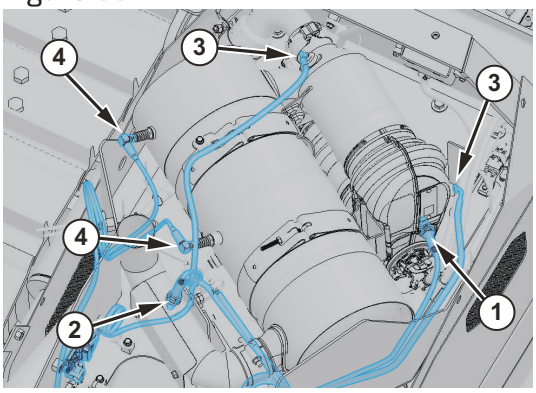
2. Remove bolts (1) and front radiator (2).
   Figure 65



DS2300051

Muffler Assembly

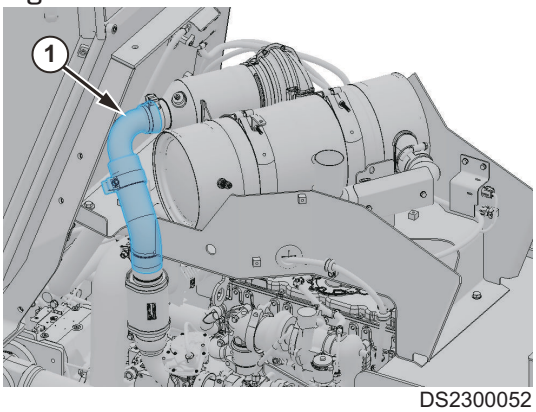
1. Disconnect NOx upstream sensor (1).
   Figure 66



DS2300041

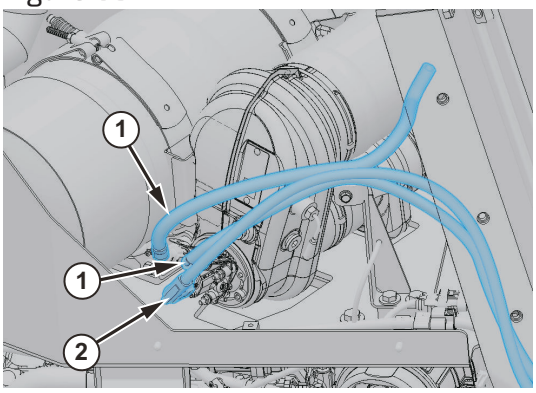
   - Torque: 49.0 N.m (5 kg.m, 36.2 ft lb)
2. Disconnect NOx downstream sensor (2).
   - Torque: 49.0 N.m (5 kg.m, 36.2 ft lb)
3. Disconnect temperature sensor (3).
   - Torque: 19.6 N.m (2 kg.m, 14.5 ft lb)
4. Disconnect soot sensor (4).
   - Torque: 1.2 N.m (0.12 kg.m, 0.9 ft lb)
5. Disconnect wiring harness.
6. Disconnect any additional electrical connections as necessary.

   NOTE: *Be careful not to let water get into electrical components (sensor, connectors). If water gets into electrical system, this will cause an electrical short circuit and result in improper machine operation.*
7. Remove V-clamp and exhaust hose (1).
   Figure 67



DS2300052

8. Remove water hose (1).
   Figure 68

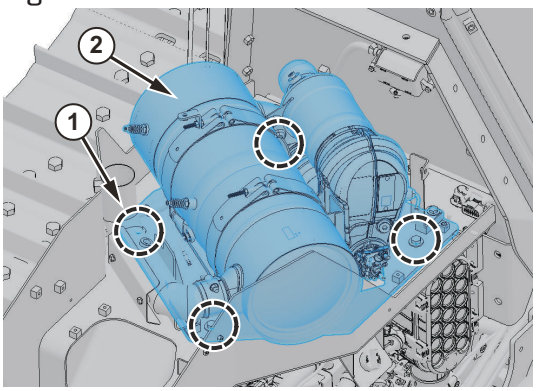


DS2300053

9. Remove DEF (AdBlue) hose (2).

   NOTE: *Be sure to use vinyl gloves disconnect DEF (AdBlue) hose.*

10. Disconnect any additional hoses as necessary.
11. Remove bolts (1) and muffler assembly (2).
    Figure 69

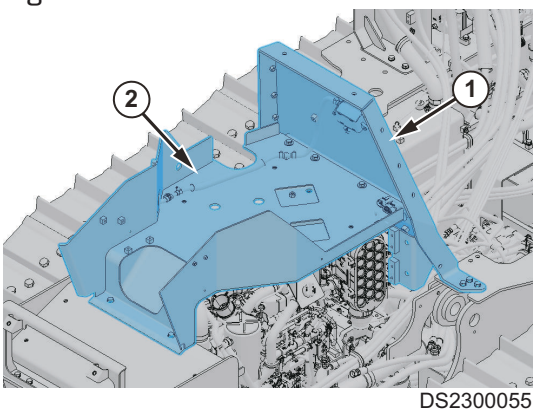


DS2300054

- Tool: 19 mm ( )
- Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)

Air Cleaner and Support

1. Separate the air cleaner and hose to remove the support.
   Figure 70



DS2300055

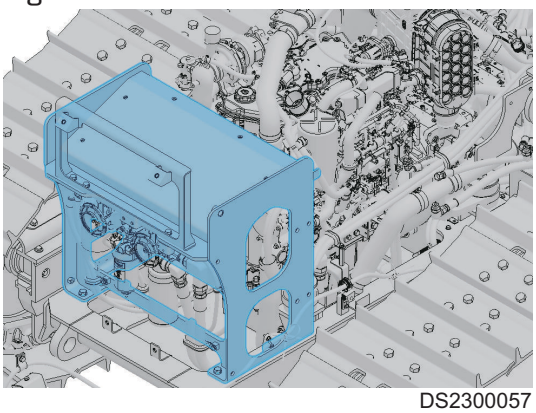
2. Remove mounting bolts from side support (1) and middle support (2).

   - Tool: 19 mm ( )

- Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)

3. Remove side support and middle support.
   - Side support weight: about 46 kg (101.4 lb)
   - Middle support weight: about 45 kg (99.2 lb)
4. Separate the filters and hoses to remove the front support.

Figure 71



DS2300057

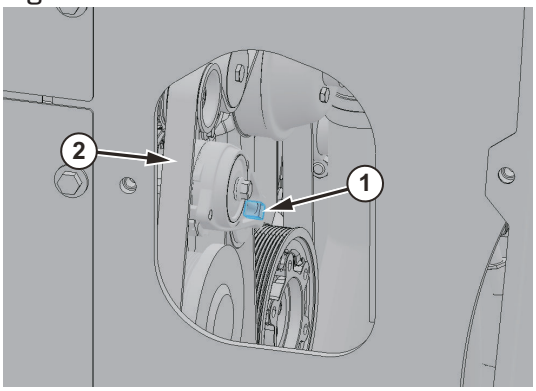
5. Remove side support and middle support.
   - Tool: 22 mm ( )
   - Torque: 176.5 N.m (18 kg.m, 130.2 ft lb)
   - Front support weight: about 85 kg (187.4 lb)

V-belt

1. Insert the tool into the auto tensioner service hole (1).

   NOTE: *Before removing the belt, check the belt layout.*

Figure 72



DS2201841

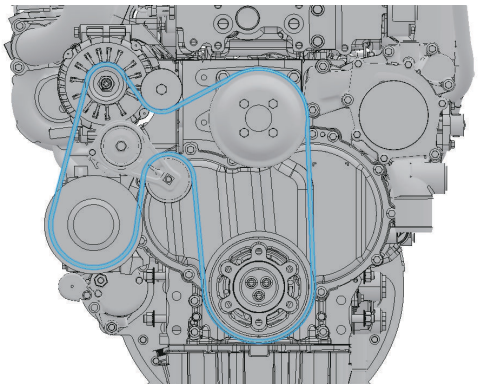
2. Turn the auto tensioner with tool clockwise to loosen and put away the V-belt (2).

   NOTE: *If reusing V-belt, mark the rotation direction on the belt.*

3. Carefully release the tension.

4. Remove tool from auto tensioner service hole.

Figure 73



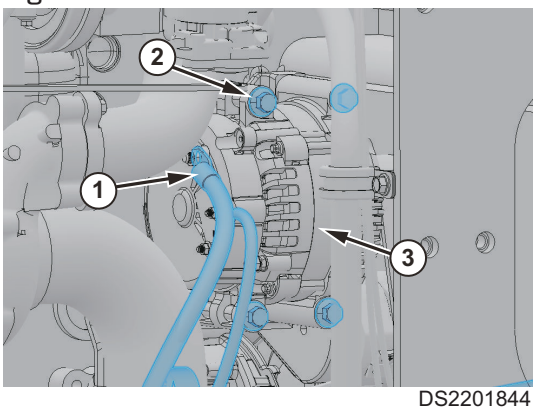
DS2201842

NOTE: *If equipped air conditioner compressor, please refer to V-belts layout.*

Wiring Harness

1. Disconnect wire harnesses (1) from alternator (3).

Figure 74



DS2201844

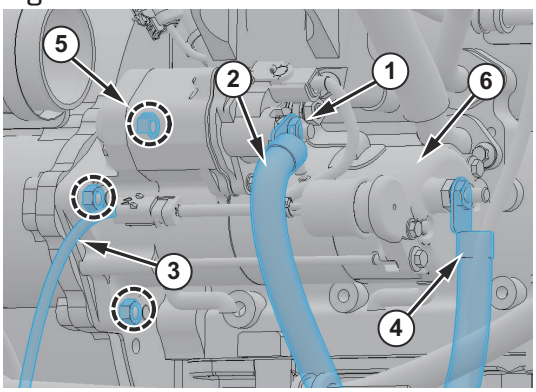
Alternator Assembly

1. Remove the mounting bolts (2) from alternator.
2. Remove the alternator (3) from engine.

Cable

1. Remove nut (1) from starter motor.

Figure 75



DS2201849

2. Disconnect the positive cable (2) from starter motor.
3. Disconnect the wiring harness (3) from starter relay.

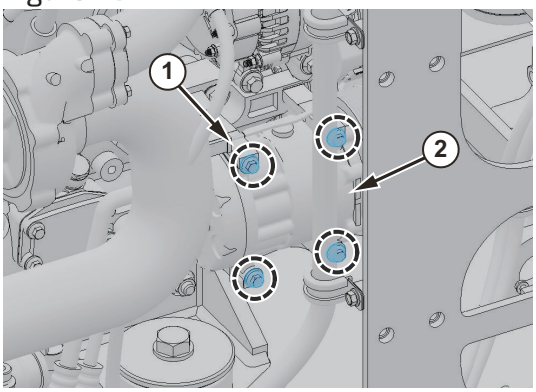
4. Remove mounting bolt and ground cable (4).

Starter Motor

1. Remove mounting bolts (5) from starter motor.
2. Remove starter motor (6).

Air Conditioner Compressor

1. Remove mounting bolts (4ea, 1) from air conditioner compressor.
   Figure 76



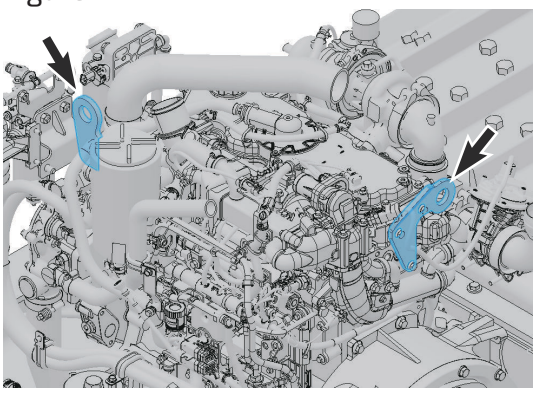
DS2300056

2. Separate air conditioner compressor (2) from engine.

   NOTE: *Do not disconnect air conditioner hoses from compressor.*

Engine Mount

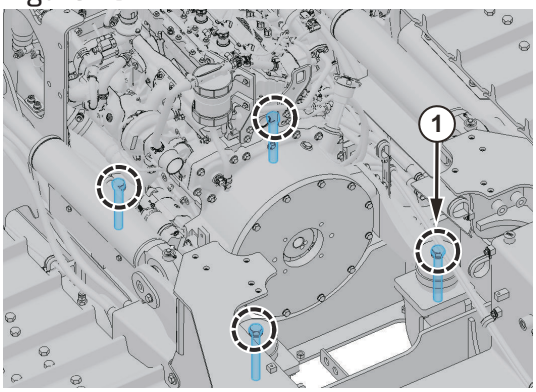
1. Attach a lifting device at lifting point.
   Figure 77



DS2300058

- Engine weight: about 570 kg (1256.6 lb)

2. Remove the engine mounting bolts (1).
   Figure 78



   - Tool: 30 mm ( )
   - Torque: 451 N.m (46 kg.m, 333 ft lb)

   NOTE: *Apply adhesive (Loctite #262) to the mounting bolt.*

   NOTE: *Mark the location of the bolts before removing.*

   NOTE: *Check the location of the engine mounting rubbers before removing.*

3. Lift the engine assembly from machine slowly and carefully.

Engine Assembly

1. Disconnect engine wire harness from engine.
2. Install the engine to the engine stand.
3. Transfer parts as needed.

Installation

1. Perform installation in the reverse order to removal.

Hydraulic Systems And Structure

Safety Instructions

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Instructions are necessary before operating or servicingmachine. Read and understand the Operation & Maintenance Manual and signs (decals) on machine. Followwarnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correctfunction after adjustments repairs or service. Untrainedoperators and failure to follow instructions can cause deathor serious injury.

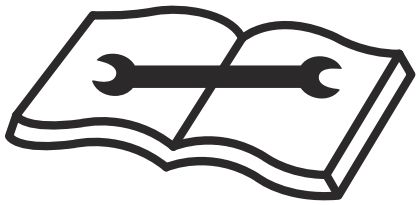
Before Removing and Installing

Preparatory Work

1. Park the machine on level ground. And lower front attachment to the ground.
2. Set parking brake switch to the parking position and then stop the engine.
3. Turn battery disconnect switch to "OFF" position.
4. Release the remaining pressure in the hydraulic circuit.
5. Cool down the hydraulic system and engine.
6. Attach a maintenance warning tag on controls.

General Precaution

1. Always read the safety section before removing and Installing.
   Figure 79



DS1901903

2. Mark the location of the bolts before removing.
3. Keep in the mind the order for tightening bolts.
4. Tighten bolts by hands, then using the tool.
5. If reusing the bolts, clean threads and apply thread locker to threads prior to installation.
6. Mark the location of wire harness connectors and hoses before disconnecting.
7. Be careful not to damage all components.
8. Do not reused gaskets, O-ring and adhesive bolts.

Completing Work

1. Check oil, coolant and fuel leak from the machine.
2. Check all oil level and if necessary, add oil.
3. Fill up the fuel tank to the standard level.
4. Apply grease to all lubrication points.
5. When fuel component has been disconnected, air must be bled from circuit.
   For details, see the Operation and Maintenance Manual.
6. When hydraulic component has been disconnected, air must be bled from circuit.
   For details, see the Operation and Maintenance Manual.
7. Start the engine and run at low idle for about 5 minutes.
8. Perform the machine performance test.

Drive Coupling

Repair Procedure Quick Guide

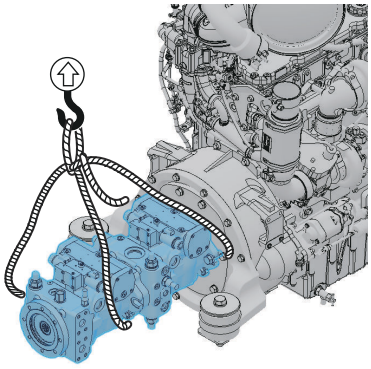
Step-A. Remove HST pump

Step-B. Remove drive coupling

Removal

HST Pump

1. Remove the HST pump.
   Figure 80



DS2201835

   For details, refer to HST pump - Removal and Installation.

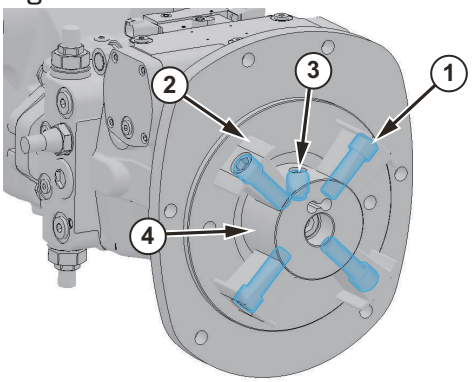
   When the pump is removed from an engine, the hub and insert would be attached on the pump.

Drive Coupling Assembly

HST Pump Side

1. Remove bolts (1) and inserts (2) from the hub (4).

   Figure 81



DS2300061

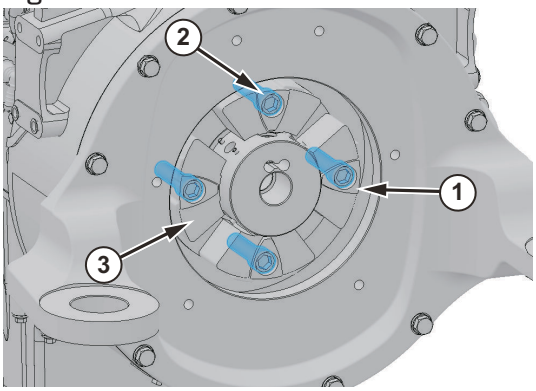
   - Torque: 215.7 N.m (22 kg.m, 159.1 ft lb)

2. Remove clamp screws (3) and hub (4) from the main pump shaft.
   - Torque: 205.9 N.m (21 kg.m, 151.9 ft lb)

Engine Side

1. Remove element (1) and bolts (2) with inserts (3) and spring pins from flywheel.

   Figure 82



DS2300060

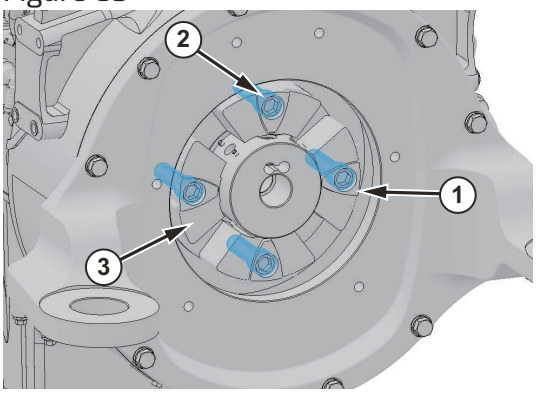
   - Torque: 215.7 N.m (22 kg.m, 159.1 ft lb)

Installation

Drive Coupling

Engine Side

1. Install bolts (2) and inserts (3) with element (1) to flywheel.
   Figure 83

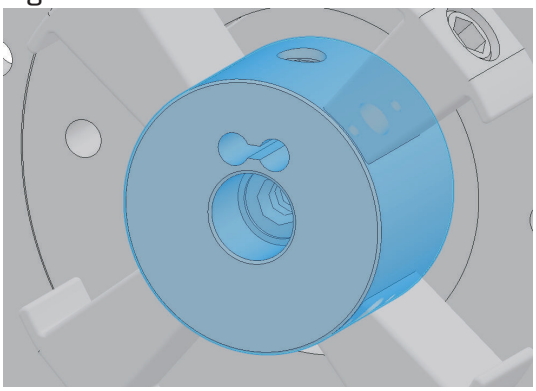


DS2300060

   - Torque: 215.7 N.m (22 kg.m, 159.1 ft lb)

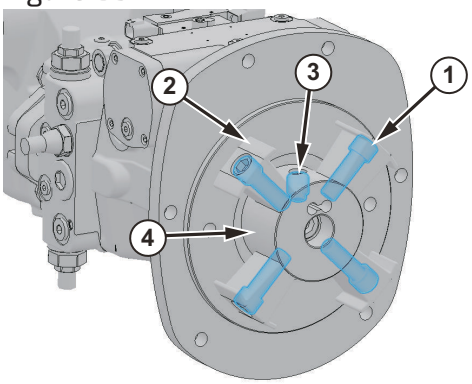
HST Pump Side

1. Check the "E" mark on the hub, it is must install toward engine side.
   Figure 84



DS2300062

2. Clearance between from pump shaft to coupling hub must be 1.85 mm.
3. Install clamp screws (3) and hub (4) to the main pump shaft.
   Figure 85



DS2300061

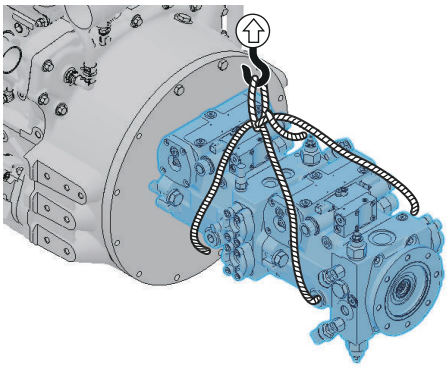
   - Torque: 205.9 N.m (21 kg.m, 151.9 ft lb)

     NOTE: *Apply adhesive (Loctite #262) to the clamp screws*

4. Install bolts (1) and inserts (2) to the hub (4).
   - Torque: 215.7 N.m (22 kg.m, 159.1 ft lb)

HST Pump Assembly

1. Install the HST pump assembly.
   Figure 86



DS2200919

For details, refer to HST Pump - Removal and Installation.

NOTICE

Element is not resistant to bonding compounds, oil or grease.
Be careful not to expose them to it.

Remove oil or dirt from flywheel cover and pump shaft before assembly.

Undercovers

Repair Procedure Quick Guide

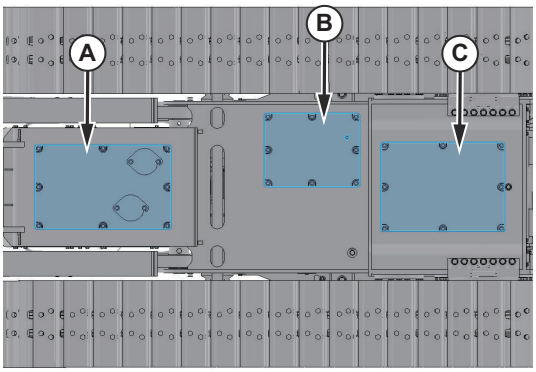
Step-A. Place the machine in the suitable service position

Step-B. Remove Undercovers

Removal

Undercovers

1. Position the machine on even, firm and level ground.
   Figure 87



DS2201816

2. Put attachment on ground.

   NOTE: *Place the machine in the suitable service position*

3. Remove undercovers.
   - Undercover (A)
     - Tool: 19 mm ( )
     - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
     - Weight: about 12 kg (26.5 lb)
   - Undercover (B)
     - Tool: 19 mm ( )
     - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
     - Weight: about 8 kg (17.6 lb)
   - Undercover (C)
     - Tool: 19 mm ( )
     - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
     - Weight: about 12 kg (26.5 lb)

Installation

1. Perform installation in the reverse order to removal.

Joystick Valve(Work Lever)

Repair Procedure Quick Guide

Step-A. Remove armrest

Step-B. Remove left stand covers

Step-C. Remove left joystick

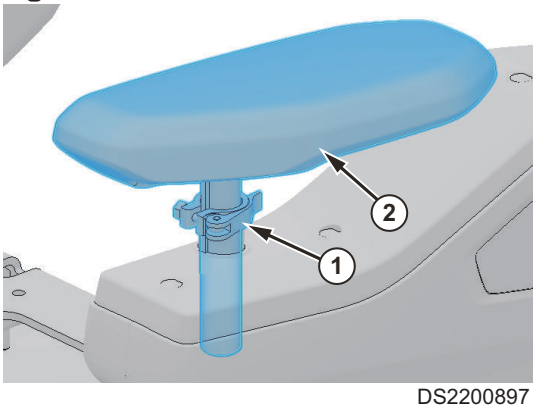
Step-D. Remove right stand covers

Step-E. Remove right joystick

Removal

Armrest

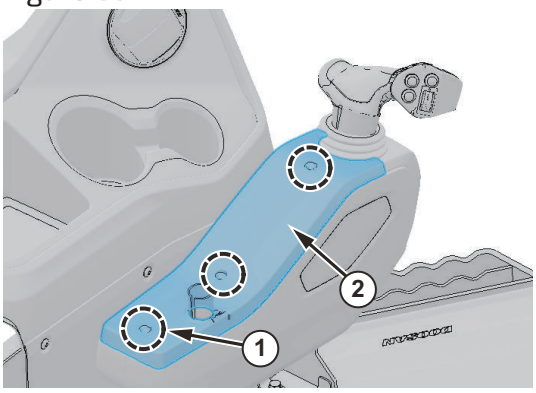
1. Remove the arm rest (2) by pulling the lever (1) of the arm rest.
   Figure 88



DS2200897

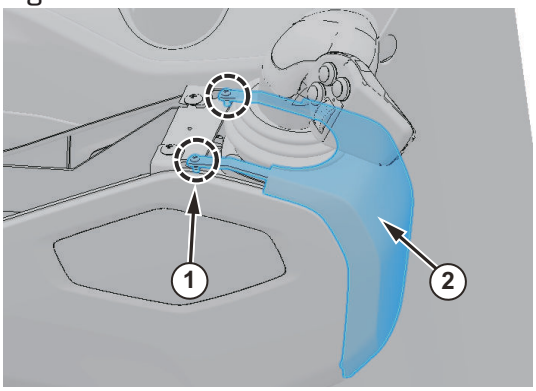
Stand Cover - Left Side

1. Remove the cap and bolts (1) from armrest bracket.
   Figure 89



DS2200898

2. Remove left stand cover (2).
3. Remove the bolts (1) from armrest bracket.
   Figure 90

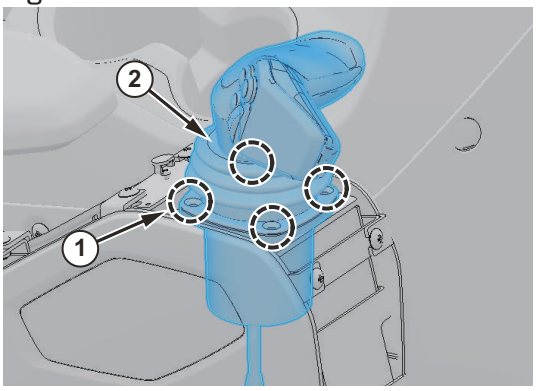


DS2200899

4. Remove left stand cover (2).

Left Joystick

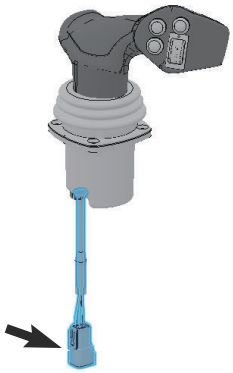
1. Remove the bolts (1) from armrest bracket.
   Figure 91



DS2200900

2. Remove left joystick (2).

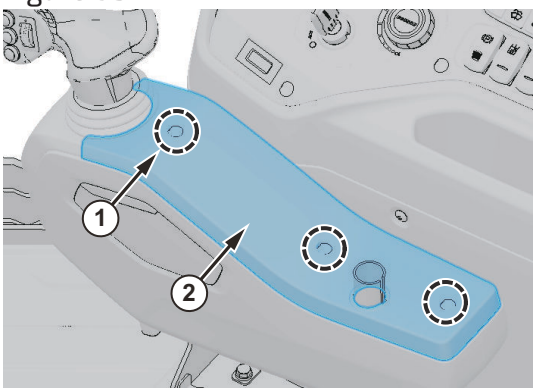
3. Disconnect harness connector.
   Figure 92



DS2200904

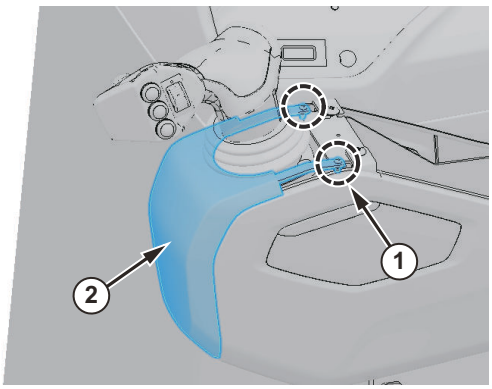
Stand Cover - Right Side

1. Remove the cap and bolts (1) from armrest bracket.
   Figure 93



DS2200901

2. Remove right stand cover (2).
3. Remove the bolts (1) from armrest bracket.
   Figure 94

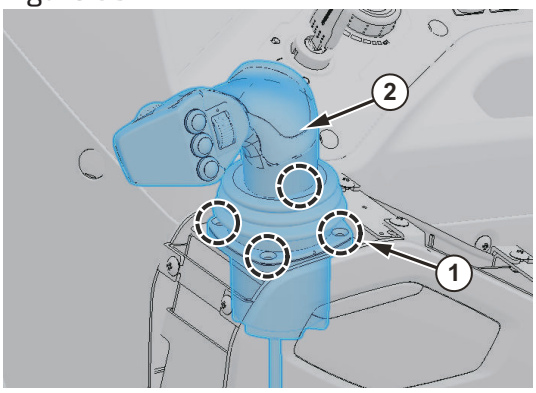


DS2200902

4. Remove right stand cover (2).

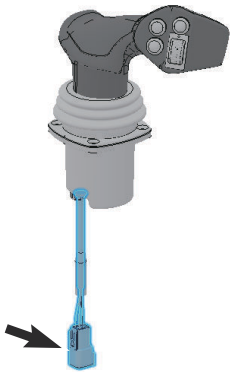
Right Joystick

1. Remove the bolts (1) from armrest bracket.
   Figure 95



DS2200903

2. Remove right joystick (2).
3. Disconnect harness connector.
   Figure 96



DS2200904

Installation

⚠ WARNING

INCORRECT INSTALLATION CAN CAUSE DEATH OR SERIOUS INJURY

Any change in the connections will lead to malfunctions.

- When connecting hydraulic components, observe the specified piping according to the hydraulic schematic diagram of the machine.

1. Perform installation in the reverse order to remove.
2. Keep the assembly angle when installing the hoses to joystick valve.

Main Control Valve

Repair Procedure Quick Guide

Step-A. Open right side doors

Step-B. Disconnect wiring harness

Step-C. Disconnect hydraulic hoses and fittings

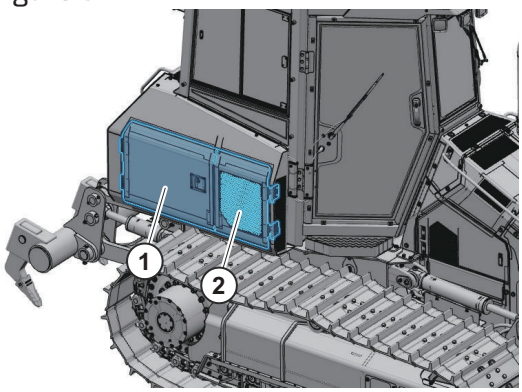
Step-D. Remove main control valve

Removal

1. Turn OFF the battery disconnect switch.

Right Side Doors

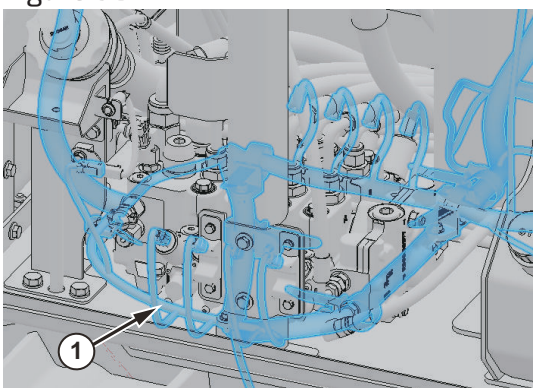
1. Open the right side doors (1, 2).
   Figure 97



DS2201158

Wiring Harness

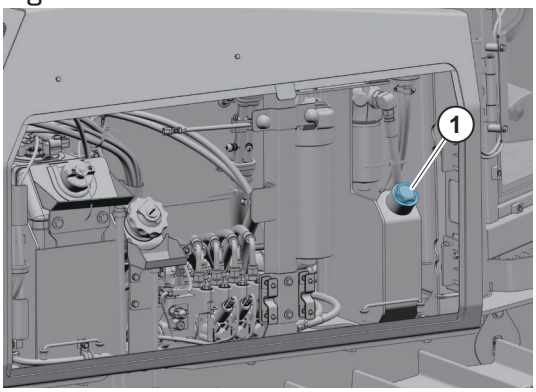
1. Disconnect wiring harnesses (1) from MCV assembly.
   Figure 98



DS2200877

Hydraulic Hoses and Fittings

1. Loosen the oil tank cap (1) slowly to release the pressure inside the hydraulic oil tank. Opening the oil tank cap the air is discharged to the atmosphere from the top of the hydraulic oil tank.
   Figure 99

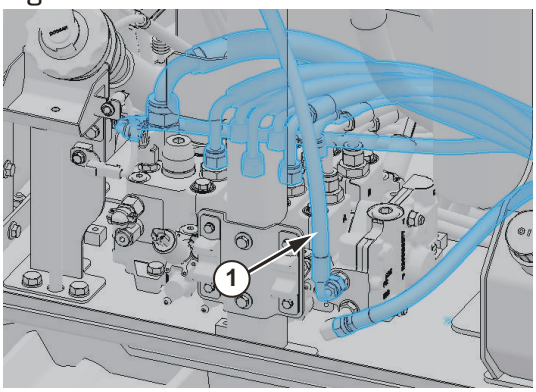


DS2300784

2. When disconnecting the hose, oil left in the hose may flow out. Therefore, place the end of the hose into a suitable container to prevent contamination of the ground and environment.
   Figure 100

EX1504170

3. Remove hose and adapters (1) from main control valve.
   Figure 101

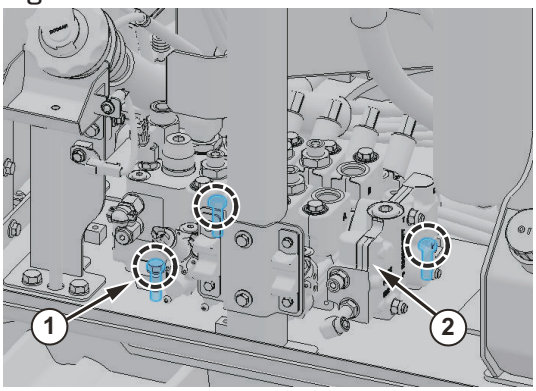


DS2200878

NOTE: *Attach identification tags to the removed hoses for reassembling. After disconnecting hoses from main control valve, plug them to prevent dirt or dust from entering. Disconnect the hoses from the bottom to top of control valve.*

Main Control Valve

1. Remove mounting bolts (1) from frame.
   Figure 102



DS2200879

- Tool: 17 mm ( )
- Torque: 63.7 N.m (6.5 kg.m, 47.0 ft lb)
- Main control valve weight: about 40.8 kg (90 lb)

NOTE: *Apply adhesive (Loctite #262) to the mounting bolt.*

2. Remove the main control valve (2) from frame.

Installation

1. Perform installation in the reverse order to removal.
2. After completing the work, check the oil level.
3. Start the engine and check for any oil leaks.

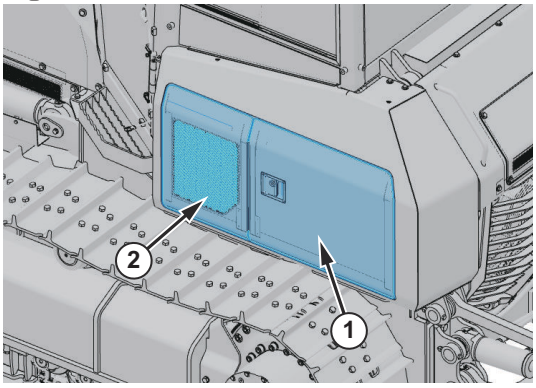
Main Pump

Repair Procedure Quick Guide

Step-A. Tilt the cabin
Step-B. Remove hoses under the cabin
Step-C. Remove window washer tank
Step-D. Remove cabin tilting cylinder
Step-E. Disconnect wiring harness connectors
Step-F. Remove the cabin
Step-G. Disconnect hydraulic hoses and fittings
Step-H. Remove fan pump
Step-I. Disconnect wiring harness
Step-J. Disconnect hydraulic hoses and fittings
Step-K. Remove main pump

Removal

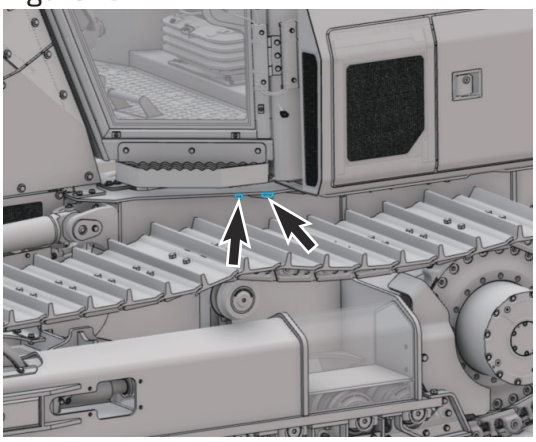
1. Open the left side door (1, 2).
   Figure 103



DS2200849

Tilt the Cabin

1. To operate cabin tilting system, remove bolts and nuts under the cabin.
   Figure 104

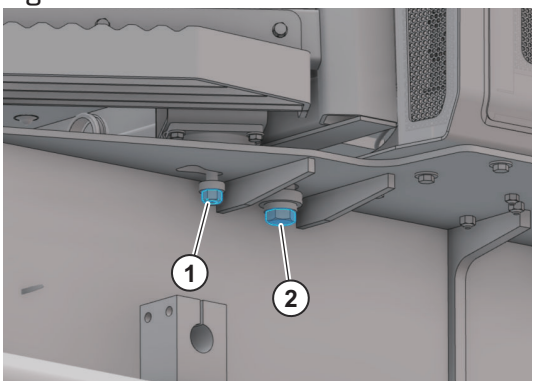


DS2201285

   NOTE: *Both the left/right bolts of the cabin must be removed.*

   NOTE: *Failure to remove bolts can cause serious damage to the machine.*

2. Remove nuts (1).
   Figure 105

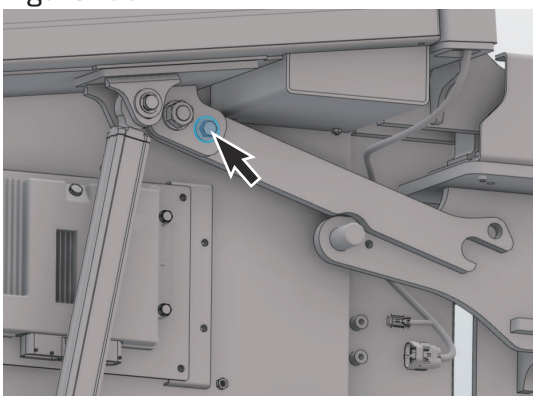


DS2201286

   - Tool: 24 mm ( )
   - Torque: 215.7 N.m (22 kg.m, 159 ft lb)

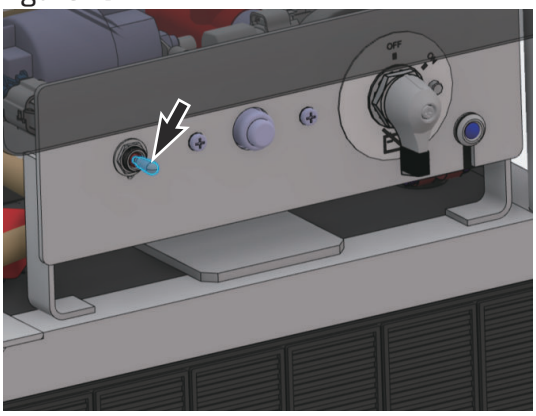
3. Remove bolts (2).
   - Tool: 36mm ( )
   - Torque: 127.4 N.m (13 kg.m, 94 ft lb)

4. Remove the bolts and washer on the safety bar. Safety bar is located in left side door.
   Figure 106



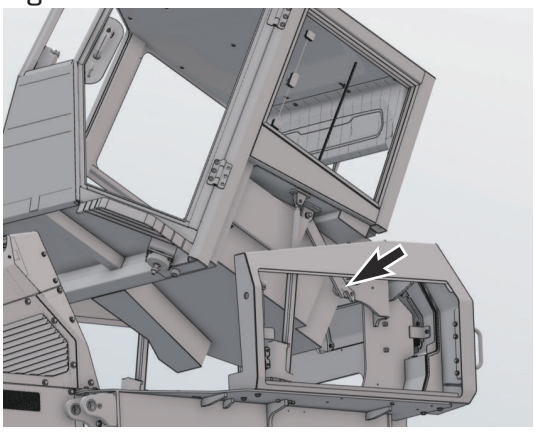
DS2201290

5. Turn cabin tilting switch to “ON” position.
   Figure 107



DS2201287

6. When the cabin tilting is completed, make sure the safety bar is fully engaged to the end and tighten the bolts and washers that were removed in step 4.
   Figure 108



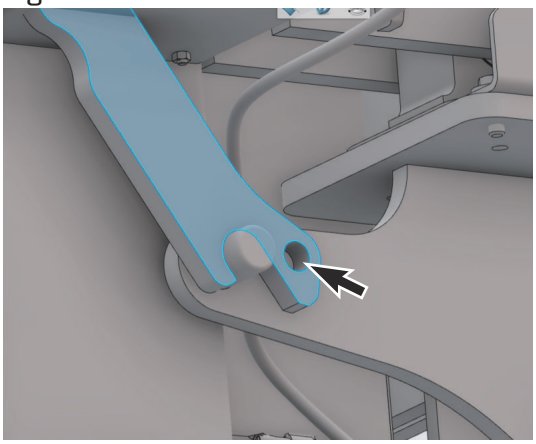
DS2201288

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Always check the installation of the safety bar during tilt operation.
It can cause death or serious injury.

Figure 109

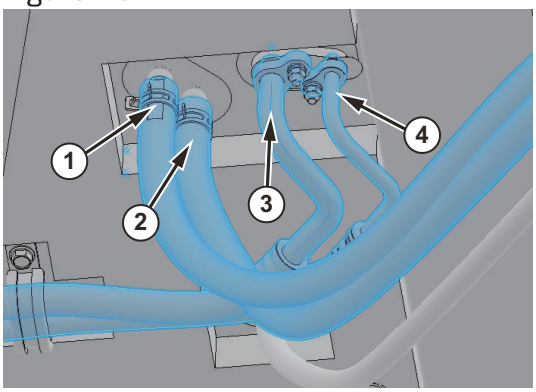


DS2201289

Hoses

1. Remove the heater hose (1).

Figure 110



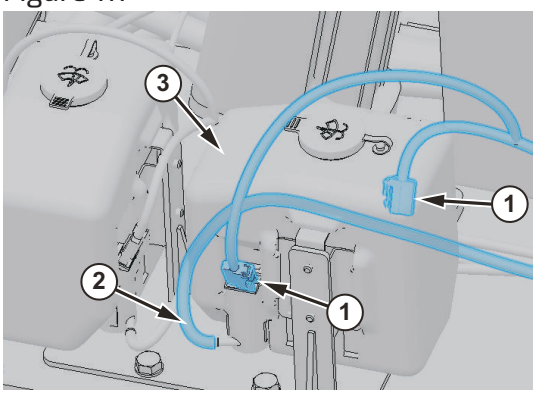
DS2200907

2. Remove the water hose (2).
3. Remove the air conditioner suction hose (3).
4. Remove the air conditioner liquid hose (4).
5. Return the tilted cabin to its original position.
6. Turn OFF the battery disconnect switch.

Window Washer Tank

1. Disconnect wiring harness (1) from window washer tank.

Figure 111

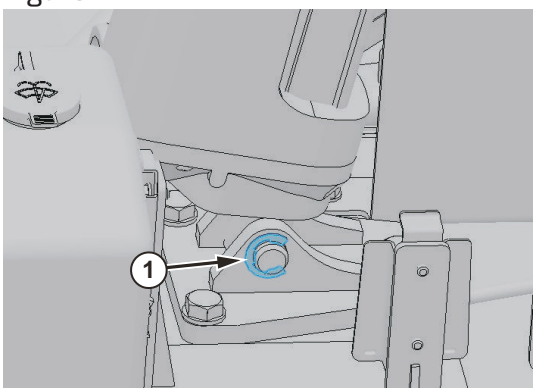


DS2200886

2. Remove water hose (2) from window washer tank.
3. Remove window washer tank (3).

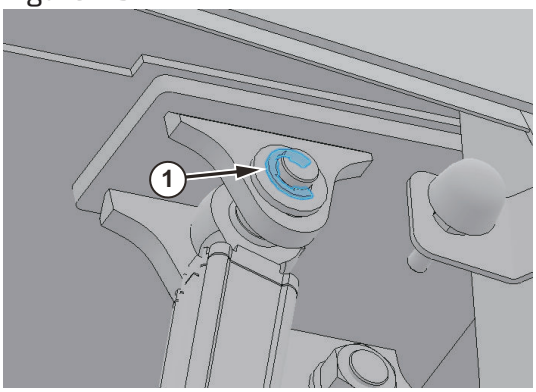
Cabin Tilting Cylinder

1. Remove the retaining ring (1) at the bottom of the cylinder.
   Figure 112



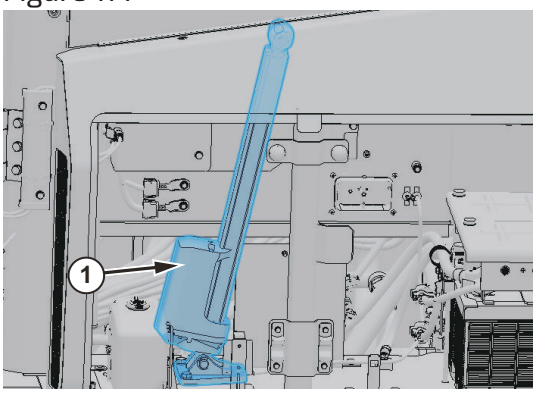
DS2200887

2. Remove the cylinder pin.
3. Remove the retaining ring (1) at the top of the cylinder.
   Figure 113



DS2200888

4. Remove the cylinder pin.
5. Remove the cabin tilting cylinder (1).
   Figure 114

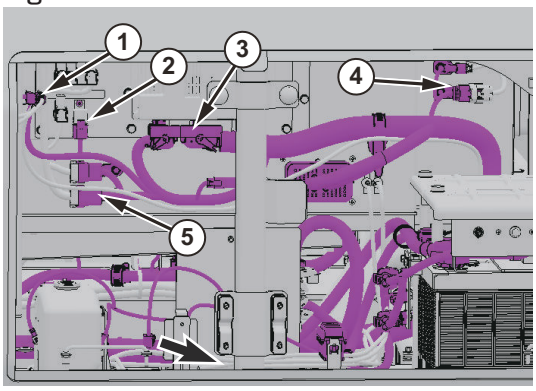


DS2200889

- Cabin tilting cylinder weight: about 10 kg (22.0 lb)

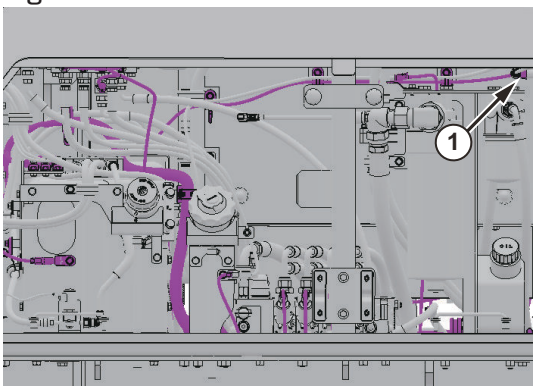
Wiring Harness Connectors

1. Disconnect wiper motor connector (1).
   Figure 115



DS2200905

2. Disconnect relay connector (2).
3. Disconnect EPOS connector (3).
4. Disconnect fan motor connector (4).
5. Disconnect wiper motor connector (1).
   Figure 116

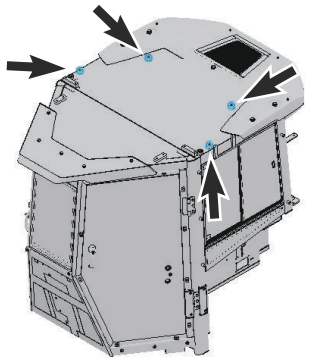


DS2200906

6. Disconnect any additional electrical connections as necessary.

Cabin

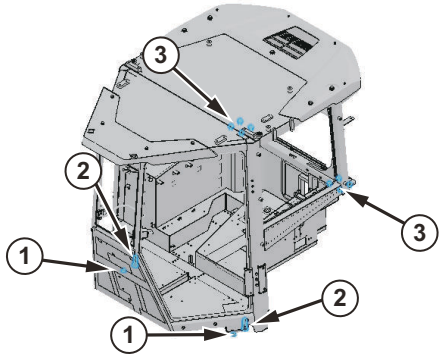
1. Using a suitable lifting device, attach slings to four lift points on top of cabin.
   Figure 117



DS2200908

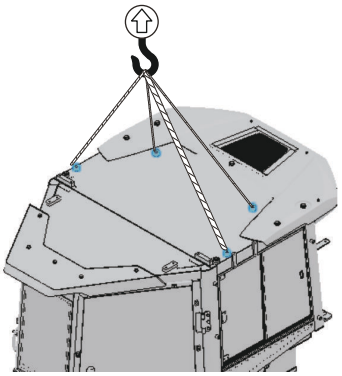
- Cabin weight: about 700 kg (1,543 lb)

2. Remove mounting nuts (1) (2 ea).
   Figure 118



DS2200909

   - Tool: 24 mm ( )
   - Torque: 205.9 N.m (21 kg.m, 151.9 ft lb)
3. Remove mounting bolts (2) (2 ea) from cabin floor.
   - Tool: 36 mm ( )
   - Torque: 127.5 N.m (13 kg.m, 94.0 ft lb))
4. Remove hinge bolts (3) (8 ea).
   - Tool: 19 mm ( )
   - Torque: 88.3 N.m (9 kg.m, 65.1 ft lb)
5. Lift cabin approximately 25 - 50 mm (1" - 2") above deck.
   Figure 119



DS2200910

6. Check that all electrical connections have been disconnected and all other items unbolted.

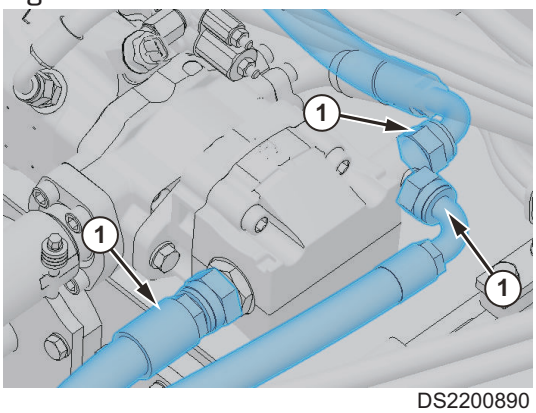
   NOTE: *Lift operator's cabin slowly to prevent damaging.*

Hydraulic Hoses and Fittings

1. When disconnecting the hose, oil left in the hose may flow out. Therefore, place the end of the hose into a suitable container to prevent contamination of the ground and environment.
   Figure 120

EX1504170

2. Disconnect the hoses and adapters from fan pump.
   Figure 121

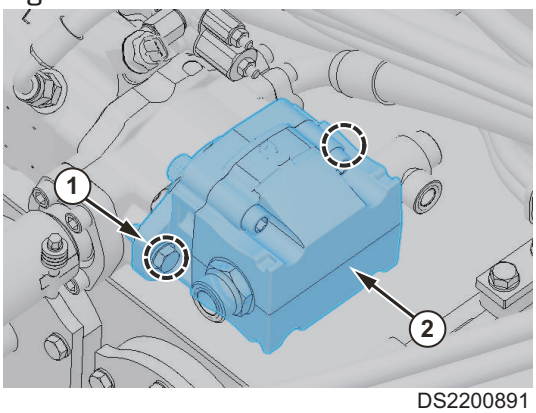


DS2200890

NOTE: *Attach identification tags to the removed hoses for reassembling. After disconnecting hoses from fan pump, plug them to prevent dirt or dust from entering. Disconnect the hoses from the bottom to top of fan pump.*

Fan Pump

1. Tie pump with rope to lift it.
   Figure 122



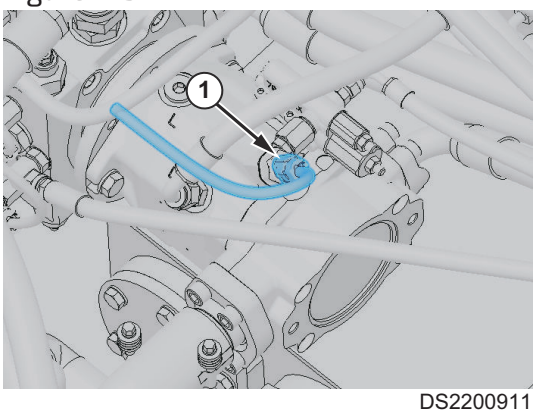
DS2200891

2. Remove mounting bolts (1) and fan pump (2) from main pump.
   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)

- Fan pump weight: about 15 kg (33 lb)

Wiring Harness

1. Turn Off the battery disconnect switch.
   Figure 123



DS2200911

2. Disconnect harness connectors (1) from main pump.

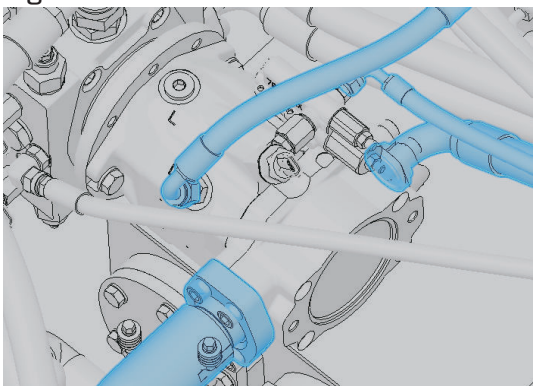
   NOTE: *Check the location of the connectors before disconnecting. Be careful not to let water get into electrical components. If water gets into electrical system, this will cause an electrical short circuit and result in improper machine operation.*

Hydraulic Hoses and Fittings

1. When disconnecting the hose, oil left in the hose may flow out. Therefore, place the end of the hose into a suitable container to prevent contamination of the ground and environment.
   Figure 124

EX1504170

2. Disconnect the hoses and adapters from main pump.
   Figure 125

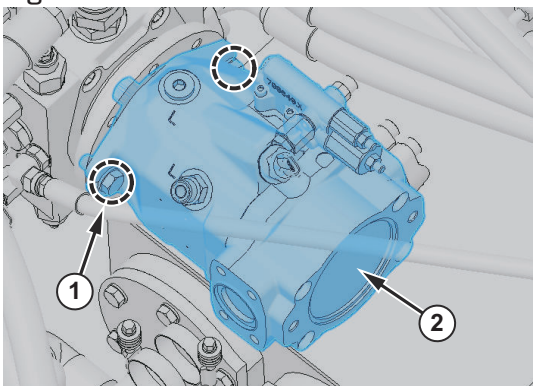


DS2200912

NOTE: *Attach identification tags to the removed hoses for reassembling. After disconnecting hoses from main pump, plug them to prevent dirt or dust from entering. Disconnect the hoses from the bottom to top of main pump.*

Main Pump

1. Tie pump with rope to lift it.
   Figure 126



DS2200913

2. Remove mounting bolts (1) and main pump (2) from HST pump.
   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
   - Main pump weight: about 28 kg (61.7 lb)

Installation

1. Perform installation in the reverse order to removal.
2. When installing the pump to engine, be careful assembling pump shaft and drive coupling. Refer to drive coupling installation.

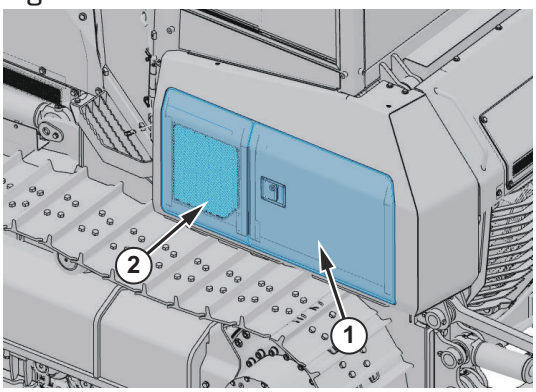
HST Pump

Repair Procedure Quick Guide

Step-A. Tilt the cabin
Step-B. Disconnect hydraulic hoses and fittings
Step-C. Remove fan pump
Step-D. Disconnect wiring harness
Step-E. Disconnect hydraulic hoses and fittings
Step-F. Remove main pump
Step-G. Remove support
Step-H. Disconnect wiring harness
Step-I. Disconnect hydraulic hoses and fittings
Step-J. Remove HST pump

Removal

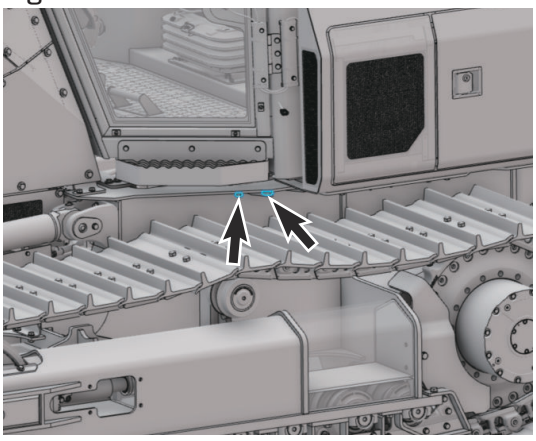
1. Open the left side door (1, 2).
   Figure 127



DS2200849

Tilt the Cabin

1. To operate cabin tilting system, remove bolts and nuts under the cabin.
   Figure 128

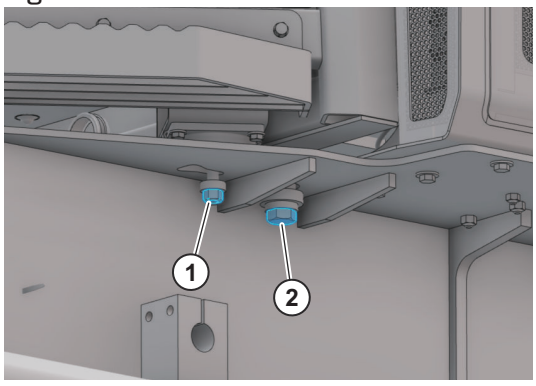


DS2201285

NOTE: *Both the left/right bolts of the cabin must be removed.*

NOTE: *Failure to remove bolts can cause serious damage to the machine.*

2. Remove nuts (1).
   Figure 129



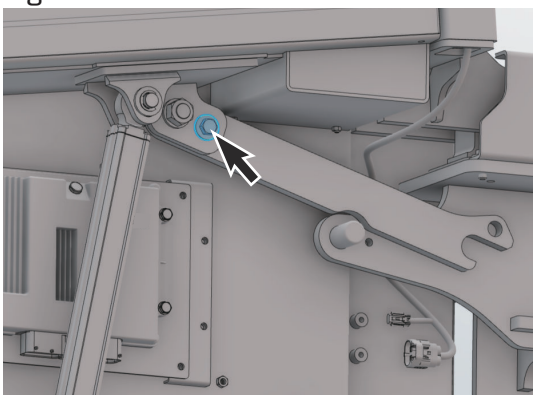
DS2201286

- Tool: 24 mm ( )
- Torque: 215.7 N.m (22 kg.m, 159 ft lb)

3. Remove bolts (2).

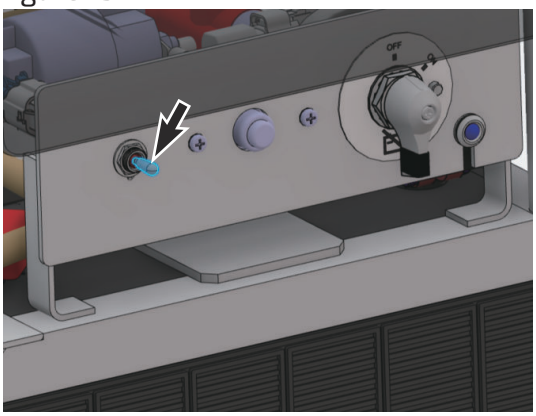
- Tool: 36mm ( )
- Torque: 127.4 N.m (13 kg.m, 94 ft lb)

4. Remove the bolts and washer on the safety bar. Safety bar is located in left side door.
   Figure 130



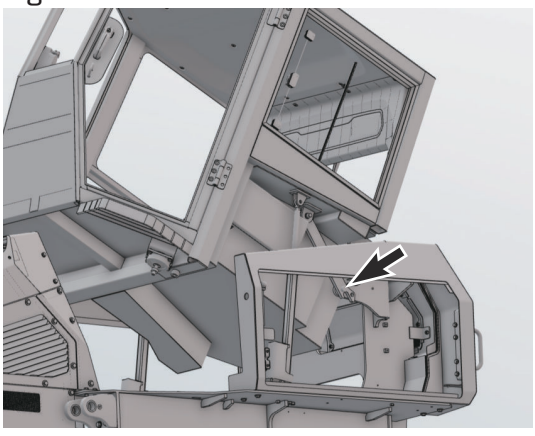
DS2201290

5. Turn cabin tilting switch to "ON" position.
   Figure 131



DS2201287

6. When the cabin tilting is completed, make sure the safety bar is fully engaged to the end and tighten the bolts and washers that were removed in step 4.
   Figure 132



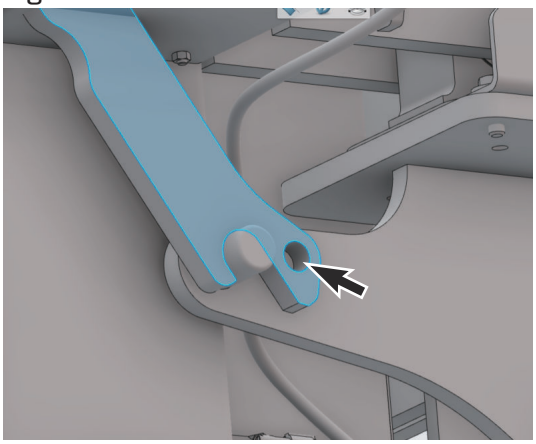
DS2201288

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Always check the installation of the safety bar during tilt operation. It can cause death or serious injury.

Figure 133



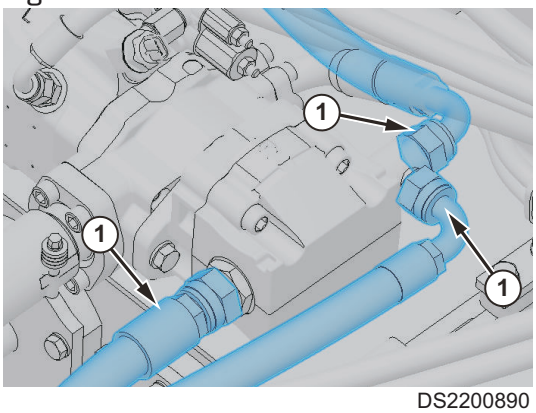
DS2201289

Hydraulic Hoses and Fittings

1. When disconnecting the hose, oil left in the hose may flow out. Therefore, place the end of the hose into a suitable container to prevent contamination of the ground and environment.
   Figure 134

EX1504170

2. Disconnect the hoses and adapters from fan pump.
   Figure 135

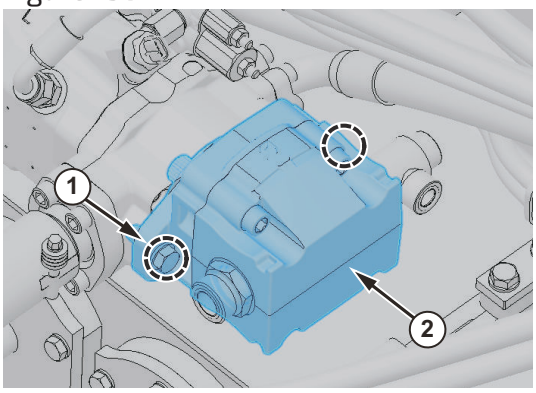


DS2200890

NOTE: *Attach identification tags to the removed hoses for reassembling. After disconnecting hoses from fan pump, plug them to prevent dirt or dust from entering. Disconnect the hoses from the bottom to top of fan pump.*

Fan Pump

1. Tie pump with rope to lift it.
   Figure 136

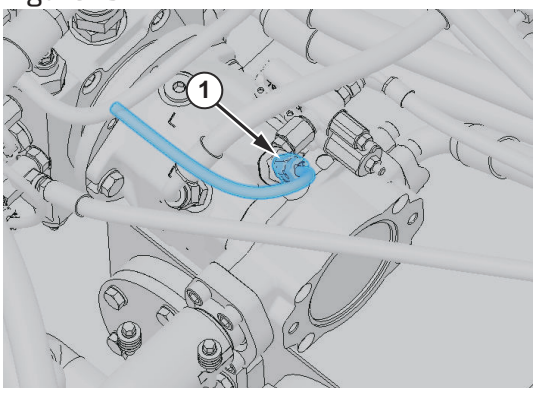


DS2200891

2. Remove mounting bolts (1) and fan pump (2) from main pump.
   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
   - Fan pump weight: about 15 kg (33 lb)

Wiring Harness

1. Turn Off the battery disconnect switch.
   Figure 137



DS2200911

2. Disconnect harness connectors (1) from main pump.

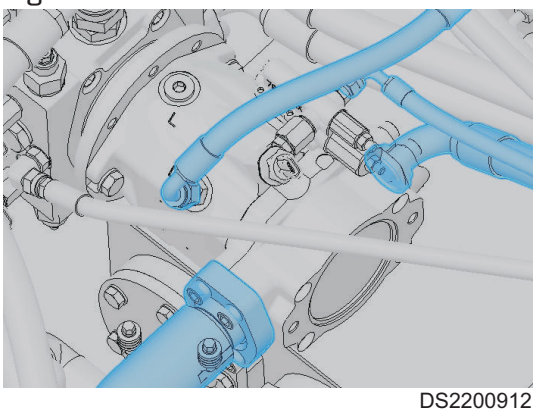
   NOTE: *Check the location of the connectors before disconnecting. Be careful not to let water get into electrical components. If water gets into electrical system, this will cause an electrical short circuit and result in improper machine operation.*

Hydraulic Hoses and Fittings

1. When disconnecting the hose, oil left in the hose may flow out. Therefore, place the end of the hose into a suitable container to prevent contamination of the ground and environment.
   Figure 138

EX1504170

2. Disconnect the hoses and adapters from main pump.
   Figure 139

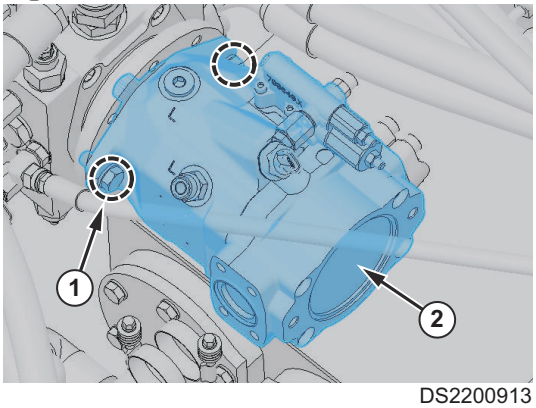


DS2200912

NOTE: *Attach identification tags to the removed hoses for reassembling. After disconnecting hoses from main pump, plug them to prevent dirt or dust from entering. Disconnect the hoses from the bottom to top of main pump.*

Main Pump

1. Tie pump with rope to lift it.
   Figure 140



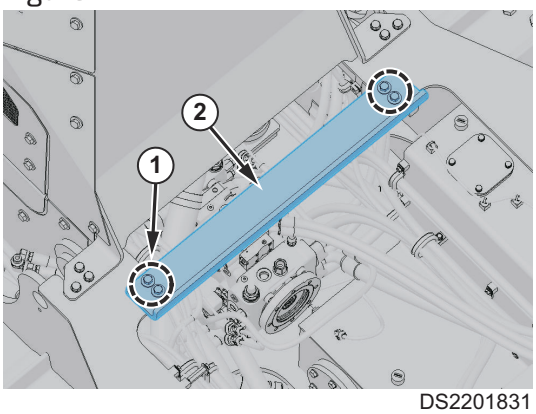
DS2200913

2. Remove mounting bolts (1) and main pump (2) from HST pump.
   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)

- Main pump weight: about 28 kg (61.7 lb)

Support

1. Remove bolts (1) from support (2).
   Figure 141

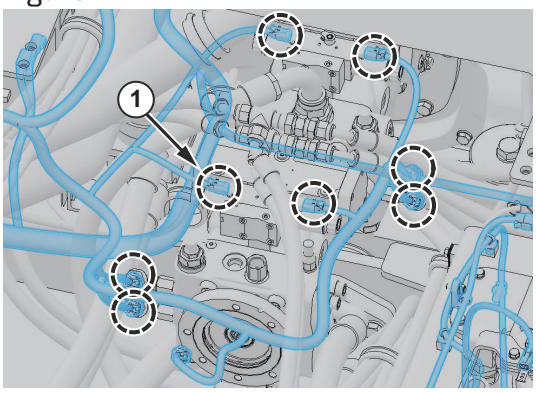


DS2201831

   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
2. Remove support (2).

Wiring Harness

1. Disconnect harness connectors (1) from HST pump.
   Figure 142



DS2201832

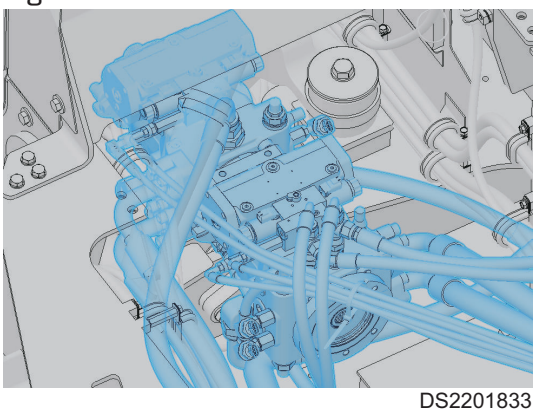
   NOTE: *Check the location of the connectors before disconnecting. Be careful not to let water get into electrical components. If water gets into electrical system, this will cause an electrical short circuit and result in improper machine operation.*

Hydraulic Hoses and Fittings

1. When disconnecting the hose, oil left in the hose may flow out. Therefore, place the end of the hose into a suitable container to prevent contamination of the ground and environment.
   Figure 143

EX1504170

2. Disconnect the hoses and adapters from HST pump.
   Figure 144

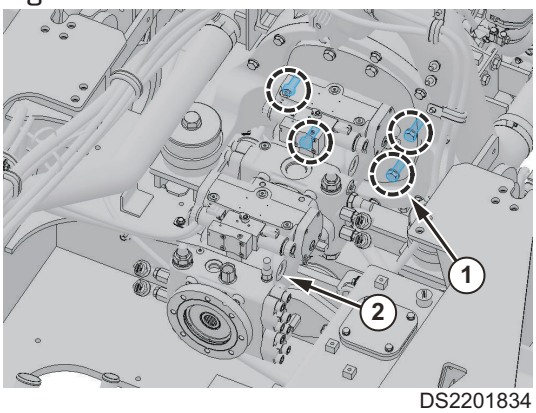


DS2201833

NOTE: *Attach identification tags to the removed hoses for reassembling. After disconnecting hoses from HST pump, plug them to prevent dirt or dust from entering. Disconnect the hoses from the bottom to top of HST pump.*

HST Pump

1. Remove bolts (1) (4 ea) of pump without top bolts (2) (2 ea).
   Figure 145

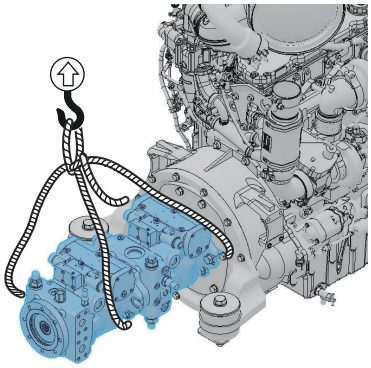


DS2201834

- Tool: 19 mm ( )
- Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)

  NOTE: *Apply adhesive (Loctite #262) to the mounting bolt.*

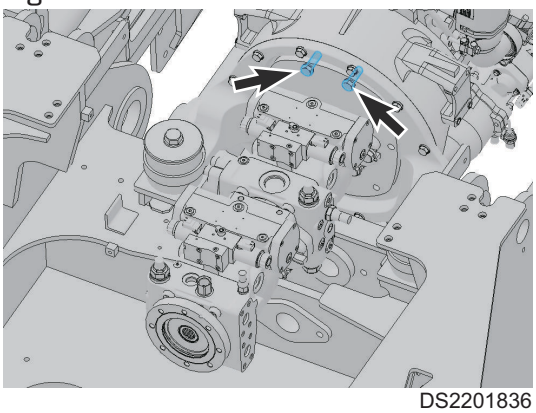
2. Attach a lifting device around pump. Raise the lifting device until the pump is supported prior to removing remaining bolts (2 ea).
   Figure 146



DS2201835

   - Weight: about 110 kg (242.5 lb)

3. Remove remaining bolts (2 ea).
   Figure 147



DS2201836

   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)

     NOTE: *Apply adhesive (Loctite #262) to the mounting bolt.*

4. Lift the pump from engine slowly and carefully.

Installation

1. Perform installation in the reverse order to removal.
2. When installing the pump to engine, be careful assembling pump shaft and drive coupling. Refer to drive coupling installation.

Hydraulic Oil Tank

Repair Procedure Quick Guide

Step-A. Tilt the cabin

Step-B. Remove hoses under the cabin

Step-C. Remove window washer tank

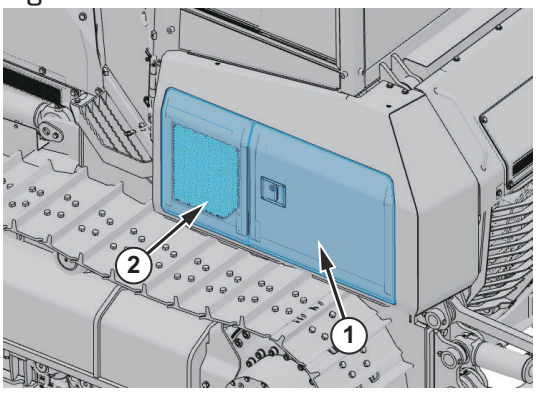
Step-D. Remove cabin tilting cylinder

Step-E. Disconnect wiring harness connectors

Step-F. Remove the cabin
Step-G. Disconnect hydraulic hoses and fittings
Step-H. Remove fan pump
Step-I. Disconnect wiring harness
Step-J. Disconnect hydraulic hoses and fittings
Step-K. Remove main pump
Step-L. Remove support
Step-M. Disconnect wiring harness
Step-N. Disconnect hydraulic hoses and fittings
Step-O. Remove HST pump
Step-P. Disconnect wiring harness
Step-Q. Disconnect hydraulic hoses and fittings
Step-R. Remove Hydraulic oil tank

Removal

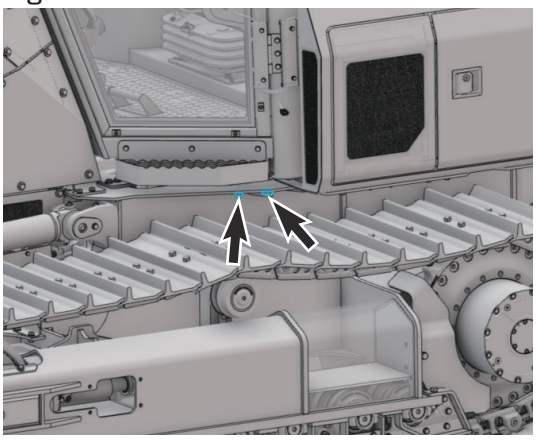
1. Open the left side door (1, 2).
   Figure 148



DS2200849

Tilt the Cabin

1. To operate cabin tilting system, remove bolts and nuts under the cabin.
   Figure 149

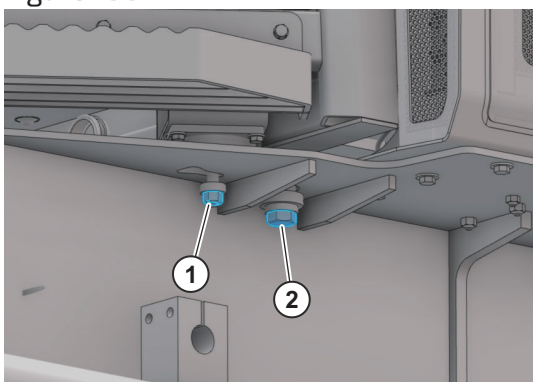


DS2201285

NOTE: *Both the left/right bolts of the cabin must be removed.*

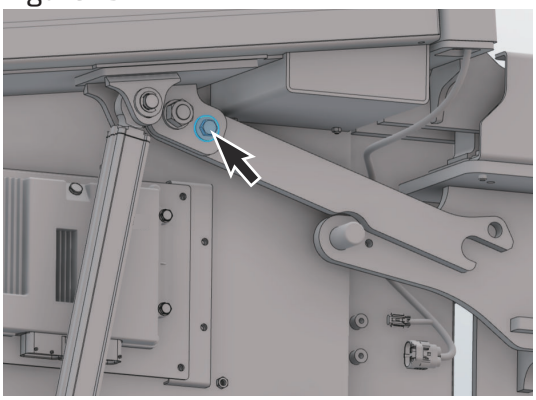
NOTE: *Failure to remove bolts can cause serious damage to the machine.*

2. Remove nuts (1).
   Figure 150



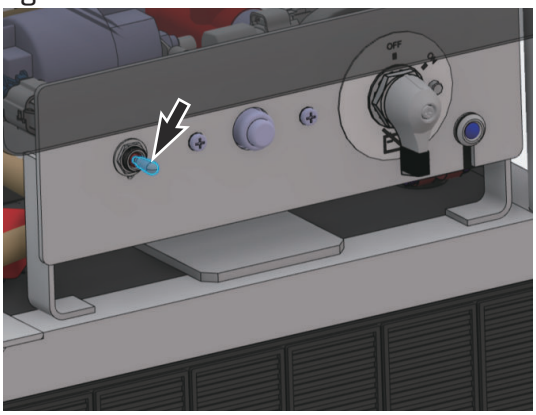
DS2201286

   - Tool: 24 mm ( )
   - Torque: 215.7 N.m (22 kg.m, 159 ft lb)
3. Remove bolts (2).
   - Tool: 36mm ( )
   - Torque: 127.4 N.m (13 kg.m, 94 ft lb)
4. Remove the bolts and washer on the safety bar. Safety bar is located in left side door.
   Figure 151



DS2201290

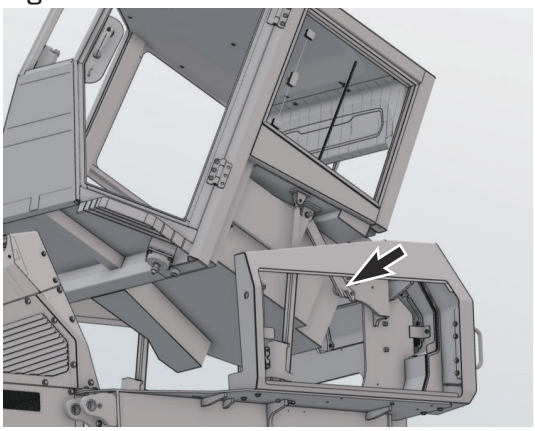
5. Turn cabin tilting switch to “ON” position.
   Figure 152



DS2201287

6. When the cabin tilting is completed, make sure the safety bar is fully engaged to the end and tighten the bolts and washers that were removed in step 4.

Figure 153



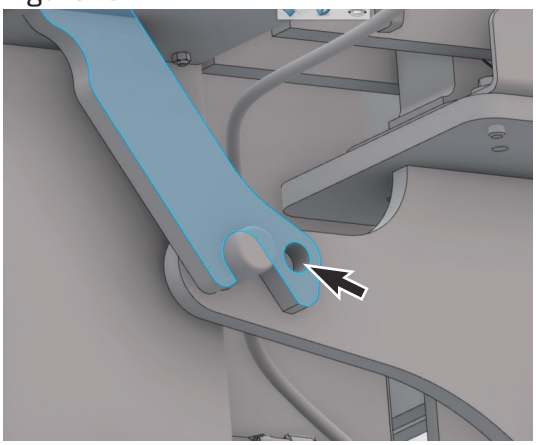
DS2201288

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Always check the installation of the safety bar during tilt operation.
It can cause death or serious injury.

Figure 154

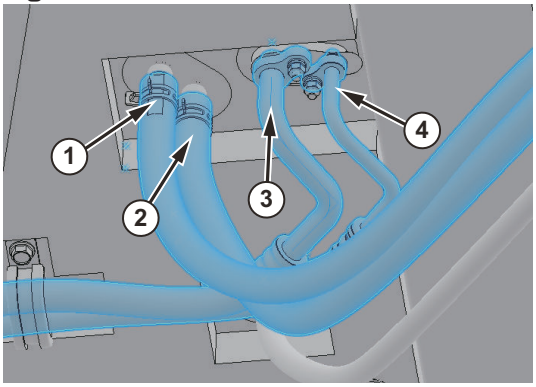


DS2201289

Hoses

1. Remove the heater hose (1).

Figure 155

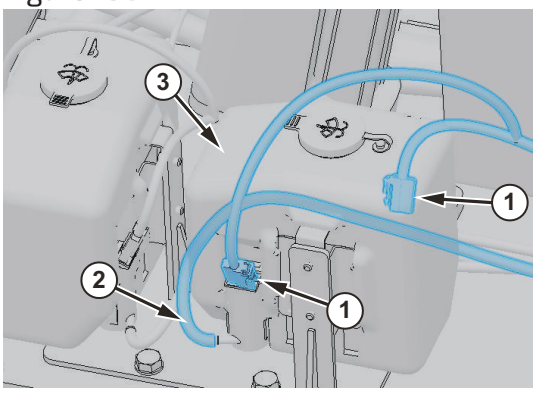


DS2200907

2. Remove the water hose (2).
3. Remove the air conditioner suction hose (3).
4. Remove the air conditioner liquid hose (4).
5. Return the tilted cabin to its original position.
6. Turn OFF the battery disconnect switch.

Window Washer Tank

1. Disconnect wiring harness (1) from window washer tank.
   Figure 156

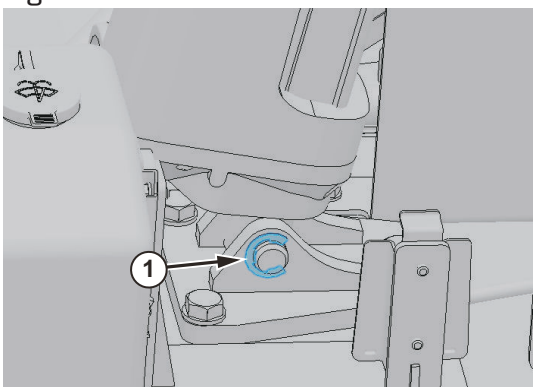


DS2200886

2. Remove water hose (2) from window washer tank.
3. Remove window washer tank (3).

Cabin Tilting Cylinder

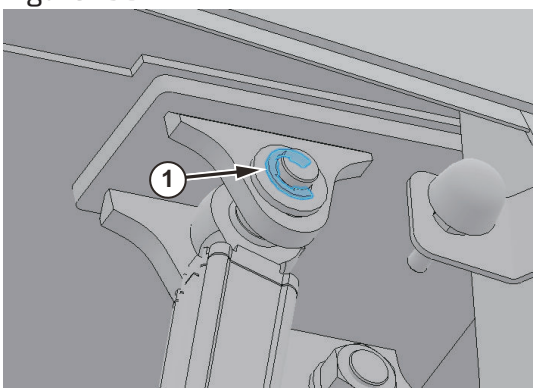
1. Remove the retaining ring (1) at the bottom of the cylinder.
   Figure 157



DS2200887

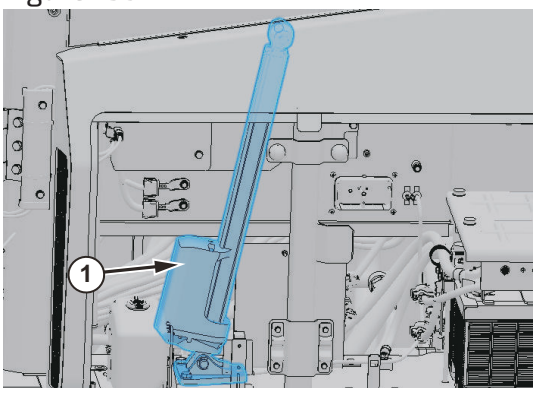
2. Remove the cylinder pin.

3. Remove the retaining ring (1) at the top of the cylinder.
   Figure 158



DS2200888

4. Remove the cylinder pin.
5. Remove the cabin tilting cylinder (1).
   Figure 159

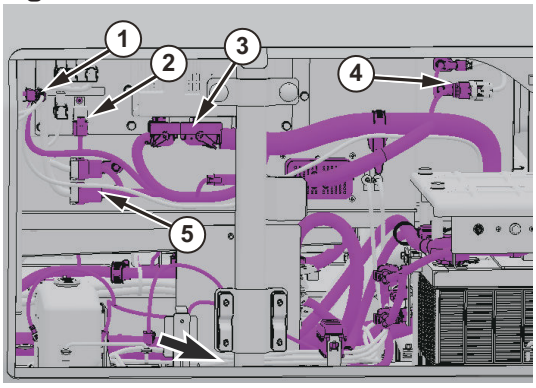


DS2200889

- Cabin tilting cylinder weight: about 10 kg (22.0 lb)

Wiring Harness Connectors

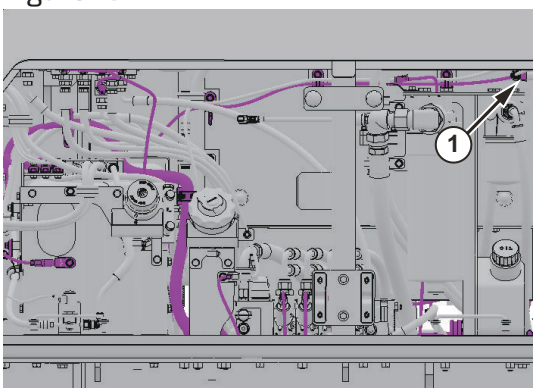
1. Disconnect wiper motor connector (1).
   Figure 160



DS2200905

2. Disconnect relay connector (2).
3. Disconnect EPOS connector (3).
4. Disconnect fan motor connector (4).

5. Disconnect wiper motor connector (1).
   Figure 161

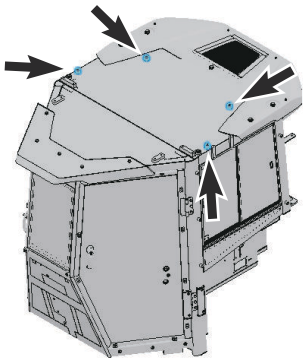


DS2200906

6. Disconnect any additional electrical connections as necessary.

Cabin

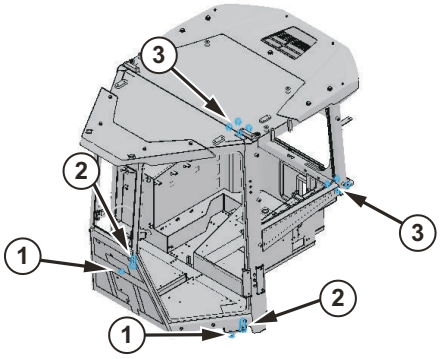
1. Using a suitable lifting device, attach slings to four lift points on top of cabin.
   Figure 162



DS2200908

   - Cabin weight: about 700 kg (1,543 lb)

2. Remove mounting nuts (1) (2 ea).
   Figure 163

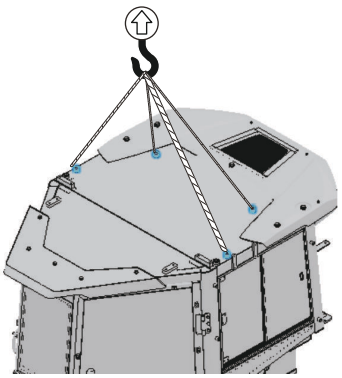


DS2200909

   - Tool: 24 mm ( )
   - Torque: 205.9 N.m (21 kg.m, 151.9 ft lb)

3. Remove mounting bolts (2) (2 ea) from cabin floor.
   - Tool: 36 mm ( )
   - Torque: 127.5 N.m (13 kg.m, 94.0 ft lb))

4. Remove hinge bolts (3) (8 ea).
   - Tool: 19 mm ( )
   - Torque: 88.3 N.m (9 kg.m, 65.1 ft lb)
5. Lift cabin approximately 25 - 50 mm (1" - 2") above deck.
   Figure 164



DS2200910

6. Check that all electrical connections have been disconnected and all other items unbolted.

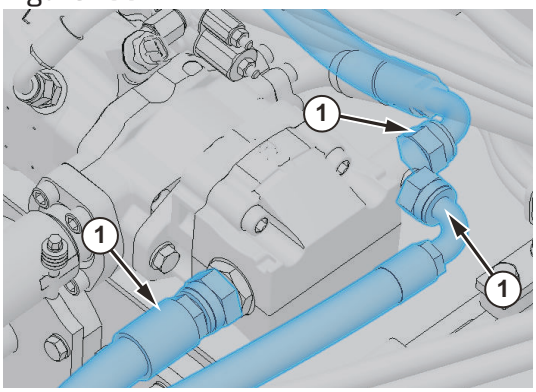
   NOTE: *Lift operator's cabin slowly to prevent damaging.*

Hydraulic Hoses and Fittings

1. When disconnecting the hose, oil left in the hose may flow out. Therefore, place the end of the hose into a suitable container to prevent contamination of the ground and environment.
   Figure 165

EX1504170

2. Disconnect the hoses and adapters from fan pump.
   Figure 166

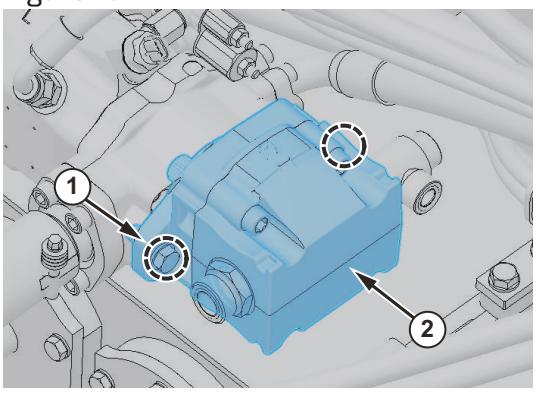


DS2200890

NOTE: *Attach identification tags to the removed hoses for reassembling. After disconnecting hoses from fan pump, plug them to prevent dirt or dust from entering. Disconnect the hoses from the bottom to top of fan pump.*

Fan Pump

1. Tie pump with rope to lift it.
   Figure 167

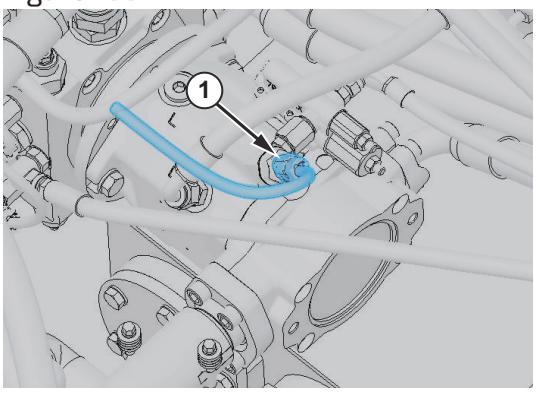


DS2200891

2. Remove mounting bolts (1) and fan pump (2) from main pump.
   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
   - Fan pump weight: about 15 kg (33 lb)

Wiring Harness

1. Turn Off the battery disconnect switch.
   Figure 168



DS2200911

2. Disconnect harness connectors (1) from main pump.

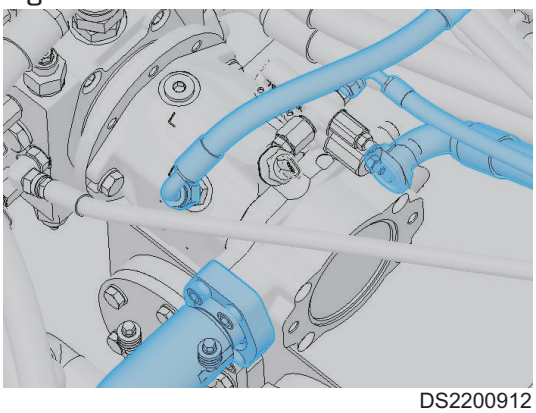
   NOTE: *Check the location of the connectors before disconnecting. Be careful not to let water get into electrical components. If water gets into electrical system, this will cause an electrical short circuit and result in improper machine operation.*

Hydraulic Hoses and Fittings

1. When disconnecting the hose, oil left in the hose may flow out. Therefore, place the end of the hose into a suitable container to prevent contamination of the ground and environment.
   Figure 169

EX1504170

2. Disconnect the hoses and adapters from main pump.
   Figure 170

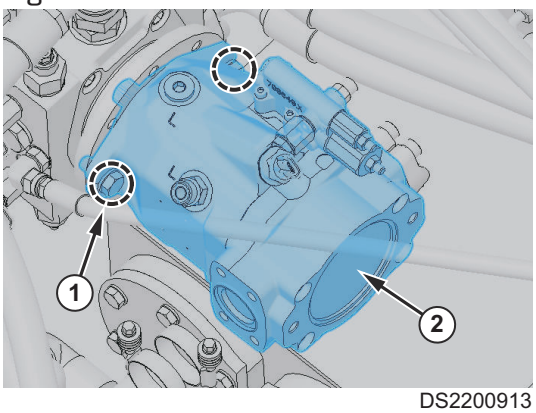


DS2200912

NOTE: *Attach identification tags to the removed hoses for reassembling. After disconnecting hoses from main pump, plug them to prevent dirt or dust from entering. Disconnect the hoses from the bottom to top of main pump.*

Main Pump

1. Tie pump with rope to lift it.
   Figure 171



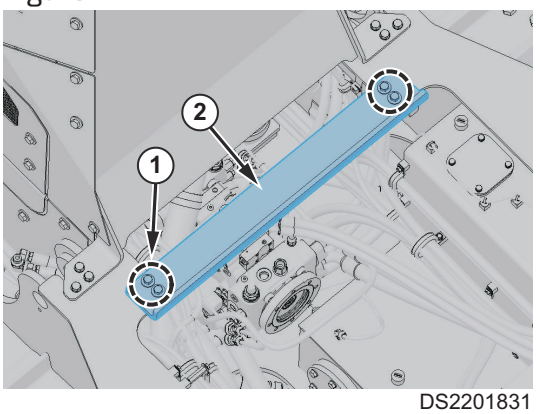
DS2200913

2. Remove mounting bolts (1) and main pump (2) from HST pump.
   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)

- Fan pump weight: about 20 kg (44.1 lb)

Support

1. Remove bolts (1) from support (2).
   Figure 172

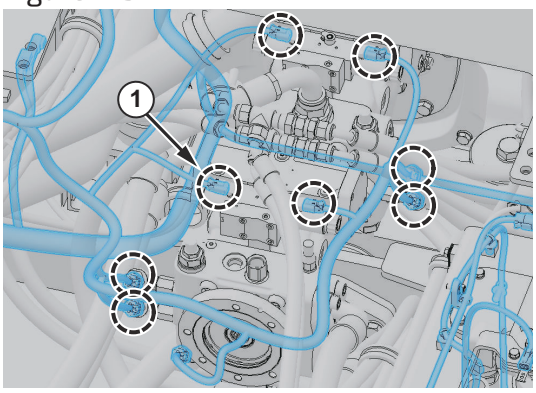


DS2201831

   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
2. Remove support (2).

Wiring Harness

1. Disconnect harness connectors (1) from HST pump.
   Figure 173



DS2201832

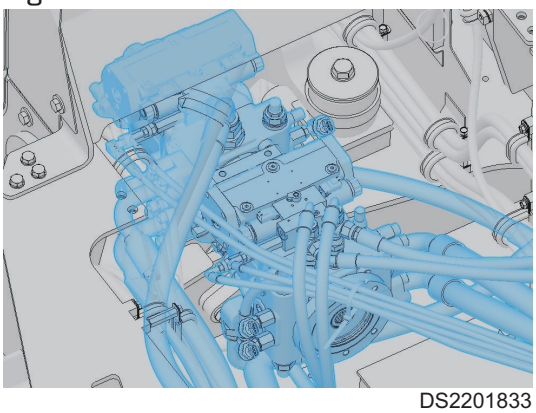
   NOTE: *Check the location of the connectors before disconnecting. Be careful not to let water get into electrical components. If water gets into electrical system, this will cause an electrical short circuit and result in improper machine operation.*

Hydraulic Hoses and Fittings

1. When disconnecting the hose, oil left in the hose may flow out. Therefore, place the end of the hose into a suitable container to prevent contamination of the ground and environment.
   Figure 174

EX1504170

2. Disconnect the hoses and adapters from HST pump.
   Figure 175

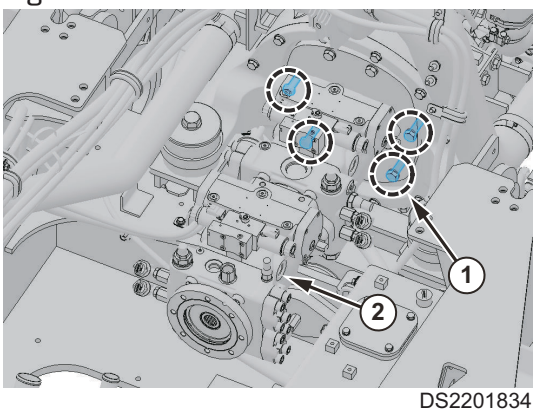


DS2201833

NOTE: *Attach identification tags to the removed hoses for reassembling. After disconnecting hoses from HST pump, plug them to prevent dirt or dust from entering. Disconnect the hoses from the bottom to top of HST pump.*

HST Pump

1. Remove bolts (1) (4 ea) of pump without top bolts (2) (2 ea).
   Figure 176

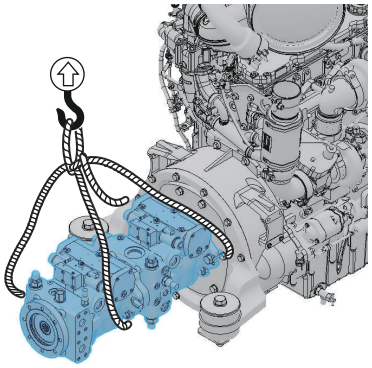


DS2201834

- Tool: 19 mm ( )
- Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)

  NOTE: *Apply adhesive (Loctite #262) to the mounting bolt.*

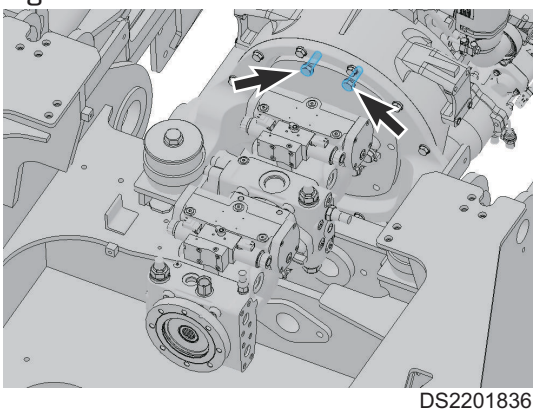
2. Attach a lifting device around pump. Raise the lifting device until the pump is supported prior to removing remaining bolts (2 ea).
   Figure 177



DS2201835

   - Weight: about 110 kg (242.5 lb)

3. Remove remaining bolts (2 ea).
   Figure 178



DS2201836

   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)

     NOTE: *Apply adhesive (Loctite #262) to the mounting bolt.*

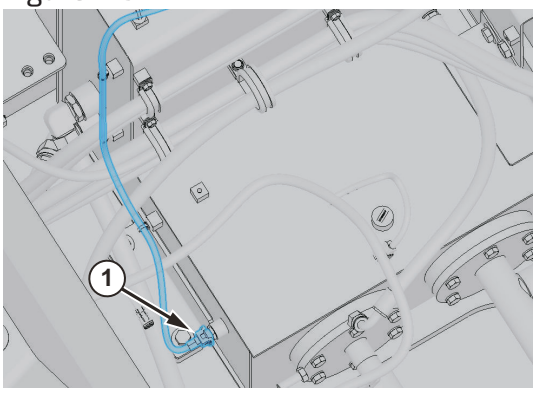
4. Lift the pump from engine slowly and carefully.

Wiring Harness

1. Disconnect harness connectors (1) from hydraulic oil tank.

NOTE: *Check the location of the connectors before disconnecting. Be careful not to let water get into electrical components. If water gets into electrical system, this will cause an electrical short circuit and result in improper machine operation.*

Figure 179



DS2201837

Hydraulic Hoses and Fittings

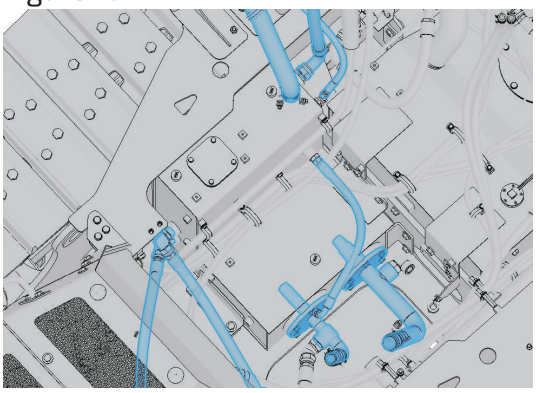
1. When disconnecting the hose, oil left in the hose may flow out. Therefore, place the end of the hose into a suitable container to prevent contamination of the ground and environment.

   Figure 180

EX1504170

2. Disconnect the hoses and adapters from hydraulic oil tank.

   Figure 181



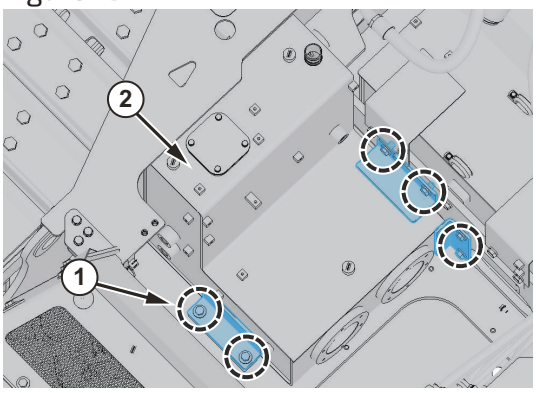
DS2201838

NOTE: *Attach identification tags to the removed hoses for reassembling. After disconnecting hoses from hydraulic oil tank, plug them to prevent dirt or dust from entering. Disconnect the hoses from the bottom to top of hydraulic oil tank.*

3. Remove hose clips from hydraulic oil tank.

Hydraulic Oil Tank

1. Remove bolts (1) and bracket (2) from frame.
   Figure 182



DS2201839

   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
2. Install eyebolts (2 ea) on the oil tank.
   And tie the rope to the bolts to lift oil tank.
3. Lift the oil tank by crane from frame slowly and carefully.
   - Oil tank weight: about 95 kg (209.4 lb)

Installation

1. Perform installation in the reverse order of removal.

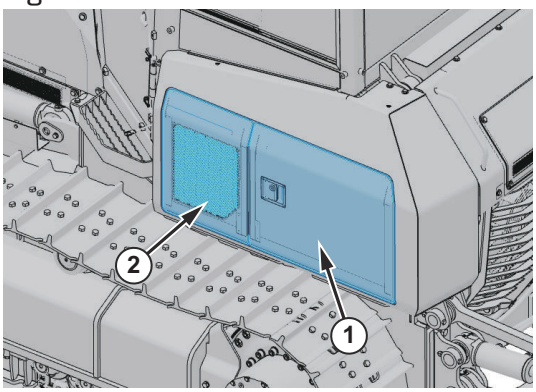
Fuel Tank

Repair Procedure Quick Guide

Step-A. Tilt the cabin
Step-B. Remove hoses under the cabin
Step-C. Remove window washer tank
Step-D. Remove cabin tilting cylinder
Step-E. Disconnect wiring harness connectors
Step-F. Remove the cabin
Step-G. Remove undercover
Step-H. Drain fuel
Step-I. Remove guardrail assembly and covers
Step-J. Disconnect wiring harness connector
Step-K. Disconnect fuel hoses and fittings
Step-L. Remove fuel tank assembly

Removal

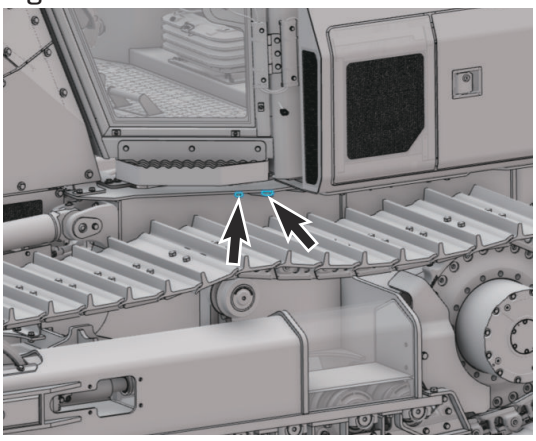
1. Open the left side door (1, 2).
   Figure 183



DS2200849

Tilt the Cabin

1. To operate cabin tilting system, remove bolts and nuts under the cabin.
   Figure 184

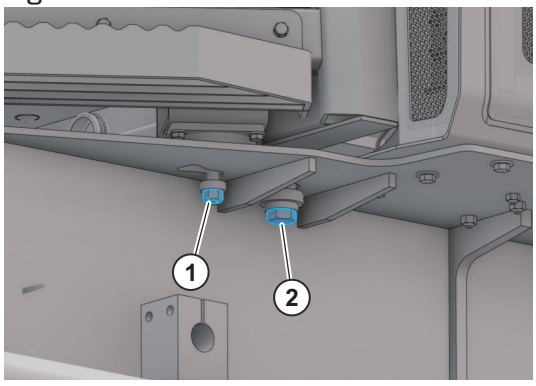


DS2201285

NOTE: *Both the left/right bolts of the cabin must be removed.*

NOTE: *Failure to remove bolts can cause serious damage to the machine.*

2. Remove nuts (1).
   Figure 185



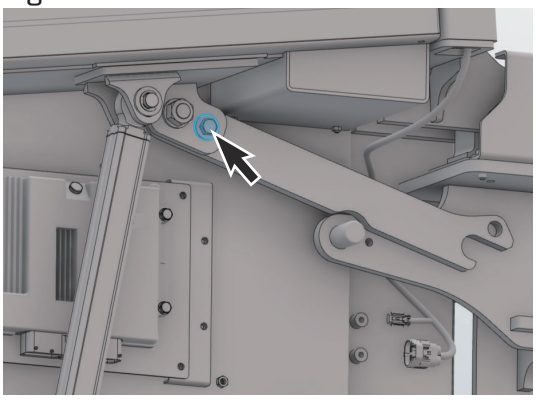
DS2201286

- Tool: 24 mm ( )
- Torque: 215.7 N.m (22 kg.m, 159 ft lb)

3. Remove bolts (2).

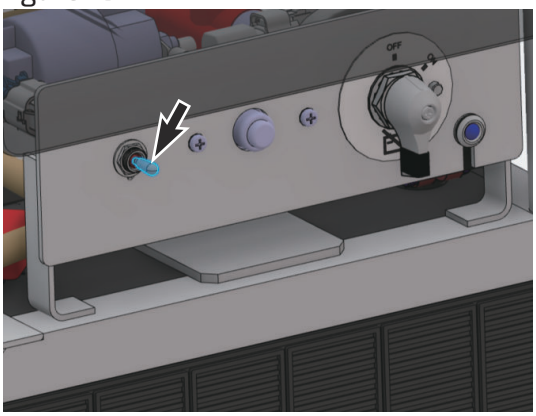
- Tool: 36mm ( )
- Torque: 127.4 N.m (13 kg.m, 94 ft lb)

4. Remove the bolts and washer on the safety bar. Safety bar is located in left side door.
   Figure 186



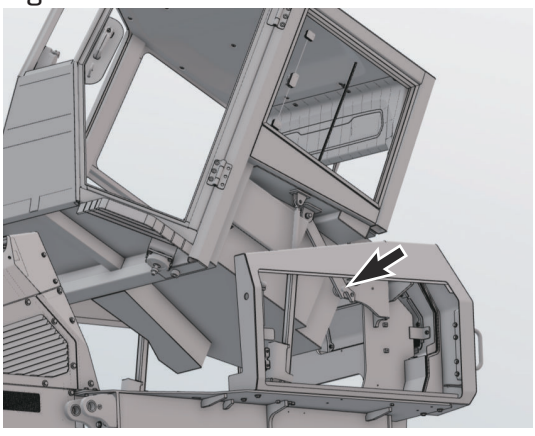
DS2201290

5. Turn cabin tilting switch to "ON" position.
   Figure 187



DS2201287

6. When the cabin tilting is completed, make sure the safety bar is fully engaged to the end and tighten the bolts and washers that were removed in step 4.
   Figure 188



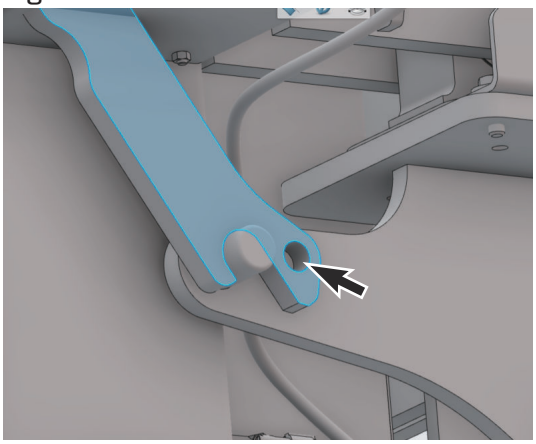
DS2201288

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Always check the installation of the safety bar during tilt operation.
It can cause death or serious injury.

Figure 189

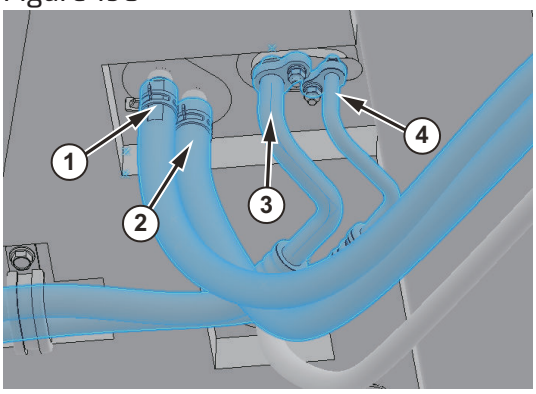


DS2201289

Hoses

1. Remove the heater hose (1).

Figure 190

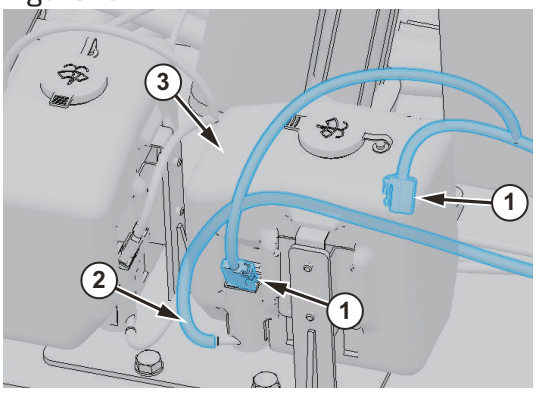


DS2200907

2. Remove the water hose (2).
3. Remove the air conditioner suction hose (3).
4. Remove the air conditioner liquid hose (4).
5. Return the tilted cabin to its original position.
6. Turn OFF the battery disconnect switch.

Window Washer Tank

1. Disconnect wiring harness (1) from window washer tank.
   Figure 191

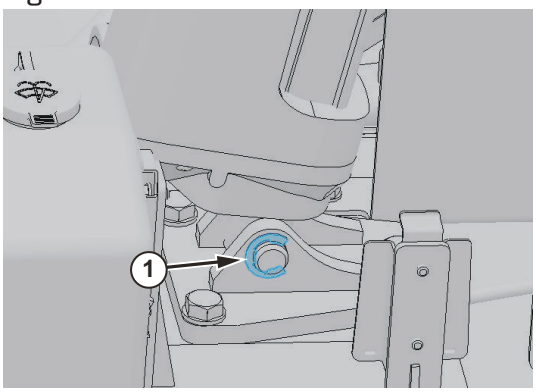


DS2200886

2. Remove water hose (2) from window washer tank.
3. Remove window washer tank (3).

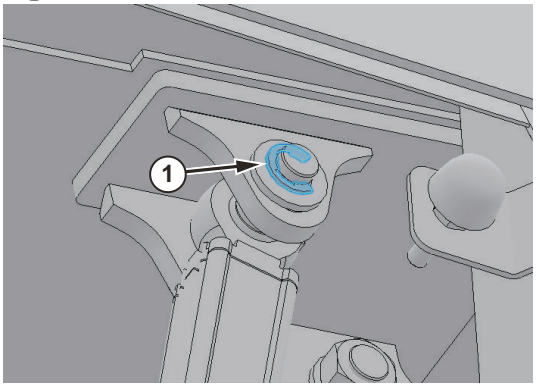
Cabin Tilting Cylinder

1. Remove the retaining ring (1) at the bottom of the cylinder.
   Figure 192



DS2200887

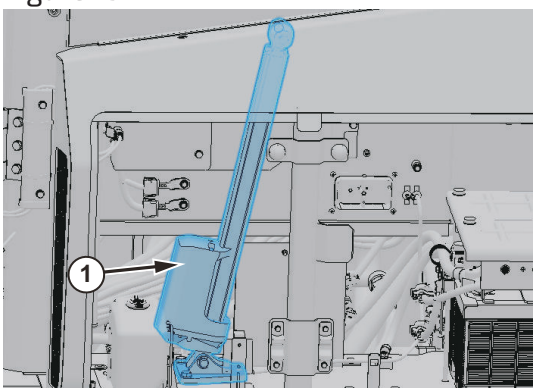
2. Remove the cylinder pin.
3. Remove the retaining ring (1) at the top of the cylinder.
   Figure 193



DS2200888

4. Remove the cylinder pin.

5. Remove the cabin tilting cylinder (1).
   Figure 194

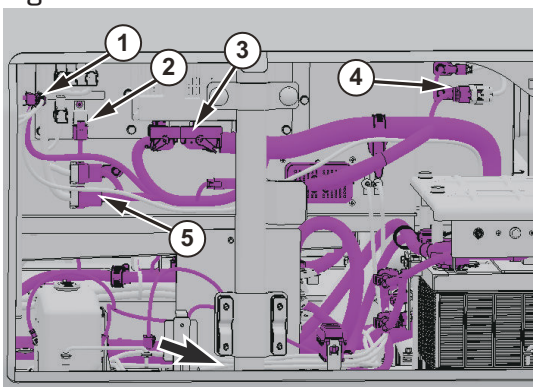


DS2200889

- Cabin tilting cylinder weight: about 10 kg (22.0 lb)

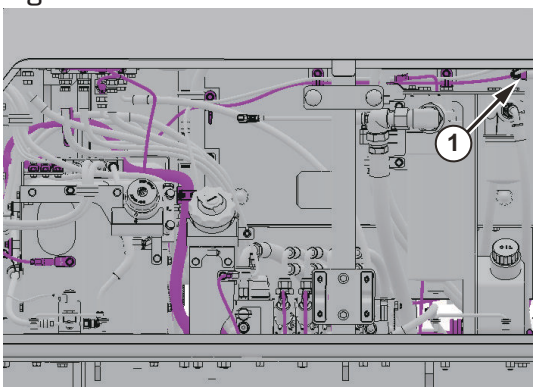
Wiring Harness Connectors

1. Disconnect wiper motor connector (1).
   Figure 195



DS2200905

2. Disconnect relay connector (2).
3. Disconnect EPOS connector (3).
4. Disconnect fan motor connector (4).
5. Disconnect wiper motor connector (1).
   Figure 196

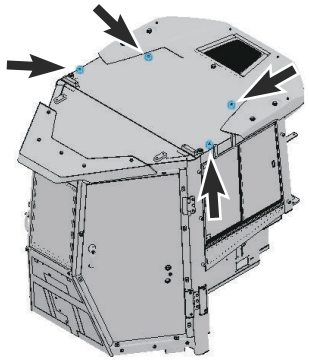


DS2200906

6. Disconnect any additional electrical connections as necessary.

Cabin

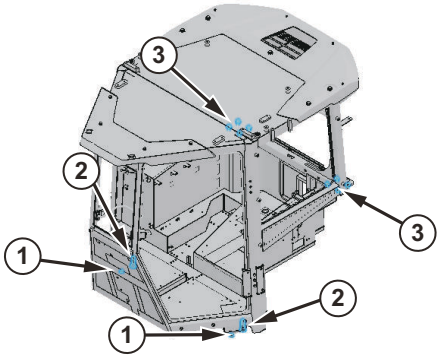
1. Using a suitable lifting device, attach slings to four lift points on top of cabin.
   Figure 197



DS2200908

   - Cabin weight: about 700 kg (1,543 lb)

2. Remove mounting nuts (1) (2 ea).
   Figure 198



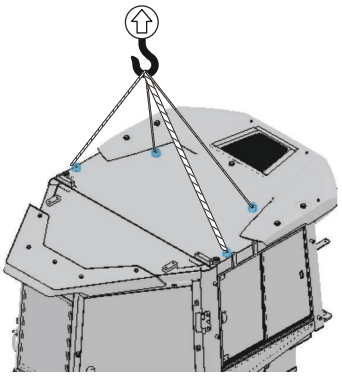
DS2200909

   - Tool: 24 mm ( )
   - Torque: 205.9 N.m (21 kg.m, 151.9 ft lb)

3. Remove mounting bolts (2) (2 ea) from cabin floor.
   - Tool: 36 mm ( )
   - Torque: 127.5 N.m (13 kg.m, 94.0 ft lb))

4. Remove hinge bolts (3) (8 ea).
   - Tool: 19 mm ( )
   - Torque: 88.3 N.m (9 kg.m, 65.1 ft lb)

5. Lift cabin approximately 25 - 50 mm (1" - 2") above deck.
   Figure 199



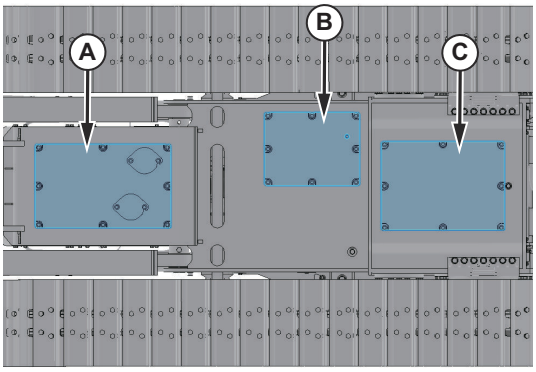
DS2200910

6. Check that all electrical connections have been disconnected and all other items unbolted.

   NOTE: *Lift operator's cabin slowly to prevent damaging.*

Undercover

1. Remove the undercover (C).
   Figure 200

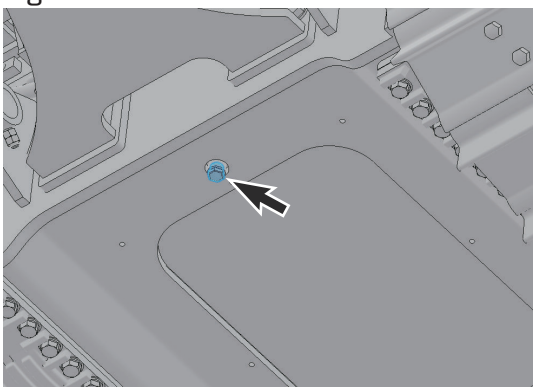


DS2201816

   For details, refer to Undercovers - Removal and Installation.

Fuel

1. Remove drain plug from fuel tank.
   Figure 201

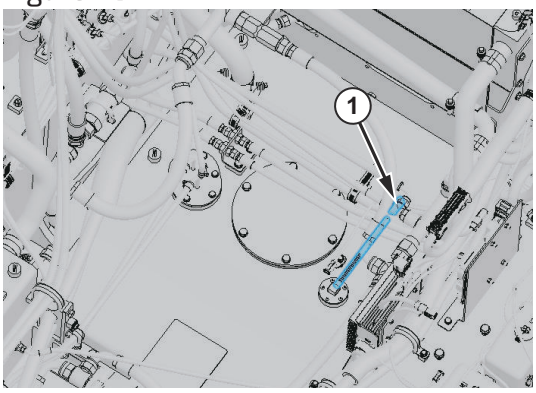


DS2201818

   - Fuel tank capacity: 190 L (50.2 U.S. gal)

Harness Connector

1. Disconnect wire harness (1) from fuel sensor.
   Figure 202



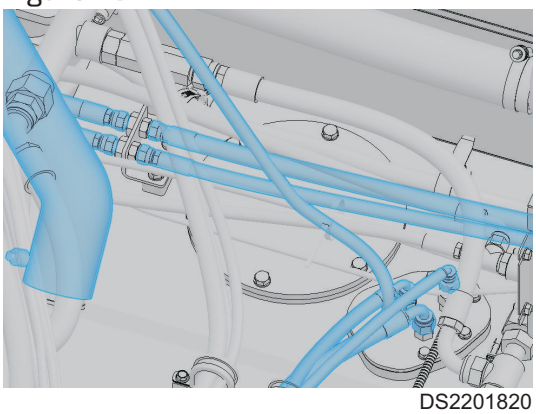
DS2200925

Hydraulic Hoses and Fittings

1. When disconnecting the hose, fuel left in the hose may flow out. Therefore, place the end of the hose into a suitable container to prevent contamination of the ground and environment.
   Figure 203

EX1504170

2. Remove hose from fuel tank.
   Figure 204



DS2201820

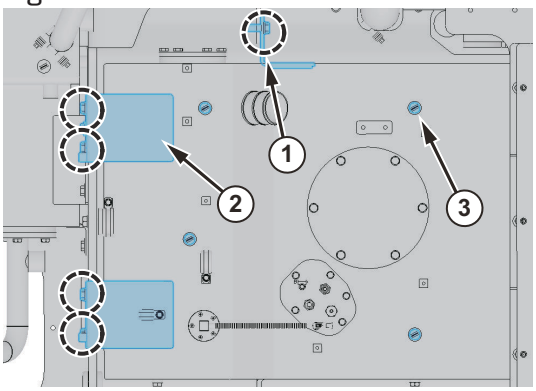
   NOTE: *Cap the open ends of hose with plug.*

3. Disconnect any additional hydraulic hose connections as necessary.

Fuel Tank Assembly

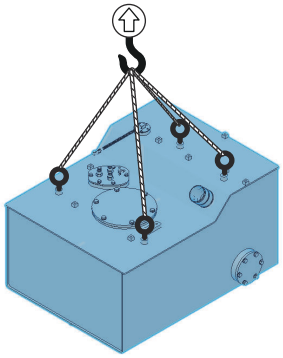
1. Remove bolts (1) and bracket (2) from fuel tank.
   - Tool: 22 mm ( )
   - Torque: 176.5 N.m (18 kg.m, 130.2 ft lb)

Figure 205



DS2201821

2. Remove lifting hole cap (3) from tank.
3. Install eyebolts (4 ea) on the fuel tank.
   Figure 206



DS2201822

   And tie the rope to the bolts to lift tank.
4. Completely remove tank after inspection.
   - Fuel tank weight: about 125 kg (275.6 lb)

Installation

1. Perform installation in the reverse order to remove.
2. Fill fuel tank and check for signs of leaks. Correct any problems found.

Fan Pump

Repair Procedure Quick Guide

Step-A. Tilt the cabin

Step-B. Remove hoses under the cabin

Step-C. Remove window washer tank

Step-D. Remove cabin tilting cylinder

Step-E. Disconnect wiring harness connectors

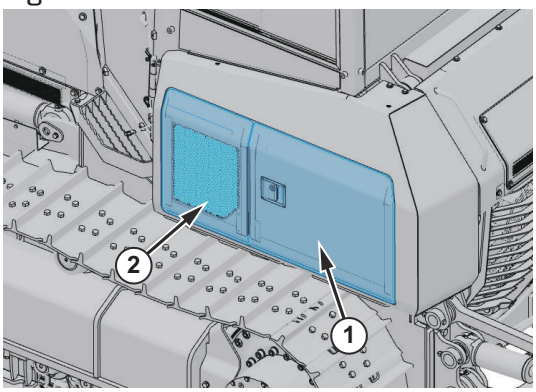
Step-F. Remove the cabin

Step-G. Disconnect hydraulic hoses and fittings

Step-H. Remove fan pump

Removal

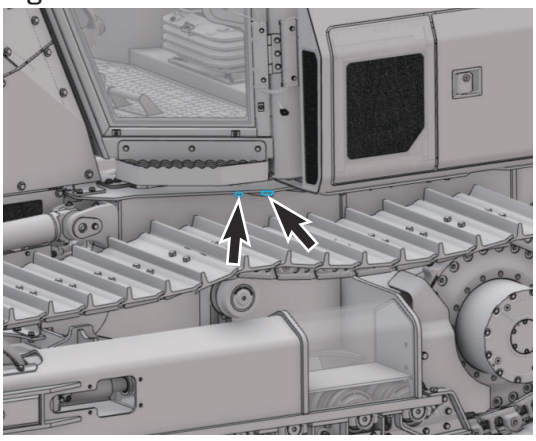
1. Open the left side door (1, 2).
   Figure 207



DS2200849

Tilt the Cabin

1. To operate cabin tilting system, remove bolts and nuts under the cabin.
   Figure 208

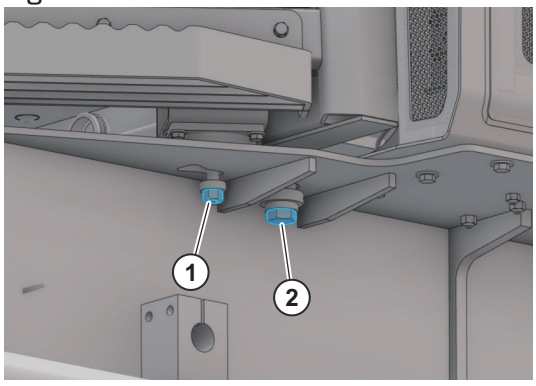


DS2201285

NOTE: *Both the left/right bolts of the cabin must be removed.*

NOTE: *Failure to remove bolts can cause serious damage to the machine.*

2. Remove nuts (1).
   Figure 209



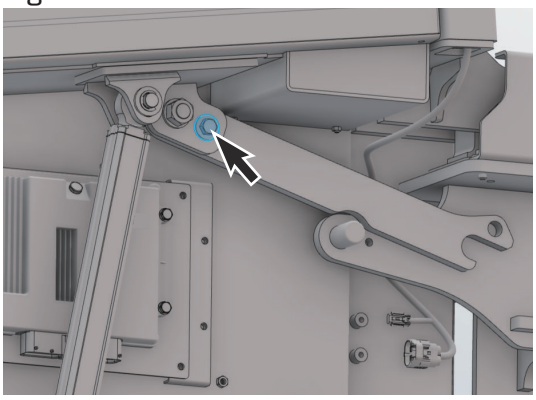
DS2201286

- Tool: 24 mm ( )
- Torque: 215.7 N.m (22 kg.m, 159 ft lb)

3. Remove bolts (2).

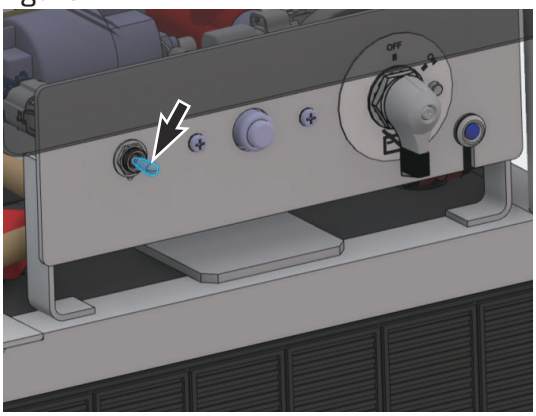
- Tool: 36mm ( )
- Torque: 127.4 N.m (13 kg.m, 94 ft lb)

4. Remove the bolts and washer on the safety bar. Safety bar is located in left side door.
   Figure 210



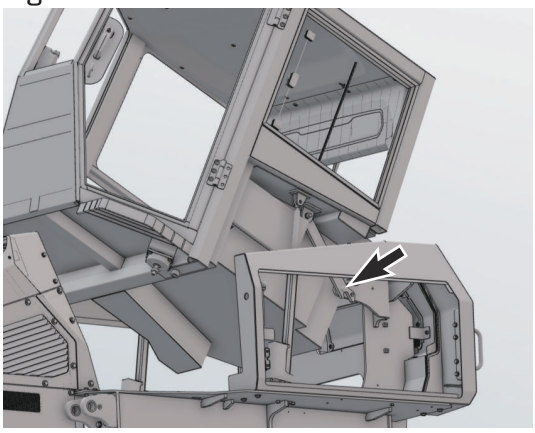
DS2201290

5. Turn cabin tilting switch to "ON" position.
   Figure 211



DS2201287

6. When the cabin tilting is completed, make sure the safety bar is fully engaged to the end and tighten the bolts and washers that were removed in step 4.
   Figure 212



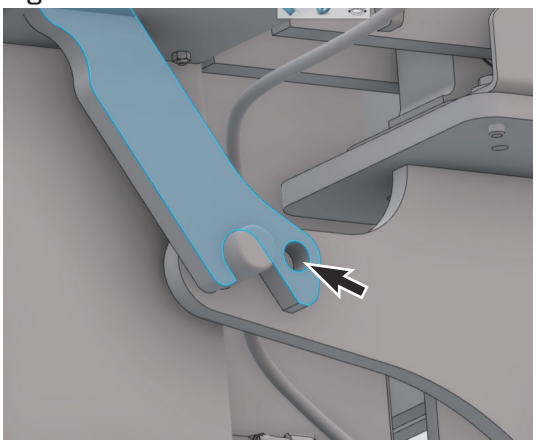
DS2201288

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Always check the installation of the safety bar during tilt operation.
It can cause death or serious injury.

Figure 213

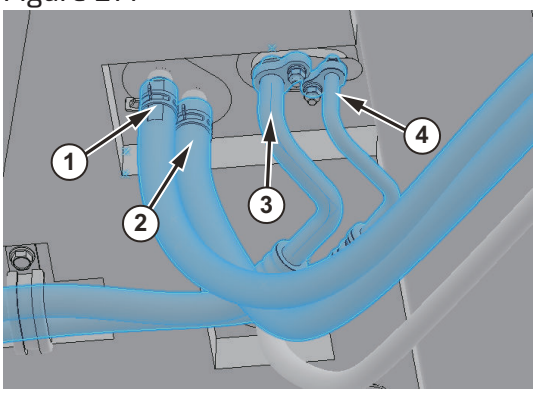


DS2201289

Hoses

1. Remove the heater hose (1).

Figure 214

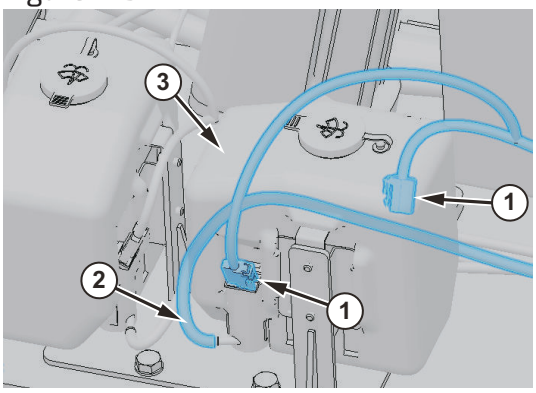


DS2200907

2. Remove the water hose (2).
3. Remove the air conditioner suction hose (3).
4. Remove the air conditioner liquid hose (4).
5. Return the tilted cabin to its original position.
6. Turn OFF the battery disconnect switch.

Window Washer Tank

1. Disconnect wiring harness (1) from window washer tank.
   Figure 215

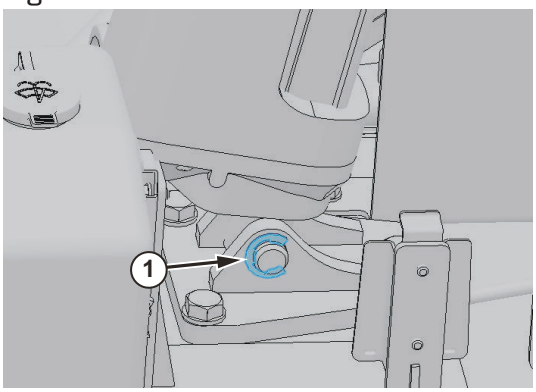


DS2200886

2. Remove water hose (2) from window washer tank.
3. Remove window washer tank (3).

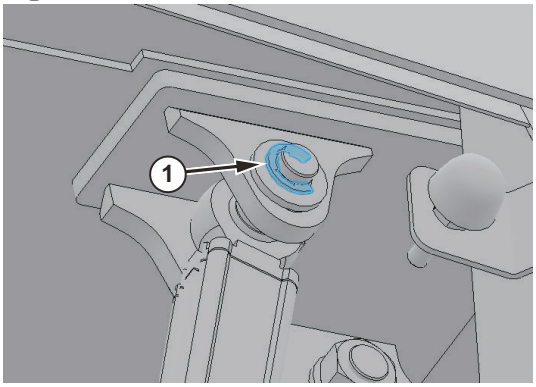
Cabin Tilting Cylinder

1. Remove the retaining ring (1) at the bottom of the cylinder.
   Figure 216



DS2200887

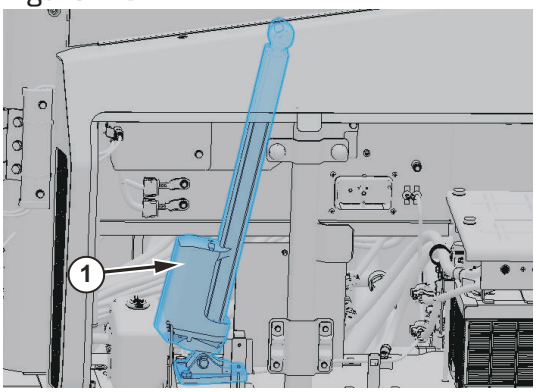
2. Remove the cylinder pin.
3. Remove the retaining ring (1) at the top of the cylinder.
   Figure 217



DS2200888

4. Remove the cylinder pin.

5. Remove the cabin tilting cylinder (1).
Figure 218

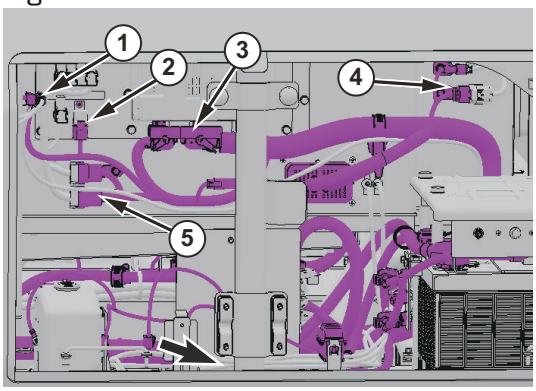


DS2200889

- Cabin tilting cylinder weight: about 10 kg (22.0 lb)

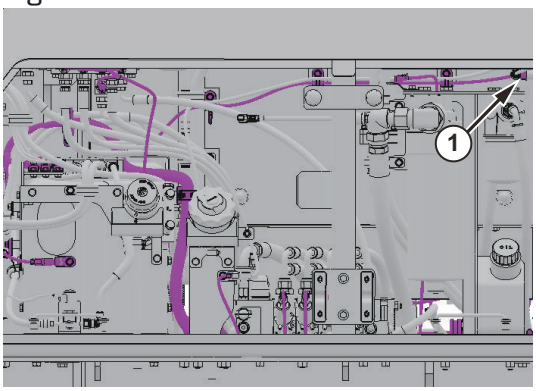
Wiring Harness Connectors

1. Disconnect wiper motor connector (1).
Figure 219



DS2200905

2. Disconnect relay connector (2).
3. Disconnect EPOS connector (3).
4. Disconnect fan motor connector (4).
5. Disconnect wiper motor connector (1).
Figure 220

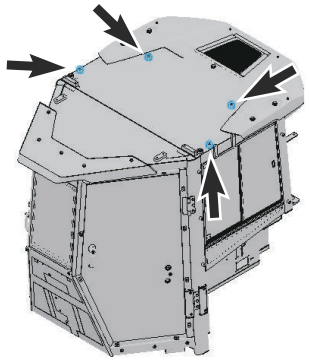


DS2200906

6. Disconnect any additional electrical connections as necessary.

Cabin

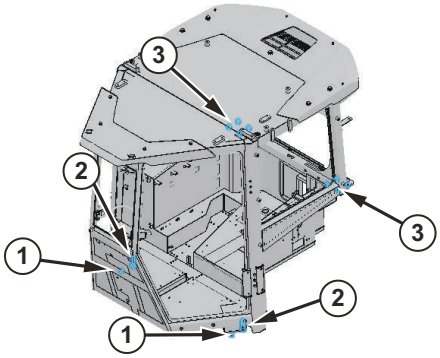
1. Using a suitable lifting device, attach slings to four lift points on top of cabin.
   Figure 221



DS2200908

   - Cabin weight: about 700 kg (1,543 lb)

2. Remove mounting nuts (1) (2 ea).
   Figure 222



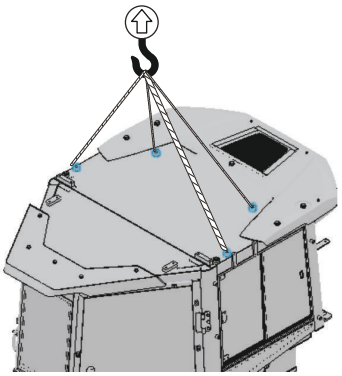
DS2200909

   - Tool: 24 mm ( )
   - Torque: 205.9 N.m (21 kg.m, 151.9 ft lb)

3. Remove mounting bolts (2) (2 ea) from cabin floor.
   - Tool: 36 mm ( )
   - Torque: 127.5 N.m (13 kg.m, 94.0 ft lb))

4. Remove hinge bolts (3) (8 ea).
   - Tool: 19 mm ( )
   - Torque: 88.3 N.m (9 kg.m, 65.1 ft lb)

5. Lift cabin approximately 25 - 50 mm (1" - 2") above deck.
   Figure 223



DS2200910

6. Check that all electrical connections have been disconnected and all other items unbolted.

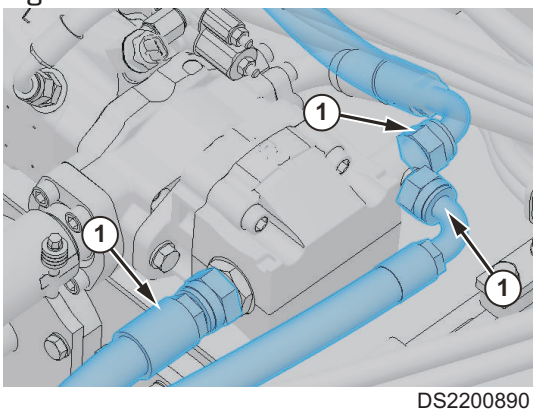
   NOTE: *Lift operator's cabin slowly to prevent damaging.*

Hydraulic Hoses and Fittings

1. When disconnecting the hose, oil left in the hose may flow out. Therefore, place the end of the hose into a suitable container to prevent contamination of the ground and environment.
   Figure 224

EX1504170

2. Disconnect the hoses and adapters from fan pump.
   Figure 225

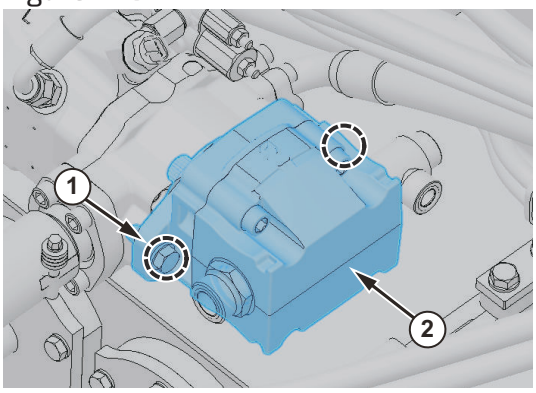


DS2200890

   NOTE: *Attach identification tags to the removed hoses for reassembling. After disconnecting hoses from fan pump, plug them to prevent dirt or dust from entering. Disconnect the hoses from the bottom to top of fan pump.*

Fan Pump

1. Tie pump with rope to lift it.
   Figure 226



DS2200891

2. Remove mounting bolts (1) and fan pump (2) from main pump.
   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
   - Fan pump weight: about 15 kg (33 lb)

Installation

1. Perform installation in the reverse order to remove.

Oil Cooler Fan Motor

Repair Procedure Quick Guide

Step-A. Remove rear cover

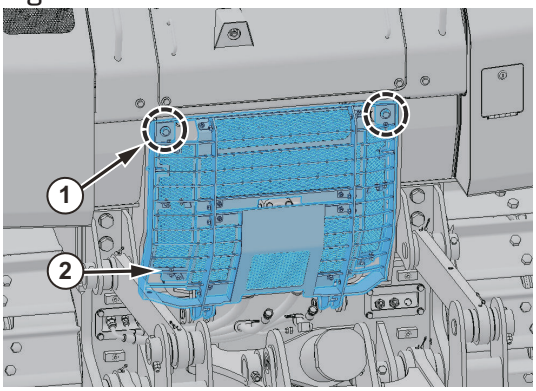
Step-B. Disconnect hydraulic hoses and fittings

Step-C. Remove fan motor

Removal

Rear Covers

1. Remove bolts and washers (1) (2 ea) from rear cover (2).
   Figure 227



DS2201817

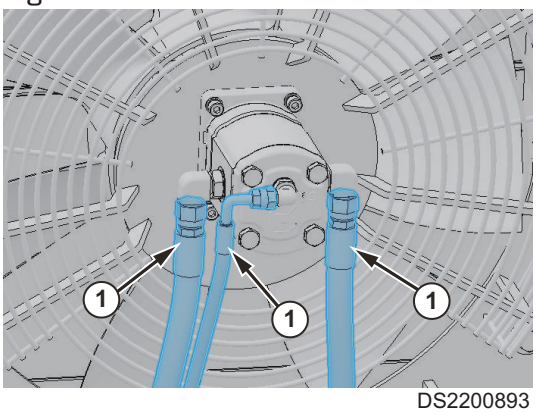
   - Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)

Hydraulic Hoses and Fittings

1. When disconnecting the hose, oil left in the hose may flow out. Therefore, place the end of the hose into a suitable container to prevent contamination of the ground and environment.
   Figure 228

EX1504170

2. Remove hoses and adapters from the fan motor.
   Figure 229

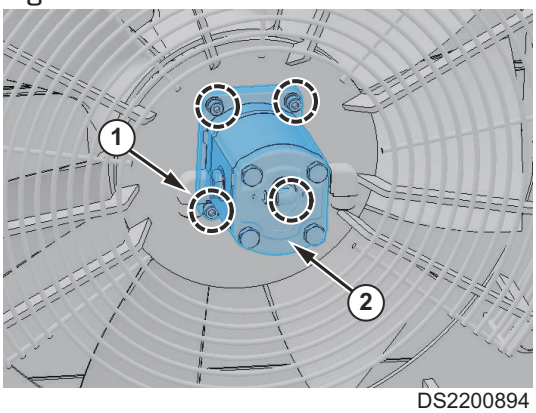


DS2200893

NOTE: *Attach identification tags to the removed hoses for reassembling. After disconnecting hoses from fan motor, plug them to prevent dirt or dust from entering. Disconnect the hoses from the bottom to top of fan motor.*

Fan Motor

1. Remove bolts and washers (1) from fan motor (2).
   Figure 230



DS2200894

   - Tool: 6 mm ( )

2. Remove fan motor (2).
   - Motor weight: about 5 kg (11.0 lb)

Installation

⚠ WARNING

INCORRECT INSTALLATION CAN CAUSE DEATH OR SERIOUS INJURY

Any change in the connections will lead to malfunctions.

- When connecting hydraulic components, observe the specified piping according to the hydraulic schematic diagram of the machine.

1. Perform installation in the reverse order to remove normally.
2. The direction of plane of hub must be assembled towards fan motor direction.

Travel Device

Repair Procedure Quick Guide

Step-A. Tilt the cabin

Step-B. Remove hoses under the cabin

Step-C. Remove window washer tank

Step-D. Remove cabin tilting cylinder

Step-E. Disconnect wiring harness connectors

Step-F. Remove the cabin

Step-G. Remove undercover

Step-H. Drain fuel

Step-I. Disconnect wiring harness connector

Step-J. Disconnect fuel hoses and fittings

Step-K. Remove fuel tank assembly

Step-L. Disconnect wiring harness connector

Step-M. Disconnect hydraulic hoses and fittings.

Step-N. Release the tension of track.

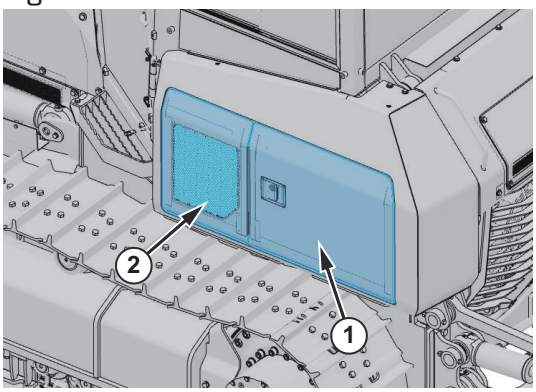
Step-O. Remove master link and shoe

Step-P. Remove track guard and sprocket

Step-Q. Remove travel device

Removal

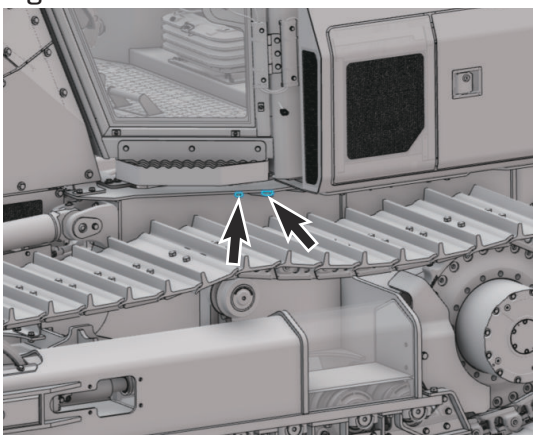
1. Open the left side door (1, 2).
   Figure 231



DS2200849

Tilt the Cabin

1. To operate cabin tilting system, remove bolts and nuts under the cabin.
   Figure 232

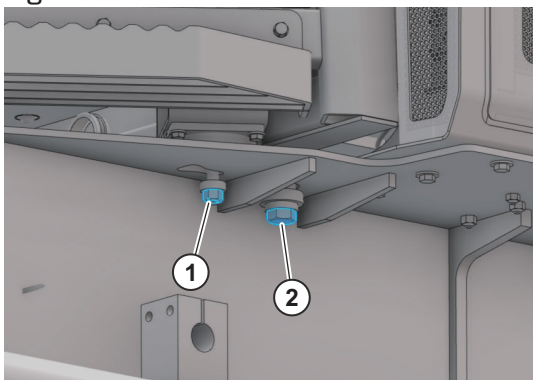


DS2201285

NOTE: *Both the left/right bolts of the cabin must be removed.*

NOTE: *Failure to remove bolts can cause serious damage to the machine.*

2. Remove nuts (1).
   Figure 233



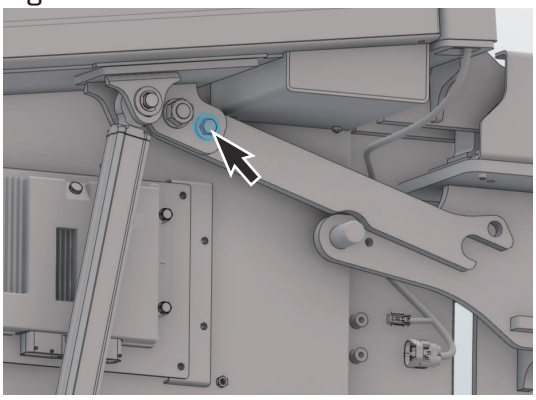
DS2201286

- Tool: 24 mm ( )
- Torque: 215.7 N.m (22 kg.m, 159 ft lb)

3. Remove bolts (2).

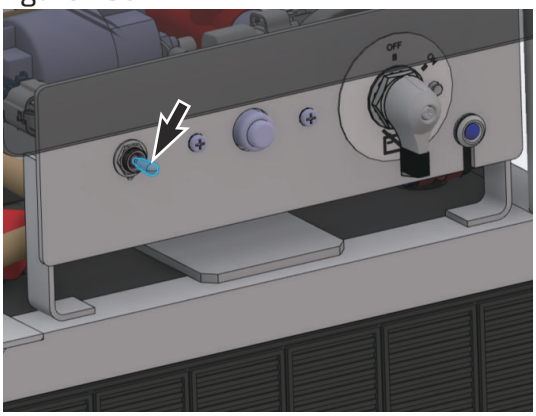
- Tool: 36mm ( )
- Torque: 127.4 N.m (13 kg.m, 94 ft lb)

4. Remove the bolts and washer on the safety bar. Safety bar is located in left side door.
   Figure 234



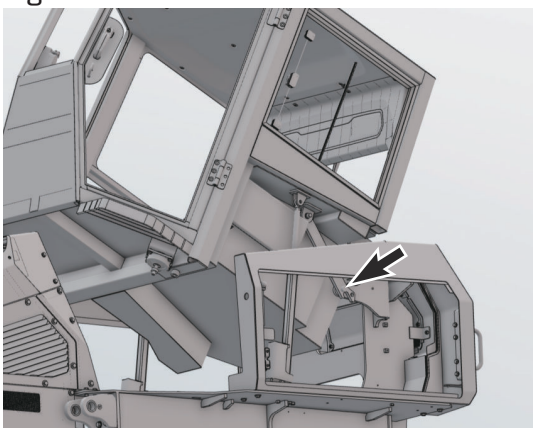
DS2201290

5. Turn cabin tilting switch to "ON" position.
   Figure 235



DS2201287

6. When the cabin tilting is completed, make sure the safety bar is fully engaged to the end and tighten the bolts and washers that were removed in step 4.
   Figure 236



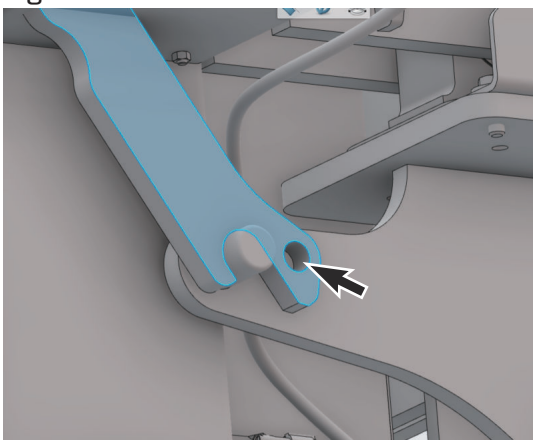
DS2201288

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Always check the installation of the safety bar during tilt operation.
It can cause death or serious injury.

Figure 237

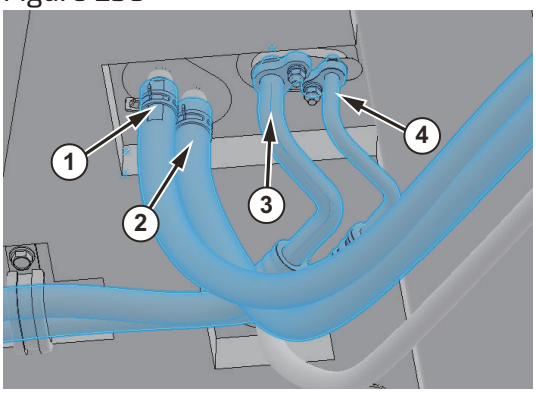


DS2201289

Hoses

1. Remove the heater hose (1).

Figure 238

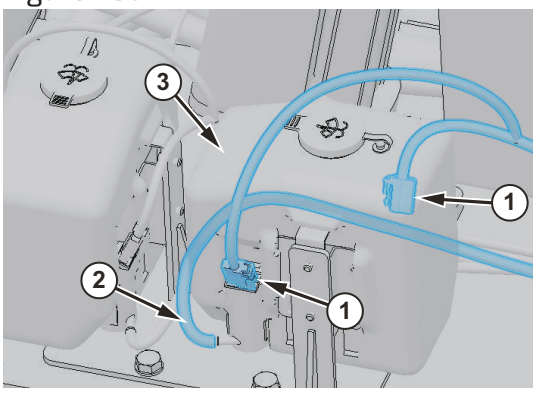


DS2200907

2. Remove the water hose (2).
3. Remove the air conditioner suction hose (3).
4. Remove the air conditioner liquid hose (4).
5. Return the tilted cabin to its original position.
6. Turn OFF the battery disconnect switch.

Window Washer Tank

1. Disconnect wiring harness (1) from window washer tank.
   Figure 239

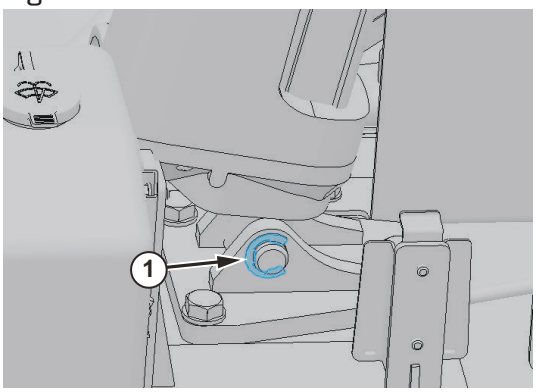


DS2200886

2. Remove water hose (2) from window washer tank.
3. Remove window washer tank (3).

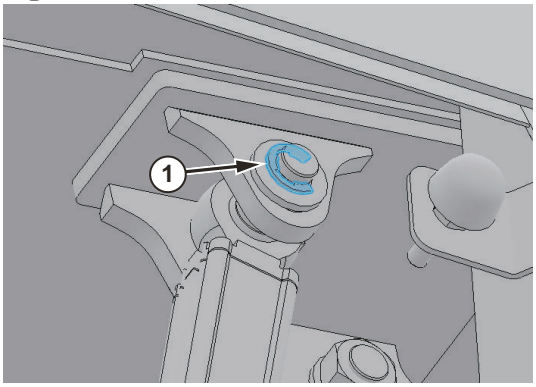
Cabin Tilting Cylinder

1. Remove the retaining ring (1) at the bottom of the cylinder.
   Figure 240



DS2200887

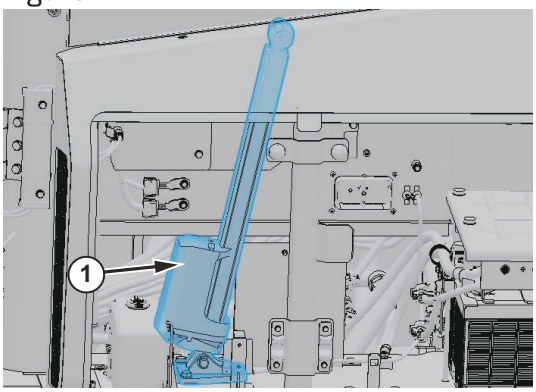
2. Remove the cylinder pin.
3. Remove the retaining ring (1) at the top of the cylinder.
   Figure 241



DS2200888

4. Remove the cylinder pin.

5. Remove the cabin tilting cylinder (1).
   Figure 242

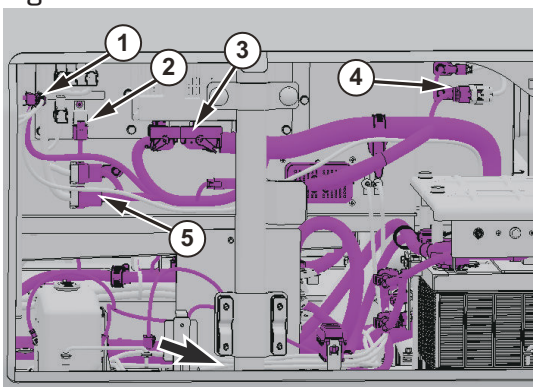


DS2200889

- Cabin tilting cylinder weight: about 10 kg (22.0 lb)

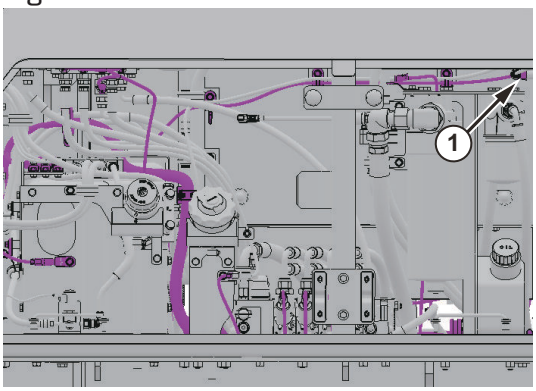
Wiring Harness Connectors

1. Disconnect wiper motor connector (1).
   Figure 243



DS2200905

2. Disconnect relay connector (2).
3. Disconnect EPOS connector (3).
4. Disconnect fan motor connector (4).
5. Disconnect wiper motor connector (1).
   Figure 244

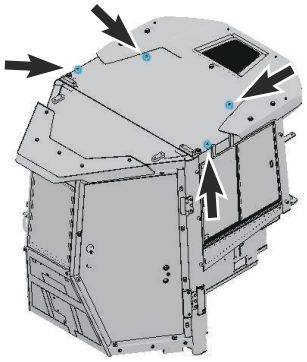


DS2200906

6. Disconnect any additional electrical connections as necessary.

Cabin

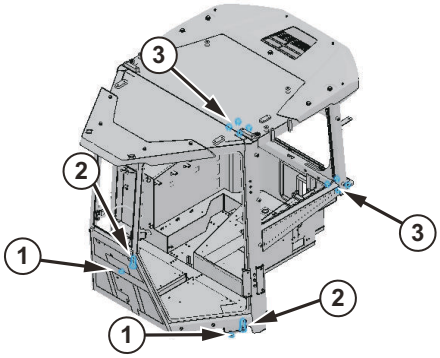
1. Using a suitable lifting device, attach slings to four lift points on top of cabin.
   Figure 245



DS2200908

   - Cabin weight: about 700 kg (1,543 lb)

2. Remove mounting nuts (1) (2 ea).
   Figure 246



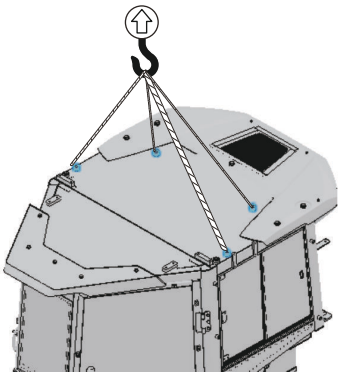
DS2200909

   - Tool: 24 mm ( )
   - Torque: 205.9 N.m (21 kg.m, 151.9 ft lb)

3. Remove mounting bolts (2) (2 ea) from cabin floor.
   - Tool: 36 mm ( )
   - Torque: 127.5 N.m (13 kg.m, 94.0 ft lb))

4. Remove hinge bolts (3) (8 ea).
   - Tool: 19 mm ( )
   - Torque: 88.3 N.m (9 kg.m, 65.1 ft lb)

5. Lift cabin approximately 25 - 50 mm (1" - 2") above deck.
   Figure 247



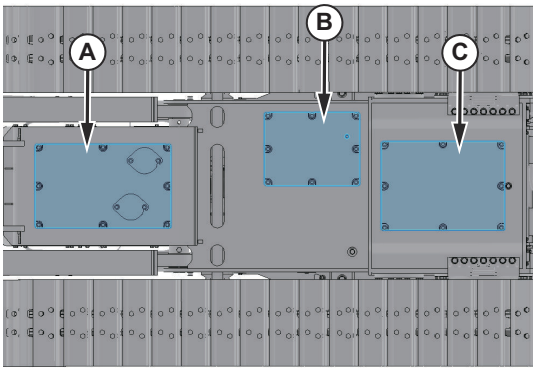
DS2200910

6. Check that all electrical connections have been disconnected and all other items unbolted.

   NOTE: *Lift operator's cabin slowly to prevent damaging.*

Undercover

1. Remove the undercover (C).
   Figure 248



DS2201816

   For details, refer to Undercovers - Removal and Installation.

Fuel

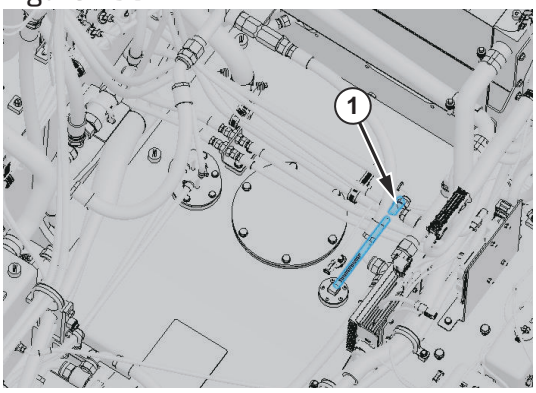
1. Remove drain plug from fuel tank.
   Figure 249

DS2201818

   - Fuel tank capacity: 190 L (50.2 U.S. gal)

Harness Connector

1. Disconnect wire harness (1) from fuel sensor.
   Figure 250



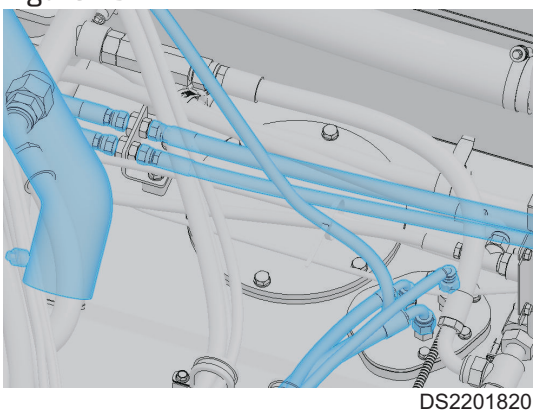
DS2200925

Hydraulic Hoses and Fittings

1. When disconnecting the hose, fuel left in the hose may flow out. Therefore, place the end of the hose into a suitable container to prevent contamination of the ground and environment.
   Figure 251

EX1504170

2. Remove hose from fuel tank.
   Figure 252



DS2201820

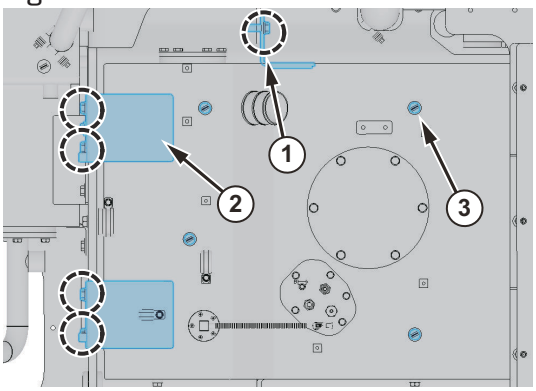
   NOTE: *Cap the open ends of hose with plug.*

3. Disconnect any additional hydraulic hose connections as necessary.

Fuel Tank Assembly

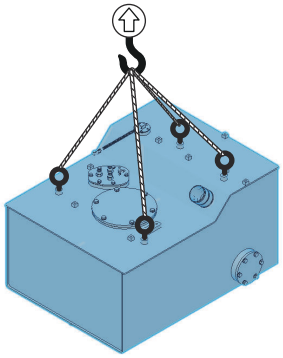
1. Remove bolts (1) and bracket (2) from fuel tank.
   - Tool: 22 mm ( )
   - Torque: 176.5 N.m (18 kg.m, 130.2 ft lb)

Figure 253



DS2201821

2. Remove lifting hole cap (3) from tank.
3. Install eyebolts (4 ea) on the fuel tank.
   Figure 254

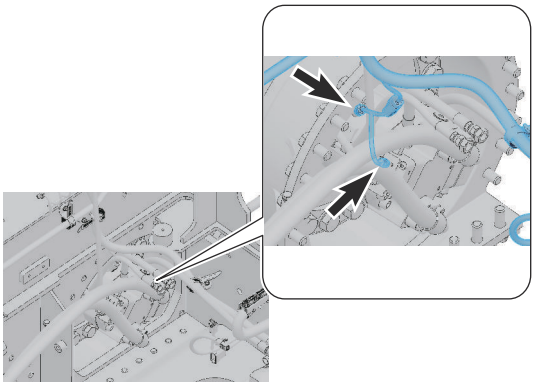


DS2201822

   And tie the rope to the bolts to lift tank.
4. Completely remove tank after inspection.
   - Fuel tank weight: about 125 kg (275.6 lb)

Wiring Harness Connectors

1. Disconnect the wiring harness connectors from inside of the frame.
   Figure 255



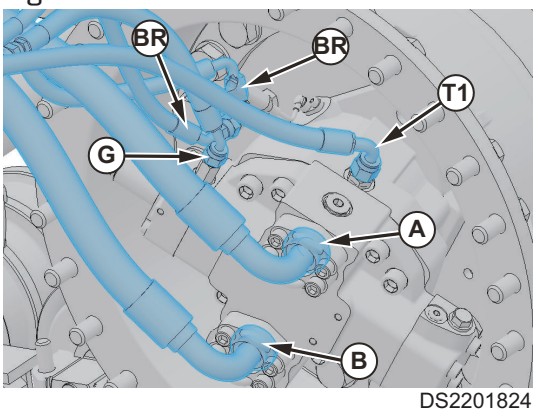
DS2201823

Hydraulic Hoses and Fittings

1. When disconnecting the hose, oil left in the hose may flow out. Therefore, place the end of the hose into a suitable container to prevent contamination of the ground and environment.
   Figure 256

EX1504170

2. Remove hoses and adapters from travel device.
   Figure 257

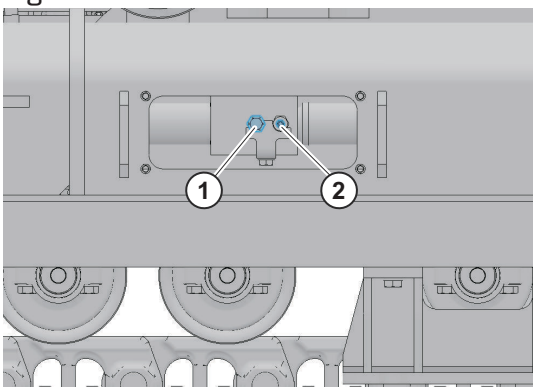


DS2201824

NOTE: *Attach identification tags to the removed hoses for reassembling. After disconnecting hoses, plug them to prevent dirt or dust from entering. Disconnect the hoses from the bottom to top of travel device.*

Tension of Track

1. Adjust the master link to be positioned at the top of the idler.
2. Loosen grease valve, and then slacken the tension of track.
   Figure 258

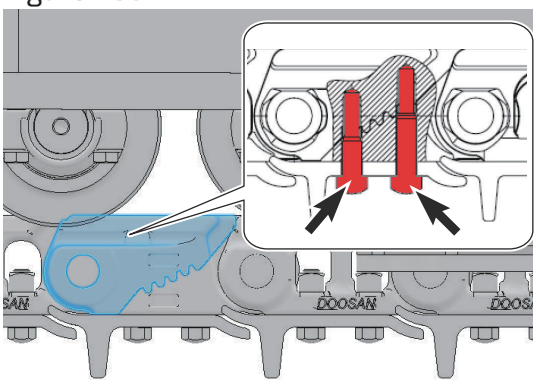


DS2201825

For details, refer to Track tension - Operation Manual.

Master Link and Shoe

1. Remove the bolts (1) from the master link.
   Figure 259



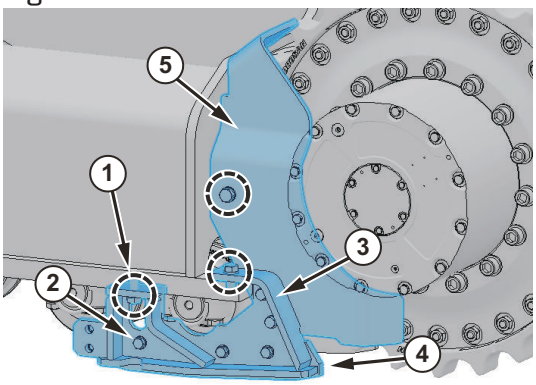
DS2200929

   - Tool: 28 mm ( )
   - Torque: 715.9 N.m (73 kg.m, 528.0 ft lb)
2. Remove the shoe pad over the master link.
3. Detach the shoe by removing the master link connecting the shoe. Be carefully.

Track Guard and Sprocket

1. Remove socket bolt (1) and bolt (2) from the frame.
   - Socket bolt (1) Tool: 17 mm ( )
   - Torque: 264.8 N.m (27 kg.m, 195.3 ft lb)
   - Bolt (2) Tool: 19 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)

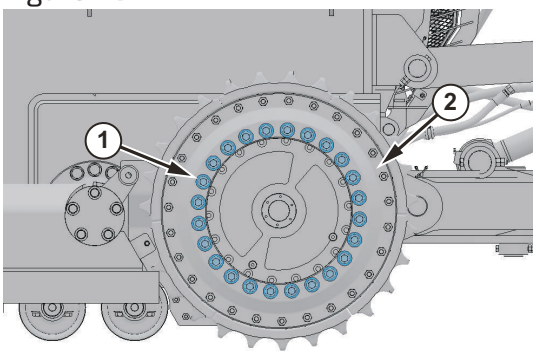
   Figure 260



DS2200932

2. Remove bolts (5ea, 3) from track guard.
   - Tool: 24 mm ( )
   - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
3. Remove track guard (4) and guard plate (5).
4. Remove nut (6) and guard cover (7).

5. Remove bolt (24ea, 1) with sprocket (2) from travel device.
   Figure 261



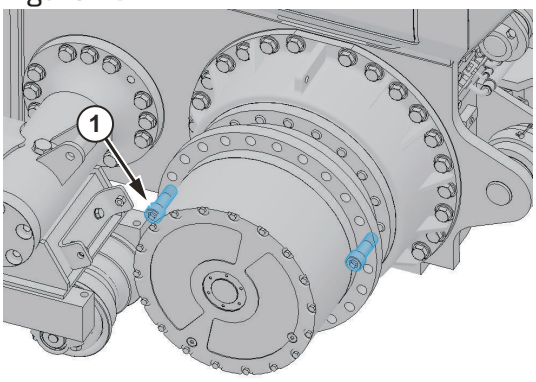
DS2201827

- Tool: 20 mm ( )
- Torque: 539.3 N.m (55 kg.m, 397.8 ft lb)
- Sprocket joint weight: about 50 kg (110.2 lb)
- Sprocket teeth (6ea) weight: about 50 kg (110.2 lb)
- Total sprocket ass'y weight: about 100 kg (220.5 lb)

  NOTE: *Apply adhesive (Loctite #262) to the mounting bolt.*

Travel Device

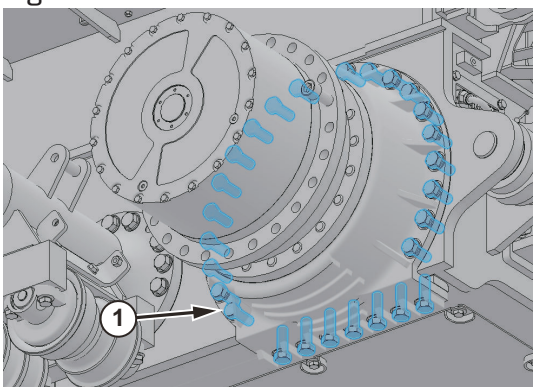
1. Install the sprocket bolts (1) to travel device, and tie the rope to the bolts to lift it.
   Figure 262



DS2201828

- Tool: 20 mm ( )

2. Remove mounting bolts (1) from track frame.
   Figure 263

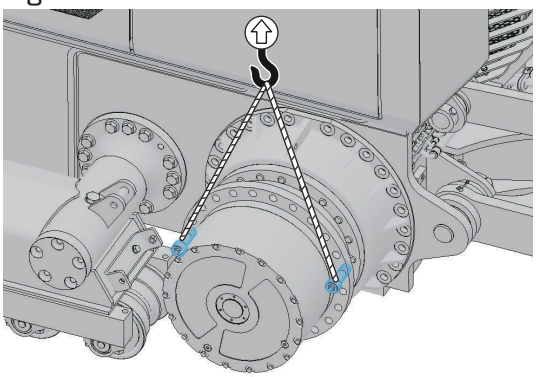


DS2201829

- Tool: 30 mm ( )
- Torque: 539.4 N.m (55 kg.m, 397.8 ft lb)

  NOTE: *Apply adhesive (Loctite #262) to the mounting bolt.*

3. Hoist and remove travel device (1) from track frame very slowly.
   Figure 264



DS2201830

- Travel device and cover Weight: about 465 kg (1025.2 lb)

Installation

1. Perform installation in the reverse order to remove.
2. When installing the hoses, install the drain hose first.

Cabin

Repair Procedure Quick Guide

Step-A. Tilt the cabin

Step-B. Remove hoses under the cabin

Step-C. Remove window washer tank

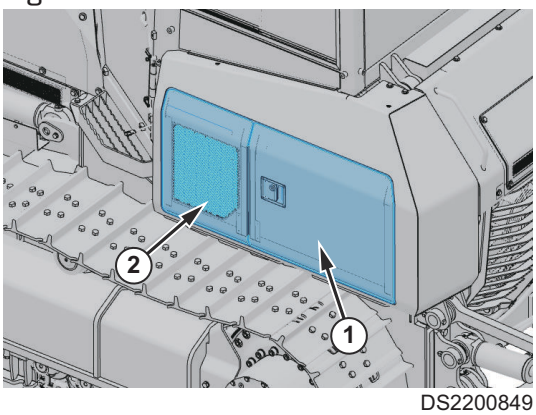
Step-D. Remove cabin tilting cylinder

Step-E. Disconnect wiring harness connectors

Step-F. Remove the cabin

Removal

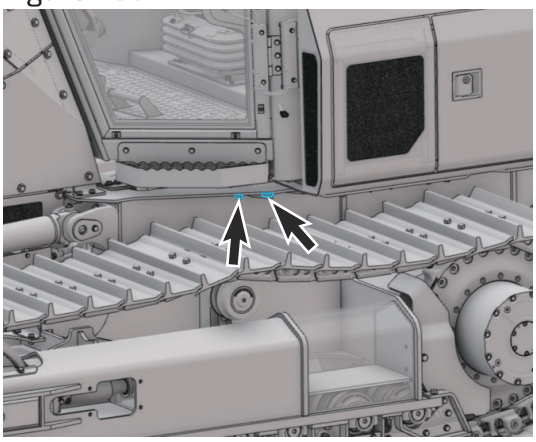
1. Open the left side door (1, 2).
   Figure 265



DS2200849

Tilt the Cabin

1. To operate cabin tilting system, remove bolts and nuts under the cabin.
   Figure 266

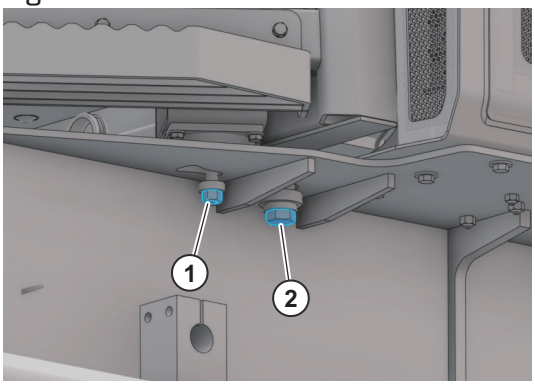


DS2201285

   NOTE: *Both the left/right bolts of the cabin must be removed.*

   NOTE: *Failure to remove bolts can cause serious damage to the machine.*

2. Remove nuts (1).
   Figure 267

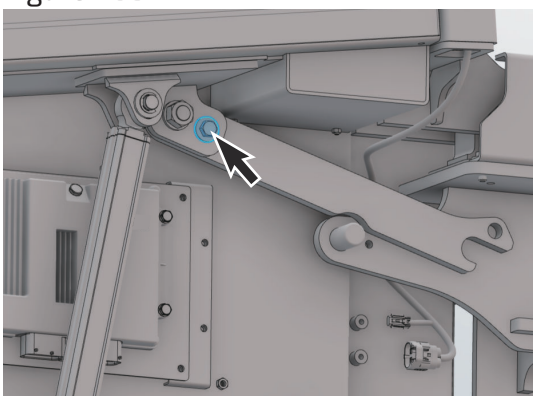


DS2201286

   - Tool: 24 mm ( )
   - Torque: 215.7 N.m (22 kg.m, 159 ft lb)

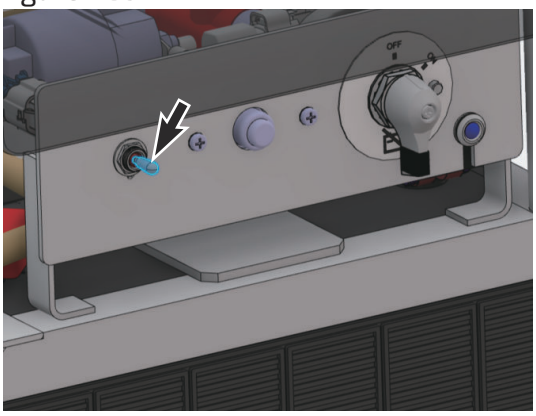
3. Remove bolts (2).
   - Tool: 36mm ( )
   - Torque: 127.4 N.m (13 kg.m, 94 ft lb)

4. Remove the bolts and washer on the safety bar. Safety bar is located in left side door.
   Figure 268



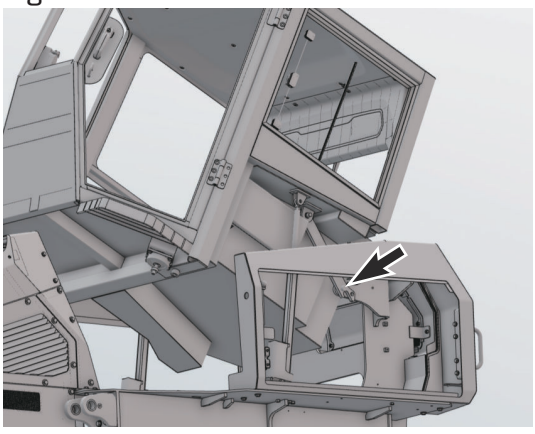
DS2201290

5. Turn cabin tilting switch to “ON” position.
   Figure 269



DS2201287

6. When the cabin tilting is completed, make sure the safety bar is fully engaged to the end and tighten the bolts and washers that were removed in step 4.
   Figure 270



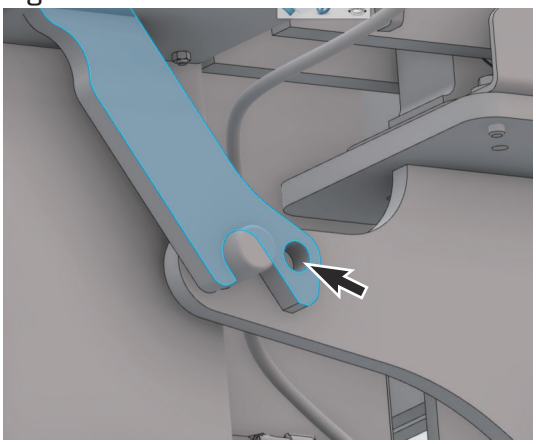
DS2201288

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Always check the installation of the safety bar during tilt operation.
It can cause death or serious injury.

Figure 271

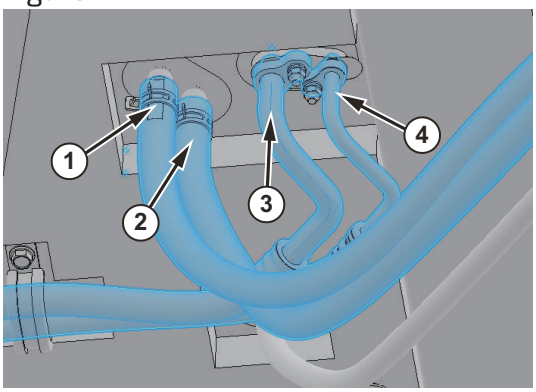


DS2201289

Hoses

1. Remove the heater hose (1).

Figure 272



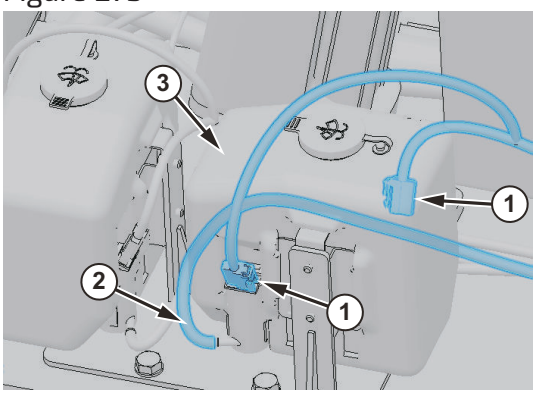
DS2200907

2. Remove the water hose (2).
3. Remove the air conditioner suction hose (3).
4. Remove the air conditioner liquid hose (4).
5. Return the tilted cabin to its original position.
6. Turn OFF the battery disconnect switch.

Window Washer Tank

1. Disconnect wiring harness (1) from window washer tank.

Figure 273

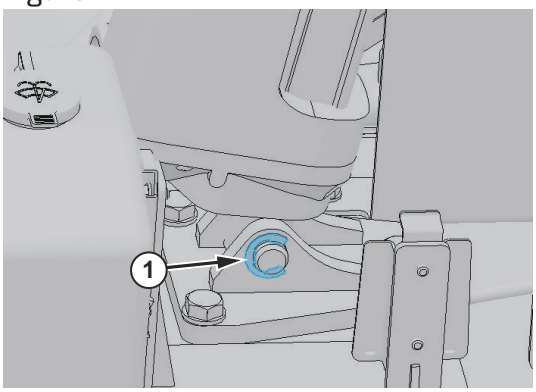


DS2200886

2. Remove water hose (2) from window washer tank.
3. Remove window washer tank (3).

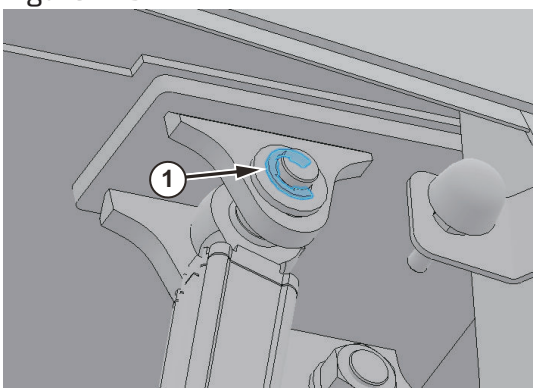
Cabin Tilting Cylinder

1. Remove the retaining ring (1) at the bottom of the cylinder.
   Figure 274



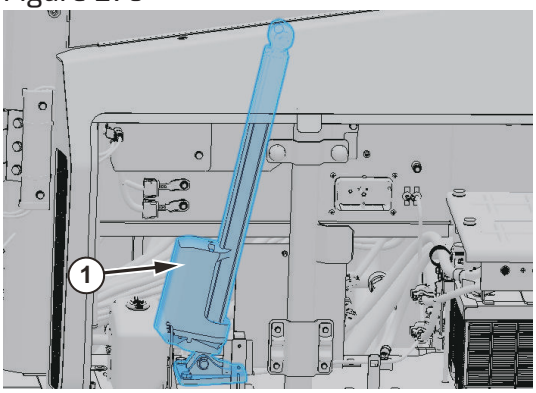
DS2200887

2. Remove the cylinder pin.
3. Remove the retaining ring (1) at the top of the cylinder.
   Figure 275



DS2200888

4. Remove the cylinder pin.
5. Remove the cabin tilting cylinder (1).
   Figure 276

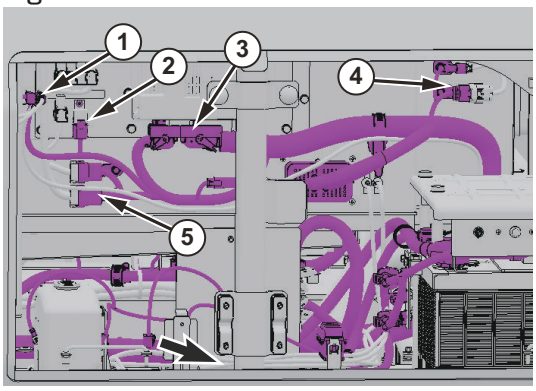


DS2200889

- Cabin tilting cylinder weight: about 10 kg (22.0 lb)

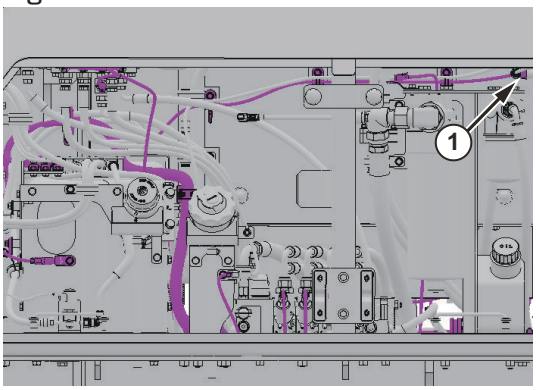
Wiring Harness Connectors

1. Disconnect wiper motor connector (1).
   Figure 277



DS2200905

2. Disconnect relay connector (2).
3. Disconnect EPOS connector (3).
4. Disconnect fan motor connector (4).
5. Disconnect wiper motor connector (1).
   Figure 278

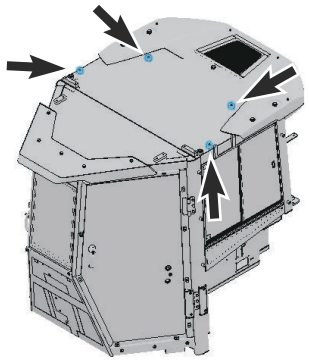


DS2200906

6. Disconnect any additional electrical connections as necessary.

Cabin

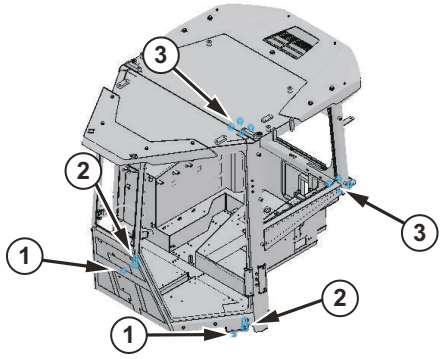
1. Using a suitable lifting device, attach slings to four lift points on top of cabin.
   Figure 279



DS2200908

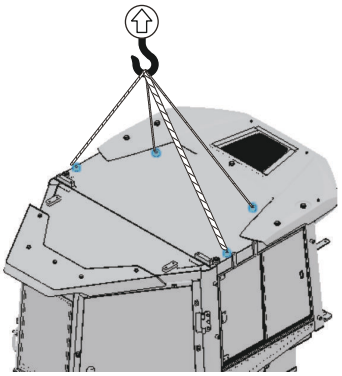
- Cabin weight: about 700 kg (1,543 lb)

2. Remove mounting nuts (1) (2 ea).
   Figure 280



DS2200909

   - Tool: 24 mm ( )
   - Torque: 205.9 N.m (21 kg.m, 151.9 ft lb)
3. Remove mounting bolts (2) (2 ea) from cabin floor.
   - Tool: 36 mm ( )
   - Torque: 127.5 N.m (13 kg.m, 94.0 ft lb))
4. Remove hinge bolts (3) (8 ea).
   - Tool: 19 mm ( )
   - Torque: 88.3 N.m (9 kg.m, 65.1 ft lb)
5. Lift cabin approximately 25 - 50 mm (1" - 2") above deck.
   Figure 281


DS2200910

6. Check that all electrical connections have been disconnected and all other items unbolted.

   NOTE: *Lift operator's cabin slowly to prevent damaging.*

Installation

1. Perform installation in the reverse order to remove.

Cabin Tilting Cylinder

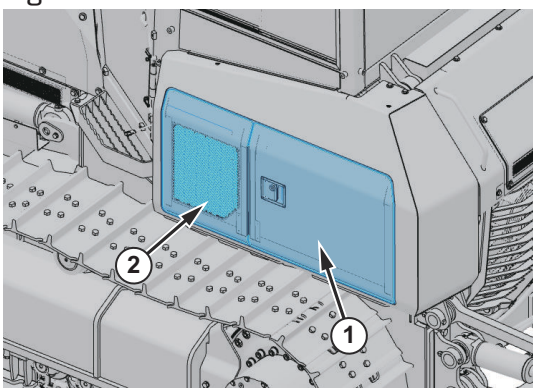
Repair Procedure Quick Guide

Step-A. Remove window washer tank.

Step-B. Remove cabin tilting cylinder

Removal

1. Open the left side door (1, 2).
   Figure 282

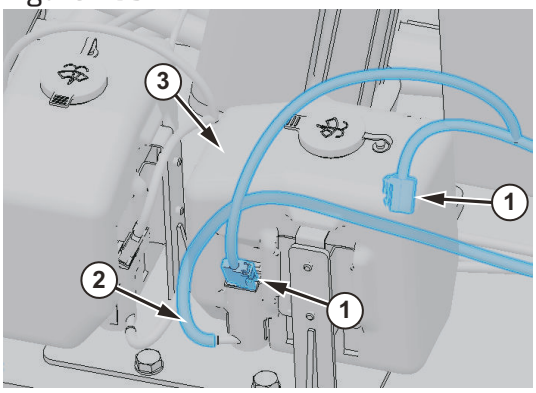


DS2200849

2. Turn OFF the battery disconnect switch.

Window Washer Tank

1. Disconnect wiring harness (1) from window washer tank.
   Figure 283

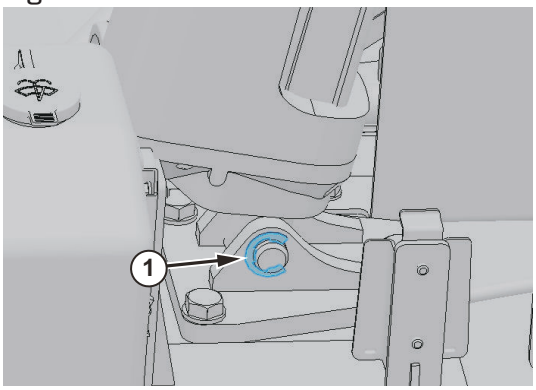


DS2200886

2. Remove water hose (2) from window washer tank.
3. Remove window washer tank (3).

Cabin Tilting Cylinder

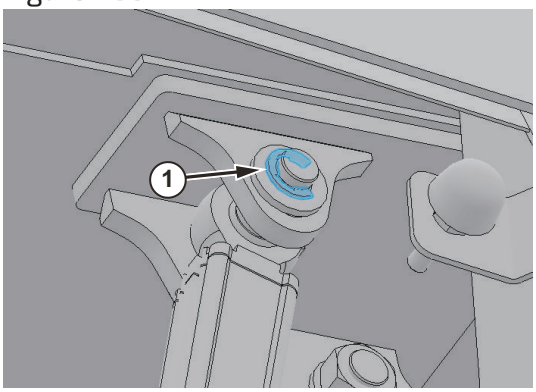
1. Remove the retaining ring (1) at the bottom of the cylinder.
   Figure 284



DS2200887

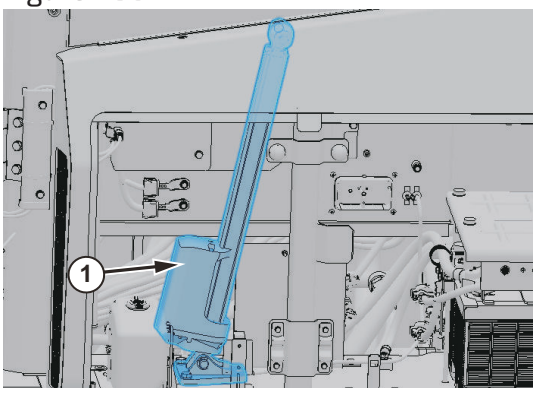
2. Remove the cylinder pin.

3. Remove the retaining ring (1) at the top of the cylinder.
   Figure 285



DS2200888

4. Remove the cylinder pin.
5. Remove the cabin tilting cylinder (1).
   Figure 286



DS2200889

   - Cabin tilting cylinder weight: about 10 kg (22.0 lb)

Installation

1. Perform installation in the reverse order to remove.

Electric And Electronic

Safety Instructions

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Instructions are necessary before operating or servicingmachine. Read and understand the Operation & Maintenance Manual and signs (decals) on machine. Followwarnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correctfunction after adjustments repairs or service. Untrainedoperators and failure to follow instructions can cause deathor serious injury.

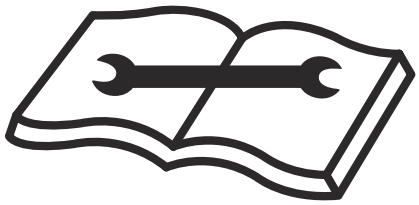
Before Removing and Installing

Preparatory Work

1. Park the machine on level ground. And lower front attachment to the ground.
2. Set parking brake switch to the parking position and then stop the engine.
3. Turn battery disconnect switch to "OFF" position.
4. Release the remaining pressure in the hydraulic circuit.
5. Cool down the hydraulic system and engine.
6. Attach a maintenance warning tag on controls.

General Precaution

1. Always read the safety section before removing and Installing.
   Figure 287



DS1901903

2. Mark the location of the bolts before removing.
3. Keep in the mind the order for tightening bolts.
4. Tighten bolts by hands, then using the tool.
5. If reusing the bolts, clean threads and apply thread locker to threads prior to installation.
6. Mark the location of wire harness connectors and hoses before disconnecting.
7. Be careful not to damage all components.
8. Do not reused gaskets, O-ring and adhesive bolts.

Completing Work

1. Check oil, coolant and fuel leak from the machine.
2. Check all oil level and if necessary, add oil.
3. Fill up the fuel tank to the standard level.
4. Apply grease to all lubrication points.
5. When fuel component has been disconnected, air must be bled from circuit.
   For details, see the Operation and Maintenance Manual.
6. When hydraulic component has been disconnected, air must be bled from circuit.
   For details, see the Operation and Maintenance Manual.
7. Start the engine and run at low idle for about 5 minutes.
8. Perform the machine performance test.

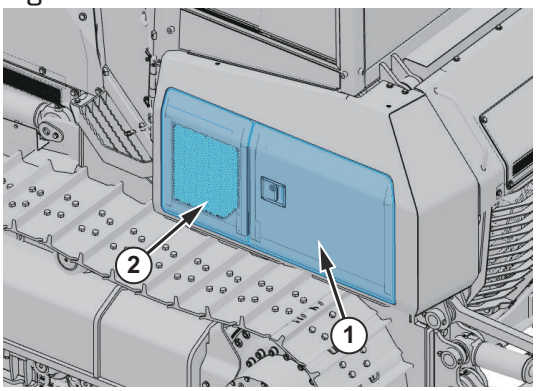
Battery Assembly

Repair Procedure Quick Guide

Step-A. Open the left side door
Step-B. Remove upper cover
Step-C. Disconnect wiring harness
Step-D. Remove battery assembly

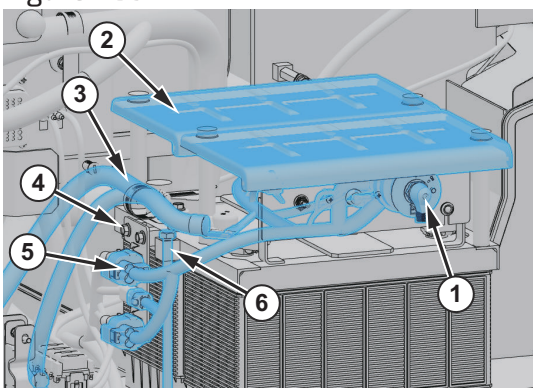
Removal

1. Open the left side door (1).
   Figure 288



DS2200849

2. Turn OFF the battery disconnect switch (1).
   Figure 289



DS2200850

3. Remove the battery upper cover (2).
4. Disconnect the negative cable and positive cable (3) from the batteries.
5. Remove the bolts (4) from bracket.
6. Disconnect any additional electrical connections as necessary (5).
7. Remove the hold down bracket and bolts (6).
   - Tool: 17 mm ( )
8. Remove batteries from frame.

Installation

1. Perform installation in the reverse order to removal.
2. Check the battery and start engine.

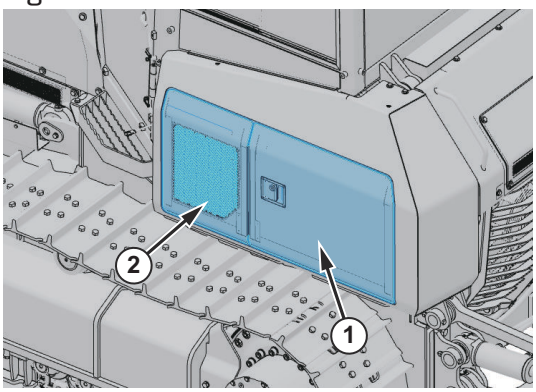
EPOS Controller

Repair Procedure Quick Guide

Step-A. Open the left side door
Step-B. Remove EPOS controller cover
Step-C. Disconnect wiring harness
Step-D. Remove EPOS controller

Removal

1. Open the left side door (1, 2).
   Figure 290

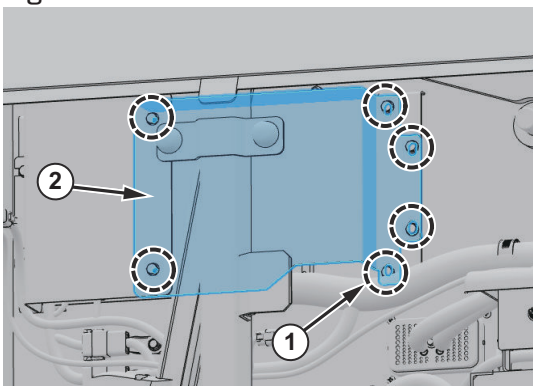


DS2200849

2. Turn OFF the battery disconnect switch.

EPOS Controller Cover

1. Remove bolts (1) from EPOS controller cover (2).
   Figure 291

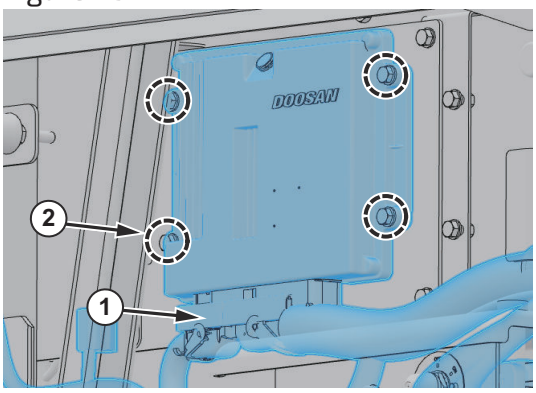


DS2200851

2. Remove EPOS controller cover.

EPOS Controller

1. Disconnect wiring harness connectors (1) from EPOS controller.
   Figure 292



DS2200852

   NOTE: *Move up connector levers when disconnect.*

2. Remove mounting bolts (2) from EPOS controller.
   - Tool: 13 mm ( )

- Torque: 19.6 N.m (2 kg.m, 14.5 ft lb)

3. Remove EPOS controller.

Installation

1. Perform installation in the reverse order to removal.

TMS Controller

Repair Procedure Quick Guide

Step-A. Open the cabin door

Step-B. Remove cabin rear cover

Step-C. Disconnect wiring harness

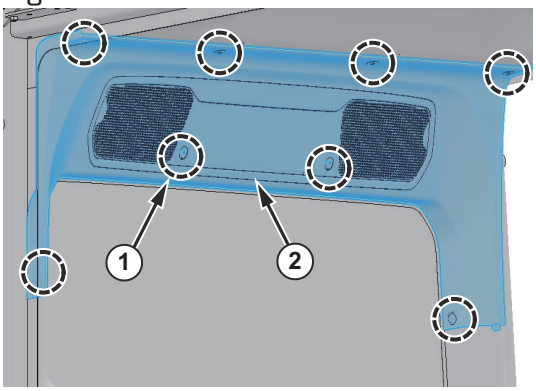
Step-D. Remove TMS controller

Removal

1. Open the left side door.
2. Turn OFF the battery disconnect switch.
3. Open the cabin door.

Cabin Rear Cover

1. Remove cap and bolts (1) from rear upper cover (2).
   Figure 293

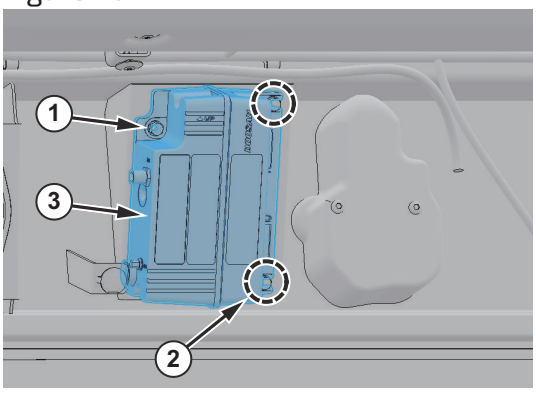


DS2200856

2. Remove rear upper cover.

TMS Controller

1. Disconnect wiring harness and cables from TMS controller.
   Figure 294



DS2200864

   NOTE: *Check the location of the connectors before disconnecting.*
2. Remove mounting bolts (1) from TMS controller (3).
3. Loosen mounting bolts (2).

   NOTE: *Do not tighten the fasteners too hard when installing.*
4. Remove TMS controller.

   NOTE: *Check the "UP" mark on the TMS controller. "UP" mark upward when TMS controller is mounted to the machine.*

Installation

1. Perform installation in the reverse order to removal.

TCU Controller

Repair Procedure Quick Guide

Step-A. Open the left side door

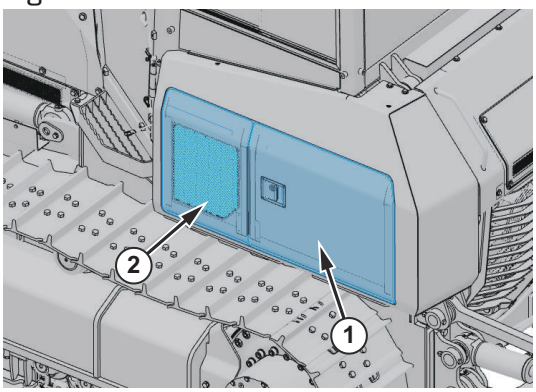
Step-B. Tilt the cabin

Step-C. Disconnect wiring harness

Step-D. Remove TCU controller

Removal

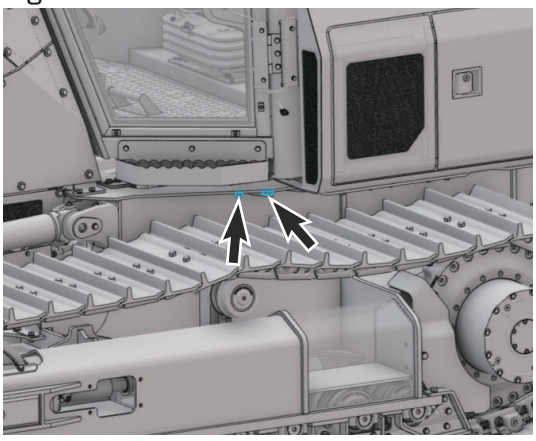
1. Open the left side door (1, 2).
   Figure 295



DS2200849

Tilt the Cabin

1. To operate cabin tilting system, remove bolts and nuts under the cabin.
   Figure 296

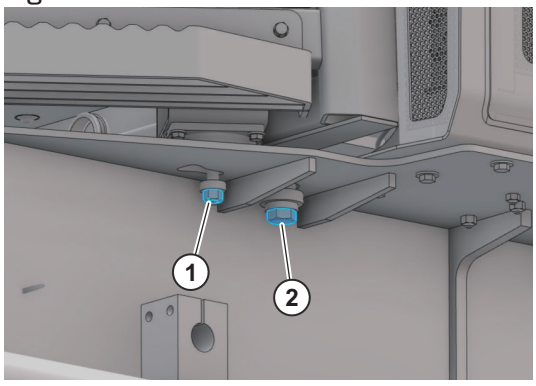


DS2201285

NOTE: *Both the left/right bolts of the cabin must be removed.*

NOTE: *Failure to remove bolts can cause serious damage to the machine.*

2. Remove nuts (1).
   Figure 297



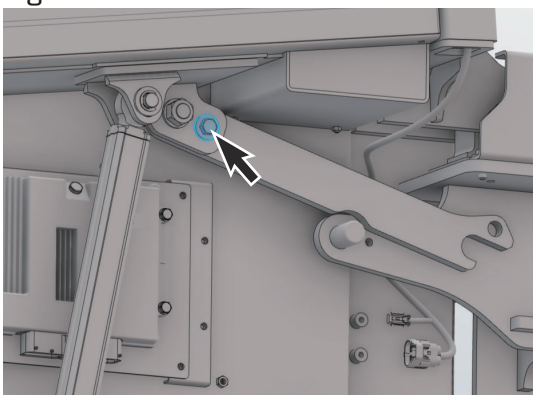
DS2201286

- Tool: 24 mm ( )
- Torque: 215.7 N.m (22 kg.m, 159 ft lb)

3. Remove bolts (2).

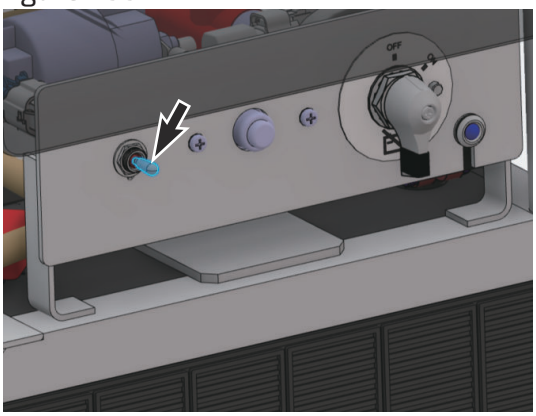
- Tool: 36mm ( )
- Torque: 127.4 N.m (13 kg.m, 94 ft lb)

4. Remove the bolts and washer on the safety bar. Safety bar is located in left side door.
   Figure 298



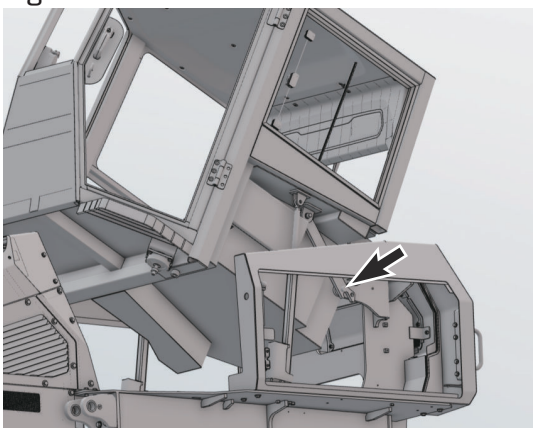
DS2201290

5. Turn cabin tilting switch to "ON" position.
   Figure 299



DS2201287

6. When the cabin tilting is completed, make sure the safety bar is fully engaged to the end and tighten the bolts and washers that were removed in step 4.
   Figure 300



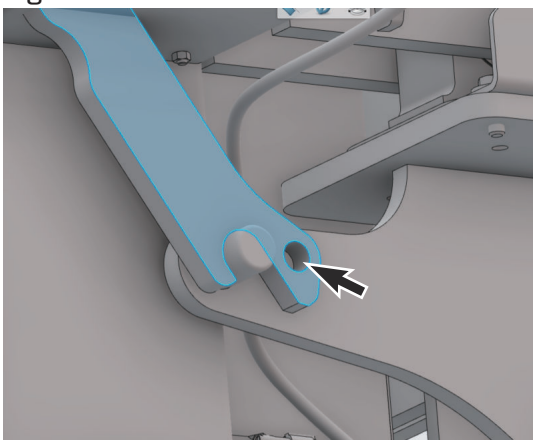
DS2201288

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Always check the installation of the safety bar during tilt operation.
It can cause death or serious injury.

Figure 301

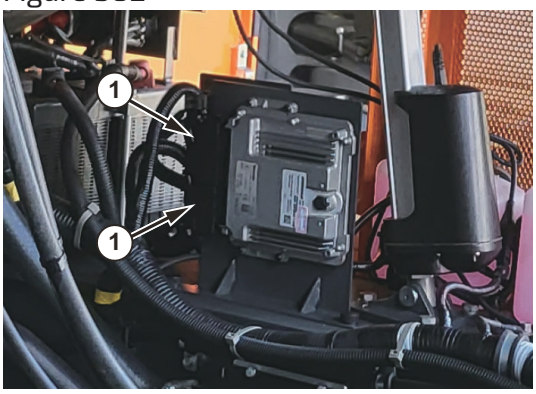


DS2201289

Wiring Harness

1. Turn Off the battery disconnect switch.

   Figure 302



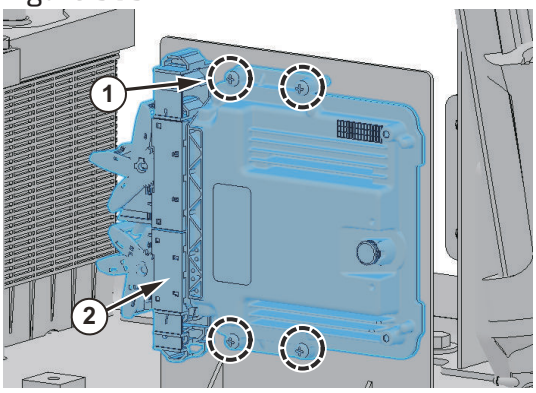
   DS2200875

2. Disconnect harness connectors (1) from TCU controller.

   NOTE: *Check the location of the connectors before disconnecting. Be careful not to let water get into electrical components. If water gets into electrical system, this will cause an electrical short circuit and result in improper machine operation.*

TCU Controller

1. Remove mounting bolts (1) from TCU controller (2).
   Figure 303



DS2200876

NOTE: *Do not tighten the fasteners too hard when installing.*

2. Remove TCU controller.

Installation

1. Perform installation in the reverse order to removal.

Cabin Switches

Repair Procedure Quick Guide

Step-A. Open the cabin door

Step-B. Remove stand covers

Step-C. Disconnect wiring harness

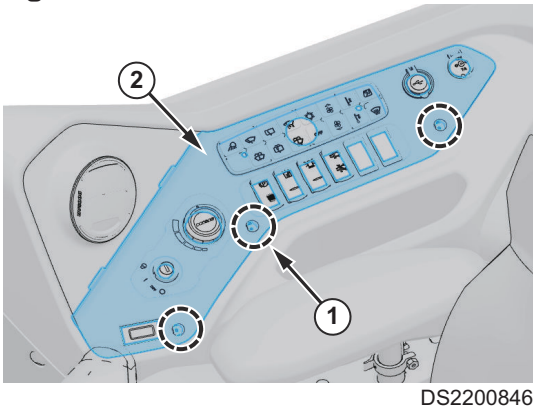
Step-D. Remove cabin switches

Removal

1. Open the left side door.
2. Turn OFF the battery disconnect switch.
3. Open the cabin door.

Stand Cover

1. Remove the plug cap and screws (1) from cabin side cover.
   Figure 304



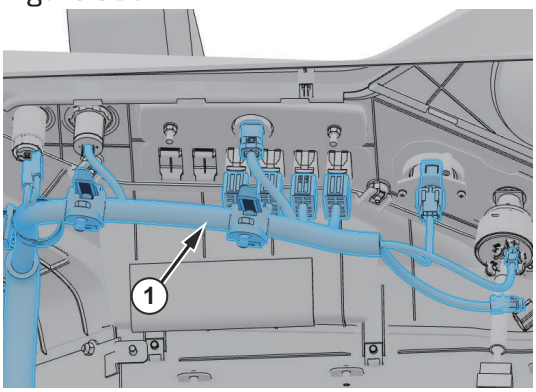
DS2200846

NOTE: *Please find the service groove.*

2. Remove the cabin side cover (2).

Wiring Harness

1. Disconnect wiring harness connector (1) and all connector from switches.
   Figure 305

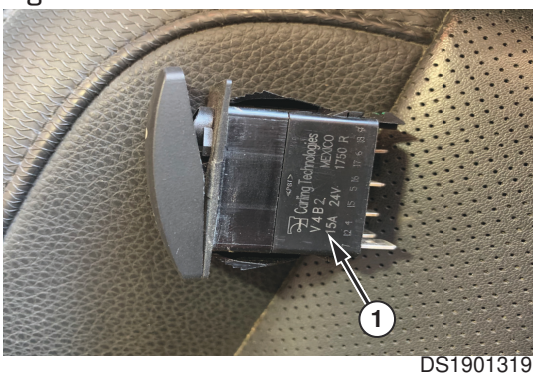


DS2200848

NOTE: *Check the location of the connectors before disconnecting.*

Cabin Switches

1. Pull up cabin switches (1) by using a flat-head screwdriver.
   Figure 306



DS1901319

NOTE: *Be careful not to break the switch assembly.*

Installation

1. Perform installation in the reverse order to removal.

Display Monitor

Repair Procedure Quick Guide

Step-A. Open the cabin door

Step-B. Remove front side cover

Step-C. Remove front upper cover

Step-D. Remove display monitor

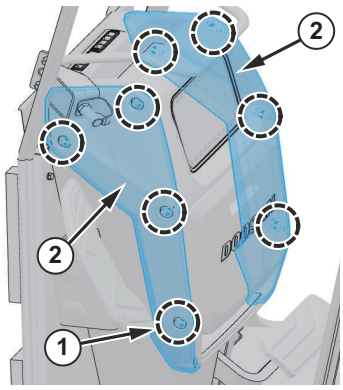
Removal

1. Open the left side door.
2. Turn OFF the battery disconnect switch.

3. Open the cabin door.

Cabin Front Side Cover

1. Remove the plug cap and screws (1) from front side cover.
   Figure 307



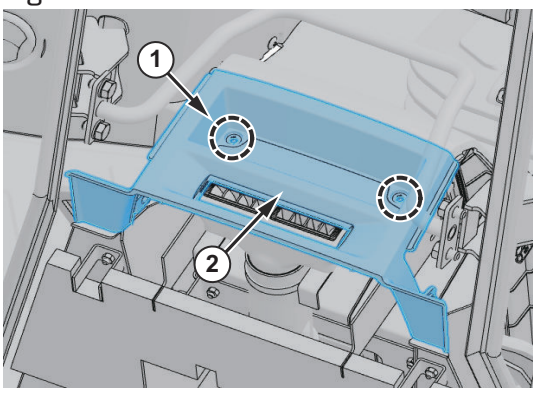
DS2200843

   NOTE: *Please find the service groove.*

2. Remove the front side cover (2).

Cabin Front Upper Cover

1. Remove the plug cap and screws (1) from front upper cover.
   Figure 308

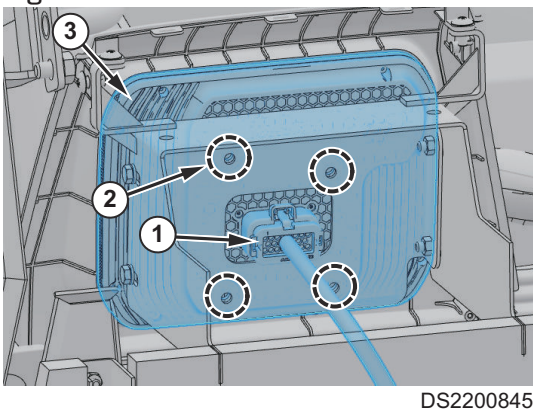


DS2200844

2. Remove the front upper cover (2).

Display Monitor

1. Disconnect wire harness (1) from display monitor (3).
   Figure 309



DS2200845

2. Remove the bolts (2) from display monitor.

- Refer to torque values for standard.

3. Remove the display monitor from bracket.

Installation

1. Perform installation in the reverse order to removal.

Hour Meter

Repair Procedure Quick Guide

Step-A. Open the cabin door

Step-B. Remove stand cover

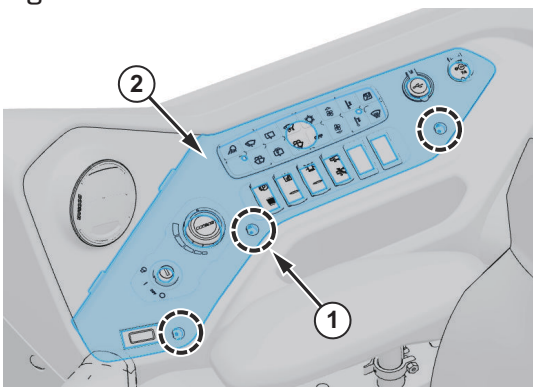
Step-C. Remove hour meter

Removal

1. Open the left side door.
2. Turn OFF the battery disconnect switch.
3. Open the cabin door.

Stand Cover

1. Remove the plug cap and screws (1) from cabin side cover.
   Figure 310



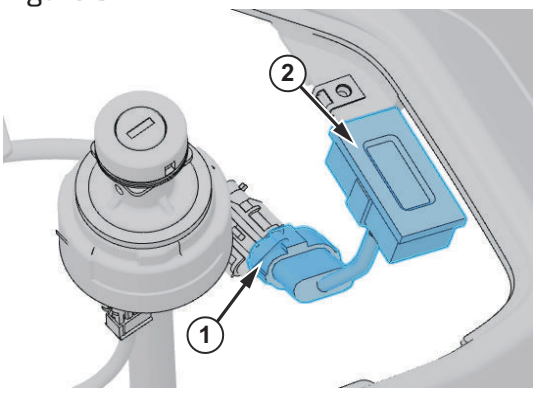
DS2200846

   NOTE: *Please find the service groove.*

2. Remove the cabin side cover (2).

Hour Meter

1. Disconnect wire harnesses (1).
   Figure 311



DS2200847

2. Remove the hour meter (2) from cabin side cover.

Installation

1. Perform installation in the reverse order to removal.

Wiper Motor

Repair Procedure Quick Guide

Step-A. Remove left, right door wiper arm and blade.

Step-B. Remove left, right wiper motor

Step-C. Remove rear glass wiper arm and blade.

Step-D. Remove rear wiper motor

Step-E. Remove front glass wiper arm and blade.

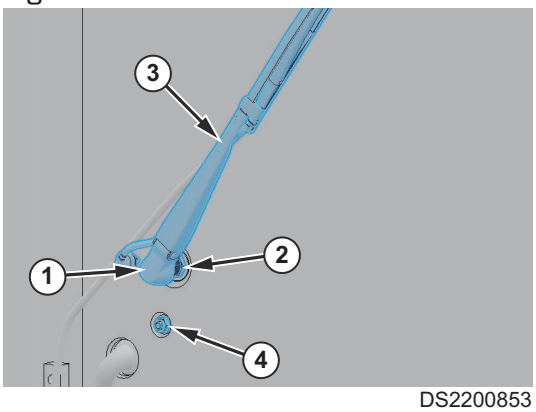
Step-F. Remove front wiper motor

Removal

1. Turn OFF the battery disconnect switch.

Left, Right Wiper Arm and Blade

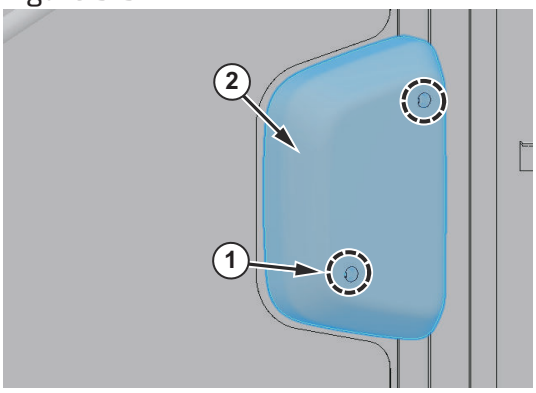
1. Open cap (1), remove nut (2, 4) and wiper arm and blade (3).
   Figure 312



DS2200853

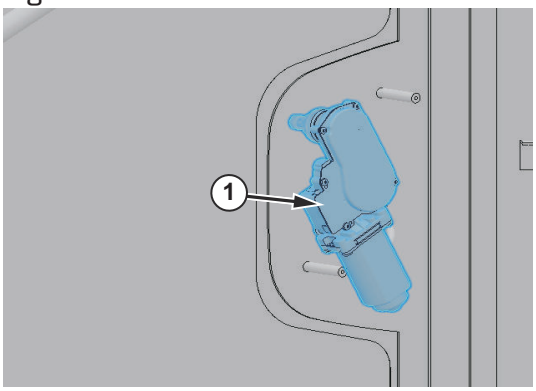
Left, Right Wiper Motor

1. Remove cap and bolts (1) from wiper motor cover (2).
   Figure 313



DS2200854

2. Remove wiper motor cover.
3. Disconnect wire harness connector from wiper motor.
   Figure 314

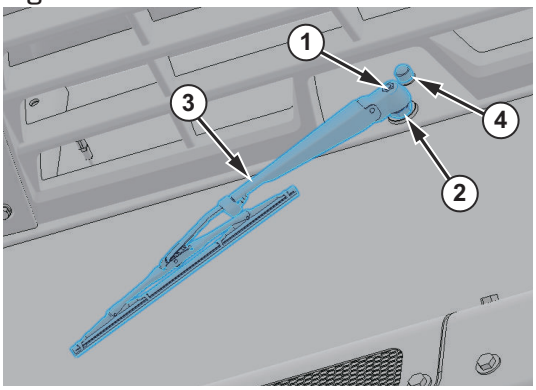


DS2200855

4. Remove wiper motor (1).

Rear Wiper Arm and Blade

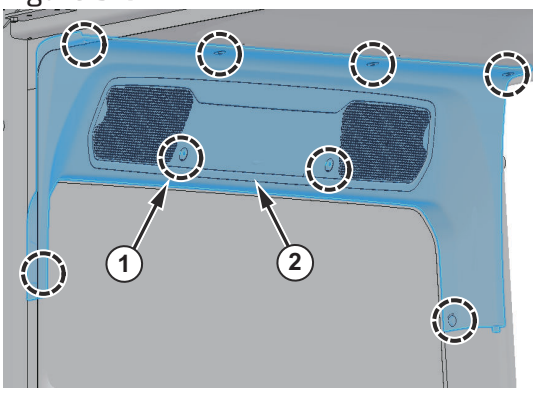
1. Open cap (1), remove nut (2, 4) and wiper arm and blade (3).
   Figure 315



DS2200859

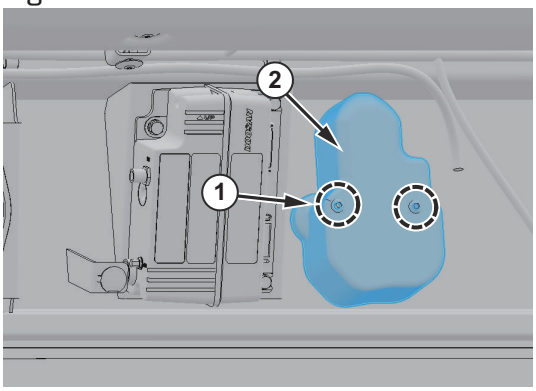
Rear Wiper Motor

1. Remove cap and bolts (1) from rear upper cover (2).
   Figure 316



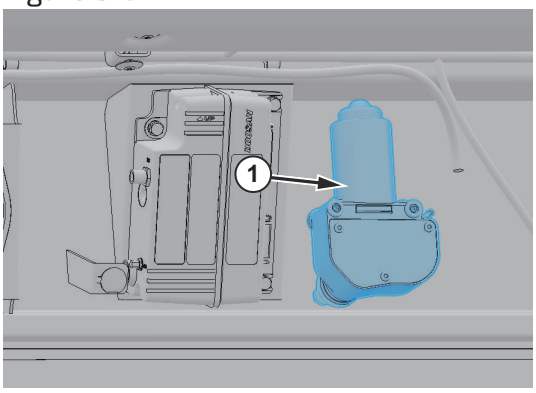
DS2200856

2. Remove rear upper cover.
3. Remove bolts (1) from rear wiper motor (2).
   Figure 317



DS2200857

4. Remove rear wiper cover.
5. Disconnect wire harness connector from wiper motor.
   Figure 318

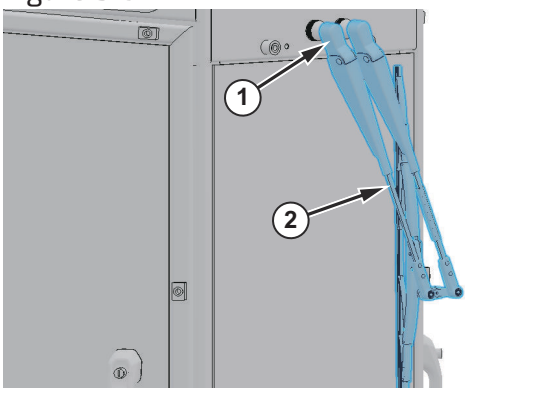


DS2200858

6. Remove wiper motor (1).

Front Wiper Arm and Blade

1. Open the cap.
   Figure 319

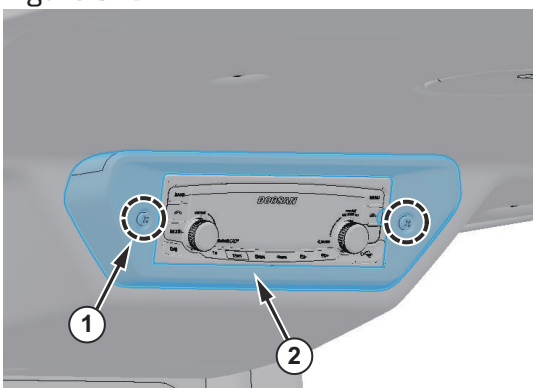


DS2200860

2. Remove nut (1) and wiper arm and blade (2).

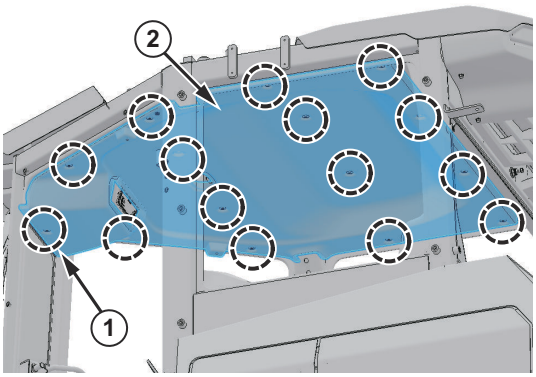
Front Wiper Motor

1. Remove bolts (1) from DAB audio cover (2).
   Figure 320



DS2200861

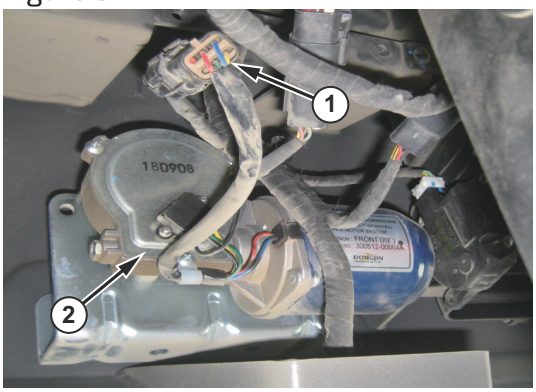
2. Remove DAB audio cover.
3. Remove bolts (1) from cabin roof cover (2).
   Figure 321



DS2200862

4. Remove cabin roof cover.

5. Disconnect wire harness (1). From front wiper motor (2).
   Figure 322



DS2200863

6. Remove front wiper motor (2) from cabin assembly.

Installation

1. Perform installation in the reverse order to removal.

Troubleshooting Guide

Wiring Harness Layout

Safety Instructions

⚠ WARNING

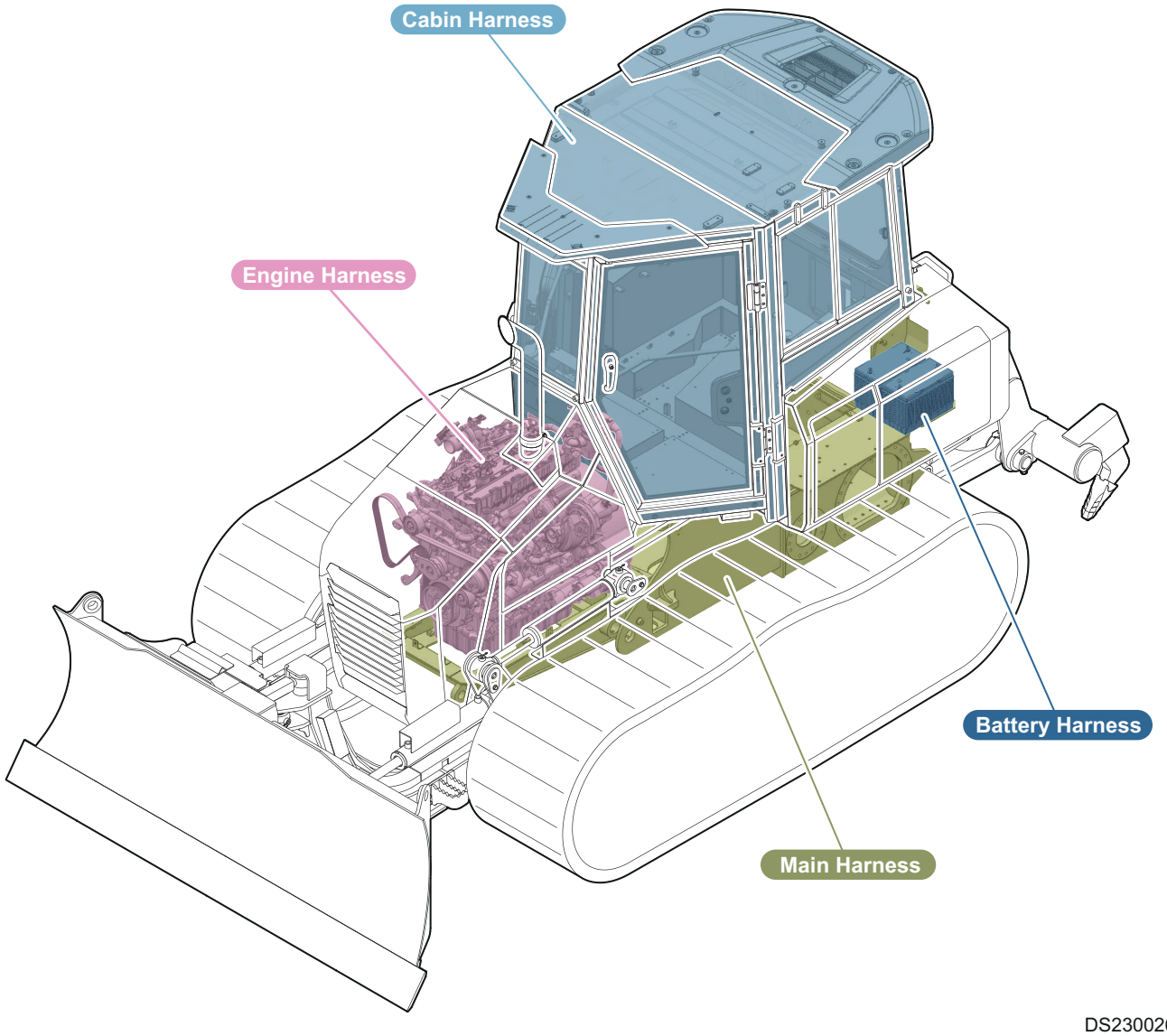
AVOID DEATH OR SERIOUS INJURY

Instructions are necessary before operating or servicingmachine. Read and understand the Operation & Maintenance Manual and signs (decals) on machine. Followwarnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correctfunction after adjustments repairs or service. Untrainedoperators and failure to follow instructions can cause deathor serious injury.

Wiring Device

Wiring Harness Layout

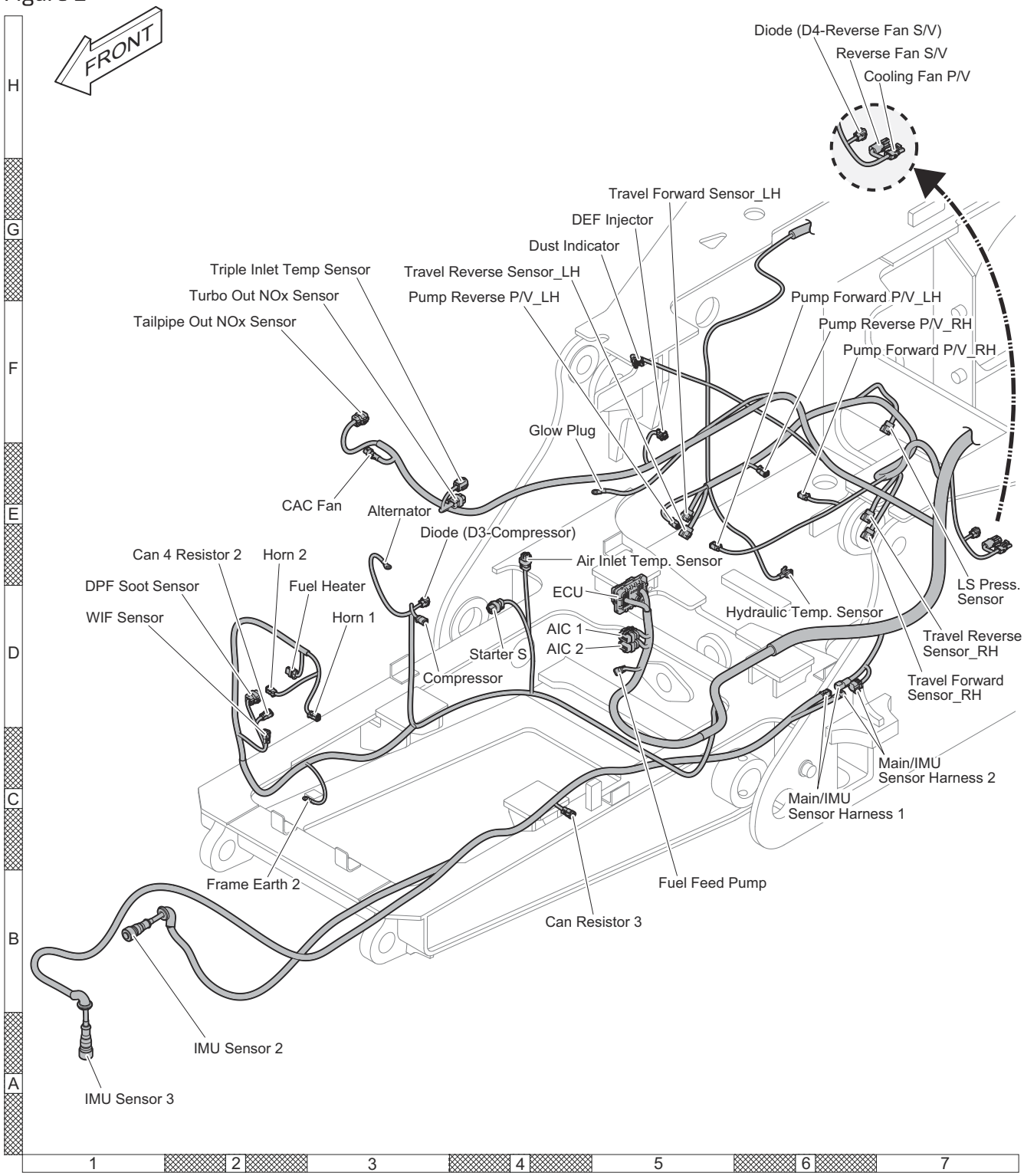
Figure 1



DS2300262

Main Harness (1/2)

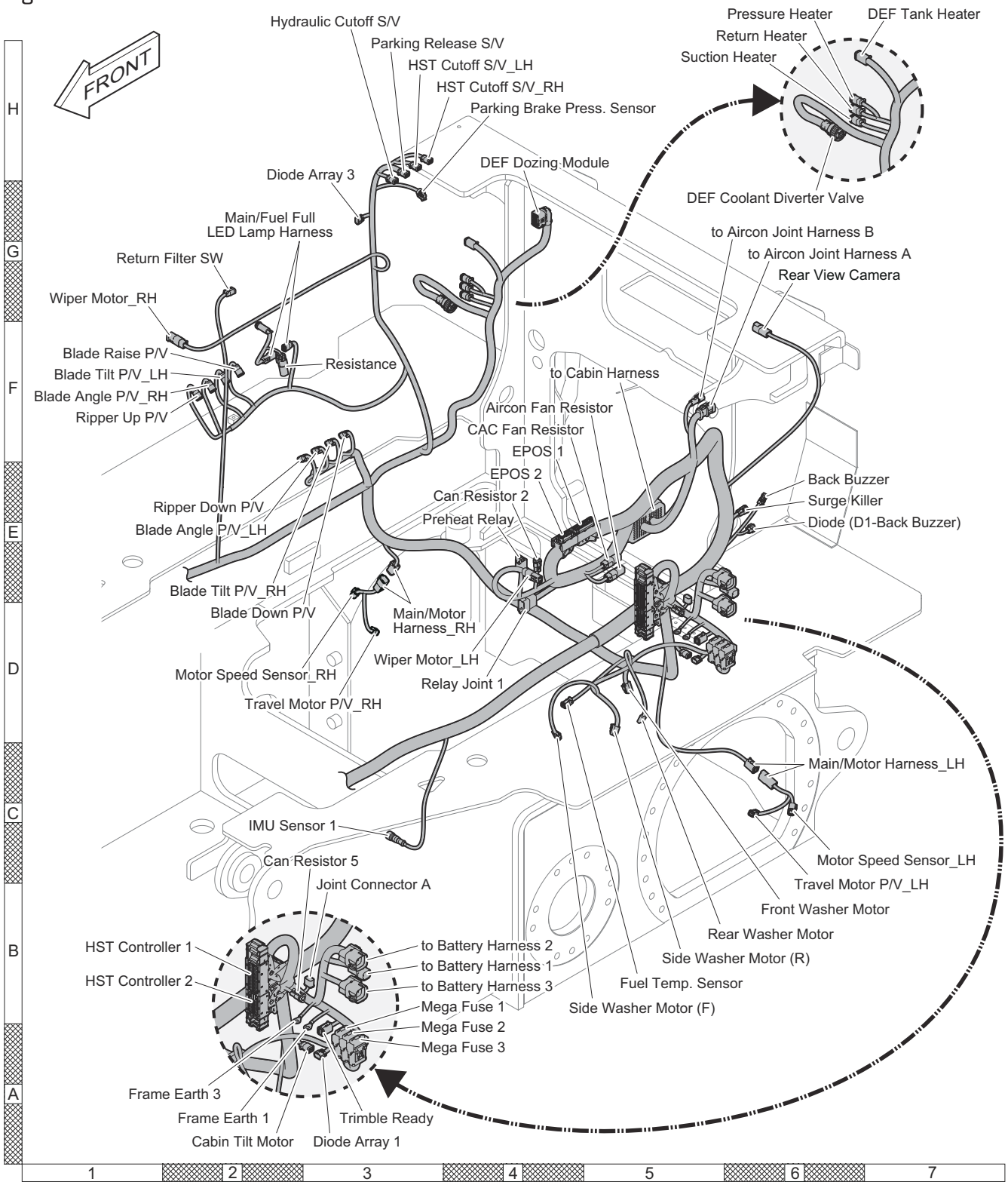
Figure 2



DS2300259

Main Harness (2/2)

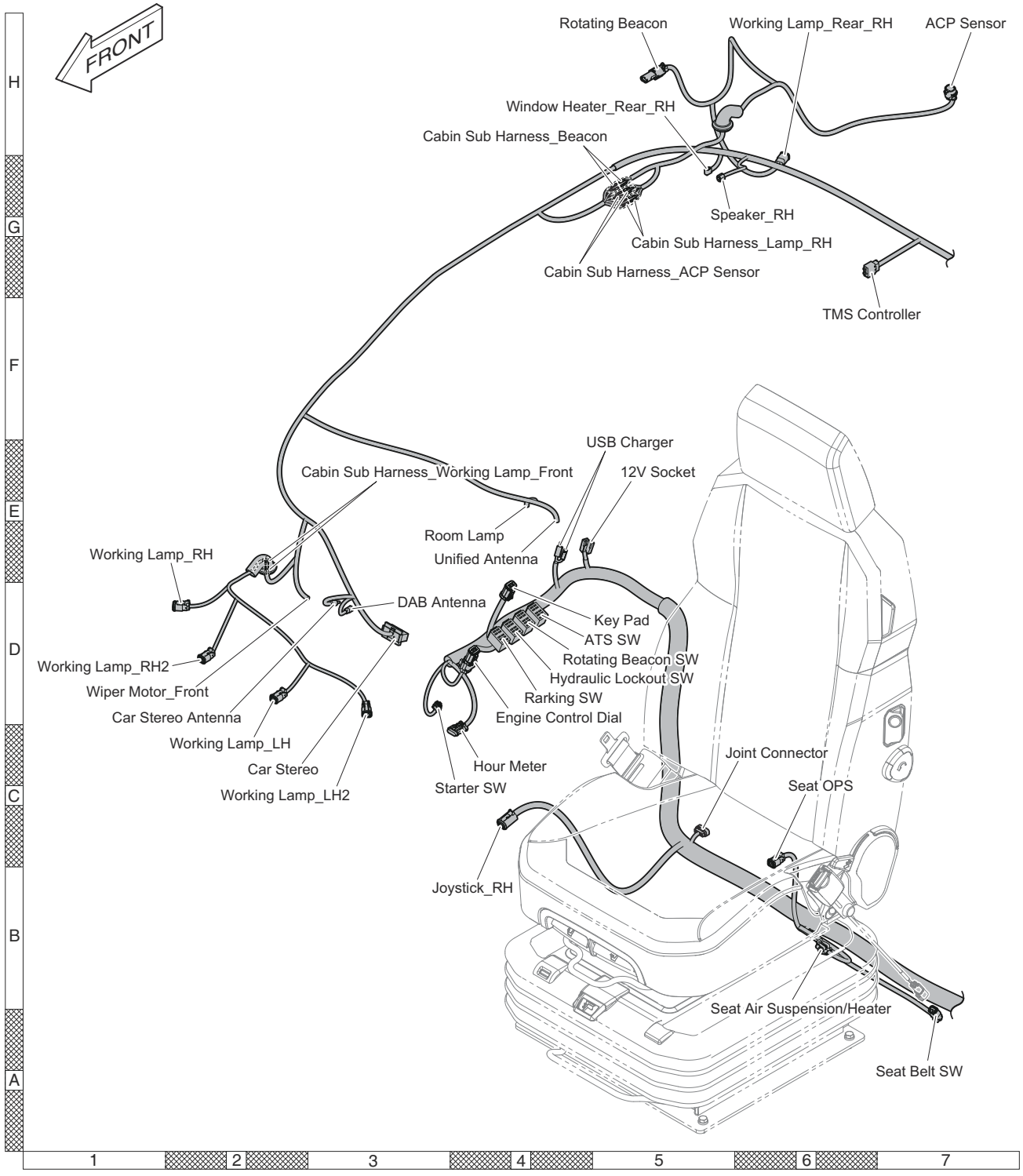
Figure 3



DS2300260

Cabin Harness (1/2)

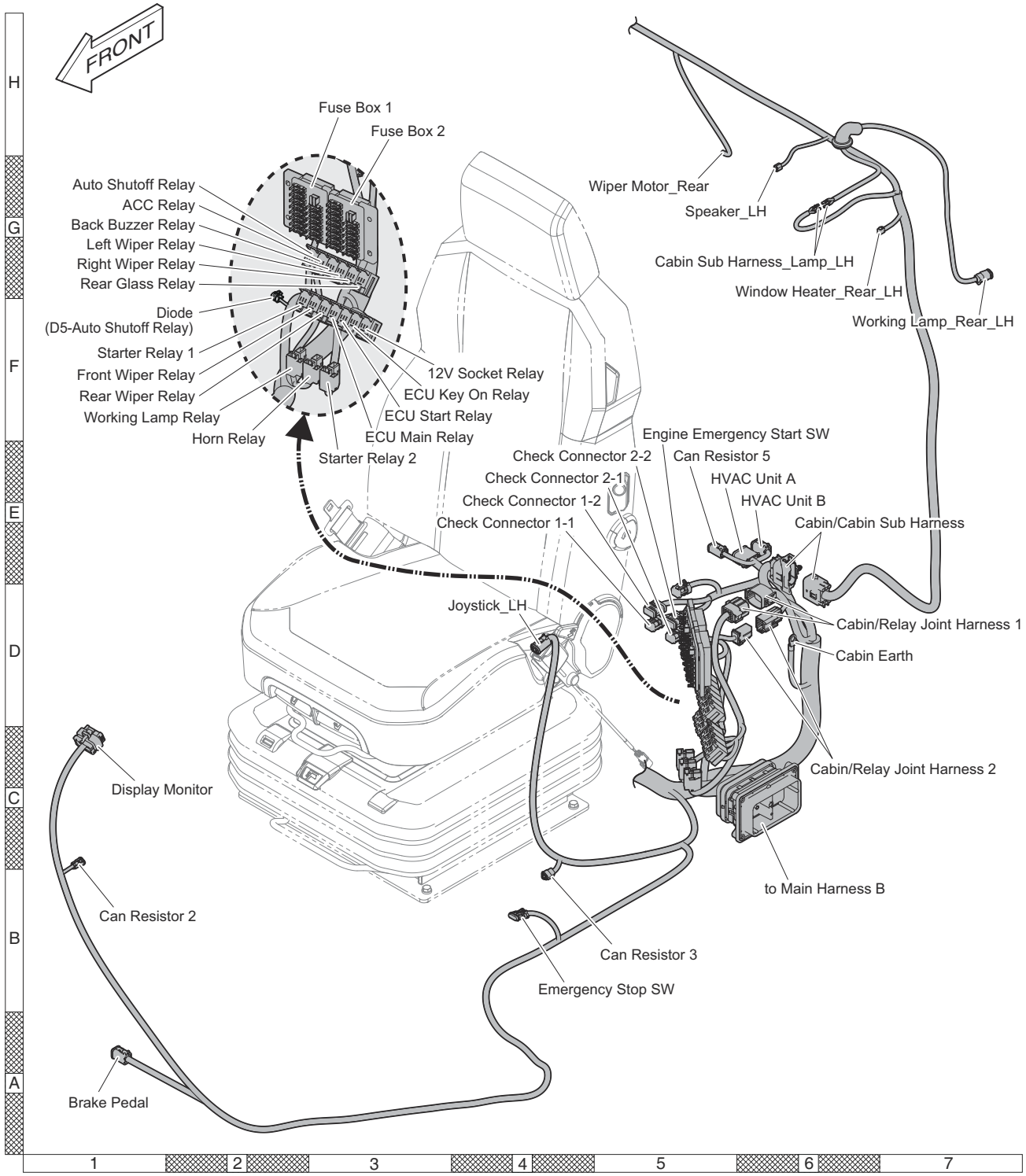
Figure 4



DS2300258

Cabin Harness (2/2)

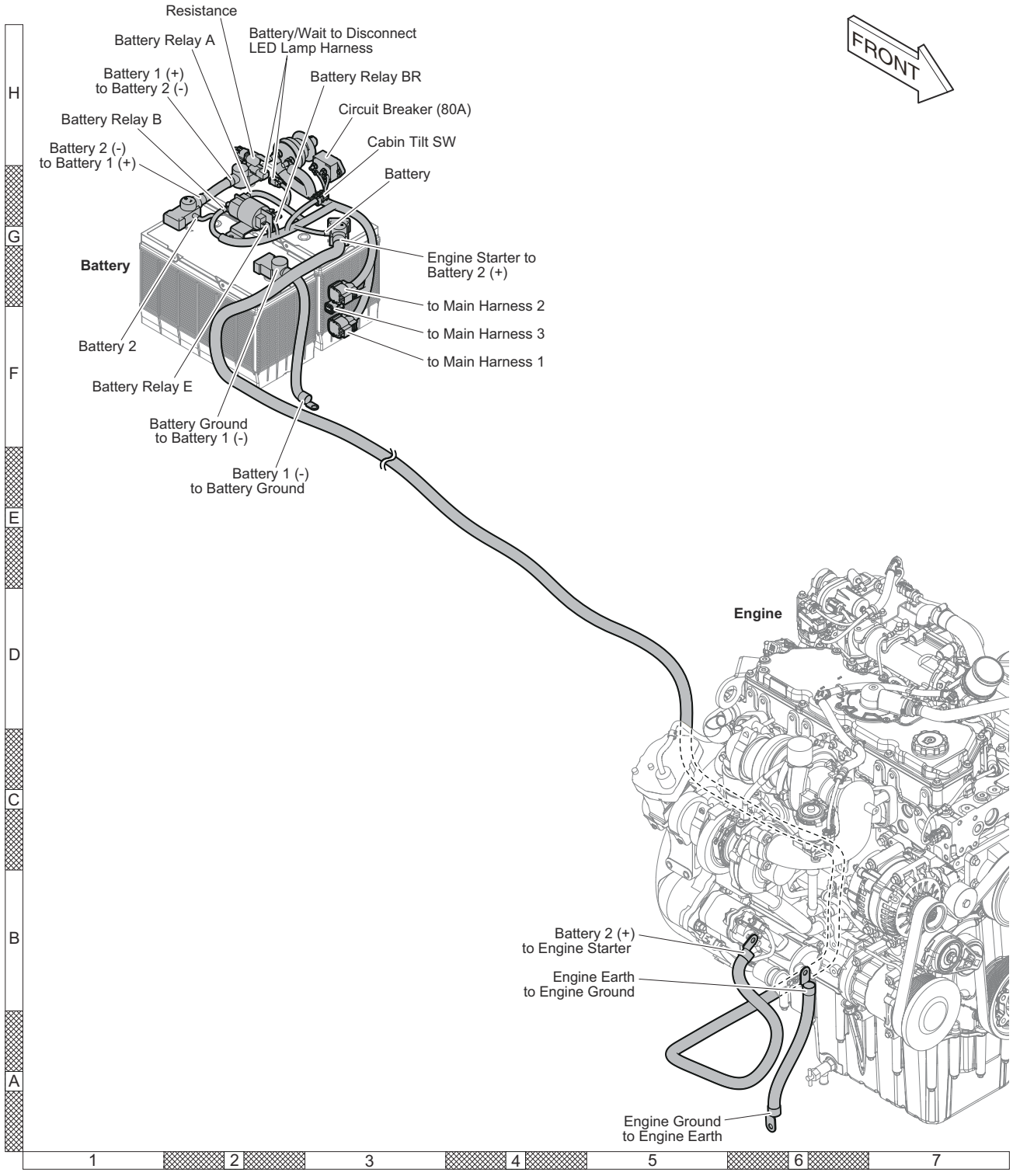
Figure 5



DS2201277

Battery Harness

Figure 6



DS2300261

Error Code

Safety Instructions

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Instructions are necessary before operating or servicingmachine. Read and understand the Operation & Maintenance Manual and signs (decals) on machine. Followwarnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correctfunction after adjustments repairs or service. Untrainedoperators and failure to follow instructions can cause deathor serious injury.

EPOS Error Code

Information Mentioned in Troubleshooting Table

Before performing troubleshooting, understand that information fully.Please refer to the DMS-5 for detailed information.

No.		Description of the Problems
1	VC0001	GAUGE PANEL Commnuication
2	VC0002	E-ECU Commnuication
3	VC0003	TCU Commnuication
4	VC0004	IMU BODY Commnuication
5	VC0005	IMU BLADE Commnuication
6	VC0006	JOYSTICK LH Commnuication
7	VC0007	JOYSTICK RH Commnuication
8	VC0008	KEYPAD Commnuication
9	VC0010	AIRCON UNIT Commnuication
10	VC0011	IMU C-FRAME Commnuication
11	VPV001	BLADE TILT RIGHT P/V
12	VPV002	BLADE TILT LEFT P/V
13	VPV003	BLADE RAISE P/V
14	VPV004	BLADE DOWN P/V
15	VPV005	BLADE ANGLE RIGHT P/V
16	VPV006	BLADE ANGLE LEFT P/V
17	VPV007	FAN CONTROL P/V (J)
18	VPV008	RIPPER UP P/V
19	VPV009	RIPPER DOWN P/V
20	VSV001	PARKING BRAKE S/V
21	VSV002	HYDRAULIC CUTOFF S/V
22	VSV003	HST CUTOFF RH S/V

23	VSV004	REVERSE FAN S/V (D)
24	VSV005	HST CUTOFF LH S/V
25	VRY001	AUTO SHUT OFF RELAY
26	VRY002	ACC RELAY
27	VRY003	CABIN LAMP RELAY
28	VRY004	BACK BUZZER RELAY
29	VRY005	HORN Relay
30	VRY006	FRONT WASHER RELAY
31	VRY007	REAR WASHER RELAY
32	VRY008	FRONT WIPER RELAY
33	VRY009	REAR WIPER RELAY
34	VRY010	SIDE WIPER RELAY
35	VRY011	SIDE WAHSER RELAY
36	VRY012	Rear Window Glass Heater Relay
37	VSP001	PARKING BRAKE PRESS. SENSOR
38	VSP002	IMPLEMENT PRESSURE SENSOR
39	VSP003	ACP SENSOR
40	VSE001	OIL TEMP. SENSOR
41	VSE002	WIF SENSOR
42	VSE003	FUEL SENSOR
43	VSE004	OPS
44	VS5001	Machine Controller +5V Output 1
45	VS5002	Machine Controller +5V Output 2,
46	VAL001	ALTERNATOR POTENTIAL
47	VGC003	ILLUMINATION
48	VGC005	CONDENSER FAN
49	VGC006	CAC FAN

1. Engine Fault Code List

Gauge Panel Fault Code	P Code	Fault Code Description
E000000-19	U0607	Timeout Error of CAN-Receive-Frame TSC1VE (Engine speed & Torque demand) - (U0607)
E000027-00	P042E	EGR Position Open jammed fault - (P042E)
E000027-01	P042F	EGR Position Closed jammed fault - (P042F)
E000027-03	P0406	EGR Position Sensor High Fault - (P0406)
E000027-04	P0407	EGR Position Sensor Low Fault - (P0407)
E000027-20	P0C17	EGR Close Position Learning Range Over Fault - (P0C17)

Gauge Panel Fault Code	P Code	Fault Code Description
E000027-22	P0C18	EGR Close Position Learning Drift Fault for long time - (P0C18)
E000027-23	P0C19	EGR Close Position Learning Drift Fault for short time - (P0C19)
E000029-03	P0223	Accel pedal position track2 sensor High fault - (P0223)
E000029-04	P0222	Accel pedal position track2 sensor Low fault - (P0222)
E000029-15	P0221	Hand pedal position track2 sensor High fault - (P0221)
E000029-17	P0224	Hand pedal position track2 sensor Low fault - (P0224)
E000051-00	P02E4	Throttle valve Position Open jammed fault - (P02E4)
E000051-01	P02E5	Throttle valve Position Closed jammed fault - (P02E5)
E000051-03	P02E9	Throttle valve Position Sensor High Fault - (P02E9)
E000051-04	P02E8	Throttle valve Position Sensor Low Fault - (P02E8)
E000051-22	P02EA	Throttle valve Close Position Learning Drift Fault for long time - (P02EA)
E000051-23	P02EB	Throttle valve Close Position Learning Drift Fault for short time - (P02EB)
E000051-30	P02E7	Throttle valve Close Position Learning Range Over Fault - (P02E7)
E000091-03	P0123	Accel pedal position track1 sensor High fault - (P0123)
E000091-04	P0122	Accel pedal position track1 sensor Low fault - (P0122)
E000091-11	P2135	Accel pedal position sensor plausibility fault (Not synchronism between track1 and track2) - (P2135)
E000091-12	P2136	Hand pedal position sensor plausibility fault (Not synchronism between track1 and track2) - (P2136)
E000091-15	P0121	Hand pedal position track1 sensor High fault - (P0121)
E000091-17	P0124	Hand pedal position track1 sensor Low fault - (P0124)
E000091-19	U0606	Timeout Error of CAN-Receive-Frame EEC2 (Pedal) - (U0606)
E000097-03	P2267	Water In Fuel Sensor signal range high fault - (P2267)
E000097-04	P2266	Water In Fuel Sensor signal range low fault - (P2266)
E000097-14	P2269	Water in fuel detected - Warning step - (P2269)
E000097-22	P2264	Water in fuel detection internal fault - (P2264)
E000097-23	P2265	Water in fuel detected - Torque de-rate step (After 20min) - (P2265)
E000098-02	P250B	Oil level out of range error of oil combination(Level and temperature) sensor - (P250B)
E000098-03	P250D	Oil combination (Level and temperature) signal output short circuit to battery error - (P250D)
E000098-04	P250C	Oil combination (Level and temperature) signal output short circuit to ground error - (P250C)
E000098-05	P250A	Oil combination (Level and temperature) sensor itself open or short circuit error - (P250A)

Gauge Panel Fault Code	P Code	Fault Code Description
E000098-18	P250F	Oil level sensor SRC error of oil combination(Level and temperature) sensor - (P250F)
E000098-22	P350D	Oil combination (Level and temperature) sensor timeout fault - (P350D)
E000098-23	P350E	Oil combination (Level and temperature) sensor itself Voltage out of range error - (P350E)
E000098-24	P350F	Engine oil level is low (Low step2) - (P350F)
E000100-01	P1522	Engine Oil Pressure Too Low Fault - (P1522)
E000100-03	P0523	Engine Oil Pressure Sensor High Fault - (P0523)
E000100-04	P0522	Engine Oil Pressure Sensor Low Fault - (P0522)
E000102-03	P0108	Intake Manifold Pressure Sensor High Fault - (P0108)
E000102-04	P0107	Intake Manifold Pressure Sensor Low Fault - (P0107)
E000105-03	P00AD	Intake manifold temperature sensor High fault - (P00AD)
E000105-04	P00AC	Intake manifold temperature sensor Low fault - (P2454)
E000105-16	P10AD	Intake manifold temperature High fault - (P10AD)
E000108-03	P2229	Atmospheric Pressure Sensor High Fault - (P2229)
E000108-04	P2228	Atmospheric Pressure Sensor Low Fault - (P02E8)
E000110-00	P1118	Coolant high temperature Fault - (P1118)
E000110-03	P0118	Coolant Temperature Sensor High Fault - (P0118)
E000110-04	P0117	Coolant Temperature Sensor Low Fault - (P0117)
E000110-10	P011E	Coolant Temperature Plausibility Fault - (P011E)
E000132-01	P00BC	Intake manifold pressure low plausibility fault (Compressor out pressure too low) - (P00BC)
E000132-03	P0103	Signal range check high error for raw value in Air mass flow sensor - (P0103)
E000132-04	P0102	Signal range check low error for raw value in Air mass flow sensor - (P0102)
E000132-05	P0101	Battery voltage error of Air mass flow sensor - (P0101)
E000132-19	P0100	Signal error of Air mass flow sensor - (P0100)
E000132-21	P00BE	Sensitivity drift error low for Air mass flow sensor - (P00BE)
E000157-10	P0087	Fuel Leakage is detected based on fuel quantity balance - (P0087)
E000157-11	P0002	Maximum positive deviation of rail pressure exceeded - (P0002)
E000157-13	P193A	Rail pressure jittering activation for injector deposit removal - (P193A)
E000157-14	P193B	Rail pressure jittering activation maximum time reached - (P193B)
E000157-26	P190C	Minimum rail pressure exceeded - (P190C)
E000157-27	P190B	Maximum rail pressure exceeded - (P190B)
E000157-28	P1934	Pressure relief valve(PRV) failure - (P1934)

Gauge Panel Fault Code	P Code	Fault Code Description
E000171-00	P1073	Environment Temperature Too High - (P1073)
E000171-03	P0073	Environment Temperature Sensor Signal High - (P0073)
E000171-04	P0072	Environment Temperature Sensor Signal Low - (P01C2)
E000172-00	P107D	Inlet air temperature High fault - (P107D)
E000172-03	P007D	Inlet air temperature sensor High fault - (P007D)
E000172-04	P007C	Inlet air temperature sensor Low fault - (P007C)
E000173-01	P0421	DOC Exothermal Efficiency Fault - (P0421)
E000174-00	P1183	Fuel temperature high fault - (P1183)
E000174-03	P0183	Fuel Temperature Sensor High Fault - (P0183)
E000174-04	P0182	Fuel Temperature Sensor Low Fault - (P0182)
E000175-00	P1198	Oil temperature too high fault - (P1198)
E000175-01	P1197	Oil temperature too low fault - (P1197)
E000175-11	P0196	Oil combination (Level and temperature) sensor itself Oil temperature out of range error - (P0196)
E000177-15	P273F	Transmission oil temperature high fault (CAN) - (P273F)
E000177-16	P274F	Transmission oil temperature high fault (H/W Switch) - (P274F)
E000190-00	P0219	Engine over speed detection fault - (P0219)
E000444-00	P1563	Battery Voltage High fault (Warning) - (P1563)
E000444-01	P1562	Battery Voltage Low fault (Warning) - (P1562)
E000444-02	P1565	Powerstage diagnosis could be disabled due to low Battery voltage - (P1565)
E000444-03	P0563	Battery Voltage Signal Range Max fault - (P0563)
E000444-04	P0562	Battery Voltage Signal Range Min fault - (P0562)
E000444-12	P1564	Powerstage diagnosis disabled due to high Battery voltage - (P1564)
E000626-12	P0512	Starter switch stuck fault (Cranking request is too long.) - (P0512)
E000636-02	P0372	Crank Signal disturbed fault - (P0372)
E000636-08	P0374	Cranks No signal error - (P0374)
E000637-02	P0344	Cam Signal disturbed fault - (P0344)
E000637-08	P0342	Cam Signal Lost fault - (P0342)
E000637-30	P0340	Cam Signal Drift Fault - (P0340)
E000639-02	U0029	CAN communication error - (U0029)
E000639-19	U0028	CAN bus off error - (U0028)
E000651-02	P268C	Injector Code(IQA) Program Missing Fault (Cylinder#1) - (P268C)
E000651-04	P02EE	Injector Short circuit Fault (Cylinder #1) - (P02EE)
E000651-05	P0201	Injector Open circuit Fault (Cylinder #1) - (P0201)
E000651-22	P32EE	Injector High Low side Short circuit Fault (Cylinder #1) - (P32EE)

Gauge Panel Fault Code	P Code	Fault Code Description
E000652-02	P268D	Injector Code(IQA) Program Missing Fault (Cylinder#2) - (P268D)
E000652-04	P02EF	Injector Short circuit Fault (Cylinder #2) - (P02EF)
E000652-05	P0202	Injector Open circuit Fault (Cylinder #2) - (P0202)
E000652-22	P32EF	Short circuit between high-side and low-side of the power stage (high-side non plausible error) for cylinder #2 - (P32EF)
E000653-02	P268E	Injector Code(IQA) Program Missing Fault (Cylinder#3) - (P268E)
E000653-04	P02F0	Injector Short circuit Fault (Cylinder #3) - (P02F0)
E000653-05	P0203	Injector Open circuit Fault (Cylinder #3) - (P0203)
E000653-22	P32F0	Injector High Low side Short circuit Fault (Cylinder #3) - (P32F0)
E000654-02	P268F	Injector Code(IQA) Program Missing Fault (Cylinder#4) - (P268F)
E000654-04	P02F1	Injector Short circuit Fault (Cylinder #4) - (P02F1)
E000654-05	P0204	Injector Open circuit Fault (Cylinder #4) - (P0204)
E000654-22	P32F1	Short circuit between high-side and low-side of the power stage (high-side non plausible error) for cylinder #4 - (P32F1)
E000676-03	P0384	Glow plug Relay driver Short circuit to Battery Fault - (P0384)
E000676-04	P0383	Glow plug Relay driver Short circuit to Ground Fault - (P0383)
E000676-05	P0380	Glow plug Relay driver Open circuit Fault - (P0380)
E000729-07	P0640	Glowplug relay plausibility fault (Not operation) - (P0640)
E000970-12	U1003	Engine shut off request through CAN (EBC1) - (U1003)
E000970-22	P0215	Engine shut off request through hardwire - (P0215)
E000975-03	P028E	PWM FAN Output short to battery circuit fault - (P028E)
E000975-04	P028D	PWM FAN Output short to ground circuit fault - (P028D)
E000975-05	P028A	PWM FAN Output open circuit fault - (P028A)
E000987-03	P1931	CE(Check engine) Lamp Short to Battery - (P1931)
E000987-04	P192F	CE(Check engine) Lamp Short to Ground - (P192F)
E000987-05	P192E	CE(Check engine) Lamp Open circuit - (P192E)
E001076-03	P0004	Fuel Metering unit plausibility error in overrun mode - (P0004)
E001076-04	P0003	Fuel Metering unit plausibility error in idle mode - (P0003)
E001076-16	P0254	Maximum negative rail pressure deviation with metering unit on lower limit is exceeded - (P0254)
E001076-20	P0252	Rail pressure too low for injection - (P0252)
E001081-03	P2381	Glow plug Lamp Short to Battery - (P2381)
E001081-04	P1904	Glow plug Lamp Short to Ground - (P1904)
E001081-05	P0381	Glow plug Lamp Open circuit - (P0381)
E001207-00	P0669	ECU temperature High fault - (P0669)
E001207-03	P06AE	ECU temperature sensor High fault (Short circuit to battery) - (P06AE)

Gauge Panel Fault Code	P Code	Fault Code Description
E001207-04	P06AD	ECU temperature sensor Low fault (Short circuit to ground) - (P06AD)
E001382-00	P018D	Fuel filter pressure high fault - (P018D)
E001382-01	P018C	Fuel filter pressure low fault - (P018C)
E001382-03	P01C6	Fuel filter pressure sensor signal high fault - (P01C6)
E001382-04	P01C2	Fuel filter pressure sensor signal low fault - (P0642)
E001382-07	P01C4	Fuel Filter Pressure low detection 1 - Warning - (P01C4)
E001382-13	P01C5	Fuel Filter Pressure low detection 2 - Torque reduction - (P01C5)
E001485-07	P0685	ECU Main relay Stuck fault - (P0685)
E001485-11	P068A	ECU Main relay Early opening fault - (P068A)
E001568-03	P2547	Multi-torque switch signal too high fault - (P2547)
E001568-04	P2546	Multi-torque switch signal too low fault - (P2546)
E001612-03	P062D	Injector bank 1st Short circuit fault - (P062D)
E001612-12	P062E	Injector bank 2nd Short circuit fault - (P062E)
E001639-03	P0528	Fan speed too high fault - (P0528)
E001639-04	P0529	Fan speed too low fault - (P0529)
E001639-11	P0527	Fan speed signal long period fault path - (P0527)
E001761-19	P1230	DEF Tank Level Signal error - (P1230)
E001867-01	P2505	ECU over temperature for SCR Monitoring - (P2505)
E001867-03	P2508	"ABE active" report due to overvoltage detection - (P2508)
E001867-04	P2507	"ABE active" report due to undervoltage detection - (P2507)
E001867-11	P2511	"WDA/ABE active" report due to unknown reason - (P2511)
E001867-19	P2509	"WDA active" report due to errors in query-response communication - (P2509)
E001867-22	P2506	ECU Software Reset 0 fault - (P2506)
E001867-23	P3506	ECU Software Reset 1 fault - (P3506)
E001867-24	P1905	ECU Software Reset 2 fault - (P1905)
E002789-00	P1546	Turbine inlet temperature High fault - (P1546)
E002789-03	P0546	Turbine inlet temperature sensor High fault - (P0546)
E002789-04	P0545	Turbine inlet temperature sensor Low fault - (P2228)
E002789-11	P0544	Turbine inlet temperature Plausibility Fault - (P0544)
E002791-03	P2145	EGR H-Bridge Driver Short circuit to battery - (P2145)
E002791-04	P2144	EGR H-Bridge Driver Short circuit to ground - (P2144)
E002791-05	P2143	EGR H-Bridge Driver Open Circuit Fault - (P2143)
E003031-14	P205E	DEF Tank temperature overheated - (P205E)
E003031-16	P1045	DEF Tank Temperature sensor High plausibility fault - (P1045)

Gauge Panel Fault Code	P Code	Fault Code Description
E003031-18	P1044	DEF Tank Temperature sensor Low plausibility fault - (P1044)
E003216-03	P2395	NOx sensor signal high fault (Upstream NOx sensor) - (P2395)
E003216-04	P2397	NOx sensor signal low fault (Upstream NOx sensor) - (P2397)
E003216-18	P225D	NOx sensor 1 (Upstream) concentration Low plausibility fault - (P225D)
E003217-03	P23A7	Linear Lambda signal high fault (Upstream NOx sensor) - (P23A7)
E003219-07	U030D	NOx sensor heating error (Upstream NOx sensor) - (U030D)
E003224-05	P2203	NOx sensor Open circuit fault (Upstream NOx sensor) - (P2203)
E003224-06	P2202	NOx sensor Short circuit fault (Upstream NOx sensor) - (P2202)
E003226-03	P2396	NOx sensor signal high fault (Downstream NOx sensor) - (P2396)
E003226-04	P2398	NOx sensor signal low fault (Downstream NOx sensor) - (P2398)
E003227-03	P23A8	Linear Lambda signal high fault (Downstream NOx sensor) - (P23A8)
E003229-07	U030E	NOx sensor heating error (Downstream NOx sensor) - (U030E)
E003234-05	P2216	NOx sensor Open circuit fault (Downstream NOx sensor) - (P2216)
E003234-06	P2215	NOx sensor Short circuit fault (Downstream NOx sensor) - (P2215)
E003236-00	P049B	EGR rate slow response positive error - (P049B)
E003236-16	P0408	Maximum EGR rate governor deviation - (P0408)
E003242-00	P1033	DPF(SCRF) inlet temperature High fault - (P1033)
E003242-03	P2033	DPF(SCRF) inlet temperature sensor High fault - (P2033)
E003242-04	P2032	DPF(SCRF) inlet temperature sensor Low fault - (P2032)
E003242-11	P2034	DPF(SCRF) inlet temperature Plausibility Fault - (P2034)
E003242-20	P2035	DPF(SCRF) inlet temperature Drift fault - (P2035)
E003251-03	P2455	DPF differential pressure sensor High fault - (P2455)
E003251-04	P2454	DPF differential pressure sensor Low fault - (P2454)
E003251-13	P3052	DPF differential pressure drift fault - (P3052)
E003251-18	P1454	DPF differential pressure too low fault - (P1454)
E003360-14	P263D	DEF pressure line heater error (Perform afterrun) - (P263D)
E003361-03	P2047	DEF dosing valve actuator Short circuit to battery Fault - (P2047)
E003361-04	P2048	DEF dosing valve actuator Short circuit to ground Fault - (P2048)
E003361-05	P2049	DEF dosing valve actuator Open Circuit Fault - (P2049)
E003361-13	P202E	DEF dosing valve actuator Over temperature Fault - (P202E)
E003361-14	P2C11	Urea dosing valve plausibility fault - (P2C11)
E003361-22	P2050	DEF dosing valve actuator HS(High side) Short circuit to battery Fault - (P2050)
E003361-23	P2051	DEF dosing valve actuator HS(High side) Short circuit to ground Fault - (P2051)

Gauge Panel Fault Code	P Code	Fault Code Description
E003361-27	P208E	DEF Dosing valve is blocked - (P208E)
E003363-03	P20B4	DEF Tank heating coolant valve output Short circuit to battery Fault - (P20B4)
E003363-04	P20B3	DEF Tank heating coolant valve output Short circuit to ground Fault - (P20B3)
E003363-05	P20B1	DEF Tank heating coolant valve output Open circuit Fault - (P20B1)
E003363-07	P30B1	DEF Tank heating coolant valve output Over temperature Fault - (P30B1)
E003509-03	P0659	ECU Sensor supply1 Over voltage fault - (P0659)
E003509-04	P0658	ECU Sensor supply1 Under voltage fault - (P0658)
E003509-05	P1657	ECU Sensor supply1 voltage fault - (P1657)
E003509-06	P0657	ECU Sensor supply1 Short circuit to ground - (P0657)
E003509-11	P0641	ECU Sensor supply Overvoltage monitoring error - (P0641)
E003510-03	P2671	ECU Sensor supply2 Over voltage fault - (P2671)
E003510-04	P2670	ECU Sensor supply2 Under voltage fault - (P2670)
E003510-05	P1669	ECU Sensor supply2 voltage fault - (P1669)
E003510-06	P2669	ECU Sensor supply2 Short circuit to ground - (P2669)
E003510-11	P0642	ECU Sensor supply Undervoltage monitoring error - (P0642)
E003511-03	P2686	ECU Sensor supply3 Over voltage fault - (P2686)
E003511-04	P2685	ECU Sensor supply3 Under voltage fault - (P2685)
E003511-05	P1684	ECU Sensor supply3 voltage fault - (P1684)
E003511-06	P2684	ECU Sensor supply3 Short circuit to ground - (P2684)
E003516-00	P106D	DEF Quality Too High fault - (P106D)
E003516-01	P106C	DEF Quality Too Low fault - (P106C)
E003516-12	P106E	DEF Quality failure status too long fault (Tampering) - (P106E)
E003517-18	P203F	DEF Tank level is empty - (P203F)
E003520-03	U1028	DEF Quality Sensor Open circuit - (U1028)
E003520-04	U1030	DEF Quality Sensor Short circuit - (U1030)
E003532-03	P203A	DEF Level Sensor Open circuit - (P203A)
E003532-04	P2041	DEF Level Sensor Short circuit - (P2041)
E003695-03	P25BC	DPF regeneration inhibit switch Short to Battery fault (Hardwire) - (P25BC)
E003696-03	P25BB	DPF regeneration enable switch Short to Battery fault (Hardwire) - (P25BB)
E003696-11	P25BA	DPF regeneration inhibit & enable switch plausibility fault (Hardwire) - (P25BA)
E003697-03	P2611	DPF lamp 1 (DPF regeneration switch enable lamp) Short to Battery - (P2611)

Gauge Panel Fault Code	P Code	Fault Code Description
E003697-04	P260F	DPF lamp 1 (DPF regeneration switch enable lamp) Short to Ground - (P260F)
E003697-05	P260E	DPF lamp 1 (DPF regeneration switch enable lamp) Open circuit - (P260E)
E003715-14	P246B	DPF regeneration failure (DPF regeneration is not performed well during machine operation mode) - (P246B)
E003720-16	P242F	DPF Ash loading High fault (Ash cleaning is needed) - (P242F)
E004082-03	P025D	Fuel metering unit Short circuit to Battery fault - (P025D)
E004082-04	P025C	Fuel metering unit Short circuit to Ground fault - (P025C)
E004082-05	P025A	Fuel metering unit Open circuit fault - (P025A)
E004082-07	P025B	Fuel metering unit Over temperature fault - (P025B)
E004335-00	P1450	DEF Overpressure error at METERINGCONTROL (DEF pump pressure is too high) - (P1450)
E004335-01	P1451	DEF Underpressure error at METERINGCONTROL (DEF pump pressure is too low) - (P1451)
E004335-02	P1457	DEF pressure build up error at PRESSUREBUILDUP (DEF pump pressure is too low) - (P1457)
E004335-07	P202D	DEF Leakage detection at METERINGCONTROL - (P202D)
E004335-12	P1452	DEF Overpressure error regardless of the state - (P1452)
E004335-15	P1459	DEF Pressure reduction error at PRESSUREREDUCTION (Detected an insufficient pressure drop) - (P1459)
E004335-16	P1460	DEF underpressure error at AFTERRUN_PRESSURECOMPENSATION - (P1460)
E004344-02	P1893	DEF backflow Line plausibility error at DETECTIONMODE (Does not detect a pressure drop) - (P1893)
E004354-05	P221D	DEF Pressure line heater circuit Open circuit Fault - (P221D)
E004354-06	P221C	DEF Pressure line heater circuit Open circuit or Short circuit to ground Fault - (P221C)
E004355-05	P221F	DEF Backflow line heater circuit Open circuit Fault - (P221F)
E004355-06	P221E	DEF Backflow line heater circuit Open circuit or Short circuit to ground Fault - (P221E)
E004356-05	P215F	DEF Suction line heater circuit Open circuit Fault - (P215F)
E004356-06	P215E	DEF Suction line heater circuit Open circuit or Short circuit to ground Fault - (P215E)
E004364-14	P20EE	SCR Efficiency Too low fault - (P20EE)
E004365-03	P2043	DEF Temperature Sensor Open circuit - (P2043)
E004365-04	P2046	DEF Temperature Sensor Short circuit - (P2046)
E004365-14	P1227	DEF Tank temperature plausibility fault (Insufficient temperature increment) - (P1227)
E004374-03	P208D	DEF Supply Pump Motor Signal output Short circuit to battery Fault - (P208D)

Gauge Panel Fault Code	P Code	Fault Code Description
E004374-04	P208C	DEF Supply Pump Motor Signal output Short circuit to ground Fault - (P208C)
E004374-05	P208A	DEF Supply Pump Motor Signal output Open circuit Fault - (P208A)
E004374-07	P208B	DEF Supply Pump Motor Signal output Over temperature Fault - (P208B)
E004374-08	P108A	DEF Supply Pump Motor Speed Deviation Fault - (P108A)
E004374-09	P108B	DEF Supply Pump Motor Speed Deviation Permanent Fault - (P108B)
E004374-12	P108C	DEF Supply Pump Motor No activation Fault - (P108C)
E004781-15	P24A3	DPF Soot mass too high status (> 120%) - (P24A3)
E004781-16	P2463	DPF Soot mass high status (> 110%) - (P2463)
E005067-03	P0593	PTO (Idle up) Lamp Short to Battery - (P0593)
E005067-04	P0592	PTO (Idle up) Lamp Short to Ground - (P0592)
E005067-05	P0591	PTO (Idle up) Lamp Open circuit - (P0591)
E005099-03	P055D	Oil Pressure Warning Lamp Short to Battery - (P055D)
E005099-04	P055C	Short circuit to ground error of oil pressure lamp - (P055C)
E005099-05	P055B	Oil Pressure Warning Lamp Open circuit - (P055B)
E005313-03	P0193	Rail pressure sensor High fault - (P0193)
E005313-04	P0192	Rail pressure sensor Low fault - (P0182)
E005419-03	P02E3	Throttle valve H-Bridge Driver Short circuit to battery - (P02E3)
E005419-04	P02E2	Throttle valve H-Bridge Driver Short circuit to ground - (P02E2)
E005419-05	P02E0	Throttle valve H-Bridge Driver Open Circuit Fault - (P02E0)
E005435-10	P1453	DEF pressure stabilization error at DETECTIONMODE (DEF pump pressure is not stable) - (P1453)
E005435-12	P204A	DEF pressure check error at DETECTIONMODE (Detected an insufficient pressure drop) - (P204A)
E005436-03	P20A3	DEF Reverting valve output Short circuit to battery Fault - (P20A3)
E005436-04	P20A2	DEF Reverting valve output Short circuit to ground Fault - (P20A2)
E005436-05	P20A0	DEF Reverting valve output Open circuit Fault - (P20A0)
E005436-07	P20A1	DEF Reverting valve output Over temperature Fault - (P20A1)
E005436-11	P20A5	DEF Reverting valve Pressure drop plausibility fault - (P20A5)
E005436-14	P1461	DEF Reverting valve is blocked (Detected an insufficient pressure drop) - (P1461)
E005491-03	P20C0	DEF Pressure line heater relay output Short circuit to battery Fault - (P20C0)
E005491-04	P20BF	DEF Pressure line heater relay output Short circuit to ground Fault - (P20BF)
E005491-05	P20BD	DEF Pressure line heater relay output Open circuit Fault - (P20BD)

Gauge Panel Fault Code	P Code	Fault Code Description
E005491-07	P30BD	DEF Pressure line heater relay output Over temperature Fault - (P30BD)
E005491-12	P20BE	DEF Pressure line heater feedback plausibility Fault - (P20BE)
E005571-22	P009B	Common rail pressure relief valve reached maximum allowed opening count - (P009B)
E005571-23	P009C	Common rail pressure relief valve Forced to open status (Pressure increase) - (P009C)
E005571-24	P009D	Common rail pressure relief valve Forced to open status (Pressure shock) - (P009D)
E005571-25	P000F	Common rail pressure relief valve is open - (P000F)
E005571-27	P009F	Averaged rail pressure is outside the expected tolerance range - (P009F)
E005571-28	P018F	Common rail pressure relief valve reached maximum allowed open time - (P018F)
E005629-14	P246C	DPF differential pressure too high fault - (P246C)
E005706-05	P214F	DEF Supply module heater circuit Open circuit Fault - (P214F)
E005706-06	P21DD	DEF Supply module heater circuit Open circuit or Short circuit to ground Fault - (P21DD)
E005706-12	P23B3	DEF Supply module heater temperature plausibility fault (Insufficient temperature increment) - (P23B3)
E005706-14	P23B4	DEF Supply module heater temperature plausibility fault at cold start (Insufficient temperature increment) - (P23B4)
E005706-22	P23B2	DEF Supply module heater plausibility fault (Insufficient temperature increment) - (P23B2)
E005746-03	P21C4	DEF Main heater relay output Short circuit to battery Fault - (P21C4)
E005746-04	P21C3	DEF Main heater relay output Short circuit to ground Fault - (P21C3)
E005746-05	P21C2	DEF Main heater relay output Open circuit Fault - (P21C2)
E005746-06	P05ED	DEF heater line circuit Short circuit to battery Fault - (P05ED)
E005746-07	P31C5	DEF Main heater relay output Over temperature Fault - (P31C5)
E005965-03	P21C9	SCR system Main relay short circuit to battery - (P21C9)
E005965-04	P21C8	SCR system Main relay short circuit to ground - (P21C8)
E005965-05	P21C7	SCR system Main relay open circuit - (P21C7)
E006323-03	P2634	Electric fuel feed pump Output short to battery circuit fault - (P2634)
E006323-04	P2633	Electric fuel feed pump Output short to ground circuit fault - (P2633)
E006323-05	P2632	Electric fuel feed pump Output open circuit fault - (P2632)
E006323-13	P2635	Electric fuel feed pump performance fault - (P2635)
E006385-19	U1033	Timeout Error of CAN-Receive-Frame EOI (Engine Starter Motor Relay Control) - (U1033)
E006875-03	P204D	DEF Supply Pump pressure sensor High fault - (P204D)

Gauge Panel Fault Code	P Code	Fault Code Description
E006875-04	P204C	DEF Supply Pump pressure sensor Low fault - (P204C)
E006875-16	P304D	DEF Supply Pump pressure sensor High plausibility fault - (P304D)
E006875-18	P304C	DEF Supply Pump pressure sensor Low plausibility fault - (P304C)
E006915-03	P3611	DPF lamp 2 (DPF Regeneration Active Lamp) Short to Battery - (P3611)
E006915-04	P360F	DPF lamp 2 (DPF Regeneration Active Lamp) Short to Ground - (P360F)
E006915-05	P360E	DPF lamp 2 (DPF Regeneration Active Lamp) Open circuit - (P360E)
E006916-03	P1908	DPF lamp 3 (DPF regeneration switch inhibit lamp) Short to Battery - (P1908)
E006916-04	P1907	DPF lamp 3 (DPF regeneration switch inhibit lamp) Short to Ground - (P1907)
E006916-05	P1906	DPF lamp 3 (DPF regeneration switch inhibit lamp) Open circuit - (P1906)
E007069-03	P20C4	DEF Backflow line heater relay output Short circuit to battery Fault - (P20C4)
E007069-04	P20C3	DEF Backflow line heater relay output Short circuit to ground Fault - (P20C3)
E007069-05	P20C1	DEF Backflow line heater relay output Open circuit Fault - (P20C1)
E007069-07	P30C1	DEF Backflow line heater relay output Over temperature Fault - (P30C1)
E007069-12	P20C2	DEF Backflow line heater feedback plausibility Fault - (P20C2)
E007107-12	P23B5	DEF Supply module temperature plausibility fault (Insufficient temperature increment) - (P23B5)
E007107-14	P23B6	DEF Supply module temperature plausibility fault at cold start (Insufficient temperature increment) - (P23B6)
E007416-03	P20BC	DEF Supply module heater relay output Short circuit to battery Fault - (P20BC)
E007416-04	P20BB	DEF Supply module heater relay output Short circuit to ground Fault - (P20BB)
E007416-05	P20B9	DEF Supply module heater relay output Open circuit Fault - (P20B9)
E007416-07	P30B9	DEF Supply module heater relay output Over temperature Fault - (P30B9)
E007416-12	P20BA	DEF Supply module heater feedback plausibility Fault - (P20BA)
E007538-12	P06F0	DEF Supply module temperature duty cycle in failure range - (P06F0)
E007538-13	P06F1	Diagnostic Fault Check for Urea supply module duty cycle in the invalid range - (P06F1)
E007538-22	P20AC	DEF Supply module heater temperature duty cycle in failure range - (P20AC)
E007538-23	P20AD	DEF Supply module heater temperature duty cycle in invalid range - (P20AD)

Gauge Panel Fault Code	P Code	Fault Code Description
E007538-24	P20B0	DEF Supply module temperature measurement non-availability fault - (P20B0)
E007538-25	P20FF	DEF Supply module time period outside specified range - (P20FF)
E007538-26	P056D	DEF Supply module PWM signal fault - (P056D)
E007540-03	P20C8	DEF Suction line heater relay output Short circuit to battery Fault - (P20C8)
E007540-04	P20C7	DEF Suction line heater relay output Short circuit to ground Fault - (P20C7)
E007540-05	P20C5	DEF Suction line heater relay output Open circuit Fault - (P20C5)
E007540-07	P30C5	DEF Suction line heater relay output Over temperature Fault - (P30C5)
E007540-12	P20C6	DEF Suction line heater feedback plausibility Fault - (P20C6)
E007748-03	P0617	Starter relay HS power stage output short circuit to battery - (P0617)
E007748-04	P0616	Starter relay HS power stage output short circuit to ground - (P0616)
E007748-05	P0615	Starter relay HS output open circuit - (P0615)
E007749-03	P26E6	Starter relay LS power stage output short circuit to battery - (P26E6)
E007749-04	P26E5	Starter relay LS power stage output short circuit to ground - (P26E5)
E007749-05	P26E4	Starter relay LS power stage output open circuit - (P26E4)
E008614-12	P213E	Injection cut off demand (ICO) for shut off coordinator - (P213E)
E055296-12	P062F	ECU EEPROM Read Error - (P062F)
E055552-12	P0630	ECU EEPROM Write Error - (P0630)
E057344-19	U01B7	Timeout Error of CAN-Receive-Frame CM1 (Status of regeneration initiate and inhibit switches) - (U01B7)
E061441-19	U01B9	Timeout Error of CAN-Receive-Frame EBC1 (Engine shut off request) - (U01B9)
E061454-19	U029D	Timeout Error of CAN-Receive-Frame AT1IG1 (NOx Upstream Concentration) - (U029D)
E061455-19	U029E	Timeout Error of CAN-Receive-Frame AT1O1 (NOx Downstream Concentration) - (U029E)
E064923-19	U02A2	Timeout Error of CAN-Receive-Frame A1DEFI (DEF Tank) - (U02A2)
E065110-19	U0619	Timeout Error of CAN-Receive-Frame AT1T1I (Urea Level, Temperature over CAN) - (U0619)
E065164-19	U1001	Timeout Error of CAN-Receive-Frame AAI (Hydraulic Oil Temperature) - (U1001)
E065241-19	U1031	Timeout Error of CAN-Receive-Frame AUXIO1 - (U1031)

Gauge Panel Fault Code	P Code	Fault Code Description
E065265-19	U1032	Timeout Error of CAN-Receive-Frame RxCCVS (PTO / Idle up) - (U1032)
E065272-19	P0218	Timeout Error of CAN-Receive-Frame TRF1 (Transmission oil temperature) - (P0218)
E065320-19	U0632	Timeout Error of CAN-Receive-Frame FanCtl (FAN Control) - (U0632)
E065320-31	U1039	DFC for error of FAN control (Fan Control) - (U1039)
E065400-19	U0608	Timeout Error of CAN-Receive-Frame RxSMVCU (Pedal & Engine speed demand from VCU) - (U0608)
E065400-22	U013C	Message Check Sum Error of CAN Receive Frame SMVCU (Pedal & Engine speed demand from VCU) - (U013C)
E065400-23	U043D	Message Counter Error of CAN Receive Frame SMVCU (Pedal & Engine speed demand from VCU) - (U043D)
E065401-19	U010F	Timeout Error of CAN-Receive-Frame DPM1 (Air Conditioning Switch Status / Oil life reset) - (U010F)
E065402-19	U01B8	Timeout Error of CAN-Receive-Frame DPM9 (Multiple torque Map select switch) - (U01B8)
E104332-09	P2383	NOx sensor Mounting Error (Upstream NOx sensor) - (P2383)
E104385-09	P2384	NOx sensor Mounting Error (Downstream NOx sensor) - (P2384)
E520601-12	P160B	CY327(Power control chipset) SPI Communication Error - (P160B)
E520618-12	P060B	ECU ADC(Analog to Digital Convertor) NTP(Null Load Test Pulse) Monitoring fault - (P060B)
E520641-12	P160F	ECU ROM Memory multiple error - (P160F)
E520642-12	P1610	ECU MM(Monitoring Module) Synchronization Loss fault during Shut-off path test - (P1610)
E520643-12	P101A	MoF(Monitoring of Function) Over Run error - (P101A)
E520696-12	P160C	ECU ADC(Analog to Digital Convertor) Test error - (P160C)
E520697-12	P160D	ECU ADC(Analog to Digital Convertor) Voltage ratio error - (P160D)
E520698-12	P060C	ECU query response-communication error - (P060C)
E520699-12	P160E	ECU SPI-communication error - (P160E)
E520700-12	P1611	ECU Shut−off path test error - (P1611)
E520701-12	P1612	ECU Wrong set response time error during shut off path test - (P1612)
E520702-12	P1613	ECU Too many SPI errors during shut off path test - (P1613)
E520703-12	P1615	ECU WDA working error during Shut-off path test - (P1615)
E520704-12	P1616	ECU OS Timeout error during Shut-off path test - (P1616)
E520705-12	P1617	ECU Positive test failure error during Shut-off path test - (P1617)
E520706-12	P1618	ECU Shut-off path test timeout fault - (P1618)
E520707-03	P1619	ECU Overvoltage error during Shut-off path test - (P1619)
E520707-04	P1614	ECU Undervoltage error during Shut-off path test - (P1614)

Gauge Panel Fault Code	P Code	Fault Code Description
E520723-12	P12E5	NCD Inducement Fault Level1 (Group1 - EGR Block) - (P12E5)
E520724-12	P12E6	NCD Inducement Fault Level2 (Group1 - EGR Block) - (P12E6)
E520725-12	P12E7	NCD Inducement Fault Level3 Final inducement (Group1 - EGR Block) - (P12E7)
E520726-12	P12E8	NCD Inducement Fault Warning (Group1 - EGR Block) - (P12E8)
E520727-12	P12E9	NCD Inducement Fault Level1 (Group2 - Dosing Interrupt) - (P12E9)
E520728-12	P12EA	NCD Inducement Fault Level2 (Group2 - Dosing Interrupt) - (P12EA)
E520729-12	P12EB	NCD Inducement Fault Level3 Final inducement (Group2 - Dosing Interrupt) - (P12EB)
E520730-12	P12EC	NCD Inducement Fault Warning (Group2 - Dosing Interrupt) - (P12EC)
E520736-12	P12F2	NCD inducement Fault Level1 (Group4 - DEF Quality) - (P12F2)
E520737-12	P12F3	NCD inducement Fault Level2 (Group4 - DEF Quality) - (P12F3)
E520738-12	P12F4	NCD inducement Fault Level3 Final inducement (Group4 - DEF Quality) - (P12F4)
E520739-12	P12F5	NCD inducement Fault Warning (Group4 - DEF Quality) - (P12F5)
E520740-12	P12F6	NCD inducement Fault Level1 (Group5 - Tampering) - (P12F6)
E520741-12	P12F7	NCD inducement Fault Level2 (Group5 - Tampering) - (P12F7)
E520742-12	P12F8	NCD inducement Fault Level3 Final inducement (Group5 - Tampering) - (P12F8)
E520743-12	P12F9	NCD inducement Fault Warning (Group5 - Tampering) - (P12F9)
E520790-12	P1303	NCD inducement Repeat offense Level1 - (P1303)
E520791-12	P1304	NCD inducement Repeat offense Level2 - (P1304)
E520792-12	P1305	NCD inducement Repeat offense Level3 Final inducement - (P1305)
E520797-12	P1013	DEF Supply Pump pressure sensor Low plausibility fault - (P1013)

HST Error Code

Information Mentioned in Troubleshooting Table

Before performing troubleshooting, understand that information fully.Please refer to the DMS-5 for detailed information.

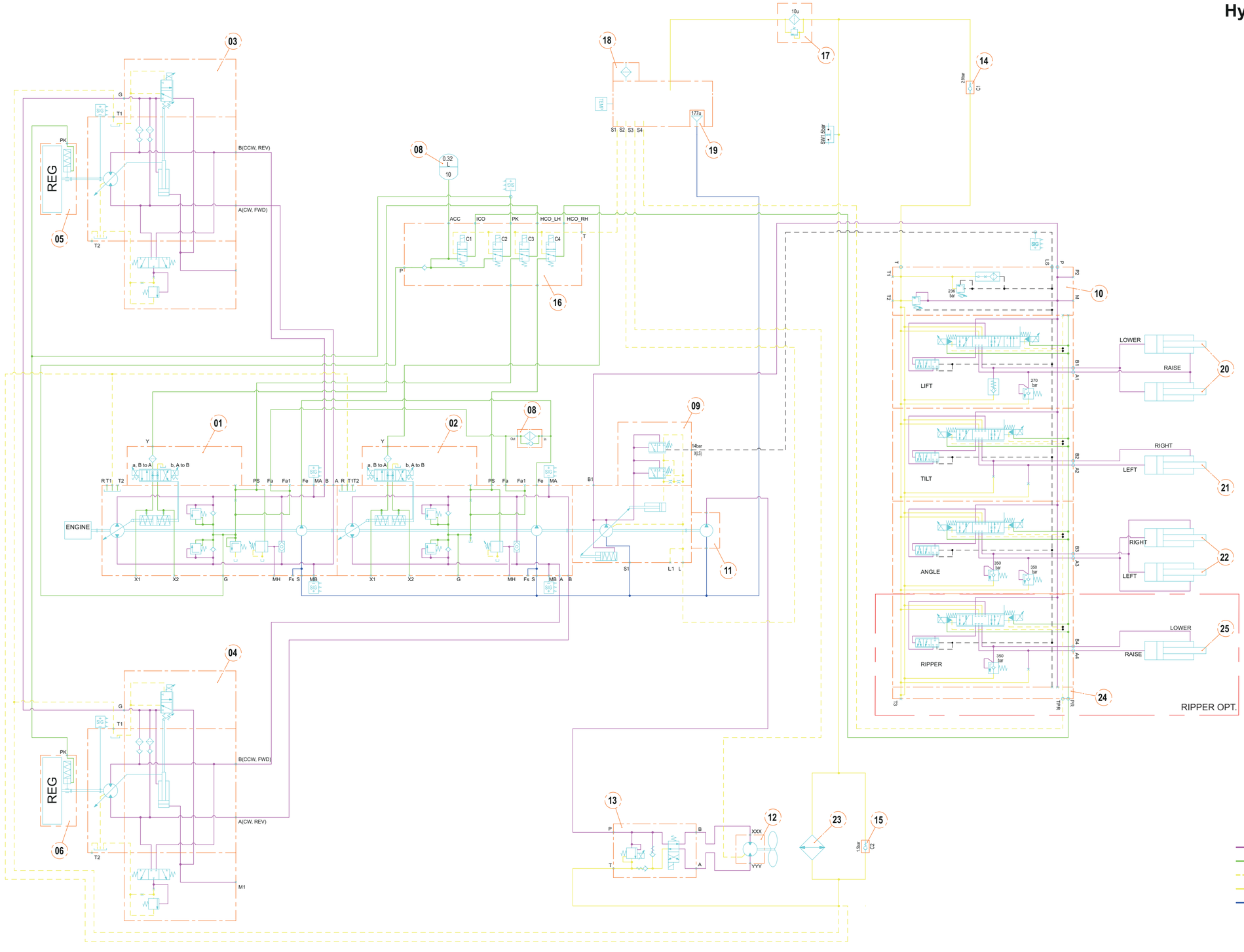
No.		Description of the Problems
1	T520194-00	speed sensor left faulty
2	T520195-00	speed sensor right faulty
3	T520197-13	automatic calibration of minimum pump currents fault
4	T520199-04	battery voltage low fault
5	T520200-04	supply voltage low after proportional central switch
6	T520202-05	solenoid pump left forward, Current below normal
7	T520202-06	solenoid pump left forward, Current above normal
8	T520203-05	solenoid pump left backward Current below normal
9	T520203-06	solenoid pump left backward Current above normal
10	T520204-05	solenoid pump right forward, Current below normal
11	T520204-06	solenoid pump right forward, Current above normal
12	T520205-05	solenoid pump right backward Current below normal
13	T520205-06	solenoid pump right backward Current above normal
14	T520206-05	solenoid motor left, Current below normal
15	T520206-06	solenoid motor left, Current above normal
16	T520207-05	solenoid motor right, Current below normal
17	T520207-06	solenoid motor right, Current above normal
18	T520209-03	battery voltage high fault
19	T520210-04	supply voltage low after digital central switch
20	T520211-03	supply voltage high after proportional central switch
21	T520212-03	supply voltage high after digital central switch
22	T520213-04	VSS_3, 5V sensor voltage low
23	T520214-03	VSS_3, 5V sensor voltage high
24	T520215-04	VSS_2, 10V sensor voltage low
25	T520216-03	VSS_2, 10V sensor voltage high
26	T520220-19	CAN message EEC1(actual engine speed) from engine ECU not received
27	T520222-02	CAN_2 bus off, probably too many error frames
28	T520223-19	CAN message ET1(coolant temperature) from engine ECU not received
29	T520227-00	Coolant temp over
30	T520229-00	Hydr.oil Temp over
31	T520230-00	Start condition : Power supply is disabled by inhibit or output-enable input pin
32	T520231-00	Start condition : Unexpected state of power supply for power stages previous to switch-off tests.
33	T520232-00	Start condition : Power supply cannot be switched on for switch-off tests.
34	T520233-00	Start condition : No power supply(Pin 201)

35	T520234-00	Start condition : Setting VP ON is locked (because of hardware monitor error).
36	T520235-00	Start condition : joystick not neutral(driving or steering)
37	T520236-0	Start condition : Monitor sets own error 2
38	T520239-0	Start condition : Monitor sets own error 1
39	T520240-04	Start condition : VSS1 voltage low (pin219, pin232, pin255)
40	T520241-04	Start condition : battery voltage low (pin245)
41	T520244-31	solenoid pump left forward or backward faulty short circuit (hi-side pin153, pin177/Low-side: pin183)
42	T520245-31	solenoid pump right forward or backward faulty short circuit (pin154, pin178, and Low-side: pin179)
43	T520246-31	solenoid EP motor left or right faulty short circuit (pin151, solenoid pin175, and Low-side: pin185)
44	T520250-31	Travel Safety function Error
45	T520251-13	Parameter error (driving enable or safety switch 1,2 not closed)
46	T520253-31	Inhibit Switch Status Error
47	T520257-31	iching pedal pin139 redundancy error
48	T520259-31	safety switch 1, 2 fault
49	T520260-31	hardware monitor error
50	T520262-13	check throttle potentiomer calibration
51	T520264-19	left hand drive joystick : Callback_CAN_2_RX_JOYtoRC_BJM1 not received
52	T520273-19	left hand drive joystick : Callback_CAN_2_RX_JOYtoRC_EJM1 not received
53	T520274-19	left hand drive joystick : Callback_CAN_2_RX_JOYtoRC_BJM3 not received
54	T520275-19	left hand drive joystick : Callback_CAN_2_RX_JOYtoRC_EJM3 not received
55	T520276-19	CAN_3 bus off, probably too many error frames

Schematics

HD130
Hydraulic Schematic

STD	1. LEFT TRAVEL PUMP 2. RIGHT TRAVEL PUMP 3. LEFT TRAVEL MOTOR 4. RIGHT TRAVEL MOTOR 5. LEFT REG. GEAR BOX 6. RIGHT REG. GEAR BOX 7. PILOT FILTER 8. PILOT ACCUMULATOR 9. IMPLEMENT PUMP 10. IMPLEMENT CONTROL VALVE(STD) 11. FAN PUMP 12. FAN MOTOR 13. FAN CONTROL VALVE 14. BYPASS VALVE(MAKE-UP) 15. BYPASS VALVE(COOLER) 16. PILOT SUPPLY VALVE 17. RETURN FILTER 18. AIR BREATHER 19. SUCTION STRAINER 20. LIFT CYLINDER 21. TILT CYLINDER 22. ANGLE CYLINDER 23. OIL COOLER
OPT	24. IMPLEMENT CONTROL VALVE(OPT) 25. RIPPER CYLINDER



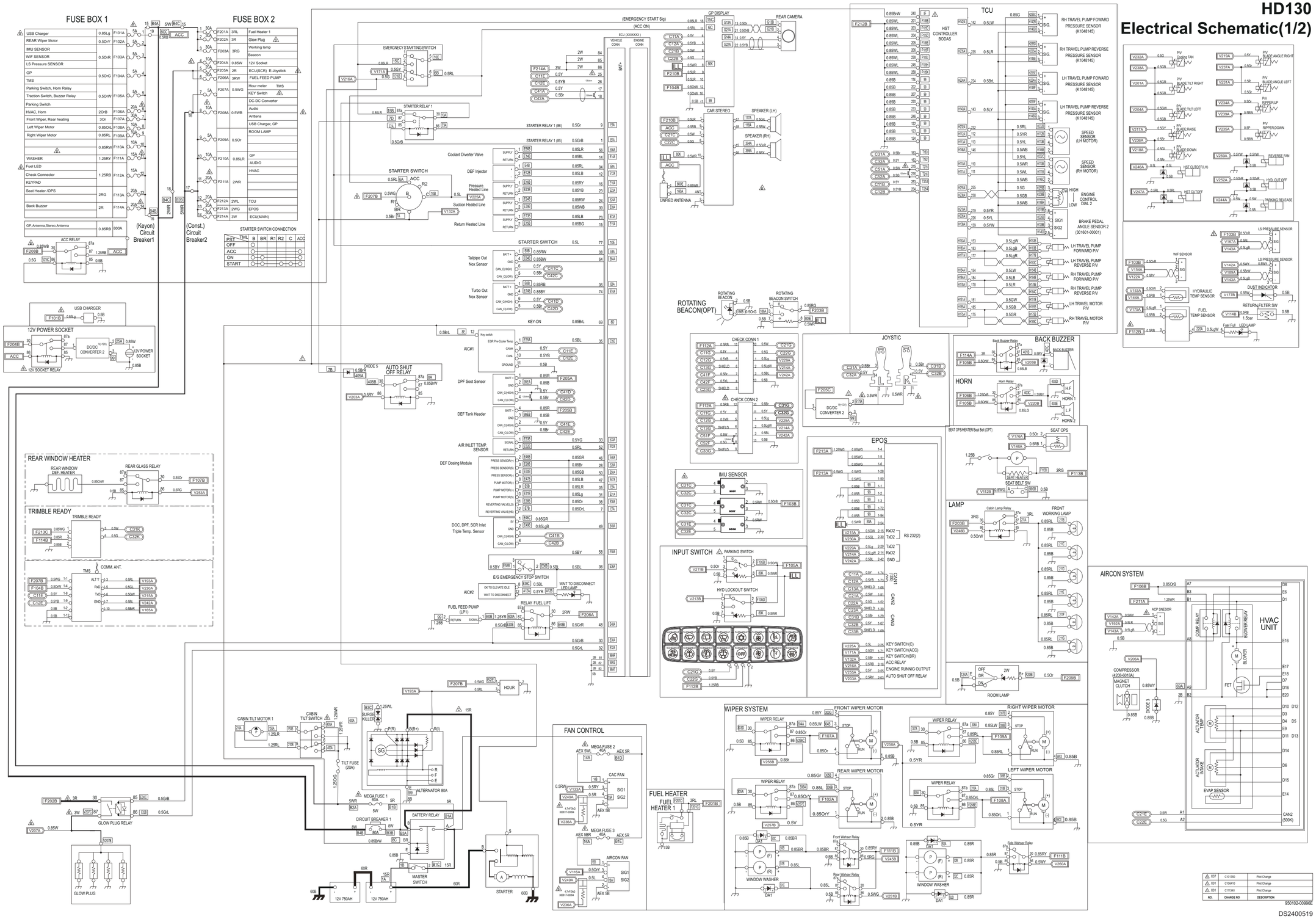
Main
Pilot
Drain
Return
Suction
Load Sensing
Option box
Text
Valve Boundary
Valve Symbol

NO.	CHANGE NO	DESCRIPTION

950102-01115

DS2400518

HD130
Electrical Schematic(1/2)

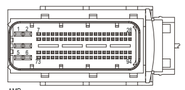


HD130
Electrical Schematic(2/2)

EPOS

1-01	2W	GND(WIF, LS Pressure sensor)
1-02	2WG	GND
1-03	0.85WL	GND
1-04	0.5WR	B+
1-05	0.85WY	B+
1-06	2WL	B+
1-07	2WR	CAN3 (LOW)
1-08	0.85WG	CAN1 (Shield)
1-09	0.85WB	CAN3 (Shield)
1-10	0.5WY	-
1-11	0.85WR	-
1-12	0.85GY	Seat belt state
1-13	2WR	-
1-14	2OR	Return filter switch
1-15	2R	-
1-16	0.5GY	Condensor FAN Fail
1-17	1.25RG	-
1-18	0.5RL	-
1-19	0.5RW	-
1-20	2RY	5V(Engine Control Dial)
1-21	1.25O	GND Output(Engine Control Dial)
1-22	2OB	GND Output(WIF, LS Pressure sensor)
1-23	0.85OG	-
1-24	0.5OL	-
1-25	0.85GY	-
1-26	2O	-
1-27	0.5OW	-
1-28	0.5R	MAIN BAT +
1-29	0.5RB	CAN3 (HIGH)
1-30	0.85RG	CAN2 (SHIELD)
1-31	1.25RY	-
1-32	0.85RW	KEY SWITCH (Br)
1-33	0.5RL	CAC FAN Fail Signal
1-34	0.5RW	-
1-35	2RY	-
1-36	1.25Or	-
1-37	2OB	-
1-38	0.85OG	-
1-39	0.5OL	-
1-40	0.85GY	-
1-41	2O	-
1-42	0.5OW	5V +
1-43	0.5R	GND Output
1-44	0.5RB	GND Output
1-45	0.85RG	-
1-46	1.25RY	OPS Input
1-47	0.85RW	-
1-48	0.5OW	-
1-49	0.5R	-
1-50	0.5RB	B+
1-51	2W	CAN2 (HIGH)
1-52	2WG	CAN2 (LOW)
1-53	0.85WL	HYD OIL TEMP SENSOR
1-54	0.5WR	WIF SENSOR
1-55	0.85WY	-
1-56	2WL	-
1-57	2WR	-
1-58	0.85WG	-
1-59	0.85WB	-
1-60	0.5WY	-
1-61	0.85WR	-
1-62	0.85GY	-
1-63	2WR	-
1-64	2OR	-
1-65	2R	TMS(3.5V input)
1-66	2RB	-
1-67	1.25RG	Parking Brake Pressure Sensor
1-68	0.5RL	-
1-69	0.5RW	-
1-70	2RY	-
1-71	1.25Or	Starter Switch (ACC)
1-72	2OB	Main GND
1-73	0.85OG	CAN1 (LOW)
1-74	0.5OL	CAN1 (HIGH)
1-75	0.85GY	Fuel Sensor (SIG)
1-76	0.5Or	Seat OPS
1-77	0.5OW	Dust Indicator
1-78	0.5R	-
1-79	0.5RB	-
1-80	0.85RG	-
1-81	1.25RY	-
1-82	0.85RW	-
1-83	0.5RL	-
1-84	0.5RW	-
1-85	2RY	-
1-86	1.25Or	-
1-87	2OB	-
1-88	0.85OG	-
1-89	0.5OL	LS PRESSURE SENSOR
1-90	0.85GY	ENGINE CONTROL DIAL(SIG)
1-91	2Or	-
1-92	0.5OW	ACP SENSOR
1-93	0.5R	ALTERNATER VOLTAGE
1-94	0.5RB	Main_GND

2-01	2W	P/V BLADE;TILT RIHGT
2-02	2WG	-
2-03	0.85WL	AUTO SHUT OFF RELAY
2-04	0.5WR	P/V BLADE;TILT LEFT
2-05	0.85WY	Back Up Alarm relay
2-06	2WL	COMPRESSOR
2-07	2WR	Glow Plug
2-08	0.85WG	-
2-09	0.85WB	-
2-10	0.5WY	-
2-11	0.85WR	PARKING SWITCH
2-12	0.85GY	Traction Control Switch
2-13	2WR	Hydraulic Lockout Switch
2-14	2OR	RS232_TXD(for DMS)
2-15	2R	TxD2_TMS
2-16	2RB	ACC RELAY
2-17	1.25RG	P/V BLADE;RAISE
2-18	0.5RL	P/V BLADE;DOWN
2-19	0.5RW	P/V BLADE;ANGLE RIGHT
2-20	2RY	HORN RELAY
2-21	1.25O	-
2-22	2OB	-
2-23	0.85OG	-
2-24	0.5OL	-
2-25	0.85GY	Starter Switch ("C")
2-26	2O	-
2-27	0.5OW	-
2-28	0.5R	-
2-29	0.5RB	RS232TXD_DMS
2-30	0.85RG	RS232TXD_TMS
2-31	1.25RY	P/V BLADE;ANGLE LEFT
2-32	0.85RW	P/V COOLING FAN
2-33	0.5RL	CONDENSOR FAN CONTROL
2-34	0.5RW	P/V RIPPER;UP
2-35	2RY	P/V RIPPER;DOWN
2-36	1.25Or	GND
2-37	2OB	GND_Output
2-38	0.85OG	GND_Output
2-39	0.5OL	GND_Output
2-40	0.85GY	GND_Output
2-41	2O	GND_Output
2-42	0.5OW	RS232_GND_DMS
2-43	0.5R	RS232_GND_TMS
2-44	0.5RB	PARKING BRAKE RELEASE
2-45	0.85RG	FRONT WASHER RELAY
2-46	1.25RY	HST CUTOFF(LH)
2-47	0.85RW	HST CUTOFF(RH)
2-48	0.5OW	CABIN LAMP RELAY
2-49	0.5R	CAC FAN CONTROL
2-50	0.5RB	-
2-51	2W	REAR WASHER RELAY
2-52	2WG	HYD. CUTOFF
2-53	0.85WL	-
2-54	0.5WR	ILLUMINATION
2-55	0.85WY	Engine Running Output Signal
2-56	2WL	FRONT WIPER RELAY
2-57	2WR	REAR WIPER RELAY
2-58	0.85WG	SIDE WIPER RELAY
2-59	0.85WB	S/V REVERSE FAN
2-60	0.5WY	SIDE WASHER RELAY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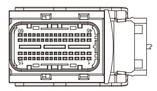
COVER: 1743417-2 / LEVER:1897059-2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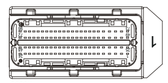
COVER: 936662-2/ LEVER: 1743543-2

[EPOS]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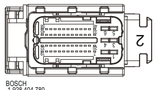
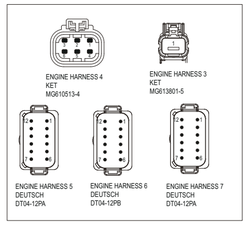
1 928 404 781


BOSCH
1 928 404 780

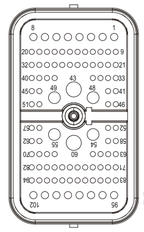
[HST CONT]


GAUGE PANNEL DISPLAY
TYCO AMP
770680-4


TMS CONTROLLER
DEUTSCH
DT06-12SA



[ENGINE -MAIN]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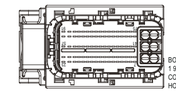
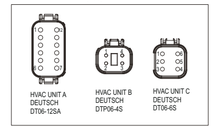
DRB16-102SAE-L018

[MAIN-CABIN]


BOSCH
1 928 405 452
COVER : 1 928 405 458
HOLDING PLATE : 1 928 405 453

[ECU]



[HVAC]


HCU
DEUTSCH
DT04-08PA

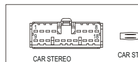

TYCO AMP
1-967325-1

[UREA TANK]

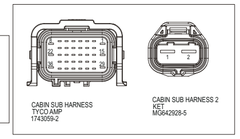

IMU BODY SENSOR
Signal Electronics
CA125AF05002D02


UREA SUPPLY MODULE
TYCO AMP
1-1703639-1

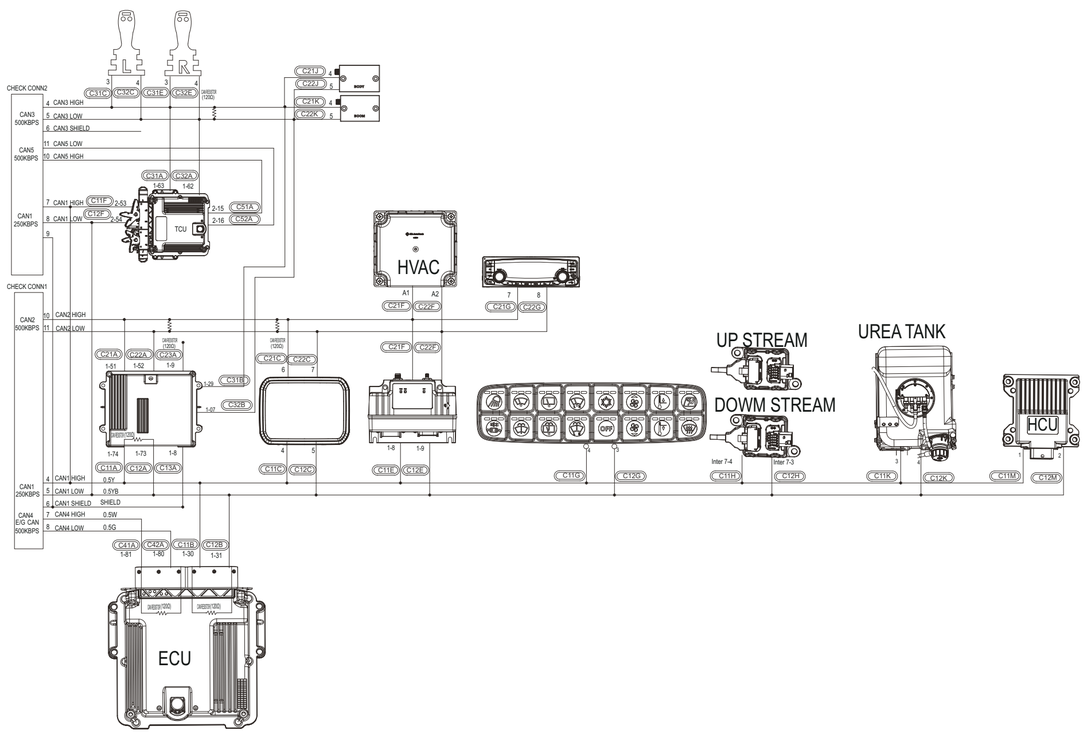

JOINT CONNECTOR
KET
MG652582-5
CAP:MG642581-5


CAR STEREO
AMP
173853-1

CAR STEREO ANTENNA


CABIN SUB HARNESS
TYCO AMP
1743059-2

CABIN SUB HARNESS 2
KET
MG642928-5



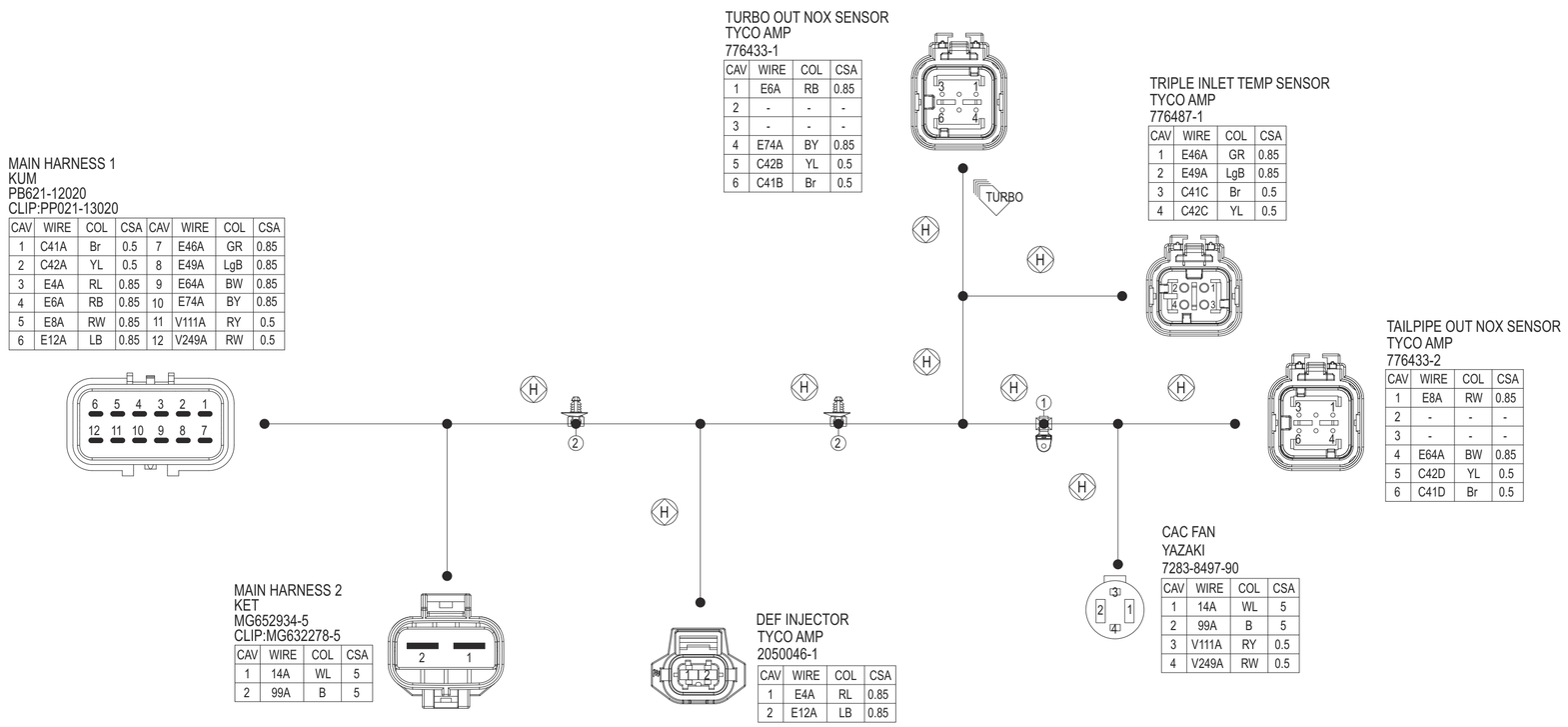
⚠ X00	C101350	Plot Change
⚠ X00	C106410	Plot Change
⚠ X00	C111340	Plot Change
NO.	CHANGE NO	DESCRIPTION

950102-00996E

DS2400520

HD130
Engine Harness

WIRE	MATERIAL	CSA	COL	FROM	CAV1	TO	CAV2
14A	AEXF	5	WL	CAC FAN	1	MAIN HARNESS 2	1
C41A	AEXF	0.5	Br	MAIN HARNESS 1	1	SP_C41S	X
C41B	AEXF	0.5	Br	TURBO OUT NOX SENSOR	6	SP_C41S	X
C41C	AEXF	0.5	Br	TRIPLE INLET TEMP SENSOR	3	SP_C41S	X
C41D	AEXF	0.5	Br	TAILPIPE OUT NOX SENSOR	6	SP_C41S	X
C42A	AEXF	0.5	YL	MAIN HARNESS 1	2	SP_C42S	X
C42B	AEXF	0.5	YL	TURBO OUT NOX SENSOR	5	SP_C42S	X
C42C	AEXF	0.5	YL	TRIPLE INLET TEMP SENSOR	4	SP_C42S	X
C42D	AEXF	0.5	YL	TAILPIPE OUT NOX SENSOR	5	SP_C42S	X
E4A	AEXF	0.85	RL	MAIN HARNESS 1	3	DEF INJECTOR	1
E6A	AEXF	0.85	RB	MAIN HARNESS 1	4	TURBO OUT NOX SENSOR	1
E8A	AEXF	0.85	RW	MAIN HARNESS 1	5	TAILPIPE OUT NOX SENSOR	1
E12A	AEXF	0.85	LB	MAIN HARNESS 1	6	DEF INJECTOR	2
E46A	AEXF	0.85	GR	MAIN HARNESS 1	7	TRIPLE INLET TEMP SENSOR	1
E49A	AEXF	0.85	LgB	MAIN HARNESS 1	8	TRIPLE INLET TEMP SENSOR	2
E64A	AEXF	0.85	BW	MAIN HARNESS 1	9	TAILPIPE OUT NOX SENSOR	4
E74A	AEXF	0.85	BY	MAIN HARNESS 1	10	TURBO OUT NOX SENSOR	4
V111A	AEXF	0.5	RY	MAIN HARNESS 1	11	CAC FAN	3
V249A	AEXF	0.5	RW	MAIN HARNESS 1	12	CAC FAN	4
99A	AEXF	5	B	MAIN HARNESS 2	2	CAC FAN	2



CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA
1	C41A	Br	0.5	7	E46A	GR	0.85
2	C42A	YL	0.5	8	E49A	LgB	0.85
3	E4A	RL	0.85	9	E64A	BW	0.85
4	E6A	RB	0.85	10	E74A	BY	0.85
5	E8A	RW	0.85	11	V111A	RY	0.5
6	E12A	LB	0.85	12	V249A	RW	0.5

CAV	WIRE	COL	CSA
1	E6A	RB	0.85
2	-	-	-
3	-	-	-
4	E74A	BY	0.85
5	C42B	YL	0.5
6	C41B	Br	0.5

CAV	WIRE	COL	CSA
1	E46A	GR	0.85
2	E49A	LgB	0.85
3	C41C	Br	0.5
4	C42C	YL	0.5

CAV	WIRE	COL	CSA
1	E8A	RW	0.85
2	-	-	-
3	-	-	-
4	E64A	BW	0.85
5	C42D	YL	0.5
6	C41D	Br	0.5

CAV	WIRE	COL	CSA
1	14A	WL	5
2	99A	B	5

CAV	WIRE	COL	CSA
1	E4A	RL	0.85
2	E12A	LB	0.85

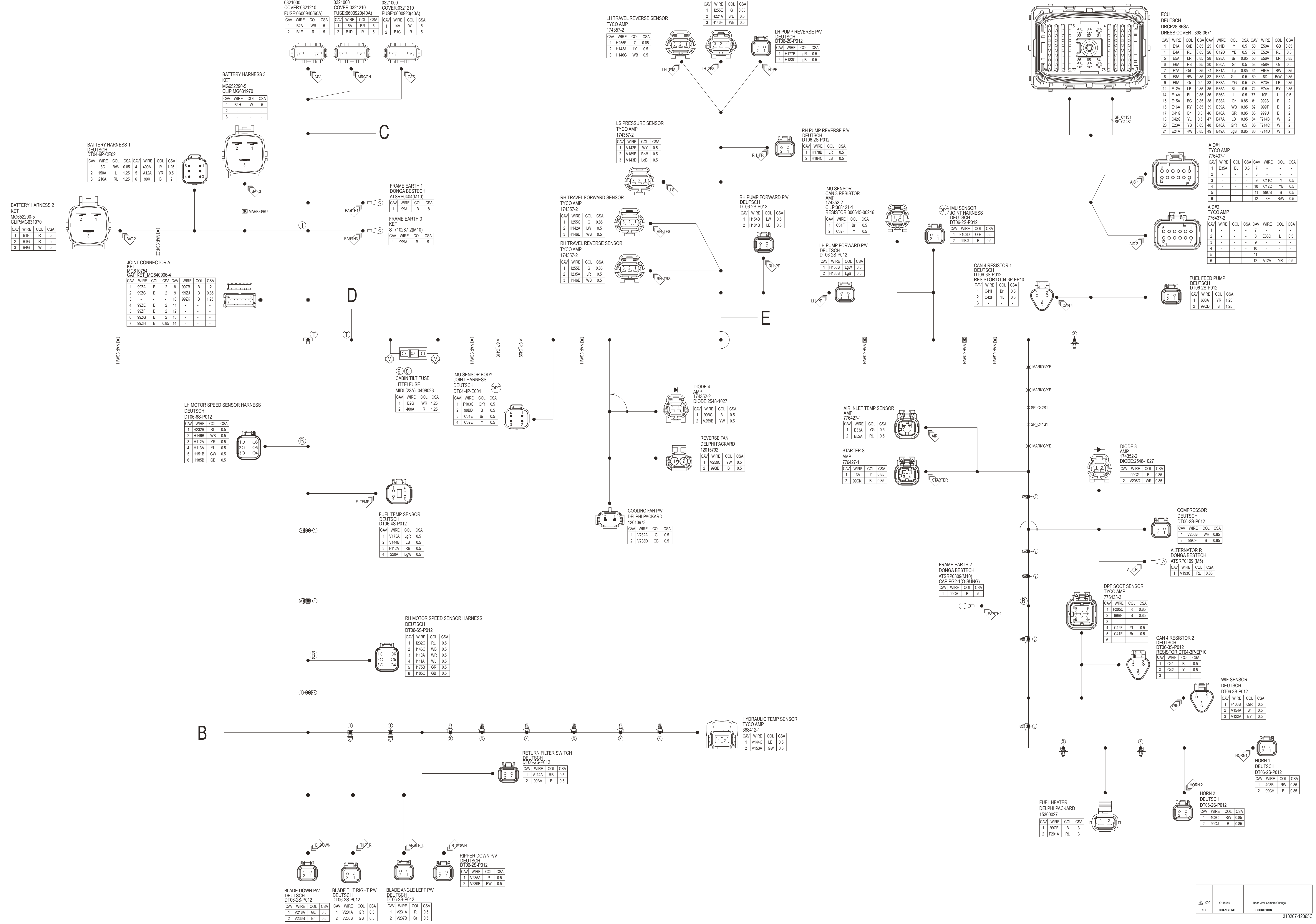
CAV	WIRE	COL	CSA
1	14A	WL	5
2	99A	B	5
3	V111A	RY	0.5
4	V249A	RW	0.5

NO.	CHANGE NO	DESCRIPTION

310207-13407

DS2400521

HD130 Main Harness(1/5)



*MEGA FUSE 1
MTA
0321000
COVER:0321210
FUSE:0600940(60A)

CAV	WIRE	COL	CSA
1	B2A	WR	5
2	B1E	R	5

*MEGA FUSE 2
MTA
0321000
COVER:0321210
FUSE:0600920(40A)

CAV	WIRE	COL	CSA
1	16A	BR	5
2	B1D	R	5

*MEGA FUSE 3
MTA
0321000
COVER:0321210
FUSE:0600920(40A)

CAV	WIRE	COL	CSA
1	14A	WL	5
2	B1C	R	5

BATTERY HARNESS 3
KET
MG652290-5
CLIP:MG631970

CAV	WIRE	COL	CSA
1	B4H	W	5
2	-	-	-
3	-	-	-

BATTERY HARNESS 1
DEUTSCH
DT04-6P-CE02

CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA
1	8C	BrW	0.85	4	400A	R	1.25
2	150A	L	1.25	5	A12A	YR	0.5
3	210A	RL	1.25	6	99X	B	2

BATTERY HARNESS 2
KET
MG652290-5
CLIP:MG631970

CAV	WIRE	COL	CSA
1	B1F	R	5
2	B1G	R	5
3	B4G	W	5

JOINT CONNECTOR A
KET
MG610754
CAP:KET_MG640906-4

CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA
1	99ZA	B	2	8	99ZB	B	2
2	99ZC	B	2	9	99ZJ	B	0.85
3	-	-	-	10	99ZK	B	1.25
4	99ZE	B	2	11	-	-	-
5	99ZF	B	2	12	-	-	-
6	99ZG	B	2	13	-	-	-
7	99ZH	B	0.85	14	-	-	-

FRAME EARTH 1
DONGA BESTECH
ATSRP0404(M10)

CAV	WIRE	COL	CSA
1	99A	B	8

FRAME EARTH 3
KET
ST710287-2(M10)

CAV	WIRE	COL	CSA
1	999A	B	5

LH TRAVEL REVERSE SENSOR
TYCO AMP
174357-2

CAV	WIRE	COL	CSA
1	H255F	G	0.85
2	H143A	LY	0.5
3	H146G	WB	0.5

LH TRAVEL FORWARD SENSOR
TYCO AMP
174357-2

CAV	WIRE	COL	CSA
1	H255E	G	0.85
2	H224A	BrL	0.5
3	H146F	WB	0.5

LH PUMP REVERSE P/V
DEUTSCH
DT06-2S-P012

CAV	WIRE	COL	CSA
1	H177B	LgR	0.5
2	H183C	LgB	0.5

LS PRESSURE SENSOR
TYCO AMP
174357-2

CAV	WIRE	COL	CSA
1	V142E	WY	0.5
2	V189B	BrW	0.5
3	V143D	LgB	0.5

RH PUMP REVERSE P/V
DEUTSCH
DT06-2S-P012

CAV	WIRE	COL	CSA
1	H178B	LR	0.5
2	H184C	LB	0.5

RH TRAVEL FORWARD SENSOR
TYCO AMP
174357-2

CAV	WIRE	COL	CSA
1	H255C	G	0.85
2	H142A	LW	0.5
3	H146D	WB	0.5

RH TRAVEL REVERSE SENSOR
TYCO AMP
174357-2

CAV	WIRE	COL	CSA
1	H255D	G	0.85
2	H235A	LR	0.5
3	H146E	WB	0.5

RH PUMP FORWARD P/V
DEUTSCH
DT06-2S-P012

CAV	WIRE	COL	CSA
1	H154B	LW	0.5
2	H184B	LB	0.5

IMU SENSOR
CAN 3 RESISTOR
AMP
174352-2
CILP:368121-1
RESISTOR:300645-00246

CAV	WIRE	COL	CSA
1	C31F	Br	0.5
2	C32F	Y	0.5

LH PUMP FORWARD P/V
DEUTSCH
DT06-2S-P012

CAV	WIRE	COL	CSA
1	H153B	LgW	0.5
2	H183B	LgB	0.5

IMU SENSOR (OPT)
JOINT HARNESS
DEUTSCH
DT06-2S-P012

CAV	WIRE	COL	CSA
1	F103D	OrR	0.5
2	99BG	B	0.5

ECU
DEUTSCH
DRCP28-86SA
DRESS COVER : 398-3671

CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA
1	E1A	GrB	0.85	25	C11D	Y	0.5	50	E50A	GB	0.85
4	E4A	RL	0.85	26	C12D	YB	0.5	52	E52A	RL	0.5
5	E5A	LR	0.85	28	E28A	Br	0.85	56	E56A	LR	0.85
6	E6A	RB	0.85	30	E30A	Gr	0.5	58	E58A	Or	0.5
7	E7A	OrL	0.85	31	E31A	Lg	0.85	64	E64A	BW	0.85
8	E8A	RW	0.85	32	E32A	GrL	0.5	69	8D	BrW	0.85
9	E9A	Gr	0.5	33	E33A	YG	0.5	73	E73A	LB	0.85
12	E12A	LB	0.85	35	E35A	BL	0.5	74	E74A	BY	0.85
14	E14A	BL	0.85	36	E36A	L	0.5	77	10E	L	0.5
15	E15A	BG	0.85	38	E38A	Or	0.85	81	999S	B	2
16	E16A	RY	0.85	39	E39A	WB	0.85	82	999T	B	2
17	C41G	Br	0.5	46	E46A	GR	0.85	83	999U	B	2
18	C42G	YL	0.5	47	E47A	LB	0.85	84	F214B	W	2
23	E23A	YB	0.85	48	E48A	GrR	0.5	85	F214C	W	2
24	E24A	RW	0.85	49	E49A	LgB	0.85	86	F214D	W	2

AIC#1
TYCO AMP
776437-1

CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA
1	E35A	BL	0.5	7	-	-	-
2	-	-	-	8	-	-	-
3	-	-	-	9	C11C	Y	0.5
4	-	-	-	10	C12C	YB	0.5
5	-	-	-	11	99CB	B	0.5
6	-	-	-	12	8E	BrW	0.5

AIC#2
TYCO AMP
776437-2

CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA
1	-	-	-	7	-	-	-
2	-	-	-	8	E36C	L	0.5
3	-	-	-	9	-	-	-
4	-	-	-	10	-	-	-
5	-	-	-	11	-	-	-
6	-	-	-	12	A12A	YR	0.5

CAN 4 RESISTOR 1
DEUTSCH
DT06-3S-P012
RESISTOR:DT04-3P-EP10

CAV	WIRE	COL	CSA
1	C41H	Br	0.5
2	C42H	YL	0.5
3	-	-	-

FUEL FEED PUMP
DEUTSCH
DT06-2S-P012

CAV	WIRE	COL	CSA
1	600A	YR	1.25
2	99CD	B	1.25

CABIN TILT FUSE
LITTELFUSE
MIDI (23A): 0498023

CAV	WIRE	COL	CSA
1	B2G	WR	1.25
2	400A	R	1.25

IMU SENSOR BODY
JOINT HARNESS
DEUTSCH (OPT)
DT04-4P-E004

CAV	WIRE	COL	CSA
1	F103C	OrR	0.5
2	99BD	B	0.5
3	C31E	Br	0.5
4	C32E	Y	0.5

DIODE 4
AMP
174352-2
DIODE:2548-1027

CAV	WIRE	COL	CSA
1	99BC	B	0.5
2	V259B	YW	0.5

REVERSE FAN
DELPHI PACKARD
12015792

CAV	WIRE	COL	CSA
1	V259C	YW	0.5
2	99BB	B	0.5

COOLING FAN P/V
DELPHI PACKARD
12010973

CAV	WIRE	COL	CSA
1	V232A	G	0.5
2	V238D	GB	0.5

AIR INLET TEMP SENSOR
AMP
776427-1

CAV	WIRE	COL	CSA
1	E33A	YG	0.5
2	E52A	RL	0.5

STARTER S
AMP
776427-1

CAV	WIRE	COL	CSA
1	13A	Y	0.85
2	99CK	B	0.85

LH MOTOR SPEED SENSOR HARNESS
DEUTSCH
DT06-6S-P012

CAV	WIRE	COL	CSA
1	H232B	RL	0.5
2	H146B	WB	0.5
3	H112A	YR	0.5
4	H113A	YL	0.5
5	H151B	GW	0.5
6	H185B	GB	0.5

FUEL TEMP SENSOR
DEUTSCH
DT06-4S-P012

CAV	WIRE	COL	CSA
1	V175A	LgR	0.5
2	V144B	LB	0.5
3	F112A	RB	0.5
4	220A	LgW	0.5

RH MOTOR SPEED SENSOR HARNESS
DEUTSCH
DT06-6S-P012

CAV	WIRE	COL	CSA
1	H232C	RL	0.5
2	H146C	WB	0.5
3	H110A	WR	0.5
4	H111A	WL	0.5
5	H175B	GR	0.5
6	H185C	GB	0.5

HYDRAULIC TEMP SENSOR
TYCO AMP
368412-1

CAV	WIRE	COL	CSA
1	V144C	LB	0.5
2	V153A	GW	0.5

RETURN FILTER SWITCH
DEUTSCH
DT06-2S-P012

CAV	WIRE	COL	CSA
1	V114A	RB	0.5
2	99AA	B	0.5

BLADE DOWN P/V
DEUTSCH
DT06-2S-P012

CAV	WIRE	COL	CSA
1	V218A	GL	0.5
2	V236B	Br	0.5

BLADE TILT RIGHT P/V
DEUTSCH
DT06-2S-P012

CAV	WIRE	COL	CSA
1	V201A	GR	0.5
2	V238B	GB	0.5

BLADE ANGLE LEFT P/V
DEUTSCH
DT06-2S-P012

CAV	WIRE	COL	CSA
1	V231A	R	0.5
2	V237B	Gr	0.5

RIPPER DOWN P/V
DEUTSCH
DT06-2S-P012

CAV	WIRE	COL	CSA
1	V235A	P	0.5
2	V239B	BW	0.5

DIODE 3
AMP
174352-2
DIODE:2548-1027

CAV	WIRE	COL	CSA
1	99CG	B	0.85
2	V206D	WR	0.85

COMPRESSOR
DEUTSCH
DT06-2S-P012

CAV	WIRE	COL	CSA
1	V206B	WR	0.85
2	99CF	B	0.85

ALTERNATOR R
DONGA BESTECH
ATSRP0109 (M5)

CAV	WIRE	COL	CSA
1	V193C	RL	0.85

FRAME EARTH 2
DONGA BESTECH
ATSRP0309(M10)
CAP:PG2-1(O-SUNG)

CAV	WIRE	COL	CSA
1	99CA	B	5

DPF SOOT SENSOR
TYCO AMP
776433-3

CAV	WIRE	COL	CSA
1	F205C	R	0.85
2	99BF	B	0.85
3	-	-	-
4	C42F	YL	0.5
5	C41F	Br	0.5
6	-	-	-

CAN 4 RESISTOR 2
DEUTSCH
DT06-3S-P012
RESISTOR:DT04-3P-EP10

CAV	WIRE	COL	CSA
1	C41J	Br	0.5
2	C42J	YL	0.5
3	-	-	-

WIF SENSOR
DEUTSCH
DT06-3S-P012

CAV	WIRE	COL	CSA
1	F103B	OrR	0.5
2	V154A	Br	0.5
3	V122A	BY	0.5

HORN 1
DEUTSCH
DT06-2S-P012

CAV	WIRE	COL	CSA
1	403B	RW	0.85
2	99CH	B	0.85

HORN 2
DEUTSCH
DT06-2S-P012

CAV	WIRE	COL	CSA
1	403C	RW	0.85
2	99CJ	B	0.85

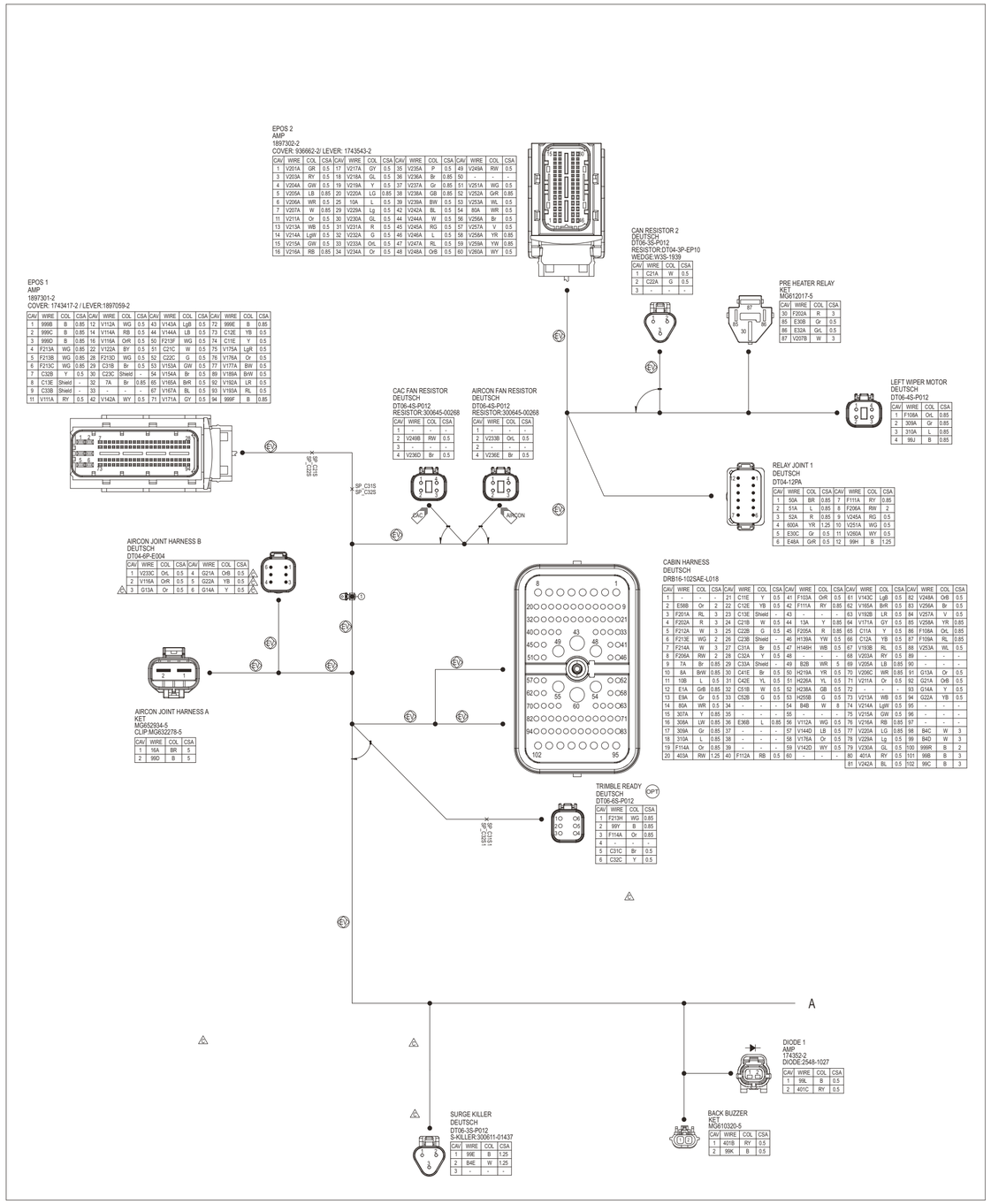
FUEL HEATER
DELPHI PACKARD
15300027

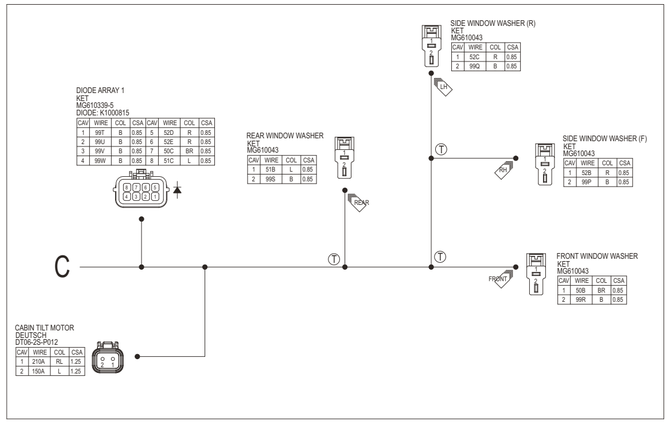
CAV	WIRE	COL	CSA
1	99CE	B	3
2	F201A	RL	3

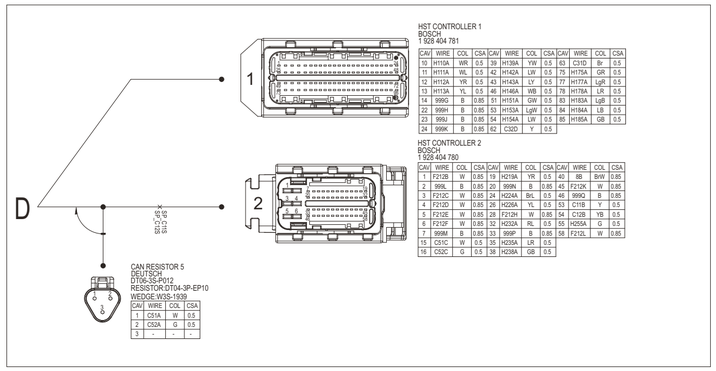
NO.	CHANGE NO	DESCRIPTION
X00	C115940	Rear View Camera Change

310207-12065C

DS2400522



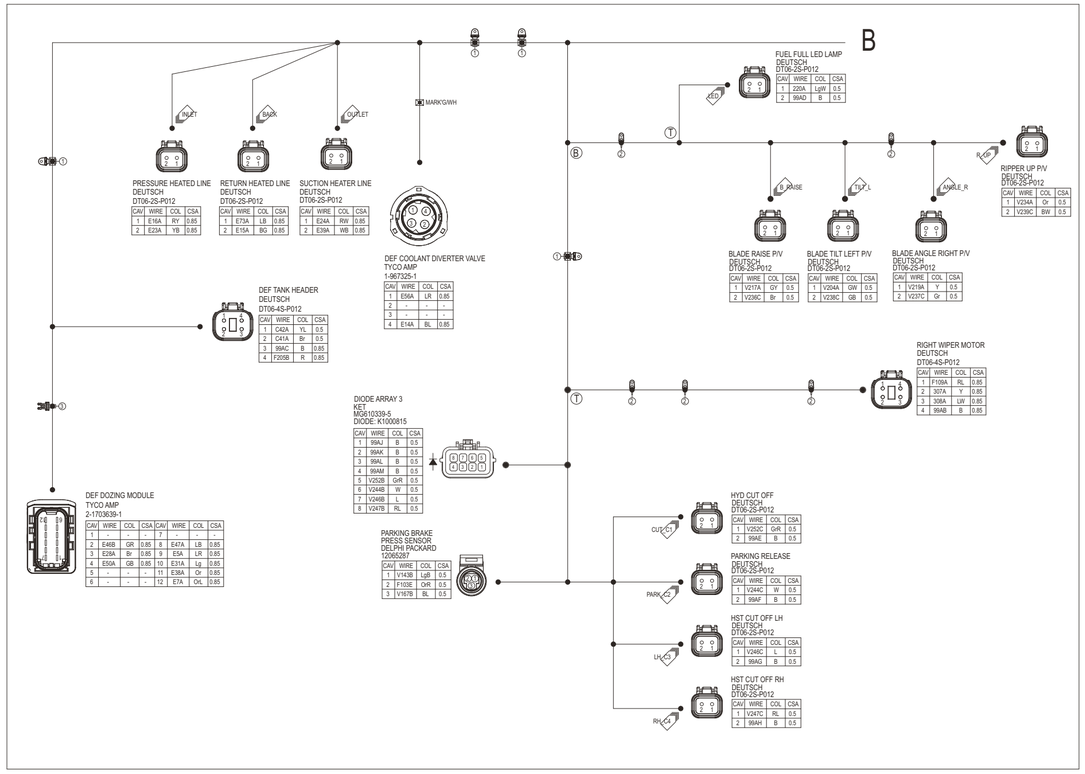


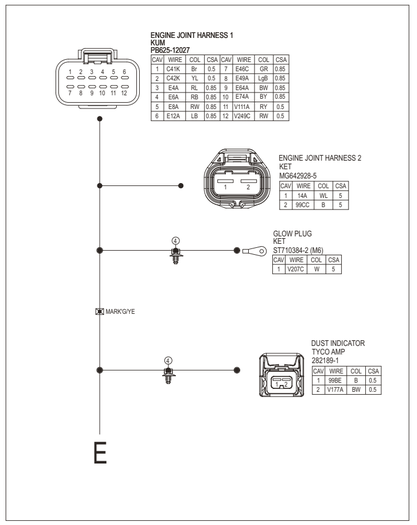


⚠ X09	C115940	Rear View Camera Change
NO.	CHANGE NO	DESCRIPTION

310207-12065C

DS2400523





⚠ X00	C115940	Rear View Camera Change
NO.	CHANGE NO	DESCRIPTION

310207-12065C

DS2400524

DD130
Main Harness(4/5)

WIRE	MATERIAL	CSA	COL	FROM	CAV1	TO	CAV2
7A	AEXF	0.85	Br	EPOS 1	32	CABIN HARNESS	9
8A	AEXF	0.85	BrW	CABIN HARNESS	10	SP_8S	X
8B	AEXF	0.85	BrW	HST CONTROLLER 2	40	SP_8S	X
8C	AEXF	0.85	BrW	BATTERY HARNESS 1	1	SP_8S	X
8D	AEXF	0.85	BrW	ECU	69	SP_8S	X
8E	AEXF	0.5	BrW	AIC#1	12	SP_8S	X
10A	AEXF	0.5	L	EPOS 2	25	SP_10S	X
10B	AEXF	0.5	L	CABIN HARNESS	11	SP_10S	X
10E	AEXF	0.5	L	ECU	77	SP_10S	X
13A	AEXF	0.85	Y	STARTER S	1	CABIN HARNESS	44
14A	AEXF	5	WL	MEGA FUSE 3	1	ENGINE JOINT HARNESS 2	1
16A	AEXF	5	BR	AIRCON JOINT HARNESS A	1	MEGA FUSE 2	1
50A	AEXF	0.85	BR	RELAY JOINT 1	1	SP_50S	X
50B	AEXF	0.85	BR	FRONT WINDOW WASHER	1	SP_50S	X
50C	AEXF	0.85	BR	DIODE ARRAY 1	7	SP_50S	X
51A	AEXF	0.85	L	RELAY JOINT 1	2	SP_51S	X
51B	AEXF	0.85	L	REAR WINDOW WASHER	1	SP_51S	X
51C	AEXF	0.85	L	DIODE ARRAY 1	8	SP_51S	X
52A	AEXF	0.85	R	RELAY JOINT 1	3	SP_52S	X
52B	AEXF	0.85	R	SIDE WINDOW WASHER (F)	1	SP_52S	X
52C	AEXF	0.85	R	SIDE WINDOW WASHER (R)	1	SP_52S	X
52D	AEXF	0.85	R	DIODE ARRAY 1	5	SP_52S	X
52E	AEXF	0.85	R	DIODE ARRAY 1	6	SP_52S	X
80A	AEXF	0.5	WR	CABIN HARNESS	14	EPOS 2	54
150A	AEXF	1.25	L	CABIN TILT MOTOR	2	BATTERY HARNESS 1	2
210A	AEXF	1.25	RL	CABIN TILT MOTOR	1	BATTERY HARNESS 1	3
220A	AEXF	0.5	LgW	FUEL TEMP SENSOR	4	FUEL FULL LED LAMP	1
307A	AEXF	0.85	Y	CABIN HARNESS	15	RIGHT WIPER MOTOR	2
308A	AEXF	0.85	LW	CABIN HARNESS	16	RIGHT WIPER MOTOR	3
309A	AEXF	0.85	Gr	CABIN HARNESS	17	LEFT WIPER MOTOR	2
310A	AEXF	0.85	L	CABIN HARNESS	18	LEFT WIPER MOTOR	3
400A	AEXF	1.25	R	CABIN TILT FUSE	2	BATTERY HARNESS 1	4
401A	AEXF	0.5	RY	CABIN HARNESS	80	SP_401S	X
401B	AEXF	0.5	RY	BACK BUZZER	1	SP_401S	X
401C	AEXF	0.5	RY	DIODE 1	2	SP_401S	X
403A	AEXF	1.25	RW	CABIN HARNESS	20	SP_403S	X
403B	AEXF	0.85	RW	HORN 1	1	SP_403S	X
403C	AEXF	0.85	RW	HORN 2	1	SP_403S	X
600A	AEXF	1.25	YR	FUEL FEED PUMP	1	RELAY JOINT 1	4
A12A	AEXF	0.5	YR	BATTERY HARNESS 1	5	AIC#2	12
B1C	AEXF	5	R	MEGA FUSE 3	2	SP_B1S	X
B1D	AEXF	5	R	MEGA FUSE 2	2	SP_B1S	X
B1E	AEXF	5	R	MEGA FUSE 1	2	SP_B1S	X
B1F	AEXF	5	R	BATTERY HARNESS 2	1	SP_B1S1	X
B1G	AEXF	5	R	BATTERY HARNESS 2	2	SP_B1S1	X
B12A	AEXF	5	R	SP_B1S	X	SP_B1S1	X
B2A	AEXF	5	WR	MEGA FUSE 1	1	SP_B2S	X
B2B	AEXF	5	WR	CABIN HARNESS	49	SP_B2S	X
B2G	AEXF	1.25	WR	CABIN TILT FUSE	1	SP_B2S	X
B4B	AEXF	8	W	CABIN HARNESS	54	SP_B4S	X
B4C	AEXF	3	W	CABIN HARNESS	98	SP_B4S	X
B4D	AEXF	3	W	CABIN HARNESS	99	SP_B4S	X
B4E	AEXF	1.25	W	SURGE KILLER	2	SP_B4S1	X
B4G	AEXF	5	W	BATTERY HARNESS 2	3	SP_B4S1	X
B4H	AEXF	5	W	BATTERY HARNESS 3	1	SP_B4S1	X
B4ZA	AEXF	5	W	SP_B4S	X	SP_B4S1	X
C11A	AEXF	0.5	Y	CABIN HARNESS	65	SP_C11S	X
C11B	AEXF	0.5	Y	HST CONTROLLER 2	53	SP_C11S	X
C11C	AEXF	0.5	Y	AIC#1	9	SP_C11S1	X
C11D	AEXF	0.5	Y	ECU	25	SP_C11S1	X
C11E	AEXF	0.5	Y	CABIN HARNESS	21	EPOS 1	74
△ C11ZA	AEXF	0.5	Y	SP_C11S	X	SP_C11S1	X
C12A	AEXF	0.5	YB	CABIN HARNESS	66	SP_C12S	X
C12B	AEXF	0.5	YB	HST CONTROLLER 2	54	SP_C12S	X
C12C	AEXF	0.5	YB	AIC#1	10	SP_C12S1	X
C12D	AEXF	0.5	YB	ECU	26	SP_C12S1	X
C12E	AEXF	0.5	YB	CABIN HARNESS	22	EPOS 1	73
△ C12ZA	AEXF	0.5	YB	SP_C12S	X	SP_C12S1	X
C13A	AEXF	-	shield	BLUNT_C13A	X	SP_C13S	X
C13B	AEXF	-	shield	BLUNT_C13B	X	SP_C13S	X
△ C13C	AEXF	-	shield	BLUNT_C13C	X	SP_C13S1	X
△ C13D	AEXF	-	shield	BLUNT_C13D	X	SP_C13S1	X
C13E	AEXF	-	shield	CABIN HARNESS	23	EPOS 1	8
△ C13ZA	AEXF	-	shield	SP_C13S	X	SP_C13S1	X
C21A	AEXF	0.5	W	CAN RESISTOR 2	1	SP_C21S	X
C21B	AEXF	0.5	W	CABIN HARNESS	24	SP_C21S	X
C21C	AEXF	0.5	W	EPOS 1	51	SP_C21S	X
C22A	AEXF	0.5	G	CAN RESISTOR 2	2	SP_C22S	X
C22B	AEXF	0.5	G	CABIN HARNESS	25	SP_C22S	X
C22C	AEXF	0.5	G	EPOS 1	52	SP_C22S	X
C23A	AEXF	-	shield	BLUNT_C23A	X	SP_C23S	X
C23B	AEXF	-	shield	CABIN HARNESS	26	SP_C23S	X
C23C	AEXF	-	shield	EPOS 1	30	SP_C23S	X
C31A	AEXF	0.5	Br	CABIN HARNESS	27	SP_C31S	X
C31B	AEXF	0.5	Br	EPOS 1	29	SP_C31S	X
C31C	AEXF	0.5	Br	TRIMBLE READY	5	SP_C31S1	X
C31D	AEXF	0.5	Br	HST CONTROLLER 1	63	SP_C31S2	X
C31E	AEXF	0.5	Br	IMU SENSOR BODY JOINT HARNESS	3	SP_C31S3	X
C31F	AEXF	0.5	Br	IMU SENSOR CAN 3 RESISTOR	1	SP_C31S3	X
△ C31ZA	AEXF	0.5	Br	SP_C31S	X	SP_C31S1	X
△ C31ZB	AEXF	0.5	Br	SP_C31S1	X	SP_C31S2	X
△ C31ZC	AEXF	0.5	Br	SP_C31S2	X	SP_C31S3	X
C32A	AEXF	0.5	Y	CABIN HARNESS	28	SP_C32S	X
C32B	AEXF	0.5	Y	EPOS 1	7	SP_C32S	X
C32C	AEXF	0.5	Y	TRIMBLE READY	6	SP_C32S1	X
C32D	AEXF	0.5	Y	HST CONTROLLER 1	62	SP_C32S2	X
C32E	AEXF	0.5	Y	IMU SENSOR BODY JOINT HARNESS	4	SP_C32S3	X
△ C32F	AEXF	0.5	Y	IMU SENSOR CAN 3 RESISTOR	2	SP_C32S3	X
△ C32ZA	AEXF	0.5	Y	SP_C32S	X	SP_C32S1	X
△ C32ZB	AEXF	0.5	Y	SP_C32S1	X	SP_C32S2	X
△ C32ZC	AEXF	0.5	Y	SP_C32S2	X	SP_C32S3	X
C33A	AEXF	-	shield	CABIN HARNESS	29	SP_C33S	X
C33B	AEXF	-	shield	EPOS 1	9	SP_C33S	X
△ C33C	AEXF	-	shield	BLUNT_C33C	X	SP_C33S1	X
△ C33D	AEXF	-	shield	BLUNT_C33D	X	SP_C33S2	X
△ C33E	AEXF	-	shield	BLUNT_C33E	X	SP_C33S3	X
△ C33F	AEXF	-	shield	BLUNT_C33F	X	SP_C33S3	X
△ C33ZA	AEXF	-	shield	SP_C33S	X	SP_C33S1	X
△ C33ZB	AEXF	-	shield	SP_C33S1	X	SP_C33S2	X
△ C33ZC	AEXF	-	shield	SP_C33S2	X	SP_C33S3	X

WIRE	MATERIAL	CSA	COL	FROM	CAV1	TO	CAV2
C41A	AEXF	0.5	Br	DEF TANK HEADER	2	SP_C41S	X
△ C41E	AEXF	0.5	Br	CABIN HARNESS	30	SP_C41S	X
C41K	AEXF	0.5	Br	ENGINE JOINT HARNESS 1	1	SP_C41S	X
C41F	AEXF	0.5	Br	DPF SOOT SENSOR	5	SP_C41S1	X
C41G	AEXF	0.5	Br	ECU	17	SP_C41S1	X
C41H	AEXF	0.5	Br	CAN 4 RESISTOR 1	1	SP_C41S1	X
C41J	AEXF	0.5	Br	CAN 4 RESISTOR 2	1	SP_C41S1	X
△ C41ZA	AEXF	0.5	Br	SP_C41S	X	SP_C41S1	X
C42A	AEXF	0.5	YL	DEF TANK HEADER	1	SP_C42S	X
△ C42E	AEXF	0.5	YL	CABIN HARNESS	31	SP_C42S	X
C42K	AEXF	0.5	YL	ENGINE JOINT HARNESS 1	2	SP_C42S	X
C42F	AEXF	0.5	YL	DPF SOOT SENSOR	4	SP_C42S1	X
C42G	AEXF	0.5	YL	ECU	18	SP_C42S1	X
C42H	AEXF	0.5	YL	CAN 4 RESISTOR 1	2	SP_C42S1	X
C42J	AEXF	0.5	YL	CAN 4 RESISTOR 2	2	SP_C42S1	X
△ C42ZA	AEXF	0.5	YL	SP_C42S	X	SP_C42S1	X
C51A	AEXF	0.5	W	CAN RESISTOR 5	1	SP_C51S	X
C51B	AEXF	0.5	W	CABIN HARNESS	32	SP_C51S	X
C51C	AEXF	0.5	W	HST CONTROLLER 2	15	SP_C51S	X
C52A	AEXF	0.5	G	CAN RESISTOR 5	2	SP_C52S	X
C52B	AEXF	0.5	G	CABIN HARNESS	33	SP_C52S	X
C52C	AEXF	0.5	G	HST CONTROLLER 2	16	SP_C52S	X
E1A	AEXF	0.85	GrB	CABIN HARNESS	12	ECU	1
E4A	AEXF	0.85	RL	ECU	4	ENGINE JOINT HARNESS 1	3
E5A	AEXF	0.85	LR	ECU	5	DEF DOZING MODULE	9
E6A	AEXF	0.85	RB	ECU	6	ENGINE JOINT HARNESS 1	4
E7A	AEXF	0.85	OrL	DEF DOZING MODULE	12	ECU	7
E8A	AEXF	0.85	RW	ENGINE JOINT HARNESS 1	5	ECU	8
E9A	AEXF	0.5	Gr	CABIN HARNESS	13	ECU	9
E12A	AEXF	0.85	LB	ENGINE JOINT HARNESS 1	6	ECU	12
E14A	AEXF	0.85	BL	DEF COOLANT DIVERTER VALVE	4	ECU	14
E15A	AEXF	0.85	BG	RETURN HEATED LINE	2	ECU	15
E16A	AEXF	0.85	RY	PRESSURE HEATED LINE	1	ECU	16
E23A	AEXF	0.85	YB	PRESSURE HEATED LINE	2	ECU	23
E24A	AEXF	0.85	RW	SUCTION HEATER LINE	1	ECU	24
E28A	AEXF	0.85	Br	DEF DOZING MODULE	3	ECU	28
E30A	AEXF	0.5	Gr	ECU	30	SP_E30S	X
E30B	AEXF	0.5	Gr	PRE HEATER RELAY	85	SP_E30S	X
E30C	AEXF	0.5	Gr	RELAY JOINT 1	5	SP_E30S	X
E31A	AEXF	0.85	Lg	DEF DOZING MODULE	10	ECU	31
E32A	AEXF	0.5	GrL	ECU	32	PRE HEATER RELAY	86
E33A	AEXF	0.5	YG	AIR INLET TEMP SENSOR	1	ECU	33
E35A	AEXF	0.5	BL	AIC#1	1	ECU	35
E36A	AEXF	0.5	L	ECU	36	SP_E36S	X
E36B	AEXF	0.85	L	CABIN HARNESS	36	SP_E36S	X
E36C	AEXF	0.5	L	AIC#2	8	SP_E36S	X
E38A	AEXF	0.85	Or	DEF DOZING MODULE	11	ECU	38
E39A	AEXF	0.85	WB	ECU	39	SUCTION HEATER LINE	2
E46A	AEXF	0.85	GR	ECU	46	SP_E46S	X
E46B	AEXF	0.85	GR	DEF DOZING MODULE	2	SP_E46S	X
E46C	AEXF	0.85	GR	ENGINE JOINT HARNESS 1	7	SP_E46S	X
E47A	AEXF	0.85	LB	DEF DOZING MODULE	8	ECU	47
E48A	AEXF	0.5	GrR	ECU	48	RELAY JOINT 1	6
E49A	AEXF	0.85	LgB	ECU	49	ENGINE JOINT HARNESS 1	8
E50A	AEXF	0.85	GB	DEF DOZING MODULE	4	ECU	50
E52A	AEXF	0.5	RL	ECU	52	AIR INLET TEMP SENSOR	2
E56A	AEXF	0.85	LR	ECU	56	DEF COOLANT DIVERTER VALVE	1
E58A	AEXF	0.5	Or	ECU	58	SP_E58S	X
E58B	AEXF	2	Or	CABIN HARNESS	2	SP_E58S	X
E64A	AEXF	0.85	BW	ECU	64	ENGINE JOINT HARNESS 1	9
E73A	AEXF	0.85	LB	RETURN HEATED LINE	1	ECU	73
E74A	AEXF	0.85	BY	ECU	74	ENGINE JOINT HARNESS 1	10
F103A	AEXF	0.5	OrR	CABIN HARNESS	41	SP_F103S	X
F103B	AEXF	0.5	OrR	WIF SENSOR	1	SP_F103S	X
F103C	AEXF	0.5	OrR	IMU SENSOR BODY JOINT HARNESS	1	SP_F103S	X
F103D	AEXF	0.5	OrR	IMU SENSOR JOINT HARNESS	1	SP_F103S	X
F103E	AEXF	0.5	OrR	PARKING BRAKE PRESS SENSOR	2	SP_F103S	X
F108A	AEXF	0.85	OrL	LEFT WIPER MOTOR	1	CABIN HARNESS	86
F109A	AEXF	0.85	RL	RIGHT WIPER MOTOR	1	CABIN HARNESS	87
F111A	AEXF	0.85	RY	CABIN HARNESS	42	RELAY JOINT 1	7
F112A	AEXF	0.5	RB	FUEL TEMP SENSOR	3	CABIN HARNESS	40
F114A	AEXF	0.85	Or	TRIMBLE READY	3	CABIN HARNESS	19
F201A	AEXF	3	RL	FUEL HEATER 1	2	CABIN HARNESS	3
F202A	AEXF	3	R	PRE HEATER RELAY	30	CABIN HARNESS	4
F205A	AEXF	0.85	R	CABIN HARNESS	45	SP_F205S	X
F205B	AEXF	0.85	R	DEF TANK HEADER	4	SP_F205S	X
F205C	AEXF	0.85	R	DPF SOOT SENSOR	1	SP_F205S	X
F206A	AEXF	2	RW	RELAY JOINT 1	8	CABIN HARNESS	8
F212A	AEXF	3	W	CABIN HARNESS	5	SP_F212S	X
F212B	AEXF	0.85	W	HST CONTROLLER 2	1	SP_F212S	X
F212C	AEXF	0.85	W	HST CONTROLLER 2	3	SP_F212S	X
F212D	AEXF	0.85	W	HST CONTROLLER 2	4	SP_F212S	X
F212E	AEXF	0.85	W	HST CONTROLLER 2	5	SP_F212S	X
F212F	AEXF	0.85	W	HST CONTROLLER 2	6	SP_F212S	X
F212H	AEXF	0.85	W	HST CONTROLLER 2	28	SP_F212S	X
F212K	AEXF	0.85	W	HST CONTROLLER 2	45	SP_F212S	X
F212L	AEXF	0.85	W	HST CONTROLLER 2	58	SP_F212S	X
F213A	AEXF	0.85	WG	EPOS 1	4	SP_F213S	X
F213B	AEXF	0.85	WG	EPOS 1	5	SP_F213S	X
F213C	AEXF	0.85	WG	EPOS 1	6	SP_F213S	X
F213D	AEXF	0.5	WG	EPOS 1	28	SP_F213S	X
F213E	AEXF	2	WG	CABIN HARNESS	6	SP_F213S	X
F213F	AEXF	0.5	WG	EPOS 1	50	SP_F213S	X
F213H	AEXF	0.85	WG	TRIMBLE READY	1	SP_F213S	X
F214A	AEXF	3	W	CABIN HARNESS	7	SP_F214S	X
F214B	AEXF	2	W	ECU	84	SP_F214S	X
F214C	AEXF	2	W	ECU	85	SP_F214S	X
F214D	AEXF	2	W	ECU	86	SP_F214S	X

WIRE	MATERIAL	CSA	COL	FROM	CAV1	TO	CAV2
△ G13A	AEXF	0.5	Or	CABIN HARNESS	91	AIRCON JOINT HARNESS B	3
△							
△						JOINT CONN C_(REAR CAM)	
△ G14A	AEXF	0.5	Y	CABIN HARNESS	93	AIRCON JOINT HARNESS B	6
△							
△							
△ G21A	AEXF	0.5	OrB	CABIN HARNESS	92	JOINT CONN C_(REAR CAM)	4
△							
△							
△ G22A	AEXF	0.5	YB	CABIN HARNESS	94	JOINT CONN C_(REAR CAM)	5
△							
△							
H110A	AEXF	0.5	WR	HST CONTROLLER 1	10	RH MOTOR SPEED SENSOR HARNESS	3
H111A	AEXF	0.5	WL	HST CONTROLLER 1	11	RH MOTOR SPEED SENSOR HARNESS	4
H112A	AEXF	0.5	YR	HST CONTROLLER 1	12	LH MOTOR SPEED SENSOR HARNESS	3
H113A	AEXF	0.5	YL	HST CONTROLLER 1	13	LH MOTOR SPEED SENSOR HARNESS	4
H139A	AEXF	0.5	YW	HST CONTROLLER 1	39	CABIN HARNESS	46
H142A	AEXF	0.5	LW	HST CONTROLLER 1	42	RH TRAVEL FORWARD SENSOR	2
H143A	AEXF	0.5	LY	HST CONTROLLER 1	43	LH TRAVEL REVERSE SENSOR	2
H146A	AEXF	0.5	WB	HST CONTROLLER 1	46	SP_H146S	X
H146B	AEXF	0.5	WB	LH MOTOR SPEED SENSOR HARNESS	2	SP_H146S	X
H146C	AEXF	0.5	WB	RH MOTOR SPEED SENSOR HARNESS	2	SP_H146S	X
H146D	AEXF	0.5	WB	RH TRAVEL FORWARD SENSOR	3	SP_H146S	X
H146E	AEXF	0.5	WB	LH TRAVEL FORWARD SENSOR	3	SP_H146S	X
H146F	AEXF	0.5	WB	LH TRAVEL FORWARD SENSOR	3	SP_H146S	X
H146G	AEXF	0.5	WB	LH TRAVEL REVERSE SENSOR	3	SP_H146S	X
H146H	AEXF	0.5	WB	CABIN HARNESS	47	SP_H146S	X
H151A	AEXF	0.5	GW	HST CONTROLLER 1	51	SP_H151S	X
H151B	AEXF	0.5	GW	LH MOTOR SPEED SENSOR HARNESS	5	SP_H151S	X
H153A	AEXF	0.5	LgW	HST CONTROLLER 1	53	SP_H151S	X
H153B	AEXF	0.5	LgW	LH PUMP FORWARD P/V	1	SP_H151S	X
H154A	AEXF	0.5	LW	HST CONTROLLER 1	54	SP_H153S	X
H154B	AEXF	0.5	LW	RH PUMP FORWARD P/V	1	SP_H153S	X
H175A	AEXF	0.5	GR	HST CONTROLLER 1	75	SP_H175S	X
H175B	AEXF	0.5	GR	RH MOTOR SPEED SENSOR HARNESS	5	SP_H175S	X
H177A	AEXF	0.5	LgR	HST CONTROLLER 1	77	SP_H177S	X
H177B	AEXF	0.5	LgR	LH PUMP REVERSE P/V	1	SP_H177S	X
H178A	AEXF	0.5	LR	HST CONTROLLER 1	78	SP_H178S	X
H178B	AEXF	0.5	LR	RH PUMP REVERSE P/V	1	SP_H178S	X
H183A	AEXF	0.5	LgB	HST CONTROLLER 1	83	SP_H183S	X
H183B	AEXF	0.5	LgB	LH PUMP FORWARD P/V	2	SP_H183S	X
H183C	AEXF	0.5	LgB	LH PUMP REVERSE P/V	2	SP_H183S	X
H184A	AEXF	0.5	LB	HST CONTROLLER 1	84	SP_H184S	X
H184B	AEXF	0.5	LB	RH PUMP FORWARD P/V	2	SP_H184S	X
H184C	AEXF	0.5	LB	RH PUMP REVERSE P/V	2	SP_H184S	X
H185A	AEXF	0.5	GB	HST CONTROLLER 1	85	SP_H185S	X
H185B	AEXF	0.5	GB	LH MOTOR SPEED SENSOR HARNESS	6	SP_H185S	X
H185C	AEXF	0.5	GB	RH MOTOR SPEED SENSOR HARNESS	6	SP_H185S	X
H219A	AEXF	0.5	YR	HST CONTROLLER 2	19	CABIN HARNESS	50
H224A	AEXF	0.5	BrL	HST CONTROLLER 2	24	LH TRAVEL FORWARD SENSOR	2
H226A	AEXF	0.5	YL	HST CONTROLLER 2	26	CABIN HARNESS	51
H232A	AEXF	0.5	RL	HST CONTROLLER 2	32	SP_H232S	X
H232B	AEXF	0.5	RL	LH MOTOR SPEED SENSOR HARNESS	1	SP_H232S	X
H232C	AEXF	0.5	RL	RH MOTOR SPEED SENSOR HARNESS	1	SP_H232S	X
H235A	AEXF	0.5	LR	HST CONTROLLER 2	35	LH TRAVEL FORWARD SENSOR	2
H238A	AEXF	0.5	GB	HST CONTROLLER 2	38	CABIN HARNESS	52
H255A	AEXF	0.5	G	HST CONTROLLER 2	55	SP_H255S	X
H255B	AEXF	0.5	G	CABIN HARNESS	53	SP_H255S	X
H255C	AEXF	0.85	G	RH TRAVEL FORWARD SENSOR	1	SP_H255S	X
H255D	AEXF	0.85	G	LH TRAVEL FORWARD SENSOR	1	SP_H255S	X
H255E	AEXF	0.85	G	LH TRAVEL FORWARD SENSOR	1	SP_H255S	X
H255F	AEXF	0.85	G	LH TRAVEL REVERSE SENSOR	1	SP_H255S	X
V111A	AEXF	0.5	RY	EPOS 1	11	ENGINE JOINT HARNESS 1	11
V112A	AEXF	0.5	WG	CABIN HARNESS	56	EPOS 1	12
V114A	AEXF	0.5	RB	EPOS 1	14	RETURN FILTER SWITCH	1
V116A	AEXF	0.5	OrR	EPOS 1	16	AIRCON JOINT HARNESS B	2
V122A	AEXF	0.5	BY	EPOS 1	22	WIF SENSOR	3
V142A	AEXF	0.5	WY	EPOS 1	42	SP_V142S	X
V142D	AEXF	0.5	WY	CABIN HARNESS	59	SP_V142S	X
V142E	AEXF	0.5	WY	LS PRESSURE SENSOR	1	SP_V142S	X
V143A	AEXF	0.5	LgB	EPOS 1	43	SP_V143S	X
V143B	AEXF	0.5	LgB	PARKING BRAKE PRESS SENSOR	1	SP_V143S	X
V143C	AEXF	0.5	LgB	CABIN HARNESS	61	SP_V143S	X
V143D	AEXF	0.5	LgB	LS PRESSURE SENSOR	3	SP_V143S	X
V144A	AEXF	0.5	LB	EPOS 1	44	SP_V144S	X
V144B	AEXF	0.5	LB	FUEL TEMP SENSOR	2	SP_V144S	X
V144C	AEXF	0.5	LB	HYDRAULIC TEMP SENSOR	1	SP_V144S	X
V144D	AEXF	0.5	LB	MAIN HANRESS	57	SP_V144S	X
V153A	AEXF	0.5	GW	EPOS 1	53	HYDRAULIC TEMP SENSOR	2
V154A	AEXF	0.5	Br	EPOS 1	54	WIF SENSOR	2
V165A	AEXF	0.5	BrR	EPOS 1	65	CABIN HARNESS	62
V167A	AEXF	0.5	BL	EPOS 1	67	SP_V167S	X
V167B	AEXF	0.5	BL	PARKING BRAKE PRESS SENSOR	3	SP_V167S	X
V171A	AEXF	0.5	GY	EPOS 1	71	CABIN HARNESS	64
V175A	AEXF	0.5	LgR	EPOS 1	75	FUEL TEMP SENSOR	1
V176A	AEXF	0.5	Or	EPOS 1	76	MAIN HARENSS	58
V177A	AEXF	0.5	BW	EPOS 1	77	DUST INDICATOR	2
V189A	AEXF	0.5	BrW	EPOS 1	89	SP_V189S	X
V189B	AEXF	0.5	BrW	LS PRESSURE SENSOR	2	SP_V189S	X
V192A	AEXF	0.5	LR	EPOS 1	92	SP_V192S	X
V192B	AEXF	0.5	LR	CABIN HARNESS	63	SP_V192S	X
V193A	AEXF	0.5	RL	EPOS 1	93	SP_V193S	X
V193B	AEXF	0.5	RL	CABIN HARNESS	67	SP_V193S	X
V193C	AEXF	0.85	RL	ALTERNATOR R(I)	1	SP_V193S	X
V201A	AEXF	0.5	GR	EPOS 2	1	BLADE TILT RIGHT P/V	1
V203A	AEXF	0.5	RY	EPOS 2	3	CABIN HARNESS	68
V204A	AEXF	0.5	GW	EPOS 2	4	BLADE TILT LEFT P/V	1
V205A	AEXF	0.85	LB	EPOS 2	5	CABIN HARNESS	69
V206A	AEXF	0.5	WR	EPOS 2	6	SP_V206S	X
V206B	AEXF	0.85	WR	COMPRESSOR	1	SP_V206S	X
V206C	AEXF	0.85	WR	CABIN HARNESS	70	SP_V206S	X
V206D	AEXF	0.85	WR	DIODE 3	2	SP_V206S	X
V207A	AEXF	0.85	W	EPOS 2	7	SP_V207S	X
V207B	AEXF	3	W	PRE HEATER RELAY	87	SP_V207S	X
V207C	AEXF	5	W	GLOW PLUG	1	SP_V207S	X
V211A	AEXF	0.5	Or	EPOS 2	11	CABIN HARNESS	71
V213A	AEXF	0.5	WB	EPOS 2	13	CABIN HARNESS	73

△ X35	C115940	Rear View Camera Change
NO.	CHANGE NO	DESCRIPTION

310207-12065C

DS2400525

WIRE	MATERIAL	CSA	COL	FROM	CAV1	TO	CAV2
V214A	AEXF	0.5	LgW	EPOS 2	14	CABIN HARNESS	74
V215A	AEXF	0.5	GW	EPOS 2	15	CABIN HARNESS	75
V216A	AEXF	0.85	RB	EPOS 2	16	CABIN HARNESS	76
V217A	AEXF	0.5	GY	EPOS 2	17	BLADE RAISE P/V	1
V218A	AEXF	0.5	GL	EPOS 2	18	BLADE DOWN P/V	1
V219A	AEXF	0.5	Y	EPOS 2	19	BLADE ANGLE RIGHT P/V	1
V220A	AEXF	0.85	LG	EPOS 2	20	CABIN HARNESS	77
V229A	AEXF	0.5	Lg	EPOS 2	29	CABIN HARNESS	78
V230A	AEXF	0.5	GL	EPOS 2	30	CABIN HARNESS	79
V231A	AEXF	0.5	R	EPOS 2	31	BLADE ANGLE LEFT P/V	1
V232A	AEXF	0.5	G	EPOS 2	32	COOLING FAN P/V	1
V233A	AEXF	0.5	OrL	EPOS 2	33	SP_V233S	X
V233B	AEXF	0.5	OrL	AIRCON FAN RESISTOR	2	SP_V233S	X
V233C	AEXF	0.5	OrL	AIRCON JOINT HARNESS B	1	SP_V233S	X
V234A	AEXF	0.5	Or	EPOS 2	34	RIPPER UP P/V	1
V235A	AEXF	0.5	P	EPOS 2	35	BLADE ANGLE LEFT P/V	1
V236A	AEXF	0.85	Br	EPOS 2	36	SP_V236S	X
V236B	AEXF	0.5	Br	BLADE DOWN P/V	2	SP_V236S	X
V236C	AEXF	0.5	Br	BLADE RAISE P/V	2	SP_V236S	X
V236D	AEXF	0.5	Br	CAC FAN RESISTOR	4	SP_V236S	X
V236E	AEXF	0.5	Br	AIRCON FAN RESISTOR	4	SP_V236S	X
V237A	AEXF	0.85	Gr	EPOS 2	37	SP_V237S	X
V237B	AEXF	0.5	Gr	BLADE ANGLE LEFT P/V	2	SP_V237S	X
V237C	AEXF	0.5	Gr	BLADE ANGLE RIGHT P/V	2	SP_V237S	X
V238A	AEXF	0.85	GB	EPOS 2	38	SP_V238S	X
V238B	AEXF	0.5	GB	BLADE TILT RIGHT P/V	2	SP_V238S	X
V238C	AEXF	0.5	GB	BLADE TILT LEFT P/V	2	SP_V238S	X
V238D	AEXF	0.5	GB	COOLING FAN P/V	2	SP_V238S	X
V239A	AEXF	0.5	BW	EPOS 2	39	SP_V239S	X
V239B	AEXF	0.5	BW	BLADE ANGLE LEFT P/V	2	SP_V239S	X
V239C	AEXF	0.5	BW	RIPPER UP P/V	2	SP_V239S	X
V242A	AEXF	0.5	BL	EPOS 2	42	CABIN HARNESS	81
V244A	AEXF	0.5	W	EPOS 2	44	SP_V244S	X
V244B	AEXF	0.5	W	DIODE ARRAY 3	6	SP_V244S	X
V244C	AEXF	0.5	W	PARKING RELEASE	1	SP_V244S	X
V245A	AEXF	0.5	RG	EPOS 2	45	RELAY JOINT 1	9
V246A	AEXF	0.5	L	EPOS 2	46	SP_V246S	X
V246B	AEXF	0.5	L	DIODE ARRAY 3	7	SP_V246S	X
V246C	AEXF	0.5	L	HST CUT OFF LH	1	SP_V246S	X
V247A	AEXF	0.5	RL	EPOS 2	47	SP_V247S	X
V247B	AEXF	0.5	RL	DIODE ARRAY 3	8	SP_V247S	X
V247C	AEXF	0.5	RL	HST CUT OFF RH	1	SP_V247S	X
V248A	AEXF	0.5	OrB	EPOS 2	48	CABIN HARNESS	82
V249A	AEXF	0.5	RW	EPOS 2	49	SP_V249S	X
V249B	AEXF	0.5	RW	CAC FAN RESISTOR	2	SP_V249S	X
V249C	AEXF	0.5	RW	ENGINE JOINT HARNESS 1	12	SP_V249S	X
V251A	AEXF	0.5	WG	EPOS 2	51	RELAY JOINT 1	10
V252A	AEXF	0.85	GrR	EPOS 2	52	SP_V252S	X
V252B	AEXF	0.5	GrR	DIODE ARRAY 3	5	SP_V252S	X
V252C	AEXF	0.5	GrR	HYD CUT OFF	1	SP_V252S	X
V253A	AEXF	0.5	WL	EPOS 2	53	CABIN HARNESS	88
V256A	AEXF	0.5	Br	EPOS 2	56	CABIN HARNESS	83
V257A	AEXF	0.5	V	EPOS 2	57	CABIN HARNESS	84
V258A	AEXF	0.85	YR	EPOS 2	58	CABIN HARNESS	85
V259A	AEXF	0.85	YW	EPOS 2	59	SP_V259S	X
V259B	AEXF	0.5	YW	DIODE 4	2	SP_V259S	X
V259C	AEXF	0.5	YW	REVERSE FAN	1	SP_V259S	X
V260A	AEXF	0.5	WY	EPOS 2	60	RELAY JOINT 1	11

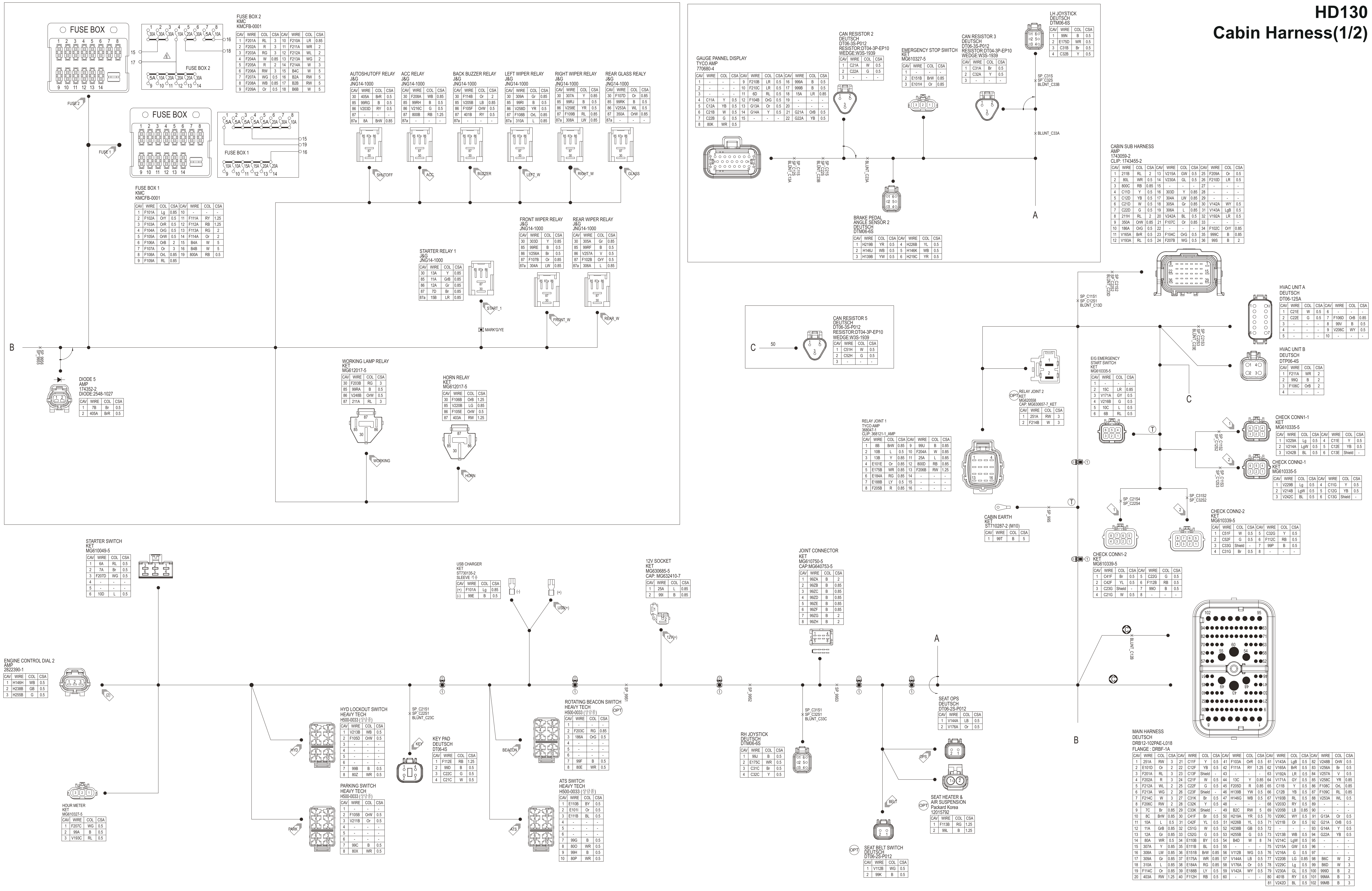
WIRE	MATERIAL	CSA	COL	FROM	CAV1	TO	CAV2
99A	AEXF	8	B	FRAME EARTH 1	1	SP_99S	X
99B	AEXF	3	B	CABIN HARNESS	101	SP_99S	X
99C	AEXF	3	B	CABIN HARNESS	102	SP_99S	X
99D	AEXF	5	B	AIRCON JOINT HARNESS A	2	SP_99S1	X
99E	AEXF	1.25	B	SURGE KILLER	1	SP_99S1	X
99XA	AEXF	5	B	SP_99S	X	SP_99S1	X
99H	AEXF	1.25	B	RELAY JOINT 1	12	SP_99S2	X
99J	AEXF	0.85	B	LEFT WIPER MOTOR	4	SP_99S2	X
99K	AEXF	0.5	B	BACK BUZZER	2	SP_99S2	X
99L	AEXF	0.5	B	DIODE 1	1	SP_99S2	X
99P	AEXF	0.85	B	SIDE WINDOW WASHER (F)	2	SP_99S4	X
99Q	AEXF	0.85	B	SIDE WINDOW WASHER (R)	2	SP_99S4	X
99R	AEXF	0.85	B	FRONT WINDOW WASHER	2	SP_99S4	X
99S	AEXF	0.85	B	REAR WINDOW WASHER	2	SP_99S5	X
99T	AEXF	0.85	B	DIODE ARRAY 1	1	SP_99S4	X
99U	AEXF	0.85	B	DIODE ARRAY 1	2	SP_99S4	X
99V	AEXF	0.85	B	DIODE ARRAY 1	3	SP_99S4	X
99W	AEXF	0.85	B	DIODE ARRAY 1	4	SP_99S5	X
99X	AEXF	2	B	BATTERY HARNESS 1	6	SP_99S5	X
99Y	AEXF	0.85	B	TRIMBLE READY	2	SP_99S5	X
99AA	AEXF	0.5	B	RETURN FILTER SWITCH	2	SP_99S6	X
99AB	AEXF	0.85	B	RIGHT WIPER MOTOR	4	SP_99S6	X
99AC	AEXF	0.85	B	DEF TANK HEADER	3	SP_99S6	X
99AD	AEXF	0.5	B	FUEL FULL LED LAMP	2	SP_99S6	X
99AE	AEXF	0.5	B	HYD CUT OFF	2	SP_99S6	X
99AF	AEXF	0.5	B	PARKING RELEASE	2	SP_99S7	X
99AG	AEXF	0.5	B	HST CUT OFF LH	2	SP_99S7	X
99AH	AEXF	0.5	B	HST CUT OFF RH	2	SP_99S7	X
99AJ	AEXF	0.5	B	DIODE ARRAY 3	1	SP_99S6	X
99AK	AEXF	0.5	B	DIODE ARRAY 3	2	SP_99S7	X
99AL	AEXF	0.5	B	DIODE ARRAY 3	3	SP_99S7	X
99AM	AEXF	0.5	B	DIODE ARRAY 3	4	SP_99S7	X
99BB	AEXF	0.5	B	REVERSE FAN	2	SP_99S8	X
99BC	AEXF	0.5	B	DIODE 4	1	SP_99S8	X
99BD	AEXF	0.5	B	IMU SENSOR BODY JOINT HARNESS	2	SP_99S8	X
99BE	AEXF	0.5	B	DUST INDICATOR	1	SP_99S9	X
99BF	AEXF	0.85	B	DPF SOOT SENSOR	2	SP_99S9	X
99BG	AEXF	0.5	B	IMU SENSOR JOINT HARNESS	2	SP_99S9	X
99CA	AEXF	5	B	FRAME EARTH 2	1	SP_99SC	X
99CB	AEXF	0.5	B	AIOH1	11	SP_99SC	X
99CC	AEXF	5	B	ENGINE JOINT HARNESS 2	2	SP_99SC	X
99CD	AEXF	1.25	B	FUEL FEED PUMP	2	SP_99SC	X
99CE	AEXF	3	B	FUEL HEATER 1	1	SP_99SD	X
99CF	AEXF	0.85	B	COMPRESSOR	2	SP_99SD	X
99CG	AEXF	0.85	B	DIODE 3	1	SP_99SD	X
99CH	AEXF	0.85	B	HORN 1	2	SP_99SD	X
99CJ	AEXF	0.85	B	HORN 2	2	SP_99SD	X
99CK	AEXF	0.85	B	STARTER S	2	SP_99SD	X
99XD	AEXF	5	B	SP_99SC	X	SP_99SD	X
99ZA	AEXF	2	B	JOINT CONNECTOR A	1	SP_99S	X
99ZB	AEXF	2	B	JOINT CONNECTOR A	8	SP_99S	X
99ZC	AEXF	2	B	JOINT CONNECTOR A	2	SP_99S2	X
99ZE	AEXF	2	B	JOINT CONNECTOR A	4	SP_99S4	X
99ZF	AEXF	2	B	JOINT CONNECTOR A	5	SP_99S5	X
99ZG	AEXF	2	B	JOINT CONNECTOR A	6	SP_99S6	X
99ZH	AEXF	0.85	B	JOINT CONNECTOR A	7	SP_99S7	X
99ZJ	AEXF	0.85	B	JOINT CONNECTOR A	9	SP_99S8	X
99ZK	AEXF	1.25	B	JOINT CONNECTOR A	10	SP_99S9	X
999A	AEXF	5	B	FRAME EARTH 3	1	SP_999S	X
999B	AEXF	0.85	B	EPOS 1	1	SP_999S1	X
999C	AEXF	0.85	B	EPOS 1	2	SP_999S1	X
999D	AEXF	0.85	B	EPOS 1	3	SP_999S1	X
999E	AEXF	0.85	B	EPOS 1	72	SP_999S1	X
999F	AEXF	0.85	B	EPOS 1	94	SP_999S1	X
999G	AEXF	0.85	B	HST CONTROLLER 1	14	SP_999S2	X
999H	AEXF	0.85	B	HST CONTROLLER 1	22	SP_999S2	X
999J	AEXF	0.85	B	HST CONTROLLER 1	23	SP_999S2	X
999K	AEXF	0.85	B	HST CONTROLLER 1	24	SP_999S2	X
999L	AEXF	0.85	B	HST CONTROLLER 2	2	SP_999S2	X
999M	AEXF	0.85	B	HST CONTROLLER 2	7	SP_999S2	X
999N	AEXF	0.85	B	HST CONTROLLER 2	20	SP_999S2	X
999P	AEXF	0.85	B	HST CONTROLLER 2	33	SP_999S2	X
999Q	AEXF	0.85	B	HST CONTROLLER 2	46	SP_999S2	X
999R	AEXF	2	B	CABIN HARNESS	100	SP_999S	X
999S	AEXF	2	B	ECU	81	SP_999S	X
999T	AEXF	2	B	ECU	82	SP_999S	X
999U	AEXF	2	B	ECU	83	SP_999S	X
999ZA	AEXF	5	B	SP_999S	X	SP_999S1	X
999ZB	AEXF	3	B	SP_999S	X	SP_999S2	X

△ X00	C110940	Rear View Camera Change
NO.	CHANGE NO	DESCRIPTION

310207-12065C

DS2400526

HD130 Cabin Harness(1/2)



FUSE BOX 2
KMC
KMCFB-0001

CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA
1	F201A	RL	3	10	F210A	LR	0.85
2	F202A	R	3	11	F211A	WR	2
3	F203A	RG	3	12	F212A	WL	2
4	F204A	W	0.85	13	F213A	WG	2
5	F205A	R	2	14	F214A	W	3
6	F206A	RW	3	15	B4C	W	5
7	F207A	WG	0.5	16	B2A	RW	5
8	F208A	WB	0.85	17	B2B	RW	5
9	F209A	Or	0.5	18	B6B	W	5

FUSE BOX 1
KMC
KMCFB-0001

CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA
1	F101A	Lg	0.85	10	-	-	-
2	F102A	OrY	0.5	11	F111A	RY	1.25
3	F103A	OrR	0.5	12	F112A	RB	1.25
4	F104A	OrG	0.5	13	F113A	RG	2
5	F105A	OrW	0.5	14	F114A	Or	2
6	F106A	OrB	2	15	B4A	W	5
7	F107A	Or	3	16	B4B	W	5
8	F108A	OrL	0.85	19	800A	RB	0.5
9	F109A	RL	0.85				

AUTOSHUTOFF RELAY
J&G
JNG14-1000

CAV	WIRE	COL	CSA
30	405A	BrR	0.5
85	99RG	B	0.5
86	V203D	RY	0.5
87	-	-	-
87a	8A	BrW	0.85

ACC RELAY
J&G
JNG14-1000

CAV	WIRE	COL	CSA
30	F208A	WB	0.85
85	99RH	B	0.5
86	V216C	G	0.5
87	800B	RB	1.25
87a	-	-	-

BACK BUZZER RELAY
J&G
JNG14-1000

CAV	WIRE	COL	CSA
30	F114B	Or	2
85	V205B	LB	0.85
86	F105F	OrW	0.5
87	401B	RY	0.5
87a	-	-	-

LEFT WIPER RELAY
J&G
JNG14-1000

CAV	WIRE	COL	CSA
30	309A	Gr	0.85
85	99RI	B	0.5
86	V258D	YR	0.5
87	F108B	OrL	0.85
87a	310A	L	0.85

RIGHT WIPER RELAY
J&G
JNG14-1000

CAV	WIRE	COL	CSA
30	307A	Y	0.85
85	99RJ	B	0.5
86	V258E	YR	0.5
87	F109B	RL	0.85
87a	308A	LW	0.85

REAR GLASS REALY
J&G
JNG14-1000

CAV	WIRE	COL	CSA
30	F107D	Or	0.85
85	99RK	B	0.5
86	V253A	WL	0.5
87	350A	OrW	0.85
87a	-	-	-

FRONT WIPER RELAY
J&G
JNG14-1000

CAV	WIRE	COL	CSA
30	303D	Y	0.85
85	99RE	B	0.5
86	V256A	Br	0.5
87	F107B	Or	0.85
87a	304A	LW	0.85

REAR WIPER RELAY
J&G
JNG14-1000

CAV	WIRE	COL	CSA
30	305A	Gr	0.85
85	99RF	B	0.5
86	V257A	V	0.5
87	F102B	OrY	0.5
87a	306A	L	0.85

STARTER RELAY 1
J&G
JNG14-1000

CAV	WIRE	COL	CSA
30	13A	Y	0.85
85	11A	GrB	0.85
86	12A	Gr	0.85
87	7D	Br	0.85
87a	15B	LR	0.85

WORKING LAMP RELAY
KET
MG612017-5

CAV	WIRE	COL	CSA
30	F203B	RG	3
85	99RA	B	0.5
86	V248B	OrW	0.5
87	211A	RL	3

HORN RELAY
KET
MG612017-5

CAV	WIRE	COL	CSA
30	F106B	OrB	1.25
85	V220B	LG	0.85
86	F105E	OrW	0.5
87	403A	RW	1.25

DIODE 5
AMP
174352-2
DIODE:2548-1027

CAV	WIRE	COL	CSA
1	7B	Br	0.5
2	405A	BrR	0.5

GAUGE PANNEL DISPLAY
TYCO AMP
770680-4

CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA
1	-	-	-	9	F210B	LR	0.5	16	999A	B	0.5
2	-	-	-	10	F210C	LR	0.5	17	999B	B	0.5
3	-	-	-	11	6D	RL	0.5	18	15A	LR	0.85
4	C11A	Y	0.5	12	F104B	OrG	0.5	19	-	-	-
5	C12A	YB	0.5	13	G13A	Or	0.5	20	-	-	-
6	C21B	W	0.5	14	G14A	Y	0.5	21	G21A	OrB	0.5
7	C22B	G	0.5	15	-	-	-	22	G22A	YB	0.5
8	80K	WR	0.5								

CAN RESISTOR 2
DEUTSCH
DT06-3S-P012
RESISTOR:DT04-3P-EP10
WEDGE:W3S-1939

CAV	WIRE	COL	CSA
1	C21A	W	0.5
2	C22A	G	0.5
3	-	-	-

EMERGENCY STOP SWITCH
KET
MG610327-5

CAV	WIRE	COL	CSA
1	-	-	-
2	E151B	BrW	0.85
3	E101H	Or	0.85

CAN RESISTOR 3
DEUTSCH
DT06-3S-P012
RESISTOR:DT04-3P-EP10
WEDGE:W3S-1939

CAV	WIRE	COL	CSA
1	C31A	Br	0.5
2	C32A	Y	0.5
3	-	-	-

LH JOYSTICK
DEUTSCH
DTM06-6S

CAV	WIRE	COL	CSA
1	99N	B	0.5
2	E175D	WR	0.5
3	C31B	Br	0.5
4	C32B	Y	0.5

BRAKE PEDAL ANGLE SENSOR 2
DEUTSCH
DTM06-6S

CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA
1	H219B	YR	0.5	4	H226B	YL	0.5
2	H146J	WB	0.5	5	H146K	WB	0.5
3	H139B	YW	0.5	6	H219C	YR	0.5

CAN RESISTOR 5
DEUTSCH
DT06-3S-P012
RESISTOR:DT04-3P-EP10
WEDGE:W3S-1939

CAV	WIRE	COL	CSA
1	C51H	W	0.5
2	C52H	G	0.5
3	-	-	-

CABIN SUB HARNESS
AMP
1743059-2
CLIP: 1743455-2

CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA
1	211B	RL	2	13	V215A	GW	0.5	25	F209A	Or	0.5
2	80L	WR	0.5	14	V230A	GL	0.5	26	F210D	LR	0.5
3	800C	RB	0.85	15	-	-	-	27	-	-	-
4	C11D	Y	0.5	16	303D	Y	0.85	28	-	-	-
5	C12D	YB	0.5	17	304A	LW	0.85	29	-	-	-
6	C21D	W	0.5	18	305A	Gr	0.85	30	V142A	WY	0.5
7	C22D	G	0.5	19	306A	L	0.85	31	V143A	LgB	0.5
8	211H	RL	2	20	V242A	BL	0.5	32	V192A	LR	0.5
9	350A	OrW	0.85	21	F107C	Or	0.85	33	-	-	-
10	186A	OrG	0.5	22	-	-	-	34	F102C	OrY	0.85
11	V165A	BrR	0.5	23	F104C	OrG	0.5	35	999C	B	0.85
12	V193A	RL	0.5	24	F207B	WG	0.5	36	99S	B	2

HVAC UNIT A
DEUTSCH
DT06-12SA

CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA
1	C21E	W	0.5	6	-	-	-
2	C22E	G	0.5	7	F106D	OrB	0.85
3	-	-	-	8	99V	B	0.5
4	-	-	-	9	V206C	WY	0.5
5	-	-	-	10	-	-	-

HVAC UNIT B
DEUTSCH
DTP06-4S

CAV	WIRE	COL	CSA
1	F211A	WR	2
2	99Q	B	2
3	F106C	OrB	2
4	-	-	-

OPT **RELAY JOINT 2**
KET
MG620558
CAP: MG630657-7_KET

CAV	WIRE	COL	CSA
1	251A	RW	3
2	F214B	W	3

E/G EMERGENCY START SWITCH
KET
MG610335-5

CAV	WIRE	COL	CSA
1	-	-	-
2	15C	LR	0.85
3	V171A	GY	0.5
4	V216B	G	0.5
5	10C	L	0.5
6	6B	RL	0.5

CHECK CONN1-1
KET
MG610335-5

CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA
1	V229A	Lg	0.5	4	C11E	Y	0.5
2	V214A	LgW	0.5	5	C12E	YB	0.5
3	V242B	BL	0.5	6	C13E	Shield	-

CHECK CONN2-1
KET
MG610335-5

CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA
1	V229B	Lg	0.5	4	C11G	Y	0.5
2	V214B	LgW	0.5	5	C12G	YB	0.5
3	V242C	BL	0.5	6	C13G	Shield	-

RELAY JOINT 1
TYCO AMP
368047-1
CLIP: 368121-1_AMP

CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA
1	8B	BrW	0.85	9	99U	B	0.85
2	10B	L	0.5	10	F204A	W	0.85
3	13B	Y	0.85	11	25A	L	0.85
4	E101E	Or	0.85	12	800D	RB	0.85
5	E175B	WR	0.85	13	F206B	RW	1.25
6	E184A	RG	0.85	14	-	-	-
7	E188B	LY	0.5	15	-	-	-
8	F205B	R	0.85	16	-	-	-

CABIN EARTH
KET
ST710287-2 (M10)

CAV	WIRE	COL	CSA
1	99T	B	5

CHECK CONN2-2
KET
MG610339-5

CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA
1	C51F	W	0.5	5	C32G	Y	0.5
2	C52F	G	0.5	6	F112C	RB	0.5
3	C33G	Shield	-	7	99P	B	0.5
4	C31G	Br	0.5	8	-	-	-

CHECK CONN1-2
KET
MG610339-5

CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA
1	C41F	Br	0.5	5	C22G	G	0.5
2	C42F	YL	0.5	6	F112B	RB	0.5
3	C23G	Shield	-	7	99O	B	0.5
4	C21G	W	0.5	8	-	-	-

STARTER SWITCH
KET
MG610049-5

CAV	WIRE	COL	CSA
1	6A	RL	0.5
2	7A	Br	0.5
3	F207D	WG	0.5
4	-	-	-
5	-	-	-
6	10D	L	0.5

ENGINE CONTROL DIAL 2
AMP
2822390-1

CAV	WIRE	COL	CSA
1	H146H	WB	0.5
2	H238B	GB	0.5
3	H255B	G	0.5

HOUR METER
KET
MG610327-5

CAV	WIRE	COL	CSA
1	F207C	WG	0.5
2	99A	B	0.5
3	V193C	RL	0.5

HYD LOCKOUT SWITCH
HEAVY TECH
H500-0033 (상담품)

CAV	WIRE	COL	CSA
1	V213B	WB	0.5
2	F105D	OrW	0.5
3	-	-	-
4	-	-	-
5	-	-	-
6	-	-	-
7	99B	B	0.5
8	80Z	WR	0.5

PARKING SWITCH
HEAVY TECH
H500-0033 (상담품)

CAV	WIRE	COL	CSA
1	-	-	-
2	F105B	OrW	0.5
3	V211B	Or	0.5
4	-	-	-
5	-	-	-
6	-	-	-
7	99C	B	0.5
8	80X	WR	0.5

USB CHARGER
KET
ST730135-2
SLEEVE 적용

CAV	WIRE	COL	CSA
(+)	F101A	Lg	0.85
(-)	99E	B	0.5

KEY PAD
DEUTSCH
DT06-4S

CAV	WIRE	COL	CSA
1	F112E	RB	1.25
2	99D	B	0.5
3	C22C	G	0.5
4	C21C	W	0.5

ROTATING BEACON SWITCH (OPT)
HEAVY TECH
H500-0033 (상담품)

CAV	WIRE	COL	CSA
1	-	-	-
2	F203C	RG	0.85
3	186A	OrG	0.5
4	-	-	-
5	-	-	-
6	-	-	-
7	99F	B	0.5
8	80E	WR	0.5

ATS SWITCH
HEAVY TECH
H500-0033 (상담품)

CAV	WIRE	COL	CSA
1	E110B	BY	0.5
2	E101I	Or	0.5
3	E111B	BL	0.5
4	-	-	-
5	-	-	-
6	-	-	-
7	99G	B	0.5
8	80O	WR	0.5
9	99H	B	0.5
10	80P	WR	0.5

12V SOCKET
KET
MG630685-5
CAP: MG632410-7

CAV	WIRE	COL	CSA
1	25A	L	0.85
2	99I	B	0.85

JOINT CONNECTOR
KET
MG610750-5
CAP:MG640753-5

CAV	WIRE	COL	CSA
1	99ZA	B	2
2	99ZB	B	0.85
3	99ZC	B	0.85
4	99ZD	B	0.85
5	99ZE	B	0.85
6	99ZF	B	0.85
7	99ZG	B	2
8	99ZH	B	2

RH JOYSTICK
DEUTSCH
DTM06-6S

CAV	WIRE	COL	CSA
1	99J	B	0.5
2	E175C	WR	0.5
3	C31C	Br	0.5
4	C32C	Y	0.5

SEAT OPS
DEUTSCH
DT06-2S-P012

CAV	WIRE	COL	CSA
1	V144A	LB	0.5
2	V176A	Or	0.5

OPT **SEAT HEATER & AIR SUSPENSION**
Packard Korea
12015792

CAV	WIRE	COL	CSA
1	F113B	RG	1.25
2	99L	B	1.25

OPT **SEAT BELT SWITCH**
DEUTSCH
DT06-2S-P012

CAV	WIRE	COL	CSA
1	V112B	WG	0.5
2	99K	B	0.5

MAIN HARNESS
DEUTSCH
DRB12-102PAE-L018
FLANGE : DRBF-1A

CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA	CAV	WIRE	COL	CSA
1	251A	RW	3	21	C11F	Y	0.5	41	F103A	OrR	0.5	61	V143A	LgB	0.5	82	V248B	OrW	0.5
2	E101D	Or	2	22	C12F	YB	0.5	42	F111A	RY	1.25	62	V165A	BrR	0.5	83	V256A	Br	0.5
3	F201A	RL	3	23	C13F	Shield	-	43	-	-	-	63	V192A	LR	0.5	84	V257A	V	0.5
4	F202A	R	3	24	C21F	W	0.5	44	13C	Y	0.85	64	V171A	GY	0.5	85	V258C	YR	0.85
5	F212A	WL	2	25	C22F	G	0.5	45	F205D	R	0.85	65	C11B	Y	0.5	86	F108C	OrL	0.85
6	F213A	WG	2	26	C23F	Shield	-	46	H139B	YW	0.5	66	C12B	YB	0.5	87	F109C	RL	0.85
7	F214C	W	3	27	C31K	Br	0.5	47	H146G	WB	0.5	67	V193B	RL	0.5	88	V253A	WL	0.5
8	F206C	RW	2	28	C32K	Y	0.5	48	-	-	-	68	V203D	RY	0.5	89	-	-	-
9	7C	Br	0.85	29	C33K	Shield	-	49	B2C	RW	5	69	V205B	LB	0.85	90	-	-	-
10	8C	BrW	0.85	30	C41F	Br	0.5	50	H219A	YR	0.5	70	V206C	WY	0.5	91	G13A	Or	0.5
11	10A	L	0.5	31	C42F	YL	0.5	51	H226B	YL	0.5	71	V211B	Or	0.5	92	G21A	OrB	0.5
12	11A	GrB	0.85	32	C51G	W	0.5	52	H238B	GB	0.5	72	-	-	-	93	G14A	Y	0.5
13	12A	Gr	0.85	33	C52G	G	0.5	53	H255B	G	0.5	73	V213B	WB	0.5	94	G22A	YB	0.5
14	80A	WR	0.5	34	E110B	BY	0.5	54	B4D	W	8	74	V214C	LgW	0.5	95	-	-	-
15	307A	Y	0.85	35	E111B	BL	0.5	55	-	-	-	75	V215A	GW	0.5	96	-	-	-
16	308A	LW	0.85	36	E151B	BrW	0.85	56	V112B	WG	0.5	76	V216A	G	0.5	97	-	-	-
17	309A	Gr	0.85	37	E175A	WR	0.85	57	V144A	LB	0.5	77	V220B	LG	0.85	98	B6C	W	2
18	310A	L	0.85	38	E184A	RG	0.85	58	V176A	Or	0.5	78	V229C	Lg	0.5	99	B6D	W	3
19	F114C	Or	0.85	39	E188B	LY	0.5	59	V142A	WY	0.5	79	V230A	GL	0.5	100	999D	B	2
20	403A	RW	1.25	40	F112H	RB	0.5	60	-	-	-	80	401B	RY	0.5	101	99MA	B	3
												81	V242D	BL	0.5	102	99MB	B	3

NO.	CHANGE NO	DESCRIPTION
X01	C111340	Pilot Improvement Change

310207-10945E

DS2400527

HD130
Cabin Harness(2/2)

WIRE	MATERIAL	CSA	COL	FROM	CAV1	TO	CAV2
6A	AVSS	0.5	RL	STARTER SWITCH	1	SP_6S	X
6B	AVSS	0.5	RL	EMERGENCY STARTING SWITCH	6	SP_6S	X
6D	AVSS	0.5	RL	GP DISPLAY	11	SP_6S	X
7A	AVSS	0.5	Br	STARTER SWITCH	2	SP_7S	X
7B	AVSS	0.5	Br	DIODE 5	1	SP_7S	X
7C	AVSS	0.85	Br	MAIN HARNESS	9	SP_7S	X
7D	AVSS	0.85	Br	STARTER RELAY 1	87	SP_7S	X
8A	AVSS	0.85	BrW	AUTOSHUTOFF RELAY	87a	SP_8S	X
8B	AVSS	0.85	BrW	RELAY JOINT 1	1	SP_8S	X
8C	AVSS	0.85	BrW	MAIN HARNESS	10	SP_8S	X
10A	AVSS	0.5	L	MAIN HARNESS	11	SP_10S	X
10B	AVSS	0.5	L	RELAY JOINT 1	2	SP_10S	X
10C	AVSS	0.5	L	EMERGENCY STARTING SWITCH	5	SP_10S	X
10D	AVSS	0.5	L	STARTER SWITCH	6	SP_10S	X
11A	AVSS	0.85	GrB	STARTER RELAY 1	85	MAIN HARNESS	12
12A	AVSS	0.85	Gr	STARTER RELAY 1	86	MAIN HARNESS	13
13A	AVSS	0.85	Y	STARTER RELAY 1	30	SP_13S	X
13B	AVSS	0.85	Y	RELAY JOINT 1	3	SP_13S	X
13C	AVSS	0.85	Y	MAIN HARNESS	44	SP_13S	X
15A	AVSS	0.85	LR	GP DISPLAY	18	SP_15S	X
15B	AVSS	0.85	LR	STARTER RELAY 1	87a	SP_15S	X
15C	AVSS	0.85	LR	EMERGENCY STARTING SWITCH	2	SP_15S	X
25A	AVSS	0.85	L	12V SOCKET	1	RELAY JOINT 1	11
80A	AVSS	0.5	WR	MAIN HARNESS	14	SP_80S	X
80E	AVSS	0.5	WR	ROTATING BEACON SWITCH	8	SP_80S	X
80K	AVSS	0.5	WR	GP DISPLAY	8	SP_80S	X
80L	AVSS	0.5	WR	CABIN SUB HARNESS	2	SP_80S	X
80O	AVSS	0.5	WR	ATS SWITCH	8	SP_80S	X
80P	AVSS	0.5	WR	ATS SWITCH	10	SP_80S	X
80X	AVSS	0.5	WR	PARKING SWITCH	8	SP_80S	X
80Z	AVSS	0.5	WR	HYD LOCKOUT SWITCH	8	SP_80S	X
186A	AVSS	0.5	OrG	ROTATING BEACON SWITCH	3	CABIN SUB HARNESS	10
211A	AVS	3	RL	WORKING LAMP RELAY	87	SP_211S	X
211B	AVSS	2	RL	CABIN SUB HARNESS	1	SP_211S	X
211H	AVSS	2	RL	CABIN SUB HARNESS	8	SP_211S	X
251A	AVS	3	RW	RELAY JOINT 2	1	MAIN HARNESS	1
303D	AVSS	0.85	Y	FRONT WIPER RELAY	30	CABIN SUB HARNESS	16
304A	AVSS	0.85	LW	FRONT WIPER RELAY	87a	CABIN SUB HARNESS	17
305A	AVSS	0.85	Gr	REAR WIPER RELAY	30	CABIN SUB HARNESS	18
306A	AVSS	0.85	L	REAR WIPER RELAY	87a	CABIN SUB HARNESS	19
307A	AVSS	0.85	Y	RIGHT WIPER RELAY	30	MAIN HARNESS	15
308A	AVSS	0.85	LW	RIGHT WIPER RELAY	87a	MAIN HARNESS	16
309A	AVSS	0.85	Gr	LEFT WIPER RELAY	30	MAIN HARNESS	17
310A	AVSS	0.85	L	LEFT WIPER RELAY	87a	MAIN HARNESS	18
350A	AVSS	0.85	OrW	REAR GLASS REALY	87	CABIN SUB HARNESS	9
401B	AVSS	0.5	RY	BACK BUZZER RELAY	87	MAIN HARNESS	80
403A	AVSS	1.25	RW	MAIN HARNESS	20	HORN RELAY	87
405A	AVSS	0.5	BrR	AUTOSHUTOFF RELAY	30	DIODE 5	2
800A	AVSS	0.5	RB	FUSE BOX1	19	SP_800S	X
800B	AVSS	1.25	RB	ACC RELAY	87	SP_800S	X
800C	AVSS	0.85	RB	CABIN SUB HARNESS	3	SP_800S	X
800D	AVSS	0.85	RB	RELAY JOINT 1	12	SP_800S	X
B2A	AVS	5	RW	FUSE BOX2	16	SP_B2S	X
B2B	AVS	5	RW	FUSE BOX2	17	SP_B2S	X
B2C	AVS	5	RW	MAIN HARNESS	49	SP_B2S	X
B4A	AVS	5	W	FUSE BOX1	15	SP_B4S	X
B4B	AVS	5	W	FUSE BOX1	16	SP_B4S	X
B4C	AVS	5	W	FUSE BOX2	15	SP_B4S	X
B4D	AVS	8	W	MAIN HARNESS	54	SP_B4S	X
B6B	AVS	5	W	FUSE BOX2	18	SP_B6S	X
B6C	AVSS	2	W	MAIN HARNESS	98	SP_B6S	X
B6D	AVS	3	W	MAIN HARNESS	99	SP_B6S	X
C11A	AVSS	0.5	Y	GP DISPLAY	4	SP_C11S	X
C11B	AVSS	0.5	Y	MAIN HARNESS	65	SP_C11S	X
C11D	AVSS	0.5	Y	CABIN SUB HARNESS	4	SP_C11S1	X
C11E	AVSS	0.5	Y	CHECK CONN1-1	4	SP_C11S2	X
C11F	AVSS	0.5	Y	MAIN HARNESS	21	SP_C11S3	X
C11G	AVSS	0.5	Y	CHECK CONN2-1	4	SP_C11S3	X
C11ZA	AVSS	0.5	Y	SP_C11S	X	SP_C11S1	X
C11ZB	AVSS	0.5	Y	SP_C11S1	X	SP_C11S2	X
C11ZC	AVSS	0.5	Y	SP_C11S2	X	SP_C11S3	X
C12A	AVSS	0.5	YB	GP DISPLAY	5	SP_C12S	X
C12B	AVSS	0.5	YB	MAIN HARNESS	66	SP_C12S	X
C12D	AVSS	0.5	YB	CABIN SUB HARNESS	5	SP_C12S1	X
C12E	AVSS	0.5	YB	CHECK CONN1-1	5	SP_C12S2	X
C12F	AVSS	0.5	YB	MAIN HARNESS	22	SP_C12S3	X
C12G	AVSS	0.5	YB	CHECK CONN2-1	5	SP_C12S3	X
C12ZA	AVSS	0.5	YB	SP_C12S	X	SP_C12S1	X
C12ZB	AVSS	0.5	YB	SP_C12S1	X	SP_C12S2	X
C12ZC	AVSS	0.5	YB	SP_C12S2	X	SP_C12S3	X
C13A	AVSS	-	Shield	BLUNT_C13A	X	SP_C13S	X
C13B	AVSS	-	Shield	BLUNT_C13B	X	SP_C13S	X
C13D	AVSS	-	Shield	BLUNT_C13D	X	SP_C13S	X
C13E	AVSS	-	Shield	CHECK CONN1-1	6	SP_C13S	X
C13F	AVSS	-	Shield	MAIN HARNESS	23	SP_C13S	X
C13G	AVSS	-	Shield	CHECK CONN2-1	6	SP_C13S	X
C21A	AVSS	0.5	W	CAN RESISTOR 2	1	SP_C21S	X
C21B	AVSS	0.5	W	GP DISPLAY	6	SP_C21S	X
C21C	AVSS	0.5	W	KEY PAD	4	SP_C21S1	X
C21D	AVSS	0.5	W	CABIN SUB HARNESS	6	SP_C21S2	X
C21E	AVSS	0.5	W	HVAC UNIT A	1	SP_C21S3	X
C21F	AVSS	0.5	W	MAIN HARNESS	24	SP_C21S4	X
C21G	AVSS	0.5	W	CHECK CONN1-2	4	SP_C21S4	X
C21ZA	AVSS	0.5	W	SP_C21S	X	SP_C21S1	X
C21ZB	AVSS	0.5	W	SP_C21S1	X	SP_C21S2	X
C21ZC	AVSS	0.5	W	SP_C21S2	X	SP_C21S3	X
C21ZD	AVSS	0.5	W	SP_C21S3	X	SP_C21S4	X
C22A	AVSS	0.5	G	CAN RESISTOR 2	2	SP_C22S	X
C22B	AVSS	0.5	G	GP DISPLAY	7	SP_C22S	X
C22C	AVSS	0.5	G	KEY PAD	3	SP_C22S1	X
C22D	AVSS	0.5	G	CABIN SUB HARNESS	7	SP_C22S2	X
C22E	AVSS	0.5	G	HVAC UNIT A	2	SP_C22S3	X
C22F	AVSS	0.5	G	MAIN HARNESS	25	SP_C22S4	X
C22G	AVSS	0.5	G	CHECK CONN1-2	5	SP_C22S4	X
C22ZA	AVSS	0.5	G	SP_C22S	X	SP_C22S1	X
C22ZB	AVSS	0.5	G	SP_C22S1	X	SP_C22S2	X
C22ZC	AVSS	0.5	G	SP_C22S2	X	SP_C22S3	X
C22ZD	AVSS	0.5	G	SP_C22S3	X	SP_C22S4	X

WIRE	MATERIAL	CSA	COL	FROM	CAV1	TO	CAV2
C23A	AVSS	-	Shield	BLUNT_C23A	X	SP_C23S	X
C23B	AVSS	-	Shield	BLUNT_C23B	X	SP_C23S	X
C23C	AVSS	-	Shield	BLUNT_C23C	X	SP_C23S	X
C23D	AVSS	-	Shield	BLUNT_C23D	X	SP_C23S	X
C23E	AVSS	-	Shield	BLUNT_C23E	X	SP_C23S	X
C23F	AVSS	-	Shield	MAIN HARNESS	26	SP_C23S	X
C23G	AVSS	-	Shield	CHECK CONN1-2	3	SP_C23S	X
C31A	AVSS	0.5	Br	CAN RESISTOR 3	1	SP_C31S	X
C31B	AVSS	0.5	Br	LH JOYSTICK	3	SP_C31S	X
C31C	AVSS	0.5	Br	RH JOYSTICK	3	SP_C31S1	X
C31G	AVSS	0.5	Br	CHECK CONN2-2	4	SP_C31S2	X
C31K	AVSS	0.5	Br	MAIN HARNESS	27	SP_C31S2	X
C31ZA	AVSS	0.5	Br	SP_C31S	X	SP_C31S1	X
C31ZB	AVSS	0.5	Br	SP_C31S1	X	SP_C31S2	X
C32A	AVSS	0.5	Y	CAN RESISTOR 3	2	SP_C32S	X
C32B	AVSS	0.5	Y	LH JOYSTICK	4	SP_C32S	X
C32C	AVSS	0.5	Y	RH JOYSTICK	4	SP_C32S1	X
C32G	AVSS	0.5	Y	CHECK CONN2-2	5	SP_C32S2	X
C32K	AVSS	0.5	Y	MAIN HARNESS	28	SP_C32S2	X
C32ZA	AVSS	0.5	Y	SP_C32S	X	SP_C32S1	X
C32ZB	AVSS	0.5	Y	SP_C32S1	X	SP_C32S2	X
C33A	AVSS	-	Shield	BLUNT_C33A	X	SP_C33S	X
C33B	AVSS	-	Shield	BLUNT_C33B	X	SP_C33S	X
C33C	AVSS	-	Shield	BLUNT_C33C	X	SP_C33S	X
C33G	AVSS	-	Shield	CHECK CONN2-2	3	SP_C33S	X
C33K	AVSS	-	Shield	MAIN HARNESS	29	SP_C33S	X
C41F	AVSS	0.5	Br	CHECK CONN1-2	1	MAIN HARNESS	30
C42F	AVSS	0.5	YL	CHECK CONN1-2	2	MAIN HARNESS	31
C51F	AVSS	0.5	W	CHECK CONN2-2	1	SP_C51S	X
C51G	AVSS	0.5	W	MAIN HARNESS	32	SP_C51S	X
C51H	AVSS	0.5	W	CAN RESISTOR 5	1	SP_C51S	X
C52F	AVSS	0.5	G	CHECK CONN2-2	2	SP_C52S	X
C52G	AVSS	0.5	G	MAIN HARNESS	33	SP_C52S	X
C52H	AVSS	0.5	G	CAN RESISTOR 5	2	SP_C52S	X
E101D	AVSS	2	Or	MAIN HARNESS	2	SP_E101S	X
E101E	AVSS	0.85	Or	RELAY JOINT 1	4	SP_E101S	X
E101H	AVSS	0.85	Or	EMERGENCY STOP SWITCH	3	SP_E101S	X
E101I	AVSS	0.5	Or	ATS SWITCH	2	SP_E101S	X
E110B	AVSS	0.5	BY	ATS SWITCH	1	MAIN HARNESS	34
E111B	AVSS	0.5	BL	ATS SWITCH	3	MAIN HARNESS	35
E151B	AVSS	0.85	BrW	EMERGENCY STOP SWITCH	2	MAIN HARNESS	36
E175A	AVSS	0.85	WR	MAIN HARNESS	37	SP_E175S	X
E175B	AVSS	0.85	WR	RELAY JOINT 1	5	SP_E175S	X
E175C	AVSS	0.5	WR	RH JOYSTICK	2	SP_E175S	X
E175D	AVSS	0.5	WR	LH JOYSTICK	2	SP_E175S	X
E184A	AVSS	0.85	RG	RELAY JOINT 1	6	MAIN HARNESS	38
E188B	AVSS	0.5	LY	RELAY JOINT 1	7	MAIN HARNESS	39
F101A	AVSS	0.85	Lg	FUSE BOX1	1	USB CHAGER	(+)
F102A	AVSS	0.5	OrY	FUSE BOX1	2	SP_F102S	X
F102B	AVSS	0.5	OrY	REAR WIPER RELAY	87	SP_F102S	X
F102C	AVSS	0.85	OrY	CABIN SUB HARNESS	34	SP_F102S	X
F103A	AVSS	0.5	OrR	FUSE BOX1	3	MAIN HARNESS	41
F104A	AVSS	0.5	OrG	FUSE BOX1	4	SP_F104S	X
F104B	AVSS	0.5	OrG	GP DISPLAY	12	SP_F104S	X
F104C	AVSS	0.5	OrG	CABIN SUB HARNESS	23	SP_F104S	X
F105A	AVSS	0.5	OrW	FUSE BOX1	5	SP_F105S	X
F105B	AVSS	0.5	OrW	PARKING SWITCH	2	SP_F105S	X
F105D	AVSS	0.5	OrW	HYD LOCKOUT SWITCH	2	SP_F105S	X
F105E	AVSS	0.5	OrW	HORN RELAY	86	SP_F105S	X
F105F	AVSS	0.5	OrW	BACK BUZZER RELAY	86	SP_F105S	X
F106A	AVSS	2	OrB	FUSE BOX1	6	SP_F106S	X
F106B	AVSS	1.25	OrB	HORN RELAY	30	SP_F106S	X
F106C	AVSS	2	OrB	HVAC UNIT B	3	SP_F106S	X
F106D	AVSS	0.85	OrB	HVAC UNIT A	7	SP_F106S	X
F107A	AVS	3	Or	FUSE BOX1	7	SP_F107S	X
F107B	AVSS	0.85	Or	FRONT WIPER RELAY	87	SP_F107S	X
F107C	AVSS	0.85	Or	CABIN SUB HARNESS	21	SP_F107S	X
F107D	AVSS	0.85	Or	REAR GLASS RELAY	30	SP_F107S	X
F108A	AVSS	0.85	OrL	FUSE BOX1	8	SP_F108S	X
F108B	AVSS	0.85	OrL	LEFT WIPER RELAY	87	SP_F108S	X
F108C	AVSS	0.85	OrL	MAIN HARNESS	86	SP_F108S	X
F109A	AVSS	0.85	RL	FUSE BOX1	9	SP_F109S	X
F109B	AVSS	0.85	RL	RIGHT WIPER RELAY	87	SP_F109S	X
F109C	AVSS	0.85	RL	MAIN HARNESS	87	SP_F109S	X
F111A	AVSS	1.25	RY	FUSE BOX1	11	MAIN HARNESS	42
F112A	AVSS	1.25	RB	FUSE BOX1	12	SP_F112S	X
F112B	AVSS	0.5	RB	CHECK CONN1-2	6	SP_F112S	X
F112C	AVSS	0.5	RB	CHECK CONN2-2	6	SP_F112S	X
F112E	AVSS	1.25	RB	KEY PAD	1	SP_F112S	X
F112H	AVSS	0.5	RB	MAIN HARNESS	40	SP_F112S	X
F113A	AVSS	2	RG	FUSE BOX1	13	SP_F113S	X
F113B	AVSS	1.25	RG	SEAT HEATER & AIR SUSPENSION	1	SP_F113S	X
F114A	AVSS	2	Or	FUSE BOX1	14	SP_F114S	X
F114B	AVSS	2	Or	BACK BUZZER RELAY	30	SP_F114S	X
F114C	AVSS	0.85	Or	MAIN HARNESS	19	SP_F114S	X
F201A	AVS	3	RL	FUSE BOX2	1	MAIN HARNESS	3
F202A	AVS	3	R	FUSE BOX2	2	MAIN HARNESS	4
F203A	AVS	3	RG	FUSE BOX2	3	SP_F203S	X
F203B	AVS	3	RG	WORKING LAMP RELAY	30	SP_F203S	X
F203C	AVSS	0.85	RG	ROTATING BEACON SWITCH	2	SP_F203S	X
F204A	AVSS	0.85	W	FUSE BOX2	4	RELAY JOINT 1	10
F205A	AVSS	2	R	FUSE BOX2	5	SP_F205S	X
F205B	AVSS	0.85	R	RELAY JOINT 1	8	SP_F205S	X
F205D	AVSS	0.85	R	MAIN HARNESS	45	SP_F205S	X
F206A	AVS	3	RW	FUSE BOX2	6	SP_F206S	X
F206B	AVSS	1.25	RW	RELAY JOINT 1	13	SP_F206S	X
F206C	AVSS	2	RW	MAIN HARNESS	8	SP_F206S	X
F207A	AVSS	0.5	WG	FUSE BOX2	7	SP_F207S	X
F207B	AVSS	0.5	WG	CABIN SUB HARNESS	24	SP_F207S	X
F207C	AVSS	0.5	WG	HOUR METER	1	SP_F207S	X
F207D	AVSS	0.5	WG	STARTER SWITCH	3	SP_F207S	X
F208A	AVSS	0.85	WB	FUSE BOX2	8	ACC RELAY	30
F209A	AVSS	0.5	Or	FUSE BOX2	9	CABIN SUB HARNESS	25
F210A	AVSS	0.85	LR	FUSE BOX2	10	SP_F210S	X
F210B	AVSS	0.5	LR	GP DISPLAY	9	SP_F210S	X
F210C	AVSS	0.5	LR	GP DISPLAY	10	SP_F210S	X
F210D	AVSS	0.5	LR	CABIN SUB HARNESS	26	SP_F210S	X
F211A	AVSS	2	WR	FUSE BOX2	11	HVAC UNIT B	1
F212A	AVSS	2	WL	FUSE BOX2	12	MAIN HARNESS	5

WIRE	MATERIAL	CSA	COL	FROM	CAV1	TO	CAV2
F213A	AVSS	2	WG	FUSE BOX2	13	MAIN HARNESS	6
F214A	AVS	3	W	FUSE BOX2	14	SP_F214S	X
F214B	AVS	3	W	RELAY JOINT 2	2	SP_F214S	X
F214C	AVS	3	W	MAIN HARNESS	7	SP_F214S	X
G13A	AVSS	0.5	Or	GP DISPLAY	13	MAIN HARNESS	91
G14A	AVSS	0.5	Y	GP DISPLAY	14	MAIN HARNESS	93
G21A	AVSS	0.5	OrB	GP DISPLAY	21	MAIN HARNESS	92
G22A	AVSS	0.5	YB	GP DISPLAY	22	MAIN HARNESS	94
H139B	AVSS	0.5	YW	BREAK PEDAL ANGLE SENSOR 2	3	MAIN HARNESS	46
H146G	AVSS	0.5	WB	MAIN HARNESS	47	SP_H146S	X
H146H	AVSS	0.5	WB	ENGINE CONTROL DIAL 2	1	SP_H146S	X
H146J	AVSS	0.5	WB	BREAK PEDAL ANGLE SENSOR 2	2	SP_H146S	X
H146K	AVSS	0.5	WB	BREAK PEDAL ANGLE SENSOR 2	5	SP_H146S	X
H219A	AVSS	0.5	YR	MAIN HARNESS	50	SP_H219S	X
H219B	AVSS	0.5	YR	BREAK PEDAL ANGLE SENSOR 2	1	SP_H219S	X
H219C	AVSS	0.5	YR	BREAK PEDAL ANGLE SENSOR 2	6	SP_H219S	X
H226B	AVSS	0.5	YL	BREAK PEDAL ANGLE SENSOR 2	4	MAIN HARNESS	51
H238B	AVSS	0.5	GB	ENGINE CONTROL DIAL 2	2	MAIN HARNESS	52
H255B	AVSS	0.5	G	ENGINE CONTROL DIAL 2	3	MAIN HARNESS	53
V112B	AVSS	0.5	WG	SEAT BELT SWITCH (OPT)	1	MAIN HARNESS	56
V142A	AVSS	0.5	WY	MAIN HARNESS	59	CABIN SUB HARNESS	30
V143A	AVSS	0.5	LgB	MAIN HARNESS	61	CABIN SUB HARNESS	31
V144A	AVSS	0.5	LB	MAIN HARNESS	57	SEAT OPS	1
V165A	AVSS	0.5	BrR	CABIN SUB HARNESS	11	MAIN HARNESS	62
V171A	AVSS	0.5	GY	EMERGENCY STARTING SWITCH	3	MAIN HARNESS	64
V176A	AVSS	0.5	Or	MAIN HARNESS	58	SEAT OPS	2
V192A	AVSS	0.5	LR	MAIN HARNESS	63	CABIN SUB HARNESS	32
V193A	AVSS	0.5	RL	CABIN SUB HARNESS	12	SP_V193S	X
V193B	AVSS	0.5	RL	MAIN HARNESS	67	SP_V193S	X
V193C	AVSS	0.5	RL	HOUR METER	3	SP_V193S	X
V203D	AVSS	0.5	RY	AUTOSHUTOFF RELAY	86	MAIN HARNESS	68
V205B	AVSS	0.85	LB	BACK BUZZER RELAY	85	MAIN HARNESS	69
V206C	AVSS	0.5	WY	HVAC UNIT A	9	MAIN HARNESS	70
V211B	AVSS	0.5	Or	PARKING SWITCH	3	MAIN HARNESS	71
V213B	AVSS	0.5	WB	HYD LOCKOUT SWITCH	1	MAIN HARNESS	73
V214A	AVSS	0.5	LgW	CHECK CONN1-1	2	SP_V214S	X
V214B	AVSS	0.5	LgW	CHECK CONN2-1	2	SP_V214S	X
V214C	AVSS	0.5	LgW	MAIN HARNESS	74	SP_V214S	X
V215A	AVSS	0.5	GW	CABIN SUB HARNESS	13	MAIN HARNESS	75
V216A	AVSS	0.5	G	MAIN HARNESS	76	SP_V216S	X
V216B	AVSS	0.5	G	EMERGENCY STARTING SWITCH	4	SP_V216S	X
V216C	AVSS	0.5	G	ACC RELAY	86	SP_V216S	X
V220B	AVSS	0.85	LG	HORN RELAY	85	MAIN HARNESS	77
V229A	AVSS	0.5	Lg	CHECK CONN1-1	1	SP_V229S	X
V229B	AVSS	0.5	Lg	CHECK CONN2-1	1	SP_V229S	X
V229C	AVSS	0.5	Lg	MAIN HARNESS	78	SP_V229S	X
V230A	AVSS	0.5	GL	CABIN SUB HARNESS	14	MAIN HARNESS	79
V242A	AVSS	0.5	BL	CABIN SUB HARNESS	20	SP_V242S	X
V242B	AVSS	0.5	BL	CHECK CONN1-1	3	SP_V242S	X
V242C	AVSS	0.5	BL	CHECK CONN2-1	3	SP_V242S	X
V242D	AVSS	0.5	BL	MAIN HARNESS	81	SP_V242S	X
V248B	AVSS	0.5	OrW	WORKING LAMP RELAY	86	MAIN HARNESS	82
V253A	AVSS	0.5	WL	MAIN HARNESS	88	REAR GLASS REALY	86
V256A	AVSS	0.5	Br	MAIN HARNESS	83	FRONT WIPER RELAY	86
V257A	AVSS	0.5	V	MAIN HARNESS	84	REAR WIPER RELAY	86
V258C	AVSS	0.85	YR	MAIN HARNESS	85	SP_V258S	X
V258D	AVSS	0.5	YR	LEFT WIPER RELAY	86	SP_V258S	X
V258E	AVSS	0.5	YR	RIGHT WIPER RELAY	86	SP_V258S	X
99A	AVSS	0.5	B	HOUR METER	2	SP_99S1	X
99B	AVSS	0.5	B	HYD LOCKOUT SWITCH	7	SP_99S1	X
99C	AVSS	0.5	B	PARKING SWITCH	7	SP_99S1	X
99D	AVSS	0.5	B	KEY PAD	2	SP_99S1	X
99E	AVSS	0.5	B	USB CHAGER	(-)	SP_99S1	X
99F	AVSS	0.5	B	ROTATING BEACON SWITCH	7	SP_99S1	X
99G	AVSS	0.5	B	ATS SWITCH	7	SP_99S2	X
99H	AVSS	0.5	B	ATS SWITCH	9	SP_99S2	X
99I	AVSS	0.85	B	12V SOCKET	2	SP_99S2	X
99J	AVSS	0.5	B	RH JOYSTICK	1	SP_99S2	X
99K	AVSS	0.5	B	SEAT BELT SWITCH	2	SP_99S3	X
99L	AVSS	1.25	B	SEAT HEATER & AIR SUSPENSION	2	SP_99S3	X
99N	AVSS	0.5	B	LH JOYSTICK	1	SP_99S3	X
99O	AVSS	0.5	B	CHECK CONN1-2	7	SP_99S4	X
99P	AVSS	0.5	B	CHECK CONN2-2	7	SP_99S4	X
99Q	AVSS	2	B	HVAC UNIT B	2	SP_99S4	X
99S	AVSS	2	B	CABIN SUB HARNESS	36	SP_99S4	X
99T	AVS	5	B	CABIN EARTH	1	SP_99S	X
99U	AVSS	0.85	B	RELAY JOINT 1	9	SP_99S5	X
99V	AVSS	0.5	B	HVAC UNIT A	8	SP_99S4	X
99RA	AVSS	0.5	B	WORKING LAMP RELAY	85	SP_99S	X
99RE	AVSS	0.5	B	FRONT WIPER RELAY	85	SP_99S5	X
99RF	AVSS	0.5	B	REAR WIPER RELAY	85	SP_99S5	X
99RI	AVSS	0.5	B	LEFT WIPER RELAY	85	SP_99S5	X
99RJ	AVSS	0.5	B	RIGHT WIPER RELAY	85	SP_99S5	X
99RH	AVSS	0.5	B	ACC RELAY	85	SP_99S6	X
99RG	AVSS	0.5	B	AUTOSHUTOFF RELAY	85	SP_99S6	X
99RK	AVSS	0.5	B	REAR GLASS REALY	85	SP_99S6	X
99MA	AVS	3	B	MAIN HARNESS	101	SP_99S6	X
99MB	AVS	3	B	MAIN HARNESS	102	SP_99S6	X
99ZA	AVSS	2	B	JOINT CONNECTOR	1	SP_99S	X
99ZB	AVSS	0.85	B	JOINT CONNECTOR	2	SP_99S1	X
99ZC	AVSS	0.85	B	JOINT CONNECTOR	3	SP_99S2	X
99ZD	AVSS	0.85	B	JOINT CONNECTOR	4	SP_99S3	X
99ZE	AVSS	0.85	B	JOINT CONNECTOR	5	SP_99S4	X
99ZF	AVSS	0.85	B	JOINT CONNECTOR	6	SP_99S5	X
99ZG	AVSS	2	B	JOINT CONNECTOR	7	SP_99S6	X
99ZH	AVSS	2	B	JOINT CONNECTOR	8	SP_99S	X
999A	AVSS	0.5	B	GP DISPLAY	16	SP_999S	X
999B	AVSS	0.5	B	GP DISPLAY	17	SP_999S	X
999C	AVSS	0.85	B	CABIN SUB HARNESS	35	SP_999S	X
999D	AVSS	2	B	MAIN HARNESS	100	SP_999S	X

X00	C111340	Plot Change
NO.	CHANGE NO	DESCRIPTION

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