SERVICE MANUAL

HL630V
HL635V

TABLE OF CONTENTS

Brake

Electrical System

Attachments

SAFETY

WHEEL LOADER SAFETY

⚠ CAUTION!
Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section. **Always use tools and equipment that is in good working order.** **Use lifting and hoisting equipment capable of safely handling load.** **Remember, that ultimately safety is your own personal responsibility.**

TABLE OF CONTENTS

TO THE OPERATOR OF A DISD WHEEL LOADER

⚠ DANGER!

Unsafe use of the wheel loader could lead to serious injury or death. Operating procedures, maintenance and equipment practices or traveling or shipping methods that do not follow the safety guidelines on the following pages could cause serious, potentially fatal injuries or extensive damage to the machine or nearby property.

Please respect the importance of taking responsibility for your own safety, and that other people who may be affected by your actions.

Safety information on the following pages is organized into the following topics.

⚠ WARNING!

Improper operation and maintenance of this machine can be hazardous and could result in serious injury or death.

Operator and maintenance personnel should read this manual thoroughly before beginning operation or maintenance.

Keep this manual in the storage compartment to the rear of the operator's seat, and have all personnel involved in working on the machine periodically read the manual.

Some actions involved in operation and maintenance of the machine can cause a serious accident, if they are not done in a manner described in this manual.

The procedures and precautions given in this manual apply only to intended uses of the machine.

If you use your machine for any unintended uses that are not specifically prohibited, you must be sure that it is safe for any others. In no event should you or others engage in prohibited uses or actions as described in this manual.

⚠ SAFETY ALERT SYMBOL ⚠

Be Prepared - Get to Know All Operating and Safety Instructions

This is the Safety Alert Symbol. Wherever it appears - in this manual or on safety signs on the machine - you should be alert to potential for personal injury or accidents. Always observe safety precautions and follow recommended procedures.

LEARN SIGNAL WORDS USED WITH SAFETY ALERT SYMBOL

Words "**CAUTION**," "**WARNING**," and "**DANGER**" used throughout this manual and on labels on machine indicate hazards or unsafe practices. All three statements indicate that safety is involved. Observe precautions indicated whenever you see the Safety Alert "Triangle," no matter which signal word appears next to the "Exclamation Point" symbol.

⚠ CAUTION!

This word is used on safety messages and safety labels and indicates potential of a hazardous situation that, if not avoided, could result in minor or moderate injury. It may also be used to alert against a generally unsafe practice.

⚠ WARNING!

This word is used on safety messages and safety labels and indicates potential of a hazardous situation that, if not avoided, could result in serious injury or death. It may also be used to alert against a highly unsafe practice.

⚠ DANGER!

This word is used on safety messages and safety labels and indicates imminent hazard of a situation that, if not avoided, is very likely to cause death or extremely serious injury. It may also be used to alert against equipment that may explode or detonate if handled or treated carelessly.

GENERAL SAFETY ESSENTIALS

ACCESSORY APPLICATIONS

This wheel loader has been designed primarily for moving earth with a bucket. For use as a grapple or for other object handling, contact Daewoo. Lifting-work applications are permitted in approved lift configuration, to rated capacity only, with no side-loading (unless prohibited by local regulation). Do not use machine for activities for which it was not intended. Do not use bucket for lifting work, unless lift slings are used in approved configuration.

LOCATION OF SAFETY LABELS

Location of safety labels (decals) can vary from unit to unit. Refer to appropriate Operation and Maintenance Manual, and Parts Manual for your unit.

There are several specific warning signs on this machine. The exact location of hazards and the description of the hazards are reviewed in the appropriate Operation and Maintenance Manual.

Please become familiarized with all warning signs.

Make sure that all of the warning signs are legible. Clean the warning signs or replace the warning signs if you cannot read the words. Replace the illustrations if the illustrations are not visible. When you clean the warning signs, use a cloth, water and soap. Do not use solvent, gasoline, or other harsh chemicals to clean the safety signs. Solvents, gasoline, or other harsh chemicals could loosen the adhesive that secures the warning sign. Loose adhesive will allow the warning sign to fall off.

Replace any safety sign that is damaged, or missing. If a safety sign is attached to a part that is replaced, install a safety sign on the replacement part.

UNAUTHORIZED MODIFICATIONS

Any modification made without authorization or written approval from Daewoo can create a safety hazard, for which the machine owner must be held responsible.

For safety's sake, replace all OEM parts with the correct authorized or genuine Daewoo part. For example, not taking the time to replace fasteners, bolts or nuts with the correct replacement parts could lead to a condition in which the safety of critical assemblies is dangerously compromised.

GENERAL HAZARD INFORMATION

SAFETY RULES

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

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

Do not operate the machine if you are not feeling well, if you are taking medication that makes you feel sleepy, if you have been drinking, or if you are suffering from emotional problems. These problems will interfere with your sense of judgement in emergencies and may cause accidents.

When working with another operator or with a person on work site traffic duty, be sure that all personnel know the nature of the work and understand all hand signals that are to be used.

Always observe strictly any other rules related to safety.

SAFETY FEATURES

Be sure that all guards and covers are installed in their proper position. Have guards and covers repaired immediately if damaged.

Be sure that you understand the method of use of safety features such as transmission lever neutral lock and the seat belt, and use them properly.

Never remove any safety features. Always keep them in good operating condition.

Failure to use safety features according to the instructions in the Operation and Maintenance Manual could result in serious bodily injury.

INSIDE OPERATOR'S COMPARTMENT

When entering the operator's compartment, always remove all mud and oil from the soles of your shoes. If you operate the accelerator and brake pedals with mud or oil stuck to your shoes, your foot may slip and this may cause a serious accident.

Clean grease and dirt from pedals and controls. This contributes to safe operation. Cleaning also provides an opportunity to inspect equipment. Minor damage can be repaired or corrected before major problems result.

Keep cab floor and consoles free of tools and personal items.

After using the ashtray, make sure that any matches or cigarettes are properly extinguished, and be sure to close the ashtray. If the ashtray is left open, there is danger of fire.

Do not stick suction pads to the window glass. Suction pads act as a lens and may cause fire.

Do not leave lighters laying around the operator's compartment. If the temperature inside the operator's compartment becomes high, there is danger that the lighter may explode.

Do not use cellular telephones inside the operator's compartment when driving or operating the machine. There is danger that this may lead to an unexpected accident.

Never bring any dangerous objects such as flammable or explosive items into the operator's cab. To ensure safety, do not use the radio or music headphones when operating the machine. There is danger that this may lead to a serious accident.

When operating the machine, do not put your hands or head out of the window.

When standing up from the operator's seat, always place transmission neutral lock lever in the "LOCK" position and set pilot cutoff switch to "O" (OFF) position. If you accidentally touch the work equipment levers when they are not locked, the machine may suddenly move and cause serous injury or damage.

When leaving the machine, lower the work equipment completely to the ground, set transmission neutral lock lever in the "LOCK" position, set pilot cutoff switch to "O" (OFF) position, "APPLY" parking brake, and shut down engine. Use the key to lock all the equipment. Always remove the key and take it with you.

CLOTHING AND PERSONAL PROTECTIVE ITEMS

Contain long hair, and avoid loose clothing and jewelry. They can catch on controls or in protruding parts and cause serious injury or death.

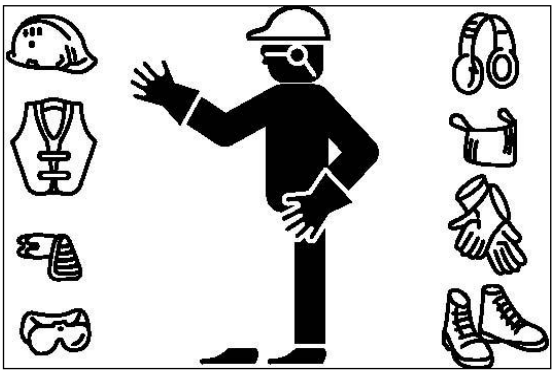


Figure 1

Do not wear oily clothes. They are highly flammable.

Full eye protection, a hard hat, safety shoes and gloves may be required at the work site. While working on the machine, never use inadequate tools.

They could break or slip, causing injury, or they may not adequately perform intended functions.

BREATHING MASKS, EAR PROTECTION MAY BE REQUIRED

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.

ASBESTOS DUST HAZARD PREVENTION

Asbestos dust can be HAZARDOUS to your health if it is inhaled. Materials containing asbestos fiber can be present on work site. Breathing air that contains asbestos fiber can ultimately cause serious or fatal lung damage. To prevent lung damage from asbestos fiber, observe following precautions;

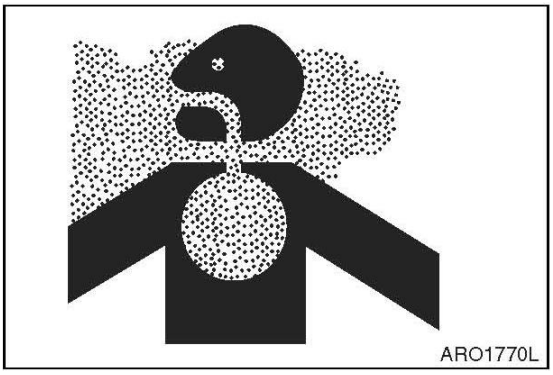


Figure 2

- Use a respirator that is approved for use in an asbestos-laden atmosphere.
- Never use compressed air for cleaning.
- Use water for cleaning to keep down the dust.
- Work on the machine or component with the wind at your back whenever possible.
- Always observe any rules and regulations related to the work site and working environment

MOUNTING AND DISMOUNTING

Before getting on or off the machine, if there is any oil, grease, or mud on the handrails, steps, or track shoes, wipe it off immediately. Always keep these parts clean. Repair any damage and tighten any loose bolts.

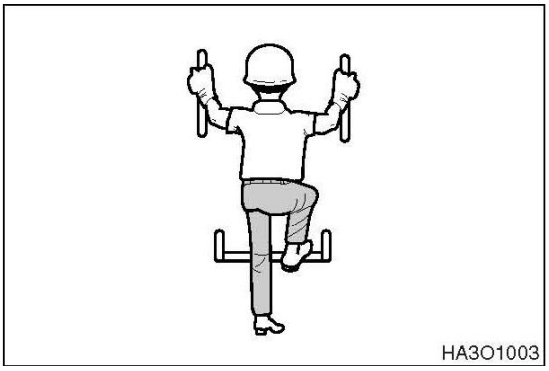


Figure 3

Never get on or off a moving machine. In particular, never get on or off a moving machine. These actions may lead to serious injury.

When getting on or off the machine, always face the machine, and maintain a three-point contact (both feet and one hand or one foot and both hands) with the handholds and steps to ensure that you support yourself securely.

Never hold any control levers when getting on or off the machine.

Never get up from operator's seat or leave operator's station and dismount machine if engine is running.

FUEL, OIL AND HYDRAULIC FLUID FIRE HAZARDS

Figure 4

Fuel, oil and antifreeze will catch fire if it is brought close to a flame. Fuel is particularly flammable and can be hazardous.

Always strictly observe the following.

Add fuel, oil, antifreeze and hydraulic fluid to the machine only in a well-ventilated area. The machine must be parked with controls, lights and switches turned "OFF." The engine must be "OFF" and any flames, glowing embers, auxiliary heating units or spark-causing equipment must be doused, turned off and/or kept well clear of the machine.

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

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

PRECAUTIONS WHEN HANDLING FLUIDS AT HIGH TEMPERATURE

Immediately after operations are stopped, the coolant, engine oil, and hydraulic oil are at high temperature and the radiator and hydraulic tank are still under pressure. Attempting to remove the cap, drain the oil or coolant, or replace the filters may lead to serious burns. Always wait for the temperature to go down, and follow the specified procedures when carrying out these operations.

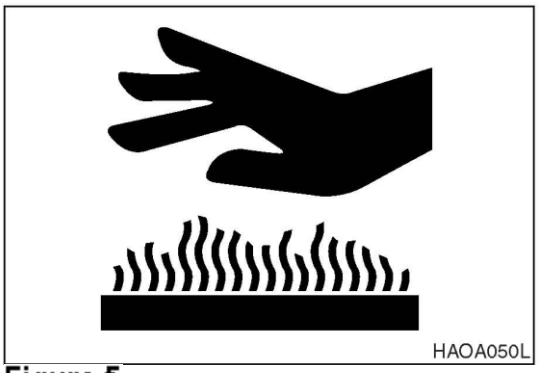


Figure 5

To prevent hot coolant from spurting out, shut down engine, wait for the coolant to cool, then loosen the cap slowly to relieve the pressure. To prevent hot oil from spurting out, shut down engine, wait for the oil to cool, then loosen the cap slowly to relieve the pressure

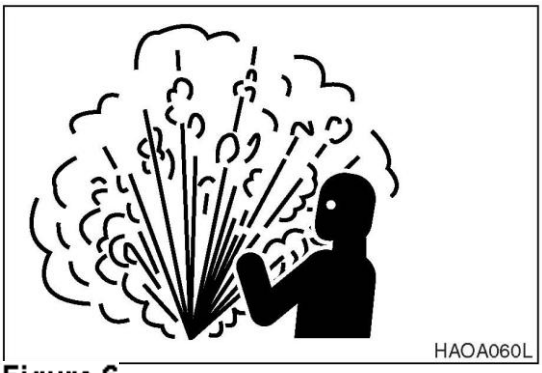


Figure 6

INJURY FROM WORK EQUIPMENT

Do not enter or put your hand, arm or any other part of your body between movable parts, such as between the work equipment and cylinders, or between the machine and work equipment.

If the control levers are operated, the clearance between the machine and the work equipment will change and this may lead to serious damage or personal injury.

If going between movable parts is necessary, always position and secure the work equipment so that it cannot move.

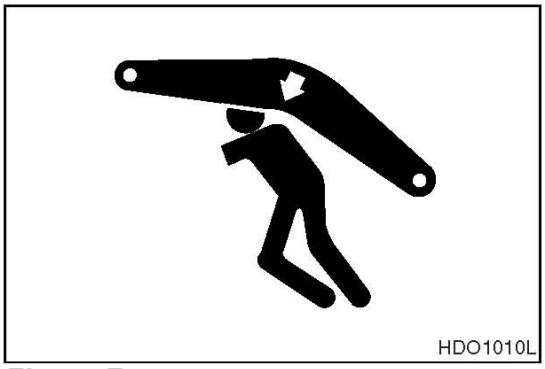


Figure 7

FIRE EXTINGUISHER AND FIRST AID KIT

As a precaution if any injury or fire should occur, always do the following.

- Be sure that fire extinguishers have been provided and read the labels to ensure that you know now 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 the cab. Check and service the fire extinguisher at regular intervals and make sure that all work site crew members are adequately trained in its use.

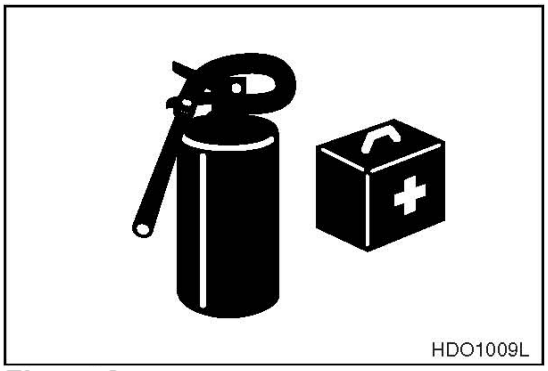


Figure 8

- Provide a first aid kit in the storage compartment and keep another at the work site. Check the kit periodically and make any additions if necessary.
- Know what to do in case of injury from fire.
- Keep emergency numbers for doctor, ambulance service, hospital and fire department you're your telephone.

If the machine catches fire, it may lead to serious personal injury or death. If a fire occurs during operation, escape from the machine as follows;

- Turn the starter switch "OFF" and shut down engine.
- If there is time, use the fire extinguisher to extinguish as much of the fire as possible.
- Use the handrails and steps to escape from the machine.

The above is the basic method for escaping from the machine, but changing the method may be necessary according to the conditions, so carry out practice drills at the work site.

PROTECTION FROM FALLING OR FLYING OBJECTS

On work sites where there is danger that falling objects or flying objects may hit the operator's cab select a guard to match the operating conditions to protect the operator.

Work in mines, tunnels, deep pits or on loose or wet surfaces could produce danger of falling rock, roll over or hazardous flying objects. Additional protection for operator's cab could be required in form of a FOPS/Falling Object Protective Structure and/or ROPS/Roll Over Protective Structure reinforcement system (Option).

Any reinforcement system that is installed on machine must pass safety and certification standards and carry appropriate labeling and rating information. For example, most often added type of reinforcement system, FOPS, must meet or exceed Society of Automotive Engineers standard SAE J1356, "Performance Criteria for Falling Object Guards for Wheel loaders. (Option)"

Figure 9

Figure 10

Never attempt to alter or modify any type of protective structure reinforcement system, by drilling holes, welding or remounting or relocating fasteners. Any serious impact or damage to system requires a complete integrity reevaluation. Reinstallation, recertification and/ or replacement of system may be necessary.

INSTALL ADDITIONAL SAFETY EQUIPMENT IF CONDITIONS REQUIRE

Laminate glass protection for the front, side or rear windows may also be recommended depending upon particular site conditions.

Contact your distributor for available safety guards and/or recommendations if there is any danger of getting hit by objects that could strike the operator's cab. Make sure that all other work site crew members are kept well away from wheel loader and safe from potential hazards.

MAINTAIN STANDARD SAFETY EQUIPMENT IN GOOD CONDITION

Machinery guards and body panel covers must be in place at all times. Keep well clear of rotating parts. Pinch point hazards such as cooling fan and alternator drive belts could catch hair, jewelry or oversize or very loose clothing.

Safety labels must be replaced if they are damaged or become unreadable. Information on labels gives work crew members an important safety reminder. Part numbers for each decal and required mounting locations are shown on pages 1-2 through 1-4 of this section.

ATTACHMENT PRECAUTIONS

Options kits are available through your dealer. Contact for information on available one-way (single-acting) and two-way (double-acting) piping / valving / auxiliary control kits. Because cannot anticipate, identify or test all attachments that owners may wish to install on their machines, please contact for authorization and approval of attachments and their compatibility with options kits.

ACCUMULATOR

The pilot control system is equipped with an accumulator. For a brief period of time after the engine has been shut down, the accumulator will store a pressure charge that may enable hydraulic controls to be activated. Activation of any controls may enable the selected function to operate under force of gravity.
When performing maintenance on the pilot control system, the hydraulic pressure in the system must be released as describe in Operation and Maintenance Manual.
The accumulator is charged with high-pressure nitrogen gas, so it is extremely dangerous if it is handled in the wrong way. Always observe the following precautions;

- Do not drill or make any holes in the accumulator or expose it any flame, fire or heat source.
- Do not weld on the accumulator, or try attaching anything to it.
- When carrying out disassembly or maintenance of the accumulator, or when disposing of the accumulator, the charged gas must be properly released. Contact your distributor.
- Wear safety goggles and protective gloves when working on an accumulator. Hydraulic oil under pressure can penetrate the skin and cause serious injuries.

ENGINE VENTILATION

Engine exhaust gases can cause loss of judgment, loss of alertness, and loss of motor control. These gases can also cause unconsciousness, serious injury and fatal accidents.

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

You should also be aware of open windows, doors or ductwork into which exhaust may be carried, or blown

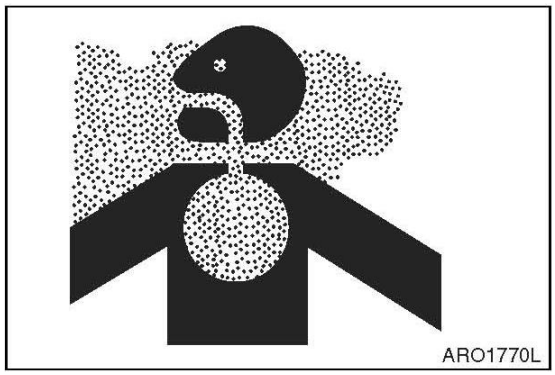


Figure 11

BEFORE STARTING ENGINE

WORK SITE PRECAUTIONS

Before starting operations, thoroughly check the area for any unusual conditions that could be dangerous.

Check the terrain and condition of the ground at the work site, and determine the best and safest method of operation.

Make the ground surface as hard and horizontal as possible before carrying out operations. If there is a lot of dust and sand on the work site, spray water before starting operations.

If you need to operate on a street, protect pedestrians and cars by designating a person for work site traffic duty or by erecting fences and posting "No Entry" signs around the work site.

Erect fences, post "No Entry" signs, and take other steps to prevent people from coming close to or entering the work site. If people come close to a moving machine, they may be hit or caught by the machine, and this may lead to serious personal injury or death.

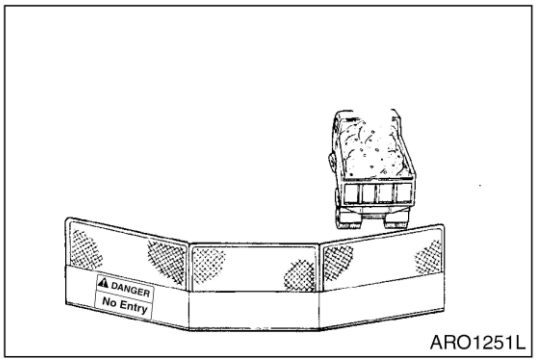


Figure 12

Water lines, gas lines, phone lines and high-voltage electrical lines may be buried under the work site. Contact each utility and identify their locations. Be careful not to damage or cut any of these lines.

NEVER be in water that is in excess of the permissible water depth. Refer to "Operation Manual."

Any type of object in the vicinity of the boom could represent a potential hazard, or cause the operator to react suddenly and cause an accident. Use a spotter or signal person working near bridges, phone lines, work site scaffolds, or other obstructions.

Minimum levels of insurance coverage, work permits or certification, physical barriers around the work site or restricted hours of operation may be mandated by governing authorities. There may also be regulations, guidelines, standards or restrictions on equipment that may have to be followed for local requirements.

There may also be regulations related to performing certain kinds of work. If there is any question about whether your machine and work site complies with the applicable standards and regulations contact your local authorities and agencies.

Avoid entering soft ground. It will be difficult for the machine to escape.

Avoid operating your machine to close to the edge of cliffs, overhangs, and deep ditches. The ground may be weak in such areas. If the ground should collapse, the machine could fall or tip over and this could result in serious injury or death.

Remember that the soil after heavy rain, blasting or after earthquakes, is weakened in these areas.

Earth laid on the ground and the soil near ditches is loose. It can collapse under the weight of vibration of your machine and cause your machine to tip over Install the head guard (FOPS) if working in areas where there is danger of falling rocks.

CHECKS BEFORE STARTING ENGINE

Every day before starting the engine for the first time, carry out the following checks. If these checks are not carried out properly, there is danger of serious injury.

- Completely remove all wood chips, leaves, grass, paper and other flammable materials accumulated in the engine compartment and around the battery. They could cause a fire.
  Remove any dirt from the window glass, mirrors, handrails, and steps.
- Do not leave tools or spare parts laying around in the operator's compartment. The vibration of the machine when traveling or during operations may cause them to fall and damage or break the control levers or switches. They may also get caught in the gap of the control levers and cause the work equipment to malfunction or move dangerously. This may lead to unexpected accidents.
- Check the coolant level, fuel level, and hydraulic tank oil level, and check for clogged air cleaner and damage to the electrical wiring.
- Adjust the operator's seat to a position where it is easy to operate the machine, and check the seat belt and mounts for damage and wear.
- Check the operation of the gauges and the angle of the mirrors, and check that the safety lever is in "LOCKED" position.
- If any abnormalities are found in the above checks, carry out repairs immediately.

ENGINE STARTING

- Walk around your machine before getting in operator’s cab. Look for evidence of leaking fluid, loose fasteners, misaligned assemblies or any other indications of possible equipment hazard.
- All equipment covers and machinery safety guards must be in place, to protect against injury while machine is being operated.
- Look around work site area for potential hazards, or people or property that could be at risk while operation is in progress.
- NEVER start engine if there is any indication that maintenance or service work is in progress, or if a warning tag is attached to controls in cab.
- A machine that has not been used recently, or is being operated in extremely cold temperatures, could require a warm-up or maintenance service before start up.
- Check gauges and monitor displays for normal operation before starting engine. Listen for unusual noises and remain alert for other potentially hazardous conditions at start of work cycle.
- Check tire inflation and check tires for damage or uneven wear. Perform maintenance before operation.
- Do not short circuit the starting motor to start the engine. This is not only dangerous, but may also damage the machine.
- When starting the engine, sound the horn as an alert.
- Start and operate the machine only while seated.

BEFORE OPERATING MACHINE

If checks are not carried out properly after starting the engine, it may result in a delay in discovering abnormalities in the machine, and this may lead to personal injury or damage to the machine.

Carry out the checks in an open area where there are no obstructions. Do not let anyone near the machine when carrying out the checks.

- Check the operating condition of the equipment, and the actuation of the bucket, boom, and travel systems.
- Check the machine for any abnormal noise, vibration, heat, smell, or abnormality with the gauges. Check also for leakage of air, oil, and fuel.
- If any abnormality is found, repair the problem immediately. If the machine is used without repairing the problems, it may lead to unexpected injury or failure.
- Clear all personnel from directly around machine and from the area.
- Clear all obstacles from the machine's path. Beware of hazards.
- Be sure that all windows are clean. Secure the doors and the windows in the open position or in the shut position.
- Adjust the rear view mirrors for best visibility close to the machine. Make sure that the horn, the travel alarm (if equipped), and all other warning devices are working properly.
- Fasten the seat belt securely.
- Warm up the engine and hydraulic oil before operating machine.
- Before moving the machine, check the position of undercarriage. The normal travel position is with idler wheels to the front under the cab and the drive sprockets to the rear. When the undercarriage is in the reversed position, the travel controls must be operated in opposite directions

MACHINE OPERATION

OPERATE WHILE SEATED AT OPERATOR'S STATION ONLY

Never reach in through a window to work a control. Do not try to operate wheel loader unless you're in command position - seated at controls. You should stay alert and focused on your work at all times. Do not twist out of seat if job activity behind you (or to the side) requires your attention.

Use a spotter or signal person if you cannot see clearly and something is happening behind you.

Replace damaged safety labels and lost or damaged operator's manuals.

Do not let anyone operate machine unless they've been fully and completely trained, in safety and in operation of the machine.

Figure 13

SEAT BELTS SHOULD BE USED AT ALL TIMES

Whenever engine is running, operator should be seated at the control station with seat belt properly engaged.

Figure 14

MOVEMENT ALARMS

If wheel loader is equipped with an audible travel movement alarm, test alarm on a daily basis. Audible alarm should sound as soon as travel system is engaged.

TRAVEL PRECAUTIONS

When traveling, wheel loader always keeps lights on; make sure that you are in compliance with all state and local regulations concerning warning flags and signs.

Never turn the starter switch to the "O" (OFF) position when traveling. It is dangerous if the engine stops when the machine is traveling. It will be impossible to operate the steering unless the unit is equipped with an emergency steering system.

Pilot control valve lever (joystick) should not be operated while traveling.

Lower work equipment so that it is 400 mm (16 in) above ground.

Never travel over obstacles or slopes that will cause machine to tilt severely. Travel around any slope or obstacle that causes 10° tilt, or more.

Do not operate the steering suddenly. The work equipment may hit the ground and cause the machine to lose its balance, and this may damage the machine or structures in the area.

When traveling on rough ground, travel at low speed, and avoid sudden changes in direction.

Always keep to the permissible water depth.

When traveling over bridges or structures on private land, check first that the bridge or structure can withstand the weight of the machine. When traveling on public roads, check with the local authorities and follow their instructions.

SLOPING TERRAIN REQUIRES CAUTION

Dig evenly around work site whenever possible, trying to gradually level any existing slope. If it's not possible to level area or avoid working on a slope, reducing size and cycling rate workload is recommended.

On sloping surfaces, use caution when positioning wheel loader before starting a work cycle. Stay alert for unstable situations to avoid getting into them. For example, you should always avoid working bucket over downhill side of machine when parked perpendicular to slope. Avoid full extensions of bucket in a downhill direction. Lifting bucket too high, too close to machine, while wheel loader is turned uphill can also be hazardous.

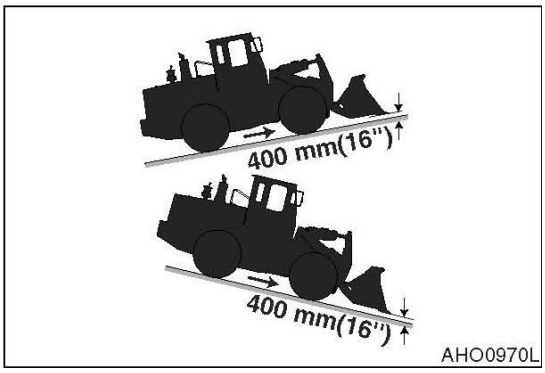


Figure 15

AVOID HIGH-VOLTAGE CABLES

Serious injury or death can result from contact or proximity to high-voltage electric lines. The bucket does not have to make physical contact with power lines for current to be transmitted.

Use a spotter and hand signals to stay away from power lines not clearly visible to operator.

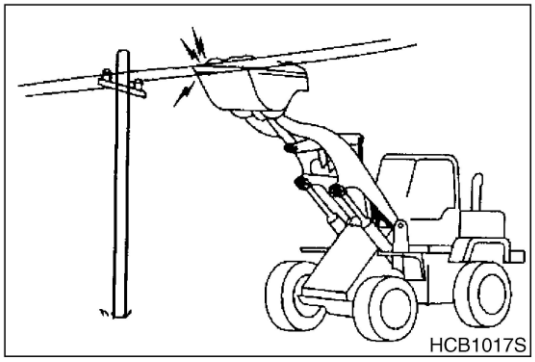


Figure 16

VOLTAGE	MINIMUM SAFE DISTANCE
6.6 kV	3 m (9’ 10")
33.0 kV	4 m (13’ 1")
66.0 kV	5 m (16’ 5")
154.0 kV	8 m (26’ 3")
275.0 kV	10 m (32’ 10")

Use these minimum distances as a guideline only. Depending upon voltage in line and atmospheric conditions, strong current shocks can occur with boom or bucket as far away as 4 - 6 m (13 - 20 ft) from power line. Very high voltage and rainy weather could further decrease that safety margin.

NOTE: *Before starting any type of operation near power lines (either above ground or buried cable-type) you should always contact power utility directly and work out a safety plan with them.*

BEFORE STARTING TO DIG, CONTACT AUTHORITIES

Below ground hazards also include natural gas lines, water mains, tunnels and buried foundations. Know what’s underneath work site before starting to dig.

BE AWARE OF HEIGHT OBSTACLES

Any type of object in vicinity of boom could represent a potential hazard, or cause operator to react suddenly and cause an accident. Use a spotter or signal person working near bridges, phone lines, work site scaffolds, or other obstructions.

USE CARE ON LOOSE SUPPORT

Working heavy loads over loose, soft ground or uneven, broken terrain can cause dangerous side load conditions and possible tip over and injury. Travel without a load or balanced load may also be hazardous.

If temperatures are changing, be cautious of dark and wet patches when working or traveling over frozen ground. Stay away from ditches, overhangs and all other weak support surfaces. Halt work and install support mats or blocking if work is required in an area of poor support.

USE SOLID SUPPORT BLOCKING

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

Figure 17

DIGGING BENEATH OVERHANGS

Digging beneath an overhang is dangerous. Overhand could collapse on top of operator and cause serious injury or death. Go on to another digging area before steep overhangs are formed. Know height and reach limits of wheel loader and plan ahead while working. Park wheel loader away from overhangs before work shut down.

DIGGING BENEATH WHEEL LOADER

Digging beneath wheel loader is dangerous. Earth beneath could collapse. This could cause wheel loader to tip, which could cause serious injury or death to operator. Working around deep pits, trenching or along high walls may require support blocks, especially after heavy rainfalls or during spring thaws.

STAY ALERT FOR PEOPLE MOVING THROUGH WORK AREA

When loading a truck you should always know where the driver is.

Avoid loading over the cab of a truck even if the driver is in a safe spot. Someone else could have gone inside, for any number of reasons. Avoid working where unseen passersby might be.

Slow down work cycle and use slower travel speeds in congested or populated areas. Use a commonly understood signal so that other members of work crew can warn operator to slow or halt work in an impending hazardous situation.

Figure 18

BE AWARE OF AND CONFORM TO LOCAL REGULATIONS

Minimum levels of insurance coverage, work permits or certification, physical barriers around work-site or restricted hours of operation may be mandated by governing authorities. There may also be guidelines, standards or restrictions on equipment that may be used to perform certain kinds of work. Check and follow all local requirements, which may also be related to below ground hazards and power lines.

NEVER USE ETHER STARTING AIDS

An electric-grid type manifold heater is used for cold starting. Glowing heater element can cause ether or other starting fluid to detonate, causing injury.

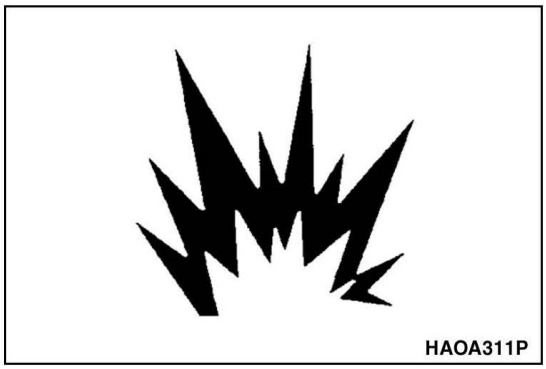


Figure 19

OBSERVE GENERAL SAFETY RULES

Only trained and authorized personnel, with a good knowledge and awareness of safe procedures, may be allowed to operate or perform maintenance or service on wheel loader.

All personnel at work site should be aware of assigned individual responsibilities and tasks.

Communication and hand signals used should be understood by everyone.

Terrain and soil conditions at work site, approaching traffic, weather-related hazards and any above or below ground obstacles or hazards should be observed and monitored by all work crew members.

TAKE TIME TO PROVIDE GOOD VISIBILITY

Be careful not to go close to the edge of a cliff by mistake.

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

To ensure an ample view, do as follows:

- When working in dark areas, attach working lights and front lights to the machine. If necessary, set up lighting at the work site.
- Stop operations when the visibility is poor, such as in fog, mist, snow, and rain. Wait for the visibility to improve to a level which causes no problems for the operation.
- Keep dirt and dust off of windows and off lens surfaces of work lights. Stop working if lights, windows or mirrors need cleaning or adjustment.

To avoid hitting the work equipment, always do the following;

- When working in tunnels, on bridges, under electric wires, or when parking the machine or carrying out other operations in places with limited height, be extremely careful not to hit the bucket or other parts.
- To prevent collisions, operate the machine at a safe speed when working in confined spaces, indoors, or in crowded areas.
- Do not pass the bucket over the heads of workers or over the operator's compartment of dump truck.

KEEP "PINCH POINT" AREAS CLEAR – USE CAUTION IN REVERSE

Use a signal person in high traffic areas and whenever operator's view is not clear, such as when traveling in reverse.

Anyone standing near wheels, or working assemblies of the attachment, is at risk of being caught between moving parts of machine.

Never allow anyone to ride on any part of machine or attachment, including any part of operator's cab.

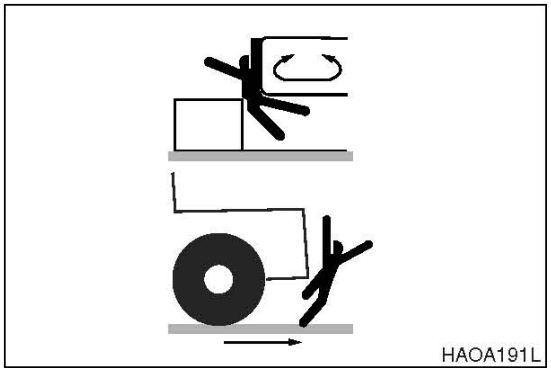


Figure 20

OPERATE CAREFULLY ON SNOW AND ICE AND IN VERY COLD TEMPERATURES

In icy cold weather avoid sudden travel movements and stay away from even very slight slopes. Machine could skid off to one side very easily.

Snow accumulation could hide or obscure potential hazards. Use care while operating or while using machine to clear snow.

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

When the temperature rises, frozen road surfaces become soft, so the machine travel becomes unstable.

In cold weather, do not touch metal surfaces with your bare hands. If you touch a metal surface in extremely cold weather, your skin may freeze to the metal surface.

PARKING MACHINE

Avoid making sudden stops, or parking machine wherever it happens to be at the end of the work day. Plan ahead so that the wheel loader will be on firm, level ground away from traffic and away from high walls, cliff edges and any area of potential water accumulation or runoff. If parking on inclines is unavoidable, block wheels to prevent movement. Lower bucket or other working attachment completely to ground, or to an overnight support saddle. There should be no possibility of unintended or accidental movement.

When parking on public roads, provide fences, signs, flags, or lights, and put up any other necessary signs to ensure that passing traffic can see the machine clearly, and park the machine so that the machine, flags, and fences do not obstruct traffic.

SHUTDOWN CONTROL FUNCTIONS

After bucket has been lowered to overnight storage position, move all switches and controls to "OFF" position. Pull parking brake knob to "APPLIED" position. This will apply parking brake. Move pilot cutoff switch to "LOCK" position. This will disable pilot control valve lever (joystick). Move key in starter switch to "OFF" position, and remove key from switch.

Engage all lock-down security equipment that may have been installed on machine.

IMPORTANT
When hydraulic system maintenance or service work must be performed, be aware that accumulators in system store fluid under pressure after system has been shut down. To release hydraulic pressure in accumulators, operate control with engine "OFF" until accumulator pressure is completely dissipated.

NEVER LET ANYONE RIDE ON ATTACHMENT

Never let anyone ride on any work attachment, such as the bucket, crusher, grapple, or clamshell (grab bucket). There is a danger of the person falling and suffering serious injury.

Figure 21

MAINTENANCE

USE WARNING TAG DURING SERVICE

Alert others that service or maintenance is being performed and tag operator's cab controls - and other machine areas if required - with a warning notice.

Figure 22

CLEAN BEFORE INSPECTION ORMAINTENANCE

Clean the machine before carrying out inspection and maintenance. This prevents dirt from getting into the machine and also ensures safety during maintenance.

If inspection and maintenance are carried out when the machine is dirty, it will become more difficult to locate the problems, and also there is danger that you may get dirt or mud in your eyes or that you may slip and injure yourself.

When washing the machine, do the following;

- Wear shoes with nonslip soles to prevent yourself from slipping and falling on wet places.
- Wear safety glasses and protective clothing when washing the machine with high-pressure steam.
- Take action to prevent touching high-pressure water and cutting your skin or having mud fly into your eyes.
- Do not spray water directly on electrical components (sensors, connector) (1, Figure 23). If water gets into the electrical system, there is danger that it will cause defective operation and malfunction.

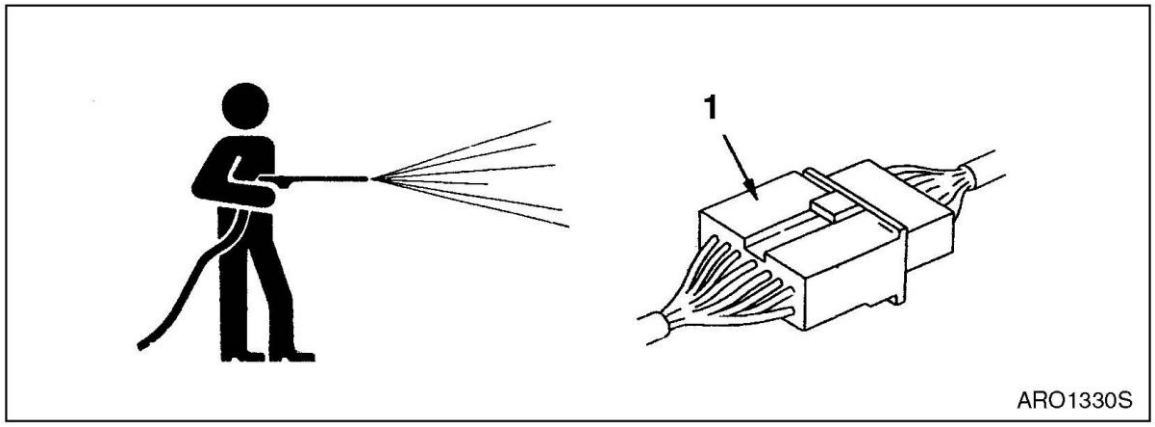


Figure 23

Pick up any tools or hammers that are laying in the work place, wipe up any grease or oil or any other slippery substances, and clean the area to make it possible to carry out the operation in safety. If the work place is left untidy, you may trip or slip and suffer injury.

PROPER TOOLS

Use only tools suited to the task. Using damaged, low qualify, faulty, or makeshift tools could cause personal injury. There is danger that pieces from, chisels with crushed heads, or hammers, may get into your eyes and cause blindness.

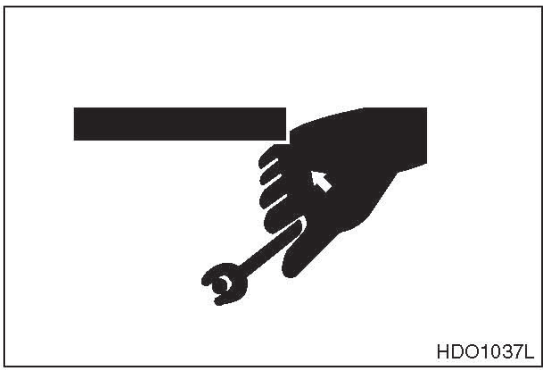


Figure 24

USE OF LIGHTING

When checking fuel, oil, battery electrolyte, or window washing fluid, always use lighting with anti-explosion specifications. If such lighting equipment is not used, there is danger of explosion.

If work is carried out in dark places without using lighting, it may lead to injury, so always use proper lighting.

Even if the place is dark, never use a lighter or flame instead of lighting. There is danger of fire.

There is also danger that the battery gas may catch fire and cause and explosion.

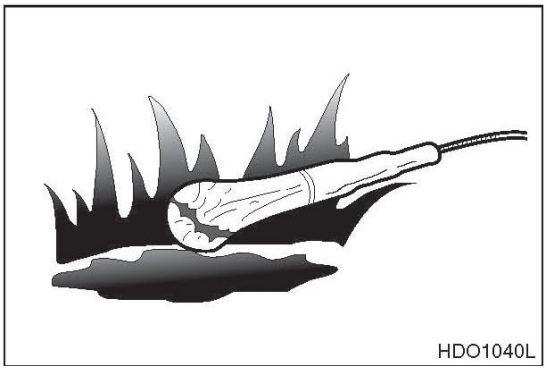


Figure 25

FIRE PREVENTION AND EXPLOSION PREVENTION

All fuels, most lubricants and some coolant mixtures are flammable. Leaking fuel or fuel that is spilled onto hot surfaces or onto electrical components can cause a fire.

Store all fuels and all lubricants in properly marked containers and away from all unauthorized persons.

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

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

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

Clean all electrical connections and tighten all electrical connections. Check the electrical wires daily for wires that are loose of frayed. Tighten all lose electrical wires before you operate the machine. Repair all frayed electrical wires before you operate the machine.

Remove all flammable materials before they accumulate on the machine.

Do not weld on pipes or on tubes that contain flammable fluids. Do not flame cut on pipes or on tubes that contain flammable fluids. Before you weld on pipes or on tubes or before you flame cut on pipes or on tubes, clean the pipes or tubes thoroughly with a nonflammable solvent.

BURN PREVENTION

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

Loosen the radiator cap gradually to release the internal pressure before removing the radiator cap.

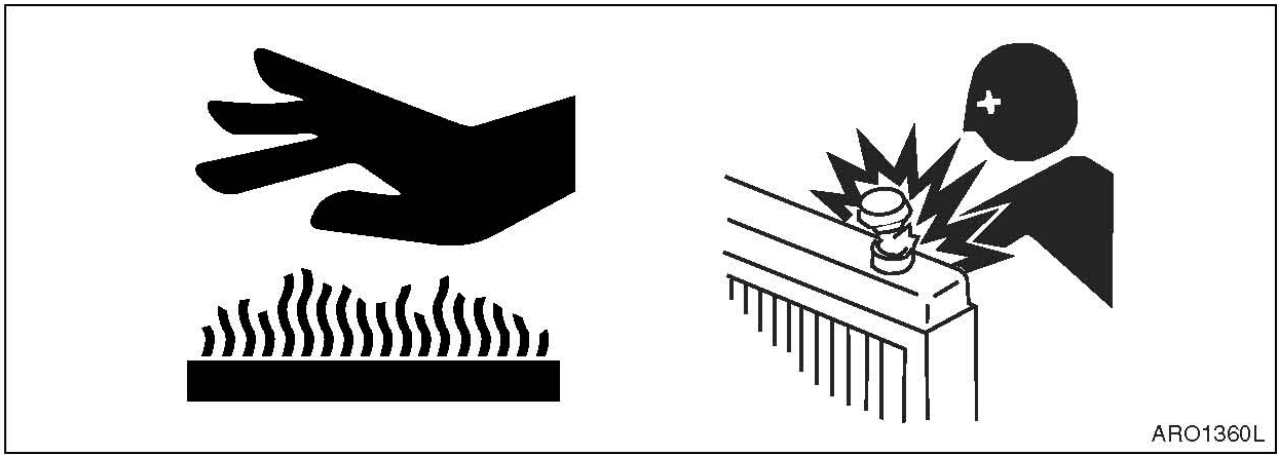


Figure 26

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

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

Allow cooling system components to cool before you drain the cooling system.

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

Remove the hydraulic tank filter plug only after the engine has been stopped. Make sure that the hydraulic tank filter plug is cool before you remove it with your bare hand. Remove the hydraulic tank filter plug slowly to relieve pressure.

Relieve all pressure in the hydraulic oil system, in the fuel system, or in the cooling system before you disconnect any lines, fittings, or related items.

Batteries give off flammable fumes that can explode.

Do not smoke while you are checking the battery electrolyte levels.

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

Always wear protective glasses when you work on batteries.

WELDING REPAIRS

When carrying out welding repairs, carry out the welding in a properly equipped place. The welding should be performed by a qualified worker. During welding operations, there is the danger of, generation of gas, fire, or electric shock, so never let an unqualified worker do welding.

The qualified welder must do the following;

- To prevent explosion of the battery, disconnect the battery terminals and remove batteries.
- To prevent generation of gas, remove the paint from the location of the weld.
- If hydraulic equipment, piping or places close to them are heated, a flammable gas or mist will be generated and there is danger of it catching fire. To avoid this, never subject these places to heat.
- Do not weld on pipes or on tubes that contain flammable fluids. Do not flame cut on pipes or on tubes that contain flammable fluids. Before you weld on pipes or on tubes or before you flame cut on pipes or on tubes, clean the pipes or tubes thoroughly with a nonflammable solvent.
- If heat is applied directly to rubber hoses or piping under pressure, they may suddenly break so cover them with a fireproof covering.
- Wear protective clothing.
- Make sure there is good ventilation.
- Remove all flammable objects and provide a fire extinguisher.

PRECAUTIONS FOR REMOVAL, INSTALLATION, AND STORAGE OFATTACHMENTS

Before starting removal and installation of attachments, decide the team leader.

Do not allow anyone except the authorized workers close to the machine or attachment.

Place attachments that have been removed from the machine in a safe place so that they do not fall. Put up a fence around the attachments and take other measures to prevent unauthorized persons from entering.

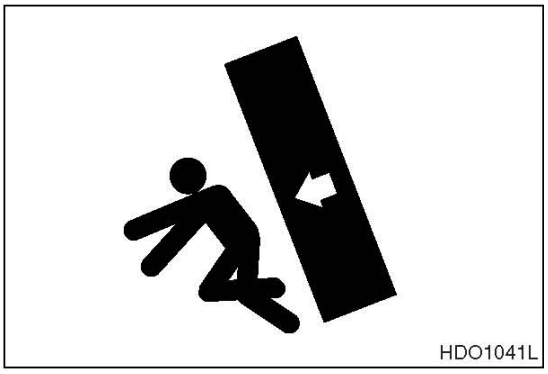


Figure 27

PRECAUTIONS WHEN WORKING ON MACHINE

When carrying out maintenance operations on the machine, keep the area around your feet clean and tidy to prevent you from falling.

Always do the following;

- Do not spill oil or grease.
- Do not leave tools laying about.
- Watch your step when walking.

Figure 28

Never jump down from the machine. When getting on or off the machine, use the steps and handrails, and maintain a three-point contact (both feet and one hand or both hands and one foot) to support yourself securely.

If the job requires it, wear protective clothing.

To prevent injury from slipping or falling, when working on the hood or covers, never use any part except the inspection passage fitted with nonslip pads.

LOCK INSPECTION COVERS

When carrying out maintenance with the inspection cover open, lock the cover securely in position with the lock bar.

If maintenance work is carried out with the inspection cover open but not locked, there is danger that it may suddenly close and cause injury if there is a gust of wind.

CRUSHING PREVENTION AND CUTTING PREVENTION

You should always have at least two people working together if the engine must be run during service. One person needs to remain in the operator's seat, ready to work the controls or stop the machine and shut off the engine.

Unless you are instructed otherwise, never attempt adjustments while the machine is moving or while the engine is running.

Stay clear of all rotating parts and moving parts.

Keep objects away from moving fan blades. The fan blades will throw objects and the fan blades can cut objects.

Do not use a wire rope cable that is kinked or flayed. Wear gloves when you handle a wire rope cable.

When you strike a retainer pin, the retainer pin might fly out. The loose retainer pin can injure personnel.

Make sure that the area is clear of people when you strike a retainer pin. To avoid injury to your eyes, wear protective glasses when you strike a retainer pin.

DO NOT RUN ENGINE IF REPAIRS OR WORK ARE BEING PERFORMED ALONE

You should always have at least two people working together if engine must be run during service. One person needs to remain in operator's seat, ready to work controls or stop machine and shut "OFF" engine.

ALWAYS USE ADEQUATE EQUIPMENT SUPPORTS AND BLOCKING

Do not allow weight or equipment loads to remain suspended. Lower everything to ground before leaving operator's seat. Do not use hollow, cracked or unsteady, wobbling weight supports. Do not work under any equipment supported solely by a lift jack.

DO NOT WORK ON HOT ENGINES OR HOT COOLING OR HYDRAULIC SYSTEMS

Wait for engine to cool off after normal operation. Park wheel loader on firm, level ground and lower all equipment before shutting down and switching "OFF" controls. When engine lube oil, gearbox lubricant or other fluids require change, wait for fluid temperatures to decrease to a moderate level before removing drain plugs.

NOTE: *Oil will drain more quickly and completely if it is warm. Do not drain fluids at temperatures exceeding 95°C (203°F), however do not allow full cool down.*

HYDRAULIC CYLINDER SEALS REQUIRE PERIODIC REPLACEMENT

Check cylinder drift rate at regular intervals.

HIGH PRESSURE HYDRAULIC LINES CAN STORE A GREAT DEAL OF ENERGY

Exposed hydraulic hoses on arm or boom could react with explosive force if struck by a falling rock, overhead obstacle or other work site hazard. Extra safety guards may be required. NEVER allow hoses to be hit, bent or interfered with during operation.

PRECAUTIONS WITH HIGH PRESSURE LINE, TUBES AND HOSES

When inspecting or replacing high-pressure piping or hoses, check that the pressure has been released from the circuit. Failure to release the pressure may lead to serious injury. Always do the following;

- Wear protective glasses and leather gloves.
- Fluid leaks from hydraulic hoses or pressurized components can be difficult to see but pressurized oil has enough force to pierce the skin and cause serious injury. Always use a piece of wood or cardboard to check for suspected hydraulic leaks. Never use your hands or expose your fingers.
- 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 installed correctly to prevent vibration, rubbing against other parts, and excessive heat during operation.
  - If any of the following conditions are found, replace the part.
  - Damage or leakage from hose end.
  - Wear, damage, cutting of covering, or exposure of strengthening wire layer.
  - Cover portion is swollen in places.
  - There is twisting or crushing at movable parts of hose.
  - Foreign material is embedded in the covering.
  - Hose end is deformed.

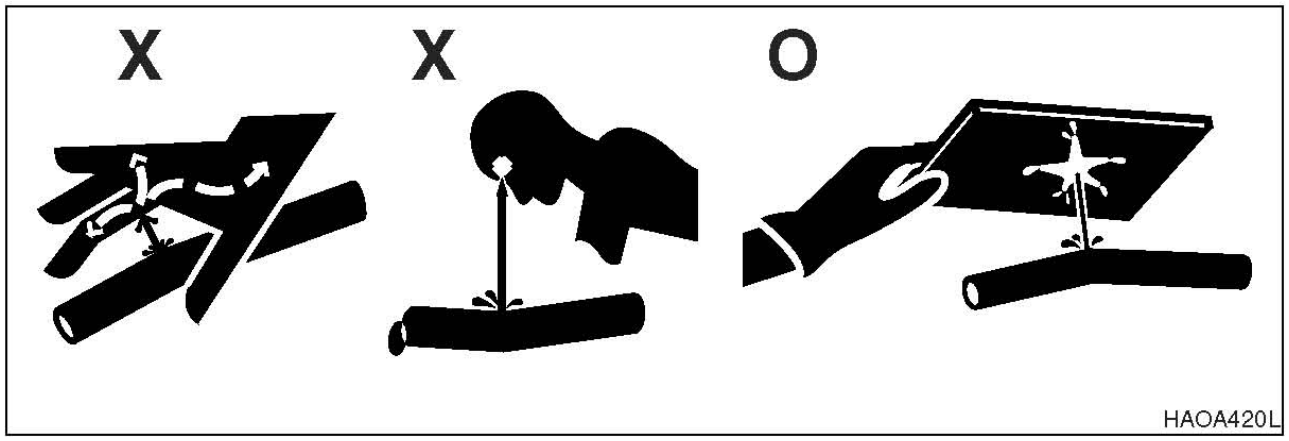


Figure 29

OBTAIN IMMEDIATE MEDICAL ATTENTION IF PRESSURIZED OIL PIERCES SKIN.

⚠ WARNING!
Failure to obtain prompt medical assistance could result in gangrene or other serious damage to tissue.

USE CORRECT REPLACEMENT FASTENERS TIGHTENED TO PROPER TORQUE

Refer to "General Maintenance" section of Shop Manual for information on tightening torques and recommended assembly compounds and always use correct part.

Poor or incorrect fastener connections can dangerously weaken assemblies.

SAFETY-CRITICAL PARTS MUST BE REPLACED PERIODICALLY

Replace following fire-related components as soon as they begin to show any sign of wear, or at regular periodic intervals, whether or not deterioration is visible:

- Fuel system flexible hoses, the tank overflow drain hose and the fuel filler cap.
- Hydraulic system hoses, especially the pump outlet lines and front and rear pump branch hoses.
- Keep mounting brackets and hose and cable routing straps tight. Hose routing should have gradual bends.

DISPOSE OF ALL PETROLEUM-BASED OILS AND FLUIDS PROPERLY

Physical contact with used motor oil may pose a health risk. Wipe oil from your hands promptly and wash off any remaining residue.

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

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

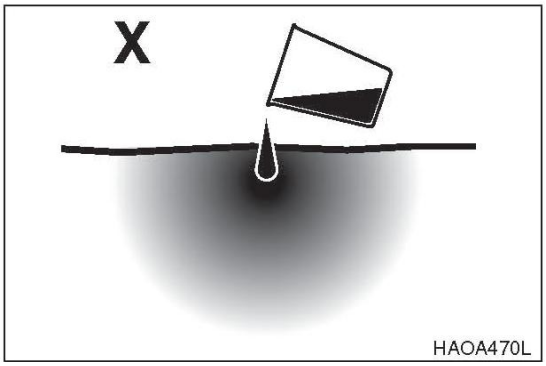


Figure 30

CHECK TIRE PRESSURE AND CONDITION

Maintain tire pressure but do not over inflate. Inspect tires and wheels daily. When inflating tires, follow procedures in Maintenance Section, which include using an extension to allow you to avoid standing in front of or over a tire. Do not change a tire unless you have both experience and proper equipment.

BATTERY HAZARD PREVENTION

Battery electrolyte contains diluted sulfuric acid and batteries generate hydrogen gas. Hydrogen gas is highly explosive, and mistakes in handling them can cause serious injury or fire. To prevent problems, always do the following;

- Do not smoke or bring any flame near the battery.
- When working with batteries, ALWAYS wear safety glasses and rubber gloves.
- If you spill battery electrolyte on yourself or your clothes, immediately flush the area with water.
- If battery electrolyte gets into your eyes, flush them immediately with large quantities of water and see a doctor at once.
- If you accidentally drink battery electrolyte, drink a large quantity of water or milk, raw egg or vegetable oil. Call a doctor or poison prevention center immediately.
- When cleaning the top surface of the battery, wipe it with a clean, damp cloth. Never use gasoline, thinner, or any other organic solvent or detergent.
- Tighten the battery caps securely.
- Explosive battery gas can be set off by sparks from incidental contact or static discharge. Turn "OFF" all switches and engine when working on batteries. Keep battery terminals tight. Contact between a loose terminal and post can create an explosive spark.
- If the battery electrolyte is frozen, do not charge the battery or start the engine with power from another source. There is danger that the battery may catch fire.
- When charging the battery or starting with power from another source, let the battery electrolyte melt and check that there is no leakage of battery electrolyte before starting the operation.
- Always remove the battery from the machine before charging.

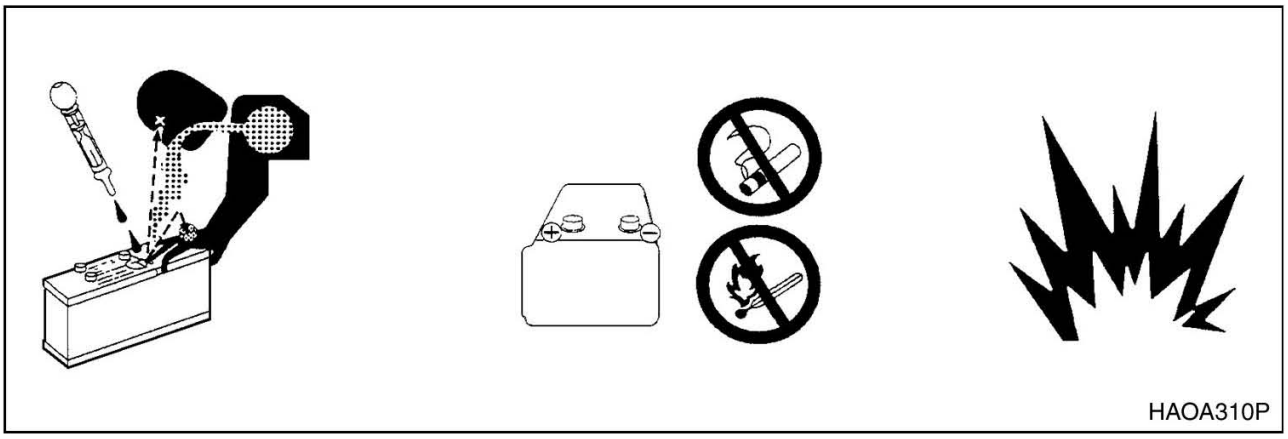


Figure 31

DISCONNECT BATTERIES BEFORE ELECTRICAL SERVICE OR ELECTRICAL WELDING

Remove cable to negative terminal first when disconnecting cable. Connect positive terminal cables first when installing a battery.

USE LOW HEAT PORTABLE LIGHTING

Hot surfaces on trouble lights or portable work lights can set off fuel or battery explosive gases.

BOOST STARTING OR CHARGING ENGINE BATTERIES

If any mistake is made in the method of connecting the booster cables, it may cause an explosion or fire. Always do the following;

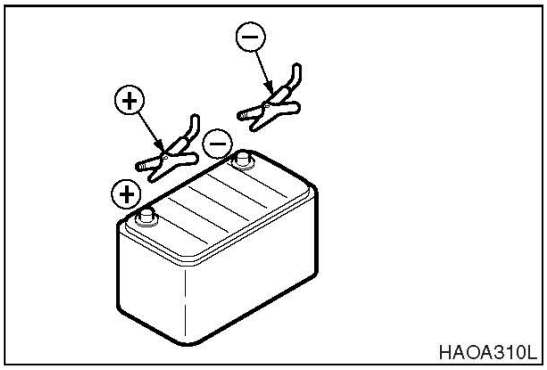


Figure 32

- Turn off all electrical equipment before connecting leads to the battery. This includes electrical switches on the battery charger or boost starting equipment.
- When boost-starting from another machine or vehicle do not allow the two machines to touch. Wear safety glasses or goggles while required battery connections are made.
- 24 volt battery units consisting of two series-connected twelve volt batteries have a cable connecting one positive terminal on one of the 12 volt batteries to a negative terminal on the other battery. Booster or charger cable connections must be made between the nonseries-connected positive terminals and between the negative terminal of the booster battery and the metal frame of the machine being boosted or charged. Refer to the procedure and illustration in Operation and Maintenance Manual.
- Connect positive cable first when installing cables and disconnect the negative cable first when removing them. The final cable connection, at the metal frame of the machine being charged or boost-started, should be as far away from the batteries as possible.

TOWING

PRECAUTIONS WHEN TOWING

If any mistake is made in the method of selecting or inspecting the towing wire or in the method of towing, it may lead to serious personal injury. Always do the following;

- Always use the method of towing given in this Operation and Maintenance Manual. Do not use any other method.
- Use leather gloves when handling the wire rope.
- When carrying out the preparation work for towing with two or more workers, determine the signals to use and follow these signals correctly.
- If the engine on the problem machine will not start or there is a failure in the brake system, always contact your DISD distributor.
- Never go between the towing machine and the towed machine during the towing operation.
- It is dangerous to carry out towing on slopes, so select a place where the slope is gradual. If there is no place where the slope is gradual, carry out operations to reduce the angle of the slope before starting the towing operation.
- When towing a problem machine, always use a wire rope with a sufficient towing capacity.
- Do not use a frayed, kinked rope or a rope with any loss of diameter.

SHIPPING AND TRANSPORTATION

OBEY STATE AND LOCAL OVER-THE-ROAD REGULATIONS

Check state and local restrictions regarding weight, width and length of a load before making any other preparation for transport.

Hauling vehicle, trailer and load must all be in compliance with local regulations governing intended shipping route.

Partial disassembly or tear-down of wheel loader may be necessary to meet travel restrictions or particular conditions at work site.

Refer to the section "Transportation" section of operation manual.

SUMMARY OF SAFETY PRECAUTIONS FOR LIFTING

⚠WARNING!
Improper lifting can allow load to shift and cause personal injury or damage to the machine

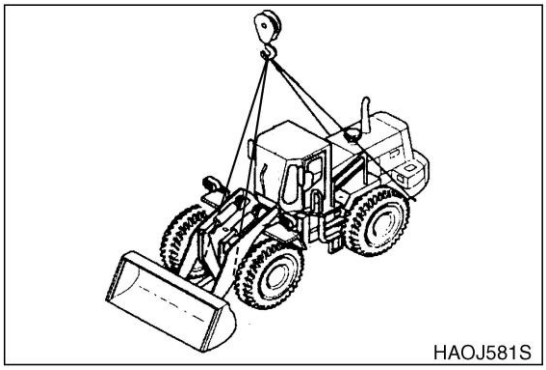


Figure 33

To make safe lifts, the following items must be evaluated by operator and work site crew.

- Condition of ground support.
- Wheel loader configuration and attachments.
- Weight, lifting height and lifting radius.
- Safe rigging of load.
- Proper handling of suspended load.

Taglines on opposite sides of load can be very helpful in keeping a suspended load secure, if they are anchored safely to control points on ground.

SPECIFICATIONS

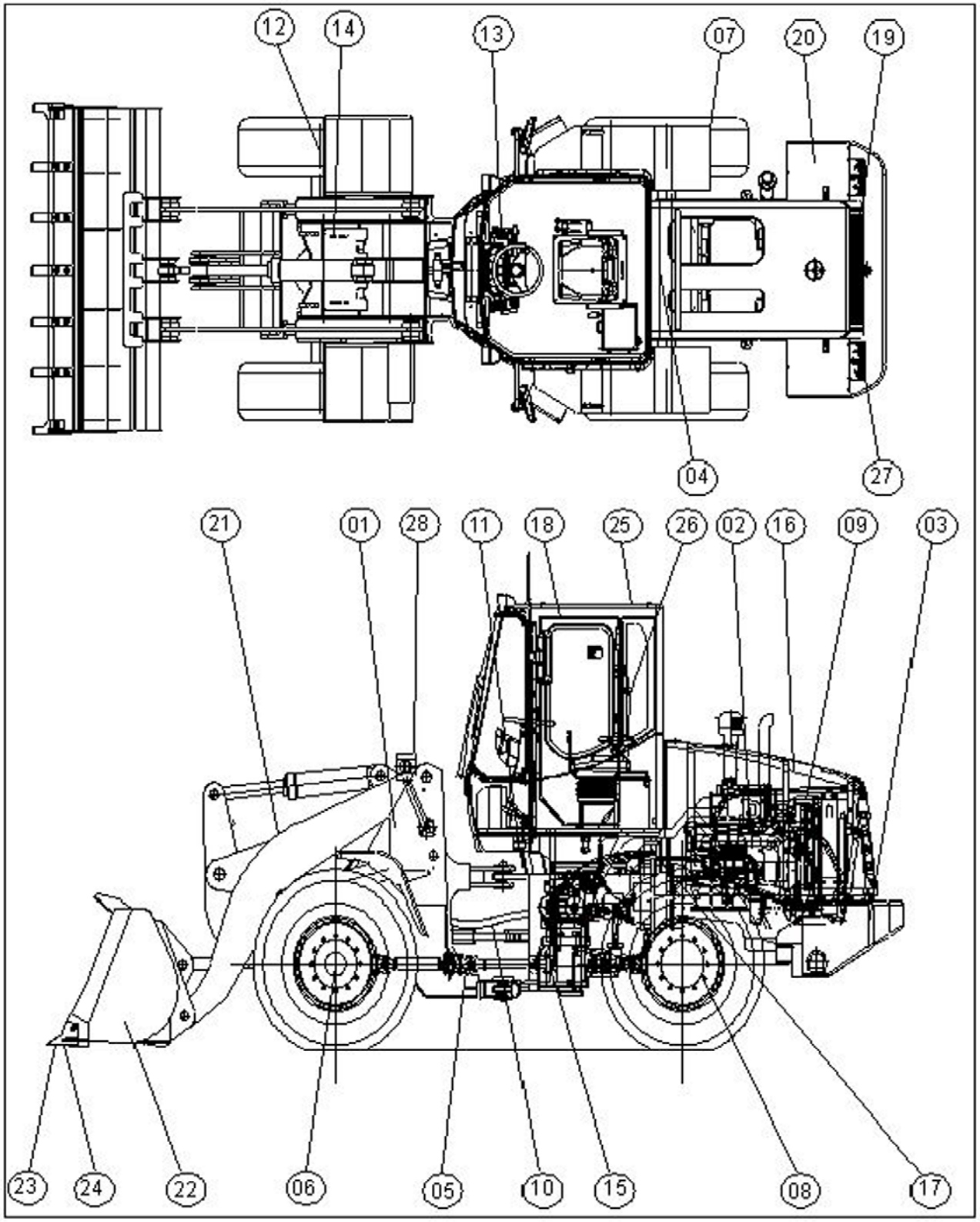
SPECIFICATIONS

⚠ CAUTION!
Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section. **Always use tools and equipment that is in good working order.** **Use lifting and hoisting equipment capable of safely handling load.** **Remember, that ultimately safety is your own personal responsibility.**

TABLE OF CONTENTS

COMPONENT LOCATIONS

Figure 1 identifies the location of major machine components.



Reference Number	Description	Reference Number	Description
1	Frame	15	Handrail
2	E/G and T/M Ass`y	16	Engine Cover
3	Fuel Tank	17	Damper
4	Oil Tank	18	Cabin Interior
5	Axel and Driving shaft	19	Radiator Grille
6	Axel and Driving shaft	20	Counterweight
7	Tire	21	Working Device
8	Axle Hub	22	Bucket
9	Cooling Pipe line	23	Tooth
10	Main Pipe line	24	Cutting Edge
11	Steering Pipe line	25	Cabin
12	Brake Pipe line	26	Seat
13	Brake System	27	Lamp-Rear
14	Main Control valve	28	Lamp-Front

GENERAL SPECIFICATIONS

Item		
Serial Number		
Standard Bucket Capacity		1.70 m^3 (2.22 yd^3)
Vehicle Weight		10,300 kg (22,708 lb)
Engine		
	Type	Weichai
	Rated power (SAE J 1995 gross)	125 ps @ 2,200 rpm (123 hp @ 2,200 rpm)
	Max. Torque (SAE J 1995 gross)	51 kg•m / 1,500 rpm (368 ft lb @ 1,500 rpm)
Transmission		
	Mechanical gear shift	Mechanical gear shift
	Speeds	2 Forward, 1 Reverse
Brake Systems		
	Service Brakes	4 Wheel, Dry Disks, Single Pedal
	Parking Brake	Dry Disc on Transmission
Performance		
	Travel Speed (1 / 2)	8 (4.97) / 15 (9.3) km/h (mph)
	Steering Angle	+ 40°
	Min. Tire Turning Radius (Tire Center)	4,241 mm
	Max Tractive Force	9,693 kg (21,772 lb)
	Max. Breakout Force	101,000kg (20,247 lb)
	Bucket Rise Time	4.6 Seconds
	Bucket Dump Time	0.9 Seconds
	Bucket Descent Time	3.7 Seconds
Working Range		
	Dump Height at 45° (w/o teeth)	2,808 mm (9’ - 6")
	Dump Reach at 45° (w/o teeth)	1,159 mm (3’ - 1")
	Max Dump Angle at Fully Raised	49°
	Max Tilt Angle at Carry	49°
Travel Dimension		
	Overall Length	6,900 mm (22’ - 8")
	Overall Width	2,496 mm (8’ - 3")
	Overall Height	3,250 mm (10’ - 9")
	Tread	1,860 mm (6’ - 1")
	Axle Base	2,700mm (9’ - 3")
	Ground Clearance	340 mm (1’ - 1")

ENGINE PERFORMANCE CURVES

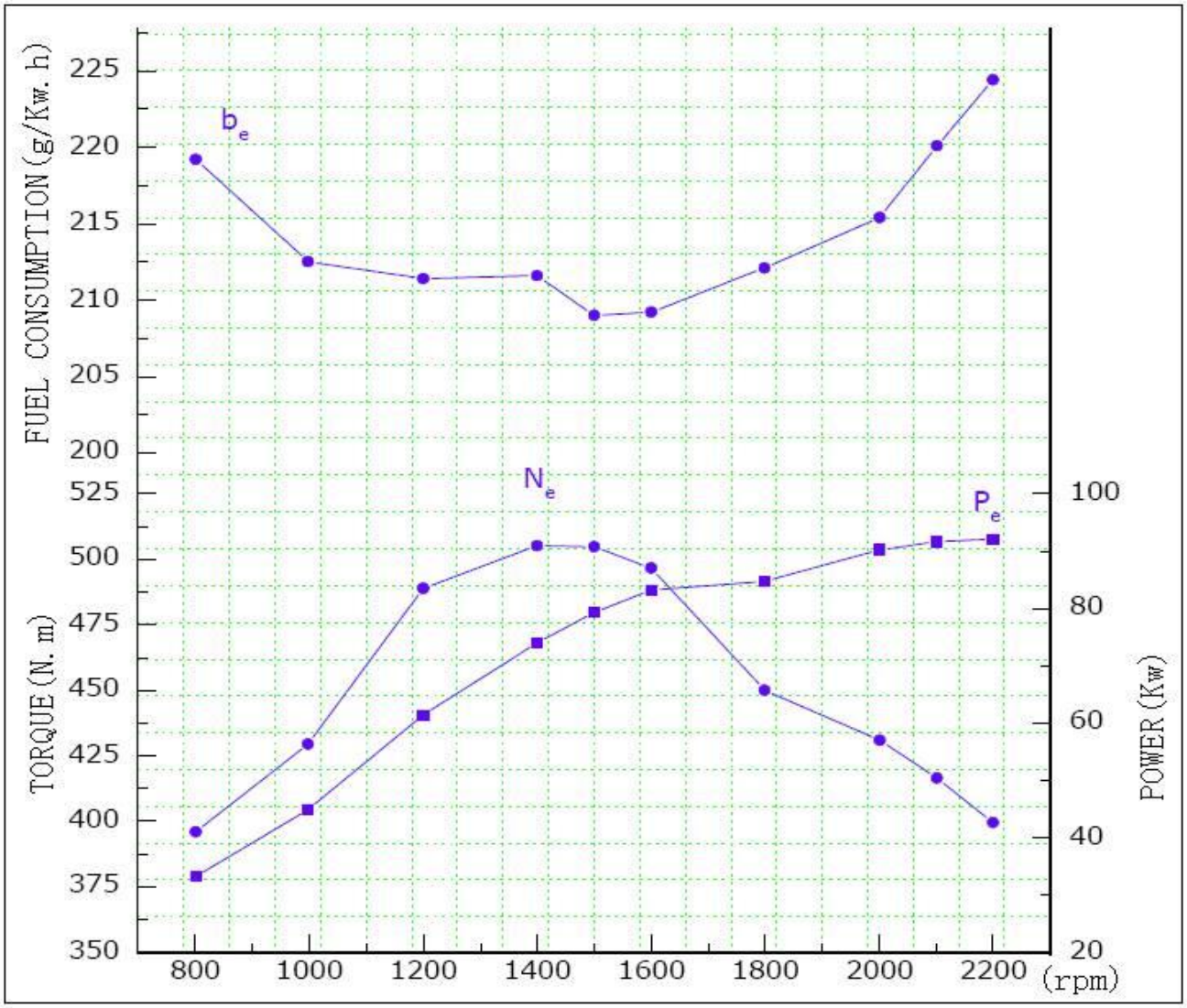


Figure 2

Serial Number	
Engine Type	WP6G125E22
Rated Power (209 hp @ 2,200 rpm)	125 ps @ 2,200 rpm (123 hp @ 2,200 rpm)
Maximum Torque (666 ft lb @ 1,300 rpm)	51 kg•m @ 1,500 rpm (368 ft lb @ 1,500 rpm)
Fuel Consumption	158 g / ps.h
Performance Standard	SAE J 1995 gross

NOTE: *Barometric Pressure: 760 mm (30") Mercury*
Temperature: 20°C (68°F)
W/O Cooling Fan: Driven by engine
Alternator: 24 V, 50 amp
Exhaust System: Complete, attached
Air Cleaner; Installed

WORKING RANGE AND DIMENSIONS

Figure 3, illustrates exterior machine dimensions and working range of machine when it is equipped with a standard bucket.

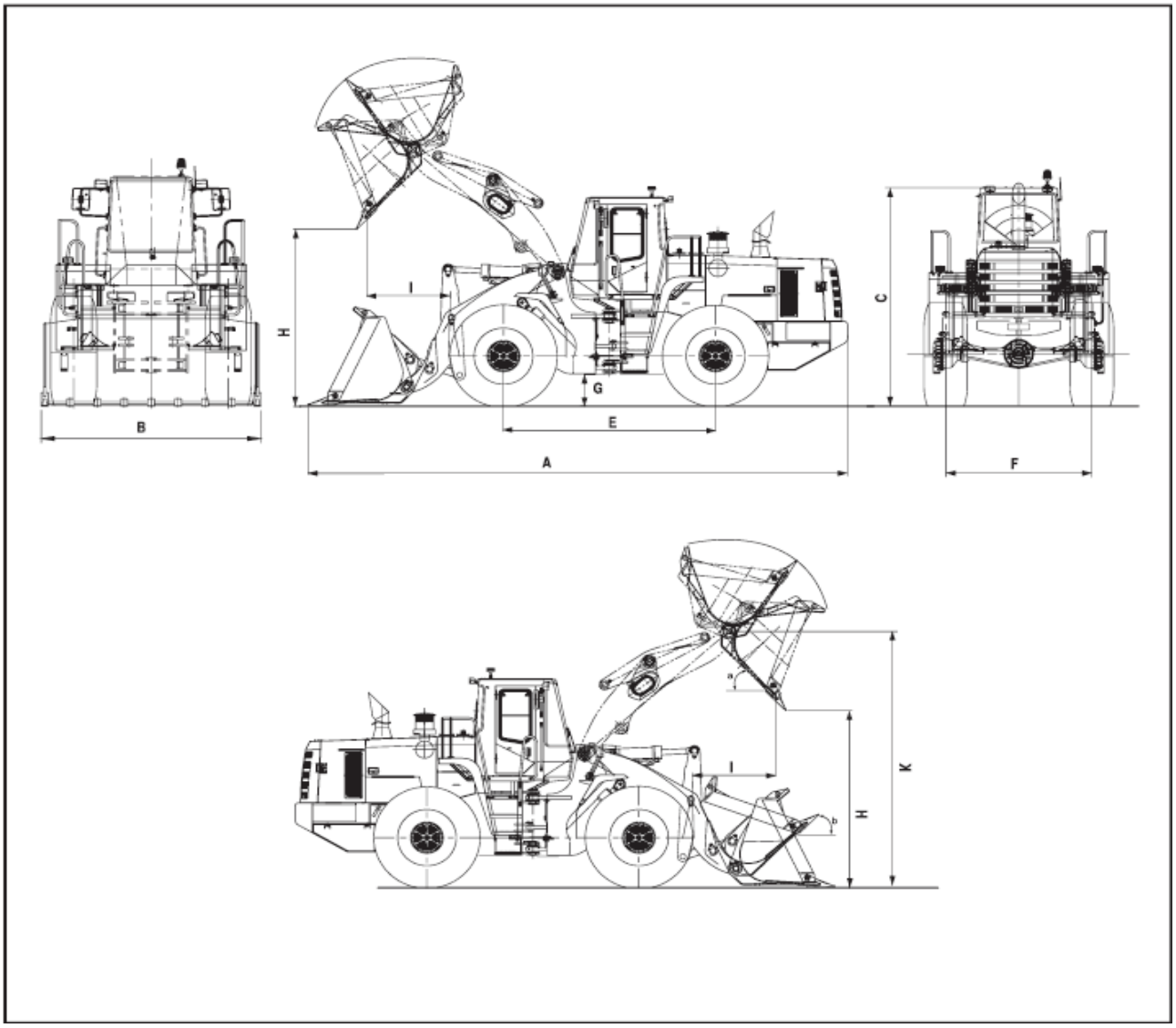


Figure 3

Category	Dimension	Category	Dimension
Overall Length (A)	6,900 mm (22’ - 8")	Dump Height, to tooth (H)	2,808 mm (9’ - 6")
Overall Width (B)	2,496 mm (8’ - 3")	Dump Distance, to Bucket Edge (I)	1,090 mm (3’ - 1")
Overall Height (C)	3,250 mm (10’ - 9")	Dump Height to Bucket Pivot (K)	3,778 mm (12’3")
Axle Base (E)	2,700mm (9’ - 3")	Max. Dump Angle at Fully Raised (a)	49°
Tread (F)	1,850 mm (6’ - 1")	Max. Tilt Angle at Carry (b)	49°
Ground Clearance (G)	330 mm (1’ - 1")	Tire Size	17.5-25

WORKING CAPACITIES

BUCKET CAPACITY

Standard toothed bucket has a capacity of 1.7 m3. An optional bucket equipped with big bucket has a capacity of 2.2 m3.

TIPPING LOAD

Static Tipping Load with bucket at max reach position is 6,530 kg (14,396 lb).

MATERIAL WEIGHT

The data below describes weight of a cubic meter (cubic yard) of many types of workload materials.

APPROXIMATE WEIGHT OF WORKLOAD MATERIALS

MATERIAL	LOW WEIGHT OR DENSITY 1,100 KG/M^3 (1,850 LB/YD^3), OR LESS	MEDIUM WEIGHT OR DENSITY 1,600 KG/M^3 (2,700 LB/YD^3), OR LESS	HIGH WEIGHT OR DENSITY 2,000 KG/M^3 (3,370 LB/YD^3), OR LESS
Charcoal	401 kg/m^3 (695 lb/yd^3)	----------	----------
Coke, blast furnace size	433 kg/m^3 (729 lb/yd^3)	----------	----------
Coke, foundry size	449 kg/m^3 (756 lb/yd^3)	----------	----------
Coal, bituminous slack, piled	801 kg/m^3 (1,350 lb/yd^3)	----------	----------
Coal, bituminous r. of m., piled	881 kg/m^3 (1,485 lb/yd^3)	----------	----------
Coal, anthracite	897 kg/m^3 (1,512 lb/yd3)	----------	----------
Clay, DRY, in broken lumps	1,009 kg/m^3 (1,701 lb/yd^3)	----------	----------
Clay, DAMP, natural bed	----------	1,746 kg/m^3 (2,943 lb/yd^3)	----------

MATERIAL	LOW WEIGHT OR DENSITY 1,100 KG/M^3 (1,850 LB/YD^3), OR LESS	MEDIUM WEIGHT OR DENSITY 1,600 KG/M^3 (2,700 LB/YD^3), OR LESS	HIGH WEIGHT OR DENSITY 2,000 KG/M^3 (3,370 LB/YD^3), OR LESS
Cement, Portland, DRY granular	----------	1,506 kg/m^3 (2,583 lb/yd^3)	----------
Cement, Portland, DRY clinkers	----------	1,362 kg/m^3 (2,295 lb/yd^3)	----------
Dolomite, crushed	----------	1,522 kg/m^3 (2,565 lb/yd^3)	----------
Earth, loamy, DRY, loose	----------	1,202 kg/m^3 (2,025 lb/yd^3)	----------
Earth, DRY, packed	----------	1,522 kg/m^3 (2,565 lb/y d^3)	----------
Earth, WET, muddy	----------	----------	1,762 kg/m^3 (2,970lb/yd3)
Gypsum, calcined, (heated, powder)	961kg/m^3 (1,620 lb/yd^3)	----------	----------
Gypsum, crushed to 3 inch size	----------	1,522 kg/m^3 (2,565 lb/y d^3)	----------
Gravel, DRY, packed fragments	----------	----------	1,810 kg/m^3 (3,051 lb/y d^3)
Gravel, WET, packed fragments	----------	----------	1,522 kg/m^3 (3,240 lb/y d^3)
Limestone, graded above 2	----------	1,282 kg/m^3 (2,160 lb/y d^3)	----------
Limestone, graded 1-1/2 or 2	----------	1,362 kg/m^3 (2,295 lb/y d^3)	----------
Limestone, crushed	----------	1,522 kg/m^3 (2,565 lb/y d^3)	
Limestone, fine	----------	----------	1,602 kg/m^3 (2,705 lb/y d^3)
Phosphate, rock	----------	1,282 kg/m^3 (2,160 lb/y d^3)	----------

MATERIAL	LOW WEIGHT OR DENSITY 1,100 KG/M^3 (1,850 LB/YD^3), OR LESS	MEDIUM WEIGHT OR DENSITY 1,600 KG/M^3 (2,700 LB/YD^3), OR LESS	HIGH WEIGHT OR DENSITY 2,000 KG/M^3 (3,370 LB/YD^3), OR LESS
Salt	929 kg/m^3 (1,566 lb/yd^3)	----------	----------
Snow, light density	529 kg/m^3 (891 lb/yd^3)	----------	----------
Sand, DRY, loose	----------	1,522 kg/m^3 (2,565 lb/yd^3)	----------
Sand, WET, packed	----------	----------	1,922 kg/m^3 (3,240 lb/yd^3)
Shale, broken	----------	1,362 kg/m^3 (2,295 lb/y d^3)	----------
Sulphur, broken	529 kg/m^3 (891 lb/yd^3)	----------	----------

IMPORTANT

Weights are approximations of estimated average volume and mass. Exposure to rain, snow or ground water; settling or compaction due to overhead weight and chemical or industrial processing or changes due to thermal or chemical transformations could all increase value of weights listed in table..

GENERAL MAINTENANCE

GENERAL MAINTENANCE PROCEDURES

⚠ CAUTION!
Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section. **Always use tools and equipment that is in good working order.** **Use lifting and hoisting equipment capable of safely handling load.** **Remember, that ultimately safety is your own personal responsibility.**

TABLE OF CONTENTS

WELDING PRECAUTIONS AND GUIDELINES

IMPORTANT

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!

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 be caused. Always consult DISD After Sales Service before welding on integral components (loader arm, frames, car body, track frames, turntable, attachment, etc.) 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.

⚠ CAUTION!

Always perform welding procedures with the proper safety equipment on hand. Adequate ventilation and a dry work area are absolutely essential. Keep a fire extinguisher nearby and always wear protective clothing and the recommended type of eye protection.

⚠ CAUTION!

Observe the following safety precautions:

1. **Use extra caution and adequate safety shielding when welding near fuel and oil tanks, batteries, hydraulic piping lines or other fire hazards.**
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, operator's cab window areas or any other assemblies that could be damaged by weld spatters, use adequate shielding protection in front of the assembly.**
5. **During 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.**

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 dimensional tolerances between moving parts - pistons and cylinders, or shoes and swash plates, for example - 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 due to neglect or careless maintenance, could all produce sufficient fluid loss to cause damage.

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 pre-filling 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 is bone dry (with no trace of factory pre-lube) or has been contaminated by dirt or by questionable oils, flushing and pre-filling 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 minimize 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.

A daily walk-around pre-start equipment safety inspection, including a quick visual scan for any exterior evidence of leaking hydraulic fluid, can help extend the service life of system components.

IMPORTANT
Hydraulic system operating conditions (repetitive cycling, heavy work loads, fluid circulating under high pressure) make it extremely critical that dust, grit or any other type of 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 filler 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 type of maintenance service or repair is being performed.

NOTE: *If the unit is being used in an extreme temperature environment (in sub-freezing climates or in high temperature, high humidity tropical conditions), frequent purging of moisture condensation from the hydraulic reservoir drain tap should 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 filter elements 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 multidisplay digital gauge on the Instrument Panel ("F-Pump" and "R-Pump") will be reduced as a result of a mechanical problem inside the pump. However, pressure loss could also be due to cavitation or air leakage, or other faults in the hydraulic system.*

Check the exterior case drain oil 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 pre-fill 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 type of troubleshooting or service is being performed, it's important to remember that the 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 lift of individual components) can be noticeably reduced if proper precautions are not observed:

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

IMPORTANT
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. Harsh, 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 very suddenly put a complete stop to normal hydraulic function. You can prevent having to make these types of repairs by 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

NOTE: *Grease lip seals before assembly.*

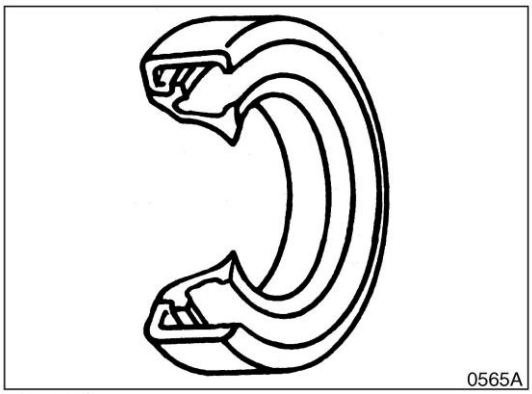


Figure 1

CLEANING AND INSPECTION

GENERAL GUIDELINES

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 fitting parts such as thrust bearing, matched parts, etc.

⚠ WARNING!
Care should be exercised to avoid inhalation of vapors, exposure to skin and creating fire hazards when using solvent type cleaners.

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 mating cup or cone at the same time. After inspection, dip bearings in light weight oil and wrap 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 snap rings when unit is disassembled than waiting for premature failures; refer to latest Micro Fiche and/or Parts Book for replacement items. Be extremely 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, on oil seals to assure an oil tight fit 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 similar process for checking for cracks that are not visible to the eye. 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. Small nicks may be removed with suitable hone. Inspect shafts and quills to make certain they have not been sprung, bent, or splines twisted and that shafts are true.

   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 foe 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 that 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 to the naked eye.

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

Smooth even surfaces with no discoloration or marks.

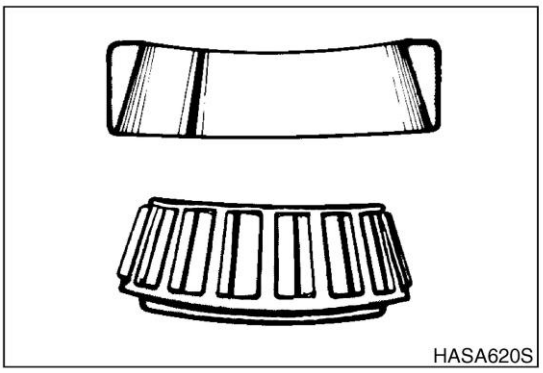


Figure 2

Bent Cage

Cage damage due to improper handling or tool usage.

Replace bearing.

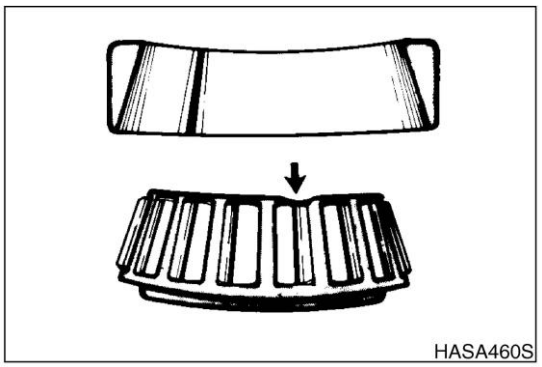


Figure 3

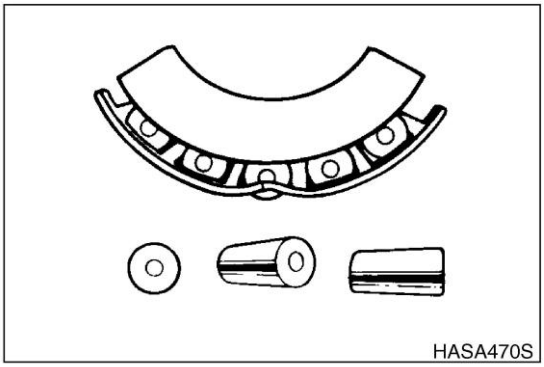


Figure 4

Galling

Metal smears on roller ends due to over heat, lubricant failure or overload.

Replace bearing - check seals and check for proper lubrication.

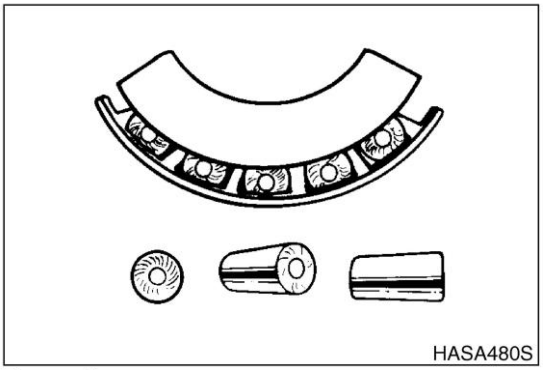


Figure 5

Abrasive Step Wear

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.

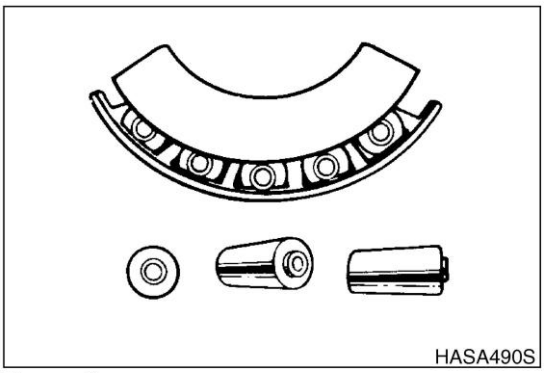


Figure 6

Etching

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.

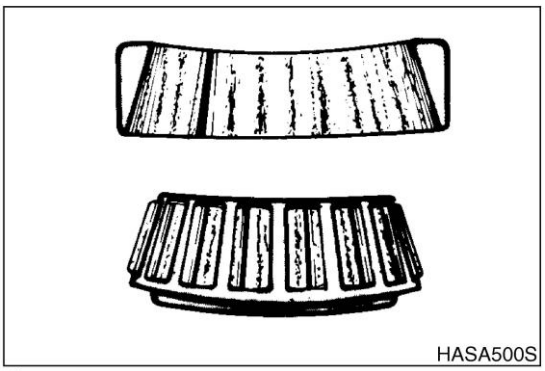


Figure 7

Misalignment

Outer race misalignment due to foreign object.

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

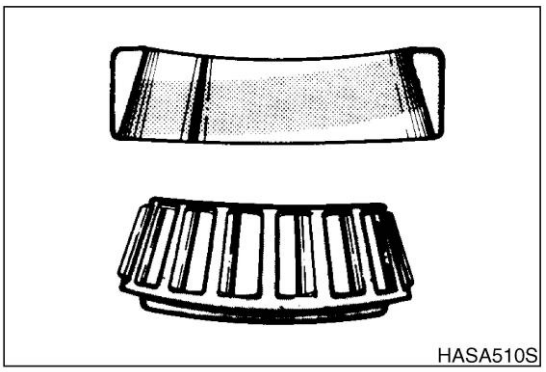


Figure 8

Indentations

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.

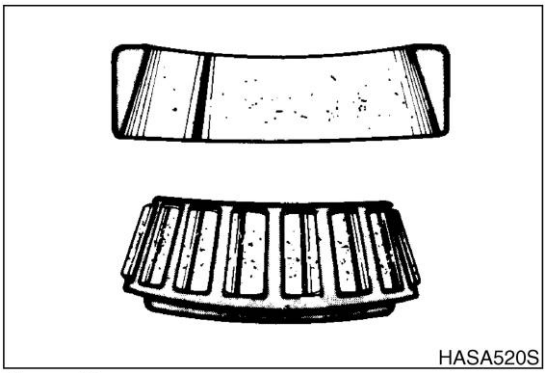


Figure 9

Fatigue Spalling

Flaking of surface metal resulting from fatigue.

Replace bearing - clean all related parts.

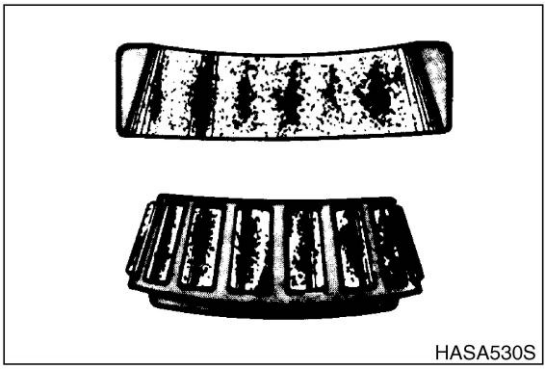


Figure 10

Brinelling

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.

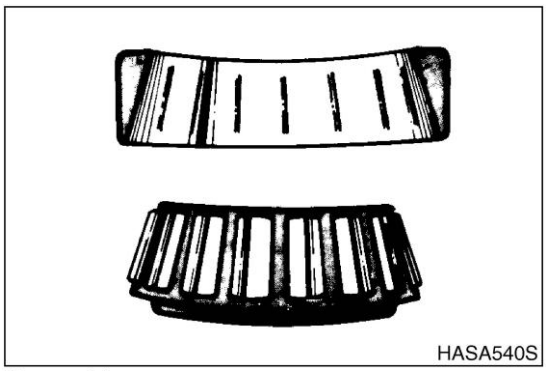


Figure 11

Cage Wear

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

Replace bearings - check seals.

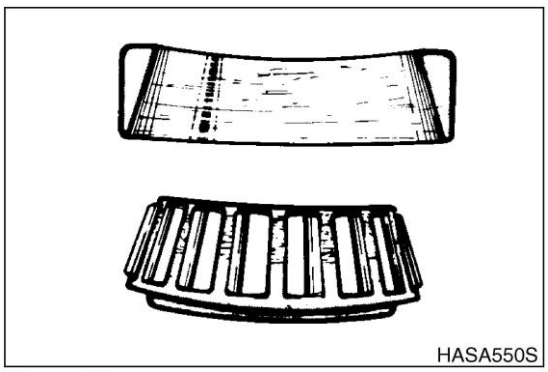


Figure 12

Abrasive Roller Wear

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.

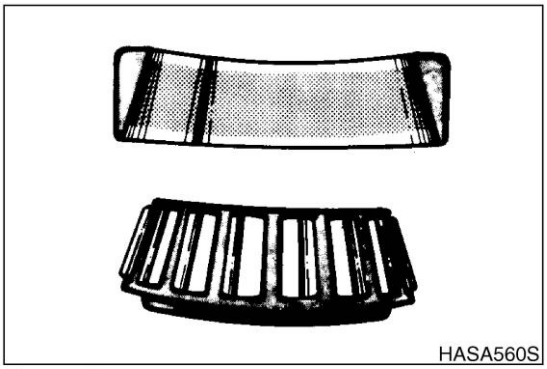


Figure 13

Cracked Inner Race

Race cracked due to improper fit, cocking or poor bearing seat.

Replace all parts and housings, check seals and bearings and replace if leaking.

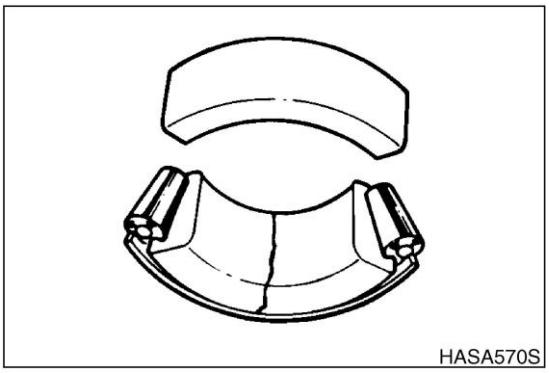


Figure 14

Smears

Smearing of metal due to slippage caused by poor fitting, lubrication, overheating, overloads or handling damage.

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

Replace shaft if damaged.

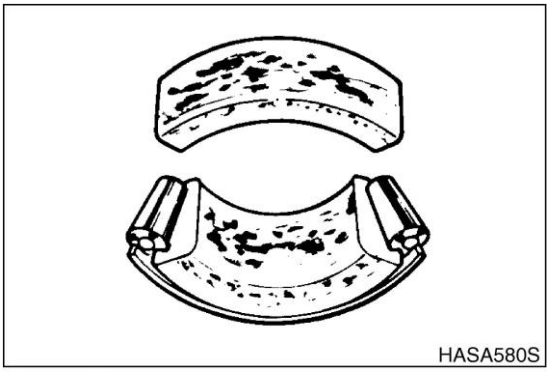


Figure 15

Frottage

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.

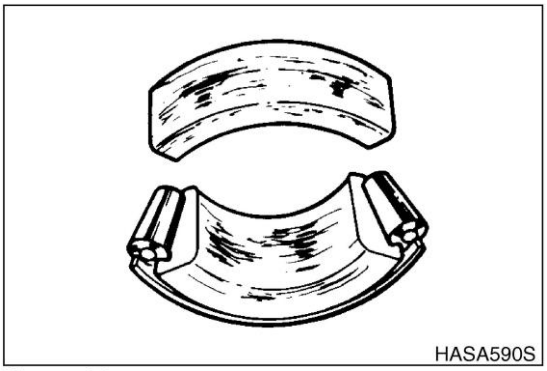


Figure 16

Heat Discoloration

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 over heating damage is indicated.

Check seals and other related parts for damage.

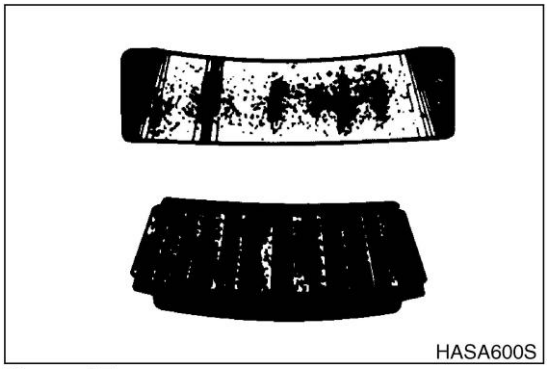


Figure 17

Stain Discoloration

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.

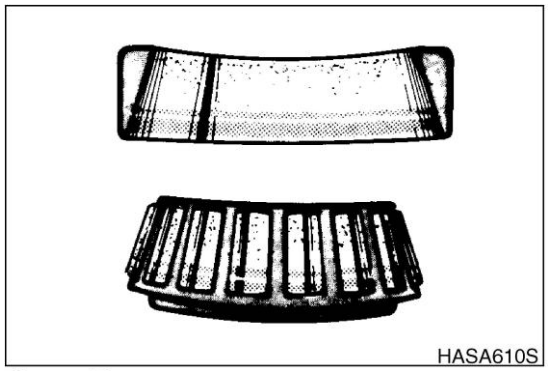


Figure 18

STANDARD TORQUES

⚠ CAUTION!
Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section. **Always use tools and equipment that is in good working order.** **Use lifting and hoisting equipment capable of safely handling load.** **Remember, that ultimately safety is your own personal responsibility.**

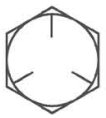
TABLE OF CONTENTS

TORQUE VALUES FOR STANDARD METRIC FASTENERS

NOTE: *The units for the torque values are kg•m (ft lb)*.

Dia. x Pitch (mm)	Grade										
	3.6 (4A)	**4.6 (4D)**	**4.8 (4S)**	**5.6 (5D)**	**5.8 (5S)**	**6.6 (6D)**	**6.8 (6S)**	**6.9 (6G)**	**8.8 (8G)**	**10.9 (10K)**	**12.9 (12K)**
M5 x Std.	0.15 (1.08)	0.16 (1.15)	0.25 (1.80)	0.22 (1.59)	0.31 (2.24)	0.28 (2.02)	0.43 (3.11)	0.48 (3.47)	0.50 (3.61)	0.75 (5.42)	0.90 (6.50)
M6 x Std.	0.28 (2.02)	0.30 (2.16)	0.55 (3.25)	0.40 (2.89)	0.55 (3.97)	0.47 (3.39)	0.77 (5.56)	0.85 (6.14)	0.90 (6.50)	1.25 (9.04)	1.50 (10.84)
M7 x Std.	0.43 (3.11)	0.46 (3.32)	0.70 (5.06)	0.63 (4.55)	0.83 (6.00)	0.78 (5.64)	1.20 (8.67)	1.30 (9.40)	1.40 (10.12)	1.95 (14.10)	2.35 (1.99)
M8 x Std.	0.70 (5.06)	0.75 (5.42)	1.10 (7.95)	1.00 (7.23)	1.40 (10.12)	1.25 (9.04)	1.90 (13.74)	2.10 (15.18)	2.20 (15.91)	3.10 (22.42)	3.80 (27.48)
M8 x 1	0.73 (5.28)	0.80 (5.78)	1.20 (8.67)	1.00 (7.23)	1.50 (10.84)	1.35 (9.76)	2.10 (15.18)	2.30 (16.63)	2.40 (17.35)	3.35 (24.23)	4.10 (29.65)
M10 x Std.	1.35 (9.76)	1.40 (10.12)	2.20 (15.91)	1.90 (13.74)	2.70 (19.52)	2.35 (19.99)	3.70 (26.76)	4.20 (30.37)	4.40 (31.18)	6.20 (44.84)	7.20 (52.07)
M10 x 1	1.50 (10.84)	1.60 (11.57)	2.50 (18.08)	2.10 (15.18)	3.10 (22.42)	2.80 (20.25)	4.30 (31.10)	4.90 (35.44)	5.00 (36.16)	7.00 (50.63)	8.40 (60.75)
M12 x Std.	2.40 (17.35)	2.50 (18.08)	3.70 (26.76)	3.30 (23.86)	4.70 (33.99)	4.20 (30.37)	6.30 (45.56)	7.20 (52.07)	7.50 (54.24)	10.50 (75.94)	12.50 (90.41)
M12 x 1.5	2.55 (18.44)	2.70 (19.52)	4.00 (28.93)	3.50 (25.31)	5.00 (36.16)	4.50 (32.54)	6.80 (49.18)	7.70 (55.69)	8.00 (57.86)	11.20 (81.00)	13.40 (96.92)
M14 x Std.	3.70 (26.76)	3.90 (28.20)	6.00 (13.23)	5.20 (37.61)	7.50 (54.24)	7.00 (50.63)	10.00 (72.33)	11.50 (83.17)	12.00 (86.79)	17.00 (122.96)	20.00 (144.66)
M14 x 1.5	4.10 (29.65)	4.30 (31.10)	6.60 (47.73)	5.70 (41.22)	8.30 (60.03)	7.50 (54.24)	11.10 (80.28)	12.50 (90.41)	13.00 (94.02)	18.50 (11.26)	22.00 (158.12)
M16 x Std.	5.60 (40.50)	6.00 (43.39)	9.00 (65.09)	8.00 (57.86)	11.50 (83.17)	10.50 (75.94)	15.50 (112.11)	17.90 (129.47)	18.50 (133.81)	26.00 (188.05)	31.00 (224.22)
M16 x 1.5	6.20 (44.84)	6.50 (47.01)	9.70 (70.16)	8.60 (62.20)	12.50 (90.41)	11.30 (81.73)	17.00 (122.96)	19.50 (141.04)	20.00 (144.66)	28.00 (202.52)	35.50 (256.77)
M18 x Std.	7.80 (56.41)	8.30 (60.03)	12.50 (90.41)	11.00 (79.56)	16.00 (115.72)	14.50 (104.87)	21.00 (151.89)	27.50 (198.90)	28.50 (206.14)	41.00 (296.55)	43.00 (311.01)
M18 x 1.5	9.10 (65.82)	9.50 (68.71)	14.40 (104.15)	12.50 (90.41)	18.50 (133.81)	16.70 (120.79)	24.50 (177.20)	27.50 (198.90)	28.50 (206.14)	41.00 (296.55)	49.00 (354.41)
M20 x Std.	11.50 (83.17)	12.00 (86.79)	20.50 (148.27)	18.00 (130.19)	25.00 (180.82)	22.50 (162.74)	35.00 (253.15)	39.50 (285.70)	41.00 (296.55)	58.00 (419.51)	68.00 (491.84)
M20 x 1.5	12.80 (92.58)	13.50 (97.64)	20.50 (148.27)	18.00 (130.19)	25.00 (180.82)	22.50 (162.74)	35.00 (253.15)	39.50 (285.70)	41.00 (296.55)	58.00 (419.51)	68.00 (491.84)
M22 x Std.	15.50 (112.11)	16.00 (115.72)	24.50 (177.20)	21.00 (151.89)	30.00 (216.99)	26.00 (188.05)	42.00 (303.78)	46.00 (332.71)	49.00 (354.41)	67.00 (484.61)	75.00 (542.47)
M22 x 1.5	17.00 (122.96)	18.50 (133.81)	28.00 (202.52)	24.00 (173.59)	34.00 (245.92)	29.00 (209.75)	47.00 (339.95)	52.00 (44.76)	56.00 (405.04)	75.00 (542.47)	85.00 (614.80)
M24 x Std.	20.50 (148.27)	21.50 (155.50)	33.00 (238.68)	27.00 (195.29)	40.00 (289.32)	34.00 (245.92)	55.00 (397.81)	58.00 (419.51)	63.00 (455.67)	82.00 (593.10)	92.00 (655.43)
M24 x 1.5	23.00 (166.35)	35.00 (253.15)	37.00 (267.62)	31.00 (224.22)	45.00 (325.48)	38.00 (202.52)	61.00 (441.21)	67.00 (484.61)	74.00 (535.24)	93.00 (672.66)	103.00 (744.99)

TORQUE VALUES FOR STANDARD U.S. FASTENERS

TYPE	S.A.E. 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.

0.90 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 in all cases where **SPECIAL TORQUE VALUES** are not given

NOTE: *TORQUE VALUES LISTED THROUGHOUT THIS MANUAL ARE LUBRICATED (WET) THREADS; VALUES SHOULD BE INCREASED 1/3 FOR NONLUBRICATED (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 (N•m)	FOOT POUNDS (ft lb)	NEWTON METER (N•m)
1/4" - 20	6	8	9	12
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 the 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 and nuts and thru 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

TORQUE VALUES FOR SPLIT FLANGES

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

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

FLANGE SIZE (*)	BOLT SIZE	BOLT TORQUE	
		KILOGRAM METER (kg•m)	INCH POUNDS (in 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

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:

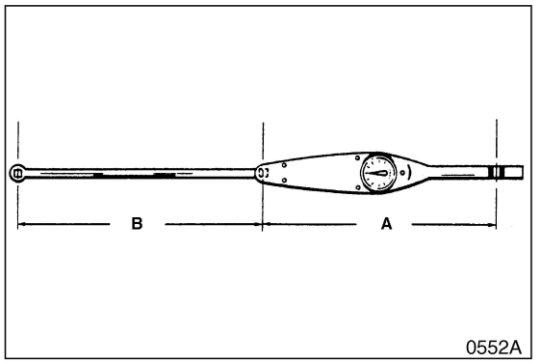


Figure 1

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:

$$I = \frac{A \times T}{A + B} = \frac{12 \times 300}{12 + 12} = \frac{3600}{24} = 150$$

NOTE: *The formula assumes that 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.

TIGHTENING TORQUE SPECIFICATIONS (METRIC)

(For coated threads, prelubricated assemblies.)

⚠ CAUTION!

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. DISD does not specifically endorse a specific manufacturer or brand name but the following table of "Loctite" applications is included for which cross-references to other makers' products should also be widely available.

IMPORTANT

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	Break-away 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 0.0012 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 nonrigid assemblies subject to shock, vibration or deflection.	Purple	Use Locquic "N" primer for faster (1/4 - 2 hours) setup. Unprimed setup 1 - 12 hours.

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.

UPPER STRUCTURE

COUNTERWEIGHT

⚠ CAUTION!
Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section. **Always use tools and equipment that is in good working order.** **Use lifting and hoisting equipment capable of safely handling load.** **Remember, that ultimately safety is your own personal responsibility.**

TABLE OF CONTENTS

Specifications

NOTE: ***weight***

Model	Weight	Serial Number Range
SD200N	1050 kg (2,315 lb)	1001 and Up
SD200	800 kg (1,767 lb)	1001 and Up
SD300	1568 kg (3,457 lb)	1001 and Up
SD300(Long Boom)	1848 kg (4,074 lb)	1001 and Up

Counterweight

1. Parts list

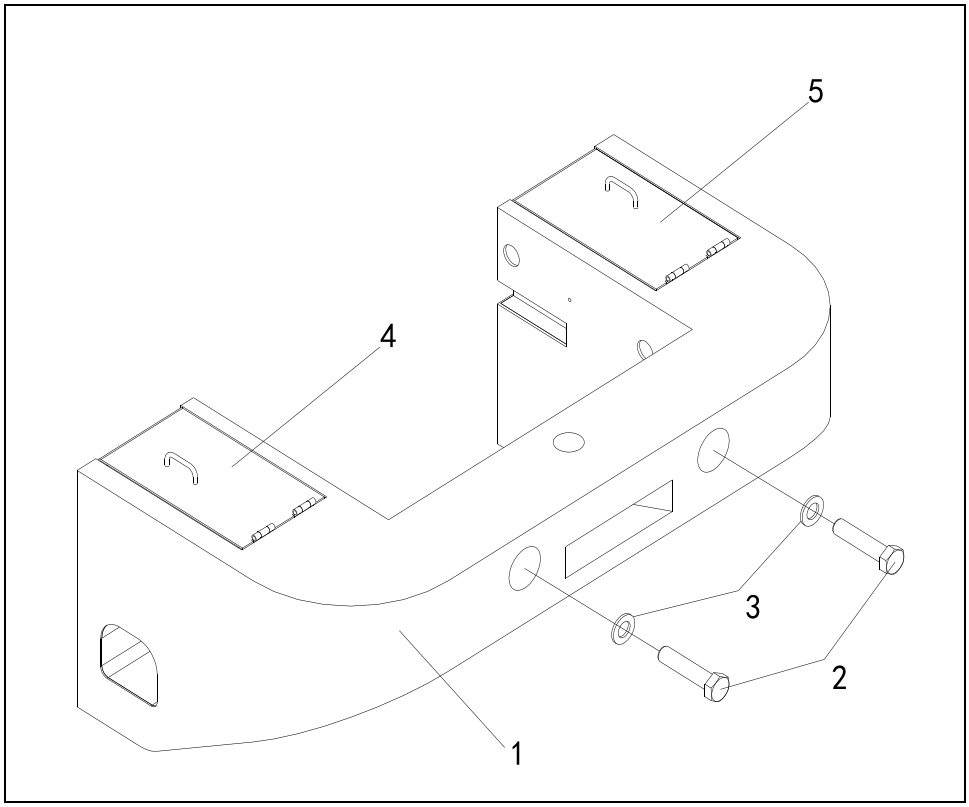


Figure 1

Reference Number	Description	Reference Number	Description
1	COUNTERWEIGHT	4	COVER(R,H)
2	BOLT	5	COVER(L,H)
3	WASHER;HARDEN		

2. TORQUE

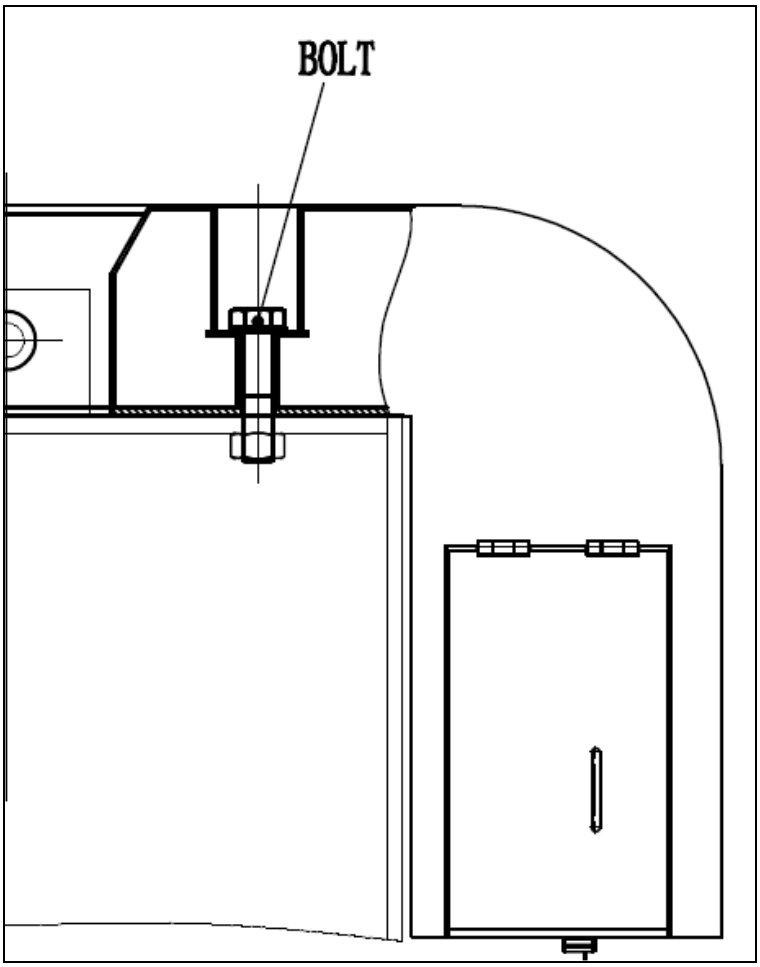


Fig.2

NOTE: *1) Tighten bolt to torque value list in the following table.*

	100kg • m (726 ft lb)

HYDRAULIC OIL TANK

⚠ CAUTION!
Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section. **Always use tools and equipment that is in good working order.** **Use lifting and hoisting equipment capable of safely handling load.** **Remember, that ultimately safety is your own personal responsibility.**

TABLE OF CONTENTS

GENERAL DESCRIPTION(PILOT LEVER)

Parts list(Pilot Lever)

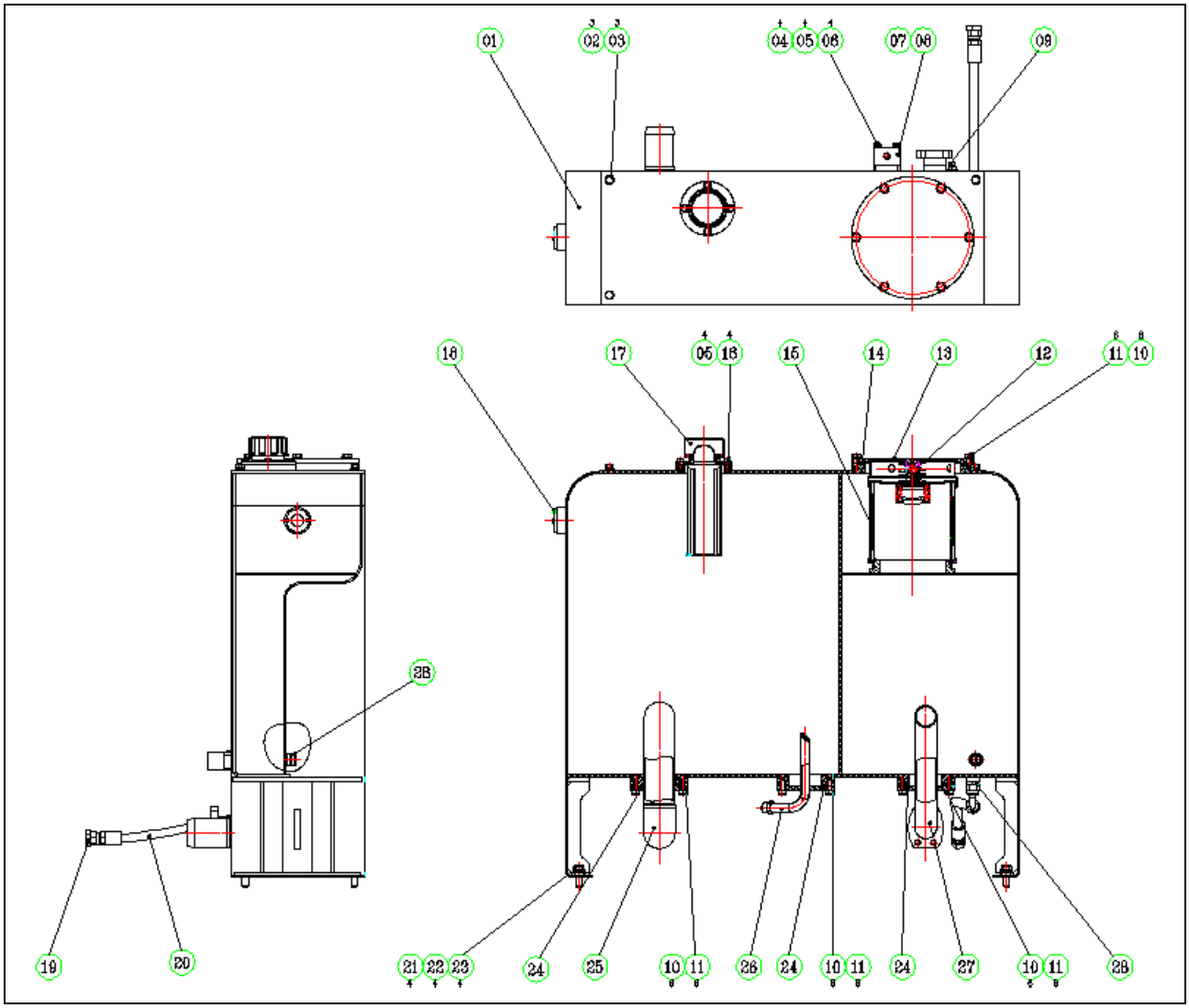


Figure 1

Reference Number	Description	Reference Number	Description
01	Oil Tank	09	Adapter
02	Plug	10	Bolt
03	Ring Seal	11	Washer Plain
04	Bolt	12	Spring
05	Washer Plain	13	Cover
06	Washer Spring	14	O Ring
07	Block	15	Filter Return
08	O Ring	16	Bolt
17	Filter	23	Washer Spring
18	Gauge Level	24	O Ring
19	Plug	25	Suction Tube
20	Hose	26	Pipe
21	Bolt	27	Pipe Return
22	Washer Plain	28	Adapter

Specifications(Pilot Lever)

TYPE	Pressure seal
Capacity (system0	124 L
Air breather	
Starting pressure	0.035 MPa
Return filter	
Filter accuracy	12μ
Pressure descending	0.045 MPa @800L/min

GENERAL DESCRIPTION (MECHANICAL LEVER)

Parts list (MECHANICAL LEVER)

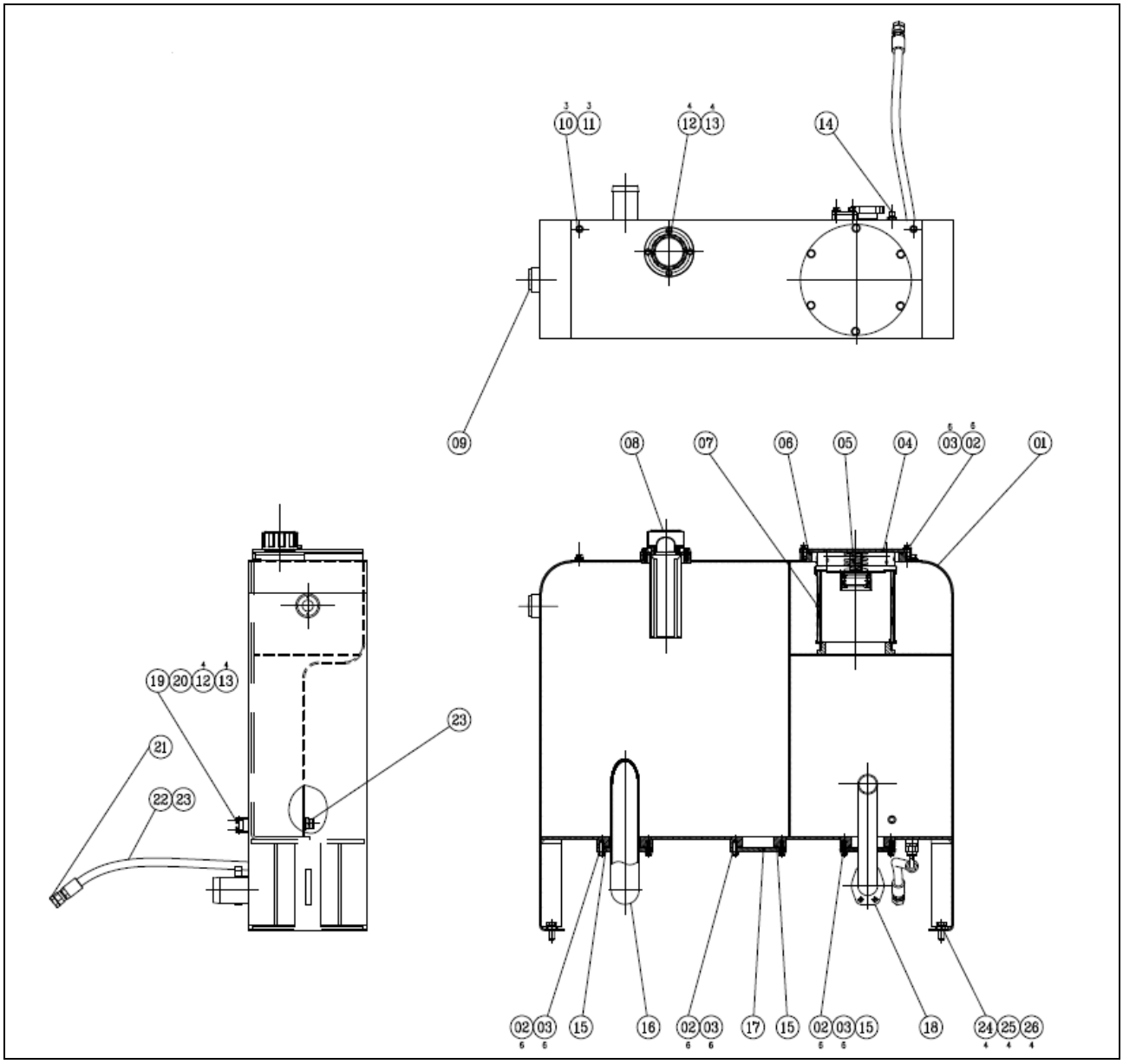


Figure 2

Reference Number	Description	Reference Number	Description
01	Oil Tank	14	Adapter
02	Bolt	15	O Ring
03	Washer Plain	16	Suck Tube
04	Cover	17	Flange
05	Spring	18	Pipe Return
06	O Ring	19	Plate
07	Filter Return	20	O Ring
08	Filter	21	Plug
09	Gauge Level	22	Hose
10	Plug	23	Adapter
11	Washer	24	Washer Plain
12	Bolt	25	Bolt
13	Washer Plain	26	Washer Spring

Specifications (Mechanical Lever)

	(MECHANICAL LEVER)
TYPE	Pressure seal
Oil Tank Capacity	124 L
Air breather	
Starting pressure	0.035 MPa
Return filter	
Filter accuracy	12μ
Pressure descending	0.045 MPa @800L/min

LOWER STRUCTURE AND CHASSIS

CENTER JOINT (ARTICULATION JOINT)

⚠ CAUTION!
Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section. **Always use tools and equipment that is in good working order.** **Use lifting and hoisting equipment capable of safely handling load.** **Remember, that ultimately safety is your own personal responsibility.**

TABLE OF CONTENTS

General Description

The loader frame is an articulated type: the front frame is joined to the rear frame with two hinge pins around which the loader pivots for steering.

⚠ CAUTION!

When the loader is steered, the area near center hinge pins becomes so narrow that you may get caught between front and rear frames. Before trying to service the loader, make sure to set frame lock plate.

Prior to moving (traveling) the loader, make sure the frame lock plate is set to original position.

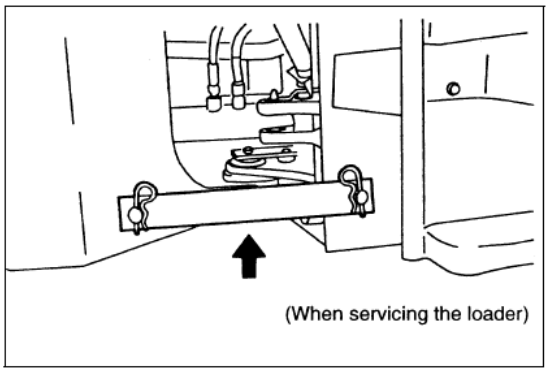


Figure 1

Maintenance Standard

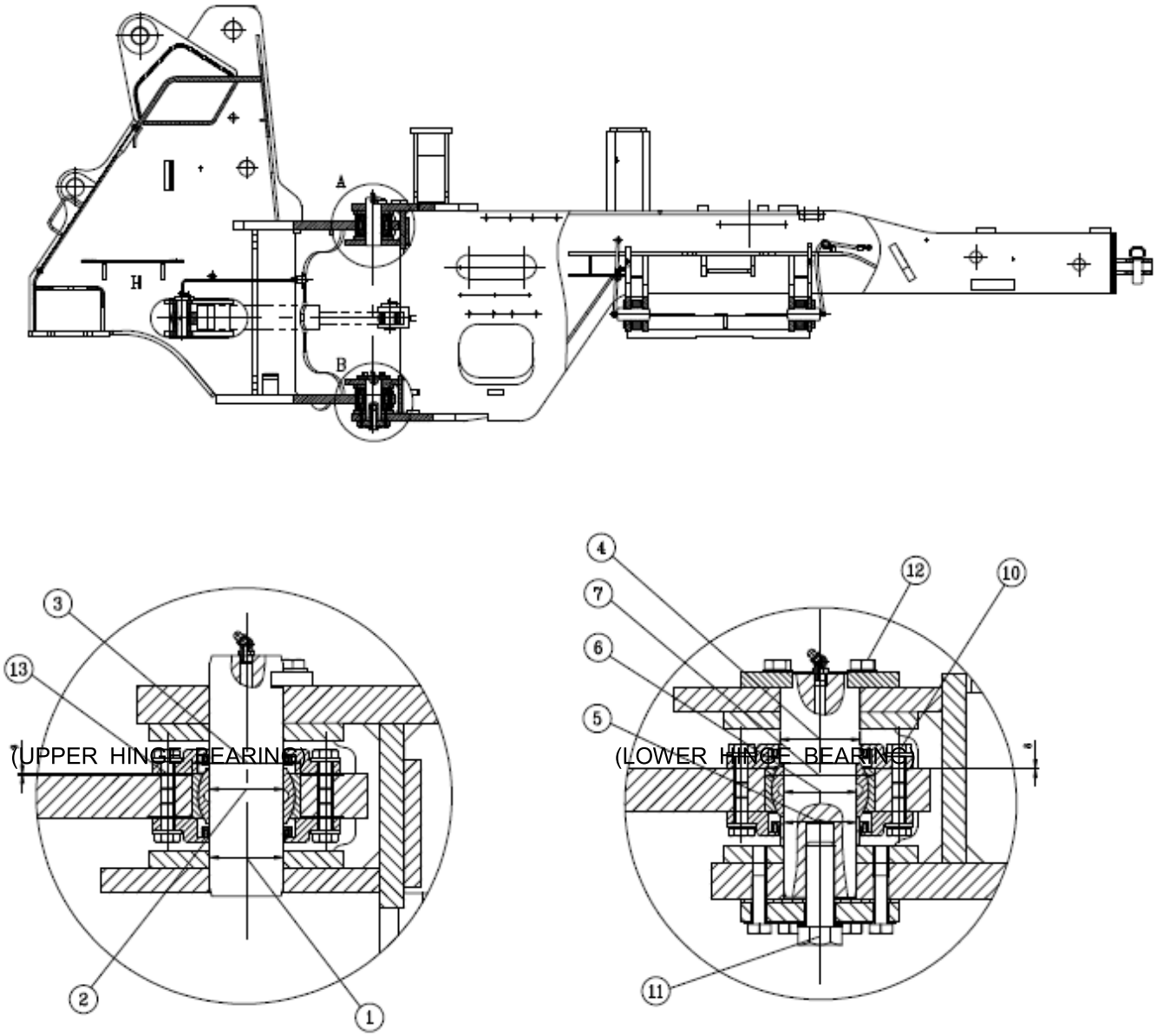


Figure 2

UNIT :*mm*

No.	Check item	Criteria					Remedy
1	Clearance between upper hinge pin and front frame	Standard size	Tolerance		Standard Clearance	Clearance limit	Replace
		60	0	+0.046	0-0.065	-	
			-0.019	0			
2	Clearance between upper hinge pin and bearing	60	0	0	-0.015-0.019	-	
			-0.019	-0.015			
3	Clearance between bearing and rear frame	90	0	0	-0.035-0.015	-	
			-0.015	-0.035			
4	Clearance between lower hinge pin and front frame	66	0	+0.046	0-0.12	-	
			-0.074	0			
5	Clearance between lower hinge pin and spacer	60	0	+0.414	0.34-0.433	-	
			-0.019	+0.34			
6	Clearance between lower hinge pin and bearing	60	0	0	-0.015-0.019	-	
			-0.019	-0.015			
7	Clearance between lower hinge bearing and rear frame	90	0	0	-0.035-0.015	-	
			-0.015	-0.035			
8	Shim thickness for lower hinge and cap (rear frame)	0.5~1.0	-	-	-	-	
9	Shim thickness for upper hinge and cap (rear frame)	0.5~1.0	-	-	-	-	
10	Tightening torque of lower hinge cap mounting bolt (M12)	Final value: 9±1.0 kg·m					Retighten
11	Tightening torque of lower hinge cap mounting bolt (M24)	Final value: 90±1.0 kg·m					
12	Tightening torque of lower hinge pin mounting bolt	When adjusting with shim: 6~7 kg·m					
		Final value: 9±1.0 kg·m					
13	Tightening torque of upper hinge cap mounting bolt	Final value: 9±1.0 kg·m					

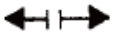
ENGINE AND DRIVING TRAIN

3ton Diesel Engine

⚠ CAUTION!
Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section. **Always use tools and equipment that is in good working order.** **Use lifting and hoisting equipment capable of safely handling load.** **Remember, that ultimately safety is your own personal responsibility.**

TABLE OF CONTENTS

DESCRIPTION OF THE ILLUSTRATION MARKS

	Dismounting (assembly parts)		Oil coating
	Fitting (assembly parts)		Special tools, such as K --- ---, KUKKO, --- ---, TS --- ---W
	Marking (do before disassemble, adjust when assemble)		Pay attention to assembly direction
	Filling- full charge (such as lubricating oil, cooling water etc.)		Deflating
	Draining off (lubricating oil or cooling water)		Unloosing (such as: unloose clamping equipment)
	(loose-proof-fixed) Coat fluid sealant		Clamping (such as: reinforcing clamp equipment)
	Accident preventing (marks for dangerous occasion)		Inspecting-adjusting (such as: tightening torque, dimension pressure and clearance)
	Replacement when reassembly		Inspecting

USAGE INSTRUCTION

OPERATING NOTICE FOR NEW DIESEL ENGINE

During the first 60th, the speed of diesel engine for construction machinery and tactor is limited to work an partial load (fuel throttle is at 3/4 position).

During the first 2000km (about 60h), the speed of diesel engine for vehicle is limited to not exceed 80% of the rated speed.

After a running-in period in the first use, the oil in new diesel engine should be replaced, If not, the parts of diesel engine could be worn out or damaged, The correct maintenance will make diesel engine better in performance, more economic running and longer in service life.

Oil-pressure gauge, temperature gauge, warning indicating lights and other instruments shall be checked every day for their normal function.

Daily inspection and maintenance should be done according to this instruction.

UNSEALING DIESEL ENGINE

After you have unpacked your diesel, firstly you should check diesel engine and the accessories with it and inspect if diesel engine is damaged, and then you begin to do the followings:

Clean the antirust coat and anti-corrosive agent on parts close to the air.

Drain off the oil in oil seals inside fuel filter and parts in fuel system (Start-up is also permitted without draining off the oil-seal's oil in fuel system, but diesel engine may not run under full load until the oil-seal's oil is used up and normally replenished by diesel engine).

Turn the wheel and spray in the air inlet valve with solvent until the oil-seal's oil id driven out.

Spray in the exhaust port of turbocharger with solvent until the oil-seal's oil is driven out.

According to the agreement between the manufacturer and the user, fill oil in the empty oil sump as per specifications.

According to the agreement between the manufacturer and the user, check the performance of coolant that has been filled up, if needed. The usable coolant must be under the conditions of temperature -30°or-50°， Ph value7-8(neutral), general hardness value 5-15° d[9-27°f(hardness)]. If the coolant cannot meet the above-mentioned requirements, drain off it and new coolant with antifreezing agent.

MOUNTING AND POSITIONING OF DIESEL ENGINE

Hoisting, mounting and positioning of diesel engine shall be done in accordance with diesel engine operation manual.

PREPARATION BEFORE START-UP

Add coolant.

Add oil.

Add fuel.

START-UP OF DIESEL ENGINE

Put the power switch and key in the starting position.

Place the gear shift lever in the neutral position.

Step on the clutch pedal and accelerator pedal, then pull the handle of excessive fuel device (if available), and operate the starter. After start-up of diesel engine, return the handle of excessive fuel device to its original position, If diesel engine cannot be started, wait for about one minute and repeat the above operation. The pressure value is shown value is shown at once on the oil manometer after start-up of the engine, In heat starting of the engine, it is unnecessary to use the excessive fuel device.

Start-up in low-temperature.

Flame-preheat starting device with electronic control.

When the water temperature of the engine is below -23°C， open the key switch and the preheating indicating light on lighting, the electro-heat plug is heated through electricity, and for 50 seconds, the preheat indicating light twinkles automatically. After the electro-heat plug has been heated to 850°C -950°C, Press the starting button and switch on the starter, So the fuel way automatically opened by the electromagnetic valve, through which the electro-heat plug can be supplied with fuel so as so start the engine at -25° smoothly with the flame preheat starting device.

RUNNING OF DIESEL ENGINE

When the engine running at the speed lower than the speed of the biggest torque, it is not allowed to continue running on full load over 1 min.

After running on full load, the engine should run in idling speed for 3-5minutes before stopped.

Often watch and check the oil pressure gauge and coolant temperature meter, Stop the engine if the pressure and temperature cannot meet the standard requirement.

NOTE: *Diesel engine can not continue to run when the coolant temperature is lower than 60°C or higher than 100°C, because this would damage the engine.*

Engine’s running stop

The oil pressure gauge and the coolant thermometer shall often be watched. If the pressure and temperature do not conform to the specified values, diesel engine should be stopped.

NOTE: *The Engine should run in idling speed for 1-2 minutes before stopped.*

GUIDE FOR MAINTENANCE OF DIESEL ENGINE

DAILY MAINTENANCE

Inspection

1. Check the oil level;
2. Check the coolant level;
3. Check whether the fan id damaged;
4. Check whether the V-belt is cracked or scratched;
5. Check whether the accessories are fixed well;
6. Check whether the water or oil is leaking;
7. Check whether the charging indicator light is in order.

PERIODIC MAINTENANCE

Regular maintenance can be conduct on as per the following table. If the operating condition is heavy dust content or engine running on started-stopped frequently, the regular maintenance period should be shortened accordingly.

Maintenance Period:

Period	Running hours(h)	Running Kilometer
The first inspection	30-50	1500-2000
Periodical inspection	Every 250	10,000
Maintenance I(WD1)	Every 500	20,000
Maintenance2(WD2)	Every 1000	40,000
Maintenance 3(WD3)	Every 2000	80,000
Maintenance4(WD4)	Every 4000	160,000

Maintenance Items:

Items	Replacement	Adjustment	Inspection
First checking	Oil Oil filter	Valve clearance	Tighten pipe clamps. Tighten V-belts.
Routine checking	Oil Oil filter		Tighten V-belts.
Level 1 maintenance	Oil Oil filter Fuel filter	Valve clearance	Air filter. Air intake system. Tighten pipe clamps. Tighten V-belts.
Level 2 maintenance	Oil Oil filter Fuel filter	Valve clearance	Air filter. Air intake system. Tighten pipe clamps. Tighten v-belts.
Level 3 maintenance	Oil Oil filter Fuel filter Coolant Air filter	Valve clearance	Air filter. Air intake system. Tighten pipe clamps. Tighten V-belts. Inspect and adjust the injection fuel pump on test bench.
Level 4 maintenance	Oil Oil filter Fuel filter Coolant Air filter	Valve clearance	Air intake system. Tighten pipe clamps. Tighten V-belt. Check the bearing clearance of turbocharger. Inspect and adjust the Injection fuel pump on test bench.

MAINTENANCE RECORD

Engine number_____ Model

User _____ Equipment

Date	Running Kilometers/ hours or interval hours	Actual Kilometers	Maintenance contents	Operator	Remark

MAINTENANCE CONTENTS OF DIESEL ENGINE

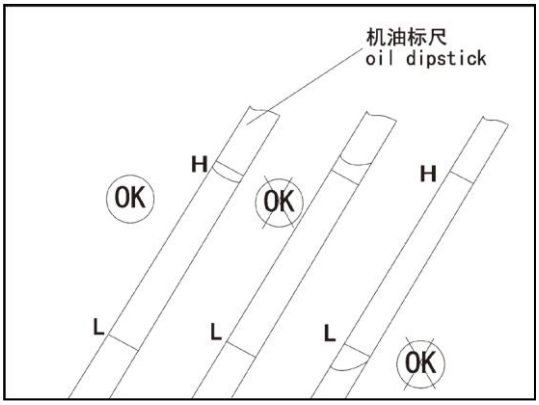
DAILY MAINTENANCE

Preventive maintenance should be done everyday in order to understand the engine's condition.

Before starting the engine should check the oil level and coolant level.

Inspect：

- Leakage
- Fast wearing parts
- Any unconventionality

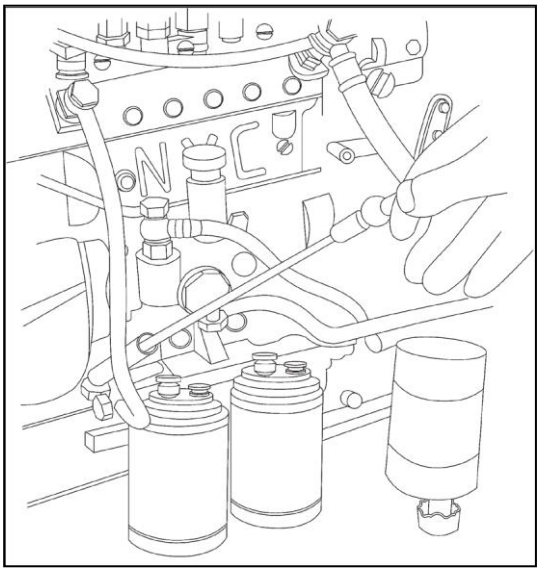


Inspect the oil level height

When the oil level is lower than the lower limit or higher than the upper limit, it is not allowed to start the engine.

After the engine stopped, inspect the oil level at least 5 minutes later in order to ensure the oil can flow back to the oil sump.

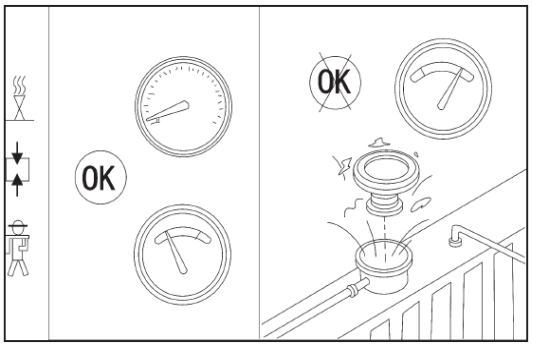
The oil-volume values from the low scale mark to the high scale mark are respectively 3.25 liter (3-cylinder engine), 5 liter (4-cylinder engine) and 6liter (6-cylinder engine).



Inspect the coolant level

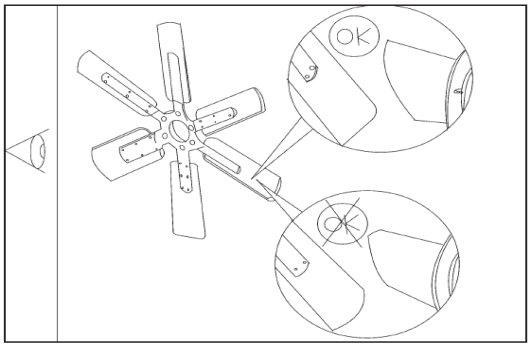
Inspect the coolant level through the vitreous view hole，if the coolant is not sufficient，open the inlet cover and fill into the coolant.

NOTE: *When opening the inlet cover，must press down the exhaust button firstly to prevent hot coolant from injuring people.*



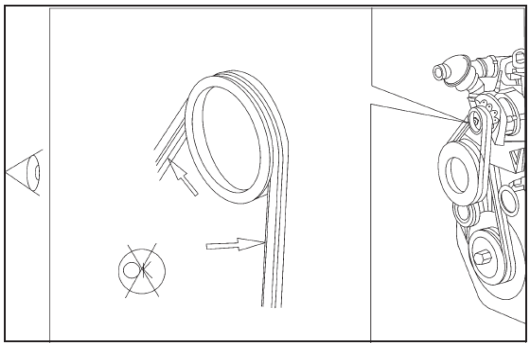
Inspect the fan

Check whether the plastic fan is distorted. For steel fan，check whether the rivet loosened and the vane is curved to ensure reliable running.



Inspect the V-belts

Inspect the V-belts with your eyes to find if there is any crack or scratch on the V-belts. Replace them if necessary.



MAINTENANCE CONTENTS AT INTERVALS OF 250H (OR RUNNING MILEAGE 10,000KM)

The following contents will be added except daily maintenance items:

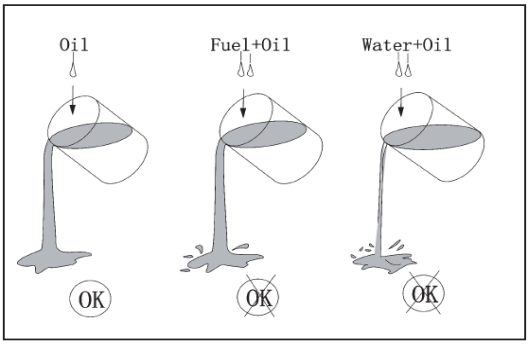
Replace the oil and oil filter.

The oil will be polluted after using，the pollution contents is of accordance with the consumption of fuel and oil.

NOTE: *The replacement period of oil under proper using condition cannot beyond 250h (10,000Kilometers).*

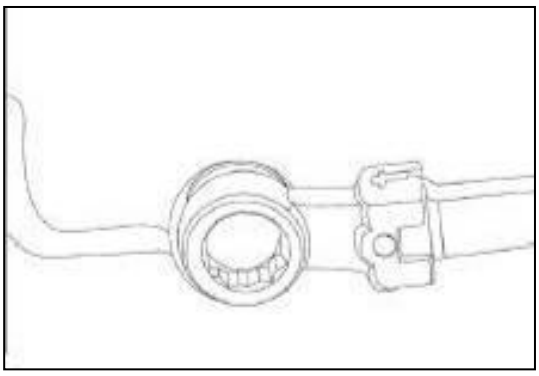
Replace the oil and oil filter to clean the impurities containing in oil.

NOTE: *The oil should be drained off when it is hot*.



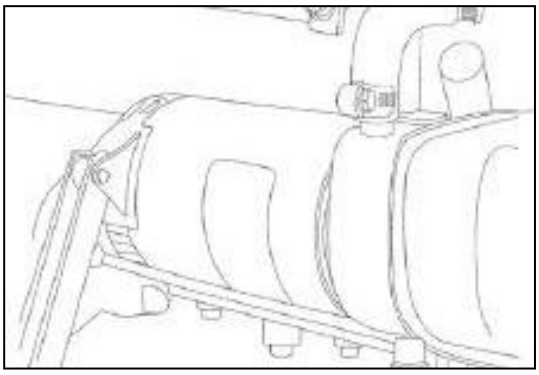
Dismantle draining plug screw; prepare to collect the oil of 7.25L, 9.25L and 13L respectively to 3-cylinder, 4 cylinder and 6cylinder engines.

Note: *Hot oil can injure people.*



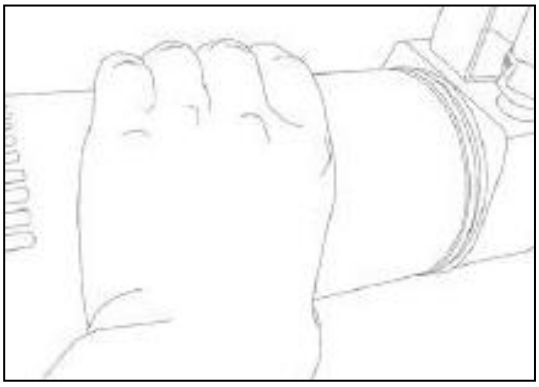
Tool: The special wrench forfilter.

Clean the end surrounding of the filter, and remove it.



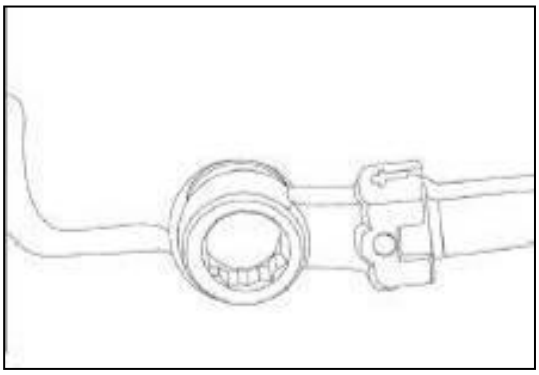
Install the new oil filter.

NOTE: *Adjust the seal ring and smear some lubricating oil on it while fitting the oil filter.*



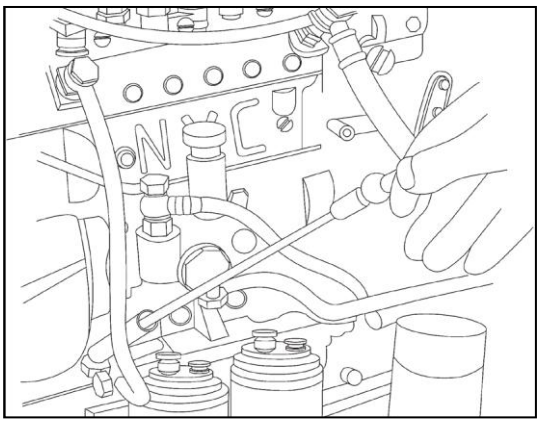
Check and clean the screw thread and seal ring， and then install the whorl plug.

TOOL: 19mm open-ended wrench.



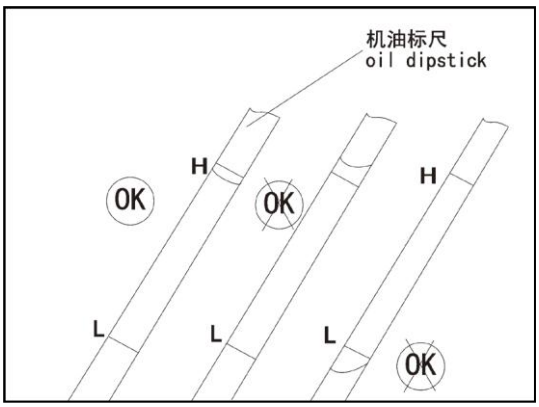
Fill the cleaned oil into diesel engine and let it reach the upper scale mark of dipstick, The capacity of oil sump is 7.25L, 9.25L or 13L respectively to 3-cylinder, 4cylinder or 6 cylinder engine.

Note: *For 3ton diesel engine CD 15W/40 grade oil must be used.*



Run the engine at idling speed and check the filter to find whether it leaks or not.

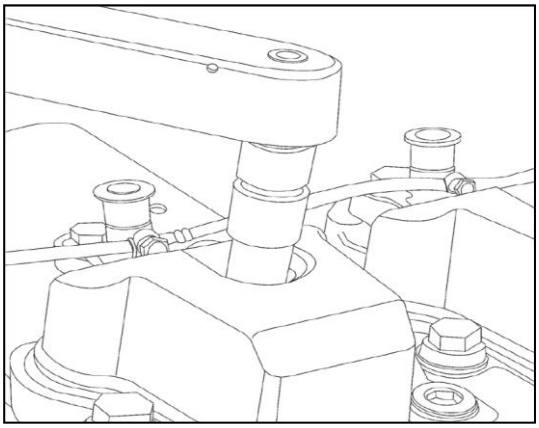
Stop the engine and make the oil run into the sump from the upper parts 5 minutes later，then check the oil level，fill oil up to the upper limit if necessary.



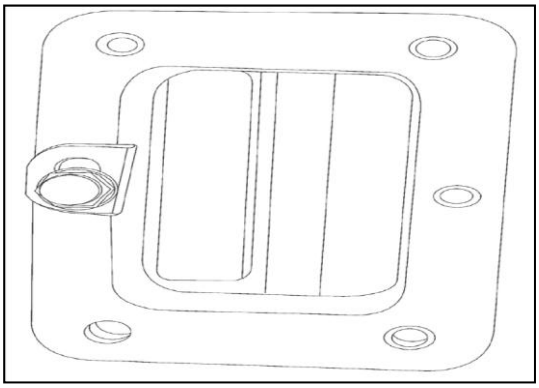
Check and adjust the valve clearance.

Disassemble 6 cylinder head covers.

TOOL: 13mm sleeve wrench



Turn diesel engine slowly, make the upper scale mark on flywheel housing align the OT scale mark on flywheel, and at this time, let the piston of the first cylinder be located in the top dead center in the compression stroke (intake and exhaust valves of Cylinder 1 closed)

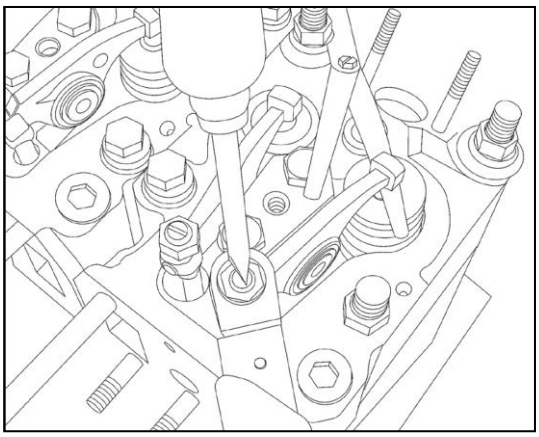


The clearance of intake valve is 0.20mm

The clearance of exhaust valve is 0.30 mm

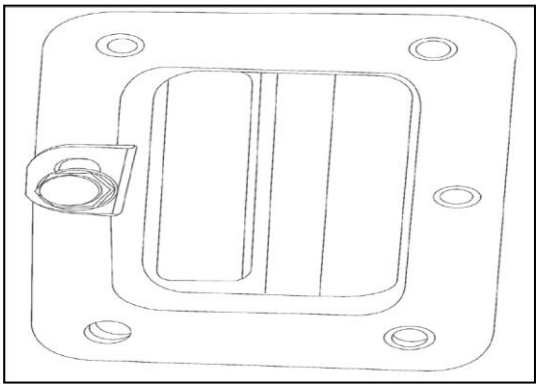
Note: *When check the clearance of valve, the engine should be at the Cool condition-its temperature is less than 60D°C. When the clearance guage glides between the top of valve rod and rocker arm and can be felt retarded and sticky, the measuring result is proper.*

TOOL: Clearance gauge.



The piston of 1st cylinder is at TDC of the compression stroke.

At this time, adjust the 1st, 2nd, 3rd, 6th, 7th and 10th of 6-cylinder engine (from crankshaft pulley end).Adjust the clearance by using the feeler and tighten the lock nuts of the rock arm. Recheck the valve clearance till it is qualified.

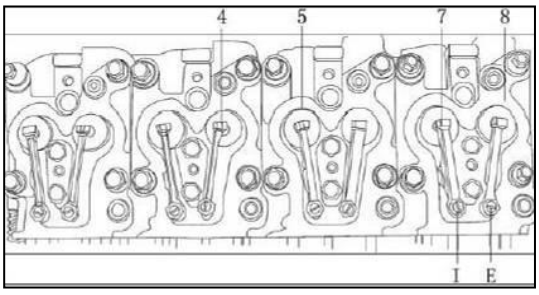


Check and adjust the valve clearance as step A (I-air intake Valve E-air exhaust valve)

Adjust the clearance by guage and tighten the fixing nut of rocker arm, re-check the clearance till it meets the requirement.

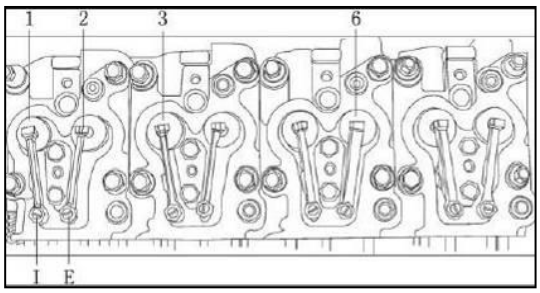
TOOL： 6# screwdriver and 14mm double offset ring wrench.

Next, turn the crankshaft to 360°C; or mark on the shock absorber, and then turn it to 360°C. At this time, adjust the 4th, 5th, 7th and 8th valve clearances of the 4-cylinder engine and 4 the, 5th, 8th, 9th, 11th and 12th of the 6-cylinder engine (counted from the crankshaft pulley end). Loosen the lock pinch nut of the rock arm, adjust it by using the feeler and tighten it well.



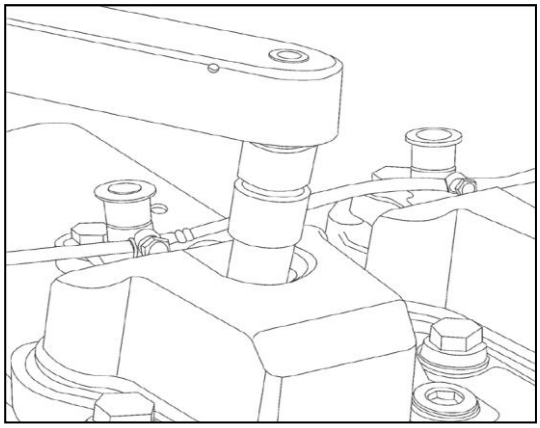
Adjust the valve clearance as step B.

Loosen the fixing nut of rocker arm, adjust the clearance by guage then tighten the nut again.



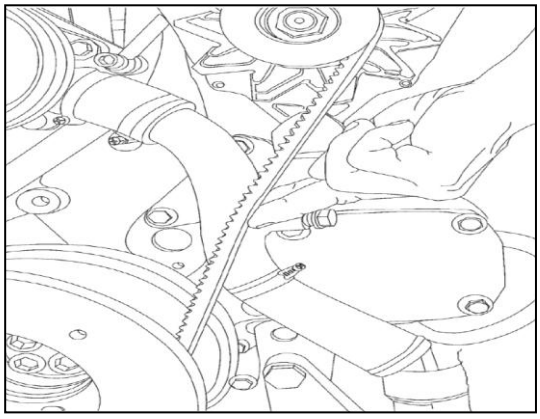
Install the gasket and cylinder head cover.

The tightening torque of bolt is 10-15N·m.



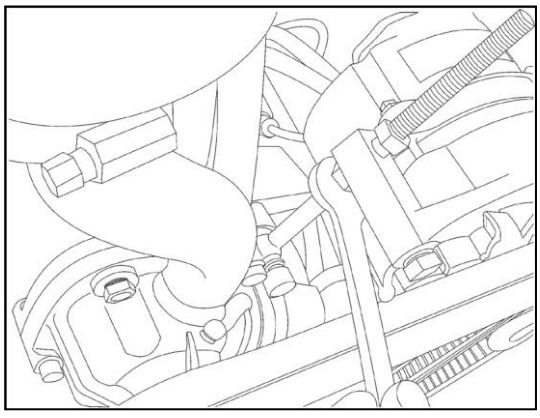
Check the tension of V-belts.

Measure the flexibility in the max. span of poly V-belt. Generally, under the pressure of 4-5kgf, the belt flexibility is less than 20mm.

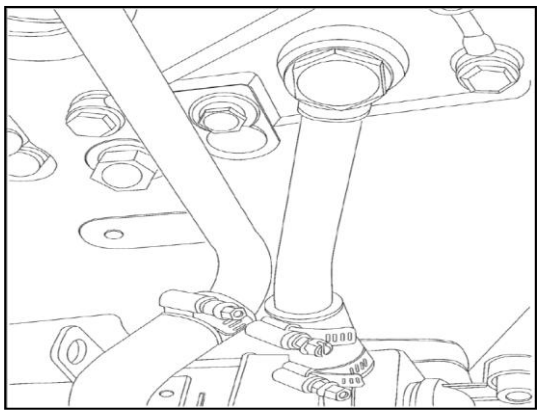


8mm inner-hexagon spanner and 16mm open-ended wrench.

If the flexibility is over 20mm, the poly V-belt is shown loose, Unscrew the tensioning bolt and the lock nut, retension the V-belt, and then tighten the tensioning bolt and the lock nut.



Check the rubber hose in the cooling pipeline for its aged and cracked situation, and check the hose clamps for its loosing. Fasten or change the related parts, if necessary, to ensure the seal Performance.

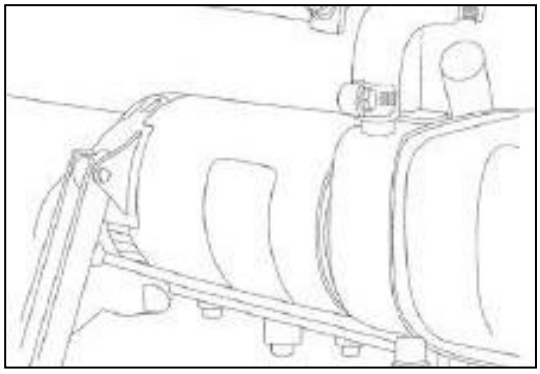


ADD THE FOLLOWING MAINTENANCE CONTENTS EVERY 500H(20,000 KILOMETERS)

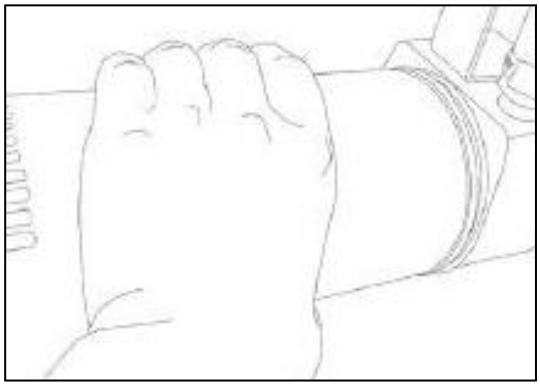
Replace the fuel filter.

Special spanner for filter.

Clean the fuel filter around the head and take down it.



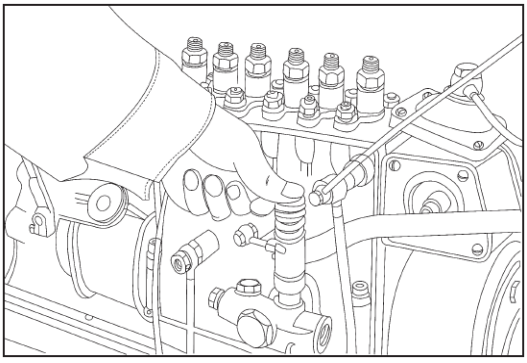
Mount a new fuel filter.



Release the air out of the low-pressure fuel passage and the fuel filter.

Unscrew the fuel-draining screw fixed in the fuel inlet of injection pump.

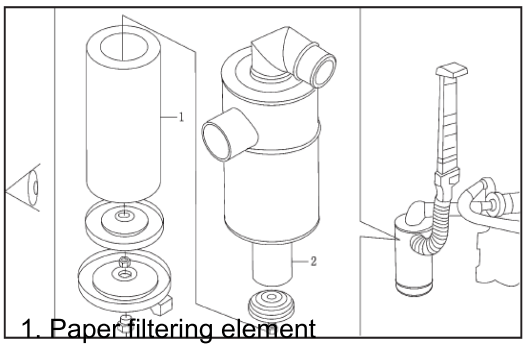
Press on the plunger of fuel transfer pump until no air exists in diesel fuel that flows out of the fuel-draining screw; and then tighten up the fuel-draining screw.



Check the air filter element

In diesel engine, the allowable max inlet resistance is 5KPa and it must be inspected when the engine works at rated speed and full load. If this resistance reaches the maximum permissible limited value, the filter element shall be cleaned or replaced according to the requirements of manufacturer.

Caution: *Never operate the engine in any case of no air filter otherwise the dust and impurities will come into diesel engine and result*



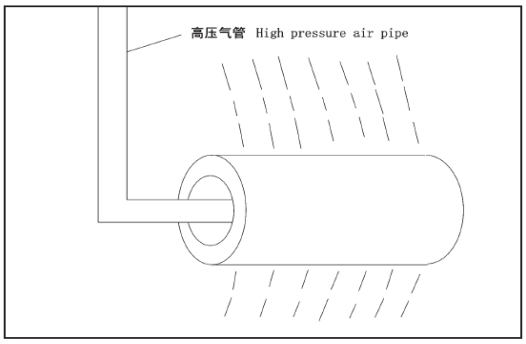
1. Paper filtering element
2. Blanketry safety filtering element

Take down the filter element from the air filter, clap it at end lightly and make dust on it fall down. Alternatively, blow it inversely with compressed air (from inner to out).

Note: *Don't blow off the air filtering paper.*

Don't clean the air filtering paper by water and oil.

Don't beat the core forcibly.

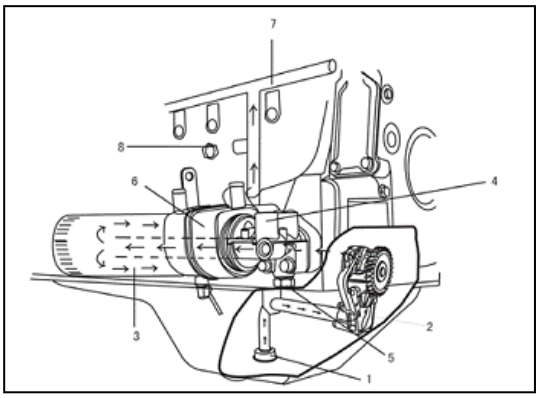


THE MAIN SYSTEM FLOW CHART OF ENGINE

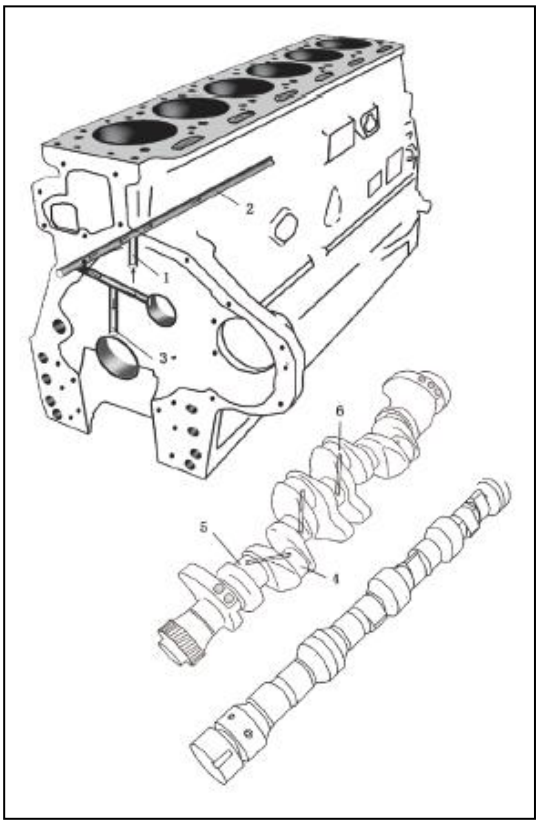
- Lubricating system;
- Cooling system:
- Intake and exhaust system;
- Fuel supplying system;

To understand the main system flow chart of the engine will give help to you for operating and maintaining the engine.

Lubricating System



1. Strainer
2. Oil pump
3. Oil filter
4. Filter seat
5. Relief valve
6. Safety valve of oil pump
7. Main oil passage
8. Pressure limiting valve



Lubricating for main moving parts

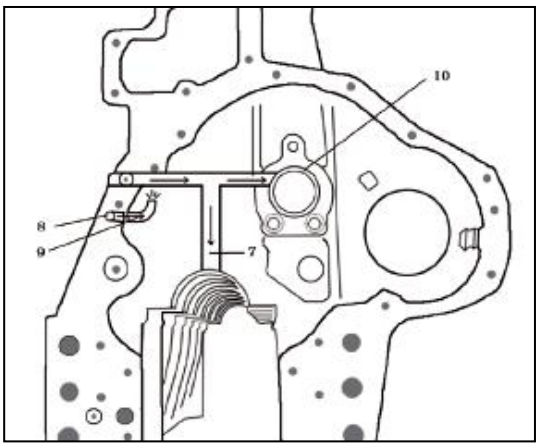
1. The oil flowing from the oil cooler
2. Main oil passage
3. Oil to the main crankshaft journal
4. Connecting rod journal
5. The main journal of crankshaft
6. Oil to connecting rod beating

7. The branch oil passage passing to main Dearing

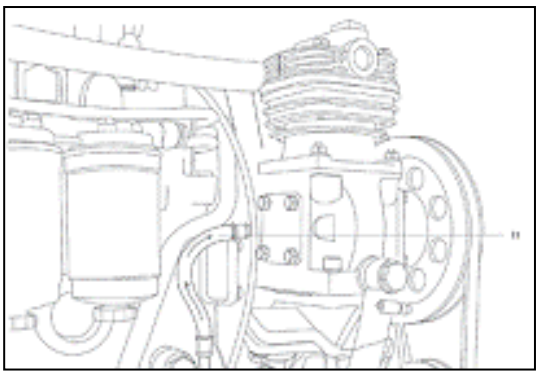
8. Sub-passage of oil

9. Oil injection nozzle to Cool piston

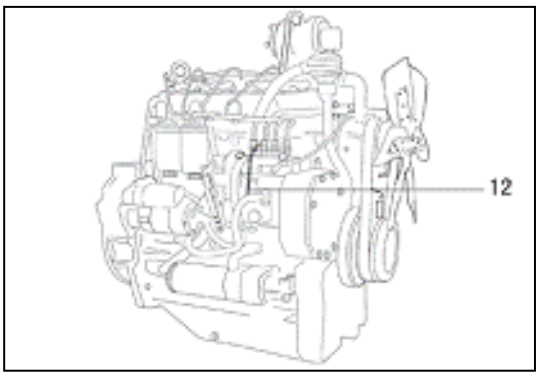
10. Camshaft beating



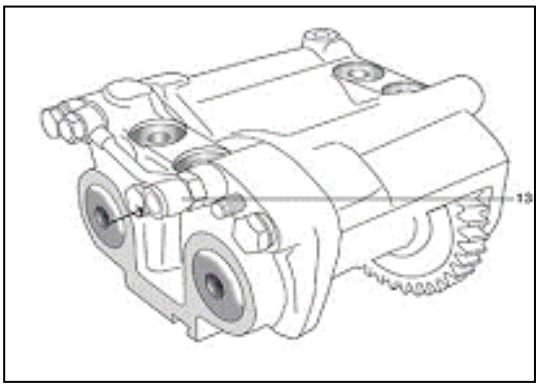
11. Lubricating air compressor with oil from main oil passage.



12. Lubricating fuel injection pump with oil from secondary oil passage.

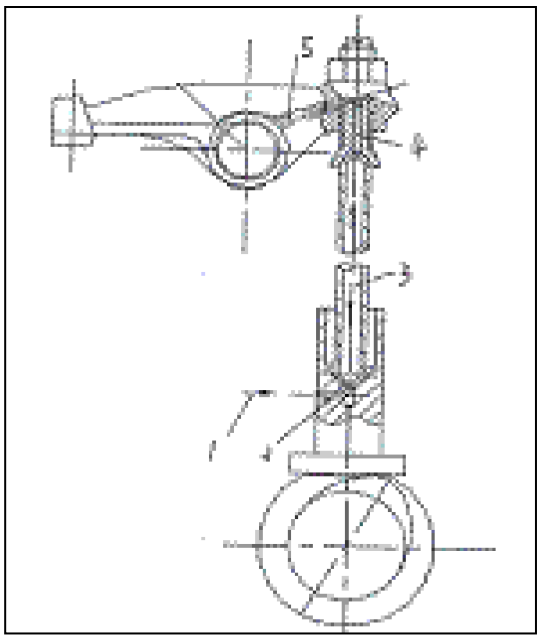


13. Lubricating two-stage balancing mechanism with oil from main oil passage.



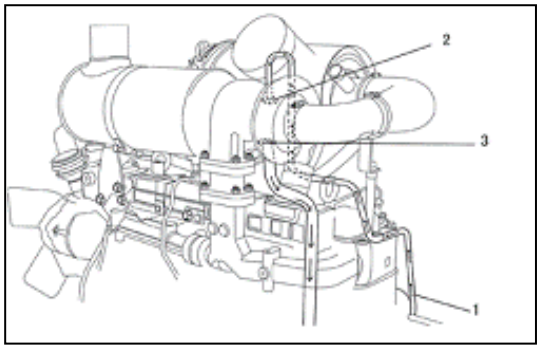
Lubricating for rocker arm system

1. Oil flowing from the oil branch passage
2. Tappet oil hole
3. Push rod oil hole
4. Oil hole of rocker arm bolt
5. Oil hole of rocker arm



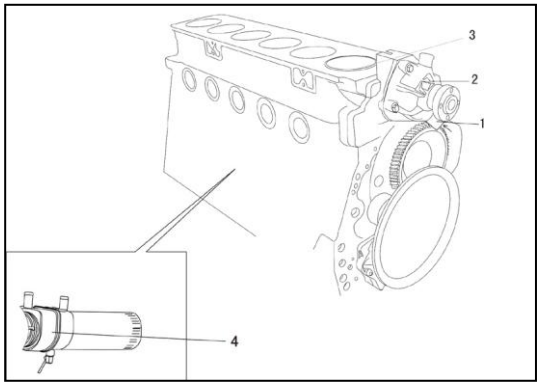
Lubricating turbocharger

1. Oil from the main oil passage
2. Oil inlet of turbocharger
3. The oil outlet of turbocharger

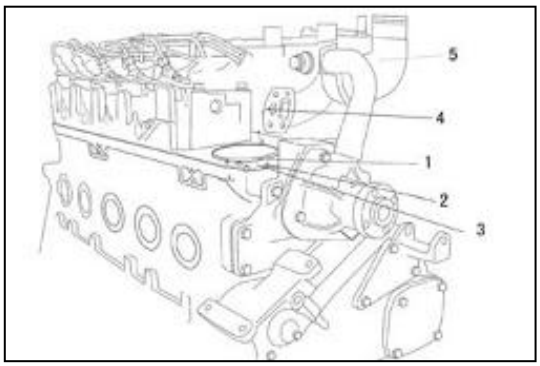


Cooling System

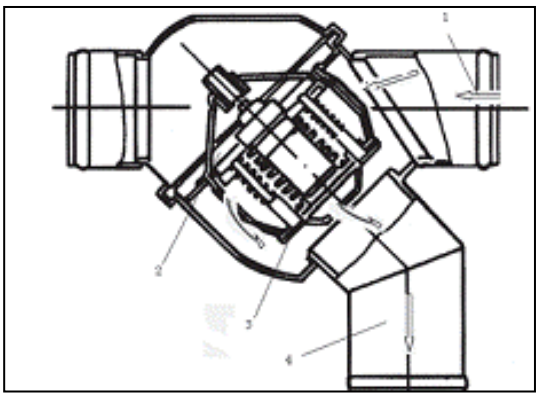
1. Water pump inlet
2. Water pump
3. Water jacket of cylinder block
4. Oil cooler

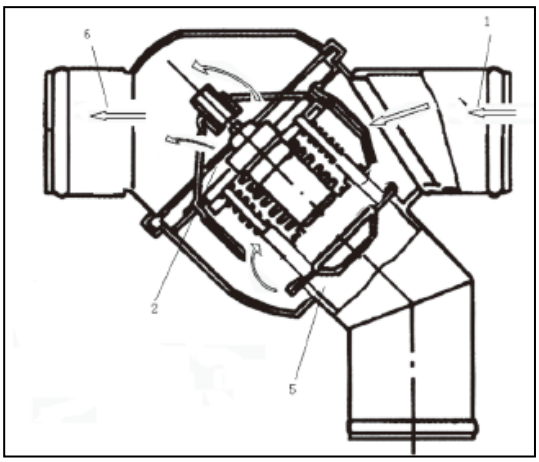


1. Water jacket of cylinder block
2. Cooling water flowing from water jacket of cylinder block
3. Cylinder head gasket
4. Cooling water passing through the water passage of cylinder head
5. Cooling water outlet



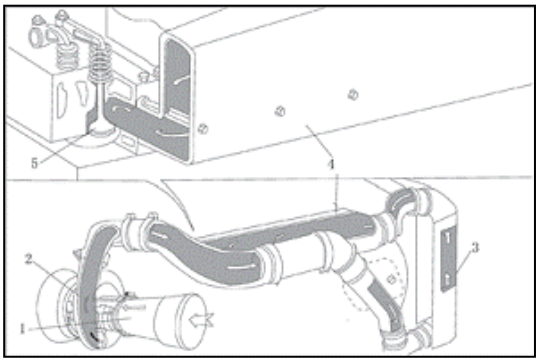
1. Coolant flowing from cylinder block
2. Thermostat
3. Bypass valve
4. Coolant flowing into water pump
5. Bypass valve closed
6. Coolant flowing into the radiator



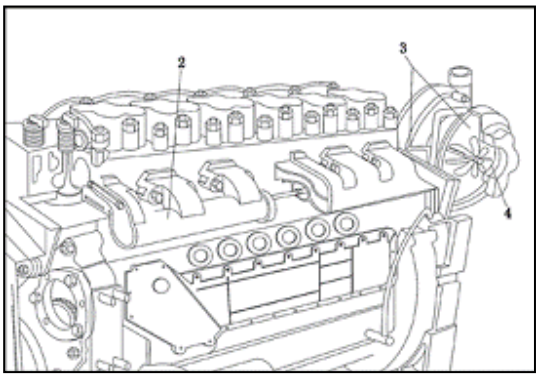


Intake and Exhaust System

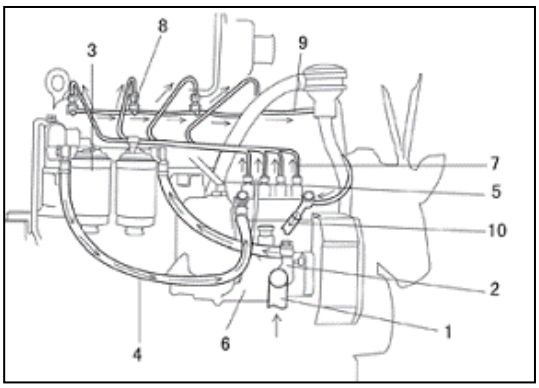
1. Air cleaned through air filter into supercharger (no supercharger unless supercharged engine)
2. Pressurized air through inter-cooler (no inter-cooler for supercharged and noninter cooled engine)
3. Inter-cooler
4. Intake manifold
5. Intake valve



1. Exhaust Valve
2. Exhaust manifold
3. Exhausting gas flowing into the turbo of turbocharger
4. Exhaust outlet of turbocharger



Fuel Supplying System

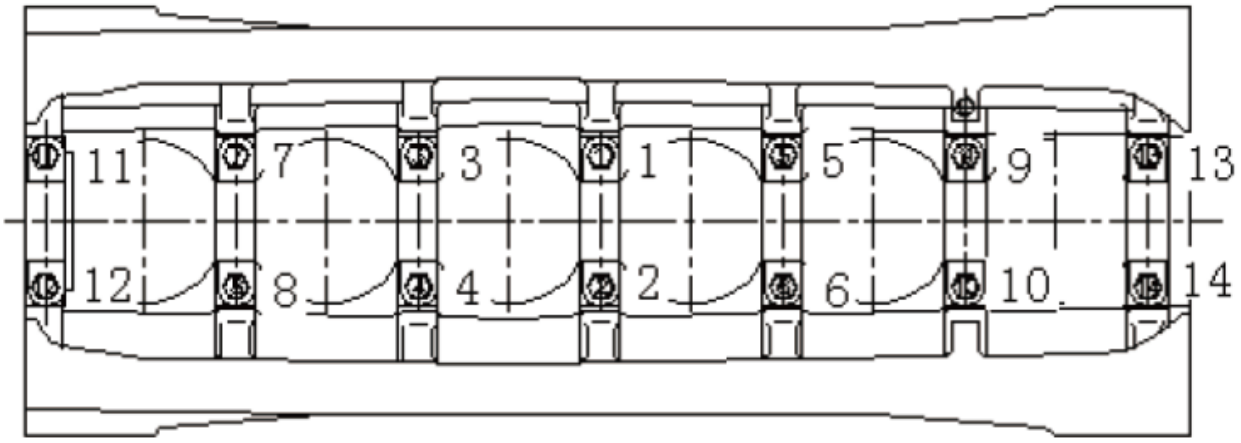


1. Fuel from the fuel tank
2. Fuel delivery pump
3. Fuel filter
4. Fuel delivery pipe
5. Air-limiting pipe of fume limiter(Only existing in supercharger)
6. Fuel injection pump
7. High pressure fuel pipe
8. Injector
9. Fuel returning pipe of injector
10. Fuel pipe back to the fuel tank

TIGHTENING TORQUE AND TIGHTENING METHOD O F HIGH STRENGTH BOLTS

MAIN-BEARING BOLT

8 pieces M14 (10 pcs for 4-cylinder engine and 14 pcs for 6-cylinder engine), sleeve wrench 22mm.



For a 6-cylinder engine, tightening is done in two times (in sequence as shown in the above figure).

Firstly, in 70 N·m;

Secondly, the bolt is turned 90°±4°. For 3-cylinder and/or 4-cylinder engines, in reference to the same figure, the bolt is screwed down in two steps, namely even in the middle and extended at two ends.

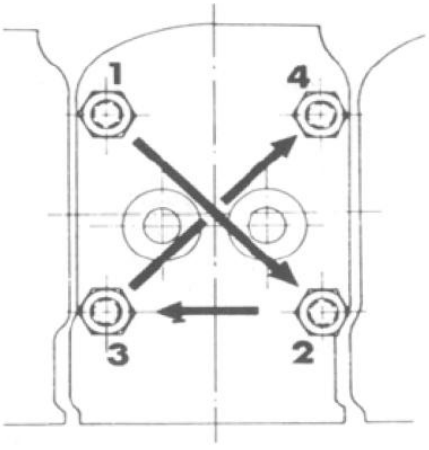
CYLINDER HEAD BOLT

12 pieces M14 (16 pcs for 4-cylinder engine and 24 pcs for 6-cylinder engine), 17mm sleeve wrench.

Following such tightening sequence：

Step 1: Cylinder head must be aligned after amounted, i.e. the sides of both air inlet and exhaust outlet should be on the same plane;

Step 2: The cylinder head bolts on each cylinder shall be screwed down in the order of the under figure;



1. Pre-tighten in 30 N·m torque;

2. Turning angle is 120°± 4°

3. Re-turning angle is 120°± 4°

Step 3: The tightening sequence of the cylinder head bolts in the whole engine is as follows:

3-cylinder engine: 2-1-3

4-cylinder engine: 2-3-4-1

6-cylinder engine: 3-4-5-2-1-6

And as per Step 2, the course of screw-down shall be carried out in three times.

Caution: *In every tightening, the bolt itself has an extension of 0.2-0.6 mm in length. In spite of its repeated use, its length cannot be over 160.5 mm, if so, it must be replaced with a new one.*

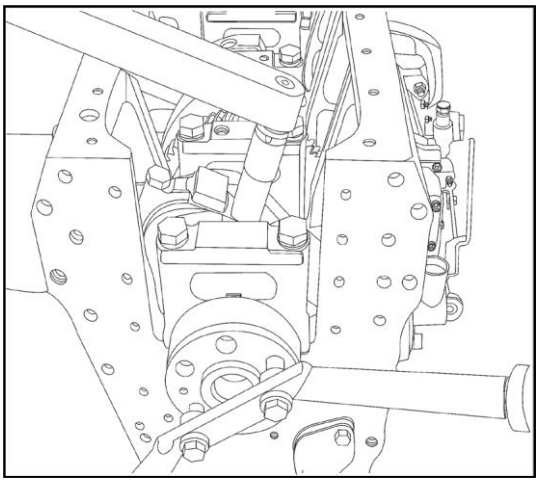
CONNECTING ROD BOLT

2 pcs M12x1.5 for each connecting rod, 19 mm sleeve wrench.

Step 1： Tighten tightly， then tighten these bolts symmetrically with a torque of 30N·m.

Step 2：Turn these bolts 60°±5°

Caution: *The connecting-rod bolt is only of one-time use and may not be used again.*



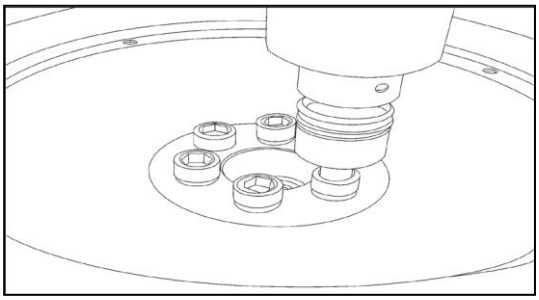
FLYWHEEL BOLT

6 pieces M16, 24mm sleeve wrench

Step1: Firstly screw on symmetrically.

Step 2: Screw down symmetrically in 285-295N·m torque. The bolt under the expected torque must be changed.

Note：*The flywheel bolt is only allowed to be reused for 2 times.*

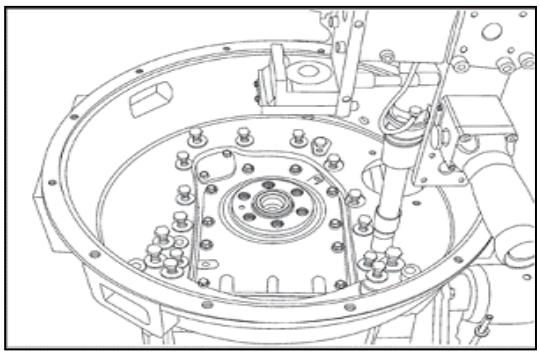


BOLT FOR FLYWHEEL HOUSING

12pieces M10, 6pieces M12, 16mm and 18mm sleeve wrenches.

Step 1: Screw on the bolts.

Step 2: Screw down the bolts in such tightening torque, for M10 80-85N·m and M12, 140-145N·m;



Replace the bolt under the required torque.

The flywheel housing bolt can only be used twice.

Caution: *All the above-mentioned strengthening bolts should be coated with lubricating oil on the thread and bearing surfaces before their screwing in.*

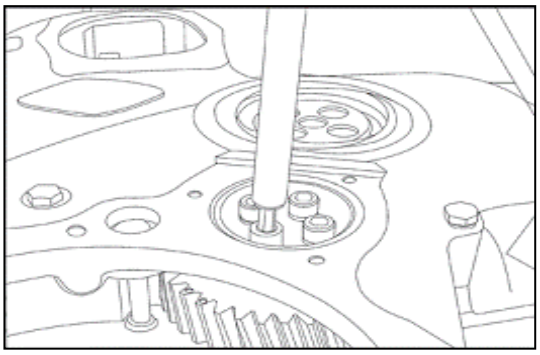
INTERMEDIATE GEAR SHAFT BOLT (EURO II ENGINE)

4 pieces M10, 15mm sleeve wrench.

Step 1: Tighten the bolts with torque 60N·m symmetrically.

Step 2: Turn the bolts 90°, let the torque value come to 100-125N·m, Replace torque value come to 100-125N·m, Replace the bolt under the required torque value.

Before screwing-in, the thread should be coated with the LOCTITE 242 Sealant (a Chinese Brand).

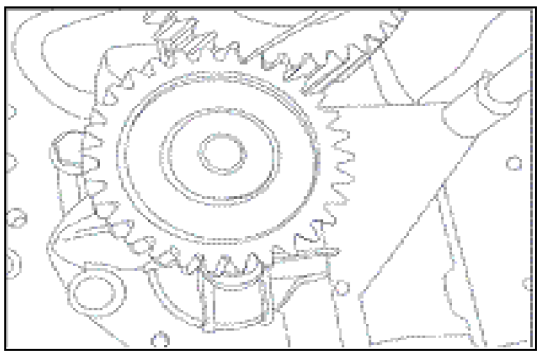


OIL PUMP BOLT

2 pcs M8, M8 nut (1 piece), 13mm sleeve wrench

The bolt M8 is once tightened to 30-40N·m and the lock nut to 20-25N·m.

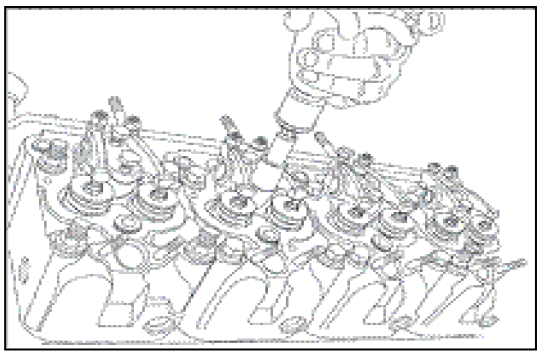
Before screwing-in, the thread should be coated with the LOCTITE 242 sealant.



ROCKER-ARM SEAT BOLT

Bolt M10, 16mm sleeve wrench

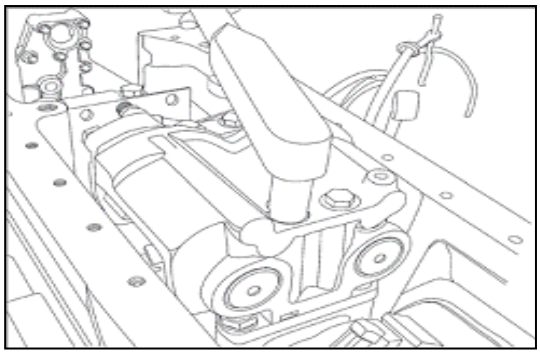
The bolt is once tightened to 40-45N·m



FASTENING BOLT FOR TWO-STAGE BALANCING MECHANISM

4 pcs bolts M10, 16mm sleeve wrench

The bolt is once tightened to 35-40N·m

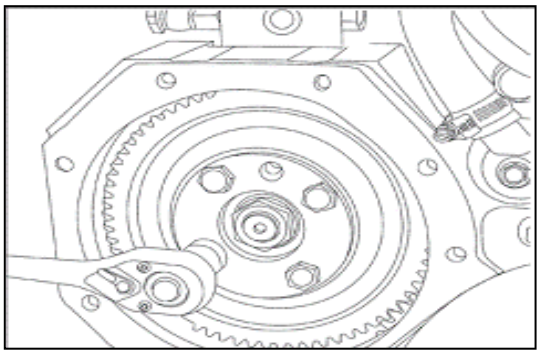


FASTENING BOLT FOR INJECTION-PUMP GEAR

4 pcs bolts M8 (M10), 13mm (16mm) sleeve wrench.

The bolt is once tightened to 30-35N·m (60-65 N·m)

Before screwing-in, the thread should be coated with the LOCTITE 242 sealant.

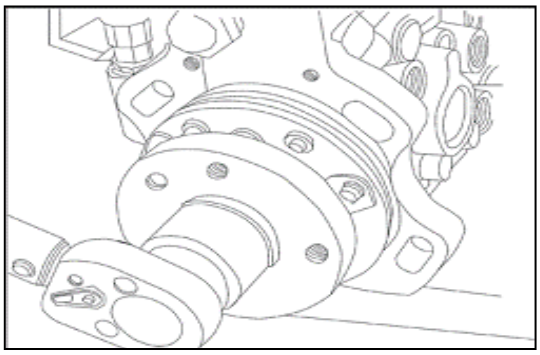


NUT FOR INJECTION-PUMP SHAFT

M18x1.5, 27mm sleeve wrench.

The nut is once tightened to 100-110N·m.

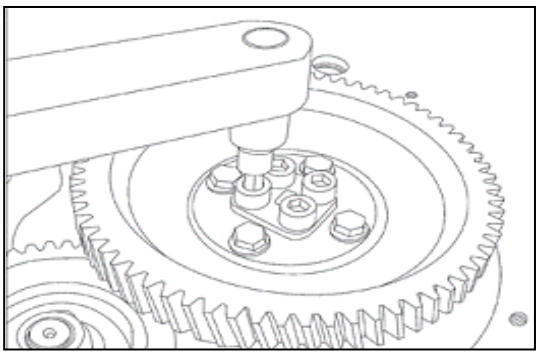
Before screwing-in, the thread should be coated with the LOCTITE 242 sealant.



FASTENING BOLT FOR CAMSHAFT GEAR

4 pcs M10x1.25, 16mm sleeve wrench. The bolt is symmetrically tightened to 85-90N·m.

Before screwing-in, the thread should be coated with the LOCTITE 242 sealant.

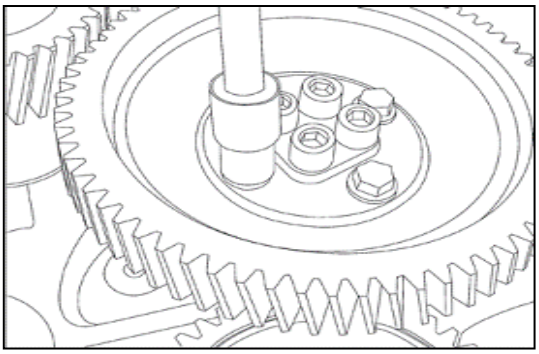


FASTENING BOLT FOR DRIVING GEAR OF CAMSHAFT-AIR COMPRESSOR

4 pcs M8, 13mm sleeve wrench.

The bolt is symmetrically tightened to 55-60N·m.

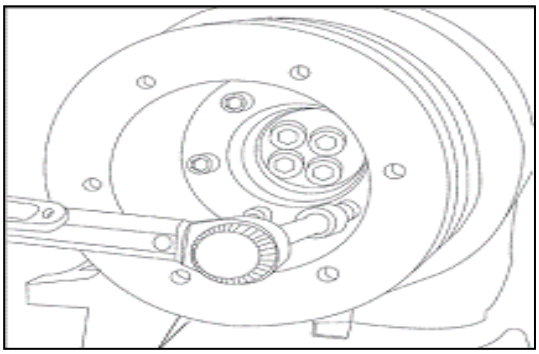
Before screwing-in, the thread should be coated with the LOCTITE sealant.



FASTENING BOLT FOR BELT PULLEY AND HUB

6 pcs M10, inner- hexagon spanner 8mm.

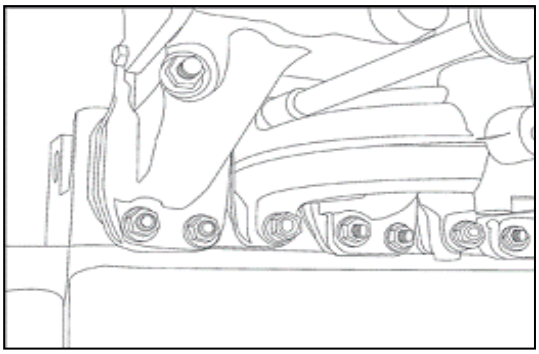
The bolt is symmetrically tightened to 65-75N·m.



FASTENING NUT FOR INTAKE AND EXHAUST MANIFOLDS

M10, 16mm sleeve wrench.

Symmetrically tightened to 45-50N·m.



FUEL, LUBRICANT, COOLANT AND AUXILIARY MATERIALS

FUEL

In Summer No.0 iesel Fuel GB 252-87 In Winter No.-10 Diesel fuel GB252-87

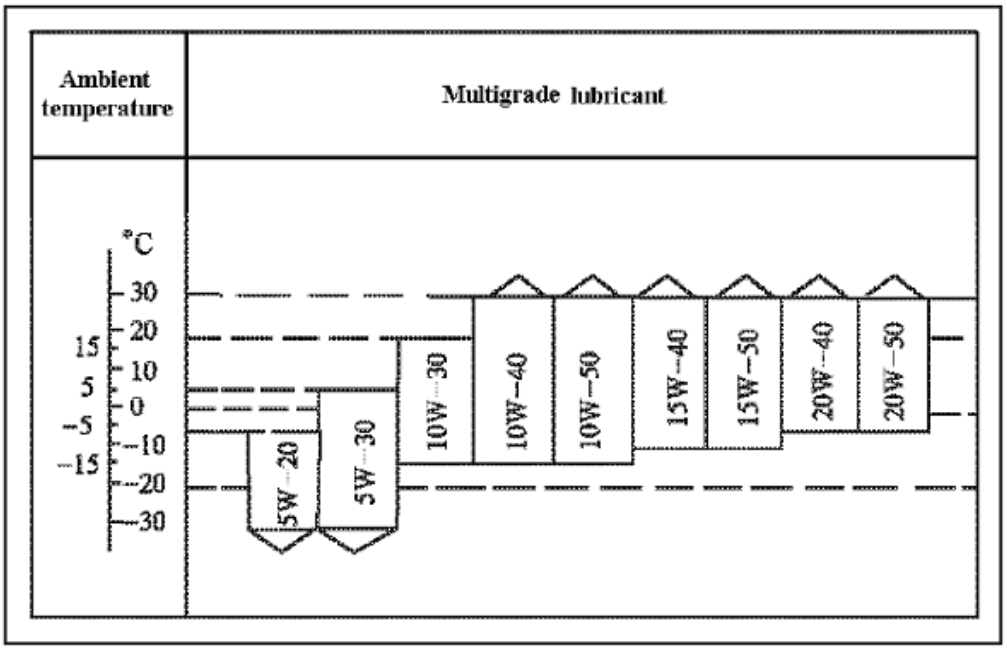
In winter, when the temperature is -20°C, you should use NO.-20 Diesel Fuel. I f the temperature is below -30°C, you should use No.-35 Diesel Fuel.

LUBRICANT

Turbocharged Engine: GB11123 CD oil.

It is allowed to replace low-grade oil with high-grade oil.

Please reference the following chart to choose viscosity of lubricant.



When the oil level is located in the upper limit position of the oil dipstick, the oil capacity is about 7.25L (9.5L for 4-cylinder engine and 13L for 6-cylinder). According to the agreement with users, by the date or delivering the machine, whether or not the oil has been charged in the oil sump is no matter. The oil that has already been filled contains a special kind of running-in (anti-corrosive) agent. Users may drain off the oil and refresh it after the working period of 2000Km or 50 hours. It is recommended to make use of the oil product, by name as Changcheng Diesel Engine Oil CD-grade 15W/40, produced by China Petrochemistry Changcheng High-Grade Lubricant Company.

COOLANT

The antifreeze that can be against rusting and freezing is added in the cooling system. Its compounding pro portion is stated in the instruction of antifreeze.

AUXILIARY MATERIALS

In the course of installation and maintenance of this diesel engine, the sealant and adhesive, such as LOCTI TE 510,242, 271,277 and 262, can be applied.

Fine molybdenum powder

Where all kinds of auxiliary materials can be used is listed in the following table.

Various auxiliary materials for 3ton Diesel Engine

Serial No.	Name	Color	Function and Application
1	Fine Molybdenum Powder	Black	Apply to smooth surface of metal to prevent biting. eg: Apply to exterior surface of cylinder liner.
2	Molybdenum disulfide Lube	Dark Grey	To prevent adhesion of parts under higher temperature. eg，Apply to the bolts of exhaust outlet of turbocharger.
3	Loctite 242 glue	Blue	Apply to thread to seal. eg，Apply to bolts and thread.
4	Loctite 262 glue	Red	Apply to thread to lock and seal. eg，Apply to auxiliary bolts of cylinder head.
5	Loctite5910 glue	Red	Apply to surface of metal to seal. eg，Apply to bond surface of cylinder block and crankcase.
6	Loctite 271 glue	Red	Apply to surface of metal to seal. eg，Apply to oil channel plug.
7	Loctite 277 glue	Red	Sealing of plug and hole. eg，Apply to the water reservoir plug of cylinder block.

Caution in this Chapter: *TO ensure that the diesel engine you have bought functions normally, you must h ave have a correct option relating to the brand and type of fuel and oil according to this instruction.*

ELECTRICAL APPLIANCE

This section consists of generator, starter, sensor of water temperature indicator, induction plug of oilpressur e, etc.

GENERATOR

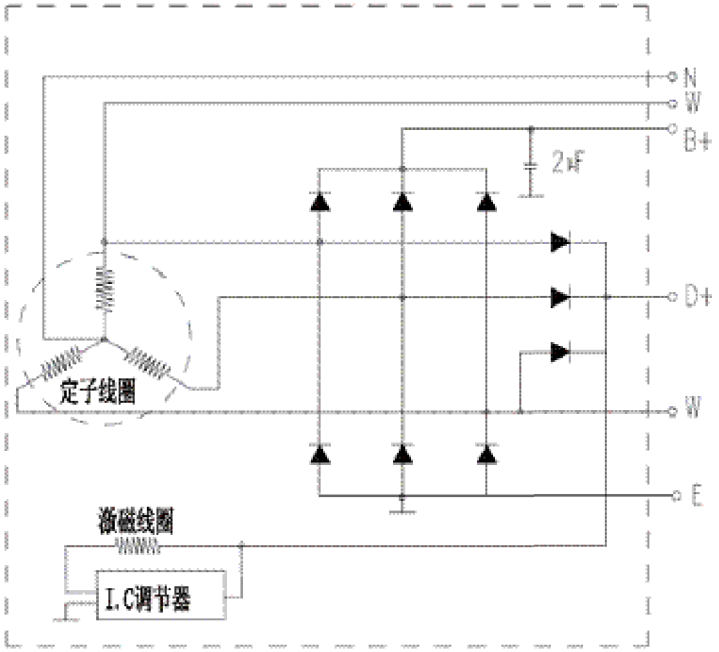
The generator is three-phase alternator, after silicon rectification the current change into direct current.

Output voltage 28V; the electric current provided is 55A Rotary direction: Right.

Max. allowable revolution speed :12000r/min

Revolution speed at rated load: 7333 r/min

Circuit Diagram:



CONNECTION POLE

D+connect to Charging (electri6cation) Indicating Lamp, the screw specification: M4

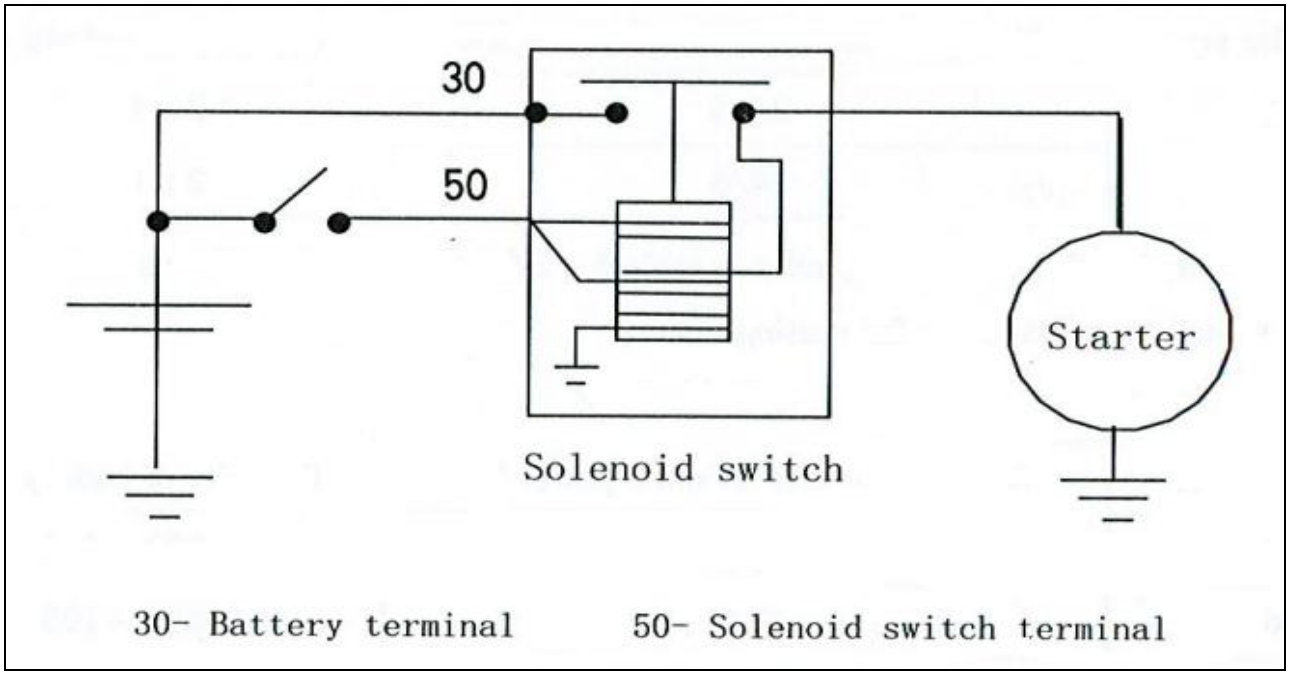
W connect to Speed Measuring Motor, the screw specification: M5

B+ connect to the positive electrode of battery, generator shell is grounded, the screw specification: M6

STARTER

DC starter voltage: 24V; Power: 6KW(4KW) right rotation(face to diesel engine output end),10 teeth.

Circuit Diagram:



EXTEMAL CONNECTION POLE

30 connect to the positive electrode of battery, the screw specification: M10

50 connect to the electromagnetic switch the screw specification:M5

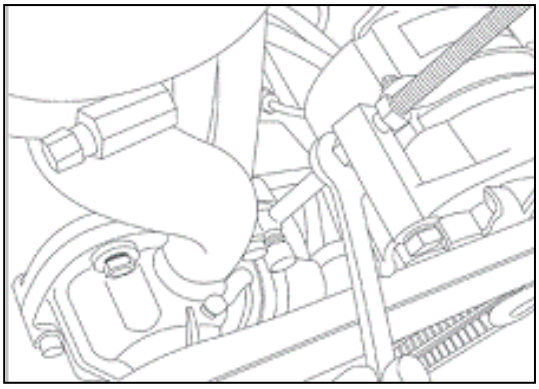
Starter casing earthing.

ADJUSTMENT AND REPLACEMENT OF MAIN COMPONENTS

COOLING SYSTEM

Replace poly V-belt

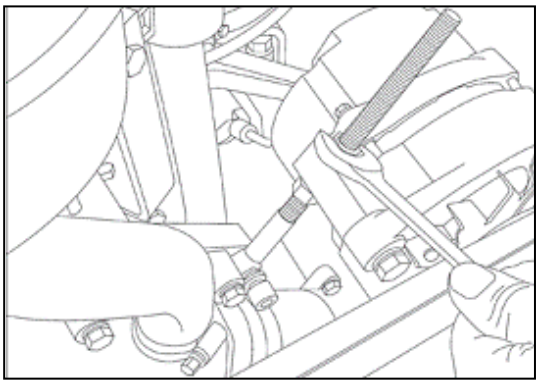
Tool: Inner-hexagon spanner 8mm, open-ended spanner 16mm.



Replace water pump

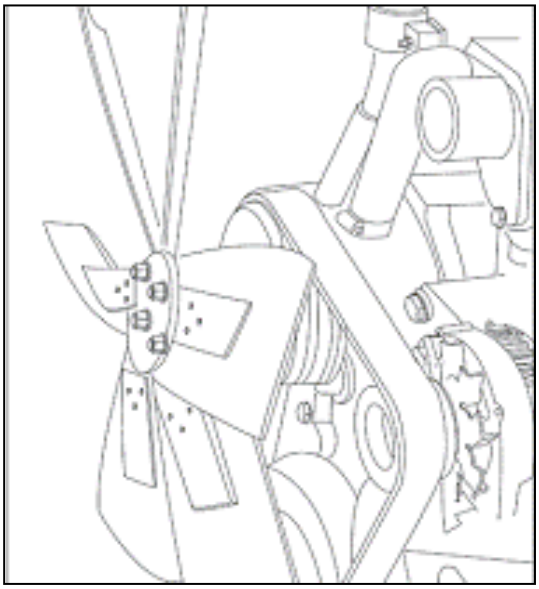
Unscrew the fastening bolt and nut of tensioning bolt, and take down the belt of generator.

Tool: Inner-hexagon spanner 8mm, open-ended spanner 16mm.



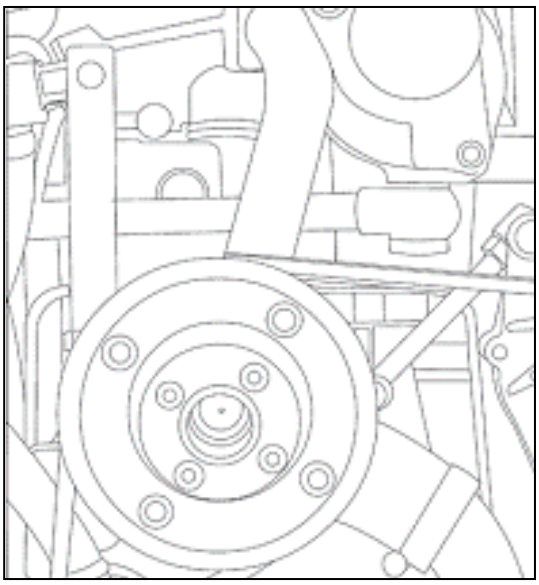
Loosen the fastening bolt of fan and dismantle the fan, intermediate flange and the belt pulley of water pump.

Tool: Open-ended spanner 13mm.



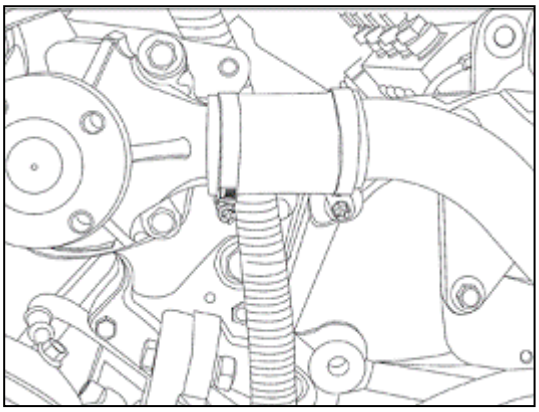
Loosen the clamp ring on rubber hose for small cycle.

Tool: 6# screw-driver.



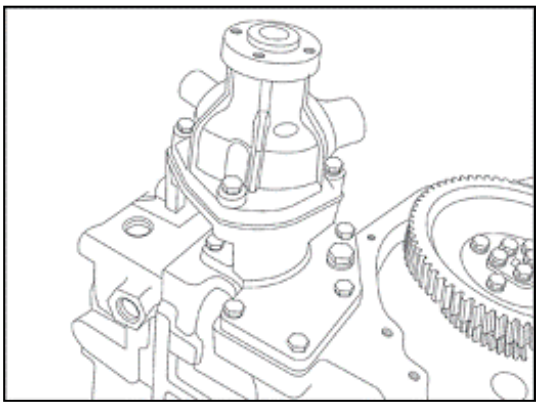
Loosen the hose clamp ring in the water inlet of water pump.

Tool: 6#screw-driver.



Take apart the fastening bolt on water pump and take away the away the water pump.

Tool: Sleeve wrench 13mm.

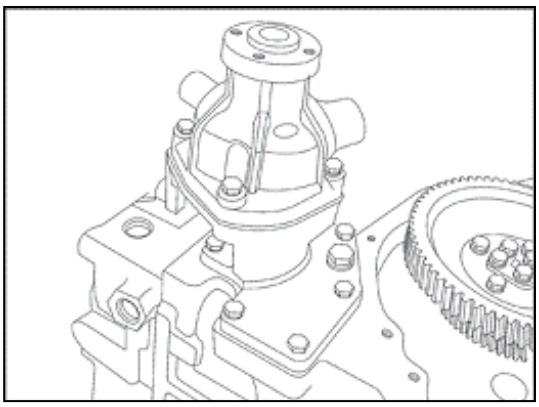


Clean the sealed surface of water pump.

Change the seal gasket of water pump.

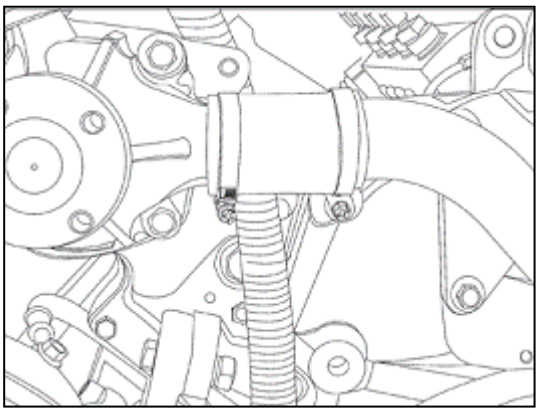
Put on a new water pump and screw down the 4 bolts to fix it.

Tool: Sleeve wrench 13mm.



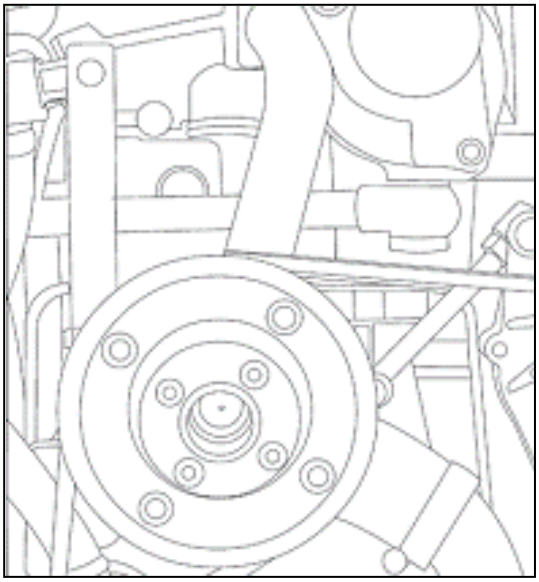
Tighten the hose clamp ring in the water inlet of water pump.

Tool: 6# screw-driver.



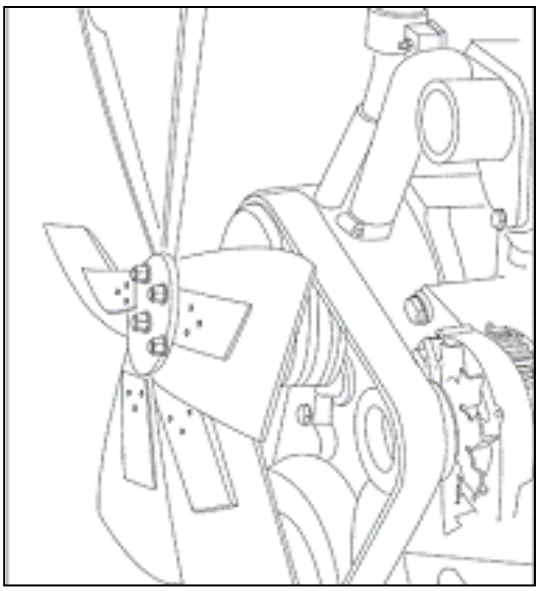
Tighten the clamp ring on rubber hose for small cycle.

Tool: 6# screw-driver.



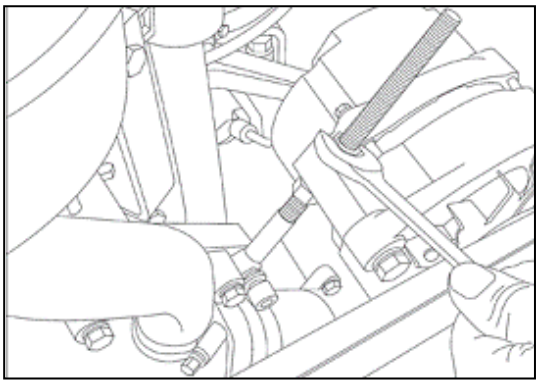
Reassemble the belt pulley, inter-flange and fan in the proper order, and tighten the 4 bolts.

Tool: Open-ended spanner 13mm.



Put on the V-belt and tension it properly, and then re-tighten the fastening bolt and nut of tensioning bolt.

Tool: Inner-hexagon spanner 8mm, open ended spanner 16mm.

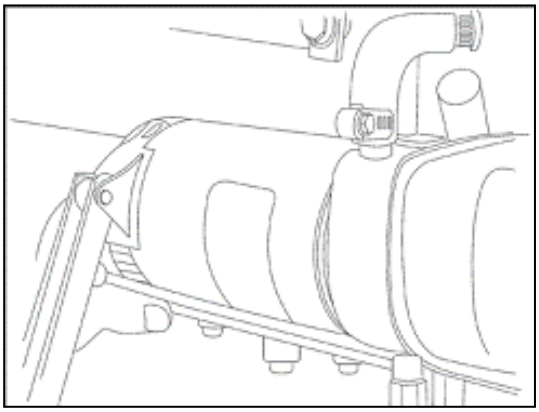


LUBRICATING SYSTEM

Replace oil cooler

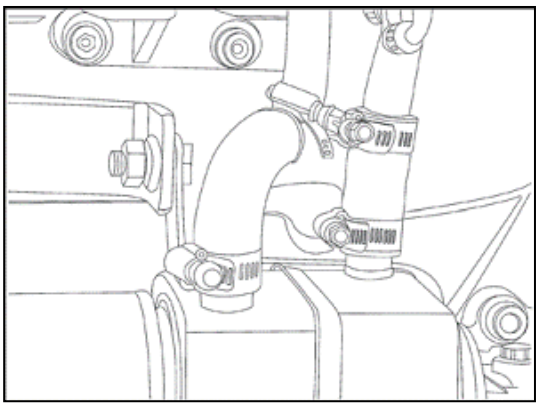
Dismantle the oil filter

Tool: Special wrench for oil filter



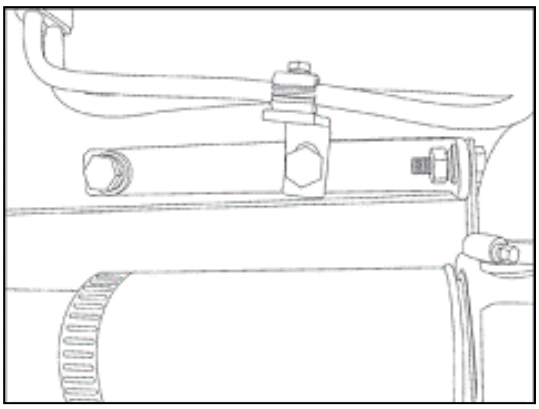
Loosen the water inlet/out hose clamp ring of oil cooler.

Tool: 6# screw-driver.



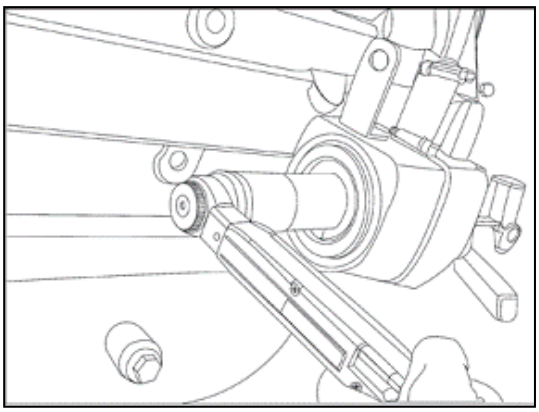
Unscrew the fastening bolt of oil cooler.

Tool: 6mm Open-ended spanner.



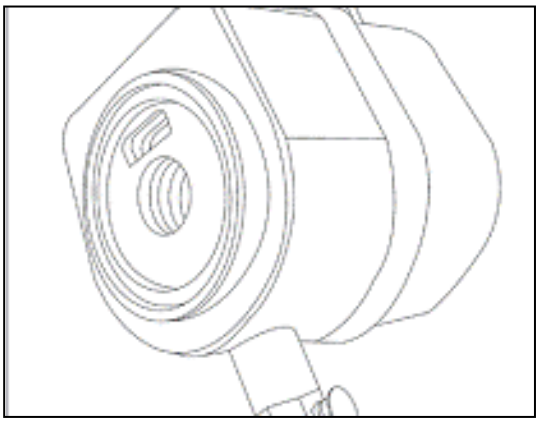
Unscrew the nipple and take down the oil cooler.

Tool: 27mm Sleeve wrench.



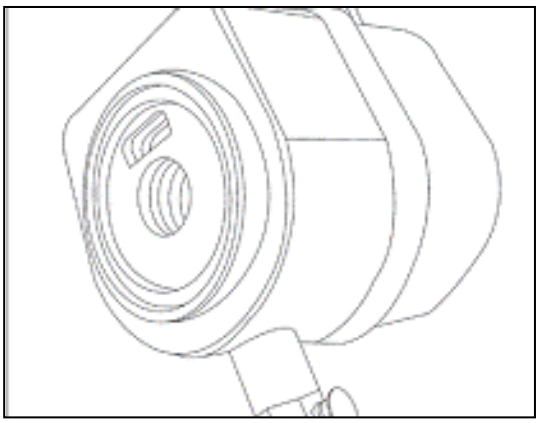
Dismantle the water-draining valve.

Tool: Open-ended spanner 17mm.



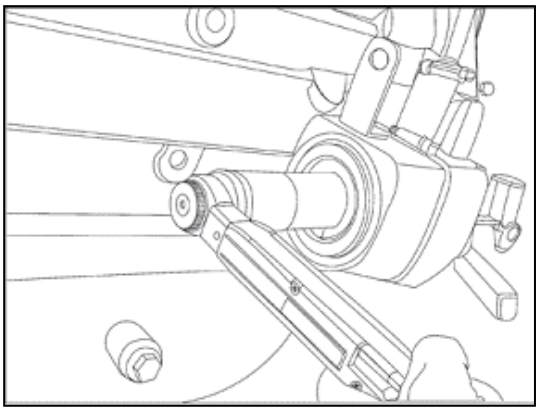
Mount the drain valve on the new oil cooler.

Tool: Open-ended spanner 17mm.



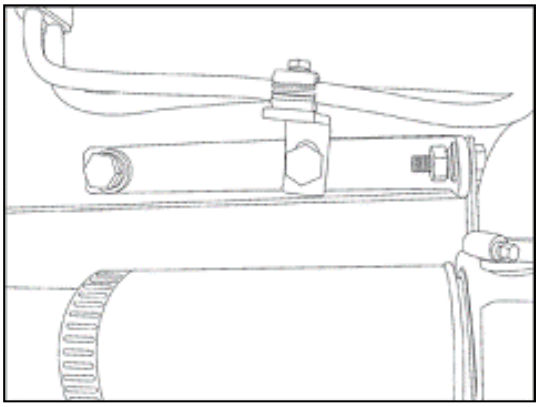
Clean the oil cooler and the connecting surface of filter seat, change the seal gasket and substitute the oil cooler with a new one, and then tighten the nipple.

Tool: 27mm Sleeve wrench.



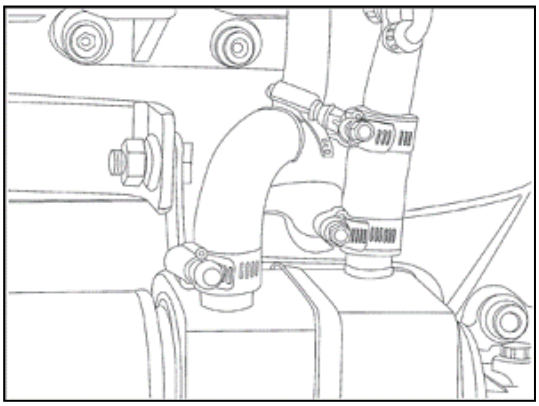
Screw down the fastening bolt for the oil cooler.

Tool: 16mm Open-ended spanner.



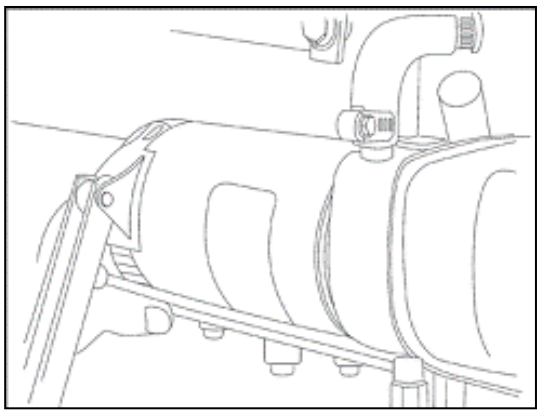
Tighten the water inlet/out hose clamp ring on the oil cooler.

Tool: 6#screw-driver.



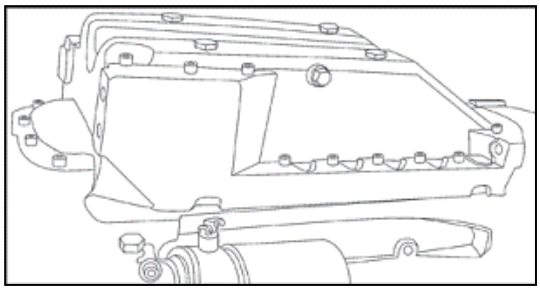
Put on the oil filter.

Tool: Special spanner for oil filter.



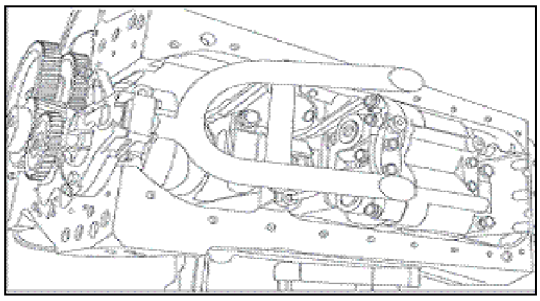
Unscrew the bolt connecting the oil sump with the flywheel housing, loosen the fastening bolt of oil sump and take down the oil sump.

Tool: 18mm Sleeve wrench, 6mm Inner-hexagon spanner.



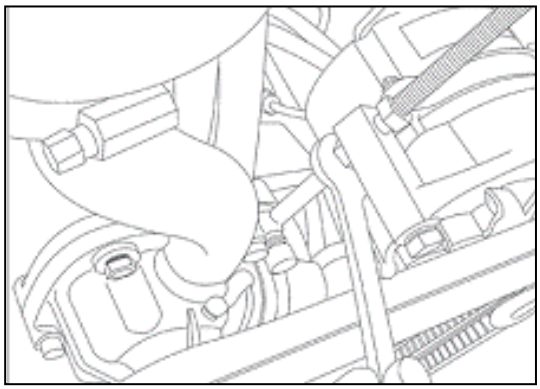
Loosen the mounting screw and the thread joint on lubricating oil inlet pipe, then take down the oil inlet pipe.

Tool: 13mm and 19mm Sleeve wrenches.



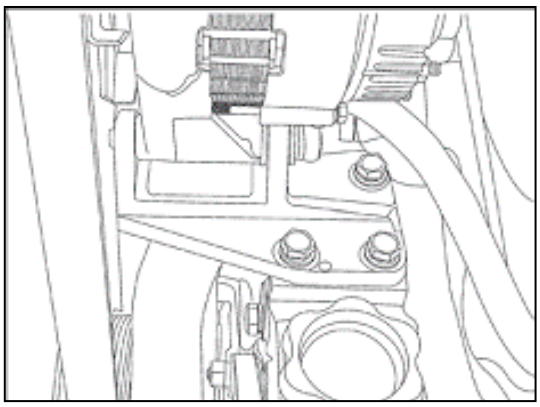
Unscrew the fastening bolt and nut of tensioning bolt of generator, and then pull down the poly V-belt.

Tool: 8mm, Inner-hexagon sleeve wrench, 16mm open-ended spanner.



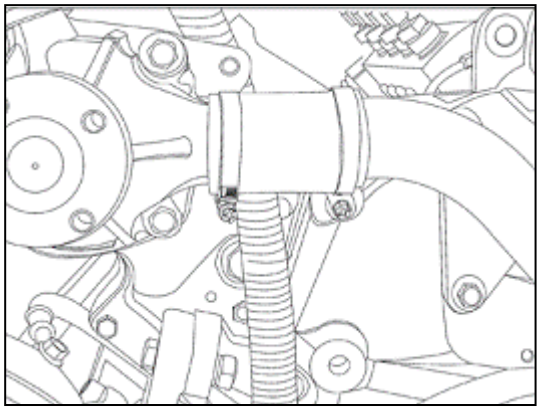
Unscrew the fastening bolt for generator and take down the generator.

Tool: 4mm Inner-hexagon sleeve wrench.



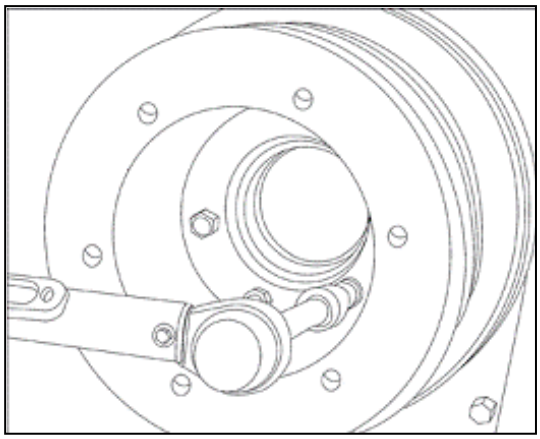
Loosen the hose clamp ring in the water inlet connecting pipe, and then dismantle the water inlet connecting pipe.

Tool: 6# screw-driver, 13mm sleeve wrenches.



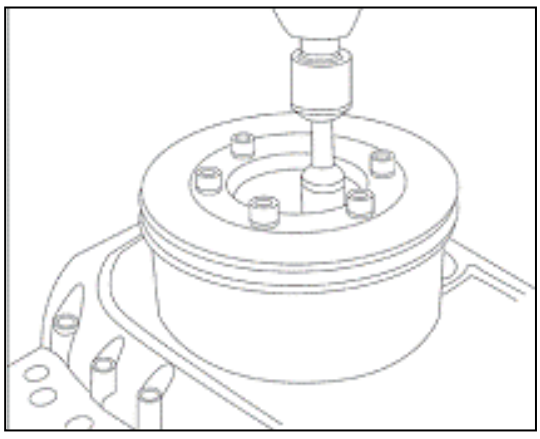
Unscrew the mounting bolt for belt pulley of crankshaft and dismantle the belt pulley the shock absorber.

Tool: Inner-hexagon 8mm sleeve wrench.



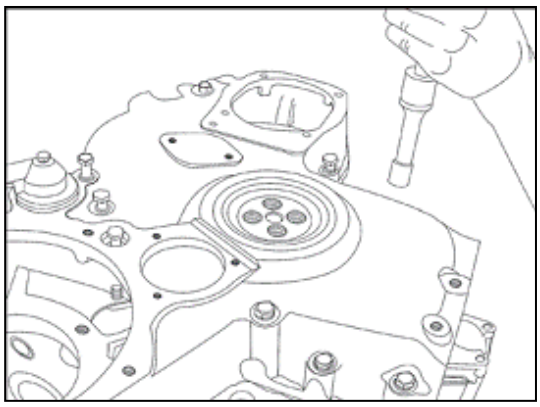
Dismantle the hub after loosening the hub bolt.

Tool: Inner-hexagon 14mm sleeve wrench.



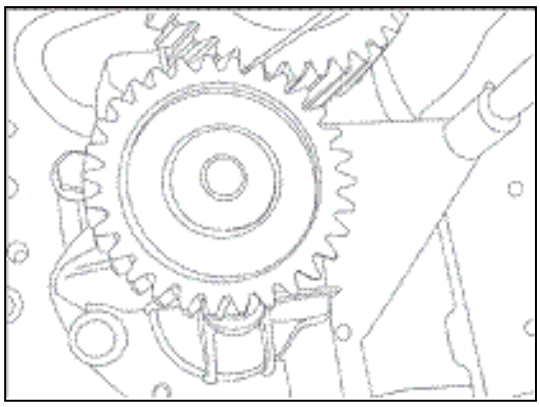
Unscrew the fastening bolt on front wall cover and dismantle the front wall cover.

Tool: Inner-hexagon 4mm sleeve wrench, 13mm sleeve wrenches.



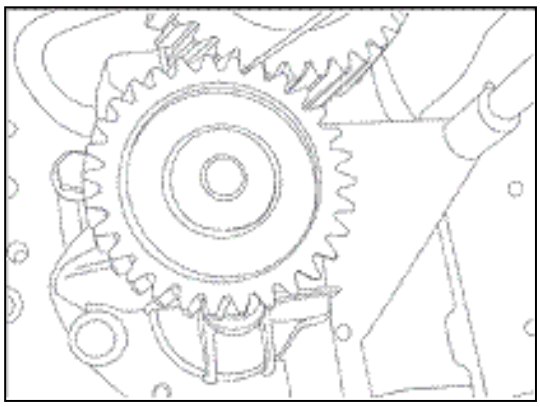
Unscrew the fastening bolt and nut, dismantle the oil pump.

Tool: 13mm Sleeve wrench.



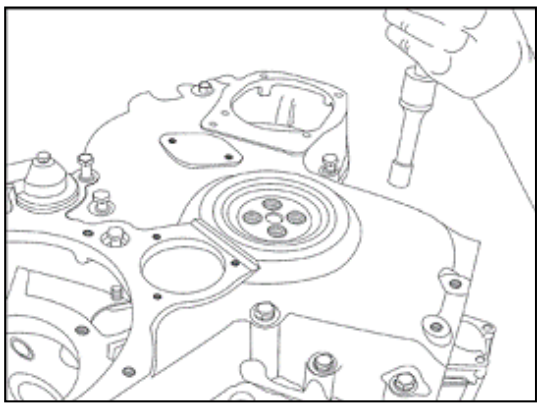
Clean the connecting surface of oil pump with cylinder block, mount a new oil pump, adjust the side clearance of gear（ side clearance 0.2 mm）,and then tighten the bolt and nut.

Tool: 13mm Sleeve wrench.



Clean up the connecting surface of the front wall cover with the cylinder body, coat the sealant on it, and then re-mount the front wall cover and tighten the bolt on it.

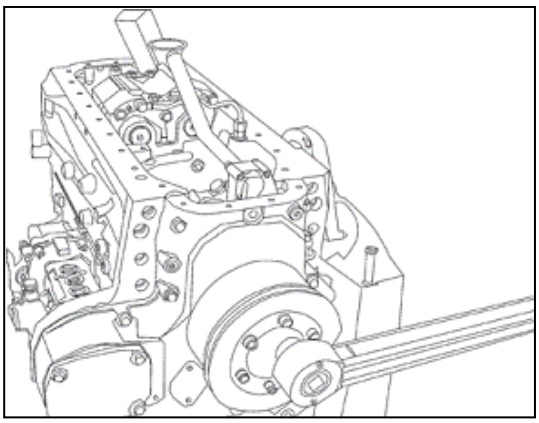
Tool: 4mm Inner-hexagon sleeve wrench, 13mm sleeve wrench.



Re-mount the hub and screw the bolt on it.

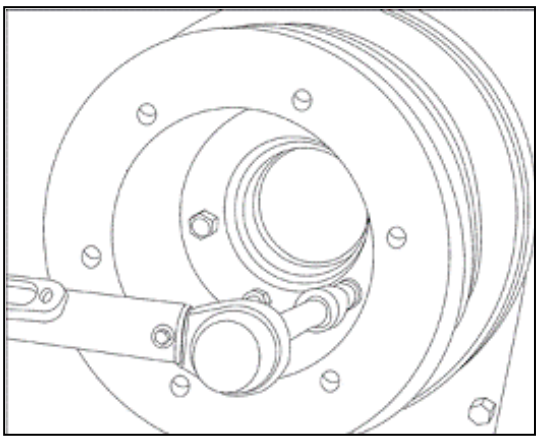
Caution: To avoid damage to the front-seal lip of crankshaft, put in the hub lightly.

Tool: Inner-hexagon 14mm sleeve.



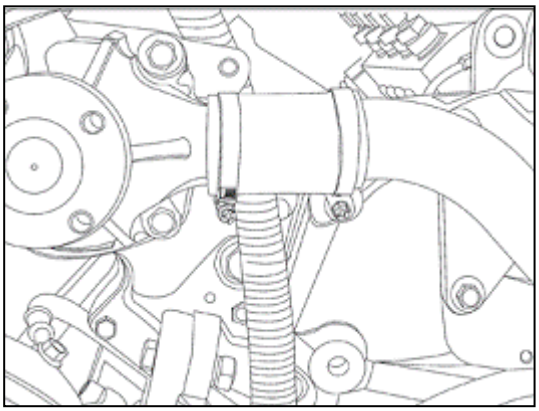
Put on the shock absorber and the belt pulley of crankshaft in turn, and then screw down the bolt on the belt pulley of crankshaft.

Tool: Inner-hexagon 8mm sleeve wrench.



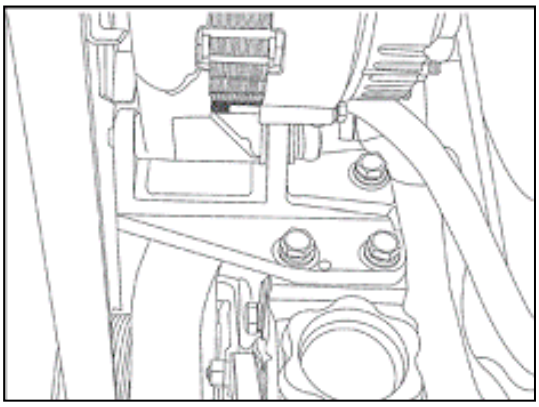
Put on the water inlet connecting pipe, tighten the water inlet hose clamp ring and the bolt on it.

Tool: 6# screw-driver, 13mm sleeve wrench.



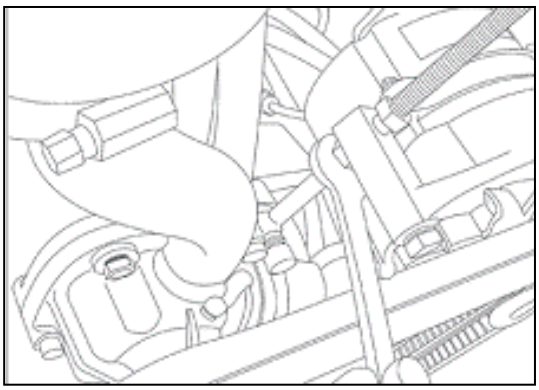
Mount the generator and tighten the bolt on it.

Tool: Inner-hexagon 4mm sleeve wrench.



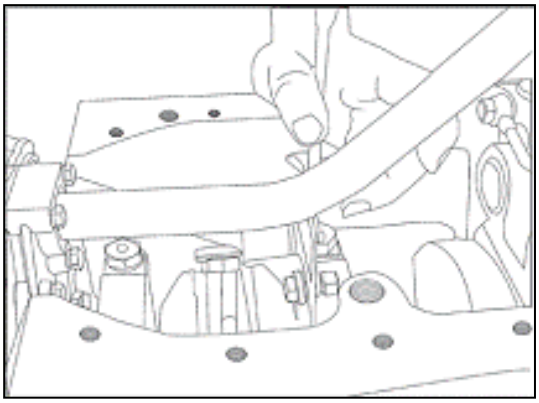
Put on the poly V-belt and adjust it properly, and then screw down the fastening bolt and nut for generator.

Tool: Inner-hexagon 8mm Sleeve wrench, 16mm open-ended spanner.



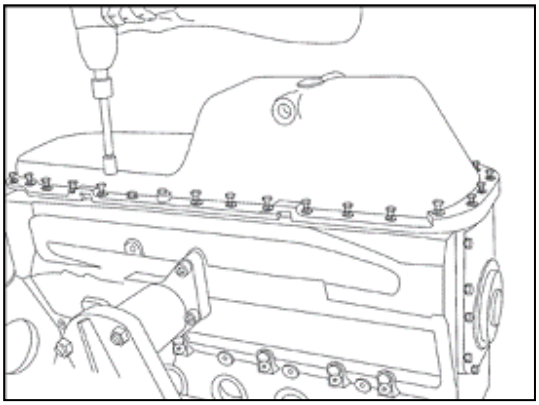
Replace the O-seal ring, fit on the lubricating oil inlet pipe, and instalt the oil inlet pipg and fasten with bolt on the angle plate.

Tool: 13mm and 19mm Sleeve wrench.



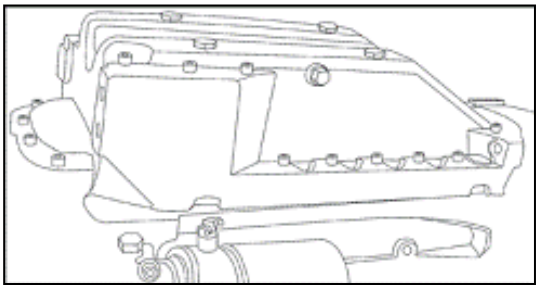
Fit on the oil sump, tighten the bolt connecting oil sump with flywheel housing and the fastening bolt for the oil sump.

Tool: 18mm Sleeve wrench, 6mm Inner-hexagon spanner.



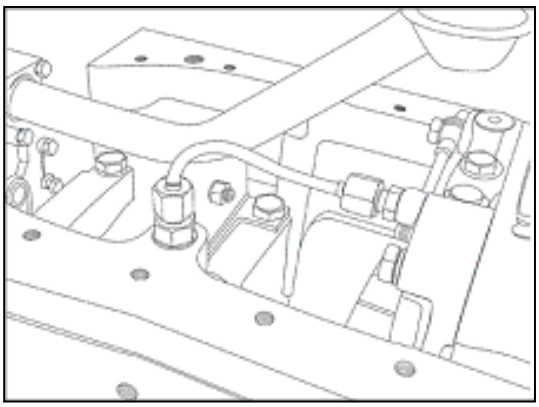
Loosen the connecting bolt between oil sump and flywheel housing, unscrew the fastening bolt on oil sump and take down the oil sump.

Tool: 18mm Sleeve wrench, 6mm Inner-hexagon spanner.



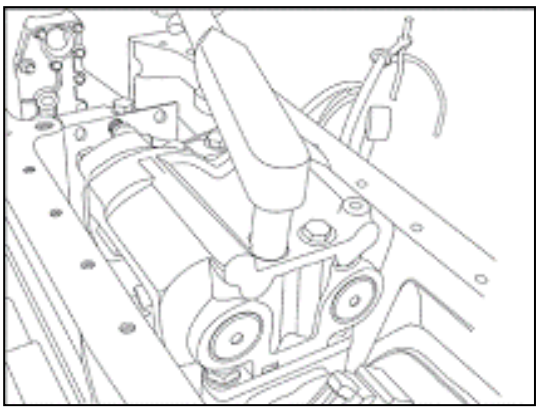
Loosen the joint of lubricating oil pipe.

Tool: 17mm Open-ended spanner.



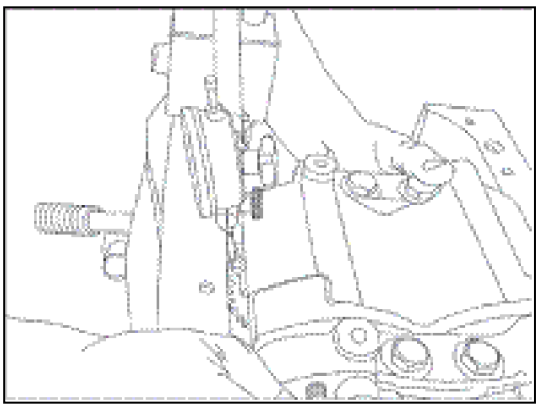
Unscrew the fastening bolt and take down the two-stage balancing mechanism.

Tool: 16mm Sleeve wrench.



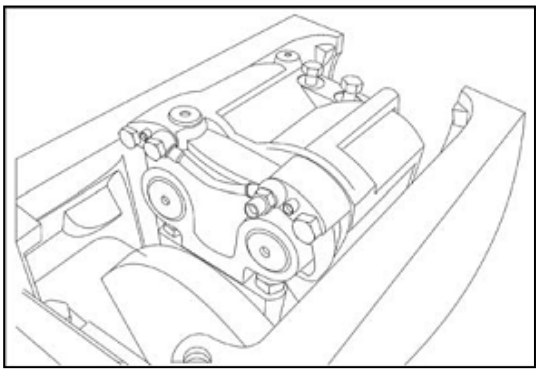
Re-mount the two-stage balancing mechanism; adjust the side clearance of gear to 0.3-0.4mm and the tightening torque to 34-40N·m.

Tool: 16mm Sleeve wrench.



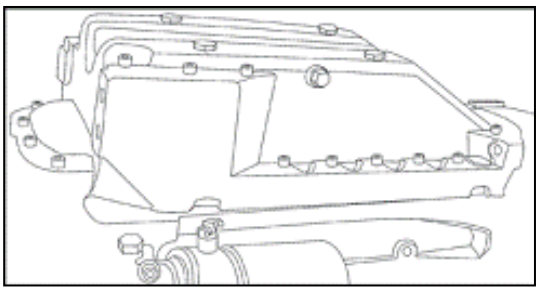
Screw down the joint of lubricating oil pipe.

Tool: 17mm Open-ended spanner.



Fit on the oil sump, tighten the bolt connecting oil sump with flywheel housing and the fastening bolt on the oil sump.

Tool: 18mm Sleeve wrench, 6mm Inner-hexagon spanner.

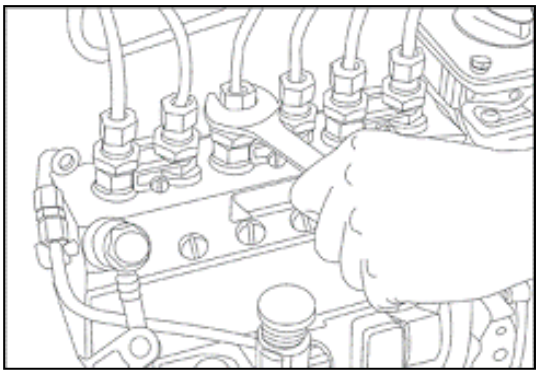


FUEL SUPPLYING SYSTEM

Replace fuel injection pump

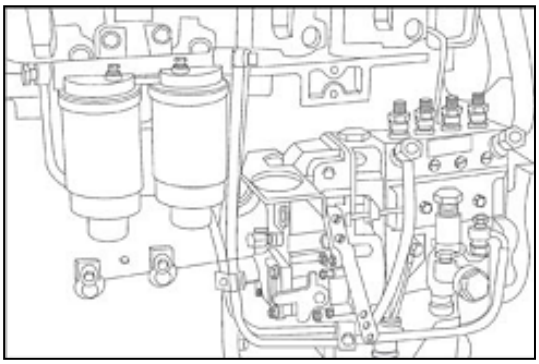
Dismantle the joint connecting high-pressure fuel pipe and fuel injection pump.

Tool: 18mm Open-ended spanner.



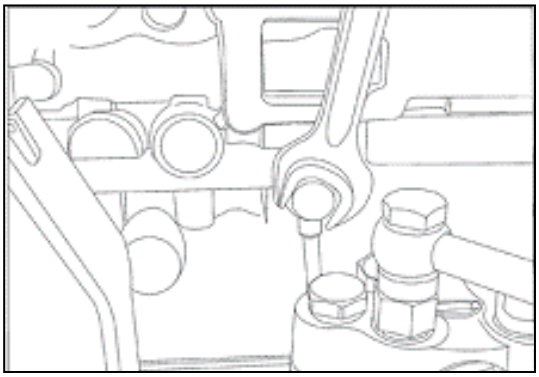
Dismantle the fuel injection pump and the oil in/out pipes of fuel filter.

Tool: 19mm Open-ended spanner.



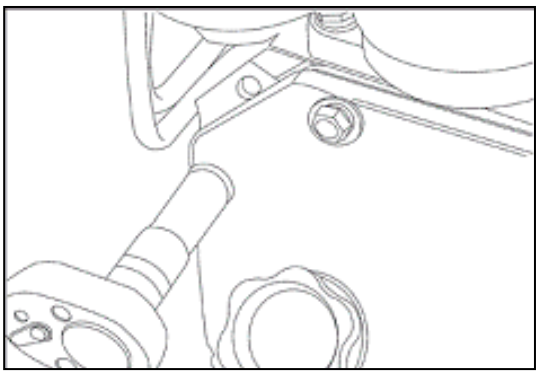
Dismantle the lubricating-oil pipe of the fuel injection pump.

Tool: 16mm Open-ended spanner.



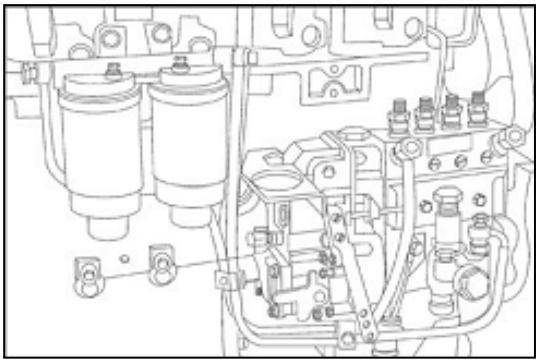
Dismantle the oil inlet joint.

Tool: 18mm Open-ended spanner.



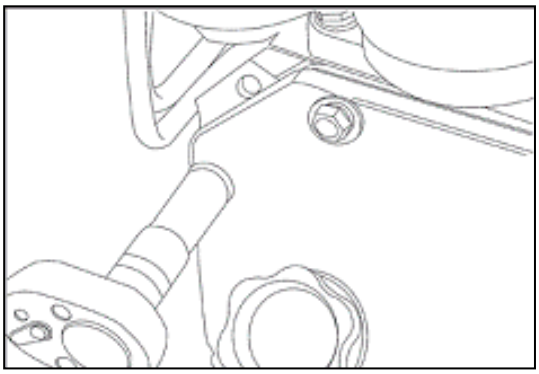
Take down the stopping electromagnet.

Tool: 10mm Sleeve wrench.



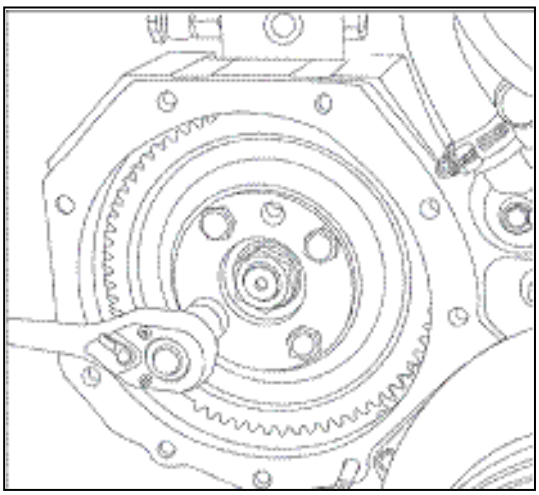
Unscrew the bolt and dismantle the cover of inspection hole on fuel injection pump. Make a slow barring of engine and let the scale mark on the flywheel housing align the “OT” mark on the flywheel, so as to determine that the piston of the first cylinder is exactly in the top dead center.

Tool: 13mm Sleeve wrench.



Unscrew the bolt and take down the fuel injection pump gear.

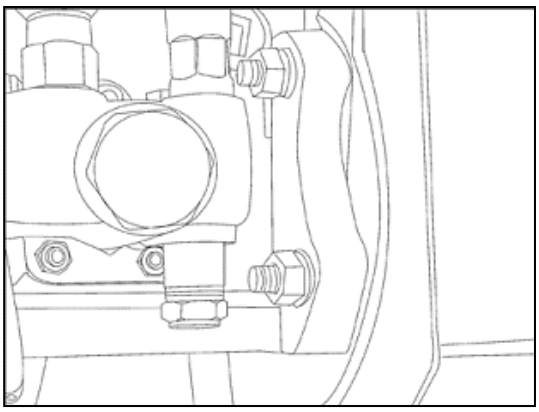
Tool: 13mm Sleeve wrench.



Unscrew the bolt and take down the fuel injection pump.

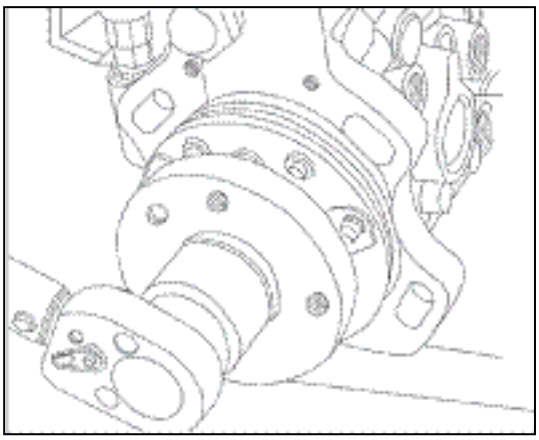
Tool: 16mm Sleeve wrench.

Caution: *Do not damage the O-ring.*



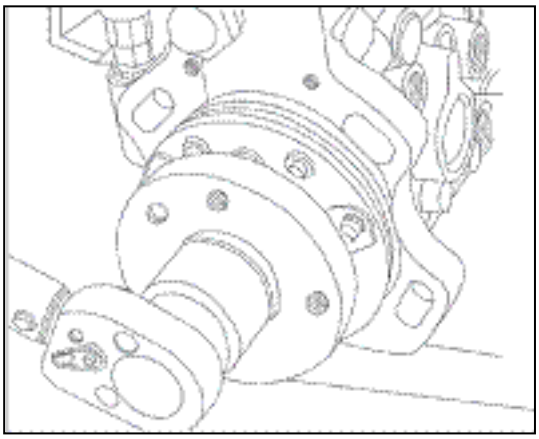
Unscrew the nut and dismantle the fuel injection pump hub.

Tool: 27mm Sleeve wrench.



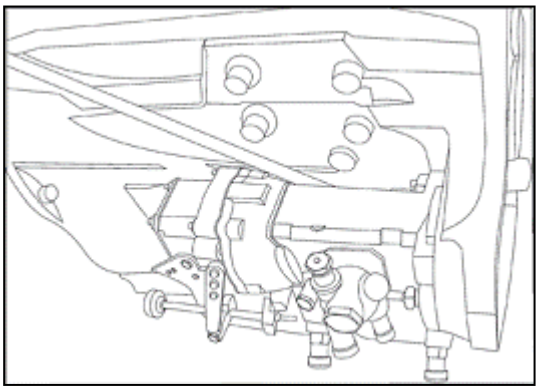
Put the hub on a new fuel injection pump and screw down the lock nut to the required torque value.

Tool: 27mm Sleeve wrench.



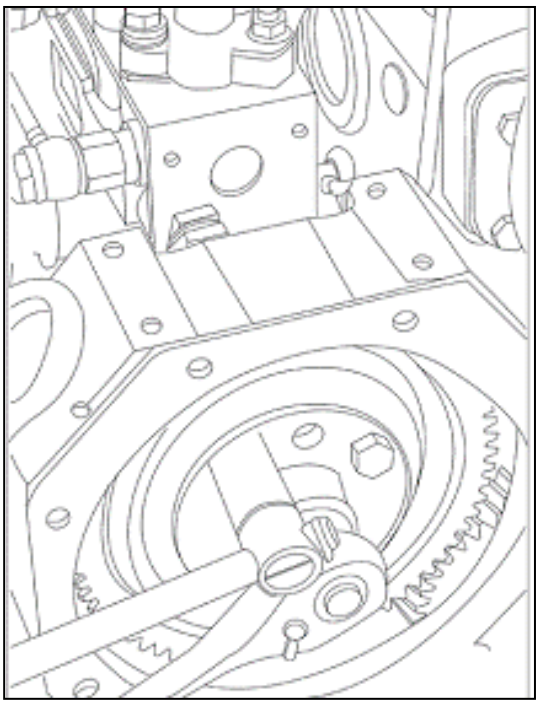
Mount the new pump and tighten the bolt to fix it.

Tool: 16mm Sleeve wrench.



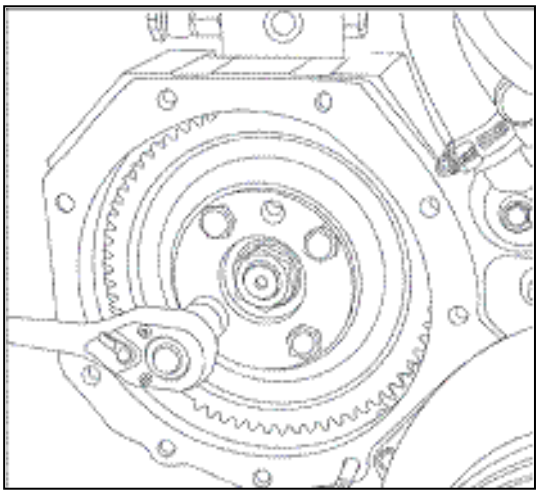
Turn the camshaft of fuel injection pump until the fuel level in the first cylinder's fuel outlet moves slightly.

Tool: 27mm Sleeve wrench.



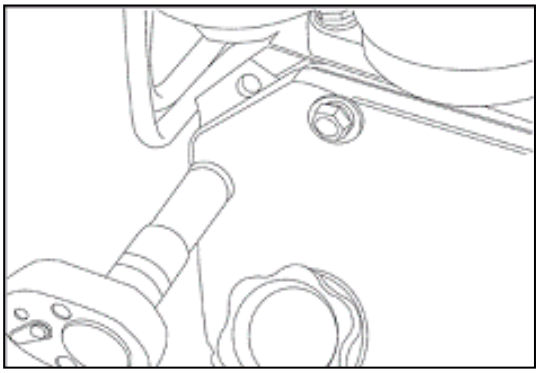
Put on the gear of fuel injection pump and tighten the bolt on it.

Tool: 13mm Sleeve wrench.



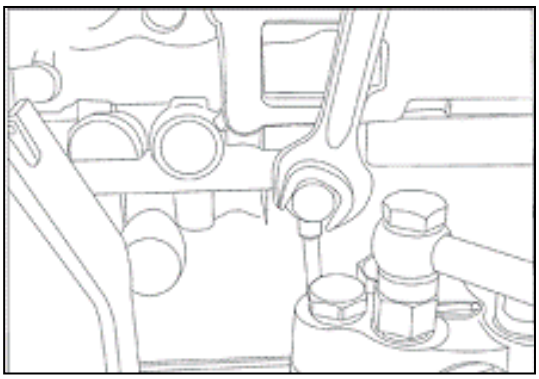
Put on the inspection hole cover of fuel injection pump and tighten the bolt on it.

Tool: 13mm Sleeve wrench.



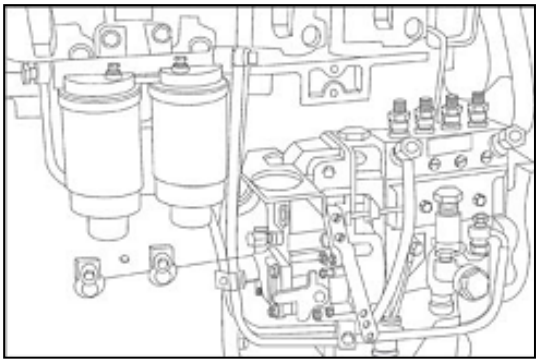
Fix the lubricating-oil inlet pipe and tighten the hollow bolt.

Tool: 16mm Open-ended spanner.



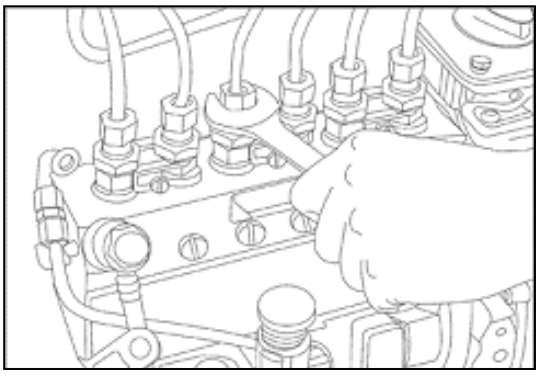
Mount the inlet and outlet pipes of fuel injection pump and fuel filter, and then tighten the hollow bolt.

Tool: 19mm Open-ended spanner.



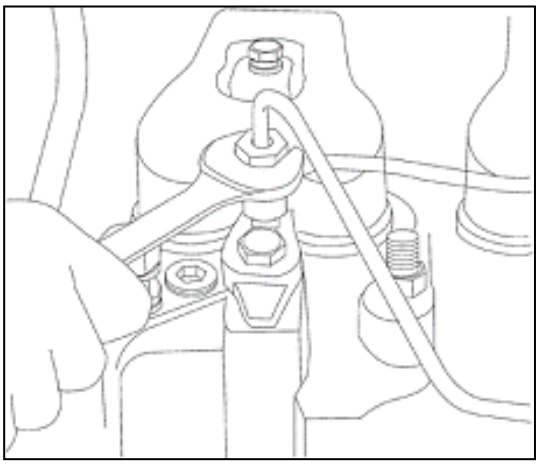
Mount the high-pressure fuel pipe and tighten the joint.

Tool: 18mm Open-ended spanner.



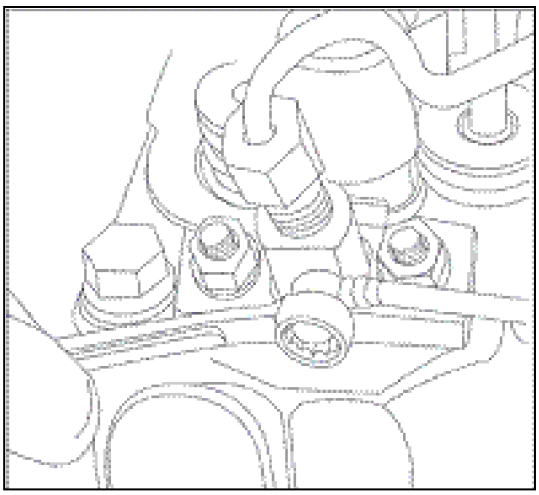
Clean the fuel injector all round and dismantle the joint connecting the high-pressure fuel pipe with the fuel injector.

Tool: 18mm Open-ended spanner.



Dismantle the fuel return pipe of fuel injector.

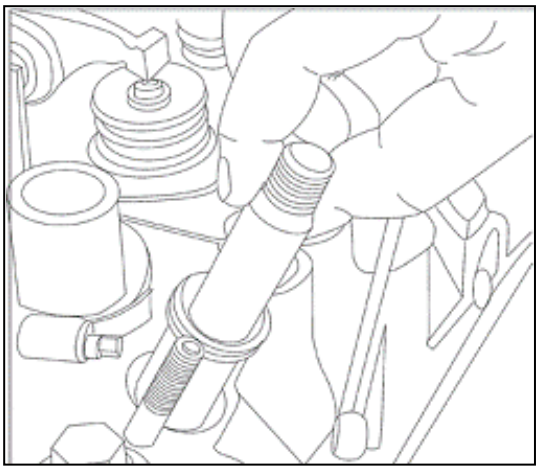
Tool: 10mm Open-ended spanner.



Unscrew the fastening nut on support and take down the support.

Dismantle the fuel injector.

Tool: 13mm Open-ended spanner.

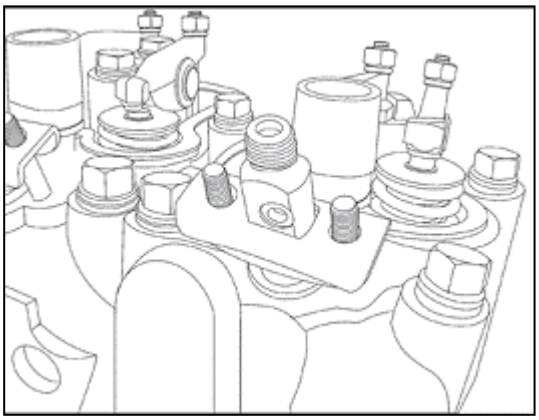


Clean the fuel-injector seat hole.

Replace the seal gasket

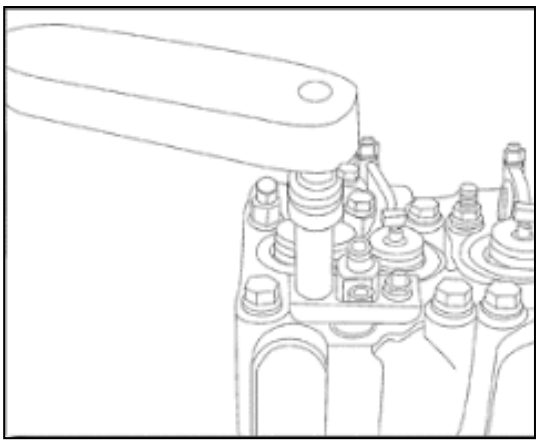
Mount a new fuel injector, and then put on new shaft checking-ring flat gasket and 0-seal ring.

Mount a new fuel injector in the fuel injector's seat hole.



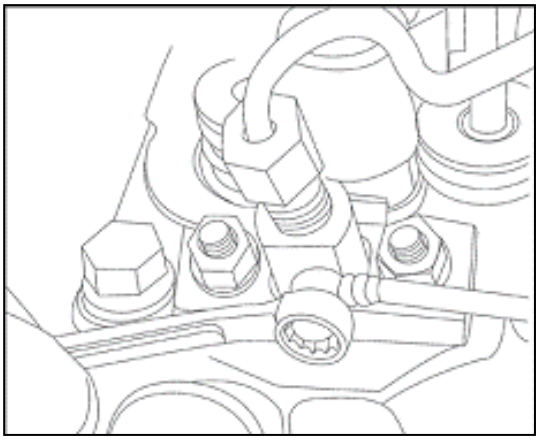
Mount the support and screw down the nut to10-15N·m.

Tool: 13mm Open-ended spanner.



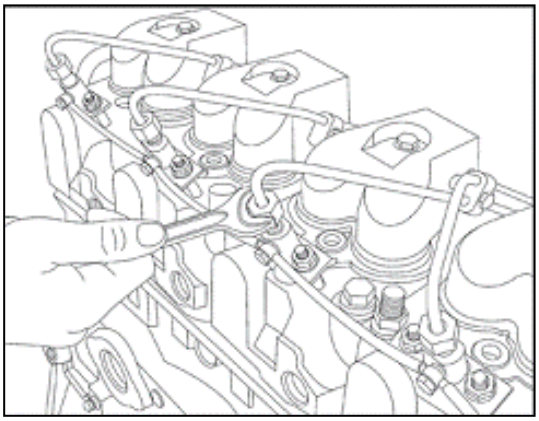
Mount the fuel return pipe of injector.

Tool: 10mm Open-ended spanner.



Screw down the joint connecting the fuel injector with the high-pressure fuel pipe.

Tool: 18mm Open-ended spanner.

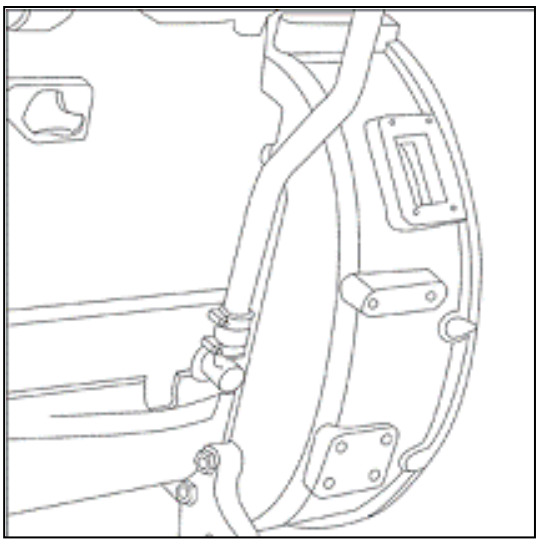


INTAKE AND EXHAUST SYSTEM

Replace the waste gas supercharger

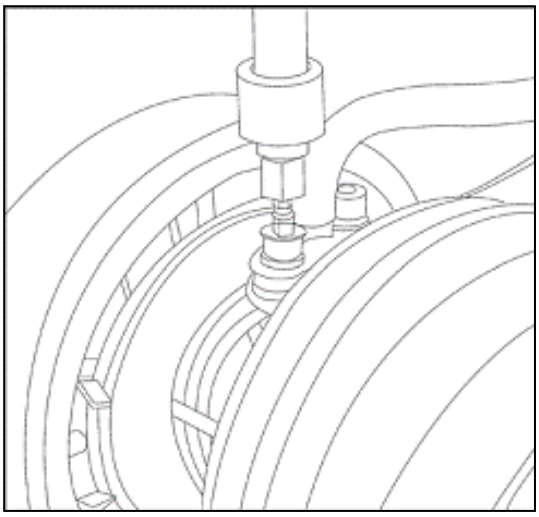
Loosen the hose clamp ring of supercharger oil return pipe.

Tool: 6mm Screw-driver.



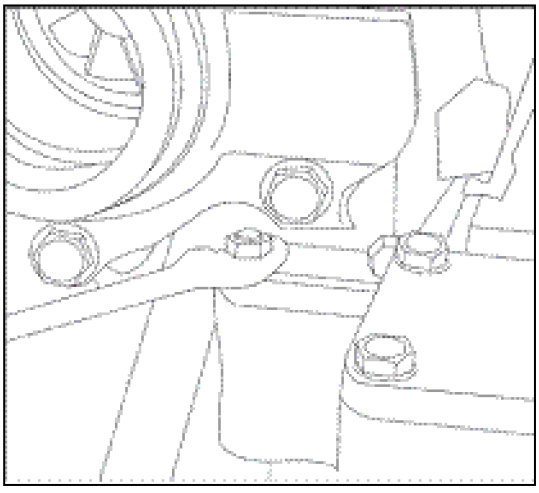
Dismantle the inner-hexagon bolt on the inlet pipe of supercharger and lift the flange of inlet pipe.

Tool: 6mm Inner-hexagon spanner.



Loosen the self-lock nut on the flange connecting exhausting pipe with supercharger, and then take down the supercharger.

Tool: 13mm Open-ended spanner.



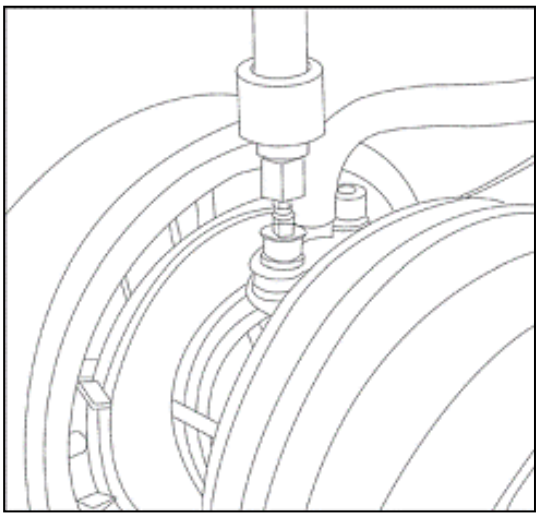
Replace the supercharger.

Caution: *If the waste gas supercharger is not replaced immediately, so all the air inlet and outlet ports should be properly covered to prevent any substances from coming into the cylinder.*

Mount new inlet pipe gasket and tighten the bolt on the inlet pipe.

Tool: 6mm Inner-hexagon spanner.

Caution: *When the oil inlet pipe is mounted, it is necessary to align the oil holes of the gasket and the supercharger flange, to add the clean oil and turn the blade wheel of turbine for the entrance of oil into the bearing area.*



TYPICAL TROUBLES AND REMEDY OF DIESEL ENGINE

There are various symptoms of diesel troubles. The failure causes vary from one diesel engine to another because of the differential structures and using environments of different diesels. A trouble might be caused by many factors; different troubles should be studied according to their peculiar symptoms.

NO START OR HARD STARTING

No	Cause	Remedy
1	Fuel system failure	
	1. Fuel tank switch is off or there is no fuel in fuel tank.	Switch on it or refuel sufficiently.
	2. Air in fuel system.	Check whether the joints of pipelines are loose and exhaust the air in fuel line.
	3. Feed pump failure	Check the feed pump and change the unqualified.
	4. Bad fuel atomization	Check and adjust the fuel injectors.
	5. Incorrect fuel supply advance angle	Check and adjust the fuel supply advance angle
	6. Fuel pipes or fuel filter jammed	Check and clean them
2	Low compression pressure of cylinders	
	1. Excessively-worn piston rings or cylinder liners	Check and change the piston rings. If necessary, change the cylinder liners and pistons
	2. Valve leakage	Check the valve clearance and valve sealing. Grind the valves.
	3. Cylinder gasket Leakage	Check whether the cylinder gaskets leak and remedy them.

3	Starting system faults	
	Low battery voltage	Check and recharge the battery
	Poor contact of the electrical circuit	Check and repair the electrical circuit.
	Starter stall or low power output	Check and repair the starting motor.
	Starter gear is unable to engage correctly with the flywheel ring gear.	Turn the flywheel ring gear for a certain angle. If it still cannot engage correctly, then check and repair the starter.

INSTABLE RUNNING

No	Cause	Remedy
1	Air in fuel system	Check whether the joints of pipelines are loose and exhaust the air in fuel line.
2	Fuel system jammed	Clean or change the fuel filter.
3	Uneven fuel delivery for each cylinder	Check the fuel injection pump and adjust the pump on the test-rig to uniform the fuel delivery for each cylinder.
4	Some injectors work poorly.	Pick out the poor injectors. Clean or change them.
5	Governor works unsteadily.	Check and repair the governor.
6	Poor fuel quality or water in fuel	Check the fuel. Change it if necessary.

INSUFFICIENT POWER

No	Cause	Remedy
1	Fuel system failure	
	1. Fuel system jammed or air in the system	Clean or change the fuel filter. Exhaust the air.
	2. Bad atomization of injectors, low injection pressure	Check the fuel injectors. Change them if necessary.
	3. Injection pump failure, insufficient fuel supply or uneven delivery	Check or change it.
	4. Incorrect fuel supply advance angle	Check and adjust the fuel supply advance angle
	5. Poor fuel quality or water in fuel	Check the fuel. Change it if necessary.
2	Low compression pressure of cylinders	
	Excessively-worn piston rings or cylinder liners	Check and change the piston rings. If necessary, change the cylinder liners and pistons.
	Valve leakage	Check the valve clearance and valve sealing. Grind the valves.
	Cylinder gasket Leakage	Check whether the cylinder gaskets leak and remedy them.
3	Air filter jammed	Clean or change the filter element
4	Exhaust passage and muffler jammed	Check and clean the exhaust passage and muffler.
5	Exhaust pipe jammed	Find out the cause and solve the problem.

ABNORMAL ENGINE OIL PRESSURE

No	Cause	Remedy
1	Low oil level in the sump	Add oil to specified level
2	Oil pressure gauge failure	Check, repair or replace
3	Primary oil filter or filter jammed	Clean or change the fuel filter element.
4	Excessively-worn crankshaft main bearing and connecting rod bearings	Check or change them.
5	Incorrect engine oil grade or water in engine oil	Check the oil grade and cause. Change the engine oil.
6	Engine oil driving, driven gears wear	Change engine oil pump
7	Pressure limiting valve failure	Check and change it.
8	Engine oil line jammed or oil leakage	Check and solve the problem correspondingly

OVERHEATING

No	Cause	Remedy
1	Long time overloaded running	Reduce the load
2	Poor combustion	Check the fuel injection and fuel supply advance angle.
3	Overheated engine oil	
	1. Insufficient or excessive engine oil	Check the oil dipstick. Increase or reduce the engine oil according to requirement.
	2. Oil cooler jammed	Clean or change the oil cooler.
4	Overheated coolant	
	1. Insufficient coolant	Change engine oil pump
	2. Low delivery capacity of the water pump	Check the impeller clearance. Change it, if necessary.
	3. Low fan speed	Adjust the tension of fan belt.
	4. Excessive scale in cooling system	Clean the scale
	5. Low radiating capability of the radiator	Clean the dirt on the cooling fins and improve the ventilation of the radiator.
	6.Thermostat failure	Change it after finding out the cause

ABNORMAL SMOKE

No	Cause	Remedy
1	Excessive white smoke	
	1. Bad atomization of fuel injectors and fuel dribbling	Check the fuel injection pressure and spray.
	2. Water in diesel fuel	Clean the fuel tank and filter. And change the diesel fuel.
	3. Low compression pressure of cylinders	Check reason for leakage of the valves, cylinder gaskets and piston rings. Solve the problems.
2	Excessive blue smoke	
	1. Excessively-high oil level in sump	Drain the redundant engine oil.
	2. Piston ring wear or low flexibility, oil blow-by	Check and change the piston rings.
	3. Valve sealing failure	Check the valve sealing and change the seal sleeve of valve stem.
3	Excessive black smoke	
	1. Diesel over-loaded	Reduce the load to the given level.
	2. Bad fuel injection and bad atomization	Check or change the delivery valves of the fuel pump and injectors.
	3. Delayed fuel supply and excess post-combustion	Adjust the fuel supply advance angle
	4. Incorrect valve clearance or bad valve sealing	Check the valve clearance and valve sealing.
	5. Air filter jammed	Clean the air filter element.
	6. Poor fuel quality	Use high quality fuel.

SUDDEN STOP

No	Cause	Remedy
1	Crankshaft is unable to rotate after diesel engine stopped.	
	1. Crankshaft and bearing shell locked together	Check and change parts.
	2. Pistons and cylinder liners locked together	Check and change the pistons, piston rings and cylinder liners.
2	Crankshaft is able to rotate easily after diesel stopped.	
	1. Air in fuel system	Exhaust the air and check the sealing of lines.
	2. Fuel system jammed	Clean or change the fuel filter element.
	3. Racks or plungers of injection pump jammed.	Check and repair the injection pump.
	4. Inlet air pipe or air filter jammed	Check and clear the air filter.
	5. Lack of fuel	Add fuel.

UNUSUAL SOUNDS

No	Cause	Remedy
1	Premature fuel injection and rhythmic tinkling knock in cylinders	Check and adjust the fuel injecting time.
2	Delayed fuel supply and hollow rapping sound in cylinders	Check and adjust the fuel injecting time.
3	Excess clearance between valves and valve arms and metallic beating sound in valve structures	Check and adjust the valve clearance
4	Excess clearance between pistons and cylinders	Check the cylinder liners fit clearance. Change the pistons and cylinders.
5	Excess clearance between the piston pin and small rod connecting bearing, pealing with a metallic beating sound, especially at high or low speed	Change the connecting rod bushing to satisfy the clearance requirement.
6	Big clearance between connecting rods and muffled raucous beating sound	Change the bearings.
7	Excess clearance of main bearing, the sound resembling the connecting rod beating sound	Change the main bearings.
8	Piston bumps the valve, tinkling near the cylinder head at low speed	Check the valve timing.
9	Excess gear clearance and bumping sound at sudden deceleration	Check and adjust the gear clearance. Change the gears if necessary.

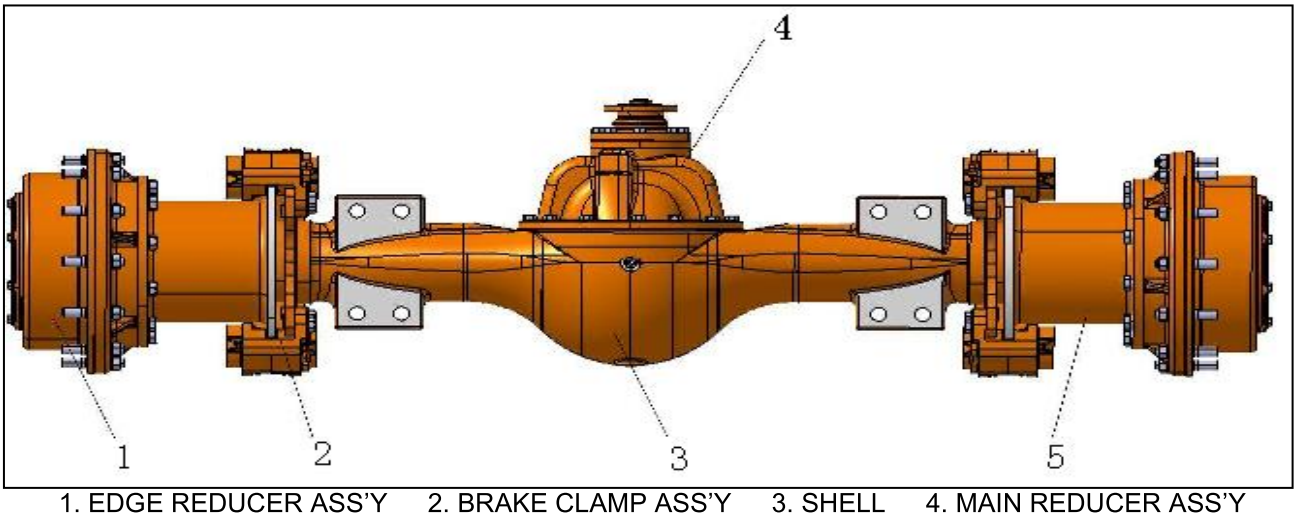
FRONT AXLE

⚠ CAUTION!
Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section. **Always use tools and equipment that is in good working order.** **Use lifting and hoisting equipment capable of safely handling load.** **Remember, that ultimately safety is your own personal responsibility.**

TABLE OF CONTENTS

GENERAL DESCRIPTION

Structure chart



1. EDGE REDUCER ASS'Y 2. BRAKE CLAMP ASS'Y 3. SHELL 4. MAIN REDUCER ASS'Y
5. HUB ASS'Y

Basic parameters of drive axle:

Main drive	Type	Spiral bevel gear grade one reduction
	Reduction ratio	4.222
Hub reduction gear	Type	Grade one planet reduction
	Reduction ratio	4.8
Axle oil	GB13895-1992 gear oil	19L

Internal structure of drive axle

Drive axle assembly is one of the most important spare parts of transmission system, its main function is reduce rotation speed from gear box and increase torque, and make wheels at both sides having speed difference. Besides, it also plays the role of bearing and transmitting. Drive axle assembly of loader is mainly composed of shell, main drive (including differential mechanism), semi axis, hub reduction gear, brake caliper assembly and other parts. Of which, the parts having reduction and differential function is main driver and hub reduction gear; power transmission between main drive and hub reduction gear is realized through semi axis, multiple spine at both sides of semi axis and axle shaft gear of differential mechanism and sun gear of hub reduction gear mesh with each other to realize power connection between main drive and hub reduction gear.

PARTS LIST

Disassembling of front and rear axle

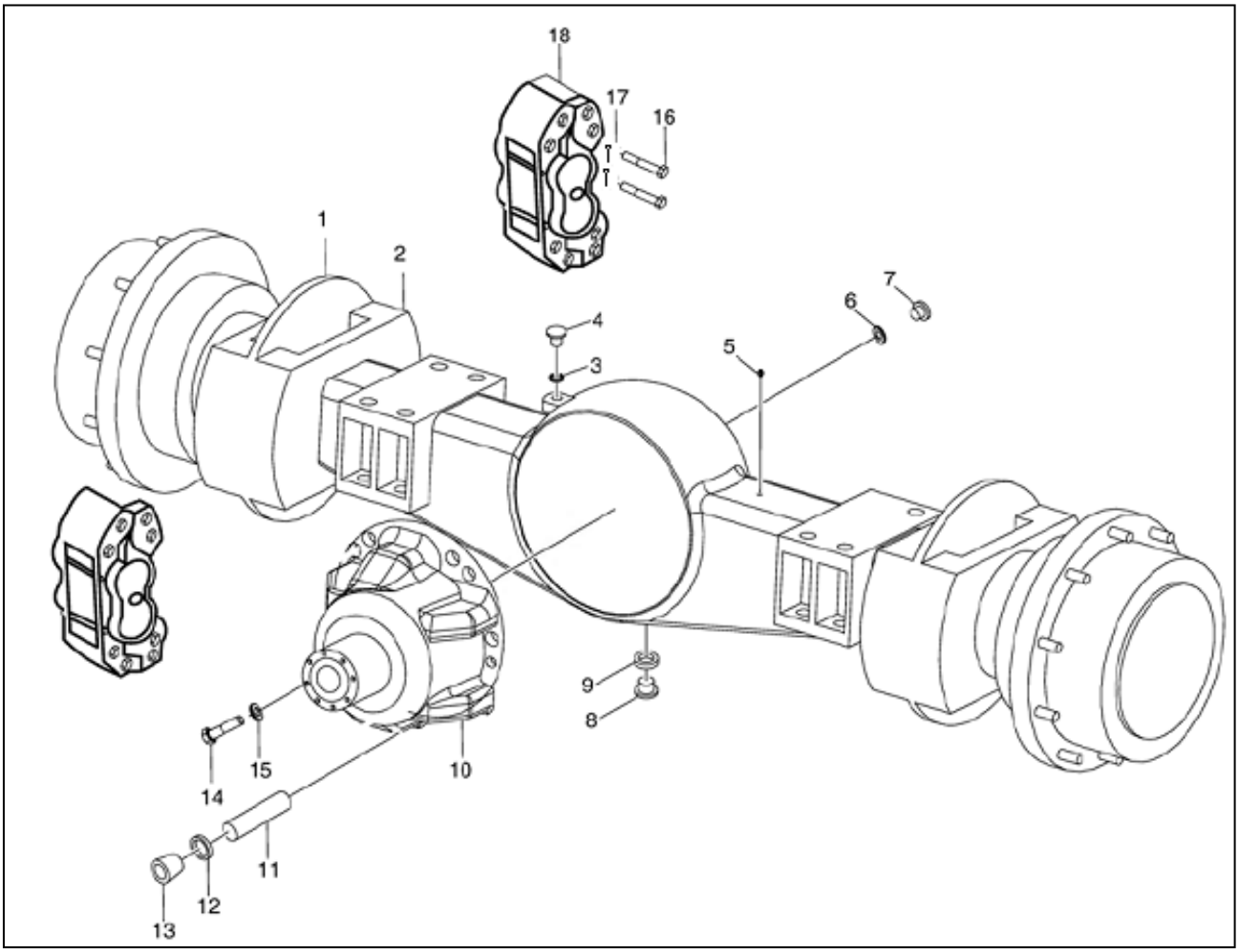


Figure 2

Reference Number	Description	Reference Number	Description
1	WHEEL REDUCER ASS'Y	10	MAIN REDUCER ASS'Y
2	AXLE ASSY;SHELL	11	STUD BOLT
3	GROUP WASHER φ24	12	SPACER 12
4	PLUG,SCREW	13	NUT M12
5	DEFLATION VALVE Z1/8	14	BOLT M12X35-10.9
6	O-RING	15	SPACER 12
7	PLUG,SCREW	16	BOLT
8	PLUG,SCREW	17	PIN
9	O-RING	18	BRAKE ASSY

Assemble of Hub drive axle

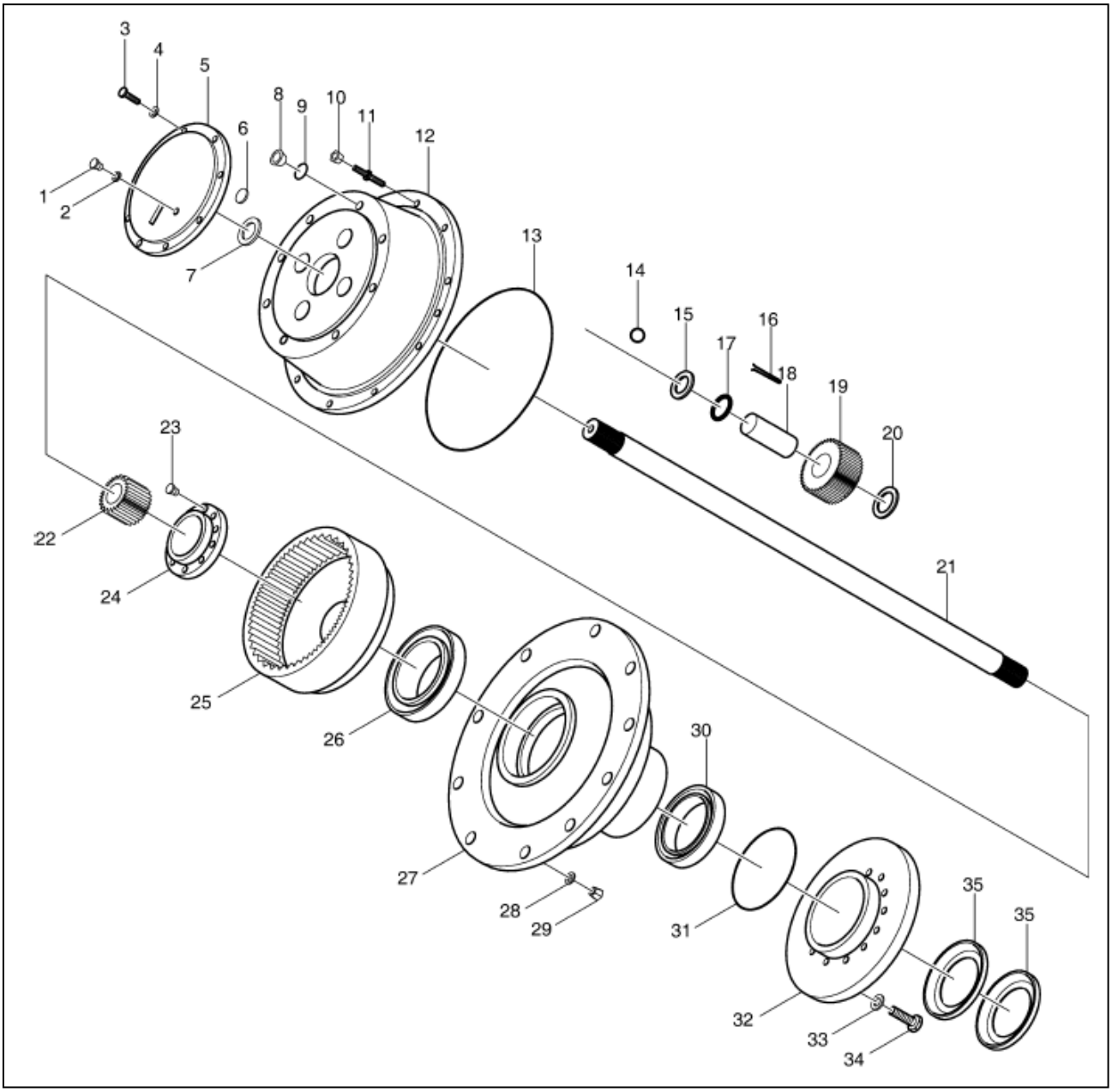


Figure 3

Reference Number	Description	Reference Number	Description
1	PLUG,SCREW	19	PLANET WHEEL
2	O-RING	20	PLANET WHEEL WASHER
3	BOLT M12X1.5-25	21	HALF SHAFT
4	SPACER 12	22	SUN WHEEL
5	COVER	23	SCREW M8X15
6	BLOCK	24	HOLDING NUT
7	RETAINER RING 48	25	INSIDE GEAR
8	PLUG,SCREW	26	BEARING 7521E
9	O-RING	27	HUB
10	HUB NUT	28	SPRING WASHER
11	HUB BOLT	29	NUT M18
12	SHELF,PLANET	30	BEARING 2007122E
13	O-RING SEAL	31	O-RING SEAL
14	STEEL BALL φ6	32	BRAKE DISC
15	PLANET WHEEL WASHER	33	WASHER 16
16	NEEDLE ROLLER 4×23.8	34	BOLT M16X45
17	SAPCER SLEEVE	35	SEAL ASSY,OIL
18	PLANET WHEEL SHAFT		

Brake assembly

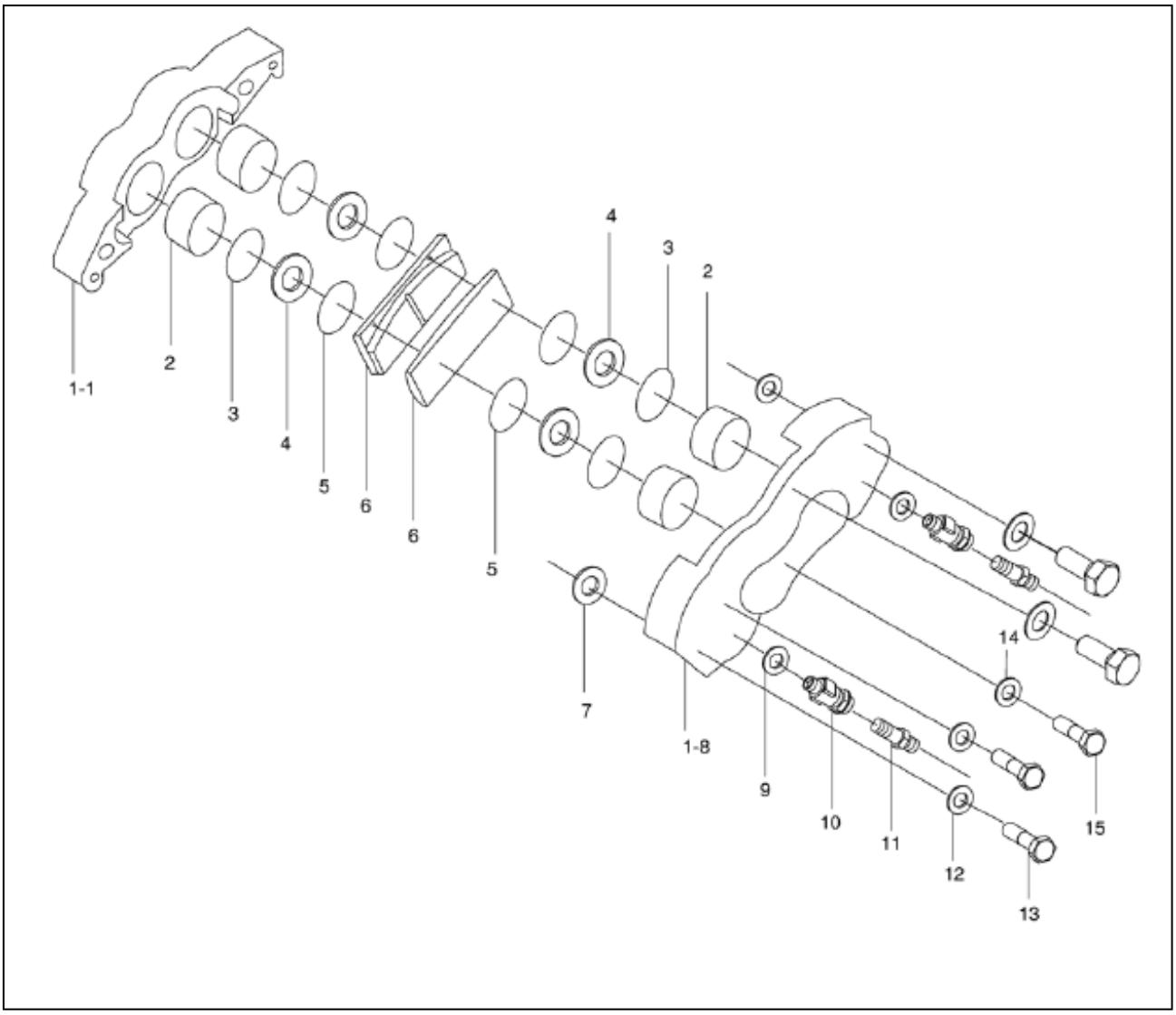


Figure 4

Reference Number	Description	Reference Number	Description
1-1	BRAKE,EXTERIOR	9	WASHER
1-8	BRAKE,INNER	10	CONNECTING
2	PISTON	11	DEFLATING VALVE
3	RECTANGULAR SEAL	12	SPACER 12
4	CASE,DUST	13	BOLT
5	BLOCK RING	14	WASHER SPRING 10
6	BRAKE DISK	15	PIN;BOLT
7	O-RING 20X2.4		

Main drive assembly

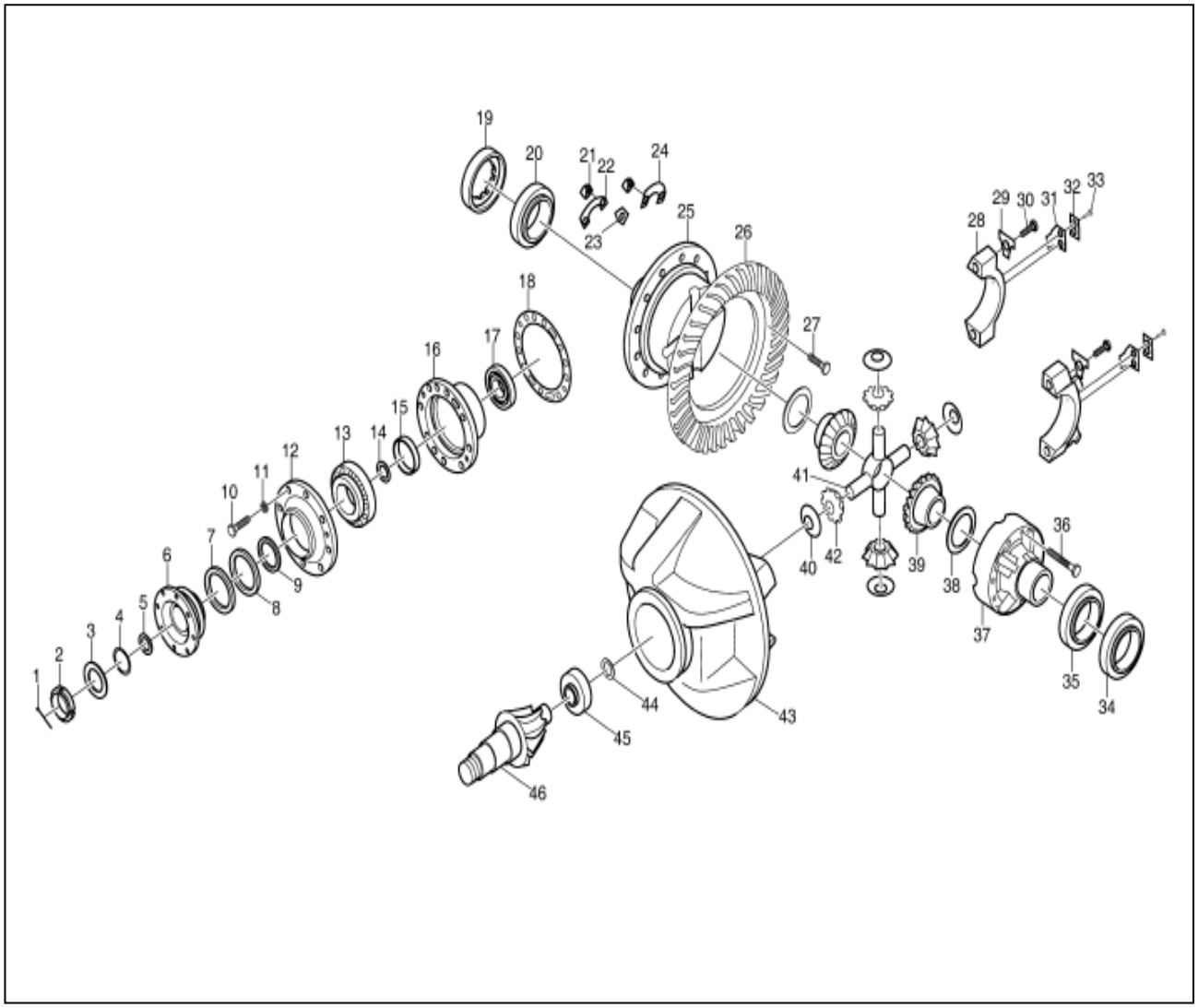


Figure 5

Reference Number	Description	Reference Number	Description
1	PIN 5X45	24	HOLDING PLATE
2	NUT M27×1.5-7H	25	DIFFERENTIAL SHELL –LEFT
3	WASHER	26	GEAR,BEVEL;DRIVE(REAR)
4	O-RING BAFFLE	28	DIFFERENTIAL BEARING COVER
5	O-RING SEAL 40X5.3	29	HOLDING PLATE
6	INPUT FLANGE GROUP	30	BOLT M18×90
7	OIL SEAL B62×93×6	31	HOLDING PLATE
8	OIL SEAL FB62×93×13	32	HOLDING PLATE
9	STOPPER WASHER	33	BOLT M8X12
10	BOLT M12×45-10.9	34	REGULATE NUT
11	SPACER 12	35	BEARING 7516E
12	OIL SEAL SEAT	36	BOLT M14X1.5
13	BEARING 27311E	37	DIFFERENTIAL SHELL – RIGHT
14	REGULATE WASHER	38	HALF SHAFT GEAR WASHER
15	SPACER SLEEVE	39	HALF SHAFT GEAR
16	BEARING SEAT	40	SUPPORT WASHER
17	BEARING 27311E	41	CROSS SHAFT
18	REGULATE WASHER	42	PLANET GEAR
19	REGULATE NUT	43	MAIN REDUCER SHELL
20	BEARING 7516E	44	RETAINER RING 30
21	NUT M14X1.5	45	BEARING 92606E
22	HOLDING PLATE	46	DRIVE GEAR;RIGHT
23	HOLDING PLATE		

SCHEDULED MAINTENANCE

Oil of new drive axle must be replaced after working for 15 days (about 100 working hours), oil shall be replaced once after working for every six months (about 1200 working hours) in following days.

Every month maintenance

1. Check abrasion condition of brake disc, if there is disruptive abrasion; please handle in time if there is any.
2. Check abrasion condition of brake block to guarantee separation and reunion of brake caliper is flexible; it shall be replaced in time when brake block is wearing close to abrasion line (at the bottom of groove).
3. Check if oil level of shell complies with requirements, please add new oil if the oil level descends.
4. Keep axle clean, keep vent pipe smooth, and avoid silt going into axle. Check loosening condition of all fasteners, especially rim nuts, if it is loosed, please refasten again.

Every half year maintenance：

Lubrication oil in axle shall be replaced every half a year, different brands of lubrication oil shall be adopted for different areas and seasons. Please refer to 4.2 for oil replacing method.

Every year maintenance：

Overhaul checking every working year:

1. Check the gap, mesh and abrasion condition of spiral bevel gear of main reducer.
2. Check abrasion condition of differential mechanism gear.
3. Check abrasion condition of hub gear.
4. Check abrasion condition of needle bearing of hub planetary gear.
5. Requirements of installation and debugging items after overhaul checking:
   1) After assembling, axle shaft gear and bevel gear shall move flexibly with hand touching rather than locking. The Min. gear backlash of gear is 0.18-0.23mm. Tooth length and tooth height of contacting area of two gears cannot be less than 50%.
   2) In order to guarantee enough bearing rigidity of active spiral gear, before assembling oil seal and sealing cover, adopt gradually reducing spacer shim between tapered roller bearing to give 1.0-1.5N.m preloaded torque to roller bearing.
   3) Gear backlash between the driving and driven spiral bevel gear is 0.25-0.45mm, the changing amount cannot be more than 0.15mm, gear backlash can be realized through adjusting nuts of both sides of differential mechanism and spacer shim of bearing sleeve. Tooth surface contacting area shall guarantee direction of tooth length and tooth height is not less than 50%, contacting position shall be at the middle side of tooth surface and closer to the smaller side.
   4) Adjusting of bearing clearance of shell at both sides of drive axle: Fasten adjusting nuts, give 28 ~ 38N.m preload to shell roller bearing, and then lock two round nuts with screw fastening

GENERAL DISASSEMBLY AND REASSEMBLY INSTRUCTIONS

⚠ WARNING!
Never use gasoline, solvents, or other flammable fluids to clean components. Only use approved commercial solvents that are nonflammable and nontoxic.

IMPORTANT
Use only GENUINE DOOSAN SPARE PARTS to warrant proper operations and prevent interchangeability problems.

GENERAL INSTRUCTIONS

1. Thoroughly clean and dry axle before disassembly.
2. All components should be thoroughly cleaned and dried before reassembly. Dirt, chips, and foreign material may cause failures.
3. All ducts and castings should be thoroughly cleaned and dried to remove dirt, chips, and foreign material to prevent damage after reassembly.
4. Reassembly should be done in a clean shop, and should be as dust free as possible.
5. Make sure tools and equipment are at hand.
6. When reassembling Daewoo strongly recommends to replace the following parts with new.
   - Seal Rings.
   - O-rings.
   - Gaskets.
   - Threaded rings with notched collar.
   - Any component damaged during disassembly.
7. When mounting heat fitted components, make sure of their proper position and direction of assembly, after they have cooled.
8. To heat bearings, use proper heating plates, piping, or suitable ovens.

NOTE: *Never heat parts by using a torch. Oil bath, heated by a torch, maybe used to warm components.*

9. Lubricate all sections concerned when reassembling shafts, bearings, etc.
10. Lubricate O-rings before installing them in relevant seats to prevent kinking during assembly, such a position would impair proper sealing.
11. Replace gears only in matched sets to make sure of proper tooth mating.

AXLE DISASSEMBLY

1 Disassembly of drive axle

1. Put drive axle on supporting and make sure main driver assembly is upward.

Figure 6

2. Loosen the connection bolts between brake caliper and brake caliper support, dismantle brake caliper assemble.

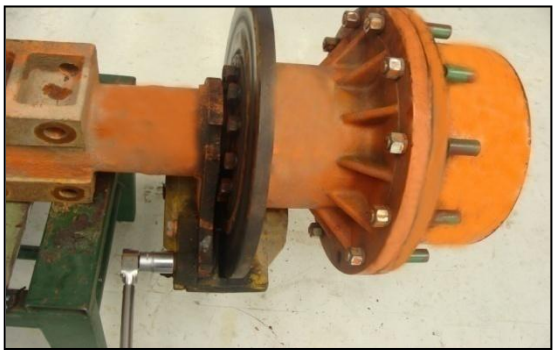


Figure 7

3. Release gear oil from planet carrier

   Loosen hub oil releasing drain plug and shell oil releasing drain plug, turn on slowly with hands to avoid oil spilling.

   Note：*Store gear oil with clean container.*

Figure 8

4. Release gear oil from shell

Turn on oil releasing bolts axle end cap to release gear oil.

Note： *Store gear oil with clean container.*

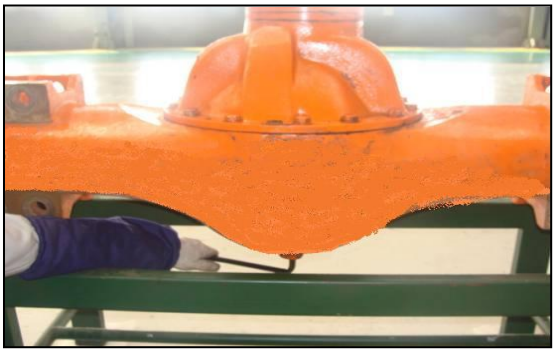


Figure 9

5. Dismantle end cap

Loosen connection bolts between planet carrier and end cap, then get end cap from hub reducer assembly with jackscrew, dismantle end cap.

Figure 10

6. Dismantle locating block

Take down locating block with hands.

Note： *If it is tight when taking down, please use assistant tools to pry out.*

Figure 11

7. Dismantle stop collar

Dismantle stop collar from semi axis with stop collar pincers.

Note： *Before dismantling stop collar, pull out a section of semi axis from shell.*

Note： *It must clamp firmly when using stop collar pincers to avoid safety hazard when it is popup.*

Figure 12

8. Dismantle sun gear

Dismantle semi axis from sun gear.。

Figure 13

9. Dismantle locating block

Dismantle locating block from semi axle with hands.

Figure 14

10. Dismantle semi axis

Take semi axis from shell slightly.

Figure 15

11. Hub reducer

First loosen rim bolts with relative tools, then loosen rim from planet carrier with jackscrew and dismantle planet carrier assembly.

Note：*Please slowly loosen planet carrier to avoid safety hazard resulted from dropping of planet carrier assembly.*

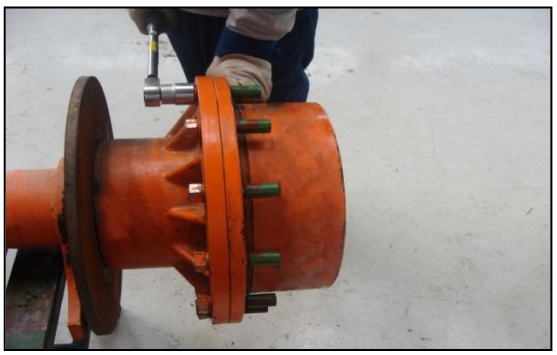


Figure 16

12. Dismantle round bolts

Dismantle round bolts.

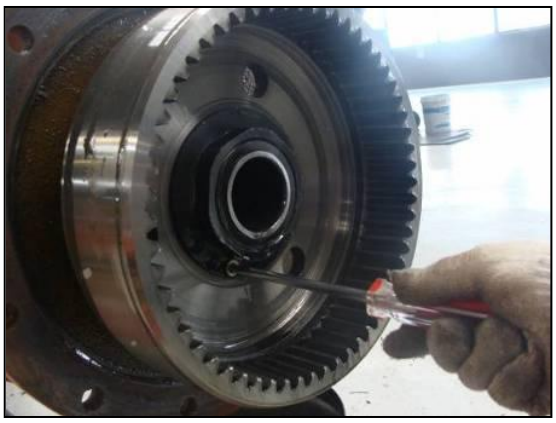


Figure 17

13. Dismantle round nuts

Dismantle round nuts.

Figure 18

14. Dismantle internal gear

Take internal gear out by slightly rocking.

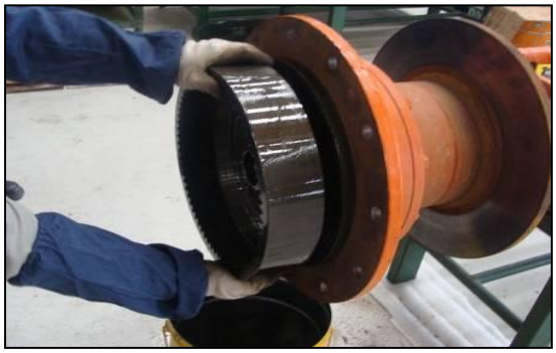


Figure 19

15. Dismantle rolling bearing

Take out rolling bearing with special dismantling tool.

Figure 20

16. Dismantle wheel hub assembly

Take wheel hub assembly from supporting axle.

Note: *During hanging and dismantling process, please keep axis of wheel hub assembly is in line with axis of hub reduction supporting axle to avoid scratching oil surface and internal spare parts during dismantling process.*

Remark: dismantle all parts at the other side of drive axle with the same methods.

Figure 21

17. Dismantle main drive assembly

Dismantle connection bolts between main drive and shell assembly, take out main drive with jackscrew, and suspend main drive assembly.

Note: *When suspending main drive assembly, guarantee suspending and dismantling tools are at the above of main drive assembly to avoid spare parts inside are knocked again during suspending and dismantling process.*

Figure 22

2 Assembly dismantling

2.1 Dismantle planet carrier assembly

1. O ring

Take out O ring.

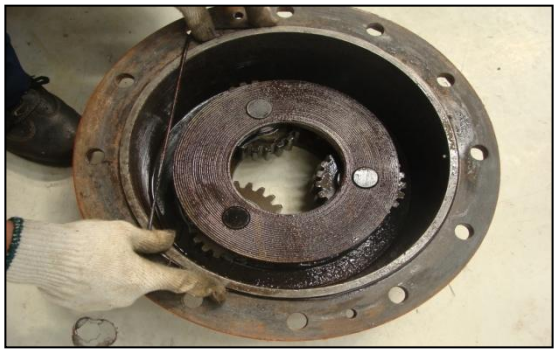


Figure 23

2. Put planet carrier on working platform horizontally.

Figure 24

3. Take out planet axle with tools.

Figure 25

4. Take out steel balls.

Figure 26

5. Take out planet wheel.

Figure 27

6. Take out baffle ring and quill roller from inside of planet wheel.

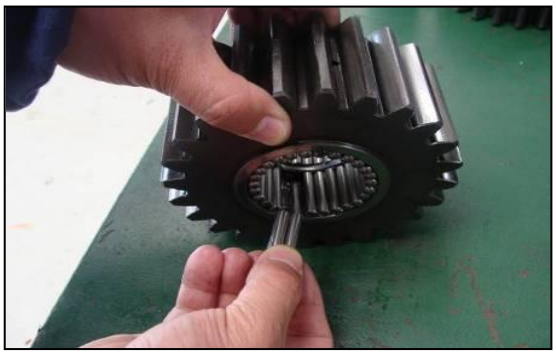


Figure 28

2.2 Dismantle hub assembly

1. Put hub assembly on working platform; loosen connection bolts between brake disc and hub.

Figure 29

2. Take out brake disc.

Figure 30

3. Take out bearing.

Figure 31

4. Take out oil seal.

Figure 32

2.3 Dismantle main drive assembly

1. Put main drive assembly (input flange upward) horizontally and fixed on supporting.

Figure 33

2. Dismantle locknut gasket, O ring and baffle ring.

Figure 34

3. Take out input flange.

Figure 35

4. Dismantle connection bolts between sealing cover and bearing sleeve, take out sealing cover.

Figure 36

5. Turn main drive for 180°, dismantle bolts fastening locking plate, take out locking plate.

Note： *Some of the machine structure may be different from this figure, please adjust working content according to actual structure.*

Figure 37

6. Dismantle connection bolts of bearing seat and take out bearing seat.

Figure 38

7. Dismantle adjusting nuts.

Figure 39

8. Dismantle bearing outer ring.

Figure 40

9. Hang out differential mechanism assembly.

Note： *Keep balance when hanging out to avoid safety hazard.*

Figure 41

10. Separate active spiral bevel gear assembly and bracket with jackscrew.

Figure 42

2.4 Dismantle differential assembly

1. Put differential assembly vertically on working platform, and guarantee it is stable.

Figure 43

2. Dismantle bearing on left and right shell of differential mechanism.

Figure 44

3. Loosen connection nuts between driven spiral bevel gear and right shell of differential mechanism, dismantle driven spiral bevel gear.

Note： *Before taking out driven spiral bevel gear, please check or mark assembling sign first so that it can be placed back to the original position.*

Figure 45

4. Loosen connection nuts of left and right shell, separate left and right shell of differential mechanism.

Note： *Before separating left and right shell of differential mechanism, please check or mark assembling sigh first so that it can be placed back to the original position.*

Figure 46

5. Take out semi axis gear gasket and semi axis gear.

Figure 47

6. Take out joint cross and differential gear together, take out differential gear gasket and gear from joint cross.

Figure 48

7. Take out semi axis gear gasket and gear.

Figure 49

2.5 Dismantle active spiral bevel gear assembly

1. Put active spiral bevel gear assembly on working platform, support flange of bearing sleeve, clamp down on thread end of active spiral bevel gear assembly with down device.

Figure 50

Note：*Do not clamp too much to avoid damaging flange, pull out bearing sleeve from active spiral bevel gear assembly.*

2. Reverse bevel gear assembly and take out bearing.

Figure 51

3. Take out bearing sleeve.

Figure 52

4. Take out adjusting gasket.

Figure 53

5. Take out spacer bush.

Figure 54

AXLE REASSEMBLY

1. Axle assembly

1. Shell

Clean shell and suspend with special supporting. Fasten gummed plug screw at oil inlet and oil filler.

Note：*Plug screw fastening torque：280～330Nm*

Note：*Loctite 262 taper thread sealant.*

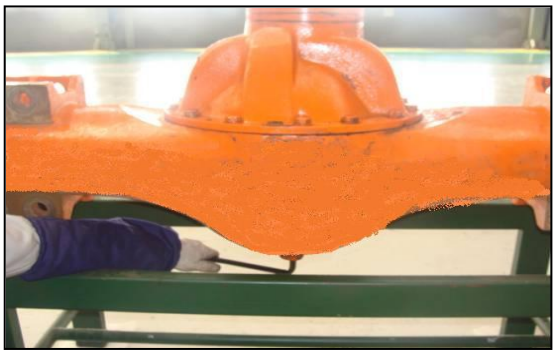


Figure 55

2. Wheel hub assembly

Coat lubrication grease on hub supporting axle of shell assembly; assemble wheel hub assembly on both sides of supporting axle of shell assembly.

Note： *Use lubrication oil.*

Figure 56

3. Rolling bearing

Assemble rolling bearing on hub supporting axle.

Figure 57

4. Internal gear

Assemble internal gear of drive axle at multiple spline at the end of supporting bearing.

Figure 58

5. Round nuts

Assemble round nuts and fasten. Knock internal gear slightly with copper stick to make internal gear in place.

Figure 59

6. Assemble round bolts

1) Grapple the hole on wheel hub with push and pull ergometer, pull ergometer along with tangential direction, indication on ergometer is 160±10N, if the indication is not within the range of 160±10N, adjust tightness degree of round bolts according to the indication until it is within the range of 160±10N. In the end, coat Loctite 262 thread fastening sealant for 5~6 from the second thread hole of internal gear (form a liquid level at 1/3 circle of thread), then fasten bolts, and fix round nuts.

2) Before dynamometry, rotate hub wheel for more than 5 times.

Note： *Loctite 262 thread fastening sealant*

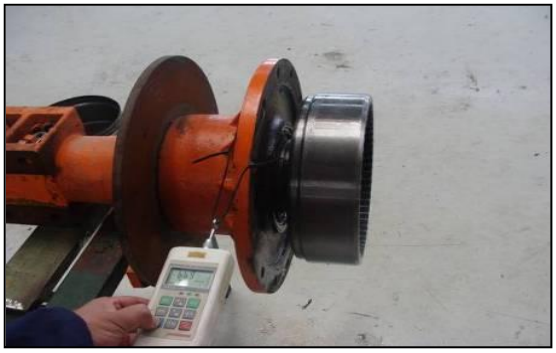


Figure 60

Figure 61

7. Assemble O sealing ring

Assemble O sealing ring on hub assemble.

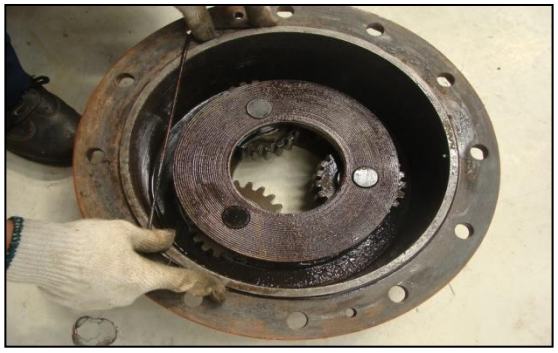


Figure 62

8. Planet carrier assembly

Assemble planet carrier assembly on wheel hub with rim bolts, gaskets and nuts.

Note： *Fastening torque：540～650Nm*

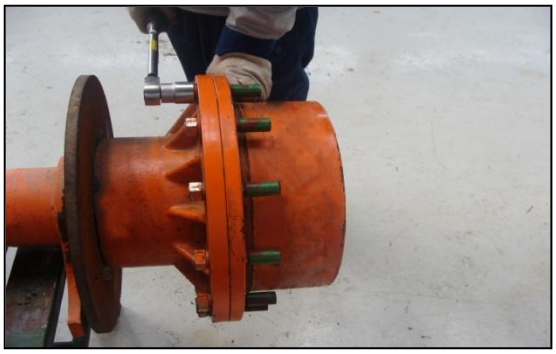


Figure 63

9. Assemble semiaxis

Assemble semiaxis in wheel hub.

Figure 64

10. Assemble sun gear

Assemble sun gear at one side of semiaxis with baffle ring groove (pay attention to semiaxis multiple spline and gear assembly).

Figure 65

11. Assemble baffle ring

Assemble baffle ring with baffle ring used for axle.

Note: *It must be clamped firmly when using baffle ring pincer to avoid safety hazard when it is popping out during assembling process.*

Figure 66

12. Assemble locating block

Stake steel ball on locating block, it can rotate flexibly after staking steel ball.

Figure 67

13. Assemble end cap

Coat Loctite 262 thread fastening sealant on screws, location of sealant is 15mm on top of thread end. Fasten cap with bolts and gaskets.

Note: *Fasten all screws according to symmetrical and crossing principle.*

Note: *Fastening torque：110～130Nm*

Note: *Loctite 262 thread fastening sealant*

Figure 68

14. Assemble brake caliper assembly

Assemble disc brake on brake caliper supporting, fix with bolts and gaskets.

Note: *Fastening torque：540～650Nm*

Note: *Coat Loctite 262 thread fastening sealant at 20mm length at thread end during assembling.*

Figure 69

15. Assemble main drive assembly

Coat Loctite 598 silicon rubber surface sealant at the joint surface between shell and bracket, coatφ3～φ6 glue saluting ring with sealing surrounding inside of thread hole at the large end of shell. The coated sealant cannot be in the air for more than ten minutes.

Note: *Loctite 598 silicon rubber surface sealant*

Figure 70

16. Assemble main drive

Hand up main drive assembly with overhead crane, put main drive at main drive shell of the axle, assemble locating pin.

Figure 71

17. Assemble bolts

Coat proper Loctite 262 threat fastening sealant on bolts, the coating position is 15mm length at thread end. Fasten main drive assembly and shell assembly with bolts and gaskets.

Note：*Fastening torque：110～130Nm*

Note：*Loctite 262 threat fastening sealant*

Note：*Fasten all screws according to symmetrical and crossing principle.*

Figure 72

18. Add oil

Add 10L 85W/90 GL-5 gear oil (GB13895-1992) in axle bag of shell and fasten plug screws.

Note：*Use 85W/90 GL-5 gear oil*

Note：*Anaerobic type pipe threat sealant*

Note：*Fastening torque：280～330Nm*

Figure 73

19. Inject 4.5L (subject to overflowing from planet carrier) 85W/90 GL-5 gear oil (GB13895-1992) into two hub reducers and fasten plug screws.

Note：*Use 85W/90 GL-5 gear oil*

Note：*Anaerobic type pipe threat sealant*

Figure 74

2. Assembly parts assembling

2.1 Install hub assembly

1. Keep the large end of hub upward, assemble bearing outer ring and turn over to keep the small end of hub upward and assemble bearing inner ring.

Figure 75

2. Coat lubrication oil at oil seal end, check completeness of oil seal, coat lubrication oil in groove of oil seal evenly, and assemble oil seal in side of oil seal end.

Figure 76

3. Assemble brake disc on hub and fasten with bolts and gaskets.

Note：*Fastening torque：280～330Nm*

Note：*Fasten all screws according to symmetrical and crossing principle.*

Figure 77

2.2 Assemble planet carrier assembly

1. Stick lubrication grease quill roller (27 units each) on walls of inner holes of planet gears, assemble baffle ring in the middle of quill roller, assemble gaskets at both sides of planet gear, then assemble to the seat hole of planet carrier.

Figure 78

2. Assemble steel balls in holes of planet gear shaft, steel ball shall aim at semi circle of planet carrier, go through the inner hole of planet gear and gasket and assemble on planet carrier. After assembly, planet gear shall rotate flexibly there is no blocking.

Figure 79

2.3 Install of main drive assembly

1. Assemble rolling bearing on bear neck of the terminal with pressure machine, rotate to the left on active spiral bevel gear front axle, and rotate to the right side.

Figure 80

2. Press inner ring into rolling bearing with pressure machine at the other side

Figure 81

3. Turn over gear and assemble outer ring of gear

Figure 82

4. Install spacer bush

Figure 83

5. Install gaskets

Figure 84

6. Install bearing sleeve

Figure 85

7. Press inner ring of antifriction bearing in the end.

Note: *when assembling main reducer, taper rolling bearing shall have certain tightness, that is on the basis of eliminating bearing clearance, and give certain preload. The purpose is to reduce axial force caused during transmission process which will result in axial displacement, improve supporting rigidity, and guarantee normal mesh of bevel gear pair. But if it is too tight, it will accelerate abrasion of taper rolling bearing. Press with P= 5420 kg pressure at the top side of inner ring of rolling bearing, grapple Φ14.5 hole with pull and push ergometer, pull ergometer along with tangential direction, indication of ergometer when pushing shall be 17.34-30.06N, if the indication is not within the range of 17.34-30.06N, increase or reduce thickness of spacer shim, repeat the above process until the indication is within 17.34-30.06N.*

Figure 86

Figure 87

2.4 Assemble of differential assembly

1. Assemble rolling bearing at the bearing position of right shell terminal of differential mechanism.

Figure 88

2. Assemble rolling bearing at the bearing position of left shell terminal of differential mechanism.

Figure 89

3. Assemble semiaxis gear

Assemble semiaxis gear gasket in left shell of differential mechanism.

Note：*The side of gasket with groove shall toward to the direction of joint cross*

Figure 90

4. Install semiaxis gear

Figure 91

5. Assemble joint cross assembly

Assemble bevel gear (internal of small terminal) and bevel gear gasket on four axles of joint cross.

Note： *Lubricate with grease when assembling bevel gear and bevel gear gasket*

Note： *Lubricate lubrication oil*

Figure 92

6. Differential mechanism shell

Assemble joint cross in right shell of differential mechanism to make bevel gear and semiaxis gear mesh, turn over left shell assembly of differential mechanism to assemble right shell assembly of differential mechanism, join right shell and left shells of differential mechanism with bolts and fasten with gaskets and nuts.

Figure 93

Note： *Nuts fastening torque180～210Nm*

Note： *1) Guarantee assembling mark of right shell and left shell of differential mechanism align.*

2) Coat proper Loctite 262 thread fastening sealant at the thread bottom within 12mm length.

3) After assembling, semiaxis gear and taper gear can be rotated manually without blocking.

Figure 94

7. Install driven spiral bevel gear

Aim at assembling mark, fasten driven spiral bevel gear (rotate to the left for rear axle, rotate to the right for front axle) with bolts, gaskets and nuts, and fasten screws.

Figure 95

Note：*Nuts fastening torque 180～210Nm。*

Note：*1) Coat proper Loctite 262 thread fastening sealant at the thread bottom within 12mm length.*

2) Judging method of left and right spiral: face to positive side of gear, right rotation refers to the spiral gear rotates to large terminal clockwise; on the contrary, left rotation refers to the spiral gear rotates to large terminal anticlockwise.

2.5 Install main reducer

1. Install the assembled active sprial bevel gear assembly in bracket, coat sealant line with diameter 2-4mm at the small end, refer to the picture for sealant line; sealant line and diameter of bearing sleeve (the other side of gasket) shall be done according to the above requirements.

Figure 96

2. Assemble sealing cover

Press oil seal in sealing cover.

Figure 97

Note：*Coat a layer of proper lubrication oil when assembling oil seal.*

3. Install input flange

Put gasket on the end face of bracket, install sealing cover assembly (coat lubrication grease on oil seal according to common requirements of drive axle), and connect with bracket with bolts and gaskets.

Note：*Screw fastening torque 110～130Nm。*

Figure 98

4. Install input flange.

Figure 99

5. Install baffle ring, O ring, coat sealant on one end face of gasket, the surface with sealant is downward, install gasket.

Note：*Coat Loctite 598 sealant*

Figure 100

6. Install gasket

Figure 101

7. Install round screws and fasten.

Note： *Screw fastening torque: 320～400Nm 。*

Note： *Before installing flange, install flange on multiple spline on main spiral bevel gear, measure radial play eccentricity of flange, guarantee it cannot be more than 0.08, and mark matching and assembling signs. If it is out of tolerance, rotate flange to certain angle and measure unitl it complies with requirements, otherwise, replace flange.*

Figure102

8. Gasket shall be close to φ2～φ3 glue line.
9. Install differential assembly

   Turnover carrier, install differential assembly in bracket.

Figure103

10. Install bearing seat with gaskets and bolts (bolts shall be a little bit tight).

Figure104

11. Install adjusting nuts.

    Note： *Two bearing seats cannot be exchanged.*

12. Coat proper thread sealant on the length of 15～25mm on thread end surface of bolts.

    Note： *Coat Loctite 262 thread fastening sealant.*

Figure105

13. Adjust spiral bevel gear

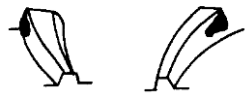
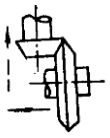
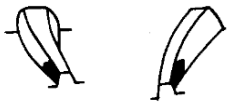
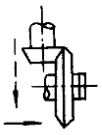
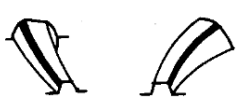
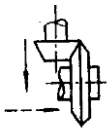
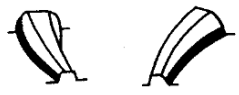
Adjustment of spiral bevel gear mesh condition refers to adjustment of mesh zone and back lash, when adjusting back lash of spiral bevel gear pair, dial gauge can be used to touch the gear surface of large side edge of driven spiral bevel gear, then rotate driven spiral bevel gear to measure back lash directly, the clearance shall be 0.2～0.35mm. Adjusting method of back mesh is to twist adjusting nuts to change position of driven spiral bevel gear (when it is necessary, move active spiral bevel gear assembly to adjust).

Figure 106

If the clearance is larger than the regulated value, approach active spiral bevel gear from driven spiral bevel gear; otherwise be away from it. In order to keep the adjusted preload of taper rolling bearing of differential mechanism, twisting numbers of adjusting nuts at one side shall be equal to twisting numbers of adjusting nuts at the other side.

When adjusting contact zone of spiral bevel gear pair, coat red color (red lead powder) on driven spiral bevel gear teeth (coat three teeth usually), rotate driven spiral bevel gear with hands repeatedly, check contacting moulage. Adjust the correct position of spiral bevel gear mesh moulage: it shall not be less than 50% along with teeth height direction and teeth length direction, mesh moulage of driven bevel gear shall be close to the center, and in the middle of teeth height, smaller than the small end on teeth length direction. Increasing preload of differential bearing: after adjusting back lash of spiral bevel gear well, it shall guarantee the clearance between taper rolling bearings at both sides of differential mechanism is 0. Following is the adjusting methods.

Adjustment of contact zone and back lash when installing spiral bevel gear

Contact zone of driven spiral bevel gear	Adjusting method	Gear moving direction
	Move driven gear to the direction of active gear, if the clearance is too small, move active gear outside	
	Move driven gear away from active gear, if the clearance is too large, move active gear inside	
	Move active gear to the direction of driven gear, if the clearance is too small, move driven gear inside and outside	
	Move active gear away from driven gear, if clearance is too large, move driven gear inside	

Method of adjusting mesh zone is usually increasing and decreasing adjusting gaskets and rotating adjusting nuts. Adjusting of contact zone will affect performance and service life greatly, it shall be carried out carefully.

Note：*After adjusting, clean off red lead powder.*

14. Install locking plate

Fasten the fixed bolts on bearing seat, fastening torque is 380～450Nm. Put locking plate at the right position, fix it on bearing seat with bolts and gaskets, and fasten fixing bolts of locking plate.

Figure 107

Note：*Fastening torque 30～36Nm*

Note：*Coat proper Loctite 262 thread fastening sealant on 5-10mm length at the end surface of fixing bolt.*

Note：*Coat Loctite 262 thread fastening sealant*

REAR AXLE

⚠ CAUTION!
Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section. **Always use tools and equipment that is in good working order.** **Use lifting and hoisting equipment capable of safely handling load.** **Remember, that ultimately safety is your own personal responsibility.**

TABLE OF CONTENTS

GENERAL DESCRIPTION

Structure chart

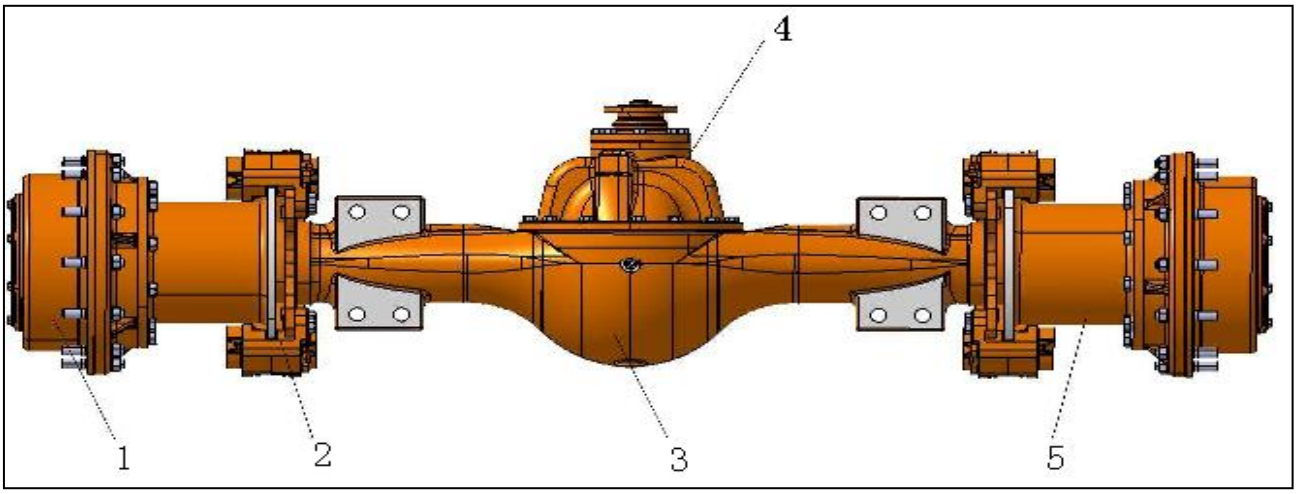


Figure 1

1. EDGE REDUCER ASS'Y 2. BRAKE CALMPS ASS'Y 3. SHELL 4. MAIN REDUCER ASS'Y 5. HUB ASS'Y

Basic parameters of drive axle:

Main drive	Type	Spiral bevel gear grade one reduction
	Reduction ratio	4.222
Hub reduction gear	Type	Grade one planet reduction
	Reduction ratio	4.8
Axle oil	GB13895-1992 gear oil	19L

Internal structure of drive axle

Drive axle assembly is one of the most important spare parts of transmission system, its main function is reduce rotation speed from gear box and increase torque, and make wheels at both sides having speed difference. Besides, it also plays the role of bearing and transmitting. Drive axle assembly of loader is mainly composed of shell, main drive (including differential mechanism), semiaxis, hub reduction gear, brake caliper assembly and other parts. Of which, the parts having reduction and differential function is main driver and hub reduction gear; power transmission between main drive and hub reduction gear is realized through semiaxis, multiple spline at both sides of semiaxis and axle shaft gear of differential mechanism and sun gear of hub reduction gear mesh with each other to realize power connection between main drive and hub reduction gear.

PARTS LIST

Disassembly of rear axle

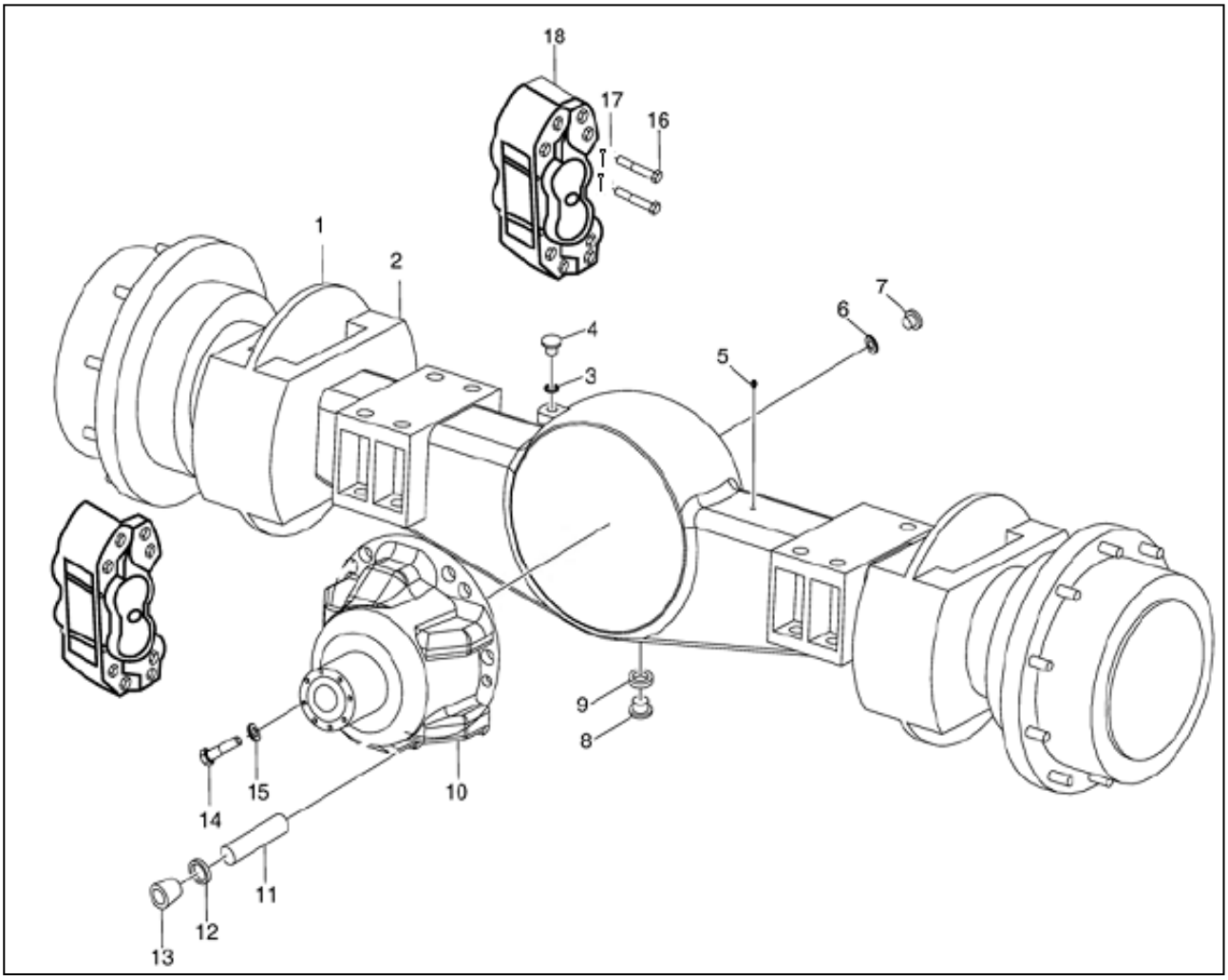


Figure 2

Reference Number	Description	Reference Number	Description
1	WHEEL REDUCER ASS'Y	10	MAIN REDUCER ASS'Y
2	AXLE ASSY;SHELL	11	STUD BOLT
3	GROUP WASHER φ24	12	SPACER 12
4	PLUG,SCREW	13	NUT M12
5	DEFLATION VALVE Z1/8	14	BOLT M12X35-10.9
6	O-RING	15	SPACER 12
7	PLUG,SCREW	16	BOLT
8	PLUG,SCREW	17	PIN
9	O-RING	18	BRAKE ASSY

Assembly of hub drive axle

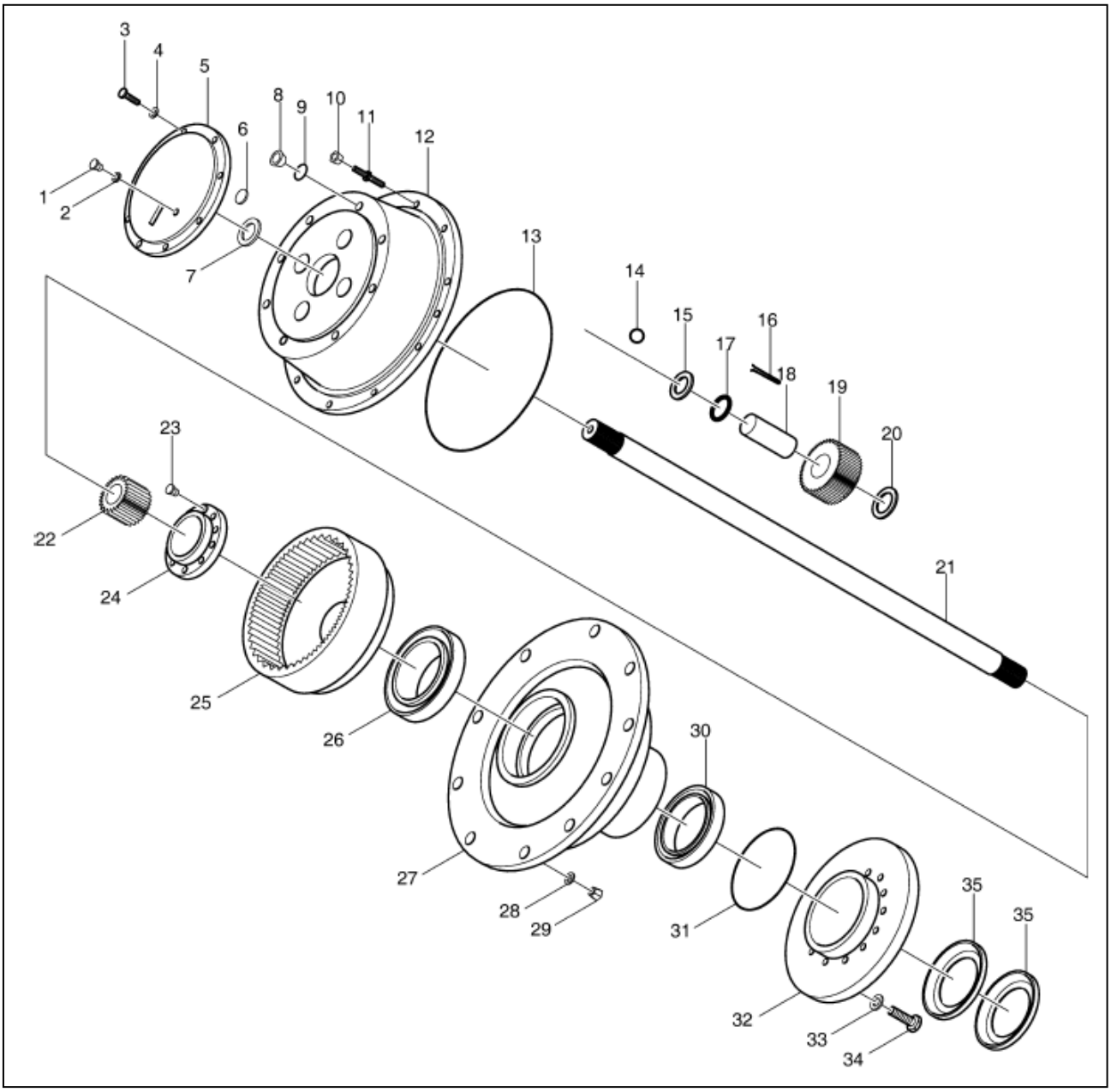


Figure 3

Reference Number	Description	Reference Number	Description
1	PLUG,SCREW	19	PLANET WHEEL
2	O-RING	20	PLANET WHEEL WASHER
3	BOLT M12X1.5-25	21	HALF SHAFT
4	SPACER 12	22	SUN WHEEL
5	COVER	23	SCREW M8X15
6	BLOCK	24	HOLDING NUT
7	RETAINER RING 48	25	INSIDE GEAR
8	PLUG,SCREW	26	BEARING 7521E
9	O-RING	27	HUB
10	HUB NUT	28	SPRING WASHER
11	HUB BOLT	29	NUT M18
12	SHELF,PLANET	30	BEARING 2007122E
13	O-RING SEAL	31	O-RING SEAL
14	STEEL BALL φ6	32	BRAKE DISC
15	PLANET WHEEL WASHER	33	WASHER 16
16	NEEDLE ROLLER 4×23.8	34	BOLT M16X45
17	SAPCER SLEEVE	35	SEAL ASSY,OIL
18	PLANET WHEEL SHAFT		

Brake assembly

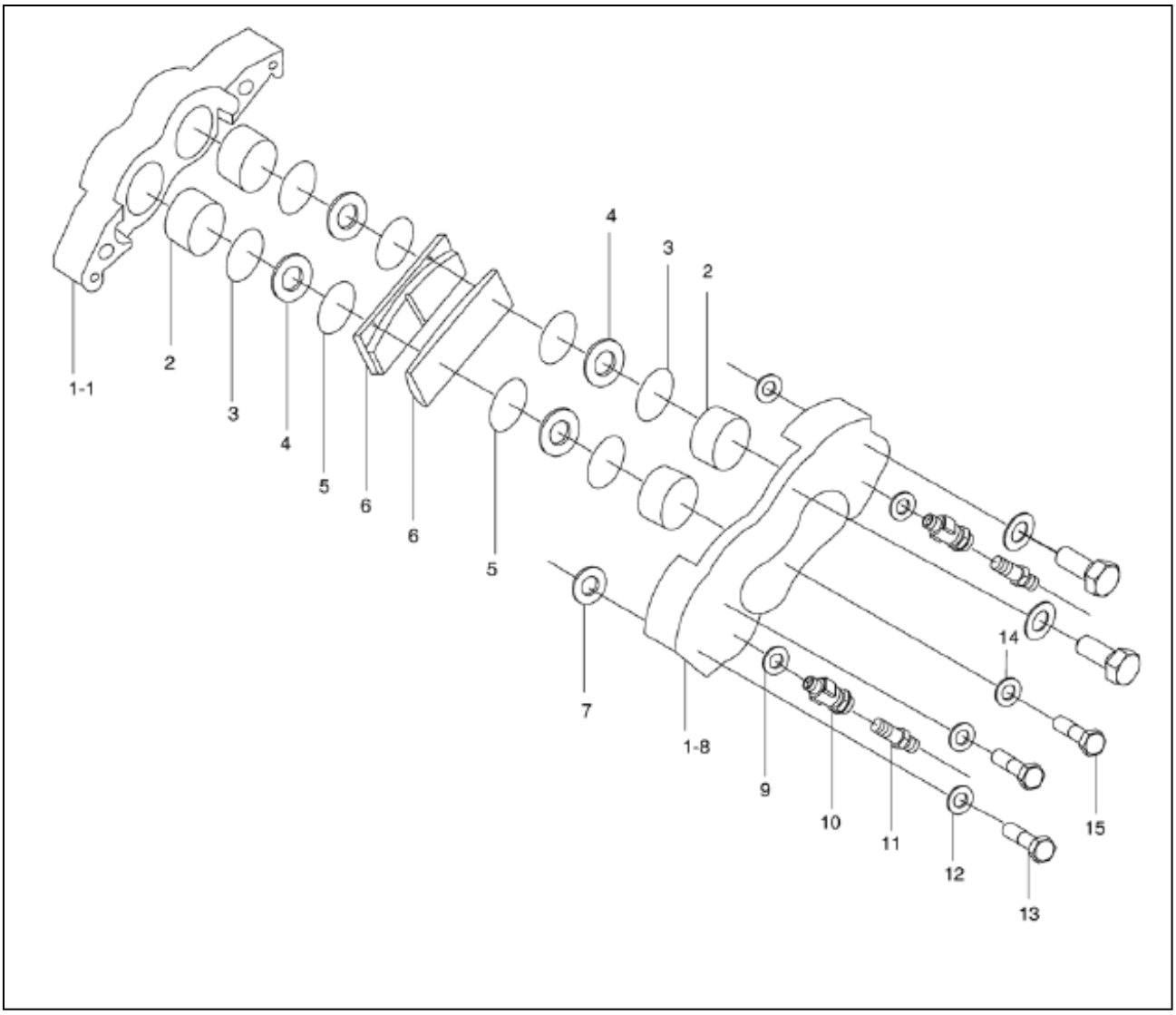


Figure 4

Reference Number	Description	Reference Number	Description
1-1	BRAKE,EXTERIOR	9	WASHER
1-8	BRAKE,INNER	10	CONNECTING
2	PISTON	11	DEFLATING VALVE
3	RECTANGULAR SEAL	12	SPACER 12
4	CASE,DUST	13	BOLT
5	BLOCK RING	14	WASHER SPRING 10
6	BRAKE DISK	15	PIN;BOLT
7	O-RING 20X2.4		

Main drive assembly

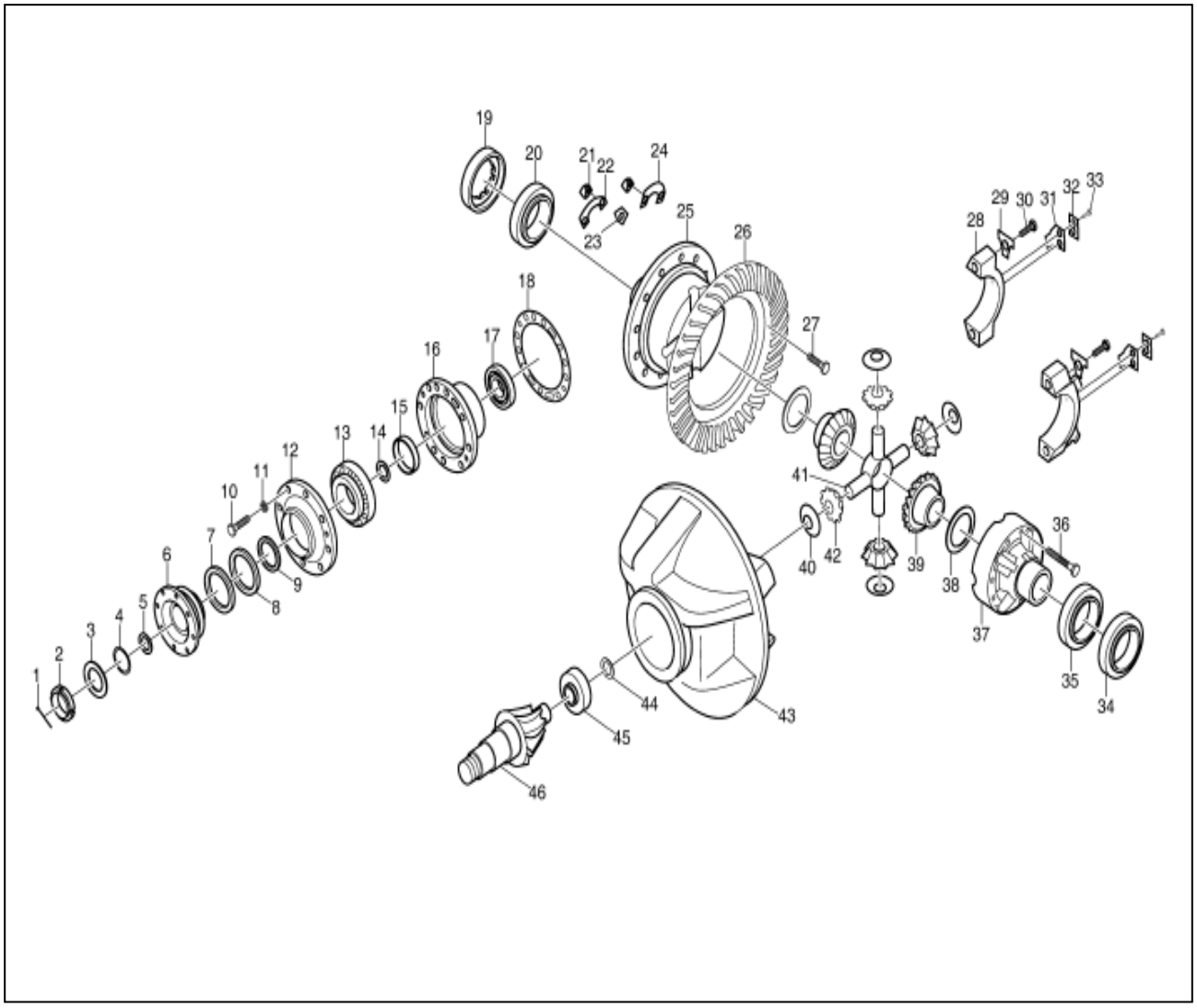


Figure 5

Reference Number	Description	Reference Number	Description
1	PIN 5X45	24	HOLDING PLATE
2	NUT M27×1.5-7H	25	DIFFERENTIAL SHELL –LEFT
3	WASHER	26	GEAR,BEVEL;DRIVE(REAR)
4	O-RING BAFFLE	28	DIFFERENTIAL BEARING COVER
5	O-RING SEAL 40X5.3	29	HOLDING PLATE
6	INPUT FLANGE GROUP	30	BOLT M18×90
7	OIL SEAL B62×93×6	31	HOLDING PLATE
8	OIL SEAL FB62×93×13	32	HOLDING PLATE
9	STOPPER WASHER	33	BOLT M8X12
10	BOLT M12×45-10.9	34	REGULATE NUT
11	SPACER 12	35	BEARING 7516E
12	OIL SEAL SEAT	36	BOLT M14X1.5
13	BEARING 27311E	37	DIFFERENTIAL SHELL – RIGHT
14	REGULATE WASHER	38	HALF SHAFT GEAR WASHER
15	SPACER SLEEVE	39	HALF SHAFT GEAR
16	BEARING SEAT	40	SUPPORT WASHER
17	BEARING 27311E	41	CROSS SHAFT
18	REGULATE WASHER	42	PLANET GEAR
19	REGULATE NUT	43	MAIN REDUCER SHELL
20	BEARING 7516E	44	RETAINER RING 30
21	NUT M14X1.5	45	BEARING 92606E
22	HOLDING PLATE	46	DRIVE GEAR;RIGHT
23	HOLDING PLATE		

SCHEDULED MAINTENANCE

Oil of new drive axle must be replaced after working for 15 days (about 100 working hours), oil shall be replaced once after working for every six months (about 1200 working hours) in following days.

Every month maintenance

1. Check abrasion condition of brake disc, if there is disruptive abrasion; please handle in time if there is any.
2. Check abrasion condition of brake block to guarantee separation and reunion of brake caliper is flexible; it shall be replaced in time when brake block is wearing close to abrasion line (at the bottom of groove).
3. Check if oil level of shell complies with requirements, please add new oil if the oil level descends.
4. Keep axle clean, keep vent pipe smooth, and avoid silt going into axle. Check loosening condition of all fasteners, especially rim nuts, if it is loosed, please refasten again.

Every half year maintenance

Lubrication oil in axle shall be replaced every half a year, different brands of lubrication oil shall be adopted for different areas and seasons. Please refer to 4.2 for oil replacing method.

Every year maintenance

Overhaul checking every working year:

1. Check the gap, mesh and abrasion condition of spiral bevel gear of main reducer.
2. Check abrasion condition of differential mechanism gear.
3. Check abrasion condition of hub gear.
4. Check abrasion condition of needle bearing of hub planetary gear.
5. Requirements of installation and debugging items after overhaul checking:
   1）After assembling, axle shaft gear and bevel gear shall move flexibly with hand touching rather than locking. The Min. gear backlash of gear is 0.18-0.23mm. Tooth length and tooth height of contacting area of two gears cannot be less than 50%.
   2）In order to guarantee enough bearing rigidity of active spiral gear, before assembling oil seal and sealing cover, adopt gradually reducing spacer shim between tapered roller bearing to give 1.0-1.5N.m preloaded torque to roller bearing.
   3）Gear backlash between the driving and driven spiral bevel gear is 0.25-0.45mm, the changing amount cannot be more than 0.15mm, gear backlash can be realized through adjusting nuts of both sides of differential mechanism and spacer shim of bearing sleeve. Tooth surface contacting area shall guarantee direction of tooth length and tooth height is not less than 50%, contacting position shall be at the middle side of tooth surface and closer to the smaller side.
   4）Adjusting of bearing clearance of shell at both sides of drive axle: Fasten adjusting nuts, give 28-38N.m preload to shell roller bearing, and then lock two round nuts with screw fastening.

GENERAL DISASSEMBLY AND REASSEMBLY

INSTRUCTIONS

⚠ WARNING!
Never use gasoline, solvents, or other flammable fluids to clean components. Only use approved commercial solvents that are nonflammable and nontoxic.

IMPORTANT
Use only GENUINE DOOSAN SPARE PARTS to warrant proper operations and prevent interchangeability problems.

GENERAL INSTRUCTIONS

1. Thoroughly clean and dry axle before disassembly.
2. All components should be thoroughly cleaned and dried before reassembly. Dirt, chips, and foreign material may cause failures.
3. All ducts and castings should be thoroughly cleaned and dried to remove dirt, chips, and foreign material to prevent damage after reassembly.
4. Reassembly should be done in a clean shop, and should be as dust free as possible.
5. Make sure tools and equipment are at hand.
6. When reassembling Daewoo strongly recommends to replace the following parts with new.
   - Seal Rings.
   - O-rings.
   - Gaskets.
   - Threaded rings with notched collar.
   - Any component damaged during disassembly.
7. When mounting heat fitted components, make sure of their proper position and direction of assembly, after they have cooled.
8. To heat bearings, use proper heating plates, piping, or suitable ovens.

NOTE: *Never heat parts by using a torch. Oil bath, heated by a torch, maybe used to warm components.*

9. Lubricate all sections concerned when reassembling shafts, bearings, etc.
10. Lubricate O-rings before installing them in relevant seats to prevent kinking during assembly, such a position would impair proper sealing.
11. Replace gears only in matched sets to make sure of proper tooth mating.

AXLE DISASSEMBLY

1 Drive axle disassembly

1. Put drive axle on supporting and make sure main driver assembly is upward.

Figure 6

2. Dismantle brake caliper assembly

   Loosen the connection bolts between brake caliper and brake caliper support, dismantle brake caliper assemble.

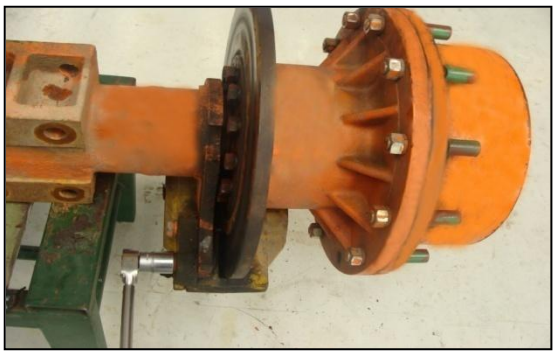


Figure 7

3. Release gear oil from planet carrier

   Loosen hub oil releasing drain plug and shell oil releasing drain plug, turn on slowly with hands to avoid oil spilling.

   Note： *Store gear oil with clean container.*

Figure 8

4. Release gear oil from shell

Turn on oil releasing bolts axle end cap to release gear oil.

Note： *Store gear oil with clean container.*

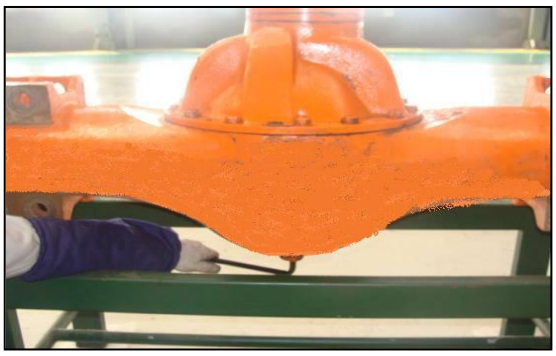


Figure 9

5. Open end cap

Loosen connection bolts between planet carrier and end cap, then get end cap from hub reducer assembly with jackscrew, dismantle end cap.

Figure 10

6. Dismantle locating block

Take down locating block with hands.

Note： *If it is tight when taking down, please use assistant tools to pry out.*

Figure 11

7. Dismantle stop collar

Dismantle stop collar from semiaxis with stop collar pincers.

Note： *Before dismantling stop collar, pull out a section of semiaxis from shell.*

Note： *It must clamp firmly when using stop collar pincers to avoid safety hazard when it is popup.*

Figure 12

8. Dismantle sun gear

Dismantle semiaxis from sun gear.。

Figure 13

9. Dismantle locating block

Dismantle locating block from semi axle with hands.

Figure 14

10. Dismantle semiaxis

Take semiaxis from shell slightly.

Figure 15

11. Hub reducer

First loosen rim bolts with relative tools, then loosen rim from planet carrier with jackscrew and dismantle planet carrier assembly.

Note: *Please slowly loosen planet carrier to avoid safety hazard resulted from dropping of planet carrier assembly.*

Figure 16

12. Dismantle round bolts

Dismantle round bolts.

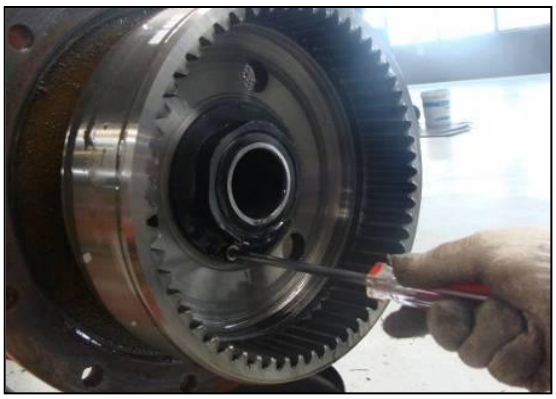


Figure 17

13. Dismantle round nuts

Dismantle round nuts.

Figure 18

14. Dismantle internal gear

Take internal gear out by slightly rocking.

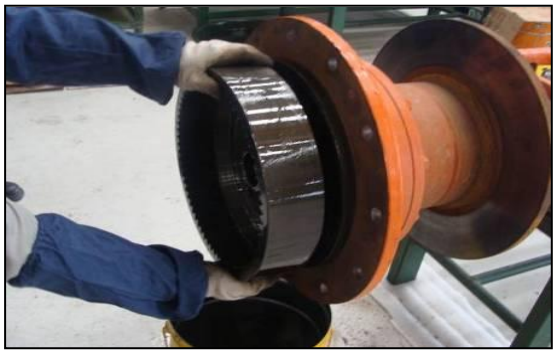


Figure 19

15. Dismantle rolling bearing

Take out rolling bearing with special dismantling tool.

Figure 20

16. Dismantle wheel hub assembly

Take wheel hub assembly from supporting axle.

Note：*During hanging and dismantling process, please keep axis of wheel hub assembly is in line with axis of hub reduction supporting axle to avoid scratching oil surface and internal spare parts during dismantling process.*

Remark: dismantle all parts at the other side of drive axle with the same methods.

Figure 21

17. Dismantle of main drive assembly

Dismantle connection bolts between main drive and shell assembly, take out main drive with jackscrew, and suspend main drive assembly.

Note：*When suspending main drive assembly, guarantee suspending and dismantling tools are at the above of main drive assembly to avoid spare parts inside are knocked again during suspending and dismantling process.*

Figure 22

2. Assembly dismantling

2.1 Dismantle planet carrier assembly

1. O ring

Take out O ring.

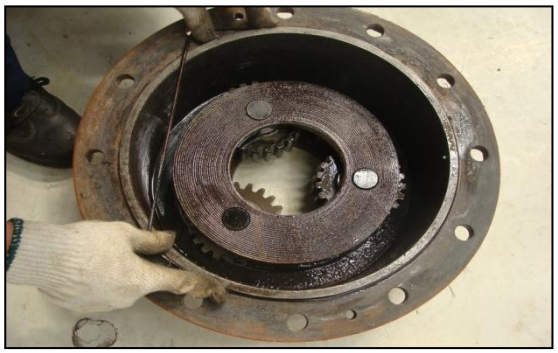


Figure 23

2. Put planet carrier on working platform horizontally.

Figure 24

3. Take out planet axle with tools.

Figure 25

4. Take out steel balls.

Figure 26

5. Take out planet wheel.

Figure 27

6. Take out baffle ring and quill roller from inside of planet wheel.

Figure 28

2.2 Dismantle hub assembly

1. Put hub assembly on working platform, loosen connection bolts between brake disc and hub.

Figure 29

2. Take out brake disc.

Figure 30

3. Take out bearing.

Figure 31

4. Take out oil seal.

Figure 32

2.3 Dismantle main drive assembly

1. Put main drive assembly (input flange upward) horizontally and fixed on supporting.

Figure 33

2. Dismantle locknut gasket, O ring and baffle ring.

Figure 34

3. Take out input flange.

Figure 35

4. Dismantle connection bolts between sealing cover and bearing sleeve, take out sealing cover.

Figure 36

5. Turn main drive for 180°, dismantle bolts fastening locking plate, take out locking plate.

Note： *Some of the machine structure may be different from this figure, please adjust working content according to actual structure.*

Figure 37

6. Dismantle connection bolts of bearing seat and take out bearing seat.

Figure 38

7. Dismantle adjusting nuts.

Figure 39

8. Dismantle bearing outer ring.

Figure 40

9. Hang out differential mechanism assembly.

Note：*Keep balance when hanging out to avoid safety hazard.*

Figure 41

10. Separate active spiral bevel gear assembly and bracket with jackscrew.

Figure 42

2.4 Dismantle differential assembly

1. Put differential assembly vertically on working platform, and guarantee it is stable.

Figure 43

2. Dismantle bearing on left and right shell of differential mechanism.

Figure 44

3. Loosen connection nuts between driven spiral bevel gear and right shell of differential mechanism, dismantle driven spiral bevel gear.

Note：*Before taking out driven spiral bevel gear, please check or mark assembling sign first so that it can be placed back to the original position.*

Figure 45

4. Loosen connection nuts of left and right shell, separate left and right shell of differential mechanism.

Note：*Before separating left and right shell of differential mechanism, please check or mark assembling sigh first so that it can be placed back to the original position.*

Figure 46

5. Take out semiaxis gear gasket and semiaxis gear.

Figure 47

6. Take out joint cross and differential gear together, take out differential gear gasket and gear from joint cross.

Figure 48

7. Take out semiaxis gear gasket and gear.

Figure 49

2.5 Dismantle active spiral bevel gear assembly

1. Put active spiral bevel gear assembly on working platform, support flange of bearing sleeve, clamp down on thread end of active spiral bevel gear assembly with down device.

   Note： *Do not clamp too much to avoid damaging flange, pull out bearing sleeve from active spiral bevel gear assembly.*

Figure 50

2. Reverse bevel gear assembly and take out bearing.

Figure 51

3. Take out bearing sleeve.

Figure 52

4. Take out adjusting gasket.

Figure 53

5. Take out spacer bush.

Figure 54

AXLE REASSEMBLY

1. Axle assembly

1. Shell

Clean shell and suspend with special supporting.

Fasten gummed plug screw at oil inlet and oil filler.

Note：*Plug screw fastening torque：280～330Nm*

Note：*Loctite 262 taper thread sealant.*

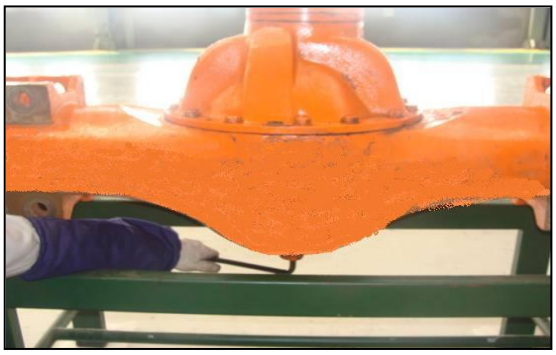


Figure 55

2. Wheel hub assembly

Coat lubrication grease on hub supporting axle of shell assembly; assemble wheel hub assembly on both sides of supporting axle of shell assembly.

Note： *Use lubrication oil.*

Figure 56

3. Rolling bearing

Assemble rolling bearing on hub supporting axle.

Figure57

4. Internal gear

Assemble internal gear of drive axle at multiple splines at the end of supporting bearing.

Figure 58

5. Round nuts

Assemble round nuts and fasten. Knock internal gear slightly with copper stick to make internal gear in place.

Figure 59

6. Assemble round bolts

1) Grapple the hole on wheel hub with push and pull ergometer, pull ergometer along with tangential direction, indication on ergometer is 160±10N, if the indication is not within the range of 160±10N, adjust tightness degree of round bolts according to the indication until it is within the range of 160±10N. In the end, coat Loctite 262 thread fastening sealant for 5~6 from the second thread hole of internal gear (form a liquid level at 1/3 circle of thread), then fasten bolts, and fix round nuts.

2) Before dynamometry, rotate hub wheel for more than 5 times.

Note：*Loctite 262 thread fastening sealant*

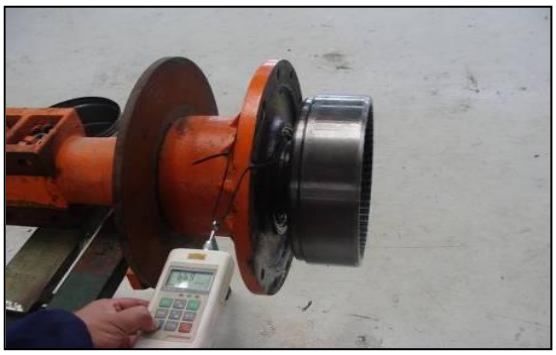


Figure 60

Figure 61

7. Assemble O sealing ring

Assemble O sealing ring on hub assemble.

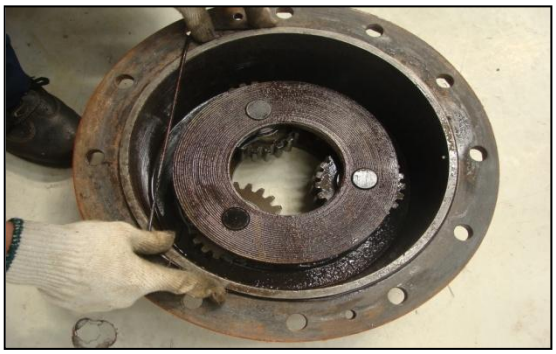


Figure 62

8. Planet carrier assembly

Assemble planet carrier assembly on wheel hub with rim bolts, gaskets and nuts.

Note：*Fastening torque：540～650Nm*

Figure 63

9. Assemble semiaxis

Assemble semiaxis in wheel hub.

Figure 64

10. Assemble sun gear

Assemble sun gear at one side of semiaxis with baffle ring groove (pay Note to semiaxis multiple spline and gear assembly).

Figure 65

11. Assemble baffle ring

Assemble baffle ring with baffle ring used for axle.

Note：*It must be clamped firmly when using baffle ring pincer to avoid safety hazard when it is popping out during assembling process.*

Figure 66

12. Assemble locating block

Stake steel ball on locating block, it can rotate flexibly after staking steel ball.

Figure 67

13. Assemble end cap

Coat Loctite 262 thread fastening sealant on screws, location of sealant is 15mm on top of thread end. Fasten cap with bolts and gaskets.

Note：*Fasten all screws according to symmetrical and crossing principle.*

Note：*Fastening torque：110～130Nm*

Note：*Loctite 262 thread fastening sealant*

Figure 68

14. Assemble brake caliper assembly

Assemble disc brake on brake caliper supporting, fix with bolts and gaskets.

Note：*Fastening torque：540～650Nm*

Note：*Coat Loctite 262 thread fastening sealant at 20mm length at thread end during assembling.*

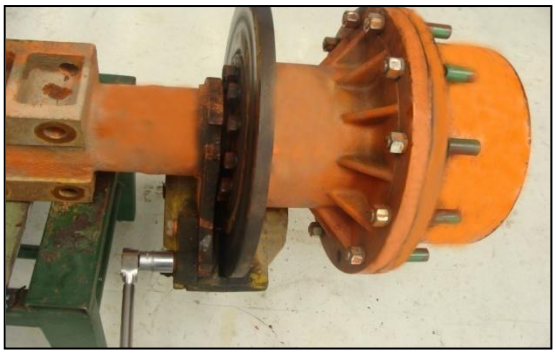


Figure 69

15. Assemble main drive assembly

Coat Loctite 598 silicon rubber surface sealant at the joint surface between shell and bracket, coatφ3～φ6 glue saluting ring with sealing surrounding inside of thread hole at the large end of shell. The coated sealant cannot be in the air for more than ten minutes.

Note：*Loctite 598 silicon rubber surface sealant*

Figure 70

16. Assemble main drive

Hand up main drive assembly with overhead crane, put main drive at main drive shell of the axle, assemble locating pin.

Figure 71

17. Assemble bolts

Coat proper Loctite 262 threat fastening sealant on bolts, the coating position is 15mm length at thread end. Fasten main drive assembly and shell assembly with bolts and gaskets.

Note：*Fastening torque：110～130Nm*

Note：*Loctite 262 threat fastening sealant*

Note：*Fasten all screws according to symmetrical and crossing principle.*

Figure 72

18. Add oil

Add 10L 85W/90 GL-5 gear oil (GB13895-1992) in axle bag of shell and fasten plug screws.

Note：*Use 85W/90 GL-5 gear oil*

Note：*Anaerobic type pipe threat sealant*

Note：*Fastening torque：280～330Nm*

Figure 73

Figure 74

2 Assembly parts assembling

2.1 Install hub assembly

1. Keep the large end of hub upward, assemble bearing outer ring and turn over to keep the small end of hub upward and assemble bearing inner ring.

Figure 75

2． Coat lubrication oil at oil seal end, check completeness of oil seal, coat lubrication oil in groove of oil seal evenly, and assemble oil seal in side of oil seal end.

Figure 76

3. Assemble brake disc on hub and fasten with bolts and gaskets.

Note: *Fastening torque：280～330Nm*

Note： *Fasten all screws according to symmetrical and crossing principle.*

Figure 77

2.2 Install planet carrier assembly

1. Stick lubrication grease quill roller (27 units each) on walls of inner holes of planet gears, assemble baffle ring in the middle of quill roller, assemble gaskets at both sides of planet gear, then assemble to the seat hole of planet carrier.

Figure 78

2. Assemble steel balls in holes of planet gear shaft, steel ball shall aim at semi circle of planet carrier, go through the inner hole of planet gear and gasket and assemble on planet carrier. After assembly, planet gear shall rotate flexibly there is no blocking.

Figure 79

2.3 Assemble of main drive assembly

1. Assemble rolling bearing on bear neck of the terminal with pressure machine, rotate to the left on active spiral bevel gear front axle, and rotate to the right side.

Figure 80

2. Press inner ring into rolling bearing with pressure machine at the other side

Figure 81

3. Turn over gear and assemble outer ring of gear,

Figure 82

4. Install spacer bush

Figure 83

5. Assemble gasket

Figure 84

6. Assemble bearing sleeve

Figure 85

7. Press inner ring of antifriction bearing in the end.

Note: when assembling main reducer, taper rolling bearing shall have certain tightness, that is on the basis of eliminating bearing clearance, and give certain preload. The purpose is to reduce axial force caused during transmission process which will result in axial displacement, improve supporting rigidity, and guarantee normal mesh of bevel gear pair. But if it is too tight, it will accelerate abrasion of taper rolling bearing. Press with P= 5420 kg pressure at the top side of inner ring of rolling bearing, grapple Φ14.5 hole with pull and push ergometer, pull ergometer along with tangential direction, indication of ergometer when pushing shall be 17.34-30.06N, if the indication is not within the range of 17.34-30.06N, increase or reduce thickness of spacer shim, repeat the above process until the indication is within 17.34-30.06 N.

Figure 86

Figure 87

2.4 Assemble of differential assembly

1. Assemble rolling bearing at the bearing position of right shell terminal of differential mechanism.

Figure 88

2. Assemble rolling bearing at the bearing position of left shell terminal of differential mechanism.

Figure 89

3. Assemble semiaxis gear

   Assemble semiaxis gear gasket in left shell of differential mechanism

   Note：*The side of gasket with groove shall toward to the direction of joint cross*

Figure 90

4. Assemble semiaxis gear

Figure 91

4. Assemble joint cross assembly

Assemble bevel gear (internal of small terminal) and bevel gear gasket on four axles of joint cross.

Note：*Lubricate with grease when assembling bevel gear and bevel gear gasket*

Note：*Lubricate lubrication oil*

Figure 92

6. Differential mechanism shell

Assemble joint cross in right shell of differential mechanism to make bevel gear and semiaxis gear mesh, turn over left shell assembly of differential mechanism to assemble right shell assembly of differential mechanism, join right shell and left shells of differential mechanism with bolts and fasten with gaskets and nuts.

Figure 93

Note：*Nuts tightening torque180～210Nm*

Note：*1) Guarantee assembling mark of right shell and left shell of differential mechanism align.*

2) Coat proper Loctite 262 thread fastening sealant at the thread bottom within 12mm length.

3) After assembling, semiaxis gear and taper gear can be rotated manually without blocking.

Figure 94

7. Assemble driven spiral bevel gear

Aim at assembling mark, fasten driven spiral bevel gear (rotate to the left for rear axle, rotate to the right for front axle) with bolts, gaskets and nuts, and fasten screws.

Figure 95

Note：*Nuts fastening torque 180～210Nm。*

Note：*1) Coat proper Loctite 262 thread fastening sealant at the thread bottom within 12mm length.*

2) Judging method of left and right spiral: Face to positive side of gear, right rotation refers to the spiral gear rotates to large terminal clockwise; on the contrary, left rotation refers to the spiral gear rotates to large terminal anticlockwise.

2.5 Assemble main reducer

1. Install the assembled active spiral bevel gear assembly in bracket, coat sealant line with diameter 2-4mm at the small end, refer to the picture for sealant line; sealant line and diameter of bearing sleeve (the other side of gasket) shall be done according to the above requirements.

Figure 96

2. Assemble sealing cover

Press oil seal in sealing cover.

Figure 97

Note：*Coat a layer of proper lubrication oil when assembling oil seal.*

3. Install input flange

Put gasket on the end face of bracket, install sealing cover assembly (coat lubrication grease on oil seal according to common requirements of drive axle), and connect with bracket with bolts and gaskets.

Note： *Screw fastening torque 110～130Nm.*

Figure 98

4. Install input flange.

Figure 99

5. Install baffle ring, O ring, coat sealant on one end face of gasket, the surface with sealant is downward, install gasket.

Note： *Coat Loctite 598 sealant*

Figure 100

6. Install gasket

Figure 101

7. Install round screws and fasten.

Note： *Screw fastening torque: 320～400Nm 。*

Note： *Before installing flange, install flange on multiple spline on main spiral bevel gear, measure radial play eccentricity of flange, guarantee it cannot be more than 0.08, and mark matching and assembling signs. If it is out of tolerance, rotate flange to certain angle and measure until it complies with requirements, otherwise, replace flange.*

Figure 102

8. Gasket shall be close to φ2～φ3 glue line.

9. Install differential assembly

Turnover carrier, install differential assembly in bracket.

Figure 103

10. Install bearing seat with gaskets and bolts (bolts shall be a little bit tight).

Figure 104

11. Install adjusting nuts.

Note： *Two bearing seats cannot be exchanged.*

12. Coat proper thread sealant on the length of 15～25mm on thread end surface of bolts.

Note： *Coat Loctite 262 thread fastening sealant.*

Figure 105

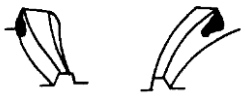
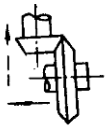
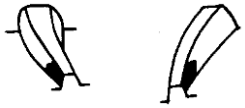
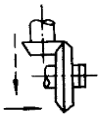
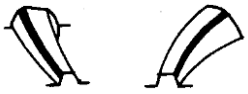
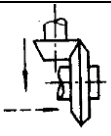
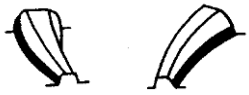
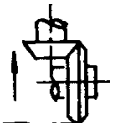
13. Adjust spiral bevel gear

Figure106

Adjustment of spiral bevel gear mesh condition refers to adjustment of mesh zone and back lash, when adjusting back lash of spiral bevel gear pair, dial gauge can be used to touch the gear surface of large side edge of driven spiral bevel gear, then rotate driven spiral bevel gear to measure back lash directly, the clearance shall be 0.2～0.35mm. Adjusting method of back mesh is to twist adjusting nuts to change position of driven spiral bevel gear (when it is necessary, move active spiral bevel gear assembly to adjust). If the clearance is larger than the regulated value, approach active spiral bevel gear from driven spiral bevel gear; otherwise be away from it. In order to keep the adjusted preload of taper rolling bearing of differential mechanism, twisting numbers of adjusting nuts at one side shall be equal to twisting numbers of adjusting nuts at the other side.

When adjusting contact zone of spiral bevel gear pair, coat red color (red lead powder) on driven spiral bevel gear teeth (coat three teeth usually), rotate driven spiral bevel gear with hands repeatedly, check contacting moulage. Adjust the correct position of spiral bevel gear mesh moulage: it shall not be less than 50% along with teeth height direction and teeth length direction, mesh moulage of driven bevel gear shall be close to the center, and in the middle of teeth height, smaller than the small end on teeth length direction. Increasing preload of differential bearing: after adjusting back lash of spiral bevel gear well, it shall guarantee the clearance between taper rolling bearings at both sides of differential mechanism is 0. Following is the adjusting methods.

Adjustment of contact zone and back lash when installing spiral bevel gear

Contact zone of driven spiral bevel gear	Adjusting method	Gear moving direction
	Move driven gear to the direction of active gear, if the clearance is too small, move active gear outside	
	Move driven gear away from active gear, if the clearance is too large, move active gear inside	
	Move active gear to the direction of driven gear, if the clearance is too small, move driven gear inside and outside	
	Move active gear away from driven gear, if clearance is too large, move driven gear inside	

Method of adjusting mesh zone is usually increasing and decreasing adjusting gaskets and rotating adjusting nuts. Adjusting of contact zone will affect performance and service life greatly, it shall be carried out carefully.

Note： *After adjusting, clean off red lead powder.*

14. Install locking plate

Fasten the fixed bolts on bearing seat, fastening torque is 380～450Nm. Put locking plate at the right position, fix it on bearing seat with bolts and gaskets, and fasten fixing bolts of locking plate.

Figure 107

Note： *Fastening torque 30～36Nm*

Note: *Coat proper Loctite 262 thread fastening sealant on 5-10mm length at the end surface of fixing bolt.*

Note： *Coat Loctite 262 thread fastening sealant*

AIR CONDITIONER

⚠ CAUTION!
Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section. **Always use tools and equipment that is in good working order.** **Use lifting and hoisting equipment capable of safely handling load.** **Remember, that ultimately safety is your own personal responsibility.**

TABLE OF CONTENTS

GENERAL DESCRIPTION

Heater and AC evaporator share one air blower, and it is located at the front side of driving cab. When it is necessary, the driver can install it in control panel room at the right of control platform to control indoor temperature.

AC of the machine has three functions of refrigeration, heating and natural wind.

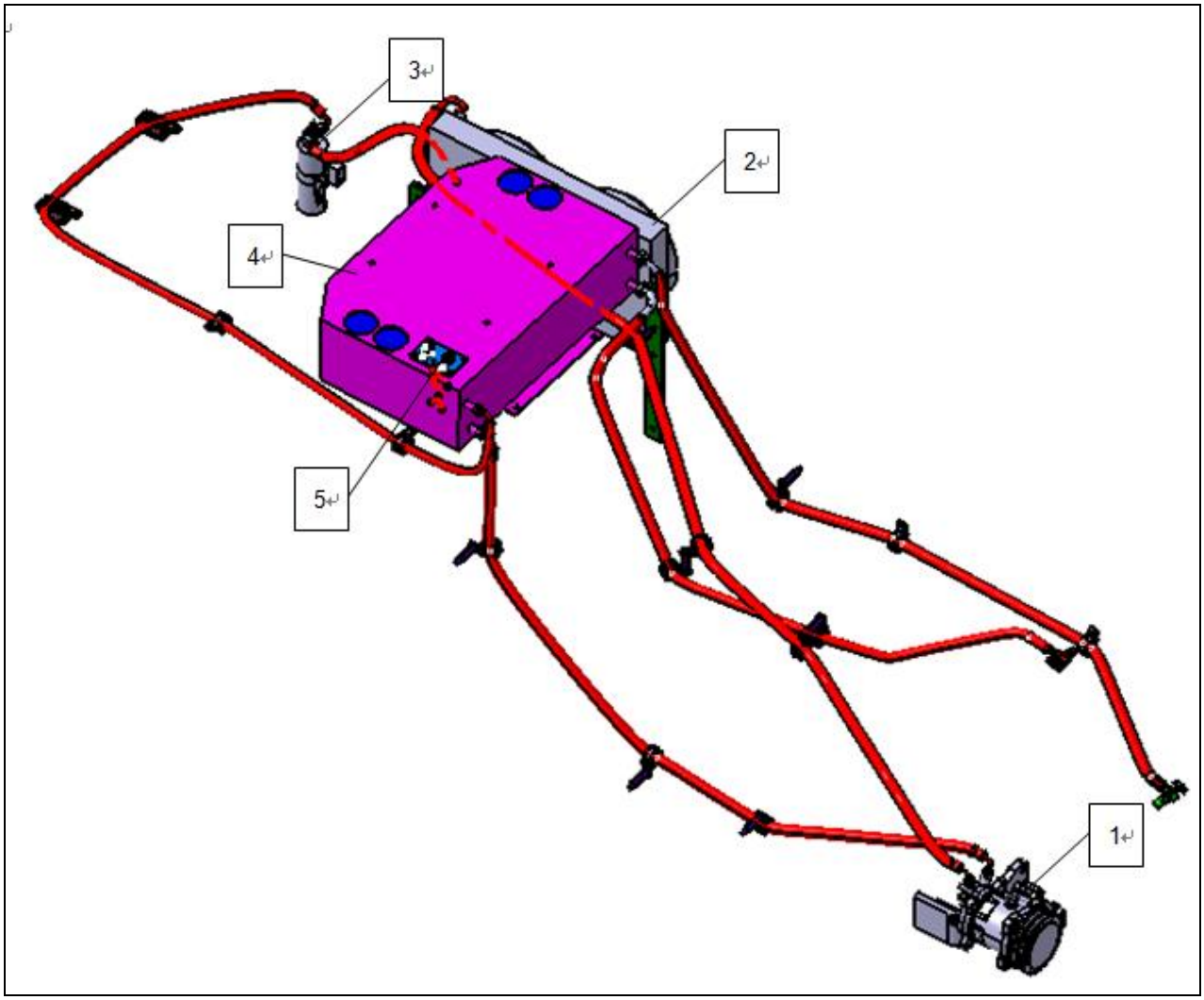


Figure 1 AC system schematic diagram

Reference Number	Description	Reference Number	Description
1	Compressor	4	Evaporator
2	Condenser	5	Control Panel
3	Receiver/Drier		

Circulation of refrigeration agent

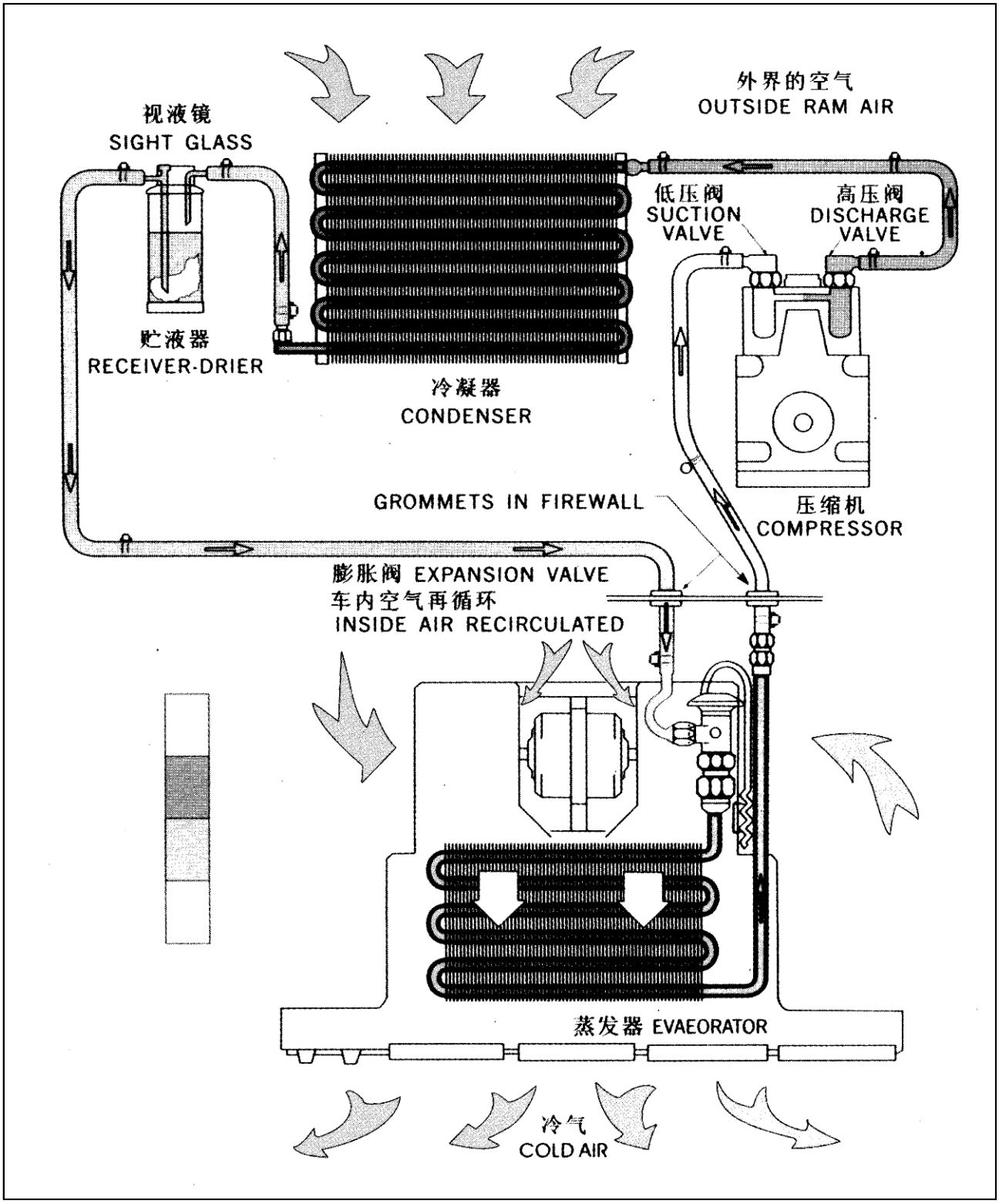


Figure 2 Refrigeration agent circulation schematic diagram

- Refrigeration agent (R134a) is compressed to 15kg/cm2（213psi）within sight view.
- Compressed refrigeration agent flows into condenser under high temperature (about 80℃（176°F）).
- Refrigeration agent of condenser is cooled down by condensation fan to about 60℃. At the same time, refrigeration agent is changed from gas state to liquid state, even if the temperature is reduced from 80°— 60℃（176°— 140°F）to 20℃（68°F）.
- Refrigeration agent is sprayed to evaporator in gas state through expansion valve. And pressure is reduced for 2 kg/cm2（28psi）, and temperature is reduced, too. The result is refrigeration agent absorbs heat from surrounding air to create refrigeration effect, refrigeration agent is changed from gas state to liquid state.
- Refrigeration agent flows into compressor in gas state again and repeat the above process.

⚠ CAUTION!

Refrigeration agent is compressed and sealed in AC system. Special protective measures are needed when injecting or releasing refrigeration agent correctly. It is strictly controlled by laws to release refrigeration agent into air. Before maintaining or repair AC, please obey the orders of all federation, states and districts, refrigeration agent used in the system must reach or exceed R134a specifications or environmental standards issued later.

Control panel

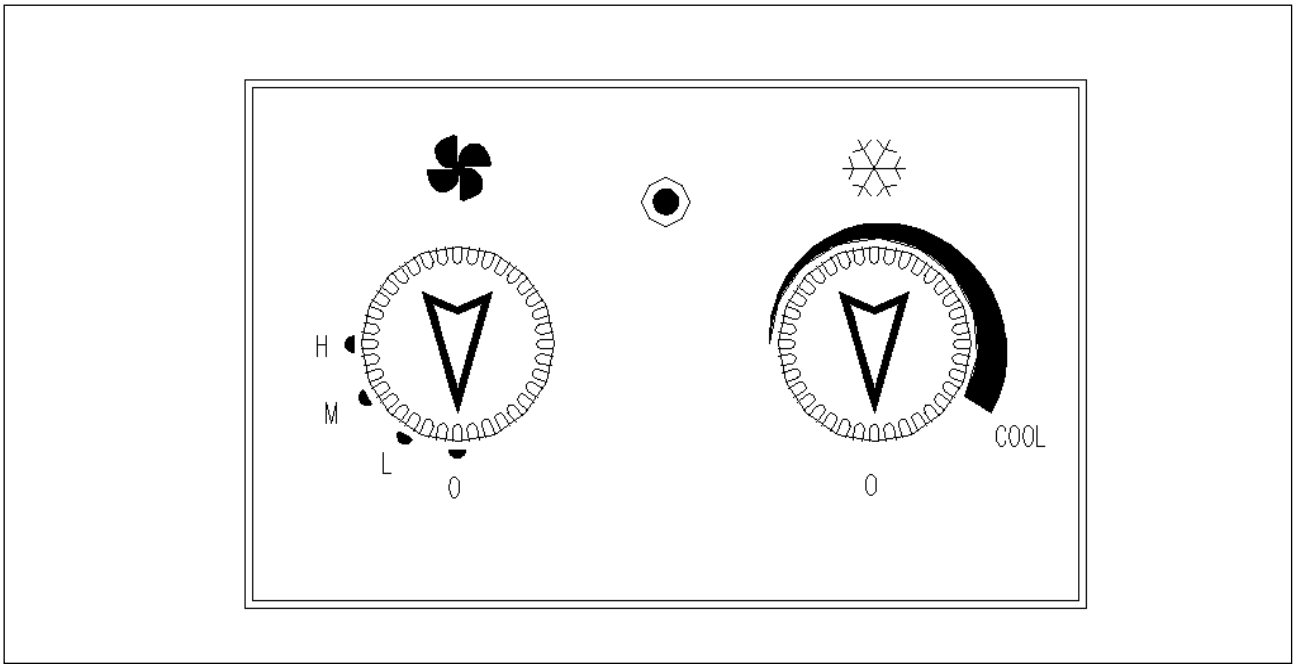
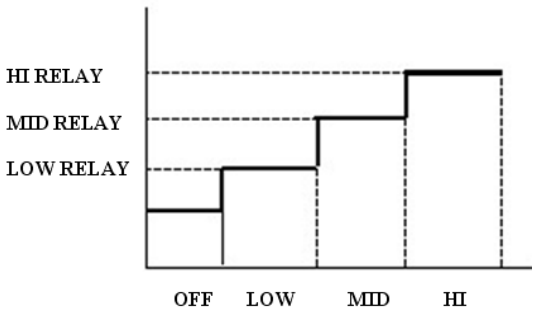
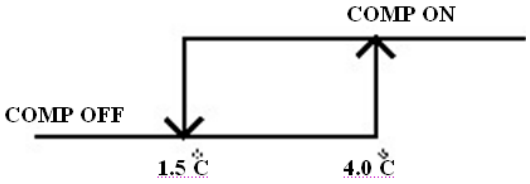


Figure 3 AC control panel diagram

Control specifications

Control item	Control switch	Control specifications
Rotation speed control of air blower	“CLOSE” switch “LOW SPEED” switch “INTERMEDIATE SPEED” switch “HIGH SPEED” switch	
Compressor control	Temperature sensor	

AC system circuit diagram

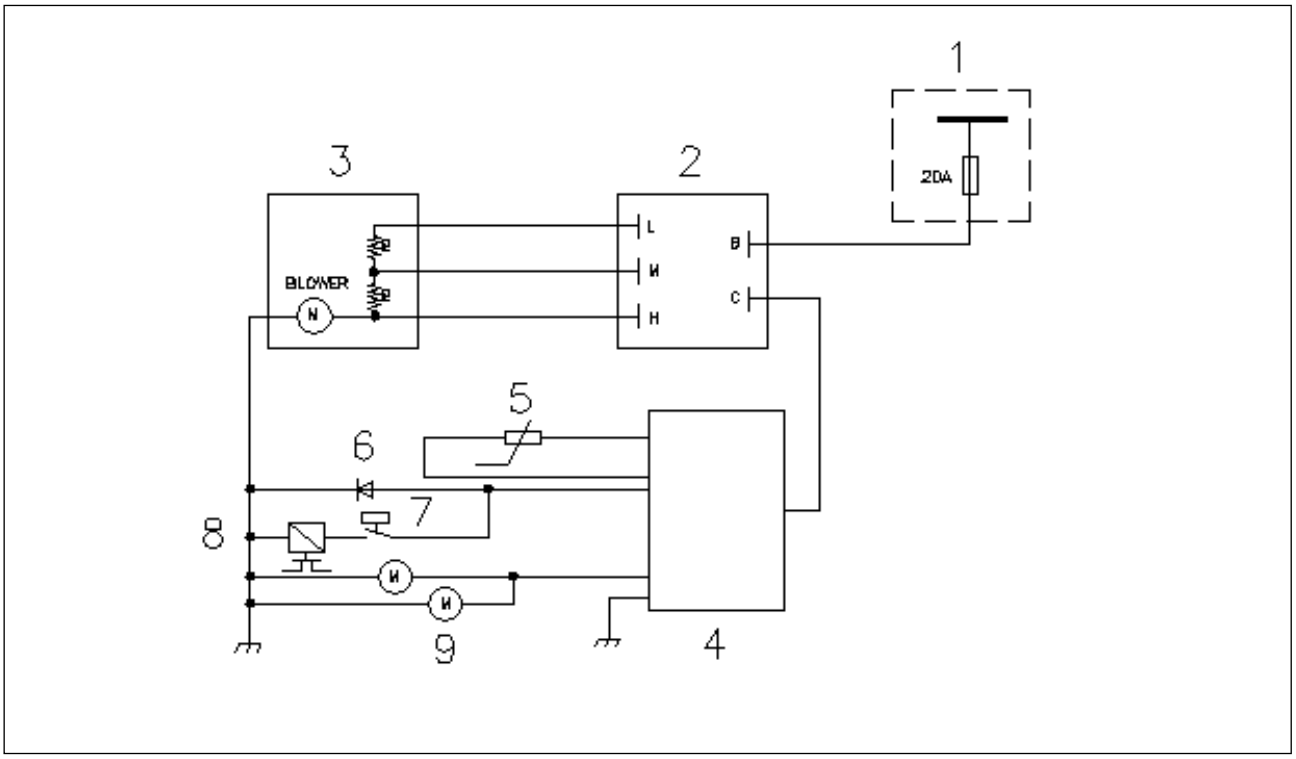


Figure 4 AC system circuit diagram

Reference Number	Description	Reference Number	Description
1	Fuse Box	6	LED
2	Blower Switch	7	Press. Cut Off Switch
3	Blower	8	Compressor
4	Thermistor	9	Condenser
5	Temperature Sensor		

Maintenance

1. AC outdoors radiator-“condenser” must be cleaned regularly; refer to figure 5.
   Treatment method: dismantle condensing fan, condenser is completely exposes, wash with water, but do not use high water pressure to avoid lodging of condenser fan and affect radiation effect.
   Maintenance standard: wash once a month in summer, if working environment is too bad, increase washing times properly.

Figure 5

2. Check if fixed bolts of compressor are loosed regularly, if belt of compressor is loosed; refer to figure 6.
   Checking method: visually check if AC bolts are loosed, checking method of belt tightness degree: put about 10kg force on middle of belt, force is downward, descending amplitude of belt is about 10-15mm, it cannot be too high or too low; maintenance standard: check once a week in summer.

Figure 6

3. Check if there is refrigeration agent in the system
   Checking method: check Freon injection mouth of compressor head (refer to the picture), screw off plastic plug, poke with keys or other sharp things (its structure is like the air tap of tyre), check if there is large amount of air jets out, if there is no air or air current is very small, it proves that Freon is leaked (wear gloves and protect eyes during operation, do not burn skin and eyes with refrigeration agent).

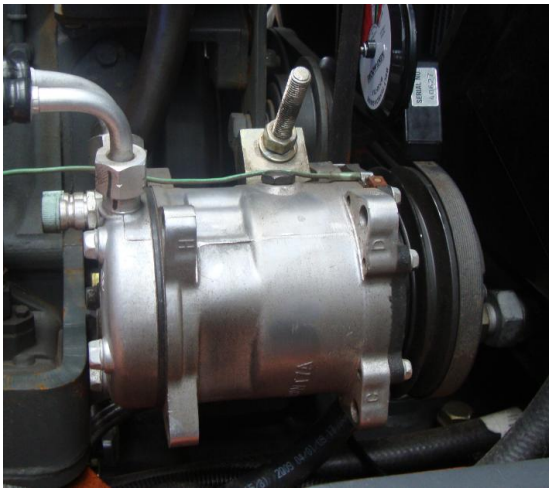


Figure 7

4. Power on checking of the entire machine. Open AC control panel, turn III gear switch to H gear and check if there is wind coming from evaporator and if wind is big enough. Turn on temperature control switch on AC control panel and turns to the maximum position, check if indication light is on, at the same time, listen if AC compressor is absorbing (turn on and turn off temperature control switch repeatedly, there should be clear and melodious absorbing “Pitter-patter” at compressor).

Figure 8

5. Confirmation of charging amount of refrigeration. Agent charging amount of refrigeration agent R134a of the AC system is 1000±50g, the process is vacuumizing, charging and retrieving.

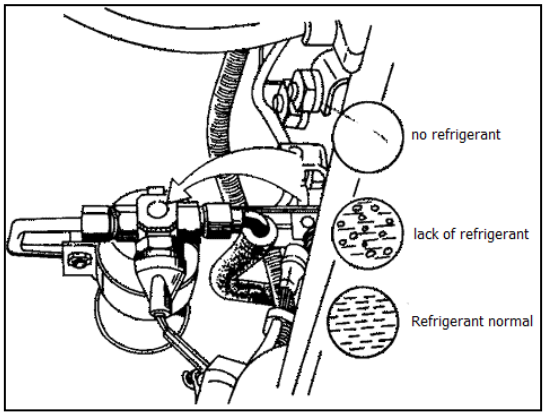


Figure 9

Comparison table between liquid sight glass state of reservoir and trouble analysis

Liquid sight glass state	Trouble analysis
Liquid sight glass is locate, bubbles can be seen at the moment of turning on and turning off AC, and bubbles become transparent suddenly.	Freon charging quantity is proper
Few bubbles flowing, compressor head is hot, refrigeration output is not enough, high and low pressure of the system are both very low.	Freon charging quantity is not enough or the system is leaking
Turn on and turn off AC, it is hard to see bubbles flowing, compressor head is cold, high and low pressure of the system are both high.	Freon is over charged
Freon charging is proper, AC does not refrigerate, it is hard to see bubbles flowing in reservoir, low pressure is negative.	Expansion valve is dirty and blocked or frozen and blocked, it shall be solved by professional personnel

Trouble shooting

Following is the common troubles and reasons

1. The entire AC system is power off

• Reason analysis

- Fuse of AC is burnout.
- Wiring harness of AC power is not connected.

2. Evaporation fan is running, after turning on temperature control switch, indication light is not on, condensation fan and compressor do not work.

• Reason analysis

- Indoor temperature of driving cab is lower than 4º
- Temperature sensing detector is open circuit or not connected.
- AC temperature control switch relay is broken.

3. Evaporation fan rotates, condensation fan rotates, compressor does not absorb

- Coil of compressor clutch is broken
- High/low pressure switch is broken.
- Freon is leaked
- Circuit from high/low pressure switch to compressor is open.

4. Evaporation fan does not run, condensation fan runs, compressor absorbs

- Earth wire of evaporation fan drops, or earth wire contact is not good.
- III gear switch is broken
- Evaporation fan is broken

Transmission and Torque Converter

⚠ CAUTION!
Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section. **Always use tools and equipment that is in good working order.** **Use lifting and hoisting equipment capable of safely handling load.** **Remember, that ultimately safety is your own personal responsibility.**

TABLE OF CONTENTS

Brief Introduction

Structure of transmission

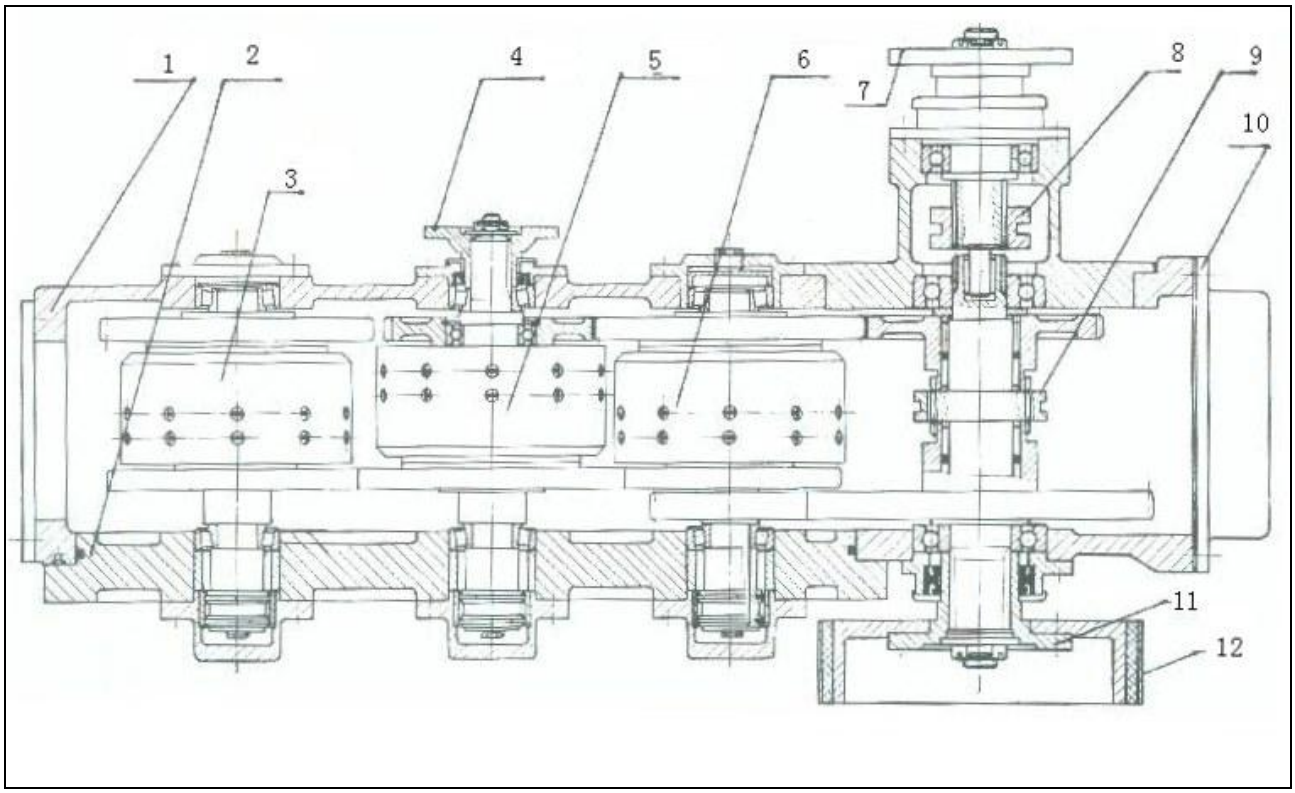


Figure 1

Reference Number	Description	Reference Number	Description
1	Transmission housing	7	Rear output Flange
2	Cover	8	Release Sliding sleeve
3	Rear shaft ass'y	9	Gear ring
4	Input shaft flange	10	Oil sump
5	Input shaft ass'y	11	Front output flange
6	Mid shaft ass'y	12	Parking break

Basic parameters of transmission

Model of bivariant assembly	ZL30 T/M
Applicable model	SD200 Wheel Loader
Hydraulic torque converter type	Single Stage, Four Part, Two turbo T/M
Max. input rotate speed	2500 r/min
Max. input torque	650 Nm
Max. input power	74 kW
Torque ratio	3.0~3.6
Type of oil cooling	Cooling Water Circulating
Working pressure	1.1~1.5MPa
Gearbox type	Dead Axle, Constant Mesh Gear, Shifting fork
Gears	Four Front Gears and Two Rear Gears
I gear ratio	3.82
II gear ratio	2.08
III gear ratio	1.09
IV gear ratio	0.59
I reverse gear ratio	3.05
II reverse gear ratio	0.87
Gear box oil	6#Fluid Drive Oil
Allowable oil temperature at the bottom of oil pan	100℃
Manipulate pressure of brake safety valve	>0.55MPa

Transmission principle

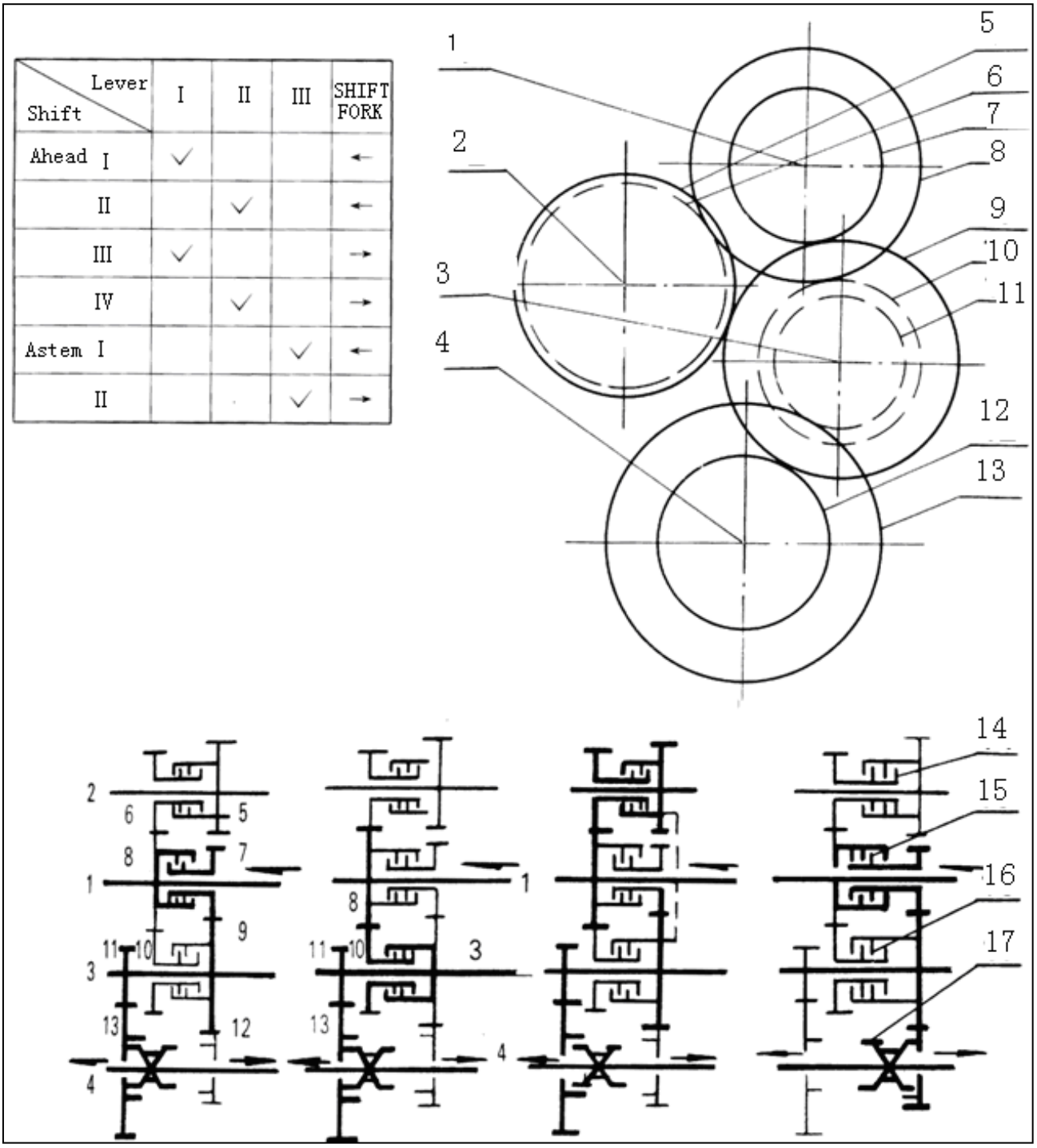


Figure 2

Working principle of torque converter

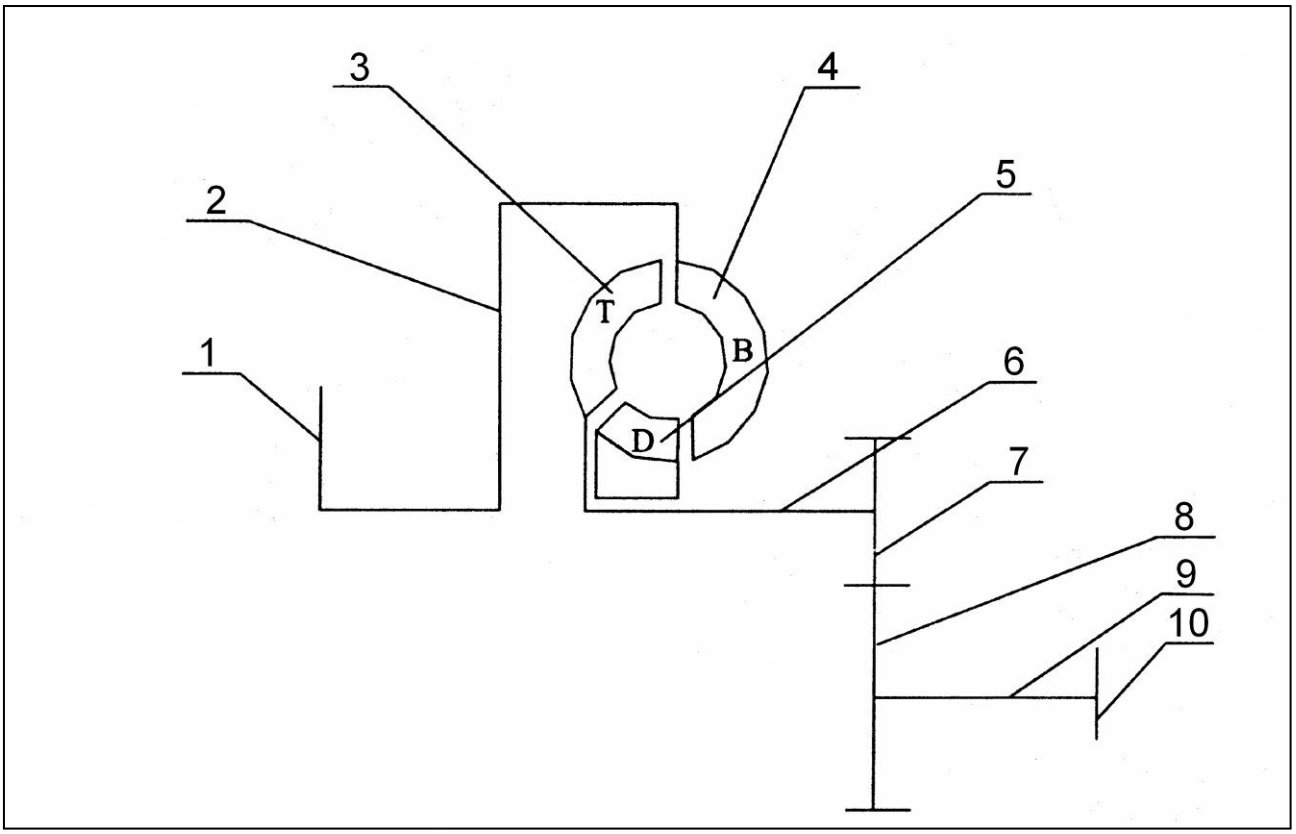


Figure 3

Reference Number	Description	Reference Number	Description
1	Spring plate	6	Turbine shaft
2	Turbine cover	7	Output initiative gear
3	turbine	8	Output driven gear
4	Pump pulley	9	Output shaft
5	guide pulley	10	Output flange

Disassembly of transmission

Disassembly of transmission assembly

1. Put transmission horizontally on working platform with oil pan upward.

Figure 4

2. Dismantle oil pan

   Use relative tools (such as sleeve, open spanner, same with following conditions, and will not state again). Loosen fixed bolts on oil pan, and dismantle oil pan.

Figure 5

3. Dismantle fixing block of oil pan

   Knock out with tools and take out fixing block.

Figure 6

4. Dismantle shifting fork

   Twist fixed blots and take out shifting fork.

Figure 7

5. Dismantle supporting seat of tie bar of shifting fork twist fixed bolts, take out supporting seat.

Figure 8

6. Turn over transmission, make the side with brake caliper upward, dismantle end cap and twist fixed bolts, take out end cap.

Figure 9

7. Dismantle speed change valve
Twist fixed bolts and get out speed change valve.

Figure 10

8. Take out clutch end cap of the first and the third gear twist fixed bolts and take out end cap.

Figure 11

9. Take out brake caliper assembly

Twist fixed bolts and take out brake caliper assembly.

Figure 12

10. Take out fixed plate, sealing ring and cover plate of front output flange, then take out front output flange.

Figure 13

11. Overturn transmission; take out screw fixing plate, sealing ring and cover plate of front output flange, then take out output flange.

Figure 14

12. Take out output flange end cap

Twist fixed bolts and take out end cap.

Figure 15

13. Take down bearing

Take down bearing with special tool.

Figure 16

14. Take down spacer bush.

Figure 17

15. Take down high speed gear.

Figure 18

16. Take down sliding tooth set

Figure 19

17. Take out output axle

Knock out output axle with tools and take out.

Figure 20

18. Take out low speed gear

Figure 21

19. Take out bearing

Knock out bearing with tools and take out.

Figure 22

20. Take out adjusting screws of the II gear, the IV gear and reverse gear.

Figure 23

21. Take out nuts, gaskets and flange of input axle

Figure 24

22. Take out end cap.

Figure 25

23. Overturn transmission; twist fixed bolts of the cover

Figure 26

24. Take out clutch end cap of the second gear, the fourth gear and reverse gear.
Twist fixed bolts and take out end cap.

Figure 27

25. Take out sealing ring of each clutch

Figure 28

26. Take out end cap of transmission.
Twist fixed bolts and take out end cap.

Figure 29

27. Take out clutch of the first and the third gear, the second and the fourth gear and reverse gear.

Figure 30

28. Take out fixed set of brake caliper
Twist fixed bolts and take out fixed seat.

Figure 31

29. Take out end cap of output axle

Twist fixed bolts and take out end cap.

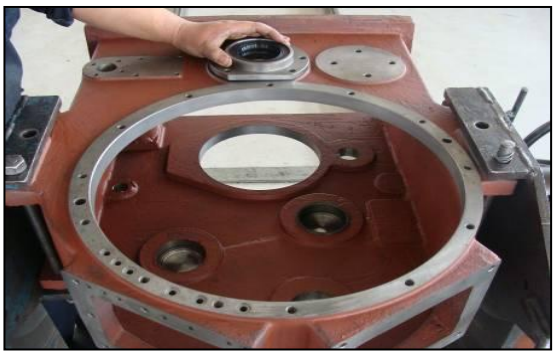


Figure 32

30. Take out bearing of output axle.

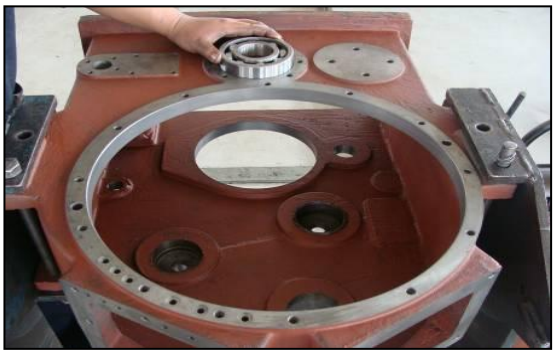


Figure 33

31. Take out sleeve of clutch.

Figure 34

32. Overturn transmission; take out clutch end cap of the second and the fourth gear and reverse gear.

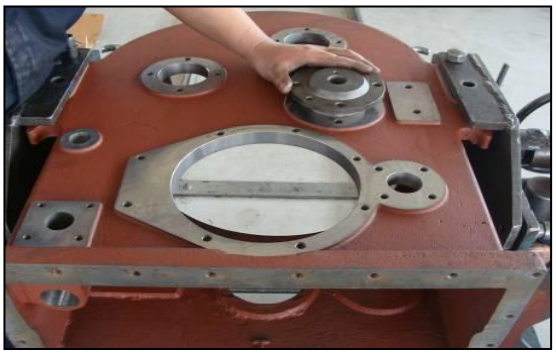


Figure 35

Assembly parts dismantling

Disassembling of torque converter assembly

1. Put torque converter on work platform horizontally.

Figure 36

2. Dismantle fixed plate of spring plate.
   Twist fixed bolts, take out fixed plate.

Figure 37

3. Dismantle elastic plate.

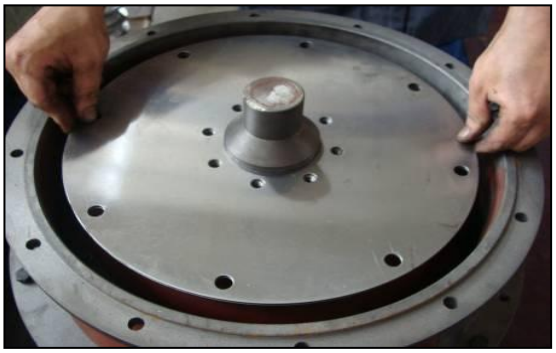


Figure 38

4. Dismantle cover wheel
   Twist fixed bolts and take out cover wheel.

Figure 39

5. Dismantle baffle ring

Note：*It must be clamped reliably when using baffle ring pincer to avoid safety hazard.*

Figure 40

6. Dismantle turbine shell

Figure 41

7. Take out sealing ring

Figure 42

8. Take out baffle ring

Note：*It must be clamped reliably when using baffle ring pincer to avoid safety hazard.*

Figure 43

9. Take out guide wheel

Figure 44

10. Take out pump pulley

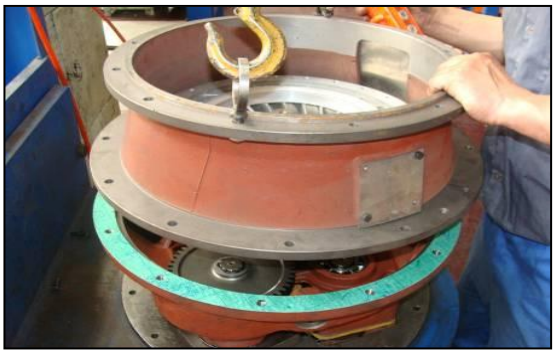


Figure 45

11. Take out gear baffle ring

Note: *It must be clamped reliably when using baffle ring pincer to avoid safety hazard.*

Figure 46

12. Take out gear

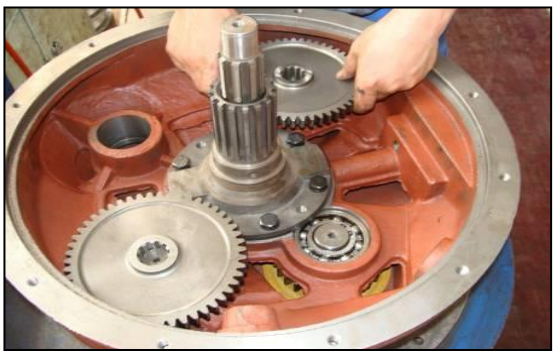


Figure 47

13. Take out guide wheel seat

Figure 48

14. Take out bearing

Figure 49

15. Overturn torque converter and take out flange.
    Twist bolts and take out flange.

Figure 50

16. Take out all output axles.

Figure 51

17. Take out baffle ring and shaft sleeve.

Figure 52

18. Take out bearings

Figure 53

19. Take out output flange

    Twist fixed bolts and take out flange.

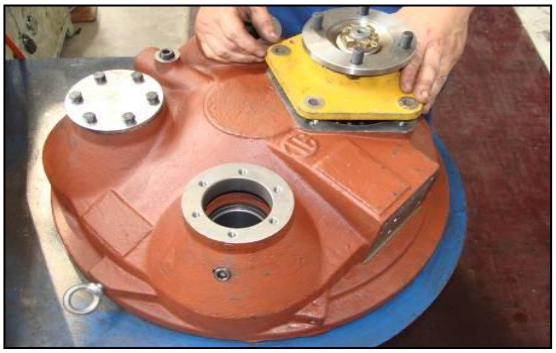


Figure 54

20. Take out sealing end cap.

Figure 55

Assembling of transmission

Assembling of transmission assembly

1. Put transmission shell on work platform horizontally.

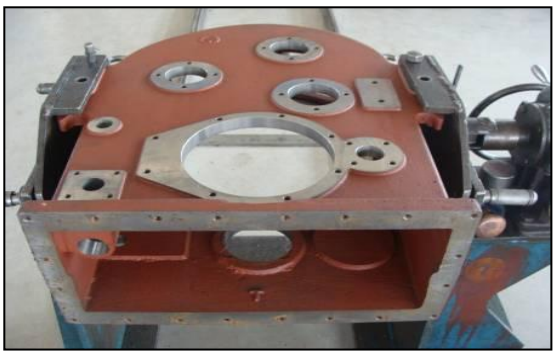


Figure 56

2. Install clutch end cap of reverse gear and the II and the IV gear

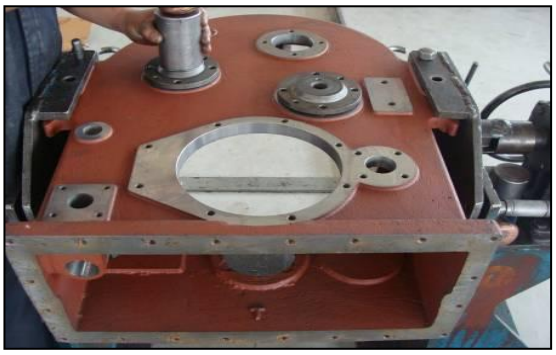


Figure 57

3. Overturn shell and put on work platform horizontally.

Figure 58

4. Install end cap spacer bush of reverse gear and the second and fourth gear.

Figure 59

5. Install output axle bearing.

Figure 60

6. Install output flange.

Note：*45～59Nm*

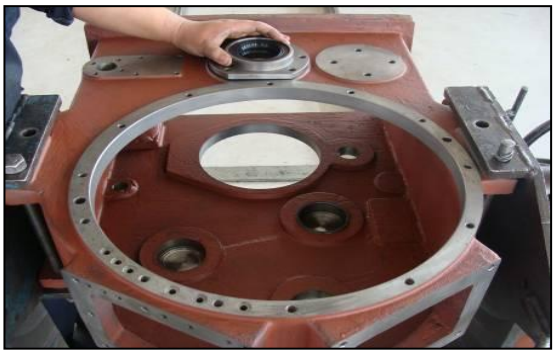


Figure 61

7. Install fixed supporting seat of hand brake disc.

Note：*Bolts fastening torque 45～59Nm*

Figure 62

5. Install bearing sleeve of the second and fourth gear.

Figure 63

9. Install clutch of the II and IV gear.

Figure 64

10. Install reverse gear bearing sleeve and reverse gear clutch.

Figure 65

11. Install bearing sleeve of the first and third gear and clutch of the first and third gear.

Figure 66

12. Install sealing ring of transmission end cap.

Figure67

13. Install end cap.

Note： *Bolts fastening torque is 45～59Nm*

Note： *Use Loctite 262 thread fastening sealant*

Note： *Use Loctite 598 surface sealant*

Figure 68

14. Install shaft sleeve of all clutches.

Figure 69

15. Install sealing rings of all clutches.

Figure 70

16. Install end cap of the first and third gear and reverse gear.

Note： *Bolts fastening torque is 45～59Nm*

Note： *Use Loctite 262 thread fastening sealant*

Note： *Use Loctite 598 surface sealant*

Figure 71

17. Overturn transmission, and put on work platform horizontally.

Figure 72

18. Install end cap of the first and third gear.

    Note：*Bolts fastening torque is 45～59Nm*

    Note：*Use Loctite 262 thread fastening sealant*

Figure 73

19. Install input flange.

Figure 74

20. Install adjusting nuts of the second and fourth gear and reverse gear

    Align teeth of the second and fourth gear and reverse gear; the horizontal height difference shall be controlled at 20-30.

Figure 75

21. Install output axle bearing.

Figure 76

22. Install output low speed gear.

Figure 77

23. Install output axle.

Figure 78

24. Install sliding teeth set.

Figure 79

25. Install output axle high speed gear.

Figure 80

26. Install space ring.

Figure 81

27. Install bearing.

Figure 82

28. Install rear output axle end cap.

Note：*Bolts fastening torque is 45～59Nm*

Note：*Use Loctite 598 surface sealant*

Note：*Use Loctite 262 thread fastening sealant*

Figure 83

29. Install output flange

Figure 84

30. Install sealing ring, pressing plate and bolt stator of output flange.

Note：*Screw fastening torque is 45～59Nm*

Figure 85

31. Turnover transmission, install flange of front output axle.

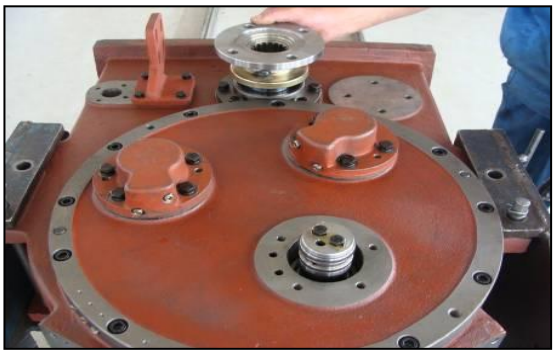


Figure 86

32. Install sealing ring, pressing plate and bolts stator respectively for front output flange.

Note：*Screw fastening torque is 45～59Nm*

Figure 87

33. Install hand brake assembly

Note： *Screw fastening torque is* 124～165Nm

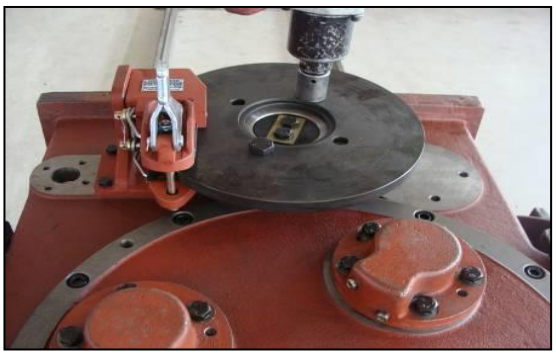


Figure 88

34. Install reverse gear bearing sleeve

Figure 89

35. Install reverse gear clutch end cap

Note： *Use Loctite 598 surface sealant*

Note： *Screw fastening torque is45～59Nm*

Note： *Use Loctite 262 thread sealant*

Figure 90

36. Install speed change control valve.

Note： *Use Loctite 262 thread sealant*

Note： *Screw fastening torque is45～59Nm*

Figure 91

37. Install end cap

Figure 92

38. Install supporting seat of shifting fork

Note：*Screw fastening torque is45～59Nm*

Figure 93

39. Install shifting fork

Note：*Screw fastening torque is45～59Nm*

Figure 94

40. Bind shifting fork with iron wire to avoid dropping of bolts.

Figure 95

41. Install fixed seat of oil pan

Figure 96

42. Install sealing gasket of oil pan.

Figure 97

43. Install oil pan

Note: *Screw fastening torque is45～59Nm*

Note: *Use Loctite 598 surface sealant*

Figure 98

Assembly parts assembling

Installation of II & IV gear clutch

1. Install low speed gear on gear ring

Figure 99

2. Install stator and screw down bolts.

Note： *Screw fastening torque is22～30Nm*

Note： *Use Loctite 262 thread sealant*

Figure 100

3. Tilt the surrounding edge of stator with tool

Figure 101

4. Put clutch gear ring on platform horizontally

Figure 102

5. Install piston sealing ring

Figure 103

6. Install piston

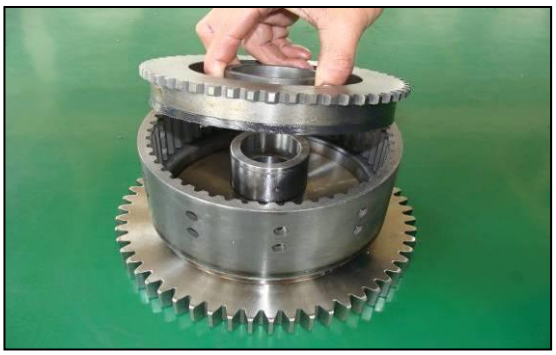


Figure 104

7. Install bearing sleeve

Figure 105

8. Install return spring

Figure 106

9. Install spring fixing seat

Figure 107

10. Install baffle ring

Note：*It must be clamped firmly when using baffle ring pincer to avoid safety hazard.*

Figure 108

11. Install driven and driving friction plate

Figure 109

12. Install fixed block

Figure 110

13. Install spring lamination

Figure 111

14. Install axle

Figure 112

15. Install baffle ring of driven gear

Note：*It must be clamped firmly when using baffle ring pincer to avoid safety hazard.*

Figure 113

16. Install driven gear

Figure 114

17. Install bearing

Figure 115

18. Install baffle ring

Note：*It must be clamped firmly when using baffle ring pincer to avoid safety hazard.*

Figure 116

19. Install high speed gear

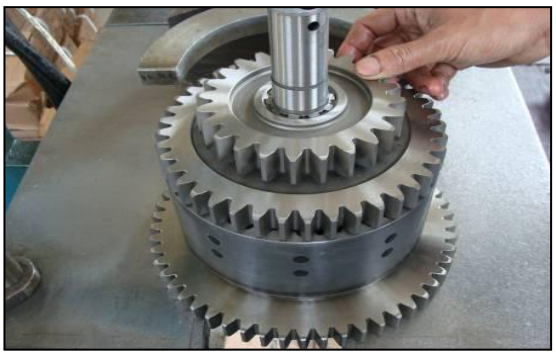


Figure 117

20. Install bearing

Figure 118

21. Install located block

Figure 119

22. Install bearing

Figure 120

23. Install cover plate

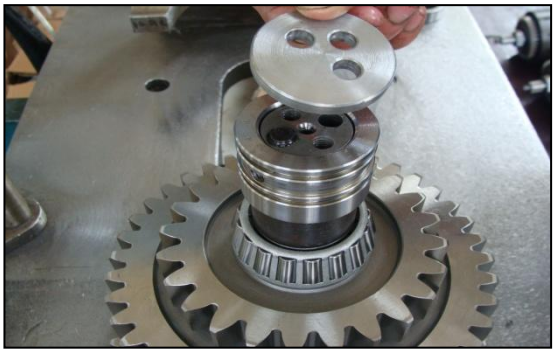


Figure 121

24. Install location

Figure 122

25. Screw down bolts and tilt the edge of stator with tool.

Note：*Screw fastening torque is22～30Nm*

Note：*Use Loctite 262 thread sealant*

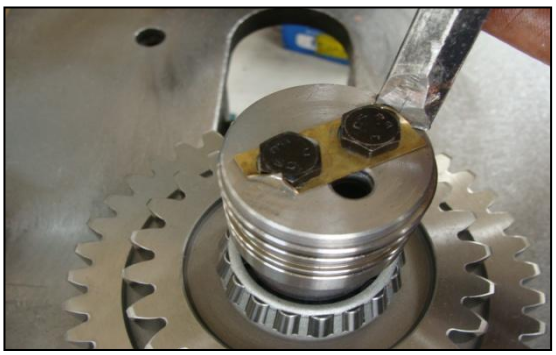


Figure 123

26. Reverse assembly, put it on work platform and install bearing.

Figure 124

Installation of reverse gear clutch

1. Install low speed gear on gear ring

Figure 125

2. Install stator and screw down bolts

Note：*Screw fastening torque is22～30Nm*

Note：*Use Loctite 262 thread sealant*

Figure 126

3. Tilt edge of stator with tools

Figure 127

4．Turnover gear ring and put it on work platform

Figure 128

5．Install piston sealing ring

Note： *Use lubrication oil*

Figure 129

6．Install piston

Note： *Use lubrication oil*

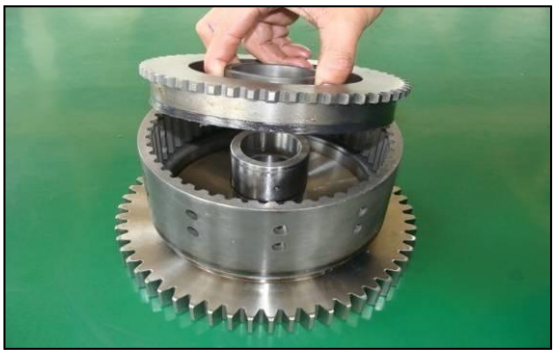


Figure 130

7．Install bearing sleeve

Figure 131

8. Install return spring

Figure 132

9. Install spring fixed seat

Figure 133

10. Install baffle ring

Note：*It must be clamped firmly when using baffle ring pincer to avoid safety hazard.*

Figure 134

11. Install driven and driving friction plate.

Figure 135

12. Install located block

Figure 136

13. Install spring plate

Figure 137

14. Install bearing

Figure 138

15. Install baffle ring on driven gear

Note：*It must be clamped firmly when using baffle ring pincer to avoid safety hazard.*

Figure 139

16. Install driven gear

Figure 140

17. Install 2 bearings with press machine

Figure 141

18. Install baffle ring

Note：*It must be clamped firmly when using baffle ring pincer to avoid safety hazard.*

Figure 142

19. Install spacer bush

Figure143

20. Install bearing

Figure 144

21. Install location block

Figure 145

22. Install shaft sleeve

Figure 146

23. Install cover plate

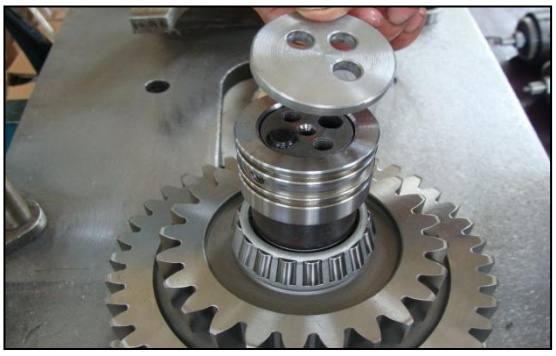


Figure 147

24. Install location plate

Figure 148

25. Screw down bolts and tilt edge of stator with tools

Note：*Bolts fastening torque is 22～30Nm*

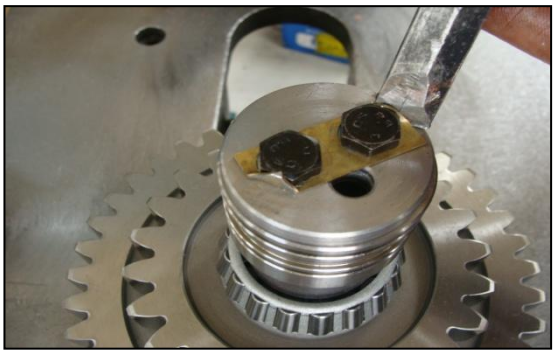


Figure 149

26. Reverse assembly and put it on work platform and install bearing

Clutch structure of I & III gear and reverse gear clutch are the same, but just size of gear is different, so installation process will not be repeated here.

Figure 150

Installation of torque converter assembly

1. Put torque converter shell on installation platform horizontally.

Figure 151

2. Install end cap

Note： *Screw fastening torque is22～30Nm*

Note： *Use Loctite 262 thread sealant*

Figure 152

3. Screw on plug

Note： *Bolt fastening torque is 193～257Nm*

Figure 153

4. Install output flange

Note： *Screw fastening torque is110～130Nm*

Note： *Use Loctite 262 thread sealant*

Figure 154

5. Install working pump and steering pump bearing

Figure 155

6. Install space ring on top of bearing

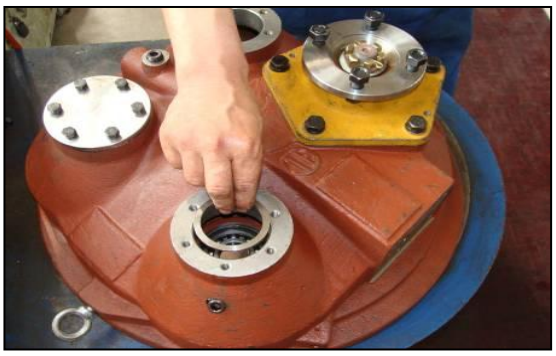


Figure 156

7. Install baffle ring

Note：*It must be clamped firmly when using baffle ring pincer to avoid safety hazard.*

Figure 157

8. Install output axle

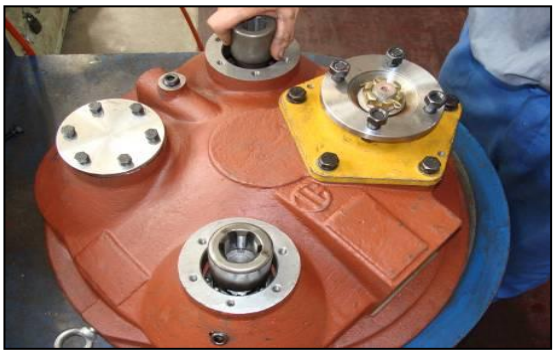


Figure 158

9. Install output flange

Note：*Screw fastening torque is110～130Nm*

Note：*Use Loctite 262 thread sealant*

Figure 159

10. Overturn torque converter and put it on work platform horizontally

Figure 160

11. Install spacer bush and bearing of working pump and steering pump

Figure 161

12. Install guide wheel seat

Note：*Use lubrication oil*

Figure 162

13. Install gear

Figure 163

14. Install baffle ring

Note： *It must be clamped firmly when using baffle ring pincer to avoid safety hazard.*

Figure 164

15. Install sealing gasket

Figure 165

16. Hang transmission shell on pump pulley shell.

Note： *Bolt fastening torque is 22～30Nm*

Note： *Use Loctite 598 surface sealant*

Note： *Guarantee suspending tool is on top of main drive assembly to avoid knocking spare parts inside during suspending process.*

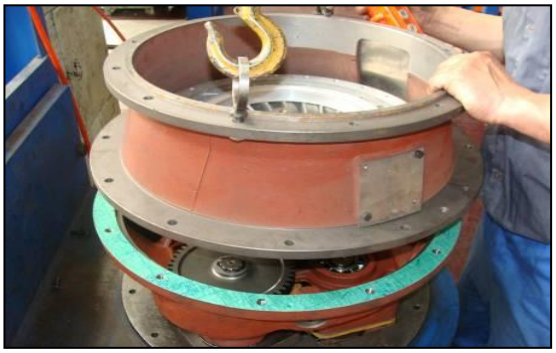


Figure 166

17. Install bearing

Figure 167

18. Install guide wheel

Figure 168

19. Install guide wheel baffle ring

Note：*It must be clamped firmly when using baffle ring pincer to avoid safety hazard.*

Figure 169

20. Install O ring

Figure 170

21. Install turbine

Note：*Bolt fastening torque is 22～30Nm*

Figure 171

22. Install turbine baffle ring

Note：*It must be clamped firmly when using baffle ring pincer to avoid safety hazard.*

Figure 172

23. Install turbine spacer bush

Figure 173

24. Install spacer bush baffle ring

Note：*It must be clamped firmly when using baffle ring pincer to avoid safety hazard.*

Figure 174

25. Install pump pulley shell

Note：*Bolt fastening torque is 45～59Nm*

Figure 175

26. Install elasticity plate

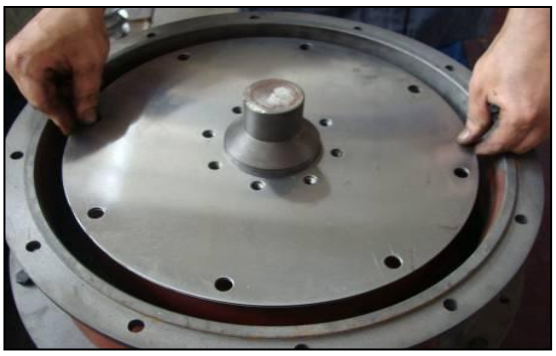


Figure 176

27. Install gasket

Note：*Bolt fastening torque is 45～59Nm*

Figure 177

28. Install sealing gasket on pressure regulating valve

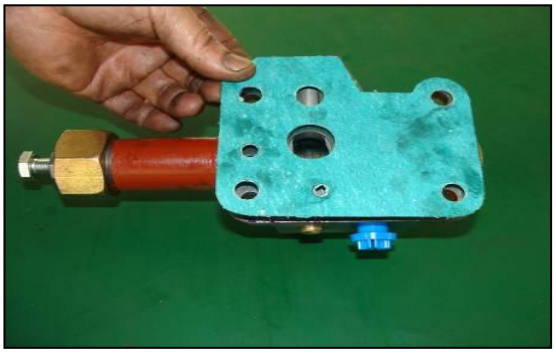


Figure 178

29. Install pressure regulating valve

Note：*Bolt fastening torque is 45～59Nm*

Note：*Loctite 598 surface sealant*

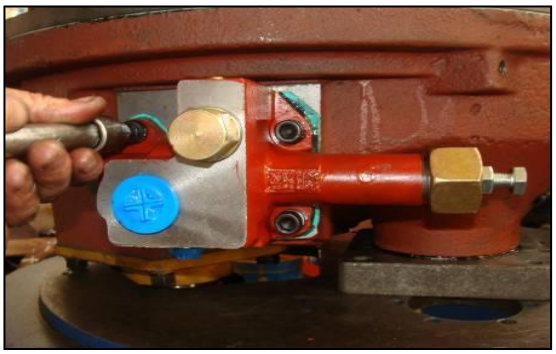


Figure 179

Installation of guide wheel seat assembly

⚠ Put guide wheel on installation platform horizontally

Figure 180

2. Install shaft sleeve

Figure 181

3. Install shaft

Figure 182

4. Install bearing

Figure 183

5. Install baffle ring

Note：*It must be clamped firmly when using baffle ring pincer to avoid safety hazard.*

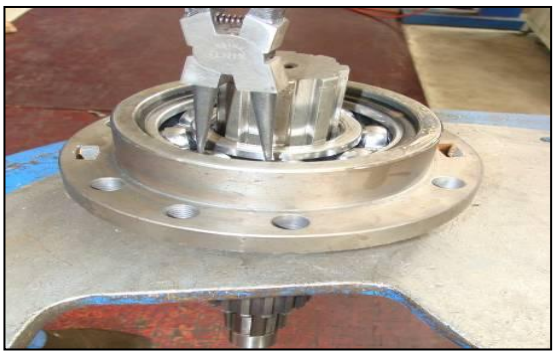


Figure184

6. Install gear

Figure 185

7. Install gear baffle ring

Note：*It must be clamped firmly when using baffle ring pincer to avoid safety hazard.*

Figure 186

Installation of output flange

- Put flange on work platform horizontally, install bearing

Figure 187

2. Install bearing baffle ring

Note：*It must be clamped firmly when using baffle ring pincer to avoid safety hazard.*

Figure 188

3. Install shaft

Figure 189

4. Install gear

Figure 190

5. Install bearing

Figure 191

6．Install bearing baffle ring

Note： *It must be clamped firmly when using baffle ring pincer to avoid safety hazard.*

Figure 192

7．Reverse output flange and put it on work platform

Figure 193

8．Install flange

Figure 194

9. Install shock insulator, sealing ring, shock insulator and hold-down but, and fix bolts with cotter pin.

Figure 195

HYDRAULICS

CYLINDERS

⚠ CAUTION!
Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section. **Always use tools and equipment that is in good working order.** **Use lifting and hoisting equipment capable of safely handling load.** **Remember, that ultimately safety is your own personal responsibility.**

TABLE OF CONTENTS

General Description

Working principle

It is usually composed of cylinder body, piston rod and sealing parts, internal of cylinder body is divided into two parts and connect with a oil hold respectively. Since compression of liquid is very small, when oil coming into one oil hole, piston will be propelled to make oil going out from another oil hole, piston drives piston rod stretching (compressing), on the contrary as before.

Cylinder is the implementing part of the straight line movement of output force and piston effective area and the pressure difference at both sides. It is used to change hydraulic energy into mechanic energy. The input of cylinder is flow rate and pressure of fluid, the output is speed and force of straight line movement. Piston of cylinder can finish straight line alternating motion, the output straight line displacement is limited. Cylinder is the energy converting device from hydraulic energy to mechanic energy for alternating straight line movement. Cylinder is basically composed of cylinder barrel, cylinder cover, piston, piston rod, sealing device and cushioning device.

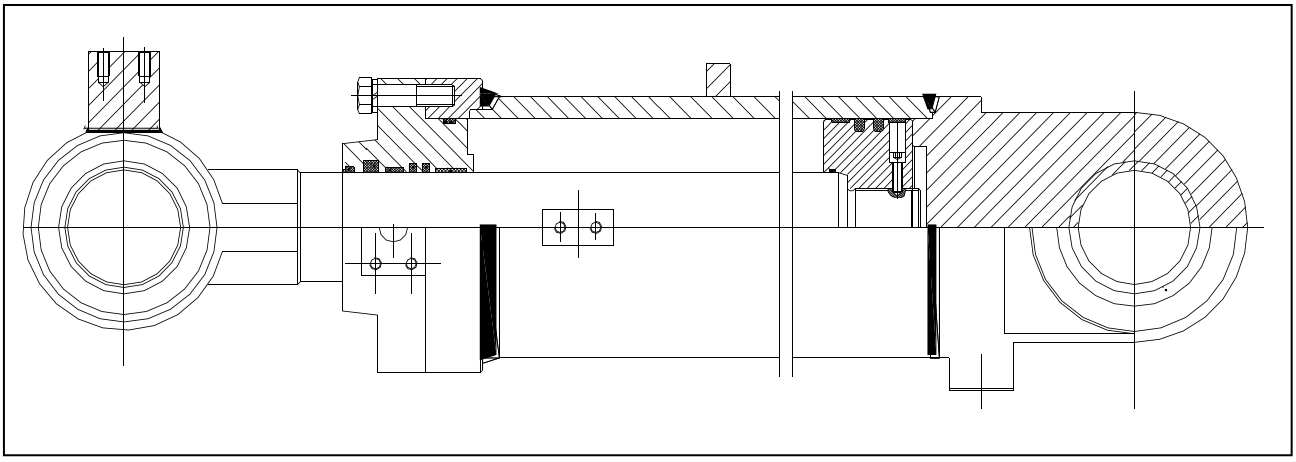


Figure 1

Detailed list of spare parts

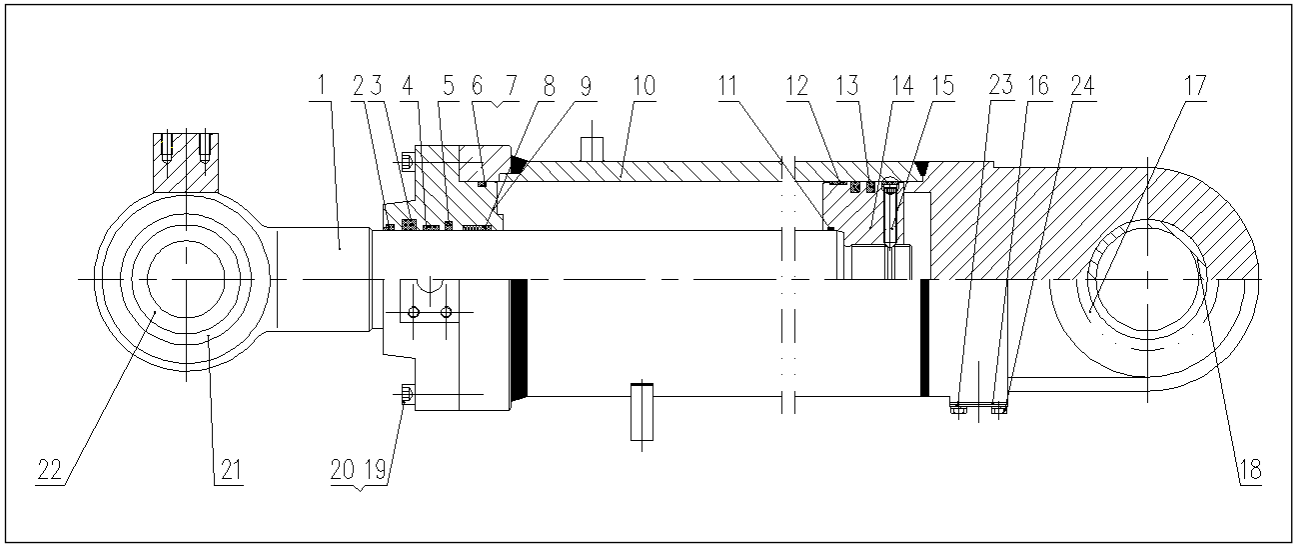


Figure 2

Reference Number	Description	Reference Number	Description
1	Cylinder rod	12	Support ring
2	Dust ring	13	SPGO
3	Obturating ring	14	Piston
4	Support ring	15	Socket head cap screw
5	Cushion seal	16	Port protecting cover
6	Support ring	17	Hole protecting cover
7	Four fluorine block circle	18	Oil cup
8	O-RING	19	Cylinder end bush
9	Guide sleeve	20	Bush
10	Cylinder block	21	Bolt
11	O-RING	22	Washer

Disassembling and assembling steps

Disassembling steps

Note: *Prepare a container which can store all hydraulic oil of the maintained cylinder, hydraulic oil will flow out from cylinder*.

1. Put the cylinder on special supporting vertically, screw down bolts of cylinder cover with pneumatic wrench or torque wrench.

Figure 3

2. Hang piston rod assembly out from cylinder and put it on special protective support.

Figure 4

3. Twist piston lock screw with special tools.

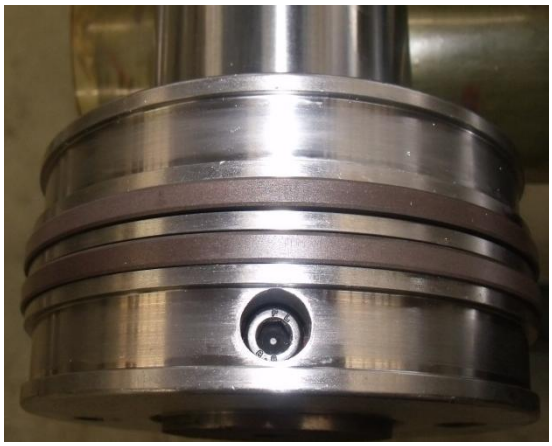


Figure 5

4. Dismantle piston with special piston tightening tool and jackhammer.

Figure 6

5. Dismantle piston and cylinder cover assembly.

Figure 7

6. Dismantle sealing parts with special tools.

Figure 8

Assembling steps

1. Install sealing parts of cylinder.

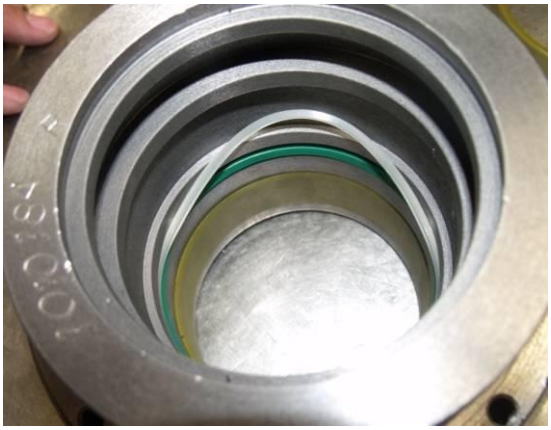


Figure 9

2. Install cylinder cover assembly.

Figure 10

3. Install piston with special tools.

Figure 11

4. Screw down piston bolts with special tools.

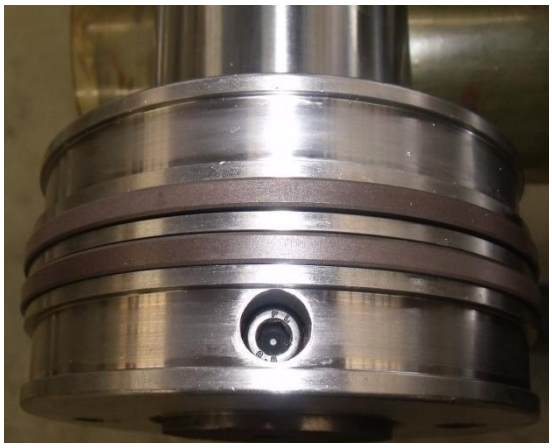


Figure 12

5. Put piston rod in cylinder barrel.

Figure 13

6. Screw down bolts of cylinder cover and cylinder barrel.

Figure 14

Main Pump

⚠ CAUTION!
Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section. **Always use tools and equipment that is in good working order.** **Use lifting and hoisting equipment capable of safely handling load.** **Remember, that ultimately safety is your own personal responsibility.**

TABLE OF CONTENTS

General description

Work principle

Function of main pump is to convert mechanic energy of diesel into pressure energy of working liquid. Main pump is a kind of hydraulic pump with simple structure and wide application, it has small size, light weight, reliable work, low cost and not too sensitive to hydraulic oil, convenient for maintenance and repair, and therefore it is widely applied in hydraulic system of loaders.

Main pump has many types, according to different pressure grade, it can be divided into four types which are: low pressure (P＜2.5MPa), medium pressure (P＞2.5—8MPa), mesohigh pressure (P＞8—16MPa) and high pressure (P＞16—31.5MPa). At present, mesohigh pressure main pumps are used often for loaders. According to difference of gear mesh form, it can be divided into main pump with external mesh and main pump with internal mesh. Of which main pumps with external mesh are more popular.

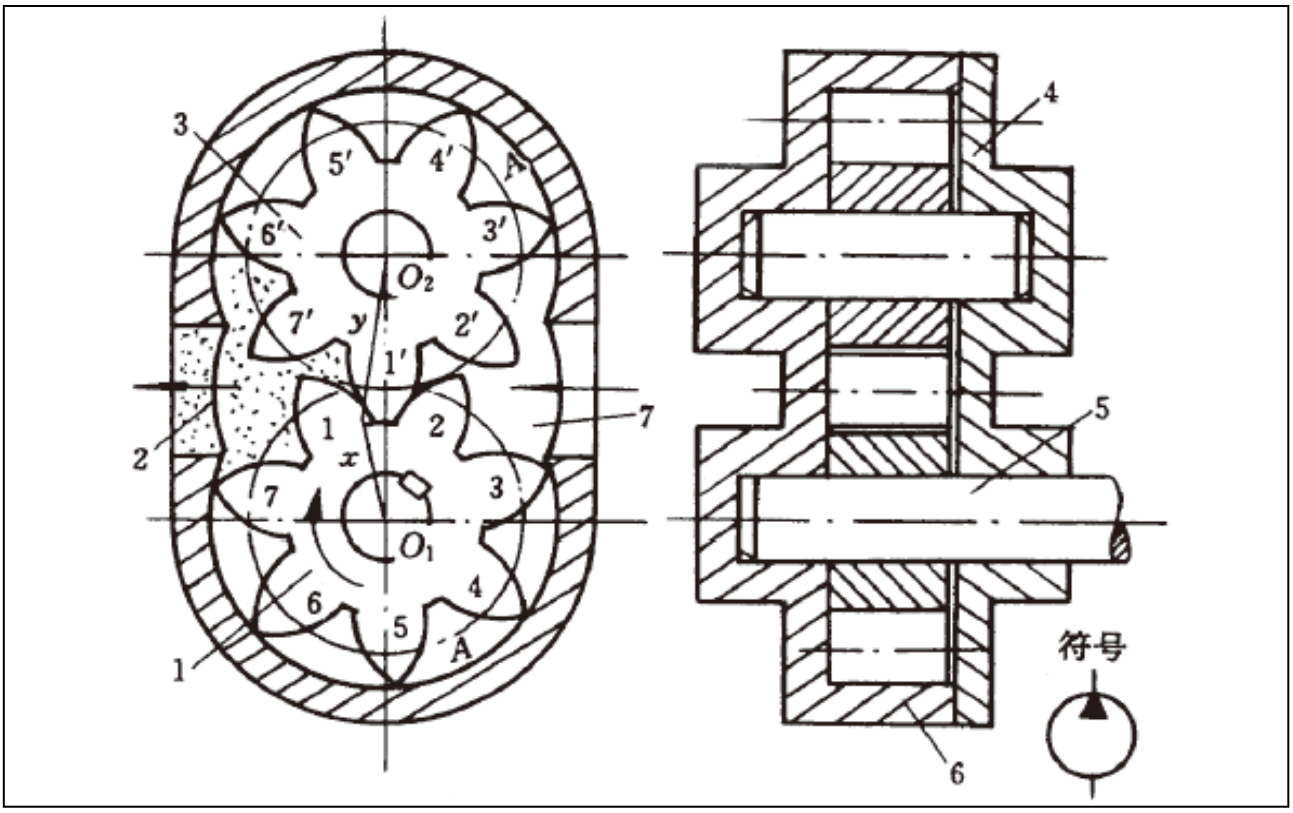


Figure 1

1. Driving gear 2. Extrusion chamber 3. Driven gear 4. End cap 5. Transmission shaft 6. Pump body 7. Suction chamber

Detailed list of spare parts

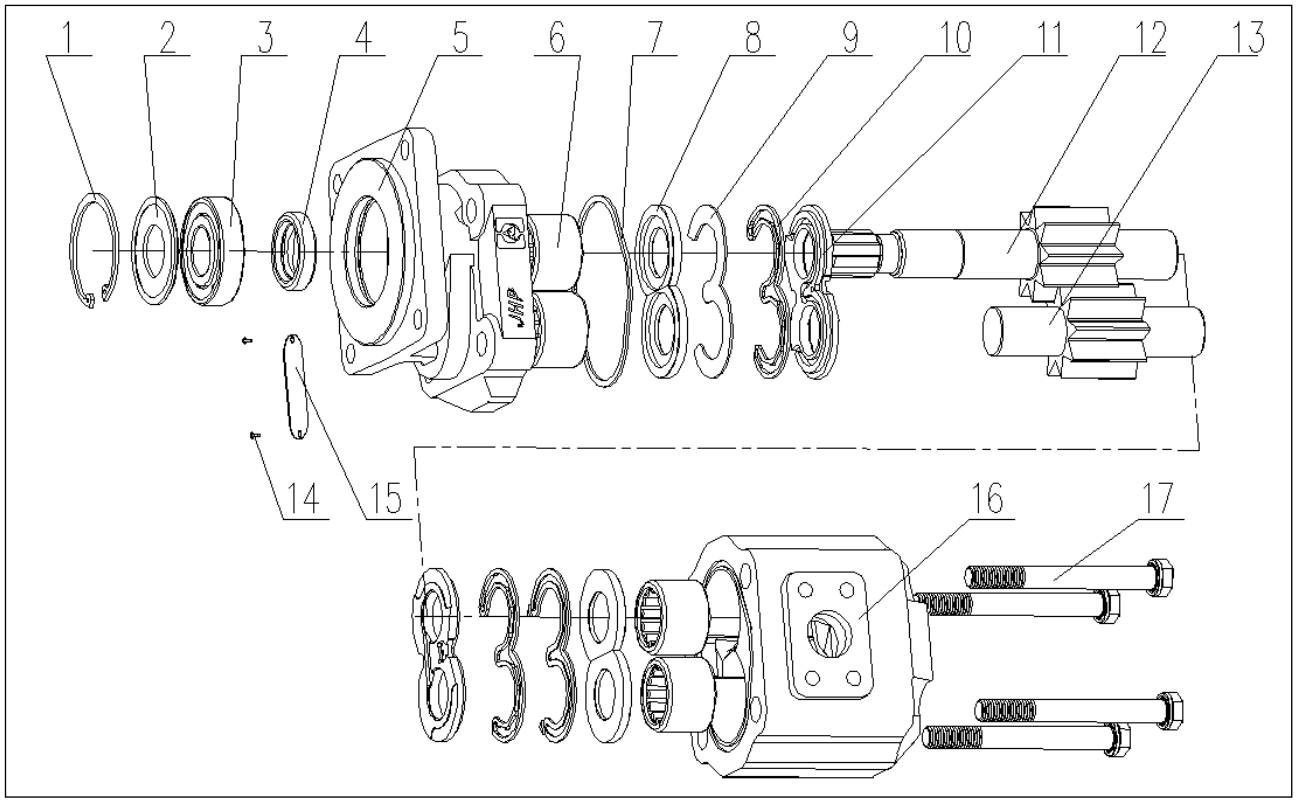


Figure 2

Reference Number	Description	Reference Number	Description
1	Circlip	10	Seal Ring
2	Shim	11	Side Plate
3	Bearing	12	Drive Gear
4	Seal Ring	13	Driven Gear
5	Front Cover	14	Rivet
6	Bearing	15	Nameplate
7	Seal Ring	16	Rear Body
8	Shim	17	Bolt
9	Baffle		

Parts replacement principle

If main pump needs to be repaired to reach the original performance index, parts replacement principle must be followed to replace parts, following is the detailed replacing rules:

1. Side plate: replace side plate when it is scratched, there is pit, spray and finishing layer sheds, burnt, deformed and cavitations corrosion.
2. Gear: replace gear when one of the following conditions happens: shaft diameter of gear shaft is scratched or worn in sealing zone; teeth surface of gear is worn, scratched, broken or deformed; addendum circle is damaged seriously; multiple spline or flat key and spindle nose are worn, deformed and broken.
3. Castings (front cover, pump body, and rear cover):
   3.1 If there is flaw on castings, and sealing zone has chip, rust, deformed pin hole, then replace castings.
   3.2 Replace pump body when one of the following conditions happens: oil mouth is broken, pump body is broken and rusty; when bore depth of pump body ＞0.08mm.
4. Round pin: round pin must be replaced when the matching does not comply with requirements, pin is broke and deformed, replace the front cover, pump body and rear cover matched with round pin when it is necessary.
5. Rolling bearing: new parts must be replaced when quill roller drops, retainer is damages, quill roller has surface pitting, roller path has surface pitting, over sintering.
6. Second sealing ring: replace with new parts when there is inner diameter abrasion, end face abrasion, thickness is milled, deformed, surface is coarse.
7. Non-metal sealing parts: all non-metal sealing parts must be replaced.
8. Outboard bearing: replace with new parts when parts are worn and rusty.
9. Fastener: replace it when it is drawn out, deformed and damaged.

Preparation before disassembling

1. Clean the surface of pump, and check if the surface has chip and rust.
2. Check model and factory releasing number on nameplate, if there is no nameplate on pump, check factory releasing number at seam allowance of front cover.
3. Fill in relative information on main pump returned for maintenance card before disassembling, such as manufacturer, applicable machine model, applicable working condition, pump model, factory releasing number, factory releasing date, head and marks of fabricator, working parameters (pressure, rotation, impact and the constant running time at the highest pressure) on main machine, total working time of main pump and reason for returning for maintenance, etc.
4. Make sure the production is released from the factory as a whole and it is not disassembled after releasing, otherwise it is not maintained.
5. If there is external leaking, do gas tightness checking to the entire pump and find out leaking position.
6. Check tightening torque of bolts (screw down bolts again with torque wrench, record the Max. tightening torque), learn if tightening torque of all bolts have reached the required specification.

Disassembly and assembly steps

Disassembly steps

1. Dismantle front end cap.

Figure 3

2. Dismantle jump ring with jump ring pincer.

Figure 4

3. Take out framework oil seal.

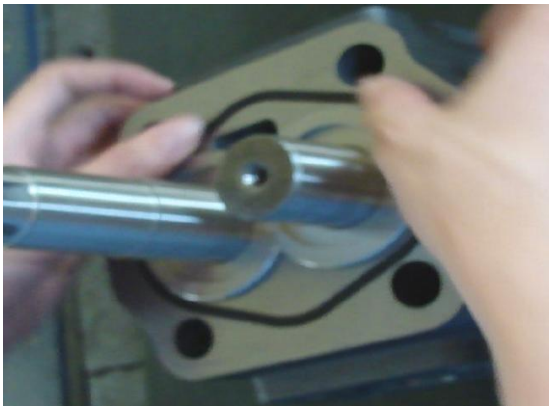


Figure 5

4. Take out support wire.

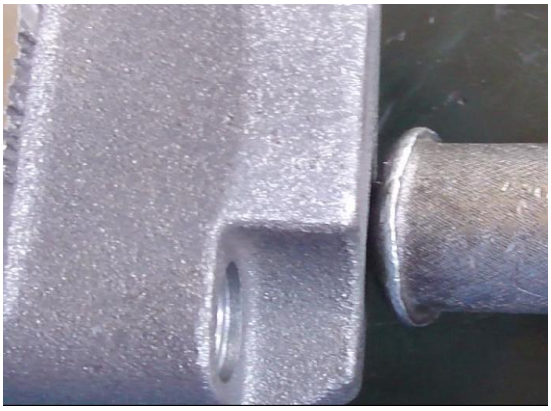


Figure 6

5. Dismantle sealing ring.

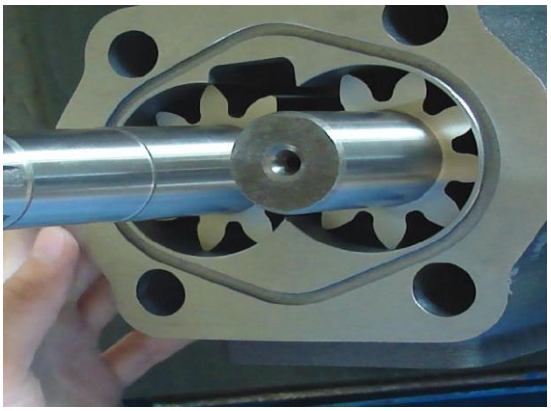


Figure 7

6. Dismantle bearing.

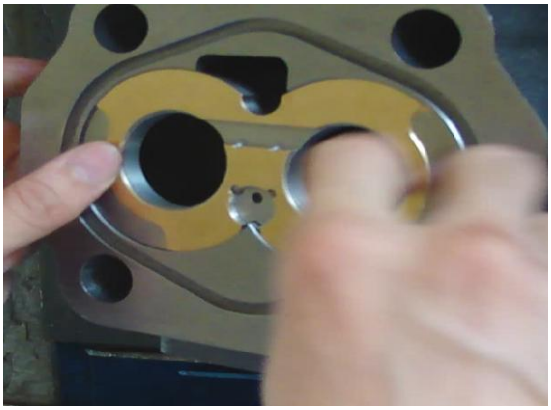


Figure 8

7. Dismantle front ear type sealing ring

Figure 9

Installation steps

1. Install bearing.

Figure 10

2. Install sealing ring.

Figure 11

3. Install limitation wire.

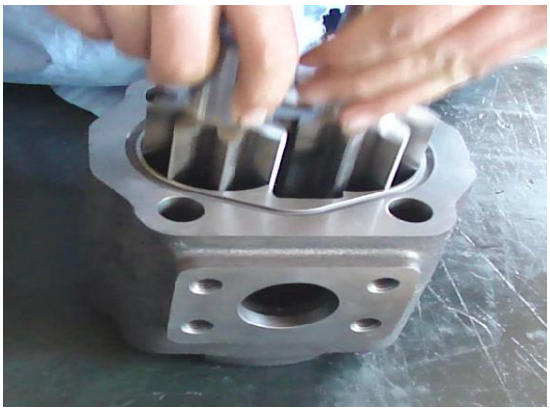


Figure 12

4. Install rear cover.

Figure 13

5. Install rear cover bolts.

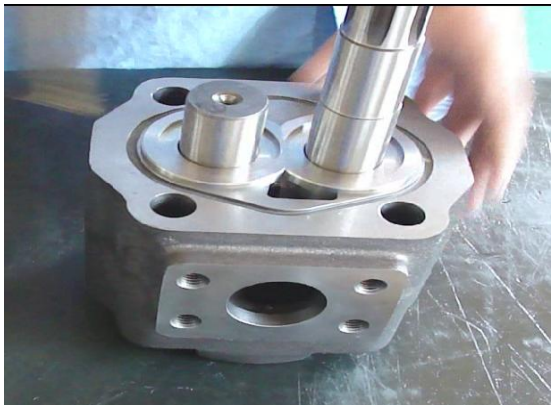


Figure 14

6. Install active gear.

Figure 15

7. Install driven gear.

Figure 16

8. Install side plate.

Figure 17

9. Install ear type sealing ring.

Figure 18

10. Install front ear type sealing ring.

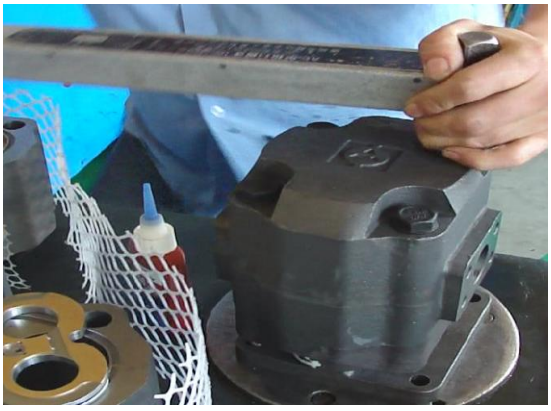


Figure 19

11. Rotate pump axis and check it.

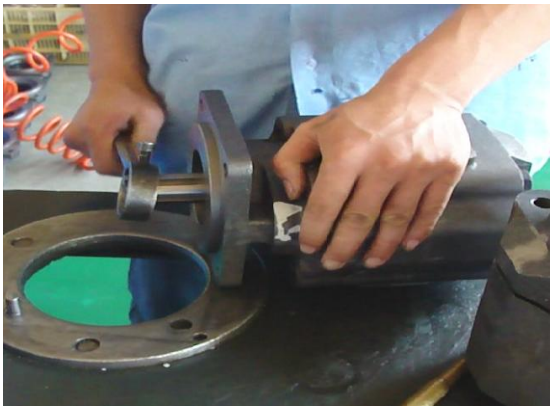


Figure 20

Note:

1. Clean parts with cleaning agent, do not use rag to avoid remaining any clothing fiber.
2. Slide touching parts and bearing, coating with hydraulic oil and assemble after cleaning.
3. Replace O ring and sealing parts with new ones:

   Disassembling order: front cover →framework oil seal→ O ring →bearing →sealing ring →side plate →driven gear →active gear →rear cover →O ring →bearing.

   Assembling order: bearing →O ring →rear cover→ active gear→ driven gear→ side plate →sealing ring→ bearing→ O ring→ framework →oil seal→ front cover.

Main Control Valve

⚠ CAUTION!
Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section. **Always use tools and equipment that is in good working order.** **Use lifting and hoisting equipment capable of safely handling load.** **Remember, that ultimately safety is your own personal responsibility.**

TABLE OF CONTENTS

General description (Pilot Lever)

1. Source: the hydraulic multi-way directional valve is domestic assorting parts for 950B, 966D and 980S wheel loaders introduced in from abroad.
2. Purpose: the valve is combined with DJS pilot valve, mainly used for ZL40, ZL50, ZL60 and other medium and large size loaders, it can also be used for hydraulic system of bulldozers and other medium and large size engineering machines.
3. Characteristics:
   a. Adopt decompression type pilot valve to control which reduce reversing operating force greatly.
   b. Improve jogging feature of multi-way valve greatly.
   c. Relief valve, overload valve, oil compensating valve and check valve adopt plug-in mounting which has good generality and easy for maintenance.
   d. Four floating is easily realized on the basis of three main valves, which make four main valve structure simple.
4. Schematic diagram

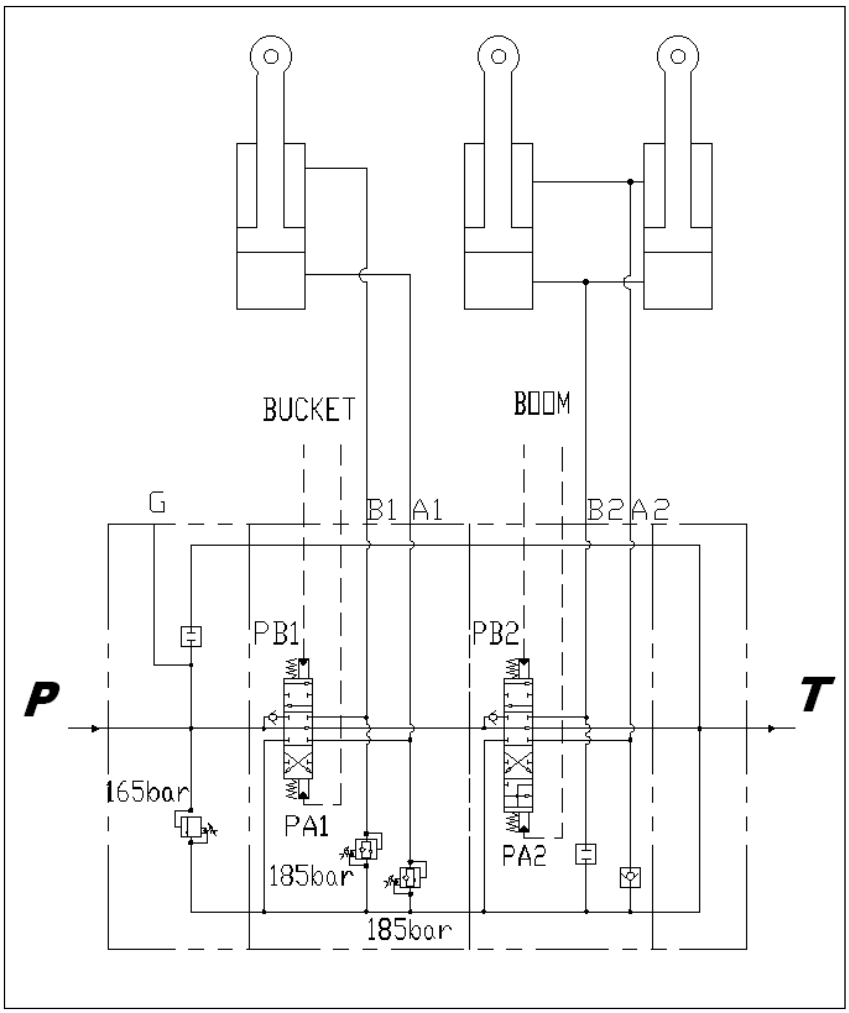


Figure 1

Detailed list of spare parts

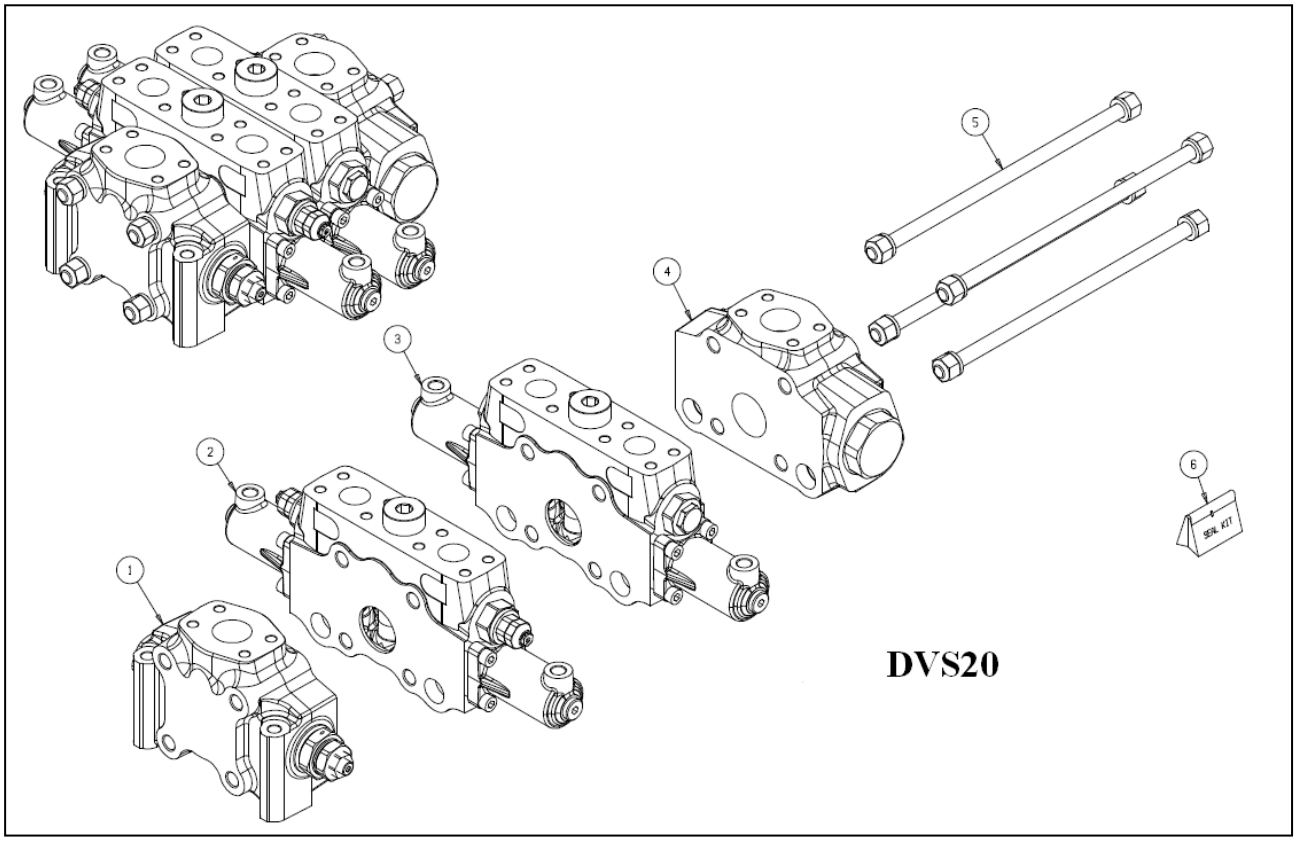


Figure 2

Pos	Code	Description	UM	Q.ta
1	60130557MQ	HC-DVS20 COLL.E. (IL 009 180 A S07)	N	1
2	60130558MQ	HC-DVS20 SIZ. (W001A H005 RT S05 04PA190 04PB190)	N	1
3	60130559MQ	HC-DVS20 SIZ. (H005 RT S05 02PA 05PB)	N	1
4	60110260DD	HC-DVS20 COLL.U. (TK A S07)	N	1
5	300188001	DVS20/2 TIRAN.PASSO 61	N	4
6	JSP18800025	KIT GUARNIZIONI-HC-DVS/2 H005 PAS	N	1

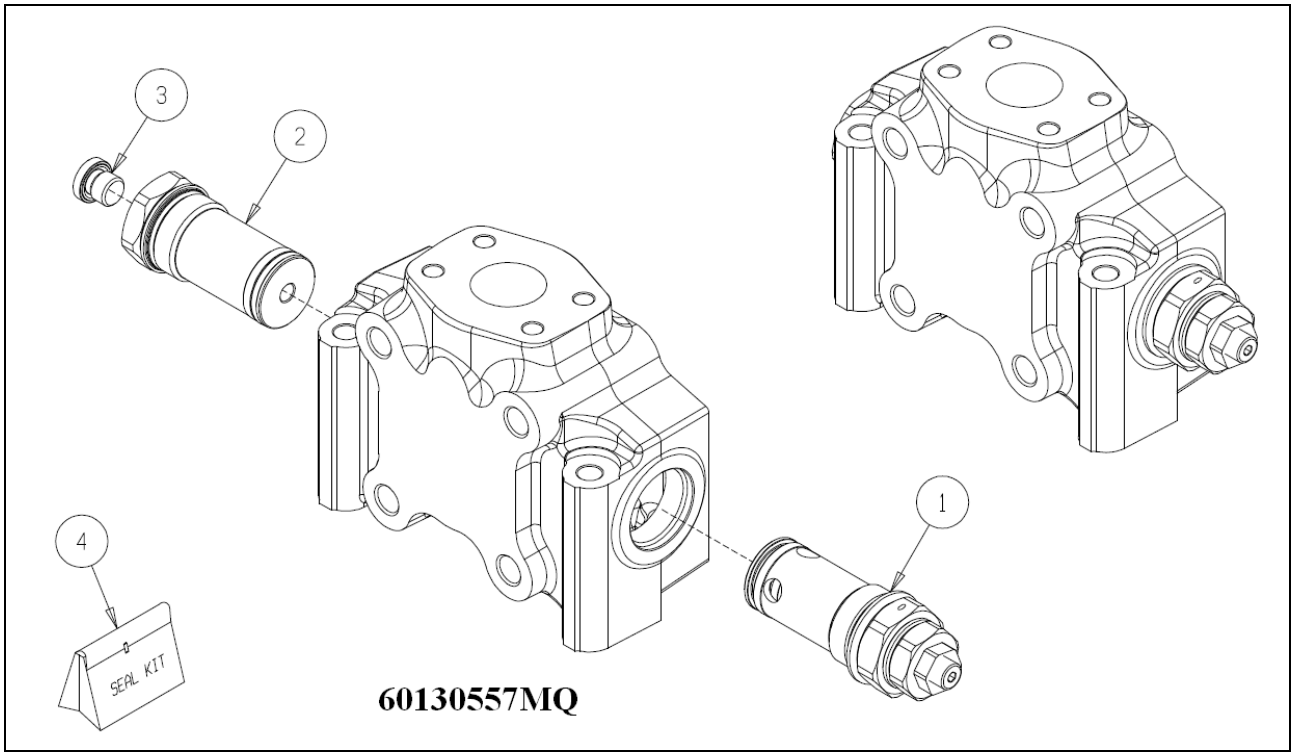


Figure 3

Pos	Code	Description	UM	Q.ta
1	86491	DVS20 V.MAX.PIL. (180DAR)	N	1
2	430188002	DVS20 ASS.TAPPO SOST.V.MAX.P+ATT.1/4"G	N	1
3	430000017	ASS.TAPPO 1/4" DIN 3852 E	N	1
4	JSP18800018	KIT GUARNIZIONI-HC-DVS20 COLLETTORE	N	1

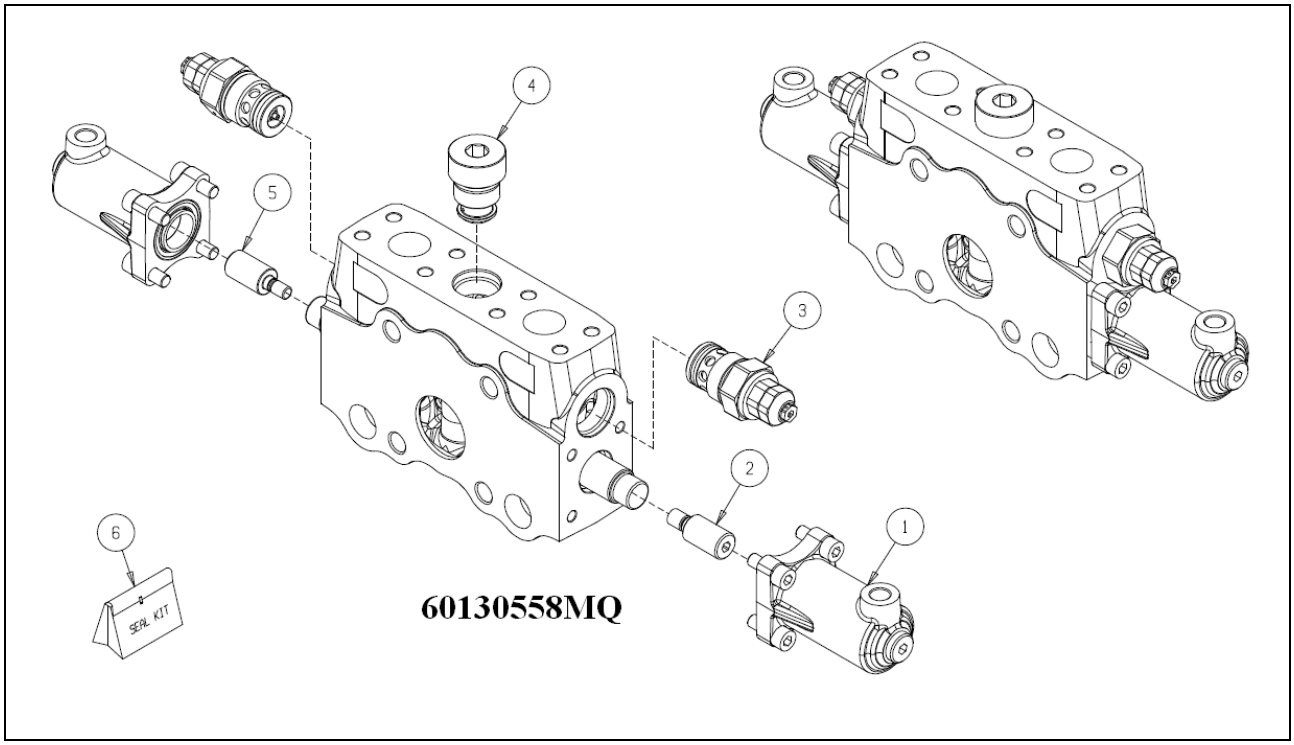


Figure 4

Pos	Code	Description	UM	Q.ta
1	320507027	D12 COM.IDR.GH. 1/4"G. H006U	N	2
2	422501218	TAPPO STL.C.I.ANT. DVS20	N	1
3	86492	DVS20: 04-PA=PB(190 BAR)	N	2
4	320288001	DVS20 KIT VR	N	1
5	422501204	TAPPO STL.C.I.ANT. POST.	N	4
6	JSO18800011	KIT GUARNIZIONI-HC-DVS20 SEZ.DE CV	N	1

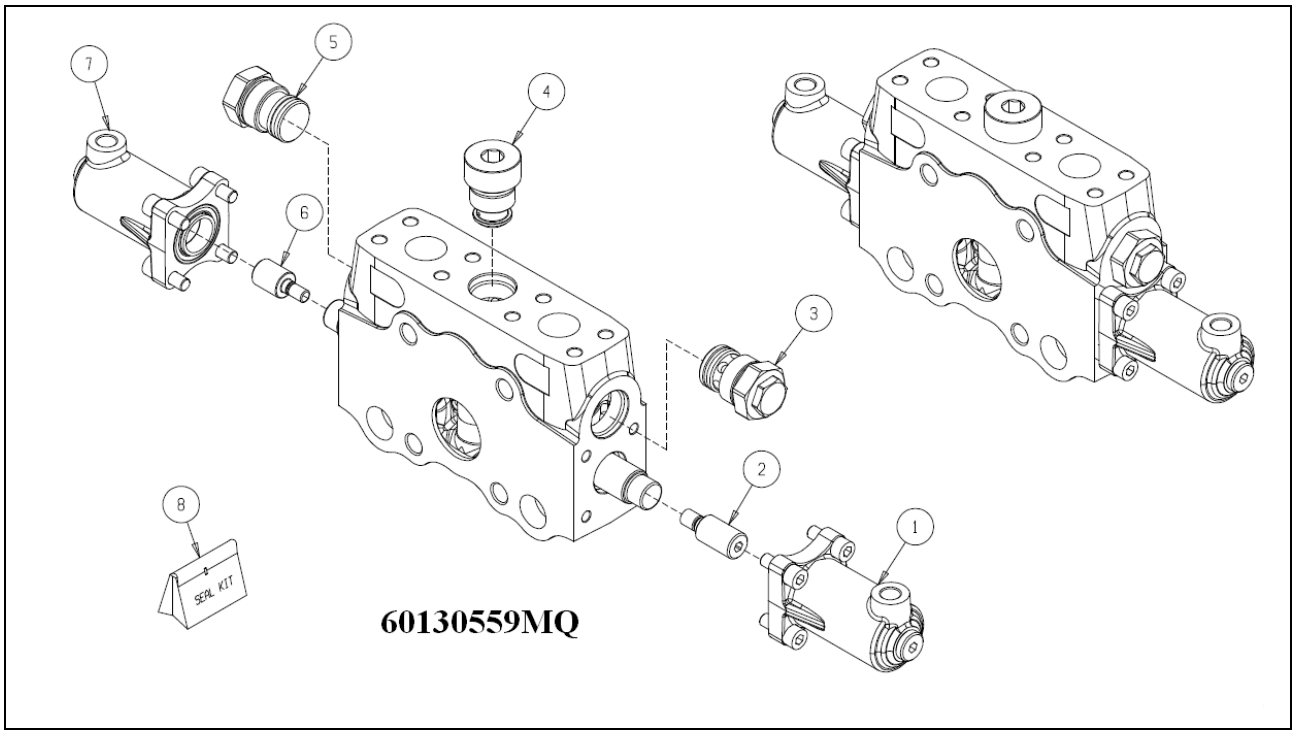


Figure 5

Pos	Code	Description	UM	Q.ta
1	320507026	D12 COM.IDR.FLOAT ANT.GH.1/4"G HOO6G	N	1
2	422501218	TAPPO STL.C.I.ANT.	N	1
3	915088801	DVS20: 02-PA=PB	N	1
4	320288001	DVS20: KIT V.R	N	1
5	430488001	DVS20: 05-PA=PB	N	1
6	422501216	TAPPO STL.C.I.FLOAT DVS20	N	1
7	320588010	DVS20 COM.IDR.FLOAT POST.GH.1/4"G.	N	1
8	JSP18800024	KIT GUARNIZIONI-HC-DVS20 SEZ. (H005)	N	1

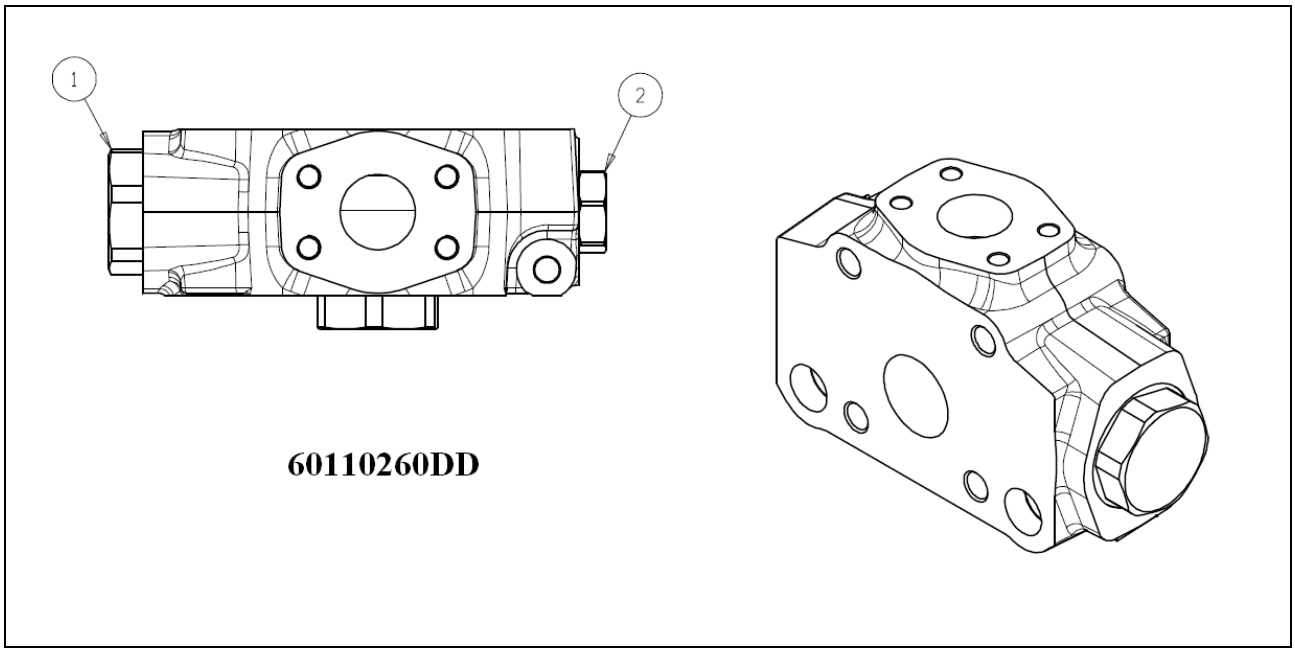


Figure 6

Pos	Code	Description	UM	Q.ta
1	300009002	KIT TAPPO 1\1/16.12 UNF D12	N	2
2	200007002	KIT TAPPO 1"5/8-12 UNF	N	1

General description (Mechanical Lever).

1. Source: the hydraulic multi-way directional valve is domestic assorting parts for 950B, 966D and 980S wheel loaders introduced in from abroad.
2. Purpose: the valve is combined with control level, mainly used for ZL40, ZL50, ZL60 and other medium and large size loaders; it can also be used for hydraulic system of bulldozers and other medium and large size engineering machines.
3. Characteristics:
   a. Adopt decompression type pilot valve to control which reduce reversing operating force greatly.
   b. Improve jogging feature of multi-way valve greatly.
   c. Relief valve, overload valve, oil compensating valve and check valve adopt plug-in mounting which has good generality and easy for maintenance.
   d. Four floating is easily realized on the basis of three main valves, which make four main valve structure simple.
4. Schematic diagram

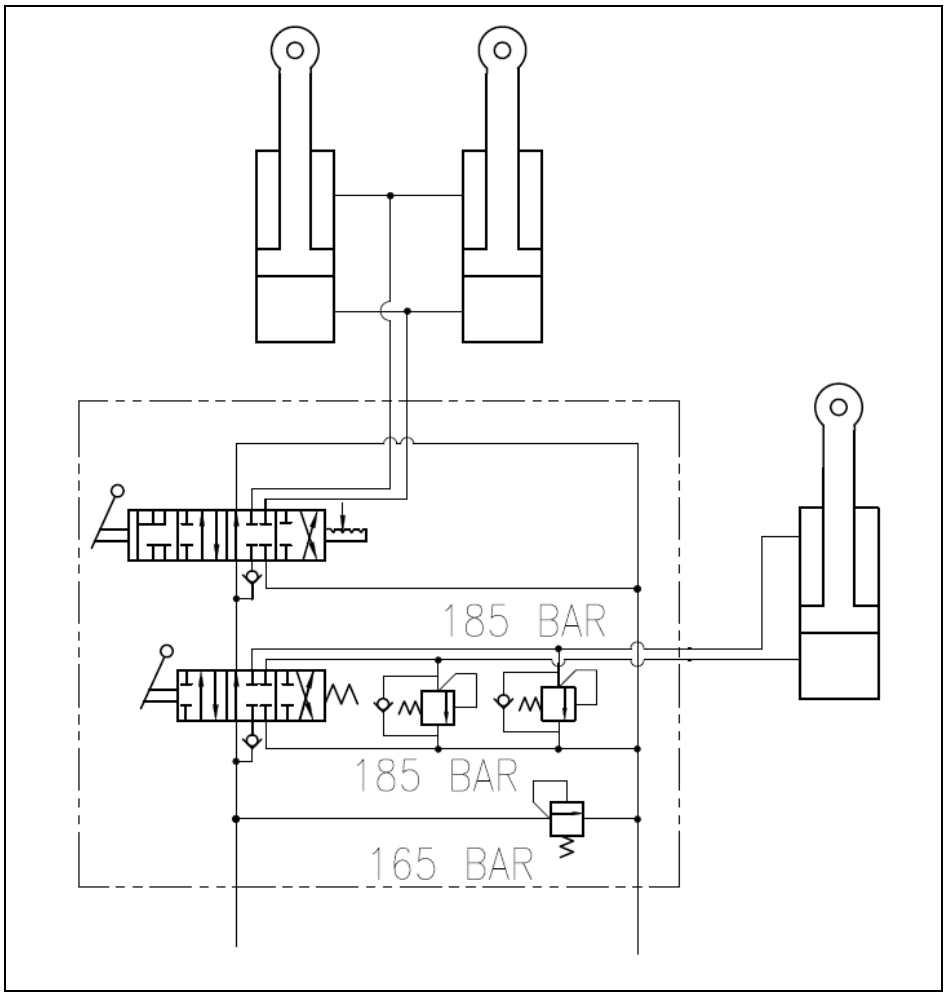


Figure 7

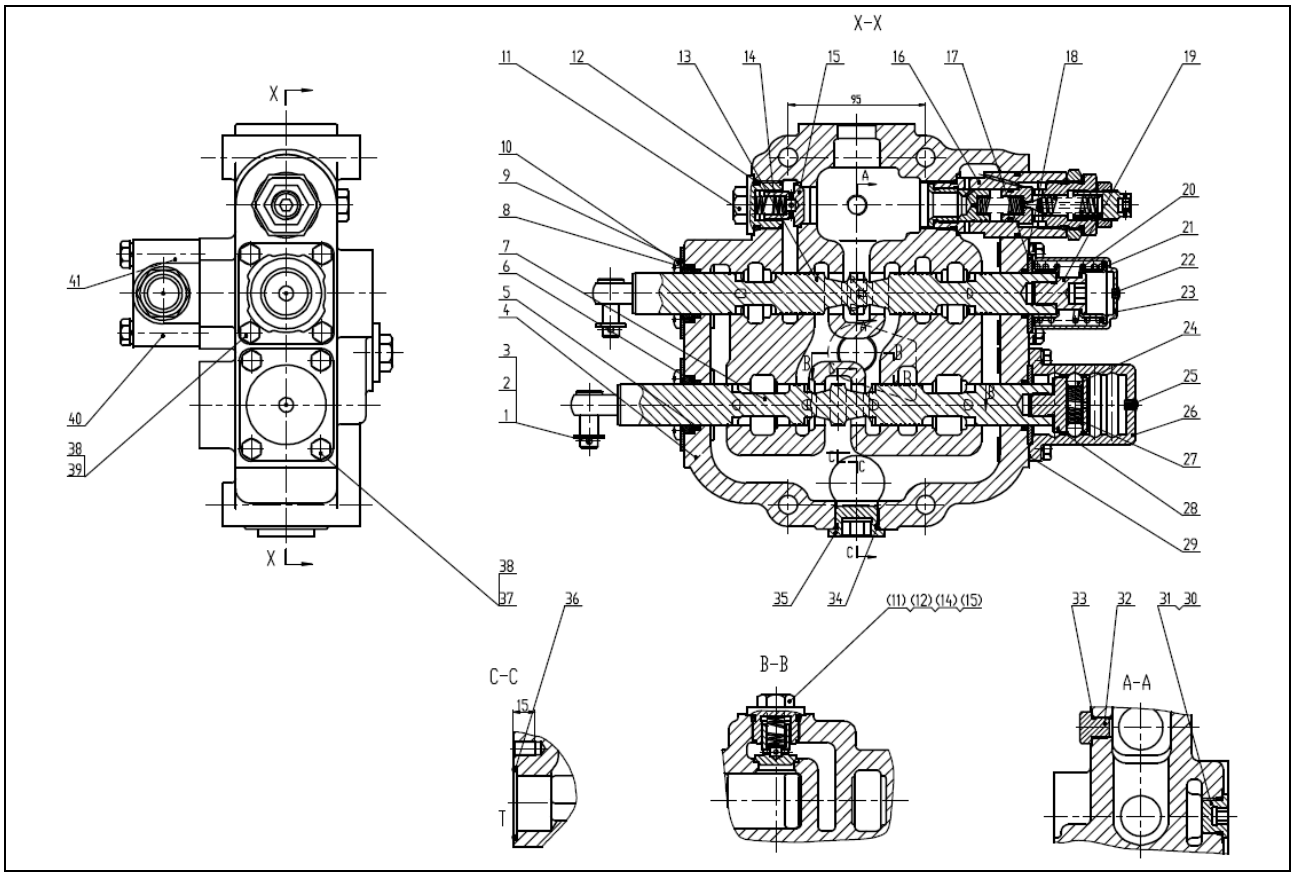

X-X
X
X
11
12
13
14
15
16
17
18
19
10
9
8
7
6
5
4
3
2
1
20
21
22
23
24
25
26
27
28
29
41
40
38
39
38
37
36
35
34
(11) (12) (14) (15)
33
32
31
30
C-C
B-B
A-A
T

Figure 8

Reference Number	Description	Reference Number	Description
01	Pin	22	Plug
02	Washer; Plain	23	Cover
03	Pin	24	Ball
04	Valve body	25	Plug
05	O-Ring	26	Cover
06	Shim	27	Spring
07	Boom Spool	28	Spring Seat
08	Wiper Scraper Seal	29	Seal Washer
09	Plate	30	O-Ring
10	Screw	31	Plug
11	Valve Cover	32	Plug
12	O-Ring	33	O-Ring
13	Bucket Spool	34	O-Ring
14	Check Valve Spring	35	Plug
15	Check Valve	36	O-Ring
16	Relief Valve	37	Bolt
17	Shim	38	Washer; Plain
18	Seal Washer	39	Bolt
19	Spring Seat	40	Overload Valve
20	Spring	41	Make up Valve
21	Spring Seat	42	

Basic faults and overcoming

S/N	Faults	Reasons	Overcoming methods
1	Working pressure is not enough	Pressure of relief valve is regulated too low	Adjust pressure of relief valve
		Slide valve of relief valve is blocked	Dismantle, clean and assemble again
		Pressure regulation spring is broken	Replace with new one
		System pipe pressure is lost too much	Replace pipeline or regulate pressure of relief valve within the allowable pressure range
2	Working flow is not enough	Oil supply of the system is not enough	Check oil source, check oil pump
		Leakage in valve is large	
		a. Oil temperature is too high, viscosity decreases	a. Take measures to reduce oil temperature
		b. Selection of oil is improper	b. Replace oil
		c. Clearance between slide valve and valve is too large	c. Replace slide valve according to reasonable clearance
		Fault of relief valve	Repair relief valve
3	Resetting does not work	Resetting spring is damaged or deformed	Replace new ones
		There is pollutant between valve rod and valve	Clean parts
4	External leakage	Sealing ring is damaged	Replace new ones
		Fasteners are loosed	Screw down fasteners
5	Slippage of swing arm is large	Clearance between multi-way valve and valve rod increases	Replace valve rod
6	Rotating bucket falls	Overload valve or oil compensating valve is blocked by pollutant	Dismantle, clean and reassemble

Priority Valve

⚠ CAUTION!
Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section. **Always use tools and equipment that is in good working order.** **Use lifting and hoisting equipment capable of safely handling load.** **Remember, that ultimately safety is your own personal responsibility.**

TABLE OF CONTENTS

General description

Work principle

When steering unit is in the middle, if the engine misses, oil pump does not supply oil, control spring of priority valve will push spool to the right side to connect with CF oil way. When diesel engine is started, priority valve will distribute pressure oil to CF oil way, pressure will be reduced after going through meso-position throttle mouth of steering unit, pressure at both sides of throttle mouth will be transferred to both sides of priority spool, the caused hydraulic force will balance with spring force of control spring and liquid power which will make spool balance. Since fluid resistance at throttle mouth is big, very few flow will create enough differential pressure to push priority valve spool moving to the left side and will push spool move to the left, EF valve is opened larger and CF valve is smaller, then flow rate of CF oil way is small.

When turning steering wheel, meso-position throttle mouth of steering unit closes, fluid flowing through steering unit creates pressure drop. Pressure from both sides of throttle changing mouth is transferred to both sides of priority valve spool and forces spool to find a new balanced position. If rotation of steering wheel is improved, throttle changing mouth is larger at the moment of changing, at this time, only more flow rate can create pressure drop before rotation speed is different at throttle mouth so that priority valve spool can be pushed to move to the left side. Therefore, open of valve mouth of CF oilway connecting with priority valve will increase with improving of steering wheel rotation. In the end, oil supplying quantity of priority valve steering unit is equal to rotation of steering wheel plus displacement of steering unit.

When steering cylinder reaches the travelling terminal, if steering wheel is continued to be turned, pressure oil cannot flow to cylinder, then overload pressure will rise quickly, pressure difference between both sides of throttle changing mouth will reduce quickly, when pressure of steering cylinder exceeds regulated value of safety valve, the valve is turned on to discharge load. Pressure drop is created when pressure oil flowing through throttle mouth, the pressure drop is transferred to both sides of priority valve spool and push spool to move to the left side which will force valve mouth connecting with CF oilway get smaller, and valve mouth connecting with EF oilway get bigger, and pressure of steering oilway decreases.

When turning flames out, steering unit can play the role of manual oil pump. Input pressure oil pushes steering cylinder piston, oil from cylinder turns to upstream of throttle mouth of check valve, that is turning when flaming out has nothing to do with priority valve.

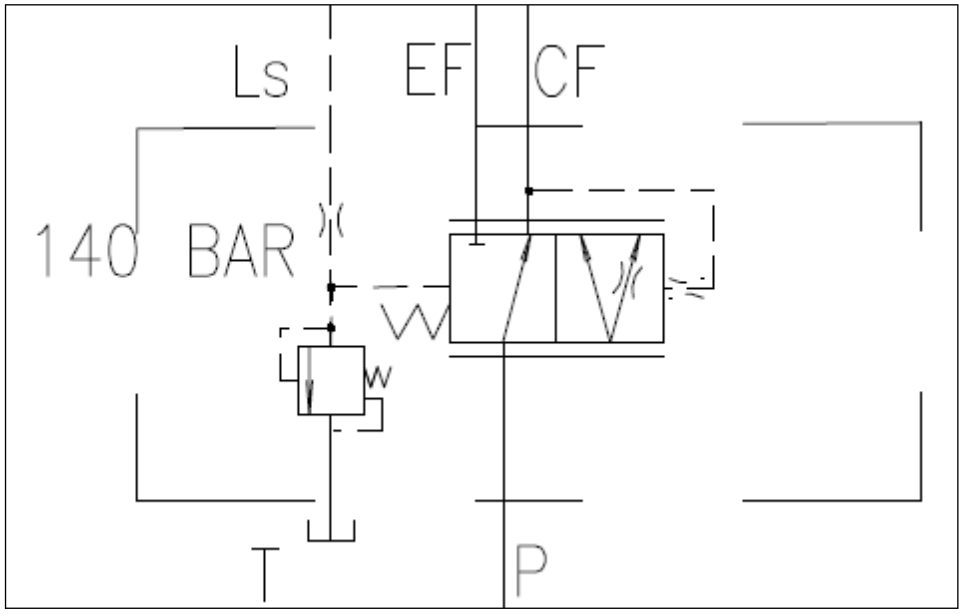


Figure1

Detailed list of spare parts

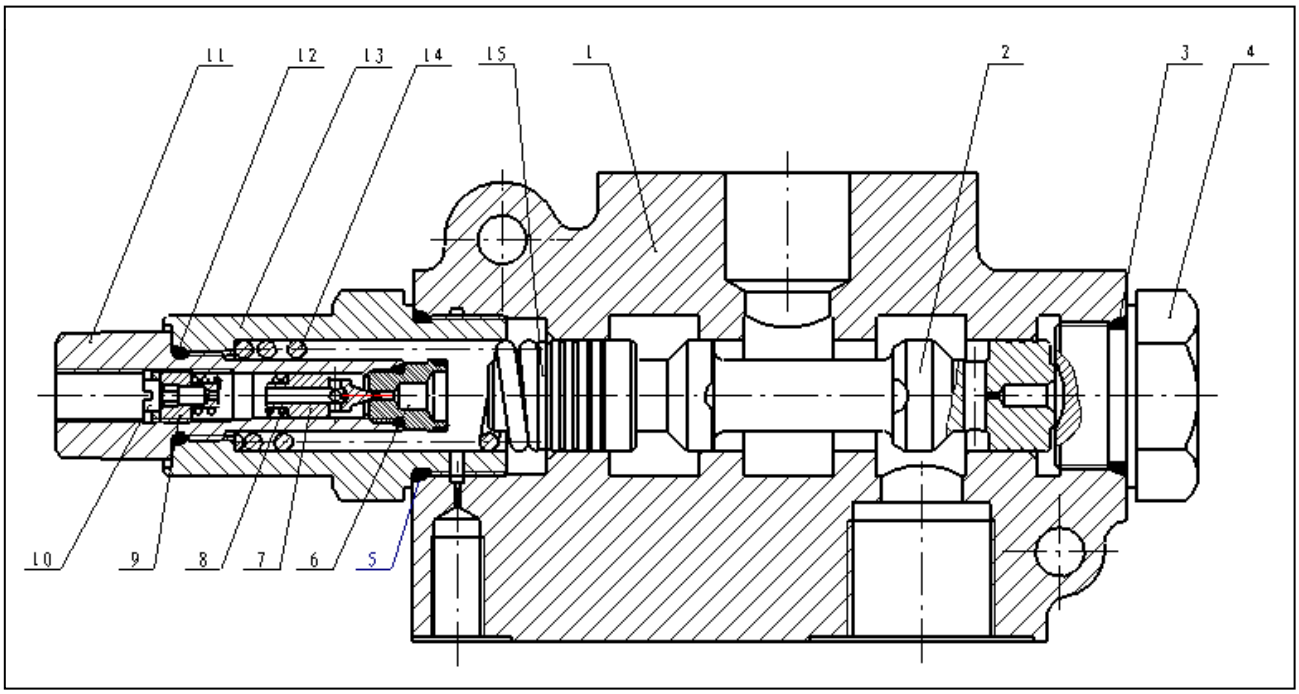


Figure2

Reference Number	Description	Reference Number	Description
1	Valve body	9	Adjustable Bolt
2	Valve spool	10	Locking Ring
3	O-Ring35X3.1	11	Relief Valve body
4	Plug	12	O-Ring 22X2.4
5	O-Ring38X3.1	13	Relief Valve seat 2
6	Relief Valve seat 1	14	Spring
7	Relief Valve spool	15	Gasket
8	Relief Valve Spring		

Disassembly steps of priority valve

1. Turn on relief valve on the left side.

   Tools: pneumatic wrench, M24 sleeve

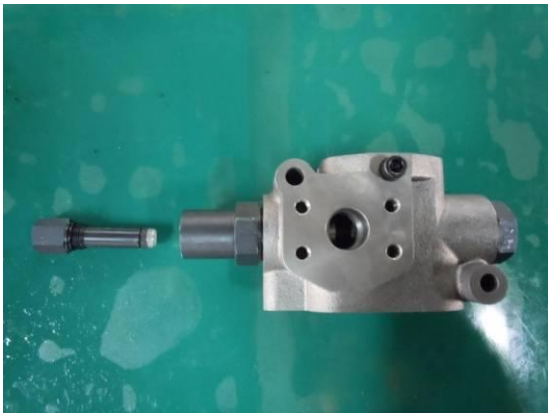


Figure 3

2. Turn on valve seat 2 of relief valve on the left to take out spring.

   Tools: pneumatic wrench, self made sleeve (41# wrench)

Figure 4

3. Turn on screw plug on the right to take out spool and gasket.

Figure 5

4. Screw out lock ring and adjustable bolt of relief valve to take out spring and relief spool, then take our valve seat 1 of relief valve.

   Tools: 4mm inner hexagonal wrench, special screwdriver (plain screwdriver), 14 #wrenches

Figure 6

5. Screw out bolts of pressure mouth

   Tool: 8mm inner hexagonal wrench

Figure 7

Matters need attention for disassembling priority valve

1. All parts shall be taken slightly during disassembling process, spool shall be pulled out slightly to avoid knock and scratch parts.
2. Step two and step three cannot be reversed (avoid screw out the screw plug on the right and spring pop out spool and cause danger).
3. Dismantle bolts of pressure mouth according to requirements.
4. Check if O ring is deformed, trimmed and aged after disassembling, usually O ring cannot be used again after disassembling.
5. After disassembling, valve body and spool shall be cleaned with 32# hydraulic oil, check if spool surface has obvious scratch; do not use spool and valve body if there is scratch.

Assembling steps of priority valve

1. Screw on bolts of pressure mouth.

   Tool: 8mm inner hexagonal wrench

Figure 8

2. Screw on valve seat 1 of relief valve, install spool and spring, then install adjustable bolts and lock ring.

   Tools: 4mm inner hexagonal wrench, special screwdriver (plain screwdriver), 14# wrench

Figure 9

3. Install spool and gasket.

Figure 10

4. Install spring, screw on valve seat 2 of relief valve and screw plug.

Tools: pneumatic wrench, self made sleeve (41# wrench)

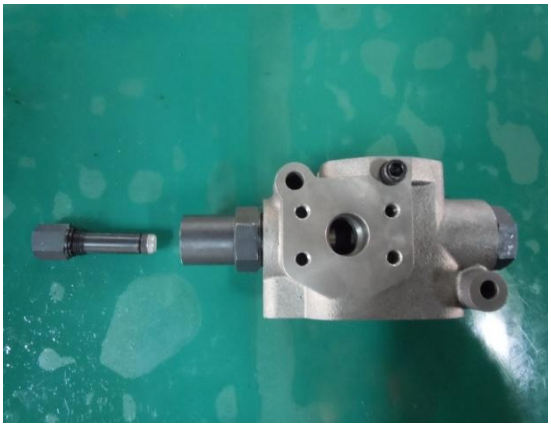


Figure 11

5. Screw on valve seat 1 of relief valve.

Tools: pneumatic wrench, M24 sleeve

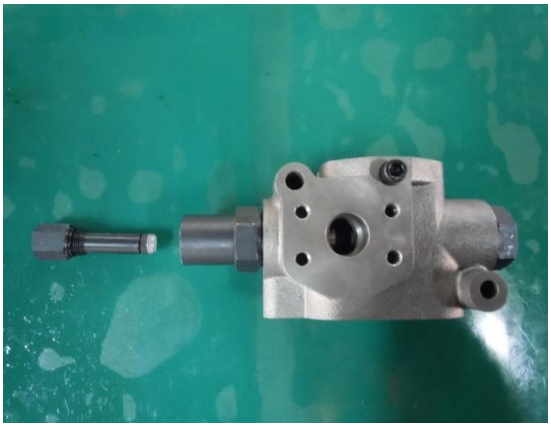


Figure 12

Matters need attention for assembling priority valve

1. Keep all parts clean before assembling.
2. During installation, all spools shall be installed slowly and guarantee they can slide flexibly, if there is blockage, grind spool surface and sharp corner slightly with find abrasive paper, clean the valve again.
3. Avoid to damage trim of O ring when screwing on screw plug, it is better to coat grease on the surface before installation.

Tools for disassembly and assembly

Main tools for disassembly and assembly are:

Torque wrench (Electric wrench)

M27 sleeve

M22 sleeve

M16 sleeve

M6 inner hexagonal spearhead

Figure 9

Steering Unit

⚠ CAUTION!
Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section. **Always use tools and equipment that is in good working order.** **Use lifting and hoisting equipment capable of safely handling load.** **Remember, that ultimately safety is your own personal responsibility.**

TABLE OF CONTENTS

General description

Work principle

When steering unit is in the middle, spool and valve bush is at meso-position with the effect of spring lamination, oil from oil pump will enter spool from two rows of holes of valve bush and spool, then returns to oil tank through T oil mouth.

When steering wheel turns right (or left), spool is driven to turn to the right (or left), since the Max. rotation quantity between spool and valve bush is 10.5°, so spool rotates against valve bush, at this moment, oil groove is connected with oil inlet way of valve bush, oil goes through valve bush and oil groove of spool, returns to rotor and stator from valve bush, drives rotor rotating against stator. At the same time, oil from rotor and stator enters one of the chamber of cylinder through oil mouth A (or B) to make cylinder piston stretch out (compress inside), and push steering wheel turns right (or left), oil from the other chamber of cylinder enters valve bush through oil mouth B (or A), returns oil groove through spool, and goes back to oil tank through T oil mouth from valve bush. The relative rotation angle of spool and valve bush is 1.5°, oil way is connected, and rotation of rotor makes oil connects with cylinder, oil supplying quantity and rotation angle of steering wheel become direct ratio.

When steering wheel turns right (or left) for an angle and keeps the state, since the above mentioned oilway is open and oil from oil pump will push rotor to turn right (left), when rotation angle of rotor is the same with rotation angle of steering wheel, since valve bush and rotor is connected through linkage axle, so rotor will drive valve bush to turn right (or left) to keep the same angle with steering wheel. At this moment, valve bush and spool form the position without rotation angle, oilway going to rotor and oil cylinder is closed, oil from oil pump will go into spool through two rows of holes through valve bush and spool, oil goes back to oil tank through T oil way from valve bush. At this time, tyre stops moving, this is hydraulic feedback servo action.

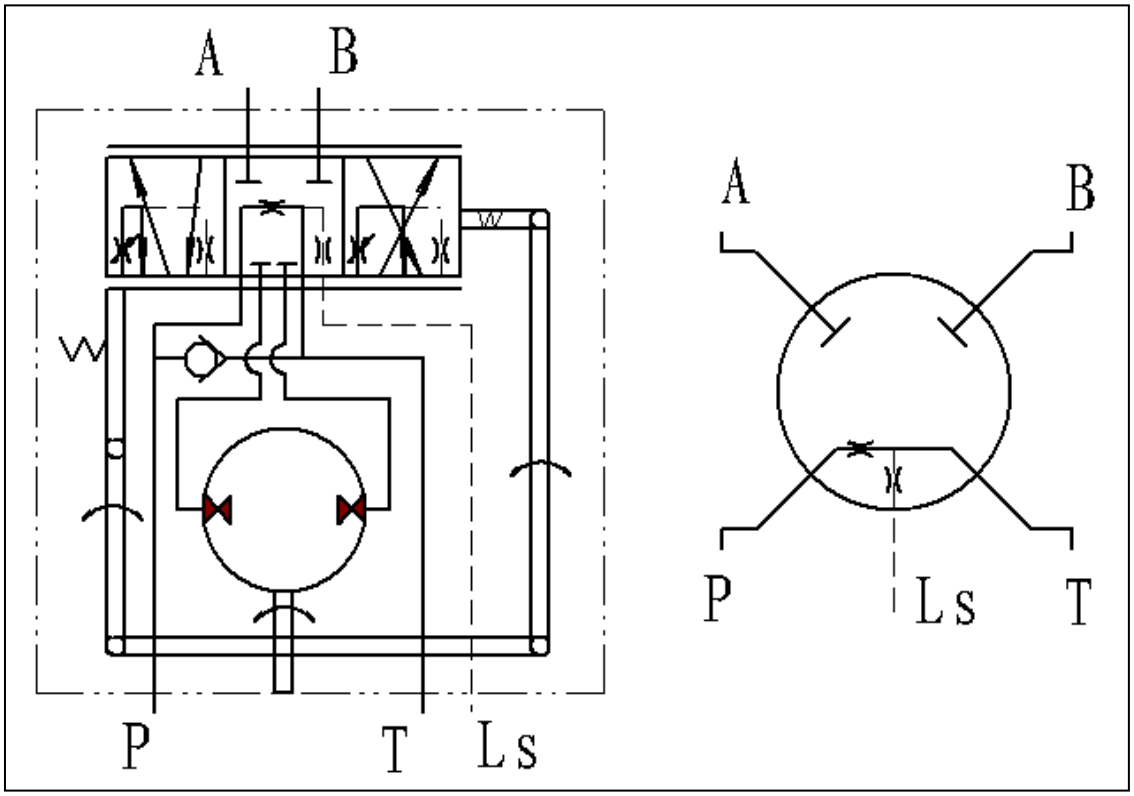


Figure 1

Detailed list of spare parts

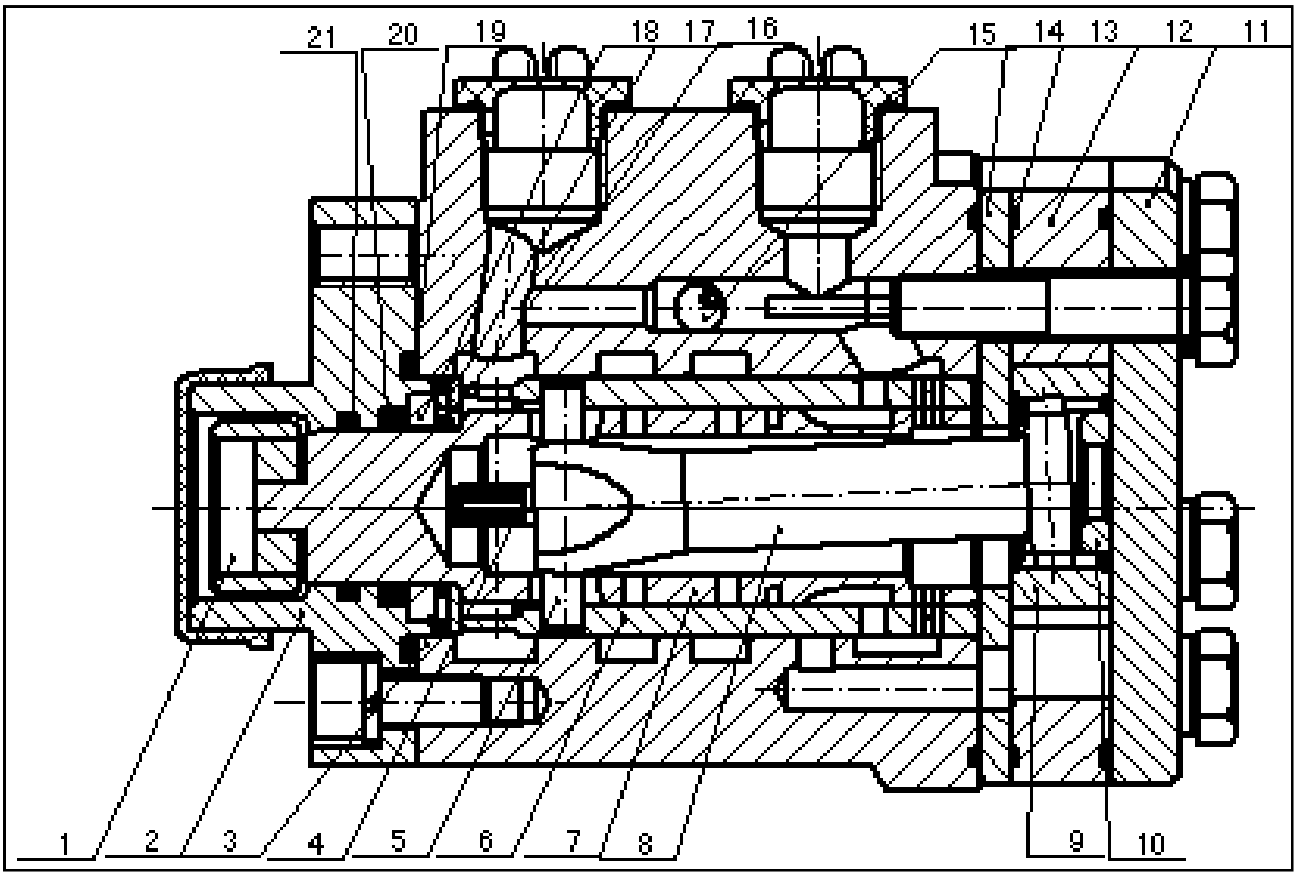


Figure 2

Reference Number	Description	Reference Number	Description
1	Link block	12	Stator
2	Front cover	13	O-Ring
3	Valve body	14	Plate
4	Spring lamination	15	Steel ball
5	Pin	16	Big Baffle ring
6	Valve bush	17	Baffle ring
7	Valve spool	18	Baffle ring
8	Shaft	19	O-Ring
9	Rotor	20	X-Ring
10	Limited post	21	O-Ring
11	Rear cover		

Disassembly steps of steering unit

1. Take out link block.

Figure 3

2. Take out front cover.

Figure 4

3. Take out multi-roll bearing

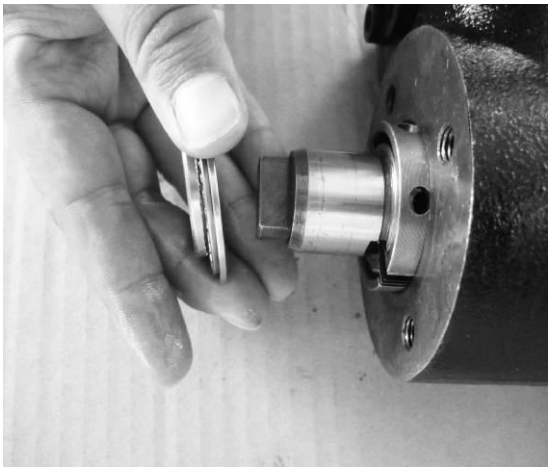


Figure 5

4. Take out bolts of rear cover.

Figure 6

5. Take out rear cover.

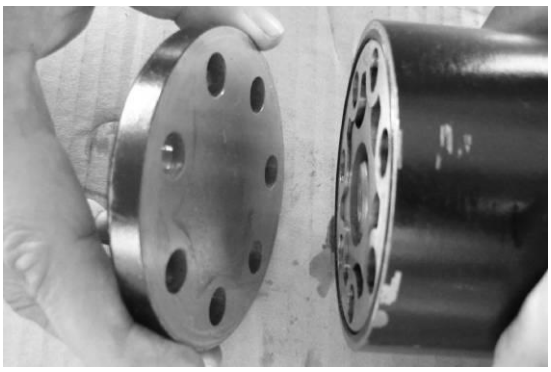


Figure 7

6. Dismantle stator

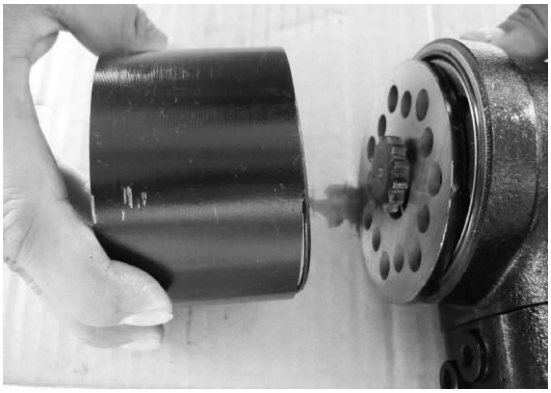


Figure 8

7. O-RING Dismantle O-RING

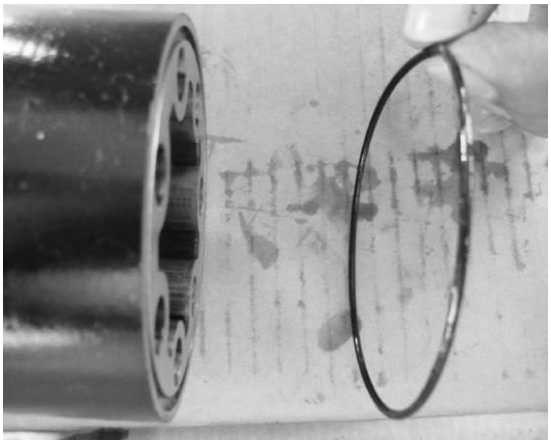


Figure 9

8. Dismantle rotor.

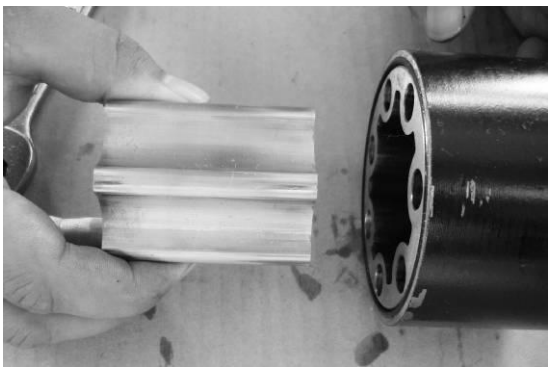


Figure 10

9. Take out limitation block

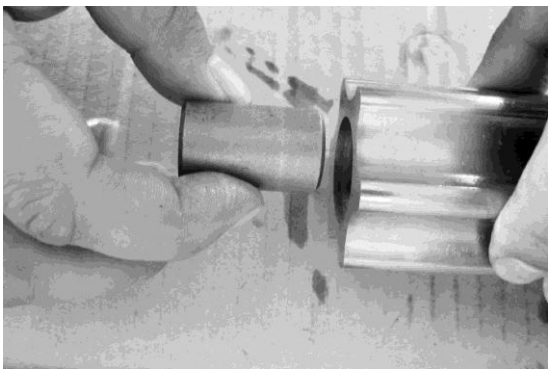


Figure 11

10. Take out link axle

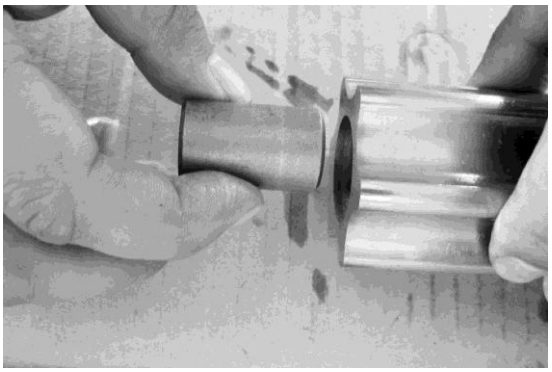


Figure 12

11. Take out clapboard

Figure 13

12. Take out valve bush and spool assembly

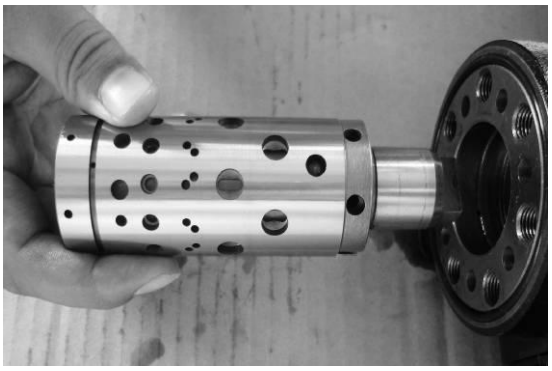


Figure 14

13. Take out dial pin

Figure 15

14. Take out spring lamination

Figure 16

15. Take out valve spool

Figure 17

16. Dismantle valve block

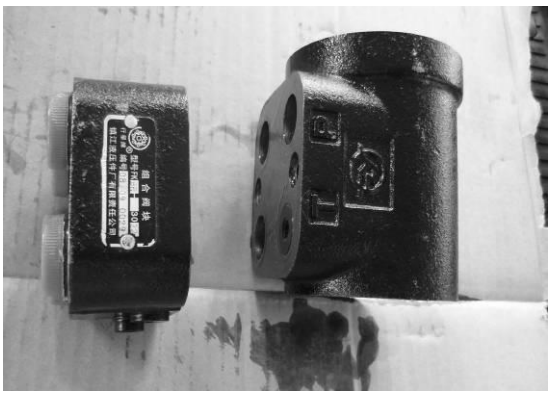


Figure 18

17. Take out check valve

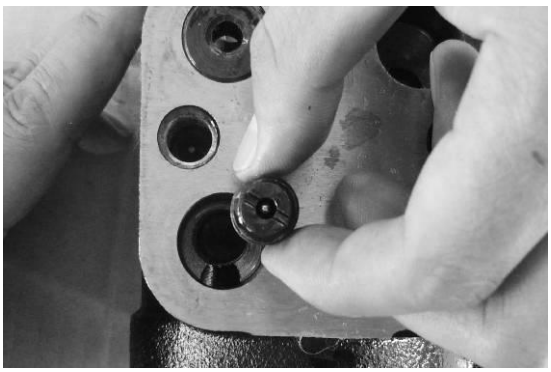


Figure 19

18. Take out oil return throttle valve

Figure 20

19. Take out oil inlet throttle valve

Figure 21

20. Take out oil compensating valve (4EA)

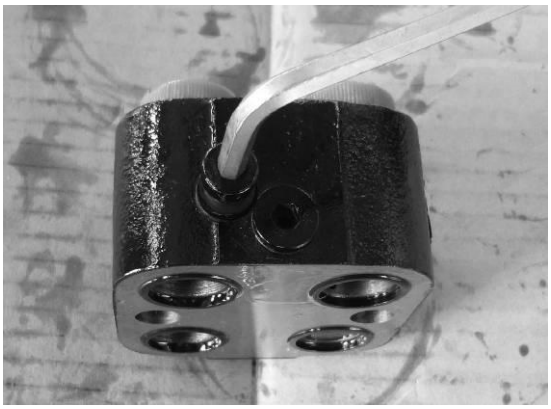


Figure 22

Assembly steps of steering unit

1. Keep four bolt holes of valve body upward.

Figure 23

2. Install valve spool, valve bush, spring lamination and dial pin.

Figure 24

3. Install well assembled valve spool and valve bush into valve body

Figure 25

4. Install big baffle ring, needle roller thrust bearing and small baffle ring

Figure 26

5. Install front cover with well assembled sealing ring

Figure 27

6. Keep fourteen holes of steering unit upward

Figure 28

7. Install sealing ring

Figure 29

8. Put Φ8mm steel balls into the thread holes as shown in the picture

Figure 30

9. Install spacer plate and align the holes.

Figure 31

10. Install couple axle, stop dial pin with linkage shaft

Figure 32

11. Install turn stator vice (note: mark on linkage shaft shall align with groove on rotor)

Figure 33

12. Install upper limitation column and sealing ring

Figure 34

13. Install rear cover, combined gasket, bolts, the position shown in the picture by arrow is cotter bolt.

Figure 35

Matters need attention during assembling

1. Clean all parts (except rubber ring) with gasoline or kerosene before assembling. If there is paint on combination surface, clean with acetone, it is forbidden to clean parts with cotton yarn or cloth, soft banister brush or silk shall be used to clean parts, it is better to blow with compressed air, after steering unit is installed well, add 50-100ml hydraulic oil before install in machines, turn around spool, install in machine for test if everything is normal
2. Combination surface of valve body, spacer plate, stator and rear cover must be highly clean, do not knock or scratch.
3. There are spot mark on end surface of rotor and linkage shaft, that is teeth of linkage shaft groove shall align with multiple spline groove inside rotor teeth bottom, pay attention to the relative position during installation.
4. Bolts of rear cover shall adopt qualified combined gaskets.
5. when fastening seven bolts of rear cover, screw on every two bolts in order, screw on gradually, the fastening torque is 40～50 N.m.
6. (Note) “P”, ”T”, ”A”, “B” oil mouth of valve body and valve block shall align with each other one by one during installation.

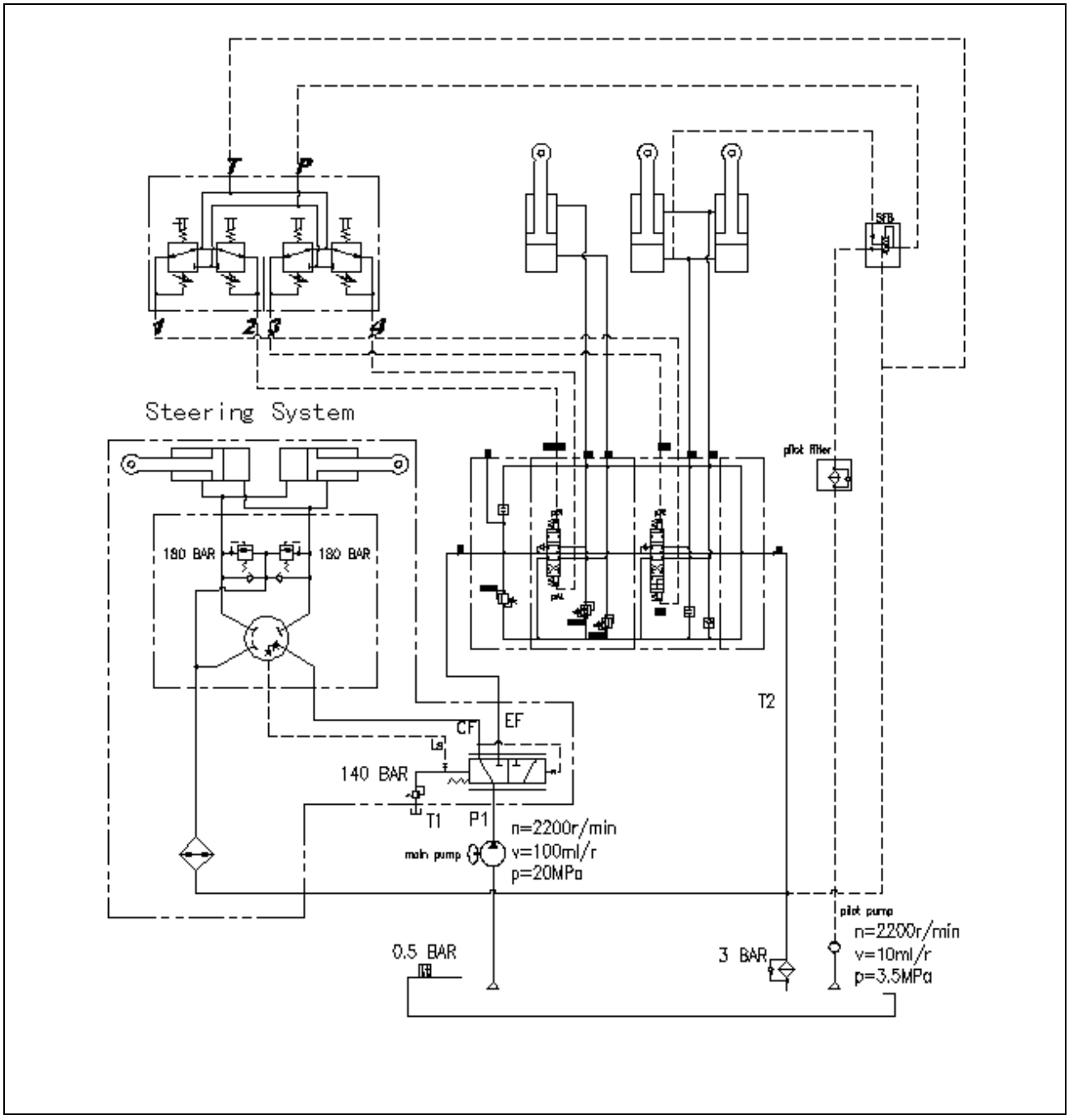
Hydraulic Schematic

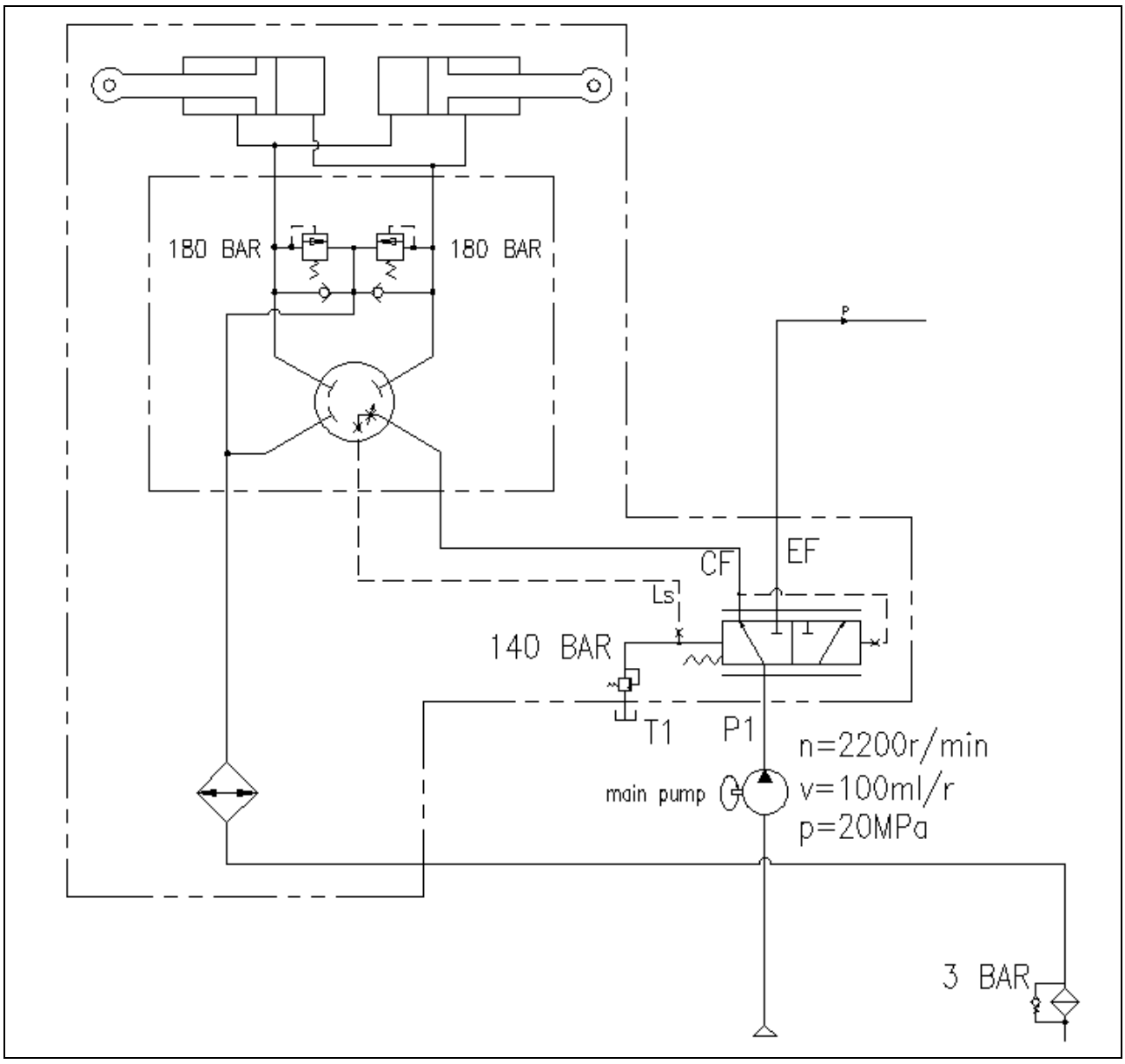
⚠ CAUTION!
Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section. **Always use tools and equipment that is in good working order.** **Use lifting and hoisting equipment capable of safely handling load.** **Remember, that ultimately safety is your own personal responsibility.**

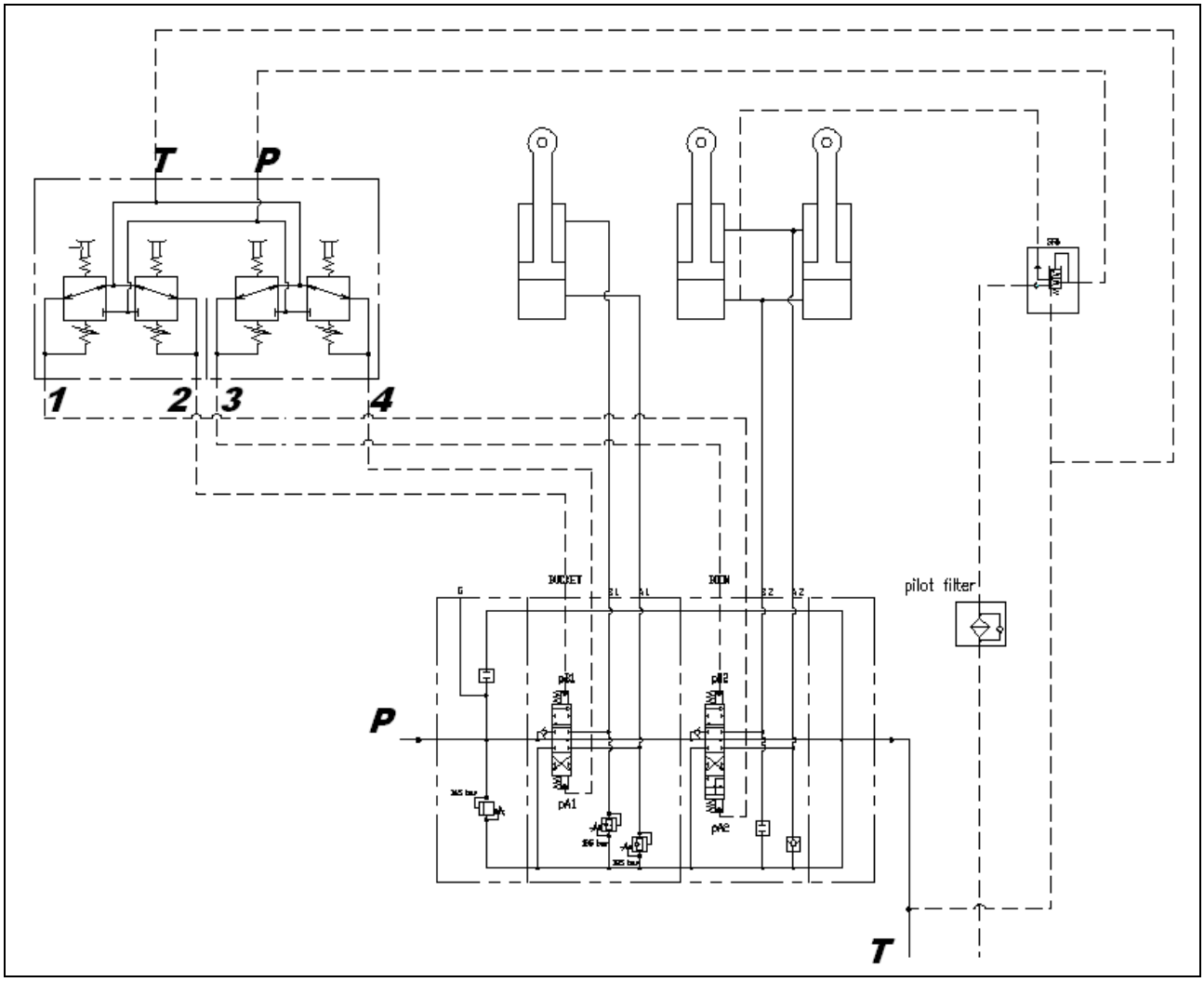
TABLE OF CONTENTS

General description(Pilot Lever)

Schematic diagram




180 BAR
180 BAR
P
CF
EF
Ls
140 BAR
T1
P1
n=2200r/min
v=100ml/r
p=20MPa
main pump
3 BAR


T
P
1
2
3
4
BUCKET
B1
A1
BOOM
B2
A2
G
pilot filter
P
T

General description (Mechanical Lever)

Schematic diagram (Mechanical Lever)

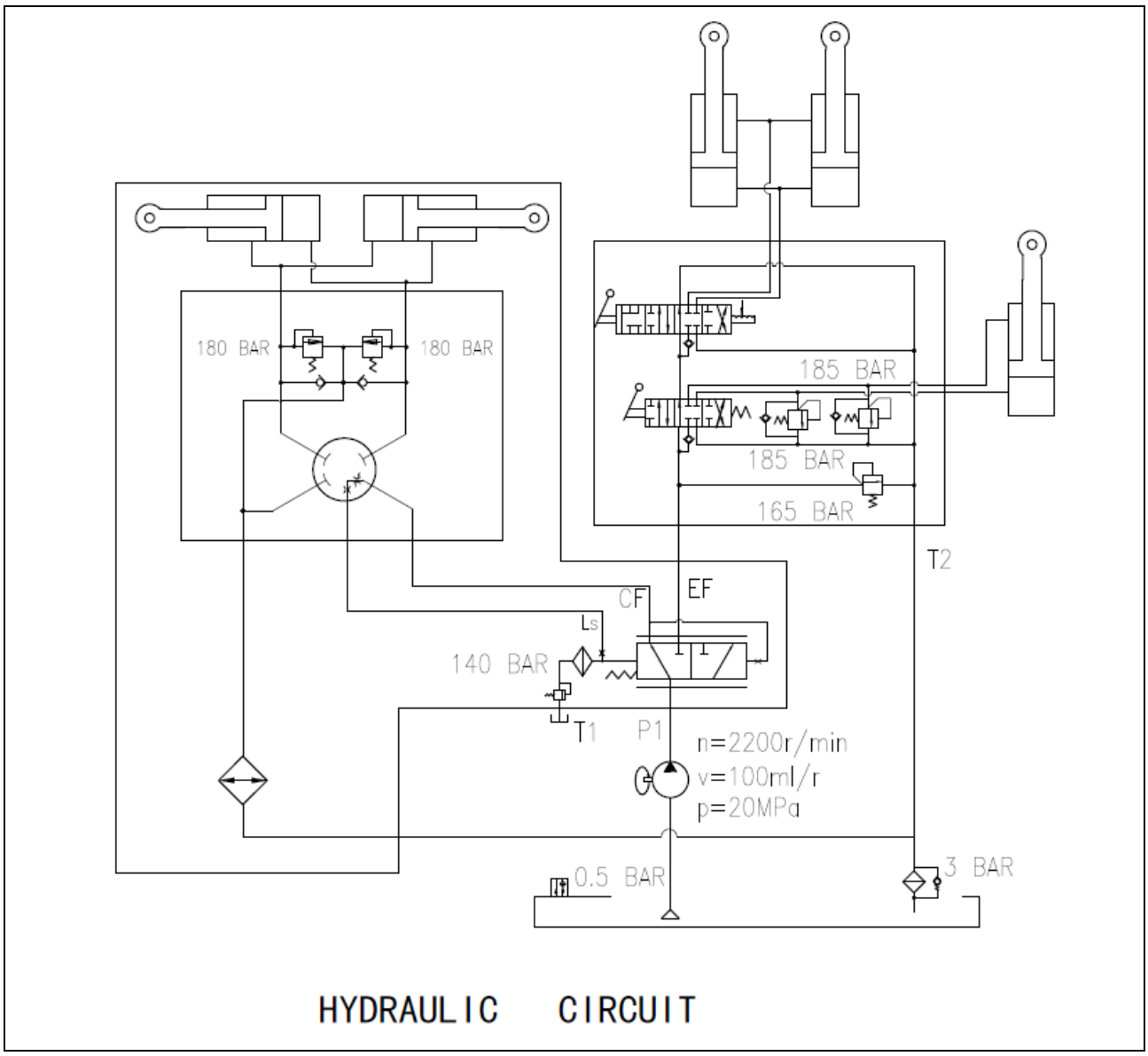


Figure 4

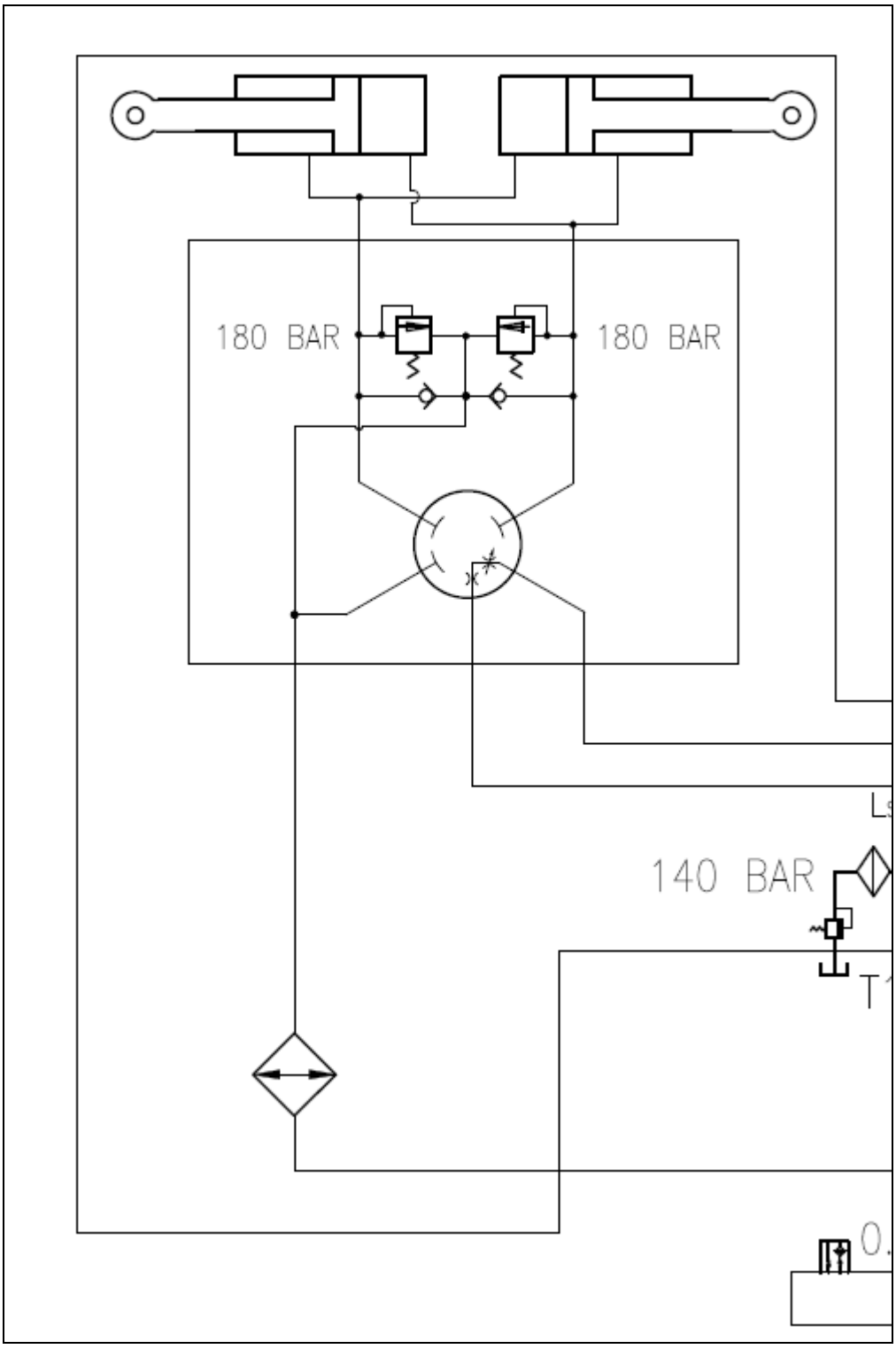
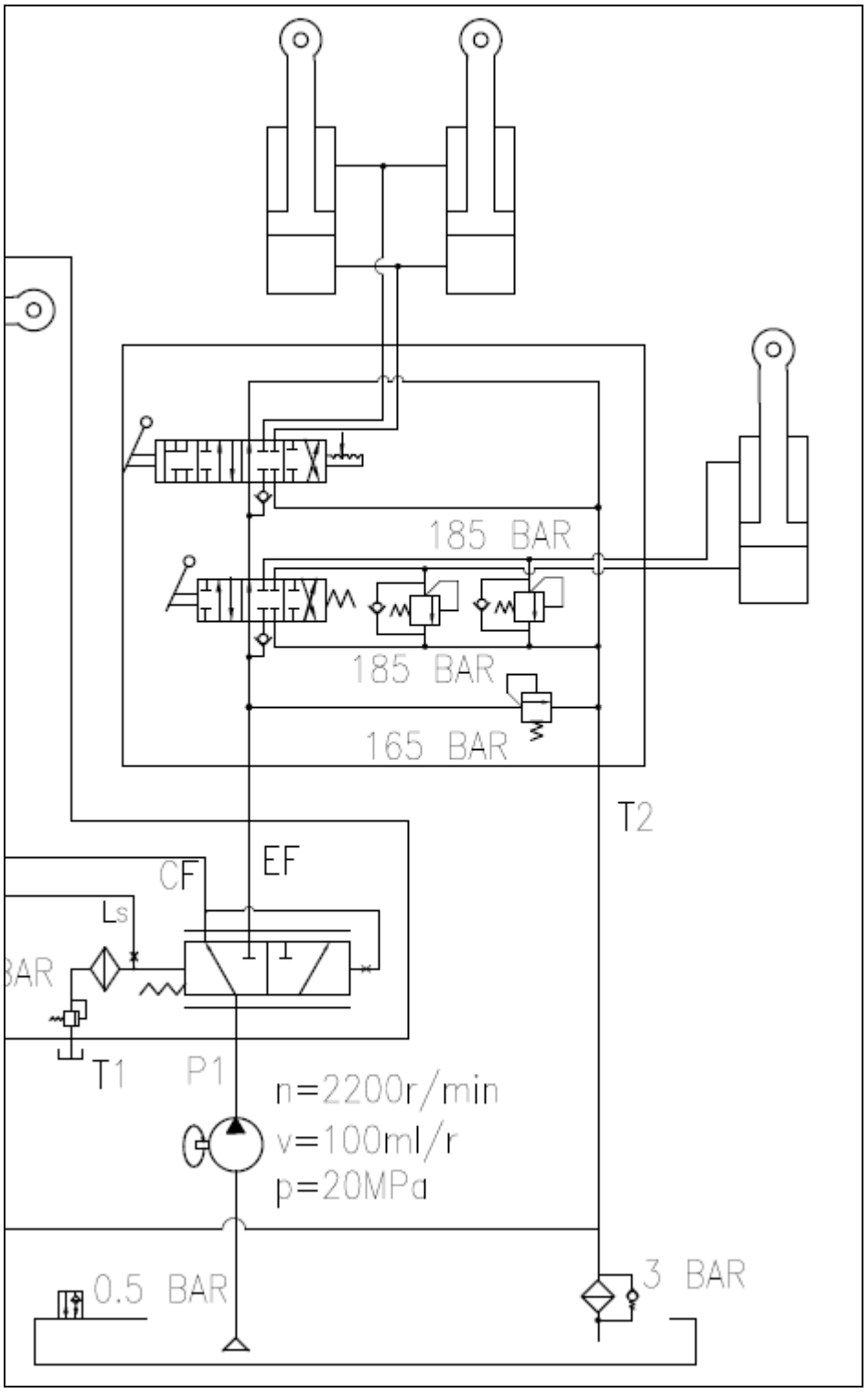


Figure 5


185 BAR
185 BAR
165 BAR
T2
EF
CF
Ls
BAR
T1
P1
n=2200r/min
v=100ml/r
p=20MPa
0.5 BAR
3 BAR

BRAKE

BRAKE SYSTEM

⚠ CAUTION!
Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section. **Always use tools and equipment that is in good working order.** **Use lifting and hoisting equipment capable of safely handling load.** **Remember, that ultimately safety is your own personal responsibility.**

TABLE OF CONTENTS

General Description

Structure of travelling brake

It usually includes air compressor, oil-water separation combination valve (oil-water separator, pressure control valve), air tank, pneumatic brake valve, air booster pump and caliper disc brake. In air circuit of brake system, there are some other accessories, such as switch of brake light etc.

Working Principle of Travelling Brake

Compressed air is output from air compressor driven by engine, and enters into air tank through oil-water separation combination valve (oil-water separator, pressure control valve). When air pressure in air tank reaches the highest braking pressure (usually around 0.784MPa) of brake system, pressure control valve will close the exit going to air tank, open load discharging mouth and discharge the compressed air from air compressor to the air directly. When compressed air in air tank reaches the lowest pressure (usually around 0.71MPa) of brake system, pressure control valve will open the exit going to air tank, and close load discharging mouth to let compressed air from air compressor into air tank for supplementation until the compressed air in air tank reaches the highest working pressure of brake system.

Following is the fundamental diagram

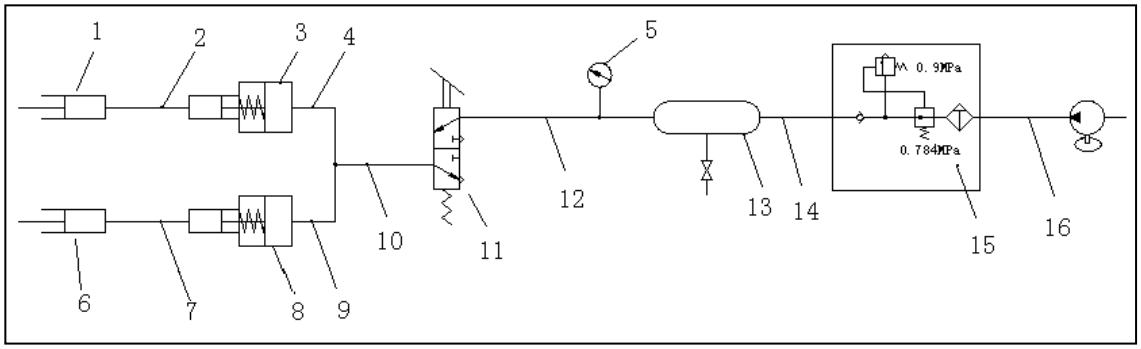


Figure 1

Reference Number	Description	Reference Number	Description
1	REAR AXLE	9	HOSE
2	HOSE	10	HOSE
3	PUMP	11	PEDAL
4	HOSE	12	HOSE
5	SWITCH;PRESSURE	13	ACCUMULATOR
6	FRONT AXLE	14	HOSE
7	HOSE	15	VALVE
8	PUMP	16	HOSE

PARTS LIST

Structure Chart of Brake System

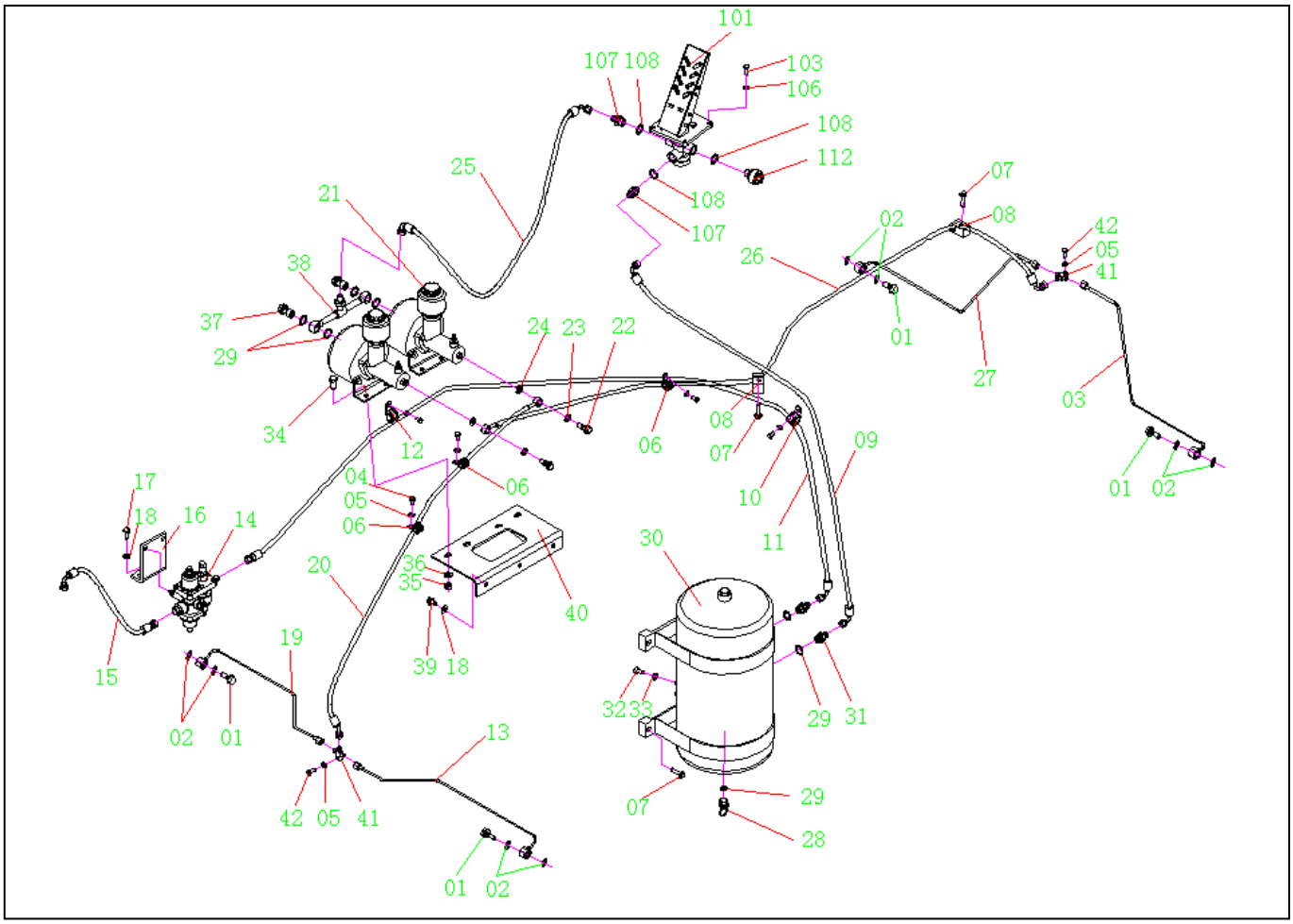


Figure 2

Reference Number	Description	Reference Number	Description
1	BOLT	26	HOSE
2	O-RING	29	TUBE
3	TUBE	30	VALVE
5	BOLT	31	WASHER
7	WASHER PLAIN	32	ACCUMULATION
8	CLAMP	33	ADAPTER
9	BOLT	34	PLUG
10	CLAMP	35	NUT
11	HOSE	36	WASHER;PLAIN
12	CLAMP	38	BOLT
13	HOSE	40	TUBE
14	CLAMP	41	BOLT
15	TUBE	42	BRACKET
16	VALVE		
17	HOSE	101	VALVE;BRAKE PEDAL
18	PLATE	103	BOLT
20	BOLT	106	WASHER;PLAIN
21	PUMP	107	ADAPTER
22	BOLT	108	WASHER
23	SEAL RING	112	SWIICH;LAMP
24	SEAL RING		
25	HOSE		

Oil-water separator

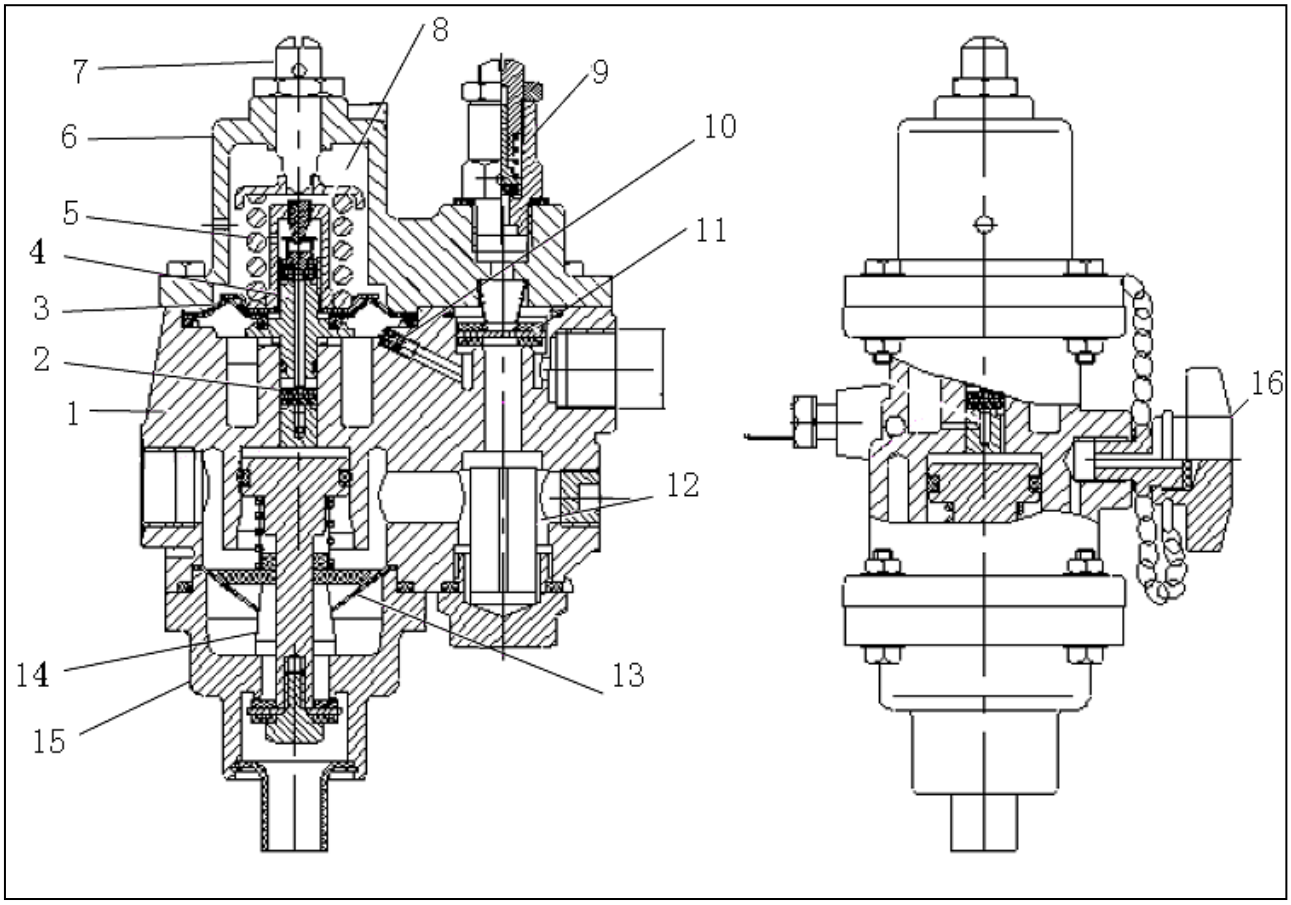


Figure 3

Reference Number	Description	Reference Number	Description
1	SHELL ASS'Y	9	RELIEF VALVE ASS'Y
2	REGULATING VALVE	10	ORIFICE PLUG
3	EAR DRUM	11	ONE-WAY VALVE
4	STEM	12	FILTER ASS'Y
5	REGULATING SPRING	13	OIL COLLECTOR
6	UPPER COVER	14	AIR BLEEDING PISTON
7	REGULATING SCREW	15	LOWER SHELL
8	CONTROLING PISTON ASS'Y	16	AEROFIOL NUT

Pneumatic brake valve

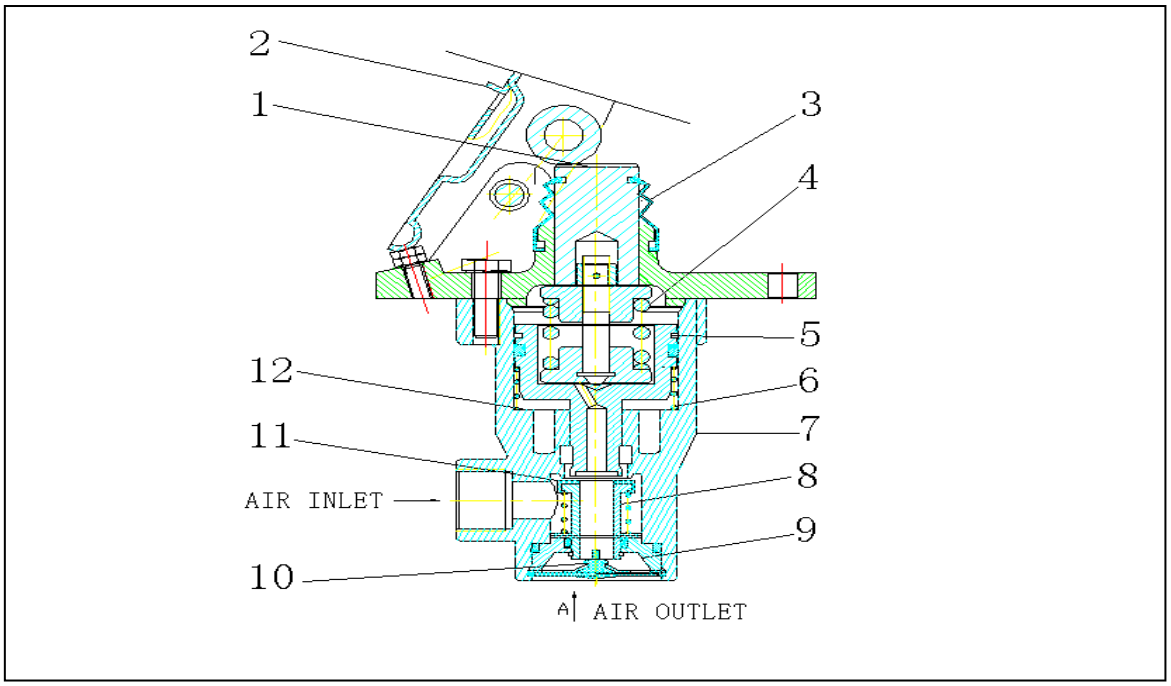


Figure 4

Reference Number	Description	Reference Number	Description
1	MANDRIL	7	VALVE BODY
2	PEDAL ASS'Y	8	INTAKE VALVE ASS'Y
3	ANTIDUST COVER	9	VALVE ASS'Y
4	BALANCING SPRING	10	OUTLET VALVE ASS'Y
5	PISTON ASS'Y	11	SEALING FIN
6	PISTON FOUR SPRING	12	SPRING SEAT

Booster pump

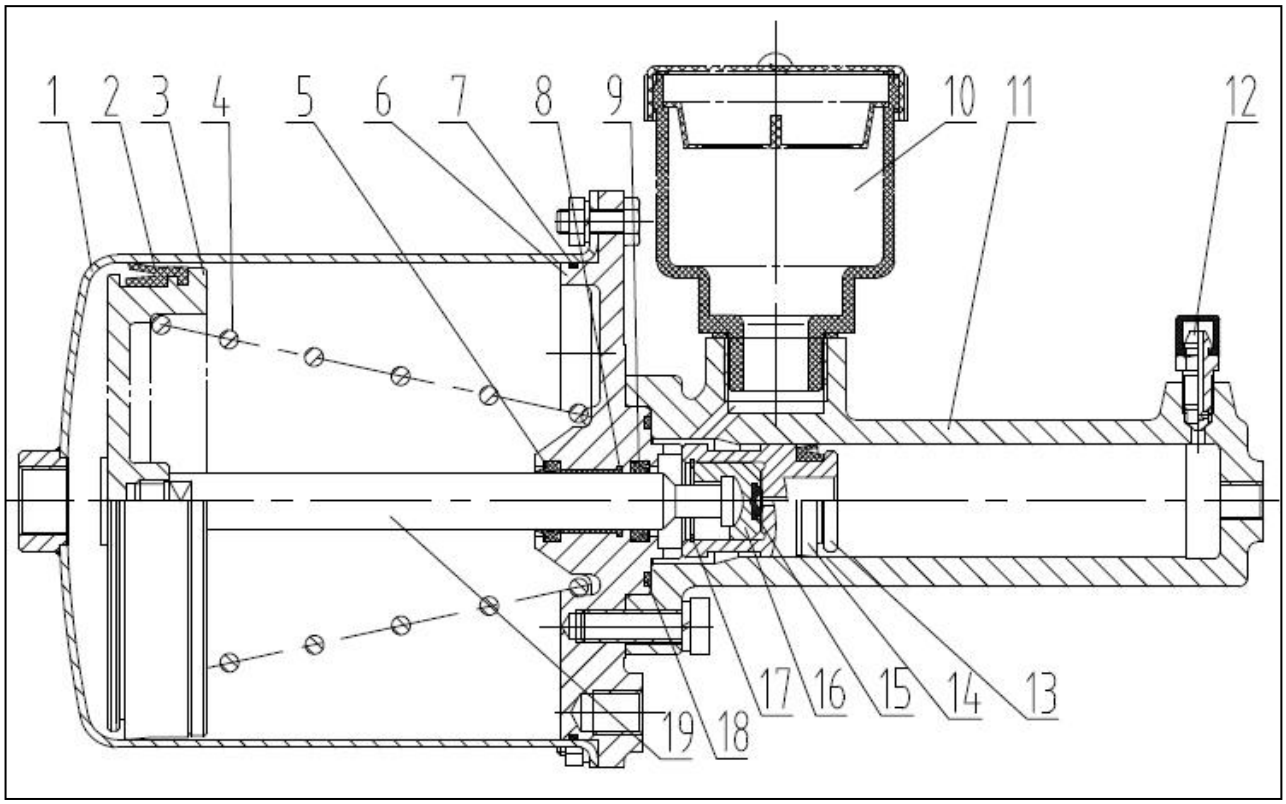


Figure 5

Reference Number	Description	Reference Number	Description
1	STRENGTH CYLINDER	8	PISTON
2	Y-SEAL RING	9	BREAKING PUMP
3	PISTON	10	AIR OUTLET SCREW
4	RELEASING SPRING	11	PUSHING BORER
5	ENDPLATE	12	MAIN PUMP FUR BOWL
6	STORAGE CUP	13	X-SEAL RING
7	PUTTING SEAT		

System Maintenance and Failures Analysis

Brake caliper is locking

The so called “locking” failure refers to brake caliper does not return to the original position, that is one of the common failures of brake system. There are many reasons causing such kind failures, such as brake caliper is blocked, booster pump is blocked or brake caliper valve is blocked. If the brake caliper of front and rear bridge is locking, it is may caused by blocking of pneumatic brake caliper. When the failures are solved, loosen pipeline between booster pump and brake caliper, manually check if the brake caliper can return, if it does not work, it may be caused by blocking of brake caliper, if it can be returned manually, but booster pump may be blocked.

No brake or brake distance is too long

1. Pressure adjustment is improper, which causes pressure of compressed air is too low, brake moment is too small. Adjust pressure gauge to the regulated range.
2. It may be caused because air compressor is air leaking or air inlet and outlet valve are blocked because wearing of cylinder barrel and piston ring is too much, driving belt is too loosened. The worn parts shall be replaced in time.
3. Foot brake valve is adjusted improperly, when brake pedal is stepped to the end, air inlet valve of brake valve is not totally opened, air throttle is caused, air pressure becomes weak when going through foot brake valve, and it cannot reach rated working pressure. Adjust the adjusting screw of brake pedal.
4. Failure of booster pump: sealing ring of booster pump is worn, compressed air goes into low pressure chamber, and movement of brake pump piston is slow, or even there is no moving distance, which cause braking power is not enough; compensation hole of brake pump is blocked by dirt, brake fluid cannot go into ante chamber of piston and oil in brake oil way is not enough.

Brake lags behind

1. Air in brake system is not evacuated, air is compressed when braking, air resets when releasing brake, which affects returning of friction plate.
2. Brake air pressure is not enough;
3. Piston of brake caliper is blocked;
4. Foot brake air bleeder or filter screen is blocked, return spring of valve core is broken, piston cannot return and blocks outlet of air hole, which makes brake air discharging is not smooth, brake pressure and oil pressure cannot reduce quickly, brake moment cannot be released, thus it is lagged behind.
5. The hole of non-pressure chamber of booster pump connecting with air is blocked or return spring is broken, which affects sensitivity of chamber piston return and cause lag.

Braking deviation

The direct reason of braking deviation is the brake moments of the left side and right side wheels are different, the common phenomenon are:

1. Brake caliper of one side of the wheel is locking, it is hard to trip off during travelling, and usually the rectangle sealing ring of brake caliper is broken.
2. When stepping foot pedal, one side brake caliper is braking, while the other side is inside leaking and oil way is blocked, brake fluid cannot go into brake caliper, which makes different brake moments and causes deviation. Under such kind of condition, please check if the sealing rings of gas cap and brake caliper are turned up or the pipelines are blocked.

There is bridle during braking, and brake is hot

1. Connection screws between brake caliper and drive axle are loosed, they rub, impact or abrade each other.
2. There are hard things between brake lining and brake disc.

Storage and usage of brake fluid

1. Brake fluid belongs to inflammable goods; please pay Note to avoid evaporation and fire during usage and storage.
2. Brake fluid shall be stored in warehouse or other assigned place, but it cannot be stored in open air and close to hot source to avoid deteriorating and become invalid.
3. The using department shall set up independent room for storage and there must be obvious marks.
4. It is forbidden to mix and use brake fluid of different brands to avoid layering and lose braking effect.
5. There must be special containers to store brake fluid to avoid mixing of other oil and cause reaction and invalidity.
6. Containers storing brake fluid must be clean and covered to avoid mechanical sundries and water. If the surface of brake fluid has dust and sundries, they must be removed before using, do not mix them, clean and special tool shall be used to add brake fluid.

Replacement of brake fluid and Notes:

Technicians shall guide clients to use and replace brake fluid strictly, when following conditions appear, all brake fluid must be replaced immediately.

1. When brake fluid is mixed with mineral substance, such as gas oil and diesel.
2. When vehicle is travelling normally, brake is light and heavy.
3. When brake fluid in the system is less or when the vehicle having liquid level is warning.
4. When oil color of brake fluid is muddy or there are sundries and sediment.

Notes during replacement:

1. When replacing brake fluid, clean the residual liquid in brake system, and check new brake liquid.
2. When replacing brake fluid, try to reduce the contacting time between brake fluid and air to avoid reducing performance of brake fluid.
3. Before replacing brake fluid, it is better to clean brake system with alcohol, release air in the oil way after replacement.

Treatment of air source

1. Clean air filter core in time.
2. Release water from air tank in time.

PARKING SYSTEM

⚠ CAUTION!
Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section. **Always use tools and equipment that is in good working order.** **Use lifting and hoisting equipment capable of safely handling load.** **Remember, that ultimately safety is your own personal responsibility.**

TABLE OF CONTENTS

General Description

Structure of parking brake

Driven method is hand flexible shaft control. The handle is located on the floor of the cabin on the right side of the seat, connected to the braking caliper in front-end of the Transmission box through a flexible shaft.

Working principle of parking brake:

After the wheel loader stops, pull up the parking brake handle, tensing the connecting flexible shaft, clamping the power output flange in front of the gearbox by the braking caliper, then the vehicle will be braking. When the need to move the loader, press the button on the top of the parking brake handle, and press the parking brake handle at the same time, you can release the parking brake. When the parking brake handle is pulled up, parking brake indicator lights; release the parking brake handle, parking brake lights off. Before move the Vehicle, the parking brake handle must be released, and brake indicator light is out. Otherwise it will accelerate wear brake disk, and cause the loss of engine power.

PARTS LIST

Assembly structure chart

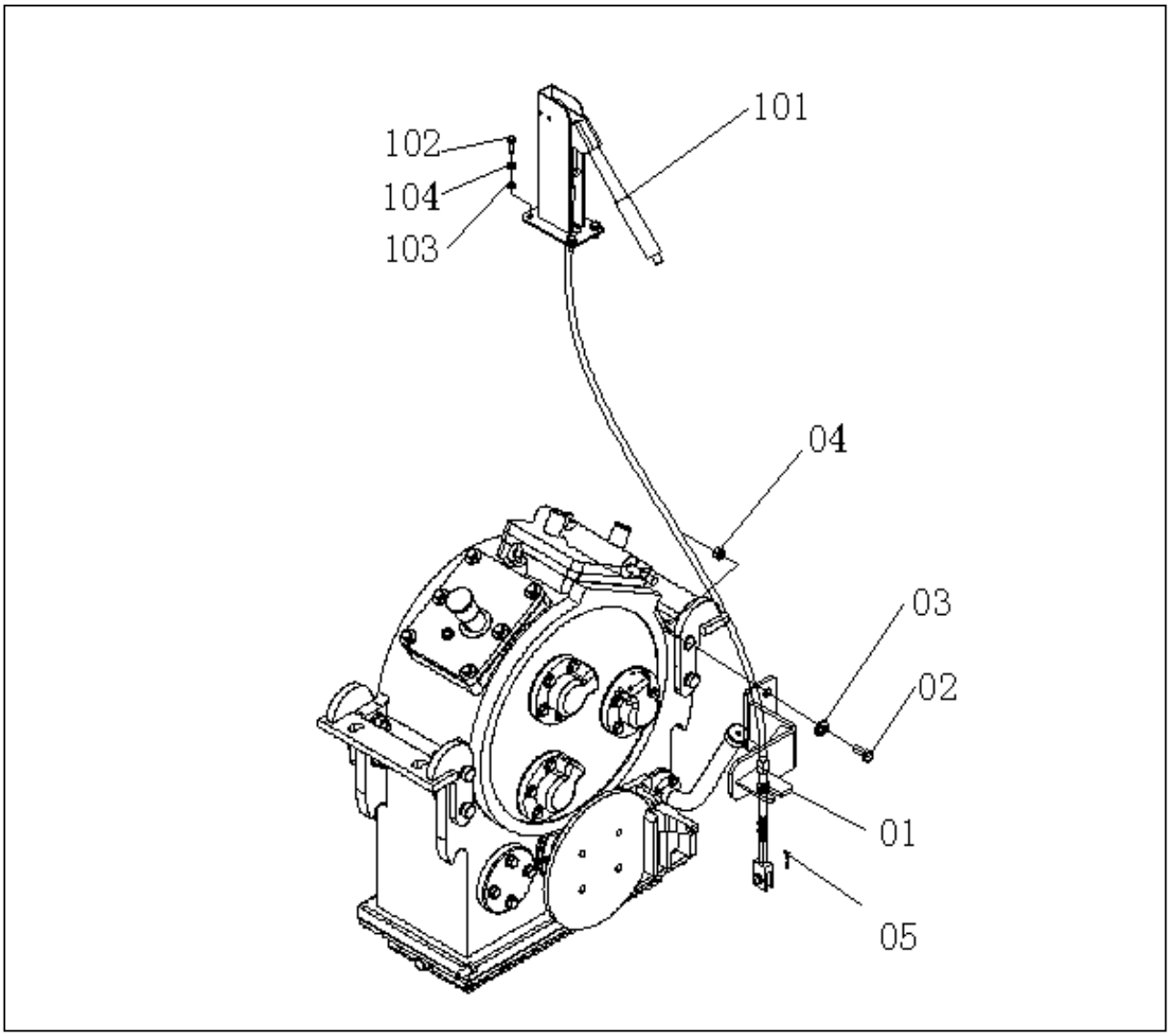


Figure 1

Reference number	Description	Reference number	Description
1	BRACKET	101	BRAKE PAKING
2	BOLT	102	BOLT
3	SPRING WASHER	103	WASHER
4	NUT	104	SPRING;WASHER
5	PIN		

ELECTRICAL SYSTEM

ELECTRICAL SYSTEM (SD200N)

⚠ CAUTION!
Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section. **Always use tools and equipment that is in good working order.** **Use lifting and hoisting equipment capable of safely handling load.** **Remember, that ultimately safety is your own personal responsibility.**

TABLE OF CONTENTS

OVERVIEW

Voltage of electrical system of the machine is DC 24V, the rated voltage of all electrical parts is 24V. Electrical cable wire adopts single wire system, and negative earth is adopted. Electrical system includes two serial 12V storage batteries and three phase DC generator with entire rectifier. Wire harness of the system can be distinguished by different insulation color. Each color symbol used for electrical system is listed below.

Electric Wire Color

Symbol	Color
W	White
G	Green
Or	Orange
B	Black
L	Blue
Lg	Light Green

Symbol	Color
R	Red
Gr	Gray
P	Pink
Y	Yellow
Br	Brown
V	Violet

NOTE: *RW: Red wire with White stripe.*
R - Base Color, W - Stripe Color.
NOTE: *0.85G: Nominal sectional area of wire core less insulator = 0.85 mm2 (0.03 in2).*

ELECTRIC SUPPLY SYSTEM

Power circuit supplies electric current to each electrical part. It is composed of storage battery, generator, fusible line and fuse box. Negative electrode of storage battery is earth connected and connects with balance weight.

Even if key's switch is at "OFF" position, when the general power is switched off, storage battery still supplies electric current to following parts, and returns back to fuse box through fusible link.

1. Input terminal of storage battery relay power supply.
2. Key switch terminal "B".
3. Cabin light power supply terminal.
4. Flash power terminal
5. Preheat relay power input terminal

When switch of keys is at "ON" and "START" position, electric current flows to fusible wire from storage battery, reaches key switch terminal "B"/"BR" through fuse box, and reaches storage battery relay control terminal "+" through guide line, activate storage battery relay coil and make the system power on.

When all contact terminals of storage battery are connected well, electrical device can be operated.

When generator does not work, all electrical equipments power source is supplied by storage battery. Once diesel engine is started, power will be supplied by generator.

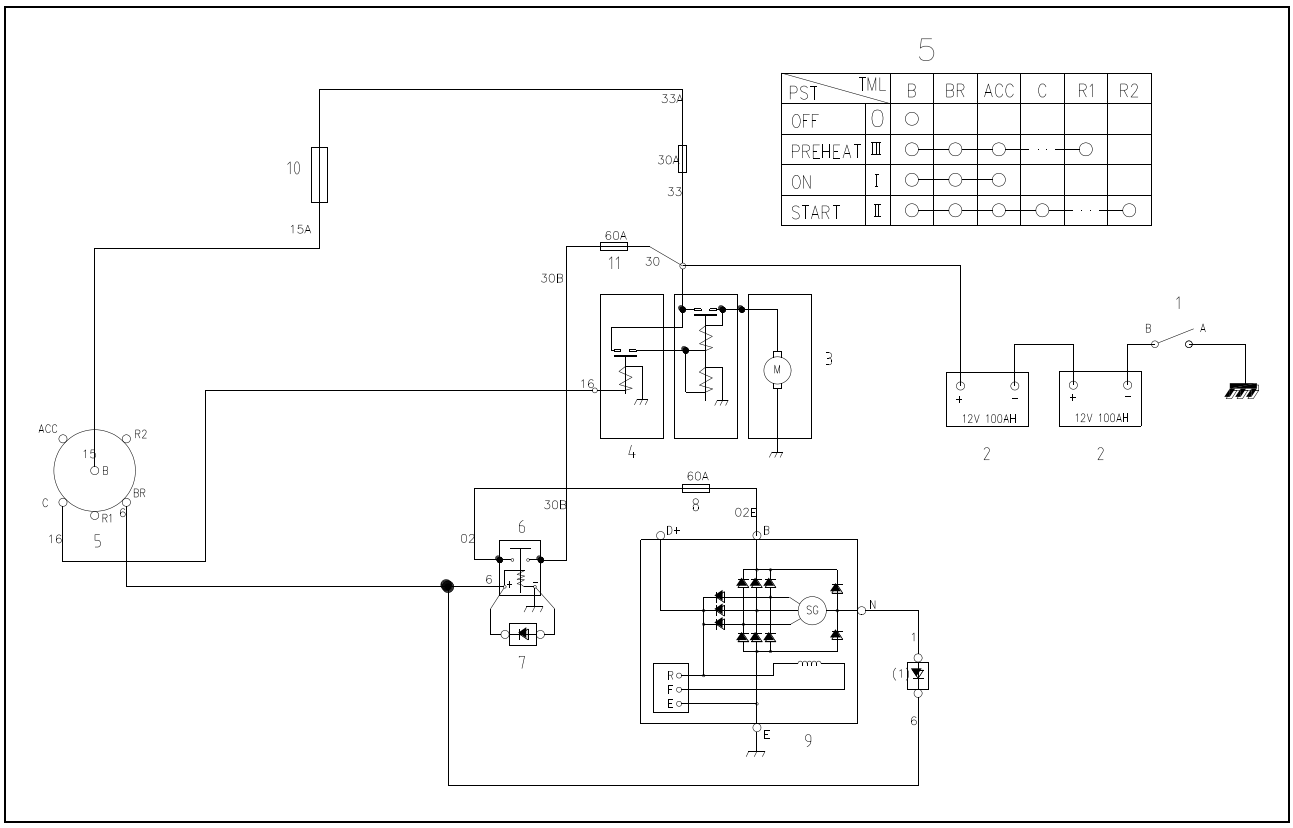


Figure 1 Power supply circuit diagram

Reference Number	Description	Reference Number	Description
1	Disconnect Switch	7	Diode
2	Battery	8	Fuse
3	Starter	9	Alternator
4	Starter Relay	10	Fuse
5	Starter Switch	11	Fuse
6	Battery Relay		

ENGINE STARTING CIRCUIT

Running condition during starting process

Turn key switch (5) to “ON” position, connect terminal “B” and “BR”, output electric current starts power relay (6), then fuse box is power on.

Then key switch (5) is turned to “ON” position, terminal “R2” and “B” are connected, starter relay (4) is started, then other contact terminals “B” and “PP” are connected, active gear of starter (3) is propelled to contact ring gear of flywheel and connect with contact terminal of starter.

Running condition after starting

Once generator is started, the belt will drive AC generator (9) to create electric current. Electric current goes through generator (9) terminal “B”, safety fuse (8), power relay (6) terminal “B” and supply power to fuse box.

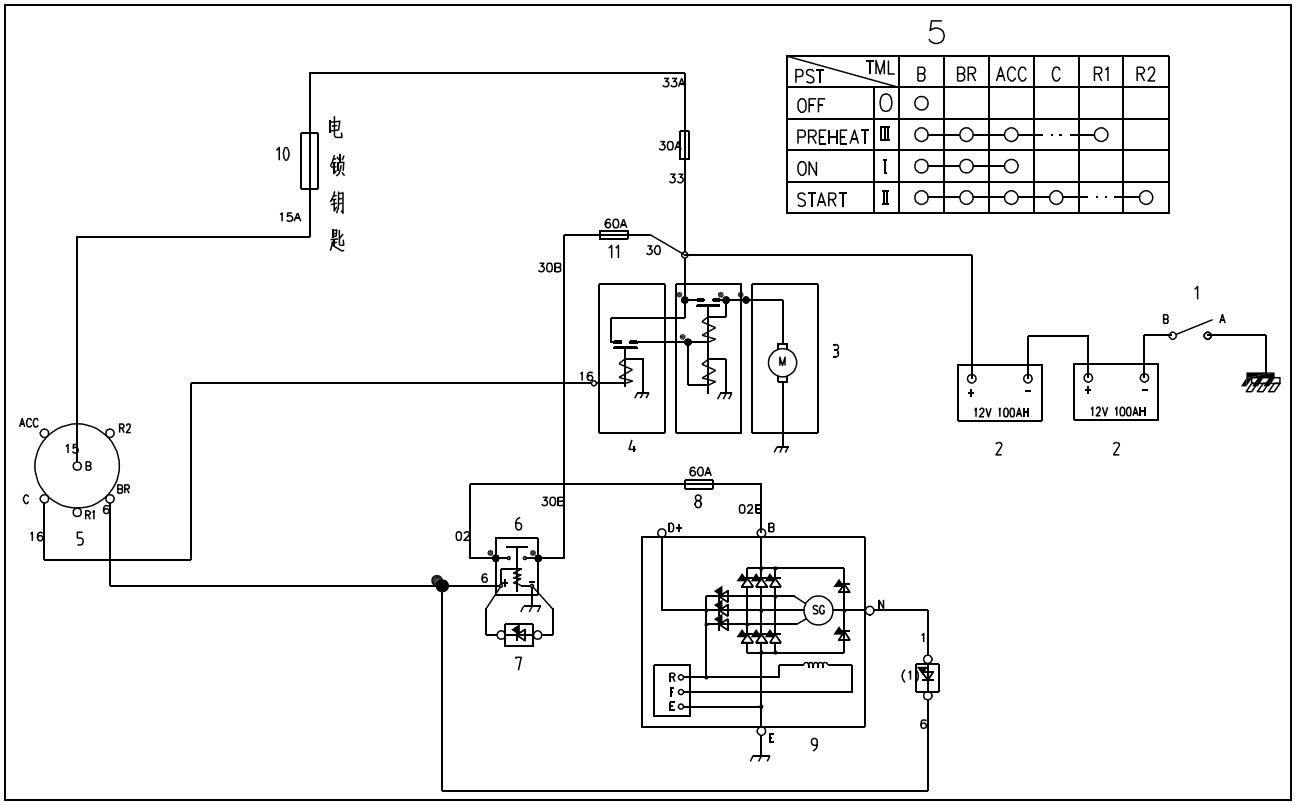


Figure 2 Starter circuit

Reference Number	Description	Reference Number	Description
1	Disconnect Switch	7	Diode
2	Battery	8	Fuse
3	Starter	9	Alternator
4	Starter Relay	10	Fuse
5	Starter Switch	11	Fuse
6	Battery Relay		

Engine Preheating System

Engine preheating system is Intake preheating system, its main functions are: heat air inlet temperature through Heating air intake to solve the problem that engine is difficult to be started in winter resulted from low temperature. Main parts include: temperature sensor (11), preheating controller (7), preheating indicator (12), preheating relay (8), and preheating plug (9).

Working principle:

1. Preheating switch (4) is turned on;
2. When water temperature of engine is higher than 0℃ (water temperature Rt resistivity is smaller than 2700±300Ω), controller (7) is not at preheating state, preheating indicator light (12) goes out after 2 s ;
3. When water temperature of engine is lower than 0℃ (water temperature Rt resistivity is smaller than 2700±300Ω), controller (7) is at preheating state; preheating time is related with water temperature;

Relationship between preheating time and voltage

Voltage（V）	18	20	22	24
Time （S）	55±5	41±4	30±3	26±2

4. When preheat time is over，preheat indicator（12）is off（If turn on the start switch in preheating period, the controller stop working)，the controller wait for starting for 30s ；
   ①. In this period（the plug is working in this period）closed the start switch（4）to “ON”，fuel supply electromagnetic valve is switched on, preheating indicator (12) light up again，preheating plug（9）is go on working；
   ②. In this period, not close the start switch（4）to “ON”，50 terminal has no 24V voltage input，That is to say did not start the engine, the controller stop working;
5. The start switch（4）return to “ON” from start position， if alternator（3）is not output Voltage signal to controller（7）from “D+ “（That did not start successfully），the controller stop working after 6S；if alternator is output voltage signal to controller from D+（That is meaning start successfully），enter the after heating period，the working time is related to water sensor（11）RT，The longest time is 120S，the shortest time is 60S；
6. When water sensor（11）Rt open circuit，preheating system work;preheat indicator（12）blink for 15S give a warning after all the launcher，the second preheating time is the longest in this time
7. When When the work voltage is below than 15，preheating system does not work，preheating indicator（12）blink for 15S give a warning；
8. When controller（7）stop working at any condition,if want to use preheating again, we must cut off the start switch（4）,meaning cut off the voltage of “15” terminal ,connect the start switch （4）again.

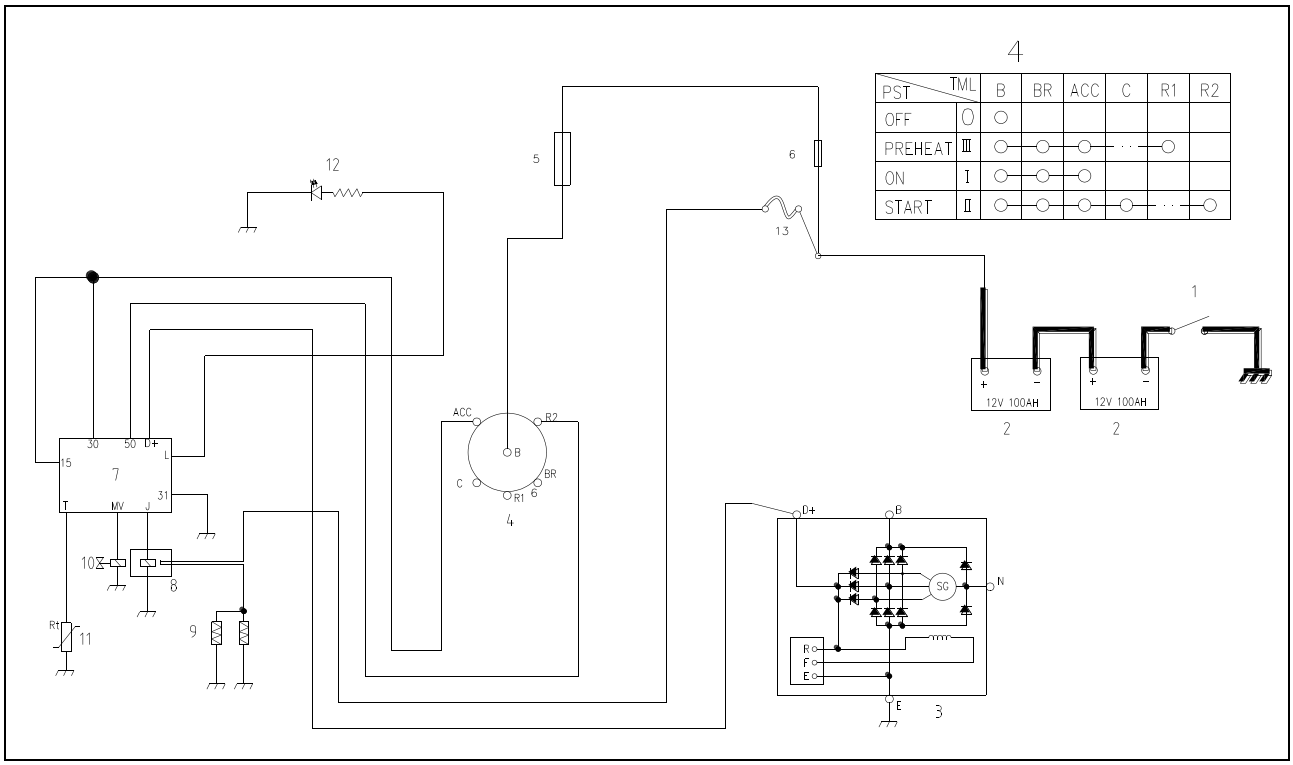


Figure 3 Control circuit of preheating system

Reference Number	Description	Reference Number	Description
1	Disconnect Switch	8	Preheat Relay
2	Battery	9	Preheater
3	Alternator	10	Solenoid Fuel Valve
4	Starter Switch	11	Water Temp. Sensor
5	Fuse	12	Preheat Indicator
6	Fuse	13	Fuse
7	Preheat Controller		

Charging System

Start switch（5）turn to“ON”position，the terminal“BR”and“B”connected and get the electric，Power relay（6）work，terminal“+”and“-”is connected; The current flow from battery（2）through fuse（11），power relay（6），fuse（12），charging indicator（8）and excitation resistance（9）to alternator（5）“D+”terminal, charging indicator（8）is lit up.In the same time alternator（5）supply excitation current. After the engine works，the alternator（5）begin to generate electricity. The current flow from alternator（5）terminal“B+”，through fuse（13）to power relay（6），fuse（11），battery（2）.Charging indicator（8）go out.

Alternator（5）flow through fuse（13），power relay（6）at the same time，and supply electricity to other electric components.

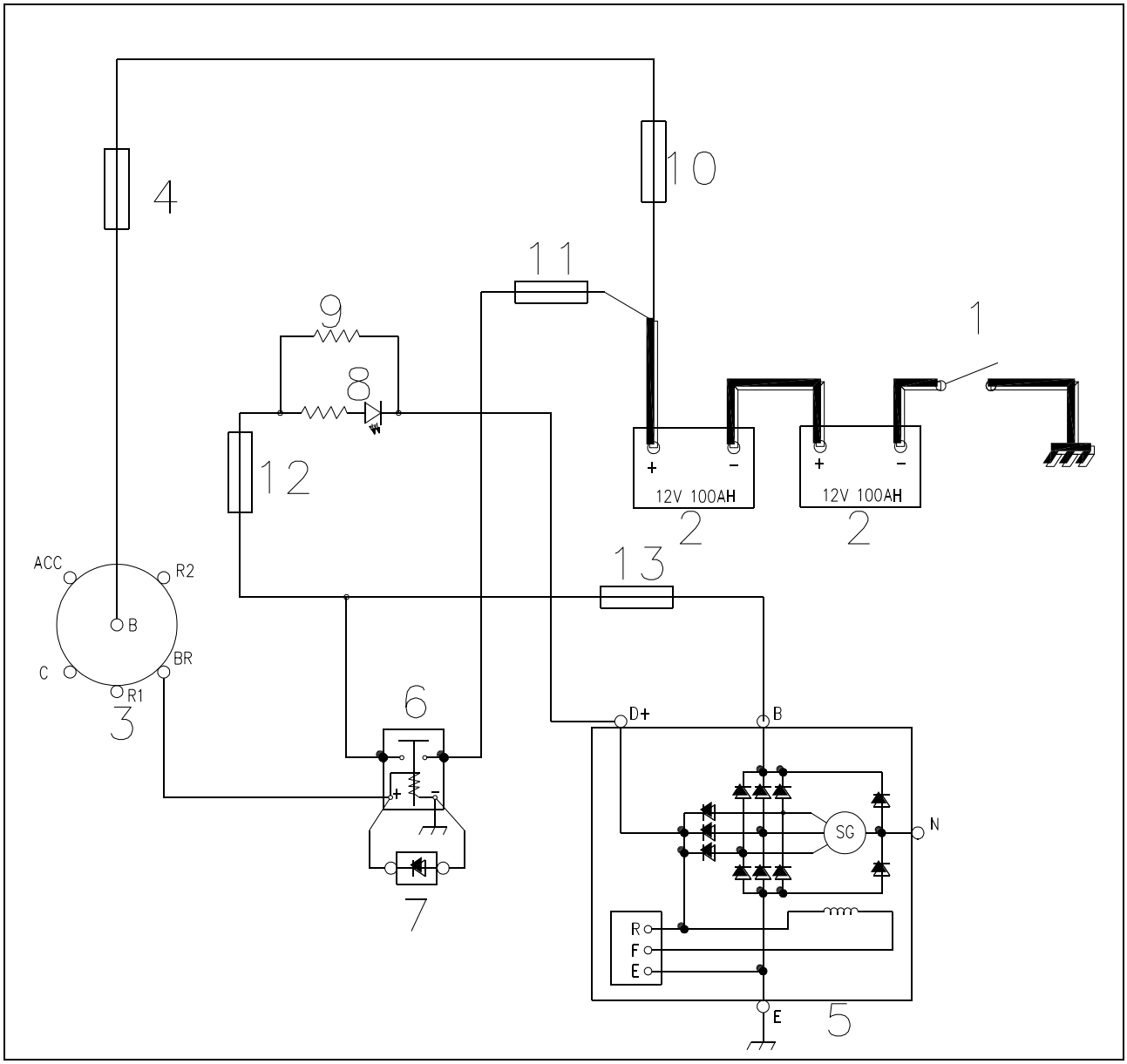


Figure 4 Engine starting system

Reference Number	Description	Reference Number	Description
1	Disconnect Switch	6	Battery Relay
2	Battery	7	Diode
3	Starter Switch	8	Charge Indicator
4	Fuse	9	Resistor
5	Alternator	10	Fuse
11	Fuse	12	Fuse
13	Fuse		

Monitoring System

This monitoring system including oil pressure gauge、oil pressure sensor、water temperature gauge, water temperature sensor、voltage meter、air pressure gauge 、low air pressure warning and so on.

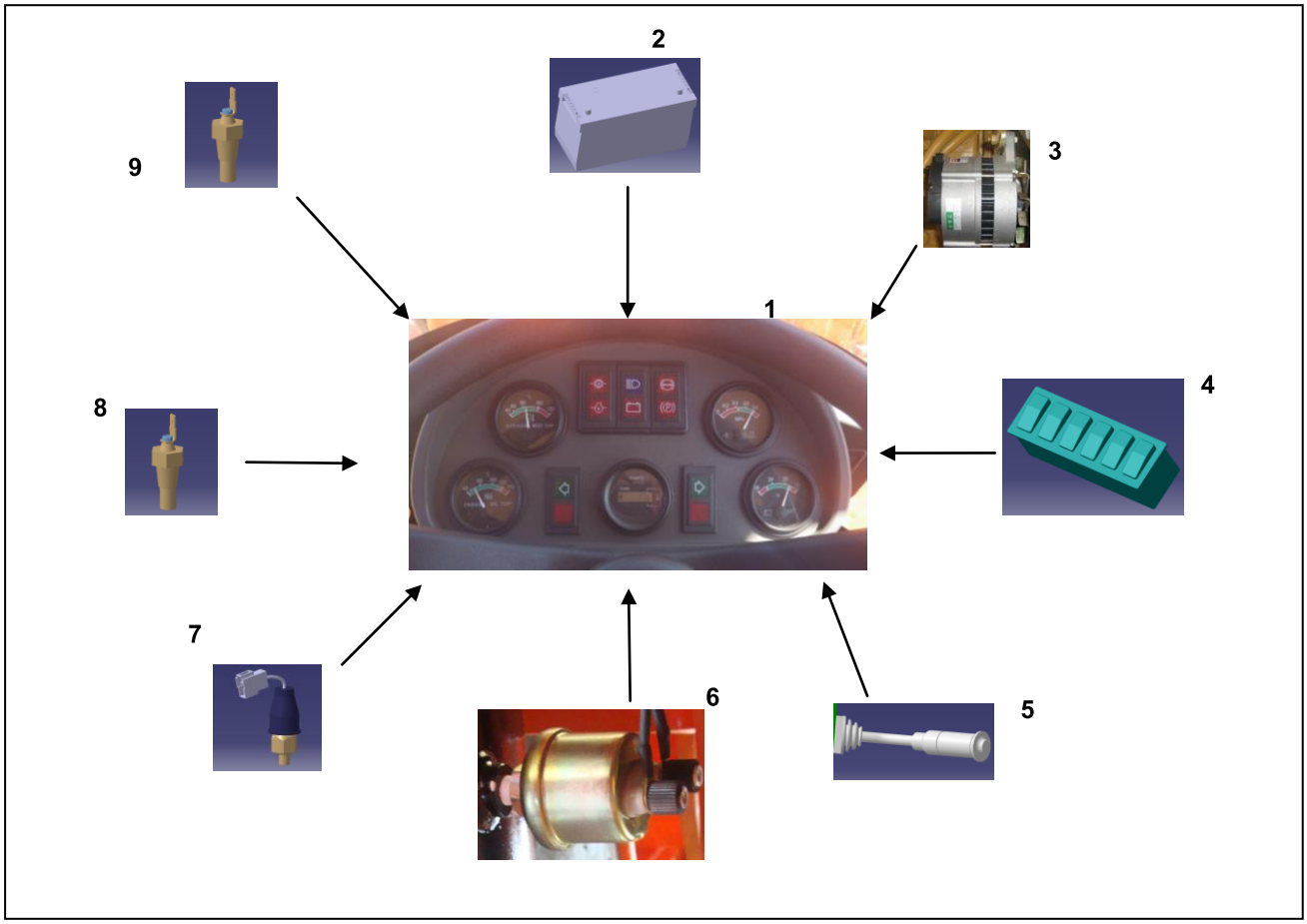


Figure 5 Monitoring System

Reference Number	Description	Reference Number	Description
1	Gauge Panel	6	Sensor
2	Battery	7	Pressure Switch
3	Alternator	8	Water Temperature Sensor
4	Rocker Switch	9	Oil Temperature Sensor
5	Switchgroup		

Monitoring system can manage all the messages which come from the sensor of the set of equipment，and display all kinds of data and warning signal on the instrument panel.

Gauge panel

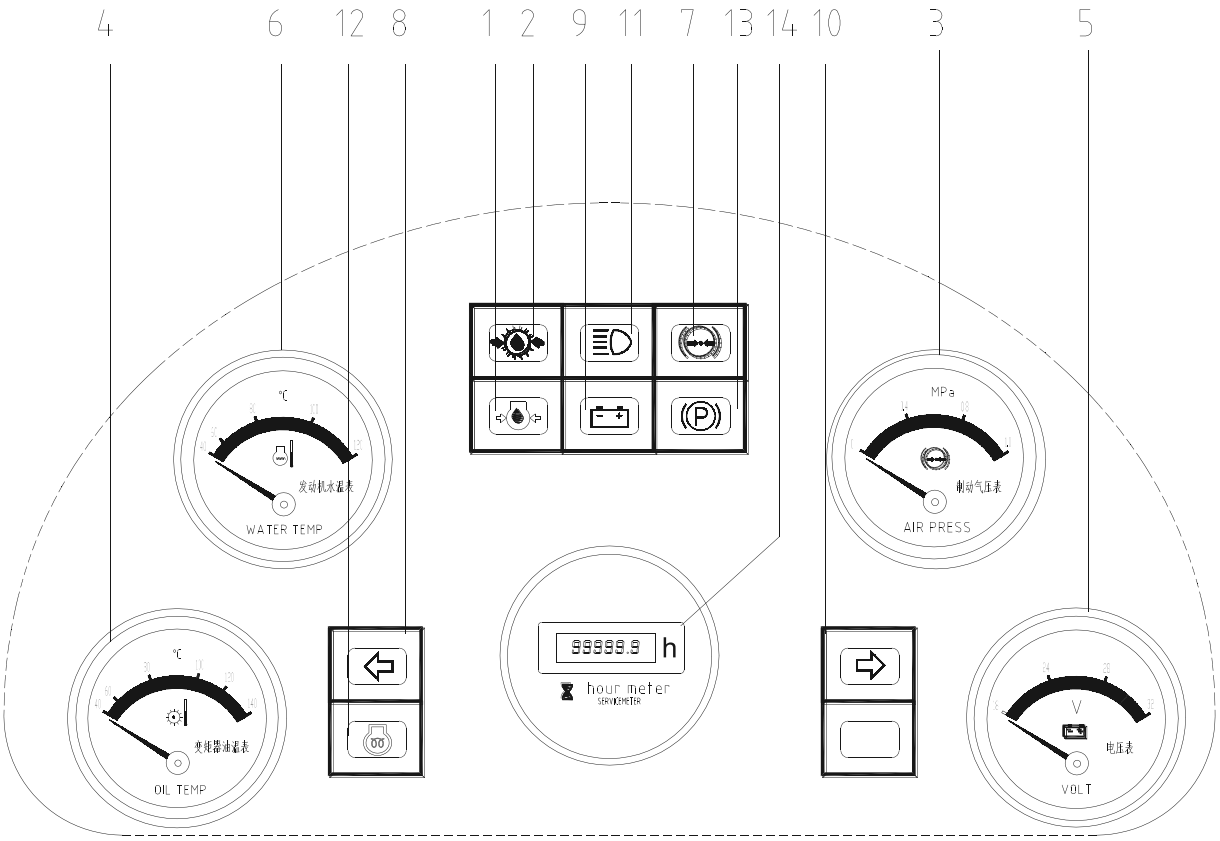
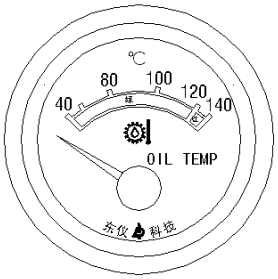
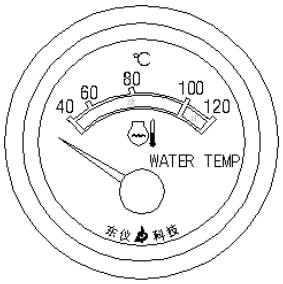
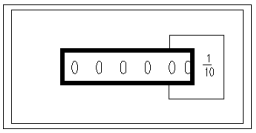
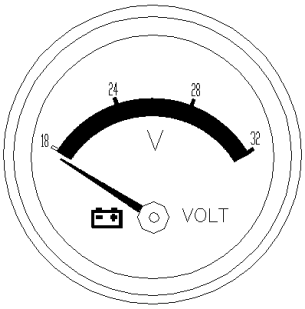


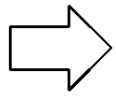
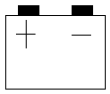
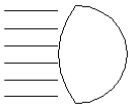
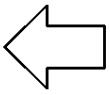
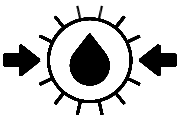
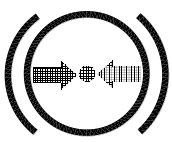
Figure 6 Gauge panel

Reference Number	Description	Reference Number	Description
1	Engine Oil Pressure Indicator	8	Turn and Hazard Warning Light
2	T/M Oil Pressure Indicator	9	Charging Warning Light
3	Air Pressure Meter	10	Turn and Hazard Warning Light
4	Torque Converter Oil Temperature Meter	11	High Beam Indicator
5	Voltmeter	12	Preheat Indicator
6	Engine Coolant Temperature Gauge	13	Parking Brake Indicator
7	AIR Pressure Indicator	14	Hour Meter

Instruments

Function	Display	Sensor Specification	
		Input Terminal	Input Specification
Torque converter oil temperature gauge			40℃——greater than 180 Ω 80℃——40 to 60Ω 100℃——20 to 40Ω 120℃——less than 20Ω 140℃——about 10Ω
Engine water temperature gauge			40℃——greater than 180Ω 60℃——80 to 100Ω 80℃——40 to 60Ω 100℃——20 to 40Ω 120℃——less than 20Ω
hourmeter			
voltmeter			

Indication light

function	display	Input terminal	operation	remark
	Right turning and warning indicator		It is lit up when the right turning or warning switch is closed.	
	charging		It is lit up when the alternator don't work. （the terminal "D+"output is lower than 24V）	Normally the indicator go out when the engine works;
	High beam		It is lit up when the high beam switch is closed.	
	preheat		It is lit up when the preheating system works.	
	Parking braking		It is lit up when parking works.	
	Left turning and warning indicator		It is lit up when the left turning or warning switch is closed.	
	Low T/M oil pressure warning lamp		It is lit up when the oil pressure is lower than 1.1MPa；	
	Low Engine oil pressure warning lamp		It is lit up when the oil pressure is lower than 0.06MPa；	
	Low air pressure warning lamp		It is lit up when the air pressure is lower than 0.4MPa；	

Schematic diagram of monitoring system

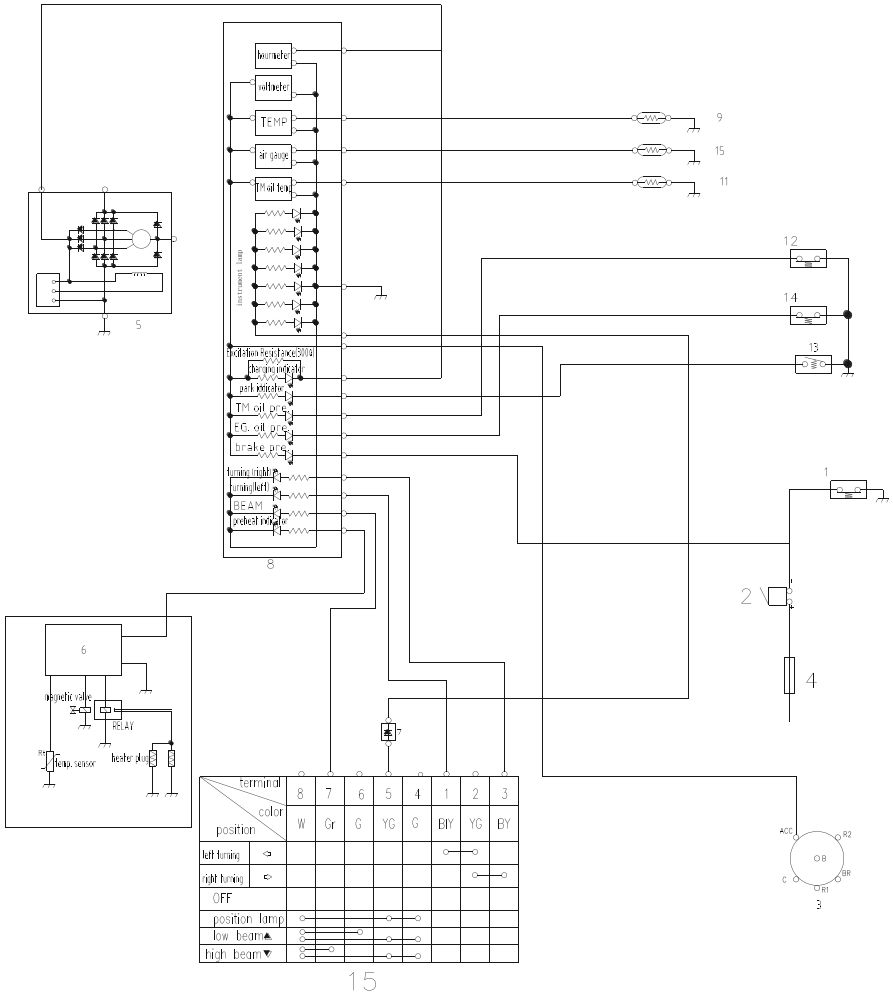


Figure 7 Schematic diagram of monitoring system

Reference Number	Description	Reference Number	Description
1	Air Pressure Alarm Switch	8	Gauge Panel
2	Buzzer	9	Water Temperature Sensor
3	Starter Switch	11	Transmission Temp. Sensor
4	Fuse	12	T/M Oil Pressure Switch
5	Alternator	13	Break Pressure Switch
6	Preheat Controller	14	Eng. Oil Pressure Switch
7	Diode	15	Combination Switch
10	Fuel Sensor	20	Blinker Unit

Windshield Wiper

Windshield wiper can be operated by combination switch (2).

1. Low speed wiper (I gear)
   Wiper works slowly，the current flow from fuse box（1）to wiper（5）to terminal “L” to rocker switch（3）to ground.
2. Wiper top gear（2 gear）
   Wiper works fast，the current flow from fuse box（1）to wiper（5）to terminal “H” to rocker switch（3）to ground.

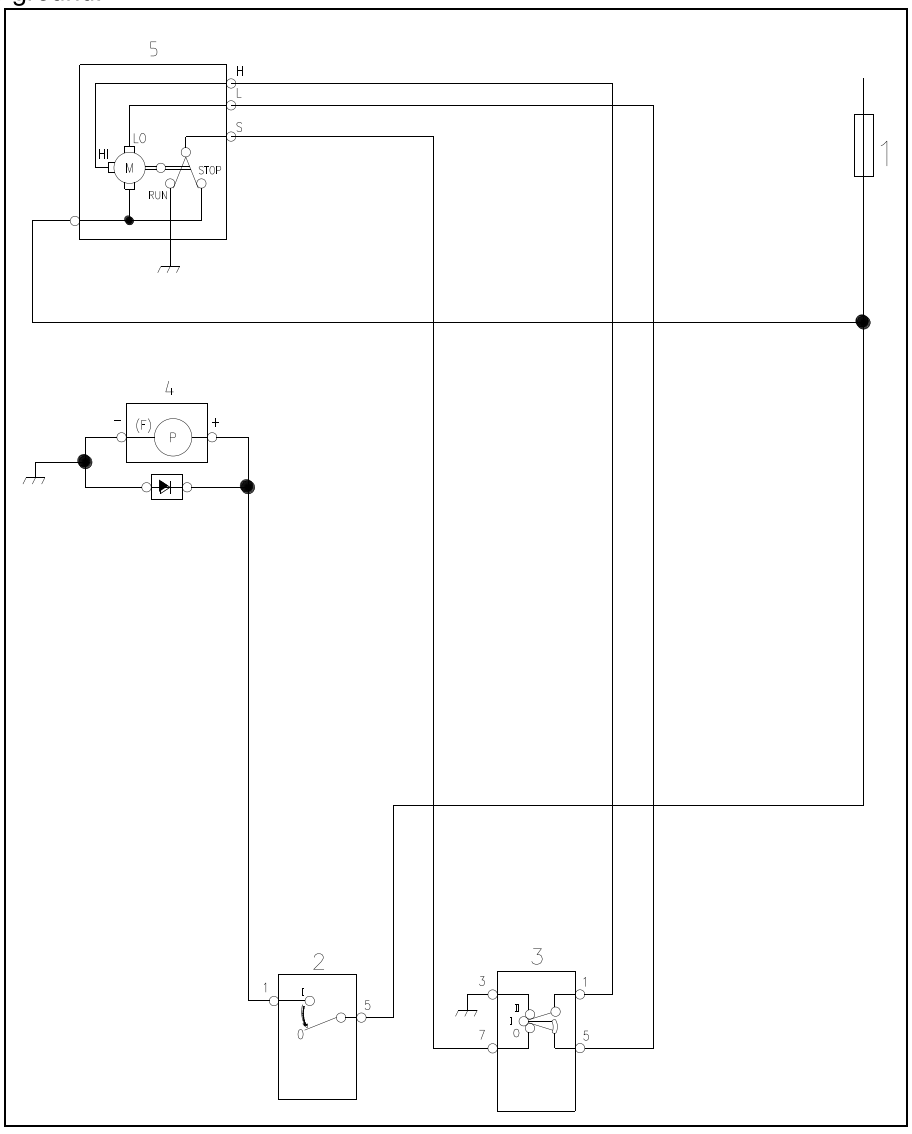


Figure 8 Circuit diagram of front windshield wiper

Reference Number	Description	Reference Number	Description
1	Fuse Box	4	Washer
2	Washer Switch	5	Wiper
3	Wiper Switch		

Lighting System

Lamping system includes big lamp, position lamp, turning signal lamp, dangerous lamp, parking lamp, working light and switches of all lamps.

1. When open the room lamp（4），the current flow from fuse box（1）to room lamp, and it is lit up.

2. When turn the combination switch（2）to low beam position，the terminal “8” and “6” connected，the current flow from fuse box（1）to combination switch（2）to front combination lamp（12）and （13），the low beam light works..

3. When turn the combination switch（2）to high beam position，the terminal “8” and “7” connected，the current flow from fuse box（1）to combination switch（2）to front combination lamp（12）and （13），the high beam light works..

4. When turn the combination switch（2）to left turning position，the terminal “1” and “2” connected，the current flow fuse box（1）through flasher（7）and combination switch（2）to the left turning lamp of front combination lamp（12）and rear combination lamp（14）.

5. When turn the combination switch（2）to left turning position，the terminal “2” and “3” connected，the current flow fuse box（1）through flasher（7） and combination switch（2）to the right turning lamp of front combination lamp（13）and rear combination lamp（15）.

6. When the braking switch（3）works，current flow from fuse box（1）to the braking lamp of rear combination lamp（14）and（15），the braking lamp works.

7. When turn the combination switch（2）to position lamp position，the terminal“5”and“8”connected. current flow from fuse box（1）to combination switch（2）to the position lamp of（10）and（11）and（16）and（17）and front combination lamp（12）（13）and rear combination lamp（14）（15）.

8. When press down the work lamp switch（10），the terminal “5” and “1” connected. the current flow from fuse box（1）to work lamp（9），the work lamp works..

9. When press down the rear work lamp switch（11），the terminal “5” and “1” connected. The current flow from fuse box（1）to rear work lamp（8），the rear work lamp works.

10. When press down the warning lamp switch（16），the terminal “5” and “1” connected. the current flow from fuse box（1）to the turning lamp of the front combination lamp（12）and（13）and rear combination lamp（14）and（15）.

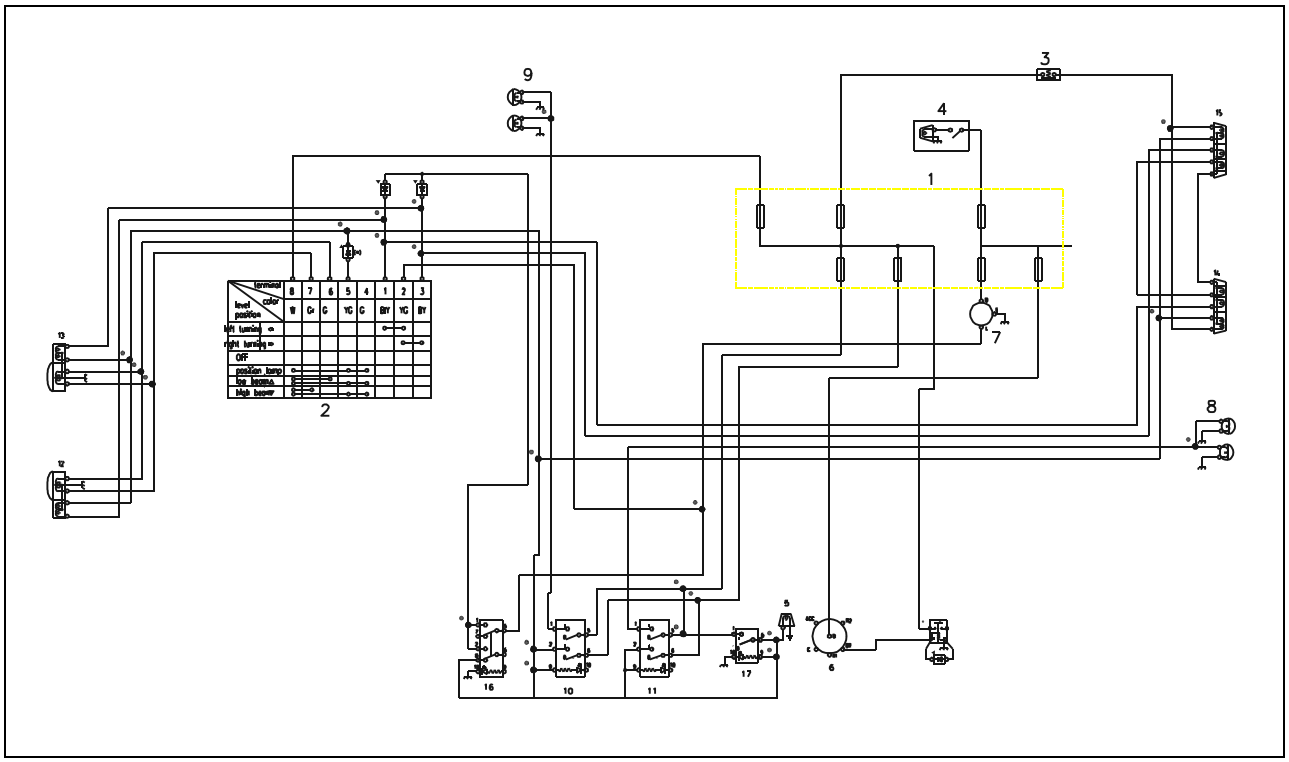


Figure 9 Lighting system circuit diagram

Reference Number	Description	Reference Number	Description
1	Fuse Box	10	Working Lamp Switch
2	Combination Switch	11	Rear Lamp Switch
3	Stop Lamp Switch	12	Front Combination Lamp(L)
4	Room Lamp	13	Front Combination Lamp(R)
5	Rotating lamp	14	Rear Combination Lamp(L)
6	Start switch	15	Rear Combination Lamp(R)
7	Blinker Unit	16	Hazard Switch
8	Rear Lamp	17	Beacon Lamp Switch
9	Working Lamp		

SPC000067

SCHEMATIC

⚠ CAUTION!
Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section. **Always use tools and equipment that is in good working order.** **Use lifting and hoisting equipment capable of safely handling load.** **Remember, that ultimately safety is your own personal responsibility.**

General Description

The overlapped edge has been considered for convenient copy, a complete schematic diagram can be formed when they are put together.

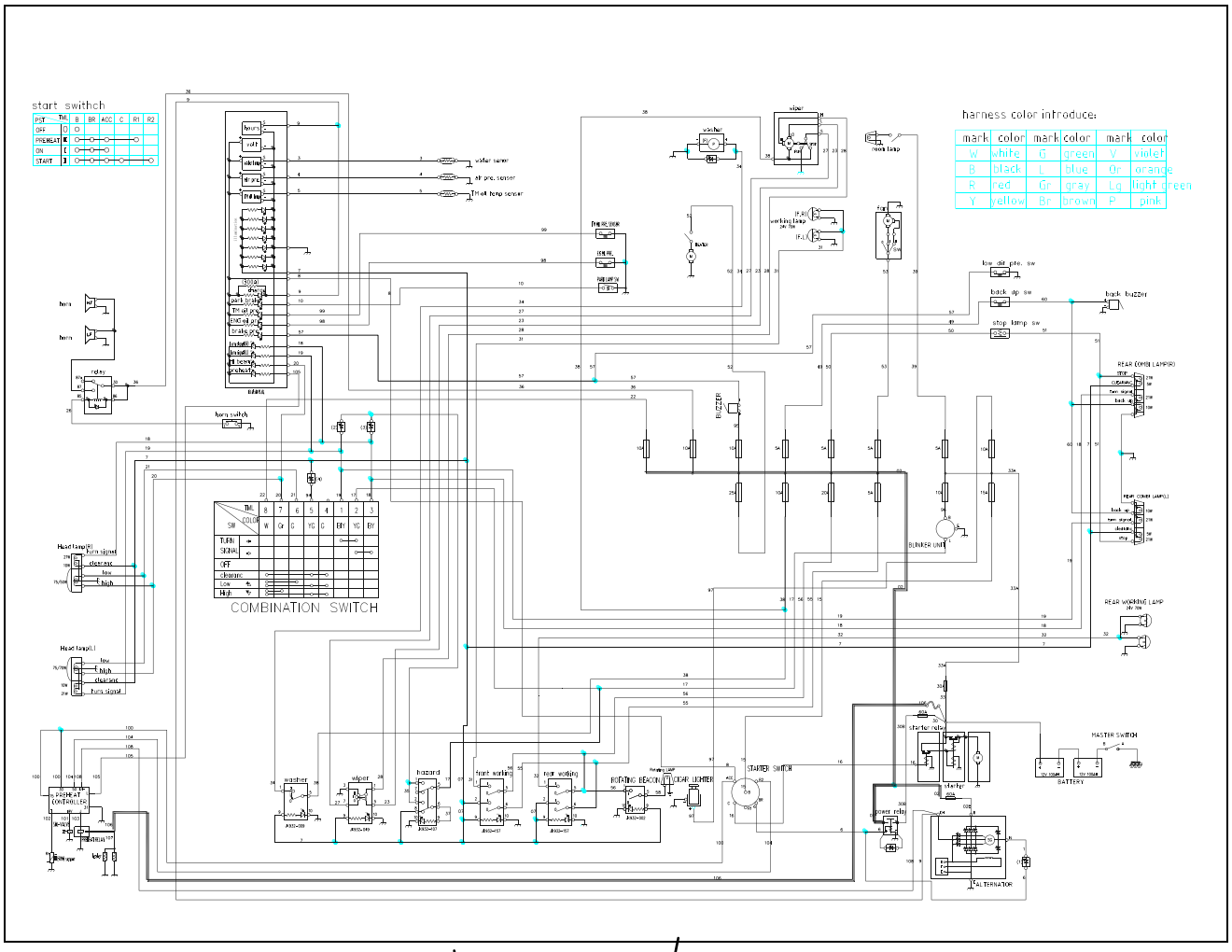
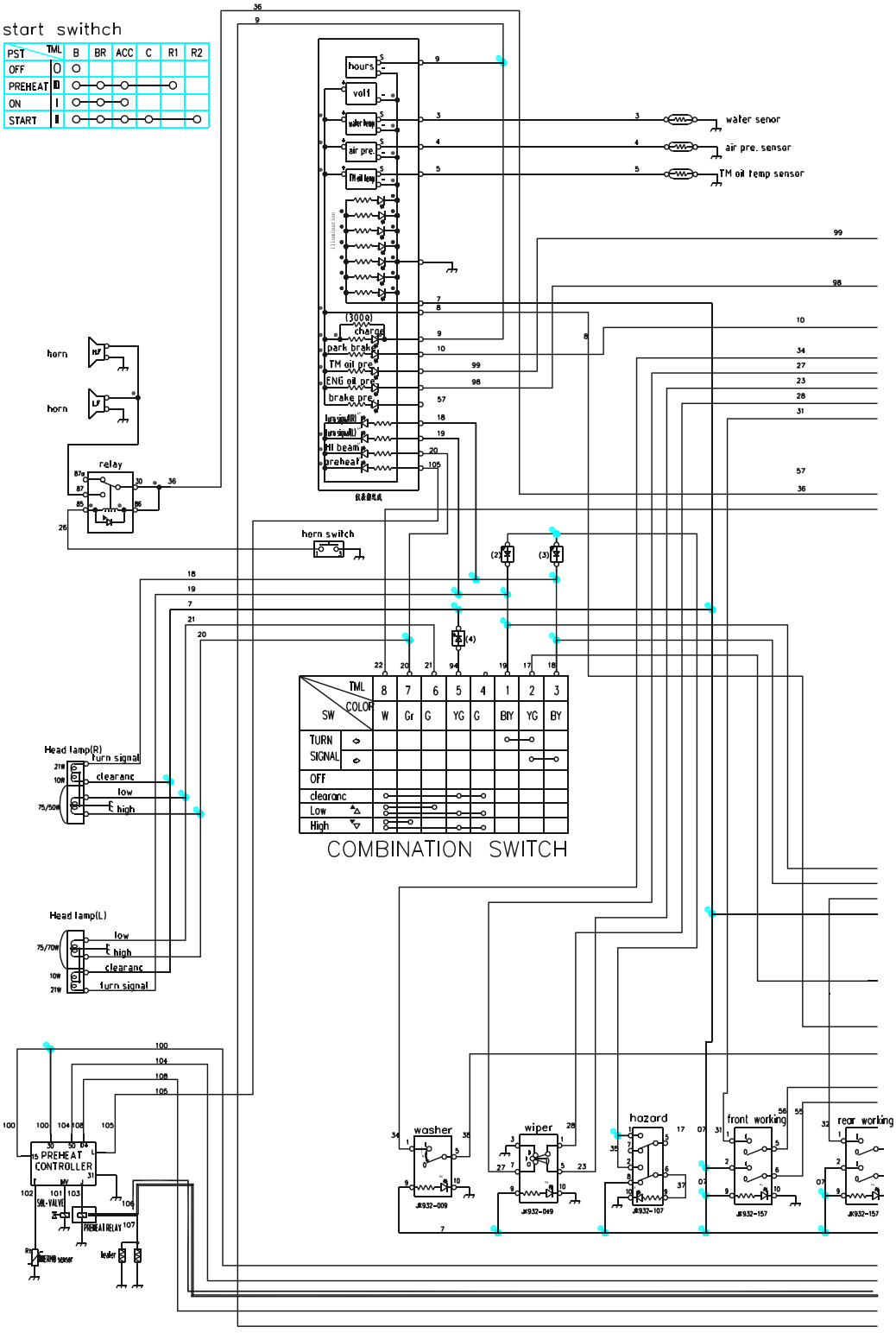
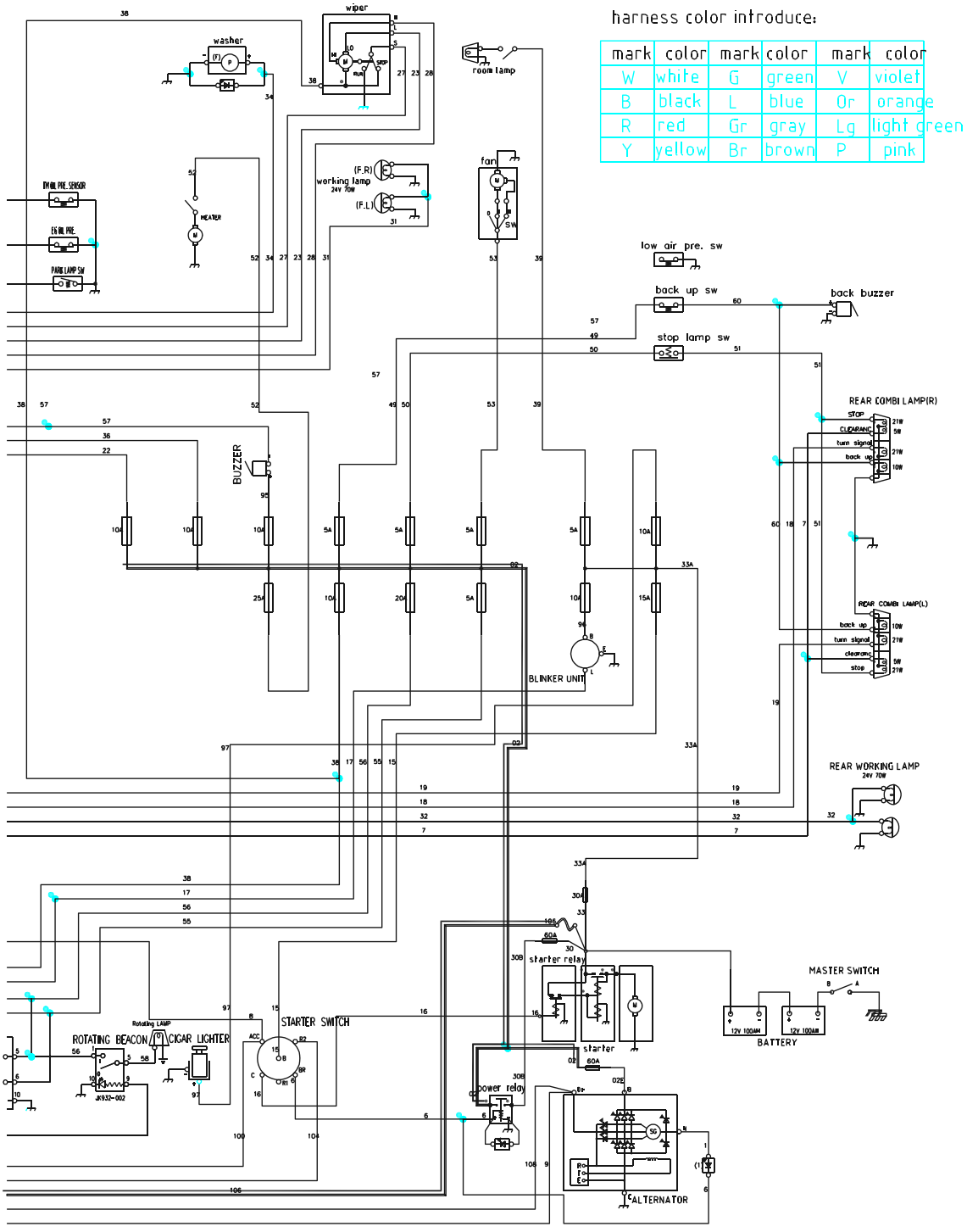


Figure 1


start swithch
PST
TML
B
BR
ACC
C
R1
R2
OFF
PREHEAT
ON
START
hours
volt
water temp
air pre.
TM oil temp
water senor
air pre. sensor
TM oil temp sensor
charge
park brake
TM oil pre
ENG oil pre
brake pre
fil beam
preheat
horn
horn
relay
horn switch
COMBINATION SWITCH
TURN SIGNAL
OFF
clearanc
Low
High
Head lamp(R)
turn signal
clearanc
low
high
Head lamp(L)
low
high
clearanc
turn signal
PREHEAT CONTROLLER
SOL-VALVE
PREHEAT RELAY
washer
wiper
hazard
front working
rear working


harness color introduce:
mark color mark color mark color
W white G green V violet
B black L blue Or orange
R red Gr gray Lg light green
Y yellow Br brown P pink
wiper
washer
room lamp
fan
(F.R) working lamp 24V 70W
(F.L)
HEATER
low air pre. sw
back up sw
back buzzer
stop lamp sw
REAR COMBI LAMP(R)
STOP
CLEARANCE
turn signal
back up
REAR COMBI LAMP(L)
BUZZER
BLINKER UNIT
REAR WORKING LAMP 24V 70W
starter relay
MASTER SWITCH
BATTERY
STARTER SWITCH
ROTATING BEACON
CIGAR LIGHTER
power relay
starter
ALTERNATOR

ATTACHMENTS