Section 2

Care and Safety

Service Manual - Side Engine Loadalls

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Notes:

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Safety Notices

Introduction

In this publication and on the machine, there are safety notices. Each notice starts with a signal word. The signal word meanings are given below.

⚠ DANGER

Denotes an extreme hazard exists. If proper precautions are not taken, it is highly probable that the operator (or others) could be killed or seriously injured.

INT-1-2-1

⚠ WARNING

Denotes a hazard exists. If proper precautions are not taken, the operator (or others) could be killed or seriously injured.

INT-1-2-2

⚠ CAUTION

Denotes a reminder of safety practices. Failure to follow these safety practices could result in injury to the operator (or others) and possible damage to the machine.

INT-1-2-3

Important Information

T1-015

The Operator Manual

⚠ WARNING

Study the Operator Manual before starting the machine. You must understand and follow the instructions in the Operator Manual. You must observe all relevant laws and regulations. If you are unsure about anything, ask your JCB dealer or employer. Do not guess, you or others could be killed or seriously injured.

INT-1-1-1_2

Do not operate the machine without an Operator Manual.

Treat the Operator Manual as part of the machine. Keep it clean and in good condition. Replace the Operator Manual immediately if it is lost, damaged or becomes unreadable.

Safety Warnings

This safety alert system identifies important safety messages in this manual. When you see this symbol, be alert, your safety is involved, carefuly read the message that follows, and inform other operators.

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INT-1-2-3

Safety Check List

Safety - Yours and Others

INT-1-3-1_3

All machinary can be hazardous. When a machine is correctly operated and properly maintained, it is a safe machine to work with. But when it is carelessly operated or poorly maintained it can become a danger to you (the operator) and others.

In this manual and on the machine you will find warning messages. Read and understand them. They tell you of potential hazards and how to avoid them. If you do not fully understand the warning messages, ask your employer or JCB distributor to explain them.

But safety is not just a matter of responding to the warnings. All the time you are working on or with the machine you must be thinking what hazards there might be and how to avoid them.

Do not work with the machine until you are sure that you can control it.

Do not start any job until you are sure that you and those around you will be safe.

If you are unsure of anything, about the machine or the job, ask someone who knows. Do not assume anything.

Remember

BE CAREFUL
BE ALERT
BE SAFE

Common Rail (SE Engine) Specific

In addition to the general safety notices and general good workshop practices issued in this section and throughout the manual, there are specific points to note when completing maintenance on SE engine equipment:

Diesel Fuel Quality

Important: *The potential for engine damage due to the use of incorrect or contaminated fuel is much greater with common rail injection technology than with mechanical injection systems.*

For more information about cleanliness requirements and fuel types refer to ***Section 1 - General Information.***

⚠ CAUTION

Do not allow dirt to enter the fuel system. Before disconnecting any part of the fuel system, thoroughly clean around the connection. When a component has been disconnected, for example a fuel pipe, always fit protective caps and plugs to prevent dirt ingress.

Failure to follow these instruction will lead to dirt entering the fuel system. Dirt in the fuel system will seriously damage the fuel injection equipment and could be expensive to repair.

ENG-1-7

Effects of Contamination

Once inside the system, fuel circuit contaminants greatly effect the performance and life of the fuel injection equipment. For example, contaminants in the fuel pump will develop internal wear to cause internal leakage and hence lower discharges. Use of poor quality fuels and poor maintenance could also lead to contaminants entering the fuel injectors. There is a possibility of catastrophic equipment failure if debris should prevent the injectors from fully closing. The main contaminants can be classified as follows: These contaminations can appear during manufacture. assembly and operation.

- Solid Particles - sand, fibres, metallic particles, welding scale, sealing materials and wear particles etc.
- Liquid - usually water and incompatible oils and gases.
- Gases - Air, sulphur dioxide etc. which can create corrosive compounds if dissolved in the fluid.

It is critical that the machine is thoroughly cleaned prior to completing any maintenance work. The main filter is rated at 2 micron = 0.002 mm (0.0007874 in).

Listed are a few typical comparisons of micron size:

- Red Blood Cell = 8 microns (0.008 mm, 0.000315 in).
- Human Hair = 70 microns (0.07 mm, 0.00275 in).
- Grain of Salt = 100 microns (0.1 mm, 0.00394 in).
- The smallest particle visible to the naked eye is 40 microns (0.00157 in) approximately.

Common Rail Safety Checklist

The following safety checklist is intended to help remind you of safety procedures and practices relating to a common rail SE engine.

SAFETY IS YOUR RESPONSIBILITY

- Do make sure the engine and surrounding area has been thoroughly cleaned prior to completing any maintenance tasks. Refer to Section 1, Cleanliness Requirements.
- Do complete all work in accordance with the Service Manual procedures.
- Do disconnect both the battery positive (+) and battery negative (-) cables prior to completing any welding on the machine.
- Do use the recommended grade of fuel (EN590). The fuel injection pump, injector or other parts of the fuel system can be damaged if you use a fuel or fuel additives not recommended by JCB. Refer to ***Section 1 - Acceptable and Unacceptable Fuels***.
- Do make sure all the necessary new parts are available before starting any maintenance work.
- Do not `crack' the injector high pressure fuel lines to bleed the fuel system. The system operates at pressures in excess of 1200 bar (17400lbs/in^2).
- Do not steam clean the electronic control unit (ECU) or the ECU connectors.
- Do not touch the ECU connector pins, this will eliminate the possibility of damage caused by electrostatic discharge.
- Do not leave any fuel connections `open' for any extended period of time.
- Do not open any new parts packaging until the part is ready to be fitted. Unnecessary exposure will increase the risk of contamination.
- Do not reuse high pressure fuel pipes. Reusing the pipes will lead to potential fuel leaks.
- Do not attempt to remove and replace the rail pressure sensor or high pressure valve. It is not possible to refit these components without the risk of fuel leaks. If the valve or sensor is diagnosed as faulty then a new common rail assembly must be fitted.

General Safety

T1-007

⚠ WARNING

Operator Manual

You and others can be injured if you operate or maintain the machine without first studying the Operator Manual. Read the safety instructions before operating the machine. If you do not understand anything, ask your employer or JCB dealer to explain it. Keep the Operator Manual clean and in good condition. Do not operate the machine without an Operator Manual in the cab, or if there is anything on the machine you do not understand.

INT-1-3-2_2

⚠ WARNING

Care and Alertness

All the time you are working with or on the machine, take care and stay alert. Always be careful. Always be alert for hazards.

INT-1-3-5

⚠ WARNING

Clothing

You can be injured if you do not wear the proper clothing. Loose clothing can get caught in the machinery. Wear protective clothing to suit the job. Examples of protective clothing are: a hard hat, safety shoes, safety glasses, a well fitting overall, ear-protectors and industrial gloves. Keep cuffs fastened. Do not wear a necktie or scarf. Keep long hair restrained.

INT-1-3-6

⚠ WARNING

Alcohol and Drugs

It is extremely dangerous to operate machinery when under the influence of alcohol or drugs. Do not consume alcoholic drinks or take drugs before or while operating the machine or attachments. Be aware of medicines which can cause drowsiness.

INT-1-3-9_2

⚠ WARNING

Feeling Unwell

Do not attempt to operate the machine if you are feeling unwell. By doing so you could be a danger to yourself and those you work with.

8-1-2-4

⚠ WARNING

Mobile Phones

Switch off your mobile phone before entering an area with a potentially explosive atmosphere. Sparks in such an area could cause an explosion or fire resulting in death or serious injury.

Switch off and do not use your mobile phone when refuelling the machine.

INT-3-3-9

⚠ WARNING

Lifting Equipment

You can be injured if you use faulty lifting equipment. Make sure that lifting equipment is in good condition. Make sure that lifting tackle complies with all local regulations and is suitable for the job. Make sure that lifting equipment is strong enough for the job.

INT-1-3-7

⚠ WARNING

Raised Equipment

Raised equipment can fall and injure you. Do not walk or work under raised equipment unless safely supported.

13-1-1-6

⚠ WARNING

Raised Machine

NEVER position yourself or any part of your body under a raised machine which is not properly supported. If the machine moves unexpectedly you could become trapped and suffer serious injury or be killed.

INT-3-3-7_1

DANGER

Lightning

Lightning can kill you. Do not use the machine if there is lightning in your area.

5-1-1-2

WARNING

Machine Modifications

This machine is manufactured in compliance with legislative and other requirements. It should not be altered in any way which could affect or invalidate any of these requirements. For advice consult your JCB Distributor.

INT-1-3-10_2

Operating Safety

WARNING

Machine Condition

A defective machine can injure you or others. Do not operate a machine which is defective or has missing parts. Make sure the maintenance procedures in this manual are completed before using the machine.

INT-2-1-2_2

WARNING

Machine Limits

Operating the machine beyond its design limits can damage the machine, it can also be dangerous. Do not operate the machine outside its limits. Do not try to upgrade the machine performance with unapproved modifications.

INT-2-1-4

WARNING

Engine/Steering Failure

If the engine or steering fails, stop the machine as quickly as possible. Do not operate the machine until the fault has been corrected.

INT-2-1-5

WARNING

The engine has exposed rotating parts. Switch OFF the engine before working in the engine compartment. Do not use the machine with the engine cover open.

5-2-6-5

WARNING

Exhaust Gases

Breathing the machine exhaust gases can harm and possibly kill you. Do not operate the machine in closed spaces without making sure there is good ventilation. If possible, fit an exhaust extension. If you begin to feel drowsy, stop the machine at once and get into fresh air.

INT-2-1-10_2

WARNING

You could be killed or seriously injured if you operate a machine with a damaged or missing ROPS/FOPS. If the Roll Over Protection Structure (ROPS)/Falling Objects Protection Structure (FOPS) has been in an accident, do not use the machine until the structure has been renewed. Modifications and repairs that are not approved by the manufacturer may be dangerous and will invalidate the ROPS/FOPS certification.

INT-2-1-9_6

WARNING

Work Sites

Work sites can be hazardous. Inspect the site before working on it. Look for potholes, weak ground, hidden rocks etc. Check for utilities such as electric cables (overhead and underground), gas and water pipes etc. Mark the positions of the underground cables and pipes. Make sure that you have enough clearance beneath overhead cables and structures.

INT-2-2-1

WARNING

Communications

Bad communications can cause accidents. Keep people around you informed of what you will be doing. If you will be working with other people, make sure any hand signals that may be used are understood by everybody. Work sites can be noisy, do not rely on spoken commands.

INT-2-2-3

WARNING

Parking

An incorrectly parked machine can move without an operator. Follow the instructions in the Operator Manual to park the machine correctly.

INT-2-2-4_2

WARNING

Banks and Trenches

Banked material and trenches can collapse. Do not work or drive too close to banks and trenches where there is danger of collapse.

INT-2-2-5

⚠ WARNING

Ramps and Trailers

Water, mud, ice, grease and oil on ramps or trailers can cause serious accidents. Make sure ramps and trailers are clean before driving onto them. Use extreme caution when driving onto ramps and trailers.

INT-2-2-6

⚠ WARNING

Safety Barriers

Unguarded machines in public places can be dangerous. In public places, or where your visibility is reduced, place barriers around the work area to keep people away.

INT-2-2-8

⚠ DANGER

Sparks

Explosions and fire can be caused by sparks from the exhaust or the electrical system. Do not use the machine in closed areas where there is flammable material, vapour or dust.

INT-2-2-10

⚠ WARNING

Hazardous Atmospheres

This machine is designed for use in normal out door atmospheric conditions. It should not be used in an enclosed area without adequate ventilation. Do not use the machine in a potentially explosive atmosphere, i.e. combustible vapours, gas or dust, without first consulting your JCB Distributor.

INT-2-1-14

⚠ CAUTION

Regulations

Obey all laws, work site and local regulations which affect you and your machine.

INT-1-3-3

⚠ WARNING

Practice

You or others can be killed or seriously injured if you do unfamiliar operations without first practising them. Practise away from the work site on a clear area. Keep other people away. Do not perform new operations until you are sure you can do them safely.

INT-2-1-1

⚠ WARNING

Reversing

Reversing at high speeds can cause accidents. Do not reverse in a high gear with full throttle. Always drive at a safe speed to suit working conditions.

INT-2-2-9_1

⚠ WARNING

Airborne particles of light combustible material such as straw, grass, wood shavings, etc. must not be allowed to accumulate within the engine compartment or in the propshaft guards (when fitted). Inspect these areas frequently and clean at the beginning of each work shift or more often if required. Before opening the engine cover, ensure that the top is clear of debris.

5-3-1-12_3

⚠ WARNING

Keep the machine controls clean and dry. Your hands and feet could slide off slippery controls. If that happens you could lose control of the machine.

2-2-3-6

⚠ WARNING

Visibility

Accidents can be caused by working in poor visibility. Use your lights to improve visibility. Keep the road lights, windows and mirrors clean.

Do not operate the machine if you cannot see clearly.

5-1-4-7

⚠ WARNING

Electrical Power Cables

You could be electrocuted or badly burned if you get the machine or its attachments too close to electrical power cables.

You are strongly advised to make sure that the safety arrangements on site comply with the local laws and regulations concerning work near electric power lines.

Before you start using the machine, check with your electricity supplier if there are any buried power cables on the site.

There is a minimum clearance required for working beneath overhead power cables. You must obtain details from your local electricity supplier.

2-2-5-4

⚠ CAUTION

If you have an attachment which is not covered in the Operator Manual do not install it, use it or remove it until you have obtained, read and understood the pertinent information. Install attachments only on the machines for which they were designed.

5-5-1-1_2

⚠ WARNING

Use only the JCB approved attachments that are specified for your machine. Operating with non-specified attachments can overload the machine, causing possible damage and machine instability which could result in injury to yourself or others.

The use of non-approved attachments could invalidate your warranty.

2-4-5-2_1

⚠ WARNING

Controls

You or others can be killed or seriously injured if you operate the control levers from outside the machine. Operate the control levers only when you are correctly seated in the machine.

0179

⚠ WARNING

Fires

If your machine is equipped with a fire extinguisher, make sure it is checked regularly. Keep it in the correct machine location until you need to use it.

Do not use water to put out a machine fire, you could spread an oil fire or get a shock from an electrical fire. Use carbon dioxide, dry chemical or foam extinguishers. Contact your nearest fire department as quickly as possible. Firefighters should use self-contained breathing apparatus.

INT-3-2-7_2

⚠ WARNING

Should the machine start to roll over, you can be crushed if you try to leave the cab. If the machine starts to roll over, do not try and jump from the cab. Stay in the cab, with your seat belt fastened.

INT-2-1-12

⚠ CAUTION

Fork Spacing

Loads can fall off incorrectly spaced forks. Always space the forks correctly for the load. Make sure the forks are completely under the load before lifting.

5-1-4-2

⚠ CAUTION

One-Fork Lifting

A load lifted on one fork can slip off. Never lift a load with one fork.

5-1-4-3

⚠ CAUTION

Unloading

Never unload the forks by stopping the machine suddenly. Follow the procedures in the Operator Manual for unloading.

5-1-4-4_2

⚠ CAUTION

Uneven Ground

Loads stacked on uneven ground can topple. Never stack loads on uneven ground.

5-1-4-5

⚠ WARNING

Scaffolding

Overloaded scaffolding can collapse. Never load scaffolding beyond the regulation capacity.

5-1-4-6

⚠ CAUTION

Overhead Clearance

A raised boom can strike overhead objects. Always check for overhead clearance before raising the boom.

5-1-5-1

⚠ WARNING

Boom/Travelling

Operating the boom while travelling can cause accidents. You will not have total control of the machine. Never operate the boom while travelling.

5-1-5-2

⚠ DANGER

Forks/Working Platform

Using the forks alone as a working platform is hazardous; you can fall off and be killed or injured. Never use the forks as a working platform.

5-1-5-3

⚠ WARNING

Forks/Turning

The forks extend beyond the end of the boom. Make sure there is enough clearance for the forks when making turns.

5-1-5-4

⚠ WARNING

Entering/Leaving

Entering or leaving the cab or canopy must only be made where steps and handrails are provided. Always face the machine when entering and leaving. Make sure the step(s), handrails and your boot soles are clean and dry. Do not jump from the machine. Do not use the machine controls as handholds, use the handrails.

INT-2-1-7_1

⚠ WARNING

Controls

You or others can be killed or seriously injured if you operate the control levers from outside the machine. Operate the control levers only when you are correctly seated in the machine.

0179

⚠ WARNING

Powershift Transmission

Do not change from a high gear to a low gear (for instance, 4th to 1st) in one sudden movement when the machine is moving. Otherwise the machine will rapidly decelerate, you or others could be killed or seriously injured. When selecting lower gears, allow the engine speed to drop before each gear change.

2-1-1-9_1

⚠ CAUTION

Passengers

Passengers in or on the machine can cause accidents. Do not carry passengers.

INT-2-2-2_1

Maintenance Safety

⚠ WARNING

Communications

Bad communications can cause accidents. If two or more people are working on the machine, make sure each is aware of what the others are doing. Before starting the engine make sure the others are clear of the danger areas; examples of danger areas are: the rotating blades and belt on the engine, the attachments and linkages, and anywhere beneath or behind the machine. People can be killed or injured if these precautions are not taken.

INT-3-1-5

⚠ WARNING

Repairs

If your machine does not function correctly in any way, get it repaired straight away. Neglect of necessary repairs could result in an accident or affect your health. Do not try to do repairs or any other type of maintenance work you do not understand. To avoid injury and/or damage get the work done by a specialist engineer.

GEN-1-5_2

⚠ WARNING

Metal Splinters

You can be injured by flying metal splinters when driving metal pins in or out. Use a soft faced hammer or copper pin to remove and fit metal pins. Always wear safety glasses.

INT-3-1-3_2

⚠ WARNING

Electrical Circuits

Understand the electrical circuit before connecting or disconnecting an electrical component. A wrong connection can cause injury and/or damage.

INT-3-1-4

⚠ CAUTION

Do not disconnect the battery while the engine is running, otherwise the electrical circuits may be damaged.

INT-3-1-14

⚠ WARNING

If you try to charge a frozen battery, or jump start and run the engine, the battery could explode. Do not use a battery if its electrolyte is frozen. To prevent the battery electrolyte from freezing, keep the battery at full charge.

0125

⚠ WARNING

Battery Gases

Batteries give off explosive gases. Keep flames and sparks away from the battery. Do not smoke close to the battery. Make sure there is good ventilation in closed areas where batteries are being used or charged. Do not check the battery charge by shorting the terminals with metal; use a hydrometer or voltmeter.

INT-3-1-8

⚠ DANGER

Electrolyte

Battery electrolyte is toxic and corrosive. Do not breathe the gases given off by the battery. Keep the electrolyte away from your clothes, skin, mouth and eyes. Wear safety glasses.

INT-3-2-1_3

⚠ WARNING

Battery Terminals

The machine is negatively earthed. Always connect the negative pole of the battery to earth.

When connecting the battery, connect the earth (-) lead last.

When disconnecting the battery, disconnect the earth (-) lead first.

INT-3-1-9

⚠ WARNING

Fluid Under Pressure

Fine jets of fluid at high pressure can penetrate the skin. Keep face and hands well clear of fluid under pressure and wear protective glasses. Hold a piece of cardboard close to suspected leaks and then inspect the cardboard for signs of fluid. If fluid penetrates your skin, get medical help immediately.

INT-3-1-10_2

⚠ WARNING

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before connecting or removing any hydraulic hose, residual hydraulic pressure trapped in the service hose line must be vented. Make sure the hose service line has been vented before connecting or removing hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11_2

⚠ WARNING

Petrol

Do not use petrol in this machine. Do not mix petrol with the diesel fuel; in storage tanks the petrol will rise to the top and form flammable vapours.

INT-3-1-6

⚠ WARNING

Diesel Fuel

Diesel fuel is flammable; keep naked flames away from the fuel system. Do not smoke while refuelling or working on the fuel system. Do not refuel with the engine running. There could be a fire and injury if you do not follow these precautions.

INT-3-2-2_1

⚠ WARNING

Oil

Oil is toxic. If you swallow any oil, do not induce vomiting, seek medical advice. Used engine oil contains harmful contaminants which can cause skin cancer. Do not handle used engine oil more than necessary. Always use barrier cream or wear gloves to prevent skin contact. Wash skin contaminated with oil thoroughly in warm soapy water. Do not use petrol, diesel fuel or paraffin to clean your skin.

INT-3-2-3

⚠ CAUTION

It is illegal to pollute drains, sewers or the ground. Clean up all spilt fluids and/or lubricants.

Used fluids and/or lubricants, filters and contaminated materials must be disposed of in accordance with local regulations. Use authorised waste disposal sites.

INT-3-2-14

⚠ WARNING

Soft Ground

A machine can sink into soft ground. Never work under a machine on soft ground.

INT-3-2-4

⚠ WARNING

Hot Coolant

The cooling system is pressurised when the engine is hot. Hot coolant can spray out when you remove the filler cap. Let the system cool before removing the filler cap. To remove the cap; turn it to the first notch and let the system pressure escape, then remove the cap.

INT-3-2-9_1

⚠ WARNING

Always wear safety glasses when dismantling assemblies containing components under pressure from springs. This will protect against eye injury from components accidentally flying out.

GEN-6-2

⚠ CAUTION

Rams

The efficiency of the rams will be affected if they are not kept free of solidified dirt. Clean dirt from around the rams regularly. When leaving or parking the machine, close all rams if possible to reduce the risk of weather corrosion.

INT-3-2-10

⚠ CAUTION

Cleaning

Cleaning metal parts with incorrect solvents can cause corrosion. Use only recommended cleaning agents and solvents.

INT-3-2-11

⚠ WARNING

When using cleaning agents, solvents or other chemicals, you must adhere to the manufacturer's instructions and safety precautions.

GEN-1-9

CAUTION

'O' rings, Seals and Gaskets

Badly fitted, damaged or rotted 'O' rings, seals and gaskets can cause leakages and possible accidents. Renew whenever disturbed unless otherwise instructed. Do not use Triochloroethane or paint thinners near 'O' rings and seals.

INT-3-2-12

WARNING

Hydraulic Hoses

Damaged hoses can cause fatal accidents. Inspect the hoses regularly for:

- **Damaged hose ends**
- **Chafed outer covers**
- **Ballooned outer covers**
- **Kinked or crushed hoses**
- **Embedded armouring in outer covers**
- **Displaced end fittings.**

INT-3-3-2

CAUTION

Waxoyl contains turpentine substitute which is flammable. Keep flames away when applying Waxoyl. Waxoyl can take a few weeks to dry completely. Keep flames away during the drying period.

Do not weld near the affected area during the drying period. Take the same precautions as for oil to keep Waxoyl off your skin. Do not breathe the fumes. Apply in a well-ventilated area.

5-3-1-9

WARNING

Working Under the Machine

Make the machine safe before getting beneath it. Ensure that any fitments on the machine are secure; engage the park brake, remove the starter key, disconnect the battery.

INT-3-3-8_2

WARNING

Certain seals and gaskets (e.g. crankshaft oil seal) on JCB machines contain fluoroelastomeric materials such as Viton, Fluorel and Technoflon. Fluoroelastomeric materials subjected to high temperatures can produce highly corrosive hydrofluoric acid. THIS ACID CAN SEVERELY BURN.

New fluoroelastomeric components at ambient temperature require no special safety precautions.

Used fluoroelastomeric components whose temperatures have not exceeded 300°C (572°F) require no special safety precautions. If evidence of decomposition (e.g. charring) is found, refer to the next paragraph for safety instructions DO NOT TOUCH COMPONENT OR SURROUNDING AREA.

Used fluoroelastomeric components subjected to temperatures greater than 300°C (572°F) (e.g. engine fire) must be treated using the following safety procedure. Make sure that heavy duty gloves and special safety glasses are worn:

1 **Thoroughly wash contaminated area with 10% calcium hydroxide or other suitable alkali solution, if necessary use wire wool to remove burnt remains.**

2 **Thoroughly wash contaminated area with detergent and water.**

3 **Contain all removed material, gloves etc. used in this operation in sealed plastic bags and dispose of in accordance with Local Authority Regulations.**

DO NOT BURN FLUOROELASTOMERIC MATERIALS.

INT-3-3-5_3

WARNING

Protect your eyes when grinding metal. Wear safety glasses or goggles. Remove or protect any combustible materials from the area which could be ignited by sparks.

GEN-1-12

⚠ WARNING

To avoid burning, wear protective gloves when handling hot components. To protect your eyes, wear goggles when using a wire brush to clean components.

HYD-1-3

⚠ WARNING

Arc Welding

To prevent the possibility of damage to electronic components, disconnect the battery and the alternator before arc-welding on the machine or attached implements.

If the machine is equipped with sensitive electrical equipment, i.e. amplifier drivers, electronic control units (E.C.U.s), monitor displays, etc., then disconnect them before welding. Failure to disconnect the sensitive electrical equipment could result in irreparable damage to these components.

Parts of the machine are made from cast iron; welds on cast iron can weaken the structure and break. Do not weld cast iron. Do not connect the welder cable or apply any weld to any part of the engine.

Always connect the welder earth (ground) cable to the same component that is being welded, i.e. boom or dipper, to avoid damage to pivot pins, bearings and bushes. Attach the welder earth (ground) cable no more than 0.6 metres (2 feet) from the part being welded.

INT-3-1-15_2

⚠ WARNING

Counterweights

Your machine may be fitted with counterweights. They are extremely heavy. Do not attempt to remove them.

INT-3-2-5

⚠ WARNING

Turning the Engine

Do not try to turn the engine by pulling the fan or fan belt. This could cause injury or premature component failure.

0094

⚠ WARNING

Accumulators

The accumulators contain hydraulic fluid and gas at high pressure. Prior to any work being carried out on systems incorporating accumulators, the system pressure must be exhausted by a JCB distributor, as the sudden release of the hydraulic fluid or gas may cause injury.

INT-3-1-17

⚠ WARNING

An exploding tyre can kill. Inflated tyres can explode if over-heated or over-inflated. Follow the instructions given when inflating the tyres. Do not cut or weld the rims. Use a tyre/wheel specialist for all repair work.

2-3-2-7_2

⚠ WARNING

Jacking

A machine can roll off jacks and crush you unless the wheels have been chocked. Always chock the wheels at the opposite end of the machine that is to be jacked. Do not work underneath a machine supported only by jacks. Always support a jacked-up machine on axle stands before working underneath it.

INT-3-2-8

⚠ WARNING

Under no circumstances must the engine be run with the transmission in gear and only one driving wheel jacked clear of the ground, since the wheel on the ground will move the machine.

INT-3-1-16

⚠ WARNING

Wheels and tyres are heavy. Take care when lifting or moving them.

Store with care to ensure that they cannot fall and cause injury.

13-3-1-7_1

CAUTION

Never use water or steam to clean inside the cab. The use of water or steam could damage the on-board computer and render the machine inoperable. Remove dirt using a brush or damp cloth.

8-3-4-8

WARNING

Boom Safety Strut

A raised boom can drop suddenly and cause serious injury. Before working under a raised boom, fit the boom safety strut. See Boom Safety Strut, MAINTENANCE section.

5-1-5-7

Safety Decals

⚠ WARNING

Decals

Decals on the machine warn you of particular hazards. You can be injured if you do not obey the decal safety instructions.

Each decal is attached close to a part of the machine where there is a possible hazard. Make sure replacement parts include warning decals where necessary.

Keep all decals clean and readable. Replace lost or damaged decals. Each decal has a part number printed on it, use this number to order a new decal from your JCB distributor.

INT-3-3-3_1

⚠ WARNING

If you need eye-glasses for reading, make sure you wear them when reading the safety decals. Decals are strategically placed around the machine to remind you of possible hazards. Do not over-stretch or place yourself in dangerous positions to read the decals.

INT-3-3-4_1

General Procedures

Introduction

When work is done on the machine it is important that the correct care is taken. This will help to prevent personal injury and reduce the risk of component failure.

As part of the procedures in this manual you will need to do some general procedures. Two examples of these general procedures are; parking the machine and making it safe, and venting hydraulic pressure.

These procedures are given here as an alternative to again and again in the manual. Where applicable you will see a cross reference to this section so that you can refer to the detailed procedures.

Related Topics

Table 1. Related Topics in This Publication

The table lists other topics in the manual that contain information related to this topic. Refer to the applicable topics to complete your procedures. Where applicable the text in this section contains cross references to this page to help you find the correct information. Some machines have different systems and devices. Make sure you refer to the correct topic, refer to ***Section 1 - Applications*****.**

Sections	Topic Titles	Sub Titles
1	***General Information***	ALL
3	***Access Panels***	ALL

Parking the Machine and Making it Safe

1 Position the machine on firm level ground. If possible choose an area that is clean and dry. When possible park the machine in a covered area if procedures include work on the hydraulic or fuel systems.

2 Lower attachments to the ground and if necessary, remove them. Refer to the correct documents and procedures.

3 If necessary install the boom safety strut. ⇨ *Boom Safety Strut (2-20)*

4 Stop the engine and apply the park brake.

5 Vent the hydraulic pressure. ⇨ *Venting Hydraulic Pressure (2-23)*

6 Remove the starter key.

7 Let the machine cool sufficiently before you do work on, or near to, the engine or hydraulic system.

8 If procedures include work on the electrical system disconnect the battery. ⇨ *Battery Disconnection/ Connection (2-29)*

⚠ WARNING

Communications

Bad communications can cause accidents. If two or more people are working on the machine, make sure each is aware of what the others are doing. Before starting the engine make sure the others are clear of the danger areas; examples of danger areas are: the rotating blades and belt on the engine, the attachments and linkages, and anywhere beneath or behind the machine. People can be killed or injured if these precautions are not taken.

INT-3-1-5

Boom Safety Strut

Note: *If you lift the boom to get access for maintenance, you must install the maintenance strut on the boom.*

Installing

⚠ WARNING

You could be killed or injured if the boom drops while you are working under it. Fit the safety strut as instructed before doing any maintenance work with the boom raised.

Keep people away from the machine while you fit or remove the strut.

5-3-1-2_1

Before installing the safety strut remove any load on the forks and make sure that buckets or attachments are empty.

1 Fully retract the boom (unless it necessary to extend it for maintenance). Lift the boom sufficiently to install the strut.

2 Stop the engine. Make sure the park brake is engaged and the transmission is in neutral. Remove the starter key.

⚠ CAUTION

You will have to climb onto the machine to fit or remove the strut. Take care, especially if the machine is wet. Remove mud and oil before climbing onto the machine. Do not use the exhaust as a handhold. It can burn you.

5-3-1-4_1

3 Remove the strut from its stowage position **A**.

The stowage location for the boom safety strut can change with each machine. ⇨ ***Table 2. Safety Strut Stowage Locations (2-20)***.

4 Put the strut **B** around the lift ram piston rod. Use the strap to attach it to the ram piston rod.

5 To prevent boom creeping down and causing injury the boom must be lowered onto the strut.

Note: *Lower the boom carefully, to prevent possible damage to the strut. Stop as soon as the weight of the boom is on the strut.*

6 Disconnect the battery to prevent accidental operation of the engine.

7 If necessary, put chocks against the two sides of the wheels before you get below the machine.

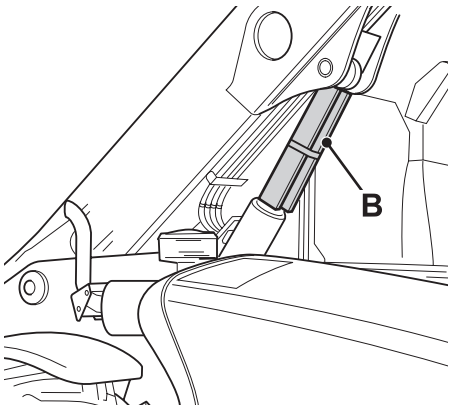

Fig 1.

Table 2. Safety Strut Stowage Locations

Model	Stowage Position
531-70, 533-105, 535-95, 536-60, 536-70, 541-70	⇨ ***Fig 2. (2-21)***
535-125 HiViz, 535-140 HiViz, 535-125	⇨ ***Fig 3. (2-21)***
540-140, 540-170	⇨ ***Fig 4. (2-21)***
526-56	⇨ ***Fig 5. (2-21)***

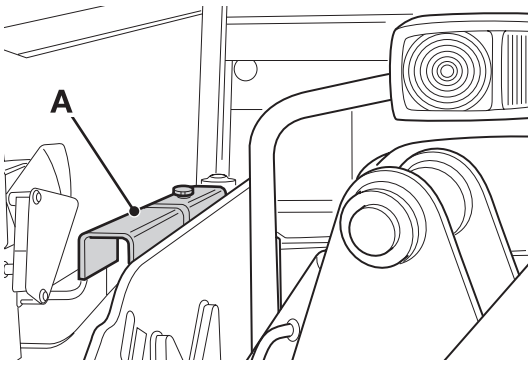

Fig 2.

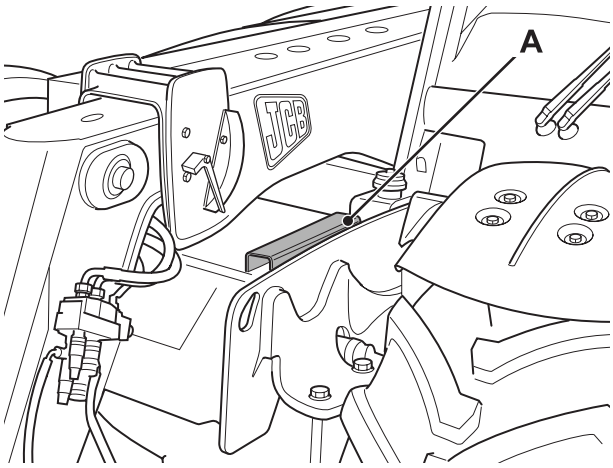

Fig 5.

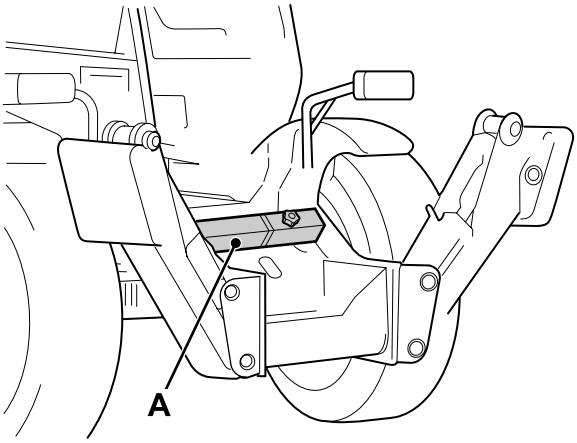

Fig 3.

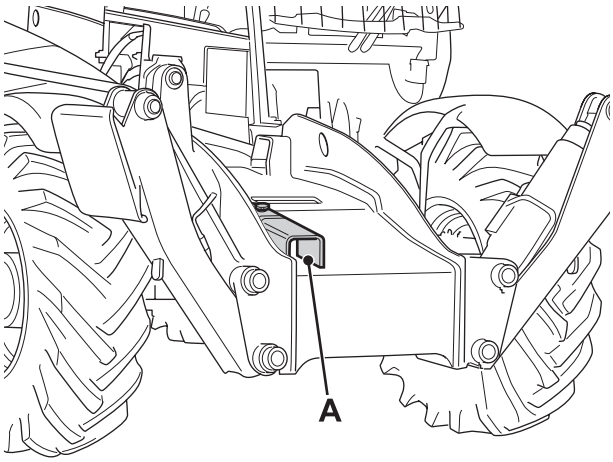

Fig 4.

Removing

⚠ WARNING

You could be killed or injured if the boom drops while you are working under it. Fit the safety strut as instructed before doing any maintenance work with the boom raised.

Keep people away from the machine while you fit or remove the strut.

5-3-1-2_1

1 Lift the boom to remove the weight from the strut.

2 Stop the engine. Make sure the park brake is engaged and the transmission is in neutral. Remove the starter key.

⚠ CAUTION

You will have to climb onto the machine to fit or remove the strut. Take care, especially if the machine is wet. Remove mud and oil before climbing onto the machine. Do not use the exhaust as a handhold. It can burn you.

5-3-1-4_1

3 Remove the strut.

4 Attach the strut to its stowage position.

The stowage location for the boom safety strut can change with each machine. ⇨ *Table 2. Safety Strut Stowage Locations (2-20)*.

Venting Hydraulic Pressure

WARNING

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before disconnecting or connecting hydraulic hoses or couplings, vent the pressure trapped in the hoses in accordance with the instructions given in this publication.

HYD-1-5

Important: *This procedure is only to be used before disconnecting hydraulic hoses. Before removing other hydraulic components refer to the correct Removal procedure.*

1 Park the machine and make it safe. ⇨ ***Parking the Machine and Making it Safe (2-19)***.

2 If necessary install the boom safety strut. ⇨ ***Boom Safety Strut (2-20)***. Stop the engine.

3 Carefully remove the hydraulic tank filler cap and vent the hydraulic pressure as follows:

a For manually operated services, operate the controls of the service to be disconnected.

b For electrical and pilot operated services, turn the starter key to the ON position but DO NOT start the engine.

Operate the controls of the service to be disconnected.

Note: *Make sure that the pressure is vented correctly. Electrical and pilot services have a small quantity of accumulated pressure available for venting.*

4 Refit the hydraulic tank filler cap.

Connecting/Disconnecting Hydraulic Hoses

Introduction

The following paragraphs describe how to connect and disconnect hydraulic hoses safely.

Connecting the Hoses

1 Connect the hoses.

a For Quick Release Couplings refer to the correct data. ⇨ *Quick Release Couplings (2-25)*

b For all other hose connections, use correct tools and ensure that connections are not cross-threaded. Support the weight of the hose until the connection is made. Do not exceed the recommended torque loading.

⚠ WARNING

Fluid Under Pressure

Fine jets of fluid at high pressure can penetrate the skin. Keep face and hands well clear of fluid under pressure and wear protective glasses. Hold a piece of cardboard close to suspected leaks and then inspect the cardboard for signs of fluid. If fluid penetrates your skin, get medical help immediately.

INT-3-1-10_2

2 Check for leaks as follows:

a Start the engine.

b Operate the controls to pressurise the required hose.

c Switch off the engine. Remove the starter key. Check for signs of leakage at the hose connections.

Disconnecting the Hoses

1 Vent the hydraulic pressure as described on this page.

2 Disconnect the hoses.

a For Quick Release Couplings see the procedures in this section. ⇨ *Quick Release Couplings (2-25)*

b For all other hose connections, plug both sides of the connection to prevent loss of fluid.

3 Check for leaks. See step 2, ⇨ *Connecting the Hoses (2-24)*

Quick Release Couplings

T4-001

Connecting and Disconnecting

Flat face quick release couplings allow the operator to remove and install attachments swiftly and efficiently. Generally, your machine pipework will have female couplings **A** fitted, and the optional attachment hoses will have male couplings **B** fitted. ⇒ *Fig 6. (2-26)*.

The quick release couplings should be trouble free and relatively easy to connect and disconnect, provided they are kept clean and used correctly. The recommendations listed below should always apply when using flat face quick release couplings.

Finally, please read the correct fitting and releasing procedures before installing or removing any optional attachment fitted with quick release couplings.

Quick Release Couplings - Do's and Don'ts

- Do wipe the two faces of the coupling and make sure they are clean before connecting.
- Do make sure the outside sleeve (female coupling) is pulled back when disconnecting.
- Do connect and disconnect a new coupling two or three times to 'work' the PTFE seals - sometimes a new coupling will stick if the seals have not been 'worked'.
- Do use a spanner on the hexagon flats of the coupling when fitting adaptors.
- Do use a rubber or hide hammer to disconnect a coupling if it sticks - sticking may occur if there is dirt present in the coupling.
- Don't attempt to re-connect a damaged half coupling - this will destroy the seals and necessitate replacing both half couplings.
- Don't leave the coupling where it may be run over by a machine or otherwise crushed - this will distort the coupling sleeve and prevent correct connection and disconnection.
- Don't clamp on the smooth diameter of the coupling when fitting adaptors - always use the hexagon.
- Don't try to turn the sleeve (female coupling) when the coupling has been disconnected - the locking ball will wedge underneath the sleeve and destroy the coupling.
- Don't damage the faces of the couplings - this can prevent connection and disconnection, or damage seals and cause leakage.
- Don't try to dismantle the couplings - they are non serviceable parts. If a coupling is damaged it should be replaced with a new one.

⚠ WARNING

Hydraulic fluid at pressure can injure you. Make the machine safe before connecting or disconnecting quick release couplings; stop the engine and then operate the attachment control a few times to vent residual hydraulic pressure in the attachment hoses.

2-4-1-11

⚠ WARNING

The external surfaces of the couplings must be clean before connecting or disconnecting. Ingress of dirt will cause fluid leaks and difficulty in connecting or disconnecting. You could be killed or seriously injured by faulty Quick Release Couplings.

2-4-1-15

Before connecting or removing any hydraulic hose, residual hydraulic pressure trapped in the service hose line must be vented. Make sure the hose service line has been vented before connecting or removing hoses.

Connecting Quick Release Couplings

1 Remove any residual hydraulic pressure trapped in the service line hose.

2 Wipe the two faces of the male and female couplings and make sure they are clean.

3 Make sure that ball **6-C** in the female coupling is located in one of its slots.

4 Fit the male coupling into the female coupling; To ensure that the coupling is not accidentally released, rotate sleeve **6-E** half a turn and make sure that the locking ball **6-C** does not align with the slot **6-D**.

Disconnecting Quick Release Couplings

1 Remove any residual hydraulic pressure trapped in the service line hose.

2 Align the slot **6-D** with ball **6-C**.

3 Pull back sleeve **6-E** to release the coupling.

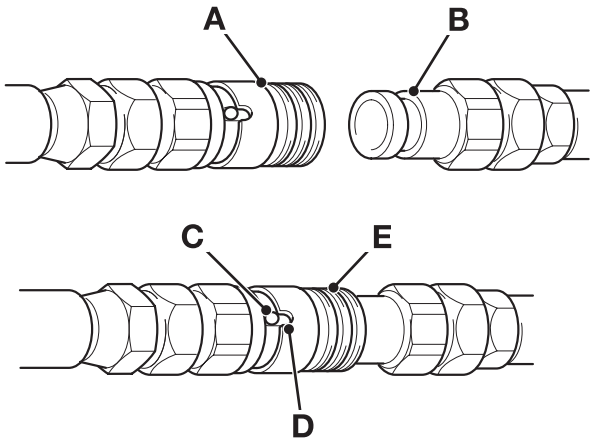

Fig 6.

Hydraulic Contamination

TE-002_2

Hydraulic Fluid Quality

Construction machinery uses a large volume of fluid in the hydraulic system for power transmission, equipment lubrication, rust prevention and sealing. According to a survey conducted by a pump manufacturer, seventy per cent of the causes of problems in hydraulic equipment were attributable to inadequate maintenance of the quality of the hydraulic fluid. Therefore, it is obvious that control of the quality of the hydraulic fluid helps prevent hydraulic equipment problems and greatly improves safety and reliability. Furthermore from an economic angle it extends the life of the hydraulic fluid if quality is maintained.

Effects of Contamination

Once inside the system, hydraulic circuit contaminants greatly effect the performance and life of hydraulic equipment. For example, contaminants in a hydraulic pump develop internal wear to cause internal leakage and hence lower discharges. Wear particles generated will circulate with the hydraulic fluid to cause further deterioration in the performance of this and other equipment. Contaminants also enter principal sliding sections of the equipment causing temporary malfunction, scuffing, sticking and leakage and can lead to major problems.The main contaminants can be classified as follows:

1 **Solid Particles** - sand, fibres, metallic particles, welding scale, sealing materials and wear particles etc.

2 **Liquid** - usually water and incompatible oils and greases.

3 **Gases** - Air, sulphur dioxide etc. which can create corrosive compounds if dissolved in the fluid.

These contaminants can appear during manufacture, assembly and operation.

Cleaning Operation

The purpose of cleaning oil is to remove contaminants of all types and sludge by filtering hydraulic fluid through a cleaning unit. ⇨ *Fig 7. (2-27)*. General Bulletin 011 also refers.

Procedure

Connect the cleaning unit in place of the hydraulic filter. ⇨ *Fig 7. (2-27)*. Run the system for sufficient time to pump all the hydraulic fluid through the unit. Disconnect the cleaning unit and reconnect the filter. Top up the system with clean hydraulic fluid as required.

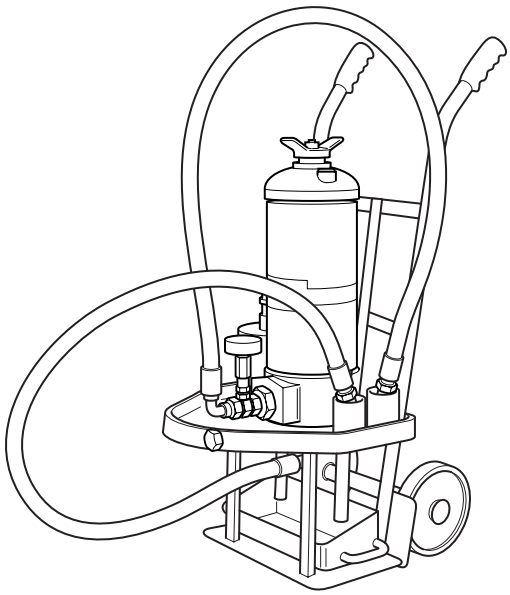

Fig 7. Cleaning Unit

Contaminant Standards

Dirt that damages your system is in many cases too small to be seen with the eye. The particle size is measured in microns.

1 micron = 0.001 mm (0.0000394 in).

Listed below are a few typical comparisons:

- Red Blood Cell = 8 microns (0.008 mm, 0.000315 in)
- Human Hair = 70 microns (0.07 mm, 0.00275 in)
- Grain of Salt = 100 microns (0.1 mm, 0.00394 in)

Smallest particle visible to the naked eye is 40 microns (0.00157) approximately.

Standards will often be quoted to ISO (International Standards Organisation) for which literature can be obtained.

Filters

The filter assembly fitted to all product ranges is designed to filter all the contamination that is generated through use to the required level of cleanliness. The filter must be serviced to the requirements of the machine Service Schedules.

To ensure optimum performance and reliability it is important that the machines hydraulic system is serviced periodically in accordance with the manufacturers requirements.

Battery Disconnection/Connection

WARNING

Keep metal watch straps and any metal fasteners on your clothes, clear of the positive (+) battery terminal. Such items can short between the terminal and nearby metal work. If it happens you can get burned.

5-2-2-4

Disconnection

1 Get access to the battery. See ⇨ *Related Topics (2-18)*

2 Remove the leads. Disconnect the earth (-) terminal first.

Connection

1 Check the battery.

a If the terminal is dirty, clean the post.

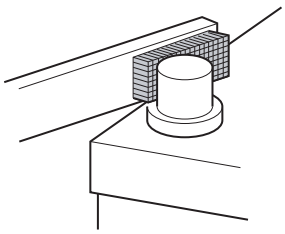

Fig 8.

b If the terminal post is corroded and generates white powder wash the terminal with hot water. If considerable corrosion is detected, clean with a wire brush or abrasive paper.

c After cleaning, apply a thin coat of petroleum jelly to the terminal.

2 Re-connect the leads. Connect the earth (-) terminal last.

3 Close and lock the access panels.

Removing and Replacing Components

Renewal of oil seals, gaskets, etc., and any component showing obvious signs of wear or damage is expected as a matter of course. It is expected that components will be cleaned and lubricated where appropriate, and that any opened hose or pipe connections will be blanked to prevent excessive loss of hydraulic fluid and ingress of dirt.

Battery Charging System Precautions

Obey the procedures below to prevent damage to the alternator and battery.

1 Ensure that the battery negative terminal is connected to the earthing cable.

2 Never make or break connections to the battery or alternator, or any part of the charging circuit whilst the engine is running. Disregarding this instruction will result in damage to the regulator or rectifying diodes.

3 Main output cables are 'live' even when the engine is not running. Take care not to earth connectors in the moulded plug if it is removed from the alternator.

4 When arc welding on the machine, protect the alternator by removing the moulded plug (or if separate output cables fitted, remove the cables).

5 If slave starting is necessary, connect the second battery in parallel without disconnecting the vehicle battery from the charging circuit. The slave battery may then be safely removed after a start has been obtained. Take care to connect batteries positive to positive, negative to negative.

Hydraulic Rams

Installation

1 Precautions when installing the ram on the machine.

a When installing and removing from the machine, suspend the ram safely.

b Suspending the ram by the piping is not only dangerous, but can also cause damage to the cylinder.

c Secure the piston rod with a band. It is very dangerous if the rod extends unexpectedly. Also, the rod can be damaged and become unusable.

2 Welding after installing the ram may result in damage.

a If electric welding is done even at a point away from the ram, there may be sparking inside the ram and it will become necessary to replace the ram with a new one.

3 When painting the machine, mask the ram.

a If paint adheres to the rod surface or to the wiper ring and the ram is operated, the wiper ring will not function properly and foreign matter and paint can easily enter the ram. This will cause damage to the seals, drastically shortening the life of the ram.

4 Install the ram only when it is clean.

Caution During Use

1 Use only under designated conditions.

a If hydraulic oil other than the designated oil is used, the seals quickly degenerate and become damaged. If the relief valve is set at a value higher than specified, it may cause ram damage and is dangerous.

b In high temperature environments (approx. 90°C and above) or low temperature environments (below -20°C), seals quickly become damaged. Special seal materials are necessary so check to see if the ram that you are using is suitable or not.

c The number one cause of ram oil leakage is rod damage. Be careful not to damage the rod.

2 Warm up sufficiently before beginning work.

a In cold conditions the rod seals may be frozen, so if the ram is operated at maximum pressure and maximum speed, the seals will be damaged.

b There is a large amount of air in a new ram or one which has been left for a long time, so the ram will not operate smoothly. Also, if pressure is applied suddenly without bleeding the air, high temperatures will be generated due to adiabatic compression and the seals may burn.

c Before beginning work, always move the ram at full stroke with no load and expel air from the cylinder.

3 When stopping or storing, do it at a safe and fixed position.

a The installed ram cannot maintain the same position for a long period of time, because the oil inside the ram may leak and the hydraulic oil volume decreases as it cools. Stop or store the machine in a safe and fixed position.

Maintenance, Inspection Points

1 Carry out daily maintenance and inspection.

a The key point for correct long-term ram function is daily maintenance and inspection. Carry out maintenance and inspection so that the ram functions fully at all times. Always remove any mud, water, dust or oil film adhering to the rod and keep it in normal condition. However, when cleaning the wiper ring and seals, do not get them wet with water but wipe clean with a rag. To prevent rust forming during storage, the amount of exposed ram piston rod should be kept to a minimum. If leaving for more than one week, apply a light coating of suitable grease or petroleum jelly to the exposed part of the ram piston rod.

2 Use genuine JCB parts when replacing parts.

a If parts other than genuine JCB parts are used, the desired results may not be obtained. Use only genuine JCB parts.

3 Caution during dismantling and reassembly.

a Dismantling the ram while it is still installed on the machine can be dangerous as unexpected movements of the machine can occur. Remove the ram from the machine and then dismantle.

b If reassembled with dirty hands, foreign matter can enter the ram causing a shorter life span and also the other hydraulic equipment may be damaged. Reassemble in a clean state.

c Follow the instructions in the diagrams regarding torque tightening for screwed parts. If the torque is too high or too low, it can cause damage.