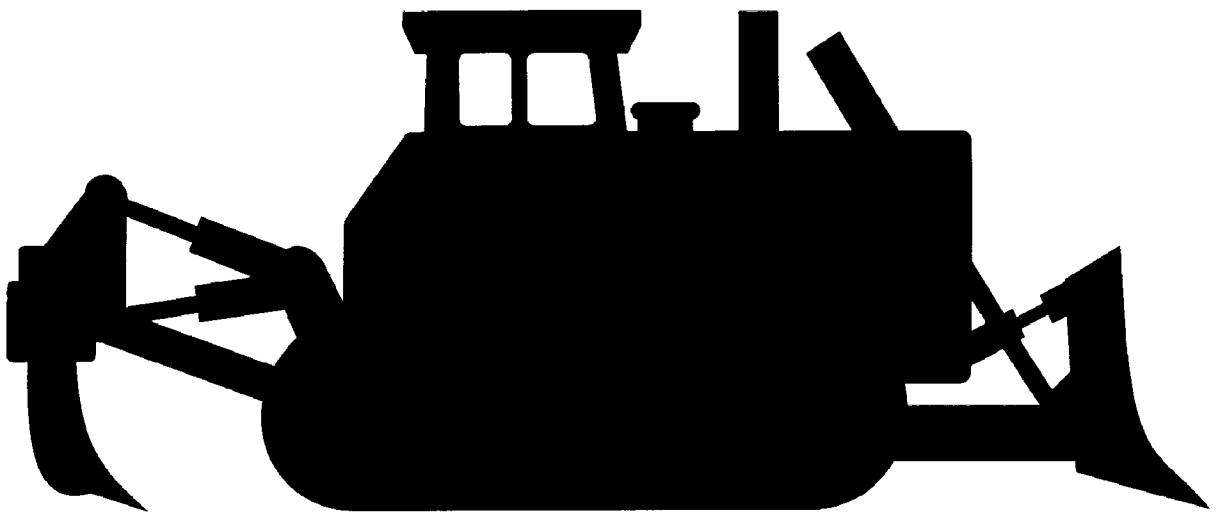


OPERATOR'S MANUAL

TD-20H

SERIAL NUMBERS
5201 AND UP



DRESSTA Co. Ltd.

A JOINT VENTURE OF KOMATSU AMERICA INTERNATIONAL CO. AND HUTA STALOWA WOLA S.A



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DUE TO THIS CONTINUOUS PROGRAM OF RESEARCH AND DEVELOPMENT, PERIODIC REVISIONS MAY BE MADE TO THIS PUBLICATION. IT IS RECOMMENDED THAT CUSTOMERS CONTACT THEIR DISTRIBUTOR FOR INFORMATION ON LATEST REVISION.

CONTENTS

1. INTRODUCTION
2. SAFETY PRECAUTIONS
3. MACHINE TRANSPORT AND STORAGE
4. OPERATING
5. MAINTENANCE
6. SPECIFICATIONS

FOREWORD

***Welcome to the growing group of value-conscious people who operate
DRESSTA machines!***

This manual covers the instructions for safe operation, lubrications, adjustments and maintenance for normal daily care. These instructions are divided into six sections to simplify your reference to the information most important to you. Refer to the contents page at the beginning of the section for a complete list of the subjects covered except for Section 1, which should be read entirely.

This manual has been prepared to help you operate and maintain your machine with utmost efficiency and safety. Read this manual thoroughly and learn your machine before you attempt to operate it.

It is our policy to improve our products whenever it is possible and practical to do so. We reserve the right to make changes or add improvements at any time without incurring any obligation to install such changes on products sold previously.

Due to this continuous program of research and development, periodic revisions may be made to this publication. It is recommended that customers contact their distributor for information on the latest revision.

DRESSTA Co. Ltd.

SECTION INDEX

SECTION 1 - INTRODUCTION

This section discusses the use of this manual, serial number locations.

SECTION 2 - SAFETY PRECAUTIONS

This section lists safety rules concerning personal safety. Read this section carefully! Maintain this manual and review it frequently for continuing safe operation and instructing new operators.

SECTION 3 - MACHINE TRANSPORT AND STORAGE

This section discusses how to ship or store this machine.

SECTION 4 - OPERATING

The front portion of this section provides you with instructions for trouble free operation of the machine, machine precautions and a universal symbol chart, text and illustrations for instruments and controls. The instrument and controls area is designed to tell you „where it is, what it does and how to use it". Read this area carefully. The remaining portion of this section outlines and illustrates the step-by-step procedures for starting, operating and stopping the machine and discusses a few operating suggestions and techniques and simple ideas to help ease the work and lengthen the useful life of your machine.

SECTION 5 - MAINTENANCE

The beginning of this section outlines a complete scheduled maintenance program, which helps to reduce down-time and expense, and increase the profit and work from your machine. Read and use this area. Following the maintenance program are the lubrication recommendations and requirements for the machine. The remainder of the section is devoted to clearly explaining the "how to" of the many maintenance and adjustment procedures listed in the maintenance program. The explanations are prepared in an easy style to help you "do it yourself" and get it right.

SECTION 6 - SPECIFICATIONS

This section covers the diagrams, general dimensions and weights, refill capacities, ground speeds and the standard and special torque values.

SECTION CONTENTS

1. INTRODUCTION

1.1. Introduction	3
1.2. Serial Numbers.....	4

2. SAFETY PRECAUTIONS

2.1. General	3
2.2. Before Starting the Engine	4
2.3. Operation	5
2.4. Maintenance	7
2.5. Shutdown	10
2.6. Safety Product Graphic Location	11

3. MACHINE TRANSPORT AND STORAGE

3.1. Machine Transport	3
3.2. Lifting Machine on Slings	3
3.3. Moving a Disabled Machine	4
3.4. Machine Storage	5

4. OPERATING

4.1. Machine Precautions	3
4.2. Universal Symbols for Instruments and Controls	4
4.3. Instrument Panel	6
4.4. Cab Controls	9
4.5. Controls and Adjustment	10
4.6. Starting the Engine	17
4.7. Stopping the Engine	20
4.8. Driving the Machine	21
4.9. Shifting the Transmission	22
4.10. Converter Overheating	22
4.11. Steering the Machine	23
4.12. Locking Both Tracks	23
4.13. Downgrade Operation	24
4.14. Operating Over an Obstruction	24
4.15. Stopping the Machine	24
4.16. Parking the Machine	25
4.17. Operating Mounted Equipment	26
4.18. Operating Techniques	32
4.19. Economical Operation of the Machine	40

5. MAINTENANCE

5.1. Service Precautions	3
5.2. Scheduled Maintenance Guide.....	4
5.3. Maintenance and Service Chart	7
5.4. Lubrication	11
5.5. Seasonal Preparation	14
5.6. Air Cleaning System	15
5.7. Belts	19
5.8. Cooling System	24

5.9.	Fan and Fan Hub	26
5.10.	Electrical System	26
5.11.	Engine	29
5.12.	Fuel System	33
5.13.	Hydraulic System	35
5.14.	Lubrication Fittings	40
5.15.	Mounted Equipment	42
5.16.	Safety Belt	48
5.17.	Final Drives	49
5.18.	Transmission System	50
5.19.	Undercarriage	55
5.20.	Adjusting Hand and Foot Controls	60
5.21.	Cab and ROPS	62

6. SPECIFICATIONS

6.1.	Application	3
6.2.	Technical Description	3
6.3.	Kinematic Diagram	5
6.4.	Equipment Hydraulic System Diagram	7
6.5.	Transmission Hydraulic System Diagram	9
6.6.	Wiring Diagram	11
6.7.	Specifications	15
6.8.	Special Torque's	19
6.9.	Standard Metric Fasteners	22
6.10.	Torque Values For Standard English Fasteners	22
6.11.	Torque Values For Split Flange Connections	23
6.12.	Torque Values For Hydraulic Tubes and Fittings	24
6.13.	Torque Values For Hose Clamps	24
6.14.	Torque Values For Air Conditioning Tubes and Fittings	25
6.15.	Torque Values For Air Conditioning O-Ring Connections	25

SECTION 1
INTRODUCTION

SECTION CONTENTS

1.1. Introduction 3
1.2. Serial Numbers 4

1.1. INTRODUCTION

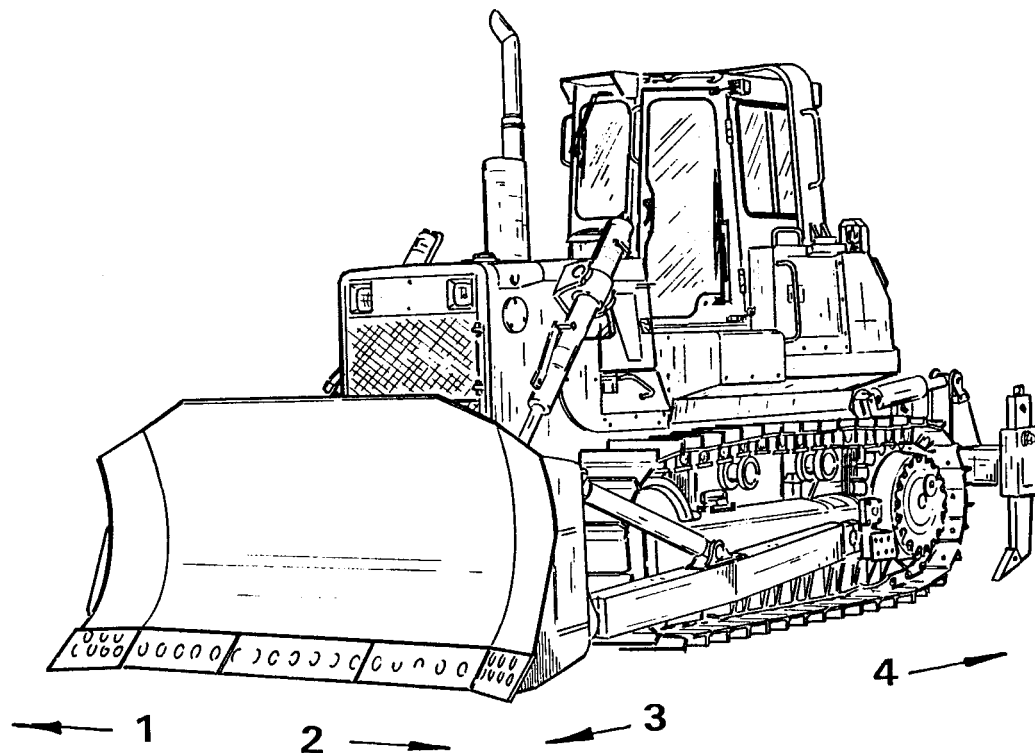


Fig. 1.1. TD-20 Series H Crawler Tractor Equipped with Bulldozer Blade and Cab

1 - Right Hand Side of the Machine
 2 - Left Hand Side of the Machine

3 - Front of the Machine
 4 - Rear of the Machine

GENERAL

Throughout this manual there will be two types of cross references. One type is to a heading in another section. The other is to a heading within the same section. Unless it is otherwise stated, references will be to the same section. Refer to the section contents page at the beginning of the individual sections for specific page numbers.

Throughout this manual the use of the terms “left”, “right”, “front”, and “rear” must be understood to avoid confusion when following instructions. “Left” and “right” indicate the left and right sides of the machine when facing forward in the operator’s seat. See Fig. 1.1.

Some illustrations are of general application of this model and may not show your machine accurately in all details.



WARNING! This symbol and text with bold letters is used throughout this manual to call your attention to instructions concerning personal safety. Observe and follow these instructions. Be certain anyone operating and service this machine is aware of these rules. Failure to follow these rules may result in injury or death.

INTRODUCTION**1.1. INTRODUCTION**

IMPORTANT: This sign and text in italics is used throughout this manual to call your attention to key problems for machine operation. Failure to follow such instructions may result in damage of the machine and heavy material losses.

NOTE: This sign and text in italics is used throughout this manual to call your attention to important function having influence on the right functioning of the machine or for informational purposes.

1.2. SERIAL NUMBERS

The product identification number (P.I.N.) is stamped on a plate attached to the front wall of the control console at the left hand side of the operator's seat (Fig. 1.2). It is also stamped on the rear face of the rear frame in the upper right hand corner (Fig. 1.3).

The bulldozer model designation is stamped on the back of the blade, near the top right hand corner (Fig. 1.4).

All other components having serial numbers are each equipped with a separate serial number plate.

Use serial numbers when requesting information or ordering parts and proper numbers from Parts Catalogue.

1.2. SERIAL NUMBERS

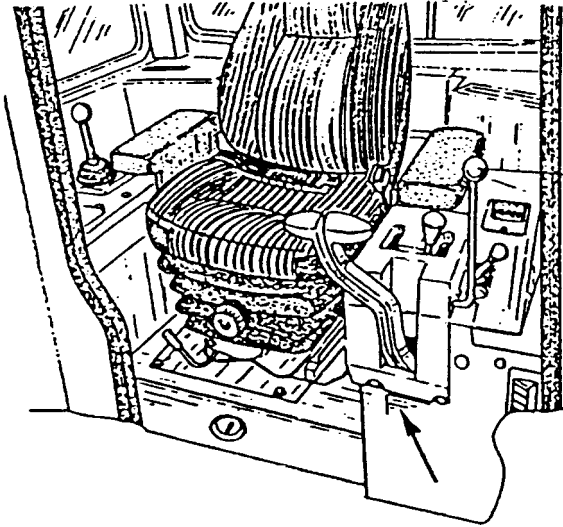


Fig. 1.2. Product Identification Number (P.I.N.)

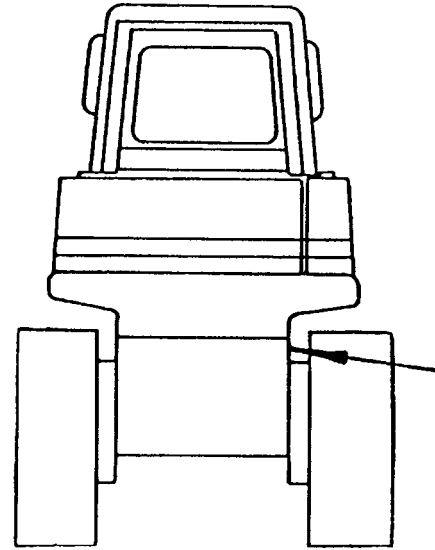


Fig. 1.3. Product Identification Number (P.I.N.)

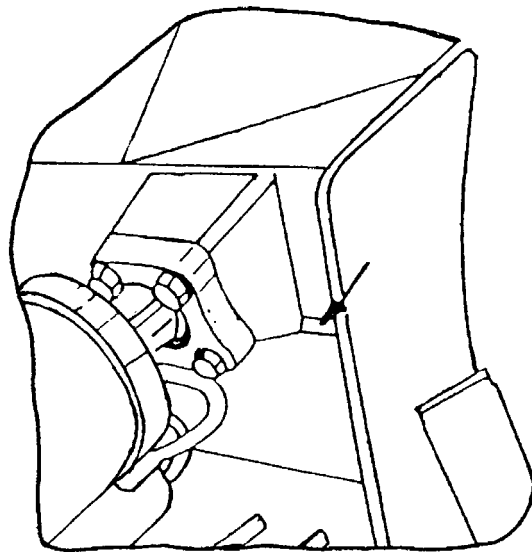


Fig. 1.4. Serial Number Designation of Blade

SECTION 2
SAFETY PRECAUTIONS

SECTION CONTENTS

2.1. General 3
2.2. Before Starting the Engine 4
2.3. Operation 5
2.4. Maintenance 7
2.5. Shutdown 10
2.6. Safety Product Graphic Location 11
 2.6.1. Safety Product Graphic 12

2.1. GENERAL

WORK SAFETY – FOLLOW THESE RULES



WARNING! This symbol and text with bold letters is used throughout this manual to call your attention to instructions concerning personal safety. Observe and follow these instructions. Be certain anyone operating and service this machine is aware of these rules. Failure to follow these rules may result in injury or death.



WARNING! The machine can only be operated by a person who is familiar with this manual, knows operation of the machine and its mechanisms, experienced and properly licensed to operate such machines. Carefully observe and follow all instructions provided in this manual.

Human error is a contributing factor in most equipment-related injuries. Haste, carelessness and lack of training are the primary causes of injuries.

Most operating injuries occur because of excessive speed, loss of control, failure to observe warning signs, slipping or falling while entering for dismounting, a lack of bars on roadways or piles, lack of a ROPS or seat belt, or not watching in the direction of travel.

Most maintenance injuries occur during welding or when using hammers or wrenches. The most common faults are improper work position, a slipped tool, missed aim, a broken tool, flying chips and no welding hood.

Think before you act. A careful operator or maintenance man is the best insurance against an accident.

Always wear proper safety equipment.

Avoid wearing jewelry and loose fitting clothing; they could catch on moving parts, which could result in serious injury or death. Hard hat, sturdy rough-soled work shoes or safety shoes, ear protectors, reflective clothing, safety glasses and heavy gloves may be required. Consult your employer for specific safety equipment requirements.

Each job site and application may have personal safety requirements. Carefully evaluate your particular application and machine for equipment such as heater and defroster, all windshield wipers, warning lights, side view and rearview mirrors, back-up alarms, fire extinguisher, rotating beacons and additional lights. If in doubt, contact your distributor.

The machine should be equipped with a fully charged fire extinguisher. All personnel should be instructed in proper usage. Recharge immediately after use.

Do not jump on or off the machine. Keep two hands and one foot or two feet and one hand in contact with the steps and grab handles and rails at all times. Place objects on machine from ground level before mounting machine.

Electrical system is 24-volt negative ground. When charging battery or starting using booster battery always use the receptacle socket on the left side of engine. When using jumper cables, precautions must be taken to minimize chances of injury or damage to electrical parts.

SAFETY PRECAUTIONS**2.1. GENERAL**

1. Attach one end of jumper cable to positive terminal of booster battery and other end to positive terminal of machine battery.
2. Attach one end of second cable to negative terminal of booster battery and other end to machine's frame away from the battery.
3. To remove cables, reverse above sequence exactly to avoid sparks near the battery.

A frozen battery can explode when the booster cables are attached.

NEVER check battery charge by placing a metal object across the battery posts. The sparks could cause an explosion. Use a voltmeter or areometer for checking.

2.2. BEFORE STARTING THE ENGINE

Never start the engine indoors unless proper exhaust ventilation is provided to remove deadly exhaust gases. Once the engine is operating, move the machine outdoors as soon as possible. Exhaust gases are dangerous and can cause unconsciousness and death.

Always place the gear selector in neutral apply neutral safety lock and lock the parking brake before starting.

The operator must be alert, physically fit and free from the influences of alcohol, drugs or medications that might affect his eyesight, hearing, reactions or judgment.

Observe and know the use of alternate exits from the operator compartment.

Safety must always be the operator's most important concern. He must refuse to operate when he knows it is unsafe and consult his supervisor when safety is in doubt. The best safety device is a safe operator.

Do not use controls or hoses as hand holds when climbing on or off the machine. Hoses and controls can move and do not provide solid support. Movement of the controls may cause inadvertent and unexpected movement of the machine or its equipment.

Follow all machine-mounted safety signs before starting, operating, maintaining or servicing the machine.

Be sure the area of the operator's compartment, all mounting steps and grab handles are free of oil, grease, loose objects, ice and mud to lessen the possibility of slipping. Remove or secure all maintenance and personal items so they will not interfere with the operator or jam the controls.

Perform a visual check of the machine before starting the engine. Look for such things as improper fluid levels, oil leaks, and loose, damaged or missing parts. Do not start the engine until any unsafe conditions are corrected. Secure all caps and filler plugs.

Know and understand the traffic flow patterns of your job and obey flagman, signs and signals.

Before entering the operator's compartment, clear the immediate area surrounding the machine of personnel and obstructions. Walk completely around the machine. After entering the operator's compartment, sound the horn to clear the immediate area of the machine.

Due to the danger of fire and explosion, never check or fill fuel tank or batteries near lighted smoking materials or open flame or sparks.

2.2. BEFORE STARTING THE ENGINE

Check work area for hazardous conditions. Be alert for soft ground conditions, especially when working on slopes, near drop-offs or excavations or fill material, which could lead to sudden tipping of the machine. At night and times of poor visibility, carefully check the work area before moving in with the machine. Use all lights provided.

Keep the windshield, windows and mirrors (if equipped) clean.

2.3. OPERATION

Before starting the engine, be sure you understand all control functions.

Check all controls, including the brakes, decelerator, steering and transmission. Check all gauges, warning lights and safety devices. Correct any malfunctions.

Only one person, the operator, should be permitted to ride on the machine when it is in operation.

Perform an operational check of the machine in a safe area before putting it to work.

Keep operating controls, hands and shoes free of grease, water and mud to insure positive control functions.

If the machine is ROPS equipped, for your personal protection, wear your seat belt.

Before driving the machine, adjust the seat and fasten the seat belt. Adjust the seat belt to fit snugly and flow around the hips to lessen the chance and severity of injury in the event of an accident. Never wear the seat belt across the abdomen.

Check overhead clearance carefully before operating the machine in areas with low overhead clearance, such as guy wires, power lines, bridges, low-hanging tree branches and building entrances or exits. These overhead obstructions could cause an accident.

After starting the engine, but before moving the machine, warn nearby personnel by giving a couple of short horn blasts.

Be sure the rear screen is properly installed on the R.O.P.S. before operating the winch. Operating without properly installed screen could result in serious injuries.

Operate the winch from the driver's seat only.

Always engage the parking brake before winching if the machine is stopped.

Use caution when installing or removing cable from the winch.

Keep all persons clear of a cable under tension.

Never use a cable that is damaged. Failure to follow these precautions could result in serious injuries.

Never mix gasoline, gasohol and/or alcohol with diesel fuel. This practice creates an extreme fire hazard and under certain conditions an explosion, which could result in personal injury or death.

Never remove the fuel tank filler caps or refill the fuel tanks while the engine is running or hot or when the machine is indoors. Fumes are dangerous, a spark or flame could result in a fire or explosion.

2.3. OPERATION

On machines equipped with a suction fan or a reversible fan in the suction position, periodically check the engine exhaust system for leaks. Exhaust gases are dangerous to the operator.

Do not operate the machine in a condition of extreme fatigue or illness.

When pulling or towing with a chain or cable, take up the slack carefully. A sudden jerk could snap the chain or cable causing it to whip dangerously. Do not pull or tow unless the operator compartment is guarded against a whipping chain or cable. Clear personnel from the area.

Be sure that the rear screen is securely fastened to the R.O.P.S. structure. Be sure chains or cables and their anchor points are strong enough to handle expected load. Inspect carefully for flaws before using.

Always wear gloves when handling cables and chains. Avoid looping or knotting the cable or chain. Do not pull with kinked chain or cable as excessively high stress in area of bending may cause a failure in the kinked area. Cables or chains for towing or winching should be fastened to the designated to this purpose attachment points only. Be sure pins are attached securely before pulling.

Stand clear of chains or cables under load.

Keep engine exhaust system and exhaust manifold clear of combustible material for your personal protection.

Know the locations of underground cables, water mains, gas lines, etc. A ruptured gas line or cut electrical cable could result in personal injury or death.

When leaving the machine unattended for any length of time, make sure the transmission shift lever is positioned and locked in neutral (N), the blade is completely lowered, the engine is stopped, the parking brake is applied, and the electrical master switch is in the "off" position. If the machine is equipped with a cab make sure that the cab is locked.

Before operating the machine read and know the Operator's Manual and all Safety Product Graphic.

The roll-over protective structure (ROPS) provides operator protection in the event of machine rollover or upset. This structure is designed to bend during a rollover to protect the operator from sudden impact loads.

Do not smoke when refueling or servicing the machine. A fire could result.
Never place gasoline or diesel fuel in an open pan.

When operating the machine, look in the intended direction of travel to be sure personnel or allied equipment does not interfere with the machine work pattern.

Never try to get on or off the machine while it is moving. A serious injury or death could result.

Never shift the transmission into neutral (N) when traveling downhill. The machine may go out of control and a rollover could result or the transmission, torque converter or engine could be damaged when the transmission is again placed in gear. Always put the transmission in low range position before starting downhill. Use the decelerator and brake pedal to slow the machine.

Avoid side hill travel whenever possible. Drive straight up and down the slope. If the machine starts slipping sideways on a grade, turn downhill immediately.

If possible avoid crossing obstacles such as ridges, rocks or logs. If you can't avoid them, reduce speed and ease over the obstacle at an angle.

2.3. OPERATION

A machine's weight and the vibration it creates can cause the edge of a high wall to collapse. Keep your machine back from the edges of banks and excavations.

Travel slowly in congested areas or on rough ground, slopes or near drop-offs or on snow, ice or slippery surfaces. Maintain a safe distance between your machine and other vehicles according to the condition of the road and load.

Never hold the hydraulic controls in their extreme position after the equipment has reached its maximum travel. This could cause overheating of the hydraulic system.

Never use the blade as a brake except in an emergency.

Do not adjust the seat position while the machine is in motion. A loss of control may result. Completely stop the machine, apply and lock the parking brake and then adjust the seat.

Carry the blade low for maximum stability and visibility.

Where noise exposure exceeds levels defined by proper health and safety authorities and applicable standards wear authorized ear protective equipment.

2.4. MAINTENANCE

Authorized personnel only is allowed to maintain or repair a machine. It is forbidden to allow unauthorized person to control the machine.

Do not hasten. It may cause accident.

Put objects onto machine standing on the ground level before you climb on machine. When service or maintenance requires access to areas that cannot be reached from the ground, use a ladder or platform. If such ladders or platforms are not available, use the machine hand holds and steps provided. Perform all service or maintenance carefully.

Loosen the radiator cap slowly to relieve all pressure in the system and use caution when removing the caps. Loosen the filler cap slowly to relieve the pressure to prevent possible injury. Always vent the hydraulic system before working on any hydraulic component.

Have all equipment resting on the ground or blocking before removing any hydraulic component.

Never work beneath the blade without proper blocking. Improper blocking could result in serious injuries.

Do not attempt to make repairs that you do not understand. Consult you distributor.

Use only approved parts for repairs and maintenance show in your parts catalog. Failure to do so could compromise your personal safety and machine performance and reliability.

Do not attempt to repair a protective structure after an accident. Repaired structures do not provide the original strength and protection. Contact your distributor for information on structure replacement. Do not operate the machine again until the ROPS has been replaced.

Do not cut, grind, weld, drill or tap holes in the ROPS. This could weaken the structure, or affect the overall energy absorption capabilities.

2.4. MAINTENANCE

Never align holes with fingers or hands. Use a proper aligning tool.

Be sure all tools are in good condition. Do not use tools which are worn, bent or have mushroomed heads. Use the proper tool for the job.

Remove sharp edges and burrs from reworked parts.

For field service, move machine to level ground if possible and block the tracks. If work is absolutely necessary on an incline, block the machine and its attachments securely. Move the machine to level ground as soon as possible.

Before working on the machine, turn OFF the electrical system master switch and take it out so no one will start it unexpectedly.

Do not carry loose objects in pockets that might catch on the machine or fall unnoticed into open compartments.

Before working on any part of the engine or electrical system, disconnect the battery ground cable. Tag the cable and all controls to alert personnel that work is in progress.

When it is necessary to make any checks or adjustments with the engine operating, always use two people. One trained person must be in the operator's seat to safeguard the second person making the checks or adjustment.

As an added precaution, when making checks or adjustments with the engine operating, make sure the transmission shift lever is locked in neutral (N), and the parking brake is locked.

Never stand on the tracks or near the blade while the engine is operating.

If the engine is running and the side doors are open or removed be careful of rotating parts such as the fan and belts that can cause serious injury.

Never operate the engine when cleaning or lubricating the machine. Serious injury could result from contacting moving parts.

Use a non-toxic, nonflammable commercial solvent for cleaning parts, unless otherwise specified.

Never use gasoline, diesel fuel, kerosene or other flammable solvents for cleaning part.

Excessive or repeated skin contact with sealant or solvents may cause skin irritation. In case of skin contact, remove sealant or solvent promptly by washing with soap and water. Follow the manufacturer's advice whenever cleaning agents or other chemicals are used.

Lower blade before making hydraulic adjustments. To prevent personal injury, be sure to personnel are standing in the way of the blade when it is being lowered.

Never allow anyone to walk under or be near unblocked raised equipment.

Provide proper ventilation when operating in a closed building to avoid danger of exhaust gases. Exhaust gases are dangerous and can cause unconsciousness and death.

Hydraulic fluid escaping under pressure from a very small hole can be almost invisible, yet have sufficient force to penetrate the skin. Use a piece of cardboard or wood to search for suspected leaks. Do not use hands. If injured by escaping fluid, see a doctor at once. Serious infection or reaction can occur if proper medical treatment is not administered immediately.

When welding, wear proper protective equipment such as a helmet, dark safety glasses, protective clothing, gloves and safety shoes. Wear dark safety glasses near welding. **DO NOT LOOK AT THE ARC WITHOUT PROPER EYE PROTECTION.**

2.4. MAINTENANCE

Wear proper protective equipment such as goggles or safety glasses with side shields, hard hat, safety shoes and heavy gloves when metal or other particles are apt to fly or fall. Many of the machine's parts are hardened and can chip.

Lift and handle all heavy parts with a lifting device of proper capacity. Be sure parts are secured by proper slings and hooks. Use lifting eyes if provided. Warn people in the area to stand clear.

When using compressed air for cleaning parts, wear goggles or safety glasses with side shields. Use a nozzle, which limits the pressure to 200 kPa.

Do not use an open flame to check for leaks or fluid levels anywhere around the machine.

Keep work area clean and dry. Remove oil and water spills immediately.

Do not pile up oily or greasy rags. They are a fire hazard. Store them in an approved, closed metal container.

Use a soft iron or nonferrous hammer to install or remove ripper teeth. It is dangerous to hammer on the teeth. Wear safety glasses with side shields or goggles to reduce the chances of injury.

Batteries give off a highly inflammable gas. Never allow sparks or open flame near the batteries. A fire or explosion could occur.

Do not charge batteries in a closed area. Provide proper ventilation to guard against accidental explosion of an accumulation of the explosive gas given off in the charging process.

When installing batteries, be sure the electrical master switch is in the "off" position. Be sure to connect the positive cable to the positive terminal and the negative (ground) cable to the negative terminal.

Ether starting fluid is flammable. Follow the precautions printed on the container. An explosion can result if sparks or flame contact the ether in the container or if the container is stored in an area in which the temperature exceeds 70°C. Observe the following precautions:

1. Follow the correct method for starting the engine. Refer to "STARTING THE ENGINE" in Section 3.
2. Do not use the ether injector when the ambient temperature is above freezing.
3. For your own personal safety, always remove the ether container when welding, grinding or fusing a torch on the machine.
4. Do not let ether come in contact with your skin, as it can cause localized freezing.
5. Do not breathe the hazardous ether vapor.
6. Keep the fluid container out of the reach of children.
7. Never puncture the fluid container or put it into a fire. Dispose of empty container properly.
8. Do not store fluid containers in the operator's compartment.

Never mix gasoline, gasohol or alcohol with diesel fuel. This creates an extreme fire or explosion hazard, which could result in personal injury or death.

Do not use bleach, color dye or solvents on the seat belt webbing. This may cause a severe loss of tensile strength. This could cause the webbing to break resulting in personal injury. It is recommended that the seat belt be cleaned only with warm water and mild detergent.

SAFETY PRECAUTIONS**2.5. SHUTDOWN**

If parking on or near traffic lanes cannot be avoided, provide appropriate flags, barriers, flares and warning signals. Also provide advance-warning signals in the traffic lane for approaching traffic. Park the machine in a non-operating and non-traffic area. Park machine on level ground whenever possible. If you must park on a slope, park at right angles to the slope. Apply and lock the brake pedal.

Never leave the machine unattended with the engine running.

When leaving the machine unattended, slowly lower the hydraulic equipment to the ground, shift the transmission into neutral and lock the neutral lock lever, shut off the engine, apply and lock the parking brake. Relieve any pressure in the hydraulic system by moving the controls in both directions. Turn off the electrical system master switch and take it out. Always lock up machine when leaving it unattended, including any anti-vandalism attachments.

Do not jump off the machine.

When operating in bad weather and storm lightening is nearby, dismount and seek shelter away from the machine. Lightening will be attracted to the machine and can cause serious injury or death.

When the machine is to be loaded onto a transport truck and trailer do so carefully. Load only when the trailer is level. The steel track shoes will slide easily on the trailer. When the machine is properly positioned chain it securely so it can not move on the trailer.

Keep head, body feet, hands and fingers away from the blade and ripper when they are in a raised position. Do not allow the hydraulic system to support the mounted equipment when leaving the machine unattended, to eliminate possibility of unexpected drop of blade or ripper.

2.6. SAFETY PRODUCT GRAPHIC LOCATION

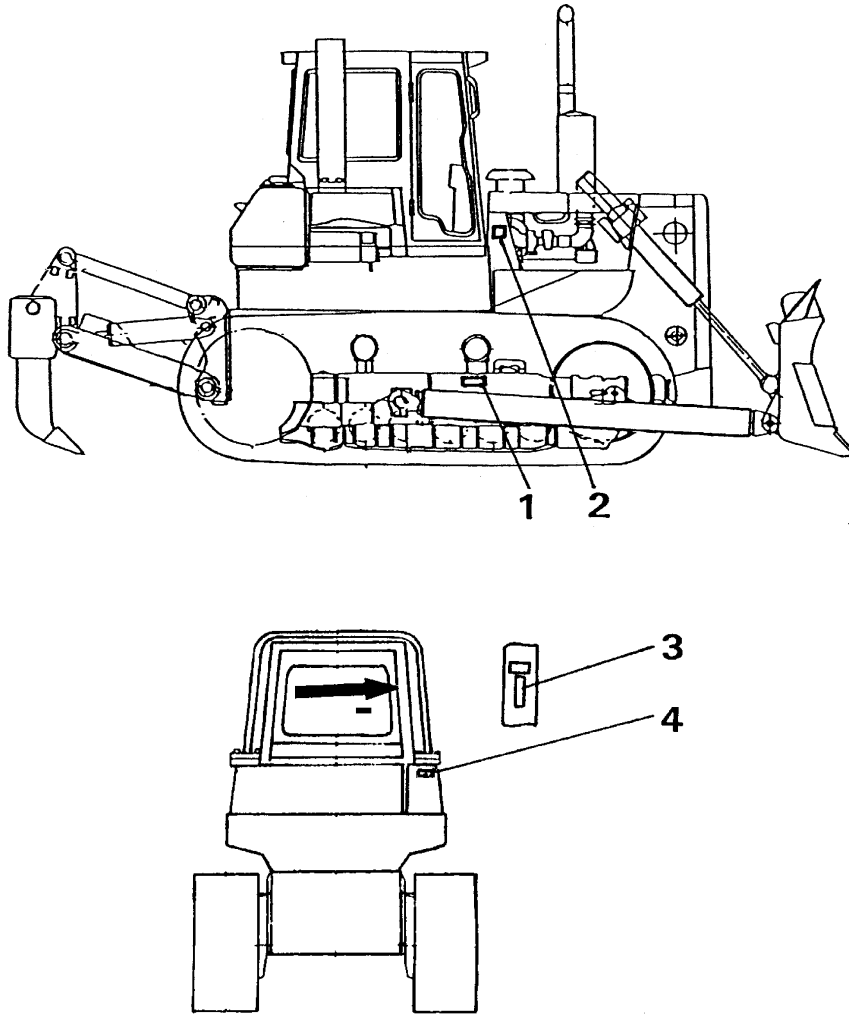


Fig. 2.1. Safety Product Graphic Location – Machine

1. Track Adjuster Caution
2. Door Caution
3. ROPS Caution
4. Pressurized Reservoir Caution

SAFETY PRECAUTIONS

2.6. SAFETY PRODUCT GRAPHIC LOCATION

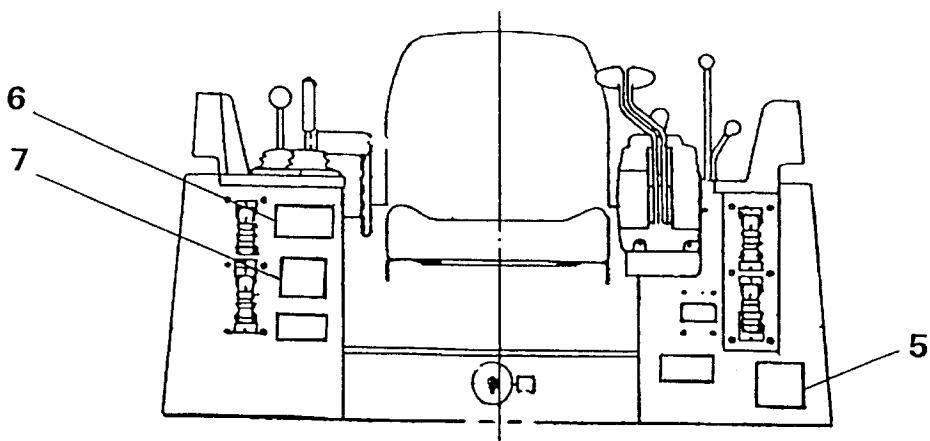


Fig. 2.2. Safety Product Graphic Location – Cab

- 5. General Caution
- 6. Instruction Caution for locking the lever to prevent incidental move of the machine.
- 7. Safety Caution

2.6.1. SAFETY PRODUCT GRAPHICS

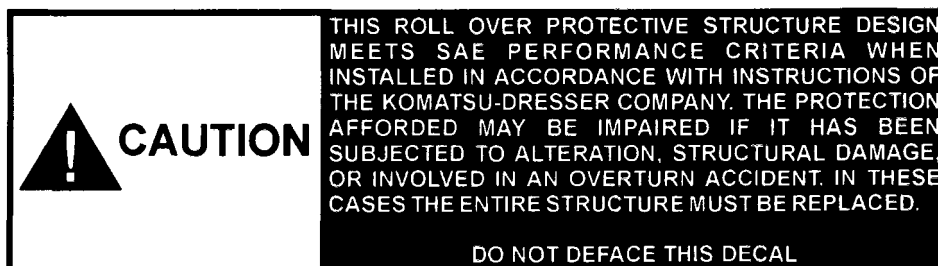


Decal 1



Decal 2

2.6. SAFETY PRODUCT GRAPHIC LOCATION



Decal 3



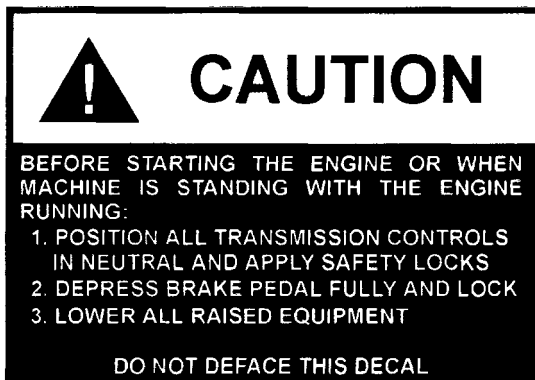
Decal 4



Decal 5

SAFETY PRECAUTIONS

2.6. SAFETY PRODUCT GRAPHIC LOCATION



Decal 6



Decal 7

SECTION 3
MACHINE TRANSPORT AND STORAGE

SECTION CONTENTS

3.1. Machine Transport 3
3.2. Lifting Machine on Slings 3
3.3. Moving a Disabled Machine 4
3.4. Machine Storage 5
 3.4.1. Preparing for Storage 5
 3.4.2. Servicing Machine During Storage 7
 3.4.3. Preparing for Operation After the Storage 7

3.1. MACHINE TRANSPORT

TRUCK

When shipping this machine by truck learn obligatory regulations. Contact local authorities for the proper shipping and loading regulations.

When preparing to transport the machine by truck, have truck and trailer level.



WARNING! Use caution when loading and unloading machine.

1. Use ramps or loading dock to maintain stability
2. Drive the machine in its lower gear
3. Use the lowest engine speed that will move the machine and not stall the engine
4. The machine can be "inched" into place by holding the steering hand levers back and slowly moving them forward into the drive position. (Be careful and move the levers simultaneously otherwise the machine will turn).
5. Pulling the steering hand levers back will disconnect the drive. Pulled back part way will permit the machine to roll freely.
6. When the machine is properly located, stop the engine, place transmission controls in Neutral, apply the Neutral Safety Lever and apply and lock the brakes.
7. Tie the machine down securely by ropes or wires and by wooden blocks to prevent unintentional movement.



WARNING! Failure to secure the machine to the truck during transporting can result in property damage, personal injury or death.

RAILROAD FLATCAR

Respective railroad loading rules and specifications must be followed when shipping this machine on open top railroad cars.

3.2. LIFTING MACHINE ON SLINGS

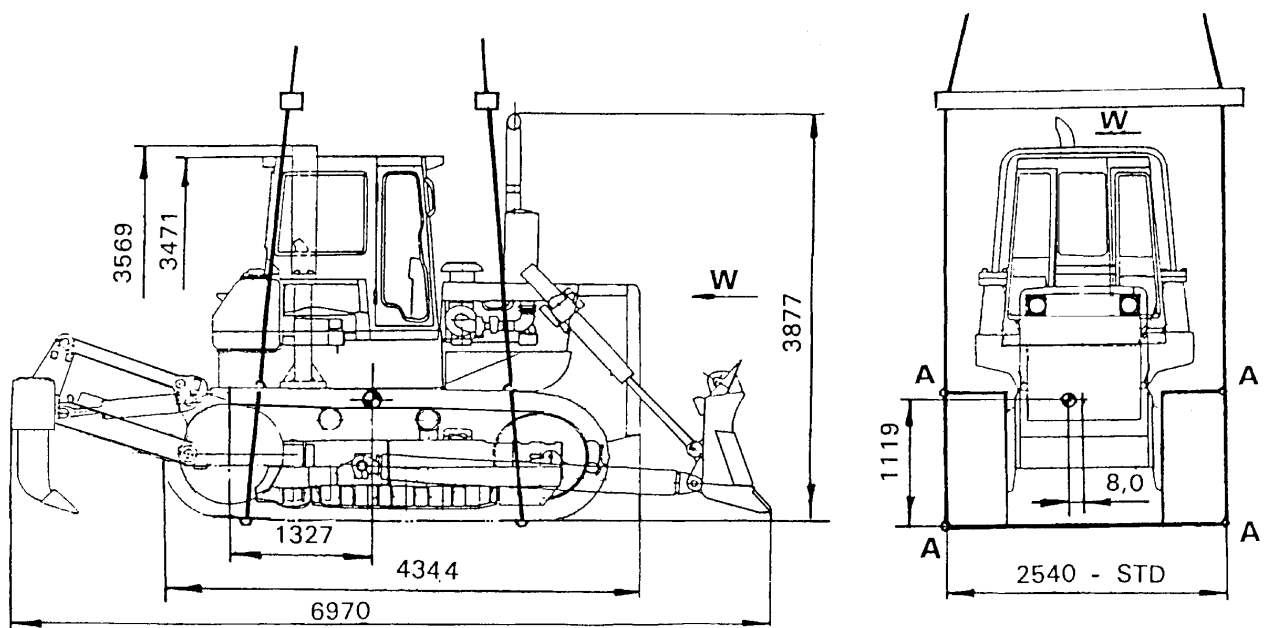


Fig. 3.1. Lifting Machine on Slings

3.2. LIFTING MACHINE ON SLINGS

1. Prior to lifting the machine depress brake and decelerator pedal and apply brake lock.
2. Use slings of sufficient strength.
3. Attach slings under the machine as shown in the drawing in the places marked by the letter „A” in the way preventing sliding the sling from the track shoe and moving the track itself.
4. Attach beams to the lifting slings.
5. Standard machine weight with the cab, R.O.P.S structure, air conditioner, blade and ripper is 26.640 kg.

3.3. MOVING A DISABLED MACHINE



WARNING! When using a chain or cable, be sure it is strong enough or the expected load and is properly secured to the drawbar pins or tow hooks (if equipped).



WARNING! When pulling with a chain or cable, take up the slack slowly to avoid jerking. A chain or cable which fails under load can whip and cause serious injury. Stand clear. Do not pull or tow unless the operator's compartment is guarded against or out of reach of a whipping chain or cable. Attach only to the machine tow hook or drawbar. Failure to follow these instructions could cause serious injury.

To avoid the possibility of power train damage, limit towing to a distance of 0.8 km at speeds less than 1.6 km/h. The brakes on this machine are spring applied automatically when the engine is stopped or the steering hydraulic system fails, and can only be released hydraulically. The diagnostic center (Fig. 3.2) has a check valves R_B and L_B for externally applying hydraulic pressure to the LH and RH brake spools to release them prior to towing per below specified procedure.

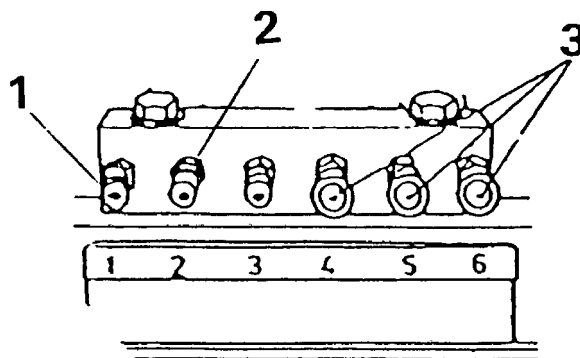


Fig. 3.2. Diagnostic Center – Tow and Pressure Check Ports

1. Check valve R_B 2. Check valve L_B 3. Caps

If the tractor can be towed and engine and steering hydraulic system can be operated, proceed as follows:

1. Lock the transmission shift lever in "NEUTRAL".
2. Start the engine.
3. Release the brake pedal.
4. Use a towing cable of sufficient strength. Keep the engine running at half throttle and gear selector locked in "NEUTRAL" during the tow.

If the tractor can be towed but the engine and/or steering hydraulic system is inoperable proceed as follows:

3.3. MOVING A DISABLED MACHINE

1. Lock the transmission shift lever in "NEUTRAL".
2. Release brake and decelerator pedal (D-H).
3. Pump sufficient grease into one of the valve (1 or 2 in Fig. 3.2.) to release the brakes. Connected pressure gauge should show the pressure 830 - 1030 kPa. The amount of grease required depends on the amount of pressure dissipation in the system.
4. Use a towing cable of sufficient strength. During the tow, it may be necessary to pump more grease into the right brake fitting to replace loss of pressure.
5. Depressing the brake pedal will relieve hydraulic pressure and apply the brakes.
6. After towing is completed, actuate the steering levers until all grease is purged from the system. There should be no pressure in the brake system (when measured at brake port) with the brake and decelerator pedal applied or the steering levers in the pivot position.

3.4. MACHINE STORAGE**3.4.1. PREPARING FOR STORAGE**

When a machine is taken out of service and stored for more than 30 days, steps must be taken to protect the machine. Leaving equipment outdoors exposed to the elements will materially shorten its life. An enclosure will protect the machine from rapid temperature changes and lesson the amount of condensation that forms in hydraulic components, engine, fuel tank and final drives. If it is not possible to put the machine in an enclosure, cover it with a tarpaulin.

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

1. Visually inspect the machine for external leakage and other defects.
2. Clean the radiator, refer to "COOLING SYSTEM."
3. Thoroughly clean the machine, be sure to rinse off any corrosive residue.
4. Correct any defects found. Consult Authorized Distributor of Construction Equipment.
5. Clean or replace the air cleaner filter elements. Refer to "AIR CLEANING SYSTEM".
6. The cooling system should be completely drained, chemically flushed, and refilled with a conditioned water/antifreeze solution suitable for the lowest temperature anticipated. Refer to "COOLING SYSTEM" for the proper antifreeze and conditioner concentrations.

IMPORTANT: *Under no circumstances should the vehicle be stored with a dry cooling system.*

7. Drain the water from the fuel tank.
8. Remove, empty, and reinstall the fuel filters. Refer to "FUEL SYSTEM".
9. It is recommended to use a fuel stabilizer quantity as instructed by the manufacturer. The stabilizer will prevent the degrading of the fuel, sludge buildup and stops the growth of bacteria in the fuel during storage. The fuel stabilizer may be purchased from:

**FIRE PREP 1000
NALCO CHEMICAL COMPANY
2901 BUTTERFIELD ROAD
OAK BROOK, ILLINOIS 60521, USA
or from Authorized Distributor of Construction Equipment**

10. Add 120 ml of volatile corrosion inhibitor "VCI" for each 100 liters of total fuel capacity to the fuel tank. The "VCI" provides corrosion protection by contact with the metal, and in a closed system, the vapors provide sufficient protection for areas that are not in contact with the oil. The "VCI" may be purchased from:

3.4. MACHINE STORAGE

NOX RUST VCI # 105 OIL
DAUBERT CHEMICAL COMPANY
1200 JORIES BLVD
OAK BROOK, ILLINOIS 60521, USA
or from Authorized Distributor of Construction Equipment



WARNING! Rust inhibitors are volatile and flammable. Prepare machine in a well ventilated place. Keep away from open flame or sparks **DO NOT SMOKE**. Store container in a secure, cool, well ventilated place.



WARNING! Due to the volatile nature of "VCI", irritation of eyes and skin may occur. Prolonged exposure to the vapors or oil should be avoided.

11. Vent the fuel system. Refer to "FUEL SYSTEM" in Section 4.
12. Start the engine and run at 1400 – 1600 RPM, no load for approximately 4 minutes and stop the engine.
13. Lubricate all points of the machine as outlined in the "SERVICE GUIDE".

NOTE: Be sure to oil or grease all linkage connections, joints, nuts, pins, shafts, and bushings not covered in the "SERVICE GUIDE".

14. Drain the crankcase oil from the engine, replace the lubricating oil filters and refill with the specified oil. Refer to "ENGINE".
15. Add 15 ml of "VCI" for each liter of engine oil capacity to the crankcase. (Example: if the total crankcase capacity is 10 liters, add 150 ml of VCI to the crankcase).



WARNING! Due to the volatile nature of "VCI", irritation of eyes and skin may occur. Avoid prolonged exposure to the vapors or oil.

16. Start the engine and run at 1400 – 1600 RPM, no load, for approximately 30 seconds and stop the engine.
17. Remove the air intake cap.
18. Seal all external openings (i.e. engine exhaust outlet, crankcase and hydraulic breathers, fuel vent line, etc.) with waterproof tape wide enough to cover the opening.

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

19. Pour 120 ml of "VCI" into the intake manifold to provide sufficient corrosion protection for the area between the top of the piston and the bottom of the cylinder head.
20. Add 350 ml of VCI to the hydraulic reservoir.
21. Remove the batteries and store them in a cool, clean, dry, well ventilated place away from areas storing or dispensing fuel and oil, not near any heat source and preferably where the temperature range is between 0°C to +21°C. Be sure the batteries are fully charged.

NOTE: Do not leave batteries on a concrete floor or in freezing temperatures

IMPORTANT: If the machine is stored with dry-charged batteries or no batteries, the alternator output lead must be disconnected and insulated. Failure to do so may result in permanent damage to the alternator. Connect the output lead only after the batteries have been activated with electrolyte. Refer to "ELECTRICAL SYSTEM".

3.4. MACHINE STORAGE

22. If the blade is detached for storage, secure the cylinders to the machine to avoid damage.
23. Coat all machined, unpainted surfaces with chassis grease to prevent rust.

3.4.2. SERVICING MACHINE DURING STORAGE

ONE-MONTH REPETITIVE SERVICE PERIOD

MACHINES WITH MAINTENANCE-FREE BATTERIES:

Check if batteries are fully charged. Never allow batteries to run down below $\frac{3}{4}$ full charge.

SIX MONTH REPETITIVE SERVICE PERIOD

1. Visually inspect the engine and radiator for leakage and other defects. Correct all defects, consult Authorized Distributor of Construction Equipment.
2. Remove all storage seals from the machine. (i.e. crankcase and hydraulic breathers, engine air intake, fuel tank vent lines, etc.).
3. Install fully charged batteries. Refer to "ELECTRICAL SYSTEM".

IMPORTANT: Check that batteries are level in the holders and securely held. The hold-down fasteners should hold the batteries firmly but not tight enough to warp or damage either the hold-down bar or batteries.



WARNING! Lay the cables so they do not chafe against the hold-down bar their fasteners. Be sure that batteries are always set down horizontally.



WARNING! Ends of the wires should be so arranged that access to the plugs is ensured. Also the wires should not rub hold-down bars. Always connect the negative ground cable last to minimize the chance of sparks or an explosion.

4. Check the coolant level in the radiator and add proper concentrations of antifreeze and coolant conditioners, if required. Refer to "COOLING SYSTEM".

NOTE: If excessive loss of coolant is detected, the problem should be corrected. Refer to "COOLING SYSTEM".

5. Perform steps 7 through 23 of "PREPARING FOR STORAGE".

3.4.3. PREPARING FOR OPERATION AFTER THE STORAGE

1. Visually inspect the machine for external leakage and other defects.
2. Clean the radiator, refer to "COOLING SYSTEM".
3. Thoroughly clean the machine.
4. Correct any defects found. Consult Authorized Distributor of Construction Equipment if necessary.
5. Remove all storage seals from the machine (i.e. crankcase and hydraulic breathers, engine air intake, fuel tank vent lines, etc.).
6. Replace the air cleaner filter elements. Refer to "AIR CLEANING SYSTEM".
7. Remove and discard fuel filters and replace with new. Refer to "FUEL SYSTEM".
8. Fill the fuel tank with approved diesel fuel. Refer to "FUEL SYSTEM".

3.4. MACHINE STORAGE

9. Lubricate all points of the machine as outlined in the "SERVICE GUIDE".

NOTE: *Be sure to oil or grease all linkage connections, joints, nuts, pins, shafts, and bushings not covered on the "SERVICE GUIDE".*

10. Drain engine oil from the crankcase and replace the engine lubricating oil filters. Refer to "ENGINE".

11. Install fully charged batteries. Refer to "ELECTRICAL SYSTEM".

NOTE: *Check that batteries are level in the holders and securely held. The hold-down fasteners should hold the batteries firmly but not tight enough to warp or damage either the hold-down bar or batteries.*



WARNING! Lay the cables so they do not chafe against the hold-down bar or the fasteners. Always connect the negative round cable last to minimize the chance of sparks and possible explosion.

12. Prime the turbocharger by placing the engine position and cranking the engine for approximately 30 seconds. Continue to crank the engine for 30-second periods until an oil pressure reading is indicated on the engine oil pressure gauge. This should provide an adequate amount of oil to lubricate the turbocharger.

IMPORTANT: *Crank the engine for a period of 30 seconds the, allow the cranking motor to cool for two minutes before cranking again to avoid damaging the cranking motor.*



WARNING! Never start the engine indoors unless proper exhaust ventilation is provided. Once the engine is running, move the machine outdoors as soon as possible.

13. Start the engine, refer to "STARTING THE ENGINE". Observe all the gauges on the instrument panel for proper operation of engine.

14. Perform an engine diagnostic test.

SECTION 4
OPERATING

SECTION CONTENTS

4.1. Machine Precautions..... 3

4.2. Universal Symbols for Instruments and Controls 4

4.3. Instrument Panel 6

4.4. Cab Controls 9

4.5. Controls and Adjustment 10

 4.5.1. Seat 10

 4.5.2. Seat Belt 10

 4.5.3. Engine Speed and Shut Down Lever 11

 4.5.4. Transmission Neutral Lock Lever 12

 4.5.5. Transmission Shift Lever 12

 4.5.6. Hand Steering Levers 13

 4.5.7. Brake and Decelerator Pedal 13

 4.5.8. Brake and Decelerator Pedal Lock 14

 4.5.9. Electrical System Master Switch 14

 4.5.10. Equipment Control Levers 15

4.6. Starting the Engine 17

 4.6.1. Ether Injector Start 18

 4.6.2. Engine Start After Oil Change or Prolonged Standstill 19

4.7. Stopping the Engine 20

4.8. Driving the Machine 21

4.9. Shifting the Transmission 22

4.10. Converter Overheating 22

4.11. Steering the Machine 23

4.12. Locking Both Tracks 23

4.13. Downgrade Operation 24

4.14. Operating Over an Obstruction 24

4.15. Stopping the Machine 24

4.16. Parking the Machine 25

4.17. Operating Mounted Equipment 26

 4.17.1. Hold 26

 4.17.2. Raise 26

 4.17.3. Lower 26

 4.17.4. Float 27

 4.17.5. Tilt 27

 4.17.6. Ripper Control Lever 27

 4.17.7. Bulldozer Blade Positions 28

 4.17.8. Angling the Blade 30

4.18. Operating Techniques 32

 4.18.1. Digging and Clearing 33

 4.18.2. Transporting, Piling or Loading 37

 4.18.3. Breaking Piles and Spreading 38

 4.18.4. Ripping 39

 4.18.4.1. Prior to Operation 39

 4.18.4.2. Ripping Techniques 39

 4.18.4.3. Cold Weather Operation 39

4.19. Economical Operation of the Machine 40

4.1. MACHINE PRECAUTIONS

During operation stay alert and watch what you are doing. Use common sense and do not operate when fatigued. Know your machine.

For your personal safety read this manual carefully and follow all instructions and precautions. Refer to and read Section 2 carefully and follow all precautions.

Before starting or operating this tractor, read the following general precautions. These are listed there to help you protect the machine and to remind you of protection for yourself and those around you. Sound judgment and observance of these rules will help make your job a safer one. Visually check out the machine for leaks and broken, missing or malfunctioning parts. Be sure all caps, dipsticks, battery covers, etc. are secure before starting. Correct any problems before operating the machine.

Keep the transmission in low gear when going downhill. Never coast downhill with the transmission in neutral. The machine could go out of control and tip over. Always drive the machine slowly when on hillsides, ramps or rough terrain. Be extremely careful when working around trenches or banks. Failure to do so could cause the machine to roll over.

Before starting operation, check the machine for correct function of steering controls, brake controls, hydraulic controls, instruments and safety equipment. Make all necessary repairs or adjustments before operating the machine.

Do not place the tractor under load without the proper engine oil pressure and operating temperature. Before starting the engine, move the engine speed control lever to the low idle position. Oil pressure after 15 seconds must be correct. Don't idle the engine more than 10 minutes.

Allow the engine to run at low idle for 3 to 5 minutes at 1000 RPM until normal oil pressure registers on the gauge to obtain complete distribution of the lubricating oil.

To prevent any possible damage to the alternator, the electrical system master switch must be in the "ON" position when the engine is running. The switch must be in the "OFF" position only when the engine is shut down at the end of each day or when the operator leaves the tractor unattended.

If the tractor is left outside during cold weather and the tracks become frozen to the ground, do not attempt to jerk them free with the power of the engine. Start the tractor slowly and, if the tracks do not break free, pry them loose. To prevent the tracks from freezing in the ground, park the tractor on planks.

In freezing weather thoroughly clean all ice and mud from the track system after each day's operation to prevent freeze-up of the system. Be sure to clean the seal area off the sprocket drives, front idlers, top idlers and rollers.

Never pour cold coolant into the radiator if the engine is very hot unless conditions make it absolutely necessary. Use extreme caution as hot coolant could burn you. Keep face away from filler neck. Under such conditions, start the engine and let it idle while slowly pouring the coolant into the radiator. Allow the engine to cool down to 50°C.

Pouring cold coolant into the engine may result in damage to cast components of the engine.

Never use water alone in the cooling system.

Fill the fuel tank at the end of each day's work to reduce moisture condensation in the tank.

When using a long chain or cable to hitch the tractor to the load, drive the tractor forward slowly until all slack is taken out.

Before shutting down, operate the engine at half speed (no load) for three to five minutes. This will aid in cooling the engine and turbocharger.

4.2. UNIVERSAL SYMBOLS FOR INSTRUMENTS AND CONTROLS











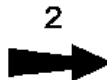

































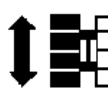



























The use of universal symbols will pictorially identify various instruments and controls. These symbols are an effort to overcome language differences for all operators in a positive way, thus enhancing their safety through quicker recognition of the instruments and controls while operating the equipment.

Study the following symbols so you will know their meaning immediately and at a glance.

NOTE: *Some symbols may not pertain to your machine.*

4.2. UNIVERSAL SYMBOLS FOR INSTRUMENTS AND CONTROLS

The above symbols are used in crawler dozers manufactured by HSW, however not all of them must be used on this machine.

							
ON (GENERAL)	OFF (GENERAL)	FWD or UP	REVERSE or DOWN	FWD or REVERSE	Hourmeter	Caution	Caution high pressure
							
Variable slide control	Variable rotation control	Next speed (straight-line)	Next speed (rotation)	NEUTRAL position	A/C	Electrical receptacle	Lighter
							
Battery isolator	Voltmeter	Lights	Dome lights	Windshield wiper	Rear window wiper	Window washer	Fan
							
Horn	Fuel filler	Fuel level	Air cleaner	Coolant level	Coolant temperature	Engine	Engine RPM
							
Oil pressure	Starting aid	Drive train oil filler	Oil pressure	Oil filter	Oil level	Oil temperature	Oil pressure diagnostic point
							
Hydraulic oil filter	Hydraulic oil level	Undercarriage	Vehicle FWD or REVERSE	LH Track driven	RH Track driven	RH Track brake	LH Track brake
							
Hydraulic filter	Blade	Raise	Hold	Lower	Float	Tilt left	Tilt right
							
Angle left	Angle right	Pitch FWD	Pitch AFT	Ripper	Raise	Hold	Lower
							
Pitch FWD	Pitch AFT	Coolant filler	Grease lubricant	Brake (GENERAL)	Parking brake	Brake ON	Lift or lift point

4.3. INSTRUMENT PANEL

General

This section covers the location and function of the various instruments and controls. More detailed information regarding operation of controls can be found in the following text within this section. Regardless of previous experience as an operator; you must be thoroughly familiar with the location and use of all instruments and controls before operating the machine.

IMPORTANT: Understand all control functions before starting the engine.

IMPORTANT: After starting and while operating observe instruments and warning lights frequently.

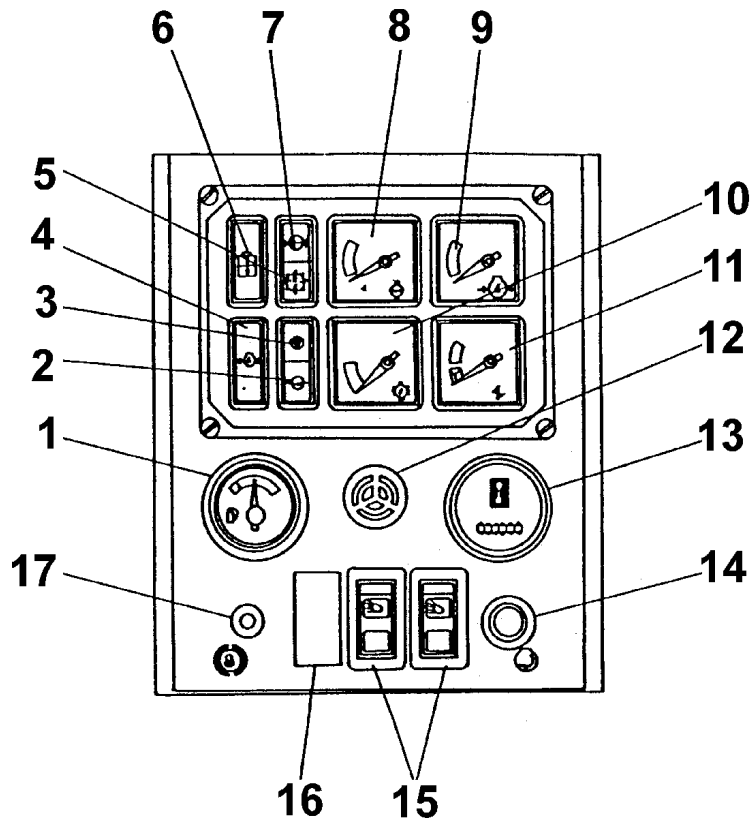


Fig. 4.2. Instrument Panel

1. Fuel Level Gauge
2. Engine Coolant Level Warning Light
3. Air Cleaner Filter Warning Light
4. Low Engine Oil Pressure Warning Light
5. Transmission Oil Pressure Filters Warning Light
6. Hydraulic Oil Filters Warning Light
7. Transmission Main Low Pressure and Clutch Low Oil Pressure Warning Light
8. Engine Coolant Temperature Gauge
9. Engine Oil Pressure Gauge
10. Torque Converter Oil Temperature Gauge
11. Voltmeter
12. Engine Coolant Low Level and Engine Low Oil Pressure Alarm
13. Hourmeter
14. Starting Button and Warning Light Check
15. Light Switches
16. Ether Injector Switch
17. Brake Lock

4.3. INSTRUMENT PANEL

1. FUEL LEVEL GAUGE

The gauge indicates quantity of fuel available for operation in fuel tank.

2. ENGINE COOLANT LEVEL WARNING LIGHT

The engine coolant level indicator will glow if coolant level drops below operating level, this light is supplemental to low engine coolant and oil pressure alarm (12) on instrument panel.

3. AIR CLEANER FILTER WARNING LIGHT

The air cleaner filter warning light will glow amber when the filter element reaches the maximum allowable restriction. When this happens, filter element service is required.

4. ENGINE OIL PRESSURE WARNING LIGHT

The engine oil pressure warning light will glow when engine oil pressure is low. Glowing of this lamp obliges the operator to immediate stopping the engine.

5. TRANSMISSION OIL PRESSURE FILTERS WARNING LIGHT

The transmission oil filter indicator will glow amber when the oil filter element reaches the maximum allowable restriction. When this happens, respective transmission pressure filter service is required.

6. HYDRAULIC OIL FILTERS WARNING LIGHT

The hydraulic oil filter warning light will glow amber when the oil filter element reaches the maximum allowable restriction. When this happens, respective filter service is required.

7. TRANSMISSION MAIN LOW PRESSURE AND CLUTCH LOW OIL PRESSURE WARNING LIGHT

The transmission clutch low oil pressure warning light will glow when there is insufficient oil pressure in neutral position or insufficient oil pressure available for the transmission clutches with transmission in gear. When warning light is activated stop the engine and clean transmission system suction filter and check oil level in rear frame. Refer to "TRANSMISSION SYSTEM" in Section 5. If the light continues to glow stop the engine and consult Authorized Distributor of Construction Equipment before operating the machine.

8. ENGINE COOLANT TEMPERATURE GAUGE

This gauge shows the temperature of the coolant circulating through the engine. After the engine has operated a sufficient length of the time, the pointer of the gauge must be in the GREEN area of the gauge.

During normal operation the gauge readings may vary between the minimum and maximum indicated by the GREEN area of the gauge.

Continuous engine operating below the minimum temperature is harmful to the engine. Low coolant temperatures will also cause exhaust smoke and increase the rate of fuel consumption.

NOTE: *In cold weather, if no louver is mounted, it may be necessary to cover part of the radiator to maintain the minimum coolant temperature indicated at the lower end of the GREEN area.*

The engine temperature under full load should remain in the GREEN of the gauge.

9. ENGINE OIL PRESSURE GAUGE

This gauge shows the pressure at which the lubricating oil is circulating through the engine. The pointer must register in the green area during operation of the engine.

4.3. INSTRUMENT PANEL

10. TRANSMISSION SYSTEM OIL TEMPERATURE GAUGE

This gauge shows the temperature of oil in transmission system. The pointer of the gauge must be in the GREEN area of the gauge.

11. VOLTMETER

The voltmeter indicates the condition of the batteries. At low idle speed, the gauge pointer should be within the green with white stripe area, which indicates a good battery charge. If the voltage drops below this area, the batteries should be checked.

With the engine operating above low idle speed, the pointer should be within the upper green area, which is the normal operating range. If the pointer drops below or exceeds this area, the battery, alternator or wiring may be at fault.

12. LOW ENGINE COOLANT AND LOW OIL PRESSURE ALARM

This alarm will sound when lubricating engine oil pressure or coolant level in radiator drops below normal. If so, stop the machine and find out which warning light glows and check gauge indication.

13. HOURMETER

The hourmeter electrically records the actual hours of engine operation. The purpose of the hourmeter is to indicate when to perform the recommended maintenance and lubrication operations. The hourmeter will register only when the engine is running.

14. START SWITCH BUTTON AND WARNING LIGHTS CHECK

The button is used to crank the engine. Place the transmission neutral lock in neutral and the transmission electrical system master switch to the ON position.

IMPORTANT: To prevent damage to the starter motor and avoid low battery output, do not continuously crank the engine for more than 30 second intervals. Allow 2 to 3 minute recovery period between cranking.

Prior to starting the engine move the engine speed and shut down lever fully forward (OFF position), depress the starting switch and check if all warning lights glow. If any warning light doesn't glow that indicates that the bulb is defective or its circuit is broken.

15. LIGHTS SWITCH

The work light switch is a rocker type switch. Activation of the switches turns on front and/or rear work lights.

16. ETHER INJECTOR SWITCH

This switch controls the ether injector for cold weather starting. Refer to "STARTING THE ENGINE" for proper operation of this switch.

17. BRAKE LOCK

This handle locks the brake pedal in the applied position for parking the machine. To lock the brake pedal, fully depress the pedal, pull out the lock handle and remove your foot from the pedal. To release the brake, simultaneously depress the brake pedal and push in the lock handle.

4.4. CAB CONTROLS

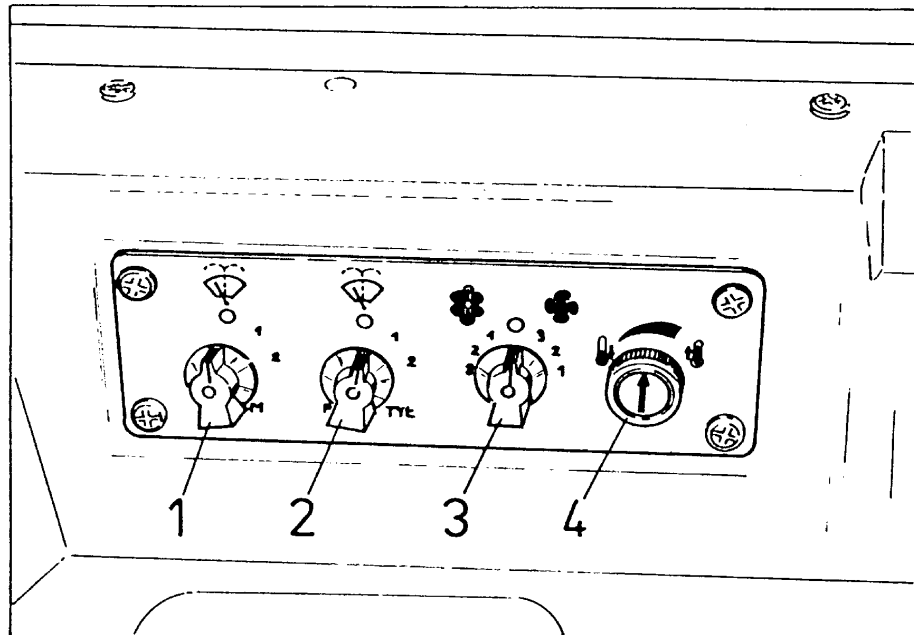


Fig. 4.3. Air Conditioner, Heater and Accessories Controls

1. Door Wiper Switch and Washer Push-button
2. Window Wiper Switch and Washer Push-button
3. Heater and/or Cooler Pressurized Control Switch
4. Temperature Control Knob

DOME LIGHT

Dome light is switched on with switch mounted in the light.

CAB VENTILATION

NOTE: For maximum cooling turn the temperature control knob fully to the left.

1. DOOR WIPER SWITCH

This switch activates window wipers and washers. Principle of operation is similar to wiper timing switch and washer.

2. WINDOW WIPER SWITCH

This switch activates window wipers and washers. The switch enables two-speed selection of the wipers, low and high speed when turn to the left and push the washer button to spray washer fluid.

3. HEATER AND/OR COOLING PRESSURIZER FAN SPEED CONTROL SWITCH

This switch controls the speed of the fan circulating air inside the cab. It has three speed settings low, medium and high. Turn the knob to the left for three fan speed selections when cooling the air, i.e. low, medium and high.

Turn the knob to right for three fan speed selections when heating air i.e. low, medium and high. To turn the fan off, turn knob to center position.

4. TEMPERATURE CONTROL KNOB

This knob is used to control temperature inside the cab. To decrease temperature turn the knob to the left position and to increase temperature turn the knob to the right position.

4.5. CONTROLS AND ADJUSTMENT

4.5.1. SEAT

SEAT ADJUSTMENT LEVERS

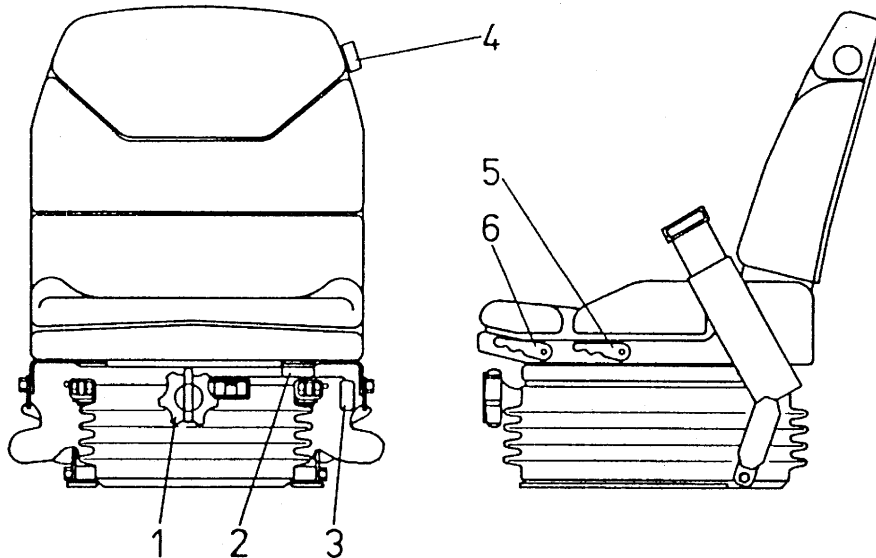


Fig. 4.4. Seat

1. Weight Adjustment Lever
2. Seat Travel Lever
3. 15° Swivel to the Right Lever
4. Back Rest Cushion Adjustment knob
5. Back Cushion Tilt Lever
6. Seat Adjustment Knob

The operator's seat is adjusted as follows:

Press tilt lever 5 to adjust required angle of back cushion.

Turn the knob 1 to adjust to own weight. Move lever 2 forward to slide the seat back or forth.

Turn the knob 4 located on the left side to adjust back rest angle.

For ripping operations lift lever 3 to swivel the seat 15° to the right.

4.5.2. SEAT BELT



WARNING! Before driving the machine adjust the seat belt and fasten the seat belt. Adjust the belt to fit snugly and low around the hips to lessen the chance and severity of injury in the event of an accident. Never wear the belt across the abdomen.

4.5. CONTROLS AND ADJUSTMENT

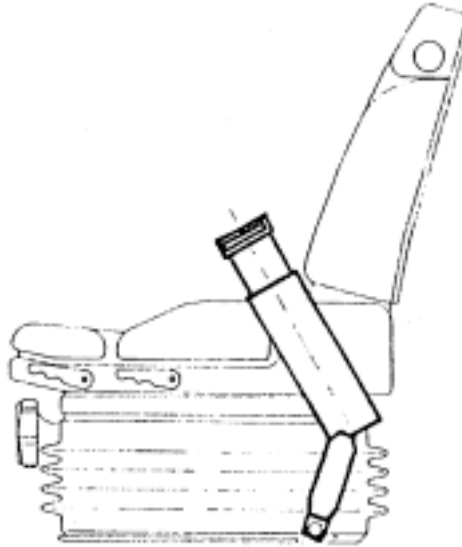


Fig. 4.5. Seat Belt

To buckle, insert the tongue portion of the buckle into the locking portion.



WARNING! Do not bleach, color dye or solvents on the seat belt webbing, this may cause a severe loss of tensile strength. This could cause the webbing to break resulting in personal injury, it is recommended that the seat belt be cleaned only with warm water and a mild detergent. Keep belt flat to avoid twisting and roping when not being used. Do not place heavy or sharp object on the belts.

4.5.3. ENGINE SPEED AND SHUT DOWN LEVER

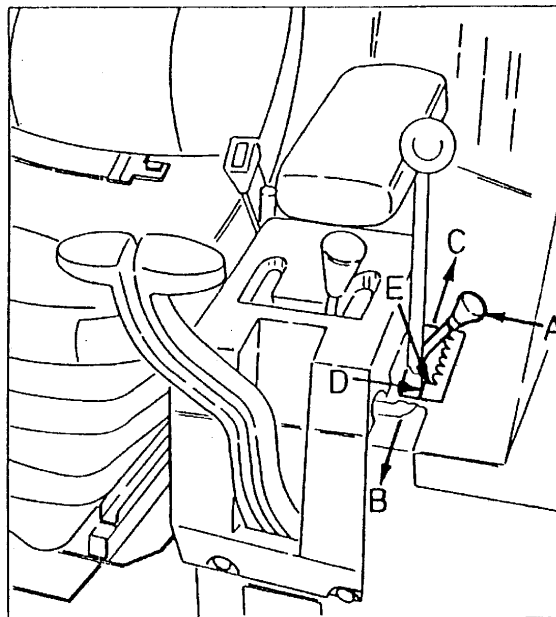


Fig. 4.6. Engine Speed and Shut Down Lever

- A – Engine Speed and Shut Down Lever
- B – Lever Forward to Decrease Speed
- C – Lever Back to Increase Speed
- D – Large Cutout for Engine Shut Down
- E – Engine start and Low Idle Speed

4.5. CONTROLS AND ADJUSTMENT

This lever (A) is used to start the engine, control this speed of the engine or to shut it off. Push this lever forward (B) to decrease engine speed. Pull the lever back (C) to increase engine speed. Position lever in this large cutout (D) to shut down the engine.

4.5.4. TRANSMISSION NEUTRAL LOCK LEVER

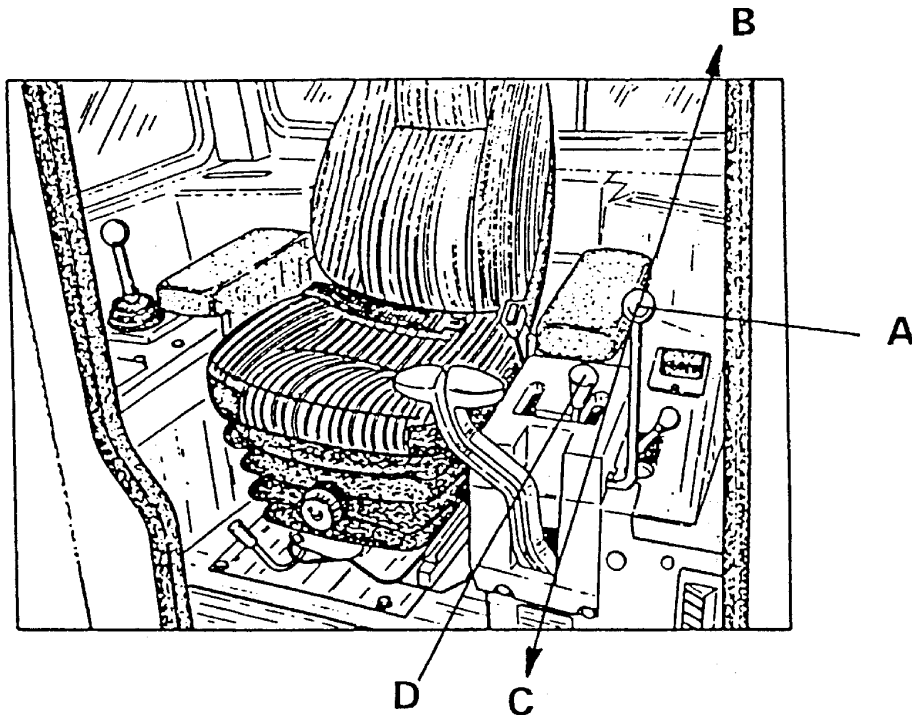


Fig. 4.7. Transmission Controls

- A – Transmission Neutral Lock Lever
- B – Lever Rearward to Lock Shift Lever
- C – Lever forward to release shift lever
- D – Transmission Shift Lever

This lever (A) is used to lock the transmission shift lever in “NEUTRAL.” Move the lever backward (B) (ON position) to lock the shift lever, or forward (C) (OFF position) to release. When starting or idling the engine with the transmission in NEUTRAL place the lock lever in the ON position.

4.5.5. TRANSMISSION SHIFT LEVER

Lever (D) is used to select the various transmission gear ranges. Refer to “DRIVING THE MACHINE.”

NOTE: When the shift lever is placed in one of the reverse positions, the back-up alarm will automatically sound.

4.5. CONTROLS AND ADJUSTMENT

4.5.6. HAND STEERING LEVERS

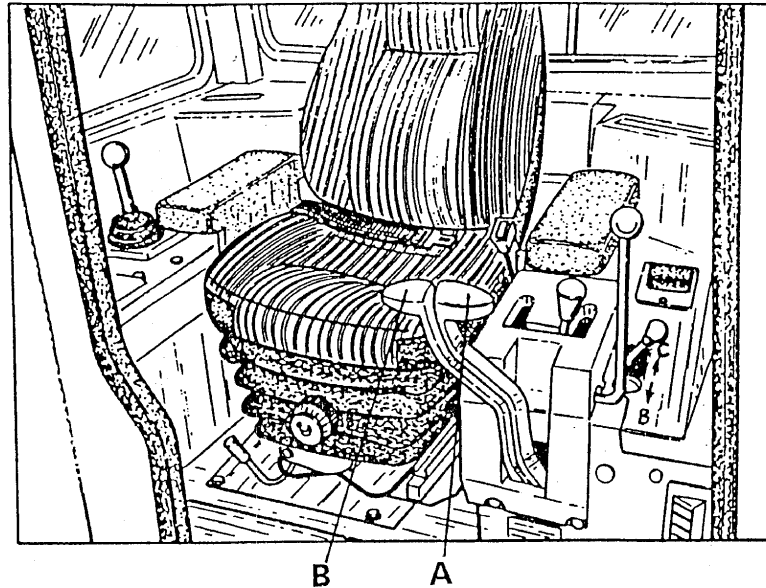


Fig. 4.8. Hand Steering Levers

- A – Left Hand Steering Lever
- B – Right Hand Steering Lever

These levers steer the machine by controlling engine power to the tracks and by applying and releasing respective speed range clutch packs and brake clutch packs. The left hand steering lever (A) controls the left track with the right hand steering lever (B) controlling the right track.

4.5.7. BRAKE AND DECELERATOR PEDAL

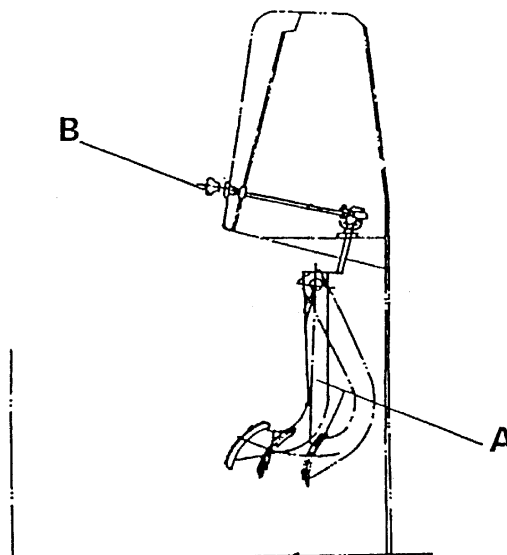


Fig. 4.9. Brake and Decelerator Pedal and Pedal Lock

- A – Brake and Decelerator Pedal
- B – Brake Lock

This pedal overrides the engine speed control lever setting. Partial depression of the pedal decreases engine speed for smoother changes in machine direction and to ease the machine up

4.5. CONTROLS AND ADJUSTMENT

to a load. Release the pedal to accelerate the engine speed control lever setting. This pedal stops the machine when fully depressed. It also serves as a parking brake when the brake pedal lock is applied and brake pedal lock knob is pulled.

Periodic adjustment of the pedal might be required. Refer to Authorized Distributor of Construction Equipment if pedal values are not within those shown in Fig. 4.10.

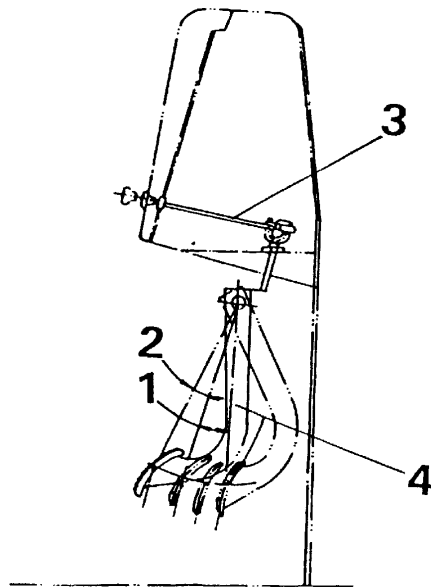


Fig. 4.10. Brake and Decelerator Pedal Adjustment

1. Deceleration Angle (10°)
2. Braking Angle (14°)
3. Brake Lock Linkage
4. Brake and Decelerator Pedal

4.5.8. BRAKE AND DECELERATOR PEDAL LOCK

This lock secures the brake and decelerator pedal in the applied position for parking the machine. To lock the brake and decelerator pedal fully depress the pedal, pull out the lock and remove your foot from the brake and decelerator pedal. To release the brake, depress the brake and decelerator pedal and push the lock.

IMPORTANT: Release the brake pedal lock before moving the machine. The brakes could burn or be damaged if the machine is driven with partially applied brakes.

4.5.9. ELECTRICAL SYSTEM MASTER SWITCH

Turn the key clockwise to connect the battery ground circuit. Turn the key counterclockwise to disconnect the battery ground circuit.

IMPORTANT: Keep the switch on while the engine is running.

4.5. CONTROLS AND ADJUSTMENT

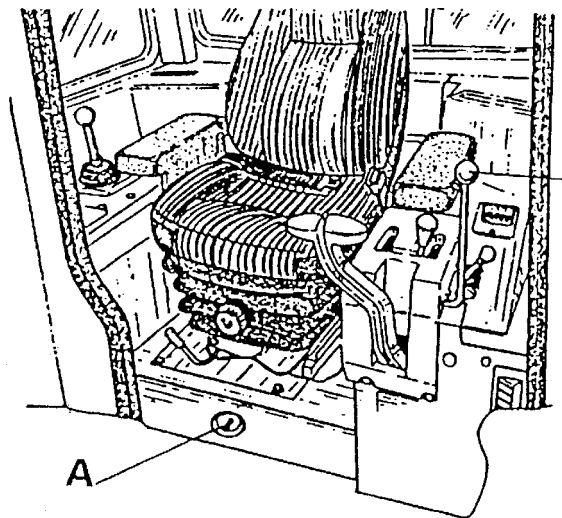


Fig. 4.11. Electrical System Master Switch
A – Electrical System Master Switch Key

4.5.10. EQUIPMENT CONTROL LEVERS

BLADE CONTROL LEVER

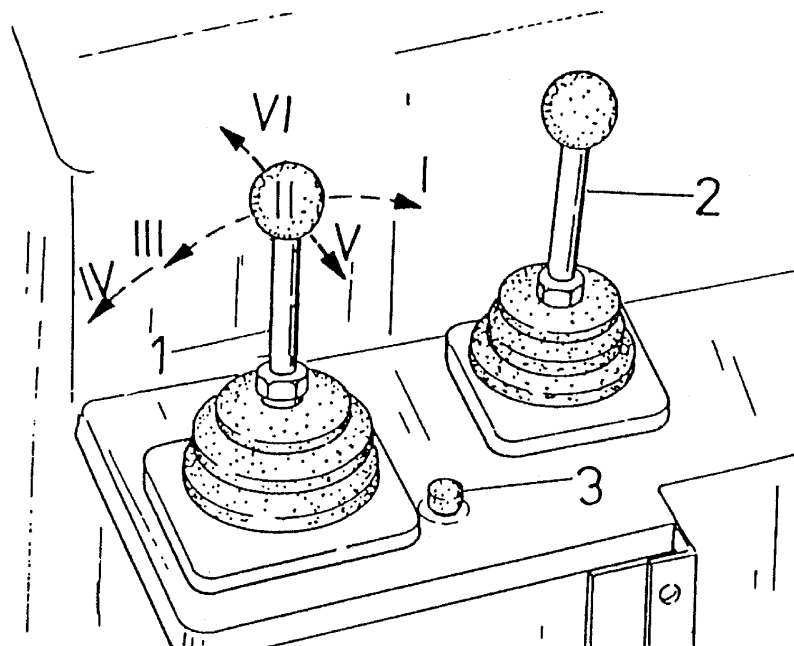


Fig. 4.12. Equipment Control Levers

- 1. Blade Raise, Lift, and Tilt Control Lever
 - I. Raising
 - II. Hold
 - III. Lowering
 - IV. Floating
 - V. Tilt to the left
 - VI. Tilt to the right
- 2. Ripper Control Lever
- 3. Horn Button

4.5. CONTROLS AND ADJUSTMENT

RIPPER CONTROL LEVER

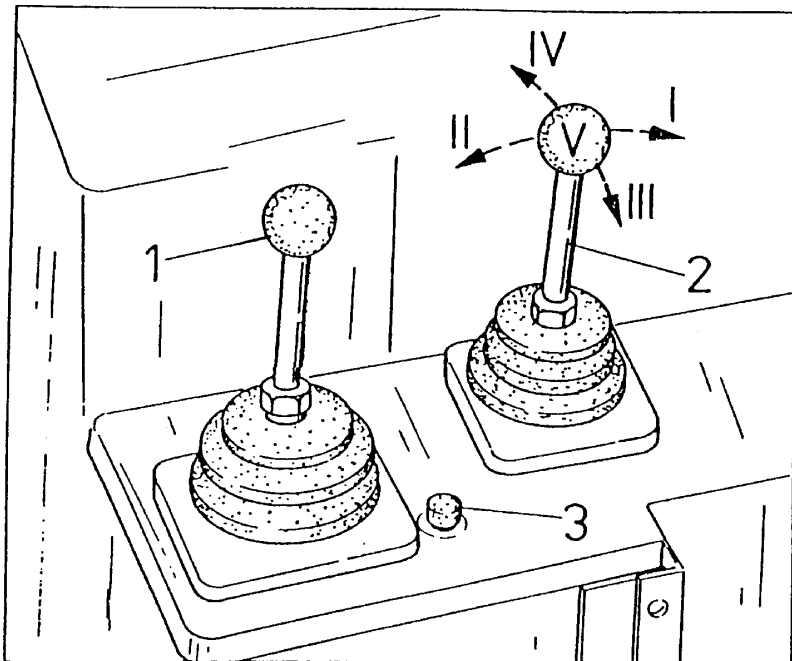


Fig. 4.13. Ripper Control Lever (2)

- | | |
|-------------------------|-------------------------|
| 1. Blade Control Lever | I. Ripper Pitch Forward |
| 2. Ripper Control Lever | II. Ripper Pitch Aft |
| 3. Horn Button | III. Ripper Raise |
| | IV. Ripper Lower |
| | V. Hold |

NOTE: For proper control of ripper control lever and observation of working tool swivel the operator seat 15° to the right.

4.6. STARTING THE ENGINE

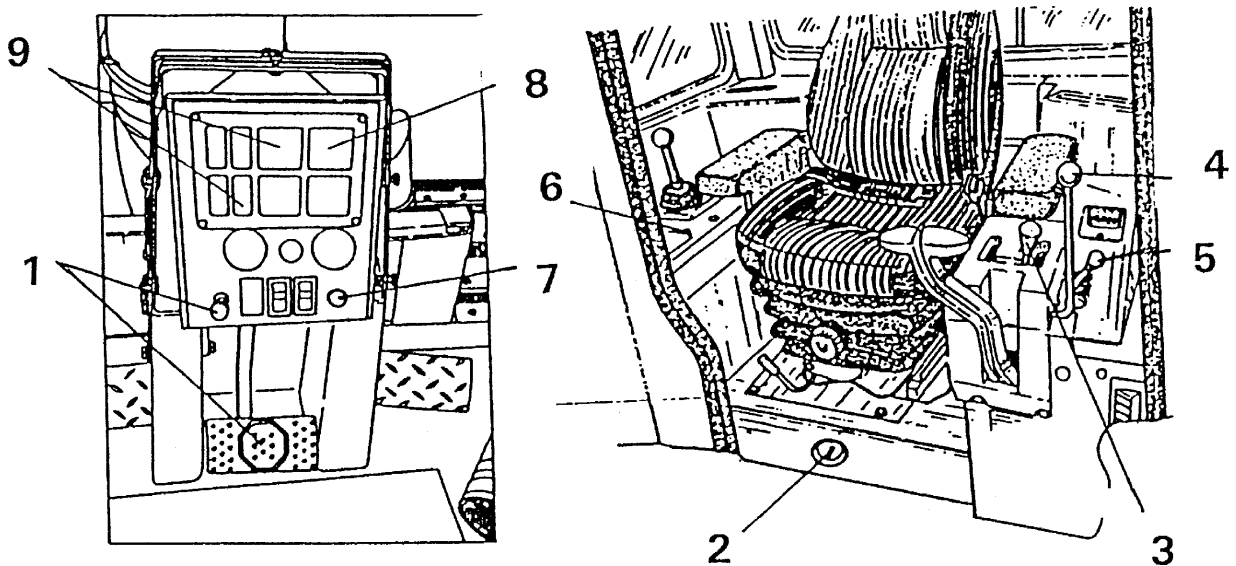


Fig. 4.14. Starting the Engine

1. Brake and Decelerator Pedal and Brake Lock Knob
2. Electrical System Master Switch
3. Transmission Shift Lever
4. Transmission Neutral Lock Lever
5. Engine Speed and Shut Down Lever
6. Horn
7. Start Switch Button
8. Engine Oil Pressure gauge
9. Engine Coolant Gauge and Light

NOTE: Before operating the machine perform each of the 10 hour maintenance requirements shown in Section 5.2. **SCHEDULED MAINTENANCE.** This engine cannot be started by towing, pushing or coasting the machine.



WARNING! Before entering the operator's compartment, walk completely around the machine and clear the area of personnel and obstructions.



WARNING! Read all product graphics before starting, operating, maintaining, or repairing the machine.



WARNING! Before starting the engine or when the machine is standing with the engine running, lock the transmission shift lever in neutral, apply brake lock and lower all raised equipment:



WARNING! Understand all control functions before starting the engine.



WARNING! Never start the engine indoors unless proper exhaust ventilation is provided to remove deadly exhaust gases. Once the engine is running, move the machine outdoors as soon as possible. Exhaust gases are hazardous and can cause unconsciousness and death.

4.6. STARTING THE ENGINE



WARNING! Be sure all personnel are clear of the machine before starting the engine. Sound the horn.



WARNING! Make sure the operator's seat is adjusted properly and fasten the safety seat belt.

NORMAL START (temperature above 0°C)

1. Apply and lock the brake and decelerator pedal.
2. Place transmission shift levers in neutral.
3. Place the neutral lock lever in vertical "ON" position.
4. Move the engine speed control lever to low speed (idle) position (Fig. 4.15).
5. Turn on electrical system master switch "ON".

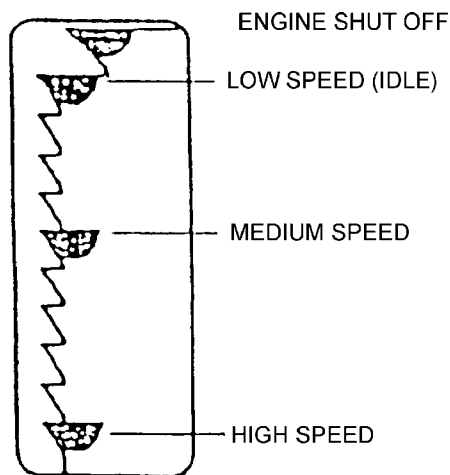


Fig. 4.15. Engine Speed and Shut Down Control Lever

1. Sound the horn to clear all personnel from the immediate area.
2. Crank engine.

IMPORTANT: Crank engine for 30 seconds at a time. If engine does not start, allow cranking motor to cool two or three minutes before cranking again.

3. Check oil pressure. Stop the engine immediately if gauge fails to show correct pressure after 15 seconds. Allow the engine to idle for 3 to 5 minutes (app.1000 RPM.) before increasing the engine speed and placing under load.
4. Check indications of all instruments to ensure that machine is operating correctly. Refer to INSTRUMENT PANEL.

IMPORTANT: It is not recommended to run the engine at low idle over 10 minutes due to possibility of faster wear of engine components.

4.6.1. ETHER INJECTOR START (temperatures below 0°C)

WARNING! Ether starting fluid is highly flammable. Follow the precautions on the container. An explosion can result if sparks or flame contact the ether or when storing ether container when the air temperature is above 70°C.

4.6. STARTING THE ENGINE

Observe the following precautions:

- Do not use the ether injector when the air temperature is above 0°C.
- Do not use open flame when using ether starting fluid.
- Do not store fluid containers in the operator's compartment.
- Store the containers in a cool, well ventilated place. Keep the fluid containers out reach of children.
- Do not breathe the hazardous ether vapor.
- Do not let ether contact you skin, because it can cause frostbite.
- Never puncture the fluid container or put it into a fire
- Dispose of empty containers per instructions printed on the container
- For your safety, remove the ether container when welding, grinding, or using a torch on the machine.
- Follow the correct method for starting the engine.
- Before any attempt to start the engine, check the ether container or insure that a supply of starting fluid is available under pressure and the system is in working condition. Pressing the switch in the instrument panel makes ether injection.



WARNING! Ether injector is to used only for starting. Misuse of ether injector while engine is running can result in serious damage to engine.

1. Perform all activities as described in item 1-6. Refer to NORMAL START (temperature above 0°C).
2. Press engine button and ether injector switch simultaneously. Allow one to two seconds for chamber in valve to fill then, with engine cranking, release ether injector switch to release a measured shot of starting fluid into the engine. If temperature is below –18°C, additional ether may be required. If engine does not fire with a maximum of 4 injections, determine cause and correct before again attempting a start.

IMPORTANT: Crank engine for 30 seconds at a time. If engine does not start, allow cranking motor to cool two or three minutes before cranking again.

4.6.2. ENGINE START AFTER OIL CHANGE OR PROLONGED STANDSTILL (over 5 days)

1. Perform all activities as described in item 1 to 3 and 5 to 6. Refer to NORMAL START.
2. Place engine speed control lever in OFF position (Fig. 4.15).
3. Turn on engine start switch in the instrument panel. Crank the engine until oil gauge registers oil pressure or low oil pressure warning light goes off.
4. Depress the start switch.
5. Move the engine speed control lever to idle position.
6. Crank engine.
7. Perform all activities as described in item 8 to 9. Refer to NORMAL START.

OPERATING

4.7. STOPPING THE ENGINE

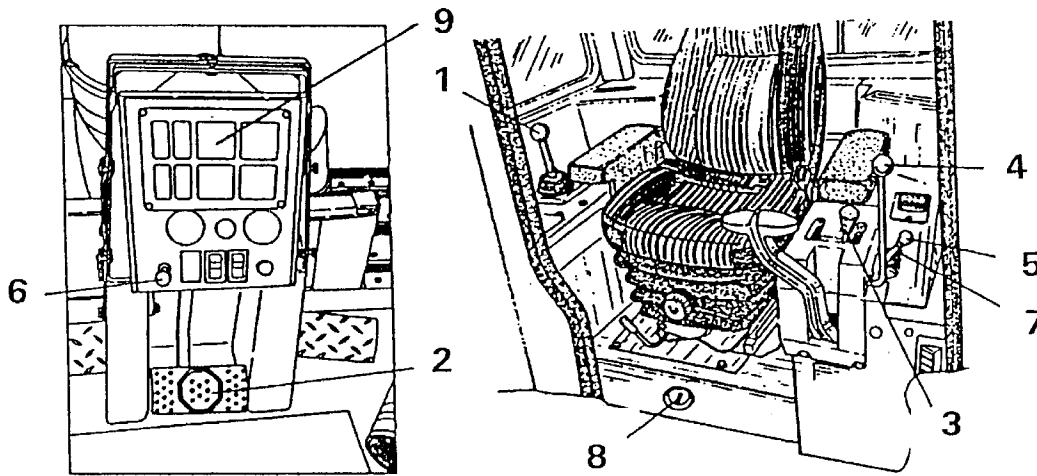


Fig. 4.16. Stopping the Engine

1. Ripper Control Lever
2. Brake and Decelerator Pedal
3. Transmission Shift Lever
4. Transmission Neutral Lock Lever
5. Engine Speed and Shut Down Lever
6. Brake Lock Knob
7. Engine Shut Down Position
8. Electrical System Master Switch
9. Engine Coolant Temperature Gauge

1. Using control lever (1) lower all mounted equipment to the ground. Depress the brake and decelerator pedal (2) and place transmission shift lever (3) into NEUTRAL.
2. Apply transmission neutral lock lever (4).
3. If engine operated under load, operate the engine at idle speed for 3 to 5 minutes to allow the engine to cool down in gradual and uniform manner.
4. Depress and lock brake and decelerator pedal.

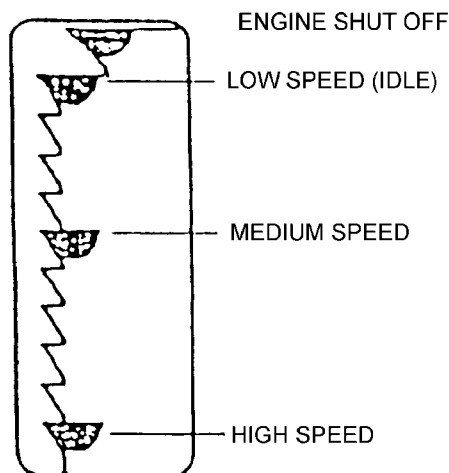


Fig. 4.17. Engine Speed and Shut Down Control Lever

IMPORTANT: Immediate engine shut down after operation under load may result in engine damage.

4.7. STOPPING THE ENGINE

1. Move the engine speed and shut down lever to large notched OFF position – the electrovalve will shut down the engine.
2. Turn the electrical master switch in OFF position.

4.8. DRIVING THE MACHINE

IMPORTANT: Read the SAFETY PRECAUTIONS in Section 2 before operating the machine.

IMPORTANT: Before operating check all instruments.

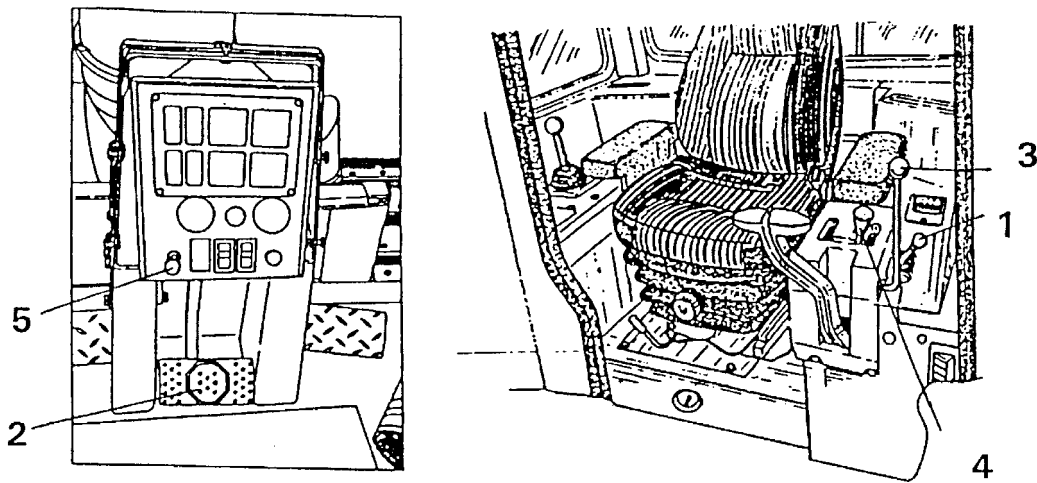


Fig. 4.18. Driving the Machine

1. Engine Speed and Shut Down Lever
2. Brake and Decelerator Pedal
3. Transmission Neutral Lock Lever
4. Transmission Shift Lever
5. Brake Lock Lever



WARNING! Never haul passengers. Only the operator should be on the machine when it is moving.



WARNING! Sit in the operator seat before operating the controls. Keep hands and footwear free of grease, water and mud to insure positive control movements.



WARNING! Before operating the machine adjust the seat to allow full access of all controls and fasten the seat belt. Failure to do so could result in serious injuries or death.



WARNING! Never get on or off the machine while it is moving because serious injury or death could result.

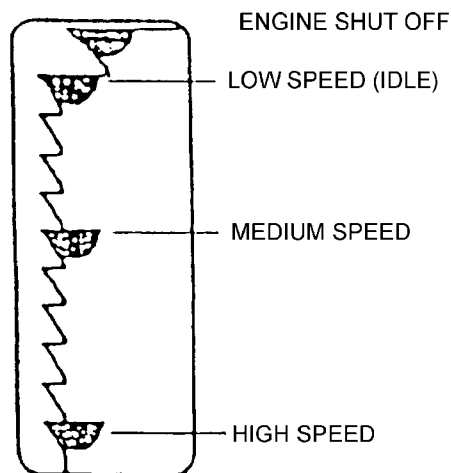
OPERATING**4.8. DRIVING THE MACHINE**

Fig. 4.19. Engine Speed and Shut Down Control Lever

1. Place the engine speed and shut down control lever in the high idle position.
2. Depress the decelerator pedal to decrease engine speed.
3. Move forward the neutral lock lever (3) from ON to OFF position.
4. Place the transmission shift lever in the desired range. Refer to **SHIFTING THE TRANSMISSION**
5. Gradually release the brake and decelerator pedal.

4.9. SHIFTING THE TRANSMISSION

The transmission has three speeds in both the forward and reverse ranges. The ranges and speeds are controlled by the transmission shift lever.

4.10. CONVERTER OVERHEATING

If the pointer of the torque converter oil temperature gauge moves out of the RUN area of the dial during operation, the transmission may be in a gear range which is too high for the load. Shift down into the next lower gear range. The temperature should reduce; if not, downshift again. If the dial pointer remain out of the RUN range in first gear, stop the machine, shift into neutral and run the engine at 1000 RPM until the gauge pointer moves into the RUN area. Stop the engine, check transmission oil level, clean radiator and clean suction filter.

If the converter still remains overheated, stop the engine and consult Authorized Distributor of Construction Equipment before operating the machine.

4.11. STEERING THE MACHINE

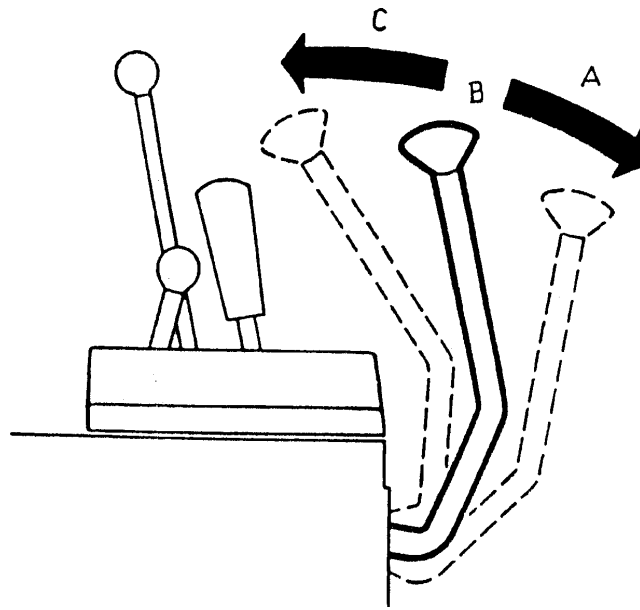


Fig. 4.20. Steering Levers

A – High Range B – Low Range C – Pivot

Steering is accomplished with the two steering levers. Each of the two levers function in three positions as shown in Fig. 4.20.

- in forward position A transmits power to the track in high range
- in middle position B transmits the power to the track in low range
- in rearward position C disconnects the power and applies the brake

To turn to the right or left pull back the steering lever on the side toward which the turn is to be made. Pull lever back just enough to make the desired turn. To make a pivot turn pull the lever all the way back.

To make a gradual left turn proceed as follows:

With steering lever in high range move LH steering in low range. When both steering levers are in low range, move RH steering lever in high range. To make a gradual right turn proceed in similar manner.

4.12. LOCKING BOTH TRACKS

When both steering levers are pulled simultaneously all the way back, the braking action stops both tracks.



WARNING! Never pull both steering levers all the way back to stop the machine unless the machine is moving very slowly. Use the foot brake to slow down or stop the machine.

4.13. DOWNGRADE OPERATION



WARNING! When operating a machine downhill, always put the transmission in the low range position. Use the brake pedal to slow the machine. Never go downhill with the transmission control in neutral. Failure to do so could result in losing control of the machine and rollover could result.

Before going downgrade, select the range, which will provide full tractor control without overspeeding the engine.

4.14. OPERATING OVER AN OBSTRUCTION

When crossing a log or ditch bank, use the decelerator pedal to slow the machine; and when possible, cross at an angle. Then gradually increase the power to the tracks as the machine moves forward, over, and down. If the load is light, it may also be necessary to use the brake pedal to avoid abrupt movements.

4.15. STOPPING THE MACHINE

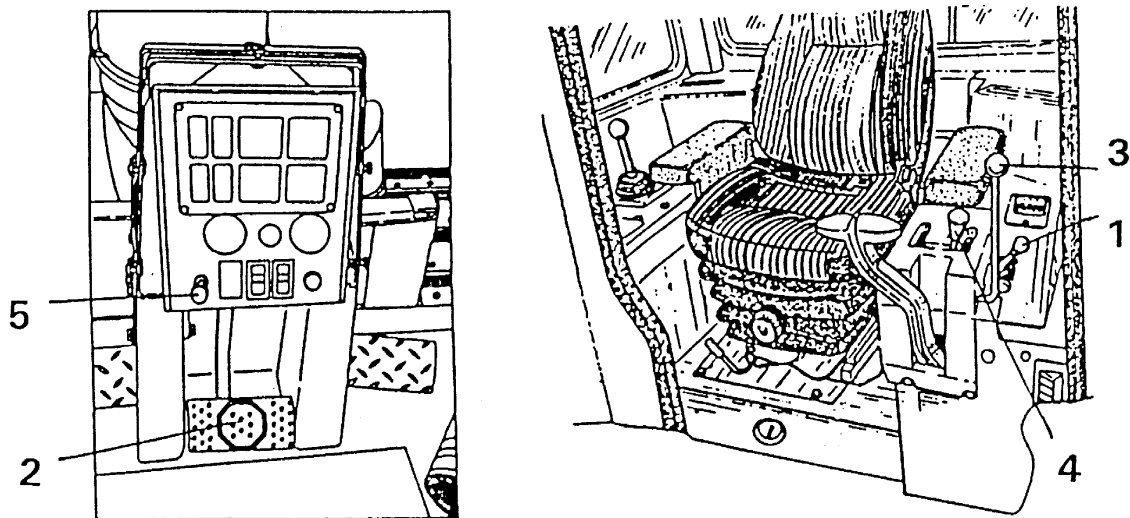


Fig. 4.21. Stopping the Machine

1. Engine Speed and Shut Down Lever
2. Brake and Decelerator Pedal
3. Transmission Neutral Lock Lever
4. Transmission Shift Lever
5. Brake Lock Lever

4.15. STOPPING THE MACHINE

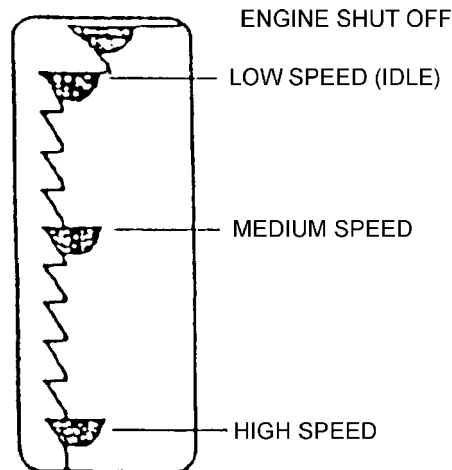


Fig. 4.22. Engine Speed and Shut Down Control Lever

Activity order for stopping the machine

1. Depress the brake and decelerator pedal until the machine is stopped.
2. Move the engine speed and shut down control lever to the low idle position.
3. Place the transmission shift lever in NEUTRAL.
4. Place the neutral lock lever in ON position.
5. Lock the brake and decelerator pedal.

4.16. PARKING THE MACHINE

A few DO suggestions to protect both lives and equipment when parking. DO park tractor on planks in freezing weather to prevent tracks from freezing to ground. Do lower hydraulically operated tractor equipment to the ground to reduce injury possibilities and to gain tractor stability.



WARNING! Never leave the machine unattended while the engine is running.

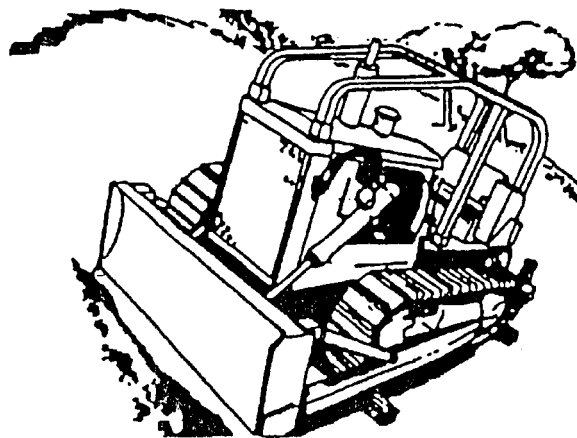


Fig. 4.23. Parking on a Slope

Parking on a slope is not recommended. Do park tractor on level ground, if at all possible to:

- a) Avoid unexpected movement
- b) Obtain accurate coolant, lubricant and fuel level checks

4.16. PARKING THE MACHINE

Avoid parking on a slope because unexpected machine movement may occur. However if necessary, park at a right angle and secure the tracks with blocks (front and rear).

4.17. OPERATING MOUNTED EQUIPMENT

General

The hydraulic system provides power for the blade equipment, ripper or various other types of equipment. Specific instructions for the operation of the blade and ripper are included in this section.

IMPORTANT: Holding a control lever in any position except HOLD or FLOAT for an extended period off time after the hydraulic cylinder rod has reached the limit of its travel will produce excessive heat in the hydraulic system which may affect equipment performance.

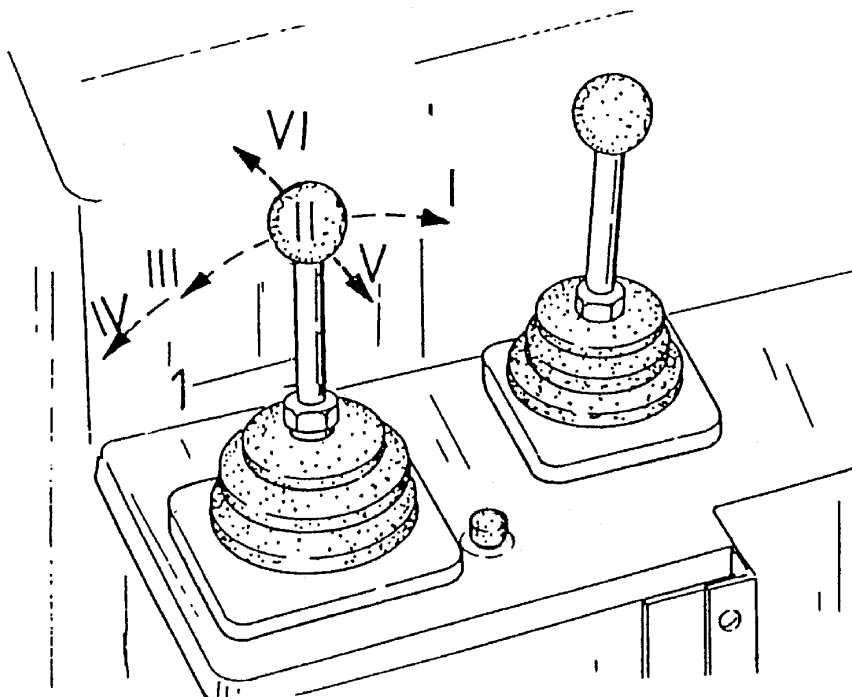


Fig. 4.24. Blade Control Lever Positions

I – Lower II - Hold III – Raise IV - LH Tilt V - RH Tilt

4.17.1. HOLD

When the lever is released from any position except “Float”, the lever automatically returns to the hold position. The blade height will remain the same, as it was when the lever was released.

4.17.2. RAISE

Pull the control lever back to raise the blade to desired height. When released the lever will return to the hold position.

4.17.3. LOWER

Push the control lever forward to lower the blade. When released the lever will return to the hold position.

4.17. OPERATING MOUNTED EQUIPMENT

4.17.4. FLOAT

With the control lever in the float position, the blade is free to follow the contour of the ground. To place the control lever in the float position, push all the way forward to its detented position in direction I in Fig. 4.25. The lever will remain in this position until it is manually returned to the hold position.

4.17.5. TILT

LH TILT

Pull the control lever to the left to lower the left hand corner of the blade. The lever will return to the hold position when released.

RH TILT

Push the control lever to the right to lower the right hand corner of the blade. The lever will return to the hold position when released.

4.17.6. RIPPER CONTROL LEVER

NOTE: For proper operation of ripper control lever and observation of working tool it is necessary to swivel the operator's seat 15° to the right.

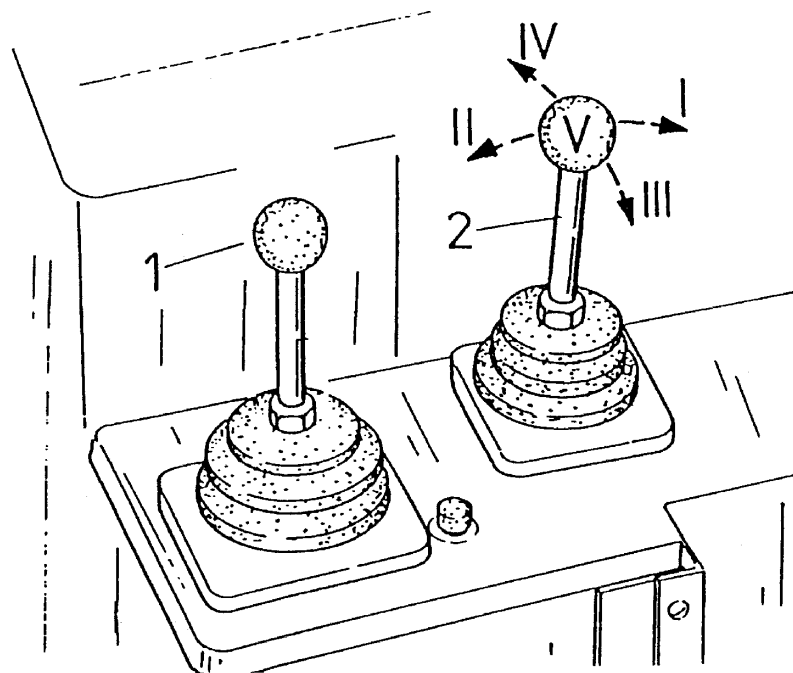


Fig. 4.25. Ripper Control Lever

- | | |
|-------------------------|-------------------------|
| 1. Blade Control Lever | I. Ripper Pitch Forward |
| 2. Ripper Control Lever | II. Ripper Pitch Aft |
| | III. Ripper Raise |
| | IV. Ripper Lower |
| | V. Hold |

1. Ripper Pitch (forward or aft)

To change angle of ripper tooth move the ripper control lever:

- a) Ripper point forward – move the lever to “I” position.
- b) Ripper point aft – move the lever to “II” position.

4.17. OPERATING MOUNTED EQUIPMENT

The control lever will return automatically to HOLD position when released (from “I” to “V” position)

2. Ripper Raise

To raise the ripper to required height move the lever in “III” position. The control lever will return automatically to HOLD position “V” when released.

3. Ripper Lower

To lower the ripper moves the lever in “IV” position. The control lever will return automatically to HOLD position “V” when released.

NOTE: Holding the control lever in any position except HOLD for an extended period of time will produce excessive heat in the hydraulic system which may affect equipment performance.

4.17.7. BULLDOZER BLADE POSITIONS

TILTING THE BLADE (MECHANICAL TILT, FIG. 4.26)

1. Raise the blade 400 mm above the ground and shut off the engine. Refer to STOPPING THE ENGINE.
2. Remove the locking pin and adjust upper strut on the side to be raised. Extend the strut by the value equal approximately to half of required blade tilt.

IMPORTANT: Do not expose any portion of the eyebolt threads.

3. Adjust the opposite side to get the desired tilt by shortening the strut by value equal to remaining part of desired tilt. Install locking pin.

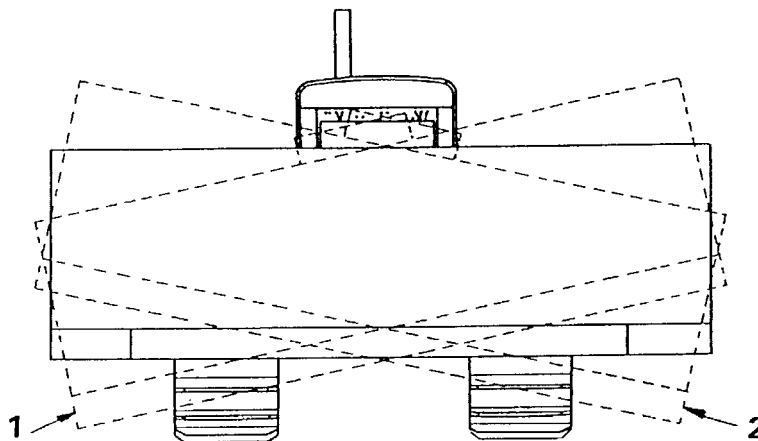


Fig. 4.26. Blade tilt

1 - Tilt to the Right 2 - Tilt to the Left

IMPORTANT: Do not tilt the blade more than 560 mm tip to tip.

TILTING THE BLADE WITH HYDRAULIC TILT

1. To obtain a desired tilt of 400 mm or less, proceed as follows:
 - a) Raise the blade about 450 mm off the ground.
 - b) Hold the tilt control lever in the tilt position on the side to which the blade is to be tilted until the desired tilt is obtained.
2. To obtain a tilt of 400 mm to maximum 710 mm, proceed as follows:

4.17. OPERATING MOUNTED EQUIPMENT

- a) hold the tilt control lever in the tilt position until the piston rod in the tilt cylinder is either fully extended or retracted (depending upon the side to be tilted). Shut off the engine. Refer to „STOPPING THE ENGINE”.
- b) Adjust the mechanical strut as described under „TILTING THE BLADE (MECHANICAL TILT)”.

LEVELLING THE BLADE WITH HYDRAULIC TILT

- 1. Place the lowest corner of the blade on a flat surface.
- 2. Hold the control lever in position on this side to which the blade is to be lowered until the blade is even along the flat surface.

PITCHING THE BLADE (FIG. 4.27)

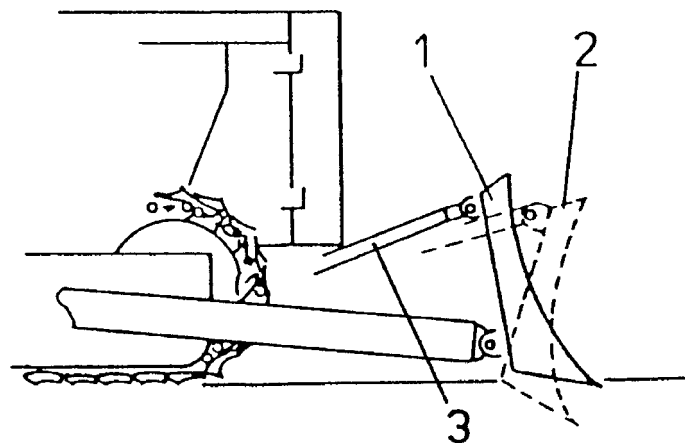


Fig. 4.27. Blade Pitch

- 1. Decreased suction angle for soft material.
- 2. Increased suction angle for hard materials.
- 3. Upper strut.

- 1. To pitch the blade forward (increasing the suction angle), raise the blade several centimeters off the ground. Shut off the engine. Refer to „STOPPING THE ENGINE”. Then extend the upper struts (3) on each side of the blade an equal amount in the range of dimensions A given on Fig. 4.28.

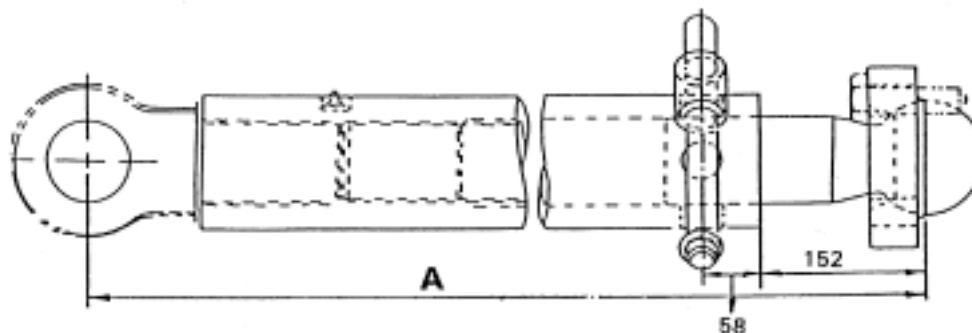


Fig. 4.28. Upper strut adjustment

- A = 1332 - Fully shortened
- A = 1434 - Fully extended

IMPORTANT: Do not expose any portion of the eyebolt threads.

4.17. OPERATING MOUNTED EQUIPMENT

2. To pitch the blade backward (decreasing the suction angle), the upper strut must be shortened on each side of the blade an equal amount.
3. After making the adjustments, secure the upper strut with the locking pin so it will not rotate.

4.17.8. ANGLING THE BLADE

ADJUSTING THE DIAGONAL ANGLE OF BLADE.

1. Raise the blade off the ground and shut off the engine. Refer to section „STOPPING THE ENGINE”
2. Remove one strut trunnion from the trunnion bracket on the C-frame, keep it close to the C-frame.
3. Remove the strut trunnion from the trunnion bracket on the opposite side of the frame, and carefully swing the strut assembly out as far as it will go.



WARNING! Stay clear of blade when performing above activities.

4. Swinging the blade will cause lost of balance and drop of blade on the side of swung strut.

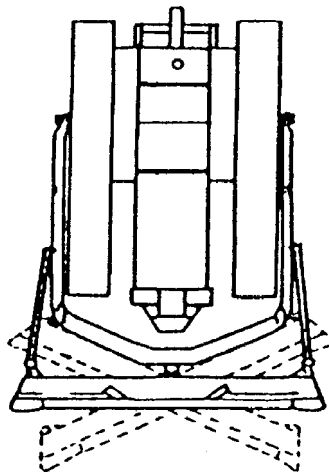


Fig. 4.29. Adjusting the Diagonal Angle of Blade

5. Swing the first disconnected strut assembly outward to regain blade balance. Level the blade and maintain this level position while repositioning the blade (changing the angle).
6. Assemble the first strut assembly to the C-frame as follows:
 - a) When connecting a blade angled to the right or the left, connect the rear most strut assembly first.
 - b) When connecting a straight blade (not angled), swing each strut assembly in until they contact the C-frame, level the blade, then assemble either strut assembly.
7. Assemble the remaining strut assembly to the C-frame. If necessary, adjust the upper struts to obtain strut trunnion alignment with the trunnion brackets on the C-frame.
8. Lock the strut trunnion in place through C-frame bracket with lock pin chained to lower strut. Loosen the clamping screws and nuts on the lower struts so that the strut eyebolt can be adjusted to fit into the swivel block.

IMPORTANT: This adjustments is made such that gaps are provided as shown in Figs. 4.30 and 4.31.

4.17. OPERATING MOUNTED EQUIPMENT

Install the mounting pin aligning the lock holes and secure with locking hardware. Retorque the strut eyebolt clamping cap screws and nuts to 450 Nm.

- Level the blade so one end does not dig in deeper than the other. This can be done by adjusting either or both upper struts. Refer to „LEVELLING THE BLADE”

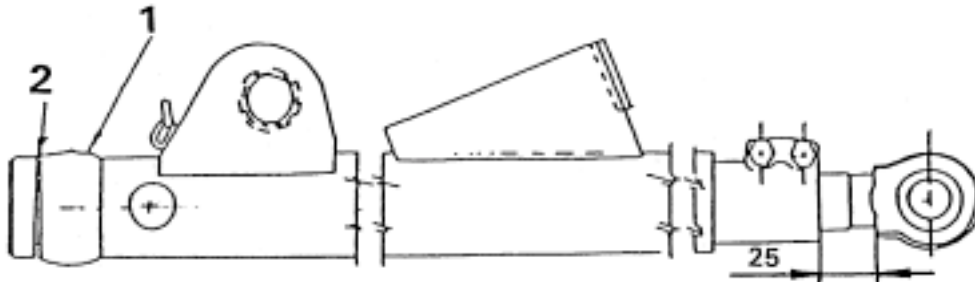


Fig. 4.30. Lower Strut Adjustment of the Angled Blade.

1. Trunnion Swivel Eye
2. Gap

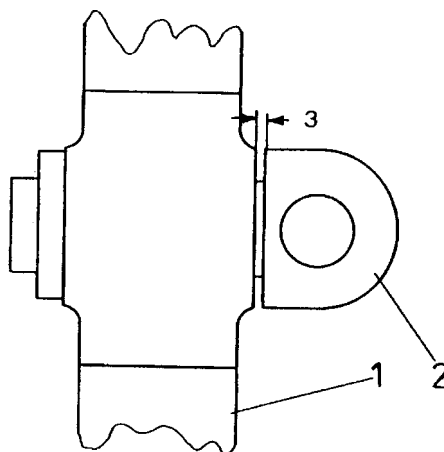


Fig. 4.31. Lower Strut Adjustment Gap.

1. C-frame
2. Swivel Pin
3. Gap

TILTING THE BLADE (MECHANICAL TILT, FIG. 4.26)

- Raise the blade 300 mm above the ground and shut off the engine. Refer to „STOPPING THE ENGINE”.
- Remove the strut trunnion from its bracket on the side to be raised, and position strut close to the C-frame.
- Adjust the opposite side to get the desired tilt by shortening the upper strut. Adjust this strut to tilt the blade about half of the desired tilt.



WARNING! Always lower the side being adjusted first so lack of balance will not cause the loose strut assembly to swing out and cause unexpected injury or damage.

- Return to the side of the machine on which the strut assembly was disengaged, and lengthen the upper strut until the strut trunnion can be inserted in its bracket on the C-frame.

4.17. OPERATING MOUNTED EQUIPMENT

NOTE: Do not tilt the blade more than 480 mm tip to tip.

5. After tilting the blade, raise the blade above the ground 300 mm and shut off the engine. Refer to „STOPPING THE ENGINE”. Adjust the upper struts to a „neutral” position (no compression or tension) so the blade connecting pins are free in their brackets.
6. Whenever the blade is tilted, adjustments to one upper strut must always be equal and opposite to the adjustment made on the other strut. (For example: if a strut on one side is shortened 1½ turns, lengthen the opposite strut 1½ turns).

LEVELLING THE BLADE WITH MECHANICAL TILT (Fig. 4.32)

1. Lift the blade off the ground and shut off the engine. Refer to „STOPPING THE ENGINE”.
2. Remove the locking pins and adjust both upper struts to the gap between the shoulder of the eyebolts (1 and 4) and the strut body, is 39 mm on each end. This will position the blade in its neutral pitch position. If the blade is not level, a half turn of the upper strut in either direction will level the blade.
3. After leveling the blade, raise the blade above the ground 300 mm and shut off the engine. Refer to „STOPPING THE ENGINE”. Adjust the upper struts to a „neutral” position (no compression or tension) so the blade connecting pins are free to revolve in their brackets.

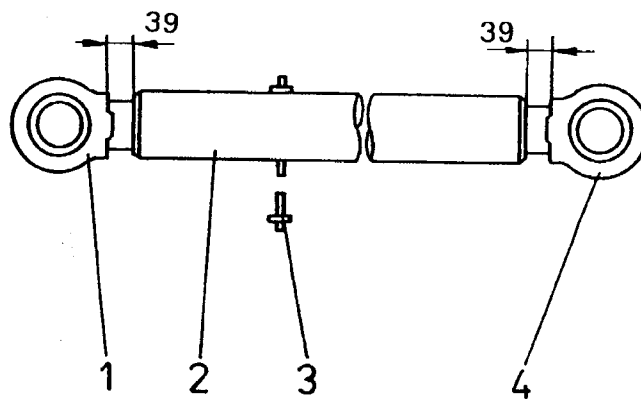


Fig. 4.32. Upper Strut Adjustment of Angle Blade.

- | | |
|---------------|----------------|
| 1. Eyebolt | 3. Locking Pin |
| 2. Strut Body | 4. Eyebolt |

4. Having determined the „neutral” position, shorten each upper strut by 1 full turn.

IMPORTANT: Adjustment made in step 4 must be made only if all strut adjustments have been made with blade raised off the ground.

5. Reinstall the upper strut locking pins.

4.18. OPERATING TECHNIQUES



WARNING! Before operating the machine, be sure the area of the operator's compartment, all mounting steps and grab handles are free of oil, grease, loose objects, ice, snow and mud to lessen the possibility of slipping. Remove or secure all maintenance and personal items so they will not interfere with the operator or jam the controls. Failure to follow these instructions may result in serious injury.

4.18. OPERATING TECHNIQUES

When the blade is held hydraulically it becomes a rigid part of the tractor, except when the valve is in "FLOAT" position, and will follow all movements of the machine. When rough terrain encountered it will be necessary to vary the height of the blade while pitching to obtain a smooth cut. When possible, start all jobs from relatively level ground. If necessary, level an area large enough to provide sufficient working space for the machine. This prevents back and forth pitch of the machine and will result in easier digging.

Avoid track spinning whenever possible; this wastes effort and converts a relatively smooth working area into ruts and piles that pitch and tilt a tractor. In cold weather this material can freeze and cause additional difficulty the following day.

Crossing ditches, ridges, rock or logs should be done slowly and, at an angle. This slows the fall, lessens the danger of upsetting the machine and reduces the fall jolt, which can be harmful to the operator and machine.

4.18.1. DIGGING AND CLEARING



WARNING! Prior to operating know the locations of gas lines, utility lines, sewers, overhead and buried power lines, and the other obstructions or hazards are known. A ruptured gas line or cut electrical line could result in personal injury.

Always feed the blade into the ground gradually until the desired depth of cut is obtained. When selecting the gear range and determining the depth of cut, allow for an increase in resistance as the load increases. When raising the blade at the end of a cut, do it gradually to avoid an abrupt ridge or bump in the path of the tractor. Move material downgrade whenever possible to take advantage of the reduced effort required (Fig. 4.33).



Fig. 4.33. Moving Material Downgrade

Two methods of cutting down a pile or hill are shown in Fig. 4.34. Type of material and local conditions may dictate which method is preferred. Further information is included in "BREAKING PILES AND SPREADING" When using Method 1, never allow the high face to become a hazard to the operator or machine. With the tractor at right angles to the face, raise the blade and dislodge the high bank before returning to the original direction of cut.

When using Method 2, make the cut wide enough to avoid trapping the tractor.



WARNING! Avoid high overhangs. Ramp up and remove the top layers first. Avoid high banks. Operate the machines as far away from the trench as possible or cave-in may result.

OPERATING

4.18. OPERATING TECHNIQUES

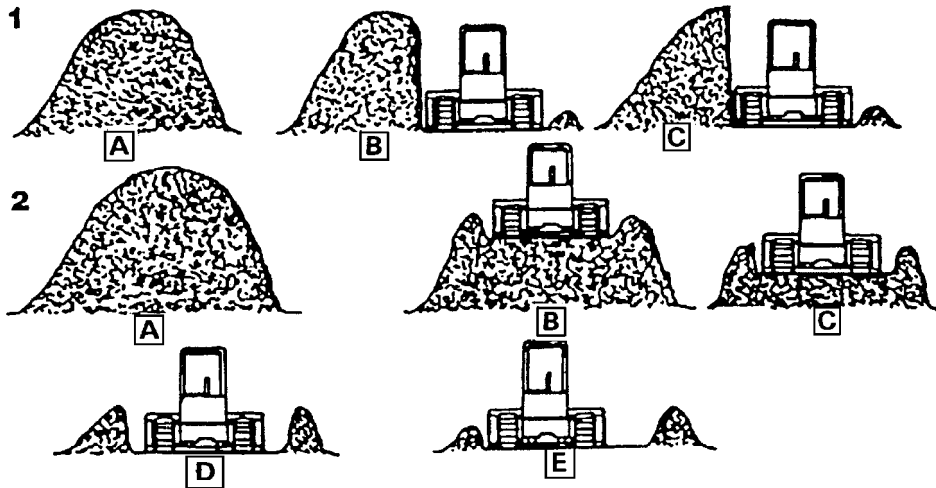


Fig. 4.34. Cutting Down a Pile or Hill

1 – Method 1 12 – Method 2

A side-hill cut can be started more easily if a small bench cut is first made as shown in Fig. 4.35. Then, when digging as in Fig. 4.36, keep the inside (uphill) surface slightly lower to gain greater tractor stability. Tilting the blade will provide this type of cut with less effort on the operator's part.

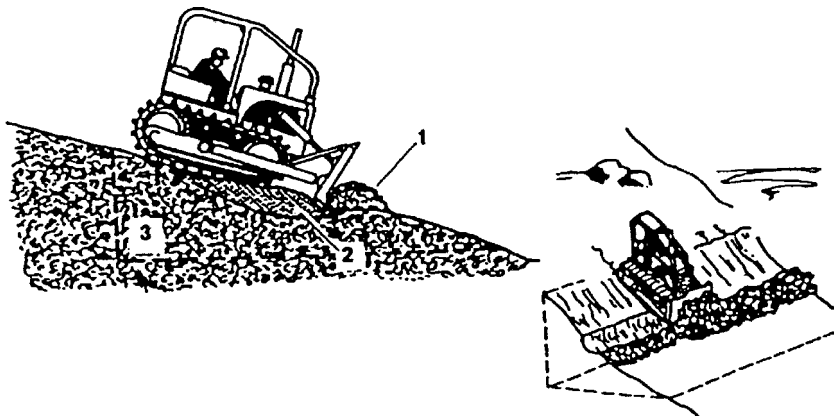


Fig. 4.35. Side-Hill Cut

1. Cut I 2. Cut II 3. Cut III

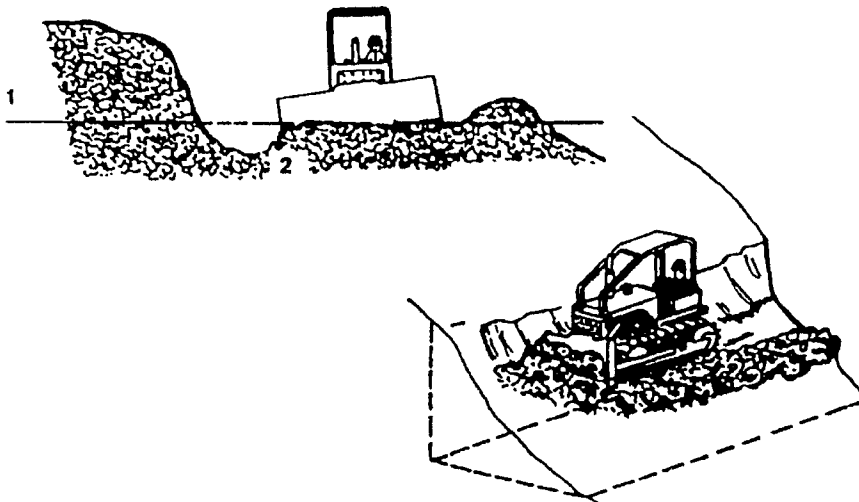


Fig. 4.36. Side Hill Cut

1. Level 2. Lower Surface

4.18. OPERATING TECHNIQUES

Always cut the shelf wide enough to provide solid support for equipment using it later. If possible, move the material downhill to gain the advantage of gravity, reduced effort and increased tractor stability. Soft soil or shallow slopes may allow the side hill cut to be made as shown in Fig. 4.37. Increased stability is realized by running the uphill track inside the ridge left by the first cut. Cuts 3, 4 and 5 illustrate the completion of the shelf.

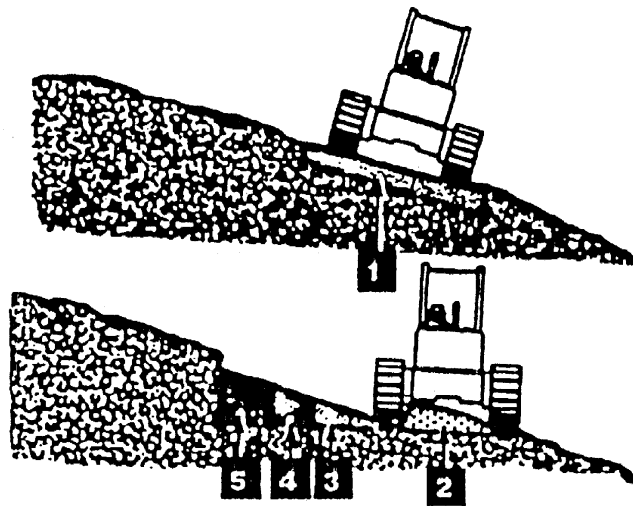


Fig. 4.37. Shallow Slope Side Hill Cut

Once again, pushing the loosened material to the lower side of the slope Fig. 4.38 will normally reduce time and cost. Do not push material beyond the point required to retain firm track support.



Fig. 4.38. Slope Edge Operation

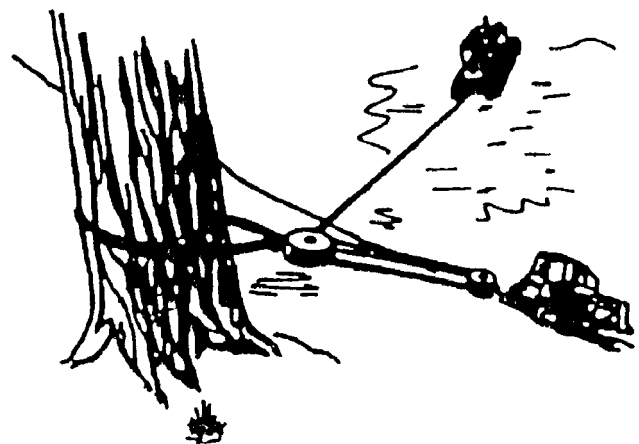


Fig. 4.39. Operating a Tandem Arrangement

When backing up, do not raise the blade as this puts extra weight on the front idlers causing greater track penetration. Let the blade float as you back away from the edge of soft fills. Initial work on steep hillsides can be safer by either securing the tractor with a winch to a suitable uphill anchor point or by operating a tandem arrangement as shown in Fig. 4.39.

When clearing trees, raise the blade high to gain leverage and make contact gently to reduce possible harm to the operator and machine (Fig. 4.40).

Heavy roots of large trees may require pushing and digging or cutting from several sides of the tree. Use a cable to topple and remove trees from soft ground (Fig. 4.41).

4.18. OPERATING TECHNIQUES



Fig. 4.40. Machine Equipped with Sweeps



Fig. 4.41. Using Cable to Remove Trees



WARNING! Falling trees and dead limbs can cause injuries. When clearing trees, operator protection must be used.

When clearing a rocky area, remove the small and loose rocks first, large and solid rocks can then be loosened and moved with less difficulty. When loosening large or solid rocks, greater force and penetration can be obtained by tilting the blade and prying under the rock with the lower edge of the blade (Fig. 4.42). Lifting the rock with the blade while pushing will increase traction and reduce track spinning.



Fig. 4.42. Loosening Rocks with Lower Edge of the Blade

Penetration on hard, frozen or rocky ground can be made easier by tilting the blade. This will add weight and power to the lower cutting edge. When the ground is frozen and the area must be ripped before it can be worked, rip a relatively small section and work it to grade before enlarging the cut. This will require ripping each section only once, not every morning after the ground has refrozen. Snow can act as an insulating blanket and reduce or eliminate the need for a ripper. Therefore, remove snow only from the area to be worked each day; leave the rest to insulate the ground.

4.18. OPERATING TECHNIQUES

4.18.2. TRANSPORTING, PILING OR LOADING

The transporting of material with a bulldozer is not always a most economical method. Natural ridges, a window formed by side blade spillage on earlier passes or side-by-side, dozing will improve the productivity (Fig 4.43). Where the quantity of material or distance involved becomes excessive, a loader, scraper or truck should be considered.

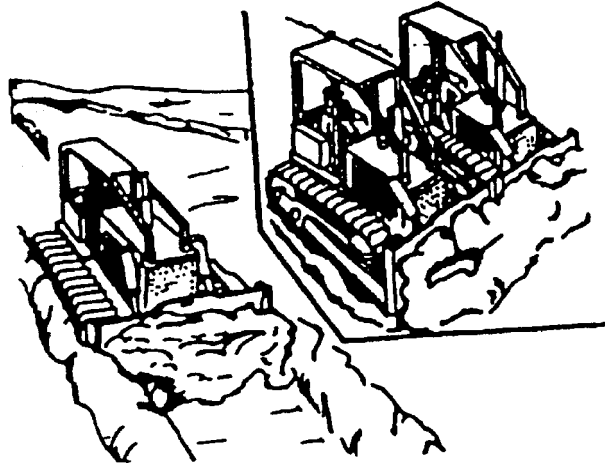


Fig. 4.43. Side-by-Side Dozing

A usual method of piling is shown in Fig. 4.44. When the piling reaches stages “D” or “E” the operator may elect to continue one of the other depending on height or area desired. When the machine is used as a pusher, aiding scraper loading (Fig. 4.45), the machine power must be carefully controlled. Excessive “push” effort can cause the scraper unit to “jackknife”, with resulting injury or damage. On turns, be sure the blade of the pusher tractor does not come in contact with the rear wheels of the scraper.

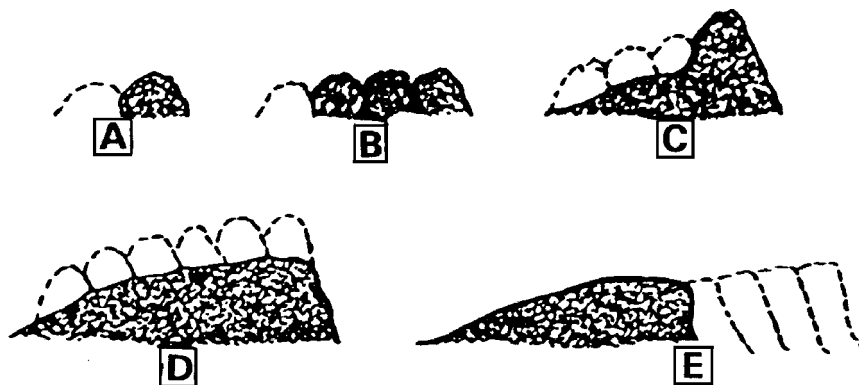


Fig. 4.44. A Usual Method of Piling

4.18. OPERATING TECHNIQUES

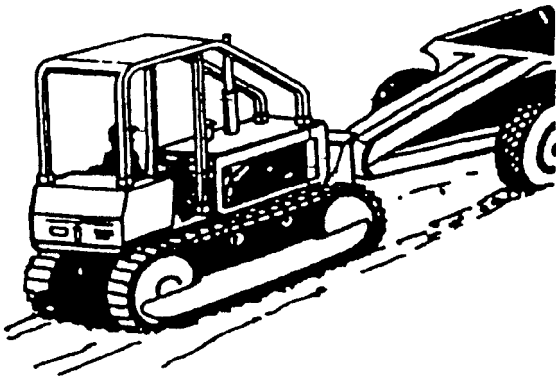


Fig. 4.45. Aiding Scraper Loading

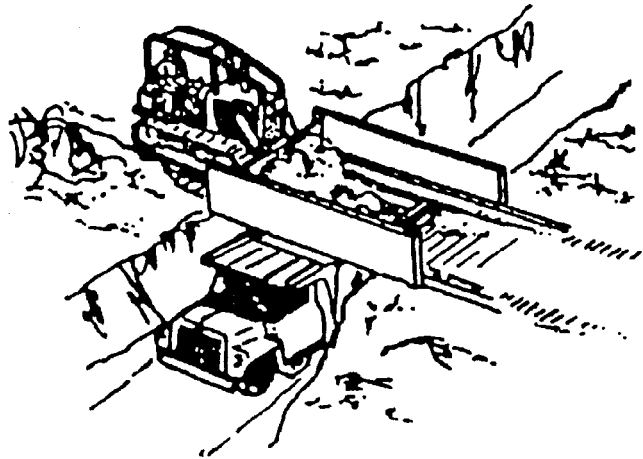


Fig. 4.46. Loading Directly

The bulldozer can be used directly as a loader if the method shown in Fig. 4.46 is used.

4.18.3. BREAKING PILES AND SPREADING

Two methods of breaking down a pile are shown in Fig. 4.47. When spreading is to be in several directions or if the pile is large or hard, Method 1 is usually desired. When using Method 1, cut into the side of the pile from different angles. When Method 2 is used, and access to the top of the pile is difficult, a slot may be started as shown below. Loosen material at the base and form a dirt "ramp" to provide a decreased angle of approach and cut.

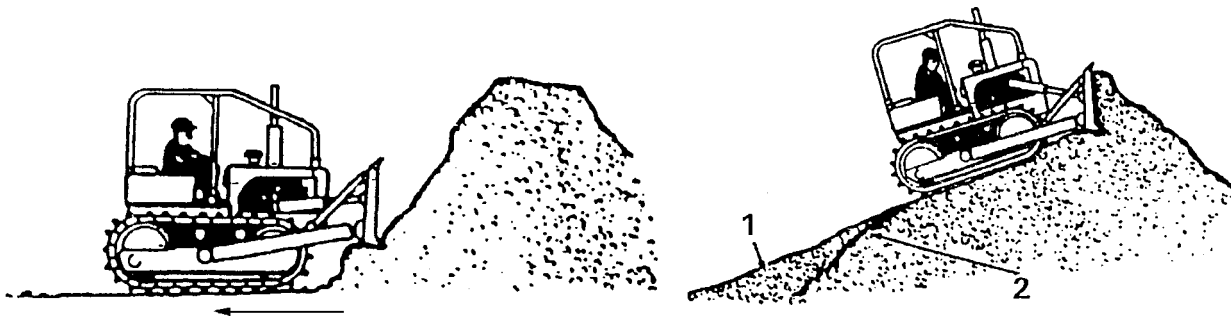


Fig. 4.47. Breaking Down a Pile

Method 1

Method 2

1. Ramp 2. Original Slope

When trucks or wagons are used for hauling, bulldozers are ideal spreading tools at the fill (Fig. 4.48). Blade should be kept in a straight position so that material is drifted directly under the cutting edge (Fig. 4.49). When finishing in non-solid materials, such as earth, drag the blade backward for a smooth job as shown in Fig. 4.49. Rock, of course, may damage the blade base, therefore, such practice is not recommended where abrasive material is common.

4.18. OPERATING TECHNIQUES

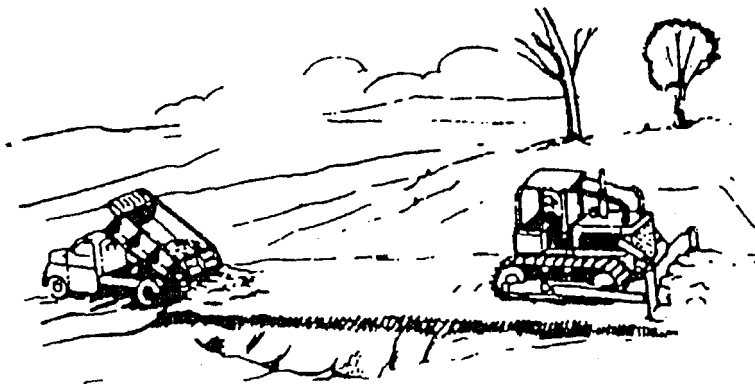


Fig. 4.48. Spreading Material Forward

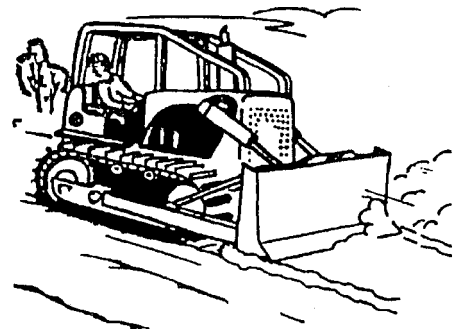


Fig. 4.49. Back dragging

4.18.4. RIPPING

4.18.4.1. Prior to Operation

Before operating the ripper proceed as follows:

1. Check all mounting hardware for torque.
2. Check hydraulic connections for leaks.
3. Check the condition of the ripper, bits, mounting hardware for completeness and torque.

4.18.4.2. Ripping Techniques

When starting ripping lower the ripper teeth slowly to required depth. Ripping of rock material must be performed in direction of easier ripping what may be established by carrying out test ripping in various directions and under various angle of inclination of the shanks. During test ripping lower the shank to half of working depth. Machine efficiency can be improved when several centimeters of loose material is left on solid rock. Ripping should be performed at a depth the best results are obtained without overloading the engine. Keep loose ground level and horizontal as much as possible. Never make turns with the machine with ripper teeth are at full depth in rocky ground. Use the common sense when working in hard ground not to damage the ripper and the machine. Do not accelerate the machine and simultaneously lower the ripper teeth into the ground – this will damage the ripper.

Pay attention not to allow rear of the machine to lift off the ground during ripping operations, as this decreases traction and accelerates wear of track system. Use new and sharp bits for hard ground.

4.18.4.3. Cold Weather Operation

Start the engine as described in “STARTING THE ENGINE” and then proceed as follows:

- move slightly and slowly ripper control to warm oil in hydraulic cylinders.
- raise the ripper at max. height and then lower it slowly until it rests on the ground.
- increase gradually pressure in ripper cylinders by keeping the control lever in LOWER position until rear of the machine is off the ground.
- prior to normal ripping operations operate the ripper at low depth for a couple of minutes to warm shank bits.
- protect shank and bits when parking the machine.

4.19. ECONOMICAL OPERATION OF THE MACHINE

Fuel consumption during operation of the dozer depends on many factors as: engine characteristics, load, terrain, operator's skill and experience, manner of operation.

Relatively of fuel consumption is quantity on moved material per unit of consumed fuel. To reach the most favorable value of this ratio observe the following principles of dozer operation:

- Avoid long distance transporting of material.
- Loading and pushing of material must be performed at gear which ensures maximum drawbar pull (1st or 2nd gear) with high blade fill ratio without losing material in blade.
- Reverse travel at top gear but keep engine speed above medium, not maximum.
- Avoid stopping machine due stall of the engine.
- Avoid track slippage.

For digging hard material pitch the blade forward, for transportation of material pitch the blade backward.

SECTION 5
MAINTENANCE

SECTION CONTENTS

- 5.1. Service Precautions 3
- 5.2. Scheduled Maintenance Guide 4
 - 5.2.1. Ground Level Inspection 6
- 5.3. Maintenance and Service Chart 7
 - 5.3.1. Refill Specifications and Capacities Chart 9
- 5.4. Lubrication 11
 - 5.4.1. When Shipped 11
 - 5.4.2. When Serviced 11
 - 5.4.3. Selection 11
 - 5.4.4. Viscosities 12
 - 5.4.5. Recommended Lubricant Chart 12
- 5.5. Seasonal Preparation 14
 - 5.5.1. Fuel System 14
 - 5.5.2. Cooling System 14
 - 5.5.3. Electrical System 15
- 5.6. Air Cleaning System 15
 - 5.6.1. Air Cleaner 15
 - 5.6.2. Primary Filter Element 15
 - 5.6.3. Safety Filter Element 17
 - 5.6.4. Air Intake System 18
 - 5.6.4.1. Precleaner 18
 - 5.6.4.2. Checking Air Intake System for Leaks 18
- 5.7. Belts 19
 - 5.7.1. Checking Tension and Adjustment 20
 - 5.7.2. Belt Tension Chart 20
- 5.8. Cooling System 22
 - 5.8.1. Water 22
 - 5.8.2. Antifreeze 22
 - 5.8.3. Inhibitors / Conditioners 23
 - 5.8.4. Radiator Cap 24
 - 5.8.5. Checking Coolant Level 25
 - 5.8.6. Cleaning the Radiator Core 25
 - 5.8.7. Adding the Coolant when Engine is Hot 25
 - 5.8.8. Changing Coolant 25
 - 5.8.8.1. Draining the System 25
 - 5.8.8.2. Filling the Drained System 26
- 5.9. Fan and Fan Hub 26
- 5.10. Electrical System 26
 - 5.10.1. Automatic Reset Circuit Breaker 27
 - 5.10.2. Batteries 27
- 5.11. Engine 29
 - 5.11.1. Checking the Crankcase Oil 29
 - 5.11.2. Changing The Crankcase Oil And Oil Filter 29
 - 5.11.2.1. Changing the Crankcase Oil 29
 - 5.11.2.2. Changing the Engine Oil Filter 30
 - 5.11.3. Ether Injector (If Equipped) 31
- 5.12. Fuel System 33
 - 5.12.1. Filling The Fuel Tank 33
 - 5.12.2. Fuel Tank Filler Strainer 33
 - 5.12.3. Fuel Tank Shutoff Valve 34
 - 5.12.4. Fuel Filters 34

5.12.4.1.	Fuel Filter Water Separator Drain Valve	34
5.12.4.2.	Replacing the Fuel Filter	35
5.12.5.	Draining Fuel Tank	35
5.13.	Hydraulic System	35
5.13.1.	Checking Oil Level	36
5.13.2.	Changing Hydraulic Oil	36
5.13.3.	Servicing the Return Filter and Equipment Hydraulic Control System Filter	37
5.13.4.	Servicing the Suction Strainer	38
5.13.5.	Servicing the Reservoir Breather	39
5.13.6.	Venting the Hydraulic System	40
5.14.	Lubrication Fittings	40
5.15.	Mounted Equipment	42
5.15.1.	Complete Blade Removal and Installation	42
5.15.1.1.	Leveling the Blade	43
5.15.1.2.	Adjustment of Diagonal Blade with Hydraulic Tilt Cylinders	43
5.15.1.3.	Filling Up and Venting the Tilt Cylinders of Diagonal Blade	44
5.15.1.4.	Blade Struts and Tilt Cylinder Adjustment	45
5.15.2.	Trunnion, Cover, Blade Cutting Edge and End Bits Mounting Bolts	47
5.15.3.	Allowable Wear of Cutting Edge and End Bits and Ripper Points	47
5.15.3.1.	Servicing the Ripper	48
5.15.3.2.	Lubrication	48
5.16.	Safety Belt	48
5.17.	Final Drives	49
5.17.1.	Checking the Oil Level	49
5.17.2.	Changing the Oil	49
5.18.	Transmission System	50
5.18.1.	Checking the Oil Level	50
5.18.2.	Changing Transmission System Oil	51
5.18.3.	Servicing the Transmission System Filters	51
5.18.3.1.	Servicing the Pressure Filter	51
5.18.3.2.	Servicing the Suction Strainer	52
5.18.4.	Servicing the Breather	53
5.18.5.	Servicing Transmission Scavenger Strainer	54
5.19.	Undercarriage	55
5.19.1.	Track Shoe Bolts	55
5.19.2.	Effect of Track Adjustment on Undercarriage Wear	55
5.19.3.	Checking the Tension	56
5.19.4.	Adjusting Tension	56
5.19.5.	Track Frame Guide	58
5.19.6.	Pivot Shaft	59
5.19.7.	Equalizer Bar	59
5.19.8.	Front Wheel	60
5.20.	Adjusting Hand and Foot Controls	60
5.21.	Cab and ROPS	62

5.1. SERVICE PRECAUTIONS



WARNING! Only authorized personnel, thoroughly trained with design and operation of all assemblies and mechanisms may be allowed to service this machine.

WORK SAFELY – FOLLOW THESE RULES

A CAREFUL OPERATOR IS THE BEST INSURANCE AGAINST AN ACCIDENT.

GENERAL SERVICE PRECAUTIONS

The procedures in this section contain many notes and precautions, which should be followed along with standard safety procedures to minimize the possibility of personal injury or improper service. Improper service could compromise the machine's safety or cause it to function improperly, which could result in personal injury or death. Review the precautions listed in Section 2 "SAFETY PRECAUTIONS".

Do not attempt to do repairs you do not understand. Use your „Service Manual“ or consult your Authorized Distributor for information.

Do not jump on or off the machine. When working under the machine or servicing in the area of the engine fan or belts, turn off the electrical system master switch, apply and lock parking brake and tag controls to warn against starting the machine.

Whenever servicing, take care to prevent accidental cranking of the engine. Turn off the electrical master switch and remove the key. It is not possible to anticipate all conceivable ways or conditions under which the machine may be serviced or to provide precautions for all the possible hazards that may result. Safety is always the most important rule.

Constantly be aware of dangers involved in working on the machine and take proper precautions.

Standard and accepted safety precautions and equipment should be used. This machine is assembled using high strength fasteners.

Do not substitute. Replacement fasteners must be of the same size and strength as the originals (refer to Section 6). Tighten fasteners to the proper torque value specified in Section 6, unless otherwise specified.

Refer to Spare Parts Catalogue for all replacement parts.

Use safety goggles, hard hats, safety shoes, heavy duty gloves and other protection during cutting, grinding, chiseling, prying or any other process which could cause material removal or projectiles.

Many machined parts are hardened and can chip.

Use the proper size and type of tool for the job being done. Select a wrench or that fits and be sure it is on straight. Keep your tools clean and in good condition.

Some procedures require the use of tools specially designed for that specific purpose.

Before substituting another tool or procedure, you must be completely satisfied that neither personal safety nor the performance of the machine will be endangered.

Scheduled maintenance is the normal maintenance necessary to provide proper and efficient equipment operation.

5.2. SCHEDULED MAINTENANCE GUIDE**Every 10 Hours of Operation (Every Day)**

1. Clean windows, lights and instrument panel.
 2. Check engine oil level. Refer to 5.11.1.
 3. Check radiator coolant level. Refer to 5.8.5
 4. Check hydraulic system oil level. Refer to 5.13.1.
 5. Check and clean precleaner screen, if necessary. Refer to 5.6.4.1.
 6. Check level in window washer reservoir. Refer to 5.2.1.
 7. Carry out ground level inspection. Refer to 5.2.1.
 8. Drain water from fuel filters prior to starting the work. Refer to 5.12.7.
 9. Visually check the condition of drive belts. (Refer to 5.7.) and fan (Refer to 5.9.)
 10. Check instruments and warning lights for operation. Refer to 4.3.
 11. Refill fuel tank at the end of each day's operation. Refer to 5.12.1.
 - 12.* Check torque:
 - track shoe bolts. Refer to 5.19.1.
 - blade cutting edge and end bit bolts. Refer to 5.15.2.
 - trunnion cap bolts and trunnion mounting bolts. Refer to 5.15.2.
- * – after initial 10 hours of operation only.

Every 50 Hours of Operation

1. Check oil level in rear mainframe. Refer to 5.18.1.
 2. Clean radiator core. Refer to 5.5.2 and 5.8.6.
 3. Check and adjust track tension, if necessary. Refer to 5.19.3.
 4. Check air intake system for leaks (hoses and clamps). Refer to 5.6.4.2.
 5. Lubricate lift cylinder bearings. Refer to 5.14.
 6. Lubricate ripper cylinder bearings. Refer to 5.14.
 - 7*. Replace hydraulic system return filters. Refer to 5.13.3.
 - 8*. Replace transmission system pressure filters. Refer to 5.18.3.
 - 9*. Clean transmission system suction strainer. Refer to 5.18.4.
 - 10*. Replace equipment pilot filter. Refer to 5.13.3.
- * – after initial 50 hours of operation only.

Every 100 Hours of Operation

1. Lubricate pivots of blade cylinders fittings. Refer to 5.14.

Every 250 Hours of Operation or every 6 months

1. Change engine crankcase oil. Refer to 5.11.2.1.
2. Change engine crankcase oil filter. Refer to 5.11.2.
3. Replace fuel filters (2 filters) (replace fuel filters earlier when drop in engine power is noticed). Refer to 5.12.4.2.
4. Check coolant for DCA concentration and replace coolant filter. Refer to 5.8.3.
5. Check alternator belt and air compressor or air conditioner (if equipped) belt tension. Refer to 5.7.2.
6. Check final drive oil level. Refer to 5.17.1.
7. Lubricate upper struts and joints. Refer to 5.14.
8. Lubricate lower struts and joints. Refer to 5.14.
9. Reverse fan blade (if equipped). Refer to 5.9.

5.2. SCHEDULED MAINTENANCE GUIDE**Every 500 Hours of Operation**

1. Check oil level in pivot shaft housing. Refer to 5.19.6.
2. Lubricate universal joints. Refer to 5.18.
3. Clean the transmission suction strainer. Refer to 15.18.4.

Every 1000 Hours of Operation

1. Change oil level in rear mainframe. Refer to 5.18.2.
2. Clean transmission system suction strainer. Refer to 5.18.4.
3. Replace transmission system pressure filter. Refer to 5.18.3.
4. Replace rear mainframe breather. Refer to 5.18.3.
5. Change final drive oil. Refer to 5.17.2.
6. Check sprocket bolt torque's. Refer to 5.19.
7. Replace hydraulic system return filter. Refer to 5.13.3.
8. Clean hydraulic reservoir breather. Refer to 5.13.5.
9. Lubricate gimbal crosstube. Refer to 5.14.
10. Clean transmission scavenger suction strainer. Refer to 5.18.6.

Periodic (at least once a year or as required)

1. Clean air cleaner elements or replace if necessary. Refer to 5.6.
2. Clean fuel tank filler strainer. Refer to 5.12.2.
3. Clean cab air filters. Refer to 5.21.
4. Drain water and sediment from fuel tank sediment bowl. Refer to 5.12.5.
5. Lubricate hand and foot linkage, check for operation and adjust if necessary. Refer to 5.20.
6. Lubricate equipment pilot valve plunger – to – plate surfaces. Refer to 5.20.
7. Check engine RPM with depressed decelerator. Refer to 5.20.
8. Check operation of brake lock. Refer to 5.20.
9. Check undercarriage components for wear. Refer to 5.19.
10. Check track frames guide clearance and adjust if necessary, lubricate track frame guides. Refer to 5.19.5.
11. Check clearance in blade socket and diagonal struts. Refer to 5.15.1.4.
12. Check the condition and amount of charge of batteries. Refer to 5.10.
13. Check the condition of electrical wires and connections. Refer to 5.10.
14. Check the condition of safety belt. Refer to 5.16.
15. Check torque:
 - cab and ROPS mounting bolts. Refer to 5.21.
 - track shoe mounting bolts. Refer to 5.19.1.
 - blade cutting edge and end bit bolts. Refer to 5.15.2.
 - trunnion cap bolts and trunnion mounting bolts. Refer to 5.15.2.
16. Check cutting edges and end bits for wear. Refer to 5.15.3.
17. Check ripper points for wear. Refer to 5.15.3.
18. Measure the gap between equalizer bar and track frame rebound. Refer to 5.19.7
19. Check front wheel guide clearance. Refer to 5.19.8.
20. Visually check the crankcase breather tube (below 0oC). Refer to 5.11.1.

**Every 1500 Hours of Operation or every year
(Per Engine Operator's Manual)**

1. Steam cleans the engine.
- 2.*Check and adjust valve and injectors.
3. Check and when necessary tighten the turbocompressor mounting bolts.
4. Check cold start aids (seasonal).

5.2. SCHEDULED MAINTENANCE GUIDE

5. Check visually water pump for leaking.
6. Check engine mounting bolts and nuts and torque if necessary.
* – after initial 1500 hours and then every 6000 hours of operation.

Every 2000 hours of operation

1. Replace equipment pilot filter. Refer to 5.13.3.
2. Change hydraulic system oil. Refer to 5.13.2.
3. Clean hydraulic system suction strainer. Refer to 5.13.4.

**Every 6000 Hours of Operation or every 2 years
(Per Engine Operator's Manual)**

1. Drain and flush cooling system. Change coolant. Refer to 5.8.6.

**Every 6000 Hours of Operation
(Per Engine Operator's Manual)**

1. Clean and calibrate injectors.
2. Clean and calibrate fuel pump
3. Inspect the following engine assemblies:
 - Turbocharger
 - Vibration dumper
 - Fan hub and fan idler pulley
 - Water pump for oil and coolant leaks

5.2.1. GROUND LEVEL INSPECTION

1. Tractor operational equipment for damage and state of proper fastening.
2. Radiator: for damage, evidence of leakage and condition of grill.
3. Hydraulic components for damage or leakage.
4. Track system: rollers, front idlers, sprockets, track shoes for cracks, excessive wear, loose components and leaks.
5. Transmission system and final drives: for possible leakage.
6. Engine compartment for fuel, oil and coolant leaks.
7. Guards: for damage or missing.
8. ROPS: general condition (no ROPS defects are permissible that may adversely affect its protection in case of machine rollover).






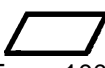




WARNING! To ensure personal protection performs all maintenance services in accordance with Scheduled Maintenance Guide and Instructions.

To prolong the service life of your equipment follows the scheduled maintenance listed in Scheduled Maintenance Guide.

5.3. MAINTENANCE AND SERVICE CHART

(Always use clean containers and lubricators)

SERVICE INTERVAL	REF. No	POINT OF SERVICE	SERVICE POINTS	LUBRICANT	SERVICE
 Every 10 Hours	13	Engine crankcase Oil Level	1	E01	Check
	18	Fuel Filter Water Separator	2		Drain
	29	Hydraulic Reservoir Oil Level	1	HDTF/E02	Check
	37	Radiator Coolant Level	1		Check
		Ground Level Inspection			Check
 Every 50 Hours	1	Rear Frame Oil Level	1	HDTF	Check
	27	Ripper Lube Fittings	10	MPG	Lube
	35	Hydraulic Cylinder Lube Fittings	2	MPG	Lube
 Every 100 Hours	34	Pivots of Hydraulic Cylinder Lube Fittings	4	MPG	Lube
 Every 250 Hours	2	Final Drive Oil Level	2	MPL	Check
	10	Fuel Filter	2		Change
	11	Engine Crankcase Oil Level	1	EO1	Change
	14	Engine Coolant Filter	1		Change
	16	Engine Crankcase Oil Filter	1		Change
	36	Upper Struts	4	MPG	Lube
	39	Diagonal Strut Balls	2	MPG	Lube
 Every 500 Hours	4	Transmission System Suction Strainer	1		Clean
	7	Universal Joint	2	MPG	Lube
	21	Pivot Shaft Housing - Oil Level	2	HDTF	Check
 Every 1000 Hours	6	Transmission System Pressure Filter	1		Change
	8	Transmission Scavenger Strainer	1		Clean
	20	Hydraulic System Return Filter	1		Change
	23	Rear frame Breather	1		Change
	24	Transmission System Oil	1	HDTF	Change
	25	Final Drive Oil	2	MPL	Change
	32	Hydraulic Reservoir Breather	1		Clean
	38	Gimbal Crosstube	2	MPG	Lube
 Every 2000 Hours	22	Hydraulic Control System Filter	1		Change
	28	Hydraulic System Oil	1	HDTF/E02	Change
	30	Hydraulic Oil Suction Strainer	1		Clean
 Periodic or at Least Once a Year	3	Fuel Tank Strainer	1		Clean
	5	Hand and Foot Control Linkage	10	MPG	Lube
	9	Crankcase Breather Tube	1		Check
	17	Air Cleaner Element	1		Clean
	19	Battery	4		Check
	31	Hydraulic Tank Strainer	1		Clean
	26	Fuel Tank Sediment Bowl	1		Drain
	33	Pilot Control Valve	1 or 2	MPG	Lube
Every 6000 Hours or Two Years	15	Engine Coolant	1		Change

5.3. MAINTENANCE AND SERVICE CHART

- E01 - Engine Oil
- E02 - Multigrade Transmission Oil
- MPG - Multi-Purpose Grease
- HDTF - Hydraulic Transmission Fluid for Heavy Condition
- MPL - Multigrade Gear Oil

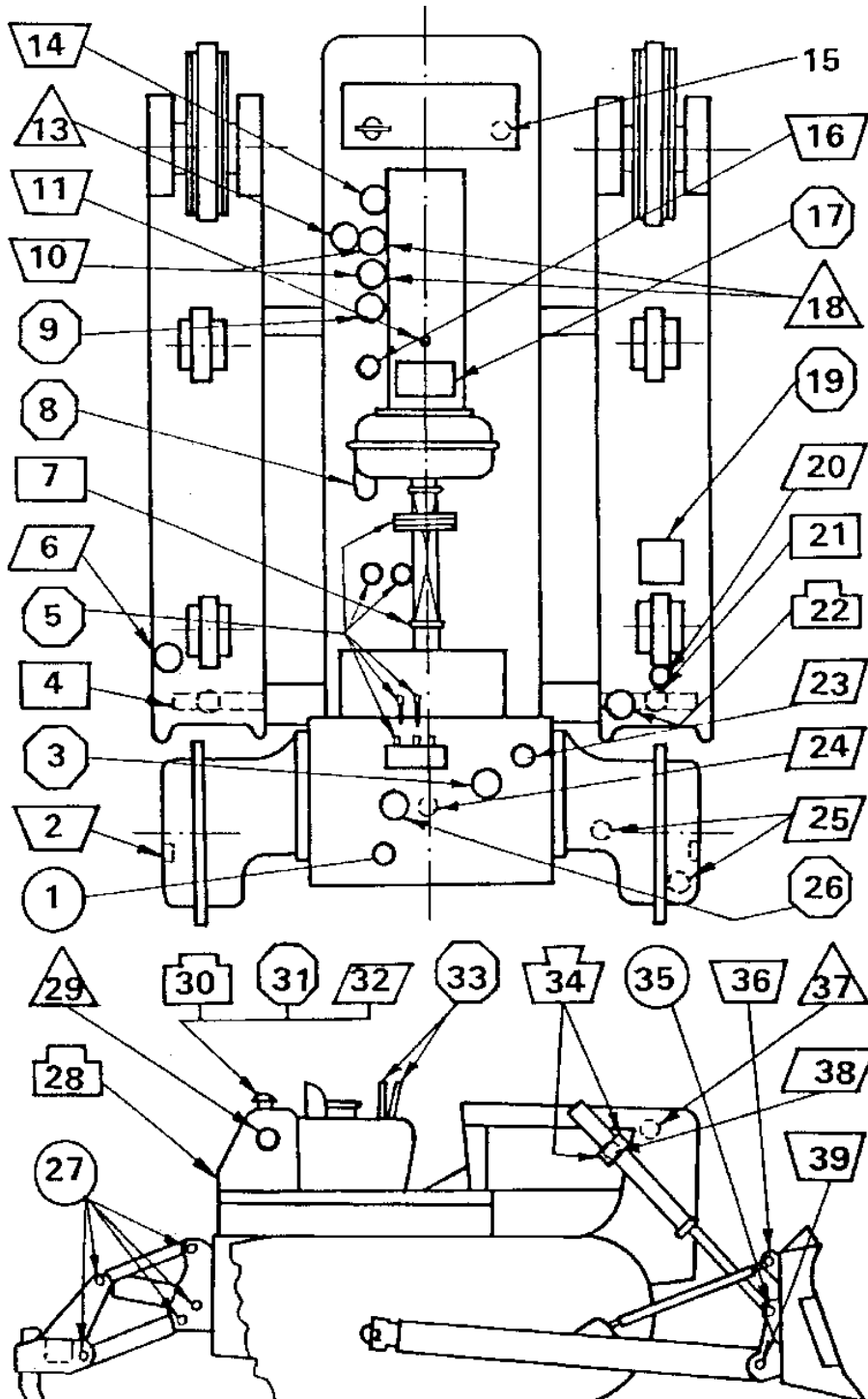


Fig. 5.1. Service Guide

5.3. MAINTENANCE AND SERVICE CHART

5.3.1. REFILL SPECIFICATIONS AND CAPACITIES CHART

MODEL	LUBRICATION POINT	REFILL CAPACITY	TYPE	AIR TEMPERATURE +40 – -7°C	AIR TEMPERATURE +21 – -23°C	TEMPERATURE -12 – -34°C	TEMPERATURE -12 – -54°C
TD-20H	Final Drive – Each	38 l	MPL	SAE 85W-140	SAE 85W-140	SAE 80W-90	MPL – ARCTIC ARCTIC GRADE 75 per HMS-B22-0003
	Engine Crankcase with Filter Change	34 l	E01	SAE 15W40	SAE 10W-30	SAE 5W-20 or SAE 5W-30	
	Transmission System	173 l	HDTF	SAE 10W		SAE 5W-30 or SAE 5W-20	
	Track Roller (each)	0.4 l					E01 - ARCTIC MULTI - PURPOSE ARCTIC OIL per HMS-B21-0001
	Top Idler (each)	0.4 l	HDTF or E02*	SAE 30			
	Front Idler (each)	0.3 l					
	D-2 Equipment Hydraulic System	126 l	HDTF or E02*		SAE 10W		
	D-2 and Ripper Equipment Hydraulic System	134 l	HDTF or E02*		SAE 10W		
	Cooling System	60 l			ANTI-FREEZE SOLUTION 0° – -37°C 50% Anti-freeze 50% Water	-37° – -54°C 62% Anti-freeze 38% Water	62% Anti-freeze 38% Water
	Fuel Tank	490 l			above - 12°C Diesel Fuel # 2D below - 12°C Diesel Fuel # 1D		Diesel Fuel WV-F-800DF-A

5.3. MAINTENANCE AND SERVICE CHART

DESCRIPTION:**HDTF:**

Severe Service Transmission Fluid per HMS B21-0006 or equivalent and passing formula C-4 and TO-4. Should not contain viscosity-improving agent.

Arctic selection: per HMS B21-0001

EO1:

Engine Oil per HMS B21-0002 or multigrade diesel engine oil CE, CF-4 per API, MIL-L-2104C with sulphated ash of 1.5% maximum.

Arctic selection: per HMS B21-0001

***EO2: for service only**

Multi – purpose engine oil per HMS B21-0003 or engine oil CD per MIL-L-2104C passing TO-2 and C-3 test with 0.10% minimum zinc.

Arctic selection: per HMS B21-0001

MPL:

Multi – purpose gear lubricant per HMS B22-0003 or API GL-5, MIL-L-2105C

Arctic selection: grade 75 per HMS B22-0003

EO:

Multi – purpose arctic selection per HMS B21-0001 or MIL-L-46167

MPG:

Multi – purpose grease 251 HEPM per HMS B27-0002 or NLGI grade #2 multi-purpose lithium grease with 3% minimum molybdenum disulfide (MoS₂).

Arctic selection: per HMS B27-0003 or MIL-L-10924D

ANTI-FREEZE:

Single Phase, ethylene glycol base per HMS B1-0001 or equivalent.

DIESEL FUEL:

Per HMS B32-0001 or ASTM D-975

Arctic selection: per VV-F-800DF-A

NOTE: *Maintenance/lubricant change service intervals are based on average operating conditions. Under unusually severe conditions of operations, reduce the interval of time between services. All inspection (maintenance) service must be carried out according to schedule.*

5.4. LUBRICATION

5.4.1. WHEN SHIPPED

This machine has been lubricated at the factory for operation in an air temperature range of +21°C to – 23°C. If this tractor is to be operated above or below this range, change to the correct lubricants.

Unless an exception is shown below, all lubricants can be used (within above temperature range) until regular scheduled (normal) change intervals occur. Refer to „MAINTENANCE AND SERVICE CHART" for the scheduled (normal) change intervals and to "REFILL SPECIFICATIONS AND CAPACITIES CHART" for the proper oil grades for ambient temperatures.

Front idlers, track idlers and track rollers are permanently lubricated with a SAE30, API CD or MIL-L-2104C engine oil.

A level check of these compartments is not required.

5.4.2. WHEN SERVICED



WARNING! When you service the machine, always follow the Operator's or Service Manual. Never grease, oil or perform any maintenance alone with the engine running. Always have another experienced person helping in the operator's compartment when maintenance must be done with the engine running. Block up all attachments securely. Do not leave the operator's seat with the engine running. Failure to follow these instructions could result in serious injury or death.

The life and performance of a tractor and its equipment depends on the service that it is given. Proper lubrication is an important part of the maintenance service. Thorough lubrication service performed at specified intervals will aid in prolonging the life of the tractor and its equipment and in reducing operating expense. The type of work being done, load, ground and weather conditions are all factors to consider in frequency of lubrication.

The scheduled intervals between lubrication periods shown on the „SERVICE CHART" are approximate, based on average operating conditions. It may be necessary to lubricate after shorter working periods under severe operating conditions such as extremely dusty, low engine temperatures, intermittent operation, excessively heavy loads with high oil temperatures, or when diesel fuel with a high sulfur content is used. However, the time intervals between lubrication periods must never exceed those indicated in this manual.

5.4.3. SELECTION

The selection of the proper type (specification) and the grade (weight or viscosity) of lubricant is important. Many tests have been made to determine the correct lubricants for this tractor and its equipment.

MAINTENANCE

5.4. LUBRICATION

5.4.4. VISCOSITIES

During cold weather, base the selection of a crankcase lubricating oil viscosity on the lowest anticipated temperature for the day to make starting easier.

For hot weather operation, base the selection on the highest anticipated temperature. Refer to the "REFILL SPECIFICATIONS AND CAPACITIES CHART".

IMPORTANT: After changing oil or break in operation for more that 5 days follow the below specified procedure Refer to 4.6.2. ENGINE START AFTER OIL CHANGE OR PROLONGED STANDSTILL.

5.4.5. RECOMMENDED LUBRICANT CHART

RECOMMENDED LUBRICANT	EQUIVALENT LUBRICANT			TYPE
	POLISH	SHELL	TEXACO	
Engine oil per HMS B21-0002 or API CE, CF-4 or CD or MIL-L02104C with sulfated ash of 1.65% maximum SAE 15W/40	LOTOS DIESEL CE/SF SAE 15W/40 SUPEROL FALCO CD. 15W/40	MYRINA TX 15W/40 RIMULA X 15W/40	URSA SUPER LA 15W/40	E01
Engine oil per HMS B21-0003 or CD MIL-L-2104C SAE 10W SAE 30	SUPEROL CD. SAE 10W SUPEROL CD. SAE 30	ROTELLA TX 10W ROTELLA TX 30	URSA SUPER LA 10W URSA SUPER LA 30	E02
Transmission Fluid HDTF per HMS B21-0006 passing formula C-4 and TO-4 SAE 10W SAE 30	GERAX TKD 10W GERAX TKD 30	DONAX TC 10 DONAX TC 30	TEXTRAN HD 10W TEXTRAN HD 30	HDTF
Gear Lube per HMS B22-0003 or API GL-5 or MIL-L-2105C SAE 85W/140 SAE 80W/90	HIPOL 85W/140 HIPOL 80W/90	SPIRAX HD 85W/140 SPIRAX HD 80W/90	GEARTEX EP-C 85W/140 GEARTEX EP-C 80W/90	MPL
Multi-purpose grease per HMS B27-0002 or NLGI grade #2 Multi-purpose lithium grease with 3% minimum molybdenum disulfide (MoS ₂)	LITOMOS EP-23	RETINAX EPX2	MOLYTEX EP-2	MPG

5.4. LUBRICATION

Anti-freeze, ethylene glycol base per HMS B1-0001	ERGOFRYZ	GLYCOSHELL DILUTED	ANTIFREEZE ETX 6042	
Arctic oil, synthetic 75W per HMS B22-0003			SYN-STAR 75W CODE 2080	MPL ARCTIC
Arctic grease per HMS B27-0003 or MIL-L-10924D		SRI grease manufactured by CONOCO Grease 2816 manufactured by EMERY Ind.		MPG ARCTIC
Arctic engine Oil, synthetic per HMS B-21-0001 or MIL-L-46167		CHEVRON SUB-ZERO Fluid OW-30 Manufactured by CHEVRON or FRIGID-GO 2809A Manufactured by EMERY Ind.		EO ARCTIC
Diesel Fuel Per HMS-B32-0001	Diesel fuel per Polish Standard PN-C-96051:1992 DL above 0°C DP above -12°C DZ above -20°C IZ-40 above -30°C For temperatures below -30°C add pour point depressant			

5.5. SEASONAL PREPARATION

General

Mechanical efficiency is enhanced during seasonal air temperature changes, when these instructions are followed.

Outside source of heat

Machines left outside for prolonged periods in sub-zero weather will suffer from "cold-soak." Lubricants become viscous and incapable of lubricating moving parts. Extreme wear could result to the engine, transmission and final drives unless proper precautions are taken.

A source of outside heat is necessary under these conditions. There are electric as well as propane-fired engine coolant heaters available. Gas-fired forced air heaters may also be obtained to heat the transmission and final drives.

When using such heaters follow manufacturer's safety instructions.



WARNING! For your personal safety, use caution and follow the manufacturer's instructions when using engine block heaters to warm the coolant or external heaters to warm the tractor.

5.5.1. FUEL SYSTEM

Refer to "FUEL SYSTEM" for the diesel fuels selection, which will give the most satisfactory performance.

5.5.2. COOLING SYSTEM

Prepare the cooling system as follows:

1. Check the entire engine system for leaks.
2. Inspect the condition of all hoses and replace the hose and hose clamps as necessary.
3. Clean cooling system. Refer to „CLEANING THE SYSTEM.”
4. Check the drive belt tension and adjust tension or replace belt. Refer to „ENGINE MANUAL”.
5. Remove all debris from the radiator core using air or water under pressure. Direct the flow through the core, opposite the normal direction of air flow.



WARNING! For your personal protection, water pressure should not exceed 275 kPa and air pressure should not exceed 210 kPa. Use safety goggles.

6. Clean the radiator guard and outside of the core.
7. Protect your cooling system from damage by using approved antifreeze and coolant. Refer to „FILLING THE DRAINED SYSTEM”.
8. Keep your cooling system clean and minimize corrosion by changing the coolant filter at correct intervals. Refer to „COOLING SYSTEM.”
9. Check the condition of fan blades.

5.5. SEASONAL PREPARATION

5.5.3. ELECTRICAL SYSTEM

Clean batteries and remove all corrosion from the battery terminals and cables. Repair or replace all wires, which have worn, cracked or frayed insulation and broken or loose wires. Service the batteries.

5.6. AIR CLEANING SYSTEM

5.6.1. AIR CLEANER

This machine has a „dry-type” cleaner with replaceable elements.

The cleaner has two elements: primary and safety. The primary can be cleaned for a limited number of times before replacement is necessary, however, the safety element must be replaced when plugged. Detailed service procedures for this air cleaner are covered in the following text.

IMPORTANT: *As a precaution against dirt entering the engine, all gasket and rubber hoses between the air cleaner, turbocharger and intake manifold, and between the manifold and cylinder head must be in good condition and the joints or connections must be tight. Never operate the engine unless a filter element is in place and filter end gasket is installed. Never remove the element from the air cleaner or service the air cleaner while the engine is running.*

5.6.2. PRIMARY FILTER ELEMENT

Service

The air cleaner primary element must be serviced whenever indicated by the air cleaner filter warning light. Refer to "AIR CLEANER FILTER WARNING LIGHT".

If after performed cleaning of primary filter element the air cleaner filter-warning light continues to glow, check for allowable restriction, precleaner screen. If the warning continues to glow replace safety filter element. If with cleaned primary filter element and replaced safety filter element the warning light still continues to glow, check air cleaner service indicator. The primary element can be cleaned by either of two methods: washing or compressed air. Washing is the preferred method as it removes more dust and soot and restore the element to an almost new condition.

The result being better performance and longer intervals between required element service. It is recommended that a spare element be obtained for use while the serviced element is drying.

NOTE: *The primary filter element must be replaced after six washing.*

Cleaning the element with compressed air is not considered an entirely satisfactory method. Some dust will remain in the element causing more frequent servicing of the element. Cleaning with compressed air should be used only as a temporary measure until sufficient time is available to clean the element by washing. Engine air intake system (hoses, clamps, rubber connectors) is recommended to be checked for leaks ever 50 hours of operation.

NOTE: *After cleaning, if an element is to be stored for later use, place it in a plastic bag and store in an element-shipping container to protect against dirt and damage.*

5.6. AIR CLEANING SYSTEM

Removal (Fig. 5.2)

1. Stop the engine. Lower equipment on the ground. Open left engine access door. Remove all dust from the element removal end of the air cleaner body (8)
2. Release two lock clamps (1) and remove cover (2) from the air cleaner body (8),
3. Unscrew the wing nut (4) remove gasket (3) and carefully remove the primary element from the body not to dislodge dust from the dirty element onto the safety element (7).
4. Check the condition of the gasket on the end of the primary element (5). If the gasket is damaged or missing, replace the primary element.
5. Remove all dirt from inside the air cleaner body with a damp cloth. A small amount of nonsudsing detergent added to the water will remove the soot.

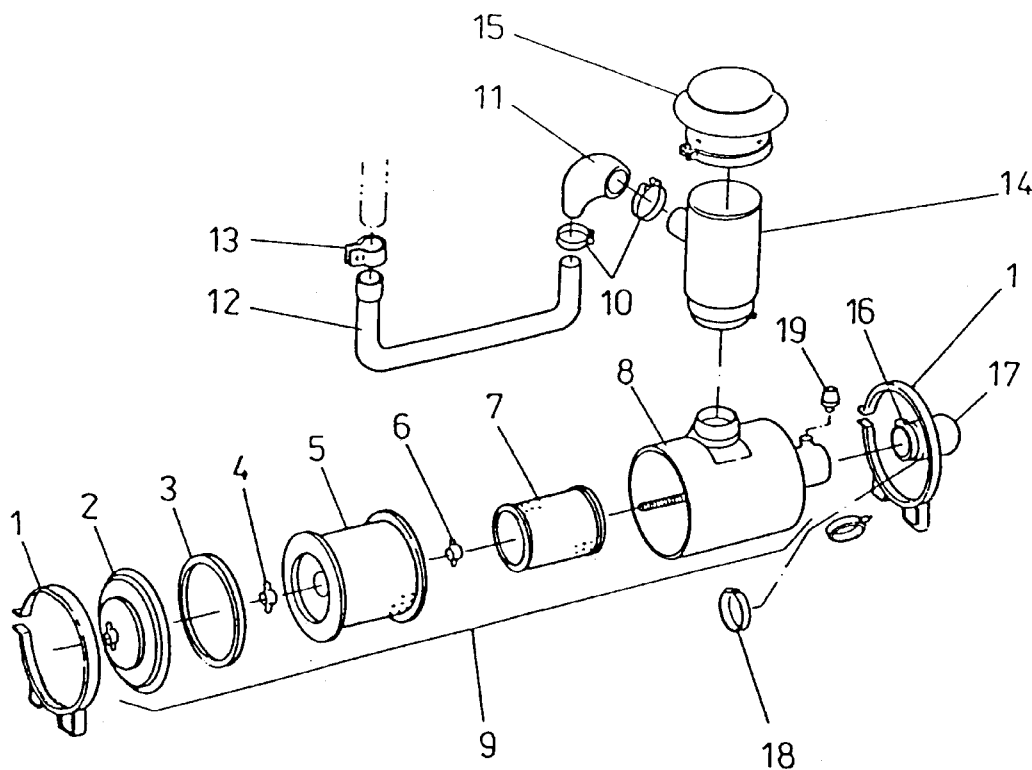


Fig. 5.2. Air Cleaner with Connections

- | | |
|------------------------|-----------------------------|
| 1. Clamp | 10. Clamp |
| 2. Cover | 11. Elbow |
| 3. Gasket | 12. Tube |
| 4. Wing nut | 13. Clamp |
| 5. Primary Element | 14. Body of Primary Filter |
| 6. Wing nut | 15. Cover of Primary Filter |
| 7. Safety Element | 16. Clamp |
| 8. Filter Body | 17. Elbow |
| 9. Air Filter Assembly | 18. Clamp |
| | 19. Pressure switch |

Washing

IMPORTANT: Never wash element in fuel, oil, gas or solvent. DO NOT OIL ELEMENTS. Do not tap the element against a hard surface; this will damage the element.

5.6. AIR CLEANING SYSTEM

1. Carefully tap the side or end of the element against the palm of your hand to remove loose dust.
2. Wash the element in clean, warm water 20°C to 40°C. A small amount of nonsudsing detergent added to the water will remove the soot.
3. Rinse the element in clear water (if a hose is used, do not exceed 275 kPa). Shake the element carefully to remove excess water.

IMPORTANT: *Do not use compressed air to speed the drying of the element; the air pressure will rupture the wet element.*

4. Lay the element on its side and allow it to air-dry before reinstalling. Overnight drying is usually sufficient. When drying the element, protect it from dirt and/or freezing

NOTE: *If no spare element is available, the wet element, after excess water has been shaken out, may be installed in the air cleaner and the engine operated at idle for 10 minutes before operating the tractor.*

5. Inspect for damage. Refer to „INSPECTION.”

Inspection

1. Inspect the filter element for leaks or damage by placing a bright light inside the element. Inspection of the element on the outside will disclose any holes where concentrated light shines through. The slightest rupture requires replacement of the filter element.
2. Inspect the contact surfaces of the air cleaner body. If faulty or damaged surfaces are noted, correct these conditions immediately.

Installation (Fig. 5.2)

1. Insert the open end of the primary element (5) into the air cleaner body (8) and secure with wing nut (4). Install cover (2) with gasket (3) onto the air cleaner body(8). Secure the cover to the body with locking clamps making sure cover is not cocked.
2. Inspect and tighten all air cleaner connections before resuming operation. Start the engine. If the air cleaner, filter warning light indicates air restriction, replace primary or primary and safety filter elements.

5.6.3. SAFETY FILTER ELEMENT

Service

Replace the safety element with every third change of the primary element or when plugged, as shown by the filter warning light.

Removal (Fig. 5.2.)

1. Remove primary element. Refer to 5.6.2.
2. Unscrew wing nut (6) and pull safety element (7).
3. Clean inside of body (8) with a damp cloth.
4. Check the condition of gasket on the end of the safety element. If the gasket is damaged or missing, replace the gasket.

5.6. AIR CLEANING SYSTEM

Installation (Fig. 5.2.)

1. Install new safety element (7) into the body (8) and secure with nut (6).
2. Install a new primary filter element (5) onto safety element (7) and secure it with wing nut (4).
3. Install cover (2) and secure it with nut making sure cover is not cocked.

5.6.4. AIR INTAKE SYSTEM

5.6.4.1. Precleaner

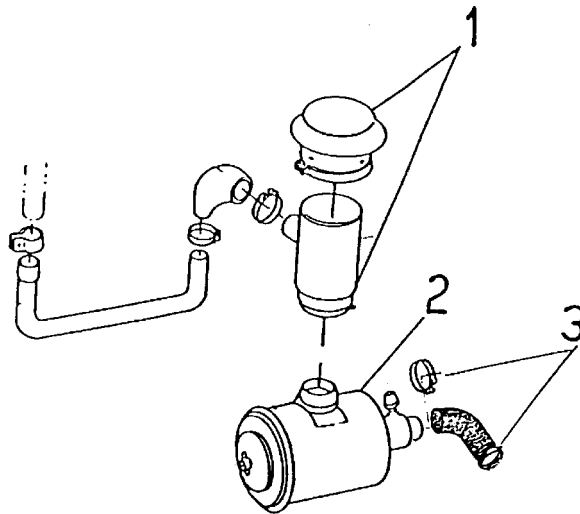


Fig. 5.3. Precleaner Assembly

1. Precleaner Filter
2. Air Cleaner
3. Air Intake Tube Clamps

The dome of the precleaner hood serves as a rain shield and the screen prevents chaff and coarse dirt from getting into the air cleaner. Keep this screen clean from all chaff, oil or dust. Clogged holes in the screen will reduce the power of the engine by restricting the flow of air.

Loosen the clamp screw on the precleaner hood. Twist and pull upward to remove the cap. Use compressed air to clean the screen. If compressed air is not available, wash in clean hot water or water containing a small amount of nonsudsing detergent.

IMPORTANT: Never wash precleaner installed on the machine as water may penetrate to the engine.

5.6.4.2. Checking air intake system for leaks

Air intake system leakproof tests must be performed after each Disassembly of intake system or if necessary (leaks or loosens clamps).

1. Remove cover from the air cleaner body.
2. Remove primary element.
3. Mask the entire perforated metal outside diameter of safety element (smaller) with the duct tape and reinstall. Sealing must be airtight. Connect regulated compressed air supply to one of existing connecting ports on air intake manifold. Connect pressure gauge to other connecting port on intake manifold or to warning light switch.

5.6. AIR CLEANING SYSTEM

4. Check if underpressure of 0.14 – 0.21 kG/cm² has been obtained by reading the pressure. If improper pressure is seen, adjust pressure to 0.14 – 0.21 kG/cm² by cranking the engine crankshaft to a position where minimum leakage occurs past engine valves.
5. Coat the following areas with soap solution and check for leaks. Leaks will cause air bubbles to form.
 - a) air cleaner body surface around the outlet pipe to app. the outside diameter of safety element
 - b) air cleaner outlet to turbocharger inlet hose to air cleaner body junction orifice and tubing from the air cleaner
 - c) all clamped hose and gasket connections between air cleaner outlet and intake manifold. This includes connections at turbocharger
 - d) surface of all air induction piping and hoses air cleaner and air intake manifold including the manifold gasket area and warning light switch connector.
6. No leakage is permitted between air cleaner and intake manifold (the entire air induction system).

IMPORTANT: Tightness of the air intake system has a great influence to the engine durability.

5.7. BELTS

General



WARNING! Keep clear of fan and fan belts when the engine is running. Rotating fan and belt contact can cause injury.

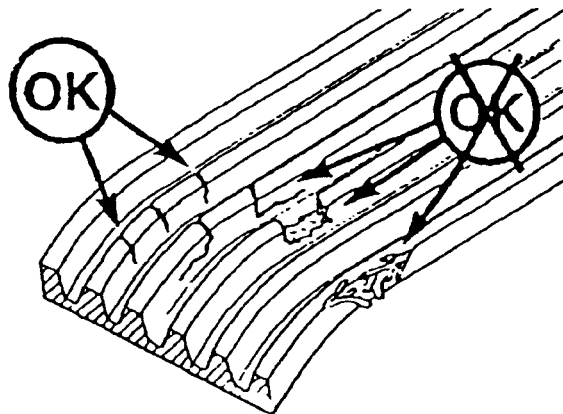


Fig. 5.4. Belt Inspection

Replace badly worn, greasy or cracked belts immediately. These conditions prevent proper belt function.

Visually inspect the drive belts for intersecting cracks. Transverse (across the belt width) cracks are acceptable. Longitudinal (direction of belt length) cracks that intersect with transverse cracks are not acceptable. Replace the belt if it is frayed or has pieces of material missing.

5.7. BELTS

5.7.1. CHECKING TENSION AND ADJUSTMENT

Checking tension

The engine is equipped with an automatic belt tensioner that maintains correct tension on the drive belt. Periodically check belt tension according to a „Belt Tension Chart“. To check belt tension a Borroughs type gauge must be used.

Adjustment

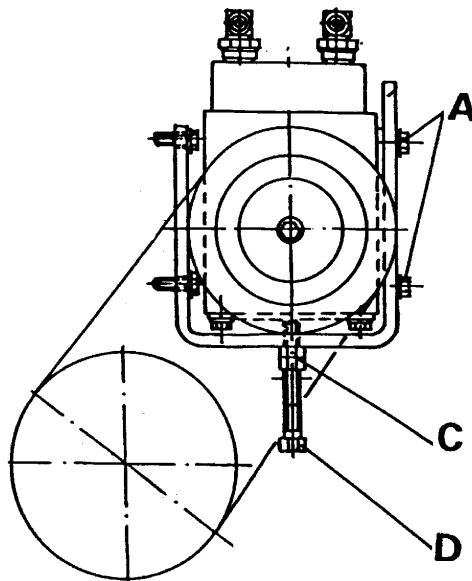


Fig. 5.5. Tension Adjustment of Air Conditioner Compressor Belt

To adjust belt tension of air conditioner compressor proceed as follows:

1. Loosen the lock nuts „C“.
2. Loosen the clamping bolt „A“ of the compressor.
3. Tense the belt with bolt „B“ to the tension according to „Belt Tension Chart“.
4. Tighten the clamping bolts and lock nuts.

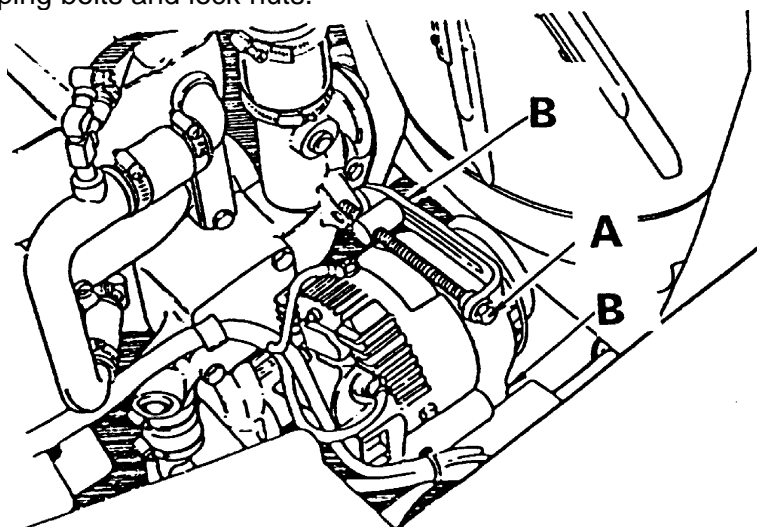


Fig. 5.6. Alternator Belt Adjusting Screw

5.7. BELTS

To adjust belt tension of alternator proceed as follows:

1. Loosen the clamping bolt „B” of the alternator.
2. Tense the belt with bolt „A” to the tension according to „Belt Tension Chart”.
3. Tighten the bolts clamping the alternator.

5.7.2. BELT TENSION CHART

BELT WIDTH	GAUGE		NEW BELT TENSION		USED BELT TENSION*	
	CLICK	BORROUGHS	N	Lbf	Lbf	N
0.38”	3822524		140	620	60 – 110	270 – 490
0.44”	3822524		140	620	60 – 110	270 – 490
1/2”	3822524	ST-1138	140	620	60 – 110	270 – 490
11/16”	3822524	ST-1138	140	620	60 – 110	270 – 490
3/4”	3822524	ST-1138	140	620	60 – 110	270 – 490
7/8”	3822524	ST-1138	140	620	60 – 110	270 – 490
4-groove	3822524	ST-1138	140	620	60 – 110	270 – 490
5-groove	3822524	ST-1138	150	670	60 – 120	270 – 530
6-groove	3822525	ST-1293	160	710	65 – 130	290 – 580
8-groove	3822525	ST-1293	200	890	80 – 160	360 – 710
10-groove	3822525	3823138	250	1110	100 – 200	440 – 890
12-groove	3822525	3823138	300	1330	120 – 240	530 – 1070
15-groove K	3822525	3823138	375	1670	150 – 300	670 – 1340
16-groove L	-----	3376344	560	2490	260 – 520	1160 – 2315
20-groove L	-----	3823772	700	3115	330 – 650	1470 – 2890

* belt is considered used if it has been run at least 10 minutes. If belt is used for a shorter period of time, apply maximum tension value specified for used belt. Groove width for type K belt is 3.5 mm and 4.3 mm for type L.

5.8. COOLING SYSTEM

General

The cooling system operates under pressure. The water pump circulates the coolant through the oil cooler, engine block, cylinder heads, and radiator. Circulation is controlled by the thermostats, which prevent coolant flow through the radiator until the engine reaches operating temperature. Proper cooling is assured only when the system is sealed, radiator cap and gasket in good condition, thermostats operate properly, system is free of coolant and/or air flow restrictions and is filled to proper level.

Selection and maintenance of the system coolant is important to long engine life. The following information provides recommendations for selecting the engine coolant, maintaining the coolant inhibitors, and servicing the cooling system. This system will operate with a water/antifreeze mixture or inhibited water as a coolant. Never use water alone because water will allow rust, scale deposits, and corrosion to occur within the system.

5.8.1. WATER

Use water, which has a low mineral content. Water used in conjunction with antifreeze, coolant filters and inhibited water must meet the following standards:

Total hardness: Not to exceed 170 parts per million to prevent scale deposits. Water containing dissolved magnesium and calcium (the usual reason for water hardness) above the specified amount will cause scale deposits to develop in the engine.

Chlorides – Not to exceed 40 parts per million to prevent corrosion.

Sulfites – Not to exceed 100 parts per million to prevent corrosion.

Dissolved solids – Not to exceed 340 parts per million to minimize sludge deposits, scale deposits and corrosion.

If any of the requirements cannot be met, use distilled de-ionized or de-mineralized water. To determine if local water supplies meet these standards, water treatment laboratories can test water samples. Softened water that is prepared using common salt (sodium chloride) contains excessive amounts of chlorides and should not be used.

5.8.2. ANTIFREEZE

Low silicate ethylene glycol antifreeze is recommended. The antifreeze should contain no more than 0.1% anhydrous alkali metasilicate. Low silicate antifreeze is recommended to avoid the formation of silica gel (hydro-gel). This gel formation can occur when cooling system contains an over concentration of high silicate antifreeze and/or supplemental coolant additive. DO NOT use methanol or alcohol as antifreeze because of its low boiling point. Antifreeze may retain its freeze protection for more than one season but coolant conditioners must be added to maintain corrosion protection. Antifreeze formulated with methoxy propanol, or propylene glycol is not recommended for this system.

IMPORTANT: Do not mix types of antifreeze solutions. Mixed solutions make it impossible to determine the protection against freezing. Antifreeze containing sealer or anti-leak additives should not be used in this system. Sealer or anti-leak additives will plug the coolant filter and cause plugging problems in the cooling system.

5.8. COOLING SYSTEM

Table included in Engine Manual shows percentage of antifreeze concentration required for various temperatures.

5.8.3. INHIBITORS / CONDITIONERS

1. All cooling system inhibitors, including those in antifreeze solutions, become depleted through normal operation. If the inhibitors in antifreeze are allowed to become depleted, the antifreeze becomes corrosive and attacks and coats the metallic surfaces of the cooling system which reduces heat transfer. Cooling system conditioners, which contain these inhibitors, must be added to maintain corrosion protection.
2. SOLUBLE OIL IS NOT RECOMMENDED for use in the engine as its use will reduce heat transfer.

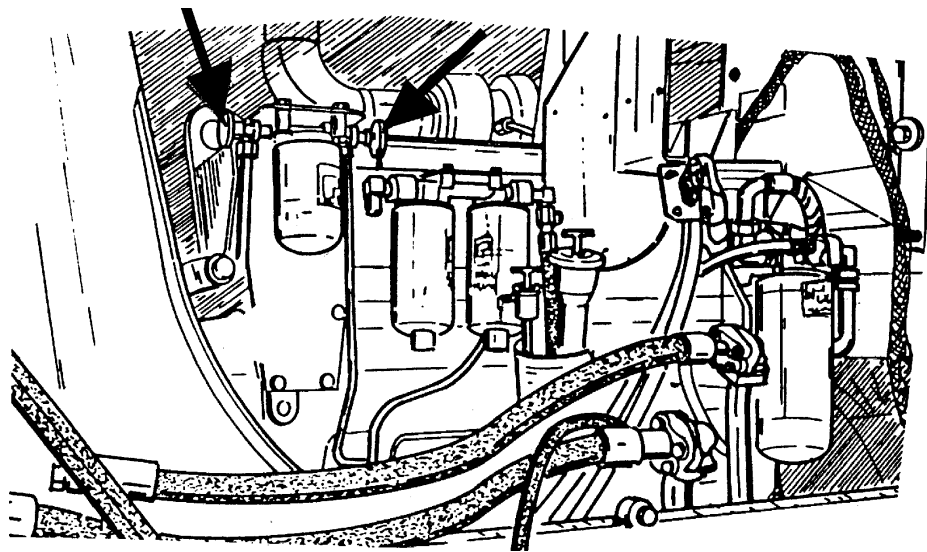


Fig. 5.7. Coolant Filter

Replenishing coolant conditioner

Replenishing coolant conditioner is performed by periodical replacement of filters containing DCA4 inhibitor protecting cooling system against corrosion and cavitation erosion of cylinder sleeves and coolant pump blades.

Coolant testing for conditioner concentration

Coolant testing for DCA4 concentration should be performed periodically before coolant filter replacement for determines proper capacity of filter to be applied. CC2626 test kit of filter manufacturer is designed for this purpose. Test procedure and filter replacement is included in Engine Manual.

Every 250 hours replace the coolant filter and test concentration of DCA4.

Prior to installation of new coolant filter close the shut-off valves (Fig. 5.7) at the cooling system filter. Upon installation of new coolant filter open the shut-off valve.

NOTE: *Mixing of DCA4 and other supplemental coolant additives is not recommended because there is currently no test kit available to measure concentration levels with mixed chemical solutions.*

5.8. COOLING SYSTEM

5.8.4. RADIATOR CAP

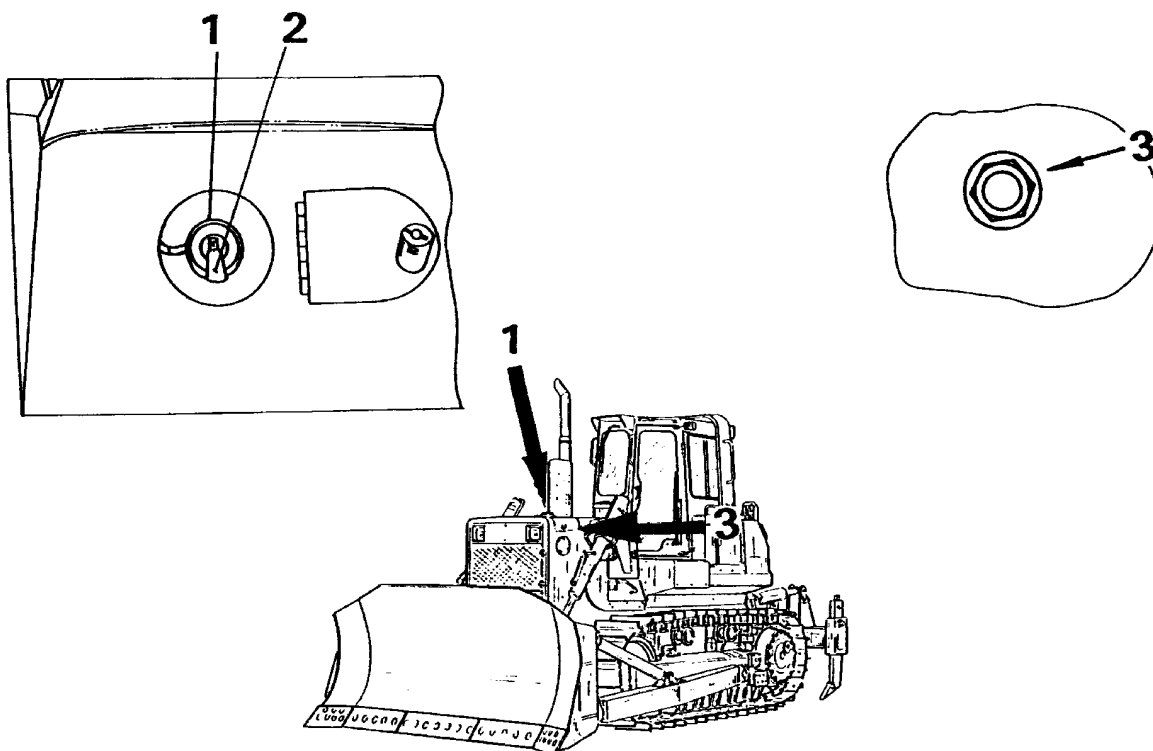


Fig. 5.8. Radiator Cap and Coolant Level Sight Gauge

- 1. Radiator Cap
- 2. Lever of Relieve Valve (if equipped)
- 3. Inspection Hole for Coolant Level.

General

The radiator cap seals the coolant filler opening of the radiator. Positive sealing requires a cap gasket and its contacting surfaces in good condition, and a properly tightened cap.

The radiator cap incorporates a pressure relief valve that keeps the pressure of the coolant at 40 – 55 kPa in top tank of the radiator.

NOTE: *Operating the machine without a radiator cap, or with a cap without a relief valve set to operate at the correct pressure can cause damage.*

Removal



WARNING! Hot, scalding coolant can spray out if the radiator cap is removed suddenly. Relieve system pressure by slowly turning the cap to the first notch or lifting the safety lever. Remove the cap only after the pressure is relieved.



WARNING! Use extreme caution when adding coolant to a hot radiator to avoid being burned. Wear gloves and goggles and keep face away from the filler neck.

To remove the cap turn the cap to the left or counterclockwise up to the safety stop until all pressure is released. Then press down on the cap and continue to turn until the cap is free to be removed.

5.8. COOLING SYSTEM

Installation

When installing the cap, gasket and contacting surfaces must be clean. Turn the cap to the right or clockwise until snug.

5.8.5. CHECKING COOLANT LEVEL

Check the coolant level before starting the engine.

1. Check the coolant level daily to be sure that level is proper. Coolant level must be seen in the inspection hole (3) Fig. 5.8.
2. For checking the coolant level place the machine on the level ground and lower the mounted equipment on the ground.
3. If coolant has to be added, remove radiator cap and pour the coolant until it will be visible in the inspection hole. After replenishing coolant in the radiator check and correct concentration of DCA4, and check freezing point in winter time.

5.8.6. CLEANING THE RADIATOR CORE

Every 50 hours of operation remove dirt from the radiator core blowing it through with compressed air in the direction opposite to fan.

5.8.7. ADDING THE COOLANT WHEN ENGINE IS HOT

IMPORTANT: *Never add coolant when engine is hot. This may result in damage to the engine. Allow the engine to cool down below 50°C prior to replenishing coolant in the radiator.*

5.8.8.CHANGING COOLANT

5.8.8.1. Draining the System

1. Run the engine until it reaches operating temperature, then stop the engine.

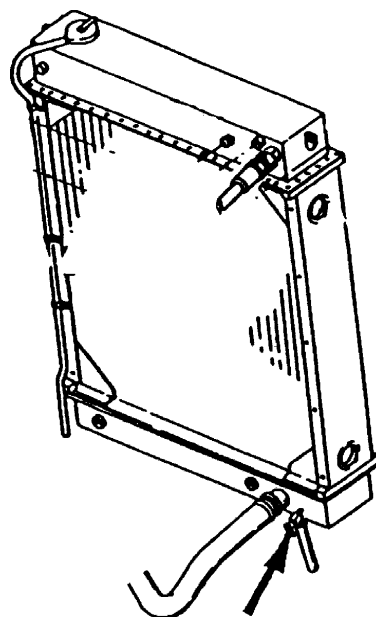


Fig. 5.9 Drain Valve of Water Cooler.

5.8. COOLING SYSTEM

2. Remove the radiator cap. Refer to "RADIATOR CAP".
3. Open the oil cooler drain valve located on the bottom of the oil cooler.
4. Open two crankcase drain valves, located at each side of the rear part of the crankcase.
5. Open radiator drain valve located on lower tank on R.H. side of the machine. Access to the valve is gained after removal of front bottom guard.
6. Allow the system to drain completely; do not let drain outlets plug up from foreign material.
7. Change coolant filter. Install a filter of greater capacity. (Procedure is shown in Engine Operation Manual).

5.8.8.2. Filling the Drained System

1. Close the oil cooler drain valve, radiator drain valve and two crankcase drain valves.
2. Fill the cooling system slowly. This allows more air to escape and the system to be filled to maximum capacity. The percentage of antifreeze to add for freeze protection can be determined from the antifreeze and coolant chart. Refer to „ANTIFREEZE“.
3. Start engine and run until normal operating temperature is reached; adding coolant when needed to keep proper level of 25 mm above the baffle.
4. After all air is removed and level remains fixed, install the radiator cap.

5.9. FAN AND FAN HUB

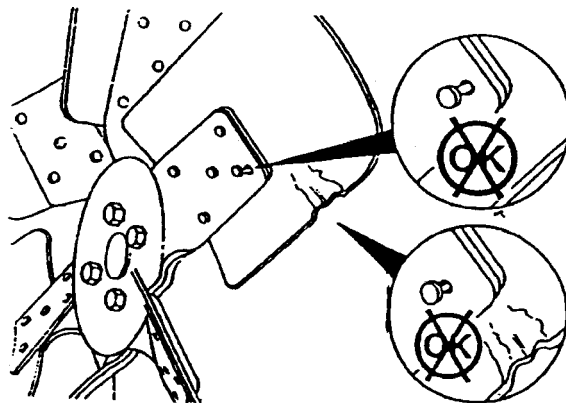


Fig. 5.10. Fan



WARNING! Keep clear of fan and fan belts when engine is running. Rotating fan and belt contact can cause injury.

1. Check the condition of fan blades (cracks, damaged, rivets, loosen mounting bolts) and bearing of idler pulley.
2. Reversible fan blades (if equipped) should be after every 250 hours reversed to prevent excessive contamination in engine and cooler compartment. After reversing the blades adjust them in required position.

5.10. ELECTRICAL SYSTEM

Precautions



WARNING! BEFORE WORKING ON THE ENGINE OR ELECTRICAL SYSTEM, turn off the electrical system master switch and remove the key. All terminals must be clean and fastened securely. Replace frayed, cracked, and poorly insulated wiring.

5.10. ELECTRICAL SYSTEM

The surface under all terminals must be clean, and good electrical connections must be established after any reassemble. Also, all clips must grip cables tightly to prevent vibrations and rapid cable wear. All clips and straps must be closed in a workmanlike manner, so as not to damage the insulation.

Batteries can only be charged using receptacle locate close to the engine on the left hand side of the machine. Receptacle can also be used to connect additional source of supply, e.g. for engine starting. Batteries can be only be charged using this receptacle, which also can be used to for connection of additional source of power to start the engine under extreme conditions.

5.10.1. AUTOMATIC RESET CIRCUIT BREAKER

Electrical circuits are protected by automatic reset circuit breakers mounted on the underside of the instrument panel. In the event of a short circuit or ground, the circuit breaker will open and close until trouble clears or is corrected. The circuit breaker will then return and stay in its normal closed position. It is forbidden to make any self-made alterations in electric system. Wrongly made alterations may cause machine damage or fire.

5.10.2. BATTERIES

General

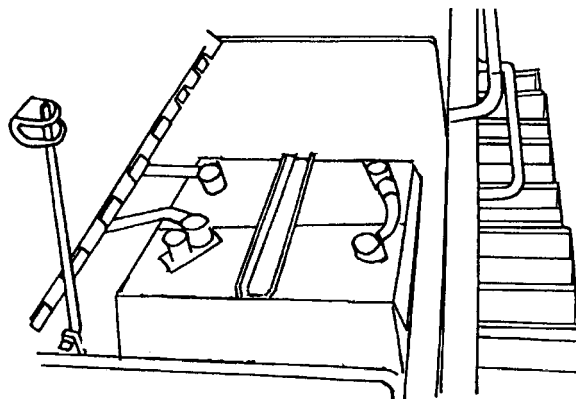


Fig. 5.11. Location of Batteries

The machine is equipped with two 12-volt battery. They are located in L.H. fender. Access is provided upon removal of three bolts and lifting the cover. Never allow a battery to stand on concrete, ground or a metal support unless proper insulation is provided. A wooden platform or board is sufficient insulation. Be sure the battery in machine is fastened securely to avoid damage from vibration.



WARNING! A battery gives off highly flammable gas. Never allow sparks, open flame or lighted smoking material near the battery. Avoid spilling any electrolyte on hands or clothing. Always wear safety glasses when working on a battery.



WARNING! Never check the battery charge by placing a metal object across the terminals. The sparks could cause a battery explosion. Use a voltmeter or hydrometer to measure charge.



WARNING! Be sure the electrical system master switch is off when connecting or disconnecting the battery to minimize the chance of sparks and explosion.

5.10. ELECTRICAL SYSTEM

Maintenance

Proper battery maintenance will assure maximum service. Following are a few simple rules: Keep battery cable terminals clean and tight. Keep filler cap vent holes unplugged. Replace worn, cracked, broken or corroded cables. Keep battery fastened securely in frame.

NOTE: *Excessive tightening can warp or crack battery case.*

Maintain the correct battery electrolyte level. Refer to „Electrolyte Level”. Always charge the battery in a ventilated area. Keep the battery clean. Refer to „Cleaning the Battery”.

The following precautions must be taken when working around batteries:

Use a battery carrier to avoid spilling electrolyte on clothing. Wearing rubber aprons and gloves is advisable.

Be careful that tools or other metallic objects do not fall across the battery terminals.

Never break a live circuit at the terminals. This could cause sparks. Make sure charger cable clamps or booster leads are clean and making good contact. If it becomes necessary to prepare electrolyte of a desired specific gravity, always pour the acid into the water.

Always turn the charger to the OFF position before connecting or removing charger leads to the battery.

When charging a battery, it is recommended that the caps be left on. A damp cloth should be placed on top of the caps.

Cleaning the Batteries

If the top of a battery is dirty, it may be cleaned with a brush dipped in ammonia or soda solution and then rinsed with water.

Electrolyte Level

The electrolyte in each cell must be at the proper level (21 to 27 mm above the plates) at all times to prevent battery failure. Check periodically the level of the electrolyte.

When the electrolyte is below this level, pure distilled water must be added. Never use hydrant water or any water which has been in a metal container. A skilled battery man must never add except acid or electrolyte. Under no circumstances add any special battery solutions or powders.

It is especially important to keep the battery at full charge for cold weather operation. Add distilled water to the battery in freezing temperatures only when the engine is to operate for several hours, to thoroughly mix the water and the electrolyte, or damage to the battery may occur.

Charging Fully Discharged Batteries

When a machine is not in use for an extended period, the maintenance-free battery can become discharged. For this reason, when a machine will not be used for over 30 days, it is recommended that the negative ground terminal cable be disconnected. Prior to starting up a machine that has been idle, always make a visual inspection of the battery and take an open circuit voltage test. A reading of 12.3 volts (75% of full charge) or less indicates a state of discharge and battery should be charged.

Check amount of charge of batteries:

100% of full charge	1.26 – 1.28 g/cm ³
75% of full charge	1.23 – 1.25 g/cm ³
50% of full charge	1.20 – 1.22 g/cm ³
Fully discharged	1.11 – 1.13 g/cm ³

5.11. ENGINE

5.11.1. CHECKING THE CRANKCASE OIL

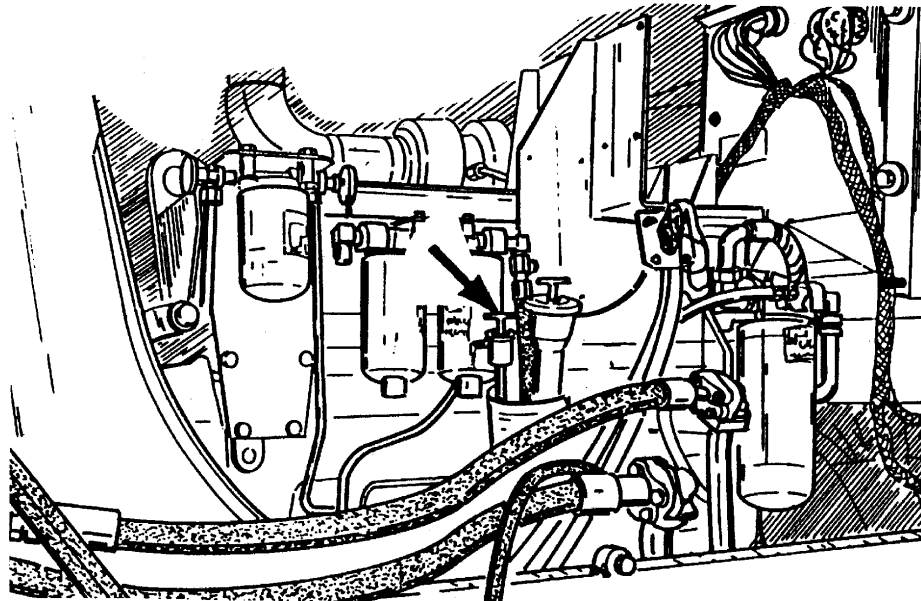


Fig. 5.12. Oil Level Gauge



WARNING! Park the machine on level ground, stop the engine, lower all mounted equipment to the ground, lock the transmission shift lever in neutral, apply the brake pedal lock, turn off the electrical system master switch.

Stop the engine and check level. For an accurate reading wait for the oil to drain into the crankcase pan. Open hood side access door.

Remove the oil level gauge and wipe it clean. Reinsert the gauge completely. Remove the gauge and check the oil level. If the level is at or below the MIN (ADD) mark, add oil through the fast fill receiver to bring the level up to the MAX (FULL) mark on the gauge. Refer to „REFILL SPECIFICATIONS AND CAPACITIES CHART” for type and viscosity of oil specified.

Reinstall the level gauge.

NOTE: *Never run the engine if the level of the oil is at or below the MIN (ADD) mark on the oil level gauge.*

1. Every day during operation in low ambient temperatures check and clean crankcase breather tube.

5.11.2. CHANGING THE CRANKCASE OIL AND OIL FILTER

5.11.2.1. Changing the Crankcase Oil

Every 250 hours change the engine oil.



WARNING! Hot parts – wear gloves. Fire hazards – do not smoke.

MAINTENANCE

5.11. ENGINE

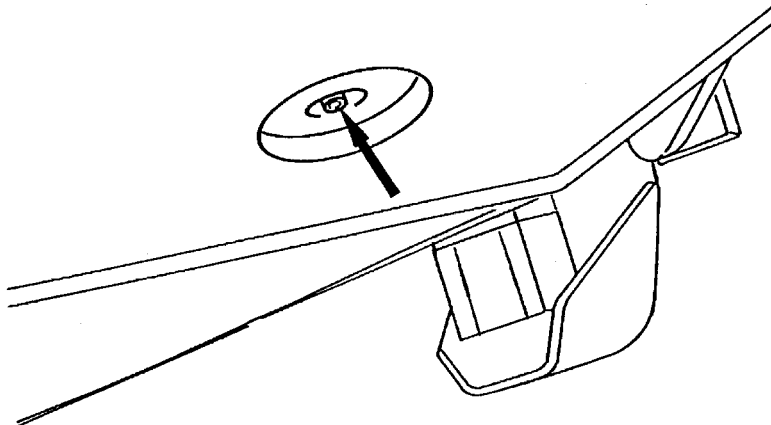


Fig. 5.13. Crankcase Guard Oil Drain Plug Location

5.11.2.2. Changing the engine oil filter



WARNING! Whenever working under the machine, turn off the electrical system master switch, remove the key and tag the controls to prevent inadvertent starting.

Every 250 hours of operation change the lubrication oil filter.

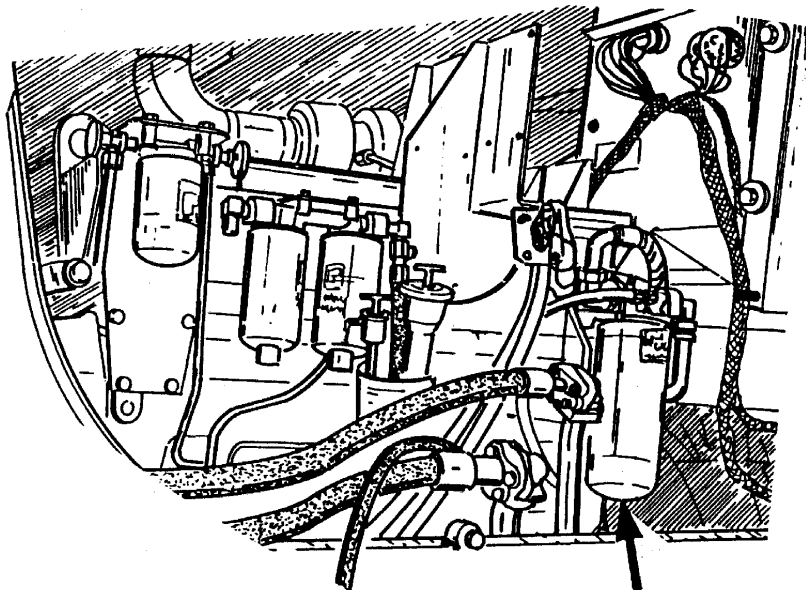


Fig. 5.14. Lubricating Oil Filter

NOTE: Use only recommended filters available from Authorized Distributor of Construction Equipment.

1. When coolant reaches the temperature of app. 60°C, stop the engine and drain the crankcase oil.
2. Clean the filter and filter head. Unscrew the filter.
3. Clean filter head in seal contact area.
4. Apply a little clean engine oil to the seal of new filter, fill the filter with engine oil and thread the filter on by hand per instructions specified on the filter.

5.11. ENGINE

IMPORTANT: Thread the filters by hand. Do not use any tools to install the filters because this can damage the filter.

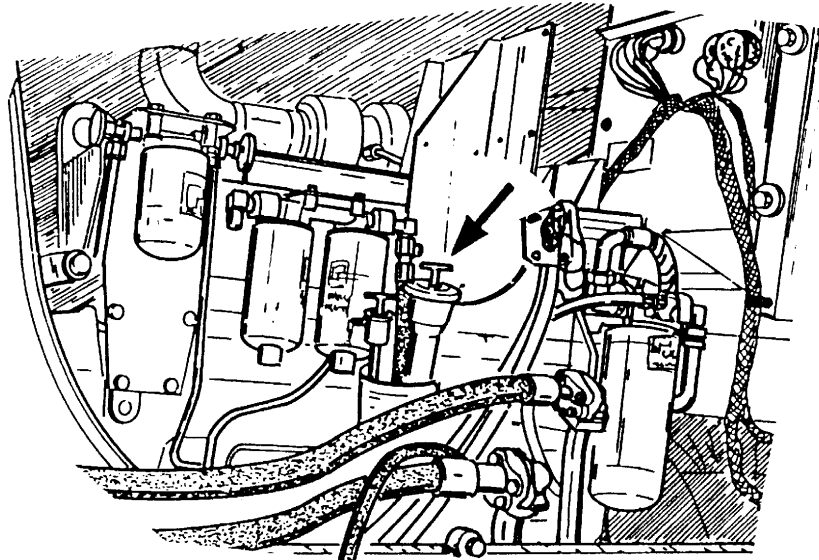


Fig. 5.15. Engine Oil Filler

5. Fill the crankcase with fresh oil. Refer to the „REFILL SPECIFICATION AND CAPACITIES CHART.”

5.11.3. ETHER INJECTOR (if equipped)

Precautions



WARNING! Ether starting fluid is highly flammable.

Follow the precautions on the container. An explosion can result if sparks or flame contact the ether.

Observe the following precautions:

Do not use the ether injector when the air temperature is above 0°C.

Do not use open flame when using ether-starting fluid.

Do not store fluid containers in the operator's compartment.

Store the containers in a cool, well-ventilated place.

Keep the fluid containers out of unauthorized personnel.

Do not breathe the hazardous ether vapor.

Do not let ether contact you skin, because it can cause frostbite.

Never puncture the fluid container or put it into a fire. Dispose of empty containers properly.

For your safety, remove the ether container when welding, grinding, or using a torch on the machine.

Follow the correct method for starting the engine. Refer to „STARTING THE ENGINE” in this manual.

NOTE: The ether starting valve inlet must be sealed against the entry of dirt at all times by having a fluid container installed or by installing the dust cap provided with the valve.

MAINTENANCE

5.11. ENGINE

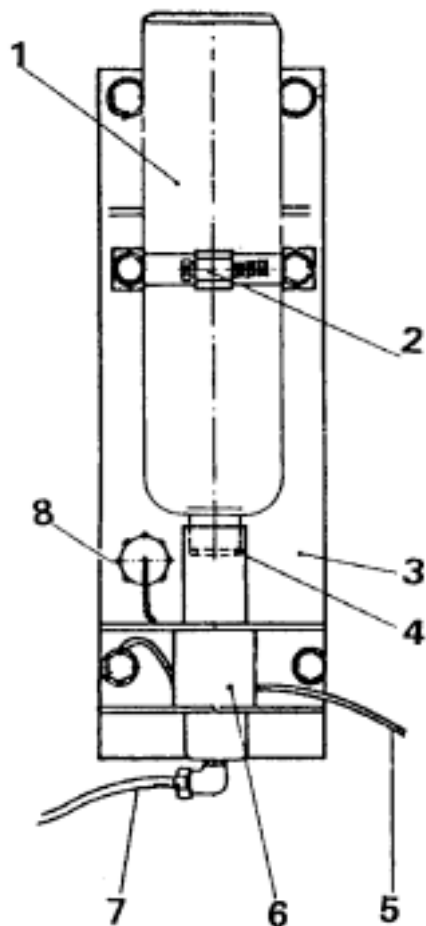


Fig. 5.16. Ether Fluid Container

- | | |
|--------------------|------------------------------|
| 1. Ether Container | 5. Electric Wire |
| 2. Clamp | 6. Injector |
| 3. Bracket | 7. Injection Pipe |
| 4. Seal Ring | 8. Plug for Container Socket |

Inspection and Cleaning

Make certain that ether is available under pressure. To do so, remove the ether container and check if a good spray is obtained.

Test the ether injector as follows:

1. Disconnect the ether tube at the spray nozzle in the engine manifold. Remove the spray nozzle.
2. Reconnect the nozzle to the tube. Direct the nozzle away from the engine and actuate the ether injector. Dribbling or no spray indicates a blocked spray nozzle or tube. If necessary, clean or replace spray nozzle and/or tube.

Changing the Fluid Container

1. Loosen the nuts securing the fluid container support saddle.
2. Unscrew and discard the container from the ether starting valve in a suitable, closed refuse container.
3. Install the new container in the valve.
4. Secure the container in place by tightening the clamp screw.

5.12. FUEL SYSTEM

General

Cleanliness of diesel fuel determines the service life of the fuel components. Water and contaminants, allowed to reach precision components, cause rapid wear and poor performance. Clean fuel and regular servicing of the fuel tank and fuel filtering components are necessary for long service life. Always clean the area around the fuel tank filler cap before refueling.



WARNING! Fire hazard – never mix gasoline and/or alcohol with diesel fuel. This practice creates an extreme fire hazard and under certain conditions an explosion, which could result in personal injury or death.



WARNING! Never remove the fuel tank filler cap or refill the fuel tank while the engine is running or hot or when the machine is indoors. Fumes are dangerous, a spark or flame could result in a fire or explosion.

5.12.1. FILLING THE FUEL TANK

Be sure fuel tank is full. Fill the tank at the end of each day's operation to reduce condensation of moisture.

5.12.2. FUEL TANK FILLER STRAINER

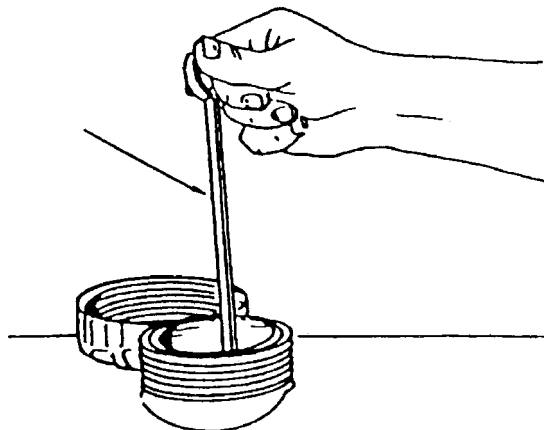


Fig. 5.17. Fuel Tank Filler Strainer and Fuel Level Dipstick

This screen filters the fuel entering the tank and eases the job of the fuel filters. Remove and clean the screen with a nonflammable commercial cleaning solvent.

MAINTENANCE

5.12. FUEL SYSTEM

5.12.3. FUEL TANK SHUTOFF VALVE

Be sure the shutoff valve is open.

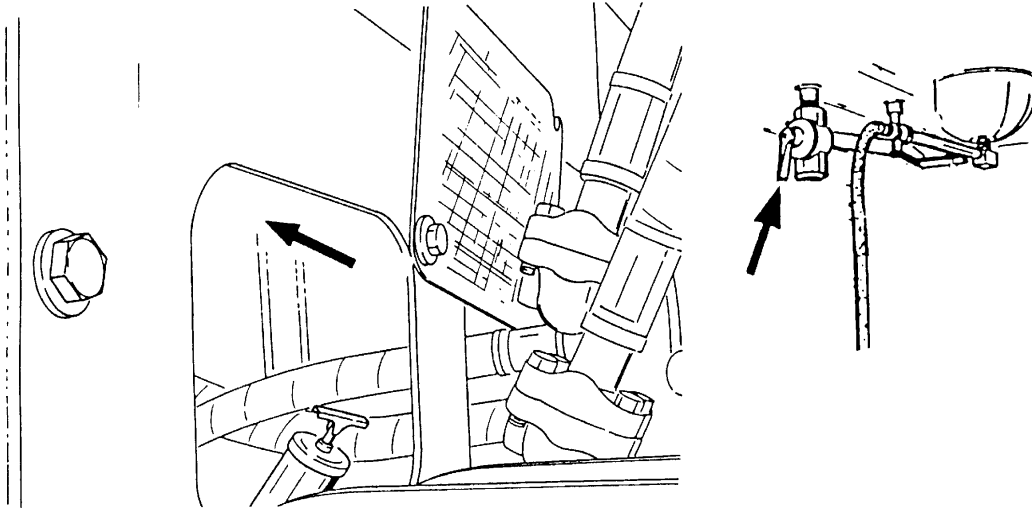


Fig. 5.18. Fuel Tank Shutoff Valve

5.12.4. FUEL FILTERS

5.12.4.1. Fuel Filter Water Separator Drain Valve

Spin-on fuel filters equipped with water separator are used in fuel system. Water and foreign materials separated from fuel, which settle to the bottom of the filter, are drained from the fuel through drain valve located in lower part of the filter.

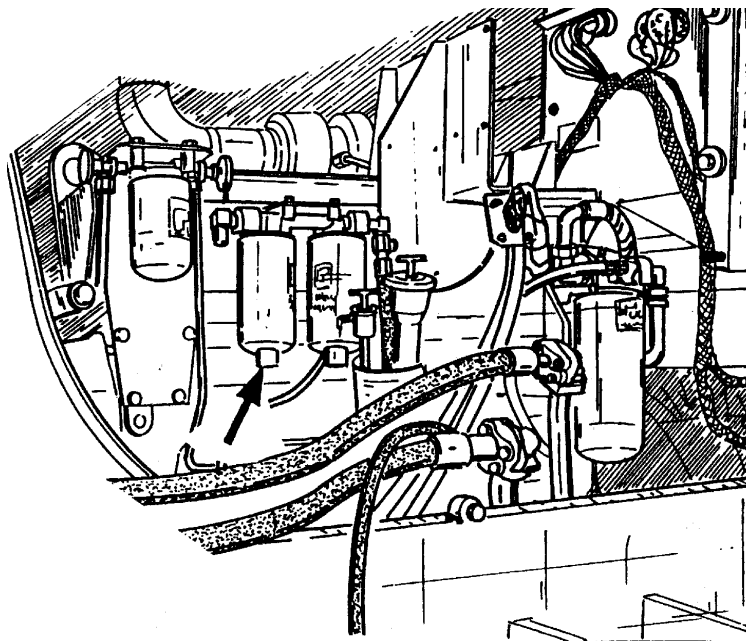


Fig. 5.19. Fuel Filters (Water and Sediment Fuel Filter Drain Valve Shown by Arrow)

Open the valve and drain water and sediment from the filter until clean diesel fuel appears. Close the valve.

5.12. FUEL SYSTEM

NOTE: Water contaminated with sediment and fuels as well as oil are detrimental to environment. Drain water to suitable container and utilize in appropriate area.

5.12.4.2. Replacing the Fuel Filter

Replace fuel filter when the engine is misfiring, loss of power is evident or after 250 hours. Keep the new filter in the original package until ready for installation. Before loosening the filter, clean the filter head to prevent dirt or foreign material from entering the system.

1. Close the fuel shutoff valve under the fuel tank.
2. Remove the fuel filters from the filter header using a filter removal wrench.
3. Thoroughly clean the filter header to prevent dirt or foreign material from entering the system.
4. Fill fuel filter with clean fuel.
5. Apply a light coating of clean engine oil to the seal surface on the new filter.
6. Install the new filter, turning it until the seal just contacts the filter head and tighten the filter an additional 1/2 to 3/4 turn.

NOTE: Thread the filters by hand. Do not use any tools to install the filters because this can damage the filter.

NOTE: Use only recommended filters available from Authorized Distributor of Construction Equipment.

5.12.5. DRAINING FUEL TANK

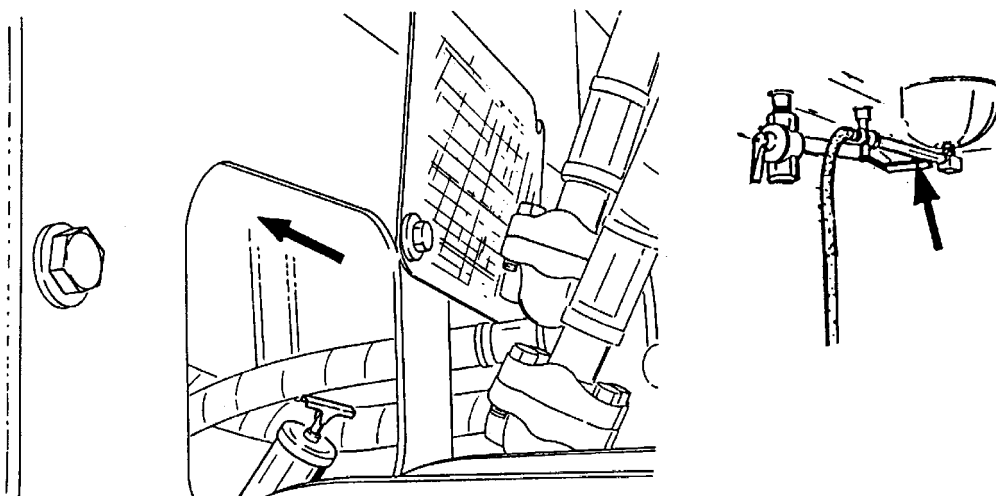


Fig. 5.20. Fuel Tank Drain Valve

Periodically open the valve and drain water and sediment from the fuel tank until clean diesel fuel appears. Close the valve.

5.13. HYDRAULIC SYSTEM

General



WARNING! Always lower all mounted equipment to the ground before performing work on the hydraulic system. With all mounted equipment lowered to the ground and the engine off, cycle all hydraulic controls in all directions to relieve trapped pressure. Slowly loosen the hydraulic reservoir filler cap to relieve trapped reservoir pressure.

5.13. HYDRAULIC SYSTEM

5.13.1. CHECKING OIL LEVEL

1. Park the machine on level ground lower the blade and the ripper to the ground and stop the engine.
2. Check oil level at sight gauge on the side of the reservoir. Add oil if level is below the center line of the gauge. Refer to „OIL CHANGE”.

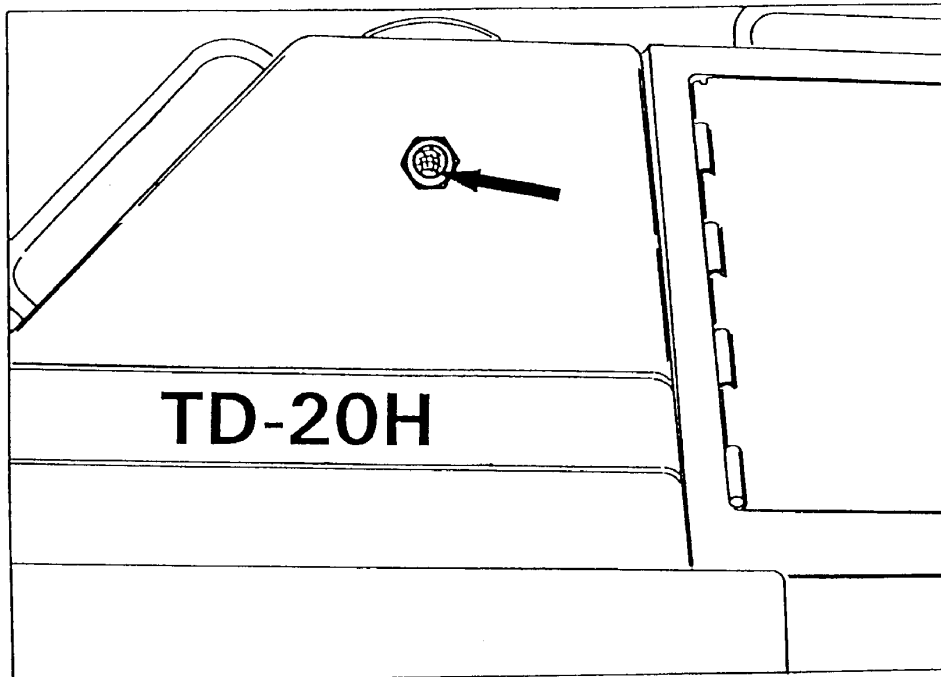


Fig. 5.21. Hydraulic Reservoir Sight Gauge

NOTE: Before removing any components from the reservoir or servicing, wipe the top surface of the reservoir, using clean kerosene or a commercial cleaning solvent.

5.13.2. CHANGING HYDRAULIC OIL

1. Start the engine and operate the blade to warm the oil for easy draining.
2. Park the machine on level ground, lower the blade and the ripper to the ground.
3. Stop the engine. Shift to neutral and apply the neutral lock lever. Apply and lock the parking brake. Turn the electrical system master switch to OFF and remove the key. Slowly loosen reservoir filler plug to relieve reservoir pressure.
4. Drain the reservoir into a suitable container by removing the filler plug and the drain plug
5. Replace return filter of hydraulic system and equipment hydraulic control circuit filter. Refer to „SERVICING THE RETURN FILTER”. Service the suction strainer as described under „SERVICING THE SUCTION STRAINER”. Service hydraulic reservoir filler strainer.

5.13. HYDRAULIC SYSTEM

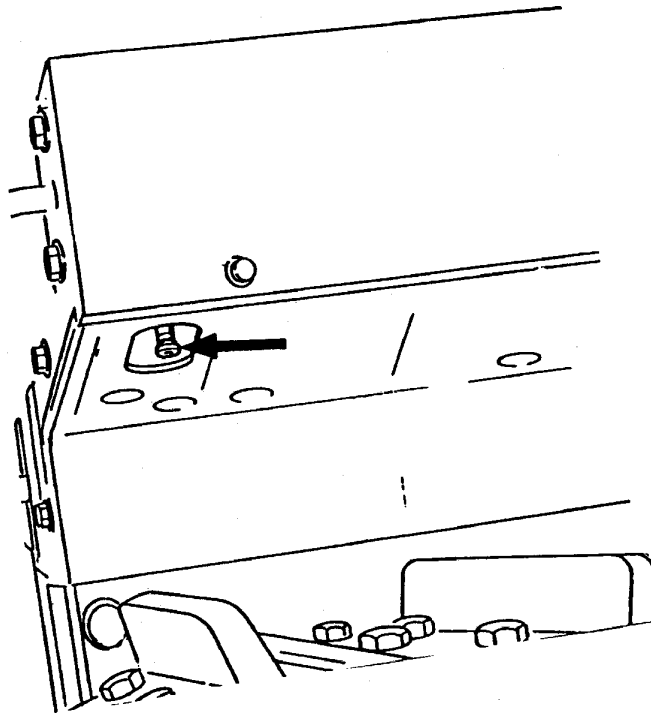


Fig. 5.22. Hydraulic Reservoir Drain Plug

NOTE: Use clean oil from a clean container. Maintain all packaging and fittings so as to prevent leakage.

6. Reinstall the drain plug. Fill the reservoir with lubricant up to the center line of the sight gauge. Refer to 6.7.2. „REFILL CAPACITIES” chart for the quantity oil specified. Reinstall the filler cap.
7. Vent the system. Refer to „VENTING THE SYSTEM”.

5.13.3. SERVICING THE RETURN FILTER AND EQUIPMENT HYDRAULIC CONTROL SYSTEM FILTER

NOTE: The hydraulic reservoir does not have to be drained in order to service this filter.

NOTE: If the filters warning light on the instrument panel, remains on at operating oil temperature with the engine running, the filter must be changed.

Hydraulic return filter and pilot filter change according SCHEDULED MAINTENANCE GUIDE as described below:

1. Park the machine on level ground lower the blade to the ground and stop the engine. Turn the electrical master switch to OFF.
2. With the engine stopped, operate the equipment lever several times in all directions to relieve any pressure. Remove return filter side cover located at R.H. side in front of the hydraulic reservoir, remove all outside dirt from filter.
3. Using a filter wrench remove the spin-on filter. Wipe the filter base, removing all of the old oil from the seal area.
4. Coat the seal on the new filter element with clean oil. Install the new element by threading it onto the filter base until the seal contacts the base, turn the filter by hand an additional 1/4 to 1/2 turn. Check the oil level in the system as outlined under CHECKING THE OIL LEVEL.

5.13. HYDRAULIC SYSTEM

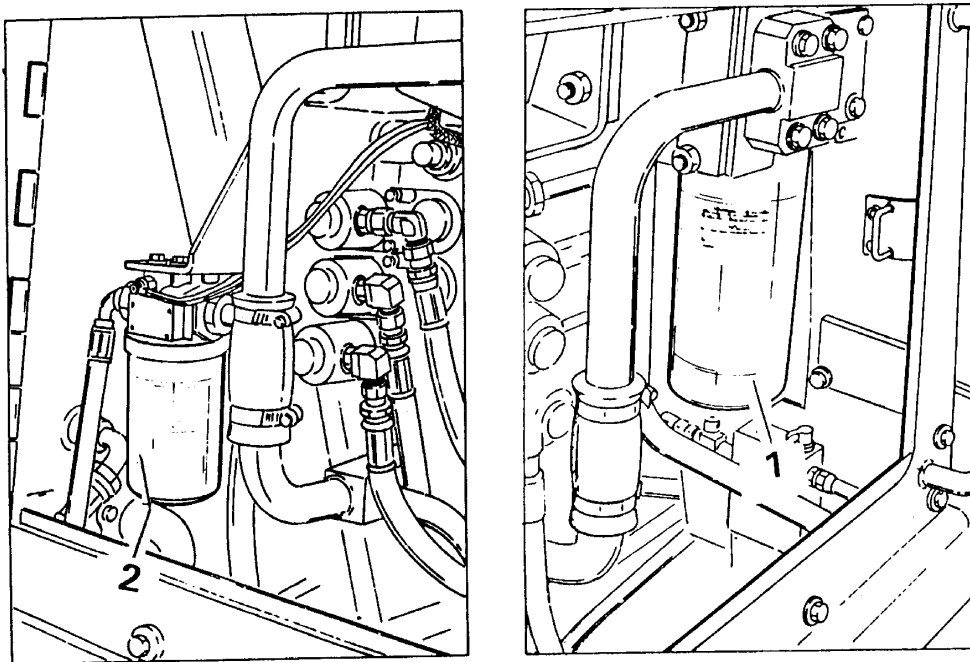


Fig. 5.23. Hydraulic System Filters

1. Return Filter
2. Equipment Hydraulic Control System Filter

5.13.4. SERVICING THE SUCTION STRAINER

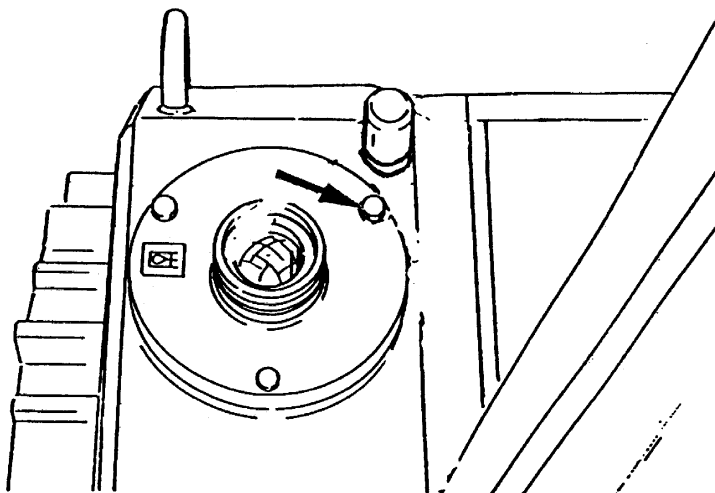


Fig. 5.24. Hydraulic Oil Suction Strainer (Inside Hydraulic Reservoir) and Filler Strainer

1. Park the machine on level ground, lower the blade to the ground and stop the engine. Turn the electrical master switch to OFF. With the engine stopped, operate the equipment lever several times to relieve any pressure. Drain the hydraulic system. Refer to CHANGING HYDRAULIC OIL.
2. Remove 3 bolts and remove cover of hydraulic reservoir. Remove the strainer from the reservoir and discard the O-ring and replace with new.
3. Clean the suction strainer in a nonflammable commercial solvent and dry thoroughly. Thoroughly clean the interior of the reservoir being sure all particles are removed from the corners.

5.13. HYDRAULIC SYSTEM



WARNING! Fire hazard – do not use kerosene, diesel fuel or flammable liquids to clean parts. A spark or a flame could cause a fire or an explosion. Use a nonflammable commercial solvent.

4. Install the strainer with new O-ring and connect elbow. Fill the system, refer to CHANGING HYDRAULIC OIL.

5.13.5. SERVICING THE RESERVOIR BREATHER

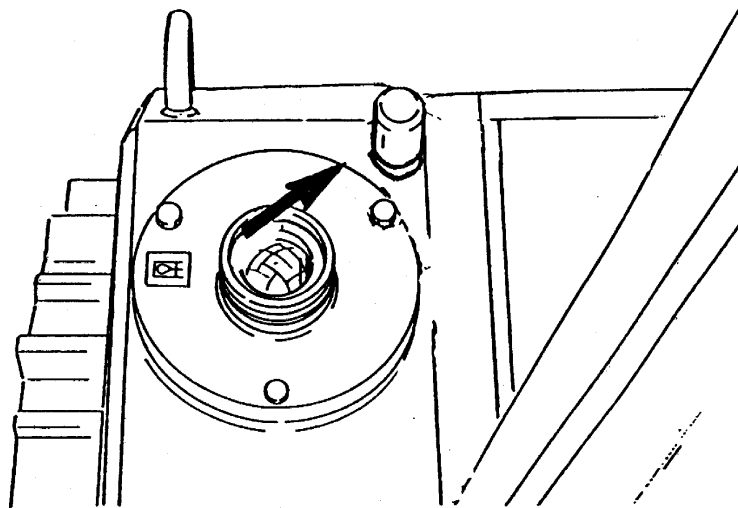


Fig. 5.25. Hydraulic Reservoir Breather Location

1. Park the machine on level ground, lower the blade to the ground and stop the engine. Turn the electrical master switch to OFF and remove the key. With the engine stopped, operate the equipment lever several times to relieve any pressure. Remove all outside dirt from breather.
2. Slowly loosen the filler plug on the reservoir in order to relieve any pressure in the reservoir.



WARNING! Pressurized Reservoir. Always loosen the filler plug slowly in case there is still some pressure in the system.

3. Remove the breather (Fig. 26) from the reservoir. Remove the lock ring (1), cover (2), element (3) and clean in a nonflammable commercial solvent. Dry thoroughly. Check O-ring (4) for wear or deterioration. Replace if necessary. Reinstall filter (3) and cover (2). Secure with lock ring (1). Reinstall the filler cap.

MAINTENANCE

5.13. HYDRAULIC SYSTEM

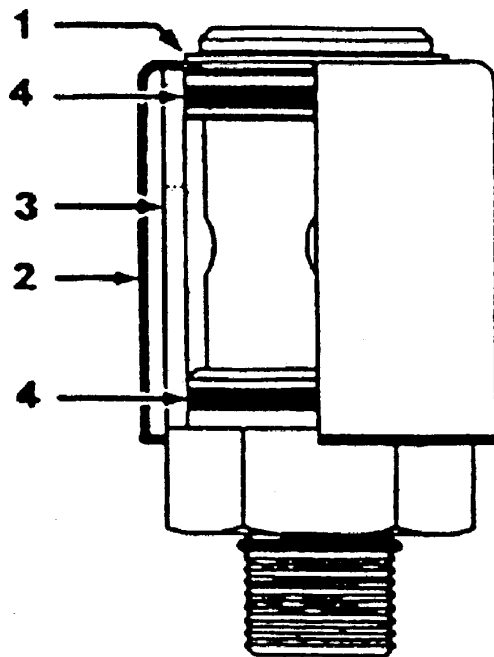


Fig. 5.26. Hydraulic Reservoir Breather

- 1.Lock Ring
- 2.Element Cover
- 3.Breather Element
- 4.O-Ring

5.13.6. VENTING THE HYDRAULIC SYSTEM

The hydraulic system has to be vented of air if:

The system has been drained and filled hydraulic lines have been disconnected or tightened after noting hydraulic leaks the hydraulic system has been operated with excessively low oil level.

1. Start the engine and run it at low idle speed. Operate all the controls through all positions four or five times so the cylinders are filled with oil and air expelled.
2. Check the oil level as described under CHECKING OIL LEVEL. Repeat this procedure until the fluid level remains at the specified level in the reservoir.

5.14. LUBRICATION FITTINGS

General

The following lubrication fittings are to be greased at the intervals indicated on the MACHINE SERVICE GUIDE.

- brake and throttle linkage (8 fittings)
- hand steering levers (2 fittings)

5.14. LUBRICATION FITTINGS

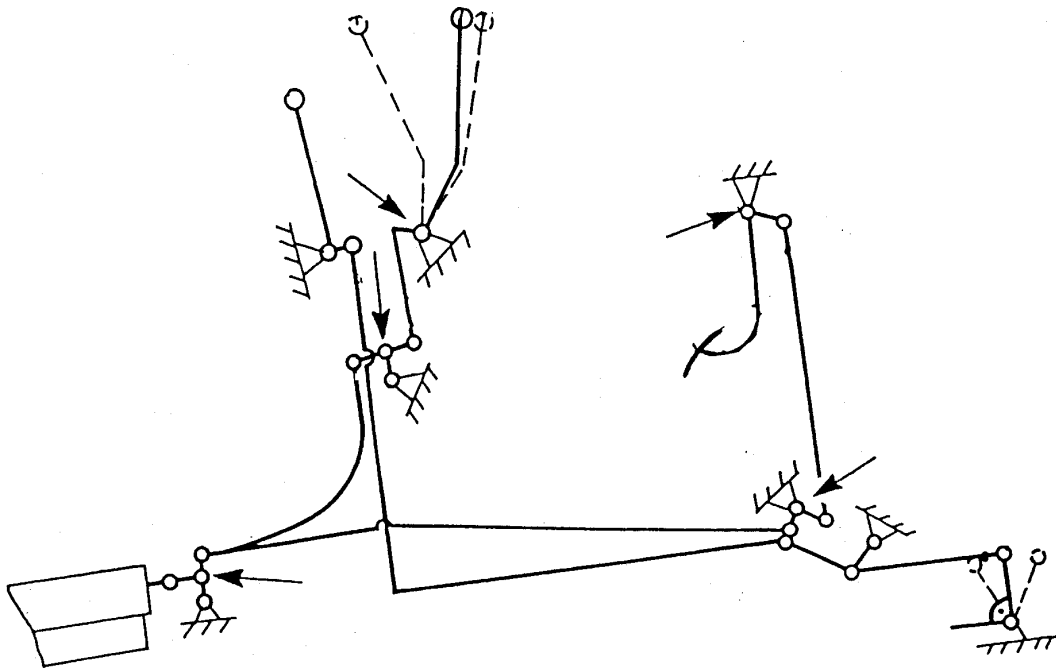


Fig. 5.27. Hand and Foot Control Linkage Lubrication Fittings

Mounted equipment fittings:

- Lift cylinder trunnion (4 fittings)
- Blade w/tilt (6 fittings)

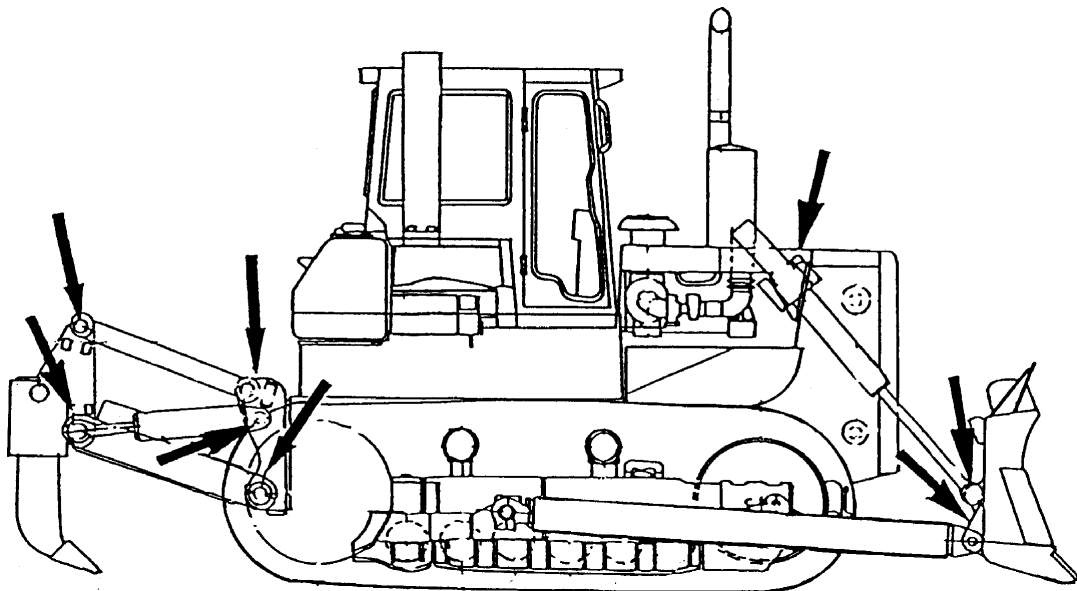


Fig. 5.28. Mounted Equipment Fittings

Apply grease until clean lubricant is visible. Always use a clean lubricator and wipe dirt from fittings before fresh grease is applied. If grease fails to go through the fitting, determine the cause and correct it.

Cross tube (lubrication with lube lines). Apply grease until clean lubricant is visible from breathers. The ripper contains 10 lube fittings.

MAINTENANCE

5.15. MOUNTED EQUIPMENT

5.15.1. COMPLETE BLADE REMOVAL AND INSTALLATION

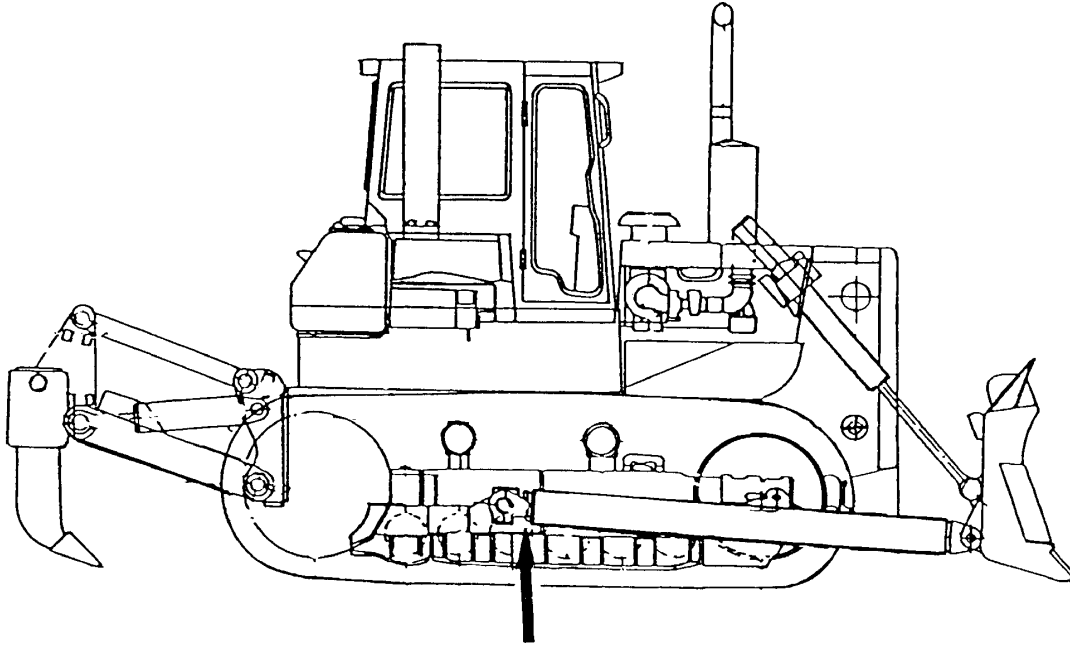


Fig. 5.29. Complete Semi-U Blade

If for any reason the complete blade is to be removed from the tractor; proceed as follows:

1. Place the blade on level ground and block up the ends of the push arms close to the trunnions. This will maintain a proper height for reassembly.

For machines with hydraulic tilt: Remove the bolts and remove lower part of the front cooler guard. Remove hose clamp securing the hoses to the right side of cooler guard and disconnect the hoses (A and B). Fit and secure plugs to the ends of hoses and pipes.

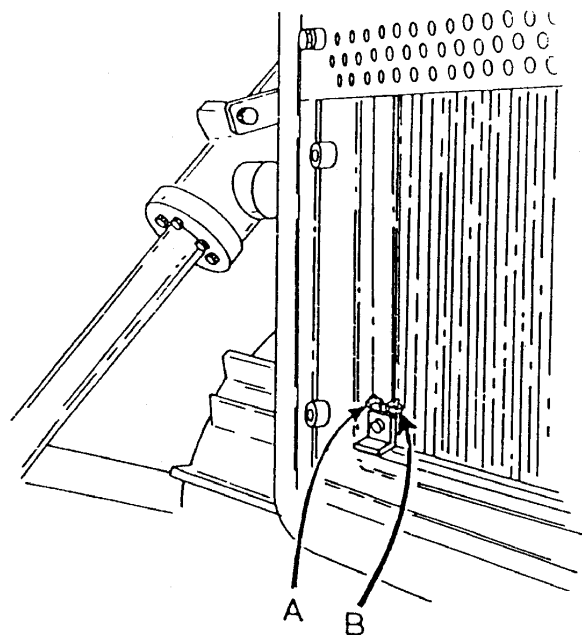


Fig. 5.30. Blade Tilt Hoses Connection Location

5.15. MOUNTED EQUIPMENT

2. Remove the pins securing the lift cylinder piston rods to the blade lift brackets at the back of the blade. Retract the piston rods fully into the cylinders. Secure the rods to the tractor using shipping hanger bars to prevent damage to the piston rods.
3. Remove two trunnion bearing cap bolts (2 Fig. 31) and remove caps (1) and shims (6) of R.H. and L.H. side trunnion (3) from push arms.
4. Back the tractor straight out and away from the push arms.
5. Reassemble shims and bearing caps to the push arms and secure with bearing cap bolts to prevent their damage or being lost. If the blade is to be stored outdoors, grease to prevent corrosion. To reassemble the blade, perform the above in reverse order.

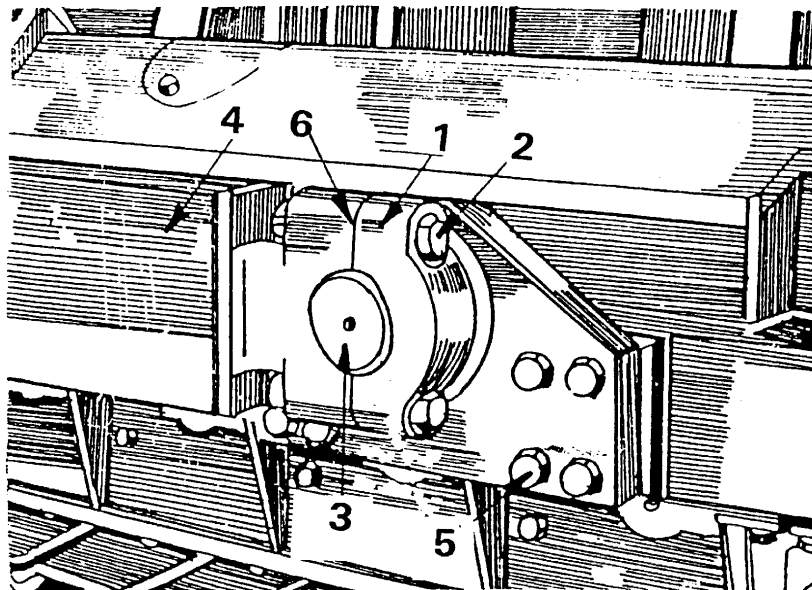


Fig. 5.31. Push Arm Mounting

- | | |
|-------------------------|----------------------------|
| 1. Trunnion Bearing Cap | 4. Push Arm |
| 2. Cap Bolts | 5. Trunnion Mounting Bolts |
| 3. Trunnion Ball | 6. Shims |

6. Check if the blade is positioned symmetrically to machine axis. Operating with blade non-symmetrical to machine axis results in damage to the blade.

5.15.1.1. Leveling the Blade

1. Place the lowest corner of the blade on a flat surface.
2. Hold the control lever in position on the side to which the blade is to be lowered until the blade is even along the flat surface.

5.15.1.2. Adjustment of Diagonal Blade with Hydraulic Tilt Cylinders.

1. Raise the blade and make several full cycles tilt of the blade.
2. Level the blade.
3. Measure the dimension „A” of tilt cylinders. If dimension „A” is less than 170 proceed as follow:
 - a) disconnect quick connector (4 Fig. 5.32) of the right tilt cylinder and direct flowing out oil to an adequate vessel.
 - b) start the engine and tilt the blade until small amount of oil will flow out through quick connector (4).
4. If the dimension „A” of tilt cylinders is above 170 mm, proceed as follows:

5.15. MOUNTED EQUIPMENT

- a) connect provisional hose to the quick connector on the mounted equipment valve,
 - b) fill the hose with oil,
 - c) connect other end of hose to the quick connector (4) on the right tilt cylinder.
 - d) start the engine and make full tilt to the right. Keep control lever in full tilt position until full extension of the right tilt cylinder piston rod.
5. Close the quick connector.
 6. Level the blade.
 7. Measure the dimension „A” of tilt cylinders.
 8. Repeat action 1 to 7 until you get dimension „A” on tilt cylinders equal to 170 mm \pm 3 mm.

5.15.1.3. Filling up and Venting the Tilt Cylinders of Diagonal Blade

Hydraulic circuit has no connection from piston rod side of tilt cylinders to the oil tank and therefore has no capability to selfventing. After every case of disconnecting the balance hose (1), the cylinders have to be filled with oil and vented as follows:

1. Upon connection of all hydraulic lines, connect provisional filling hose (2) between one of the quick connectors located on each tilt cylinder and the quick connector on the tilt valve pressure line.
2. Connect short venting hose (3) to the quick connector on the other cylinder where filling hose is not connected. Direct the venting hose to suitable container.
3. Start the engine with control lever pushed to the locking position and keep engine running at maximum speed until the oil leaking from venting hose (3) will be free from air bubbles. If higher pressure is required for filling and venting, it can be increased by switching from lifting circuit to the enforced lowering.

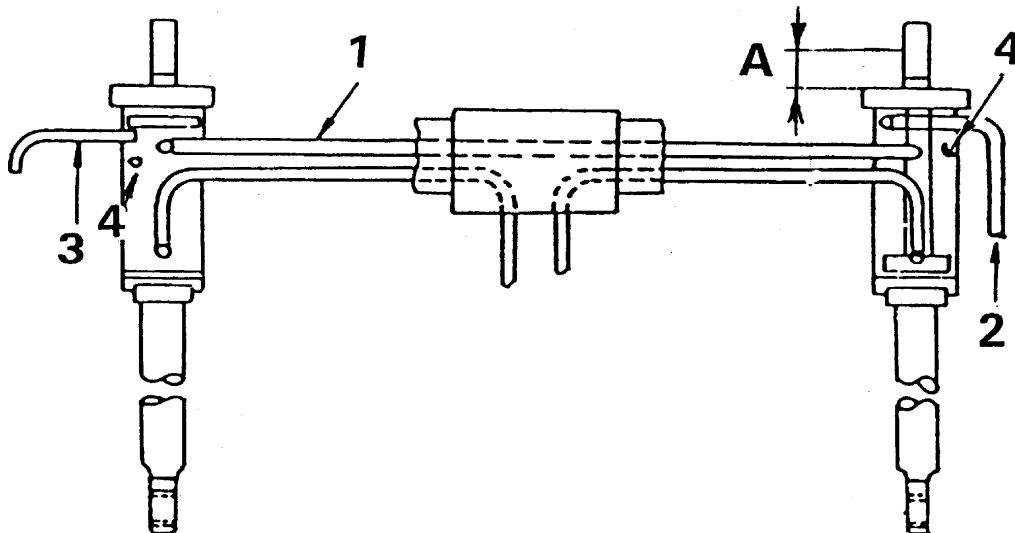


Fig. 5.32. Filling and venting the tilt cylinders.

- | | |
|-----------------|---------------------|
| 1. Balance Hose | 3. Venting Hose |
| 2. Filling Hose | 4. Quick Connectors |

4. Disconnect provisional hoses (2 and 3). Raise the blade and make several full tilt cycles.
5. Check oil level in the oil tank and add if necessary.

5.15. MOUNTED EQUIPMENT

5.15.1.4. Blade Struts and Tilt Cylinder Adjustment

UPPER STRUT AND TILT CYLINDER ADJUSTMENT

The upper strut and tilt cylinder sockets must be checked occasionally to ensure excessive movement does not occur between the cap and blade socket. When movement exceeding 1.3 mm is detected readjustment is necessary.

Adjust as follows:

- Attach a suitable hoist and sling to the upper stud or tilt cylinder (1). Remove cap screws (2) securing cap (5) to blade socket (4). Retract upper strut or tilt cylinder (1) while supporting the assembly with the hoist and sling. Remove shims (3). Re-extend strut or tilt cylinder (1) until the ball on the strut or tilt cylinder bottoms in the blade socket (4). Reinstall cap (5) with four cap screws (2). Torque cap screws (2) to 270 Nm evenly to ensure the cap is not cocked on the strut ball. Using the removed shims (Fig. 5.41) determine the maximum amount of shims which will fill the gap between the cap (5) and socket (4). When the correct shim pack for the gap between the strut cap (5) and socket (4) is determined add one shim to provide clearance. Each shim is 0.75 mm. Prior to final assembly clean all shims (3), mating surfaces of strut caps (5) and socket (4) mating surfaces of all foreign material, dirt and paint. Insert the shims over the strut or tilt cylinder ball and extend until the ball bottoms in the blade socket. Install all cap screws (2) and torque to 845 Nm. Readjust blade strut to desired blade angle.

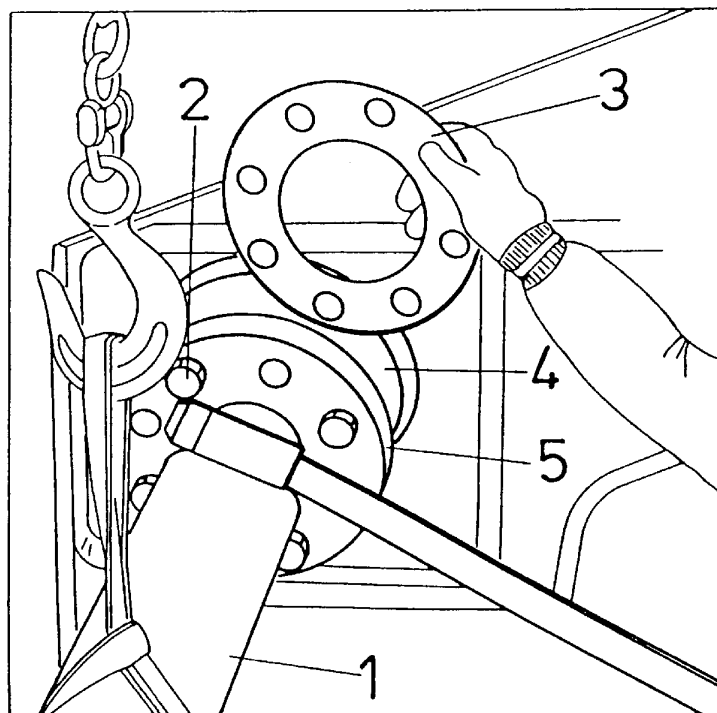


Fig. 5.33. Adjusting the Upper Strut and Tilt Cylinder

- | | |
|----------------|-----------------|
| 1. Upper Strut | 4. Blade Socket |
| 2. Cap Screws | 5. Strut Cap |
| 3. Shims | |

5.15. MOUNTED EQUIPMENT

DIAGONAL STRUT ADJUSTMENT

The diagonal strut adjustment must be checked occasionally and if it is found that strut press on the blade it has to be adjusted as follows:

With the blade on the ground and stopped engine, remove the pin at the push arm bracket connection. Adjust the length of strut so that hole of eyebolt is aligned with bracket bore on a beam.

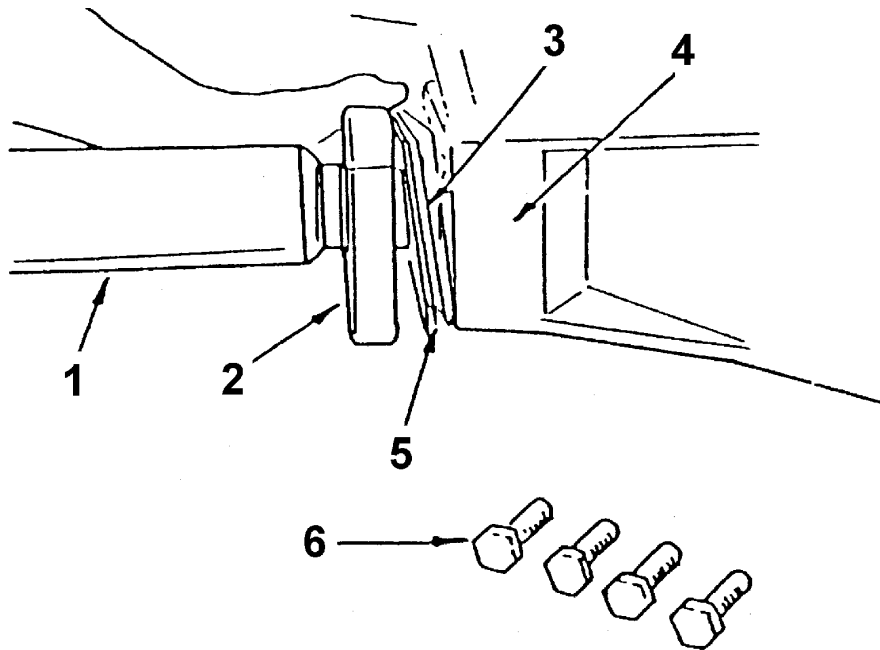


Fig. 5.34. Diagonal Shimming

- | | |
|------------------|------------------------------------|
| 1.Diagonal Strut | 4. Socket in Stress Reliever Lever |
| 2.Strut Cap | 5. Shims |
| 3.Ball End | 6. Cap Screws |

Extend the strut to maximum keeping the possibility to insert the pin. Install and secure the pin in the connection with the bracket on arm beam and tighten the clamping screw to prevent turning.

Making this adjustment remember that the distances between inner surface of blade beam and the fixed point on the track frame should be the same on both sides.

Put the ball end (3) without shims to the socket (4). Install and fix the strut cap with four cap screws (6) so that flange will adjoin tightly to the ball seated firmly in the socket. Determine the number of necessary shims (5) by measuring the gap between the flange and the socket. Ensure that gap between the socket (4) and strut cap (2) is the same all around. To ensure adequate play add one more shim.

Remove strut (1) and install determined earlier number of shims. Reinstall the struts (1) turning them additionally by a half turn in order to get proper pressure stress. Tighten the cap screws to the torque 1050 Nm.

5.15. MOUNTED EQUIPMENT

5.15.2. TRUNNION, COVER, BLADE CUTTING EDGE AND END BITS MOUNTING BOLTS.

Check torque of trunnion mounting bolts, bearing cap screws and cutting edge and end bits bolts after initial 10 hours of operation, and then periodically.

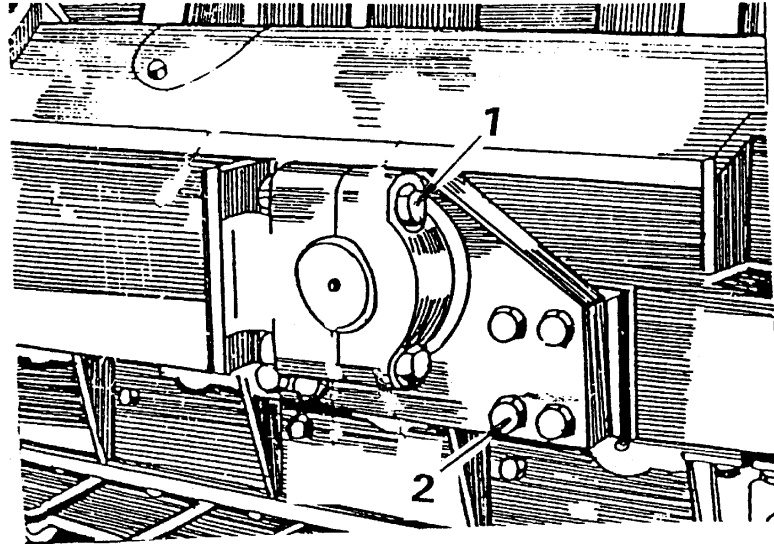


Fig. 5.35. Tightening Trunnion and Blade Beam Bearing Cap Bolts

- 1. Cap Bolts
- 2. Trunnion Bolts

Tighten the cap and trunnion bolts to the torque 1050 Nm.

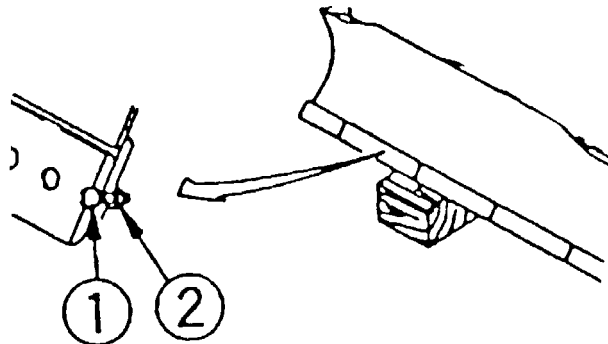


Fig. 5.36. Tightening Blade Cutting Edge Bolts

- 1. Bolt
- 2. Nut



WARNING! Never work beneath the blade without securing it by wooden blocks.

5.15.3. ALLOWABLE WEAR OF CUTTING EDGE AND END BITS AND RIPPER POINTS

Reverse or replace the cutting edge and end bits before the mounting plate is worn or damaged.

To replace the cutting edge and end bits:

1. Raise the blade about 300 mm above the ground and set the pilot valve lever in „HOLD” position. Prop up the push arms and stop the engine.

MAINTENANCE

5.15. MOUNTED EQUIPMENT



WARNING! Never work beneath the blade without securing it by wooden blocks.

2. Remove the cutting edge and end bits mounting bolts.
3. Install the cutting edge or the end bits and tighten the bolts to the torque 725 Nm.
4. Authorized Distributor of Construction Equipment can supply these specially heat-treated bolts.

NOTE: *Do not substitute bolts. Loosening of bolts mounting cutting edge and end bits may result in tear off cutting edge or end bits and blade damage.*

5.15.3.1. Servicing the Ripper

Prior to each day’s work carry out ripper inspection and remedy if any malfunction is found. Operating defective ripper results in reduced job efficiency and may cause its damage.

The following table specifies services to be carried out during inspection:

POINT OF SERVICE	SERVICE DESCRIPTION
Ripper Assy	Visually check for cracks, breakage, loose parts and completeness
Hydraulic hoses and connections	Check for leaks and remedy, if any.
Hydraulic reservoir	Check hydraulic reservoir oil level. Refer to Hydraulic System
Ripper pins	Check if pins are secured correctly and tighten loosened bolts if necessary.
Ripper shank point	Check for wear. Replace, if 1/3 of point is worn. Excessively worn shank point makes ripping difficult.

Replace ripper shank point as follows:

1. Raise ripper tooth about 300 mm above ground and prop up to prevent ripper tooth from lowering during service.
2. Stop the engine.
3. Remove point mounting pin.
4. Install new point and mounting pin.

5.15.3.2. Lubrication

Apply lubricant to ripper lube fittings. Service interval of 50 hours refers to average operating conditions. Under unusually severe operating conditions reduce the interval of time between services. Always use clean lubricators and containers. Apply sufficient lubricant to force out old lubricant and dirt. Lubricating points are shown on Fig. 5.28.

5.16. SAFETY BELT



WARNING! Seat belt – do not clean with solvents or bleach or redye color of webbing as this may cause a severe loss of strength. This could cause the webbing to break and result in personal injury. Wash in warm water with a mild detergent.

Keep belt flat to avoid twisting and roping when not being used. Do not place heavy or sharp objects on belt.

5.16. SAFETY BELT

The entire seat belt assembly should be inspected periodically for corrosion, wear, fraying or wear spots. The seat belt mounting bolts should also be periodically inspected for tightness.

5.17. FINAL DRIVES

5.17.1. CHECKING THE OIL LEVEL

Position the machine on level ground so the „OIL LEVEL” mark on the final drive housing is positioned horizontally. Remove the magnetic filler and level plug, check the lubricant and, if the lubricant is low, fill to the level of the plug opening. Also, check the plug for metallic particles that may be present. If this condition continues after periodic checks, consult Authorized Distributor of Construction Equipment. Reinstall the plug and tighten.

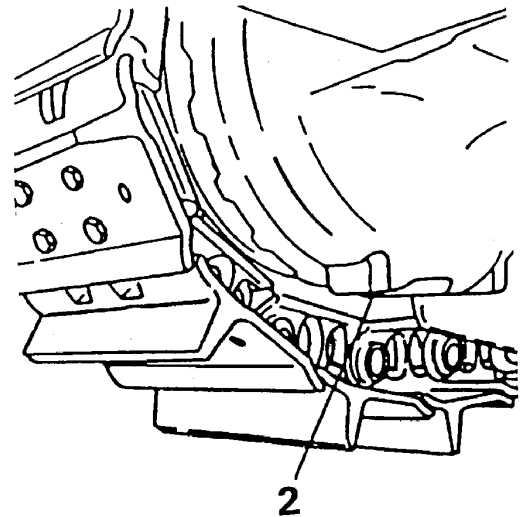
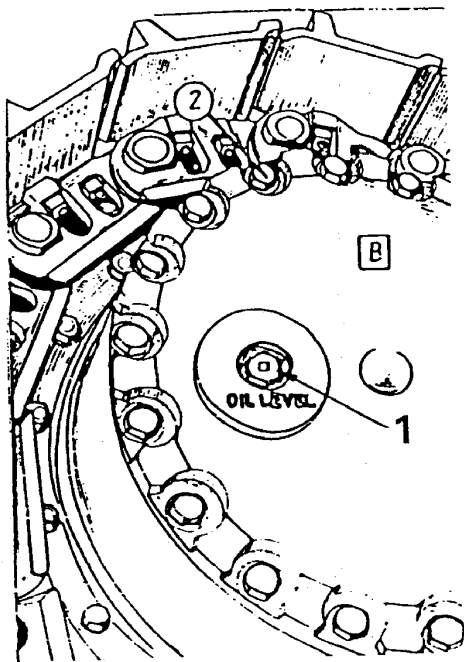


Fig. 5.37. Checking the Lubricant Level

- 1. Filler and Level Plug
- 2. Drain Plug

5.17.2. CHANGING THE OIL

While the oil is at operating or warm ambient temperature, park the machine on level ground so the „OIL LEVEL” mark on the final drive housing is positioned horizontally. Remove the drain plugs (2) and levels plugs (1) and allow the lubricant to drain into a suitable container. Remove metal particles from the magnetic plugs. Install and tighten the drain plugs. Fill app.8 liters of fuel oil up to the housing and install the plugs.

Operate the machine in low gear (with no load) for a few minutes. Remove the drain plugs and thoroughly drain the fuel oil into a suitable container. Reinstall and tighten the drain plugs. Remove the filler and level plugs. Fill the housing with fresh oil up to the bottom of the filler and level plug opening. Refer to the REFILL SPECIFICATIONS AND CAPACITIES chart for grade of lubricant specified. Reinstall and tighten the filler and level plugs.

5.18. TRANSMISSION SYSTEM

UNIVERSAL JOINTS

Every 500 hours lubricate the universal joints of transmission system.

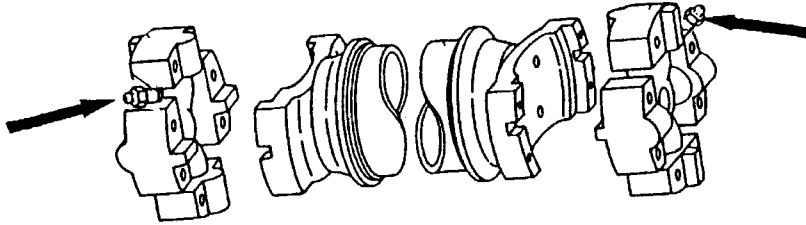


Fig. 5.38. Grease Nipples of the Universal Joints.

General

The rear frame is the common oil reservoir for the transmission, torque converter and hydraulic steering drive. The system has a pressure filter and a suction strainer which require service.

5.18.1. CHECKING THE OIL LEVEL

1. With the engine shutdown open L.H. side rear access door, unscrew the T handle of the oil level gauge, remove the gauge and wipe it clean.



Fig. 5.39. Rear Frame Oil Level

2. Insert the gauge fully into the filler sleeve. Do not tighten. Remove the gauge and check the lubricant level. If necessary, add oil through the filler to bring the level. Reinstall and secure the gauge. The gauge has two marks: LO for low oil level and HI for high oil level for HOT oil on one side and two marks: LO for low oil level and HI for high oil level for COLD oil on the other. Check oil level with engine stopped.

IMPORTANT: Never operate the machine if the level of the oil is at or below the LOW mark on the oil level gauge.

5.18. TRANSMISSION SYSTEM

5.18.2. CHANGING TRANSMISSION SYSTEM OIL

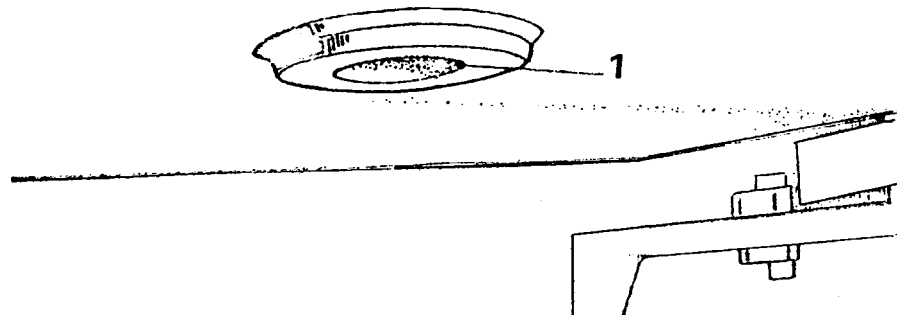


Fig. 5.40. Rear Frame drain Plug

1. Drain Plug

The transmission system lubricant must be changed at least once a year, even if the 1000 hours operational period has not elapsed.

1. To drain oil, warm it and remove the drain plug in the rear frame.
2. Remove oil level gauge with cover. Drain out used oil and pour lubricant into the rear frame through the filler tube to bring the level up to the FULL mark on the gauge.
3. Reinstall the oil level gauge.

5.18.3. SERVICING THE TRANSMISSION SYSTEM FILTERS

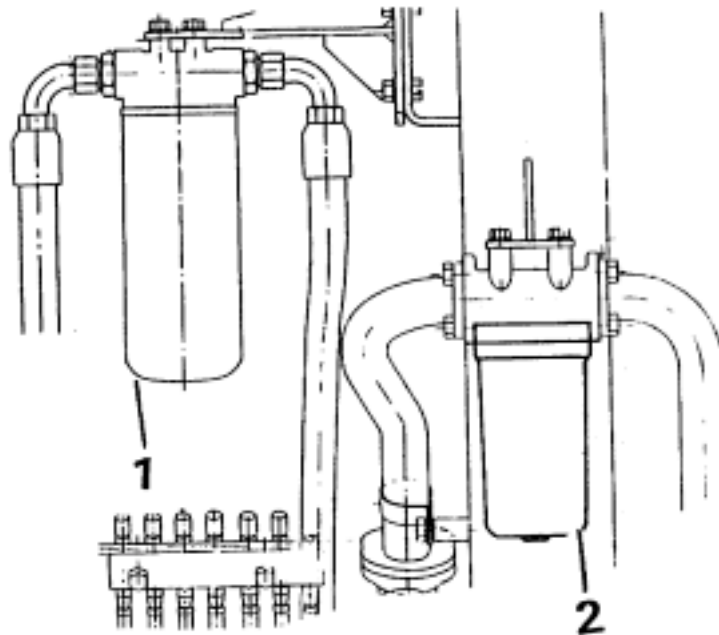


Fig. 5.41. Transmission System Filters on the Left Side Back of the Machine.

1. Pressure Filter 2. Suction Strainer

5.18.3.1. Servicing the Pressure Filter

NOTE: If the pressure filter warning light on the instrument panel remains on at operating oil temperature with engine running, the restricted pressure filter must be changed. Besides, filter has to be changed according to maintenance schedule as described below:

5.18. TRANSMISSION SYSTEM

1. With the engine stopped, operate the steering levers several times to relieve any pressure. Open the L.H. side access door. Remove all outside dirt from filter and using a filter wrench remove spin-on filter. Wipe the filter base, removing all of the old oil from the seal area.
2. Coat the seal on the new filter with clean oil. Install the filter by threading it onto the filter base until the seal contacts the base, turn the filter by hand an additional 1/4 to 1/2 turn. Start the engine and let it idle for approximately 5 minutes. During this time operate the steering levers several times, check filters for leaks and remove leaks if any.
3. Check oil level in the transmission system.

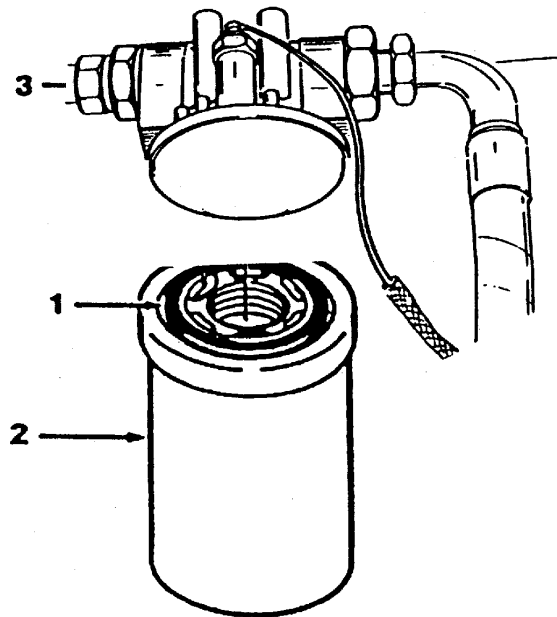


Fig. 5.42. Transmission Pressure Filter

1. Filter Seal 2. Filter Element 3. Filter Base

5.18.3.2. Servicing the Suction Strainer

After the first 50 hours of operation clean the filter element. Further servicing perform periodically according to „Maintenance Schedule”

5.18. TRANSMISSION SYSTEM

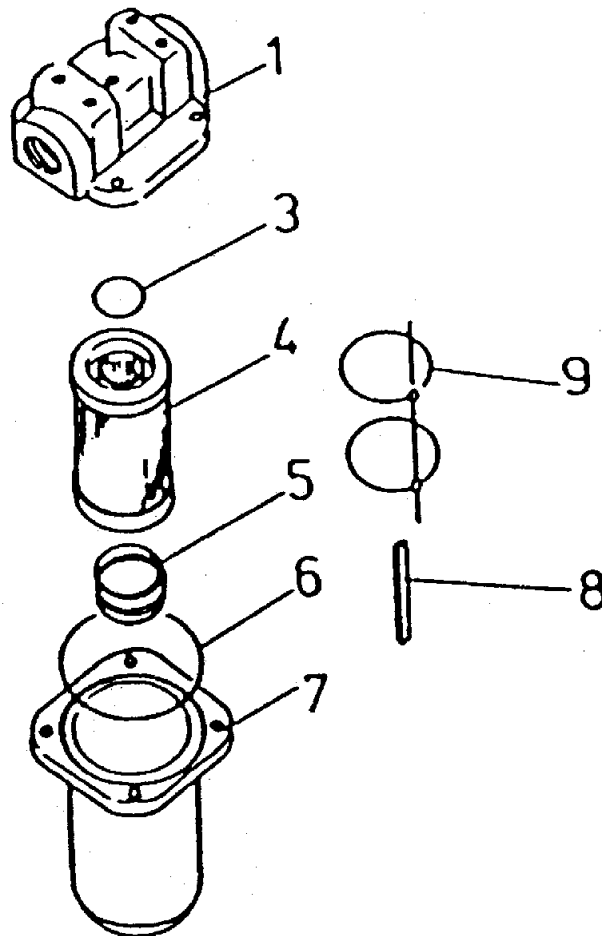


Fig. 5.43. Suction Strainer

- | | | |
|-------------------|------------|------------------|
| 1. Filter Base | 5. Spring | 8. Magnet |
| 3. O-ring | 6. O-ring | 9. Pressing ring |
| 4. Filter Element | 7. Housing | |

To gain access to suction strainer follow procedure similar to pressure filter.

1. Remove four bolts and separate the housing from the base.
2. Remove the element with magnets and O-ring. Clean the magnets with clean soft cloth. **DO NOT STRIKE THE MAGNETS.**
3. Wash the element and housing in a commercial solvent and dry thoroughly. Replace O-ring. Remove all dirt from the inside of the base using a cloth dampened with solvent.
4. Check that the new O-ring is in place in the groove in the element. Slip the non O-ring end of the element into the housing. Secure the housing to the base with the hardware previously removed.
5. Start the engine and let it idle for approximately five minutes. During this time, check the strainer for leaks. Correct all leaks no matter how minor. Then check the level in the transmission system as outlined under „CHECKING THE OIL LEVEL”.

5.18.4. SERVICING THE BREATHER

NOTE: To prevent dirt from entering the critical areas of the transmission system, keep the breather clean. Replace the breather as indicated when changing oil in the rear frame.

The breather is located on the transmission system filler tube. Unscrew the breather from the reducer nipple. Install the new breather on the nipple.

5.18. TRANSMISSION SYSTEM

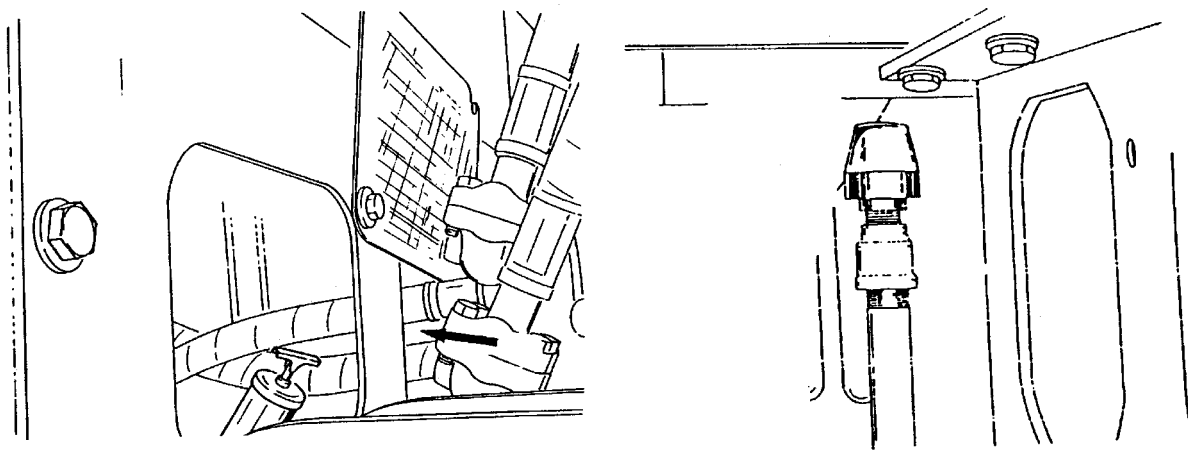


Fig. 5.44. Transmission System Breather

5.18.5. SERVICING TRANSMISSION SCAVENGER STRAINER

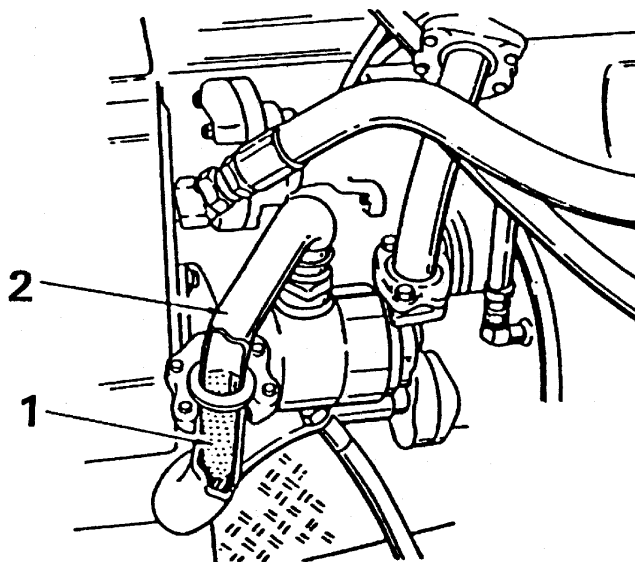


Fig. 5.45. Transmission Scavenger Oil Strainer

1. Hose with Filter Strainer
2. Intake Pipe with Scavenger Pump

With the transmission system drained after 1000 hours of operation as described in „Maintenance Schedule”, remove the scavenger oil strainer and clean as described below:

1. To gain access to the oil strainer first remove the center cover in floor of cab.
2. Disconnect the transmission scavenger hose (1) from the intake pipe (2).
3. Remove the strainer from the hose (1).
4. Clean the strainer with a nonflammable commercial cleaning solvent.
5. Reinstall the strainer into hose (1).
6. Reinstall the transmission scavenger hose to the pipe (2). Make sure that filter strainer is properly seated in the hose.
7. Reinstall the center cover.

5.19. UNDERCARRIAGE

Periodically make observation checks on your undercarriage components. Check tracks, track rollers, track idlers, front idlers etc. for abnormal wear. Make adjustments to these problems before damages to these components occur. Once the wear on these components drops below zero percentage the option to recondition will also be lost. Refer to TD-40C Service Manual for dimensions indicating percentage of allowable wear. If this Service Manual is not available contact Authorized Distributor of Construction Equipment.

Clean mud and debris should from the undercarriage so components can perform properly. Every 1000 hours of operation check torque of sprocket mounting bolts and tighten if necessary.



WARNING! Special knowledge and equipment are required to service lubricated track systems and their components. Unless you are completely familiar with servicing lubricated track systems do not make any attempt to remove them. Disconnecting the master link could cause the chain to whip off the front idler causing serious personal injury.

Improper track tension and loose track shoes will cause damage and premature wear to the track. When new tracks or track shoes are installed, track tension and track shoe bolts should be checked after initial 10 hours of operation and adjusted if necessary.

5.19.1. TRACK SHOE BOLTS

The bolts used for attaching the track shoes to the tracks are heat-treated alloy bolts and will stand a considerable tightening strain. Ordinary bolts must not be used. Nuts must be assembled so that washer face is not against track link. Radius side of nuts must be against track link.

If removed coat bolt threads and area under the head with engine oil. Torque value is given in Section 6.8.

5.19.2. EFFECT OF TRACK ADJUSTMENT ON UNDERCARRIAGE WEAR

Tracks adjusted too tightly increase operating loads on final drives and accelerate wear on undercarriage components, especially in packing conditions.

A machine in forward operation with correctly adjusted tracks will experience track loads only along the ground from the front idler to where the bushings engage the sprocket.

Lubricated track systems are to be adjusted to provide a sag in the track chain between to front top idler and the front idler. Correct tension reduces stress levels throughout the undercarriage system.

5.19. UNDERCARRIAGE

5.19.3. CHECKING THE TENSION

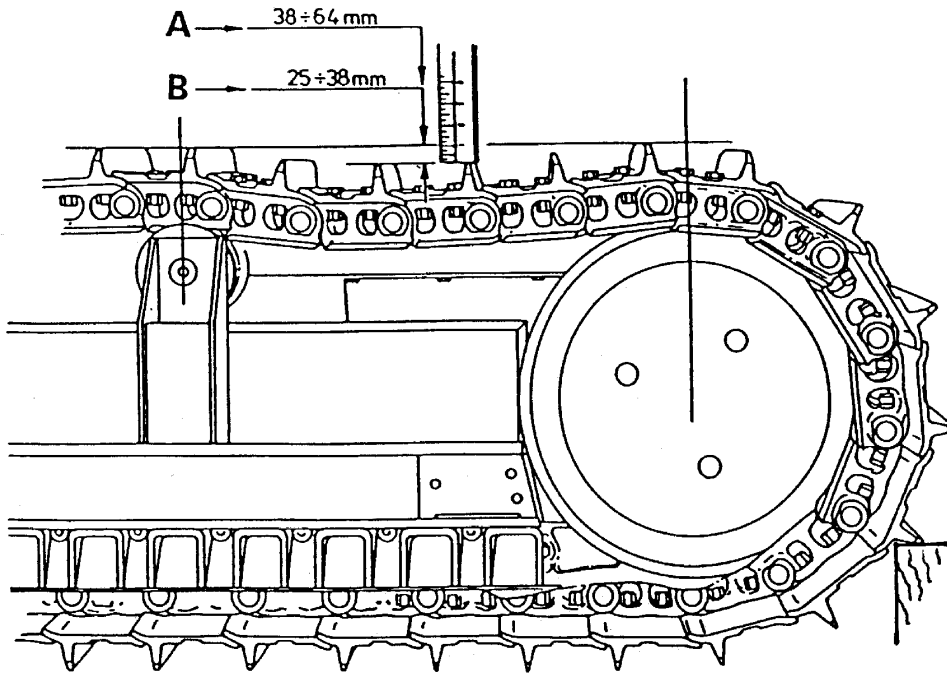


Fig. 5.44. Checking Track Tension

1. Track Sag of Lubricated Chain
2. Track Sag for Nonlubricated Chain

1. Place a wooden block, ~300 mm in height, under the front most track shoe lug. Drive the machine forward until the track chain is tight along the ground and around the sprocket. Apply and lock the brake pedal, lock the transmission shift lever in the NEUTRAL position and stop the engine.
2. Stand on the track between the front idler and the first track idler in order to accumulate all the chain slack at this point.
3. Place a straightedge on the track so the ends rest over the front idler and track idler. Measure the clearance between the bottom of the straightedge and the top of the shoe grouser with a ruler at the midway point between the idlers. If the distance is more than 64 mm or less than 38 mm for lubricated chain and 38 or 25 respectively for nonlubricated chain, adjust the track tension.
4. For mud and snow packing conditions track should be adjusted so sag is 64 – 76 mm for lubricated chain and 38 - 50 mm for nonlubricated chain.

5.19.4. ADJUSTING TENSION

The track chains are adjusted by hydraulic pressure. When lubricant is introduced into the front idler fork through the lubrication fitting, it acts upon the piston within the front idler fork forcing the front idler fork and front idler forward for track adjustment.



WARNING! To avoid possible injury, always stand to the side of the bleeder plug when making track adjustment. The pressure in the front idler fork is held by the bleeder plug and check valve. A loose or improper thread fit of either of these parts can allow them to be ejected by the pressure of the lubricant, causing possible injury. When increasing track tension, be sure the bleeder plug and check valve are properly torqued. When relieving track tension, never loosen the bleeder plug and check valve more than 2 – 2 1/2 turns.

5.19. UNDERCARRIAGE

1. Remove the bolts and track adjuster cover.



WARNING! Before adding lubricant for track adjustment, be sure the ball check and relief valves are properly torqued to 61 – 75 Nm.

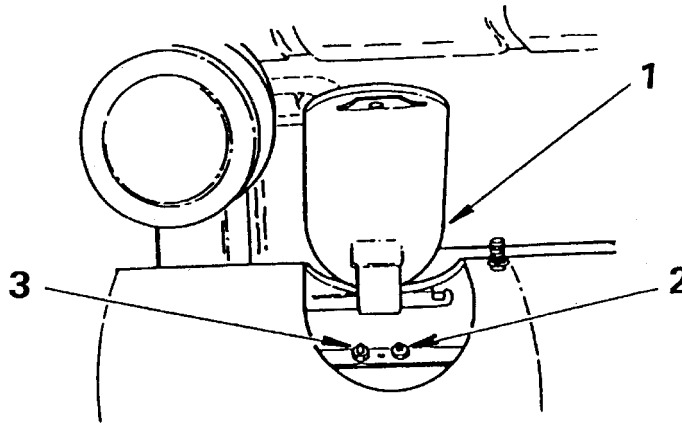


Fig. 5.47. Track Adjuster

1. Track Adjuster Cover
2. Relief Valve
3. Lubrication Fitting (Ball Check Valve)

2. To increase track tension, connect a lubricator nozzle to the lubrication fitting (3). Determine the amount of adjustment necessary, and add lubricant to obtain the proper track chain tension. It is advisable to move the machine forward and backward slightly to be sure the correct tension has been obtained.
3. To reduce track tension, loosen the relief valve (2) 1/2 to 1 full turn to allow the pressurized lubricant to escape through the relief passage. If lubricant does not appear, loosen the check valve (located under the lubrication fitting) 1/2 to one full turn to allow the pressurized lubricant to escape from a second relief passage.
4. If lubricant still does not appear, use the following emergency method. Should the relief passages still be blocked, unscrew the ball check and/or relief valve an additional 1 1/2 to 2 turns (2 1/2 total turns).



WARNING! Use extreme care when relieving pressure with the following emergency method. If loosened excessively, the cylinder pressure can eject the ball check or relief valve. NEVER loosen these parts more than a total of 2 1/2 turns.

5. When the proper tension has been obtained, tighten the ball check and/or relief valve to 61 – 75 Nm. Install the cover and secure with removed hardware.

NOTE: Never remove one link to bring a stretched track to within the range of proper track adjustment. A track that is worn badly enough to take up the length of one link, will be so far out of pitch that the increased wear on the sprocket will far more than offset the saving obtained by the removal of one link in the track chain.

MAINTENANCE

5.19. UNDERCARRIAGE

5.19.5. TRACK FRAME GUIDE

To avoid excessive wear of undercarriage components and track frame suspension points, the track frame guide must be checked periodically.

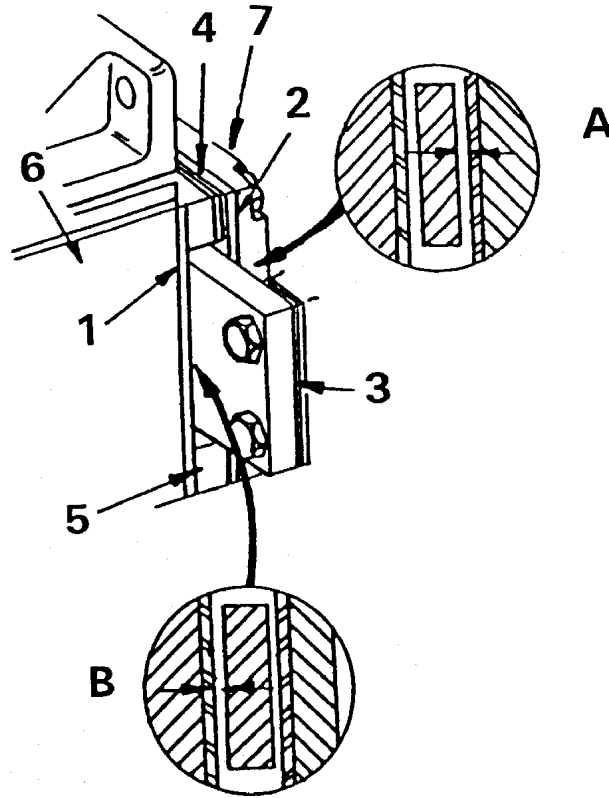


Fig. 5.48. Track Frame Guide

- | | | |
|---------------------|--------------------|----------------------------|
| 1. Outer Wear Plate | 4. Shims | 6. Track Frame |
| 2. Inner Wear Plate | 5. Guide Bar Block | 7. Track Frame Guide Plate |
| 3. Guide Plate | | |

Measure clearances "A" and "B". If the total is 6.5 mm or more, adjust by removing shims (4) from between the spacer blocks (5) and inner wear plate (2). Remove enough shims to reduce the total clearance (A+B) to 0.8 mm. Keep the removed shims for future use.

If removal of all the shims (4) will not provide a total clearance of less than 6.5 mm, replace the wear plates (1 and 2) worn guide plate (3), as required. Reinstall the shims and repeat the check. Lubricate track frame guides.

5.19. UNDERCARRIAGE

5.19.6. PIVOT SHAFT

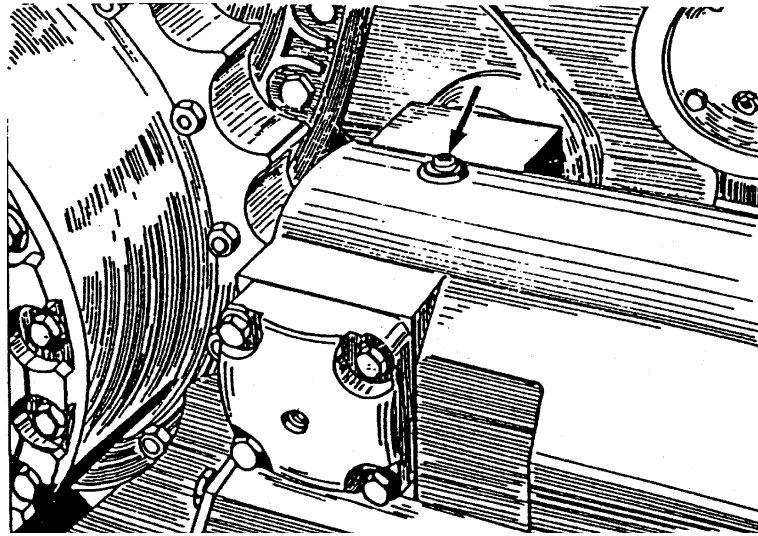


Fig. 5.49. Track Frame Oil Filler Plug

Remove the plug (one at each side), check oil level and if the lubricant is low, fill to the level of the plug opening. Reinstall and tighten the plug.

NOTE: Refer to the „REFILL SPECIFICATIONS AND CAPACITIES” chart for grade of lubricant specified.

5.19.7. EQUALIZER BAR

Periodically check the condition of wear pads that support equalizer bar ends in track frame rebound brackets. The distance (A) between equalizer bar (3) and rebound bracket (1) is to be measured periodically too. Perform measurement when both track frames are leveled. Add or remove such a number of shims (2) to obtain distance of 4.8 - 6.3 mm. Replace pads if any cracks are found.

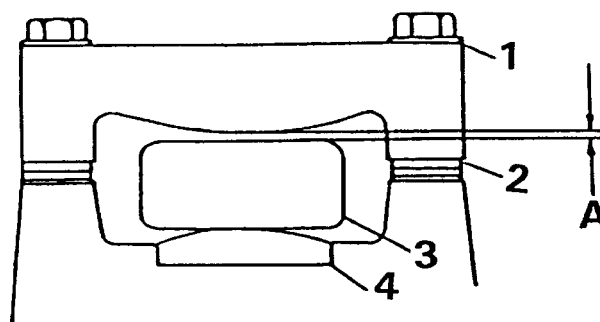


Fig. 5.50. Rebound Gap of the Equalizer Bar

- | | |
|--------------------|-------------------|
| 1. Rebound bracket | 3. Equalizing Bar |
| 2. Shims | 4. Pad |

5.19. UNDERCARRIAGE

5.19.8. FRONT WHEEL

Periodically check the thickness of front wheel guides. (4 off in the right track frame and 4 off in the left track frame). If they are worn (min. thickness is 16 mm) replace them.

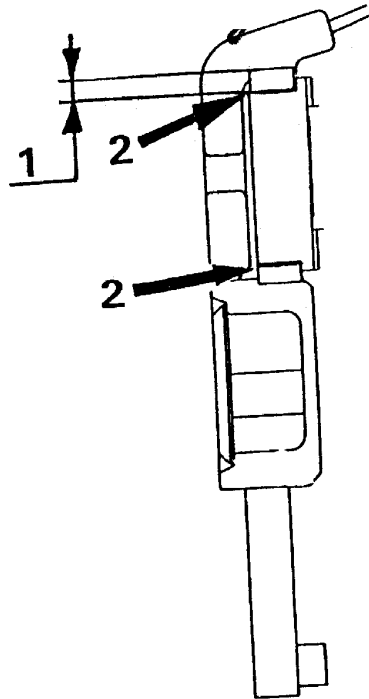


Fig. 5.51. Idle Wheel Guides
1. Minimum thickness 16 mm. 2. Guides

5.20. ADJUSTING HAND AND FOOT CONTROLS

Check engine high and deceleration RPM. If RPM values are incorrect proceed as follows:

Check adjustment of hand levers and foot pedals per below given drawing.

- a) Adjust lever „4” to vertical position of the lever for high idle speed (2300 RPM) During the adjustment the lever „1” must be placed in its foremost position.
- b) Adjust lever „2” to maintain the dimension 200 mm and 36 mm.
- c) Adjust foot pedal „3” to maintain the dimensions in mm (Refer to Fig. 5.52):
 - I - Engine high speed position (2300 ± 100 RPM)
 - II - End of deceleration (1100 ± 50 RPM)
 - III - Beginning of braking
 - IV - Full brake

After adjustment made lubricate linkage and fill bearings with grease through lubrication fittings (refer to „LUBRCATION FITTINGS”) and check if the machine is stopped with applied Decelerator–Brake pedal (Refer to 3.3. for brake operation principle). Perform brake test as follows:

- start the engine and bring transmission system to operating temperature
- shift to 2nd speed with engine at top speed and brake the machine for a while

With correct adjustment made the machine should stop. If in doubt contact Authorized Distributor of Construction Equipment.

5.20. ADJUSTING HAND AND FOOT CONTROLS

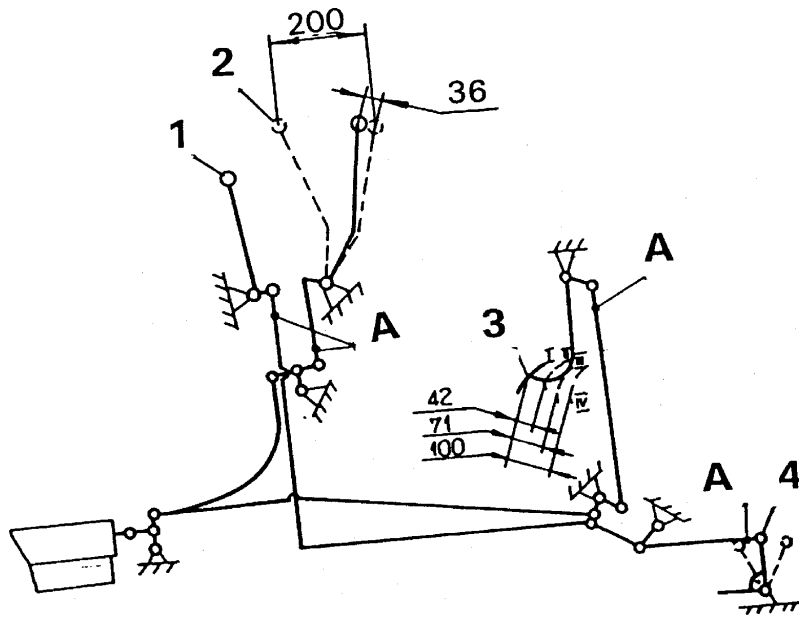


Fig. 5.52. Hand and Foot Controls

- | | |
|------------------------|--------------------------------|
| 1. Engine Speed Lever | 3. Decelerator and Brake Pedal |
| 2. Hand Steering Lever | 4. Fuel Pump Lever |
| | A – Controls for Adjustment |

Periodically lubricate plate to plunger contact area and ends of plungers of pilot valve. To perform lubrication remove the right arm-rest and plastic shield of the right column and then unscrew 4 bolts fixing it. (Fig. 5.53)

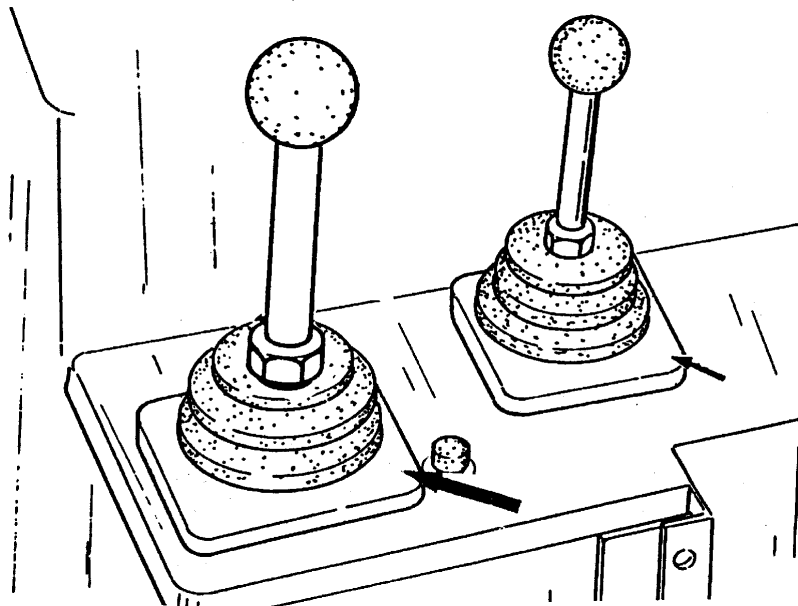


Fig. 5.53. Lubricating the Ends of Plungers.

MAINTENANCE

5.21. CAB AND ROPS

The dozer can be equipped with ROPS protective structure with canopy or cab with separate ROPS protective structure.

Open three latches and remove the filter. Clean the filter with compressed air directing air in reverse direction to that of normal operation. Clean filter housing.

Reinstall the filter and secure cover with latches.

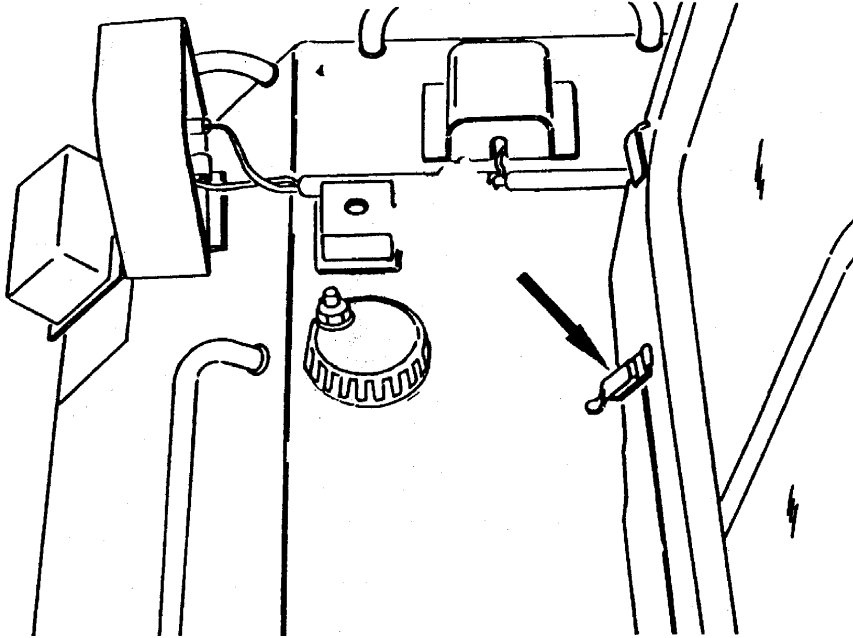


Fig. 5.54. Air Conditioner Filter Cover (Latch)

Periodically check torque of ROPS and operator's platform mounting bolts, clean air conditioner filters and check instruments and controls for proper operation, tighten or adjust mounting bolts of mirrors, wipers and shields.

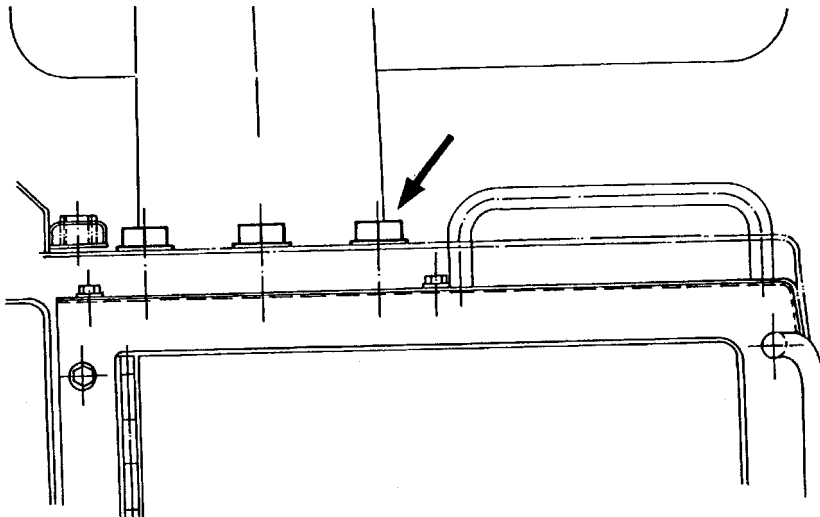


Fig. 5.55. ROPS Mounting Bolts

5.21. CAB AND ROPS

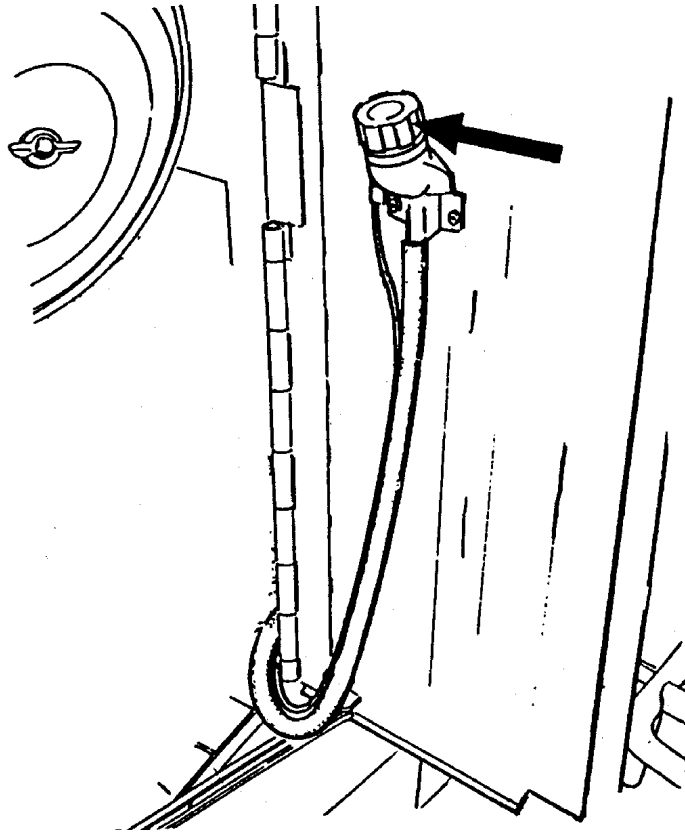


Fig. 5.56. Window Washer Reservoir Filler Spout.

SECTION 6
SPECIFICATIONS

SECTION CONTENTS

6.1. Application 3

6.2. Technical Description 3

6.3. Kinematic Diagram..... 5

6.4. Equipment Hydraulic System Diagram 7

6.5. Transmission Hydraulic System Diagram 9

6.6. Wiring Diagram 11

 6.6.1. Cab Wiring Diagram..... 13

6.7. Specifications 15

 6.7.1. Overall Dimensions of Dozers 15

 6.7.2. Refill Capacities 16

 6.7.3. Tracks 16

 6.7.4. Engine 17

 6.7.5. Torque Converter 17

 6.7.6. Travel Speeds 17

 6.7.7. Weight (Approximate) 17

 6.7.8. Operation Weights 18

 6.7.9. Electrical System 18

 6.7.10. Fuel Consumption 18

6.8. Special Torque's 19

6.9. Standard Metric Fasteners 22

6.10. Torque Values For Standard English Fasteners 22

6.11. Torque Values For Split Flange Connections 23

6.12. Torque Values For Hydraulic Tubes And Fittings 24

6.13. Torque Values For Hose Clamps 24

6.14. Torque Values For Air Conditioning Tubes and Fittings 25

6.15. Torque Values For Air Conditioning O-Ring Connections 25

6.1. APPLICATION

TD-20H Crawler dozer has been designed to perform many different jobs at medium and large construction sites in variety of soils, bulk materials, etc. Principal range of application covers:

- loosening the ground
- transporting materials at short distances
- grading and clearing
- digging
- piling
- breaking piles and spreading
- other jobs with blade, ripper and drawbar

The TD-20H dozer is easy in operation and maintenance.

The blades have been specially designed for various applications.

The TD-20H is designated for normal operation conditions, where there is no fire or explosion hazard.

6.2. TECHNICAL DESCRIPTION

TD-20H Crawler Dozer features powershift speed changes and hydraulic control of all mounted equipment.

TD-20H includes the following main assemblies / systems:

- undercarriage
- superstructure
- drive train
- transmission hydraulic system
- mounted equipment
- equipment hydraulic system

Undercarriage

Undercarriage includes two box section track frames with track rollers, track idlers, front idlers and track chains with track shoes, sprockets.

Track tension can be hydraulically increased to force the front idler forward for track chain adjustment by use of a common grease gun and released by turning pressure relief valve located under an easily removed plate.

Track frames are attached to the mainframe by the pivot shaft and to flexible equalizer bar attached to the saddle in the front mainframe.

Superstructure

Superstructure includes one-piece weldment consisting of front and rear frame. The mainframe is mounting base for radiator, cooler, engine, transmission and final drive. Superstructure includes engine hood, instrument panel, fenders, fuel tank, battery box, hydraulic reservoir, operator's platform and operator's seat.

The TD-20H Crawler Dozer is equipped with cab with air conditioner and can also be equipped with external individually mounted ROPS.

Drive train:

Drive train includes the following components:

- Engine with Radiator
- Torque Converter
- Universal Joint
- Transmission

6.2. TECHNICAL DESCRIPTION

- Pinion / Bevel Gear Set and Steering Drive
- Final Drives

Engine power is transmitted thru torque converter, universal joint, transmission, pinion / bevel gear set and steering drive to two final drives with mounted sprockets.

Three-speed powershift transmission combined with two-speed steering gives 6 speeds forward and 6 speeds reverse or when combined with one-speed steering gives 3 speeds forward and 3 speeds reverse.

Steering is accomplished by application of clutch packs in steering drive.

Hydraulics of transmission system

Transmission system includes oil tank which is rear frame, suction filter, torque converter mounted pump, main regulator valve, rate of rise valve, range selector valve and transmission and steering drive control valves.

Mounted equipment

- Semi-U Blade with beams and tilt cylinder (model D-2)
- Diagonal Blade with C-frame and tilt cylinders (model G-2)
- Straight Blade LGP
- Multi-Shank Ripper (max. 3)
- Drawbar

Blade lift and lower movements are accomplished with two blade lift cylinders.

Blade tilt to the right and left is accomplished with one tilt cylinder.

Multi-shank ripper – 3 shanks, tool beam raised and lowered with hydraulic cylinder, ripper shanks are equipped with hydraulic pitch and can be adjusted in two vertical positions.

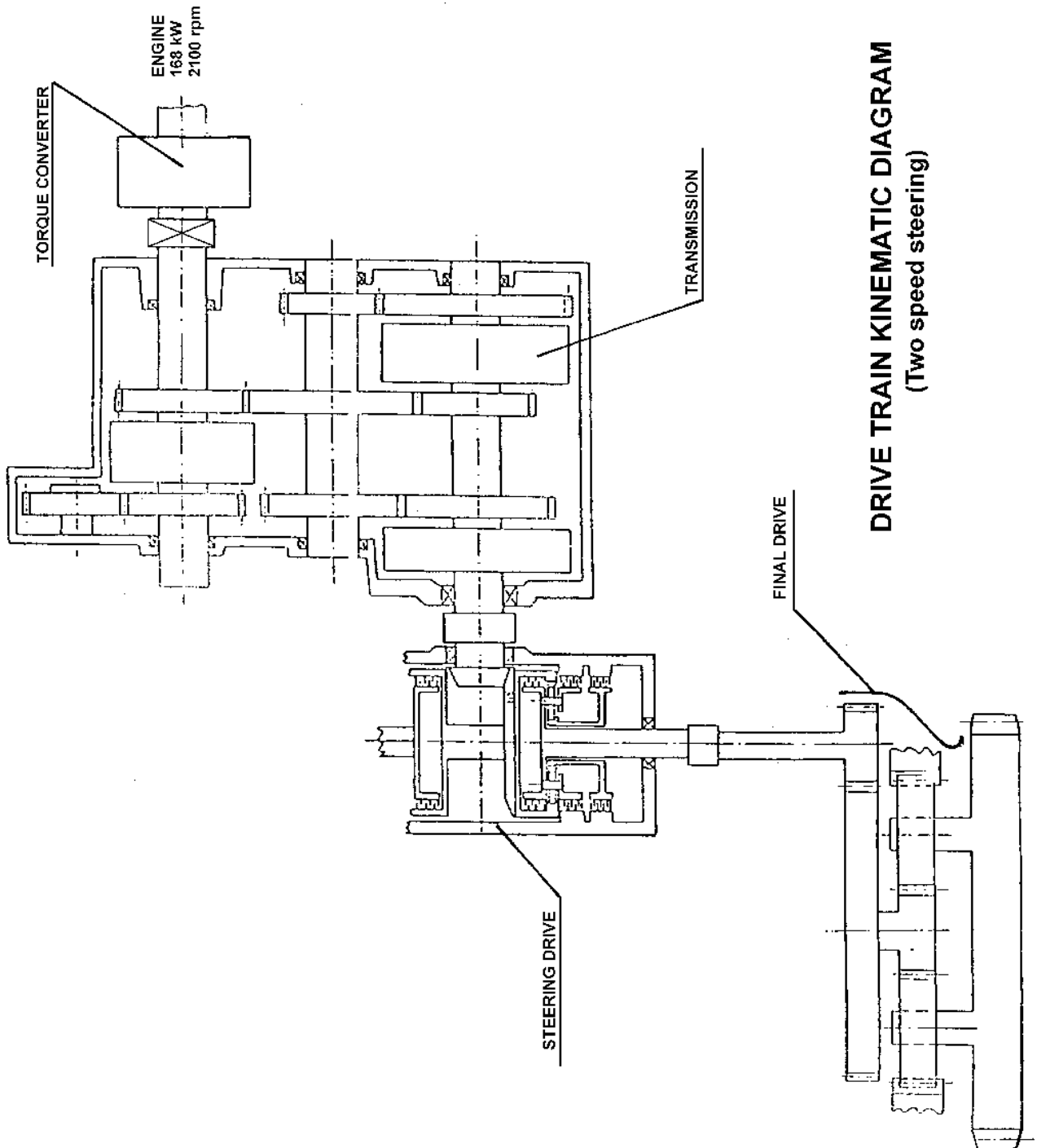
Fixed drawbar with vertical pin.

Equipment hydraulic system

Equipment hydraulic system consists of hydraulic reservoir with sight gauge and breather, suction filter, hydraulic pump, pilot control valves, control valves with pressure relief valve supplying hydraulic cylinders, quick drop valve and return filters. Hydraulic cylinder operating pressure is 17.5 MPa.

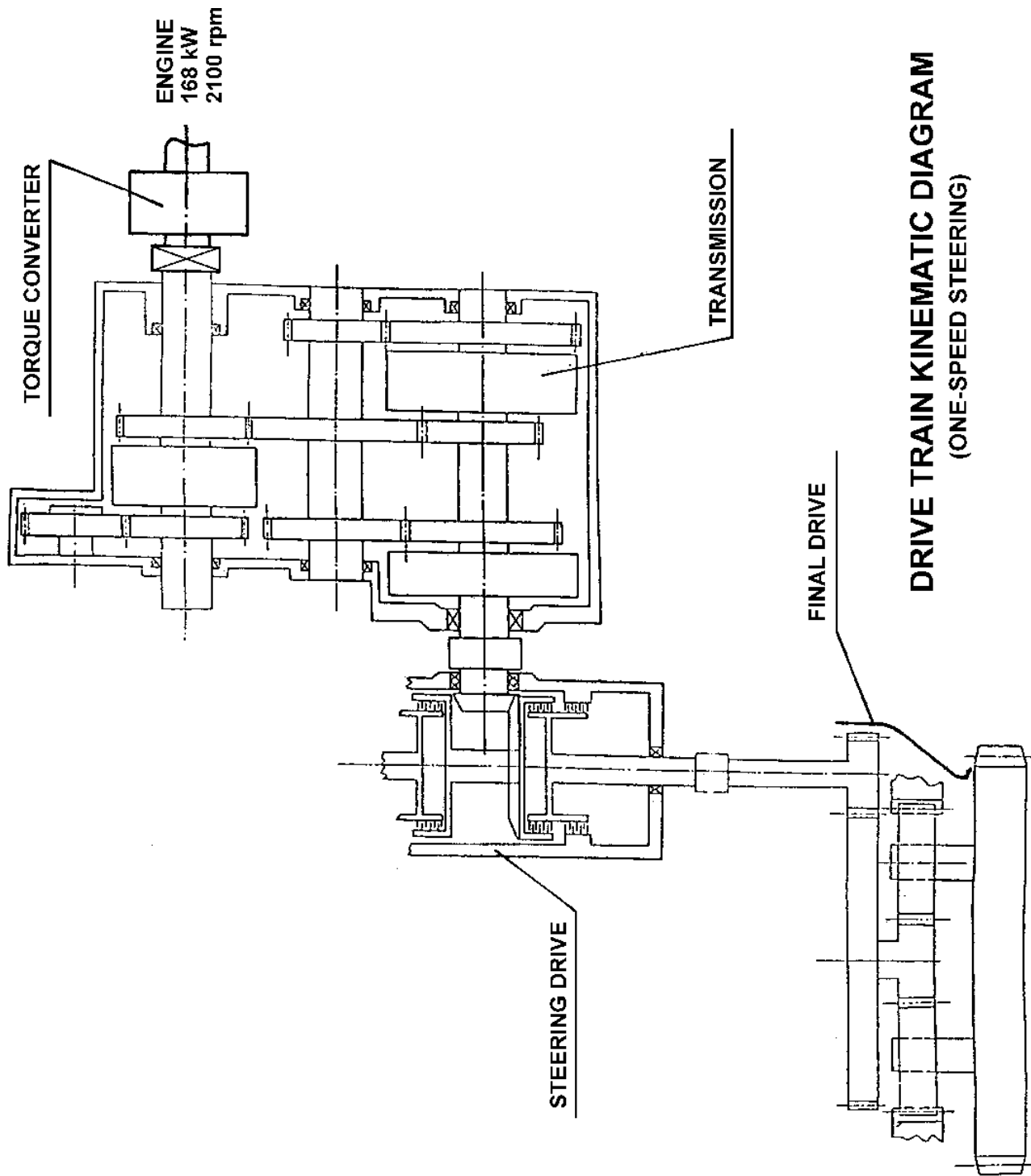
SPECIFICATIONS

6.3. KINEMATIC DIAGRAM



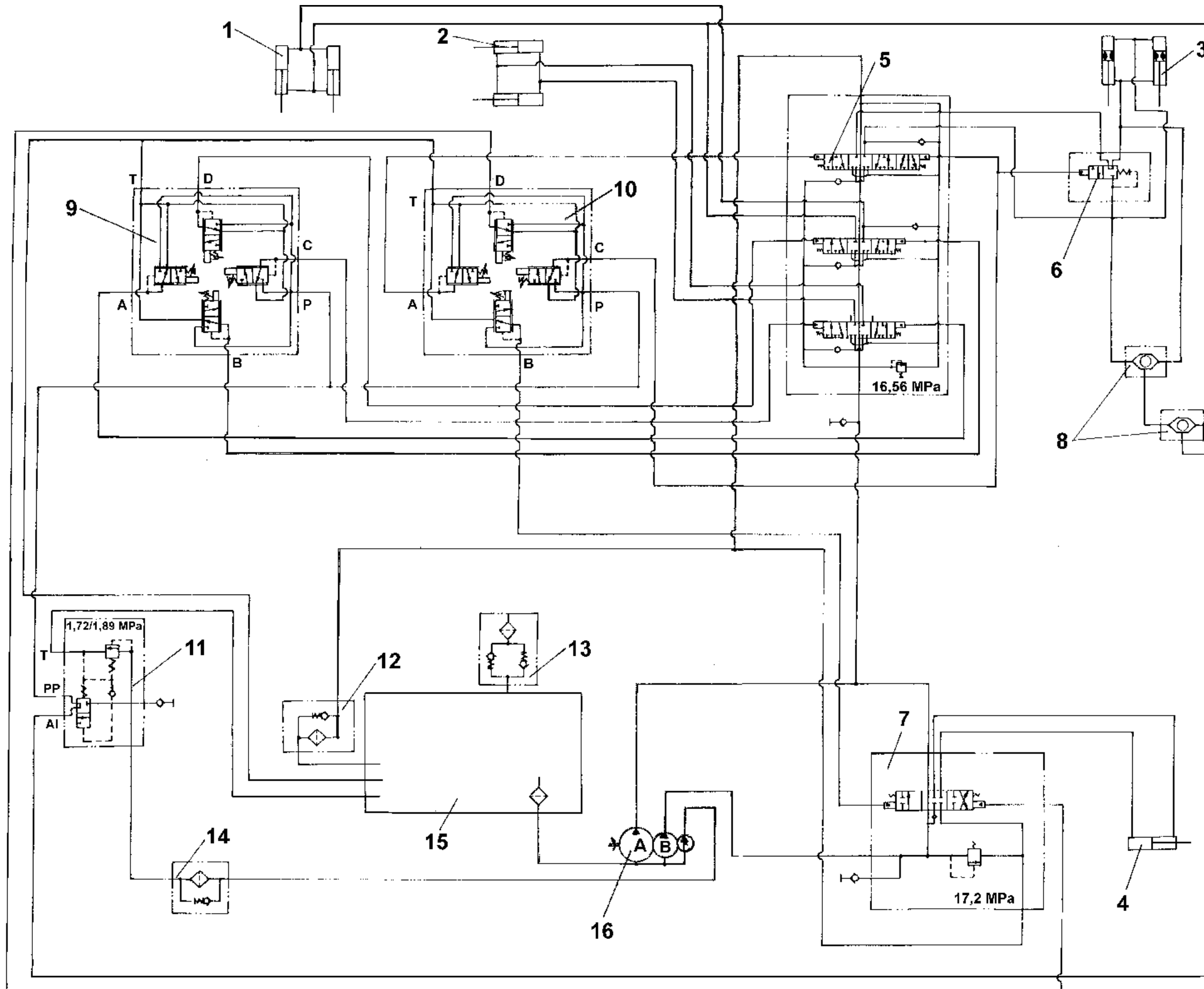
SPECIFICATIONS

6.3. KINEMATIC DIAGRAM (One-speed steering)



SPECIFICATIONS

6.4. EQUIPMENT HYDRAULIC SYSTEM DIAGRAM



EQUIPMENT HYDRAULIC SYSTEM DIAGRAM

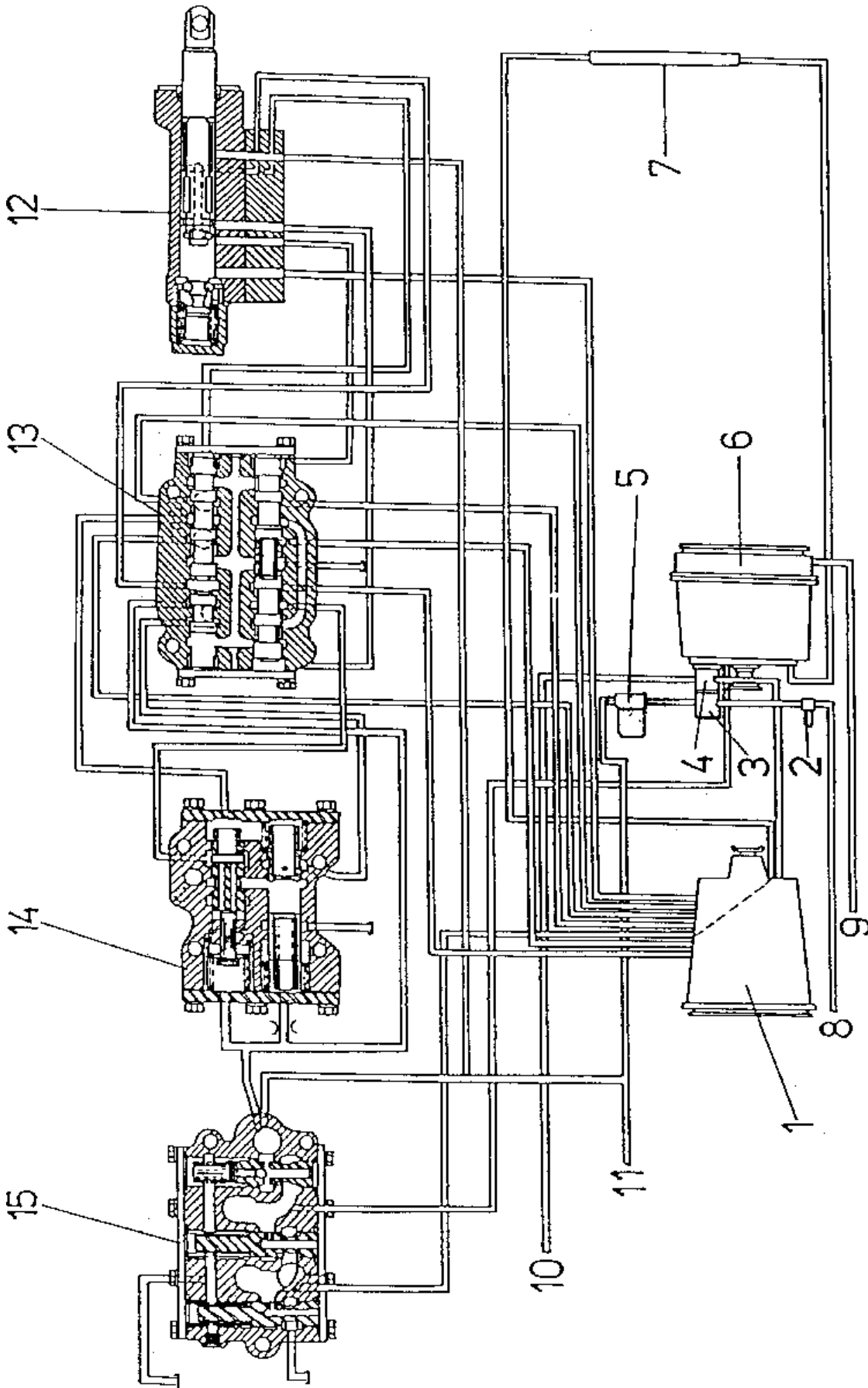
6.4. EQUIPMENT HYDRAULIC SYSTEM DIAGRAM

Legend to equipment hydraulic system diagram

1. Ripper Lift Cylinders
2. Ripper Pitch Cylinders
3. Blade Lift Cylinders
4. Blade Tilt Cylinder
5. Main Control Valve
6. Quick Drop Valve
7. Tilt Control Valve
8. Directional Valves
9. Ripper Pilot Control Valve
10. Blade Pilot Control Valve
11. Pressure Regulator
12. Return Filter
13. Breather
14. Hydraulic Pilot System Filter
15. Hydraulic Reservoir
16. Triple Pump

SPECIFICATIONS

6.5. TRANSMISSION HYDRAULIC SYSTEM DIAGRAM



TRANSMISSION HYDRAULIC SYSTEM DIAGRAM

6.5. TRANSMISSION HYDRAULIC SYSTEM DIAGRAM

Legend to transmission hydraulic system

1. Transmission
2. Suction Filter
3. Charge Pump
4. Scavenger Pump
5. Pressure Filter
6. Torque Converter
7. Oil Cooler
8. Suction Hose from Rear Frame
9. Hose for Leakages (to rear frame)
10. Steering Drive Lubrication Line
11. Steering Drive Valve Line
12. Transmission Control Valve
13. Range Selector Valve
14. Rate of Rise Valve
15. Main Regulator Valve

6.6. WIRING DIAGRAM

1. Wire
2. Wire
3. Wire
4. Wire
5. Wire
6. Main Harness
7. Control Panel Harness
8. Rear Harness
9. Transmission Neutral Lock Lever Harness
10. Front Wiring Harness
11. Cranking Motor
12. Alternator 24V-50A
13. Engine Oil Pressure Sensor
14. Engine Oil Pressure Switch
15. Torque Converter Oil Temperature Sensor
16. Coolant Temperature Sensor
17. L.H. Coolant Level Switch
18. R.H. Coolant Level Switch
19. Fuel Level Sensor
20. Transmission Neutral Lock Lever Switch
21. Automatic Breaker
22. Magnetic Switch
23. Coolant Level Relay
24. Battery
25. Master Switch
26. Warning Lamp Delay Relay
27. Transmission Main Low Pressure and Range Clutch Pressure Warning Light Switch
28. Fuel Electrovalve Switch
29. Back up Alarm
30. Back up Alarm Pressure Switch
31. Horn
32. Pilot Oil Filter Warning Light Switch
33. Hydraulic Filter Warning Light Switch
34. Transmission Filter Warning Light Switch
35. Horn Pushbutton
36. Ether Solenoid Valve
37. Fuel Solenoid Valve
38. Window Washers Pump
39. Air Filter Vacuum Warning Light Switch
40. Front Tractor Headlamps
41. Rear Headlamp
42. Diode Assembly
43. Air Conditioner Compressor Electromagnetic Clutch
45. Instrument Panel Complete
46. Gauge Cluster
47. Hourmeter
48. Audible Alarm (Engine Oil Pressure or Low Coolant Level)
49. Fuel Level Gauge
50. Warning Lamp Check Relay
51. Automatic Circuit Breaker 15A
52. Automatic Circuit Breaker 20A
53. Automatic Circuit Breaker 10A
54. Automatic Circuit Breaker 6A

6.6. WIRING DIAGRAM

- 55. Cab Headlamps Switch
- 56. Tractor Headlight Switch
- 57. Ether Pushbutton
- 58. Start Button and Signal Lamp Check

Gauge cluster components:

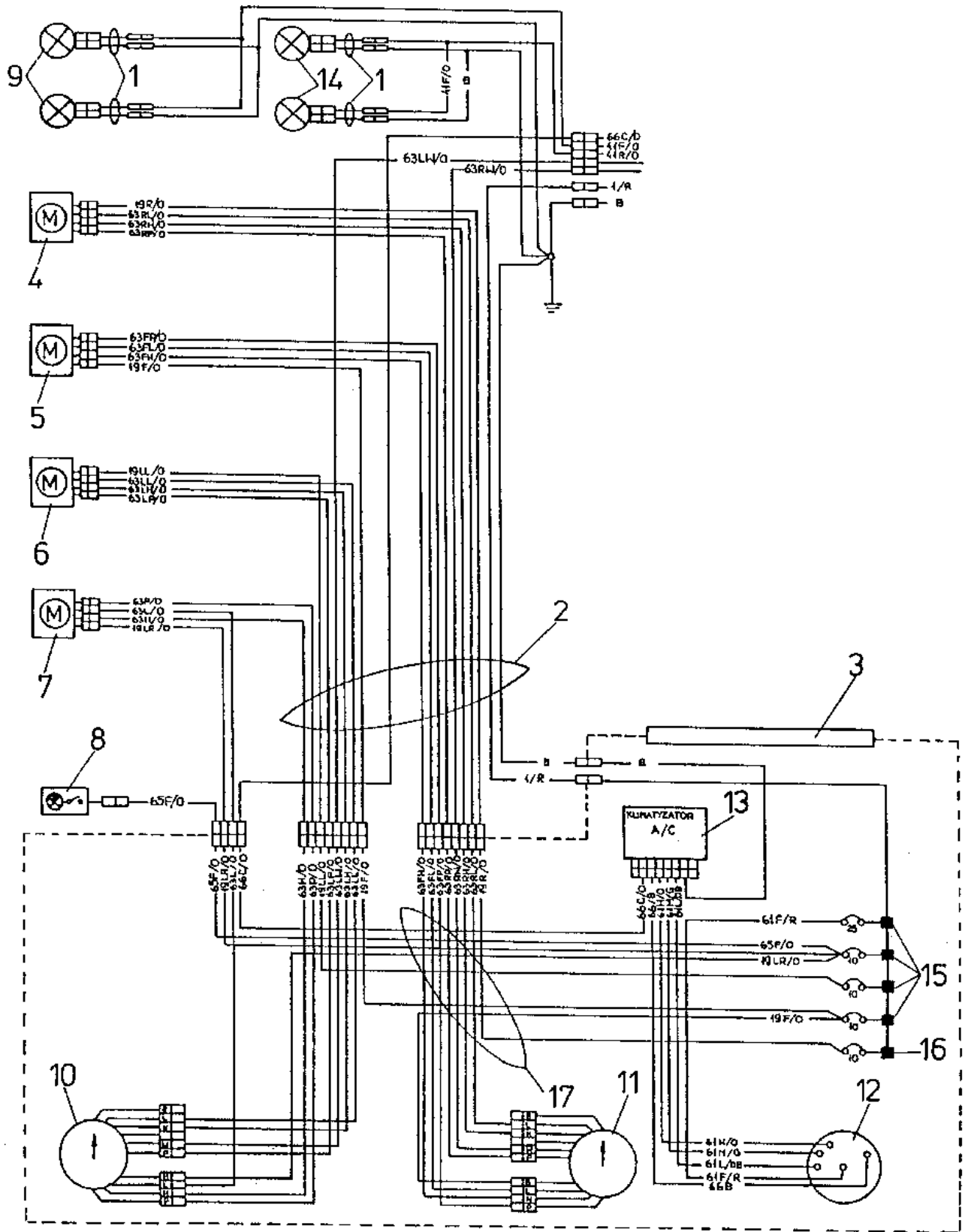
- A – Hydraulic Oil Filter Warning Light
- B – Low Pressure Oil Engine Switch
- C – Main and Speed Clutches Oil Pressure Warning Light
- D – Transmission Oil Filters Warning Light
- E – Air Filter Vacuum Warning Light
- F – Coolant Low Level Warning Light
- H – Coolant Temperature Gauge
- J – Torque Converter Temperature Gauge
- K – Engine Oil Pressure Gauge
- L – Gauges Lamps
- M - Voltmeter

6.6.1. CAB WIRING DIAGRAM

LEGEND to Cab Wiring System

- 1. Cab Lights Harness
- 2. Cab Harness
- 3. Cab Controls Panel
- 4. Rear Wiper
- 5. Front Wiper
- 6. L.H. Wiper
- 7. R.H. Wiper
- 8. Cab Lamp
- 9. Cab Front Headlight
- 10. Left and Right Wiper and Washer Switch
- 11. Front and Rear Wiper and Washer Switch
- 12. Air Conditioner Switch
- 13. Air Conditioner
- 14. Cab Rear Headlamp
- 15. Automatic Circuit Breaker 10A
- 16. Automatic Circuit Breaker 20A

6.6. WIRING DIAGRAM



CAB CONTROLS PANEL HARNESS

6.7. SPECIFICATIONS

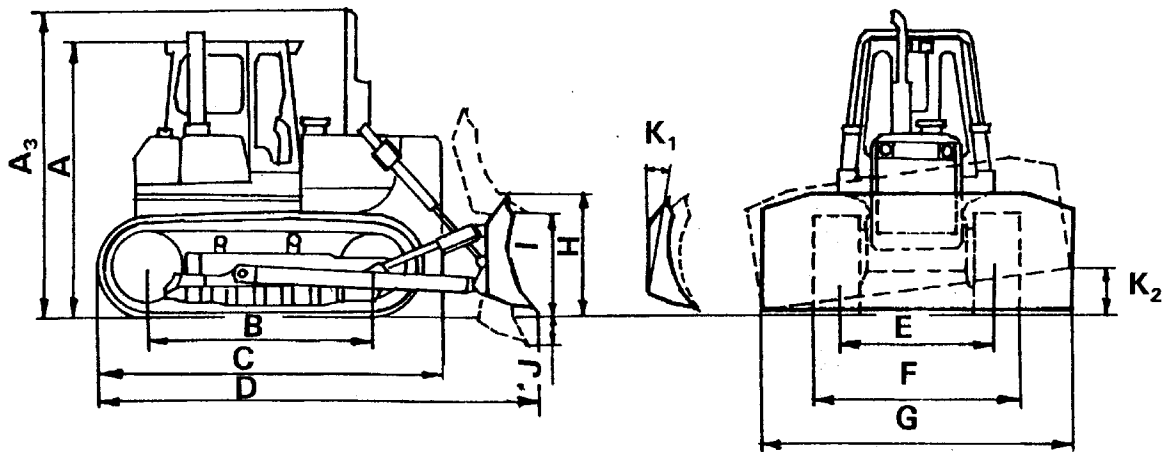


Fig. 6.1. Dimensions

6.7.1. OVERALL DIMENSIONS OF DOZERS:

	TD-20H	TD-20H-LGP
	mm	mm
A. Height with cab	3471	3471
A.1. Height with R.O.P.S.	3569	3569
A.2. Height with F.O.P.S. and R.O.P.S.	3615	3615
A.3 Height to exhaust pipe	3877	3877
B. Distance between sprocket and idle wheels	2860	3080
	3080 for LT	
C. Length without mounted equipment	4340	4340
D. Length with front blade	5920	5680
(for TD-20H with std drawbar)		
D.1. Length with diagonal blade (Model G-2)		
- blade set up frontally	5920	
- blade diagonally	6250	
D.2. Length with blade and ripper	6970	
E. Gauge	1980	2185
F. Width (with track shoes)		
508 mm.	2490	
560 mm	2540	
610 mm	2590	
660 mm	2640	
864 mm		3050
F.1. Machine width including trunnions	2890	3320
F.2. Machine width with C-frame	3170	
G. Machine width (Model D-2)	3500	4060
G.1. Diagonal Blade width		
- blade positioned frontally (model G-2)	4410	
- blade positioned diagonally	4000	
H. Blade height (Model D-2)		
- struts in central position	1490	1300
H. Blade height (Model G-2)		
- angle blade	1090	
I. Max. blade raise		
- straight blade	1180	1260
- tilted blade	1510	

6.7. SPECIFICATIONS

J. Max. blade pitching		
- front blade (Model D-2)	440	662
- diagonal blade (Model G-2)	550	
K. Blade tilt		
- front blade (Model D-2)	670	660
- diagonal blade (Model G-2)	480	
K.1. Blade tilt angle	25 ⁰	
K.2. Max. pitching angle	9 ⁰	
L. Ripper shank:		
- length	2130	
- section (height x width)	305x381	
- clearance under shank		
with lowered shank	178	
with raised shank	1295	
number of pockets / ripper teeth	3/3	
Maximum teeth pitching	610	
Clearance with fully rised tooth	686	
Ripper weight with one tooth	2900	
Tooth weight	190 kg	

6.7.2. REFILL CAPACITES

Fuel tank	490 liters
Cooling system	60 liters
Crankcase with filter	34 liters
Transmission system	173 liters
Rear frame	76 l min - 90 l max
Final drive(each)	38 liters
Track roller (each)	0.4 liter
Track idler (each)	0.4 liter
Front idler (each)	0.3 liter
Pivot shaft reservoir (each)	2.8 liters

Equipment hydraulic system:

Model D-2	
(Equipped with hydraulic tilt)	126 liters
Model D-2 Blade & Ripper	
(Equipped with hydraulic tilt)	134 liters
Model G-2	
(Equipped with hydraulic tilt)	133 litres
Hydraulic reservoir	69 l min - 73.5 l max
Air conditioning refrigerant	1.22 kg

Track rollers, track idlers and front idlers are permanently lubricated with SAE 30 engine oil when assembled and do not require any additional lubrication except when reconditioned.

6.7.3. TRACKS

	TD-20H	TD20H-LGP
Gauge	1.98 m STD<	2.185 m
Track on ground	2.86 m&3.08 m LT	3.08 m
Track shoe width, standard	560 mm	
Track shoe width, max.	660 mm	864 mm
Track shoes each side	40 &42 for LT	42

6.7. SPECIFICATIONS

6.7.4. ENGINE

Make and model	Cummins M11C
Type	4-cycle diesel, turbocharged
No of cylinders	6
Bore	125 mm
Stroke	147 mm
Displacement	11 liters
Net flywheel power @2100 RPM	168 kW

Engine speed

Full load governed	2300 RPM
Low idle	750 ± 50 RPM
Decelerator	1100 ± 50 RPM

6.7.5. TORQUE CONVERTER

Type	single-stage, single-range
Venting	Self-venting thru breather
Oil operating temperature range	82° – 121°C
Effective diameter (size)	360 mm (14")
Torque ratio	2.6 : 1

6.7.6. TRAVEL SPEEDS

Forward:

1 st , low range	0 – 2.8 km/h
1 st , high range	0 – 3.7 km/h
2 nd , low range	0 – 5.1 km/h
2 nd , high range	0 – 6.6 km/h
3 rd , low range	0 – 8.0 km/h
3 rd , high range	0 – 10.3 km/h

Reverse:

1 st , low range	0 – 3.4 km/h
1 st , high range	0 – 4.3 km/h
2 nd , low range	0 – 6.0 km/h
2 nd , high range	0 – 7.7 km/h
3 rd , low range	0 – 9.4 km/h
3 rd , high range	0 – 12.0 km/h

6.7.7. WEIGHT (APPROXIMATE)

Machine without mounted equipment, 10% fuel, ROPS, track roller guard, sprocket rock deflector, crankcase and transmission guards, pull hook and lights:

TD-20H	TD-20H-LT	TD20H-LGP
20490 kg	21050 kg	21520 kg

6.7. SPECIFICATIONS

6.7.8. OPERATION WEIGHTS

Machine with mounted equipment (hydraulic tilt), operator, full fuel tank and standard equipment:

	TD-20H	TD-20H-LT	TD-20H-LGP
Blade	Semi-U	Semi-U	straight
R.O.P.S.	23190 kg	23750 kg	24230 kg
Cab with A/C and ROPS	23740 kg	24300 kg	24770 kg

6.7.9. ELECTRICAL SYSTEM

System voltage	24V, negative ground
Batteries (maintenance-free)	two 12V
Alternator	50A

6.7.10. FUEL CONSUMPTION

During intensive slot dozing tests in sandy soil (soil density app. 1.89 t/cu.m.) average fuel consumption amounted to app. 39 l/h.

Average operational fuel consumption

The above specified fuel consumption value refers to short period of intensive operation of the machine only. However, taking into consideration actual longer periods of machine operation fuel consumption value is considerably lower and can be estimated at the level of app. 30 l/h.

6.8. SPECIAL TORQUES

No	Description of tightening place	Size of thread	Torque N.m	No of places
1	Rear harness to steering valve manifold screw	4-40	0.7	4
2	Main harness to pod at rear of console	4-40	0.7	4
3	Light alarm terminal (on instrument panel)	6-32	0.7	2
4	Fuel sensor terminal	6-32	0.7	2
5	Magnetic switch terminal	10-32	1.8-3.4	2
6	Horn switch terminal (on RH console)	8-32	1.8-3.4	2
7	Neutral start & engine shutdown switch terminal	8-32	2	4
8	Hourmeter switch terminal (on engine)	8-32	2	3
9	Back-up alarm terminal	8-32	2	2
10	Back-up alarm terminal (in console)	8-32	1.4	2
11	Fuel shut-off terminal (on LH console)	8-32	2	1
12	Cab dome light mounting screw	10-24	2	2
13	Gauge cluster mounting screw (on instrument panel)	10-24	2	4
14	Transmission filter warning light switch	10-24	1.4-1.8	2
15	Hydraulic filter warning light switch	10-24	1.4-1.8	1
16	Hydraulic pilot filter light switch	10-32	2	1
17	Cooling temperature sensor terminal	10-32	2	1
18	Circuit breaker mounting screw (on hood support)	10-32	10	2
19	Circuit breaker mounting screw (on instrument panel)	10-32	2	12
20	Circuit breaker terminal (on instrument panel)	10-32	2	21
21	Engine oil pressure sensor (on engine)	10-32	2	1
22	Fuel sensor mounting screw	10-32	2	5
23	Fuel level gauge terminal	10-32	2	3
24	Fuel level gauge mounting screw	10-32	1-1.4	2
25	Cranking motor switch terminal (DELCO)	10-32	1-1.4	1
26	Torque converter temperature sensor terminal	10-32	2	1
27	Washer bottle spout mounting screw	M5	7	2
28	Cab plastic trim mounting screw	M6	5.4	63
29	Circuit breaker terminal (on hood support)	1/4"-28	6	2
30	Alternator to battery (+) terminal (DELCO)	1/4"-28	6-8	1
31	Magnetic switch terminal	5/16"-18	5-8	1
32	Cab plastic trim mounting screw	M8	13	6
33	Transmission internal tube mounting bolt	3/8"-16	60	2
34	Battery terminal nut	3/8"-16	30	10
35	Freon compressor mounting bolt	3/8-16	60	4
36	Compressor adapter mounting bolt	3/8-16	50	2
37	Freon compressor adapter mounting bolt	3/8"-16	50	2

6.8. SPECIAL TORQUES

38	Pipe plug track roller, top roller and front idler shaft	3/8-18	24	All
39	Master disconnect terminal	3/8"-24	12	2
40	Track idler cover bolt	M10	60	24
41	Battery hold down bolt	3/8"	9	2
42	Quick drop valve mounting bolt	M12	60-85	3
43	Cranking motor switch terminal (DELCO)	1/2"	27-35	1
44	Output shaft bush bolt	1/2"	110	24
45	Track roller bushing retainer bolt	1/2"	134	12
46	U-joint bolt	1/2"	110	All
47	Final drive pinion bearing cover bolt	1/2"	100	6
48	Sprocket gear hub brg. retainer pl. prevailing torque	1/2"	125	6
49	Ring gear retainer prevailing torque bolt	1/2"	125	6
50	Planet gear shaft prevailing torque bolt	1/2"	125	3
51	Eg. bar pivot retainer plate bolt	5/8"	265	8
52	Rear main frame cover bolt	5/8"	265	28
53	Sprocket hub retainer plate bolt	5/8"	244	16
54	Track adjuster relief valve	5/8"	68	2
55	Pinion gear housing bolt	5/8"	220	6
56	Planet gear shaft prevailing torque bolt	5/8"	220	6
57	Front idler upper guide bar bolt	5/8"	220	8
58	Front idler dirt shield bolt	5/8"	220	8
59	Starting switch nut	5/8"	4.5	1
60	Rear screen bolt	5/8"	92	8
61	Cutting edge (front blade)	7/8"	725	17
62	End bit (front blade)	7/8"	725	14
63	Cutting edge (diagonal blade)	7/8"	725	24
64	End bit (diagonal blade)	7/8"	725	14
65	Equalizer bar rebound bracket mounting bolt	3/4"	455	8
66	Master switch mounting nut	3/4"-16	50	1
67	NEUTRAL, START and ENGINE SHUTOFF switch nut	3/4"-16	50	2
68	Track roller shield mounting bolt	3/4"	455	6
69	Front idler fork mounting bolt	3/4"	455	2
70	Sprocket mounting nut	3/4"	435	36
71	Track roller mounting bolt	3/4"	455	All
72	Track shoe bolt	3/4"	700**	All
73	Engine to rear trunnion bolt	3/4"	455	4
74	Pivot shaft cover bolt	3/4"	455	8
75	Track roller shield mounting bolt	3/4"	455	24

6.8. SPECIAL TORQUES

76	Track roller shield plate bolt	3/4"	455	10
77	Sprocket rock deflector mounting bolt	3/4"	455	32
78	Equalizer bar pin retainer plate bolt	3/4"	455	8
79	Front idler shaft support bolt	7/8"	730	4
80	Final drive cover mounting bolt (to frame)	7/8"	735	20
81	Final drive planet carrier mounting bolt	7/8"	610	18
82	Diagonal strut cap nut (front blade)	3/4"	450	4
83	Vertical strut cap nut (diagonal blade)	3/4"	450	4
84	Cylinder yoke bolt (front blade)	3/4"	450	8
85	Cylinder yoke bolt (diagonal blade)	3/4"	450	8
86	Front and rear track idler mounting block bolts	7/8"	735	16
87	Rear frame drain plug	7/8"	48 - 32	3
88	Push arm trunnion cap bolt (front blade)	1"	1050	4
89	C-frame trunnion cap bolt (front blade)	1"	1050	4
90	Vertical strut cap bolt (front blade)	1"	1050	8
91	Diagonal strut cap bolt (front blade)	1"	1050	8
92	Transmission mounting bolt	1"	920	1
93	Transmission mounting bolt	1"	920	2
94	Counterweight drawbar mounting bolt	1"	920	1
95	Track frame guide plate mounting bolt	1"	1110	8
96	Track frame guide retainer bolt	1"	1110	8
97	Ripper mounting frame bolts	1-1/4"	1800	14
98	Rigid drawbar mounting bolt	1-1/4"	2190	8
99	Pivot shaft lock pin retainer plug	1-3/4"	275	2
100	Pivot trunnion bolt	1"	1050	16

Torque tolerances $\pm 10\%$

*) - tighten with LOCTITE 262

**) - cover the thread and face under the bolt head with engine oil - torque $400 \pm 70 \text{ Nm}$ + tightening by the angle of 120°

6.9. STANDARD METRIC FASTENERS

This chart provides tightening torque for general-purpose applications using original equipment standard hardware. Original equipment standard hardware is defined as coarse thread metric class 10.9 bolts and class 10.0 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 apply to phosphate coated bolts designed for 60% yield strength. The torques shown below also apply to phosphate coated bolts used with phosphate coated prevailing torque nuts, phosphate coated bolts used with copper plated weld nuts and are applied to the steel and cast iron parts.

NOMINAL THREAD DIAMETER (mm)	STANDARD TORQUE ±10% (Nm)
6	10
7	16
8	23
10	46
12	80
14	125
16	200
18	275
20	385
22	530
24	670
27	980
30	1330
33	1790
36	2325

6.10. TORQUE VALUES FOR STANDARD ENGLISH FASTENERS

This chart provides tightening torque for general purpose applications using original equipment standard hardware as listed in the Parts Catalog for the machine involved. **DO NOT SUBSTITUTE.** 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. 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). 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.

6.10. TORQUE VALUES FOR STANDARD ENGLISH FASTENERS

NOMINAL THREAD DIAMETER (in)	STANDARD TORQUE $\pm 10\%$ (Nm)
1/4	10
5/16	21
3/8	38
7/16	60
1/2	92
9/16	130
5/8	180
3/4	325
7/8	520
1	780
1-1/8	1110
1- 1/4	1565
1- 3/8	2050
1- 1/2	2720
1- 3/4	3380
2	5080

6.11. TORQUE VALUES FOR SPLIT FLANGE CONNECTIONS

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

Bolt size (in)	Flange size (in)*	Torque Value (Nm)
1/2	5/16	20–24
3/4	3/8	30–37
1	3/8	37–47
1- 1/4	7/16	47–61
1- 1/2	1/2	62–79
2	1/2	75–88
2- 1/2	1/2	107–123
3	5/8	187–203
3- 1/2	5/8	159–180

* – Inside diameter of hydraulic tube or hose fitting.

6.12. TORQUE VALUES FOR HYDRAULIC TUBES AND FITTINGS

Size	Tubing o.d. in inches	Thread size in inches	Torque values for 37° flared fittings	Torque values for O-ring boss plugs, locknuts and 37° flared fittings
4	1/4	7/16-20	12-16	8-14
5	5/16	1/2 -20	16-20	14-20
6	3/8	9/16-18	29-33	20-27
8	1/2	3/4 -16	47-54	34-42
10	5/8	7/8-14	72-79	47-54
12	3/4	1-1/16-12	104-111	81-95
14	7/8	1-3/16-12	122-138	95-109
16	1	1-5/16-12	149-163	108-122
20	1- 1/4	1-5/8-12	190-204	129-156
24	1- 1/2	1-7/8-12	217-237	163-190
32	2	2-1/2-12	305-325	339-407

Above torque figures are recommended for plain, cadmium or zinc plated fittings, dry or wet installations. These torques are not recommended for tube with wall thickness of 0.889 mm or less

6.13. 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 ± 0.6 Nm	
	Radiator, Air Cleaner, Boots, etc. (Nm)	Hydraulic System (Nm)
"T" Bolt (any diameter)	6.2 -7.3	—
Worm Drive – 1-3/4 in. Open Diameter & Under	2.2 – 3.3	4.5 – 5.6
Worm Drive – Over 1-3/4 in. Open Diameter	4.5 – 5.6	—
Worm Drive – Al1 "Ultra-tite"	10.7 – 11.8	4.5 – 5.6

6.14. TORQUE VALUES FOR AIR CONDITIONING TUBES AND FITTINGS

SWAGED 45° CONNECTIONS

SIZE	THREAD SIZE (in)	TORQUE VALUES FOR MATERIALS (Nm)			
		STEEL-STEEL	BRONZE -STEEL	COPPER-STEEL	ALUMINUM-STEEL
1/4	7/16-20	16 – 23	15 – 20	15 – 20	12 – 18
3/8	5/8-18	27 – 33	23 – 38	23 – 38	20 – 25
1/2	3/4-16	47 – 54	38 – 46	38 – 46	28 – 36
5/8	7/8-14	61 – 68	45 – 53	45 – 53	34 – 42
3/4	1-1/16-12	72 – 80	49 – 57	49 – 57	45 – 53
	1-1/16-14	72 – 80	49 – 57	49 – 57	45 – 53

6.15. TORQUE VALUES FOR AIR CONDITIONING O-RING CONNECTIONS

SIZE	THREAD SIZE (in)	TORQUE VALUES FOR MATERIALS (Nm)	
		STEEL-STEEL	
1/4	7/16-20	15 – 25	
3/8	5/8-18	27 – 33	
1/2	3/4-16	40 – 48	
5/8	7/8-14	47 – 54	
3/4	1-1/16-12	54 – 61	
	1-1/16-14	54 – 61	