GEHL®

Form No.
918254
Revision B
Jan. 2012

Model 283Z

Compact Excavator

Operator's Manual

GEHL COMPANY

WARRANTY

GEHL COMPANY, hereinafter referred to as Gehl, warrants new Gehl equipment to the Original Retail Purchaser to be free from defects in material and workmanship for a period of twelve (12) months from the Warranty Start Date.

GEHL WARRANTY SERVICE INCLUDES:

Genuine Gehl parts and labor costs required to repair or replace equipment at the selling dealer's business location.

GEHL MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED (INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE), EXCEPT AS EXPRESSLY STATED IN THIS WARRANTY STATEMENT.

ANY OF THESE LIMITATIONS EXCLUDED BY LOCAL LAW SHALL BE DEEMED DELETED FROM THIS WARRANTY; ALL OTHER TERMS WILL CONTINUE TO APPLY.

SOME STATES DO NOT PERMIT THE EXCLUSION OR LIMITATION OF THESE WARRANTIES AND YOU MAY HAVE GREATER RIGHTS UNDER YOUR STATE LAW.

GEHL WARRANTY DOES NOT INCLUDE:

1. Transportation to selling dealer's business location or, at the option of the Original Retail Purchaser, the cost of a service call.
2. Used equipment.
3. Components covered by their own non-Gehl warranties, such as tires, batteries, trade accessories and engines.
4. Normal maintenance service and expendable, high-wear items.
5. Repairs or adjustments caused by: improper use; failure to follow recommended maintenance procedures; use of unauthorized attachments; accident or other casualty.
6. Liability for incidental or consequential damages of any type, including, but not limited to lost profits or expenses of acquiring replacement equipment.

No agent, employee or representative of Gehl has any authority to bind Gehl to any warranty except as specifically set forth herein.

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NOTES

CHAPTER 1 – GENERAL INFORMATION

INTRODUCTION

This Operator's Manual was written to assist the owner/operator in preparing, adjusting, maintaining and servicing the compact excavator. More important, this manual provides an operating plan for safe and proper use of the machine. Major points of safe operation are detailed in Chapter 2–Safety.

Read and understand the contents of this manual completely and become familiar with the machine before attempting to operate it. Contact your dealer to obtain additional manuals.

Throughout this manual, information is introduced by the word **Note** or **IMPORTANT**. Be sure to read the message carefully and comply with the message. Following this information will improve operating and maintenance efficiency, help to avoid breakdown and damage and extend the service life of the machine.

Do not use the machine for any application or purpose other than described in this manual. Consult your dealer before using special attachments or equipment not approved for use with the machine. Persons making unauthorized modifications are responsible for the consequences.

Use of the machine is subject to certain hazards which cannot be eliminated by mechanical means – only by exercising intelligence, care and common sense. Such hazards include, but are not limited to: hillside operation, overloading, load stability, poor maintenance and using the machine for purposes for which it was not designed or intended.

It is essential to have competent and careful operators, who are not physically or mentally impaired and are thoroughly trained in safe operation and proper load handling.

It is recommended that operators be capable of obtaining a valid motor vehicle operator's license.

Some illustrations in this manual may show doors, guards and shields open or removed for illustrative purposes only. BE SURE all doors, guards and shields are secured in the proper operating positions BEFORE starting the engine to operate the machine.

Manitou Americas, Inc. reserves the right to make changes and improvements in the design and construction of any part or feature on the machine without incurring the obligation to install such changes on any machine previously delivered

The Manitou Americas dealer network stands ready to provide any assistance you may require, including genuine Manitou Americas service parts. All service parts should be obtained from your dealer. Give complete information about the part and include the model and serial number of the machine. Record the serial numbers in the following spaces, as a handy reference.

Purchased From: _____

Date of Purchase: _____

Model No.: _____

Machine Serial No.:_____

Cab Serial No.: _____

Engine Type No.:_____

Machine and Cab Serial Number Locations

The machine serial number plate (1, Figure 1-1) is located on the front of the swing frame, below the operator's cab and above the horn. The cab/canopy serial number (2) is located inside on the frame pillar near the cab door/canopy access.

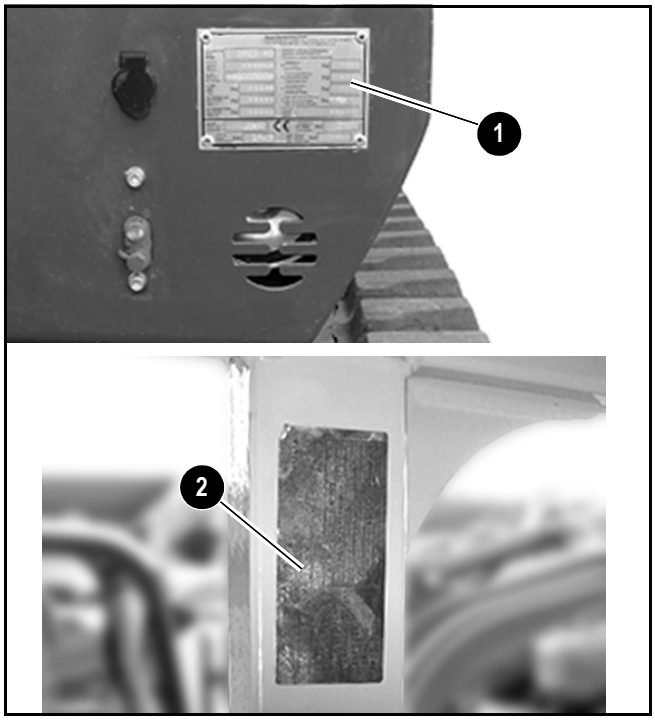


Figure 1-1 – Serial Number Locations

Engine Serial Number Location

The engine serial number (3, Figure 1-2) is on the engine's cylinder head cover.

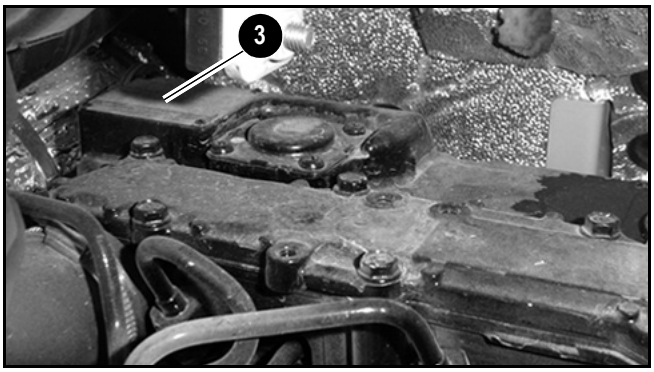
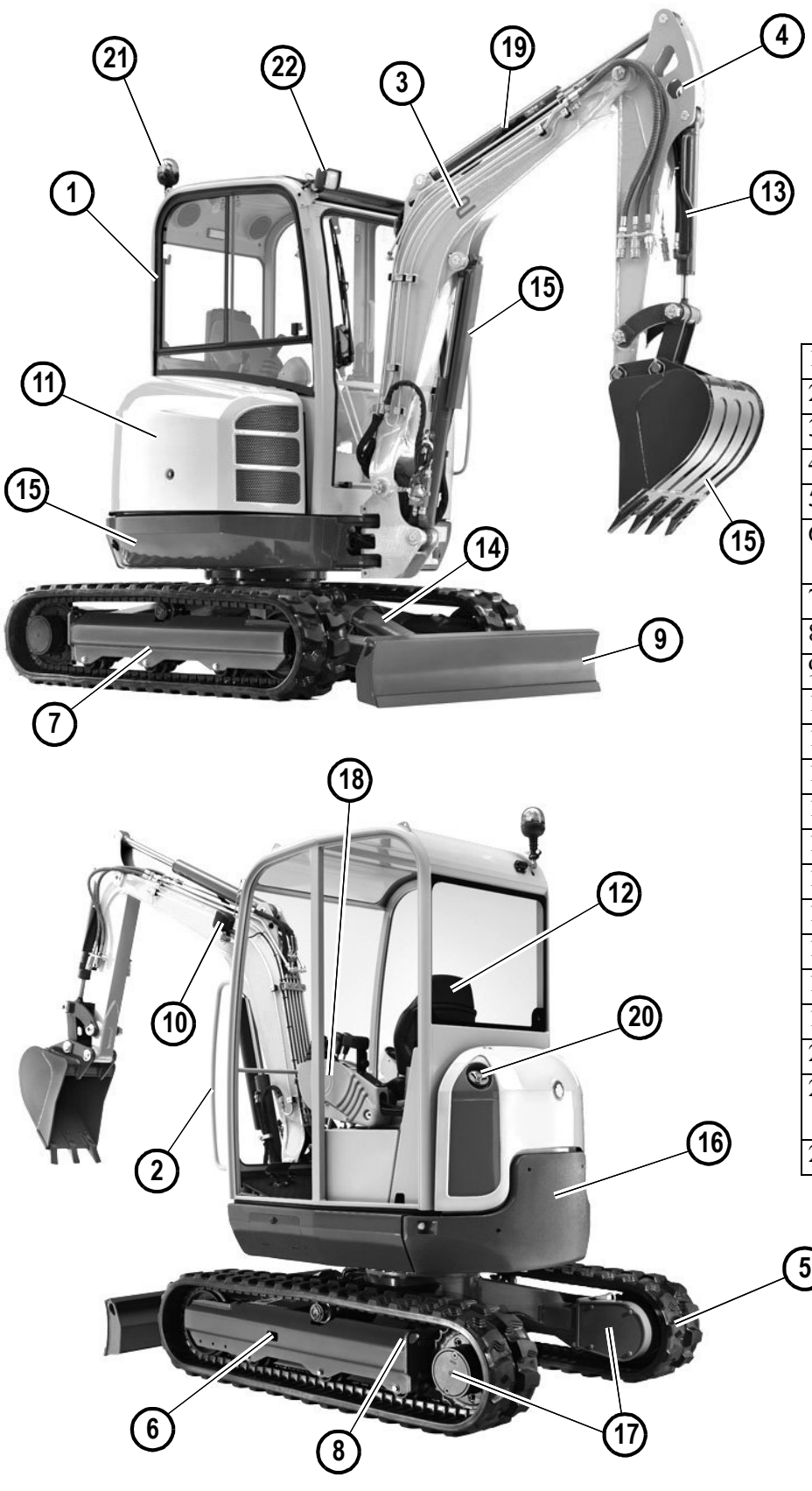


Figure 1-2 – Engine Serial Number Location

Ownership Change

If the machine was purchased second-hand, or if the owner's address has changed, please provide your dealer or the Manitou Americas Service Department with the owner's name and current address, along with the machine model and serial numbers. This will allow the registered owner information to be updated, so that the owner can be notified directly in case of an important product issue, such as a safety update program.



1	Cab/Canopy
2	Hand-Hold
3	Boom
4	Dipper Arm
5	Track
6	Track Tension Lubrication Point
7	Track Frame
8	Tie-Down Point
9	Dozer Blade
10	Work Light
11	Engine Cover
12	Operator's Seat
13	Bucket Cylinder
14	Boom Cylinder
15	Bucket
16	Counterweight
17	Travel Drive Motor
18	Left Lock-Out Console
19	Dipper Arm Cylinder
20	Fuel Fill
21	Rotating Beacon (option)
22	Cab Light (option)

Figure 1-3 – Component Identification

SPECIFICATIONS

Fluid Capacities/Lubricants

Component/ Application	Lubricant	Specification	Season/ Temperature	Capacity[1]
Diesel Engine	Engine Oil[2]	SAE 10W-40	-4°F (-20°C) +104°F (+40°C)	3.5 qts. (3.3 L)
Travel Drive	Gearbox Oil[3]	SAE 80W-90	Year-round	0.63 qts. (0.6 L) each
Hydraulic Oil Tank	Hydraulic Oil[4]	HVLP46	Year-round	7 gal. (26.5 L) (Complete system capacity: 14 gal. [53 L])
	Biodegradable Oil[5]	PANOLIN HLP Synth 46		
		BP BIOHYD SE-46		
Grease	Roller and Friction Bearings[6]	KF2K-25 lithium	Year-round	As Required
	Open Gear (live ring gears)	KP2N-20 calcium sulfonate complex		
Grease Zerks	Multipurpose Grease[7]	KF2K-25 lithium	Year-round	As Required
Battery Terminals	Acid-proof Grease[8]	FINA Marson L2	Year-round	As Required
Diesel Fuel Tank	Diesel Fuel[9]	2-D ASTM D975 – 94	Depending on outside temperatures	9.5 gal. (36 L)
		1-D ASTM D975 – 94		
Engine and Hydraulic Oil Cooler	Coolant	Soft water + antifreeze ASTM D4985	Year-round	1.2 gal. (4.5 L)
		Distilled water + antifreeze ASTM D4985		
Windshield Washer	Cleaning Agent	Water + Antifreeze	Year-round	1.25 qts. (1.2 L)

1. Capacities shown are approximate; use only oil level check to determine correct oil level
2. BP Vanellus MG 15W40, BP Vanellus C-Extra 10W30, Chevron Delo 400 15W40 or equivalent
3. Hypoid gearbox oil based on basic mineral oil (API GL-4, GL-5)
4. Mobile DTE15M, Amoco Rykon 46, BP Energol HLP-HD 46 or equivalent
5. Hydraulic ester oils (HEES)
6. FINA Energrease 21M, Chevron RPM Heavy-Duty Grease No. 2, Mobilgrease Moly 52, or BP Energrease Moly EP2
7. FINA Energrease 21M, Chevron RPM Heavy-Duty Grease No. 2, Mobilgrease Moly 52, or BP Energrease Moly EP2
8. Standard acid-proof grease
9. Sulphur content below 0.05%; Cetane number over 45

Engine

Make and Model	Yanmar 3TNV76-NNS
Type	3-cylinder, water-cooled diesel
Displacement	68 cid (1116 cc)
Bore and Stroke	2.9 x 3.2 in. (76 x 82 mm)
Net Power	20.4 hp (15.2 kW) @ 2500 rpm
Max. Torque	48.75 lb.-ft. (66.1 Nm) @ 1800 rpm
Max. Engine Speed (with no load)	2675 +/- 25 rpm
Idle Engine Speed	1300 +/- 25 rpm
Fuel Injection System	Indirect Injection
Starting Aid	Glow Plug (preheating time 4 seconds)
Max. Inclined Angle (engine still supplied with oil)	25° in all direction
Exhaust Emission Compliance	97/68EC; U.S. EPA – Tier 4 compliant

Hydraulic System

Pump	Double variable-capacity + Two gear pumps 0.70 + 0.70 + 0.48 + 0.16 cu. in. (11.5 + 11.5 + 8 + 2.7 cm^3)
Flow Rate (@2500 rpm)	8.1 + 8.1 + 5.6 + 2.0 gpm (30.8 + 30.8 + 21.4 + 7.2 L/min.)
Working Pressure	3263 psi (225 bar)
Swing System Pressure	2987 psi (206 bar)
Boom/Bucket/Dipper Arm Pressure	3263 +/- 44 psi (225 +/-3 bar)
Dozer Blade Pressure	2988 +/- 44 psi (206 +/-3 bar)
Hydraulic Oil Cooler	Standard
Filter	Return

Dozer Blade

Width	5′2" (1570 mm)
Height	11.4" (290 mm)
Maximum Lift Above Ground	15" (380 mm)
Maximum Depth Below Ground	16.5" (419 mm)

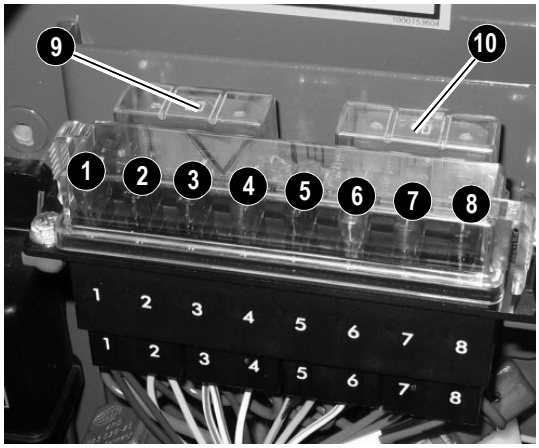
Undercarriage and Swing System

Travel Speed (Dual Speed)	
Low Speed	1.3 mph (2.1 km/hr)
High Speed	2.3 mph (3.8 km/hr)
Ground Clearance	10.9" (277 mm)
Swing (Slew) Speed	10.25 rpm
Gradability	30° = 58%
Rubber Track Width	11.8" (300 mm)
Top / Bottom Rollers (per side)	1 / 3
Sprocket Center	104" (2642 mm)
Average Ground Pressure	3.8 psi (26.2 kPa)
Maximum Drawbar Pull	5732 lbf (25.5 kN)

Electrical System

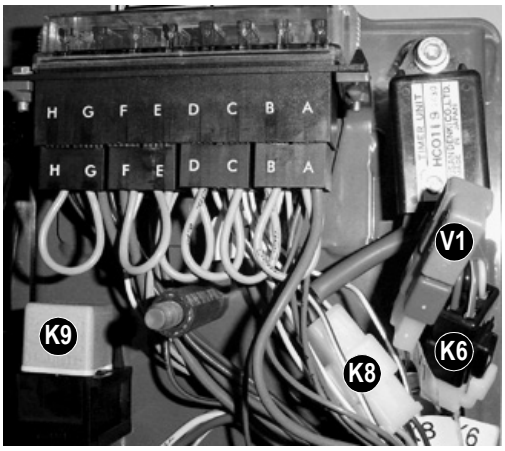
Alternator	12 V, 40 A
Starter	12 V, 1.1 kW
Battery	12 V, 44 Ah; 630 CCA
Socket	15 A max. - Accessory Socket

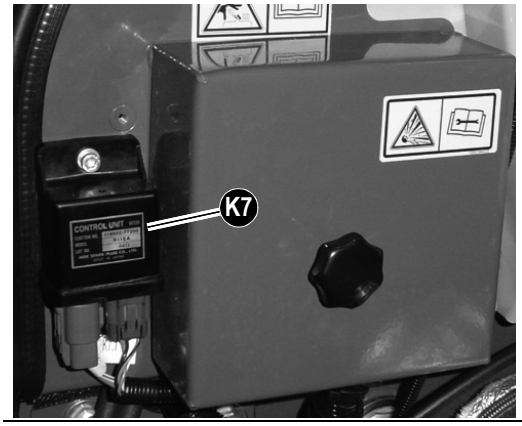
Fuses



Fuse No.	Rated Current	Protected Circuit
1	15 A	Accessory socket, cigarette lighter
2	10 A	Rotating beacon, radio
3	5 A	Proportional controls (unused)
4	15 A	Windshield wiper, interior light
5	10 A	Cab roof lights
6	15 A	Valves, horn
7	15 A	Boom light, heating
8	10 A	Indicators, cutoff solenoid, relays
9	40 A	Start, preheat, cutoff solenoid
10	50 A	Ignition lock

Relays





Relay No.	Protected Circuit
V1	Blocking diode
K6	Preheating time lag relay
K7	Starting relay
K8	Cutoff solenoid time lag relay
K9	Pickup contact cutoff solenoid relay

Coolant Compound Table

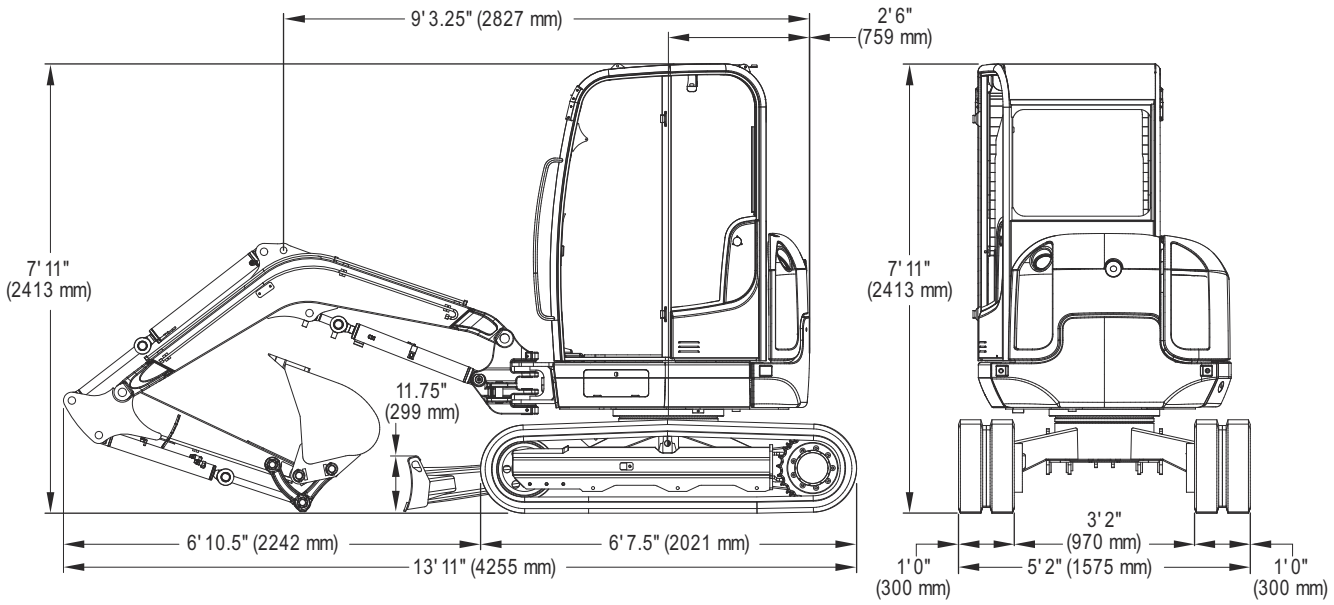
Note: *Do not mix coolant types. Machine filled at factory with Eurolub SF D12 (ethylene glycol basis)*

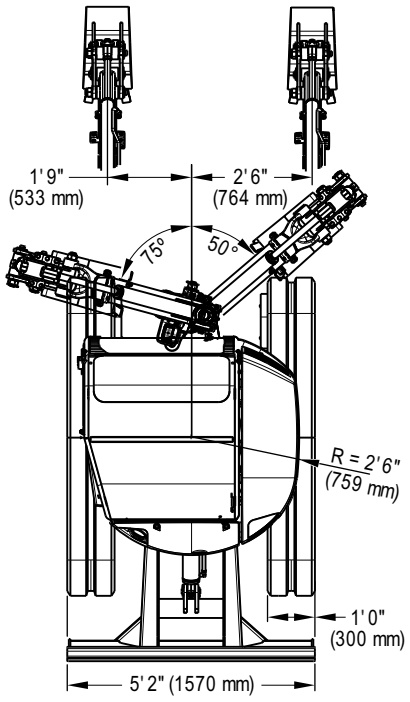
Outside Temperature Up to °F (°C)	Coolant: Halvoline XLC (based on ethylene glycol)			
	Water	Anti-corrosion Agent		Antifreeze Agent
	% by Volume	in^3/gal (cm^3/L)	% by Volume	% by Volume
+39 (4)	99	2.6 (10)	1	–
+14 (-10)	79			20
-4 (-20)	65			34
-13 (-25)	59			40
-22 (-30)	55			44
-34.6 (-37)	50			50

Sound Levels

Sound Power (L_{WA})	97 dB(A)
Sound Pressure (L_{PA})	68 dB(A)

General Specifications





Weight (with cab)	5886 lbs. (2670 kg)
Weight (with canopy)	5681 lbs. (2577 kg)
Height	7′ 11" (2413 mm)
Width	5′ 2" (1575 mm)
Transport length	13′ 11.5" (4254.5 mm)
Dipper arm length	4′ 1" (1250 mm)
Max. digging depth	9′ 0" (2743 mm)
Max. vertical wall digging depth	7′ 1" (2152 mm)
Max. digging height	14′ 1" (4299 mm)
Max. dump height	9′ 8.9" (2972 mm)
Max. digging radius	15′ 4" (4681 mm)
Max. reach at ground level	15′ 4" (4681 mm)
Max. bucket dig force	5057 lbf (22.5 kN)
Max. arm force	4923 lbf (21.8 kN)
Min. tail swing radius	2′ 6" (760 mm)
Max. tail end lateral projection over tracks	0′ 0" (0 mm)
Max. boom distance to bucket center (right side)	1′ 9" (533 mm)
Max. boom distance to bucket center (left side)	2′ 6" (764 mm)
Max. swing (slew) angle (left side/right side)	75°/ 50°

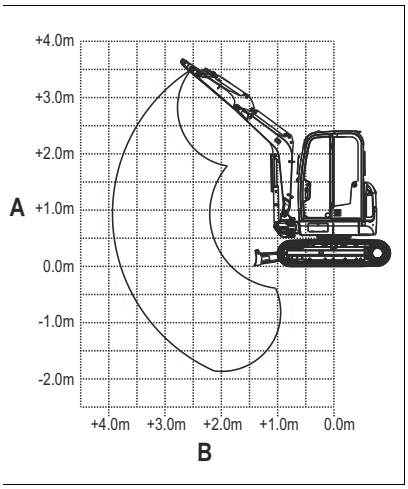
Fields of Applications/Approved Attachments

The machine is designed and intended to be used only with the approved attachments listed in the following table. To avoid possible personal injury, equipment damage or performance problems, use only attachments that are approved for use on and within the rated operating capacity of the machine. Contact your dealer or the Manitou Americas, Inc. service department for information about attachment approval. Manitou Americas, Inc. cannot be responsible if the machine is used with non-approved attachments.

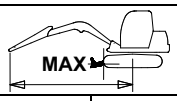
Attachment	**Size**	**Capacity**
Heavy-Duty Bucket	12 in. (300 mm)	1.8 ft^3 (0.051 M^3)
	16 in. (400 mm)	2.4 ft^3 (0.068 M^3)
	20 in. (500 mm)	3.1 ft^3 (0.088 M^3)
	24 in. (600 mm)	3.8 ft^3 (0.108 M^3)
	30 in. (700 mm)	4.8 ft^3 (0.136 M^3)
Ditching Bucket	42 in. (1000 mm)	4.1 ft^3 (0.116 M^3)
	55 in. (1400 mm)	5.9 ft^3 (0.167 M^3)
Swivel Bucket	39 in. (1000 mm)	3.9 ft^3 (0.110 M^3)
	55 in. (1400 mm)	5.6 ft^3 (0.159 M^3)

Load Diagrams

Without Counterweight



Maximum permissible loads

			11' 6" (3.5 m)		9' 10" (3.0 m)		8' 2" (2.5 m)	
A / B								
+9' 10" (+3.0 m)	1009* (458*)	747 (339)			933* (423*)	933* (423*)		
+6' 6" (+2.0 m)	985* (447*)	558 (253)	993* (450*)	705 (320)	1044* (473*)	919* (417*)		
+3' 3" (+1.0 m)	1000* (453*)	499 (226)	1161* (526*)	659 (299)	1378* (625*)	837 (380)	1788* (811*)	1101 (499)
0' 0" (0.0 m)	1026* (465*)	512 (232)	1269* (575*)	621 (282)	1588* (720*)	776 (352)	2116* (960*)	1009 (458)
-3' 3" (-1.0 m)	1033* (468*)	626 (284)			1425* (646*)	769 (349)	1879* (852*)	1004 (455)

Maximum permissible load on extended dipper arm	
A	Overhang from the center of the turntable
B	Height of load fixing point
*	Lifting capacity hydraulically limited

All table values are in lbs. (kg) and for a machine in a horizontal position on firm ground without bucket.

	Dozer blade support in drive direction.
	Dozer blade support 90° to drive direction.

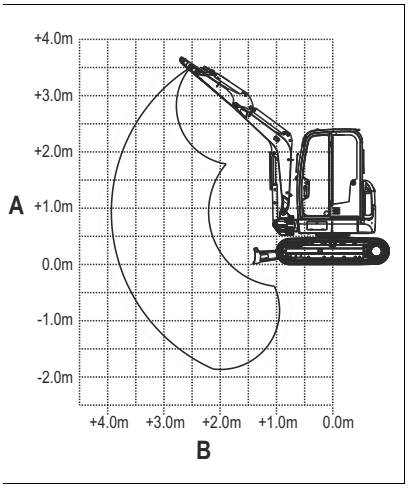
If equipped with a bucket or other implements, lift capacity or tilt load is reduced by bucket or implement weight.

Calculation basis: According to ISO 10567.

The excavator’s lift capacity is restricted by the settings of the pressure relief valves and the hydraulic system's stabilizing features.

Neither 75% of the static tilt load nor 87% of the hydraulic lift capacity is exceeded.

With Counterweight



Maximum permissible loads

A / B	MAX		11' 6" (3.5 m)		9' 10" (3.0 m)		8' 2" (2.5 m)	
+9' 10" (+3.0 m)	1121* (508*)	941 (427)			1085* (492*)	1085* (483*)		
+6' 6" (+2.0 m)	1078* (489*)	706 (320)	1084* (492*)	808 (366)	1157* (525*)	1041* (472*)	1297* (588*)	1297 (588)
+3' 3" (+1.0 m)	1088* (494*)	640 (290)	1222* (554*)	768 (348)	1463* (663*)	965 (437)	1923* (872*)	1253 (568)
0' 0" (0.0 m)	1110* (504*)	670 (304)	1282* (581*)	738 (335)	1611* (731*)	914 (414)	2132* (967*)	1182 (536)
-3' 3" (-1.0 m)	1098* (498*)	391 (399)			1335* (605*)	919 (417)	1774* (805*)	1191 (540)

Maximum permissible load on extended dipper arm	
A	Overhang from the center of the turntable
B	Height of load fixing point
*	Lifting capacity hydraulically limited

All table values are in lbs. (kg) and for a machine in a horizontal position on firm ground without bucket.

	Dozer blade support in drive direction.
	Dozer blade support 90° to drive direction.

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The excavator’s lift capacity is restricted by the settings of the pressure relief valves and the hydraulic system's stabilizing features.

Neither 75% of the static tilt load nor 87% of the hydraulic lift capacity is exceeded.

NOTES

Pre-Delivery Checklist

The following checklist is an important reminder of valuable information and inspections that MUST be made before delivering the machine to the customer. Check off each item after the prescribed action is taken.

✓ CHECK THAT:

- ❑ Machine has not been damaged in shipment. Check for such things as dents and loose or missing parts. Correct or replace components as required.
- ❑ Battery is securely mounted and not cracked. Be sure cable connections are tight.
- ❑ Cylinders, hoses and fittings are not damaged, leaking or loosely connected.
- ❑ Coolant/radiator hoses and fittings are not damaged, leaking or loosely connected. Coolant system is filled to the proper level and has proper antifreeze protection.
- ❑ Filters are not damaged, leaking or loosely secured.
- ❑ Machine is properly lubricated and no grease fittings are missing or damaged.
- ❑ Hydraulic system reservoir, engine crankcase and drive motors are filled to their proper levels.
- ❑ All adjustments are made to comply with settings provided in *Chapter 4 – Maintenance* of this manual.
- ❑ All guards, shields and decals are in place and secured.
- ❑ Model and serial numbers for the machine are recorded in the space provided on this page and on page 1-1

IMPORTANT

Start the engine and test run the unit while checking that all controls operate properly.

✓ CHECK THAT:

- ❑ Drive controls and boom/arm/bucket/dozer blade/swing/pivot controls operate properly and are not damaged or binding.
- ❑ Drive controls are properly adjusted for correct neutral position.
- ❑ The parking and travelling gear brake, along with the lock-out devices, are activated with the machine stationary (no pilot control pressure).
- ❑ All hydraulic functions are NOT operational with the left control console in the raised lock-out position.
- ❑ All instrument panel gauges, indicator lights, etc. function properly and all installed lights, such as work lights, function properly.

I acknowledge the pre-delivery procedures were performed on this unit as outlined on this page.

_____

Dealership's Name

_____

Dealer Representative's Name

_____

Date Checklist Filled Out

_____

Model & Serial Number

Delivery Checklist

The following checklist is an important reminder of valuable information that MUST be passed on to the customer at the time of delivery. Check off each item as you explain it to the customer.

✓ EXPLAIN:

- ❑ The *Safety* and *Operation* chapters of this manual, regarding the safe operation of the machine.
- ❑ The *Maintenance* and *Troubleshooting* chapters for information regarding the proper maintenance of the machine. Explain that regular lubrication and maintenance is required for continued safe operation and long machine life.
- ❑ Give this Operator's Manual and the AEM Compact Excavator Safety Manual to the customer and instruct the customer to read and completely understand the contents before operating the machine.
- ❑ Complete the Owner's Registration, including customer's signature and return it to Manitou Americas, Inc.
- ❑ Explain that a copy of the product warranty is included on the inside front cover of this Operator's Manual.

_____

Customer's Signature

_____

Date Delivered

RETAIN FOR CUSTOMER'S RECORDS

INTENTIONALLY BLANK

Remove dealer's file copy at perforation.

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Customer's Signature

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Date Delivered

RETAIN FOR CUSTOMER'S RECORDS

INTENTIONALLY BLANK

CHAPTER 2 – SAFETY

GENERAL SAFETY INFORMATION

Manitou Americas, Inc, in cooperation with the Society of Automotive Engineers (SAE), has adopted this safety alert symbol: ⚠ This warning symbol, used with a "signal word," indicates situations or conditions that can cause injury or death if precautions are not followed. The signal words used with the safety alert symbol are:

"**CAUTION**," "**WARNING**," and "**DANGER**," which indicate the level of risk and severity of hazards. All three levels indicate that safety is involved. Observe the precautions whenever you see the safety alert symbol, no matter which signal word is used.

The following signal words are used throughout this manual and on decals on the machine to warn of potential hazards:

⚠ DANGER

"DANGER" indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury.

⚠ WARNING

"WARNING" indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury.

⚠ CAUTION

"CAUTION" indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury. May also alert against unsafe practices.

IMPORTANT

"IMPORTANT" is used to draw attention to a procedure that must to be followed to prevent machine damage.

GENERAL SAFETY RULES

Before operating the machine, first read and study the safety information in this manual. Be sure that anyone who operates or works on the machine is familiar with the safety precautions. This includes providing translations of the warnings and instructions for operators who are not fluent in reading English.

It is essential that operators be thoroughly trained in the safe operation of the machine and handling loads. Operators must not be physically or mentally impaired. Do not allow minors or unqualified personnel to operate the machine, or to be near the machine unless they are properly supervised. It is recommended that the operator be capable of obtaining a valid motor vehicle operator's license.

Only trained and authorized personnel, with a full awareness of safe procedures, should be allowed to operate or perform maintenance or service on the excavator.

Read the operator's manual provided with each attachment before using it.

Use of the machine is subject to certain hazards that cannot be eliminated by mechanical means, but only by exercising intelligence, care and common sense. Such hazards include: hillside operation, overloading, load instability, poor maintenance, and using the machine for a purpose for which it was not intended or designed.

Manitou Americas, Inc. always takes operator's safety into consideration during the design process. Guards and shields are provided, which protect the operator and bystanders from moving parts and other hazards. Operators must be alert, however, because some areas cannot be guarded or shielded without preventing or interfering with proper operation.

Different applications may require optional safety equipment. Users must evaluate the work site hazards and equip the machine and the operator as necessary. The information in this manual does not replace any applicable safety rules and laws. Before operating the machine, learn the rules and laws for the local area. Make sure the machine is equipped as required according to these rules/laws.

Remember that some risks to your health may not be immediately apparent. Exhaust gases and noise pollution may not be visible, but these hazards can cause permanent injuries.

Some photographs in this manual may show doors, guards and shields open or removed for the purposes of illustration only. Be sure all doors, guards, shields and panels are in the proper operating positions before starting the engine to operate the machine.

Do not modify the Falling Object Protective Structure ("FOPS") unless instructed to do so in approved installation instructions. Modifications, such as welding, drilling or cutting, can weaken the structure and reduce the protection it provides. A damaged protective structure cannot be repaired – it must be replaced.

For safety reasons, use only genuine replacement service parts. For example, using incorrect fasteners could lead to a condition in which the safety of critical assemblies is dangerously compromised.

The machine is designed and intended to be used only with approved attachments. To avoid possible personal injury, equipment damage or performance problems, use only attachments that are approved for use on and within the rated operating capacity of the machine. Contact your dealer or the Manitou Americas, Inc. service department for information about attachment approval and compatibility with specific machine models. Manitou Americas, Inc. cannot be responsible if the machine is used with non-approved attachments.

Do not use the machine for any application or purpose other than described in this manual.

Unauthorized Modifications

Any machine modification made without authorization from Manitou Americas, Inc. could create a safety hazard, for which the machine owner would be responsible.

For safety reasons, use only genuine replacement service parts. For example, using incorrect fasteners could lead to a condition in which the safety of critical assemblies is dangerously compromised.

Attachment Precautions

Optional kits are available through your dealer. Contact your dealer for more information about optional kits.

MANDATORY SAFETY SHUTDOWN PROCEDURE

Before leaving the machine:

1. Bring the machine to a complete stop on a level surface. Avoid parking on an incline or a hillside, but if this is not possible, park across the slope; place chocks under the tracks to prevent the machine from moving.
2. Lower the working equipment to the ground and support it securely.
3. Run the engine at idle speed for a few minutes to allow systems to cool after operation at full speed.
4. Turn the ignition key fully counter-clockwise to shut off the engine. Wait for all movement to stop.
5. Turn the ignition key to the first position. Move the joysticks in all directions to verify the hydraulic system is de-pressurized. Shut off the engine.
6. Lock out controls by raising left control console.
7. Remove the ignition key and take it with you. Exit the machine using the hand-holds.

SAFETY DURING OPERATION

Before Operation

Contact the proper local authorities for utility line locations BEFORE starting to dig. In North America, contact the North American One-Call Referral System at 8-1-1 in the U.S., or 1-888-258-0808 in the U.S. and Canada.

Remove all trash and debris from the machine every day, especially in the engine compartment, to minimize the risk of fire.

The operator's area, steps and hand holds must be kept free of oil, dirt, ice and unsecured objects.

Never use ether starting aids. Glow plugs are used for cold weather starting. Glow plugs can cause ether or other starting fluid to detonate, causing injury or damage.

Walk around the machine and inspect it before using it. Look for damage, loose or missing parts, leaks, etc. Repair as required before using the machine.

Check the tracks for damage at regular intervals. Repair or replace as necessary.

Warn all nearby personnel before starting the machine.

Below-ground hazards also include water mains, tunnels and buried foundations. Know what is underneath the work site before starting to dig.

Before working near power lines (either above-ground or buried cable-type), always contact the power utility and establish a safety plan with them.

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

Depending upon the voltage in the line and atmospheric conditions, strong current shocks can occur if the boom or bucket is closer than 10 ft. (3 m) to the power line. Very high voltage and rainy weather can further increase the safe operating distance.

If a lighting system is installed, check its operation before working in darkness.

Use warning tag/control lockout procedures during service. Alert others that service or maintenance is being performed by tagging the operator's controls — and other machine areas if required — with a warning notice. **NEVER** start the engine if there is any indication that maintenance or service work is in progress, or if a warning tag is attached to controls in the cab.

Replace damaged safety decals and a lost or damaged operator's manual. Always store this operator's manual in the storage compartment provided for it inside the cab.

Work crew members should observe and monitor all terrain and soil conditions at the work site, along with traffic, weather-related hazards and any above- or below-ground obstacles and hazards.

If the machine is equipped with a cab, keep the windshield, mirrors and windows clean. If equipped, adjust the rearview mirrors to provide the best view to the rear of the machine. Poor visibility can cause accidents.

Adjust the seat to allow complete and comfortable access to the controls. Never adjust the seat during machine operation.

Stop the engine and lock out the controls by raising left control console before mounting attachments. Check that attachments are securely fastened to the excavator before using them.

Before working on or with the machine, remove jewelry, tie back long hair, and do not wear loose fitting garments, such as, scarves, ties, unzipped jackets, etc., which could become caught in the moving parts of the machine and cause injury.

Do not use the machine when maintenance is scheduled to be performed. Postponing maintenance can result in a serious reduction of the service life of the machine, more serious and costly equipment failures, and contribute to unsafe operating conditions.

During Operation

ALWAYS fasten the seat belt securely and properly. Never operate the machine without the seat belt fastened around the operator.

Operate ONLY while seated in the operator's seat. Never reach in through a window to work a control. Do not try to operate the excavator unless you're in the operator's position, seated at the controls. Stay alert and focused on your work at all times.

Always keep hands and feet inside the operator's compartment while operating the machine.

Control the machine cautiously and gradually until fully familiar with all the controls and handling. Avoid high-voltage lines. Serious injury or death can result from contact or proximity to high-voltage electric lines. The bucket or boom does not have to make physical contact with power lines for current to be transmitted.

Use care on loose ground. Working heavy loads over loose, soft ground or uneven, broken terrain can cause dangerous side-load conditions and possible tip over and injury. Traveling with a suspended load or an unbalanced load can also be hazardous.

Stay away from ditches and weak support surfaces. Be sure the surrounding ground has adequate strength to support the weight of the machine and the load.

If temperatures are changing, be cautious of dark and wet patches when working or traveling over frozen ground.

Stay away from ditches, overhangs and other weak support surfaces. Halt work and install support mats or blocking if work is required in an area of poor track support.

Overhangs are hazardous. Digging under an overhang is dangerous. Know the height and reach limits of the excavator and plan ahead while working. Avoid creating dangerous situations caused by moving around the work site while making excavations. Move to another digging area before large overhangs are formed. Working around deep pits or along high-walls or trenches may require support blocks, especially after heavy rainfalls or during spring thaws. Park the excavator away from overhangs.

Exposed hydraulic hoses could react with explosive force if struck by falling or overhead items. NEVER allow hoses to be hit, bent or interfered with during operation. Extra guards may be required. Replace any damaged hoses.

To avoid tipping, travel with the bucket or attachment as low as possible: 8-12 inches (200-300 mm) from the ground. In an emergency, lower the attachment immediately to the ground to aid stopping the machine.

Sloping terrain requires caution. Dig evenly around the work site whenever possible, trying to gradually level any existing slope. If it is not possible to level the area or avoid working on a slope, reduce the size and cycling rate of the load.

On sloping surfaces, use caution when positioning the excavator prior to starting a work cycle. Stay alert for instability situations. For example, always avoid working the bucket over the downhill crawler tracks when parked perpendicular to the slope. Slow all downhill swing movements and avoid full extensions of the bucket in a downhill direction. Lifting the bucket too high, too close to the machine, while the excavator is turned uphill can also be hazardous.

If the machine becomes unstable and starts to tip, keep the seat belt fastened, hold on firmly and brace yourself. Lean away from the point of impact and stay with the machine. If tipping occurs, DO NOT jump from the machine. The machine is equipped with rollover protection, which can only protect the operator while in the operator's seat. Trying to escape from a tipping machine can result in death or serious personal injury.

Stay alert for people moving through the work area. When loading a truck you should always know where the driver is.

Avoid loading over the cab of a truck, even if the driver is in a safe spot, because someone else could have gone inside.

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

Use a signal person if you can't see the entire work area clearly.

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

All personnel at the work site should be aware of assigned individual responsibilities. Communication and hand signals used should be understood by everyone.

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

Be aware that attachments affect the handling and balance of the machine. Adjust the operation of the machine as necessary when using attachments.

Before coupling or uncoupling the hydraulic lines for the attachment, stop the engine and release the pressure in the hydraulic system by moving the joysticks in all directions a couple of times.

DO NOT raise or lower a loaded bucket suddenly. Abrupt movements under load can cause serious instability.

Make sure that no one comes inside the swing radius of the machine. Anyone standing near the track frames, swing frame or the attachment is at risk of being caught between moving parts of the machine.

Do not use the machine to lift or transport people. Never carry riders. Do not allow others to ride on the machine or attachments, because they could fall or cause an accident.

Unless necessary for servicing the engine, the engine hood must not be opened while the engine is running.

Engine exhaust gases can cause unconsciousness and fatalities. Ensure adequate ventilation before starting the engine in an enclosed area.

Operators should also be aware of any open windows, doors or ductwork into which exhaust gases may be carried, exposing others to danger.

Do not overload the machine. See the Load Diagrams starting on page 1-10, for load limits.

If the machine becomes damaged or malfunctions, stop the machine immediately and lock and tag it. Repair the damage or malfunction before using the machine.

Never jump off the machine. Always leave the machine using the steps and hand-holds. Never get on or off a moving machine.

After the machine has been parked properly, shut down the engine and cycle all controls to release any remaining hydraulic system pressure. Be sure all switches and operating controls are in the OFF position and the left-hand console is raised, locking out the hydraulic functions.

Exposure to Crystalline Silica

Exposure to crystalline silica (found in sand, soil and rocks) has been associated with silicosis, a debilitating and often fatal lung disease. A Hazard Review (Pub. No. 2002-129) by the U.S. National Institute for Occupational Safety and Health (NIOSH) indicates that a significant risk (at least 1 in 100) of chronic silicosis for workers exposed to inhaled crystalline silica over a working lifetime. NIOSH recommends an exposure limit of 0.05 mg/m3 as a time-weighted average for up to a 10-hr workday during a 40-hr workweek. NIOSH also recommends substituting less hazardous materials when feasible, using respiratory protection, and regular medical examinations for exposed workers.

Parking the Machine

When shutting down the machine for the day, plan ahead so that the excavator will be on a firm, level surface away from traffic and away from high-walls, cliff edges and any area of potential water accumulation or runoff. If parking on an incline is unavoidable, block the crawler tracks to prevent movement. Lower the bucket and dozer blade to the ground. There should be no possibility of unintended or accidental machine movement.

After the machine has been parked properly, shut down the machine according to the “Mandatory Safety Shutdown Procedure” on page 2-2.

Travel Controls May Produce Reversed Travel Operations

Before starting the machine, always check to see which end of the track frame is under the operator’s cab. In the normal travel configuration, travel motors are at the rear of the machine, under the engine, and with the dozer blade to the front.

If the operator rotates the swing frame 180º, travel motors will be underneath the operator’s cab, and operating travel will be reversed.

Use caution in reverse travel and swing frame rotation.

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

Additional Travel Precautions

Swing frame control levers should not be operated while traveling.

Do not change selected travel mode (FAST/SLOW) while traveling.

Fold in work equipment so that the outer end of the boom is as close to the machine as possible, and is as low as possible (8”-12” [200 mm-300 mm]) to the ground.

Never travel over obstacles or slopes that will cause the machine to tilt severely. Travel around any slope or obstacle that would cause a tilt greater than 10º.

Snow, Ice and Cold Temperature Operation Precautions

In cold weather, avoid sudden travel movements and stay away from even very slight slopes. The machine can slide sideways on icy slopes.

Snow accumulation can hide potential hazards. Use care while operating and while using the machine to clear snow.

FIRE HAZARDS

The machine has several components that operate at high temperature under normal operation conditions, primarily the engine and exhaust systems. Also, the electrical system, if not properly maintained or if damaged, can arc or produce sparks. These conditions make it extremely important to avoid circumstances where explosive dust or gases can be ignited by arcs, sparks or heat.

The machine must be cleaned on a regular basis to avoid the buildup of flammable debris such as leaves, straw, etc. Accumulated debris, particularly in the engine compartment, poses a fire hazard.

Add fuel, oil, antifreeze and hydraulic fluid to the machine only in a well ventilated area. The machine must be parked with controls, lights and switches turned off. The engine must be turned off before refueling or service checks are performed.

Static electricity can produce dangerous sparks at the fuel-filling nozzle. In very cold, dry weather or other conditions that could produce static discharge, keep the tip of the fuel nozzle in constant contact with the filler neck of the fuel tank, to provide a ground. Make sure that the static line is connected from the excavator to the service truck before fueling begins.

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

Do not smoke while filling the fuel tank, while working on the fuel or hydraulic systems, or while working around the battery.

Take care to avoid spilling combustible fluids, such as oil or fuel, on a hot engine.

Fire Extinguisher Recommendation

It is recommended that a 5 lb. (2.27 kg) or larger, multi-purpose “A/B/C” fire extinguisher be mounted in the cab. on the cab/canopy frame behind the operator’s seat. Check the fire extinguisher periodically and be sure that work crew members are trained in its use.

IMPORTANT: Installation of a fire extinguisher according to DIN-EN 3 must be performed by an authorized dealer.

NOTE: A fire extinguisher is neither included as standard equipment nor available as an option from Manitou Americas, Inc.

IMPORTANT: Inspect the fire extinguisher at regular intervals as recommended by the fire extinguisher equipment manufacturer(s).

ADDITIONAL SAFETY EQUIPMENT

Severe operation may require use of additional safety equipment

Work in mines, tunnels, deep pits or on loose or wet surfaces could produce the hazard of falling rock, roll over or falling objects.

Any operator protective system installed on the machine must comply with applicable safety standards and carry appropriate labeling and rating information. For example, the cab of an excavator used in applications with falling object hazards must meet Society of Automotive Engineers Standard SAE J1356, “Performance Criteria for Falling Object Guards for Excavators.”

Never attempt to alter or modify the protective structure, by drilling holes, welding or re-locating fasteners. Any serious impact or damage to the system requires a complete integrity re-evaluation, and the replacement of the system may be necessary.

Install additional safety equipment if conditions require.

When working with a hydraulic breaker, a front guard over the windshield may be required.

Laminated glass or polycarbonate protection for the front, side or rear windows may also be recommended depending upon particular work conditions.

Contact your dealer for available safety guards and/or recommendations if there is any risk of being hit by objects that could strike the operator's cab.

Eye Protection and Safety Clothing

Wear full eye protection, ear and head protection, safety shoes, gloves and any other protective clothing or equipment as needed while operating the machine.

Safety Equipment Maintenance

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

All safety equipment must be maintained so it is always in good condition.

Safety-critical parts must be periodically replaced. Replace the following potentially fire-sensitive components as soon as they begin to show signs of deterioration:

- Fuel system flexible hoses, fuel tank overflow drain hose and the fuel filler cap.
- Hydraulic system hoses, especially the pump outlet lines.

Keep mounting brackets and hose and cable routing straps tight. Hose routing should have gradual bends.

Breathing Masks and Ear Protection

Remember that some risks to your health may not be immediately apparent. Exhaust gases and noise pollution may not be visible, but these hazards can cause permanent injuries.

MAINTENANCE SAFETY

Only trained and authorized personnel, with a full awareness of safe procedures, should be allowed to operate or perform maintenance or service on the machine.

Use solid support blocking. Never rely on jacks or other inadequate supports when maintenance work is being done. Block tracks front and back to prevent any movement.

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

Never attempt to bypass the ignition switch to start the engine. Use only the proper jump-starting procedure according to See "Using a Booster Battery (Jump-Starting)" on page 4-20.

Never use hands to search for hydraulic fluid leaks. Instead, use a piece of paper or cardboard. Escaping fluid under pressure can be invisible and can penetrate the skin and cause serious injury. If any fluid is injected into your skin, see a doctor at once. Injected fluid must be surgically removed by a doctor or gangrene may result.

Always wear safety glasses with side shields when striking metal against metal. In addition, it is recommended that a softer (chip-resistant) material be used to cushion the blow, otherwise, serious injury to the eyes or other parts of the body could result.

Use care when seating retainer pins — retainer pins can fly out or splinter when struck and could cause injury.

Do not smoke or have any spark- or flame-producing equipment or materials in the area while filling the fuel tank or working on the fuel or hydraulic systems.

Do not attempt to loosen or disconnect any hydraulic lines, hoses, fittings, covers or caps without first relieving hydraulic circuit pressure. Relieve hydraulic pressure by performing the "Mandatory Safety Shutdown Procedure" on page 2-2. Be careful not to touch any hydraulic components that have been in recent operation, because they can be hot and cause burns.

Refer to the parts manual for information about assembly of components. Always use the correct parts and the proper torques — incorrect fastener connections can dangerously weaken assemblies.

Do not run the engine if repairs are being performed alone. There should always be at least two people working together if the engine must be run during service. Both persons must maintain visual contact with each other. Keep a safe distance away from all rotating and moving parts.

Always use the proper tools while working on the machine. Inappropriate tools could break or slip, causing injury, or they may not adequately perform intended functions.

Unless necessary for servicing the machine, do not open the engine cover while the engine is running.

Keep mounting brackets and hose and cable routing straps tight. Hose routing should have gradual bends.

After cleaning the machine, examine all fuel, lubricant and hydraulic oil lines for leaks, chafe marks and damage. Tighten any loose connections and repair or replace parts as necessary.

Use warning tag/control lockout procedures during service.

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

Don't run the engine if repairs or work is being performed alone.

Do not run the engine if repairs or work is performed alone. There should always be at least two people working together if the engine must be run during service.

Always use adequate equipment supports and blocking.

Lower bucket to the ground before leaving the operator's seat. Don't work under any equipment supported solely by a lift jack.

Track tension adjustments require caution.

NEVER fully remove the track tension grease fitting. To release pressure from the crawler frame track tension assembly, you should loosen the grease fitting slightly, no more than two turns.

Keep your face and body away from the fitting. Refer to "Checking and Adjusting Track Tension" on page 4-23.

Don't work on hot engines, cooling or hydraulic systems.

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

Temperatures below 120°F (49°C) will reduce the chances of scalding exposed skin while allowing the fluid to drain quickly and completely. However, do not let the fluid to fully cool, because drain time will be substantially increased.

Cool-down is required prior to radiator or hydraulic reservoir checks.

Stop the engine and allow it to cool before performing service on the engine radiator or hydraulic reservoir. Both assemblies have pressure vents at the filler cap for venting pressure. LOOSEN CAPS SLOWLY. Vent the pressure before removing the filler caps.

Release hydraulic system pressure by cycling controls and releasing hydraulic reservoir pressure before removing hydraulic reservoir access cover.

The hydraulic reservoir is pressurized. Vent the system pressure by rotating the filler cap. LOOSEN CAP SLOWLY prior to removal.

Make sure to release any hydraulic pressure stored in the lines by cycling the operator's controls in each direction after the engine has been shut down.

Pressurized hydraulic oil leaks can be hazardous.

Fluid leaks from hydraulic hoses and pressurized components can be difficult to see, but pressurized oil can have enough force to pierce the skin and cause serious injury.

Always use a piece of wood or cardboard to check for suspected hydraulic leaks. Never use your hands. Obtain immediate medical attention if pressurized oil pierces the skin. Failure to obtain prompt medical assistance could result in gangrene or other serious damage to tissue.

Use correct replacement fasteners tightened to proper torque.

Refer to the Parts Manual for information on torques and assembly of components.

IMPORTANT

Always use the correct, original-equipment parts. Incorrect fastener connections can dangerously weaken assemblies.

Dispose of all petroleum-based oils and fluids properly.

Dispose of all petroleum-based oils and fluids properly. Used motor oil may pose a health risk. Wipe oil from your hands promptly and wash off any residue. Used motor oil is an environmental contaminant and may only be disposed of at approved collection facilities. Never drain any petroleum-based product on the ground or dispose of used oil in municipal waste collection containers, or in metropolitan sewer systems or landfills. Check state and local regulations for other requirements.

When handling oil, grease and other chemical substances, follow the product-related safety requirements (Material Safety Data Sheet (MSDS) carefully to prevent burning or scalding yourself or other persons.

Safety Decals

Safety decals must be replaced if they become unreadable. Safety decal mounting locations are shown starting on page 2-11.

Hydraulic Cylinder Seal Periodic Replacement

Check cylinder drift rate at regular intervals. Maximum allowable rates are included at the end of the Hydraulic section in the Excavator Service Manual. Overhaul seal kits are available through Manitou Americas dealer.

High Pressure Hydraulic Lines Store Energy

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

Operator's Cab and Swing Frame Deck Maintenance

Cleaning off accumulations of grease and dirt helps extend equipment service life. Cleaning also provides an opportunity to inspect equipment. Minor damage can be repaired or corrected before major problems result.

Battery Electrolyte and Explosive Gas Hazard

Flush eyes with water for 10-15 minutes if battery acid is splashed in the face. Anyone who swallows acid must have immediate medical aid. Call the Poison Control center listing in the telephone directory.

Sparks can set off explosive battery gas from incidental contact or static discharge. Turn off all switches and the engine when working on batteries. Keep battery terminals tight. Contact between a loose terminal and post can create an explosive spark.

Battery Disconnection Precaution

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

Jump-starting or Charging the Battery

Turn off all electrical equipment before connecting leads to the battery, including electrical switches on the battery charger or jump-starting equipment.

When jump-starting from another machine or vehicle, do not allow the machines to touch. Wear safety glasses or goggles while battery connections are made.

Batteries contain acid and produce explosive gases. Keep sparks, flames and lit cigarettes away from batteries at all times.

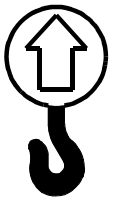
Connect positive cable first when installing jumper cables. The final cable connection, at the metal frame of the machine being charged or jump-started, should be as far away from the batteries as possible.

Disconnect the negative cable first when removing the jumper cables. For specific jump-starting instructions refer to "Using a Booster Battery (Jump-Starting)" on page 4-20 in the Maintenance chapter of this manual.

LIFTING THE MACHINE WITH A CRANE

Only lift the machine according to the following guidelines:

- The crane and rigging equipment must have sufficient capacity. See “Lifting the Machine” on page 3-28.
- Lift the machine according to “Lifting the Machine” on page 3-28.
- Secure the machine against unintentional movement. Use taglines as needed.
- Do not lift the machine with persons on or in the machine.
- Any person guiding the crane operator must be within sight or sound of the crane operator.
- Lift the machine only with the standard bucket installed, the bucket empty and in the transport position.
- Persons must stay clear of and not under the machine when it is lifted.
- Fasten the rigging equipment so the machine is horizontal when it is lifted.
- Do not lift the machine by the eye hooks on the cab. Attach the rigging equipment only at the lift points identified by this symbol:



TRANSPORTING

Obey state and local over-the-road regulations. Check state and local restrictions regarding weight, width and length of a load. The hauling vehicle, trailer and load must all be in compliance with local regulations. Refer to the Transporting section of this manual.

SAFETY AND INFORMATION DECALS

The machine has decals shown on the following pages that provide safety information and precautions. These decals must be kept legible. If missing or illegible, they must be replaced promptly. Replacements can be obtained from your dealer.

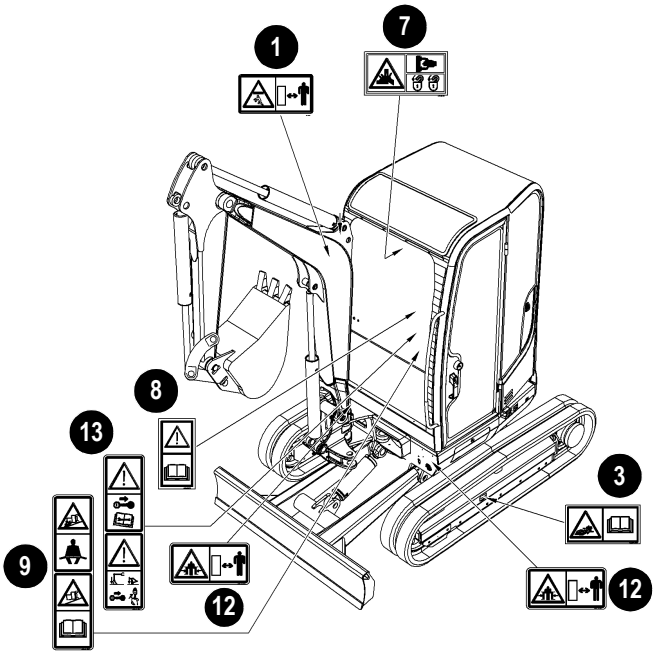
Refer to the Parts Manual for decal part numbers and ordering information.

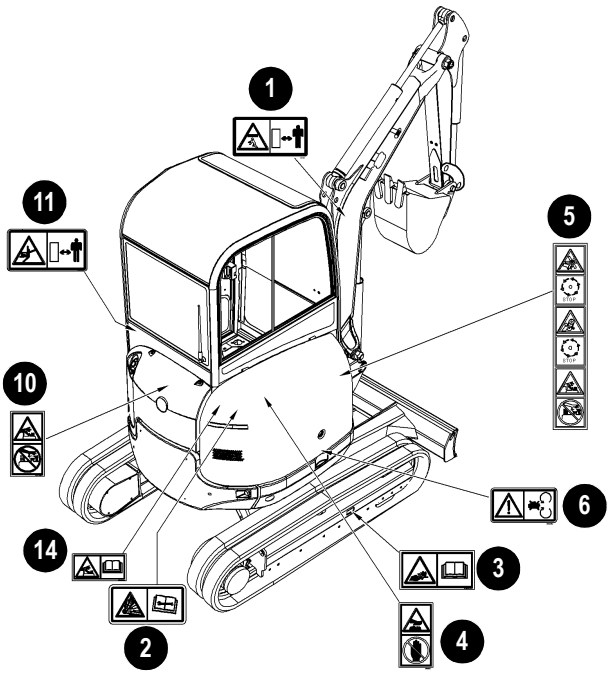
New Decal Application

Surfaces must be free of dirt, dust, grease and foreign material before applying the decal. Remove the smaller portion of the decal backing paper and apply the exposed adhesive to the clean surface, maintaining proper position and alignment. Peel the rest of the backing paper and apply hand pressure to smooth out the decal surface. Refer to the following pages for proper decal locations.

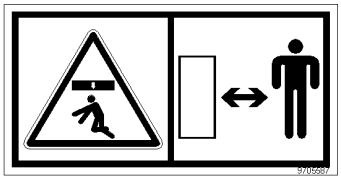
If replacing a part that has a decal on it, ensure that the replacement part has the same decal.

ISO-Style Safety Decal Locations (Later Machines)





1



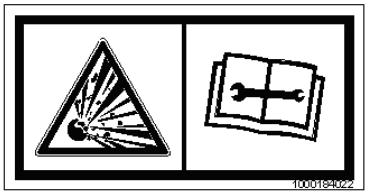
WARNING! Danger Zone Decal

AVOID INJURY OR DEATH!

Located on both sides of the boom.

Keep bystanders away from the machine when it is in use.

2



WARNING! Hydraulic Reservoir Under Pressure

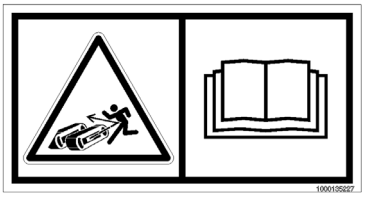
AVOID INJURY OR DEATH!

Located on the fuse box cover under the hydraulic system vent valve inside the engine compartment.

Relieve hydraulic pressure before servicing machine. Removed hydraulic reservoir cap slowly.

Refer to the maintenance section in the operator's manual before servicing the machine.

3



WARNING! Stay Clear Decal

AVOID INJURY OR DEATH!

Located next to the track tension grease fitting on both sides of the machine.

WARNING! Grease is under high pressure. Keep your face and body away from the fitting.

Do not loosen the fitting more than two turns. Do not loosen parts other than the fitting.

Refer to the operator's manual for track adjustment procedure.

4

WARNING! Hot Surfaces Decal

AVOID SERIOUS INJURY!

Located inside the engine compartment.

Stop the engine and wait for all parts to cool before opening the engine compartment. Hot surfaces can cause severe burns.

Read the operator's manual before performing any maintenance on the machine.

ISO-Style Safety Decal Locations (Later Machines) (Continued)

5

WARNING! Rotating and Hot Components Decal

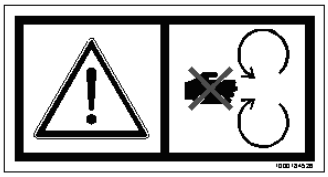
AVOID SERIOUS INJURY!

Located on the fan shroud inside the engine compartment.

Stop the engine and wait for all parts to cool before opening the engine compartment. Rotating parts can cause severe injury. Hot surfaces and liquids can cause severe burns.

Read the operator's manual before performing any maintenance on the machine.

6



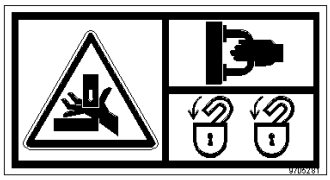
WARNING! Rotating Components! Danger of Entanglement! Decal

AVOID SERIOUS INJURY!

Located below the engine cover latch.

Stop the engine before opening the engine compartment. Rotating parts can cause severe injury.

7



WARNING! Crushing Hazard Decal

AVOID SERIOUS INJURY!

Located on the inside of the front window on cab-equipped machines.

Only open and close the front window using the handles.

Always lock the front window using both locks.

8

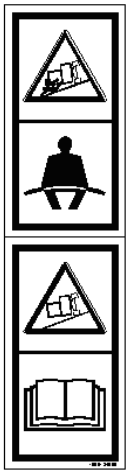
WARNING! Read Operator's Manual

AVOID INJURY OR DEATH!

Located on the door pillar inside the cab.

Read the operator's manual before operating or performing any maintenance on the machine.

9



WARNING! Decal

AVOID INJURY OR DEATH!

Located on the door pillar inside the cab.

No riders! Never use work tool as work platform.

Operate only from operator's seat.

ALWAYS wear seatbelt.

WARNING: Avoid Overturn

Side stability is reduced when: 1) turning; 2) operating on rough terrain or side slopes; and 3) carrying load raised.

Carry load low. Do not exceed Rated Operating Capacity.

Avoid steep slopes and high speed turns.

Travel up and down slopes with heavy end uphill.

Read the operator's manual before operating the machine.

10

WARNING! Hot Components Decal

AVOID SERIOUS INJURY!

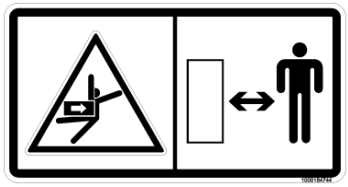
Located on the hydraulic valve compartment cover in the location of the hydraulic oil fill (hydraulic oil fill is located inside the hydraulic valve compartment).

Stop the engine and wait for all parts to stop and cool before. Hot surfaces and liquids can cause severe burns.

Read the operator's manual before performing any maintenance on the machine.

ISO-Style Safety Decal Locations (Later Machines) (Continued)

(11)



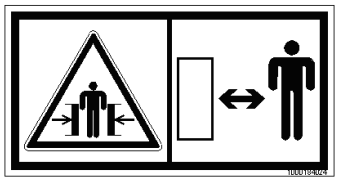
WARNING! Danger Zone Decal

AVOID INJURY OR DEATH!

Located on the back of the swing frame.

Keep bystanders away from the machine when it is in use.

(12)



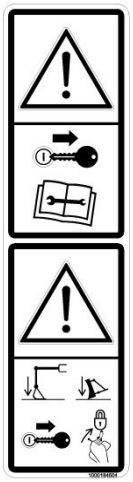
WARNING! Danger Zone Decal

AVOID INJURY OR DEATH!

Located on both sides of the boom swivel bracket.

Swiveling boom can cause crushing. Keep bystanders away from the machine when it is in use.

(13)



WARNING! Mandatory Safety Shutdown Decal

AVOID INJURY OR DEATH!

Located on the door pillar inside the cab.

Before leaving the machine, or performing any service on the machine, perform the "Mandatory Safety Shutdown Procedure" on page 2-2.

1. Lower the working equipment to the ground and support it securely.

2. Run the engine at idle speed for a few minutes to allow systems to cool after operation at full speed.

3. Turn the key fully counter-clockwise to shut off the engine.

4. Lock out controls by raising left control console.

5. Remove the ignition key and take it with you.

(14)

WARNING! Hot Components Decal

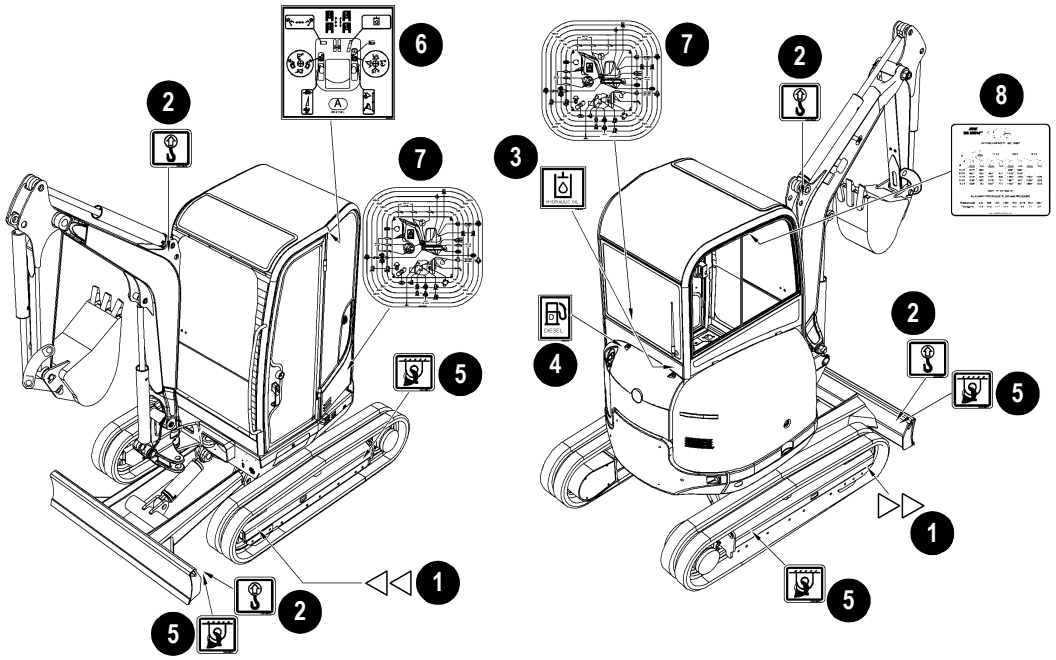
AVOID SERIOUS INJURY!

Located near the hydraulic system vent valve inside the engine compartment.

Stop the engine and wait for all parts to stop and cool before. Hot surfaces and liquids can cause severe burns.

Read the operator's manual before performing any maintenance on the machine.

ISO-Style Information Decal Locations (Later Machines)



1 **Track Front Decal**

Located near the front of the track frame on both sides of the machine

Indicates the front of the track frame.

2 **Lift Point Decal**

Located on both sides of the boom on the dipper arm cylinder bracket and on both ends of the dozer blade.

Apply lift hooks only in these locations.

3 **Hydraulic Fluid Decal**

Located on the back of the cab/ canopy in the location of the hydraulic oil fill (hydraulic oil fill is located inside the hydraulic valve compartment).

USE HYDRAULIC FLUID ONLY!

4 **Diesel Fuel Decal**

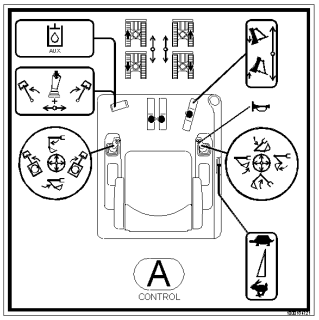
USE DIESEL FUEL ONLY! Located near the fuel filler.

5 **Tie-Down Point Decal**

Located on both ends of the dozer blade and near the rear end of the track frame on both sides of the machine.

Only use tie-down points to secure the machine during transport.

6



Operator Controls Decal

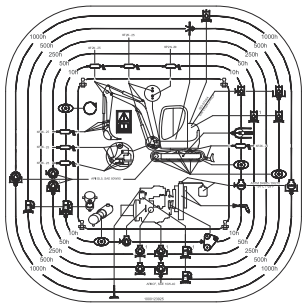
Located on the ceiling inside the cab/canopy.

Provides quick-reference for the SAE operator's control option inside the cab.

Read the operator's manual before operating the machine. Refer to the operator's manual for details about the operator's controls.

ISO-Style Information Decal Locations (Later Machines) (Continued)

7



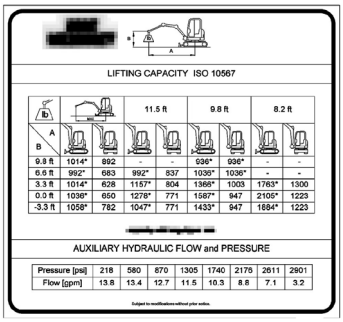
Maintenance Decal

Located on the back window of the cab and the side of the canopy.

Provides maintenance intervals quick-reference.

Read the operator's manual before maintenance on the machine. Refer to "Maintenance Schedule" on page 4-5.

8



Lift Capacity Decal

Located on the back window of the cab.

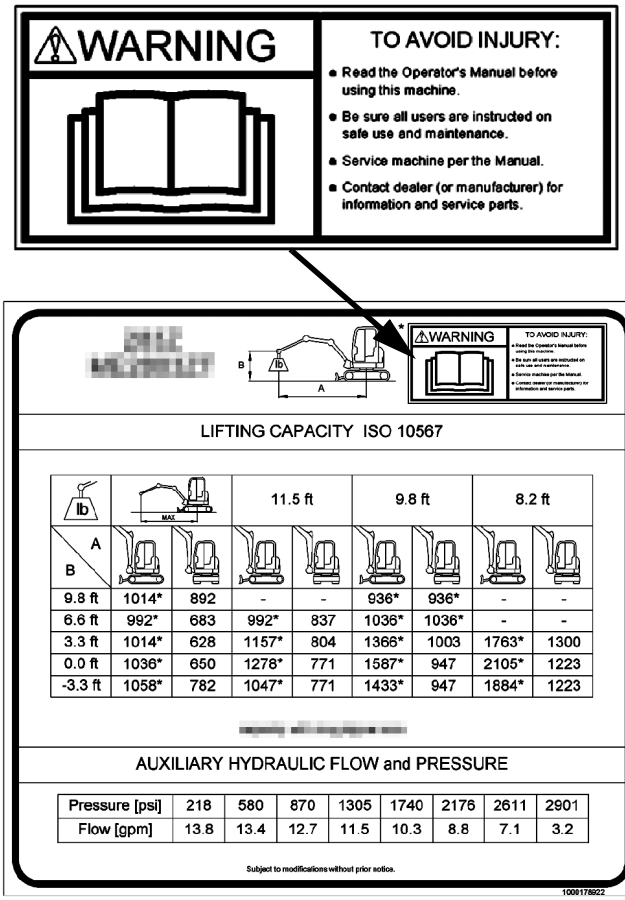
Provides maintenance intervals quick-reference.

Read the operator's manual before maintenance on the machine. Refer to "Maintenance Schedule" on page 4-5.

ANSI-Style Safety/Information Decal Locations (Early Machines)

Lift Capacity Label

(cab/canopy ceiling)



Swing Radius Warning Decal

(boom - both sides)

Read Operator's Manual Decal

(right inside cab/canopy wall)

ANSI-Style Safety/Information Decal Locations (Early Machines) (Continued)

Hydraulic Oil & Pressure Warning Decals
(cab frame above rear cover)

Avoiding Injury Decal
(cab/canopy ceiling)

Shutdown Procedures Decal
(cab/canopy ceiling)

Track Tensioner Warning Decal
(track frame - both sides)

Rotating Fan, Entanglement, and Hot Surface Warning Decals *(inside engine compartment)*

Hot Surface Warning Decal
(inside engine compartment)

ANSI-Style Safety/Information Decal Locations (Early Machines) (Continued)

Front Window Warning Decal

(near cab roof—cab model only)

Avoid Injury Warning Decal

(inside engine compartment)

Rotating Fan Warning Decal

(engine cover hand recess)

CHAPTER 3 – OPERATION

OPERATING CONTROLS

⚠ WARNING

- **Read and understand this entire manual. Follow warnings and instructions for operation and maintenance. Failure to follow instructions can result in injury or death.**
- **Read and understand all safety decals before operating the machine. DO NOT operate the machine unless all factory-installed guards and shields are in place.**
- **Be sure you are familiar with all safety devices and controls before operating the machine.**
- **Know how to stop the machine before starting.**
- **Use only with approved accessories or referral attachments. The manufacturer cannot be responsible for safety if the unit is used with non-approved attachments.**
- **Check for correct function after adjustments or maintenance.**

Machine Orientation

All references to "right" and "left" are determined from the operator's position facing forward.

Guards and Shields

Whenever possible, guards and shields are used to protect potentially hazardous areas on the machine. In many places, decals are also provided to warn of potential hazards and/or to display special operating procedures; see "Safety and Information Decals" on page 2-10.

The left operator's console (A, Figure 3-1) should be raised to enter and exit the cab. In the raised position, the console locks out all hydraulic functions of the machine.

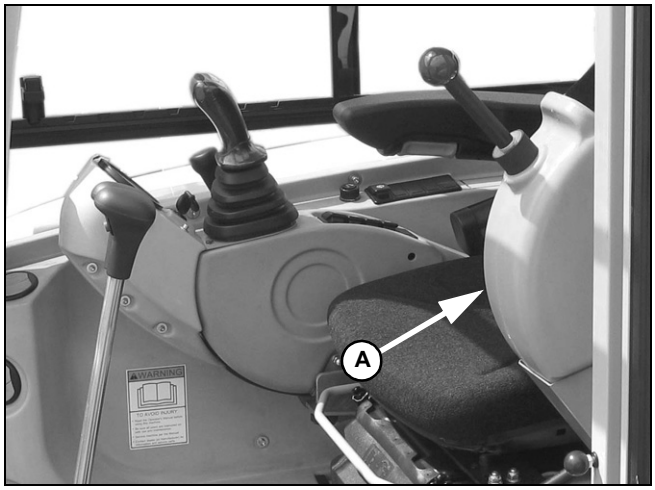


Figure 3-1 – Operator's Left Console in Lock-out Position

The height of the left operator's console can be adjusted using stop bolt (B, Figure 3-2).

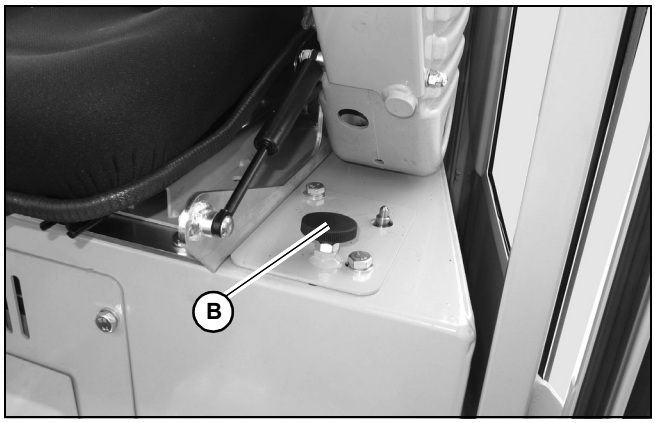


Figure 3-2 – Left Console Height Adjustment

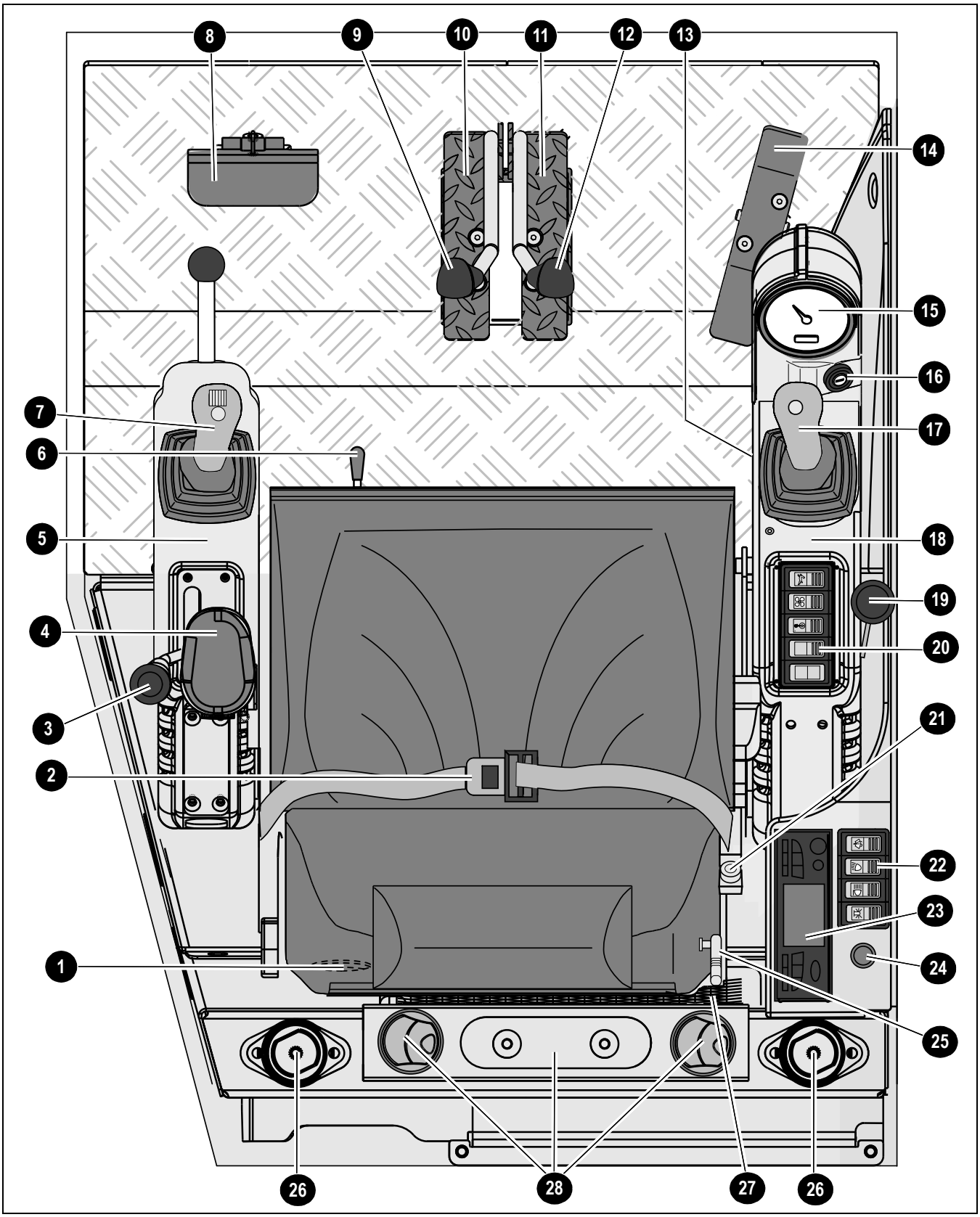
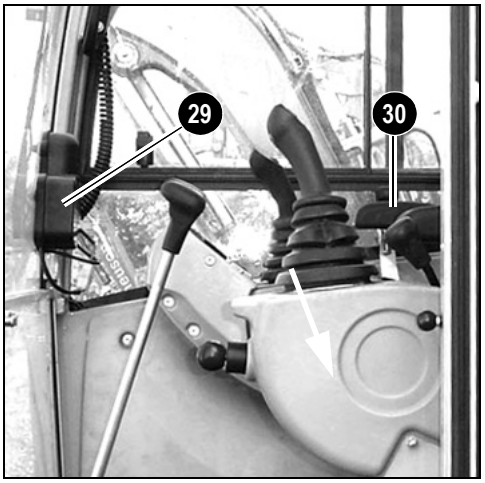
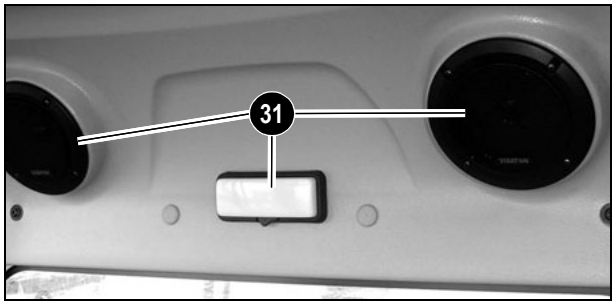


Figure 3-3 – Equipment and Controls

Item	Description	For more info, see page
1	SAE/ISO changeover valve (behind operator's seat)	3-8
2	Seat Belt (latch)	
3	Throttle Lever	3-7
4	Armrest (left)	3-11
5	Control Lever Base (left)	
6	Seat Horizontal Adjustment Lever	3-11
7	Joystick (left)	3-9
8	Hammer Pedal for Boom Swivelling	3-28
9	Drive Lever (left)	3-8
10	Drive Pedal (left)	3-8
11	Drive Pedal (right)	3-8
12	Drive Lever (right)	3-8
13	Air Temperature Control Knob	3-13
14	Auxiliary Hydraulics Pedal	3-28
15	Instrument Cluster	3-4
16	Engine Preheating/Ignition Switch	3-7
17	Joystick (right)	3-9, 3-28
18	Control Lever Base (right)	
19	Dozer Blade Lever	3-7
20	Switch Panel	3-4
21	Seat Backrest Adjustment	3-11
22	Switch Panel	3-4
23	Radio (option)	
24	Cigarette Lighter	
25	Seat Suspension Adjustment	3-11
26	Cab Hold-down Hardware	
27	Storage Net	
28	Cup Holders	
29	Windshield Wiper Motor (cab model only; inside front windshield)	
30	Armrest (right)	
31	Cab Light and Radio Speakers (cab model only; above rear window)	





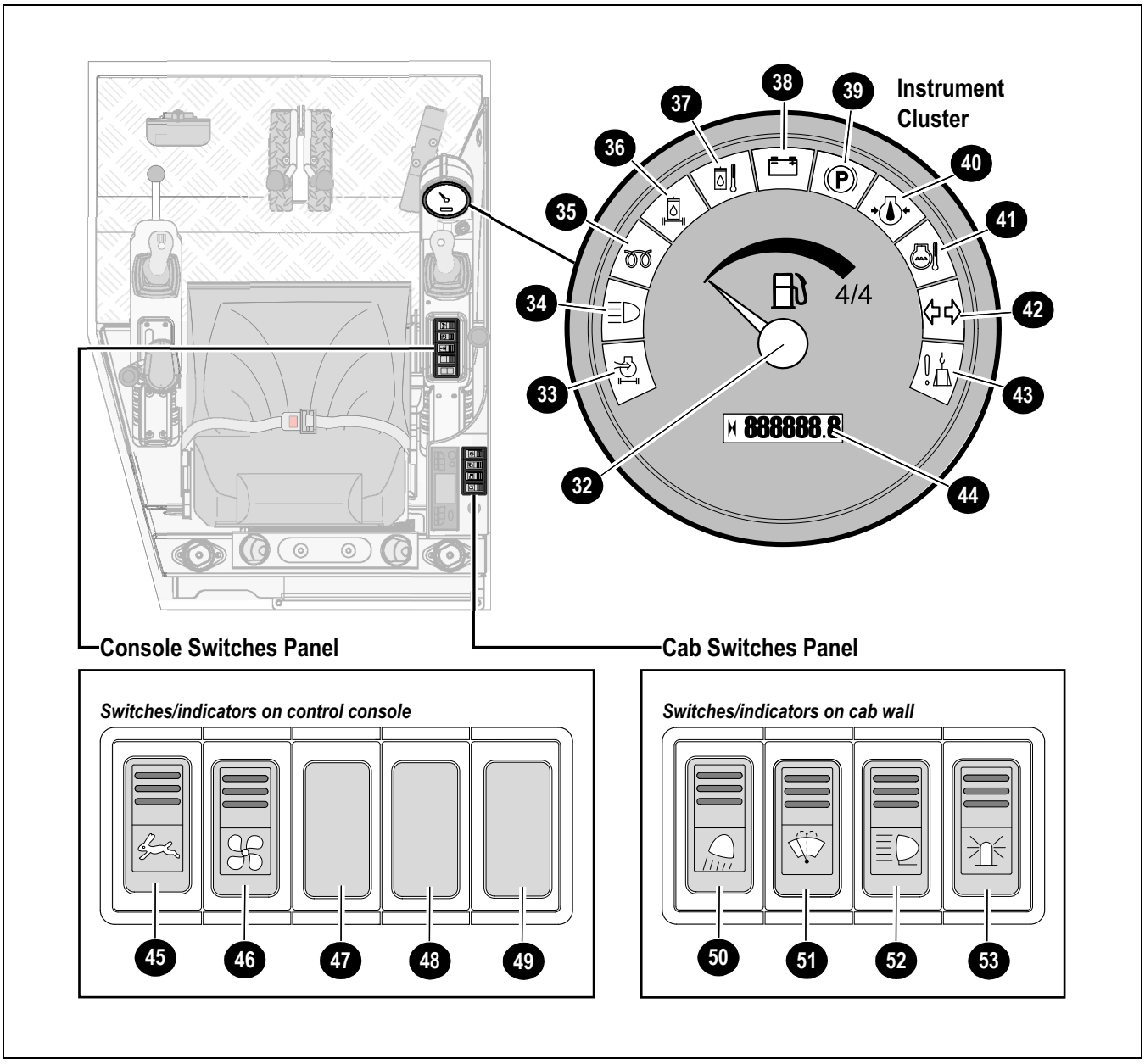


Figure 3-4 – Instrument Panel, Switches and Indicators

Item	Description
32	**Fuel level gauge** – The fuel gauge displays the amount of fuel in the tank.
33	**Unassigned**
34	**Unassigned**
35	**Cold-start indicator (yellow)** – Cold start indicator light comes on when the ignition key is in the glow plug activation position; see "Ignition Key Switch" on page 3-7. Indicator will go out when the engine pre-heater has heated the engine sufficiently to start.
36	**Hydraulic oil filter indicator (red)** – Hydraulic oil filter indicator light comes on when hydraulic oil filter requires servicing or while the hydraulic oil is cold.
37	**Unassigned**
38	**Battery charge indicator (red)** – Battery charge indicator light comes on when the ignition is turned on and goes off when the engine starts. If the indicator light comes on while the engine is running, the battery is not charging, indicating a faulty charging circuit in the alternator or problems with the V-belt. **NOTE:** a faulty V-belt affects cooling pump operation, which can lead to overheating and more serious engine problems. Shut off the engine IMMEDIATELY and determine/fix the cause if this indicator comes on when the engine is running.
39	**Unassigned**
40	**Engine oil pressure indicator (red)** – Engine oil pressure light comes on when the ignition is turned on and goes off as soon as the engine is running. During normal operation, this indicator should remain off. The indicator will light if the engine oil pressure drops too low. If this occurs, shut off the engine IMMEDIATELY and determine the cause of the pressure drop.
41	**Engine coolant temperature indicator (red)** – Coolant temperature indicator light comes on if coolant temperature rises above specification. Shut off the engine and determine/fix the cause if this indicator comes on when the engine is running
42	**Unassigned**
43	**Unassigned**
44	**Hourmeter** – Indicates the total operating hours of the machine. Use the hourmeter to track maintenance in the maintenance log.
45	**Auto2Speed switch (transport speed)** – Pressing the switch will enable high travel speed.
46	**Ventilation fan (two-speed)** – Press the two-position switch to turn on the ventilation fan. Pressing switch to the first position is the low fan speed position, and the second position is the high fan speed position. If the heater control (cab model only) is in the heating position, this switch functions as the cab heater ON/OFF switch.
47	**Unassigned**
48	**Unassigned**
49	**Unassigned**
50	**Boom light** – Press switch ON to turn on the boom work light.
51	**Windshield wiper switch (cab models only)** – Pressing the two-position switch to the first position turns on the windshield wiper. Pressing and holding the switch indicator in the second position activates the washer fluid pump.
52	**Roof work lights (option, cab only)** – Press switch ON to turn on the cab roof work lights.
53	**Rotating beacon (option, cab only)** – Press switch ON to turn on the rotating beacon.

Engine Compartment Components

Note: *See Figure 3-4 for the corresponding numbers.*

1. Windshield washer reservoir (cab only)
2. Air cleaner
3. Engine hood support arm
4. Engine coolant radiator cap
5. Radiator overflow reservoir
6. Engine coolant radiator
7. Battery
8. Engine oil fill (2 places)
9. Engine oil dipstick
10. Engine oil filter
11. Fuel filter
12. Hydraulic transfer case
13. Fuel/water separator
14. Hydraulic fluid level sight gauge
15. Fuse/relay box
16. Hydraulic oil cooler
17. Hydraulic oil pressure breather
18. Engine hood support bracket

Accessing the Engine Compartment

The engine hood must be opened to access the engine compartment. To open the hood, press in the hood latch button (19, Figure 3-6). The hood is secured open when its support arm (3) slides up and drops into the support bracket (18). To release the hood:

1. Push the hood up slightly to take pressure off the support arm (3).
2. With your free hand, lift the support arm and slip it into the hole above the support bracket (18).

   Important: *Ensure support arm (3) passes through the opening in support bracket (18). Prevent support arm (3) from touching air intake hose (19) when closing the hood, or damage to intake hose (19) may result.*
3. Close the engine hood.

The hood is properly closed and secured when the lock button makes an audible click sound. To lock or unlock the hood:

1. Insert the ignition key into the latch button (19).
2. Turn the key **counter-clockwise** (left) to **lock** hood.
3. Turn the key **clockwise** (right) to **unlock** hood.

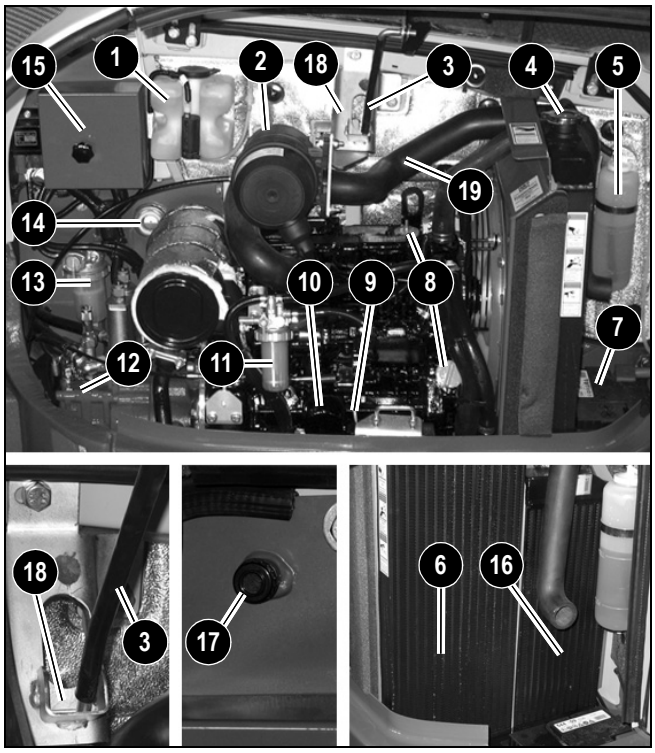


Figure 3-5 – Engine Compartment Components

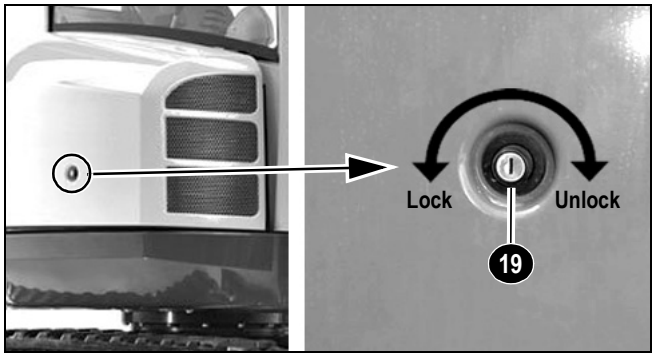


Figure 3-6 – Engine Hood Lock

Ignition Key Switch

Note: *The engine can only be started if the both control lever consoles are pivoted down into the operation position.*

With the key in the fully counter-clockwise "P" position, all power is shut off. The key can be inserted or removed when the switch is in this position.

With the key in the "0" position, power to the accessory circuit is turned on. The key can be inserted or removed when the switch is in this position.

With the key in the "I" position, power is turned on to all controls and electrical circuits. The battery charge indicator light and the oil pressure indicator light will come on.

With the key in the "II" position, the engine pre-heater indicator will come on while the pre-heater warms intake air in cold weather.

With the key turned fully clockwise "III" and held in position, the engine will crank/start. The indicator lights should go out when the engine starts. Release the key after the engine starts (the key returns to the "I" position when it is released after starting the engine).

Note: *The key must be in the "I" position between attempts to start the engine to activate the pre-heat system.*

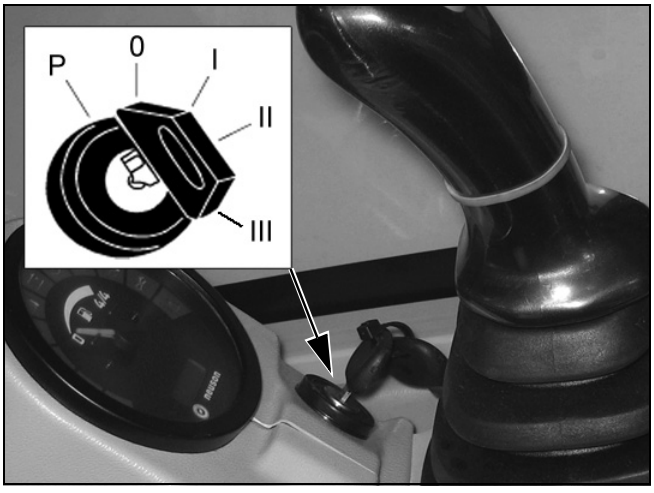


Figure 3-7 – Ignition Key Switch

Boom Swivel Control

The boom can be swiveled without moving the swing frame. See "Swiveling the Boom" on page 3-10.

Dozer Blade Control

The dozer blade is controlled by the dozer control lever (1) located next to the right joystick. See Figure 3-8.

- Push lever forward to lower the blade.
- Pull lever rearward to raise the blade.

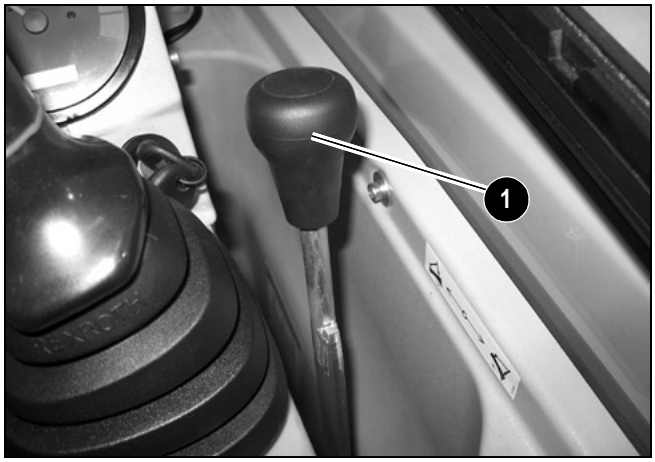


Figure 3-8 – Dozer Blade Lever

Engine Speed Control/Throttle Lever

The engine speed is controlled by the throttle lever (2) located behind the left joystick. See Figure 3-9.

- Push lever forward to decrease engine speed.
- Pull lever rearward to increase engine speed.

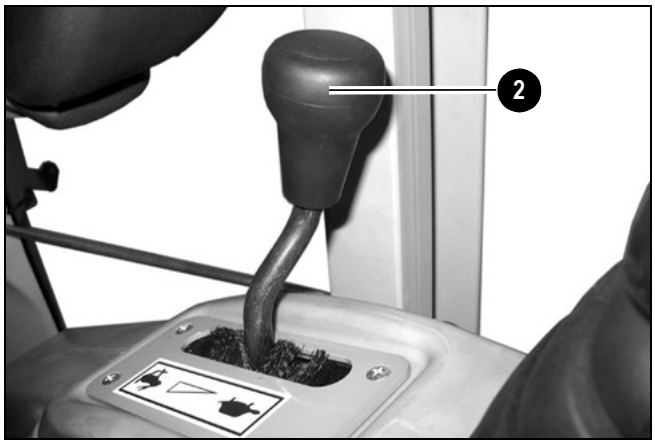


Figure 3-9 – Throttle Lever

Travel Controls

⚠ WARNING

- **Levers and controls should return to neutral position when released.**
- **Be sure the levers and controls are in the neutral (middle) position before starting the engine.**
- **Operate controls gradually and smoothly. Excessive speed and quick control movements without regard for conditions and circumstances are hazardous and could cause an accident.**

⚠ WARNING

Be sure that the dozer blade is "in front." When the operator's cab is facing forward, the blade will be visible and travel controls will operate as expected. If the dozer blade is not visible, the operator's cab is facing to the rear, and the travel controls will operate in reverse.

Forward Travel

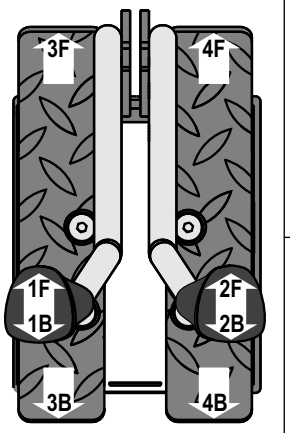
Both travel control levers or pedals must be moved forward. The farther they are moved forward, the faster the machine will travel. See Figure 3-10.

Reverse Travel

Both travel control levers or pedals must be moved rearward. The farther they are moved rearward, the faster the machine will travel. See Figure 3-10.

Turning During Travel

Pivot (wide) turns are made by rotating only one track forward or rearward so the machine pivots on the stationary track. **Spin turns** are made by rotating one track forward and one track rearward. The machine will spin around its mid-point. See Figure 3-10.



F=Forward; B=Rearward

Drive Levers

Move:	For Excavator To:
1F and 2F	Move Forward
1B and 2B	Move Rearward
1F	Wide Turn Right
1F and 2B	Spin Turn Right
2F	Wide Turn Left
1B and 2F	Spin Turn Left

Drive Pedals

Move:	For Excavator To:
3F and 4F	Move Forward
3B and 4B	Move Rearward
3F	Wide Turn Right
3F and 4B	Spin Turn Right
4F	Wide Turn Left
3B and 4F	Spin Turn Left

Figure 3-10 – Travel Controls

Spin Turn

Move the levers in opposite directions to spin the machine on its axis. To spin turn left, move the right control lever forward while pulling the left control lever to the rear; to spin turn right, move the left control lever forward while pulling the right control lever to the rear. See Figure 3-10.

High-Speed Travel

Toggle switch (2, Figure 3-11) controls the two-speed travel drive. Press switch (2) to select high-speed travel. Press switch (2) again to select low-speed travel.

Press and hold switch (3) to change to high-speed travel momentarily.

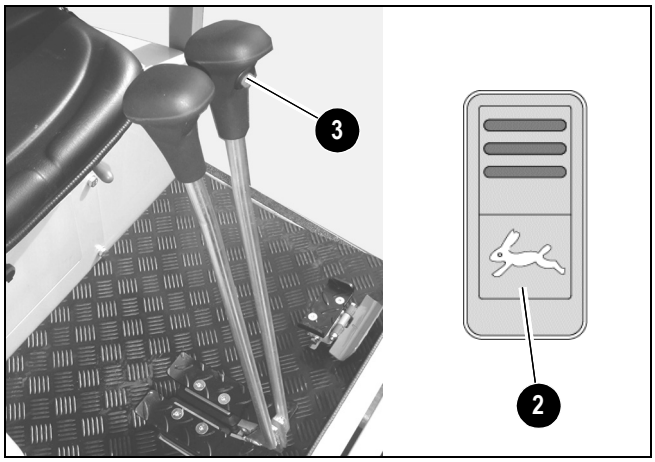


Figure 3-11 – High-Speed Switches

⚠ CAUTION

The high-speed travel setting can reduce traction and will effect control when cornering.

SAE/ISO Selector Valve

The SAE/ISO selector valve is behind the operator's seat and accessible through an opening in the rear cab wall. See Figure 3-12.

Note: *The machine has been set at the factory for SAE standard operation (2).*

To change selector valve setting:

1. Using the horizontal seat adjustment lever (see Figure 3-18 on page 3-11), move the operator seat as far forward as possible.
2. Locate the valve access cover on the rear cab wall (1, Figure 3-12). Open the door to access the valve.
3. Loosen wing nut (4) on top of the valve.
4. Rotate the valve handle 90° to the desired position. SAE is position (2), and ISO is position (3), shown in Figure 3-12.
5. Tighten wing nut (4).
6. Close the valve access cover and return the operator seat to the operating position.

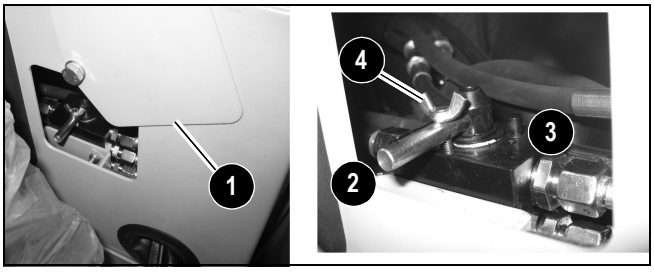


Figure 3-12 – SAE/ISO Selector Valve

SAE Operating Controls

SAE boom and bucket functions are controlled by the right and left joystick control levers located on the seat consoles.

SAE Left Joystick – See Figure 3-13.

1 – Arm extend
2 – Arm retract
3 – Swing left
4 – Swing right

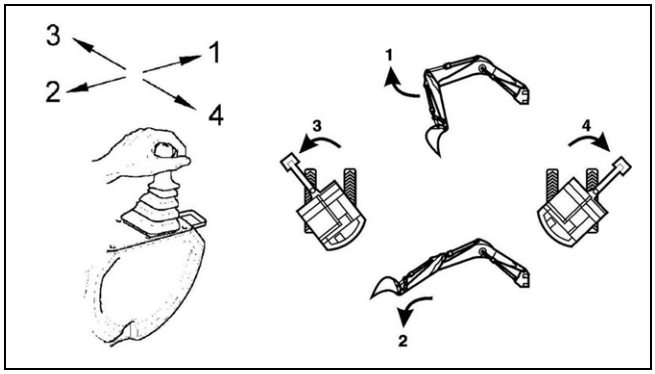


Figure 3-13 – SAE Left Joystick

SAE Right Joystick – See Figure 3-14.

5 – Boom lower
6 – Boom raise
7 – Curl bucket in
8 – Curl bucket out

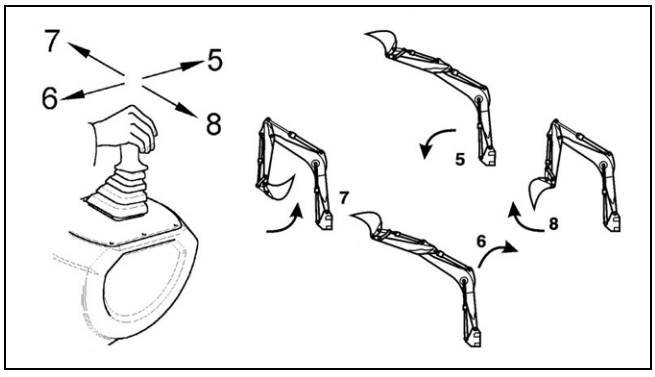


Figure 3-14 – SAE Right Joystick

Note: *The joystick controls are pilot-operated. The farther the controls are moved from center, the faster the machine will function.*

ISO Operating Controls

ISO boom and bucket functions are controlled by the right and left joystick control levers located on the seat consoles.

ISO Left Joystick – See Figure 3-15.

1 – Boom lower
2 – Boom raise
3 – Swing left
4 – Swing right

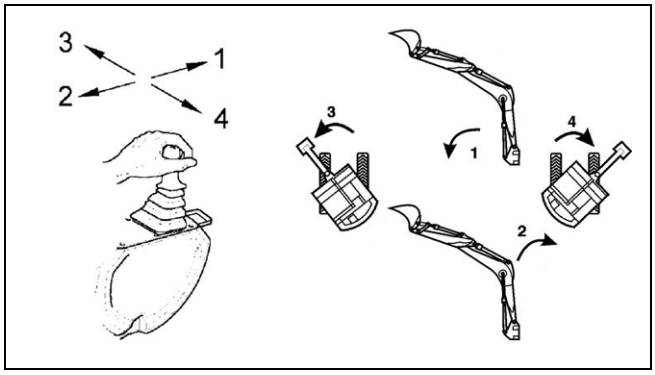


Figure 3-15 – ISO Left Joystick

ISO Right Joystick – See Figure 3-16.

5 – Arm extend
6 – Arm retract
7 – Curl bucket in
8 – Curl bucket out

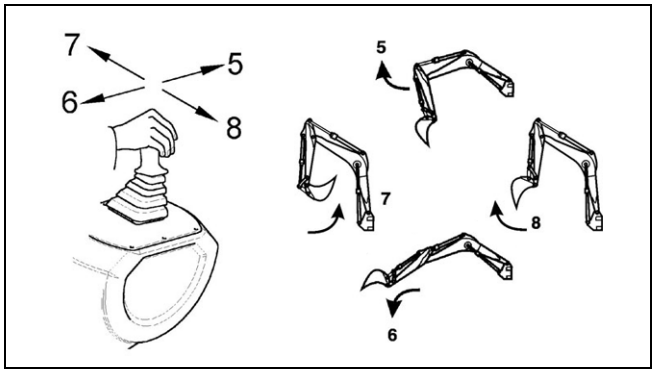


Figure 3-16 – ISO Right Joystick

Note: *The joystick controls are pilot-operated. The farther the controls are moved from center, the faster the machine will function.*

Swiveling the Boom

WARNING

Working with the boom swiveled to the side reduces lifting capacity.

Overloading the bucket can cause an unstable condition and increase the possibility of tipping the machine.

The boom can be swiveled 55º to the right and 75º to the left for excavating trenches along walls, fences, etc. See Figure 3-17.

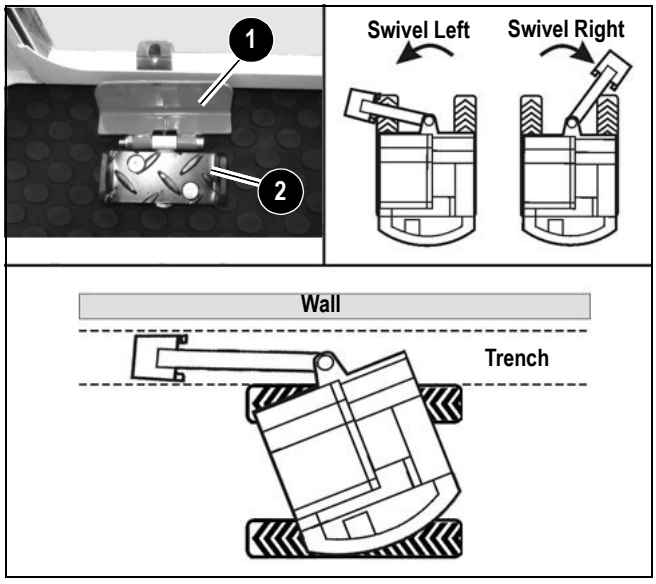


Figure 3-17 – Boom Swivel Controls

Lift cover (1, Figure 3-17) over the hammer pedal and push down on the left or right side of the hammer pedal (2, Figure 3-17) to swivel the boom to the left or right, respectively.

Note: *Bucket controls are not affected when the boom is swiveled.*

CAUTION

Lower cover (1) over the hammer pedal when it is not in use to prevent the boom from swiveling unintentionally.

Operator's Seat Adjustments

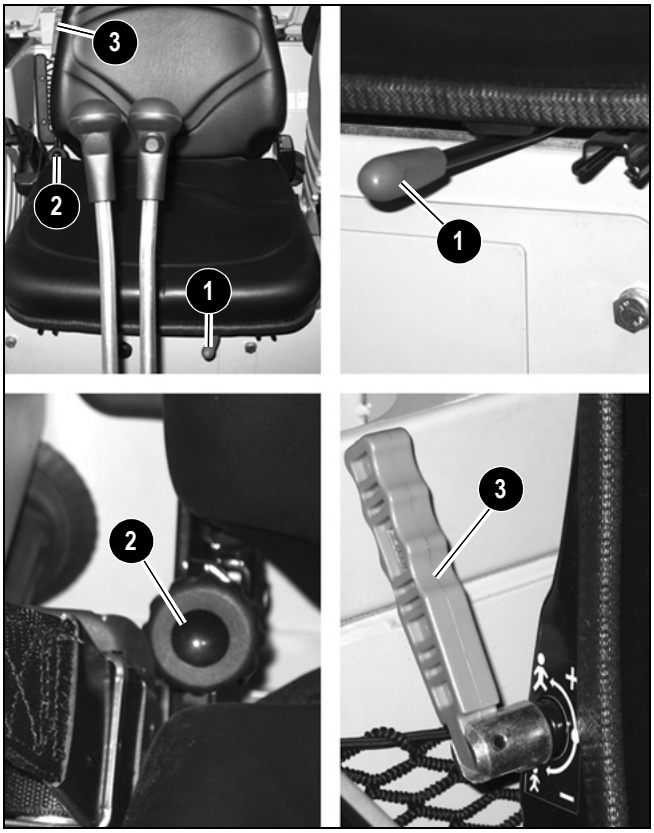


Figure 3-18 – Seat Adjustment

1. **Horizontal Seat Adjustment**

   The seat adjustment lever (1, Figure 3-18) moves the seat forward and rearward. Pull up and hold the lever while moving the seat to the desired position. Release the lever to lock the seat into place.

2. **Backrest Adjustment**

   The backrest adjustment knob (2, Figure 3-18) moves the seat backrest forward (incline) and rearward (recline). Rotate the knob counter-clockwise to recline the backrest and clockwise to incline the backrest.

3. **Seat Suspension Adjustment**

   a. Pull the seat adjustment lever (1, Figure 3-18) and slide the seat as far forward as possible. Release the lever to lock the seat in place.

   b. Locate the seat suspension handle (3, Figure 3-18) on the left side of the seat. Rotate the handle clockwise to stiffen suspension and counter-clockwise to loosen suspension.

   c. Use the seat adjustment lever (1) to return the seat to its previous location.

4. **Armrest Adjustment**

   The armrest on either console is adjusted using knurled-head screw (4, Figure 3-19). Loosen the screw on the armrest you wish to adjust so the armrest bracket can move vertically. Once the desired position is reached, tighten the screw to secure the armrest.

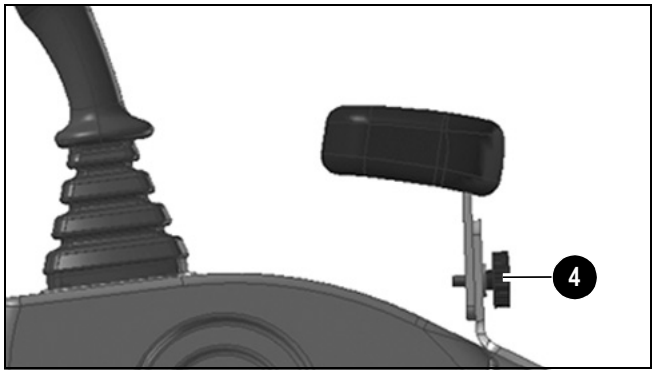


Figure 3-19 – Armrest Adjustment

Seat Belt

⚠ WARNING

ALWAYS fasten the seat belt securely and properly. Never operate the machine without the seat belt fastened around the operator.

Keep the seat belt clean because dirt can impair seat belt operation. Check seat belt condition regularly and have damaged or worn belts immediately repaired by an authorized workshop.

After an accident the seat belt strap is stretched and must be replaced with a new strap installed by an authorized workshop.

Make sure the seat belt is not twisted when it is fastened, and that it is fastened over the hips and not the stomach.

Fasten the seat belt tightly and securely. Remove hard, edged or fragile objects from your pockets or clothes that might lie between the seat belt and your body.

Fastening/Unfastening the Seat Belt

Fasten the seat belt around your hips and waist and insert tab (1, Figure 3-20) into buckle (2) until it clicks securely in place. Slack in the seat belt should automatically retract into seat belt spool (4).

Unfasten the seat belt by pressing button (3).

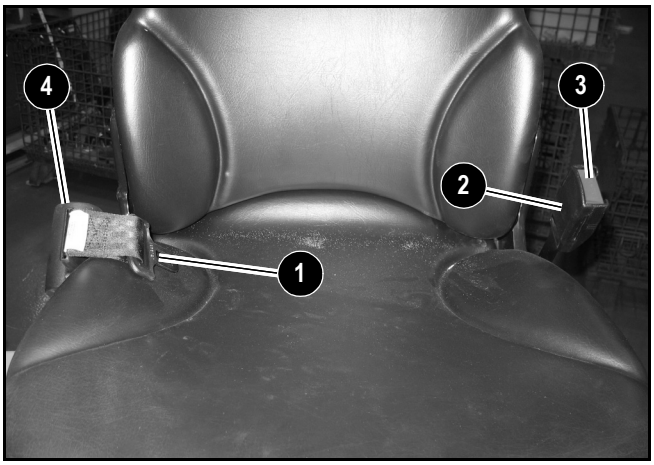


Figure 3-20 Seat Belt

Ventilation (Cab Only)

Windshield

⚠ WARNING

When opening the windshield, be sure to lock both latches. When closing the windshield, keep hands on handle and away from path of window. Head injury can result if the windshield falls unexpectedly.

Opening the Windshield

The windshield can be opened to provide cab ventilation.

1. Push latches (1, Figure 3-21) down on both handles to unlock the windshield.

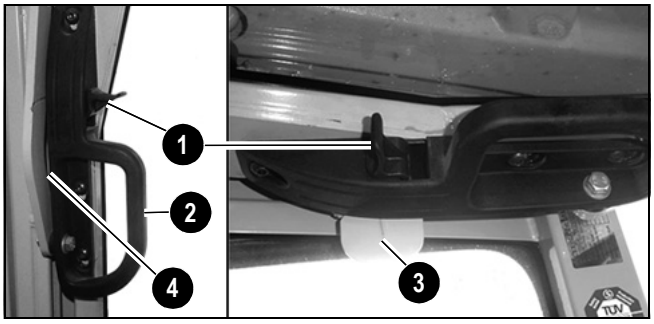


Figure 3-21 – Windshield Handles

2. Pull the windshield inward and push upward to the roof with the handles (2). Align each handle with its corresponding ceiling catch (3). Push the window (1) firmly up and confirm it has locked into the ceiling catches (3).

Closing the Windshield

1. Keep a hand on each windshield handle (2, Figure 3-21) to avoid sudden windshield movement and possible head injury when the windshield is released from the cab ceiling catches.
2. Squeeze each latch (1) until the windshield is released. Pull the windshield down by the handles (2) and push it forward toward the frame. Be sure each latch rests against its cab frame catch (4). Push the window forward (1) and confirm it has locked into the frame catches (4).

Opening/Closing the Lower Front Window

The lower front window (5, Figure 3-22) can be removed.

- To remove the lower front window, open and lock the windshield and lift the lower front window out of the window frame.

  Note: *A storage location for the lower front window is provided between the operator's seat backrest and the rear cab wall.*

- To replace the lower front window, open and lock the windshield and slide the lower front window into the window frame.

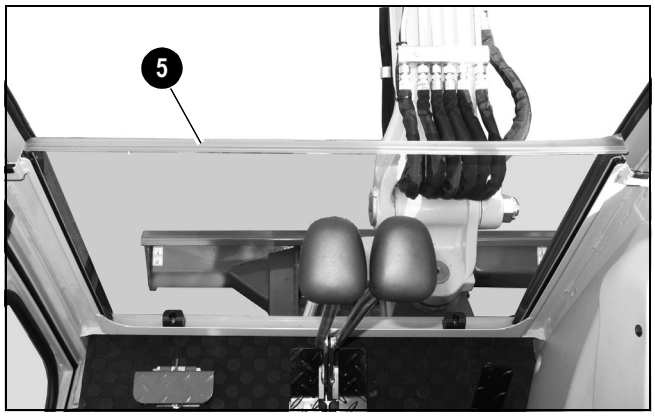


Figure 3-22 – Lower Front Window

Opening the Side Window

IMPORTANT

The side window must be locked into place, whether open or closed, to avoid breakage when driving and working the machine.

1. Press and hold button (5, Figure 3-23) up to release the side window lock.
2. Slide the window to any of the six slots (6) on the track where the lock can be secured.
3. Once the lock is in one of the six slots (6), release the button (5) to secure the side window into place.

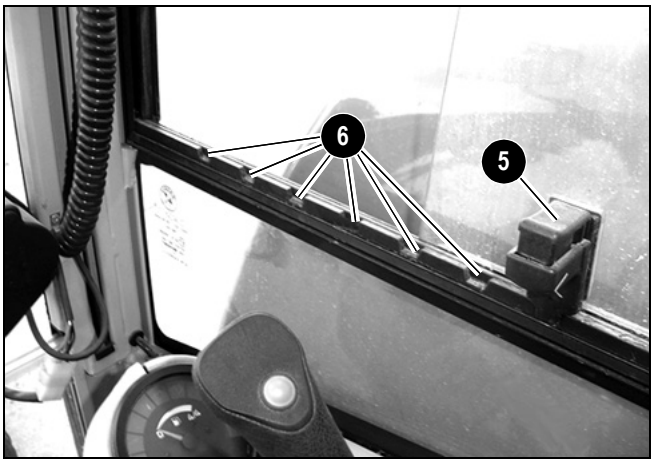


Figure 3-23 – Side Window Lock Release

Opening, Securing and Releasing the Cab Door

The cab door can be secure in the open position for additional ventilation.

1. Press the lever next to the door lock (1, Figure 3-24) down to open the cab door from inside the cab.
2. Open the door and swing it around until the door fastener (2) on the outer door frame engages the door latch (3) on the side of the cab frame. There will be a click sound when the door is securely latched.
3. To release the door fastener, pull knob (4) forward.

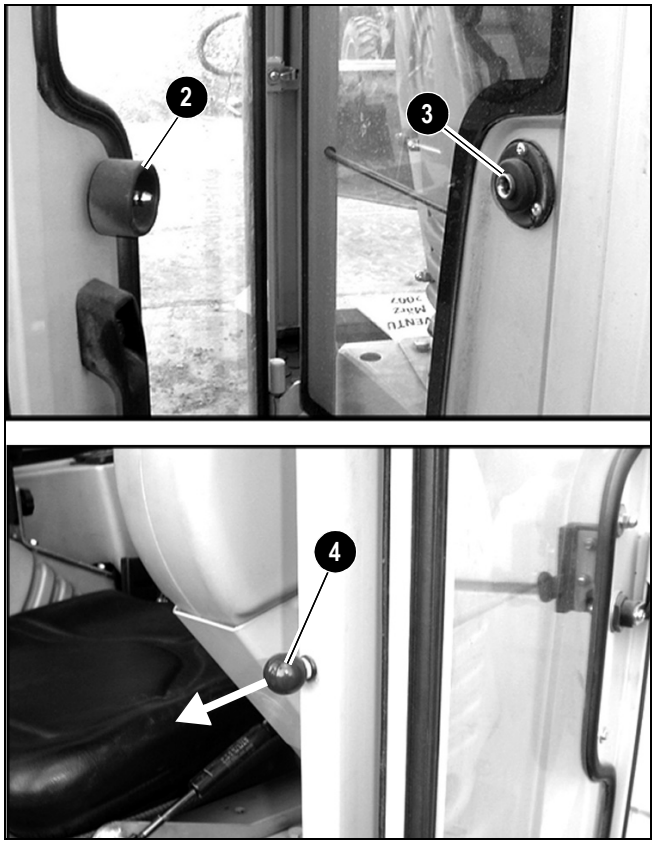


Figure 3-24 – Cab Door

Cab Air Circulation/Heat Control (cab only)

Air is circulated through the grille underneath the operator's seat (5, Figure 3-25). Air flow is controlled with the fan speed switch (7) located on the switch panel.

During colder months, the cab can be heated using the heater control knob (6). The knob is on the cab right-side wall near the floor. Rotate the control knob clockwise to lower the circulated air temperature, and counter-clockwise to raise the circulated air temperature.

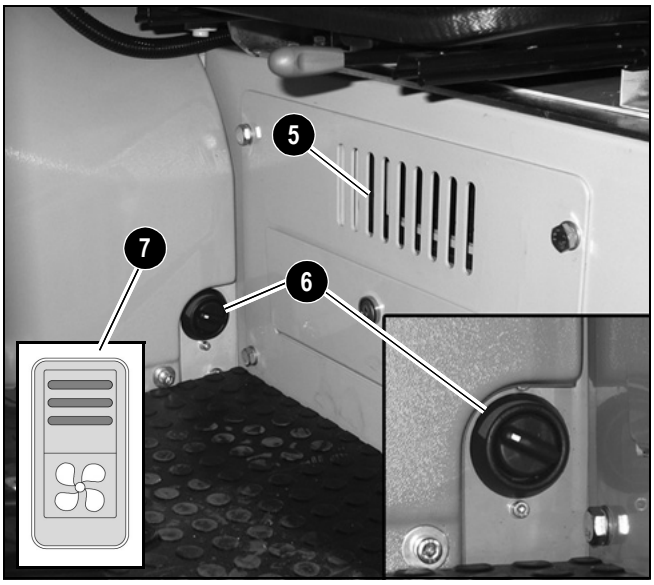


Figure 3-25 – Cab Heater Control

MACHINE OPERATION

⚠ WARNING

- **Read and understand this entire manual. Follow warnings and instructions for operation and maintenance. Failure to follow instructions can result in injury or death.**
- **Read and understand all safety decals before operating the machine. DO NOT operate the machine unless all factory installed guards and shields are in place.**
- **Be sure you are familiar with all safety devices and controls before operating the machine.**
- **Know how to stop the machine before starting.**
- **Use only with Manitou Americas-approved accessories or referral attachments. The Manitou Americas cannot be responsible for safety if the unit is used with non-approved attachments.**
- **Check for correct function after adjustments or maintenance.**

Pre-Operation Checklist

IMPORTANT

See the table of recommended lubricants in "Fluid Capacities/Lubricants" on page 1-4 for the proper engine and hydraulic oil specifications. Only use lubricants specified in the table.

Check the following items at the beginning of each work day or every 12 working hours:

- Seat belt and mounting hardware
- Safety decals (replace as required)
- Air cleaner and intake hoses
- Engine coolant level and system for leaks
- Clean engine area of any flammable materials (clean as required)
- Engine oil level (fill if required)
- Hydraulic system for leaks
- Hydraulic fluid level (fill if required)
- Pivot points for proper operation
- Track tension and condition
- Windshield washer reservoir level (cab machines only)
- Attachment safely locked onto machine and attachment condition
- V-belt condition and tension
- Lubrication points lubricated
- Broken and/or loose parts (repair as required)
- Engine cover securely latched
- Fuel level

IMPORTANT

Do not run the engine until the fuel tank is completely empty. If this happens, air will enter the fuel system, and the fuel system will have to be bled. Always fill the tank with fresh fuel at the end of the working day.

⚠ WARNING

Never use ether starting aids. A pre-heater is used for cold weather starting. The pre-heater can cause ether or other starting fluid to detonate, causing injury.

Engine Start

Note: *When all machine controls are stationary (no pilot control pressure), the swing motor and travel motor brakes are automatically applied. When any control is activated, the appropriate brake is automatically released.*

Note: *All hydraulic functions are locked out when the operator's seat left console is in the raised position.*

Engine Start Procedure

⚠ DANGER

DO NOT run the engine in an enclosed area without proper ventilation. Be sure there is adequate fresh air if running the machine in an enclosed area.

1. Adjust the operator's seat to desired settings.
2. Fasten the seat belt.
3. Pivot the left control console down.
4. Be sure all levers and controls are in the neutral positions.
5. Insert the ignition key into the switch and turn it clockwise to the "I" position; see Figure 3-7 on page 3-7. Indicators for oil pressure and battery voltage will light. In cold weather, the glow plug indicator will come on while the glow plugs warm the engine.
6. Turn the key fully clockwise and hold it until the engine starts, and then release the key.

Note: *The key must be returned to the OFF position between attempts to start the engine in order to activate the pre-heating system.*

IMPORTANT

Do not activate the starter motor for longer than 20 seconds during each starting attempt. If the engine does not start, turn the key to the OFF position, wait 30 seconds, and then attempt to start the engine again.

IMPORTANT

Indicator lights must go out when engine starts. If they do not, turn the engine off IMMEDIATELY. Do not use the machine until the problem has been identified and repaired.

7. If necessary, clean the tracks. See "Track Cleaning" on page 4-22.
8. Allow engine to warm up at idle speed for approximately 10 - 15 minutes to fully warm up all systems before using the machine at maximum loads and speed. Use the warm-up time to check for unusual noise, exhaust color, leaks, malfunctions or damage. Additionally, check instruments and indicators and controls pedals/levers for any malfunctions. If anything is detected, shut down the machine, determine the cause, and have it repaired.

Cold-weather Engine Starting Procedure

Note: *Install an in-block engine heater to keep engine block and oil warm for easier cold-weather starting.*

Note: *Be sure the engine oil is correct type and viscosity for the ambient (air) temperature. Refer to "Fluid Capacities/ Lubricants" on page 1-4.*

Note: *Be sure the battery is fully charged.*

1. Start the engine according to "Engine Start Procedure" on page 3-17.
2. Advance the throttle to 1/4 engine speed for a faster warm up.
3. As the engine warms up, move the throttle lever to the idle position.

Engine Shut-down

Perform the "Mandatory Safety Shutdown Procedure" on page 2-2 before leaving the machine:

1. Lower the working equipment to the ground and support it securely.
2. Run the engine at idle speed for a few minutes to allow systems to cool after operation at full speed.
3. Turn the key fully counter-clockwise to shut off the engine.
4. Lock out controls by raising left control console.
5. Remove the ignition key and take it with you.

New Machine Break-in Procedure

A new machine requires reduced operational speed during the first 100 operating hours for proper break-in. If the machine is subjected to hard use during the break-in period, damage to operating systems may occur.

Perform the following when operating a new machine:

- Check all fluid levels:
  - Engine oil
  - Engine coolant
  - Hydraulic fluid
- Start engine and let it idle for 10 - 15 minutes so all components and systems can warm up.
- Operate machine at about 80% of maximum loads and speed.
- Do not abruptly change engine speed during operation.
- After the first 100 operational hours, drain and replace the engine oil and engine oil filter.

Travel

⚠ WARNING

- **Before operating the travel levers, be sure you know which direction the machine is pointing. If the dozer blade is not visible from the operator's cab, you are facing the rear of the machine and the travel controls will be the reverse of normal operation.**
- **Before moving, be sure no one is in the way of the machine. Sound the horn as an alert that you are about to move the machine.**
- **Be sure the path is clear during travel.**
- **Use extreme caution when reversing travel. Be sure there is a clear path behind the machine.**
- **Operate the travel control levers smoothly to avoid sudden starts and stops.**
- **Before leaving the operator's seat, be sure to lock out all control systems and shut down the engine to avoid accidental activation.**

Travel Speed Selection

Two travel speed ranges can be selected by using the Auto2Speed switch (1, Figure 3-26) located on the control console. The machine's transmission automatically switches from high to low speed when it senses a load during operations such as grading, changing direction, and travelling uphill. The transmission automatically returns to the higher speed once the resistance is gone.

Travel speeds are:

- Slow Speed (maximum): 1.3 mph (2.1 km/h)
- High Speed (maximum): 2.4 mph (3.8 km/h)

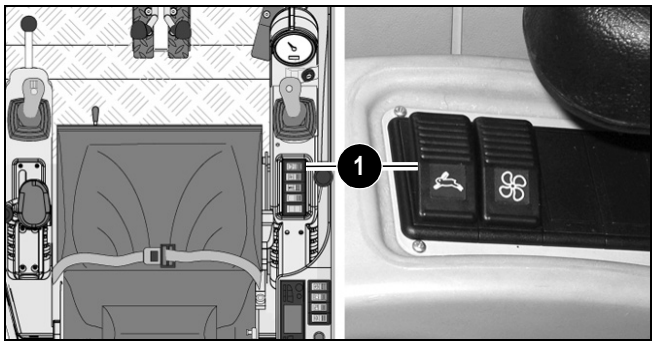


Figure 3-26 – Travel Speed Selection

General Travel Instructions

1. Avoid sudden movements and sharp turns.
2. Travel slowly on rough, frozen, or uneven terrain.
3. Travel straight up and down slopes – never across. See Figure 3-29. Extend the dipper arm and lower the boom to keep the bucket about 12" (300 mm) off the ground. If the machine starts to slide or becomes unstable, lower the bucket to regain control. If the engine stalls, lower the bucket, make sure all controls are in the neutral position and restart the engine.
4. See "Travel Controls" on page 3-8 for moving the machine forward, rearward, or turning it in either direction.
5. The excavator can travel in water as deep as the top of the upper track rollers. Be sure that the footing is solid so that the machine will not sink.

Operating Instructions

Operating Precautions

DANGER

- **DO NOT elevate the front end of the tracks using downward pressure on the dozer blade. This will cause the machine to become unstable.**
- **DO NOT excavate underneath the machine.**
- **Always be sure that there is adequate support when working near trenches. Be aware of conditions that could cause the earth to collapse, resulting in risk of injury or death.**
- **Be sure there is the proper clearance from overhead electrical lines.**
- **Be sure that all underground electrical power and gas supply lines are clearly marked and avoided.**

WARNING

- **DO NOT rest your feet on the travel pedals during normal machine operation. Unexpected machine movement could occur.**
- **When working close to an excavated edge, be sure that the ground the machine is sitting on is solid and keep the travel motors to the rear. See Figure 3-27.**

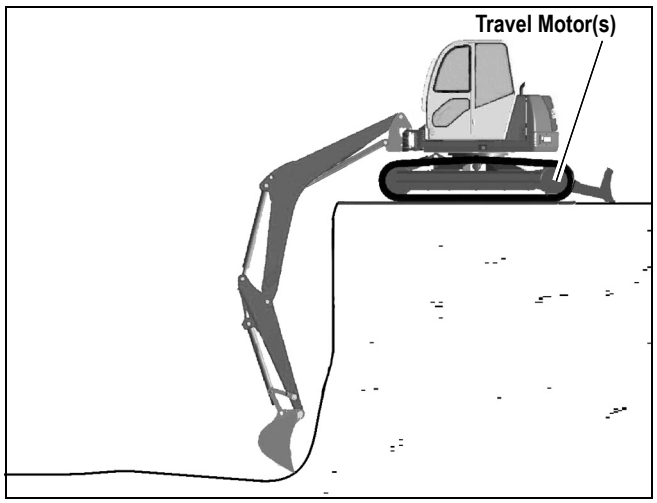


Figure 3-27 – Machine Position for Edge Excavating

DO NOT use machine travel or swing to provide additional breakout force when the bucket is in the ground.

DO NOT jam the bucket into the ground and/or use the weight of the machine to provide additional breakout force.

DO NOT use the bucket as a hammer or ramming device.

When working on soft or muddy ground, be sure that the machine does not sink.

IMPORTANT

When digging at maximum excavation depth, BE SURE that the dozer blade does not contact the boom cylinder. Damage to the boom cylinder can occur if it contacts the dozer blade.

Joystick Controls

Extending and retracting the cylinders (boom, dipper arm and bucket) are controlled by the joysticks located on the consoles attached to the operator's seat. See the information starting on page 3-9 for control configurations.

Note: *The joystick controls are pilot-operated. The farther the controls are moved from center, the faster the machine will function.*

Hydraulic Swivel Unit Brake

The upper carriage's rotation is sufficiently braked by moving the control lever back to the initial position. Moving the control lever in the opposite direction brakes the upper carriage with full hydraulic pressure.

IMPORTANT

Hydraulic swivel unit brake function is not optimal if the hydraulic system has not reached operating temperature.

Mechanical Stop Brake

A multi-disc brake integrated into the rotation drive has an additional mechanical brake effect with a time delay. This brake is used to prevent unintentional swivel unit rotation.

Slope Operation

⚠ WARNING

- **Do not travel up or across a slope steeper than 15°. Do not travel down a slope steeper than 25°. Keep the boom centered while traveling.**
- **Keep attachments as low as possible when traveling on slopes or rough terrain.**

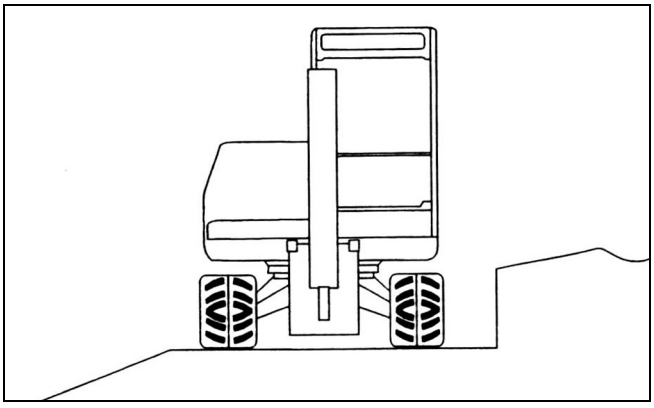


Figure 3-28 – Working from a Level Area

Operating on a slope is hazardous. It is recommended the work area be leveled as shown in Figure 3-28. If this is not possible, use the following guidelines:

- Travel straight up and down slopes — never across. See the bottom of Figure 3-29. Extend the dipper arm and lower the boom to keep the bucket about 12" (300 mm) off the ground. If the machine starts to slide or becomes unstable, lower the bucket to regain control. If the engine stalls, lower the bucket, be sure that all controls are in the neutral position and restart the engine.
- When traveling down a slope, put the machine in the position shown in the middle of Figure 3-29, control the speed with the travel levers and the throttle controls, and reduce engine speed.

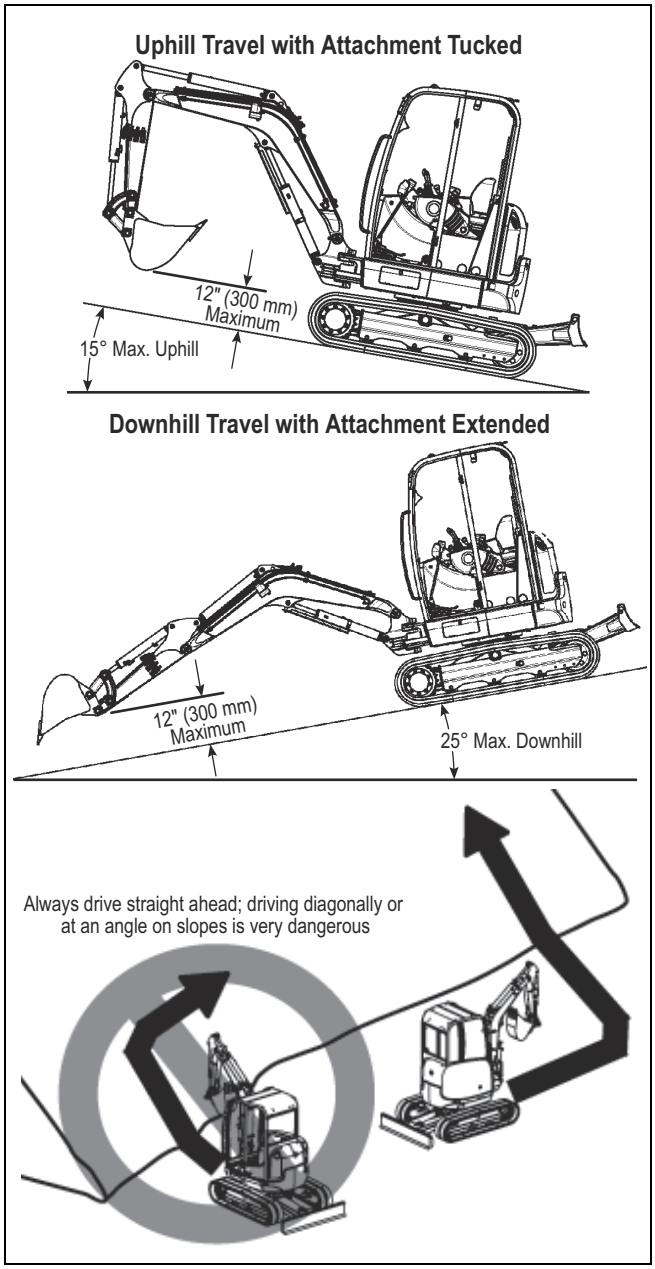


Figure 3-29 – Traveling Up or Down Slopes

- To achieve the best stability while excavating, lower the dozer blade to the ground.
- Operate as slowly as possible and avoid sudden changes in direction.
- Avoid traveling over objects such as rocks, trees, stumps, etc.
- Stop the machine travel before moving the bucket or dozer controls.
- Slow the work cycle. Take your time.
- Avoid working with the tracks positioned across the slope. Position the machine with the dozer blade downhill and lowered.
- Avoid swinging or extending the bucket farther than necessary in a downhill direction. If you must swing the bucket downhill, keep the boom low and skid the bucket along the ground.
- When working with the bucket on the uphill side, keep the bucket as close to the ground as possible. Unload far enough away from the excavation to prevent the possibility of a cave-in.

Cold Weather Operation

In cold weather, mud should be removed from the machine before parking. If possible, park the machine on solid ground, or on wood planks, to prevent the track or undercarriage from freezing to the ground.

Operating in Water

1. In cold weather, remove mud and/or water from the machine before parking. If possible, park the machine on solid ground, or wood planks, to prevent the track or undercarriage from freezing to the ground.
2. Do not operate or immerse the machine in water higher than the tracks.
3. Thoroughly grease the machine if it has been operated in deep water.

Excavation

The following section applies to an excavator with a standard bucket, which is used mainly for digging into the ground to loosen, excavate and load loose or solid material.

IMPORTANT

The excavator attachments should never be used to perform actions other than digging, grading, loading or excavating. Equipment damage may result when:

- **the machine's swivel force is employed so the bucket serves as a hammer or battering ram (1, Figure 3-30).**
- **the bucket is lowered into the ground while rotating the upper carriage or driving the excavator (2).**
- **the dipper arm's falling force is employed so the bucket serves as a hammer, hoe or pile-driver (3).**
- **the machine's falling force is employed for digging or excavating (4).**

- Use caution when retracting the bucket to prepare for driving or transport. Hitting the bucket into the dozer blade might damage either attachment, especially the bucket teeth.
- The dozer blade is meant for grading only; using it as a battering ram risks serious damage to the blade, its cylinder or connections.
- When excavating, lower the dozer blade to the ground to aid machine stability. It is best to use the dozer blade on the same side as excavating but lower the blade on the opposite side of excavating if the situation prevents the former.

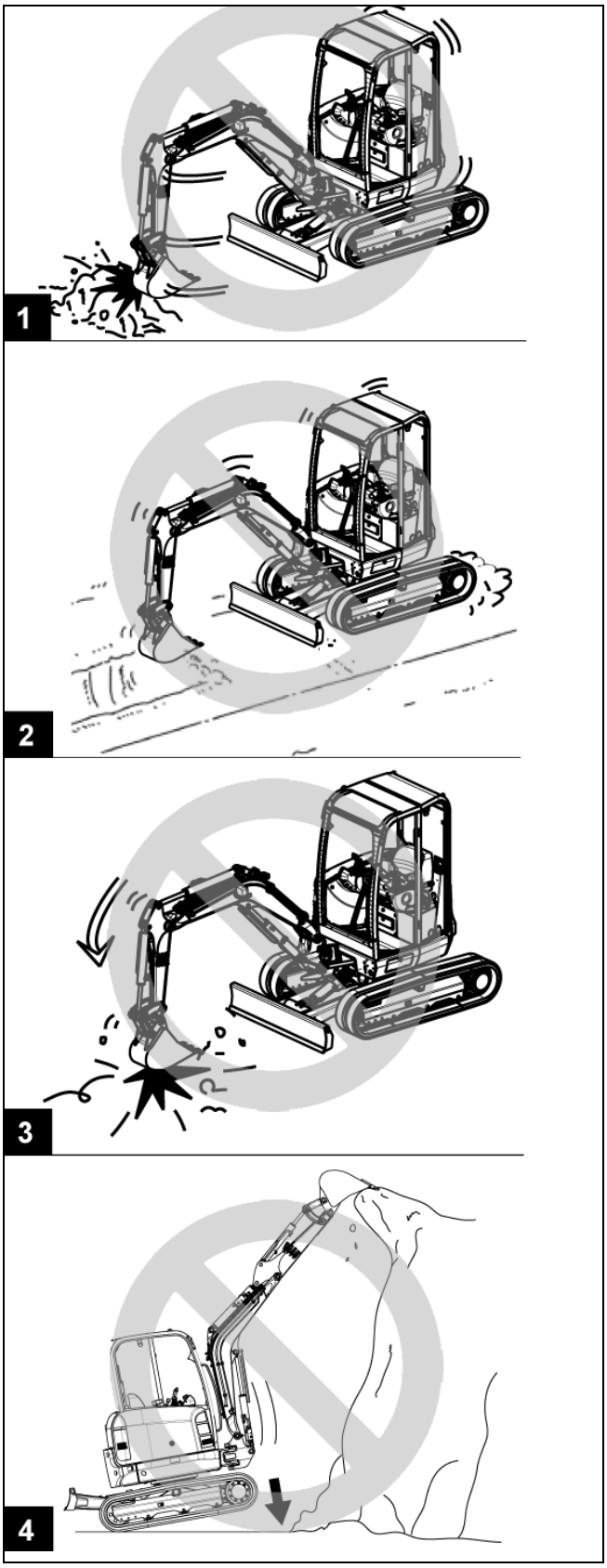


Figure 3-30 – Machine Operation Exclusions

Proper Excavation Bucket Position

Move the flat side of the bucket cutting edge so it is parallel to the ground. See 1, Figure 3-31.

IMPORTANT

Positions 2 and 3 in Figure 3-31 show improper positions for using the bucket.
Position 2 forces the bucket downward into the ground, slowing work and subjecting the engine and hydraulic pump to overloading.
Position 3 forces the bucket upward toward the ground surface, slowing work because of smaller loads being dug.

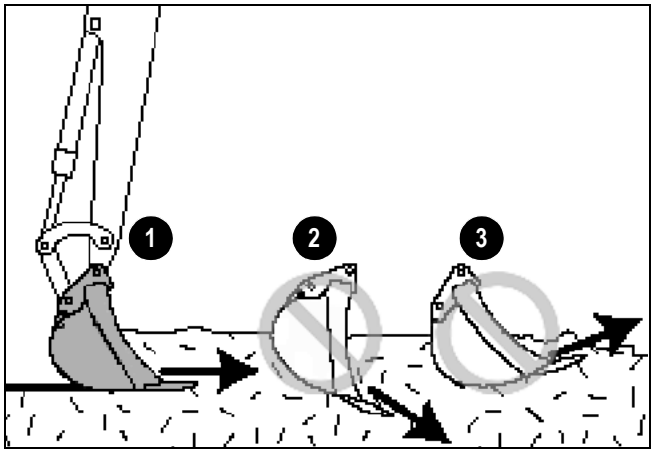


Figure 3-31 – Proper Bucket Position

Proper Digging Technique

1. Lower the bucket into the ground (4, Figure 3-32).
2. Once the bucket penetrates the ground, adjust so the flat side of the cutting edge is parallel to the ground (5, Figure 3-32).
3. Pull the bucket towards the excavator by:
   a. Moving the dipper arm towards the excavator and
   b. Lowering the boom.
4. Once the bucket is sufficiently filled:
   a. Continue moving the dipper arm towards the excavator.
   b. Extend the dipper arm cylinder so the bucket is tilted upward (6, Figure 3-32) and
   c. Raise the boom.

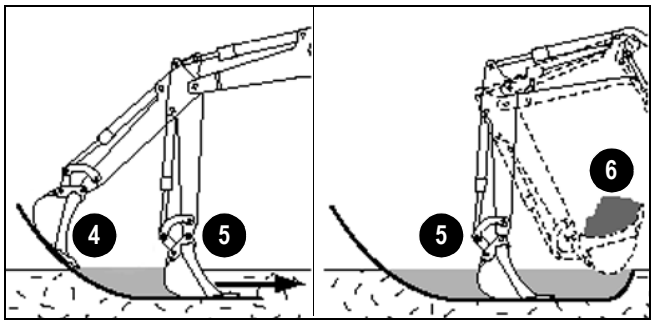


Figure 3-32 – Proper Digging Technique

Trench Excavation

Trench excavating is most efficient when the machine tracks are parallel to the limit line of the trench. See Figure 3-33. For large trenches, excavate both ends of the trench first and then the center.

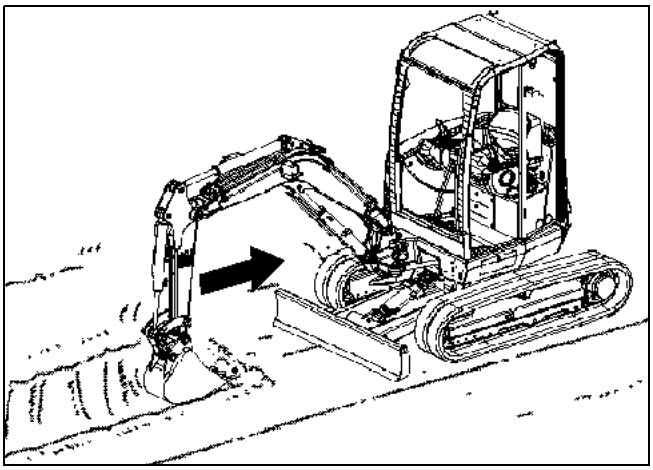


Figure 3-33 – Efficient Trench Excavating

When trench excavating is needed in confined areas, the excavating can be done by rotating the upper carriage and swiveling the boom. See Figure 3-34.

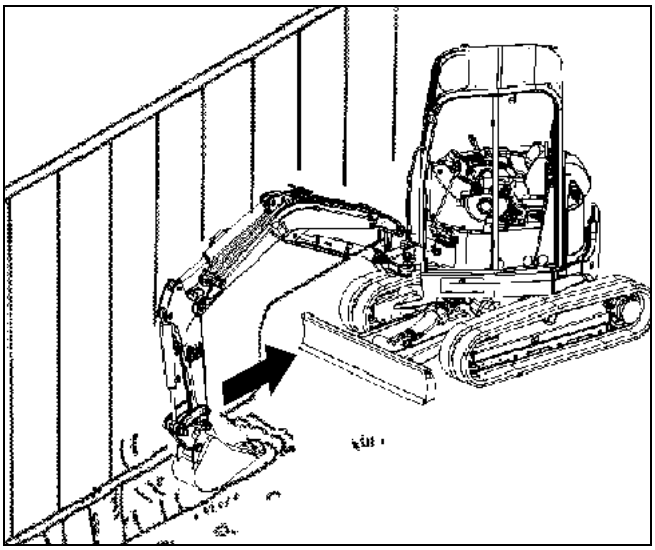


Figure 3-34 – Excavating Trenches Sideways

- Working alongside trenches and deep excavation are two applications where the dozer blade might restrict bucket movement. When working alongside trenches, lower and place the dozer blade onto the ground for greatest stability. When deep excavating, position the machine so the lowered dozer blade is on the side opposite the excavation to avoid contacting the boom cylinder against the dozer blade. See Figure 3-35.

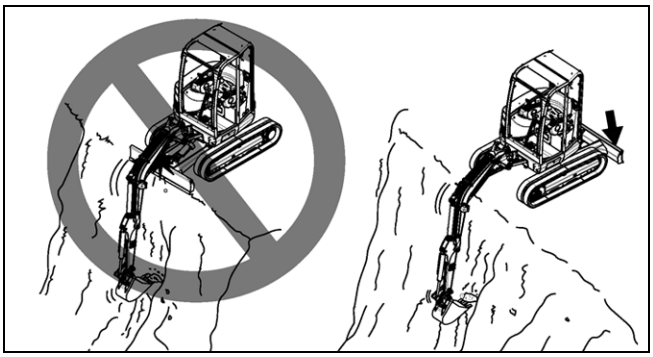


Figure 3-35 – Machine Position for Deep Excavating

⚠ WARNING

Placing the dozer blade on the opposite side of the excavating decreases machine stability. Always operate the machine with operator safety in mind, especially when less-than-ideal working conditions exist.

Grading (Bulldozing)

⚠ WARNING

- **Be sure there is proper clearance for attachments when bulldozing.**
- **Be sure that attachments do not contact overhead power lines or obstructions during bulldozing.**
- **DO NOT drive the machine into the excavation or onto loose soil, which can cause an unstable condition, and could possibly tip the machine.**

1. Raise or lower the dozer blade using the control lever (1, Figure 3-36) located next to the right joystick. Move the lever forward to lower the dozer blade and rearward to raise it.

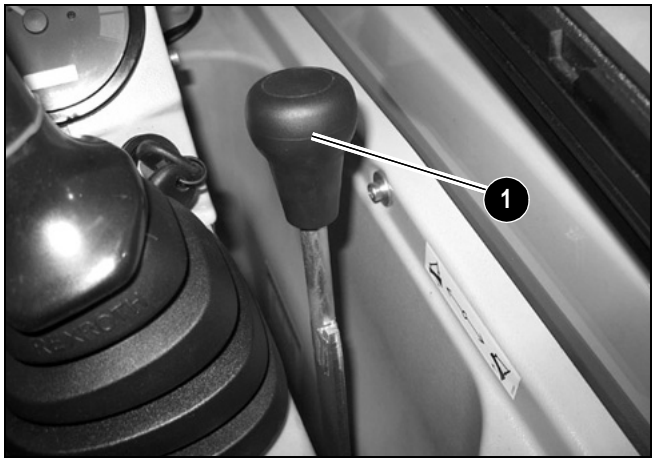


Figure 3-36 – Dozer Blade Lever

2. The boom must be fully raised and the bucket curled in (up) when grading.
3. When grading, the material may be pushed away to the front or the side.
4. Raise the dozer blade slightly if excessive resistance occurs.

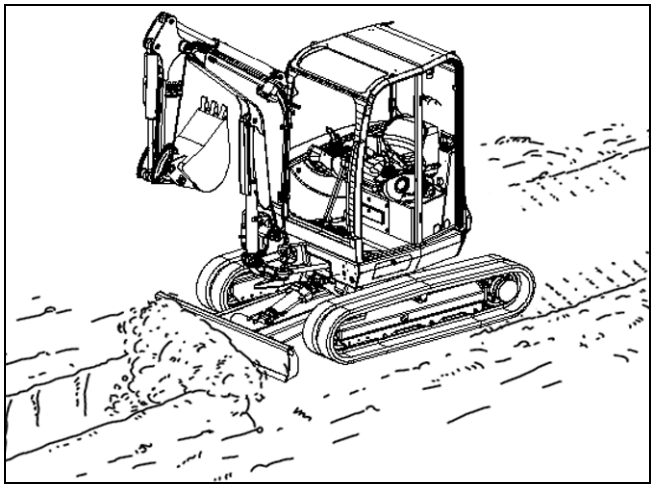


Figure 3-37 – Grading

Loading Vehicles

When loading vehicles, consider the following:

- Whenever loading in a confined area with a limited range of motion, position the truck so maximum visibility is ensured for the excavator operator.
- When work conditions permit, position the truck so the excavator can load material at the rear of the truck instead of the sides (1, Figure 3-38). The most effective way to load into the rear of the truck is when the truck and excavator form a 45° angle (2, Figure 3-38).
- Raise the boom and dipper arm to dump height just before you rotate towards the truck.
- Whenever possible, dump upwind to keep dust and airborne debris away from your eyes, and the excavator air filters and fans.

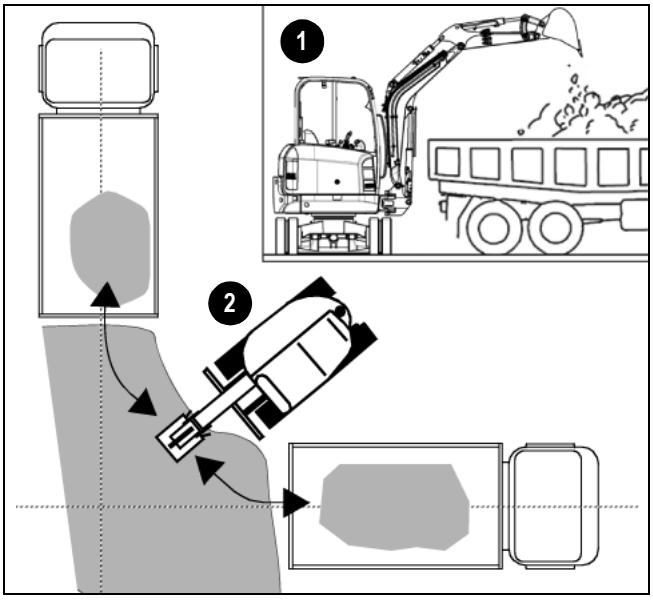


Figure 3-38 – Loading Vehicles

Bucket Mounting/Removal

ALWAYS wear protective goggles, helmets, gloves, steel-toed shoes, etc.

DO NOT service the bucket while the engine is running.

DO NOT stand behind the bucket when removing the pins.

DO NOT use your hands or fingers to align the bucket and dipper arm holes.

ALWAYS verify the bucket is safely locked before starting the engine and resuming operation.

⚠ WARNING

- **DO NOT use a hammer directly on a securing pin to loosen it. The pounding may cause splintering, which may lead to serious injury.**
- **The bucket can crush hands or feet. DO NOT use your hands or feet as substitutes for the correct equipment.**

Bucket Removal

1. Lower the bucket to the ground with the flat side facing down (1, Figure 3-39).

IMPORTANT

Place the bucket against the ground with minimum pressure. More pressure increases resistance, which will make it more difficult to remove the pins.

2. Stop the engine.
3. Remove the two lynch pins (2A and 2B, Figure 3-39).

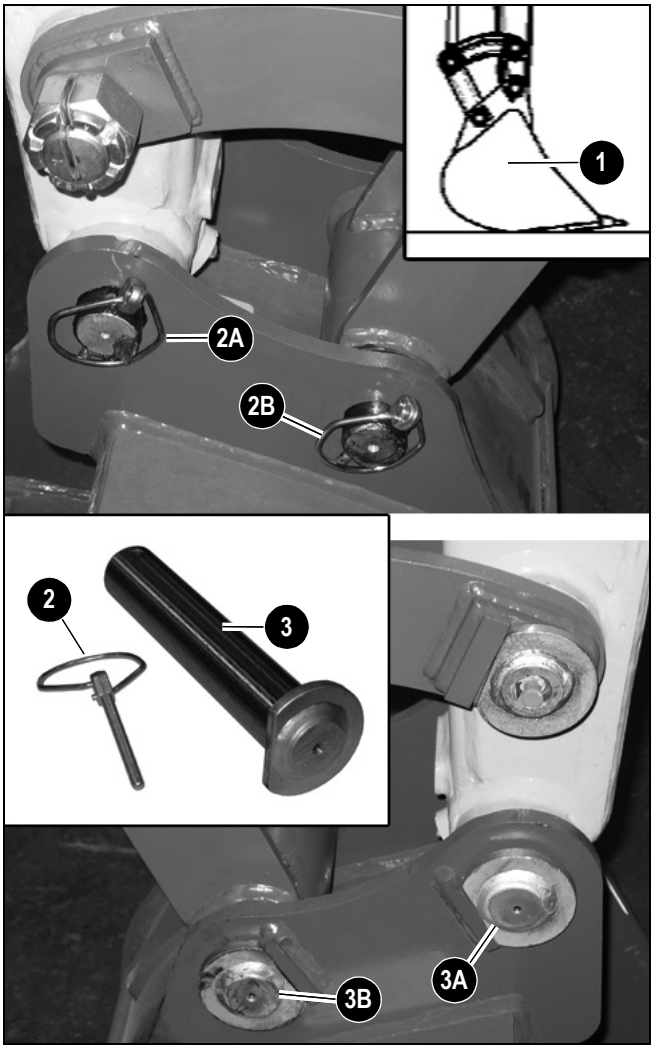


Figure 3-39 – Bucket Removal/Mounting

4. Remove the lower securing pin first (3B, Figure 3-39) and then the remaining pin (3A). Carefully remove the pins with a hammer and brass punch if they are stuck. Once pin (3B) is removed, pin (3A) might have more pressure applied against it, making it difficult to remove. If this happens:
   a. Start the engine.
   b. Slightly raise and lower the boom to relieve pressure from the pin.
   c. Turn off the engine.
   d. Try removing the pin again, using a hammer and brass punch if needed.

Attaching A Bucket

1. Grease the dipper arm and bucket holes.
2. Since the bucket is on the ground and stationary, maneuver the machine until the dipper arm holes align flush with the bucket holes.

⚠ WARNING

DO NOT use your hands or fingers to align the bucket and dipper arm holes.

3. Stop the engine.
4. Insert the upper securing pin first (3A, Figure 3-39). If needed, use a hammer and brass punch to gently tap the pin through the hole. Insert a lynch pin (2A, Figure 3-39) through the hole in the pin and lock.

IMPORTANT

The flat side of each securing pin head must align with the flat guide on each side of the hole; see (3A) and (3B) in Figure 3-39 for how the pins look when properly installed.

5. Insert the lower securing pin (3B, Figure 3-39). If needed, use a hammer and brass punch to gently tap the pin through the hole. Insert a lynch pin (2B, Figure 3-39) through the hole in the pin. Lock the lynch pin securely in place.
6. Verify the bucket is locked and secure before starting the engine and resuming operation.

Auxiliary Hydraulics Connections

IMPORTANT

Follow the instructions in the operator's manual from the attachment manufacturer for connecting the attachment to the machine's auxiliary hydraulics.

Figure 3-40 shows the three quick connections on the dipper arm meant for auxiliary hydraulics, which are for the following:

- **1:** Pressure line (male connector)
- **2:** Large return line (female connector)
- **3:** Pressure line (female connector)

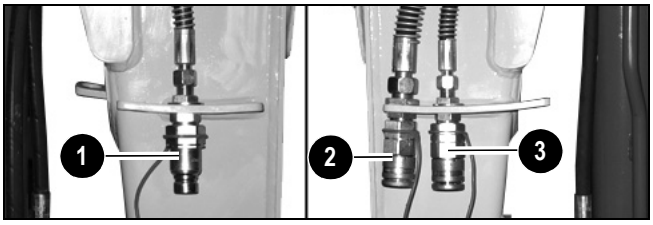


Figure 3-40 – Auxiliary Hydraulics Connections

Connecting the Quick Couplings

1. Park the machine on firm and level ground.
2. Extend the dipper arm cylinder halfway (1, Figure 3-41).
3. Stop the engine.
4. Turn the ignition key to position I. See "– Ignition Key Switch" on page 3-7 for more details.
5. Release pressure from the bucket cylinder by moving the left control lever to the left and right. See left joystick control details on page 3-9 for more information.
6. Lift the left control lever base as a safety precaution. See "– Operator's Left Console in Lock-out Position" on page 3-1 for more details.
7. To connect couplers:
   a. If necessary, rotate lock sleeve (2, Figure 3-41) so notch (3) aligns with lock ball (4).
   b. Pull lock sleeve (2) downward.
   c. Insert the attachment coupling into the corresponding auxiliary hydraulics connection coupling.
   d. Release lock sleeve (2) so it snaps into place and locks the couplings together. Verify the lock sleeve (2) is snapped closed and the coupling is securely locked together.
   e. Twist lock sleeve (2) so notch (3) is NOT aligned with lock ball (4), to help prevent accidental de-coupling.

Disconnecting the Quick Couplings

1. Perform steps 1 through 6 in "Connecting the Quick Couplings" on page 3-27 before proceeding to the next step.
2. To disconnect each coupling:
   a. Pull down on the spring-loaded lock sleeve (2, Figure 3-41).
   b. Listen for the hissing sound to verify that any pressure has been released from the connection.
   c. Turn the notch in the lock sleeve (3, Figure 3-41) so it is aligned with the lock ball (4).
   d. Push lock-sleeve (2) up in the direction of arrow (6) to disconnect the coupling.

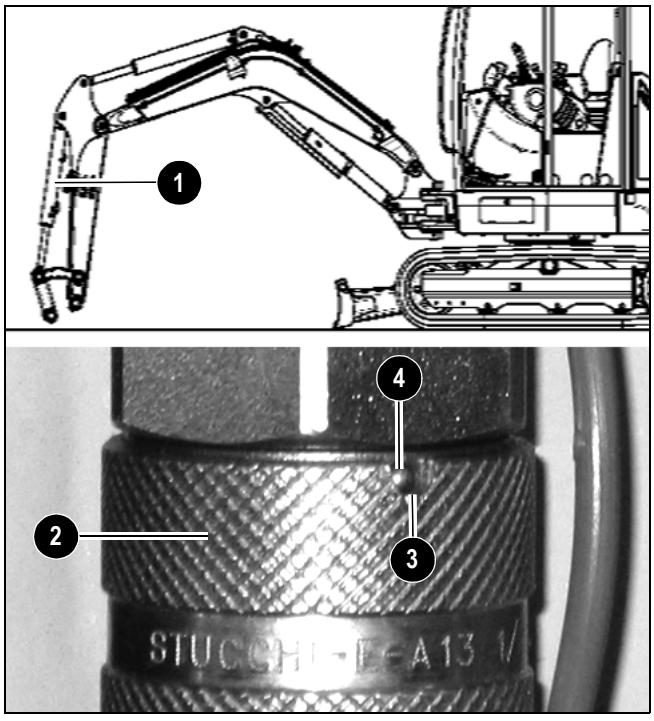


Figure 3-41 – Quick Coupling Connections

Operating Auxiliary Hydraulics

Use the auxiliary hydraulics pedal (1, Figure 3-42) to regulate oil flow through auxiliary attachments. Press the pedal forward (F) for oil to flow into the auxiliary attachments and rearward (R) for oil to flow out.

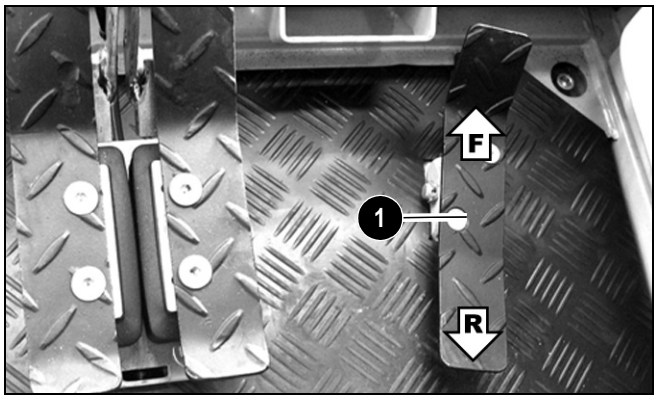


Figure 3-42 – Auxiliary Hydraulics Control

Transporting

Towing

⚠ WARNING

- **When towing the machine, make sure no one is close to the towing apparatus, or in between the vehicles. The machine may only be towed using suitable towing equipment, in connection with suitable towing apparatus, such as a towing coupling, hooks and eyes.**
- **Do not use a towing apparatus that is kinked, twisted, or otherwise damaged.**
- **Do not apply high loads abruptly to the retrieval apparatus. The towing bracket has a maximum admissible load of 6992 lbf (3110 daN).**
- **The towing bracket is designed for retrieving the machine only. Do not use the excavator to tow other vehicles.**
- **Do not tow the machine if the travel drive is damaged. Damage to the machine cause by towing is not covered under warranty.**

The excavator can be towed by using the towing bracket (1, Figure 3-43). Secure a towing shackle, shackle pin and lock (2) of adequate size to the towing bracket (1) as shown. Tow the machine slowly.

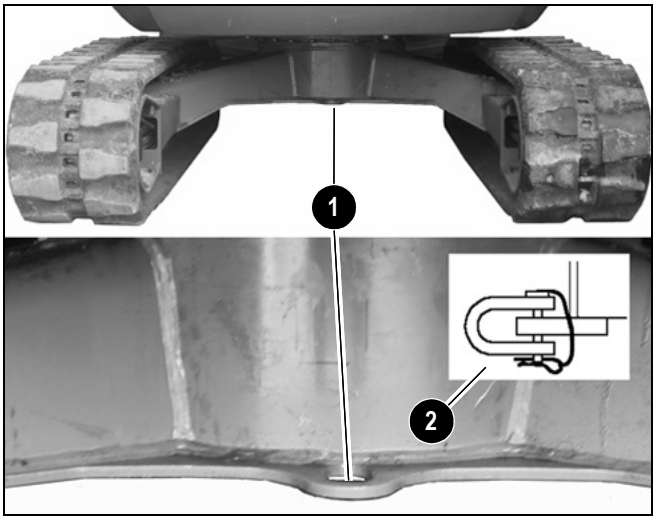


Figure 3-43 – Towing

Lifting the Machine

⚠ WARNING

- **Use a lifting device with sufficient capacity for the weight of the machine plus any attachments.**
- **Maintain the center-of-gravity and balance points on the machine. See Figure 3-44.**
- **Do not swing the boom.**
- **Never lift the machine with the operator aboard.**

The lifting point decals on the boom and dozer blade (see Figure 3-44) identify the lifting point locations. Secure the lifting fixture sling to these lifting points (1, Figure 3-44) on the machine as follows:

- Length L1 on the lifting sling for the boom must be 6′6-3/4" (2 m) long.
- Length L2 on the lifting sling must be 11′4-1/4" (3.47 m) long.

Do not exceed rated load capacity of the lifting machine. See “General Specifications” on page 1-8 for excavator weight.

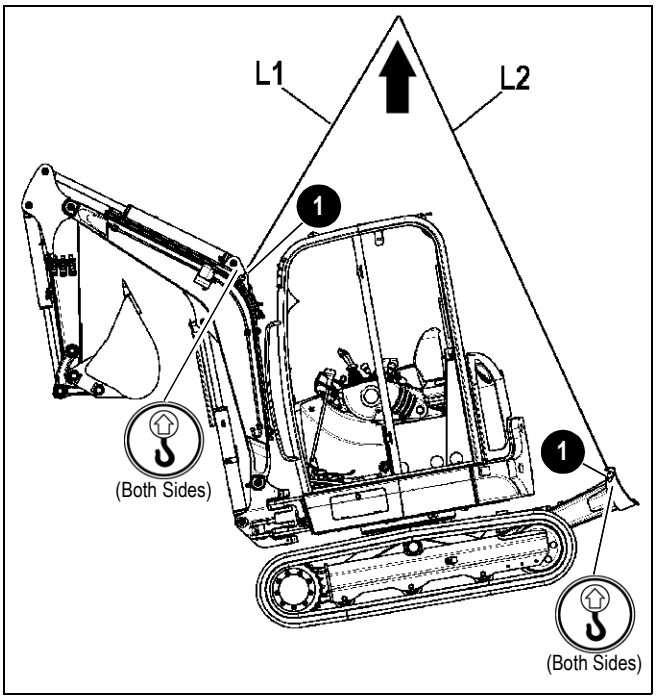


Figure 3-44 – Machine Lifting Points

Loading and Transporting

Note: *Refer to Figure 3-45.*

Use only transporters that are in proper working order and are approved for use on public roads.

When using ramps to load the transporter:

- Do not exceed an incline of 17°.
- Clean dirt, mud, ice and snow from the ramps and tracks.
- Use metal loading ramps with a slip-resistant surface, and with beveled ends to prevent damage to rubber tracks.

Loading Procedure:

1. Attach ramps securely to the transporter to prevent them from slipping off during loading.
2. Load the transporter on solid, even ground.
3. Engage the transporter parking brake and chock the wheels.
4. Determine the direction of the track movement (blade facing forward) before moving the excavator onto the ramps.
5. After the excavator is on the transporter, perform the "Some photographs in this manual may show doors, guards and shields open or removed for the purposes of illustration only. Be sure all doors, guards, shields and panels are in the proper operating positions before starting the engine to operate the machine." on page 2-2.
6. Lock the cab.
7. Place chocks under the excavator tracks.
8. Secure the excavator to the transporter at the tie-down points (2, Figure 3-45) to prevent the excavator from slipping, overturning or moving during transport.

Note: *The tie-down points on the excavator are identified by decals (3, Figure 3-45).*

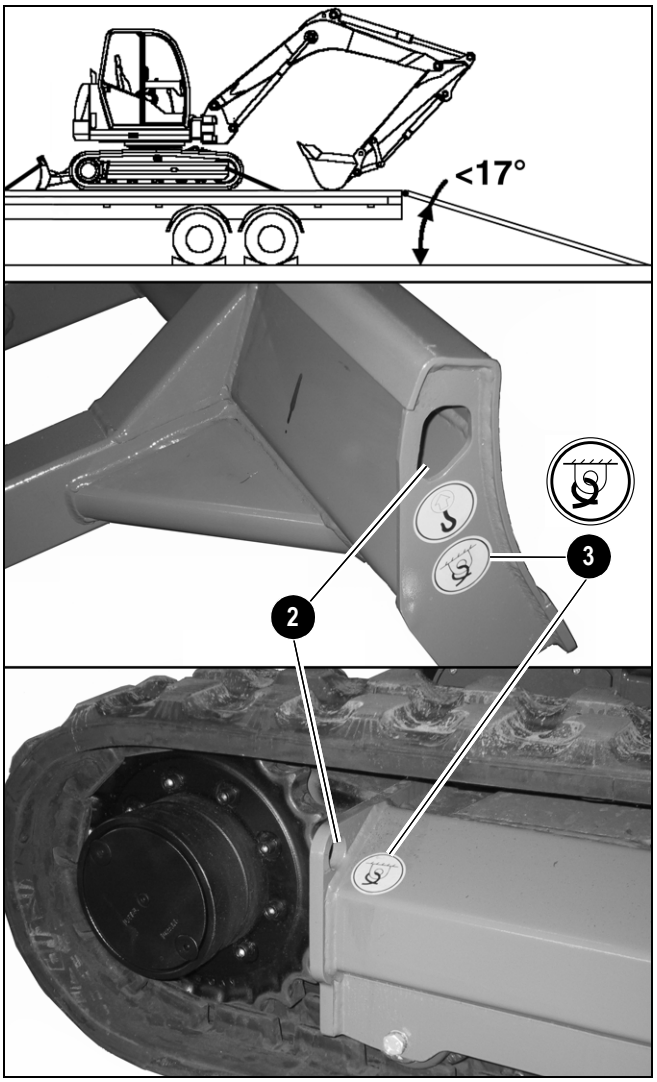


Figure 3-45 – Loading and Transporting

Notes:

CHAPTER 4 – MAINTENANCE

GENERAL INFORMATION

⚠ WARNING

Read and understand this entire manual before operating and/or servicing the machine. Follow warnings and instructions for operation and maintenance. Check for correct function after adjustments or maintenance. Failure to follow instructions can result in injury or death.

⚠ WARNING

Be sure you are familiar with all safety devices and controls before operating or servicing the machine. Know how to stop before starting. The machine is designed for use only with approved accessories or referral attachments. The GEHL Company cannot be responsible for safety if the machine is used with non-approved attachments.

⚠ WARNING

The hydraulic reservoir is under pressure. Avoid contact with leaking hydraulic fluid or diesel fuel under pressure. It can penetrate the skin and eyes.

Care and Servicing

Care and servicing have a significant influence on the operational condition and the service life of the machine.

Use of lubricants not corresponding to the manufacturer's recommendations may invalidate warranty claims.

More frequent servicing, other than the recommended intervals, may be required under extreme conditions (extremely dusty or hot conditions).

Always dispose of waste lubrication oils and hydraulic fluids according to environmental laws or take to a recycling center for proper disposal. **DO NOT** pour fluids onto the ground or down a drain.

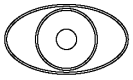
DO NOT power-wash the main hydraulic pumps and controls, throttle solenoids and sealed bearings. High pressure water can be forced through seals and trapped within these components, causing premature failure.

The operating pressure settings of the hydraulic system should only be adjusted by trained, qualified personnel. If malfunctions are caused by unauthorized alteration of operating pressure settings, all warranty responsibilities of the manufacturer are invalidated.

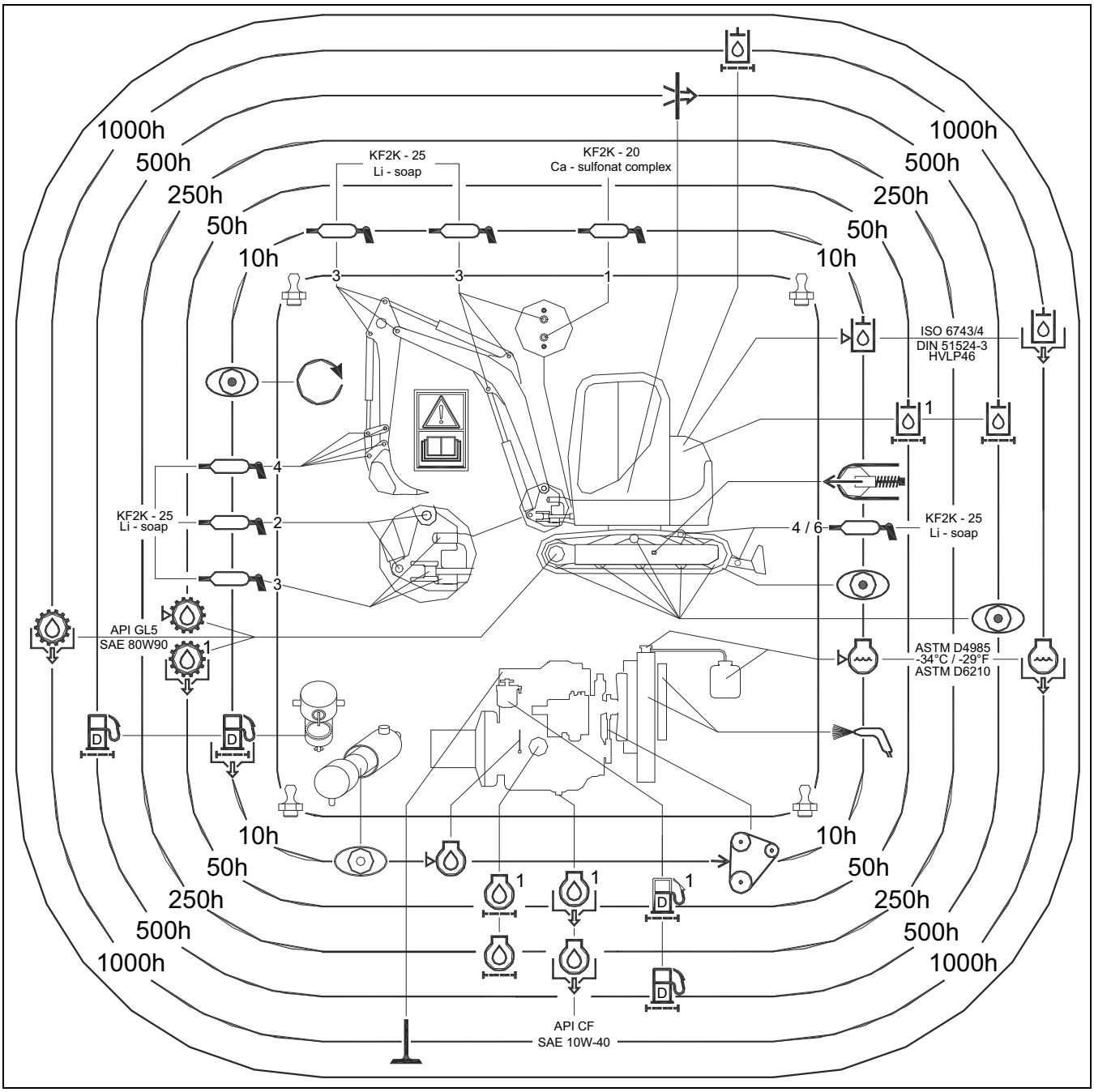
Maintenance Safety

- Never service the machine without reading the applicable instructions.
- Always lower bucket and dozer blade to the ground before performing any maintenance.
- Use correct procedures to lift and support the machine. Always lift the dozer blade fully before installing jackstands.
- Keep the engine hood and hydraulic valve covers closed except for service. Close and latch covers before operating the machine.
- Be sure to have the work area properly ventilated when grinding or welding parts. Wear a dust mask.
- Exhaust fumes can kill. Exhaust system must be tightly sealed. If working in an enclosed area, vent exhaust to outside if the engine must be run for service.
- Never perform unapproved modifications or add unapproved attachments.
- Stop the engine and let cool, then clean any flammable materials from the engine before checking fluid levels.
- Never service or adjust the machine with the engine running unless it is required by the service procedure.
- Avoid contact with leaking hydraulic fluid and diesel fuel under pressure. The pressurized fluids can penetrate the skin and eyes. NEVER use your hands to search for hydraulic fluid leaks — use a piece of paper or cardboard. Escaping fluid under pressure can be invisible, and if it penetrates the skin it can cause serious injury. If any fluid is injected into your skin, see a doctor at once. Injected fluid MUST be surgically removed by a doctor familiar with this procedure or gangrene may result.
- Never fill the fuel tank with the engine running, while smoking or when near open flame.
- Wipe up fuel spills immediately.
- Keep your body, jewelry and clothing away from moving parts, electrical contacts, hot parts and exhaust.
- Wear eye protection when servicing the machine.
- Lead-acid batteries produce flammable and explosive gas. Keep arcs, sparks, flames and lighted tobacco away from batteries.
- Batteries contain acid, which burns eyes and skin on contact. Wear protective clothing. If acid contacts body, flush well with water. For eye contact, flush well with water and get immediate medical attention.

Maintenance Label Symbols

Symbol	Assembly	Explanation
	General	Visual check
	General	Grease instructions
	Fuel system	Drain condensation from fuel
	Fuel system	Replace the fuel filter, clean the fuel prefilter
	Radiator	Check the coolant level
	Radiator	Drain and fill in new coolant
	Engine	Check valve clearance (adjust if necessary)
	Engine	Check the engine oil level
	Engine	Change engine oil
	Engine	Replace the oil filter
	Engine	Check V-belt tension
	Travel drive	Change oil
	Travel drive	Check the oil
	Undercarriage	Check track tension
	Hydraulic system	Check oil level
	Hydraulic system	Change hydraulic oil
	Hydraulic system	Replace the hydraulic oil filter, replace the breather filter
	Radiator fins	Clean

Maintenance Label



Note: *Maintenance label is located on cab rear window or inside right canopy wall.*

MAINTENANCE SCHEDULE

The following service schedule is a recommended. Maintenance work must be done at regular intervals. Failure to perform scheduled maintenance work will result in excessive wear and early machine failures. The following service schedule is a recommended.

Check, Clean and Inspect

Service Activity	Daily	Every 50 Hours	Every 250 Hours	Every 500 Hours	Every 1000 Hours	Customer	Dealer
Engine oil level	x					x	
Engine coolant level	x					x	
Hydraulic oil level	x					x	
Check engine/hydraulic oil radiator and air conditioning for debris; clean if necessary	x					x	
Cab machines: windshield wipers condition; replace if necessary	x					x	
Cab machines: windshield washer reservoir; fill if necessary	x					x	
Check cooling system, heating and hoses for leaks and pressure (visual check)	x					x	
Air filter for damage; squeeze dust valve	x					x	
Inspect water separator pre-filter; drain water if necessary	x					x	
Check V-belt condition and tension	x					x	
Check exhaust system for damage	x					x	
Check tracks for cracks, cut or other damage	x					x	
Check track tension; adjust if necessary	x					x	
Inspect cylinder piston rods for damage	x					x	
Ensure bucket and attachment pins are secure and locked	x					x	
Pin lock (dipper arm and attachment)	x					x	
Inspect hydraulic line clamps for tightness/damage; hydraulic system for leaks	x					x	
Clean hydraulic couplings/dirt build-up on the hydraulic system dust caps	x					x	
Grease frame lubrication system	x					x	
Check air filter restriction indicator[1]		x		x		x	
Check primary pressure relief valve pressure[1]		x		x			x
Travel final drive gearbox oil level		x					x
Check fasteners for tightness[2]		x		x			x
Check indicator lights for correct function[1]		x		x			x

1. Use in acidic air environments, such as acid/chemical, steel/aluminum/non-ferrous metal production facilities.
2. Check after first 50 hrs; every 500 hrs thereafter.

Check, Clean & Inspect (continued)

Service Activity	Daily	Every 50 Hours	Every 250 Hours	Every 500 Hours	Every 1000 Hours	Customer	Dealer
Insulating mats in the engine compartment		x					x
Warning decals and Operator's Manual in place/undamaged		x					x
Clean water separator			x				x
Clean battery				x		x	
Replace cab air filter for heating and air conditioning				x			x
Empty diesel fuel tank[1]				x			x
Check alternator, starter and electrical connections, starter bearing play and function				x			x
Preheating system and electrical connections				x			x
Check bearing play on tread rollers, track carrier rollers and front idlers				x			x
Fuel injection pump, injection and pressure, injection nozzles and valves					x		x
Check injection timing; adjust if necessary					x		x
Check engine valve clearance; adjust if necessary					x		x
Check pilot control valve filter/restrictor; clean/replace if necessary					x		
Clean drain holes in cab/canopy					x		x

1. After emptying the tank, water must be removed and air must be purged from the fuel system before use. See "Water Separator" on page 4-13 and "Purging Air from the Fuel System" on page 4-14.

Fluid and Filter Changes

Service Activity	Daily	Every 50 Hours	Every 250 Hours	Every 500 Hours	Every 1000 Hours	Customer	Dealer
Engine oil		x[1]	x[2]	x			x
Engine oil filter		x[1]		x			x
Fuel filter		x[3]		x			x
Hydraulic oil filter		x[3]		x			x
Gearbox oil		x[4]			x		x
Hydraulic oil				x			x
Breather-hydraulic oil tank					x		x
Air filter element when indicator light comes on					x	x	
Engine coolant					x		x

1. Change after first 50 hrs; every 500 hrs thereafter.
2. Dusty work environment, high temperature, high rate of hammer use, and similar intensive use conditions.
3. Change after first 50 hrs; every 500 hrs thereafter.
4. Change after first 50 hrs; every 1000 hrs thereafter.

Swing Gear Ring

Service Activity	Daily	Weekly	Every 50 Hours	Every 125-250 Hours	Every 500 Hours	Every 1000 Hours	Annually
Check gear ring					x		
Check bearing system		x					x

Cab Heating System

Service Activity	Daily	Weekly	Every 50 Hours	Every 125-250 Hours	Every 500 Hours	Every 1000 Hours	Annually
Check fan			x				
Check system function			x				
Check heating system for leaks			x				
Check seals			x				

Bucket, Boom and Dozer Blade

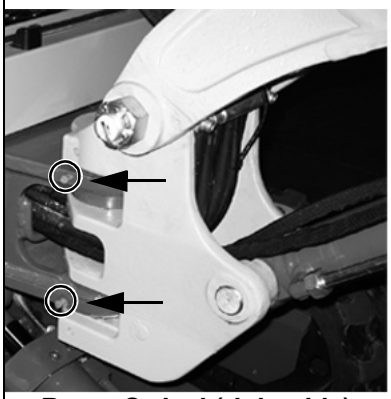
Service Activity	Daily	Weekly	Every 50 Hours	Every 125-250 Hours	Every 500 Hours	Every 1000 Hours	Annually
Lubricate daily service points	x						
Lubricate weekly service points		x					
Check bucket teeth for wear	x						
Check hydraulic fittings for leaks	x						
Check hydraulic cylinder under load						x	
Check bearing play				x			

Daily Lubrication

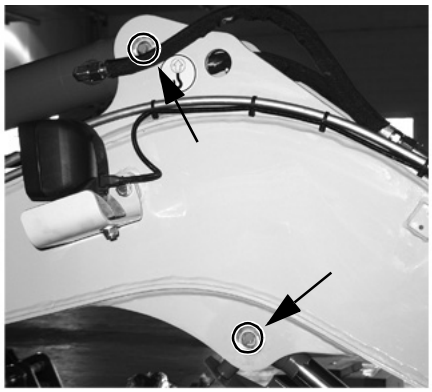
(See Figure 4-1)

Service Activity	Daily	Every 50 Hours	Every 250 Hours	Every 500 Hours	Every 1000 Hours	Customer	Dealer
Dozer blade	x					x	
Swiveling console	x					x	
Boom	x					x	
Dipper arm	x					x	
Attachments	x					x	
Chassis (front of undercarriage)	x					x	

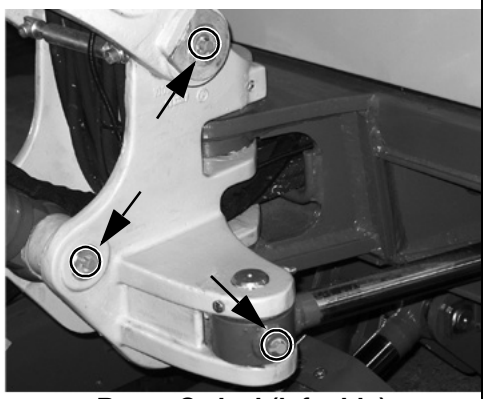
Lubricate daily at the points indicated



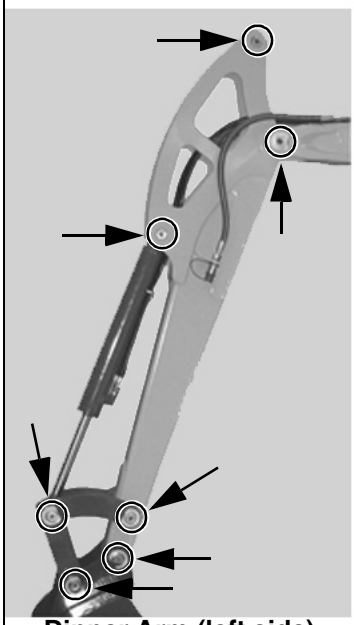
Boom Swivel (right side)



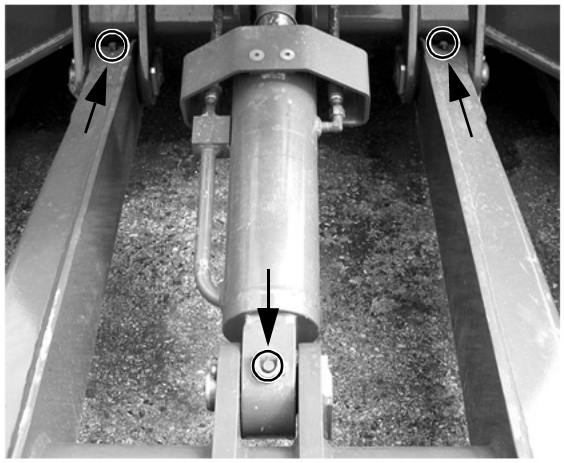
Boom



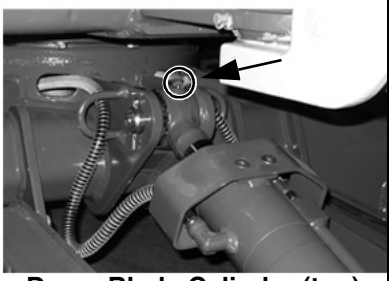
Boom Swivel (left side)



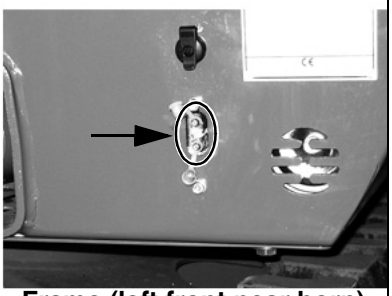
Dipper Arm (left side)



Dozer Blade Arms and Cylinder (bottom)



Dozer Blade Cylinder (top)



Frame (left front near horn)

Figure 4-1 – Lubrication Points

RECOMMENDED LUBRICANTS

Engine Oil

IMPORTANT

Be sure to read the engine manual supplied with the machine for detailed engine specifications.

See "Fluid Capacities/Lubricants" on page 1-4 for proper engine oil specifications.

Hydraulic Oil

See "Fluid Capacities/Lubricants" on page 1-4 for proper hydraulic oil specifications.

Swing Ring

Lubricate with a heavy-duty lithium complex grease with 3% molybdenum disulfide, such as Chevron RPM Heavy Duty Grease No. 2, Mobilgrease Moly 52 or BP Energrease Moly EP2.

Final Drive Unit

An EP grade gear oil that conforms to API GL5, such as Chevron Delo Gear 80W90 or BP Transgear 80W90.

Swing Gear Unit

An EP grade gear oil that conforms to API GL5, such as Chevron Delo Gear 80W-90 or BP Transgear 80W-90 is required.

Lubrication Points

See Figure 4-1 for lubrication points. Apply a heavy-duty lithium complex grease with 3% molybdenum disulfide. See "Fluid Capacities/Lubricants" on page 1-4 for more detailed specifications.

Ranges of Applications

From -4° F to +104° F (-20° C to +40° C) for the outside temperature.

ENGINE

Checking Engine Oil Level

IMPORTANT

See "Fluid Capacities/Lubricants" on page 1-4 for engine oil grade. To prevent damage to the engine, only use the engine oils specified, or oils of equivalent quality and grade.

To check the engine oil, the machine must be on a level surface and the engine turned off. Check the oil level before starting the engine or at least 5 minutes after shutting off the engine.

1. Open the engine hood (see "Accessing the Engine Compartment" on page 3-6).
2. Check the engine oil level using the dipstick (1, Figure 4-2) located on the right side of the engine. The acceptable oil level is between the maximum and minimum marks on the dipstick.
3. Add oil, if required, through the oil filler neck (2, Figure 4-2).
4. Drain excess oil if required.
5. Close the engine hood and confirm it is latched securely.

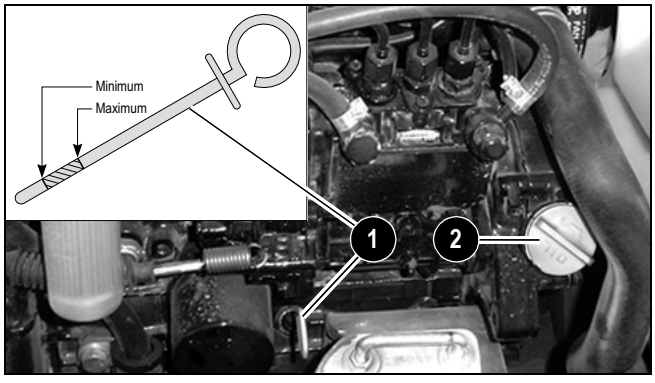


Figure 4-2 – Oil Dipstick and Filler Neck Locations

Changing Engine Oil and Filter

1. Position the machine on a level surface.

IMPORTANT

The machine must be positioned on a level surface for the oil to drain completely.

2. The engine oil drain plug is accessed from underneath the machine. If necessary, rotate and position the cab/canopy so the engine oil drain access hole (9, Figure 4-3) is accessible.
3. Perform the "Mandatory Safety Shutdown Procedure" on page 2-2, but do not allow the engine to fully cool because warm oil will drain more completely.
4. Open the engine hood (see "Accessing the Engine Compartment" on page 3-6).
5. Access the oil pan drain plug from underneath the machine through hole (9, Figure 4-3) at the bottom of the engine compartment.

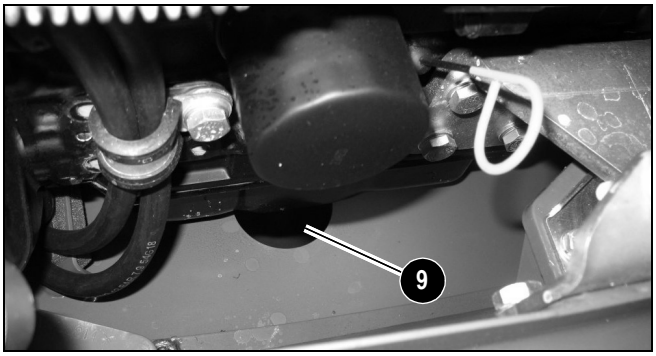


Figure 4-3 – Engine Oil Drain Access

6. Position a waste oil collection container underneath the access hole and engine oil drain plug.
7. Remove the drain plug from the oil pan and allow the oil to drain into the collection container.

IMPORTANT

Dispose of waste engine oil according to environmental laws or take to a recycling center for proper disposal. DO NOT pour waste engine oil onto the ground or down a drain.

8. Remove the oil filter (1, Figure 4-4), using a filter wrench as needed.

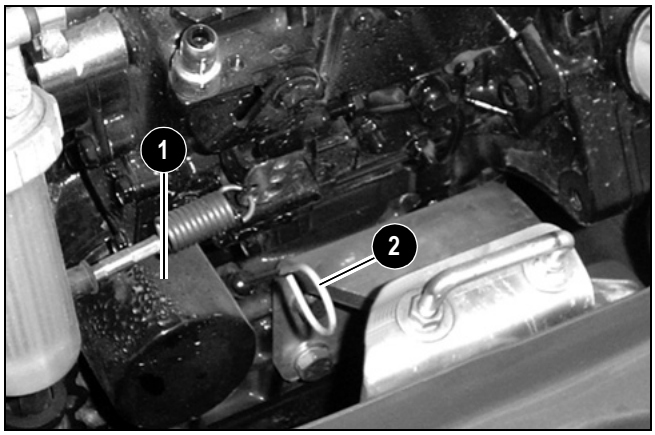


Figure 4-4 – Oil Filter Location

9. Clean the filter gasket surface on the engine block. Put a film of clean oil on the filter gasket.
10. Install the new filter and gasket and hand-tighten. Once hand-tightened, tighten the filter another 1/4 to 1/2 rotation.
11. Reinstall the drain plug.
12. Clean the area around the oil filler cap (2, Figure 4-2).
13. Remove the oil filler cap and raise the oil dipstick (2, Figure 4-4) slightly to allow any trapped air to escape.
14. Add oil to the engine through the oil filler. Crankcase capacity with filter is 3.5 qts. (3.3 L). Do NOT fill crankcase above the MAX mark on the dipstick.
15. Reinstall the oil filler cap.
16. Wait about three minutes to allow the oil to settle and check the oil level according to "Checking Engine Oil Level" on page 4-9.
17. Start the engine and let it run for several minutes. Watch the engine oil light on the control panel. The light should turn off after several seconds. If it does not, shut off the engine, determine the cause and fix the problem before restarting the engine.
18. Stop the engine and check for leaks at the oil filter and oil drain plug. If no leaks are found, close the engine hood and confirm it is latched securely.

Engine Air Cleaner

Air Cleaner Dust Valve

Squeeze dust valve (6, Figure 4-5) daily to purge accumulated dust from the air cleaner housing.

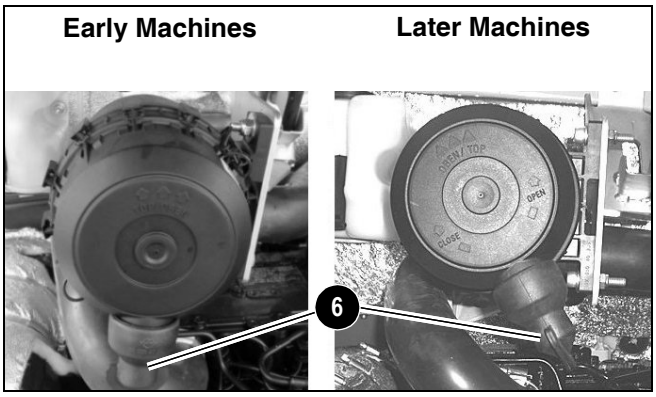


Figure 4-5 – Air Filter Dust Valve

Air Filter Element Replacement

To access the engine air cleaner, open the engine hood (see "Accessing the Engine Compartment" on page 3-6). The air filter restriction gauge (1, Figure 4-6) will read "Service" when the elements require replacement.

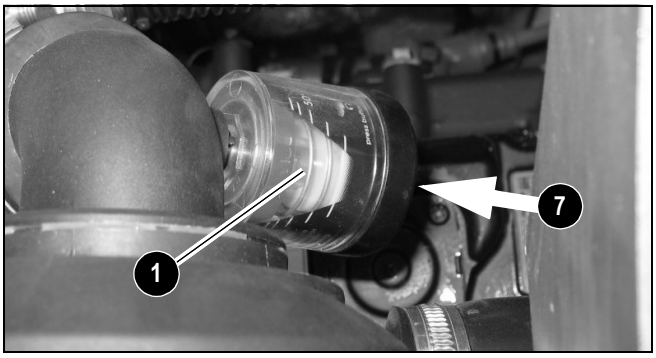


Figure 4-6 – Air Filter Restriction Gauge

To service the elements:

1. Perform the "Mandatory Safety Shutdown Procedure" on page 2-2.
2. Release the bow clips (2, Figure 4-7) to remove the air cleaner cover and gasket (3).
3. Carefully remove the outer air cleaner element (4). Carefully remove the inner air cleaner element (5).
4. Clean all contamination (dust) inside the air cleaner housing and cover.
5. Replace the filter elements as required and/or according to "Maintenance Schedule" on page 4-5. Install both elements (4 and 5), gasket and air cleaner cover (3). Fasten bow clips (2). Ensure dust valve (6, Figure 4-5) points down.
6. Press button (7, Figure 4-6) on air filter restriction gauge to reset the gauge.
7. Close the engine hood and confirm it is latched securely.

IMPORTANT

Do not knock air filter elements against a solid object to remove dust. The elements may become distorted and damaged.

IMPORTANT

Do not operate engine without the air cleaner components installed or damage to the engine could occur.

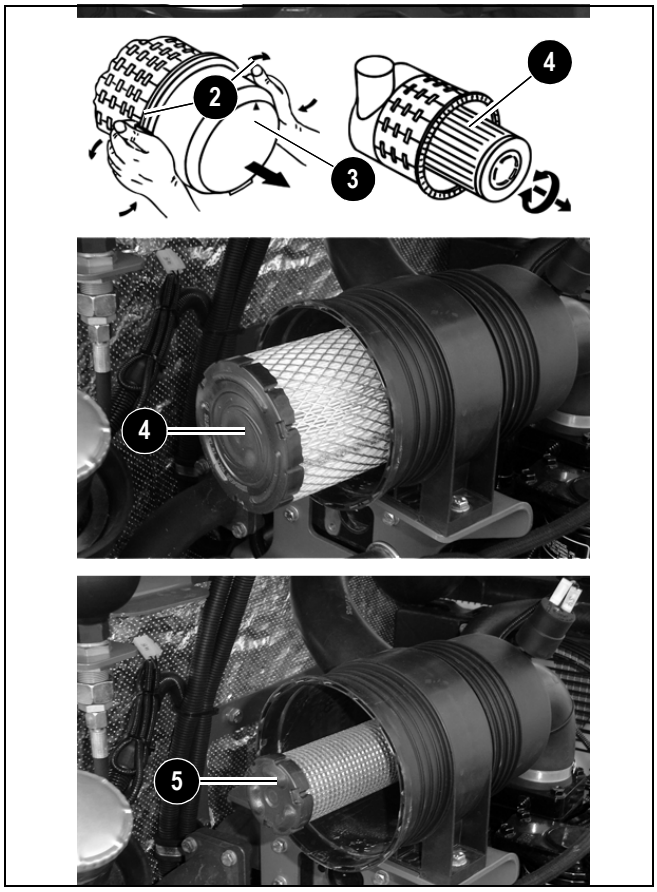


Figure 4-7 – Air Filter Service

Fuel System

Filling the Fuel Tank

⚠ WARNING

Stop and cool the engine before adding fuel. NO SMOKING! Failure to obey warnings can cause an explosion or fire.

The fuel gauge on the cab console indicates the fuel level in the tank.

1. To fill the tank, swivel lock cover (7, Figure 4-8) on fuel filler cap (5) and unlock cap (5) using key (7). Remove cap.
2. Check fuel filler screen (8) for debris, and clean if necessary. Replace screen (8) back into the fuel filler neck.
3. Fill the fuel tank using only high-grade diesel fuel (rated 1-D or 2-D ASTM D975-94).
4. After fueling, re-install and lock the fuel cap.

Figure 4-8 – Fuel Filler

IMPORTANT

Unless draining fuel tank for servicing, never operate the machine until the fuel tank is completely empty. The fuel system has to be bled of air whenever the fuel tank is run empty. Always fill the fuel tank after use.

IMPORTANT

When using the machine in cold weather, make sure to use the proper fuel blend to prevent the fuel filters from "jelling" up. If this happens, the fuel filter and water separator elements will have to be replaced, and the fuel will have to be replaced with the proper fuel.

⚠ DANGER

When handling fuel, there is a high risk of fire. Never work on the fuel system around open flames or sparks. DO NOT smoke when working on the fuel system or refueling. Before refueling, turn off the engine and remove the ignition key. Do not refuel in closed rooms. Wipe up fuel spills immediately. Keep the machine clean to reduce the risk of fire.

Fuel Filter

Note: *For fuel filter location, see "Engine Compartment Components" on page 3-6.*

1. Perform the "Mandatory Safety Shutdown Procedure" on page 2-2. Wait for the engine to cool.
2. Open the engine hood (see "Accessing the Engine Compartment" on page 3-6).
3. Turn fuel shut-off valve lever (1, Figure 4-9) on the fuel filter to the "OFF" position.
4. Loosen retaining ring (2, Figure 4-9) until the cup (3, Figure 4-9) can be removed.

5. Carefully remove cup (3). Discard any fuel in the cup according to environmental laws. DO NOT pour fuel onto the ground or down a drain.
6. Wash the inside of the cup. Inspect the O-ring (not shown) and replace it if required.
7. Remove and discard the old fuel filter properly.
8. Install a new fuel filter in the cup. Install the cup onto the mounting flange and tighten retaining ring (2). Hand tighten only.
9. Turn the fuel shut-off valve on the fuel filter to the "ON" position.
10. Close the engine hood and confirm it is latched securely.
11. Purge air (bleed) from the fuel system according to "Purging Air from the Fuel System" on page 4-14.

IMPORTANT

Do not turn the ignition key to the start position before bleeding/priming the fuel system. Damage to the starter motor, coils, pinion or ring gear could result.

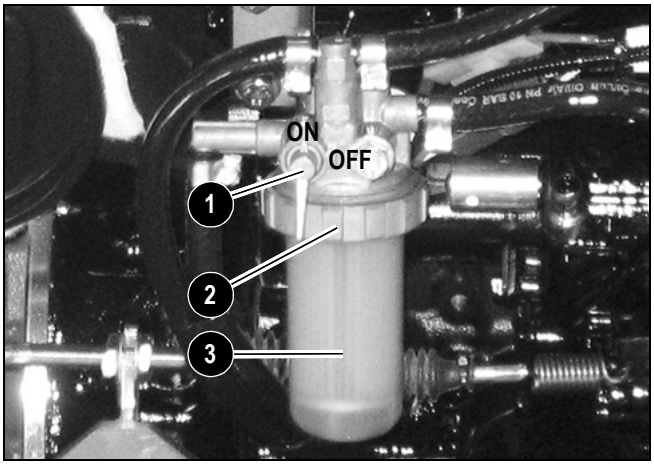


Figure 4-9 – Fuel Filter

12. Start the engine and run for one minute. Check the fuel filter for leaks and repair/tighten as necessary.

Water Separator

Note: *For water separator location, see "Engine Compartment Components" on page 3-6.*

The water separator contains a red indicator ring that will float on top of any accumulated water. Under normal conditions, this ring sits at the bottom of the separator. If the red ring is somewhere between the bottom and the white ring (5, Figure 4-10), then the accumulated water must be drained.

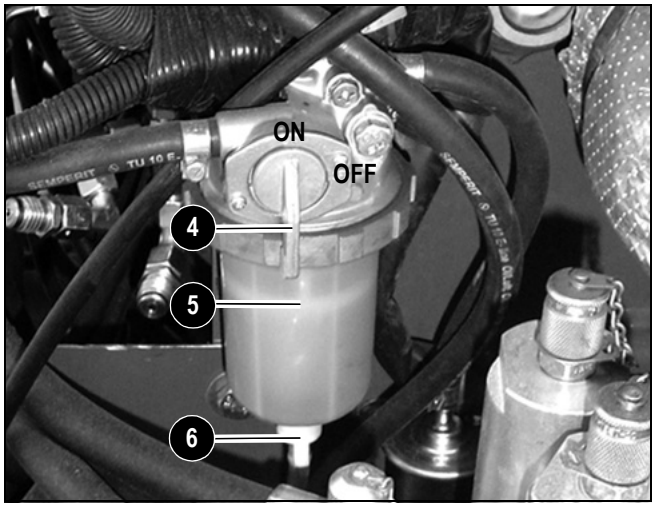


Figure 4-10 – Water Separator

1. Perform the "Mandatory Safety Shutdown Procedure" on page 2-2. Wait for the engine to cool.
2. Open the engine hood (see "Accessing the Engine Compartment" on page 3-6).
3. Turn the fuel shut-off valve lever (4, Figure 4-10) on the water separator to the "OFF" position.
4. Drain plug (6, Figure 4-10) has a hose connected to it. Place a container underneath this hose to collect the water. Loosen plug (6) until water begins draining out through the hose. Allow water to drain until the red indicator ring returns to the bottom of the water separator.
5. Tighten the drain plug and discard fuel/water according to environmental laws. DO NOT pour the fuel/water onto the ground or down a drain.
6. Turn the fuel shut-off valve lever (4) on the water separator to the "ON" position.
7. Close the engine hood and confirm it is latched securely.

Purging Air from the Fuel System

IMPORTANT

DO NOT bleed/prime the fuel system if the engine is hot. Spilled fuel can cause a fire.

Trapped air must be removed (bled) from the fuel system if the following conditions exist:

- the fuel tank has run dry
- any component in the fuel system was replaced, including the fuel filter element
- the machine has not been operated in a long time

To bleed air from the fuel system:

1. Fill the fuel tank.
2. Verify the fuel shut-off valve levers (1, Figure 4-9 and 4, Figure 4-10) on the fuel filter and the water separator are both in the "ON" position.
3. Turn the ignition key to the "I" (ON) position.
4. Wait five minutes.
5. Start the engine.

If the engine runs smoothly and then stops, or if it does not run smoothly, switch off the engine and repeat steps 1 through 6. If the engine still does not run smoothly, contact your dealer.

Cooling System

Checking Coolant Level

1. Perform the "Mandatory Safety Shutdown Procedure" on page 2-2. Wait for the engine to cool.

Note: *The engine must be cold in order to accurately check the coolant level.*

2. Open the engine hood (see "Accessing the Engine Compartment" on page 3-6).
3. Check the coolant level in the expansion reservoir. If the coolant level is at or below the low line (3, Figure 4-11), remove the reservoir cap (1).
4. Carefully loosen the radiator cap to allow the coolant system to vent. Fill reservoir to FULL line (2). Refer to "Fluid Capacities/Lubricants" on page 1-4 for the correct coolant type and to "Coolant Compound Table" on page 1-7 for the correct coolant mixture. Replace the reservoir cap. Tighten the radiator cap
5. Close the engine hood and confirm it is latched securely.

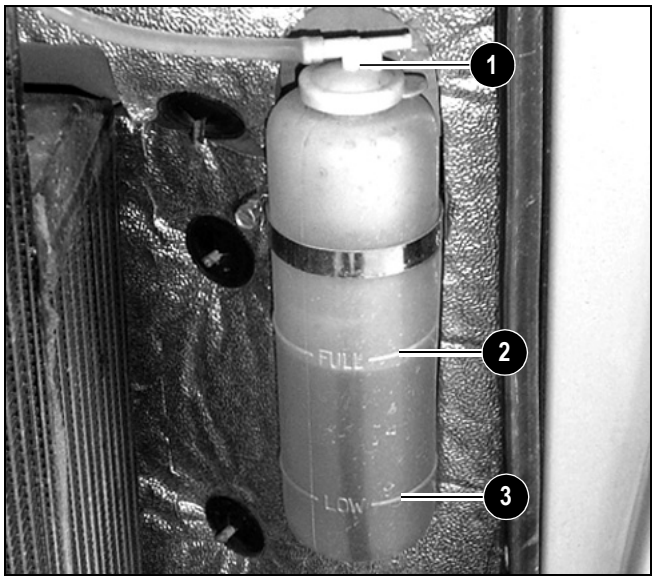


Figure 4-11 – Coolant Expansion Reservoir

Hydraulic System

⚠ WARNING

The hydraulic reservoir is under pressure. Never use your hands to search for hydraulic fluid leaks; use a piece of paper or cardboard to find leaks. Escaping fluid under pressure can be invisible and can penetrate the skin, causing serious injury. If any fluid is injected into your skin, see a doctor at once. Injected fluid MUST be surgically removed by a doctor familiar with this procedure, or gangrene may result.

Checking Hydraulic Oil Level

1. Position the machine on a level surface.
2. For an accurate reading, fully extend the bucket and boom. Retract the dipper arm and lower the bucket and dozer blade to the ground. Refer to Figure 4-12.
1. Perform the "Mandatory Safety Shutdown Procedure" on page 2-2.
2. Open the engine hood (see "Accessing the Engine Compartment" on page 3-6).

Note: *See "Engine Compartment Components" on page 3-6 to locate the sight gauge and breather cap described below.*

3. Check the hydraulic oil level sight gauge (2, Figure 4-12). Oil level should be approximately at point (3).
4. If the hydraulic oil level is low:
    a. Slowly loosen the breather cap (4, Figure 4-12) to relieve pressure in the hydraulic system. Re-tighten the breather cap after relieving pressure.
    b. Remove the hydraulic valve cover on the rear of the machine (5, Figure 4-12) to access the hydraulic oil filler cap (6).
    c. Slowly open and remove the hydraulic oil filler cap (6).
    d. Add hydraulic oil until it is at the ideal level registered at the sight glass (2, Figure 4-12).
    e. Replace and tighten the oil filler cap (6).
    f. Start the engine and let it idle for a few minutes.
    g. Cycle all hydraulic functions and check the oil level at the sight glass. Repeat steps "a" through "f" (excluding b) if oil must be added.
    h. Once oil is at the correct level (3, Figure 4-12), replace the hydraulic valve cover (5) and tighten the hardware securely.
5. Close the engine hood and confirm it is latched securely.

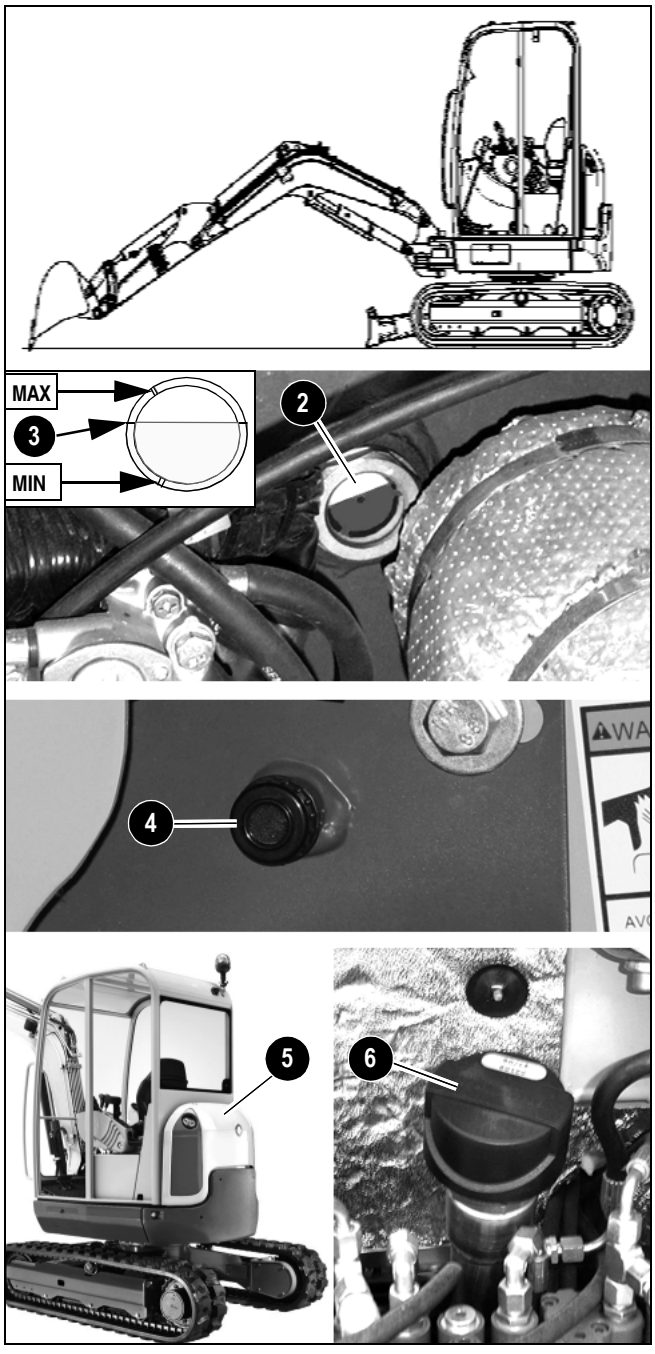


Figure 4-12 – Hydraulic Reservoir

Changing Hydraulic Oil

1. Position the machine on a level surface. Fully extend the bucket and boom, retract the arm and position as shown in Figure 4-12.
2. Lower the bucket and dozer blade to the ground. Perform the "Mandatory Safety Shutdown Procedure" on page 2-2.
3. Open the engine hood (see "Accessing the Engine Compartment" on page 3-6).
4. Slowly loosen the breather cap (3, Figure 4-12) to relieve pressure in the hydraulic system. Re-tighten the breather cap after relieving pressure.
5. Remove the hydraulic valve cover on the rear of the machine to access the hydraulic oil filler cap.
6. Slowly open and remove the hydraulic oil filler cap (4, Figure 4-13). Cover the hydraulic oil filler opening with a clean cloth to prevent contamination.

IMPORTANT

Protect the area from spilled or dripping hydraulic fluid.

7. Open the hydraulic reservoir drain plug and drain the oil into a suitable container. Once drained, re-install the drain plug and tighten securely.

IMPORTANT

Always dispose of hydraulic fluids according to environmental laws or take to a recycling center for proper disposal. DO NOT pour onto the ground or down a drain.

8. Remove the hydraulic system filter cover (1, Figure 4-13). Remove and discard old filter. Put clean hydraulic fluid onto the gasket on a new filter and install the new filter into the filter reservoir. Replace and tighten filter cover (1).

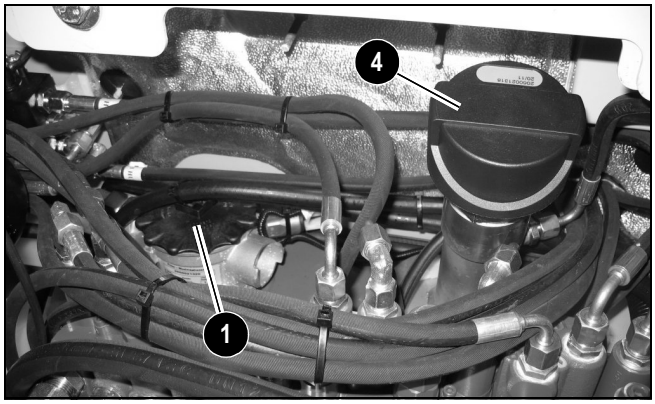


Figure 4-13 – Hydraulic System Filter

9. Remove the cloth from the hydraulic oil filler opening and add hydraulic oil until it is at the correct level (3, Figure 4-12) indicated at the sight glass.
10. Replace and tighten the hydraulic oil filler cap (4, Figure 4-13).
11. Start the engine and let it idle for a few minutes.
12. Cycle all hydraulic functions and check the oil level at the sight glass. If oil must be added, repeat the preceding steps except for steps 5 and 7.
13. Replace the hydraulic valve cover. Tighten hardware securely.
14. Close the engine hood and confirm it is latched securely.

Hydraulic Cooling System

See "Engine Compartment Components" on page 3-6 for the hydraulic cooler location. Inspect the cooler for leaks or damage.

Pilot Valve

IMPORTANT

Hydraulic oil contamination can damage pilot valve control spools. Check the pilot control valve filter/restrictor every 1000 hours and clean if necessary. Replace the filter/restrictor if it is damaged in any way.

Checking Pilot Control Valve Filter:

1. Fully extend the bucket and boom, retract the arm and position as shown in Figure 4-12.
2. Lower the bucket and dozer blade to the ground. Perform the "Mandatory Safety Shutdown Procedure" on page 2-2.
3. Open the engine hood (see "Accessing the Engine Compartment" on page 3-6).
4. Slowly loosen the breather cap (4, Figure 4-12) to relieve pressure in the hydraulic system. Re-tighten the breather cap after relieving pressure.
5. Disconnect the hose connected to the pilot control filter/restrictor fitting (B, Figure 4-14) on the right joystick control valve.

IMPORTANT

Hydraulic oil will leak during this procedure. Place absorbent material under valve to catch leaking oil. Always dispose of hydraulic fluids according to environmental laws or take to a recycling center for proper disposal.

6. Disconnect the pilot control filter/restrictor fitting (B) from the valve.

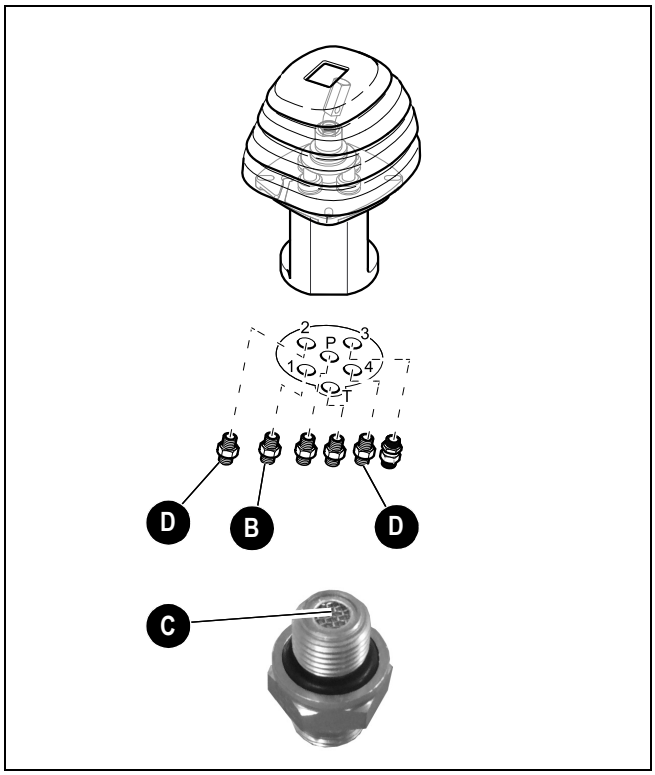


Figure 4-14 Pilot Control Filter/Restrictor

7. Check the filter/restrictor fitting filter screen (C) for contamination/dirt and clean if necessary. Replace the filter/restrictor if it is damaged.
8. Replace filter/restrictor fitting (B) back into the valve, and reconnect hose to the filter/restrictor (C). Tighten securely.
9. Repeat steps 5-8 for the left joystick control valve, checking the filter/restrictors (D).

Hydraulic Hose Maintenance

⚠ WARNING

- **Hydraulic hoses and connections must be inspected by a trained technician before the first use of the machine, and at least annually thereafter, for leaks and/or damage.**
- **Leakages and damaged pressure lines must be immediately repaired or replaced by an authorized service center.**
- **Never use your hands to check for suspected hydraulic leaks. Always use a piece of wood or cardboard.**
- **Leaks from hydraulic hoses or pressurized components can be difficult to see, but pressurized oil can have enough force to pierce the skin and cause serious injury.**
- **Obtain immediate medical attention if pressurized oil pierces the skin. Failure to obtain prompt medical assistance could result in gangrene or other serious damage to tissue.**
- **Always relieve hydraulic system pressure before performing any maintenance on the machine. Do not tighten leaking connections when the hydraulic system is under pressure.**
- **Never weld or solder damaged or leaking pressure lines and/or screw connections. Always replace damaged hydraulic components.**
- **Hydraulic hoses must be replaced every six years from the date of manufacture, even if they do not appear damaged. The date of manufacture (month or quarter and year) is indicated on hydraulic hoses. See Figure 4-15.**

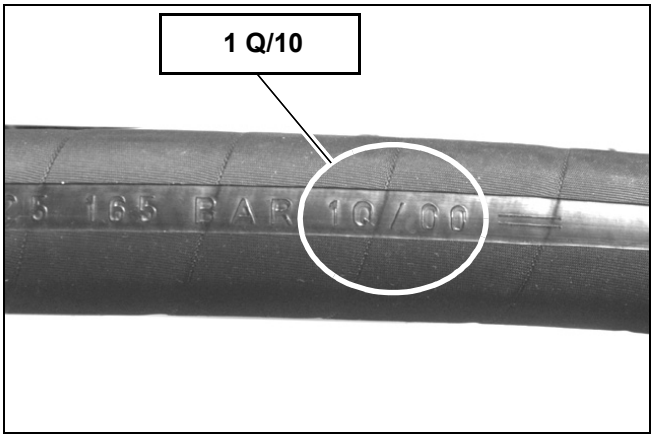


Figure 4-15 Hydraulic Hose Manufacture Date

Electrical System

Fuses

1. Open the engine hood (see "Accessing the Engine Compartment" on page 3-6).
2. See "Fuses" on page 1-6 to locate and identify the fuses.
3. To replace a fuse:
   a. Perform the "Mandatory Safety Shutdown Procedure" on page 2-2. Wait for the engine to cool.
   b. Remove the panel cover.
   c. Remove the old fuse from the socket.
   d. Install a new fuse of the same rating.

IMPORTANT

Determine what caused the fuse to blow and repair the problem before replacing the fuse.

4. Replace the fuse panel cover.
5. Close the engine hood and confirm it is latched securely.

Battery

⚠ WARNING

Before servicing the battery or electrical system, disconnect the negative cable from the negative battery terminal, or if the machine is equipped with a battery disconnect switch, turn the switch to the "OFF" position.

Explosive gas is produced while a battery is in use or being charged. Keep flames or sparks away from the battery area. ALWAYS charge the battery in a well ventilated area.

Do not jump-start a frozen battery, or it may explode. A discharged battery can freeze at 14°F (10°C).

⚠ WARNING

Never lay a metal object on top of a battery, because a short circuit can result. Battery acid is harmful to skin and fabrics. If acid spills, follow these first-aid tips:

Immediately remove any clothing on which acid spill.

• If acid contacts skin, rinse the affected area with running water for 10 to 15 minutes.

• If acid contacts eyes, flood eyes with running water for 10 to 15 minutes. See a doctor at once. Never use any medication or eye drops unless prescribed by the doctor.

• To neutralize acid spilled on the floor, use one of the following mixtures:

• 0.5 kg (1 lbs.) of baking soda in 4 L (4 qts.) of water.

• 0.5 L (0.5 qts.) of household ammonia in 4 L (4 qts.) of water.

Note: *See "Engine Compartment Components" on page 3-6 to locate the battery.*

Battery cables must be clean and tight. Remove any acid or corrosion from the battery and cables with a sodium bicarbonate and water solution. Cover the battery terminals and cable ends with battery-saver grease.

Note: *The battery is maintenance-free and requires no other service.*

IMPORTANT

Damage to the alternator can occur if:

- **the engine is operated with the battery cables disconnected,**
- **the battery cables are connected when using a fast charger or when welding on the machine (When welding on the machine, remove both cables from the battery and ground the welder to the machine frame near the repair area), or**
- **extra battery cables (booster cables) are connected incorrectly.**

Using a Booster Battery (Jump-Starting)

⚠ WARNING

- **Keep arcs, sparks, flames and lighted tobacco away from batteries. When jump-starting from a booster battery, make final connection (negative) at engine frame away from the battery. Batteries can create flammable gases. Sparks or open flames can cause this gas, and the battery, to explode.**
- **DO NOT jump-start or charge a frozen battery. Warm battery to 60°F (16°C) before connecting to a charger. Unplug charger before connecting or disconnecting cables to battery.**

IMPORTANT

When jump-starting from another machine, be sure the second machine is not running if pre-heating the unstarted machine. High voltage spikes from a running machine can burn out the engine pre-heating system.

IMPORTANT

The booster battery must be 12 volt.

1. Turn the ignition key on the machine with the discharged battery to the "P" position (see Figure 4-16).
2. Open the engine hood (see "Accessing the Engine Compartment" on page 3-6).
3. Stop the engine of the machine with the booster battery.
4. Connect one end of a jumper cable to the positive (+) terminal on the booster battery.
5. Connect the other end of the same cable to the positive (+) terminal on the discharged battery.
6. Connect one end of the second jumper cable to the negative (-) terminal on the booster battery.
7. Connect the other end of the same cable to the frame of the machine with the discharged battery.
8. Start the engine of the machine with the discharged battery.
9. Once the engine is running, remove the cable connected to the frame first.
10. Disconnect the other cable from the positive (+) terminal on the discharged battery.
11. Remove the cables from the booster battery.

IMPORTANT

DO NOT allow the booster cable ends to touch together when removing them from the batteries. Arcs and direct short circuits can cause severe damage to the electrical systems.

12. Close the engine hood and confirm it is latched securely.

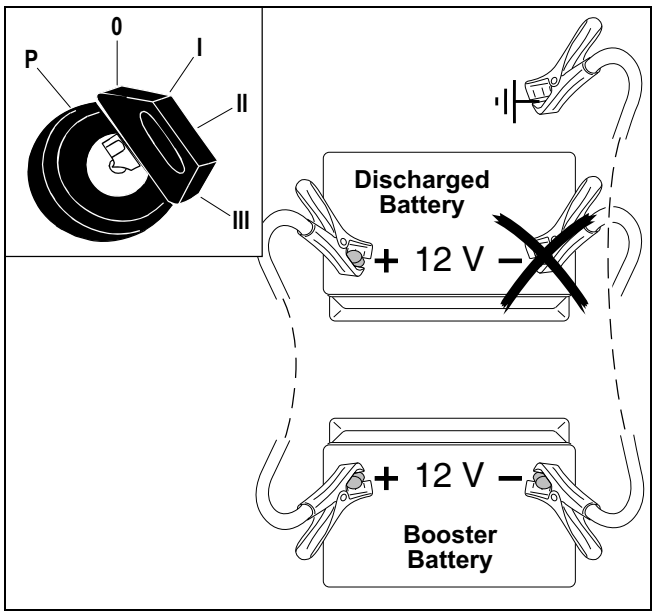


Figure 4-16 – Jump-starting

Checking & Adjusting V-belt Tension

1. Perform the "Mandatory Safety Shutdown Procedure" on page 2-2. Wait for the engine to cool.
2. Open the engine hood (see "Accessing the Engine Compartment" on page 3-6).
3. Inspect the V-belt (1, Figure 4-17) for damage. If the V-belt is damaged, have it replaced by your dealer.
4. Press on the V-belt to check deflection. The belt should deflect no more than 5/16" (8 mm).
5. If deflection is more than 5/16" (8 mm):
   a. Loosen the adjustment bolt (2, Figure 4-17) and rotate the alternator (3) as necessary until V-belt tension is correct.
   b. Tighten bolt (2) and re-check V-belt tension.

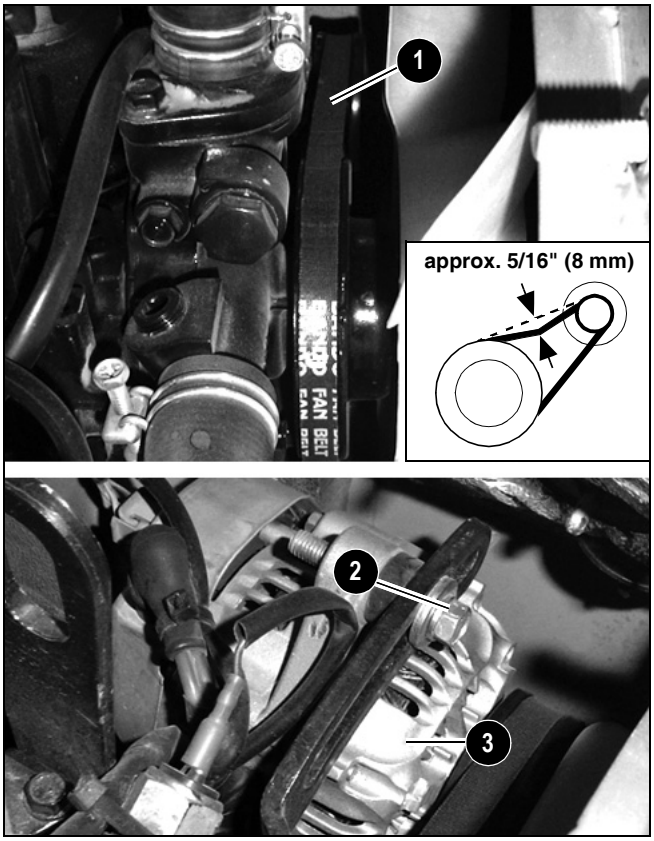


Figure 4-17 – V-belt Tension

Windshield Washer Fluid

1. Perform the "Mandatory Safety Shutdown Procedure" on page 2-2.
2. Open the engine hood (see "Accessing the Engine Compartment" on page 3-6).
3. Open the windshield washer reservoir cover (1, Figure 4-18) and fill the tank with windshield washer fluid.
4. Close the windshield washer tank cover securely.
5. Close the engine hood and confirm it is latched securely.

Figure 4-18 – Fluid Reservoir

Track System

Track Cleaning

If dirt or mud builds up in the track frame, raise the track frame using the boom and dipper arm and then operate the elevated track to clean it. Be sure that the build-up has been cleared from the track. Repeat for the other track. See Figure 4-19.

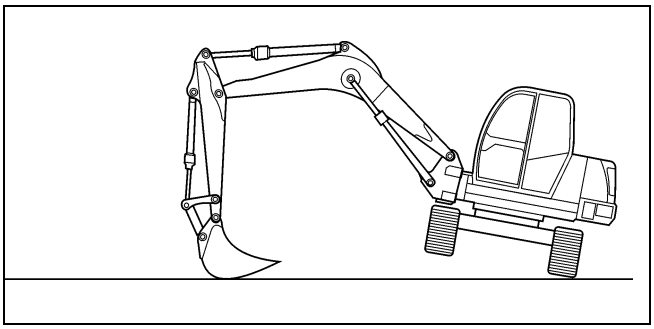


Figure 4-19 – Track Cleaning

Checking the Drive Oil

1. Position the machine on a level surface with drive plugs positioned as shown in Figure 4-20.
2. Perform the "Mandatory Safety Shutdown Procedure" on page 2-2.
3. Remove the top and center plugs (1 and 2, Figure 4-20).
4. If a slight amount of oil does not flow out of the opening for center plug (2), add oil (Chevron Delo Gear 80W-90 or BP Transgear 80W-90) into the top opening (1) until oil flows out of center plug opening (2).
5. Re-install plugs (1) and (2).
6. Wipe off any oil that has flowed out and properly dispose of the soiled towel(s).

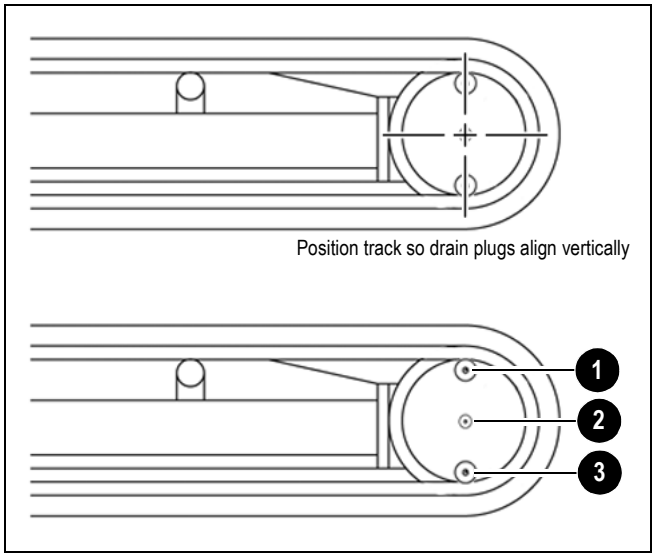


Figure 4-20 – Plugs for Drive Oil Check/ Change

Changing the Drive Oil

1. Position the machine on a level surface with final drive plugs positioned as shown in Figure 4-20.
2. Perform the "Mandatory Safety Shutdown Procedure" on page 2-2.
3. Place a container to catch draining oil underneath the bottom drain plug (3, Figure 4-20).
4. Remove the center plug (2, Figure 4-20).
5. Remove the bottom plug (3) to drain oil into the container. Once all oil has drained, re-install the bottom plug (3).
6. Remove the top drain plug (1, Figure 4-20).
7. Add oil (Chevron Delo Gear 80W-90 or BP Transgear 80W-90) into top plug (1) until oil begins to flow out of center plug hole(2).
8. Re-install plugs (1) and (2).
9. Wipe off any oil that has flowed out and properly dispose of the soiled towel(s) and drained oil in the container.

IMPORTANT

Always dispose of oil according to environmental laws or take to a recycling center for proper disposal. DO NOT pour fluids onto the ground or down a drain.

Checking and Adjusting Track Tension

1. Position the machine on a level surface.
2. Locate the mark (1, Figure 4-22) on the rubber track. Move the machine until this mark is at top center, midway between points A and B (2, Figure 4-22).
3. Use the bucket and dozer blade to lift the unit up until the track is just clear of the ground as shown in Figure 4-21.
4. Perform the "Mandatory Safety Shutdown Procedure" on page 2-2.
5. Measure the clearance of the raised track at the second track roller from the drive gear. Deflection should be between 3/4 - 1" (20 - 25 mm). See Figure 4-22.
6. Using a wrench, loosen the grease fitting (3, Figure 4-22) **one full turn only.** Using a grease gun, pump grease into the fitting until the track is properly tensioned.

Note: *A grease gun is supplied in the machine tool kit.*

IMPORTANT

Do not over-tension the track. If the track is too tight, loosen the grease fitting no more than one full turn to relieve the pressure.

⚠ WARNING

Do not loosen the grease fitting more than two turns, or the fitting could be ejected under pressure and cause injury. Keep your face and body away from the fitting when loosening.

7. Start the engine. Lower the unit to the ground.
8. Repeat this procedure for the other track.

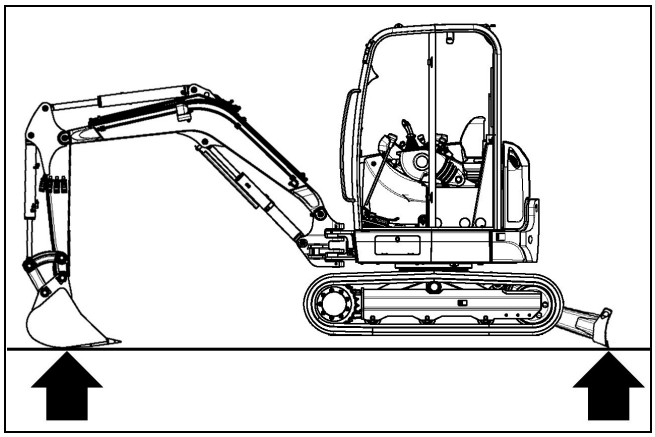


Figure 4-21 – Track Adjustment Position

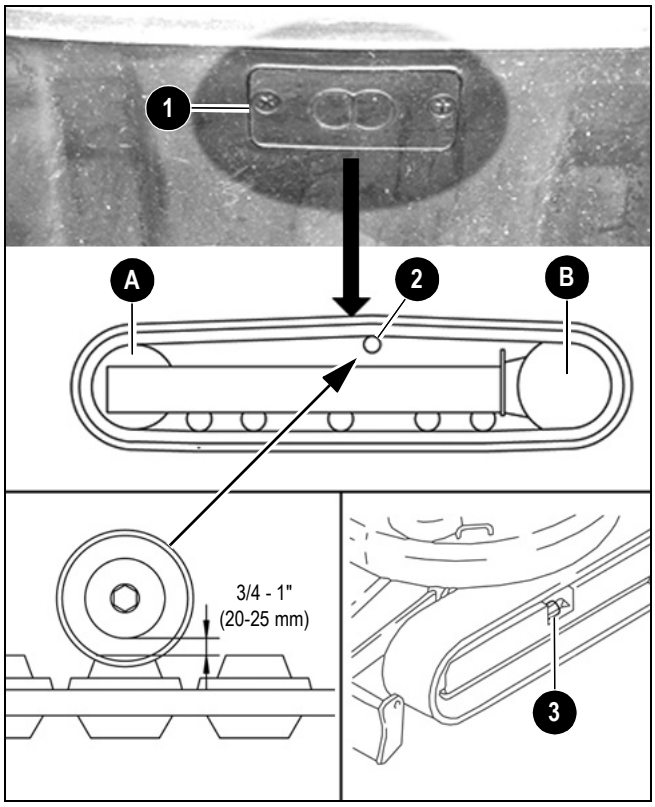


Figure 4-22 – Track Adjustment

Replacing the Cab Filter (cab model only)

The heater unit is located underneath the operator's seat. It has an intake filter that will affect heater performance if it becomes clogged or filled. To check the filter:

1. Use a socket wrench to remove the four bolts securing the heater intake plate (2, Figure 4-16).
2. Lift the floor insulating mat (3) and the floor access door (4).
3. Remove the heater intake plate to access the heater unit.
4. Remove and visually inspect the existing filter (5). If it is clogged with dust and other particulates, replace with a new filter.
5. Replace the heater intake plate. Replace and hand tighten the top two bolts.
6. Close the floor access door and replace the floor insulating mat **before** replacing the bottom two bolts.
7. Once the four bolts have been replaced and hand tightened, finish tightening them with the socket wrench.

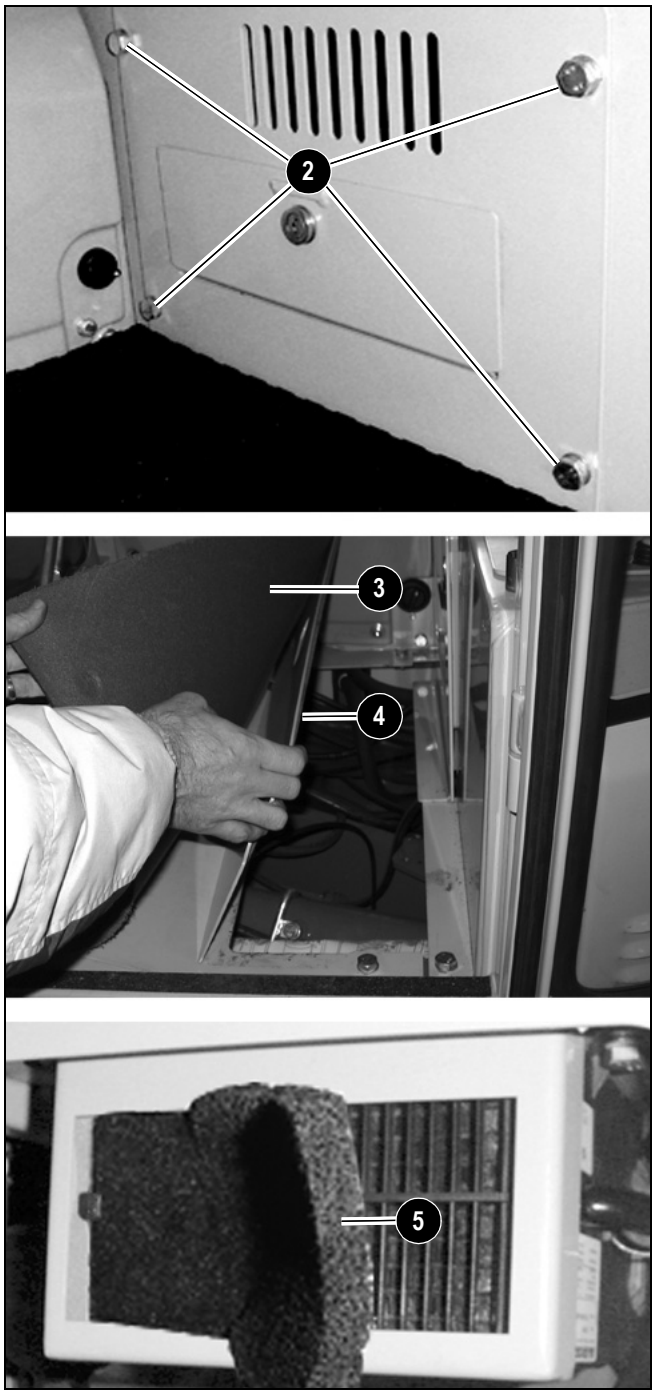


Figure 4-23 – Accessing the Heater Filter

LONG-TERM STORAGE

If storing the machine for a long period (longer than two months), perform the procedures in this section.

Before Storage

1. Wash the entire machine.
2. Lubricate all grease fittings. See "Daily Lubrication" on page 4-8.
3. Change the engine oil and filter according to "Changing Engine Oil and Filter" on page 4-10.
4. Add a fuel stabilizer to the fuel system according to the fuel supplier's recommendations.
5. Remove and fully charge the battery. Store the battery in a cool, dry location.
6. If the machine will not be operated for a month or longer, apply grease to all exposed hydraulic cylinder rod areas or retract all cylinders so rod exposure is minimized. Apply grease to any remaining rod areas.
7. If the ambient temperature (at any time during the storage period) is expected to drop below freezing, make sure the engine coolant is either completely drained from the radiator and engine block or that the amount of anti-freeze is adequate to keep the coolant from freezing. Refer to the engine manual for anti-freeze recommendations and quantities.
8. Protect against extreme weather conditions such as moisture, sunlight and temperature.

During Storage

About once each month, connect the battery and check all fluid levels to make sure they are at the proper level before starting the engine.

Start the engine and allow it to run until it warms up and then move the machine a short distance to help lubricate internal parts. Run the engine until the battery has a chance to recharge and then shut off the engine.

IMPORTANT

If it is desired to operate the hydraulic cylinders at this time, BE SURE to wipe the protective grease (and any adhering dirt) from the cylinder rods prior to starting the engine. After operating, BE SURE to reapply grease to the cylinder rods if the machine will be returned to storage.

After Storage

After removing the machine from storage and before operating it, perform the following:

1. Replace and re-connect the battery.
2. Wipe off grease (and any adhering dirt) from cylinder rods.
3. Check V-belt tension.
4. Check all fluid levels and top-off as necessary.
5. Start the engine. Observe all indicators. If all indicators are functioning properly and reading normally, move the machine outside.
6. When outside, park the machine and let the engine idle for at least five minutes.
7. Shut off the engine and walk around machine. Make a visual inspection looking for evidence of leaks.Review and re-familiarize yourself with all safety precautions starting on page 2-1.
8. Follow the starting and warm-up procedures according to starting on page 3-17.

FINAL SHUTDOWN / DECOMMISIONING

IMPORTANT

Dispose of all materials properly. Used oils/ fluids are environmental contaminants and may only be disposed of at approved collection facilities. Never drain any oils/ fluids directly onto the ground, in municipal waste collection containers, or into metropolitan sewer systems or landfills. Check state and local regulations for other material disposal requirements.

If the machine will no longer be used as intended, shutdown, decommision and dispose of it according to the valid regulations.

Before Disposal

1. Shutdown the machine according to valid regulations regarding proper shutdown.
2. Park the machine on level, dry ground. Ensure the surface can support the weight of the machine. Ensure the location is protected against access by unauthorized persons.
3. Move the throttle to the low-idle position and allow the engine to cool for approximately 2 minutes.
4. Shut off the engine.
5. Move the hydraulic controls to verify that the controls do not cause movement.
6. Raise the left operator console to lock out the hydraulic controls.
7. Switch off all electrical switches.
8. Unfasten the seat belt, remove the ignition key and take it with you.
9. Ensure the machine cannot be operated after shutdown until further disposal.
10. Ensure no environmentally hazardous materials, fluids and/or fuel can escape the machine. Specifically check for leaks form the engine, the hydraulic system and the coolant system.
11. Ensure the machine poses no dangers in the place where it is standing.
12. Remove any dirt and/or debris from the engine compartment, the chassis and the cylinder rod surfaces.
13. Remove the battery
14. Lock the cab door and the storage, hydraulic valve and engine compartments. Remove all keys and take them with you.

Machine Disposal

Make sure all materials are disposed of in an ecologically sound manner.

Recycling the machine in accordance with the current state of the art at the time of recycling. Observe all accident prevention regulations.

Dispose of all parts at the at the recycling sites specific to the material of the part. Take care to separate different materials for recycling.

CHAPTER 5 – TROUBLESHOOTING

ENGINE

Problem	Possible Cause	Corrective Action
Engine hard staring or fails to start	No fuel	Add fuel to tank; bleed air from fuel system
	Incorrect engine oil SAE grade	Replace engine oil with proper grade (“Fluid Capacities/Lubricants” on page 1-4)
	Incorrect fuel grade	Replace fuel with proper grade (“Fluid Capacities/Lubricants” on page 1-4)
	Loose, or corroded starter circuit connections	Repair starter circuit. Contact authorized service center
	Incorrect engine valve clearance	Adjust valve clearance. Contact authorized service center
	Battery power insufficient	Charge battery or replace if necessary (“Battery” on page 4-19)
	Fuel filter contaminated	Replace fuel filter (“Fuel Filter” on page 4-12)
	Malfunctioning fuel injector(s)	Repair fuel injector(s). Contact authorized service center
	Starter not working / pinion fails to engage	Repair starter/pinion. Contact authorized service center
	Pre-heating system not working	Repair pre-heating system. Contact authorized service center
Rough running engine	Incorrect fuel grade	Replace fuel with proper grade (“Fluid Capacities/Lubricants” on page 1-4)
	Incorrect engine valve clearance	Adjust valve clearance. Contact authorized service center
	Fuel line leakage	Replace fuel line. Contact authorized service center
	Malfunctioning fuel injector(s)	Repair fuel injector(s). Contact authorized service center.
Insufficient engine power	Fuel line leakage	Replace fuel line. Contact authorized service center
	Air filter contaminated	Service air filter. (“Engine Air Cleaner” on page 4-11)
	Engine not at operating temperature	Warm up the engine
	Incorrect fuel grade	Replace fuel with proper grade (“Fluid Capacities/Lubricants” on page 1-4)
	Incorrect engine valve clearance	Adjust valve clearance. Contact authorized service center
	Oil level too high	Adjust oil level (“Changing Engine Oil and Filter” on page 4-10)
	Malfunctioning fuel injector(s)	Repair fuel injector(s). Contact authorized service center
	Engine overheated	Check cooling system

Problem	Possible Cause		Corrective Action
Engine overheats	Oil level too low		Add engine oil (“Checking Engine Oil Level” on page 4-9)
	Fouled oil cooler fins		Clean oil cooler. Contact authorized service center
	Damaged fan. Damaged or loose V-belt		Replace the fan / service V-belt (“Hydraulic Hose Maintenance” on page 4-18). Contact authorized service center
	Coolant level too low		Add coolant (“Fluid Capacities/Lubricants” on page 1-4)
	Oil level too high		Adjust oil level (“Changing Engine Oil and Filter” on page 4-10)
	Oil level too low		Add engine oil (“Checking Engine Oil Level” on page 4-9)
	Malfunctioning fuel injector(s)		Repair fuel injector(s). Contact authorized service center
High engine oil consumption	Oil level too high		Adjust oil level (“Changing Engine Oil and Filter” on page 4-10)
	Machine inclination too high		15° maximum inclination up and across slopes; 25° maximum inclination down slopes
	Incorrect engine oil SAE grade		Replace engine oil with proper grade (“Fluid Capacities/Lubricants” on page 1-4)
Engine smoke	Blue	Oil level too high	Adjust oil level (“Changing Engine Oil and Filter” on page 4-10)
		Machine inclination too high	15° maximum inclination up and across slopes; 25° maximum inclination down slopes
	White	Incorrect fuel grade	Replace fuel with proper grade (“Fluid Capacities/Lubricants” on page 1-4)
		Engine starting temperature too low	Wait for engine pre-heat cycle to complete before starting engine
		Incorrect engine valve clearance	Adjust valve clearance. Contact authorized service center
		Malfunctioning fuel injector(s)	Repair fuel injector(s). Contact authorized service center
	Black	Air filter contaminated	Service air filter. (“Engine Air Cleaner” on page 4-11)
		Incorrect engine valve clearance	Adjust valve clearance. Contact authorized service center
		Malfunctioning fuel injector(s)	Repair fuel injector(s). Contact authorized service center

INDICATOR LAMPS

Problem	Possible Cause	Corrective Action
Engine oil pressure indicator light comes on during operation	Engine oil pressure too low	Stop engine immediately. Check oil level and add oil if necessary (“Checking Engine Oil Level” on page 4-9). If oil level is correct, oil pump may have failed
	Engine oil level too low	Add oil (“Checking Engine Oil Level” on page 4-9)
	Oil pump not working	Stop engine immediately. Replace oil pump. Contact authorized service center
	Machine inclination too high	15° maximum inclination up and across slopes; 25° maximum inclination down slopes
	Incorrect engine oil SAE grade	Replace engine oil with proper grade (“Fluid Capacities/Lubricants” on page 1-4)
Water temperature display light comes on during operation (Engine overheating)	Coolant level too low	Add coolant (“Fluid Capacities/Lubricants” on page 1-4)
	Fan blades rotating too slowly	Adjust V-belt tension (“Hydraulic Hose Maintenance” on page 4-18)
	Air filter contaminated	Service air filter. (“Engine Air Cleaner” on page 4-11)
	Coolant system malfunction	Service cooling system. Contact authorized service center
Battery voltage light comes on during operation	Alternator not charging properly / malfunctioning alternator	Adjust V-belt tension (“Hydraulic Hose Maintenance” on page 4-18). Service alternator. Contact authorized service center
	Loose, or corroded charging circuit connections	Repair charging circuit. Contact authorized service center
Fuel light comes on	Low fuel	Add fuel
Air filter light comes on	Air filter contaminated	Service air filter (“Engine Air Cleaner” on page 4-11)

SEALS AND HOSES

Problem	Possible Cause	Corrective Action
Oil, coolant or fuel leakage under engine	Loose hose connection(s)	Tighten hose connection(s)
	Seals or hoses damaged	Change seals or hoses and check engine oil, engine coolant or fuel levels. Add engine oil, coolant or fuel if necessary
Hydraulic fluid losses from hydraulic system	Loose hose connection(s)	Tighten hose connection(s)
	Seals, hoses or lines damaged	Service seals, hoses and/or lines. Contact authorized service center

TRAVELING GEAR

Problem	Possible Cause	Corrective Action
Machine will not travel	Obstruction jamming track mechanism	Remove object
	Gears inoperative	Repair gears. Contact authorized service center
Machine will not travel straight forward or rearward	Obstruction jamming track mechanism	Remove object
	Unequal track tension	Adjust track tension (“Checking and Adjusting Track Tension” on page 4-23)
	Travel valves damaged	Repair/replace valves. Contact authorized service center

BUCKET, BOOM AND DOZER BLADE

Problem	Possible Cause	Corrective Action
Swing frame rotation malfunctioning	Swing brake does not release	Contact authorized dealer
	Insufficient lubrication	Lubricate swing gear using remote grease fitting
Front end attachments do not work or work only at a low performance level	Low hydraulic fluid level	Add hydraulic fluid (“Checking Hydraulic Oil Level” on page 4-15)
	Low engine power	See Insufficient engine power on page 5-1. Contact authorized service center
	Engine to pump coupling or hydraulic pump damaged	Contact authorized service center
	Pressure limiting valves set too low	Contact authorized service center
	Hydraulic cylinder damaged	Contact authorized service center
	Control valves damaged	Contact authorized service center
Hydraulic cylinders lower too quickly	Seals contaminated or damaged	Contact authorized service center
	Heavy internal leakage at control spools	Contact authorized service center
	Secondary cartridge valves damaged	Contact authorized service center
Hydraulic lines overheat	Hydraulic oil filter blocked	Replace filter
	Low hydraulic fluid level	Add hydraulic fluid (“Checking Hydraulic Oil Level” on page 4-15)
	Secondary cartridges set too low	Contact authorized service center
	Hydraulic fluid cooling system not in working order	Service hydraulic fluid cooling system. Contact authorized service center

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TORQUE SPECIFICATIONS

*Note: Use these torque values when tightening **Gehl** hardware (excluding: locknuts and self-tapping, thread forming and sheet metal screws) unless specified otherwise.*

Hydraulic fittings with various seals (light application). All torque values are in lb.-ft. (Nm) unless marked otherwise.

Thread	Straight pipe fitting with thread and screwed plug (GE)			Non-return with elastic seal	Identification aid outside Ø
	Sealing washer	Elastic seal	O-ring		
M10X1.0	7 (9)	13 (18)	11 (15)	13 (18)	0.4 in. (10 mm)
M12X1.5	15 (20)	18 (25)	18 (25)	18 (25)	0.5 in. (12 mm)
M14X1.5	26 (35)	33 (45)	26 (35)	26 (35)	0.6 in. (14 mm)
M16X1.5	33 (45)	41 (55)	30 (40)	37 (50)	0.6 in. (16 mm)
M18X1.5	41 (55)	52 (70)	33 (45)	52 (70)	0.7 in. (18 mm)
M22X1.5	48 (65)	92 (125)	44 (60)	92 (125)	0.9 in. (22 mm)
M27X2.0	66 (90)	133 (180)	74 (100)	107 (145)	1.0 in. (27 mm)
M33X2.0	111 (150)	229 (310)	118 (160)	155 (210)	1.3 in. (33 mm)
M42X2.0	177 (240)	332 (450)	155 (210)	266 (360)	1.7 in. (42 mm)
M48X2.0	214 (290)	398 (540)	192 (260)	398 (540)	1.9 in. (48 mm)
G1/8A	7 (9)	13 (18)	11 (15)	13 (18)	0.4 in. (9.73 mm)
G1/4A	26 (35)	26 (35)	22 (30)	26 (35)	0.5 in. (13.16 mm)
G3/8A	33 (45)	52 (70)	33 (45)	37 (50)	0.7 in. (16.66 mm)
G1/2A	48 (65)	66 (90)	41 (55)	48 (65)	0.8 in. (20.96 mm)
G3/4A	66 (90)	133 (180)	74 (100)	103 (140)	1.0 in. (26.44 mm)
G1A	111 (150)	229 (310)	118 (160)	140 (190)	1.3 in. (33.25 mm)
G1 1/4A	177 (240)	332 (450)	155 (210)	266 (360)	1.7 in. (41.91 mm)
G1 1/2A	214 (290)	398 (540)	192 (260)	398 (540)	1.9 in. (47.80 mm)

Hydraulic fittings with various seals (heavy application). All torque values are in lb.-ft. (Nm) unless marked otherwise.

Thread	Straight pipe fitting with thread and screwed plug (GE)			Non-return with elastic seal	Identification aid outside Ø
	Sealing washer	Elastic seal	O-ring		
M12X1.5	15 (20)	26 (35)	26 (35)	26 (35)	0.5 in. (12 mm)
M14X1.5	26 (35)	41 (55)	33 (45)	33 (45)	0.6 in. (14 mm)
M16X1.5	33 (45)	52 (70)	41 (55)	41 (55)	0.6 in. (16 mm)
M18X1.5	41 (55)	66 (90)	52 (70)	52 (70)	0.7 in. (18 mm)
M20X1.5	41 (55)	92 (125)	59 (80)	74 (100)	0.8 in. (20 mm)
M22X1.5	48 (65)	100 (135)	74 (100)	92 (125)	0.9 in. (22 mm)
M27X2.0	66 (90)	133 (180)	125 (170)	100 (135)	1.0 in. (27 mm)
M33X2.0	111 (150)	229 (310)	229 (310)	155 (210)	1.3 in. (33 mm)
M42X2.0	177 (240)	332 (450)	243 (330)	266 (360)	1.7 in. (42 mm)
M48X2.0	214 (290)	398 (540)	310 (420)	398 (540)	1.9 in. (48 mm)
G1/8A	26 (35)	41 (55)	33 (45)	33 (45)	0.5 in. (13.16 mm)
G1/4A	33 (45)	59 (80)	44 (60)	44 (60)	0.7 in. (16.66 mm)
G3/8A	48 (65)	85 (115)	55 (75)	74 (100)	0.8 in. (20.96 mm)
G1/2A	66 (90)	133 (180)	125 (170)	107 (145)	1.0 in. (26.44 mm)
G3/4A	111 (150)	229 (310)	229 (310)	192 (260)	1.3 in. (33.25 mm)
G1A	177 (240)	332 (450)	243 (330)	266 (360)	1.7 in. (41.91 mm)
G1 1/4A	214 (290)	398 (540)	310 (420)	398 (540)	1.9 in. (47.80 mm)

With coarse-pitch thread. All torque values are in lb.-ft. (Nm) unless marked otherwise.					
Thread	Threads according to DIN 912, DIN 931, DIN 933, etc.			Threads according to DIN 7984	
	8.8	10.9	12.9	8.8	10.9
M5	4.1 (5.5)	6 (8)	7 (10)	4 (5)	5 (7)
M6	7 (10)	10 (14)	13 (17)	6.3 (8.5)	9 (12)
M8	18 (25)	26 (35)	31 (42)	15 (20)	22 (30)
M10	33 (45)	48 (65)	59 (80)	30 (40)	44 (59)
M12	64 (87)	81 (110)	108 (147)	51 (69)	74 (100)
M14	100 (135)	133 (180)	170 (230)	81 (110)	118 (160)
M16	155 (210)	203 (275)	258 (350)	125 (170)	184 (250)
M18	207 (280)	302 (410)	354 (480)	181 (245)	254 (345)
M20	302 (410)	420 (570)	509 (690)	251 (340)	361 (490)
M22	406 (550)	575 (780)	686 (930)	339 (460)	487 (660)
M24	524 (710)	738 (1000)	878 (1190)	435 (590)	620 (840)
M27	767 (1040)	1092 (1480)	1305 (1770)	642 (870)	922 (1250)
M30	1047 (1420)	1482 (2010)	1770 (2400)	885 (1200)	1254 (1700)

With fine-pitch thread. All torque values are in lb.-ft. (Nm) unless marked otherwise.					
Thread	Threads according to DIN 912, DIN 931, DIN 933, etc.			Threads according to DIN 7984	
	8.8	10.9	12.9	8.8	10.9
M8X1.0	18 (25)	27 (37)	32 (43)	16 (22)	24 (32)
M10X1.0	37 (50)	55 (75)	65 (88)	32 (43)	48 (65)
M10X1.25	36 (49)	52 (71)	61 (83)	31 (42)	46 (62)
M12X1.25	64 (87)	96 (130)	111 (150)	55 (75)	81 (110)
M12X1.5	61 (83)	92 (125)	107 (145)	53 (72)	77 (105)
M14X1.5	100 (135)	148 (200)	173 (235)	89 (120)	129 (175)
M16X1.5	155 (210)	229 (310)	266 (360)	133 (180)	195 (265)
M18X1.5	232 (315)	332 (450)	391 (530)	199 (270)	284 (385)
M20X1.5	325 (440)	465 (630)	538 (730)	277 (375)	391 (530)
M22X1.5	435 (590)	620 (840)	723 (980)	369 (500)	524 (710)
M24X2.0	546 (740)	789 (1070)	922 (1250)	465 (630)	664 (900)
M27X2.0	811 (1100)	1143 (1550)	1328 (1800)	679 (920)	959 (1300)
M30X2.0	1106 (1500)	1586 (2150)	1844 (2500)	959 (1300)	1364 (1850)

WARNING

THIS OPERATOR'S MANUAL IS PROVIDED FOR OPERATOR USE

DO NOT REMOVE FROM THIS MACHINE

Do not start, operate or work on the machine until you carefully read and thoroughly understand the contents of this Operator's Manual.

Failure to follow safety, operating and maintenance instructions can result in serious injury to the operator or bystanders, poor operation, and costly breakdowns.

If you have any questions on proper operation, adjustment or maintenance of the machine, contact your dealer or the Gehl Company Service Department before starting or continuing operation.

California Proposition 65 Warnings:

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer and birth defects and other reproductive harm.

Battery post, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and birth defects and other reproductive harm. **Wash hands after handling battery**.

GEHL®

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