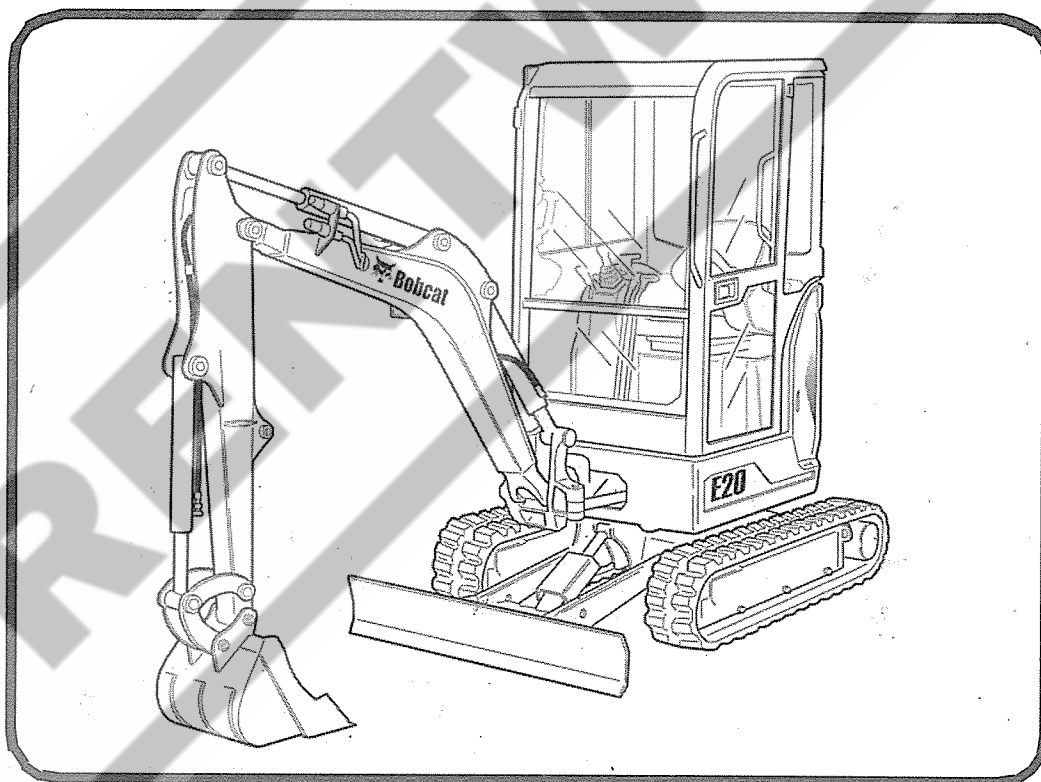




Bobcat®

Operation & Maintenance Manual E20 Compact Excavator

S/N B3BL11001 & Above



RENTWAY

OPERATOR SAFETY WARNING



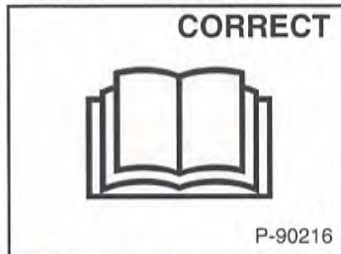
WARNING

Operator must have instructions before operating the machine. Untrained operators can cause injury or death.

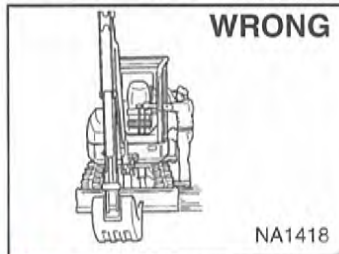
W-2001-0502



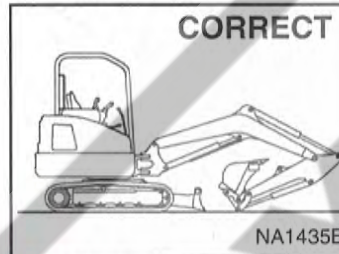
Safety Alert Symbol: This symbol with a warning statement, means: "Warning, be alert! Your safety is involved!" Carefully read the message that follows.



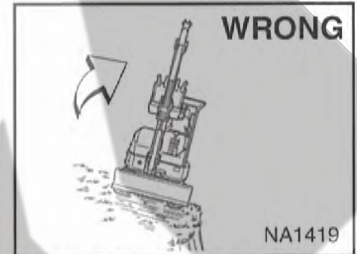
- ⚠ Never operate without instructions.
- ⚠ Read machine signs, and Operation & Maintenance Manual, and Operator's Handbook.



- ⚠ Do not grasp control handles when entering cab / canopy.
- ⚠ Be sure controls are in neutral before starting.
- ⚠ Sound horn and check behind machine before starting.



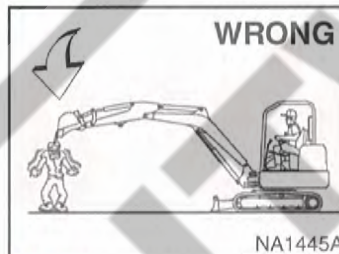
- ⚠ Never operate without approved cab / canopy.
- ⚠ Never modify equipment.
- ⚠ Never use attachments not approved by Bobcat Company.



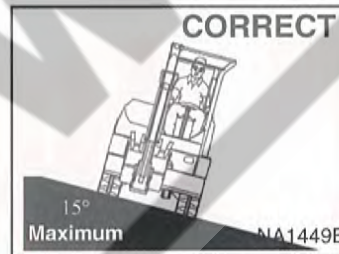
- ⚠ Avoid steep areas or banks that could break away.



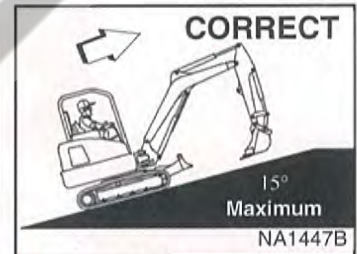
- ⚠ Use caution to avoid tipping - do not swing heavy load over side of track.
- ⚠ Operate on flat, level ground.



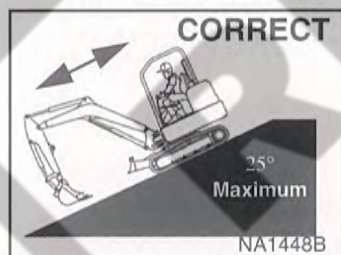
- ⚠ Keep bystanders out of maximum reach area.
- ⚠ Do not travel or turn with bucket extended.
- ⚠ Never carry riders.



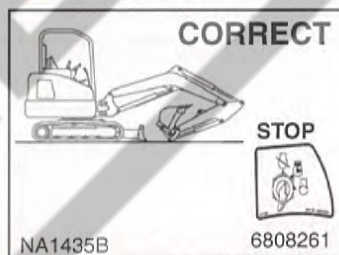
- ⚠ Never exceed a 15° slope to the side.



- ⚠ Never travel up a slope that exceeds 15°.



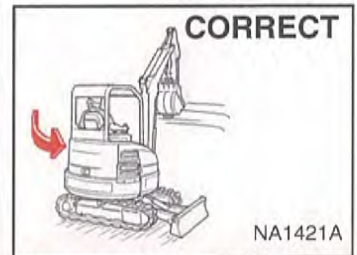
- ⚠ Never exceed 25° when going down or backing up a slope.



- ⚠ To leave excavator, lower the work equipment and the blade to the ground. Stop the engine.



- ⚠ Fasten seat belt securely.
- ⚠ Operate controls only from operator's seat.



- ⚠ Look in the direction of rotation and make sure no bystanders are in the work area.

SAFETY EQUIPMENT

The excavator must be equipped with safety items necessary for each job. Ask your dealer about attachments and accessories.

1. SEAT BELT: Check belt fasteners and check for damaged webbing or buckle.
2. OPERATOR CAB / CANOPY (ROPS and TOPS): Check condition and mounting hardware.
3. OPERATOR'S HANDBOOK: Must be in the cab / canopy.
4. LEFT HAND CONSOLE: When raised must deactivate the travel and hydraulic functions.
5. SAFETY SIGNS (DECALS): Replace if damaged.
6. GRAB HANDLES: Replace if damaged.
7. INTEGRATED SLEW LOCK BRAKE.
8. SAFETY TREAD.: Replace if damaged.

OSW66-0409



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REFERENCE INFORMATION

Write the correct information for YOUR Bobcat excavator in the spaces below. Always use these numbers when referring to your Bobcat excavator.

Excavator Serial Number B3BL13918

Engine Serial Number D122-4 HF4830

NOTES:

~~YOUR BOBCAT DEALER:~~

Burgo's Equipment Hire

ADDRESS:

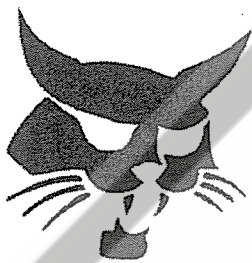
118-120 Mount Lindesay Hwy, Gleneagle QLD 4285

PHONE:

0448 665 010 0437 183 777

Bobcat Company
P.O. Box 128
Gwinner, ND 58040-0128
UNITED STATES OF AMERICA

Doosan Benelux SA
Drève Richelle 167
B-1410 Waterloo
BELGIUM



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FOREWORD

This Operation & Maintenance Manual was written to give the owner / operator instructions on the safe operation and maintenance of the Bobcat excavator. READ AND UNDERSTAND THIS OPERATION & MAINTENANCE MANUAL BEFORE OPERATING YOUR BOBCAT EXCAVATOR. If you have any questions, see your Bobcat dealer. This manual can illustrate options and accessories not installed on your excavator.

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RENTAL

BOBCAT COMPANY IS ISO 9001 CERTIFIED



ISO 9001 is an international standard that specifies requirements for a quality management system that controls the processes and procedures which we use to design, develop, manufacture and distribute Bobcat products.

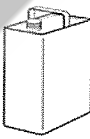
British Standards Institute (**BSI**) is the Certified Registrar Bobcat Company chose to assess the Company's compliance with the ISO 9001 at Bobcat's manufacturing facilities in Gwinner and Bismarck, North Dakota (U.S.A.), Pontchateau (France), Dobris (Czech Republic) and the Bobcat corporate offices (Gwinner, Bismarck and West Fargo) in North Dakota. Only certified assessors, like BSI, can grant registrations.

ISO 9001 means that as a company we say what we do and do what we say. In other words, we have established procedures and policies, and we provide evidence that the procedures and policies are followed.

CALIFORNIA PROPOSITION 65 WARNING

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

REGULAR MAINTENANCE ITEMS

	ENGINE OIL FILTER 6671057		BATTERY 6670251
	FUEL FILTER 6667352 FUEL FILTER - Pre-Filter 7247169		HYDRAULIC FILL / BREATHER CAP 6692836
	AIR FILTER, Outer 6673752		FLUID, Hydraulic / Hydrostatic 6903117 - 9,5 L (2.5 U.S. gal) 6903118 - 18,9 L (5 U.S. gal) 6903119 - 208 L (55 U.S. gal)
	AIR FILTER, Inner 6673753		
	PRIMARY HYDRAULIC FILTER 6661248		ANTI-FREEZE, Propylene Glycol 6983128 - Premixed 6983129 - Concentrate
			RADIATOR CAP 7257434
ENGINE OIL 7023080 SAE 15W40 CE/SG (12 qt) 7023076 SAE 10W30 CE/SG (12 qt) 6903109 SAE 30W CE/SG (12 qt) 7023082 SAE 15W40 CE/SG (2.5 U.S. gal) 7023078 SAE 10W30 CE/SG (2.5 U.S. gal) 6903111 SAE 30W CE/SG (2.5 U.S. gal)		ENGINE OIL 7023081 SAE 15W40 CE/SG (1 U.S. gal) 7023077 SAE 10W30 CE/SG (1 U.S. gal) 6903110 SAE 30W CE/SG (1 U.S. gal)	

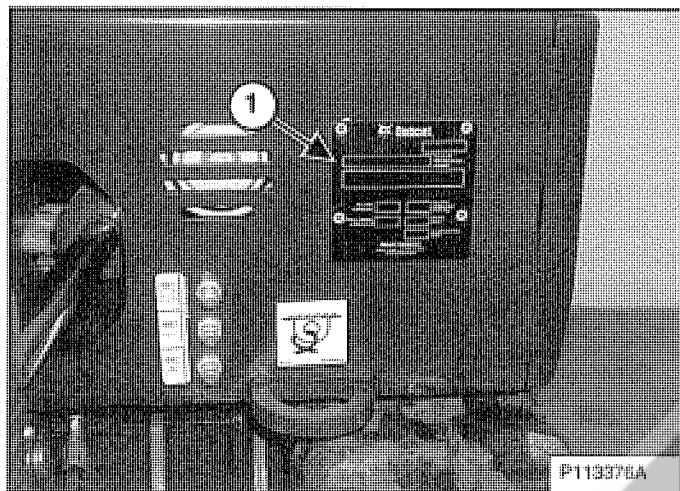
NOTE: Always verify Part Numbers with your Bobcat dealer.

SERIAL NUMBER LOCATIONS

Always use the serial number of the excavator when requesting service information or when ordering parts. Early or later models (identification made by serial number) can use different parts, or it can be necessary to use a different procedure in doing a specific service operation.

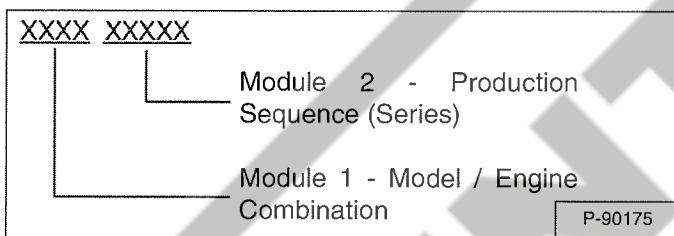
Excavator Serial Number

Figure 1



The excavator serial number plate (Item 1) [Figure 1] is located on the frame of the machine in the location shown.

Figure 2

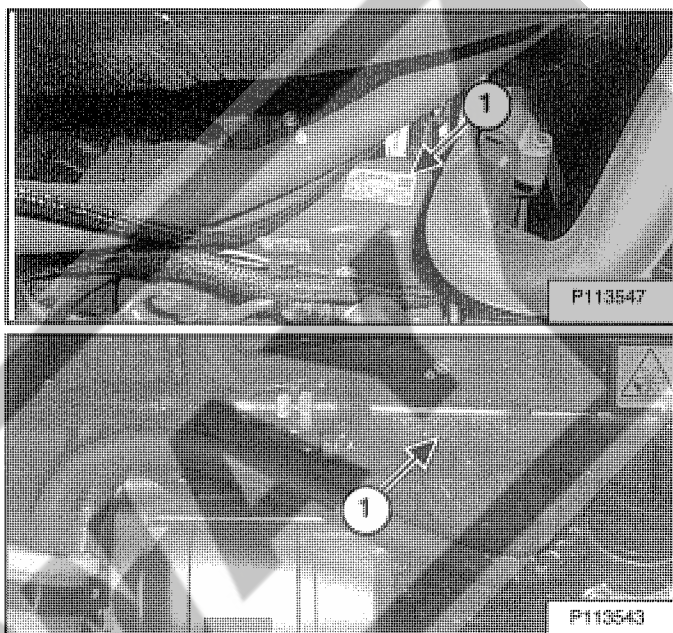


Explanation of excavator Serial Number [Figure 2]:

1. The four digit Model / Engine Combination Module number identifies the model number and engine combination.
2. The five digit Production Sequence Number identifies the order which the excavator is produced.

Engine Serial Number

Figure 3



The engine serial number is located on the top cover (Item 1) or on the side of the engine block (Item 2) [Figure 3] above the fuel pump.

DELIVERY REPORT

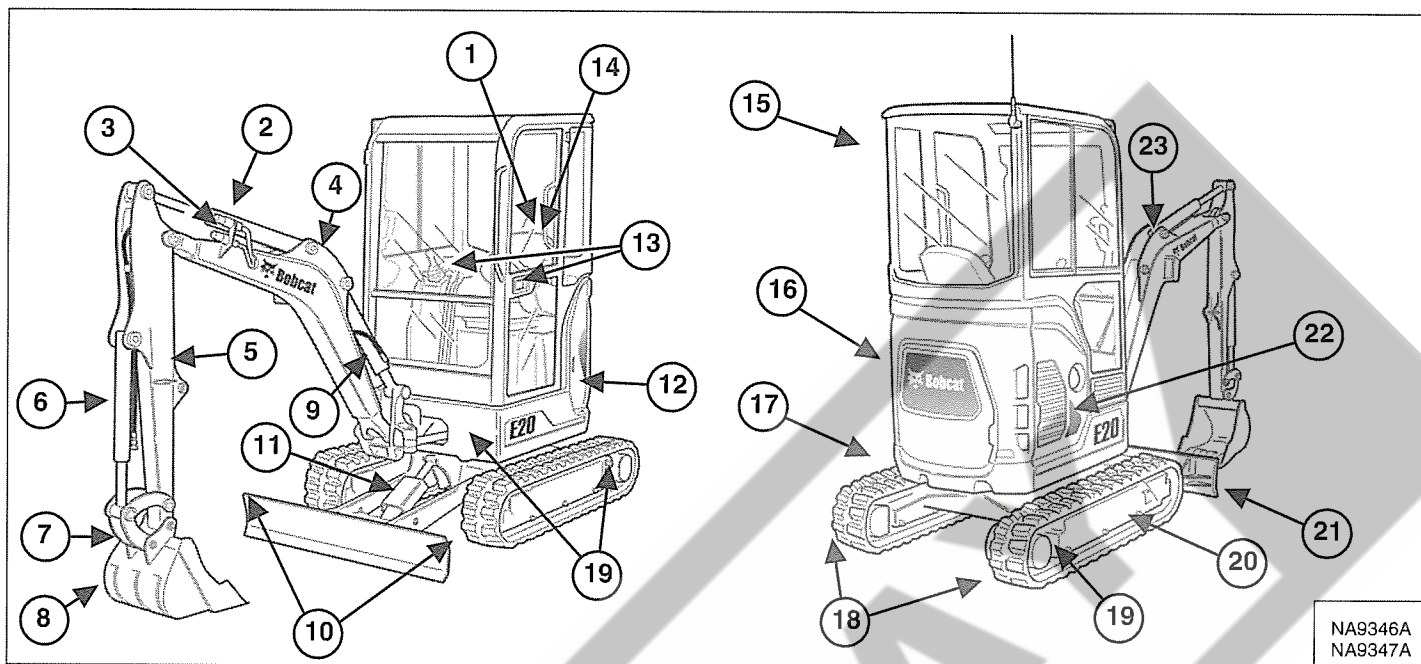
Figure 4

A form titled 'DELIVERY REPORT'. It contains several sections: 'WARNING' (with a warning symbol), 'ITEMS TO BE EXPLAINED OR SHOWN TO OWNER OR OPERATOR', and 'SIGNED BY DEALER'. The form is divided into columns for 'ITEM', 'EXPLANATION', and 'SIGNED BY'. The bottom right corner has the number 'B-16315'.

The delivery report [Figure 4] contains a list of items that must be explained or shown to the owner or operator by the dealer when the Bobcat excavator is delivered.

The delivery report must be reviewed and signed by the owner or operator and the dealer.

EXCAVATOR IDENTIFICATION



ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	Operator's Handbook	15	Cab (ROPS / TOPS) [B]
2	Arm Cylinder	16	Rear Cover
3	Auxiliary Quick Couplers	17	Counterweight
4	Boom	18	Tracks
5	Arm	19	Tie Downs (Both Sides)
6	Bucket Cylinder	20	Track Frames
7	Bucket Link	21	Blade
8	Bucket [A]	22	Right Side Cover
9	Boom Cylinder	23	Lift Point
10	Tie Downs / Lift Points		
11	Blade Cylinder		
12	Upperstructure		
13	Control Levers (Joysticks)		
14	Operator's Seat with Seat Belt		

[A] BUCKET - Several different buckets and other attachments are available for the Bobcat excavator.

[B] ROPS, TOPS - (Roll-Over Protective Structure / Tip-Over Protective Structure) as standard equipment. The ROPS / TOPS meets ISO 12117-2 AND ISO 12117.

FEATURES, ACCESSORIES AND ATTACHMENTS

Standard Items

Model E20 Bobcat excavators are equipped with the following standard items:

- 1354 mm (53.3 in) Dozer Blade (Including extensions)
- Canopy with ROPS / TOPS Approval
- 230 mm (9.0 in) Rubber Tracks
- Two-Speed Travel
- Auxiliary Hydraulics On Boom With Quick Couplers
- Engine Speed Control Lever
- Hydraulic and Travel Control Lockouts
- Work Light - Boom Mounted
- Engine with Shut Down
- Track Retraction - Expansion Valve / Switch
- Horn
- Hydraulic Joystick Controls
- Adjustable Seat
- Retractable Seat Belt
- Spark Arrester Muffler
- Advanced Diagnostics
- Counterweight

Options And Accessories

Below is a list of some equipment available from your Bobcat excavator dealer as Dealer and / or Factory Installed Accessories and Factory Installed Options. See your Bobcat dealer for other available options, accessories and attachments.

- Auto Shift Drive Motors
- Auxiliary Hydraulics On Arm
- Enclosed Cab With Heater
- Travel Motion Alarm
- Keyless Start
- Canopy / Cab Mounted Lights
- Cab Top Guard Kit (FOGS) (Standard with Canopy)
- Special Application Kit
- Load Holding Valve - Boom
- Load Holding Valve - Arm
- Lift Eye
- Suspension Seat
- Strobe Light
- Side Mirror
- Additional Counter Weight
- Fire Extinguisher
- Radio

Specifications subject to change without notice and standard items can vary.

Attachments

These and other attachments are approved for use on this model Bobcat excavator. Do not use unapproved attachments. Attachments not manufactured by Bobcat can not be approved.

The versatile Bobcat excavator quickly turns into a multi-job machine with a variety of attachments.

See your Bobcat dealer for information about approved attachments and attachment Operation & Maintenance Manuals.

- Auger
- Breaker
- Hydraulic Clamp
- Grading bucket
- Trenching Buckets

Buckets Available

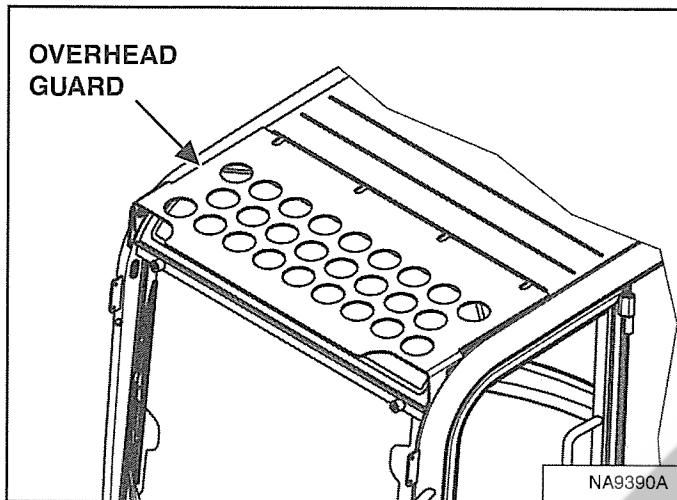
Increase the versatility of your Bobcat excavator with a variety of bucket sizes.

Many bucket styles, widths and different capacities are available for a variety of different applications. They include Trenching, Digging, Grading, Tilt, to name a few. See your Bobcat dealer for the correct bucket for your Bobcat excavator and application.

FEATURES, ACCESSORIES AND ATTACHMENTS (CONT'D)

Falling-Object Guards (FOGS)

Figure 5



Available for special applications that require protection from smaller objects that can fall on the canopy / cab or restrict material from entering cab openings [Figure 5] and [Figure 6].

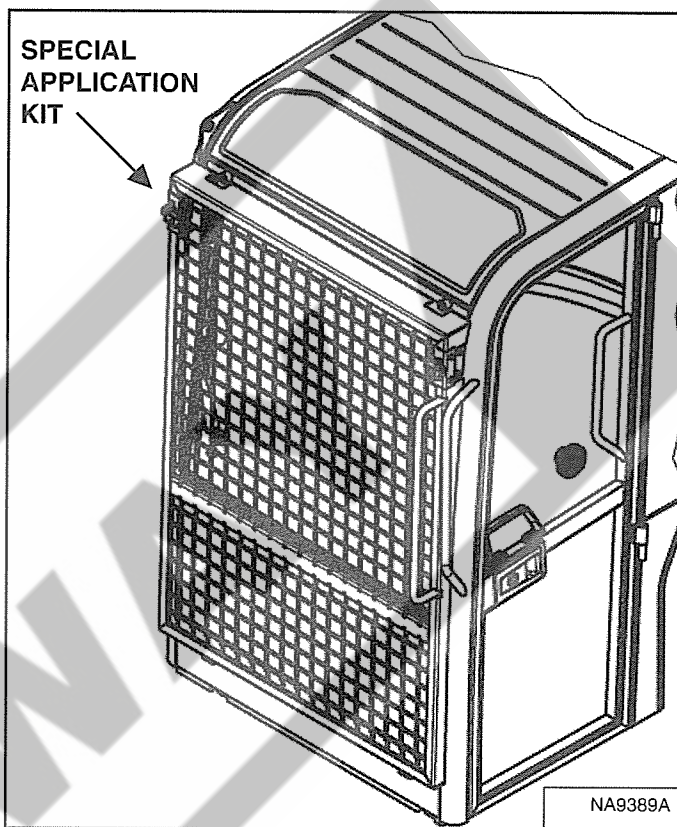
Excavator equipped with a cab (canopy excavators are equipped with the overhead guard as standard equipment) must have the overhead guard [Figure 5] installed to meet the top guard requirements in ISO 10262.

See your Bobcat Dealer for more information.

NOTE: The Falling-Object Guard is factory installed on the canopy.

Special Applications Kit

Figure 6



The excavator must have the special applications kit [Figure 6] installed to meet the front guard requirements in ISO 10262 - level 1.

Kit includes an upper and lower screen guard.

See your Bobcat Dealer for more information.

Special Applications Kit Inspection And Maintenance

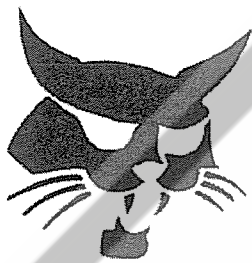
The Special Applications Kit must be regularly inspected and maintained. Inspect the screen for damage. Replace parts as necessary.



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SAFETY AND TRAINING RESOURCES

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SAFETY INSTRUCTIONS

Before Operation

Carefully follow the operating and maintenance instructions in this manual.

The Bobcat excavator is highly maneuverable and compact. It is rugged and useful under a wide variety of conditions. This presents an operator with hazards associated with off highway, rough terrain applications, common with Bobcat excavator usage.

The Bobcat excavator has an internal combustion engine with resultant heat and exhaust. All exhaust gases can kill or cause illness so use the excavator with adequate ventilation.

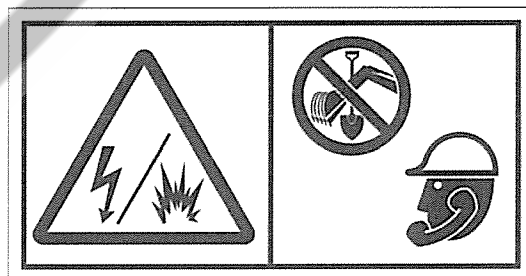
The dealer explains the capabilities and restrictions of the Bobcat excavator and attachment for each application. The dealer demonstrates the safe operation according to Bobcat instructional materials, which are also available to operators. The dealer can also identify unsafe modifications or use of unapproved attachments. The attachments and buckets are designed for a Rated Lift Capacity. They are designed for secure fastening to the Bobcat excavator. The user must check with the dealer, or Bobcat literature, to determine safe loads of materials of specified densities for the machine - attachment combination.

The following publications and training materials provide information on the safe use and maintenance of the Bobcat machine and attachments:

- The Delivery Report is used to assure that complete instructions have been given to the new owner and that the machine and attachment is in safe operating condition.
- The Operation & Maintenance Manual delivered with the machine or attachment gives operating information as well as routine maintenance and service procedures. It is a part of the machine and can be stored in a container provided on the machine. Replacement Operation & Maintenance Manuals can be ordered from your Bobcat dealer.
- Machine signs (decals) instruct on the safe operation and care of your Bobcat machine or attachment. The signs and their locations are shown in the Operation & Maintenance Manual. Replacement signs are available from your Bobcat dealer.

- An Operator's Handbook is fastened to the operator cab of the excavator. It's brief instructions are convenient to the operator. The handbook is available from your dealer in an English edition or one of many other languages. See your Bobcat dealer for more information on translated versions.
- The AEM Safety Manual delivered with the machine gives general safety information.
- The Compact Excavator Operating Training Course is available through your Bobcat dealer. This course is intended to provide rules and practices of correct operation of the Bobcat excavator. The course is available in English and Spanish versions.
- Service Safety Training Courses are available from your Bobcat dealer. They provide information for safe and correct service procedures.
- See the PUBLICATIONS AND TRAINING RESOURCES Page in this manual or your Bobcat dealer for Service and Parts Manuals, printed materials, videos, or training courses available. Also check the Bobcat web sites www.training.bobcat.com or www.bobcat.com

The dealer and owner / operator review the recommended uses of the product when delivered. If the owner / operator will be using the machine for a different application(s) he or she must ask the dealer for recommendations on the new use.



Call Before You Dig
Dial 811 (USA Only)
1-888-258-0808 (USA & Canada)

When you call, you will be directed to a location in your state / province, or city for information about buried lines (telephone, cable TV, water, sewer, gas, etc.).

SI EXC-0913

SAFETY INSTRUCTIONS (CONT'D)

Safe Operation Is The Operator's Responsibility



Safety Alert Symbol

This symbol with a warning statement means:
"Warning, be alert! Your safety is involved!"
Carefully read the message that follows.



WARNING

Operator must have instructions before operating the machine. Untrained operators can cause injury or death.

W-2001-0502

IMPORTANT

This notice identifies procedures which must be followed to avoid damage to the machine.

I-2019-0284



DANGER

The signal word **DANGER** on the machine and in the manuals indicates a hazardous situation which, if not avoided, will result in death or serious injury.

D-1002-1107



WARNING

The signal word **WARNING** on the machine and in the manuals indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

W-2044-1107

The Bobcat excavator and attachment must be in good operating condition before use.

Check all of the items on the Bobcat Service Schedule Decal under the 8-10 hour column or as shown in the Operation & Maintenance Manual.

Safe Operation Needs A Qualified Operator

For an operator to be qualified, he or she must not use drugs or alcoholic drinks which impair alertness or coordination while working. An operator who is taking prescription drugs must get medical advice to determine if he or she can safely operate a machine.

A Qualified Operator Must Do The Following:

Understand the Written Instructions, Rules and Regulations

- The written instructions from Bobcat Company include the Delivery Report, Operation & Maintenance Manual, Operator's Handbook, Safety Manual and machine signs (decals).
- Check the rules and regulations at your location. The rules may include an employer's work safety requirements. Regulations may apply to local driving requirements or use of a Slow Moving Vehicle (SMV) emblem. Regulations may identify a hazard such as a utility line.

Have Training with Actual Operation

- Operator training must consist of a demonstration and verbal instruction. This training is given by your Bobcat dealer before the product is delivered.
- The new operator must start in an area without bystanders and use all the controls until he or she can operate the machine and attachment safely under all conditions of the work area. Always fasten seat belt before operating.
- Operator Training Courses are available from your Bobcat dealer in English and Spanish. They provide information for safe and efficient equipment operation. Safety videos are also available.
- Service Safety Training Courses are available from your Bobcat dealer. They provide information for safe and correct service procedures.

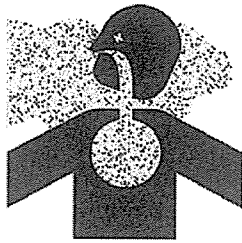
Know the Work Conditions

- Know the weight of the materials being handled. Avoid exceeding the Rated Lift Capacity of the machine. Material which is very dense will be heavier than the same volume of less dense material. Reduce the size of load if handling dense material.
- The operator must know any prohibited uses or work areas, for example, he or she needs to know about excessive slopes.
- Know the location of any underground lines. Call local utilities or the TOLL FREE phone number found in the *Before Operation* section of this manual.
- Wear tight fitting clothing. Always wear safety glasses when doing maintenance or service. Safety glasses, respiratory equipment, hearing protection or Special Applications Kits are required for some work. See your Bobcat dealer about Bobcat safety equipment for your model.

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SAFETY INSTRUCTIONS (CONT'D)

Avoid Silica Dust



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

FIRE PREVENTION



Maintenance

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

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

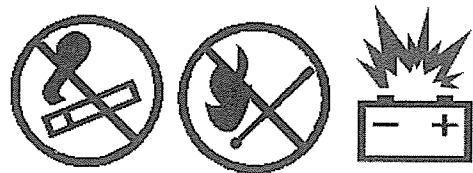
The operator's area, engine compartment and engine cooling system must be inspected every day and cleaned if necessary to prevent fire hazards and overheating.

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

Operation

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

Electrical



Check all electrical wiring and connections for damage. Keep the battery terminals clean and tight. Repair or replace any damaged part or wires that are loose or frayed.

Battery gas can explode and cause serious injury. Use the procedure in the Operation & Maintenance Manual for connecting the battery and for jump starting. Do not jump start or charge a frozen or damaged battery. Keep any open flames or sparks away from batteries. Do not smoke in battery charging area.

SI EXC-0913

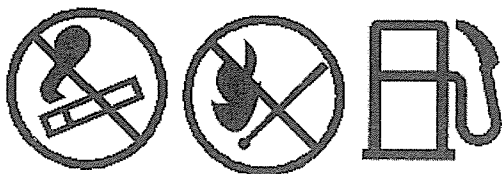
FIRE PREVENTION (CONT'D)

Hydraulic System

Check hydraulic tubes, hoses and fittings for damage and leakage. Never use open flame or bare skin to check for leaks. Hydraulic tubes and hoses must be properly routed and have adequate support and secure clamps. Tighten or replace any parts that show leakage.

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

Fueling



Stop the engine and let it cool before adding fuel. No smoking! Do not refuel a machine near open flames or sparks. Fill the fuel tank outdoors.

Ultra Low Sulfur Diesel (ULSD) poses a greater static ignition hazard than earlier diesel formulations with higher Sulfur content. Avoid death or serious injury from fire or explosion. Consult with your fuel or fuel system supplier to ensure the delivery system is in compliance with fueling standards for proper grounding and bonding practices.

Starting

Do not use ether or starting fluids on any engine that has glow plugs or air intake heater. These starting aids can cause explosion and injure you or bystanders.

Use the procedure in the Operation & Maintenance Manual for connecting the battery and for jump starting.

Spark Arrester Exhaust System

The spark arrester exhaust system is designed to control the emission of hot particles from the engine and exhaust system, but the muffler and the exhaust gases are still hot.

Check the spark arrester exhaust system regularly to make sure it is maintained and working properly. Use the procedure in the Operation & Maintenance Manual for cleaning the spark arrester muffler (if equipped).

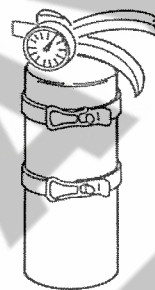
Welding And Grinding

Always clean the machine and attachment, disconnect the battery, and disconnect the wiring from the Bobcat controllers before welding. Cover rubber hoses, battery and all other flammable parts. Keep a fire extinguisher near the machine when welding.

Have good ventilation when grinding or welding painted parts. Wear dust mask when grinding painted parts. Toxic dust or gas can be produced.

Dust generated from repairing nonmetallic parts such as hoods, fenders or covers can be flammable or explosive. Repair such components in a well ventilated area away from open flames or sparks.

Fire Extinguishers

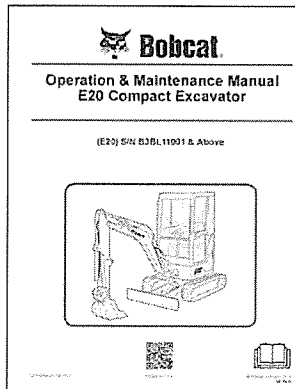


Know where fire extinguishers and first aid kits are located and how to use them. Inspect the fire extinguisher and service the fire extinguisher regularly. Obey the recommendations on the instructions plate.

PUBLICATIONS AND TRAINING RESOURCES

The following publications are also available for your Bobcat excavator. You can order them from your Bobcat dealer.

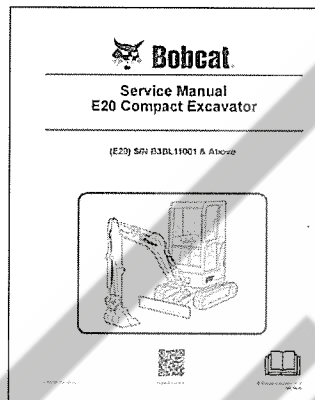
For the latest information on Bobcat products and the Bobcat Company, visit our web site at www.bobcat.com; you can also order Operator and Service Training materials online through www.bobcatstore.com



- Complete instructions on the correct operation and the routine maintenance of the Bobcat excavator.

OPERATION & MAINTENANCE MANUAL

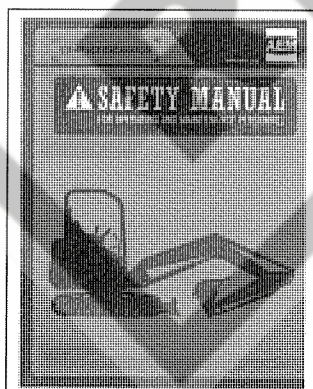
7255004enUS



- Complete maintenance instructions for your Bobcat excavator.

SERVICE MANUAL

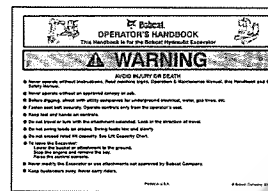
7255008enUS



- Provide basic safety procedures and warnings for your Bobcat excavator.

SAFETY MANUAL

6901951



OPERATOR'S HANDBOOK

7255006enUS

Gives basic operation instructions and safety warnings



COMPACT EXCAVATOR OPERATOR TRAINING COURSE

6903186

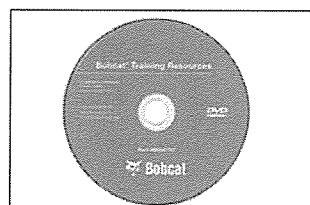
Introduces operator to step-by-step basics of compact excavator operation. Also available in Spanish P/N 6903228



EXCAVATOR SERVICE SAFETY COURSE

6900916

Introduces Service Technicians to step-by-step basics of proper and safe excavator maintenance and servicing procedures



OPERATOR SAFETY DVD

6904762

Provides basic safety instructions contained in all Bobcat Safety Videos in both English and Spanish.



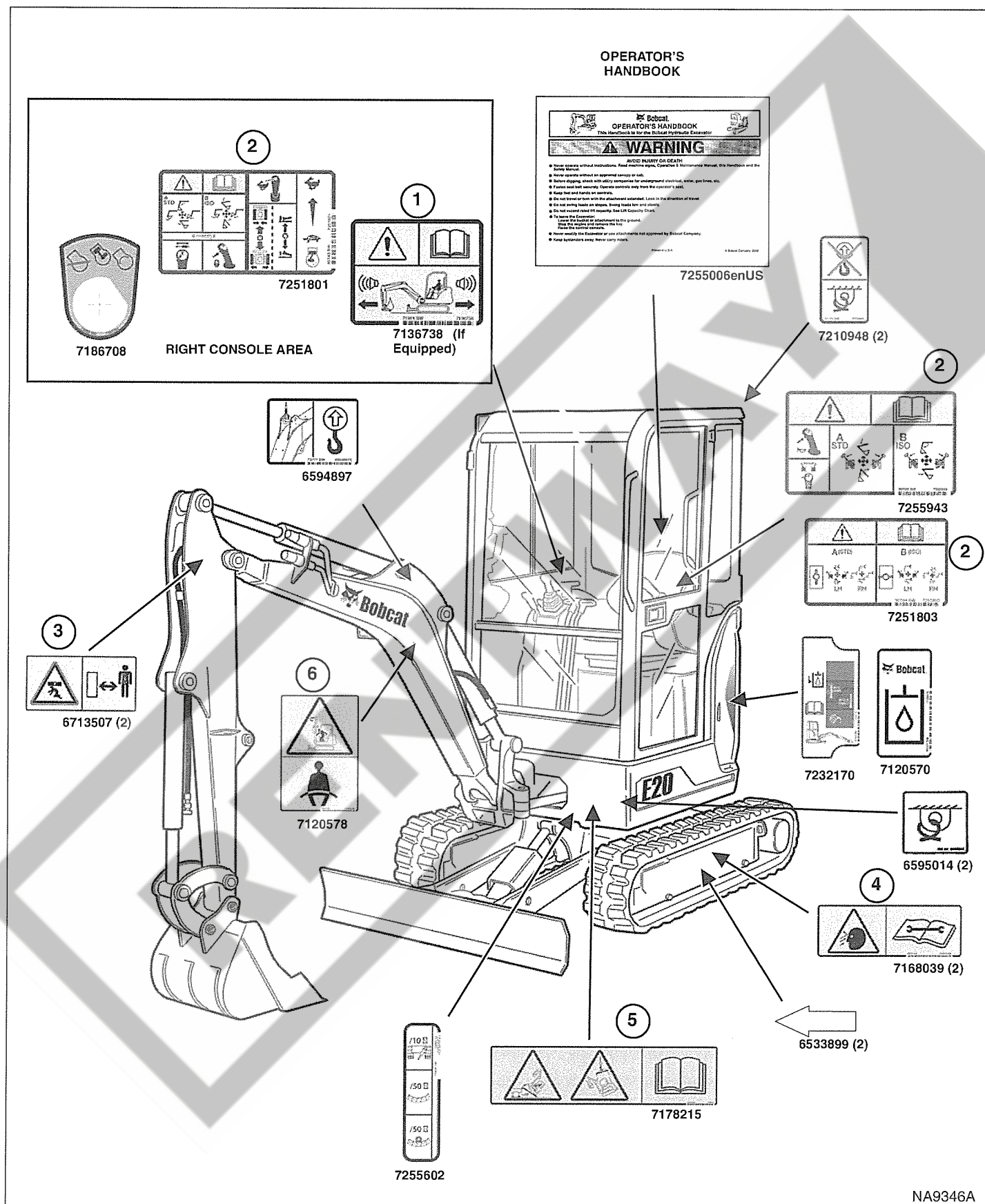
EXCAVATOR SAFETY VIDEO

(Mobile device with quick response code application required)

Scan the code above to watch the excavator safety video or view at www.training.bobcat.com.

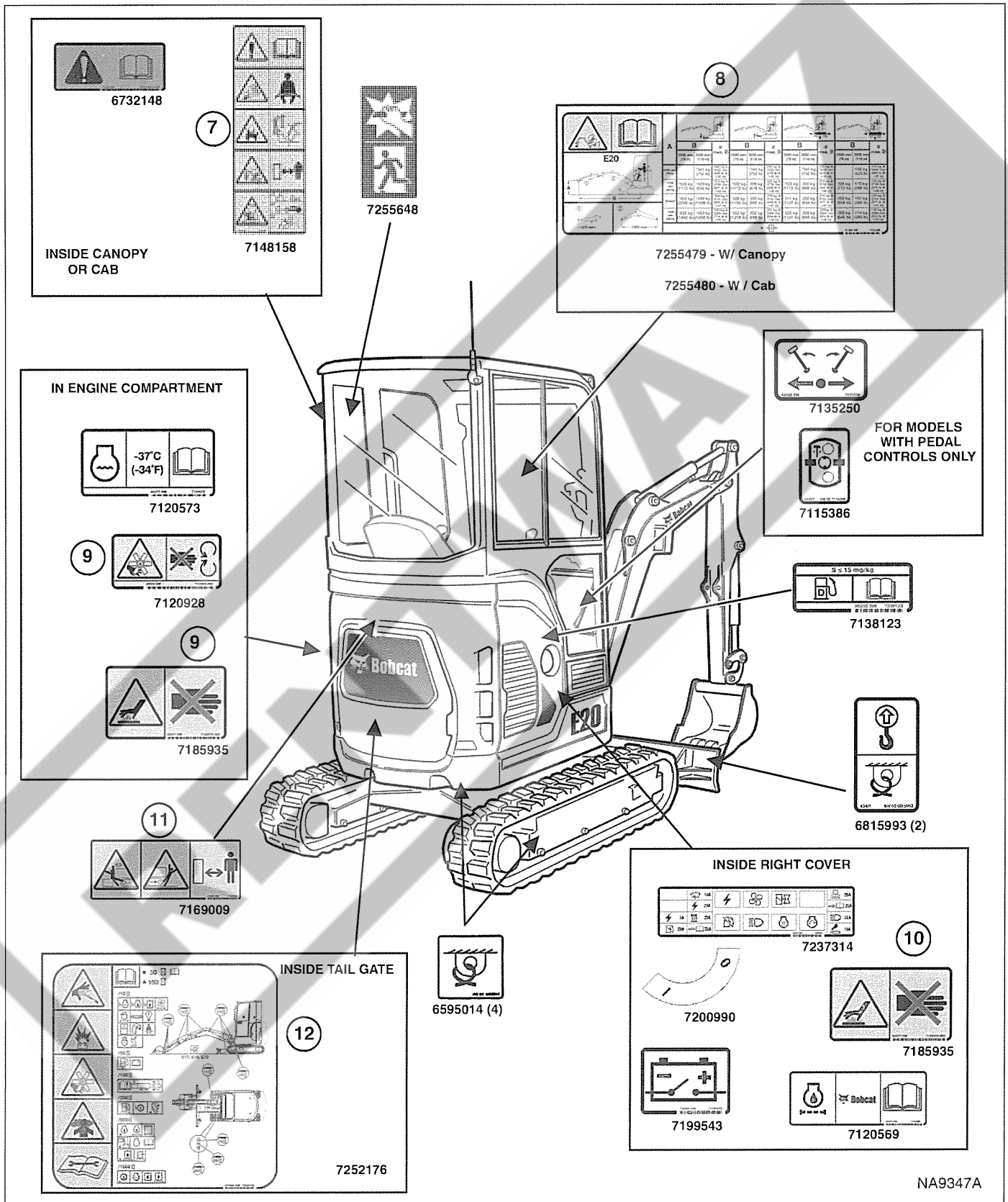
MACHINE SIGNS (DECALS)

Follow the instructions on all the Machine Signs (Decals) that are on the excavator. Replace any damaged machine signs and be sure they are in the correct locations. Machine signs are available from your Bobcat excavator dealer.



MACHINE SIGNS (DECALS) (CONT'D)

Follow the instructions on all the Machine Signs (Decals) that are on the excavator. Replace any damaged machine signs and be sure they are in the correct locations. Machine signs are available from your Bobcat excavator dealer.

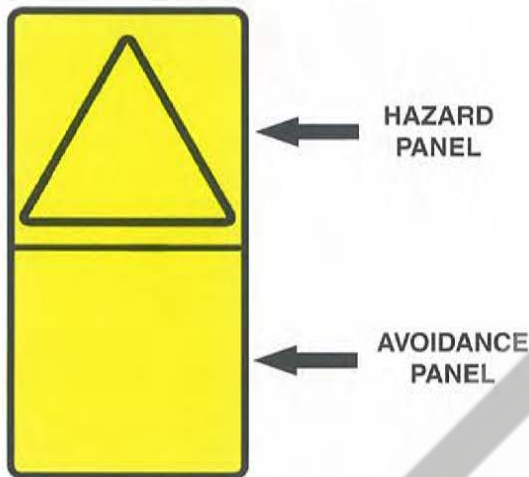


MACHINE SIGNS (DECALS) (CONT'D)

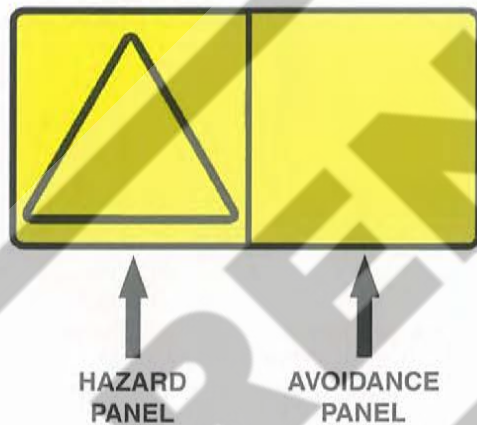
No-Text Safety Signs

Safety signs are used to alert the equipment operator or maintenance person to hazards that may be encountered in the use and maintenance of the equipment. The location and description of the safety signs are detailed in this section. Please become familiarized with all safety signs installed on the excavator.

Vertical Configuration



Horizontal Configuration



The format consists of the hazard panel(s) and the avoidance panel(s):

Hazard panels depict a potential hazard enclosed in a safety alert triangle.

Avoidance panels depict actions required to avoid the hazards.

A safety sign may contain more than one hazard panel and more than one avoidance panel.

NOTE: See the numbered MACHINE SIGNS (DECALS) on Page 20 and Machine Signs (Decals) (Cont'd) on Page 21 for the machine location of each corresponding numbered no-text decals as shown below.

1. Motion Alarm (7136738)

This safety sign is located on the right rear console.



This machine is equipped with a motion alarm.
ALARM MUST SOUND!
when operating forward or backward.

Failure to maintain a clear view in the direction of travel could result in serious injury or death.

The operator is responsible for the safe operation of this machine.

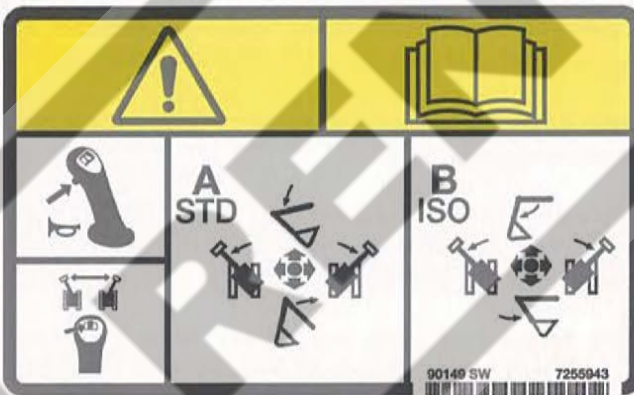
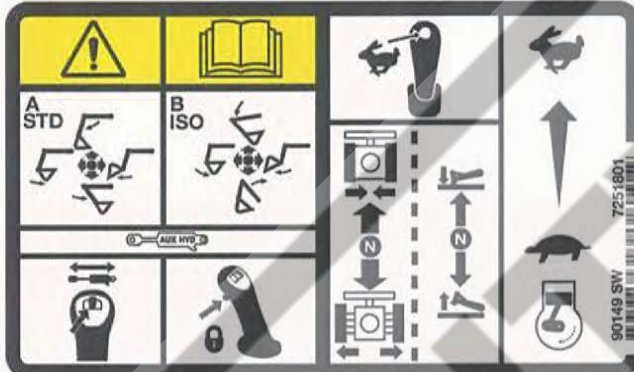
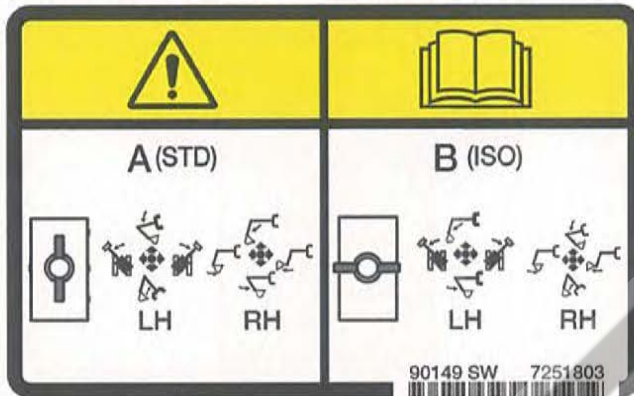
W-2786-0309

MACHINE SIGNS (DECALS) (CONT'D)

No-Text Safety Signs (Cont'd)

2. Control Pattern / Joystick (7251803, 7255943)

This safety signs are located on the left console by the seat and on both consoles by the joysticks.



Know the control pattern before operating.

W-2989-0714

3. Crush Hazard (6713507)

This safety sign is located on both sides of the boom.



Keep away from the operating machine to avoid serious injury or death.

W-2520-0106

4. Thrown Or Flying Objects (7168039)

This safety sign is located on the outside of both tracks.



High pressure grease can cause serious injury. Do not loosen grease fitting. Do not loosen bleed fitting more than 1 - 1/2 turns.

Read and understand the Operation & Maintenance Manual for more information.

W-2516-0110

MACHINE SIGNS (DECALS) (CONT'D)

No-Text Safety Signs (Cont'd)

5. Transporting And Lifting (7178215)

This safety sign is located on the front of the cab.



WARNING

Improper loading, transporting and lifting procedures can cause serious injury or death. Read and understand the Operation & Maintenance Manual prior to transporting or lifting the machine.

W-2517-0110

6. Transporting And Lifting (7120578)

This safety sign is located on the front of the cab.



WARNING

- Keep out of swing area.
- Keep bystanders away.
- Operate the excavator from the operator's position only.

W-2990-0714

7. General Hazard (7148158)

This safety sign is located inside the operator's area on the right rear window.



WARNING

Failure to obey warning signs and instructions can cause serious injury or death. Never use excavator without instructions. Read and understand the Operation & Maintenance Manual and Handbook.

Keep away from dropoffs, steep areas or banks that could break away.

Explosion or electrocution can occur if machine contacts utility lines or pipes. Check for overhead or underground lines before operating.

Keep bystanders away. No riders. Check location of blade for direction of travel before moving steering controls.

Failure to operate machine from the operator's position can cause serious injury or death.

To Leave Excavator:

1. Lower attachment and blade to ground.
2. Stop engine and remove the key (if equipped).
3. Raise control console.

W-2518-0110

MACHINE SIGNS (DECALS) (CONT'D)

No-Text Safety Signs (Cont'd)

8. Lift Capacity (7255479, 7255480)

This safety sign is located on the right side cover.

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

MACHINE SIGNS (DECALS) (CONT'D)

No-Text Safety Signs (Cont'd)

10. Hot Surfaces (7185935)

This safety sign is located in the engine compartment.



AVOID BURNS

Do not remove radiator cap when the engine is hot.
You can be seriously burned.

W-2070-1203

11. Stay Away (7169009)

This safety sign is located on both upper rear corners of the upperstructure.



AVOID INJURY OR DEATH

- Keep out of swing area or travel path.
- Always look in the direction of travel.
- Make sure swing area is clear of bystanders and objects.

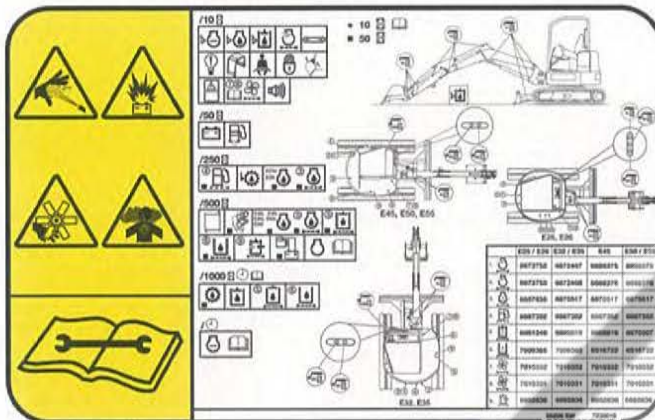
W-NEW-1108

MACHINE SIGNS (DECALS) (CONT'D)

No-Text Safety Signs (Cont'd)

12. High Pressure, Battery, Rotating Fan, Exhaust Gases and Service Schedule (7252176)

This safety sign is located on the right front corner of the upperstructure. For Service Schedule Information,





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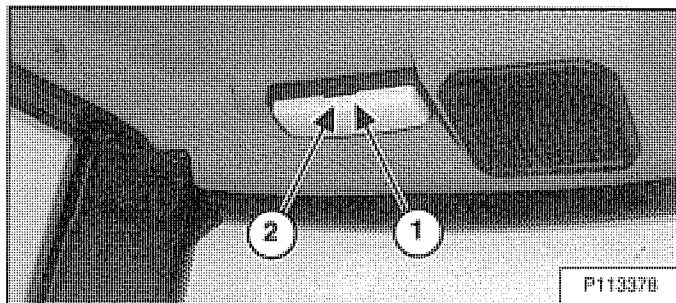
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INSTRUMENTS AND CONSOLES

Cab Interior Light

Interior light is equipped on excavators with a cab.

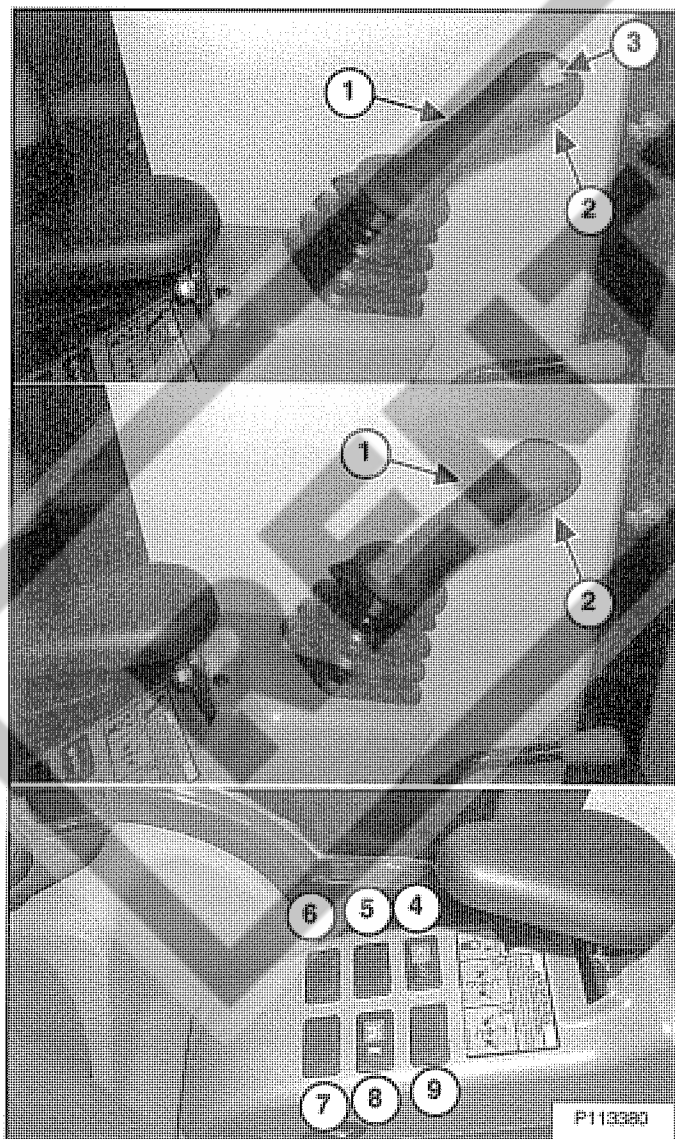
Figure 7



Press the switch to the right (Item 1) to turn the light ON. Press the switch to the left (Item 2) [Figure 7] to turn the light OFF.

Left Console

Figure 8



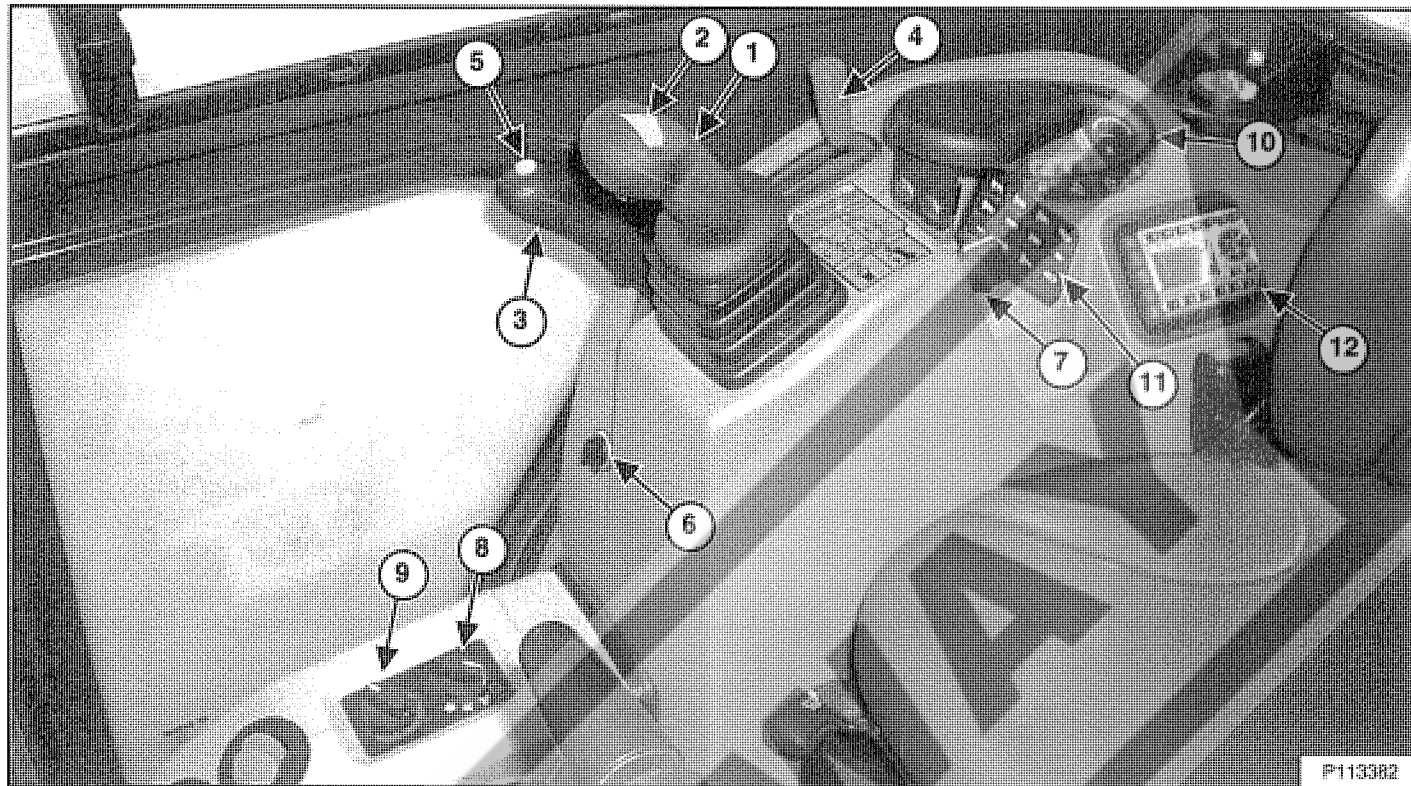
Left Console [Figure 8]

REF. NO	DESCRIPTION	FUNCTION / OPERATION
1	Left Joystick	(See HYDRAULIC CONTROLS on Page 52.)
2	Horn	Press the switch on the left joystick to sound horn.
3	Boom Swing Switch (If Equipped)	Move the switch to the left to swing the boom to the left. Move the switch to the right to swing the boom to the right. NOTE: For machine not equipped with switch (Item 3) in the left joystick, (See BOOM SWING on Page 60.)
4	Wiper / Washer Switch (If Equipped)	Press the switch to the left to turn wiper ON. Press and hold switch to the left to activate window washer. Press the switch to the right to turn wiper OFF.
5	Not Used	---
6	Beacon / Strobe Light (If Equipped)	Press switch to the left to turn ON the beacon / Strobe light. Press the switch to the right to turn OFF.
7	Not Used	---
8	Blade / Track Retraction - Expansion Switch	Press the switch to the left to retract / expand the tracks. Press the switch to the right to raise and lower the boom. (See TRACK RETRACTION / EXPANSION in this manual.)
9	Not Used	---

INSTRUMENTS AND CONSOLES (CONT'D)

Right Console

Figure 9



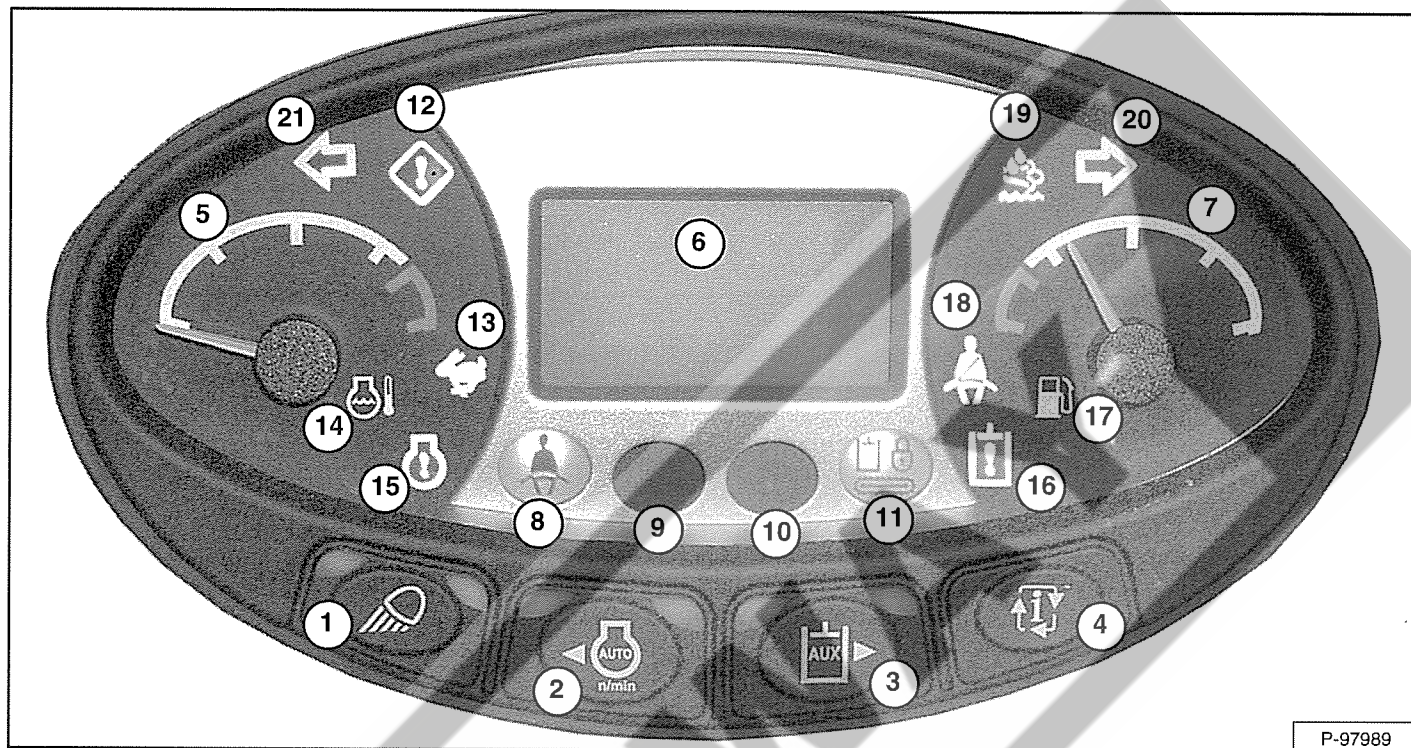
REF	DESCRIPTION	FUNCTION / OPERATION
1	Right Joystick	(See HYDRAULIC CONTROLS in this manual.)
2	Auxiliary Hydraulic Switch (If Equipped)	Controls the fluid flow to the auxiliary quick couplers (attachment). (See Auxiliary Hydraulics - Joystick Controls on Page 55.) NOTE: For machine not equipped with switch (Item 2) in the right joystick, see Auxiliary Hydraulic Pedal information. (See Auxiliary Hydraulics - Manual Controls on Page 56.)
3	Blade Control Lever / Track Retraction - Expansion Lever	Controls raising and lowering the blade. (See BLADE CONTROL LEVER on Page 57.) Controls extending and retracting the tracks. (See TRACK FRAME RETRACTION / EXPANSION on Page 58.)
4	Engine Speed Control Lever	Controls rpm of the engine. (See ENGINE SPEED CONTROL LEVER in this manual).
5	Two-Speed Button	Engages and disengages High Range Travel Speed. (See Two-Speed Travel on Page 41.) and (See Auto Shift Drive Motors (If Equipped) on Page 41.)
6	Auxiliary Power Outlet	12 volt receptacle for accessories.
7	Key Switch / Rotary Start Switch	Always perform the <i>PRE-STARTING PROCEDURE</i> . (See <i>PRE-STARTING PROCEDURE</i> in this manual), before starting the engine. (See <i>STARTING THE ENGINE</i> in this manual).
8	Fan Motor Switch (If Equipped)	Turn clockwise to increase fan speed; counterclockwise to decrease.
9	Temperature Control (If Equipped)	Turn clockwise to increase temperature; counterclockwise to decrease.
10	Instrument Panel	See Standard or Deluxe Instrument Panel
11	Keyless (If Equipped)	(Always perform the <i>PRE-STARTING PROCEDURE</i> , (See <i>PRE-STARTING PROCEDURE</i> in this manual), before starting the engine. (See <i>STARTING THE ENGINE</i> in this manual).
12	Radio (If Equipped)	(See RADIO information in this manual).

NOTE: Always turn key switch and all accessories to OFF position when the engine is stopped, the battery will discharge if the key is left ON.

INSTRUMENTS AND CONSOLES (CONT'D)

Instrument Panel

Figure 10



REF. NO.	DESCRIPTION	FUNCTION / OPERATION
1	Lights	Press once for work lights. (Left green LED illuminates.) Press again to turn all lights off. (Left green LED off.) Press and hold 5 seconds to display software version in display screen.
2	Auto Idle Feature (NOT USED FOR THIS MODEL)	-----
3	Auxiliary Hydraulic Button (Used With Joystick Switch Activated Auxiliary Hydraulics Only)	Press once to enable auxiliary hydraulic function. (Left green LED illuminates.) NOTE: Used with right hand joystick with auxiliary hydraulic switch only. (See Auxiliary Hydraulics - Joystick Controls on Page 55.)
4	Information	Cycles through (after each button press) (The following information is displayed in the Data Display Screen, Item 6): • Hourmeter (On startup) • Job Clock (1 and 2) • Engine rpm • Battery voltage • Maintenance clock (Press and hold 7 seconds when displayed to reset the maintenance clock.) • Service codes*
5	Engine Temperature Gauge	Shows the engine coolant temperature.

INSTRUMENTS AND CONSOLES (CONT'D)

Instrument Panel (Cont'd)

REF. NO.	DESCRIPTION	FUNCTION / OPERATION
6	Data Display Screen	The data display screen shows the Hourmeter at start up and then changes to engine rpm during normal operation of the excavator. When preheat is activated, the display screen will show the remaining preheat time. Can also be used to display Job Clock, Engine rpm, and Selectable Auxiliary Hydraulic Flow. (See Job Clock in this manual).
7	Fuel Gauge	Shows the amount of fuel in the tank.
8	Seat Belt	Fasten Seat Belt Reminder - Light stays on for 45 seconds to remind operator to fasten seat belt.
9		Not used for this model.
10		Not used for this model.
11	Left Console Lockout	Icon ON when left console is raised. Icon OFF when left console is lowered.
12	General Warning **	Malfunction with one or more machine functions. (See Service Codes in this manual.)
13	High Range Engaged ***	Icon is illuminated when two-speed travel is enabled.
14	Engine Coolant Temperature **	Engine coolant temperature high or sensor error.
15	Engine Malfunction **	Engine malfunction or failure.
16	Hydraulic System Malfunction **	Hydraulic system malfunction or failure.
17	Fuel	Fuel level low or sensor error. (Icon is ON when fuel level is low, Icon flashes when fuel sensor fault is activated.)
18		Not used for this model.
19		Not used for this model.
20		Not used for this model.
21		Not used for this model.

* See SYSTEM SETUP AND ANALYSIS for Service Code Description. (See DIAGNOSTIC SERVICE CODES on Page 139.)

** Icons will be ON or flashing when diagnostic system indicates a problem. (See DIAGNOSTIC SERVICE CODES on Page 139.)

*** Icons will be flashing when diagnostic system indicates a problem. (See DIAGNOSTIC SERVICE CODES on Page 139.)

INSTRUMENTS AND CONSOLES (CONT'D)

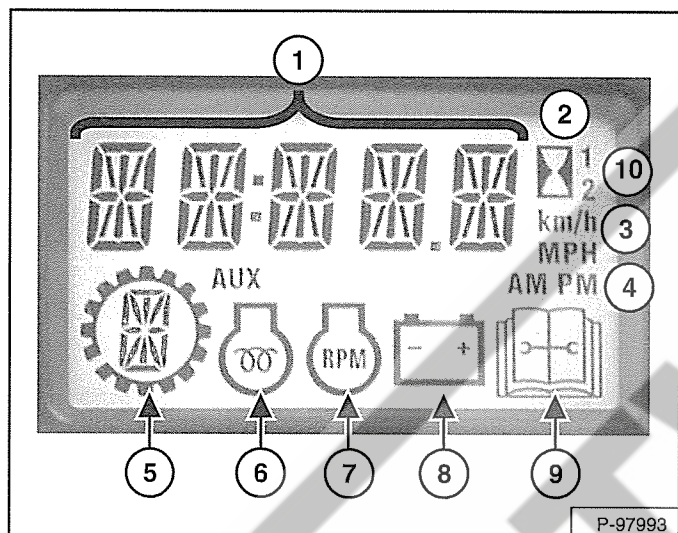
Instrument Panel - Standard (Cont'd)

Indicator Icons

The display screen can display the following information:

- Operating hours
- Job Clock (1 and 2)
- Engine rpm
- Battery voltage
- Maintenance clock countdown
- Service codes

Figure 11



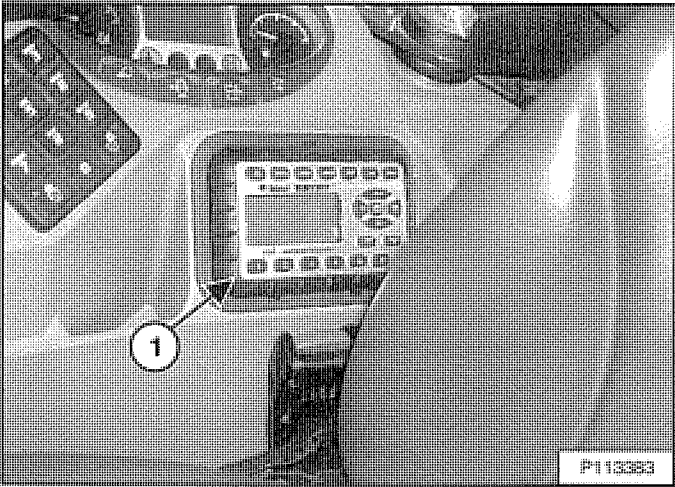
The display screen is shown in [Figure 11]. The data display will show operating hours upon startup.

1. Data Display
2. Hourmeter
3. Metric / English (Not Used For This Model)
4. Clock (Not Used For This Model)
5. Selectable Auxiliary Flow
6. Engine Preheat
7. Engine RPM
8. Battery / Charging Voltage
9. Service
10. Job Clock (1 and 2)

INSTRUMENTS AND CONTROLS (CONT'D)

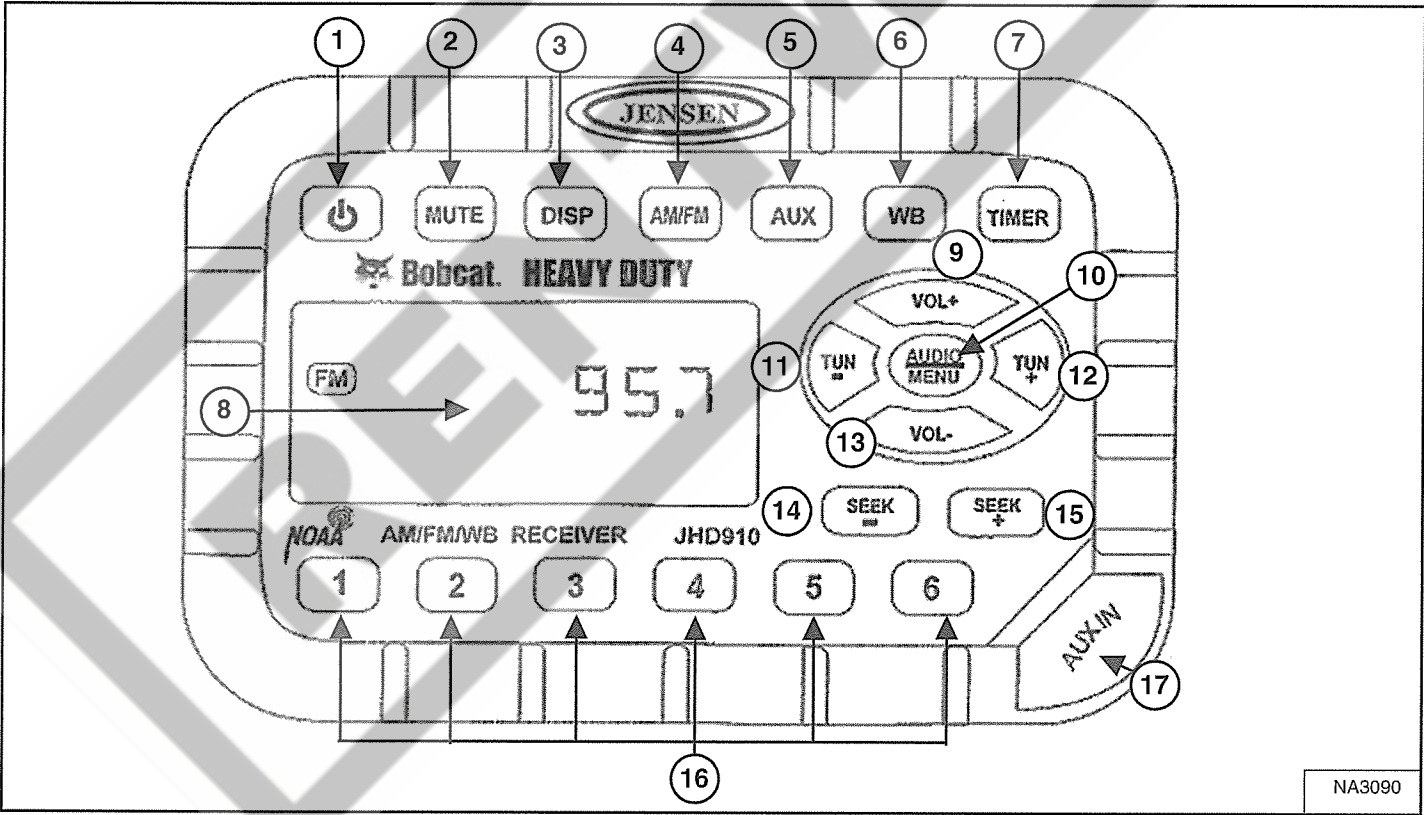
Radio Option

Figure 12



This excavator may be equipped with a radio (Item 1) [Figure 12].

Figure 13



NOTE: See DISPLAY (Item 3) in the following table for clock setting instructions.

INSTRUMENT AND CONTROLS (CONT'D)

Radio (Cont'd)

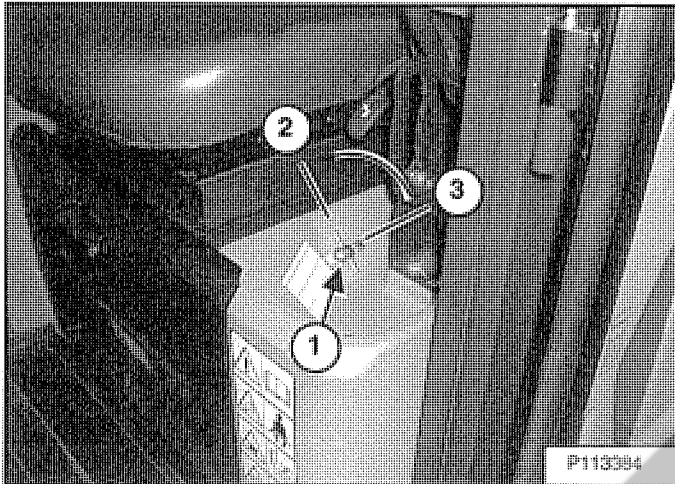
REF. NO.	DESCRIPTION	FUNCTION / OPERATION
1	POWER	Press to turn ON; press again to turn OFF.
2	MUTE	Press to mute audio output; MUTE will appear in display screen; press again to turn OFF.
3	DISPLAY	Press to toggle between function mode (showing tuner frequency, auxiliary input, weather band information, or timer) and clock mode. Press and hold to enter clock setting mode; use FREQUENCY DOWN (TUN -) button to adjust hours and FREQUENCY UP (TUN +) button to adjust minutes; normal operation will resume automatically.
4	BAND	Press to select tuner mode. Press to cycle through 2 AM (MW) bands and 3 FM bands.
5	AUXILIARY	Press to select Auxiliary Input mode. Portable audio device (MP3 player) must be attached to auxiliary input jack.
6	WEATHER BAND	Press to select weather band; use FREQUENCY UP (TUN +) and FREQUENCY DOWN (TUN -) buttons to adjust to the clearest station. The weather alert feature, if activated, will automatically switch from the current function to the weather band if a weather warning is received. See AUDIO / MENU ADJUSTMENT in this table.
7	TIMER	Press to access timer mode. Press to start the timer function; press again to stop timer; press again to resume timer or press and hold to reset timer and exit from timer mode.
8	DISPLAY SCREEN	Displays the time, frequency, and activated functions.
9	VOLUME UP	Adjusts volume up; current volume (0 - 40) will appear briefly in display screen.
10	AUDIO / MENU ADJUSTMENT	AUDIO ADJUSTMENT: Press to cycle through bass, treble, and balance settings; use VOLUME UP (VOL +) and VOLUME DOWN (VOL -) buttons to adjust when desired option is displayed; normal operation will resume automatically. MENU ADJUSTMENT: Press and hold for 3 seconds to enter menu adjustment settings; press to cycle through the following settings; use VOLUME UP (VOL +) and VOLUME DOWN (VOL -) buttons to adjust when desired option is displayed; normal operation will resume automatically. • Beep Confirm (On or Off) - Determines if beep will sound with each button press. • Operation Region (USA or Europe) - Selects the appropriate region. • Clock Display (12 or 24) - Selects a 12-hour or 24-hour clock display. • Display Brightness (Low, Medium, or High) - Determines brightness level of display screen. • Backlight Color (Amber or Green) - Determines backlight color of display screen. • Power On Volume (0 - 40) - Selects default volume setting when radio is turned on. • WB Alert (On or Off) - Determines if weather band alert feature is activated.
11	FREQUENCY DOWN	Press to manually tune the radio frequency down.
12	FREQUENCY UP	Press to manually tune the radio frequency up.
13	VOLUME DOWN	Adjusts volume down; current volume (0 - 40) will appear briefly in display screen.
14	SEEK FREQUENCY DOWN	Press to automatically tune frequency down to next strong station.
15	SEEK FREQUENCY UP	Press to automatically tune frequency up to next strong station.
16	PRESET STATIONS	Used to store and recall stations for each AM and FM band. Press and hold to store current station; press button to recall station.
17	AUXILIARY INPUT JACK	Connect line output of portable audio device (MP3 player) to 3,5 mm (1/8 in) jack and press AUXILIARY button.

INSTRUMENTS AND CONTROLS (CONT'D)

STD / ISO Selector Valve

The STD / ISO selector valve (if equipped) is located to the left of the operator's seat.

Figure 14



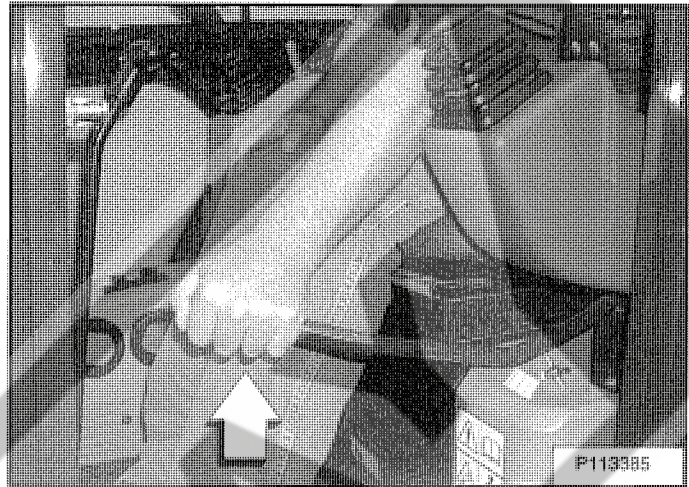
The joystick hydraulic function can be switched from Standard control pattern to ISO control pattern.

Rotate the lever (Item 1) counterclockwise (Item 2) to select STANDARD Control Pattern. Rotate the lever clockwise (Item 3) to select ISO Control Pattern [Figure 14].

Raising And Lowering The Console

Raise the console before exiting the cab.

Figure 15



Pull up on the release handle [Figure 15]. The lift spring will assist in raising the console.

Lower the console before operating the excavator.

Push down on the console [Figure 15] until the latch is engaged.

NOTE: When the console is raised, the hydraulic and traction system functions are locked and will not operate.

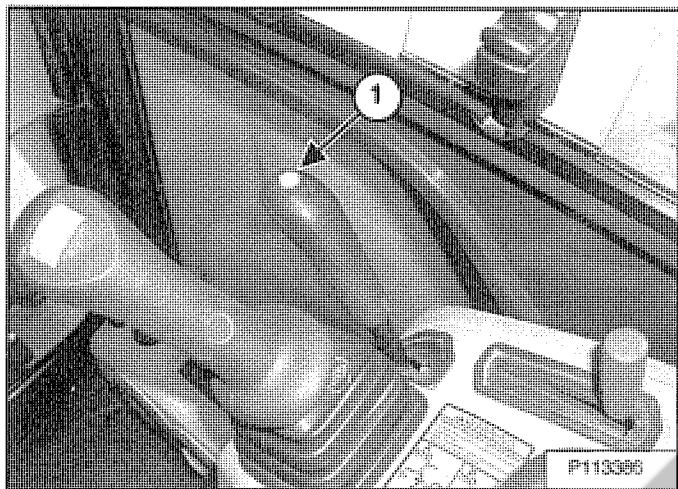
If the engine stops, the boom / bucket (attachments) can be lowered to the ground using hydraulic pressure in the accumulator.

The control console must be in the locked down position, and the key switch in the ON position.

INSTRUMENTS AND CONTROLS (CONT'D)

Two-Speed Travel

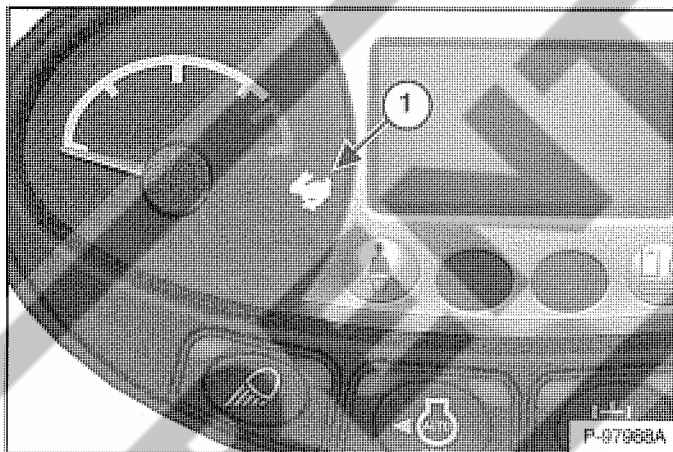
Figure 16



Press the button (Item 1) [Figure 16] to engage the high range. Press a second time to disengage.

NOTE: When engaging high range, two audible beeps will be heard. When engaging low range, one audible beeps will be heard.

Figure 17



When high range is engaged, the two-speed travel icon (Item 1) [Figure 17] will illuminate.

Press the button (Item 1) [Figure 16] again to disengage.

Auto Shift Drive Motors (If Equipped)

The travel motors may be equipped with an auto shift feature that senses hydraulic pressure. When in high range, the travel motors will automatically shift to low range when more torque is required and return to high range when hydraulic pressure decreases.

NOTE: Always set the travel speed to low range when loading or unloading the excavator onto a transport vehicle.

OPERATOR CANOPY (ROPS / TOPS)

Description

The Bobcat excavator has an operator canopy (ROPS / TOPS) as standard equipment to protect the operator if the excavator is tipped over. The seat belt must be worn for ROPS / TOPS protection.

Check the ROPS / TOPS canopy, mounting, and hardware for damage. Never modify the ROPS / TOPS canopy. Replace the canopy and hardware if damaged. See your Bobcat dealer for parts.

ROPS / TOPS - Roll-Over Protective Structure per ISO 12117-2, and Tip-Over Protective Structure per ISO 12117.



Never modify operator cab by welding, grinding, drilling holes or adding attachments unless instructed to do so by Bobcat Company. Changes to the cab can cause loss of operator protection from rollover and falling objects, and result in injury or death.

W-2069-0200

OPERATOR CAB (ROPS / TOPS)

Description

The Bobcat excavator has an optional operator cab (ROPS / TOPS) as standard equipment to protect the operator if the excavator is tipped over. The seat belt must be worn for ROPS / TOPS protection.

Check the ROPS / TOPS cab, mounting, and hardware for damage. Never modify the ROPS / TOPS cab. Replace the cab and hardware if damaged. See your Bobcat dealer for parts.

ROPS / TOPS - Roll-Over Protective Structure per ISO 12117-2, and Tip-Over Protective Structure per ISO 12117.



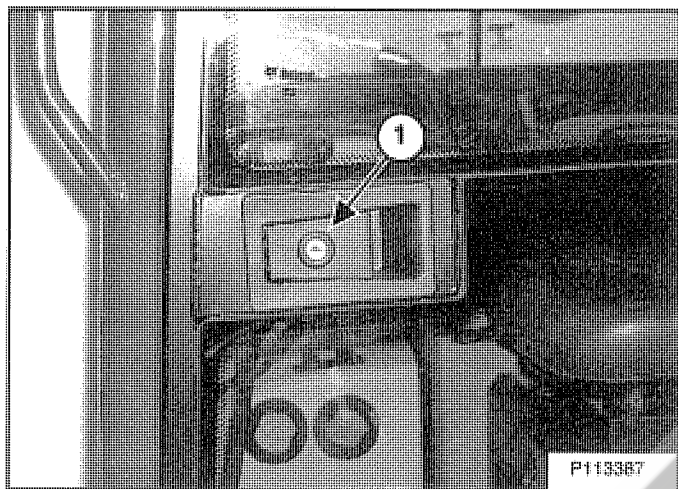
Never modify operator cab by welding, grinding, drilling holes or adding attachments unless instructed to do so by Bobcat Company. Changes to the cab can cause loss of operator protection from rollover and falling objects, and result in injury or death.

W-2069-0200

OPERATOR CAB (ROPS / TOPS) (CONT'D)

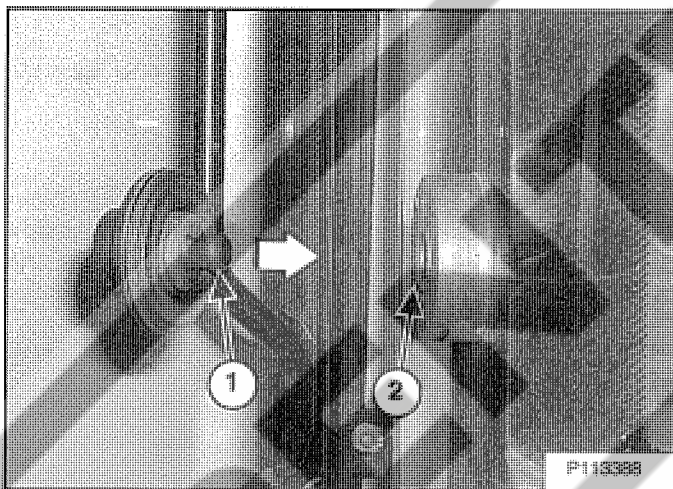
Cab Door

Figure 18



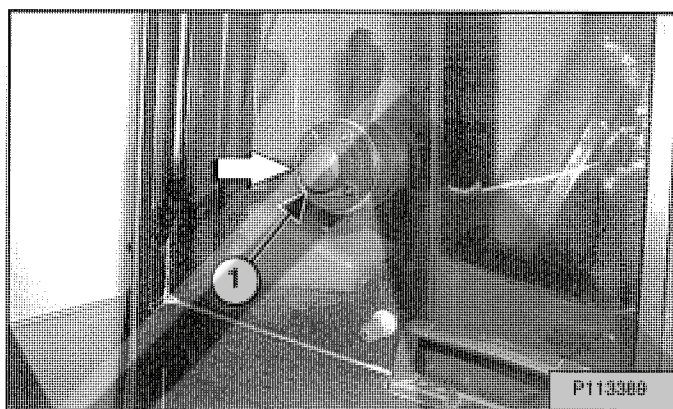
The cab door can be locked (Item 1) [Figure 18] with the same key as the starter switch. Pull on the latch to open the door.

Figure 19



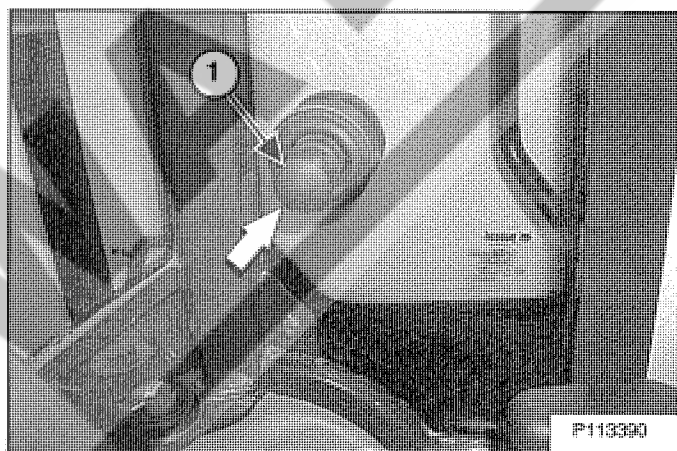
Push the door all the way open until the latch post (Item 1) engages in the latch (Item 2) [Figure 19] to hold the door in the open position.

Figure 20



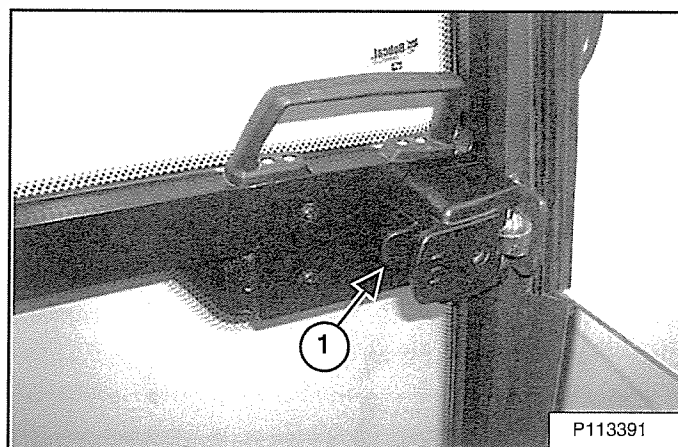
When the door is in the open position, push on the latch (Item 1) [Figure 20] and close the door.

Figure 21



From inside the cab, push on the latch (Item 1) [Figure 21] and close the door.

Figure 22



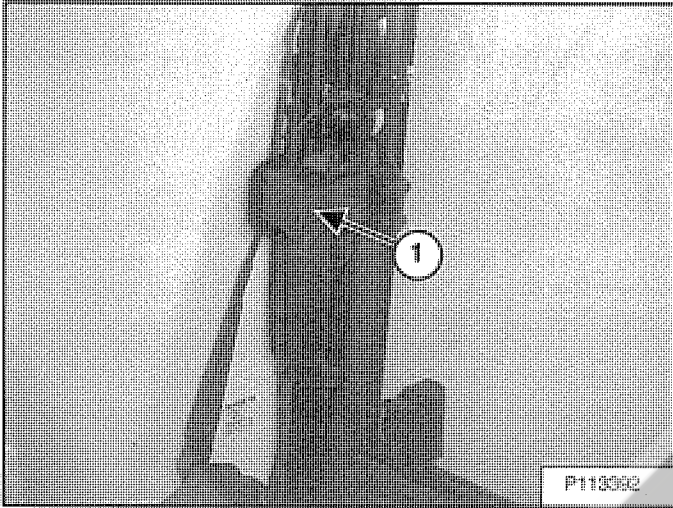
From inside the cab, to open the door, pull on the latch (Item 1) [Figure 22] and open the door.

OPERATOR CAB (ROPS / TOPS) (CONT'D)

Front Window

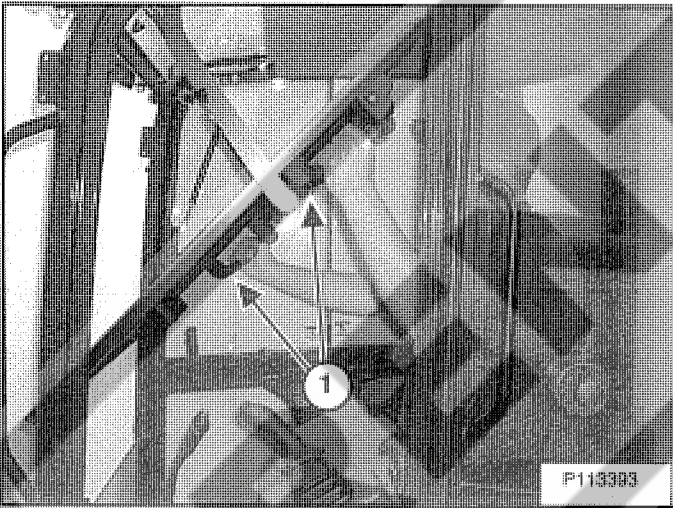
Opening The Front Window

Figure 23



Press the window latch button (Item 1) [Figure 23] (both sides).

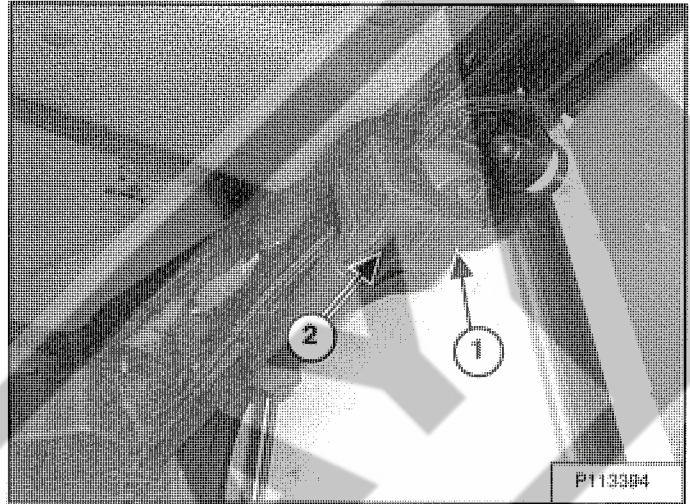
Figure 24



Use both window grab handles (Item 1) [Figure 24] to pull the top of the window in.

Continue moving the window in and up over the operator's head until the window is fully raised.

Figure 25



When the window is fully raised, the latch (Item 1) [Figure 25] (both sides) will close on the bracket in the latched position.

Pull down and forward slightly on the window to make sure it is fully latched.

Closing The Front Window

Use both window grab handles to support the window while pressing the window latch button (Item 2) [Figure 25] (both sides).

Use both window grab handles (Item 1) [Figure 24] to pull the window down fully.

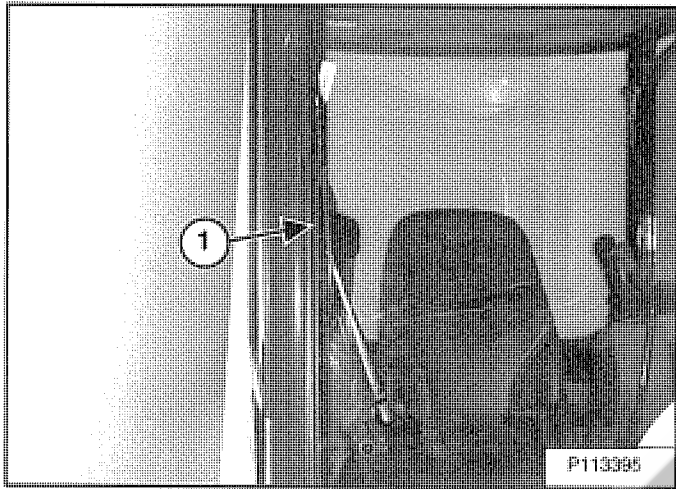
Press the top of the window in until the latch locks into the latched position (both sides) [Figure 23].

Pull inward and upward slightly on the window to make sure it is fully latched in the closed position.

OPERATOR CAB (ROPS / TOPS) (CONT'D)

Front Wiper

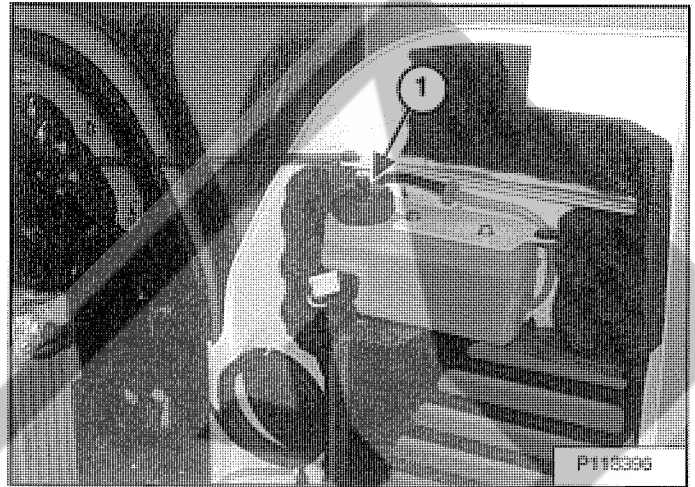
Figure 26



The front window is equipped with a wiper (Item 1) [Figure 26] and washer.

Window Washer Reservoir

Figure 27



The window washer reservoir (Item 1) [Figure 27] is located on the right side cover.

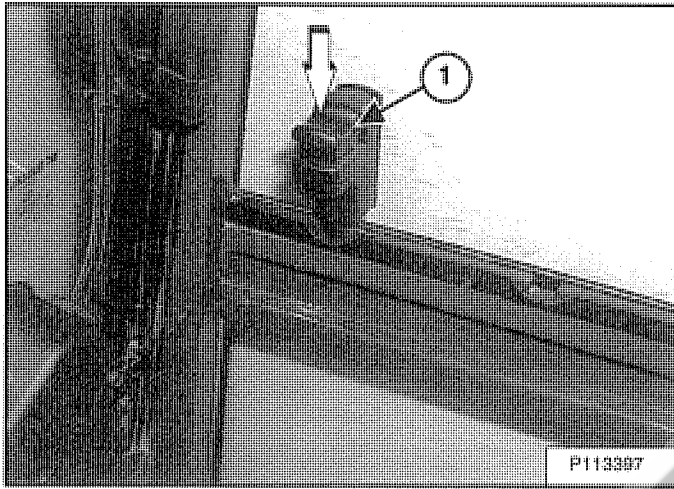
NOTE: When temperatures are to reach below freezing, use a washer fluid that is recommended for use in cold temperatures to avoid damage to the washer reservoir.

OPERATOR CAB (ROPS / TOPS) (CONT'D)

Right Side Window

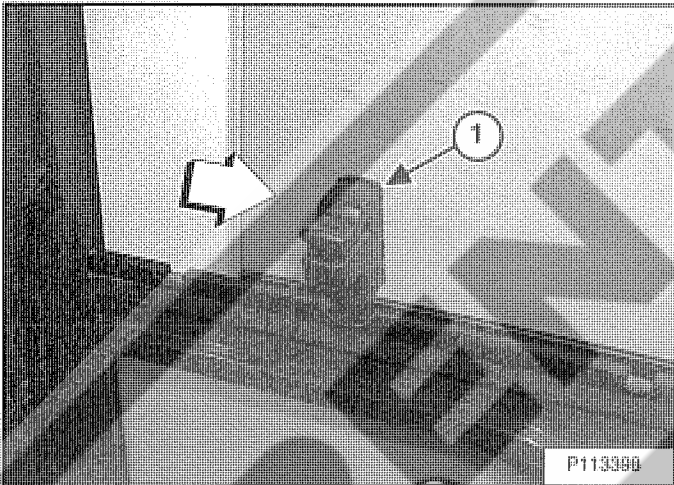
Opening The Right Front Window

Figure 28



Press down on the latch (Item 1) [Figure 28] located at the front of the front window.

Figure 29



Pull the latch (Item 1) [Figure 29] backward to open the window until the desired stop. Release the latch and latch the window in place.

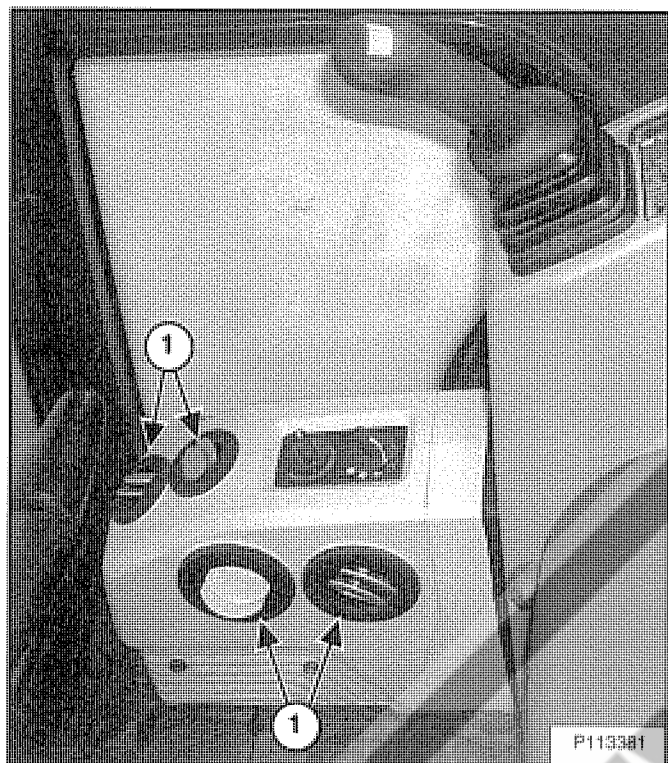
Closing The Right Front Window

Press down on the latch (Item 1) [Figure 28] and push the latch forward to close the window.

OPERATOR CAB (ROPS / TOPS) (CONT'D)

Heating And Ventilation Ducting

Figure 30



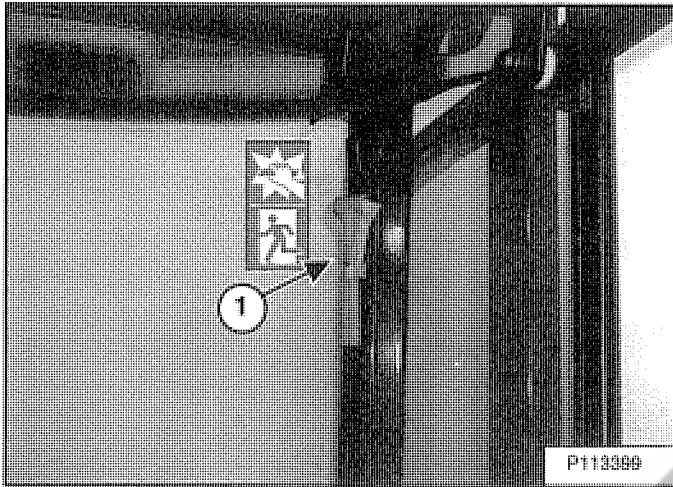
The heating and ventilation louvers (Item 1) [Figure 30] can be positioned as needed to direct the air flow to various areas in the cab.

EMERGENCY EXIT

The door, the rear window and the front window provide exits.

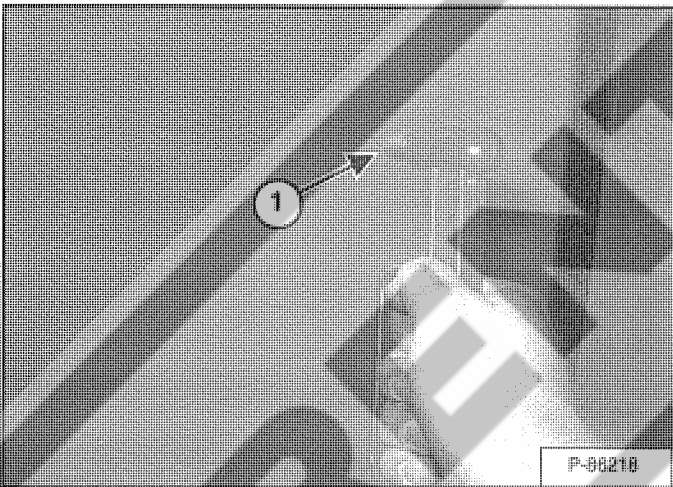
Rear Window

Figure 31



If emergency exit through the rear window is required, use the supplied hammer (Item 1) [Figure 31] located on the left rear side of the cab to break the window.

Figure 32

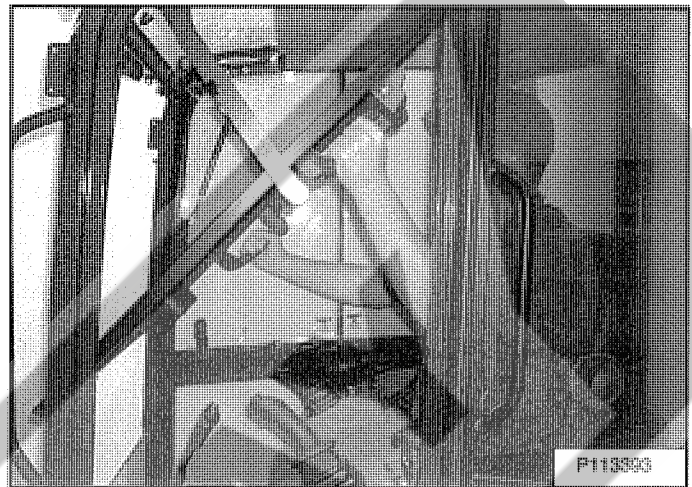


Remove the hammer from the storage position and strike the glass with the pointed end of the hammer [Figure 32].

Use the hammer to remove broken glass from the edge of the window before exiting.

Front Window

Figure 33



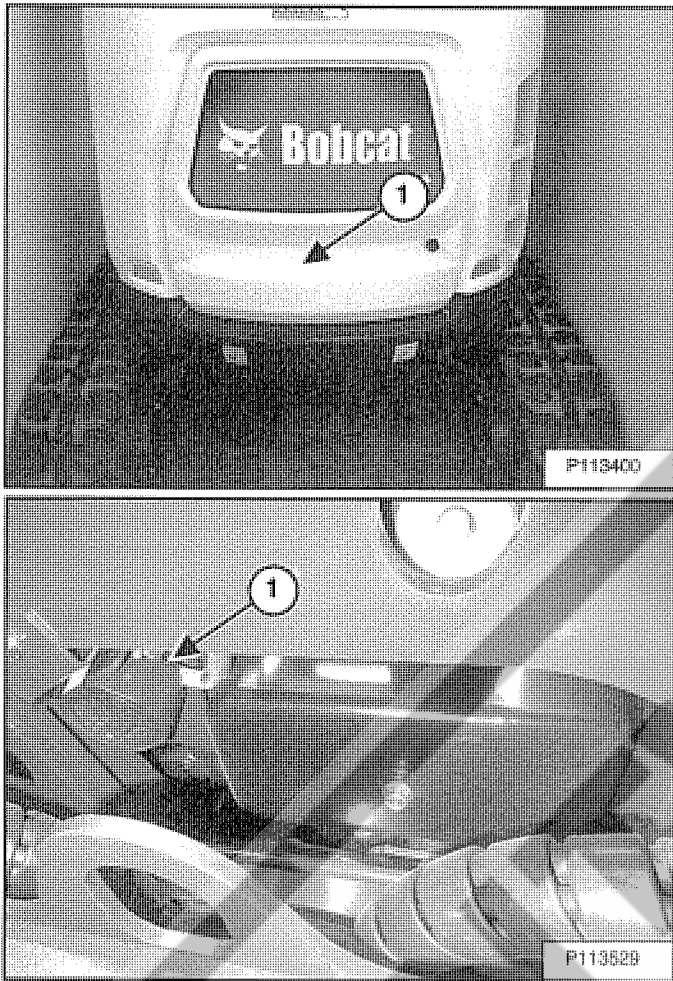
Open the front window and exit [Figure 33].

NOTE: If the excavator has a Special Applications Kit installed, the front window is NOT an emergency exit.

MOTION ALARM SYSTEM

Operation

Figure 34



This excavator can be equipped with a motion alarm system. The motion alarm is located inside the rear (Item 1) [Figure 34] of the excavator.



WARNING

This machine is equipped with a motion alarm.
ALARM MUST SOUND!
when operating forward or backward.

Failure to maintain a clear view in the direction of travel could result in serious injury or death.

The operator is responsible for the safe operation of this machine.

W-2786-0309

The motion alarm will sound when the operator moves the travel control levers (Item 1) [Figure 35] in either the forward or reverse direction.

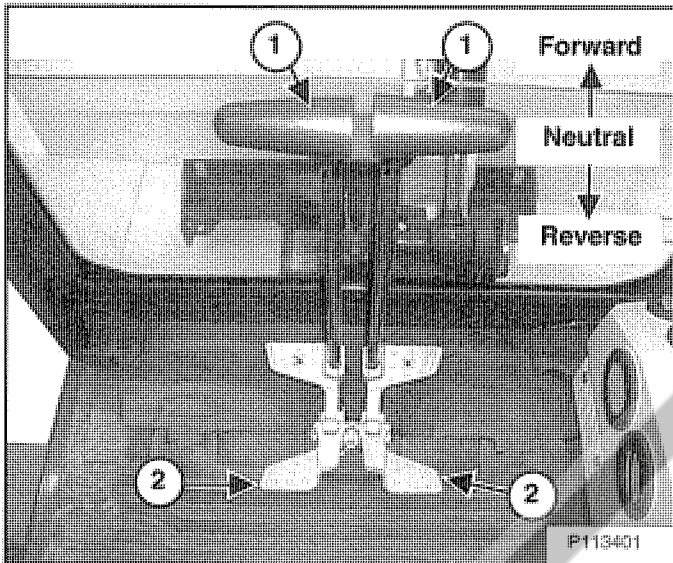
If alarm does not sound or for adjustment instructions, see inspection and maintenance instructions for the motion alarm system in the preventive maintenance section of this manual. (See MOTION ALARM SYSTEM on Page 101.)

TRAVEL CONTROLS

Forward And Reverse Travel

NOTE: The following procedures describe forward, reverse, left and right as seated in the operator's seat.

Figure 35



Put the blade so that it is at the front of the machine (as you sit in the operator's seat). Slowly move both steering levers* (Item 1) [Figure 35] forward for forward travel; backward for reverse travel.

* Travel can also be controlled with foot pedals (Item 2) [Figure 35]. Pivot the heel of the pedals forward for additional space on the floor.



WARNING

AVOID INJURY OR DEATH

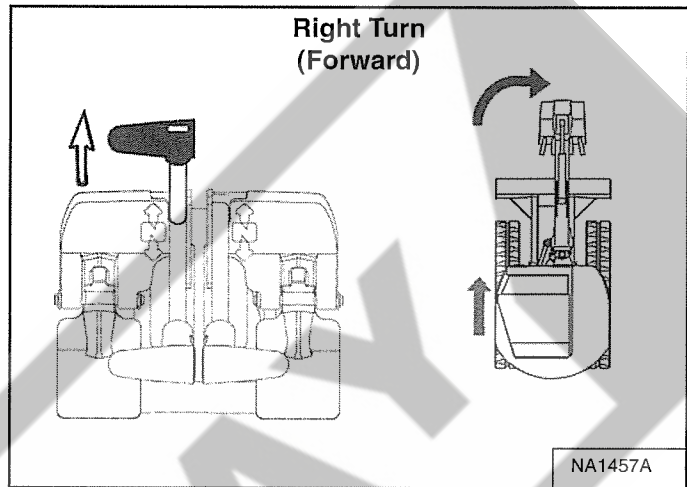
- Check the blade location before traveling. When the blade is to the rear, operate the steering levers / foot pedals in the opposite direction to when the blade is in the front.
- Move the steering levers / foot pedals slowly. Abrupt lever motion will cause the machine to jerk.

W-2235-0396

Turning

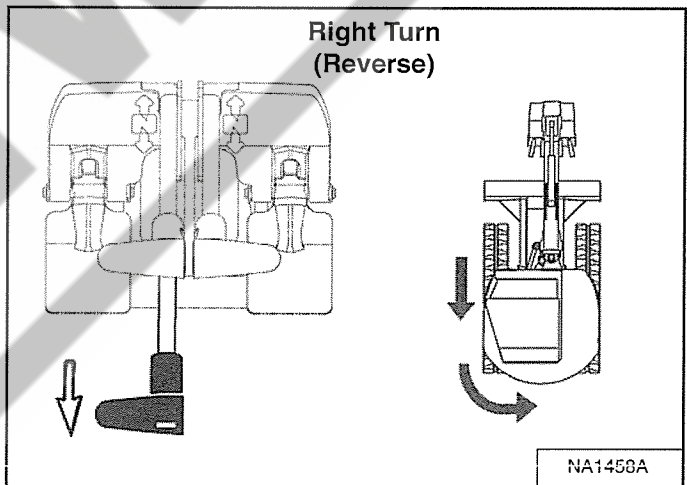
Right Turn

Figure 36



Push the left steering lever forward to turn right [Figure 36] while traveling forward.

Figure 37



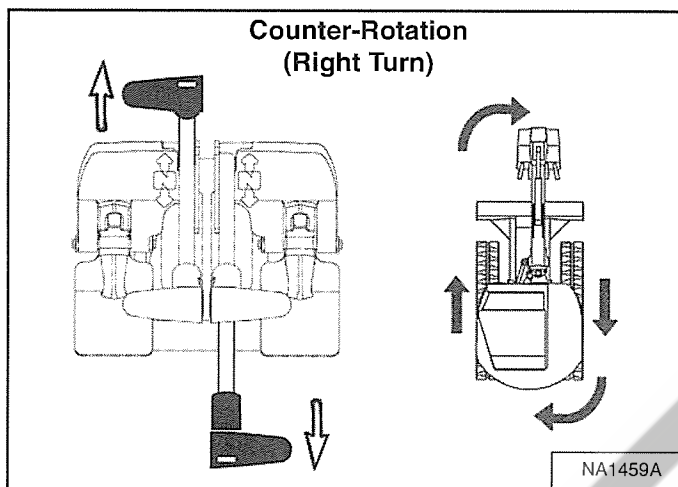
Pull the left steering lever backward to turn right while traveling backward [Figure 37]

TRAVEL CONTROLS (CONT'D)

Turning (Cont'd)

Counter-Rotation Right Turn

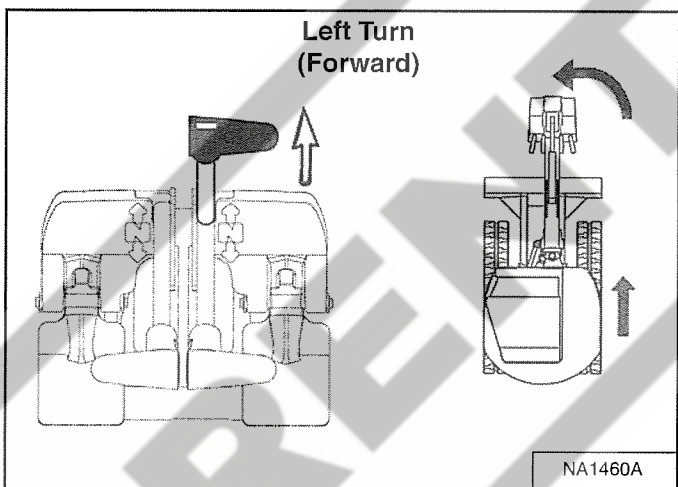
Figure 38



Push the left steering lever forward and pull the right steering lever backward [Figure 38].

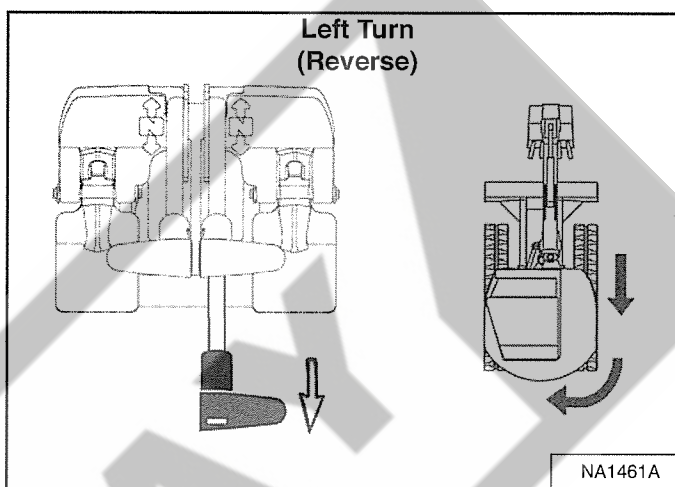
Left Turn

Figure 39



Push the right steering lever forward to turn left while traveling forward [Figure 39].

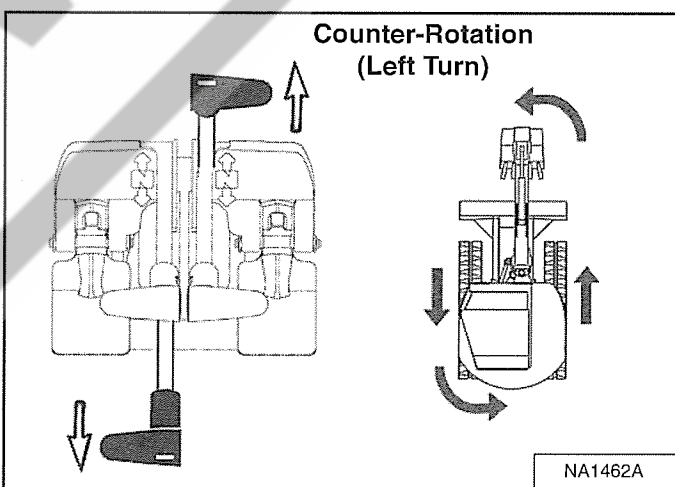
Figure 40



Pull the right steering lever backward to turn left while traveling backward [Figure 40].

Counter-Rotation Left Turn

Figure 41



Push the right steering lever forward and pull the left steering lever backward [Figure 41].

HYDRAULIC CONTROLS

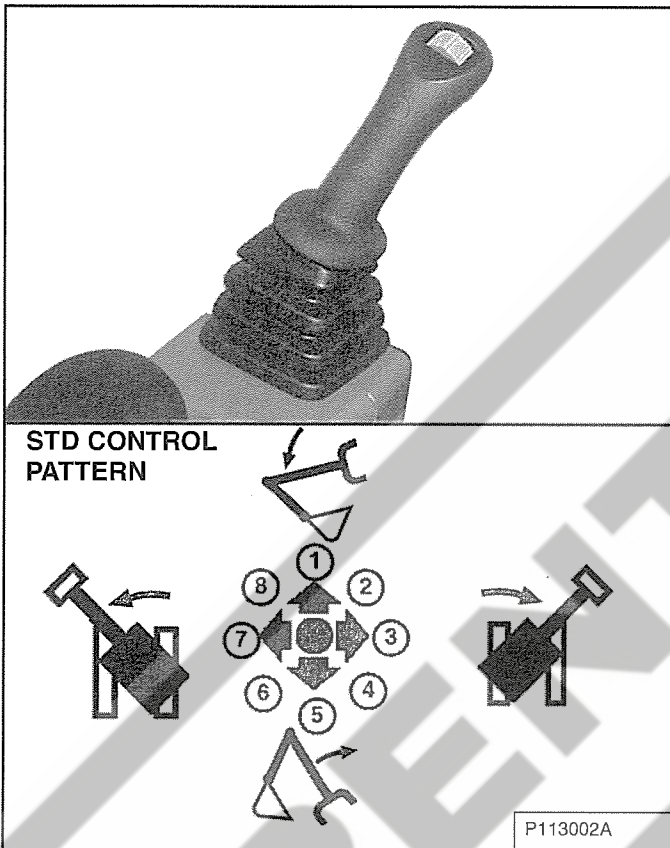
Description

The work equipment (boom, arm, bucket, and upperstructure slew) is operated by using the left and right control levers (joysticks). These joysticks can be used in either a STANDARD Control Pattern [Figure 42] and [Figure 43] or in the ISO Control Pattern [Figure 44] and [Figure 45].

STANDARD Control Pattern

Left Control Lever (Joystick)

Figure 42

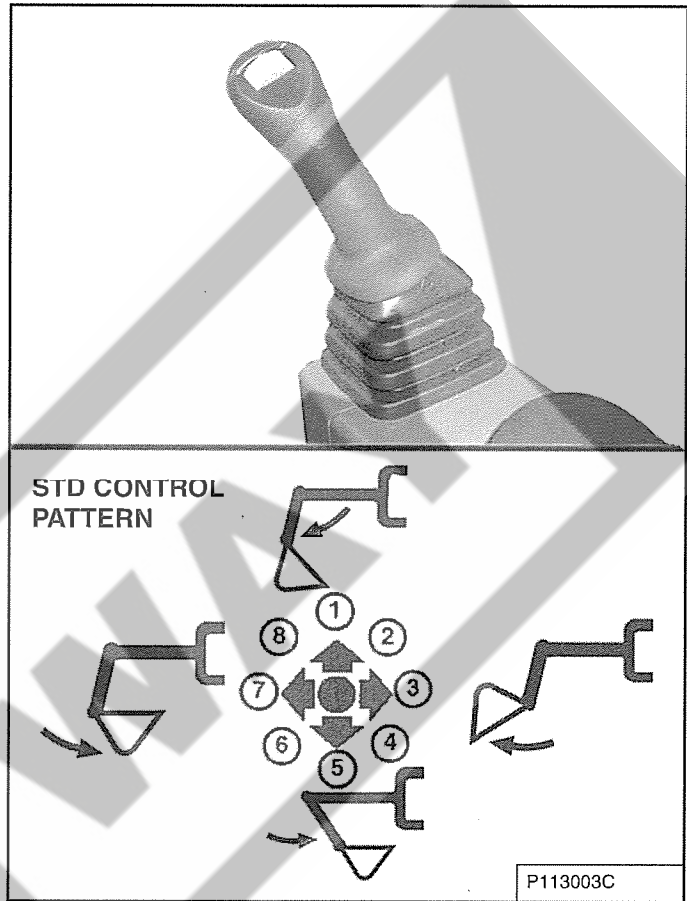


The left lever (joystick) is used to operate the boom and slew the upperstructure [Figure 42].

1. Boom lower.
2. Boom lower and slew right.
3. Slew right.
4. Boom raise and slew right.
5. Boom raise.
6. Boom raise and slew left.
7. Slew left.
8. Boom lower and slew left.

Right Control Lever (Joystick)

Figure 43



The right lever (joystick) is used to operate the arm and bucket [Figure 43].

1. Arm out.
2. Arm out and bucket dump.
3. Bucket dump.
4. Arm in and bucket dump.
5. Arm in.
6. Arm in and bucket curl.
7. Bucket curl.
8. Arm out and bucket curl.



WARNING

AVOID INJURY OR DEATH

Before leaving the machine:

- Lower the work equipment to the ground.
- Lower the blade to the ground.
- Stop the engine and remove the key.
- Raise the control console.

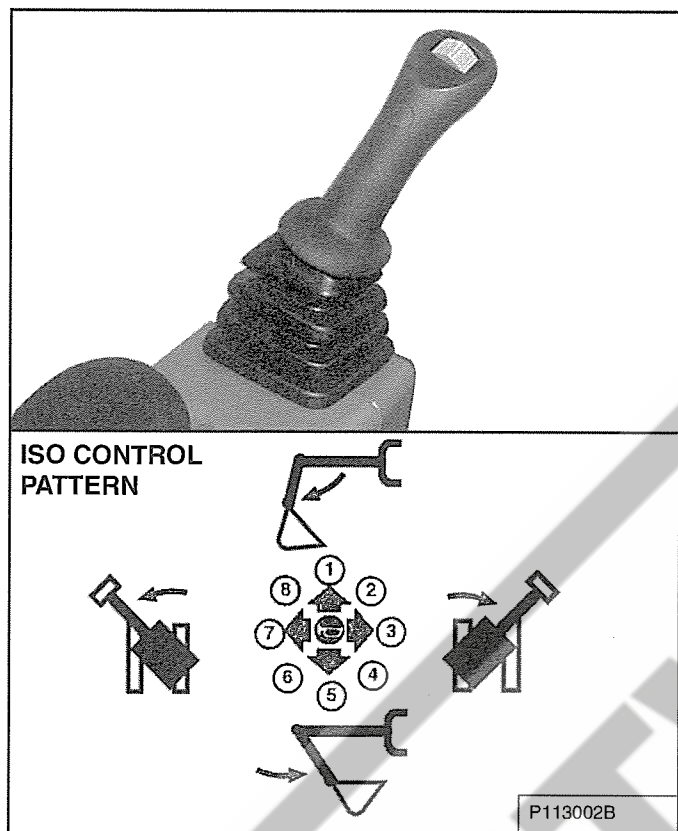
W-2780-0109

HYDRAULIC CONTROLS (CONT'D)

ISO Control Pattern

Left Control Lever (Joystick)

Figure 44

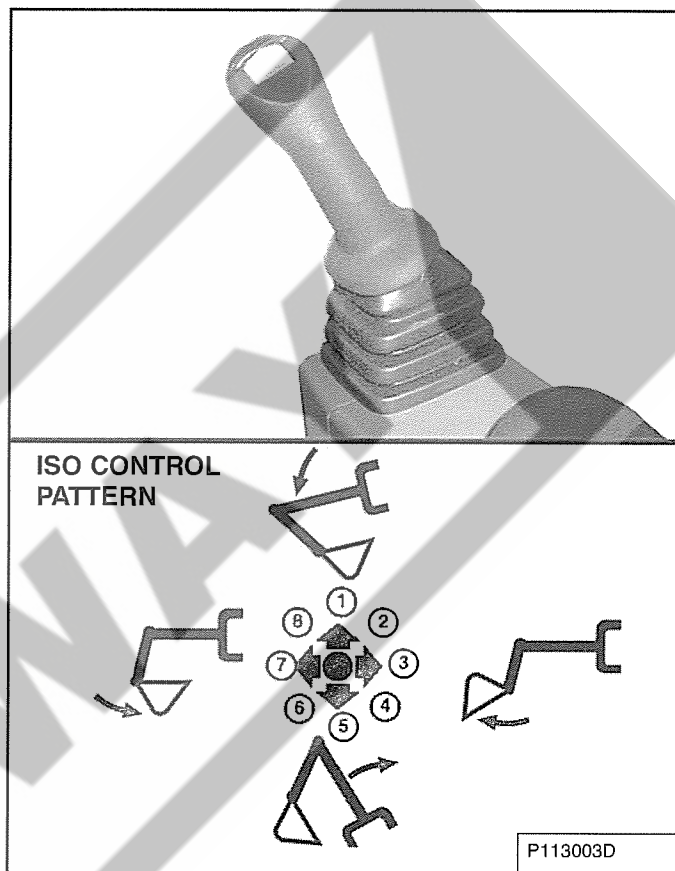


The left lever (joystick) is used to operate the arm and slew the upperstructure [Figure 44].

1. Arm out.
2. Arm out and slew right.
3. Slew right.
4. Arm in and slew right.
5. Arm in.
6. Arm in and slew left.
7. Slew left.
8. Arm out and slew left.

Right Control Lever (Joystick)

Figure 45



The right lever (joystick) is used to operate the boom and bucket [Figure 45].

1. Boom lower.
2. Boom lower and bucket dump.
3. Bucket dump.
4. Boom raise and bucket dump.
5. Boom raise.
6. Boom raise and bucket curl.
7. Bucket curl.
8. Boom lower and bucket curl.



WARNING

AVOID INJURY OR DEATH

Before leaving the machine:

- Lower the work equipment to the ground.
- Lower the blade to the ground.
- Stop the engine and remove the key.
- Raise the control console.

W-2780-0109

HYDRAULIC CONTROLS (CONT'D)

Quick Couplers

WARNING

AVOID BURNS

Hydraulic fluid, tubes, fittings and quick couplers can get hot when running machine and attachments. Be careful when connecting and disconnecting quick couplers.

W-2220-0396

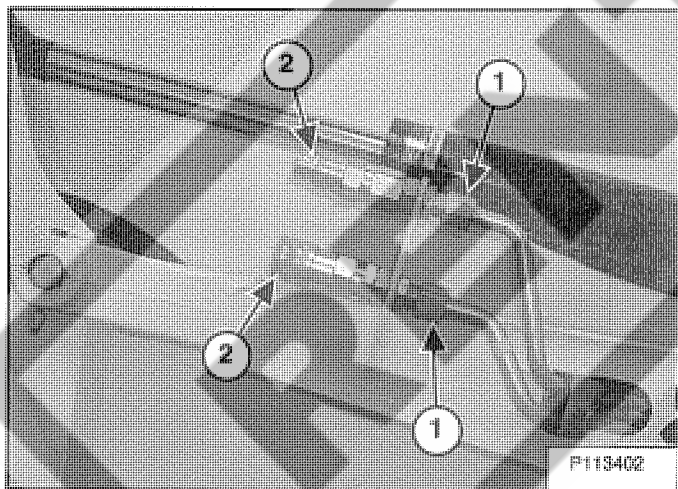
WARNING

AVOID INJURY OR DEATH

Diesel fuel or hydraulic fluid under pressure can penetrate skin or eyes, causing serious injury or death. Fluid leaks under pressure may not be visible. Use a piece of cardboard or wood to find leaks. Do not use your bare hand. Wear safety goggles. If fluid enters skin or eyes, get immediate medical attention from a physician familiar with this injury.

W-2072-0807

Figure 46



The excavator is supplied with hydraulic lines (Item 1) [Figure 46] that supply the hydraulic fluid for attachments.

Excavators and attachments are supplied with flush faced couplers (Item 2) [Figure 46].

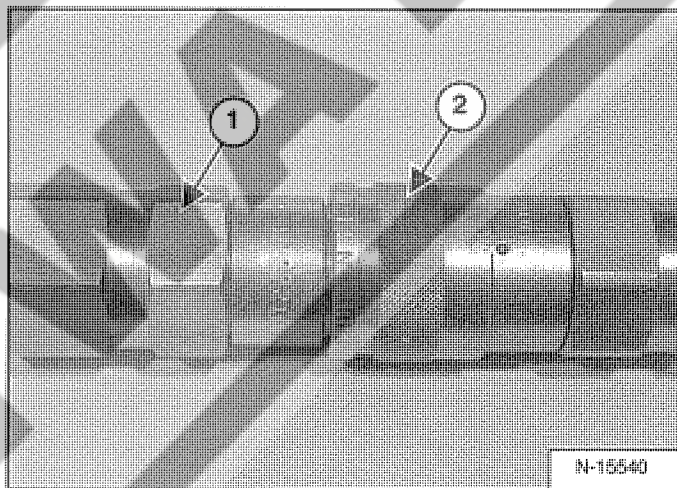
To Connect:

Remove any dirt or debris from the surface of both the male and female couplers, and from the outside diameter of the male coupler. Visually check the couplers for corroding, cracking, damage, or excessive wear, if any of these conditions exist, the coupler(s) (Item 2) [Figure 46] must be replaced.

Install the male coupler into the female coupler. Full connection is made when the ball release sleeve slides forward on the female coupler.

To Disconnect:

Figure 47



Hold the male coupler (Item 1). Retract the sleeve (Item 2) [Figure 47] on the female coupler until the couplers disconnect.

HYDRAULIC CONTROLS (CONT'D)

Auxiliary Hydraulics - Joystick Controls

If equipped with the auxiliary hydraulic switch (Item 1) [Figure 49] see the following information. If equipped with the auxiliary hydraulic pedal (Item 1) [Figure 51] (See Auxiliary Hydraulics - Manual Controls on Page 56.)

Continuous Hydraulic Flow

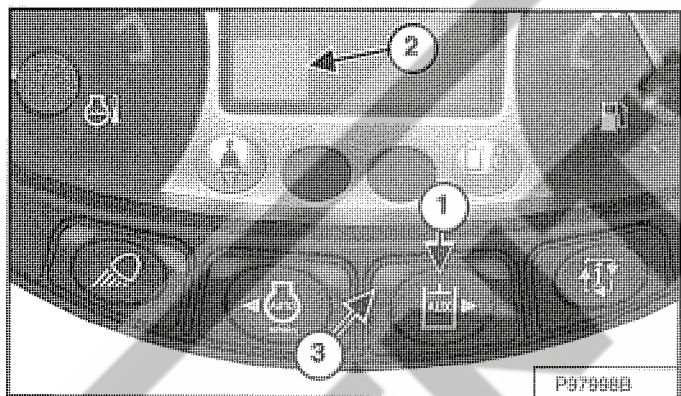
Press the button (Item 2) [Figure 49] on the front of the handle to provide continuous flow to the female coupler.

NOTE: Pressing the switch (Item 1) to the left while pressing the button (Item 2) [Figure 49] on the front of the handle will provide continuous flow to the male coupler.

Press the button (Item 2) [Figure 49] a second time to stop auxiliary flow to the quick couplers.

NOTE: Reverse flow can cause damage to some attachments. Use reverse flow with your attachment only if approved. See your attachment Operation & Maintenance Manual for detailed information.

Figure 48



Selectable Auxiliary Hydraulics Flow

Press the auxiliary hydraulics button (Item 1) once to enable the selectable hydraulic flow. The light (Item 2) [Figure 48] will be illuminated when the selectable auxiliary hydraulics are enabled.

Press the button (Item 1) a second time to disable the auxiliary hydraulics. The light (Item 2) [Figure 48] will turn OFF.

NOTE: If the auxiliary hydraulics are enabled when the engine is turned OFF, they will stay enabled when the engine is restarted.

Press the Auxiliary Hydraulics button (Item 1) (an audible beep will sound each time the auxiliary button is pressed). The last selected auxiliary hydraulic flow (Aux3, Aux2 or Aux1) will appear in the data display (Item 2). The LED (Item 3) [Figure 48] will be illuminated.

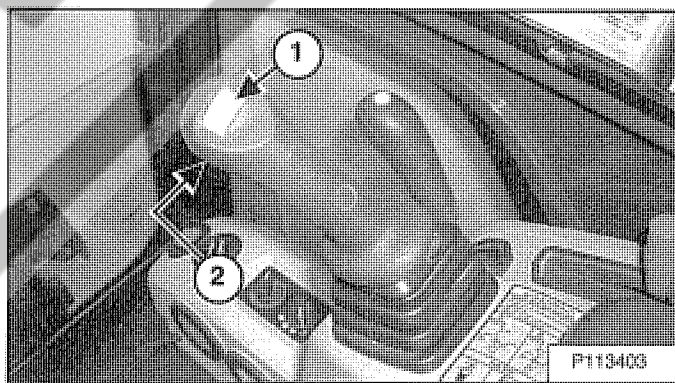
To change the auxiliary flow, press the Auxiliary Hydraulics button (Item 1) to toggle through the settings, each time the button is pressed, the next setting will appear in the data display (Item 2) [Figure 48]. Once the desired setting is selected, it will stay at that setting until a different auxiliary flow is selected by the operator. (Example: Even if the engine was STOPPED, if Aux2 has been selected, after key OFF and engine restart, the Aux2 setting will still be the active hydraulic flow when the machine is started.)

Examples For Selecting Auxiliary Hydraulic Flow And The Attachments Used:

AUX FLOW SETTING	FLOW	ATTACHMENTS
Aux3	Maximum	Breaker, Auger
Aux2	Medium	Clamp
Aux1	Low	Attachments requiring very low flow for controllability

NOTE: Use only approved attachments for your model excavator. Attachments are approved for each model of excavator based on various factors. Using unapproved attachments could cause damage to the attachment or to the excavator.

Figure 49



Move the switch (Item 1) [Figure 49] on the right control lever to the right to supply hydraulic flow to the female coupler. Move the switch to the left to supply hydraulic flow to the male coupler. If you move the switch halfway, the auxiliary functions move at approximately one-half speed.

Press the button (Item 2) [Figure 49] on the front of the handle to provide continuous selectable flow to the female coupler.

NOTE: Pressing the switch (Item 1) to the left while pressing the button (Item 2) [Figure 49] on the front of the handle will provide continuous selectable flow to the male coupler.

Press the button (Item 2) [Figure 49] a second time to stop auxiliary flow to the quick couplers.

HYDRAULIC CONTROLS (CONT'D)

Relieve Hydraulic Pressure - With Joystick Controls (Excavator And Attachment)

NOTE: The following is for auxiliary hydraulics with the joystick switch (Item 1) [Figure 49] only. For manual auxiliary hydraulic controls, see [Figure 51].

Excavator:

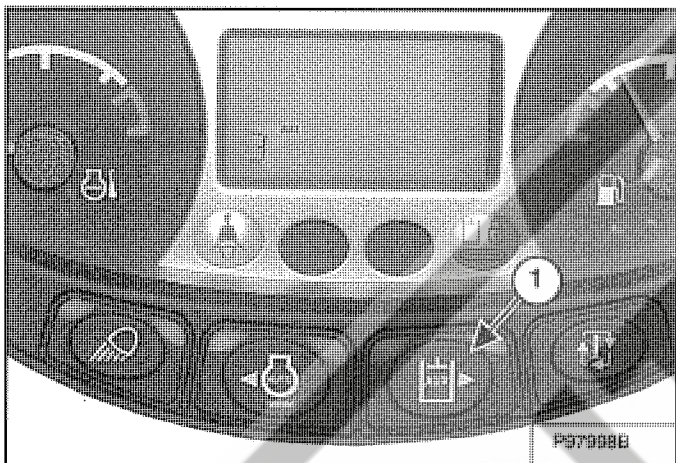
Put the attachment flat on the ground.

Stop the engine and turn the key switch to ON.

NOTE: The left console must be fully lowered for relieving hydraulic pressure.

NOTE: Excavator engine must have recently been started to relieve hydraulic pressure.

Figure 50



If the auxiliary hydraulics are disabled, press AUX HYD button (Item 1) [Figure 50] and then move the switch (Item 1) [Figure 49] to the right and left several times.

If the auxiliary hydraulics are enabled, then move the switch (Item 1) [Figure 49] to the right and left several times.

Attachments:

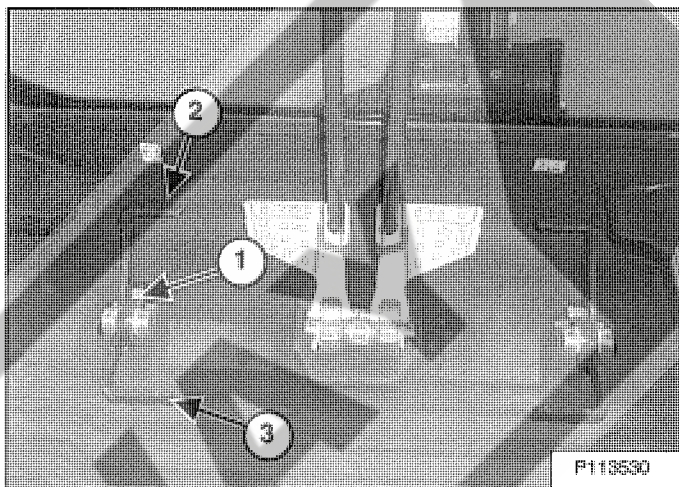
- Follow procedure above to relieve hydraulic pressure in excavator.
- Connect male coupler from attachment to female coupler of excavator then repeat procedure above. This will relieve pressure in the attachment.
- Connect the female coupler from the attachment.

Hydraulic pressure in the auxiliary hydraulic system can make it difficult to engage quick couplers to an attachment.

Auxiliary Hydraulics - Manual Controls

If equipped with the auxiliary hydraulic pedal (Item 1) [Figure 51] control, see the following information. If equipped with the joystick auxiliary hydraulic switch (Item 1) [Figure 49] (See Auxiliary Hydraulics - Joystick Controls on Page 55.)

Figure 51



Press the toe of the pedal (Item 2) [Figure 51] to supply hydraulic flow to the female coupler (if equipped).

Press the heel of the pedal (Item 3) [Figure 51] to supply hydraulic flow to the male coupler (if equipped).

Relieve Hydraulic Pressure - With Manual Controls (Excavator And Attachment)

Put the attachment flat on the ground.

Stop the engine.

Excavator:

With the engine off, move the pedal (Item 1) [Figure 51] in both directions several times.

Attachments:

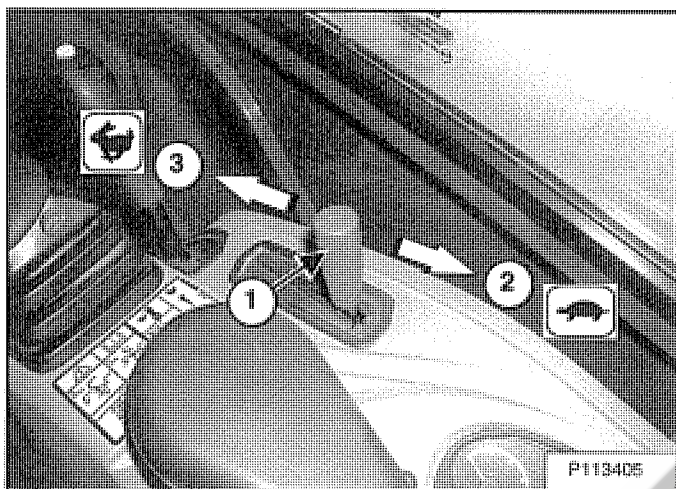
- Follow the procedure above to release pressure in the excavator.
- Connect the male coupler from attachment to the female coupler of the excavator. Then repeat procedure above. This will release pressure in the attachment.
- Connect the female coupler from the attachment.

Hydraulic pressure in the auxiliary hydraulic system can make it difficult to engage quick couplers to an attachment.

ENGINE SPEED CONTROL

Setting Engine Speed (RPM)

Figure 52



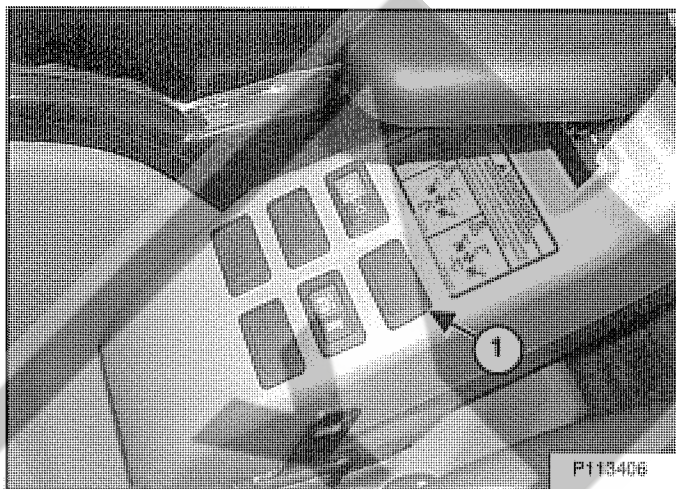
The engine speed control lever (Item 1) [Figure 52] controls engine rpm.

Move the engine speed control lever back (Item 2) to reduce engine rpm. Move the engine speed control dial forward (Item 3) [Figure 52] to increase engine rpm.

BLADE CONTROL LEVER

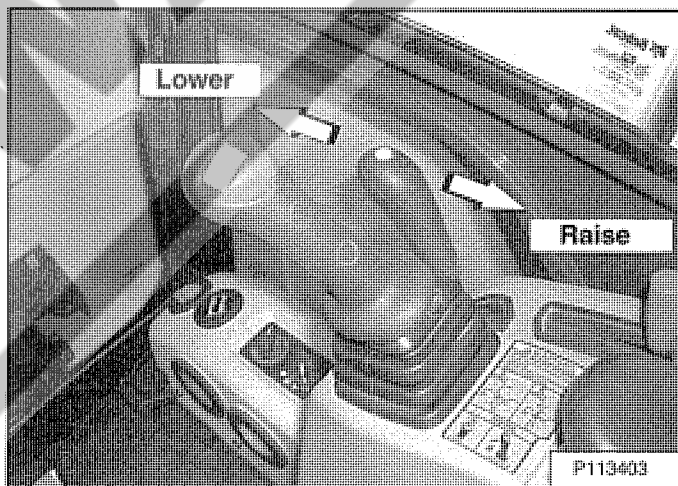
Raising And Lowering Blade

Figure 53



Push the Blade / Track Retraction - Expansion Switch (Item 1) [Figure 53] to the Blade position.

Figure 54



Move the Blade / Track Retraction - Expansion Lever forward to lower the blade [Figure 54].

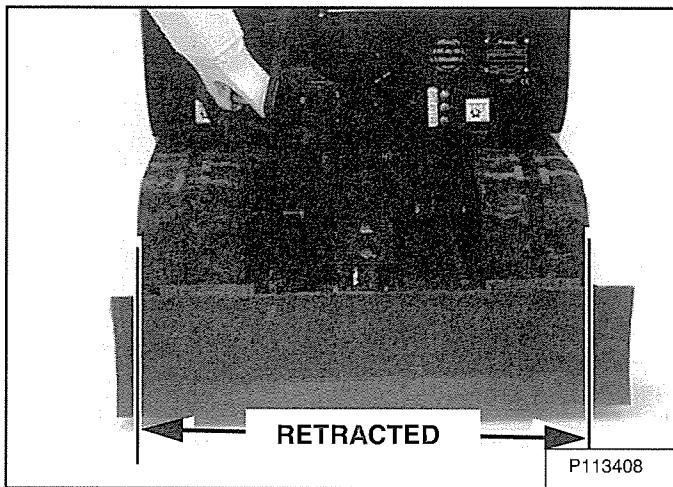
Move the Blade / Track Retraction - Expansion Lever backward to raise the blade [Figure 54].

NOTE: Keep blade lowered for increased digging performance.

TRACK FRAME RETRACTION / EXPANSION

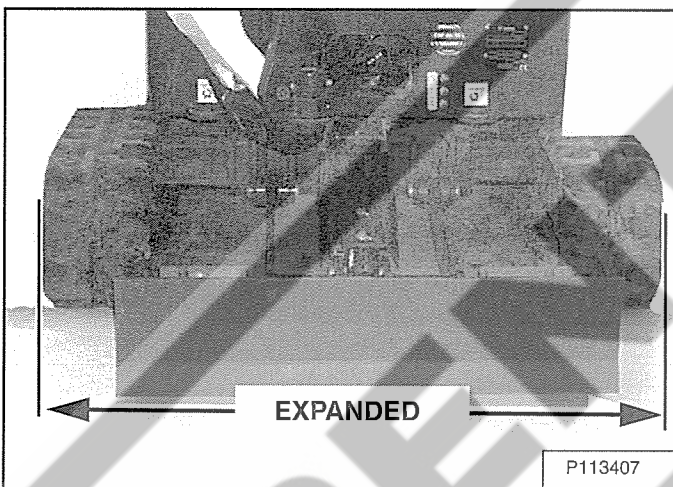
Operation

Figure 55



The excavator can be operated with the track frame retracted for transportation on a trailer or to access narrow areas [Figure 55].

Figure 56



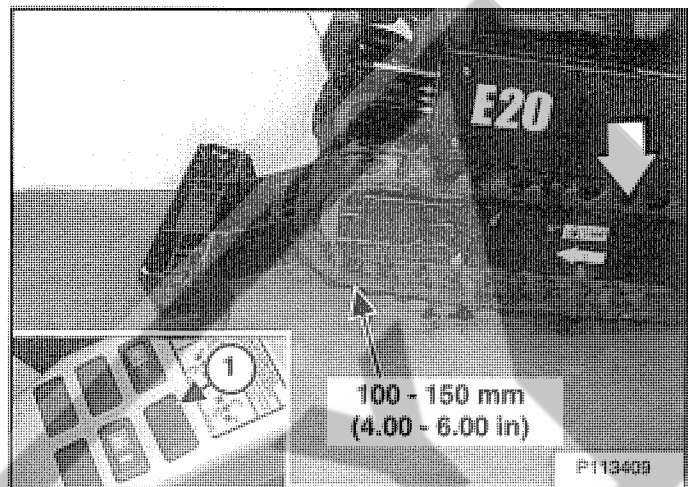
Expand the track frame for increased digging performance and for entering and exiting the excavator [Figure 56].

IMPORTANT

To prevent wear and damage to the track, always lift the excavator before expanding or retracting the track frame.

I-2193-0599

Figure 57

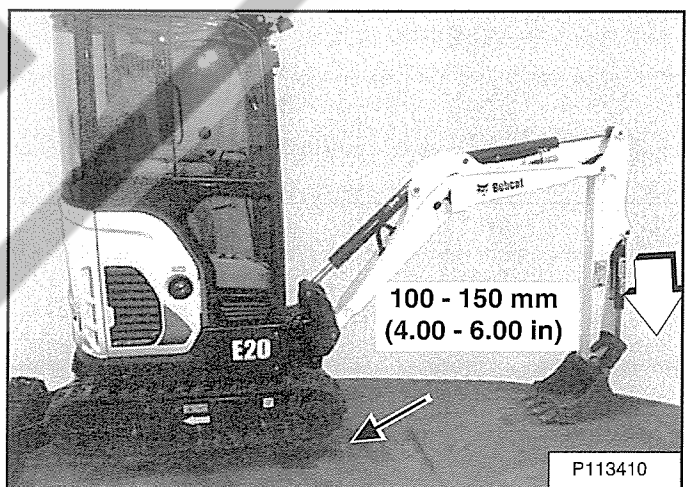


Put the Blade / Track Retraction - Expansion Switch (Item 1) [Figure 57] to the right in the Blade position.

With the boom and arm positioned over the blade, lower the blade until the track is raised 100 - 150 mm (4.00 - 6.00 in) off the ground [Figure 57].

Rotate the upperstructure 180 degrees.

Figure 58



Lower the boom and arm to raise the rear of the excavator until the track is 100 - 150 mm (4.00 - 6.00 in) off the ground [Figure 58].

TRACK FRAME RETRACTION / EXPANSION (CONT'D)

Operation (Cont'd)

Figure 59



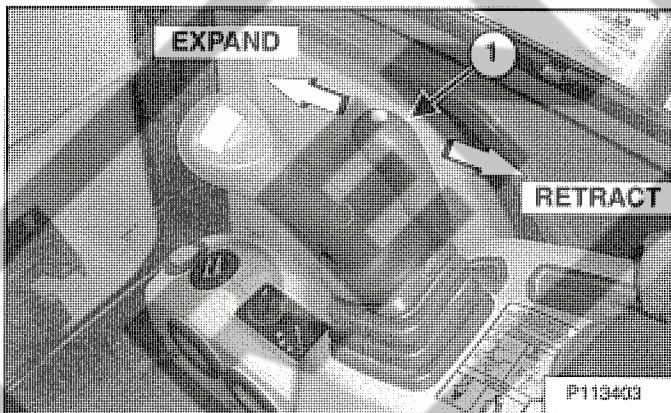
Push the Blade / Track Retraction - Expansion Switch (Item 1) [Figure 59] to the Track Expansion position.

IMPORTANT

To prevent wear and damage to the track, always lift the excavator before expanding or retracting the track frame.

I-2193-0599

Figure 60

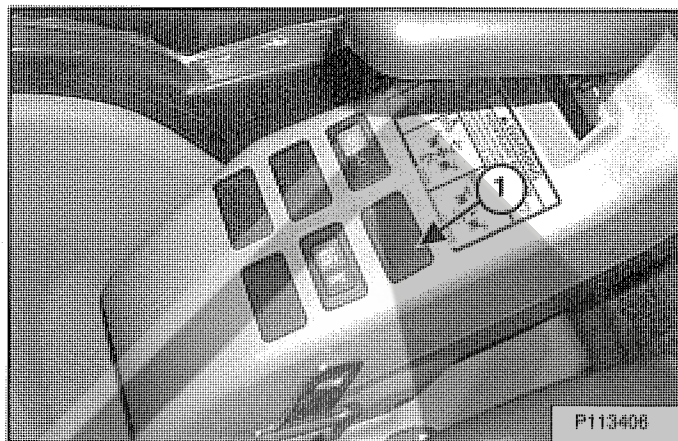


Push the Blade / Track Retraction - Expansion Lever (Item 1) [Figure 60] forward to expand the track frame. Hold the lever forward until the track frame is fully expanded.

Pull the Blade / Track Retraction - Expansion Lever [Figure 60] back to retract the track frame. Hold the lever back until the track frame is fully retracted.

The track frame must be either in the fully expanded or fully retracted position when in use.

Figure 61



NOTE: Always return the Blade / Track Retraction - Expansion Switch (Item 1) [Figure 61] to the Blade position during operation so that the track does not move when using the Blade / Track Retraction - Expansion Lever.

Raise the boom and arm to lower the rear of the excavator to the ground.

Rotate the upperstructure 180 degrees.

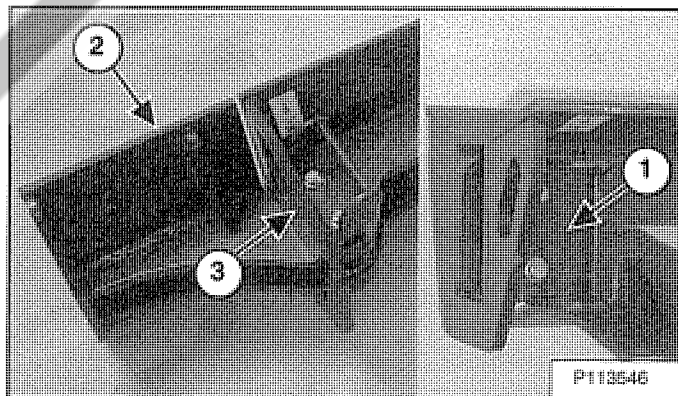
Raise the blade until the tracks are on the ground.

NOTE: Always operate the machine with the tracks fully expanded or fully retracted.

NOTE: Tracks must be fully expanded for entering and exiting the excavator.

Blade Expansion

Figure 62



Raise the blade slightly and place a block under the blade. Lower the blade fully.

Remove the blade retainer pin assembly (Item 1) [Figure 62].

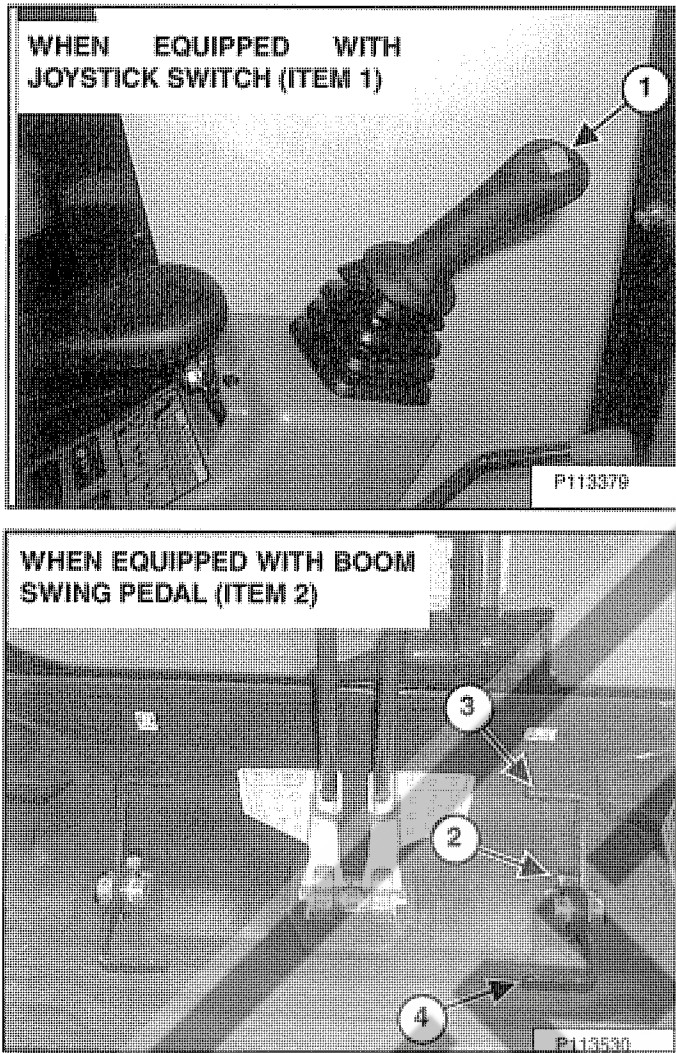
Remove and reposition the blade extension (Item 2) [Figure 62] to the outside blade position.

Reinstall the blade retainer pin assembly (Item 3) [Figure 62].

BOOM SWING

Operation

Figure 63



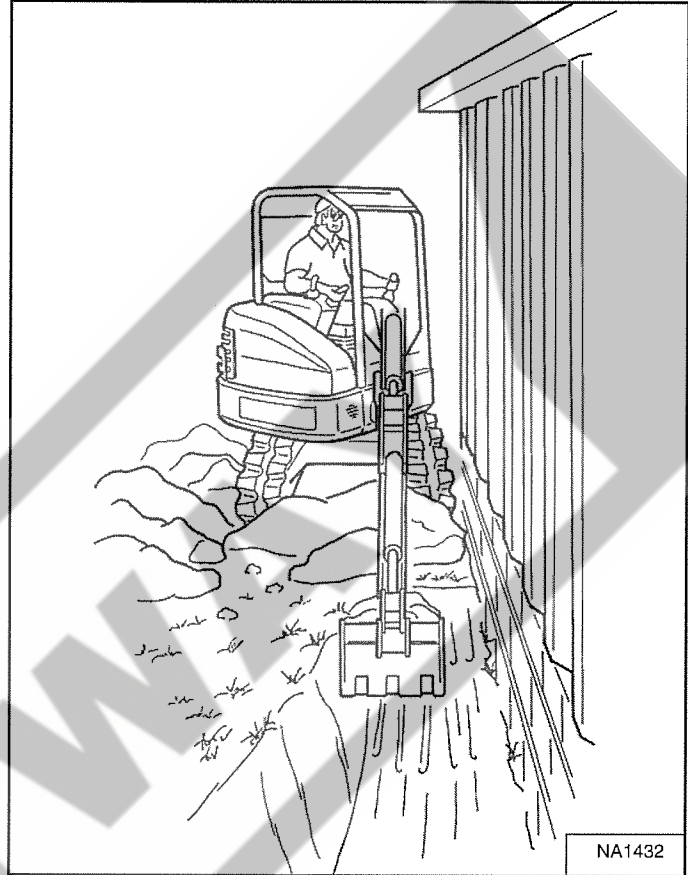
When equipped with Joystick Switch (Item 1) [Figure 63]:

The boom swing switch (Item 1) [Figure 63] (if equipped) on the left control lever (joystick) controls boom swing. Move the switch to the left to swing the boom to the left. Move the switch to the right to swing the boom to the right.

When equipped with Boom Swing Pedal (Item 2) [Figure 63]:

The boom swing pedal (Item 2) (if equipped) controls boom swing. Press the toe (Item 3) of the pedal to swing the boom to the left. Press the heel (Item 4) [Figure 63] of the pedal to swing the boom to the right.

Figure 64



NOTE: The purpose of the boom swing is to offset the boom with respect to the upperstructure for digging close to a structure [Figure 64].

BOOM LOAD HOLDING VALVE

Description

The boom load holding valve (if equipped) will hold the boom in its current position in the event of hydraulic pressure loss.

WARNING

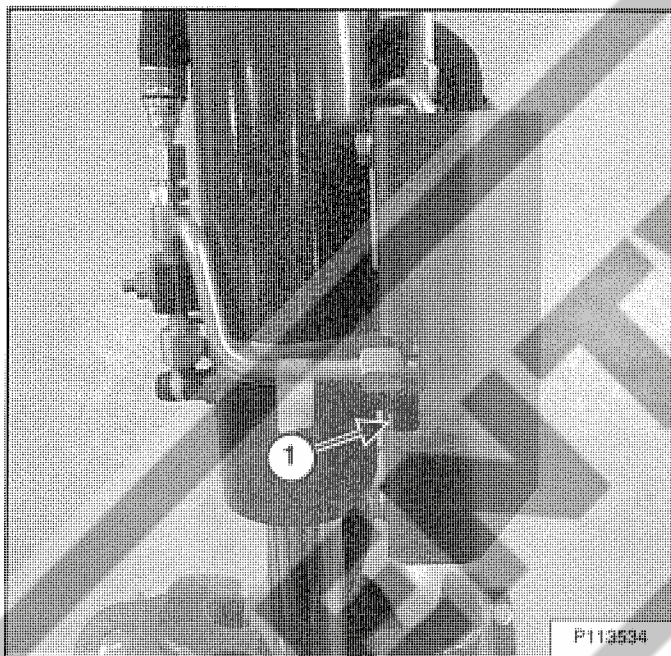
AVOID INJURY OR DEATH

Do Not work or stand under raised work equipment or attachment.

W-2793-0409

Lowering Boom With Load Holding Valve

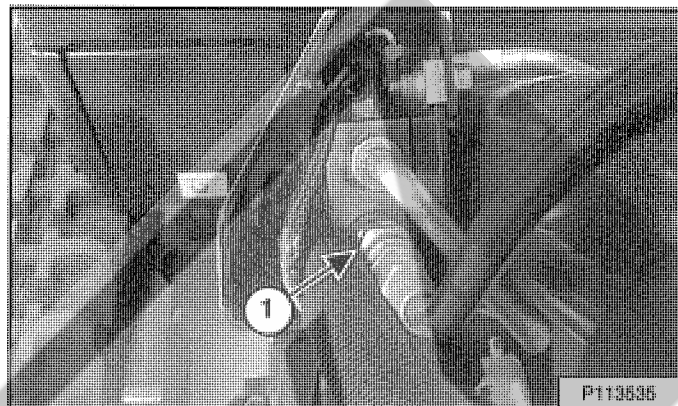
Figure 65



If the excavator is equipped with a boom load holding valve (Item 1) [Figure 65], it will be attached to the boom cylinder at the rod end.

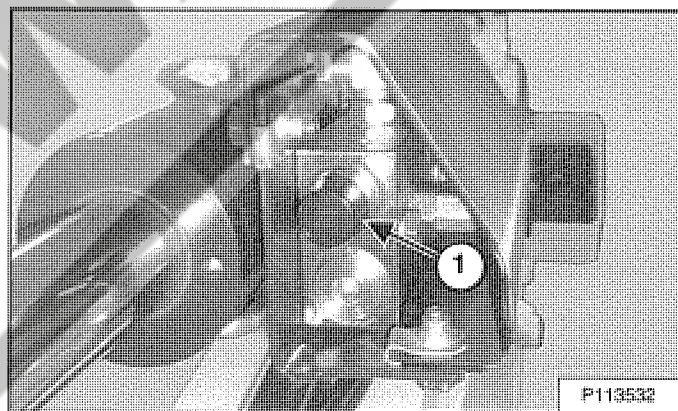
NOTE: DO NOT remove or adjust the two port relief valves (Item 2) [Figure 65]. If the port relief valves have been tampered with, see your Bobcat dealer for service.

Figure 66



NOTE: DO NOT remove or adjust the port relief valve (Item 1) [Figure 66] (that the drain hose is connected to). If the port relief valve have been tampered with, see your Bobcat dealer for service.

Figure 67



Remove the plastic protective cap (Item 1) [Figure 67] from the valve.

WARNING

AVOID BURNS

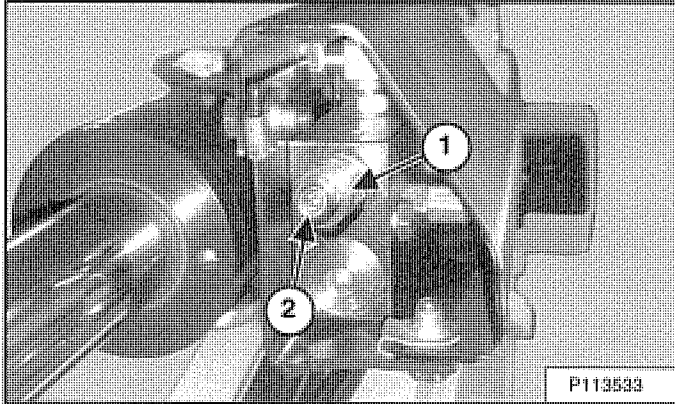
Hydraulic fluid, tubes, fittings and quick couplers can get hot when running machine and attachments. Be careful when connecting and disconnecting quick couplers.

W-2220-0396

BOOM LOAD HOLDING VALVE (CONT'D)

Lowering Boom With Load Holding Valve (Cont'd)

Figure 68



Lowering procedures:

With base end hose failure, or with rod end hose failure and NO accumulator pressure:

NOTE: If the relief valve must be adjusted to lower the boom, the relief valve must be replaced. It can not be reset back to the factory setting.

Loosen the jam nut (Item 1). Install a hex wrench into the valve screw (Item 2) [Figure 68] and slowly rotate the screw clockwise and allow the boom to lower to the ground.

Replace the relief valve [Figure 68]. See your Bobcat dealer for service parts.

With rod end hose failure - with accumulator pressure:

Place a container under the valve and hose end to contain hydraulic fluid. Enter the excavator and turn the key switch to the ON position or press the ENTER CODE Button (Keyless Panel), but do not start the engine. Slowly move the joystick boom lower function and allow the boom to lower to the ground.

Loss of hydraulic pressure:

Use the same procedure as: **With base end hose failure, or with rod end hose failure and NO accumulator pressure.**

ARM LOAD HOLDING VALVE

Description

The arm load holding valve (if equipped) will hold the arm in its current position in the event of hydraulic pressure loss.

WARNING

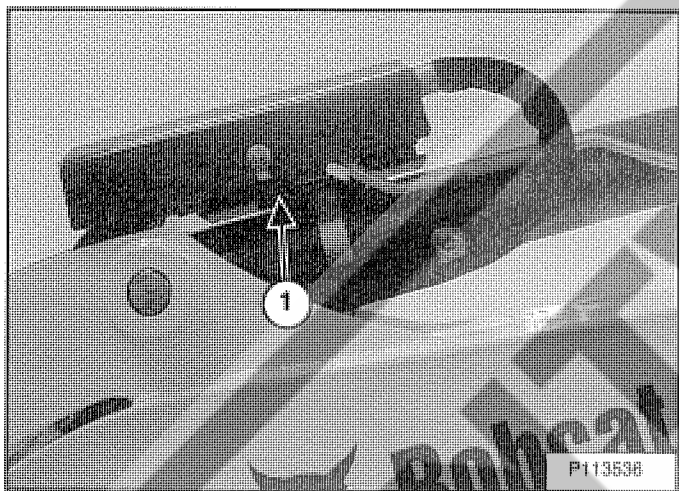
AVOID INJURY OR DEATH

Do Not work or stand under raised work equipment or attachment.

W-2793-0409

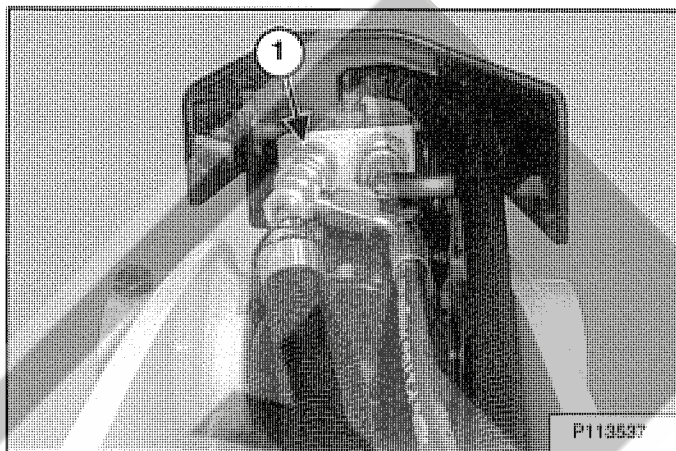
Lowering Arm With Load Holding Valve

Figure 69



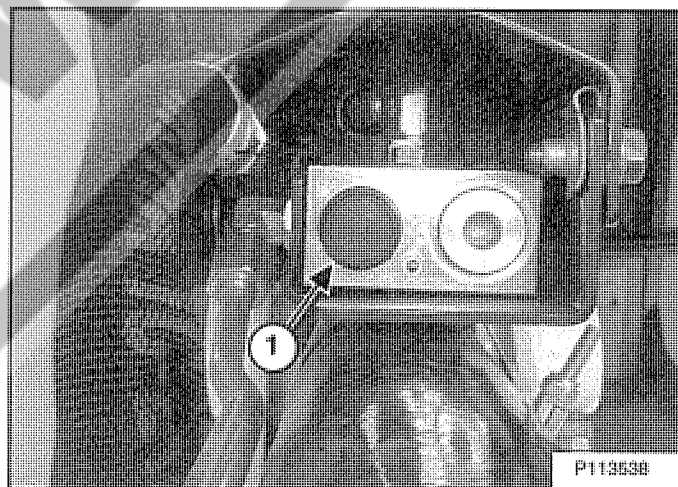
If the excavator is equipped with arm load holding valve (Item 1) [Figure 69], it will be attached to the arm cylinder base end as shown.

Figure 70



NOTE: DO NOT remove or adjust the port relief valve (Item 1) [Figure 70] (that the drain hose is connected to). If the port relief valve have been tampered with, see your Bobcat dealer for service.

Figure 71



Remove the plastic protective cap (Item 1) [Figure 71] from the valve.

WARNING

AVOID BURNS

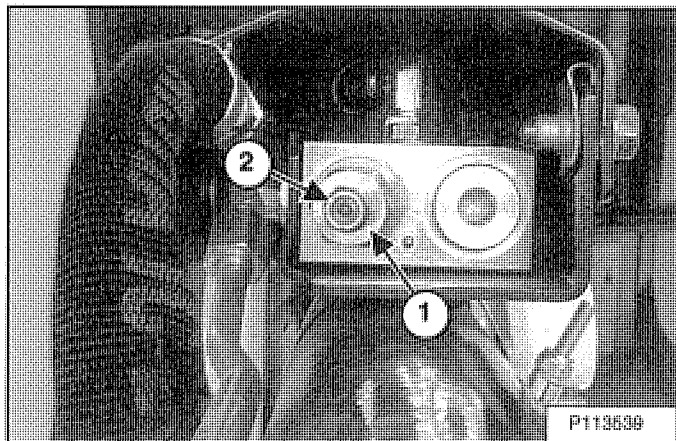
Hydraulic fluid, tubes, fittings and quick couplers can get hot when running machine and attachments. Be careful when connecting and disconnecting quick couplers.

W-2220-0396

ARM LOAD HOLDING VALVE (CONT'D)

Lowering Arm With Load Holding Valve (Cont'd)

Figure 72



Lowering procedures:

With base end hose failure, or with rod end hose failure and NO accumulator pressure:

NOTE: If the relief valve must be adjusted to lower the boom, the relief valve must be replaced. It can not be reset back to the factory setting.

Loosen the jam nut (Item 1). Install a hex wrench into the valve screw (Item 2) [Figure 72] and slowly rotate the screw clockwise and allow the arm to lower to the ground.

Replace the relief valve [Figure 72]. See your Bobcat dealer for service parts.

With rod end hose failure - with accumulator pressure:

Place a container under the valve and hose end to contain hydraulic fluid. Enter the excavator and turn the key switch to the ON position or press the ENTER CODE Button (Keyless Panel), but do not start the engine. Move the joystick arm retract function to slowly lower the arm.

Loss of hydraulic pressure:

Use the same procedure as: **With base end hose failure, or with rod end hose failure and NO accumulator pressure.**

OVERLOAD WARNING DEVICE

Description

NOTE: The excavator must be equipped with the optional boom load holding valve to installed for the overload warning device.

The overload warning device (if equipped) senses hydraulic pressure in the boom lift circuit. When the hydraulic pressure in the boom lift circuit reaches a predetermined pressure setting, a buzzer will sound that indicates an overload condition.

If the buzzer sounds, immediately move the arm closer to the excavator and lower the boom. Reduce the size of the load before attempting to re-lift the load.



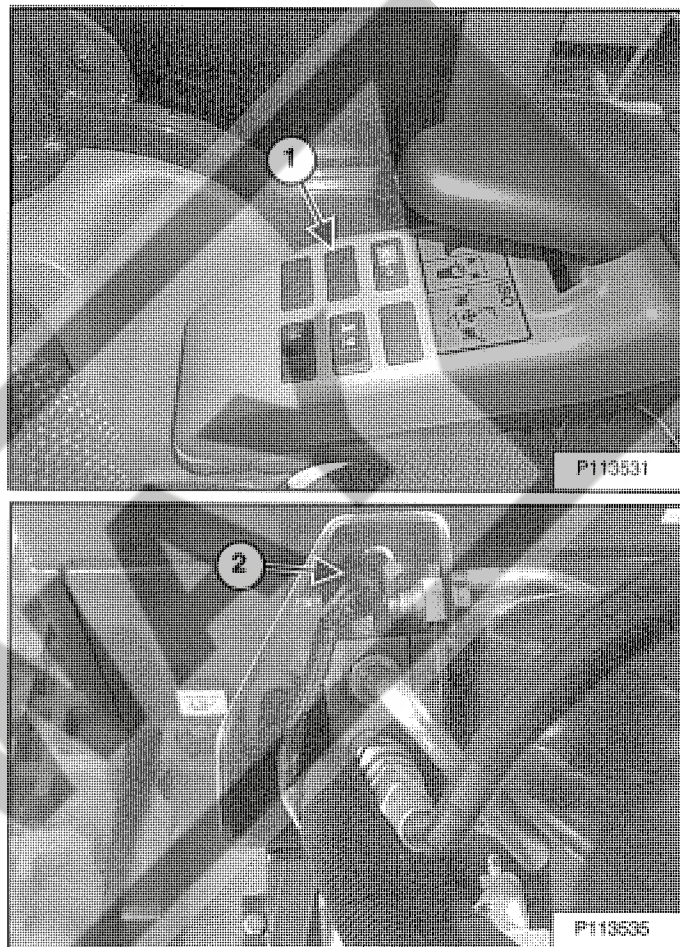
AVOID INJURY OR DEATH

Do Not work or stand under raised work equipment or attachment.

W-2793-0409

Operation

Figure 73



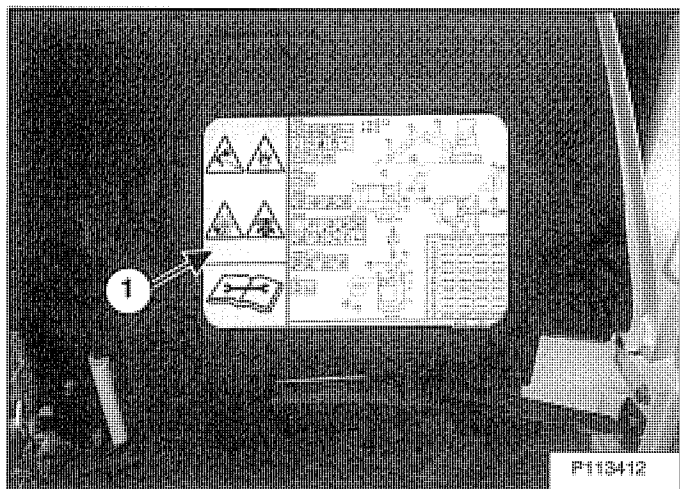
Press the switch (Item 1) to the left. This will activate the optional pressure switch (Item 2) [Figure 73] in the boom load hold valve.

Press the switch (Item 1) [Figure 73] to the right to shut the overload warning feature OFF.

DAILY INSPECTION

Daily Inspection And Maintenance

Figure 74



Maintenance work must be done at regular intervals. Failure to do so will result in excessive wear and early failures. The service schedule is a guide for correct maintenance of the Bobcat excavator. The decal (Item 1) [Figure 74] is located on the inside of the tailgate. (See SERVICE SCHEDULE on Page 97.)

Check the following items before each day of operation:

- Operator Canopy or Cab (ROPS / TOPS) and mounting hardware.
- Seat belt and mounting hardware. Replace seat belt if damaged.
- Check for damaged decals, replace as needed.
- Check control console lockout.
- Check Attachment Mounting System (if equipped) for damage or loose parts.
- Air cleaner and intake hoses / clamps.
- Engine oil level and engine for leaks.
- Drain water from fuel filter.
- Engine coolant level and engine for leaks.
- Check engine area for flammable materials.
- Check hydraulic oil level and system for leaks.
- Check indicator lights for correct operation.
- Grease all pivot points.
- Check cylinder and attachment pivot points.
- Check the track tension.
- Repair broken and loose parts.
- Clean cab heater filter (if equipped).
- Check front horn and motion alarm (if equipped) for proper function.



WARNING

Operator must have instructions before operating the machine. Untrained operators can cause injury or death.

W-2001-0502

Fluids such as engine oil, hydraulic oil, coolants, etc. must be disposed of in an environmentally safe manner. Some regulations require that certain spills and leaks on the ground must be cleaned in a specific manner. See local state and federal regulations for correct disposal.

IMPORTANT

PRESSURE WASHING DECALS

- Never direct the stream at a low angle toward the decal that could damage the decal causing it to peel from the surface.
- Direct the stream at a 90 degree angle and at least 300 mm (12 in) from the decal. Wash from the center of the decal toward the edges.

I-2226-0910

IMPORTANT

This machine is factory equipped with a U.S.D.A. Forestry Service approved spark arrester exhaust system.

The spark arrester muffler, if equipped, must be cleaned to keep it in working condition. The spark arrester muffler must be serviced by dumping the spark chamber every 100 hours of operation.

On some models, the turbocharger functions as the spark arrester and must operate correctly for proper spark arrester function.

If this machine is operated on flammable forest, brush, or grass covered land, it must be equipped with a spark arrester attached to the exhaust system and maintained in working order. Failure to do so will be in violation of California State Law, Section 4442. PRC. Refer to local laws and regulations for spark arrester requirements.

I-2284-0111

PRE-STARTING PROCEDURE

Operation & Maintenance Manual And Operator's Handbook Locations

Figure 75

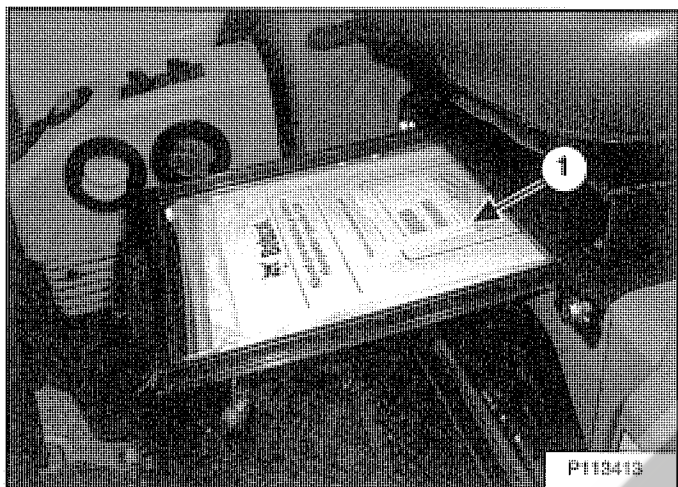
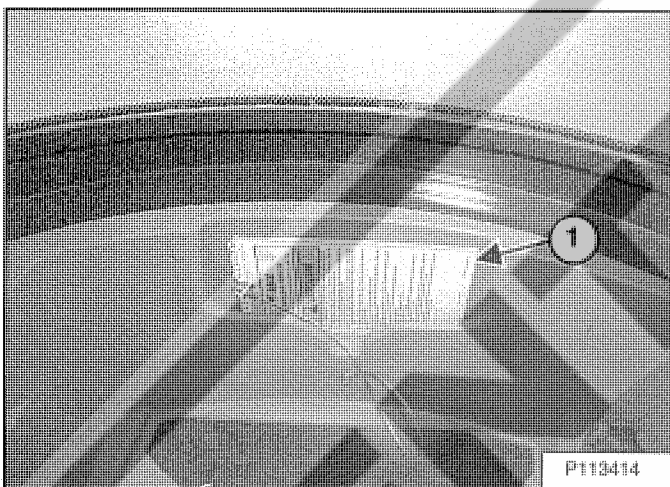


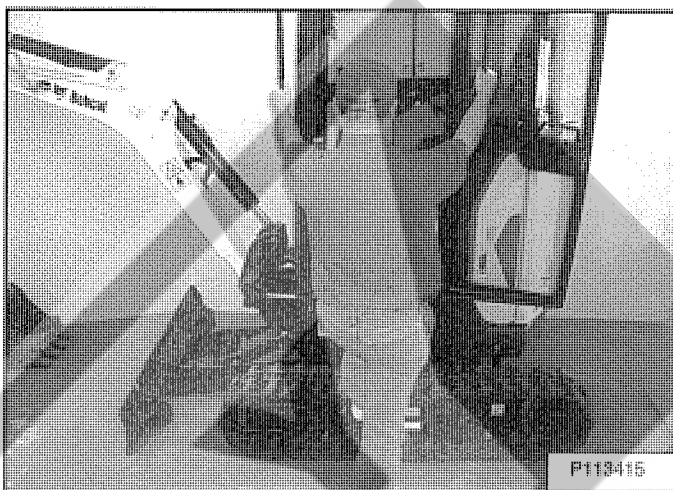
Figure 76



Read and understand the Operation & Maintenance Manual (Item 1) [Figure 75] (located inside the storage box below the operator's seat) and the Operator's Handbook (Item 1) [Figure 76] located behind the operator's seat before operating.

Entering The Excavator

Figure 77



Use the grab handles and tracks to enter the canopy / cab [Figure 77].

NOTE: Tracks must be fully expanded for entering and exiting the excavator.



WARNING

AVOID INJURY OR DEATH

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

W-2003-0807

PRE-STARTING PROCEDURE (CONT'D)

Seat Adjustment

Basic Seat (If Equipped)

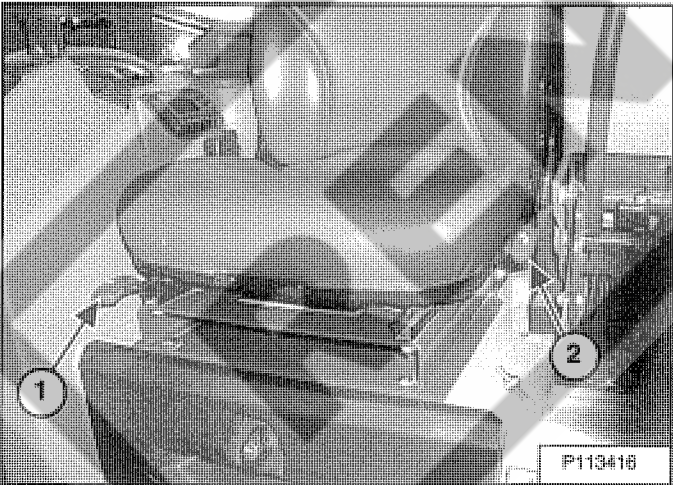
Figure 78



The basic seat has no adjustments [Figure 78].

Standard Seat (If Equipped)

Figure 79

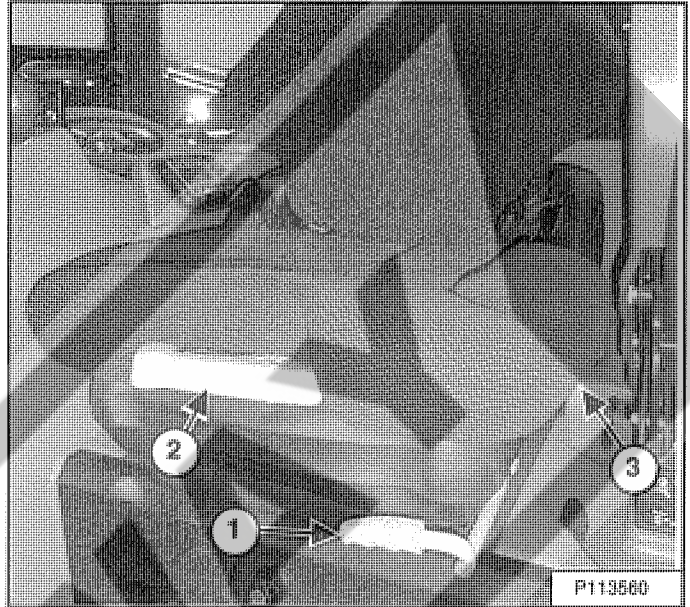


Release the seat lever (Item 1) [Figure 79] to adjust the seat forward or back.

Release the seat lever (Item 2) [Figure 79] to adjust the position of the back cushion.

Suspension Seat (If Equipped)

Figure 80



Release the seat lever (Item 1) [Figure 80] to adjust the seat forward or back.

Turn the handle (Item 2) [Figure 80] to change the adjustment for operator weight.

Release the lever (Item 3) [Figure 80] to change the incline of the seat back.

Seat Belt

Figure 81

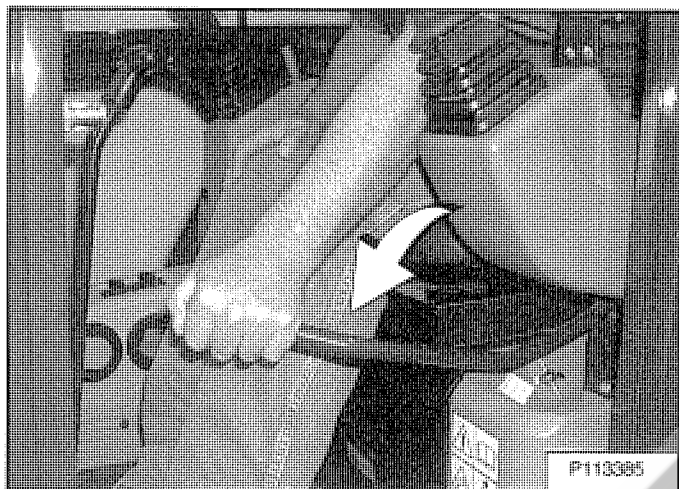


Fasten the seat belt [Figure 81].

PRE-STARTING PROCEDURE (CONT'D)

Control Console

Figure 82



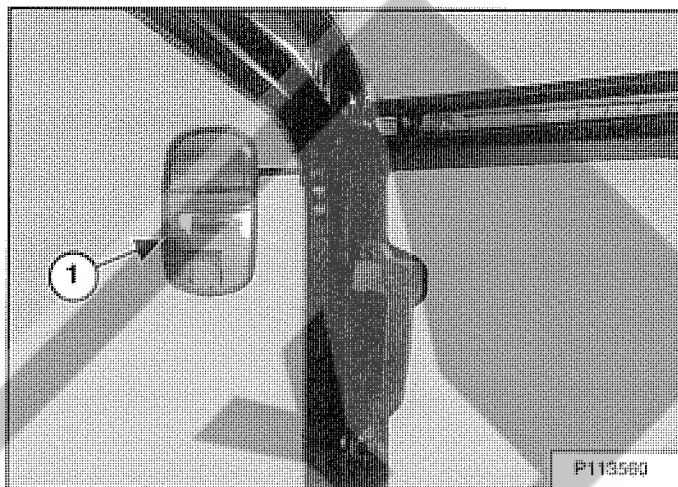
Lower the control console [Figure 82].

NOTE: There is a control lock sensor in the left console which deactivates the hydraulic control levers (joysticks) and the traction drive system when the control console is raised. The console must be in the locked down position for the hydraulic control levers (joysticks) and traction system to operate.

NOTE: If the control lock sensor does not deactivate the control levers and traction system when console is raised, see your Bobcat dealer for service.

Mirror Adjustment

Figure 83



Adjust mirror(s) (Item 1) [Figure 83] (if equipped).

STARTING THE ENGINE

Key Switch

! WARNING

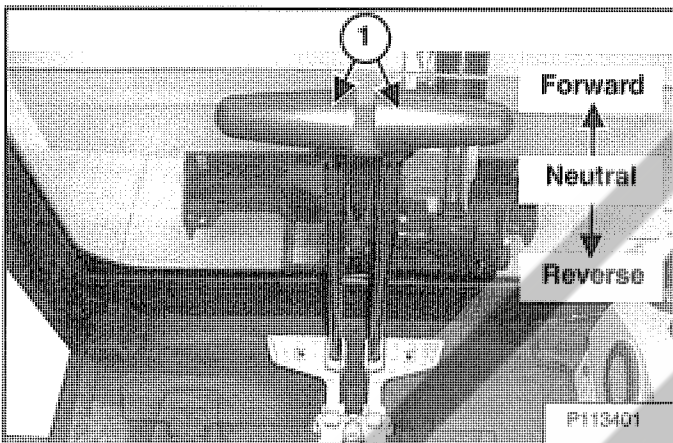
AVOID INJURY OR DEATH

- Fasten seat belt, start and operate only from the operator's seat.
- Never wear loose clothing when working near machine.

W-2135-1108

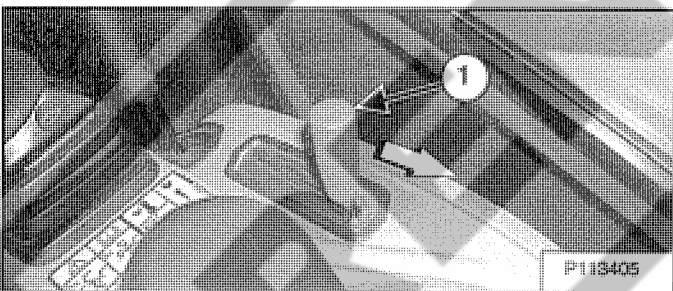
Perform the PRE-STARTING PROCEDURE. (See PRE-STARTING PROCEDURE on Page 67.)

Figure 84



Put control levers (Item 1) [Figure 84] in the neutral position.

Figure 85



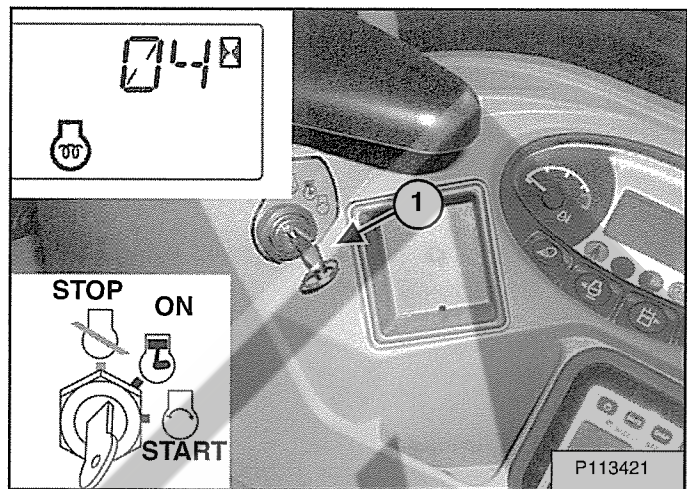
Move the engine speed control lever (Item 1) [Figure 85] back to low idle.

IMPORTANT

Do not engage the starter for longer than 15 seconds at a time. Longer use can damage the starter by overheating. Allow starter to cool for one minute before using starter again.

I-2034-0700

Figure 86



Turn the key (Item 1) [Figure 86] to the ON position. If preheating is required, the glow plugs will automatically cycle and the remaining preheat time (in seconds) will show in the data display screen (see inset). (Preheat icon will be ON).

NOTE: It is recommended in cold weather to cycle the glow plugs twice before attempting to start the engine. This will allow for additional heating time for cold weather starting.

Turn the key to START and release the key when the engine starts. It will return to the ON position [Figure 86].

Stop the engine if the warning lights and alarm do not go OFF. Check for the cause before starting the engine again.

Turn the key switch OFF to stop the engine.

! WARNING

AVOID INJURY OR DEATH

When an engine is running in an enclosed area, fresh air must be added to avoid concentration of exhaust fumes. If the engine is stationary, vent the exhaust outside. Exhaust fumes contain odorless, invisible gases which can kill without warning.

W-2050-0807

! WARNING

AVOID SERIOUS INJURY OR DEATH

- Engines can have hot parts and hot exhaust gas. Keep flammable material away.
- Do not use machines in atmosphere containing explosive dust or gases.

W-2051-0212

STARTING THE ENGINE (CONT'D)

Keyless

! WARNING

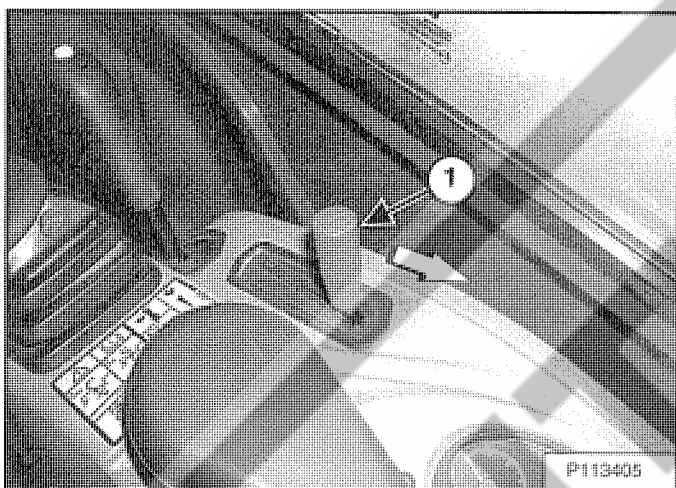
AVOID INJURY OR DEATH

- Fasten seat belt, start and operate only from the operator's seat.
- Never wear loose clothing when working near machine.

W-2135-1108

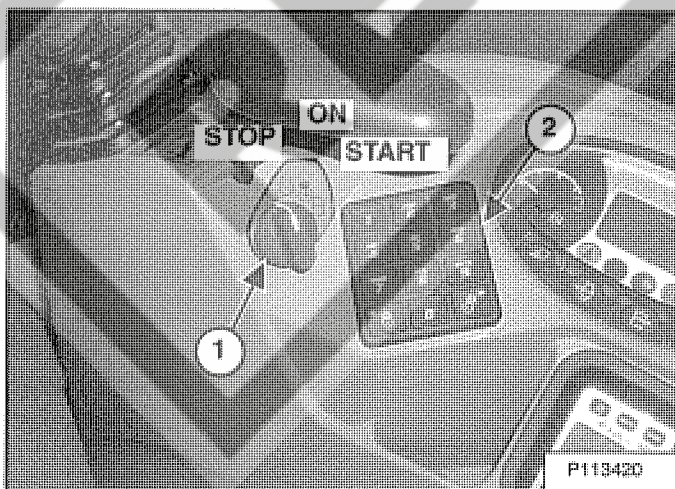
Perform the PRE-STARTING PROCEDURE. (See PRE-STARTING PROCEDURE on Page 67.)

Figure 87



Move the engine speed control lever (Item 1) [Figure 87] back to low idle.

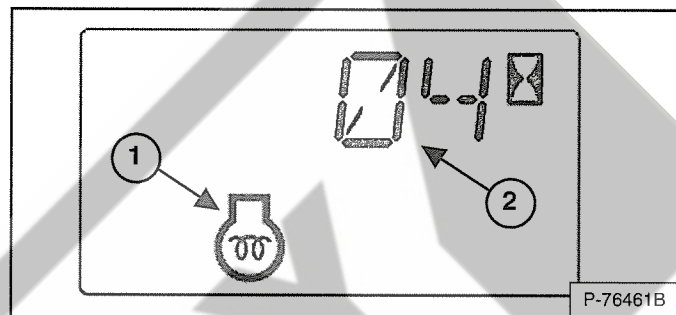
Figure 88



Turn the start switch (Item 1) [Figure 88] to ON. The indicator lights on the instrument panel will come ON briefly and the Instrument Panel / monitoring system will do a self test.

Use the keypad (Item 2) [Figure 88] to enter the password.

Figure 89



If preheating is required, the glow plugs will automatically cycle based on temperature. The engine preheat icon (Item 1) will be ON and the cycle time remaining (Item 2) [Figure 89] will be shown on the data display.

NOTE: It is recommended in cold weather to cycle the glow plugs twice before attempting to start the engine. This will allow for additional heating time for cold weather starting.

When the engine preheat icon goes OFF, turn the start switch (Item 1) [Figure 88] to START position and hold it until the engine starts. Release the switch and it will return to the ON position.

IMPORTANT

Do not engage the starter for longer than 15 seconds at a time. Longer use can damage the starter by overheating. Allow starter to cool for one minute before using starter again.

I-2034-0700

Turn the start switch (Item 1) [Figure 88] to the STOP position to stop the engine.

Stop the engine if the warning lights and alarm do not go OFF.

Check for the cause before starting the engine again.

Password Lockout Feature

See Password Lockout Feature. (See Password Lockout Feature on Page 142.)

STARTING THE ENGINE (CONT'D)

Warming The Hydraulic System

IMPORTANT

When the temperature is below -30°C (-20°F), hydrostatic oil must be warmed before starting. The hydrostatic system will not get enough oil at low temperatures and will be damaged. Park the machine in an area where the temperature will be above -18°C (0°F) if possible.

I-2007-0910

Let the engine run at least 5 minutes to warm the engine and hydraulic fluid before operating the excavator.

Cold Temperature Starting

WARNING

AVOID INJURY OR DEATH

Do not use ether with glow plug (preheat) systems. Explosion can result which can cause injury, death, or severe engine damage.

W-2071-0907

If the temperature is below freezing, perform the following to make starting the engine easier:

- Replace the engine oil with the correct type and viscosity for the anticipated starting temperature. (See Engine Oil Chart on Page 112.)
- Make sure the battery is fully charged.
- Install an engine heater.

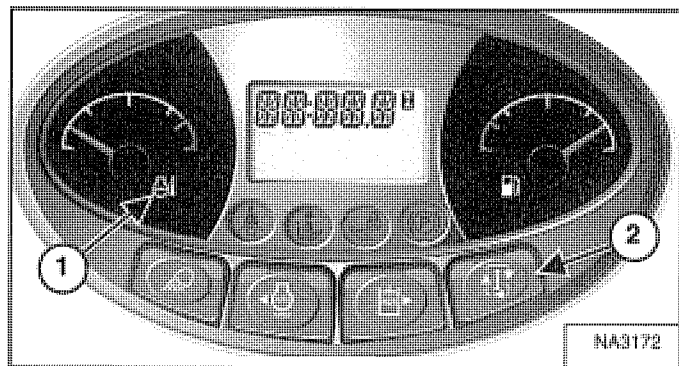
NOTE: If the battery is discharged (but not frozen) a booster battery can be used to jump start the excavator. (See Using A Booster Battery (Jump Starting) on Page 119.)

NOTE: The display screen on the instrument panel may not be at full intensity when the temperature is below -26°C (-15°F). The display screen may take 30 seconds to several minutes to warm up. All systems remain monitored even when the display screen is off.

MONITORING THE DISPLAY PANELS

Instrument Panel

Figure 90



Frequently monitor the temperature and fuel gauges [Figure 90].

After the engine is running, frequently monitor the instrument panel [Figure 90] for machine condition.

The associated icon is displayed if there is an error condition.

EXAMPLE: Engine Coolant Temperature is High.

The Engine Coolant Temperature icon (Item 1) [Figure 90] is ON.

Press the Information button (Item 2) [Figure 90] repeatedly to cycle the data display until the service code screen is displayed. One of the following SERVICE CODES is displayed.

- [M0810] Engine Coolant Temperature Too High
- [M0811] Engine Coolant Temperature Extremely High

Find the cause of the service code and correct before operating the excavator again. (See DIAGNOSTIC SERVICE CODES on Page 139.)

Warning And Shutdown

When a WARNING condition exists; the associated icon light is ON and the alarm sounds 3 beeps. If this condition is allowed to continue, there may be damage to the engine or hydraulic systems.

When a SHUTDOWN condition exists; the associated icon light is ON and the alarm sounds continuously. The monitoring system will automatically stop the engine in 15 seconds. The engine can be restarted to move or relocate the excavator.

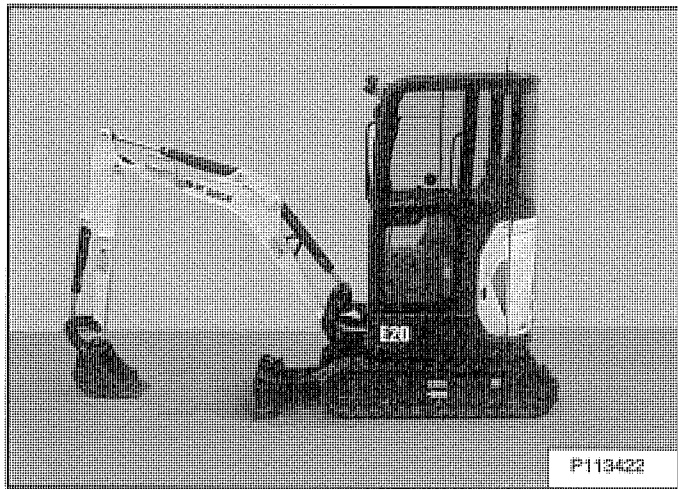
The SHUTDOWN feature is associated with the following icons:

General Warning
Engine Malfunction
Engine Coolant Temperature

STOPPING THE ENGINE AND LEAVING THE EXCAVATOR

Procedure

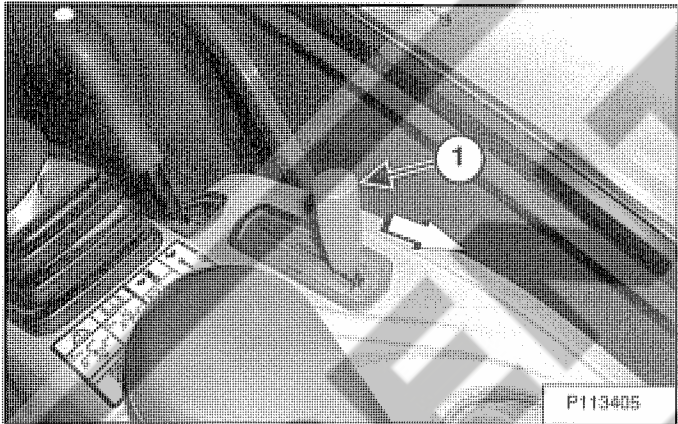
Figure 91



Stop the machine on level ground. Lower the work equipment and the blade to the ground [Figure 91].

NOTE: Tracks must be fully expanded for entering and exiting the excavator.

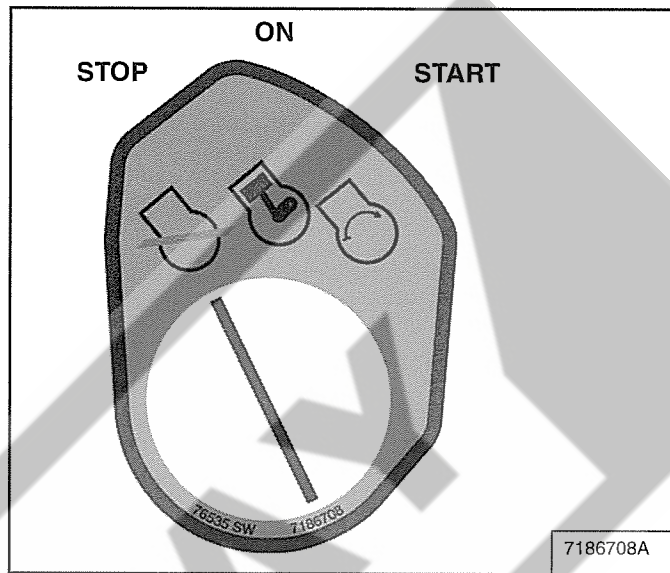
Figure 92



Move the engine speed control lever (Item 1) [Figure 92] back to low idle.

Run the engine at idle speed for about 5 minutes to allow it to cool.

Figure 93



Turn the switch to STOP [Figure 93].

Disconnect the seat belt. Remove the key from the switch (If Equipped) to prevent operation of machine by unauthorized personnel. Raise the control console and exit the machine.

ATTACHMENTS

Installing And Removing The Attachment (Pin-On Attachment)

Installation

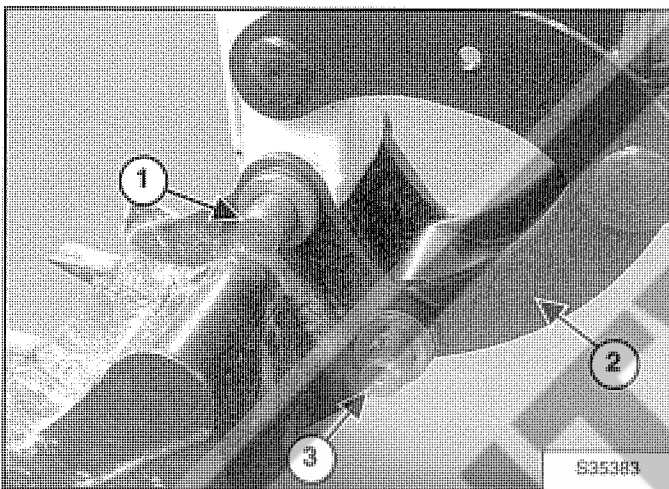
**WARNING**

AVOID INJURY OR DEATH

Stop the machine on a firm flat surface. When removing or installing attachments (such as a bucket), always have a second person in the operator's seat, give clear signals and work carefully.

W-2140-0189

Figure 94

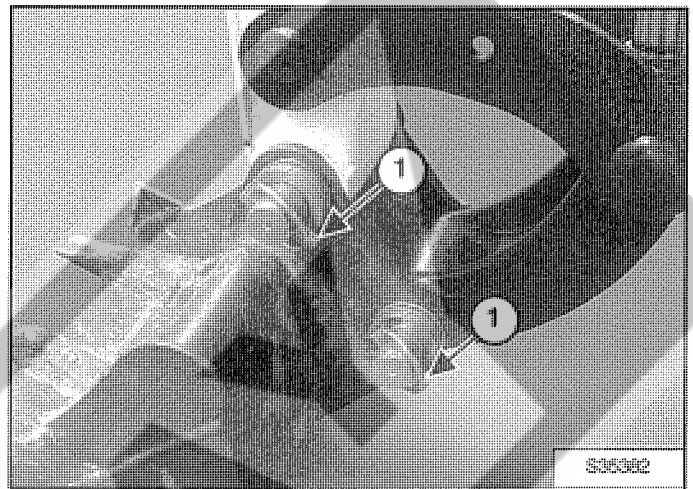


Install the arm into the bucket and align the mounting hole.

Install the pin (Item 1) [Figure 94] and washers.

Install the link (Item 2) in the bucket and align the mounting hole. Install the pin (Item 3) [Figure 94] and washers.

Figure 95



Install the two retainer pins (Item 1) [Figure 95]. Install grease in the grease fittings.

Removal

Park the excavator on a flat surface and lower the bucket fully.

Remove the two retainer pins (Item 1) [Figure 95].

Remove the washers and pins (Items 1 and 3) [Figure 94].

Do not damage the dust seals in the arm.

**WARNING**

AVOID INJURY OR DEATH

Never use attachments or buckets which are not approved by Bobcat Company. Buckets and attachments for safe loads of specified densities are approved for each model. Unapproved attachments can cause injury or death.

W-2052-0907

OPERATING PROCEDURE

Inspect The Work Area

Before beginning operation, inspect the work area for unsafe conditions.

Look for sharp drop-offs or rough terrain. Have underground utility lines (gas, water, sewer, irrigation, etc.) located and marked. Work slowly in areas of underground utilities.

Remove objects or other construction material that could damage the excavator or cause personal injury.

Always check ground conditions before starting your work:

- Inspect for signs of instability such as cracks or settlement.
- Be aware of weather conditions that can affect ground stability.
- Check for adequate traction if working on a slope.

Basic Operating Instructions

When operating on a public road or highway, always follow local regulations. For example: A slow moving vehicle (SMV) sign, or direction signals can be required.

Run the engine at low idle speed to warm the engine and hydraulic system before operating the excavator.



Machines warmed up with moderate engine speed and light load have longer life.

I-2015-0284

New operators must operate the excavator in an open area without bystanders. Operate the controls until the excavator can be handled at an efficient and safe rate for all conditions of the work area.

Operating Near An Edge Or Water

Keep the excavator as far back from the edge as possible and the excavator tracks perpendicular to the edge so that if part of the edge collapses, the excavator can be moved back.

Always move the excavator back at any indication the edge may be unstable.

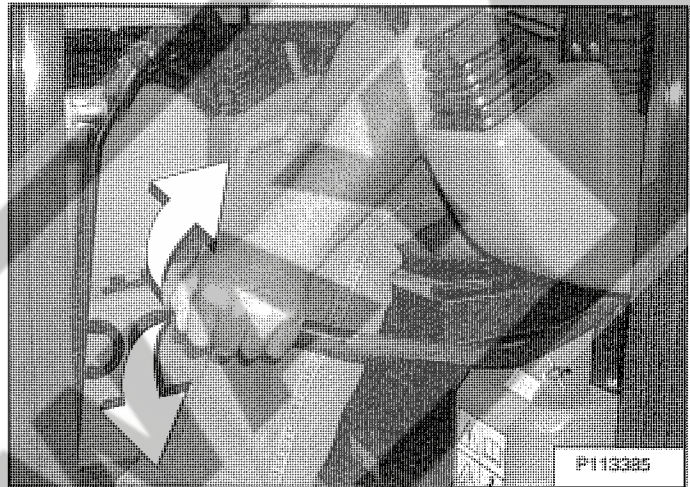
Lowering The Work Equipment (Engine STOPPED)

The hydraulic control levers control the movement of the boom, arm, bucket and upperstructure slew functions.

The console must be in the locked down position, and the key switch in the ON position.

Use the control lever to lower the boom.

Figure 96



The joystick lock switch disengages the hydraulic control functions from the joysticks when the console are raised [Figure 96].

NOTE: If the engine stops, the boom / bucket (attachments) can be lowered to the ground using hydraulic pressure in the accumulator.

The control console must be in the locked down position, and the key switch in the ON position.

Use the control lever to lower the boom.

Lower the control console to engage the hydraulic control functions of the joysticks [Figure 96].

OPERATING PROCEDURE (CONT'D)

Object Handling

Do not exceed the Rated Lift Capacity. (See MACHINE SIGNS (DECALS) on Page 20.)



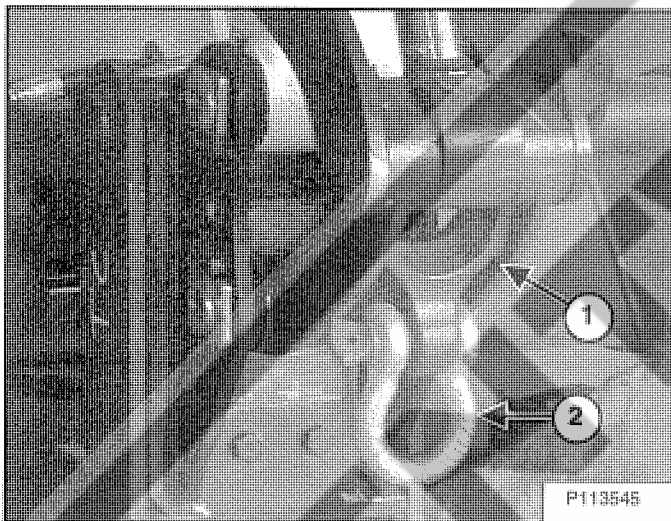
AVOID INJURY OR DEATH

Do not exceed rated lift capacity. Excessive load can cause tipping or loss of control.

W-2374-0500

Extend the bucket cylinder completely and lower the boom to the ground. Stop the engine. Exit the excavator. (See STOPPING THE ENGINE AND LEAVING THE EXCAVATOR on Page 74.)

Figure 97

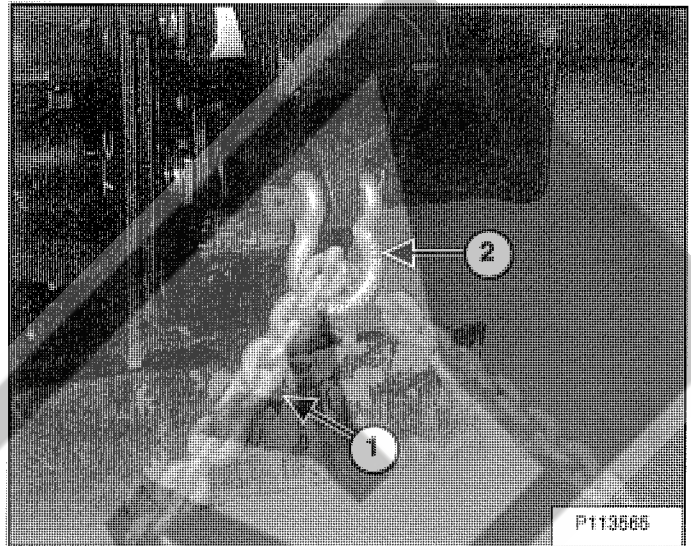


The excavator must be equipped with the optional lift eye link (Item 1) [Figure 97]. See your Bobcat dealer for available Kits.

NOTE: Always inspect the lift eye, clevis, chain or other type of lifting device for damage. Replace parts as necessary.

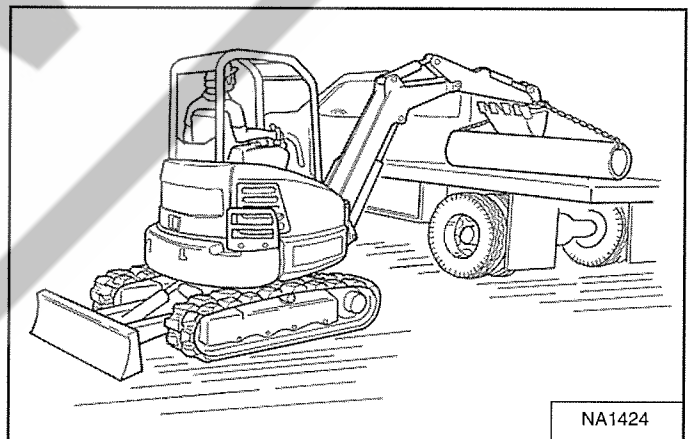
Install a clevis (Item 2) through the lift eye (Item 1) [Figure 97].

Figure 98



Install a lift chain (Item 1) (or other type of lifting device) through the clevis (Item 2) [Figure 97] and connect to the object to be lifted.

Figure 99



Make sure the load is evenly weighted and centered on the lifting chain (or other type of lifting device), and is secured to prevent the load from shifting [Figure 99].

Lift and position the load. Once the load is in position and tension is removed from the lift chain (secondary lift system), remove the secondary lift system.

NOTE: Always use chains or other types of lifting devices that are of adequate strength for the object being lifted.

OPERATING PROCEDURE (CONT'D)

Lift Capacity

The lifting capacities were calculated with a machine that was equipped with the pin-on interface. The difference between the weight of the attachment and the hydraulic clamp (if equipped) must be subtracted.



WARNING

AVOID INJURY OR DEATH

Do not exceed rated lift capacity. Excessive load can cause tipping or loss of control.

W-2374-0500

Figure 100

A

B

**@
max. B**

B

**@
max. B**

B

**@
max. B**

B

**@
max. B**

**2000 mm
(79 in) 3000 mm
(118 in)**

**2000 mm
(79 in) 3000 mm
(118 in)**

**2000 mm
(79 in) 3000 mm
(118 in)**

**2000 mm
(79 in) 3000 mm
(118 in)**

**2000 mm
(79 in)**

***341 kg
(752 lb)**

***380 kg @
3422 mm
(838 lb @
135 in)**

***341 kg
(752 lb)**

**262 kg @
3422 mm
(578 lb @
135 in)**

***341 kg
(752 lb)**

**260 kg @
3422 mm
(574 lb @
135 in)**

**192 kg
(423 lb)**

**154 kg @
3422 mm
(340 lb @
135 in)**

**1000 mm
(39 in)**

***532 kg
(1172 lb) *423 kg
(934 lb)**

***372 kg @
3758 mm
(821 lb @
148 in)**

***532 kg
(1172 lb) 308 kg
(678 lb)**

**222 kg @
3758 mm
(489 lb @
148 in)**

***532 kg
(1172 lb) 302 kg
(666 lb)**

**219 kg @
3758 mm
(482 lb @
148 in)**

**328 kg
(772 lb) 176 kg
(388 lb)**

**125 kg @
3758 mm
(276 lb @
148 in)**

Ground

***952 kg
(2098 lb) *398 kg
(878 lb)**

***364 kg @
3741 mm
(801 lb @
147 in)**

**528 kg
(1165 lb) 300 kg
(662 lb)**

**219 kg @
3741 mm
(482 lb @
147 in)**

**511 kg
(1127 lb) 292 kg
(644 lb)**

**216 kg @
3741 mm
(477 lb @
147 in)**

**283 kg
(624 lb) 167 kg
(368 lb)**

**123 kg @
3741 mm
(271 lb @
147 in)**

**-1000 mm
(-39 in)**

***398 kg
(878 lb) *453 kg
(1000 lb)**

***351 kg @
3365 mm
(774 lb @
133 in)**

**552 kg
(1218 lb) 302 kg
(666 lb)**

**251 kg @
3365 mm
(554 lb @
133 in)**

**522 kg
(1151 lb) 299 kg
(660 lb)**

**250 kg @
3365 mm
(551 lb @
133 in)**

**293 kg
(646 lb) 174 kg
(383 lb)**

**143 kg @
3365 mm
(315 lb @
133 in)**

91385 SW

7255470

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*** 423 kg
(934 lb)**

7255479

The following example will show how to calculate the lift capacity differences between the lift capacity charts with standard equipment and when using optional equipment.

The standard equipment weights used when determining lift capacity are as follows:

Standard Bucket = 42 kg (92 lb)

The following lists the weight of the optional hydraulic clamp:

- Hydraulic Clamp And Cylinder = 32 kg (71 lb)
- Optional Buckets and Attachments (See **NOTE** below)

NOTE: For bucket weights, see your Bobcat dealer. For attachment weights, see the attachment Operation & Maintenance Manual.

OPERATING PROCEDURE (CONT'D)

Lift Capacity (Cont'd)

The following is an example for determining the lift capacity using the sample chart shown above **[Figure 100]**.

- Machine Position: Over Blade, Tracks Expanded, Blade Down
- Lift Radius: 3000 mm (118 in)
- Lift Point Height: 1000 mm (39 in)
- Hydraulic Clamp and Cylinder
- Standard Bucket

1. Obtain Lift Capacity from Chart: 423 kg (934 lb)

2. Subtract the difference between the weight of the standard configuration and optional equipment which in this case is the Standard Bucket and the Hydraulic Clamp.

Standard machine weight: minus Standard Bucket 42 kg (92 lb), minus Hydraulic Clamp and Cylinder: 32 kg (71 lb)

3. Calculate actual Lift Capacity for machine as configured:

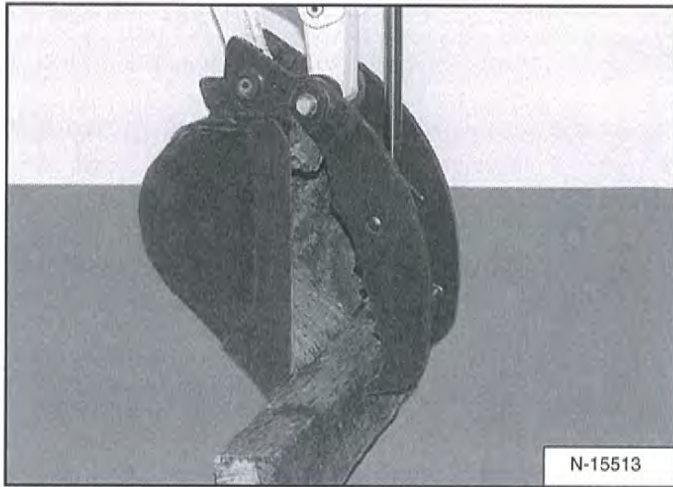
423 kg (934 lb) - 42 kg (92 lb) (standard bucket) - 32 kg (71 lb) (hydraulic clamp and cylinder) = 349 kg (771 lb)

** The lift capacity charts (decals) are based off of ISO 10567: 2007. The lifting capacities are defined as the lower value of 75% of tipping load or 87% of the hydraulic lift capacity.*

OPERATING PROCEDURE (CONT'D)

Using The Clamp

Figure 101



The optional lifting clamp attachment gives the excavator a wider range of use and mobility for debris removal [Figure 101].

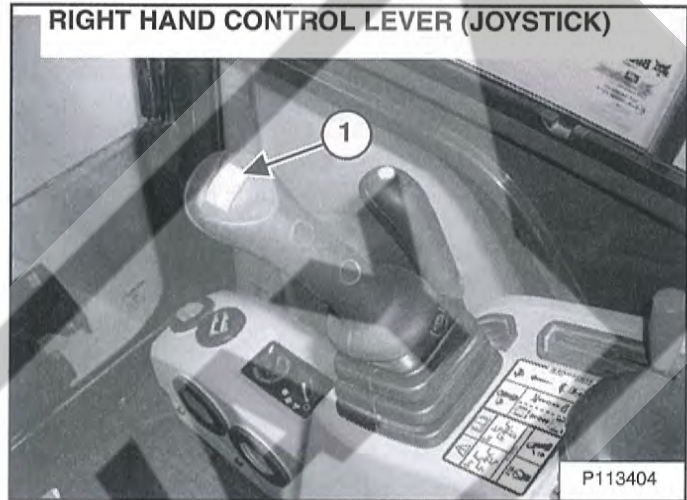
The lifting clamp cylinder must be fully retracted when the machine is being used for excavating.

The lift capacities are reduced by 32 kg (71 lb) if the excavator is equipped with the optional lifting clamp.

Using Right Joystick Switch To Activate Clamp

Engage auxiliary hydraulics. (See Auxiliary Hydraulics - Joystick Controls on Page 55.)

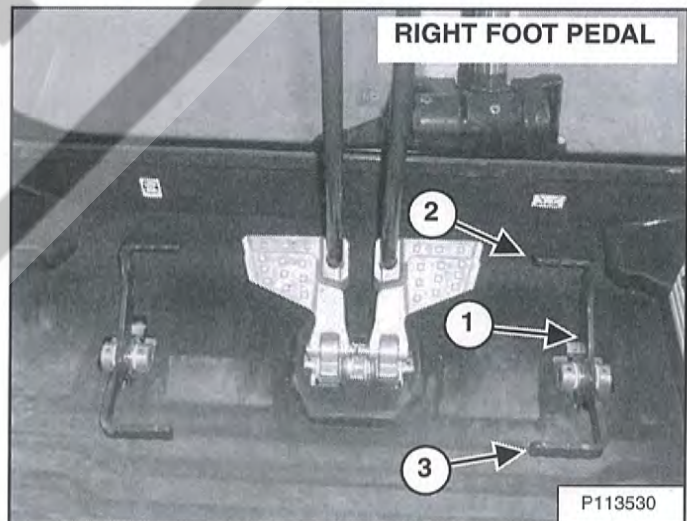
Figure 102



If equipped with the switch in the right joystick, move the switch (Item 1) [Figure 102] to the right to open the clamp. Move the switch to the left to close the clamp.

Using Auxiliary Hydraulic Pedal To Activate Clamp

Figure 103



If equipped, the auxiliary hydraulic pedal (Item 1), controls the hydraulic clamp. Press the toe (Item 2) of the auxiliary hydraulic pedal to open the clamp. Press the heel (Item 3) [Figure 103] of the pedal to close the clamp.

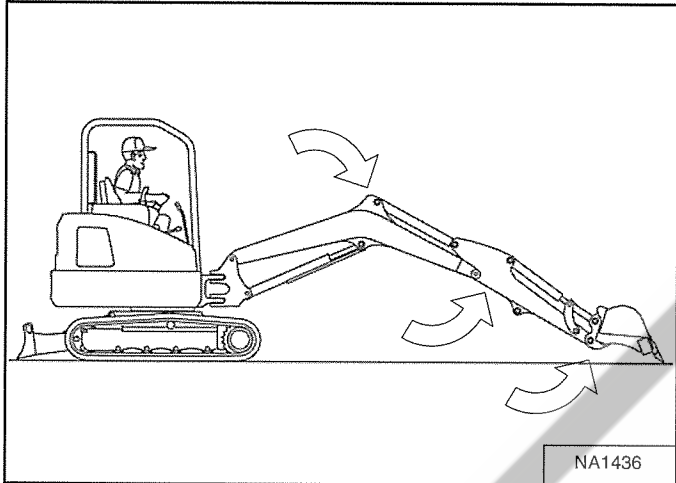
OPERATING PROCEDURE (CONT'D)

Excavating

Expand the tracks fully. (See TRACK FRAME RETRACTION / EXPANSION on Page 58.)

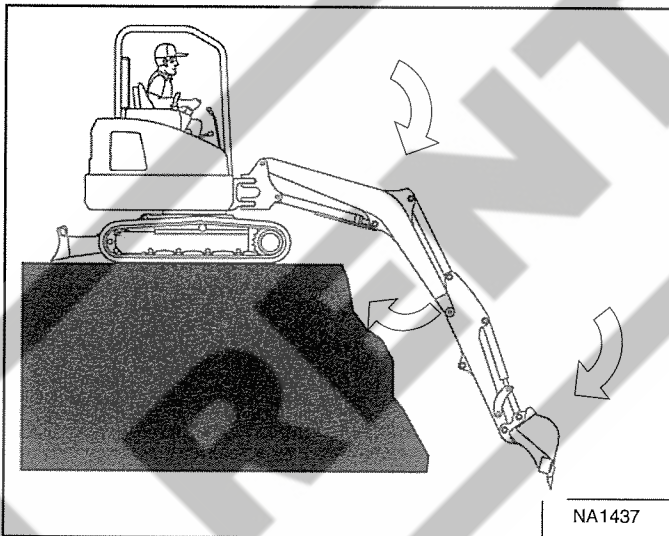
Lower the blade to increase digging performance.

Figure 104



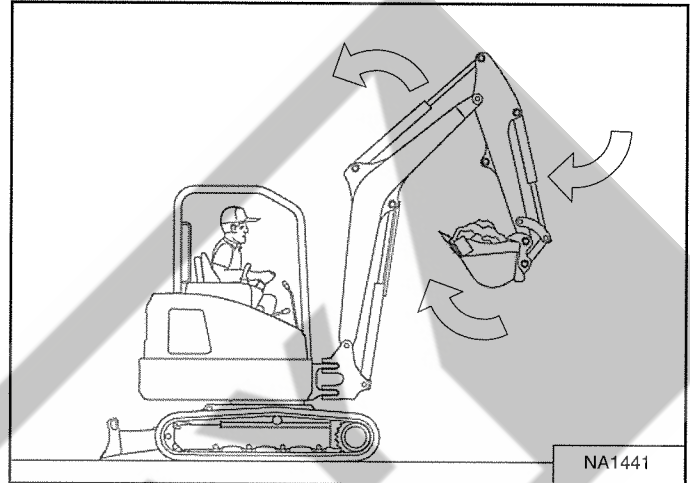
Extend the arm, lower the boom, and open the bucket [Figure 104].

Figure 105



Retract the arm, while lowering boom and curling the bucket [Figure 105].

Figure 106



Raise the boom, retract the arm and curl the bucket [Figure 106].

Rotate the upperstructure.

NOTE: Do not allow the bucket teeth to contact the ground when slewing the upperstructure.



WARNING

Keep all bystanders 6 m (20 ft) away from equipment when operating. Contact with moving parts, a trench cave-in or flying objects can cause injury or death.

W-2119-0910



WARNING

AVOID INJURY OR DEATH

Check area to be excavated for overhead or underground electrical power lines. Keep a safe distance from electrical power lines.

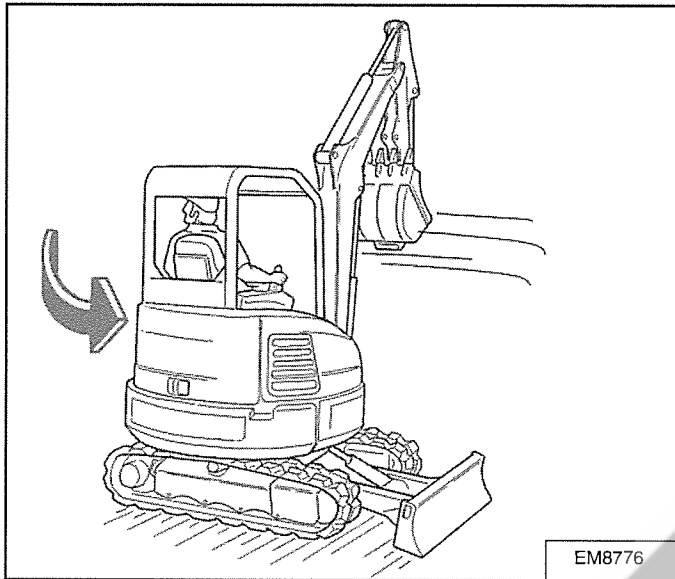
LINE VOLTAGE	MINIMUM APPROACH DISTANCE
50 kV	At least 3 m (10 ft)
230 kV	At least 5 m (17 ft)
740 kV	At least 10 m (33 ft)

W-2757-0910

OPERATING PROCEDURE (CONT'D)

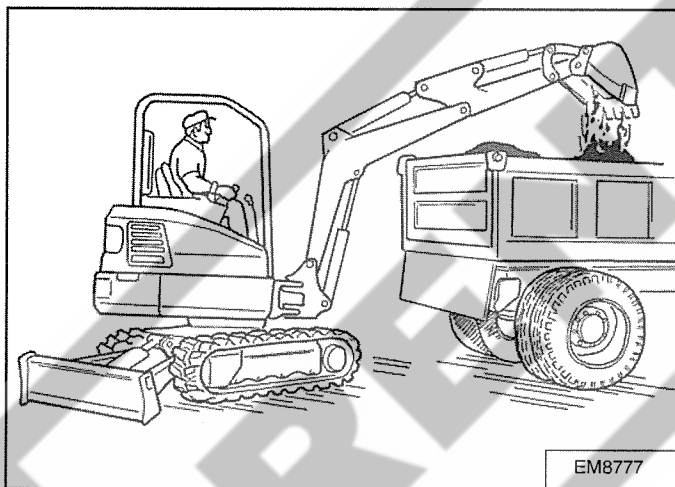
Excavating (Cont'd)

Figure 107



Look in the direction of rotation and make sure there are no bystanders in the work area before rotating the upperstructure [Figure 107].

Figure 108



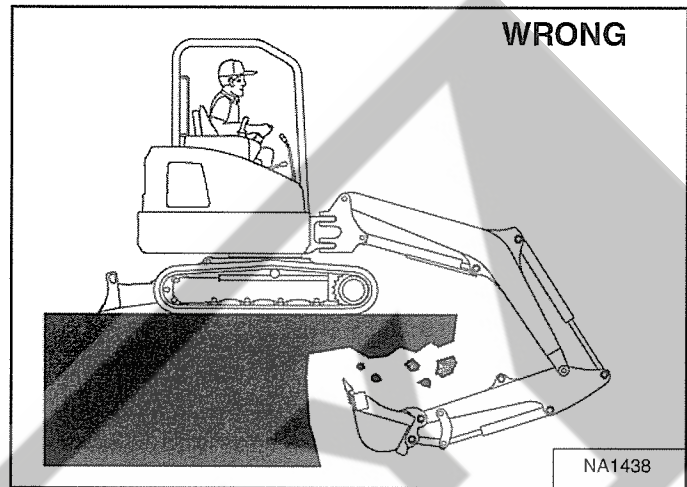
Extend the arm and uncurl the bucket to dump the material into a pile or truck [Figure 108].

IMPORTANT

Avoid operating hydraulics over relief pressure. Failure to do so will overheat hydraulic components.

I-2220-0503

Figure 109



Do not dig under the excavator [Figure 109].

Do not use the bucket as a breaker or pile driver. It is better to excavate hard or rocky ground after breaking it with other equipment. This will reduce damage to the excavator.

Do not move the excavator while the bucket is in the ground.

Dig only by moving the boom and arm toward the excavator.

Do not back dig (digging by moving the boom and arm away from the excavator). Damage to the quick coupler and attachments can occur.

OPERATING PROCEDURE (CONT'D)

Boom Swing

Figure 110

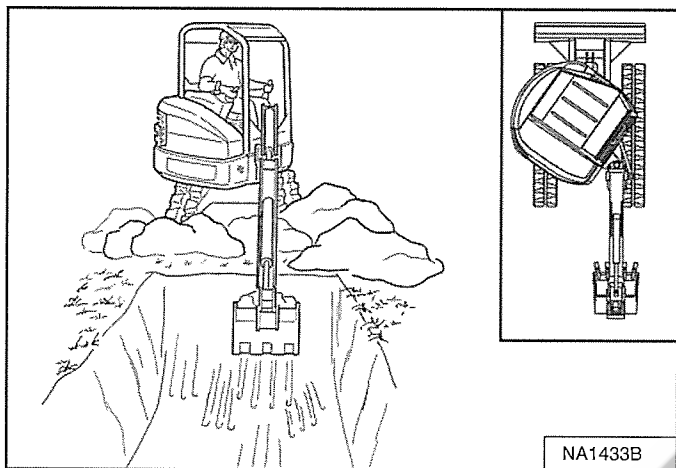


Figure 111

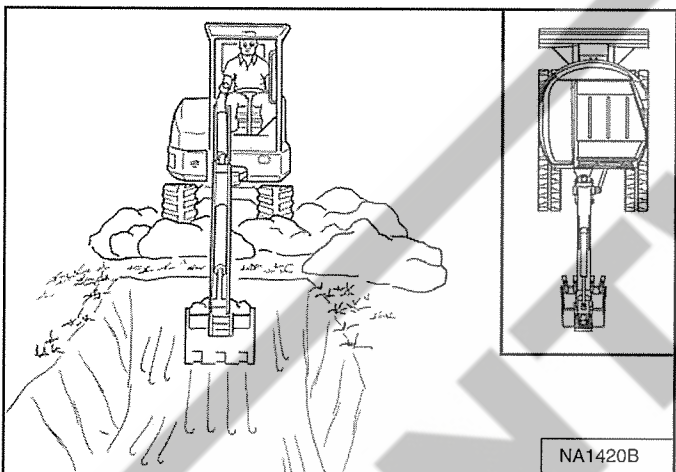
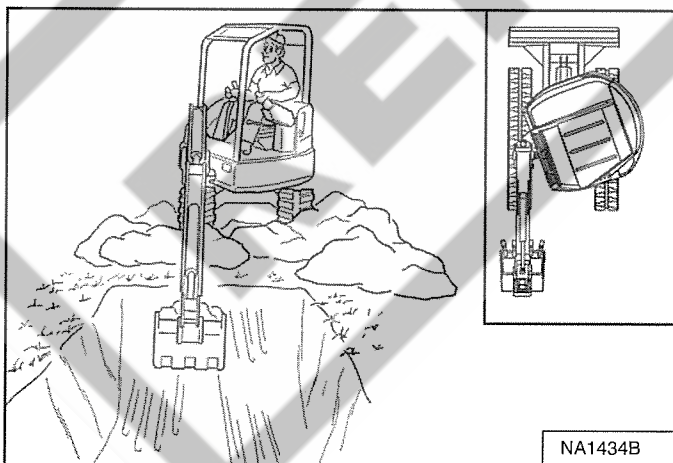
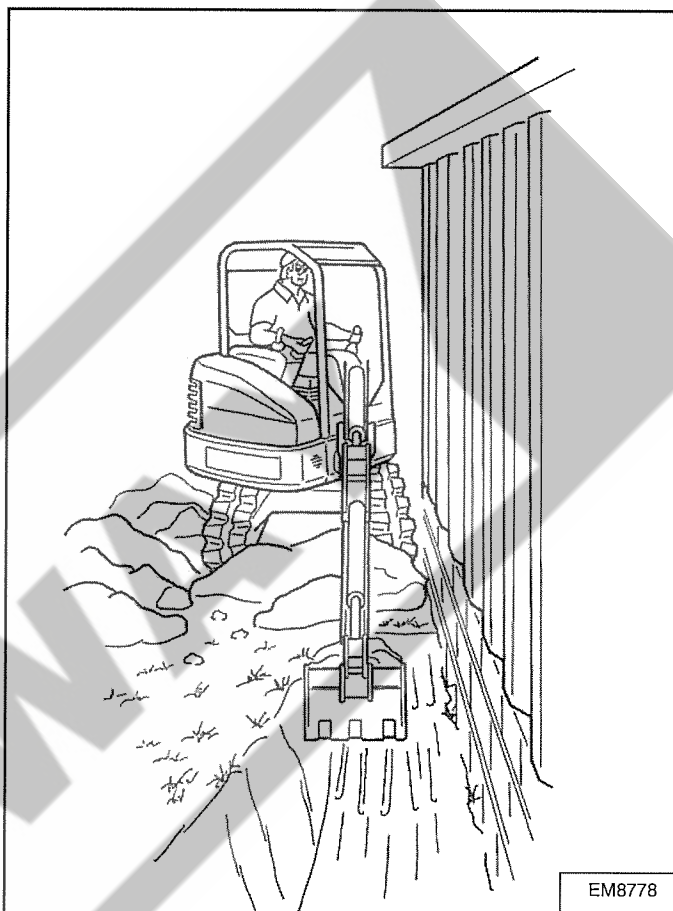


Figure 112



Slew the upperstructure, swing the boom to the right [Figure 110], center [Figure 111] and left [Figure 112] to dig a square hole the width of the machine without repositioning the excavator.

Figure 113



The boom swing allows the operator to offset the boom and dig close to buildings and other structures [Figure 113].

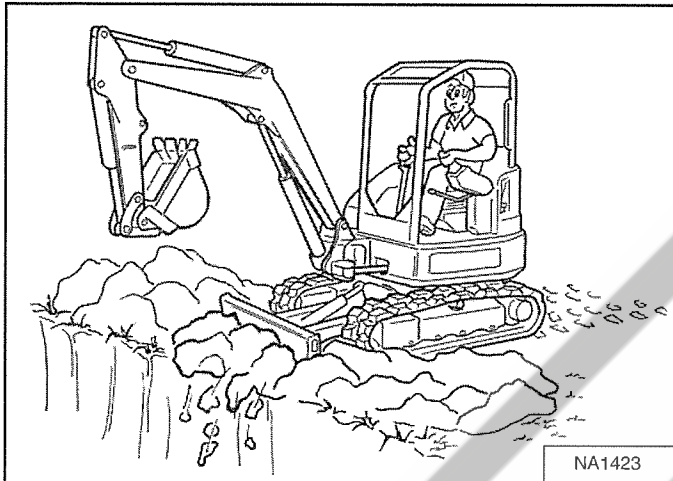
Backfilling

IMPORTANT

Avoid impacting objects with the blade. Damage to blade and undercarriage components may occur.

I-2256-0507

Figure 114



Use the blade to backfill the trench or hole after excavating [Figure 114].

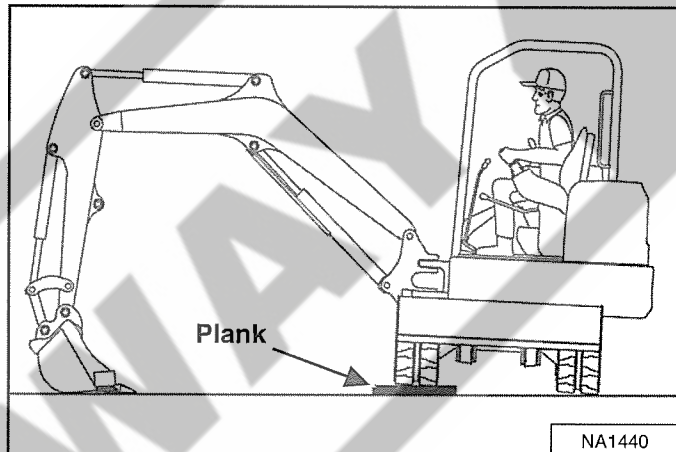
Driving The Excavator

When operating on uneven ground, operate as slow as possible and avoid sudden changes in direction.

Avoid traveling over objects such as rocks, trees, stumps, etc.

When working on wet or soft ground, put planks on the ground to provide a solid base to travel on and prevent the excavator from getting stuck.

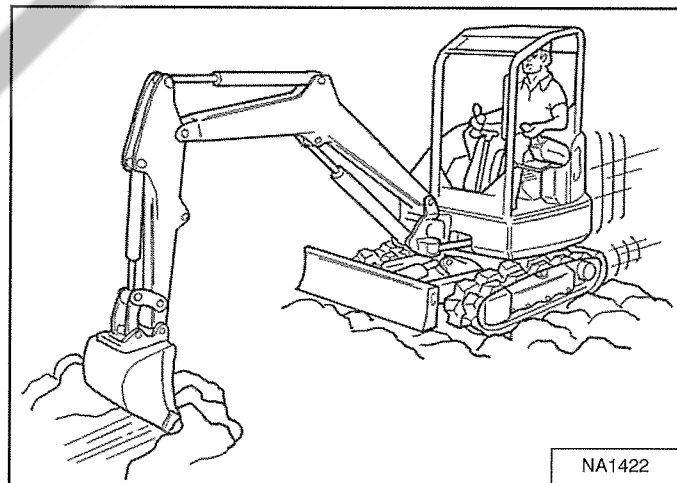
Figure 115



If one or both tracks have become stuck in soft or wet ground, raise one track at a time by turning the upperstructure and pushing the bucket against the ground [Figure 115].

Put planks under the tracks and drive the excavator to dry ground.

Figure 116



The bucket can also be used to pull the excavator. Raise the blade, extend the arm and lower the boom. Operate the boom and arm in a digging manner [Figure 116].

OPERATING PROCEDURE (CONT'D)

Operating On Slopes

WARNING

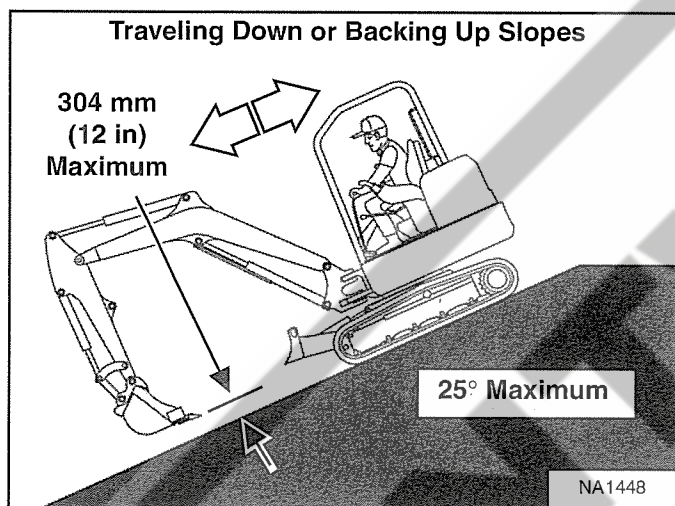
AVOID INJURY OR DEATH

- Do not travel across or up slopes that are over 15 degrees.
- Do not travel down or back up slopes that exceed 25 degrees.
- Look in the direction of travel.

W-2497-0304

When going down a slope, control the speed with the steering levers and the speed control dial gauge.

Figure 117



When going down grades that exceed 15 degrees, put the machine in the position shown, and run the engine slowly [Figure 117].

Operate as slow as possible and avoid sudden changes in lever direction.

Avoid traveling over objects such as rocks, trees, stumps, etc.

Stop the machine before moving the upper equipment controls. Never allow the blade to strike a solid object. Damage to the blade or hydraulic cylinder can result.

WARNING

AVOID INJURY OR DEATH

- Avoid steep areas or banks that could break away.
- Keep boom centered and attachments as low as possible when traveling on slopes or in rough conditions. Look in the direction of travel.
- Always fasten seat belt.

W-2498-0304

Figure 118

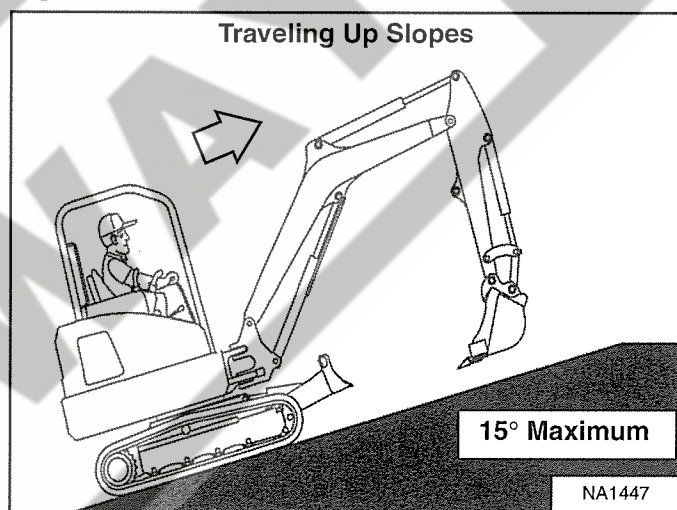
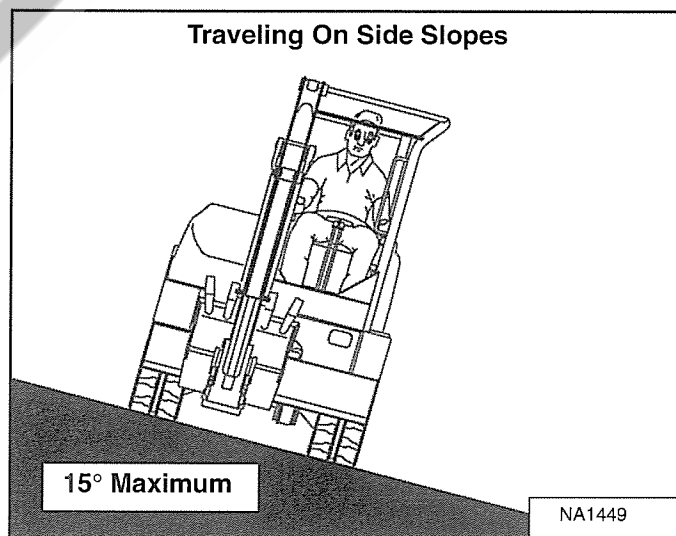


Figure 119

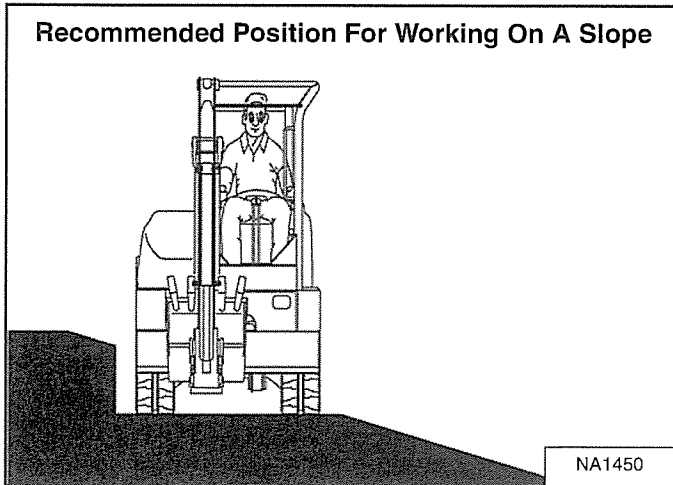


When traveling up slopes or on side slopes that are 15 degrees or less, position the machine as shown and run the engine slow [Figure 118] and [Figure 119].

OPERATING PROCEDURE (CONT'D)

Operating On Slopes (Cont'd)

Figure 120



When operating on a slope, level the work area before beginning [Figure 120].

If this is not possible, the following procedures should be used:

Do not work on slopes which are over 15 degrees.

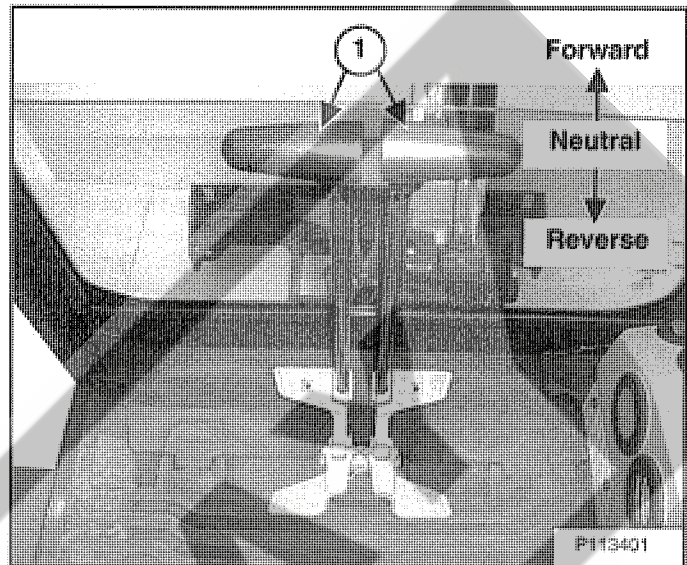
Use a slow work cycle.

Avoid working with the tracks across the slope. This will reduce stability and increase the tendency for the machine to slide. Position the excavator with the blade downhill and lowered.

Avoid swinging or extending the bucket more than necessary in a down hill direction. When you must swing the bucket downhill, keep the arm low and skid the bucket downhill.

When working with the bucket on the uphill side, keep the bucket as close to the ground as possible. Dump the spoil far enough away from the trench or hole to prevent the possibility of a cave in.

Figure 121



To brake the machine when going down a slope, move the steering levers (Item 1) [Figure 121] to the **NEUTRAL** position. This will engage the hydrostatic braking.

When the engine stops on a slope, move the steering levers to the neutral position. Lower the boom / bucket to the ground.

NOTE: If the engine stops, the boom / bucket (attachments) can be lowered to the ground using hydraulic pressure which is stored in the accumulator.

The console must be in the locked down position, and the key switch in the ON position.

Use the control lever to lower the boom.

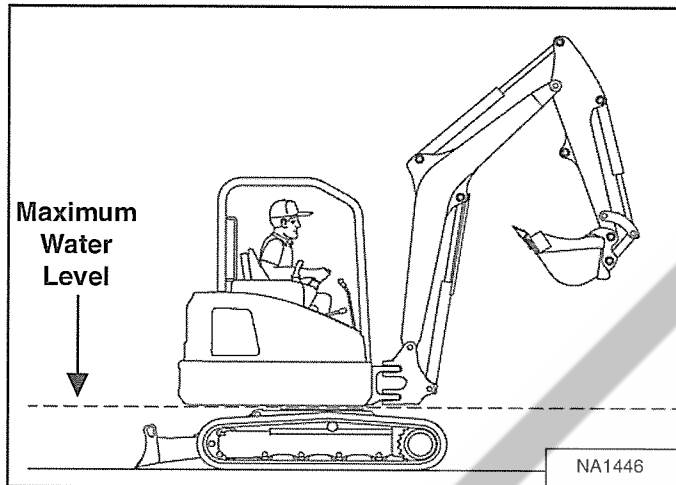
Start the engine and resume operation.

OPERATING PROCEDURE (CONT'D)

Operating In Water

Mud and water should be removed from the machine before parking. In freezing temperatures, park the machine on boards or concrete to prevent the track or undercarriage from freezing to the ground and preventing machine movement.

Figure 122



Do not operate or immerse the excavator in water higher than the bottom of the slew bearing [Figure 122].

Grease the excavator when it has been operated or immersed in water for a period of time. Greasing forces the water out of the lubrication areas.

Water must be removed from the cylinder rods. If water freezes to the cylinder rod, the cylinder seals can be damaged when the rod is retracted.

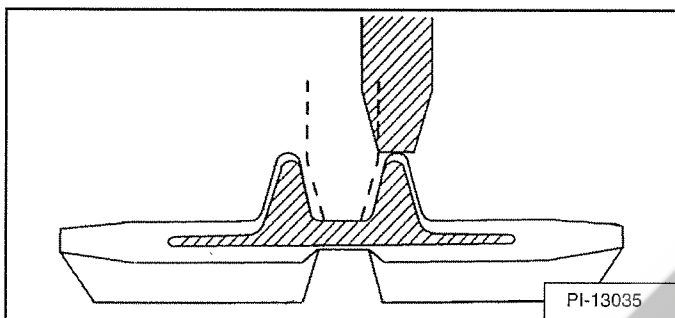
OPERATING PROCEDURE (CONT'D)

Avoiding Track Damage

Mud and water should be removed from the machine before parking. In freezing temperatures, park the machine on boards or concrete to prevent the track or undercarriage from freezing to the ground and preventing machine movement.

Some Causes Of Track Damage:

Figure 123

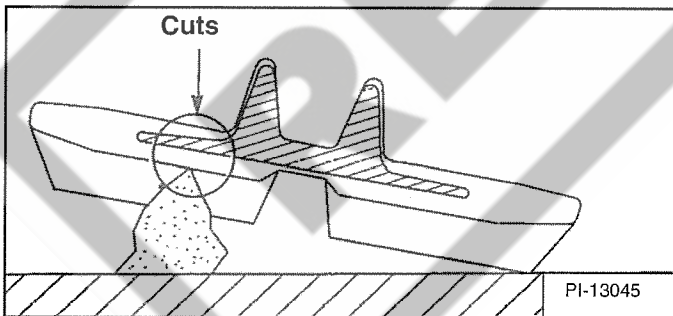


Incorrect track tension: When the rubber track is detracting, the idler or sprocket rides on the projections of the embedded metal **[Figure 123]** causing the embedded metal to be exposed to corrosion. (See TRACK TENSION on Page 127.)

If rubber track is clogged with stones or foreign objects, these can get wedged between the sprocket / rollers and cause detracting and track stress.

When moisture invades through cuts on the track, the embedded steel cords will corrode. The deterioration of the design strength can lead to the breaking of the steel cords.

Figure 124

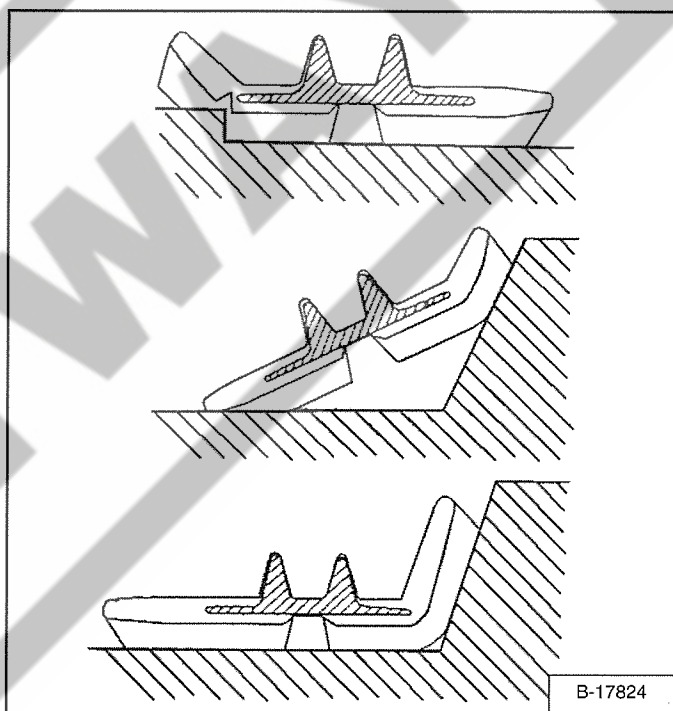


When rubber tracks drive over projections or sharp objects in the field, the concentrated forces applied cause cuts on the lug side rubber surface **[Figure 124]**. In case of making turns on projections, the lug side rubber surface will have an even higher chance to be cut. If the cuts run through the embedded steel cords, it might result in the steel cords' breakage due to their corrosion.

Avoid quick turns on bumpy and rocky fields.

Driving over sharp objects should be avoided. If this is impossible, do not make turns while driving over sharp objects.

Figure 125



When rubber tracks drive over sharp projections, intensive stress is applied to the lug side rubber surface, especially at the edges of embedded metals, causing cracks and cuts in the area around the embedded metals **[Figure 125]**.

Avoid extensive stress applied to the lug root where metals are embedded. Operators should try to avoid driving over stumps and ridges.

TOWING THE EXCAVATOR

Procedure

There is not a recommended towing procedure for the excavators.

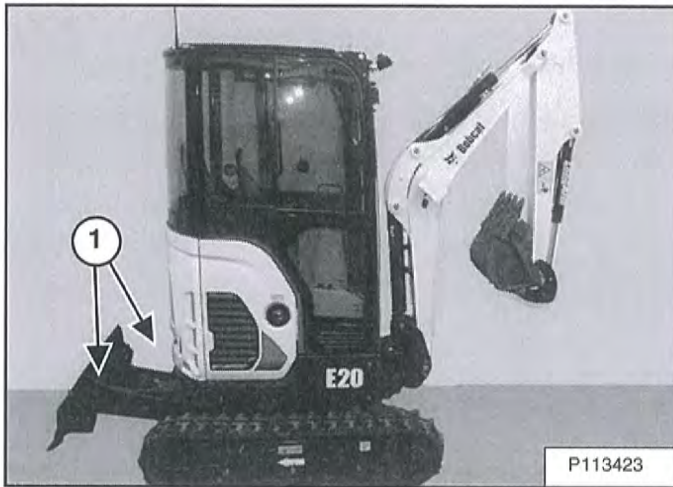
- The excavator can be lifted onto the transport vehicle.
- The excavator can be skidded a short distance for service (EXAMPLE: Move onto a transport vehicle) without damage to the hydraulic system. (The tracks will not turn.) There might be slight wear to the tracks when the excavator is skidded.
- The towing chain (or cable) must be rated at 1.5 times the weight of the excavator. (See Performance on Page 149.)

RENT
TWAY

LIFTING THE EXCAVATOR

Procedure

Figure 126



Fully extend the cylinders of the bucket, arm, and boom so that the excavator is in the position as shown [Figure 126].

Raise the blade all the way.

Put all the control levers in neutral.

WARNING

AVOID INJURY OR DEATH

- Use chains and lifting equipment with sufficient capacity for the weight of the excavator plus any added attachments.
- Maintain center of gravity and balance when lifting.
- Do not swing boom or upperstructure.
- Never lift with operator on machine.
- Never lift with the blade angled (if equipped).

W-2800-0709

Figure 127

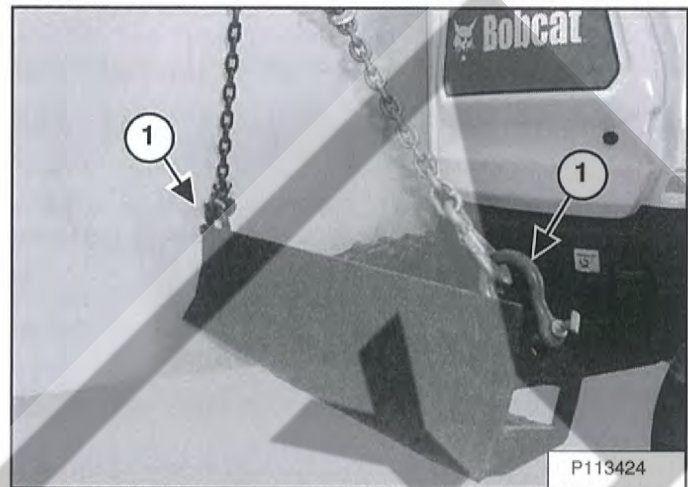
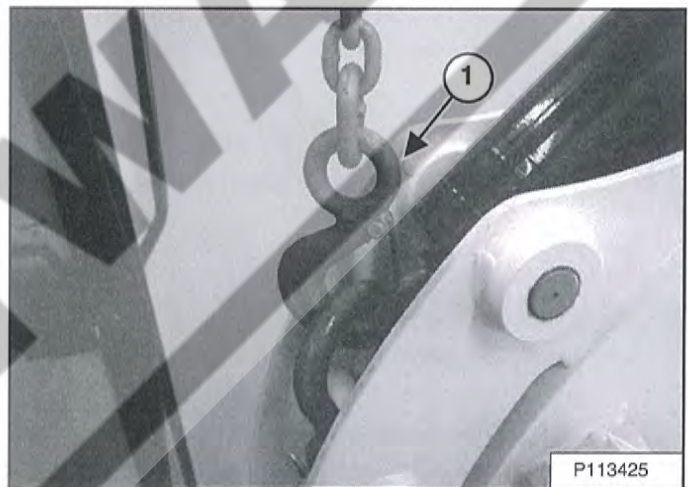


Figure 128



Fasten chains to the ends of the blade (Item 1) [Figure 126] and [Figure 127] and up to a lifting fixture above the canopy / cab. The lifting fixture must extend over the sides of the canopy / cab to prevent the chains from hitting the ROPS / TOPS.

Fasten a chain (Item 1) [Figure 128] from the rod to the lift fixture.

NOTE: Depending on the type of chain hooks, it may be necessary to install a clevis at the lift points and then hook to the clevis.

TRANSPORTING THE EXCAVATOR ON A TRAILER

Loading And Unloading

When transporting the machine, observe the rules, motor vehicle laws, and vehicle limit ordinances. Use a transport and towing vehicle of adequate length and capacity.

Secure the parking brakes and block the wheels of the transport vehicle.

Align the ramps with the center of the transport vehicle. Secure the ramps to the truck bed and be sure ramp angle does not exceed 15 degrees.

Use metal loading ramps with a slip resistant surface.

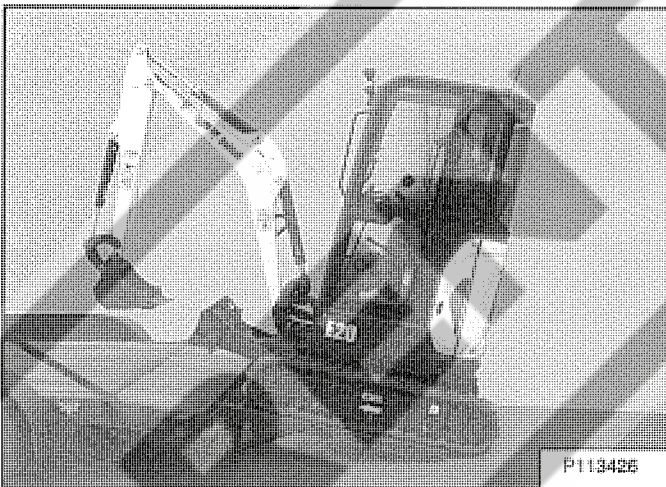
Use ramps that are the correct length and width and can support the weight of the machine.

The rear of the trailer must be blocked or supported when loading or unloading the machine to prevent the front of the transport vehicle from raising.

Determine the direction of the track movement before moving the machine (blade forward).

Disengage the auto idle feature and move the two speed travel to the low range position.

Figure 129



Move the machine forward onto the transport vehicle [Figure 129].

Do not change direction of the machine while it is on the ramps.

Lower the boom, arm, bucket, and blade to the transport vehicle.

Stop the engine and remove the key (if equipped).

Put blocks at the front and rear of the tracks.

Fastening

Figure 130

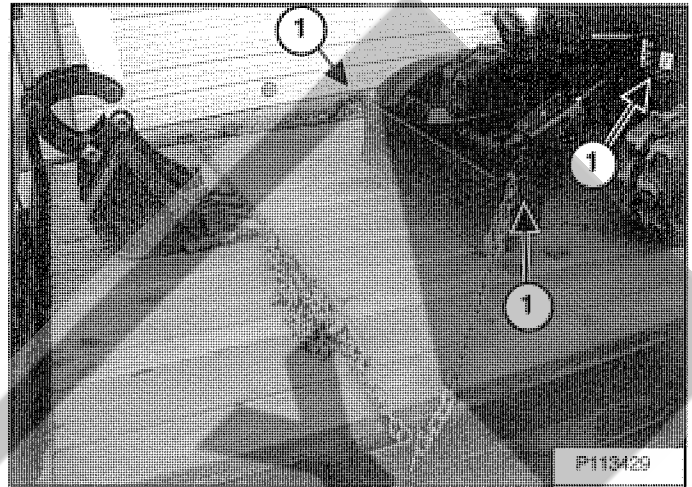
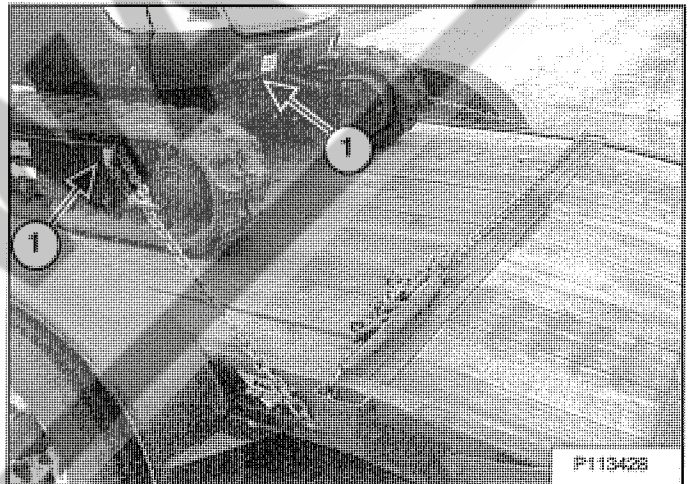


Figure 131



Fasten chains to the front corners of the blade (Item 1) [Figure 130] (or the front corner of the upperstructure) and to the tie down loop at both sides of the track frame (Item 1) [Figure 131] (or the tie down on the rear of the upperstructure) to prevent it from moving when going up or down slopes or during sudden stops.

Use chain binders to tighten the chains and then safely tie the chain binder levers to prevent loosening.

WARNING

AVOID SERIOUS INJURY OR DEATH

Adequately designed ramps of sufficient strength are needed to support the weight of the machine when loading onto a transport vehicle. Wood ramps can break and cause personal injury.

W-2058-0807



Bobcat®

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MAINTENANCE SAFETY



WARNING

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

W-2003-0807



Safety Alert Symbol: This symbol with a warning statement, means: "Warning, be alert! Your safety is involved!" Carefully read the message that follows.

CORRECT



P-90216

- Never service the Bobcat Compact Excavator without instructions.

CORRECT



NA1428

- Use the correct procedure to lift and support the excavator.

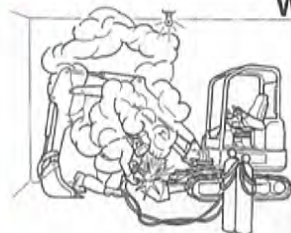
CORRECT



NA1425

- Cleaning and maintenance are required daily.

WRONG



NA1427

- Have good ventilation when welding or grinding painted parts.
- Wear dust mask when grinding painted parts. Toxic dust and gas can be produced.

WRONG



NA1426

- Vent exhaust to outside when engine must be run for service.
- Exhaust system must be tightly sealed. Exhaust fumes can kill without warning.

WRONG



NA1429

- Always lower the bucket and blade to the ground before doing any maintenance.
- Never modify equipment or add attachments not approved by Bobcat Company.

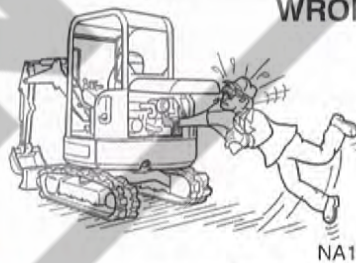
WRONG



NA1430

- Stop, cool and clean engine of flammable materials before checking fluids.
- Never service or adjust machine with the engine running unless instructed to do so in the manual.
- Avoid contact with leaking hydraulic oil or diesel fuel under pressure. It can penetrate the skin or eyes.
- Never fill fuel tank with engine running, while smoking, or when near open flame.

WRONG



NA1431

- Keep body, jewelry and clothing away from moving parts, electrical contact, hot parts and exhaust.
- Wear eye protection to guard from battery acid, compressed springs, fluids under pressure and flying debris when engines are running or tools are used. Use eye protections approved for type of welding.
- Keep tailgate closed except for service. Close and latch tailgate before operating the excavator.

WRONG

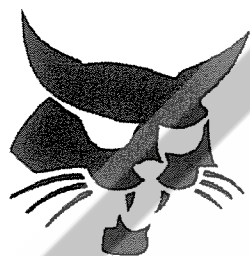


B-19798

- Lead-acid batteries produce flammable and explosive gases.
- Keep arcs, sparks, flames and lighted tobacco away from batteries.
- Batteries contain acid which burns eyes or skin on contact.
- Wear protective clothing. If acid contacts body, flush well with water. For eye contact flush well and get immediate medical attention.

Maintenance procedures which are given in the Operation & Maintenance Manual can be performed by the owner / operator without any specific technical training. Maintenance procedures which are **not** in the Operation & Maintenance Manual must be performed **ONLY BY QUALIFIED BOBCAT SERVICE PERSONNEL**. Always use genuine Bobcat replacement parts. The Service Safety Training Course is available from your Bobcat dealer.

MSW38-0409



Bobcat®

SERVICE SCHEDULE

Maintenance Intervals

Maintenance work must be done at regular intervals. Failure to do so will result in excessive wear and early failures.

The service schedule is a guide for correct maintenance of the Bobcat excavator.

WARNING

AVOID INJURY OR DEATH

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

W-2003-0807

Every 10 Hours (Before Starting The Excavator)

- **Engine Oil** - Check level and add as needed. (See Page 112.)
- **Engine Air Filters and Air System** - Check air clearer condition indicator. Service only when required. Check for leaks and damaged components. (See Page 106.)
- **Engine Cooling System** - Check coolant level COLD and add premixed coolant as needed. (See Page 115.) and (See Page 116.)
- **Fuel Filters** - Check filters for moisture or contamination. Drain and replace as needed. (See Page 106.)
- **Hydraulic Fluid** - Check fluid level and add as needed. (See Page 122.)
- **Fuel Filter** - Check water from fuel filter. (See Page 110.)
- **Seat Belt, Seat Belt Retractors, Seat Belt Mounting hardware, Control Console Lockout** - Check the condition of seat belt and mounting hardware. Clean or replace seat belt retractors as needed. Check the control console lockout lever for proper operation. Clean dirt and debris from moving parts. (See Page 100.)
- **Motion Alarm** - Check for proper function. (See Page 101.)
- **Operator Cab** - Check the cab condition and mounting hardware.
- **Cab Heater Filters** - Clean filters (if equipped). (See Page 105.)
- **Indicators and Lights** - Check for correct operation of all indicators and lights. (See Page 35.)
- **Safety Signs** - Check for damaged signs (decals). Replace any signs that are damaged. (See Page 20.)
- **Console Lockout** - Check console lockout for proper operation.
- **Track Tension** - Check tension and adjust as needed. (See Page 127.)
- **Pivot Points** - Grease all machinery pivot points. Grease track expansion. Grease clamp (if equipped). (See Page 132.)
- **Attachment Coupler** - Check for damage or loose parts (if equipped). (See Page 131.)

Every 50 Hours

- **Swing Bearing** - Grease swing bearing and swing pinion. Service every 10 hours when operating in water. (See Page 132.)
- **Battery** - Check cables, connections, and electrolyte level; add distilled water as needed. (See Page 117.)
- **Fuel Tank** - Drain water and sediment from fuel tank and fuel filter. (See Page 110.)

Every 100 Hours

- **Spark Arrestor** - Empty spark chamber. (See Page 125.)

SERVICE SCHEDULE (CONT'D)

Maintenance Intervals (Cont'd)

Every 250 Hours Or Every 12 Months

- **Fuel Filter** - Replace fuel filter. (See Page 110.)
- **Travel Motors (Final Drive)** - Check fluid level and add as needed. (See Page 129.)
- **Drive Belts (Alternator)** - Check condition. Replace as needed. Service at first 50 hours, then as scheduled. (See Page 130.)

Every 500 Hours Or Every 12 Months

- **Engine Oil and Filter** - Service at first 50 hours, then as scheduled. Replace oil and filter. (See Page 113.)
- **Cooling System** - Clean debris from radiator / hydraulic fluid cooler. (See Page 114.)
- **Hydraulic Filter and Hydraulic Reservoir Breather Cap** - Replace the hydraulic filter and the reservoir breather cap. Service at first 100 hours, then as scheduled. (See Page 123.)
- **Alternator and Starter** - Service at first 100 hours, then as scheduled. Check connections.
- **Heater** - Clean housing and coils (if equipped). (See Page 105.)

Every 1000 Hours Or Every 12 Months

- **Hydraulic Fluid and Filters** - Replace hydraulic fluid and filters. (See Page 123.)
- **Engine Valves** - Adjust the engine valve clearance.
- **Travel Motors (Final Drive)** - Service at first 100 hours, then as scheduled. Replace fluid. (See Page 129.)

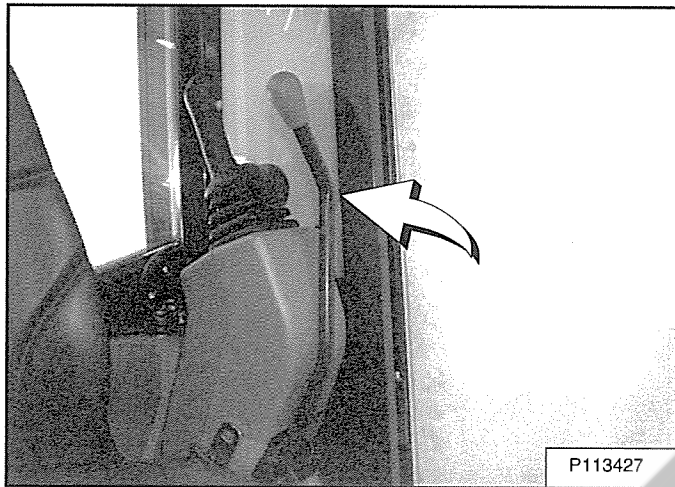
Every 24 Months

- **Coolant** - Replace the coolant. (See Page 116.)

CONTROL CONSOLE LOCKOUTS

Inspection And Maintenance

Figure 132



When the left console is raised **[Figure 132]**, the hydraulic control levers (joysticks) and traction system must not function.

Sit in the operator's seat, fasten the seat belt and start the engine.

Raise the left console **[Figure 132]**.

Move the joystick control levers. There should be no movement of the boom, arm, slew or bucket.

Move the steering control levers. There should be no movement of the excavator tracks.

Service the system if these controls do not deactivate when the left control console is raised. (See your Bobcat dealer for service.)

SEAT BELT

Inspection And Maintenance

! WARNING

Failure to properly inspect and maintain the seat belt can cause lack of operator restraint resulting in serious injury or death.

W-2466-0703

Check the seat belt daily for correct function.

Inspect the seat belt system thoroughly at least once each year or more often if the machine is exposed to severe environmental conditions or applications.

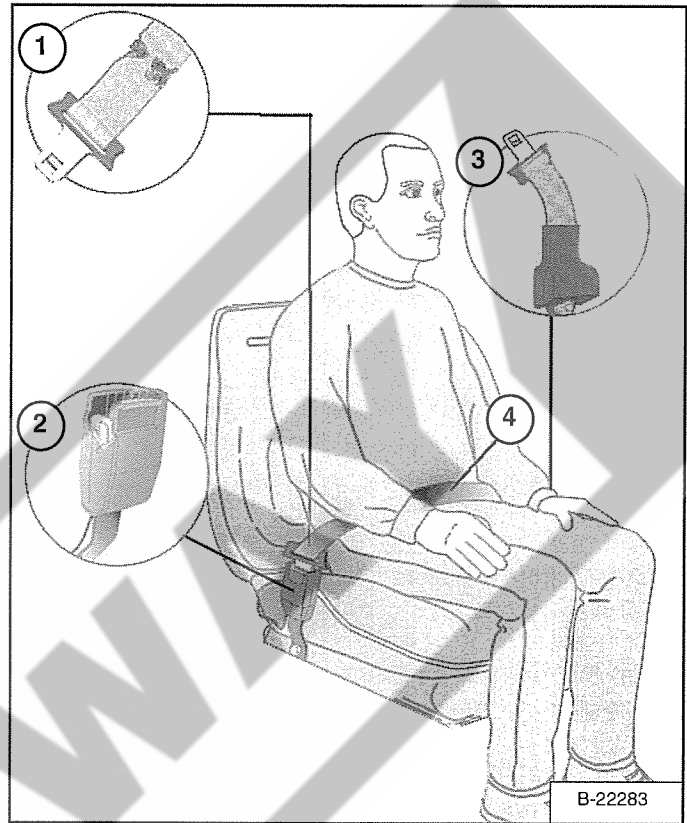
Any seat belt system that shows cuts, fraying, extreme or unusual wear, significant discolorations due to ultraviolet UV exposure, dusty / dirty conditions, abrasion to the seat belt webbing, or damage to the buckle, latch plate, retractor (if equipped), hardware or any other obvious problem should be replaced immediately.

The items below are referenced in [Figure 133].

1. Check the webbing. If the system is equipped with a retractor, pull the webbing completely out and inspect the full length of the webbing. Look for cuts, wear, fraying, dirt and stiffness.
2. Check the buckle and latch for correct operation. Make sure latch plate is not excessively worn, deformed or buckle is not damaged or casing broken.
3. Check the retractor web storage device (if equipped) by extending webbing to determine if it looks correct and that it spools out and retracts webbing correctly.
4. Check webbing in areas exposed to ultraviolet (UV) rays from the sun or extreme dust or dirt. If the original color of the webbing in these areas is extremely faded and / or the webbing is packed with dirt, the webbing strength can have deteriorated.

See your Bobcat dealer for seat belt system replacement parts for your machine.

Figure 133



MOTION ALARM SYSTEM

Description

This excavator can be equipped with a motion alarm system. The motion alarm will sound when the operator moves the travel control levers in either the forward or reverse direction. Slight movement of the steering levers in either the forward or reverse direction is required with hydraulic components before the motion alarm will sound.

Inspecting

Figure 134

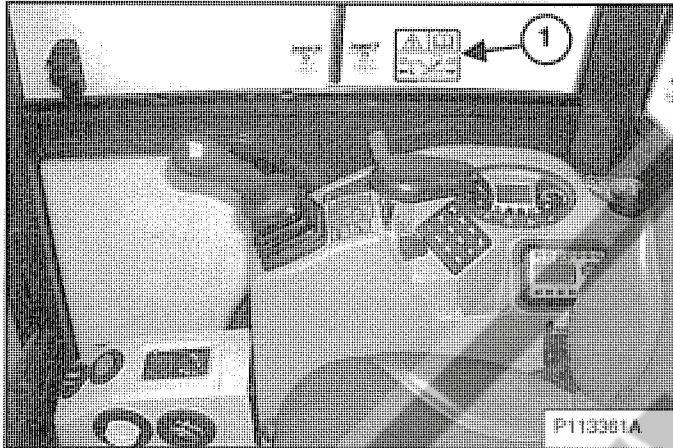
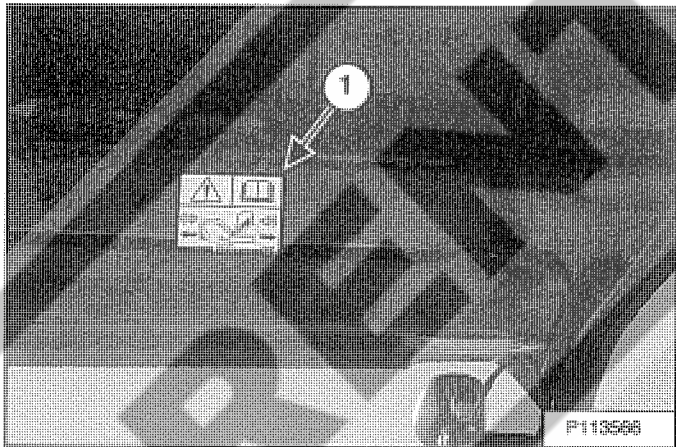


Figure 135



Inspect for damaged or missing motion alarm decal (Item 1) [Figure 134] (cab machine) or (Item 1) [Figure 135] (canopy machine). Replace if required.

NOTE: The excavator will need to be moved slightly in both the forward and reverse direction to test the motion alarm. Keep all bystanders away from machine during test.

WARNING

AVOID INJURY OR DEATH

When an engine is running in an enclosed area, fresh air must be added to avoid concentration of exhaust fumes. If the engine is stationary, vent the exhaust outside. Exhaust fumes contain odorless, invisible gases which can kill without warning.

W-2050-0807

Sit in the operator's seat and fasten the seat belt. Start the engine. (See PRE-STARTING PROCEDURE on Page 67.)

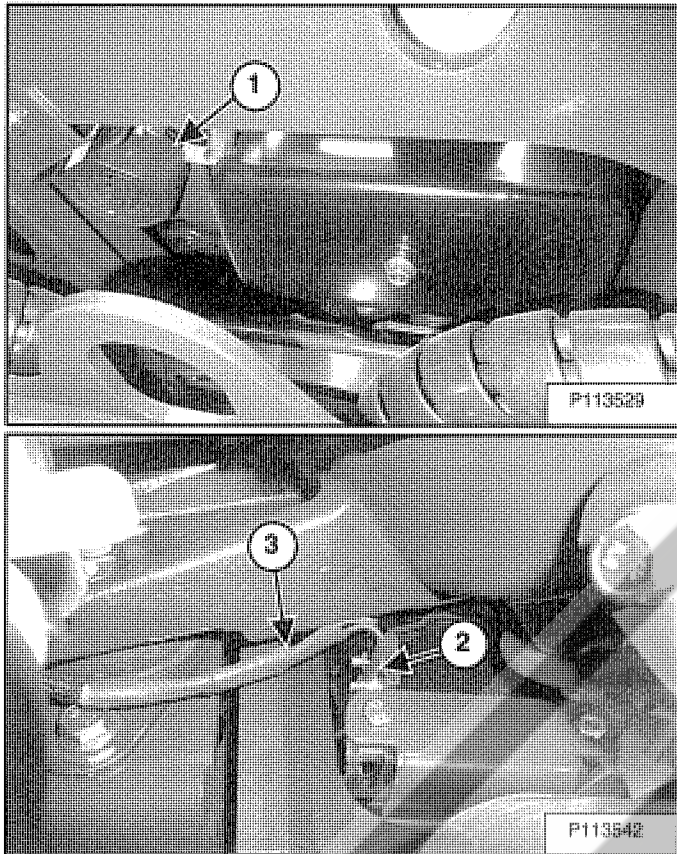
Move the travel control levers (one lever at a time) in the forward direction. The motion alarm must sound. Move the travel control levers (one lever at a time) in the reverse direction. The motion alarm must sound.

Return both levers to neutral and turn excavator key to OFF position. Exit the excavator. (See STOPPING THE ENGINE AND LEAVING THE EXCAVATOR on Page 74.)

MOTION ALARM SYSTEM (CONT'D)

Inspecting (Cont'd)

Figure 136



The motion alarm (Item 1) [Figure 136] is mounted to the bottom rear of the excavator. (Next to the engine oil pan.)

Inspect the motion alarm electrical connections (Item 2), wire harness (Item 3) [Figure 136] and motion alarm switch (Item 1) [Figure 137] for tightness and damage. Repair or replace any damaged components.

The motion alarm switch are non-adjustable, see the following information.

WARNING

This machine is equipped with a motion alarm.
ALARM MUST SOUND!
when operating forward or backward.

Failure to maintain a clear view in the direction of travel could result in serious injury or death.

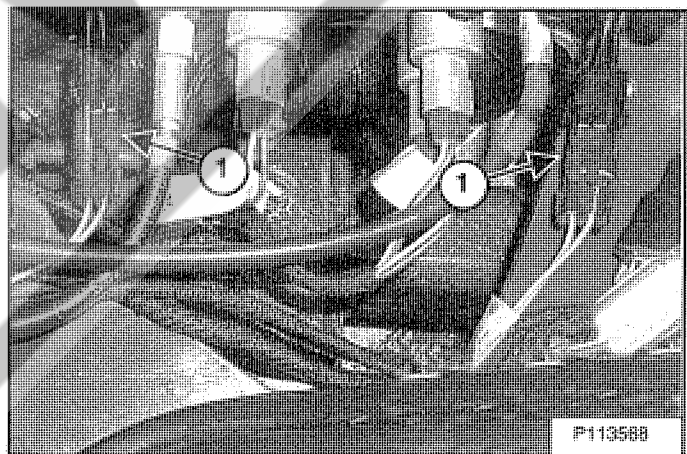
The operator is responsible for the safe operation of this machine.

W-2786-0309

Adjusting Switch Position

The two motion alarm switches are located in the two travel control sections of the control valve that is located under the floorplate. Remove the floor mat and the floorplate. (See the Service Manual for the correct procedure.)

Figure 137



The two switches are non-adjustable. They must be fully installed into both of the travel control valve section housing and tightened. Tighten the switch to 18 - 20 N•m (13 - 15 ft-lb).

Inspect the motion alarm electrical connections (Item 1) [Figure 137] and wire harness for tightness and damage. Repair or replace any damaged components.

Inspect the motion alarm system for proper function after switch replacement.

TAILGATE

Opening And Closing

**WARNING**

AVOID INJURY OR DEATH

Never service or adjust the machine when the engine is running unless instructed to do so in the manual.

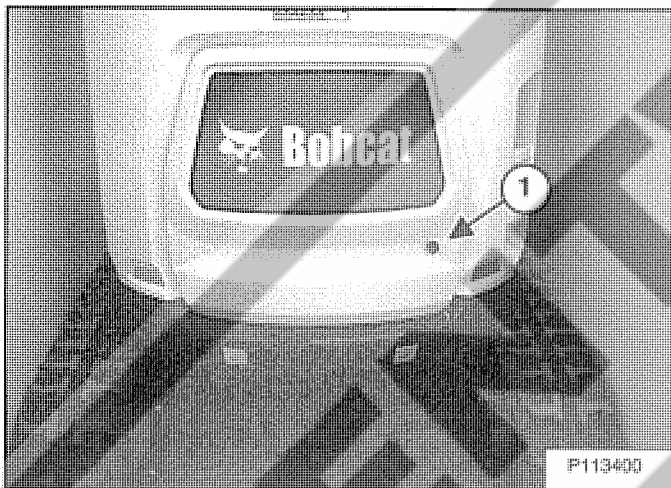
W-2012-0497

**WARNING**

Keep the rear door closed when operating the machine. Failure to do so could seriously injure a bystander.

W-2020-1285

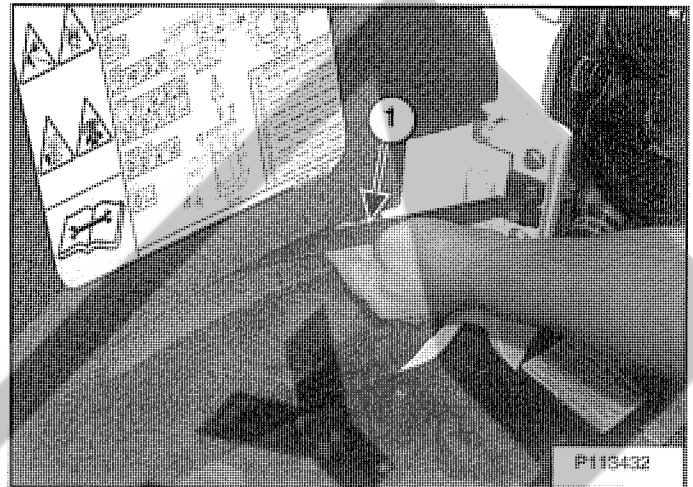
Figure 138



Press the button (Item 1) [Figure 138] and open the tailgate.

Open the tailgate and rotate outward until it is held open by the latch (Item 1) [Figure 139].

Figure 139

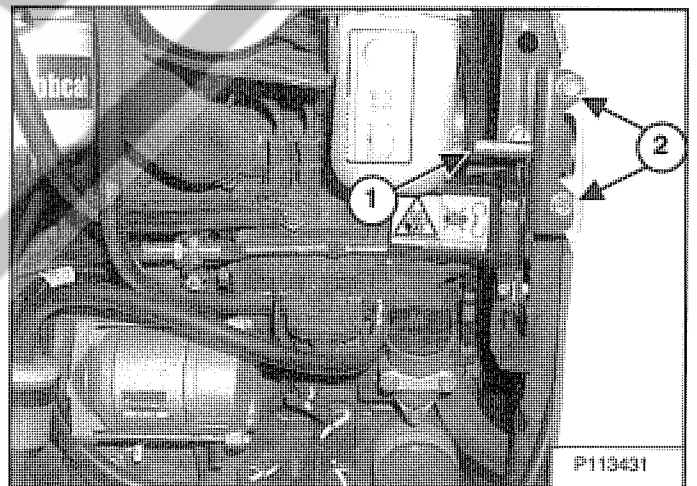


To close the tailgate, lift up on the latch (Item 1) [Figure 139] and slowly start to close the tailgate.

Push firmly to close the tailgate.

Adjusting The Latch

Figure 140



The tailgate latch (Item 1) can be adjusted by loosening the two bolts (Item 2) [Figure 140], moving the latch, and tightening the two bolts.

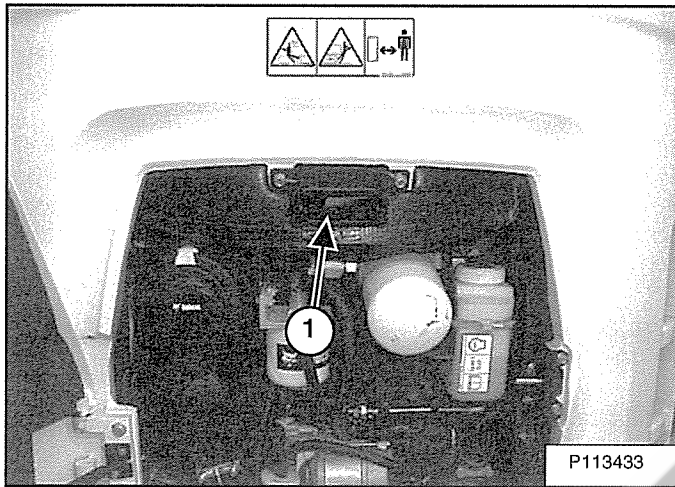
Close the tailgate before operating the excavator.

RIGHT SIDE COVER

Opening And Closing

Right Side

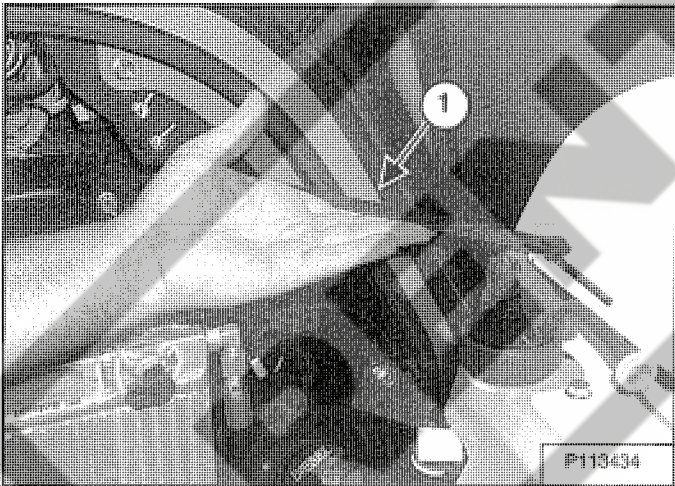
Figure 141



Open the tailgate to access the right side cover latch (Item 1) [Figure 141].

Pull out the lever (Item 1) [Figure 141] and open the right side cover.

Figure 142



Open the right side cover and rotate forward until it is held open by the latch (Item 1) [Figure 142].

To close the tailgate, lift up on the latch (Item 1) [Figure 142] and slowly start to close the tailgate.

CAB FILTERS

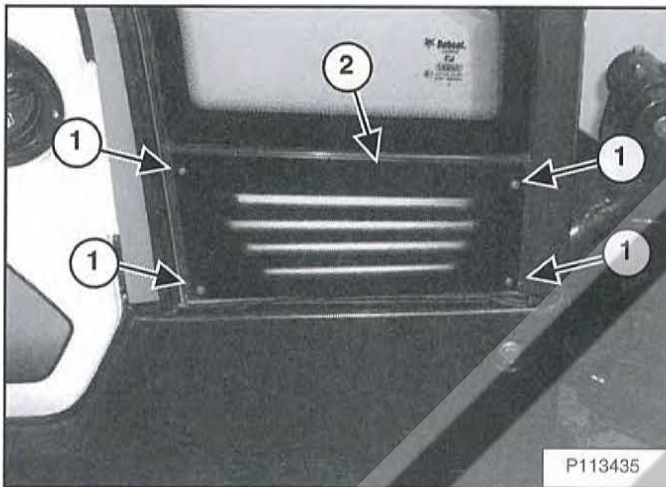
Cleaning And Maintenance

Fresh Air Filter

The fresh air filter must be cleaned regularly. (See SERVICE SCHEDULE on Page 97.)

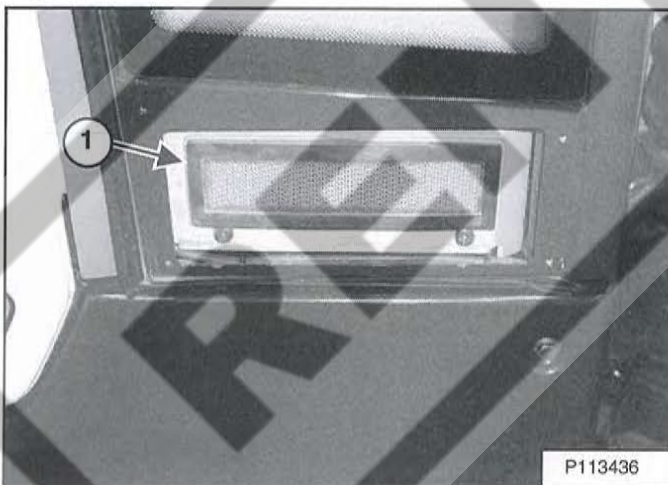
The fresh air filter is located on the right front corner of the cab.

Figure 143



Remove the four screws (Item 1) and remove the cover (Item 2) [Figure 143].

Figure 144



Pull the filter (Item 1) [Figure 144] out of the housing.

Use low air pressure to clean the filter. Replace the filter when very dirty.

Reinstall the cover (Item 2) and the four screws (Item 1) [Figure 143].

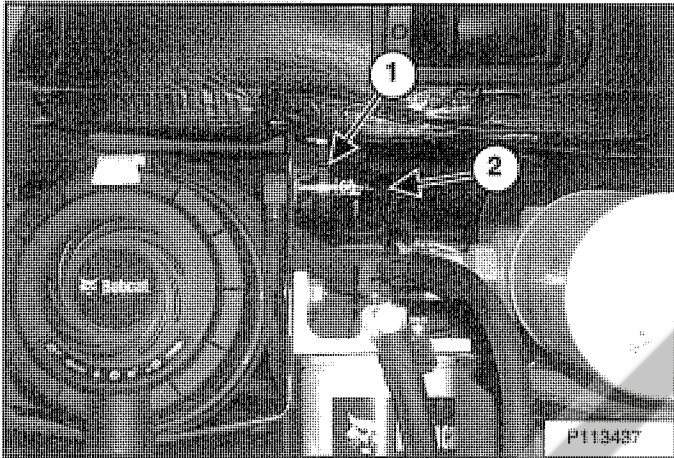
AIR CLEANER SERVICE

See the service schedule for the correct service interval. (See SERVICE SCHEDULE on Page 97.)

Daily Check

The air cleaner is located in the engine compartment. Open the tailgate to access the air cleaner for service. (See TAILGATE on Page 103.)

Figure 145



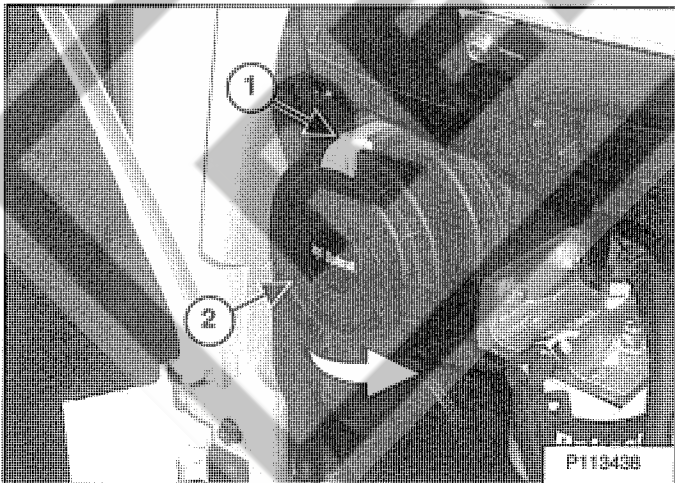
Check the condition indicator (Item 1) [Figure 145]. If the red ring shows in the condition indicator, the filter needs to be replaced.

Replace the inner filter every third time the outer filter is replaced or as indicated.

Replacing The Filter Elements

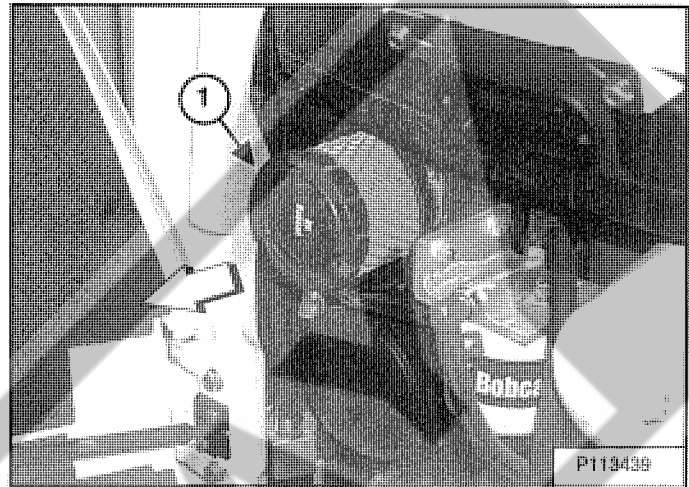
Outer Filter

Figure 146



Pull out on the latches (Item 1). Rotate the cover counterclockwise and remove the dust cover (Item 2) [Figure 146].

Figure 147



Slightly rotate the filter and pull the outer filter (Item 1) [Figure 147] from the air cleaner housing.

Check the housing for damage.

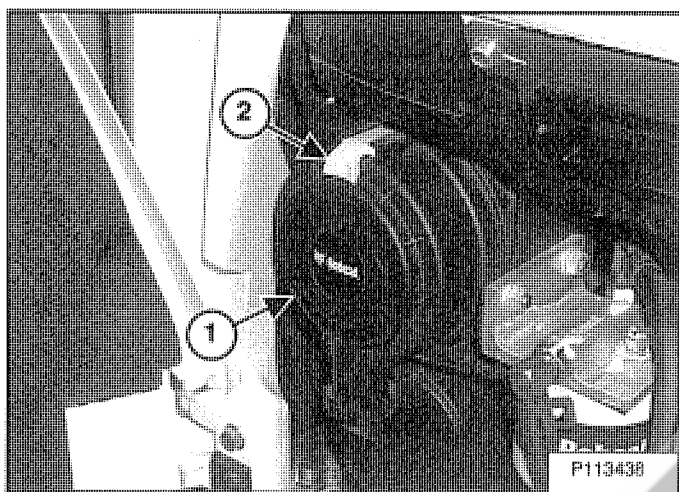
Clean the housing and the seal surface. DO NOT use compressed air.

Install a new filter.

AIR CLEANER SERVICE (CONT'D)

Replacing The Filter Elements (Cont'd)

Figure 148



Position the dust cover (Item 1) [Figure 148] to the housing. Rotate the housing clockwise until the latch is at the top as shown.

Secure the dust cover (Item 1) and by pushing in on the latch (Item 2) [Figure 148].

Check the air intake hose and the air cleaner housing for damage. Make sure all connections are tight.

After the outer filter has been replaced, press the button (Item 2) [Figure 145] on the end of the condition indicator.

Start the engine. Run at full rpm, then reduce engine speed and stop the engine.

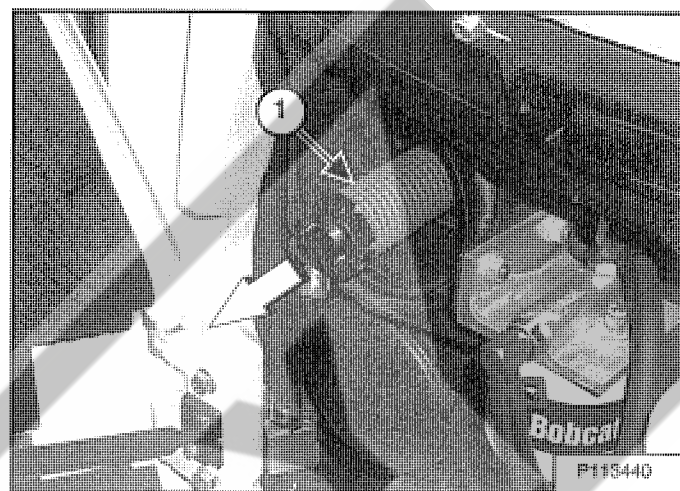
If the red ring (Item 1) [Figure 145] shows in the condition indicator, replace the inner filter.

Inner Filter

Only replace the inner filter under the following conditions:

- Replace the inner filter every *third* time the outer filter is replaced.
- After the outer filter has been replaced, press the button (Item 2) [Figure 145] on the condition indicator and start the engine. Run at full rpm, then reduce engine speed and stop the engine. If the red ring shows in the condition indicator, replace the inner filter.

Figure 149



Remove the dust cover, outer filter and inner filter (Item 1) [Figure 149].

NOTE: Make sure all sealing surfaces are free of dirt and debris.

Install the new inner filter.

Install the outer filter and the dust cover.

Press the button on the condition indicator to reset the red ring.

FUEL SYSTEM

Fuel Specifications

Ultra low sulfur diesel fuel must be used in this machine. Ultra low sulfur is defined as 15 mg/kg (15 ppm) sulfur maximum.

Use only clean, high quality diesel fuel, Grade Number 2-D or Grade Number 1-D.

The following is one suggested blending guideline that should prevent fuel gelling during cold temperatures:

TEMPERATURE	GRADE 2-D	GRADE 1-D
Above -9°C (+15°F)	100%	0%
Down to -21°C (-5°F)	50%	50%
Below -21°C (-5°F)	0%	100%

NOTE: Contact your local fuel supplier to receive specific recommendations for your region.

NOTE: Biodiesel blend fuel may also be used in this machine. Biodiesel blend fuel must contain no more than five percent biodiesel mixed with ultra low sulfur petroleum based diesel. This biodiesel blend fuel is commonly marketed as B5 blended diesel fuel. B5 blended diesel fuel must meet ASTM D975 (US Standard) or EN590 (EU Standard) specifications.

Biodiesel Blend Fuel

Biodiesel blend fuel has unique qualities that should be considered before using in this machine:

- Cold weather conditions can lead to plugged fuel system components and hard starting.
- Biodiesel blend fuel is an excellent medium for microbial growth and contamination that can cause corrosion and plugging of fuel system components.
- Use of biodiesel blend fuel may result in premature failure of fuel system components, such as: plugged fuel filters and deteriorated fuel lines.
- Shorter maintenance intervals may be required, such as: cleaning the fuel system and replacing fuel filters and fuel lines.
- Using biodiesel blended fuels containing more than five percent biodiesel can affect engine life and cause deterioration of hoses, tubelines, injectors, injector pump, and seals.

Apply the following guidelines if biodiesel blend fuel is used:

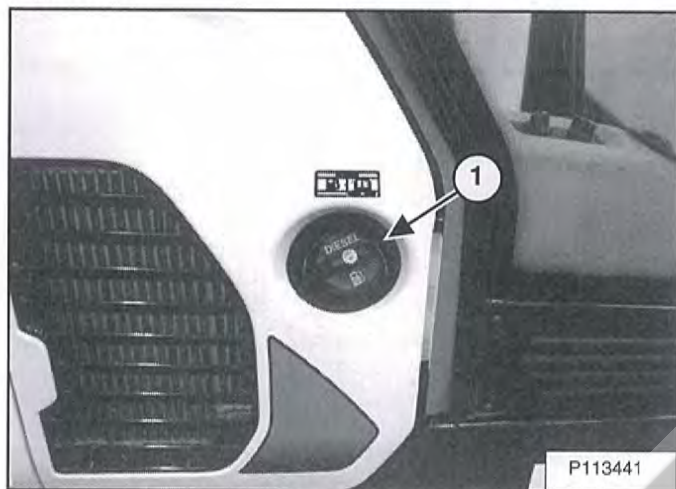
- Ensure the fuel tank is as full as possible at all times to prevent moisture from collecting in the fuel tank.
- Ensure that the fuel tank cap is securely tightened.
- Biodiesel blend fuel can damage painted surfaces, remove all spilled fuel from painted surfaces immediately.
- Drain all water from the fuel filter daily before operating the machine.
- Do not exceed engine oil change interval. Extended oil change intervals can cause engine damage.
- Before machine storage; drain the fuel tank, refill with 100% petroleum diesel fuel, add fuel stabilizer, and operate the engine for at least 30 minutes.

NOTE: Biodiesel blend fuel does not have long term stability and should not be stored for more than 3 months.

FUEL SYSTEM (CONT'D)

Filling The Fuel Tank

Figure 150



The fuel cap uses the start key to unlock the fuel cap.

Remove the fuel fill cap (Item 1) [Figure 150].

Use a clean, approved safety container to add fuel. Add fuel only in an area that has a free movement of air and no flames or sparks. **NO SMOKING!**

Install and tighten the fuel fill cap.

Clean up any spilled fuel.

See the service schedule for the service interval when to remove water from or replace the fuel filter. (See SERVICE SCHEDULE on Page 97.)

NOTE: When filling the fuel tank, with the left console raised, turn the start switch to the ON position. As fuel is added to the tank, a buzzer will beep and the closer the tank gets to full, the quicker the beeps. When the tank is full, the buzzer will sound continuously. Stop fueling when buzzer sounds continuously. Turn the start switch OFF.

WARNING

AVOID INJURY OR DEATH

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

W-2063-0807

WARNING

AVOID INJURY OR DEATH

Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire.

W-2103-0508

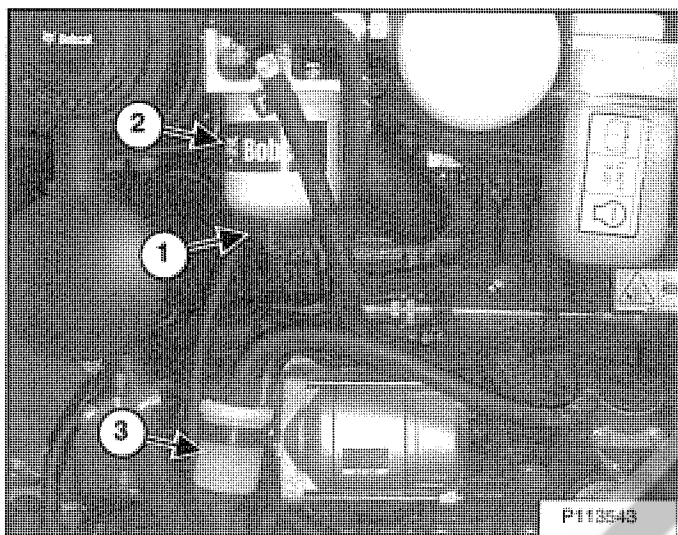
FUEL SYSTEM (CONT'D)

Fuel Filter

Removing Water

Open the tailgate. (See TAILGATE on Page 103.)

Figure 151



Loosen the drain (Item 1) [Figure 151] at the bottom of the filter to drain water from the filter into a container.

Inspect the fuel pre-filter (Item 3) [Figure 151] daily for moisture and contamination. Replace as necessary.

Clean up any spilled fuel.

Replacing Elements

Remove and replace the fuel pre-filter (Item 3) [Figure 151].

Remove the filter (Item 2) [Figure 151].

Clean the area around the filter housing. Put clean oil on the seal of the new filter. Install the fuel filter and hand tighten.

Remove the air from the fuel system. (See Removing Air From The Fuel System on Page 111.)



AVOID INJURY OR DEATH

Diesel fuel or hydraulic fluid under pressure can penetrate skin or eyes, causing serious injury or death. Fluid leaks under pressure may not be visible. Use a piece of cardboard or wood to find leaks. Do not use your bare hand. Wear safety goggles. If fluid enters skin or eyes, get immediate medical attention from a physician familiar with this injury.

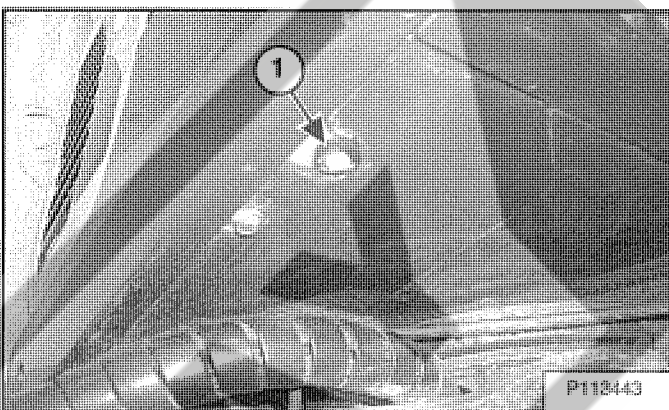
W-2072-0807

Draining The Fuel Tank

See the service schedule for the correct service interval. (See SERVICE SCHEDULE on Page 97.)

The fuel tank can be drained in several ways. See below.

Figure 152



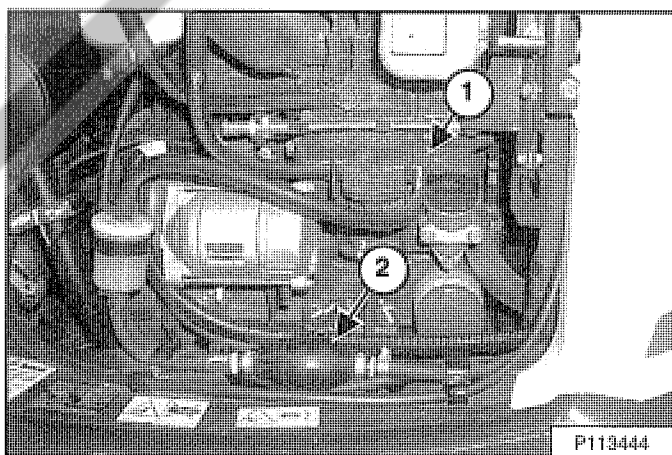
Rotate the upperstructure so the fuel tank drain plug (Item 1) is located between the rear tracks. Remove the drain plug (Item 1) [Figure 152].

Drain the fuel into the container.

Reuse, recycle or dispose of fuel in an environmentally safe manner.

Reinstall the drain plug.

Figure 153



Second option for draining tank. Remove the fuel hose (Item 1) at the fuel pump. Route the hose out of the engine compartment and into a container. Squeeze the primer bulb (Item 2) [Figure 153] to start a siphon and drain the tank.

Reinstall the fuel hose (Item 1) [Figure 153].

FUEL SYSTEM (CONT'D)

Removing Air From The Fuel System

After replacing the fuel filter or when the fuel tank has run out of fuel, air must be removed from the fuel system before starting the engine.

Open the tailgate. (See Opening And Closing on Page 103.)

Figure 154

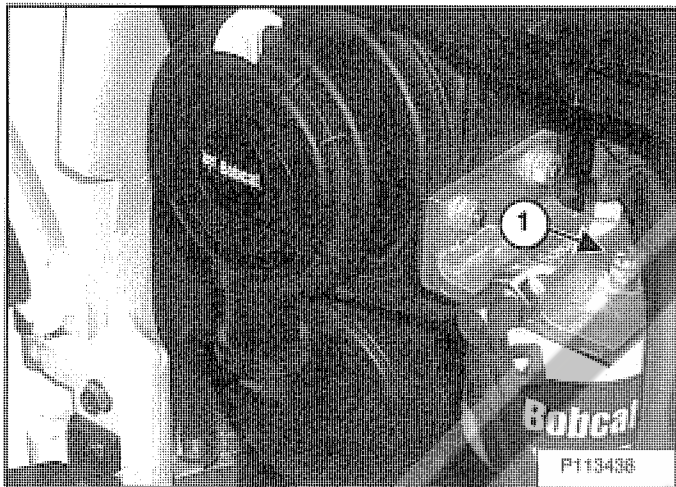
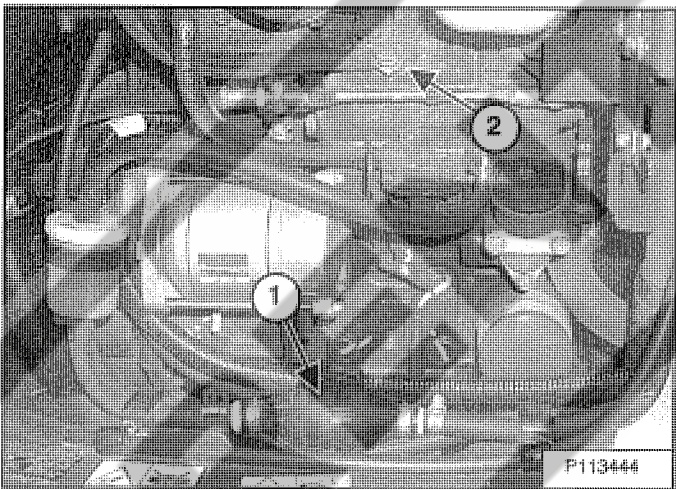


Figure 155



Open the fuel filter vent (Item 1) [Figure 154] and operate the hand pump (priming bulb) (Item 1) [Figure 155] until the fuel flows from the vent (Item 1) [Figure 154] with no air bubbles.

Close the vent (Item 1) [Figure 154].

Start the engine. It may be necessary to open the vent (Item 2) [Figure 155] (at the fuel injection pump) briefly until the engine runs smoothly.



WARNING

AVOID INJURY OR DEATH

Diesel fuel or hydraulic fluid under pressure can penetrate skin or eyes, causing serious injury or death. Fluid leaks under pressure may not be visible. Use a piece of cardboard or wood to find leaks. Do not use your bare hand. Wear safety goggles. If fluid enters skin or eyes, get immediate medical attention from a physician familiar with this injury.

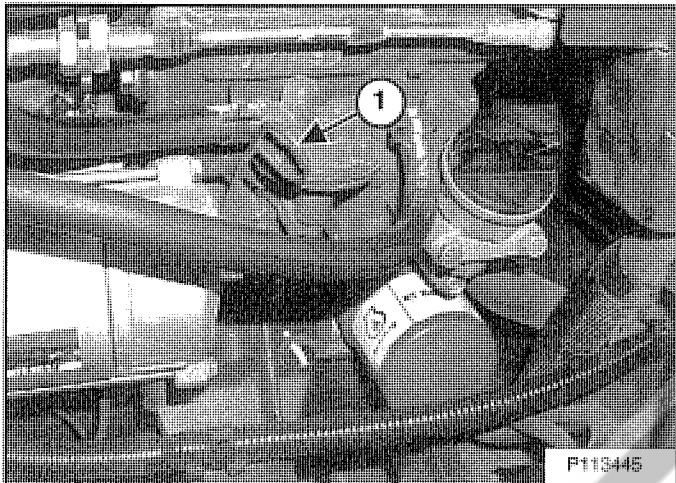
W-2072-0807

ENGINE LUBRICATION SYSTEM

Checking And Adding Engine Oil

Check the engine oil after every 8 - 10 hours of operation and before starting the engine. (See SERVICE SCHEDULE on Page 97.)

Figure 156



Open the tailgate and remove the dipstick (Item 1) [Figure 156].

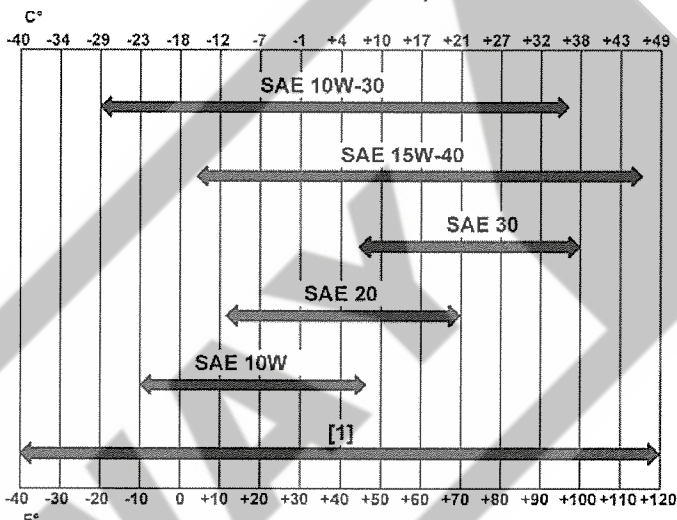
Keep the oil level between the marks on the dipstick.

Use a good quality motor oil that meets the correct API Service Classification.

Engine Oil Chart

Figure 157

ENGINE OIL RECOMMENDED SAE VISCOSITY NUMBER (LUBRICATION OILS FOR DIESEL ENGINE CRANKCASE)



TEMPERATURE RANGE ANTICIPATED BEFORE
NEXT OIL CHANGE (DIESEL ENGINES MUST USE API
CLASSIFICATION CI-4 OR BETTER)

[1] Synthetic Oil - Use recommendation from Synthetic Oil Manufacturer.

Use good quality engine oil that meets API Service Classification of CI-4 or better [Figure 157].



WARNING

AVOID INJURY OR DEATH

Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire.

W-2103-0508

ENGINE LUBRICATION SYSTEM (CONT'D)

Removing And Replacing Oil And Filter

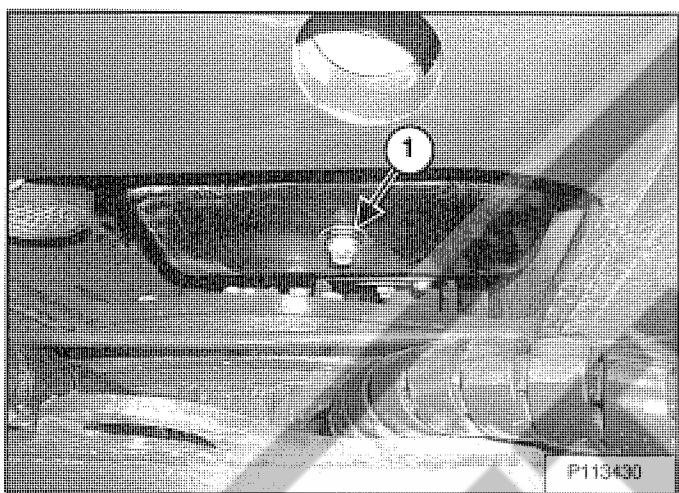
See the service schedule for the service interval for replacing the engine oil and filter. (See SERVICE SCHEDULE on Page 97.)

Rotate upperstructure so that the oil drain plug is between the rear tracks.

Run the engine until it is at operating temperature. Stop the engine.

Open the tailgate. (See Opening And Closing on Page 103.)

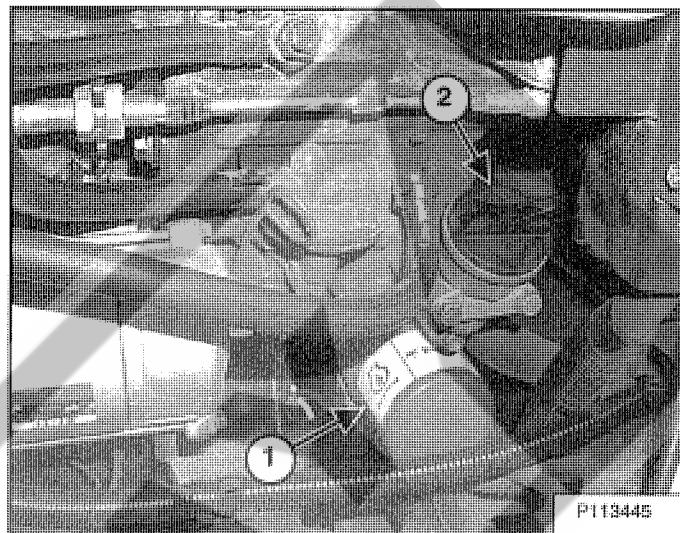
Figure 158



Place a container under the oil pan. Remove the drain plug (Item 1) [Figure 158] from the bottom of the engine oil pan.

Recycle or dispose of used oil in an environmentally safe manner.

Figure 159



Remove the oil filter (Item 1) [Figure 159] and clean the filter housing surface.

Use a genuine Bobcat replacement filter. Put clean oil on the filter gasket. Install the filter and hand tighten.

Install and tighten the drain plug (Item 1) [Figure 158].

Remove the fill cap (Item 1) [Figure 159].

Put oil in the engine. (See Checking And Adding Engine Oil on Page 112.)

Install the fill cap (Item 1) [Figure 159].

Start the engine and let it run for several minutes.

Stop the engine. Check for leaks at the oil filter. Check the oil level.

Add oil as needed if it is not at the top mark on the dipstick.

ENGINE COOLING SYSTEM

Check the cooling system every day to prevent overheating, loss of performance or engine damage. (See SERVICE SCHEDULE on Page 97.)

Cleaning

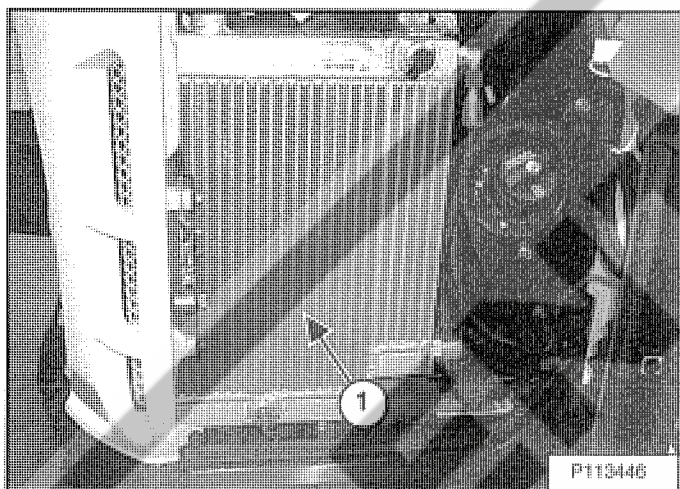
NOTE: This excavator uses a pusher fan so flow through the radiator / oil cooler will be from inside the engine compartment to outside the right cover. When cleaning the radiator, clean both the inside and outside surfaces of the radiator / oil cooler.

Open the tailgate. (See Opening And Closing on Page 103.)

Open the right side cover. (See Opening And Closing on Page 104.)

NOTE: Allow the cooling system and engine to cool before servicing or cleaning the cooling system.

Figure 160



Use air pressure or water pressure to clean the radiator / oil cooler (Item 1) [Figure 160] (both inside and outside surfaces). Be careful not to damage fins when cleaning.

Close the right side cover. (See Opening And Closing on Page 104.)

Close the tailgate. (See Opening And Closing on Page 103.)

ENGINE COOLING SYSTEM (CONT'D)

Checking Level

WARNING

AVOID BURNS

Do not remove radiator cap when the engine is hot. You can be seriously burned.

W-2070-1203

WARNING

AVOID INJURY OR DEATH

Wear safety glasses to prevent eye injury when any of the following conditions exist:

- When fluids are under pressure.
- Flying debris or loose material is present.
- Engine is running.
- Tools are being used.

W-2019-0907

IMPORTANT

AVOID ENGINE DAMAGE

Always use the correct ratio of water to antifreeze.

Too much antifreeze reduces cooling system efficiency and may cause serious premature engine damage.

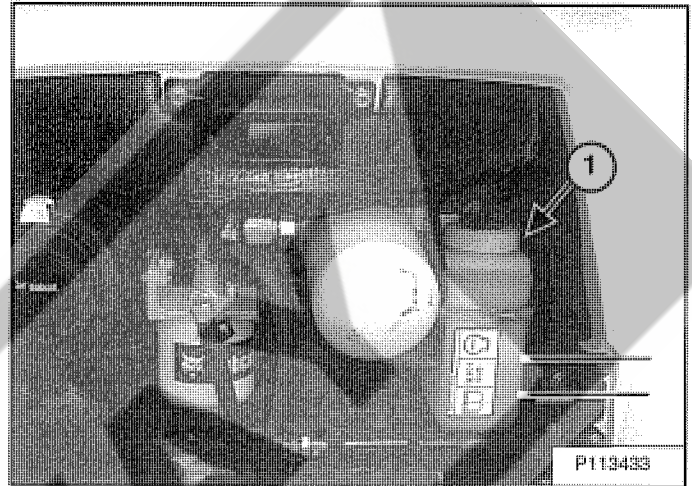
Too little antifreeze reduces the additives which protect the internal engine components; reduces the boiling point and freeze protection of the system.

Always add a premixed solution. Adding full strength concentrated coolant can cause serious premature engine damage.

I-2124-0497

Open the tailgate. (See Opening And Closing on Page 103.)

Figure 161



Check the coolant level in the coolant recovery tank (Item 1) [Figure 161].

The coolant level must be filled so it is within the MAX / MIN line marked on the on the coolant recovery tank.

NOTE: The cooling system is factory filled with propylene glycol (purple color). DO NOT mix propylene glycol with ethylene glycol.

ENGINE COOLING SYSTEM (CONT'D)

Removing And Replacing Coolant

See the service schedule for correct service intervals. (See SERVICE SCHEDULE on Page 97.)

Stop the engine. Open the tight side cover. (See Opening And Closing on Page 104.)



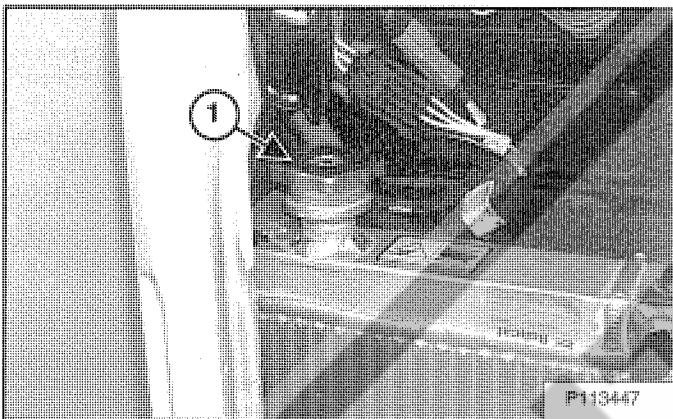
WARNING

AVOID BURNS

Do not remove radiator cap when the engine is hot. You can be seriously burned.

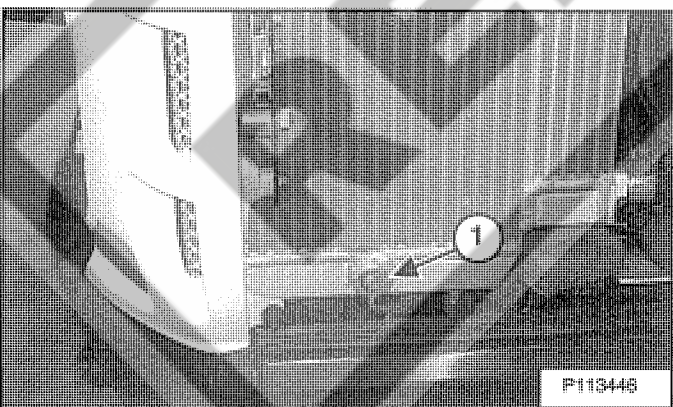
W-2070-1203

Figure 162



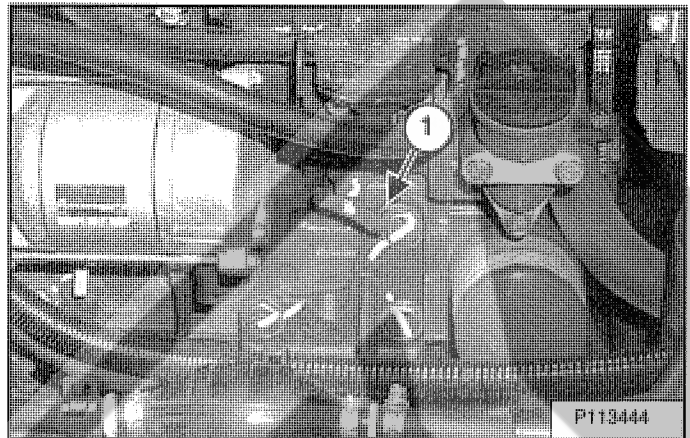
When the engine is cool, loosen and remove the coolant fill cap (Item 1) [Figure 162].

Figure 163



Install a hose on the drain valve at the bottom of the radiator. Open the drain valve (Item 1) [Figure 163] and drain the coolant into a container.

Figure 164



Install a hose on the drain valve located at the engine block by the end of the started. Open the drain valve (Item 1) [Figure 164] and drain the coolant into a container.

After all the coolant is removed, close both drain valves.

Recycle or dispose of the used coolant in an environmentally safe manner.

Mix the coolant in a separate container. (See Capacities on Page 152.)

NOTE: The cooling system is factory filled with propylene glycol (purple color). DO NOT mix propylene glycol with ethylene glycol.

The correct mixture of coolant to provide a -37°C (-34°F) freeze protection is 5 L propylene glycol mixed with 4,4 L of water **OR** 1 U.S. gal propylene glycol mixed with 3.5 qt of water.

Add premixed coolant, 47% water and 53% propylene glycol to the coolant tank until the coolant level reaches the lower marker on the tank.

Use a refractometer to check the condition of propylene glycol in your cooling system.

Add premixed coolant until the level is correct. Install the coolant fill cap.

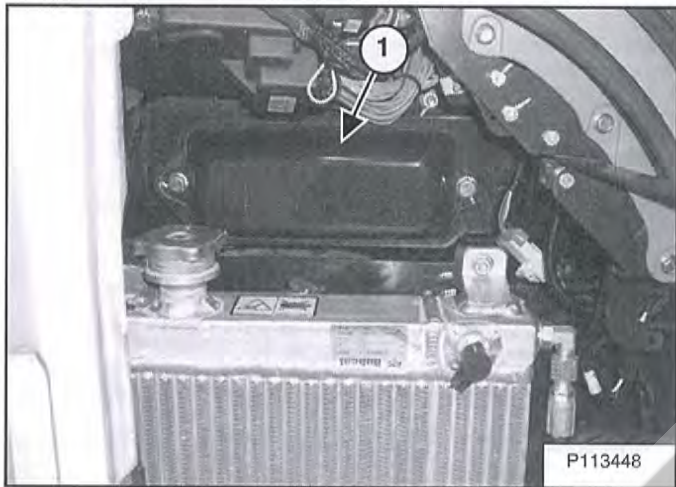
Run the engine until it is at operating temperature. Stop the engine. Check the coolant level when cool. Add coolant as needed. Install the coolant fill cap.

Close the tailgate.

ELECTRICAL SYSTEM

Description

Figure 165



The excavator has a 12 volt, negative ground electrical system. The electrical system is protected by fuses located under the right side cover of the excavator (Item 1) [Figure 165]. The fuses will protect the electrical system when there is an electrical overload. The reason for the overload must be found and corrected before starting the engine again.

The battery cables must be clean and tight. Check the electrolyte level in the battery. Add distilled water as needed. Remove acid or corrosion from the battery and cables with a sodium bicarbonate and water solution.

Put Battery Saver P/N 6664458 or grease on the battery terminals and cable ends to prevent corrosion.



WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

W-2065-0807

Fuse And Relay Location / Identification

A decal is inside the fuse cover to show location and amp ratings.

Remove the cover to check or replace the fuses and relays.

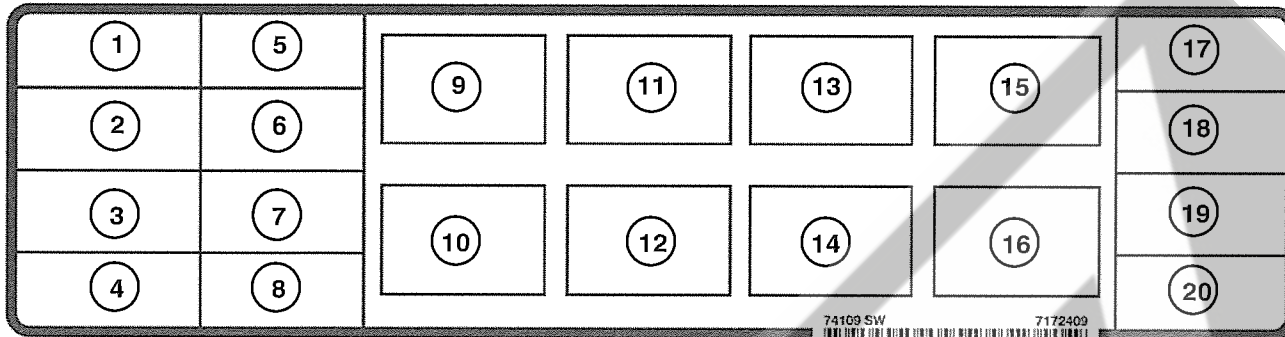
The location and amperage ratings are shown in [Figure 166].

Always replace fuses using the same type and capacity.

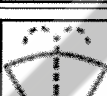
ELECTRICAL SYSTEM (CONT'D)

Fuse And Relay Location / Identification (Cont'd)

Figure 166



The location and amperage ratings are shown in the table below and on the decal [Figure 166]. Relays are identified by the letter “R” in the AMP column.

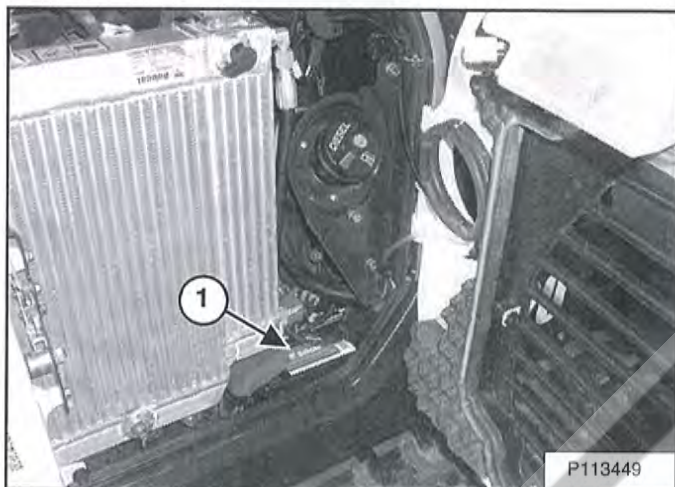
REF	ICON	DESCRIPTION	AMP	REF	ICON	DESCRIPTION	AMP	REF	ICON	DESCRIPTION	AMP
1		NOT USED		9		Switched Power	R	17		Panel / Display Controller	25
2		NOT USED		10		Fuel Shutoff	R	18		ACD Unswitched Power	25
3		Start Key	5	11		Heater Fan	R	19		Lights	25
4		Fuel Shutoff	25	12		Lights	R	20		Power Port	15
5		Wiper / Washer	10	13		Hydraulic By-Pass / Power Beyond	R				
6		Switched Power	20	14		Glow Plugs	R				
7		Alternator Excite / Heater	25	15		NOT USED	R				
8		ACD Switched Power	25	16		Starter	R				

ELECTRICAL SYSTEM (CONT'D)

Battery Maintenance

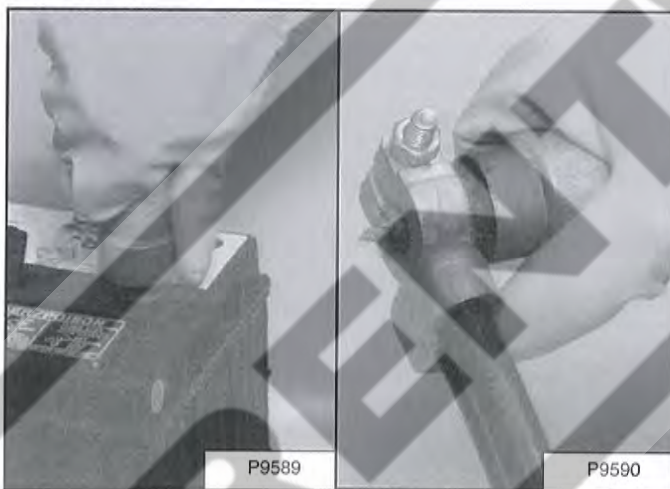
Open the right side cover. (See Opening And Closing on Page 104.)

Figure 167



The battery (Item 1) [Figure 167] is located in the right side upperstructure below the oil cooler.

Figure 168



The battery cables must be clean and tight [Figure 168]. Remove acid or corrosion from the battery and cables using a sodium bicarbonate and water solution. Cover the battery terminals and cable ends with battery saver grease to prevent corrosion.

Check for broken or loose connections.

If the battery cables are to be removed for any reason, disconnect the negative (-) cable first. When installing the battery cables, make the last connection the negative (-) cable to the battery.

The original equipment battery is maintenance free. If a replacement battery is installed, check the electrolyte level in the battery.

If the electrolyte level is lower than 13 mm (0.50 in) above the plates, add distilled water only.



WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

W-2065-0807

Using A Booster Battery (Jump Starting)

IMPORTANT

If jump starting the excavator from a second machine:

When jump starting the excavator from a battery installed in a second machine, make sure the engine is NOT running while using the glow plugs. High voltage spikes from a running machine can burn out the glow plugs.

I-2060-0906

If it is necessary to use a booster battery to start the engine, BE CAREFUL! There must be one person in the operator's seat and one person to connect and disconnect the battery cables.

Be sure the key switch is OFF. The booster battery must be 12 volt.

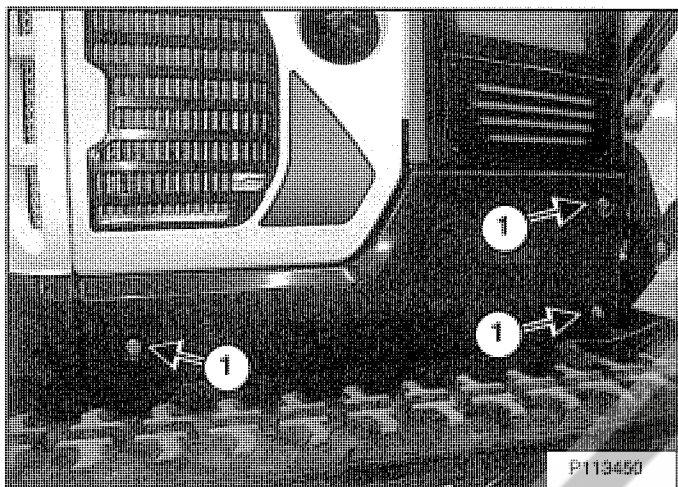
Open the tailgate. (See Opening And Closing on Page 103.)

ELECTRICAL SYSTEM (CONT'D)

Using A Booster Battery (Jump Starting) (Cont'd)

NOTE: To access the battery for jump starting, the battery hold-down will need to be removed and the battery moved outward to access the positive battery post.

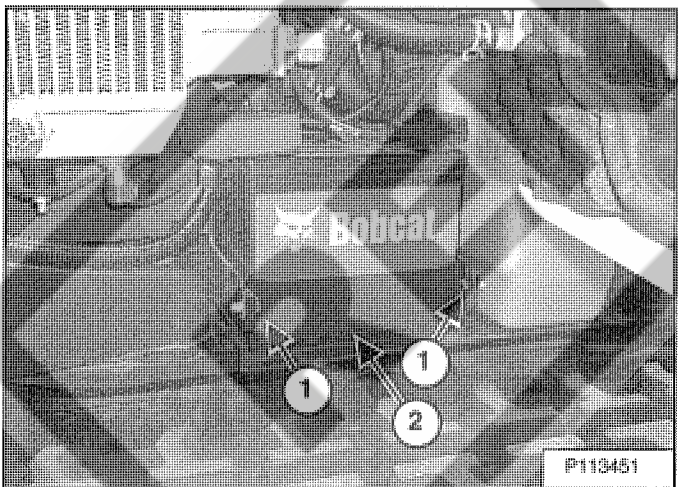
Figure 169



Remove the three bolts (Item 1) and remove the right side lower cover (Item 2) [Figure 169].

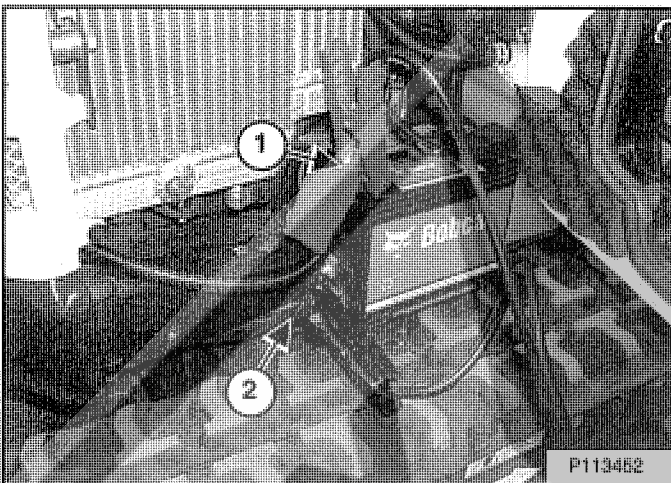
Open the right side cover. (See Opening And Closing on Page 104.)

Figure 170



Remove the two bolts (Item 1) and remove the battery hold-down plate (Item 2) [Figure 169].

Figure 171



Connect one end of the first cable to the positive (+) terminal of the booster battery. Connect the other end of the same cable to the positive (+) terminal (Item 1) [Figure 169] of the excavator battery.

Connect one end of the second cable to the negative (-) terminal of the booster battery. Connect the other end of the same cable to a frame grounding point (Item 2) [Figure 171].

Start the engine. After the engine has started, remove the negative (-) cable first (Item 1) [Figure 171].

Disconnect the cable from the excavator starter (Item 1) [Figure 169].

Replace the positive battery cable cover and push the battery in fully. Reinstall the battery hold-down plate (Item 2) and the two bolts (Item 1) [Figure 170].

Reinstall the lower right side cover [Figure 169].

NOTE: (See Cold Temperature Starting on Page 72.)

IMPORTANT

Damage to the alternator can occur if:

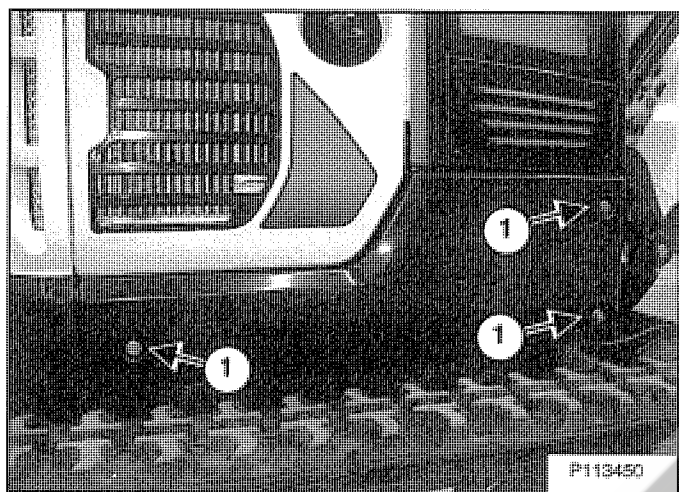
- Engine is operated with battery cables disconnected.
- Battery cables are connected when using a fast charger or when welding on the excavator. (Remove both cables from the battery.)
- Extra battery cables (booster cables) are connected wrong.

I-2223-0903

ELECTRICAL SYSTEM (CONT'D)

Removing And Installing The Battery

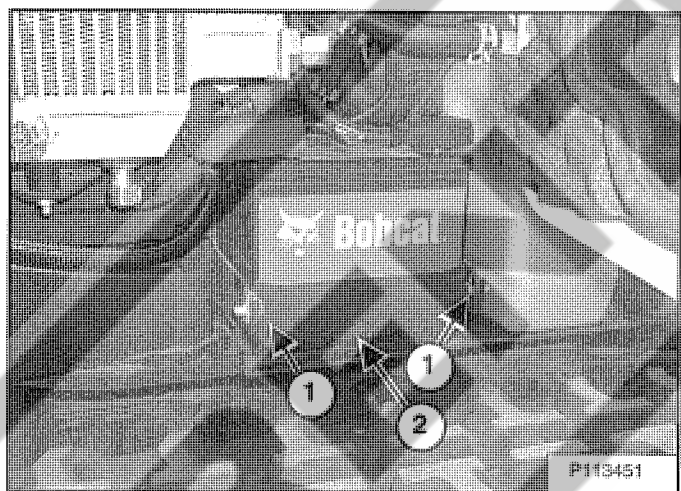
Figure 172



Remove the three bolts (Item 1) and remove the right side lower cover (Item 2) [Figure 172].

Open the right side cover. (See Opening And Closing on Page 104.)

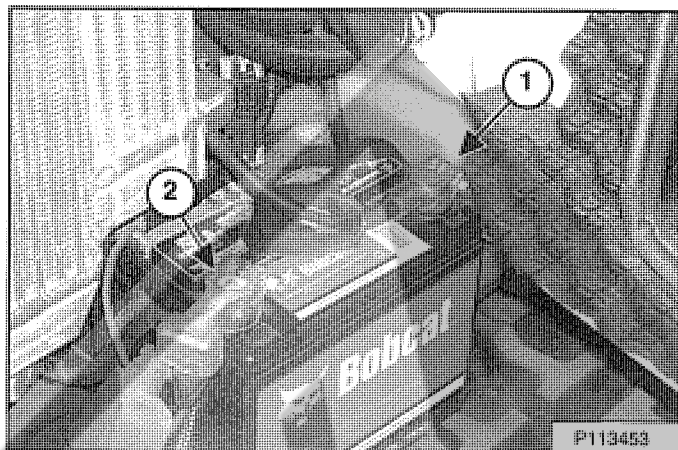
Figure 173



Remove the two bolts (Item 1) and remove the battery hold-down plate (Item 2) [Figure 173].

Slide the battery to the right to access the battery cables.

Figure 174



Disconnect the negative (-) cable (Item 1) [Figure 174] first.

Disconnect the positive (+) cable (Item 2) [Figure 174].

Remove the battery.

Always clean the terminals and the cable ends, even when installing a new battery.

Position the battery into the battery box.

Connect the battery cables. Connect the negative (-) cable (Item 1) [Figure 174] last to prevent sparks. Reinstall the battery post covers and slide the battery in fully.

Tighten the terminal clamp nuts to 7 N•m (5 ft-lb) torque.

Install the hold-down plate (Item 2) and the two bolts (Item 1) [Figure 169]. Reinstall the lower cover [Figure 172].

WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

W-2065-0807

HYDRAULIC SYSTEM

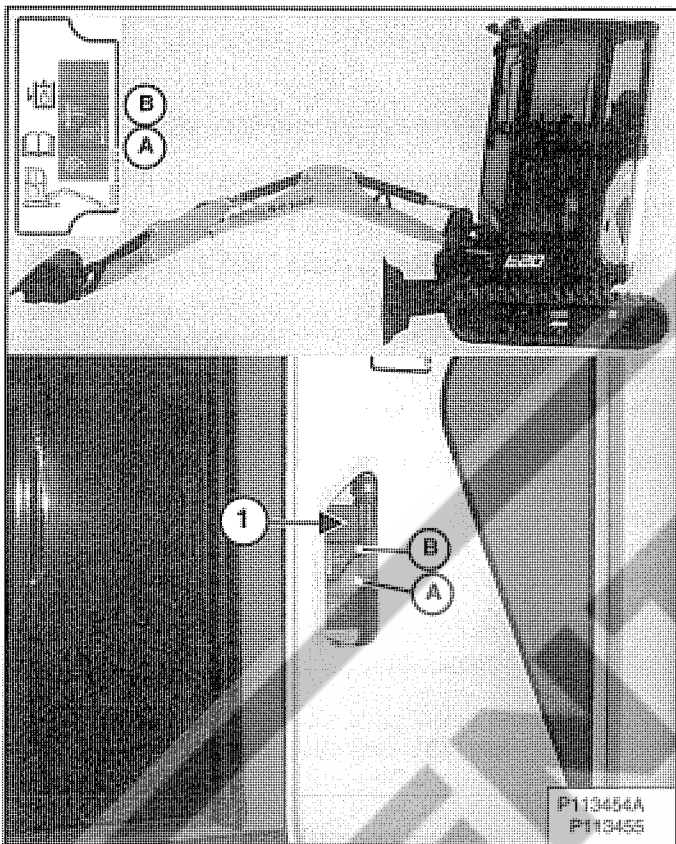
Checking And Adding Hydraulic Oil

Put the machine on a flat level surface.

Retract the arm and bucket cylinders, put the bucket on the ground and lower the blade. Stop the engine.

Open the right side cover. (See Opening And Closing on Page 104.)

Figure 175



Park the machine in the position shown [Figure 175]. (The preferred method is to check the hydraulic oil when it is cold.)

Check the hydraulic oil level, it must be visible in the sight gauge (Item 1) [Figure 175]. The decal on the hydraulic tank shows the correct fill level.

A - Correct Oil Level COLD (Preferred)
B - Correct Oil Level HOT (Optional)

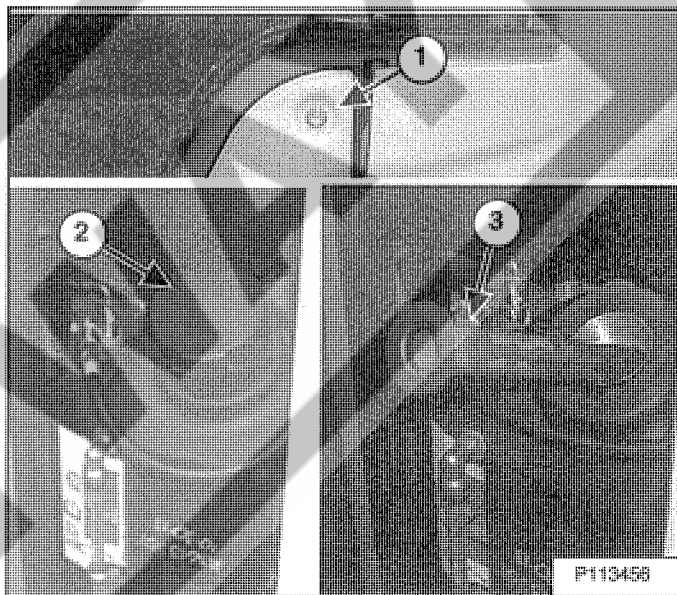
WARNING

AVOID INJURY OR DEATH

Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire.

W-2103-0508

Figure 176



Remove screw (Item 1) [Figure 176] from the top of the cover and remove the left side cover.

Clean the surface around the reservoir cap and remove the cap from the reservoir (Item 2) [Figure 176].

Check the condition of the fill strainer screen (Item 3) [Figure 176]. Clean or replace as necessary.

Be sure the screen is installed before adding fluid.

Add the correct fluid to the reservoir until it is visible in the sight gauge.

Check the cap and clean as necessary. Replace the cap if damaged.

Install the cap.

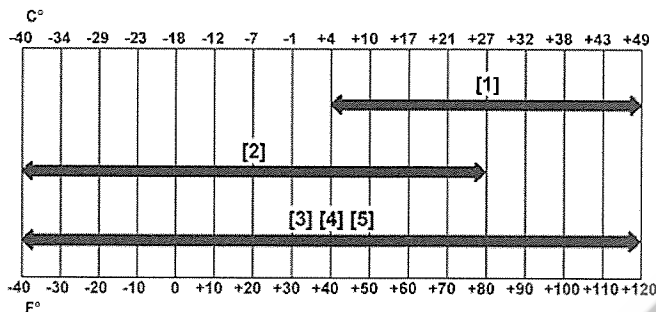
Close the right side cover and tailgate.

HYDRAULIC SYSTEM (CONT'D)

Hydraulic / Hydrostatic Fluid Chart

Figure 177

HYDRAULIC / HYDROSTATIC FLUID RECOMMENDED ISO VISCOSITY GRADE (VG) AND VISCOSITY INDEX (VI)



TEMPERATURE RANGE ANTICIPATED DURING MACHINE USE

- [1] VG 100; Minimum VI 130
- [2] VG 46; Minimum VI 150
- [3] BOBCAT All-Season Fluid
- [4] BOBCAT Synthetic Fluid
- [5] BOBCAT Biodegradable Hydraulic / Hydrostatic Fluid (Unlike biodegradable fluids that are vegetable based, Bobcat biodegradable fluid is formulated to prevent oxidation and thermal breakdown at operating temperatures.)

Install the oil fill cap.

Removing And Replacing The Hydraulic Filters

WARNING

AVOID INJURY OR DEATH

Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire.

W-2103-0508

Hydraulic Filter

See the service schedule for the correct service interval. (See SERVICE SCHEDULE on Page 97.)

Open the tailgate. (See Opening And Closing on Page 103.)

Figure 178



Remove the hydraulic filter (Item 1) [Figure 178].

Clean the housing where the filter gasket makes contact.

Put clean hydraulic oil on the gasket. Install the new filter and hand tighten only. Use a genuine Bobcat replacement filter.

WARNING

AVOID INJURY OR DEATH

Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire.

W-2103-0508

HYDRAULIC SYSTEM (CONT'D)

Removing And Replacing The Hydraulic Oil

See the service schedule for the correct service interval.
(See SERVICE SCHEDULE on Page 97.)



AVOID INJURY OR DEATH

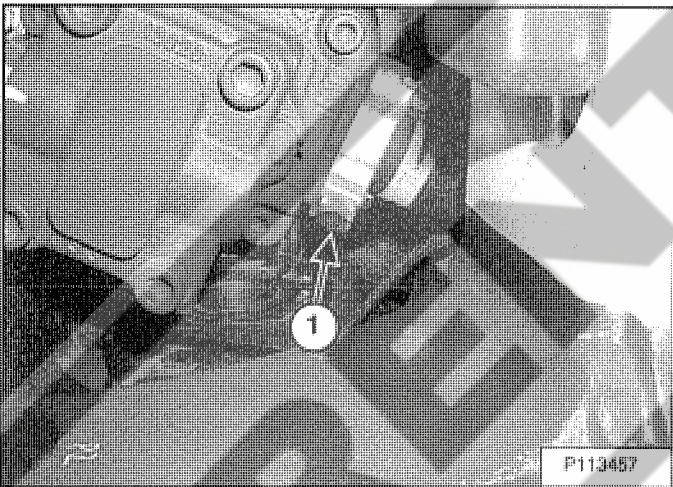
Diesel fuel or hydraulic fluid under pressure can penetrate skin or eyes, causing serious injury or death. Fluid leaks under pressure may not be visible. Use a piece of cardboard or wood to find leaks. Do not use your bare hand. Wear safety goggles. If fluid enters skin or eyes, get immediate medical attention from a physician familiar with this injury.

W-2072-0807

Retract the arm and bucket cylinders, lower the bucket to the ground. Stop the engine.

Open the tailgate. (See Opening And Closing on Page 103.)

Figure 179



The hydraulic oil drain plug (Item 1) [Figure 179] is located on the hydraulic pump inlet fitting.

Remove the plug (Item 1) [Figure 179].

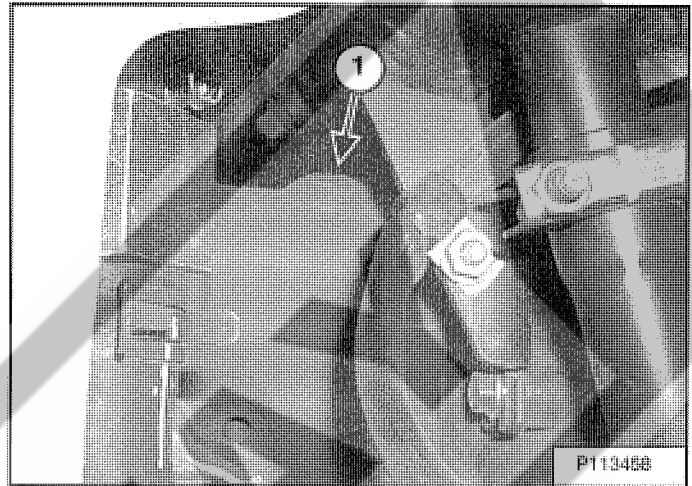
Drain the fluid into a container.

Recycle or dispose of the fluid in an environmentally safe manner.

Install the plug (Item 1) [Figure 179].

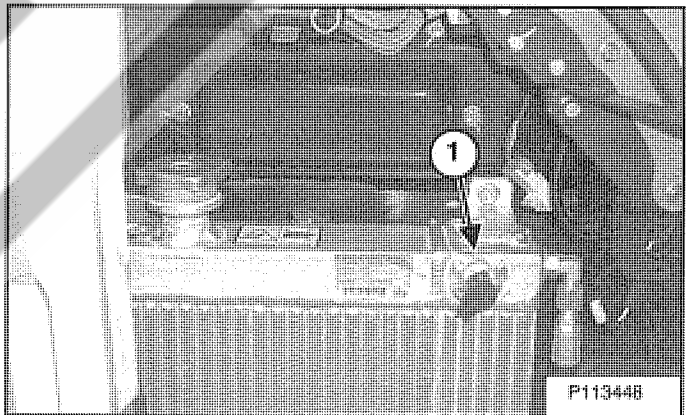
Add fluid to the reservoir. (See Checking And Adding Hydraulic Oil on Page 122.)

Figure 180



With the engine OFF, loosen the plug (Item 1) [Figure 180] on the hydraulic pump. Tighten the plug after a steady stream of hydraulic oil, free of any air bubbles, drains from the plug. **DO NOT RUN THE MACHINE WITH THE PLUG OPEN.** Tighten the plug to 30 -34 N•m (22 - 25 ft-lb) torque.

Figure 181



There is also a port (Item 1) [Figure 181] on the hydraulic cooler for bleeding air. Install a diagnostic coupler and hose on this fitting to allow air to be bled from the hydraulic system after the hydraulic oil has been replaced. Remove the hose and coupler before starting the engine.

Start the engine and operate the machine through the hydraulic functions. Stop the engine. Check the fluid level and add as needed.

SPARK ARRESTOR MUFFLER

Cleaning Procedure

See the SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 97.)

WARNING

AVOID INJURY OR DEATH

When an engine is running in an enclosed area, fresh air must be added to avoid concentration of exhaust fumes. If the engine is stationary, vent the exhaust outside. Exhaust fumes contain odorless, invisible gases which can kill without warning.

W-2050-0807

WARNING

Stop engine and allow the muffler to cool before cleaning the spark chamber. Wear safety goggles. Failure to obey can cause serious injury.

W-2011-1285

WARNING

Never use machine in atmosphere with explosive dust or gases or where exhaust can contact flammable material. Failure to obey warnings can cause injury or death.

W-2068-1285

WARNING

When the engine is running during service, the steering levers must be in neutral.

Failure to do so can cause injury or death.

W-2203-0595

IMPORTANT

This machine is factory equipped with a U.S.D.A. Forestry Service approved spark arrester exhaust system.

The spark arrester muffler, if equipped, must be cleaned to keep it in working condition. The spark arrester muffler must be serviced by dumping the spark chamber every 100 hours of operation.

On some models, the turbocharger functions as the spark arrester and must operate correctly for proper spark arrester function.

If this machine is operated on flammable forest, brush, or grass covered land, it must be equipped with a spark arrester attached to the exhaust system and maintained in working order. Failure to do so will be in violation of California State Law, Section 4442. PRC. Refer to local laws and regulations for spark arrester requirements.

I-2284-0111

Do not operate the excavator with a defective exhaust system.

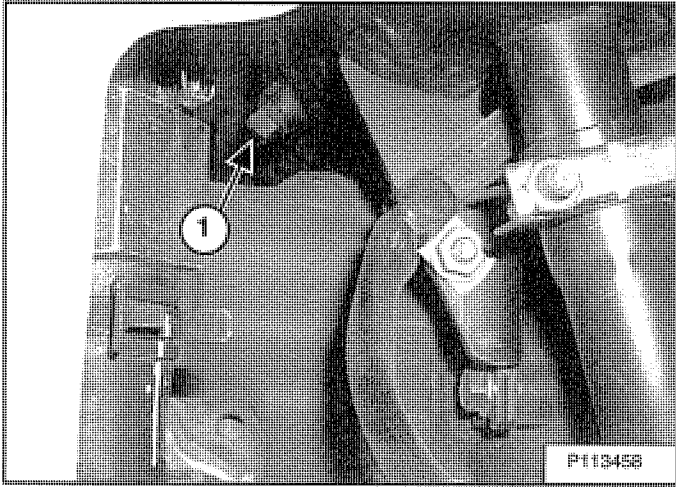
Stop the engine. Open the tailgate. (See TAILGATE on Page 103.)

Remove the left side cover.

SPARK ARRESTOR MUFFLER

Cleaning Procedure (Cont'd)

Figure 182



Remove the plug (Item 1) [Figure 182] from the bottom of the muffler.

Start the engine and run for about 10 seconds while a second person, wearing safety glasses, holds a piece of wood over the outlet of the muffler. The carbon deposits will be forced out of the muffler plug hole (Item 1) [Figure 182].

Stop the engine. Install and tighten the plug.

Close the tailgate.

TRACK TENSION

Checking Tension

NOTE: The wear of the pins and bushings on the undercarriage vary with the working conditions and the different types of soil conditions. It is necessary to inspect track tension and maintain the correct tension. See service schedule for the correct service interval. (See **SERVICE SCHEDULE** on Page 97.)

Raise the side of the machine (approximately 102 mm [4 in]) using the boom and arm.

Figure 183

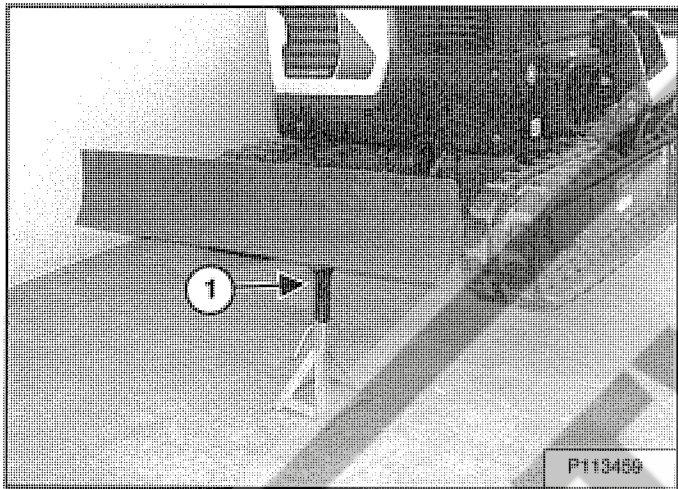
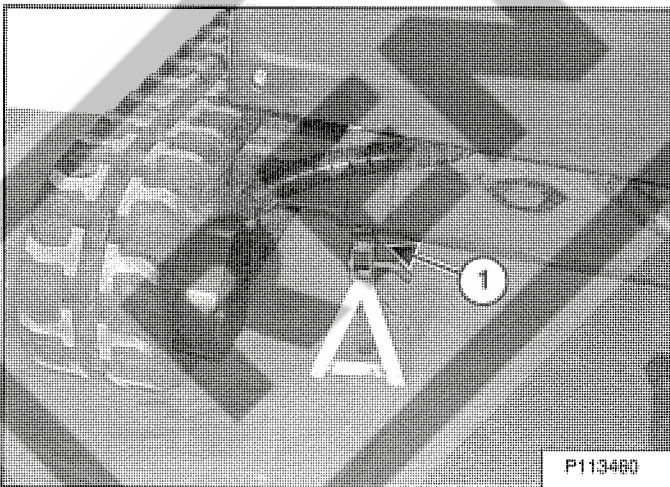


Figure 184



Raise the blade fully and install jackstands under the blade and track frame (Item 1) [Figure 183] and [Figure 184]. Raise the boom until all machine weight is on the jackstands.

Stop the engine.



WARNING

AVOID INJURY

Keep fingers and hands out of pinch points when checking the track tension.

W-2142-0903

Track Clearance

Figure 185

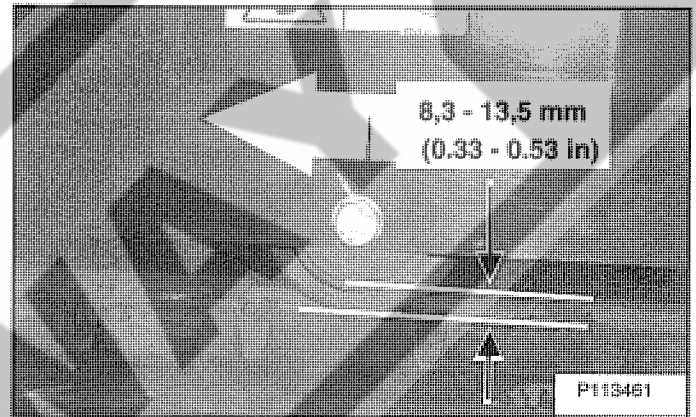
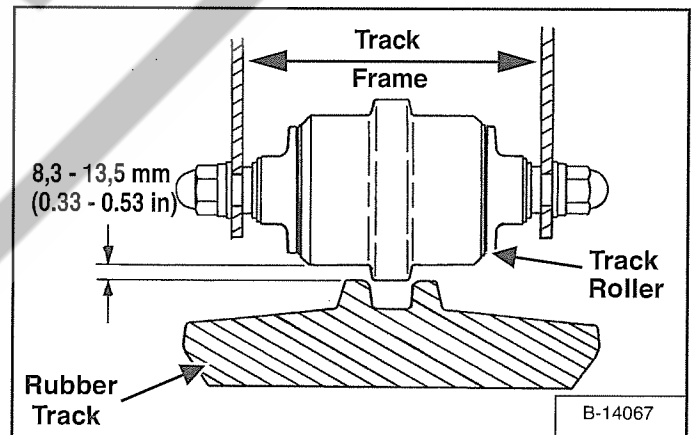


Figure 186



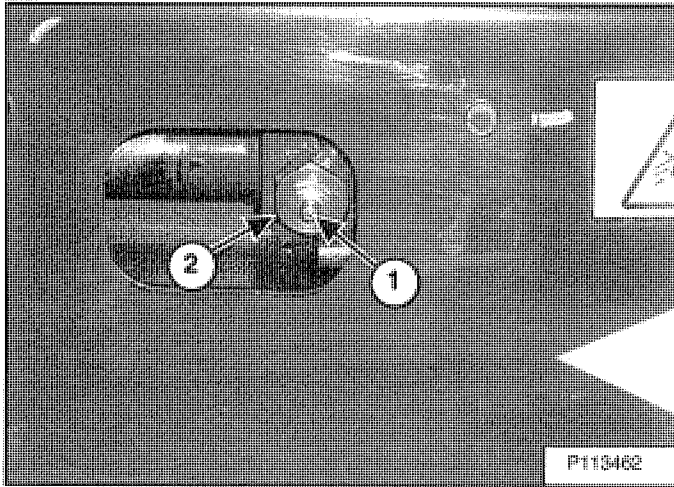
Measure the clearance at either middle track roller. Do not get fingers into pinch points between the track and the track roller. Use a bolt or a dowel of the appropriate size to check the gap between the contact edge of the roller and the top edge of the track guide [Figure 185] and [Figure 186].

Track Clearance	8,3 - 13,5 mm (0.33 - 0.53 in)
-----------------	-----------------------------------

TRACK TENSION (CONT'D)

Adjusting Tension

Figure 187



Loosen the access cover bolts and pivot the access cover open [Figure 187].

Increase Track Tension

Add grease to the fitting (Item 1) [Figure 187] until the track tension is correct.

Decrease Track Tension



AVOID INJURY OR DEATH

If grease fitting is removed before pressure is released, the fitting can come off with great force and cause serious injury or death.

W-2490-0104

Pressure must be released from the grease cylinder to decrease track tension.

Loosen the bleed fitting (NOT the grease fitting) (Item 2) [Figure 187] and release pressure until the track tension is correct.

NOTE: DO NOT loosen the bleed fitting (Item 2) [Figure 187] for more than eight turns.

Tighten the bleed fitting to 80 - 100 N•m (59 - 74 ft-lb) torque.

Pivot the access cover closed and tighten the access cover bolts.

Raise the machine and remove the jackstands.

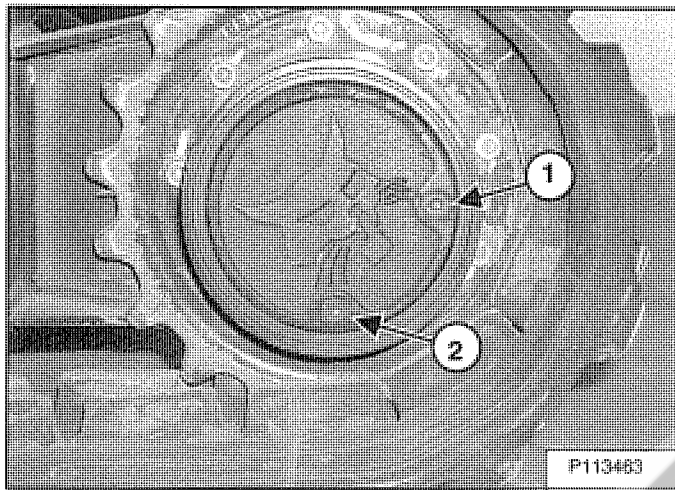
Repeat the procedure for the other side.

Dispose of grease in an environmentally safe manner.

TRAVEL MOTOR

Checking And Adding Oil

Figure 188



Park the excavator on a level surface with the plugs (Items 1 and 2) [Figure 188] in the position as shown.

Remove the plug (Item 1) [Figure 188]. The fluid level must be at the bottom edge of the hole.

Add lubricant (SAE 80W90) through the hole if the fluid level is low.

Removing And Replacing Oil

See the service schedule for the correct service interval. (See SERVICE SCHEDULE on Page 97.)

Park the excavator on a level surface with plugs (Items 1 and 2) [Figure 188] in the position shown. Remove both plugs and drain the lubricant into a container.



AVOID INJURY OR DEATH

Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire.

W-2103-0508

Install the bottom plug (Item 2) [Figure 188]. Add fluid through the center plug hole until the fluid level is at the bottom edge of the hole.

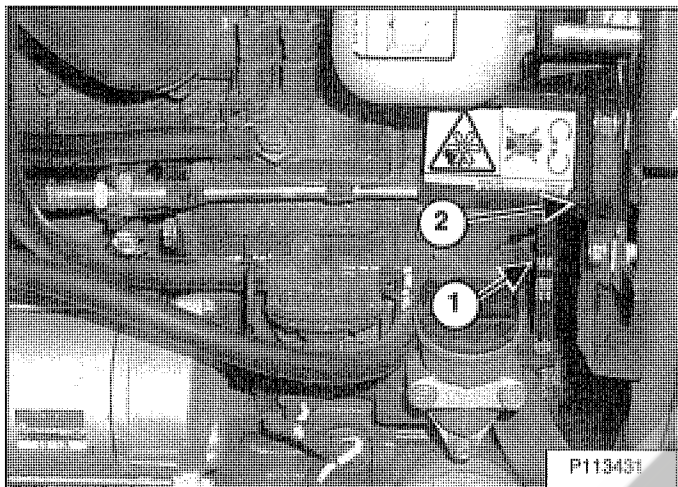
Install the plug (Item 1) [Figure 188].

ALTERNATOR AND FAN BELT

Belt Adjustment

Stop the engine and open the tailgate. (See Opening And Closing on Page 103.)

Figure 189

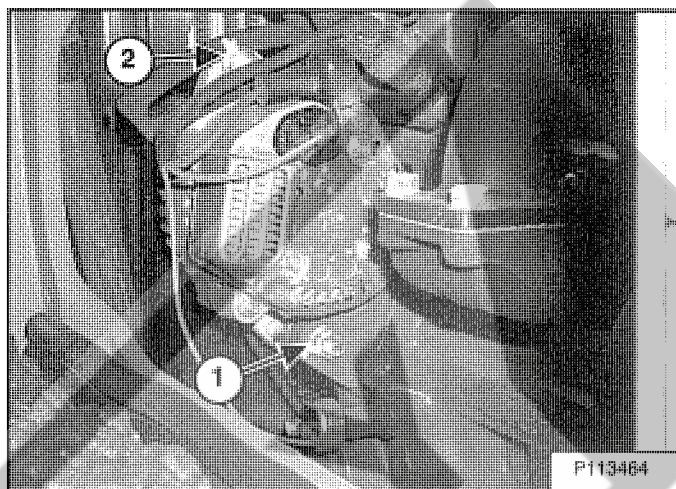


Measure the belt (Item 1) [Figure 189] tension at the middle of the belt span.

If a belt tension tool is available, move the alternator until the belt has (new belt = 272 - 292 N [61 - 65 lbf] or used belt = 233 - 252 N [53 - 57 lbf]) tension.

If a belt tension tool is not available, move the alternator until the belt has 8,0 mm (5/16 in) movement at the middle of the belt span with 66 N (15 lbf) of force.

Figure 190



NOTE: The seat is shown removed for photo clarity. The alternator adjusting bolts can be accessed by removing the belt guard (Item 2) [Figure 189] and reaching around the engine.

If the belt tension is not correct, loosen the bolt and nut (Item 1) and the bolt (Item 2) [Figure 190] until the alternator can be moved toward the engine.

Adjust belt tension to correct specifications [Figure 189].

Tighten the mounting and adjustment bolts.

Close the tailgate.

Belt Replacement

Loosen the bolt and nut (Item 1) and the bolt (Item 2) [Figure 190] until the alternator can be moved toward the engine.

Remove the old belt and install a new belt.

Adjust belt tension to correct specifications [Figure 189].

Tighten the mounting and adjustment bolts.

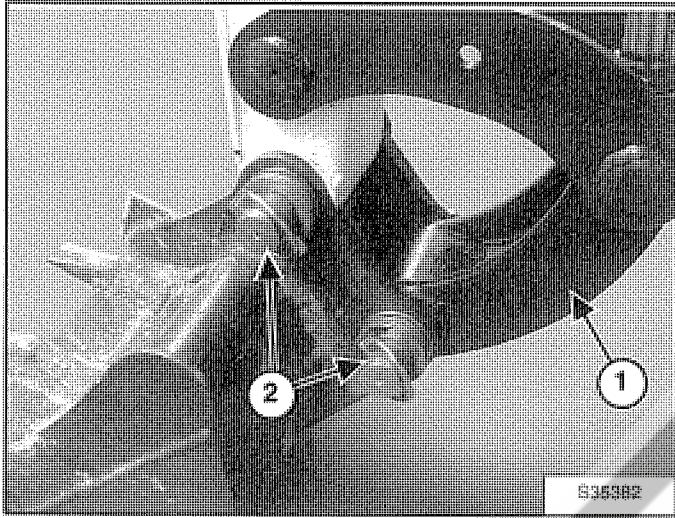
Reinstall the belt guard (Item 2) [Figure 189].

Close the tailgate.

QUICK COUPLER

Bucket Link And Attachment Inspection And Maintenance

Figure 191



Inspect the bucket link (Item 1) for wear or damage. Inspect the attachment pins (Item 2) [Figure 191] for wear or damage.

Repair or replace damaged parts.

TRACK ROLLER AND IDLER LUBRICATION

Procedure

The track rollers and idlers require no maintenance. The bearings are a sealed design.

LUBRICATION OF THE HYDRAULIC EXCAVATOR

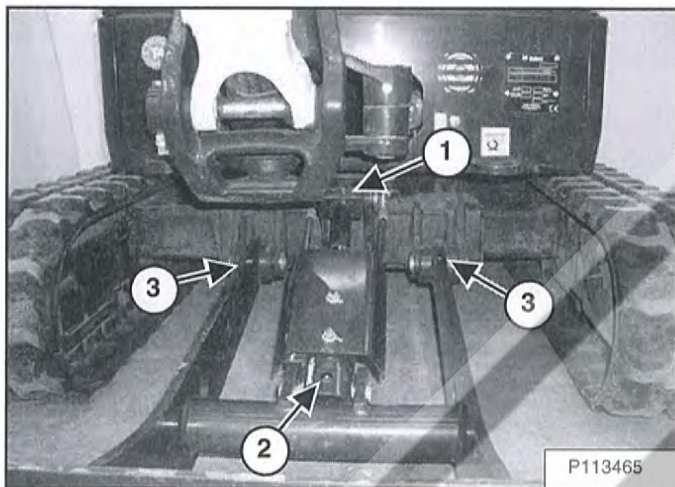
Lubrication Locations

Lubricate the excavator as specified in the service schedule for the best performance of the machine. (See SERVICE SCHEDULE on Page 97.)

Always use a good quality lithium based multipurpose grease when lubricating the machine. Apply the lubricant until extra grease shows.

Lubricate the following locations on the excavator **EVERY 8 - 10 HOURS**:

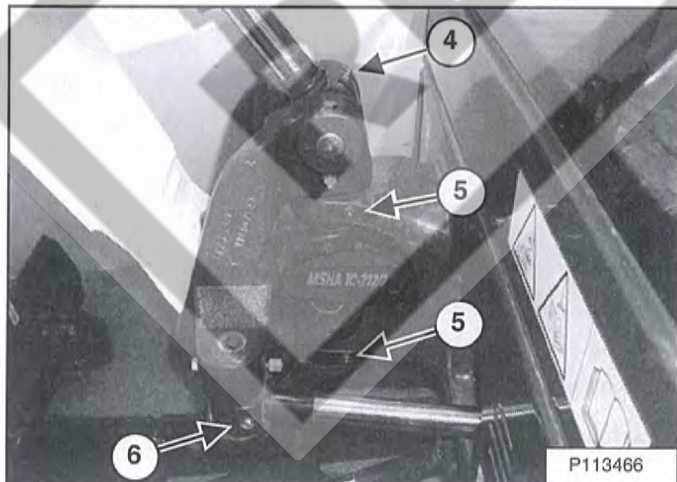
Figure 192



Ref Description (# of Fittings)

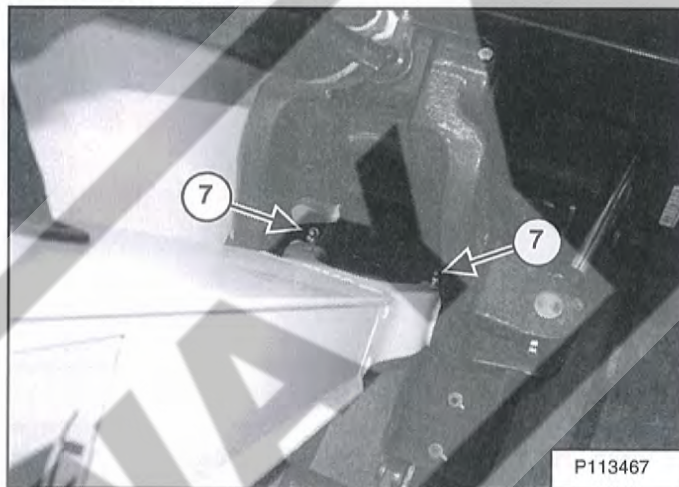
1. Blade Cylinder Rod End (1) [Figure 192]
2. Blade Cylinder Base End (1) [Figure 192]
3. Blade Pivots (2) [Figure 192]

Figure 193



4. Boom Cylinder Rod End (1) [Figure 193]
5. Boom Swing Pivot (3) [Figure 193]
6. Boom Swing Cylinder Rod End (1) [Figure 193]

Figure 194

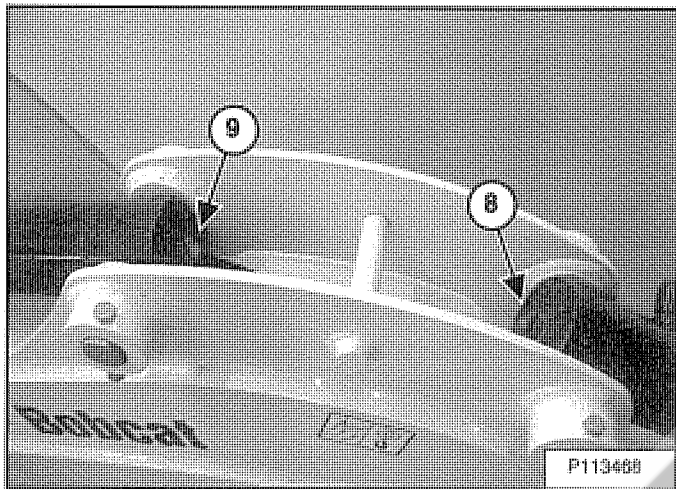


7. Boom Pivot (2) [Figure 194]

LUBRICATION OF THE HYDRAULIC EXCAVATOR (CONT'D)

Lubrication Locations (Cont'd)

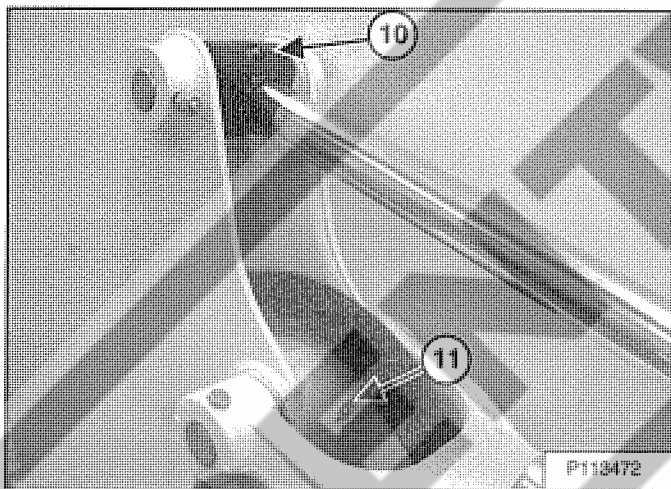
Figure 195



8. Boom Cylinder Base End (1) [Figure 195]

9. Arm Cylinder Base End (1) [Figure 195]

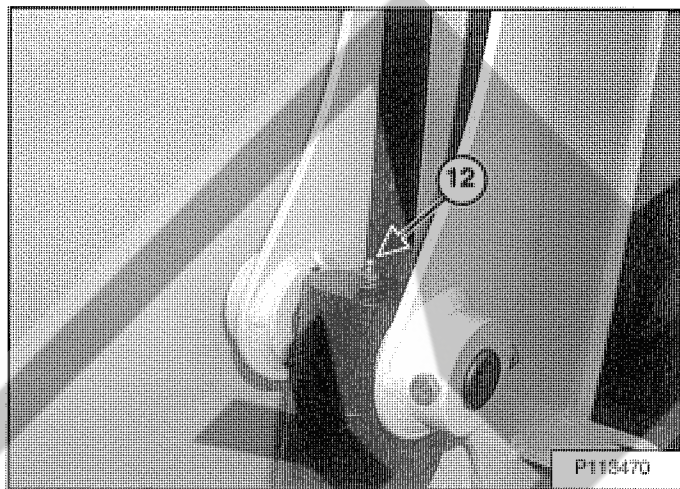
Figure 196



10. Arm Cylinder Rod End (1) [Figure 196]

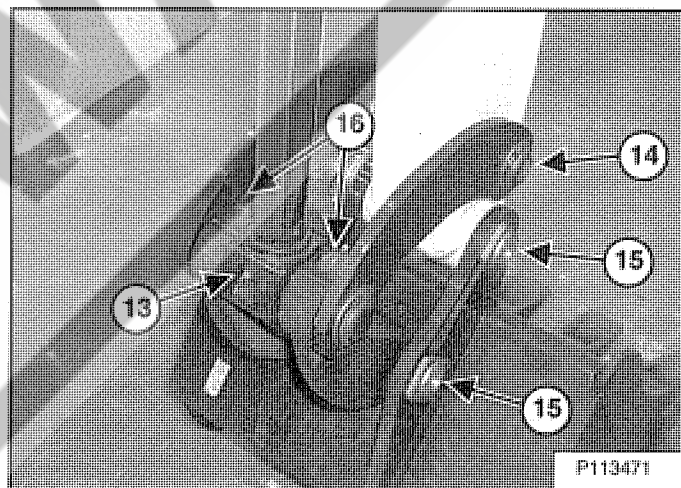
11. Arm Pivot (1) [Figure 196]

Figure 197



12. Bucket Cylinder Base End (1) [Figure 197]

Figure 198



13. Bucket Cylinder Rod End (1) [Figure 198]

14. Bucket Link Pin (1) [Figure 198]

15. Bucket Pivot (2) [Figure 198]

16. Bucket Link (2) [Figure 198]

LUBRICATION OF THE HYDRAULIC EXCAVATOR (CONT'D)

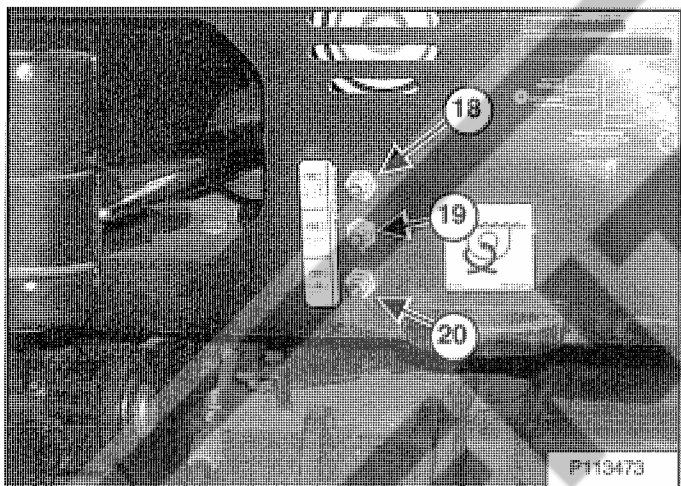
Lubrication Locations (Cont'd)

Figure 199



17. Cab Door hinges (3) [Figure 199] (If Equipped)

Figure 200



18. Boom Swing Cylinder Base (1) [Figure 200]

Lubricate the following locations on the hydraulic excavator **EVERY 50 HOURS**:

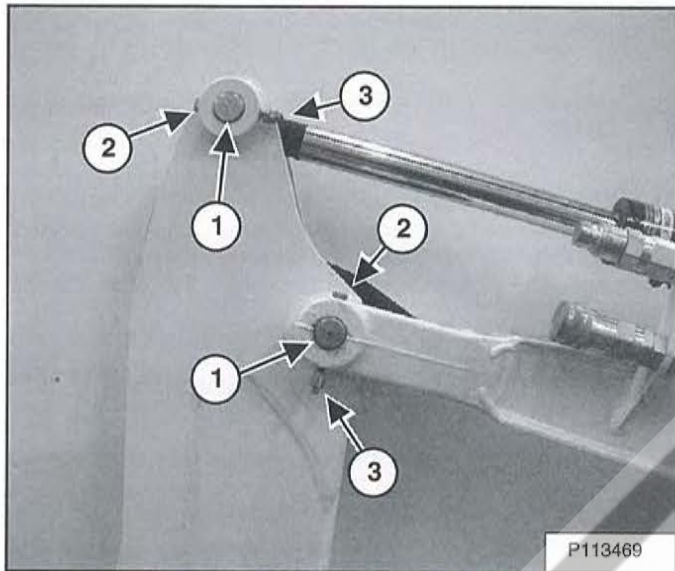
19. Slew Circle (1) [Figure 200]

20. Slew Pinion (1) [Figure 200]. (Install three to four pumps of grease then rotate the upperstructure 90°. Install three to four pumps of grease and again rotate the upperstructure 90°. Repeat this until the slew pinion has been greased at four positions.)

PIVOT PINS

Inspection And Maintenance

Figure 201



The pivots and cylinders (Item 1) have a large pin held in position with a bolt (Item 2) and double nuts (Item 3) [Figure 201] securing the pin.

The two nuts (Item 3) are used as jam nuts to hold the bolt (Item 2) without tightening the bolt (Item 2) to the pin boss. After the nuts (Item 3) are tightened together, the bolt (Item 2) [Figure 201] should be free to spin. See your Bobcat dealer for replacement parts.

EXCAVATOR STORAGE AND RETURN TO SERVICE

Storage

Sometimes it can be necessary to store your Bobcat excavator for an extend period of time. Below is a list of items to perform before storage.

- Thoroughly clean the excavator including the engine compartment.
- Lubricate the excavator.
- Replace worn or damaged parts.
- Drive the excavator onto planks in a dry protected shelter.
- Lower the boom fully with the bucket flat on the ground.
- Put grease on any exposed cylinder rods.
- Put fuel stabilizer in the fuel tank and run the engine a few minutes to circulate the stabilizer to the pump and fuel injectors.
- Drain and flush the cooling system. Refill with premixed coolant.
- Replace all fluids and filters (engine, hydraulic).
- Replace all filters (For example: air cleaner, heater, etc.).
- Put all controls in neutral position.
- Remove the battery. Be sure the electrolyte level is correct then charge the battery. Store it in a cool dry place above freezing temperatures and charge it periodically during storage.
- Cover the exhaust pipe opening.
- Tag the machine to indicate that it is in storage condition.

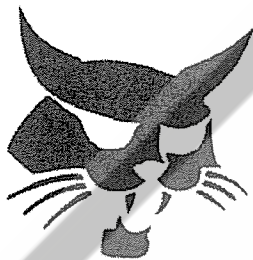
Return To Service

After the Bobcat excavator has been in storage, it is necessary to follow a list of items to return the excavator to service.

- Check the engine and hydraulic oil levels; check coolant level.
- Install a fully charged battery.
- Remove grease from exposed cylinder rods.
- Check all belt tensions.
- Be sure all shields and guards are in place.
- Lubricate the excavator.
- Remove cover from exhaust pipe opening.
- Start the engine and let run for a few minutes while observing the instrument panels and systems for correct operation.
- Drive the excavator off of the planks.
- Operate machine, check for correct function.
- Stop the engine and check for leaks. Repair as needed.

SYSTEM SETUP AND ANALYSIS

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Bobcat®

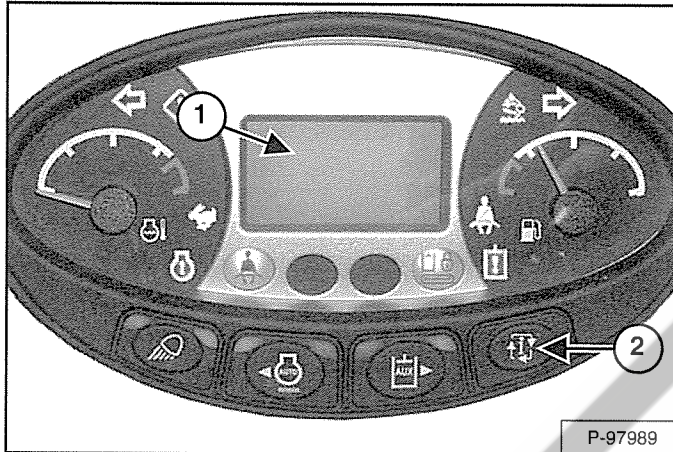
DIAGNOSTIC SERVICE CODES

Viewing Service Codes

The Service Codes will aid your dealer in diagnosing conditions that can damage your machine.

Standard Instrument Panel

Figure 202



Press the Information button (Item 2) to cycle the data display (Item 1) [Figure 202] until the service code screen is displayed. If more than one service code is present, the codes will scroll on the data display.

When no service code is present, [NONE] is displayed [Figure 202].

NOTE: Corroded or loose grounds can cause multiple service codes and / or abnormal symptoms. All instrument panel lights flashing, alarm sounding, headlights and taillights flashing, can indicate a bad ground. The same symptoms can apply if the voltage is low, such as loose or corroded battery cables. If you observe these symptoms, check grounds and positive leads first.

DIAGNOSTIC SERVICE CODES (CONT'D)

Number Codes List

CODE		CODE	
M0216	Hydraulic Filter Not Connected	M1705	Hydraulics Enable Solenoid Short to Battery
M0217	Hydraulic Filter Plugged	M1706	Hydraulics Enable Solenoid Short to Ground
		M1707	Hydraulics Enable Solenoid Open Circuit
		M1732	Hydraulics Enable Solenoid Overcurrent
M0309	Battery Voltage Low		
M0310	Battery Voltage High	M1802	Power Beyond Relay Error On
M0311	Battery Voltage Extremely High	M1803	Power Beyond Relay Error Off
M0314	Battery Voltage Extremely Low	M1807	Power Beyond Output Open Circuit
M0322	Battery Voltage Out of Range Low		
		M1902	Power Beyond Valve Relay Error On
M0610	Engine Speed High	M1903	Power Beyond Valve Relay Error Off
M0611	Engine Speed Extremely High		
M0613	Engine Speed No Signal	M2005	Two Speed Solenoid Short to Battery
M0615	Engine Speed Shutdown	M2006	Two Speed Solenoid Short to Ground
M0618	Engine Speed Out of Range	M2007	Two Speed Solenoid Open Circuit
M0810	Engine Coolant Temperature High	M2102	Glow Plug Output Error On
M0811	Engine Coolant Temperature Extremely High	M2103	Glow Plug Output Error Off
M0815	Engine Coolant Temperature Shutdown	M2107	Glow Plug Output Open Circuit
M0821	Engine Coolant Temperature Out of Range High		
M0822	Engine Coolant Temperature Out of Range Low	M2202	Starter Output Error On
		M2203	Starter Output Error Off
M0909	Fuel Level Low	M2207	Starter Output Open Circuit
M0921	Fuel Level Out of Range High	M2228	Starter Output Failure
M0922	Fuel Level Out of Range Low		
		M2302	Starter Relay Error On
M1121	Console Sensor Out of Range High	M2303	Starter Relay Error Off
M1122	Console Sensor Out of Range Low		
M1128	Console Sensor Failure	M2402	Fuel Pull Relay Error On
		M2403	Fuel Pull Relay Error Off
M1305	Fuel Hold Solenoid Short to Battery		
M1306	Fuel Hold Solenoid Short to Ground	M2521	Load Sense Sensor Out of Range High
M1307	Fuel Hold Solenoid Open Circuit	M2522	Load Sense Sensor Out of Range Low
		M2005	Two Speed Solenoid Short to Battery
M1405	Fuel Pull Solenoid Short to Battery		
M1406	Fuel Pull Solenoid Short to Ground	M2602	Glow Plug Relay Error On
M1407	Fuel Pull Solenoid Open Circuit	M2603	Glow Plug Relay Error Off
M1605	Hydraulics Bypass Solenoid Short to Battery	M3128	Interrupted Power Failure
M1606	Hydraulics Bypass Solenoid Short to Ground		
M1607	Hydraulics Bypass Solenoid Open Circuit		
M1632	Hydraulics Bypass Solenoid Overcurrent		

DIAGNOSTICS SERVICE CODE (CONT'D)

Number Codes List (Cont'd)

CODE		CODE	
M4109	Alternator Low	M6204	Load Moment Sensor In Error
M4110	Alternator High	M6221	Load Moment Sensor Out of Range High
		M6222	Load Moment Sensor Out of Range Low
M4304	Keyless Start Panel No Communication		
		M6402	Switched Power Relay Error On
M4404	Secondary Controller No Communication		
M4621	5V Sensor Supply Out of Range High	M7002	Switched Power Output Error On
M4622	5V Sensor Supply Out of Range Low	M7003	Switched Power Output Error Off
		M7007	Switched Power Output Open Circuit
M4721	8V Sensor Supply Out of Range High	M7028	Switched Power Output Failure
M4722	8V Sensor Supply Out of Range Low		
M5002	Light Output Error On	M7423	Main Controller Not Programmed
M5003	Light Output Error Off	M7497	Main Controller Software Updated
M5205	Offset Base Solenoid Short to Battery	M7604	Standard Display Panel No Communication
M5206	Offset Base Solenoid Short to Ground		
M5207	Offset Base Solenoid Open Circuit	M7748	Key Switch Multiple
M5232	Offset Base Solenoid Overcurrent		
		M7839	Hourmeter Changed
M5305	Offset Rod Solenoid Error On		
M5306	Offset Rod Solenoid Short to Ground		
M5307	Offset Rod Solenoid Open Circuit		
M5332	Offset Rod Solenoid Overcurrent		
		R7404	No Communication To Main Controller
M5421	Offset Control Switch Out of Range High		
M5422	Offset Control Switch Out of Range Low		
M5424	Offset Control Switch Out of Neutral		
M5505	Auxiliary Base Solenoid Short to Battery		
M5506	Auxiliary Base Solenoid Short to Ground		
M5507	Auxiliary Base Solenoid Open Circuit		
M5532	Auxiliary Base Solenoid Overcurrent		
M5605	Auxiliary Rod Solenoid Short to Battery		
M5606	Auxiliary Rod Solenoid Short to Ground		
M5607	Auxiliary Rod Solenoid Open Circuit		
M5632	Auxiliary Rod Solenoid Overcurrent		
M5721	Auxiliary Control Switch Out of Range High		
M5722	Auxiliary Control Switch Out of Range Low		
M5724	Auxiliary Control Switch Out of Neutral		

PASSWORD SETUP (KEYLESS START PANEL)

Password Description

Master Password:

A permanent, randomly selected password set at the factory that cannot be changed. This password is used for service by the Bobcat dealer if the owner password is not known or to change the owner password.

Owner Password:

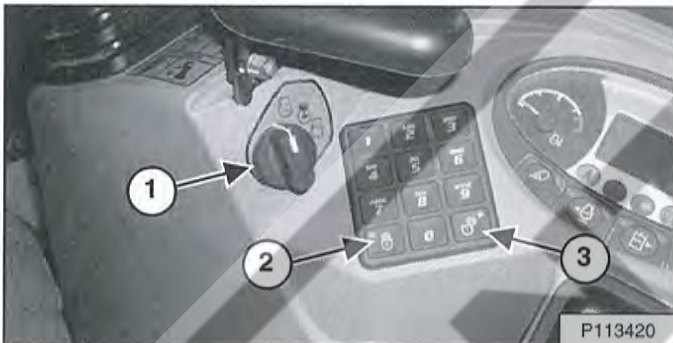
Allows for full use of the excavator. Must be used to change the owner password.

Changing The Owner Password

Turn the start switch (Item 1) [Figure 203] to the ON position to turn on the excavators electrical system.

Enter the five digit owner password using the number keys (1 through 0) if locked.

Figure 203



Press and hold the lock (Item 2) and unlock (Item 3) [Figure 203] keys for 2 seconds.

The lock key red light will flash and the instrument panel display screen will show [ENTER].

Enter a new five digit owner password using the number keys (1 through 0). An asterisk will show in the left panel display screen for each key press.

The instrument panel display screen will show [AGAIN].

Enter the new five digit owner password again.

The lock key red light will become solid.

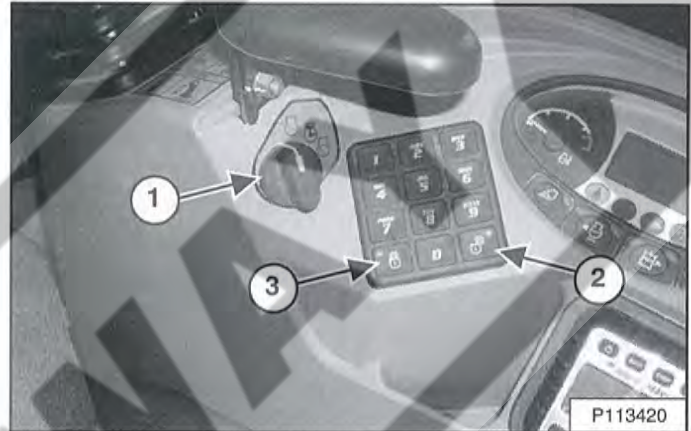
Password Lockout Feature

This feature allows the owner to unlock the password feature so that a password does not need to be used every time the engine is started.

Turn the start switch (Item 1) [Figure 204] to the ON position to turn on the excavators electrical system.

Enter the five digit owner password using the number keys (1 through 0).

Figure 204



Press the unlock key (Item 2) [Figure 204].

The left panel display screen will show [CODE].

Enter the five digit owner password using the number keys (1 through 0). The unlock key green light will flash, then become solid.

The excavator can now be started without using a password.

NOTE: Use the following procedure to reset the machine lock so that the excavator requires a password to start the engine.

Turn the start switch to the ON position to turn on the excavators electrical system.

Press the lock key (Item 3) [Figure 204].

The lock key red light will flash and the left panel display screen will show [CODE].

Enter the five digit owner password using the number keys (1 through 0). The unlock key green light will flash, then the lock key red light will become solid.

You must now enter the password every time to start the excavator.

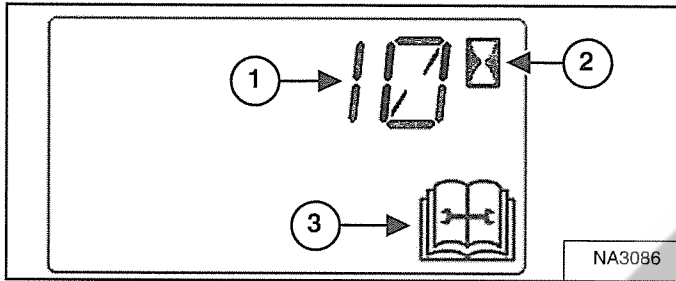
MAINTENANCE CLOCK

Description

The Maintenance Clock alerts the operator when the next service interval is due. *EXAMPLE:* The maintenance clock can be set to a 500 hour interval as a reminder for the next 500 hour planned maintenance.

Standard Instrument Panel

Figure 205



During machine operation, a 2 beep alarm will sound when there are less than 10 hours until the next planned maintenance.

The remaining hours before maintenance is required (Item 1) will appear in the data display for 5 seconds while the service icon (Item 3) and the hourmeter icon (Item 2) [Figure 205] flash.

NOTE: The display will show negative numbers after counting down to zero.

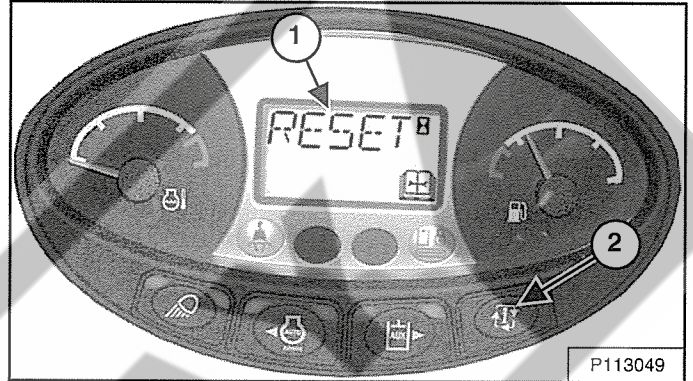
The display will revert to the previous display and will appear for 5 seconds every time the machine is started until the maintenance clock is reset.

Setup

See your Bobcat dealer about installation of this feature.

Reset

Figure 206



Press the Information button (Item 2) [Figure 206] until the display screen shows the maintenance clock.

Press and hold the Information button (Item 2) for 7 seconds until [RESET] (Item 1) [Figure 206] appears in the display screen.



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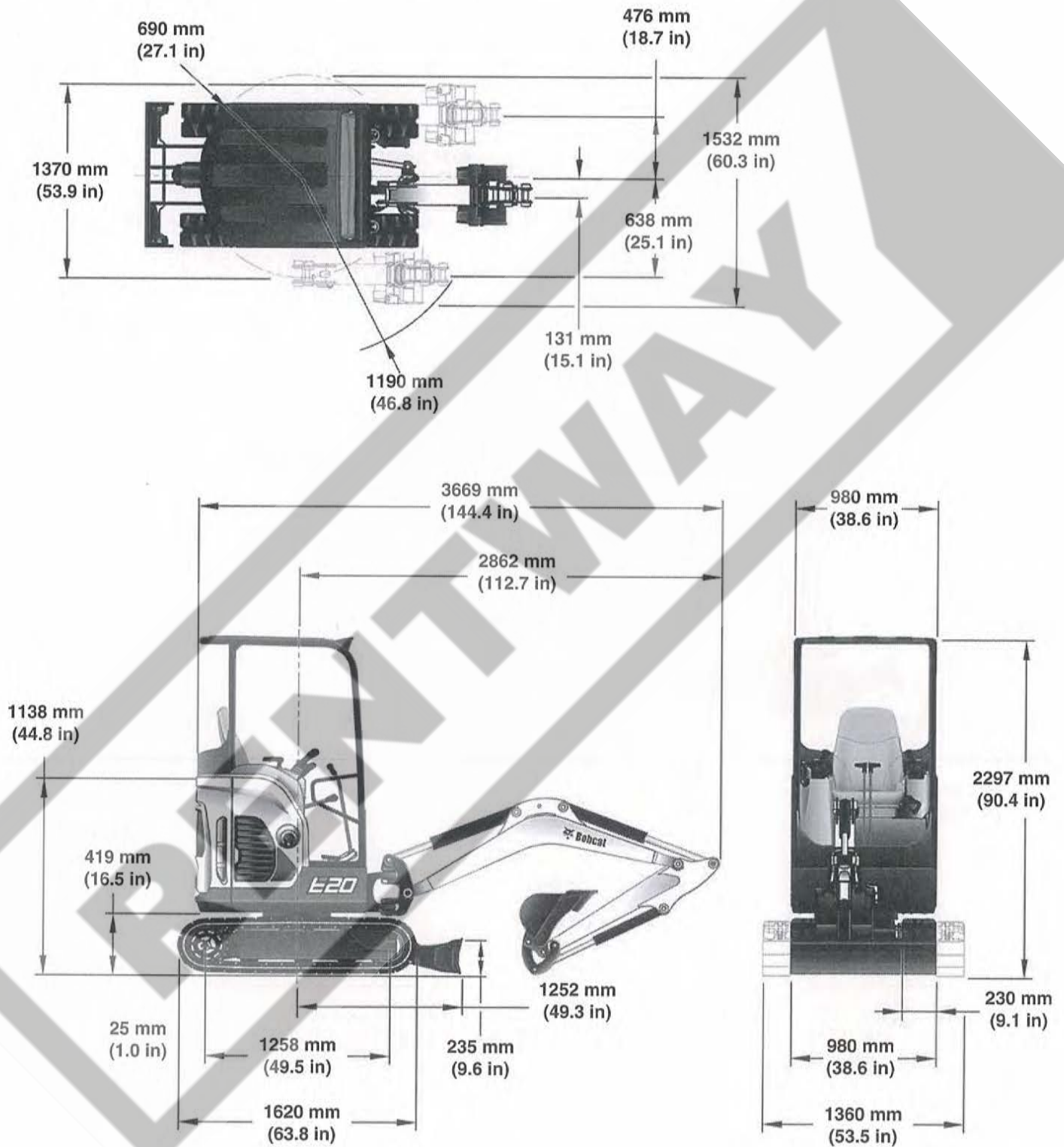


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EXCAVATOR SPECIFICATIONS

Machine Dimensions

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.

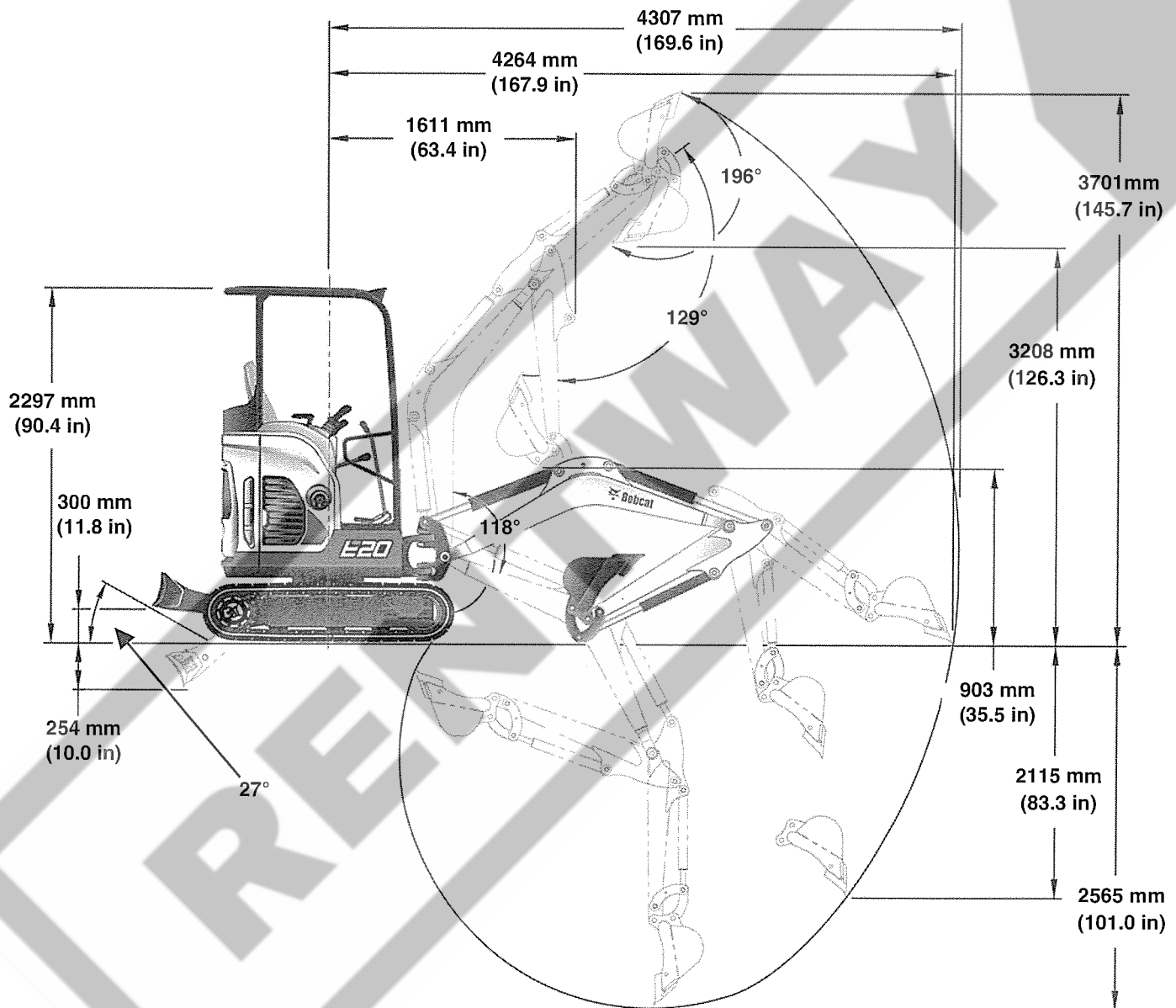


NA9376

EXCAVATOR SPECIFICATIONS (CONT'D)

Machine Dimensions (Cont'd)

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



NA9376

EXCAVATOR SPECIFICATIONS (CONT'D)

Performance

Operating weight (canopy w/ rubber tracks, counterweight, basic seat and standard bucket)	1953 kg (4306 lb)
If equipped with the following, add:	Cab w/ Heater, add 81 kg (178 lb); Standard Seat, add 8 kg (18 lb) Suspension Seat, add 14 kg (30 lb)
Maximum Approved Attachment Weight	300 kg (661 lb)
Travel Speed (Low / High)	2,5 km/h / 4,0 km/h (1.5 mph / 2.5 mph)
Digging Force (per ISO 6015)	
With Long Arm	Arm - 9279 N (2086 lb) Bucket - 20835 N (4684 lb)

Controls

Steering	Two hand levers (optional foot pedals)
Hydraulics	Two hand operated levers (joysticks) control boom, bucket, arm and upperstructure slew
Blade	Hand lever
Two Speed	Switch on blade lever
Boom Swing	Electric switch in left joystick or R.H. foot pedal
Auxiliary Hydraulics	Electric switch in right joystick or L.H. foot pedal
Auxiliary Pressure Release	Electric switch in right joystick or L.H. foot pedal
Engine	Engine speed control lever, key type start switch
Starting Aid	Glow Plugs - activated by key switch
Brakes	
Travel	
Service and Parking	Hydraulic lock in motor circuit
Slew	
Service	Hydraulic lock on motor
Holding	Spring applied - hydraulic release

EXCAVATOR SPECIFICATIONS (CONT'D)

Engine

Make / Model	Kubota D722-E4B-BCZ-7 Tier 4
Fuel / Cooling	Diesel NO.2-D / Liquid
Horsepower (SAE Net) @ 2500 rpm	9,9 kW (13,3 hp)
Torque @ 2000 rpm (SAE)	42,3 N•m (31.9 ft-lb)
Number Of Cylinders	3
Displacement	0,719 L (43.9 in³)
Bore / Stroke	67 x 68 mm (2.64 x 2.68 in)
Lubrication	Forced Lubrication / Cartridge type
Crankcase Ventilation	Closed breathing
Air Cleaner	Dual dry replacement paper elements
Ignition	Diesel-Compression
Low Idle Speed	1200 ± 50 rpm
High Idle Speed	2650 ± 20 rpm
Engine Coolant	Propylene Glycol / water mixture (53% PG / 47% water)

Hydraulic System

Pump Type	Engine driven, dual outlet, variable displacement, load sensing, torque limited, piston pump with gear pump
Pump Capacity Piston Pump Gear Pump	2 x 15 L/min (2 x 4.0 U.S. gpm) 11,3 L/min (3.0 U.S. gpm)
Auxiliary Flow Standard Flow	30,0 L/min (7.9 U.S. gpm)
Hydraulic Filter	Full flow replaceable, 3 micron synthetic media element
Control Valve	9 spool, parallel series type, open center.
System Relief Pressure Blade	20600 kPa (206 bar) (2987 psi)
Slew Relief Pressure	13700 kPa (137 bar) (1987 psi)
Boom Swing, Boom Arm, Bucket, and Travel	23097 kPa (231 bar) (3350 psi)
Joystick Control Pressure	3103 kPa (31 bar) (450 psi)
Auxiliary Relief	17995 kPa (180 bar) (2610 psi)
Arm Port Relief Base And Rod End	24994 kPa (250 bar) (3625 psi)
Boom Port Relief Base End, Boom Port Relief Rod End	21000 kPa (210 bar) (3046 psi) 24994 kPa (250 bar) (3625 psi)
Bucket Port Relief Base And Rod End	24994 kPa (250 bar) (3625 psi)
Blade Port Relief Base End and Track Expansion Port Relief Base End	29000 kPa (290 bar) (4206 psi)
Main Hydraulic Filter Bypass	345 kPa (3,4 bar) (50 psi)

EXCAVATOR SPECIFICATIONS (CONT'D)

Hydraulic Cylinders

Cylinder	Bore	Rod	Stroke
Boom (cushion up)	69,9 mm (2.75 in)	41,3 mm (1.63 in)	445,0 mm (17.5 in)
Arm (cushion retract / extend)	60,3 mm (2.375 in)	38,1 mm (1.50 in)	424,9 mm (16.75 in)
Bucket	57,1 mm (2.25 in)	31,8 mm (1.50 in)	385,0 mm (15.16 in)
Boom Swing	60,3 mm (2.375 in)	31,8 mm (1.25 in)	411,2 mm (16.19 in)
Blade	63,5mm (2.5 in)	34,9 mm (1.375 in)	107,9 mm (4.25 in)
Track Expansion	44,5mm (1.75 in)	25,4 mm (1.00 in)	385,0 mm (15.16 in)

Hydraulic Cycle Times

Bucket Curl	2,00 seconds
Bucket Dump	1,20 seconds
Arm Retract	2,40 seconds
Arm Extend	2,00 seconds
Boom Raise	4,40 seconds
Boom Lower	3,80 seconds
Boom Swing Left (80°)	2,90 seconds
Boom Swing Right (60°)	3,60 seconds
Blade Raise	2,60 seconds
Blade Lower	2,60 seconds
Track Expand	4,10 seconds
Track Retract	3,50 seconds

Electrical

Starting Aid	Glow Plugs
Alternator	12 volt, 40 Amp open frame w/ internal regulator
Battery	12 volt - 530 CCA @ -18°C (0°F)
Starter	12 volt; gear reduction 1,4 kW (1.4 hp)
Instrumentation	Fuel gauge, audible alarm, visual warning for engine functions and hourmeter
Lights	
Work Lights	65 watt (2)
Boom Light (If Equipped)	35 watt

Drive System

Final Drive	Each track is driven by hydrostatic axial piston motor
Drive Reduction	30,36:1 two stage planetary
Gradeability	30*
Brakes	Hydraulic lock on motor

EXCAVATOR SPECIFICATIONS (CONT'D)

Slew System

Slew Drive	Orbital motor, direct drive
Slew Circle	Single row shear type ball bearings with internal gear
Gear Reduction	21.5:1
Brake	Spring applied, pressure released
Slew Speed	8,4 rpm

Undercarriage

Crawler Track Design	Sealed track rollers with boxed section track roller frame, grease type track adjuster with shock absorbing recoil spring
Width of crawler - Retracted	980 mm (38.6 in)
Width of crawler - Expanded	1360 mm (53.5 in)

Capacities

Fuel Tank	19,0 L (5.0 U.S. gal)
Hydraulic Reservoir Only (Center of Sight Glass)	Tank Cap. 14,3 L (3.78 U.S. gal)
Hydraulic System (with Reservoir)	19,0 L (5.0 U.S. gal)
Cooling System	3,3 L (0.87 U.S. gal)
Engine Oil and Filter	3,3 L (3.5 qt)
Final Drive (each)	0,4 L (0.11 qt)

Tracks

Type	Rubber
Width	230 mm (9.0 in)
Number Of Shoes	Single Assembly
Number of Track Rollers (per side)	3

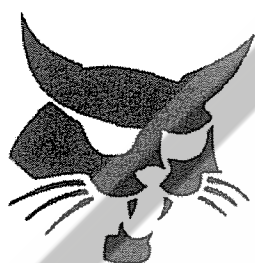
Ground Pressure

Rubber Tracks	30,1 kPa (0,301 bar) (4.36 psi)
---------------	---------------------------------

WARRANTY

WARRANTY155

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WARRANTY

Bobcat Excavators

Bobcat Company warrants to its authorized dealers and authorized dealers of Bobcat Equipment Ltd., who in turn warrant to the owner, that each new Bobcat Excavator will be free from proven defects in material and workmanship with respect to (i) all components of the product except as otherwise specified herein for twelve (12) months, (ii) tracks for twelve (12) months on a prorated basis based on the remaining depth of the track at the time any defect is discovered, and (iii) Bobcat brand batteries, for an additional twelve (12) months after the initial twelve month warranty period, provided that Bobcat Company shall only reimburse a fixed portion of the cost of replacing the battery during such additional twelve months. The foregoing time periods shall all commence after delivery by the authorized Bobcat dealer to the original buyer.

During the warranty period, the authorized Bobcat dealer shall repair or replace, at Bobcat Company's option, without charge for parts and labor, any part of the Bobcat product except as otherwise specified herein which fails because of defects in material or workmanship. The owner shall provide the authorized Bobcat dealer with prompt written notice of the defect and allow reasonable time for repair or replacement. Bobcat Company may, at its option, require failed parts to be returned to the factory. Travel time of mechanics and transportation of the Bobcat product to the authorized Bobcat dealer for warranty work are the responsibility of the owner. The remedies provided in this warranty are exclusive.

This warranty does not apply to diesel engine fuel injection pumps and injectors. The owner shall rely solely on the warranty, if any, of the respective manufacturers thereof. This warranty does not cover replacement of scheduled service items such as oil, filters, tune-up parts, and other high-wear items. This warranty does not cover damages resulting from abuse, accidents, alterations, use of the Bobcat product with any accessory or attachment not approved by Bobcat Company, air flow obstructions, or failure to maintain or use the Bobcat product according to the instructions applicable to it.

THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES AND CONDITIONS, EXCEPT THE WARRANTY OF TITLE. BOBCAT COMPANY DISCLAIMS ALL OTHER WARRANTIES AND CONDITIONS, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL BOBCAT COMPANY OR THE AUTHORIZED BOBCAT DEALER BE LIABLE FOR ANY SPECIAL, INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES, WHATSOEVER, INCLUDING, BUT NOT LIMITED TO, LOSS OR INTERRUPTION OF BUSINESS, LOST PROFITS, OR LOSS OF MACHINE USE, WHETHER BASED ON CONTRACT, WARRANTY, TORT, NEGLIGENCE, STRICT LIABILITY, STATUTE OR OTHERWISE, EVEN IF BOBCAT COMPANY OR THE AUTHORIZED BOBCAT DEALER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. THE TOTAL LIABILITY OF BOBCAT COMPANY AND THE AUTHORIZED BOBCAT DEALERS WITH RESPECT TO THE PRODUCT AND SERVICES FURNISHED HEREUNDER SHALL NOT EXCEED THE PURCHASE PRICE OF THE PRODUCT UPON WHICH SUCH LIABILITY IS BASED.

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WARRANTY (CONT'D)

In this emissions limited warranty, the term "Manufacturer" means Kubota Corporation as the holder of the U.S. Environmental Protection Agency (U.S. EPA) Certificate of Conformity and California Executive Order for the vehicle. The emission control limited warranty is in addition to the standard limited warranty for your vehicle.

Your Bobcat dealer is authorized to perform all warranty and service repairs on your diesel engine. To locate a Bobcat dealer, visit www.bobcat.com or call 1-800-743-4340.

KUBOTA Corporation FEDERAL & CALIFORNIA EMISSION CONTROL SYSTEMS LIMITED WARRANTY for NON-ROAD ENGINES (CI)

The U.S. Environmental Protection Agency (EPA), the California Air Resources Board (CARB), and KUBOTA Corporation are pleased to explain the Federal and California Emission Control System Warranty on your non-road engine. In California, new heavy duty off-road engines must be designed, built and equipped to meet California's stringent anti-smog standards adopted by the Air Resources Board pursuant to its authority in Chapter 1 and 2, Part 5, Division 26 of the California Health and Safety Code. In other states of the U.S.A., new non-road engines subject to the provisions of 40 CFR 1039 subpart A must be designed, built and equipped, at the time of sale, to meet the U.S. EPA regulations for nonroad engines.

KUBOTA must warrant the emission control system on your Compression Ignition engine for the period of time listed below provided there has been no abuse, vandalism, neglect, improper maintenance or unapproved modifications to your engine. This emission warranty is applicable in all states of the U.S.A., its provinces and territories regardless of whether an individual state, province, or territory has enacted warranty provisions that differ from the Federal warranty provisions. This emission warranty is also applicable in all provinces and territories of CANADA.

Your emission control system may include parts such as the fuel injection system and the air induction system. Also included may be hoses, belts, connectors and other emission-related assemblies.

Where a warrantable condition exists, KUBOTA will repair your engine at no cost to you, including diagnosis (if the diagnostic work is performed at an authorized dealer), parts and labor.

EMISSION DESIGN AND DEFECT WARRANTY COVERAGE

The emissions warranty period for the engine begins on the original date of sale to the initial purchaser and continues for each subsequent purchaser for the period mentioned below.

The emissions warranty period for all engines rated under 19kW (25Hp) is 2000 hours of operation or two (2) years of use, whichever first occurs.

The emissions warranty period for constant speed engines rated under 37kW (50Hp) with rated speeds greater than or equal to 3000 rpm is 2000 hours of operation or two (2) years of use, whichever first occurs.

The emissions warranty period for all other engines not already listed is 3000 hours of operation or five (5) years of use, whichever first occurs.

If any emission related part on your engine is defective, the part will be repaired or replaced by KUBOTA free of charge.

OWNER'S WARRANTY RESPONSIBILITIES

(a) As the engine owner, you are responsible for the performance of the required maintenance listed in your KUBOTA operator's manual. KUBOTA recommends that you retain all receipts covering maintenance on your engine, but KUBOTA cannot deny a warranty claim solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.

(b) As the engine owner, you should be aware, however, that KUBOTA may deny your warranty coverage if your engine or a part has failed due to abuse, vandalism, neglect, improper maintenance or unapproved modifications.

(c) Your engine is designed to operate on Ultra Low Sulfur Diesel Fuel only. Use of any other fuel may result in your engine no longer operating in compliance with Federal or California's emissions requirements.

(d) You are responsible for presenting your engine to the nearest dealer or service station authorized by KUBOTA when a problem exists. The warranty repairs should be completed in a reasonable amount of time, not to exceed 30 days.

(e) If you have any questions regarding your warranty rights and responsibilities or the location of the nearest authorized dealer or distributor, you should contact: KUBOTA ENGINE AMERICA CORPORATION, Service department at 1-800-532-9808, EEWRI@kubotaengine.com or KUBOTA TRACTOR CORPORATION, National Service Department at 1-800-558-2682, KubotaEmissionsWarranty@kubota.com or KUBOTA CANADA LTD at (905) 294-7477.

COVERAGE

KUBOTA warrants to the initial purchaser and each subsequent purchaser that your engine will be designed, built and equipped, at the time of sale, to meet all applicable regulations. KUBOTA also warrants to the initial purchaser and each subsequent purchaser that your engine shall be free from defects in materials and workmanship which cause the engine to fail to conform to applicable regulations for the period mentioned above from the original date of sale.

KUBOTA shall remedy warranty defects at any authorized KUBOTA engine dealer or warranty station. Any authorized work done at an authorized dealer or warranty station shall be free of charge to the owner if such work determines that a warranted part is defective. Any KUBOTA approved or equivalent replacement part (including any KUBOTA approved aftermarket part) may be used for any warranty maintenance or repairs on emission related parts, and must be provided free of charge to the owner if the part is still under warranty.

KUBOTA is liable for damages to other engine components caused by the failure of a warranted part still under warranty. The use of replacement parts not equivalent to the original parts may impair the effectiveness of your engine emission control system. If such a replacement part is used in the repair or maintenance of your engine, and KUBOTA determines it is defective or causes a failure of a warranted part, your claim for repair of your engine may be denied.

Listed below are the parts covered by the Federal and California Emission Control Systems Warranty. Some parts listed below may require scheduled maintenance and are warranted up to the first scheduled replacement point for that part. The warranted parts are (if applicable):

- | | | |
|--|---------------------------------------|---|
| 1) Air-Induction System | 4) Electronic Control System | 6) Particulate Controls |
| a) Intake Manifold | a) ECU | a) Any device used to capture particulate emissions. |
| b) Turbocharger System | b) Engine Speed / Timing Sensor | b) Any device used in the regeneration of the particulate control device. |
| c) Charge Air Cooling System (Intercooler) | c) Accelerator Position Sensor | c) Control Device Enclosures and Manifolding |
| 2) Catalyst or Thermal Reactor System | d) Coolant Temperature Sensor | d) Diesel Particulate Filter Temperature Sensor |
| a) Catalytic converter | e) Atmospheric Pressure Sensor | e) Differential Pressure Sensor |
| b) Exhaust manifold | f) Intake Pressure Sensor | 7) Miscellaneous Items |
| 3) Fuel Injection System | g) Intake Manifold Temperature Sensor | a) Closed Breather System |
| a) Fuel Supply Pump | h) Intake Air Flow Sensor | b) Hoses*, Clamps*, Fittings, Tubing* |
| b) Injector | i) Common Rail Pressure Sensor | c) Gaskets, Seals |
| c) Injection Pipe | 5) Exhaust Gas Recirculation System | d) Kubota supplied engine Wiring Harnesses |
| d) Common Rail | a) EGR Valve | e) Kubota supplied engine Elec. Connectors |
| e) Smoke Puff Limiter | b) EGR Cooler | f) Air Cleaner Element*, Fuel Filter Element* |
| f) Speed Timer | c) EGR Valve Opening Rate Sensor | g) Emission Control Information Labels |
| g) Cold Advance Timer | | |
| h) Injection Pump | | |

*Warranty period is equivalent to manufacturer's recommended first replacement interval as stated in the applicable model's operator's manual and/or service (workshop) manual.

MAINTENANCE REQUIREMENTS

The owner is responsible for the performance of the required maintenance as defined by KUBOTA in the operator's manual.

LIMITATIONS

This Emission Control System Warranty shall not cover any of the following:

(a) Repair or replacement required because of misuse or neglect, improper maintenance, repairs improperly performed or replacements not conforming to KUBOTA specifications that adversely affect performance and/or durability, and alteration or modifications not recommended or approved in writing by KUBOTA.

(b) Replacement of parts and other services and adjustments necessary for required maintenance at and after the first scheduled replacement point.

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COMPACT EXCAVATOR

www.aem.org



SAFETY MANUAL

FOR OPERATING AND MAINTENANCE PERSONNEL



FORM CESE-1009
Printed in U.S.A.

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Acknowledgment

We wish to acknowledge the contributions of the members of AEM's Compact Loader/Compact Excavator Council to the preparation of this Safety Manual.

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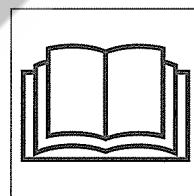
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Revised 05/03, 09/10

Foreword

This safety manual is intended to point out some of the basic safety situations that may be encountered during the normal operation and maintenance of the machine and to suggest possible ways of dealing with these conditions. This manual is **NOT** a substitute for the compact excavator manufacturer's operator manual(s).

Additional precautions may be necessary, or some instructions may not apply, depending on equipment, attachments and conditions at the worksite or in the service area. The manufacturer has no direct control over equipment application, operation, inspection or maintenance. Therefore, it is **YOUR** responsibility to use safe work practices in these areas.

The information provided in this manual supplements the specific information about the machine that is contained in the manufacturer's manual(s). Other information that may affect the safe operation of the machine may be contained on safety signs or in insurance requirements, employer's safety and training programs, safety codes, local, state/provincial and federal laws, rules and regulations.



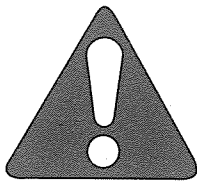
IMPORTANT! Before you operate the compact excavator, make sure you have the manufacturer's manual(s) for this machine and all attachments. If the manufacturer's manuals are missing, obtain replacement manuals from your employer, equipment dealer or directly from the manufacturer. Keep this safety manual and the manufacturer's manuals with the machine at all times. Read and understand all manuals.

Safety videos and other training resources are available from some manufacturers. Operators are encouraged to periodically review the safety video.

Safety Alerts

Symbol

This Safety Alert Symbol means: **“ATTENTION! STAY ALERT! YOUR SAFETY IS INVOLVED!”**



The Safety Alert Symbol identifies important safety messages on equipment, safety signs, in manuals or elsewhere. When you see this symbol, be alert to the possibility of death or personal injury. Carefully read the message that follows and inform other operators. Follow instructions in the safety message.

Signal Words

Signal words are distinctive words that will typically be found on safety signs on the compact excavator and other worksite equipment. These words may also be found in this manual and the manufacturer's manuals. These words are intended to alert the operator to a hazard and the degree of severity of the hazard.



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



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

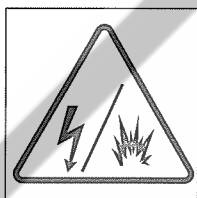


CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

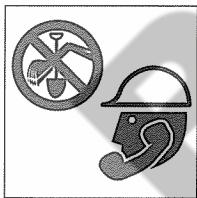


NOTICE indicates a property damage message.

One-Call First



Call Before You Dig
Dial 811 (USA only)



888-258-0808
(USA and Canada)

Call

Before starting any digging project, contact the local One-Call service by dialing 811 (USA only) to have underground utilities located. A One-Call referral number, **1-888-258-0808**, is also available for both USA and Canada.

One-Call will notify participating utility companies that you intend to dig. You must also call utility companies that do not participate in the One-Call service.

Always inspect the jobsite for evidence of unmarked utilities and contact others if necessary.

Plan The Work

Be aware of the lead time for marking the work area. This time may vary from state to state and county to county. If you do not locate utilities, you may have an accident or suffer injuries, cause service interruptions, damage the environment or experience job delays.

Dig

Most utilities mark their underground facilities using American Public Works Association (APWA) underground color codes. Verify marks before digging.

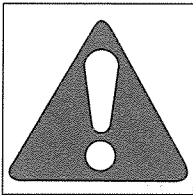
In the United States, OSHA Standard 29 CFR 1926.651 requires that the estimated location of underground utilities be determined before beginning an excavation. When actual excavation approaches an estimated utility location, the exact location of the underground installation must be determined by a safe, acceptable and dependable method. Other OSHA regulations may also apply to the jobsite.

A Word To The User/Operator

It is **YOUR** responsibility to read and understand the safety manual and the manufacturer's manuals before operating this machine. This safety manual takes you step by step through the working day.

Graphics have been provided to help you understand the text.

IMPORTANT: This manual covers safe practices for Compact Excavators. If the machine is equipped with special attachments, read the manufacturer's operator and safety manuals pertaining to those attachments before using them.



Remember that **YOU** are the key to safety. Good safety practices not only protect you but also protect the people around you. Study this manual and the manufacturer's manuals for the specific machine. Make them a working part of your safety program. Keep in mind that this safety manual is written only for compact excavators.

Contact the manufacturer of the equipment to answer any questions about safe operation that remain after studying the manufacturer's manual(s) and this safety manual.

Practice all other usual and customary safe working precautions and remember:

SAFE OPERATION IS UP TO YOU!

YOU CAN PREVENT DEATH OR SERIOUS INJURY CAUSED BY UNSAFE WORK PRACTICES!

Follow A Safety Program

Be Alert!

Know where to get assistance. Know where to find and how to use a first aid kit and fire extinguisher/fire suppression system.

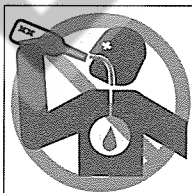
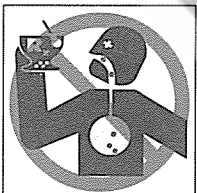
Be Aware!

Take advantage of training programs offered.

Be Careful!

Human error is caused by many factors: carelessness, fatigue, overload, preoccupation, unfamiliarity of the operator with the machine or attachment, drugs, and alcohol to name a few. You can prevent death or serious injury caused by unsafe work practices.

For your safety and the safety of others, encourage fellow workers to act safely.



For Safe Operation

You must be a qualified and authorized operator for safe operation of this machine. You must clearly understand the written instructions supplied by the manufacturer, be trained—including actual operation of the compact excavator—and know the safety rules and regulations for the worksite. It is a good safety practice to point out and explain safety signs and practices and ensure others understand the importance of following these instructions.

WARNING! Drugs and alcohol affect an operator's alertness and coordination and the operator's ability to safely operate the equipment. **Never operate the compact excavator while impaired by use of alcohol or drugs. Never knowingly allow the operation of this machine when operator alertness or coordination is impaired.** An operator taking prescription or over-the-counter medication must consult a medical professional regarding any side effects of the medication that would hinder the ability to safely operate this equipment.

Follow A Safety Program

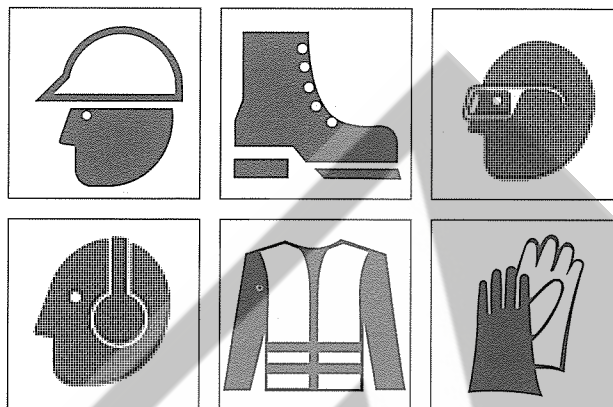
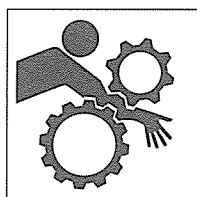
Protect Yourself

Wear personal protective clothing and Personal Protective Equipment (PPE) issued to you or called for by job conditions.

You may need:

- Hard hat
- Safety boots with non-slip soles
- Safety glasses, goggles or face shield
- Heavy-duty gloves
- Hearing protection
- Reflective or high-visibility clothing
- Wet weather gear
- Respirator or filter mask

Wear whatever is needed to protect yourself—do not take chances.



WARNING! Prevent death or serious injury from entanglement. **Do not wear loose clothing or accessories. Restrain long hair. Stay away from all rotating components when the engine is running.** Contact, wrapping or entanglement with rotating or moving parts could result in death or serious injury.

Follow A Safety Program

Know The Rules

Most employers have rules governing operation and maintenance of equipment. Before you start work at a new location, check with your supervisor or the safety coordinator. Ask about the rules you will be expected to obey.

The Occupational Safety and Health Administration (OSHA) enforces federal laws within the United States that apply to the safe operation, application and maintenance of equipment on a worksite. It is the employer's responsibility to comply with these laws. A federal representative may periodically inspect a worksite to see that these laws are being followed.

There may also be local, state/provincial, federal laws or international regulations that apply to this equipment and its use, along with specific worksite or employer rules. It is important that you know and comply with all applicable laws and rules, including those requiring operator training and certification.

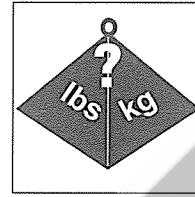
Safety Rules	
• _____	• _____
• _____	• _____
• _____	• _____
• _____	• _____
• _____	• _____



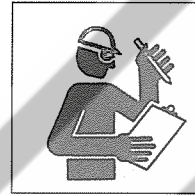
Follow A Safety Program

Some Rules You Must Work By

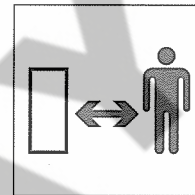
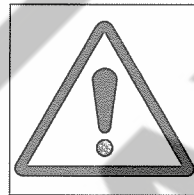
- Know the limitations and operating characteristics of the compact excavator. Do not overload it.
- Always wear the seat belt, if equipped. If the compact excavator is equipped with a foldable TOPS/ROPS, do not fasten the seat belt when the TOPS/ROPS is in the down position.
- Always have all shields and guards properly installed before operating the machine.
- Inspect the machine and all attachments before each use as specified by the manufacturer and your employer. Ensure the attachment is properly installed. (See page 9, **Quick-coupling Device Safety**.)
- Only use parts and attachments that are approved by the original equipment manufacturer.
- Never modify or remove any part of the equipment (except for service—then make sure it is replaced).
- Read and understand all safety signs installed on the machine.
- Know the location of other personnel and machines and make sure they are a safe distance from the machine.
- Know the worksite. Be aware of possible hazards that you may encounter.



**Know Machine
Limitations
And Operating
Characteristics**



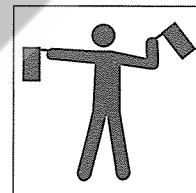
**Inspect
The Machine Before
Each Workday**



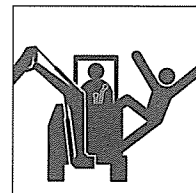
**Be Aware Of
Worksite Hazards,
Keep Bystanders
Away**

Follow A Safety Program

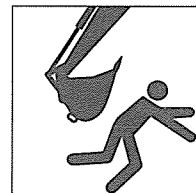
- Always look in the direction of machine or boom movement. Drive facing the travel direction whenever possible.
- Make sure you understand the rules covering traffic at the worksite. Know what all signs, flags and markings mean.
- Understand hand, flag, horn, whistle, siren and bell signals, if used at the worksite.
- Know when to use lights, turn signals, flashers and horns, if equipped.
- Do not allow riders.
- Keep hands and feet on controls when operating.
- Never lift or swing a load or attachment over anyone.
- Whenever you leave the machine, lower the excavator blade, bucket or other attachments to the ground. Stop the engine. Cycle the hydraulic controls, including auxiliary hydraulic control, to relieve trapped pressure. Engage control lock if equipped, and remove the ignition key. (See page 20, **Machine Shutdown**.)
- When transporting the compact excavator on a trailer, follow the manufacturer's instructions for loading, tying down and unloading the compact excavator.



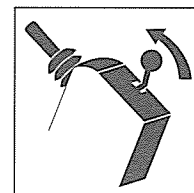
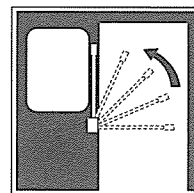
**Understand
Worksite Signals**



No Riders



**Never Lift Or
Swing A Load Or
Attachment
Over Anyone**



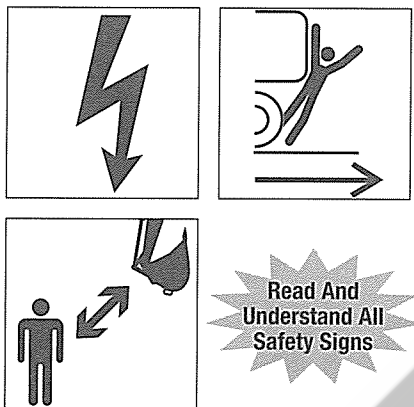
**Engage
Control Lock**

Follow A Safety Program

Know The Equipment

Read and understand the DANGER, WARNING, CAUTION and NOTICE safety signs and other informational signs found on the compact excavator and in the manufacturer's operator manual. Ask your supervisor to explain any information you do not understand. Failure to obey safety instructions could result in death or serious injury.

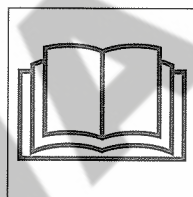
Make sure all the manufacturer's protective structures, guards, shields, screens and panels are in good repair, in place and securely fastened. Damaged, missing or



weakened safety components can create a hazardous situation for you as the operator. **Never** remove or modify any safety components on the compact excavator. The excavator can be operated temporarily with a foldable TOPS/ROPS lowered for access through height-restricted openings. Do not fasten the seat belt when the TOPS/ROPS is in the down position.

Know the following about this compact excavator and all attachments.

- Function, purpose and use of controls
- The functions of all gauges, lights, dials, switches
- Slope and uneven terrain capabilities and proper operation – never operate on a slope with a foldable TOPS/ROPS in the down position.
- Braking and steering characteristics
- Turning radius and clearances
- How to quickly stop equipment in an emergency



Read And Understand Manuals Before Operating

Prepare For Safe Operation

Check And Use All Available Protective And Safety Devices

Keep all protective devices in place and tightly fastened. Make certain all guards, screens and panels, manufacturer's operator manuals, and safety signs are installed on the machine and legible as supplied by the manufacturer. See that each item is securely in place and in operating condition.

The machine may be equipped with:

- A seat belt or other type of restraint
- Control locking device
- Safety signs
- Access and egress system (i.e., grab handles, handrails) and protective covers
- Travel alarm and back-up alarm
- Falling object guard structure (FOGS), falling object protective structure (FOPS), roll-over protective structure (ROPS)/tip-over protective structure (TOPS)
- Guards
- Special enclosures or accessories required for task or worksite conditions
- Operator protective structure (OPS) – side, front and rear shields, screens and doors

- Warning lights and devices
- Alternate exits
- Mirrors
- Fire extinguisher
- First aid kit
- Windshield wipers and washers
- Window defroster
- Operating lights
- Horn

Know which devices are required for protection during your specific operation and use them. The excavator can be operated temporarily with the TOPS/ROPS lowered for access through height restricted openings. Do not fasten the seat belt when the TOPS/ROPS is in the down position.

WARNING! NEVER remove or modify safety equipment. Operating a machine without a protective structure (TOPS/ROPS, FOGS/FOPS or OPS) could result in death or serious injury. (See page 23, **Protective Structure Safety.**)

Checklist	
☒	_____
☒	_____
☒	_____
☒	_____
☒	_____

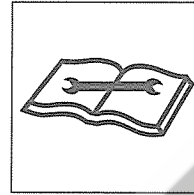
Follow A Checklist

Prepare For Safe Operation

Check The Machine

Before you begin the workday, inspect the machine and have all systems in good operational condition. Do not operate the machine until all problems are corrected.

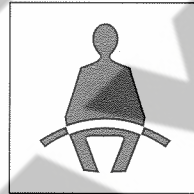
- Perform daily and periodic service procedures as instructed by the equipment manufacturer.
- Check that no safety switches or interlocks have been bypassed and that no warning tags have been placed on the machine.
- Check that safety signs, special instructions, lift capacity charts and operator manuals are legible and in the proper location.
- Check condition and operation of the seat belt and its mounts, if equipped.
- Make sure that the foldable TOPS/ROPS, if equipped, is properly secured in the raised position.
- Check condition and operation of the attachment quick-coupling device, if equipped. Perform daily cleaning and maintenance following the manufacturer's instructions. (See page 9, **Quick-coupling Device Safety.**)
- Inspect steps, guardrails, platforms and handholds for damage or loose parts.



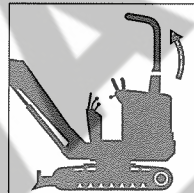
Maintain Machine



Check Manuals And Safety Signs



Check Seat Belt And Its Mounts



Check That TOPS/ROPS Is Raised And Properly Secured

Prepare For Safe Operation

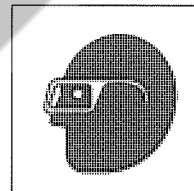
- Check the fuel and hydraulic systems. Have leaks repaired and fill to proper level.
- Check all exposed hydraulic components for leaks, routing problems or damage. Report worn or damaged components.

WARNING! Diesel fuel and hydraulic fluid under pressure can penetrate the skin or eyes and cause serious injury, blindness or death. Fluid leaks under pressure may not be visible. **Use a piece of cardboard or wood to find leaks, not your hand. Wear a face shield or safety goggles for eye protection.** If fluid is injected into the skin, it must be removed within a few hours by medical personnel familiar with this type of injury. (See page 24, **Hydraulic System Hazards.**)

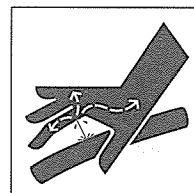
- Check the cooling system.

WARNING! Prevent possible injury from explosive release of hot fluids. **Allow the radiator to cool before checking the fluid level.** (See page 23, **Cooling System Hazards.**)

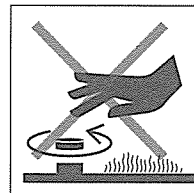
- Keep radiators and coolers clean and free of oil, grease, dirt, debris and moisture.
- Make sure all doors, guards and covers are in place and secured properly.



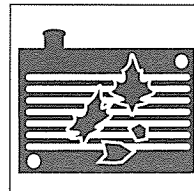
Wear Eye Protection



High Pressure Fluid Can Inject Into The Body



Do Not Loosen Cap Until Cool



Check The Radiator And Engine

Prepare For Safe Operation

Check The Machine (continued)

- Check the tracks for broken or damaged pins, bushings, and other parts.
- Check the tracks for proper tension adjustment according to manufacturer's instructions.
- Check the tracks for damage or wear. Replace badly worn or damaged tracks.
- Check the slew/swing brake for proper operation.
- Inspect working and other lights for proper operation.
- Inspect boom, arm and attachment for wear and damage.
- Make sure fire extinguishers are fully charged and in good working order.

Check Attachment And Coupler Installation

When changing buckets or installing attachments, follow the manufacturer's instructions for proper maintenance and coupling. Make sure all connectors are securely fastened. Tighten all bolts, nuts and screws to torques recommended.

Check the attachment coupler and the attachment for wear and hydraulic leaks before coupling the attachment.

Before operating, ensure that quick-coupler pins or wedges are fully engaged and visibly locked to the attachment.

WARNING! Avoid possible crushing injury. **Failure to properly secure the attachment to the machine coupler can allow the attachment to come off and could result in death or serious injury.** (See page 9, Quick-coupling Device Safety.)

Prepare For Safe Operation

Quick-coupling Device Safety

Before using a quick-coupling device you must know and understand proper installation, maintenance and operation.

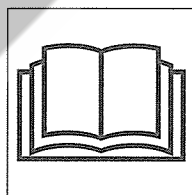
WARNING! Failure to read and follow manufacturer's instructions for the correct operation and maintenance of the quick-coupler can allow the attachment to come off and cause death or serious injury.

Protect yourself from injury:

- Install and maintain equipment, attachments and their operating systems according to manufacturers' instructions.
- Securely latch attachments before work begins.
- Follow the manufacturer's instructions for using positive locks on quick-coupling equipment.
- Make frequent visual inspections of quick-coupling systems—especially after changing attachments.
- Always check for interference limits of the coupler or tool with the carrier before operating.

Do not operate the machine if:

- there exists an incompatibility among components.
- there are broken, damaged or badly worn components.
- the lock/secure feature of the quick-coupler is impaired.
- the engaging lever or device is not fully engaged in a lock/secure condition.



WARNING! A quick-coupler that is not properly locked/secured could result in death or serious injury.

Perform all steps to lock/secure the device. The steps to confirm that the device is properly locked/secured may include any or all of the following:

- Manually installing a locking pin, actuating a lever or other device.
- Movement of the attached work tool to confirm its engaged lock/secure condition.
- A visual check of the components as instructed by the quick-coupler manufacturer.

WARNING! A quick-coupler that is disengaged when the attachment is in an unstable position could result in death or serious injury. **Place the attachment in a stable position, as instructed by the manufacturer, whenever coupling or uncoupling the attachment.**

Prepare For Safe Operation

Clean Up

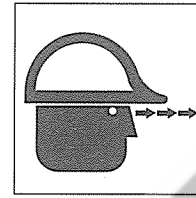
Clean windshields, mirrors and all lights. Use water and a clean cloth. Know and follow the manufacturer's recommendations for using cleaning agents other than clean water on polycarbonate glazing.

Clean out the operator's area. Steps and handholds must be clean and functional. Oil, grass, leaves, needles, snow, ice or mud in these areas can cause you to slip and fall.

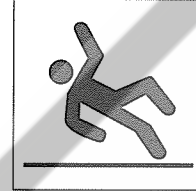
Clean your boots before getting on the machine.

Clean out trash and debris buildup promptly, especially in the engine compartment, the battery box, around exhaust components, under the machine and around rotating components.

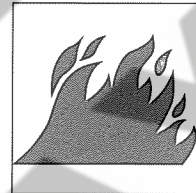
Remove all loose personal items or other objects from the operator's compartment. Secure these items in a fixed tool box or remove them from the machine. Do not store any flammable material such as ether/cold-start fluid or oily rags in the operator's compartment.



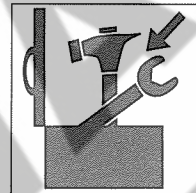
**Maintain Vision –
Clean Up**



**Avoid Falls –
Clean Slippery
Surfaces**



**Avoid Fire –
Clean Out Debris**



**Put Away Tools
And Loose Items**

Prepare For Safe Operation

Check The Work Area

Know—beforehand—as much about the worksite as possible. Locate all ground workers near the worksite and make sure clothing worn is easily seen. Be aware of weather conditions that can affect visibility, ground stability and traction.

Check for:

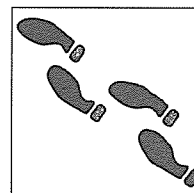
- Location of steep slopes, slide areas, drop-offs and overhangs
- Adequate traction on slopes
- Traffic locations and movement
- Thick dust, smoke and fog
- Soil conditions—look for signs of instability such as cracks or settlement
- Standing water and marshy areas
- Rocks and stumps
- Holes, obstructions, mud or ice
- Location of open trenches
- Exact location of any buried and/or overhead electrical, gas, telephone, water, sewer or other utility lines

Have the utility company mark, shut off or relocate the utility before you begin working.

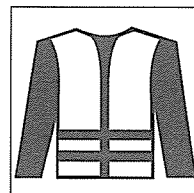
Know the location and work plan for other machines on the worksite.

Correct unsafe conditions. Avoid operating in problem areas that cannot be corrected.

When operating the machine inside a building, know what clearances you will encounter—overhead, doorway, aisles, etc. Also, know the weight limitations of floors and ramps. Make sure there is sufficient ventilation for inside operation.



**Walk Around
The Worksite**



**Be Seen –
Wear Visible
Clothing**

Prepare For Safe Operation

Check The Work Area (continued)

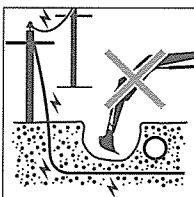
Know the exact location of electrical, telephone, gas or other utility lines. (See page 3, **One-Call First.**)

DANGER! Death or serious injury will result from touching or being near a machine that is in contact with or near an energized electrical source. **Never approach power lines with any part of the machine or load unless all local, state/provincial and federal (OSHA) required safety precautions have been taken.** Use extreme caution because high voltage sources can arc without contact.

When working near power lines, you must assume all lines are energized.

Maintain a safe distance from all utilities.

(See page 16, **Utilities—Overhead And Underground.**)



Locate All
Utilities, Maintain
A Safe Distance

Use Caution When Fueling

IMPORTANT! Always use approved fuel containers and dispensing equipment.

Fuels are flammable, so observe these practices to reduce the possibility of a serious accident.

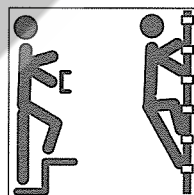
- Shut off engine and ignition during refueling.
- Always ground the fuel nozzle against the filler neck to avoid sparks.
- Keep sparks and open flames away from fuel.
- Do not use a cell phone or two-way radio while fueling or handling fuel—they could cause sparks.
- Do not smoke while refueling or when handling fuel containers.
- Do not overfill the tank or spill fuel. Clean up spilled fuel immediately.

Prepare For Safe Operation

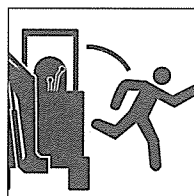
Mount And Dismount Properly

When you enter or leave the machine:

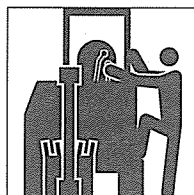
- Maintain a three-point contact with the machine. Three-point contact is defined as maintaining contact with at least one hand and two feet, or two hands and one foot, at all times.
- Face the machine when either mounting or dismounting.
- Use handholds, handrails, ladders or steps (as provided).
- The upperstructure and undercarriage must be oriented to align the access system.
- Never use control levers as handholds.
- Never step on foot controls when entering or leaving.
- Clean your boots and wipe your hands before mounting or dismounting.
- Never jump on or off the machine.
- Never attempt to mount or dismount a moving machine.
- Never mount or dismount while carrying tools or objects that prevent three-point contact.



Maintain
Three-Point Contact –
Face Machine



Do Not Jump Off
Machine



Do Not
Use Controls As
Handholds

Start Safely

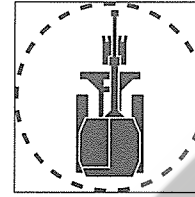
Look Out For Others

Before starting, walk completely around the machine operating area. Make sure no one is under it, on it or close to it. Do not start the engine until everyone is clear of the operating area.

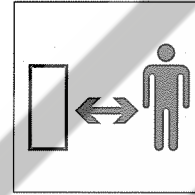
Starting The Engine

Do not start the engine or move any of the controls if there is a "DO NOT OPERATE" or similar warning tag attached to the start switch or controls. Check with your supervisor.

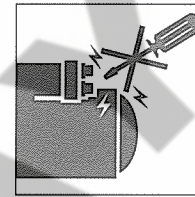
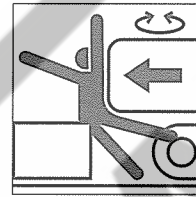
WARNING! Start the engine only from the operator's seat. Never attempt to start the engine by shorting across starter terminals or reaching for the key from outside the cab. This could result in the machine moving suddenly and unexpectedly and cause death or serious injury.



Walk-Around Inspection



Keep Bystanders Away



Start Only From Operator's Position

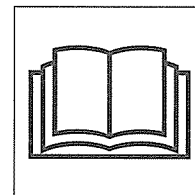
Start Safely

Know the exact starting procedures for this machine. See the manufacturer's manual(s) for starting procedures.

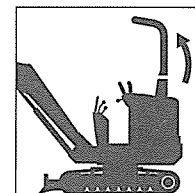
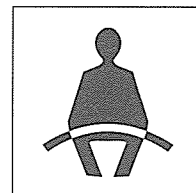
- Clear the area of all persons.
- Sit in the operator's seat and adjust the seat so you can operate all the controls properly.
- Familiarize yourself with warning devices, gauges and operating controls.
- Close or secure the cab door, if equipped.
- Fasten the seat belt, if equipped. If the compact excavator is equipped with a foldable TOPS/ROPS, do not fasten the seat belt when the TOPS/ROPS is in the down position.
- Put all controls, including those for auxiliary equipment, in the neutral/park position.
- Activate controls by releasing the control lock, if equipped.
- Start the engine following the instructions in the manufacturer's manual(s).

If it is necessary to run the engine or operate the machine within an enclosed area, be sure there is adequate ventilation.

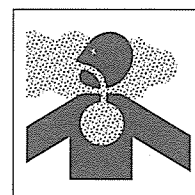
WARNING! Never operate any type of engine without proper ventilation—exhaust fumes can kill.



Know Starting Procedure, Read Manual



Fasten Seat Belt, Use TOPS/ROPS



Ventilate Work Area

Start Safely

Starting Aids

Do not use ether/cold-start fluid if the engine is equipped with glow plugs or intake manifold preheater.

Ether/cold-start fluid is **HIGHLY FLAMMABLE**.

Before using it, always read the instructions on the ether/cold-start fluid container and the instructions in the manufacturer's manual(s). **Do not** carry loose cans of starting fluid on the machine while operating.

If booster cables are used, follow the instructions in the manufacturer's manual(s). The operator must be in the operator's seat when boost-starting the engine so that the machine will be under control when the engine starts. Boost-starting is a two-person operation. A battery explosion or a run-away machine could result from improper starting procedures.

Never boost-start a frozen battery. (See page 25, **Avoid Battery Explosion.**)

After Starting The Engine

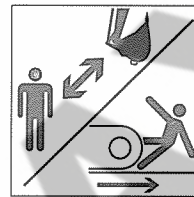
Observe gauges, instruments, and warning lights to ensure that they are functioning and their readings are within the operating range.

With the control levers or joysticks in neutral, test engine speed control.

Run An Operating Check

Do not use a machine that is not in proper operating condition. It is the **operator's responsibility** to check the condition of all systems, and to run the check in a safe area.

WARNING! Do not allow anyone to stand within the operating work radius of the machine and load. Contact with moving parts of the compact excavator or load can cause death or serious injury.



Keep
Bystanders
Away

Start Safely

Test All Controls

Follow the manufacturer's recommended warm-up procedures and bring all machine systems to operating temperature.

Machines come equipped with various control configurations, patterns and operating modes. Some have selectable or configurable controls that allow operation to suit personal preferences or specific applications. Make sure that you know which control pattern has been selected and understand how the machine will operate.

Make sure the engine is operating correctly. Operate each machine control to check all functions.

Check for possible interference between the attachment and the cab and operate appropriately.

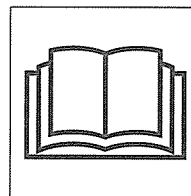
Make sure the attachment quick-coupling device (if equipped) is operating properly, fully engaged and visibly locked. (See page 9, **Quick-coupling Device Safety.**)

Check the blade location before traveling. When the blade is in the rear, operate the steering levers in the opposite direction as when the blade is in the front. See the machine manufacturer's manual.

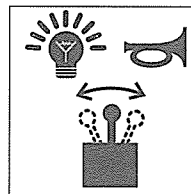
Operate the control(s) to ensure correct operation in forward, neutral and reverse.

Test steering—right and left—while moving slowly.

WARNING! Prevent possible injury from loss of control. Know and understand the selected control pattern and operating mode before operating. Be certain you can control speed, direction, braking and boom motion before operating the machine.



Read And
Understand Manuals
Before Operating

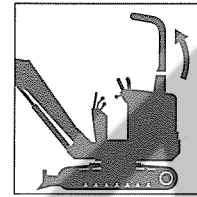
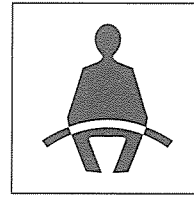


Check
Instruments
And Controls

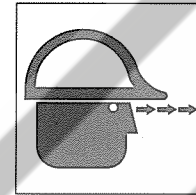
Operate Safely

Remember

- Stay in the operator's seat, with the seat belt fastened, if equipped. If the compact excavator is equipped with a foldable TOPS/ROPS, do not fasten the seat belt when the TOPS/ROPS is in the down position.
- Understand the machine's limitations. Be in control of the machine at all times.
- Assure yourself that the work area is clear of all bystanders and other machines. Stop the machine immediately if anyone approaches.
- If a failure that causes loss of control occurs, stop all machine motion as quickly as possible. Shut the machine down and remove the key. Correct or report the problem immediately.



**Fasten Seat Belt,
Use TOPS/ROPS**



**Look Before
Moving The Machine
Or Boom**

Never use a bucket or other attachment as a work platform or personnel carrier.

WARNING! Prevent possible injury from fall or runover. The compact excavator is a one-person machine. **NEVER PERMIT RIDERS.**

Always look around before you travel or move the boom. Look in the direction of machine movement.

Awareness on your part can prevent accidents.

Remember The Other Person

WARNING! Never allow an untrained or unqualified person to operate this machine. Handled improperly, this machine could cause death or serious injury.

Do not allow anyone within the operating work radius of the compact excavator.

Operate Safely

Traveling On The Worksite

Know and understand the worksite traffic flow patterns and obey signalmen, road signs and flagmen.

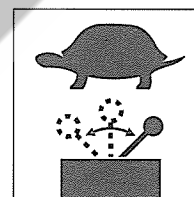
Check blade location before traveling. When blade is positioned to the rear, operate the steering levers in the opposite direction as when the blade is in the front.

The retractable track frame, if equipped, should be extended for traveling on the worksite. The track frame can be retracted to access narrow areas. Read and know manufacturer's instructions before operation.

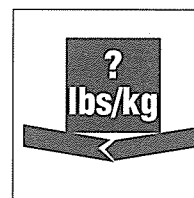
Know the maximum height and width of the machine. Do not obstruct your vision when traveling. Always look in the direction of travel. Drive facing the travel direction when possible.

Operate the controls smoothly and slowly. Rapid and jerky movement of the controls can cause loss of both machine stability and control of the load.

When moving the machine, watch that enough clearance is available on both sides and above the boom and cab. Be especially careful to allow extra clearance on uneven ground.



**Operate
Controls Smoothly
And Slowly**



**Know
Weight Limits**

Check for hazards or obstructions before entering an underpass or other area with restricted clearance. Check height and side clearances.

WARNING! Avoid possible injury. The weight of the machine may cause the ground, dock, ramp or floor to give way, causing loss of control, fall or tipover. **Know weight limits and stay clear of the edges of excavations and drop-offs.** Failure to know and observe weight limits and use caution could result in death or serious injury.

Operate Safely

Traveling On The Worksite (continued)

Make sure all surfaces will support the weight of the machine.

Do not cross ditches, creeks or wet draws without an adequate fill or bridge crossing.

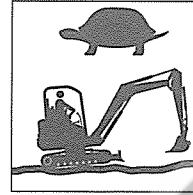
Match travel speed to the traffic, weather and ground conditions. Take it slow and easy when traveling. Travel cautiously over rough or slippery ground and on slopes. Reduce speed when travelling over a rise.

Always give the right of way to loaded machines. Maintain a safe distance from other machines.

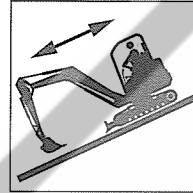
If you encounter a blind corner, stop and then proceed with caution.

Avoid traveling over obstacles (logs, tree stumps, rough terrain, ditches, curbs, railroad tracks) whenever possible. If you must cross an obstacle, do so slowly and with caution.

Avoid steep slopes or unstable surfaces. If it is necessary to travel on a slope, follow manufacturer's specific instructions. When on a slope, keep the boom centered and attachment as low and as close to the



Travel Slowly Over
Rough, Hazardous
Terrain



Drive Straight
Up And Down – NOT
ACROSS – Steep
Slopes

machine as possible. Proceed with extreme caution. Do not drive **ACROSS** a steep slope under any circumstances. Drive straight up and down a slope.

Avoid turning on a slope. If it is necessary, use extreme caution and make the turn **WIDE and SLOW** with the boom centered and attachment as low and as close to the machine as possible.

Avoid sudden movement of the travel controls.

Operate Safely

Safety Precautions

Never reach into the compact excavator and attempt to operate the controls from outside the cab.

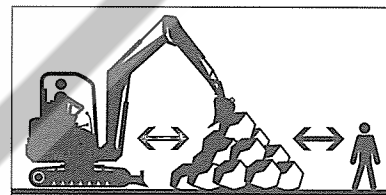
Before starting to excavate, set up safety barriers to the sides and rear area of the swing pattern to prevent anyone from walking into the working area.

Read and know manufacturer's instructions before operation.

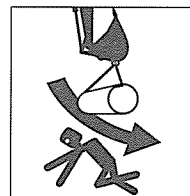
Make sure you are aware of personnel or machines that may be hidden in blind spots on the worksite, such as piles or stacks of material.

Make sure the machine has sufficient clearance from other machines or material on the worksite to prevent contact during machine or attachment movement.

WARNING! Prevent death or serious injury. **Never lift, move or swing a load over any person or any machine cab.**



Check Clearance,
Look Out For
Others



Do Not Lift
Or Swing A Load
Or Attachment
Over Anyone

Know and use the hand signals required for particular jobs. Know who has the responsibility for signaling. Take signals from one person only.

Do not operate during storms with high winds or lightning strikes. Do not mount or dismount during a period of lightning strikes. If you are on the machine, stay on it. Warn others to stay clear of the machine in case of a lightning strike.

Operate Safely

Load Lifting

Consult the rated lift capacity chart. Do not overload this machine. Know the exact lifting capacity of the machine as equipped. Make sure you have and know how to use a current lift capacity chart for the machine. Changing conditions such as slopes, wind, ice, mud, soft ground, type of load or the weight of attachments will affect the capacity and operating characteristics of the machine.

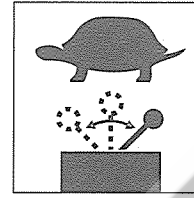
Consult your lift chart. Lifting and handling loads over the end of the machine, rather than over either side, will improve the lifting performance of the machine.

The retractable track frame, if equipped, should be fully extended for increased lifting performance.

Attach loads only to the manufacturer's designated lifting points, if equipped.

If equipped, keep blade lowered for increased lifting performance. If ground is soft, place pads or timbers under the blade.

Operate the controls smoothly and slowly. Rapid and jerky movement of the controls can cause loss of both machine stability and control of the load.



Operate Controls Smoothly And Slowly

When lifting, be sure the load is properly balanced. Move slowly so the load does not sway or swing around. Use a tag line for control.

If tracks or blade leave the ground, slowly lower the load to return the machine to the ground. Do not drop the load suddenly, because this can lead to loss of control.

Do not exceed rated lift capacity. Excessive load can cause tipping or loss of control.

Carry the load/attachment low and as close to the machine as possible. You must allow for movement in all directions. Be careful to maintain clearance of the attachment and load from the cab.

Keep all guards in place and windows closed or locked open. Keep cab doors closed or otherwise secured, if equipped.

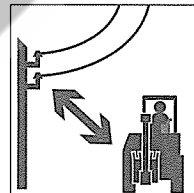
Never leave the operator's seat with a load suspended. (See page 20, **Machine Shutdown.**)

Operate Safely

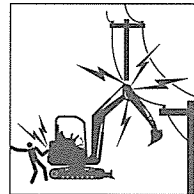
Utilities – Overhead And Underground

DANGER! Electrocutation or serious injury will result from CONTACTING or APPROACHING power lines or apparatus. Maintain Minimum Approach Distance. (See chart.)

DANGER! Death or serious injury will result from touching or being near a machine that is in contact with or near an energized electrical source. Never approach power lines with any part of the machine or load unless all local, state/provincial and federal (OSHA) required safety precautions have been taken. Use extreme caution because high voltage sources can arc without contact.



Maintain Minimum Approach Distance



Stay Clear Of Energized Equipment

REQUIRED CLEARANCE FOR OPERATION NEAR HIGH VOLTAGE POWER LINES		
Normal Voltage, kV (Phase to Phase)	Minimum Approach Distance [Note (1)]	
	ft	(m)
to 50	10	(3.0)
Over 50 to 200	15	(4.6)
Over 200 to 350	20	(6.1)
Over 350 to 500	25	(7.6)
Over 500 to 750	35	(10.7)
Over 750 to 1,000	45	(13.7)
NOTE: (1) Environmental conditions such as fog, smoke or precipitation may require increased clearances.		

Check overhead clearances. If possible, have power to the lines de-energized and visibly grounded. If not possible, request a signal person for guidance to maintain at least the Minimum Approach Distance. (See chart.)

If the machine or load contacts an energized line, stay in the machine and attempt to break contact. Warn others to stay away from the machine. If machine catches fire and you are forced to leave, jump clear of the machine with both feet together and hop or shuffle away. **DO NOT** touch machine and ground at the same time.

Operate Safely

Locate All Underground Utilities

Confirm that One-Call has been contacted. Confirm that any utilities not subscribing to One-Call have been contacted. Confirm that the site has been marked or cleared. (See page 3, **One-Call First**.)

Obtain all information pertaining to the locate request, including the One-Call confirmation code or ticket number. If the facility owner has provided a locate sketch, obtain a copy. Review any engineering drawings provided by utilities. This information should be retained.

Personally verify One-Call utility marks. There are variations from state to state.

Take a copy of the locate sketch to the job site. Confirm all of the locates. Review the site for signs of unmarked utilities. These signs may include pedestals, pole risers, meters, trench lines, manhole covers, sewer drain outlets, etc. Review not only the immediate area, but also the perimeter of the area for utility markers.

Additionally, the area should be swept by an experienced operator using a device to locate utilities and large metal objects.

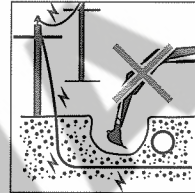
Any inconsistencies with line locations or any inaccurate locates must be resolved.

When excavating near underground services, expose the service by hand-digging or by using soft excavation, such as vacuum excavation, if permitted by local utilities.

When gas lines are present on the site, do not smoke or do anything to cause a spark in the vicinity of a gas line.

Make plans to restrict working area access—with cones and tape, barriers, warning signs, fences, etc.—until the job is complete.

Make certain that you are in compliance with all local, state/provincial, national and other requirements and regulations, including those regarding open excavations, or “potholes.”



**Locate All
Utilities, Maintain
A Safe Distance**

Operate Safely

Trenching Safety Precautions

Follow the worksite plan for proper construction of the trench. Check with your supervisor if you are unsure of correct trench construction or if operating conditions change.

Stay alert to changes in soil conditions. Trench collapse is hazardous to all workers in the area and could cause the machine to slide into the trench.

Keep heavy loads and equipment as far from the trench as possible.

Keep spoil and stored materials such as pipe at least two feet from the edge of the trench.

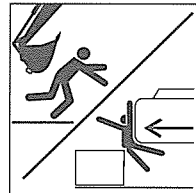
Keep personnel away from the equipment and attachments.

Never swing a load or attachment over anyone.

Do not undercut the machine.

WARNING! Do not dig under the machine or blade. A resulting cave-in could cause death or serious injury.

WARNING! Avoid possible death or serious injury from trench wall collapse. Before backfilling, see the manufacturer's manual for any specific instructions. Do not get too close to the edge of the cut. The weight of the machine plus the fill could cause the trench wall to collapse.



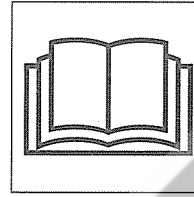
**Keep
Personnel Away
From Equipment
And Attachments**

Operate Safely

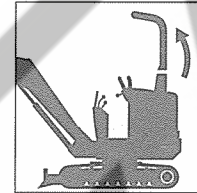
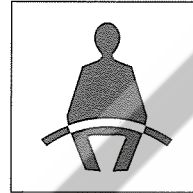
Slope And Uneven Terrain Operation

Compact excavator stability and load capacity are greatly reduced on slopes. Ensure the operation can be done safely. Prevent overturns and maintain stability control:

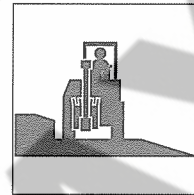
- Use machines equipped with TOPS/ROPS and a seat belt. Make sure folding TOPS/ROPS is raised and locked in place—always use the seat belt.
- The retractable track frame, if equipped, should be extended for operating on slopes or uneven terrain. Read and know manufacturer's instructions before operation.
- Review the manufacturer's manual for specific instructions and limitations, including those for proper operation of alternate/emergency exits.
- Avoid extremely steep slope operation.
- Keep machine movements slow and smooth.
- Level the working area and machine as much as possible.
- Avoid working with the tracks across a slope. This will reduce stability and increase the tendency of the machine to slide. Position the machine with the tracks running up and down the slope—blade downhill and lowered.
- Avoid slippery ground conditions.



**Always Check
Manuals For Specific
Instructions**



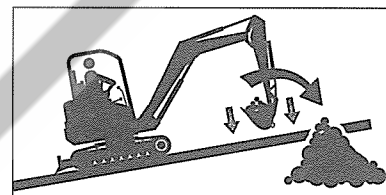
**Fasten Seat Belt,
Use TOPS/ROPS**



**Level The
Work Area
If Possible**

Operate Safely

- Travel straight up and down the slope with the attachment low and close to the machine. Do not move the boom while travelling.
- Avoid swinging to the downhill side of a slope. Always keep the boom and attachment as low and close to the machine as possible.



**Swing Load
Uphill When On
A Slope**

If the machine begins to tip, roll or slide, stay in the machine with the seat belt securely fastened. Lower the attachment immediately. Hold on firmly and brace your feet on the floor. Lean away from the point of impact.

When operating the compact excavator on a slope, swing to the uphill side to dump load, if possible. If downhill dumping is necessary, swing only as far as required to dump the bucket. Use extreme caution. Always drop spoil a sufficient distance from a trench to prevent cave-ins.

If possible, avoid working with the tracks across a slope.

Before moving the machine, raise the blade sufficiently to clear the ground, and then drive the machine forward or backward as required. Lower the blade to level the machine.

Operate Safely

Hazardous Conditions

When working in hazardous areas, be extremely alert.

Always consult the manufacturer's operator manual for specific instructions.

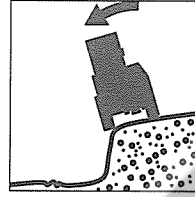
Extreme caution is required when working near the edge of an excavation. Keep the machine a safe distance away from the edge. Avoid undercutting.

WARNING! Never undercut a high bank. The edges could collapse or a slide could occur, resulting in death or serious injury.

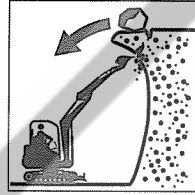
Work the jobsite in a manner that avoids creating overhangs or the need to be on top of banks or slopes. Never operate the machine close to the edge of an overhang or stockpile.

Extreme caution should be used when working along the top of banks and slopes. Keep as far back from the edge as possible. Level the area if possible. Keep the machine tracks perpendicular to the edge so that if part of the edge collapses, the machine can be moved back.

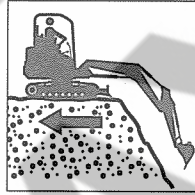
Immediately move the machine back at any indication the edge may be unstable.



Use Caution –
Stay Safely Away
From Bank Or
Excavation Edge



Never Undercut
A High Bank



Operate
Perpendicular To
Banks – Stay Back
From The Edge

Operate Safely

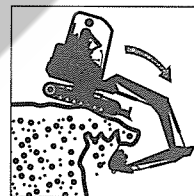
WARNING! Do not dig under the machine. A cave-in could result and the machine could fall into the excavation, resulting in death or serious injury.

Avoid Silica Dust

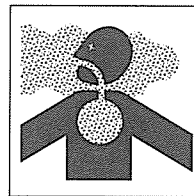
Cutting or drilling concrete or rock containing quartz may result in exposure to silica dust. **Do not exceed Permissible Exposure Limits (PEL) to silica dust as determined by OSHA or other worksite rules and regulations.** Use a respirator, water spray or other means to control dust. Silica dust can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

Operation In Flammable/Explosive Atmosphere

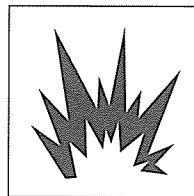
WARNING! Avoid possible death or serious injury. Never operate an excavator in these areas. Use of these excavators in explosive atmospheres can result in fires and explosions, causing death or serious injury.



Use Caution Near
Excavation Edge –
Do Not Undercut
Machine



Avoid
Silica Dust



Do Not Operate In
Explosive/Flammable
Atmosphere

Operate Safely

Towing

Many compact excavators may not be towed. Refer to the manufacturer's manual(s) for specific towing instructions.

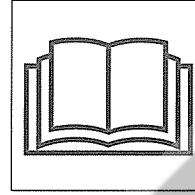
Never straddle a tow line or stand near a tow line under tension.

Parking

Park the machine in a designated area out of traffic, preferably on level ground. (See page 20, **Machine Shutdown**.)

If freezing conditions are expected, the tracks should be first cleared of mud and dirt and the machine parked on planks or suitable debris.

Public roads are not suitable for parking. If the machine is disabled or you must park on a public road, barricade and mark the machine according to local and worksite regulations.



Consult
Manufacturer's
Manual Before
Towing

Shut Down Safely

Machine Shutdown

Properly shutting down a compact excavator can help prevent accidents when the machine is left unattended. Shut down the excavator following the specific procedures in the manufacturer's operator manual.

A typical list includes:

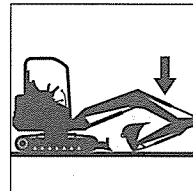
- Stop the machine.
- Make sure the area around the machine is clear of personnel.
- Slew the machine to align the upperstructure with the undercarriage, if possible.
- Return controls to neutral, including the auxiliary hydraulic controls.
- Lower the attachment and blade to the ground with slight down-pressure.
- Idle engine for a short cool-down period.
- Stop the engine.
- Cycle all hydraulic controls to relieve system pressure.
- Engage the control locking device, if equipped.
- Remove ignition key.
- Block the tracks if on a slope or incline.

- Check for and clean out trash build-up, especially in the engine compartment, battery box, around exhaust components, in confined spaces, under the machine and around rotating components.

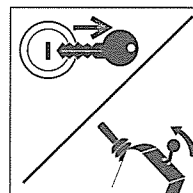
Safe Dismounting

Never dismount from moving equipment. Observe proper shutdown practices before dismounting. Check for slippery steps and handholds.

Dismount carefully using three-point contact facing the machine. (See page 11, **Mount And Dismount Properly**.)



Lower
Attachment



Shut Off Engine,
Remove Key, Engage
Control Lock

Load And Unload The Machine Safely

Loading And Unloading For Transport

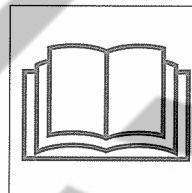
All machines are not loaded in the same way, and the procedures given in the manufacturer's manual(s) should always be followed.

Some precautions apply to all machines:

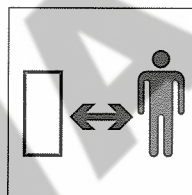
- Keep bystanders away.
- Wear the seat belt, if equipped.
- If the compact excavator is equipped with a foldable TOPS/ROPS, make sure it is properly secured in the raised position.
- Place transport vehicle on a firm, level surface.
- Block or support the rear of the trailer.
- Secure the parking brake and block transport vehicle so it cannot move.
- Use ramps with slip-resistant surfaces, adequate size and strength, low angle (15 degrees or less) and proper height.
- Keep trailer bed and ramps clear of mud, oil, ice, snow, leaves and other debris.
- Position the attachment to the front of the machine.
- Drive forward up the ramps, raising the blade high enough for clearance.
- Cover or remove any SMV (Slow-Moving Vehicle) emblem.

- Secure the cab door, attachment and accessories in the transport position.
- Engage upperstructure slew lock, if equipped.
- Chain and block the excavator securely for transport. Refer to the manufacturer's operator manual for tie-down procedures.

Measure the transport height and width of the loaded machine to avoid overhead and width obstructions. Make sure clearance flags, all lights and warning signs are in place and visible.



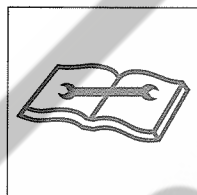
Read
Operator Manual



Keep
Bystanders
Away

Perform Maintenance Safely

Maintain Equipment



Maintain
Equipment

Be sure to maintain equipment according to manufacturer's instructions. Regularly check the operation of the protective and safety devices.

Do not perform any work on the compact excavator unless you are authorized and qualified to do so.

If you have been authorized to maintain the equipment, **read the operator, maintenance and service manuals.** Study the instructions, check the lubrication charts and examine all the instruction messages on the machine. Maintenance can be dangerous unless performed properly. Be sure you have the necessary skill, information, tools and equipment to do the job correctly.

If adjustments must be made with the engine running, always work as a 2-person team with one person sitting in the operator's seat while the other works on the machine.

IMPORTANT! Do not modify equipment or add components not approved by the manufacturer. Use parts, lubricants and service techniques recommended by the manufacturer.

Protect Yourself

Wear personal protective clothing and Personal Protective Equipment (PPE) issued to you or called for by job conditions.

You may need:

- Hard hat
- Safety boots with non-slip soles
- Safety glasses, goggles or face shield
- Apron and heavy-duty gloves
- Hearing protection
- Welding helmet or goggles
- Respirator or filter mask

Wear whatever is needed to protect yourself—do not take chances.

Perform Maintenance Safely

WARNING! Prevent death or serious injury from entanglement. **Do not wear loose clothing or accessories. Restrain long hair. Stay away from all rotating components when the engine is running.**

Contact with or entanglement in rotating or moving parts could result in death or serious injury.

Wear a rubber apron and rubber gloves when working with corrosives. Wear gloves and safety shoes when handling wooden blocks, wire rope or sharp-edged metal.

Always use safety glasses, goggles or a face shield. They provide eye protection from fluids under pressure, during grinding and while servicing batteries. Protection is also needed from flying debris, liquids and loose material produced by equipment, tools and pressurized air/water/oil/fuel.

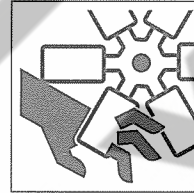
Wear a face shield when you disassemble spring-loaded components or work with battery acids. Wear a welding helmet or goggles with a shaded filter when you weld or cut with a torch.

Do not sand, grind, flame-cut, braze or weld without an approved respirator or appropriate ventilation. If welding

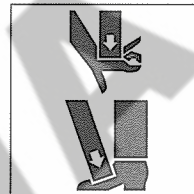
is required on the machine, refer to the manufacturer's manuals or consult the equipment dealer for proper procedures. Make sure all flammable material is cleared from the area.

Keep pockets free of all objects that could fall out and drop into machinery.

Handle tools and heavy parts sensibly, with regard for yourself and other persons. Lower items—do not drop them.



Avoid
Rotating Parts



Avoid
Pinch Points

Perform Maintenance Safely

Prepare The Work Area

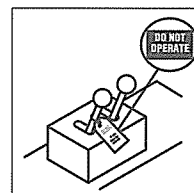
- Position the compact excavator in a level area out of the way of other working equipment.
- Make sure there is adequate light, ventilation and clearance.
- Remove oil, grease, ice and snow or water to eliminate any slippery surfaces.
- Clean around the machine and work area to minimize contamination. Clean up oil or fuel spills promptly and dispose of the material properly.

- Remove only guards or covers that provide access to the area being serviced. Replace all guards and covers when work is complete.

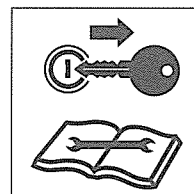
Prepare The Machine

- Attach a "DO NOT OPERATE" warning tag to the control levers and remove the ignition key if the machine should not be started.
- Block the tracks.
- Release all hydraulic, water and air pressure. Lower, lock or block all hydraulically supported components.

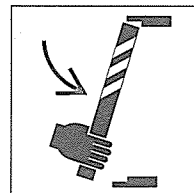
WARNING! Disconnecting or loosening any hydraulic component or a part failure can cause unsupported equipment to drop. **Do not go under or near raised equipment unless supported by a manufacturer-approved support device(s).** Death or serious injury could result from falling equipment.



Use
Warning Tags



Remove
Key And Read
Maintenance
Manual



Use
Approved
Support Device

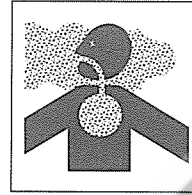
Perform Maintenance Safely

Use Approved Ventilation

If it is necessary to run an engine in an enclosed area, remove the exhaust fumes from the area with an exhaust pipe extension.

WARNING! Prevent possible injury. **Never work on machinery with the engine running unless instructed by the manufacturer's manuals for specific service.**

WARNING! Never operate any type of engine without approved ventilation—EXHAUST FUMES CAN KILL.



Ventilate
Work Area

Use Jacks And Hoists Carefully

If you must work beneath raised equipment, use solid wood blocks, jack-stands or other rigid and stable supports. Never use concrete blocks. When using jacks or hoists, always be sure they are adequately supported and of adequate capacity.

Make sure the hoists or jacks you use are in good repair. Never use jacks with cracked, bent or twisted parts. Never use frayed, twisted or pinched cables. Never use bent, worn or distorted hooks.

Protective Structure Safety

Do not remove or modify a protective structure (TOPS/ROPS, FOGS/FOPS OPS) except for service. Reinstall with manufacturer-approved fasteners before further machine operation.

Replace a damaged protective structure. Refer to the manufacturer's manual for specific instructions and inspection requirements.

Perform Maintenance Safely

Common Maintenance Safety Practices

Fuel Hazards

IMPORTANT! Always use approved fuel containers and dispensing equipment.

Fuels are flammable, so observe these practices to reduce the possibility of a serious accident.

- Shut off engine and ignition before refueling.
- Always ground the fuel nozzle against the filler neck to avoid sparks.
- Keep sparks and open flames away from fuel.
- Do not use a cell phone or two-way radio while fueling or handling fuel—they could cause sparks.
- Do not smoke while refueling or when handling fuel containers.
- Do not cut or weld on or near fuel lines, tanks or containers.
- Do not overfill the tank or spill fuel. Clean up spilled fuel immediately.

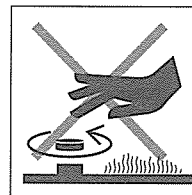
Always use a nonflammable solvent when you clean parts. Do not use gasoline, diesel fuel or other flammable fluids.

Store all flammable fluids and materials away from work areas in suitable containers, per local regulations.

Cooling System Hazards

Liquid cooling systems build up pressure as the liquid gets hot, so **use extreme caution** before removing the radiator or tank cap. Be sure to:

- Stop the engine and wait for the system to cool.
- Wear protective clothing and safety glasses.
- Turn the radiator or tank cap slowly to the first stop to allow the pressure to escape before removing the cap completely.



Do Not
Loosen Cap
Until Cool

Perform Maintenance Safely

Hydraulic System Hazards

The hydraulic system is under pressure whenever the engine is running and may hold pressure even after the engine is shut off. Cycle all hydraulic controls, including auxiliary controls, after the engine is shut down to relieve trapped pressure in the lines.

During inspection of the hydraulic system:

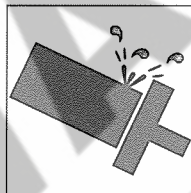
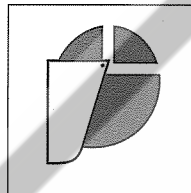
- Wait for fluid to cool before disconnecting the lines. Hot hydraulic fluid can cause SEVERE BURNS.
- **Do not** use your hand to check for leaks.
- Wear appropriate eye protection. Hydraulic fluid can cause permanent eye injury.

WARNING! Diesel fuel and hydraulic fluid under pressure can penetrate the skin or eyes and cause serious injury, blindness or death. Fluid leaks under pressure may not be visible. **Use a piece of cardboard or wood to find leaks, not your hand. Wear a face shield or safety goggles for eye protection.** If fluid is injected into the skin, it must be removed within a few hours by medical personnel familiar with this type of injury.

When venting or filling the hydraulic system, loosen the filler cap slowly and remove it gradually.

Never reset any relief valve in the hydraulic system to a pressure higher than recommended by the manufacturer. Follow manufacturer's instructions when taking oil samples.

Do not permit an open flame around the hydraulic system.



Perform Maintenance Safely

Electrical System Hazards

Before working on the electrical system, disconnect the battery cable(s).

- Remove the battery negative (-) cable(s) first.
- When reconnecting the battery, connect the battery negative (-) cable(s) last.

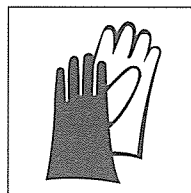
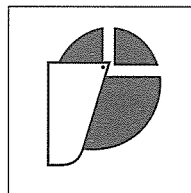
Battery electrolyte contains acid, which is a POISON and can cause SEVERE CHEMICAL BURNS.

Avoid Injury

- Wear a face shield to prevent electrolyte contact with your eyes.
- Wear chemical-resistant gloves and clothing to keep electrolyte off your skin and regular clothing.

WARNING! Electrolyte will damage eyes or skin on contact. **Always wear a face shield to avoid getting electrolyte in eyes.** If electrolyte contacts eyes, flush immediately with clean water and get medical attention. **Wear rubber gloves and protective clothing to keep electrolyte off skin.** If electrolyte contacts exposed skin or clothing, wash off immediately with clean water.

If electrolyte is ingested, seek MEDICAL ATTENTION IMMEDIATELY. NEVER give fluids that would induce vomiting.



Perform Maintenance Safely

Avoid Battery Explosion

WARNING! Avoid possible death or serious injury from explosion. Lead-acid batteries produce extremely explosive gases, especially when being charged. **Keep arcs, sparks, flames and lighted tobacco away.**

- **Do not** smoke near batteries.
- Check battery cables for worn or damaged insulation.
- Keep arcs, sparks and open flames away from batteries.
- Provide adequate ventilation.

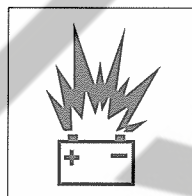
Never check the battery by placing a metal object across the battery posts; the resulting spark could cause an explosion.

WARNING! Avoid possible death or serious injury from battery explosion. **Do not charge a battery or boost-start the engine if the battery is frozen. Warm to 60°F (15.5°C) or the battery may explode.**

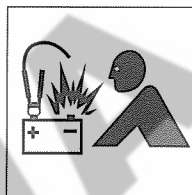
Safety rules during battery boost-starting:

- Follow the instructions for proper “battery boost-starting” as specified in the manufacturer’s manual.
- Be sure the machines are not touching.

- Observe the polarity of the batteries and connections.
- Make the final cable connection to the engine or the ground point farthest from the battery and away from fuel lines. Never make the final connection at the starter or dead battery—sparks may ignite the explosive gases present at the battery.
- When disconnecting cables after boost-starting, remove the cables in reverse order of connection (i.e., final connection first).



**Avoid Sparks
And Open Flames
Near Batteries**



**Observe
Polarity – Make
Final Connection At
Ground Point**

Perform Maintenance Safely

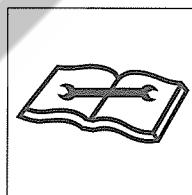
Track Maintenance And Adjustment

Check the tracks daily because the stability of the compact excavator can be dramatically affected by damage to tracks.

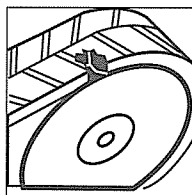
Check for:

- Damage or wear
- Correct tension according to manufacturer’s instructions
- Proper lubrication of track rollers and idlers—refer to the manufacturer’s manuals.

Track tension is important for good performance, reducing excessive track wear and preventing the tracks from coming off. Track and roller wear varies with working conditions and soil conditions. Special tools and procedures may be needed to check or adjust track tension. Follow manufacturer’s specific service procedure(s) when removing and installing tracks.



**Follow
Maintenance
Instructions**



**Check For
Track Damage**

WARNING! Track tensioning systems have compressed springs or pressurized fluid (oil or grease). Improperly releasing track tension forces can result in death or serious injury. **Always follow the manufacturer’s warnings and instructions for track adjustment and other maintenance and servicing procedures.**

WARNING! Avoid possible death or serious injury. **Never strike or pound on track tension springs.** They may be under very high compression and could shatter explosively.

Perform Maintenance Safely

Complete Service And Repairs Before Machine Is Released

Tighten all bolts, fittings and connections to torques specified by the manufacturer.

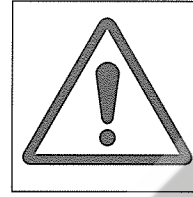
Clean or replace all damaged, missing or painted-over signs, plates and decals that cannot be read.

Inspect and install all guards, covers and shields after servicing. Replace or repair any damaged parts. Refill and recharge pressure systems only with manufacturer-approved or recommended fluids.

Check readiness of fire extinguishers, if so equipped. Do not paint over or otherwise interfere with fire detectors or fire extinguisher access points.

Follow the instructions in the manufacturer's manual(s) for proper service of any fire suppression equipment on the machine.

Air conditioning service is limited to approved service personnel. Refer to the manufacturer's manual(s).



Verify
Service Work
When
Completed

Start the engine and check for leaks. (See page 24, **Hydraulic System Hazards**.) Operate all controls to make sure the machine is functioning properly. Test the machine if necessary. After testing, shut down and check the work you performed. Are there any missing cotter pins, washers, locknuts, etc.? Recheck all fluid levels before releasing the compact excavator for operation.

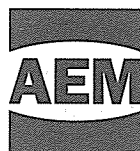
All parts should be inspected during repair and replaced if worn, cracked or damaged. Excessively worn or damaged parts can fail and cause death or injury.

Final Word To The User

You have just finished reading the AEM Compact Excavator Safety Manual. It is impossible for this manual to cover every safety situation you may encounter on a daily basis. Knowledge of these safety precautions and your application to the basic rules of

safety will help to build good judgment in all situations. Our objective is to help you develop, establish and maintain good safety habits to make operating a Compact Excavator easier and safer for you.

This manual is another in a series on the safe operation of machinery published by AEM. Many pictorials in this safety manual can be found and downloaded at <http://pictorials.aem.org>. For additional publications visit our website at www.safetymaterials.org.



ASSOCIATION OF
EQUIPMENT MANUFACTURERS

e-mail safetymaterials@aem.org
www.aem.org



AUGER TORQUE



AUGER DRIVE UNIT OPERATOR'S MANUAL

99-5100 – ENGLISH

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PRODUCT & MODEL :

SERIAL NUMBER :

Note: always quote the serial number in any communication with your dealer

SUPPLIER / DEALER :

..... X2000

..... 20160982 

..... 16-04-2018

DATE OF DELIVERY / INSTALLATION :

MANUFACTURER / DISTRIBUTOR :



Auger Torque Australia Pty Ltd.
122 Boundary Road, Rocklea
Queensland 4106
Australia.
Ph. (07) 3274 2077
Fax. (07) 3274 5077

OWNER OR OPERATOR :

.....

PARENT MACHINE MAKE & MODEL :

Suppliers of both new and second hand machines are advised to retain documentary evidence that this manual was provided with the machine.

Auger Torque Australia Pty Ltd thank you for purchasing your new product. This operating manual has been prepared to enable you to operate the equipment in a safe manner.



Warning, Cautions and Notes

This symbol is used to highlight important messages. When you see this symbol, be alert to the possibility of injury to yourself or others. Carefully read the messages that accompany it.

NOTE:

This operating manual should be used in conjunction with the parent machine's operating instructions.

Instruction books should be regarded as part of the machine. They should always be kept safe with the machine for easy and quick reference.

New or extra copies can be obtained from your Auger Torque dealer or direct from Auger Torque Australia Pty Ltd.

Auger Torque Auger Drive Units have been designed for use with specific parent machines along with the Auger Torque range of mounting frames, augers, auger extensions and auger wearparts. Provided these are used and maintained correctly, they will provide a safe and reliable method of boring holes in the earth.

Auger Torque Australia Pty Ltd continually strives to improve and increase its range of products and therefore reserves the right to alter its specifications at any time without notice or obligation. The company accepts no responsibility for discrepancies which may occur between specifications of its machines and descriptions thereof contained in its publications.

When ordering spare parts please quote the serial number of the drive unit, which can be identified by the serial number plate.

SAFETY FIRST



NEVER COMPROMISE ON SAFETY IT COULD CAUSE SERIOUS INJURY OR DEATH. All operators must read and ensure they fully understand all of the safety, operating and maintenance instructions before using the Auger Drive Unit.

If you are in any doubt as to any of the instructions or information provided you must contact your dealer or Auger Torque Australia Pty Ltd before attempting to use the Auger Drive Unit.

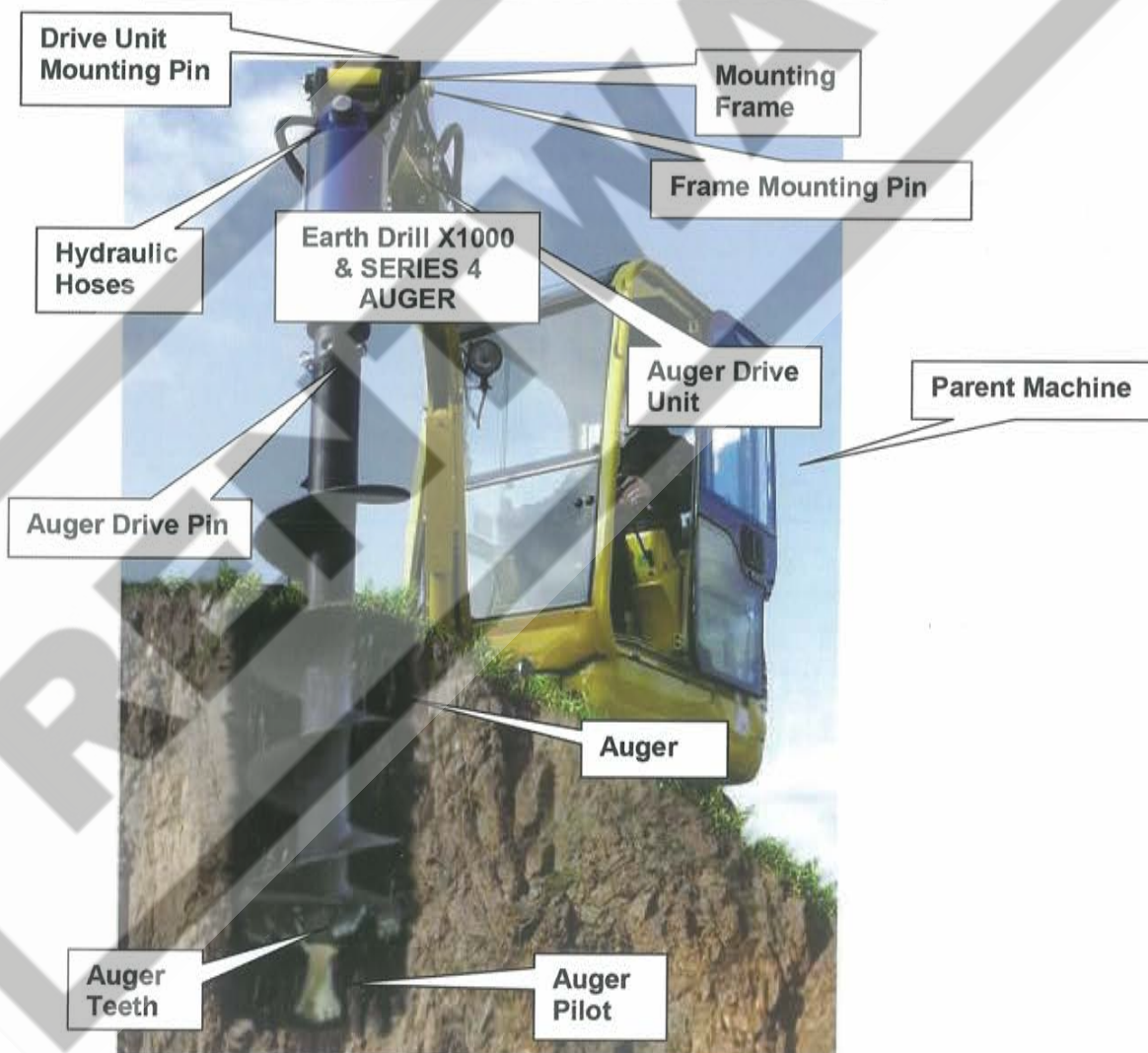
AUGER TORQUE

Auger Torque Australia Pty Ltd.
5A Priority Street, Wacol, Qld 4076
www.augertorque.com.au

Model		Date Of Manufacture
Serial No.		
Flow (max)		Lpm
Pressure (max)		Bar
Weight		Kg



Data Plate
Enter product information for easy reference



WORKPLACE HEALTH AND SAFETY RISK STATEMENT

5

Working with the Auger Drive Unit exposes the operator and others at the work site to workplace health and safety hazards. The table below describes these hazards and recommendations for their control.

Hazard	Recommended Hazard Controls
Mechanical Hazards	
Damaged hydraulic hoses may eject fluid with enough pressure to penetrate the skin.	Ensure hydraulic hoses are regularly inspected and maintained.
Vehicular accident with persons or property.	Develop a traffic management program for the work site to prevent vehicles, people and property coming into contact.
Entanglement may occur with the rotating auger.	Enforce a 6 meter operating zone around operating plant. Erect barriers as required preventing persons coming into contact with operating machinery. Ensure any work done on the auger, or in close proximity to the auger is carried out while the auger is not in motion and cannot be accidentally put into motion. Use a 'lock out' system to prevent accidental operation of plant while maintenance is carried out.
Pinch points when attaching the auger drive unit, the auger and fitting the locating pins	Ensure hands are kept well clear of the point where the machinery is coming into contact and when using the locating pins. Where possible develop a process where the drive unit and the auger are held in position through jigs or other methods where the use of manual positioning is eliminated or minimised.
Impact with material ejected from plant when changing teeth	If the auger teeth must be removed using force use safety goggles to prevent eye injury.
Non-Mechanical Hazards	
Auger attachment may fall onto persons or property if not attached correctly	Follow the Auger Torque instructions for attachment of the auger. Ensure the attachment is secure before raising or moving.
Tripping hazard if auger and associated equipment is inappropriately stored	Ensure proper housekeeping on the work site. Create a designated storage area for equipment and keep walkways clear.
Electrocution by contact with overhead or underground powerlines and non-insulated nature of the plant item	Ensure site specific hazards are identified and safe methods of work are developed before operation of equipment.

Hazard		Recommended Hazard Controls
	Use of oils and lubricants	Many oils and lubricants are hazardous substances. Obtain a Material Safety Data Sheet (MSDS) from the supplier or manufacturer for any chemicals used in the operation or maintenance of Auger Torque equipment. The MSDS will indicate if the substance is hazardous and if so, carry out a risk assessment on the use of those substances to identify and control health and safety hazards associated with their use. <i>(Note: Refer to the Code of Practice for Hazardous Substances for further information. Available from www.whs.qld.gov.au)</i>
	Noise	Carry out noise level testing of the parent machine/s used with Auger Torque equipment. If the noise levels are above the exposure standard of $L_{Aeq,8h}$ of 85 dB(A) implement a hearing protection program. <i>(Note: Noise assessments should be carried out by a specialist. Refer to the Advisory Standard for Noise for further information. Available from www.whs.qld.gov.au)</i>
Ergonomics		
	Manual handling	The use of team lifting is discouraged. Use the hitch to lift the auger drive unit. Implement a system that minimises or eliminates the need to manually lift or move the auger attachment or the drive unit. Risk assessments should be carried out on all manual tasks associated with Auger Torque equipment before they are used. This assessment should identify any manual handling or ergonomic hazards associated with the use of the equipment. Controls to reduce or eliminate this risk should then be developed implemented. <i>(Note: Refer to the Advisory Standard for Manual Handling for further information. Available from www.whs.qld.gov.au)</i>
Work Environment		
	Working on hot parts	Operation of the equipment may create hot parts. Be aware of hot parts when handling the equipment and use non-slip gloves to protect hands where necessary.
Plant Controls		
	Emergency stops	Ensure the parent machine has appropriate emergency stops fitted. Regularly test these to ensure they are working.
Plant Guarding		
	Guarding	Ensure any guarding used remains in place and is regularly inspected to ensure serviceability and that it has not been tampered with. Additional guarding can be supplied with the trencher. Carry out risk management to identify if these or any other guarding is necessary to ensure a safety when using the trencher at your workplace.

Auger Drive Operators Manual

Hazard	Recommended Hazard Controls
Other	
Licensing of persons operating mobile plant	Ensure persons operating the parent machine are appropriately licensed.
Competency of operators	Ensure persons operating the parent machine and any Auger Torque equipment are appropriately trained and competent.
General operation of plant	Persons in control of plant at a workplace have workplace health and safety (WH&S) obligations under the WH&S Act 1997 to ensure the plant is safe and without risk to health and to ensure a safe workplace. Employers should carry out risk management in relation to plant at the workplace. This includes considerations for inspection, maintenance, repair, modification, servicing and cleaning. Ensure any hazards associated with use of Auger Torque plant at the workplace are identified and controlled. Employees also have obligations under the WH&S Act 1997. Inform employees about their obligation to: • Comply with instructions for health and safety given by the employer or principal contractor. • Not wilfully or recklessly interfere with or misuse anything provided to ensure the healthy and safe use of plant at a workplace. • Not to wilfully injure themselves. • To use personal protective equipment if the equipment is provided and properly instructed in its use. <i>(Note: Refer to the Advisory Standard for Plant for further information. Available from www.whs.qld.gov.au)</i>



Never operate or assemble the Auger Drive without fully understanding the operating instructions of both the Auger Drive Unit and the parent machine. Auger Torque Australia Pty Ltd recommend you receive dealer instruction before operating the Auger Drive Unit.

Never operate the Auger Drive unless you are in good physical condition and mental health.

Never operate the Auger Drive under the influence of any substance (including drugs & alcohol), which might impair vision, dexterity or judgement.

Always survey the work area before work. Boring below ground risks electrocution and explosion through contact with unseen hazards such as electricity cables and gas pipes.



Always ensure that the parent machine is secure and stable with its engine switched off before carrying out any maintenance work.

Never operate the Auger Drive with worn, damaged or missing parts. Only use genuine replacement parts.



Never allow bystanders (including animals) within 6 metres of the work area or allow minors to operate the Auger Drive Unit.



Never expose fuel or lubricants to any possible source of ignition.



Always protect yourself and the environment. Hydraulic oil, lubricants and exhaust fumes are toxic.



Always tie back long hair and remove jewellery before work. Wear suitable clothing that is close fitting whilst allowing freedom of movement.

Never wear clothing that could become entangled with the Auger or its drive.



Always protect hands - auger parts are sharp. Select gloves that are non-slip to improve grip and ones that protect against contact with oils and greases.



Always protect feet with safety boots (non-slip soles and steel-toe are recommended). Auger and drive parts are heavy and sharp.



Always wear head protection and eye protection when working on the Auger Drive.



Always follow parent machine instructions regarding NOISE protection



Auger Torque Auger Drive Units have been designed for use with specific Auger Torque mounting frames, augers, auger extensions and auger wearparts. Provided these are used and maintained correctly, they will provide a safe and reliable method of boring holes in the earth.

All Auger Torque Auger Drive Units require a 'flow' and 'return' of hydraulic oil from the parent machine's auxiliary hydraulic power supply to operate. All gearboxes are reversible, but require the host machine to be fitted with a two-way flow auxiliary circuit. (Check with parent machine dealer for advice). Ensure that the drilling rotation of the Auger Drive Unit is clockwise.

Some models of Auger Torque Auger Drive Units are supplied with hydraulic hoses and hydraulic Quick Release Couplers, which are required for connection to the parent machine. Check to insure the Couplers are compatible with those on the parent machine. The parent machine auxiliary hydraulic connections are normally located near the end of the loader arms, excavator dipper or truck crane booms.



It is critical that the supply of oil is within the stated limits for the particular drive unit. Flow (l/min) & pressure (bar).



IF IN DOUBT ASK YOUR AUGER TORQUE DEALER!



1

**Fit Mounting
Frame**



Single Pin Hitch
(see pages 9 & 11)



Double Pin Hitch
(see pages 10 & 11)



Double Pin Cradle Hitch
(see page 12)



Skid - Steer Mounting
Frame Hitch
(see page 13)

2

Fit Auger Drive Unit.



3

Fit Auger.

Auger Drive Operators Manual



ALWAYS work in pairs (2 skilled operatives) whenever Auger Drive Unit components are being assembled or disassembled from the parent machine.

ALWAYS check parent machine:

- **Is in correct working order**
- **Is parked correctly on flat ground**
- **The hydraulic circuit is locked out and the engine switched OFF.**

Check that the mounting frame is of the correct model and type to fit the parent machine.

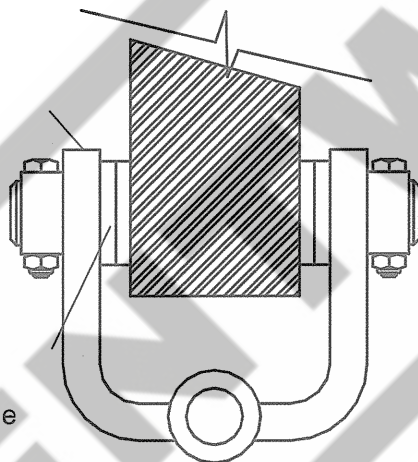
Ensure mounting frame and attachment points are clean before fitting.

Use suitably rated lifting equipment if required (see data plate for weight).

1

Fit mounting frame to parent machine

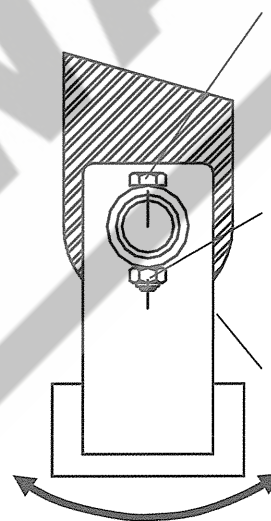
Use the spacers provided to centralise the frame (if required)



Align bolt location holes and fit location bolts and nyloc nuts.

Tighten nyloc nut to 26 Nm

Check single pin mounting frames are free to swing



IF IN DOUBT ASK YOUR AUGER TORQUE DEALER!



ALWAYS work in pairs (2 skilled operatives) whenever Auger Drive Unit components are being assembled or disassembled from the parent machine.

ALWAYS check parent machine:

- **Is in correct working order**
- **Is parked correctly on flat ground**
- **The hydraulic circuit is locked out and the engine switched OFF.**

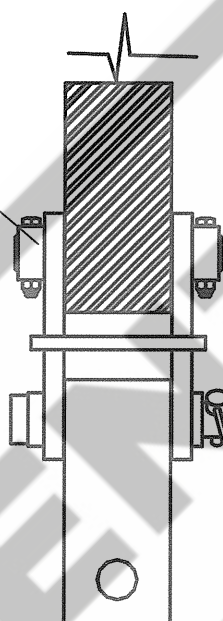
Check that the mounting frame is of the correct model and type to fit the parent machine.

Ensure mounting frame, and attachment points are clean before fitting.

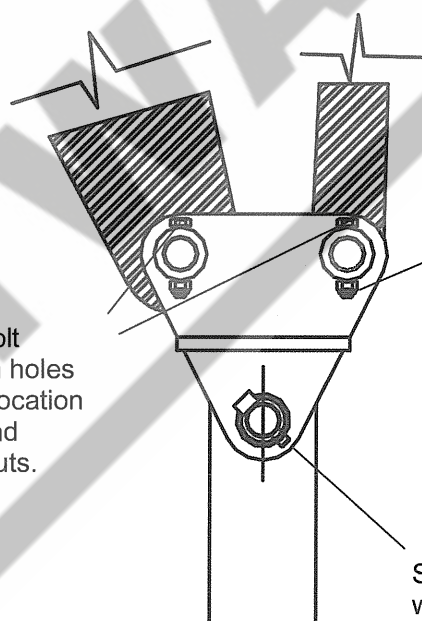
Use suitably rated lifting equipment if required (**see data plate for weight**).

1

Fit mounting frame to parent machine arms



Align bolt location holes and fit location bolts and nyloc nuts.



Tighten nyloc nuts to 26 Nm

Secure pivot with lynch pin



IF IN DOUBT ASK YOUR AUGER TORQUE DEALER!



ALWAYS work in pairs (2 skilled operatives) whenever Auger Drive Unit components are being assembled or disassembled from the parent machine.

ALWAYS check parent machine:

- **Is in correct working order**
- **Is parked correctly on flat ground**
- **The hydraulic circuit is locked out and the engine switched OFF.**

Check that the Auger Drive is of the correct model and type to fit the parent machine.

Ensure that the Auger Drive Unit, and its connections are clean before fitting.

Use suitably rated lifting equipment if required (see data plate for weight).

1

Refer to the parent machine operator's manual for attaching accessories



Align the Auger Drive Unit and mounting frame pivot holes then locate and secure the Pivot Pin with its Lynch Pin

2

Locate the flow and return hydraulic pipes onto the Auger Drive Unit



Connect quick release couplers. Ensure drilling rotation is clockwise!



Grease location pin(s) (see lubrication section).

Check that hydraulic pipes are of sufficient length to allow the drive unit to articulate during work



IF IN DOUBT ASK YOUR AUGER TORQUE DEALER!



ALWAYS work in pairs (2 skilled operatives) whenever Auger Drive Unit components are being assembled or disassembled from the parent machine.

ALWAYS check parent machine:

- **Is in correct working order**
- **Is parked correctly on flat ground**
- **The hydraulic circuit is locked out and the engine switched OFF.**

Check that the Auger Drive is of the correct model and type to fit the parent machine.

Ensure that the Auger Drive Unit, and its connections are clean before fitting.

Use suitably rated lifting equipment if required (see data plate for weight).

1

Align the Auger Drive Unit and mounting frame pivot holes then locate and secure the pivot pin with its lynch pin.

NOTE: It is good work practice to store the Auger Drive Unit on the cradle.

Locate the flow and return hydraulic pipes onto the Auger Drive Unit.

BEWARE: Some Auger Drive Units require a third drain line.



Refer to the parent machine operator's manual for attaching accessories.

Dipper Pin

Bucket Crowd Ram

2



With the Auger lying horizontally on the ground, use the excavator to move the Auger Drive Unit and Cradle Hitch to the auger. Rotate the Auger Drive Unit Output Shaft if necessary. Insert the auger pin and lynch pin.

Gently lift the Auger and retract bucket crowd ram, keeping the bottom of the auger close to the ground for stability, until the auger is in a vertical position.



IF IN DOUBT ASK YOUR AUGER TORQUE DEALER!

Auger Drive Operators Manual



ALWAYS work in pairs (2 skilled operatives) whenever Auger Drive Unit components are being assembled or disassembled from the parent machine.

ALWAYS check parent machine:

- Is in correct working order
- Is parked correctly on flat ground
- The hydraulic circuit is locked out and the engine switched OFF.

Check that the Auger Drive is of the correct model and type to fit the parent machine.

Ensure that the Auger Drive Unit, and its connections are clean before fitting.

Use suitably rated lifting equipment if required (see data plate for weight).

1



Refer to the parent machine operator's manual for attaching accessories



Earth Drill 3000

Align the Auger Drive Unit and mounting frame pivot holes then locate and secure the pivot pin with its lynch pin

2

Connect quick release couplers. Ensure drilling rotation is clockwise!



Locate the flow and return hydraulic pipes onto the Auger Drive Unit

Grease location pin(s).



Earth Drill 3000

Check that hydraulic pipes are of sufficient length to allow the drive unit to articulate during work



IF IN DOUBT ASK YOUR AUGER TORQUE DEALER!

Auger Drive Operators Manual



ALWAYS work in pairs (2 skilled operatives) whenever Auger Drive Unit components are being assembled or disassembled from the parent machine.

ALWAYS check parent machine:

- **Is in correct working order**
- **Is parked correctly on flat ground**
- **Has its hand brake ON and its engine switched OFF.**

Check that the Auger Drive is of the correct model and type to fit the parent machine.

Ensure that the Auger Drive Unit, and its connections are clean before fitting.

Use suitably rated lifting equipment if required (see data plate for weight).

1

Refer to the parent machine operator's manual for attaching accessories.

(Some cranes require an additional short manual extension for mounting the Auger Drive Unit.)



Remove the lifting hook, and insert the Linkage onto the hook pin. Now Align the Auger Drive Unit and the linkage holes. Locate and secure the pivot pin with its lynch pin

2

Grease location pin(s) (see lubrication section).

Locate the flow and return hydraulic pipes onto the Auger Drive Unit



Connect quick release couplers.

Ensure drilling rotation is clockwise!

Please Note: Crane mounted stowage devices are available for storage of the Auger Drive Unit on the crane when not in use. Please contact Auger Torque Australia Pty Ltd for further information.



IF IN DOUBT ASK YOUR AUGER TORQUE DEALER!

Auger Drive Operators Manual



ALWAYS work in pairs (2 skilled operatives) whenever Auger Drive Unit components are being assembled or disassembled from the parent machine.

ALWAYS check parent machine:

- **Is in correct working order**
- **Is parked correctly on flat ground**
- **The hydraulic circuit locked out and the engine switched OFF.**

Check that the Auger is the correct model and type to fit the Auger Drive Unit.

Ensure that the Auger connections are clean before fitting.

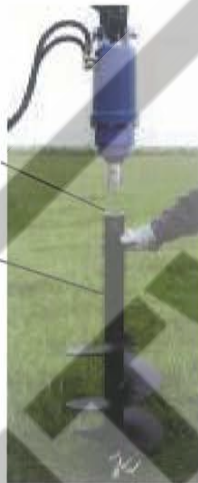
Use suitably rated lifting equipment if required (**see data plate for weight**).

1

Position the Auger in the vertical work position



Ensure the Auger is in a stable condition and cannot fall over



2

Lower the Auger Drive Unit onto the Auger

Align the Auger Drive pin holes



3

Locate Auger drive pin

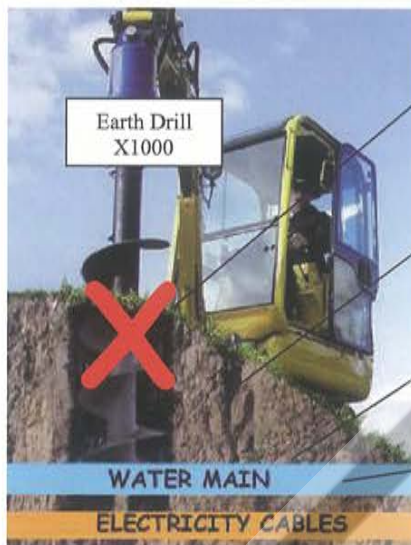


Secure Auger drive pin with lynch pin



IF IN DOUBT ASK YOUR AUGER TORQUE DEALER!

1



CONSIDER the topography (e.g. risk of subsidence, slope angle, position to embankments and any previous excavation)

NOTE the type of soil and its condition to enable selection of suitable teeth and pilot

ALWAYS carry out a site survey and risk assessment **BEFORE** starting work

AVOID underground hazards, such as Water / Gas / Electricity / Communication Lines etc.

If in doubt detection equipment and professional advice **should always be considered** before carrying out any work.

2



SET Auger in a vertical drilling position

ENSURE the direction of rotation of the Auger for drilling is **CLOCKWISE**.

ONLY start drilling after a site survey on a pre - marked safe spot.

3



GRADUALLY lower the parent machine arm(s) to apply down force to the Auger.

The harder the ground the more down force required.

Maintain drilling speed. **DO NOT CONTINUALLY STALL** the Auger Drive Unit with excessive down force, as this will overheat the hydraulic oil and could damage the machine.



IF IN DOUBT ASK YOUR AUGER TORQUE DEALER!

4

MAXIMISE efficiency and avoid damaging the Auger assembly by keeping the Auger vertical.



As many parent machine arm(s) travel through an arc, it maybe necessary to reposition the parent machine as the Auger lowers into the ground to maintain vertical drilling.



REGULARLY raise the Auger out of the ground to clear material from the Auger.

This will help maintain drilling effectiveness and ensure your machine does not become unstable.

5



NEVER leave the Auger assembly suspended.

ALWAYS park with Auger on ground



IF IN DOUBT ASK YOUR AUGER TORQUE DEALER!

Auger Drive Operators Manual



When attached to the parent machine the standard Auger Unit is free to swing and can be extremely dangerous during transport.

TRANSPORTATION ON PUBLIC HIGHWAYS:

- **ALWAYS** remove the Auger and Drive Unit before driving or transporting the parent machine on public highways.
- **ALWAYS** store the Auger and Drive Unit securely and safely when removed from the parent machine taking special care of the hydraulic hoses and connections.

TRANSPORTATION WITHIN THE JOB SITE:

- **ALWAYS** operate the parent machine slowly when on site taking great care to avoid the Auger swinging.
- **RECOMMENDED:** where fitted use the hitch cradle (identified below) to support the Auger Drive Unit when manoeuvring or slewing when on site.



IF IN DOUBT ASK YOUR AUGER TORQUE DEALER!

	Safety at all times
	Ensure environmentally safe disposal of waste oil: Do not pour down drain!
	Avoid Fire or Explosion: Do not smoke near, or expose lubricants to, any possible sources of ignition (e.g. fire, electrical sparks or heat sources.)
	All lubricants are toxic and potentially carcinogenic (cancer causing).
	• Avoid contact with skin and eyes: Wear suitable protective clothing and gloves. Always use a suitable barrier cream in case of skin contact.
	• Always wear eye protection: In the event of skin contact wash with soap and water. In the event of eye contact wash with water and seek medical advice.
	• Do not ingest: If swallowed seek medical advice immediately.

Auger Torque Auger Drive Unit features a sealed gear housing filled with gear oil to lubricate the planetary gearset components and bearings within the housing.

Auger Torque Auger Drive Units are low maintenance, however regular checks for oil leaks and following the service schedules are recommended to ensure a trouble free product.

Weekly:

Grease hitch and drive unit pivot pins.

After first 500 hours of use or six (6) months:

To maximise life and maintain warranty the Auger Drive Unit gear oil requires draining and replacing with Castrol SP320 (or equivalent) after the first 500 hours of use or six (6) months from date of purchase – whichever occurs first. (Note this first service is LABOUR FREE provided your Auger Torque dealer carries it out).

Important: To maintain product warranty your Auger Torque dealer must record proof of this first oil change.

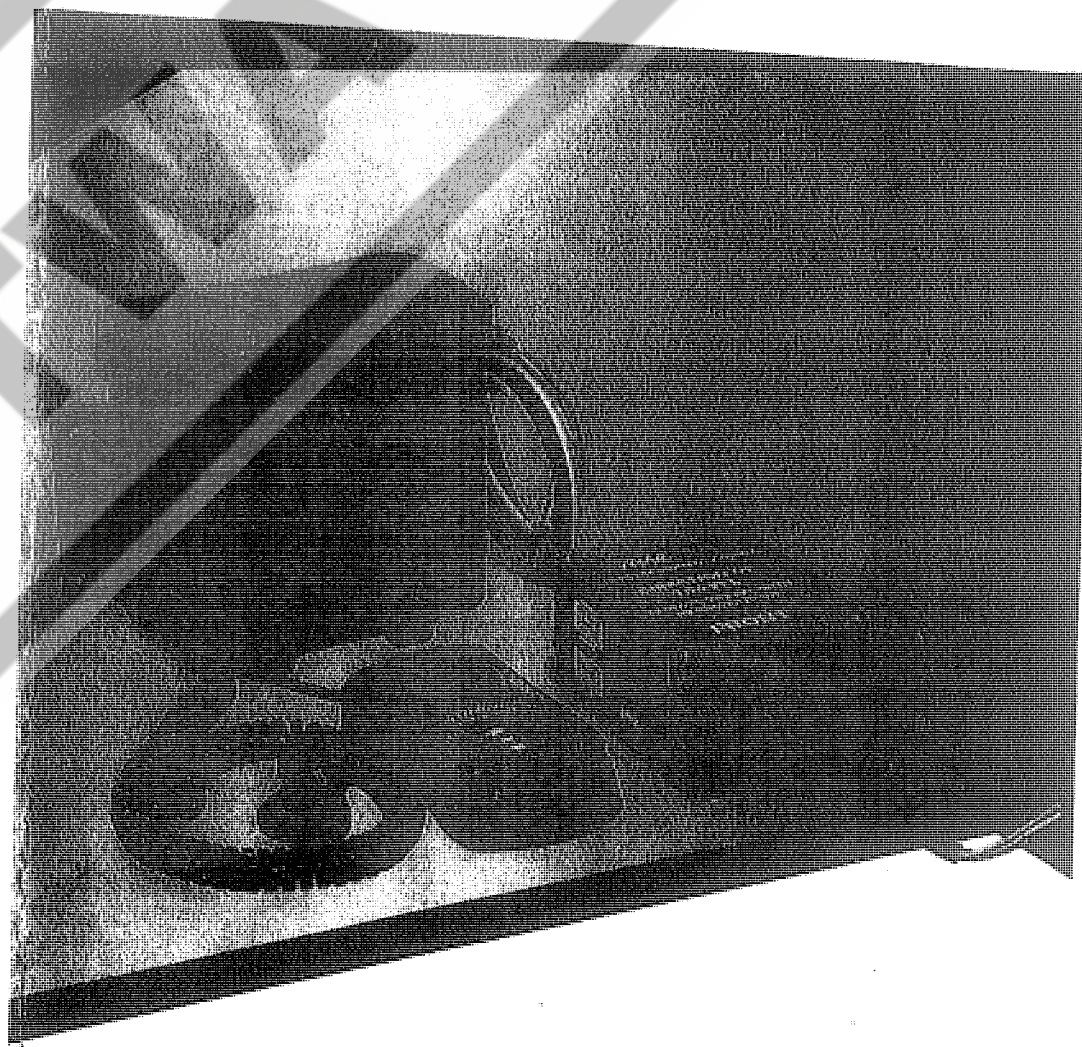
Yearly or after every 2000 hours of use (whichever is sooner):

The Auger Drive Unit gear oil requires draining and replacing with Castrol SP320 (or equivalent) every twelve (12) months or 2000 hours – whichever occurs first. See Parts Manual for volumes.



IF IN DOUBT ASK YOUR AUGER TORQUE DEALER!

Operating Instructions



Installation Instructions

Mount the Brake controller according to the mounting orientation instructions on page 4.

Wire the brake controller according to the instructions below.

It is important that trailers fitted with the SE braking system are also fitted with 12/24 volt LED lights, not voltage specific incandescent or LED lights.

The controller is capable of running trailers with up to 6 wheels braked with electric drum brakes.

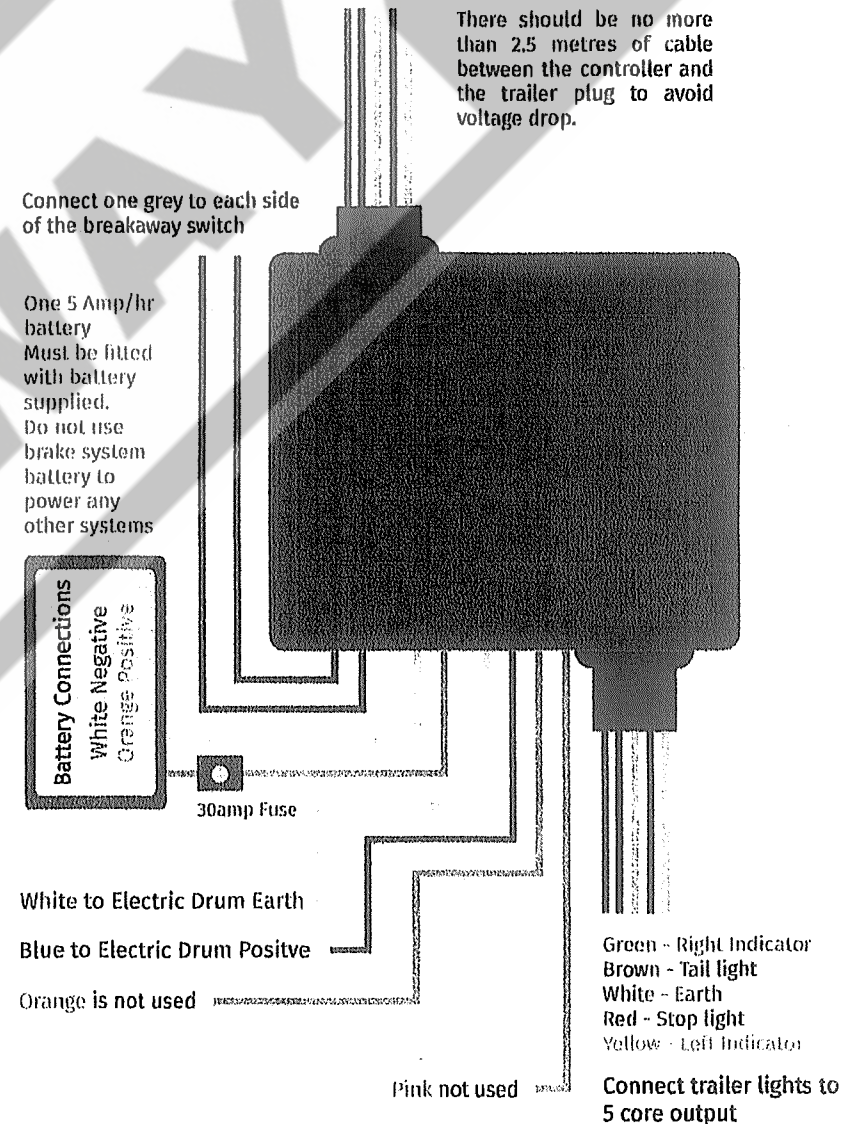
The earth from the trailer brakes and the trailer battery must only connect to the brake controller output earths as shown in the diagram. They cannot be connected to a common chassis earth.

Cable gauge should be of sufficient size to avoid voltage drop. For electric drum brakes a minimum of 15 amp cable should be used and a separate feed should be run per two wheels that are fitted with brakes.

The trailer lights must only be connected to the 5 core lighting output from the controller and cannot bypass this directly to the trailer plug.

There is a spare orange wire that is not used when installing on a trailer fitted with electric drum brakes. This can be cut short if desired.

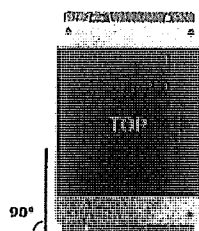
Electric Drum Wiring Diagram



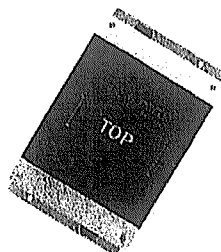
Mounting Orientation



CORRECT



INCORRECT

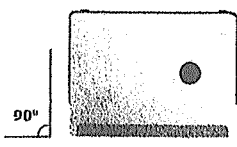


Direction of Travel

Must be mounted straight longitudinally, i.e. parallel to direction of travel



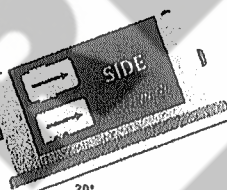
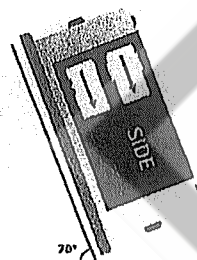
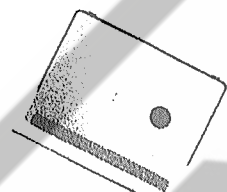
CORRECT



Unit Must Be Level Laterally



INCORRECT



Direction of Travel

Back can be up to 70 Degrees Up

OR

Back can be up to 20 Degrees Down

Cab Controls

1 Emergency Brake – When activated, this will apply the trailer brakes at 75% of the current gain setting. This can be used to control trailer sway situations and stop the vehicle combination in an emergency.

2 Gain Control – Adjusting Gain Control: The plus button will increase the maximum brake percentage, and the minus button will decrease it. This should be set so the vehicle will brake to a halt without the trailer wheels locking up. An effective benchmark is to perform a brisk stop on a straight flat stretch of road from 30 kph. The vehicle trailer combination should halt without the trailer wheels locking. Increase or decrease the gain setting until the trailer is braking at just under the lock up level. Ensure conditions are safe around you before carrying out this procedure.

3 Sensitivity Control – This will control how quickly and aggressively the brakes will activate, with 1 being the least and 5 the most aggressive. Pressing this will advance the setting from 1 up to 5 and then back to 1. Setting this to 3 will provide mid-range braking. Decrease this setting to 2 or 1 if brakes come on too suddenly. Increase this setting if braking action seems too slow.

4 Screen – This will provide feedback about the operation of the controller and warn of any faults that might occur.

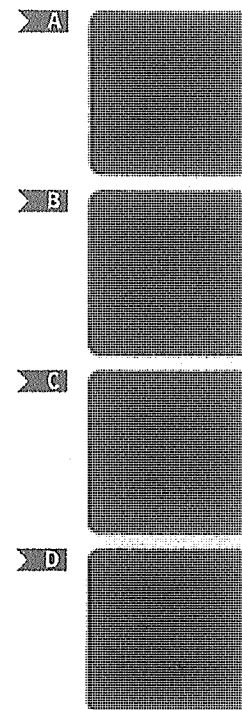
A Normal operation – Head lamps on, no brake applied.

B Brake Applied – When sitting still this will show a braking level around 0% - 5%. When travelling this will show a percentage from 0% up to 99% depending on the level of braking and the current gain setting.

C Ec Error – If this shows with a slow steady beep it indicates your headlamps are not on or if they are that there is a loss of communication between the trailer and cab modules. In the event of communication loss, providing the headlamps are on and the lighting connection between the tow vehicle and the trailer is not faulty the brakes will continue to operate at the last setting. This should however be investigated as soon as it is safe to stop.

D Eb error – The unit will beep 4 times and flash Eb in the event of the battery charge dropping below an unsafe level, meaning that the brakes may not operate correctly.

Note: Both the trailer and the cab modules of the brake controller are compatible with 12 and 24 volt vehicles.

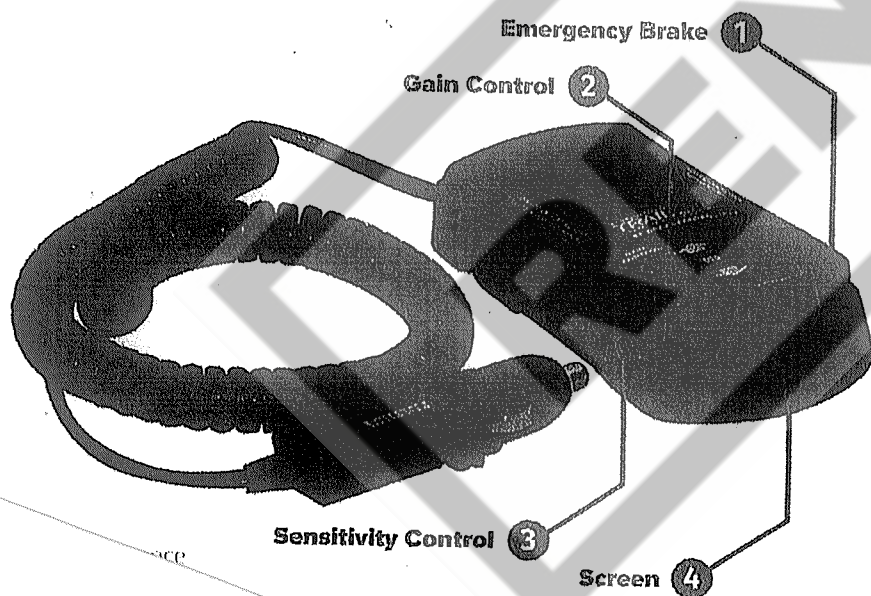


Operating Instructions

The SE Braking system meets Australian Design Rules 38 braking regulations and is legal for trailers up to 4500kg GVM when used according to these instructions.

Operation

- The in cab controller must be connected at all times and located within easy reach of the Driver.
- The Vehicle park, or head-lights must be switched on when towing the trailer. This energises the trailer side of the system and also will allow the trailer batteries to charge.
- Check the plug and socket of the trailer and tow vehicle are securely connected and that the trailer lighting functions all work correctly. A faulty or intermittent lighting connection could mean the brakes do not operate correctly.
- Ensure the break away cable is securely fastened to the vehicle.
- Test the emergency brake is working. First adjust the gain control setting to read 75%. Depress emergency stop button fully, and begin to pull forwards while still holding the button down. The trailer brakes should lock the wheels.
- Do not use the emergency stop feature or breakaway function as a parking brake.



Periodic Maintenance and Checks

Check battery is keeping well charged. A well charged battery should be at or above 13 volts. This is particularly important if the trailer is left parked for extended periods of time. If the trailer is not used for extended periods the battery should be removed every 2 months and charged to ensure it does not become damaged. This can happen if the battery charge drops below 10.5 volts.

Check the trailer plug and vehicle socket to ensure they are not damaged and they give a sound electrical connection. An intermittent or faulty connection could mean the brakes do not function correctly.

If fitted with a hydraulic actuator make sure the fluid level remains sufficient. The fluid should be changed in line with general trailer service intervals.

If fitted with electric drums make sure they are kept properly adjusted and that the magnets and linings are not excessively worn and are replaced in line with general trailer service intervals.

Other Information

The trailer and cab parts of the controller are uniquely paired together by their serial numbers. The serial number is a 3 or 4 digit number and is located on the bottom of the cab unit and is stamped on the front of the alloy mounting plate of the trailer unit.

Available from VENTA Pty Ltd.
Phone us on 1300 538 598

For More Information
www.trailequip.co.nz

Owner's Manual

Jimboomba Trailers and Fabrication Pty Ltd

ABN: 86267711065 ACN: 148052671

74 High Road, Bethania QLD 4205

Ph 07 3200 2427 Fax 07 3200 9331 Email: info@jtf.net.au

www.jtf.net.au

Introduction

Acquisition & Warranty

Record below the serial number of your trailer and keep it in a secure place to help trace the trailer and assist us when you order parts.

Model	
Month/Year of Manufacture	
Serial Number (VIN)	
Original Owner (name and address)	
Delivery Date	
Purchased through what Dealer	

This Document contains the Original Operating Instructions for this machine and is verified by the Manufacturer.



JTF Director

Disclaimer

Every effort has been made to ensure that the information in this manual was accurate and up to date at the time of going to print. JTF reserves the right to make subsequent changes to the trailers, where necessary, without notification.

The Company will not be responsible for any damage or consequential loss arising out of misinterpretation or failure to follow recommended procedures. Nor will it be liable for any damage caused by or arising out of modification or misuse of its product.

The owner has a responsibility to protect himself and others by observing all safety information and road regulations and by ensuring all operators are well acquainted with the safety information, trained in the correct use of the trailer and applying safe work practices.

The Owner's Manual

Your new JTF Trailer will give long and efficient service if serviced regularly and operated as intended.

This owner's manual is provided so that you can become thoroughly familiar with the design of the trailer and to provide information on the correct operation, applicable adjustment and maintenance.

Only persons well acquainted with these guidelines should be allowed to use the equipment.

A general parts list has been included in this document so that if any parts are required your dealer will be able to suitably describe the item and request them by part numbers.

The manual is considered part of the trailer and must be issued when the trailer is sold.

Right and left hand references in this manual are determined by standing behind the trailer and facing in the direction of travel.

Trailer Type and Usage

JTF Supply and manufacture a variety of plant and equipment trailers to suit a range of private and commercial application in both steel and aluminum. This document will identify a number of standard and common features to assist in the operation of your trailer. If a particular feature is not made mention for please contact the manufacturer for instruction or clarification.

Our standard product/ model range includes;

JTF-A001-2T	2T ALUMINIUM EXCAVATOR TRAILER (form bent) 2100X1140 (drive up)
JTF-A002-2T	2T ALUMINIUM SKID STEER TRAILER (Suit S70) (form bent) 2100x1500
JTF-A003-2T	2T ALUMINIUM ROLLER & SCISSOR LIFT TRAILER (form bent) 2100X1140
JTF-A004-2T	2T ALLOY JTF MINI LOADER TRAILER (a-frame) 3000X1500 w beavertail
JTF-A005-2.8T	2.8T ALLOY JTF MINI LOADER TRAILER (a-frame) 3000X1500 w beavertail
JTF-A006-2.8T	2.8 Tonne ALUMINIUM EXCAVATOR TRAILER (form bent) 2100X1140 (drive up)
JTF-A007-3.5T	3.5T ALUMINIUM EXCAVATOR TRAILER (form bent) 2400X1850
JTF-A008-3.5T	3.5T ALUMINIUM MACHINE TRAILER (a-frame) 4000X1850
JTF-A009-4.5T	4.49T ALUMINIUM MACHINE TRAILER (a-frame) 4000X1850
JTF-S001-1.4T	1.4t Single Axle Steel Excavator Trailer (form bent) 1000X1500 (plus bucket mount)
JTF-S002-1.8T	1.8T STEEL RANGER TRAILER (a-frame) 3600x1900 w beavertail
JTF-S003-2T	2T JTF MINI LOADER TRAILER (a-frame) 3000x1500 w beavertail
JTF-S005-2.8T	2.8T STEEL JTF MINI LOADER TRAILER (a-frame) 3600x1500 w beavertail
JTF-S006-2.8T	2.8T STEEL MACHINE TRAILER (form bent) 3000x1500 (sloped deck)
JTF-S007-3.5T	3.5T STEEL MACHINE TRAILER (a-frame) 4000x1900 w beavertail
JTF-S008-4.5T	4.49T STEEL MACHINE TRAILER (a-frame) 4000x1900 w beavertail
JTF-S009-7T	TANDEM AXLE PLANT TRAILER (JTF 7T PLANT) (a-frame) 500x2250 w beavertail
JTF-S010-9T	TANDEM AXLE PLANT TRAILER (JTF 9T PLANT) 6000x2250 w beavertail

*If the trailer you have purchased is outside the above range then any additional information will be provided for on the point of delivery but may not be specifically mentioned within this document.

Manufacturer Advised Capacities

Trailers are built with a reference to ATM; this is by definition is 'Aggregated Trailer Mass'. This is total mass of the trailer when carrying the maximum load recommended by the manufacturer.

As the operator you are responsible for the load you are carrying and must consider the operating weight of your cargo or equipment before loading and or towing. It is also recommended that you reference your tow vehicles operating manual for safe towing requirements for tow limits and limitations.

Please refer to the plate attached to your drawbar for specifics on your trailers capacities.

General Capacities are as follows;

Component	Maximum Capacities (manufactures guidance- estimated)
JTF-A001-2T Ramps	Combined capacity not exceeding 1.86tonne
JTF-A002-2T Ramps	
JTF-A003-2T Ramps	
JTF-A004-2T Ramps	
JTF-A005-2.8T Ramps	Combined Capacity not exceeding 2.4tonne
JTF-A006-2.8T Ramps	
JTF-A007-3.5T Ramps	Combined Capacity not exceeding 2.9tonne
JTF-A008-3.5T Ramps	
JTF-A009-4.5T Ramps	Combined Capacity not exceeding 3.6tonne
JTF-S001-1.4T Ramps	Combined Capacity not exceeding 1tonne
JTF-S002-1.8T Ramps	Combined Capacity not exceeding 1.4tonne
JTF-S003-2T Ramps	Combined Capacity not exceeding 1.5tonne
JTF-S005-2.8T Ramps	Combined Capacity not exceeding 2.1tonne
JTF-S006-2.8T Ramps	
JTF-S007-3.5T Ramps	Combined Capacity not exceeding 2.5tonne
JTF-S008-4.5T Ramps	Combined Capacity not exceeding 3.2tonne
JTF-S009-7T Ramps	Combined Capacity not exceeding 4.7tonne
JTF-S010-9T Ramps	Combined Capacity not exceeding 6.5tonne
*Auger Power Drive attachment mount (standard)	Capacity not exceeding 75kg
*Trencher attachment mount (industry average)	Capacity not exceeding 110-175kg
*Augers attachment mount (pending size) (industry average)	Capacity not exceeding 35-65kg
*Leveller Bar attachment mount (industry average)	Capacity not exceeding 100kg
*Rock Breaker attachment mount (industry average)	Capacity not exceeding 120-175kg
*4 in 1 Bucket attachment mount (industry average)	Capacity not exceeding 165kg
185/14LT Tyre	850kg per tyre (some variation between brands)
195/14LT Tyre	950kg per tyre (some variation between brands)
225/75 R 15"	880-975KG per tyre (some variation between brands)
225/75 R 16"	880-975KG per tyre (some variation between brands)
235/75 R 15"	880-975KG per tyre (some variation between brands)
235/75/R 16"	880-975KG per tyre (some variation between brands)
235/75/R17.5	2800kg per tyre (some variation between brands)
Swing Up Jockey Wheel 8" wheel	Rated Maximum Capacity 350kg
Swing Up Jockey Stand	Rated Maximum Capacity 350kg
Bull-Dog Trailer Jack	Rated Maximum Capacity 4500kg

*these are industry averages and are used as a guide only

SAFETY – General

This section of the manual offers general guidelines for the safe operation of the trailer rather than specific hazards. It does not replace local safety regulations or road regulations. These guidelines were current at the time of publication, but may be superseded by later regulations. JTF has made every effort to highlight all risks to personnel or property. Owners and operators have a responsibility to exercise care and safe work practices at all times in the vicinity of the trailer. Owners are advised to keep up to date on safety issues and to communicate these to all users of the trailer. If you have safety concerns specifically related to this trailer, contact your dealer immediately.

Under no circumstances are passengers to be permitted on the trailer while it is in operation or being transported. Any footboards and/or footsteps are provided solely for the purpose of preparing the trailer for use.

Keep clothing and body extremities well clear of pinch points while operating the trailer. Keep well clear of moving parts at all times. These include couplings, ramps brackets, wheels, brakes and pivot points, etc.

Always exercise extreme caution in the vicinity of sharp edges and points.

Footboards, footsteps, drawbars and other machine surfaces may be slippery when wet. Apply extra caution in wet conditions and in the early morning when surfaces are wet.

SAFETY – Towing

Apart from the driver's legal responsibilities, towing requires a greater degree of knowledge and skill than normal driving.

When towing, you should:

- ✓ Allow for the extra length and width of the trailer when entering traffic;
- ✓ Apply the accelerator, brakes and steering smoothly and gently to avoid sway, especially in wet or slippery conditions;
- ✓ Maintain a space of at least 60 metres between you and the vehicle in front to allow for a longer stopping distance;
- ✓ Engage a lower gear in both manual and automatic vehicles to increase vehicle
- ✓ Allow more time and a greater distance in which to overtake. When towing, your vehicle's capacity to accelerate is reduced;
- ✓ If possible, reverse with a person watching the rear of the trailer;
- ✓ Where areas are provided, pull off the road to allow traffic building up behind you to overtake;
- ✓ Be aware that towing is more stressful than normal driving and is more likely to cause fatigue. Therefore, more rest stops should be planned.

The loaded mass of your trailer must not exceed:

- ✓ The capacity of the towbar; or
- ✓ The maximum towing mass specified by the tow vehicle's manufacturer; or
- ✓ The trailers manufactures guidance

- ✓ Due consideration needs to be given when loading the machine or equipment onto the trailer and it is recommended you following the trailer manufactures guidance as to the load direct of the equipment
- ✓ Tow ball height on the tow vehicle is also a critical consideration (see below)



Safety - Operator

All trailers are potentially dangerous and should be treated with caution and respect.

It is strongly suggested that you carefully read this before operating the new equipment. Learn how to use this trailer safely. Be thoroughly familiar with the controls and the proper use of the trailer before using it. Take careful note of all safety instructions both in this manual and on the trailer itself. Failure to comply with instructions could result in personal injury and/or damage to the trailer. It is recommended that you periodically replace missing or damaged safety signs on the trailer to ensure that these remain clearly visible.

It is the owner's responsibility to ensure that anyone who operates, adjusts, maintains, cleans or uses the trailer in any way has had suitable instruction and is familiar with the information in this manual (particularly with regard to safety aspects general).

Operators and other users of the trailer should be aware of potential hazards and operating limitations.

Load Restraint

Please refer to the 'National Transport Commission (NTC) publication Load Restraint Guide'

www.ntc.gov.au/heavy-vehicles/safety/load-restraint-guide/

– 'Grade 70 Chain, Components & Load Binders' (AS/NZS 4344)

Appropriate Dress

Wear close fitting clothing and avoid rings or other forms of jewellery which could become caught on the trailer. People with long hair must have it securely fixed and confined close to the head. Please refer to local safety standards for protective clothing and recommended safety equipment.

Trailer in transit

Ensure that all linkage pins and clips are fitted correctly. Ensure the ramps are stowed accordingly and secured with pins or clips. When loading equipment or cargo ensure that the load is secured and meets Road Regulations (refer to Safe Towing – All about safe towing, Department of Transport and Main Roads and Load Restraint Guide from the National Transport Commission).

- A speed of 100km/h must not be exceeded.

Practice Safe Maintenance

Keep the trailer in safe working condition.

Routine maintenance and regular servicing will help reduce risks and prolong the life of the trailer.

These are the suggested minimum maintenance guidelines;

- ✓ You must visually inspect and check tension of all nuts, bolts, U-bolts and wheel bearings after the first two (2) hours of use. (Tension of nuts, bolts and U-bolts is recommended at 120 newtons)
- ✓ You must visually inspect and check the tension of all wheel nuts. It is vital that wheel nuts are inspected every 100km for the first 300km of use. This recommendation is also strongly encouraged at any time a wheel is removed and or replaced.
- ✓ Visually inspect and grease wheel bearings 3 monthly (strongly recommended).
- ✓ If fitted, brakes will require adjusting dependent on the load and tow vehicle.
- ✓ Brake components should be regularly inspected whether that is disc or electric. Trailers fitted with a break-away system will need to be visually inspected prior to every use, to ensure the independent battery is functioning and charged sufficiently.
- ✓ Suspension components should be visually inspected regularly (after every 100 hours of use is recommended).
- ✓ Inspect and adjust the coupling screw adjuster as required to suit tow vehicle tow ball.
- ✓ Do not store damp materials in or on the trailer. If possible it is recommended to store the trailer out of the elements when not in use.
- ✓ Do not use jockey wheel and or stand for transport or movement of trailer. Jockey wheel and or stand are to be used for hitching purposes only.
- ✓ Check the integrity of the trailer and areas of high wear for damage or stress

*Note: Suggested maintenance is the minimum recommended. If the trailer is being employed commercially then the intervals between inspections should be reviewed based on usage. For further information please contact the manufacturer.

Routine Maintenance

To ensure the safety and reliable operation of your suspension system the following routine maintenance is strongly recommended. The service periods recommended below are based on normal road usage. For commercial and or abnormal conditions maintenance intervals will need to be more frequent and daily visual inspections are recommended.

Maintenance should be carried out by a competent person.

The suspension, tyres and braking system has be fitted and selected according to the vehicle manufacturers recommended Aggregate Trailer Mass (ATM) which can be found on the vehicles compliance plate. It is important that these figures are not exceeded.

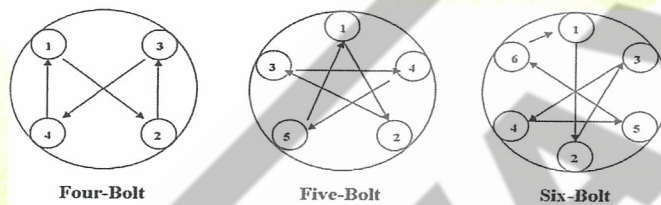
	1 st 100klm	1 st 300klm	1 st 1000klm	5000klm	10000klm	20000klm
Wheel Nuts Tightened	✓	✓	✓	✓	✓	✓
Suspension and mounting bolts	✓		✓			
Suspension Bushes	✓		✓			
Wheel Bearings Checks	✓		✓		✓	
Wheel Bearings Service				✓	✓	
Check Brake mounting bolts	✓	✓	✓	✓	✓	✓
Brake Adjustment and Checks	✓			✓	✓	
Brake Service		✓		✓		
Wheel Alignment				✓		✓
Axle Mounting				✓		✓

TIGHTNESS OF WHEEL NUTS

When a wheel is first fitted or removed there is an immediate settling in period where the wheel nuts will need retightening. Trailers tend to experience higher wheel loads than cars especially in tandem configuration and so extra effort should be taken to ensure wheel nuts remain tight.

Proceed as follows:

- ✓ Make sure the wheel and hub mating surfaces, as well as the wheel studs and nuts, are free of oil and all foreign material. Do not lubricate wheel studs.
- ✓ Using a wheel or air wrench, lightly tighten all the wheel nuts, in a criss-cross pattern, until they are snug.
- ✓ Using a torque wrench, tighten the wheel nuts in a criss-cross pattern to the vehicle manufacturer's torque specification.



IMPORTANT: Torque settings may need to be reduced depending on wheel rim design and type. Please consult manufacturer or wheel supplier for recommended specifications to suit the wheels supplied with your trailer.

- Maximum torque is based on 80% of stud yield strength.
- Wheel nuts should be torqued using a calibrated torque wrench and checked at regular intervals as recommended above.
- Wheel nuts should be tightened in a diagonal (criss-cross) sequence as shown above.

Stud Size	Grade	Maximum Stud Torque (N.m)
7/16" UNF	SAE Grade 8	120
1/2" UNF	SAE Grade 8	200
9/16" UNF	SAE Grade 8	270
5/8" UNF	SAE Grade 8	375
M12x1.5	Class 10.9	155
M14x1.5	Class 10.9	245

SUSPENSION

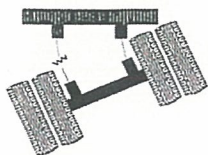
Using a torque wrench check all bolts for tightness. Required torque settings given in Table 1 and Table 2 below.

45mm Wide Springs - All bolts should be tightened until locked and then backed off until suspension is free to move but not loose.

Remove bushes, bolts, pins and spindles and inspect. Any parts showing signs of wear should be replaced. Smear a small amount of grease on bushes and outside of pins and spindles prior to reassembly. Torque all bolts in accordance with specifications below, ensuring that new nylon insert nuts are fitted where used.

Parabolic Suspension		
Bolt/Nut Size	Application	Torque (N.m)
1/2" x 3 1/2" Bolt UNC & 1/2" Nylon Insert Nuts	Single Leaf - Shackles & Hangers	200

Load Share - Suspension		
Bolt/Nut Size	Application	Torque (N.m)
9/16" x 3.5" Shackle Bolt & 9/16" Nylon Insert nut - 45mm Spring	Leaf Suspension - Shackles & Hangers	200
9/16" x 3.5" – Greasable Shackle Bolt & 9/16" Nylon – 45mm centre rocker	Leaf Suspension - Shackles & Hangers	200
5/8" X 4" Shackle bolt & 5/8" Nylon Insert Nut - 60mm Spring	Leaf Suspension - Shackles & Hangers	200
5/8" X 4" – Greasable Shackle Bolt & Nylon Nut – 60mm spring center rocker	Leaf Suspension - Shackles & Hangers	200



Loose suspension fasteners and worn parts may cause vehicle instability resulting in loss of control or upset.

Overtorquing could result in fastener failure.

5 TON MECH SUSPENSION AND AXLE TORQUE REQUIREMENTS

CHECK TORQUE VALUES AFTER "BREAK IN" PERIOD OF APPROXIMATELY 1000 TO 3000 MILES, (OR 1600 TO 4800 KILOMETERS) AND ANNUALLY THEREAFTER

U-BOLT NUTS, STEEL SPRINGS 5/8" UNF	177 ft-lb (240 Nm)
ROCKER BOX BOLT, M30x3.5P	885 ft-lb (1200 Nm)
REAR HANGER BOLT NUTS, M16X2P	7.5 ft-lb (10 Nm)
LEAF SPRING EYE BOLT, M20X2.5P	265 ft-lb (360 Nm)
CHECK WHEEL NUTS TORQUE SETTINGS	332 ft-lb (450 Nm)
MAKE SURE THE GREASE CAP IS TIGHT	
CHECK BEARING GREASE EVERY 12 MONTHS OR 100,000 KMS	
FOR BEARING ADJUSTMENTS, CHECK PERIODIC MAINTENANCE	
AT WWW.ABSTRAILQUIP.COM	

NOTICE: THESE SETTINGS MUST BE MAINTAINED AT ALL TIMES. VALUES ARE EXPRESSED IN ENGLISH UNITS, ft-lb=FOOT-POUNDS, AND METRIC UNITS, Nm=NEWTON-METERS

The torque figures quoted are approximate and are applicable to fasteners in a clean and un-lubricated condition, free from rust or corrosion. Correct pre-loading of the bolt resists the effects of fatigue. Providing that the bolt pre-load is greater than the applied load, the fatigue life of the bolt will be infinite.

Always remember that the best method for retaining a nut on a bolt is by regular inspections and proper tightening.

**Note we reserve the right to change the bolt and nut combination throughout the manufacturing cycle pending operational requirements*

BRAKES

At recommended intervals, inspect brakes, check operation, clean and adjust accordingly.

On hydraulic systems check condition of brake lines & hoses and check for signs of leaks on calipers and connection points. If you discover any worn items these should be replaced immediately

On disc brakes check the condition of the bolts, caliper and brake pads for wear and tear. If you discover any worn items these should be replaced immediately.

The electric brakes on your trailer are similar to the drum brakes on your car. The basic difference is that your vehicle brakes are actuated by hydraulic pressure whilst your electric trailer brakes are actuated by an electromagnet. The electrical current is fed into the system by the brake controller (in-car); it flows through the electromagnets into the brakes. The electromagnets are energized and are attracted to the rotating surface of the drums which moves the actuating levers in the direction that the drums are turning. The resulting force forces the primary shoe out against the inside surface of the brake drum. The force generated by the primary shoe acting through the adjuster link then moves the secondary shoe out into contact with the brake drum.

Therefore increasing the electrical flow (braking force) to the electromagnet makes the magnet grip tighter to the surface of the brake drum until the desired stop is accomplished.

Park Brake Operation - The brakes is mechanically operated by cable. The cable attachment occurs outside of the brake backing plate. Cable force applied to the parking lever operates a cam assembly which results in a spreading force between the primary and secondary shoes. In some circumstances some adjustment may need to be made to the brake cable when the trailer is under load.

Your trailer brakes are designed to work in synchronization with your tow vehicle brakes. Never use your tow vehicle or trailer brakes alone to stop the combined load.

Electric brake controllers provide a modulation function that varies the current to the electric brakes with the pressure on the brake pedal or amount of deceleration of the tow vehicle. It is important that your brake controller provided approximately 2 volts to the braking system when the brake pedal is first depressed and gradually increases the voltage to 12 volts as brake pedal pressure is increased.

Proper synchronization of tow vehicle to trailer braking can only be accomplished by road testing (when safe to do so). Brake lockup, excessive grabbing or harshness is quite often due to the lack of synchronization between the tow vehicle and the trailer being towed.

If the trailer brakes lock and slide, decrease the gain setting on the in-car controller. If they do not slide, try increasing the gain setting to the point of impending wheel skid. There should be no sensation of the trailer 'jerking' or 'pushing' the tow vehicle.

The trailer should not be breaking the towing vehicle otherwise overheating of the brakes and premature wear will occur.

Brake adjustments will also vary depending on the load being carried and road surface conditions. It is important to test and adjust the brake settings depending on the weight of the load being carried and or if the trailer is empty and not under load.

	1 st 100klm	1 st 300klm	1 st 1000klm	5000klm	10000klm	20000klm
Brake Adjustment & Check	✓	✓	✓	✓	✓	✓
Brake Service				✓	✓	

Your trailer brakes must be inspected and serviced at yearly intervals or more often as use and performance requires.

- ✓ Clean the backing plate, magnet arm, magnet and brake shoes.
- ✓ Inspect the magnet arm for any loose or worn parts.
- ✓ Check shoe return springs, hold down springs, and adjuster springs for stretch or deformation and replace if required.
- ✓ Magnets should be inspected and replaced if worn unevenly or abnormally.
- ✓ Visually inspect the brake linings and replace if the lining is worn (to within 1.6mm or less), contaminated with grease or oil, or abnormally scored or gouged.

WHEEL BEARINGS

After the first 1,000km of use we recommend you check for excessive bearing play and adjust if necessary.

Every 6 months or 10,000km we recommend that the wheel bearings should be dismantled and visually inspected. Lubricate with grease and replace bearings if they are showing signs of excessive wear and tear.

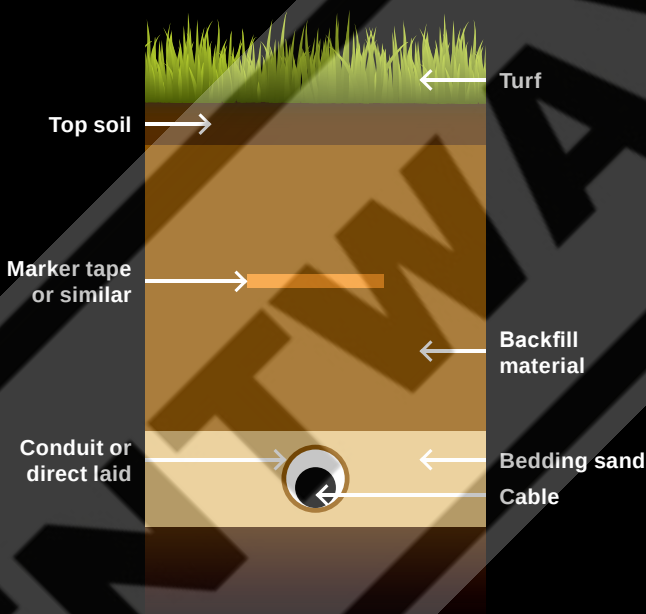
WHEEL ALIGNMENT

Visually inspect tires for abnormal wear. The suspension system is designed to have a small amount of negative camber at full load.

BRAKE TROUBLE SHOOTING

COMPLAINT	POSSIBLE CAUSE	REPAIR PROCEDURE
NO BRAKES	Open Circuit	Check for broken wires, loose connections. Improper grounding, faulty connector plug, between car and trailer, etc.
	Improperly wired or Inoperative Controller	Rewire Controller, check controller operation.
	Poor Brake Adjustment	Adjust brakes.
	Selective resistor defective	Check resistor for loose connections
	Worn or defective magnet	Replace magnet(s)
INTERMITTENT OR SURGING BRAKES	Short Circuit	Check electrical circuit.
	Out of round drums	Turn or replace drums
	Inadequate trailer ground	Check for proper grounding. (Note: aground through the trailer hitch is adequate)
	Broken magnet lead wires	Bench check magnets and replace if necessary
	Loose wheel bearings	Check and adjust bearings
WEAK BRAKES	Loose connections	Check that all connections are clean and tight.
	Inadequate trailer ground	Check for proper grounding.
	Short circuit	Check electrical circuit.
	Selective resistor setting incorrect	Check for proper setting to avoid too much resistance.
	Worn or defective magnets	Replace magnets (magnet power gets better with wear).
	Poor brake adjustment	Adjust brakes.
	Bent Backing plate	Check backing plate flange. Correct if necessary.
	Contaminated lining	Check and replace badly contaminated linings.
	Excessive load on trailer	Check to be sure trailer is not under braked. Also be sure to have brakes on every axle.
	Using trailer brakes only	Use of trailer brakes can cause early fade or loss of friction due to excessive heat.
GRABBING OR LOCKING BRAKES	Contaminated lining	Check and replace badly contaminated linings. Disconnect red wire on Controller.
	Controller not modulating	Disconnect red wire on Controller. Road test for braking modulation. If modulation is OK check the red wire. Bench test Controller and replace if necessary.
DRAGGING BRAKES	Weak or broken springs	Check for weak or broken springs, and replace is necessary.
	Electrical defect in controller	Insufficient gap between Controller contactor strip and coil may cause brakes to drag.
	Hydraulic defect in Controller	Excessive residual pressure in tow car hydraulic system or a 'gummed up' Controller cylinder may cause the Controller to be held on slightly.
NOISY BRAKES	Badly corroded brake assembly	Check brake assemblies for corrosion. Check to be sure magnet levers operate freely. Clean and lubricate brake assemblies.
	Weak or Broken springs	Check for weak or broken springs, replace if necessary.
	Lining excessively worn	Check and replace if necessary.
	Weak or broken springs	Check for weak or broken springs, replace if necessary.
	Range improperly located, bent backing plates	Check and repair if necessary
	Contaminated lining	Check and replace badly contaminated linings.
	Improper bearing adjustment	Check and adjust bearings. Check for worn or damaged bearings, replace if necessary.
	Brakes incorrectly adjusted	Check brake adjustment.

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Working near underground power cables

Have you checked for underground services?

In the planning stages prior to performing any earthmoving or excavation work, make sure you are aware of the location of underground power cables. Remember to follow the four Ps:

- **Plan** – Contact Dial Before You Dig (www.1100.com.au) to request a plan for your underground assets.
- **Pothole** – Potholing may be required to determine the exact location of the services.
- **Protect** – Underground assets may require mechanical protection.
- **Proceed** – Only after you are confident that you have put in place all required controls is it safe to proceed.

Colour	Underground Assets
Orange	Electricity
Yellow	Gas
Green	Water
White	Communications
Red	Fire Services
Cream	Sewerage
Purple	Reclaimed Water
Silver/Grey	Steam
Brown	Oils, Flammable Liquids
Light Blue	Air
Black	Other Liquids

