FX25

Operator's Manual

CE

CMW®

Issue 2.0

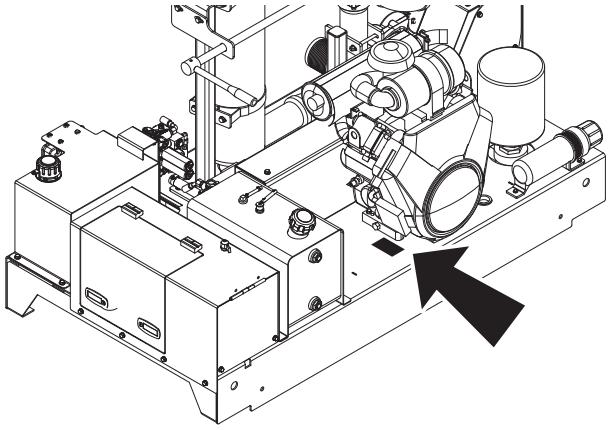
053-2379

Overview

Chapter Contents

Serial Number Location

Record serial numbers and date of purchase in spaces provided. FX25 serial number is located as shown.



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Date of manufacture	
Date of purchase	
FX25 serial number (shown)	
Engine serial number	
Blower serial number	
Water pump serial number	
Trailer serial number	

Intended Use

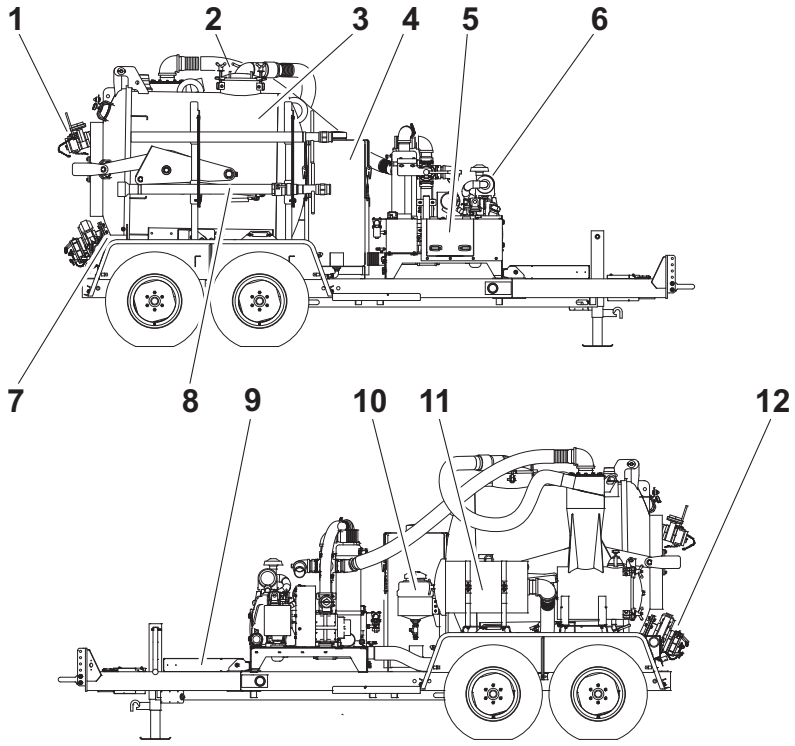
The FX25 is a self-contained vacuum excavation unit capable of vacuuming a wide variety of non-hazardous, non-flammable liquid and solid debris. It is designed to perform efficient soft excavation, including exposing utilities for visual verification and/or potholing. The optional reverse flow system allows for spoils transfer to another tank. The FX25 is intended for operation in ambient temperatures from 0° to 115°F (-18° to 46°C). Use in any other way is considered contrary to the intended use.

The FX25 should be operated, serviced, and repaired only by persons familiar with its particular characteristics and acquainted with the relevant safety procedures.

Equipment Modification

This equipment was designed and built in accordance with applicable standards and regulations. Modification of equipment could mean that it will no longer meet regulations and may not function properly or in accordance with the operating instructions. Modification of equipment should only be made by competent personnel possessing knowledge of applicable standards, regulations, equipment design functionality/requirements and any required specialized testing.

Unit Components



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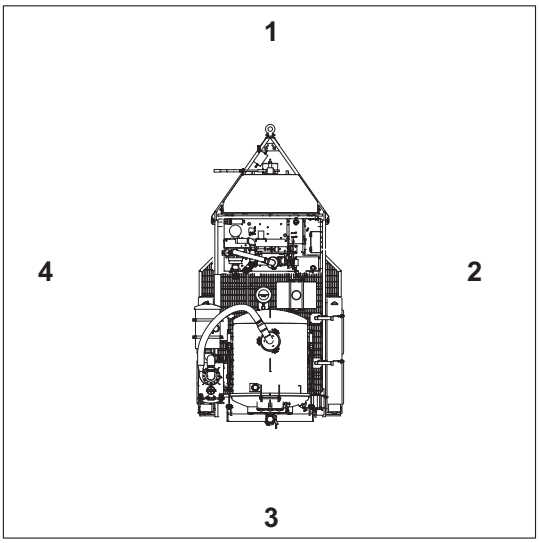
1. Inlet valve
2. Vacuum tank
3. Primary shut-off valve
4. Water tank
5. Operator's station
6. Power pack
7. Hose reel
8. Potholing tools
9. Tool storage
10. Antifreeze tank
11. Vacuum filter
12. Drain/Outlet valve

Operator Orientation

1. Front of unit
2. Right of unit
3. Rear of unit
4. Left of unit

Right and left sides of machine are determined by facing towing vehicle.



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About This Manual

This manual contains information for the proper use of this machine. See **Operation Overview** for basic operating procedures. Cross references such as "See page 50" will direct you to detailed procedures.

Bulleted Lists

Bulleted lists provide helpful or important information or contain procedures that do not have to be performed in a specific order.

Numbered Lists

Numbered lists contain illustration callouts or list steps that must be performed in order.

Foreword

This manual is an important part of your equipment. It provides safety information and operation instructions to help you use and maintain your Ditch Witch equipment.

Read this manual before using your equipment. Keep it with the equipment at all times for future reference. If you sell your equipment, be sure to give this manual to the new owner.

If you need a replacement copy, contact your Ditch Witch dealer. If you need assistance in locating a dealer, visit our website at **www.ditchwitch.com** or write to the following address:

The Charles Machine Works, Inc.
Attn: Marketing Department
PO Box 66
Perry, OK 73077-0066
USA

The descriptions and specifications in this manual are subject to change without notice. The Charles Machine Works, Inc. reserves the right to improve equipment. Some product improvements may have taken place after this manual was published. For the latest information on Ditch Witch equipment, see your Ditch Witch dealer.

Thank you for buying and using Ditch Witch equipment.

Reporting Safety Defects (Trailer-Mounted Units)

If you believe that your vehicle has a defect which could cause a crash or could cause injury or death, you should immediately inform the National Highway Traffic Safety Administration (NHTSA) in addition to notifying the Product Safety Coordinator at The Charles Machine Works, Inc.

If NHTSA receives similar complaints, it may open an investigation, and if it finds that a safety defect exists in a group of vehicles, it may order a recall and remedy campaign. However, NHTSA cannot become involved in any individual problems between you, your Ditch Witch dealer, or The Charles Machine Works, Inc.

To contact NHTSA you may either call the Auto Safety Hotline toll-free at 1-888-327-4236 (TTY: 1-800-424-9153), go to http://www.safercar.gov, or write to:

Administrator
NHTSA
1200 New Jersey Avenue S.E.
Washington, DC 20590

You can also obtain other information about motor vehicle safety from http://www.safercar.gov.

FX25
Operator's Manual

Issue number 2.0/OM-7/12
Part number 053-2379

Contents

Safety

Chapter Contents

Guidelines

Follow these guidelines before operating any jobsite equipment:

- Complete proper training and read operator's manual before using equipment.
- Contact your local One-Call (811 in USA) or the One-Call referral number (888-258-0808 in USA and Canada) to have underground utilities located before digging. Also contact any utilities that do not participate in the One-Call service.
- Classify jobsite based on its hazards and use correct tools and machinery, safety equipment, and work methods for jobsite.
- Mark jobsite clearly and keep spectators away.
- Wear personal protective equipment.
- Review jobsite hazards, safety and emergency procedures, and individual responsibilities with all personnel before work begins. Safety videos are available from your Ditch Witch dealer.
- Replace missing or damaged safety shields and safety signs.
- Use equipment carefully. Stop operation and investigate anything that does not look or feel right.
- Do not operate unit where flammable gas may be present.
- Contact your Ditch Witch dealer if you have any question about operation, maintenance, or equipment use.

Safety Alert Classifications

These classifications and the icons defined on the following pages work together to alert you to situations which could be harmful to you, jobsite bystanders or your equipment. When you see these words and icons in the book or on the machine, carefully read and follow all instructions. YOUR SAFETY IS AT STAKE.

Watch for the three safety alert levels: **DANGER**, **WARNING** and **CAUTION**. Learn what each level means.

DANGER indicates a hazardous situation that, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.

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

CAUTION indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

Watch for two other words: ***NOTICE*** and **IMPORTANT**.

NOTICE indicates information considered important, but not hazard-related (e.g., messages relating to property damage).

IMPORTANT can help you do a better job or make your job easier in some way.

Safety Alerts

DANGER Electric shock. Contacting electric lines will cause death or serious injury. Know location of lines and stay away.

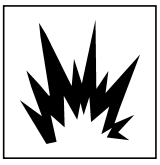
DANGER Confined space will cause suffocation. Use proper procedures for entering or stay away.

DANGER Vacuum will suffocate. Maintain distance between face and vacuum inlets.

WARNING Jobsite hazards could cause death or serious injury. Use correct equipment and work methods. Use and maintain proper safety equipment.

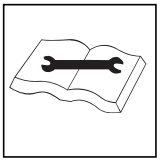
WARNING Crushing weight could cause death or serious injury. Use proper procedures and equipment or stay away.

WARNING Moving parts could cut off hand or foot. Stay away.



WARNING Explosion possible. Serious injury or equipment damage could occur. Follow directions carefully.

WARNING Incorrect procedures could result in death, injury, or property damage. Learn to use equipment correctly.



WARNING Improper control function could cause death or serious injury. If control does not work as described in instructions, stop machine and have it serviced.

WARNING Fire or explosion possible. Fumes could ignite and cause burns. No smoking, no flame, no spark.

WARNING Moving traffic - hazardous situation. Death or serious injury could result. Avoid moving vehicles, wear high visibility clothing, post appropriate warning signs.

⚠ WARNING Hot pressurized cooling system fluid could cause serious burns. Allow to cool before servicing.

⚠ CAUTION Flying objects may cause injury. Wear hard hat and safety glasses.

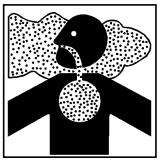
⚠ CAUTION Hot parts may cause burns. Do not touch until cool.

⚠ CAUTION Exposure to high noise levels may cause hearing loss. Wear hearing protection.

⚠ CAUTION Fall possible. Slips or trips may result in injury. Keep area clean.

⚠ CAUTION Battery acid may cause burns. Avoid contact.

⚠ CAUTION Improper handling or use of chemicals may result in illness, injury, or equipment damage. Follow instructions on labels and in material safety data sheets (MSDS).



⚠ CAUTION Breathing crystalline silica dust may cause lung disease. Cutting, drilling, or working materials such as concrete, sand, or rock containing quartz may result in exposure to silica dust. Use dust control methods or appropriate breathing protection when exposed to silica dust.

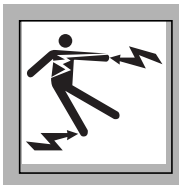
Emergency Procedures


WARNING Jobsite hazards could cause death or serious injury. Use correct equipment and work methods. Use and maintain proper safety equipment.

Before operating any equipment, review emergency procedures and check that all safety precautions have been taken.

EMERGENCY SHUTDOWN - Turn ignition switch to stop position or push remote engine stop button (if equipped).

Electric Strike Description



DANGER Electric shock. Contacting electric lines will cause death or serious injury. Know location of lines and stay away.

When working near electric cables, remember the following:

- Electricity follows all paths to ground, not just path of least resistance.
- Pipes, hoses, and cables will conduct electricity back to all equipment.
- Low voltage current can injure or kill. Many work-related electrocutions result from contact with less than 440 volts.

Most electric strikes are not noticeable, but indications of a strike include:

- power outage
- smoke
- explosion
- popping noises
- arcing electricity

If any of these occur, assume an electric strike has occurred.

If an Electric Line is Damaged

If you suspect an electric line has been damaged and you are **on truck or trailer**, DO NOT MOVE. Remain on truck or trailer and take the following actions. The order and degree of action will depend on the situation.

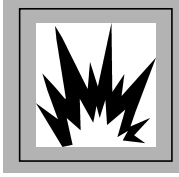
- Warn people nearby that an electric strike has occurred. Instruct them to leave the area and contact utility.
- Do not allow anyone into area until given permission by utility company.
- Do not allow anyone to touch equipment.

If you suspect an electric line has been damaged and you are **off truck or trailer**, DO NOT TOUCH EQUIPMENT. Take the following actions. The order and degree of action will depend on the situation.

- LEAVE AREA. The ground surface may be electrified so take small shuffle steps with feet close together to reduce the hazard of being shocked from one foot to the other.
- Contact utility company to shut off power.
- Do not return to area or allow anyone into area until given permission by utility company.

If a Gas Line is Damaged

WARNING Fire or explosion possible. Fumes could ignite and cause burns. No smoking, no flame, no spark.



WARNING Explosion possible. Serious injury or equipment damage could occur. Follow directions carefully.

If you suspect a gas line has been damaged, take the following actions. The order and degree of action will depend on the situation.

- Immediately shut off engine(s), if this can be done safely and quickly.
- Remove any ignition source(s), if this can be done safely and quickly.
- Warn others that a gas line has been cut and that they should leave the area.
- Leave jobsite as quickly as possible.
- Immediately call your local emergency phone number and utility company.
- If jobsite is along street, stop traffic from driving near jobsite.
- Do not return to jobsite until given permission by emergency personnel and utility company.

If a Fiber Optic Cable is Damaged

Do not look into cut ends of fiber optic or unidentified cable. Vision damage can occur.

If Machine Catches on Fire

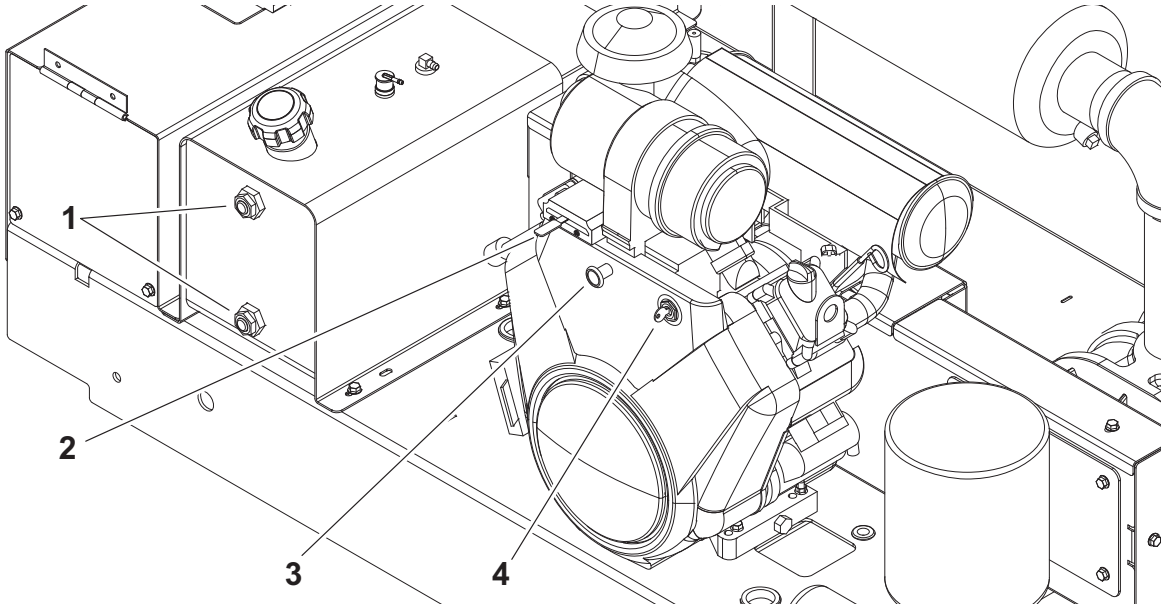
Perform emergency shutdown procedure and then take the following actions. The order and degree of action will depend on the situation.

- Immediately move battery disconnect switch (if equipped and accessible) to disconnect position.
- If fire is small and fire extinguisher is available, attempt to extinguish fire.
- If fire cannot be extinguished, leave area as quickly as possible and contact emergency personnel.

Controls

Chapter Contents

Engine



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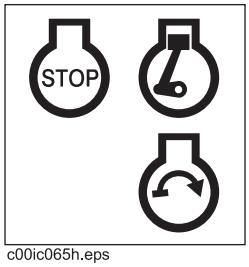
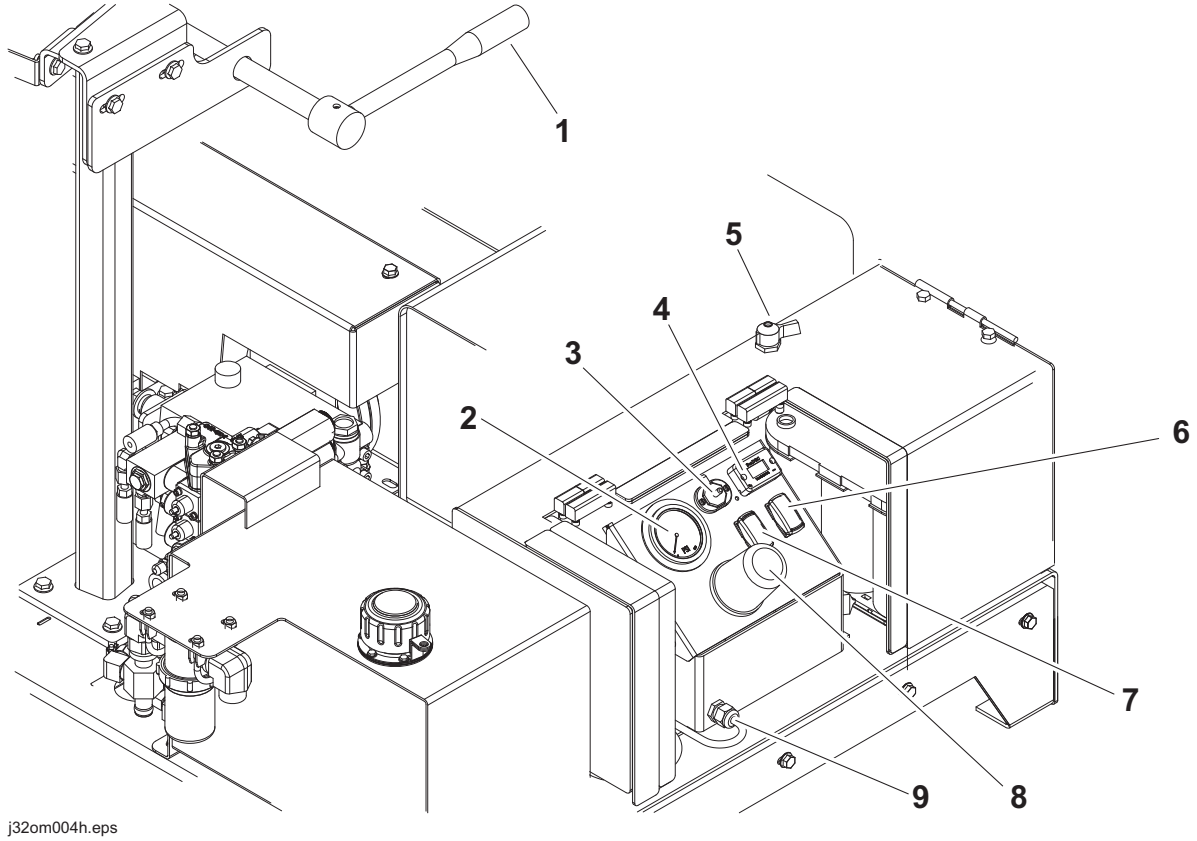
1. Fuel level sight glasses
2. Throttle
3. Choke
4. Ignition switch

Item	Description	Notes
1. Fuel level sight glasses	Monitor sight glasses to determine fuel level.	
2. Throttle	To increase engine speed, move to right. To decrease engine speed, move to left.	**IMPORTANT:** Run engine at full throttle during operation.
3. Choke	To help start cold engine, pull knob. When engine has warmed, push in completely.	
4. Ignition switch  c00ic065h.eps	To start engine, insert key and turn clockwise. To stop engine, turn key counterclockwise.	**IMPORTANT:** • When engine is on, blower operates and vacuum is present at tank inlet. • All indicators should light briefly at startup.

Operator Station



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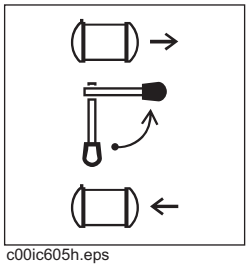
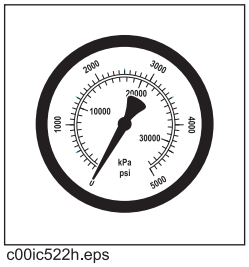
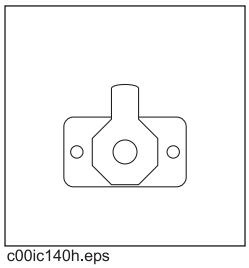
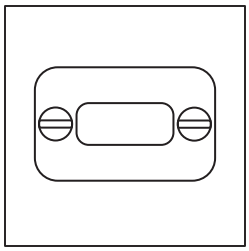
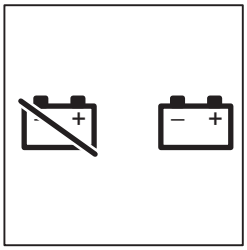
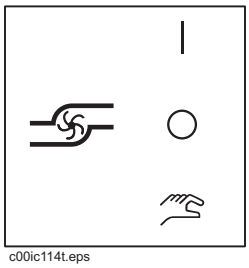
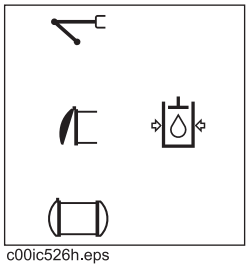
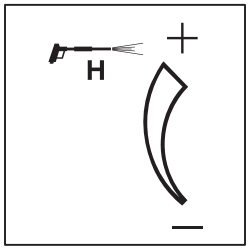
1. Flow direction control
1. Water pressure gauge
2. Auxiliary outlet
3. Hourmeter
4. Battery disconnect switch
5. Water pressure switch
6. Hydraulic function switch
7. Water pressure control
8. Tethered tank control outlet

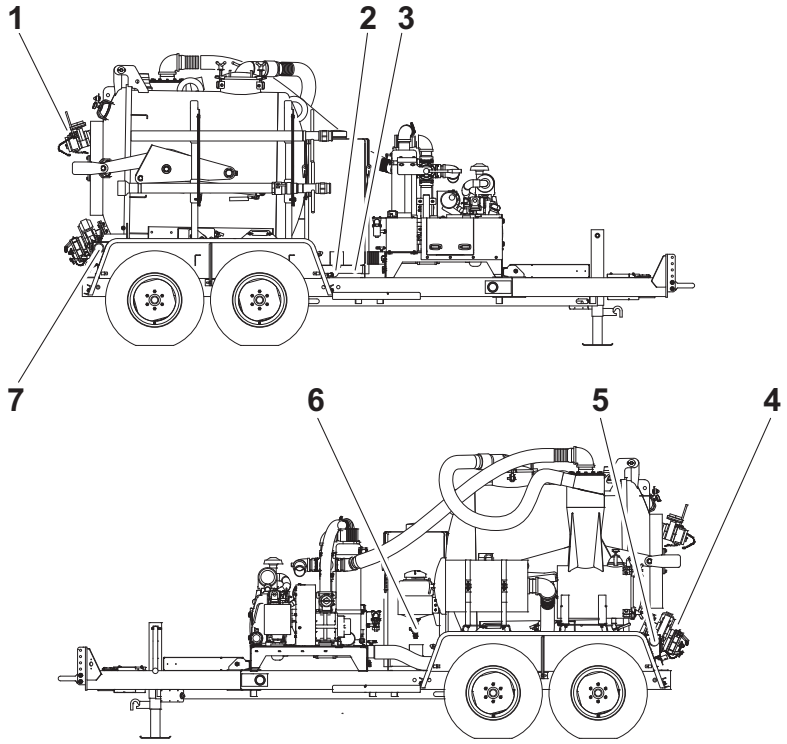
Item	Description	Notes
1. Flow direction control  c00ic605h.eps	To operate in reverse flow mode, turn counterclockwise. To operate in vacuum mode, turn clockwise.	Use reverse flow to unload tank contents to another tank. Operate in reverse flow mode only when drain/ outlet valve is open.

Item	Description	Notes
2. Water pressure gauge  c00ic522h.eps	Displays water pressure when water pressure switch is on and spray wand is in use.	
3. Auxiliary outlet  c00ic140h.eps	To operate work lights or other 12V devices, plug into outlet.	Outlet has power only when ignition switch is on.
4. Hourmeter  c00ic112t.eps	Displays engine operating time.	Hourmeter runs when engine is running. Use these times to schedule service.
5. Battery disconnect switch  c00ic063t.eps	To connect, turn clockwise. To disconnect, turn counterclockwise.	**IMPORTANT:** Use battery disconnect switch when servicing, welding, and during long-term storage.

Item	Description	Notes
6. Water pressure switch  c00ic114t.eps	To turn on water pump, press top. To turn off water pump, move to center position. To bypass low water indication, press bottom. Water pump will operate for 60 seconds.	Use bypass to feed antifreeze into system when freshwater tank is empty. See "Add Antifreeze" on page 58.
7. Hydraulic function switch  c00ic526h.eps	To operate the vacuum boom option, press top. To operate hydraulic door lift, move to center position. To operate hydraulic tank tilt, press bottom.	
8. Water pressure control  c00ic113t.eps	To increase water pressure, turn clockwise. To decrease water pressure, turn counterclockwise.	
9. Tethered tank control outlet	Connection for tethered tank control.	

Item	Description	Notes
Tethered tank control  c00ic064t.eps  c00ic065t.eps	To lift and lower tank, set hydraulic function switch to the tank position, then • To lift tank, press UP. • To lower tank, press DOWN. To open and close tank door, set hydraulic function switch to the door position, then • To open door, press UP. • To close door, press DOWN.	***NOTICE:*** When opening and closing door, stand in a position with a full view of the door.

Machine



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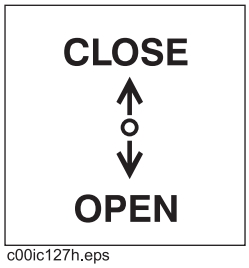
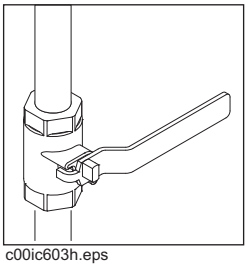
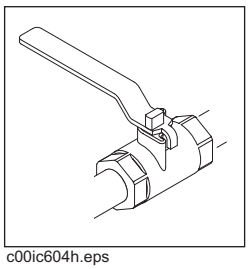
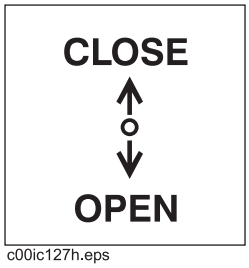
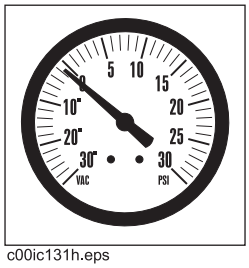
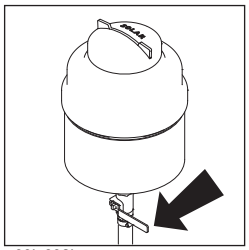
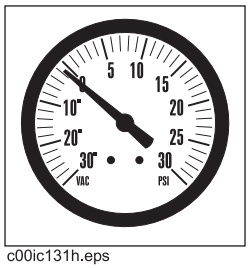
1. Inlet valve
2. Water tank supply valve
3. Water tank drain
4. Drain/Outlet valve
5. Reverse flow gauge
6. Antifreeze tank supply valve
7. Vacuum gauge

Item	Description	Notes
1. Inlet valve  c00ic127h.eps	To close valve (stop suction), rotate up. To open valve (start suction), rotate down.	***NOTICE:*** Do not idle engine with inlet valve closed.

Item	Description	Notes
2. Water tank supply valve  c00ic603h.eps	To open valve (send water from the water tank through the pump and water lance), rotate counterclockwise. To close valve (stop water flow), rotate clockwise.	**IMPORTANT:** Water tank supply valve or antifreeze supply valve must be open when pump is running or pump will be damaged.
3. Water tank drain  c00ic604h.eps	To drain tank, open valve. Close valve when tank is empty.	
4. Drain/Outlet valve  c00ic127h.eps	To drain tank, rotate down. To close drain, rotate up.	
5. Reverse flow gauge  c00ic131h.eps	Displays reverse flow pressure.	

Item	Description	Notes
6. Antifreeze tank supply valve  c00ic602h.eps	To open valve (send antifreeze through pump and water lance), rotate counterclockwise. To close valve (stop antifreeze flow), rotate clockwise.	**IMPORTANT:** Water tank supply valve or antifreeze supply valve must be open when pump is running or pump will be damaged.
7. Vacuum gauge  c00ic131h.eps	Displays blower vacuum reading in inches of mercury. Vacuum relief valve opens when vacuum reaches 15" (381 mm).	

Operation Overview

Chapter Contents

Planning

1. Gather information about jobsite (page 34).
2. Inspect jobsite (page 35).
3. Check supplies and prepare equipment (page 37).

Setting Up at Jobsite

1. Prepare jobsite (page 36).
2. Position vacuum excavation unit (page 30).
3. Leave unit hitched to towing vehicle or properly stabilized if trailer-mounted unit.
4. Block trailer wheels if trailer-mounted unit.

Vacuuming

1. Connect hoses (page 44).
2. Start unit (page 47).
3. Remove debris (page 48).
4. Disconnect hoses.
5. Drain tank (page 51) or unload to another tank (page 53).

Potholing

1. Connect hoses (page 44).
2. Start unit (page 47).
3. Pothole (page 49).
4. Disconnect hoses.
5. Drain tank (page 51).

Leaving Jobsite

1. Rinse unit and tools (page 59).
2. Stow tools (page 59).

Storing Equipment

1. For cold weather storage, antifreeze vacuum excavation unit (page 58).
2. For long-term storage, disconnect battery disconnect switch (page 22).

Prepare

Chapter Contents

Gather Information

A successful job begins before the excavation. The first step in planning is reviewing information already available about the job and jobsite.

Arrange for Traffic Control

If working near a road or other traffic area, contact local authorities about safety procedures and regulations.

Prepare for Working Near Existing Utilities

If jobsite may contain electrical lines, wear protective boots and gloves meeting the following standards:

- Boots must have high tops and meet the electric hazard protection requirements of ASTM F2413 or ASTM F1117, when tested at 14,000 volts. Tuck legs of pants completely inside boots.
- Gloves must have 17,000 AC maximum use voltage, according to ASTM specification D120.

If working around higher voltage, use gloves and boots with appropriately higher ratings.

Plan for Emergency Services

Have the telephone numbers for local emergency and medical facilities on hand. Check that you will have access to a telephone.

Inspect Jobsite

- Follow U.S. Department of Labor regulations on excavating and trenching (Part 1926, Subpart P) and other similar regulations.
- Contact your local One-Call (811 in USA) or the One-Call referral number (888-258-0808 in USA and Canada) to have underground utilities located before working. Also contact any utilities that do not participate in the One-Call service.
- Inspect jobsite and perimeter for evidence of underground hazards, such as:
  - "Buried utility" notices
  - Utility facilities without overhead lines
  - Gas or water meters
  - Junction boxes
  - Drop boxes
  - Light poles
  - Manhole covers
  - Sunken ground
- Mark location of all buried utilities and obstructions.

Prepare Jobsite

⚠WARNING Jobsite hazards could cause death or serious injury. Use correct equipment and work methods. Use and maintain proper safety equipment.

To help avoid injury:

- If jobsite classification is in question or if the possibility of unmarked electric utilities exists, classify jobsite as electric.
- Cutting high voltage cable can cause electrocution. Expose lines by hand before using unit.
- All vegetation near operator's station must be removed. Contact with trees, shrubs, or weeds during electrical strike could result in electrocution.

Prepare Excavation Point

- Clear the area to be excavated. Remove rocks or branches too large for vacuum hose.
- Select a solid area to stand on while excavating.

Check Supplies and Prepare Equipment

Assemble Accessories

Fire Extinguisher

If required, mount a fire extinguisher near the power unit but away from possible points of ignition. The fire extinguisher should always be classified for both oil and electric fires. It should meet legal and regulatory requirements.

Lighting Kit

If you will need additional light, plug lighting kit into provided outlet. Contact your Ditch Witch dealer for further information.

Check Supplies

- water and additional hoses
- fuel
- keys
- spray lubricant
- personal protective equipment, such as hard hat and safety glasses

Prepare Equipment

Fluid Levels

- fuel
- battery
- engine oil
- blower oil

Condition and Function

- filters (air, oil)
- belts
- blower
- tires
- hoses and valves
- couplers and fittings
- water tanks
- trailer parking brake (trailer-mounted unit)

Transport

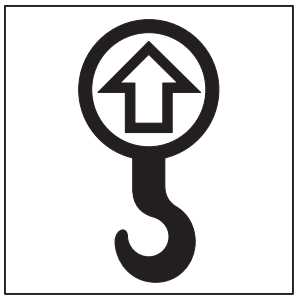
Chapter Contents

Lift

⚠WARNING Crushing weight. If load falls or moves it could kill or crush you. Use proper procedures and equipment or stay away.

Points

Lifting points are identified by lifting decals. Lifting at other points is unsafe and can damage machinery.



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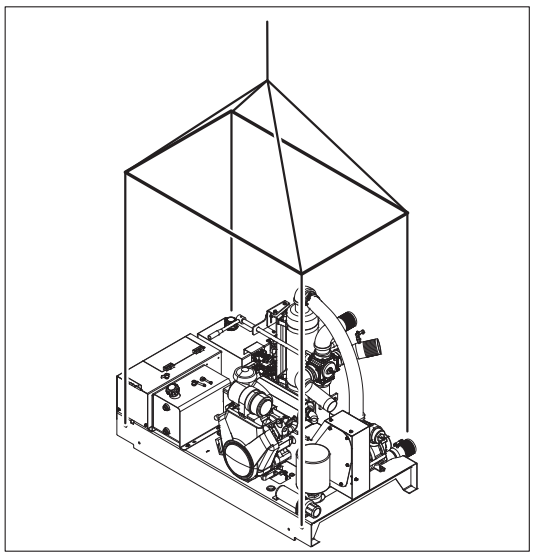
Procedure

Power Pack

Use a crane capable of supporting 1500 lb (680 kg). Attach lifting device to corners and lift as shown.



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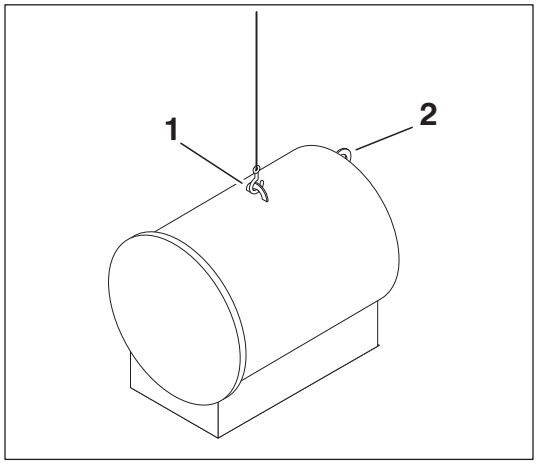
Tank

Use crane capable of supporting the 2000 lb (907 kg). Use top lift point (1) as shown. Use end lift point (2) to drain tank if machine is disabled.

NOTICE:

- Relieve pressure in tank before storing or transporting.
- Only lift empty water or spoils tanks.



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Haul

WARNING Crushing weight. If load falls or moves it could kill or crush you. Use proper procedures and equipment or stay away.

To help avoid injury:

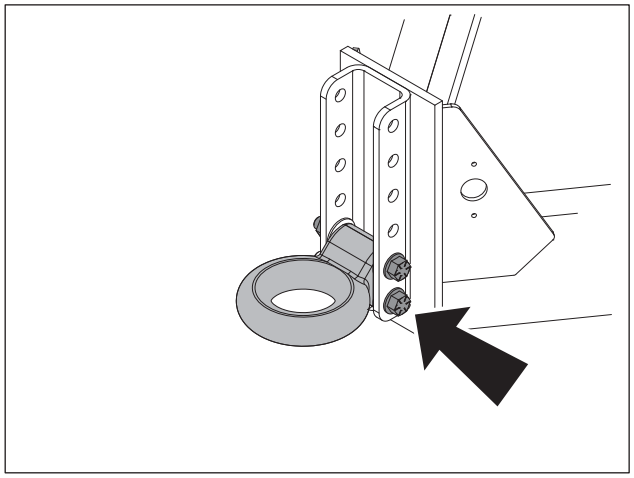
- Do not haul or move trailer unless tank is fully lowered and horizontal. Damage to machine or injury to personnel could occur.
- Do not travel on roads with reducer or any other fitting installed on tank outlet valve. Fitting will extend beyond the rear impact guard and will not be legal for operation on roadways.

Inspect Trailer

- Check hitch for wear and cracks. Lubricate if needed.
- Check battery for 12V charge.
- Inspect lights for cleanliness and correct operation. Inspect reflectors and replace if needed.
- Check tire pressure. Check lug nut torque with a torque wrench.
- Ensure trailer brakes are adjusted to come on in synchronization with tow vehicle brakes.
- Check ramps (if equipped) and trailer bed for cracks.

Hitch Trailer

1. Back tow vehicle to trailer.
2. Put manual transmission into first or reverse gear or automatic transmission into park. Turn off ignition. Set parking brake.
3. Connect trailer drawbar, lunette or coupler to tow vehicle hitch and lock in place with lock pin. If needed, adjust drawbar, lunette or coupler height (shown) to level load.
4. Connect safety chains to tow vehicle chain keepers (cross-shaped slots on bumper of tow vehicle). Attach left chain to right side of tow vehicle and vice versa to cradle hitch. Do not connect to pintle hook or hitch ball.
5. Connect breakaway switch cable to tow vehicle. Do not connect to pintle hook or hitch ball.
6. Plug trailer electrical connector into tow vehicle connector.
7. Use jack crank to raise jack base and stow.
8. Remove wheel blocks.



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Unhitch Trailer

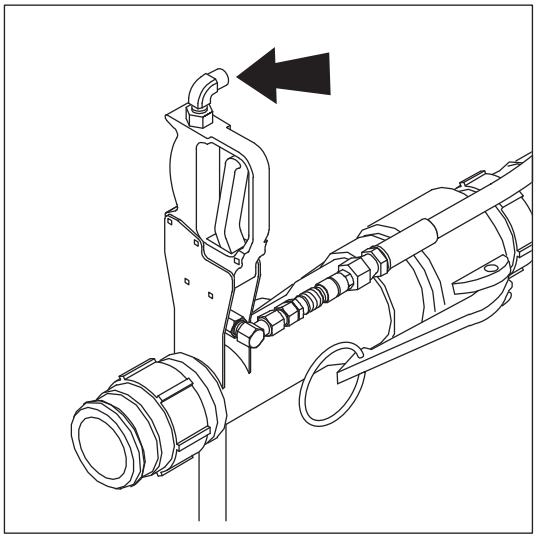
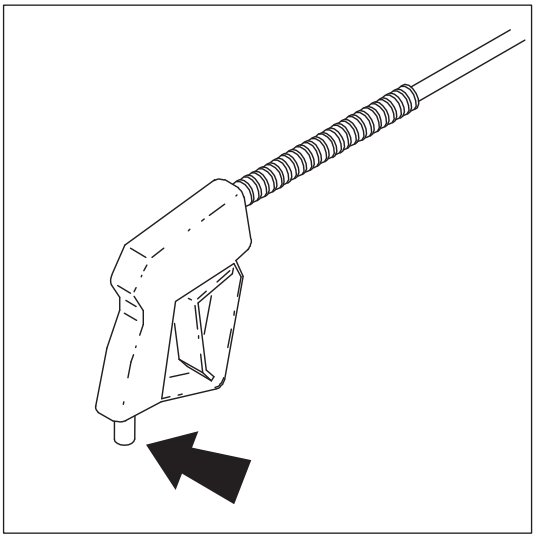
1. Stop tow vehicle and trailer on level ground.
2. Put manual transmission into first or reverse gear or automatic transmission into park. Turn off ignition. Set parking brake.
3. Block trailer wheels.
4. To unhitch trailer from tow vehicle, reverse "Hitch Trailer" steps.

Vacuum and Pothole

Chapter Contents

Connect Hoses

1. Remove vacuum hoses from storage.
2. If potholing, remove 2-in-1 potholing tool or basic potholing tool from storage.
3. Connect hoses. Secure all locking clamps.
4. Ensure drain valve is closed.
5. If potholing, connect water pressure hose.

2-in-1 Tool	Basic Tool
 j08om006h.eps	 j08om007h.eps

Determine Tank Fill Level

Use these reference charts to help determine how full of various materials the vacuum tank can be without overloading trailer. **Exceeding the maximum fill level will overload the trailer**.

Never exceed the trailer capacity. You can exceed the vacuum tank lifting capacity if you drain the tank down to the lifting capacity before lifting tank.

To use these charts, first select the appropriate table based on trailer and vacuum tank size. Next find the material being excavated. If the material being excavated is not listed, find a material with similar density. Then, determine the maximum fill level based on the amount of water in the water tank.

IMPORTANT: For all materials, the vacuum tank should be no more than half full when lifting the tank.

500-gal Vacuum Tank on T9S Trailer

Material	**Maximum Vacuum Tank Fill Level**	
Water tank fill level	full (80 gal)	empty (0 gal)
wood chips (dry)	100%	100%
snow (dry)	100%	100%
water	95%	100%
light weight mud (8-10 lb/gal)	88%	100%
earth (dry, loose)	83%	95%
caliche	76%	87%
earth, loam	76%	87%
medium weight mud (10-12 lb/gal)	72%	83%
limestone (crushed)	62%	71%
asphalt	59%	68%
sand (dry)	59%	68%
earth (wet, excavated)	59%	68%
heavy weight mud (12-15 lb/gal)	59%	67%
gravel (dry)	58%	66%
shale, riprap	56%	65%
sand (wet)	46%	52%

500-gal Vacuum Tank on T12S Trailer

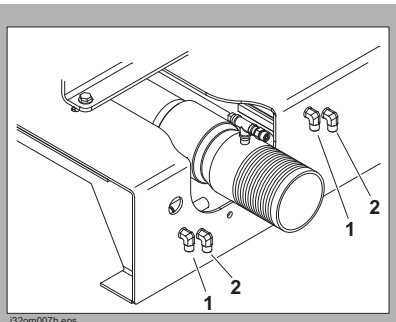
Material	**Maximum Vacuum Tank Fill Level**	
Water tank fill level	full (200 gal)	empty (0 gal)
wood chips (dry)	100%	100%
snow (dry)	100%	100%
water	100%	100%
light weight mud (8-10 lb/gal)	100%	100%
earth (dry, loose)	100%	100%
caliche	94%	100%
earth, loam	94%	100%
medium weight mud (10-12 lb/gal)	89%	100%
limestone (crushed)	77%	100%
asphalt	73%	95%
sand (dry)	73%	95%
earth (wet, excavated)	73%	95%
heavy weight mud (12-15 lb/gal)	72%	94%
gravel (dry)	71%	92%
shale, riprap	70%	91%
sand (wet)	56%	73%

Start Unit

EMERGENCY SHUTDOWN: Turn ignition switch to STOP.

Standard Procedure

IMPORTANT: If power pack is not connected to external tank control valves, connect a -04 hose with a minimum working pressure rating of 3000 psi (207 bar) from pressure (1) to power beyond (2) connections on power pack.



1. Open tank inlet valve.

NOTICE: Avoid idling engine with inlet valve closed.

2. Insert key.
3. Turn key clockwise. See page 20 for more information.

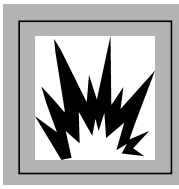
Remove Debris

EMERGENCY SHUTDOWN: Turn ignition switch to STOP.

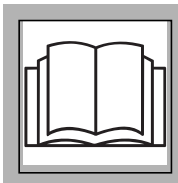
Procedure

1. Position vacuum hose in area to be excavated.
2. Start engine.

DANGER Vacuum will suffocate. Maintain distance between face and vacuum inlets.



WARNING Fire or explosion possible. Do not vacuum flammable or combustible substances.



WARNING Incorrect procedures could result in death, injury, or property damage. Learn to use equipment correctly.

To help avoid injury: Do not excavate hazardous or toxic materials. Unit is designed to excavate only soil cuttings, drilling fluids, and other non-toxic waste.

3. Open inlet valve.

NOTICE: Avoid idling engine with inlet valve closed.

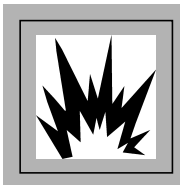
4. Use sight glasses to monitor debris level in tank. Vacuum will shut off when tank is full. Engine will remain running.

Pothole

EMERGENCY SHUTDOWN: Turn ignition switch to STOP.

1. Start engine.

DANGER Vacuum will suffocate. Maintain distance between face and vacuum inlets.



WARNING Fire or explosion possible. Do not vacuum flammable or combustible substances.

2. Open inlet valve.

NOTICE: Avoid idling engine with inlet valve closed.

3. Open water tank valve.
4. Move water pump switch to on.
5. Position tool over area to be excavated and begin pothole.

DANGER Electric shock. Contacting electric lines will cause death or serious injury. Know location of lines and stay away.

To help avoid injury: Do not direct water lance at overhead lines. Water conducts electricity.

2-in-1 Tool	Basic Tool
• Squeeze water pressure lever to start water pressure. • Work pressurized water in a rocking or circular motion to loosen and excavate soil until hole is at the desired diameter and depth.	• First use water lance to loosen soil. • Work tool in a rocking or circular motion to excavate soil. • Use water lance and tool alternately until hole is at the desired diameter and depth.

6. Adjust water pressure as needed to match soil conditions and/or material of utility being exposed.

⚠WARNING Jobsite hazards could cause death or serious injury. Use correct equipment and work methods. Use and maintain proper safety equipment.

To help avoid injury: Test water pressure on a sample of the utility line material to be exposed. Adjust pressure until no damage occurs to the material. High pressure water can cut utility lines.

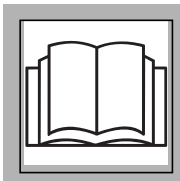
7. Ensure that water sprays from nozzle in a fan pattern. If it does not, nozzle may be clogged and pump will not function properly. Clean or replace nozzle as necessary.
8. When freshwater tank is empty, stop operation and turn water pump switch to off.

NOTICE: Do **not** continue to operate with freshwater tank empty. Running water pump with no water will damage pump.

Drain Tank

EMERGENCY SHUTDOWN: Turn ignition switch to STOP.

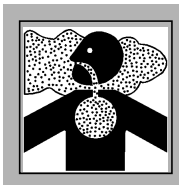
1. Ensure that unit is hitched to vehicle. See "Hitch Trailer" on page 42.
2. Haul unit to approved dumping area.



WARNING Incorrect procedures could result in death, injury, or property damage. Learn to use equipment correctly.

To help avoid injury:

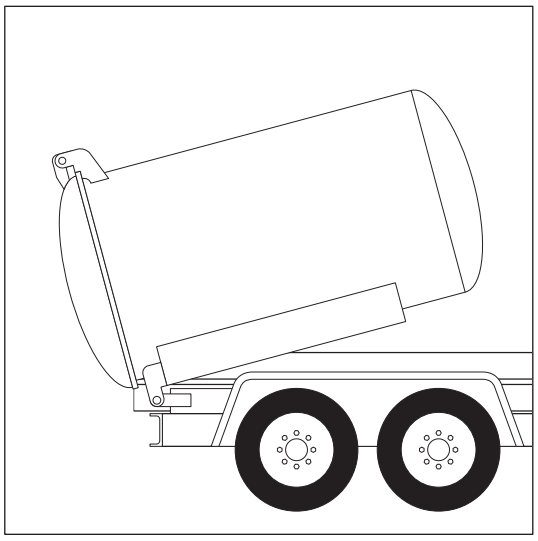
- Do **not** unhitch unit from tow vehicle before or during dumping. A freestanding unit can become unstable when tilting tank.
- Do not unlatch door with tank tilted up.
- Do not unlatch vacuum boom (optional) with tank tilted up.



CAUTION Breathing crystalline silica dust may cause lung disease. Cutting, drilling, or working materials such as concrete, sand, or rock containing quartz may result in exposure to silica dust. Use dust control methods or appropriate breathing protection when exposed to silica dust.

NOTICE: Do not drive with tank or door raised.

3. Open drain/outlet valve and inlet valve.
4. Allow tank to drain in the horizontal position until tank is approximately half drained. Monitor sight glasses.
5. When tank is half drained, start engine and run at low idle.
6. Tilt tank up to help flush solids from tank.
7. Lower tank to the full horizontal position.
8. Close drain/outlet valve and inlet valve.



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9. If further draining is necessary, open tank door. See "Open/Close Tank Door" on page 55.

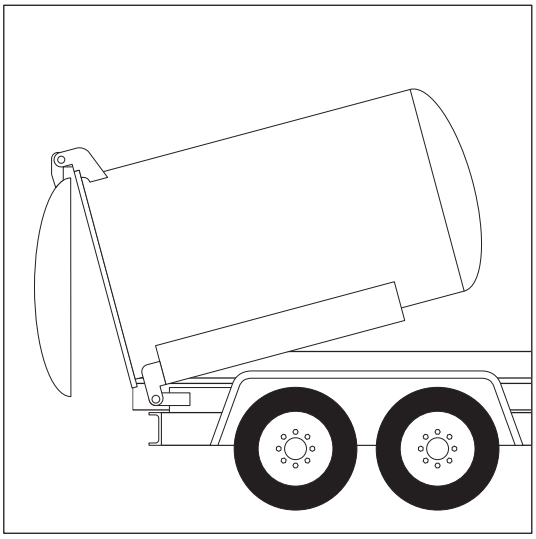
⚠ WARNING Crushing weight could cause death or serious injury. Use proper procedures and equipment or stay away.

To help avoid injury: Use tools (provided with unit) if unit must be serviced with tank door up.

10. Tilt tank up fully. Allow tank to drain completely.
11. Connect water pressure hose to water lance.
12. Turn water pump switch on. Adjust water pressure.
13. Use water lance to thoroughly rinse inside of tank and around door seal.

⚠ DANGER Confined space will cause suffocation. Use proper procedures for entering or stay away.

To help avoid injury: Enter tank only if necessary. Follow U.S. Department of Labor guidelines for entering confined spaces.



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14. Return tank to the fully lowered horizontal position.

Unload to Another Tank

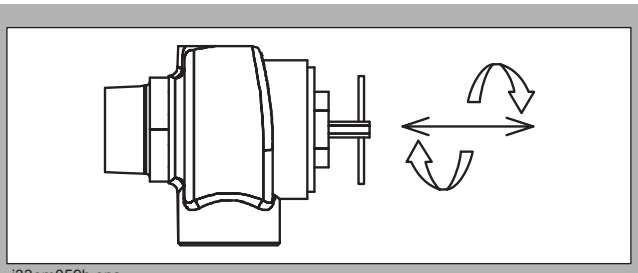
Optional reverse flow mode can be used to transfer vacuumed material to another tank or disposal site.

WARNING Incorrect procedures could result in death, injury, or property damage. Learn to use equipment correctly.

To help avoid injury:

- Keep unit in "vacuum" mode unless pressure is needed.
- Restrain hose prior to pressurization. Unrestrained hose may cause property damage, injury or death.
- Do not open fitting cams or valves when tank is pressurized. Flying debris, plugs and doors can cause injury or death.
- Do not open tank door while tank is pressurized.
- Do not use pressure to clear clogs in vacuum hose.

IMPORTANT: Check relief valve as shown before each use.



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1. Throttle down completely and turn off engine. Securely connect transfer hose to FX tank. Ensure drain/outlet valve on FX tank is closed.
2. Securely connect other end of transfer hose to offboard tank. Ensure inlet valve on offboard tank is closed and tank is vented.
3. **O**pen FX tank drain/outlet valve. Material will flow into transfer hose.
4. Open offboard tank inlet valve.

5. Move valve handle counterclockwise to engage "reverse flow" mode and start engine. Material will flow into offboard tank.
6. Increase throttle as desired to transfer material.
7. When transfer is complete, throttle down completely and turn off engine. Close FX tank drain/outlet valve.
8. Close offboard tank inlet valve and disconnect hose from offboard tank inlet valve.
9. Move handle clockwise to "vacuum" mode and turn on engine.
10. Open FX tank drain/outlet valve. Material will empty from transfer hose.
11. Close FX tank drain/outlet valve, throttle down and turn off engine.
12. Disconnect transfer hose from FX tank.

Open/Close Tank Door

Open

WARNING Crushing weight could cause death or serious injury. Use proper procedures and equipment or stay away.

To help avoid injury: Use tools (provided with unit) if unit must be serviced with tank door up.

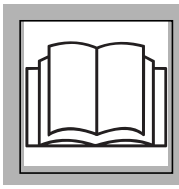
To help avoid injury: Do not raise tank with door held closed only by vacuum. Door may suddenly open and possibly injure someone.

NOTICE: Do not drive with tank or door raised.

IMPORTANT: Depressurize tank before emptying cyclonic canister, cleaning filter, clearing hoses or opening any doors.

1. If using optional reverse flow mode, turn off engine and ensure handle is down (in "vacuum" mode).
2. If tank is tilted, lower tank fully before opening door.
3. Open tank inlet valve.
4. Set hydraulic function switch to door position.
5. Press OPEN on tethered control.

Close



WARNING Incorrect procedures could result in death, injury, or property damage. Learn to use equipment correctly.

1. Press CLOSE on tethered control until the linkage on both sides of the tank is fully collapsed.
2. Close tank inlet valve.

Complete the Job

Chapter Contents

Antifreeze Fluid Excavation Unit

Add Antifreeze

Follow these steps for overnight or long-term storage of unit during cold weather.

1. Fill antifreeze tank with a propylene-glycol based antifreeze.
2. Ensure that water tank valve is closed.
3. Open antifreeze tank valve.
4. Connect water pressure hose to water lance.
5. Start engine.
6. Move water pump switch to on. If freshwater tank is empty, move to bypass.
7. Squeeze water lance handle and run until antifreeze runs through the water lance.
8. Move water pump switch to off.
9. Close antifreeze tank supply valve.
10. Turn ignition switch to off.
11. Drain water tank completely.

Reclaim Antifreeze

1. Turn water pressure down.
2. Move water pump switch to on.
3. Put end of water lance in antifreeze tank.
4. Squeeze water lance handle and run until water comes out of lance.
5. Move water pump switch to off.

Rinse Equipment

Spray water onto equipment to remove dirt and mud. Use water lance. Thoroughly rinse inside of tank and around door seal.

DANGER Confined space will cause suffocation. Use proper procedures for entering or stay away.

To help avoid injury: Enter tank only if necessary. Follow U.S. Department of Labor guidelines for entering confined spaces.

NOTICE: Do not spray water onto operator's console. Electrical components could be damaged. Wipe down instead.

Disconnect

Disconnect and store the following hoses and cables (if used):

- vacuum hoses
- water pressure hose

Stow Tools

Make sure potholing tools, water lance, and other tools are properly stowed.

Service

Chapter Contents

Service Precautions

⚠WARNING Incorrect procedures could result in death, injury, or property damage. Learn to use equipment correctly.

To help avoid injury:

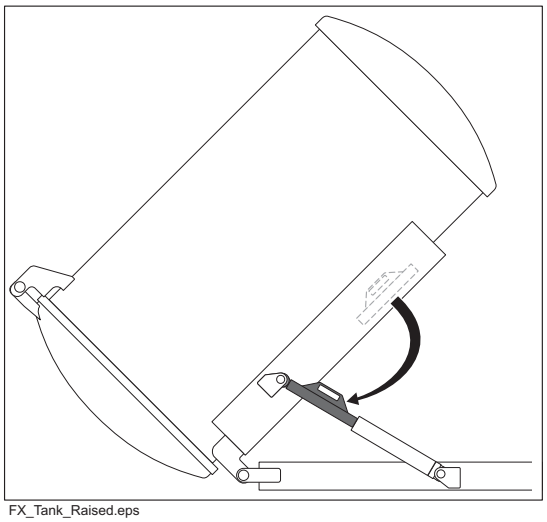
- Unless otherwise instructed, all service should be performed with engine off.
- Refer to engine manufacturer's manual for engine maintenance instructions.

Working Under Raised Debris Tank

⚠WARNING Crushing weight could cause death or serious injury. Use proper procedures and equipment or stay away.

To help avoid injury: Use tools (provided with unit) if hydraulic system must be serviced with tank tilted up.

1. Raise vacuum tank.
2. Remove cylinder lockout tool.
3. Place channel of lock around extended cylinder and secure.
4. Lower vacuum tank until load is supported by cylinder lockout tool.



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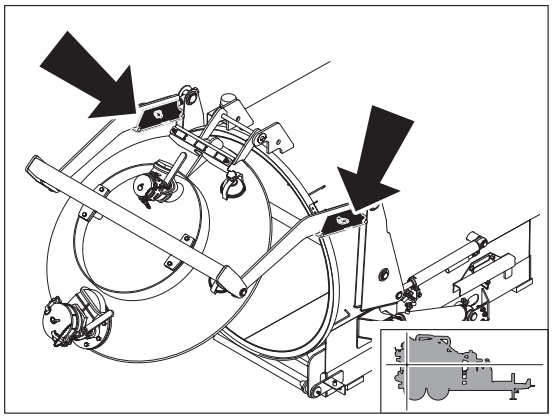
Working Under Raised Tank Door

WARNING Crushing weight could cause death or serious injury. Use proper procedures and equipment or stay away.

To help avoid injury: Use tools (provided with unit) if unit must be serviced with tank door up.

1. Locate door lock tools in tool storage area and bring to rear of tank.
2. Raise tank door completely.
3. Place door lock tools over extended cylinder rods and pin into place.
4. Lower tank lid until load is supported by door lock tools.



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Welding Precaution

NOTICE: Welding can damage electronics.

- Disconnect battery to prevent damage to battery. Do not turn off battery disconnect switch with engine running, or alternator and other electronic devices may be damaged.
- Connect welder ground clamp close to welding point and make sure no electronic components are in the ground path.
- Always disconnect the Engine Control Unit ground connection from the frame, harness connections to the ECU, and other electronic components prior to welding on machine or attachments.

Washing Precaution

NOTICE: Water can damage electronics. When cleaning equipment, do not spray electrical components with water.

Recommended Lubricants/Service Key

Item	Description
GEO	Gasoline engine oil meeting API service classification CF-4 or E1-96 and SAE viscosity recommended by engine manufacturer (SAE 15W40)
SGL	Synthetic gear oil (ISO 100), cmw p/n 256-044
MPG	Multipurpose grease meeting ASTM D217 and NLGI 5
HTG	High temperature, NLGI #2 premium grade, petroleum-based grease with high temperature resistance and good mechanical stability
NDO	30W non-detergent oil
THF	Tractor hydraulic fluid, similar to Phillips 66 HG, Mobilfluid 423, Chevron Tractor Hydraulic Fluid, Texaco TDH Oil, or equivalent
DOT	DOT 3 or 4 brake fluid
	Check level of fluid or lubricant
	Check condition
	Filter
	Change, replace, adjust, service or test "Fluid capacities" on page 101

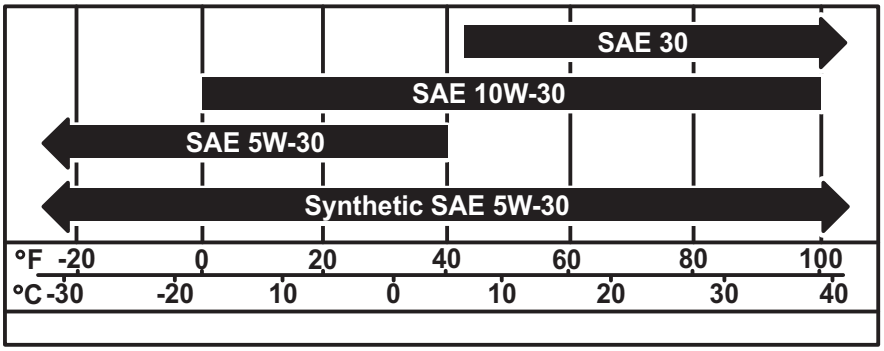
Proper lubrication and maintenance protects Ditch Witch equipment from damage and failure. Service intervals listed are for minimum requirements. In extreme conditions, service machine more frequently. Use only recommended lubricants. Fill to capacities listed in "Specifications" on page 99.

For more information on engine lubrication and maintenance, see your engine manual.

NOTICE:

- Use only genuine Ditch Witch parts, filters, approved lubricants, TJC, and approved coolants to maintain warranty.
- Use the "Service Record" on page 109 to record all required service to your machine.

Engine Oil Temperature Chart



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Temperature range anticipated before next oil change

IMPORTANT: If temperature is below 40°F (4°C), using SAE 30 will result in hard starting. If temperature is above 80°F (27°C), using 10W-30 can cause increased oil consumption. Check oil level more frequently.

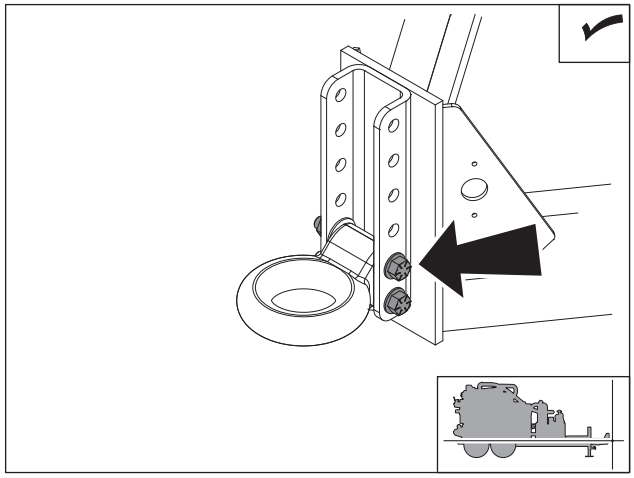
10 Hour

Location	Task	Notes
TRAILER	Check tightness of trailer hitch bolts	
	Check hydraulic brake actuator bolts	If equipped
	Check hydraulic brake fluid level	If equipped, DOT
	Check trailer battery	
	Check tire pressure and lug nut torque	
	Check lights and reflectors	
VACUUM SYSTEM	Check engine air filter service indicator	
	Check engine oil level	GEO
	Check hydraulic hoses	
	Check hydraulic fluid level	THF
	Check blower oil level	SGL
	Check blower belt tension	
	Check water pump oil level	NDO
	Clean water pump filter	
	Check tension of water pump belts	
	Clean vacuum air filter	
	Check spray nozzle	
	Drain cyclonic separator canister	
DEBRIS TANK	Check strobe light	
	Check vacuum tank door seals/fittings	

Trailer

Check Hitch Bolts

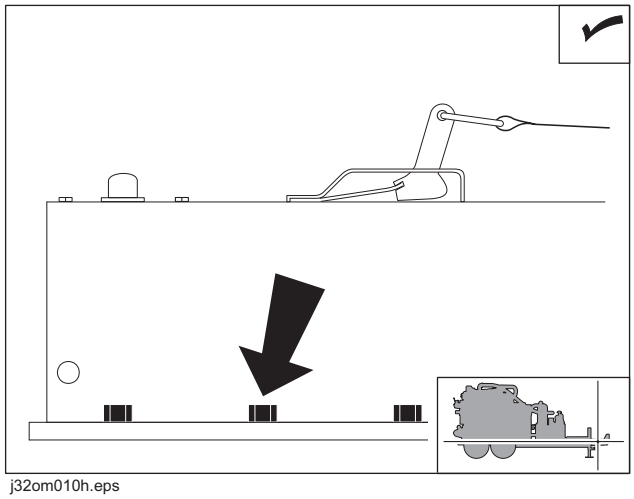
Check that trailer hitch bolts are properly tightened. Torque varies by trailer model. Refer to "Specifications" beginning on page 99.



j32om009h.eps

Check Hydraulic Brake Actuator Bolts

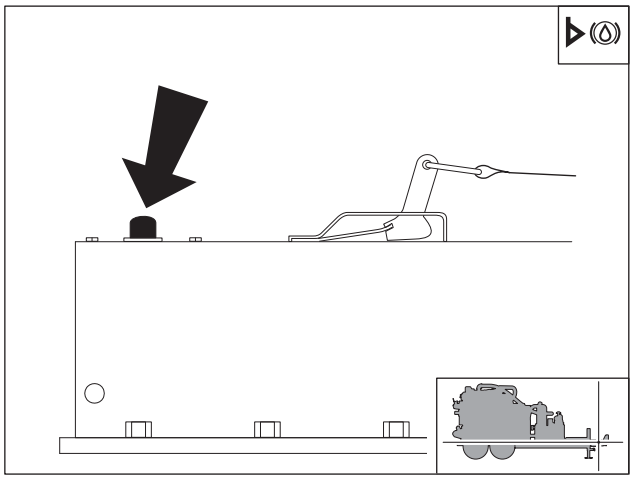
Check that hydraulic brake actuator bolts are properly tightened.



j32om010h.eps

Check Hydraulic Brake Fluid Level

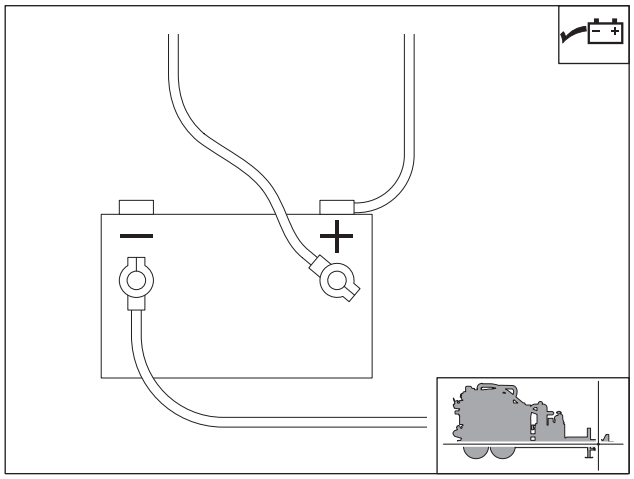
Check hydraulic brake fluid level at master cylinder each use. Fluid should be visible at top of master cylinder. Add DOT 3 or DOT 4 brake fluid and bleed brakes as needed. See page 91.



j32om011h.eps

Check Trailer Battery

Check battery connections for wear or corrosion. Keep connections clean and tight. Batteries supplied by factory are maintenance-free. Service replacement batteries according to manufacturer's instructions.

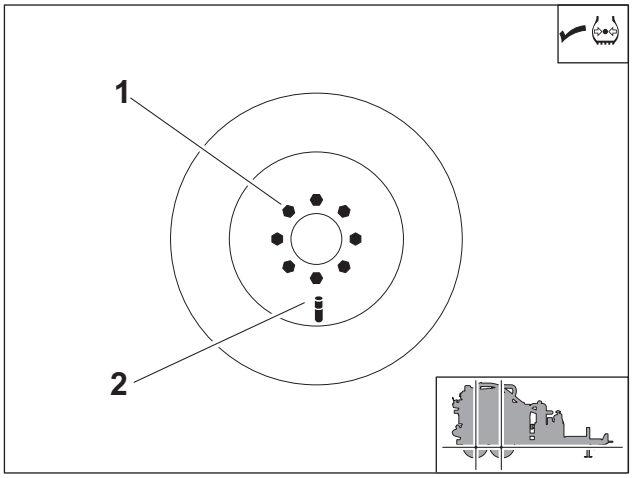


j32om013h.eps

Check Trailer Tire Pressure and Lug Nut Torque

Check tire pressure (2) and lug nut (1) torque. See below for correct pressure and torque. To verify trailer model, see the certification plate located on the trailer tongue.

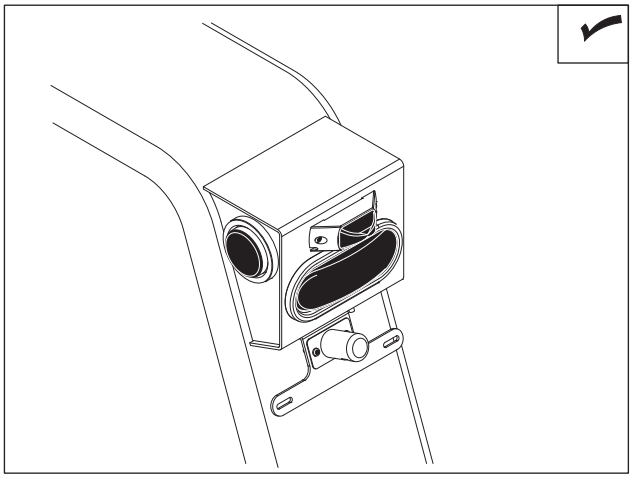
Trailer	Pressure	Torque
T9S/ T12SE	80 psi (5.5 bar)	95 ft•lb (129 N•m)



j32om012h.eps

Check Trailer Lights and Reflectors

Check lights and reflectors for correct operation and cleanliness.



j33om013h.eps

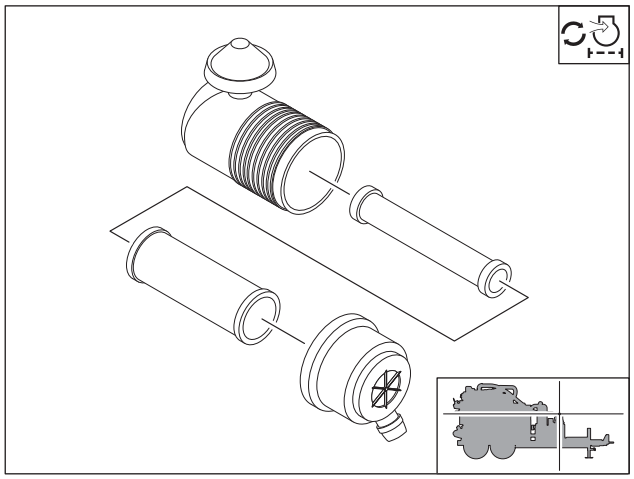
Vacuum System

Check Engine Air Filter

Check air filter every 10 hours. Press dust ejector valve to release dust. Change air filter elements when air filter restriction indicator (1) reaches the red zone.

NOTICE: Only open the air filter canister when air restriction is indicated. Change the elements, do not attempt to clean them.

- Compressed air or water may damage filter element.
- Tapping filter elements to loosen dirt may damage the element.

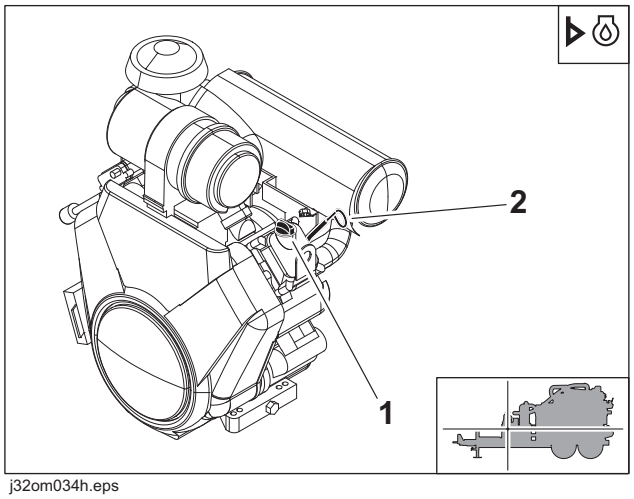

j32om033h.eps

.**To change:**

1. Remove air filter cover and remove element.
2. Wipe inside of housing and wash cover.
3. Insert new element.
4. Replace cover.

Check Engine Oil Level

While engine oil is warm, check oil level at dipstick (2) every 10 hours. Add GEO at fill (1) as necessary to keep oil level at highest line on dipstick.



j32om034h.eps

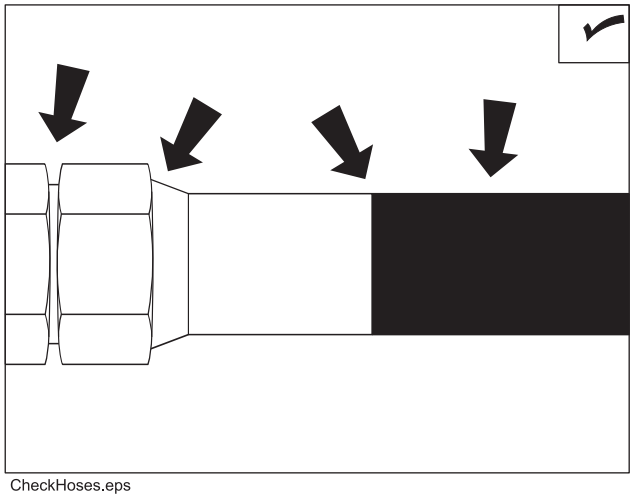
Check Hydraulic Hoses

⚠ WARNING Fluid or air pressure could pierce skin and cause injury or death. Stay away.

To help avoid injury: Escaping pressurized fluid can cause injury or pierce skin and poison.

- Before disconnecting a hydraulic line, turn engine off and operate all controls to relieve pressure. Lower, block, or support any raised component with a hoist. Cover connection with heavy cloth and loosen connector nut slightly to relieve residual pressure. Catch all fluid in a container.
- Before using system, check that all connections are tight and all lines are undamaged.
- Use a piece of cardboard or wood, rather than hands, to search for leaks.
- Wear protective clothing, including gloves and eye protection.
- If you are injured, seek immediate medical attention from a doctor familiar with this type of injury.

Check hydraulic hoses for leaks every 10 hours.

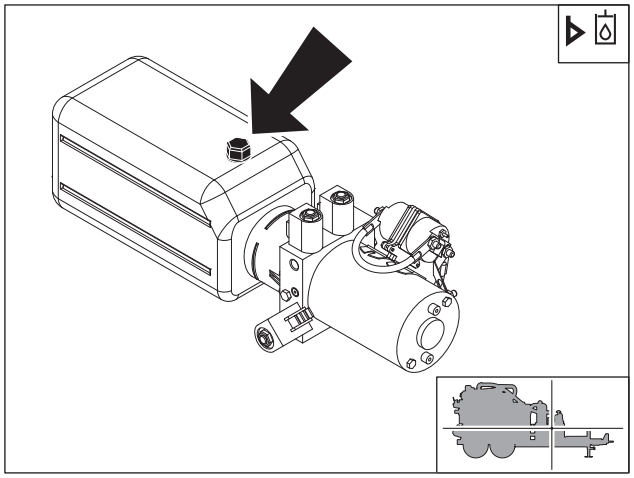


CheckHoses.eps

Check Hydraulic Fluid Level

DC Units

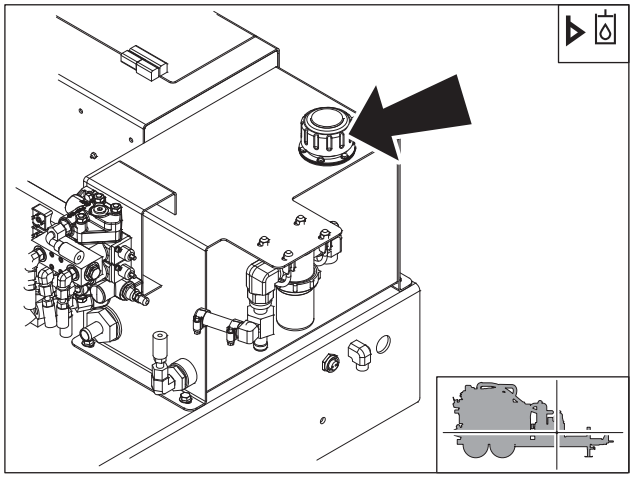
Check hydraulic fluid level every 10 hours. Maintain fluid level at 3/4 tank when engine is off and fluid is cool. Add THF at hydraulic fluid fill (shown) as necessary.



j32om035h.eps

Gear Pump Units

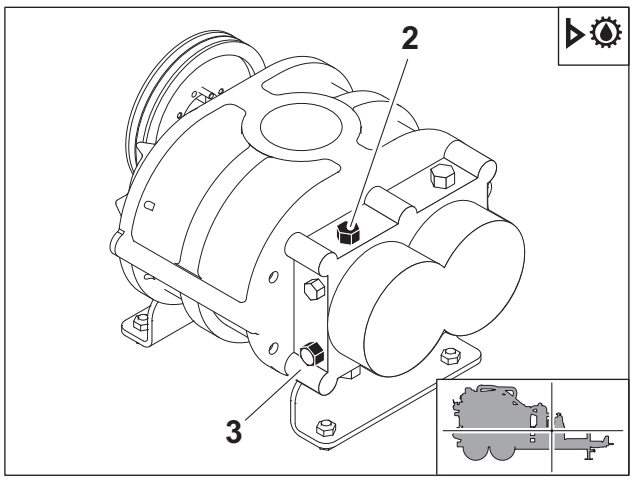
Check hydraulic fluid level at cap (shown) every 10 hours. Maintain fluid level at 2" (51 mm) from top of tank when engine is off and fluid is cool. Add THF at hydraulic fluid fill (shown) as necessary.



j32om056h.eps

Check Blower Oil Level

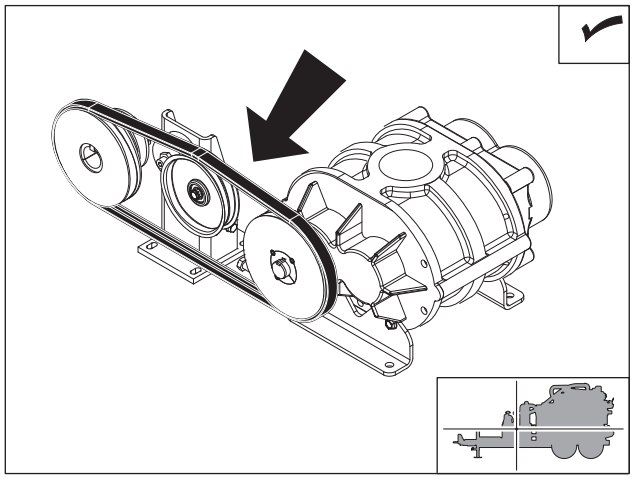
With frame level, check blower oil at sight glass (3) every 10 hours. Add SGL at fill (2) as necessary to maintain oil level at halfway point on sight glass (3). Do not overfill.



j32om036h.eps

Check Blower Belt Tension

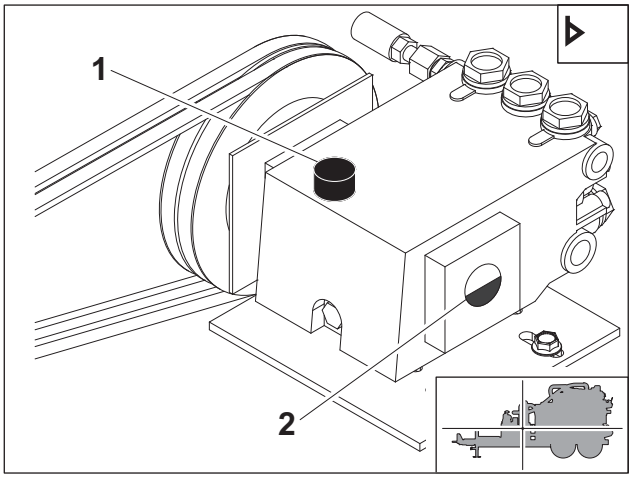
Check belt every 10 hours for correct tension, damage or wear. Idler pulley tensioner should be set to 70 lb of force. Verify that the indication marks on tensioner are in the same position as initially set, or apply 10 lb of force to the belt and check that deflection is .25-.375" (6-10 mm).



j32om037h.eps

Check Water Pump Oil Level

With frame level, check water pump oil at sight glass (2) every 10 hours. Add NDO at fill (1) as necessary to keep oil at halfway mark on sight glass.

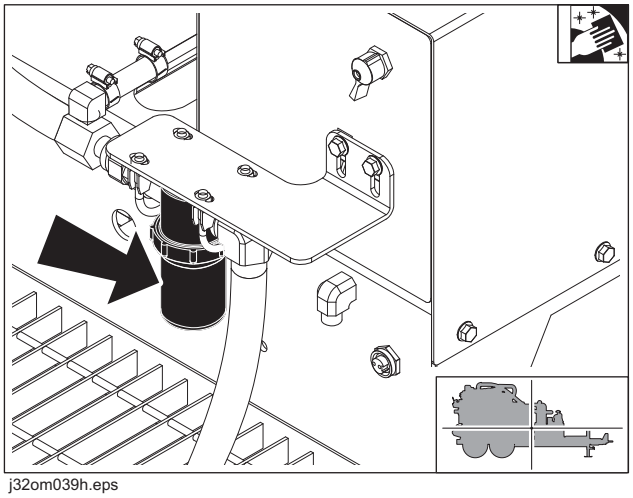


j32om038h.eps

Clean Water Pump Filter

Clean water pump filter every 10 hours and replace as needed.

1. Open filter housing.
2. Remove element and rinse housing thoroughly with water.
3. Inspect element for signs of collapse and for brittle or broken rubber seals on the ends of the element. Replace as needed. See page 88.
4. Replace element and close filter housing.



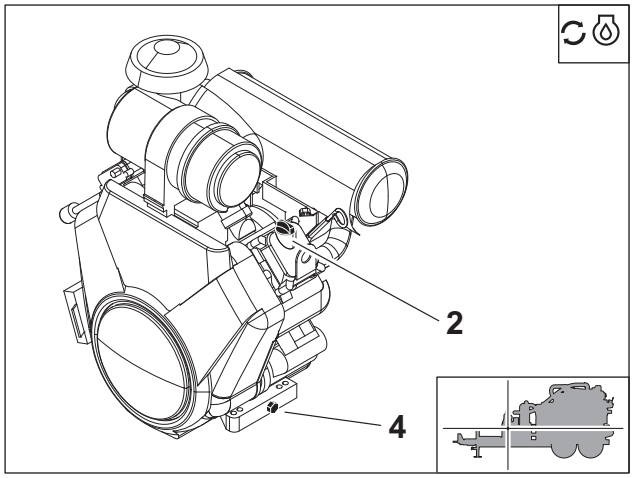
j32om039h.eps

Check Water Pump Belt Tension

Check belt every 10 hours for correct tension, damage or wear. Contact your Ditch Witch dealer for adjustment or belt replacement.

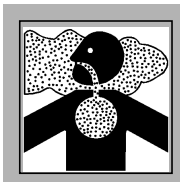
To check

1. Turn ignition to STOP and remove key.
2. Apply moderate thumb pressure to belt between pulleys.
3. Belt is properly tensioned when deflection is .125-.25" (3-6 mm).



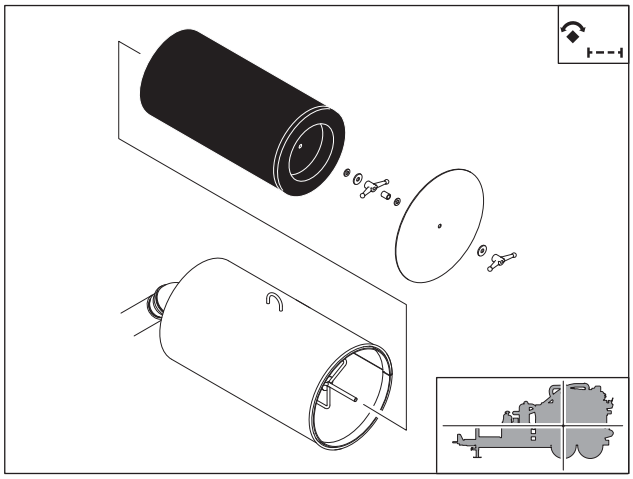
j32om040h.eps

Clean Vacuum Air Filter



⚠ CAUTION Breathing crystalline silica dust may cause lung disease. Cutting, drilling, or working materials such as concrete, sand, or rock containing quartz may result in exposure to silica dust. Use dust control methods or appropriate breathing protection when exposed to silica dust.

Clean filter every 10 hours or as needed.


j32om015h.eps

To clean filter:

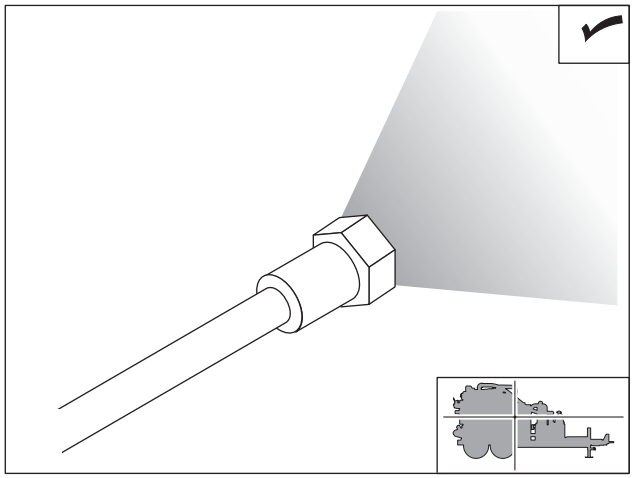
1. Remove filter from canister.
2. Run low pressure water into inside of filter.

NOTICE: Do not use high pressure water to clean filter. Filter will be damaged.

3. Allow filter to dry completely before returning to canister.

Check Spray Nozzle

Check spray nozzle every 10 hours. Ensure that water sprays from nozzle in a fan pattern. Clean or replace nozzle as necessary.

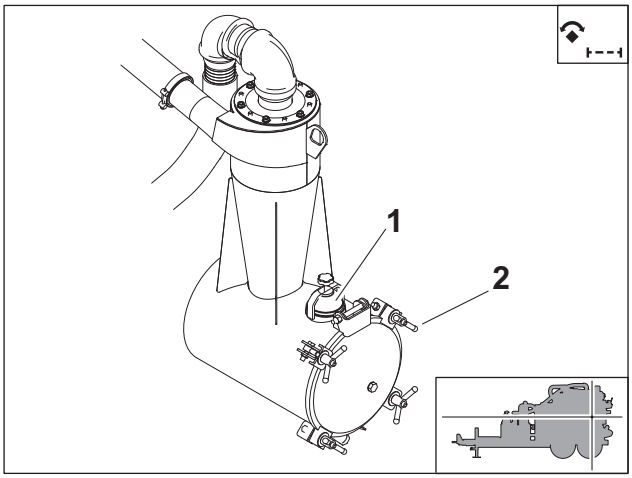


j32om016h.eps

Drain Cyclonic Separator Canister

IMPORTANT: Depressurize tank before emptying cyclonic canister, cleaning filter, clearing hoses or opening any doors.

Drain canister at drain (2) every 10 hours or when water is visible in sight glass

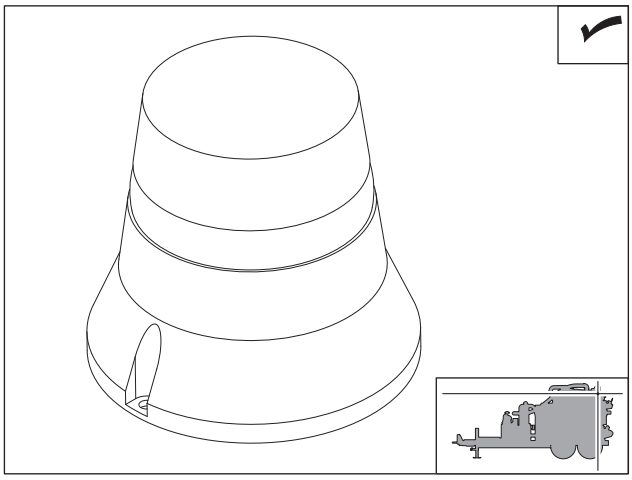


j32om017h.eps

Debris Tank

Check Strobe Light

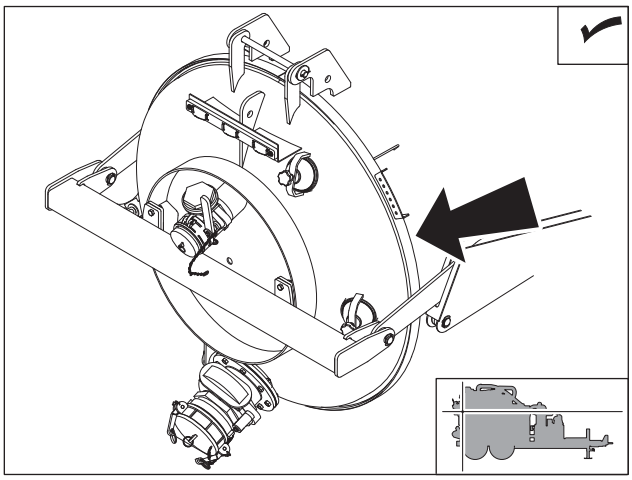
Check strobe light for proper function every 10 hours. When ignition is on, strobe light should be flashing. Repair if necessary.



j32om018h.eps

Check Vacuum Tank Door Seals and Fittings

Check door seal every 10 hours for wear or damage. Repair if necessary. Check for leaks and loose fittings every 10 hours. Repair or replace if necessary.



j32om019h.eps

50 Hour

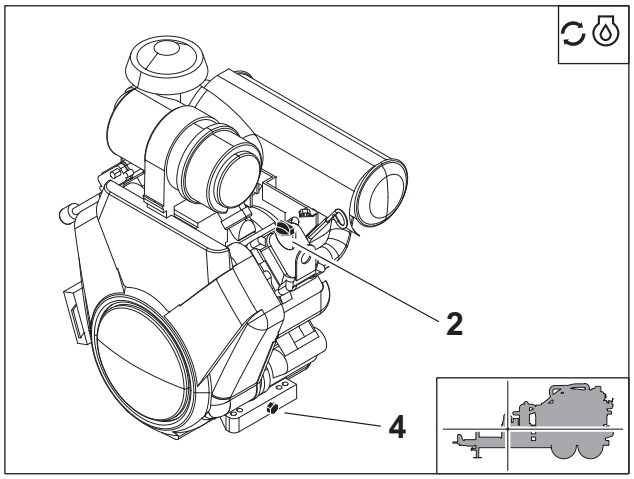
Location	Task	Notes
VACUUM SYSTEM	Change engine oil and filter	Initial service, GEO
	Change fuel filters	Initial service
	Check battery	
	Check water pressure hoses	
	Check vacuum relief valve	
	Lube blower bearings	
	Change water pump oil	Initial service, NDO
DEBRIS TANK	Lube tank pivot pins	

Vacuum System

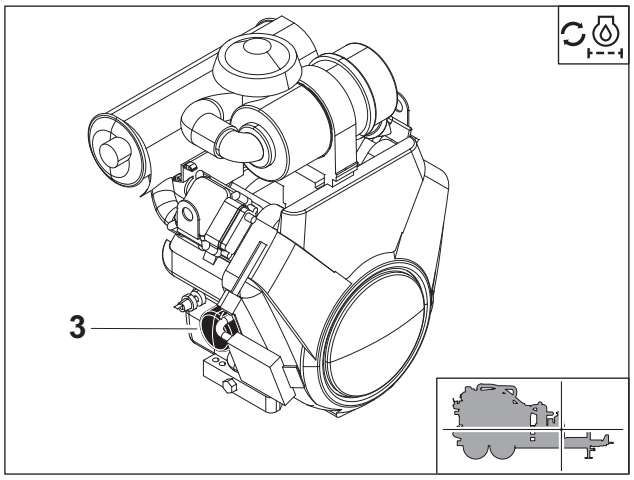
Change Engine Oil and Filter (Initial Service)

Change engine oil and filter after 50 hours, and every 100 hours thereafter. Drain oil (4), change filter (3), and add 4.2 qt (4 L) of GEO at fill (2).

IMPORTANT: Use oil specified in temperature chart found in "Recommended Lubricants/ Service Key" on page 64.



j32om040h.eps

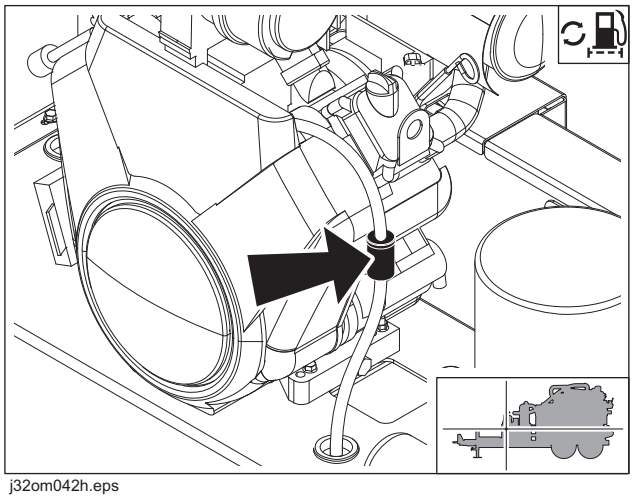


j32om041h.eps

Change Fuel Filter (Initial)

Replace filter after the first 50 hours of operation, and every 100 hours thereafter.

1. Remove filter.
2. Install new filter. Apply fuel oil thinly over the gasket and hand-tighten.



j32om042h.eps

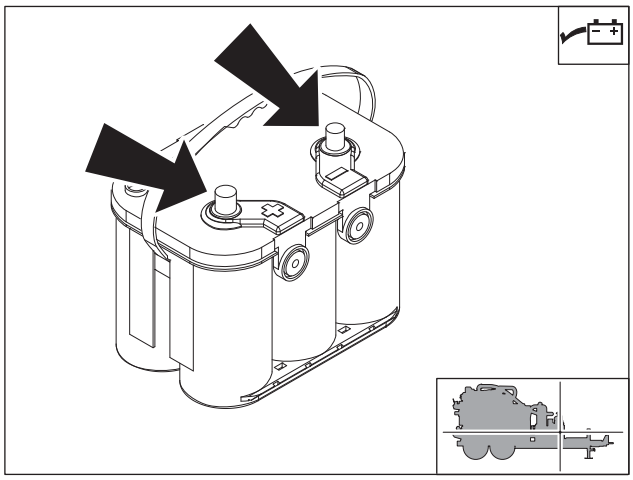
Check Battery

Keep battery clean and free of corrosion. Apply coat of grease to cable clamps after cleaning.

In cold weather, battery loses some starting ability. Closely watch voltmeter for signs of battery discharge.

If battery will not hold charge, see your Ditch Witch dealer for replacement battery.

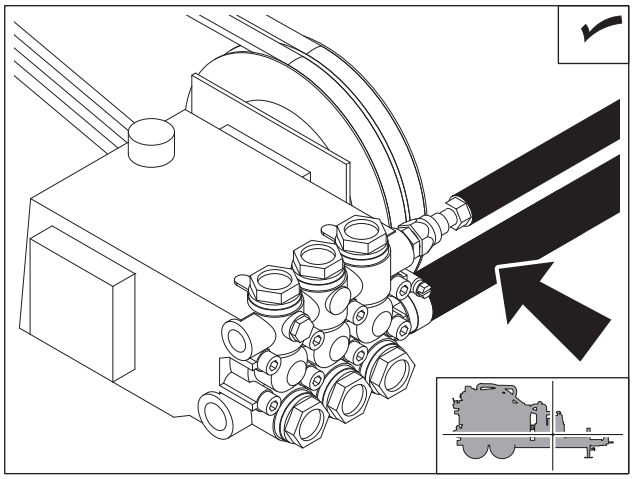
IMPORTANT: Use battery disconnect switch when servicing, welding, and during long-term storage.



j32om043h.eps

Check Water Pressure Hoses

Check hoses every 50 hours for wear or damage. Replace as necessary.

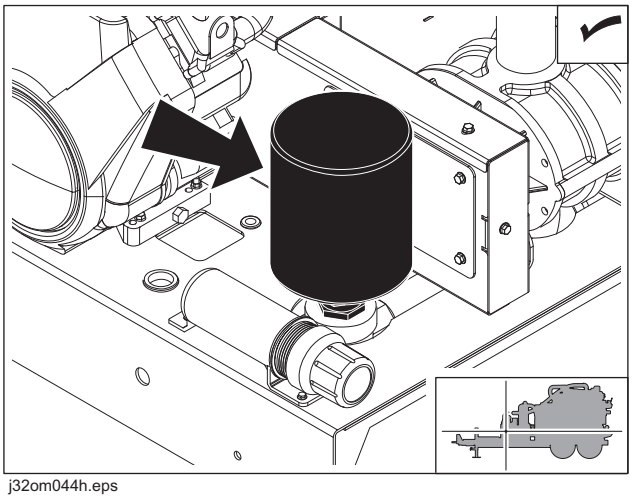


j32om020h.eps

Check Vacuum Relief Valve

Check relief valve for proper operation every 50 hours. To check:

1. Ensure that vacuum inlet valve and drain valve are both closed.
2. Start engine. Vacuum will start to build.
3. When vacuum goes over relief, check for suction at the bottom of the relief air filter.
4. If suction is not present, stop engine and change relief valve.

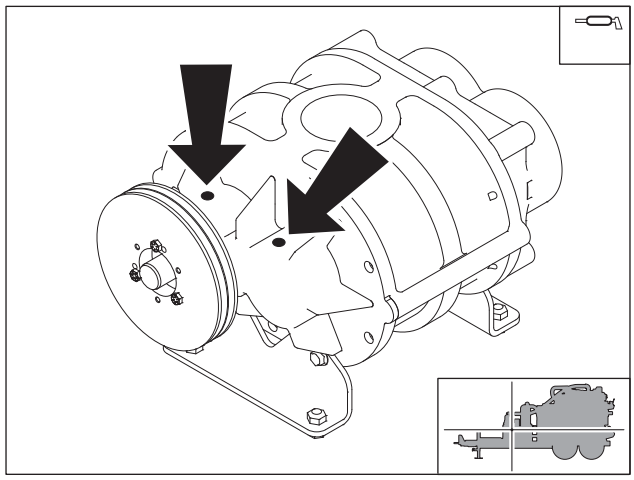


j32om044h.eps

Lube Blower Bearings

Wipe two zerks clean and lube every 50 hours with HTG. Inject grease into zerk until clean grease comes out of relief fittings.

NOTICE: Do not inject grease too quickly. Drive shaft seal damage could occur.

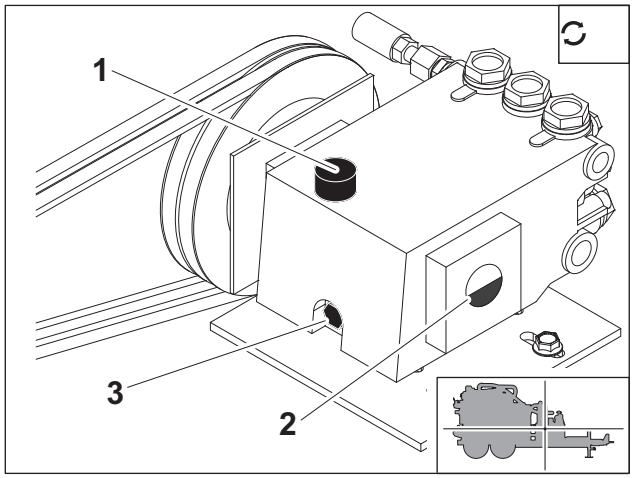


j32om045h.eps

Change Water Pump Oil

Change oil after the first 50 hours of operation and every 100 hours thereafter. Change oil more frequently if working in dusty conditions.

- Drain at drain plug (3) while oil is warm.
- Add NDO at fill (1) until oil is at halfway mark on sight glass (2).

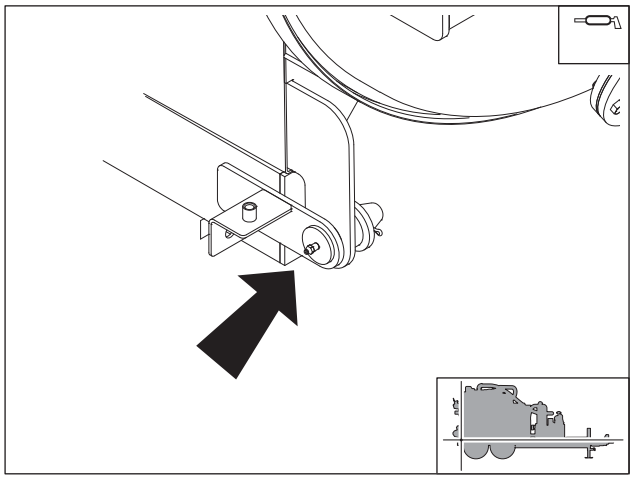


j32om046h.eps

Debris Tank

Lube Tank Pivot Pins

Lube two pins every 50 hours with MPG.



j32om021h.eps

100 Hour

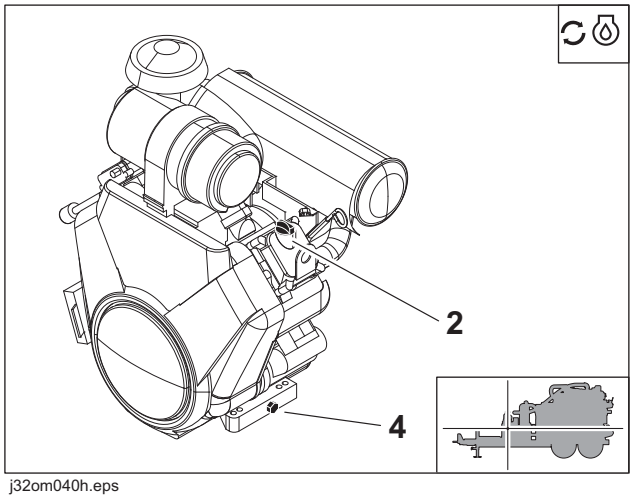
Location	Task	Notes
VACUUM SYSTEM	Change engine oil and filter	GEO
	Change fuel filters	
	Change blower oil	initial service, SGL
	Change hydraulic fluid	DC unit initial service, THF
	Change water pump oil	NDO
DEBRIS TANK	Check tank deflector	
	Check tank mounting bolts	

Vacuum System

Change Engine Oil and Filter (Regular Service)

Change engine oil and filter every 100 hours. Drain oil (4), change filter (3), and add 4.2 qt (4 L) of GEO at fill (2).

IMPORTANT: Use oil specified in temperature chart found in "Recommended Lubricants/ Service Key" on page 64.



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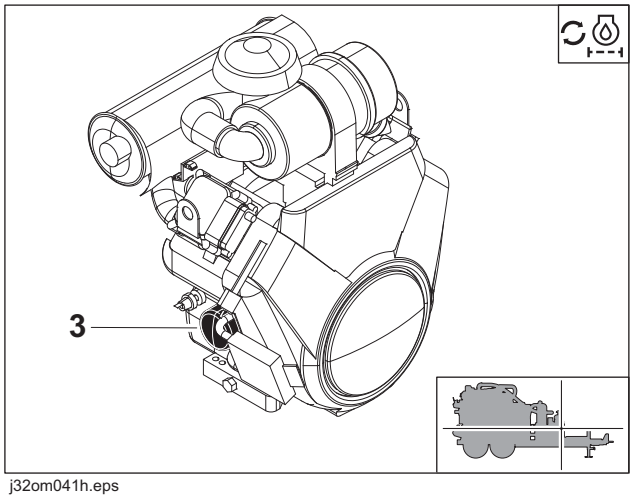
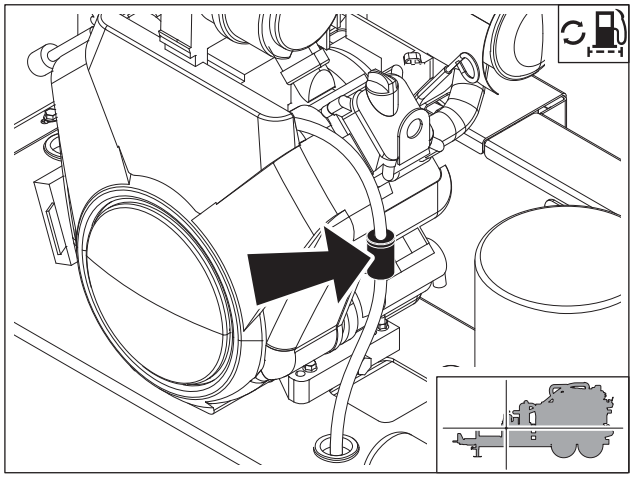


j32om041h.eps

Change Fuel Filter

Replace filter every 100 hours.

1. Remove filter.
2. Install new filter. Apply fuel oil thinly over the gasket and hand-tighten.

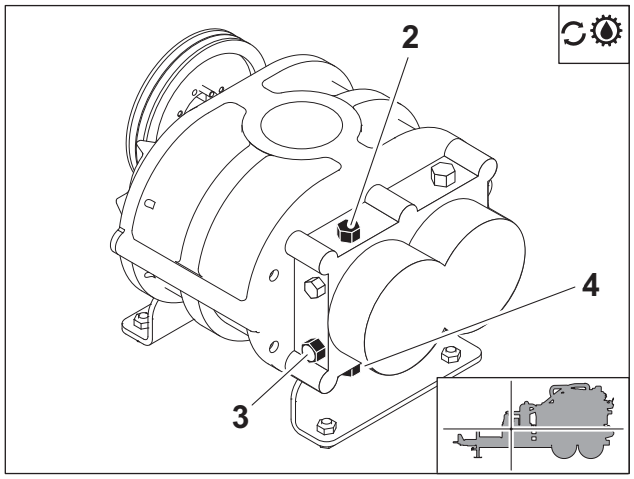


j32om042h.eps

Change Blower Oil

Change oil after the first 100 hours of operation, and every 1000 hours thereafter. Change oil more frequently if working in dusty conditions.

- Drain at drain plug (4) while oil is warm.
- Add SGL at fill (2) until oil is at halfway point on sight glass (3).



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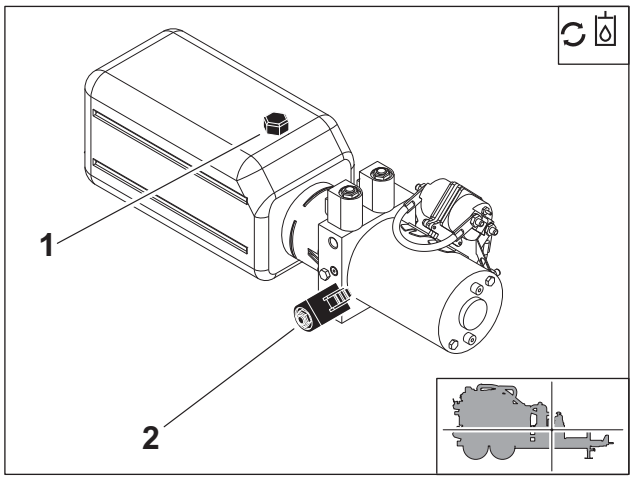
Change Hydraulic Fluid (DC Units)

Change hydraulic fluid after the first 100 hours, and every 1000 hours thereafter. Drain hydraulic fluid (2), add THF at hydraulic fluid fill (1) and check level.

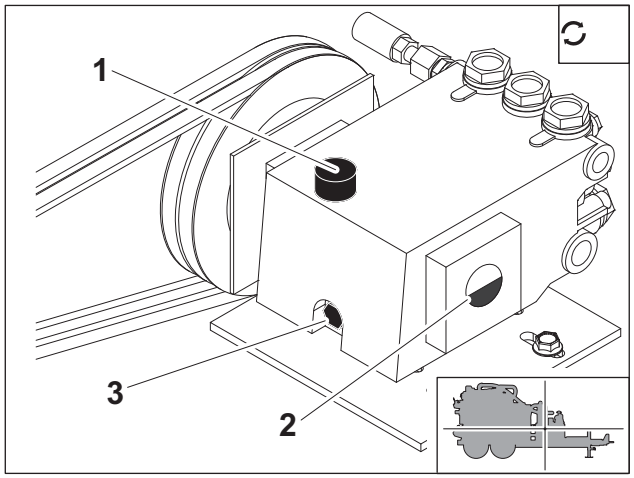


j32om048h.eps

Change Water Pump Oil

Change oil after the first 25 hours of operation and every 100 hours thereafter. Change oil more frequently if working in dusty conditions.

- Drain at drain plug (3) while oil is warm.
- Add NDO at fill (1) until oil is at halfway mark on sight glass (2).

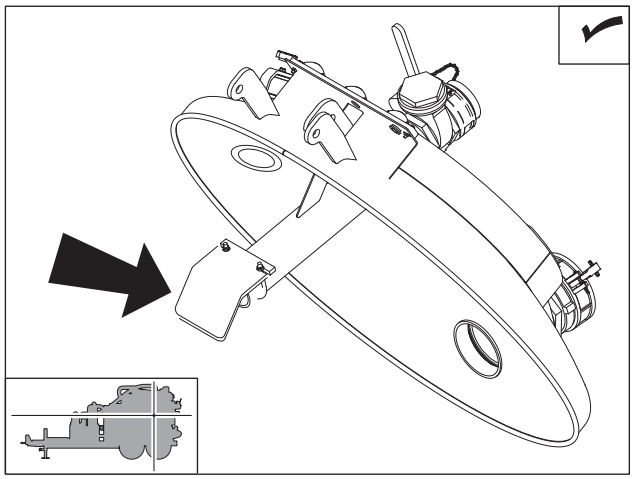


j32om046h.eps

Debris Tank

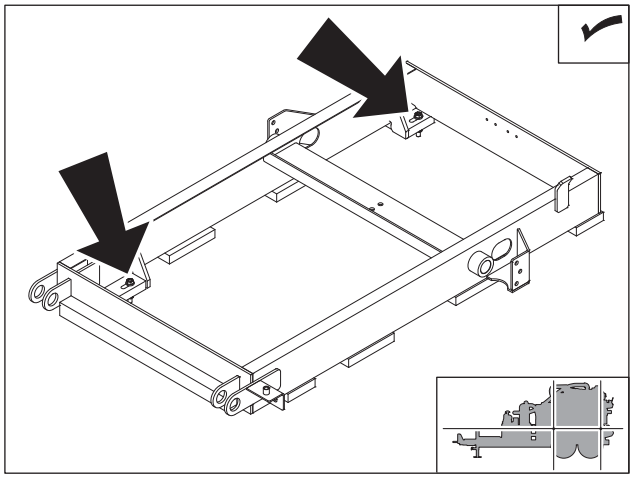
Check Tank Deflector

Check tank deflector every 100 hours for wear or damage. Replace as needed.


j32om023h.eps

Check Tank Mounting Bolts

Check vacuum tank mounting bolts (shown, both sides) every 100 hours for looseness and damage. Tighten or replace as needed.


j32om054h.eps

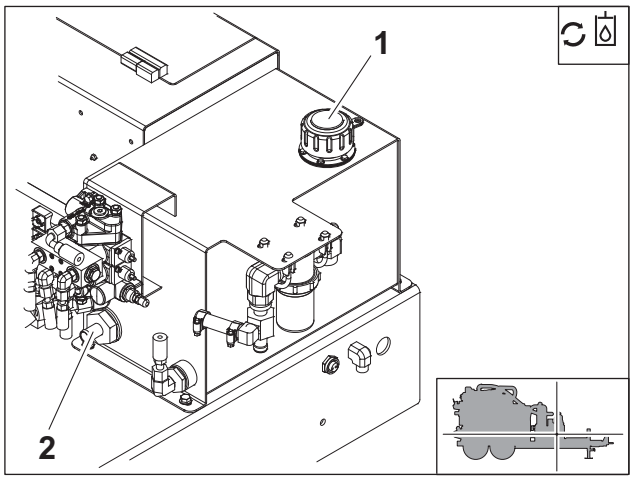
250-Hour

Location	Task	Notes
VACUUM SYSTEM	Change hydraulic fluid	gear pump unit initial service, THF

Vacuum System

Change Hydraulic Fluid (Gear Pump Units)

Change hydraulic fluid after the first 250 hours, and every 1000 hours thereafter. Drain hydraulic fluid (2), remove and clean strainer, add THF at hydraulic fluid fill (1) and check level.



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1000 Hour

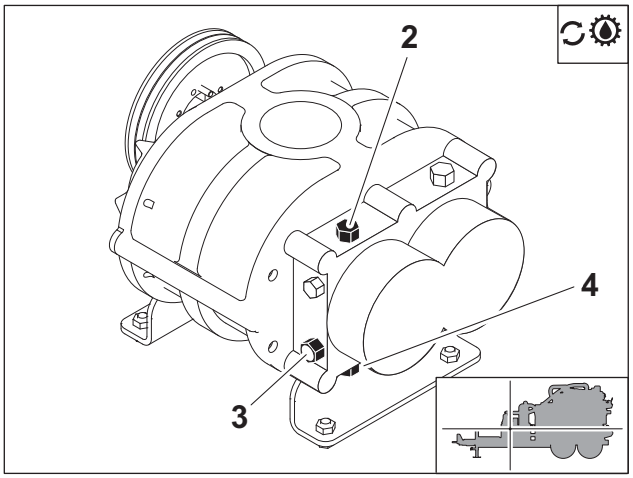
Location	Task	Notes
VACUUM SYSTEM	Change blower oil	SGL
	Change hydraulic fluid	THF

Vacuum System

Change Blower Oil

Change oil every 1000 hours. Change oil more frequently if working in dusty conditions.

- Drain at drain plug (4) while oil is warm.
- Add SGL at fill (2) until oil is at halfway point on sight glass (3).



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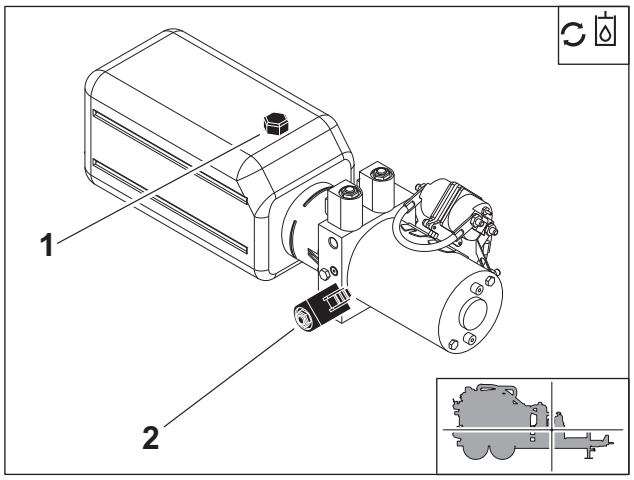
Change Hydraulic Fluid

DC Units

Change hydraulic fluid every 1000 hours. Drain hydraulic fluid (2), add THF at hydraulic fluid fill (1) and check level.



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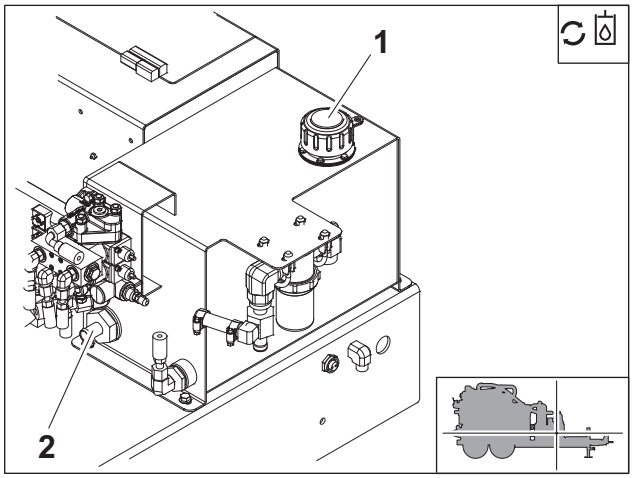
Gear Pump Units

Change hydraulic fluid every 1000 hours. Drain hydraulic fluid (2), remove and clean strainer, add THF at hydraulic fluid fill (1) and check level.



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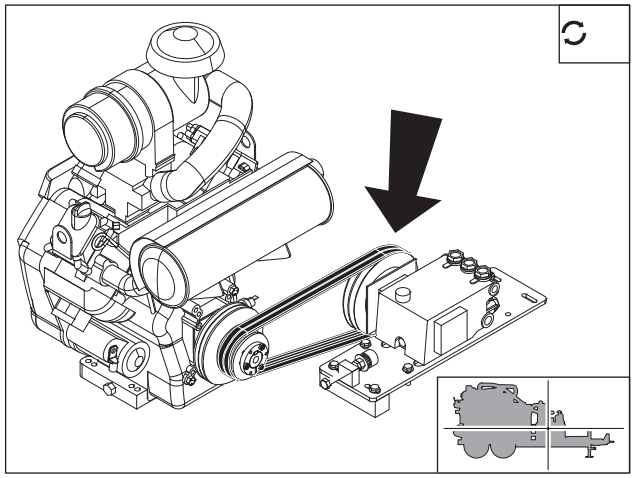
2000 Hour

Location	Task	Notes
VACUUM SYSTEM	Replace water pump belts	
	Replace blower belt	

Vacuum System

Replace Water Pump Belts

Replace belt every 2000 hours.



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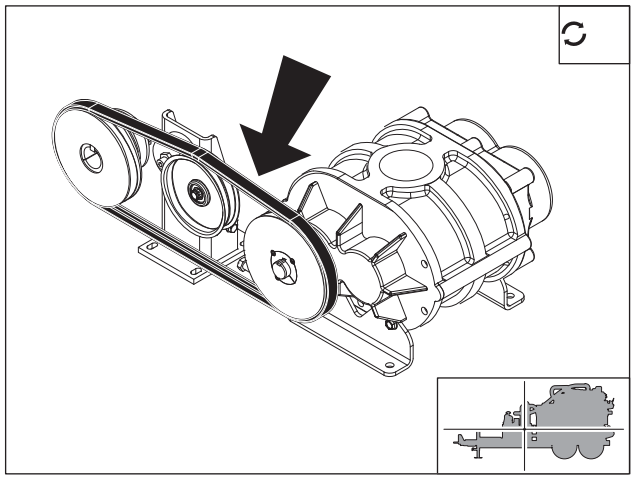
Replace Blower Belt

Replace belt every 2000 hours.



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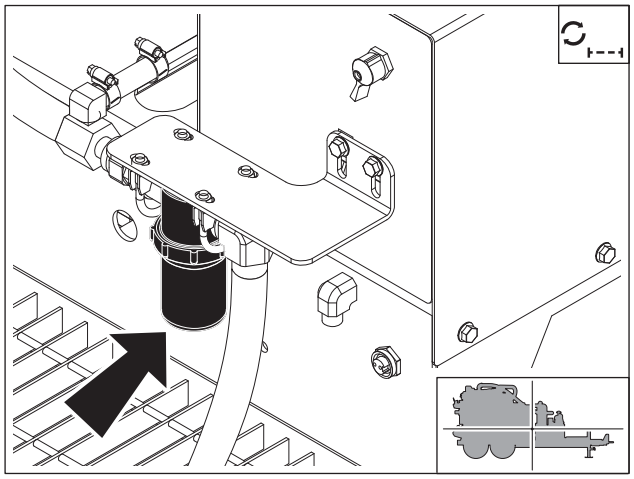
As Needed

Location	Task	Notes
VACUUM SYSTEM	Change water pump filter	
	Lube blower for longterm storage	
	Change blower relief air filter	
	Empty cyclonic filter canister	
DEBRIS TANK	Clean primary shutoff valve	
TRAILER	Add surge brake fluid	DOT 3 or 4

Vacuum System

Change Water Pump Filter

1. Open filter housing.
2. Remove element and rinse housing thoroughly with water.
3. Replace element and close filter housing.



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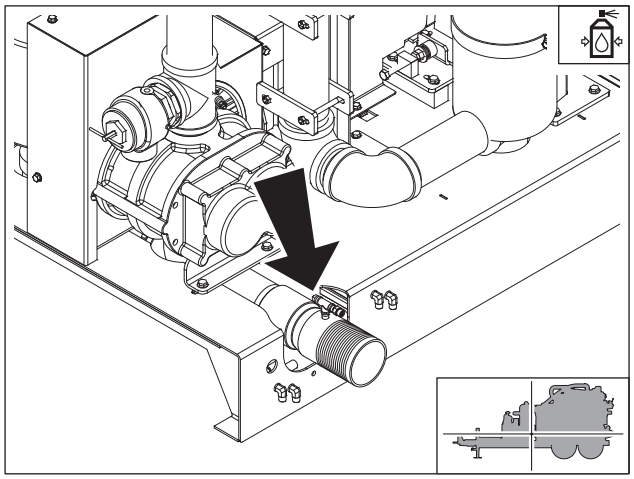
Lube Blower for Long-term Storage

Lubricate blower before long-term storage to help prevent rust and siezing.

1. Remove filter.
2. Start engine.
3. Spray light oil into port and run unit for 1-2 minutes.
4. Turn off engine.



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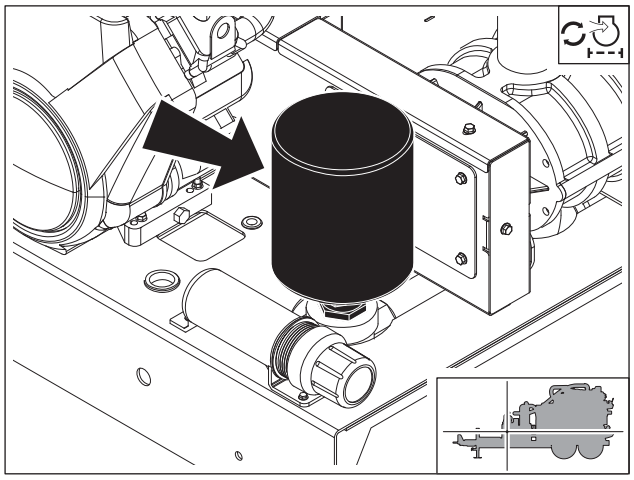
Change Blower Relief Air Filter

Check air filter whenever vacuum gauge goes over 16" (406 mm) of mercury. Change as needed.

NOTICE: Operating system above 16" (406 mm) of mercury may result in blower damage.

1. Remove clamp.
2. Remove filter and discard.
3. Install new filter.
4. Replace clamp.



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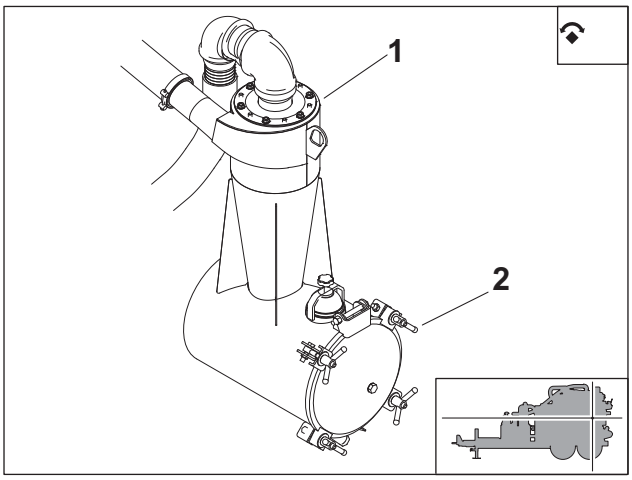
Empty Cyclonic Separator Canister

IMPORTANT: Depressurize tank before emptying cyclonic canister, cleaning filter, clearing hoses or opening any doors.

Empty cyclonic separator canister (2) as needed. Open door and dump tank. Clean out cyclone through upper access door (1) as needed.



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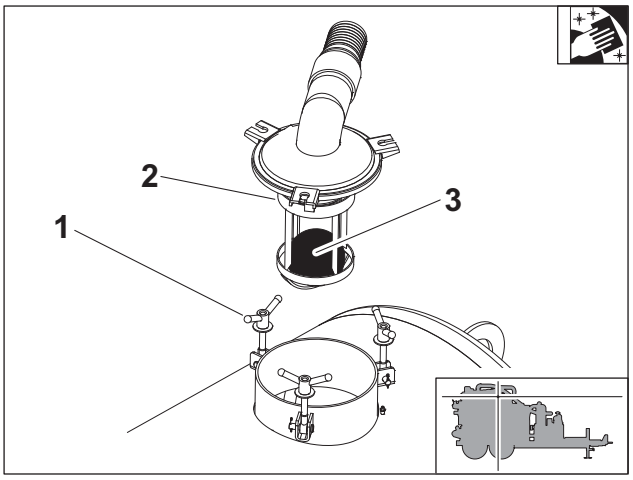
Debris Tank

Clean Primary Shut-off Valve

Clean primary shut-off valve as needed. Replace primary shut-off valve as needed.

To clean:

1. Open tank door. See "Drain Tank" on page 51.
2. Spray valve housing inside vacuum tank with high-pressure water.
3. Store water pressure hose.
4. Close tank door. See "Drain Tank" on page 51.



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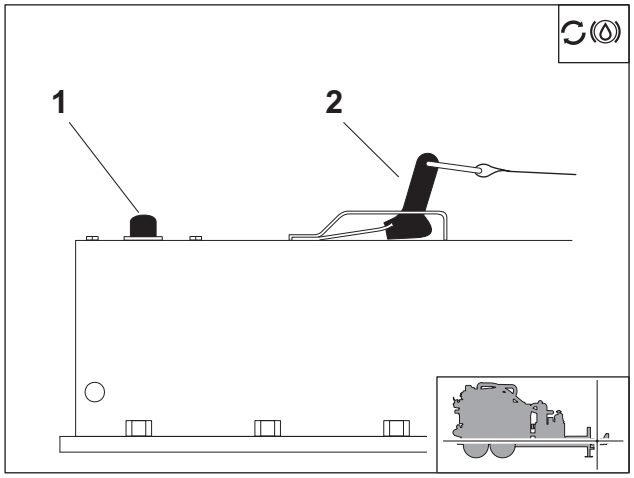
To remove:

1. Loosen three wingnuts (1) and pull out valve housing (2).
2. Remove ball (3).
3. Clean ball and housing with high-pressure water.
4. Replace ball and housing.
5. Tighten wingnuts.

Trailer

Add Surge Brake Fluid



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Add surge brake fluid at cap (1) as needed and bleed brakes.

1. Remove lever guide and flat emergency lever spring by removing two 5/16" hex head bolts and lock washers.
2. Using short strokes, pull forward on emergency lever (2) until brake fluid in master cylinder stops bubbling.
3. Attach bleeder hose to bleeder valve on one wheel and submerge other end of hose into a transparent container partially filled with brake fluid.
4. Loosen bleeder valve one turn and use emergency lever to pump master cylinder. Continue to pump the lever until bubbles no longer appear in brake fluid in container.

NOTICE: Check fluid level in master cylinder every 4-5 strokes and add fluid as necessary to keep master cylinder at least half full while bleeding brakes.

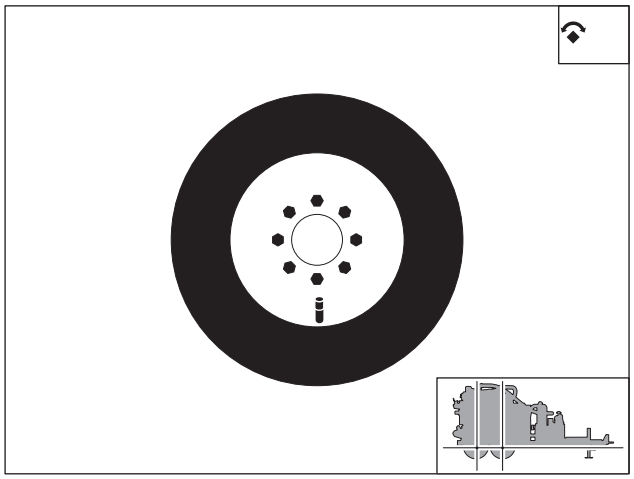
5. When bubbles stop, close bleeder valve and repeat process on remaining wheels.
6. After all wheels have been bled, fill master cylinder and attach cap securely.
7. Install emergency lever spring and lever guide using hex head bolts and lock washers.
8. Test brakes.
   - Pull emergency lever forward until it locks into its second notch.
   - Attempt to rotate all wheels in forward direction.
   - If any wheel rotates, adjust brakes.

200 Mile

Location	Task	Notes
Trailer	Adjust electric brakes	Initial
	Adjust hydraulic brakes	Initial

Trailer

Adjust Electric Brakes (Initial)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Adjust brakes after 200 miles (320 km).

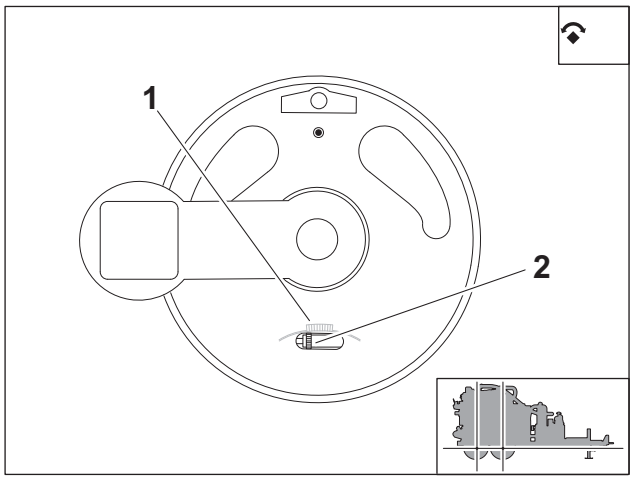
1. Place adequate jack stands under frame rails and remove wheels.
2. Remove cover from adjusting slot on bottom of backing plate.
3. Rotate adjuster starwheel with screwdriver or brake spoon to expand brake shoes. Adjust until drum is very difficult to turn by hand.
4. Rotate starwheel the other direction until drum turns with slight drag.
5. Replace adjusting slot cover and replace wheel.
6. Repeat procedure for all remaining brakes.
7. Remove jack stands and lower wheels to ground.

Adjust Hydraulic Brakes (Initial)

Adjust hydraulic brakes after 200 miles (320 km).

WARNING Crushing weight could cause death or serious injury. Use proper procedures and equipment or stay away.

1. Use a jack and suitable jack stands to raise wheels so that wheels can be rotated by hand.
2. Rotate wheel forward by hand to reposition free backing primary brake shoe.
3. Remove adjusting plug from backing plate at wheel.
4. Use a slender screwdriver or similar tool to push the adjuster screw spring (1) away from the adjuster assembly.
5. At the same time, use a brake adjusting tool to tighten adjuster assembly (2). Adjust until brake linings become tight enough that wheel cannot be turned by hand, then back off 11 clicks for brakes that have not been used, and 15 clicks for brakes already burnished in.



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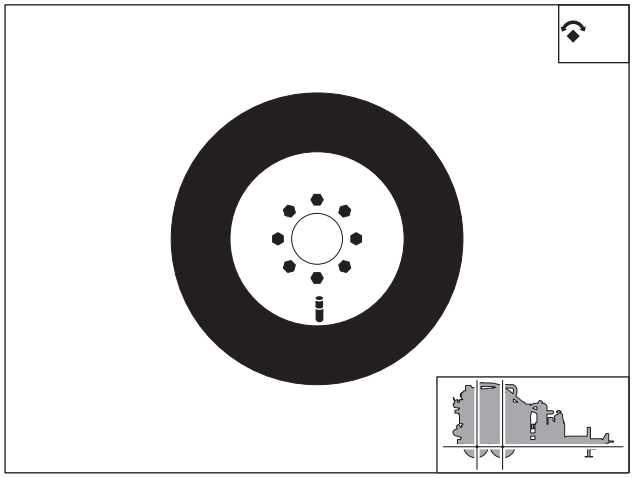
6. Rotate wheel forward by hand. Wheel should rotate freely.
7. Replace adjusting plug in backing plate.
8. Repeat adjustment procedure at each wheel. To ensure even braking, make sure that all wheels have approximately the same amount of drag.

3000 Mile

Location	Task	Notes
Trailer	Adjust electric brakes	
	Adjust hydraulic brakes	

Trailer

Adjust Electric Brakes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Adjust brakes every 3000 miles (5000 km).

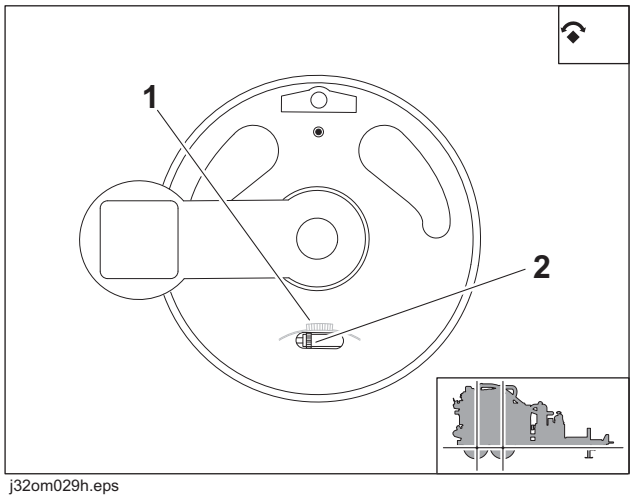
1. Place adequate jack stands under frame rails and remove wheels.
2. Remove cover from adjusting slot on bottom of backing plate.
3. Rotate adjuster starwheel with screwdriver or brake spoon to expand brake shoes. Adjust until drum is very difficult to turn by hand.
4. Rotate starwheel the other direction until drum turns with slight drag.
5. Replace adjusting slot cover and replace wheel.
6. Repeat procedure for all remaining brakes.
7. Remove jack stands and lower wheels to ground.

Adjust Hydraulic Brakes

Adjust hydraulic brakes every 3000 miles (5000 km).

WARNING Crushing weight could cause death or serious injury. Use proper procedures and equipment or stay away.

1. Use a jack and suitable jack stands to raise wheels so that wheels can be rotated by hand.
2. Rotate wheel forward by hand to reposition free backing primary brake shoe.
3. Remove adjusting plug from backing plate at wheel.
4. Use a slender screwdriver or similar tool to push the adjuster screw spring (1) away from the adjuster assembly.
5. At the same time, use a brake adjusting tool to tighten adjuster assembly (2). Adjust until brake linings become tight enough that wheel cannot be turned by hand, then back off 11 clicks for brakes that have not been used, and 15 clicks for brakes already burnished in.



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6. Rotate wheel forward by hand. Wheel should rotate freely.
7. Replace adjusting plug in backing plate.
8. Repeat adjustment procedure at each wheel. To ensure even braking, make sure that all wheels have approximately the same amount of drag.

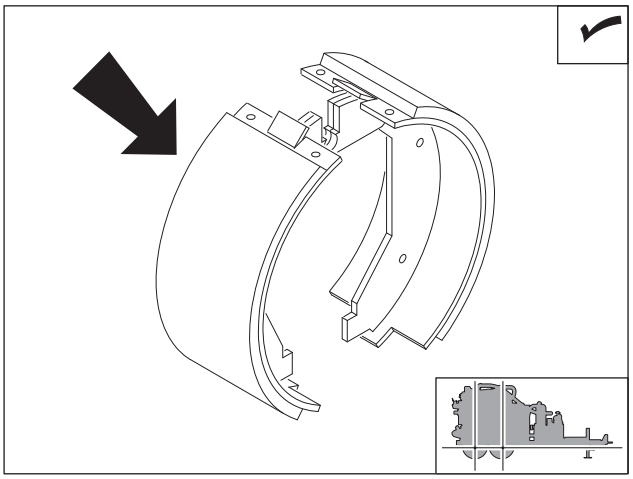
12,000 Mile

Location	Task	Notes
Trailer	Inspect brake shoes and linings	
	Adjust and lubricate bearings	

Trailer

Inspect Brake Shoes and Linings

Inspect shoes and linings every 12 months or 12,000 miles (20 000 km) for wear. When lining is worn to 1/16" (2 mm) or less, replace linings. Replace shoe and lining if contaminated by oil.



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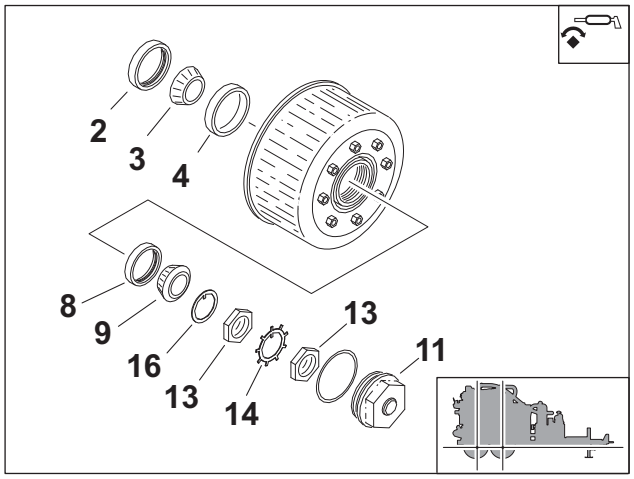
Adjust and Lubricate Bearings



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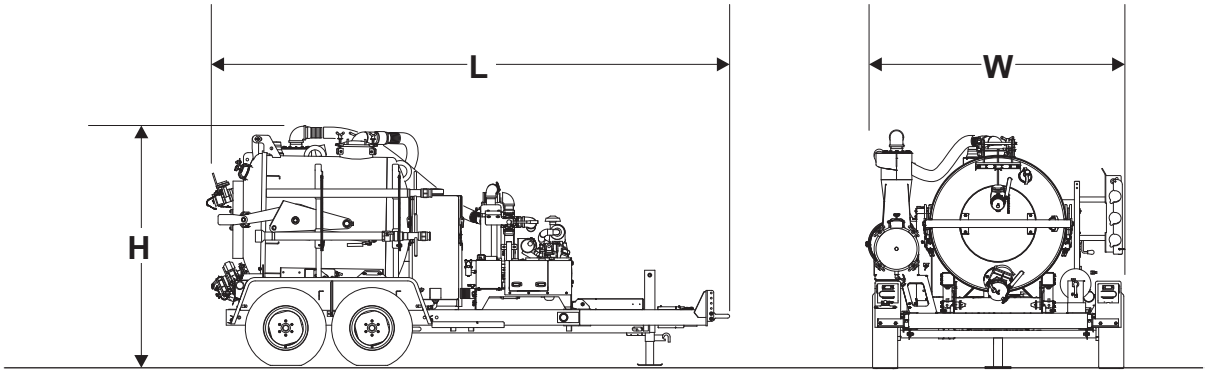
1. Place adequate jack stands under frame rails and remove wheels.
2. Unscrew grease cap (11) while holding the hub stationary.
3. Bend locking tang (14) down from outer spindle nut (13) and remove spindle nut (3).
4. Remove tang washer, unscrew inner spindle nut and remove spindle washer (16).
5. Remove hub from spindle. Do not drop outer bearing cone.
6. Pry seal (2) from hub and remove inner bearing cone (3).
7. Inspect brake drum for excessive wear or heavy scoring.

Condition	Recommended Action
Brake drum worn more than .020" (.5 mm).	Remachine drum surface
Brake drum worn out of round more than .015" (.39 mm).	
Brake drum has scoring and other wear greater than .090" (2.29 mm)	Replace drum

8. Clean all grease from bearing cups (4,8), cones (9,3), hardware, and hub bore using suitable solvent. Dry components with lint free cloth.
9. Inspect bearing cups and cones for pitting, spalling, and corrosion. Replace if damaged.
10. Pack all cones using an extreme pressure, water resistant lithium complex grease. Apply light coating of grease to bearing cones.
11. Install the bearing and washer into the hub. Thread on the inner nut, rotate the hub, and tighten the nut until the hub will not rotate. This requires a minimum of 100 ft•lb (136 N•m) of torque.
12. Loosen the nut to remove preload torque.
13. Hand tighten the nut and back it off 1/4 to 3/4 of a turn.
14. Place tang washer on spindle and bend one tang inward over the nut. This will keep the inner nut from turning while torque is applied to the outer nut.
15. Install the outer nut. Ensure that inner nut does not turn. Bend two tangs from the tang washer over the outer flats to secure.
16. Install cap with o-ring and plug installed. Rotate the hub and check bearing adjustment. Allowable end play is .001-.010" (.025-.25 mm).

Specifications

500



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Dimensions		U.S.	Metric
L	Length, T9S or T9SH trailer	200 in	5.1 m
H	Height	86 in	2.3 m
W	Width	96 in	2.2 m
Weight: suction only unit			
	Dry	4805 lb	2180 kg
	Full	8870 lb	4023 kg
Weight: suction and water unit			
	Dry	4930 lb	2236 kg
	Full water tank, empty vac tank	5665 lb	2570 kg
	Empty water tank, full vac tank	9120 lb	4137 kg
	Full water tank, full vac tank	9765 lb	4430 kg

NOTICE: Do not transport vac system and T9S, T9SH trailer with full water tank and full vac tank. Doing so will exceed the trailer's rated Gross Motor Vehicle Weight.

Engine		**U.S.**	**Metric**
Briggs & Stratton Vanguard, gasoline			
	Cooling medium	air	
	Aspiration	natural	
	Number of cylinders	2	
	Displacement	54.68 in^3	896 cc
	Bore	3.37 in	86 mm
	Stroke	3.07 in	78.5 mm
Engine manufacturer's gross power rating (per SAE J1940)		31 hp	23.1 kW
Rated engine speed		3600 rpm	3600 rpm
Emissions compliance: EPA LSI, EU Stage II			

Hydraulic system	**U.S.**	**Metric**
Pressure	2500 psi	172 bar
Drive type	gear pump	
Flow rate	3.0 gpm	11.4 L/min
Tank lift cylinder size (2)	3 in	76 mm
Maximum tilt angle	45°	45°

Battery
SAE res. cap. 180 min; SAE cold crank @ 0°F (-18°C) 800A, 12V

Noise levels
Operator 87 dBA sound pressure per ISO 6394, at operator ear 25' (7.6 m) behind centerline of power pack. Exterior 110 dBA sound power per ISO 6393.

Vacuum system	U.S.	Metric
Tank capacity	500 gal	1893 L
Drive type	belt	
Displacement	543 cfm	15.3 m^3/min
Maximum vacuum	15 in Hg	381 mm Hg
Vacuum tank door diameter	52 in	1.3 m
Drain valve size	6 in	152 mm
Inlet valve size	4 in	102 mm
Primary shutoff valve size (ball type)	12 in	305 mm
Filter type	washable polyester	
Filter area	100 ft^2	9.3 m^2
Suction hose size	3 in	76 mm
Suction hose length (total)	30 ft	9.1 m

Water pump system	U.S.	Metric
Maximum pressure	3000 psi	207 bar
Flow	4 gpm	15.1 L/min
Hose reel capacity (locking)	50 ft	15.3 m
Antifreeze	50/50 water/antifreeze mix	
Clutch type	electric with auto de-clutch	

Fluid capacities	U.S.	Metric
Engine oil with filter	4.2 qt	4 L
Fuel tank	6.9 gal	26.1 L
Vacuum pump	1.5 qt	1.4 L
Hydraulic reservoir	6.0 gal	22.7 L
Water pump	41 oz	1.2 L
Water tank	80 gal	303 L

T9S Trailer		U.S.	Metric
Dimensions			
	Clearance (at jack foot pad)	12 in	305 mm
	Adj. coupler height	18-24 in	457-610 mm
	Width between fenders	76 in	1.9 m
	Width outside fenders	96 in	2.4 m
General			
	Number of axles	2	
	Coupler (square mount drawbar)	3 in or 2.5 in	76 mm or 64 mm
	Type of brakes	electric or hydraulic surge	
	Lug nut torque	90-120 ft•lb	122-163 N•m
	Hitch bolt torque	160 ft•lb	217 N•m
	Electrical system	12V DC	
Tire	ST235/85R16 load range E	80 psi	5.5 bar
Load rating			
	Tongue weight (empty water, empty vac)	1350 lb	612 kg
	Tongue weight (full water, empty vac)	1500 lb	680 kg
	Tongue weight (full vac, empty water)	1218 lb	552 kg
	GVWR (gross vehicle weight rating)	9950 lb	4513 kg
	GAWR (gross axle weight rating, each)	6000 lb	2722 kg

Load ratings for speeds up to 65 mph (104 km/h).

T12SE Trailer		U.S.	Metric
Dimensions			
	Clearance (at jack foot pad)	12 in	305 mm
	Adj. coupler height	18-24 in	457-610 mm
	Width between fenders	76 in	1.9 m
	Width outside fenders	96 in	2.4 m
General			
	Number of axles	2	
	Coupler (square mount drawbar)	3 in or 2.5 in	76 mm or 64 mm
	Type of brakes	electric or hydraulic surge	
	Lug nut torque	90-120 ft•lb	122-163 N•m
	Hitch bolt torque	160 ft•lb	217 N•m
	Electrical system	12V DC	
Tire	LT215/85R16 load range E	80 psi	5.5 bar
Load rating			
	Tongue weight (empty water, empty vac)	815 lb	370 kg
	Tongue weight (full water, empty vac)	1200 lb	544 kg
	Tongue weight (full vac, empty water)	1645 lb	746 kg
	GVWR (gross vehicle weight rating)	9950 lb	4513 kg
	GAWR (gross axle weight rating, each)	6000 lb	2722 kg

Load ratings for speeds up to 65 mph (104 km/h).

Support

Procedure

Notify your dealer immediately of any malfunction or failure of Ditch Witch equipment.

Always give model, serial number, and approximate date of your equipment purchase. This information should be recorded and placed on file by the owner at the time of purchase.

Return damaged parts to dealer for inspection and warranty consideration if in warranty time frame.

Order genuine Ditch Witch replacement or repair parts from your authorized Ditch Witch dealer. Use of another manufacturer's parts may void warranty consideration.

Resources

Publications

Contact your Ditch Witch dealer for publications and videos covering safety, operation, service, and repair of your equipment.

Ditch Witch Training

For information about on-site, individualized training, contact your Ditch Witch dealer.

Warranty

Ditch Witch Equipment and Replacement Parts Limited Warranty Policy

Subject to the limitation and exclusions herein, free replacement parts will be provided at any authorized Ditch Witch dealership for any Ditch Witch equipment or parts manufactured by The Charles Machine Works, Inc. (CMW) that fail due to a defect in material or workmanship within one (1) year of first commercial use (Exception: 2 years for all SK5 attachments). Free labor will be provided at any authorized Ditch Witch dealership for installation of parts under this warranty during the first year following "initial commercial" use of the serial-numbered Ditch Witch equipment on which it is installed. The customer is responsible for transporting their equipment to an authorized Ditch Witch dealership for all warranty work.

Exclusions from Product Warranty

- All incidental or consequential damages.
- All defects, damages, or injuries caused by misuse, abuse, improper installation, alteration, neglect, or uses other than those for which products were intended.
- All defects, damages, or injuries caused by improper training, operation, or servicing of products in a manner inconsistent with manufacturer's recommendations.
- All engines and engine accessories (these are covered by original manufacturer's warranty).
- Tires, belts, and other parts which may be subject to another manufacturer's warranty (such warranty will be available to purchaser).
- ALL IMPLIED WARRANTIES NOT EXPRESSLY STATED HEREIN, INCLUDING ANY WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE AND MERCHANTABILITY.

IF THE PRODUCTS ARE PURCHASED FOR COMMERCIAL PURPOSES, AS DEFINED BY THE UNIFORM COMMERCIAL CODE, THEN THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE FACE HEREOF AND THERE ARE NO IMPLIED WARRANTIES OF ANY KIND WHICH EXTEND TO A COMMERCIAL BUYER. ALL OTHER PROVISIONS OF THIS LIMITED WARRANTY APPLY INCLUDING THE DUTIES IMPOSED.

Ditch Witch products have been tested to deliver acceptable performance in most conditions. This does not imply they will deliver acceptable performance in all conditions. Therefore, to assure suitability, products should be operated under anticipated working conditions prior to purchase.

Defects will be determined by an inspection within thirty (30) days of the date of failure of the product or part by CMW or its authorized dealer. CMW will provide the location of its inspection facilities or its nearest authorized dealer upon inquiry. CMW reserves the right to supply remanufactured replacements parts under this warranty as it deems appropriate.

Extended warranties are available upon request from your local Ditch Witch dealer or CMW.

Some states do not allow exclusion or limitation of incidental or consequential damages, so above limitation of exclusion may not apply. Further, some states do not allow exclusion of or limitation of how long an implied warranty lasts, so the above limitation may not apply. This limited warranty gives product owner specific legal rights and the product owner may also have other rights which vary from state to state.

For information regarding this limited warranty, contact CMW's Product Support department, P.O. Box 66, Perry, OK 73077-0066, or contact your local Ditch Witch dealer.

First version: 1/91; Latest version: 7/05

A Note To Ditch Witch Equipment Owners:

If your equipment was purchased through a Ditch Witch dealer, there is no need to read further.

However, if you purchased from any other source, please fill out the form on the reverse side and return it to us.

This will enable you to receive updates on this equipment as well as information on new products of interest.

Thanks for using Ditch Witch equipment.

(Please Fold Along This Line And Seal At Bottom With Tape)

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO 23 PERRY OKLAHOMA

POSTAGE WILL BE PAID BY

The Charles Machine Works, Inc.
P.O. Box 66
Perry, Oklahoma 73077-9989

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FIRST CLASS PERMIT NO 23 PERRY OKLAHOMA

POSTAGE WILL BE PAID BY

The Charles Machine Works, Inc.
P.O. Box 66
Perry, Oklahoma 73077-9989

Ditch Witch® Registration Card

Please Type or Print All Information

Purchaser's Company Name

Attention

Street Address or P.O. Box

City County

State Zip Nation

( )

Phone Number With Area Code

Model Serial Number

Attachments/Accessories Serial Numbers

Attachments/Accessories Serial Numbers

Attachments/Accessories Serial Numbers

Name of Ditch Witch Dealership

Your Signature

Ditch Witch® Registration Card

Please Type or Print All Information

Purchaser's Company Name

Attention

Street Address or P.O. Box

City County

State Zip Nation

( )

Phone Number With Area Code

Model Serial Number

Attachments/Accessories Serial Numbers

Attachments/Accessories Serial Numbers

Attachments/Accessories Serial Numbers

Name of Ditch Witch Dealership

Your Signature

Service Record

Service Performed	Date	Hours

Service Performed	Date	Hours

Appendix

Chapter Contents

Tire Safety Information

TIRE SAFETY INFORMATION

1.1. STEPS FOR DETERMINING CORRECT LOAD LIMIT – TRAILER

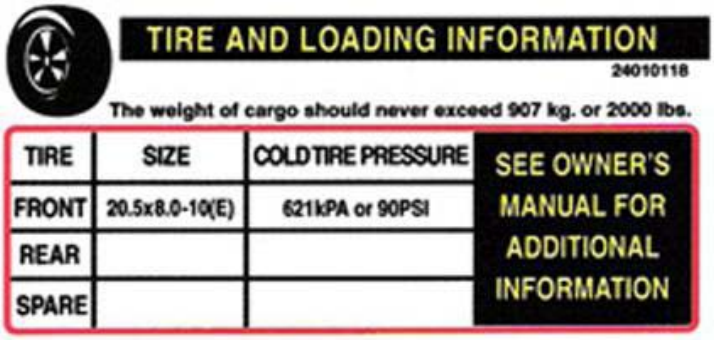
Determining the load limits of a trailer includes more than understanding the load limits of the tires alone. On all trailers there is a Federal certification/VIN label that is located on the forward half of the left (road) side of the unit. This certification/VIN label will indicate the trailer's Gross Vehicle Weight Rating (GVWR). This is the most the fully loaded trailer can weigh. It will also provide the Gross Axle Weight Rating (GAWR). This is the most a particular axle can weigh. If there are multiple axles, the GAWR of each axle will be provided.

If your trailer has a GVWR of 10,000 pounds or less, there is a vehicle placard located in the same location as the certification label described above. This placard provides tire and loading information. In addition, this placard will show a statement regarding maximum cargo capacity. Cargo can be added to the trailer, up to the maximum weight specified on the placard. The combined weight of the cargo is provided as a single number. In any case, remember: the total weight of a fully loaded trailer can not exceed the stated GVWR.

When loading your cargo, be sure it is distributed evenly to prevent overloading front to back and side to side. Heavy items should be placed low and as close to the axle positions as reasonable. Too many items on one side may overload a tire. The best way to know the actual weight of the trailer is to weigh it at a public scale. Talk to your dealer to discuss the weighing methods needed to capture the various weights related to the trailer. This would include the weight empty or unloaded, weights per axle, wheel, hitch or king-pin, and total weight.

Excessive loads and/or underinflation cause tire overloading and, as a result, abnormal tire flexing occurs. This situation can generate an excessive amount of heat within the tire. Excessive heat may lead to tire failure. It is the air pressure that enables a tire to support the load, so proper inflation is critical. The proper air pressure may be found on the certification/VIN label and/or on the Tire Placard. This value should never exceed the maximum cold inflation pressure stamped on the tire.

1.1.1. TRAILERS 10,000 POUNDS GVWR OR LESS



Tire and Loading Information Placard – Figure 1-1

1. Locate the statement, "The weight of cargo should never exceed XXX kg or XXX lbs.," on your trailer's placard. See figure 1-1.
2. This figure equals the available amount of cargo load capacity.
3. Determine the combined weight of cargo being loaded on the trailer. That weight may not safely exceed the available cargo load capacity.

The Tire Information Placard is attached adjacent to or near the trailer's VIN (Certification) label at the left front of the trailer.

1.1.2. TRAILERS OVER 10,000 POUNDS GVWR (NOTE: These trailers are not required to have a tire information placard on the trailer.)

1. Determine the empty weight of your trailer by weighing the trailer using a public scale or other means. This step does not have to be repeated.
2. Locate the GVWR (Gross Vehicle Weight Rating) of the trailer on your trailer's VIN (Certification) label.
3. Subtract the empty weight of your trailer from the GVWR stated on the VIN label. That weight is the maximum available cargo capacity of the trailer and must not be exceeded.

1.2. STEPS FOR DETERMINING CORRECT LOAD LIMIT – TOW VEHICLE

1. Locate the statement, "The combined weight of occupants and cargo should never exceed XXX lbs.," on your vehicle's placard.
2. Determine the combined weight of the driver and passengers who will be riding in your vehicle.
3. Subtract the combined weight of the driver and passengers from XXX kilograms or XXX pounds.
4. The resulting figure equals the available amount of cargo capacity. For example, if the "XXX" amount equals 1400 lbs. and there will be five 150 lb. passengers in your vehicle, the amount of available cargo and luggage capacity is 650 lbs. (1400-750 (5 x 150) = 650 lbs.).
5. Determine the combined weight of cargo being loaded on the vehicle. That weight must not exceed the available cargo capacity calculated in Step # 4.
6. If your vehicle will be towing a trailer, load from your trailer will be transferred to your vehicle. Consult the tow vehicle's manual to determine how this weight transfer reduces the available cargo and luggage capacity of your vehicle.

1.3. GLOSSARY OF TIRE TERMINOLOGY

Bead - the part of the tire that is made of steel wires, wrapped or reinforced by ply cords and that is shaped to fit the rim.
Bead separation - the breakdown of the bond between components in the bead.
Bias ply tire - a pneumatic tire in which the ply cords that extend to the beads are laid at alternate angles substantially less than 90 degrees to the centerline of the tread.
Carcass - the tire structure, except tread and sidewall rubber which, when inflated, bears the load.
Chunking - the breaking away of pieces of the tread or sidewall.
Cold inflation pressure - the pressure in the tire before you drive.
Cord - the strands forming the plies in the tire.
Cord separation - the parting of cords from adjacent rubber compounds.
Cracking - any parting within the tread, sidewall, or inner liner of the tire extending to cord material.
Curb weight - the weight of a vehicle with standard equipment.
Groove - the space between two adjacent tread ribs.
Gross Axle Weight Rating (GAWR) - the maximum weight that any axle can support, as published on the Certification / VIN label on the front left side of the trailer. Actual weight determined by weighing each axle on a public scale, with the trailer attached to the towing vehicle.
Gross Vehicle Weight Rating (GVWR) - the maximum weight of the fully loaded trailer, as published on the Certification / VIN label. Actual weight determined by weighing trailer on a public scale, without being attached to the towing vehicle.
Tongue Weight - the downward force exerted on the hitch ball or lunette by the trailer coupler.
Innerliner - the layer(s) forming the inside surface of a tubeless tire that contains the inflating medium within the tire.

Innerliner separation - the parting of the innerliner from cord material in the carcass.
Light truck (LT) tire - a tire designated by its manufacturer as primarily intended for use on lightweight trucks or multipurpose passenger vehicles.
Load rating - the maximum load that a tire is rated to carry for a given inflation pressure.
Maximum load rating - the load rating for a tire at the maximum permissible inflation pressure for that tire.
Maximum permissible inflation pressure - the maximum cold inflation pressure to which a tire may be inflated.
Maximum loaded vehicle weight - the sum of curb weight, accessory weight, vehicle capacity weight, and production options weight.
Outer diameter - the overall diameter of an inflated new tire.
Overall width - the linear distance between the exteriors of the sidewalls of an inflated tire, including elevations due to labeling, decorations, or protective bands or ribs.
Ply - a layer of rubber-coated parallel cords.
Ply separation - a parting of rubber compound between adjacent plies.
Pneumatic tire - a mechanical device made of rubber, chemicals, fabric and steel or other materials, that, when mounted on an automotive wheel, provides the traction and contains the gas or fluid that sustains the load.
Radial ply tire - a pneumatic tire in which the ply cords that extend to the beads are laid at substantially 90 degrees to the centerline of the tread.
Recommended inflation pressure - the inflation pressure provided by the vehicle manufacturer on the Tire Information label and on the Certification / VIN tag.
Rim - a metal support for a tire or a tire and tube assembly upon which the tire beads are seated.
Rim diameter - the nominal diameter of the bead seat.
Rim size designation - the rim diameter and width.
Rim type designation - the industry of manufacturer’s designation for a rim by style or code.
Rim width - the nominal distance between rim flanges.
Sidewall - that portion of a tire between the tread and bead.
Sidewall separation - the parting of the rubber compound from the cord material in the sidewall.
Special Trailer (ST) tire - the "ST" is an indication the tire is for trailer use only.
Tread - that portion of a tire that comes into contact with the road.
Tread rib - a tread section running circumferentially around a tire.
Tread separation - pulling away of the tread from the tire carcass.
Treadwear indicators (TWI) - the projections within the principal grooves designed to give a visual indication of the degrees of wear of the tread.
Vehicle maximum load on the tire - the load on an individual tire that is determined by distributing to each axle its share of the maximum loaded vehicle weight and dividing by two.
Vehicle normal load on the tire - the load on an individual tire that is determined by distributing to each axle its share of the curb weight and dividing by 2.

1.4. TIRE SAFETY - EVERYTHING RIDES ON IT

The National Traffic Safety Administration (NHTSA) has published a brochure (DOT HS 809 361) that discusses all aspects of Tire Safety, as required by CFR 575.6. This brochure is reproduced in part below. It can be obtained and downloaded from NHTSA, free of charge, from the following web site: http://www.nhtsa.dot.gov/cars/rules/TireSafety/ridesonit/tires_index.html

Studies of tire safety show that maintaining proper tire pressure, observing tire and trailer load limits (not carrying more weight in your trailer than your tires or trailer can safely handle), avoiding road hazards, and inspecting tires for cuts, slashes, and other irregularities are the most important things you can do to avoid tire failure, such as tread separation or blowout and flat tires. These actions, along with other care and maintenance activities, can also:

- ◊ Improve vehicle handling
- ◊ Help protect you and others from avoidable breakdowns and accidents
- ◊ Improve fuel economy
- ◊ Increase the life of your tires.

This booklet presents a comprehensive overview of tire safety, including information on the following topics:

- ◊ Basic tire maintenance
- ◊ Uniform Tire Quality Grading System
- ◊ Fundamental characteristics of tires
- ◊ Tire safety tips.

Use this information to make tire safety a regular part of your trailer maintenance routine. Recognize that the time you spend is minimal compared with the inconvenience and safety consequences of a flat tire or other tire failure.

1.5. SAFETY FIRST–BASIC TIRE MAINTENANCE

Properly maintained tires improve the steering, stopping, traction, and load-carrying capability of your trailer. Underinflated tires and overloaded vehicles are a major cause of tire failure. Therefore, as mentioned above, to avoid flat tires and other types of tire failure, you should maintain proper tire pressure, observe tire and trailer load limits, avoid road hazards, and regularly inspect your tires.

1.5.1. FINDING YOUR TRAILER'S RECOMMENDED TIRE PRESSURE AND LOAD LIMITS

Tire information placards and vehicle certification labels contain information on tires and load limits. These labels indicate the vehicle manufacturer's information including:

- ◊ Recommended tire size
- ◊ Recommended tire inflation pressure
- ◊ Vehicle capacity weight
- ◊ Front and rear gross axle weight ratings

Both placards and certification labels are permanently attached to the trailer near the left front.

1.5.2. UNDERSTANDING TIRE PRESSURE AND LOAD LIMITS

Tire inflation pressure is the level of air in the tire that provides it with load-carrying capacity and affects the overall performance of the trailer. The tire inflation pressure is a number that indicates the amount of air pressure– measured in pounds per square inch (psi) or kilopascals (kpa) –a tire requires to be properly inflated.

This number based on the trailer's design load limit, that is, the greatest amount of weight a trailer can safely carry and the tire size. The proper tire pressure for your trailer is referred to as the "recommended cold inflation pressure." (As you will read below, it is difficult to obtain the recommended tire pressure if your tires are not cold.)

Because tires are designed to be used on more than one type of vehicle, tire manufacturers list the "maximum permissible inflation pressure" on the tire sidewall. This number is the greatest amount of air pressure that should ever be put in the tire under normal driving conditions.

1.5.3. CHECKING TIRE PRESSURE

It is important to check your trailer's tire pressure at least once a month for the following reasons:

- ◊ Most tires may naturally lose air over time.
- ◊ Tires can lose air suddenly if you drive over a pothole or other object or if you strike the curb when parking.
- ◊ With radial tires, it is usually not possible to determine underinflation by visual inspection.

For convenience, purchase a tire pressure gauge to keep with your trailer. Gauges can be purchased at tire dealerships, auto supply stores, and other retail outlets.

The recommended tire inflation pressure that manufacturers provide reflects the proper psi when a tire is cold. The term cold does not relate to the outside temperature. Rather, a cold tire is one that has not been driven on for at least three hours. When you drive, your tires get warmer, causing the air pressure within them to increase. Therefore, to get an accurate tire pressure reading, you must measure tire pressure when the tires are cold or compensate for the extra pressure in warm tires.

1.5.4. STEPS FOR MAINTAINING PROPER TIRE PRESSURE

Step 1: Locate the recommended tire pressure on the trailer's tire information placard, certification label, or in the owner's manual.
Step 2: Record the tire pressure of all tires.
Step 3: If the tire pressure is too high in any of the tires, slowly release air by gently pressing on the tire valve stem with the edge of your tire gauge until you get to the correct pressure.
Step 4: If the tire pressure is too low, note the difference between the measured tire pressure and the correct tire pressure. These "missing" pounds of pressure are what you will need to add.
Step 5: Add the missing pounds of air pressure to each tire that is underinflated.
Step 6: Check all the tires to make sure they have the same air pressure (except in cases in which the front and rear tires are supposed to have different amounts of pressure).

If you have been towing your trailer and think that a tire is underinflated, fill it to the recommended cold inflation pressure indicated on your trailer's tire information placard or certification label. While your tire may still be slightly underinflated due to the extra pounds of pressure in the warm tire, it is safer to drive with air pressure that is slightly lower than the recommended cold inflation pressure than to drive with a significantly underinflated tire. Since this is a temporary fix, don't forget to recheck and adjust the tire's pressure when you can obtain a cold reading.

1.5.5. TIRE SIZE

To maintain tire safety, purchase new tires that are the same size as the trailer's original tires or another size recommended by the manufacturer. Look at the tire information placard, the owner's manual, or the sidewall of the tire you are replacing to find this information. If you have any doubt about the correct size to choose, consult with your dealer.

1.5.6. TIRE TREAD

The tire tread provides the gripping action and traction that prevent your trailer from slipping or sliding, especially when the road is wet or icy. In general, tires are not safe and should be replaced when the tread is worn down to 1/16 of an inch. Tires have built-in treadwear indicators that let you know when it is time to replace your tires. These indicators are raised sections spaced intermittently in the bottom of the tread grooves. When they appear "even" with the outside of the tread, it is time to replace your tires. Another method for checking tread depth is to place a penny in the tread with Lincoln's head upside down and facing you. If you can see the top of Lincoln's head, you are ready for new tires.

1.5.7. TIRE BALANCE AND WHEEL ALIGNMENT

To avoid vibration or shaking of the trailer when a tire rotates, the tire must be properly balanced. This balance is achieved by positioning weights on the wheel to counterbalance heavy spots on the wheel-and-tire assembly. A wheel alignment adjusts the angles of the wheels so that they are positioned correctly relative to the trailer's frame. This adjustment maximizes the life of your tires. These adjustments require special equipment and should be performed by a qualified technician.

1.5.8. TIRE REPAIR

The proper repair of a punctured tire requires a plug for the hole and a patch for the area inside the tire that surrounds the puncture hole. Punctures through the tread can be repaired if they are not too large, but punctures to the sidewall should not be repaired. Tires must be removed from the rim to be properly inspected before being plugged and patched.

1.5.9. TIRE FUNDAMENTALS

Federal law requires tire manufacturers to place standardized information on the sidewall of all tires. This information identifies and describes the fundamental characteristics of the tire and also provides a tire identification number for safety standard certification and in case of a recall.

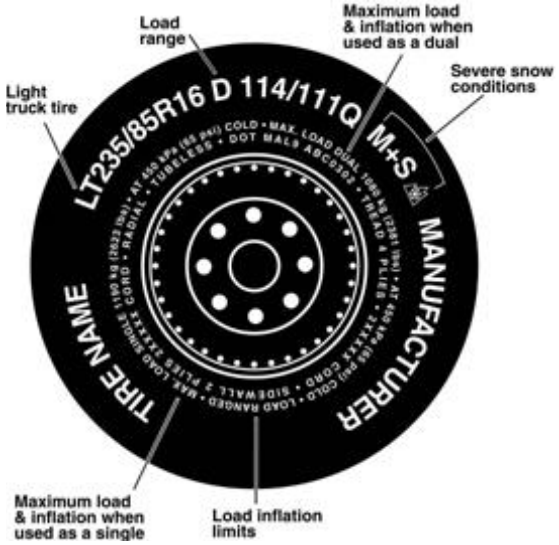
1.5.9.1. UTQGS Information

Treadwear Number - indicates the tire's wear rate. The higher the treadwear number is, the longer it should take for the tread to wear down. For example, a tire graded 400 should last twice as long as a tire graded 200.

Traction Letter - indicates a tire's ability to stop on wet pavement. A higher graded tire should allow you to stop your car on wet roads in a shorter distance than a tire with a lower grade. Traction is graded from highest to lowest as "AA","A", "B", and "C".

Temperature Letter - indicates a tire's resistance to heat. The temperature grade is for a tire that is inflated properly and not overloaded. Excessive speed, underinflation or excessive loading, either separately or in combination, can cause heat build-up and possible tire failure. From highest to lowest, a tire's resistance to heat is graded as "A", "B", or "C".

1.5.9.2. Information on Light Truck Tires
Please refer to the diagram below.



Tires for light trucks have other markings besides those found on the sidewalls of passenger tires.
LT - indicates the tire is for light trucks or trailers.
ST - indicates the tire is for trailer use only.
Max. Load Dual kg (lbs) at kPa (psi) Cold - indicates the maximum load and tire pressure when the tire is used as a dual, that is, when four tires are put on each axle.
Max. Load Single kg (lbs) at kPa (psi) Cold - indicates the maximum load and tire pressure when the tire is used as a single.
Load Range - identifies the tire's load-carrying capabilities and its inflation limits.

1.6. TIRE SAFETY TIPS

Preventing Tire Damage

- ◊ Slow down if you have to go over a pothole or other object in the road.
- ◊ Do not run over curbs or other foreign objects in the roadway, and try not to strike the curb when parking.

Tire Safety Checklist

- ◊ Check tire pressure regularly (at least once a month), including the spare (if equipped).
- ◊ Inspect tires for uneven wear patterns on the tread, cracks, foreign objects, or other signs of wear or trauma.
- ◊ Remove bits of glass and foreign objects wedged in the tread.
- ◊ Make sure your tire valves have valve caps.
- ◊ Check tire pressure before going on a long trip.
- ◊ Do not overload your trailer. Check the Tire Information and Loading Placard or Owner's Manual for the maximum recommended load for the trailer.