ST37x

Operator's Manual

CE

Issue 1.0

Original Instruction

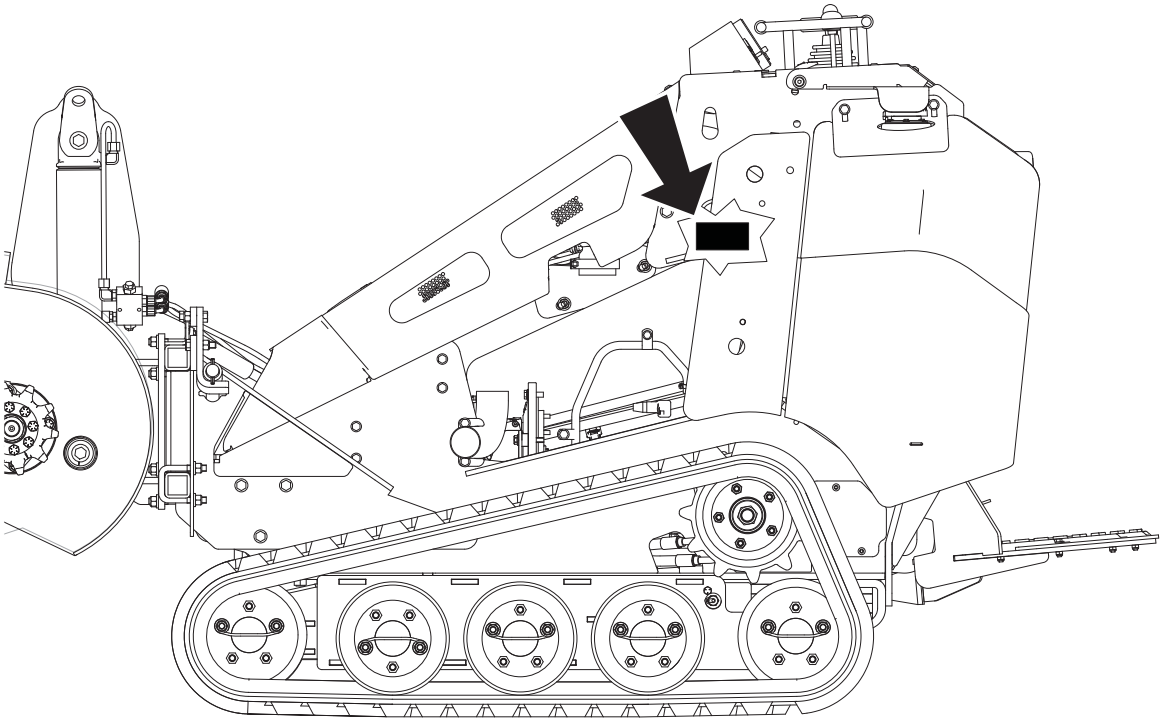
053-2977

Overview

Chapter Contents

Serial Number Location

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



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Item	
date of manufacture	
date of purchase	
unit serial number	
engine serial number	

Intended Use

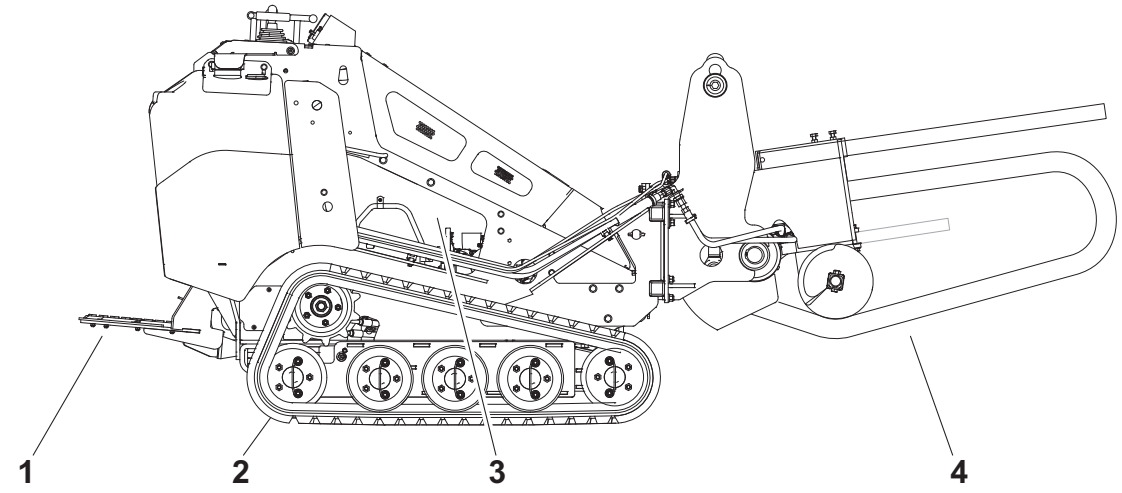
The ST37x is a platform, rubber track trencher designed for light-to medium-duty construction work. The unit is designed for operation in temperatures typically experienced in earth moving and construction work environments. Provisions may be required to operate in extreme temperatures. Contact your Ditch Witch® dealer. Use in any other way is considered contrary to the intended use.

The ST37x 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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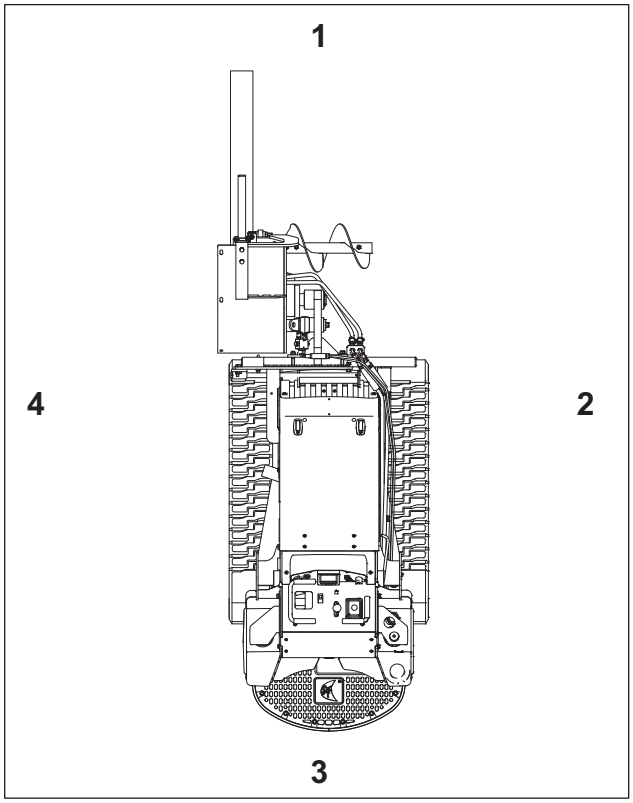
1. Operator station
2. Tracks
3. Engine compartment
4. Trencher boom

Operator Orientation

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



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About This Manual

This manual contains information for the proper use of this machine. See the beige **Operation Overview** pages 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.

ST37x
Operator's Manual

Issue number 1.0 / OM-12/16
Part number 053-2977

Contents

Safety

Chapter Contents

Guidelines

When you see this safety alert sign, carefully read and follow all instructions.
YOUR SAFETY IS AT STAKE. Read this entire section before using your equipment.

Follow these guidelines before operating any jobsite equipment:

- Complete proper training and read operator's manual before using equipment.
- Mark proposed path with white paint and have underground utilities located before working. In the US or Canada, call 811 (US) or 888-258-0808 (US and Canada). Also contact any local utilities that do not participate in the One-Call service. In countries that do not have a One-Call service, contact all local utility companies to have underground utilities located.
- 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 or at www.ditchwitch.com/safe. Safety Data Sheets (MSDS) are available at www.ditchwitch.com/support.
- Fully inspect equipment before operating. Repair or replace any worn or damaged parts. Replace missing or damaged safety shields and safety signs. Contact your Ditch Witch dealer for assistance.
- 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.
- Only operate equipment in well-ventilated areas.
- Contact your Ditch Witch dealer if you have any question about operation, maintenance, or equipment use.
- Complete the equipment checklist located at www.ditchwitch.com/safe.

California Proposition 65 Warning

This product may contain chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

- battery posts, terminals and related accessories
- engine exhaust
- ethylene glycol

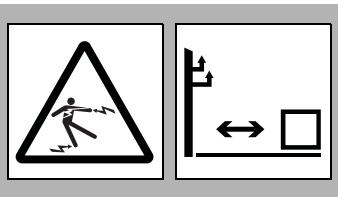
Emergency Procedures

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 will cause death or serious injury. Stay away. 274-049

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 tractor, DO NOT MOVE. Remain on tractor and take the following actions. The order and degree of action will depend upon the situation.

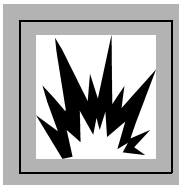
- Warn people nearby that an electric strike has occurred. Instruct them to leave the area and contact utility.
- Raise attachments and drive from immediate area.
- Contact utility company to shut off power.
- Do not return to jobsite or allow anyone into area until given permission by utility company.

If you suspect an electric line has been damaged and you are **off tractor**, DO NOT TOUCH TRACTOR. Take the following actions. The order and degree of action will depend upon the situation.

- LEAVE AREA. The ground surface may be electrified, so take small steps with feet close together to reduce the hazard of being shocked from one foot to the other. For more information, contact your Ditch Witch® dealer.
- Contact utility company to shut off power.
- Do not return to jobsite 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. 275-419 (2P)



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 orders 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. Contact utility company.

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.

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.

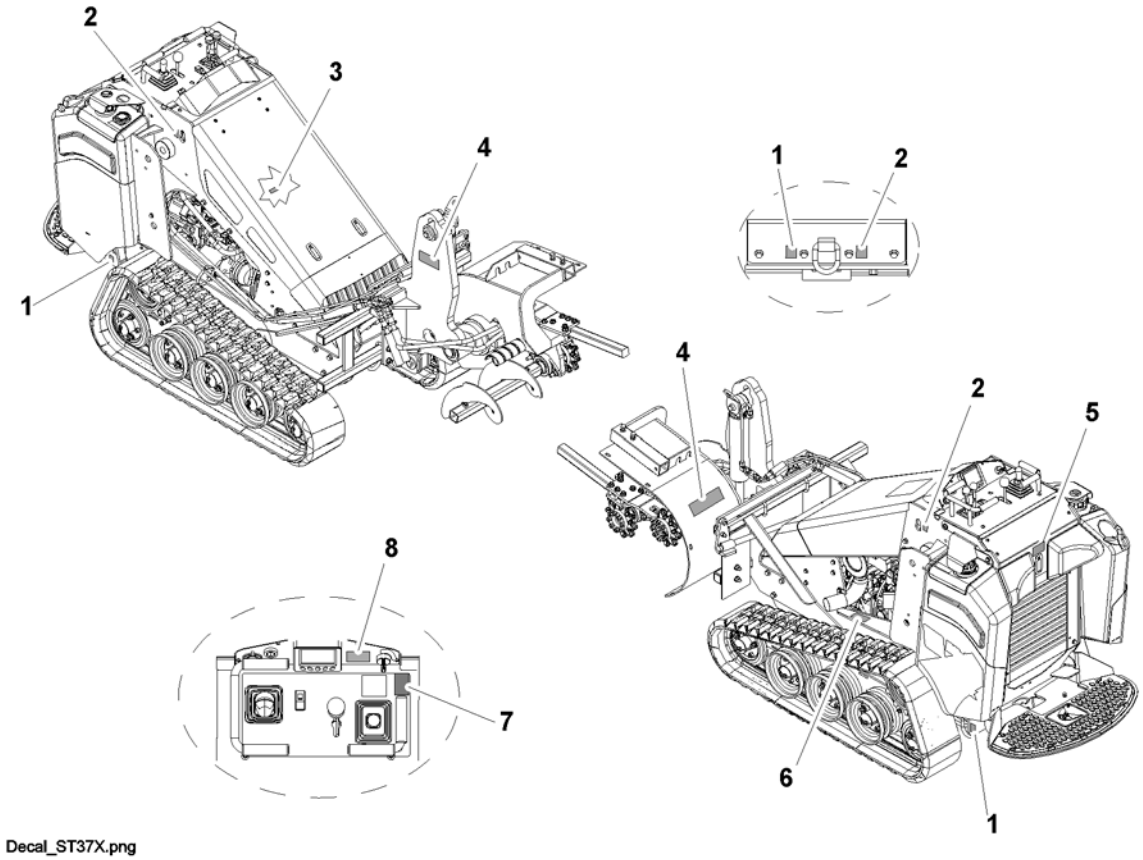
CAUTION indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

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

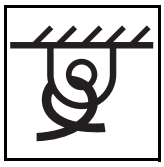
NOTICE indicates information considered important, but not hazard-related (e.g., messages relating to property damage).

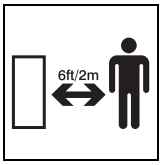
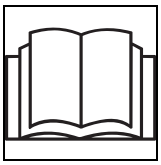
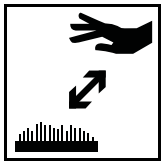
IMPORTANT can help you do a better job or make your job easier in some way.

Machine Safety Alerts



Decal_ST37X.png

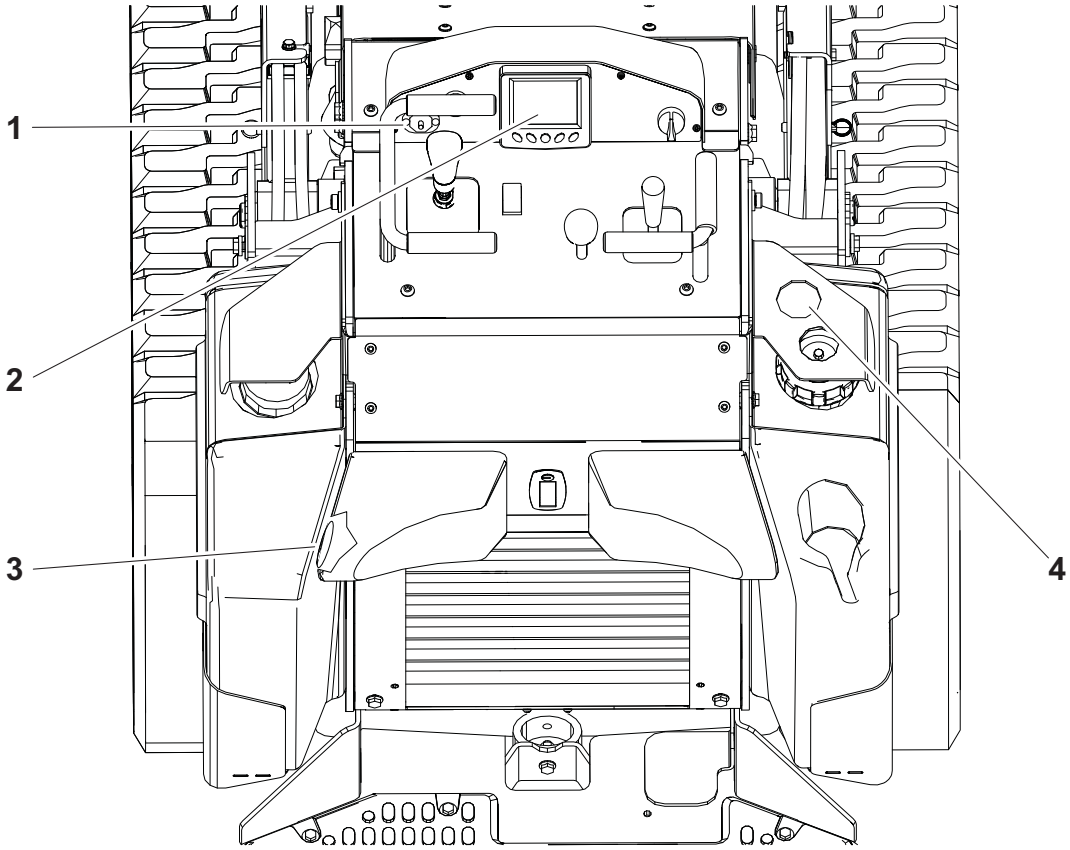
1		Tiedown location. See Transport chapter for more information. 274-318
2		Lift point. See Transport chapter for more information. 274-442
3	 	**WARNING** Fire or explosion possible. Do not use starter fluid. 273-459 (2P), 274-206 (2P), 700-206 (2P)

4	 	**DANGER** Moving digging teeth will cause death or serious injury. Trench cave-in can cause you to fall. Stay away. 274-002; 275-097
5	 	**WARNING** Read operator's manual. Know how to use all controls. Your safety is at stake. 273-475
6	 	**CAUTION** Hot parts may cause burns. Do not touch until cool or wear gloves. 275-355 (2-P)
7	 	**CAUTION** Exposure to high noise levels may cause hearing loss. Wear hearing protection. 700-009 (2-P)
8	 	**WARNING** Jobsite hazards could cause death or serious injury. Use correct equipment and work methods. Use and maintain proper safety equipment. 274-050; 274-724 (2P), 700-133

Controls

Chapter Contents

Gauges and Indicators



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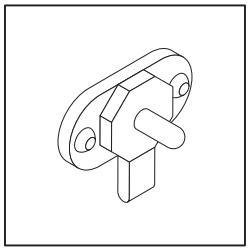
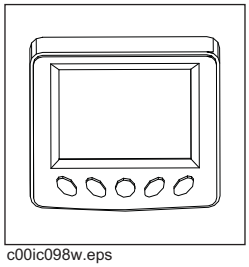
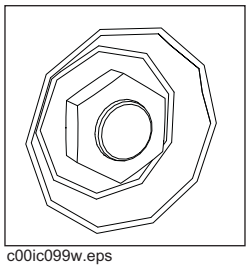
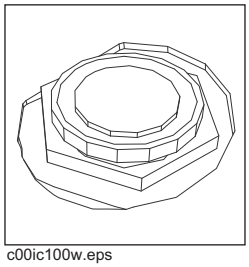
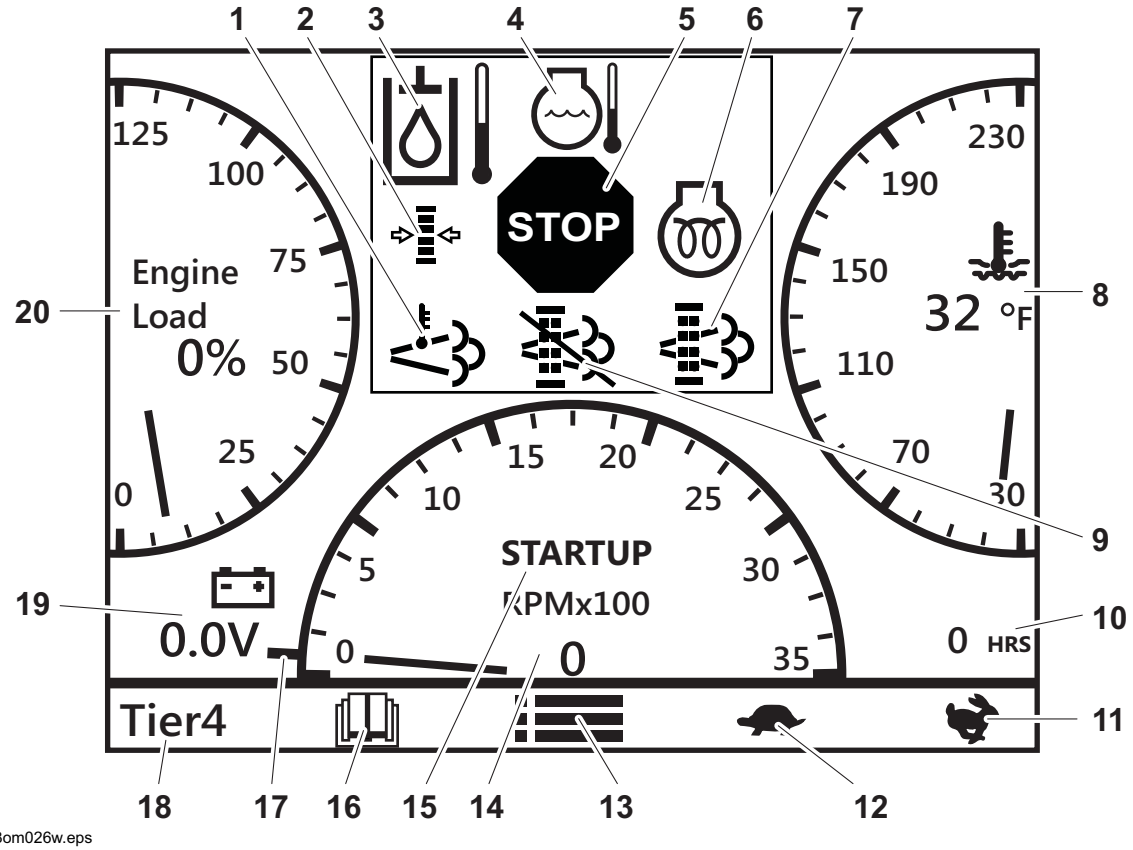
1. Auxiliary outlet
2. Graphic display
3. Hydraulic fluid level sight glass
4. Fuel gauge

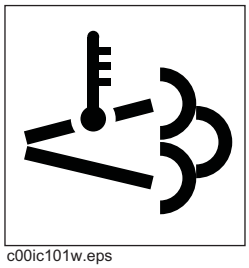
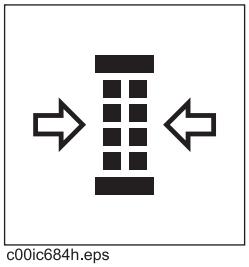
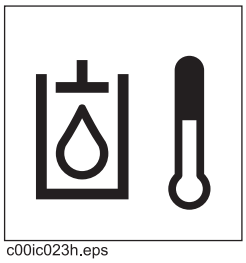
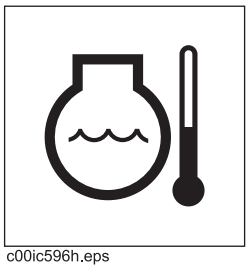
Item	Description	Notes
1. Auxiliary outlet  c00ic114a.eps	To operate work lights or other 12V devices, plug into outlet.	

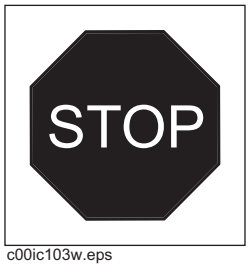
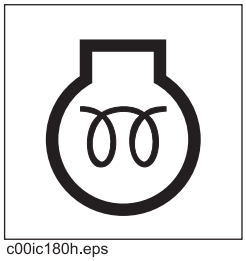
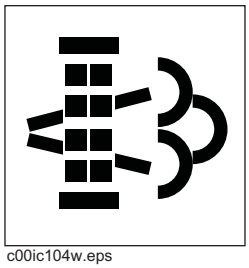
Item	Description	Notes
2. Graphic display  c00ic098w.eps	See "Graphic Display" on page 22.	
3. Hydraulic fluid sight glass  c00ic099w.eps	Shows level of hydraulic fluid in tank. Maintain fluid at halfway point on glass.	
4. Fuel gauge  c00ic100w.eps	Shows level of fuel in tank.	***NOTICE:*** Use low sulfur or ultra low sulfur fuel only.

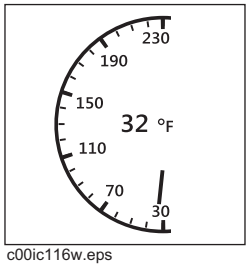
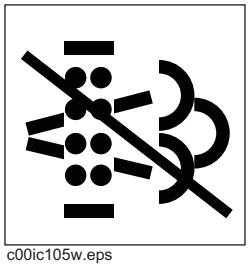
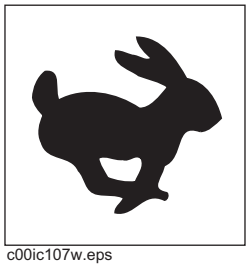
Graphic Display

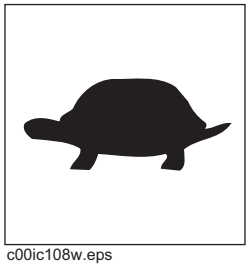
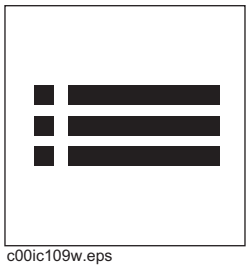
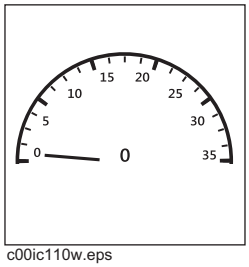
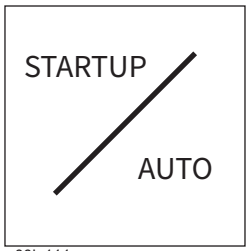


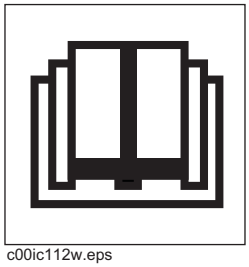
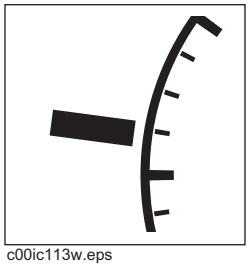
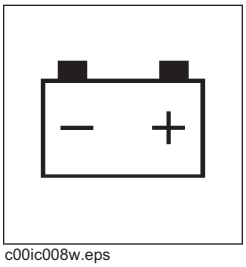
1. High exhaust temperature indicator
2. Air filter restriction indicator
3. Hydraulic fluid temperature indicator
4. Engine over-temperature indicator
5. Diagnostic message indicator
6. Glow plug indicator
7. DPF regeneration indicator
8. Engine coolant temperature indicator
9. DPF inhibited indicator
10. Hourmeter
11. Engine speed setpoint increase button
12. Engine speed setpoint decrease button
13. Menu button
14. Engine speed (RPM)
15. Throttle system state indicator
16. Service reminders button
17. Engine RPM setpoint indicator
18. Tier 4 menu button
19. Electrical system voltage
20. Engine percent load gauge

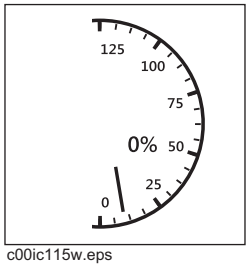
Item	Description	Notes
1. High exhaust temperature indicator  c00ic101w.eps	Indicates high exhaust temperature.	**IMPORTANT:** Will light when exhaust cleaning (DPF regeneration) is occurring.
2. Air filter restriction indicator  c00ic684h.eps	Indicator will begin flashing once the air filter is 25% unrestricted. Percentage will decrease as air filter becomes more restricted. For best results, replace filter between 25% and 0%. Reset after replacing air filter.	To view the air filter percentage before 25% unrestricted, press the diagnostics menu button at any time.
3. Hydraulic fluid temperature indicator  c00ic023h.eps	Lights and alarm sounds when hydraulic fluid is overheating.	Check hydraulic fluid level. Reduce load. Ensure oil cooler is clean.
4. Engine over-temperature indicator  c00ic596h.eps	Flashes when temperature rises above 230°F (110°C).	**IMPORTANT:** If temperature goes above 230°F (110°C): 1. Stop operation, set throttle to low idle, and allow engine to cool. 2. Stop engine. 3. Check coolant level. 4. Ensure radiator is clean.

Item	Description	Notes
5. Diagnostic message indicator  c00ic102w.eps  c00ic103w.eps	Appears when there is a diagnostic trouble code. This indicates a warning code. This indicates a stop code.	Go to Diagnostics menu to see the active and stored error messages.
6. Glow plug indicator  c00ic180h.eps	Lights when ignition switch is on and engine ECU determines glow plugs are required to start machine.	
7. DPF regeneration indicator  c00ic104w.eps	Flashes if regeneration is needed but has not occurred yet. Lights solid while regeneration is occurring.	

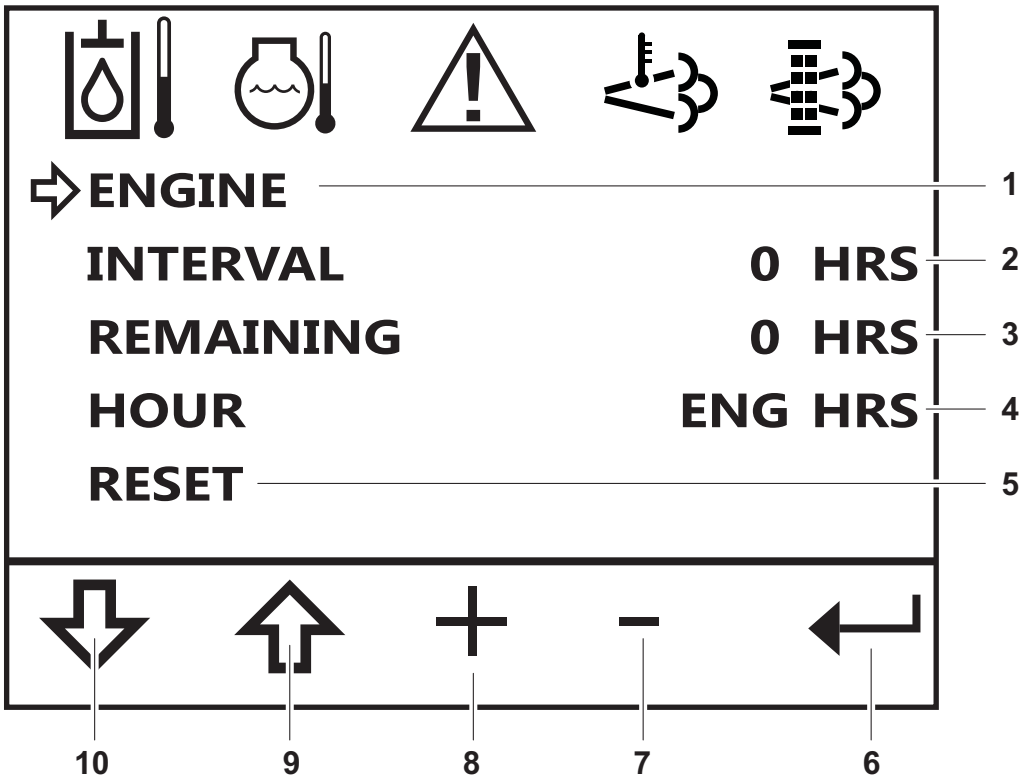
Item	Description	Notes
8. Engine coolant temperature indicator  c00ic116w.eps	Displays coolant temperature.	**IMPORTANT:** If temperature goes above 230°F (110°C): 1. Stop operation, set throttle to low idle, and allow engine to cool. 2. Stop engine. 3. Check coolant level. 4. Ensure radiator is clean.
9. DPF regen inhibited indicator  c00ic105w.eps	Lights when automatic exhaust cleaning (DPF regeneration) has been inhibited.	**IMPORTANT:** System will remain in inhibited mode until unit is returned to automatic mode. Manual exhaust cleaning (DPF REGEN) must be initiated through Tier 4 menu when this indicator is on. See "Exhaust Cleaning - Tier 4 Only" on page 70.
10. Hourmeter  c00ic106w.eps	Displays engine operating time.	Use these times to schedule service.
11. Engine speed increase button  c00ic107w.eps	To increase engine speed, push once. To increase to full speed, push twice.	**IMPORTANT:** • Increasing engine speed also increases attachment speed. • Each button press increases engine by 360 rpm.

Item	Description	Notes
12. Engine speed decrease button  c00ic108w.eps	To decrease engine speed, push once. To decrease to lowest speed, push twice.	**IMPORTANT:** Each button press decreases engine by 360 rpm.
13. Menu button  c00ic109w.eps	Press to go to the menu screen.	
14. Engine speed (RPM)  c00ic110w.eps	Displays engine RPM.	
15. Throttle system state indicator  c00ic111w.eps	Displays one of the three states of the throttle system.	• Startup indicates the system is controlling its own throttle during startup conditions. • Auto indicates that the auto-throttle system is active and controlling engine throttle based on the user's selected rpm setpoint. To enable auto-throttle, go to the settings menu. • No indication means that the rpm setting is under manual control.

Item	Description	Notes
16. Service reminders button  c00ic112w.eps	Press to go to the service reminders screen.	
17. Engine RPM setpoint indicator  c00ic113w.eps	Indicates the current throttle setpoint.	**IMPORTANT:** • When in manual throttle mode, this is the RPM the engine will try to maintain. • When in auto-throttle mode, this indicates the full throttle setpoint.
18. Tier 4 menu button  c00ic114w.eps	Press to go to the exhaust cleaning (REGEN) control menu.	
19. Electrical system voltage  c00ic008w.eps	Displays system voltage.	Should show 12-14V with engine running.

Item	Description	Notes
20. Engine percent load gauge  c00ic115w.eps	Displays the load on the engine.	

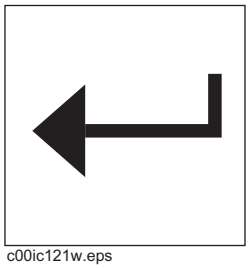
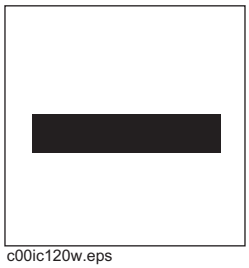
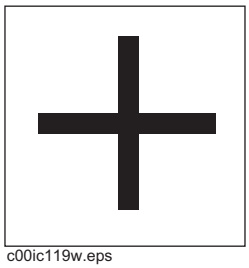
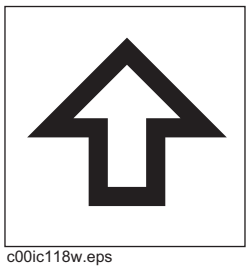
Service Interval Screen

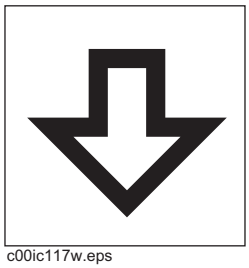


t43om032w.eps

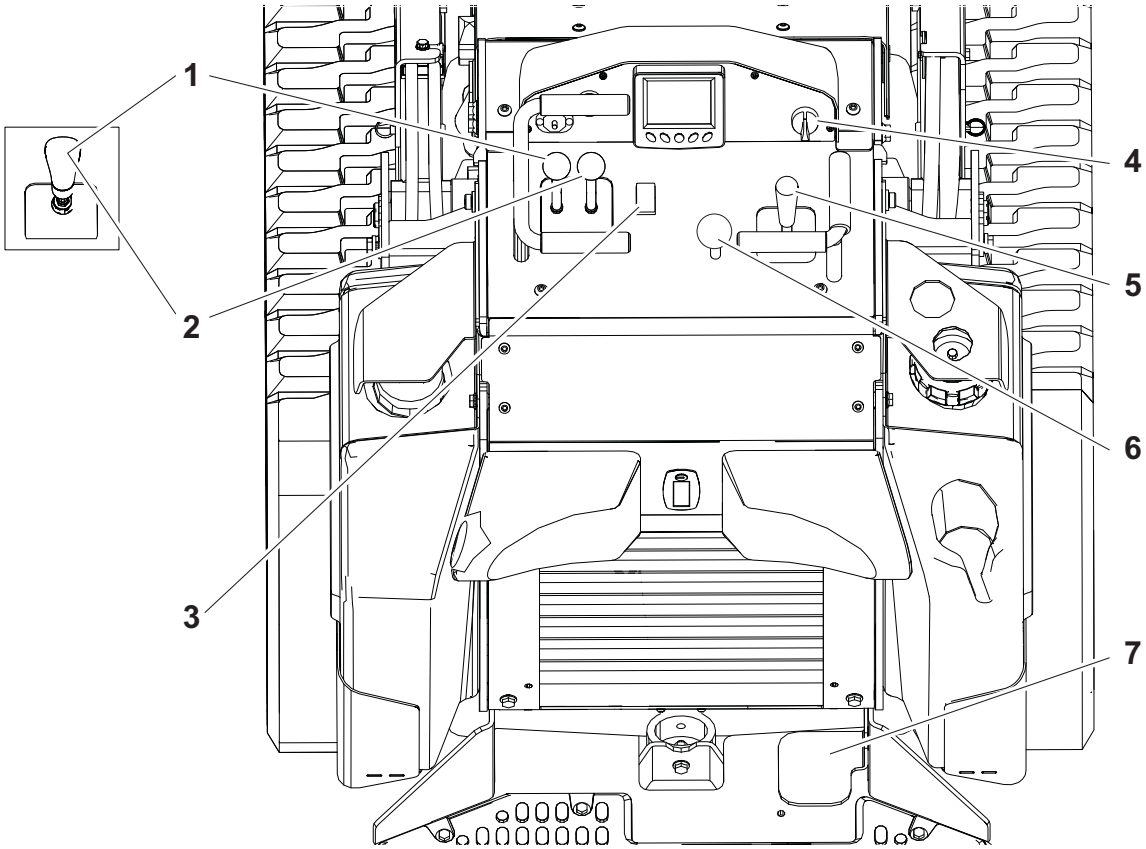
1. Selected service reminder
2. Service reminder interval
3. Time remaining
4. Time base calculator
5. Reset option
6. Return to main gauge display
7. Interval decrease
8. Interval increase
9. Up selection
10. Down selection

Item	Description	Notes
1. Selected service reminder	Displays current service reminder.	Service reminders are programmed to follow initial service reminders. See the Service chapter on page 65 for intervals.
2. Service reminder interval	Displays current interval of the service reminder.	
3. Time remaining	Displays time remaining until the next service reminder.	

Item	Description	Notes
4. Time base calculator	Displays the time base for the service reminder.	
5. Reset option	Resets service reminder.	
6. Return to main gauge display  c00ic121w.eps	Returns to the main gauge display.	
7. Interval decrease  c00ic120w.eps	Selects the previous reminder or parameter, or decreases service intervals by 10 hours.	**IMPORTANT:** Use the Service chapter beginning on page 65 to set service reminder intervals.
8. Interval increase  c00ic119w.eps	Selects the next reminder or parameter, or increases service interval by 10 hours.	
9. Up selection  c00ic118w.eps	Will move the selection on the screen up.	

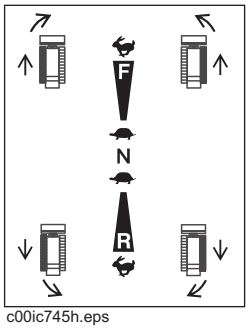
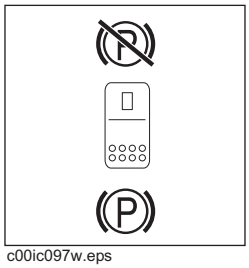
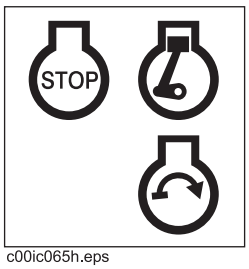
Item	Description	Notes
10. Down selection  c00ic117w.eps	Will move the selection on the screen down.	

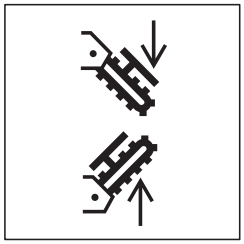
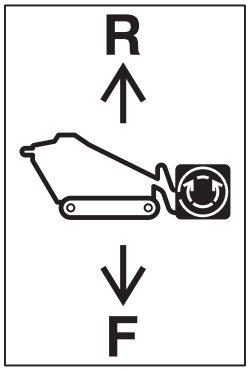
Controls



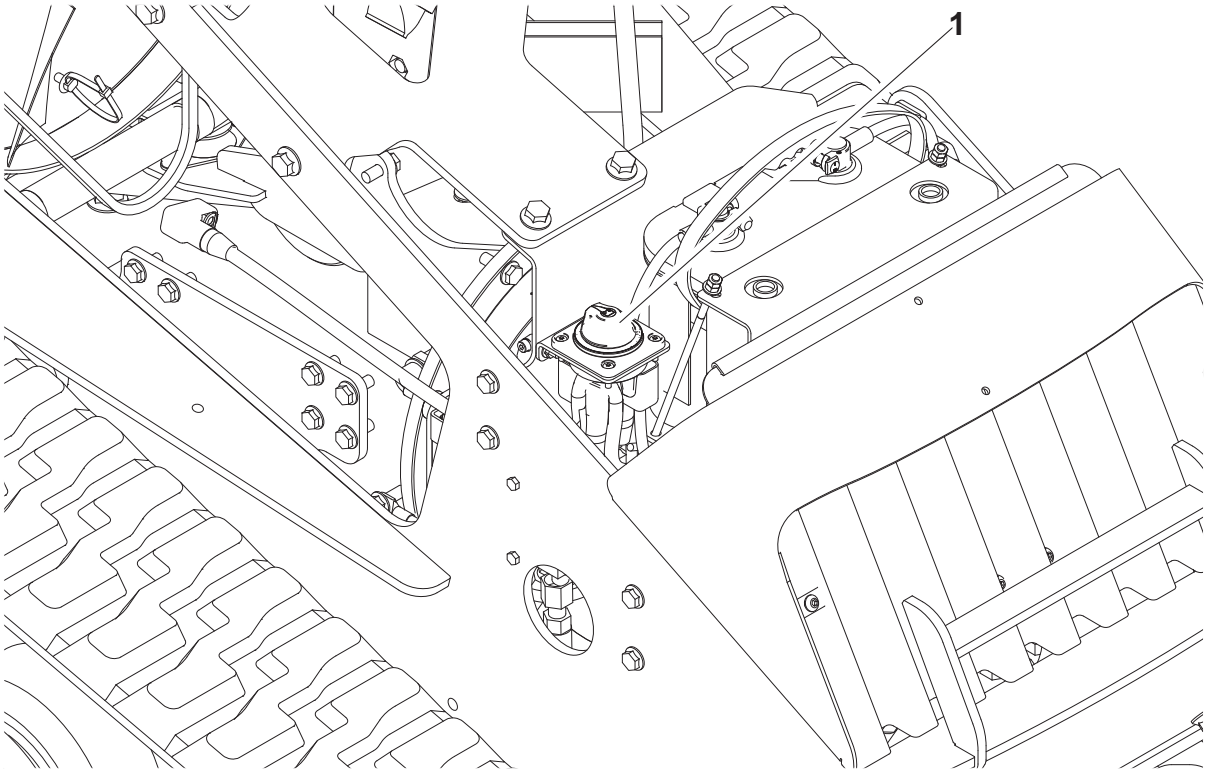
t53om006h.eps

1. Left track drive control or Track drive joystick (optional)
2. Right track drive control or Track drive joystick (optional)
3. Parking brake switch
4. Ignition switch
5. Boom lift control
6. Attachment drive control
7. Attachment drive foot control

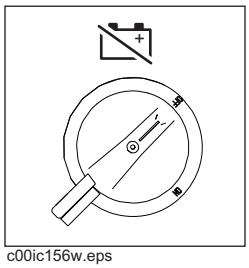
Item	Description	Notes
1. Left track drive control **2. Right track drive control**  c00ic745h.eps	To move forward, push. To move backward, pull. To go faster in either direction, move control farther from neutral position. To stop, move to neutral position.	To turn right, move left control farther forward than right control. To turn left, move right control farther forward than left control. To counter-rotate in either direction, move controls in opposite directions as indicated above.
Track drive joystick (optional)	To move forward, push. To move backward, pull. To go faster in either direction, move control farther from neutral. To stop, move to neutral.	To steer while moving forward, push joystick forward, then move left or right. Unit will gradually turn left or right. To steer while moving backward, pull joystick back, then move left or right. Unit will gradually turn left or right. For tight steering in low speed, move joystick to center position then to left or right side. Tracks will counter rotate and turn unit in a tight circle.
3. Parking brake switch  c00ic097w.eps	To engage, move red switch toward operator and press back of switch down. To disengage, move red switch toward operator and press front of switch down.	**IMPORTANT:** • Ensure unit is stopped before setting parking brake. • Parking brake disengages hydraulics.
4. Ignition switch  c00ic065h.eps	To start engine, insert key and turn clockwise. To stop engine, turn key counterclockwise.	**IMPORTANT:** • If engine does not start or stalls, turn key to STOP and then restart. • Do not allow starter motor to run continuously for more than 20 seconds. • Unit will buzz when key is in on position without engine running.

Item	Description	Notes
5. Boom lift control  c00ic083a.eps	To lower boom, push. To raise boom, pull.	
6. Attachment drive control  c00ic090a.eps	To engage attachment drive in reverse, push forward. To engage attachment drive in forward, pull back.	**IMPORTANT:** Use foot pedal to hold attachment control in the on position when hands are busy operating track drive controls.
7. Attachment drive foot control	To hold attachment drive in engaged position (forward or reverse), move lever in desired direction, and press pedal. To return attachment drive control to neutral, release pedal.	**IMPORTANT:** • Use foot pedal to hold attachment control in the on position when hands are busy operating track drive controls. • If attachment drive control handle moves when foot control pedal is pressed completely, adjust pedal. See "Adjust Attachment Drive Controls" on page 89.

Engine Compartment



1. Battery disconnect switch

Item	Description	Notes
1. Battery disconnect switch  c00ic156w.eps	To connect, turn clockwise. To disconnect, turn counterclockwise.	

Prepare

Chapter Contents

Gather Information

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

All Jobs

Review Job Plan

Review blueprints or other plans. Check for information about existing or planned structures, elevations, or proposed work that may be taking place at the same time.

Arrange for Traffic Control

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

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.

Ground-Penetrating Jobs

Notify One-Call Services

Mark proposed path or excavation area with white paint and have underground utilities located before working.

- In the US or Canada, call 811 (US) or 888-258-0808 (US and Canada). Also contact any local utilities that do not participate in the One-Call service.
- In countries that do not have a One-Call service, contact all local utility companies to have underground utilities located.

Above-Ground Jobs

Locate Overhead Lines

Note location and height of all overhead lines in jobsite and ensure that fully lifted attachment and/or load cannot touch lines.

Inspect Site

Identify Hazards

Inspect jobsite before transporting equipment. Check for the following:

- changes in elevation such as hills or other open trenches
- obstacles such as buildings, railroad crossings, or streams
- signs of utilities
  - "buried utility" notices
  - utility facilities without overhead lines
  - gas or water meters
  - junction boxes
  - drop boxes
  - light poles
  - manhole covers
  - sunken ground
- traffic
- access
- soil type and condition

Have an experienced locating equipment operator sweep area within 20' (6 m) to each side of work path. Verify previously marked line and cable locations.

Identify safety hazards and classify jobsite if attachment will penetrate ground. See "Classify Jobsite" on page 40.

Classify 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:

- Wear personal protective equipment including hard hat, safety eye wear, and hearing protection.
- Do not wear jewelry or loose clothing.
- Comply with all utility notification regulations before digging or drilling.
- Mark proposed path or excavation area with white paint and have underground utilities located before working.
- Verify location of previously marked underground hazards.
- Mark jobsite clearly and keep spectators away.

Remember, jobsite is classified by hazards in place -- not by line being installed.

Select a Classification

Jobsites are classified according to underground hazards present.

If working . . .	then classify jobsite as . . .
within 10' (3 m) of a buried electric line	electric
within 10' (3 m) of a natural gas line	natural gas
in sand or granite which is capable of producing crystalline silica (quartz) dust	crystalline silica (quartz) dust
within 10' (3 m) of any other hazard	other

NOTICE: If you have any doubt about jobsite classification, or if jobsite might contain unmarked hazards, take steps outlined previously to identify hazards and classify jobsite before working.

Apply Precautions

Once classified, precautions appropriate for jobsite must be taken.

Electric Jobsite Precautions

Use one or both of these methods.

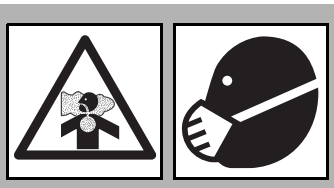
- Expose line by careful hand digging or soft excavation.
- Have service shut down while work is in progress. Have electric company test lines before returning them to service.

Natural Gas Jobsite Precautions

In addition to positioning equipment upwind from gas lines, use one or both of these methods.

- Expose lines by careful hand digging or soft excavation.
- Have gas shut off while work is in progress. Have gas company test lines before returning them to service.

Crystalline Silica (Quartz) Dust Precautions



⚠ 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.

To help avoid injury:

- Use water spray or other means to control dust.
- Refer to U.S. Department of Labor Occupational Safety and Health Administration guidelines to learn more about appropriate breathing protection and permissible exposure limits.

Crystalline silica dust is a naturally occurring substance found in soil, sand, concrete, granite, and quartz. Breathing silica dust particles while cutting, drilling, or working materials may cause lung disease or cancer.

Other Jobsite Precautions

You may need to use different methods to safely avoid other underground hazards. Talk with those knowledgeable about hazards present at each site to determine which precautions should be taken or if job should be attempted.

Check Supplies and Prepare Equipment

Check Supplies

- fuel

> ***NOTICE:*** Use low sulfur or ultra low sulfur fuel only.

- keys
- lubricants
- personal protective equipment, such as hard hat and safety glasses

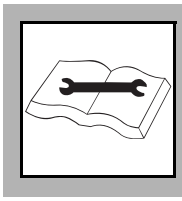
Prepare Equipment

Fluid Levels

- fuel
- hydraulic fluid
- battery charge
- engine oil

Condition and Function

- all controls



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.

- parking brake pins (See "Check Brake Operation" on page 72.)
- filters (air, oil, hydraulic)
- tracks
- pumps and motors
- hoses and valves
- signs, guards, and shields

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.

Drive

Chapter Contents

Start Unit

1. Ensure all controls are in neutral.
2. Set parking brake.
3. Move throttle to half open.
4. Turn ignition switch to start position and release when engine starts.

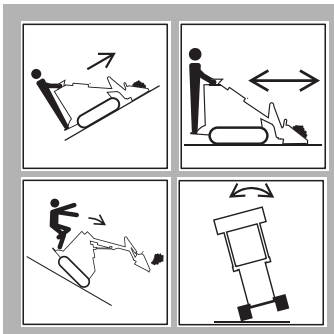
NOTICE:

- Start and operate only from the platform.
- Only operate in well ventilated areas.

EMERGENCY SHUTDOWN: Turn ignition switch to STOP.

Drive

General Operation



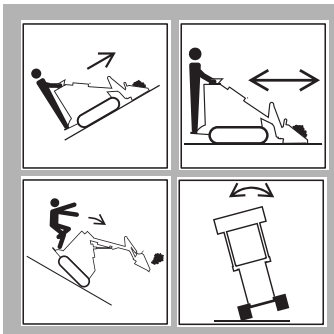
WARNING Tipover possible. Machine can tip over and crush you.

To help avoid injury:

- Always operate with heavy end uphill.
- Drive cautiously at all times.
- Never jerk control levers. Use a steady even motion.

1. Disengage parking brake.
2. Pull boom lift control to raise boom off ground.
3. Move track drive control to steer unit. See page 33
4. Adjust throttle as needed.

Safe Slope Operation



WARNING Tipover possible. Machine can tip over and crush you.

To help avoid injury:

- Always operate with heavy end uphill.
- Drive cautiously at all times.
- Never jerk control levers. Use a steady even motion.
- Do not park unit on slope without lowering attachment to the ground, returning all controls to neutral position, shutting down unit, and applying parking brake.

Operating safely on a slope depends upon many factors including:

- Distribution of machine weight, including front loading and absence of load
- Height of load
- Even or rough ground conditions
- Potential for ground giving way causing unplanned tilt forward, reverse or sideways
- Nearness of ditches, ruts, stumps or other obstructions and sudden changes in slope
- Speed
- Turning
- Braking performance
- Operator skill

These varying factors make it impractical to specify a maximum safe operating angle in this manual. It is therefore important for the operator to be aware of these conditions and adjust operation accordingly. Maximum engine angle and braking performance are two absolute limits which must never be exceeded. These maximums are stated below since they are design limits. **These design limits usually exceed the operating limits and must never be used alone to establish safe operating angle for variable conditions.**

Maximum engine lubrication angle – 20°

Maximum service brake retarding force – equal to traction of both tracks.

Maximum park brake holding force – equal to traction of one track.

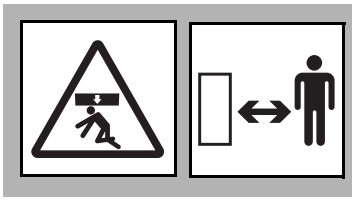
Shut Down

1. Lower boom to ground.
2. Move all controls to neutral position.
3. Engage parking brake.
4. Turn ignition switch to STOP.
5. Remove key.

Transport

Chapter Contents

Lift

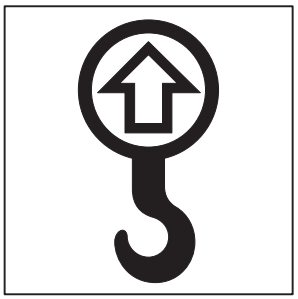


WARNING Crushing weight. If load falls or moves it could kill or crush you. Use proper procedures and equipment or stay away.

To help avoid injury: Only lift unit without attachment installed.

Points

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

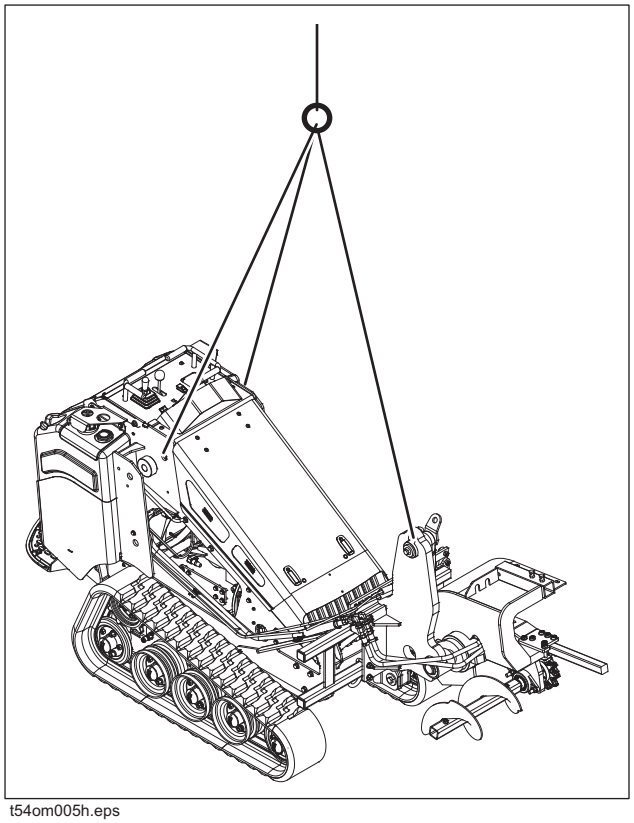


ic1319a.eps

Procedure

Use a hoist capable of supporting the equipment's size and weight. See "Specifications" on page 97 or measure and weigh equipment before lifting.

Use three lift points as shown.



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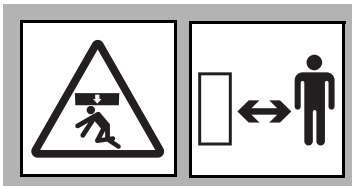
Haul

Load



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:

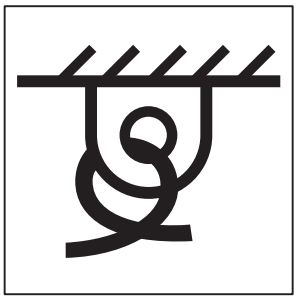
- Load and unload trailer on level ground.
- Incorrect loading can cause trailer swaying.
- Attach trailer to vehicle before loading or unloading.
- Only operate unit from operator platform.
- To help prevent trailer sway, load trailer so that ten to fifteen percent of total vehicle weight (equipment plus trailer) is on tongue.
- If loading onto tilt-bed trailer, be prepared for trailer to tilt.
- Move all controls to neutral position when stopped.

1. Disengage parking brake.
2. Start engine.
3. Adjust throttle to low speed.
4. Pull boom lift control to raise boom clear of trailer, but keep it low.
5. Move unit to rear of trailer and align with ramps.
6. Drive forward slowly to move unit onto trailer until tiedown position is reached.
7. Push boom lift control to lower boom to trailer bed.
8. Engage parking brake.
9. Ensure that all controls are in neutral position.
10. Turn ignition switch to STOP.
11. Tie down unit.

Tie Down

Points

Tiedown points are identified by tiedown decals. Securing to truck or trailer at other points is unsafe and can damage machinery.



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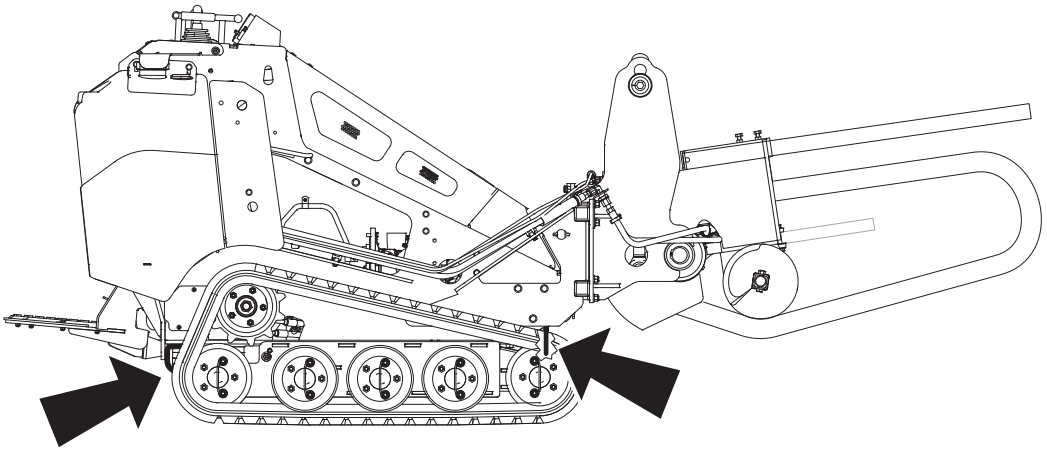
Procedure

Loop tiedowns around unit at tiedown points. Make sure tiedowns are tight before transporting.



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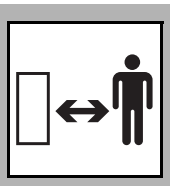
Unload

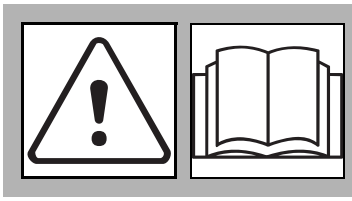
WARNING Crushing weight. If load falls or moves it could kill or crush you. Use proper procedures and equipment or stay away.

To help avoid injury:

- Load and unload trailer on level ground.
- Attach trailer to vehicle before loading or unloading.
- Only operate unit from operator platform.
- If unloading from tilt-bed trailer, be prepared for trailer to tilt.

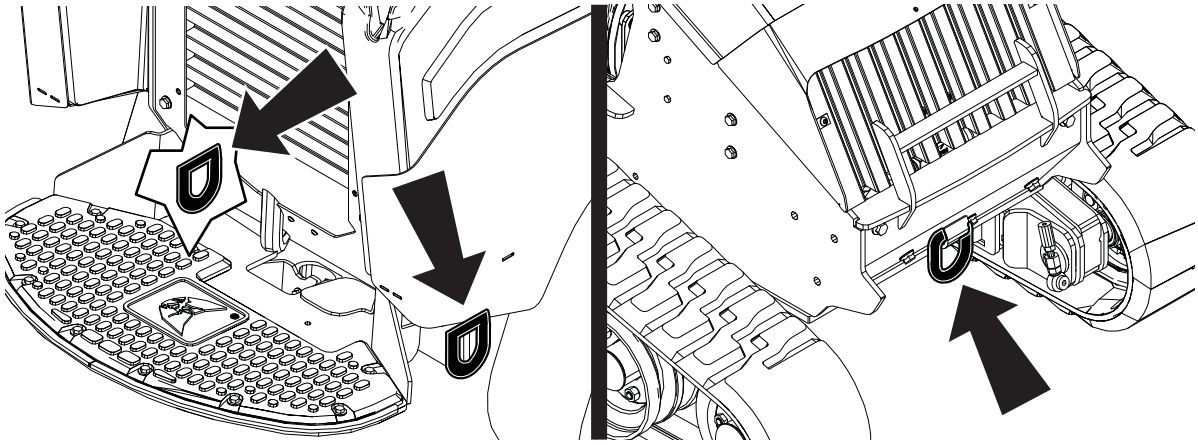
1. Prepare trailer and ramps for unloading.
2. Remove tiedowns.
3. Start engine.
4. Disengage parking brake.
5. Pull boom lift control to raise boom off ground, but keep it low.
6. Adjust throttle to low speed and slowly back unit down trailer or ramps.

Retrieve



WARNING Read operator's manual. Know how to use all controls. Your safety is at stake. 273-475

Under normal conditions, unit should not be towed. If unit breaks down and retrieval is necessary:



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rear tow point

front tow point

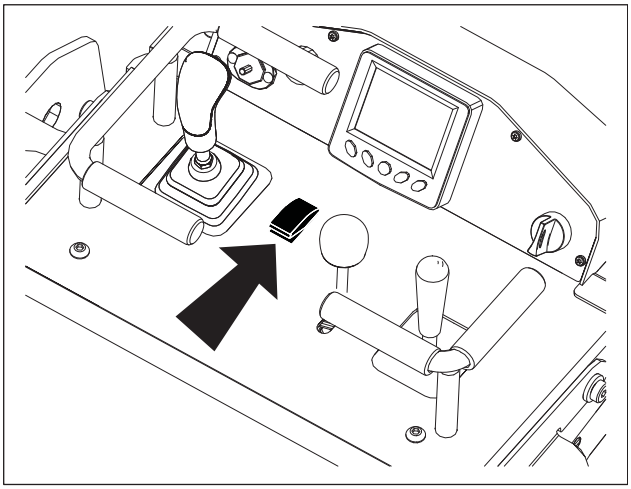
- attach chains to tow points facing towing vehicle
- tow for short distances at less than 1 mph (1.6 km/h)
- do not tow for more than 100' (30 m)
- use no more than 1,300 lb (5800 N) of towing force
- open bypass valve on each pump section

NOTICE: When bypass valve is open, unit has no brakes.

- if engine will not start, remove rear panel and unbolt parking brake assembly.

Prepare Unit for Towing

1. Block tracks.
2. Engage parking brake if engine will start (shown).



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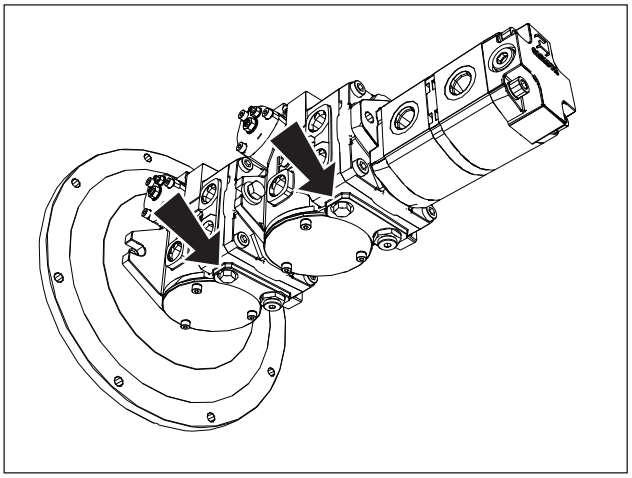
3. Loosen bypass valves (shown) three turns.

IMPORTANT: Open bypass valves in both front and rear pumps.

NOTICE: When bypass valves are open, unit has no brakes.



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Return Unit to Normal Operation

1. Tighten bypass valves and tighten locknut to 15-18 ft•lb (20-25 N•m).

IMPORTANT: Close bypass valve in both front and rear pumps.

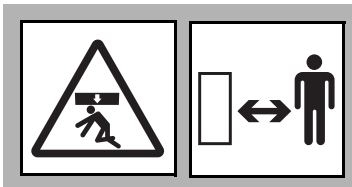
2. Disengage parking brake.
3. Unblock tracks.

Trench

Chapter Contents

Set Up

EMERGENCY SHUTDOWN - Turn ignition switch to STOP.

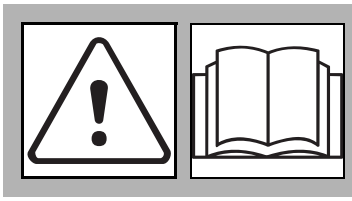


WARNING Crushing weight could cause death or serious injury. Use proper procedures and equipment or stay away.

To help avoid injury: Use attachments or counterweights to make front and rear loads balance when all attachments are raised. Contact your Ditch Witch® dealer about counterweighting for your equipment.

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: Comply with all utility notification regulations before digging or drilling.



WARNING Read operator's manual. Know how to use all controls. Your safety is at stake. 273-475

1. Start unit. See page 50 for start-up procedures.
2. Drive to starting point. Move in line with planned trench. See page 46 for operating procedures.

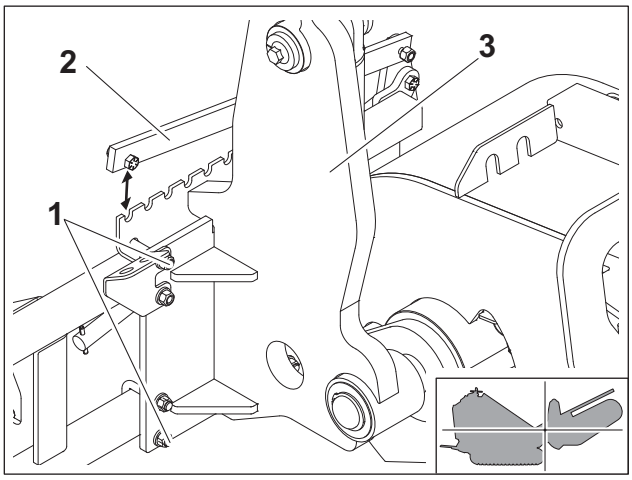
IMPORTANT:

- When cutting asphalt, start trench in soil at edge of road and use shortest possible boom at full depth.
- Sight along center of hood to a stake driven beyond end of trench line for straight trench.

3. Engage parking brake.
4. Lower boom to just above ground.
5. Check that attachment speed/direction control and ground drive controls are in neutral.
6. Adjust boom position, if desired.

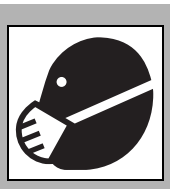
Adjust Boom Position

1. Engage parking brake.
2. Shut down unit.
3. Loosen four bolts (1) on both sides of pivot frame (3).
4. Raise bar (2) and slide boom to desired position.
5. Lower bar into a slot.
6. Tighten bolts.



t54om032h.eps

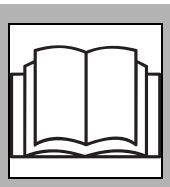
Trench

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. 270-4952

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

To help avoid injury: Expose lines by hand before digging. Cutting high voltage cable can cause electrocution.

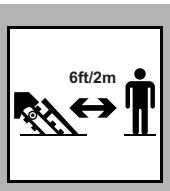



WARNING Read operator's manual. Know how to use all controls. Your safety is at stake. 273-475

To help avoid injury:

- Comply with all utility notification regulations before digging or drilling.
- Notify companies that do not subscribe to One-Call.


CAUTION Flying objects thrown by machine may strike people. Wear hard hat and safety glasses. 275-193

DANGER Moving digging teeth will cause death or serious injury. Stay away. 275-097

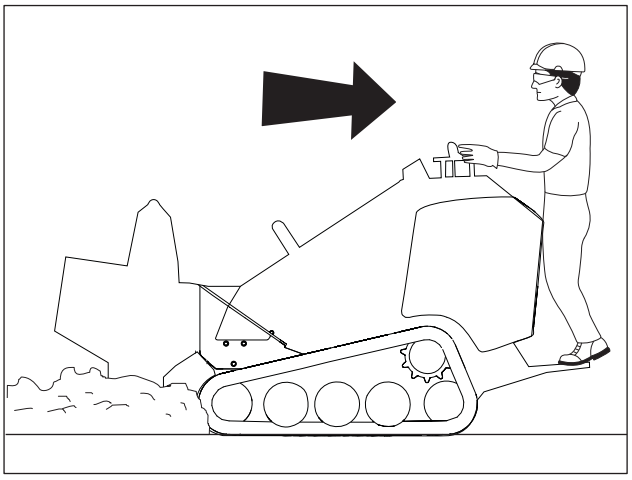
To help avoid injury:

- Ensure parking brake is engaged.
- Allow 3' (1 m) between digging teeth and obstacle. Machine might jerk when digging starts.
- Keep everyone at least 6' (2 m) from machine, attachments, and their range of movement.

1. Adjust throttle to low idle.
2. Engage attachment control.
3. Increase engine speed to full throttle.
4. Slowly lower digging boom to depth.
5. Move ground drive control to desired speed.
6. Pull ground drive control rearward to desired trenching speed. Trenching movement is toward you.

NOTICE:

- Do not make sharp turns. Lower boom to full depth when turning.
- If an object becomes lodged in chain, move attachment speed/direction control to neutral and raise boom slightly. Reverse chain direction. If object must be removed manually, turn engine off and engage parking brake.



t43om033w.eps

7. When trench is complete, move ground drive control to neutral.
8. Adjust throttle to low idle.
9. Raise boom.
10. As boom clears top of trench, move attachment speed/direction control to neutral.
11. Drive a short distance away from work site.
12. Shut down unit. See page 48 for proper shutdown procedures.

Complete the Job

Chapter Contents

Rinse Equipment

1. Spray water onto equipment to remove dirt and mud.

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

2. Open hood and allow unit to cool. Remove debris from inside of unit.
3. Remove mud from track sprockets.
4. Wash undercarriage. Pay special attention to brake pin area.

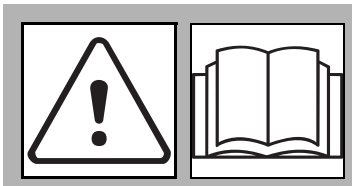
Stow Tools

Make sure all tools and accessories are loaded and properly secured on trailer.

Service

Chapter Contents

Precautions



WARNING Read operator's manual. Know how to use all controls. Your safety is at stake. 273-475

To help avoid injury:

- Unless otherwise instructed, all service should be performed with engine off.
- Before servicing equipment, lower unstowed attachments to ground.

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.

Recommended Lubricants/Service Key

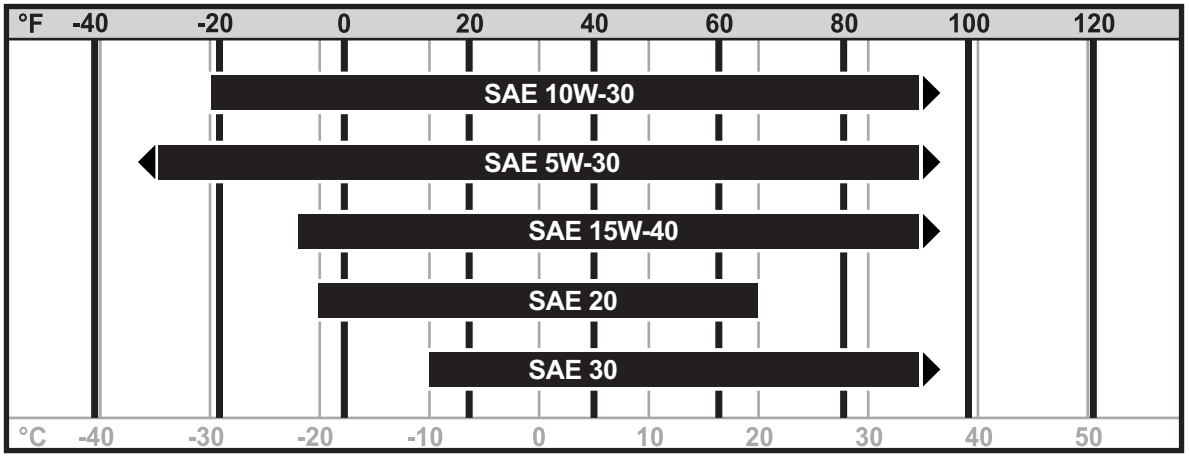
Item	Description		
DEO	Diesel engine oil meeting or exceeding API service classification CJ-4, ACEA E6, or JASO DH-2. No synthetics. Engine must use low sulfated ash, phosphorous, and sulfur (low SAPs) oil. See "Engine Oil Temperature Chart" on page 68.		
DEAC	Diesel engine antifreeze/coolant meeting CES 14603.		
THF	Tractor hydraulic fluid, similar to Phillips 66® PowerTran Fluid, Mobilfluid® 423, Chevron® Tractor Hydraulic Fluid, Texaco® TDH Oil, or equivalent		
MPG	Multipurpose grease meeting NLGI GC-LB Grade 2		
	Check level of fluid or lubricant		Check condition
	Filter		Change, replace, adjust, service or test

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 genuine Ditch Witch parts, filters, approved lubricants, TJC, and approved coolants to maintain warranty. Fill to capacities listed in "Specifications" on page 97.

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

IMPORTANT: Use the "Service Record" on page 105 to record all required service to your machine.

Engine Oil Temperature Chart



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Temperature range anticipated before next oil change

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

Approved Coolant

This unit was filled with coolant meeting Cummins® CES 14603 before shipment from factory. Add or replace only with coolant meeting this specification, such as Fleetguard® ES Compleat coolant. This coolant is available, pre-diluted, from your Ditch Witch® dealer as part number 255-1055. Contact your Cummins service partner for a full list of approved coolants meeting CES 14603.

NOTICE:

- Do not use water or high-silicate automotive-type coolant. This will lead to engine damage or premature engine failure.
- Do not mix heavy-duty diesel engine coolant and automotive-type coolant. This will lead to coolant breakdown and engine damage.

Approved Fuel

Tier 4 Engine (U.S., Canada, EU, and Japan)

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

This engine is designed to run on diesel fuel. Use only high quality fuel meeting ASTM D975 No. 2D, EN590, or equivalent. At temperatures below 32°F (0°C) winter fuel blends are acceptable. See the engine operation manual for more information.

NOTICE: Use only Ultra Low Sulfur Diesel (less than 15 ppm (15 mg/kg) sulfur content) in this unit. Operating with higher sulfur content will damage the engine and aftertreatment device.

Biodiesel blends up to 5% (B5) are approved for use in this unit. The fuel used must meet the specifications for diesel fuel shown above. In certain markets, higher blends may be used if certain steps are taken. Extra attention is needed when using biodiesel, especially when operating in cold weather or storing fuel. Contact your Ditch Witch® dealer or the engine manufacturer for more information.

Exhaust Cleaning - Tier 4 Only

This engine has a Diesel Particulate Filter (DPF) that purifies NOx emissions in the exhaust into nitrogen and water. The DPF system uses a small amount of engine lubricating oil to during the high-temperature combustion. The system cleans itself automatically, unless it is manually inhibited by the operator.

Automatic exhaust cleaning (REGEN) happens during normal machine operation when sensors in the engine determine the need. During an engine exhaust cleaning cycle, engine exhaust can reach high temperatures. When this happens, the high exhaust temperature icon will light.

If the jobsite is in an area where high exhaust temperature might cause a problem, inhibit exhaust cleaning through the Tier 4 menu (see "Tier 4 menu button" on page 27) for the duration of the job and return to automatic cleaning when the job is finished. The exhaust cleaning inhibited icon will light and remain on until the system is returned to automatic exhaust cleaning mode.

The exhaust cleaning icon will light when the system is inhibited and an exhaust cleaning cycle is needed.

- The icon will flash when exhaust cleaning is needed. If the area will allow it, return the unit to automatic cleaning mode in the Tier 4 menu and let it run automatically.
- A manual exhaust cleaning cycle (DPF REGEN) is required after automatic exhaust cleaning has been inhibited multiple times. Take system out of inhibited mode through the Tier 4 menu, set the engine to low throttle with no load and initiate the DPF REGEN exhaust cleaning cycle. The light will remain on steady until the manual exhaust cleaning cycle is finished (approximately 30 minutes). If manual cleaning is not done when indicated, the engine will derate.
- Ash buildup in soot filter part of DPF will have adverse effects on engine performance. The soot filter must be serviced every 3000 hours of operation or more often if high-ash oil and/or fuel is used. See your Yanmar engine distributor for this service.

Startup/10 Hour

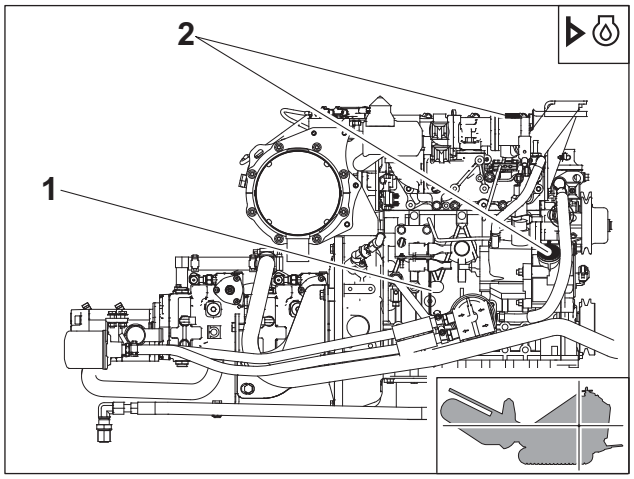
Location	Task	Notes
Power Unit	Check engine oil level	DEO
	Check engine air filter service indicator	
	Check hydraulic fluid level	THF
	Check brake operation	
	Check lug nut torque	88-95 ft•lb (108-129 N•m)
	Check engine coolant level	DEAC
	Check water separator filter	
	Check track tension	
	Check hydraulic hoses	
Trencher	Lube auger bearing	MPG
	Check digging chain tension	
	Check restraint bar position	MPG

Power Unit

Check Engine Oil Level

Check engine oil level at dipstick opening (1) at startup and every 10 hours. Oil level should be at top of marking. If low, add DEO at fill (2). Check with unit on level surface and at least 15 minutes after stopping engine.

IMPORTANT: Use oil specified in "Engine Oil Temperature Chart" on page 68.



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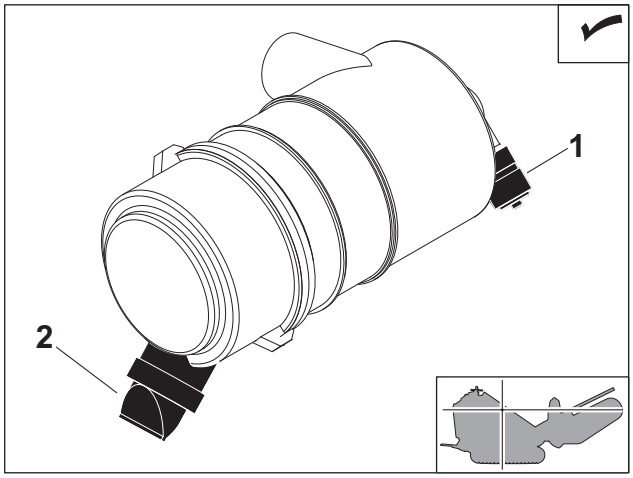
Check Engine Air Filter Service Indicator

Check air filter service indicator (1) and dust ejector (2) at startup and every 10 hours and change filter as needed.



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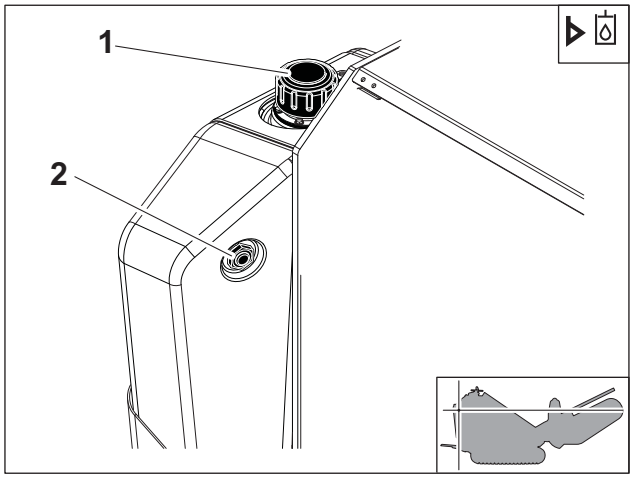
Check Hydraulic Fluid Level

Check hydraulic fluid level at startup and every 10 hours. Maintain fluid level at halfway point on sight glass (2), when engine is off, cylinders are fully retracted, and fluid is cool. If low, add THF at fill (1).



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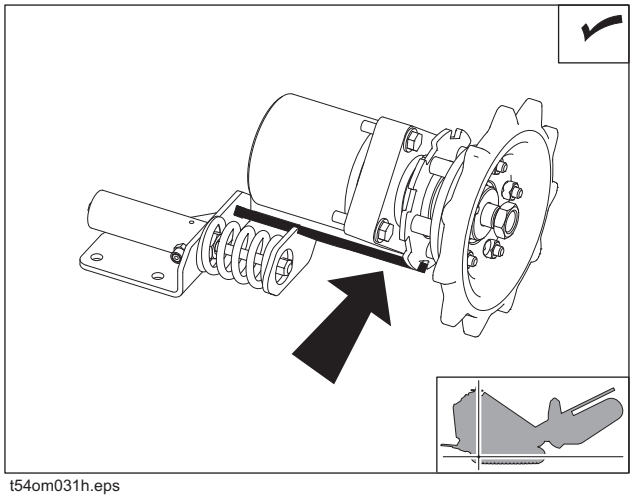
Check Brake Operation

Check brake operation at startup and every 10 hours or more often when conditions warrant..

IMPORTANT: Engine must be running to check brake operation.

- Ensure parking brake pin (shown) moves freely allowing brake to be engaged and disengaged.
- Clean mud and debris from area around pin.



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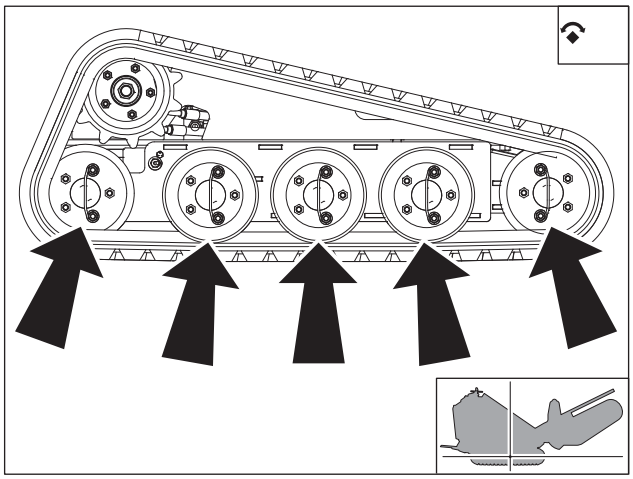
Check Lug Nut Torque

Check lug nut torque at 10 hours, 50 hours and every 200 hours thereafter. Tighten to 88-95 ft•lb (108-129 N•m) as needed.



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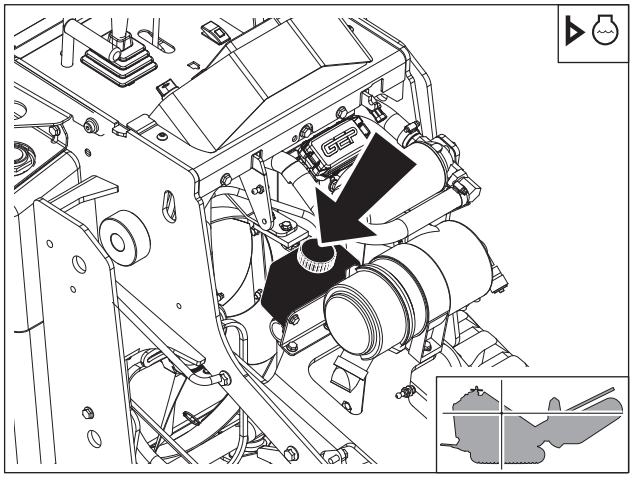
Check Coolant Level

Check coolant level at overflow coolant bottle, with engine cool, at startup and every 10 hours. Maintain coolant level at 1/3 point on bottle. If low, add approved coolant.

IMPORTANT: See page 68 for information on approved coolants.



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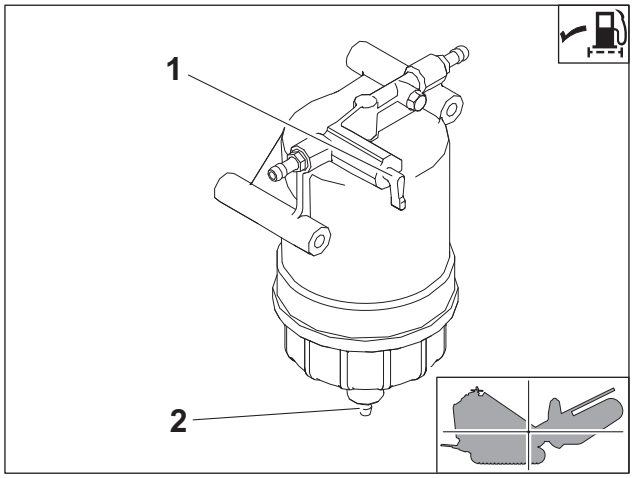
Check Water Separator Filter

Check water separator filter at startup and every 10 hours. When red float ring is raised, water should be drained. See "Drain Water Separator Filter" on page 88.



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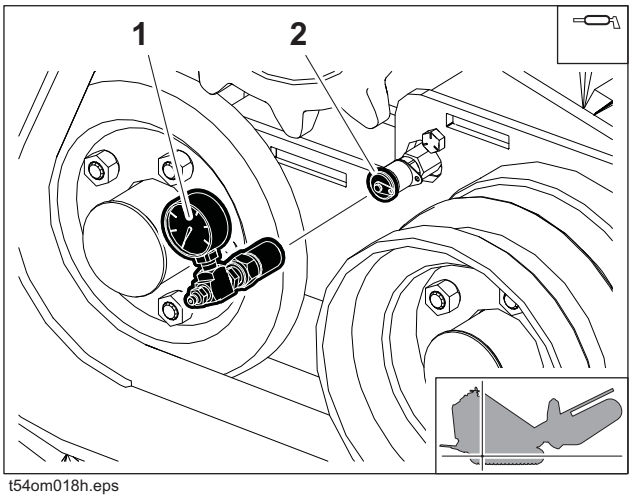
Check Track Tension

Check track tension at startup and every 10 hours and adjust as needed.

Track is correctly tensioned when gauge measures between 700-900 psi (48-62 bar).

To adjust:

1. Remove gauge from operator's manual compartment.
2. Thread gauge (1) into connection (2).
3. Pump MPG into grease zerk to check pressure.



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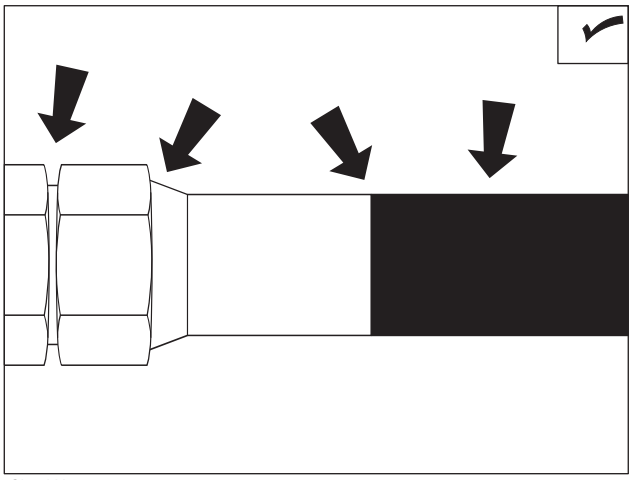
Check Hydraulic Hoses

WARNING Pressurized fluid or air could pierce skin and cause severe injury. Refer to operator's manual for proper use. 270-6035

To help avoid injury:

- Use a piece of cardboard or wood, rather than hands, to search for leaks.
- Wear protective clothing, including gloves and eye protection.
- 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.
- If you are injured, seek immediate medical attention from a doctor familiar with this type of injury.

Check hydraulic hoses for leaks at startup and every 10 hours.

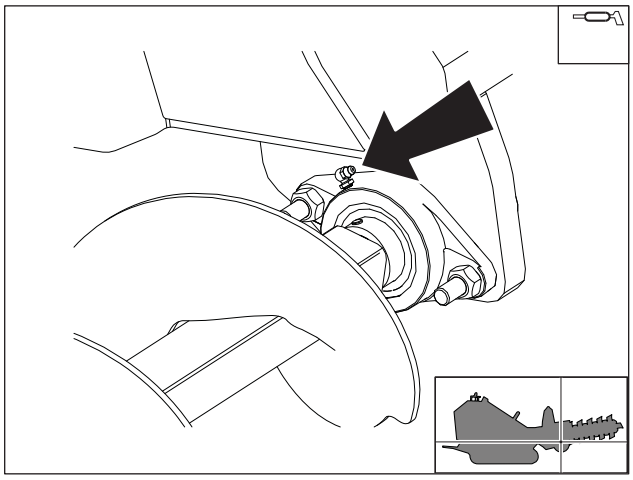


CheckHoses.eps

Trencher

Lube Auger Bearing

Lube auger bearing zerk with MPG every 10 hours.



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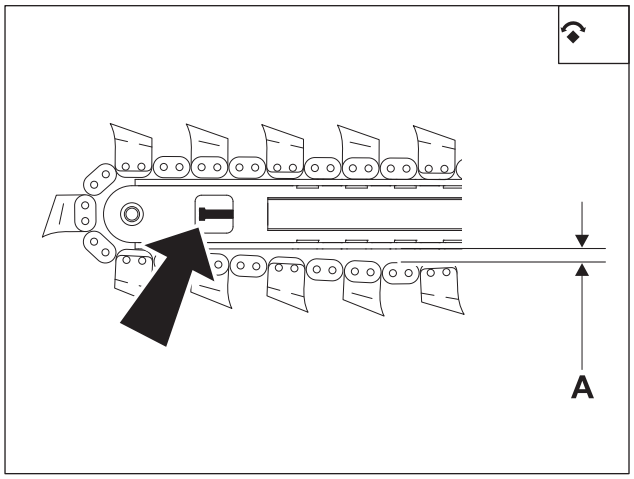
Check Digging Chain Tension

Check digging chain tension every 10 hours and adjust as needed. With boom horizontal, measure distance A from bottom of boom to chain. When properly tensioned, distance A should be 1.5-2.0" (38-51 mm).

NOTICE: Do **not** overtighten chain. Overtightening will cause chain stretch, loss of machine performance, and possible premature chain failure.

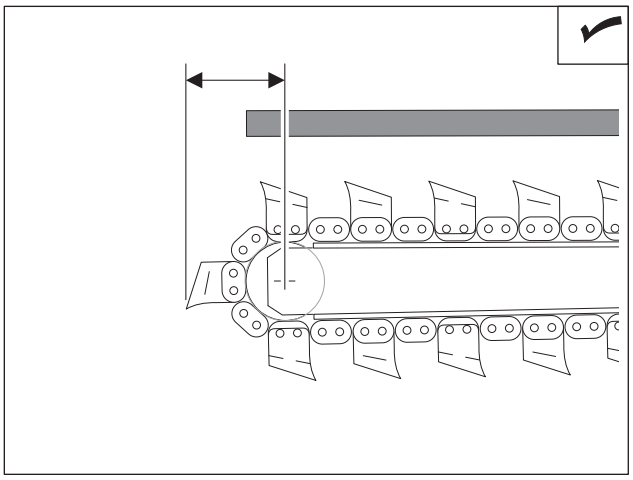


DiggingChainTension_Screw2.eps

1. Loosen jam nut on adjustment screw (shown).
2. To tighten digging chain, turn adjustment screw clockwise. To loosen digging chain, turn counterclockwise.
3. When proper tension is reached, tighten jam nut.

Check Restraint Bar Position

Check restraint bar position every 10 hours, or anytime the digging chain is adjusted or replaced. The restraint bar is properly positioned when the end of bar extends between the center of the tail roller/sprocket and the end of the digging chain.



RestraintBarPosition.eps

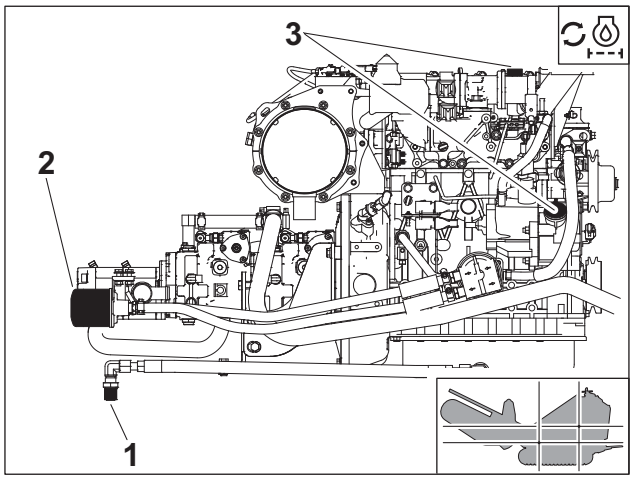
50 Hour

Location	Task	Notes
	Change engine oil and filter	initial service
	Check fan belt tension and damage	1/4-1/3" (7-9 mm), initial
	Change hydraulic fluid filter	initial
	Check fuel hose and clamp band	
	Check radiator/hydraulic fluid cooler for dirt and debris	
	Check lug nut torque	88-95 ft•lb (108-129 N•m)
	Check idler roller bearings	

Change Engine Oil and Filter (Initial)

Change engine oil after 50 hours. Drain oil (1) and add 5 qt (4.7 L) of DEO at fill (2).

IMPORTANT: Use oil specified in "Engine Oil Temperature Chart" on page 68.



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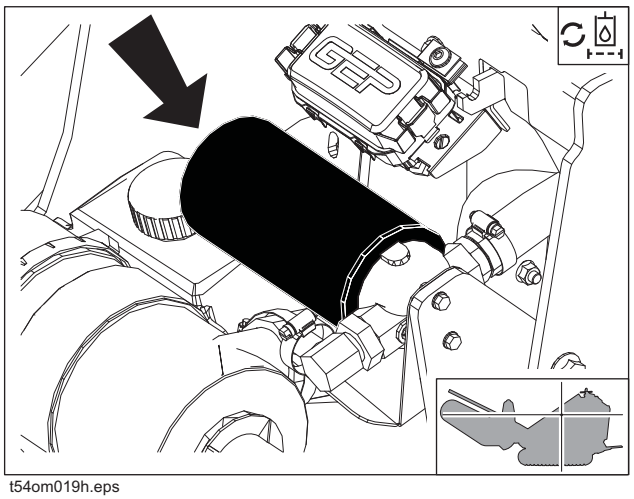
Change Hydraulic Filter (initial)

Change hydraulic filter after 50 hours.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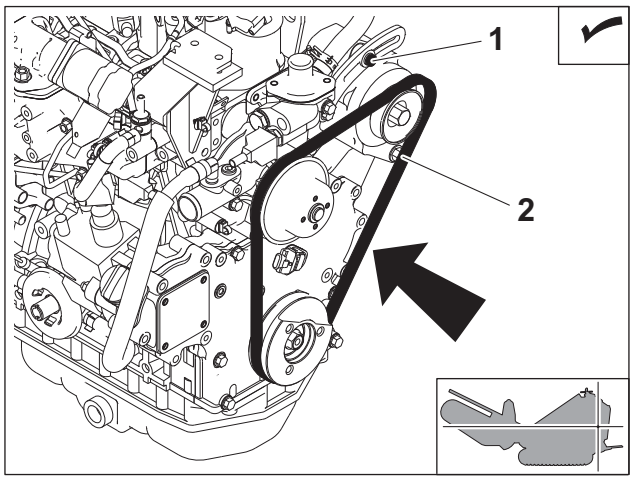
Check Fan Belt for Tension and Damage

Check belt tension after 50 hours. Belt is properly tensioned when it moves about 1/4-3/8" (7-9 mm) when pushed at the long span. Replace the belt when it is worn and sinks into the pulley groove.

Adjust Tension

1. Loosen two alternator bolts (shown).
2. Adjust position as needed.
3. Tighten bolts.
4. Check tension.



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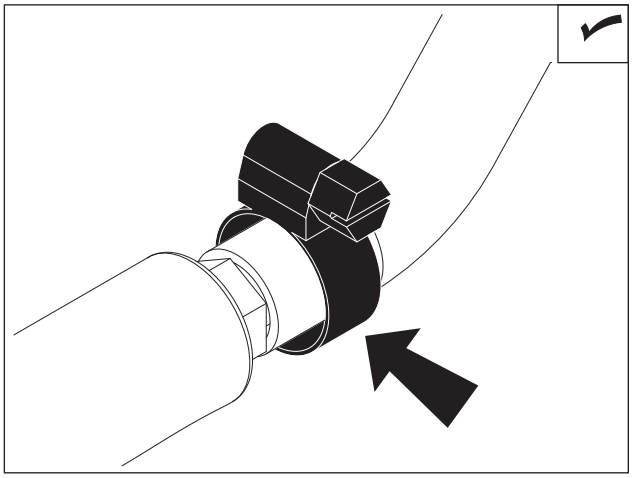
Check Fuel Hose and Clamp Bands

Check fuel hose and clamp bands every 50 hours.

If the clamp is loose, apply oil to the threads and retighten it. If the hose is worn, replace it.

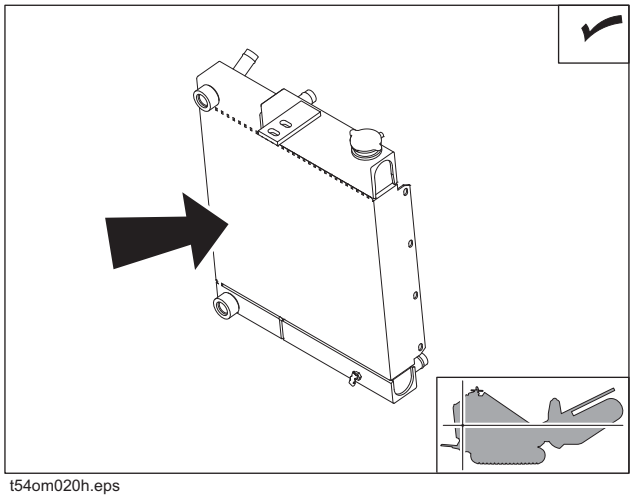
Bleed the fuel system if the hose and/or clamp is changed.


HoseClampBand.eps

Check Radiator/Fluid Cooler

Check radiator/hydraulic fluid cooler for dirt, grass, and other foreign matter every 50 hours. Clean out with compressed air or spray wash if required. Be careful not to damage fins with high-pressure air or water. Check more often if operating in dusty or grassy conditions.

Check radiator hoses for wear. Check hose clamps for proper tightness.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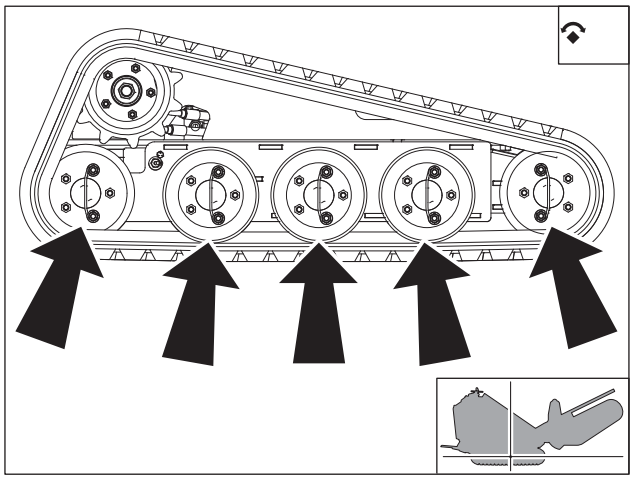
Check Lug Nut Torque

Check lug nut torque at 10 hours, 50 hours and every 200 hours thereafter. Tighten to 88-95 ft•lb (108-129 N•m) as needed.



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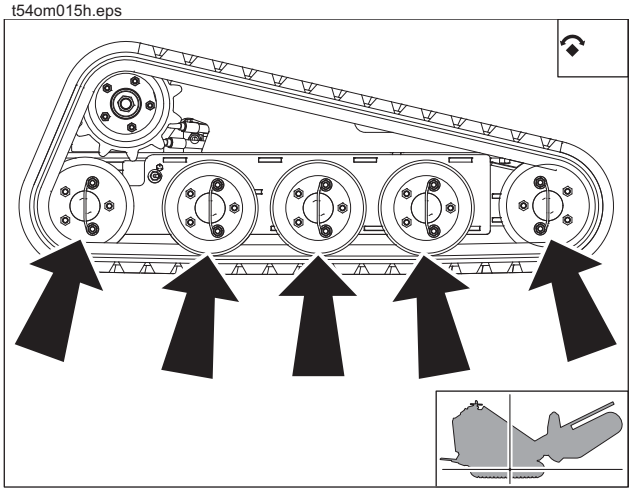
Check Idler Roller Bearings

Check for proper positioning of idler roller bearings at 50 hours and every 250 hours thereafter.

To check:

1. Lift unit off ground.
2. Release track tension. See "Check Track Tension" on page 74.
3. Check for movement of each hub when rocked back and forth. If hub has noticeable movement, adjust idler roller bearing. See "Adjust Idler Roller Bearings" on page 90.
4. Adjust track tension.



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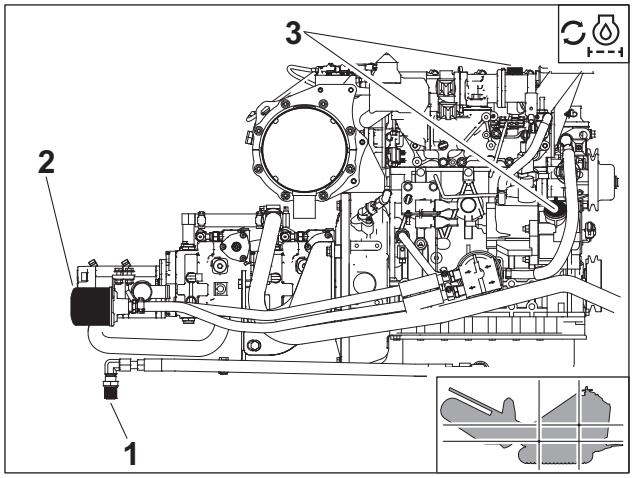
250 Hour

Location	Task	Notes
	Change engine oil and filter	DEO
	Check intake air line	
	Check fan belt for tension and damage	1/4-1/3" (7-9 mm)
	Change hydraulic filter	
	Check lug nut torque	88-95 ft•lb (108-129 N•m)
	Check idler roller bearings	

Change Engine Oil and Filter

Change engine oil and filter every 250 hours. Drain oil (1), change filter (2) and add 5 qt (4.7 L) of DEO at fill (3). See page 78.

IMPORTANT: Use oil specified in "Engine Oil Temperature Chart" on page 68.



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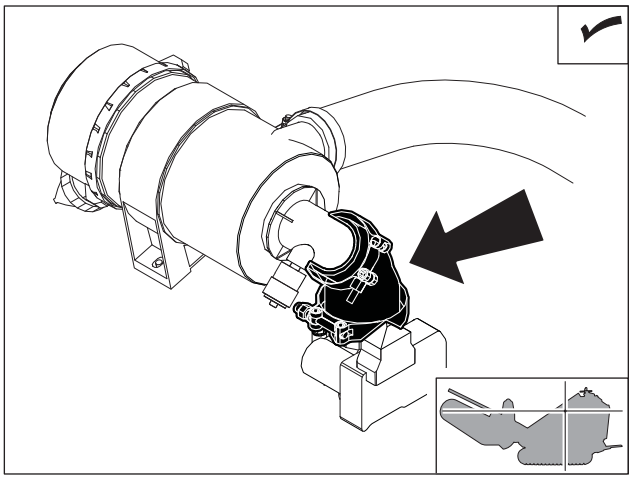
Check Intake Air Line

Check the intake air line every 250 hours.

NOTICE: Keep dust out of the intake air line to prevent damage to the engine.

If the clamp is loose, apply oil to the threads and retighten it.

If the hose appears cracked or worn, replace it.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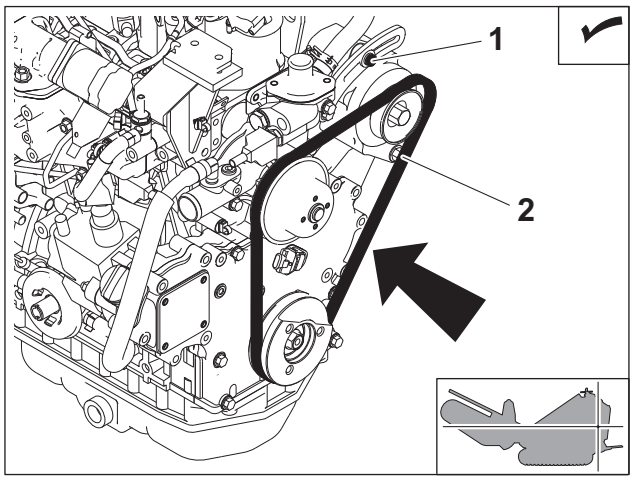
Check Fan Belt for Tension and Damage



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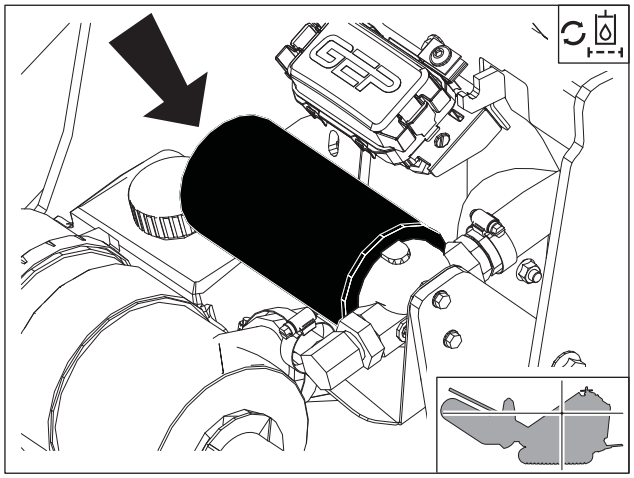
Check belt tension every 250 hours. Belt is properly tensioned when it moves about 1/4-3/8" (7-9 mm) when pushed at the long span. Replace the belt when it is worn and sinks into the pulley groove.

Adjust Tension

1. Loosen two alternator bolts (shown).
2. Adjust position as needed.
3. Tighten bolts.
4. Check tension.

Change Hydraulic Filter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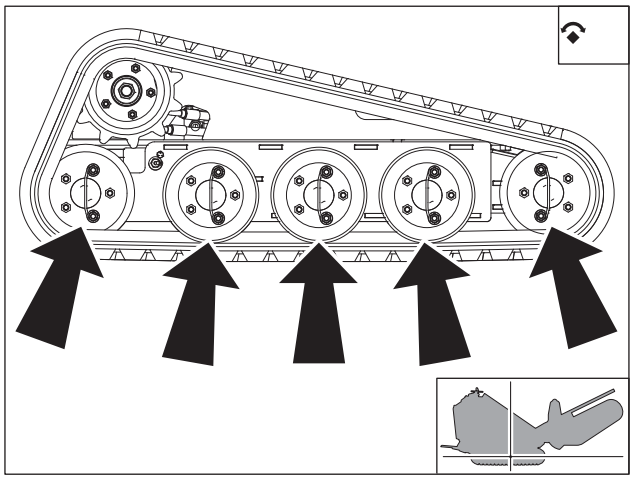
Change hydraulic filter every 250 hours.

Check Lug Nut Torque

Check lug nut torque at initial intervals and every 250 hours thereafter. Tighten to 88-95 ft•lb (108-129 N•m) as needed.



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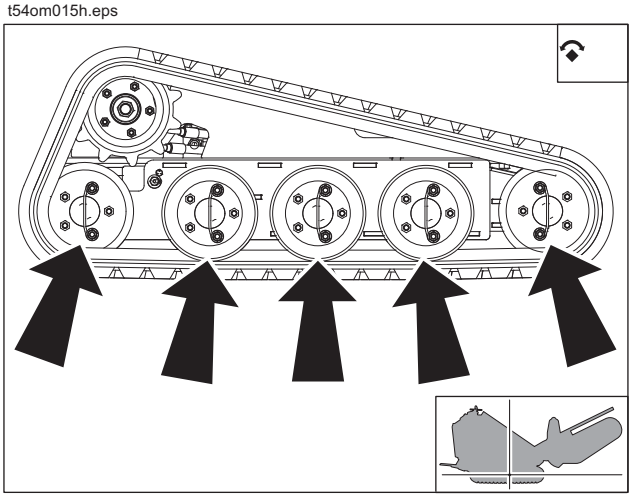
Check Idler Roller Bearings

Check for proper positioning of idler roller bearings every 300 hours.

To check:

1. Lift unit off ground.
2. Release track tension. See "Check Track Tension" on page 74.
3. Check for movement of each hub when rocked back and forth. If hub has noticeable movement, adjust idler roller bearing. See "Adjust Idler Roller Bearings" on page 90.
4. Adjust track tension.



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500 Hour

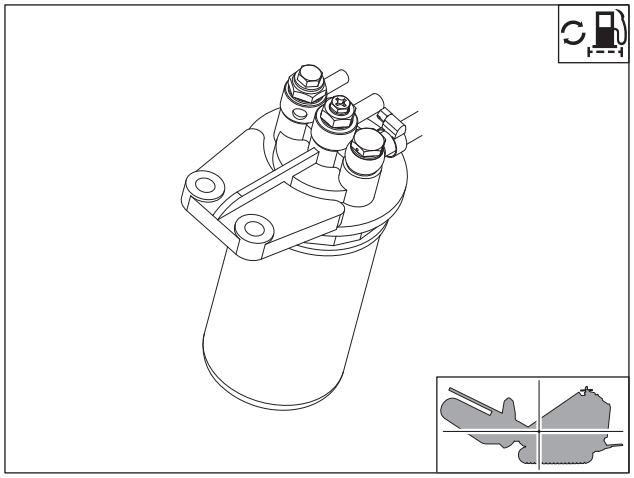
Location	Task	Notes
	Change fuel filter	
	Change hydraulic fluid and filter	
	Change water separator filter	

Change Fuel Filter

Change filter every 500 hours. If you refuel from cans, replace filter more often.

The canister filter is located in the engine compartment.

See parts manual or contact your Ditch Witch® dealer for correct replacement filter.



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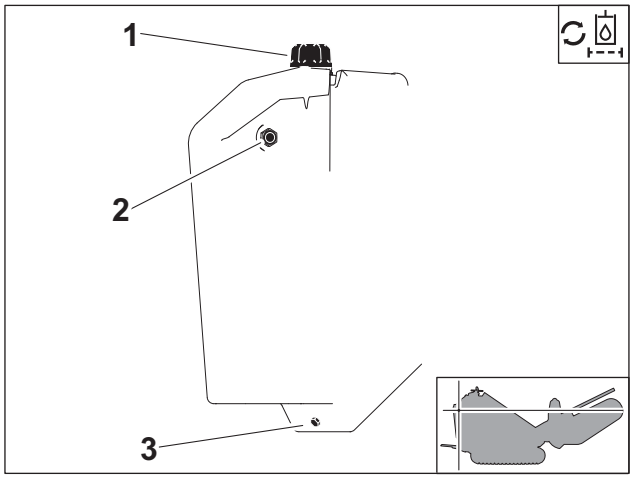
Change Hydraulic Fluid and Filter

Change hydraulic fluid and filter every 500 hours. Change every 250 hours if jobsite temperature exceeds 100°F (38°C) more than 50% of the time.

1. Remove drain plug (3).
2. Drain fluid and replace plug.
3. Change filter. See page 82.
4. Add THF at fill (1) until fluid level is at halfway point on sight glass (2). Capacity is 9.2 gal (35 L).



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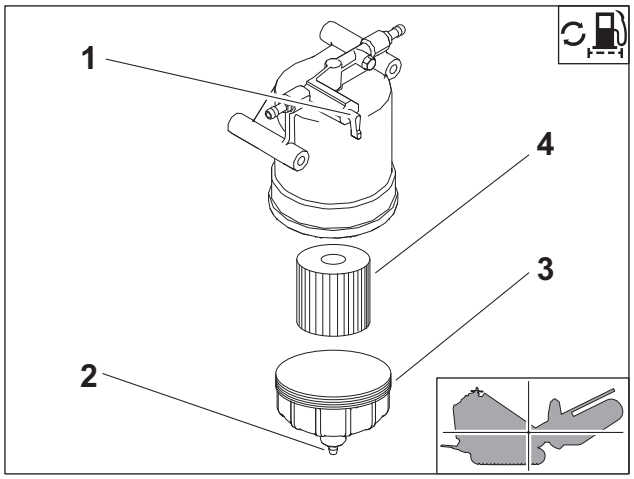
Change Water Separator Filter

Change water separator filter every 500 hours.

1. Turn off at valve (1).
2. Purge fuel out of filter by unscrewing bottom drain plug (2).
3. Unscrew bottom of filter (3).
4. Replace filter (4).
5. Screw bottom of filter back on.
6. Turn on at valve.



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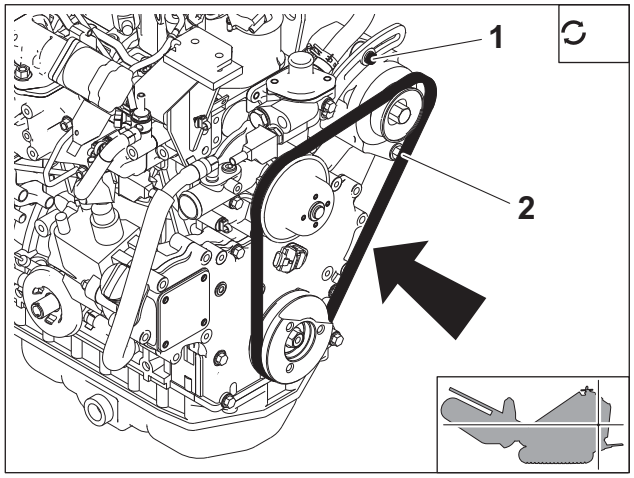
Change Fan Belt

Change fan belt every 500 hours. Belt is properly tensioned when it moves about 1/4-3/8" (7-9 mm) when pushed at the long span (shown).

To change:

1. Loosen two alternator bolts (1,2).
2. Replace fan belt. Adjust position as needed.
3. Tighten bolts.
4. Check tension.



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1000 Hour

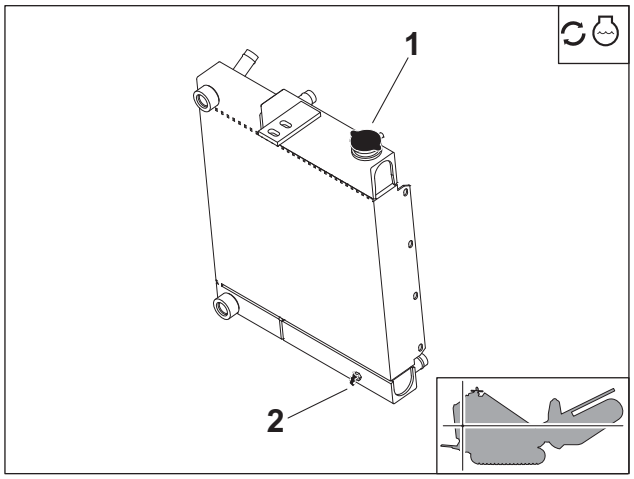
Location	Task	Notes
	Change engine coolant	
	Adjust valve clearance	Yanmar® certified technician

Change Engine Coolant

Drain cooling system at drain (2). Add approved coolant at fill (1) every 1000 hours.

NOTICE:

- The use of non-approved coolant may lead to engine damage or premature engine failure and will void engine warranty.
- See page 68 for list of approved coolants.



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Adjust Valve Clearance

Adjust valve clearance every 1000 hours.

To adjust, see a certified Yanmar® engine technician.

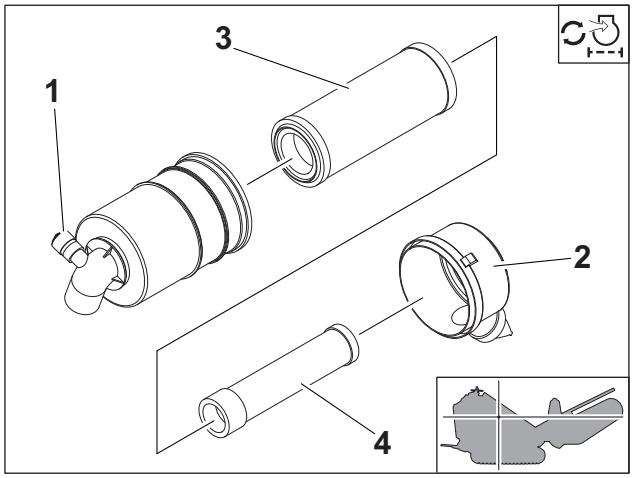
NOTICE: If valve clearance is adjusted by anyone other than a certified Yanmar® engine technician, engine warranties could be voided. Please see engine manual for more information.

As Needed

Location	Task	Notes
Power Unit	Change air filter	
	Drain water separator filter	
	Adjust attachment drive foot control	
	Adjust idler roller bearings	
	Check battery	
	Charge battery	
Trencher	Check digging chain rollers, sidebars, pins, and bushings	
	Check digging chain teeth and bits	
	Check trencher headshaft sprocket bolts	
	Replace digging chain	

Power Unit

Change Air Filter



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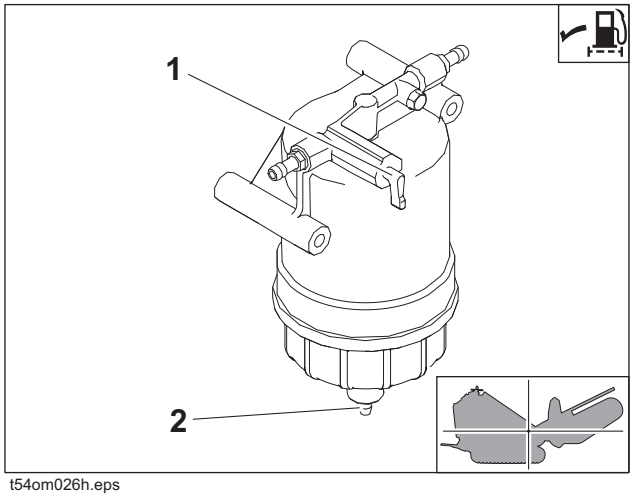
Change air filter when red band on indicator (1) is visible. Replace secondary element (4) every third change of primary element (3) or any time primary element has become damaged.

1. Open air filter housing at latches (2).
2. Remove primary element (3).
3. Wipe inside of housing and end cup (2) and clean dust ejector valve.
4. Insert new secondary element if necessary and ensure it is seated correctly.
5. Insert new primary element.
6. Latch air filter housing with dust ejector facing downward.
7. Reset air filter service indicator.

NOTICE: Only open the air filter housing when red band on indicator is visible. Change the elements. Do not attempt to clean them.

- Improperly installed primary element can lead to premature engine failure.
- Compressed air or water may damage filter elements.
- Tapping filter elements to loosen dirt may damage the elements.

Drain Water Separator Filter



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Drain water separator filter when red float ring is raised, indicating water in the filter.

1. Turn off at valve (1).
2. Unscrew drain plug (2) at bottom and drain water out.
3. Tighten drain plug.
4. Turn on at valve.

Adjust Attachment Drive Controls

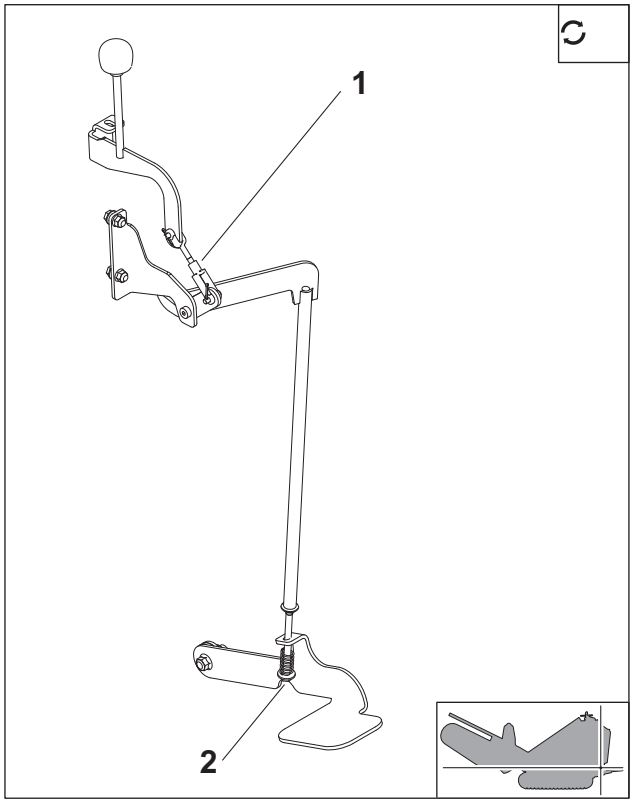
Adjust foot control if stepping on pedal moves attachment drive control handle.

To adjust foot control:

1. Stand on platform and press attachment drive foot control pedal down completely.
2. If attachment drive control handle moves, open back cover and grille to loosen screw (2).
3. Repeat steps 1 and 2 until attachment drive control handle remains in neutral when pedal is pressed completely.
4. Install back cover and grille.

To adjust control handle:

1. After foot control pedal is adjusted, step on platform, press pedal down completely and move control handle forward and backward.
2. If more resistance is desired, open rear panel and lengthen clevis (2).
3. Repeat steps 1 and 2 until handle moves with desired resistance.
4. Close rear panel.



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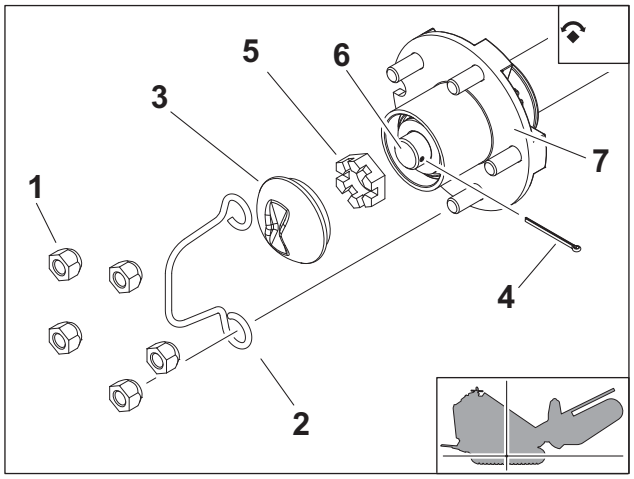
Adjust Idler Roller Bearings



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Adjust idler roller bearings to keep dirt, grass, and other foreign matter from damaging bearings as needed when hubs become loose.

1. Release track tension. See "Check Hydraulic Hoses" on page 75.
2. Remove lug nuts (1) to remove dust cap retainer (2).
3. Remove dust cap (3).
4. Remove cotter pin (4).
5. Ensure bearings are properly seated by tightening castle nut (5) to 30-40 ft•lb (40.7-54.2 N•m) while turning the hub (7).

IMPORTANT: Do not move the hub after this step is completed.

6. Loosen the castle nut.
7. Hand-tighten the castle nut.
8. Insert the cotter pin into the wheel spindle (6).

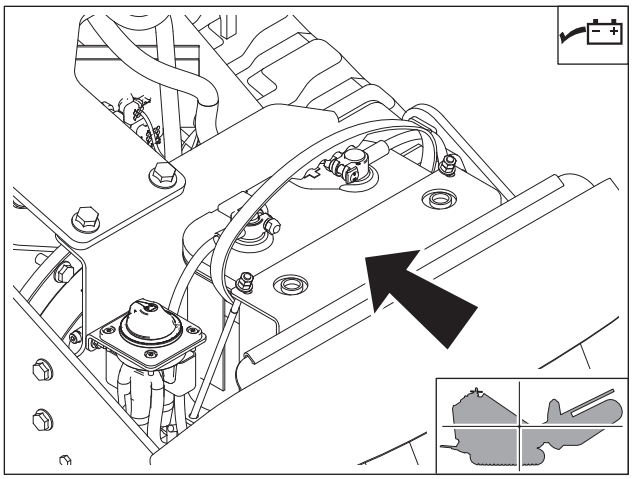
NOTICE: If hole is visible in slot but cotter pin cannot be inserted, slightly loosen or tighten castle nut to align slot with hole and insert cotter pin. If hole is not visible in slot, loosen to next available slot and install cotter pin.

9. Bend the legs of the cotter pin over the top of the spindle.

IMPORTANT: The hub should not have noticeable movement when rocked back and forth.

10. Replace dust cap retainer and lug nuts. Tighten lug nuts to 80 ft•lb (108 N•m).
11. Adjust track tension.

Check Battery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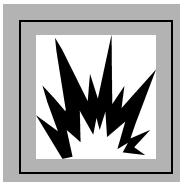
Check battery as needed. Keep battery clean and terminals free of corrosion.

To clean:

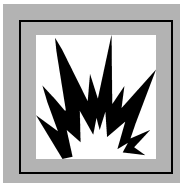
1. Turn battery disconnect switch, if equipped, to the off position.
2. Ensure that no ignition sources are near batteries.
3. Loosen and remove battery cable clamps carefully, **negative (-)** cable first.
4. Clean cable clamps and terminals to remove dull glaze.
5. Check for signs of internal corrosion in cables.
6. Connect battery cable clamps, **positive (+)** cable first.
7. Tighten any loose connections.
8. Ensure that battery tiedowns are secure.
9. Turn battery disconnect switch to the on position.



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

To help avoid injury: Do not create sparks and do not short across battery terminals for any reason.

Charge Battery



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

To help avoid injury:

- Use a single 12V maximum source for charging. Do not connect to rapid chargers or dual batteries.
- Use caution and wear personal protective equipment such as safety eyewear, when charging or cleaning battery.
- Keep sparks, flames, and any ignition source away from batteries at all times. Internal contents are extremely hazardous. Leaking fluid is corrosive. Battery may be explosive at higher temperatures.
- NEVER lean over battery when making connections.
- Do not allow vehicles to touch when charging.
- Do not attempt to charge a battery that is leaking, bulging, heavily corroded, frozen, or otherwise damaged.
- NEVER short-circuit battery terminals for any reason or strike battery posts or cable terminals.
- Refer to MSDS for additional information regarding this battery.

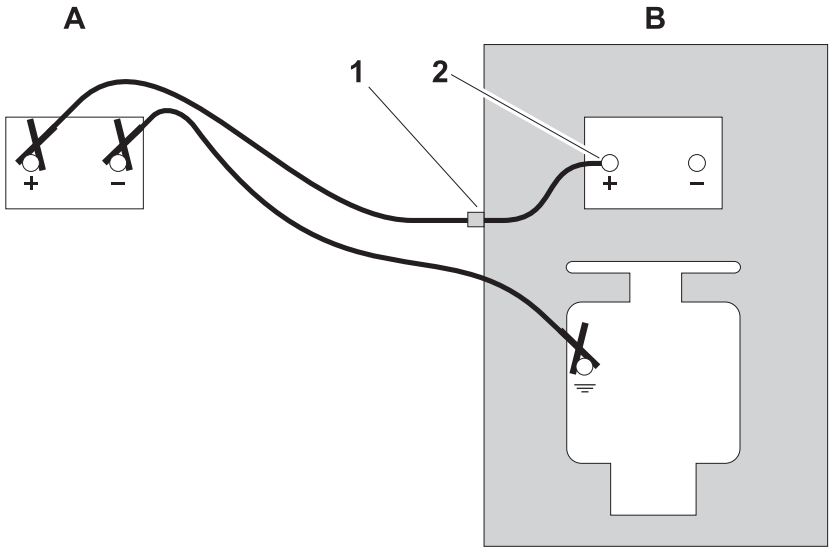
Before You Start

Electronic components can be easily damaged by electrical surges. Jump starting can damage electronics and electrical systems, and is not recommended. Try to charge the battery instead. Use quality large diameter jumper cables capable of carrying high currents (400 amps or more). Cheap cables may not allow enough current flow to charge a dead/discharged battery.

Read all steps thoroughly and review illustration before performing procedure.

Charging Procedure (Engine Off)

1. Park service vehicle close to disabled equipment but do not allow vehicles to touch. Engage parking brake in both vehicles.
2. Turn the ignition switch to the OFF position in both vehicles, and turn off all electrical loads. Disconnect the machine controller.



3. Inspect battery in disabled vehicle (B) for signs of cracking, bulging, leaking, or other damage. Connect red positive (+) jumper cable clamp to positive (+) post (2) of battery in disabled vehicle first.

IMPORTANT: Some equipment may have a positive jumper cable terminal (1) located externally. If so equipped, connect red positive (+) jumper cable clamp to terminal.

4. Connect the other red positive (+) jumper cable clamp to positive (+) post of battery (A) in the service vehicle.
5. Connect black negative (-) cable clamp to negative (-) post of battery (A) in service vehicle.
6. Connect the other black negative (-) cable clamp to the engine or frame ground on the disabled vehicle, at least 12" (305 mm) from the failed battery, as shown.
7. Operate service vehicle engine at 1500-2000 rpm for a few minutes to build an electrical charge in the failed battery.
8. Stop engine in service vehicle.
9. Remove jumper cables from the service vehicle, black negative (-) clamp first. Do not allow clamps to touch.
10. Remove black negative (-) cable clamp from the disabled engine or frame ground first.
11. Remove red positive (+) cable clamp from the disabled vehicle positive (+) battery post last.
12. Reconnect machine controller and try to start disabled vehicle.
13. If the disabled vehicle did not start, check for loose or corroded battery cable connections. Poor connections will prevent current from charging the failed battery. Clean terminals and posts if necessary and repeat steps above.

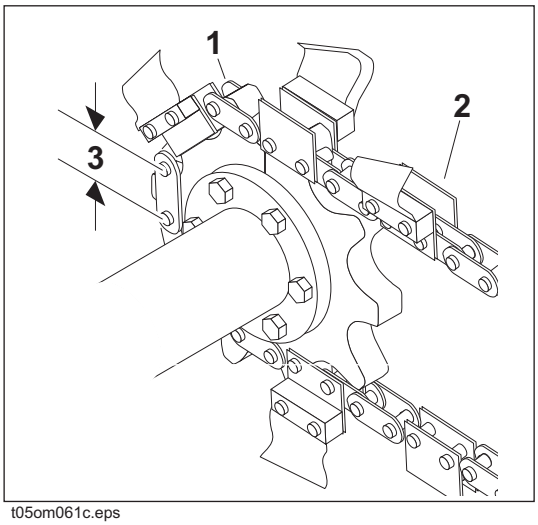
Trencher

Check Digging Chain Rollers, Sidebars, Pins, and Bushings

Perform periodic visual inspections of digging chain. Check for wear on rollers (1) and sidebars (2). Check pins and bushing wear by measuring distance (3) between chain pins and comparing it to new chain.

NOTICE:

- If sidebars are bending or getting loose on chain pins, use chain spacers to join sidebars.
- Replace worn or broken chains.
- Replace sprockets when new chain is installed.



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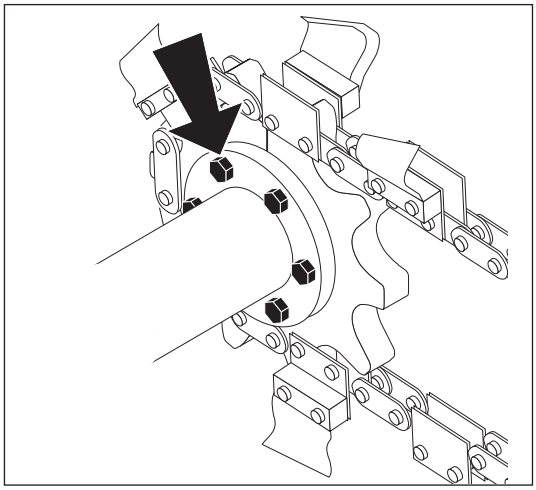
Check Digging Chain Teeth and Bits

Inspect digging chain teeth for wear as needed. Replace worn teeth with new Ditch Witch® teeth. Each unit is equipped with a standard tooth configuration. When replacing teeth, maintain original tooth pattern. Depending on soil conditions and type of chain, a different configuration might produce better results. Contact your authorized Ditch Witch dealer for more information about digging teeth patterns.

Alligator chain bits, like teeth, wear out. When tungsten cap or insert is gone, bit will wear quickly. Replace it before bit adapter is damaged.

Check Trencher Headshaft Sprocket Bolts

Check tightness of headshaft sprocket bolts as needed. Tighten lubricated bolts to 85 ft•lb (115 N•m)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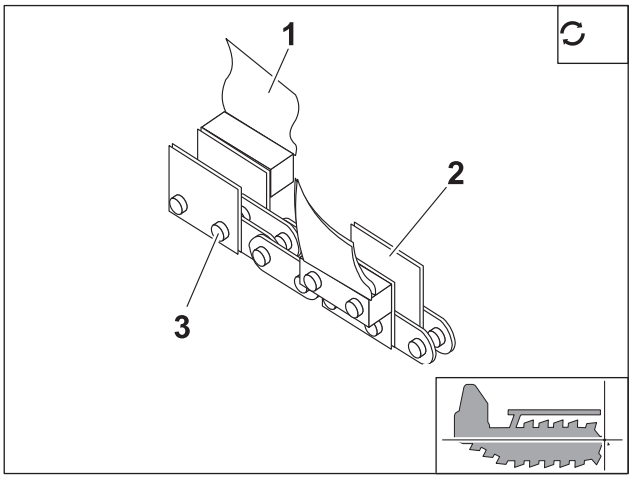
Replace Digging Chain

Visually check digging chains for wear on rollers and sidebars (2). Check pins (3) and bushing wear by measuring distance between chain pins and comparing it with a new chain. Also check digging teeth (1).

NOTICE: Replace sprockets when a new chain is installed.



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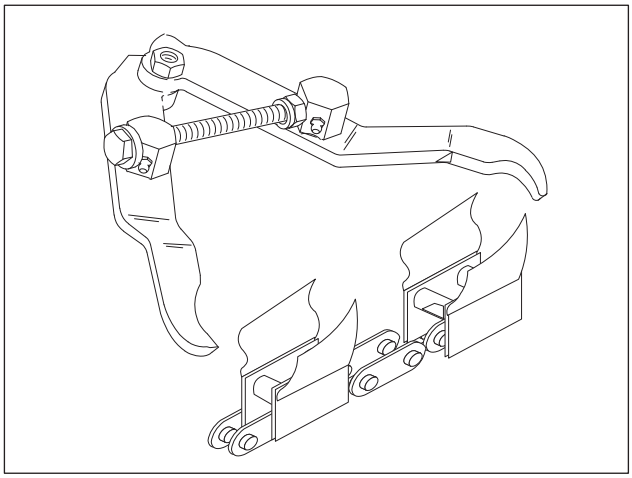
To remove chain:

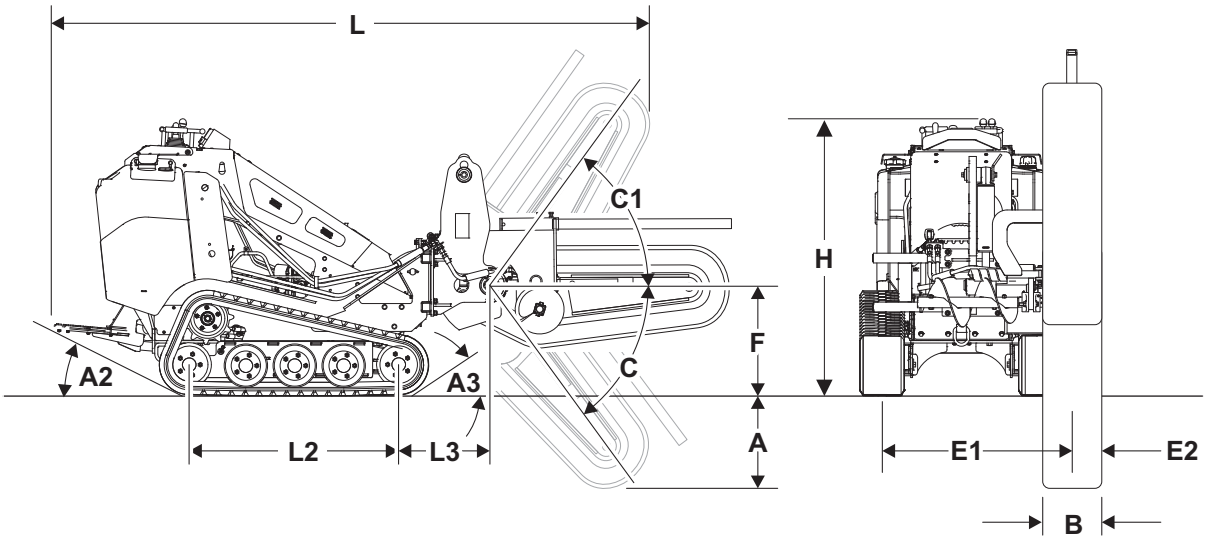
1. Fasten and adjust seat belt.
2. Start unit. See page 46 for proper start-up procedures.
3. Move attachment direction/speed control until digging chain connector pin is on top of boom.
4. Lower boom to ground.
5. Engage parking brake.
6. Turn ignition switch to STOP.
7. Roller booms: Secure chain by clamping links on either side of connector pin with chain jaws (shown). Squeeze jaws to reduce pressure on connector pin.

   Sprocket booms: Lock rear idler sprocket.


Digging_Chain_Remove_01.eps

Specifications

ST37x



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Dimensions		U.S.	Metric
	Overall height of machine	57 in	1450 mm
L	Overall length of machine, without chain	104.5 in	2654 mm
	Overall length of machine, with 36" chain	130 in	3302 mm
	Overall width of machine	42 in	1065 mm
	Width of machine, excluding tracks	35 in	890 mm
L2	Wheelbase/track length	43 in	1092 mm
A2	Angle of departure	27°	27°
A3	Angle of approach	30°	30°
	Ground clearance, min (center)	7.4 in	188 mm
	Ground clearance, min (side)	3.7 in	94 mm
A	Trench depth, maximum	36 in	914 mm
B	Trench width, maximum	16 in	406 mm
C	Boom travel down	60°	60°
C1	Boom travel up	60°	60°
E1	Centerline trench to outside edge of unit, left	4-20 in	102-508 mm

Dimensions		**U.S.**	**Metric**
E2	Centerline trench to outside edge of unit, right	21-37 in	533-940
F	Headshaft height	23 in	584 mm
L3	Headshaft overhang	18 in	457 mm
	Swing radius, front, w/36" chain	81 in	2057 mm
	Swing radius, rear	44 in	1120 mm
	Digging chain: 50K		
Machine weight (30" boom, 12" combo chain) Includes machine weight, 165-lb (75-kg) operator		4110 lb	1864 kg

Power	**U.S.**	**Metric**
Engine: Yanmar® 3TNV88C, diesel, EPA Tier 4 Final, EU Stage IIIA		
Number of cylinders	3	
Displacement	100.1 in^3	1.64 L
Bore	3.46 in	88 mm
Stroke	3.54 in	90 mm
Manufacturer's gross power rating (per SAE J1955)	36.9 hp	27.5 kW
Estimated net power rating (per SAE 1348)	35.1 hp	26.2 kW
Rated engine speed	3000 rpm	3000 rpm
Maximum tilt angle, fore and aft *	30°	30°
Maximum tilt angle, side to side *	30°	30°

* Exceeding these operating angles will cause engine damage. This DOES NOT imply that the machine is stable to maximum angle of safe engine operation.

Performance	**U.S.**	**Metric**
Ground drive speed, forward and reverse	4.7 mph	7.6 km/h
Ground pressure, 9" (230 mm) tracks *	5.5 psi	0.38 bar

* Includes machine weight and 165 lb (75 kg) operator.

Hydraulic System	U.S.	Metric
Auxiliary: double gear pump		
Combined flow rate	13.9 gpm	52.7 L/min
Pressure	3625 psi	250 bar
Chain speed	369 fpm	112 m/min
Ground drive: dual hydrostat		
Flow rate	15 gpm	56.8 L/min
Pressure	3625 psi	250 bar

Fluid Capacities	U.S.	Metric
Fuel tank	10.5 gal	40 L
Engine oil, with filter	5.0 qt	4.7 L
Hydraulic reservoir	9.2 gal	35 L
Coolant capacity	1.28 gal	4.8 L

Battery
SAE reserve capacity 110 min, SAE cold crank @ 0°F (-18°C) 800 amp, 12V electrical system

Noise Levels
Operator 89 dBA sound pressure per ISO 6394 Exterior 103 dBA sound power per ISO 6393

Vibration Level
Average vibration transmitted to the operator's hand/arm during normal operation is 2.51 m/sec^2. Average vibration transmitted to the whole body during normal operation is 1.11 m/sec^2.

Specifications are called out according to SAE recommended practices. Specifications are general and subject to change without notice. If exact measurements are required, equipment should be weighed and measured. Due to selected options, delivered equipment may not necessarily match that shown.

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 Ditch Witch factory that fail due to a defect in material or workmanship within one (1) year of first commercial use. 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 Ditch Witch Product Support (DWPS) or its authorized dealer. DWPS will provide the location of its inspection facilities or its nearest authorized dealer upon inquiry. DWPS 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 the Ditch Witch factory.

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 the DWPS department, P.O. Box 66, Perry, OK 73077-0066, or contact your local dealer.

First version: 1/91; Latest version: 8/16

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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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

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( )

Phone Number With Area Code

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Name of Ditch Witch Dealership

Your Signature

Service Record

Service Performed	Date	Hours

Service Performed	Date	Hours

Appendix

Chapter Contents

Engine Diagnostic Codes

Engine Diagnostic Trouble Codes

Yanmar 3TNV88C engine

P code	SPN	FMI	Part	State
P0336	522400	2	Crank speed sensor	Crank signal malfunction
P0337		5		No crank signal
P0341	522401	2	Cam speed sensor	Cam signal malfunction
P0342		5		No cam signal
P1341		7		Angle offset failure
P0008	523249	5	Crank speed, cam speed sensor	No signal on both crank and cam speed sensor
P0123	91	3	Accelerator sensor 1	Accelerator sensor 1 (excessive sensor output)
P0122		4		Accelerator sensor 1 (insufficient sensor output)
P0223	28	3	Accelerator sensor 2	Accelerator sensor 2 (excessive sensor output)
P0222		4		Accelerator sensor 2 (insufficient sensor output)
P1646	522624	7	Accelerator sensor 1 + 2	Dual accelerator sensor (closed position) failure
P1647	522623	7		Dual accelerator sensor (open position) failure
P0228	29	3	Accelerator sensor 3	Accelerator sensor 3 (excessive sensor output)
P0227		4		Accelerator sensor 3 (insufficient sensor output)
P1227		8	Pulse sensor	Pulse sensor failure (pulse communication)
P1126	28	0	Accelerator sensor 3	Accelerator sensor 3 failure (foot pedal in open position)
P1125		1		Accelerator sensor 3 failure (foot pedal in closed position)
P02E9	51	3	Intake throttle opening sensor	Intake throttle opening sensor fault (high voltage)
P02E8		4		Intake throttle opening sensor fault (low voltage)
P0238	102	3	EGR low pressure side sensor	EGR low pressure side sensor fault (high voltage)
P0237		4		EGR low pressure side sensor fault (low voltage)
P0236		13		EGR low pressure side sensor fault (abnormal learning value)
P0473	1209	3	EGR high pressure side sensor	EGR high pressure side sensor fault (high voltage)
P0472		4		EGR high pressure side sensor fault (low voltage)
P0471		13		EGR high pressure side sensor fault (abnormal learning value)
P0118	110	3	Cooling water temperature sensor	Cooling water temperature sensor fault (high voltage)
P0117		4		Cooling water temperature sensor fault (low voltage)
P0217		0		Cooling water temperature abnormal high (overheat)
P0113	172	3	New air temperature sensor	New air temperature sensor fault (high voltage)
P0112		4		New air temperature sensor fault (low voltage)
P0183	174	3	Fuel temperature sensor	Fuel temperature sensor fault (HIGH voltage)
P0182		4		Fuel temperature sensor fault (low voltage)
P0168		0		Fuel temperature sensor temperature abnormal high
P0193	157	3	Rail pressure sensor	Rail pressure sensor fault (high voltage)
P0192		4		Rail pressure sensor fault (low voltage)
P2455	3251	3	DPF differential pressure sensor	DPF differential pressure sensor fault (high voltage)
P2454		4		DPF differential pressure sensor fault (low voltage)
P2452		0		DPF differential pressure sensor abnormal high
P2453		13		DPF differential pressure sensor (abnormal learning value)
P1455	3609	3	DPF high pressure side sensor	DPF high pressure side sensor fault (high voltage)
P1454		4		DPF high pressure side sensor fault (low voltage)
P1428	3242	3	DPF inlet temperature sensor	DPF inlet temperature sensor fault (high voltage)
P1427		4		DPF inlet temperature sensor fault (low voltage)
P1436		0		DPF inlet temperature sensor abnormal high

P1434	3250	3	DPF intermediate temperature sensor	DPF intermediate temperature sensor fault (high voltage)
P1435		4		DPF intermediate temperature sensor fault (low voltage)
P0420		1		DPF intermediate temperature sensor temperature abnormal low
P1426		0		DPF intermediate temperature sensor temperature abnormal high (post-injection failure)
P2229	108	3	Atmospheric pressure sensor	Atmospheric pressure sensor fault (high voltage)
P2228		4		Atmospheric pressure sensor fault (low voltage)
P1231		10		Atmospheric pressure sensor characteristic fault
P041D	412	3	EGR gas temperature sensor	EGR gas temperature sensor fault (high voltage)
P041C		4		EGR gas temperature sensor fault (low voltage)
P040D	105	3	Intake manifold temperature sensor	Intake manifold temperature sensor fault (high voltage)
P040C		4		Intake manifold temperature sensor fault (low voltage)
P0546	173	3	Exhaust manifold temperature sensor	Exhaust manifold temperature sensor fault (high voltage)
P0545		4		Exhaust manifold temperature sensor fault (low voltage)
P068B	1485	7	Main relay	Main relay contact stuck
P068A		2		Main relay early opening
P0543	522243	5	Startup assist relay	Startup assist relay interrupted
P0541		6		Startup assist relay GND interrupted
P0204 (4TNV), P0203 (3TNV)	651 (4TNV), 652 (3TNV)	5	**Injector 1** 4TNV: Cyl No. 4, 3TNV: Cyl No. 3; **Corresponding port** 4TNV: 1-2, 3TNV: 1-3	Injector 1 open circuit (inherent location of the injector)
P0271 (4TNV), P0268 (3TNV)		6		Injector 1 coil short circuit
P1271 (4TNV), P1262 (3TNV)		3		Injector 1 short circuit
P0202	653	5	**Injector 2** 4TNV: Cyl No. 2, 3TNV: Cyl No. 2; **Corresponding port** 4TNV: 2-1, 3TNV: 1-2	Injector 2 open circuit (inherent location of the injector)
P0265		6		Injector 2 coil short circuit
P1265		3		Injector 2 short circuit
P0201	654	5	**Injector 3** 4TNV: Cyl No. 1, 3TNV: Cyl No. 1; **Corresponding port** 4TNV: 2-2, 3TNV: 1-1	Injector 3 open circuit (inherent location of the injector)
P0262		6		Injector 3 coil short circuit
P1262		3		Injector 3 short circuit
P0203	652	5	**Injector 4** 4TNV: Cyl No. 3; **Corresponding port** 4TNV: 1-1	Injector 4 open circuit (inherent location of the injector)
P0268		6		Injector 4 coil short circuit
P1268		3		Injector 4 short circuit
P0611	4257	12	Injector (common)	Injector drive IC error
P1146	2797	6		Injector drive circit (Bank1) short circuit (4TN: Common circuit for No. 1, No. 4 and all 3TN cylinders)
P1149	2798	6		Injector drive circit (Bank2) short circuit (4TN: Circuit for No. 2 and No. 3 cylinders)
P1648	523462	13	Injector (correction value)	IQA corrected injection amount for injector 1 error
P1649	523463	13		IQA corrected injection amount for injector 2 error
P1650	523464	13		IQA corrected injection amount for injector 3 error
P1651	523465	13		IQA corrected injection amount for injector 4 error

P1641	522571	3	SCV (MPROP)	High-pressure pump drive circuit (low side VB short-circuit)
P1643		6		High-pressure pump drive circuit (low side GND short-circuit)
P0629	633	3		High-pressure pump drive circuit (high side VB short-circuit)
P1642		6		High-pressure pump drive circuit (high side GND short-circuit)
P0627		5		High-pressure pump drive circuit (open circuit)
P062A	522572	6		High-pressure pump drive circuit (drive current (high level))
P1645		11		High-pressure pump drive circuit (pump overload error)
P0088	157	0	Abnormal rail pressure	Actual rail pressure rise error
P0094		18		Rail pressure deviation error during the actual rail pressure drop
P0093		15		Rail pressure deviation error during the actual rail pressure rise
P000F		16	PLV (Common rail pressure limit valve)	PLV open valve
P1666	523469	0		Rail pressure fault (the times of PLV valve opening error)
P1667	523470	0		Rail pressure fault (the time of PLV valve opening error)
P1668	523489	0		Rail pressure fault (the actual rail pressure is too high during PRV limp home)
P1665	523468	9		Rail pressure fault (controlled rail pressure error after PLV valve opening)
P1669	523491	0	Rail pressure control	Rail pressure fault (injector B/F temperature error during PLV4 limp home)
P1670	523460	7		Rail pressure fault (operation time error during RPS limp home)
P0219	190	16	Overspeed	Overspeed
P0660	2950	5	Intake throttle drive circuit	No-load of throttle valve drive H bridge circuit
P1658		3		Power short circuit of throttle valve drive H bridge output 1
P1659		4		GND short circuit of throttle valve drive H bridge output 1
P1660		6		Overload on the drive H bridge circuit of throttle valve
P1661	2951	3		VB Power short circuit of throttle valve drive H bridge output 2
P1662		4		GND short circuit of throttle valve drive H bridge output 2
U0292	522596	9	CAN2	TSC1 (CAN message) reception time out (SA1)
U1301	522597	9		TSC1 (CAN message) reception time out (SA2)
U1292	522599	9		Y_ECR1 (CAN message) reception time out
U1293	522600	9		Y_EC (CAN message) reception time out
U1294	522601	9		Y_RSS (CAN message) reception time out
U1296	522603	9		VH (CAN message) reception time out
U1298	522605	9		Y_ECM3 (CAN message) reception time out
U0168	237	31		VI (CAN message) reception time out
U3002		13		VI (CAN message) reception data fault
U1300	522609	9		Y_ETCP1 (CAN message) reception time out
U1302	522618	9		EBC1 (CAN message) reception time out
U1303	522619	9		Y_DPFIF (CAN message) reception time out
U010B	522610	9	CAN1	CAN1 (for EGR): reception time out
U1107	522611	9		Exhaust throttle (CAN message from the exhaust throttle time out)

P0404	2791	0	EGR valve	EGR over-voltage fault
P1404		1		EGR under-voltage fault
P1409		7		EGR feedback malfunction
U0401		9		EGR ECM data fault
P0403		12		Open circuit between the EGR motor coils
P1405	522579	12		Short circuit between the EGR motor coils
P0488	522580	12		EGR position sensor malfunction
P148A	522581	7		EGR stuck open valve malfunction
P049D	522582	7		EGR initialization malfunction
P1410	522183	1		EGR high temperature thermistor malfunction
P1411	522184	1		EGR low temperature thermistor malfunction
U1401	522617	12		EGR target value out of range
P1438	522746	12	Exhaust throttle	Exhaust throttle (voltage fault)
P1439	522747	12		Exhaust throttle (motor fault)
P1440	522748	12		Exhaust throttle (sensor system fault)
P1441	522749	12		Exhaust throttle (MPU fault)
P1442	522750	12		Exhaust throttle (PCB fault)
P1443	522751	19		Exhaust throttle (CAN fault)
P0601	630	12	EEPROM	EEPROM memory deletion error
P160E	522576	12		EEPROM memory read error
P160F	522578	12		EEPROM memory writing error