Form No. 3426-517 Rev E

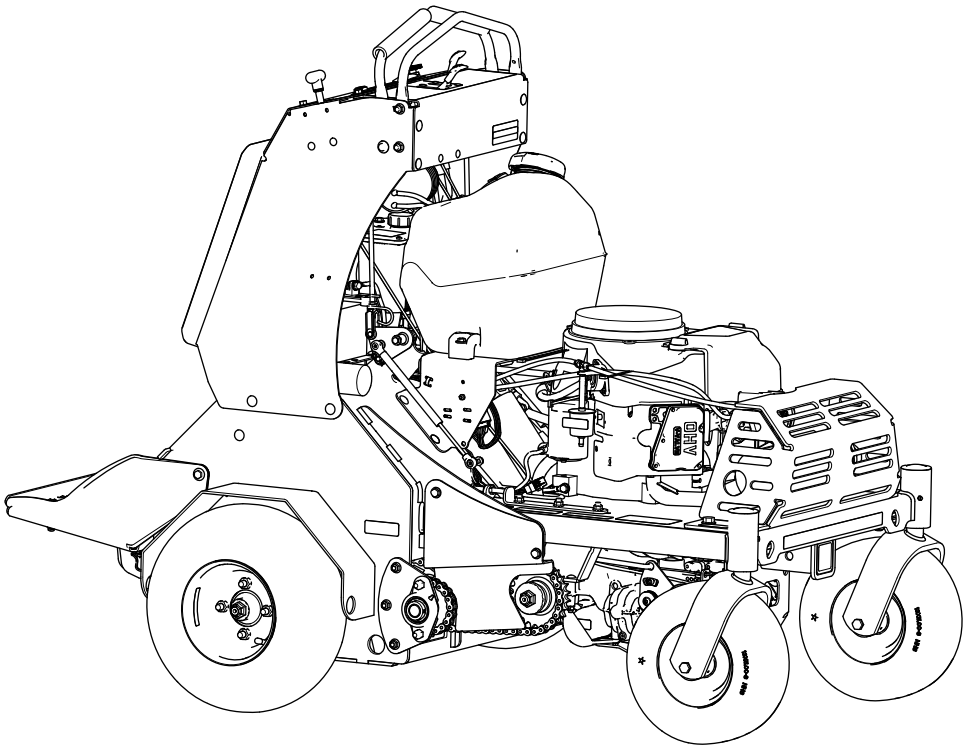
TORO®

Count on it.

Operator's Manual

30in Stand-On Aerator

Model No. 29521—Serial No. 400000000 and Up



Register at www.Toro.com.
Original Instructions (EN)

3426-517 E

It is a violation of California Public Resource Code Section 4442 or 4443 to use or operate the engine on any forest-covered, brush-covered, or grass-covered land unless the engine is equipped with a spark arrester, as defined in Section 4442, maintained in effective working order or the engine is constructed, equipped, and maintained for the prevention of fire.

The enclosed engine owner's manual is supplied for information regarding the US Environmental Protection Agency (EPA) and the California Emission Control Regulation of emission systems, maintenance, and warranty. Replacements may be ordered through the engine manufacturer.

⚠ WARNING

CALIFORNIA
Proposition 65 Warning

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling.

Use of this product may cause exposure to chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

Introduction

This aerator is intended to be used by trained operators in residential and commercial applications. It is primarily designed for aerating areas of well-maintained lawns on residential grounds, parks, sports fields, and on commercial grounds.

Read this information carefully to learn how to operate and maintain your product properly and to avoid injury and product damage. You are responsible for operating the product properly and safely.

Visit www.Toro.com for product safety and operation training materials, accessory information, help finding a dealer, or to register your product.

Whenever you need service, genuine Toro parts, or additional information, contact an Authorized Service Dealer or Toro Customer Service and have the model and serial numbers of your product ready. Figure 1 identifies the location of the model and serial numbers on the product. Write the numbers in the space provided.

Important: **With your mobile device, you can scan the QR code on the serial number decal (if equipped) to access warranty, parts, and other product information.**

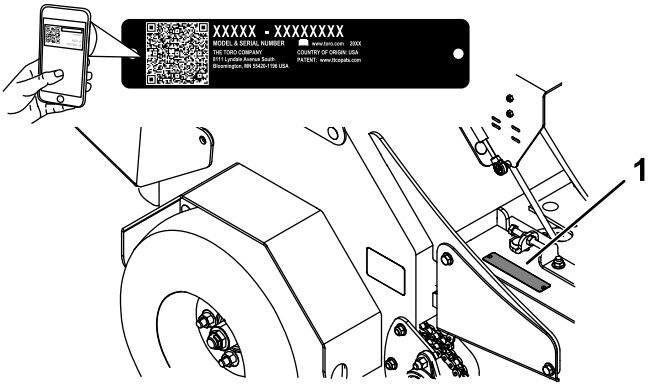


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Figure 1

1. Location of the model and serial numbers

Model No. _____

Serial No. _____

This manual identifies potential hazards and has safety messages identified by the safety-alert symbol (Figure 2), which signals a hazard that may cause serious injury or death if you do not follow the recommended precautions.

g000502

Figure 2
Safety-alert symbol

This manual uses 2 words to highlight information. **Important** calls attention to special mechanical information and **Note** emphasizes general information worthy of special attention.

Contents

Safety

Safety Alert Symbol

This Safety Alert Symbol (Figure 3) is used both in this manual and on the machine to identify important safety messages which must be followed to avoid accidents.

This symbol means: **ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!**

g000502

Figure 3
Safety Alert Symbol

The safety alert symbol appears above information which alerts you to unsafe actions or situations and will be followed by the word **DANGER**, **WARNING**, or **CAUTION**.

DANGER: Indicates an imminently hazardous situation which, if not avoided, **Will** result in death or serious injury.

WARNING: Indicates a potentially hazardous situation which, if not avoided, **Could** result in death or serious injury.

CAUTION: Indicates a potentially hazardous situation which, if not avoided, **May** result in minor or moderate injury.

This manual uses two other words to highlight information. **Important** calls attention to special mechanical information and **Note** emphasizes general information worthy of special attention.

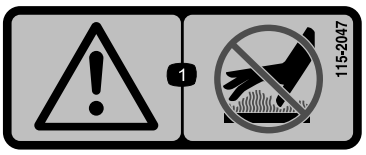
General Safety

This machine is capable of amputating hands and feet and of throwing objects. Toro designs and tests this machine to offer reasonably safe service; however, failure to comply with safety instructions may result in injury or death.

- Read, understand, and follow all instructions and warnings in the Operator's Manual and other training material, on the machine, engine, and attachments. All operators and mechanics should be trained. If the operator(s) or mechanic(s) can not read this manual, it is the owner's responsibility to explain this material to them; other languages may be available on our website.
- Only allow trained, responsible, and physically capable operators that are familiar with the safe operation, operator controls, and safety signs and instructions to operate the machine. Never let children or untrained people operate or service the equipment. Local regulations may restrict the age of the operator.
- Do Not operate the machine near drop-offs, ditches, embankments, water, or other hazards.
- Do Not put your hands or feet near moving components of the machine.
- Never operate the machine with damaged guards, shields, or covers. Always have safety shields, guards, switches and other devices in place and in proper working condition.
- Stop the machine, shut off the engine, and remove the key before servicing, fueling, or unclogging the machine.

Safety and Instructional Decals

Safety decals and instructions are easily visible to the operator and are located near any area of potential danger. Replace any decal that is damaged or missing.



decal115-2047

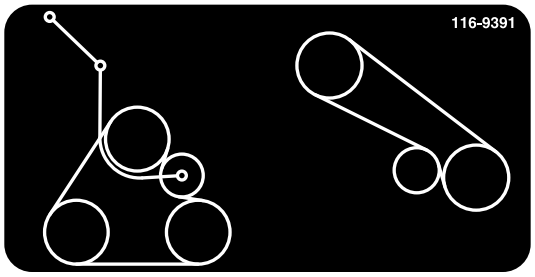
115-2047

1. Warning—do not touch the hot surface.

decal115-4212

115-4212

1. Hydraulic fluid level
2. Read the *Operator's Manual*.
3. Warning—do not touch the hot surface.



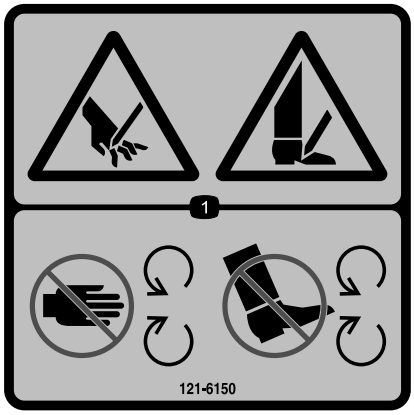
decal116-9391

116-9391

decal120-9570

120-9570

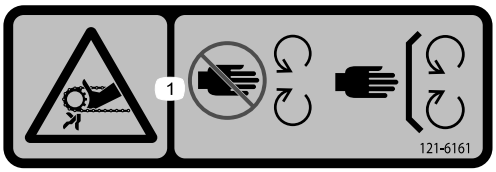
1. Warning—stay away from moving parts; keep all guards and shields in place.



decal121-6150

121-6150

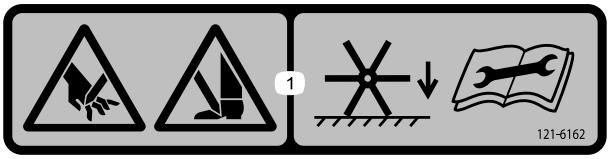
1. Cutting hazard of hand and foot—stay away from moving parts.



decal121-6161

121-6161

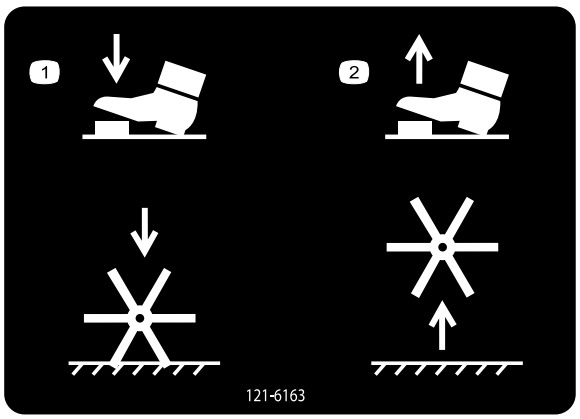
1. Entanglement hazard, belt—stay away from moving parts; keep all guards in place.



decal121-6162

121-6162

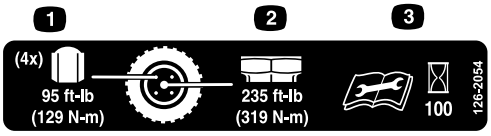
1. Cutting/dismemberment hazard of hand or foot—lower the tines to the ground; read the *Operator's Manual* for the disassembly procedure.



decal121-6163

121-6163

1. Press to lower the tines.
2. Release to raise the tines.



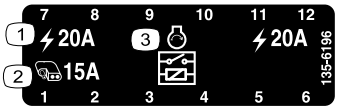
decal126-2054

126-2054

1. Wheel lug nut torque 129 N·m (95 ft-lb) (4x)
2. Wheel hub nut torque 319 N·m (235 ft-lb)
3. Read and understand the *Operator's Manual* before performing any maintenance; check the torque every 100 hours.

decal133-8062

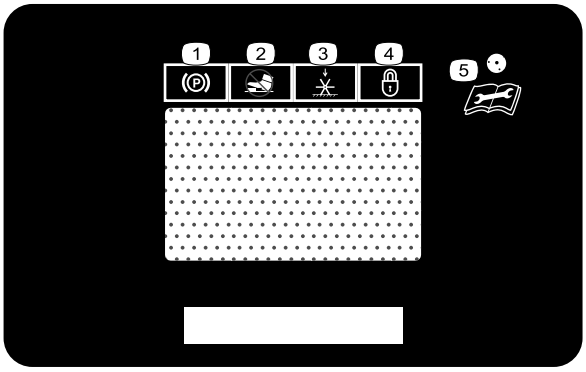
133-8062



decal135-6196

135-6196

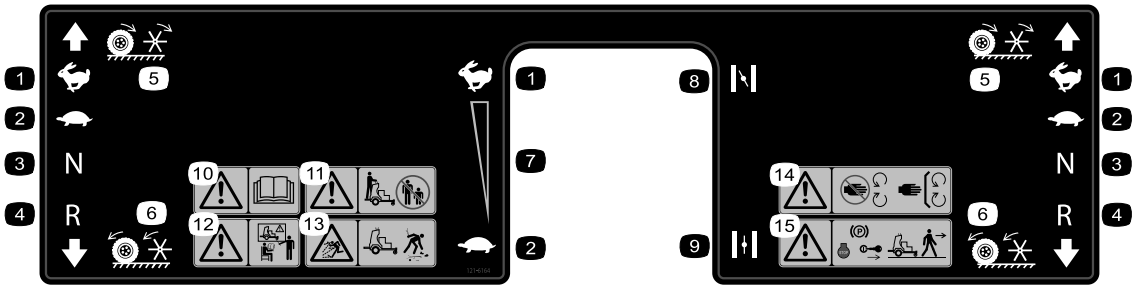
1. Electric
2. Accessory
3. Engine start relay



decal135-1854

135-1854

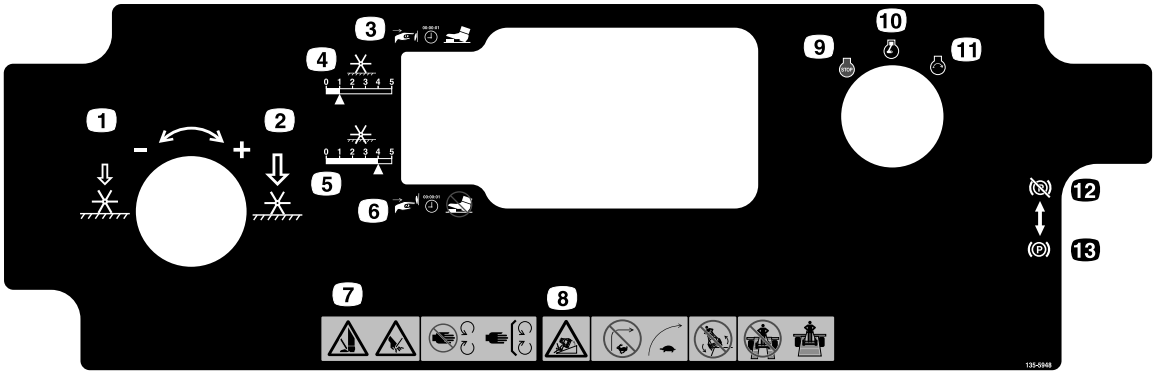
1. Parking brake
2. Tine engagement lockout switch
3. Tines—down
4. Depth setting—lock
5. Read the *Operator's Manual* before performing maintenance.



decal121-6164

121-6164

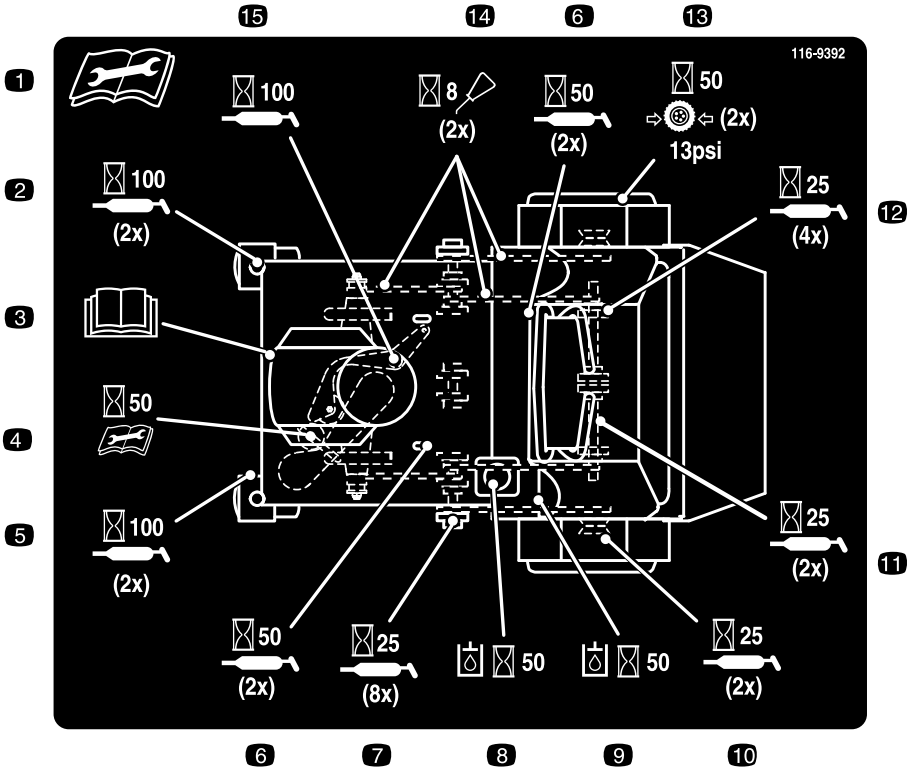
1. Fast
2. Slow
3. Neutral
4. Reverse
5. Wheels and tines rotate when moving forward
6. Wheels and tines rotate when moving backward
7. Continuous variable setting
8. Choke—on
9. Choke—off
10. Warning—read the *Operator's Manual*.
11. Warning—keep bystanders away.
12. Warning—do not operate the machine unless you are trained.
13. Thrown object hazard—pick up debris before operating the machine.
14. Warning—stay away from moving parts; keep all guards in place.
15. Warning—shut off the engine, engage the parking break, and remove the key before leaving the machine.



decal135-5948

135-5948

1. Rotate counterclockwise to decrease pressure.
2. Rotate clockwise to increase pressure.
3. Press and hold for 1 second to turn on—tine ground engagement foot switch unlock
4. Electronic tine depth—decrease
5. Electronic tine depth—increase
6. Press and hold for 1 second to turn off—tine ground engagement foot switch lock
7. Cutting/dismemberment hazard of hand or foot, tines–stay away from moving parts; keep all guards in place.
8. Tipping hazard—Do not turn sharply while traveling fast; slow down and turn gradually. Do not operate the machine near drop-offs. Do not use split ramps; use full width ramps to load a machine for transport.
9. Engine—Off
10. Engine—On
11. Engine—Start
12. Parking brake—disengage
13. Parking brake—engage



decal116-9392

116-9392

1. Read and understand the *Operator's Manual* before servicing this machine.
2. Grease the front caster pivots (2x) every 100 hours.
3. Refer to the engine owner's manual for service.
4. Check the auxiliary pump-drive belt tension every 50 hours.
5. Grease the front caster wheel bearings (2x) every 100 hours.
6. Grease the control pivots (4x) every 50 hours.
7. Grease the jackshaft bearings (8x) every 25 hours.
8. Check the hydraulic-fluid level (2x) every 50 hours.
9. Check the auxiliary hydraulic tank every 50 hours.
10. Grease the wheel bearings (2x) every 25 hours.
11. Grease the tine assembly idlers (2x) every 25 hours.
12. Grease the tine shaft bearings (4x) every 25 hours.
13. Check the tire pressure, 13 psi, (2x) every 50 hours.
14. Clean and oil the chains and check the chain tension (2x) every 8 hours.
15. Grease the belt idler pivot every 100 hours.

Setup

Media and Additional Parts

Description	Qty.	Use
Operator's Manual	1	Read before operating the machine.
Key	2	Start the machine.

1

Checking Tire Air Pressure

No Parts Required

Procedure

Check the air pressure in the drive tires, and adjust the pressure as needed; refer to Checking the Air Pressure in the Tires (page 46).

Note: You do not adjust air pressure for the semi-pneumatic caster tires.

2

Servicing the Battery

No Parts Required

Procedure

Note: The machine is shipped with a filled, lead-acid battery.

1. Move the key switch to the OFF position and remove the key.
2. Measure the voltage of the battery with a voltmeter.
3. Use the table that follows to locate the charge state or the battery, and if needed, the battery-charger setting and charging interval recommended to charge the battery to 12.6 V or greater; refer to the battery charge table below.

   Important: **Make sure that the negative battery cable is disconnected, and the battery charger used for charging the battery has an output of 16 V and 7 A or less to avoid damaging the battery (see chart for recommended charger settings).**

Battery Charge Table

Voltage Reading	Percent Charge	Maximum Charger Settings	Charging Interval
12.6 or greater	100%	16 V/ 7 A	No charging required
12.4 to 12.6	75 to 100%	16 V/ 7 A	30 minutes
12.2 to 12.4	50 to 75%	16 V/ 7 A	1 hour
12.0 to 12.2	25 to 50%	14.4 V/ 4 A	2 hours
11.7 to 12.0	0 to 25%	14.4 V/ 4 A	3 hours
11.7 or less	0%	14.4 V/ 2 A	6 hours or more

4. If the positive cable is also disconnected, connect the **positive (red) cable** to the positive battery terminal and slip the terminal cover over the positive terminal.
5. Remove the screw, washer, and ground cable from the engine. Connect the negative battery cable as shown in Figure 4.

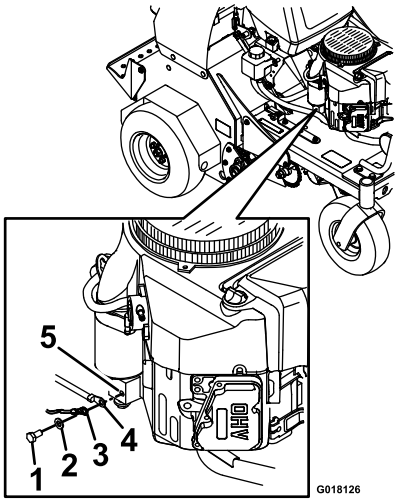


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Figure 4

1. Screw
2. Washer
3. Ground wire
4. Negative battery cable
5. Engine

Note: If time does not permit charging the battery or if charging equipment is not available, connect the negative battery cables and run the vehicle continuously for 20 to 30 minutes to charge the battery.

3

Servicing the Engine Oil

No Parts Required

Procedure

The engine is shipped with oil; check the engine-oil level and, if necessary, add oil to the appropriate level. Refer to Checking the Engine-Oil Level (page 37) for instructions and the oil specification.

4

Servicing the Transmission Fluid

No Parts Required

Procedure

The machine is shipped with transmission fluid; check the transmission-fluid level and, if necessary, add fluid to the appropriate level. Refer to Checking the Transmission Fluid Level (page 53) for instructions and the oil specification.

5

Servicing the Auxiliary Hydraulic Fluid

No Parts Required

Procedure

The machine is shipped with hydraulic fluid; check the hydraulic-fluid level and, if necessary, add fluid to the appropriate level. Refer to Checking the Auxiliary Hydraulic-Fluid Level (page 51) for instructions and the oil specification.

Product Overview

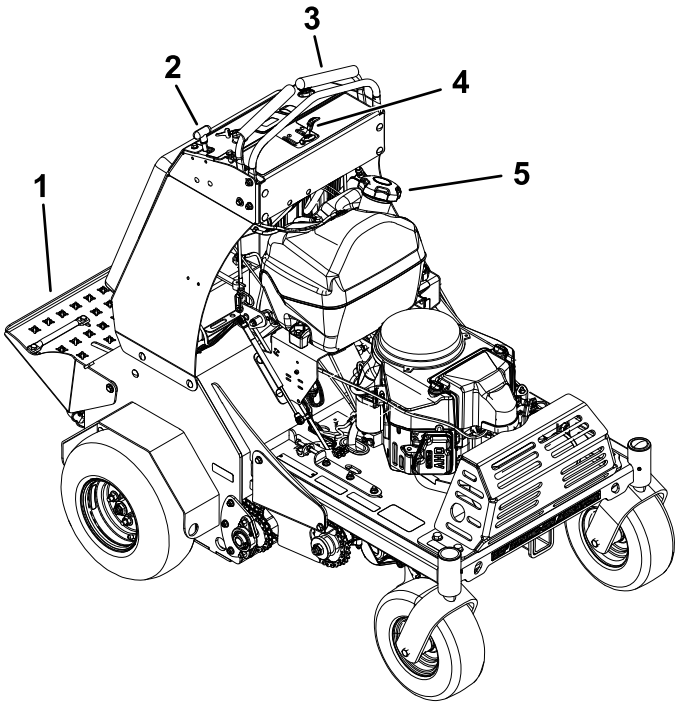

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Figure 5

1. Platform
2. Parking-brake knob
3. Motion-control levers
4. Engine controls
5. Fuel cap

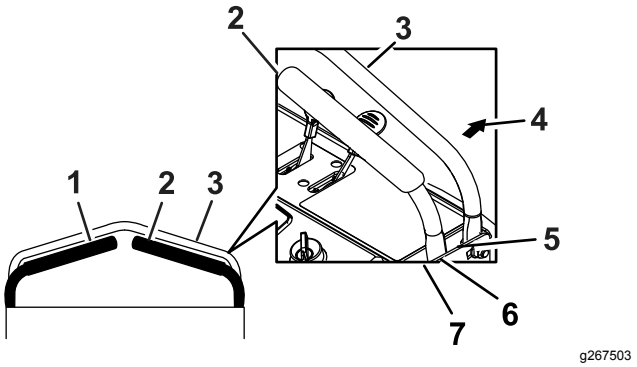
Controls

Motion-Control Levers

The motion-control levers are located on each side of the top console and control the forward and reverse motion of the machine.

Move the levers forward or backward to control the drive wheel on the same side forward or reverse respectively. The wheel speed is proportional to the amount you move the lever.

Important: **The tines rotate when the motion-control levers are moved out of the NEUTRAL position.**



g267503

Figure 6

1. Left motion-control lever
2. Right motion-control lever
3. Front reference bar
4. Front of the machine
5. Forward
6. Neutral
7. Reverse

Throttle Lever

The throttle lever (Figure 7) is located on the control console (red lever).

Use the throttle lever to control engine speed. Move the throttle lever forward to increase engine speed; moving the throttle lever rearward to decrease the engine speed.

Note: Move the throttle lever forward into the detent for full throttle.

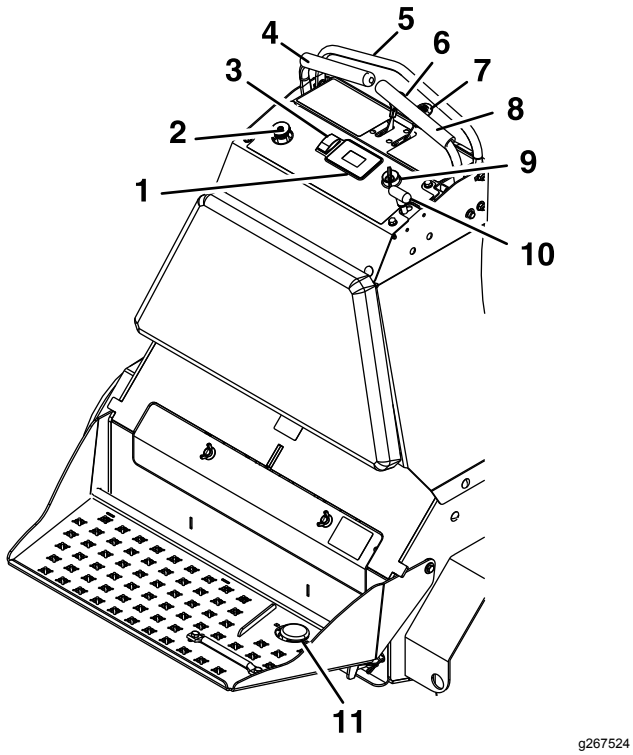
Choke Lever

The choke lever (Figure 7) is located on the control console (black lever).

Use the choke lever is used to aid in starting a cold engine. Move the choke lever forward to set the choke to the ON position; move the choke lever to the rearward to reduce the choke.

Note: Pull the choke lever back into the detent to set the choke to the OFF position.

Note: Do not run a warm engine with the choke in the ON position.



g267524

Figure 7

1. Hour meter/tine-engagement display
2. Operator weight adjustment control
3. Multi-function switch
4. Left motion-control lever
5. Front reference bar
6. Throttle lever
7. Choke lever
8. Right motion-control lever
9. Ignition switch
10. Parking-brake handle
11. Tine ground-engagement foot switch

Parking-Brake Handle

The parking-brake handle is located on the control console, to the right of the key switch (Figure 7).

Note: The brake handle engages a parking brake in each of the transmissions.

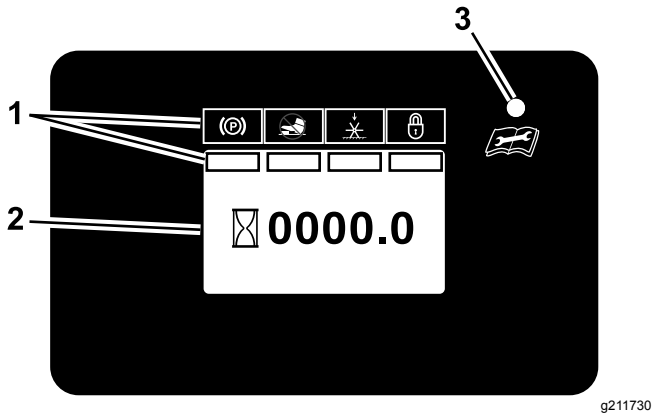
- To engage the parking brake, pull the handle out and slide it rearward.
- To release the parking brake, push the handle forward into the detent.

When parking on a steep slope, chock or block the wheels in addition to engaging the parking brake. Tie down the machine and engage the parking brake when transporting the machine.

Hour Meter/Tine Engagement Display

Located to the left of the ignition switch on the control console.

- The hour meter monitors and displays the engine hours.



g211730

Figure 8

Hour meter display

1. LCD Indicators/Information screen
2. Hour display
3. LED status light

Hours are displayed when the key is off or when the machine is running. Hours are not displayed when the machine is aerating.

Note: The LCD indicator appears in the park brake setting when it meets the “safe to start” mode (parking brake engaged).

- The tine-engagement display monitors and displays the electronic tine-depth setting.

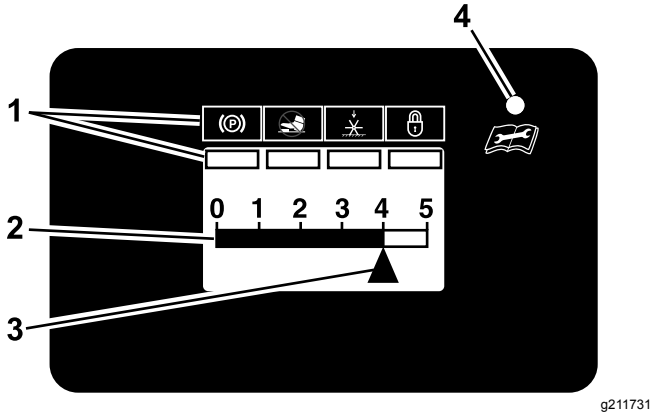


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Figure 9

Tine-engagement display

1. LCD Indicators/Information screen
2. Tine depth status bar
3. Tine depth setting indicator
4. LED status light

There are 2 ways to activate the display:

1. Tap the multi-function switch either up or down to display the tine-engagement meter.
2. Step on the tine ground-engagement foot switch.

A higher number on the status bar increases the length of the aeration plug and a lower number decreases it.

Note: If the plug length is not desired length, the machine may need to be adjusted to accommodate for the weight of the operator; refer to Adjusting the Operator Weight Control Setting (page 24) for more information.

LED Status Lights

Located on the right side of the hour meter/tine-engagement display.

The LED is multi-colored to indicate the system status and is located on the right side of the panel.

- **Solid green**—indicates normal operating activity.
- **Blinking red**—indicates a fault is active.
- **Solid red**—indicates maintenance is required.

Tines Ground-Engagement Foot Switch

The switch is located on the operator platform (Figure 7).

To lower the tines into the ground, stand on the tine ground-engagement switch. The LED illuminates in the hour meter/tine engagement display when the tine engagement is activated. To raise the tines, remove your foot from the switch.

This switch can be disabled with the multi-function switch.

- Tap and hold the bottom of the switch to override and disable the foot switch. The LED illuminates in the hour meter/tine engagement display. Use this feature when transporting the machine.
- To unlock, tap and hold the top of the multi-function switch until the LED light disappears.

Note: The disable feature is engaged each time you shut off the engine.

Key Switch

The key switch is located on the right side of the control console (Figure 7).

Use the key switch to start and shut off the engine. The switch has 3 positions: OFF, ON, and START (Figure 10).

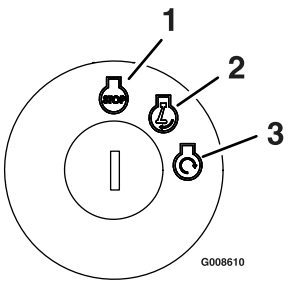

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Figure 10

1. OFF
2. ON
3. START

Multi-Function Switch

Located to the left of the hour meter/tine-engagement display.

This switch allows you to do the following:

- Increase/decrease the depth of an aeration plug.
- Lock or unlock the tine-depth setting.
- Lock or unlock the tine ground-engagement foot switch.

Fuel-Shutoff Valve

The fuel-shutoff valve is located behind the engine and under the fuel tank (Figure 11).

Use the fuel-shutoff valve to shut off the fuel when the machine will not be used for a few days, when transporting the machine to and from the jobsite, or when the machine is parked inside a building.

- To open for fuel-shutoff valve, rotate the handle of the fuel-shutoff valve until it is aligned with the fuel line.
- To close the fuel-shutoff valve, rotate the handle 90° to the fuel line.

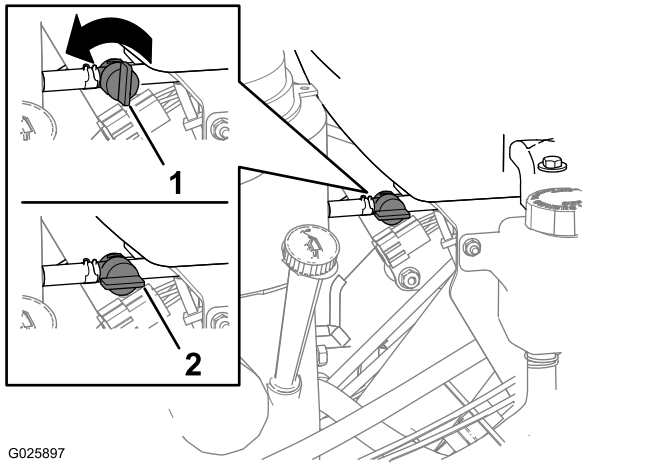


Figure 11

1. OFF position
2. ON position

Drive-Wheel Release Valves

⚠ WARNING

Your hands may become entangled in the rotating drive components below the engine deck, which could result in serious injury or death.

Shut off the engine, remove the key, and allow all moving parts to stop before accessing the drive-wheel release valves.

⚠ WARNING

The engine and hydraulic components can become very hot. Touching a hot engine or hydraulic components can cause severe burns.

Allow the engine and hydraulic components to cool completely before accessing the drive-wheel release valves.

Located on the left and right sides underneath the front of the machine.

During normal operating conditions, the washer on the lever is positioned outside the slots. If you need to push the machine by hand, you must position the lever for the drive wheel release valve to the valve released position (Figure 12).

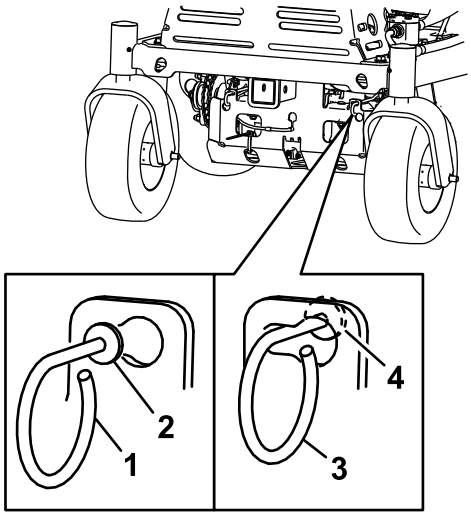


Figure 12

1. Lever—drive wheel release valve (normal operating position)
2. Washer outside of the slot
3. Lever—drive wheel release valve (push the machine position)
4. Washer inside the slot (valve released position)

To release the drive wheels, move the lever to the larger opening of the slot, push it in until the washer is inside the frame, then move the lever back to the narrow portion of the slot. Repeat this on each side of the machine.

Disengage the parking brake. The machine is now able to be pushed by hand.

Do not tow machine.

To reset the drive system back to the operating position:

Move the lever to the larger opening of the slot, pull outward until the washer is outside the frame, then move the lever back to the narrow portion of the slot. Repeat this on each side of the machine.

Specifications

Height	132 cm (52 inches)
Length	163 cm (64 inches)
Width	121 cm (48 inches)
Aeration width	76 cm (30 inches)
Coring range	5.1 to 12.7 cm (2 to 5 inches)
Weight	460 kg (1,015 lb)

Attachments/Accessories

A selection of Toro approved attachments and accessories is available for use with the machine to enhance and expand its capabilities. Contact your Authorized Service Dealer or authorized Toro distributor or go to www.Toro.com for a list of all approved attachments and accessories.

To ensure optimum performance and continued safety certification of the machine, use only genuine Toro replacement parts and accessories. Replacement parts and accessories made by other manufacturers could be dangerous, and such use could void the product warranty.

Operation

Before Operation

Before Operation Safety

- Evaluate the terrain to determine what accessories and attachments are needed to properly and safely perform the job. Only use accessories and attachments approved by Toro.
- Inspect the area where the equipment is to be used and remove all rocks, toys, sticks, wires, bones, and other foreign objects. These can be thrown or interfere with the operation of the machine and may cause personal injury to the operator or bystanders.
- Mark and avoid hidden objects such as sprinkler heads, underground wires/cables, invisible fences, etc. to prevent damage to these systems when aerating.
- Wear appropriate personal protective equipment such as safety glasses, substantial slip-resistant footwear, and hearing protection. Tie back long hair and avoid loose clothing and loose jewelry which may get tangled in moving parts.

⚠ CAUTION

This machine produces sound levels in excess of 85 dBA at the operator's ear and can cause hearing loss through extended periods of exposure.

Wear hearing protection when operating this machine.

- Check that the operator presence controls, safety switches, and shields are attached and functioning properly. Do Not operate unless they are functioning properly.
- Do Not operate the machine when people, especially children, or pets are in the area. Stop the machine and attachment(s) if anyone enters the area.
- Do Not operate the machine with damaged guards, shields, or covers. Always have safety shields, guards, switches and other devices in place and in proper working condition. Frequently check for worn or deteriorating components and replace them with the manufacturer's recommended parts when necessary.

Fuel Safety

Use extreme care when handling fuel.

⚠ DANGER

In certain conditions gasoline is extremely flammable and vapors are explosive.

A fire or explosion from gasoline can burn you, others, and cause property damage.

- **Fill the fuel tank outdoors on level ground, in an open area, when the engine is cold. Wipe up any gasoline that spills.**
- **Never refill the fuel tank or drain the machine indoors or inside an enclosed trailer.**
- **Do Not fill the fuel tank completely full. Fill the fuel tank to the bottom of the filler neck. The empty space in the tank allows gasoline to expand. Overfilling may result in fuel leakage or damage to the engine or emission system.**
- **Never smoke when handling gasoline, and stay away from an open flame or where gasoline fumes may be ignited by spark.**
- **Store gasoline in an approved container and keep it out of the reach of children.**
- **Add fuel before starting the engine. Never remove the cap of the fuel tank or add fuel when engine is running or when the engine is hot.**
- **If fuel is spilled, Do Not attempt to start the engine. Move away from the area of the spill and avoid creating any source of ignition until fuel vapors have dissipated.**
- **Do Not operate without entire exhaust system in place and in proper working condition.**

⚠ DANGER

In certain conditions during fueling, static electricity can be released causing a spark which can ignite gasoline vapors. A fire or explosion from gasoline can burn you and others and cause property damage.

- **Always place gasoline containers on the ground away from your vehicle before filling.**
- **Do Not fill gasoline containers inside a vehicle or on a truck or trailer bed because interior carpets or plastic truck bed liners may insulate the container and slow the loss of any static charge.**
- **When practical, remove gas-powered equipment from the truck or trailer and refuel the equipment with its wheels on the ground.**
- **If this is not possible, then refuel such equipment on a truck or trailer from a portable container, rather than from a gasoline dispenser nozzle.**
- **If a gasoline dispenser nozzle must be used, keep the nozzle in contact with the rim of the fuel tank or container opening at all times until fueling is complete. Do Not use a nozzle lock open device.**

⚠ WARNING

Gasoline is harmful or fatal if swallowed. Long-term exposure to vapors has caused cancer in laboratory animals. Failure to use caution may cause serious injury or illness.

- **Avoid prolonged breathing of vapors.**
- **Keep face away from nozzle and gas tank/container opening.**
- **Keep away from eyes and skin.**
- **Never siphon by mouth.**

To help prevent fires:

- Keep engine and engine area free from accumulation of grass, leaves, excessive grease or oil, and other debris which can accumulate in these areas.
- Clean up oil and fuel spills and remove fuel soaked debris.
- Allow the machine to cool before storing the machine in any enclosure. Do Not store near flame or any enclosed area where open pilot lights or heat appliances are present.

Adding Fuel

⚠ DANGER

In certain conditions, fuel is extremely flammable and highly explosive. A fire or explosion from fuel can burn you and others and can damage property.

- **Fill the fuel tank outdoors, in an open area, and when the engine is cold. Wipe up any fuel that spills.**
- **Do not fill the fuel tank completely full. Add fuel to the fuel tank until the level is 6 to 13 mm (1/4 to 1/2 inch) below the bottom of the filler neck. This empty space in the tank allows the fuel to expand.**
- **Never smoke when handling fuel, and stay away from an open flame or where a spark may ignite the fuel fumes.**
- **Store fuel in an approved fuel container and keep it out of the reach of children.**
- **Never buy more than a 30-day supply of fuel.**

⚠ DANGER

In certain conditions during fueling, static electricity can be released, causing a spark, which can ignite the fuel vapors. A fire or explosion from fuel can burn you and others and can damage property.

- **Always place fuel containers on the ground away from your vehicle before filling.**
- **Do not fill fuel containers inside a vehicle or on a truck or trailer bed because interior carpets or plastic truck bed liners may insulate the container and slow the loss of any static charge.**
- **When practical, remove fuel-powered equipment from the truck or trailer and refuel the equipment with its wheels on the ground.**
- **If this is not possible, then refuel such equipment on a truck or trailer from a portable container rather than from a fuel-dispenser nozzle.**
- **If you must use a fuel-dispenser nozzle, keep the nozzle in contact with the rim of the fuel tank or container opening at all times until fueling is complete.**

⚠ WARNING

Fuel is harmful or fatal if swallowed. Long-term exposure to vapors can cause serious injury and illness.

- **Avoid prolonged breathing of vapors.**
- **Keep your face away from the nozzle and fuel tank or conditioner bottle opening.**
- **Avoid contact with skin; wash off spills with soap and water.**

Fuel Specification

Petroleum fuel	Use unleaded gasoline with an octane rating of 87 or higher ((R+M)/2 rating method).
Ethanol blended fuel	Use an unleaded-gasoline blend with up to 10% ethanol (gasohol) or 15% MTBE (methyl tertiary butyl ether) by volume is acceptable. Ethanol and MTBE are not the same. Gasoline with 15% ethanol (E15) by volume is not approved for use. Never use gasoline that contains more than 10% ethanol by volume, such as E15 (contains 15% ethanol), E20 (contains 20% ethanol), or E85 (contains up to 85% ethanol). Using unapproved gasoline may cause performance problems and/or engine damage which may not be covered under warranty.

Important: **For best results, use only clean, fresh fuel (less than 30 days old).**

- Do not use gasoline containing methanol.
- Do not store fuel either in the fuel tank or fuel containers over the winter unless you use a fuel stabilizer.
- Do not add oil to gasoline.

Using Stabilizer/Conditioner

Always use fuel stabilizer/conditioner in the machine to keep the fuel fresh longer.

Important: **Do not use fuel additives containing methanol or ethanol.**

Add the amount of fuel stabilizer/conditioner to fresh fuel as directed by the fuel-stabilizer manufacturer.

Fueling the Machine

Fuel-tank capacity: 18.9 L (5 US Gallons)

1. Clean around the fuel-tank cap.
2. Remove the cap from the tank.
3. Fill the fuel tank with fuel to within 6 to 13 mm (1/4 to 1/2 inch) from the top of the tank. **Do not fill into the filler neck.**

Important: **Do not fill the tank more than 6 mm (1/4 inch) from the top of the tank because the fuel must have room to expand.**

4. Install the fuel-tank cap and wipe up any spilled fuel.

Performing Daily Maintenance

Before starting the machine each day, perform each use/daily maintenance procedures that follow:

- Lubricating the Chains (page 33)
- Checking the Engine-Oil Level (page 37)
- Checking the Safety-Interlock System (page 42)
- Checking the Condition of the Sprockets (page 56)
- Checking the Condition and Tension of the Chains (page 56)
- Checking the Tines (page 58)
- Checking for Loose Hardware (page 59)
- Cleaning the Engine and the Exhaust System Area (page 60)
- Cleaning the Debris from the Machine (page 60)

During Operation

Note: Determine the left and right sides of the machine from the normal operating position.

During Operation Safety

General Safety

The operator must use their full attention when operating the machine. **Do Not** engage in any activity that causes distractions; otherwise, injury or property damage may occur.

⚠ WARNING

Operating engine parts, especially the muffler, become extremely hot. Severe burns can occur on contact and debris, such as leaves, grass, brush, etc. can catch fire.

- **Allow engine parts, especially the muffler, to cool before touching.**
- **Remove accumulated debris from muffler and engine area.**

⚠ WARNING

Engine exhaust contains carbon monoxide, which is an odorless deadly poison that can kill you.

Do Not run engine indoors or in a small confined area where dangerous carbon monoxide fumes can collect.

- The owner/user can prevent and is responsible for accidents or injuries occurring to himself or herself, other people or property.
- This machine was designed for one operator only. Do not carry passengers and keep all others away from machine during operation.
- Do Not operate the machine under the influence of alcohol or drugs.
- Operate only in daylight or good artificial light.
- Lightning can cause severe injury or death. If lightning is seen or thunder is heard in the area, Do Not operate the machine; seek shelter.
- Use extra care while operating with accessories or attachments. These can change the stability of the machine and cause a loss of control. Follow directions for counter weights if required.
- Keep away from holes, ruts, bumps, rocks, and other hidden hazards. Use care when approaching blind corners, shrubs, trees, tall grass or other objects that may hide obstacles or obscure vision. Uneven terrain could overturn the machine or cause the operator to lose their balance or footing.
- Be sure all drives are in neutral and parking brake is engaged before starting engine.
- Start the engine carefully according to instructions with feet well away from the tines.
- Never operate the machine with damaged guards, shields, or covers. Always have safety shields, guards, switches and other devices in place and in proper working condition.
- Keep clear of the tines at all times.
- Keep hands and feet away from moving parts. If possible, Do Not make adjustments with the engine running.

⚠ WARNING

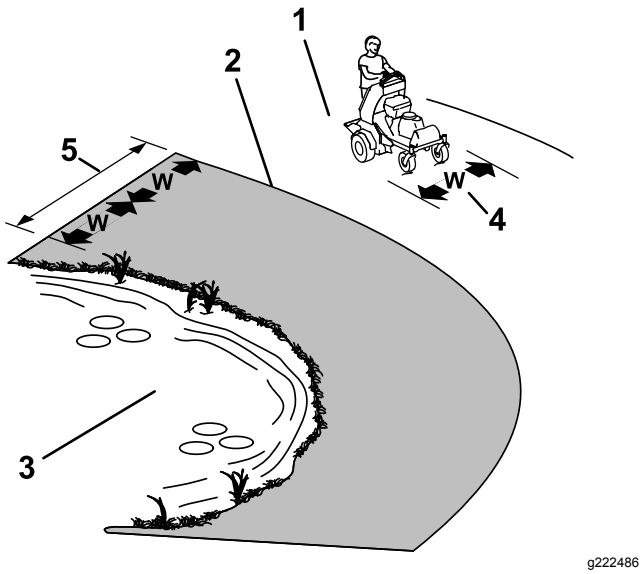
Hands, feet, hair, clothing, or accessories can become entangled in rotating parts. Contact with the rotating parts can cause traumatic amputation or severe lacerations.

- **– Do Not operate the machine without guards, shields, and safety devices in place and working properly.**
- **– Keep hands, feet, hair, jewelry, or clothing away from rotating parts.**

- Be aware of the discharge path and direct discharge away from others. Avoid discharging material against a wall or obstruction as the material may ricochet back toward the operator. Raise the tines, slow down, and use caution when crossing surfaces other than grass and when transporting the machine to and from the work area.
- Be alert, slow down and use caution when making turns. Look behind and to the side before changing directions. Do Not operate in reverse unless absolutely necessary.
- Do Not change the engine governor setting or overspeed the engine.
- Park the machine on level ground. Stop engine, wait for all moving parts to stop, and remove the spark plug wire(s).
  - – Before checking, cleaning or working on the machine.
  - – After striking a foreign object or abnormal vibration occurs (inspect the machine for damage and make repairs before restarting and operating the machine).
  - – Before clearing blockages.
  - – Whenever you leave the machine. Do Not leave a running machine unattended.
- Stop engine, wait for all moving parts to stop:
  - – Before refueling.
- Tragic accidents can occur if the operator is not alert to the presence of children. Children are often attracted to the machine and the working activity. Never assume that children will remain where you last saw them.
  - – Keep children out of the working area and under the watchful care of another responsible adult, not the operator.
  - – Be alert and turn the machine off if children enter the area.
  - – Before and while backing or changing direction, look behind, down, and side-to-side for small children.
  - – Never allow children to operate the machine.
  - – Do Not carry children, even with the blades shut off. Children could fall off and be seriously injured or interfere with the safe operation of the machine. Children that have been given rides in the past could suddenly appear in the working area for another ride and be run over or backed over by the machine.

Slope Safety

- Slopes are a major factor related to loss of control and rollover accidents, which can result in severe injury or death. The operator is responsible for safe slope operation. Operating the machine on any slope requires extra caution. Before using the machine on a slope, the operator must:
  - – Review and understand the slope instructions in the manual and on the machine.
  - – Evaluate the site conditions of the day to determine if the slope is safe for machine operation. Use common sense and good judgment when performing this evaluation. Changes in the terrain, such as moisture, can quickly affect the operation of the machine on a slope.
- Operate across slopes, never up and down. Avoid operation on excessively steep or wet slopes.
- Identify hazards at the base of the slope. Do not operate the machine near drop offs, ditches, embankments, water or other hazards. The machine could suddenly roll over if a wheel goes over the edge or the edge collapses. Keep a safe distance (twice the width of the machine) between the machine and any hazard. Use a walk behind machine or a hand held tool to operate in these areas.



g222486

Figure 13

1. Safe Zone — Use the machine here
2. Danger Zone - Use a walk behind machine or a hand held tool near drop offs, ditches, embankments, water or other hazards.
3. Water
4. W=width of the machine
5. Keep a safe distance (twice the width of the machine) between the machine and any hazard.

- Avoid starting, stopping or turning the machine on slopes. Avoid making sudden changes in speed or direction; turn slowly and gradually.
- Do not operate a machine under any conditions where traction, steering or stability is in question. Be aware that operating the machine on wet grass, across slopes or downhill may cause the machine to lose traction. Loss of traction to the drive wheels may result in sliding and a loss of braking and steering. The machine can slide even if the drive wheels are stopped.
- Remove or mark obstacles such as ditches, holes, ruts, bumps, rocks or other hidden hazards. Tall grass can hide obstacles. Uneven terrain could overturn the machine.
- Use extra care while operating with accessories or attachments. These can change the stability of the machine and cause a loss of control. Follow directions for counter weights.
- If you lose control of the machine, step off and away from the direction of travel of the machine.

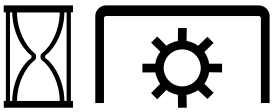
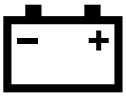
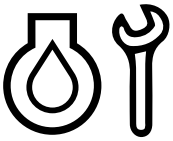
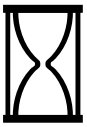
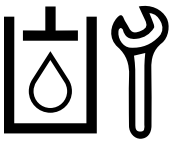
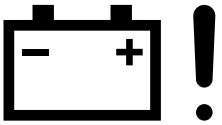
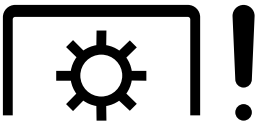
Using the Smart Controller/Electronic Depth Control

Hour Meter/Tine Engagement Display

The smart controller/electronic depth control monitors the overall electrical system and displays information in the hour meter/tine engagement display. The controller displays machine hours, interlock status, and maintenance reminders.

Screen Icons

The information screen uses the following icons:

 **Aerating Hours**	 **Parking brake**
 **Battery Voltage**	 **Engine Oil Maintenance**
 **Hour Meter**	 **Transmission Oil Maintenance**
 **Voltage Error**	 **Valve Solenoid Error**
 **Valve Solenoid Connection Error**	

Information Screens

The main information screens include:

- The Startup Screens
- The Default Screen (engine-on)
- The Tine Engagement Display
- Maintenance Reminders and Alerts
- Alerts and Error Messages

Start-up Screens

When the key is switched from OFF to RUN position, the following screens display for 2 seconds:

Note: The LED status light changes from red to orange to green.

The first screen displays the firmware version.

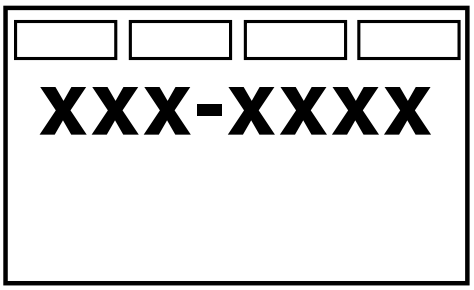


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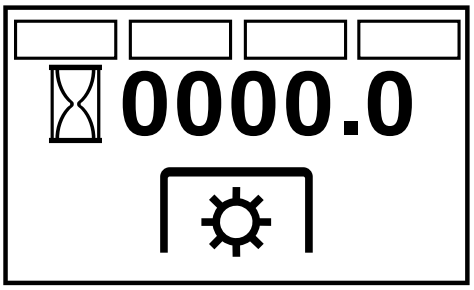
Figure 14

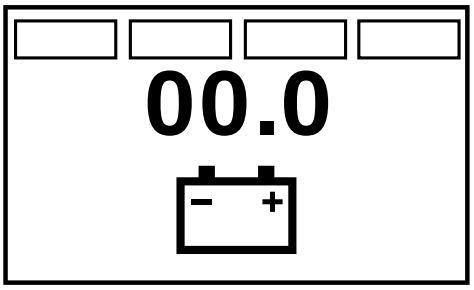
The second screen displays the aeration hours.



g212114

Figure 15

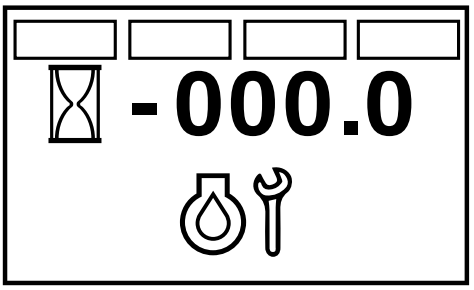
The third screen displays the electrical system voltage.



g212115

Figure 16

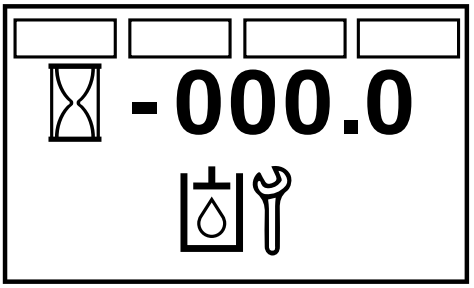
The fourth screen displays the number of hours until the engine oil maintenance is required.



g212117

Figure 17

The final screen displayed is the number of hours until transmission oil maintenance is required.



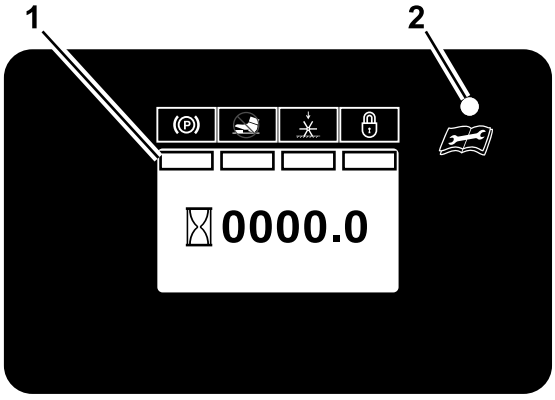
g212118

Figure 18

The Default Screen

After the start-up screens display, the default screen (Figure 19) appears.

The information screen displays icons and information relative to machine operation.



g211884

Figure 19

Default Screen

1. Information screen
2. LED status light

- The safety interlock status indicator illuminates when the control meets the “safe to start” mode (park brake engaged).

- The hour meter displays engine hours when the hour glass symbol is flashing.
- The display turns off after 5 minutes after the ignition key is switched to the OFF position.

The Tine Engagement Display

Electronic Depth Control Screen

There are 2 ways to activate the tine engagement display:

- Tap the multi-function switch either up or down to display the tine engagement meter.
- Step on the tine ground engagement foot switch.

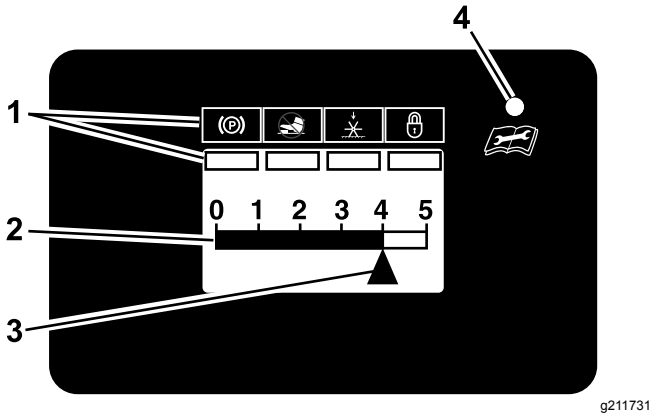


Figure 20

1. LCD Indicators/Information screen
2. Tine depth status bar
3. Tine depth setting indicator
4. LED status light

A higher number on the status bar (Figure 20) increases the length of the aeration plug and a lower number decreases it.

Note: If the plug length is not the desired length, you may need to adjust the machine to accommodate for your weight; refer to Adjusting the Operator Weight Control Setting (page 24).

LED Status Light

The LED is multi-colored light (Figure 19 and Figure 20) used to indicate the system status:

- **Solid Green**—indicates normal operating activity
- **Blinking Red**—indicates an active fault
- **Solid Red**—indicates that maintenance is required

Maintenance Reminder Screens

The hour meter displays the number of engine hours until either the engine oil or transmission oil maintenance is due. When maintenance is due, the smart controller/electronic depth control displays flashing icons for an engine oil maintenance alert or a transmission oil maintenance alert, and the LED status light displays a steady red light.

- A maintenance alert occurs when the maintenance counter reaches zero.
- If the service is not performed, the maintenance counter displays time as negative hours to indicate the number of hours past due for the service (up to -500 hours).
- The hour meter switches between the default screen and the active alert screen.
- If more than 1 alert is active, the display cycles between the alerts in the order that they occurred before cycling back to the default screen.

The maintenance alerts only display when the default screen has been active for 2 seconds; however, if the key is moved to the START position, the alerts occur immediately. When the machine is aerating, the alert screen does not display but the LED status light remains a steady red.

Service Engine Reminder

The engine-oil service reminder (Figure 21) counts down from the initial break-in service interval of 5 engine hours and then counts down from 100 hours for each service interval thereafter.

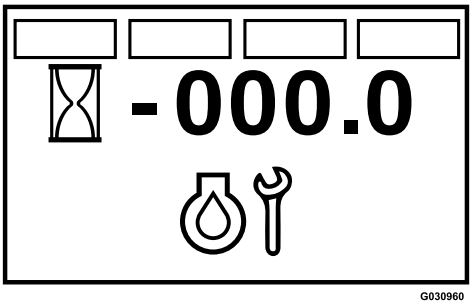


Figure 21

Service Transmission Reminder

The transmission oil maintenance reminder (Figure 22) counts down from the initial break-in service interval of 100 engine hours and then counts down from 250 hours for each service interval thereafter.

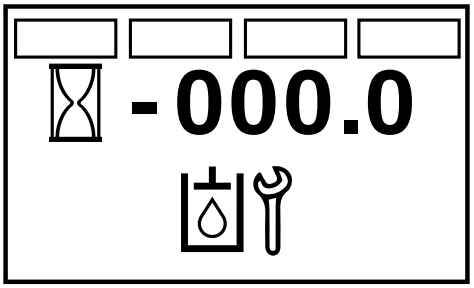


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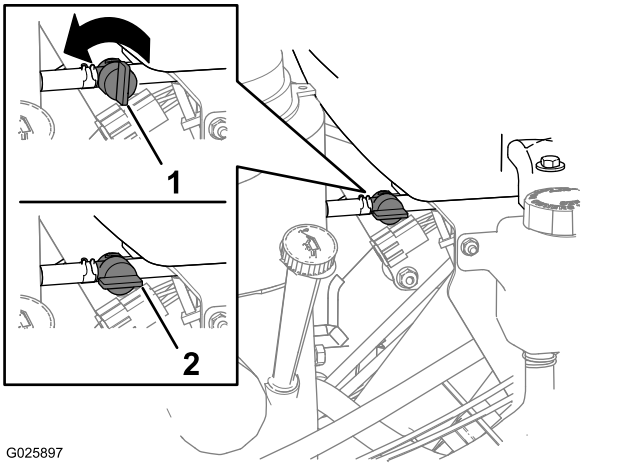
Figure 22

Operating the Machine

Using the Fuel-Shutoff Valve

Rotate the lever of the fuel-shutoff valve to align the lever with the fuel line.



g025897

Figure 23

1. OFF position
2. ON position

Starting the Engine

1. Move the motion-control levers to the neutral position and engage the parking brake; refer to Motion-Control Levers (page 11) and Parking-Brake Handle (page 12).

   Note: To start the engine, the parking brake must be engaged. It is not necessary for the operator to be on the platform.

2. Place the throttle lever midway between the SLOW and FAST positions; refer to Throttle Lever (page 11).
3. If the engine is cold, push the choke lever forward to the ON position; refer to Throttle Lever (page 11).

   Note: If the engine is warm, pull the choke lever to the OFF position.

4. Rotate the key switch to the START position; refer to Key Switch (page 13).

   Note: Release the switch as soon as the engine starts.

   Important: **Do not crank the engine continuously for more than 10 seconds at a time. If the engine does not start, allow a 60-second cooldown period between starting attempts. Failure to follow these guidelines can burn out the starter motor.**

5. If the choke lever is in the ON position, gradually move the lever toward the OFF position as the engine warms up.

Lowering the Tines

⚠ DANGER

The rotating tines under the engine deck are dangerous. Tine contact can cause serious injury or kill you.

Do not put your hands or feet under the machine when the engine is running.

1. Disengage the parking brake.
2. Move the throttle lever to the FAST position.
3. The lockout feature is engaged each time the engine is switched off. To unlock, tap and hold the top of the multi-function switch until the LED light disappears.
4. Tap the switch once to display the tine-engagement depth setting.

   Note: Adjust if necessary.

5. Lower the tines by pressing the tine ground-engagement foot switch.

   The LED indicator should illuminate under the tine down position on the hour meter.

6. Stand on the switch and move the motion-control levers forward to aerate.

   Note: The foot-rocker bar, located behind the tine ground-engagement foot switch, can be adjusted for your comfort. To adjust, loosen the foot-rocker bar hardware, slide the bar forward or rearward, and tighten the hardware.

Locking/Unlocking the Tine Depth Setting

The settings can be locked to ensure that the tine depth is not inadvertently changed by the operator or left unlocked.

- To activate the depth lock: turn the ignition key from the OFF position to the ON position 5 times (stop at the ON position). Use the multi-function switch to adjust the tine depth to the desired setting. Press and hold the multi-function switch down for 1 second to lock.
- To deactivate the depth lock: turn the ignition key from the OFF position to the ON position 5 times (stop at the ON position). Press and hold the multi-function switch up for 1 second to unlock.

Switch the key to the OFF position or START position when you are finished.

Adjusting the Operator Weight Control Setting

1. With the tines raised, drive the machine to a hard, flat surface (such as concrete) and stop the aerator, but leave it running.
2. Set throttle to the FAST position and disengage the parking brake.
3. Use the multi-function switch to set the tine depth to 3.0; refer to Adjusting the Tine-Depth Setting (page 24).
4. Press and hold the tine ground-engagement foot switch to lower the tines.
   - If the machine raises and the ground tires are no longer touching, rotate the operator weight-adjustment control counterclockwise to lower the machine until the tires touch the ground.
   - If the tines are not touching the ground, rotate the operator weight-adjustment control clockwise until the tines lower and touch the ground (but do not raise the machine).

   Important: **To maximize lateral machine stability, always keep the drive tires on the ground.**
5. Release the tine ground-engagement foot switch.

Adjusting the Tine-Depth Setting

Tap the multi-function switch up or down to set the aeration depth.

Tap the bottom of the multi-function switch to increase the tine depth to remove a longer plug.

Tap the top of the switch to decrease the tine depth to remove a shorter plug.

Note: You can make tine-depth adjustments with the multi-function switch only. The ideal plug depth is 6.4 to 7.6 cm (2-1/2 to 3 inches). Adjust the controls to adapt to the soil conditions.

Raising the Tines

To raise the tines, remove your foot from the tine-elevation switch (Figure 7).

Important: **The tines rotate when the motion-control lever is moved out of the neutral position.**

Shutting Off the Engine

1. Move the motion-control levers to the neutral position and bring the machine to a full stop; refer to Motion-Control Levers (page 11).
2. Lift your foot off the tine ground-engagement foot switch control to raise the tines; refer to Raising the Tines (page 24).
3. Place the throttle in the midway between the SLOW and FAST positions; refer to Throttle Lever (page 11).
4. Allow the engine to run for a minimum of 15 seconds, then turn the key switch to the OFF position to shut off the engine; refer to Key Switch (page 13).
5. Engage the parking brake; refer to Parking-Brake Handle (page 12).
6. Remove the key to prevent children or other unauthorized persons from starting the engine.
7. Close the fuel-shutoff valve when the machine will not be used for a few days, when transporting, or when the machine is parked inside a building; refer to Using the Fuel-Shutoff Valve (page 23).

Driving the Machine

⚠ CAUTION

Machine can spin very rapidly by positioning 1 lever too much ahead of the other. You may lose control of the machine, which may cause damage to the machine or injury.

- **Use caution when making turns.**
- **Slow the machine down before making sharp turns.**

Important: **To drive the machine (forward or backward), disengage the brake lever before you can move the motion-control levers.**

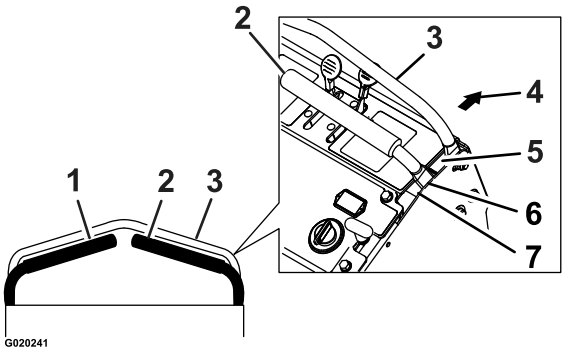


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Figure 24

1. Left motion-control lever
2. Right motion-control lever
3. Front reference bar
4. Front of the machine
5. Forward
6. Neutral
7. Reverse

Driving Forward

1. Make sure that the motion-control levers are in the neutral position.
2. Disengage the parking brake.
3. To move forward in a straight line, move both levers forward with equal pressure.

   Note: The machine moves faster the farther the motion-control levers are moved from the neutral position.

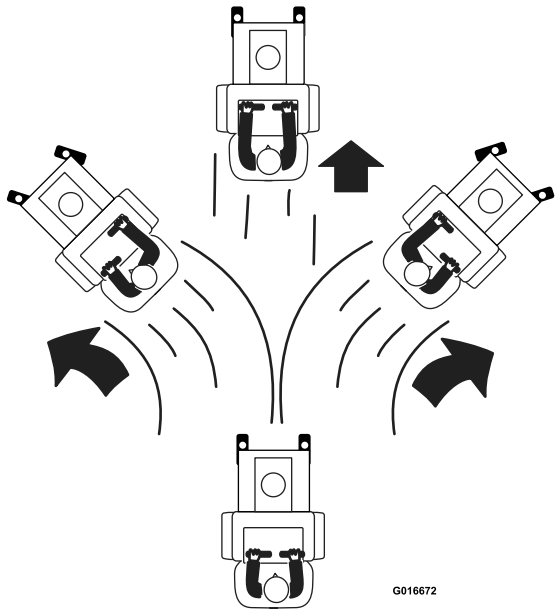

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Figure 25

4. To turn left or right, pull the motion-control lever back toward neutral in the desired turn direction. The tines can be in the down position when making gradual turns.
5. To make zero-turns, lift your foot off the tine engagement foot switch control to raise the tines. The head raises in 1 second.

   Important: **Do not make a zero-turn when the tines are down, otherwise you may tear the turf.**
6. To stop the machine, move both motion-control levers to the neutral position.

Driving in Reverse

1. Move the motion-control levers to the neutral position.
2. To move rearward in a straight line, slowly move both levers rearward with equal pressure.

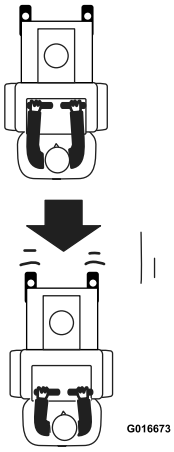

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Figure 26

3. To turn left or right, release pressure on the motion-control lever toward the desired turn direction.
4. To make zero-turns, lift your foot off the tine-elevation switch to raise the tines. The head raises in 1 second.

   Important: **Do not make a zero-turn when the tines are in the down position.**
5. To stop the machine, position both motion-control levers in the neutral operate position.

Adjusting the Front Reference/Speed-Control Bar

Adjust the front reference/speed control bar for desired maximum forward speed.

1. Stop the machine and move the motion-control levers to the NEUTRAL position.
2. Loosen the nuts on each side of the control panel (Figure 27).

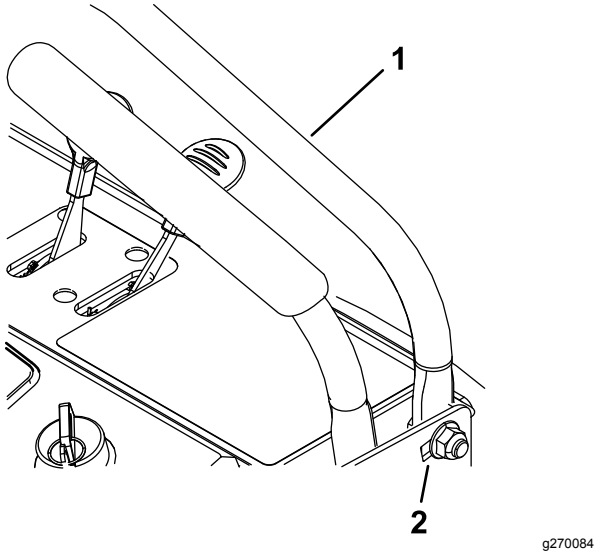

Figure 27

1. Nut
2. Front reference/speed-control bar

3. Move the bar forward to obtain the fastest speed.

   Move the bar rearward to obtain the slowest speed.

4. On both sides, tighten the nuts and bolts.

Important: **Ensure that the nuts and bolts are tight so that the front reference/speed-control bar does not move during operation.**

After Operation

After Operation Safety

General Safety

- Park machine on level ground, disengage drives, set parking brake, stop engine, remove key or disconnect spark plug wire. Wait for all movement to stop and allow the machine to cool before adjusting, cleaning, repairing, or storing. Never allow untrained personnel to service machine.
- Clean the machine as stated in the Maintenance section. Keep engine and engine area free from accumulation of grass, leaves, excessive grease or oil, and other debris which can accumulate in these areas. These materials can become combustible and may result in a fire.
- Frequently check for worn or deteriorating components that could create a hazard. Tighten loose hardware.

Transporting the Machine

Machine weight: 460 kg (1,015 lb)

⚠ CAUTION

This machine does not have proper turn signals, lights, reflective markings, or a slow moving vehicle emblem. Driving on a street or roadway without such equipment is dangerous and can lead to accidents, causing personal injury. Driving on a street or roadway without such equipment may also be a violation of state laws, and you may be subject to traffic tickets and/or fines.

Do not drive the machine on a public street or roadway.

Loading the Machine onto a Transport Vehicle

⚠ WARNING

Loading the machine onto a trailer or truck increases the possibility of tip-over and could cause serious injury or death.

- **Use extreme caution when operating a machine on a ramp.**
- **Use only a single, full-width ramp; do not use individual ramps for each side of the machine.**
- **If you must use individual ramps, use enough ramps to create an unbroken ramp surface wider than the machine.**
- **Do not exceed a 15-degree angle between ramp and ground, or between a ramp, a trailer, or a truck.**
- **Avoid sudden acceleration while driving machine up a ramp to avoid tipping backward.**
- **Avoid sudden deceleration while backing machine down a ramp to avoid tipping backward.**

Important: **Do not attempt to turn the machine while on the ramp; you may lose control and drive off the side.**

- Use extreme caution when loading units onto trailers or trucks.
- Use 1 full-width ramp that is wide enough to extend beyond the rear tires instead of individual ramps for each side of the machine (Figure 28). The platform, when down and locked into position, must extend back between the rear wheels, and serves as a stop for tipping backward. Having a full-width ramp provides a surface for the platform to contact if the machine starts to tip backward. With the platform up, a full-width ramp provides a surface to walk on behind the machine.
- The ramp should be long enough so that the angles do not exceed 15 degrees (Figure 28). A steeper angle may cause tine components to get caught, as the machine moves from ramp to trailer or truck. A steeper angle may also cause the machine to tip backward. If loading on or near a slope, position the trailer or truck so it is on the down side of the slope and the ramp extends up the slope. This minimizes the ramp angle. The trailer or truck should be as level as possible.

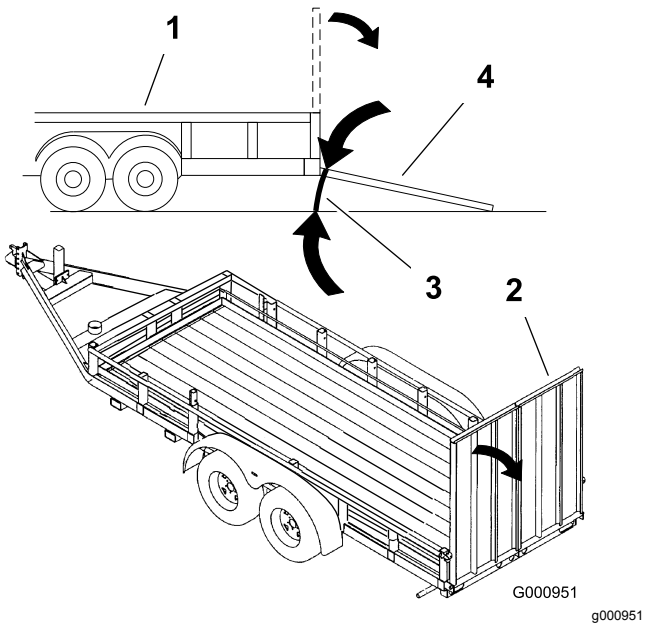

Figure 28

1. Trailer
2. Full-width ramp
3. Not greater than 15 degrees
4. Full-width ramp (side view)

- You should determine if it is best to have the platform up or down when loading, depending on conditions. If it is not possible to use 1 full-width ramp, use enough individual ramps to simulate a full-width, continuous ramp.
- Avoid sudden acceleration when driving up a ramp and sudden deceleration when backing down a ramp. Both maneuvers can cause the machine to tip backward.

Transporting the Machine

Use a heavy-duty trailer or truck to transport the machine. Ensure that the trailer or truck has all the necessary brakes, lighting, and marking as required by law. Please carefully read all the safety instructions.

1. Raise the tines of the machine before driving onto the trailer or truck.
2. If using a trailer, connect it to the towing vehicle and connect the safety chains.
3. If applicable, connect the trailer brakes.
4. Load the machine onto the trailer or truck.
5. Shut off the engine, remove the key, engage the parking brake, and close the fuel valve.
6. Engage the parking brake and block the tires.
7. Use the tie-down points on the machine to securely bind the machine to the trailer or truck with straps, chains, cable, or ropes (Figure 29).

   Note: Refer to your local ordinances for specific trailer and tie-down regulations.

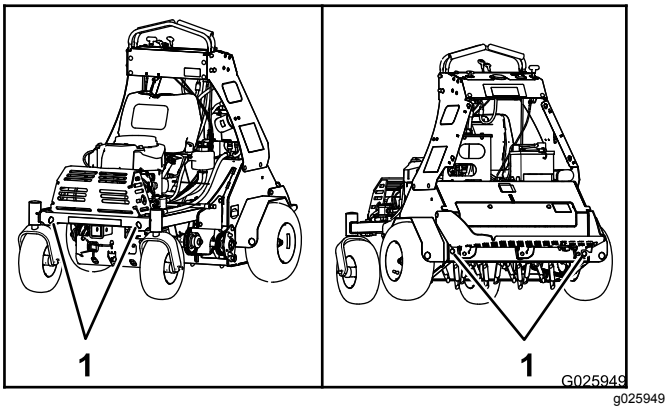

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Figure 29

1. Tie-down points

Maintenance

Maintenance Safety Information

⚠ WARNING

While maintenance or adjustments are being made, someone could start the engine. Accidental starting of the engine could seriously injure you or other bystanders.

Remove the key from the ignition switch, engage parking brake, and pull the wire(s) off the spark plug(s) before you do any maintenance. Also push the wire(s) aside so it does not accidentally contact the spark plug(s).

- Park machine on level ground, raise the tines, set parking brake, stop engine, remove key or disconnect spark plug wire. Wait for all movement to stop and allow the machine to cool before adjusting, cleaning or repairing. Never allow untrained personnel to service machine.

⚠ WARNING

The engine can become very hot. Touching a hot engine can cause severe burns.

Allow the engine to cool completely before service or making repairs around the engine area.

- Disconnect battery or remove spark plug wire before making any repairs. Disconnect the negative terminal first and the positive last. Reconnect positive first and negative last.
- Keep the machine, guards, shields and all safety devices in place and in safe working condition. Frequently check for worn or deteriorating components and replace them with the manufacturer's recommended parts when necessary.

⚠ WARNING

Removal or modification of original equipment, parts and/or accessories may alter the warranty, controllability, and safety of the machine. Unauthorized modifications to the original equipment or failure to use original Toro parts could lead to serious injury or death. Unauthorized changes to the machine, engine, fuel or venting system, may violate applicable safety standards such as: ANSI, OSHA and NFPA and/or government regulations such as EPA and CARB.

- Use care when checking and servicing tines. Wrap the tine(s) or wear gloves, and use caution when servicing them. Only replace damaged tines. Never straighten or weld them.
- Use jack stands to support the machine and/or components when required.

⚠ CAUTION

Raising the machine for service or maintenance relying solely on mechanical or hydraulic jacks could be dangerous. The mechanical or hydraulic jacks may not be enough support or may malfunction allowing the machine to fall, which could cause injury.

Do not rely solely on mechanical or hydraulic jacks for support. Use adequate jack stands or equivalent support.

- Carefully release pressure from components with stored energy.

⚠ WARNING

Hydraulic fluid escaping under pressure can penetrate skin and cause injury. Fluid accidentally injected into the skin must be surgically removed within a few hours by a doctor familiar with this form of injury or gangrene may result.

- **If equipped, make sure all hydraulic fluid hoses and lines are in good condition and all hydraulic connections and fittings are tight before applying pressure to hydraulic system.**
- **Keep body and hands away from pinhole leaks or nozzles that eject high pressure hydraulic fluid.**
- **Use cardboard or paper, not your hands, to find hydraulic leaks.**
- **Before performing any work on the hydraulic system:**
  - **Safely relieve all pressure in the ground drive hydraulic system by placing the motion control levers in neutral and shutting off the engine.**
  - **Safely relieve all pressure in the auxiliary hydraulic system by shutting off the engine, turning the ignition switch to the "ON" position, and pressing the tine ground engagement switch. Once the tines have lowered to the ground, release the tine ground engagement switch and turn the ignition switch to the "OFF" position.**

- Keep hands and feet away from moving parts. If possible, Do Not make adjustments with the engine running. If the maintenance or adjustment procedure require the engine to be running and components moving, use extreme caution.

⚠ WARNING

Contact with moving parts or hot surfaces may cause personal injury.

Keep your fingers, hands, and clothing clear of rotating components and hot surfaces.

- Check all bolts frequently to maintain proper tightness.

Recommended Maintenance Schedule(s)

Maintenance Service Interval	Maintenance Procedure
After the first 5 hours	• Change the engine oil. • Change the engine-oil filter (more often in extremely dusty or sandy conditions). • Check the torque of the wheel hub nuts. • Check the torque of the transmission output shaft nut.
After the first 100 hours	• Change the auxiliary hydraulic reservoir filter and fluid. • Change the transmission filters. • Fill the transmission with fluid when changing the filter.
Before each use or daily	• Lubricate the chains. • Check the engine-oil level. • Check the safety-interlock system. • Check the condition of the sprockets. • Check the condition and tension of the chains. • Check the tines. • Check for loose hardware. • Clean the engine and the exhaust system area (more often in dry or dirty conditions). • Clean the grass and debris buildup from the machine.
Every 25 hours	• Grease the jackshaft bearings. • Grease the wheel bearings. • Grease the tine shaft bearings. • Grease the tine assembly idlers.
Every 50 hours	• Grease the control pivots. • Check spark arrester (if equipped). • Check the pressure in the tires. • Check the condition and tension of the belts. • Check the auxiliary hydraulic-fluid level. • Check the hydraulic transmission fluid level.
Every 80 hours	• Remove the engine shrouds and clean the cooling fins.
Every 100 hours	• Change the engine oil. • Change the engine-oil filter (more often in extremely dusty or sandy conditions).
Every 160 hours	• Check, clean and gap the spark plug.
Every 250 hours	• Service the foam air-cleaner element (more often in extremely dusty or sandy conditions). • Change the auxiliary hydraulic reservoir filter and fluid. • Change the transmission filters. • Fill the transmission with fluid when changing the filter.
Every 500 hours	• Replace the paper air-cleaner element (more often in extremely dusty or sandy conditions).
Every 800 hours	• Replace the fuel filter.
Monthly	• Check the battery.
Yearly	• Grease the front caster pivots. • Grease the belt idler pivot. • Grease the caster pivots and hubs. • Lubricate the caster-wheel hubs. • Lubricate the caster-wheel hubs. • Check the torque of the wheel hub nuts. • Check the torque on the wheel lug nuts. • Check the torque of the transmission output shaft nut. • Prepare the machine for storage.

Pre-Maintenance Procedures

Preparing for the Machine for Maintenance

Perform the following before servicing, cleaning, or making any adjustments to the machine.

1. Park the machine on a level surface.
2. Shut off the engine, engage the parking brake, wait for all moving parts to stop.
3. Remove the key from the key switch.

Accessing the Console Compartment

Removing the Console Pad

1. Loosen the 4 flanged-head bolts that secure the pad to the left and right console panels (Figure 30).

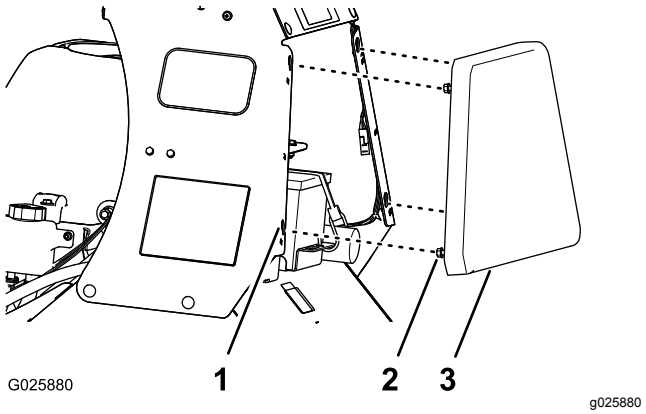


Figure 30

1. Keyhole slot (console panel)
2. Fanged-head bolt
3. Pad

2. Lift the console pad (Figure 30) approximately 13 mm (1/2 inch).
3. Pull the console pad straight back and remove the pad from the machine (Figure 30).

Installing the Console Pad

1. Align the 4 flanged-head bolts at the forward face of the console pad to the 4 keyhole slots in the frame of the console (Figure 30).
2. Move the pad forward until the pad is flush to the console frame (Figure 30).
3. Move the pad down until the flanged-head bolts are seated in the keyhole slots (Figure 30).
4. Tighten the flanged-head bolts to 1978 to 2542 N·cm (175 to 225 in-lb).

Lubrication

Lubricating the Grease Fittings

Grease type: National Lubricating Grease Institute (NGLI) grade #2 multi-purpose gun grease.

Note: Refer to the lubrication chart for service intervals.

Lubrication Chart

Fitting Locations	Initial Pumps	Number of Places	Service Interval
Front caster pivots	*0	2	Yearly
Jackshaft bearings	1	8	25 hours
Wheel bearings	1	2	25 hours
Tine shaft bearings	1	4	25 hours
Tine assembly idlers	1	2	25 hours
Control pivots	1	4	50 hours
Belt idler pivot	1	1	Yearly
Front caster hubs	*0	2	Yearly

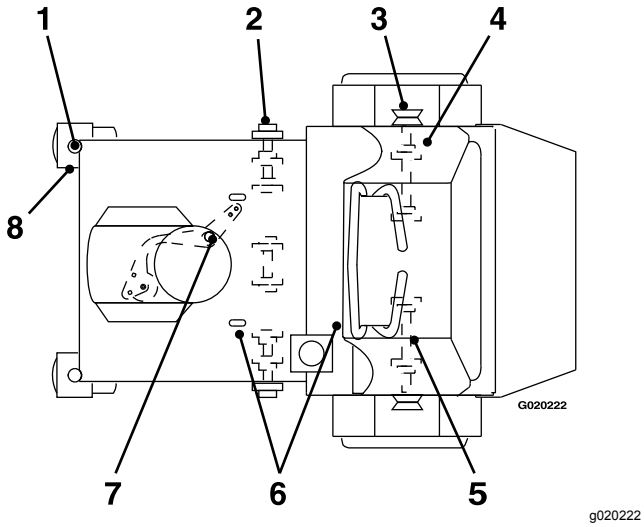


Figure 31

1. Front caster pivots
2. Jackshaft bearings
3. Wheel bearings
4. Tine shaft bearings
5. Tine assembly idlers
6. Control pivots
7. Belt idler pivot
8. Front caster hubs

1. Shut off the engine, engage the parking brake, wait for all moving parts to stop, and remove the key.
2. Wipe clean the grease fittings with a rag (Figure 31).
3. Connect a grease gun to the fitting (Figure 31).
4. Pump grease into the fittings until grease begins to ooze out of the bearings.
5. Wipe up any excess grease.

Lubricating the Chains

Service Interval: Before each use or daily

Lubricant type: Oil or chain lubricant.

***Important:* Do not lubricate chains with penetrating oil or solvents.**

1. Shut off the engine, engage the parking brake, wait for all moving parts to stop, and remove the key.
2. Raise the machine and support it with jack stands with a 460 kg (1,015 lb) capacity.

⚠ CAUTION

Raising the machine for service or maintenance relying solely on mechanical or hydraulic jacks could be dangerous. The mechanical or hydraulic jacks may not be enough support or may malfunction allowing the machine to fall, which could cause injury.

Do not rely solely on mechanical or hydraulic jacks for support. Use adequate jack stands or equivalent support.

3. Start the engine and move the throttle level ahead to the half-throttle position.

⚠ WARNING

You must run the engine and turn the drive wheels so that you can perform adjustments. Contact with moving parts or hot surfaces may cause personal injury.

Keep your fingers, hands, and clothing clear of rotating components and hot surfaces.

4. Disengage the parking brake.
5. With the engine running, slowly move the motion-control levers forward and lubricate all 6 chains (Figure 69).
6. Check the condition and tension of the chains; refer to Checking the Condition and Tension of the Chains (page 56).

Lubricating the Casters

Grease type: National Lubricating Grease Institute (NGLI) grade No. 2 multi-purpose gun grease.

Greasing the Caster Pivots

Service Interval: Yearly

1. Remove cap and hex plug from the top of the caster pivot (Figure 32).

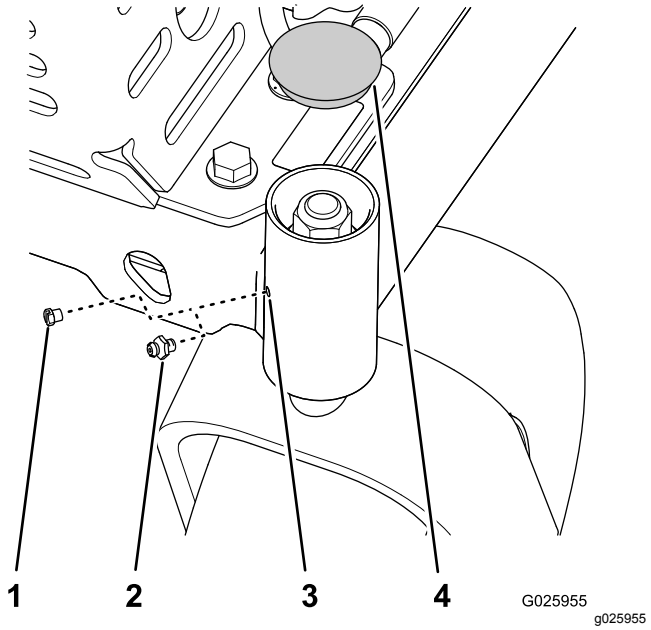


Figure 32

1. Hex plug
2. Grease fitting
3. Caster pivot
4. Cap

2. Thread grease fitting in hole (Figure 32).
3. Pump grease into the fitting until grease oozes out around top bearing (Figure 32).
4. Remove grease fitting and install the plug that you removed in 1 (Figure 32).
5. Install the cap that you removed in step 1 (Figure 32).
6. Repeat steps 1 through 5 to the other caster.

Lubricating the Caster-Hubs Bearings

Service Interval: Yearly

Removing the Caster-Wheel Assembly

1. Shut off the engine, engage the parking brake, wait for all moving parts to stop, and remove the key.
2. Lift the front of the machine and support it with jack stands.
3. Remove the wheel nut and bolt, and remove the caster-wheel assembly from the fork (Figure 33).

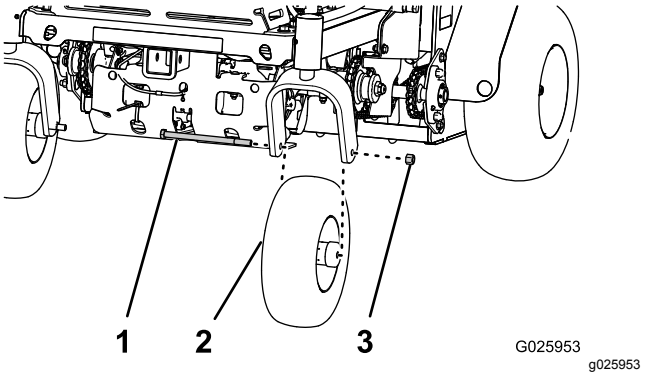


Figure 33

1. Wheel bolt
2. Caster-wheel assembly
3. Wheel nut

Disassembling the Caster-Wheel Hub and Greasing the Bearings

Service Interval: Yearly

Important: **Use new bearing seals when lubricating the caster-wheel hubs.**

Important: **To prevent seal and bearing damage, check the bearing adjustment often. Spin the caster tire. The tire should not spin freely (more than 1 or 2 revolutions) or have any side play. If the wheel spins freely, adjust torque on spacer nut until there is a slight amount of drag. Apply thread-locking compound.**

Grease type: National Lubricating Grease Institute (NGLI) grade No. 2 multi-purpose gun grease.

1. Remove the 2 seal guards from the wheel hub (Figure 34).

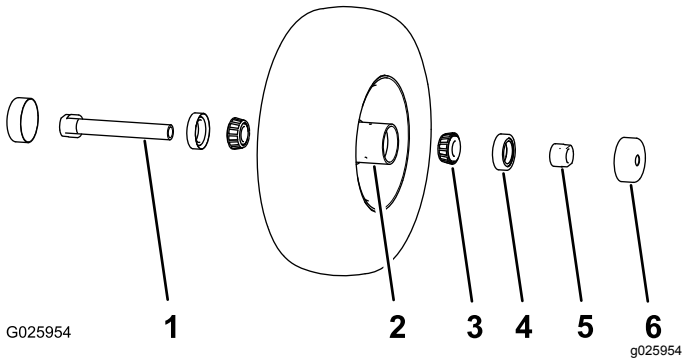


Figure 34

1. Axle (spacer nut still assembled)
2. Hub
3. Bearing
4. Spacer nut
5. Bearing seal
6. Seal guard

2. Remove 1 of the spacer nuts from the axle assembly in the caster wheel (Figure 34).

   Note: Note that thread-locking compound has been applied to lock the spacer nuts to the axle (Figure 34).

3. Remove the axle (with the other spacer nut still assembled to it) from the caster-wheel assembly (Figure 34).
4. Pry out both bearing seals (Figure 34).

   Note: Discard the old seals.

5. Remove both bearings and inspect them for wear or damage (Figure 34).

   Note: Replace the bearing if it is worn or damaged.

6. Pack the 2 bearings with the specified grease.

Assembling the Caster-Wheel Hub

1. Install 1 bearing into the hub of the wheel (Figure 34).
2. Install the bearing seal into the hub at the bearing (Figure 34).
3. If you removed (or broke loose) both of the spacer nuts from the axle assembly, perform the following:
   A. Clean the threads of the axle and spacer nut.
   B. Apply a thread-locking compound to the threads at 1 end of the axle.
   C. Thread the axle nut, with the wrench flats facing outward, onto the end of the axle that is prepared with thread-locking compound (Figure 34).

      Note: Do not thread spacer nut all the way onto the axle. Leave approximately 3 mm (1/8 inch) from the outer surface of the spacer nut to the end of the axle inside the nut.

4. Insert the assembled nut and axle into the wheel at the side of the wheel with the new seal and bearing (Figure 34).
5. With the open end of the wheel facing up, fill the area inside wheel cavity (around the axle) with the specified grease.
6. Install the other bearing and new seal into the wheel (Figure 34).
7. Apply a thread-locking compound to the second spacer nut and thread it onto the axle with the wrench flats facing outward.
8. Torque the spacer nut to 8 to 9 N·m (75 to 80 in-lb), loosen, then torque it 2 to 3 N·m (20 to 25 in-lb).

   Important: **Ensure that the axle does not extend beyond either nut.**

9. Install the seal guards over the wheel hub (Figure 34).

Installing the Caster-Wheel Assembly

1. Align the hole in the axle of the caster-wheel assembly between the holes in the fork of the caster (Figure 33).
2. Secure the wheel assembly to the fork with the wheel nut and bolt (Figure 33) that you removed in step 3 of Removing the Caster-Wheel Assembly (page 34).
3. Torque the wheel nut to 91 to 113 N·m (67 to 83 ft-lb).

Engine Maintenance

Servicing the Air Cleaner

Inspect the foam and paper elements, and replace them if they are damaged or excessively dirty.

Important: **Do not apply oil to the foam or paper element.**

Accessing the Foam and Paper Elements

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Clean around the air cleaner to prevent dirt from getting into the engine and causing damage (Figure 35).

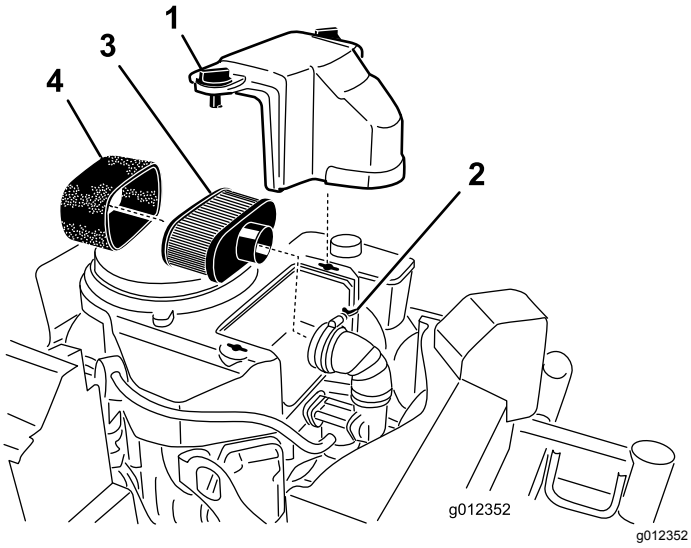


Figure 35

1. Cover
2. Hose clamp
3. Paper element
4. Foam element

3. Rotate the cover knobs 1/4 turn counterclockwise and remove the air-cleaner cover (Figure 35).
4. Rotate the thumbscrew of the hose clamp counterclockwise until you can separate the air-cleaner assembly from the inlet duct (Figure 35).

Servicing the Foam Air-Cleaner Element

Service Interval: Every 250 hours (more often in extremely dusty or sandy conditions).

1. Carefully remove the foam element from the paper element (Figure 35).
2. Inspect the both elements for tears, an oily film, or damaged (Figure 35).

   Important: **Replace the element(s) if it is worn or damaged.**
3. Wash the foam element in liquid soap and warm water. When the element is clean, rinse it thoroughly.
4. Dry the element by squeezing it in a clean cloth.
5. Assemble the foam element onto the paper element (Figure 35).
6. Install the air-cleaner elements onto the inlet duct of the engine (Figure 35).
7. Rotate the thumbscrew of the hose clamp clockwise (Figure 35).
8. Assemble the air-cleaner cover onto the engine and rotate the cover knobs 1/4 turn clockwise.

Replacing the Paper Air-Cleaner Element

Service Interval: Every 500 hours—Replace the paper air-cleaner element (more often in extremely dusty or sandy conditions).

Important: **Do not wash the paper air-cleaner element.**

1. Discard the old paper element.
2. Assemble the foam element onto the new paper element (Figure 35).
3. Install the air-cleaner elements onto the inlet duct of the engine (Figure 35).
4. Rotate the thumbscrew of the hose clamp clockwise (Figure 35).
5. Assemble the air-cleaner cover onto the engine and rotate the cover knobs 1/4 turn clockwise.

Servicing the Engine Oil

Engine-Oil Specifications

Oil Type: Detergent oil (API service SJ or later)

Engine-Oil Capacity: 1.7 L (1.8 US qt) with the filter removed; 1.5 L (1.6 US qt) without the filter removed

Engine-Oil Viscosity: Refer to the table below.

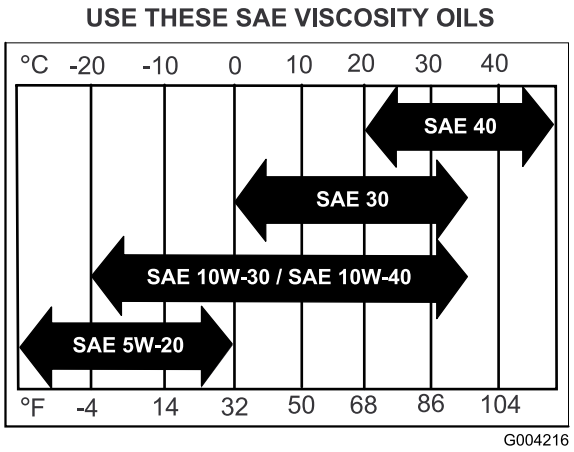


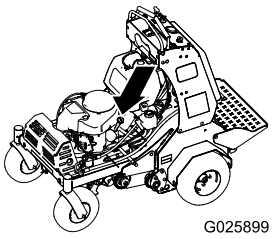
Figure 36

Checking the Engine-Oil Level

Service Interval: Before each use or daily

Important: **Do not operate the engine with the oil level below the Low (or Add) mark on the dipstick, or over the Full mark.**

1. Park the machine on a level surface, engage the parking brake, shut off the engine, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Allow the engine to cool.
3. Check the engine-oil level as shown in Figure 37.



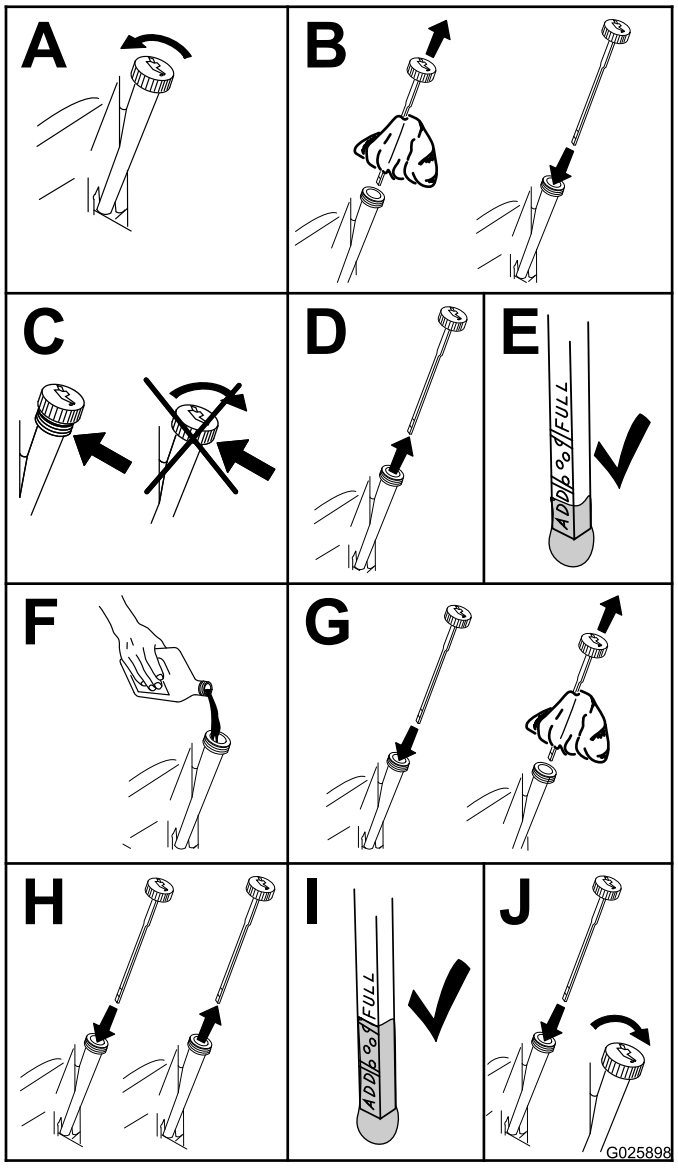


Figure 37

4. If the oil level is low, wipe off the area around the oil fill cap, remove cap and add the specified oil until the oil level is at the Full mark on the dipstick.

   Note: **Do not** overfill the engine with oil.

Changing the Engine Oil

Service Interval: After the first 5 hours

Every 100 hours

Note: Dispose of the used oil at a recycling center.

1. Park the machine so that the drain side is slightly lower than the opposite side to assure the oil drains completely.
2. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
3. Change the engine oil as shown in Figure 39.

   Note: Torque drain plug to 27 to 33 N·m (20 to 24 ft-lb).

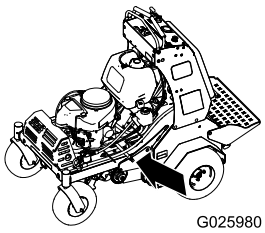


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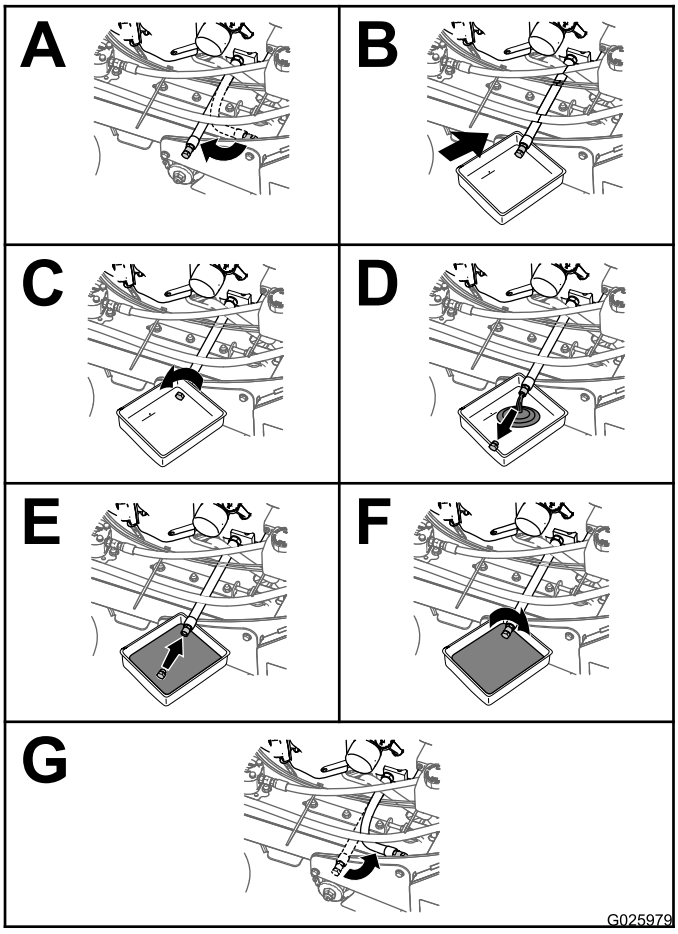
Figure 38



g025979

Figure 39

4. Slowly pour approximately 80% of the specified oil into the filler tube, and slowly add the additional oil to bring it to the **Full** mark (Figure 40).

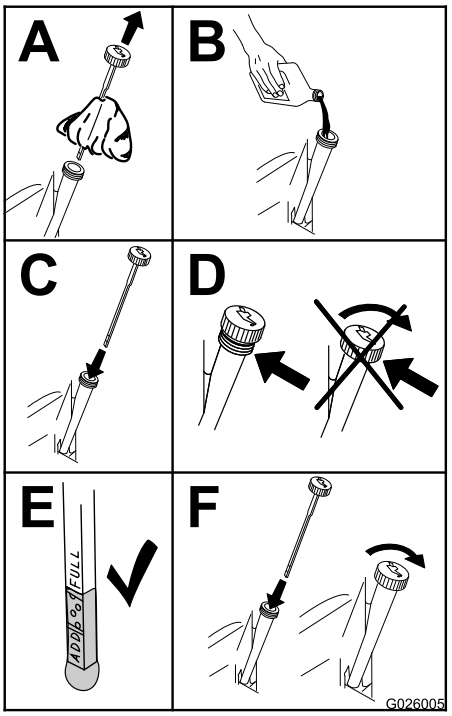


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Figure 40

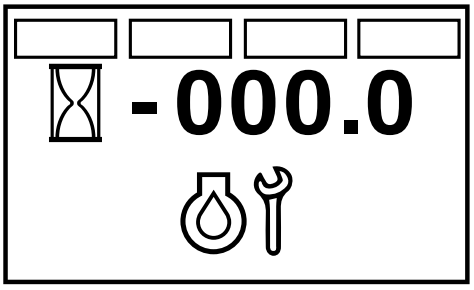
5. Start the engine and drive to a flat area.
6. Check the engine-oil level.
7. Reset the engine-oil service reminder; refer to Resetting the Engine-Oil Maintenance Reminder (page 38).

Resetting the Engine-Oil Maintenance Reminder

1. Prepare the machine for maintenance; refer to Preparing for the Machine for Maintenance (page 32).

   Note: You must engage the parking brake to reset the maintenance reminder.
2. Cycle the key switch between the RUN position and the OFF position 4 times within 8 seconds.

   The Service Engine screen displays and flashes (Figure 41).



g212117

Figure 41
Service Engine Screen

3. Press down the multi-function switch.

   The engine-oil maintenance reminder resets to 100.0 (hours), exits the Service Engine screen, and returns to the default screen.

Note: You can exit the Service Engine screen at any time by turning the key to either the OFF or the START positions.

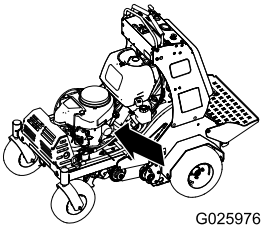
Changing the Engine-Oil Filter

Service Interval: After the first 5 hours (more often in extremely dusty or sandy conditions).

Every 100 hours (more often in extremely dusty or sandy conditions).

1. Drain the oil from the engine; refer to Changing the Engine Oil (page 38).
2. Place a rag under the oil filter to soak up any spilled oil.

   Important: **Spilled oil may drain under the engine. Wipe up any spilled oil.**
3. Change the engine-oil filter (Figure 42).



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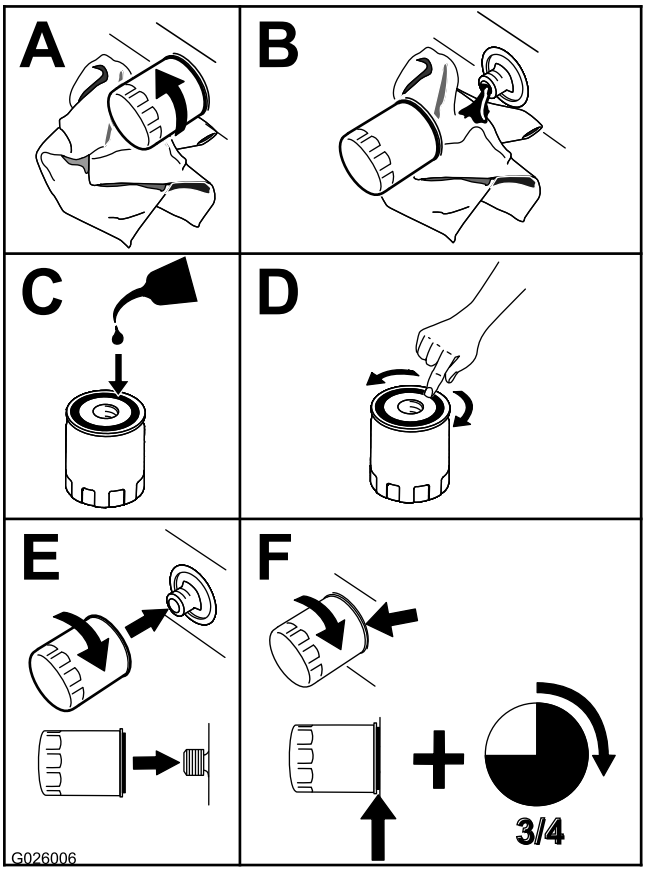


g026006

Figure 42

Note: Ensure that the oil-filter gasket touches the engine, and then turn the filter an extra 3/4 turn.

4. Fill the crankcase with the specified type of new oil; refer to Figure 36.

Servicing the Spark Plug

Service Interval: Every 160 hours

Type for all Engines: NGK BPR4ES or equivalent

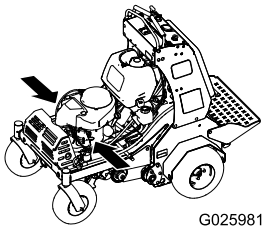
Air Gap: 0.75 mm (0.03 inch)

Make sure that the air gap between the center and side electrodes is correct before installing the spark plug.

Use a spark plug wrench for removing and installing the spark plug(s) and a gapping tool/feeler gauge to check and adjust the air gap. Install a new spark plug(s) if necessary.

Removing the Spark Plug

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Remove the spark plug as shown in Figure 43.



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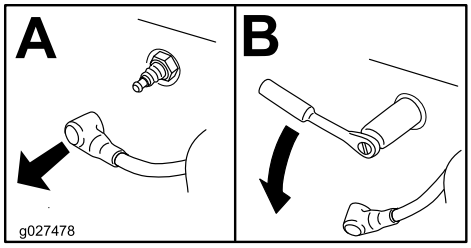

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Figure 43

Checking the Spark Plug

Important: **Do not clean the spark plug(s). Always replace the spark plug(s) when it has a black coating, worn electrodes, an oily film, or cracks.**

If you see light brown or gray on the insulator, the engine is operating properly. A black coating on the insulator usually means the spark plug is dirty.

Set the gap to 0.75 mm (0.03 inch).

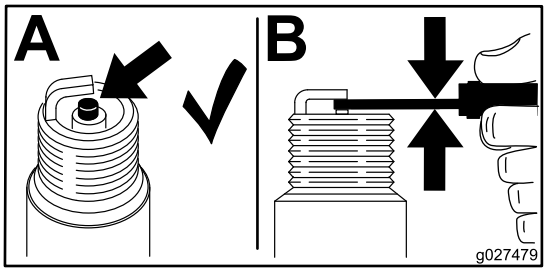

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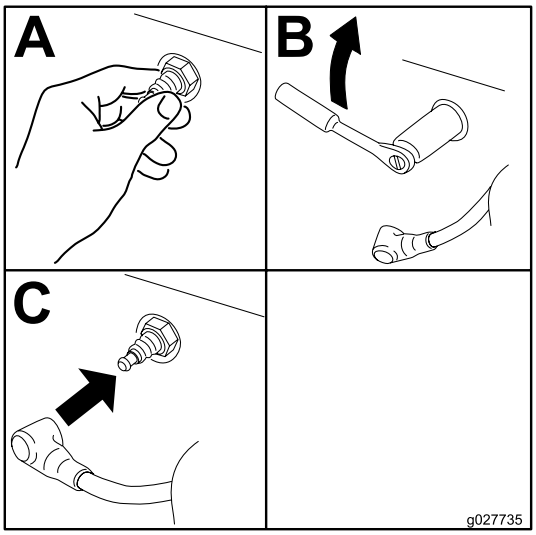
Figure 44

Installing the Spark Plug

Tighten the spark plug(s) to 22 N·m (16 ft-lb).



g027735

Figure 45

Checking the Spark Arrester

Machines with a Spark Arrester Only

Service Interval: Every 50 hours

⚠ WARNING

Hot exhaust system components may ignite fuel vapors even after the engine is shut off. Hot particles exhausted during engine operation may ignite flammable materials. Fire may result in personal injury or property damage.

Do not refuel or run engine unless spark arrester is installed.

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Allow the muffler to cool.
3. Check the spark arrester for breaks in the screen or welds.

   Note: Replace the spark arrester if it is worn or damaged.
4. If you see that the screen is plugged, perform the following:
   A. Remove the spark arrester.
   B. Shake loose the particles from the arrester and clean screen with a wire brush.

      Note: Soak the arrester screen in solvent if necessary.
   C. Install spark arrester onto exhaust outlet.

Fuel System Maintenance

Servicing the Fuel Filter

Replacing the Fuel Filter

Service Interval: Every 800 hours/Yearly (whichever comes first)

Note: Wipe up any spilled fuel.

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Close the fuel-shutoff valve; refer to Using the Fuel-Shutoff Valve (page 23).
3. Squeeze the ends of the hose clamps together and slide them away from the filter (Figure 46).

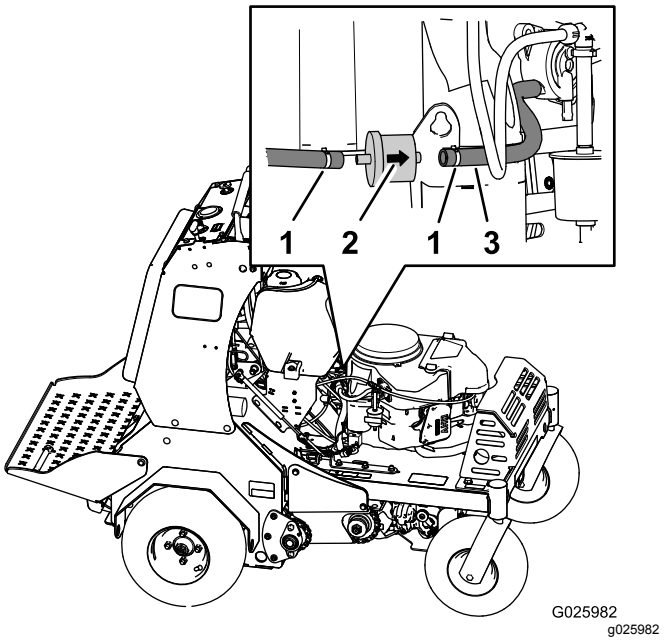


Figure 46

1. Hose clamp
2. Flow direction arrow (fuel filter)
3. Hose

4. Remove the filter from the fuel hoses (Figure 46).

   Note: Do not install a dirty filter after it is removed from the fuel line.
5. Install a new filter with the flow-direction arrow aligned as illustrated in Figure 46.

   Note: Ensure that the fuel hoses are fully seated onto the hose fittings of the fuel filter.
6. Align the hose clamps over the hose and the fuel-filter fittings (Figure 46).

7. Open the fuel-shutoff valve; refer to Using the Fuel-Shutoff Valve (page 23).
8. Check for fuel leaks and repair if needed.
9. Wipe up any spilled fuel.

Electrical System Maintenance

Checking the Safety-Interlock System

Service Interval: Before each use or daily

⚠ CAUTION

If the safety-interlock switches are disconnected or damaged, the machine could operate unexpectedly, causing personal injury.

- **Do not tamper with the interlock switches.**
- **Check the operation of the interlock switches daily and replace any damaged switches before operating the machine.**

Understanding the Safety-Interlock System

The safety-interlock system is designed to prevent the engine from starting unless the motion-control levers are in the neutral position.

Checking the Safety-Interlock System

1. Disconnect the spark-plug wires.
2. While on level ground, block the wheels of the machine to prevent unintended movement.
3. Disengage the parking brake.
4. With the motion-control levers in the neutral position turn the key to the START position—the starter must not crank.

Note: If the machine does not pass this test, do not operate the machine. Contact your Authorized Service Dealer.

Important: **It is essential that the operator safety mechanisms are connected and in proper operating condition prior to use.**

Servicing the Battery

Service Interval: Monthly

Always keep the battery clean and fully charged. Use a paper towel to clean the battery case. If the battery terminals are corroded, clean them with a solution of 4 parts water and 1 part baking soda. Apply a light coating of grease to the battery terminals to prevent corrosion.

Voltage: 12 V

⚠ DANGER

Charging or jump starting the battery may produce explosive gases. Battery gases can explode causing serious injury.

- **Keep sparks, flames, or cigarettes away from battery.**
- **Ventilate when charging or using battery in an enclosed space.**
- **Make sure venting path of battery is always open once battery is filled with acid.**
- **Always shield eyes and face from battery.**

⚠ DANGER

Battery electrolyte contains sulfuric acid, which is fatal if consumed and causes severe burns.

Do not drink electrolyte, and avoid contact with skin, eyes, and clothing. Wear safety glasses to shield your eyes and rubber gloves to protect your hands.

⚠ CAUTION

If the key switch is in the ON position, there is potential for sparks and engagement of components. Sparks could cause an explosion or moving parts could accidentally engage, causing personal injury.

Ensure that the key switch is in the OFF position before charging the battery.

Removing the Battery

⚠ WARNING

Battery terminals or metal tools could short against metal machine components, causing sparks. Sparks can cause the battery gasses to explode, resulting in personal injury.

- **When removing or installing the battery, do not allow the battery terminals to touch any metal parts of the machine.**
- **Do not allow metal tools to short between the battery terminals and metal parts of the machine.**

⚠ WARNING

Incorrect battery-cable routing could damage the machine and cables, causing sparks. Sparks can cause the battery gasses to explode, resulting in personal injury.

- **Always disconnect the negative (black) battery cable before disconnecting the positive (red) cable.**
- **Always connect the positive (red) battery cable before connecting the negative (black) cable.**

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Remove the console pad; refer to Removing the Console Pad (page 32).
3. On the battery, lift the black terminal cover from the negative cable (Figure 47).

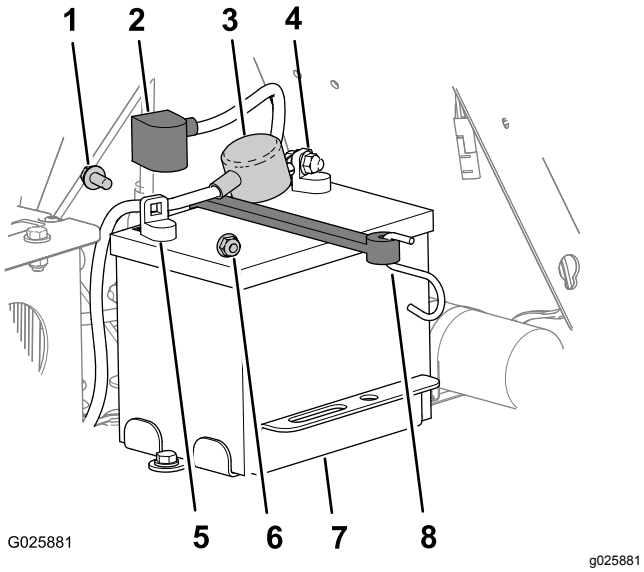


Figure 47

1. Flanged bolt
2. Terminal cover (black—negative battery terminal)
3. Terminal cover (red—positive battery terminal)
4. Positive (+) battery terminal
5. Negative (-) battery terminal
6. Flanged nut
7. Battery tray
8. Battery strap

4. Disconnect the negative battery cable from the negative (-) battery terminal, and remove the cable from the battery (Figure 47).
5. Slide the red terminal cover off the positive battery terminal (Figure 47).
6. Disconnect the positive (red) battery cable, and remove the cable from the battery (Figure 47).
7. Remove the hook of the battery strap from the battery tray (Figure 47), and remove the battery.

Installing the Battery

1. Place the battery onto the machine (Figure 47).
2. Secure the battery to the battery tray with the battery strap.
3. Install the positive (red) battery cable to positive (+) battery terminal with a flanged bolt and flanged nut (Figure 47).
4. Slide the red terminal cover over the positive-battery terminal.
5. Install the negative battery cable and the ground wire to the negative (-) battery terminal with a flanged bolt and flanged nut (Figure 47).
6. Slide the black terminal cover over the negative-battery terminal.

Charging the Battery

⚠ WARNING

Charging the battery produces gasses that can explode.

Never smoke near the battery and keep sparks and flames away from the battery.

Important: **Always keep the battery fully charged (1.265 specific gravity) to prevent battery damage when the temperature is below 0°C (32°F).**

1. Remove the battery from the chassis; refer to Removing the Battery (page 43).
2. Check the electrolyte level.
3. Ensure that the filler caps are installed on the battery.
4. Charge the battery for 1 hour at 25 to 30 A or 6 hours at 4 to 6 A.
5. When the battery is fully charged, unplug the charger from the electrical outlet, and disconnect the charger leads from the battery posts (Figure 48).
6. Install the battery onto the machine and connect the battery cables; refer to Installing the Battery (page 44).

   Note: Do not run the machine with the battery disconnected; electrical damage may occur.

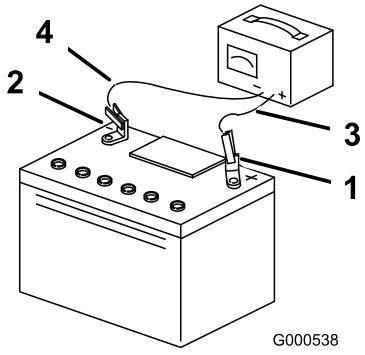


Figure 48

1. Positive battery post
2. Negative battery post
3. Red (+) charger lead
4. Black (-) charger lead

Jump Starting a Discharged Battery

The following instructions are adapted from the SAE J1494 Rev. Dec. 2001 – Battery Booster Cables – Surface Vehicle Recommended Practice (SAE – Society of Automotive Engineers).

⚠ DANGER

Jump starting a weak battery that is cracked, frozen, has low electrolyte level, or an open/shorted battery cell, can cause an explosion resulting in serious personal injury.

Do not jump start a weak battery if these conditions exist.

⚠ WARNING

Batteries contain acid and produce explosive gases.

- **Always shield your eyes and face from the battery.**
- **Do not lean over the batteries.**

Preparing to Jump Start the Battery

⚠ CAUTION

Corrosion or loose connections can cause unwanted electrical voltage spikes at any time during the jump starting procedure.

Do Not attempt to jump start with loose or corroded battery terminals or damage to the engine may occur.

1. Check the cable clamps and battery terminals of the discharged battery for corrosion (white, green, or blue “snow”) and check that the hardware for the clamps is tight.

   Clean corrosion from the battery terminals and cable clamps.
2. Check that the hardware for the cable clamps is tight.

   Tighten the cable-clamp hardware as needed.
3. Check that the vent caps on the discharged battery and booster battery are tight and level.
4. If available, place damp clothes over the vent caps of both batteries.
5. If you are jump starting from the battery in another vehicle, ensure that it has a 12 V lead acid battery.

   Important: **Ensure that the 2 vehicles do not touch.**
6. Ensure that the booster battery is fully charged with 12.6 volts or greater.
7. Select properly sized jumper cables (4 to 6 AWG) with short lengths to reduce voltage drop between systems.

   Choose jumper cables with color coded or polarity labeled cables or clamps.

Connecting the Jumper Cables

⚠ CAUTION

Connecting the jumper cables incorrectly (wrong polarity) can immediately damage the electrical system.

Be certain of battery terminal polarity and jumper cable polarity when hooking up batteries.

1. Connect the positive jumper cable—red (+) to the positive-battery terminal of the discharged battery as shown in Figure 49.

   Note: The positive-battery terminal is wired to the starter or solenoid

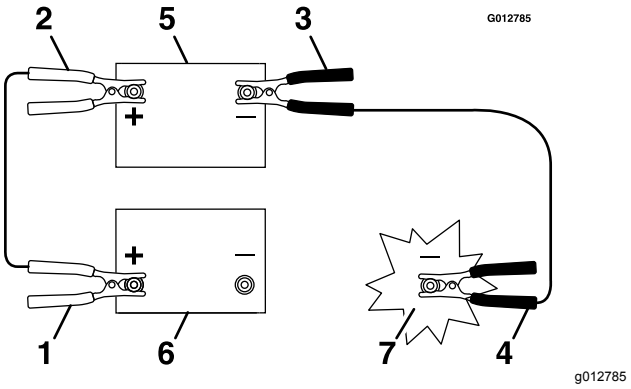


Figure 49

1. Positive (+) jumper cable at the discharged battery
2. Positive (+) jumper cable at the booster battery
3. Negative (–) jumper cable at the booster battery
4. Negative (–) jumper cable to the engine block (the machine with a discharged battery)
5. Booster battery
6. Discharged battery
7. Engine block (the machine with a discharged battery)

2. Connect the other end of the positive cable to the positive-battery terminal of the booster battery (Figure 49).
3. Connect the negative jumper cable—black (–) to the negative-battery terminal of the booster battery.
4. At the machine with a discharged battery, connect the other end of the negative jumper cable to the engine block, at a location away from the battery and belts (Figure 49).

Starting the Engine and Removing the Jumper Cables

1. Start the engine.
2. Remove the negative cable from the engine block (Figure 49).
3. Remove the negative cable from the discharged battery (Figure 49).
4. Remove the positive cable from the booster battery (Figure 49)
5. Remove the positive cable from the discharged battery (Figure 49)

Servicing the Fuses

The electrical system is protected by fuses, and requires no maintenance. If a fuse blows, check the component or circuit for a malfunction or short.

1. Release the cushion from the rear of the machine.
2. Remove the negative-battery cable from the battery terminal.

   Note: Ensure that the negative battery cable does not touch the battery terminal.
3. Pull the fuse from the socket of the fuse block (Figure 50).

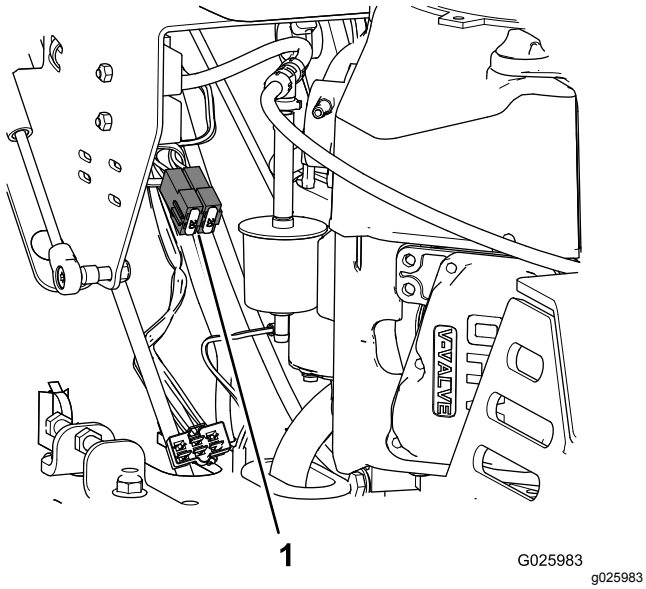


Figure 50

1. Fuse block

4. Install a fuse of the same type and amperes into the socket of the fuse block (Figure 50).
5. Install the negative-battery cable from the battery terminal; refer to steps 5 and 6 of Installing the Battery (page 44).

Drive System Maintenance

Checking the Air Pressure in the Tires

Service Interval: Every 50 hours

Note: The semi-pneumatic caster tires do not need to be inflated.

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Check the pressure of the drive tires.
3. Inflate the drive tires to 83 to 97 kPa (12 to 14 psi).

Checking the Wheel Hub Nuts

Service Interval: After the first 5 hours

Yearly

Torque the wheel hub nuts (Figure 51) to 285 to 350 N·m (210 to 260 ft-lb).

Note: Do not use anti-seize compound on the wheel hub.

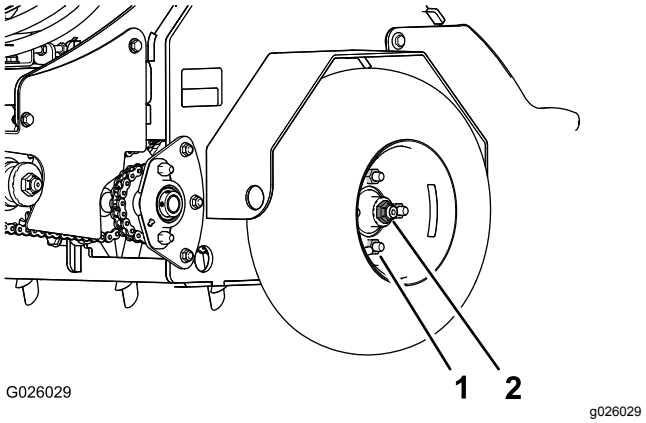


Figure 51

1. Lug nut
2. Hub nut

Checking the Torque of the Wheel Lug Nuts

Service Interval: Yearly

Torque the wheel lug nuts (Figure 51) to 122 to 129 N·m (90 to 95 ft-lb).

Checking the Torque of the Transmission Output Shaft Nut

Service Interval: After the first 5 hours

Yearly

Torque the nut (Figure 52) on the transmission output tapered shaft to 285 to 353 N·m (210 to 260 ft-lb).

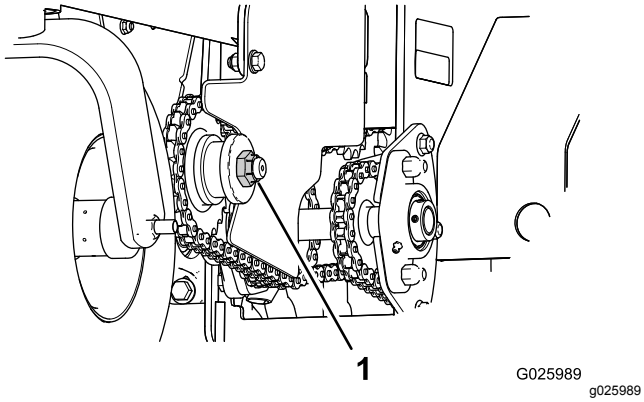


Figure 52

1. Transmission output shaft nut

Adjusting the Caster Pivot Bearings Pre-Load

Note: If you disassemble the caster pivot bearings, ensure that the spring-disc washers are installed as shown in Figure 53.

1. Remove dust cap from caster hub (Figure 53).

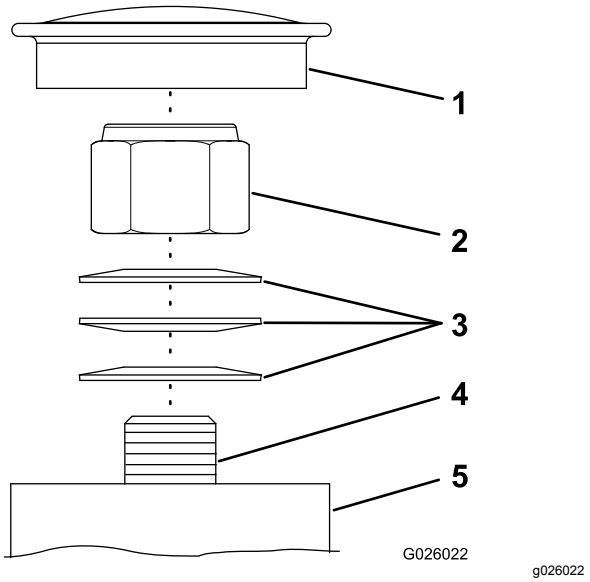


Figure 53

1. Dust cap
2. Locknut
3. Spring-disc washers
4. Spindle
5. Caster hub

2. Tighten the locknut clockwise until the spring-disc washers are flat (Figure 53).
3. Rotate the locknut counterclockwise 1/4 turn (Figure 53).
4. Install the dust cap (Figure 53).

Brake Maintenance

Adjusting the Parking Brake

If the parking brake does not hold securely, an adjustment is required.

1. Park the machine on a level surface.
2. Shut off engine and wait for all moving parts to stop.
3. Check the air pressure in the drive tires.

   Note: If needed, adjust to the recommended inflation; refer to Checking the Air Pressure in the Tires (page 46).
4. Loosen the jam nut on the brake cable under the console (Figure 54).

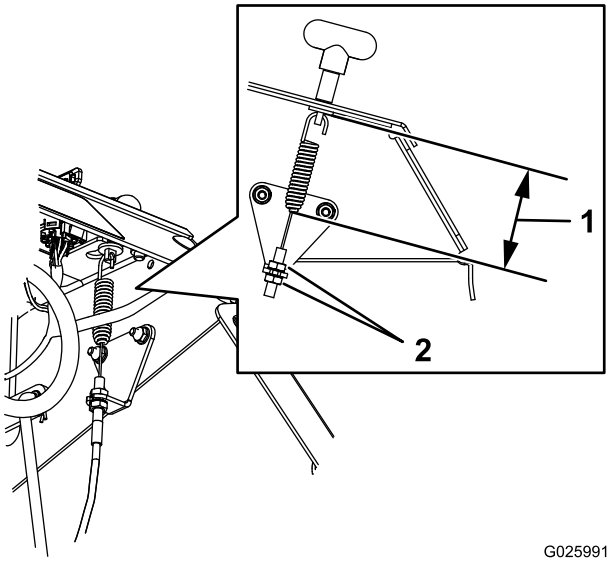


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Figure 54

1. 7.9 cm (3-1/8 inch)

5. Engage the parking brake (Figure 54).
6. Adjust the jam nut position until 7.9 cm (3-1/8 inch) from the bottom of the link to the bottom of the spring (Figure 54).
7. Secure the adjustment of the cable by tightening the jam nuts (Figure 54).
8. Check the parking brake; if necessary, repeat steps 4 through 7.

Adjusting the Brake Switch

1. Park the machine on a level surface.
2. Shut off the engine and wait for all moving parts to stop.
3. Prior the adjusting the brake switch ensure that the parking brake is properly adjusted; refer to Adjusting the Parking Brake (page 48).
4. Engage the parking brake.
5. Check the distance between the parking brake-switch bracket to the brake arm of the transmission (Figure 55).

   Note: The distance should be 3.2 mm (1/8 inch).

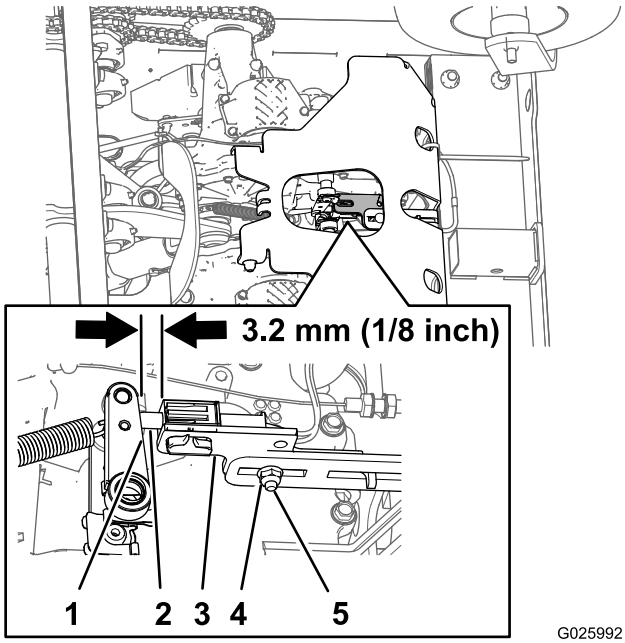

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Figure 55

1. Brake arm (transmission)
2. Plunger (brake switch)
3. Brake-switch bracket
4. Locknut
5. Carriage bolt

6. If adjustment is required, preform the following:
   A. Loosen the locknut and carriage bolt securing the parking brake switch bracket (Figure 55).
   B. Adjust the position of the brake-switch bracket until the gap (Figure 55) between the switch bracket and the brake arm is 3.2 mm (1/8 inch)
   C. Tighten the locknut and carriage bolt (Figure 55) securing the brake-switch bracket to 1017 to 1243 N·cm (90 to 110 in-lb).

Belt Maintenance

Checking the Condition and Tension of the Belts

Service Interval: Every 50 hours

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Raise the machine and support it with jack stands with a 460 kg (1,015 lb) capacity.
3. Check the auxiliary pump-drive belt condition and tension (Figure 56).

   Note: The belt should deflect 1.3 cm (1/2 inch) when 1.4 kg (3 lb) of force is applied to the belt midway between the auxiliary pump and engine pulleys. If the belt tension is too high or too low, refer to Adjusting the Auxiliary Pump-Drive Belt (page 49).
4. Check condition of the transmission-drive belt (Figure 56).

   Note: The transmission belt has an automatic-spring tensioner.

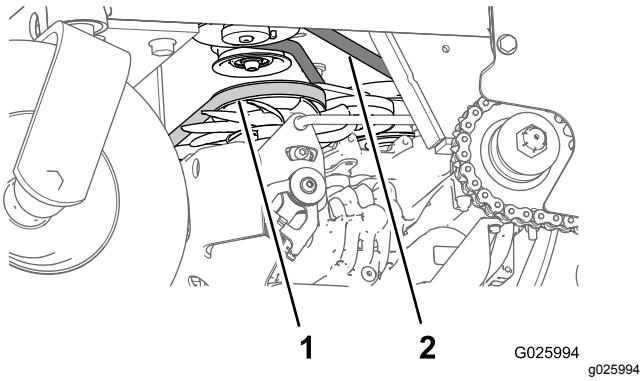


Figure 56

1. Transmission-drive belt
2. Auxiliary pump-drive belt

Adjusting the Auxiliary Pump-Drive Belt

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Loosen the locknut (3/8 inch) that secures the auxiliary pump-idler pulley to the chassis of the machine.

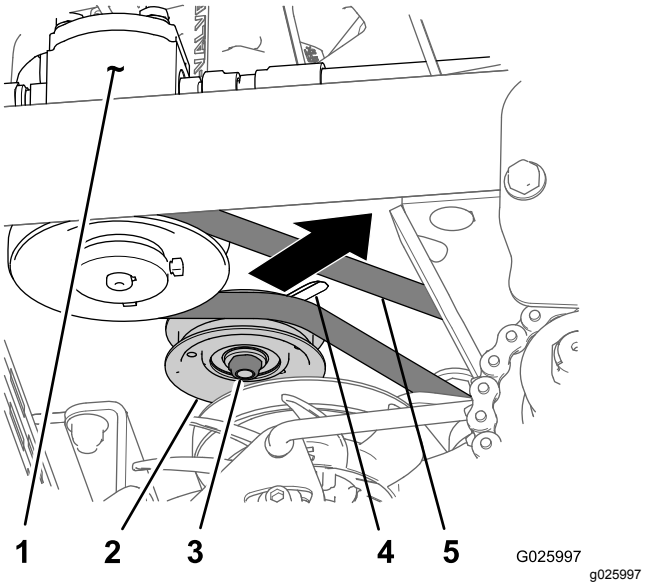


Figure 57

1. Auxiliary pump
2. Auxiliary pump-idler pulley
3. Locknut (3/8 inch)
4. Adjustment slot (chassis)
5. Auxiliary pump-drive belt

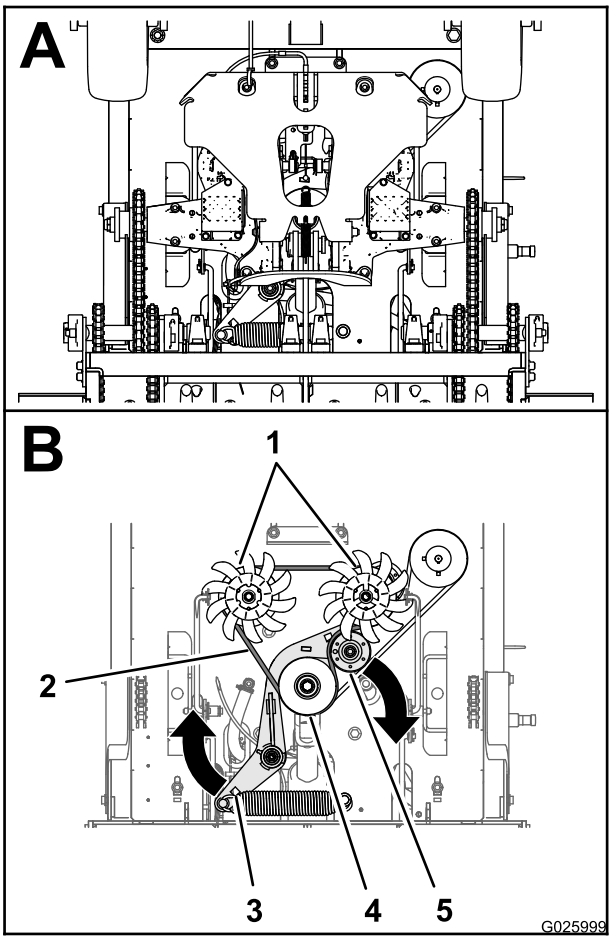
3. Adjust the belt tension as follows:
   - Move the auxiliary pump-idler pulley rearward and outward to tighten the belt.
   - Move the auxiliary pump-idler pulley forward and inward to loosen the belt.

   Note: The belt should deflect 1.3 cm (1/2 inch) when 1.4 kg (3 lb) of force is applied to the belt midway between the auxiliary pump and engine pulleys.
4. Tighten locknut to 37 to 45 N·m (27 to 33 ft-lb).

Replacing the Transmission-Drive Belt

Note: No adjustments are required for belt tension.

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Insert a breaker bar into the socket of the belt-tension bracket and move the bracket outward and forward (Figure 58).



g025999

Figure 58

1. Transmission pulley
2. Transmission
3. Socket (belt-tension bracket)
4. Engine pulley
5. Tensioner pulley

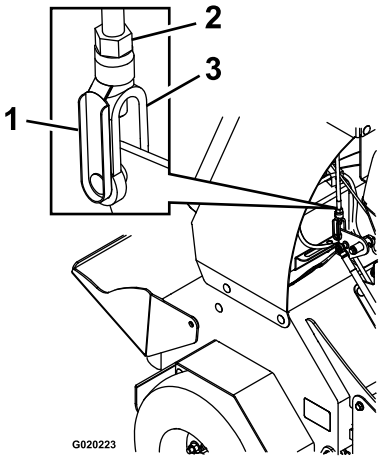
3. Slip the transmission-drive belt of the engine, tensioner, and transmission pulleys (Figure 58).
4. Route the new transmission-drive belt around the engine, tensioner, and transmission pulleys as shown in Figure 58
5. Release the belt-tension bracket and allow the spring to tension the belt (Figure 58).

   Note: Make sure that the belt-tension bracket and pulley can move freely.

Controls System Maintenance

Adjusting the Traction-Control Linkage

1. Park the machine on a level surface.
2. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
3. Push the control lever all the way forward toward the front reference bar.
4. If the control lever **contacts the reference bar** or If the gap between the control lever and reference bar is **larger than 1.6 mm (1/16 inch)**, perform the following:
   A. Release the control lever and allow it to return to the neutral position.
   B. Remove the spring-clevis pin from the fork fitting of the traction-control linkage (Figure 59).



g020223

Figure 59

1. Spring-clevis pin
2. Locknut
3. Turnbuckle

   C. Adjust the fork fitting to set the initial gap as follows:
      - If the control lever **contacts the reference bar**, rotate the fork fitting (Figure 59) counterclockwise (as viewed from the top of the machine).
      - If the gap between the control lever and reference bar is **larger than 1.6 mm (1/16 inch)**, rotate the fork fitting (Figure 59) counterclockwise.
   D. Install the spring clevis pin (Figure 59) and move the control lever forward.

E. Repeat steps A through D until there is a gap approximately 1.6 mm (1/16 inch) between the control lever and the front reference bar.

F. Remove the spring-clevis pin, rotate the turnbuckle clockwise 1 additional turn, and insert the spring-clevis pin (Figure 59).

5. Repeat steps 4A through 4 F for the other traction-control linkage.

Hydraulic System Maintenance

Maintaining the Auxiliary Hydraulic System

Hydraulic Fluid Specification

AW-32 hydraulic fluid

Checking the Auxiliary Hydraulic-Fluid Level

Service Interval: Every 50 hours

1. Park the machine on a level surface.
2. Lower the tines to the ground.
3. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
4. Remove the console pad; refer to Removing the Console Pad (page 32).
5. Clean the area around the hydraulic reservoir cap (Figure 60).

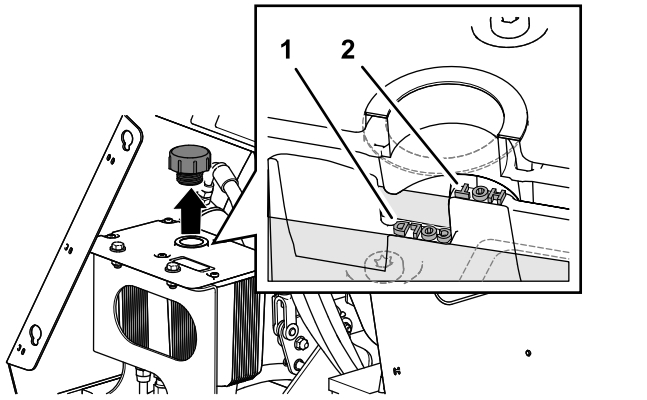


Figure 60

1. **Cold** fluid level
2. **Hot** fluid level

6. Remove the cap and check hydraulic-fluid level in the reservoir (Figure 60).

   Note: The hydraulic-fluid level should cover the word **Cold** that is embossed into the baffle of the reservoir.

7. If necessary, add the specified hydraulic fluid to the reservoir until the fluid covers the **Cold** fluid level on the baffle (Figure 60).

   Note: The baffle ion the reservoir is labeled **Hot** and **Cold**. Fill the reservoir to the appropriate level depending upon the temperature of the fluid. The fluid level varies with the temperature

of the fluid. The **Cold** level shows the level of the fluid when it is at 24°C (75°F). The **Hot** level shows the level of fluid when it is at 107°C (225°F).

For example: If the fluid is at ambient-air temperature, about 24°C (75° F), fill only to the **Cold** level. If the fluid is about 65°C (150° F), fill to halfway between the **Hot** and **Cold** levels.

8. Replace the hydraulic reservoir cap and tighten it until it is snug (Figure 60).

Note: Do not overtighten the reservoir cap.

9. Install the console pad; refer to Removing the Console Pad (page 32).

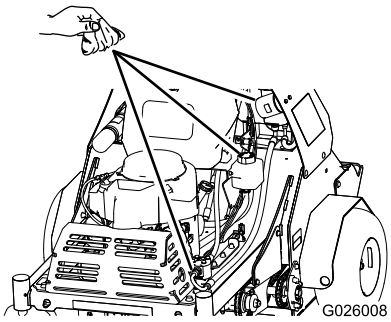
Changing the Auxiliary Hydraulic Reservoir Fluid and Filter

Service Interval: After the first 100 hours

Every 250 hours thereafter

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Carefully clean area around the front of the auxiliary pump, fill cap for the reservoir, and filter (Figure 61).

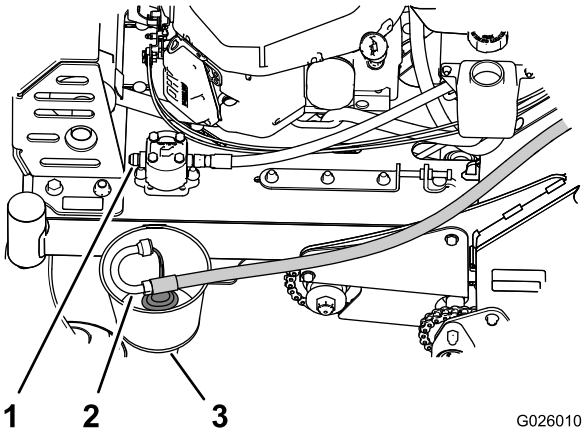
Important: **Ensure that no dirt or contamination enters hydraulic system.**



g026008

Figure 61

3. At the front of the auxiliary hydraulic pump, remove the inlet hose from the hydraulic fitting in the pump, place the end of the hose in a drain container, and allow the fluid to drain (Figure 62).

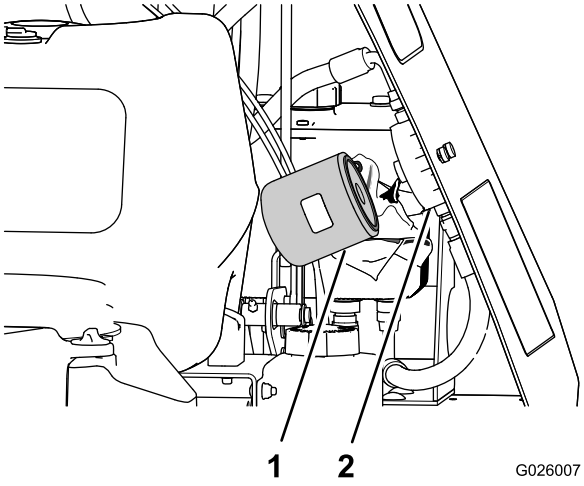


g026010

Figure 62

1. Hydraulic fitting (auxiliary hydraulic pump)
2. Inlet hose
3. Drain container

4. Clean around the fitting for the hydraulic pump.
5. Rotate the auxiliary hydraulic filter counterclockwise and remove it from the base of the filter adapter (Figure 63). Allow the fluid to drain.



g026007

Figure 63

1. Auxiliary hydraulic filter
2. Filter adapter

6. Apply a thin coat of specified fluid onto the seal of the new hydraulic filter.
7. Install the filter by rotating it clockwise onto the filter adapter until the seal contacts the filter adapter, then tighten the filter an additional 2/3 to 3/4 turn (Figure 63).
8. Install the inlet hose onto the fitting in the pump and torque the hose fitting to 50 N·m (37 ft-lb).

9. Add the specified fluid until the level reaches the Cold fill line located on the reservoir tank; refer to Checking the Auxiliary Hydraulic-Fluid Level (page 51).
10. Start the engine and raise and lower the tines.
11. Lower the tines to the ground and refill the reservoir to the Cold fill line.

Maintaining the Transmission

Transmission Fluid Specification

Toro® HYPR-OIL™ 500 hydraulic fluid or Mobil® 1 15W-50 synthetic motor oil.

Important: **Use the specified fluid. Other fluids could cause system damage.**

Checking the Transmission Fluid Level

Service Interval: Every 50 hours

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Allow the machine to cool.
3. Remove the cap from the expansion tank and check the hydraulic-fluid level in the tank (Figure 64).

   Note: The transmission fluid level should cover the Full Cold line molded into the side of the tank.

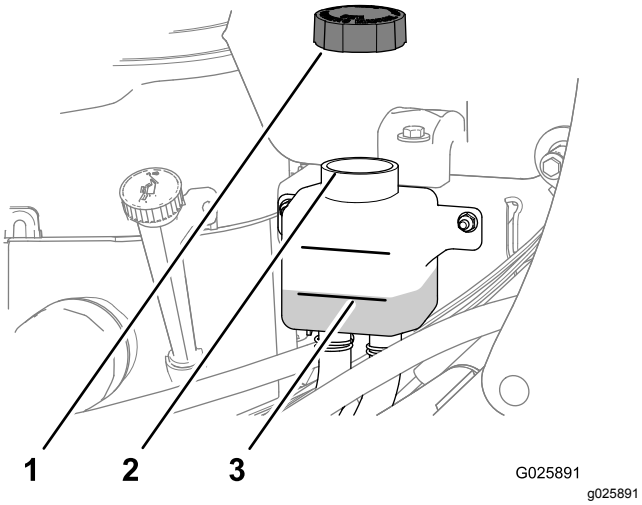


Figure 64

1. Cap
2. Filler neck (expansion tank)
3. Full Cold line

4. If necessary, add the specified transmission fluid until the fluid level is at the Full Cold line of the expansion tank (Figure 64).
5. Replace expansion-tank cap and tighten it until snug.

   Important: **Do not overtighten the expansion-tank cap.**

Changing the Transmission Filters

Service Interval: After the first 100 hours

Every 250 hours thereafter

Note: Do not change the hydraulic system fluid (except for what can be drained when changing filter), unless the fluid has been contaminated or been extremely hot.

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Raise the machine and support it with jack stands with a 460 kg (1,015 lb) capacity.
3. Remove the 3 washer-head bolts (1/4 x 3/4 inch) that secure the filter guard to the transmission, and remove the guard (Figure 65).

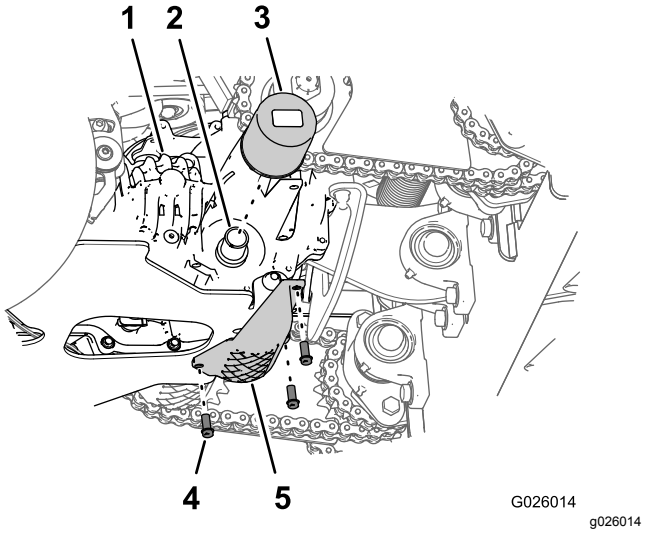


Figure 65

1. Transmission
2. Filter adapter
3. Transmission filter
4. Washer-head bolts (1/4 x 3/4 inch)
5. Filter guard

4. Clean the around the transmission filter (Figure 65).
5. Align a drain pan under the filter.
6. Rotate the filter counterclockwise and remove the filter (Figure 65).

   Note: Allow the fluid to completely drain from the filter adapter of the transmission.

7. Apply a thin coat of specified fluid onto the seal of the new transmission filter.
8. Install the filter by rotating it clockwise onto the filter adapter until the seal contacts the base of the adapter, then tighten the filter an additional 3/4 to 1 turn (Figure 65).
9. Install the filter guard with the 3 washer-head bolts (1/4 x 3/4 inch) that you removed in step 3 (Figure 65), and tighten the bolts to 1117 to 1243 N·cm (90 to 110 in-lb).

Filling the Transmissions with Fluid

Service Interval: After the first 100 hours

Every 250 hours thereafter

1. Raise the rear of machine up and support with jack stands (or equivalent support) just high enough to allow the drive wheels to turn freely.

⚠ CAUTION

Raising the machine for service or maintenance relying solely on mechanical or hydraulic jacks could be dangerous. The mechanical or hydraulic jacks may not be enough support or may malfunction allowing the machine to fall, which could cause injury.

Do not rely solely on mechanical or hydraulic jacks for support. Use adequate jack stands or equivalent support.

2. Align a drain pan under the sight plugs of the transmissions (Figure 66 and Figure 67).

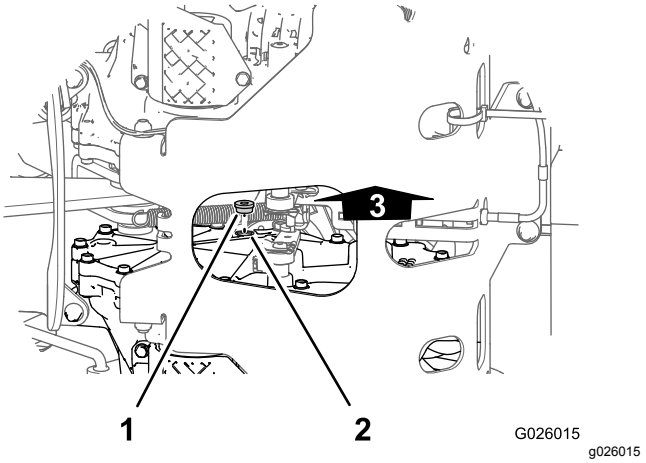


Figure 66

Left transmission shown

1. Sight plug
2. Sight-plug port
3. Up

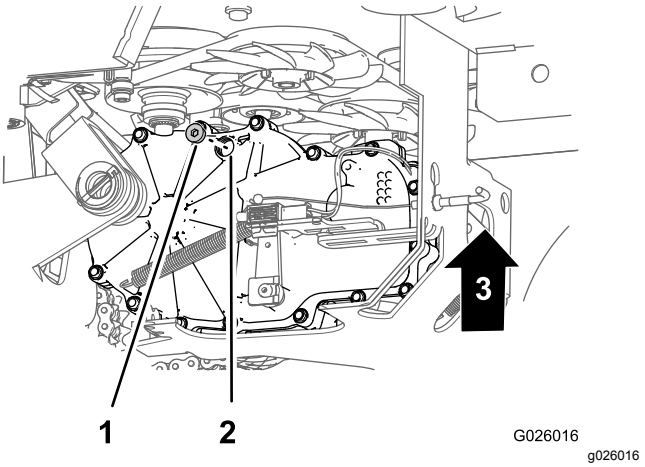


Figure 67

Left transmission shown

1. Sight plug
2. Sight-plug port
3. Up

3. At the inboard side of the transmission, near the top, remove the sight plug from 1 of the transmissions (Figure 66 and Figure 67).
4. Add the specified fluid to the expansion tank until fluid flows from the sight-plug port; refer to Checking the Transmission Fluid Level (page 53).
5. Install the sight plug and torque it to 244 N·m (180 in-lb).
6. Repeat steps 3 through 5 for the other transmission.
7. Add the specified fluid into the expansion tank until the fluid level is at the Full Cold line of the tank.

8. Start the engine and move the throttle midway between the SLOW and FAST positions
9. Disengage the parking brake.
10. Slowly move the motion-control levers in the forward and reverse directions 5 to 6 times.

    Note: Cycling the traction-controls forward and reverse purges air from the transmissions.
11. Shut off the engine and remove the key.
12. Check the fluid level in the expansion tank, and add the specified fluid as required; refer to Checking the Transmission Fluid Level (page 53).
13. Repeat steps 8 through 12 until all the air is completely purged from the transmissions.

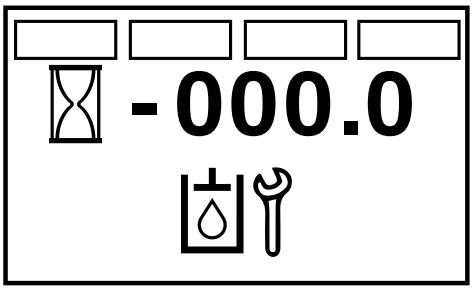
    Note: The air is purged when the transmissions when the transmissions operate at normal noise levels and smoothly move forward and reverse at normal speeds.
14. Lower the machine and remove the jack stands.
15. Reset the transmission-oil maintenance reminder; refer to Resetting the Transmission-Oil Maintenance Reminder (page 55).

Resetting the Transmission-Oil Maintenance Reminder

1. Prepare the machine for maintenance; refer to Preparing for the Machine for Maintenance (page 32).

   Note: You must engage the parking brake to reset the maintenance reminder.
2. Cycle the key switch between the RUN position and the OFF position 6 times within 8 seconds.

   The Service Transmission screen displays and flashes (Figure 68).



g212118

Figure 68
Service Transmission Screen

3. Press down the multi-function switch.

   The transmission-oil maintenance reminder resets to 250 (hours), exits the service transmission screen, and returns to the default screen.

Note: You can exit the service transmission screen at any time by turning the key to either the OFF or the START positions.

Chain Maintenance

Checking the Condition of the Sprockets

Service Interval: Before each use or daily

1. Shut off the engine, engage the parking brake, wait for all moving parts to stop, and remove the key.
2. Inspect sprockets for wear and replace as required (Figure 69).

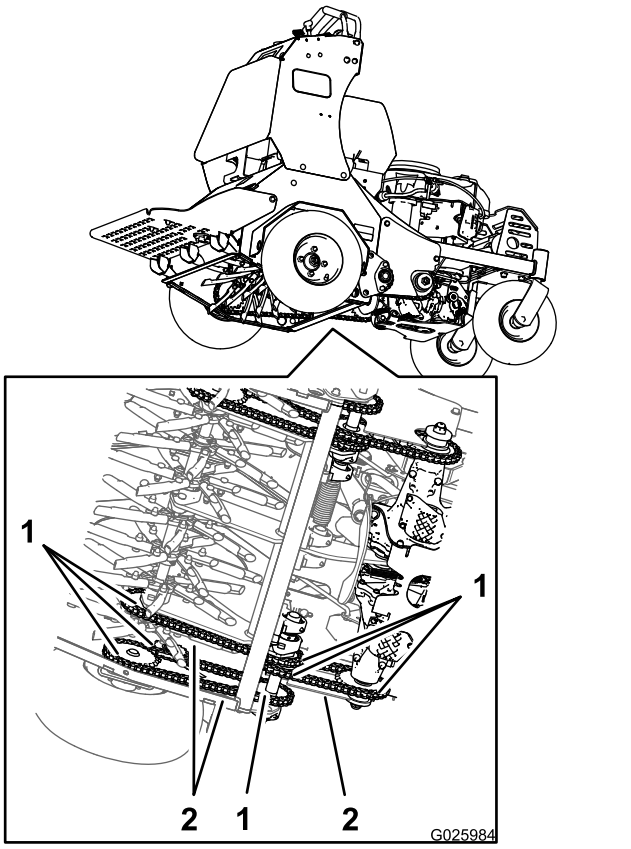


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Figure 69

1. Sprockets
2. Chains

Checking the Condition and Tension of the Chains

Service Interval: Before each use or daily

1. Shut off the engine, engage the parking brake, wait for all moving parts to stop, and remove the key.
2. Check the condition and chain tension for the following chains at both sides of the machine:
   - Jackshaft drive-chain
   - Drive wheel chain
   - Tine drive chain

   The chains should move up and down 6 to 12 mm (1/4 to 1/2 inch).

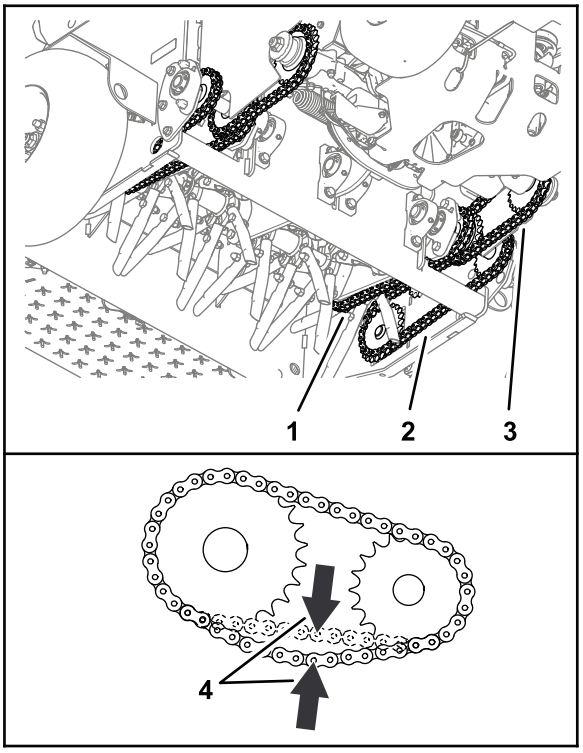

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Figure 70

1. Tine drive chain
2. Drive wheel chain
3. Jackshaft drive-chain
4. 6 to 12 mm (1/4-1/2 inch)

3. If the chains pop, snap, or the tension is incorrect, adjust the chain tension; refer to Adjusting the Jackshaft Drive-Chain Tension (page 56), Adjusting the Drive Wheel Chain Tension (page 57), or Adjusting the Tine Drive Chain (page 58).

Adjusting the Jackshaft Drive-Chain Tension

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Lift the rear of the machine and support it using jack stands or equivalent support.
3. Check the chains on both sides of the machine for proper tension.

   Note: The chains should move up and down 6 to 12 mm (1/4 to 1/2 inch).
4. At each side of the machine, loosen the 3 nuts and bolts that secure the transmission mount

and tensioner plate, and the 2 nuts securing the adjustment bolt at the tensioner plate as shown in Figure 71.

Note: You must loosen the nuts and bolts that secure the transmission mount and tensioner plate at both sides of the machine.

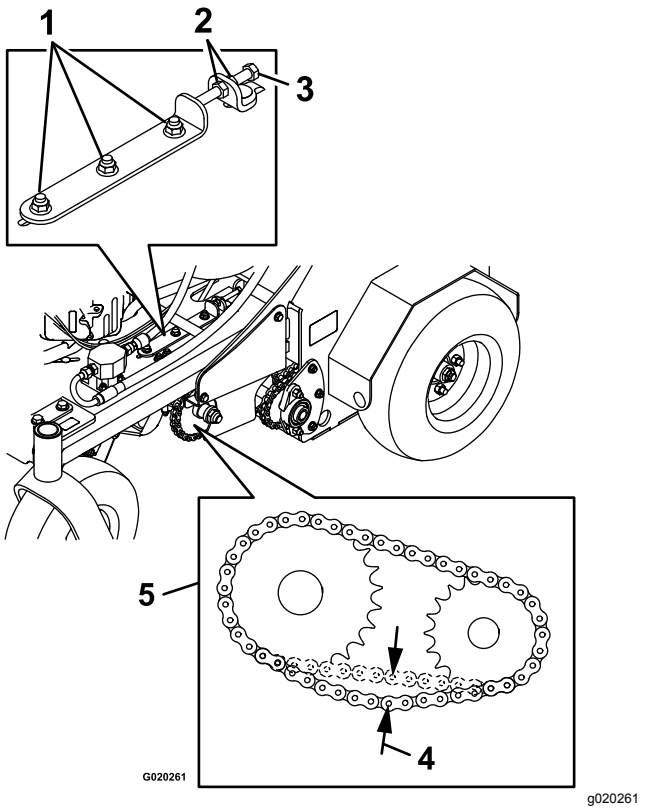


Figure 71

1. Hydro mounting bolts and nuts
2. Nuts
3. Adjustment bolt
4. 6 to 12 mm (1/4-1/2 inch)
5. Guard removed for clarity

5. Turn the adjustment bolt to move transmission adjustment plates and transmission.
6. When the chains can move up and down 6 to 12 mm (1/4 to 1/2 inch), tighten the nuts on both sides of the adjustment bolts.
7. Tighten nuts and bolts that secure the hydro mounting.
8. Adjust the traction-control linkage, refer to Adjusting the Traction-Control Linkage (page 50).

Adjusting the Drive Wheel Chain Tension

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Lift the rear of the machine and support it using jack stands.
3. Check the tension of the drive-wheel chains (Figure 72).

   Note: The chains should move up and down 6 to 12 mm (1/4 to 1/2 inch).

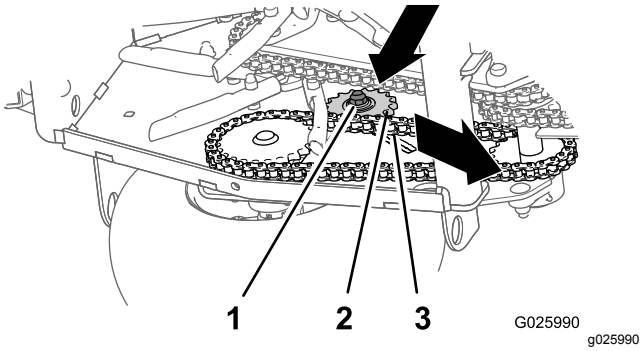


Figure 72

1. Locknut
2. Idler sprocket
3. Drive-wheel chain

4. Loosen the locknut and carriage bolt that secure the idler sprocket (Figure 72).
5. Increase or decrease chain tension by performing the following:
   - Push down and forward on the sprocket to increase the chain tension as shown in Figure 72.
   - Lift up and back on the sprocket to decrease the chain tension.
6. Torque the locknut to 91 to 113 N·m (67 to 83 ft-lb).
7. Check the chain tension and if necessary repeat steps 4 through 6 until you can move the chain up and down 6 to 12 mm (1/4 to 1/2 inch).

Adjusting the Tine Drive Chain

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Remove the rear cover; refer to step 3 of Checking the Tines (page 58).
3. Check the chains on both sides of the machine for proper tension.

   Note: The chains should move up and down 6 to 12 mm (1/4 to 1/2 inch).
4. Loosen the locknut and carriage bolt that secure the idler sprocket (Figure 73).

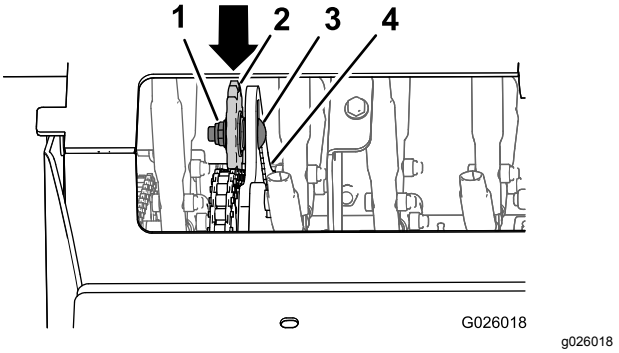


Figure 73

1. Locknut
2. Idler sprocket
3. Carriage bolt
4. Slot (trail plate)

5. Increase or decrease chain tension by performing the following:
   - Push down and forward on the sprocket to increase the chain tension as shown in Figure 73.
   - Lift up and back on the sprocket to decrease the chain tension.
6. Torque the locknut to 91 to 113 N·m (67 to 83 ft-lb).
7. Check the chain tension and if necessary repeat steps 4 through 6 until you can move the chain up and down 6 to 12 mm (1/4 to 1/2 inch).
8. Install the rear panel; refer to steps 6 and 7 of Checking the Tines (page 58).

Tine Maintenance

Checking the Tines

Service Interval: Before each use or daily

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Raise the machine and support it with jack stands with a 460 kg (1,015 lb) capacity.

⚠ CAUTION

Raising the machine for service or maintenance relying solely on mechanical or hydraulic jacks could be dangerous. The mechanical or hydraulic jacks may not be enough support or may malfunction allowing the machine to fall, which could cause injury.

Do not rely solely on mechanical or hydraulic jacks for support. Use adequate jack stands or equivalent support.

3. Remove the 2 bolts (3/8 x 1 inch) and 2 washers (3/8 inch) that secure the rear-cover panel to the chassis, and remove the panel (Figure 74).

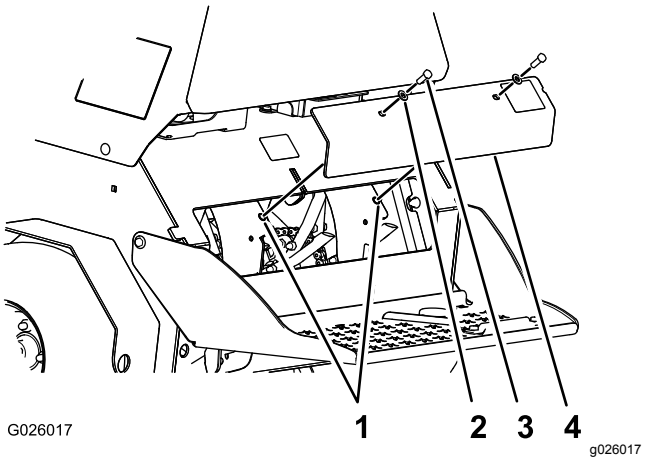


Figure 74

1. Chassis holes
2. Washer (3/8 inch)
3. Bolt (3/8 x 1 inch)
4. Rear panel

4. Remove rocks and other debris from the tines.
5. Inspect the tines for wear and damage.

   Note: Replace any tines that are worn or damaged.
6. Align the holes in the rear-cover panel to the holes in the chassis (Figure 74).

7. Secure the cover panel to the chassis with the 2 bolts and 2 washers (Figure 74) that you removed in step 3, and torque the bolts to 37 to 45 N·m (27 to 33 in-lb)

Chassis Maintenance

Checking for Loose Hardware

Service Interval: Before each use or daily

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop.
2. Visually inspect machine for any loose hardware or any other possible problem.

   Note: Tighten all loose hardware or repair the problem before operating the machine.

Cleaning

Wash the machine as needed using water alone or with a mild detergent. You may use a rag when washing the machine.

Important: **Do not use brackish or reclaimed water to clean the machine.**

Important: **Do not use power-washing equipment to wash the machine. Power-washing equipment may damage the electrical system, loosen important decals, or wash away necessary grease at friction points. Avoid excessive use of water near the control panel, engine, and battery.**

Important: **Do not wash the machine with the engine running. Washing the machine with the engine running may result in internal engine damage.**

Cleaning the Engine and the Exhaust System Area

Service Interval: Before each use or daily (more often in dry or dirty conditions).

⚠ CAUTION

Excessive debris around engine cooling air intake and exhaust system area can cause engine, exhaust area, and hydraulic system to overheat, which can create a fire hazard.

Clean all debris from engine and exhaust system area.

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Clean all debris from screen at the top of the engine, around engine shrouding, and exhaust system area.
3. Wipe up any excessive grease or oil around the engine and exhaust system area.

Removing the Engine Shrouds and Cleaning the Cooling Fins

Service Interval: Every 80 hours

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Remove cooling shrouds from engine.
3. Clean cooling fins of the engine.

   Note: Also clean dust, dirt, and oil from external engine surfaces, which can cause improper cooling.
4. Install the cooling shrouds into the engine.

   Important: **Operating the engine without the cooling shrouds will cause engine damage from overheating.**

Cleaning the Debris from the Machine

Service Interval: Before each use or daily

Important: **Wash the machine with mild detergent and water. Do not pressure wash the machine. Avoid excessive use of water, especially near the control panel, around the engine, hydraulic pumps, and motors.**

1. Shut off the engine, engage the parking brake, remove the key, and wait for all moving parts to stop before leaving the operating position.
2. Clean off any oil, debris, or grass buildup on the machine and aerator deck.
3. Clean off any debris or grass under the chain guards, around the fuel tank, and around the engine and exhaust area.

Waste Disposal

Disposing of the Engine Oil

Engine oil and hydraulic fluid are both pollutants to the environment. Dispose of used oil at a certified recycling center or according to your state and local regulations.

Disposing of the Battery

⚠ DANGER

Battery electrolyte contains sulfuric acid, which is poisonous and can cause severe burns. Swallowing electrolyte can be fatal or can cause severe burns if it touches skin.

- **Wear safety glasses to shield eyes, and rubber gloves to protect skin and clothing when handling electrolyte.**
- **Do not swallow electrolyte.**
- **In the event of an accident, flush with water and call a doctor immediately.**

Federal law states that batteries should not be placed in the garbage. Management and disposal practices for batteries must follow relevant federal, state, or local laws.

If you are replacing the battery or your machine is no longer operated and it is being scrapped—remove the battery; take the battery to a local certified recycling center. If no local recycling is available return the battery to any certified battery reseller.

Storage

Preparing the Machine for Storage

Service Interval: Yearly

1. Raise the tines, stop the machine, shut off the engine, engage the parking brake, and remove the key.
2. Remove dirt and grime from the entire machine.

   Important: **You can wash the machine with mild detergent and water. Do not pressure-wash the machine. Avoid excessive use of water, especially near the engine and hydrostatic drive.**
3. Service the air cleaner; refer to Servicing the Air Cleaner (page 36).
4. Lubricate the machine; refer to Lubrication (page 33).
5. Change the engine oil; refer to Changing the Engine Oil (page 38).
6. Check and tighten all bolts, nuts, and screws. Repair or replace any part that is damaged.
7. Paint all scratched or bare metal surfaces. Paint is available from your Authorized Service Dealer.
8. Store the machine in a clean, dry garage or storage area.
9. Cover the machine to protect it and keep it clean.

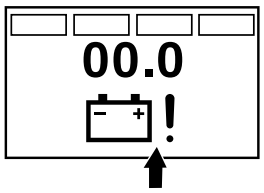
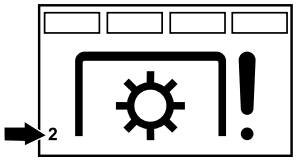
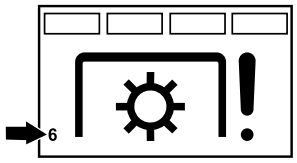
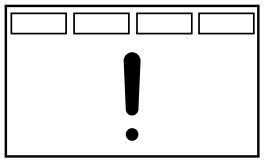
Troubleshooting

Important: **Ensure that all operator-safety mechanisms are connected and in operating condition before using the machine.**

The following table lists common causes of trouble. Do not attempt to service or replace major items or any items that call for special timing of adjustments procedures (such as valves, governor, etc.). Have this work done by your Engine Service Dealer.

Note: When disconnecting electrical connectors Do not pull on the wires to separate the connectors.

Alert and Error Messages

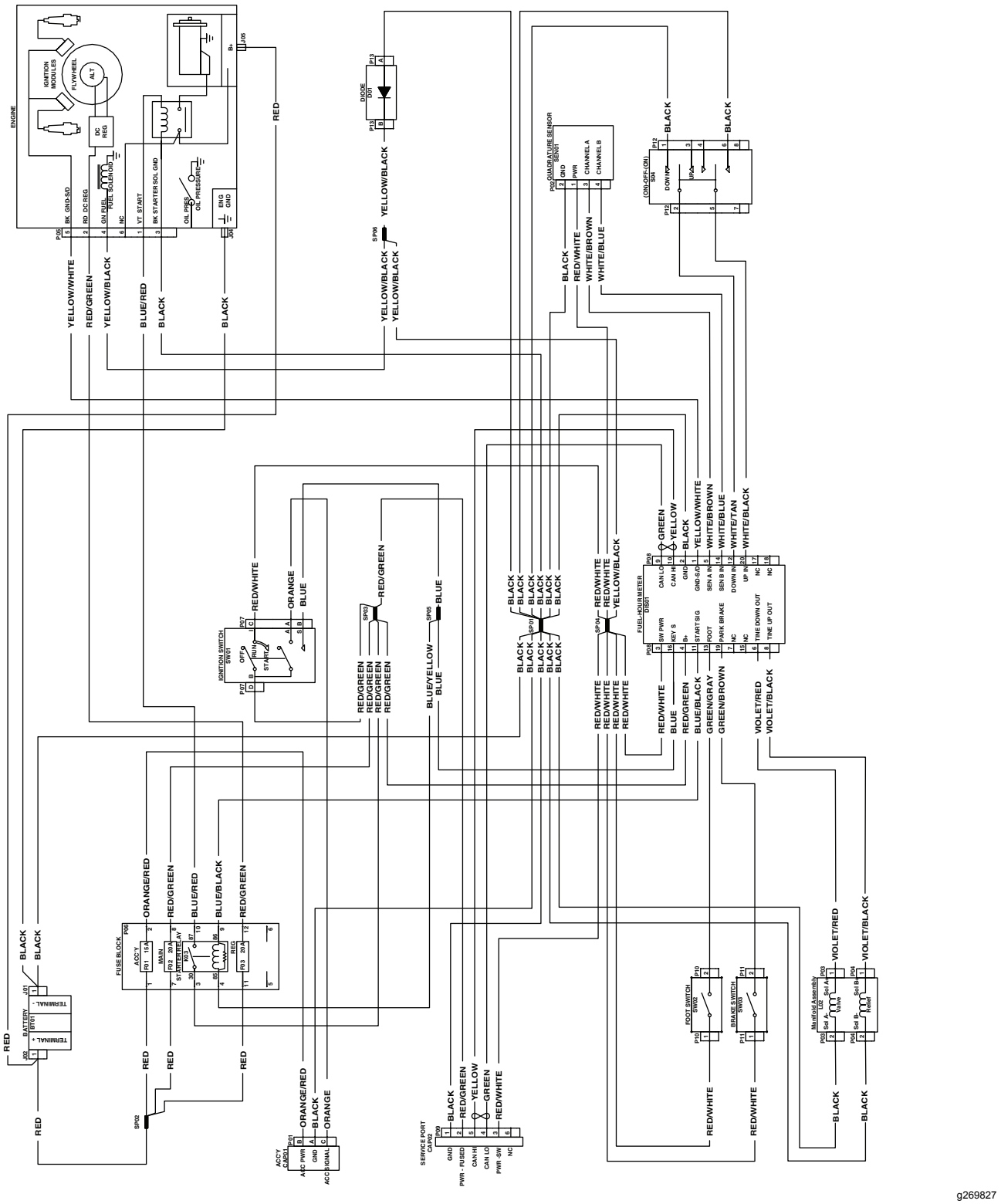
Message	Icon	Description	Resolution
Voltage Error		The ignition key is in the RUN position and the smart controller/electronic depth control measures that the electrical system is less than 12.3V or greater than 16V. The voltage error icon displays, and the LED status light flashes a red.	Check the battery, charging system, and wiring.
Valve Solenoid Overcurrent Error		An over-current event occurs at the solenoid valve. The valve solenoid over-current error displays with the number 2 and the LED status light flashes a red.	Check the valve solenoid and inspect it for damage and wear.
Valve Solenoid Open Error		1 of the 2 valve solenoids or both valve solenoids are disconnected. The valve solenoid open error displays with the number 6 and the LED status light flashes a red.	Connect the valve solenoid(s).
Valve Solenoid Connection Error		The valve solenoids are connected wrong (the connector for the relief valve is connected to the other valve solenoid). The valve solenoid connection error alert displays, and the tines will not operate until the fault is corrected.	Swap the valve solenoid connectors.

Troubleshooting Table

Problem	Possible Cause	Corrective Action
The starter does not crank.	1. The parking brake is not engaged. 2. The brake switch is not adjusted properly. 3. The battery does not have a full charge. 4. The electrical connections are corroded, loose, or damaged. 5. A fuse is blown. 6. A relay or switch is defective.	1. Engage the parking brake. 2. Adjust the brake switch. 3. Charge the battery. 4. Check the electrical connections for good contact. Clean the connector terminals thoroughly with electrical contact cleaner, apply dielectric grease, and reconnect. 5. Replace the blown fuse. 6. Contact an Authorized Service Dealer.
The engine does not start, starts hard, or fails to keep running.	1. The fuel tank is empty. 2. The fuel-shutoff valve is closed. 3. The throttle and choke are not in the correct position. 4. There is dirt in the fuel filter. 5. There is dirt, water, or stale fuel is in the fuel system. 6. The air cleaner is dirty. 7. The electrical connections are corroded, loose, or damaged. 8. A relay or switch is defective. 9. The spark plug is worn or damaged. 10. The spark-plug wire is not connected.	1. Fill the fuel tank. 2. Open the fuel-shutoff valve. 3. Be sure that the throttle level is midway between the SLOW and FAST positions, and the choke is in the ON position for a cold engine or the OFF position for a warm engine. 4. Replace the fuel filter. 5. Contact an Authorized Service Dealer. 6. Clean or replace the air-cleaner element. 7. Check the electrical connections for good contact. Clean connector terminals thoroughly with electrical contact cleaner, apply dielectric grease, and reconnect. 8. Contact an Authorized Service Dealer. 9. Clean, adjust, or replace the spark plug. 10. Check the spark-plug wire connection.
The engine loses power.	1. The engine load is excessive. 2. The air cleaner is dirty. 3. The oil level in the crankcase is low. 4. The cooling fins and air passages for the engine are plugged. 5. There is dirt in the fuel filter. 6. There is dirt, water, or stale fuel is in the fuel system.	1. Reduce the ground speed or aeration depth. 2. Clean or replace the air-cleaner element. 3. Add oil to the crankcase. 4. Remove the obstructions from the cooling fins and air passages. 5. Replace the fuel filter. 6. Contact an Authorized Service Dealer.
The engine overheats.	1. The engine load is excessive. 2. The oil level in the crankcase is low. 3. The cooling fins and air passages for the engine are plugged.	1. Reduce the ground speed or aeration depth. 2. Add oil to the crankcase. 3. Remove the obstructions from the cooling fins and air passages.
The machine pulls left or right (with levers fully forward).	1. The tire pressure in drive tires is not correct. 2. The tracking needs adjustment.	1. Adjust the tire pressure in the drive tires. 2. Adjust the traction-control linkage.

Problem	Possible Cause	Corrective Action
The machine does not drive.	1. The transmission belt worn, loose, or broken. 2. The transmission belt is off a pulley.	1. Change the belt. 2. Change the belt.
There is abnormal vibration.	1. A tine is bent. 2. The tine mounting bolt is loose. 3. The engine mounting bolts are loose. 4. There is a loose engine pulley or idler pulley. 5. The engine pulley is damaged. 6. A belt is damaged. 7. The chains are not properly tensioned.	1. Install a new tine. 2. Tighten the tine mounting bolt. 3. Tighten the engine mounting bolts. 4. Tighten the appropriate pulley. 5. Contact an Authorized Service Dealer. 6. Install a new belt. 7. Check the jackshaft drive-chain tension, the drive wheel chain tension, and the tine drive-chain tension.
The tines do not raise.	1. There is an auxiliary pump belt problem. 2. The tine down pressure setting is too low. 3. There is a short in the wiring harness. 4. The auxiliary reservoir is low on fluid.	1. Tension or replace the belt. 2. Increase the down pressure. 3. Contact an Authorized Service Dealer. 4. Add fluid to the reservoir.
The tines do not engage the ground.	1. The tine down pressure setting is too low. 2. The wire harness or the switch is damaged. 3. The auxiliary reservoir is low on fluid. 4. The cylinder stop is in place.	1. Increase the tine-down pressure. 2. Contact your Authorized Service Dealer. 3. Add fluid to the reservoir. 4. Remove cylinder stop, clevis pin and hair pin.

Schematics



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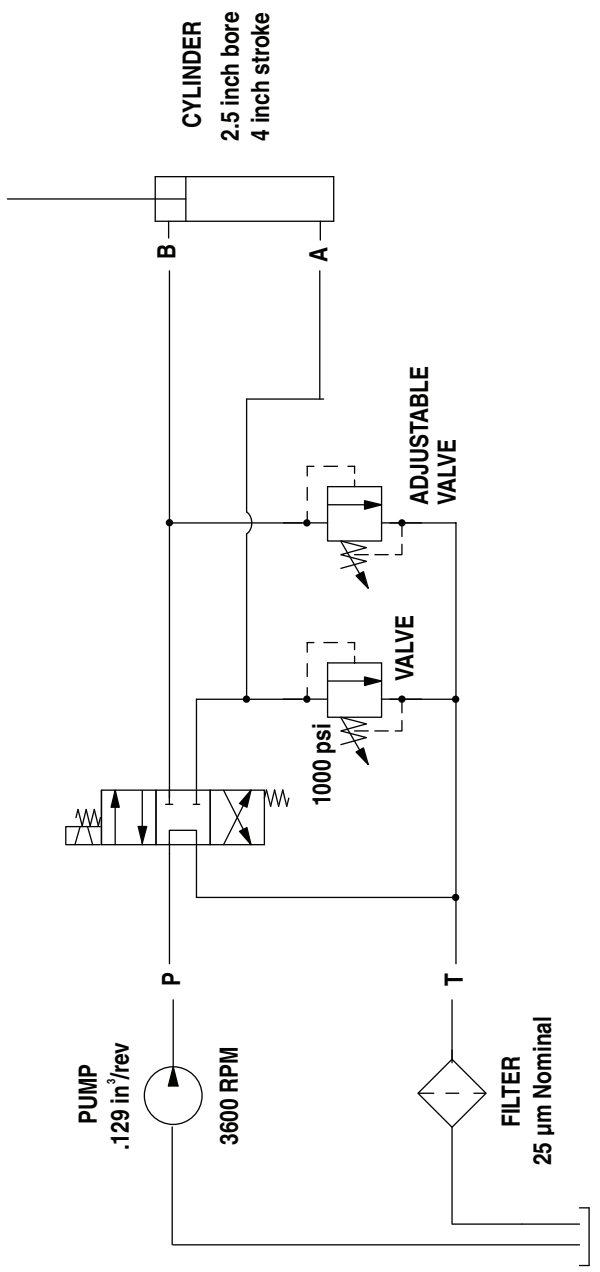
Electrical Schematic (Rev. A)



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Hydraulic Schematic (Rev. A)

California Proposition 65 Warning Information

What is this warning?

You may see a product for sale that has a warning label like the following:

WARNING: Cancer and Reproductive Harm—www.p65Warnings.ca.gov.

What is Prop 65?

Prop 65 applies to any company operating in California, selling products in California, or manufacturing products that may be sold in or brought into California. It mandates that the Governor of California maintain and publish a list of chemicals known to cause cancer, birth defects, and/or other reproductive harm. The list, which is updated annually, includes hundreds of chemicals found in many everyday items. The purpose of Prop 65 is to inform the public about exposure to these chemicals.

Prop 65 does not ban the sale of products containing these chemicals but instead requires warnings on any product, product packaging, or literature with the product. Moreover, a Prop 65 warning does not mean that a product is in violation of any product safety standards or requirements. In fact, the California government has clarified that a Prop 65 warning "is not the same as a regulatory decision that a product is 'safe' or 'unsafe.'" Many of these chemicals have been used in everyday products for years without documented harm. For more information, go to https://oag.ca.gov/prop65/faqs-view-all.

A Prop 65 warning means that a company has either (1) evaluated the exposure and has concluded that it exceeds the "no significant risk level"; or (2) has chosen to provide a warning based on its understanding about the presence of a listed chemical without attempting to evaluate the exposure.

Does this law apply everywhere?

Prop 65 warnings are required under California law only. These warnings are seen throughout California in a wide range of settings, including but not limited to restaurants, grocery stores, hotels, schools, and hospitals, and on a wide variety of products. Additionally, some online and mail order retailers provide Prop 65 warnings on their websites or in catalogs.

How do the California warnings compare to federal limits?

Prop 65 standards are often more stringent than federal and international standards. There are various substances that require a Prop 65 warning at levels that are far lower than federal action limits. For example, the Prop 65 standard for warnings for lead is 0.5 µg/day, which is well below the federal and international standards.

Why don't all similar products carry the warning?

- Products sold in California require Prop 65 labelling while similar products sold elsewhere do not.
- A company involved in a Prop 65 lawsuit reaching a settlement may be required to use Prop 65 warnings for its products, but other companies making similar products may have no such requirement.
- The enforcement of Prop 65 is inconsistent.
- Companies may elect not to provide warnings because they conclude that they are not required to do so under Prop 65; a lack of warnings for a product does not mean that the product is free of listed chemicals at similar levels.

Why does Toro include this warning?

Toro has chosen to provide consumers with as much information as possible so that they can make informed decisions about the products they buy and use. Toro provides warnings in certain cases based on its knowledge of the presence of one or more listed chemicals without evaluating the level of exposure, as not all the listed chemicals provide exposure limit requirements. While the exposure from Toro products may be negligible or well within the "no significant risk" range, out of an abundance of caution, Toro has elected to provide the Prop 65 warnings. Moreover, if Toro does not provide these warnings, it could be sued by the State of California or by private parties seeking to enforce Prop 65 and subject to substantial penalties.

Count on it.