

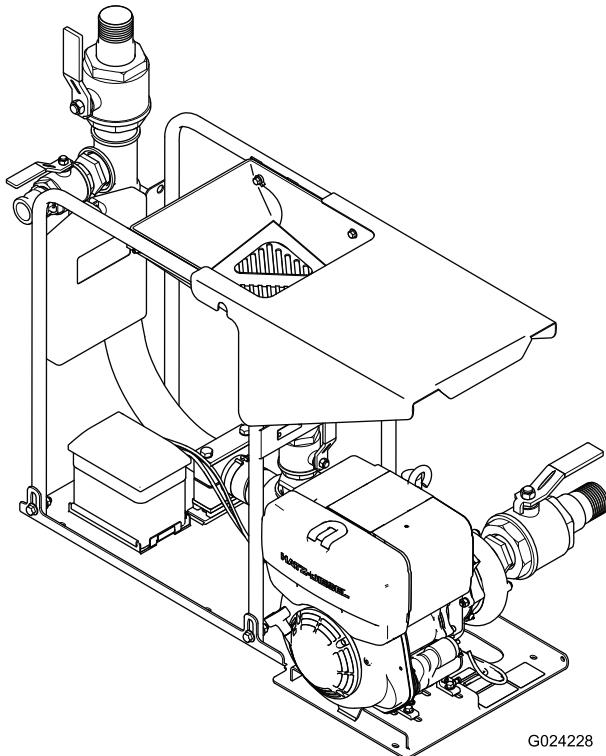
**TORO**<sup>®</sup>

**Count on it.**

# Operator's Manual

## Diesel-Powered FM 330 Fluid Mixer

Model No. 23892—Serial No. 313000001 and Up



This product complies with all relevant European directives. For details, please see the separate product-specific Declaration of Conformity (DOC) sheet.

## ⚠ WARNING

### CALIFORNIA Proposition 65 Warning

**This product contains a chemical or chemicals known to the State of California to cause cancer, birth defects, or reproductive harm.**

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

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

Because in some areas there are local, state, or federal regulations requiring that a spark arrester be used on the engine of this machine, a spark arrester is available as an option. If you require a spark arrester, contact your Authorized Toro Service Dealer.

Genuine Toro spark arresters are approved by the USDA Forestry Service.

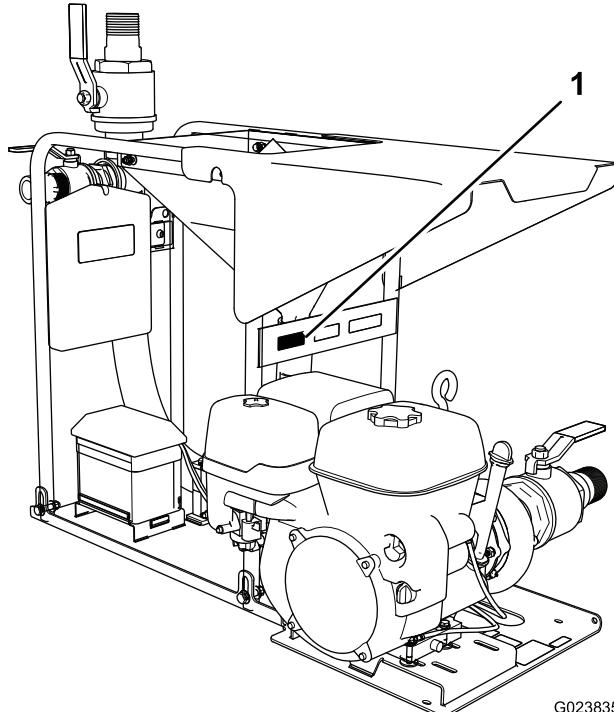
**Important:** It is a violation of California Public Resource Code Section 4442 to use or operate the engine on any forest-covered, brush-covered, or grass-covered land without a spark arrester muffler maintained in working order, or the engine constricted, equipped, and maintained for the prevention of fire. Other states or federal areas may have similar laws.

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.

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.

You may contact Toro directly at [www.Toro.com](http://www.Toro.com) for product and 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. Write the numbers in the space provided.



**Figure 1**

1. Model and serial number location

**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.



**Figure 2**

1. 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.

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# Safety

Improperly using or maintaining the machine can result in injury. To reduce the potential for injury, comply with these safety instructions and always pay attention to the safety alert symbol **▲**, which means: *Caution*, *Warning*, or *Danger*—personal safety instruction. Failure to comply with the instruction may result in personal injury or death.

## Safe Operating Practices

Always follow all safety instructions to avoid serious injury or death.

### ▲ WARNING

Handling various drilling-fluid materials can generate dust and fumes containing chemicals, such as silica, known to cause serious or fatal injury or illness, such as respiratory disease, silicosis, cancer, birth defects, or other reproductive harm.

- Use good work practices and follow the recommendations of the manufacturer or suppliers, OSHA, and other occupational and trade associations.
- Always follow respiratory precautions.
- When the hazards from inhalation cannot be eliminated, the operator and any bystanders should wear a respirator approved by OSHA for the material being handled.

### ▲ WARNING

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

Do not run the engine indoors or in an enclosed area.

## Training

- Read the *Operator's Manual* and other training material. If the operator(s) or mechanic(s) cannot read or understand the information, it is the owner's responsibility to explain this material to them.
- Become familiar with the safe operation of the equipment, operator controls, and safety signs.
- All operators and mechanics should be trained. The owner is responsible for training the users.
- Never let children or untrained people operate or service the equipment. Local regulations may restrict the age of the operator.
- The owner/user can prevent and is responsible for accidents or injuries to people or damage to property.

## Preparation

Become familiar with the safe operation of the equipment, operator controls, and safety signs.

- Use only accessories and attachments approved by the manufacturer.
- Wear a respirator or a dust mask.
- Operating the equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating the machine.
- Use extra care when handling fuels. They are flammable, and the vapors are explosive. Use the following practices when handling fuel:
  - Use only an approved fuel container.
  - Never remove the fuel cap or add fuel with the engine running.
  - Allow the engine to cool before refueling.
  - Do not smoke.
  - Never add fuel or drain the machine indoors.
  - Replace the fuel cap and tighten it securely.
  - Keep the container nozzle in contact with the tank during filling.
  - Never fill a container while it is inside a vehicle, trunk, pick-up bed, or any surface other than the ground.
  - Never store the machine or fuel container inside where there is an open flame, such as near a water heater or furnace.
  - If fuel is spilled, wipe it off the engine and equipment.
- Ensure that the machine is on a level surface before operating the machine.
- Before every use, ensure that the machine is properly secured.

## Operation

- Never run an engine in an enclosed or poorly ventilated area.
- Only operate the machine in good lighting conditions.
- Before starting the machine, make sure that there are no persons or obstacles near or under the machine.
- Stop the engine before leaving the machine for any reason.

Never leave a running machine unattended. Always stop the engine and verify that all moving parts have stopped.

- Avoid prolonged breathing of exhaust fumes. Engine exhaust fumes can cause sickness or death.
- Do not operate the machine under the influence of alcohol or drugs.
- Ensure that the area is clear of other people or pets before operating the machine. Stop the machine if anyone enters the area.

- Do not touch parts which may be hot from operation. Allow them to cool before attempting to maintain, adjust, or service the machine.
- Never move the machine while the engine is running.
- Ensure that all the guards and shields are securely in place before operating the machine.
- If the machine should start making an unusual noise or vibration, stop the engine. Wait for all moving parts to come to a complete stop and cool. Vibration is generally a warning of trouble. Inspect for clogging or damage. Clean and repair and/or replace damaged parts.
- Do not change the engine governor setting or overspeed the engine.
- Lightning can cause severe injury or death. If you see lightning or hear thunder in the area, do not operate the machine; seek shelter.

## Maintenance and Storage

- Before performing maintenance, do the following:
  - Ensure that the machine is on level ground.
  - Stop the engine. Wait for all movement to stop before adjusting, cleaning, or repairing.
  - Let the engine cool before performing maintenance or storing.
  - Disengage all power and operation controls.
- Never lubricate, service, repair, or adjust the machine while it is running.
- Keep equipment materials clear from the muffler and engine to help prevent fires. Clean up any oil or fuel spillage.
- Never allow untrained personnel to service the machine.
- Keep hands, feet, and clothing away from moving parts. If possible, do not make adjustments with the engine running.
- Keep all parts in good working condition and all hardware tightened. Replace all worn or damaged decals.
- Remove any buildup of grease, oil, or debris from the machine.
- Stop and inspect the machine if a foreign object enters the hopper or causes another obstruction. Make any necessary repairs before starting the machine.
- Do not tamper with safety devices.
- Keep all nuts, bolts, screws, and hose clamps securely tightened. Keep equipment in good condition.
- To best protect your investment and maintain optimal performance of your Toro equipment, count on Toro genuine parts. When it comes to reliability, Toro delivers replacement parts designed to the exact engineering specifications of our equipment. For peace of mind, insist on Toro genuine parts.

## Hauling

- Ensure that the transport vehicle has a carrying capacity to handle the weight of the machine and a full tank of fluid—**in addition to** any other machines or materials that the transport vehicle may need to carry. The mixing system alone requires a carrying capacity of at least 2,268 kg (5,000 lb) for a system that uses a single 1,893 L (500-gallon) tank, up to 9,072 kg (20,000 lb) for a system that uses two 3,785 L (1000-gallon) tanks.
- Use care when loading or unloading the machine onto a trailer or truck.
- Ensure that the tank is empty before loading the machine onto a trailer or truck.
- Secure the machine using adequate bolts through all the mounting holes of both the mixer frame and the tank frame.

## Sound Power Level

This unit has a sound power level of 108 dBA, which includes an Uncertainty Value (K) of 1 dBA.

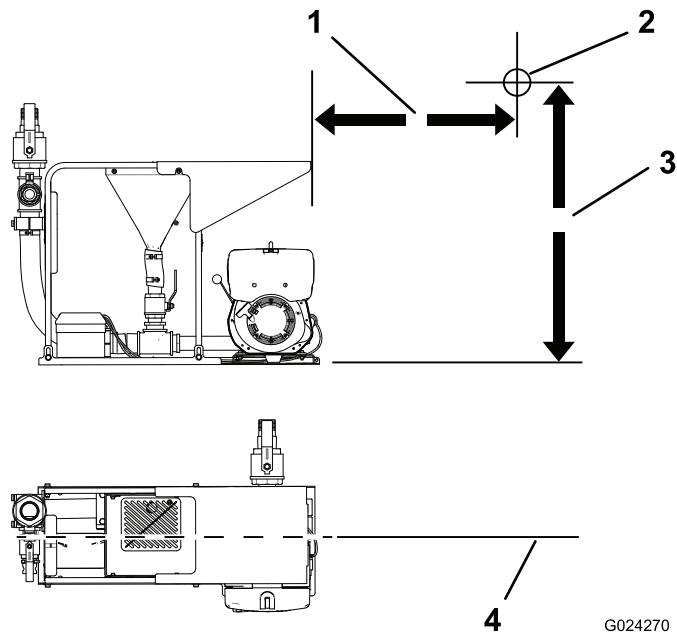
The sound power level was determined according to the procedures outlined in EN/ISO 3744.

## Sound Pressure Level

This unit has a sound pressure level at the operator's ear of 95 dBA, which includes an Uncertainty Value (K) of 1 dBA.

As this product does not have a dedicated operator's position, the sound pressure level was determined according to the procedures outlined in the Machinery Safety Directive 2006/42/EC.

Measurements were taken on all 4 sides of the machine with the microphone positioned along the centerline of the area facing the microphone. In each case, the microphone was located at a height of 1.6 m from the ground and a distance of 1.0 m from the surface area of the machine. For this model, the loudest tested point is shown in Figure 3.



**Figure 3**

G024270

1. 1.0 m (39 inches)
2. Measurement point
3. 1.6 m (63 inches)
4. Centerline of 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 lost.

## CALIFORNIA SPARK ARRESTER WARNING

Operation of this equipment may create sparks that can start fires around dry vegetation. A spark arrester may be required. The operator should contact local fire agencies for laws or regulations relating to fire prevention requirements. 117-2718

117-2718



119-0217

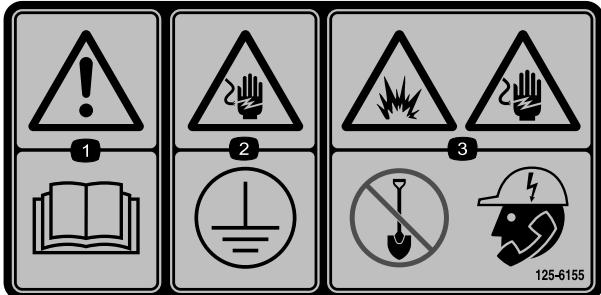
1. Warning—stop the engine; keep away from moving parts; keep all guards and shields in place.

125-6136



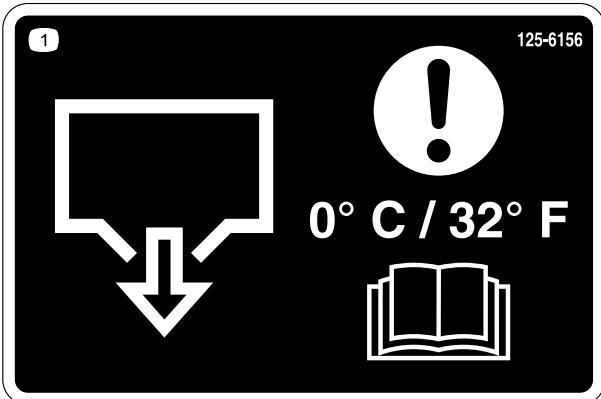
LOW OR  
ULTRA-LOW SULFUR  
DIESEL ONLY

125-6136



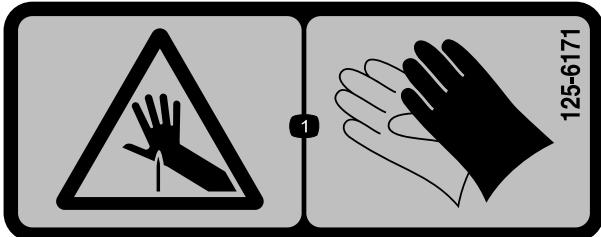
125-6155

1. Warning—read the *Operator's Manual*.
2. Electrical shock hazard—ensure the equipment is grounded before starting drill operation.
3. Explosion hazard; electrical shock hazard—Call local utilities before digging underground.



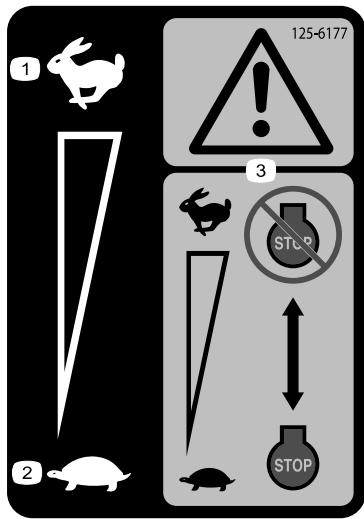
125-6156

1. Tank drain—read the *Operator's Manual*.



125-6171

1. Piercing hazard—wear hand protection.



**125-6177**

1. Fast
2. Slow
3. Warning—do not stop the engine at high speeds; only stop the engine at slow speed.

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# Setup

## Loose Parts

Use the chart below to verify that all parts have been shipped.

Description	Qty.	Use
Bolt (5/16 x 3/4 inch)	2	Connect the battery.
Nut (5/16 inch)	2	
Circulation hose	1	Connect the pump to the tank.
Hose clamp	3	

## Media and Additional Parts

Description	Qty.	Use
Transfer hose	1	Connect the mixer to the drill.

## Connecting the Battery

### ⚠ WARNING

#### CALIFORNIA Proposition 65 Warning

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.

1. Remove the red plastic cover from the positive battery terminal (Figure 4).

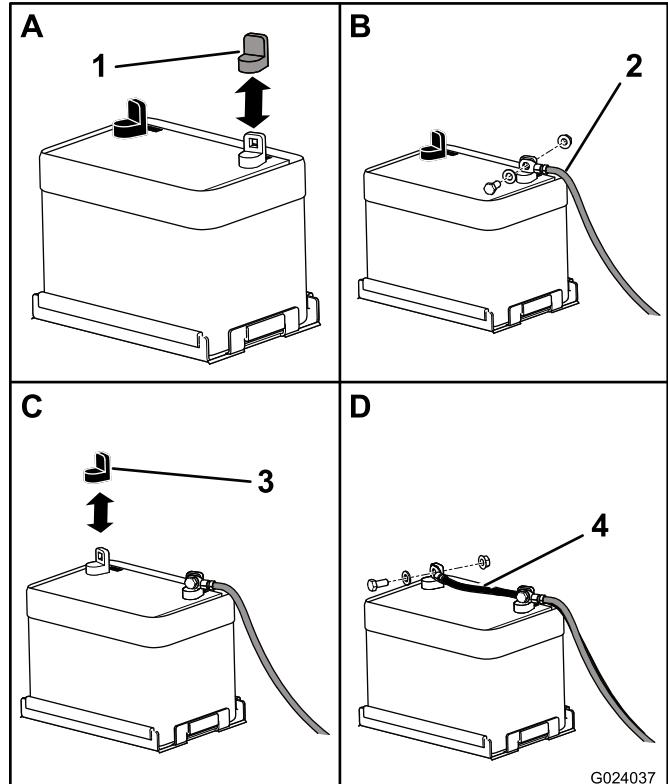


Figure 4

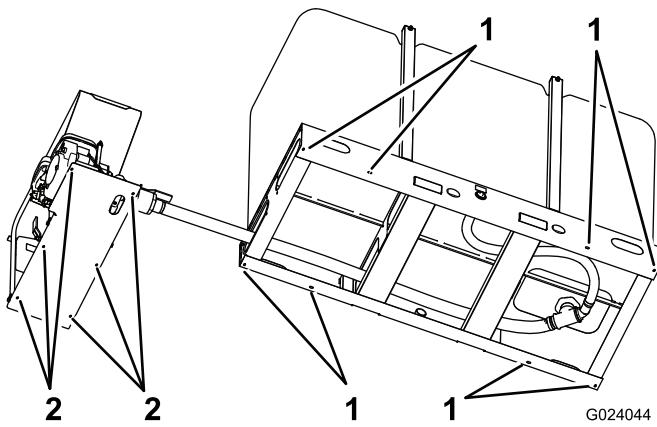
1. Red cover	3. Black cover
2. Positive cable	4. Negative cable

2. Use a bolt (5/16 x 3/4 inch) and a nut (5/16 inch) to mount the positive cable to the positive battery terminal.
3. Remove the black plastic cover from the negative battery terminal.
4. Use a bolt (5/16 x 3/4 inch) and a nut (5/16 inch) to mount the negative cable to the negative battery terminal.

# Connecting the Pump to the Tank

Ensure that the frame of the fluid mixer and the frame of the tank are secured to a strong surface, with an adequate fastener through each mounting hole (Figure 5).

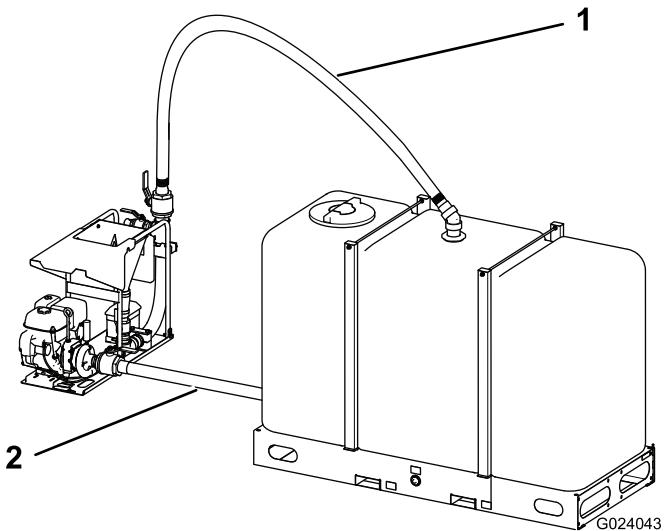
**Note:** Ensure that the mixer and the tank are in a position that allows the hoses to connect them without stretching or kinking.



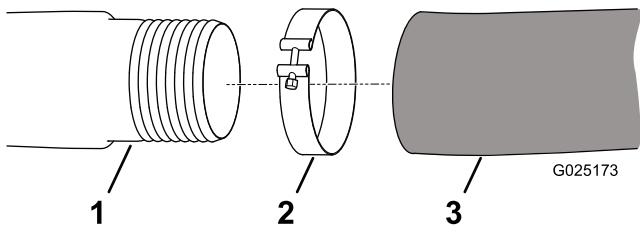
**Figure 5**  
Underside shown

1. Mounting holes in tank frame      2. Mounting holes in mixer frame

1. Locate the suction hose connected to the bottom of the tank, and pull the loose end out from under the tank.
2. Use a hose clamp (provided) to connect the loose end of the hose to the pump inlet on the mixer as shown in Figure 6, Figure 7, and Figure 8.

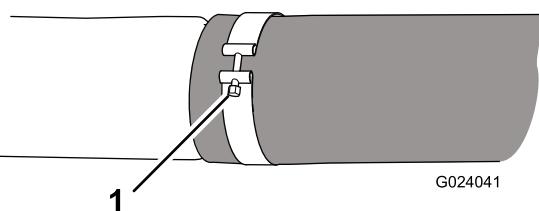


1. Circulation hose      2. Suction hose



**Figure 7**

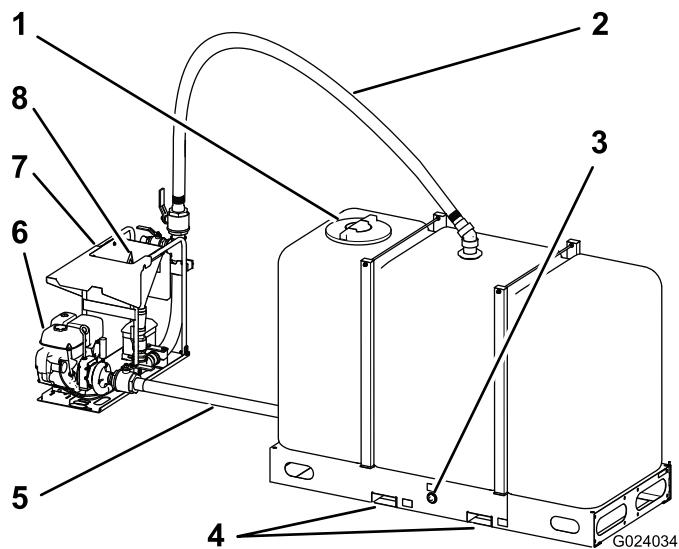
1. Fitting  
2. Hose clamp  
3. Hose



**Figure 8**

1. Locknut  
3. Tighten the hose clamp by tightening the locknut.  
4. Use 2 hose clamps (provided) to connect the other hose to the top of the tank and the top of the mixer as shown in Figure 6, Figure 7, and Figure 8.  
5. Tighten the hose clamps by tightening the locknuts.

# Product Overview

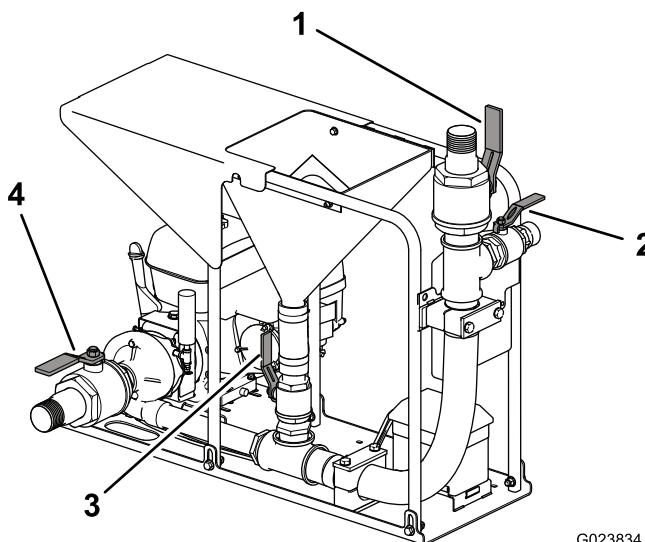


**Figure 9**  
Tank sold separately

- 1. Access hatch
- 4. Forklift pockets
- 7. Hopper
- 2. Circulation
- 5. Suction hose
- 8. Grate
- 3. Tank drain plug
- 6. Engine

## Controls

Become familiar with all the controls before you start the engine and operate the machine.



- 1. Circulation valve
- 3. Hopper valve
- 2. Transfer valve
- 4. Suction valve

## Circulation Valve

The circulation valve (Figure 10) controls the flow from the pump to the tank.

## Suction Valve

The suction valve (Figure 10) controls the flow from the tank to the pump.

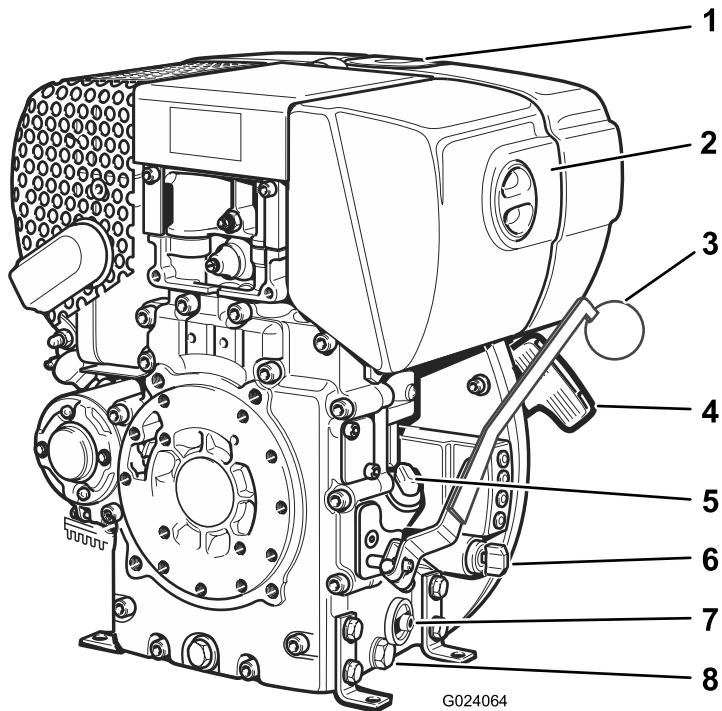
## Hopper Valve

The hopper valve (Figure 10) controls the flow from the hopper into the mixing system. The hopper valve is most effective when it is just slightly open, as the fluid then creates a vacuum effect and draws the bentonite and other components into the flow.

## Transfer Valve

The transfer valve (Figure 10) controls the flow from the mixing system to the drill.

## Engine Controls



- 1. Fuel tank
- 4. Recoil-start handle
- 7. Oil filter
- 2. Air cleaner
- 5. Dipstick
- 8. Oil-drain plug
- 3. Speed-control handle
- 6. Electric-start switch

## Electric-start Switch

The electric-start switch (Figure 12) allows the operator of the machine to start the engine. This switch is located on the front of the engine. Rotate the ignition switch to the **Start** position to start the engine. Rotate the ignition switch to the **Run** position to allow the engine to run. After you stop the engine with the speed-control handle, rotate the ignition switch to the **Off** position.

**Note:** The switch does not stop the engine.

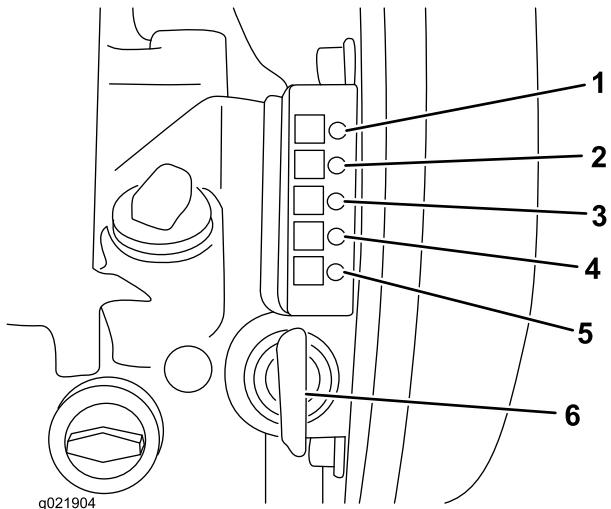


Figure 12

1. Engine-run light	4. Engine-temperature light
2. Battery-charge light	5. Engine-preheat light
3. Oil-pressure warning light	6. Ignition switch

## Speed-control Handle

The speed-control handle (Figure 14) controls the engine speed and also stops the engine. Moving it all the way to the left (counterclockwise) stops the engine. Moving it to the right (clockwise) increases the engine speed.

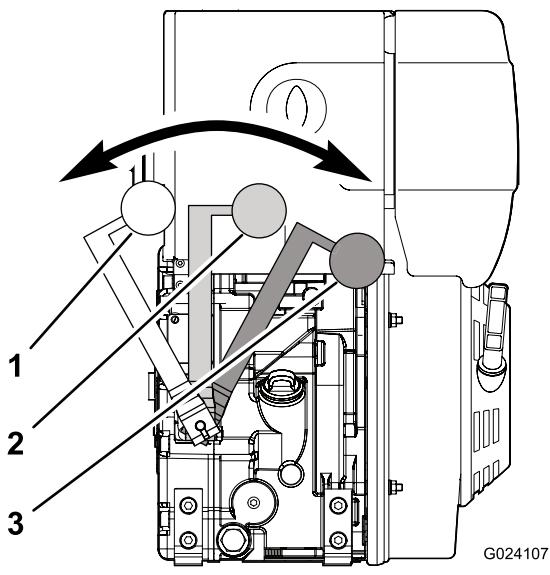


Figure 14

1. Off position	3. Fast-speed position
2. Medium-speed position	

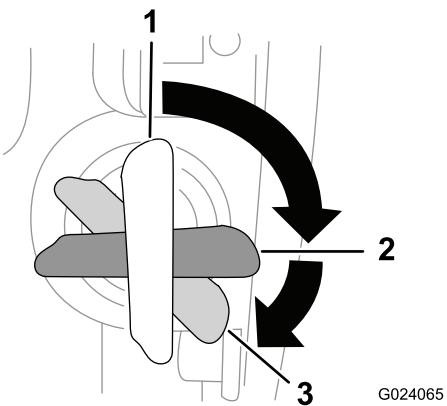


Figure 13

1. Off position	3. Start position
2. Run position	

## Recoil-start Handle

If the battery is not charged, you can start the engine with the recoil-start handle. To start the engine, pull the recoil-start handle (Figure 11) quickly to turn the engine over. The engine controls described above must all be set correctly for the engine to start.

# Specifications

## Mixer

Flow rate	Length	Width	Height	Weight
Up to 1249 L/minute (330 gallons/minute)	141 cm (55.4 inches)	90 cm (35.3 inches)	116.2 cm (45.8 inches)	204 kg (450 lb)

## Tanks

Capacity	Length	Width	Height	Dry weight
1893 L (500 US gallons)	203.2 cm (80.0 inches)	78.7 cm (31.0 inches)	177.8 cm (70.0 inches)	241 kg (532 lb)
3785 L (1000 US gallons)	257.2 cm (101.3 inches)	108.6 cm (42.8 inches)	191.1 cm (75.3 inches)	397 kg (876 lb)

# Operation

## Preparing to Use the Machine

- Review all of the safety decals on the machine.
- Use a dust mask or respirator.
- Ensure that you are familiar with the safety regulations and shutdown procedures described in the *Operator's Manual* and the engine owner's manual.
- Ensure that all guards are in place and in good condition.
- Check the fuel and oil levels of the engine.
- When preparing to mix fluid:
  1. Move the machine to a level job-site surface.
  2. Ensure that the hoses are connected appropriately and securely.

## Grounding the Mixer and the Tank

Ground the mixing system.

Connect a braided grounding strap or a jumper cable (sold separately) from the **mixer** frame to the ground.

## Adjusting the Valves

### ⚠ WARNING

If you run the engine when the mixing valves are not adjusted as directed, the pump can direct fluid out through the hopper and push the grate into the air.

Ensure that the mixing valves are adjusted appropriately and that the grate is tethered to the hopper, before starting the engine.

To open a valve, turn the handle so that it is in line with the pipe. To close a valve, turn the handle so that it is perpendicular to the pipe (Figure 15).

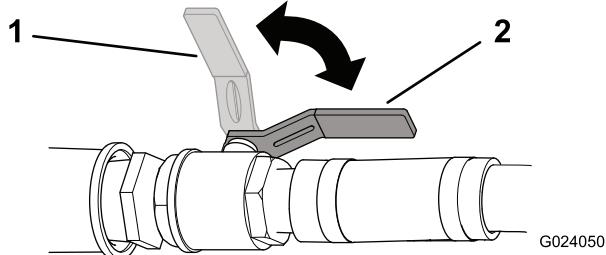


Figure 15

1. Closed position      2. Open position

Before starting the engine, ensure that the hopper valve and the transfer valve are both **closed**, and the suction valve and the circulation valve are both **open** (Figure 10).

## Adding Fuel

- The engine runs on clean, fresh, ultra-low-sulfur diesel fuel.
- Purchase fuel in quantities that can be used within 30 days to ensure fuel freshness.
- Use summer-grade diesel fuel (Number 2-D) at temperatures above -7°C (20°F) and winter-grade diesel fuel (Number 1-D or Number 1-D/2-D blend) below -7°C (20°F).
- Never mix kerosene, used engine oil, or residual fuels with the diesel fuel.
- Do not store fuel either in the fuel tank or fuel containers over the winter.
- Fuel additives are not recommended. Some fuel additives may cause poor engine performance.

## ⚠ 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.

Use only diesel fuel. Filling the fuel tank with gasoline may result in a fire.

- Fill the fuel tank and store fuel in a well-ventilated area.
- Never fill the fuel tank while the engine is running.
- Do not fill the fuel tank completely full. This empty space in the tank allows fuel to expand.
- Never smoke when handling fuel, and stay away from an open flame or where fuel may be ignited by a spark.
- Store fuel in an approved container and keep it out of the reach of children. Do not buy more than a 30-day supply of fuel.
- Do not operate without the 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 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 fuel the equipment with the 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 a fuel-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.

## ⚠ 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 the fuel tank or conditioner opening.
- Keep fuel away from your eyes and skin.

**Important:** Do not mix oil with diesel.

Diesel fuel should comply with the following specification. The table lists 7 worldwide specifications for diesel fuels.

Diesel Fuel Specifications	Location
Number 2-D, Number 1-D, ASTM D975-94	USA
EN590:96	European Union
ISO 8217 DMX	International
BS 2869-A1 or A2	United Kingdom
JIS K2204 Grade Number 2	Japan
KSM-2610	Korea
GB252	China

## Using Fuel Stabilizer/Conditioner

Use a diesel fuel stabilizer/conditioner in the machine to keep the fuel fresh during storage of 90 days or less. If you are storing the machine for longer, drain the fuel tank; refer to Storage (page 23).

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

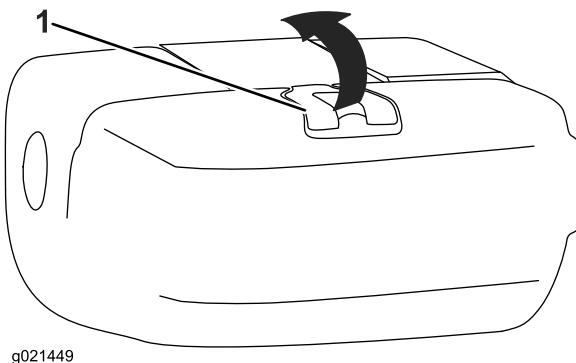
Add the correct amount of fuel stabilizer/conditioner to the fuel, and follow the directions of the manufacturer.

**Note:** Fuel stabilizer/conditioner is most effective when mixed with fresh fuel.

## Filling the Fuel Tank

**Capacity:** 5.0 L (5.3 US qt)

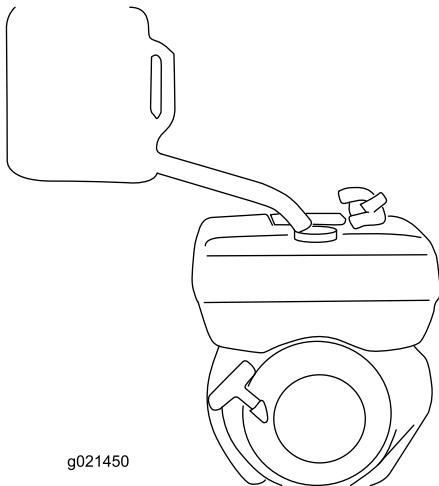
1. Stop the engine, allow the engine to cool, and ensure that the machine is on a level surface.
2. Clean around the fuel-tank cap and remove it (Figure 16).



**Figure 16**

1. Fuel-tank cap
3. Add diesel fuel to the fuel tank (Figure 17).

**Important:** Do not overfill the fuel tank.



**Figure 17**

4. Install the fuel-tank cap securely.
5. Wipe up any fuel that may have spilled.

## Checking the Engine-oil Level

**Service Interval:** Before each use or daily

**Important:** Use 4-cycle engine oil that meets or exceeds the following guidelines and classifications:

- API Service Categories CH-4, CI-4, CJ-4 or higher
- ACEA Service Categories E-3, E-4, and E-5

**Note:** Toro Premium Engine Oil is available from your Authorized Toro Dealer.

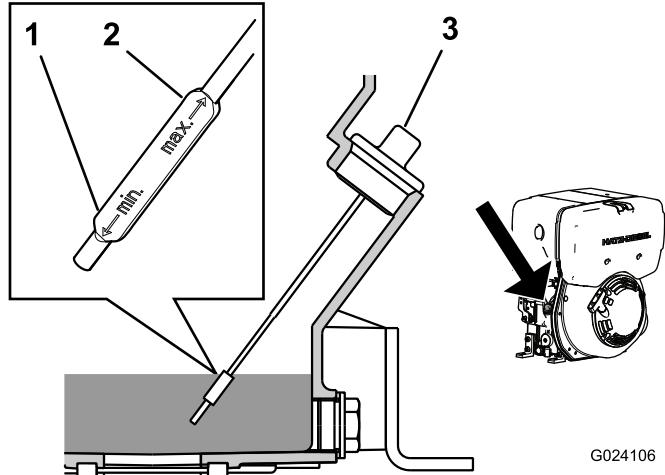
**Crankcase Capacity:** 1.5 L (1.59 US qt)

**Important:** If the oil level in the crankcase is too low or too high and you run the engine, you may damage the engine. This type of damage is not covered by the warranty.

**Viscosity:** SAE 5W-30

**Note:** If the ambient temperature is above 35°C (95°F), use SAE 5W-40 or SAE 10W-40

1. Ensure that the machine is on a level surface.
2. Run the engine for a few minutes to warm the oil.
3. Stop the engine and wait for all moving parts to stop.
4. Clean around the dipstick (Figure 18) so that dirt cannot fall into the filler hole and damage the engine.



**Figure 18**

1. Minimum oil level
2. Maximum oil level
3. Dipstick
5. Unscrew the dipstick and wipe the end clean (Figure 18).
6. Screw the dipstick fully onto the filler tube (Figure 18).
7. Unscrew the dipstick again and look at the end.

**Note:** If the engine oil level is low, slowly pour only enough oil into the filler tube to raise the level to the maximum mark on the dipstick.

## Starting and Stopping the Engine

### ⚠ WARNING

If you run the engine when the mixing valves are not adjusted as directed, the pump can direct fluid out through the hopper and push the grate into the air.

Ensure that the mixing valves are adjusted appropriately and that the grate is tethered to the hopper, before starting the engine.

**Important:** Because the fluid cools the pump seal, the pump may overheat if you run the engine without fluid

in the mixer. Do not run the engine without fluid in the mixer.

## Starting the Engine

1. Move the speed-control handle to the right (Figure 14); refer to Speed-control Handle (page 11).
- Note:** If smoke comes from the exhaust, move the speed-control handle to the left.
2. Rotate the ignition switch to the Run position (Figure 19); refer to Electric-start Switch (page 11).

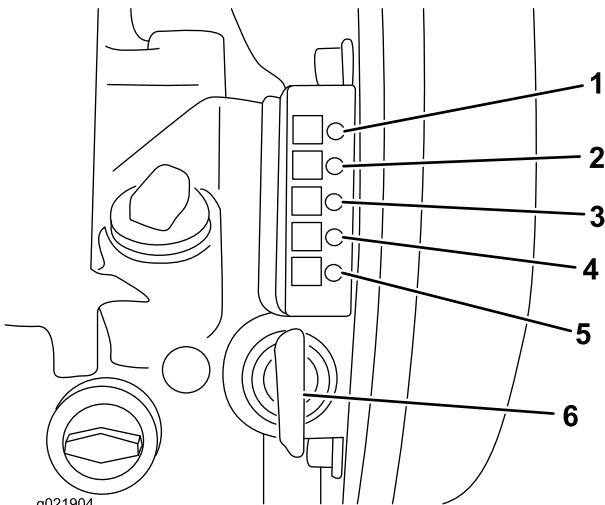


Figure 19

1. Engine-run light	4. Engine-temperature light
2. Battery-charge light	5. Engine-preheat light
3. Oil-pressure warning light	6. Ignition switch

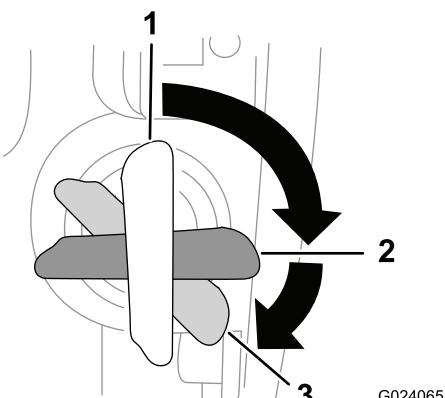


Figure 20

1. Stop position	3. Start position
2. Run position	

3. Turn the ignition switch to the Start position, and hold it there until the engine starts (Figure 20).

**Important:** If the engine does not start within 15 seconds, release the key, and wait at least 10 seconds before operating the starter again. Using

the electric starter for too long will overheat the starter motor and can damage it.

**Note:** If after several attempts of starting the exhaust begins to emit white smoke, move the speed adjustment lever all the way to the left, and pull the recoil-start handle out slowly 5 times. Repeat the starting procedure.

## Stopping the Engine

### ⚠ WARNING

In an emergency situation, stop the engine immediately.

1. Move the speed-control handle to the Stop position (Figure 14); refer to Speed-control Handle (page 11).
2. Rotate the electric-start switch to the Off position; refer to Electric-start Switch (page 11).

**Important:** Keep the ignition switch in the Stop position. Leaving the ignition switch in the Run position while the engine is off will discharge the battery.

## Mixing the Fluid

### ⚠ WARNING

If you run the engine when the mixing valves are not adjusted as directed, the pump can direct fluid out through the hopper and push the grate into the air.

Ensure that the mixing valves are adjusted appropriately and that the grate is tethered to the hopper, before starting the engine.

### ⚠ WARNING

Drilling fluid can be very slippery. If there are drilling-fluid components on the ground or other surfaces, someone could slip and fall, resulting in serious personal injury.

Wear slip-resistant footwear and use caution while working in areas with drilling-fluid components.

There is a variety of materials available for creating different types of drilling fluid. Match the drilling fluid to suit the needs of the soil conditions, and follow the manufacturer's instructions that are printed on the packaging of the product.

**Note:** The order in which you add the components of the fluid is important. Follow the instructions of the manufacturers.

1. Ensure that the grate is tethered to the hopper and that the valves are adjusted appropriately; refer to Adjusting the Valves (page 12).
2. Start the engine; refer to Starting the Engine (page 15).

3. Add the appropriate amount of water to the tank through the hatch (Figure 9).  
If you are using water from a ditch or a pond, place a very fine screen over the inlet of the hose to prevent unwanted material from entering the mixing system.  
Ensure that there is enough room for additives in the mixing system.
4. Test the pH of the water. If it is below 8, add soda ash until the pH is 8 or higher.

**Note:** Supplies for testing pH are available where swimming-pool supplies are sold.

5. Slightly open the valve at the bottom of the hopper.  
**Note:** The valve works more effectively when it is open only slightly; it creates a vacuum effect that allows the dry components to enter the mixer at a faster rate.
6. Add the appropriate amount of bentonite to the hopper.  
**Note:** Add the bentonite slowly to avoid clumping—1 bag in approximately 3 to 5 minutes. Open the tank cover and look to ensure that the fluid components are mixing correctly. If you see any clumps, add the components at a slower rate.
7. After you have added the appropriate amount of bentonite, add any polymers that the particular soil conditions require.
8. Lastly, add any other liquids that the soil conditions require.
9. Allow the machine to thoroughly mix the fluid for several minutes.

## Pumping the Fluid to the Drill

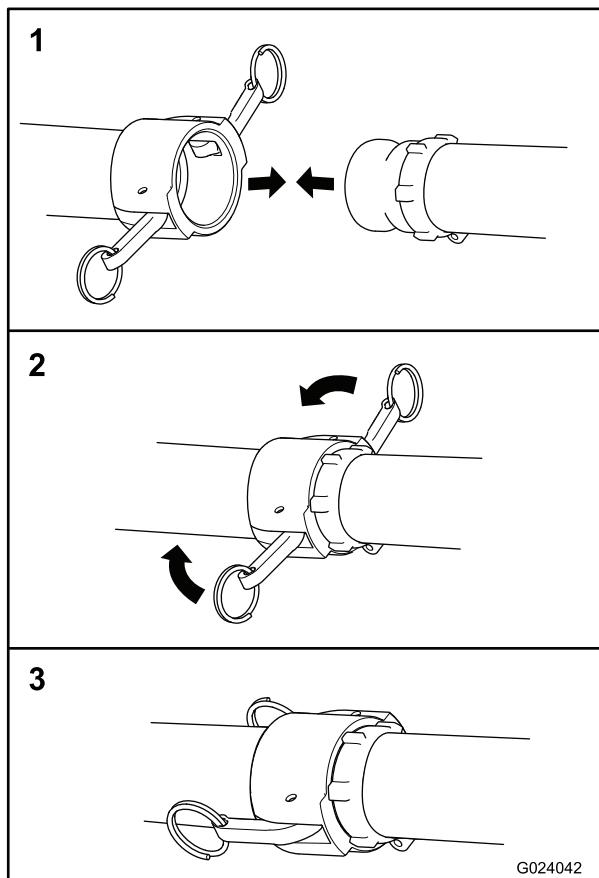
### **DANGER**

The fluid mixer will be electrified if the hose is attached to the drill and the drill strikes an electrical line. Contacting the fluid mixer during an electrical strike may cause bodily harm.

- Ensure that the fluid-mixer frame and the tank frame are bonded to the ground rod.
- If a strike occurs, stay away from the fluid mixer and the drill. Do not contact the mixer until the electrical strike has been corrected.

1. Use the transfer hose (provided) to connect the mixer and the drill.

**Note:** The mixer has a male camlock fitting (Figure 21) located after the transfer valve.



**Figure 21**

2. Open the transfer valve to allow the fluid to flow to the drill.

**Note:** Keep the circulation valve open so that the fluid continues to circulate in the mixer.

**Important:** Unless you are using additional equipment to thoroughly clean the drilling fluid, do not circulate the used fluid through the mixer. Doing so may damage the pump.

Dispose of the used drilling fluid, as well as the unused fluid left in the tank, according to environmental regulations.

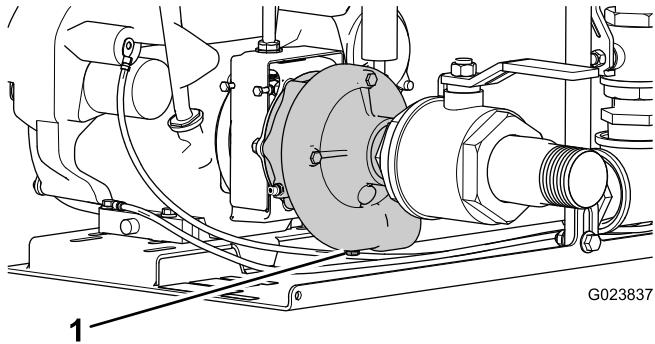
## Draining the Tank

To drain the tank, remove the drain plug from the side of the tank frame (Figure 9).

Dispose of the used drilling fluid, as well as the unused fluid left in the tank, according to environmental regulations.

# Protecting the Machine from Freezing

1. Ensure that all the valves are open.
2. Rinse the tank with clean clear water and then pump it through the system, removing as much of the slurry mix in the system as possible.
3. Drain the tank; refer to Draining the Tank (page 16).
4. Drain any remaining fluid from the pump by removing the drain plug in the bottom of the pump (Figure 22).



**Figure 22**

1. Drain plug
2. To prevent the valve at the base of the hopper from freezing around the edges, either leave the valve open half way, or close the valve and pour an environmentally friendly antifreeze into the hopper until about 51 mm (2 inches) of fluid covers the valve.

## Operating Tips

- Use the correct fluid formula for the situation and the soil conditions.
- When using fluid with any polymer in it, do not over-mix the fluid, as over-mixing can lower the viscosity of it. Partially close the circulation valve, or decrease the engine speed; refer to Speed-control Handle (page 11).
- Some types of polymers prevent additional bentonite from mixing with the fluid. If the fluid contains polymer and you need more fluid, drain the mixer and make a new batch of fluid.
- Ensure that the valves are adjusted appropriately when the machine is running; refer to Adjusting the Valves (page 12).
- Clean the drilling fluid out and rinse the inside of the hoses and the tank with water to prevent the fluid from drying up and plugging the lines.
- Keep the hopper inlet clean to prevent the dry mix from mixing with rain or dew and causing a plug.

# Maintenance

**Important:** Before performing any maintenance procedures, first stop the engine and wait 5 minutes to allow all moving parts to come to a complete stop and cool.

## Recommended Maintenance Schedule(s)

Maintenance Service Interval	Maintenance Procedure
After the first 25 hours	<ul style="list-style-type: none"><li>Change the engine oil.</li></ul>
Before each use or daily	<ul style="list-style-type: none"><li>Check the engine-oil level.</li><li>Inspect the air-cleaner element.</li></ul>
After each use	<ul style="list-style-type: none"><li>Clean the machine.</li></ul>
Every 20 hours	<ul style="list-style-type: none"><li>Check the water trap.</li></ul>
Every 50 hours	<ul style="list-style-type: none"><li>Clean the air-cleaner element. Clean it more frequently in dusty operating conditions.</li></ul>
Every 100 hours	<ul style="list-style-type: none"><li>Lubricate the pump.</li><li>Change the engine oil.</li><li>Check the battery cable connections.</li></ul>
Every 300 hours	<ul style="list-style-type: none"><li>Replace the air-cleaner element. Replace it more frequently in dusty operating conditions.</li></ul>
Every 500 hours	<ul style="list-style-type: none"><li>Replace the fuel filter.</li></ul>

**Important:** Refer to your engine owner's manual for additional maintenance procedures.

## Premaintenance Procedures

### Preparing the Machine for Maintenance

- Park the transport vehicle on a level surface and chock the tires, or remove the machine from the transport vehicle.
- Ensure that the engine and muffler are cool.
- Turn the electric-start switch to the Off position.

## Lubrication

### Lubricating the Pump

Service Interval: Every 100 hours

Grease Type: NLGI #1 heavy-duty EP grease (Toro part 505-162)

Use a grease gun to pump grease into the grease fitting on the side of the pump (Figure 23).

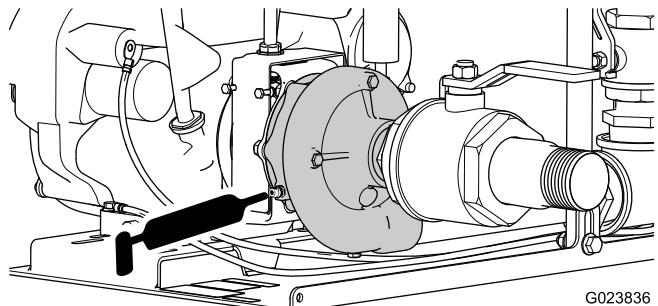


Figure 23

# Engine Maintenance

## Servicing the Air Cleaner

**Service Interval:** Before each use or daily—Inspect the air-cleaner element.

Every 50 hours—Clean the air-cleaner element. Clean it more frequently in dusty operating conditions.

Every 300 hours/Yearly (whichever comes first)—Replace the air-cleaner element. Replace it more frequently in dusty operating conditions.

**Important:** Do not operate the engine without the air filter assembly; extreme engine damage will occur.

1. Set the throttle to slow, stop the engine, and wait for all moving parts to stop.
2. Unscrew the cover nut and remove the cover (Figure 24).

**Note:** Be careful to prevent dirt and debris from falling into the base.

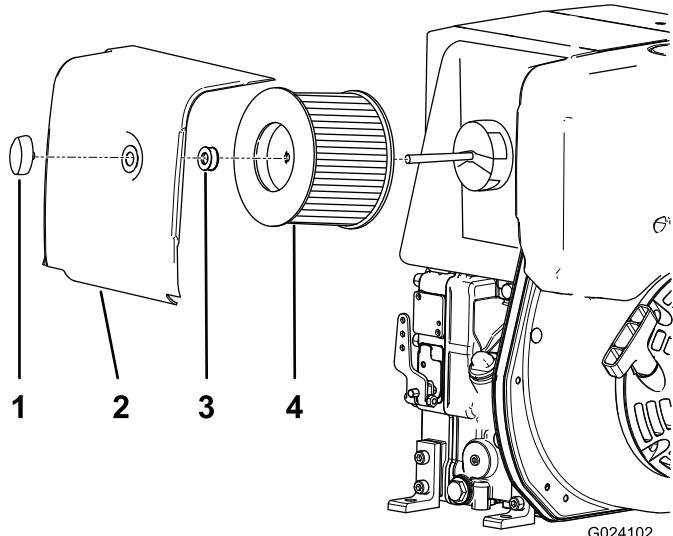


Figure 24

1. Cover nut
2. Cover
3. Filter nut
4. Filter element

3. Unscrew the filter nut and remove the element (Figure 24).
4. Inspect the element, and replace it if it is damaged or excessively dirty.

**Note:** Never try to brush dirt off the paper element; brushing forces the dirt into the fibers.

5. Wipe dirt from the base and the cover with a moist rag.
6. Install the air cleaner paper element and ensure that it is properly positioned.
7. Securely install the cover with the cover nut.

## Servicing the Engine Oil

**Service Interval:** After the first 25 hours

Every 100 hours

**Important:** Use 4-cycle engine oil that meets or exceeds the following guidelines and classifications:

- API Service Categories CH-4, CI-4, CJ-4 or higher
- ACEA Service Categories E-3, E-4, and E-5

**Note:** Toro Premium Engine Oil is available from your Authorized Toro Dealer.

**Crankcase Capacity:** 1.5 L (1.59 US qt)

**Important:** If the oil level in the crankcase is too low or too high and you run the engine, you may damage the engine. This type of damage is not covered by the warranty.

**Viscosity:** SAE 5W-30

**Note:** If the ambient temperature is above 35°C (95°F), use SAE 5W-40 or SAE 10W-40

## Changing the Engine Oil

1. Ensure that the machine is on a level surface.
2. Run the engine for a few minutes to warm the oil.

**Note:** Warm oil flows better and carries more contaminants.

3. Stop the engine and wait for all moving parts to stop.
4. Place a suitable receptacle under the oil-drain plug (Figure 25).

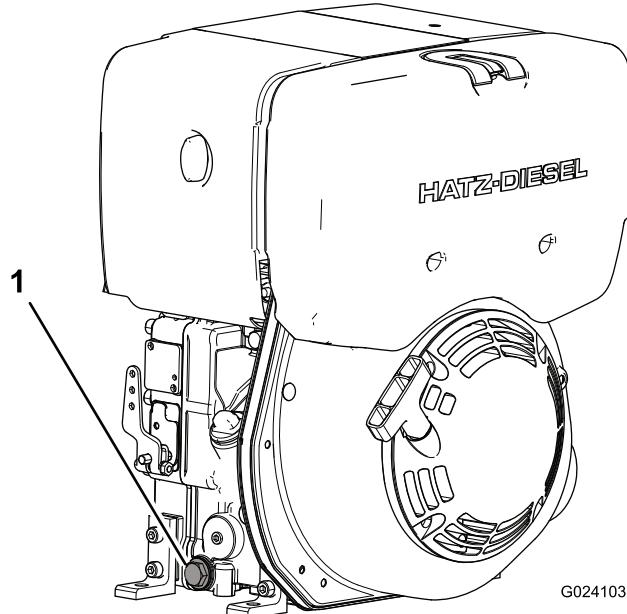


Figure 25

1. Oil-drain plug

5. Remove the drain plug.

- Clean around the dipstick (Figure 26) so that dirt cannot fall into the filler hole and damage the engine.

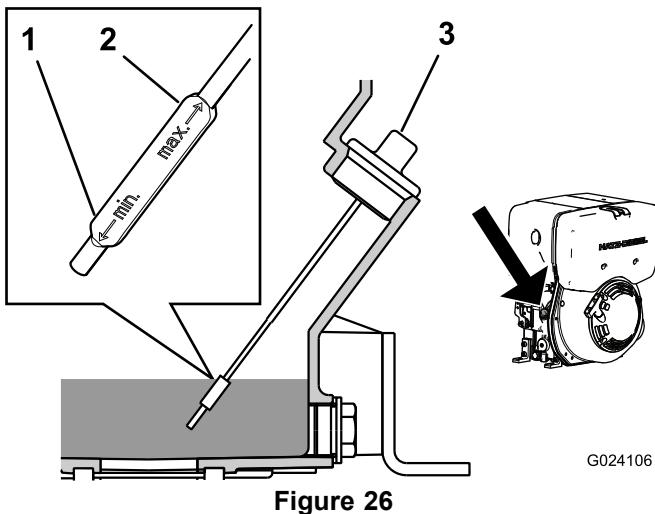


Figure 26

- Minimum oil level
- Maximum oil level
- Dipstick

- Unscrew the dipstick and wipe the end clean.
- Screw the dipstick fully onto the filler tube.
- Unscrew the dipstick again and look at the end.

**Note:** If the engine-oil level is low, slowly pour only enough oil into the filler tube to raise the level to the maximum mark on the dipstick.

# Fuel System Maintenance

## Checking the Water Trap

**Service Interval:** Every 20 hours

- Set the throttle to slow, stop the engine, and wait for all moving parts to stop.
- Loosen the water-trap bolt 3 to 4 rotations (Figure 27).

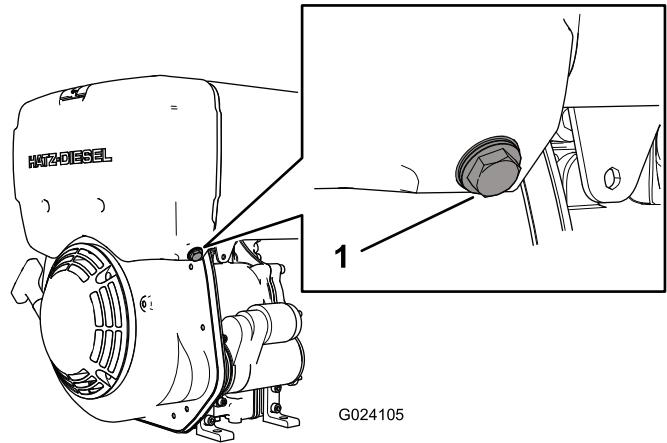


Figure 27

- Water-trap bolt
- Use a transparent container to catch the drips from the bolt.
- Note:** Because water is denser than diesel fuel, any water that is present will emerge first.
- As soon as diesel fuel emerges, tighten the water-trap bolt.
- Dispose of the water and the fuel according to environmental regulations.

# Replacing the Fuel Filter

Service Interval: Every 500 hours

**Note:** The engine has a dual-filter system. Replace only the external filter.

1. Stop the engine, remove the key, and wait for the engine to cool down.
2. Remove the fuel-tank cap.
3. Pull the fuel filter out of the fuel tank (Figure 28).

**Note:** The filter is tethered to the fuel-tank cap.

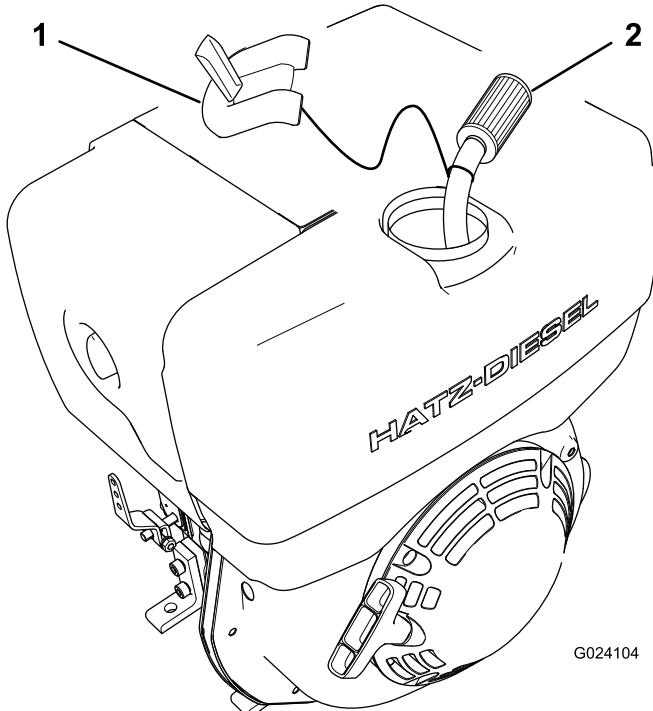


Figure 28

1. Fuel-tank cap      2. Fuel filter

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4. Pull the filter off the fuel hose.
5. Install a new filter into the fuel hose.
6. Place the filter into the fuel tank, and install the fuel-tank cap.

# Electrical System Maintenance

## Replacing the Battery

1. Remove the cover of the battery box.
2. Disconnect the negative (black) ground cable from the battery post.

### ⚠ WARNING

Incorrect battery cable routing could damage the machine and cables, causing sparks. Sparks can cause the battery gases 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.

### ⚠ WARNING

Battery terminals or metal tools could short against metal machine components, causing sparks. Sparks can cause the battery gases 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.

3. Remove the positive (red) battery cable.
4. Remove the battery.
5. Place the new battery in the tray.
6. Install the positive (red) battery cable to the positive (+) battery terminal, and tighten the nut onto the bolt.
7. Install the negative (black) ground cable to the negative (-) battery terminal, and tighten the nut onto the bolt.
8. Install the cover of the battery box, and secure it with the strap.
9. Recycle the old battery at an authorized facility.

# Charging the Battery

## ⚠ WARNING

Charging the battery produces gases that can explode, seriously injuring you or bystanders.

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

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

1. Charge the battery for 10 to 15 minutes at 25 to 30 amps, or 30 minutes at 10 amps.
2. When the battery is fully charged, unplug the charger from the electrical outlet, and disconnect the charger leads from the battery posts (Figure 29).
3. Install the battery in the machine and connect the battery cables; refer to Replacing the Battery (page 21).

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

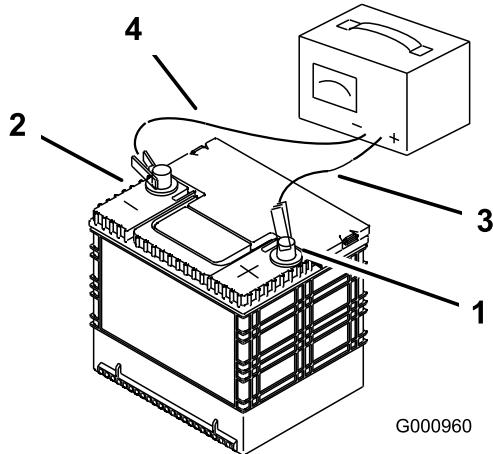


Figure 29

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

# Checking and Cleaning the Battery

**Service Interval:** Every 100 hours—Check the battery cable connections.

Keep the top of the battery clean. If the machine is stored in a location where temperatures are extremely high, the battery will discharge more rapidly than if the machine is stored in a cooler location.

Keep the top of the battery clean by washing it with a brush dipped in ammonia or a solution of sodium bicarbonate. Flush the top surface with water after cleaning. Do not remove the fill cap while cleaning the battery.

The battery cables must be tight on the terminals to provide good electrical contact.

If corrosion occurs at the battery terminals, disconnect the cables, negative (-) cable first, and scrape the clamps and terminals separately. Connect the cables, positive (+) cable first, and coat the terminals with petroleum jelly.

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If the battery no longer holds a charge, replace it; refer to Replacing the Battery (page 21).

# Cleaning

## Cleaning the Machine

Regular cleaning and washing will increase the life span of the machine. Clean the machine after each use, before the dirt hardens.

Ensure that the fuel-tank cap and oil cap/dipstick are secure to avoid getting water in the engine.

Use care when using a high-pressure sprayer, because it can damage warning decals, instruction signs, and the engine.

# Storage

## Storing the Machine

For storage over 30 days, prepare the machine as follows:

1. Remove dirt and grime from the external parts of the entire machine, especially the engine. Clean dirt and debris from the outside of the engine cylinder-head fins and blower housing.

**Important:** You can wash the machine with mild detergent and water.

2. Condition the fuel system as follows:
  - A. Add a petroleum-based stabilizer/conditioner to fuel in the tank. Follow the mixing instructions from the stabilizer manufacturer. **Do not** use an alcohol-based stabilizer (ethanol or methanol).

**Important:** Do not store stabilizer/conditioned fuel over 90 days.

**Note:** Fuel stabilizer/conditioner is most effective when mixed with fresh fuel and used at all times.

- B. Run the engine for 5 minutes to distribute the conditioned fuel through the fuel system.

**Important:** Do not run the engine without water in the tank, or the pump will be damaged.

- C. Stop the engine, allow it to cool, and drain the fuel tank using a pump-type siphon. Dispose of fuel properly; recycle it according to local codes.

- D. Start the engine and run it until it stops.

- E. Choke the engine.

- F. Start and run the engine until it will not start again.

3. Service the air cleaner; refer to Servicing the Air Cleaner (page 19).

4. Change the engine crankcase oil; refer to Servicing the Engine Oil (page 19).

5. Grease the machine; refer to Lubricating the Pump (page 18).

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 Toro 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

Problem	Possible Cause	Corrective Action
The engine does not start.	<ol style="list-style-type: none"><li>1. The engine On/Off switch is in the Off position.</li><li>2. The fuel tank is empty.</li><li>3. The engine contains bad or old fuel.</li></ol>	<ol style="list-style-type: none"><li>1. Rotate the switch to the On position.</li><li>2. Fill the fuel tank with fresh fuel.</li><li>3. Drain the fuel tank. Fill the fuel tank with fresh fuel.</li></ol>
The engine lacks power or runs rough.	<ol style="list-style-type: none"><li>1. The air filter is restricted.</li><li>2. The engine contains bad or old fuel.</li><li>3. There is water or contamination in the fuel.</li><li>4. The fuel line is restricted.</li><li>5. There is too much oil in the engine crankcase.</li></ol>	<ol style="list-style-type: none"><li>1. Clean or replace the air-filter element(s).</li><li>2. Drain the fuel tank. Fill the fuel tank with fresh fuel.</li><li>3. Drain the fuel tank. Fill the fuel tank with fresh fuel.</li><li>4. Clean the fuel filter.</li><li>5. Drain the oil to the proper level.</li></ol>
The fluid does not circulate at full efficiency.	<ol style="list-style-type: none"><li>1. The pump inlet is clogged.</li></ol>	<ol style="list-style-type: none"><li>1. Contact an Authorized Service Dealer.</li></ol>

# Notes:

# Notes:

# Notes:



# The Toro Underground Warranty

## A Limited Warranty

Underground  
Equipment

### Conditions and Products Covered

The Toro Company and its affiliate, Toro Warranty Company, pursuant to an agreement between them, jointly warrant your Toro Underground Equipment ("Product") to be free from defects in materials or workmanship. Where a warrantable condition exists, we will repair the Product at no cost to you including diagnostics, labor, and parts. The following warranty applies from the date the Product is delivered to the original retail purchaser or rental owner.

#### Products

RT600, RT1200, DD2024, and DD4045

All Other Engine Powered Base Units and Fluid Mixers

All Serialized Attachments

Rock Hammer

Engines

#### Warranty Period

2 years or 1500 operating hours, whichever occurs first

1 year or 1000 operating hours, whichever occurs first

1 year

6 months

Through engine manufacturers:

2 years or 2000 operating hours, whichever occurs first

filters, lights, bulbs, belts, tracks or tires, digging teeth, digging booms, digging, drive, or track chains, track pads, drive sprockets, idlers, rollers, blades, cutting edges, or other ground engaging components.

- Failures caused by outside influence. Conditions considered to be outside influence include, but are not limited to, weather, storage practices, contamination, use of unapproved fuels, coolants, lubricants, additives, water, or chemicals, etc.
- Failure or performance issues due to the use of fuels (e.g. gasoline, diesel, or biodiesel) that do not conform to their respective industry standards.
- Normal noise, vibration, wear and tear, and deterioration.
- Normal "wear and tear" includes, but is not limited to, damage to seats due to wear or abrasion, worn painted surfaces, scratched decals, etc.
- Hauling expenses, travel time, mileage, or overtime associated with transporting product to the authorized Toro dealer.

### Parts

Parts scheduled for replacement as required maintenance in the *Operator's Manual*, are warranted for the period of time up to the scheduled replacement time for that part. Parts replaced under this warranty are covered for the duration of the original product warranty and become the property of Toro. Toro will make the final decision whether to repair any existing part or assembly or replace it. Toro may use remanufactured parts for warranty repairs.

### Maintenance is at Owner's Expense

Engine tune-up, lubrication, cleaning and polishing, replacement of filters, coolant, and completing recommended maintenance are some of the normal services Toro products require that are at the owner's expense.

### General Conditions

Repair by an Authorized Toro Underground Dealer is your sole remedy under this warranty.

**Neither The Toro Company nor Toro Warranty Company is liable for indirect, incidental or consequential damages in connection with the use of the Toro Products covered by this warranty, including any cost or expense of providing substitute equipment or service during reasonable periods of malfunction or non-use pending completion of repairs under this warranty. Except for the Emissions warranty referenced below, if applicable, there is no other express warranty. All implied warranties of merchantability and fitness for use are limited to the duration of this express warranty.**

Some states do not allow exclusions of incidental or consequential damages, or limitations on how long an implied warranty lasts, so the above exclusions and limitations may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

### Note regarding engine warranty:

The Emissions Control System on your Product may be covered by a separate warranty meeting requirements established by the U.S. Environmental Protection Agency (EPA) and/or the California Air Resources Board (CARB). The hour limitations set forth above do not apply to the Emissions Control System Warranty. Refer to the Engine Emission Control Warranty Statement supplied with your product or contained in the engine manufacturer's documentation for details.

### Countries Other than the United States or Canada

Customers who have purchased Toro products exported from the United States or Canada should contact their Toro Distributor (Dealer) to obtain guarantee policies for your country, province, or state. If for any reason you are dissatisfied with your Underground Dealer's service or have difficulty obtaining guarantee information, contact the Toro importer.

**Australian Consumer Law:** Australian customers will find details relating to the Australian Consumer Law either inside the box or at your local Toro Dealer.