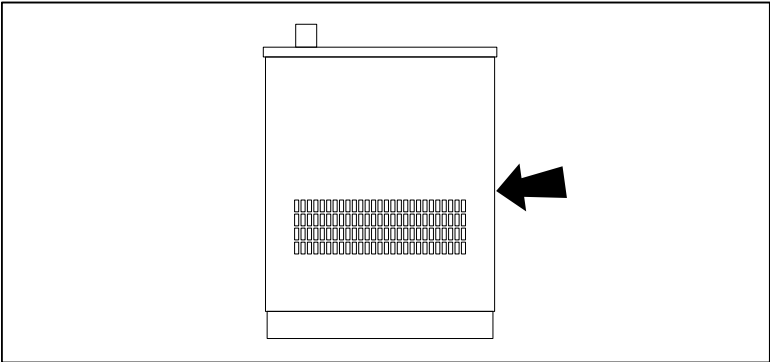


SUPPORT

SERIAL NUMBER

Record the serial number and date of purchase of your equipment in the spaces below.



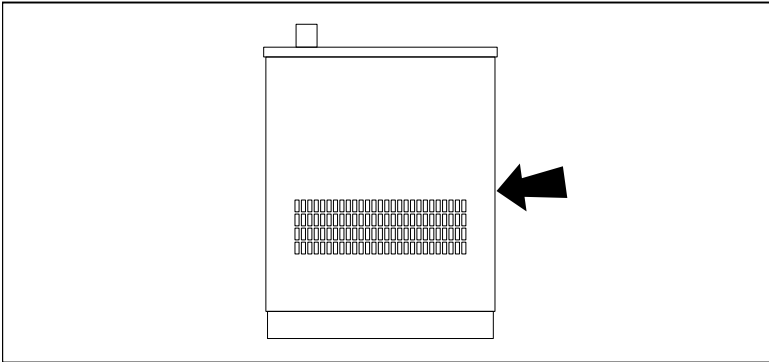
j03om003a.eps

Date of manufacture:	
Date of purchase:	
Generator set serial number: (inside right door)	

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j03om003a.eps

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Date of purchase:	
Generator set serial number: (inside right door)	

SUPPORT PROCEDURE

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

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

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

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

RESOURCES

Publications

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

Ditch Witch Training

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

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FOREWORD

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

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

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

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

The descriptions and specifications in this manual are subject to change. The Charles Machine Works, Inc. reserves the right to improve equipment. Some product improvements may have taken place after this manual was published. For the latest information on Ditch Witch equipment, see your Ditch Witch dealer.

Thank you for buying and using Ditch Witch equipment.

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**Operator's Manual
FM50**

Issue No. 2.0/OP-3/02
Part Number 054-076

Copyright 2001, 2002
by The Charles Machine Works, Inc.,
Perry, Oklahoma



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CMW, Power Pipe, The Underground, and The Underground Authority Worldwide are pending trademarks of The Charles Machine Works, Inc.

This product is covered by one or more of the following patents:

U.S. B1 4,858,704; 4,953,638; 5,148,880; 5,242,026; 5,341,887; 5,390,750; 5,392,868; 5,490,569; 5,544,712; 5,546,833; 5,564,455; 5,682,956; 5,684,466; 5,713,423; 5,794,719; 5,799,740; 5,941,322; 6,085,852; 6,109,371; 6,179,065; 6,250,403; 6,250,404; 6,290,606; 6,311,790; **Germany** 694 17 019.4-08; **EP** 0 683 845; **Mexico** 189,369; **Australia** 684,595; 689,533; 697,665; 718,034; 706,544; **UK** 2,209,239; 2,312,006; **Singapore** 49,288; other U.S. and foreign patents pending.

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CONTENTS

SUPPORT	1
Serial Number	1
Support Procedure	2
Resources	2
FOREWORD	3
OVERVIEW	9
Complete System	9
Generator Set	10
Mixing Tanks	11
Hopper	12
CONTROLS	13
Generator Overview	13
Generator Descriptions	14
Hopper Overview	23
Hopper Descriptions	24
SAFETY	31
Accessories	32
Emergency Procedures	33
Safety Alert Classifications	36
Safety Alerts	37

CONTENTS

SUPPORT	1
Serial Number	1
Support Procedure	2
Resources	2
FOREWORD	3
OVERVIEW	9
Complete System	9
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Hopper Descriptions	24
SAFETY	31
Accessories	32
Emergency Procedures	33
Safety Alert Classifications	36
Safety Alerts	37

LIFT	39
Lift Points	39
Procedure	40
INSTALLATION	43
Consider Load Requirements	43
Overview	44
Install Components	45
Connect Hoses	51
Connect Electrical Components	65
PREPARATION	67
Check Equipment	67
Select Drilling Fluid	68
Plan Drilling Fluid Requirements	71
OPERATION	73
Start Engine	74
Mix Drilling Fluid	75
Use Accessory Outlets	77
Measure Funnel Viscosity	79
Pump Fluid to Drilling Unit	80
Move Transfer/Bypass Hose	81
Shut Down System	82
Drain System	83
Transport System	85

LIFT	39
Lift Points	39
Procedure	40
INSTALLATION	43
Consider Load Requirements	43
Overview	44
Install Components	45
Connect Hoses	51
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PREPARATION	67
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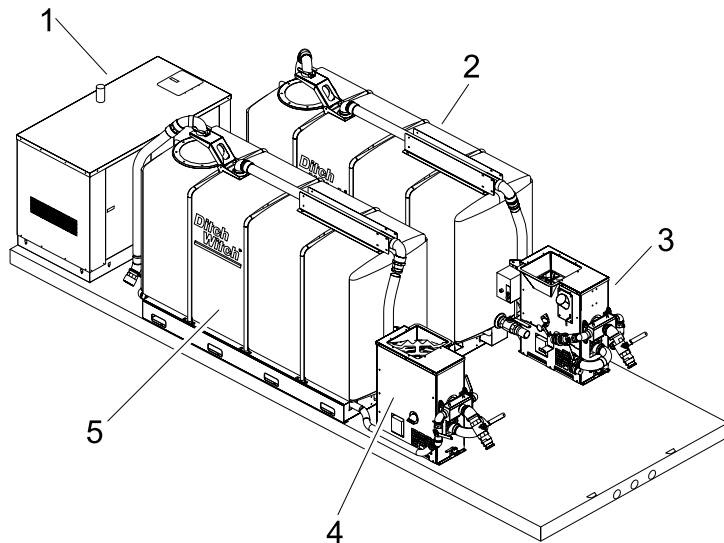
LUBRICATION AND MAINTENANCE	87
Lubrication Schedule	88
Engine	89
Hopper	91
Maintenance Schedule	92
Engine	93
Electrical	101
TROUBLESHOOTING	105
Fluid Mixing Components	105
Engine Components	107
Accessory Outlets	111
SPECIFICATIONS	113
Generator Set	113
Hopper	114
Mixing Tanks	115
Accessory Outlets	116

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Mixing Tanks	115
Accessory Outlets	116

OVERVIEW

The FM50 is an electrically driven venturi mixing system that efficiently mixes drilling fluid and transfers it for use with directional drilling systems. The FM50 comes with a generator set, two 1000 gal (3785 L) fluid mixing tanks, and two hoppers.

COMPLETE SYSTEM



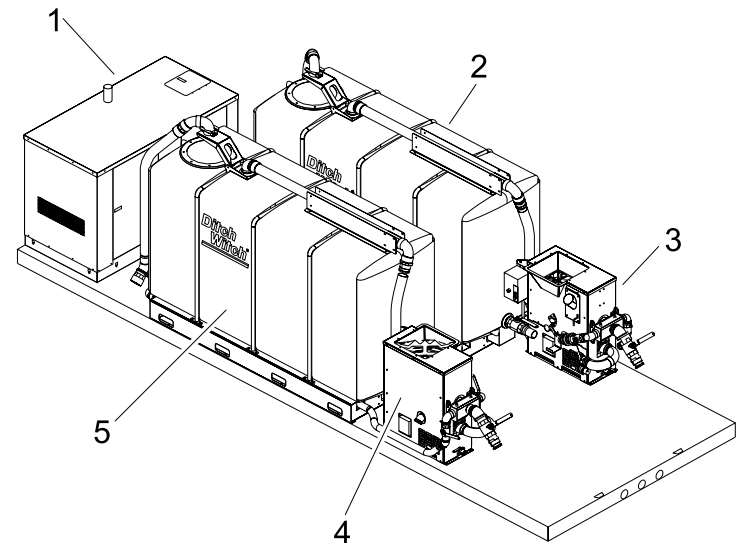
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- | | |
|----------------------|---------------------|
| 1. generator set | 4. left hopper |
| 2. right mixing tank | 5. left mixing tank |
| 3. right hopper | |

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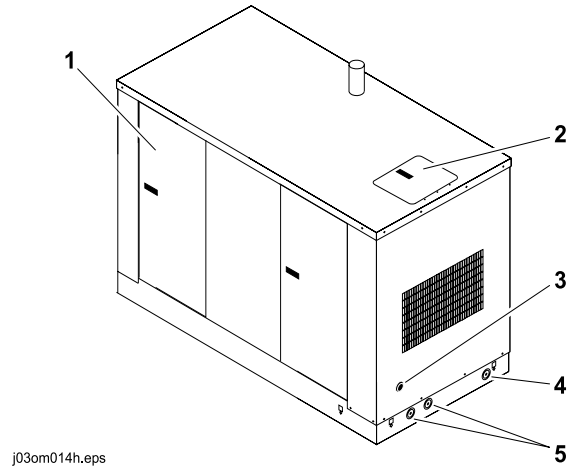
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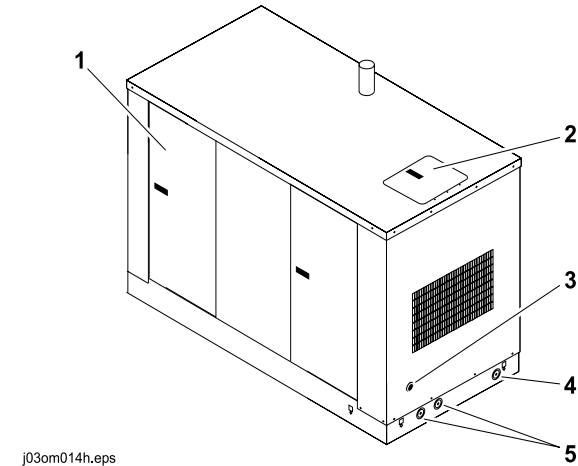
- | | |
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GENERATOR SET



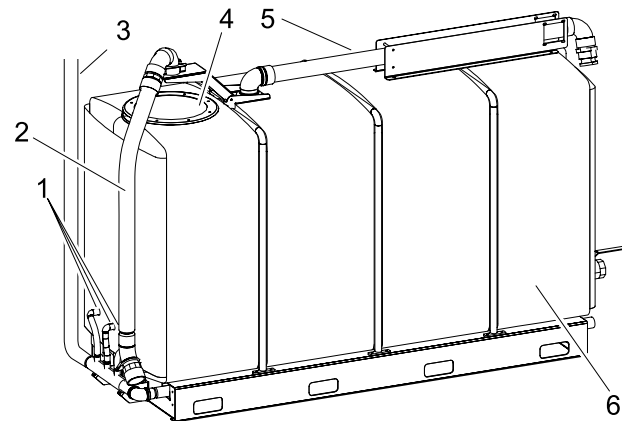
- 1. control panel door
- 2. radiator door
- 3. emergency stop switch
- 4. base drain (on both ends)
- 5. oil and coolant drains

GENERATOR SET



- 1. control panel door
- 2. radiator door
- 3. emergency stop switch
- 4. base drain (on both ends)
- 5. oil and coolant drains

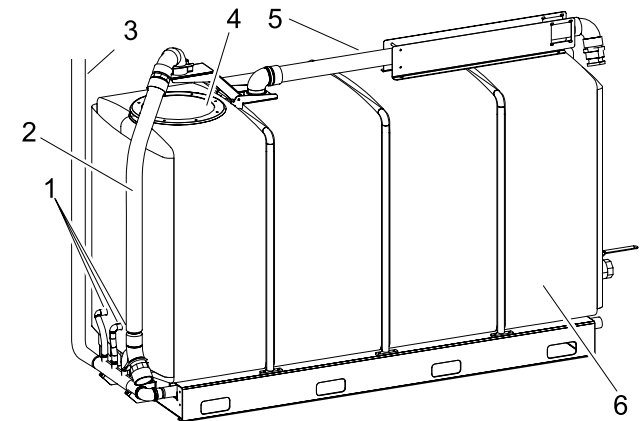
MIXING TANKS



j03om015h.eps

- | | |
|-------------------------|----------------------|
| 1. tank mixing jets | 4. fillwell |
| 2. tank fill pipe | 5. upper return pipe |
| 3. transfer/bypass hose | 6. mixing tank |

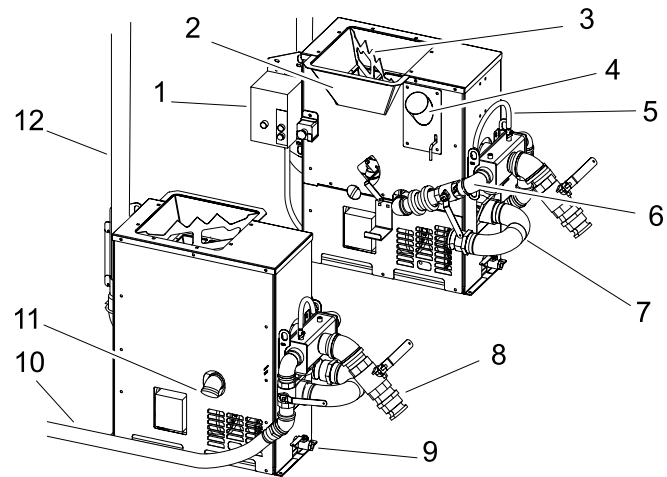
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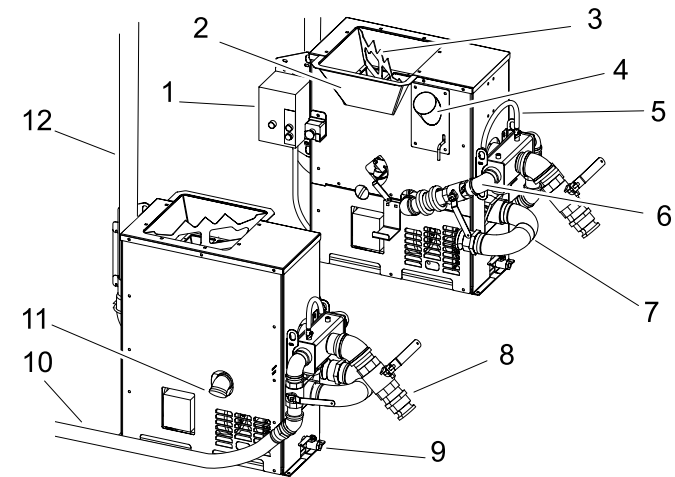
HOPPER



j03om013h.eps

- | | |
|------------------------|-------------------------|
| 1. motor control box | 7. suction hose elbow |
| 2. dry chemical hopper | 8. discharge connection |
| 3. bag cutter | 9. pump drain valve |
| 4. wet chemical hopper | 10. tank jet hose |
| 5. wash hose | 11. venturi drain |
| 6. venturi return pipe | 12. lower return hose |

HOPPER

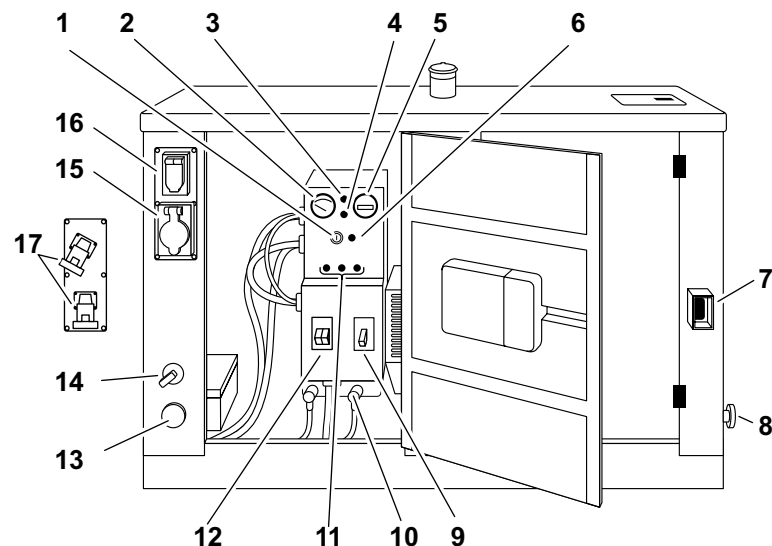


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CONTROLS

GENERATOR OVERVIEW

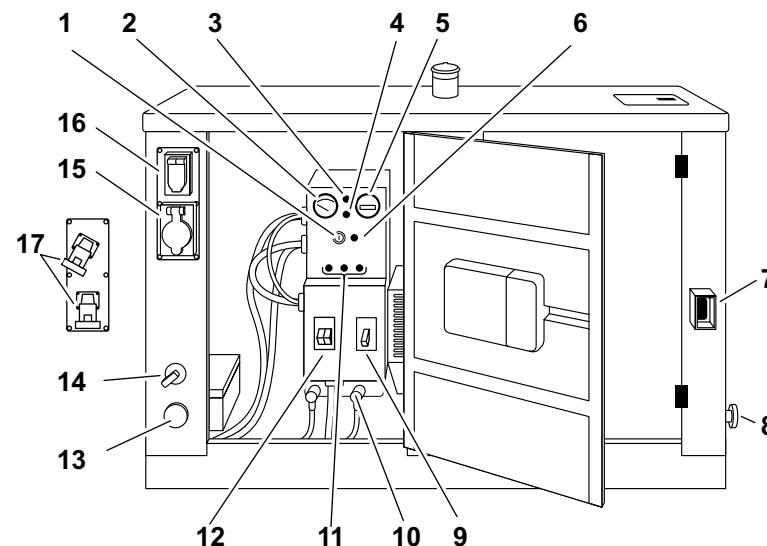


j03om025h.eps

- | | |
|-------------------------------------|--|
| 1. Ignition switch | 11. Circuit breaker |
| 2. Fuel gauge | 12. Accessory GFCI circuit breaker |
| 3. Engine temperature indicator | 13. Emergency stop switch |
| 4. Engine oil pressure indicator | 14. Battery disconnect switch |
| 5. Hourmeter | 15. 200V, 50 Hz / 240V, 60 Hz accessory GFCI** outlet |
| 6. Glow plug switch | 16. 115V, 50 Hz / 139V, 60 Hz accessory GFCI** outlets |
| 7. Engine speed switch | 17. 230V / 50 Hz, 277V / 60 Hz accessory GFCI** outlets* |
| 8. Emergency stop switch | |
| 9. Mixing pump circuit breaker | *Optional |
| 10. Remote emergency stop connector | ** Ground Fault Circuit Interrupter |

CONTROLS

GENERATOR OVERVIEW



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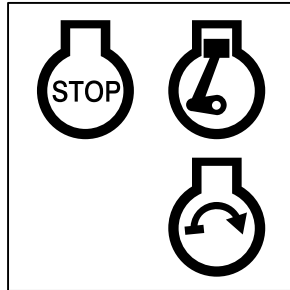
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| 10. Remote emergency stop connector | ** Ground Fault Circuit Interrupter |

GENERATOR DESCRIPTIONS

Ignition Switch

This switch has three positions.

- Insert key and turn clockwise to first position.
- Turn switch all the way clockwise.
- Release when engine starts. Key will return to on position.



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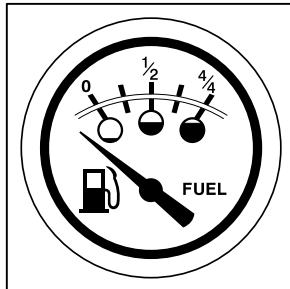
IMPORTANT: If engine does not start in cold weather, see “Cold Start” in **OPERATION**.

- Turn counterclockwise to STOP to stop engine.

Fuel Gauge

This gauge indicates the amount of fuel in the tank.

Use #2 diesel fuel. Tank holds 15 gal (27 L).



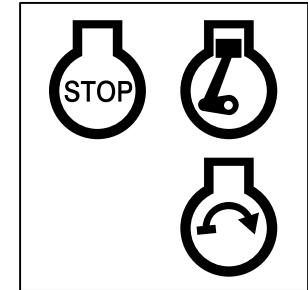
c00ic020a.eps

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ic1271a.eps

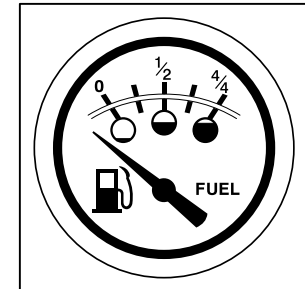
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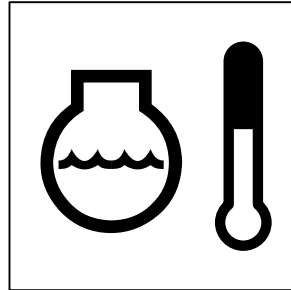


c00ic020a.eps

Engine Temperature Indicator

This indicator lights if engine coolant overheats.

- Turn off engine and let cool.
- Check engine coolant level.



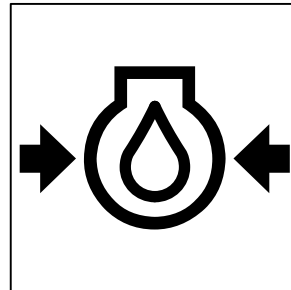
ic1293a.eps

Engine Oil Pressure Indicator

This indicator lights when oil pressure is low. Light will come on briefly when engine is started.

If light remains on:

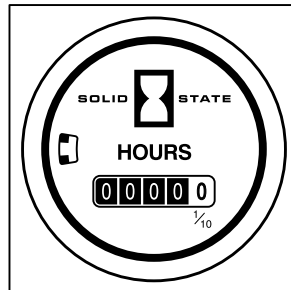
- Turn off engine.
- Check oil level.
- Check for leaks before starting engine.



ic1294a.eps

Hourmeter

This gauge records engine operating time. Use these times to schedule lubrication and maintenance.

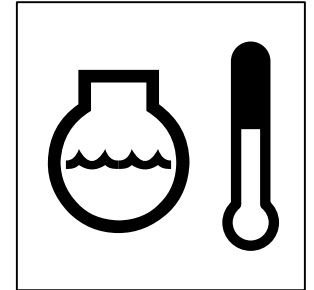


c00ic017a.eps

Engine Temperature Indicator

This indicator lights if engine coolant overheats.

- Turn off engine and let cool.
- Check engine coolant level.



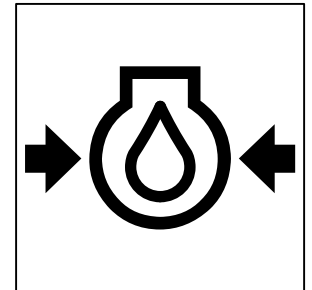
ic1293a.eps

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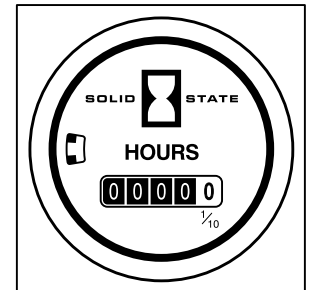
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ic1294a.eps

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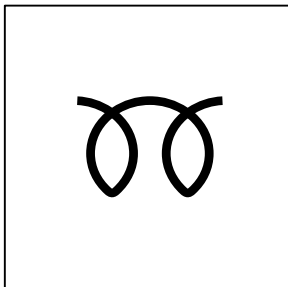


c00ic017a.eps

Glow Plug Switch

This button helps start the engine when the temperature is 50° F (23°C) or below (see “Start Engine” in **OPERATION**).

- Move ignition switch to on position.
- Press glow plug button as instructed.
- Turn ignition switch clockwise and release when engine starts.

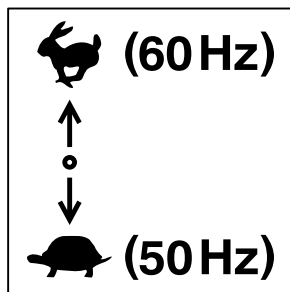


c00ic022a.eps

Engine Speed Switch

This rocker switch changes the engine speed from 1800 rpm (60 Hz) to 1500 rpm (50 Hz).

- Press top of switch for 60 Hz.
- Press bottom of switch for 50 Hz.



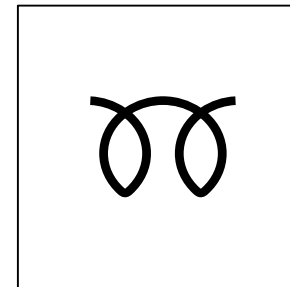
c00ic024a.eps

IMPORTANT: CMW is not responsible for any damages to devices connected to the FM50 system. See “Use Accessory Outlets” in **OPERATION** for the voltages that the FM50 system produces.

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This button helps start the engine when the temperature is 50° F (23°C) or below (see “Start Engine” in **OPERATION**).

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- Press glow plug button as instructed.
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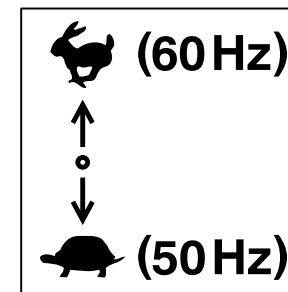


c00ic022a.eps

Engine Speed Switch

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- Press top of switch for 60 Hz.
- Press bottom of switch for 50 Hz.



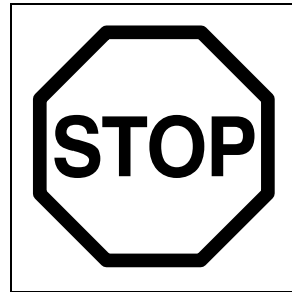
c00ic024a.eps

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Emergency Stop Switches

These buttons stop generator set.

- Push to stop generator set.
- Pull to start generator set.



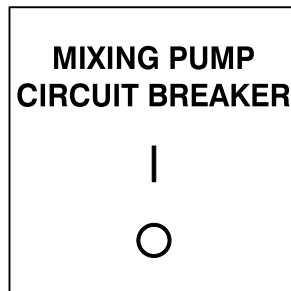
IMPORTANT: If either switch is used to stop generator set, pull button out and turn ignition switch off and then on before attempting to restart engine.

Mixing Pump Circuit Breaker

This breaker provides protection to mixing pump circuit.

If mixing pumps will not turn on, check this breaker.

When circuit is overloaded, breaker will trip. Push switch down and then up to reset breaker.

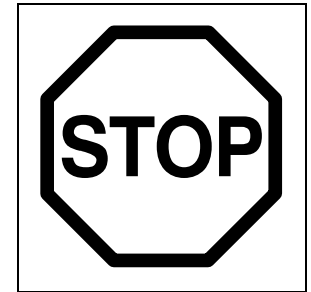


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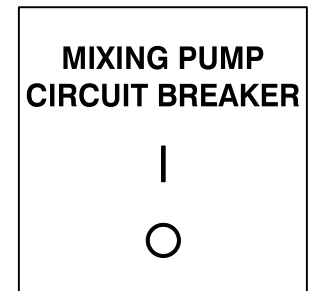
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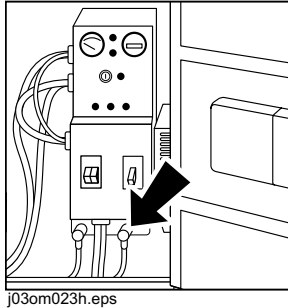
c00ic027a.eps

Remote Emergency Stop Connector

IMPORTANT: This connector must be in place to start engine.

This connector ties the emergency stop switch on the control box of the hopper to the generator set.

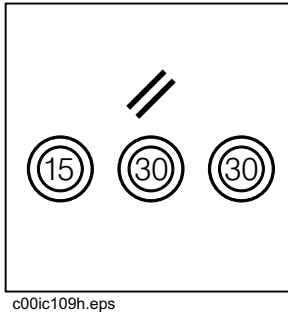
Check this connector if engine shuts down unexpectedly.



Circuit Breakers

These breakers protect three electrical circuits. From left to right, they are:

- ignition circuits
- throttle control
- glow plug



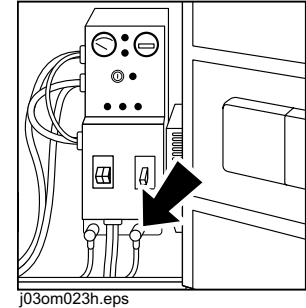
When a circuit is overloaded, breaker will extend. Press to reset circuit.

Remote Emergency Stop Connector

IMPORTANT: This connector must be in place to start engine.

This connector ties the emergency stop switch on the control box of the hopper to the generator set.

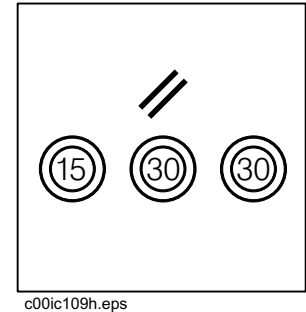
Check this connector if engine shuts down unexpectedly.



Circuit Breakers

These breakers protect three electrical circuits. From left to right, they are:

- ignition circuits
- throttle control
- glow plug



When a circuit is overloaded, breaker will extend. Press to reset circuit.

Accessory GFCI Circuit Breakers

Standard 20 amp circuit breaker provides overload and short protection for AC circuits used by North American style accessory outlets.

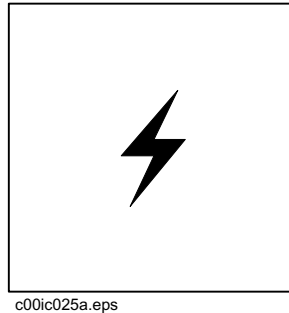
This circuit breaker also provides 5 milliamp ground fault protection for personnel and equipment.

Optional 16 amp circuit breaker provides overload and short protection for AC circuits used by IEC style accessory outlets.

This circuit breaker also provides 30 milliamp ground fault protection for personnel and equipment.

If breaker is tripped, push the breaker all the way down and then back up to reset the circuit.

IMPORTANT: See "GFCI Circuit Breakers" in **LUBRICATION AND MAINTENANCE** for testing instructions.



Accessory GFCI Circuit Breakers

Standard 20 amp circuit breaker provides overload and short protection for AC circuits used by North American style accessory outlets.

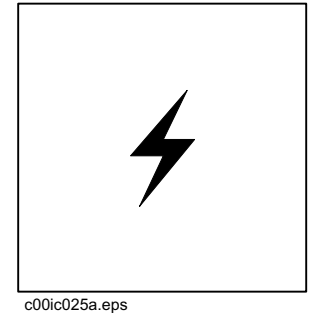
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If breaker is tripped, push the breaker all the way down and then back up to reset the circuit.

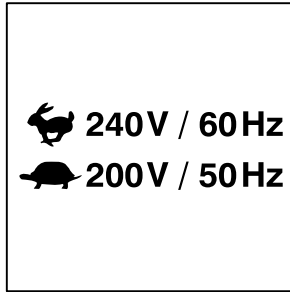
IMPORTANT: See "GFCI Circuit Breakers" in **LUBRICATION AND MAINTENANCE** for testing instructions.



**240V / 60 Hz, 200V / 50 Hz
Accessory GFCI Outlet**

This outlet supplies up to 20 amps of power to run accessory equipment.

Outlet has power only when the ignition switch is on and the engine is running.



c00ic029a.eps

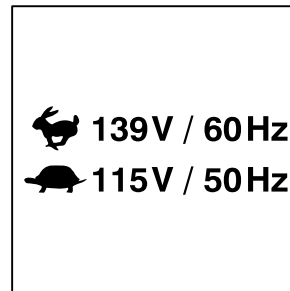
If a ground fault has occurred, outlet has power only after the white button on accessory GFCI circuit breaker has been pressed in.

IMPORTANT: CMW is not responsible for any damages to devices connected to the FM50 system. See “Use Accessory Outlets” in **OPERATION** for the voltages that the FM50 system produces.

**139V / 60 Hz, 115V / 50 Hz
Accessory GFCI Outlets**

This duplex outlet supplies up to 20 amps of power for lights, heaters, or other equipment.

Outlet has power only when the ignition switch is on and the engine is running.



c00ic028a.eps

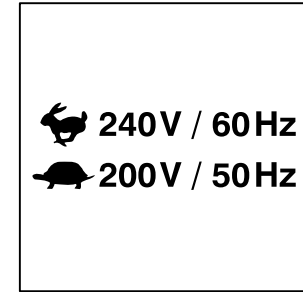
If a ground fault has occurred, outlet has power only after the red reset button on receptacle and white reset button on GFCI circuit breaker have been pressed in.

IMPORTANT: CMW is not responsible for any damages to devices connected to the FM50 system. See “Use Accessory Outlets” in **OPERATION** for the voltages that the FM50 system produces.

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c00ic029a.eps

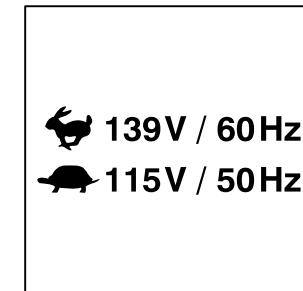
If a ground fault has occurred, outlet has power only after the white button on accessory GFCI circuit breaker has been pressed in.

IMPORTANT: CMW is not responsible for any damages to devices connected to the FM50 system. See “Use Accessory Outlets” in **OPERATION** for the voltages that the FM50 system produces.

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c00ic028a.eps

If a ground fault has occurred, outlet has power only after the red reset button on receptacle and white reset button on GFCI circuit breaker have been pressed in.

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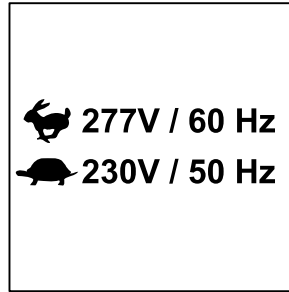
277V / 60 Hz, 230V / 50 Hz Accessory GFCI Outlets

These outlets supply up to 16 amps of power to run accessory equipment.

Outlet has power only when the ignition switch is on and the engine is running.

Outlet has power only when the black and white handles are in the up position.

IMPORTANT: CMW is not responsible for any damages to devices connected to the FM50 system. See “Use Accessory Outlets” in **OPERATION** for the voltages that the FM50 system produces.



c00ic110h.eps

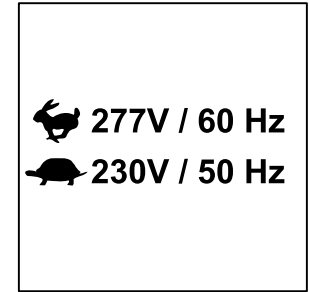
277V / 60 Hz, 230V / 50 Hz Accessory GFCI Outlets

These outlets supply up to 16 amps of power to run accessory equipment.

Outlet has power only when the ignition switch is on and the engine is running.

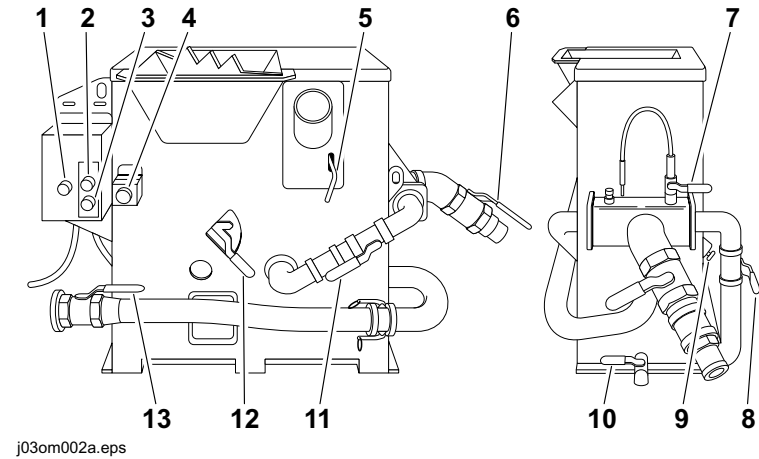
Outlet has power only when the black and white handles are in the up position.

IMPORTANT: CMW is not responsible for any damages to devices connected to the FM50 system. See “Use Accessory Outlets” in **OPERATION** for the voltages that the FM50 system produces.



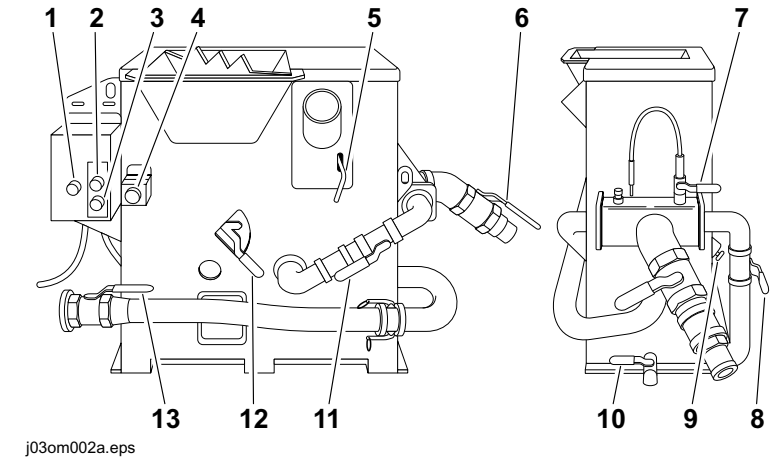
c00ic110h.eps

HOPPER OVERVIEW



- | | |
|---------------------------------|-------------------------|
| 1. Reset switch | 8. Tank jet valve |
| 2. Mixing pump ON switch | 9. Venturi drain valve |
| 3. Mixing pump OFF switch | 10. Pump drain valve |
| 4. Remote emergency stop switch | 11. Venturi valve |
| 5. Liquid chemical hopper valve | 12. Dry chemical hopper |
| 6. Discharge valve | 13. Suction valve |
| 7. Wash hose valve | |

HOPPER OVERVIEW



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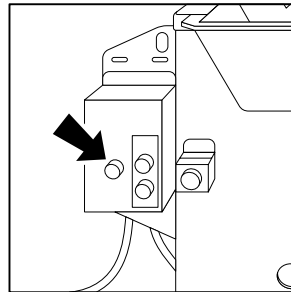
HOPPER DESCRIPTIONS

Reset Switch

This blue button resets the motor overload relay. Motor overload relay protects electric motor by shutting off power to the motor anytime the current exceeds normal levels.

Press button to reset relay.

NOTICE: If the motor overload relay trips after resetting, a problem may exist with the motor or pump. Shut down the system and contact your Ditch Witch dealer.

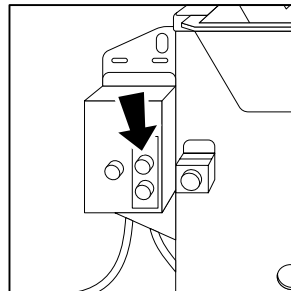


j03om004a.eps

Mixing Pump ON Switch

This green button starts the mixing pump motor.

Press to start motor.



j03om005a.eps

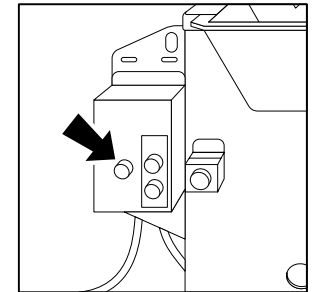
HOPPER DESCRIPTIONS

Reset Switch

This blue button resets the motor overload relay. Motor overload relay protects electric motor by shutting off power to the motor anytime the current exceeds normal levels.

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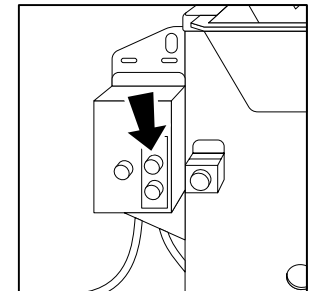


j03om004a.eps

Mixing Pump ON Switch

This green button starts the mixing pump motor.

Press to start motor.

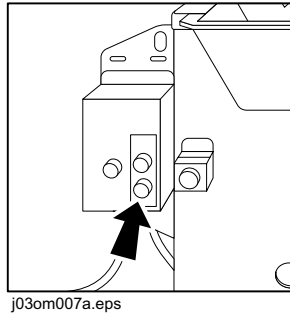


j03om005a.eps

Mixing Pump OFF Switch

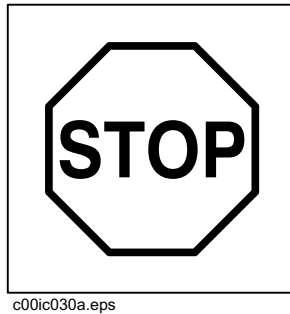
This red button stops the mixing pump motor.

Press to stop motor.

**Remote Emergency Stop Switch**

This red button stops generator set.

Push to stop generator set.

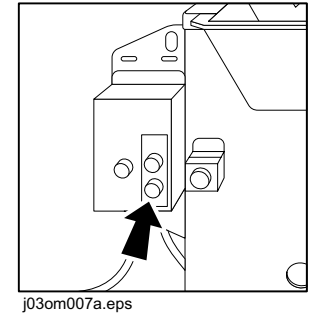


IMPORTANT: If switch is used to stop generator set, pull button out and turn ignition switch off and then on before attempting to restart engine.

Mixing Pump OFF Switch

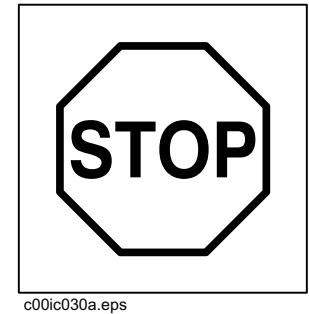
This red button stops the mixing pump motor.

Press to stop motor.

**Remote Emergency Stop Switch**

This red button stops generator set.

Push to stop generator set.

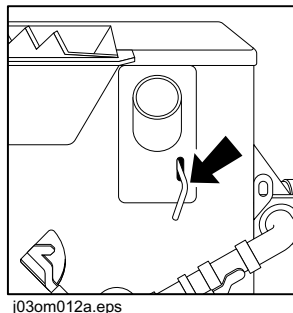


IMPORTANT: If switch is used to stop generator set, pull button out and turn ignition switch off and then on before attempting to restart engine.

Liquid Chemical Hopper Valve

This valve controls flow of liquid polymers or wetting agents to the mixing system.

- Pull out to open hopper valve.
- Push in to close hopper valve.

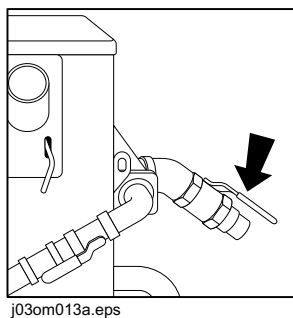


IMPORTANT: Do not open valve unless pump is running and mixing venturi valve is open. Fluid could flow back into hopper.

Discharge Valve

This valve controls flow of drilling fluid from mixing tank to drilling unit.

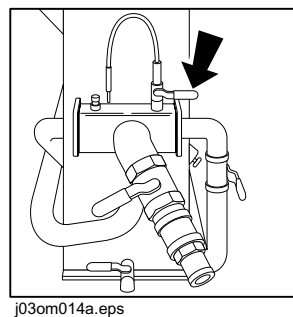
- Turn inline to open discharge valve.
- Turn perpendicular to close discharge valve.



Wash Hose Valve

This valve controls flow of fluid through the wash hose.

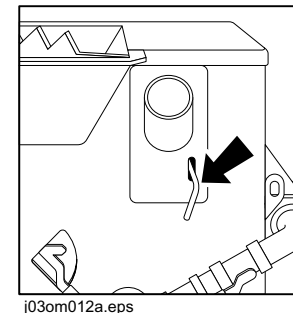
- Turn inline to open valve and allow flow through the wash hose.
- Turn perpendicular to close valve and stop flow through the wash hose.



Liquid Chemical Hopper Valve

This valve controls flow of liquid polymers or wetting agents to the mixing system.

- Pull out to open hopper valve.
- Push in to close hopper valve.

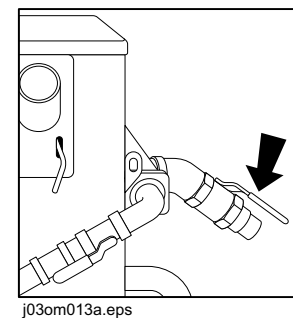


IMPORTANT: Do not open valve unless pump is running and mixing venturi valve is open. Fluid could flow back into hopper.

Discharge Valve

This valve controls flow of drilling fluid from mixing tank to drilling unit.

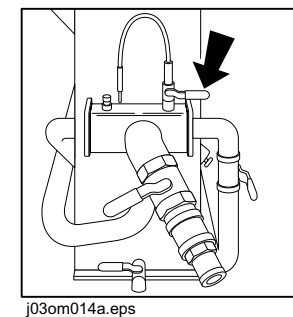
- Turn inline to open discharge valve.
- Turn perpendicular to close discharge valve.



Wash Hose Valve

This valve controls flow of fluid through the wash hose.

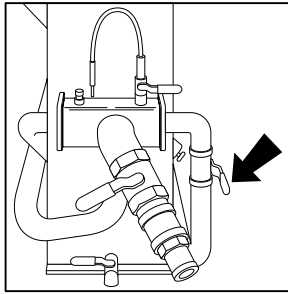
- Turn inline to open valve and allow flow through the wash hose.
- Turn perpendicular to close valve and stop flow through the wash hose.



Tank Jet Valve

This valve controls flow of fluid from pump to mixing jets in the tank.

- Turn inline to open valve.
- Turn perpendicular to close valve.

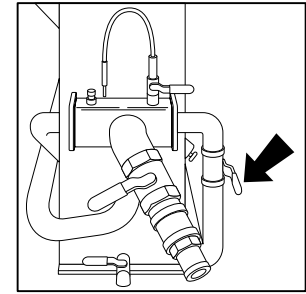


j03om015a.eps

Tank Jet Valve

This valve controls flow of fluid from pump to mixing jets in the tank.

- Turn inline to open valve.
- Turn perpendicular to close valve.

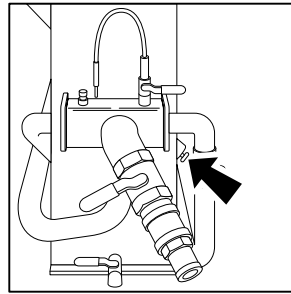


j03om015a.eps

Venturi Drain Valve

This valve drains fluid from venturi hose.

- Turn counterclockwise to open valve.
- Turn clockwise to close valve.

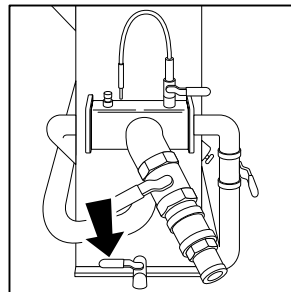


j03om016a.eps

Pump Drain Valve

This valve drains fluid from fluid lines and pump.

- Turn inline to open.
- Turn perpendicular to close.

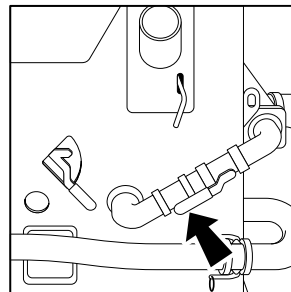


j03om017a.eps

Venturi Valve

This valve controls flow of fluid through mixing venturi at the bottom of the dry hopper.

- Turn inline to open.
- Turn perpendicular to close.

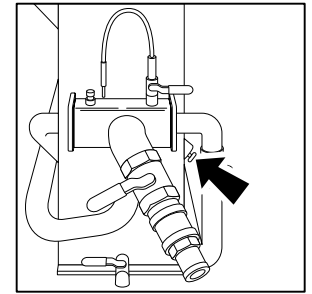


j03om018a.eps

Venturi Drain Valve

This valve drains fluid from venturi hose.

- Turn counterclockwise to open valve.
- Turn clockwise to close valve.

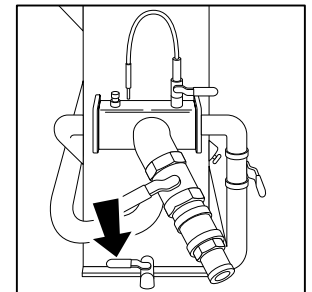


j03om016a.eps

Pump Drain Valve

This valve drains fluid from fluid lines and pump.

- Turn inline to open.
- Turn perpendicular to close.

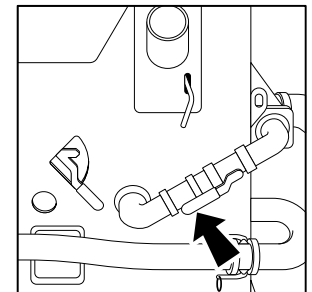


j03om017a.eps

Venturi Valve

This valve controls flow of fluid through mixing venturi at the bottom of the dry hopper.

- Turn inline to open.
- Turn perpendicular to close.

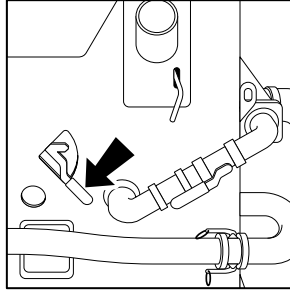


j03om018a.eps

Dry Chemical Hopper Valve

This valve controls flow of dry chemicals into mixing venturi.

- Pull up to open valve.
- Push down to close valve.



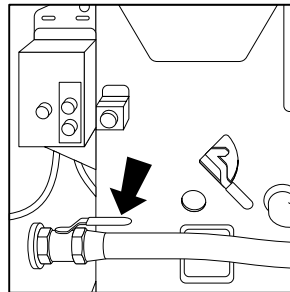
j03om019a.eps

IMPORTANT: Do not open valve unless pump is running and mixing venturi valve is open. Fluid could flow back into hopper.

Suction Valve

This valve draws water from tank and pumps it through hopper for mixing with dry or liquid chemicals.

- Turn inline to open.
- Turn perpendicular to close.



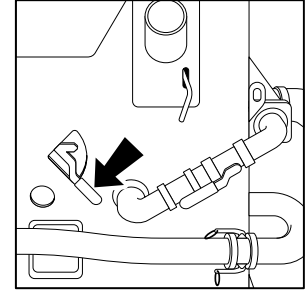
j03om020a.eps

IMPORTANT: Close suction valve to make repairs to hopper without draining water tank.

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This valve controls flow of dry chemicals into mixing venturi.

- Pull up to open valve.
- Push down to close valve.



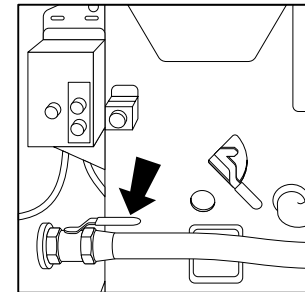
j03om019a.eps

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Suction Valve

This valve draws water from tank and pumps it through hopper for mixing with dry or liquid chemicals.

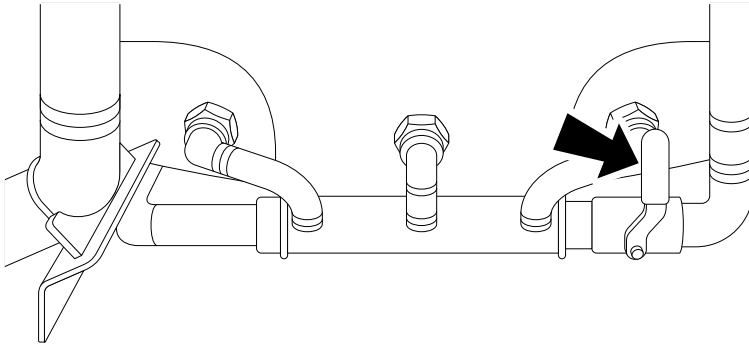
- Turn inline to open.
- Turn perpendicular to close.



j03om020a.eps

IMPORTANT: Close suction valve to make repairs to hopper without draining water tank.

Transfer/Bypass Valve

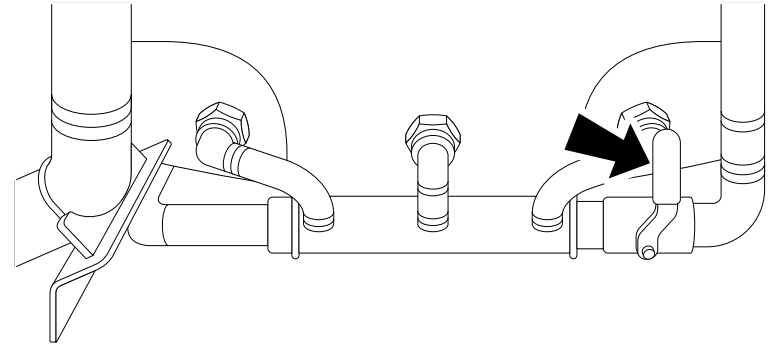


j03om011a.eps

This valve is located on the inside end of both tank jet manifolds. It controls the flow of fluid from one tank to the other or allows the operator to bypass a portion of the fluid being pumped to reduce pressure to the drilling unit.

- Turn inline to open.
- Turn perpendicular to close.

Transfer/Bypass Valve



j03om011a.eps

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- Turn inline to open.
- Turn perpendicular to close.

SAFETY

Follow these guidelines before operating any jobsite equipment:

- Complete proper training and read operator's manual before using equipment.
- Classify jobsite based on its hazards and use correct tools and machinery, safety equipment, and work methods for jobsite.
- Mark jobsite clearly and keep spectators away.
- Wear personal protective equipment.
- Review jobsite hazards, safety and emergency procedures, and individual responsibilities with all personnel before work begins. Safety videos are available from your Ditch Witch dealer.
- Replace missing or damaged safety shields and safety signs.
- Use equipment carefully. Stop operation and investigate anything that does not look or feel right.
- Do not operate unit where flammable gas is present.

Contact your Ditch Witch dealer if you have any question about operation, maintenance, or equipment use.

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ACCESSORIES

Fire Extinguisher

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

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

EMERGENCY PROCEDURES

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

EMERGENCY SHUTDOWN - Push one of the 3 emergency stop switches located on the system.

Electric Strike Description

When working near electric cables, remember the following:

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

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

- Power outage
- Smoke
- Explosion
- Popping noises
- Arcing electricity

If any of these occur, or if strike alarm sounds or flashes, assume an electric strike has occurred.

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- Arcing electricity

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If an Electric Line is Damaged

While On The Trailer Or Truck Bed

1. DO NOT MOVE. Remain on trailer or truck bed.
2. DO NOT TOUCH ANY EQUIPMENT connected to the trailer or truck bed.
3. Warn people nearby that an electric strike has occurred.
4. Have someone contact electric company.
5. Stay where you are unless you are wearing electric insulating boots. If you leave, do not return to area or allow anyone into area until given permission by electric company.

If a Gas Line is Damaged

1. Immediately shut off engine(s) and remove any ignition sources.
2. LEAVE AREA as quickly as possible.
3. Warn others that a gas line has been cut and that they should leave area.
4. Contact emergency personnel.
5. Contact utility company.
6. Do not return to area until given permission by utility company.

If an Electric Line is Damaged

While On The Trailer Or Truck Bed

1. DO NOT MOVE. Remain on trailer or truck bed.
2. DO NOT TOUCH ANY EQUIPMENT connected to the trailer or truck bed.
3. Warn people nearby that an electric strike has occurred.
4. Have someone contact electric company.
5. Stay where you are unless you are wearing electric insulating boots. If you leave, do not return to area or allow anyone into area until given permission by electric company.

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4. Contact emergency personnel.
5. Contact utility company.
6. Do not return to area until given permission by utility company.

Crystalline Silica (Quartz) Dust Precautions

Follow OSHA or other guidelines for exposure to crystalline silica when trenching, sawing or drilling through material that might produce dust containing crystalline silica (quartz).

Other Jobsite Precautions

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

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Other Jobsite Precautions

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

SAFETY ALERT CLASSIFICATIONS

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

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

 **DANGER** indicates 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.

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

NOTICE can keep you from doing something that might damage the machine or someone's property. It can also alert you against unsafe practices.

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

SAFETY ALERT CLASSIFICATIONS

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

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

 **DANGER** indicates 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.

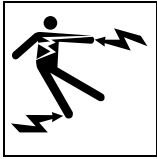
 **CAUTION** indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

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

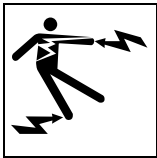
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IMPORTANT can help you do a better job or make your job easier in some way.

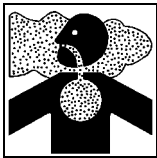
SAFETY ALERTS



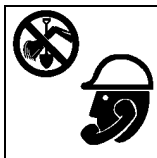
⚠ DANGER **ELECTRIC SHOCK** will cause death or serious injury. Disconnect all power to this equipment before servicing.



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



⚠ DANGER Deadly gases. Lack of oxygen or presence of gas will cause sickness or death. Provide ventilation.

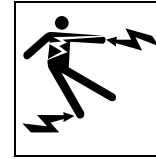


⚠ WARNING Jobsite hazards could cause death or serious injury. Use correct equipment and work methods. Use and maintain proper safety equipment.

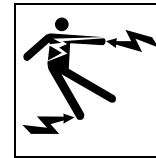


⚠ WARNING Crushing weight could cause death or serious injury. Use proper procedures and equipment or stay away.

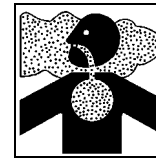
SAFETY ALERTS



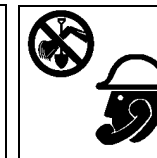
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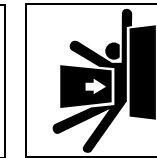
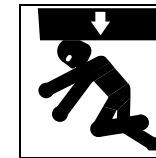
⚠ DANGER Electric shock. Contacting electric lines will cause death or serious injury. Know location of lines and stay away.



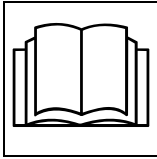
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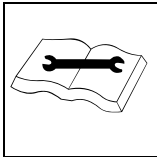
⚠ WARNING Crushing weight could cause death or serious injury. Use proper procedures and equipment or stay away.

**⚠ WARNING**

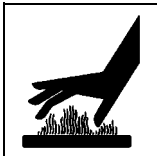
Incorrect procedures could result in death, injury, or property damage. Learn to use equipment correctly.

**⚠ WARNING**

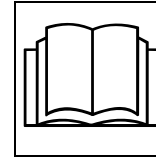
Moving traffic - hazardous situation. Death or serious injury could result. Avoid moving vehicles, wear high visibility clothing, post appropriate warning signs.

**⚠ WARNING**

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

**⚠ CAUTION**

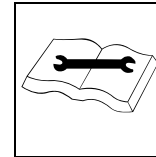
Hot parts may cause burns. Do not touch until cool.

**⚠ WARNING**

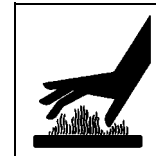
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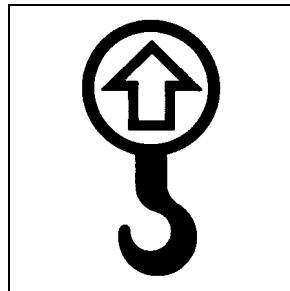
LIFT



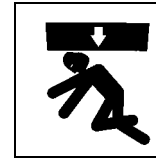
⚠ WARNING Crushing weight. If load falls or moves it could kill or crush you. Use proper procedures and equipment or stay away.

LIFT POINTS

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



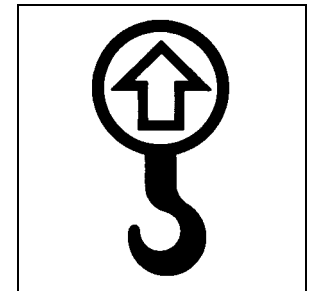
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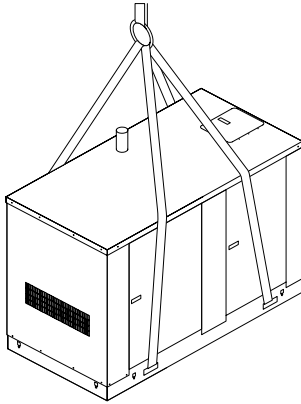
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PROCEDURE

Generator Set

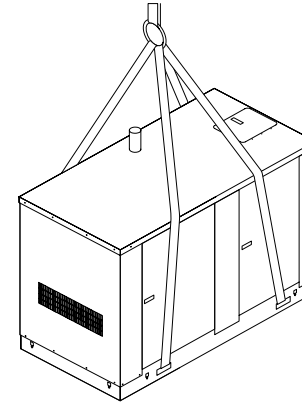


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Lift generator set by connecting sling through tubes on bottom of set.

PROCEDURE

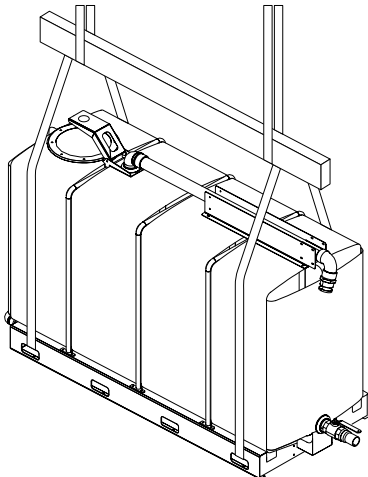
Generator Set



j03om010a.eps

Lift generator set by connecting sling through tubes on bottom of set.

Tank

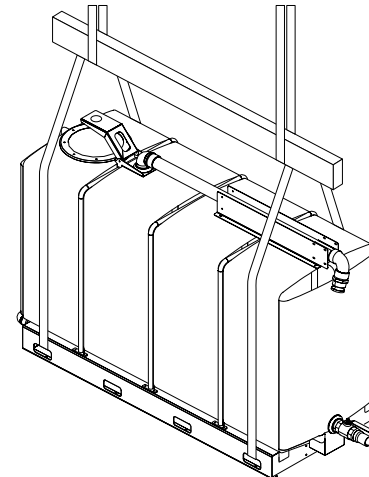


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Lift mixing tank by attaching sling to lift points located on side of tank base. Attach securely to cross members.

IMPORTANT: Empty tank before lifting.

Tank

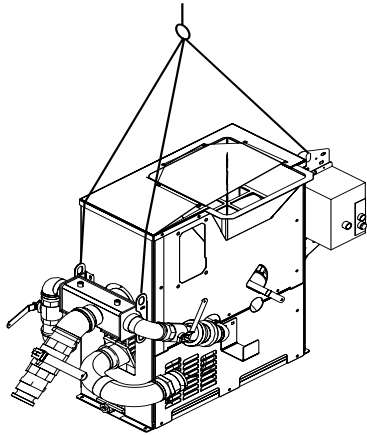


j03om009a.eps

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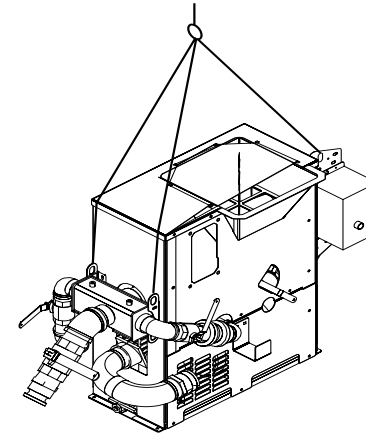
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Hopper



Lift hopper by attaching chains to designated lift points on brackets on ends of hopper.

Hopper

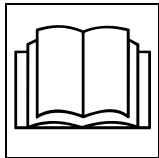


Lift hopper by attaching chains to designated lift points on brackets on ends of hopper.

INSTALLATION

The instructions in this chapter are for the installation of the FM50 system. You may need to install the system differently than what is described. Whether you use the installation in this manual or another installation be sure that load and truck requirements are met. Basic load requirements are described below.

Contact your Ditch Witch dealer for help in calculating the placement of FM50 components on your trailer or truck.



⚠ WARNING

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

NOTICE: Adequate frame members or structure must be present under the trailer or truck bed to hold tanks during transport. Death, injury or serious property damage could occur if base structure is not sufficiently strong to hold tanks. If frame members are not pre-existing, they must be installed.

CONSIDER LOAD REQUIREMENTS

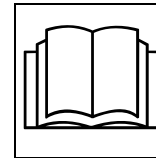
The FM50 unit must be installed on a trailer or truck that meets the following requirements.

- All trailer or truck components including axles and tires are in good condition.
- Axle loads meet US requirements. In countries other than the US, check local regulations.

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The instructions in this chapter are for the installation of the FM50 system. You may need to install the system differently than what is described. Whether you use the installation in this manual or another installation be sure that load and truck requirements are met. Basic load requirements are described below.

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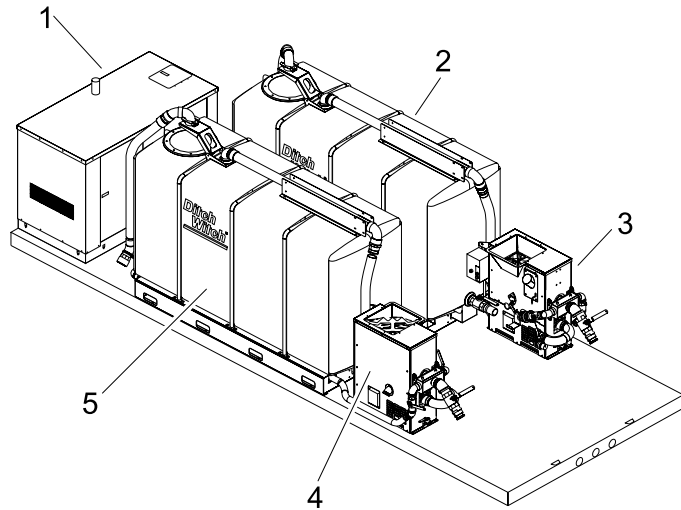
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OVERVIEW

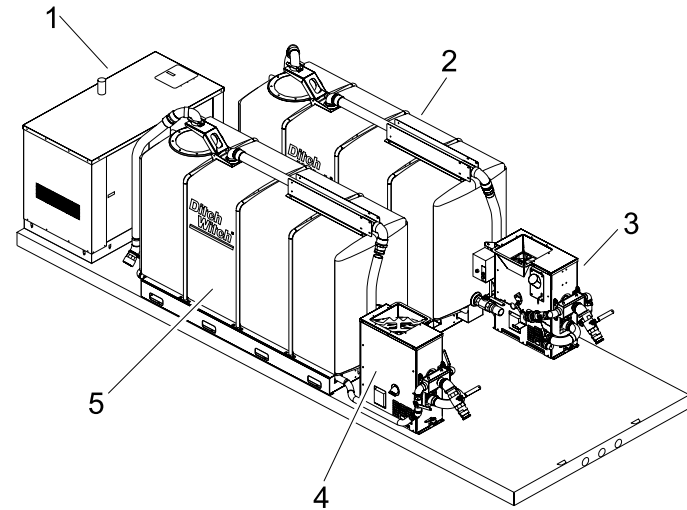


j03om001h.eps

1. Generator set
2. 1000-gal (3785-L) tank (right side)
3. Right hopper
4. Left hopper
5. 1000-gal (3785-L) tank (left side)

IMPORTANT: When installing the FM50 system, plan the placement of components so that hand-operated electrical controls are between 2 ft (0.6 m) - 6.2 ft (1.9 m) above service level. For emergency stop switches on ends of generator, this is height above ground level. For all other controls, it is height above deck level.

OVERVIEW



j03om001h.eps

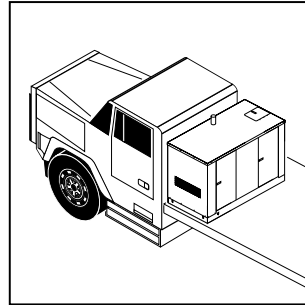
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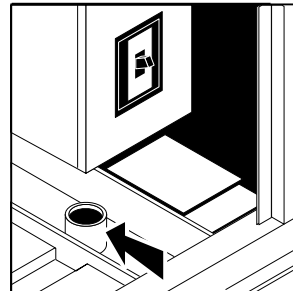
INSTALL COMPONENTS

Mount Generator Set

1. Install a mounting bracket (p/n 315-116 or p/n 314-881) onto each corner of the generator base, securing with clip nuts (p/n 106-558) and flange screws (p/n 106-724 or p/n 106-162).
2. Using lift, place generator set toward front of trailer or truck bed with generator doors facing the back of the trailer or truck as shown. If installing on a truck, leave at least 6 in (150 mm) between cab and generator.
3. Open left door of generator and find the conduit tube in the floor of the generator set as shown.
4. Through the conduit tube, mark hole to be cut for electrical wiring on trailer or truck bed.
5. On outside of generator set, mark the bottom holes of the mounting brackets on the trailer or truck bed.



j03om002h.eps

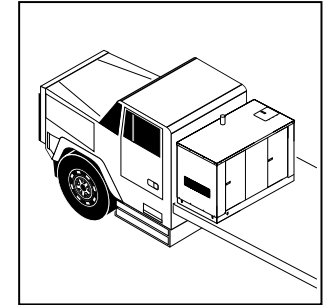


j03om011h.eps

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5. On outside of generator set, mark the bottom holes of the mounting brackets on the trailer or truck bed.



j03om002h.eps



j03om011h.eps

6. Using lift, move generator set away from front end of trailer or truck bed.
7. Cut hole for electrical cables under generator set.
8. Install protective edging (p/n 115-686) around the edge of the hole.

NOTICE: Rough edges can fray or cut into the electrical wiring, causing it to short. Death, serious injury, electric shock, or property damage could occur.

9. Drill holes through marks made for mounting brackets.
10. Using lift, move generator set back to front end of trailer or truck bed. Position it over holes.
11. Insert M10 grade 8.8 or 3/8" grade 5 flange screws of suitable length through mounting bracket holes. Install lockwashers and screw self-locking nuts onto flange screws. Tighten to 25 ft•lb (34 N•m).

IMPORTANT: Flange screws and self-locking nuts are not supplied. Lockwashers must be used to ensure good electrical bonding between generator base and vehicle frame.

NOTICE: Generator set base must be electrically bonded to the vehicle frame. If the generator set is not directly bolted to the frame (i.e. bolted to wood deck planks), then a 6 gauge or larger copper ground conductor must be connected from the generator ground stud to the vehicle frame.

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Mount Tanks

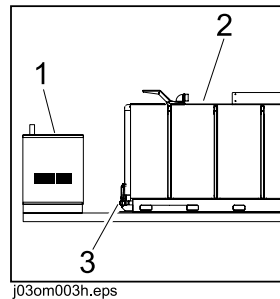


⚠ WARNING Crushing weight could cause death or serious injury. Use proper procedures and equipment or stay away.

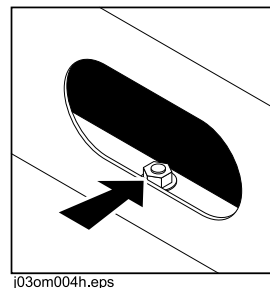
NOTICE: Adequate frame members or structure must be present under the trailer or truck bed to hold tanks during transport. Death, injury or serious property damage could occur if base structure is not sufficiently strong to hold tanks. If frame members are not pre-existing, they must be installed

1. Using lift, place tank on the trailer or truck bed with fillwell end (2) toward the generator set (1) as shown.

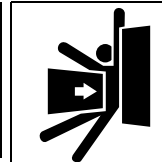
IMPORTANT: For easy access to valves and generator set, leave at least 2 ft (610 mm) between generator set and bottom edge of tank (3).



2. Locate the 4 mounting holes inside the 4 long slots on either side of tank base as shown (8 total).
3. Mark the 8 mounting holes on the trailer or truck bed.



Mount Tanks

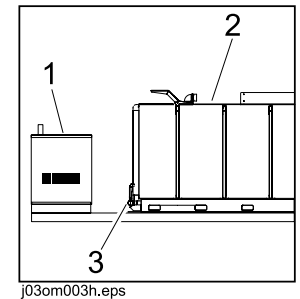


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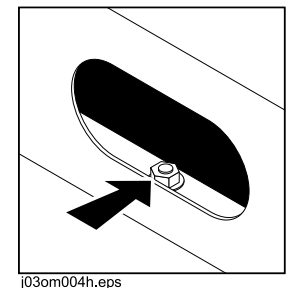
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2. Locate the 4 mounting holes inside the 4 long slots on either side of tank base as shown (8 total).
3. Mark the 8 mounting holes on the trailer or truck bed.



4. Using lift, move tank until the marks for the mounting holes are accessible.
5. Cut or drill holes through the trailer or truck bed at each of the spots marked.

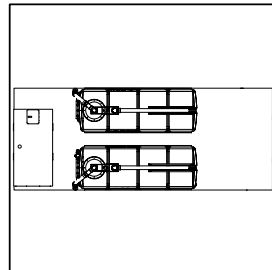
NOTICE: Do not attempt to cut holes while tank is still in place. Damage could result to the tank or its components.

6. Using lift, move tank back to desired position on bed lining up the holes in the tank base with the holes in the trailer or truck bed.
7. Insert eight M14 class 8.8 or 9/16 in grade 5 flange screws of suitable length into mounting holes.
8. Thread eight M14 class 8.8 or 9/16 in grade 5 self-locking nuts onto the flange screws. Tighten to 60 ft•lb (80 N•m).

NOTE: Screws and self-locking nuts are not supplied.

9. Using lift, move second tank to the trailer or truck bed and place parallel to first tank as shown.

IMPORTANT: For easy access from the generator set to the hoppers, leave as much space as possible between the tanks.



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10. Repeat steps 2 through 8 to install second tank.

4. Using lift, move tank until the marks for the mounting holes are accessible.
5. Cut or drill holes through the trailer or truck bed at each of the spots marked.

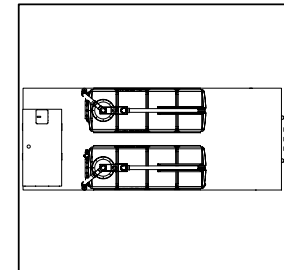
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7. Insert eight M14 class 8.8 or 9/16 in grade 5 flange screws of suitable length into mounting holes.
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NOTE: Screws and self-locking nuts are not supplied.

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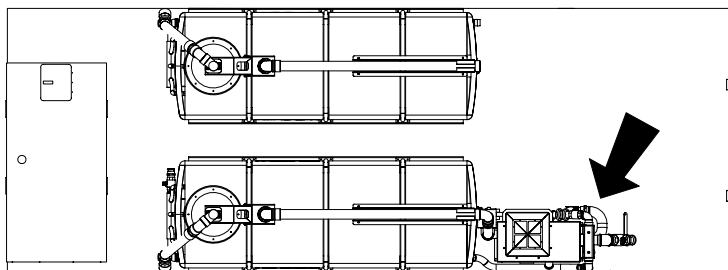
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j03om006h.eps

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Mount Hoppers

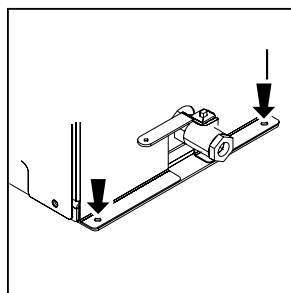


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1. Using lift, move first hopper onto trailer or truck bed and position it as shown.

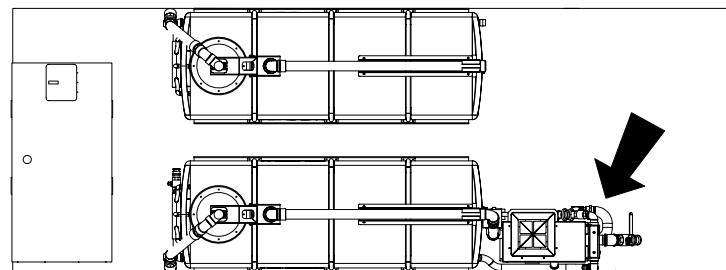
IMPORTANT: Leave approximately 4 in (100 mm) from the outside edge of the hopper to the outside edge of the trailer or truck bed.

2. Ensure that the hopper is close enough to the tank to connect all hoses and valves.
3. Mark through the two holes on the flanged bottom of each of the end panels as shown.
4. Using the lift, move the hopper until the marks for the holes are accessible.



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Mount Hoppers

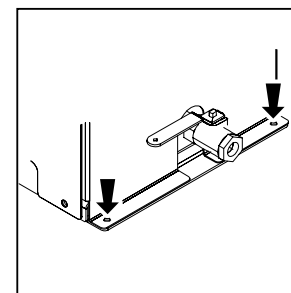


j03om008h.eps

1. Using lift, move first hopper onto trailer or truck bed and position it as shown.

IMPORTANT: Leave approximately 4 in (100 mm) from the outside edge of the hopper to the outside edge of the trailer or truck bed.

2. Ensure that the hopper is close enough to the tank to connect all hoses and valves.
3. Mark through the two holes on the flanged bottom of each of the end panels as shown.
4. Using the lift, move the hopper until the marks for the holes are accessible.



j03om005h.eps

5. Drill through the 4 holes.
6. Using the lift, move the hopper until the 4 holes in the flanged bottom are lined up with the 4 holes in the trailer or truck bed.
7. Insert (4) M8 grade 8.8 or 3/8 in grade 5 flange screws of suitable length into holes.
8. Thread (4) M8 grade 8.8 or 3/8 in grade 5 self-locking nuts onto screws. Tighten to 20 ft•lb (27 N•m).

NOTE: Screws and self-locking nuts are not supplied.

9. To install the second hopper, repeat steps 1 through 8 on the opposite side of the trailer or truck bed.

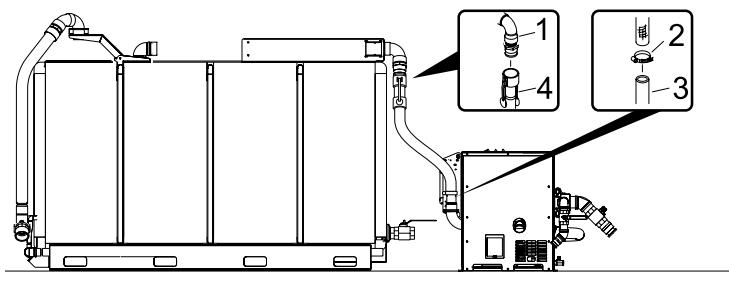
5. Drill through the 4 holes.
6. Using the lift, move the hopper until the 4 holes in the flanged bottom are lined up with the 4 holes in the trailer or truck bed.
7. Insert (4) M8 grade 8.8 or 3/8 in grade 5 flange screws of suitable length into holes.
8. Thread (4) M8 grade 8.8 or 3/8 in grade 5 self-locking nuts onto screws. Tighten to 20 ft•lb (27 N•m).

NOTE: Screws and self-locking nuts are not supplied.

9. To install the second hopper, repeat steps 1 through 8 on the opposite side of the trailer or truck bed.

CONNECT HOSES

Return Hose



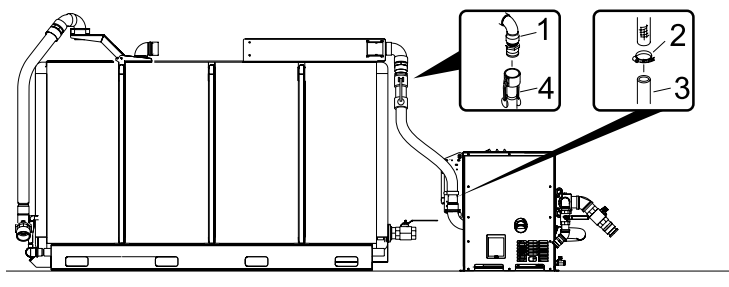
j03om009h.eps

Ref.	P/N	Description
1	-----	fluid return elbow
2	110-367	worm clamp (3.250 to 4.125 in)
3	-----	return riser
4	155-264	FHC body

1. Install worm clamp (2) over hose and push hose onto return riser (3) on the lower rear of the hopper.
2. Tighten worm clamp.
3. Install another worm clamp over other end of hose.

CONNECT HOSES

Return Hose



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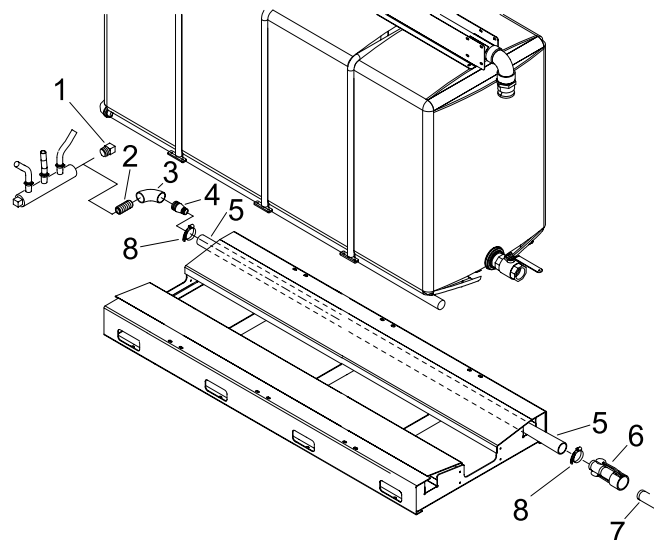
Ref.	P/N	Description
1	-----	fluid return elbow
2	110-367	worm clamp (3.250 to 4.125 in)
3	-----	return riser
4	155-264	FHC body

1. Install worm clamp (2) over hose and push hose onto return riser (3) on the lower rear of the hopper.
2. Tighten worm clamp.
3. Install another worm clamp over other end of hose.

4. Push cam lock coupler (4-FHC) into end of hose.
5. Tighten worm clamp.
6. Install cam lock coupler over the adapter on fluid return elbow (1) at the top of the tank.
7. Pull levers on coupler down to lock into place.

4. Push cam lock coupler (4-FHC) into end of hose.
5. Tighten worm clamp.
6. Install cam lock coupler over the adapter on fluid return elbow (1) at the top of the tank.
7. Pull levers on coupler down to lock into place.

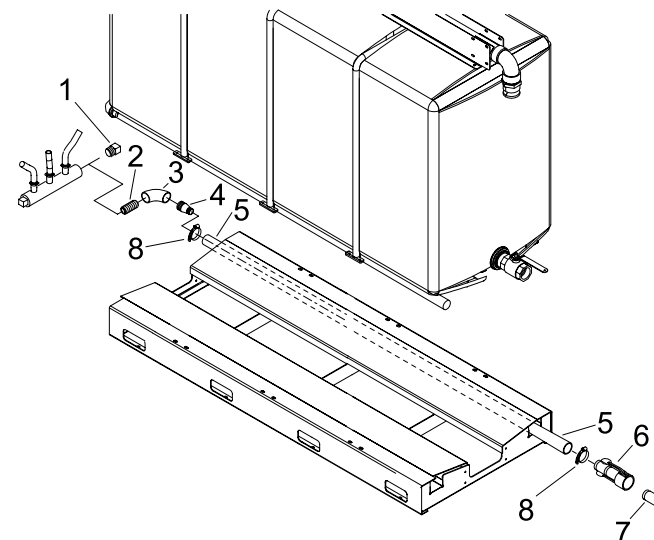
Tank Jet Hose



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Ref.	P/N	Description
1	114-008	plug (32N. SQ.GALV)
2	115-050	nipple (32N-6 in)
3	115-293	elbow (32NF-32NF90)
4	515-089	S/O coupler (32N-32H)
5	116-505	bulk hose (2 in)
6	159-180	FHC body (40-32H)
7	existing	male adapter
8	110-134	worm clamp (2.062 to 2.750 in)

Tank Jet Hose



j03om010h.eps

Ref.	P/N	Description
1	114-008	plug (32N. SQ.GALV)
2	115-050	nipple (32N-6 in)
3	115-293	elbow (32NF-32NF90)
4	515-089	S/O coupler (32N-32H)
5	116-505	bulk hose (2 in)
6	159-180	FHC body (40-32H)
7	existing	male adapter
8	110-134	worm clamp (2.062 to 2.750 in)

1. Near bottom of tank, remove the plug (1) from the outside end of the tank jet manifold.
2. Thread pipe nipple (2) into end of tank jet manifold.
3. Thread the elbow (3) onto the nipple.
4. Push the slip-on coupler (4) into the hose.
5. Install worm clamp (8) over hose.
6. Slide hose (5) through outside hose tray in tank base as shown.
7. Thread slip-on coupler (4) into the elbow.

NOTE: Cut hose to fit, if needed.

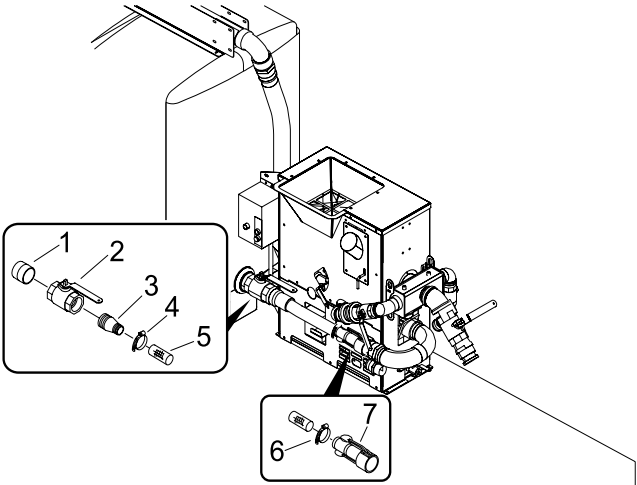
8. To install hopper end of hose, place a worm clamp (8) over end of hose.
9. Push cam lock coupler (6-FHC) into the end of hose and tighten worm clamp.
10. Push cam lock coupler (6-FHC) over the male adapter (7) on the tank jet valve.
11. Pull levers on coupler to lock into place.
12. Repeat steps 1 through 10 to install tank jet hose on other tank.

1. Near bottom of tank, remove the plug (1) from the outside end of the tank jet manifold.
2. Thread pipe nipple (2) into end of tank jet manifold.
3. Thread the elbow (3) onto the nipple.
4. Push the slip-on coupler (4) into the hose.
5. Install worm clamp (8) over hose.
6. Slide hose (5) through outside hose tray in tank base as shown.
7. Thread slip-on coupler (4) into the elbow.

NOTE: Cut hose to fit, if needed.

8. To install hopper end of hose, place a worm clamp (8) over end of hose.
9. Push cam lock coupler (6-FHC) into the end of hose and tighten worm clamp.
10. Push cam lock coupler (6-FHC) over the male adapter (7) on the tank jet valve.
11. Pull levers on coupler to lock into place.
12. Repeat steps 1 through 10 to install tank jet hose on other tank.

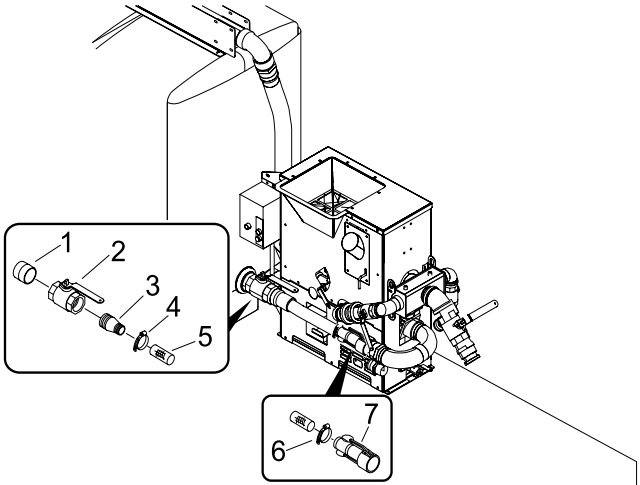
Water Suction Hose



j03om016h.eps

Ref.	P/N	Description
1	115-299	nipple (48N-3 in)
2	120-060	shutoff (48NF-48NF)
3	514-168	S/O adapter (48N-48H)
4	110-367	worm clamp (3.250 to 4.125 in)
5	116-506	bulk hose (3 in)
6	110-367	worm clamp (3.250 to 4.125 in)
7	155-264	FHC body (56-48H)

Water Suction Hose



j03om016h.eps

Ref.	P/N	Description
1	115-299	nipple (48N-3 in)
2	120-060	shutoff (48NF-48NF)
3	514-168	S/O adapter (48N-48H)
4	110-367	worm clamp (3.250 to 4.125 in)
5	116-506	bulk hose (3 in)
6	110-367	worm clamp (3.250 to 4.125 in)
7	155-264	FHC body (56-48H)

1. Thread nipple (1) into bulkhead connection in end of tank.
2. Thread shutoff valve (2) into nipple.
3. Thread slip-on adapter (3) into valve.

IMPORTANT: Ensure elbow inside tank remains pointing down. Reposition if necessary.

4. To install tank end of hose, place a worm clamp (4) over end of hose (5).
5. Push hose over slip-on adapter (3) and tighten worm clamp.
6. To install hopper end of hose, place a worm clamp (6) over other end of hose.

NOTE: Cut hose to fit, if needed.

7. Push cam lock coupler (7, FHC) into end of hose and tighten worm clamp.
8. Push cam lock coupler over adapter.

IMPORTANT: To ease installation of cam lock coupler over adapter, loosen or remove the 4 bolts in the pump suction flange. Carefully note orientation of flapper in pump and after cam lock coupler is installed, replace in same position. Tighten bolts to 15 ft•lb (20N•m).

9. Push levers on coupler to lock into place.
10. Repeat steps 1 through 8 for suction hose on other tank.

1. Thread nipple (1) into bulkhead connection in end of tank.
2. Thread shutoff valve (2) into nipple.
3. Thread slip-on adapter (3) into valve.

IMPORTANT: Ensure elbow inside tank remains pointing down. Reposition if necessary.

4. To install tank end of hose, place a worm clamp (4) over end of hose (5).
5. Push hose over slip-on adapter (3) and tighten worm clamp.
6. To install hopper end of hose, place a worm clamp (6) over other end of hose.

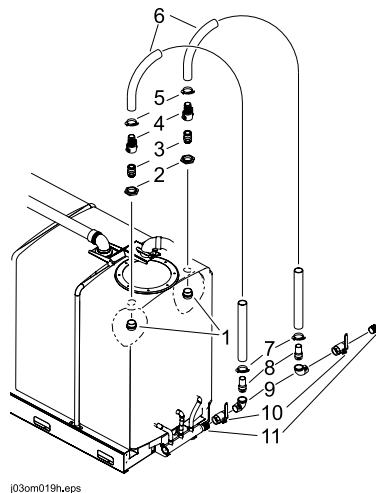
NOTE: Cut hose to fit, if needed.

7. Push cam lock coupler (7, FHC) into end of hose and tighten worm clamp.
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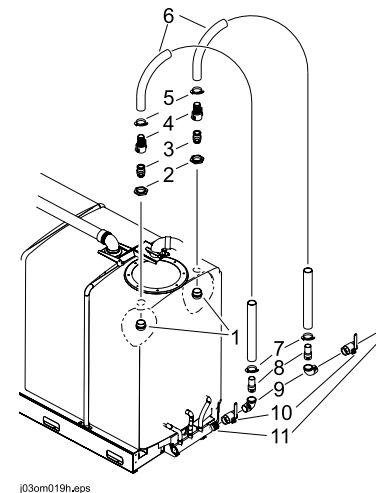
9. Push levers on coupler to lock into place.
10. Repeat steps 1 through 8 for suction hose on other tank.

Transfer/Bypass Hoses



Ref.	P/N	Description
1	101-092	BK connector (32NF-32NFNYL)
2	-----	mating nut
3	159-181	FHC adapter (40-32H)
4	159-180	FHC body (40-32H)
5	110-134	worm clamp (2-1/16 to 2-3/4 in)
6	116-505	bulk hose (2 in)
7	110-134	worm clamp (2-1/16 to 2-3/4 in)
8	514-089	S/O coupler (32N-32H)
9	114-004	street elbow (32N-32NF90)
10	120-059	shut-off (32NF-32NF)
11	115-295	all thread (32N-2 in)

Transfer/Bypass Hoses



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9	114-004	street elbow (32N-32NF90)
10	120-059	shut-off (32NF-32NF)
11	115-295	all thread (32N-2 in)

Install Fittings

1. On the top of each tank, cut two 2.75 in (70 mm) holes centered over two dimples or marks on fillwell end of tank as shown.
2. Insert a bulkhead connector (1) into each of the 4 holes from the inside and thread mating nut (2) counterclockwise on the outside of the tank to secure.

IMPORTANT: When installing the mating nut, be careful not to overtighten and strip the threads on the connector.

3. Thread cam lock adapter (3-FHC) into each bulkhead connector.
4. On bottom of tanks, remove the plugs (not shown) from the end of the tank jet manifolds that are toward the center of the truck or trailer.
5. Thread an all thread nipple (11) into each tank jet manifold.
6. Thread the shut-off valves (10) into the all thread nipples.

NOTE: One shut-off valve is on the right end of one manifold and one shut-off valve is on the left end of the other manifold. The shut-off valve on the right end the manifold cannot be installed unless the handle is removed first. After this shut-off valve is installed, replace the handle.

7. Ensure that both handles can be fully opened and closed.
8. Thread the street elbows (9) into the shut-off valves.
9. Thread the slip-on couplers (8) into the street elbows.

Install Fittings

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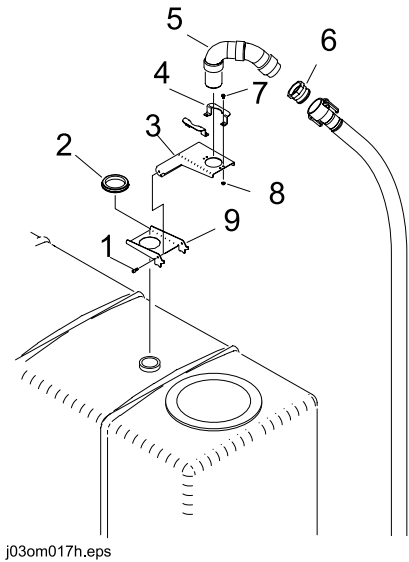
Install Hoses

1. To install lower end of hoses, place a worm clamp (7) over end of each hose.
2. Push hose (6) over slip-on couplers (8) and tighten worm clamps.
3. To install upper end of hoses, place a worm clamp (5) over end of each hose.
4. Push a cam lock coupler (4-FHC) into the top end of each hose and tighten worm clamps.
5. Push cam lock couplers down over adapters (3) as shown.
6. Push levers on coupler up to lock into place.
7. Install FHC caps into unused cam lock adapters.

Install Hoses

1. To install lower end of hoses, place a worm clamp (7) over end of each hose.
2. Push hose (6) over slip-on couplers (8) and tighten worm clamps.
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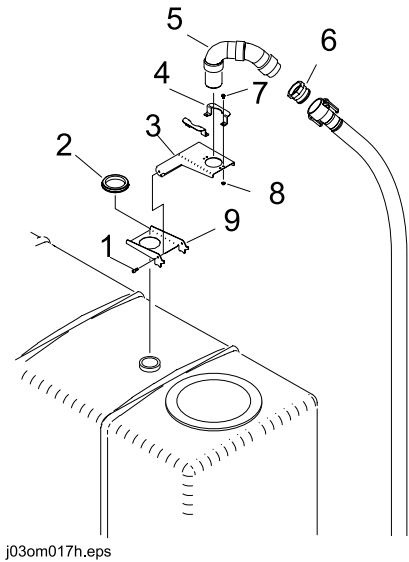
Tank Fill Hose



Upper Tank Fill Components

Ref.	P/N	Description
1	107-746	SHLD bolt (M10 x 12 mm, M8-1.25)
2	153-549	BK connector (48NF-48NF, NYL)
3	315-438	upper mounting bracket
4	310-927	retainer bracket
5	315-754	tank fill elbow
6	149-955	FHC connector (56-48NF)
7	106-380	flange lock screw (M8-1.25 x 16 mm)
8	106-386	flange locknut (M8-1.25)
9	310-602	mounting bracket

Tank Fill Hose



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6	149-955	FHC connector (56-48NF)
7	106-380	flange lock screw (M8-1.25 x 16 mm)
8	106-386	flange locknut (M8-1.25)
9	310-602	mounting bracket

IMPORTANT: For easiest hookup to water supply, tank fill connection should face the outside edge of the tank that will usually be closest to the water source.

Install Upper Fittings

1. Remove existing return pipe, elbow, and bulkhead connector nut (2) by turning nut clockwise.

IMPORTANT: Hold on to bulkhead connector on the inside of the tank so it does not fall into tank.

2. Place lower mounting bracket (9) onto tank over bulkhead fitting.
3. Replace bulkhead nut (2) to secure the mounting bracket.
4. Replace return pipe and elbow.
5. Install upper mounting bracket (3) onto lower mounting bracket as shown and fasten with bolt (1).
6. Insert lower part of tank fill elbow (5) into hole in upper mounting bracket.
7. Install retainer brackets (4) on either side of the mounting bracket to secure tank fill elbow.
8. Fasten with flange lock screws (7) and flange locknuts (8).
9. Thread male cam lock adapter (6-FHC) onto tank fill elbow.

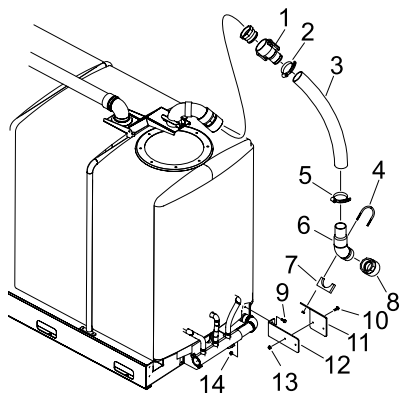
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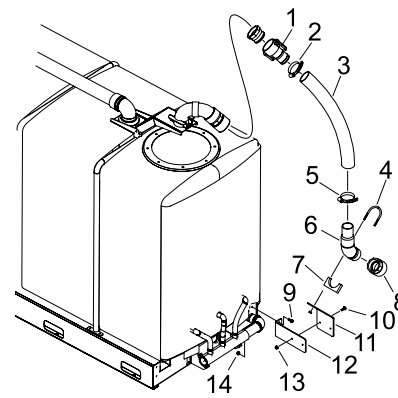
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4. Replace return pipe and elbow.
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6. Insert lower part of tank fill elbow (5) into hole in upper mounting bracket.
7. Install retainer brackets (4) on either side of the mounting bracket to secure tank fill elbow.
8. Fasten with flange lock screws (7) and flange locknuts (8).
9. Thread male cam lock adapter (6-FHC) onto tank fill elbow.



Lower Tank Fill Components and Tank Fill Hose

Ref.	P/N	Description
1	155-264	FHC body (56-48H)
2	110-367	worm clamp (3-1/4 in to 4-1/8 in)
3	116-506	bulk hose (3 in)
4	195-993	U-bolt clamp-top (3.5 in)
5	110-367	worm clamp (3-1/4 in to 4-1/8 in)
6	315-488	elbow
7	195-993	U-bolt clamp-bottom (3.5 in)
8	153-368	FHC body (3-1/2 in FHC x 3 in NPTF)
9	106-724	flange screw (M10-1.50 x 25 mm)
10	106-724	flange screw (M10-1.50 x 25 mm)
11	315-490	angled bracket
12	315-491	bracket
13	106-387	flange locknut (M10-1.50)
14	106-387	flange locknut (M10-1.50)



Lower Tank Fill Components and Tank Fill Hose

Ref.	P/N	Description
1	155-264	FHC body (56-48H)
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11	315-490	angled bracket
12	315-491	bracket
13	106-387	flange locknut (M10-1.50)
14	106-387	flange locknut (M10-1.50)

Install Lower Fittings

1. Find the 2 existing holes on the lower end of the tank base.
2. Place bracket (12) onto end of tank base and line up holes in short end of bracket with the existing holes.
3. Attach securely using nuts (14) and flange screws (9).
4. Place bracket (11) onto first bracket with angled part toward the center of the trailer or truck bed.
5. Line up holes and attach securely using nuts (13) and flange screws (10).
6. Install U-bolt clamp (4) over lower elbow (6) and attach to bracket (7) with the barbed end up.
7. Thread cam lock coupler (8-FHC) onto lower elbow.

Install Lower Fittings

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3. Attach securely using nuts (14) and flange screws (9).
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5. Line up holes and attach securely using nuts (13) and flange screws (10).
6. Install U-bolt clamp (4) over lower elbow (6) and attach to bracket (7) with the barbed end up.
7. Thread cam lock coupler (8-FHC) onto lower elbow.

Install Hose

1. Place worm clamp (5) over lower end of hose (3).
2. Push hose over barbed end of lower elbow (6).
3. Tighten worm clamp.
4. Place worm clamp (12) over upper end of hose (3).

NOTE: Cut hose to fit, if needed.

5. Push cam lock coupler (1-FHC) into the end of hose and tighten worm clamp.
6. Push cam lock coupler (1-FHC) over the male adapter on the upper elbow.
7. Pull levers on coupler to lock into place.

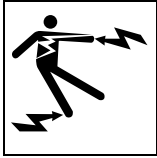
Install Hose

1. Place worm clamp (5) over lower end of hose (3).
2. Push hose over barbed end of lower elbow (6).
3. Tighten worm clamp.
4. Place worm clamp (12) over upper end of hose (3).

NOTE: Cut hose to fit, if needed.

5. Push cam lock coupler (1-FHC) into the end of hose and tighten worm clamp.
6. Push cam lock coupler (1-FHC) over the male adapter on the upper elbow.
7. Pull levers on coupler to lock into place.

CONNECT ELECTRICAL COMPONENTS

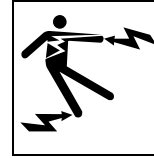


⚠ DANGER **ELECTRIC SHOCK** will cause death or serious injury. Disconnect all power to this equipment before servicing.

NOTICE: The generator set operates at 480 volts AC. Only a trained service technician should make the electrical connections required on the FM50 system. Any electrical work done on the generator set should also be done by a trained service technician.

To connect the electrical components on this system, see the instructions that come in the electrical component kit.

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PREPARATION

CHECK EQUIPMENT

Check the following before starting each day's work. Refer to **LUBRICATION AND MAINTENANCE** for additional information and locations.

- General appearance of equipment.
- Safety sign location and readability.
- All guard and shield locations. Replace if missing or worn.
- Condition of all wear items such as strainers, filters, hoses, and clamps.
- Drilling fluid hoses and electric cables for signs of leakage, wear, or other damage.
- Engine crankcase oil level. Keep oil level at the highest line on dipstick. Do not overfill.
- Fuel level. Fuel tank should be filled at the end of the day to reduce condensation in the tank.
- Coolant level in the overflow tank. Add coolant if necessary.
- All nuts and bolts. Tighten if necessary.

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SELECT DRILLING FLUID

For productive drilling and equipment protections, use these recommended Baroid® products, available from your Ditch Witch dealer.

- Soda ash
- Quik-Gel™ dry powder bentonite (p/n 259-804)
- E-Z Mud™ liquid polymer (p/n 259-805)
- Liqui-Trol™ liquid polymer suspension (p/n 259-808)
- Quik-Trol™ dry powder polymer (p/n 259-809)
- Bore-Gel™ drilling fluid (p/n 259-807)
- Con-Det™ water-soluble cleaning solution (p/n 259-810)

Guidelines

Match drilling fluid to soil type. Although specific conditions at each jobsite vary, use the following guidelines when selecting a drilling fluid.

If soil is...	use...
Smooth, flowing sand	Bentonite or Bore-Gel + medium chain polymer
Coarse sand or light soil	Bentonite or Bore-Gel
Heavy clay	Long chain polymer + Con-Det
Swelling clay	Long chain polymer + Con-Det
Rock	Bore-Gel

For recommended mixture to reach desired drilling fluid viscosity or thickness, contact your Ditch Witch dealer.

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If soil is...	use...
Smooth, flowing sand	Bentonite or Bore-Gel + medium chain polymer
Coarse sand or light soil	Bentonite or Bore-Gel
Heavy clay	Long chain polymer + Con-Det
Swelling clay	Long chain polymer + Con-Det
Rock	Bore-Gel

For recommended mixture to reach desired drilling fluid viscosity or thickness, contact your Ditch Witch dealer.

Bentonite

Bentonite is a dry powder. When properly mixed with water, it forms a thin cake on bore walls, lubricating the bore, keeping it open, and holding fluid in the bore.

Some things to remember when mixing bentonite:

- Use clean water free of salt, calcium, or excessive chlorine.
- Use water with pH level between 9 and 10.
- Use water with hardness of less than 120 ppm.
- Do not use bentonite containing sand.
- Mix bentonite thoroughly or it will settle in tank.
- Do not mix bentonite to a funnel viscosity of over 50.

For information on measuring funnel viscosity, read "Measuring Funnel Viscosity" in **OPERATION**.

Polymer

This drilling fluid additive provides excellent lubrication and increases viscosity in average soils and heavy clay. In swelling clay, polymer can reduce swelling that traps pipe in the bore.

There are two types of polymer:

- Long chain such as Baroid EZ-Mud
- Medium chain such as Baroid Quik-Trol

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Mixtures

Bentonite does not mix well in water containing polymer. To use both, mix bentonite first, then add polymer. When adding other products follow the order listed below.

NOTICES:

- If chemicals are added in the wrong order, they will not mix properly and will form clumps.
- If tank contains bentonite/polymer mix and more drilling fluid is needed, completely empty tank and start with fresh water before mixing another batch.

General mixing order:

1. Soda ash
2. Bentonite
3. Polymer
4. Con-Det

Bore-Gel contains premixed bentonite, polymer, and soda ash. Use approximately 15 lb/100 gal (7 kg/380 L) in normal drilling conditions, up to 45 lb/100 gal (21 kg/380 L) in sand or gravel and up to 50 lb/100 gal (23 kg/380 L) in rock.

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PLAN DRILLING FLUID REQUIREMENTS

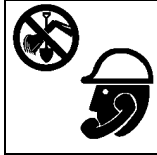
1. Determine drilling conditions and choose appropriate drilling fluid mix.
2. Estimate amount of supplies needed and check availability.
 - Drilling fluid
 - Water supply. If more water than can be carried with the unit will be needed, arrange to transport additional water.
 - Bentonite and/or polymer
3. Check water quality.
 - Use meter or pH test strips to test pH of water. If pH is below 9.0, add 1 cup (.25 L) soda ash per tank. Test and repeat until pH is between 9 and 10.
 - Check water hardness using hardness test strips. Treat with soda ash if hardness exceeds 125 ppm.

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OPERATION

This section covers basic operation. For questions about specific situations, contact your Ditch Witch dealer.



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

At electrical jobsites:

- Locate mixing unit where operator can see or hear drilling unit alarms.
- Place cones around all electrically bonded equipment, including mixing unit.
- All personnel, including those at mixing unit, must wear electrically insulating boots and gloves.

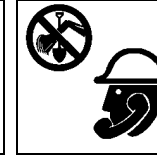
At all jobsites:

- Wear personal protective equipment including hard hat, safety eye wear, and electric strike boots.
- If it is required by the job or local codes, make sure the generator set is properly grounded to earth. External protective conductor must be 6 gauge or larger copper wire. See your Ditch Witch dealer for optional ground kit.
- Do not wear jewelry or loose clothing.
- Do not spray water onto electrical controls.

NOTICE: The neutral conductor of the generator is connected to generator frame and to the ground terminal.

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START ENGINE

1. Remove small cap from mixing tank.
2. Fill tank with water.
3. Set engine speed at generator.

NOTE: Set engine on high speed (60 Hz) for maximum mixing performance.

4. Turn battery disconnect switch to on position.
5. On engine control panel, turn ON/OFF switch to on position.
6. Press START button until engine starts.

IMPORTANT: If temperature is 50°F to 23°F (10°C to -5°C) press GLOW PLUG button for 5 seconds before starting. If temperature is below 23°F (-5°C) press GLOW PLUG button for 10 seconds before starting.

7. Allow generator to run for 5 minutes before turning on the mixing pumps.

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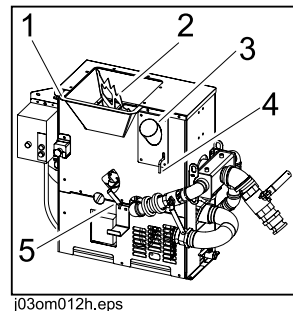
NOTICES:

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- If tank contains bentonite/polymer mix and more drilling fluid is needed, completely empty tank and start with fresh water before mixing another batch.

1. Open tank jet valve and mixing venturi valve.
2. Press START button on mixing pump.
3. Partially open dry chemical hopper valve (5). Listen for a noticeable “suction” sound.

IMPORTANT: Add dry polymers at a very slow rate.

4. For dry chemicals, open sack using bag ripper (2) located inside dry chemical hopper (1) and pour chemicals into hopper.
5. Open dry chemical valve (5) slowly.
6. For liquid polymer and other liquid chemicals, pour needed amount of additive into the liquid chemical hopper (3).



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IMPORTANT: Liquid chemical hopper holds approximately 1 qt (.9 L) when filled within 1/2 in (13 mm) of lip.

7. Open liquid chemical valve (4) slowly.

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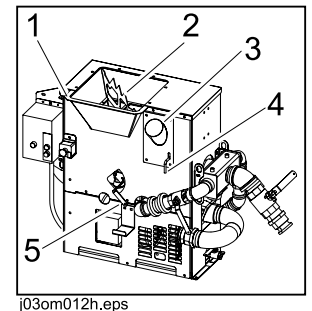
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8. Open fillwell on top of tank and check fluid in tanks to ensure that chemicals are mixed correctly.
9. If clumps of chemical or polymer can be seen in fluid tanks, reduce the rate that you add materials.

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USE ACCESSORY OUTLETS

After engine has warmed up, loads can be added to the accessory outlets.



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IMPORTANT: Read the following information before adding loads.

The main function of the FM50 generator set is to produce three-phase electric power at 480V, which enables the two mixing pump motors to operate at their full rated power. Additionally, the generator set produces single-phase power at two engine speeds (1800 rpm or 1500 rpm) that can be used to operate additional electrical devices by means of accessory outlets.

The engine speed of the FM50 affects both the voltage produced and the frequency (Hz). The higher the speed, the more voltage and frequency produced.

Available voltage settings for the FM50 generator set are:

	50 Hz	60 Hz
Duplex outlet	115V	139V
Twist-lock outlet	200V	240V
Optional IEC outlet	230V	277V

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In North America, typical electrical devices require 120V at 60 Hz. In Europe and in many other regions, typical electrical devices require 220V at 50 Hz.

Note that the voltages and frequencies available with the FM50 are different than what typical electrical devices use. In general, many devices are not affected by the change in frequency or by variations in voltage. However, some devices, such as analog clocks and devices that use motors, will run faster or slower as frequency is changed. Also, operating a resistance device such as a light bulb or an electric heater at a higher voltage may damage or reduce the life of the device.

NOTICE: It is the operator's responsibility to determine the compatibility of the voltage produced by the FM50 generator set with any device that is being connected to it. CMW will not be responsible for any device that is damaged by operating it from the FM50 generator set.

Accessory outlets are protected by ground fault circuit interrupters (GFCIs) that trip when a ground fault is detected by the interrupters. Test GFCI breakers regularly. See "GFCI Breakers" in **LUBRICATION AND MAINTENANCE**.

NOTICE: The GFCIs will not trip if a user comes into contact with two or more live circuits. Shock, injury, or death could occur. Check all accessory equipment before connecting to outlets on the FM50.

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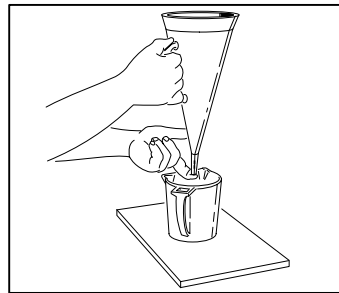
MEASURE FUNNEL VISCOSITY

Viscosity is the measure of internal resistance of a fluid to flow; the greater the resistance, the higher the viscosity. Viscosity of drilling fluids must be controlled.

To determine viscosity, you will need a Marsh funnel (p/n 259-267) and a measuring cup, available from your Ditch Witch dealer.

IMPORTANT: Make sure Marsh funnel is clean and free of obstruction and that you have a stopwatch available for timing the viscosity.

1. Using wash hose and a clean container, take a fresh sample of drilling fluid. The sample must be at least 1.5 qt (1.4 L).
2. With finger over bottom of funnel, fill with fluid from the container through the screen until fluid reaches the bottom of the screen.
3. Move funnel over 1 qt (.95 L) container.
4. Remove finger from bottom of funnel and use the stopwatch to count the number of seconds it takes for 1 qt (.95 L) of fluid to pass through the funnel. The number of seconds is the viscosity.
5. Thoroughly rinse measuring cup and Marsh funnel.



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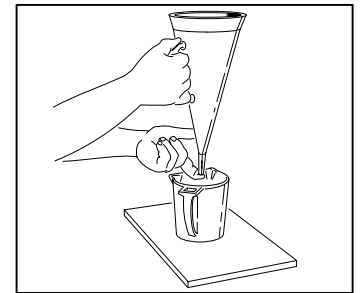
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PUMP FLUID TO DRILLING UNIT

**⚠ DANGER**

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

NOTICE: If electrical strike occurs while fluid hose is connected to drilling unit, fluid system will also become electrified.

1. Connect mixing pump hose to drilling unit.

NOTICE: To prevent damage to the drilling pump, make sure y-strainer is used in-line between mixing unit and drilling unit.

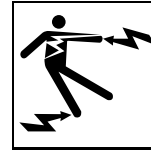
2. Fully open discharge valve of mixing pump.
3. Select engine speed.

IMPORTANT: Run engine at 50 Hz (1500 rpm) to reduce pump flow rate and pressure and to conserve fuel.

4. If pump pressure is too much for the drilling unit:
 - Leave mixing venturi valve open to reduce pressure and flow to drilling unit.
 - If pressure is still too much, open transfer/bypass valve as needed to further reduce pressure.

NOTICE: Do not attempt to reduce pressure to drilling unit by adjusting the discharge valve. Doing so will reduce flow and will damage high pressure pump on the drilling unit.

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5. If pump pressure is not enough for the drilling unit,
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 - If pump pressure is still not enough for the drilling unit, check to see if venturi valve is open. Close venturi valve when hopper is not in use to increase pressure.

IMPORTANT: Run engine at 60 Hz (1800 rpm) to increase pump flow rate and pressure.

6. To reduce agitation in tank when using polymer-based drilling fluids, partially close the tank jet valve.

IMPORTANT: Overmixing of polymer-based fluids can reduce fluid viscosity.

MOVE TRANSFER/BYPASS HOSES

Normally, the FM50 system will be used as it is initially set up. However, you may need to move the transfer/bypass hoses either to reduce the pressure or to change the tank the fluid is transferred from (transfer tank) to the tank that the fluid is mixed in (mixing tank). Always close the transfer/bypass valves on both tanks before moving the hoses.

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SHUT DOWN SYSTEM

1. Turn off or remove all loads on accessory outlets.
2. Turn off mixing pumps.
3. Run engine 5 minutes at low idle without loads to allow it to cool down.
4. Stop engine by turning the engine ON/OFF switch to the OFF position.
5. Turn battery disconnect switch to off position.
6. Lock all doors to avoid unauthorized access.

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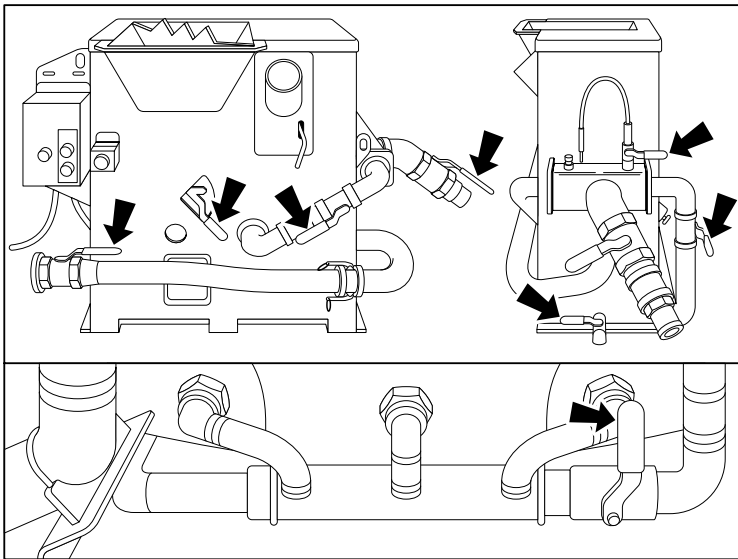
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DRAIN SYSTEM

Drain system under the following circumstances:

- Temperature is expected to be 32°F (0°C) or below.
- System is not going to be used for several days.
- System is going to be used on a different job requiring different chemicals.

1. Pump as much fluid as possible out of tanks.
2. Shut off pumps and open all valves (shown). Disconnect tank jet hose.



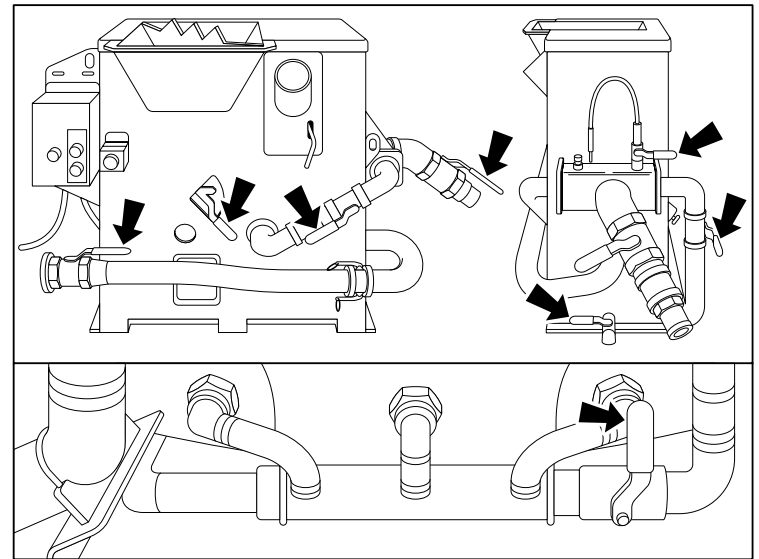
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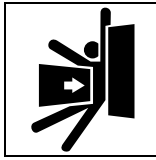


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3. Allow fluid to drain into suitable containers.
4. Recycle or properly dispose of fluid.
5. If needed, drain any remaining fluid in tank by removing plug on bottom of tank's suction end.
6. When finished, pull up the ground wire and grounding stake (if used). Store in secure place.

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TRANSPORT SYSTEM



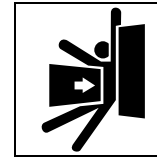
⚠ WARNING Crushing weight could cause death or serious injury. Use proper procedures and equipment or stay away.

NOTICE: Do not exceed 15 mph (24 km/h) when driving over rough or unpaved roads. This can damage the generator and cause an imbalanced load in the tanks.

Check the following items before transport.

- If fluid remains in one or both tanks, use transfer/bypass hose and valve to evenly distribute the fluid between the two tanks.
- Ensure that all doors and lids are closed and that there are no loose items on the trailer or truck bed.
- Ensure that any dry chemical bags are closed and placed so that they will not spill during transport.
- Drive with caution, especially around corners and when on inclines.

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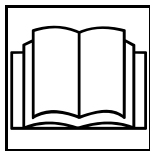
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LUBRICATION AND MAINTENANCE

Proper lubrication and maintenance protects Ditch Witch equipment from damage and failure. In extreme conditions, lubricate more frequently.

Use only recommended lubricants. Fill to capacities listed in **SPECIFICATIONS**.

Recommended Lubricants	
DEO	Diesel engine oil (SAE 10W40) meeting API engine service classification SF/CD or CE
NLGI #1	Lithium-based grease



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

NOTICES:

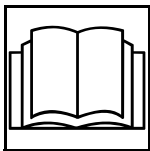
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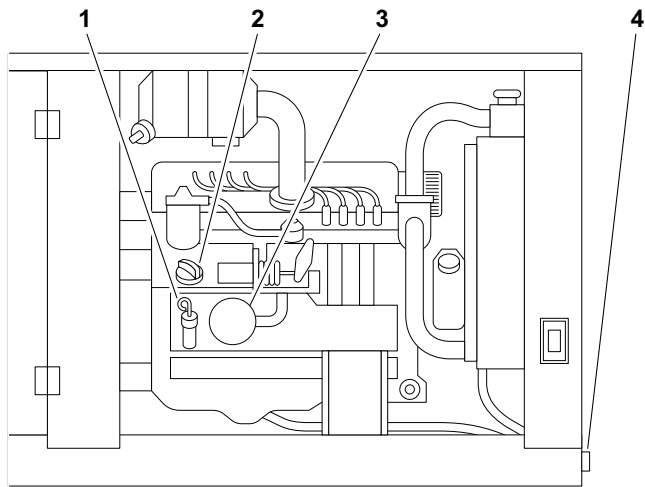
LUBRICATION SCHEDULE

Hours	Task	Page
10	check engine oil	90
50	change engine oil and filter (initial)	90
	lube hopper pump motors	91
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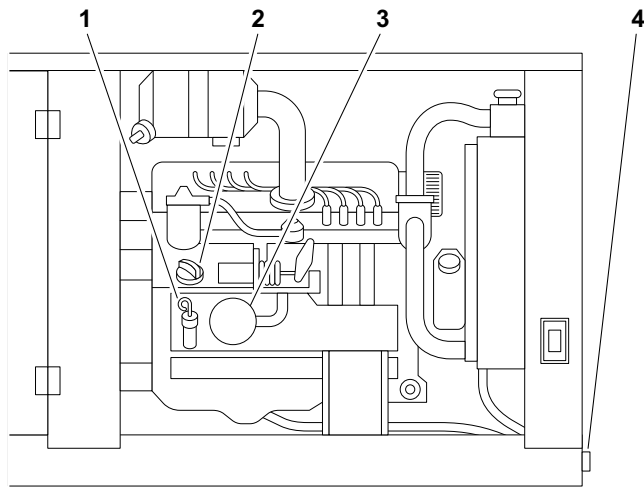
ENGINE



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Ref.	Task	Hours	Lubricant
1	Check engine oil	10	DEO
1, 2, 3, 4	Change engine oil and filter (initial)	50	DEO
1, 2, 4	Change engine oil	200	DEO
3	Replace oil filter	400	DEO

ENGINE



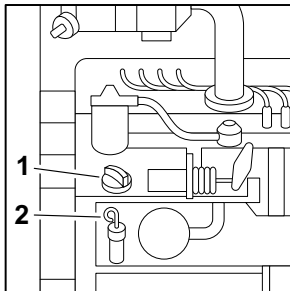
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Ref.	Task	Hours	Lubricant
1	Check engine oil	10	DEO
1, 2, 3, 4	Change engine oil and filter (initial)	50	DEO
1, 2, 4	Change engine oil	200	DEO
3	Replace oil filter	400	DEO

Check

Check engine oil at dipstick (2) before operation and every 10 hours thereafter.

Add DEO at fill (1) as necessary to keep oil level at highest line on dipstick.

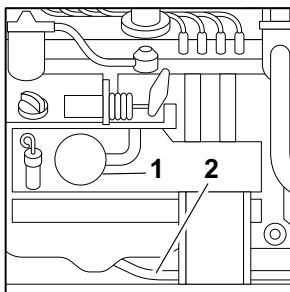


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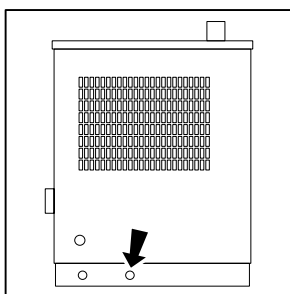
Change

Change oil and filter after first 50 hours of operation. Thereafter, change oil every 200 hours and filter every 400 hours. Change oil more frequently if working in dusty conditions.

1. Open crankcase drain valve on inside of generator set where drain hose exits the generator set (2).
2. Drain crankcase through remote drain (shown) while oil is warm.
3. Replace filter (1) every 400 hrs.
4. Refill with DEO at fill neck.



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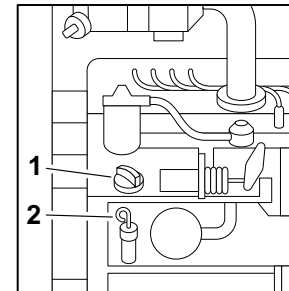


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Add DEO at fill (1) as necessary to keep oil level at highest line on dipstick.

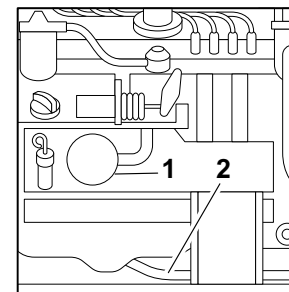


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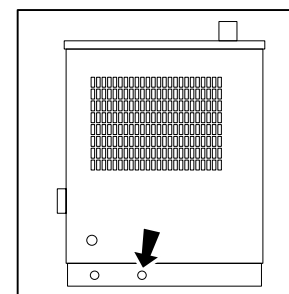
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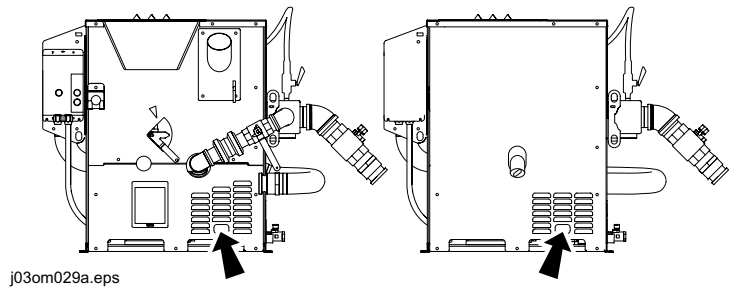


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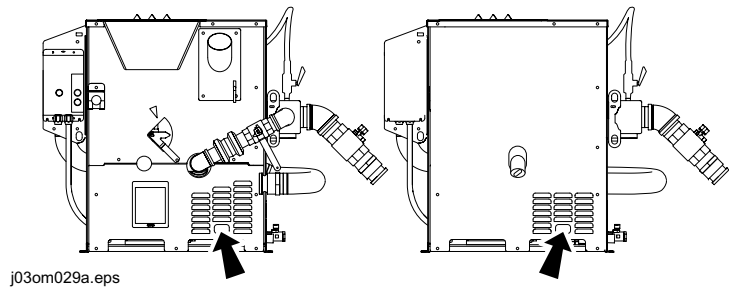
HOPPER



Ref.	Task	Hours	Lubricant
	lube hopper motors	50	NLGI #1

Lube two zerks with NLGI #1 every 50 hours. Pump grease until grease escapes from the grease relief valve on the opposite side of the hopper.

HOPPER



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	lube hopper motors	50	NLGI #1

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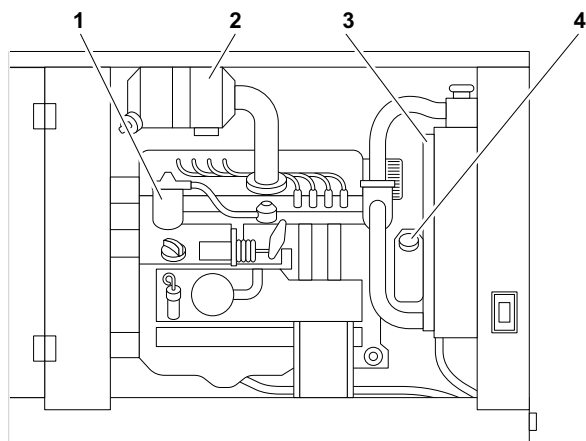
MAINTENANCE SCHEDULE

Hours	Task	Page
10	check coolant level in radiator or overflow tank	96
	test gfci breakers	102
	inspect hoses, fittings, and belts	
50	check and clean radiator cooling fins as needed	97
	check air cleaner	
	check battery connectors for wear or erosion	102
100	check battery electrolyte level	103
	check fan belt tightness	95
200	check radiator hoses and hose clamps	96
	check intake air line	
400	replace fuel filter	94
	check engine components and clean or replace as required	
	check electrical wiring for chafing or wear	
500	replace fan belt	95
	check sca level	97
800	replace air filter	100
2 years	flush cooling system	98
	replace battery	103
as needed	replace radiator hoses and hose clamps	96

MAINTENANCE SCHEDULE

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800	replace air filter	100
2 years	flush cooling system	98
	replace battery	103
as needed	replace radiator hoses and hose clamps	96

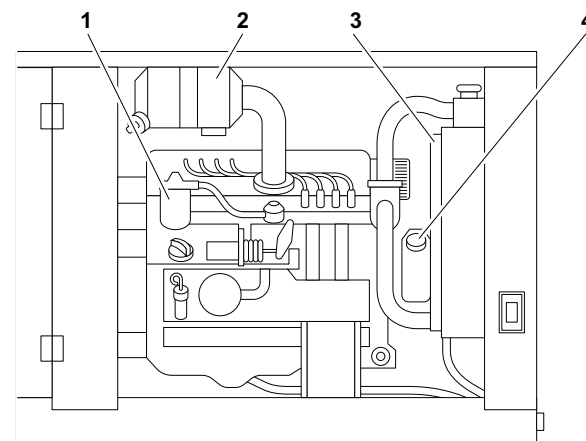
ENGINE



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Ref.	Task	Hours
4	check coolant level in radiator and overflow tank	10
	inspect hoses, fittings, and belts	10
	check and clean radiator cooling fins as needed	50
2	check air cleaner	50
3	check fan belt tightness	100
	check radiator hoses and hose clamps	200
	check air intake line	200
1	replace fuel filter	400
3	replace fan belt	500
4	check SCA level	600
2	replace air filter	6 months
4	flush cooling system	2 years
	replace radiator hoses and hose clamps	as needed

ENGINE



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Ref.	Task	Hours
4	check coolant level in radiator and overflow tank	10
	inspect hoses, fittings, and belts	10
	check and clean radiator cooling fins as needed	50
2	check air cleaner	50
3	check fan belt tightness	100
	check radiator hoses and hose clamps	200
	check air intake line	200
1	replace fuel filter	400
3	replace fan belt	500
4	check SCA level	600
2	replace air filter	6 months
4	flush cooling system	2 years
	replace radiator hoses and hose clamps	as needed

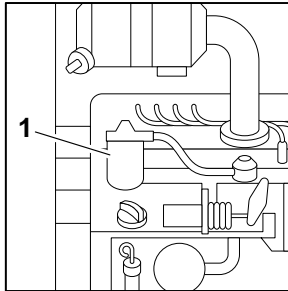
Fuel Filters

Change

Change fuel filter (1) every 400 hours. If refueling from cans, replace filter more often.

To change:

1. Remove filter.
2. Install new filter. Apply fuel oil thinly over the gasket and hand-tighten.
3. Air-bleed the injection pump.



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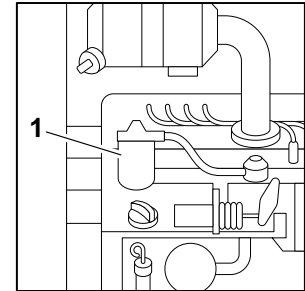
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j03om026a.eps

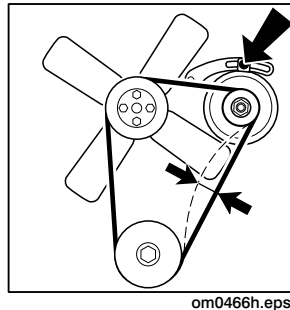
Fan Belt

Check

Check belt every 100 hours for damage or wear. Replace worn belt.

Adjust

1. Turn off engine.
2. Apply moderate thumb pressure to belt between pulleys, as shown.
3. Belt is properly tensioned when deflection is 0.3 to 0.4 in (8 to 10 mm).
4. If needed, loosen alternator bolts (shown) and pull alternator out until correct tension is reached.
5. Tighten alternator bolts.



Replace

Replace belt every 500 hours.

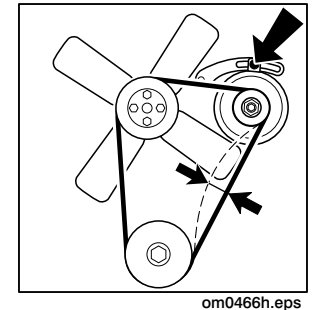
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Replace

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Cooling System

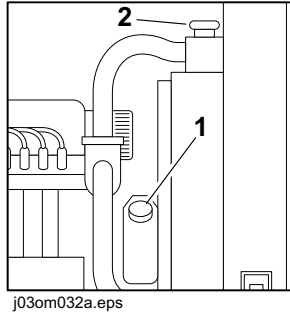
Check System

Check coolant level in overflow tank (1) every 10 hours. Coolant should be between LOW and FULL marks on tank.

Fill overflow tank as needed with Ditch Witch approved coolant (p/n 255-006), or other fully formulated ethylene-glycol-based low silicate heavy duty engine coolant meeting ASTM specification D6210, TMC RP329, or John Deere specification JDM H24A2. Do not fill over FULL mark on tank.

IMPORTANT: Use only deionized water or 50/50 premixed coolant.

Check clamps and hoses for looseness or wear every 200 hours. Tighten loose clamps. Replace swollen, hardened, or cracked hoses as needed.



Cooling System

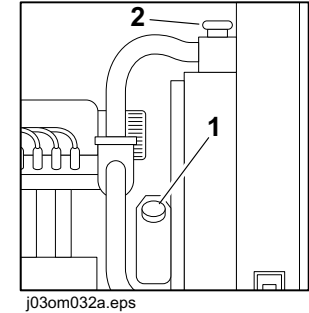
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Check and Clean Radiator Cooling Fins

Check radiator for dirt, grass, and other foreign matter every 50 hours. Check more often if operating in dusty or grassy conditions. Clean fins with compressed air as needed

NOTICE: Do not use a high pressure washer to clean the radiator fins.

Check SCA Level

Check SCA level every 600 hours using 3-Way Heavy Duty Coolant Test Kit (p/n 256-032). If SCA levels do not fall within appropriate range, attach tube to drain plug and empty radiator. Refill with an approved coolant. Check again.

IMPORTANT: Always check expiration date on 3-Way Heavy Duty Coolant Test Kit. An expired kit will not give accurate readings.

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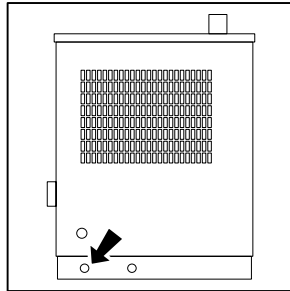
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Flush Cooling System

Flush cooling system and refill with approved coolant (p/n 255-006) every 2 years or 2000 hours.

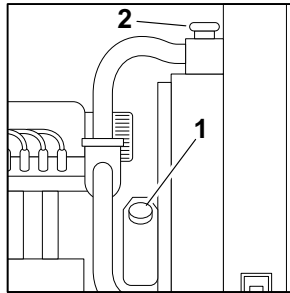
NOTICE: Do not use water or an automotive-type coolant. This will lead to engine damage or premature engine failure.

1. Allow engine to cool.
2. Open valve on inside of generator set behind the drain fitting (shown).



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3. Open drain and radiator cap (2) and drain coolant.
4. Drain overflow tank (1).
5. Close drain and valve and fill (1, 2) with Ditch Witch approved coolant (p/n255-006) or equivalent (see previous page).



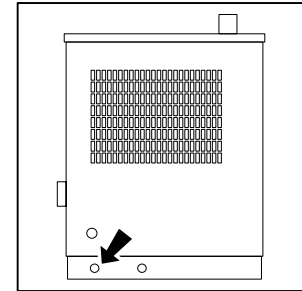
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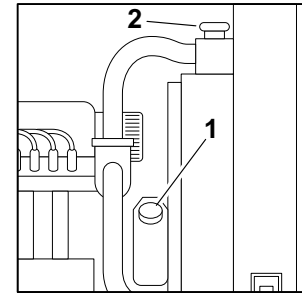
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Approved Coolants

The following coolants are approved for use with Ditch Witch equipment:

- John Deere® Cool-Gard
- John Deere Engine Antifreeze/Summer Coolant
- BASF GO5 (available in Europe)

The following coolants are approved for use with Ditch Witch equipment, but may shorten the working life of the resulting mixture:

- Fleet Guard EG Compleat, manufactured by Cummins®
- Fleet Charge, manufactured by Penray®
- Prestone® Heavy Duty Diesel Engine Coolant
- Hitachi® Diesel Engine Coolant (available in east Asia and the Pacific Rim)

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Air Filter

Check

Check air cleaner every 50 hours for wear or holes. Check air intake line every 200 hours. Check more often if working in dusty conditions.

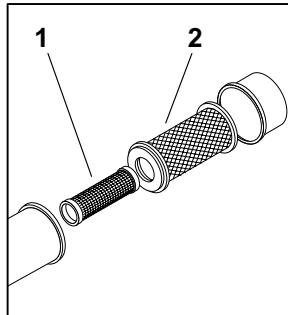
Change

Change air filter every 800 hours. Change more often if working in dusty conditions.

1. Open air filter housing.
2. Remove primary (2) and safety (1) elements.

IMPORTANT: Do not remove safety element unless both elements are to be replaced.

3. Wipe inside of housing and wash end cup.
4. Insert new primary and safety elements.
5. Close air filter case.



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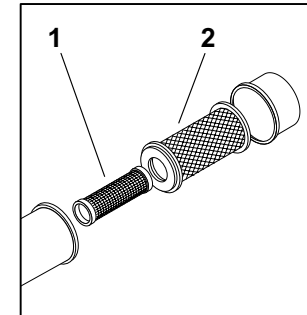
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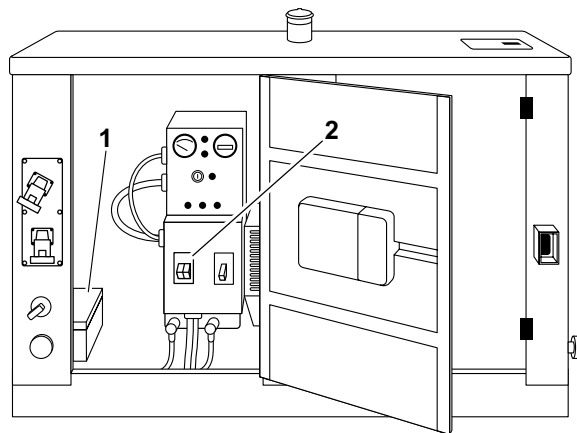
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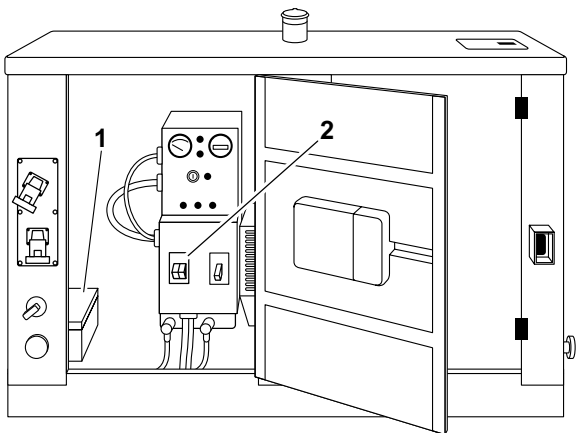
ELECTRICAL



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Ref.	Task	Hours
1	check battery connections for wear or corrosion	50
1	check battery electrolyte level	100
	Check electrical wiring for chafing or wear. Contact your Ditch Witch dealer if wiring needs replaced. Do not operate system until problem is corrected.	400
1	replace battery	2 years
2	test GFCI breakers	100

ELECTRICAL



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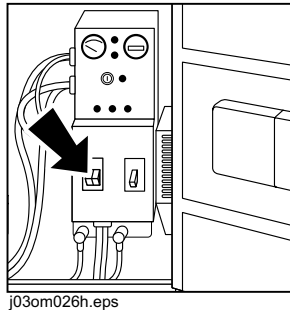
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GFCI Breakers

Test

Test GFCI breakers every 100 hours.

NOTICE: If handle does not trip, contact a trained service technician.

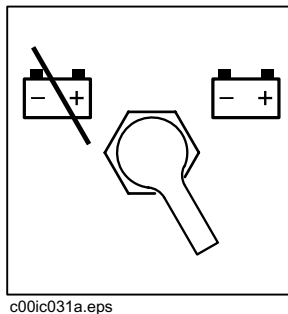


1. Turn generator set on.
2. Ensure that the GFCI breaker is in ON position (all the way up).
3. Press the red or white test button. Handle will trip to center position.
4. Reset circuit breaker by moving handle all the way up and then down.

Battery

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

IMPORTANT: Turn engine off before moving battery disconnect switch to OFF. Damage could occur to charging system if engine is on.

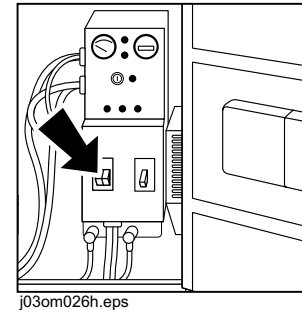


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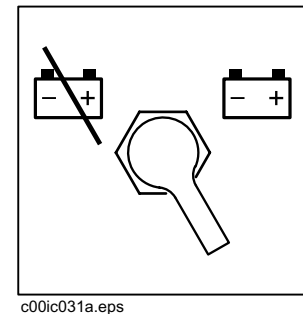


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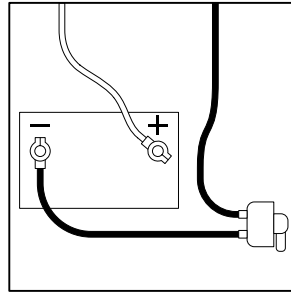
IMPORTANT: Turn engine off before moving battery disconnect switch to OFF. Damage could occur to charging system if engine is on.



Check

Check batteries every 50 hours. Keep batteries clean and free of corrosion. Keep battery connections clean and tight. Apply coat of grease to cable clamps after cleaning.

In cold weather, batteries lose some starting ability. If batteries will not hold charge, see your Ditch Witch dealer for replacement batteries. When replacing batteries, refer to wiring diagram.



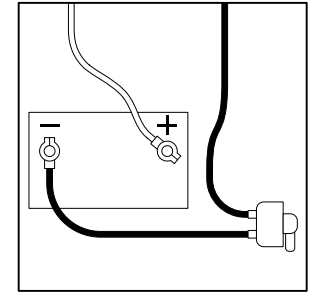
Check Electrolyte Level

Check electrolyte level in battery every 100 hours. Fill with deionized water if level is not up to mark inside battery.

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TROUBLESHOOTING

If problems are not corrected after the suggested solutions are used, contact your Ditch Witch dealer for assistance. Only trained service technicians should attempt procedures beyond what are listed.

FLUID MIXING COMPONENTS

Problem	Possible solutions
Slow feed rate from hopper	Run engine at full speed (60 Hz setting)
	Place control valves in recommended mixing positions.
	Clear obstructions from hopper and check that screen is in place.
	Remove build-up from venturi chamber.
	Clean plugged hoses and fittings. Repair or replace damaged hoses and fittings.
	Drilling fluid is too thick. See "Measuring Funnel Viscosity" in Operation for procedure on checking fluid viscosity.
Poor drilling fluid mix characteristics	Test water pH and treat if necessary (see "Plan Drilling Fluid Requirements" in PREPARATION for instructions).
Clumps in drilling fluid tank	Check feed rate. Slow feed rate if necessary.

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Clumps in drilling fluid tank	Check feed rate. Slow feed rate if necessary.

Problem	Possible solutions
Low yield properties	Check water pH. If pH is below 9.0 add 1 cup (.25 L) soda ash per tank. Test and repeat until pH is between 9 and 10.
	Check water hardness. Treat water if hardness is greater than 125 ppm.
	Check feed rate. Adjust if needed.
	Try different brand of drilling fluid.
	Add polymer to drilling fluid tank only after bentonite has fully yielded out.

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ENGINE COMPONENTS

Problem	Possible Solutions
Engine shuts down unexpectedly	Emergency stop switch is pushed in. Pull button out. See "Emergency Stop Switch" in CONTROLS for restarting instructions.
	Remote emergency stop connector is loose or pulled out. Reconnect securely.
	Low crankcase oil level. Check oil level and refill as needed.
	High coolant temperature. Inspect overflow tank. If empty, suspect a coolant problem. After engine has cooled sufficiently, inspect radiator, thermostat, and water pump. Replace or fix components as needed.
	Improper coolant or water mixture. Use an approved 50/50 water and anti-freeze mixture only.

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Problem	Possible Solutions
Engine will not crank	Battery disconnect is not on. Turn battery disconnect switch on.
	Emergency stop button is pushed in. Check emergency stop buttons. Pull out if needed.
	Circuit breaker on control panel has tripped. Reset breaker.
	Engine shutdown timer has "timed out" (30 seconds). Turn ignition switch to OFF position and then back to ON position to reset.
	Loose battery cable or discharged battery. Check battery cable and battery electrolyte level. Recharge as necessary.
	Defective starter solenoid or starter. Replace solenoid or starter.
	Contaminated fuel. Check fuel tank for contamination. Drain fuel if necessary. Replace fuel filter.

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Problem	Possible Solutions
Engine turns over, but will not run	Unit out of fuel. Check fuel level gauge and fill as needed.
	Ignition breaker is not fully pushed in. Check breaker and if out, push in to reset.
	Air in fuel system. Drain fuel in system until air is cleared.
	Clogged fuel system. Check fuel system and clean if necessary.
	Clogged air intake. Check air cleaner and clean, if necessary.
	Clogged exhaust. Check exhaust and clean, if necessary.
Low engine speed	Clogged fuel system. Check for clogged fuel filter, kinked fuel line, or clogged fuel pick-up tube.
	Blocked air intake or blocked exhaust system. Check air filter and engine exhaust system. Remove any obstruction(s).
	Contaminated fuel. Check fuel tank for contamination. Drain fuel if necessary.

Problem	Possible Solutions
Engine turns over, but will not run	Unit out of fuel. Check fuel level gauge and fill as needed.
	Ignition breaker is not fully pushed in. Check breaker and if out, push in to reset.
	Air in fuel system. Drain fuel in system until air is cleared.
	Clogged fuel system. Check fuel system and clean if necessary.
	Clogged air intake. Check air cleaner and clean, if necessary.
	Clogged exhaust. Check exhaust and clean, if necessary.
Low engine speed	Clogged fuel system. Check for clogged fuel filter, kinked fuel line, or clogged fuel pick-up tube.
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	Contaminated fuel. Check fuel tank for contamination. Drain fuel if necessary.

Problem	Possible Solutions
Fluctuating or surging engine speed.	Check engine fuel system for air leaks, plugged filters, or a clogged pick-up tube in fuel tank. Fix air leaks, change filters, or remove clog.
Engine loses power under load.	Unit is overloaded. Reduce load.
	Clogged fuel system. Check fuel system for air or blockage in the fuel lines. Discharge fuel until air clears or obstruction is removed.
	Blocked air intake. Check air cleaner. Replace filter if needed.
	Blocked exhaust. Check exhaust system. Remove blockages.
	Contaminated fuel. Check tank for contamination. Drain fuel if needed.
	Broken fan belt. Inspect fan belts and replace as needed.
Motor overload relay or breaker keeps tripping when put under load.	Unit is overloaded. Reduce the load.
	Fluid in pump is frozen. Pull system into warm area and allow to thaw.
	Impeller shaft is jammed. Turn all power off and check impeller shaft. If pump does not rotate freely, contact your Ditch Witch dealer.
	Faulty breaker. Have a trained service technician replace breaker.

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ACCESSORY OUTLETS

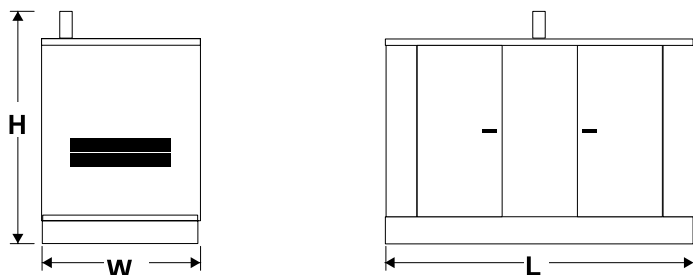
Problem	Possible Solutions
Accessory tools will not operate.	Check GFCIs at outlets. Push in reset buttons.
Accessory tools still will not operate.	Check GFCI breakers inside generator. If tripped, push breakers all the way down and then back up.
Accessory tools still will not operate.	Faulty breaker. Have a trained service technician replace breaker.

ACCESSORY OUTLETS

Problem	Possible Solutions
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SPECIFICATIONS

GENERATOR SET



Dimensions	U.S.	Metric
L, length	72 in	1.8 m
H, height	47 in	1.2 m
W, width	36 in	914 mm
Weight	2000 lb	907 kg
Fluid capacities	U.S.	Metric
Fuel tank	15 gal	57 L
Engine oil	14 qt	13.2 L
Engine	U.S.	Metric
Engine: Kubota V3300		
Generator: 20 kW, 3 phase, 480VAC		
Fuel: diesel		
Cooling medium: John Deere Cool-Gard 50/50 premixed coolant		
Number of cylinders: 4		
Displacement	201 in ³	3.3 L
Gross power @ 1800 rpm	50 hp	37 kW

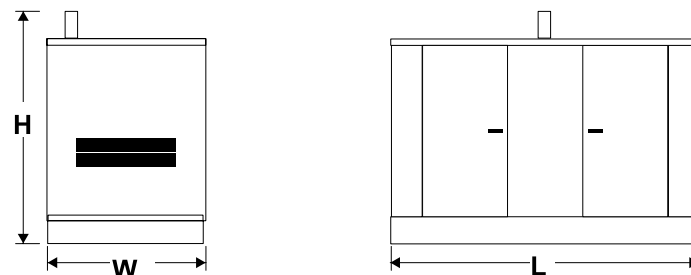
Noise Levels:

Operator 79 dbA sound pressure per ISO 6394.

Exterior 100 dbA sound power per ISO 6393.

SPECIFICATIONS

GENERATOR SET



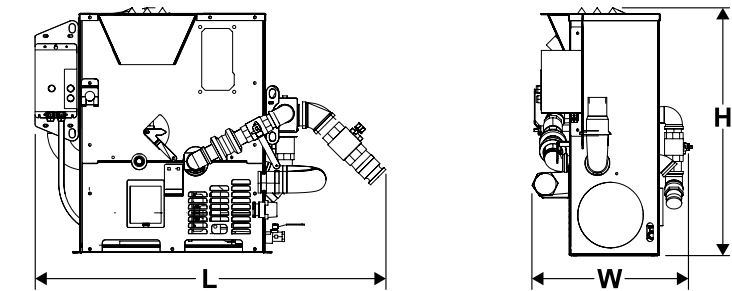
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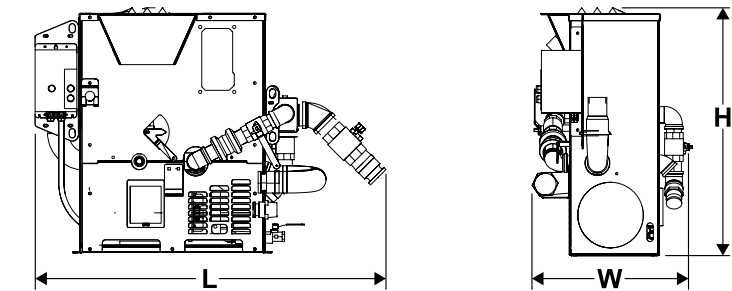
HOPPER



j03om0022h.eps

Dimensions	U.S.	Metric
L, length	58 in	1.5 m
H, height	40 in	1 m
W, width	26 in	660 mm
Weight	500 lb	227 kg
Drilling fluid system	U.S.	Metric
Maximum flow rate at 26 viscosity (2X)	300 gpm	1135 L/min
Mixing hopper capacity	1.0 cu ft	28 L
Liquid chemical hopper capacity	1.0 qt	.9 L
Drilling fluid/mixing tank (2X)	1000 gal	3785 L
Mixing time for 50 lb (22.7 kg)	0.5 min	0.5 min
Mixing time for 100 lb (45 kg)	1 min	1 min

HOPPER

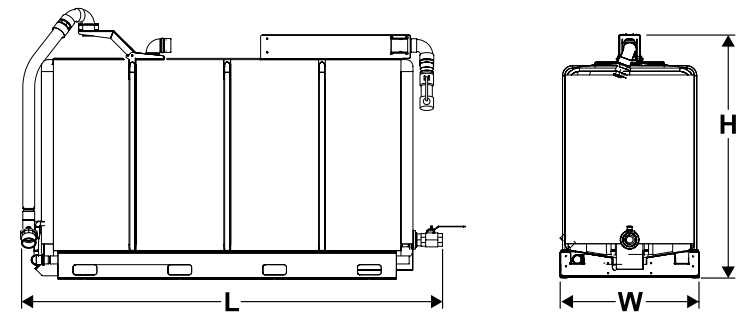


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MIXING TANKS

1000 gal (3785 L) tank

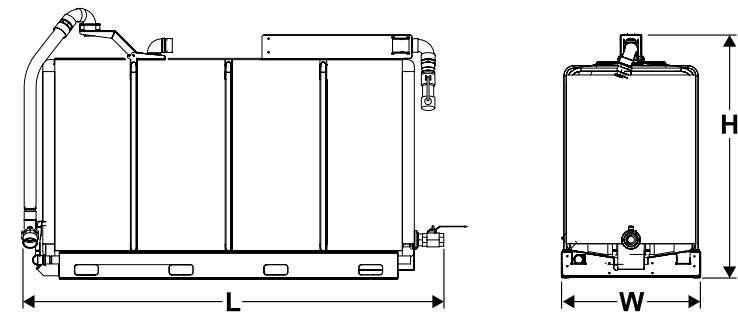


j03om021h.eps

Dimensions	U.S.	Metric
L, length	125 in	3.2 m
H, height (with tank fill)	80 in	2 m
W, width	42 in	1 m
Weight (empty)	1000 lb	454 kg
Weight (full of water)	9350 lb	4241 kg

MIXING TANKS

1000 gal (3785 L) tank

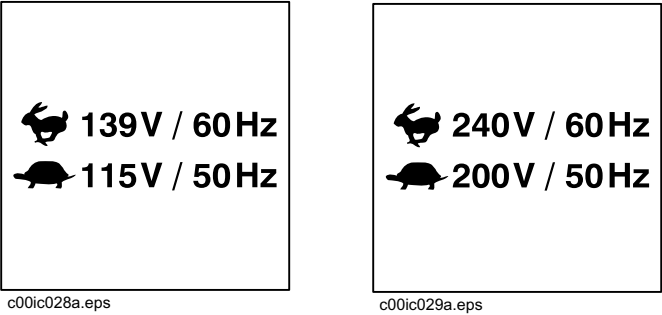


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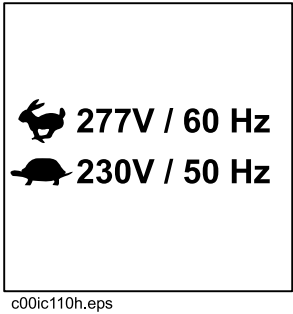
ACCESSORY OUTLETS

Standard Outlets



duplex outlet	twist-lock outlet
139V @ 60 Hz	240V @ 60 Hz
115V @ 50 Hz	200V @ 50 Hz

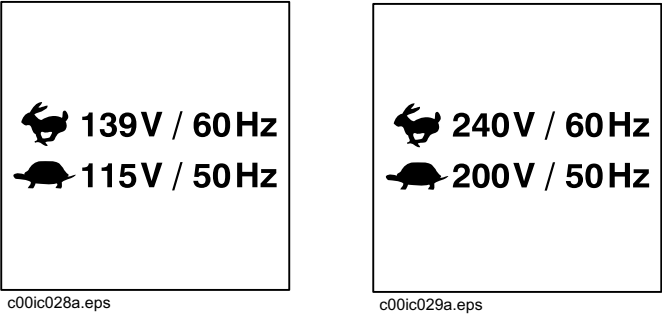
Optional Outlets



IEC style outlets
277V @ 60 Hz
230V @ 50 Hz

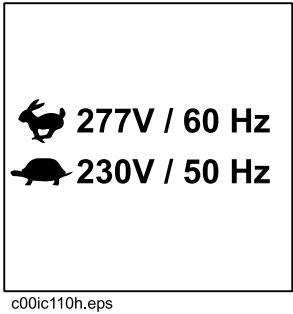
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WARRANTY

Ditch Witch Equipment and Parts Limited Warranty Policy

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

Exclusions from Product Warranty

- Wear-related failure of parts subject to ground contact including, but not limited to, digging teeth, digging chains, sprockets, backhoe buckets, plow blades, drill pipe, drill bits, backreamers, and swivels.
- All incidental or consequential damages.
- All defects, damages, or injuries caused by misuse, abuse, improper installation, alteration, neglect, or uses other than those for which products were intended.
- All defects, damages, or injuries caused by improper training, operation, or servicing of products in a manner inconsistent with manufacturer's recommendations.
- All engines and engine accessories (these are covered by original manufacturer's warranty).
- Tires, belts, and other parts which may be subject to another manufacturer's warranty (such warranty will be available to purchaser).
- All implied warranties not expressly stated herein, including any warranty of fitness for a particular purpose and merchantability.

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

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

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

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

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

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

First version: 1/91; Latest version: 4/00

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**A Note To
Ditch Witch**

Equipment Owners:

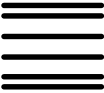
If your equipment was purchased through a Ditch Witch dealer, there is no need to read further.

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

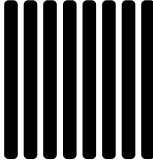
This will enable you to receive updates on this equipment as well as information on new products of interest.

Thanks for using Ditch Witch equipment.

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



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

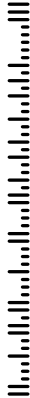


BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO 23 PERRY OKLAHOMA

POSTAGE WILL BE PAID BY

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



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Ditch Witch**

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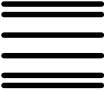
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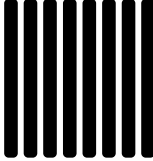
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Ditch Witch® Registration Card

Please Type or Print All Information

Purchaser's Company Name		
Attention		
Street Address or P.O. Box		
City	County	
State	Zip	Nation
()		
Phone Number With Area Code		
Model	Serial Number	
Attachments/Accessories	Serial Numbers	
Attachments/Accessories	Serial Numbers	
Attachments/Accessories	Serial Numbers	
Name of Ditch Witch Dealership		
Your Signature		

Ditch Witch® Registration Card

Please Type or Print All Information

Purchaser's Company Name		
Attention		
Street Address or P.O. Box		
City	County	
State	Zip	Nation
()		
Phone Number With Area Code		
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