Wagner Smith Equipment Co.

SERVICE FROM POLE TO POLE

**OPERATOR'S AND PARTS MANUAL**

**MODEL T-1DP-2200-FT4**
SINGLE DRUM PULLER
CONTROL # _____
SERIAL #_____


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# OPERATOR'S MANUAL INDEX


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# SECTION “A”
# SAFETY

**ATTENTION:**

This manual is intended to give operational, parts, and maintenance information for the unit referenced on the front cover. It is not intended to replace safe operating practice or serve as a tension/stringing operation procedures manual. This piece of equipment is designed for use in tension/stringing operations within its specification only. Any other use outside of this is not authorized by Wagner-Smith Equipment Co., is potentially dangerous and could result in severe injury or death. Additionally, this equipment should only be operated by trained personnel who are fully aware of the proper operating procedures and potential safety hazards encountered during tension/stringing operations.


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# SECTION “A”
# SAFETY

**RECOGNIZE SAFETY INFORMATION**

This is the **safety-alert** symbol. When you see this symbol on your machine or in this manual, be alert to the potential for personal injury.

Follow recommended precautions and safe operating practices.

**“DANGER”** – Is used to indicate a hazardous situation which has a high probability of death or severe injury.


**“WARNING”** – Is used to indicate a hazardous situation which has some probability of death or serious injury.


**“CAUTION”** – Is used to indicate a hazardous situation which may result in minor or moderate injury.


**FOLLOW SAFETY INSTRUCTIONS**

Carefully read all safety messages in this manual and on your machine safety signs. Keep safety signs in good condition. Replace missing or damaged safety signs.

Learn how to operate the machine and how to use controls properly. Do not let anyone operate without instruction.

Keep your machine in proper working condition. Unauthorized modifications to the machine may impair the function and/or safety and effect machine life.

If you do not understand any part of this manual and need assistance, contact Wagner-Smith Equipment Co.

# SECTION “A”
# SAFETY

**PREPARE FOR EMERGENCIES**

Be prepared if a fire or accident occurs. Keep a first aid kit and fire extinguisher handy. Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.


**PROTECT AGAINST NOISE**

Prolonged exposure to loud noise can cause impairment or loss of hearing.

Wear a suitable hearing protective device such as earmuffs or earplugs to protect against uncomfortable loud noises.

**STAY CLEAR OF ROTATING SPINDLES AND CHAIN DRIVES**

Entanglement in rotating reel spindle and reel spindle drive can cause serious injury or death.

Keep all guards in place at all times.

Wear close fitting clothing. Stop the engine and be sure the drives are completely stopped before performing any type of service on the equipment.

**PRACTICE SAFE MAINTENANCE**

Understand service procedures before doing work. Keep area clean and dry. Never lubricate, service, or adjust machine while it is moving. Keep hands, feet, and clothing from power driven parts. Disengage all power and operate controls to relieve pressure. Stop the en-gine. Remove the key. Allow machine to cool.

Keep all parts in good condition and properly installed. Fix damage immediately. Replace worn or broken parts. Remove all buildup of grease, oil, or debris.

Disconnect battery ground cable (-) before making adjustments on electrical systems or welding on machine.

# SECTION “A”
# SAFETY

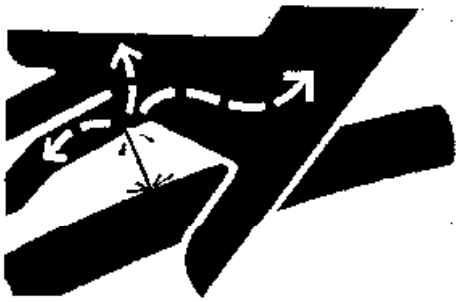
**AVOID HIGH-PRESSURE FLUIDS**

Escaping fluid under pressure can penetrate the skin causing serious injury.

Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

Protect hands and body from high pressure fluids.

If an accident occurs, see a doctor immediately.



**REMOVE PAINT BEFORE WELDING OR HEATING**

Avoid potentially toxic fumes and dust.

Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch.

Do all work in a well-ventilated area. Dispose of paint and solvent properly.

Remove paint before welding or heating:

- If you use sand or grind paint, avoid breathing the dust. Wear an approved respirator.
- If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper container and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.


**SERVICE COOLING SYSTEM SAFELY**

Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to to relieve pressure before removing completely.

# SECTION “A”
# SAFETY

**FILLING FUEL TANK**

**CAUTION:** Handle fuel carefully. Do not fill the fuel tank when engine is running.

**DO NOT** smoke while filling fuel tank or servicing fuel system.

**IMPORTANT:** The fuel tank is vented through the filler cap. If a new filler cap is required, always replace it with an original vented cap.

**WARNING**

# ELECTROCUTION HAZARD

## DO NOT OPERATE THIS MACHINE WITHOUT PROPER GROUNDING

# SECTION “A”
# SAFETY


**THIS MACHINE IS A HIGHLY**

**SPECIALIZED PIECE OF**

**EQUIPMENT THAT SHOULD BE**

**OPERATED ONLY BY**

**QUALIFIED PERSONNEL**

# SECTION “B”
# INTRODUCTION


| FIG | DESCRIPTION | PAGE # |
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# SECTION “B”
# INTRODUCTION


The Wagner-Smith Company Model T-1DP-2200-FT4 is a trailer mounted, single drum puller. The unit is equipped with a pulling reel with wire rope for transmission work. Haul back is a feature available for paying out through the use of mooring. The hydraulic system on this machine incorporates variable pressure and electronic controls which provide the operator with superior control during pulling operations. This unit is equipped with an electronics system that displays real time pull data such as line pull, line speed, and reel diameter for more precise control.

The purpose of this manual is to acquaint the operator with the unit and its operation and maintenance. Each of its components will be described so that the operator may understand its function.

The manufacturer’s manuals, if any, for the majority of this unit’s components, are included to facilitate repairs should they become necessary.

# SECTION “C”
# SPECIFICATIONS


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# SECTION “C”
# SPECIFICATIONS

**WAGNER-SMITH**
**MODEL T-1DP-2200-FT4**

**TRAILER MOUNTED**
**SINGLE DRUM**
**PULLER**

Specification No. 402200-12
Date 04/13/26

## UNIT PERFORMANCE

- Max Torque Rating ..... 2,200,000 lb.-in.
- Full Drum Line Pull Rating ..... 50,000 lbs.
- Line Speed (average) ..... 3.5 mph

## PULLING DRUMS

- Diameter ..... 88 in.
- Core Diameter ..... 42 in.
- Inside Width ..... 50 in.
- Maximum Rope Capacity ..... 22,000 ft. of 7/8 in. steel rope

## POWERTRAIN

- Engine ..... 525 HP Final Tier IV John Deere water-cooled
- Fuel Type ..... Ultra Low Sulfur Diesel
- Fuel Capacity ..... 100 gallons
- Hydraulic Oil Type ..... Chevron Rando HDZ ISO Grade 46
- Hydraulic Oil Capacity ..... 150 gallons
- Reel Drive ..... Direct drive closed loop hydraulic system

## UNIT DIMENSIONS

- Unit Length ..... 48’ 7”
- Unit Width ..... 8’ 0”
- Unit Height ..... 12’ 8”
- Unit Weight ..... 86,540 lbs.
- GVWR ..... 93,300 lbs.
- GAWR ..... 52,000 lbs.
- King Pin Weight ..... 38,700 lbs.

# SECTION “C”
# SPECIFICATIONS

**WAGNER-SMITH**
**MODEL T-1DP-2200-FT4**

**TRAILER MOUNTED**
**SINGLE DRUM**
**PULLER**

Specification No. 402200-12
Date 04/13/26

## UNDERCARRIAGE

- Tires ..... 285/75R24.5
- Axles ..... Triple 27,500 lb. capacity each
- Suspension ..... Hutchens 9700 Leaf Spring
- Brakes ..... Full Air w/ABS Brake system

## STANDARD FEATURES

- Levelwind ..... Rail type, automatically driven with manual override
- Front Hitch ..... Fifth Wheel King Pin
- Lighting ..... DOT Regulation (LED)
- Electric Plug ..... 7-way socket
- Front Jacks ..... Hydraulic
- Rear Jacks ..... None
- Grounding Lugs ..... Mounted center and rear
- Operator Seat ..... Adjustable (includes foot rest)
- Vandalism Package ..... Lockable control panel cover

# SECTION “D”
# DESCRIPTION OF INDIVIDUAL FUNCTIONS


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# SECTION “D”
# DESCRIPTION OF INDIVIDUAL FUNCTIONS

## HYDRAULIC REEL DRIVE

The hydraulic reel drive consists of a John Deere diesel engine (Fig. 3) that drives a variable displacement, pressure-compensated, hydraulic pump which drives a variable displacement hydraulic motor (Fig. 1) that rotates the reel through a high efficiency planetary gearbox reduction.

The fail-safe brake is mounted on the planetary gearbox and is controlled manually from the operator’s panel by a palm valve (Fig. 2). The brake is automatically applied in the event of a hydraulic system failure.


**Figure 1:** Hydraulic Motor


**Figure 2:** Hydraulic Brake Control

## AXIAL PISTON PUMPS

The variable displacement, pressure-compensated pumps (Fig. 3) are driven by the John Deere diesel engine and are connected to the variable displacement motors in a closed-loop configuration. During normal operation, the displacement is controlled by the electronic joystick (Fig. 4) located on the control panel. Should the required line pull exceed the preset pressure on the unit, the mooring control will de-stroke the pump and maintain the preset pressure. The engine should be run at high idle (2,100 RPM) when pulling with the reel.

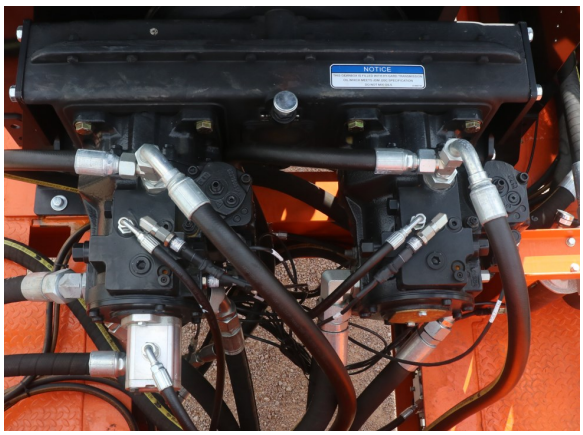


**Figure 3:** Axial Piston Pumps


**Figure 4:** Directional Control

# SECTION “D”
# DESCRIPTION OF INDIVIDUAL FUNCTIONS

## HYDRAULIC OIL RESERVOIR AND FILTER

The purpose of the hydraulic oil reservoir (Fig. 5A) is to provide hydraulic fluid to the pumps. The purpose of the hydraulic filter (Fig. 5B) is to clean the hydraulic oil as it circulates through the system.

**NOTE: It is imperative that the hydraulic reservoir and filter be serviced at the recommended intervals. Cleanliness is the life of a hydraulic system.**

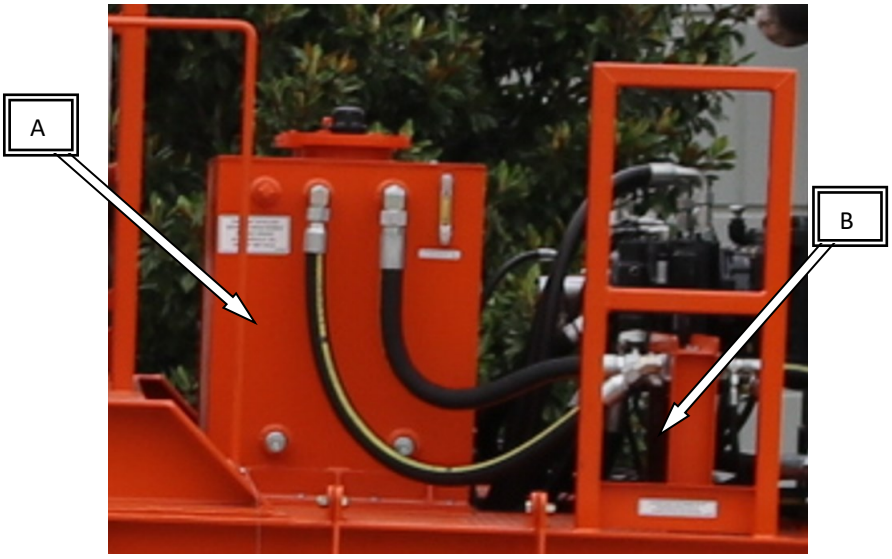


**Figure 5:** Hydraulic Oil Reservoir & Filter

## HYDRAULIC OIL HEAT EXCHANGER

The hydraulic oil heat exchanger (Fig. 6) keeps oil temperatures in safe operating range and extends the life of the hydraulic system. Oil temperature operating range is between 80°F to 180°F. When the hydraulic oil is below 110°F, the oil bypasses the heat exchanger by means of a thermal valve. The heat exchanger fan is off and switches on once the hydraulic oil reaches 110°F. The fan runs until the tank hydraulic oil temperature drops below 105°F.

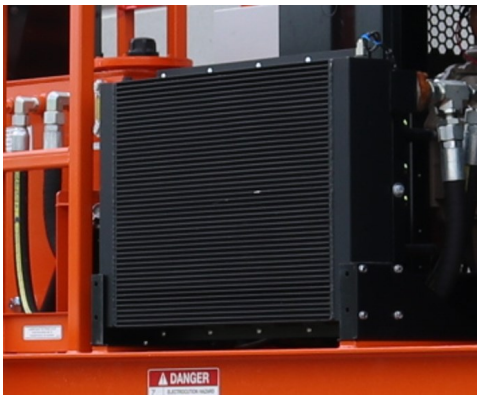


**Figure 6:** Hydraulic Oil Heat Exchanger

# SECTION “D”
# DESCRIPTION OF INDIVIDUAL FUNCTIONS

## LEVELWIND

The pulling drum is designed to levelwind the wire rope without the assistance of the hydraulic levelwind system. The dual cylinder levelwind is intended to be used as a back-up method only. Should the wire rope fail to wrap properly, the levelwind should be used to get the wrap back on track. The operator can take control of the levelwind by using the control valve (Fig. 8) located on the control panel.

**Figure 7:** Levelwind


**Figure 8:** Levelwind Horizontal Control

**Figure 9:** Levelwind Head

# SECTION “D”
# DESCRIPTION OF INDIVIDUAL FUNCTIONS

## OPERATOR CONTROL STAND

### Control Panel

Listed below are all controls, indicators, and devices found on the operator control panel along with a brief description of their individual functions.

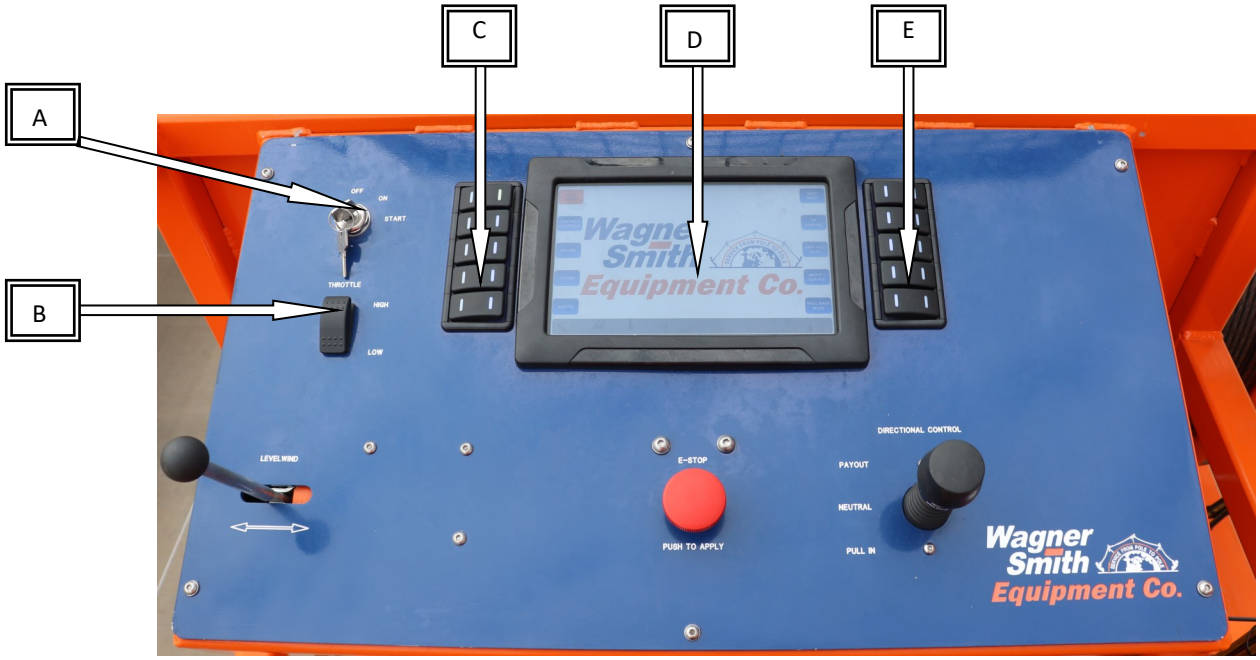


**Figure 10:** Control Panel

- **Ignition Key Switch (Fig. 10A):** A 4-position ignition switch: off (center), on (right), start (far right), acc (far left)
- **Throttle (Fig. 10B):** A two-position toggle switch: low idle (down) and high idle (up). The engine is at 800 RPM at low idle and 2,100 RPM at high idle
- **Button Panels (Fig. 10C & E):** Used to navigate the display located at the center of the panel. Touch screen is also available, but is not recommended when wearing gloves
- **Display (Fig. 10D):** Displays information relevant to the pulling/tensioning operation. Diagnostic information related to the engine and hydraulics system is also available on this screen

# SECTION “D”
# DESCRIPTION OF INDIVIDUAL FUNCTIONS

## OPERATOR CONTROL STAND (cont.)

### Control Panel (cont.)

Listed below are all controls, indicators, and devices found on the operator control panel along with a brief description of their individual functions.


**Figure 10 (repeated):** Control Panel

- **Levelwind Directional Control (Fig. 10F):** Moves levelwind to desired position when winding wire rope.
- **Palm Valve (Fig. 10G):** Engages the reel brake when depressed.
- **Joystick (Fig. 10K):** Used to control the direction and speed of the reel.

# SECTION “D”
# DESCRIPTION OF INDIVIDUAL FUNCTIONS

## OPERATOR CONTROL STAND (cont.)

### Auxiliary Controls & Connections

- **USB port (Fig. 11A):** Download pull data including: line pull, line speed, and distance pulled.
- **12V port (Fig. 11B):** Use 12V adapter to power auxiliary systems.
- **Battery studs (Fig. 11C):** Provides power to auxiliary systems.

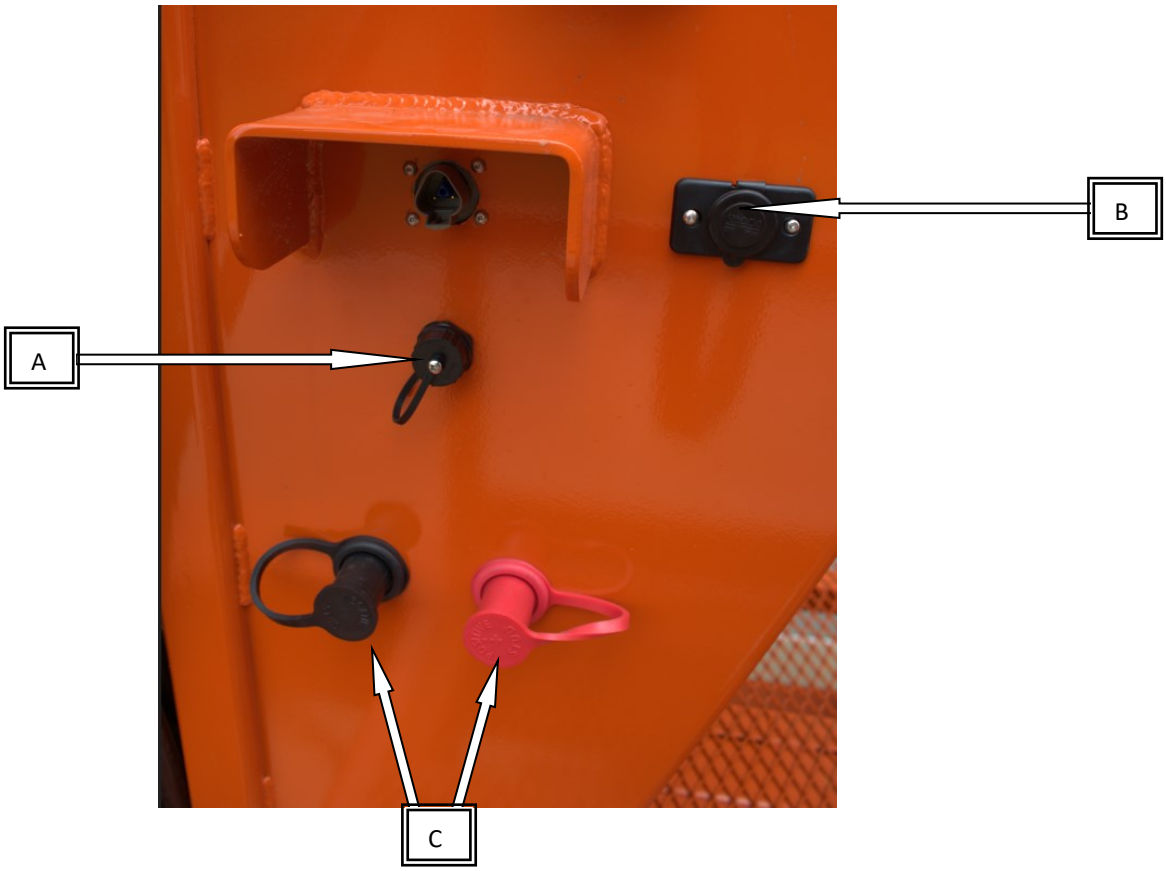


**Figure 11:** Auxiliary Connections

# SECTION “D”
# DESCRIPTION OF INDIVIDUAL FUNCTIONS

## OPERATOR CONTROL STAND (cont.)

### Display Functions

The digital display (Fig. 10D) provides the operator with real time information about the engine and hydraulic system. Line pull data including line pull, pull speed, and pull distance are shown and can be downloaded to a USB drive. An alert system lets the operator know when unit parameters exceed the recommended values including the John Deere engine. The display consists of a series of screens which are detailed below.

1) Home Screen (Fig. 12):

- Screen displayed after turning the unit on. Shows where each button on the display will take the operator.


**Figure 12:** Home Screen

# SECTION “D”
# DESCRIPTION OF INDIVIDUAL FUNCTIONS

## OPERATOR CONTROL STAND (cont.)

### Display Functions (cont.)

2) Line Pull Controls Screen (Fig. 13):

A) **Line Pull:** Indicates the calculated line pull with both a gauge and a readout.

B) Additional readouts available on this screen:

- Speed
- Distance
- Reel Diameter
- Time
- Fuel level

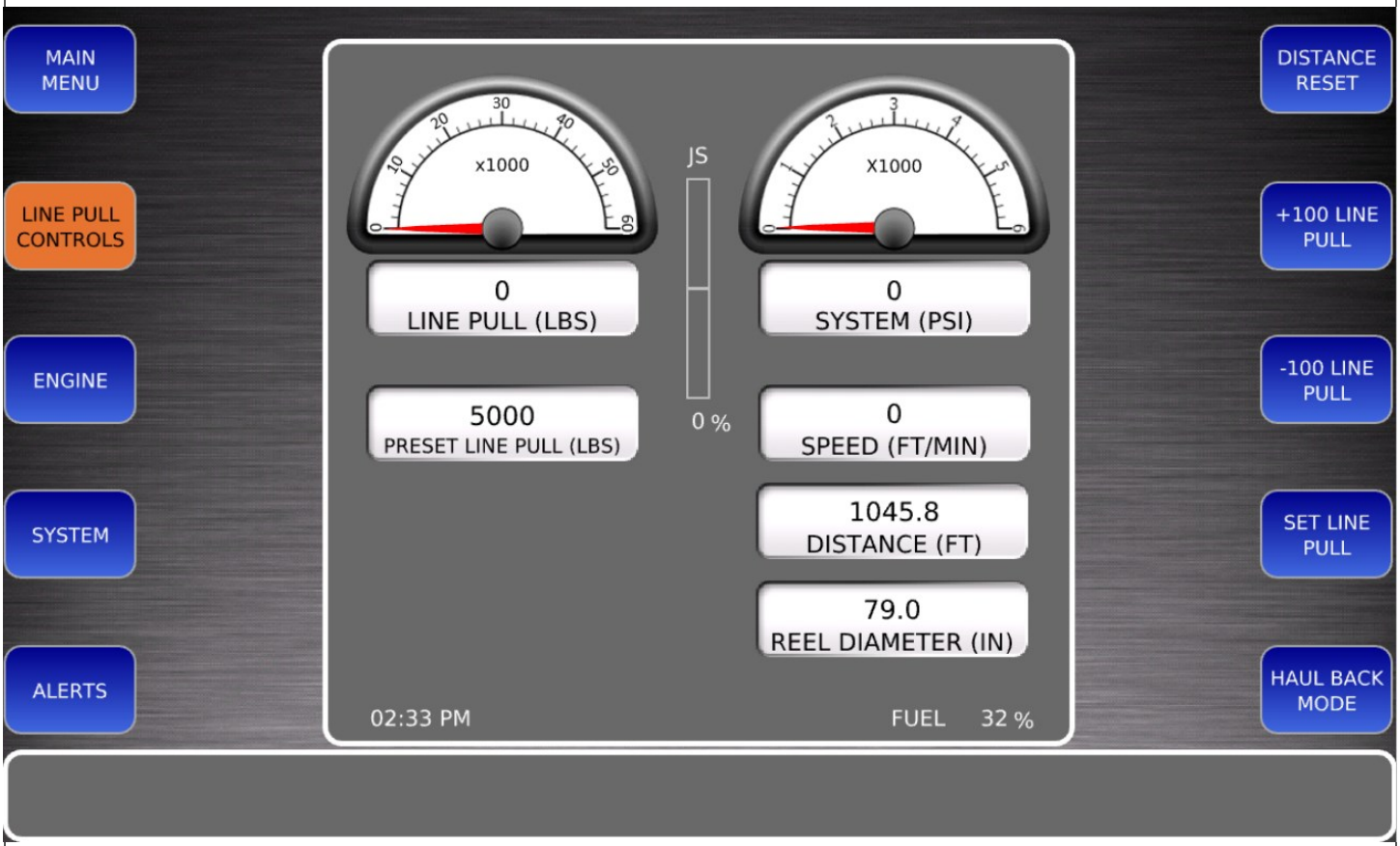


**Figure 13:** Puller Controls Screen

# SECTION “D”
# DESCRIPTION OF INDIVIDUAL FUNCTIONS

## OPERATOR CONTROL STAND (cont.)

### Display Functions (cont.)

3) Haul back Screen (cont.) (Fig. 14):

- Tap the haul back mode button

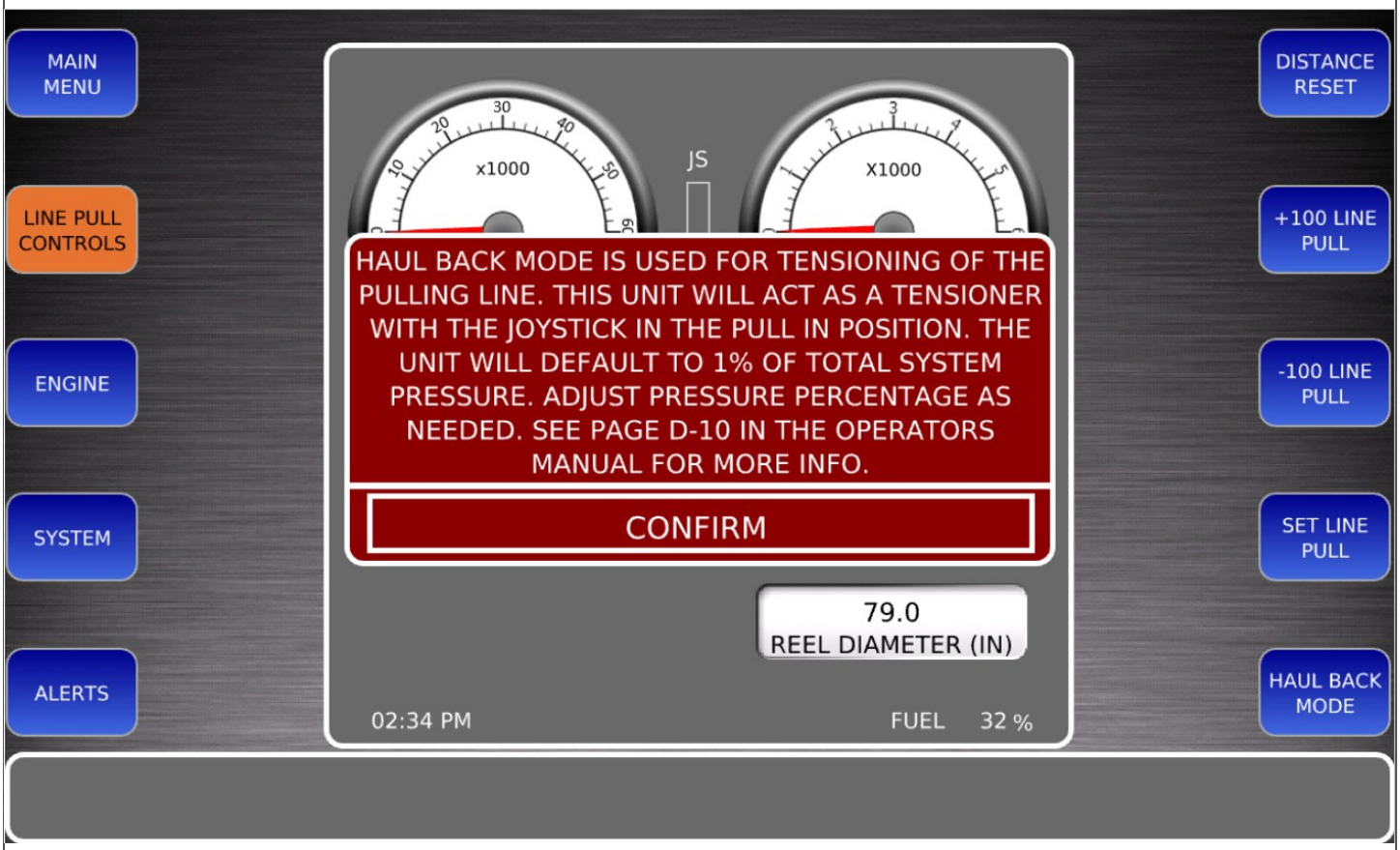


**Figure 14:** Haul back Screen

# SECTION “D”
# DESCRIPTION OF INDIVIDUAL FUNCTIONS

## OPERATOR CONTROL STAND (cont.)

### Display Functions (cont.)

The haul back mode is used to payout rope in a controlled manner by adding enough tension to keep the reel from unwinding when another piece of equipment is being used to take rope off the reel. Haul back should not be used to operate the unit as a puller.

3) Haul back Screen (Fig. 15):

- Select ‘Set Pressure %’
- The side buttons can be used to increase/decrease the pressure value (Fig. 20)
- The number pad can also be used to increase/decrease the pressure value

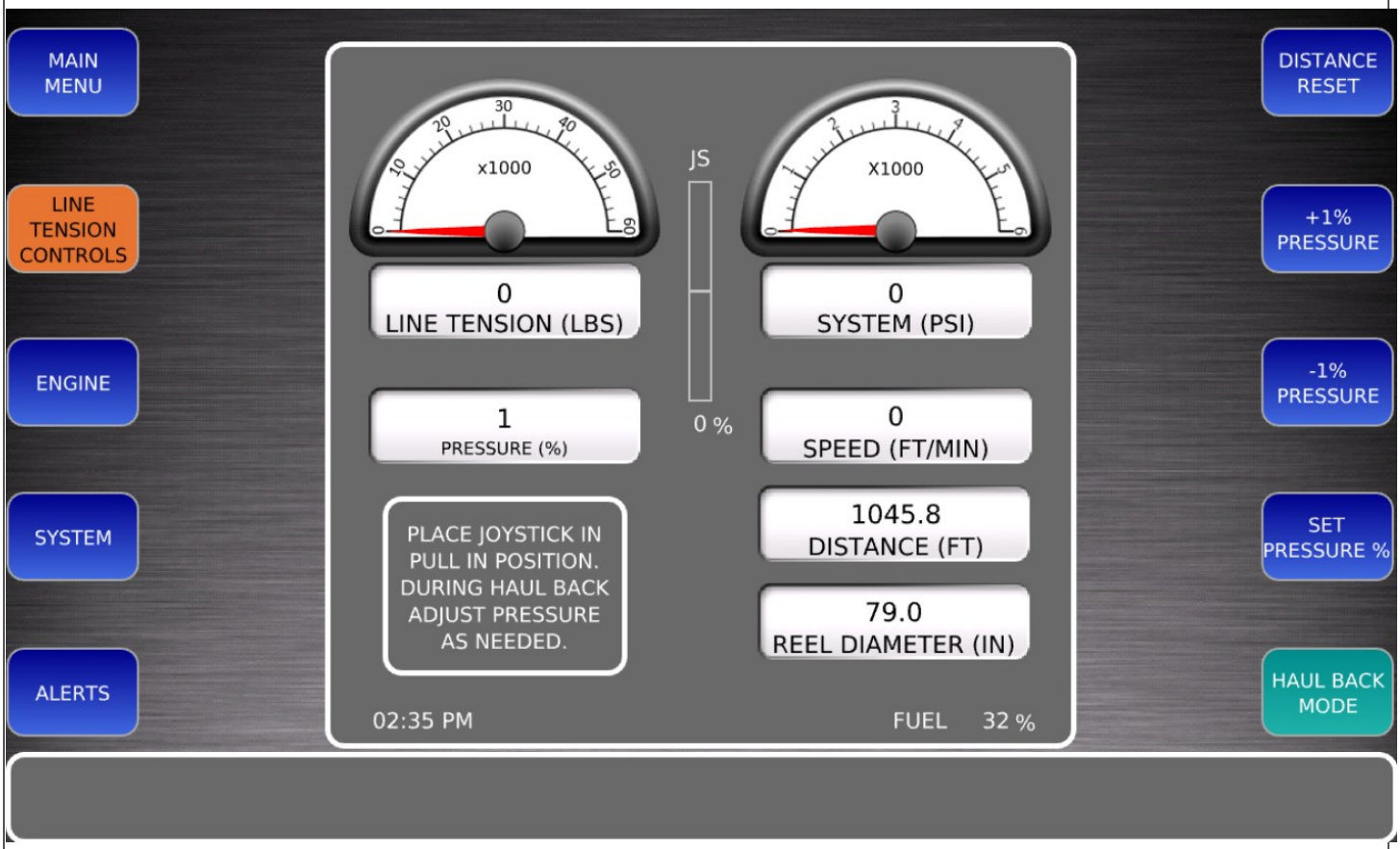


**Figure 15:** Haul back Screen

# SECTION “D”
# DESCRIPTION OF INDIVIDUAL FUNCTIONS

## OPERATOR CONTROL STAND (cont.)

### Display Functions (cont.)

4) Engine Screen (Fig. 16):

- **Tachometer:** Indicates engine RPM
- **Fuel gauge:** Indicates fuel tank level
- **Coolant temperature gauge:** Indicates engine coolant temperature
- **Voltmeter:** Indicates if the alternator is charging the battery or electrical system
- **Oil pressure gauge:** Indicates engine oil pressure
- **Engine hours:** Indicates the total hours the engine has ran
- **Engine % load:** Indicates the load in percentage that is currently on the engine

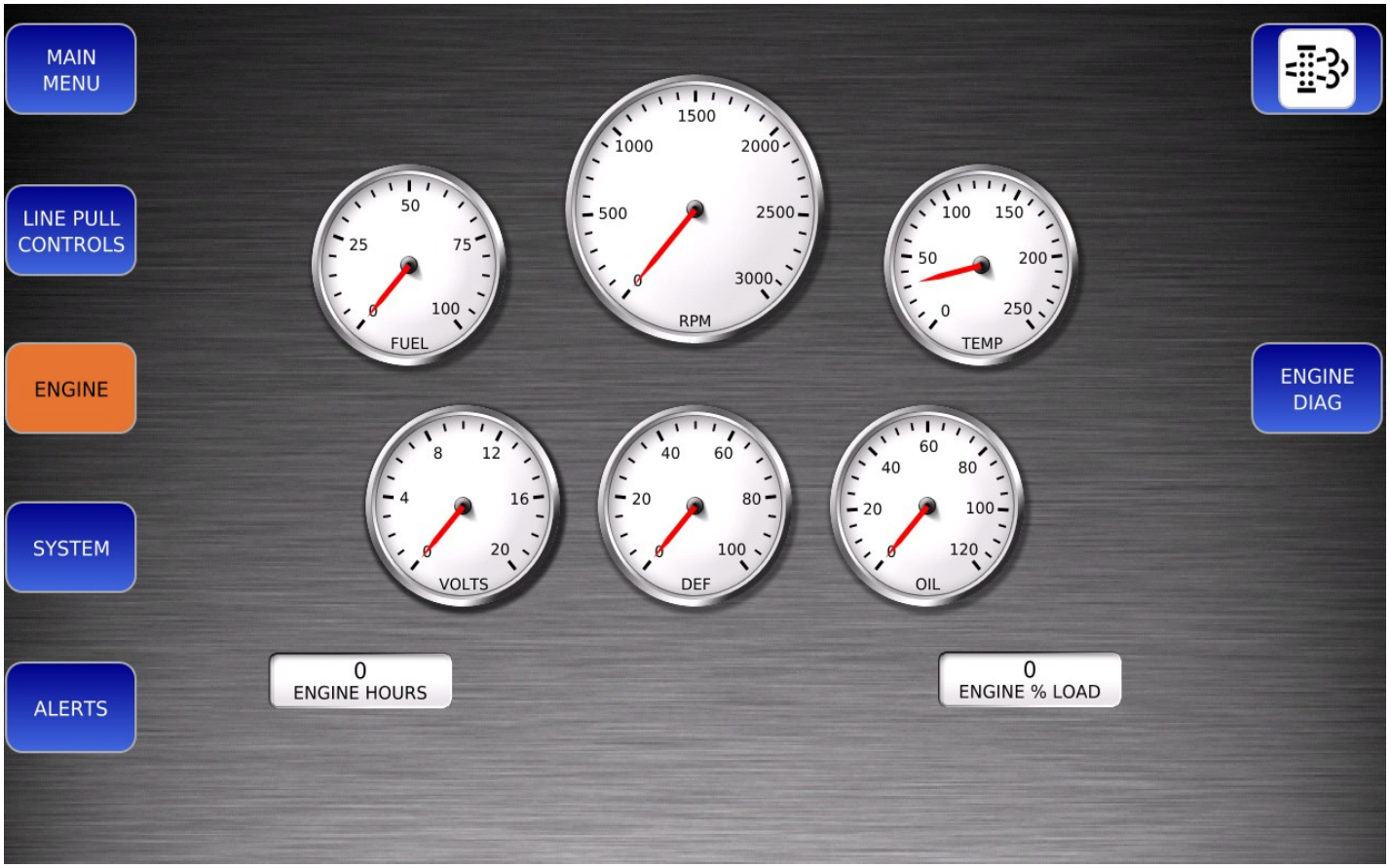


**Figure 16:** Engine Screen

# SECTION “D”
# DESCRIPTION OF INDIVIDUAL FUNCTIONS

## OPERATOR CONTROL STAND (cont.)

### Display Functions (cont.)

4) Engine Screen (cont.) (Fig. 16):

- **Exhaust Filter Cleaning (Fig. 16A):** Automated process that allows the system to clean the exhaust filter with no impact on engine performance. This process is handled in the background during normal operation unless disabled by the operator. If the “Exhaust Filter Cleaning” has been disabled and the engine is requesting one, the operator can press the button to request the engine to perform the cleaning.

**NOTE: See Appendix A John Deere Engine for a complete list of engine lamps and descriptions.**

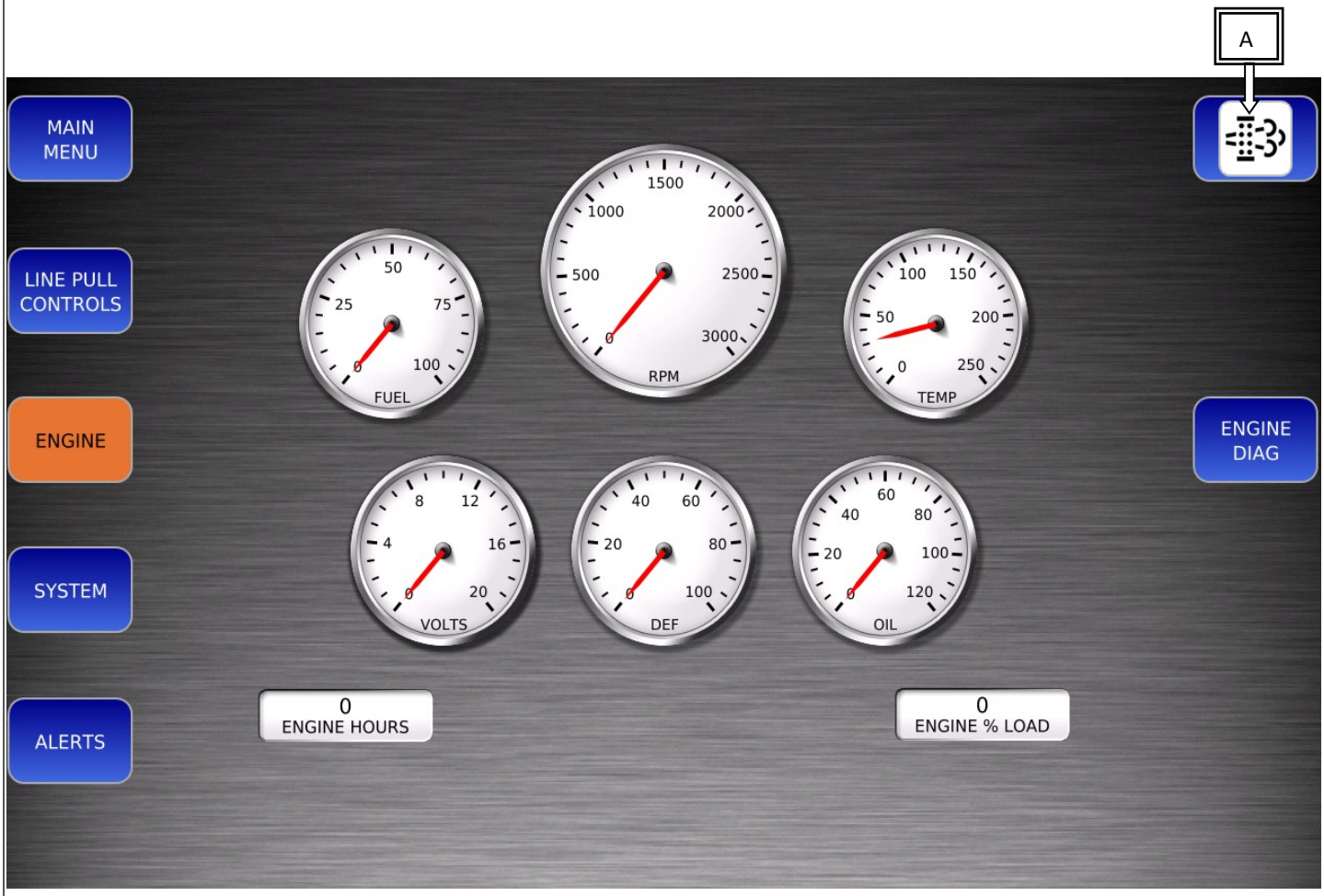


**Figure 16:** Engine Screen

# SECTION “D”
# DESCRIPTION OF INDIVIDUAL FUNCTIONS

## OPERATOR CONTROL STAND (cont.)

### Display Functions (cont.)

5) System Screen (Fig. 17):

- **System pressure:** Indicates working pressure
- **Charge pressure:** Indicates gauge pressure
- **Hydraulic brake pressure:** Indicates brake pressure for the entire system
- **Tank temp:** Indicates temperature of fluid inside hydraulic reservoir
- **Outlet temp:** Indicates temperature of fluid exiting the heat exchanger in route to the reservoir

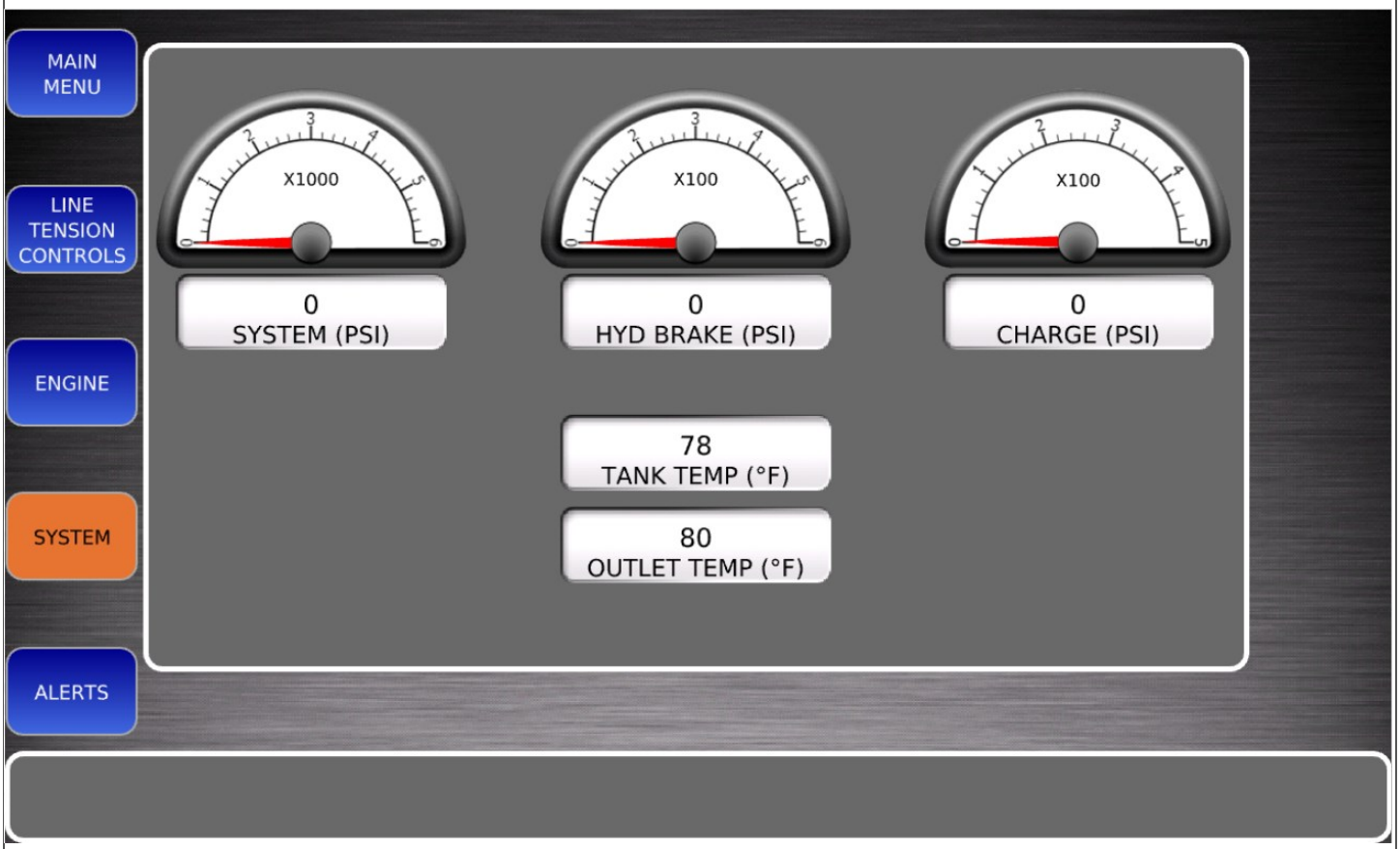


**Figure 17:** System Screen

# SECTION “D”
# DESCRIPTION OF INDIVIDUAL FUNCTIONS

## OPERATOR CONTROL STAND (cont.)

### Display Functions (cont.)

6) Alerts Screen (Fig. 18):

- **Charge pressure OK:** Indicates charge pressure is within the allowable limits
- **Fuel level OK:** Indicates fuel level is above the minimum setpoint
- **Hydraulic temperature OK:** Indicates if hydraulic temperature is within the allowable limits
- **Brake hydraulic pressure OK:** Indicates brake pressure is above the minimum setpoint
- **Joystick OK:** Indicates joystick is operating properly

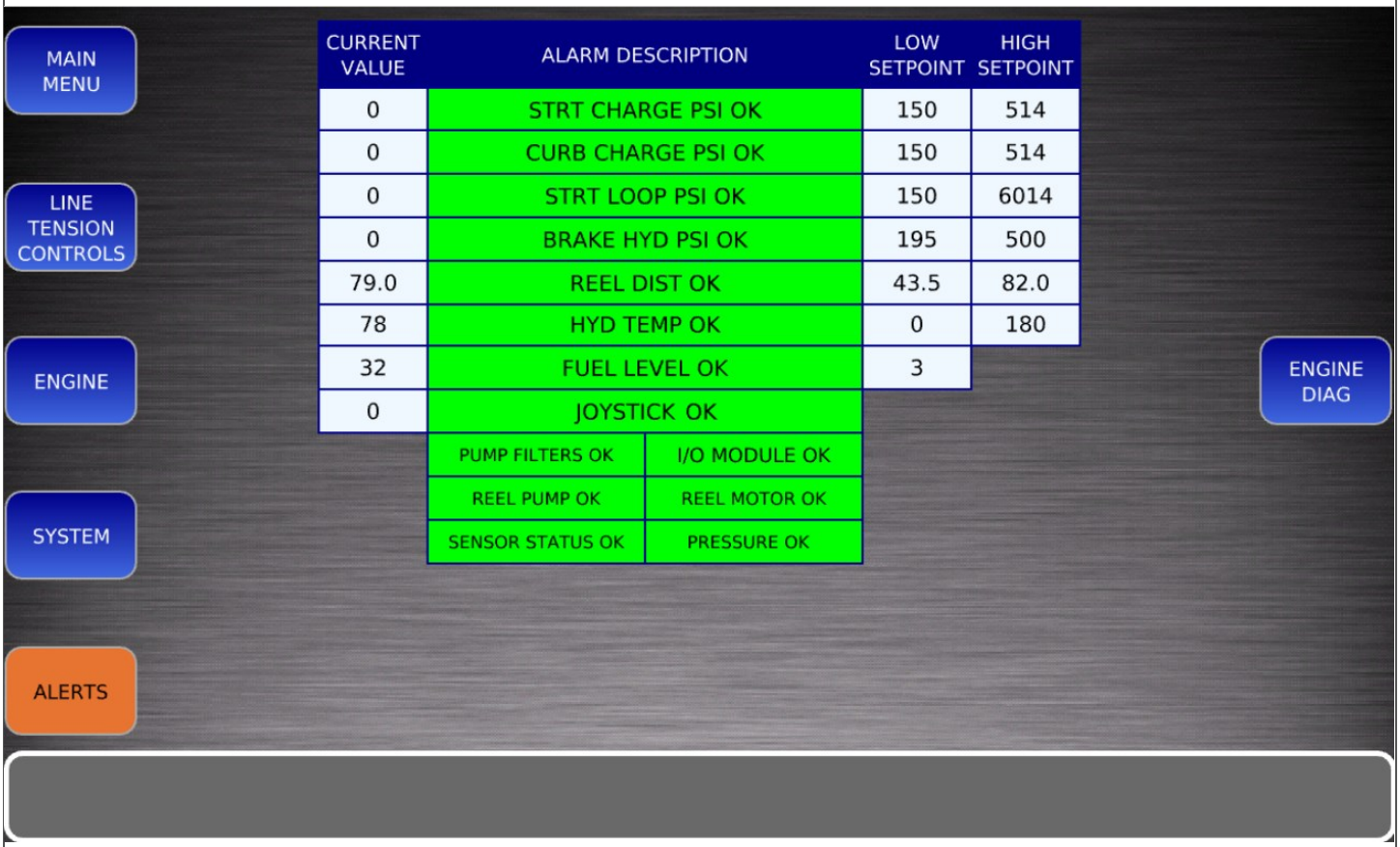


**Figure 18:** Alerts Screen

# SECTION “D”
# DESCRIPTION OF INDIVIDUAL FUNCTIONS

## OPERATOR CONTROL STAND (cont.)

### Display Functions (cont.)

7) Save Pull Data Screen (Fig. 19):

A) Provides instructions for how to download pull data information to a USB drive. Insert a USB drive into the USB port on the side of the control stand and press the download button on the display. Once the screen updates with complete remove the USB drive.

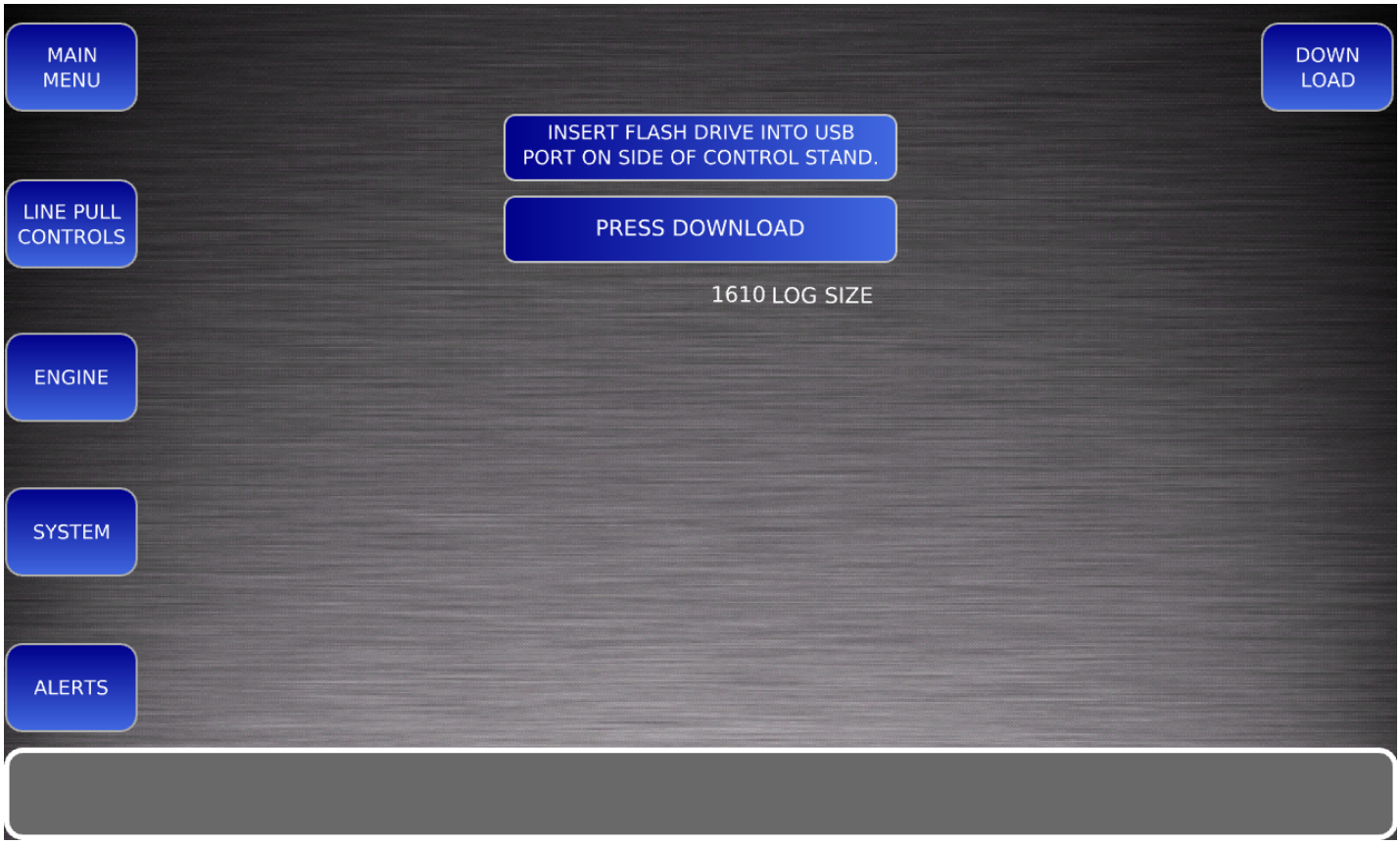


**Figure 19:** Save Pull Data Screen

# SECTION “E”
# OPERATIONS


| FIG | DESCRIPTION | PAGE # |
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| | FIELD SET UP | E-3 |
| | DAILY PREVENTATIVE MAINTENANCE | E-3 |
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| Figure 4...6 | HYDRAULIC PAYOUT | E-7 |
| | HAUL BACK PAYOUT | E-7 |

# SECTION “E”
# OPERATIONS

## TOWING PROCEDURES

Use a properly equipped and sized vehicle when towing this equipment. Always check to see that the fifth wheel hitch is secure and locked, air lines attached, and lighting/brake pigtail are properly fastened to tow vehicle. Jacks are in the retracted position and locked. Any loose equipment or objects must be removed, or tied down, so not to become a hazard while the unit is being transported. Before leaving the yard check brakes. Check running, turn, and brake lights on trailer. Tires should be inflated while cold for maximum payload capacity; tire pressure varies with tire sizes.

**Towing checklist:**

1) Fifth Wheel Hitch secure and locked (Fig. 2-A)
2) Air hoses attached (Fig. 1-A)
3) Lighting and brake Pigtail attached (Fig. 1-B)
4) Jacks in up and locked position (Fig. 2-B)
5) Any loose objects removed from unit
6) Check operation of brakes
7) Check lighting (turning, running, and brakes) (Fig. 1-C)
8) Tires and tires’ air pressure (Fig. 2-C)

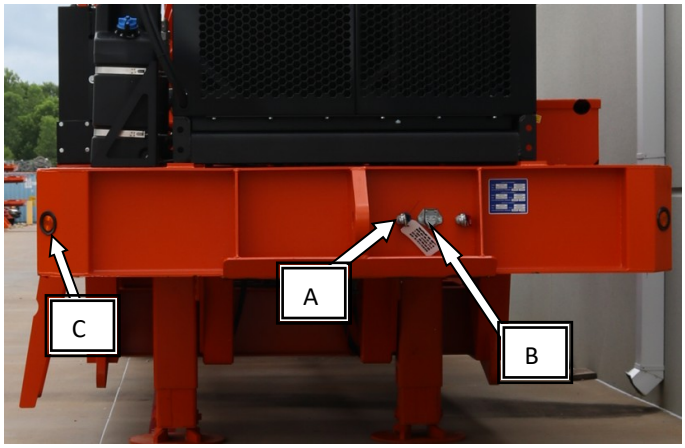


**Figure 1:** Trailer Front

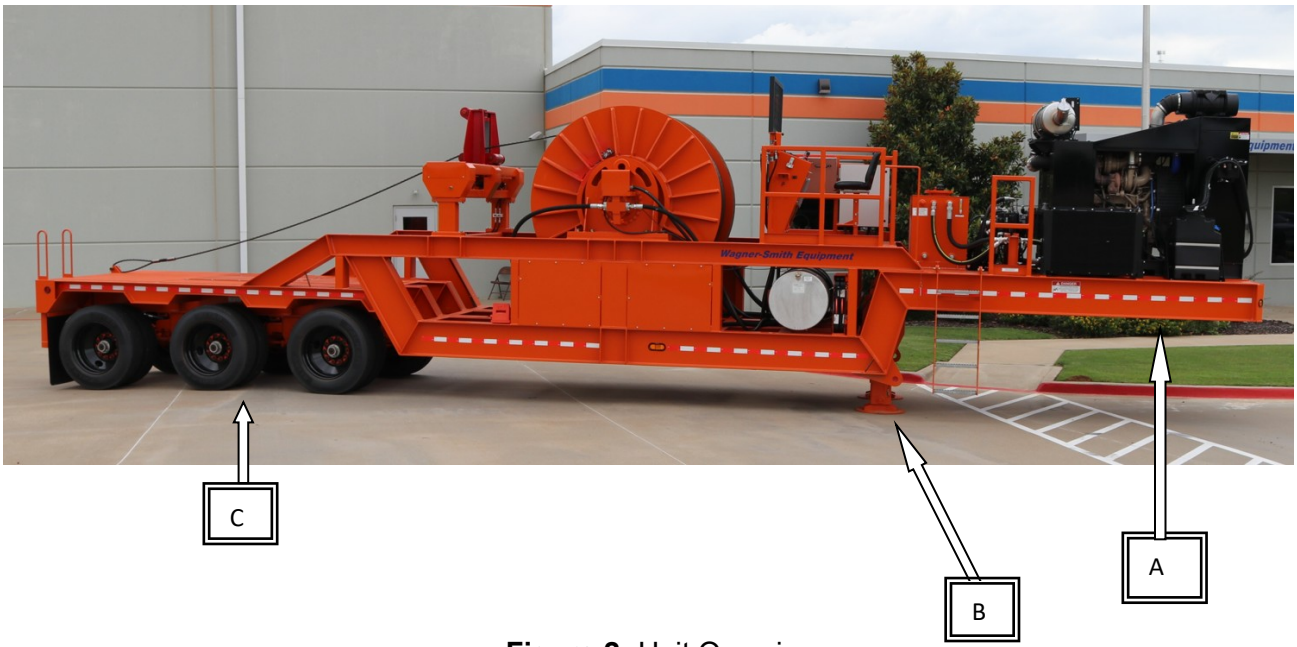


**Figure 2:** Unit Overview

# SECTION “E”
# OPERATIONS

## FIELD SETUP

Position the puller in line with the first pole or tower and a minimum one and a half (1-1/2) times the height of the pole or tower back from the base. (Example: If the utility pole or tower is 45 feet above the ground, the machine should be positioned approximately 65—75 feet (45 x 1.5 = 67.5) from the base of the pole.) This will give a good fleet angle from the stringing block to the puller and will help decrease the line pull. After you position the puller, anchor it securely. Stabilize and level the unit. **Ground the unit properly** to prevent the unit from becoming electrically energized and avoid operator injury. Each unit has grounding bars already welded to it for the proper additional grounding attachments. Unit should be grounded to IEEE or your company’s standard procedures.

### Field Setup Checklist:

1) Locate the unit on as level ground as possible.
2) Line it up with the conductor to be pulled.
3) Distance from the pole or tower should be a minimum of 1-1/2 times the height of the pole or tower.
4) Level the unit.
5) **Anchor unit securely** with anchors rated at or above the maximum rating of the machine.
6) **Ground unit** according to IEEE or your company’s standard procedures.

## DAILY PREVENTATIVE MAINTENANCE

Perform daily maintenance to ensure that the machine operates as expected and at its rated values.

**1) Before starting the engine, check:**
   a) Engine oil level.
   b) Engine fuel level.
   c) Hydraulic system oil level.
   d) The hydraulic oil shutoff valve should be open, turned fully counter-clockwise.
   e) The hydraulic oil system pressure gauge should read zero.

**2) After starting the engine, check:**
   a) Charge pressure gauge reads around 350 psi at 2,100 RPM.
   b) Brake control pressure gauge reads 350 to 375 psi at 2,100.
   c) Check for any fluid leaks.
   d) If there are any unusual noises, shut down engine immediately.

**3) After engine shutdown, check:**
   a) Inspect for fluid leaks.
   b) Inspect for loose bolts, pins, etc.
   c) Hydraulic oil reservoir filler cap in place and secure.

# SECTION “E”
# OPERATIONS

## PULLING

Before starting the engine please read Section D—Description of Individual Functions. A thorough understanding of each individual function of this unit will be of great value, and particularly so to the inexperienced operator. The unit has been designed to be simple to operate and to provide the utmost in safety and operating convenience.

A) **DO NOT** allow contamination of any kind (dirt, water, etc.) to enter the hydraulic fluid reservoir.
B) **DO NOT** operate the unit without adequate grounding. Grounding lugs are provided for this purpose.
C) When starting the engine, the reel drive joystick should be in the neutral (center) position, and the system brake should be applied.

This unit is designed to pull the conductor against the resistance of a tensioner that is at the opposite end of the set-up. The PULLER handles the speed and pull of the conductor and the TENSIONER on the other end is in control of the amount of sag or tension on the conductor. This is accomplished by increasing or decreasing brake or hydraulic pressure on the bullwheels or drums. The tensioner can slow down or stall out a properly adjusted puller at any time during a pull.

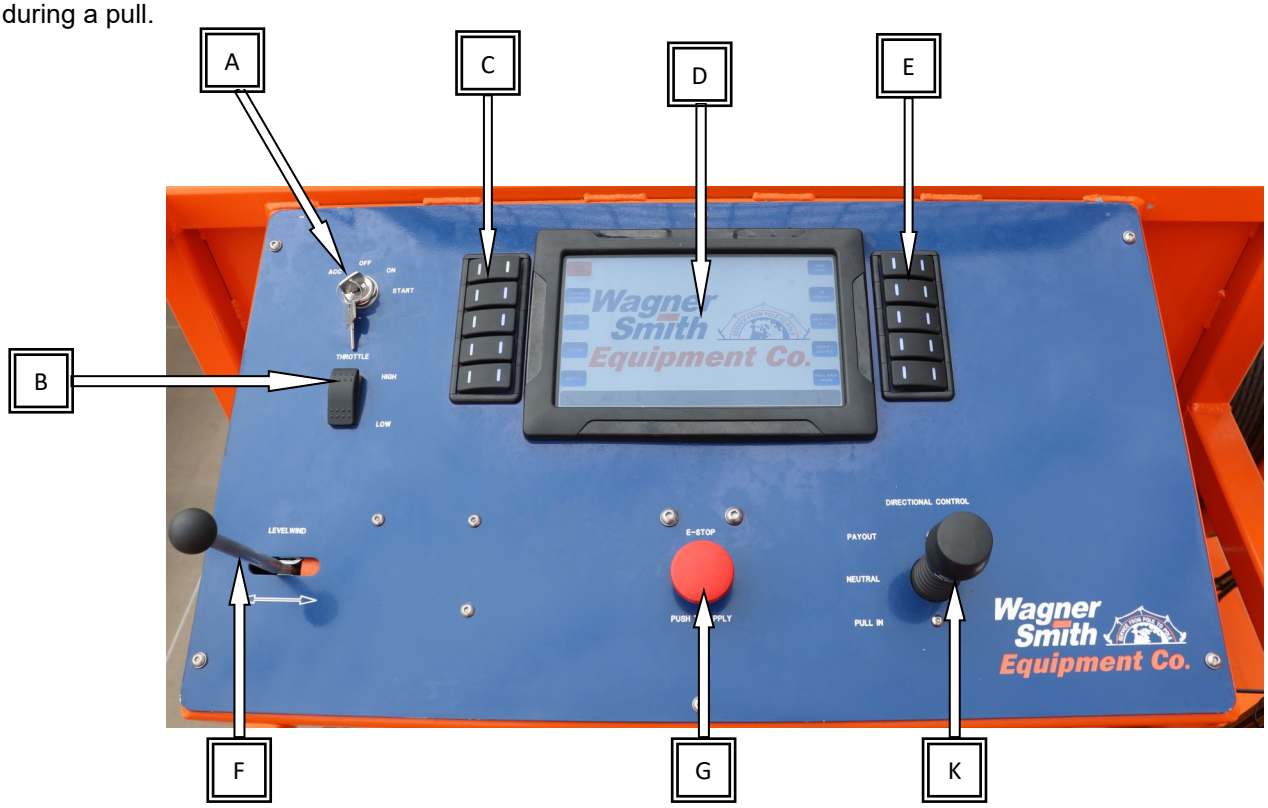


**Figure 3:** Controls

# SECTION “E”
# OPERATIONS

## PULLING (cont.)

To prepare for pulling, perform the procedures outlined in the field set up paragraph (page E-3). Apply the system brake (Fig. 3D) before starting the engine. Allow the system adequate time to warm up. To start the pull do the following:

A) Bring the engine RPM to high idle (Fig. 3B).
B) Set the desired maximum line pull tension.

**NOTE: Always adjust your starting and operating line pull force lower to allow the puller to stall out before damaging, over-stressing the conductor, or utility poles if the pulling rope or conductor gets hung up. This machine adjusts pressure so that the line force and speed can be maintained at any diameter of the reel. If the pulling load of the unit is larger than the input pull force the unit will meet, that load but will slow down.**

**NOTE: Before completing the next step, verify the system brake is set to avoid accidental drum rotation and injury while inserting the pulling rope into the levelwind.**

Verify the cable is strung through the levelwind head. The levelwind helps wind the pulling rope onto the pulling reel in an even manner. If needed, adjust the levelwind head so that it lines up with the first groove on the pulling reel.

When ready to pull, signal the tensioner and release the system brake (Fig. 3D). Pull the joystick (Fig. 3E) slightly into the pull-in position. The reel will start to rotate and take up the slack in the line. It is recommended that you pull slowly until the conductor is through the first set of blocks and then signal or radio the tensioner to see if everything is okay before increasing the line speed. If the hydraulic pressure is not high enough the unit will stall. If this happens, increase the line pull setting until the reel starts to rotate and then further increase the line pull as needed. This will allow the puller to stall before damaging a tower or over stressing the conductor in case the line becomes snagged. The line speed is directly proportional to the distance the joystick is moved toward the pull-in position.

As the reel fills with rope, the line speed will remain relatively constant. The pressure will remain constant as well up to a predetermined reel diameter after which the pressure will begin to increase as normal operation. The preset line pull can be monitored at anytime during a pull by using the side buttons or key pad to increase or decrease values. This will allow a safety margin between the actual line pull required and the maximum allowable line pull.

If the unit is stopped during a pull it may be necessary to increase the line pull slightly. Always operate near the minimum line pull required to make the pull.

As the pulling rope and conductor comes to the last span and/or last stringing block, signal or radio the tensioner that you are slowing down and stopping. The puller will slow down by moving the joystick toward neutral. Once stopped apply the palm brake (Fig. 3D). The TENSIONER will increase the pressure on the brake so the bullwheels will not rotate or pay-out any more conductor. To pull the conductor up to sag the PULLER will release the palm brake and increase the line pull until the reel starts to rotate. Once the conductor is to sag and the reel comes to a stop apply the palm brake and put the joystick into neutral. This should hold the conductor so it can be caught off and terminated.

# SECTION “E”
# OPERATIONS

## PULLING (cont.)

**Summary for Puller**

1) Verify the field set-up has been properly completed
2) Apply palm brake
3) Start engine
4) Set the Line Pull
   A) Increase the engine RPM to high idle
   B) Set the desired maximum line pull tension
6) Signal or radio the tensioner that the pull is starting
7) Release the palm brake
8) Move the joystick slightly into the pull-in position
9) Adjust line pull value if the unit stalls or slows down accordingly
10) As the pull ends, slow down by slowly pushing the joystick toward the neutral position. After the reel stops apply the palm brake.

# SECTION “E”
# OPERATIONS

## HYDRAULIC PAYOUT

Before starting payout, ensure that the field set-up procedure has been completed and that the appropriate reel has been engaged. Apply the hydraulic brake and start the engine and allow for the engine and hydraulic oil to reach operating temperatures. Switch engine to high idle and release the palm brake. Move the electronic joystick slightly into payout position to payout the wire rope. The electronic joystick controls the speed for payout.

## HAUL BACK PAYOUT

The haul back mode of the puller is to help with installing the pulling rope through the stringing blocks.

To use this mode:

1. Make sure the palm brake is depressed
2. Turn on the engine and set the speed to high idle
3. Select ‘Haul Back Mode’
4. Set a pressure %
5. Release the brake
6. Pull in the joystick

# SECTION “F”
# ROUTINE MAINTENANCE


| FIG | DESCRIPTION | PAGE # |
|---|---|---|
| Figure 1 | BEFORE STARTING ENGINE | F-3 |
| | AFTER STARTING ENGINE | F-4 |
| | 50 HOUR INSPECTION | F-5 |
| | 100 HOUR INSPECTION | F-5 |
| Figure 2 | HYDRAULIC SYSTEM | F-6 |
| | COMPONENT SERVICING | F-6 |

# SECTION “F”
# ROUTINE MAINTENANCE


The Wagner-Smith Equipment Company Model T-1DP-2200-FT4 is a self contained trailer mounted drum type puller. This unit must be given regular care and operated in accordance with the instructions.

It is imperative that the advanced hydraulic system incorporated by this design be kept clean. It is suggested that a good periodic preventative maintenance schedule be followed in maintaining this unit.

Upon receipt, this unit should be checked for damage from shipping. In addition, the following checks listed in this section should be made.

# SECTION “F”
# ROUTINE MAINTENANCE

**Before Starting Engine:**

1) Check all mounting bolts and nuts for tightness
2) Check hydraulic system oil level
   A) Oil level must be at “full” mark before daily startup.
   B) Operating oil temperature should range between 80°F-180°F
3) Check that hydraulic reservoir shutoff valve is fully open

   **NOTE: These valves are tie wrapped from the factory in the full open position to prevent accidental closing.**

4) Check fuel gauge (turn key switch to “ON” position to check gauge on display)
5) System pressure gauge should read zero psi
6) Refer to Appendix A in this manual for John Deere’s “Daily Prestarting Checks”.

**Figure 1:** Hydraulic Oil Level Gauge W/ Temp Indicator & Shutoff Valves

# SECTION “F”
# ROUTINE MAINTENANCE

**After Starting Engine:**

1) Check for any fuel leaks.
2) Check for any hydraulic oil leaks.
3) Check hydraulic functions:
   A) Switch engine to high idle (2,100 RPM), apply hydraulic e-brake:
      1. With joystick in neutral position, system pressure gauge should read approximately 325 psi
      2. With joystick in pay-out position, system pressure gauge should read approximately 2,000 psi
      3. With joystick in pay-in position, system pressure gauge should read approximately 6,000 psi
   B) After completing step A, release the hydraulic e-brake:
      1. Slightly place the joystick in the pull-in position. The reel should slowly rotate in the pull-in direction. Moving the joystick further in the pull-in position should increase the reel speed in the pull-in direction.
         a) Verify charge pressure gauge on display reads approximately 350 psi. When the pressure drops to 250 psi the filter must be serviced.
      2. Return the joystick to the neutral position. The reel should stop rotating, if it doesn’t please contact Wagner-Smith Equipment Co.
      3. Slightly place the joystick in the pay-out position. The reel should slowly rotate in the pay-out direction. Moving the joystick further in the pay-out position should increase the reel speed in the pay-out direction.

# SECTION “F”
# ROUTINE MAINTENANCE

**Daily Inspection Checklist:**

1) Before starting the engine check:
    a) Engine oil level.
    b) Engine fuel level.
    c) Hydraulic system oil level.
    d) The hydraulic oil shutoff valve is open, turned full clockwise.
    e) Hydraulic oil system pressure gauge reads zero.
2) After starting the engine check:
    a) Charge pressure gauge reads 350 psi and brake release pressure gauge reads 390-410 psi when engine is at high idle (2,100 RPM) when the brake is applied and the joystick in pull-in position.
    b) Check for any fluid leaks.
    c) If there are any unusual noises, shut down engine immediately.
3) After engine shutdown check:
    a) For any fluid leaks.
    b) Loose nuts and bolts.
    c) Hydraulic oil reservoir filler cap in place and secure.

## 50 HOUR INSPECTION

1) Check for water in hydraulic oil (water will cause the oil to look milky).

## 100 HOUR INSPECTION

1) Perform 50 hour inspection.
2) During first 100 hours of operation replace the charge pump filter located on the pump.
3) During first 100 hours of operation refer to Appendix A of this manual for John Deere’s “Break-In Service”.

# SECTION “F”
# ROUTINE MAINTENANCE

## HYDRAULIC SYSTEM

1) Change hydraulic oil and hydraulic oil filters when filter gauges display in the red:
   a) It may be necessary to change the fluid more frequently than the above intervals if the fluid becomes contaminated with foreign matter (dirt, water, grease, etc.) or if the fluid as been subjected to temperature levels greater than the recommended maximum. Never reuse fluid.
   b) The filters should be changed whenever the fluid is changed or whenever the filter indicators shows that it is necessary to change the filters. Hydraulic fluid for all Wagner-Smith hydraulic systems is **Chevron Rando HDZ ISO Grade 46**. Consult Wagner-Smith before using any other hydraulic fluids.

   **CAUTION: Do not mix hydraulic fluids.**

**Figure 2:** Hydraulic Filter

## COMPONENT SERVICING

1) Refer to Appendix A John Deere Engine for all maintenance needs of the engine. It is important that the maintenance schedule provided by the engine manufacturer is followed to ensure peak performance.

# APPENDIX A
# JOHN DEERE ENGINE


| FIG | DESCRIPTION | PAGE # |
|---|---|---|
| | BREAK-IN SERVICE | 20-1 |
| | EXHAUST FILTER CLEANING | 25-7 - 9 |
| | LUBRICATION AND MAINTENANCE | 30-1 - 60-5 |
| | ENGINE LAMPS | |

## Break-In Service

Extra care during the first 100 hours of operation results in satisfactory long-term engine performance and life.

1. This engine is factory-filled with John Deere Break-In Plus™ oil. Operate the engine at heavy loads with minimal idling during the break-in period.
2. If the engine has significant operating time at idle, constant speeds, and/or light load usage, or additional oil is required in the first 100 hour period, a longer break-in period may be required. In these situations, an additional 100 hour break-in period is recommended using a new change of John Deere Engine Break-In Plus Oil and a new John Deere oil filter.
3. Check oil more frequently during engine break-in period. If oil must be added during this period, John Deere Break-In Plus Oil is preferred. See John Deere Break-In Plus™ Engine Oil — Interim Tier 4, Final Tier 4, Stage IIIB, and Stage IV in the Fuels, Lubricants, and Coolants Section for other oils allowed.

**IMPORTANT: DO NOT fill above the top of the crosshatch pattern or the FULL mark, whichever is present. Oil levels anywhere within crosshatch are considered in the acceptable operating range. John Deere Break-In Plus engine oil should be used to make up any oil consumed during the break-in period.**

4. During the first 20 hours, avoid prolonged periods of engine idling. If engine idles longer than 5 minutes, stop engine.
5. During the initial operation of a new or rebuilt engine with Break-In Plus, change the oil and filter between a minimum of 100 hours and a maximum of up to 500 hours (B). (Top-load oil filter illustrated.) (See Changing Engine Oil and Replacing Filter in the Lubrication & Maintenance — 500 Hours/12 Months Section.) Fill crankcase with seasonal viscosity grade oil. (See Diesel Engine Oil — Interim Tier 4, Final Tier 4, Stage IIIB, and Stage IV in the Fuels, Lubricants, and Coolants Section.)

*NOTE: Some increase in oil consumption may be expected when low viscosity oils are used. Check oil levels more frequently.*

*If temperature is below 0 °C (32 °F), it may be necessary to use cold weather starting aids (See Cold Weather Operation in the Engine Operation Section).*

*If air temperature is below 0 °C (32 °F), use an engine block heater.*

6. Watch coolant temperature gauge closely during engine operation. If coolant temperature rises above 113 °C (235 °F), the engine reduces power automatically. Unless temperature drops quickly, stop the engine and determine the cause before resuming operation.

   Monitor oil pressure and coolant temperature to ensure that they are within specification.

| Specification | |
|---|---|
| Engine —Oil Pressure at Full Load Rated Speed | 370 kPa (3.70 bar) (54 psi) |
| Minimum Oil Pressure at Low Idle | 150 kPa (1.50 bar) (22 psi) |
| Coolant Temperature Range | 85°–97 °C (185°–207 °F) |

7. Check belt for proper seating in pulley grooves.

*Break-In Plus is a trademark of Deere & Company*

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## Generator Set (Standby) Applications

To assure that your engine will deliver efficient standby generator operation when needed, start engine and run at rated speed (with 50%—70% load) for 30 minutes every 2 weeks. DO NOT allow engine to run for an extended period of time with no load.

Biodiesel fuel is not recommended for standby equipment that can have minimal fuel consumption (such as standby generators, fire protection, etc.). For standby applications, use only petroleum based diesel fuel with John Deere approved fuel conditioners and additives. For fuel conditioners and additives, check with your local John Deere dealer.

Petroleum diesel fuel should not be stored in service tanks longer than two years even when using fuel additives. See your fuel distributor or John Deere dealer for more information.

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## Passive Regeneration

Periodically, the exhaust filter experiences higher temperature levels simply through the engine operating at higher loads. During these times, the higher exhaust temperature cleans a small amount of soot build-up in the exhaust filter. Conversely, unnecessary idling can cause additional exhaust filter soot to accumulate. For the best possible engine operation which requires the least amount of operator interaction, work engine at higher load conditions whenever possible and keep idling to a minimum.

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## Automatic (AUTO) Exhaust Filter Cleaning

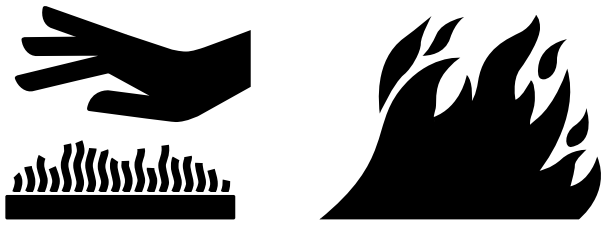
*NOTE: Operator display icons and procedures can vary in other applications. The information contained in this section specifically applies to only OEM engines. If you are operating a vehicle, please see the vehicle operator manual for exhaust filter cleaning and handling information and procedures.*

Operating the engine in AUTO Mode allows the ECU to perform intelligent exhaust filter cleaning as required. The Exhaust Filter Cleaning Indicator will illuminate when the system is actively performing an exhaust filter cleaning. During this process, the doser will inject small amounts of fuel into the exhaust stream to assist in cleaning the exhaust filter. When the exhaust filter cleaning process has completed its cycle, the cleaning indicator will atomically turn off.

**CAUTION:**

**Servicing machine or attachments during exhaust filter cleaning can result in serious personal injury. Avoid exposure and skin contact with hot exhaust gases and components.**

**During auto or manual/stationary exhaust filter cleaning operations, the engine will run at elevated idle and hot temperatures for approximately 30 minutes. Exhaust gases and exhaust filter components reach temperatures hot enough to burn people, ignite, or melt common materials.**



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**CAUTION: If the machine is not in a safe location for elevated exhaust temperatures, move the machine to a safe location and check for adequate fuel level before beginning the exhaust filter cleaning process. Any PTO driven devices (if equipped) should be powered off or disconnected.**

If the machine is not able to be moved into a safe location, the operator should temporarily disable auto exhaust filter cleaning (see Disable Exhaust Filter Cleaning later in this section). If the machine is located in a safe location, the auto mode should always be enabled.

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## Manual/Parked Exhaust Filter Cleaning

*NOTE: Operator display icons and procedures can vary in other applications. The information contained in this section specifically applies to only OEM engines. If you are operating a vehicle, please see the vehicle operator manual for exhaust filter cleaning and handling information and procedures.*

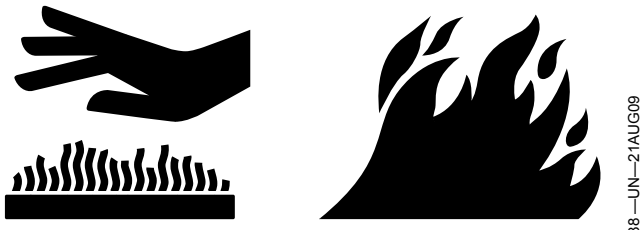
Manual/Parked Exhaust Filter Cleaning is an automated process initiated at the request of the operator. This process allows the system to clean the exhaust filter when the operator previously needed to engage the disable exhaust filter cleaning because of specific conditions. During the process the engine speed will be controlled by the ECU and the machine must remain parked to complete the procedure. Time required for the Manual/Parked Exhaust Filter Cleaning process is dependent upon the level of exhaust filter restriction, ambient temperatures, and current exhaust gas temperature.

Complete cleaning times will vary on several criteria including fuel type, oil type, duty cycle, and the number of previously aborted exhaust filter cleaning requests. Average time for a standard cleaning can range from 20-50 minutes or longer.

**CAUTION:**

**Servicing machine or attachments during exhaust filter cleaning can result in serious personal injury. Avoid exposure and skin contact with hot exhaust gases and components.**

**During auto or manual/parked exhaust filter cleaning operations, the engine will run at elevated idle and hot temperatures for approximately 30 minutes. Exhaust gases and exhaust filter components reach temperatures hot enough to burn people, ignite, or melt common materials.**



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**CAUTION: Always park the machine in a safe location and check for adequate fuel level before beginning the exhaust filter cleaning process. Any PTO driven devices (if equipped) should be powered off or disconnected.**

The exhaust filter indicator will remain off when Filter Cleaning is complete. If you are not returning the machine to service immediately after the procedure, allow the engine and the exhaust filter time to return to normal operating temperature before stopping engine. At any time during the parked procedure, the process can be canceled

Avoid disabling the cleaning procedure unless absolutely necessary. Repeated disabling or ignoring prompts to perform a manual/parked cleaning procedure will cause additional engine power limitations and can eventually lead to dealer required service.

Utilize Exhaust Filter Cleaning AUTO mode to avoid additional service.

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## Disable Exhaust Filter Cleaning

*NOTE: Operator display icons and procedures can vary in other applications. The information contained in this section specifically applies to only OEM engines. If you are operating a vehicle, please see the vehicle operator manual for exhaust filter cleaning and handling information and procedures.*

*NOTE: Disabling the exhaust filter cleaning request is not preferred. Disable the automatic exhaust filter cleaning only when necessary. Whenever possible, cleaning should be allowed and the diagnostic gauge should be left in the auto mode. When left in auto mode, soot buildup in the exhaust filter system will be at a minimum.*

*NOTE: When AUTO or PARKED/MANUAL cleaning is enabled, the exhaust temperature may be high under no load or light load conditions at certain times during the exhaust filter cleaning cycle. Disable exhaust filter cleaning in conditions where it may be unsafe for elevated exhaust temperatures.*

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## Exhaust Filter Service Required

The exhaust filter cleaning procedures listed earlier in this section clean the soot from your exhaust filter. The exhaust filter also traps ash deposits over time which are not removed during an exhaust filter cleaning. When the exhaust filter has run several thousand hours, these ash deposits can restrict engine performance due to increased back pressure. To correct this situation, replace the exhaust filter or have the exhaust filter cleaned in specialized equipment. See Diesel Particulate Filter Maintenance and Service in the Aftertreatment Section.

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## Required Emission-Related Information

**Service Provider**

A qualified repair shop or person of the owner's choosing may maintain, replace, or repair emission control devices and systems with original or equivalent replacement parts. However, warranty, recall, and all other services paid for by John Deere must be performed at an authorized John Deere service center.

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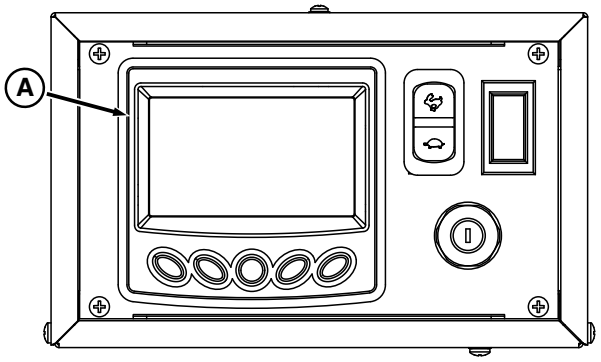
## Observe Service Intervals

In an emergency, where an authorized John Deere service location is not available, repairs may be performed at any available service establishment, or by the owner, using any replacement part, provided such parts are warranted by their manufacturer to be the equivalent of John Deere parts in performance and durability and the failure does not arise from the owner's failure to perform required maintenance.

Using hour meter (A) as a guide, perform all services at the hourly intervals indicated on following pages. At each scheduled maintenance interval, perform all previous maintenance operations in addition to the ones specified. Keep a record of hourly intervals and services performed, using charts provided in Lubrication and Maintenance Records section.

**IMPORTANT: Recommended service intervals are for normal operating conditions. Perform maintenance at interval which occurs first, for example, either at 500 hours of operation or every 12 months. Service more often if engine operated under adverse conditions. Neglecting maintenance can result in failures or permanent damage to the engine.**




*Hour Meter On Instrument Panel*

**A—Hour Meter**

Perform all services at the hourly intervals. Record the services performed in the Lubrication and Maintenance Records Section. When scheduled service at any hourly level is performed, also perform all subordinate hourly level services.

| Main Service | Subordinate Services | | | |
|---|---|---|---|---|
| | 500 Hours | 1500 Hours | 3000 Hours | 6000 Hours |
| 500 Hours | X | | | |
| 1500 Hours | X | X | | |
| 3000 Hours | X | X | X | |
| 6000 Hours | X | X | X | X |

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## Use Correct Fuels, Lubricants, and Coolant

**IMPORTANT: Use only fuels, lubricants, and coolants meeting specifications outlined in Fuels, Lubricants, and Coolant Section when servicing your John Deere Engine.**

Consult your John Deere Servicing Distributor or your nearest John Deere Parts Network for recommended fuels, lubricants, and coolant. Also available are necessary additives for use when operating engines in tropical, arctic, or any other adverse conditions.


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## Lubrication and Maintenance Service Interval Chart

| | Lubrication and Maintenance Service Intervals | | | | | | |
|---|---|---|---|---|---|---|---|
| Item | Daily/Before Every Startup | 500 Hours of Operation or Every 12 Months | 1500 Hours of Operation | 1500 Hours of Operation or Every 36 Months | 3000 Hours of Operation or Every 36 Months | 6000 Hours of Operation or Every 72 Months | As Required |
| Check Engine Oil | • | | | | | | |
| Check Coolant Level | • | | | | | | |
| Drain Water From Fuel Filters | • | | | | | | |
| Check Air Cleaner Dust Valve Restriction Indicator Gauges | • | | | | | | |
| Perform Inspection of Engine Compartment | • | | | | | | |
| Service Fire Extinguisher | | • | | | | | |
| Service Battery | | • | | | | | |
| Change Engine Oil And Replace Oil Filter [a] [b] | | • | | | | | |
| Check Coolant Pump Weep Hole | | • | | | | | |
| Check Open Crankcase Vent (OCV) System | | • | | | | | |
| Replace Fuel Filter Elements | | • | | | | | |
| Check Belt Tensioner and Belt Wear | | • | | | | | |
| Check Cooling System | | • | | | | | |
| Pressure Test Cooling System | | • | | | | | |
| Check Engine Speeds | | • | | | | | |
| Check Engine Mounts | | • | | | | | |
| Check Engine Ground Connection | | • | | | | | |
| Change Open Crankcase Ventilation (OCV) Filter[c] | | | • | | | | |
| Change DEF Dosing Unit Filter | | | | • | | | |
| Replace DEF Tank Header Suction Screen | | | | • | | | |
| Adjust Engine Valve Clearance | | | | | • | | |
| Test Glow Plugs for Continuity | | | | | • | | |
| Flush and Refill Cooling System | | | | | | • | |
| Test Thermostats | | | | | | • | |
| Drain Water From Fuel Filters When Alarm Sounds | | | | | | | • |
| Add Coolant | | | | | | | • |
| Clean DEF Tank | | | | | | | • |
| Pre-Start Cleaning Guide | | | | | | | • |
| Service Air Cleaner Filter Elements | | | | | | | • |
| Clean Diesel Particulate Filter [c] | | | | | | | • |
| Replace Alternator/Fan Belt | | | | | | | • |
| Check Fuses | | | | | | | • |
| Check Electrical Wiring and Connections | | | | | | | • |
| Check Air Compressors (If Equipped) | | | | | | | • |
| Check Refrigerant (A/C) Compressor (If Equipped) | | | | | | | • |
| Replace Aftertreatment DEF Dosing System Coolant Filter | | | | | | | • |

*[a] During the initial operation of a new or rebuilt engine with Break-In Plus, change the oil and filter between a minimum of 100 hours and a maximum of up to 500 hours.*

*[b] Service intervals depend on sulfur content of the diesel fuel, oil pan capacity, and the oil and filter used. (See Diesel Engine Oil and Filter Service Intervals in the Fuels, Lubricants, and Coolants Section.)*

*[c] Actual service should take place when the dash indicator light comes on or as indicated by the diagnostic gauge.*

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## Daily Prestarting Checks

Check the following items BEFORE STARTING THE ENGINE for the first time each day:

- Check engine oil level on dipstick. Fill cap/dipstick may be located on left or right side, depending on application. Add as required, using seasonal viscosity grade oil. (See Diesel Engine Oil — Interim Tier 4, Final Tier 4, Stage IIIB, and Stage IV in the Fuels, Lubricants, and Coolants Section for oil specifications.)

  *NOTE: Wipe all fittings, caps, and plugs before performing any maintenance to reduce the chance of system contamination.*

- Check the coolant level when engine is cold. Fill radiator or surge tank with proper coolant if level is low. (See Adding Coolant in the Service As Required Section.) Check overall cooling system for leaks.
- Check radiator for leaks and trash buildup.

  *NOTE: It is normal for a small amount of coolant to weep from the coolant pump weep hole, especially as the engine cools down and parts contract. If enough coolant weeps from the engine where coolant drips from the engine, this may indicate the need to replace the coolant pump seal. Contact your engine distributor or servicing dealer for repairs.*

- Check fan, alternator, and accessory drive belts for cracks, breaks or other damage.
- Loosen water drain valve on each fuel filter all the way so that the valve opens to drain water and debris as needed. Retighten valves securely.

  *NOTE: Any water in fuel is drained into the bottom of the fuel filters. The operator is signaled by an amber indicator on the instrument panel. To service, see Drain Water From Fuel Filters in the Service As Required Section.*

- Squeeze the automatic dust unloader valve (if equipped) on air cleaner assembly to clear away any dust buildup.
- Check air intake restriction indicator gauge and service air cleaner as required (if equipped).
- Check air intake system hoses and connections for cracks and loose clamps.
- Inspect the engine compartment. Look for fluid leaks, worn fan and accessory drive belts, loose connections, and trash buildup. Remove trash buildup and have repairs made as needed.

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## Servicing Fire Extinguisher

A fire extinguisher (A) is available from your authorized servicing dealer or engine distributor.

Read and follow the instructions which are packaged with it. The extinguisher should be inspected at least every 500 hours of engine operation or every 12 months. Once extinguisher is operated, no matter how long, it must be recharged. Keep record of inspections on the tag which comes with the extinguisher instruction booklet.

**A—Fire Extinguisher**


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*Fire Extinguisher*

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## Servicing Battery

**CAUTION: Battery gas can explode. Keep sparks and flames away from batteries. Use a flashlight to check battery electrolyte level.**

**Never check battery charge by placing a metal object across the posts. Use a voltmeter or hydrometer.**

**Always remove grounded NEGATIVE (—) battery clamp first and replace it last.**

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

**IMPORTANT: Wear personal Protective Equipment while doing any type of Battery check or replacement.**

1. On regular batteries, check electrolyte level. Fill each cell to bottom of filler neck with distilled water.

*NOTE: Low-maintenance or maintenance-free batteries should require little additional service. However, electrolyte level can be checked by cutting the center section of decal on dash-line, and removing cell plugs. Fill each cell to bottom of filler neck with distilled water.*

2. Keep batteries clean by wiping them with a damp cloth. Keep all connections clean and tight. Remove any corrosion, and wash terminals with a solution of 1 part baking soda and 4 parts water. Tighten all connections securely.

TS204 —UN—15APR13

*Exploding Battery*

*NOTE: Coat battery terminals and connectors with a mixture of petroleum jelly and baking soda to retard corrosion.*

3. Keep battery fully charged, especially during cold weather. If a battery charger is used, turn off charger before connecting charger to battery(ies). Attach POSITIVE (+) battery charger lead to POSITIVE (+) battery post. Then attach NEGATIVE (—) battery charger lead to a good ground.

**Continued on next page**

ZE59858,0000016 -19-28JUL14-1/2

**CAUTION: Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, eat holes in clothing, and cause blindness if splashed into eyes.**

**Avoid the hazard by:**

1. **Filling batteries in a well-ventilated area.**
2. **Wearing eye protection and rubber gloves.**
3. **Avoiding breathing fumes when electrolyte is added.**
4. **Avoiding spilling or dripping electrolyte.**
5. **Using proper jump start procedure.**

**If you spill acid on yourself:**

1. **Flush your skin with water.**
2. **Apply baking soda or lime to help neutralize the acid.**
3. **Flush your eyes with water for 10—15 minutes. Get medical attention immediately.**

**If acid is swallowed:**

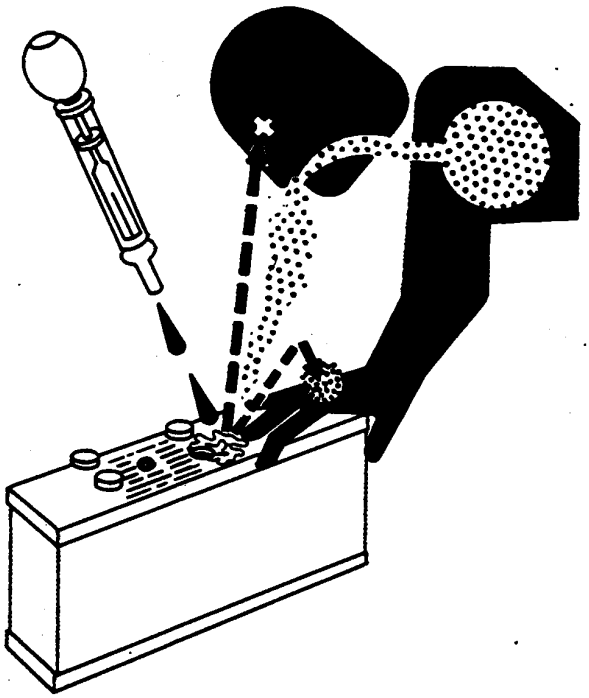
1. **Drink large amounts of water or milk.**
2. **Then drink milk of magnesia, beaten eggs, or vegetable oil.**
3. **Get medical attention immediately.**

In freezing weather, run engine at least 30 minutes to ensure thorough mixing after adding water to battery.

Replacement battery(ies) must meet or exceed the following recommended capacities[1] at -18 °C (0 °F):

| Specification | |
|---|---|
| 12-Volt System—Minimum Battery Capacity—Cold Cranking Amps | 640 Minimum |
| Reserve Capacity (Minutes) | 285 Minimum |
| 24-Volt System—Minimum Battery Capacity—Cold Cranking Amps | 570 Minimum |
| Reserve Capacity (Minutes) | 275 Minimum |

*[1] Total recommended capacity based on batteries connected in series or parallel.*



TS203 —UN—23AUG88

*Sulfuric Acid*

ZE59858,0000016 -19-28JUL14-2/2

## Changing Engine Oil and Replacing Filter

**IMPORTANT: Changing engine oil and filter every 500 hours or 12 months depends on the following requirements:**

- **Engine equipped with an oil pan that allows capacity for this extended drain interval.**
- **Use of premium oil John Deere Plus-50, API CJ-4, ACEA E9, or ACEA E6.**
- **Perform engine oil analysis to determine the actual extended service life of API CJ-4, ACEA E9, or ACEA E6 oils.**
- **Use of the approved John Deere oil filter.**
- **Use of Ultra Low Sulfur Diesel (ULSD) fuel with sulfur content less than 0.0015% (15 mg/kg) is required.**

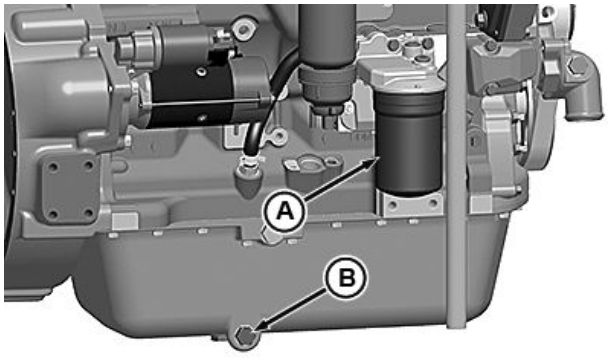
**The oil and filter change interval is reduced if ANY of the above listed requirements are not followed.**

*NOTE: During the initial operation of a new or rebuilt engine with Break-In Plus, change the oil and filter between a minimum of 100 hours and a maximum of up to 500 hours.*

*NOTE: Service intervals depend on sulfur content of the diesel fuel, oil pan capacity, engine power, and the oil and filter used. For more information, see Diesel Engine Oil and Filter Service Intervals in the Fuels, Lubricants, and Coolants Section.*

OILSCAN™ or OILSCAN PLUS™ is a John Deere sampling program to help you monitor machine performance and identify potential problems before they cause serious damage. OILSCAN™ and OILSCAN PLUS™ kits are available from your John Deere engine distributor or servicing dealer. Oil samples should be taken prior to the oil change. Refer to instructions provided with kit.

*OILSCAN is a trademark of Deere & Company.*
*OILSCAN PLUS is a trademark of Deere & Company.*




RG26252 —UN—30JUL14

*Oil Filter*

**A—Oil Filter** **B—Oil Pan Drain Plug**

**IMPORTANT: Engine oil and metal surfaces of engine may be hot to the touch after shutdown. Use care to prevent burns.**

1. Run engine approximately 5 minutes to warm up oil. Shut engine off.

*NOTE: Drain plug location may vary, depending on the application.*

2. Remove oil pan drain plug (B).
3. Drain crankcase oil from engine while warm.
4. Install oil pan drain plug with a new O-ring and tighten to specifications.

| Specification | |
|---|---|
| Oil Pan Drain Plug (Stamped Steel Pan)—Torque | 40 N·m (30 lb.-ft.) |
| Oil Pan Drain Plug (Cast Pan)—Torque | 48 N·m (35 lb.-ft.) |

**Continued on next page**

5. Remove oil filter. Discard oil filter.
6. Apply clean engine oil to the new filter at the inner (B) and outer (C) seals and to filter threads.
7. Wipe both sealing surfaces of the header (D and E) with a clean rag. Ensure notches in dust seal (F) are properly installed in the slots in the housing. Replace dust seal if damaged.

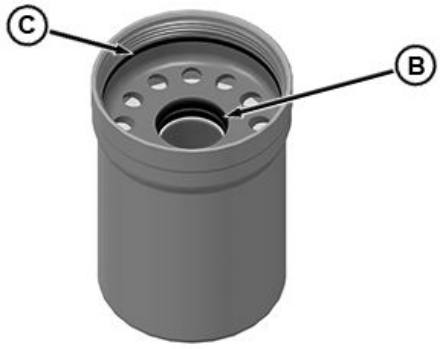
**IMPORTANT: When installing filter element, HAND TIGHTEN only. A filter wrench may be used for REMOVAL ONLY. Be sure notches in dust seal (F) are properly installed in the slots in the housing.**

8. Install and tighten oil filter by hand until firmly against dust seal (F). DO NOT apply an extra 3/4 to 1-1/4 turn after gasket contact, as done with standard filters.
9. Fill engine crankcase with correct John Deere engine oil through oil filler cap on either side of engine depending on engine application. (See Diesel Engine Oil — Interim Tier 4, Final Tier 4, Stage IIIB, and Stage IV in Fuels, Lubricants, and Coolant Section for determining correct engine oil.)

   To determine the correct oil fill quantity for your engine, see Engine Crankcase Oil Fill Quantities in the Specifications Section of this manual.

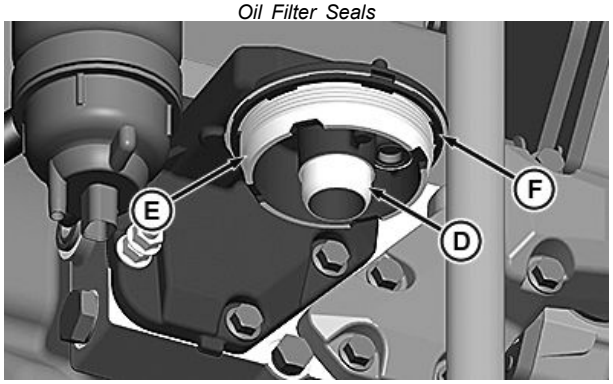
*NOTE: Crankcase oil capacity may vary slightly. ALWAYS fill crankcase within crosshatch marks on dipstick. DO NOT overfill.*

10. Start engine and run to check for possible leaks.
11. Stop engine and check oil level after 10 minutes. Oil level reading should be within crosshatch marks on dipstick.




RG26253 —UN—30JUL14

*Oil Filter Seals*




RG26254 —UN—30JUL14

*Oil Filter Header*

**B—Inner Seal**
**C—Outer Seal**
**D—Sealing Surface On Header**
**E—Sealing Surface On Header**
**F—Dust Seal**

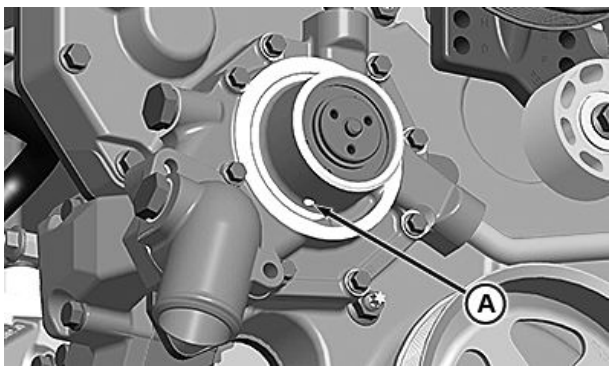
ZE59858,0000017 -19-11AUG14-2/2

## Visually Inspecting Coolant Pump

*NOTE: Cooling pump drive pulley is removed for clarity purposes.*

1. Coolant leakage indicates a damaged front seal. Inspect weep hole (A) for coolant leakage.
2. Replace complete coolant pump assembly if leakage is detected. A slight weeping of coolant is normal. If enough coolant leaks from the weep hole that it drips from the engine, the coolant pump assembly should be replaced. Individual repair parts are not available.

**A—Weep Hole**




RG26265 —UN—30JUL14

ZE59858,0000018 -19-30JUL14-1/1

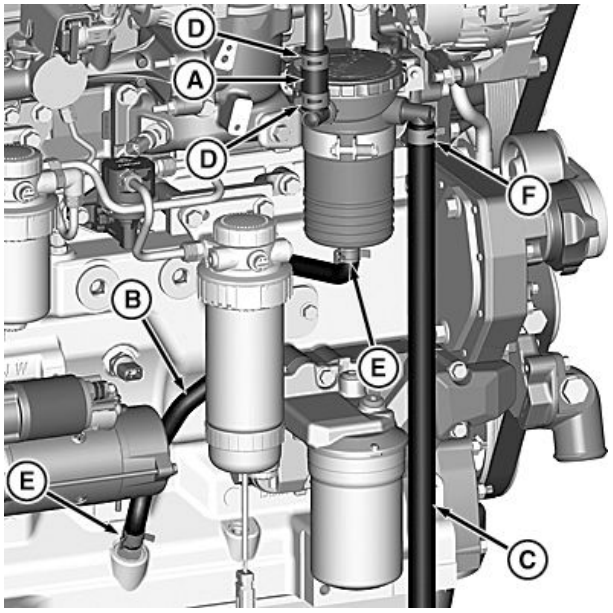
## Checking Open Crankcase Vent (OCV)

Inspect OCV hoses (A, B, and C) for worn, cracked, leaking, or bulging.

Check hose clamps (D, E, and F) for good clamp tension.

Replace any worn or damaged parts.

**A—OCV Inlet Hose**
**B—Air Outlet Hose**
**C—Oil Drain Hose**
**D—Clamp — Inlet Hose**
**E—Clamp — Oil Drain Hose**
**F—Clamp — Outlet Hose**




RG20672 —UN—11JUL11

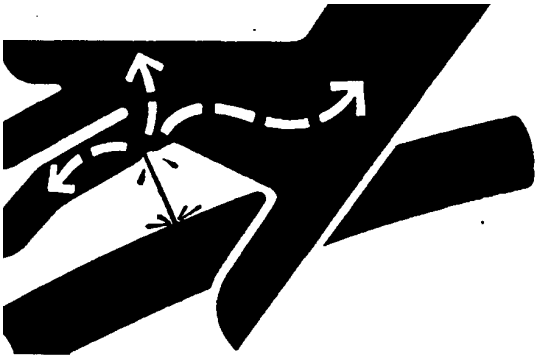
ZE59858,0000019 -19-30JUL14-1/1

## Removing and Installing Fuel Filters

Engines are equipped with dual fuel filters: a primary filter with water bowl, and a final filter. Both filters are replaced at the same 500 hour or 12 months interval.

**⚠ CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. To search for leaks use a piece of cardboard or paper. Do not use your hand.**

**If any fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.**



X9811 —UN—23AUG88

*High-Pressure Fluids*

**IMPORTANT: Replace fuel filter elements anytime audible alarm sounds and diagnostic trouble codes (DTCs) indicate plugged fuel filters (low fuel pressure). If no alarm sounds during the 12 month or after 500 hours service interval, replace elements.**

**Continued on next page**

ZE59858,000001A -19-14AUG14-1/3

**Remove and Install Primary Fuel Filter Element**

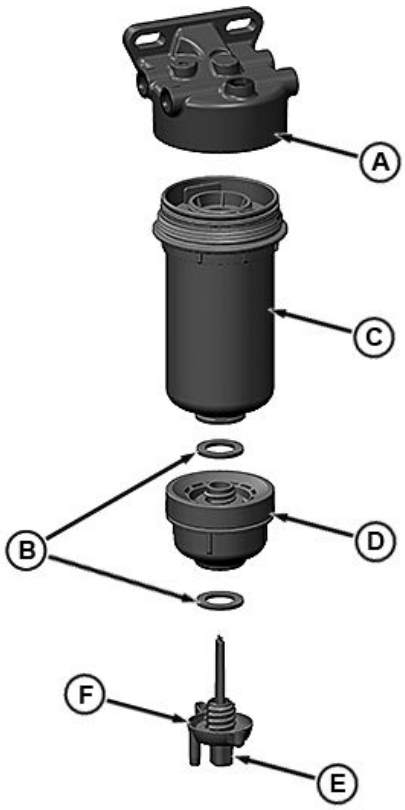
*NOTE: For applications other than OEM, refer to the application operator's manual for proper servicing, hourly replacement intervals, and filter locations.*

*NOTE: Both the primary and the final fuel filter elements must be replaced at the same time.*

1. Thoroughly clean filter header (A) and surrounding area to prevent dirt and debris from entering fuel system.
2. Connect a hose to filter drain valve (F) on bottom of filter and drain all fuel from filter canister.
3. Disconnect water-in-fuel sensor connector (E).
4. Remove fuel filter element (C).
5. Place new O-ring (B) on filter element.
6. Apply a thin film of fuel on O-ring.

**IMPORTANT: Do not fill the new filter with fuel before installing. This could contaminate the fuel system with unfiltered fuel.**

7. Install new filter and tighten until the top portion of the filter contacts the filter header assembly.
8. Reconnect water-in-fuel sensor connector.




RG26246 —UN—14AUG14

*Replace primary fuel filter*

**A—Primary Fuel Filter Header**
**B—O-rings**
**C—Primary Fuel Filter Element**
**D—Sediment Bowl**
**E—Water-in-Fuel Sensor Connector**
**F—Drain Valve**

**Continued on next page**

ZE59858,000001A -19-14AUG14-2/3

**Remove and Install Secondary Fuel Filter Element**

*NOTE: For applications other than OEM, refer to the application operator's manual for proper servicing, hourly replacement intervals, and filter locations.*

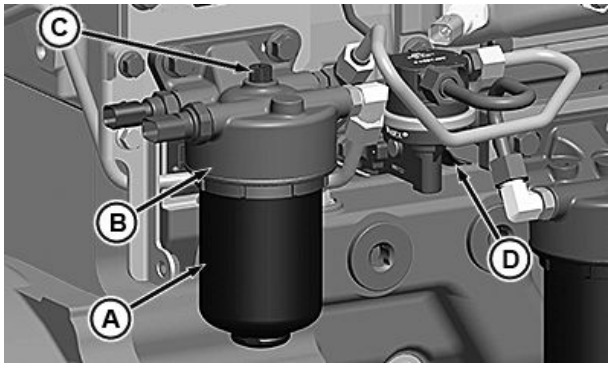
1. Thoroughly clean filter header (B) and surrounding area to prevent dirt and debris from entering fuel system.
2. Loosen and remove fuel filter element (A).
3. Apply a thin film of fuel on packing.

**IMPORTANT: Do not fill the new filter with fuel before installing. This could possibly contaminate the fuel system with unfiltered fuel.**

4. Install new filter and tighten until the top portion of the filter contacts the filter header assembly.

*NOTE: For electronic fuel pump: To prime the fuel system before starting engine. Turn ignition key to ON for 60 seconds.*

*NOTE: For mechanical fuel pump: To prime the fuel system before starting engine. Open bleed vent screw, pump primer lever until fuel flows out of bleed vent screw, then tighten bleed vent screw securely.*




RG26322 —UN—13AUG14

*Replace Secondary Fuel Filter Element*

**A—Secondary Fuel Filter Element**
**B—Secondary Fuel Filter Header**
**C—Bleed Vent Screw**
**D—Primer Lever**

ZE59858,000001A -19-14AUG14-3/3

## Checking Belt Wear

*NOTE: While belt is loosened, inspect pulleys and bearings. Rotate and feel for hard turning or any unusual sounds. If pulleys or bearings need replacement, see your John Deere dealer.*

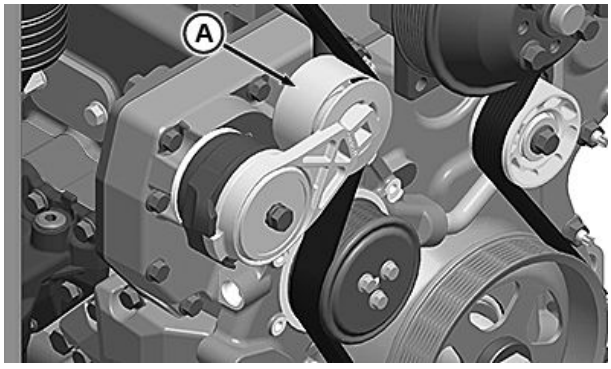
The belt tensioner is designed to operate within the limit of arm movement provided by the cast stops when correct belt length and geometry are used.

Visually inspect cast stops on belt tensioner (A) assembly.

If the tensioner stop on swing arm is hitting the fixed stop, check mounting brackets (alternator, belt tensioner, idler pulley, etc.) and the belt length.

- Verify belt grooves mate correctly with all pulleys
- Inspect for excessive cracks
- Inspect for glazing
- Inspect for tears or cuts

Replace belt as needed based on wear and belt condition. Use correct belt routing during installation (see Replacing Fan Belt in the Service As Required Section).




RG26255 —UN—30JUL14

**A—Belt Tensioner Assembly**

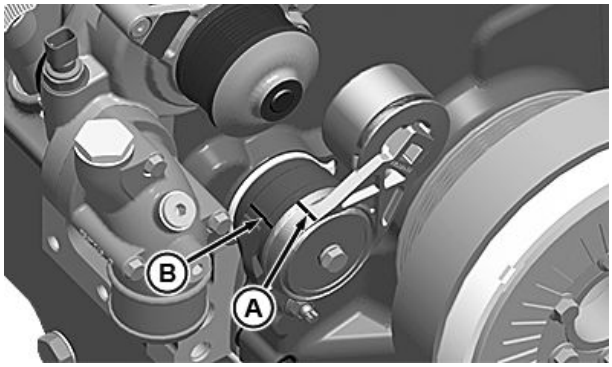
ZE59858,000001B -19-30JUL14-1/1

## Checking Tensioner Spring Tension

A belt tension gauge will not give an accurate measure of the belt tension when automatic spring tensioner is used. Measure tensioner spring tension using a torque wrench and procedure outlined below:

1. Release tension on belt using a long-handled 1/2 inch drive tool in tensioner arm. Remove belt from pulleys.
2. Release tension on tensioner arm and remove drive tool.
3. Put a mark (A) on swing arm of tensioner as shown.
4. Measure 21 mm (0.83 in.) from mark (A) and put a mark (B) on tensioner mounting base.

**A—Mark** **B—Mark**




RG24039 —UN—07AUG13

*Checking Belt Tension Spring Tension*

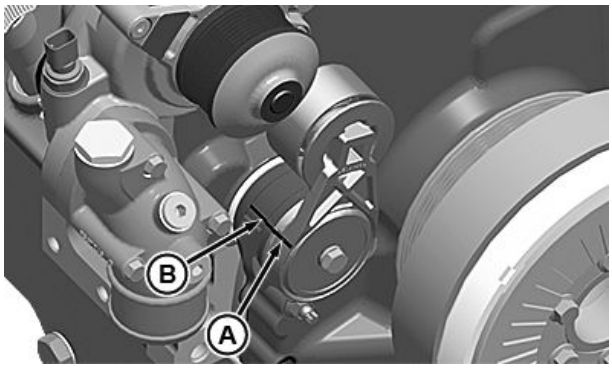
ZE59858,000001C -19-29JUL14-1/2

5. Rotate the swing arm using a torque wrench until marks (A and B) are aligned.
6. Record torque wrench measurement and compare with specification below. Replace tensioner assembly as required.

**Specification**

Spring—Tension..... 18—22 N·m (13—16 lb.-ft.)

**A—Mark** **B—Mark**




RG24040 —UN—07AUG13

*Checking Belt Tensioner Spring Tension*

ZE59858,000001C -19-29JUL14-2/2

## Checking Cooling System

**CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.**

**Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.**

**IMPORTANT: Air must be expelled from cooling system when system is refilled. Loosen temperature sending unit fitting at rear of cylinder head or plug in thermostat housing to allow air to escape when filling system. Retighten fitting or plug when all the air has been expelled. Cooling system must be free of air by time engine coolant temperature reaches 80 °C (176 °F) or damage to EGR cooler (if equipped) may result.**

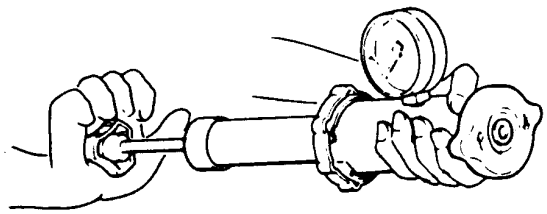
TS281 —UN—15APR13

*High Pressure Fluids*

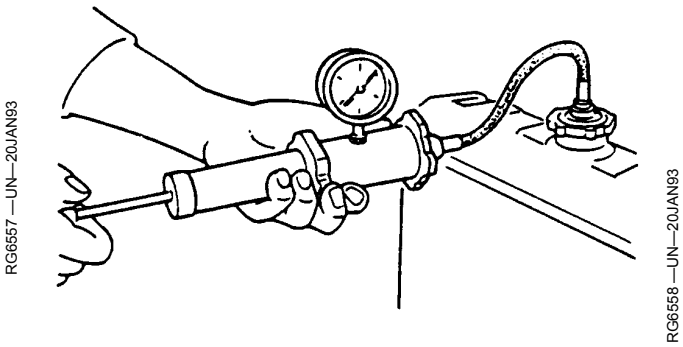
1. Check entire cooling system for leaks. Tighten all clamps securely.
2. Thoroughly inspect all cooling system hoses for hard, flimsy, or cracked conditions. Replace hoses if any of the above conditions are found.

RK80614,000002D -19-11JUL13-1/1

## Pressure Testing Cooling System



*Test Radiator Cap*




*Test Cooling System*

**⚠ CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.**

**Shut off engine. Only remove filler cap when cool enough to touch with bare hands. To relieve pressure before completely removing, slowly remove pressure cap and allow pressure to relieve before completely removing cap.**

### Test Radiator Cap

1. Remove radiator cap and attach to D05104ST Tester, or similar, as shown.
2. Pressurize cap to following specifications.[1]. Gauge should hold pressure for 10 seconds within the normal range if cap is acceptable.

| Specification | |
|---|---|
| Radiator Cap—Maximum Pressure | 124 kPa (1.24 bar) (18 psi) |

   If gauge does not hold pressure, replace radiator cap.

3. Remove the cap from gauge, turn it 180°, and retest cap. This verifies that the first measurement was accurate.

### Test Cooling System for Leaks

*NOTE: Engine should be warmed up to test overall cooling system for leaks.*

1. Allow engine to cool, then carefully remove radiator cap.
2. Fill radiator with coolant to the normal operating level.

**IMPORTANT: DO NOT apply excessive pressure to cooling system; doing so may damage radiator and hoses.**

3. Connect gauge and adapter to radiator filler neck, or expansion tank. Pressurize cooling system to the following specifications[1].

| Specification | |
|---|---|
| Cooling System—Maximum Pressure | 124 kPa (1.24 bar) (18 psi) |

4. With pressure applied, check all cooling system hose connections, radiator, and overall engine for leaks.

   If leakage is detected, correct as necessary and pressure test system again.

   If no leakage is detected, but the gauge indicated a drop in pressure, coolant may be leaking internally within the system or at the block-to-head gasket. Have your servicing dealer or distributor correct this problem immediately.

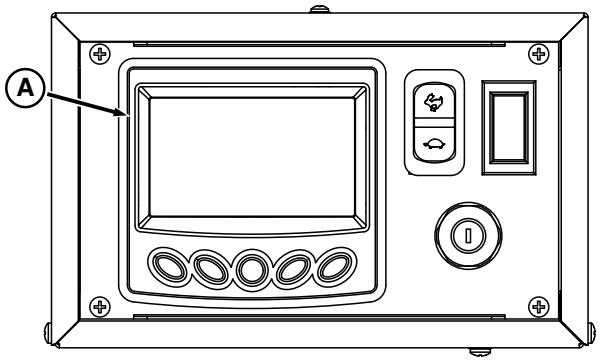
*[1]Test pressures recommended are for all Deere OEM cooling systems. On specific vehicle applications, test cooling system and pressure cap according to the recommended pressure for that vehicle.*

ZE59858,00000B9 -19-26AUG13-1/1

## Checking and Adjusting Engine Speeds

Use tachometer on the diagnostic gauge (A) to verify engine speeds. (See Engine Power and Speed Rating Specifications in the Specifications Section for engine speed specifications.) If engine speed adjustment is required, see your authorized servicing dealer or engine distributor.

**A—Diagnostic Gauge**




RG22413 —UN—27AUG13

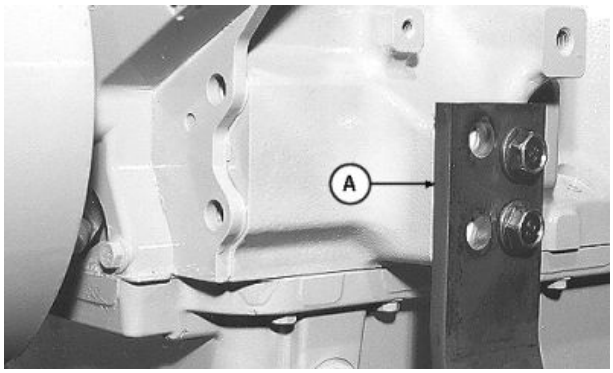
RK80614,0000030 -19-16DEC13-1/1

## Checking Engine Mounts

Engine mounting is the responsibility of the Original Equipment Manufacturer. Follow manufacturer's guidelines for mounting specifications.

**IMPORTANT: Use only Grade SAE 8 or higher grade of hardware for engine mounting.**

1. Check the engine mounting brackets (A), vibration isolators, and mounting bolts on support frame and engine block for tightness. Tighten as necessary.
2. Inspect overall condition of vibration isolators, if equipped. Replace isolators, as necessary, if rubber has deteriorated or mounts have collapsed.




RG9905 —UN—06JAN99

*Engine Mounting*

**A—Mounting Bracket**

RK80614,0000031 -19-11JUL13-1/1

## Checking Engine Ground Connection

Check engine ground connection to be sure that it is secure and clean. This will prevent electrical arcing which can damage engine.

Verify engine to frame ground.

Verify battery ground to frame.

Verify Engine Control Unit to ground (Remote Mount).

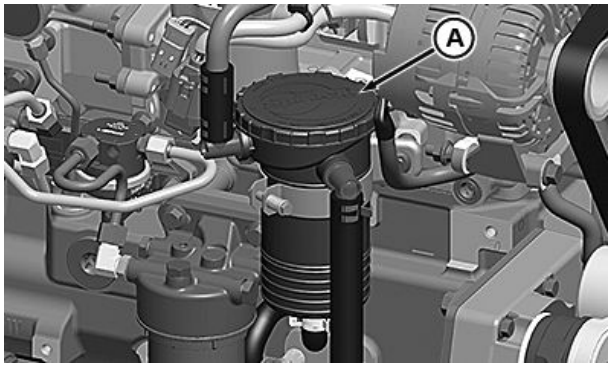
RK80614,0000033 -19-11JUL13-1/1

## Changing Open Crankcase Ventilation (OCV) Filter

Service checks of the OCV include checking and/or replacement of worn, cracked, leaking, or bulging hoses and for good clamp tension on all hose ends.

Expectation for minimal service interval will be at least 1500 hours or when the service indicator light comes on or as indicated by the diagnostic gauge.

1. Remove cap (A).
2. Remove OCV filter from canister. Discard old OCV filter.
3. Install new OCV filter.
4. Install cap (A).




RG26250 —UN—30JUL14

*Changing OCV*

**A—Cap**

ZE59858,000001E -19-30JUL14-1/1

## Access DEF Dosing Unit

See your application manual for information on accessing the DEF dosing unit.

ZE59858,000008D -19-20NOV17-1/1

## Changing Diesel Exhaust Fluid (DEF) Dosing Unit Filter

**CAUTION: Avoid contact with eyes. In case of contact, immediately flush eyes with large amounts of water for a minimum of 15 minutes. Reference the Materials Safety Data Sheet (MSDS) for additional information.**

**IMPORTANT: If DEF is spilled or contacts any surface other than the storage tank, immediately clean the surface with clear water. DEF is corrosive to painted and unpainted metallic surfaces and can distort some plastic and rubber components.**

**Spilled DEF, if left to dry or if only wiped away with a cloth, leaves a white residue. Improperly cleaned DEF spill can interfere with diagnosis of Selective Catalytic Reduction (SCR) system leakage problems.**

*NOTE: DEF dosing unit filter and tank header suction screen must be replaced together every 1500 hours or 36 months, which ever occurs first.*

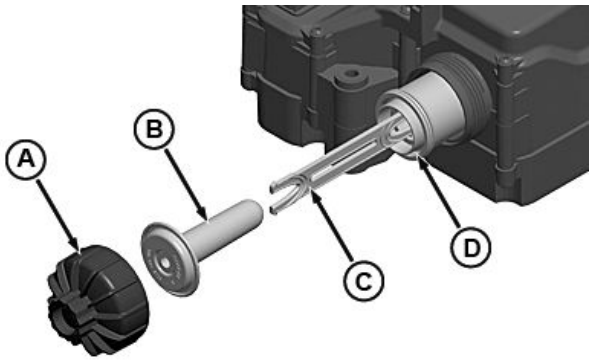
*NOTE: Servicing DEF dosing unit filter may require removing additional covers or components. See Access DEF Dosing Unit for location information.*

1. Remove DEF dosing unit filter cover (A).
2. Remove and discard DEF dosing unit filter equalizing element (B).

*NOTE: DEF dosing unit filter tool (C) is supplied with replacement filter.*

3. Insert “Black” end of DEF dosing unit filter tool (C) into DEF dosing unit filter (D) until CLICK is felt or heard indicating DEF dosing unit filter tool is fully engaged.

*NOTE: A tool such as a screwdriver can be inserted into DEF dosing unit filter tool slot to assist removal.*




RG22534 —UN—21MAR13

*DEF Dosing Unit Filter*

**A—DEF Dosing Unit Filter Cover**
**B—DEF Dosing Unit Filter Equalizing Element**
**C—DEF Dosing Unit Filter Tool (supplied with new filter)**
**D—DEF Dosing Unit Filter**

4. Pull DEF dosing unit filter tool and DEF dosing unit filter from DEF dosing unit. Discard DEF dosing unit filter and DEF dosing unit filter tool.
5. Clean DEF dosing unit threads and mating surfaces with distilled water.
6. Lubricate DEF filter O-rings with clean DEF. Carefully insert DEF dosing unit filter into DEF dosing unit.
7. Install new DEF dosing unit filter equalizing element into DEF dosing unit filter.
8. Install DEF dosing unit filter cover and tighten to specification.

**Specification**

DEF Dosing Unit Filter Cover—Torque.....23 N·m (204 lb·in)

DX,DEF,CHANGE,FILT -19-15AUG17-1/1

## Access DEF Tank Header

See your application manual for information on accessing the DEF tank header.

EJ20264,00002E7 -19-20NOV17-1/1

## Replace Diesel Exhaust Fluid (DEF) Tank Header Suction Screen

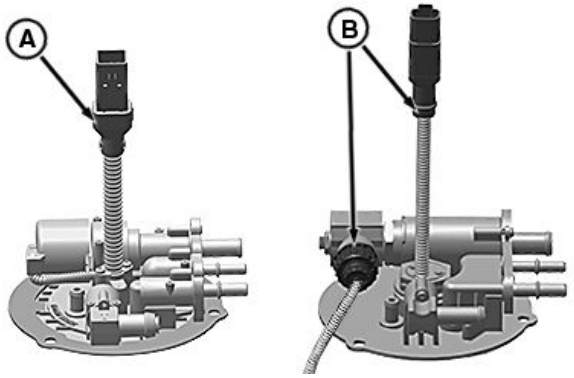
### DEF Tank Header Identification

*NOTE: Accessing DEF tank header may require removing additional covers or components. See Access DEF Tank Header for location information.*

Type A DEF tank header has one wiring harness connection (A). Type B DEF tank header has two wiring harness connections (B). Refer to the procedure that is applicable to your DEF tank header.

**A—Type A DEF Tank Header (one electrical connection)**

**B—Type B DEF Tank Header (two electrical connections)**




RG29623 —UN—18JUL17

*DEF Tank Header Identification*

DX,DEF,REPL,THSCREEN -19-08DEC17-1/12

### Replace Type A DEF Tank Header Suction Screen

**CAUTION: Avoid contact with eyes. In case of contact, immediately flush eyes with large amounts of water for a minimum of 15 minutes. Reference the Materials Safety Data Sheet (MSDS) for additional information.**

**IMPORTANT: If DEF is spilled or contacts any surface other than the storage tank, immediately clean the surface with clear water. DEF is corrosive to painted and unpainted metallic surfaces and can distort some plastic and rubber components.**

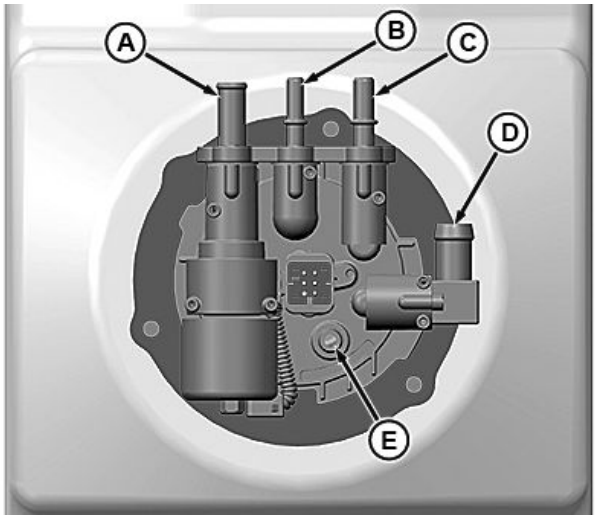
**Spilled DEF, if left to dry or if only wiped away with a cloth, leaves a white residue. Improperly cleaned DEF spill can interfere with diagnosis of Selective Catalytic Reduction (SCR) system leakage problems.**

*NOTE: DEF tank header suction screen must be replaced every 1500 hours or 36 months, whichever occurs first. The DEF dosing unit filter must be replaced at the same time.*

1. Clear all debris from area around DEF tank header.

**CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns. Before disconnecting coolant hoses, wait until engine coolant is cool enough to touch the radiator or surge tank cap with bare hands. Slowly loosen radiator or surge tank cap to first stop to relieve pressure.**

**IMPORTANT: Cap and plug all lines and fittings to prevent contamination. Coolant in DEF causes Selective Catalytic Reduction (SCR) system performance issues.**




RG29624 —UN—19JUL17

*DEF Tank Header Fittings*

**A—Coolant Outlet Fitting**
**B—DEF Return Line Fitting**
**C—DEF Supply Line Fitting**
**D—Coolant Inlet Fitting**
**E—Vent Line Fitting**

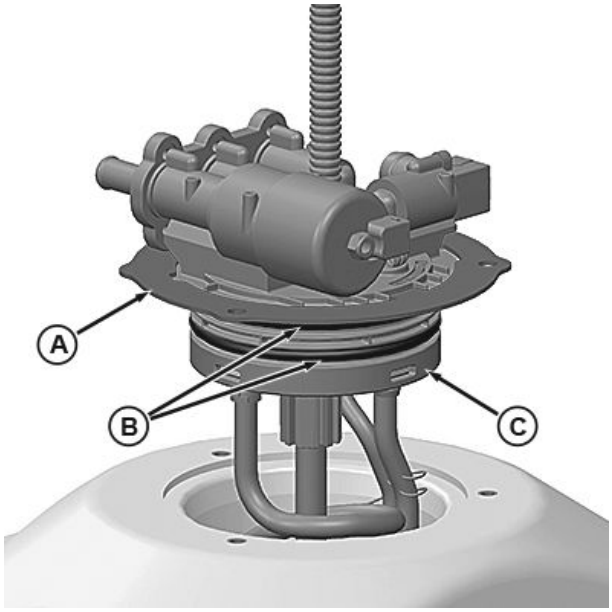
2. Disconnect coolant hoses from fittings (A and D).
3. Disconnect DEF return and supply lines from fittings (B and C).
4. Disconnect DEF tank header electrical connector.
5. Remove vent hose from fitting (E).

**Continued on next page**

DX,DEF,REPL,THSCREEN -19-08DEC17-2/12

6. Remove cap screws from DEF tank header locking ring (A).
7. Remove DEF tank header (C) from tank.
8. Remove O-rings (B) and inspect for damage.
9. Replace O-rings (B) if necessary.

**A—DEF Tank Header Locking Ring**
**B—O-Ring (2 used)**
**C—DEF Tank Header**




RG29625 —UN—25JUL17

*DEF Tank Header*

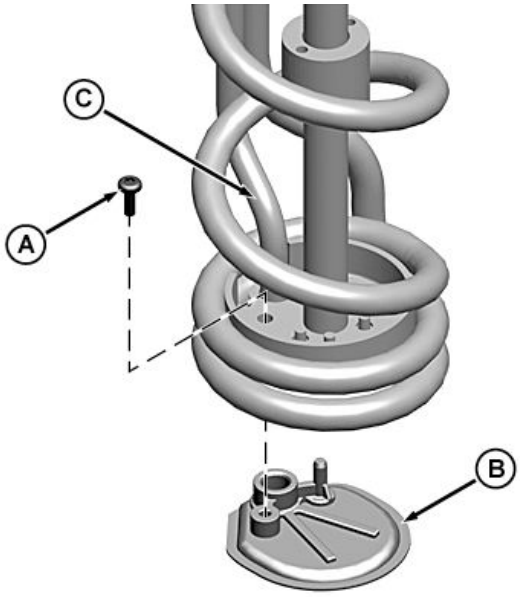
DX,DEF,REPL,THSCREEN -19-08DEC17-3/12

10. Remove screw (A) that secures suction screen (B) to suction tube (C).
11. Remove suction screen (B).
12. Install suction screen (B) to suction tube (C).
13. Install screw (A) and tighten to specification.

**Specification**

DEF Suction Screen
Screw—Torque.....1 N·m (11 lb·in)

**A—Screw**
**B—Suction Screen**
**C—Suction Tube**




RG23672 —UN—01JUL13

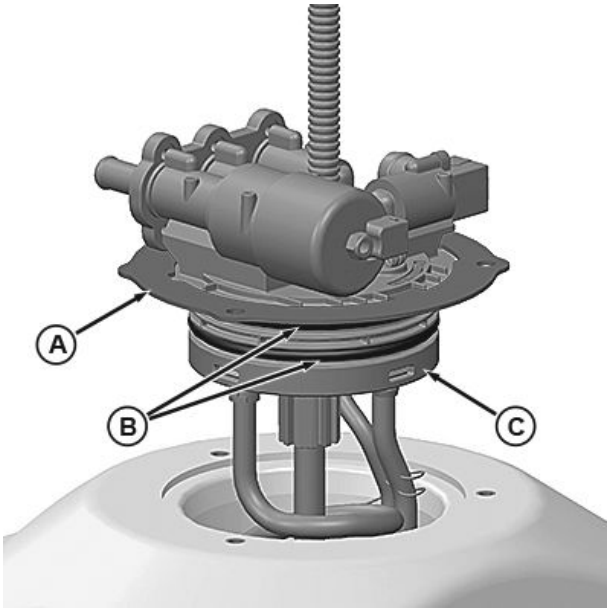
*DEF Suction Screen*

**Continued on next page**

DX,DEF,REPL,THSCREEN -19-08DEC17-4/12

14. Lubricate O-rings (B) with clean DEF.
15. Insert DEF header into tank and align holes on locking ring (A) with holes in tank.

**A—DEF Tank Header Locking Ring**
**B—O-Ring (2 used)**
**C—DEF Tank Header**




RG29625 —UN—25JUL17

*DEF Tank Header*

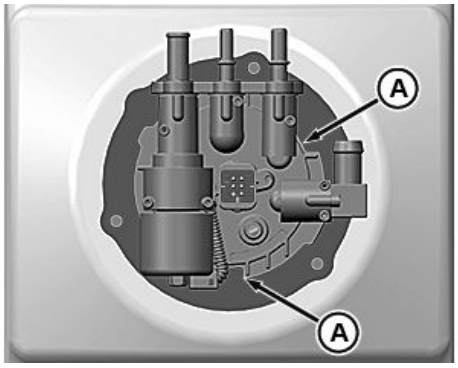
DX,DEF,REPL,THSCREEN -19-08DEC17-5/12

**IMPORTANT: Prevent DEF leak, header, and lock ring damage. Ensure that alignment notches on the locking ring are properly aligned with plastic tabs on the header.**

16. Install stainless steel cap screws into mounting holes and tighten to specification.

| Specification | |
|---|---|
| DEF Tank Header M6 Cap Screw—Torque | 9 N·m (80 lb·in) |

**A—Alignment Notch (2 used)**




RG25370 —UN—03APR14

*Alignment Notches*

**Continued on next page**

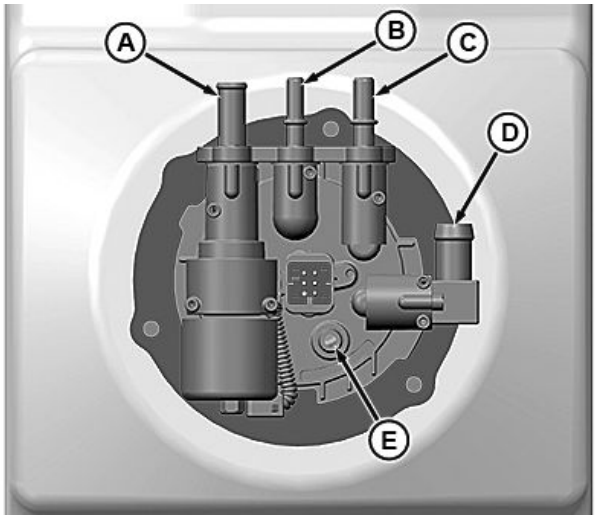
DX,DEF,REPL,THSCREEN -19-08DEC17-6/12

17. Connect 9.5 mm (3/8 in) vent hose to fitting (E).
18. Connect 16 mm (5/8 in) coolant hose to coolant inlet fitting (D).
19. Connect 13 mm (1/2 in) coolant hose to coolant outlet fitting (A).

**IMPORTANT: Push DEF line onto fitting until you hear a “click”, then lightly pull back to ensure that it is connected and locked in place.**

*NOTE: DEF supply and return lines have unique sized fittings.*

20. Connect DEF return and supply lines to fittings (B and C).
21. Connect DEF tank header electrical connector.




RG29624 —UN—19JUL17

*DEF Tank Header Fittings*

**A—Coolant Outlet Fitting**
**B—DEF Return Line Fitting**
**C—DEF Supply Line Fitting**
**D—Coolant Inlet Fitting**
**E—Vent Line Fitting**

**Continued on next page**

DX,DEF,REPL,THSCREEN -19-08DEC17-7/12

**Replace Type B DEF Tank Header Suction Screen**

**CAUTION: Avoid contact with eyes. In case of contact, immediately flush eyes with large amounts of water for a minimum of 15 minutes. Reference the Materials Safety Data Sheet (MSDS) for additional information.**

**IMPORTANT: If DEF is spilled or contacts any surface other than the storage tank, immediately clean the surface with clear water. DEF is corrosive to painted and unpainted metallic surfaces and can distort some plastic and rubber components.**

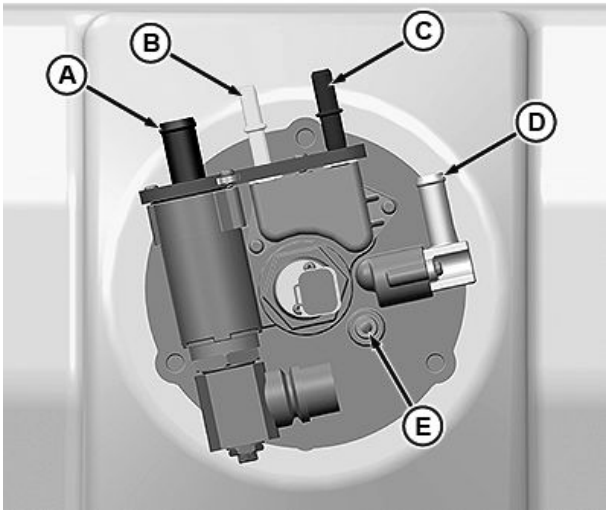
**Spilled DEF, if left to dry or if only wiped away with a cloth, leaves a white residue. Improperly cleaned DEF spill can interfere with diagnosis of Selective Catalytic Reduction (SCR) system leakage problems.**

*NOTE: DEF tank header suction screen must be replaced every 1500 hours or 36 months, whichever occurs first. The DEF dosing unit filter must be replaced at the same time.*

1. Clear all debris from area around DEF tank header.

**CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns. Before disconnecting coolant hoses, wait until engine coolant is cool enough to touch the radiator or surge tank cap with bare hands. Slowly loosen radiator or surge tank cap to first stop to relieve pressure.**

**IMPORTANT: Cap and plug all lines and fittings to prevent contamination. Coolant in DEF causes Selective Catalytic Reduction (SCR) system performance issues.**




RG29626 —UN—19JUL17

*DEF Tank Header Fittings*

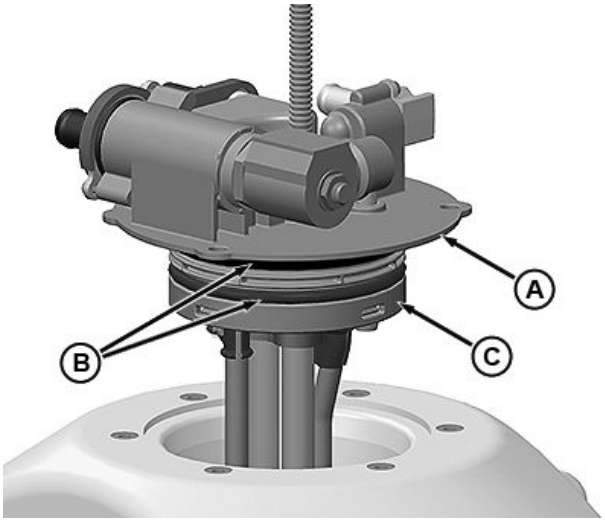
**A—Coolant Inlet Fitting**
**B—DEF Return Line Fitting**
**C—DEF Supply Line Fitting**
**D—Coolant Outlet Fitting**
**E—Vent Line Fitting**

2. Disconnect coolant hoses from fittings (A and D).
3. Disconnect DEF return and supply lines from fittings (B and C).
4. Disconnect DEF tank header electrical connectors.
5. Remove vent hose from fitting (E).

DX,DEF,REPL,THSCREEN -19-08DEC17-8/12

6. Remove cap screws from DEF tank header mounting flange (A).
7. Remove DEF tank header (C) from tank.
8. Remove O-rings (B) and inspect for damage.
9. Replace O-rings (B) if necessary.

**A—DEF Tank Header Mounting Flange**
**B—O-Ring (2 used)**
**C—DEF Tank Header**




RG29627 —UN—19JUL17

*DEF Tank Header*

**Continued on next page**

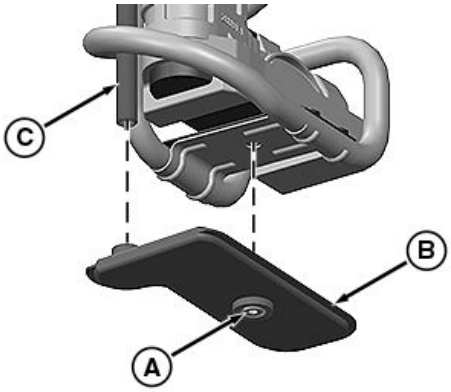
DX,DEF,REPL,THSCREEN -19-08DEC17-9/12

10. Remove screw (A) that secures suction screen (B) to suction tube (C).
11. Remove suction screen (B).
12. Install suction screen (B) to suction tube (C).
13. Install screw (A) and tighten to specification.

**Specification**

DEF Suction Screen
Screw—Torque.....1 N·m
(11 lb·in)

**A—Screw**
**B—Suction Screen**
**C—Suction Tube**




RG28054 —UN—29MAR16

*DEF Suction Screen*

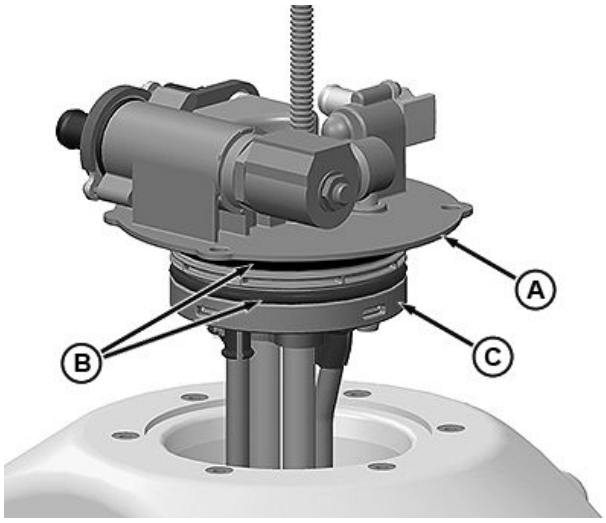
DX,DEF,REPL,THSCREEN -19-08DEC17-10/12

14. Lubricate O-rings (B) with clean DEF.
15. Insert DEF header (C) into tank and align mounting holes on mounting flange (A) with holes in tank.
16. Install stainless steel M6 cap screws into mounting holes and tighten to specification.

**Specification**

DEF Tank Header Cap
Screw—Torque.....9 N·m
(80 lb·in)

**A—DEF Tank Header Mounting Flange**
**B—O-Ring (2 used)**
**C—DEF Tank Header**




RG29627 —UN—19JUL17

*DEF Tank Header*

**Continued on next page**

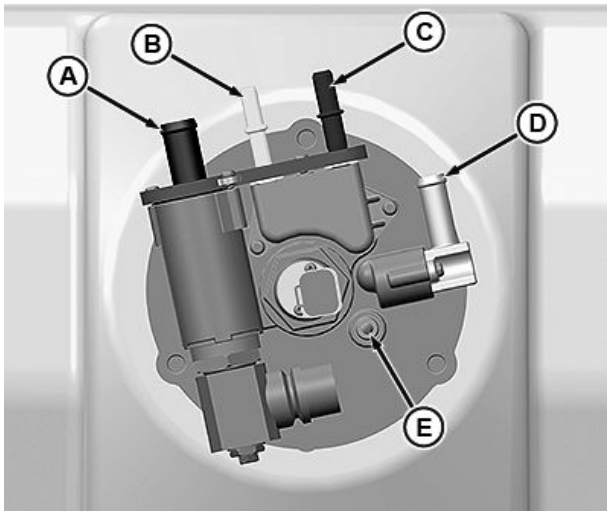
DX,DEF,REPL,THSCREEN -19-08DEC17-11/12

17. Connect 9.5 mm (3/8 in) vent hose to fitting (E).
18. Connect 16 mm (5/8 in) coolant hose to coolant inlet fitting (A).
19. Connect 13 mm (1/2 in) coolant hose to coolant outlet fitting (D).

**IMPORTANT: Push DEF line onto fitting until you hear a “click”, then lightly pull back to ensure that it is connected and locked in place.**

*NOTE: DEF supply and return lines have unique sized fittings.*

20. Connect DEF return and supply lines to fittings (B and C).
21. Connect DEF tank header electrical connectors.




RG29626 —UN—19JUL17

*DEF Tank Header Fittings*

**A—Coolant Inlet Fitting**
**B—DEF Return Line Fitting**
**C—DEF Supply Line Fitting**
**D—Coolant Outlet Fitting**
**E—Vent Line Fitting**

DX,DEF,REPL,THSCREEN -19-08DEC17-12/12

## Adjusting Valve Clearance

**CAUTION: To prevent accidental starting of engine while performing valve adjustments, always disconnect NEGATIVE (—) battery terminal.**

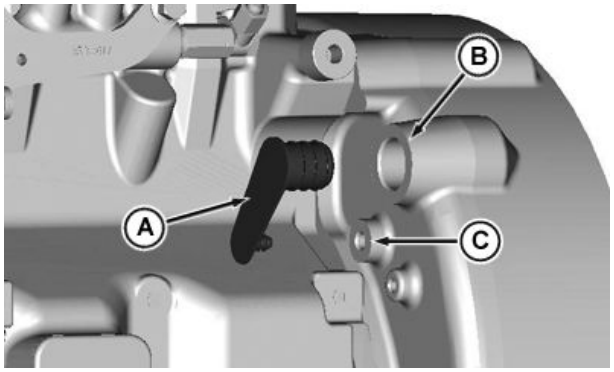
**IMPORTANT: Valve clearance MUST BE checked and adjusted with engine COLD.**

1. Remove rocker arm cover and crankcase ventilation tube.
2. Remove plastic plug (A) from engine timing/rotation hole (B) and timing pin hole (C).

**IMPORTANT: Visually inspect contact surfaces of bridges, and rocker arm wear pads. Check all parts for excessive wear, breakage, or cracks. Replace parts that show visible damage.**

**Rocker arms that exhibit excessive valve clearance should be inspected more thoroughly to identify damaged parts.**

3. Install JDG820 flywheel turning tool and JDG1571 timing pin.
4. Rotate engine with the flywheel turning tool until locking pin engages timing hole in flywheel.




RG20536 —UN—03JUN11

*Bores to Insert Flywheel Turning Tool and Locking Pin*

**A—Plastic Plug**
**B—Flywheel Turning Tool Bore**
**C—Locking Pin Bore**

*NOTE: If the rocker arms for No. 1 (front) cylinder are loose, the engine is at No. 1 top dead center.*

*NOTE: If the rocker arms for No. 4 (rear) cylinder are loose, the engine is at No. 4 top dead center. Rotate the engine one full revolution (360°) to No. 1 top dead center.*

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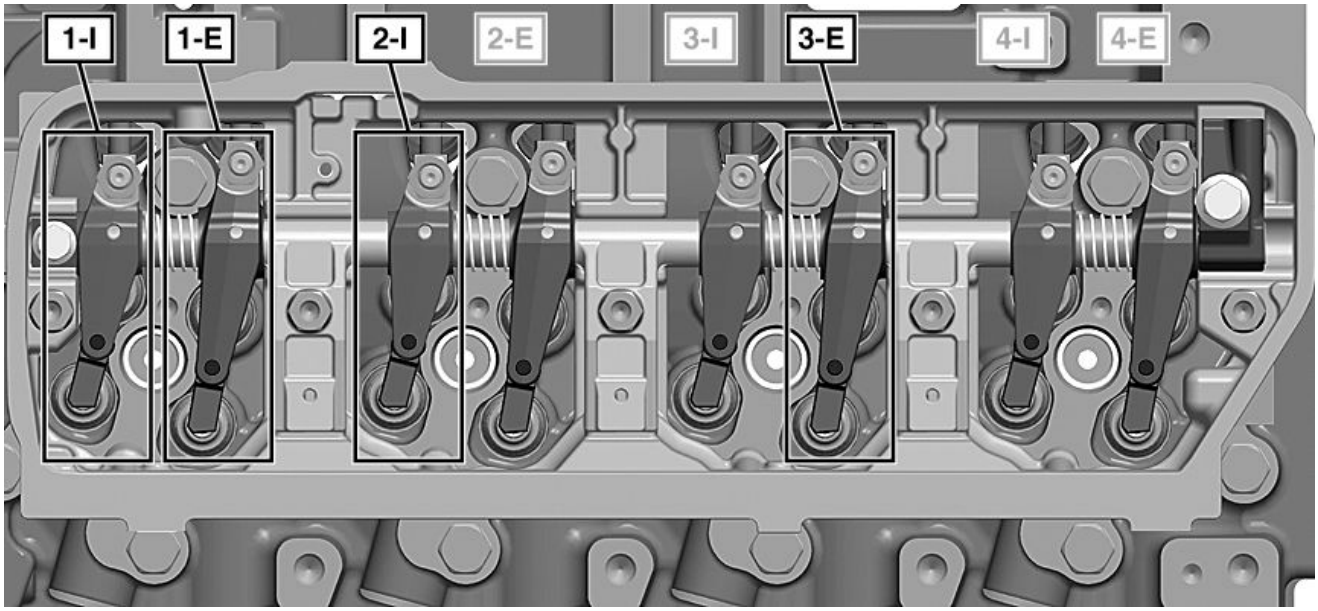
ZE59858,000001F -19-13AUG14-1/4

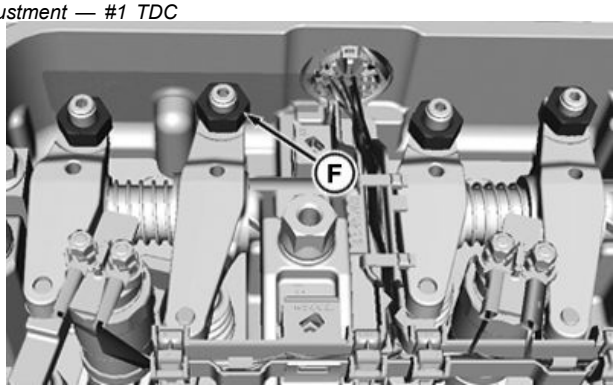



RG20492 —UN—24JUN11

*Valve Clearance Adjustment — #1 TDC*

5. With engine locked at “TDC” of No. 1 piston compression stroke, use a bent feeler gauge to check valve clearance on No. 1 and 3 exhaust and No. 1 and 2 intake valves. Loosen lock nut (F) on rocker arm adjusting screw. Turn adjusting screw with a 4 mm hex key until feeler gauge slips with a slight drag. Hold the adjusting screw from turning and tighten lock nut to specifications

| Specification | |
|---|---|
| Intake Valve Clearance (Rocker Arm-to-Valve Bridge With Engine Cold)—Clearance | 0.46 mm (0.018 in.) |
| Exhaust Valve Clearance (Rocker Arm-to-Valve Bridge With Engine Cold)—Clearance | 0.53 mm (0.021 in.) |
| Valve Adjusting Screw Lock Nut—Torque | 27 N·m (20 lb.-ft.) |




RG25615 —UN—24APR14

*Rocker Arm Lock Nut*

**F—Lock Nut**

Recheck clearance again after tightening lock nut. Readjust clearance as necessary.

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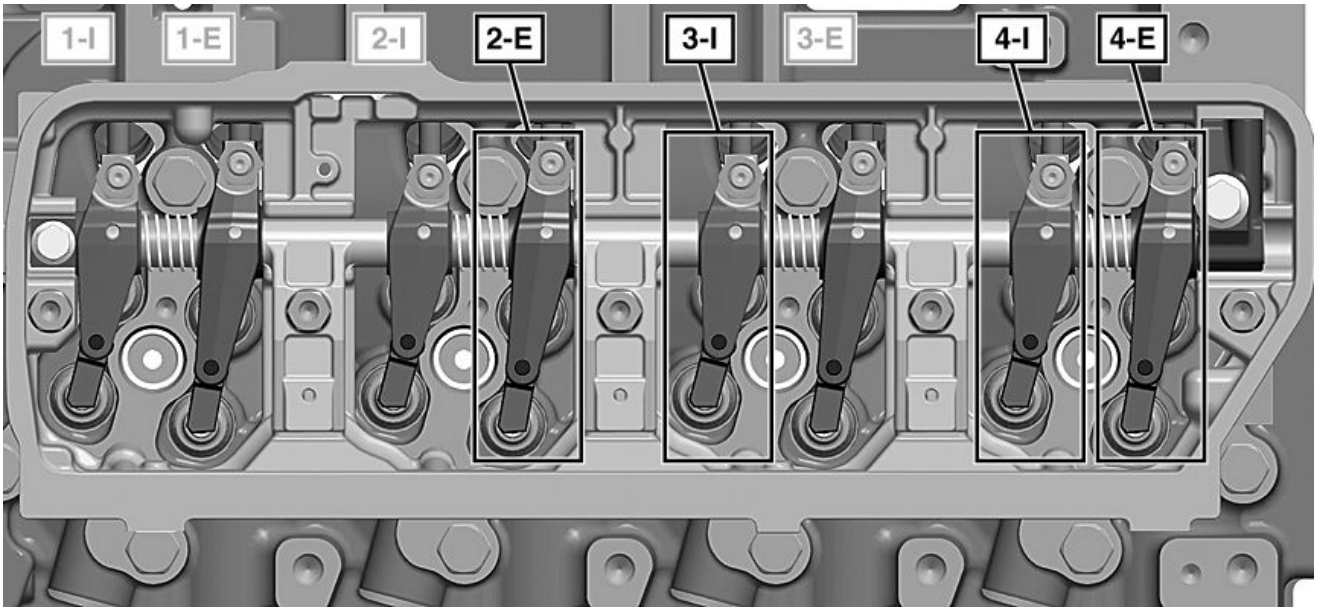
ZE59858,000001F -19-13AUG14-2/4




RG20493 —UN—24JUN11

*Valve Clearance Adjustment — #4 TDC*

6. Rotate flywheel 360° until No. 4 piston is at “TDC” of its compression stroke. Rocker arms for No. 4 piston should be loose.
7. Check and adjust valve clearance to the same specifications on for No. 2 and 4 exhaust and No. 3 and 4 intake valves.

ZE59858,000001F -19-13AUG14-3/4

8. Install rocker arm cover gasket.

**IMPORTANT: When reinstalling rocker arm cover, inspect gasket for damage prior to reusing.**

9. Tighten cap screws to specifications, in the sequence shown.

| Specification | |
|---|---|
| Rocker Arm Cover Cap Screws—Torque | 11 N·m (97 lb.-in.) |

10. Install vent tube to rocker arm cover.


RG25069 —UN—14FEB14

*Rocker Arm Cap Screws Tightening Sequence*

ZE59858,000001F -19-13AUG14-4/4

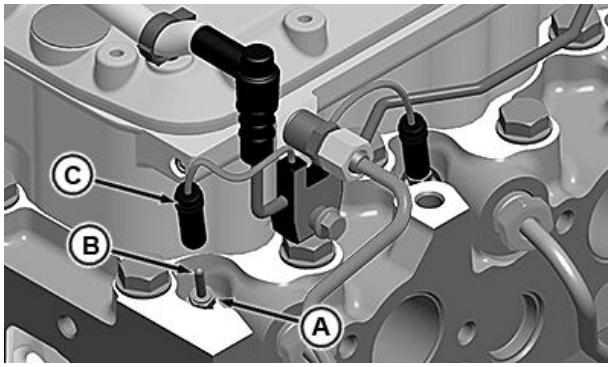
## Testing Glow Plugs for Continuity

**CAUTION: To prevent accidental starting of engine while performing this test, always disconnect NEGATIVE (—) battery terminal.**

1. Remove glow plug wiring harness connector (C).
2. Using a multimeter, check resistance from terminal (B) to the outer body of glow plug (A).
   If resistance is more than 10 Ohms, the glow plug is damaged and must be replaced.
3. If needed, install new glow plugs and torque to specifications.

**Specification**

Glow Plug—Torque..... 15 N·m (133 lb.-in.)




RG26311 —UN—13AUG14

*Check Glow Plug*

**A—Glow Plug**
**B—Terminal**
**C—Harness Connector**

ZE59858,0000020 -19-13AUG14-1/1

## Flushing and Refilling Cooling System

**CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.**

**Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly remove the pressure cap and allow pressure to relive before completely removing cap.**

*NOTE: If COOL-GARD II is not used, the drain interval is reduced to 2000 hours or 24 months of operation.*

1. Pressure test entire cooling system and pressure cap if not previously done. (See Pressure Testing Cooling System in the Lubrication & Maintenance — 500 Hours/12 Months Section.
2. Slowly open the engine cooling system filler cap or radiator cap to relieve pressure and allow coolant to drain faster.

*High-Pressure Fluids*

TS281 —UN—15APR13

**Continued on next page**

ZE59858,0000021 -19-12AUG14-1/2

*NOTE: Drain coolant from the lowest point in the cooling system. This location will vary by application.*

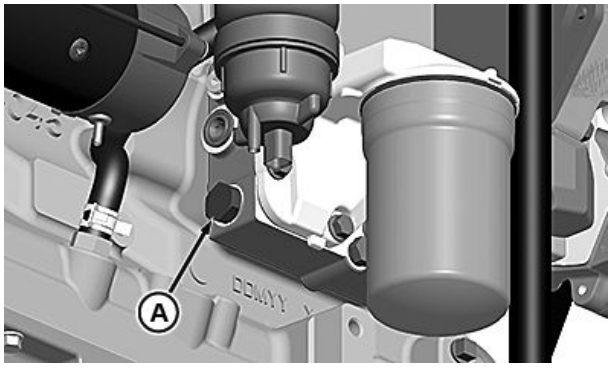
3. Drain all coolant from engine block.
4. Open radiator drain valve. Drain all coolant from radiator.
5. Remove thermostats at this time, if not previously done. Install cover (without thermostats and seals) and tighten socket head cap screws to specifications.

| Specification | |
|---|---|
| Thermostat Cover — Socket Head Cap Screws—Torque | 73 N·m (54 lb.-ft.) |

6. Close all drain valves after coolant has drained.

**⚠ CAUTION: Do not run engine longer than 10 minutes. Doing so may cause engine to overheat which may cause burns when radiator water is draining.**

7. Fill the cooling system with clean water. Run the engine about 7 minutes to stir up possible contaminates or foreign particles.
8. Stop engine, pull off lower radiator hose and remove radiator cap. Immediately drain the water from system before contaminates or foreign particles settle.
9. After draining water, close drain valves. Install radiator cap, radiator hose, and clamp. Fill the cooling system with clean water and a heavy duty cooling system cleaner such as Restore or Restore Plus. Follow manufacturer's directions on label.
10. After cleaning the cooling system, drain cleaner and fill with water to flush the system. Run the engine about 7 minutes. Stop engine, remove radiator cap and drain water.
11. Close all drain valves on engine and radiator.
12. Perform Testing Thermostat Opening Temperature in the Lubrication & Maintenance — 6000 Hours/72 Months Section.




RG26298 —UN—12AUG14

*Engine Block Coolant Drain Plug—Right Side of Engine*

**A—Right Side of Engine Block Coolant Drain Plug**

13. Install thermostats using a new gasket. Tighten thermostat cover socket head cap screws to specifications.

| Specification | |
|---|---|
| Thermostat Cover — Socket Head Cap Screws—Torque | 73 N·m (54 lb.-ft.) |

14. Add coolant to surge tank (See application manual for coolant volume).

| Specification | |
|---|---|
| 4.5 L Engine—Coolant Capacity (Excluding Radiator) | 8.5 L (9 qt.) |

15. Run engine until it reaches operating temperature. This mixes the solution uniformly and circulates it through the entire system. The normal engine coolant temperature range is 85—103 °C (185—217 °F).
16. After running engine, check coolant level and entire cooling system for leaks.
17. Inspect the fan belt for wear and check belt tension. (See Checking Belt Wear in the Lubrication & Maintenance — 500 Hours/12 Months Section.

ZE59858,0000021 -19-12AUG14-2/2

## Testing Thermostat Opening Temperature

### Removing Thermostats

**CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns. DO NOT drain coolant until it has cooled below operating temperature. Always loosen radiator pressure cap or drain valve slowly to relieve pressure.**

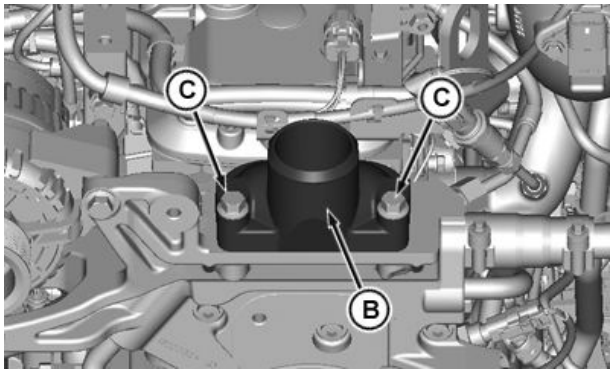
TS281 —UN—15APR13

*High Pressure Fluids*

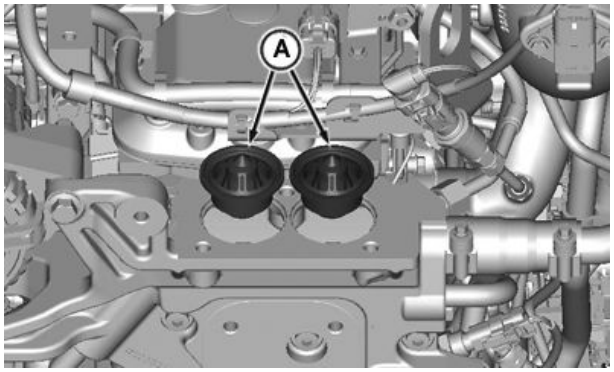
ZE59858,0000022 -19-18AUG14-1/4

1. Visually inspect area around thermostat housing for leaks.
2. Remove radiator pressure cap and partially drain cooling system.
3. Remove three cap screws (C) and thermostat cover (B) clean and check cover for cracks or damage.
4. Remove both thermostats (A) from the housing.

**A—Thermostats (2 Used)**
**B—Thermostat Cover**
**C—Cap Screws (3 Used)**




RG20113 —UN—18MAR11




RG20112 —UN—18MAR11

*Removing Thermostats*

**Continued on next page**

ZE59858,0000022 -19-18AUG14-2/4

**Testing Thermostats Opening Temperature**

*NOTE: Perform the following test for both thermostats.*

1. Visually inspect thermostats for corrosion or damage. Replace as a matched set, as necessary.

**CAUTION: DO NOT allow thermostat or thermometer to rest against the side or bottom of container when heating water. Either may rupture if overheated.**

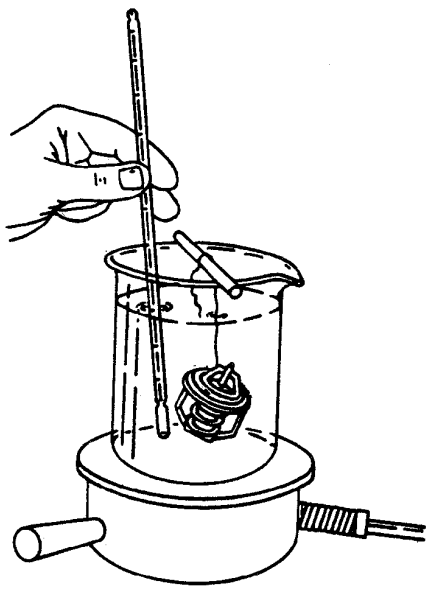
2. Suspend thermostat and a thermometer in a container of water.
3. Stir the water as it heats. Observe opening action of thermostat and compare temperatures to specifications.

*NOTE: Due to varying tolerances of different suppliers, initial opening and full open temperatures may vary slightly from specified temperatures.*

**Specification**

Thermostat
Opening—Temperature..... 85 °C—97 °C (185 °F—207 °F)

4. Remove thermostat and observe its closing action as it cools. In ambient air the thermostat should close completely. Closing action should be smooth and slow.



RG5971 —UN—23NOV97

*Testing Thermostat Opening Temperature*

5. If any thermostat is defective, replace both thermostats.

**Continued on next page**

ZE59858,0000022 -19-18AUG14-3/4

### Installing Thermostats

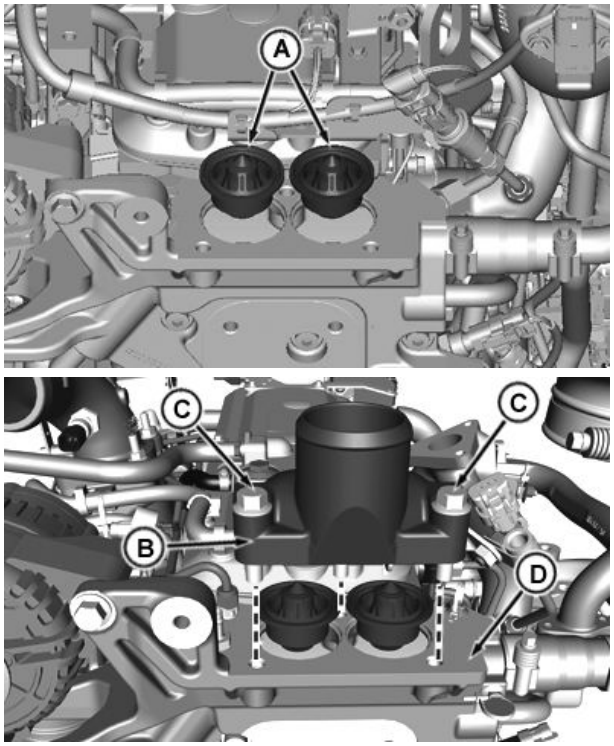
1. Install new rubber seal for each thermostat (A).
2. Install thermostats into housing (D).
3. Install thermostat cover (B) and tighten thermostat cover cap screws (C) to specifications.

| Specification | |
|---|---|
| Thermostat Cover Cap Screw—Torque | 73 N·m (54 lb.-ft.) |

4. Fill cooling system and check for leaks.

**IMPORTANT: Air must be expelled from cooling system when refilled.**

**A—Thermostats**
**B—Thermostat Cover**
**C—Cap Screws (3 Used)**
**D—Thermostat Housing**




RG20112 —UN—18MAR11
RG25248 —UN—12MAR14

*Installing Thermostats*

ZE59858,0000022 -19-18AUG14-4/4

| Indicator | Active When | Operator Action |
|---|---|---|
| **DEF Indicator**  | 1. DEF tank has approximately 10% or less remaining. | Fill DEF tank. |
| **DEF And Warning Indicator**  | 1. DEF tank has 0% measurable volume and machine performance is reduced. ***DTC: 001761.18 will be present.**<br>2. DEF system has lost its prime and machine performance is reduced. ***DTC: 001761.08 will be present.** | Fill DEF tank. |
| **Engine Emissions System Malfunction Indicator**  | 1. Engine emissions outside of normal operating range.<br>2. Engine emissions system fault. | Contact your service dealer. |
| **Engine Emissions System Malfunction and Warning Indicator**  | 1. Engine emissions outside of normal operating range. Machine performance will be reduced.<br>2. Engine emissions system fault. Machine performance will be reduced. | Contact your service dealer. |
| **Engine Emissions Temperature Indicator**  | 1. Engine gas temperature is high.<br>2. Exhaust filter cleaning is in process.<br>**If at all possible do not abort a Regen in progress.** | Machine can be operated as normal. If operating in an area where high exhaust temperatures may be an issue, abort exhaust filter cleaning by using the disable feature. **Too many aborted Regens will cause the need for a Parked or Recovery Regen.** |
| **Engine Emissions Temperature Indicator and Warning Indicator**  | Exhaust gas temperature is higher than expected.<br>Machine performance is reduced. | Contact your service dealer. |
| **Engine Emissions Temperature Indicator and Stop Indicator**   | Exhaust gas temperature is higher than expected.<br>Machine performance is reduced. | Contact your service dealer. |
| **Exhaust Filter Indicator**  | 1. Soot level in the exhaust filter indicates need for an exhaust filter cleaning. ***DTC: 003719.15 will be present.**<br>2. Aftertreatment System Fault. | Enable auto exhaust filter cleaning to allow a cleaning cycle or begin a manual / parked cleaning. If exhaust filter cleaning is performed and indicator is still active: Contact your service dealer. **1200 RPM minimum speed required for AUTO Regen to start.** |
| **Exhaust Filter and Warning Indicator**  | 1. Machine performance is reduced due to moderately high soot level. ***DTC: 003719.16 will be present.**<br>2. Aftertreatment System Fault. Machine performance will be reduced. | Begin a manual / parked cleaning. If filter cleaning is performed and indicator is still active: Contact your service dealer. |
| **Exhaust Filter and Stop Indicator**   | 1. Exhaust filter requires service. Machine performance is reduced due to extremely high soot level and a stop engine request is made. ***DTC: 003719.00 will be present.**<br>2. Aftertreatment System Fault. Machine performance is reduced. | Service the exhaust filter.<br>Contact your service dealer. **Recovery Regen required due to too many aborted or disabled Regens.** |
| **Auto Cleaning Disabled Indicator**  | Auto exhaust filter cleaning is disabled.<br>**If you need assistance enabling AUTO Regen please call (800) 562-8049 and ask for Technical Assistance.**<br>***Diagnostic Trouble Codes (DTC)*** | If possible, enable auto exhaust filter cleaning. **Auto Regen is your Friend, please use it. This setting will allow the engine to clean the filter with no operator action as long as the engine speed is above 1200 RPM. Machine can operate as normal but will not idle below 1200 RPM until Regen is complete.** |

**FOR CLARIFICATION RELATED TO EXHAUST FILTER REGEN OR OPERATIONS OF ENGINE, PLEASE REFER TO ENGINE OPERATORS MANUAL**