



# Diesel Particulate Filter Operation Guide

## Machines with Yanmar Tier 4-F Engines

Software Guide

## Introduction

This Software Guide describes operation of the machine software that controls the diesel particulate filter regenerations for the machines with the 3-button InfoCenter.

## Safety

Read this information carefully to learn how to operate the InfoCenter control on your product. You are responsible for operating the product properly and safely.

You may contact Toro directly at [www.Toro.com](http://www.Toro.com) for product safety and operation training materials, accessory information, or help finding a dealer.

## Operation

### Diesel Particulate Filter Regeneration

The diesel particulate filter (DPF) is part of the exhaust system. The diesel-oxidation catalyst of the DPF reduces harmful gasses and the soot filter removes soot from the engine exhaust.

The DPF regeneration process uses heat from the engine exhaust to incinerate the soot accumulated on the soot filter, converting the soot to ash, and clears the channels of the soot filter so that filtered engine exhaust flows out the DPF.

The engine computer monitors the accumulation of soot by measuring the back pressure in the DPF. If the back pressure is too high, soot is not incinerating in the soot filter through normal engine operation. To keep the DPF clear of soot, remember the following:

- Passive regeneration occurs continuously while the engine is running—run the engine at full engine speed when possible to promote DPF regeneration.
- If the back pressure in the DPF is too high or a reset regeneration has not occurred for 100 hours, the engine computer signals you through the InfoCenter when reset regeneration is running.
- Allow the reset regeneration process to complete before shutting off the engine.

Operate and maintain your machine with the function of the DPF in mind. Engine load at high idle (full throttle) engine speed generally produces adequate exhaust temperature for DPF regeneration.

**Important:** Minimize the amount of time that you idle the engine or operate the engine at low-engine speed to help reduce the accumulation of soot in the soot filter.


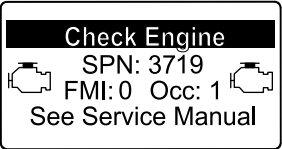


# DPF Soot Accumulation

- Over time, the diesel particulate filter accumulates soot in the soot filter. The computer for the engine monitors the soot level in the DPF.
- When enough soot accumulates, the computer informs you that it is time to regenerate the DPF.

- DPF regeneration is a process that heats the DPF to convert the soot to ash.
- In addition to the warning messages, the computer reduces the power produced by the engine at different soot-accumulation levels.

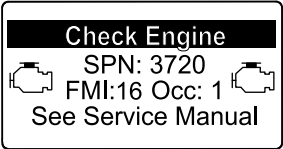

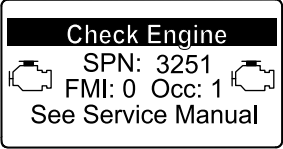
## Engine Warning Messages—Soot Accumulation

Indication Level	Fault Code	Engine Power Rating	Recommended Action
<p>Level 1: Engine Warning</p>	 <p style="text-align: center;"><small>g213866</small></p> <p style="text-align: center;"><b>Figure 1</b></p> <p style="text-align: center;">Check Engine SPN 3719, FMI 16</p>	<p>The computer de-rates the engine power to 85%.</p>	<p>Perform a parked regeneration as soon as possible; refer to <a href="#">Parked or Recovery Regeneration (page 9)</a>.</p>
<p>Level 2: Engine Warning</p>	 <p style="text-align: center;"><small>g213867</small></p> <p style="text-align: center;"><b>Figure 2</b></p> <p style="text-align: center;">Check Engine SPN 3719, FMI 0</p>	<p>The computer de-rates the engine power to 50%.</p>	<p>Perform a recovery regeneration as soon as possible; refer to <a href="#">Parked or Recovery Regeneration (page 9)</a>.</p>

# DPF Ash Accumulation


- The lighter ash is discharged through the exhaust system; the heavier ash collects in the soot filter.
- Ash is a residue of the regeneration process. Over time, the diesel particulate filter accumulates ash that does not discharge with the engine exhaust.
- The computer for the engine calculates the amount of ash accumulated in the DPF.
- When enough ash accumulates, the engine computer sends information to the InfoCenter in the form of an engine fault to indicate the accumulation of ash in the DPF.
- The fault messages indicate that it is time to service the DPF.
- In addition to the warnings, the computer reduces the power produced by the engine at different ash-accumulation levels.

## InfoCenter Advisory and Engine Warning Messages—Ash Accumulation


Indication Level	Fault Code	Engine Speed Reduction	Engine Power Rating	Recommended Action
Level 1: Engine Warning	 <p>g213863</p> <p><b>Figure 3</b> Check Engine SPN 3720, FMI 16</p>	None	The computer de-rates the engine power to 85%.	Service the DPF; refer to Servicing the Diesel-Oxidation Catalyst (DOC) and the Soot Filter in the OPERATOR'S MANUAL for your machine.
Level 2: Engine Warning	 <p>g213863</p> <p><b>Figure 4</b> Check Engine SPN 3720, FMI 16</p>	None	The computer de-rates the engine power to 50%.	Service the DPF; refer to Servicing the Diesel-Oxidation Catalyst (DOC) and the Soot Filter in the OPERATOR'S MANUAL for your machine.
Level 3: Engine Warning	 <p>g214715</p> <p><b>Figure 5</b> Check Engine SPN 3251, FMI 0</p>	Engine speed at maximum torque + 200 rpm	The computer de-rates the engine power to 50%.	Service the DPF; refer to Servicing the Diesel-Oxidation Catalyst (DOC) and the Soot Filter in the OPERATOR'S MANUAL for your machine.

# Types of Diesel Particulate Filter Regeneration


## Types of diesel particulate filter regeneration that are performed while the machine is operating:

Type of Regeneration	Conditions that cause DPF regeneration	DPF description of operation
<b>Passive</b>	Occurs during normal operation of the machine at high-engine speed or high-engine load	<ul style="list-style-type: none"> <li>The InfoCenter does not display an icon indicating passive regeneration.</li> <li>During passive regeneration, the DPF processes high-heat exhaust gasses, oxidizing harmful emissions, and burning soot to ash.</li> </ul> Refer to <a href="#">Passive DPF Regeneration (page 7)</a> .
<b>Assist</b>	Occurs because of low-engine speed, low-engine load, or after the computer detects the DPF is becoming obstructed with soot	<ul style="list-style-type: none"> <li>The InfoCenter does not display an icon indicating assist regeneration.</li> <li>During assist regeneration, the engine computer adjusts the engine settings to raise the exhaust temperature.</li> </ul> Refer to <a href="#">Assist DPF Regeneration (page 7)</a> .
<b>Reset</b>	Occurs every 100 hours  Also occurs after assist regeneration only if the computer detects that assist regeneration did not sufficiently reduce the soot level	 <ul style="list-style-type: none"> <li>When the high exhaust-temperature icon is displayed in the InfoCenter, a regeneration is in progress.</li> <li>During reset regeneration, the engine computer adjusts the engine settings to raise the exhaust temperature.</li> </ul> Refer to <a href="#">Reset Regeneration (page 7)</a> .

## Types of diesel particulate filter regeneration that require you to park the machine:

Type of Regeneration	Conditions that cause DPF regeneration	DPF description of operation
<b>Parked</b>	Occurs because the computer detects back pressure in the DPF due to soot buildup  Also occurs because the operator initiates a parked regeneration  May occur because you set the InfoCenter to inhibit reset regeneration and continued operating the machine, adding more soot when the DPF already needs a reset regeneration  May result from using the incorrect fuel or engine oil	<ul style="list-style-type: none"> <li>When the reset-standby/parked or recovery regeneration icon  or ADVISORY #188 displays in the InfoCenter, a regeneration is requested.</li> <li>Perform the parked regeneration as soon as possible to avoid needing a recovery regeneration.</li> <li>A parked regeneration requires 30 to 60 minutes to complete.</li> <li>You must have at least a 1/4 tank of fuel in the tank.</li> <li>You must park the machine to perform a parked regeneration.</li> </ul> Refer to <a href="#">Parked or Recovery Regeneration (page 9)</a> .

## Types of diesel particulate filter regeneration that require you to park the machine: (cont'd.)

Type of Regeneration	Conditions that cause DPF regeneration	DPF description of operation
Recovery	Occurs because the operator ignored requests for a parked regeneration and continued operating the machine, adding more soot to the DPF	<ul style="list-style-type: none"> <li>When the reset-standby/parked or recovery regeneration icon  or ADVISORY #190 displays in the InfoCenter, a recovery regeneration is requested.</li> <li>A recovery regeneration requires up to 3 hours to complete.</li> <li>You must have at least a 1/2 tank of fuel in the machine.</li> <li>You must park the machine to perform a recovery regeneration.</li> </ul> <p>Refer to <a href="#">Parked or Recovery Regeneration (page 9)</a>.</p>

## Accessing the DPF Regeneration Menus

### Accessing the DPF Regeneration Menus

1. Access the Service menu, press the center button to scroll down to the DPF REGENERATION option ([Figure 6](#)).

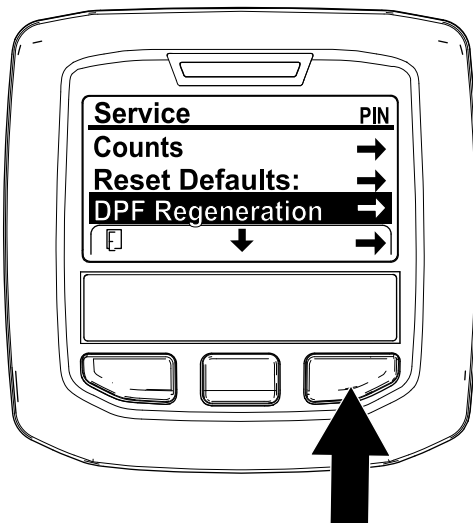


Figure 6

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### Time Since Last Regeneration

Access the DPF Regeneration menu, press the center button to scroll down to the LAST REGEN field ([Figure 7](#)).

Use the LAST REGEN field to determine how many hours you have run the engine since the last reset, parked, or recovery regeneration.

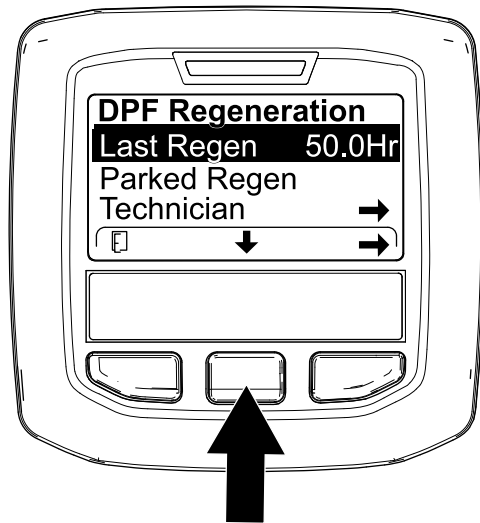


Figure 7

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2. Press the right button to select the DPF Regeneration entry ([Figure 6](#)).

## Technician Menu

**Important:** For operating convenience, you may decide to perform a parked regeneration before the soot load reaches 100%, provided the engine has run more than 50 hours since the last successful reset, parked, or recovery regeneration.

Use the technician menu to view the current state of engine regeneration control and view the reported soot level.

Access the DPF Regeneration menu, press the center button to scroll down to the **TECHNICIAN** option, and press the right button to select the Technician entry (Figure 8).

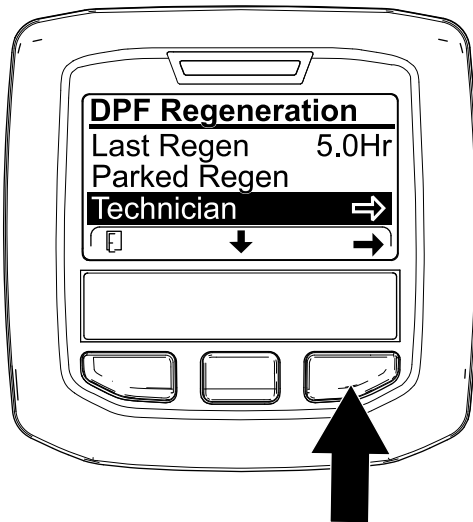


Figure 8

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- Use the DPF operation table to understand the current state of DPF operation (Figure 9).

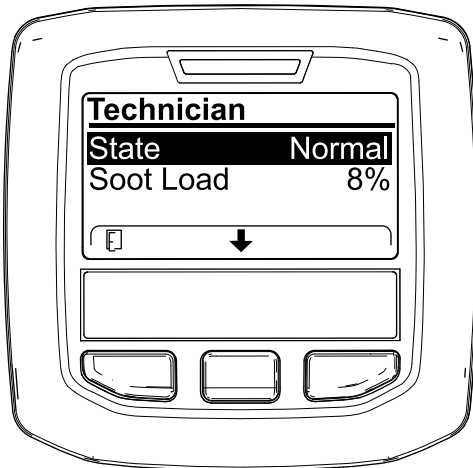


Figure 9

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## DPF Operation Table

State	Description	
Normal	The DPF is in normal-operating mode—passive regeneration.	
Assist Regen	The engine computer is performing an assist regeneration.	
Reset Stby	The engine computer is trying to run a reset regeneration, but 1 of the following conditions prevents regeneration:	The regen inhibit setting is set to ON.
		The exhaust temperature is too low for regeneration.
Reset Regen	The engine computer is running a reset regeneration.	
Parked Stby	The engine computer is requesting that you run a parked regeneration.	
Parked Regen	You initiated a parked regeneration request and the engine computer is processing the regeneration.	
Recov. Stby	The engine computer is requesting that you run a recovery regeneration.	
Recov. Regen	You initiated a recovery regeneration request and the engine computer is processing the regeneration.	

- View the soot load which is measured as the percentage of soot in the DPF (Figure 10); refer to the soot-load table.

**Note:** The soot load value varies as the machine is operated and DPF regeneration occurs.

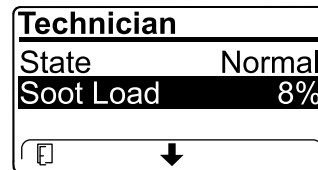


Figure 10

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## Soot-Load Table

Important Soot Load Values	Regeneration State
0% to 5%	Minimum soot load range
78%	The engine computer performs an assist regeneration.
100%	The engine computer automatically requests a parked regeneration.
122%	The engine computer automatically requests a recovery regeneration.

## Passive DPF Regeneration

- Passive regeneration occurs as part of normal engine operation.
- While operating the machine, run the engine at full-engine speed and high load when possible to promote DPF regeneration.

## Assist DPF Regeneration

- The engine computer adjusts engine settings to raise the exhaust temperature.
- While operating the machine, run the engine at full engine speed and high load when possible to promote DPF regeneration.

## Reset Regeneration

### ⚠ CAUTION

The exhaust temperature is hot (approximately 600°C (1,112°F)) during DPF regeneration. Hot exhaust gas can harm you or other people.

- Never operate the engine in an enclosed area.
- Make sure that there are no flammable materials around the exhaust system.
- Never touch a hot exhaust system component.
- Never stand near or around the exhaust pipe of the machine.

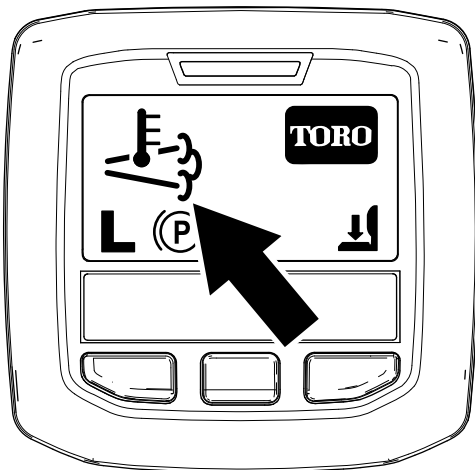



Figure 11

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- The high exhaust-temperature icon  displays in the InfoCenter (Figure 11).
- The engine computer adjusts engine settings to raise the exhaust temperature.

**Important:** The high exhaust-temperature icon indicates that the exhaust temperature discharged from of your machine may be hotter than during regular operation.

- While operating the machine, run the engine at full engine speed and high load when possible to promote DPF regeneration.
- The icon displays in the InfoCenter while the reset regeneration is processing.
- Whenever possible, do not shut off the engine or reduce engine speed while the reset regeneration is processing.

**Important:** Whenever possible, allow the machine to complete the reset regeneration process before shutting off the engine.

## Periodic Reset Regeneration

If the engine has not completed a successful Reset, Parked, or Recovery regeneration in the previous 100 hours of engine operation, the engine computer will attempt to perform a reset regeneration.

## Setting the Inhibit Regen

### Reset Regeneration Only

**Note:** If you set the InfoCenter to inhibit regeneration, the InfoCenter displays ADVISORY #185 (Figure 12) every 15 minutes while the engine requests a reset regeneration.

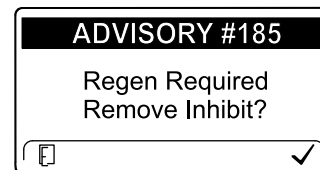


Figure 12

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A reset regeneration produces the elevated engine exhaust. If you are operating the machine around trees, brush, tall grass, or other temperature-sensitive plants or materials, you can use the Inhibit Regen setting to prevent the engine computer from performing a reset regeneration.

**Important:** When you shut off the engine and start it again, the inhibit regen setting defaults to OFF.

1. Access the DPF Regeneration menu, press the center button to scroll down to the INHIBIT REGEN option, and press the right button to select the Inhibit Regen entry (Figure 13).

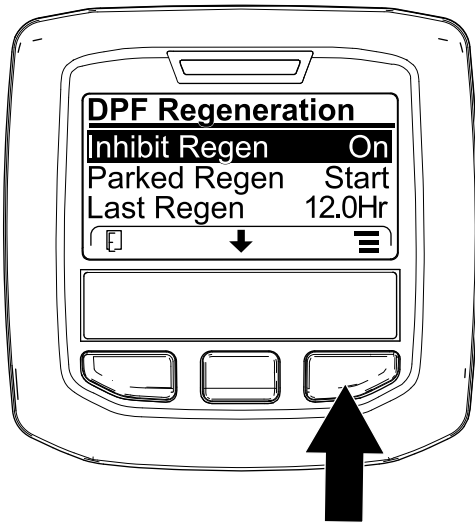


Figure 13

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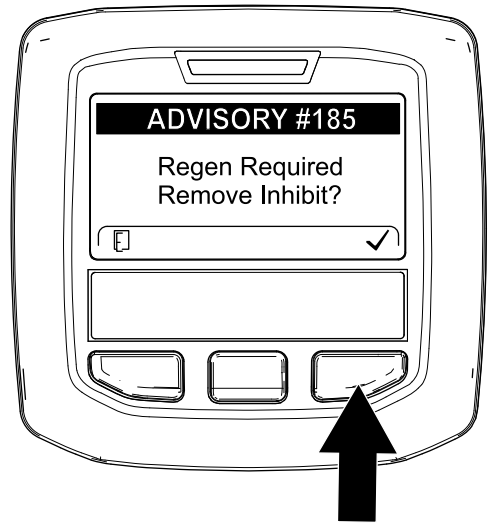


Figure 15

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- Press the right button to change the inhibit regeneration setting from On to Off (Figure 13) or from Off to On (Figure 14).

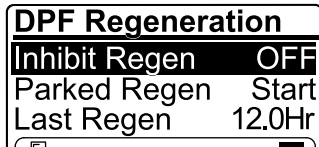


Figure 14

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**Note:** If the engine exhaust temperature is too low, the InfoCenter displays ADVISORY #186 (Figure 16) to inform you to set the engine to full throttle (high idle).

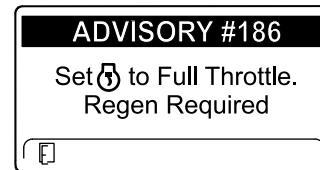



Figure 16

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### Allowing a Reset Regeneration

The InfoCenter displays the high exhaust-temperature

icon  when the reset regeneration is in process.

**Note:** If INHIBIT REGEN is set to ON, the InfoCenter displays ADVISORY #185 (Figure 15). Press button 3 to set inhibit regeneration setting to OFF and continue with the reset regeneration.

**Note:** When the reset regeneration completes, the

high exhaust-temperature  disappears from the InfoCenter screen.



## Parked or Recovery Regeneration

- When the engine computer requests either a parked regeneration or a recovery regeneration, the regeneration request icon (Figure 17) displays in the InfoCenter.

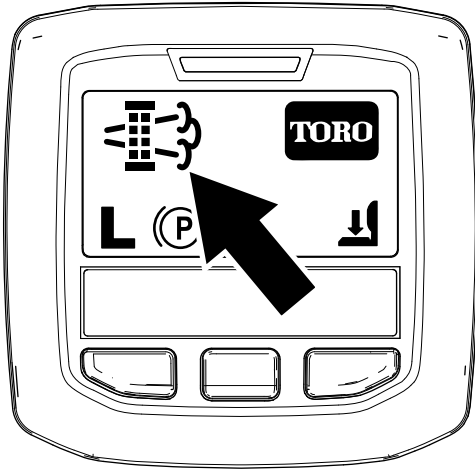


Figure 17

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- The machine does not automatically perform a parked regeneration or a recovery regeneration, you must run the regeneration through the InfoCenter.

## Parked Regeneration Messages

When a parked regeneration is requested by the engine computer the following messages display in the InfoCenter:

- Engine warning SPN 3720, FMI 16 (Figure 18)

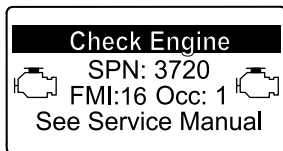


Figure 18

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- Parked regeneration required ADVISORY #188 (Figure 19)

**Note:** Advisory #188 displays every 15 minutes.

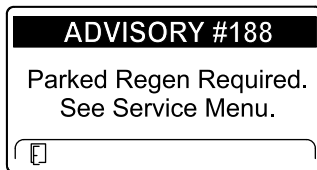


Figure 19

g224397

- If you do not perform a parked regeneration within 2 hours, the InfoCenter displays parked

regeneration required—power takeoff disabled  
ADVISORY #189 (Figure 20).

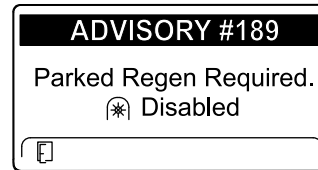


Figure 20

g224398

**Important:** Perform a parked regeneration to restore the PTO function; refer to [Preparing to Perform a Parked or Recovery Regeneration \(page 10\)](#) and [Performing a Parked or Recovery Regeneration \(page 10\)](#).

**Note:** The Home screen displays the PTO disabled Icon (Figure 21).

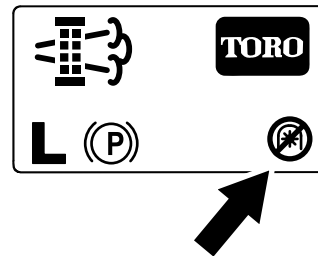


Figure 21

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## Recovery Regeneration Messages

When a recovery regeneration is requested by the engine computer, the following messages display in the InfoCenter:

- Engine warning SPN 3719, FMI 0 (Figure 22)

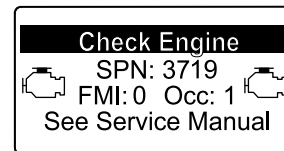


Figure 22

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- Recovery regeneration required—power takeoff disabled ADVISORY #190 (Figure 23)

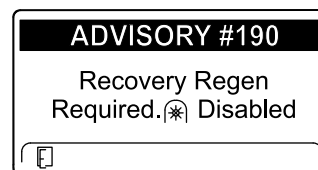


Figure 23

g224399

**Important:** Perform a recovery regeneration to restore the PTO function; refer to [Preparing to Perform a Parked or Recovery Regeneration \(page 10\)](#) and [Performing a Parked or Recovery Regeneration \(page 10\)](#).

**Note:** The Home screen displays the PTO disabled icon; refer to [Figure 21 in Parked Regeneration Messages \(page 9\)](#).

### DPF Status-Limitation

- If the engine computer requests a recovery regeneration or is processing a recovery regeneration and you scroll down to the PARKED REGEN option, parked regeneration locks and the lock icon ([Figure 24](#)) appears in the lower right corner of the InfoCenter.

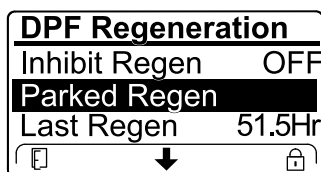


Figure 24

g224625

- If the engine computer has not requested a recovery regeneration and you scroll down to the RECOVERY REGEN option, the recovery regeneration locks and the lock icon ([Figure 25](#)) appears in the lower right corner of the InfoCenter.

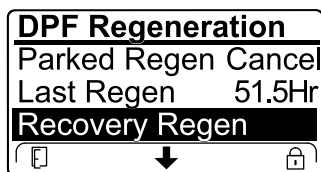


Figure 25

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### Preparing to Perform a Parked or Recovery Regeneration

- Ensure that the machine has fuel in the tank for the type of regeneration you are performing:
  - Parked Regeneration:** Ensure that you have 1/4 tank of fuel before performing the parked regeneration.
  - Recovery Regeneration:** Ensure that you have 1/2 tank of fuel before performing the recovery regeneration.

- Move the machine outside to an area away from combustible materials.
- Park the machine on a level surface.
- Ensure that the traction control or motion-control levers are in the NEUTRAL position.
- If applicable, shut off the PTO, and lower the cutting units or accessories.
- Engage the parking brake.
- Set the throttle to the low IDLE position.

### Performing a Parked or Recovery Regeneration

#### **CAUTION**

The exhaust temperature is hot (approximately 600°C (1,112°F) during DPF regeneration. Hot exhaust gas can harm you or other people.

- Never operate the engine in an enclosed area.
- Make sure that there are no flammable materials around the exhaust system.
- Never touch a hot exhaust system component.
- Never stand near or around the exhaust pipe of the machine.

**Important:** The computer of the machine cancels DPF regeneration if you increase the engine speed from low idle or release the parking brake.

- Access the DPF Regeneration menu, press the center button to scroll down to either the PARKED REGEN START option or the RECOVERY REGEN START option ([Figure 26](#)), and press the right button to select the start the regeneration ([Figure 26](#)).

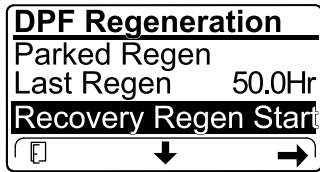
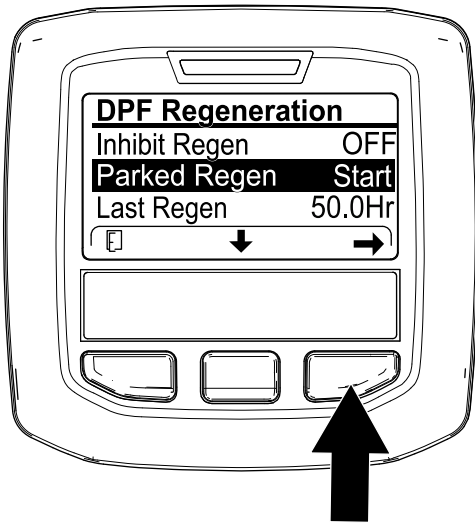
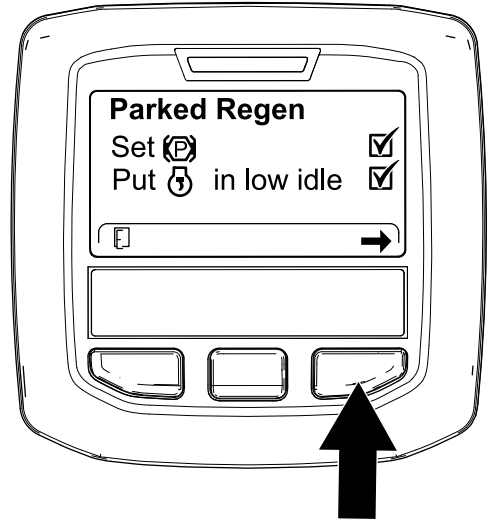


Figure 26

g224402

g224629

- At the DPF checklist screen, verify that the parking brake is engaged and that the engine speed is set to low idle (Figure 28).



g224407

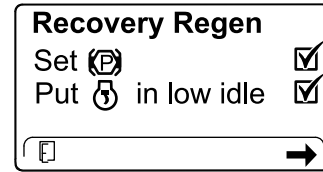
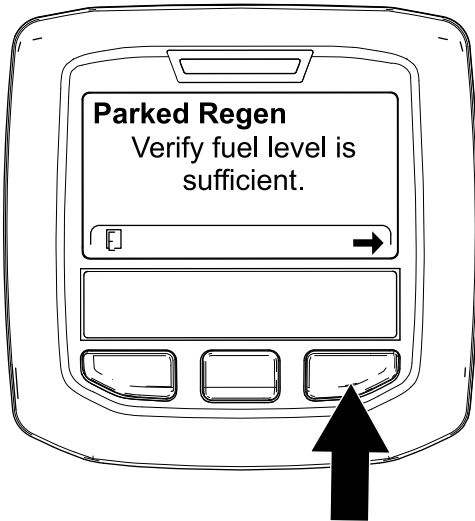


Figure 28

g227679

- At the VERIFY FUEL LEVEL screen, verify that you have 1/4 tank of fuel if you are performing the parked regeneration or 1/2 tank of fuel if you are performing the recovery regeneration, and press the right button to continue (Figure 27).



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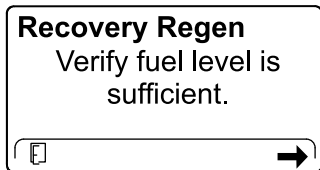
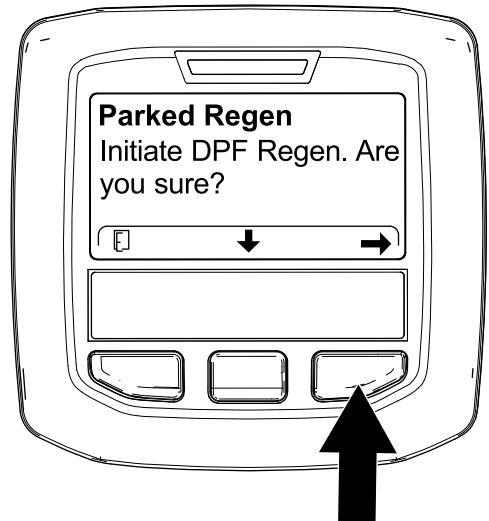


Figure 27

g227678

- At the INITIATE DPF REGEN screen, press the right button to continue (Figure 29).



g224626



Figure 29

g224630

5. The InfoCenter displays the INITIATING DPF REGEN message (Figure 30).

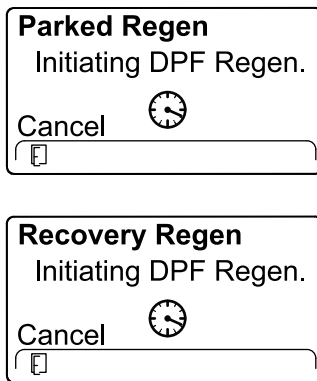


Figure 30

6. The InfoCenter displays the time to complete message (Figure 31).

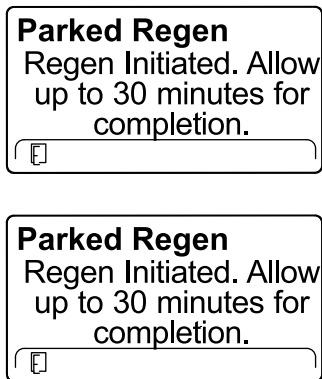


Figure 31

7. The engine computer checks the engine state and fault information. The InfoCenter may display the following messages found in the table that follows:

### Check Message and Corrective Action Table

<p><b>Parked Regen</b> Regen refused: 50 hour limit.</p>	
<p><b>Corrective Action:</b> Exit the regeneration menu and run the machine until the time since last regeneration is greater than 50 hours; refer to <a href="#">Time Since Last Regeneration (page 5)</a>.</p>	
<p><b>Parked Regen</b> Regen refused active engine faults.</p>	<p><b>Recovery Regen</b> Regen refused active engine faults.</p>
<p><b>Corrective Action:</b> Troubleshoot the engine fault and retry DPF regeneration.</p>	

### Check Message and Corrective Action Table (cont'd.)

<p><b>Parked Regen</b> ⚠ must be running</p>	<p><b>Recovery Regen</b> ⚠ must be running</p>
<p><b>Corrective Action:</b> Start and run the engine.</p>	
<p><b>Parked Regen</b> Ensure ⚠ is running and above 60C/140F.</p>	<p><b>Recovery Regen</b> Ensure ⚠ is running and above 60C/140F.</p>
<p><b>Corrective Action:</b> Run the engine to warm the coolant temperature to 60°C (140°F).</p>	
<p><b>Parked Regen</b> Put ⚠ in low idle.</p>	<p><b>Recovery Regen</b> Put ⚠ in low idle.</p>
<p><b>Corrective Action:</b> Change the engine speed to low idle.</p>	
<p><b>Parked Regen</b> Regen refused by ECU.</p>	<p><b>Recovery Regen</b> Regen refused by ECU.</p>
<p><b>Corrective Action:</b> Troubleshoot the engine computer condition and retry DPF regeneration.</p>	

8. The InfoCenter displays the home screen and the regeneration acknowledge icon (Figure 32) appears in the lower right corner of the screen as the regeneration processes.

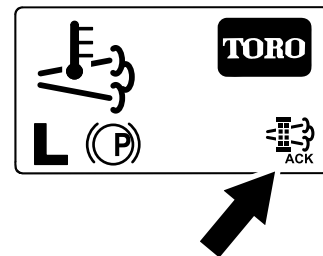


Figure 32

**Note:** While the DPF regeneration runs, the InfoCenter displays the high

exhaust-temperature icon .

9. When the engine computer completes a parked or recovery regeneration, the InfoCenter

displays ADVISORY #183 (Figure 33). Press the left button to exit to the home screen.

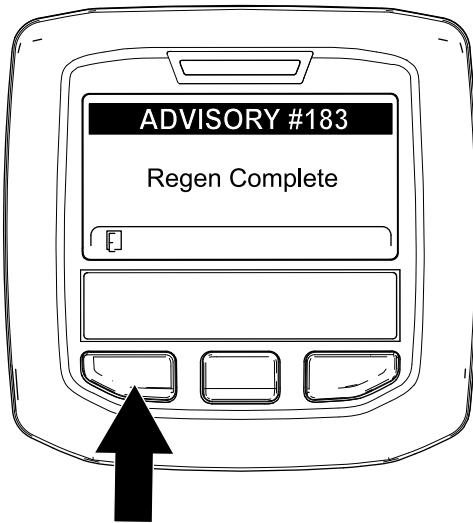


Figure 33

g224392

**Note:** If the regeneration fails to complete, the InfoCenter displays Advisory #184 (Figure 34). Press the left button to exit to the home screen.

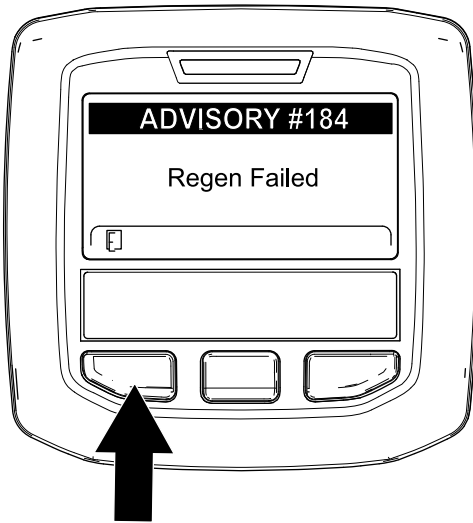


Figure 34

g224393

## Canceling a Parked or Recovery Regeneration

Use the Parked Regen Cancel or Recovery Regen Cancel setting to cancel a running parked or recovery regeneration process.

1. Access the DPF Regeneration menu (Figure 35).

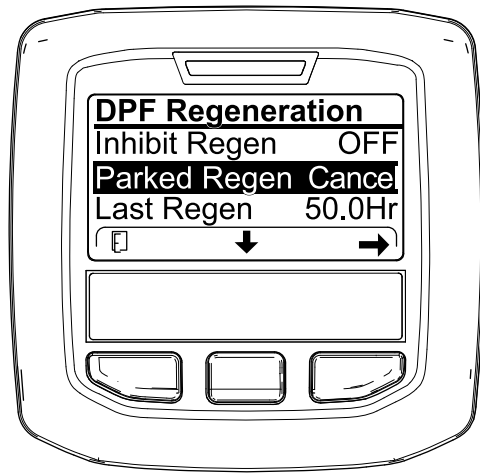


Figure 35

g227305

2. Press the center button to scroll down to the PARKED REGEN CANCEL (Figure 35) or the RECOVERY REGEN CANCEL option (Figure 36).

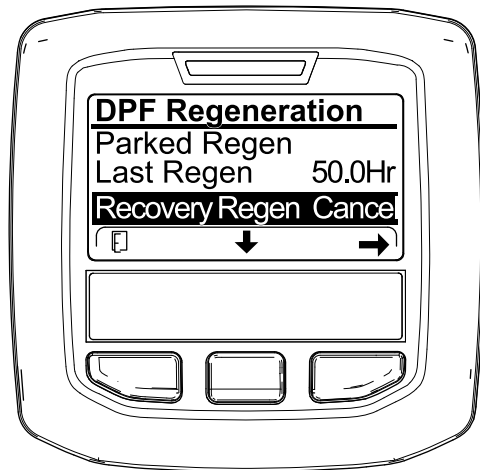


Figure 36

g227306

3. Press the right button to select the Regen Cancel entry (Figure 35 or Figure 36).

**Notes:**

**Notes:**



**Count on it.**