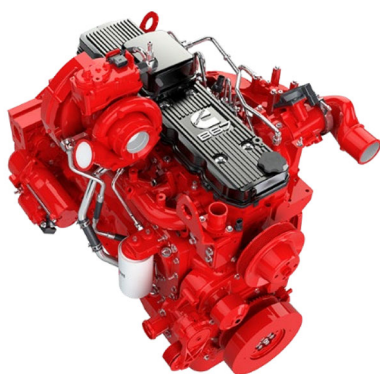


# OPERATION MANUAL



***B4.5***



***B6.7***

## ***CUMMINS Engine B4.5 & B6.7 Stage 5***

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MANUFACTURER OF SPECIAL VEHICLES

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# 1 Introduction

## 1.1 How to use this document

This document is a supplement to the main tractor operation manual and advice specifically on the operation and safety of the Cummins Stage V engine.

The manual **MUST** be read thoroughly before using the tractor.

Terberg is in no way responsible for damage caused by using or maintaining this tractor. The given instructions are an advice. You are responsible for creating a safe working environment.

No attempt should be made to operate or maintain this equipment until this manual and its supplements have been read and fully understood.

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Terberg Benschop B.V. reserves the right to make changes without prior notice.

These are the original instructions. The English language is binding. Request your language if it is missing.

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## 1.2 Abbreviations and phrases

AdBlue:	Known as Diesel Exhaust Fluid. (DEF), Urea or (in the USA): AIR1.
DIM:	Driver Information Module (part of the dashboard).
Derate:	Reduction in engine power.
ATS:	Aftertreatment System.
EATS:	Electronic Aftertreatment System.
DOC:	Diesel Oxidation Catalyst.
DPF:	Diesel Particulate Filter.
HEST:	High Exhaust System Temperature.
NOX:	Nitrogen oxides.
Regeneration:	Exhaust cleaning process to burn exhaust particulates using a high temperature. This process can start automatically or manually.
SCR:	Selective Catalytic Reduction. The NOX in the exhaust gases reacts with injected AdBlue and breaks down into nitrogen and water.
PTO:	Power Take-Off.

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## 2 Safety

### 2.1 General

**Important**  
Read this document carefully before use.  
Keep it for future reference.

### 2.2 Warning messages

#### DANGER



**Indicates a potentially and imminently hazardous situation which, if not avoided, will result in death or serious injury.**  
All DANGER notifications will be indicated with this RED symbol.

#### WARNING



**Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**  
All WARNING notifications will be indicated with this ORANGE symbol.

#### CAUTION



**Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.**  
All CAUTION notifications will be indicated with this YELLOW symbol.

#### NOTICE



**Notices will be used to show special procedures or point out important facts. Notices will also designate important information regarding this manual and its use.**  
All NOTICE notifications will be indicated with this BLUE symbol.

### 2.3 Graphical symbols

#### DAMAGE



**Notices will be used to show special procedures or point out important facts. Notices will also designate important information regarding this manual and its use.**  
All NOTICE notifications will be indicated with this ORANGE symbol.


## 2.4 Instructions for safe use

### DANGER



High temperature exhaust gas during regeneration (over 500 °C / 930 °F).

Risk of fire or explosion in environments with flammable gases or materials.

- **Do not start regeneration when entering environments with flammable gases or materials.**
- **Set the Inhibit switch in STOP position  to prevent automatic regeneration will occur.**
- **Make sure that materials that can explode, burn or melt are kept at least 1,5 m / 5 ft from the exhaust outlet.**
- **Make sure that there are no gases or vapours nearby that can explode, burn or contribute to a fire.**
- **Always apply the parking brake before leaving the cabin**


### WARNING



- **If you operate in environments that contain explosive vapours or flammable materials, set the regeneration STOP switch to the STOP position.**
- **The STOP position must be activated prior to entering the environment(s) to prevent automatic regeneration from occurring, which could cause an explosion or fire.**
- **Failure to activate the regeneration STOP switch before entering a combustible environment may cause an explosion or fire that could lead to death, personal injury, equipment or property damage.**

### WARNING



When HEST lamp illuminates , the exhaust gas temperature could reach 500 °C, which is hot enough to ignite or melt common materials and to burn people.

- **Make sure that the exhaust outlet is not directed at any surface or material that can melt, burn or explode.**

### WARNING



- **Do not set the main power switch to the OFF position within 2 minutes after the ignition key has been set to the OFF position.**

### 3 General lay-out of the system

To meet emissions levels, this engine is equipped with an Aftertreatment System (ATS) to reduce NOX and particulates.

The EATS consist of 4 subsystems:

- Diesel Oxidation Catalyst (DOC).
- Diesel Particular Filter (DPF).
- Selective Catalytic Reduction (SCR).
- AdBlue dosing system.

#### **Diesel Oxidation Catalyst (DOC)**

The DOC reduces the emission of Carbon Monoxide (CO), Hydrocarbons (HC) and Particulate Matter (PM) by oxidising these in to Carbon Dioxide (CO<sub>2</sub>) and water (H<sub>2</sub>O).

#### **Diesel Particular Filter (DPF)**

The DPF captures soot particles from the engine exhaust. The DPF is designed to trap and retain the soot particles until the particles can be oxidized or burned in the DPF itself, through a process called regeneration.

#### **Selective Catalytic Reduction (SCR)**

During operation, the primary function of the SCR is to reduce NOX in the exhaust gas to nitrogen.

#### **AdBlue dosing system**

The dosing unit sprays AdBlue in the exhaust system to initiate the breakdown of NOX into nitrogen and water. AdBlue must meet ISO 2241 standards / API AUS 32

## 4 Engine operation

Check the oil pressure, temperature indicators, warning lights, and other gauges daily to make sure they are operational.

Let the engine warm up to normal operation temperature before operating at full power.

Avoid long-term operation at idle or at low load.

The operation temperature is important for fuel economy, environmental protection and engine life.

- Load the engine as soon as possible.
- Turn off the engine instead of running on idle for longer periods.
- Avoid load levels below 20% as constant operation.

### 4.1 Running in the engine

Running in is not required.

### 4.2 Engine shutdown

Let the engine run at high idle (1500 - 1800 rpm) before switching off.

- 5 minutes after use at more than 50% load.
- 3 minutes after use with less than 50% load.

Do not switch off the main switch within 2 minutes after turning of the ignition.

The engine and the tractor need time to save data to the engine control unit.

### 4.3 Regeneration


Under certain conditions the ATS will start a SCR and DPF cleaning process. During this regeneration process exhaust particulates are burned at high temperature.

Normally this process starts automatically during operation and is called “**automatic regeneration**”. The HEST lamp can be illuminated.

During a regeneration, the exhaust gas temperature will rise significantly. In environments where high exhaust temperatures and exhaust gases can be dangerous, the regeneration can be stopped or prevented. A stopped regeneration can be re-activated again when you press the SCR system cleaning button. This is called “**Manual regeneration**”.

#### WARNING



When HEST lamp illuminates , the exhaust gas temperature could reach 816 °C, which is hot enough to ignite or melt common materials and to burn people.

- **Make sure that the exhaust outlet is not directed at any surface or material that can melt, burn or explode.**

**NOTICE**

The HEST lamp does not signify the need of service. It alerts the operator to high exhaust temperatures. It will be common for the HEST lamp to illuminate on and off during normal vehicle operation as the engine completes a regeneration.

#### 4.4 Automatic regeneration

When the engine temperature is high enough to meet cleaning requirements, the automatic regeneration starts automatically and the HEST lamp illuminates. This process is part of the normal engine operation.

**NOTICE**

An automatic regeneration is not displayed with the SCR system cleaning lamp. Only the HEST lamp illuminates. During regeneration there can be an increase in turbocharger noise.

The exhaust gas can reach a high temperature during a regeneration, there are conditions where an automatic regeneration needs to be stopped or prevented.

These conditions can be for example:

- Operation in an environment that contains explosive vapours.
- Operation in an environment that contains flammable materials.

The switch prevents automatic regeneration or stops manual regeneration.

The SCR system cleaning stop lamp illuminates when the regeneration is stopped or prevented.



When this lamp is left in the STOP position, the ATS cleaning lamp might be illuminated eventually. This means it is necessary to do a **manual** regeneration.

**CAUTION**

- **Do not leave the switch in the STOP position unless you need to cancel or stop a regeneration. Running the engine with the switch in the STOP position will result in increased soot levels in the DPF and could eventually cause the engine to derate.**

#### 4.5 Manual regeneration

When the exhaust temperatures are not high enough to meet cleaning requirements, a manual regeneration is necessary. To increase the exhaust temperatures extra fuel will be injected, this is controlled by the engine.

The need for a manual regeneration is indicated by an illuminated SCR system cleaning lamp.

If the STOP switch is in the STOP position and the SCR system cleaning lamp illuminates then cleaning is required.

### WARNING



Make sure that during a regeneration the following is observed:

- **Keep the exhaust outlet away from people and anything that can burn, melt or explode.**
- **Make sure that nothing is within 0.6 m of the exhaust outlet.**
- **Make sure that nothing can burn, melt or explode within 1.5 m (such as fuel, wood, paper, plastics, fabric, compressed gas containers or hydraulic lines).**

In an emergency, set the ignition key to the OFF position to stop the flow of the exhaust.

To start a manual regeneration, do the procedure as follows:

- Make sure to follow all relevant warnings. The exhaust outlet temperature is much higher than normal!
- Park the vehicle outside at an appropriate location. If your vehicle is equipped with an exhaust facing down or side wards: choose a surface that will not burn, melt or explode under high exhaust temperatures (such as concrete or gravel, not grass or asphalt).
- Apply the parking brake.
- Put the transmission in neutral [N].
- Make sure that the ignition key is set to the ON position and that the engine is at idle.
- Make sure that a PTO is in the OFF position.
- Press the regeneration START switch to start a manual regeneration. The regeneration can take approximately from 45 to 90 minutes.
- Once a regeneration is initiated, the engine speed and turbocharger noise can increase. The HEST lamp can be illuminated and the SCR system cleaning lamp will flash.
- As soon as the regeneration is finished, the engine will return to idle and the SCR system cleaning lamp will not be illuminated anymore.
- In an emergency, set the ignition key to the OFF position to stop the flow of the exhaust.

## 5 Operator warnings

As soon as there is an error with the ATS, the operator will be informed with illuminated or flashing lamps. There are also combinations of lamps possible. Eventually the engine power will decrease and derate in several levels.

### 5.1 ATS cleaning lamp

This light shows the status of the ATS cleaning processes.

ON: Do a manual regeneration as soon as possible.

FLASHING: Manual regeneration is in progress.



### 5.2 ATS cleaning STOP lamp

This light illuminates when the automatic regeneration is inhibited and the manual regeneration process is stopped. The SCR cleaning system is not active and a cleaning process cannot occur. There can be a reduction in engine power (derate) if the STOP lamp is in the STOP position. The SCR system cleaning lamp might be illuminated eventually. This means it is necessary to do a manual regeneration.



### 5.3 ATS cleaning warning

If the engine CHECK lamp and the ATS cleaning illuminate both then aftertreatment SCR needs to be cleaned immediately.

If action is not taken then the Engine power will be limited automatically.



- Do a manual regeneration as soon as possible.

### 5.4 High Exhaust System Temperature lamp (HEST)


This light illuminates when exhaust temperatures are high and could illuminate during normal engine operation or during a regeneration.

As the exhaust gas temperature is high, do follow all warnings below.



#### WARNING



When HEST lamp illuminates , the exhaust gas temperature could reach 816 °C, which is hot enough to ignite or melt common materials and to burn people.

- Make sure that the exhaust outlet is not directed at any surface or material that can melt, burn or explode.**

## 5.5 AdBlue level

When the AdBlue level in the tank is low then the AdBlue low level lamp illuminates. This light shows the status of the ATS cleaning processes.

ON: The level is below 10%. Fill the AdBlue tank as soon as possible.



FLASHING: The level is below critical level. Fill the AdBlue tank immediately.

If the engine CHECK lamp and the ATS cleaning illuminate both then aftertreatment SCR needs to be cleaned immediately. If action is not taken then the Engine power will be limited automatically.



- Do a manual regeneration as soon as possible.

If engine STOP, engine CHECK and the AdBlue low level illuminate then:

- The engine derates to the third level.
- The engine will go low idle and no longer rev up.
- Fill the AdBlue tank immediately.

