

Understanding Tier 4 Interim (Stage IIIB) Emissions Regulations



A guide to
2012 emissions
regulations and
their impact



Compliance

By the mid-1990s, much of the developed world had committed to laws **that reduce the release of harmful pollutants** linked to non-road diesel engine emissions.



Compliance continued...

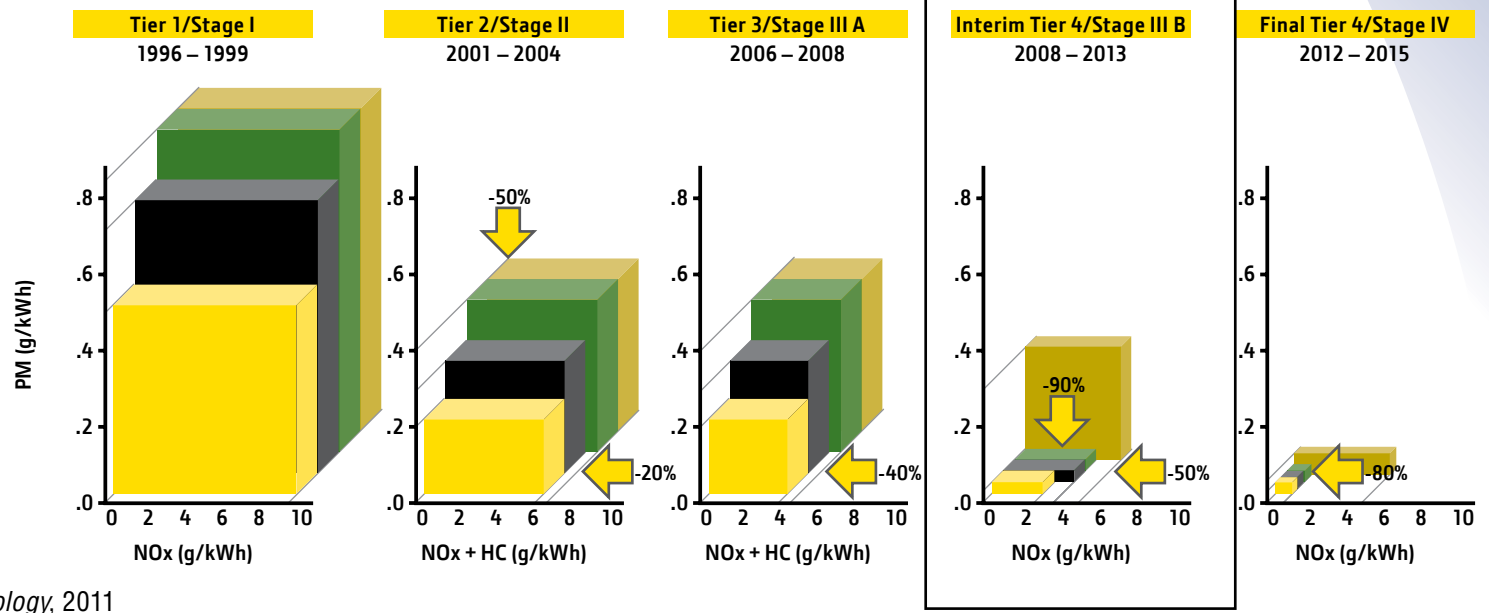


An aggressive, multi-year course was adopted, phasing in new emissions standards based on rated engine power classifications.

EPA and EU nonroad emissions regulations: 37 – 560 kW (50 – 750 hp)

LEGEND:

- 50 – 74 hp
(37 – 55 kW)
- 75 – 99 hp
(56 – 74 kW)
- 100 – 173 hp
(75 – 129 kW)
- 174 – 750 hp
(130 – 560 kW)



Source: John Deere – Emissions Technology, 2011

Compliance continued...



The U.S. EPA and Environment Canada-led emission compliance levels are known as **Tier 1 – 4**, including a distinction between Tier 4 Interim and Tier 4 Final.

EPA nonroad emissions regulations

kW	hp	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
56 - 74	75 - 99				7.5 0.40				4.7 0.40				3.4 0.19 0.02			0.40 0.19 0.02
75 - 129	100 - 174			6.6 0.30				4.0 0.30					3.4 0.19 0.02			0.40 0.19 0.02

Legend

EPA	Tier 1	Tier 2	Tier 3	Interim Tier 4	Final Tier 4
EU	Stage I	Stage II	Stage III A	Stage III B	Stage IV

Examples

NOx	2.0
NMHC	0.19
PM	0.025
NMHC + NOx	7.5
PM	0.80

2.0, the maximum amount of nitrogen oxides (NOx) allowed in g/kWh.
 0.19, the maximum amount of nonmethane hydrocarbons (NMHC) allowed in g/kWh.
 0.025, the maximum amount of particulate matter (PM) allowed in g/kWh.

7.5, the maximum amount of NMHC + NOx allowed in g/kWh.
 0.80, the maximum amount of PM allowed in g/kWh.

Compliance continued...



The European Union (EU) equivalents are known as Stage I – IV, including distinction between Stage IIIA and Stage IIIB.

EU nonroad emissions regulations

kW	hp	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
56 - 74	75 - 99				7.0 1.3 0.40				4.7 0.40				3.3 0.19 0.025			0.40 * 0.19 0.025
75 - 129	100 - 174			6.0 1.0 0.30				4.0 0.30					3.3 0.19 0.025			0.40 * 0.19 0.025

Legend

EPA	Tier 1	Tier 2	Tier 3	Interim Tier 4	Final Tier 4
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NMHC + NO _x	7.5
PM	0.80

7.5, the maximum amount of NMHC + NO_x allowed in g/kWh.
 0.80, the maximum amount of PM allowed in g/kWh.

About

It is generally accepted that Tier 4 Interim (Stage IIIB) regulations will have the most significant impact on the market, as compared to the previous compliance levels.

In addition to **requiring ultra-low sulfur diesel fuel**, these engines may be equipped with **sophisticated exhaust after-treatment components** dedicated to regulating emissions.

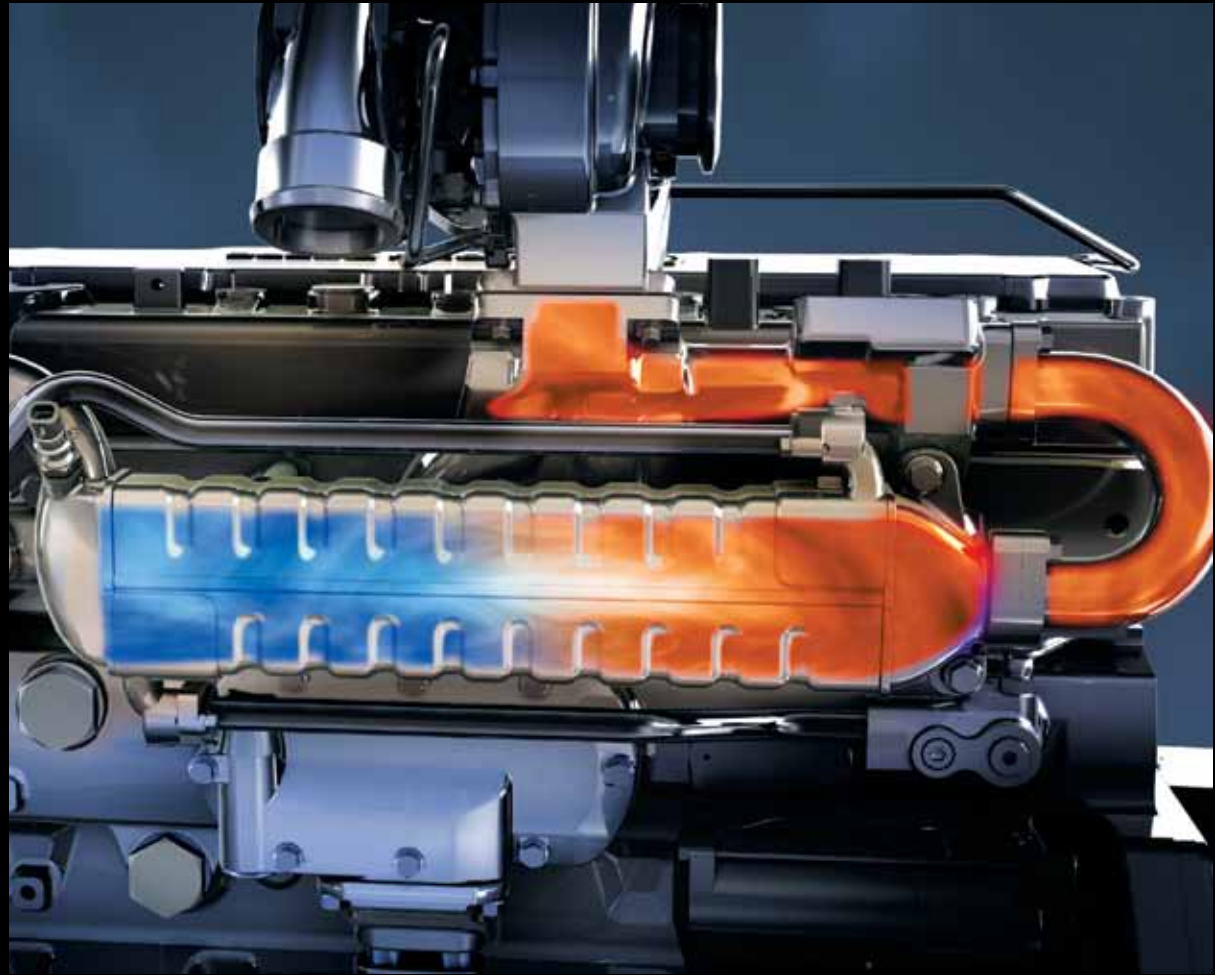


Image provided courtesy of John Deere Power Systems

About continued...

Vermeer equipment with rated power levels between **174 – 750 hp (130 – 560 kW)** have been subject to Tier 4 Interim (Stage IIIB) regulations since 2011.

Effective 2012, all new non-road equipment powered by diesel engines in the 75 – 174 hp (56 – 129 kW) classification must meet Tier 4 Interim (Stage IIIB) emissions regulations in North America and Europe.



About continued...

Popular Vermeer models affected, among others, include:

- **D24x40 Series II Navigator® horizontal directional drill**
- **BC1200XL brush chipper**
- **RTX1250 utility tractor**



About continued...

In some cases, this compliance technology results in an engine price increase that affects the engine manufacturer, Vermeer Corporation, Vermeer dealers and the asset owner.



Technology

As most commonly affecting the 75 – 174 hp (56 – 129 kW) power category, the engine includes an **exhaust gas recirculation (EGR)** design that helps manage a lower combustion temperature, reducing nitrous oxide (NO_x) emissions.

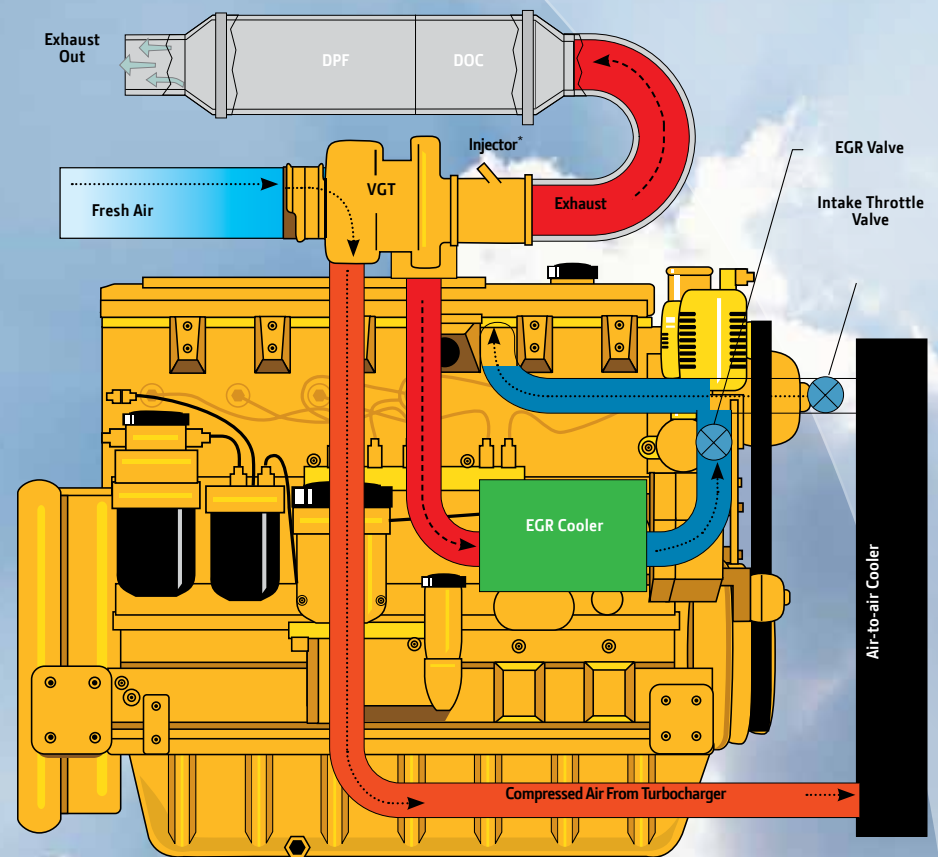


Image provided by John Deere

Technology continued...

The exhaust gas is typically routed through a **Diesel Oxidation Catalyst (DOC) and Diesel Particulate Filter (DPF)** that are contained in combination within a stainless steel component near the top of the engine or remotely mounted.

Within the DOC, a chemical reaction is induced to **convert hydrocarbons, nitrous oxides and other pollutants characteristic of diesel exhaust to less harmful compounds like carbon dioxide.** This is a similar action to the catalytic converter required in cars.

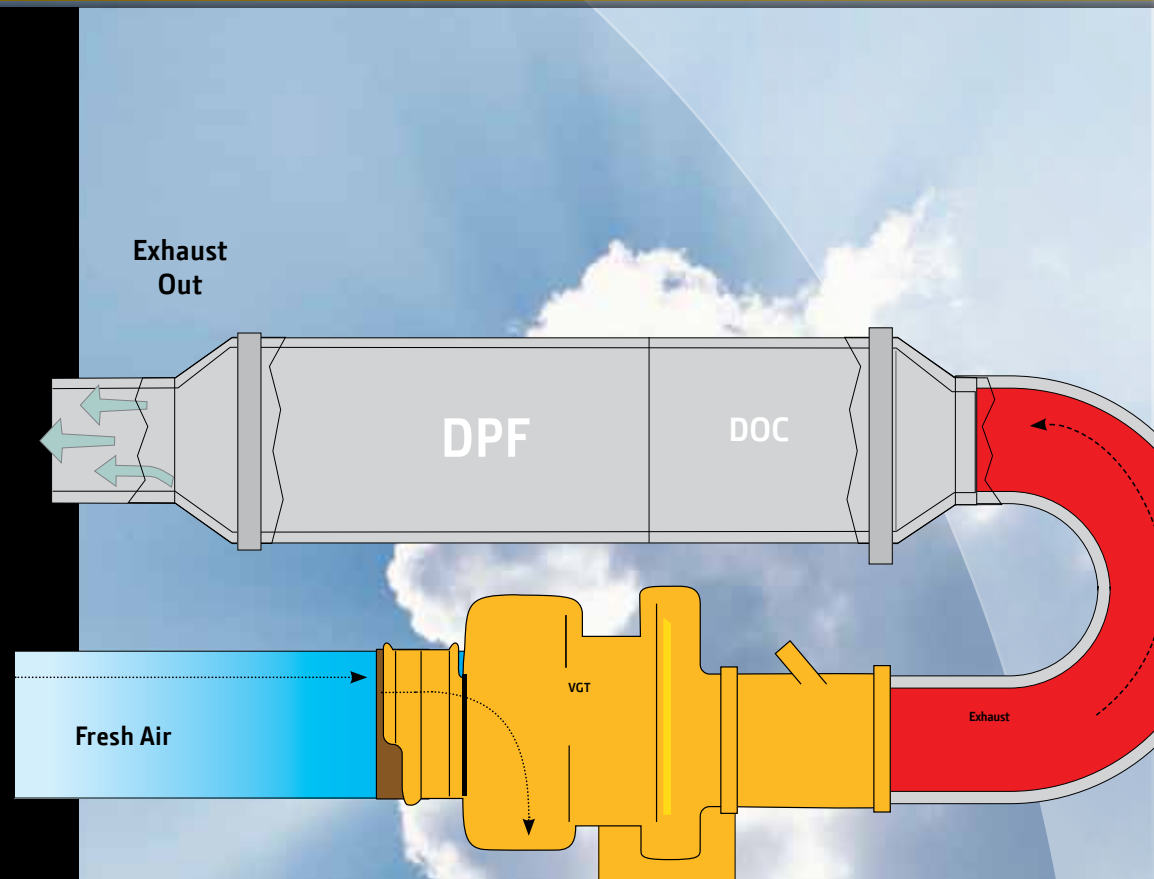


Image provided by John Deere

Technology continued...

The remaining particles, commonly known as soot, are reduced by the DPF. Occasionally, a process commonly referred to as **regeneration removes the accumulated soot from the filter.**

Details of this process vary among engine manufacturers, but most inject an atomized fuel to induce an elevated exhaust temperature. This process is typically seamless to the operator.



Design Impact

Due to the exhaust after-treatment system and larger cooling systems characteristic of Tier 4 Interim (Stage IIIB) engines, **space claim for the power source** within the various models exceeds previous generation engines.

The dynamics of a physically larger engine and the need to **maintain power-to-size ratios** expected by the market today has required extensive engineering time on behalf of Vermeer.



Performance

Vermeer works closely with the **industry's top diesel engine manufacturers** including John Deere, CAT, Cummins and Kubota, to appropriately match the power source to the intended application of the machine.

Vermeer equipment powered by a Tier 4 Interim (Stage IIIB) compliant engine **should perform comparably** to an equivalent Tier 3 (Stage IIIA) powered unit.



Reliability

In addition to the test hours completed by the engine manufacturers, Vermeer has completed **comprehensive validation programs** for Tier 4 (Stage IIIB)-powered units in our unique applications.



Service

Your local independent, authorized Vermeer dealer is your **first point of contact for service items** related to the engine or otherwise.

Note: Tampering with the after-treatment system by anyone except a certified representative of the engine manufacturer could void warranty.



Equipment shown is for illustrative purposes only and may display optional accessories or components. Please contact your local Vermeer dealer for more information on machine specifications. Vermeer Corporation reserves the right to make changes in engineering, design and specifications; add improvements; or discontinue manufacturing at any time without notice or obligation.

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