

Emission legislation in Europe

Non-road mobile machinery

In recent years, (inter)national and local governmental bodies started implementing regulations to limit air pollution through engine use. These regulations apply to both road and non-road applications, which means this also impacts the machines you are building or manufacturing. Read the article below to learn more about the consequences for your Mitsubishi diesel engines.

Emission legislation in Europe

Within Europe, the general legislation for non-road mobile machinery (NRMM) is Stage V. This regulation was proposed in 2014 and finalized in September 2016. The standards are effective from 2019 for engines below 56 kW and above 130 kW, and from 2020 for engines of 56-130 kW. This emission legislation limits the emission of carbon oxide (CO), hydrocarbons (HC), nitrogen oxides (NOx) and particulate matter (PM).

Next to this legislation, so apart from the NRMM Stage V, there is regulating the pleasure boats used for leisure purposes called RCD2 which stands for Recreational Craft Directive.

For this article we will only focus on the NRMM legislation.

Stage V for NRMM

NRMM applications can be described as machinery which is used off the road, such as:

- Gardening and handheld equipment (lawn mowers, chainsaws, etc);
- Construction machinery (excavators, bulldozers, etc);
- Agricultural & farming machines (harvesters, cultivators);
- Locomotives, inland waterway vessels;
- Generators.

Engines which comply with the limits set in Stage V regulations, will have some sort of exhaust aftertreatment system, are electric or use a different type of fuel such as LNG. This means that diesel engines are fitted with a DPF, a diesel particulate filter and a SCR, selective catalytic reduction.

Diesel particulate filter

As the name says, diesel particulate filters filter out the harmful particulate matter or soot particles from the exhaust of a diesel engine. Filters nowadays filter out 30 to more than 95% of the soot.

Selective catalytic reduction

An SCR converts NOx (nitrogen oxides) into the not harmful diatomic nitrogen (N₂) and water (H₂O) through the use of a catalyst. The exhaust gases are mixed with a gaseous redundant (such as ammonia or urea) and are absorbed onto a catalyst.

Regulations for diesel engines

The NRMM category can be divided into several groups of power applications. Firstly, the regulation makes a distinction between compression ignition engines (CI, or diesel engines) and



spark ignited engines (SI, or petrol engines). The focus here is on CI engines, which have been subdivided into several categories.

For industrial applications we have the following categories:

- Category NRE—Engines for NRMM, suited to move or to be moved, that are not included in any of the points below;
- Category NRG—Engines above 560 kW used in generating sets;
- Category RLL—Engines for the propulsion of railway locomotives;
- Category RLR—Engines for the propulsion of railcars;

For marine applications we have the following categories within NRMM Stage V:

- IWW: Inland Waterway. This category consists of:
 - IWP: engines over 19kW, only used in inland waterway vessels and used for propulsion
 - IWA: auxiliary engines with an output of exactly or more than 19kW, only used in inland waterway vessels;

Differences between NRE and IWW

1. Effective date

The effective dates as well as subdivisions into power output differ between NRE and IWW. See an overview of these differences in the table below.

	NRE (land based)	IWW (IWP and IWA)
	EFFECTIVE DATE	
<56 kW & >130kW	1-1-2020	
Rest	1-1-2019	
<300 kW		1-1-2019
> 300kW		1-1-2020

2. Limits in emission

For the IWW categories, some power ranges will remain without regulation (engines below 19kW are not regulated). For NRE Stage V complete power range is regulated.

Looking at the higher power ranges, we can conclude that IWW engines are regulated more strictly than NRE engines. IWW engines over 300kW have to comply to more strict regulations than the NRE >560kW engines;

- Levels of NOx are lower
- Emission of soot is reduced
- Heavier restriction on quantity of particles

3. Repowering

By repowering we mean repowering of an existing application containing a CI engine. For each of the NRMM categories, there are some specific regulations with regards to repowering.



- i) NRE
- Replacement engine should meet at least the emission level of the replaced engine
 - Broken engines can be replaced with an engine of the same emission stage within 20 years after the end of stage application.
 - Engine does not have to be a copy of the previous engine. You can replace by different engine as long as you maintain comparable power output.
- ii) IWW
- No regulation applicable for Stage V below 19KW, neither for repowering
 - Above 19kW engine should meet current regulation (Stage V) regardless of regulation of the replaced engine

Bunkering scheme

As a part of the transition period, it is allowed to place non-Stage V certified engines on the market when these engines have been manufactured during the previous stage. These engines need to be fitted into a machine within 18 months after introduction and need to be sold 24 months after the engine was introduced onto the market.

This bunkering scheme may differ slightly for smaller OEM's as well as manufacturers of mobile cranes and snow throwers.

Ready for Stage V with Mitsubishi

During 2019, Mitsubishi will start the manufacturing of Stage V compliant engines. See the table below to find out which engine series will become Stage V compliant.

CONSTANT SPEED		
SERIES	POWER OUTPUT	EMISSION
L-Series	4kW – 17kW	Non-Emission – Stage V
SL-Series	8kW – 28kW	Non-Emission – Stage V
SQ-Series	18kW – 40kW	Non-Emission – Stage 3a
SS-Series	28kW – 70kW	Non-Emission – Stage 3a
SK-Series	42kW – 100kW	Non-Emission
D-Series	64kW – 240kW	Non-Emission
SA-Series	240kW- 1080kW	Non-Emission
SR-Series	380kW – 2430kW	Non-Emission – ½ TA Luft
SU-Series	590kW – 3800kW	Non-Emission



VARIABLE SPEED		
SERIES	POWER OUTPUT	EMISSION
L-Series	4kW – 17kW	Non-Emission – Stage V
SL-Series	8kW – 28kW	Non-Emission – Stage V
SQ-Series	18kW – 40kW	Stage 3a
SS-Series	28kW – 90kW	Stage 3a
SK-Series	38kW – 100kW	Non-Emission
D-Series	70kW – 230kW	Non-Emission

Contact us

We understand that emission regulations are a complex subject. We are happy to give advice about these regulations and discuss the options for a repowering with you. [Contact us] and let us know how we can help you.



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