

## Exhaust gas measurements on gas and diesel engines

With its Directive 2016/2284 of December 14, 2016, the EU issued a regulation on the maximum permissible emissions in the individual EU member states.

The aim is to reduce national emissions of certain air pollutants and also to set binding emission limit values, e.g. for nitrogen oxides (NO<sub>x</sub>), unburned hydrocarbons (HC) and particles (PM) for engines.

In the revised regulation (EU) 2016/1628 "Requirements relating to gaseous and particulate pollutant emission limits and type-approval for internal combustion engines for non-road mobile machinery" has been set new emission ceilings set for the main engines and auxiliary units of inland waterway vessels, as well as engines for locomotives and railcars.

These limit values apply from January 1, 2020, but only for new buildings or when replacing engines in older ships or locomotives.

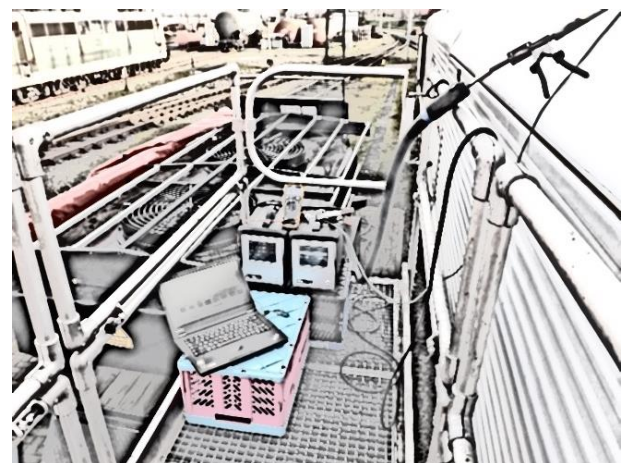
Die Partikelemissionen sowie die Stickoxidemissionen der derzeit verwendeten Lokomotiv- und Schiffsantriebe tragen sowohl punktuell an Belastungspunkten in der Nähe der Bahn- bzw. Schifffahrtswege als auch im städtischen Hintergrund zur Schadstoffbelastung bei.

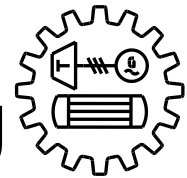
The particle and nitrogen oxide emissions from the locomotive and ship propulsion systems contribute to high pollution points near the rail or shipping routes and in the urban background.

Especially in cities bordering rivers with high volumes of shipping and rail hubs, there it will be necessary reduce the emissions in the future.

The reduction of pollutants in existing engines can be technically solved in various ways, such as fuel-water emulsion, fuel microfilter systems, combustion chamber optimization or exhaust gas aftertreatment systems such as SCR catalytic converters or particle filters.

To verifying, that the optimized and retrofitted engines comply with the new exhaust gas limit values, it is necessary to examine the emissions of ship and rail drives. That allows to show how the emissions of the most important pollutants PM, NO<sub>x</sub> and HC can be reduced by improving existing drives.





Exhaust gas measurements on gas and diesel engines will be done by Ermen-Engineering. These exhaust gas measurements will be supporting the operators or service companies by the verification and control of exhaust gas emission values.

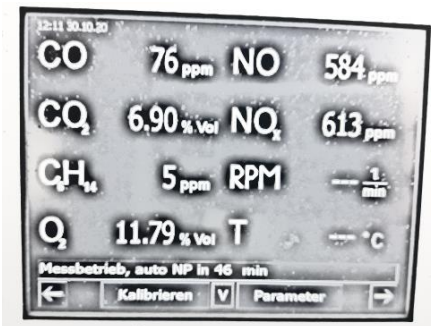
An optimal combustion guarantees minimized energy consumption and emissions of the engine. The comprehensive measurement of exhaust emissions delivers important values about the number of pollutants and the exhaust gas measurements support the operator by optimizing the engine settings.

The following emission values will be measured:

Carbon monoxide CO  
Carbon dioxide CO<sub>2</sub>  
Nitric oxide NO  
Nitrogen dioxide NO<sub>2</sub>

Hydrocarbons CxHy  
Oxygen O<sub>2</sub>  
Particles  
Exhaust gas temperature

The emitted mass of the respective pollutant [g / kWh] will be calculated by measuring the specific exhaust gas emissions, the fuel consumption, the power output and the combustion air volume, humidity and temperature will be also measured. Furthermore, the technical data of the engine or the operating unit must be documented.



The specific exhaust emissions [g / kWh] will be calculated and documented in accordance with the ISO 8178-4..

The prerequisite for the measurement must be a 230 V power connection, access to the exhaust gas measuring point (preferably a probe opening in the exhaust pipe) and the possibility to measuring fuel and combustion air.

