

EMISSION LIMITS OF INLAND WATERWAY VESSEL ENGINES IN ACCORDANCE WITH EU LEGISLATION

The problems of legislation of the EU relating to gaseous and particulate pollutants from internal combustion engines installed in non – road mobile machinery deals with directive of the European Parliament and of the Council 97/68/ES reformed with directive 2004/26/ES include inland shipping vessels.

Keywords: *emission, inland shipping vessels, emission elimination, Directive 97/68/EC, Directive 2004/26/EC, non road mobile machineries, diesel engines*

Community programme of policy and action in relation to the environment and sustainable development recognizes as a fundamental principle that all persons should be effectively protected against recognized health risks. One of the way how to eliminate this kind of pollution is to control emission (nitrogen oxide, carbon monoxide), solid particles (“black smoke”), even other greenhouse and acid gas (carbon dioxide, hydrocarbon...)

EC extends the Convention of Long-range, interstate air pollution accepted in July 1982.

The emission elimination is the most effective by harmonization of member countries (EC) law, which are concerned with rules of air pollution caused by non road machineries. Research proves that the transportation belong to one of the biggest polluter. Even if the biggest part of it represents the road transport, the other transportations contribute on it by increasing way, an exception is the railway transport for its electrification. The railway transportation is taken to be the most ecological transportation even with respect of it capacity.

The aim of directive approvals

The aim of the Directive 97/68/EC is an approximation of member states juridical regulations, which are related to emission regulations and confirmation methods of non-road mobile machinery engines. The Directive 97/68/EC is also renewed by the Directive 2004/26/EC additional about inland water vessels and diesel engines assigned for railway vehicle traction.

The European Parliament and of the Council adopted a principle of two phases of diesel engines certification in accordance with member states can not decline type acceptance allocation of an engine type and can not apply another type acceptance requirements relative to air pollution of non road mobile machineries, in which is installed a diesel engine, if this engine fulfills the directive standards.

The first two phases deal with non-road mobile machineries with exception of vessels, airplanes, locomotives and road mobile machinery (any mobile machine, transportable industrial equipment or vehicle with or without body work, not intended for the use of passenger- or goods-transport on the road), therewith a type acceptance deadline of the last engine category was 31. December 2002. The date of registration allowance and product launched was 31. December 2003.

The European Parliament and of the Council prolonged a type acceptance, registration, and a date of registration allowance processes for two more phases (solved in the Directive 2004/26/EC), for the reason of a further need of an air quality improvement, a new emission reduction technologies existence, limit values correction need on the basis technological development tendencies in USA and launch emission limits need for inland navigation vessels and railway locomotives.

Determination

Inland waterway vessels are vessels dedicated for inland waterways, that are longer than 20m and their displacement is more than 100m³ specified by following formula 1, or push-tugs designed for towing, pushing or navigation of side arrangement of vessels.

$$L \cdot B \cdot T = \text{displacement [m}^3\text{]} \quad (1)$$

where: L – max. length of the hull without rudder and stem, B – max. breadth of the hull measured to outer boundary of side plating (except of outer peddle wheels, rubbing stripe, ...), T – a vertical distance between the lowest hull, or keel point to max draft

This definition does not require:

- Vessels designed for passenger transportation –not more than 12 passengers except the crew,
- Pleasure boats not longer than 24m,
- Service vessels belonged to supervisory organizations
- Firefighting vessels,
- Military vessels
- Fishing vessels from fishing register community
- Sea ships including, towing and pushing tugs having a mother port in coastal water or operating in this location, having a valid navigation or safety certificate (SOLAS or MARPOL certificate).

Testing method

The testing method ISO should be used for inland waterway vessel engines, as is specified by ISO 8178 – 4:2002[E] and by IMO MARPOL 73/78.

Arrangements refer to inland waterway vessel engines. Every auxiliary engine with power more than 560kW will have to be suitable with same requirements as for main engines.

Type approval phase IIIA for propulsion engines used for inland navigation vessels

Member states refuse registration of these engine types:

- V1:1: after 31st December 2005 - engines 37kW or more with 0,9l fuel delivery per stroke or more,
- V1:2: after 30th Jun 2005 – engines with (0,9÷1,2l) fuel delivery per stroke,
- V1:3: after 30th Jun 2005 – engines with (1,2÷2,5l) fuel delivery per stroke or and engines 37kW ≤ V < 75kW,
- V1:4: after 31st December 2006 – engines with (2,5÷5l) fuel delivery per stroke,
- V2: after 31st December 2007 engines with 5l fuel delivery per stroke an more

If an engine does not fulfill the Directive 2004/26/EC requirements and if solid elements and gas emission from the engine does not fulfill limit amounts initiate in table 1.

Placing on the market

Member states shall only permit placing on the market of new engines, whether or not already installed in machinery, which meet the requirements and type marks of the Directive 2004/26/EC.

For the phases IIIA - inland navigation vessel engines

- Category V1:1: - 31st December 2006
- Category V1:2: - 31st December 2006
- Category V1:3: - 31st December 2006
- Category V1:4: - 31st December 2006
- Category V2: - 31st December 2006

Emission of carbon monoxide, hydrocarbon mixture, nitrogen oxide and solid elements can not exceed values in phase IIIA. Values are initiated in the tab.1.

The rules do not hold for engines fulfill requirements accepted by Central Commission for the Navigation on the Rhine (CCNR), because CCNR does not accept equivalency between the Directive

2004/26/EC and requirements determined by Mannheim Convention.

Member states can not refuse placing on the market of new engines suiting CCNR requirements.

- Emission limits valid till 30th Jun 2007 are initiated in Table 2,
- Emission limits valid from 1st Jul 2007 till next emission limits package by a consequence of the Directive 2004/26/EC changes, Table 3

Conclusion

Emission limits are not definite yet as emerge from directives. It is expected they will become more strictly with respect to development of new engine construction technologies and development on fuel market. Certain deficiency carry over because requirement equivalency of EC directives and strangers. For example exceptions of engines accepted in accordance with CCNR.

Tab. 1. Engines and machineries of inland navigation vessels.

Category: fuel delivery per stroke/power [SV/P], [litres per stroke/kW]	carbon monoxide [CO], [g/kWh]	Hydrocarbon and nitrogen oxide mixture [HC+NO _x], [g/kWh]	Solid elements [PT], [g/kWh]
V1:1 SV < 0.9 ; P ≥ 37kW	5.0	7.5	0.40
V1:2 0.9 ≤ SV < 1.2	5.0	7.2	0.30
V1:3 1.2 ≤ SV < 2.5	5.0	7.2	0.20
V1:4 2.5 ≤ SV < 5	5.0	7.2	0.20
V2:1 5 ≤ SV < 15	5.0	7.8	0.27
V2:2 15 ≤ SV < 20a	5.0	8.7	0.50
V2:3 15 ≤ SV < 20	5.0	9.8	0.50
V2:4 20 ≤ SV < 25	5.0	9.8	0.50
V2:5 25 ≤ SV < 30	5.0	11.0	0.50

Tab. 2. CCNR phases I

P _N (kW)	CO (g/kWh)	HC (g/kWh)	NO _x (g/kWh)	PT (g/kWh)
37 ≤ P _N < 75	6,5	1,3	9,2	0,85
75 ≤ P _N < 130	5,0	1,3	9,2	0,70
P ≥ 130	5,0	1,3	$n \geq 2800 \text{ tr/min} = 9,2$ $500 \leq n < 2800 \text{ tr/min} = 45 \cdot x$ $n^{(0.2)}$	0,54

Tab. 3. CCNR phases II

P _N (kW)	CO (g/kWh)	HC (g/kWh)	NO _x (g/kWh)	PT (g/kWh)
18 ≤ P _N < 37	5,5	1,5	8,0	0,8
37 ≤ P _N < 75	5,0	1,3	7,0	0,4
75 ≤ P _N < 130	5,0	1,0	6,0	0,3
130 ≤ P _N < 560	3,5	1,0	6,0	0,2
P _N ≥ 560	3,5	1,0	$n \geq 3150 \text{ min}^{-1} = 6,0$ $343 \leq n < 3150 \text{ min}^{-1} = 45 \cdot x$ $n^{(0.2)} - 3$ $n < 343 \text{ min}^{-1} = 11,0$	0,2

References

- [1] DIRECTIVE 97/68/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
- [2] DIRECTIVE 2004/26/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
- [3] Sosedova, J. et al.: Project VEGA MŠ SR 1/3831/06 Transport – Juridical Conditions of Inland Shipping and their Economic Consequences for Carriers after the Entrance of the Slovak Republic to the European Union, Žilina University, 2006

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