VOLVO PENTA

Stage V marine newsletter (OEM's, operators)

Dear customer,

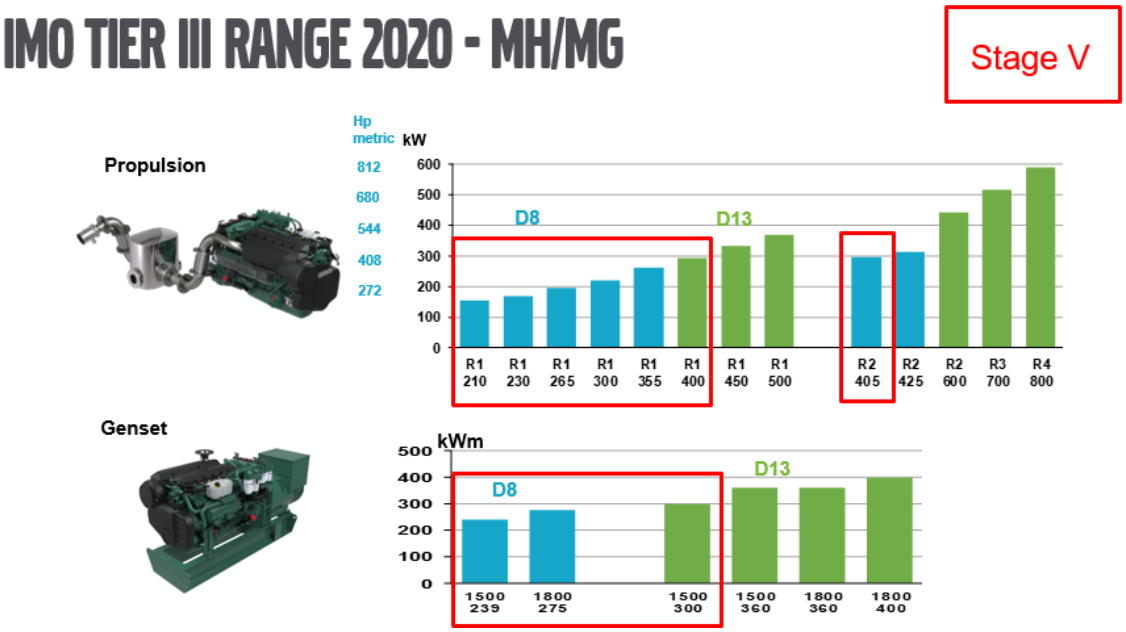
Please find enclosed an update on all Stage V marine scenarios we're running as Volvo Penta and together with third parties

1. *Volvo Penta Factory solution D8/D13 <300kW*
2. *Third party certification D16 MH/MG by Koedood Marine*
3. *Third party conversion of TAD 1385 VE by Volvo Penta and local dealers*

1. Volvo Penta Factory solution for D8 and D13 MH/MG <300kw

The Stage V marine solution is based on the IMO III after treatment system. The adaptations are in the software and extra requirements to meet the Stage V marine regulations.

The D8 - D13 Stage V will be available as complete package from the factory and is available as type approved version. In the below overview you will find the complete range of products, which will be available with Stage V marine emission certificate.



The first Stage V deliveries for the D13 are planned for week 6-7 2021. For the D8 we still have to wait till week 23 2021.

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In order to get a wider range of products and to create a price attractive offer for this power node, we have started two initiatives to fulfill these requirements.

2. Initiative 1. Third party certification D16 MH/MG by Koedood Marine

Koedood Marine is the biggest distributor in Europe of Mitsubishi engines for Inland Waterway applications. Koedood Marine has initiated the certification process of the Mitsubishi range for Stage V marine. This is an intense and very costly process since a legally mandatory 2.500 hour endurance test is part of the program as well.

In the collaboration with Koedood Marine we agreed that they take care of certification of our existing D16 MH and MG engine. The intention is that you as customer can buy complete package from your local Volvo Penta dealer or OEM.

Where are we in the process?

- The expectation is that after Koedood has finished the test of the S6R, the D16 will be placed on same testbench with same after treatment system for a small test
    - Aimed timing for this D16 test is April 2021. So earliest certification is ready in May / June 2021.
    - We will test MH and MG curves for certification.
- Targeted **market** price of the after treatment including Stage V certificate is
    - € 70.000,- excluding additional burner, installation and start up
    - € 90.000,- including additional burner, excl. installation and start up.

A burner is required when the application has a low loadprofile. This to be defined during the project.

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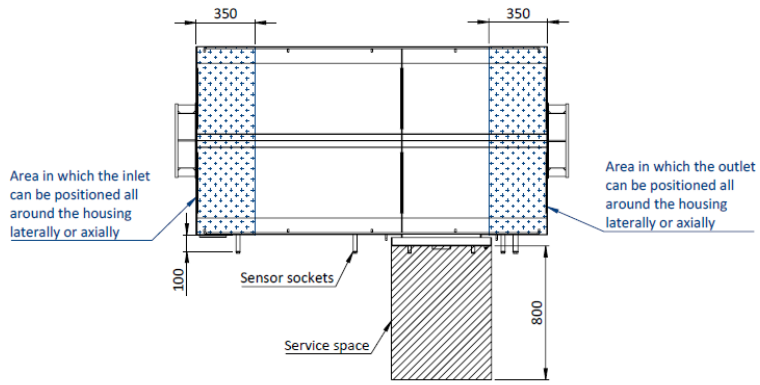
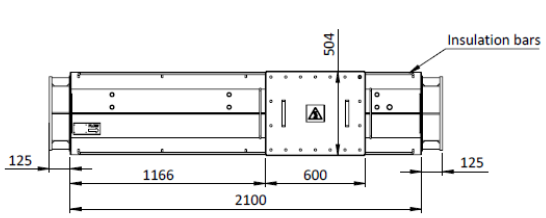
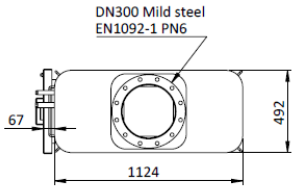
Koedood Marine has developed two standard after treatment housings which will be offered for the existing Volvo Penta D16 MH and MG range. One for the SCR and one for the DPF + burner.

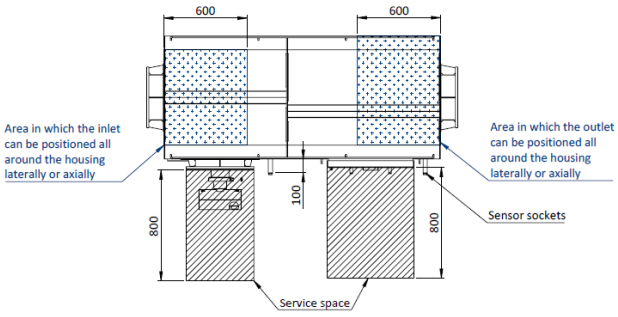
SCR housing

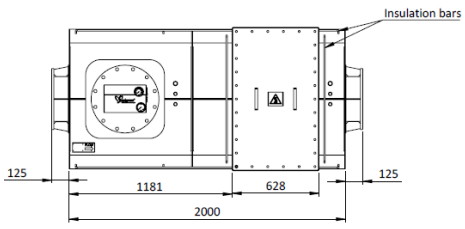


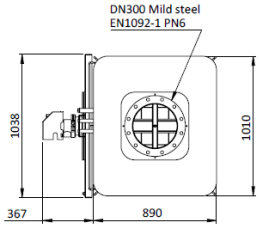


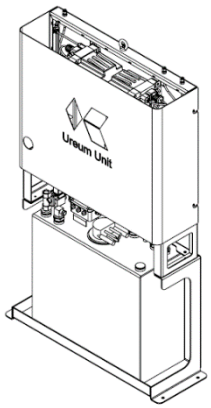


DPF housing









Control cabinet incl. day tank

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3. Initiative 2, Third party conversion of TAD 1385 VE by Volvo Penta and local dealers.

To offer a price competitive solution just above the 300kW power node, we have started a joined project with two local dealers in the Benelux. The goal is to use standard Volvo Penta parts as much as possible in order to make the industrial engine suitable for marine use and compliant to the valid EU regulations.

Keep in mind that this engine is **NON type approved** so can **NOT** be used in vessels which require a classed Stage V marine engine in this power node.

If that is the case you need to work with option 1 or 2 from this newsletter.

There are two adaptations required, e.g. **3.1** Hardware wise, done by a local cooperation of dealers and **3.2** software wise, which will be done by the Volvo Penta factory.

3.1 Hardware modifications

- A TAD 1385VE has been ordered for local hardware modification by a joint cooperation of our dealers Volvo Marine & Industrie, Antwerp, Belgium and Visscher Scheepsreparatie B.V, Sliedrecht The Netherlands. Following works will be carried out;
    - Adaptation of the complete engine for keel cooled (KC) use
    - Insulate hot spots on the exhaust and turbo
    - Select after cooler and other required components to make it work
    - Prepare a full package for resale to other dealers

D13 MH

TAD1385 VE

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The TAD1385 VE has arrived week 39 at our dealer for hardware modifications

- Targeted **market** price approx. € 75.000,- for a complete delivered, but not installed installation.

3.2 Software modifications

In order to comply to the rules and regulations of Stage V Marine and ES-TRIN we have investigated some question marks;

- Any event (emission related) should be stored in a permanent an un-erasable memory.
  - An investigation @ Industrial and legislation dept. learns that the engine complies with this rules so no modification is required but not 100% confirmed yet.
- A notification body should have the possibility to read out the events on board the vessel with his own "scanner"
  - There is a Can bus reader available who could be used by third party as read out tool.
- A Permanent inducement override (in the NRE standard software this is limited to 120 hours)
  - There is still an ongoing lobby to convince our local Government and CCNR that a 120 hour limitation, which is required in the standard NRE engine, is "unlimited" for an IWW applications to get out of an unsafe situation.
  - Since we expect no "overnight" outcome from these formal parties involved we will start an internal project in parallel anyhow.

Another argument we brought forward is that in the NRE Stage V industrial engine it is mandatory to limit the inducement override to 120 hours, by taking this away the engine does not comply anymore to NRE rules so this is a bit of a contradiction.

Due to the above, Volvo Penta has started up below process in parallel not to lose any more valuable time

1. A project is required to modify the standard NRE software and overrule the 120 hour timer.
2. A special routine needs to secure that this special software is only available for NRE engines used in IWW applications.
3. An in depth study is required to secure a 100% success rate on point and 2 and 3.
4. The aim is to start this is project before year end.
5. Time to market unknown due to the above.

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In the event that we succeed short term to convince the official societies that a standard NRE engine is also a safe solution for IWW applications, it will shorten the time to market since no special software is required. In that case, we expect a ready to market product before year end.

When we are not successful, Volvo Penta needs to adapt the control software, which will require extra time and money. In this case, it will be at least end of the year or beginning of next year before this verification project could start which means time to market is earliest Q1/Q2 2021.

A short summary

		Power range	Genset and Aux use fixed speed	Propulsion and Aux use variable speed	Emission type approval	Class type approval?	Engine	After treatment	Third party deliveries	Timeline
?	Under investigation	>75<130 KW	To early to make any statement							
1	**Factory solution** **D8 + D13 MH and MG**	>130kW <300 kW	Yes	Yes	Yes[1] IW-P / IW-A	Yes	VP	VP	N.A.	D8 Stage V, week 23, 2021 D13 Stage V, week 6, 2021
2	**Koedood solution** **D16MH/MG**	>368kW <550kW	Yes	Yes	Yes[2] IW-P / IW-A	Yes	VP	Koedood	Koedood	Earliest summer 2021
3	**Industrial conversion** **TAD 1381-85 VE**	>300 >405kW	No	Yes	Yes[1] NRE	No	VP	VP	Visscher VMIC	Depending on discussion with official societies
							Warranty			

[1] *Emission Certificate by Volvo Penta*

[2] *Emission Certificate by Koedood*

If you have any questions, feel free to contact your local Volvo Penta representative. They can provide you with a status update on request.

Best regards,

Jan-Willem Vissers

Director Marine Commercial

Volvo Penta Europe