



**TYPE APPROVAL CERTIFICATE**  
**No. MAC135511XG**

**This is to certify that the product identified below is in compliance with the regulations herewith specified.**

<i>Description</i>	<b>Reciprocating Internal Combustion Engine</b>
<i>Type</i>	<b>D16 D16MH (R1) D16MH (R2) D16MG-HE (R1)</b>
<i>Applicant</i>	<b>AB VOLVO PENTA GROPEGARDSGATAN S-405 08 GOTEBOG SWEDEN</b>
<i>Manufacturer</i>	<b>AB VOLVO PENTA</b>
<i>Place of manufacture</i>	<b>GROPEGARDSGATAN S-405 08 GOTEBOG SWEDEN</b>
<i>Reference standards</i>	<b>Part C, Chapter 1, Section 2 of RINA Rules for the Classification of Ships</b>

*Issued in* **Hamburg** on **November 28, 2011**. *This Certificate is valid until* **November 27, 2016**

**RINA**  
**Daniele Chirulli**

This certificate consists of this page and 1 enclosure

**TYPE APPROVAL CERTIFICATE**

No. **MAC135511XG**  
Enclosure - Page 1 of 2  
**D16**

<b>Reference Documents</b>	
File and Test Report no.	Report of tests No. 777768-1, dated 19/02/2006 and CL0688, dated 26/04/2006 and relevant enclosures. File 2011XG011355; Report No. HMMC/2011/00362/MBT, dated 23.11.2011.

<b>Technical Characteristics</b>			
Type Approved MCR(s) [kW] - rpm	<p><b>D16MH (R1):</b> 478 [kW] at 1800 [rpm] (MEP 1.97 N/mm<sup>2</sup>)</p> <p><b>D16MH (R2):</b> 551 [kW] at 1900 [rpm] (MEP 2.16 N/mm<sup>2</sup>)</p> <p><b>D16MG-HE (R1):</b> 450 [kW] at 1500 [rpm] (MEP 2.23 N/mm<sup>2</sup>) 500 [kW] at 1800 [rpm] (MEP 2.07 N/mm<sup>2</sup>)</p>		
Declared Time Between Overhaul	According to the Manufacturer's Maintenance Instructions	Hours	
Cycle	Diesel	2 or 4 stroke	4
Cooling	Water	Swept Volume [l/cyl]	2.687
Cylinder Bore [mm]	144	Stroke [mm]	165
Numbers Of cylinders (In Line)	6	Numbers Of cylinders (Vee Type)	---
Supercharged (yes or no)	Yes	Air Cooling (Yes or No)	Yes
Reversible (yes or no)	No	Compression Ratio	17.5 : 1
Max Firing Pressure [N/mm <sup>2</sup> ]	<p><b>MH (R1):</b> 16.5</p> <p><b>MH (R2):</b> 17.7</p> <p><b>MG (R1):</b> 16.9 -17.6</p>	Mean Effective Pressure [N/mm <sup>2</sup> ]	see above
Specific Fuel Consumption [g/kWh]	---		

**TYPE APPROVAL CERTIFICATE**

No. **MAC135511XG**

Enclosure - Page 2 of 2

**D16**

Manufacturer Of Injection Pumps	Type Of Injection Pumps	Flow / Holes
Delphi	EU 1200/E1 3829087P02 (acc.dwg. 3817837.01, 889205.03)	2.8 / 6

Manufacturer Of The Turbocharger	Number And Type Of Turbocharger:
Borg Warner Turbo Systems	1xS500 (acc. dwg. 3809940.04)

<b>Fields Of Application</b>	
The Engine May Be Intended For The Following Services:	Propulsion and Auxiliary Service See Remark (1) for Emergency Service

<b>Tests Carried Out</b>
According To Requirements Of Part C, Chapter 1, Section 2 of RINA Rules for the Classification of Ships On Engine: Type D16 having No. 6 cylinders and Serial No. 1219.

<b>Remarks</b>
Crankshaft Conforming To Drawings Approved With No.: MAC-17644 and MAC-17645, dated 08/02/2006 (ref. dwg. No. 20463959.05, page 1&2).
Maximum Allowable Alternating Torsional Stress (Referred To The Crankpin) [N/mm <sup>2</sup> ): 24.0 N/mm <sup>2</sup>
(1) Emergency applications are subject to special consideration. <ul style="list-style-type: none"> <li>● This Type Approval Certificate does not include the control-, alarm- and safety electronic systems, which are to be separately type approved.</li> <li>● It is intended that the minimum required monitoring equipment as per Pt C, Ch 1, Sec 2, Tabs 2-3-4 as applicable, are to be fitted to all engines intended to classified ships, unless otherwise agreed for restricted navigation.</li> <li>● The approval is intended for propulsion of <u>classed ships</u> having multiple engine installations only, single Engine installation is subject to special consideration.</li> <li>● On the engines which will be installed on <u>non-classed ships</u> below 200 GT having: single propulsion plant, sea worthiness or safety certificate and restricted navigation, a spare electronic governor ready for a fast connection to the engine is to be fitted.</li> <li>● Emergency Genset first Loadstep: 1500 [rpm] / 50 [Hz]: 214 [kWe] / 221 [kWm] 1800 [rpm] / 60 [Hz]: 241 [kWe] / 250 [kWm] A spare electronic governor ready for a fast connection to the engine is to be fitted.</li> <li>● Foundation arrangement to be submitted for each installation.</li> <li>● Torsional Vibration calculations has to be submitted for each installation.</li> </ul>

Hamburg November 28, 2011

