Certificate No:
TAM0000014

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Diesel Engine

with type designation(s)
G45 (ME-C, stroke 2250)

Issued to
MAN Diesel & Turbo SE
Copenhagen, Denmark

is found to comply with
Det Norske Veritas' Rules for Classification of Ships

Application :

The approval is valid for propulsion duty.
Rating **See on page 2**

This Certificate is valid until **2019-07-13**.

Issued at **Høvik** on **2015-07-14**
DNV GL local station: **Copenhagen**

for **DNV GL**

Approval Engineer: **Amir Dzaferi**

Oddvar Deinboll
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid.
The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

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Job Id:
Certificate No: **TAM0000014**

Product description

Two stroke diesel engine:

Type:	G45 ME-C
Cylinder bore:	450 mm
Piston stroke:	2250 mm
No. of cylinders:	5-8 in line

Application/Limitation

Main data	at 100% load
Mean effective pressure:	17.6 bar
Max cylinder pressure:	185 bar
Rated cont. output:	1050 kW/cyl
Corresponding to:	100 RPM

Tests carried out

Marking of product

The product to be marked with manufacturer's name or trademark and type identification.

Periodical assessment

Meetings on regularly basis and at least every second year with the Type Approval applicant (hereof: the Engine Designer) shall be arranged with the objective to verify that the conditions for the Type Approval are not altered since the Type Approval Certificate was issued, and to keep DNV updated with regard to:

- The latest development status and design as covered by the Type Approval certificate.
- Damages and failures of products certified by DNV leading to break down or other malfunctions in service. The causes and reasons for the failure and results from investigations are to be made available to DNV upon request. Failure to inform DNV may lead to suspension of this Type Approval certificate.

In cases where the Type Approved design is manufactured at other companies, DNV shall verify that the Type Approval applicant has a quality control system for consistent production at their licensees/subcontractors.

Other conditions:

- This Type Approval covers the design of mechanical parts for listed engine types.
- Engine safety, control and monitoring systems, including sensors and actuators are not covered by this Type Approval certificate. Documentation for engine safety, control (including speed governing) and monitoring systems shall be submitted for approval according to DNV Rules Pt.4 Ch.9 Sec.1 Table C2 and/or as listed in relevant Type Approval certificates.
- Electric cables and installation of this is not covered by this Type Approval and must be verified to comply with the requirement of DNV Rules Pt.4 Ch.8.
- Torsional vibration calculations to be submitted for each installation according to the DNV Rules Pt.4 Ch.3 Sec.1 A600. Torsional vibration dampers to be used on the a.m. engines shall be approved according to DNV Rules Pt.4 Ch.3 Sec.1 B1400 and/or as listed in relevant Type Approval certificates.
- Signboards to be according to the DNV Rules Pt.4 Ch.3 Sec.1 C406.
- Flexible hoses with couplings for flammable fluids to be Type Approved by DNV.
- The turbocharger and turbocharger arrangement are not included in this Type Approval. The turbocharger installed on each engine shall have a separate valid Type Approval Certificate.

- Welding of main structural parts (bedplate and framebox) is to be carried out in accordance with "MAN Diesel & Turbo's" Welding and Quality Instruction (0742642* and 0743097 *). The welding procedure specifications are to be qualified according to a recognized standard or the DNV Rules.

- Alignment of bedplate, framebox and crankshaft, as well as crossheads (reciprocating parts) is to be carried out in accordance with "MAN Diesel & Turbo's" specifications.

- NDT of bedplate, framebox and crankshaft to be in accordance with relevant specifications given in MAN Diesel's "Selected specifications from IACS UR M44" no. 0743359*.

- NDT of cylinder liners to be in accordance with MAN Diesel's QS no. 0743359*

* document revision at the date the certificate is issued