DNV·GL

Certificate No:
TAM000001M

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Turbocharger

with type designation(s)
TCA55/66/77/88

Issued to
Mitsui Engineering & Shipbuilding Co. Ltd., Tamano Works
Tamano Okayama Pref., Japan

is found to comply with
Det Norske Veritas' Rules for Classification of Ships/High Speed and Light Craft

Application :

The turbochargers are approved for use on diesel engines with application data as given in the certificate.

Products approved by this certificate are accepted for installation on all vessels classed by DNV GL.

This Certificate is valid until **2019-10-22**.

Issued at **Høvik** on **2015-10-23**

for **DNV GL**

DNV GL local station: **Kobe**

Approval Engineer: **Tage Olav Alexander Strøm**

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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Product description

Exhaust driven turbochargers served by cylinder groups with combined power in the range 5000 kW to 29000 kW

The turbochargers are manufactured based on licence agreement with MAN Diesel & Turbo SE.

Application/Limitation

Rotor shafts and bearings are supplied by MAN Diesel & Turbo SE. Reference to relevant Type Approval Certificate: M-11659 (or replacements of this certificate)

Maximum allowed compressor ratio, operating speed and exhaust gas temperature at turbine entry:

Model	N_{max} (rpm)	T_{max} (°C)	Max compressor ratio
TCA 55	20100	500	4.4
TCA 66	16900	500	4.4
TCA 77	14200	500	4.4
TCA 88	12000	500	4.4

ALARM LEVELS:

Overspeed, maximum alarm level: 0.97 n_{max}.

High exhaust temperature at turbine entry, maximum alarm level: T_{max}

Low lubrication oil pressure at turbocharger inlet, minimum alarm level (gauge pressure):

Normal operation: 1.2 bar < $P_{Öl}$ < 2.2 bar
Alarm: 1.0 bar < $P_{Öl}$ ≤ 1.2 bar
Engine slow down: 0.8 bar < $P_{Öl}$ ≤ 1.0 bar
Engine shut down: $P_{Öl}$ < 0,8 bar

High temperature increase from oil inlet to oil outlet, maximum alarm level: 40°C

Application constraints

Maximum allowable vibration level		
Frequency range (Hz)	Measurement locations	Acceleration (G)
60-100	Silencer front wall	2
60-130	Flange of compressor casing	1
130-900	Flange of bearing casing	0.8 (limit of first order)

Allowable inclination of turbocharger during operation		
Direction of turbocharger	Continuous	Short period
Longitudinal	15°	22.5°
Lateral	15°	22.5°

Tests witnessed by the Society

Type	Date
TCA 55-20002	19.01.2004
TCA 66-40001	04.06.2003
TCA 66-20020	07.03.2003
TCA 77-40009	21.11.2002
TCA 88-25005	20.02.2008

Marking of product

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

Periodical assessment

For retention of the Type Approval, a DNV surveyor shall perform a survey every second year and before the expiry date of this certificate to verify that the conditions of the type approval are complied with.

The objective of the Periodical Assessment is to verify that the conditions for the Type Approval are not altered since the
Type Approval Certificate was issued. The main scope of the Periodical Assessment will normally include:

- Verification of the Type Approval applicant's production and quality system w.r.t. ensuring continued consistent production of the Type Approved products at the Type Approval applicant's own premises and at other companies that are given the responsibility for manufacturing of the products.
- Review of the Type Approval documentation and that this is still used as basis for the production
- Review of possible changes to the design, the material and the performance of the product
- Verification of the product marking.

END OF CERTIFICATE