Certificate No.: 2503041531441247

TÜRK LOYDU

TYPE APPROVAL CERTIFICATE

This is to certify that the

Turbochargers

TL Project No	**24-2767**
Manufacturer	**MAN Energy Solutions SE**
Address	**Stadtbachstrasse 1, 86224 Augsburg**
Product Type	**TCA 33, TCA 44. TCA 55, TCA 66, TCA 77, TCA 88**
Reference Rule	**TL Rules, Part E, Chapter 103 - Metallic Materials, Special Materials for Naval Ships, 01.01.2022** **TL Rules, Part E, Chapter 104 - Naval Ship Technology, Propulsion Plants, 01.01.2022** **TL Rules, Part E, Chapter 107 - Naval Ship Technology, Ship Operation Installations and Auxiliary System, 01.01.2022** **TL Rules, Part A, Chapter 2, Material, 01.07.2024** **TL Rules, Part B, Chapter 4, Machinery, 01.07.2024**
Expire Date of Previous Certificate	-
Place and Date	**ISTANBUL / 04.03.2025**

Subject to the conditions referred to in the following pages, this certificate is valid until 04.03.2030.

132415

Emrah SÖĞÜTÇÜ

New Building Division Manager

This certificate is subject to terms and conditions described below:

- Any significant change in design or construction may render this Certificate invalid. Type Approval Certificate is not valid for equipment, the design or manufacture of which has been varied or modified from the specimen tested. This certificate is not valid for products without marking above mentioned. The manufacturer should notify TÜRK LOYDU of any modifications or changes to equipment in order to obtain valid certificate. This certificate shows that tested specimens as representative of the product complies of the TÜRK LOYDU rules, and revelant international instruments that apply to it.

Product	: Turbochargers
Type of Product	: TCA 33, TCA 44. TCA 55, TCA 66, TCA 77, TCA 88
Product Description	: - Exhaust driven turbochargers served by cylinder groups with combined power in the range 5000 kW to 29000 kW. - The turbochargers are approved for use on internal combustion engines with application data as given in the certificate. - Product approved by this certificate is accepted for installation on all vessels classed by TL.
Approval No / Date	: PAE-EPAS/020117/24-2767/VA, 04.12.2024
Max Inclination Limit	: Static (continous): ±15°; Dynamic (short time): 0° ± 22.5°
Performed Tests	: - Quality Management System Audit - Controls according to Approved Drawings - Sub-component controls - Review of calibration certificates of measurement and test tools -- The following type test report were reviewed: - TCA33-42026 on dated 06.11.2013 - TCA44-23024 on dated 26.04.2012 - TCA55-40003 on dated 19.03.2004 - TCA66-40001 on dated 05.06.2003 - TCA77-40009 on dated 21.11.2002 - TCA88-40001 on dated 23.06.2004 were found satisfactory.
Test Place	: MAN ENERGY SOLUTIONS SE, Augsburg, Germany
Last Inspection Date	: 21.01.2025

	Turbocharger Type	Max Operating Speed	Max Operation Temperature	Max. Engine Output	Others
1	TCA 33	28300 (rpm)	650 °C	5400 kW	Max compressor ratio: 5.3
2	TCA 33	31700 (rpm)	650 °C	5400 kW	Max compressor ratio: 5.3
3	TCA 44	22900 (rpm)	530 °C	7900 kW	Max compressor ratio: 5.3
4	TCA 55	21000 (rpm)	650 °C	10400 kW	Max compressor ratio: 5.4
5	TCA 55	20400 (rpm)	650 °C	10400 kW	Max compressor ratio: 5.4
6	TCA 55	20400 (rpm)	650 °C	19900 kW	Max compressor ratio: 5.4

Surveyor Name : Sezer Mahir TUĞCU

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7	TCA 55	20400 (rpm)	650 °C	19900 kW	Max compressor ratio: 5.4
8	TCA 66	17650 (rpm)	650 °C	14800 kW	Max compressor ratio: 5.4
9	TCA 66	17200 (rpm)	650 °C	14800 kW	Max compressor ratio: 5.4
10	TCA 66	16800 (rpm)	650 °C	14800 kW	Max compressor ratio: 5.4
11	TCA 66	17200 (rpm)	650 °C	14800 kW	Max compressor ratio: 5.4
12	TCA 77	14900 (rpm)	620 °C	21000 kW	Max compressor ratio: 5.5
13	TCA 77	14500 (rpm)	620 °C	21000 kW	Max compressor ratio: 5.5
14	TCA 77	14100 (rpm)	620 °C	21000 kW	Max compressor ratio: 5.5
15	TCA 77	14500 (rpm)	620 °C	21000 kW	Max compressor ratio: 5.5
16	TCA 88	12500 (rpm)	650 °C	30000 kW	Max compressor ratio: 5.5
17	TCA 88	12200 (rpm)	650 °C	30000 kW	Max compressor ratio: 5.5
18	TCA 88	11900 (rpm)	650 °C	30000 kW	Max compressor ratio: 5.5
19	TCA 88	11600 (rpm)	650 °C	30000 kW	Max compressor ratio: 5.5

Approval Conditions : Application/Limitation:

1. Turbochargers are to be designed to operate at least under the ambient conditions given in IACS UR M46 and IACS UR M28. The component lifetime and the alarm level for speed shall be based on 45°C air inlet temperature.
2. Alarm Levels:

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Overspeed, maximum alarm level: 0.97 nmax.(see type plate)
High exhaust temperature at turbine entry, maximum alarm level: tmax(see type plate)
Low lubrication oil pressure at turbocharger inlet, minimum alarm level (gauge pressure):
Normal operation: 1.2 bar < POil < 2.2 bar
Alarm: POil < 1.2 bar
Engine slow down: POil < 1.0 bar
Engine shut down: POil < 0.8 bar
High temperature increases from oil inlet to oil outlet, maximum alarm level*: 40°C
* Alarm only required for turbochargers served by cylinder groups with combined power > 2500 kW
3. Turbocharger vibration limit levels
- Frequency range (Hz): 2 to 200
- Silencer front plate, horizontal, vertical and axial (mm/s): 45
- Flange of the compressor casing, horizontal, vertical and axial (mm/s): 35
- Flange of the bearing casing, radial: 0-peak, single value measure point
5. The product to be marked with manufacturer?s name or trademark and type number identification.
6. This Type Approval covers the mechanical parts of the TCAxx turbochargers. For TCAxx turbochargers with electronically controlled VTA (Variable Turbine Nozzle Ring) system, the Type Approval shall be used together with the corresponding and valid DNV Type Approval Certificate for the control system of the VTA system, or a separate approval of this control system on a case-by-case basis.
7. Turbochargers are categorized in three categories depending on power served by each turbocharger: Category A = < 1000 kW, Category B = > 1000 kW and < 2500 kW, Category C = > 2500 kW.
8. Turbochargers shall be delivered with a product certificate issued by the manufacturer (category B) or by the class society (category C). For turbochargers of category A an certificate is not mandatory.

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