Certificate No.: 2410241044001247

TÜRK LOYDU

TYPE APPROVAL CERTIFICATE

This is to certify that the

INTERNAL COMBUSTION ENGINES

TL Project No	**24-2955**
Manufacturer	**MAN Energy Solutions SE**
Address	**Stadtbachstrasse 1, 86224 Augsburg**
Product Type	**V28/33D STC**
Reference Rule	**TL Rules, Part B, Chapter 4-1, Automation, 01.01.2022** **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 105 - Naval Ship Technology, Electrical Installations, 01.01.2022** **TL Rules, Part E, Chapter 107 - Naval Ship Technology, Ship Operation Installations and Auxiliary System, 01.01.2022** **TL Rules, Part B, Chapter 5, Electric , 01.01.2024** **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	**21.09.2024**
Place and Date	**ISTANBUL / 14.01.2025**

Subject to the conditions referred to in the following pages, this certificate is valid until 21.09.2029.

Emrah SÖĞÜTÇÜ

New Building Division Manager

132144

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.

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Product	: INTERNAL COMBUSTION ENGINES
Type of Product	: V28/33D STC
Product Description	: Four stroke, v-engine, non-reversible, trunk-piston, with supercharging, with charge air cooling, constant-pressure charging system, direct injection, injection operation by cams, valve operation by cams, liquid fuel.
Approval No / Date	: - It has been accepted that the non-revised documents are the same as in our letter dated 16.03.2020 and 31.05.2022 and numbered PAE-EPAS/005726/19-1812/SÜ and PAE-EPAS/012796/22-0186/SÜ. - As minor design changes were made, the conformity of the documents changed within the scope of Type Approval Renewal was evaluated according to the updated TL Rules. This relevant letter is PAE-EPAS/019849/24-2955/VA, 24.10.2024.
Method of Operation	: Four Stroke
Kind of Starting Device	: Air/ Battery
Kind of Cooling	: Water
Fuel Type	: Diesel Oil
Turbocharger Manufacturer	: MAN Energy Solutions SE
Turbocharger Type	: TCA 33
Last Inspection Date	: 24.10.2024
Performed Tests	: - Controls According to Approved drawing - Subcomponent Controls (crankshaft, pistons, connecting road etc.) - Review of calibration certificates of measurement and test tools were found satisfactory. - The following test report was reviewed. It was found to be satisfactory: Type Approval Test V28/33D STC+ V28/33 D, Place of test: MAN Diesel & Turbo SE, Augsburg, Bed 33, Date of test 2014-02-05 until 2014-02-07
Test Place	: MAN Energy Solutions SE, Augsburg, Germany
Surveyor Remarks	: - The main engines must be fitted with stand-by oil pumps that operate independently.- In systems with multiple main engines, if each machine has independent lubrication and ifthe main lubrication pumps can be replaced on board, ready-to-install pumps can be consid ered stand-by oil pumps. - Crankcase explosion relief valves are to be type approved.(IACS UR M66). At least one safety valve is to be present in one of both crank slices. - Oil mist detectors are to be type approved. Oil mist detection arrangements are to be tested in accordance with TL-R M67 and comply with TL Rules Chapter 4-Section 2.F -4.3.2 to 4.3.13.
Application/Limitation	: 1.Product description 1.1-- The approval is based on MAN Engine type Diesel Engine designation V28/33D STC with main characteristic as stated below 1.2-- Four stroke, V-engine, non-reversible, trunk-piston, with supercharging, with charge air cooling, constant-pressure charging system, direct injection, injection operation + valve operation by cams, liquid fuel diesel engine. Continuous Power : 455/500(**)kW/cyl@1000/1032 rpm(**) Number of Cylinders : 12-16-20 Cylinder Bore : 280 [mm] Stroke : 330 [mm] Compression Ratio : 14,2 Method of Air Charging : Exhaust gas turbocharging Turbocharger : TCA33 Mean Effective Pressure : 26,9/28,6(**) [bar]

Surveyor Name : Sezer Mahir TUĞCU

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Maximum Firing Pressure : 210 [bar]
(**)This is "Fuel stop power" acc. to ISO 3046/1 and valid for special applications only in accordance with TL Rules Part B, Ch.4, Section 2 A.2.2.5
2--The ambient conditions are ;
Inclination limits (degrees) Athwartships Fore --and--aft.
Static Dynamic Static Dynamic
Main Engine ± 15,0° ± 22,5° ± 5,0° ± 7,5°
Seawater temperature: +32 °C
Temperature range: 0°C ÷ +45 °C
Atmospheric pressure: 1 bar
Suction air temperature: +45 °C
Relative humidity: 60 %
For electric components: 0°C ÷ +55 °C
3--Limitation
3.1--In order for these engines to be used on ships with single-engine propulsion applications, the control of the engine (in case of failure of the regulator or actuator) must be done with another independent control system. In other words, two separate engine control systems should be arranged. The main engines must be fitted with stand-by cooling pumps that operate independently. If this equipment is not on the engine, the ships should be equipped with more than one main engine. Filter cleaning of lubrication system is to be possible without interrupting the fuel supply while the engines is running.
3.2-- Other Conditions
3.2.1--Flexible hoses with couplings are to be type approved.
3.2.2--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 the TL Part B- Chapter 4-1-Section 2 (January 2022). (It is only required for Türk Loydu?s product certificate.)
3.2.3--Electric cables and cabling are not covered by this approval and must be verified to comply to the TL Part B- Chapter 5-Section 12 (January 2024). (It is only required for Türk Loydu?s product certificate.)
3.2.4-- MAN is responsibilty to inform the shipbuilders and/or their subcontractors about the installation, use, general maintenance of the approved equipment and the conditions of this approval.
3.3--Service Restriction:
3.3.1--Unit Certification (Türk Loydu"s product certification) is required for this product to be used on TL-classed ships.
3.3.2--Signalization and protection related to the engine shall be subjected to Türk Loydu approval in each particular case and will depend on service applied and the degree of the vessel's automation. These engines can be installed on ships with automation notation provided that all the conditions specified in our rules are followed. For this purpose, equipment that meets the requirements of the Automation Rules must be on the engine and our surveyors must check whether these requirements are met during FAT or ship trials.
3.3.3--Equipment must be provided for enabling "turning gear engaged" signal.

Others : 4--Comments
4.1--Torsion vibration analysis is required for each propulsion installation unit.
4.2--The fitting of Rules required protective devices is to be verified at installation on board a vessel in class with the Türk Loydu as well as the Rule required quantity of pump units depending on actual installation arrangements.
4.3--For engines intended to be used for emergency services, supplementary tests in accordance with regulations of the Administration whose flag the vessel flies may be required.

Surveyor Name : Sezer Mahir TUĞCU

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4.4--Products requiring witnessed testing by a Surveyor as part of their Certification for use on a vessel,or facility classed by Türk Loydu ,as defined in the applicable section of the Rules,will continue to require witnessed testing. Each engine produced in future where Türk Loydu certification is required is to be shop tested in the presence of our Surveyor.
4.5--Minimum tensile strenght of crankshaft material is 780 N/mm².
4.6--This certificate does not cover the following plans which are to be reviewed for each installation:
4.6.1--Schematic diagram of engine control and safety system.
4.6.3--Ship piping diagram of fuel oil system, lubricating oil system and cooling water system.
4.6.4--Governor Arrangements.
4.6.5--Turbocharger.
4.6.6--Flexible Hoses and Expansion Joint
4.6.7--The electrical and electronic equipment located within areas protected by local Fixed Pressure Water-spraying or
Water-mist Fire Extinguishing system and those with in adjacent areas exposed to direct spray are to have a degree of protection not less than IP 44.
4.7--The Manufacturer has provided a declaration about the control of, or the lack of Asbestos in this product.
4.8--Use of the Product for non- Türk Loydu units is subject to agreement between the manufacturer and intended client.
4.9--Non-overload machines can be used for special ships and special applications, only subject to class approval. Diesel engines to drive electric generators must be able to be overloaded.

	Application	Rated Power	Rated RPM	Number of Cylinders	Stroke	Bore	Mean Effective Pressure	Max Firing Pressure
1	Propulsion, multi engine plant	500 [kW/cyl.]	1000 [rpm]	12, 16, 20	330 [mm]	280 [mm]	28.6 [bar]	210 [bar]

Approval Conditions : -

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