



Certificate No. 03-001986/031670

TYPE APPROVAL CERTIFICATE

This is to certify that this product complies with the Rules for the classification of ships, Part 1 - General requirements, Chapter 3 - Type approval of products.

TYPE AND DESCRIPTION OF PRODUCT:

EMISSION REDUCTION CONTROL SYSTEM – SELECTIVE CATALYTIC REDUCTION

MAN B&W ERCS – SCR

MANUFACTURER:

**MAN Energy Solutions
Teglholmegade 41
DK-2450 Copenhagen SV
DENMARK**

THE PRODUCT MEETS FOLLOWING RULES/REGULATIONS:

**Croatian Register of Shipping: Rules for the classification of ships,
Part 9. – Machinery
Part 12. – Electrical Equipment
Part 13. – Automation**

FURTHER DETAILS OF THE PRODUCT AND CONDITIONS FOR CERTIFICATION ARE GIVEN OVERLEAF.

APPROVAL IS VALID UNTIL: **2027-11-07**

Place and date: Split, 2023-11-07

Seal

Marinko Popović, dipl.ing.

NOTE: This certificate is not valid for equipment, the design or manufacture of which has been varied or modified from the specimen tested. The manufacturer should notify Croatian Register of Shipping of any modification or changes to the product in order to obtain a valid certificate.

DETAILED PRODUCT DESCRIPTION:

Selective Catalytic Reduction (SCR) is an exhaust gas treatment method to significantly reduce the formation of NO_x in marine diesel engines. The NO_x reduction is obtained by a catalytic process in an SCR reactor installed in the exhaust gas line after the combustion process. In the SCR reactor, the NO_x is reduced catalytically to nitrogen and water by adding ammonia as a reducing agent.

By using this method, the Tier III requirements in NO_x Emission Control Areas (ECA) can be met.

The SCR system comes in two main configurations:

- High-pressure SCR installation (HPSCR) adapted for either low- or high-sulphur fuel.
- Low-pressure SCR installation (LPSCR) applicable only for low-sulphur fuel.

HPSCR process takes place in the SCR line, which consists of three major components: the SCR reactor, combined vaporizer/mixer unit and the dosing unit. The SCR line is placed between the engine and the turbocharger. The engine for HPSCR includes a CBV (Cylinder Bypass Valve) valve that is used to increase the HPSCR temperature above the minimum temperature if possible.

LPSCR process also consists of the three major components: the SCR reactor, combined vaporizer/mixer unit and the dosing unit, but the SCR line is placed after the turbocharger. The engine for LPSCR includes an EGB valve that is used to increase the LPSCR temperature as much as possible.

The SCR control is handled by the ME-ECS engine control system which is updated with Emission Reduction Control System (ERCS). ME-ECS and ERCS controls the user interface, SCR valves operation, calculation of reducing agent dosing demands and the NO_x sensor operation. The ERCS is based on the same platform as the ME-ECS, meaning that controllers, HMI, Alarm handling and network are identical to that of the ME-ECS.

ECS components update: The Engine Control System are to be assembled by MAN ES designed and specified OEM (Original Electronic Manufacturer) and COTS (Commercial Off The Shelf) components listed in a "selection list" in document: 3093398-0, List of approved electronic components for MAN ES Engine Control Systems.

- Minor changes is as an example amendment of alternative components to the selection list, to increase liability in the supply chain.
Where amendment of components are regarded as minor change, the amendment is informed via a letter of notification to CRS.
- Major changes is including new functionality to ECS referring to IACS UR E22 table 1, system categories.
Where the amendment of components is regarded as major change, this will be included in a Type Approval Test of the ECS.

Software update: The procedure for Software release depends on the impact on the safety critical functions:

- Minor updates of Software have no influence on the safety critical functions and their release is performed by submission of Design Update Notes including information about software version and implemented changes.
- Major updates of Software, which alter the safety critical functions, are introduced after performance of a Type Approval Test witnessed and approved by the classification societies.

APPLICATION / LIMITATIONS:

ERCS software version ERCS-SW-2011-2 is compatible with following ME-ECS software versions:

- ME-ECS-SW-1909-9 for MPC platform (ref. to doc. 3094410-5)
- ME-ECS-SW-2210-1-GA for Triton platform (ref. to doc. 3096107-4)

The high-pressure SCR system covers an SCR system design which is able to handle operation on HFO with a sulphur content of up to 3.5%. This system can also be operated on low-sulphur fuel.

The high-pressure low-sulphur SCR system covers an SCR system design which is limited to operate on fuel with a sulphur content of maximum 0.1%.

The low-pressure SCR system covers an SCR system design which is limited to operate on fuel with a sulphur content of maximum 0.1%.

TYPE APPROVAL DOCUMENTATION:

<i>Type Approval Test</i>		<i>Documentation</i>
ERCS for EGR/SCR	15 th March 2016, Tamano, Japan	doc. 3099643-3 Type Approval Seminar ERCS for EGR/SCR

Document MAN B&W ERCS for SCR General System Information, doc. 3099639-8.3, approved by CRS letter 2525/TSE/NP/ZS/031670, dated 2023-11-07.

MARKING OF PRODUCT:

The Manufacturer and Type Designation of the product, serial number, date of manufacture, supply voltage and software version.

CONDITIONS FOR CERTIFICATION:

For each application on board CRS classed vessels complete technical documentation and drawings shall be submitted for examination and approval prior installation on board, with reference to this Type Approval Certificate.

A separate ERCS product certificate is not required.