

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Exhaust gas cleaning systems for the reduction of NOx**with type designation(s)
SR-HPSCR-Series

Issued to

Sunrui Marine Environment Engineering Co.,Ltd.
QINGDAO, China

is found to comply with

DNV GL class programme DNVGL-CP-0353 – Type Approval - Selective catalytic reduction systems**DNV GL rules for classification – Ships Pt.4 Ch.6 Piping systems****Application :****Selective Catalytic Reduction (SCR) System with soot blower arrangement****Products approved by this certificate are accepted for installation on all vessels classed by DNV GL****Design pressure: 5 bar (reactor side) / 10 bar (dosing side)****Pressure drop: 70 mbar (max. including all components)****Design temperature: 500 °C (reactor side) / 55 °C (dosing side)**Issued at **Hamburg** on **2017-12-29**This Certificate is valid until **2022-12-28**.for **DNV GL**DNV GL local station: **Qingdao**Approval Engineer: **Yongju Park**

Olaf Drews
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.



Product description

High-Pressure SCR system including the components of SCR reactor (catalyst) with soot blower arrangement, mixer, UREA solution supplying system with flushing function, venting system, stand-by heat system and control equipments (ref. to DNV GL TA certificate no. xxxxxx). Maximum applicable engine power rating 40000 kW.

Type Specification for models : HPSCR-4000, 5000, 7000, 9000, 10000,12500, 16000, 19000, 22500,25000, 30000, 36000, 40000

Type	Catalyst Type	Max. Allowable pressure drop across SCR system except valves	Allowable fuel quality, standard	Reactor Arrangement	Mixer arrangement	Max. allowable inlet temperature
HPSCR-4000	Vanadium based catalyst	≤ 7000 Pa	ISO8217-2012 Sulphur content ≤ 3.5 %	Horizontal / Vertical	Horizontal	280-500 °C
HPSCR-5000						
HPSCR-7000						
HPSCR-9000						
HPSCR-10000						
HPSCR-12500						
HPSCR-16000						
HPSCR-19000						
HPSCR-22500						
HPSCR-25000						
HPSCR-30000						
HPSCR-36000						
HPSCR-40000						

Treatment fluid system :

1. Aqueous urea solution (Urea 40 % or 32.5%) as a reactant.
2. UREA Supply pump : 2 X Type – UP 1002 and 1003 (design capacity 0.21 L/ MW/h)
3. Pipes material : Stainless Steel (dosing side and mixer) / 13CrMo4-5 (reactor) - Pipe dimension as listed on the type approval documentation

Application/Limitation

1. SCR bypass arrangements are not covered by this certificate. If bypass is required due to vessel machinery configuration, the arrangement shall be reviewed, ref. Rules for ships Pt.4 Ch.6 Sec.8 2.3 Exhaust gas systems
2. Pipe dimensions and standard to be according to DNV Rules Pt.4 Ch.6 Sec.9
3. The system is arranged with by-pass arrangement. If it is to be arranged by other than certificate holder, then the arrangement is shall be according to Rules for ships Pt.4 Ch.6 Sec.8 2.3 Exhaust gas systems
4. Two supply pumps (MP-A, MP-B with 273 L/ h @ 10 bar each) are tested according to Pt.4 Ch.6 Sec.9 2.3 and 2.4.
5. Below is not scope of this approval
 - Control and monitoring system. Items listed in Table 2 in Rules for ships Pt.4 Ch.6 Sec. 8 2.5.
 - Certificates according to Rules for ships Pt.4 Ch.6 Sec.1 3.2.1 Table 5 "Certification requirements – piping components"
 - Urea storage arrangements, including tank instrumentation, filling, ventilation and sounding arrangements
 - Electric cables and installation of this is not covered by this approval and must be verified to comply with the requirement of the Rules Pt.4 Ch.8 – Electrical Installation

6. NO_x Emission reduction capacity assessment according to in Appendix A1 – A4 in DNV-GL-CP-0353

This is to confirm that the emission measurements as part of the survey have been performed to demonstrate the function and performance of the system in compliance with NO_x Technical Code 2008, chapter 5 as well as MEPC.291(71) and found to be in compliance with Tier III emission limits as specified in Revised MARPOL Annex VI, regulation 13 paragraph 5.1.1.

Particulars of the testing	
Date of test	2017-11-09
Place of test	China Shipbuilding Industry Corporation Diesel Engine Co., Ltd, Qingdao Base
Fuel oil specification	ISO-F-DMA, Sulphur content: 0.010 % m/m
Test cycle(s)	E3 Test cycle for "Propeller-law-operated main and propeller-law-operated auxiliary engine" application

Specification of the engine fitted to the SCR System during the test	
Manufacturer	China Shipbuilding Industry Corporation Diesel Engine Co., Ltd, Qingdao Base
Engine Type	MAN - 6S60ME-C8.5
Serial No.	QDSR-001
Rated Power	9934 kW
Rated Speed	91.5 rpm

In the above specified combination, the specific NO_x emission value of the engine and SCR system for the E3 cycle is:

2.67 g/kWh

(NO_x Tier III limit at 91.5 rpm: 3.4 g/kWh)

The NO_x Reduction rate η is: > 74.9 % at all load points of the E3 cycle

- The selection of the SCR system type shall be based on the observance of acceptable exhaust back pressure to the engine and on the maximum allowable space velocity to enable the required NO_x reduction rate
- An overdosing test was performed to demonstrate the measures to prevent reductant slip and to avoid the supply of an excessive amount of reductant in the system. The NO_x reduction rate is : > 93% at 70 and 75% loading point when ammonia slip is less than 10 ppm
- This additional assessment does not replace the Engine International Air Pollution Prevention Certificate (EIAPP) and cannot be converted into an EIAPP certificate
- Where this SCR system is to be included within the EIAPP certification, it must be considered as a component of the engine, and its presence shall be reported in the engine's Technical File
- The deterioration rate of the catalyst material is not scope of this additional assessment

Type Approval documentation

Tests carried out

Shop Test Report of SunRui SCR system for DNV GL Type Approval

Marking of product

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

Periodical assessment

Periodical assessment is to be performed after 2 years and after 3.5 years. A renewal assessment will be performed at renewal of the certificate.

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.

This will be according to Class Guideline DNVGL-CG-0338, Section 4.