

SE-CORP 東南股份

LEADING GREEN SHIPPING TO GUARD THE BLUE SEA AND BLUE SKY



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SCR

SELECTIVE CATALYTIC REDUCTION SYSTEM

COMPANY PROFILE

Sailing Toward a New Green Voyage

Shipping serves as the lifeblood of global trade, with colossal vessels traversing continents to propel economic growth. However, accelerated industrialization has rendered ship exhaust emissions a major threat to marine ecosystems and coastal air quality. Annually, hundreds of millions of tons of nitrogen oxides (NO_x), sulfur oxides (SO_x), and particulate matter are discharged. In some heavily trafficked port cities, these emissions account for up to 30% of air pollution, triggering smog, acid rain, and endangering marine life—leading to the decline of fishery resources.

Confronting these challenges, Nanjing Southeast Industrial Equipment Co.'s SCR exhaust treatment systems for ships rise to the occasion. Leveraging cutting-edge technology, they efficiently convert harmful exhaust components, delivering robust momentum for vessel emission reduction. This propels the shipping industry toward a sustainable future, inaugurating a new chapter of harmonious coexistence between marine ecology and economic prosperity.



CERTIFICATIONS OF THE COMPANY'S PRODUCTS FOR SHIPS



ABS Approval



DNV GL Approval



CCS Approval



BV Approval



LR Approval



KR Approval



NK Approval



RS Approval



RINA Approval

SCR APPLICATION RANGE

2-Stroke
Diesel
Engine

2-Stroke
DF
Engine

4-Stroke
Gas
Engine

4-Stroke
DF
Engine

4-Stroke
Diesel
Engine

COOPERATION WITH UNIVERSITY RESEARCH INSTITUTIONS

Our company works closely with Wuhan University of Technology, forming an industry-university partnership that integrates cutting-edge academic research with practical engineering experience. Through establishing internship programs, scholarships, and other initiatives, our company provides students with practical platforms, attracting top talent to join its R&D teams and enabling seamless integration of academic knowledge with industrial applications.

This tightly integrated industry-academia-research model accelerates the translation of scientific achievements into market-ready products. It continuously infuses the company with innovative vitality, empowering it to scale new heights in ship exhaust treatment technology and lead the pace for the industry's green transformation.



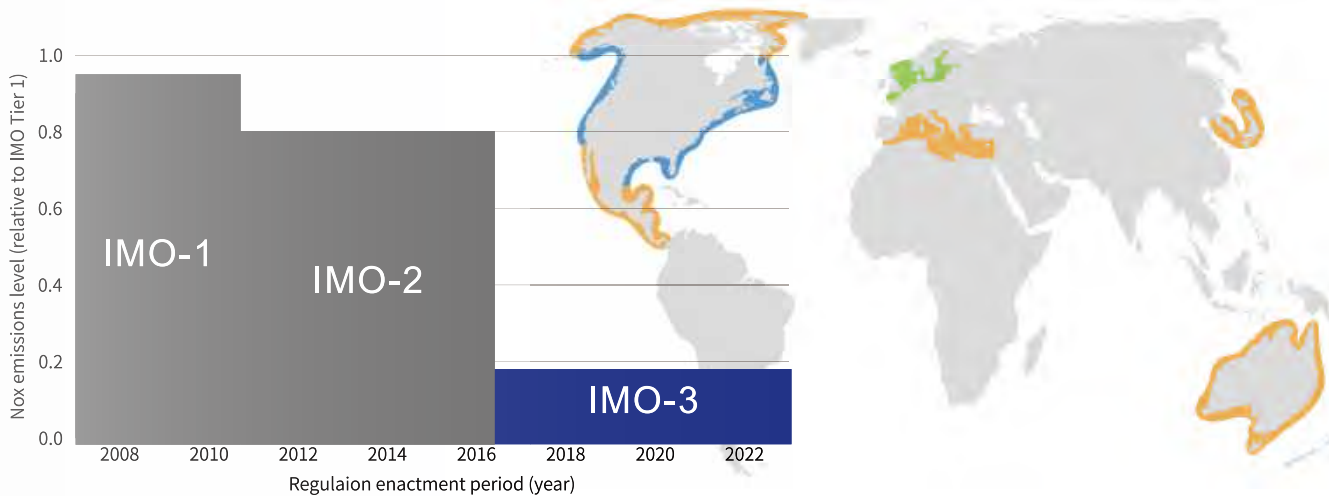
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LAWS AND REGULATIONS

INTERNATIONAL EMISSION REGULATIONS

To mitigate the environmental impact of ship exhaust emissions on the atmosphere, nations and international organizations worldwide have progressively established stringent maritime emission regulations. The International Maritime Organization (IMO) has adopted the International Convention for the Prevention of Pollution from Ships (MARPOL Annex VI), while Emission Control Areas (ECAs) impose particularly stringent restrictions on vessels navigating in these zones. The installation of SCR systems compliant with IMO Tier III standards has thus become a mandatory requirement.



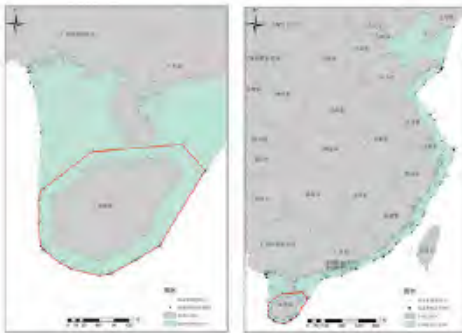
DOMESTIC EMISSION REGULATIONS

Domestically, to thoroughly implement the Central Committee and State Council's directives on accelerating ecological civilization construction, winning the battle against pollution, and securing the Blue Sky Protection Campaign—while promoting green shipping development and vessel energy efficiency—the Ministry of Transport of the People's Republic of China issued the Implementation Plan for Ship Air Pollutant Emission Control Areas on November 30, 2018, pursuant to the Air Pollution Prevention and Control Law of the People's Republic of China and relevant international conventions ratified by China.

Key provisions include:

Effective January 1, 2022: Marine diesel engines with $\geq 30\text{L}$ per-cylinder displacement, whether newly installed or undergoing major retrofitting, must comply with Tier III standards.

Effective January 1, 2025: All vessels operating within domestic Emission Control Areas (ECAs) that meet the criteria specified in Article 1 shall satisfy Tier III requirements, subject to timely assessment.



CORE TECHNOLOGY

Selective Catalytic Reduction(SCR) System

PURIFICATION PRINCIPLE –

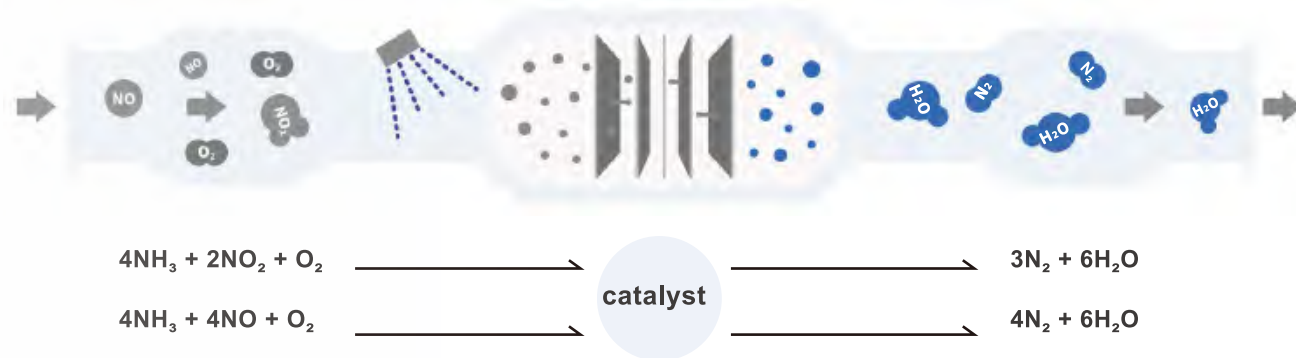
Transforming Pollution with Technology

Selective Catalytic Reduction (SCR) technology, as the core solution for ship exhaust purification, operates on an ingeniously efficient principle. When high-temperature exhaust laden with nitrogen oxides (NOx) from marine diesel engines enters the SCR system, a remarkable "purification transformation" commences.

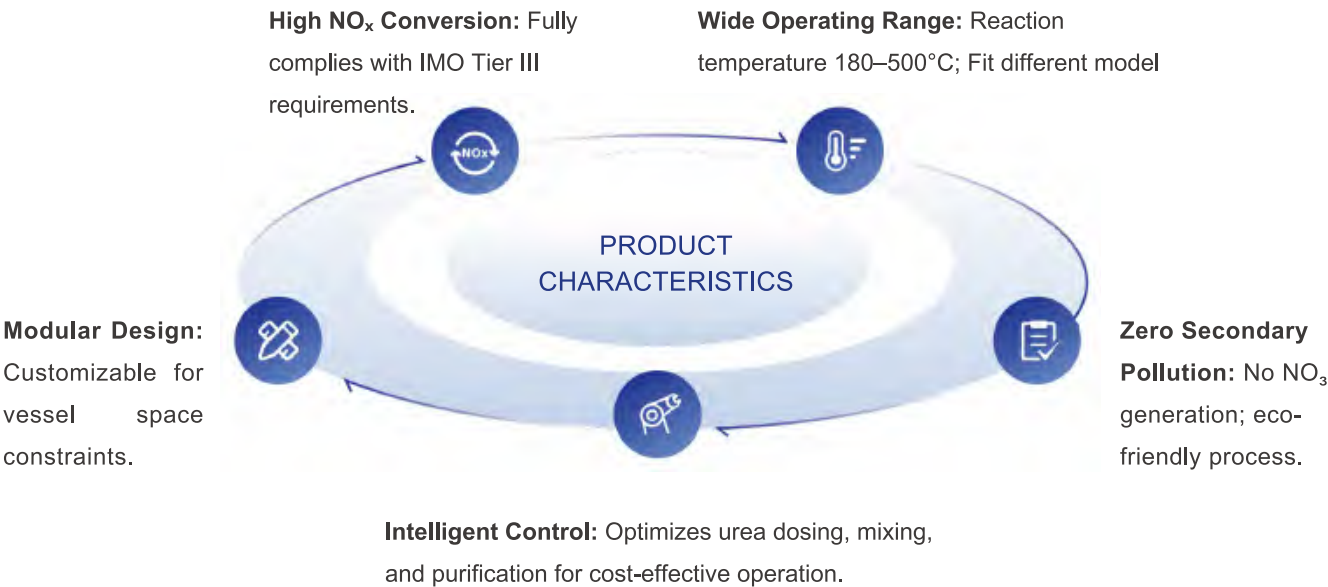
Within the reactor, catalysts—functioning as highly trained "environmental guardians"—await the exhaust stream. Simultaneously, a urea solution reductant is injected through a precision dosing system, mixing uniformly into the exhaust flow like a fine mist. Under elevated temperatures and catalytic action, the urea solution undergoes rapid thermal decomposition and hydrolysis, converting into ammonia gas (NH₃). Subsequently, the ammonia engages in selective catalytic reduction reactions with NOx on the catalytic surfaces.

Through this reaction cascade, nitrogen oxides (NOx) are transformed into harmless nitrogen gas (N₂) and water vapor (H₂O), achieving a remarkable metamorphosis from hazardous pollutants to clean emissions.

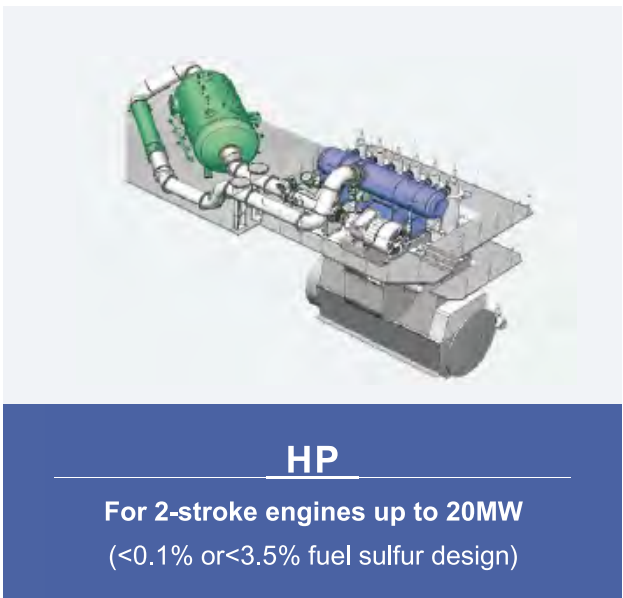
Reaction principle diagram



Product Characteristics



SCR for Ship Engines

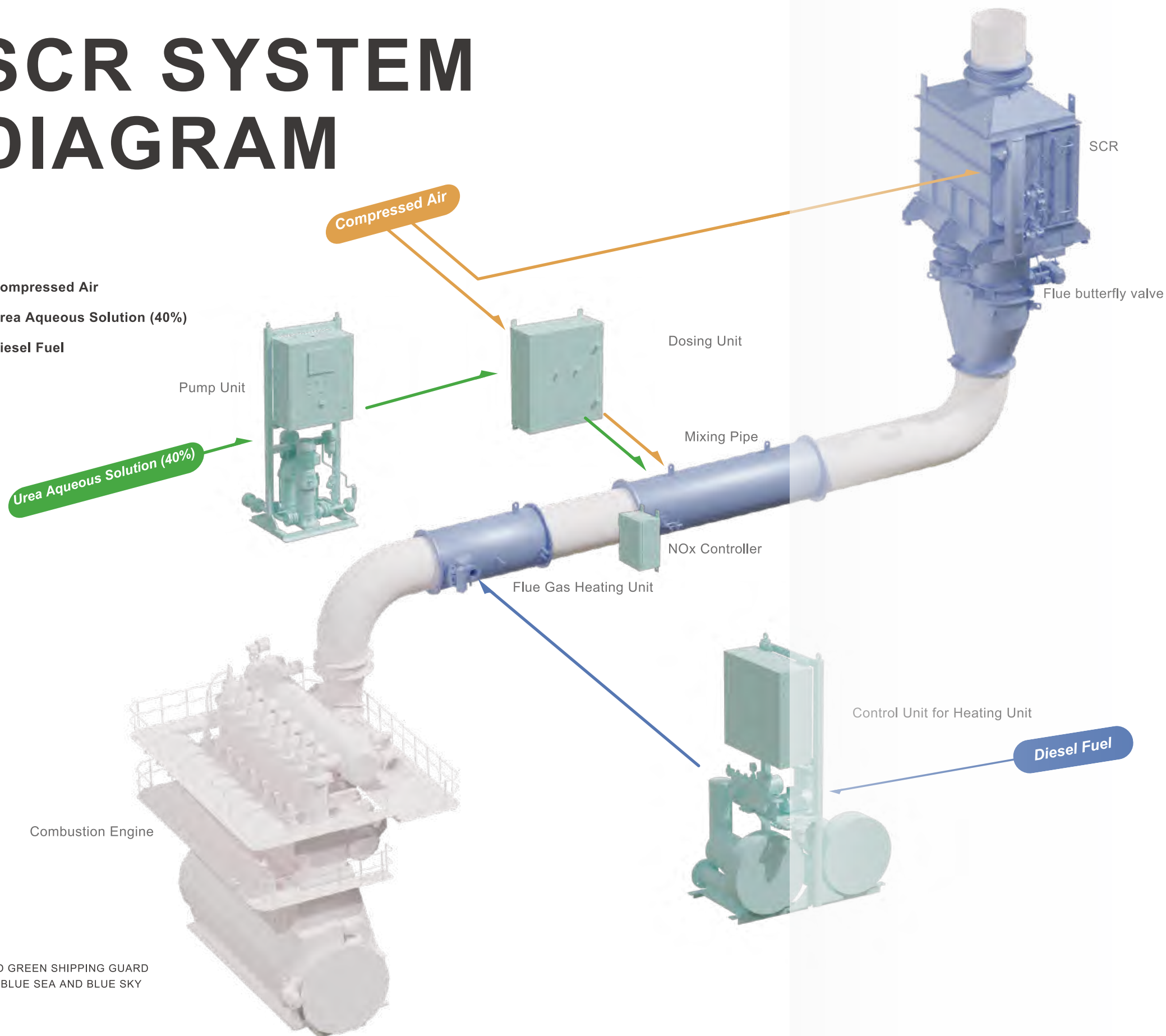


SCR SYSTEM DIAGRAM

● Compressed Air

● Urea Aqueous Solution (40%)

● Diesel Fuel



LEAD GREEN SHIPPING GUARD
THE BLUE SEA AND BLUE SKY



Compliant with International Maritime Organization Regulations

- IMO Tier III Certified
- High reduction efficiency
- Multi-certified



Optimal Installation Adaptability

- Easy component integration
- Seamless connection to engine systems
- Compact & adaptable layout



Convenient Operation and Maintenance

- Verify SCR before installation on board
- Low operating costs
- Global service and high-quality spare parts



Fully Automatic Control System

- Fully automatic control system
- Qualified design that meets ship requirements
- Online status monitoring

SYSTEM COMPOSITION:

Synergistic Operation, Building an Environmental Fortress

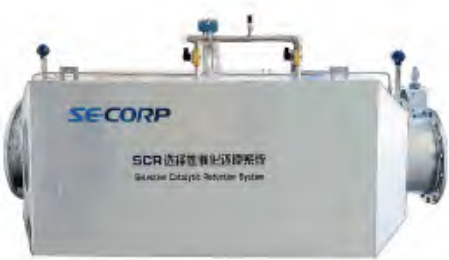
SCR ship exhaust gas treatment system is a highly integrated and precisely coordinated system. Each subsystem performs its own dedicated function, working in concert to achieve the goal of green emissions reduction. It primarily consists of the following components: SCR reactor, SCR injection and mixing unit, pump unit, reductant supply unit, NOx detection unit, flue gas butterfly valve (optional), and exhaust gas heating device (optional).

① SCR Reactor

The SCR reactor unit serves as the system's core component—rightly termed the "purification heart"—where NOx and NH₃ undergo catalytic reduction reactions under the catalyst's action. This process drives high-yield conversion of nitrogen oxides into harmless nitrogen gas (N₂) and water vapor (H₂O), accomplishing the pivotal purification stage to achieve clean emissions from internal combustion engines.

Components

Reactor housing, catalyst modules, temperature/pressure sensors, flow diffuser.



PRODUCT MODEL

MODEL	Exhaust Flow (kg/h)	Dimensions L×W×H (mm)	MODEL	Exhaust Flow (kg/h)	Dimensions L×W×H (mm)
SEN001	700~1450	2350×475×241	SEN017	18000~21500	2950×1410×1180
SEN002	2000~2900	2350×475×475	SEN020	21500~25800	2950×1415×1415
SEN002P	2000~2900	2700×830×475	SEN024	25800~30000	2950×1645×1415
SEN003	2900~4400	2350×710×475	SEN024P	25800~30000	3100×1950×1410
SEN003P	2900~4400	2612×830×710	SEN028	30000~35000	2950×1645×1645
SEN005	4400~6600	2500×710×710	SEN028P	30000~35000	3100×1950×1645
SEN005P	4400~6600	2612×1064×710	SEN032	35000~40000	2950×1875×1645
SEN007	6600~8800	2500×945×710	SEN036	40000~46000	2950×1875×1875
SEN007P	6600~8800	2950×1250×710	SEN041	46000~52000	3200×2110×1875
SEN009	8800~11600	2750×945×945	SEN046	52000~58000	3200×2110×2110
SEN009P	8800~1160	2950×1245×940	SEN051	58000~65000	3200×2340×2110
SEN011	11600~14500	2750×1180×945	SEN057	65000~72000	3200×2340×2340
SEN012P	11600~15400	2750×1180×1180	SEN063	72000~80000	3200×2575×2340
SEN014	14500~18000	3500×2575×2575	SEN069	80000~88000	3500×2575×2575

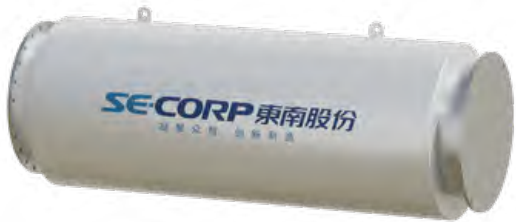
Note: Dimensions exclude insulation. Certified drawings prevail.

② SCR Jet Mixing Unit

The Mixing Unit, serving as the front-end interface of the SCR system, handles NOx concentration monitoring, reductant supply, and precision injection. Utilizing real-time exhaust mass flow rate and NOx concentration data, the injection lance atomizes urea solution into the core exhaust stream. This ensures optimal mixing uniformity, thereby facilitating subsequent catalytic reactions in the SCR reactor.

Components

Centrifugal pump, Y-strainer, pressure sensor, check valves, control system.



JPRODUCT MODEL

External dimensions and interface dimensions			
Model	Inlet ØD ₁ (mm)	Outlet ØD ₂ (mm)	Length (mm)
SENP350	350	350	2600
SENP400	400	400	3000
SENP500	500	500	3000
SENP600	600	600	3000
SENP700	700	700	3000
SENP800	800	800	3500/3000
SENP900	900	900	3500/3000
SENP1000	1000	1000	3000

NOTE: Interface pipe diamete:r:s D1/D2 and their connecting flanges are adaptable to exhaust stack dimensions of internal

combustion engines. Actual dimensions shall be governed by approved drawings.

③ Urea Pump Unit

Pump Group Unit: This unit pressurizes urea solution for delivery to the supply module. Its primary components include:Centrifugal pump, Suction strainer, Pressure sensors, Check valve, Ball valves, Control system, The control system enables automated operation with real-time monitoring and alarm capabilities across all subsystems.

Component

Centrifugal pump, Y-strainer, pressure sensor, check valves, control system.



PRODUCT MODEL

External dimensions and interface dimensions				
Model	Length L (mm)	Width W (mm)	Height H (mm)	Weight (kg)
SENB100	690	790	1700	160

NOTE: Outline dimensions (L×W×H) and net weight are adjustable based on site-specific constraints. Final specifications shall be governed by approved drawings.

④ Reductant Dosing Unit

This unit achieves quantitative reductant control for the SCR system while enabling real-time monitoring of operational parameters, anomaly alerting, and operational data retrieval. Signal transmission is implemented via RS485 bus.

Components

Air filter, reductant flow sensor, solenoid valves, pressure sensor.



PRODUCT MODEL

External dimensions and interface dimensions							
Model	L (mm)	W (mm)	D (mm)	L ₁ (mm)	W ₁ (mm)	R (mm)	Weight (kg)
SENG060	700	600	250	750	750	750	25

NOTE: Outline dimensions (L×W×H) and net weight are adjustable based on site-specific constraints. Final specifications shall be governed by approved drawings.

⑤ NO_x MEASURING

Serving as the detection module for SCR system intake/exhaust streams, this unit measures NO_x and oxygen concentrations in engine exhaust. It is installed at both the upstream inlet and downstream outlet of the SCR reactor assembly.

Components

NO_x concentration sensors, junction box.



PRODUCT MODEL

External dimensions and interface dimensions					
Model	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)
5WK9	245	175	4-Ø12	370	320

NOTE: Outline dimensions (L×W×H) and net weight are adjustable based on site-specific constraints. Final specifications shall be governed by approved drawings.

⑥ FLUE BUTTERFLY VALVE (Optional)

The flue butterfly valve actuates switching between the main and bypass paths. Upon SCR system initiation, it engages the main path to direct the mixed exhaust stream through the reactor assembly during normal operation.

Operating Temp

≤550℃



PRODUCT MODEL

External dimensions and interface dimensions				
Model	Valve seat diameter DN (mm)	Length (mm)	Height (mm)	Weight (kg)
SENV300	293	170	1090	55
SENV350	347	170	1140	74
SENV400	396	190	1200	86
SENV450	451	190	1250	95
.....				
SENV800	781	210	1638	175
SENV900	882	250	1737	205
SENV1000	984	250	1841	239
SENV1100	1086	250	1953	228

NOTE: Nominal diameter (DN), outside diameter (OD), and net weight are adaptable to site-specific installation constraints. Final dimensional specifications shall be governed by approved drawings.

⑦ FLUE GAS HEATER (Optional)

When exhaust temperatures are insufficient to reach the reductant thermal decomposition threshold—compromising optimal catalytic reduction efficiency—or when fuel sulfur content exceeds the catalyst's maximum tolerance limit, the exhaust preheating device activates to elevate gas temperatures, ensuring continuous SCR system operation. The requisite thermal load of the preheating device is determined via thermodynamic modeling based on real-time exhaust temperature and mass flow rate data.

Components

Burner, blower, controller, valves.



PRODUCT MODEL

External dimensions and interface dimensions					
Model	H (mm)	D (mm)	W (mm)	W ₁ (mm)	Weight (kg)
JFWD45	1800	650/1250	680	250/400	70/150

NOTE: Outline dimensions (L×W×H) and net weight are adjustable based on site-specific constraints. Final specifications shall be governed by approved drawings.

EXHAUST GAS CLEANING SYSTEM

Southeast's marine exhaust purification system (DOC + DPF) provides particulate and odor control for marine diesel engines in both newbuild and in-service vessels. Its modular design combines DOC oxidation with DPF capture to markedly reduce PM, CO, and HC, while maintaining low pressure drop and a compact footprint.

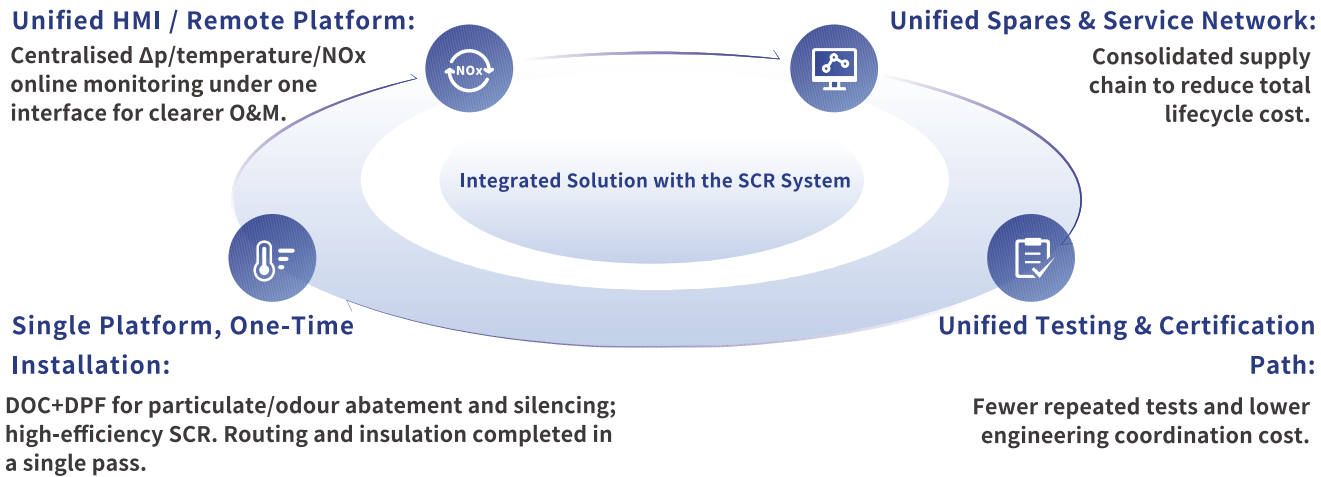


Components

Integrated silencer (opt.) — Overall noise reduction: 25 dB(A) (typ.)
Monitoring: Δp + Temperature (dual). Alerts: Intelligent anomaly detection. Maintenance: Smart push recommendations.
DOC (oxidiser): Converts CO/HC to reduce odour and raises the thermal window for DPF regeneration.
DPF (particulate filter): Efficiently captures PM; with passive or active regeneration, it maintains filtration efficiency and a stable pressure drop.

Core Features & Advantages

- 01 Low resistance, controllable pressure drop: System engineered for low pressure drop; total pressure drop ≤ 4 kPa (project-specific option), balancing performance and fuel economy.
- 02 Significant PM and odour reduction: Marked decreases in PM, HC, and CO, improving deck/engine-room air quality and crew experience.
- 03 Space-efficient: Optional integrated DOC + DPF + silencer shortens overall length, reduces hanger/support points, and shortens installation time.
- 04 Smart O&M: Supports online Δp /temperature monitoring and regeneration strategy management; can interface with your existing online monitoring platform.
- 05 Lower lifecycle cost: Replaceable cartridges and reconditionable/cleanable filters with visualised maintenance intervals; stable spare parts and service response.



UREA SOLUTION PREPARATION UNIT (AUS Generator)

This equipment is a skid-mounted unit integrating urea production and transfer systems.

- 01 Easier loading: uses solid urea powder; no IBCs or transfer pumps required.
- 02 Lower material cost: on-board AUS from powder is generally cheaper than purchasing liquid AUS.
- 03 No large storage tank required: a small buffer tank suffices, reducing footprint and one-off fill volume.
- 04 On-demand accurate preparation ensures consistent quality and helps prevent catalyst fouling.

Components

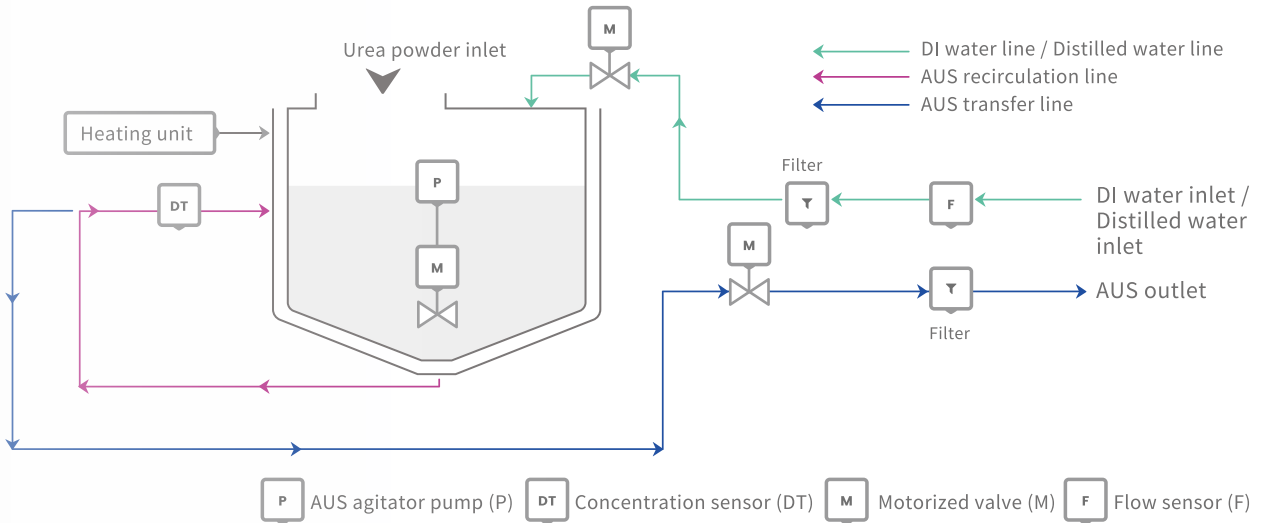
Urea solution generator (with heater), transfer pump metering instruments, valves, piping, control module



PRODUCT MODEL

Model	SU-100	SU-300	SU-500	SU-800
Urea Pellet Weight (kg)	100	300	500	800
Urea Solution (L)	225	675	1125	1800
Total Power (kW)	25	30	35	40
Dimensions(mm)	1200×1500	1400×1700	1600×1800	2000×2200
Production Cycle (min)	60	60	60	60

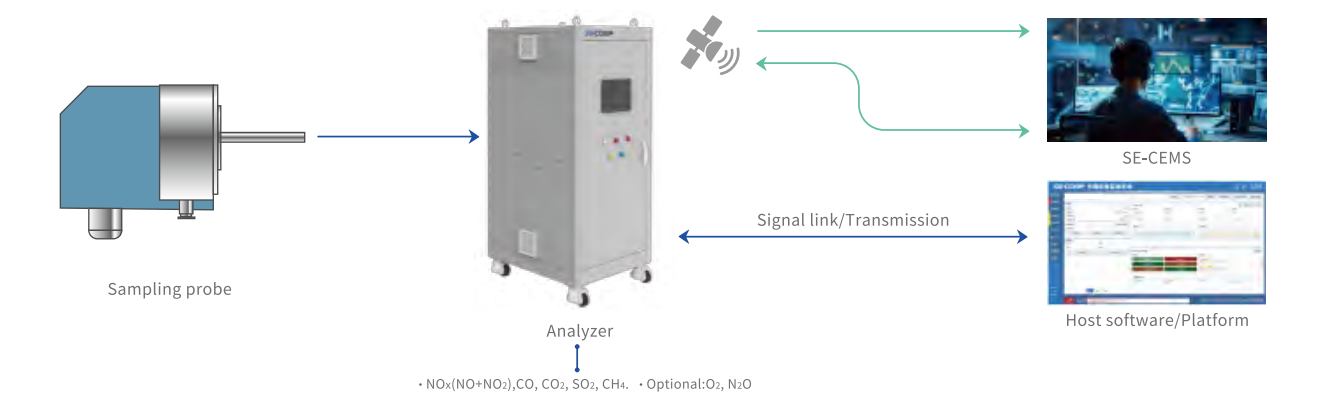
NOTE: Length, width, height, and dead weight are subject to adjustment according to the installation environment. Final dimensions shall be as per the approved drawings.



Piping, valves, and fittings from the AUS outlet to the shipyard storage tank shall be stainless steel.

Continuous Emission Monitoring System

The Continuous Emission Monitoring System (CEMS) measures flue gas continuously from marine diesel engine exhaust. Using online, distributed measurement and calculation, the CEMS supports data-driven emission management. Under various fuel and emission conditions, it also provides ship-owners with a stable platform for measurement and recording.



TECHNICAL PARAMENTERS

System configuration	Sampling Probe + Pretreatment Unit + Analyzer + Data/Remote Management
Measurement methods	DOAS: NO、NO ₂ 、SO ₂ ;
	NDIR: CO、CO ₂ ;
	TDLAS: H ₂ O
Measured components	NO ₂ 、NO、SO ₂ 、O ₂ 、CO ₂ 、CO、NH ₃ 、PM
Measurement ranges	NO ₂ : 0–1500 ppm; NO: 0–150 ppm; SO ₂ : 0–500 ppm;
	O ₂ : 0–25% (vol) ; CO ₂ : 0–30000 ppm; CO: 0–20% (vol) ;
	NH ₃ : 0–100 ppm; PM: 0–100 mg/m ³
Sampling temperature	≤ 545 °C
Flue gas temperature	≤ 325 °C
Zero drift	≤ ±2% F.S.
Span drift	≤ ±2% F.S.
Repeatability	≤ ±1% F.S.
Response time	T90 ≤ 30 s

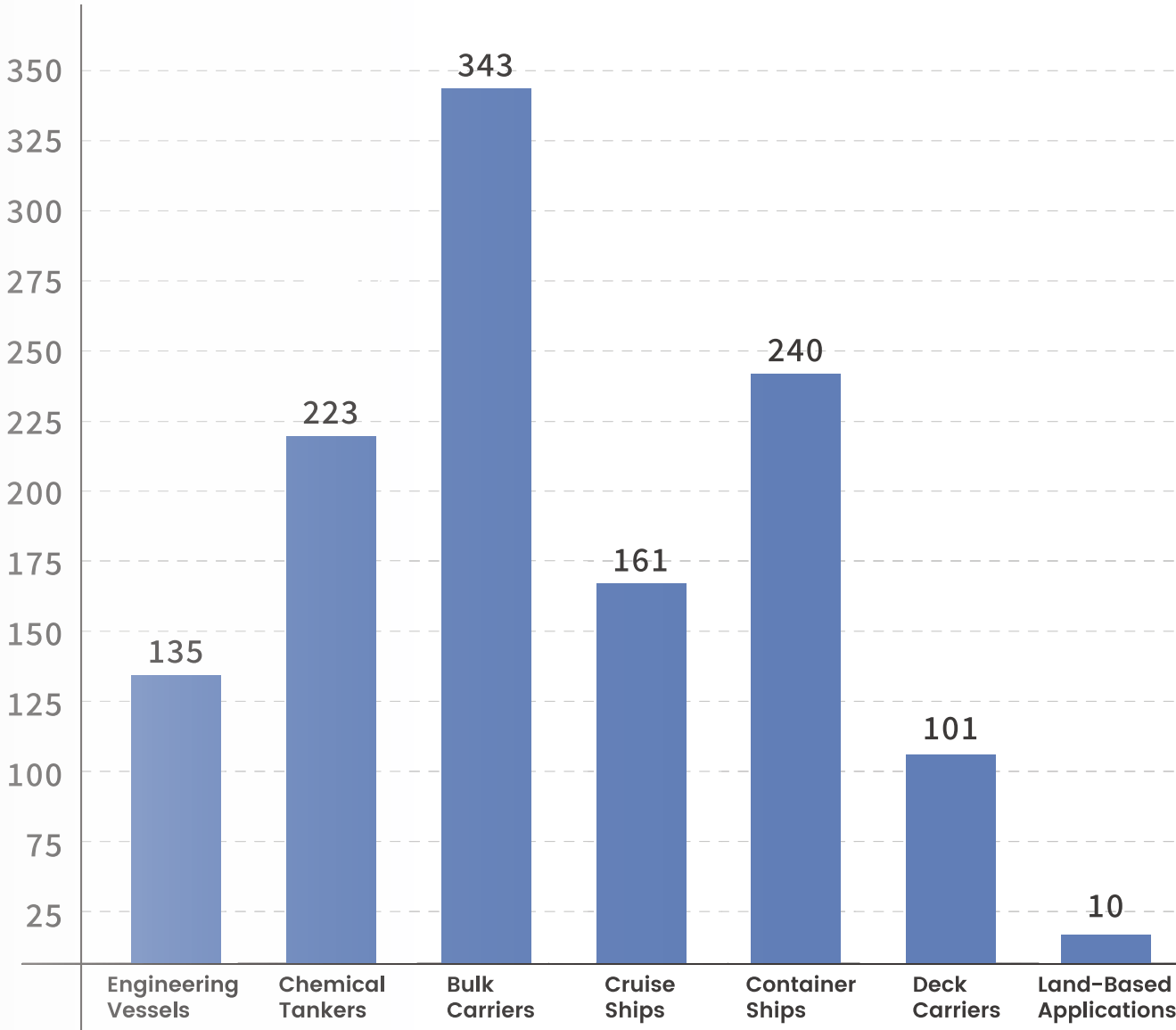
ON-BOARD EXHAUST GAS EMISSION TESTING

In accordance with IMO MEPC.399(83), we provide on-board exhaust gas testing services (online or portable), delivering test reports to support certification, commissioning, and compliance.

COOPERATION CASES

PLAN A(WITH SCR SYSTEM)

2-Stroke+4-Stroke
1091 SETS



SCHEME B(CONVERSION OF EXISTING VESSELS)

01 Zhonggu Logistics 4,600 TEU Container Vessels

Completed SCR retrofits on 4,600 TEU series.



02 New Yangzijiang 4,600 TEU Container Vessels

Delivered 6 SCR systems. Optimized production workflow for rapid installation (14 days/vessel).



03 Wuzhou 5,500m³ LPG Carrier

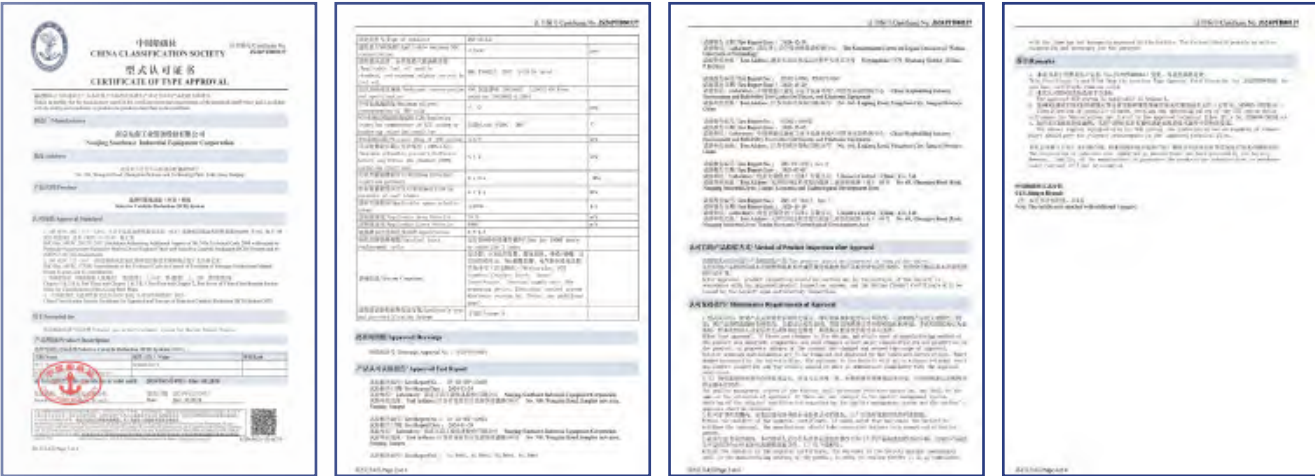
Retrofitted SCR system through expert commissioning, ensuring green compliance.



04 AKASAKA 5,500m³ LPG Carrier
Completed SCR integration for main engine via technical innovation and teamwork.



CERTIFICATE RELATED TO SCHEME B



COMPARISON BETWEEN SCHEME A AND SCHEME B

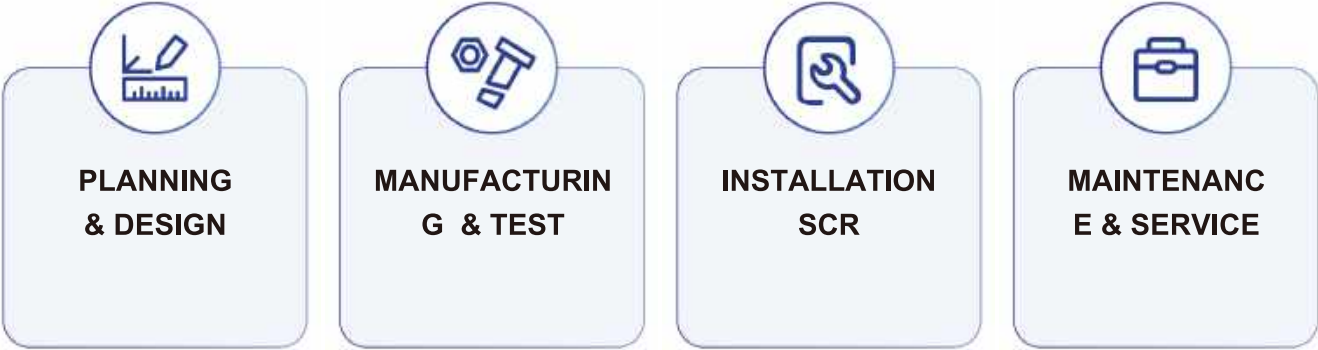
PLAN A	PLAN B
Advantages: Full engine power (100%), integrated design cycle	Advantages: Suitable for retrofits, engine power 75%
Tier III Engine + SCR	Tier III Engine
Tier III Engine	Technical document review
Tier III Certificate (EIAPP Certification)	Scale-model simulation test
	Onboard verification
	Tier III Certificate (EIAPP Certification)

GLOBAL SERVICE



CREATE THE BEST SOLUTION FOR YOUR SHIP

We deliver tailored solutions to meet your specific requirements. Leveraging our specialized expertise, we guarantee optimal system performance and reliable commissioning throughout your vessel's service life. We provide timely after-sales support to ensure long-term operational stability, and we look forward to establishing a lasting partnership as we embark together on a journey of excellence in shipbuilding innovation.



SERVICE ADVANTAGE

