



YANMAR

Selective Catalytic Reduction system



SCR System

Selective Catalytic Reduction System

YANMAR POWER TECHNOLOGY CO., LTD.

Large Power Products Business

1-1-1, Nagasu-Higashidori, Amagasaki, Hyogo, Japan
TEL: +81-6-6489-8069 FAX: +81-6-6489-1082

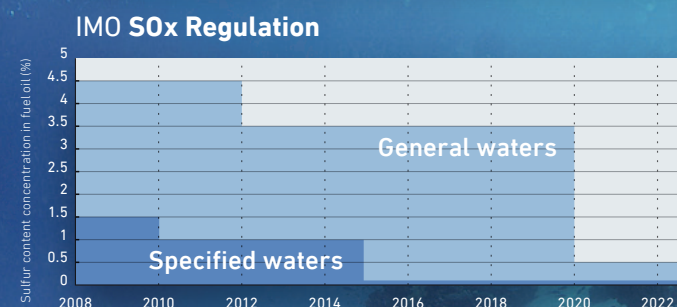
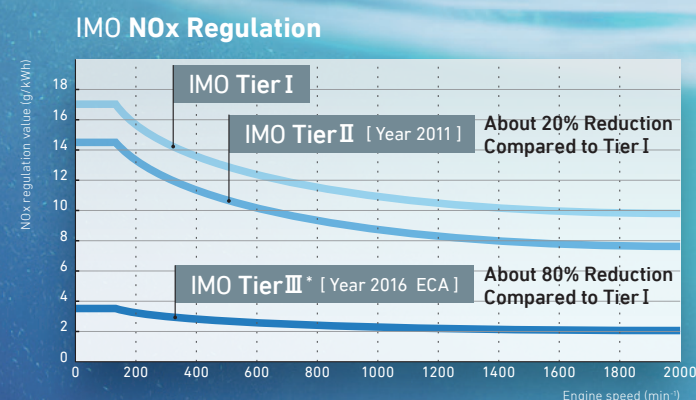
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Cleaner exhaust gas for ocean and sky More convenience for vessels

Recently, from the point of caring the environment, emission requirements around the world is becoming stricter.

TierⅢ* of IMO applied from 2016 says to reduce 80% of NOx exhaust compared to Tier I, in North American Emission Control Area (ECA).

In Yanmar, we have developed an SCR system that can solely clear this new environmental regulation requiring this strict NOx reduction. With our unique technology and experience, we have created designs and functions that perfectly fit for vessel use. We provide this SCR system that best matches the engine specification as a high quality solution to customers, that is human-friendly and eco-friendly at the same time.



* Tier III is applied in general waters
ECA = Emission Control Area IMO = International Maritime Organization
NOx = Nitrogen Oxides SOx = Sulfur Oxides

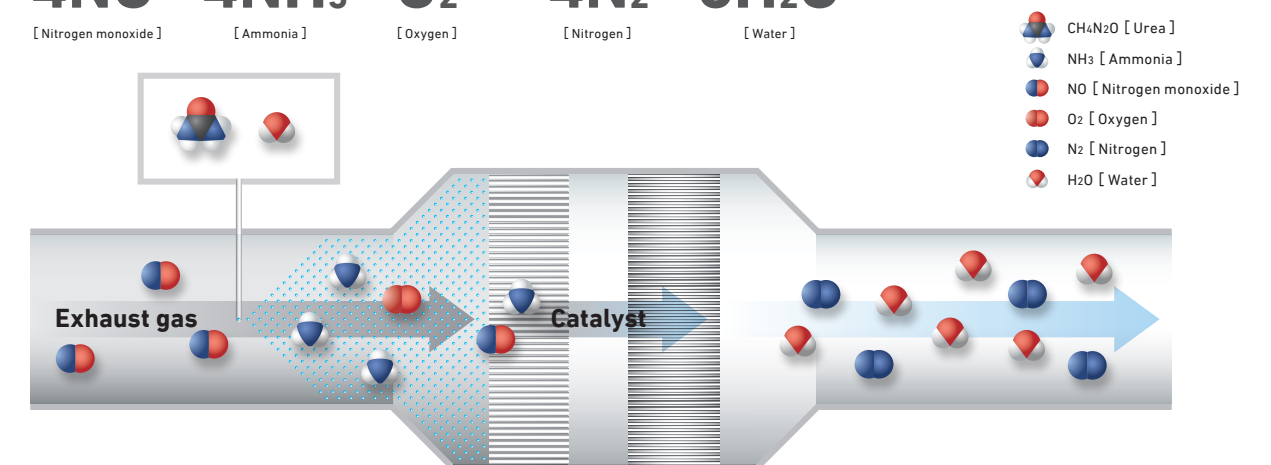
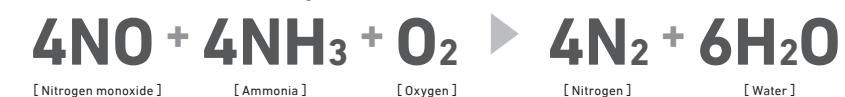
NOx is converted into nontoxic “nitrogen” and “water” through chemical reactions.

Urea solution (safe to be used as reducing agent) is injected into exhaust gas, and hydrolyzed at high temperature. By this, the generated ammonia reacts with NOx through catalyst, resulting in nontoxic nitrogen and water being discharged into open air.

■ Ammonia is generated from urea solution.



■ Ammonia reduces NOx to nitrogen and water.

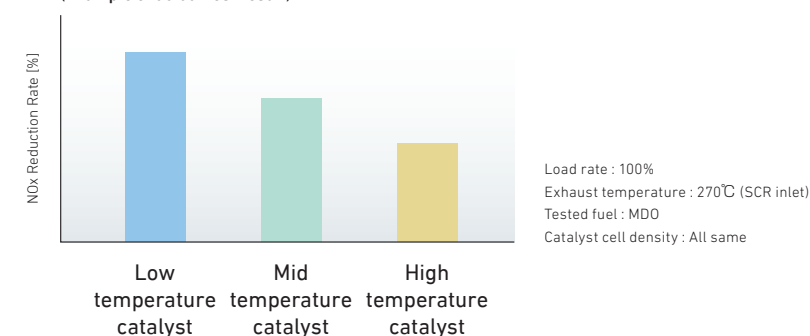


Adjusting to the engine performance, this system exerts excellent NOx reduction even in low exhaust temperatures.

We have adopted the best catalyst type considering high activeness in low temperature, trade-off of pressure loss and NOx reduction rate, and durability.

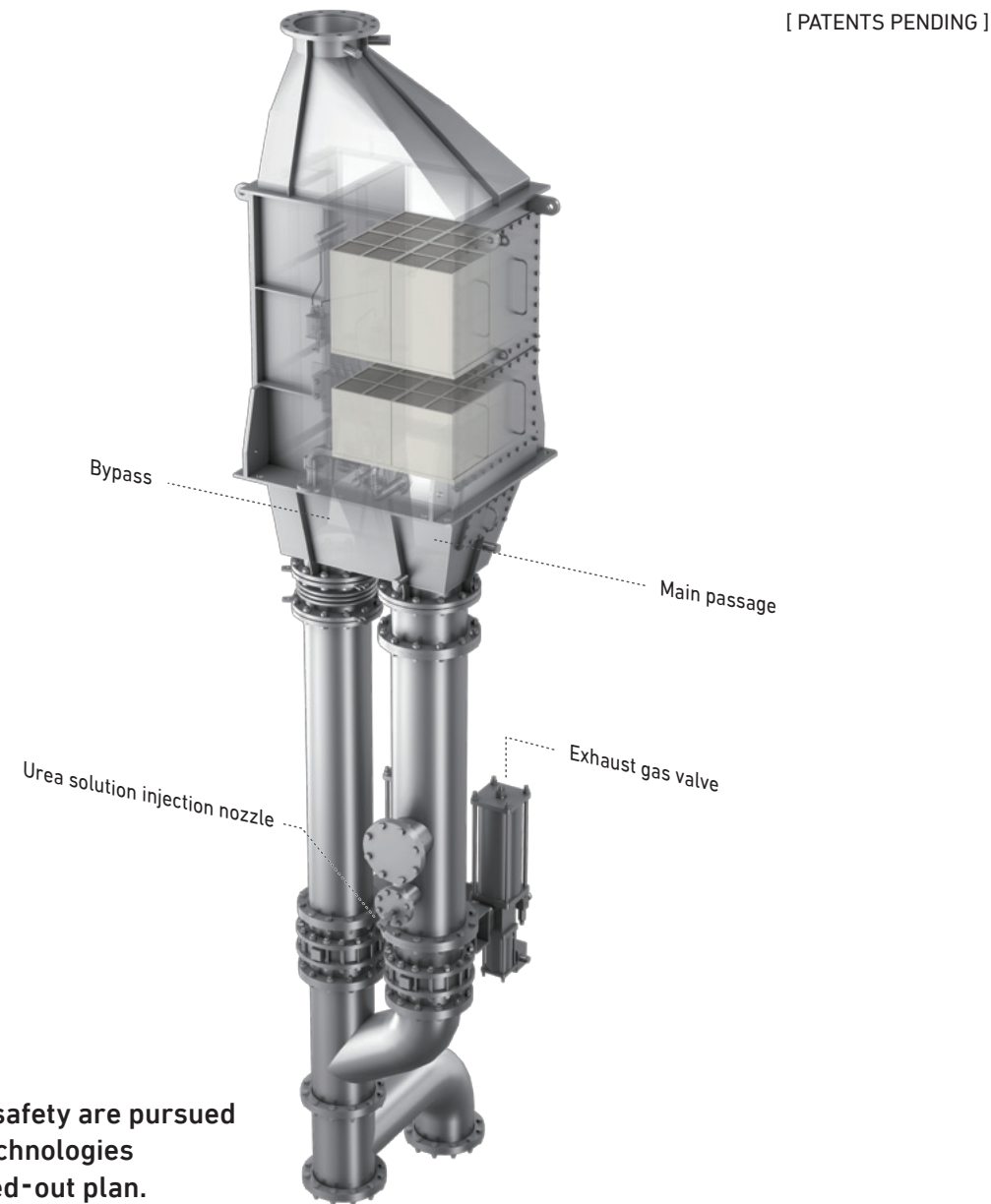
* However, the fuel used for the engine during SCR operation is either MGO or MDO with sulfur content concentration of 0.1% or lower.

Effect on NOx reduction rate under low temperature
(Example of actual test result)



Compact design : Unified catalyst line and bypass

The newly installed bypass operation, which does not allow exhaust gas to pass through the catalyst, contributes to longer catalyst lifetime and achieves optimum operations adjusting to every marine water. The integrated catalytic reactor facilitates the installation and reduces designing burden at shipyards.

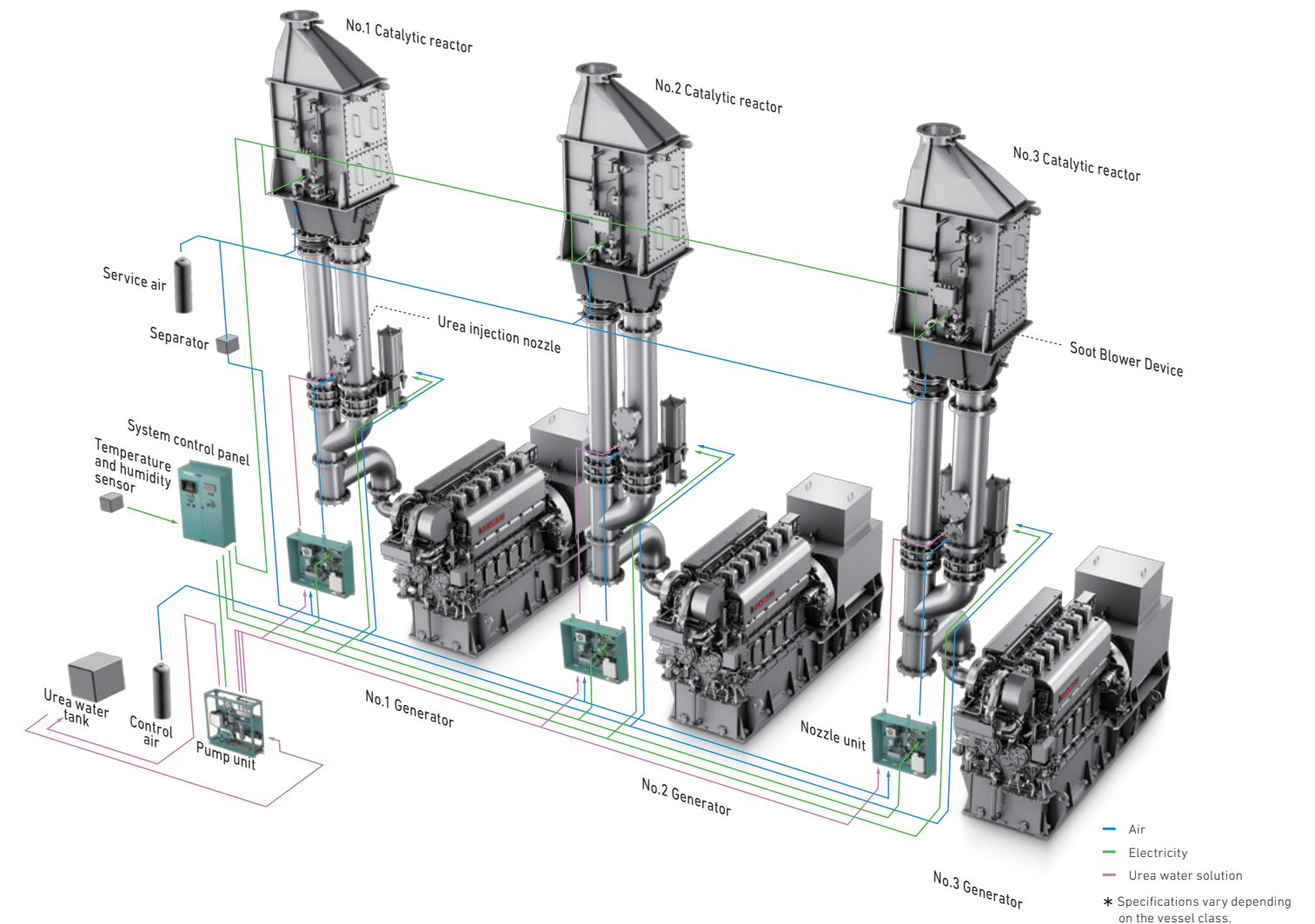


Efficiency and safety are pursued with various technologies and fully worked-out plan.

- By adopting a straight pipe from the urea solution injection nozzle through the catalytic reactor, high denitrification performance is ensured without affecting the piping layout predetermined by shipyards. This design also contributes to ensuring the acquisition of the Scheme-A certificate.
- The installation of the urea solution injection nozzle downstream of the bypass branching prevents ammonia from leaking to the bypass pipe in case the exhaust valve is broken.
- The automatic soot blow device prevents soot deposition and catalyst deterioration, and suppresses pressure loss from increasing.
- The air-assisted urea solution injection improves the denitrification efficiency.
- The injection of urea solution is automatically controlled to the best amount to prevent generating excess ammonia.

Saving space for multiple generator engines as well

All devices including the catalytic converters installed in individual engines are controlled integrally.



Nozzle unit



Urea solution injection nozzle



Control panel monitor



Pump unit

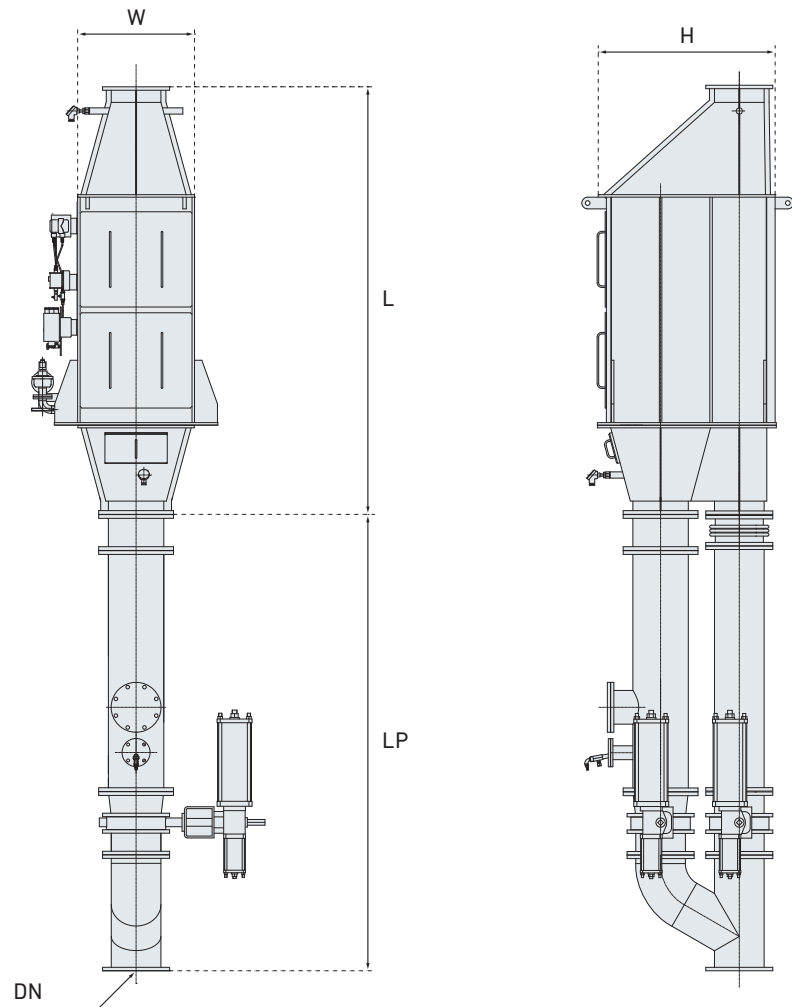


System control panel

SCR System

- ☐ Nozzle unit
- ☐ System control panel
- ☐ Urea solution injection nozzle
- ☐ Pump unit
- ☐ Catalytic reactor
- ☐ Urea solution tank
- ☐ Air tank
- ☐ Soot blow pipe
- ☐ Air treatment unit
- ☐ Temperature and humidity sensor

Full view



SCR model	Catalytic reactor dimension (mm)			Exhaust pipe dimension (mm)			Engine model	Power (kW)
	H	W	L	DN-in	DN-out	LP		
Y155SCR-L	1080	750	2530	250A	300A	2760	6AYLS	438~491
Y16SCR-L	1080	750	2390	250A	250A	2080	6NY16LWS	353~441
Y165SCR-L	1140	750	2465	300A	300A	2325	6N165LWS	485
	1140	750	2615	300A	300A	2325		530
Y18SCR-(A)L	1140	750	2615	300A	300A	2930	6EY18(A)LWS	455~615
	1140	750	2765	300A	300A	2930		660~800
Y21SCR-AL	1480	1050	2760	350A	400A	3330	6EY21ALWS	880~1020
Y22SCR-(A)L	1480	1070	2760	400A	400A	3620	6EY22(A)LWS	880~1100
	1480	1070	2910	400A	400A	3620		1180~1370
Y22SCR-AL	1480	1070	2910	400A	500A	3620	6EY22ALWS	1500
Y26SCR-6L	1700	1430	3465	500A	500A	4300	6EY26LWS	1400~1840
Y26SCR-8L	1920	1430	3330	550A	600A	4400	8EY26LWS	1900~2130
	1920	1430	3480	550A	600A	4400		2245~2450
Y33SCR-6L	2135	1750	3850	650A	650A	5335	6EY33LWS	2400~3360
Y33SCR-8L	2430	1750	3900	750A	750A	6100	8EY33LWS	3600~4500

* Feel free to contact for detailed informations on dimensions, etc.

SCR system scheduled inspection table

Component	Maintenance items [What to do]	Inspection period (in SCR Operating time)				
		2 months or 300	2 years or 4000 to 5000	5 years or 8000 to 12000	10 years or 16000 to 20000	16000 to 20000
Catalytic reactor	Catalytic converters, catalyst [Inspect / Clean* ¹]		■			
	Catalyst [Replace]					■
	Solenoid valve for soot blow [Replace]			■		
Urea solution injection nozzle	Urea injection nozzle tip [Clean]	■				
	Air cap [Replace]		■			
	Cap nut [Replace]		■			
	Fluid cap [Replace]			■		
Pump unit	Pump head [Replace]			■		
	Pump motor [Replace]				■	
	Y strainer element (before the pump) [Clean]		■			
	Filter element (after the pump) [Replace]			■		
Nozzle unit	Strainer element [Clean]		■			
NOx sensor * ²	Metal filter [Clean]		■			
	Sensor [Replace]		■			
Calibration unit * ²	Span/zero gas filter [Clean]		■			

Inspection period (in Engine operating hours)		
Exhaust Gas Valve	Seat ring, sheet gasket, gland packing [Replace]	2 to 3 years or 8000 to 12000
	Filter regulator element [Replace / Clean * ¹]	
Air treatment unit	Filter element [Replace]	
	Water separator element [Replace]	
	Micro-mist separator element [Replace]	

Replacement cycle		
Temperature and humidity sensor	Sensor [Replace]	2.5 years
All SCR System	Electronic devices [Replace]	7 years (in general)
Control Panel	Controller backup battery [Replace]	3 years (in general) or when alarm goes off
	Backup battery for touch panel [Replace]	
Urea solution concentration meter	Battery [Replace]	3 years (in general)
NH3 alarm unit * ³	Battery (detection part) [Replace]	1 year (in general)

*¹: After inspection, clean or replace if necessary.
*²: When the NOx sensor is equipped (optional)
*³: When NH3 leak alarm unit is equipped (optional)

A reliable engine manufacturer’s quality and support



IMO TierⅢ for NOx cleared.

Certificates of conformity to the TierⅢ regulation for NOx are being obtained from IMO and nine major Classification Societies. We took a certification test conducted under Scheme A*, in which engines are tested together with the SCR system.

* This omits on-board certification test.



Engines and SCR system provided together

Through our in-house development taking advantages as an engine manufacturer, such as the technology to control exhaust gas temperature to facilitate reduction reactions, are fully utilized to provide a total SCR system best suited for your engines.



After-sales service

Even after delivery, total support will be given to your engines and SCR system. Spot-check service is also available and we will provide you a wide range of services from on-board NOx measuring to reporting the Classification Society.



Reliable technologies based on multiple testing to actual vessels

Under the joint research scheme of ClassNK in cooperation with Mitsui O.S.K. Lines and Namura Shipbuilding Co., Ltd., sea trials on three generator engines equipped with the SCR system were completed in October 2014. The SCR system for ocean-going vessels was established with a high degree of perfection.

Integrated manufacturing of high-quality large engines at Yanmar’s Amagasaki factory.

Amagasaki factory started in 1936 as world’s first factory to produce small sized diesel engines. Today, the factory mass produces large-sized diesel engines for marine and generator use, and also produces diesel and gas engines for land use and general power source. From 1983, the factory also produces gas turbines, and continues to produce high quality products ever since.

Highly accurate and efficient production system

Amagasaki factory uses its unique, high performance devices and advanced machines for automatic and laborsaving operation. Furthermore, a suitable order-entry system matching each product is applied and controlled with an accurate quality management system. Therefore, we are able to produce highly reliable products to customers. Yanmar is the only company that produces the entire engine integrally within one factory.



11 awards in the engine industry

Amagasaki factory is a certified factory of the 11.prestigious Classification Societies in the world. The world’s first factory to qualify the self-inspection system in all 11 Classes.



Certificate of the 11 major Classification Societies

- | | | |
|-----------------------|-----------------------|-----------------------|
| NK [Japan] | RINA [Italy] | GL [Germany] |
| ABS [US] | BV [France] | IRS [India] |
| LR [UK] | KR [Korea] | RS [Russia] |
| DNV [Norway] | CCS [China] | |

Research and development with advanced technology

Yanmar continues to research and develop environmental-friendly technology in a higher degree, such as developing cleaner emission gas, low fuel consumption, and less vibration and noise, based on our unique engine technology.



Internationally qualified quality management and environmental friendliness

In June 1992, acquired “ISO9001*1” from the British certification organization LRQA. With early adaption to environmental problems, by June 1997, we received the “ISO14001*2” qualification as a first manufacturing factory for land-and-marine-use large diesel engines. Furthermore, we were the first engine manufacturer in Japan to acquire a certificate (NK) of“IMO exhaust gas regulation (NOx emission control value)” (TierI in 2001 and TierII in 2011). We are highly evaluated in advanced technology considering environmental protection.

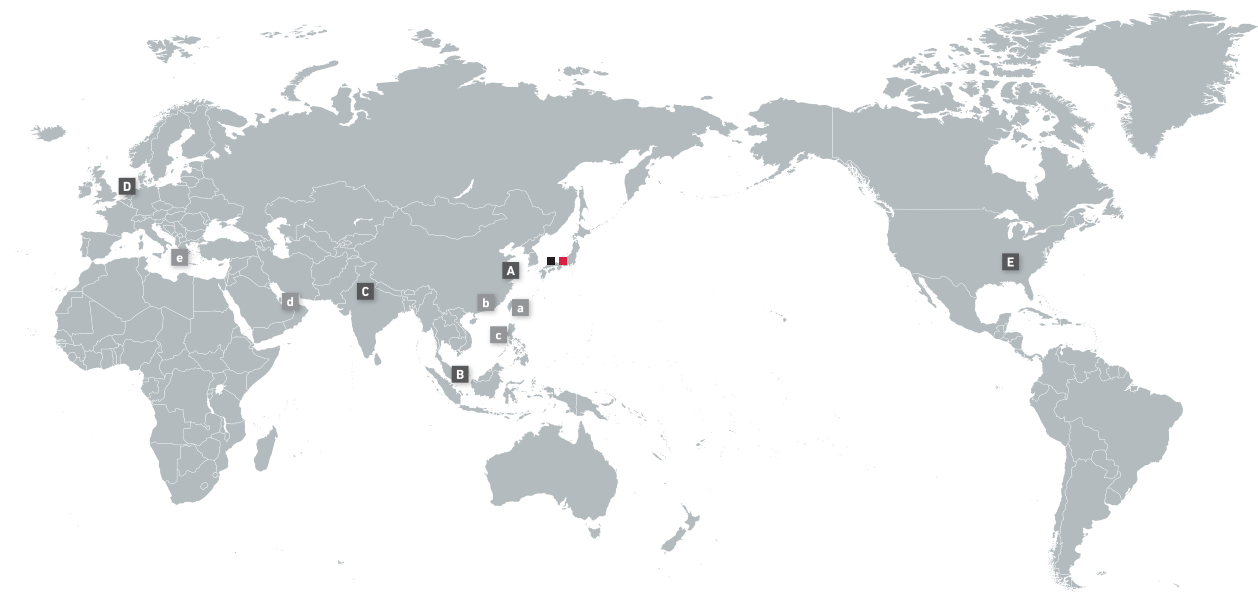


*1 ISO9001
(International Organization for Standardization):
International standard for Quality Management System
(Confirmation number: 912208)



*2 ISO14001
(International Organization for Standardization):
International standard for Environmental Management System
(Confirmation number: 770250)

Service Network



ASIA

JAPAN Country Code " 81 "

■ **YANMAR POWER TECHNOLOGY CO., LTD.**

HEAD OFFICE
YANMAR FLYING-Y BUILDING, 1-32,
Chayamachi, Kita-ku, Osaka, 530-8311, Japan
WEB: yanmar.com

AMAGASAKI PLANT
1-1-1, Nagasu Higashi-dori, Amagasaki,
Hyogo, 660-8585, Japan

OVERSEAS SALES DIVISION.
TEL: 6-6489-8042 FAX: 6-6489-1082

QUALITY ASSURANCE DIVISION.
TEL: 6-6489-8017 FAX: 6-6489-4009

■ **YANMAR ENGINEERING CO., LTD.**

YANMAR ENGINEERING (HEAD OFFICE)
1-1-1, Nagasu Higashi-dori,
Amagasaki, Hyogo, 660-8585, Japan
TEL: 6-6489-8045 FAX: 6-6489-8075

OVERSEAS ENGINEERING DIVISION.
TEL: 6-6489-8048 FAX: 6-6481-6101

CHINA Country Code " 86 "

A YANMAR ENGINE (SHANGHAI) CO., LTD.
1101-1106, Gopher Center Building,
No.757 Meng Zi Road, Shanghai, China 200023
TEL: 21-2312-0688 FAX: 21-6880-8090 / 21-6880-8682
WEB: yanmar.com/cn/

TAIWAN Country Code " 886 "

B YANMAR ENGINEERING CO., LTD.
TAIWAN BRANCH
No.56, Yugangjung 2 Rd.,
Chienchen Dist, Kaohsiung, Taiwan
TEL: 7-815-3156 FAX: 7-815-3280

HONG KONG Country Code " 852 "

B YANMAR ENGINEERING (HK) CO., LTD.
Room J, 23/F, King
Palace Plaza 55 King Yip Street,
Kwun Tong, Kowloon, Hong Kong, China
TEL: 2833-9032 FAX: 2904-7783

PHILIPPINES Country Code " 63 "

C YANMAR ENGINEERING CO., LTD.
PHILIPPINES LIAISON OFFICE
Bldg. 3, Berthaphil South, Bayanihan St.,
Jose Abad Santos Avenue,
Clark Freeport Zone 2023, Pampanga, Philippines
TEL: 45-499-1541/1542 FAX: 45-499-1543

SINGAPORE Country Code " 65 "

B YANMAR ASIA (SINGAPORE)
CORP. PTE. LTD. (YASC)
4 Tuas Lane, Singapore 638613
TEL: 6595-4200 FAX: 6862-5189

INDIA Country Code " 91 "

C YANMAR INDIA PRIVATE LIMITED
707, Real Tech Park, Sector 30/A, Vashi,
Navi Mumbai, 400703, Maharashtra, India
TEL: 22-6900 0848 / 2781 0975

MIDDLE EAST

U.A.E. Country Code " 971 "

D YANMAR ENGINEERING CO., LTD. (BRANCH)
Building 6EA, 8th Floor, Room No.816,
Dubai Airport Free Zoone, P.O.Box : 214831, Dubai, UAE
P.O. Box 214831, Dubai, U.A.E.
TEL: 4-341-8787 FAX: 4-341-8778

EUROPE

NETHERLANDS Country Code " 31 "

D YANMAR EUROPE B.V. (YEU)
Brugplein 11, 1332 BS Almere-de Vaart,
Netherlands
TEL: 36-5493200 FAX: 36-5493209

GREECE Country Code " 30 "

C YANMAR ENGINEERING CO.,LTD.
GREECE LIAISON OFFICE
5th FL.,130 Sygrou Avenue., Athens, Greece
TEL: 210-922-2481 FAX: 210-922-2484

NORTH AMERICA

U.S.A. Country Code " 1 "

E YANMAR AMERICA CORP. (YA)
101 International Parkway, Adairsville,
GA 30103, U.S.A.
TEL: 770-877-9894 FAX: 770-877-9009