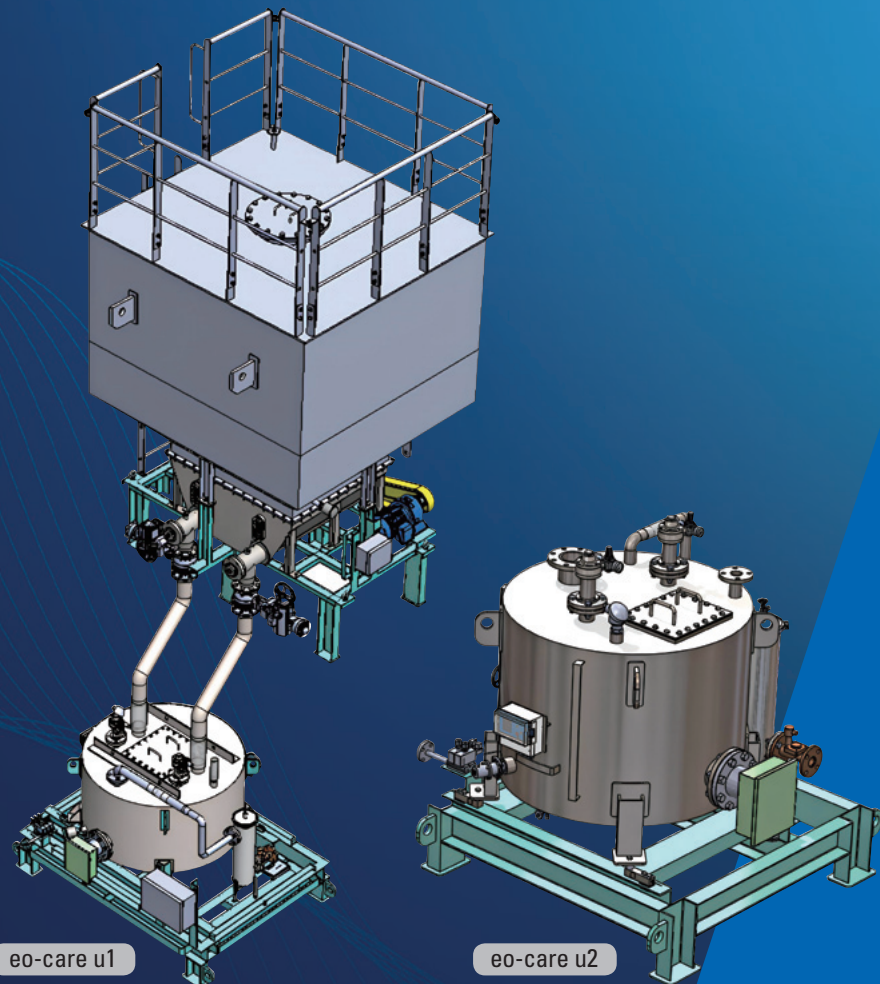


▶ **First Mover** for low carbon and green energy technologies

eco-care u1/u2



eco-care U1/U2

The purpose of this eco-care U1 is to make and service as an automatic real time the aqueous urea solution at 40 % concentration(AUS 40), which is needed to operate SCR (selective catalytic reduction) converters at onboard during sailing.

We eco-care U1 is not need the big urea tank with additional chiller system and we can save cost for AUS40.

Benefits

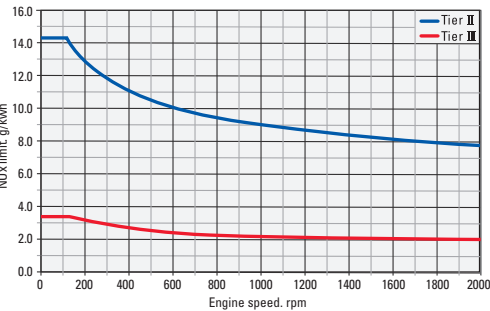
- Save space : No big Tank
- Save Time : No Urea bunkering
- Save Cost

NOx reduction – Tier III solutions

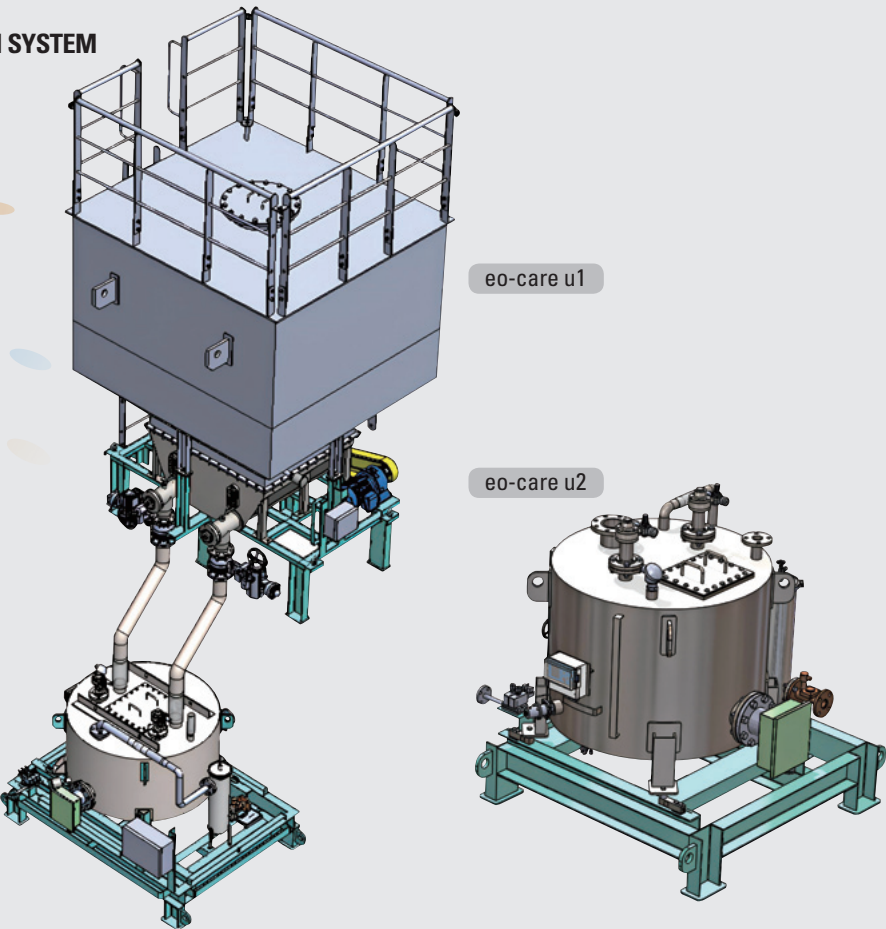


NOx Limits

The international NOx emission limits on marine diesel engines as determined by MARPOL Annex VI are shown below graph as a function of the rated engine speed, rpm.



AUS40 SWITCH SYSTEM
Patent



Two-way approach to NOx reduction

- EGR(exhaust gas recirculation)
- SCR(selective catalytic reduction)

Recently, Most owner considers to install the SCR or EGR to meet the NOx reduction - IMO Tier III solutions.

Selective Catalytic Reduction (SCR) is an advanced active emissions control technology system that injects a liquid-reductant agent through a special catalyst into the exhaust stream of a diesel engine. The reductant source is usually aqueous urea solution(AUS32 or AUS40).

AUS 40 (aqueous urea solution)

Specified in ISO 18611-1. These recommendations and requirements are necessary to preserve the specified quality of AUS40 from any point of production to the point where it is filled into the on-board tank of the vehicle, in order to ensure the proper function of the selective catalytic reduction (SCR) converter systems.

Urea content limits : 39% ~ 41%

First, In order to prevent decomposition of the urea, as well as the evaporation of water in the case of vented containers, prolonged transportation or storing above 25°C should be avoided; Prolonged storage at temperatures above 25°C can reduce the shelf life (see Table shelf life).

Second, in order to prevent solidification of AUS 40, storage below 1 °C should be avoided;

Additional equipments for storage

- Insulation
- Chiller system
- Heater system(in case of cold sea)

Shelf life as a function of temperature

Constant ambient storage temperature (°C)	Minimum shelf life (months)
0-25	18
< 30	12
< 35	6
> 35	Possible significant loss of shelf life: check every batch before use

NOTE:
The main factors taken into account to define the shelf life in this table are the ambient storage temperature and the initial alkalinity of AUS 40. The difference in evaporation between vented and non-vented storage containers is an additional factor.

Economic study

According to Emission project guide of MAN B&W.

182K Bulk Carrier (New build)

eco-care U1 Payback						
AUS40	Powder		Cost Diff		Payback	
\$56,200/year	\$15,000/year		\$41,200/year		10 months	
Engine load. % MCR	25%	50%	75%	100%		
NECA load Profile Time	30%	30%	30%	10%	Total per hour	Total per year
Additional fuel	3.5	3.7	3.7	0.8	11.7 kg/h	7.0 ton/year
El. power	24.7	24.7	24.7	8.2	82.2 l/h	49.3 MWh/year
Urea	36	57	69	23	185 l/h	110 m³/year

Table 1.51c: Accumulated SCR operating values 13

Item	Parameter	Volume	Margin	Tank size
Urea tank	300 hours	55 m³	10 %	61 m³

Table 1.51d: Tank capacity of reducing agent

12,000TEU Container (New build)

eco-care U1 Payback						
AUS40	Powder		Cost Diff		Payback	
\$365,000/year	\$97,000/year		\$268,000/year		4 months	
Engine load. % MCR	25%	50%	75%	100%		
ECA load profile	15%	15%	50%	20%	Total per hour	Total per year
Additional fuel	1.0	1.0	5.1	2.7	9.8 kg/h	19.6 ton/year
Power supply	20.3	20.3	67.7	27.1	135.3 kWh/h	270.6 MWh/year
Urea supply	16.3	32.7	163.4	87.1	299.5 l/h	599.0 m³/year
NH3 supply (alt.)	6.1	12.1	60.5	32.3	110.9 l/h	221.9 m³/year

Table 1.39c: Total ECA consumption value - according to specified load profile and ECA sailing time 11

Substance	Bunker/year	m³	Margin	Tank
Urea	6	99.8	33 %	132.8 m³
NH3 (alternative)	6	37.0	33 %	49.2 m³

Table 1.39d: Tank capacity of reducing agent

We hope that you will not miss good opportunity with your wise choice. If you need more information or specific data for eco-care U1, Don't hesitate contact me anytime.

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