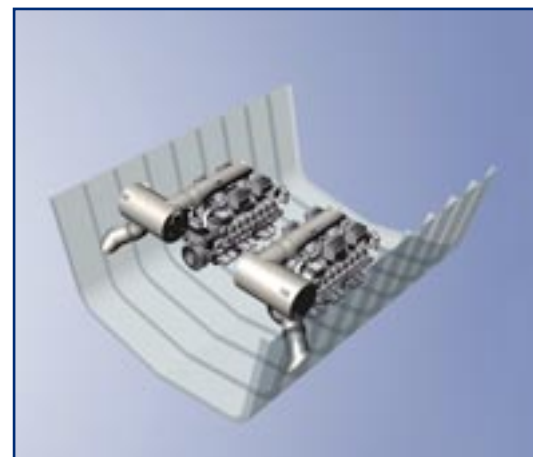


# mecmar

complete exhaust gas systems for marine diesel engines and gas turbines



Mecmar AS®  
Mechanical and  
marine engineering

## A Pioneer of Engineering

*“Mecmar delivers groundbreaking engineering solutions, based on known scientific principles, in the marine diesel engine exhaust gas management field.”*

Mecmar develops and delivers solutions reflecting the combinations of maritime tradition, modern technology, superior workmanship and environmental sensibility.

The company principle to take on the challenge of being first in engineering solution applications in our selected field has placed Mecmar at the forefront of stealth solutions in naval vessels and in pollution reduction in all maritime applications through Exhaust Gas Treatment after combustion.

To retain the winning edge in Marine Exhaust Systems the highly skilled staff of Mecmar typically covers the following disciplines from design to final delivery:

- Mechanical Engineering
- Marine Engineering
- Naval Architecture
- Project Management
- Logistics Engineering and
- Quality Management

## Documentation and Quality Management

*“Mecmar is committed to achieve product delivery through a structured, auditable process. This approach ensures design and production traceability, complete with well documented installation, commissioning and through life support data.”*

Mecmar conforms to ISO 9001

Depending on customer requirement Mecmar can deliver the following documentation:

- Computational Fluid Dynamics (CFD) analysis
- Back Pressure analysis
- Shock and Vibration analysis
- Weight data
- Attenuation Calculations
- Installation Documentation
- Commissioning Procedures
- Drawings and Parts Lists
- Installation Checkout procedures
- Test procedures
- Harbour Acceptance Trials /Sea Acceptance Trials (HAT/SAT) records
- Technical Manuals
- Factory Acceptance Trials (FAT) records



## Innovative Technology – Optimal Performance

*“Mecmar is focused on long term performance in the marine market sector through reliable, state of the art yet simple and practical exhaust system designs with maximum benefits to the client.”*

Mecmar’s strategy is to offer the Marine market complete exhaust gas systems based on well known principles proven on smaller vessels and pleasure crafts. Experience has shown that these systems could be scaled, adapted and developed to match the power range and operational conditions applicable to commercial and naval vessels.

Our exhaust system technology growth and increasing demand for new deliveries bears testimony to the success of this approach.

Furthermore, we provide our customers with:

- Quality engineering activities based on cutting edge technology.
- Products and systems displaying quality workmanship to the highest standard.
- Delivery of reliable and cost effective solutions.
- Interactive co-operation to ensure a full understanding of the requirements to shape the solution.
- A full range of support during installation, commissioning and testing where required.
- Complete in-service engineering support to build lasting partnerships in order to maintain our fielded systems.

## Continued Growth – Research and Development

*“Mecmar’s growth is vested in continued investment in product development to track emerging technologies in pace with client and statutory demand.”*

In the quest for pioneering solutions based on proven applied technologies Mecmar invested in a development test installation.

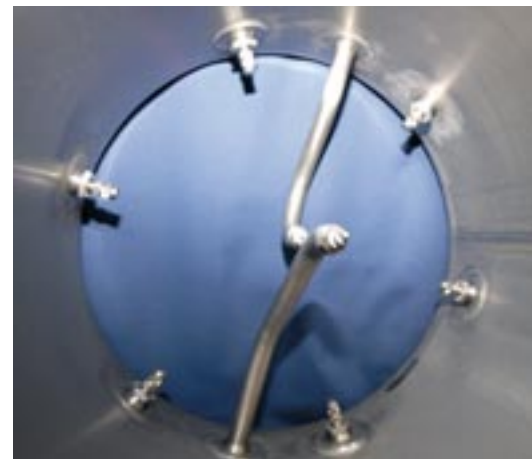
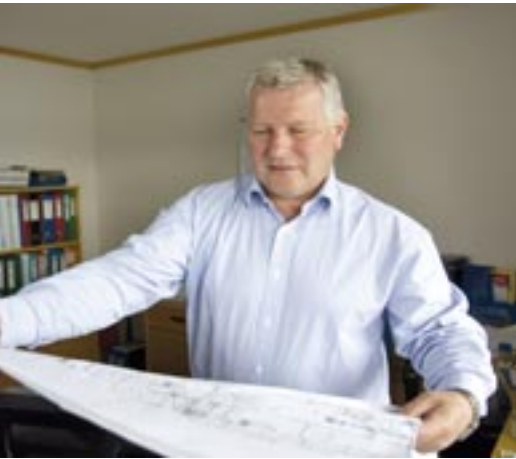
Our test stand is fully calibrated and is used for developing Mecmar exhaust gas system technology. The test stand consists of a 735 kW engine installation. The engine has a hydraulic brake to dissipate the engine power and purpose built exhaust gas systems can be fitted for test and qualification purposes.

The installation is used to verify new product concepts such as Nitrous Oxide (NO<sub>x</sub>)-, Sulphur Oxide (SO<sub>x</sub>)-, particle- and noise-reduction.

The latest development project involves direct injection of ammonia into the exhaust gas stream to refine the Selective Catalytic Reduction (SCR) application in Marine Diesel Exhaust Systems.



– a pioneer of engineering



# Customised Solutions

*Mecmar supplies complete customized exhaust gas systems optimally designed for specific engine installations in each vessel*

*Since 1994, the Company has delivered more than 500 systems world-wide for various types of vessels such as high speed catamarans, monohull vessels, car ferries and offshore petroleum installations as well as naval vessels.*

## Exhaust Gas Systems for Marine Diesel Engines and Marine Gas Turbines

Mecmar will produce an exhaust system to suit the client's requirements. Initially the systems used a unique solution to inject sea water into the exhaust gas stream. The technology and material selection incorporated in the solution were developed and refined to meet the extremely challenging environment of heat, salt, corrosive exhaust gas products and the limited space onboard most vessels to integrate bulky exhaust systems.

The Marine Industry, with all types of vessels it employs, is a significant contributor to environmental pollution. Essentially the engine manufacturers have economically optimised the ability to burn fuel more efficiently and cleaner.

Ever increasing limits on exhaust pollutants is driving the Marine Industry in the same direction as it did the road vehicle industry, i.e. the use of post combustion treatment of the exhaust gas to meet the requirements for a cleaner environment.

During the last decade developments in energy conservation, increased sensitivity to, and subsequent legislation in terms of carbon footprints and pollution constraints, provided ever increasing challenges to engineers and industrial developments.

True to the pioneering spirit of Mecmar, new ways of improving the benefits of the proven Sea Water Injection Exhaust Systems in Marine Applications are constantly sought. To this end the Mecmar Exhaust System solutions now incorporate the following options:

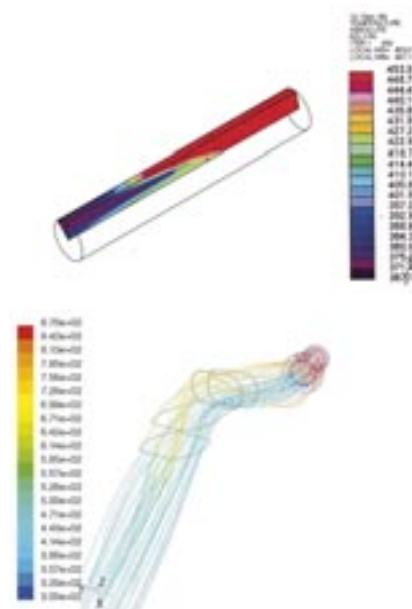
- Standard Sea Water Injection.
- Integrated Selective Catalytic Reduction with the standard system.
- Integrated Exhaust Gas Economisers with either or both the previous two options.



## The Benefits of Sea Water Injection

The basic exhaust gas systems supplied by Mecmar are characterised by injection of sea water into the exhaust gas. Seawater is used to cool the exhaust gas, for reducing emission of harmful components to the atmosphere and to increase safety onboard the vessels. Further, as a consequence of cooling the exhaust gas, the volume of the exhaust gas to be handled is considerably reduced, and hence the systems are more compact and lighter when compared to conventional exhaust gas systems.

In the military application it also enhances the stealth characteristics of the vessel.



## Pollutant Emission Reduction

Although not the only means to do so, introducing sea water into the exhaust stream reduces air pollution to a fractional component of that from conventional dry exhaust gas emissions.

Measurements performed and observations made on in service exhaust gas systems delivered by Mecmar indicate typically the following reduction emission to the atmosphere through water injection alone:

- Sulphur Oxides (Sox) 90-95 %
- Aldehydes 60-70 %
- Aromatic Hydrocarbons 30-50 %
- Nitrous Oxides (NOx) 6-10 %
- Particles considerable



## Safety

Low surface temperature in the exhaust gas system has removed a possible ignition source in case of an oil or fuel leakage, and hence the danger of fire and explosion is reduced. In addition, crew safety is enhanced due to more benign surface temperatures in the engine room area.



## System Integration

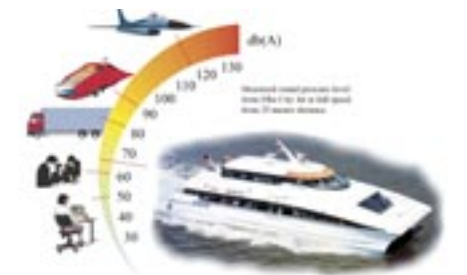
The cooled Exhaust Gas has a significantly lower volume compared to conventional dry systems. The nett effect is that the piping systems and other components downstream from the seawater injection point is more compact and light, with a commensurate space, weight and cost saving to the shipbuilder.

The Mecmar systems are also characterised by the fact that the outlets are above or below the waterline through the ship's side or transom. This feature removes the need for space hungry exhaust trunking through the superstructure, freeing up internal space in the vessel and allowing superior all round visibility from the bridge and command positions.



## Installation

Mecmar supplies the systems complete and ready for installation with all the necessary components. The high degree of completion leads to shorter installation time and better installation economy for the shipbuilder. Furthermore, the low weight of components leads to easier transportation and handling during installation.



## Material Selection

In the hot area of the exhaust system before sea water injection Stainless Steel Alloys are used.

Due to its excellent corrosion resistance, low weight, high elasticity and good fatigue strength a titanium alloy is used in the sea water cooled parts of the exhaust gas system.

The use of materials with good fatigue and anti-corrosion properties ensures that the lifetime of a Mecmar system exceeds a conventional full temperature system.



# Exhaust gas system for marine diesel and gas turbines

## Marine Diesel Engine Installations

A typical exhaust gas system delivered by Mecmar for a Diesel Engine Installation comprises the following main assemblies:

- Primary Silencer and Inlet Pipes
- Seawater Supply System and Pump
- Sea Water Injectors, Primary and Secondary
- Main Silencer
- Outlet Pipes
- Drainage System
- Flexible Bulkhead and Hull Penetrators
- Compensators
- Flexible Supporting Elements
- Temperature and Pressure Sensors
- Control and Monitoring System
- Reduction Agent Injection System (optional)
- SCR Unit (optional)
- Integrated SCR Control System (optional)
- Economiser or Waste Heat Boiler (optional)

The exhaust gas is led from each turbo charger through insulated inlet pipes to the primary silencer designed as a single chamber reflection muffler. In this part of the system, the exhaust gas is at high temperature. Where the SCR option is included the SCR Reactor replaces the primary silencer.

Downstream from the primary silencer, in the primary injector, sea water is injected through several nozzles into the exhaust gas, and the exhaust gas is quenched to approximately 60°C.

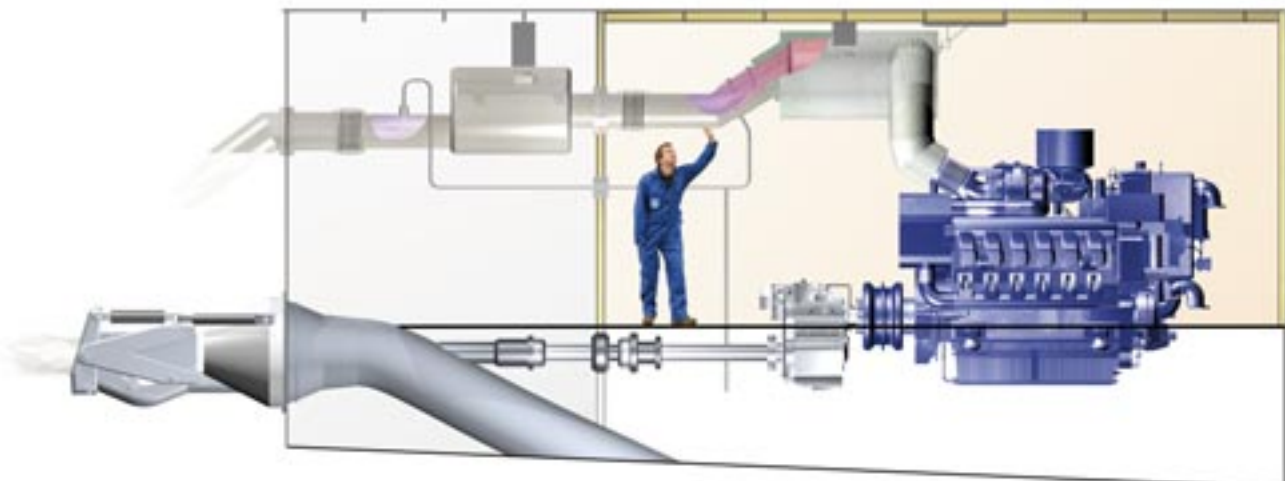
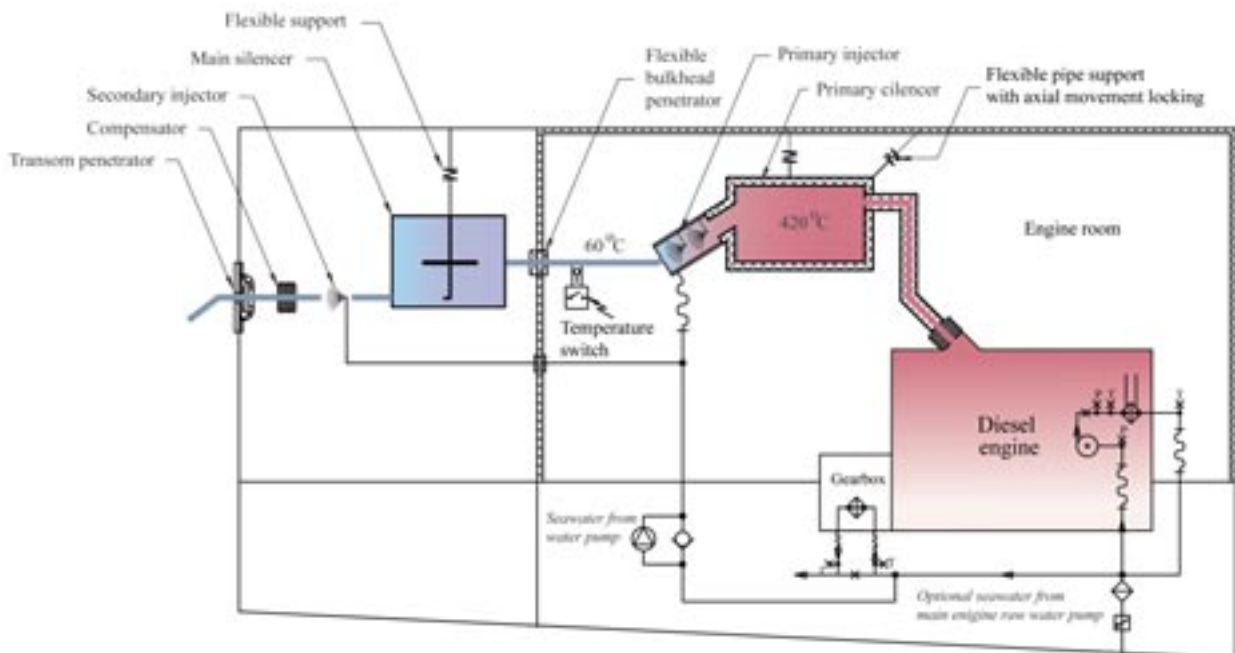
The main silencer attenuates the acoustic noise and leads the cooled exhaust gas from the primary injector to the outlet pipes. A secondary injector is normally installed downstream of the main silencer for the final cooling stage and to scrub particles from the exhaust gas.

Residual water droplets that are not entrained in the exhaust gas through the main silencer are collected and the surplus water is drained and lead overboard by the exhaust piping.

Downstream from the main silencer the exhaust gas is routed overboard through the outlet pipe either to the ships side or through a transom outlet, depending on the engine configuration.

Where the SCR option is selected by the client, the SCR Reactor acts as a primary silencer as well as facilitating the catalytic reaction and is incorporated in the exhaust line before the Main Silencer. With this option there will be a reducing agent injection and mixing device included between the Engine manifold and the SCR Reactor.

Where the Waste Heat Boiler is selected it is integrated into the hot section of the line to maximize the benefit. The boiler has a cooling effect on the gas and therefore reduces the amount of heat to be extracted by the sea water injection process.



## Gas Turbine Installations

As for the Diesel Engines, the sea water injection principle is equally applicable to Gas Turbine installations and Mecmar has successfully delivered exhaust systems for the luxury motor yacht market as well as for the military market.

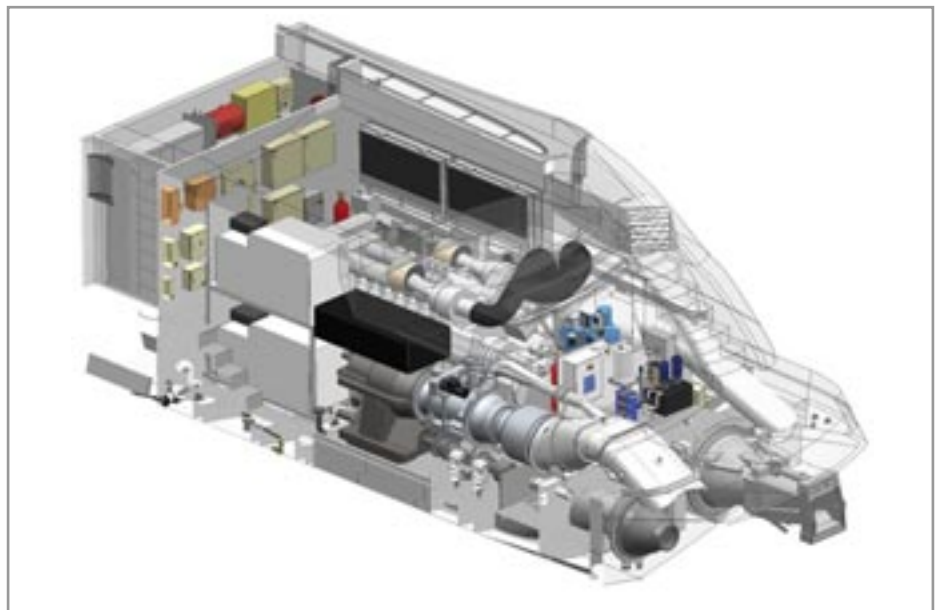
Seawater may be injected immediately downstream from the diffuser/compensator outlet of the Gas Turbine. Performance results achieved to date are similar to that of the Diesel Engine installations.

The control and monitoring principles are similar and the same logic is used in the Gas Turbine applications.

The system also uses two-stage injection. The main difference in the Gas Turbine application is the absence of the silencers, otherwise the mountings, exhaust pipes and ancillary equipment are of the same type.

The functional and system description is therefore the same for the Diesel Engine and Gas Turbine application. Due to the power of the Gas Turbine installation the volume of exhaust gas and therefore the volume of water injected obviously varies and the pumps, piping and size of exhaust piping and ducting is much larger in order to handle the respective volume flows.

The SCR technology and waste heat boiler options have not yet been incorporated into the Gas Turbine exhaust system solutions.



# Selective Catalytic Reduction Systems for NOx Reduction

## Development Drivers

The intensification with nitrous oxide (NOx) reduction in Marine combustion engine exhaust gas is to achieve a better environment; we therefore strive to remove all the NOx from the exhaust gas.

The following are a few of the detrimental effects of NOx in the atmosphere:

- It has proven direct and indirect effects on the environment and health.
- NOx is a part of the process of acid rain formation and leads to over-fertilization of lakes and soil.
- In the presence of unburned hydrocarbons and sunlight, NOx participates in the formation of photochemical smog and ozone.

Although there are other sources that produce NOx, the contribution from shipping to these emissions is significantly high.

To improve the Maritime profile in the global onslaught on pollution the International Maritime Organisation (IMO) decided as far back as 1997 to aim at reducing ship emissions of NOx world-wide by 30%. In order to realize the aim IMO demands against NOx reduction has been stepped up and is increasing. We are currently at a stage where the economical viability of improving on the engine and fuel side has been exhausted and the time where compliance with IMO NOx regulations will be impossible without any additional post combustion process or treatment of the exhaust gas.

## Current Status

There are several methods utilised to reduce NOx emissions, typically:

- Adapting Operational Procedures.
- Optimising vessel design to minimise power requirements.
- Optimising engine design for clean burning and better specific fuel consumption.
- Exhaust gas cleaning through some form of after treatment.
- Sea water injection into the exhaust gas.
- Installation of selective catalytic converters in the exhaust line.
- Using alternative fuels.
- Using fuel additives to improve combustion efficiency.

Aligned with the company core business of designing and delivering customised and specialised exhaust systems to the marine industry, Mecmar chose to support the industry in their quest to comply with the regulations. To contribute to a better, cleaner and healthier environment, the existing designs were adapted by incorporating the SCR process to further improve the system efficiency in pollutant removal; specifically the NOx components. The following environmental benefits and emission reduction performance figures are achievable with a SCR System:

- NOx Reduction 80 – 98 %
- Hydro Carbon Reduction 80 – 90 %
- Soot Reduction 20 – 30 %
- Sound Attenuation 20 – 35 dB(A)

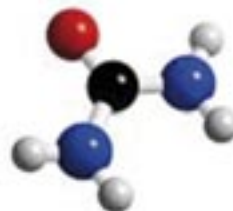
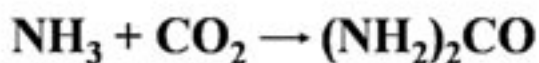
## SCR Process Application

One method to reduce the NOx emission is to let the Nitrous Oxide react with Ammonia (NH<sub>3</sub>) as a reducing agent. In this way the NOx is transformed to Nitrogen Gas and Water Vapour. The following two are the governing reduction equations for the process:

- $4\text{NH}_3 + 4\text{NO} + \text{O}_2 \rightarrow 4\text{N}_2 + 6\text{H}_2\text{O}$
- $4\text{NH}_3 + 2\text{NO} + 2\text{NO}_2 \rightarrow 4\text{N}_2 + 6\text{H}_2\text{O}$

The components will normally only react at temperatures above 900°C; however, reaction can also be achieved at a much reduced exhaust gas temperature of about 280°C when using a catalyst.

To accelerate the reaction with a catalyst the exhaust gas is mixed with ammonia gas. The mixture is then passed over a honeycomb structure containing Vanadium Penta-Oxide as a catalyst. The catalytic structure is contained in the SCR Reactor where the Ammonia and the NOx in the exhaust gas will react and then create Nitrogen and Water Vapour.



## Reducing Agent Alternatives

As illustrated before, Ammonia is the required reducing agent in the governing equations. In an exhaust system with an integrated SCR-system there are two options to obtain the Ammonia:

- From Urea or Carbamide which is commercially produced from ammonia and carbon dioxide. Urea is normally delivered in aqueous solution for use in SCR systems.
- It can be supplied in fluid form delivered in pressure containers, similar to LPG and used in a direct injection process.

Regardless of which option is used, either Urea or pure Ammonia, it is the Ammonia in gaseous form which is required to benefit from the catalyst. In the case of Urea there therefore has to be a two stage reaction, first to free the Ammonia out of the Urea and then to combine the Ammonia with the NOx in the SCR reactor to achieve the reduction to Nitrogen and Water Vapour.

## Application Regimes for Urea Injection and Ammonia Injection

Ship design is a process of compromises and so are its systems. Generalising, one can say that small vessels are normally very space and weight sensitive whilst large vessels are more tolerant to space- and weight-impacting system solutions.

In case of the two sources for Ammonia Gas in the SCR applications in exhaust systems there is a significant difference in the payload required to obtain the same volume of Ammonia Gas. There is furthermore a distinctly different set of design parameters that must be addressed in the two cases.

Generally speaking, the Urea Injection solution is only suited to larger vessels since it involves a Liquid- or Granular-Urea storage facility which is space demanding and the Liquid Urea is also weight demanding. Typical vessels would be tankers, cargo vessels, cruise ships and offshore platform support vessels.

The direct Ammonia Injection solution is much lighter and compact and therefore lends itself better to smaller craft implementation where space and weight is at a premium. Typical installations would be on fast passenger ferries, car ferries, fishing vessels and the like.



# Mecmar SCR System Solutions

## Urea Injection

Irrespective of the vessel, available space is invariably very limited. This solution therefore requires a compact design and good co-operation with the shipyard from the very beginning of the project is essential to ensure proper system integration in the overall design.

The Urea is normally delivered as a 32,5% or 40% liquid solution. The quantity to be stored is dependent on the operating profile required by the owner and the shipyard is normally responsible to design and supply the storage facility.

The process flow of the exhaust gas requires the following functional components in sequence:

- The gas leaves the engine outlet and is piped through the Urea injection/mixer element.
- The vaporised Urea and Exhaust Gas mixture travels through a length of pipe that will allow sufficient time for the Ammonia Gas to be released before getting to the SCR Reactor.
- It passes through the reactor where the reduction reaction of the NOx takes place and the first stage of sound attenuation is achieved.
- The reduced mixture of Exhaust Gas now enters the Primary Sea Water Injector element where the bulk of the heat is extracted and the temperature is reduced through the vaporisation phase change of the water before entering the Main Silencer where the required attenuation levels are achieved.

• Secondary Injection is normally combined in the outlet from the Main Silencer where particle scrubbing takes place.

• The cleaned and cooled Exhaust Gas Mixture and surplus water is then led overboard and discharged to atmosphere.

If a solution with a Waste Heat Boiler is selected the SCR reactor is placed before the boiler due to relatively high temperature of between 280°C and 510°C required by the reduction process. The Mixer/Injector Unit can be installed in a vertical or horizontal section of the exhaust gas pipe.

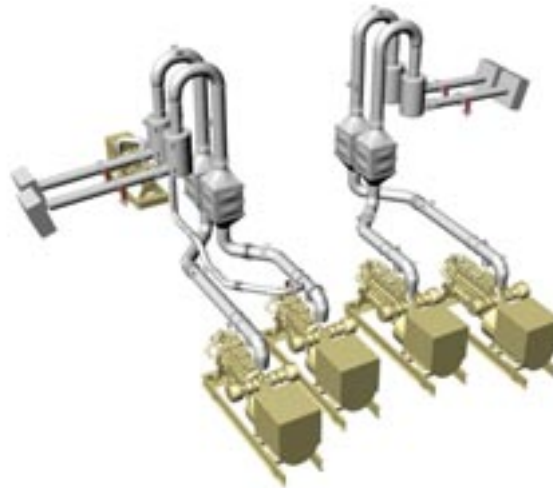
The dosing of the correct amount of Urea is governed by the engine load signal and is based on an algorithm mapped for each engine during commissioning.

In addition to that, a continuous monitoring system (NOx Analyser) can monitor system performance and can be integrated in a close loop control system.

The process is controlled through a Programmable Logic Controller (PLC) in a control cabinet. The PLC is programmed to operate fully automatically.

The system components are as listed under the functional description in the brochure for the basic sea water injection exhaust system with the following additional ancillary elements:

- Injector/Mixing Unit
- SCR Reactor
- Urea tank
- Urea Pump Module
- Urea Dosing Unit
- Compressor or Ships Working Air
- NOx Analyser (optional)



**Compensators for every conceivable situation**

Quality by Belman Bellows

**Belman**  
www.belman.dk

**STORM HALVORSEN AS** Industri Nozzles

**INDUSTRI NOZZLES**  
Flat Jet Tank Washing  
Full Cone Cleaning

**30.000 nozzles from stock.**

**www.stormhalvorsen.no**

**Storm Halvorsen AS**  
Klinestadmoen 5.  
3241 Sandefjord

**storm@ish.no**  
Tel. +47 33 42 36 30  
Fax +47 33 42 36 31

## Direct Ammonia Injection

The benefits with injection of ammonia directly into the exhaust gas are many. However, the most important one is the fact that this installation does not have such a weight impact as the Urea injection system. This is the single most important aspect that opens up the SCR application regime to include the many smaller vessels in the shipping and marine industry that contribute to the significant fuel based sources of NOx emissions.

On smaller vessels such as fast passenger ferries, the weight is critical and also the space is much more limited, making this the only feasible solution for SCR technology application.

The system components are essentially the same as for the Urea injection system but with the main difference of no Urea storage tank and a simpler injection and control system.

Ammonia is an unpleasant and aggressive gas when inhaled. Human safety therefore plays a more important role when using pure Ammonia in the system, specifically on passenger ferries where free Ammonia can cause panic and further complicate an emergency situation.

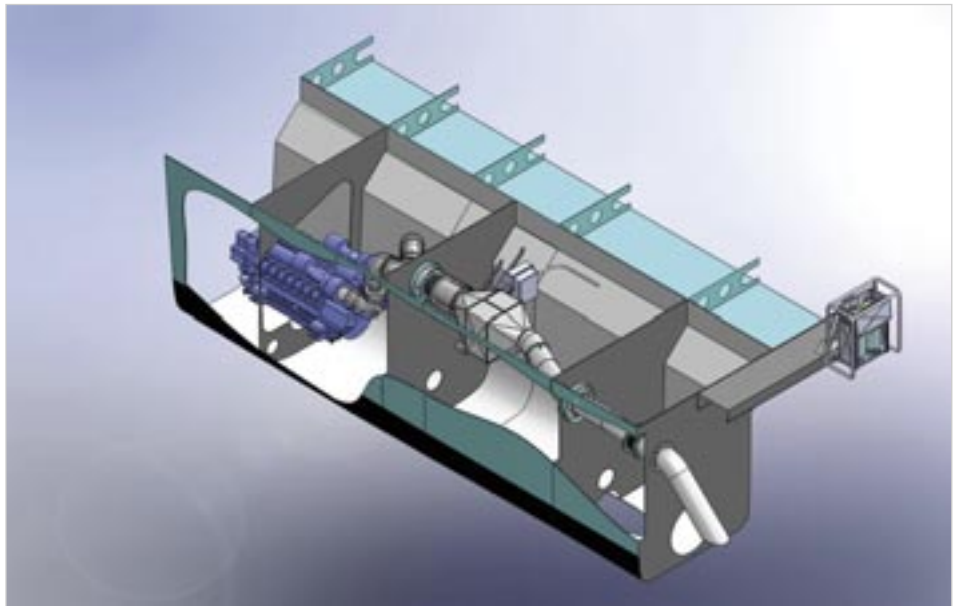
However, the design has been adapted to take care of any such eventualities. The ammonia bottles are normally stored astern and outside the vessel in a drop-rack. This configuration allows the possibility to jettison the bottles in case of an emergency situation onboard where ammonia should not be present.

The system may also be installed on larger vessels where the space and weight is critical or sensitive.

The main components are the same as for the systems already described with the absence of the Urea storage tank but including the following:

- Ammonia Bottle(s)
- Ammonia Bottle Rack

Mecmar fully subscribes to this application and believe that it will become the system of choice to supply the Ammonia as required by the SCR process as applied to Marine Systems.



CNC- Machining - established 1981



Industrivegen 75, 5200 OS  
Tel: +47 56 30 21 00 – Fax: +47 56 30 02 41  
post@osmaskinering.no www.osmaskinering.no

Strategic partner for Mecmar AS

ADVOKATFIRMAET

**RASMUSSEN & BROCH**

Postboks 4154 Dreggen • 5835 BERGEN

Bradbenken 1, 5003 Bergen - Tel: + 47 55 55 92 00  
www.rasmussen-broch.no

**We deliver:**

- Valves
- Valves Activation
- Level Control
- Flow Control



**Your safest choice  
of hoses and fluid connectors!**

**Tel: +47 55 11 78 40**

**www.slange.no**



Controlteam as is an independent supplier of electrical control systems for ships, offshore and industrial applications. Our goal is to develop solutions together with our customers to get the best results for the end user, as we do together with Mecmar.



Ulsmågeveien 7, 5224 Nesttun  
[www.controlteam.no](http://www.controlteam.no) • [controlteam@controlteam.no](mailto:controlteam@controlteam.no)  
Tel: +47 55 92 79 50, Fax: +47 55 92 79 51

**EagleBurgmann**

*The Name for Sealing Technology...*

EagleBurgmann Norway AS  
P.O. Box 143  
Industriveien 25 D  
N-2021 Skedsmokorset  
Phone +47 / 64 / 83 75 50  
Telefax +47 / 64 / 83 75 75  
[www.eagleburgmann.com](http://www.eagleburgmann.com)



**H + H Umwelt- und  
Industrietechnik GmbH**

Tel: +49-671-92064-0 / Fax -20  
[Herbert.Roemich@HuHGmbH.com](mailto:Herbert.Roemich@HuHGmbH.com)  
[Michael.Heck@HuHGmbH.com](mailto:Michael.Heck@HuHGmbH.com)

**NOx Emissions ?  
we can help you !**

<b>NOx-Reduction</b>	<b>90 – 98 %</b>
<b>HC Reduction</b>	<b>80 – 90 %</b>
<b>PM Reduction</b>	<b>20 – 30 %</b>
<b>Sound Reduction</b>	<b>20 – 35 dB(A)</b>

SCR Systems from H+H **EcoMarin**<sup>®</sup>



**SCR References/Customers:**

Tallink, Aker Langsten, Aker Yards AS, Greentop, Karlsund Maritime, Silja Line, Viking Line, Wärtsilä Oy, Braren Reederei, Polferries, PonPower and many others...

[www.huhgmbh.com](http://www.huhgmbh.com)



Permascand AB fabricates customized products in Titanium and alloy for applications where corrosion resistance and high strength/low weight is crucial.



**www.permascand.com**

*Titanium - for all needs*

# Felix Schuh Marine Technologies & Services GmbH



Our more than 80 years of on-board experience make us a competent partner.

Felix Schuh Marine Technologies & Services GmbH offers tailor-made solutions in shipbuilding:

- System installation
- Engineering
  - Interior furnishing
  - Insulation and fire protection
  - Repairs

As full-service specialists, dependability and top quality are our hallmarks.



Felix Schuh  
Marine Technologies & Services GmbH  
Bredowstr. 10  
D-22113 Hamburg  
Tel. +49 (0)40/733 43-2200  
Fax +49 (0)40/733 43-2299  
info@schuh-marine.com  
www.schuh-marine.com

A subsidiary of **VINCI** ENERGIES 

## Just a few words about OHL

### Shut-off and control of highest quality

The company OHL Gutermuth emerged from the companies OHL (formerly in Limburg, founded 1867, production of valves since 55 years ago) and Gutermuth (formerly in Frankfurt, founded 1923, production of valves since 50 years).

Control and shut-off-valves from OHL Gutermuth are the right choice when it comes to regulating the flow of gases, vapours, liquids and granulates in a safe and economic way.

Decades of experience in the development and manufacture of industrial valves ensure that the customer will receive a product that has been specifically designed and built to satisfy his requirements. Personal discussion with the customer is first and foremost to our endeavours. Convincing technology and highest quality are important factors that allow us to fulfill the quality management requirements of ISO 9001:2000 and the Pressure Equipment Directive PED 97/23/EC Module H as certified by the German TÜV. The results of our commitment are demonstrated by great customer satisfaction and longterm business relationships.

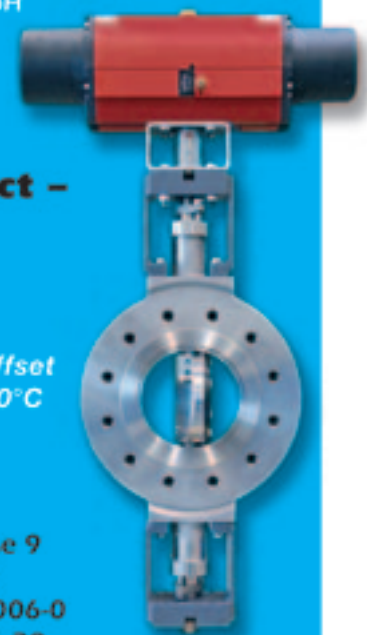
The customer's wishes and the solution required by his problem are the starting point of any production. OHL Gutermuth has several decades of experience in the development and production of industrial valves offering the customer the reliability he needs in his application.



  
**OHL**  
OHL Gutermuth  
Industrial Valves GmbH

**Others  
simply sell  
you a product -  
we offer  
a solution.**

*Triple Offset  
up to 800°C*



Helmershäuserstraße 9  
D-63674 Altenstadt  
Phone +49.6047.8006-0  
Fax +49.6047.8006-29  
E-Mail og@ohl-gutermuth.de

**www.ohl-gutermuth.de**

**A control and shut off technique you can rely on.**



*Størksen Rustfri Industri AS is an industrial company centrally located in a modern industrial complex near Bergen City-Norway. We have 22 employees and our speciality is stainless steel fabrication, however, we also work with aluminum, copper, brass and steel etc.*

*We have modern machinery such as CNC-controlled punching machines and pressbrakes. We also have CNC laser- and water jet cutting machines, and roller hydraulic bending machines for sheets and tubing.*

*Størksen Rustfri Industri AS has a large market share; we have our customer base in the construction industry, offshore industry and we subcontract to the shipping industry on the West Coast of Norway. We have been in business for 75 years, and we always have endeavored to be a modern company within our business sector. We have modern machinery, well qualified and professional workers and we would be happy to share our expertise.*

*We have delivered to the oil industry, construction- and building industries and the food industry as well as to general industry. We work with prototype- and series production to the specification of our customers.*



## SPECIALISTS IN STAINLESS STEEL

### Your partner for:

- Water Jet cutting
- Laser cutting
- Punching
- Bending
- Welding
- Sawing
- Pipe or Profile forming
- Grinding and Polishing

### Our strength is through the fact that:

- we have modern fabrication facility
- we have modern machinery
- we strive for most effective production
- our employees have very high technical skills
- our final product have a high quality surface finish (our own polishing workshop)

# STØRKSEN RUSTFRI\*INDUSTRI AS

### Visiting address:

Leirvikflaten 19  
5179 Godvik

### Postal address:

Postboks 22 - Godvik  
N-5882 Bergen

**Tel:** +4755 50 64 00

**Fax:** +4755 50 64 01

**E-mail:** sri@storksen.no

## TITANIUM INDUSTRIES SOUTH AFRICA (PTY) LTD

QUALITY  
ISO 9001 : 2000

P.O BOX 145576, BRACKEN GARDENS, 1452 SOUTH AFRICA

551 DELFOS AVENUE, ALRODE SOUTH, ALBERTON, 1451 SOUTH AFRICA

TEL: +27 11 868-5611/2/3 - +27 11 900-2719 • FAX: +27 11 900-2901 • WEB SITE: [www.TitaniumIndustries.co.za](http://www.TitaniumIndustries.co.za)  
admin@TitaniumIndustries.co.za • enquires@TitaniumIndustries.co.za • sales@TitaniumIndustries.co.za

*Titanium by any other name is just simply not Titanium Industries*

• Stockists & Suppliers of Plate, Sheet, Pipe, Tube, Wire, Fittings, Pumps, Valves, Round Bar, Square Bar, Expanded Metal, Fasteners, Castings and Forgings

• Fabricators of Heat Exchangers, Condensers, Pressure Vessels, Evaporators, Columns, Coils

• Industries Supplied , Chemical Process , Metal Refining , Pulp and Paper, Food and Pharmaceutical , Metal Finishing, Medical, Water and Effluent Treatment

• Marine Applications - Exhaust Gas Systems

• Representation Of International Proprietary Technology



**TITANIUM • ZIRCONIUM • TANTALUM • HASTELLOY • ALLOYS 400, 625, 825 • DUPLEX S/S**

# We share the same values. We share the same world.

MTU engines are in use on all seas, rivers, and lakes on the planet. Our engines embody high performance, efficiency, reliability, and longevity.

And those values are exactly what we look for in a partnership. A partnership like the one we have been maintaining with Mecmar AS – and wish to carry on doing so. We look forward to successful projects together in the future.

## Powered by MTU.



[www.mtu-online.com](http://www.mtu-online.com)





Mecmar AS®  
Mechanical and  
marine engineering

Mecmar AS  
Røtingavegen 1  
N-5216 Lepsøy  
Phone + 47 56 30 41 30  
Fax + 47 56 30 41 49  
E-mail: [mecmar@mecmar.no](mailto:mecmar@mecmar.no)  
[www.mecmar.no](http://www.mecmar.no)



**mecmar**

from Norway to the world