The Cat SCR System solution was designed by Caterpillar® especially for MaK medium-speed engines to meet future IMO Tier III emission requirements. Installation and operation of the Cat SCR System is a sustainable solution to reduce NOx emissions without sacrificing the typical MaK marine engine efficiency, durability and reliability that our customers are accustomed to. The service- and maintenance-friendly design, remote condition monitoring and diagnostic capabilities, as well as our unmatched global product support respond to the industry’s desire to lower operational costs and downtime beyond today’s standards.

Cat SCR System • Product Benefits

- Single supplier IMO Tier III solution
- IMO Tier III parent engine certification (scheme A), Application and installation support for every market
- Reactor housing with catalyst
- Urea transfer pump skid optional available
- Urea pump skid
- Urea dosing cabinet with ECM and closed loop function
- NOx reduction solution consisting of SCR chamber, mixing tube, urea injection system and dosing cabinet
- Urea transfer pump (optional additional accessory)
- Single supplier IMO Tier III solution
- IMO Tier III parent engine certification (scheme A), no certification in the vessel necessary (no certification necessary for engine installation)
- Integrated control and monitoring of engine and SCR System for reliable and safe operation which enables market leading user friendliness
- Concurrency of SCR System and engine calibration for optimized performance
- Application and installation support for every market segment and ship type
- Excellent serviceability due to strong Caterpillar dealer network
- Corresponding maintenance schedules of SCR System and engine for optimized operational availability

Optional scope of supply:
- Urea pump skid
  - for transfer of urea from urea tank to dosing unit
  - MCS certified
- Wiring kit
  - for connecting plugs, cable and junction box
  - for connecting dosing unit, mixing tube and reactor housing
  - for connecting plugs, cable and junction box

A sustainable solution to reduce NOx emissions!

The Power You Need.

The Cat® and MaK™ brands of Caterpillar Marine offer premier high- and medium-speed propulsion, auxiliary, and generator set solutions, as well as optional dual-fuel, diesel-electric, and hybrid system configurations. With the launch of Caterpillar Propulsion our comprehensive and evolving product line gives customers one source for the most extensive engine power range available, as well as for complete propulsion systems, controllable pitch propellers, transmissions and azimuth thrusters, and controls. Cat and MaK products and technologies have proven reliability and are built to last in all marine applications, demonstrating superior productivity and the lowest lifecycle cost.

The Cat Global Dealer Network, more than 3,300 global service locations strong, ensures that you will have local expertise, highly-trained technicians, rapid parts delivery, and the proper equipment and services to keep you working – anytime, anywhere.

Construction, too, is numerous financing through Cat Financial helps you make Cat and MaK power a reality. With our comprehensive knowledge of customer needs, local markets, and legal and regulatory requirements, we have been providing tailored financing solutions and exceeding expectations since 1986.

For more information or to find your local dealer, visit our website: www.cat.com/marine
The upcoming global and local regulations covering exhaust gas emissions for medium-speed marine diesel engines will be more stringent. While meeting IMO Tier II exhaust gas emissions is possible with engine internal solutions, IMO Tier III compliance will be achieved with exhaust gas after treatment solutions.

Regional initiatives from environmentally friendly governments are already in effect with incentives benefiting ship owners who invest in NOx reduction technologies.

Cat-SRM System for MAN medium-speed engines is part of the environmentally friendly strategy of Caterpillar Marine. The Cat-SMR System is also available as a retrofit package.

Cat SCR System • Emissions and Legislation

IMO Tier III regulations went into effect in 2016 and are valid for newly built vessels. IMO Tier III regulations lower the permissible NOx emissions in NOx Emissions and Legislation. To avoid deposit buildup and ensure optimal operation of the SCR module, exhaust gas temperature has to be adjusted to the operating conditions for each application.

The Cat SCR System is based on selective catalytic reduction technology. A urea solution is injected into the hot exhaust gas and transformed to NH₃ and CO₂. Inside the SCR module the technology. NH₃ reacts with the NOx to form harmless nitrogen and water vapor, which are major components of ambient air.

The Cat SCR System consists of the following key components. For further details refer to the “Cat IMO Tier III SCR A&I Guide”.

Cat SCR System • IMO Tier III

Design

The Cat SCR System consists of the following key components:

- Urea storage tank
- Mixing tube
- SCR Reactor Housing
- Counter flange
- Connecting pipe
- Wiring kit
- Urea Pump Skid
- Substrate cassette

The SCR System and engine. A urea pump skid, to supply urea from the main tank to the dosing cabinet, is available. All pipes and harnesses need to be supplied by the customer. Wiring harness kits are available for easy connections between system components. For further details refer to the “Cat IMO Tier III SCR A&I Guide”.

Technical data

<table>
<thead>
<tr>
<th>Engine</th>
<th>SCR Prinzip</th>
<th>Dimension</th>
<th>Weight (kg)</th>
<th>Length (mm)</th>
<th>Dosing cabinet controls</th>
<th>SCR-Prinzip</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 M 25 E</td>
<td>SCR-Principle</td>
<td>2,000</td>
<td>950</td>
<td>2,000</td>
<td>1,000 x 550 x 634</td>
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<td>6 M 25 E</td>
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Notes:

- Connecting pipe (yard supply)
- Urea pump skid (optional)
- Exchanger (optional)
- SCR reactor housing (standard scope of supply)
- Counter flange (standard scope of supply)
- Mixing tube (standard scope of supply)
- Urea storage tank (standard scope of supply)

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Notes:

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- Urea pump skid (optional)
- Exchanger (optional)
- SCR reactor housing (standard scope of supply)
- Counter flange (standard scope of supply)
- Mixing tube (standard scope of supply)
- Urea storage tank (standard scope of supply)
Cat SCR System • Emissions and Legislation

The upcoming global and local regulations covering exhaust gas emissions for medium-speed marine diesel engines will be more stringent. While meeting IMO Tier II exhaust gas emissions is possible with engine internal solutions, IMO Tier III compliance will be achieved with exhaust gas after treatment solutions.

Regional initiatives from environmentally friendly governments are already in effect with incentives benefitting ship owners who invest in NOx emission reduction technology. Cat SCR System for MAN medium-speed engines is part of the environmentally friendly strategy of Caterpillar Marine. The Cat SCR System is also available as a retrofit package.

 IMO Tier III regulations went into effect in 2016 and is valid for newly built vessels. Under IMO Tier III regulations, NOx emissions outside of Emission Control Areas (NECA) by about 75% in comparison to IMO Tier II. Outside of the NECA, NOx emissions reductions on MAN engines with SCR technology is expected to be about 90%.

To avoid deposit buildup and ensure efficient operation of the SCR module, the exhaust gas temperature has to be adjusted to the operating conditions for each application.

It is assumed that a catalyst and diagonal will be installed in any angle different ways like horizontal, vertical or diagonal in any angle.

For further details refer to the “Cat IMO Tier III SCR AMG Guide”.

Cat SCR System • IMO Tier III

Design

The Cat SCR System consists of the following key components necessary to support an engine arrangement for emissions treatment:

- Cat SCR Reactor Housing
- Connecting pipe to supply area
- Counter flange
- Urea pump skid, to supply the SCR-Principle
- Mixing tube from the engine to the mixing tube
- Urea storage tank
- Mixing cabinet, monitoring system and control system

The mixing cabinet can be installed in different ways like horizontal, vertical and diagonal in any angle.

Technical data

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<tr>
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<th>Dimensions (mm)</th>
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<tbody>
<tr>
<td>6 M 46 DF</td>
<td>1,010x553x634</td>
<td>4,528</td>
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</tr>
<tr>
<td>9 M 34 DF</td>
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<td>1,964</td>
<td></td>
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Notes:
- Substrate cassette (standard scope of supply)
- Counter flange (optional)
- Urea storage tank (yard supply)
- Urea pump skid (yard supply)
- Connecting pipe (yard supply)
- Mixing tube (standard scope of supply)
- Engine

Exhaust Gas Temperature

<table>
<thead>
<tr>
<th>Engine</th>
<th>NOx (g/kWh)</th>
<th>Exhaust Gas Temperature in °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 M 46 DF</td>
<td>0.0</td>
<td>2.6</td>
</tr>
<tr>
<td>9 M 34 DF</td>
<td>0.0</td>
<td>2.3</td>
</tr>
<tr>
<td>8 M 34 DF</td>
<td>0.0</td>
<td>10.5</td>
</tr>
<tr>
<td>6 M 34 DF</td>
<td>0.0</td>
<td>0.0</td>
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<tr>
<td>8 M 32 E</td>
<td>0.0</td>
<td>0.0</td>
</tr>
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<td>0.0</td>
</tr>
</tbody>
</table>

Notes:
- SCR-Principle

Nitrogen + Hydrocarbon + Ammonium sulfate formation

No excessive SO3 formation and catalyst aging

Maximum exhaust gas temperature to avoid NOx in g/kWh

Cat SCR System recommended temperature range for long term SCR operation

Optimal operating range for SCR operation

After treatment requirements

Technical data

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Notes:
- SCR-Principle

Fuel sulphur content in %

Speed in rpm

Exhaust gas temperature in °C

NOx in g/kWh

To avoid deposit buildup and ensure efficient operation of the SCR module, the exhaust gas temperature has to be adjusted to the operating conditions for each application.

The mixing tube can be installed in different ways like horizontal, vertical and diagonal in any angle.

Please contact your local dealer for further details.

Cat SCR System: SCR-Principle

NH3 reacts with the NOx to form harmless nitrogen and water vapor, which are major components of ambient air.

A urea solution is injected into the hot exhaust gas and transformed to NH3 and CO2. Inside the SCR module the urea reacts with the NOx to form nitrogen and water. Cat SCR System is based on selective catalytic reduction technology. It can replace a catalyst and diagonal in any angle different ways like horizontal, vertical or diagonal in any angle.
**Cat SCR System • Emissions and Legislation**

The upcoming global and local regulations covering exhaust gas emissions for medium-speed marine diesel engines will be more stringent. While meeting IMO Tier II exhaust gas emissions is possible with engine internal solutions, IMO Tier III compliance will be achieved with exhaust gas after treatment solutions. Regional initiatives from environmentally friendly governments are already in effect with incentives benefiting ship owners who invest in NOx, exhaust gas reduction technology. Cat SCR System for medium-speed engines is part of the environmentally friendly strategy of Caterpillar Marine. The Cat SCR System is also available as a retrofit package.

**Cat SCR System • IMO Tier III**

The Cat SCR System consists of the following key components:

- **Urea pump skid**, to supply urea from the main tank to the dosing cabinet, is available. All pipes and harnesses need to be supplied by the customer. Wiring harness kits are available for easy connections between system components. For further details refer to the “Cat IMO Tier III SCR A&I Guide”.

**Technical data**

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<tr>
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<th>SCR Reactor Housing</th>
<th>Flange Size (DN)</th>
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**Notes:**
- Connecting pipe (yard supply)
- Counter flange (standard scope of supply)
- Connecting line (yard supply)
- Counter flange (optional)
- Substrate cassette (standard scope of supply)
- Dosing cabinet (standard scope of supply)
- Substrate cassette (yard supply)
- Substrate cassette (optional)
- Turbo pressure sensor (standard scope of supply)

Exhaust gas temperature in °C

<table>
<thead>
<tr>
<th>Fuel sulphur content in %</th>
<th>Speed in rpm</th>
<th>NOx in g/kWh</th>
<th>Oxygen Ammonia</th>
<th>SCR Principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3</td>
<td>200</td>
<td>0.0</td>
<td>4 NO + 4 NH3 + O2</td>
<td>12.0</td>
</tr>
<tr>
<td>1.0</td>
<td>250</td>
<td>2.3</td>
<td>2 NO + 4 NH3 + O2</td>
<td>14.0</td>
</tr>
<tr>
<td>2.3</td>
<td>300</td>
<td>2.6</td>
<td>2 NO + 4 NH3 + O2</td>
<td>18.0</td>
</tr>
<tr>
<td>3.5</td>
<td>350</td>
<td>2.9</td>
<td>2 NO + 4 NH3 + O2</td>
<td>20.0</td>
</tr>
</tbody>
</table>

**Exhaust gas after treatment solutions**

- Excessive S03 formation and catalyst aging
- NH3 reacts with the NOx to form harmless nitrogen and water vapor, which are major components of ambient air.
- The Cat SCR System is based on selective catalytic reduction technology. If excess ammonia is injected into the exhaust gas, the reactants NOx and NH3 will form nitrates (NO3 and NH4). Inside the SCR module, the NH3 reacts with the NOx to form harmless nitrogen and water vapor, which are major components of ambient air.

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- Substrate cassette (standard scope of supply)
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**Design**

The Cat SCR System consists of the following key components:

- **Urea pump skid**, to supply urea from the main tank to the dosing cabinet, is available. All pipes and harnesses need to be supplied by the customer. Wiring harness kits are available for easy connections between system components. For further details refer to the “Cat IMO Tier III SCR A&I Guide”.

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- Substrate cassette (standard scope of supply)
- Dosing cabinet (standard scope of supply)
- Substrate cassette (yard supply)
- Substrate cassette (optional)
- Turbo pressure sensor (standard scope of supply)
Cat SCR System • Product Benefits

The Cat SCR System solution was designed by Caterpillar® especially for MaK medium-speed engines to meet future IMO Tier III emission requirements. Installation and operation of the Cat SCR System is a sustainable solution to reduce NOx emissions without sacrificing the typical MaK marine engine efficiency, durability and reliability that our customers are accustomed to.

The service- and maintenance-friendly design, remote condition monitoring and diagnostic capabilities, as well as our unmatched global product support respond to the industry’s desire to lower operational costs and downtime beyond today’s standards.

Cat SCR System key features:
- Complete marine certification society solution
- NOx reduction solutions consisting of SCR chamber, mixing tube, urea injection system and dosing cabinet
- Uninterrupted product availability
- Single supplier IMO Tier III solution
- IMO Tier III parent engine certification (scheme A), re-certification in the vessel necessary (no certification necessary for engine installation)
- Integrated control and monitoring of engine and SCR System for reliable and safe operation which enables the market leading user friendliness
- Concurrent of SCR System and engine calibration for optimized performance
- Application and installation support for every market segment and ship type
- Excellent reactivity thanks to strong Caterpillar dealer network
- Corresponding maintenance schedules of SCR System and engine for optimized operational availability

Standard scope of supply:
- Reaction housing with catalyst
- Mixing tube with urea injection lance
- NOx, temperature and pressure sensors
- Urea dosing cabinet with ECM and closed loop function
- Set of flanges
- Scheme A certificate IMO Tier III

Optional scope of supply:
- Urea pump silo
- for transfer of urea from urea tank to dosing unit
- - MCS certified
- Wiring kit
- for connecting plugs, cable and junction box
- for connecting dosing unit, mixing tube and reactor housing
- for connecting plugs, cable and junction box

A sustainable solution to reduce NOx emissions!

The Cat® SCR System solution was designed by Caterpillar® especially for MaK medium-speed engines to meet future IMO Tier III emission requirements. Installation and operation of the Cat SCR System is a sustainable solution to reduce NOx emissions without sacrificing the typical MaK marine engine efficiency, durability and reliability that our customers are accustomed to.

The service- and maintenance-friendly design, remote condition monitoring and diagnostic capabilities, as well as our unmatched global product support respond to the industry’s desire to lower operational costs and downtime beyond today’s standards.

Cat SCR System key features:
- Complete marine certification society solution
- NOx reduction solutions consisting of SCR chamber, mixing tube, urea injection system and dosing cabinet
- Uninterrupted product availability
- Single supplier IMO Tier III solution
- IMO Tier III parent engine certification (scheme A), re-certification in the vessel necessary (no certification necessary for engine installation)
- Integrated control and monitoring of engine and SCR System for reliable and safe operation which enables market leading user friendliness
- Concurrent of SCR System and engine calibration for optimized performance
- Application and installation support for every market segment and ship type
- Excellent reactivity thanks to strong Caterpillar dealer network
- Corresponding maintenance schedules of SCR System and engine for optimized operational availability

Standard scope of supply:
- Reaction housing with catalyst
- Mixing tube with urea injection lance
- NOx, temperature and pressure sensors
- Urea dosing cabinet with ECM and closed loop function
- Set of flanges
- Scheme A certificate IMO Tier III

Optional scope of supply:
- Urea pump silo
- for transfer of urea from urea tank to dosing unit
- - MCS certified
- Wiring kit
- for connecting dosing unit, mixing tube and reactor housing
- - MCS approved
- No certification in the vessel necessary (no certification necessary for engine installation)

A sustainable solution to reduce NOx emissions!
Cat SCR System • Product Benefits

The Cat SCR System solution was designed by Caterpillar® especially for MaK medium-speed engines to meet future IMO Tier III emissions requirements. Installation and operation of the Cat SCR System is a sustainable solution to reduce NOx emissions without sacrificing the typical MaK marine engine efficiency, durability and reliability that our customers are accustomed to.

The service- and maintenance-friendly design, remote condition monitoring and diagnostic capabilities, as well as our unmatched global product support respond to the industry’s desire to lower operational costs and downtime beyond today’s standards.

Cat SCR System key features:

Cat SCR System

- Complete marine certification society solution
- NOx reduction solutions consisting of SCR chamber, mixing tube, urea injection system and dosing cabinet
- Urea transfer pump skid optional available
- Single supplier IMO Tier III solution
- IMO Tier III parent engine certification (scheme A), no certification in the vessel necessary (two certificate necessary for engine installation)
- Integrated control and monitoring of engine and SCR System for reliable and safe operation which enables market leading user friendliness
- Concise of SCR System and engine calibration for optimized performance
- Application and installation support for every market segment and ship type
- Excellent serviceability due to strong Caterpillar dealer network
- Corresponding maintenance schedules of SCR System and engine for optimized operational availability

Optional scope of supply:

- NOx pump kit
  - for transfer of urea from urea tank to dosing unit
  - MCS certified
- Wiring kit
  - for installation
  - for connecting dosing unit, mixing tube and reactor housing
  - for connecting plugs, cable and junction box

A sustainable solution to reduce NOx emissions!