EPA Tier 4 Emissions
DEF Urea Supply Chain

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SCR – Selective Catalytic Reduction

Patented in the USA in 1957 by Engelhard Corporation
Started in mobile applications in Europe in the 1990’s

What is Selective Catalytic Reduction?
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 automotive-grade urea, otherwise known as Diesel Exhaust Fluid (DEF). The DEF sets off a chemical reaction that converts nitrogen oxides into nitrogen, water and tiny amounts of carbon dioxide (CO2), natural components of the air we breathe, which is then expelled through the vehicle tailpipe.

*Schematic is not representative of all manufacturers’ approach to achieve near zero emissions.
History of SCR – It is a very proven technology

NAVISTAR MARKS COMPLETION OF HEAVY-DUTY PRODUCT TRANSITION TO SCR

• INTERNATIONAL LONESTAR WITH CUMMINS ISX15 NOW AVAILABLE FOR ORDER

• LISLE, Ill., Oct. 29, 2013 /PRNewswire/ -- Navistar, Inc. today announced its International® LoneStar® on-highway tractor with Cummins ISX15 engine with Selective Catalytic Reduction (SCR) emissions technology is now available for order. The LoneStar is the company's final heavy-duty Class 8 on-highway truck model to incorporate SCR emissions technology since Navistar began its SCR transition in December 2012.

EGR ADDS HIGH SOOT TO YOUR ENGINE

• Unfortunately, the EGR gasses from a diesel tend to bring a sooty mess with them it’s a lot like cholesterol in your body. That sooty mess tends to gum up the EGR valve, EGR cooler, intake ports, and any sensors that are exposed to it. Take a look at these two 6.0L Power Stroke EGR valves. The one on the right is almost new, and the one on the left is so gummed up from EGR that it stopped working. And keep in mind, that as bad as EGR is, if your diesel is tuned to blow black smoke out the exhaust your EGR system is being exposed to that same stuff!
MARINE ENGINE MANUFACTURERS AGREE!

Cat – Cummins – EMD – MaK - Mitsubishi – MTU – Wartsilla

✓ Efficiency
✓ Simplicity
✓ Proven
✓ Reliability
✓ Durable

NON MISSION DISABLING – YOUR BOAT STILL DOES THE WORK!

May 20-22 | St. Louis, MO
The Dome @ America’s Center
PROVEN! → 150+ MARINE T4F ENGINES SOLD

- 1000 to 6200 bhp
- We're here to help!
- Application & Installation
- Commissioning
- System Integration
- Dealer support
- Caterpillar Marine Solutions
- 50 hp to 10,000 + hp
- Ask Us........

Booth # 117
CMI Product Lineup for Marine Tier4/IMO III

- **IMO III (Non Tier4)**
  - QSK60 (2200-2700 HP) – Propulsion and Auxiliary
  - QSK50 (1500-1900 HP) – Propulsion and Auxiliary
  - QSK38 (800 – 1400 HP) – Propulsion and Auxiliary
  - QSK19 (700-800 HP) – Propulsion and Auxiliary

- **Tier4 and IMO III**
  - QSK60 (2200 – 3000 HP) – Propulsion and Auxiliary
  - QSK38 (1000 – 1500 HP) – Propulsion and Auxiliary

**Cummins Booth - #340**

May 20-22 | St. Louis, MO
The Dome @ America’s Center
EMD Engine for US EPA Tier 4

EMD Tier 4 Ratings
Same as US EPA Tier 3
2000 – 5000 HP

Same core engine platform.
EPA Tier 4 solution is based on EPA Tier 3 platform + compact integrated selective catalytic reduction.

EPA Tier 4
IMO III

Booth #729
• S12R-T4F_Mechanical 1260hp@1600rpm
  • Booth 126

• S16R-T4F_Mechanical 1675hp@1600rpm in Development
OVER 6,000,000,000 DEF Gallons Sold in USA Last Year!
EPA Tier 4 Emissions and DEF/Urea Supply Chain

Urea Source
- Global Nitrogen Producers
- 32.5%, 40%
- Barge, Tanker, Bulk, Drum availability

Terminal Network
- Quality gate – in and out
- Solutionizing or Dilution
- Packaging – Totes
- Warehouse
- Bulk Inventory
- Coastal and Inland network

- Marine market is a small % of urea tons
- NA producers have capacity
- Has been in highway and off-highway use for years

- Infrastructure investments for “on highway” DEF can be used for 40%.
- New locations will crop up as underserved areas demand increases.
- 40% marine preferred as more efficient for volume stored

- Distributors exist who can deliver DEF to the inland marine vessels.
- Experience in delivering to this market is key to ensure customers receive high quality product and reliable service.
IMO 2020 Impact on Domestic Marine Fuel

EIA projections of U.S. distillate, residual fuel oil prices

USGC products vs Mars spreads

Indexed gasoil and heavy sulfur fuel oil prices* 2017-2025 (NWE CIF)
What is AUS 40
ISO 18611 Marine Nox reduction agent

Table 1 — Quality characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Unit</th>
<th>Limits</th>
<th>Test methods</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>min.</td>
<td>max.</td>
</tr>
<tr>
<td>Urea content[^a]</td>
<td>% (m/m)[^d]</td>
<td>39</td>
<td>41</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Density at 20 °C[^b]</td>
<td>kg/m³</td>
<td>1.105</td>
<td>1.177</td>
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<tr>
<td>Refractive index at 20 °C[^c]</td>
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<td>1.3947</td>
<td>1.3982</td>
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<tr>
<td>Alkalinity as NH₃</td>
<td>% (m/m)[^d]</td>
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<td>0.5</td>
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<tr>
<td>Biuret</td>
<td>% (m/m)[^e]</td>
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<tr>
<td>Aldehydes</td>
<td>mg/kg</td>
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<td>100</td>
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<tr>
<td>Insoluble matter</td>
<td>mg/kg</td>
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<td>50</td>
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<tr>
<td>Phosphate (PO₄)</td>
<td>mg/kg</td>
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<tr>
<td>Calcium</td>
<td>mg/kg</td>
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</tr>
<tr>
<td>Iron</td>
<td>mg/kg</td>
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<tr>
<td>Magnesium</td>
<td>mg/kg</td>
<td>—</td>
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<tr>
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<td>Identity</td>
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<td>identical to reference</td>
<td>ISO 18611-2, Annex J</td>
</tr>
</tbody>
</table>

- 40% high purity urea / 60% high purity water
- Weight per gallons 9.28 lbs
- Crystalizes at 35 deg F (-11 deg C)
- Do not store below 35 deg F
- Non-Hazardous
- Color – clear
- Smell – slight ammonia smell
- Corrosive – stainless steel and poly should be used or a lined steel tank
- Shelf life – dependent on temperature. 1 year is typical.
- If spilled clean with soap and water
- Avoid contact with skin and eyes (refer to suppliers SDS)
Availability
Economy Boat Store
EPA Tier 4 Emissions & DEF/Urea Supply Chain
From Coast to Coast... Delivery across the US

37 States
120 Facilities
~2,000 TMIs

Extensive footprint enabling:
1) Surety of Supply
2) Logistics Solutions

Corporate
West Coast
Marine
Mining & Industrial
Energy, C&I and Cardlock Fueling

Economy Boat Store
Annual DEF Statistics and Capabilities
(Pilot Thomas / Economy Boat Store Network)

- Distributes > 1 Million gallons annually
- Turn-Key DEF Storage & Dispensing Systems
- System-wide supply chain in place
- Sourcing → Storage → Distribution
Geographic Footprint of Economy

- Six locations provide comprehensive services to the Mississippi River system and Gulf of Mexico waterway traffic

- Full Service:
  - Wood River, IL
  - Wickliffe, KY
  - Memphis, TN

- Partial Service:
  - St. Louis Harbor
  - Baton Rouge, LA
  - Mobile, AL
Product and Service Offerings

• Marine Fueling and Fuel Services:
  • Exclusively ULSD Fueling
  • Petroleum Management Solutions
  • Lubricants and Chemicals (incl. DEF)
  • Potable Water and Slop, Trash and Oily Waste Removal
  • Tug and Towing Services

• “Last Mile” Logistics Solutions:
  • Crew Changes
  • Warehousing and Distribution

• Groceries & Marine Supplies

• Loading Rack Fuel Sales:
  • ULSD – Clear and Dyed
  • DMA

• Bulk Storage Tank Leasing
Thank You

Any Questions?