GEA Exhaust Gas Recirculation Cooler

Reliable Emission Reduction for the Future
Since the introduction of level III emission regulations for marine diesel engines and the subsequent approx. 80% reduction in NOx emissions were announced, it has become obvious that new technologies are necessary to comply with these values.

GEA Maschinenkühltechnik has developed a new generation of coolers which ensure that exhaust emissions, coming from the exhaust gas recirculation of a ship’s diesel engines, are added to the combustion air at the lowest possible temperature. This effectively reduces NOx generation during the combustion process. Based on decades of experience with charge air coolers for ship Diesel engines, GEA Maschinenkühltechnik presents an innovative cooling system which, owing to its special, patented construction, can cool exhaust gas from more than 700°C to 50°C.

This new cooler generation is based on a newly developed fin tube system.

Designed with a CFD program, both the fin tube configuration and especially the fin geometry of this new system provide a high efficiency for the heat exchanger by minimizing fouling at the gas side cooling surface. The embossed and specially formed structures on the fin surface also play a significant role in this process by creating the necessary turbulence inside the fin tube stack and guiding the air flow through the heat exchanger in such a way that almost the entire fin surface participates in the heat transfer process.

Depending on prevailing environmental conditions, different stainless steel materials can be used for the new fin tube system, such as: 1.4512 (AISI 409), 1.4404 (AISI 316L) or 1.4539 (904L acc. ASTM A240).
At the high pressure EGR system, exhaust gas is discharged into the upstream part of the turbocharger turbine. After it has been cooled by a HT-EGR cooler and a LT-EGR cooler (optional), it is recirculated into the combustion air at the downstream part of the turbocharger compressor.

Challenges for coolers in a high pressure EGR system are:
- High temperature range at gas side of between 700°C and 50°C
- High pressure pulsation
- Fouling
- Corrosion induced by condensation
- High vibration level from the Diesel engine

GEA has developed two different EGR cooler designs of the high pressure EGR system:
- The high temperature (HT) EGR cooler, which can handle the high temperatures and pressure pulsation
- The highly efficient low temperature (LT) EGR cooler, which can cool the exhaust gas to 50°C and which is designed for easy cleaning

Both designs are characterized by an elongated basic shape with a small air inlet cross section. This shape ensures a high gas velocity inside the EGR cooler and, in combination with the special fin design, the turbulence in the gas flow needed to minimize fouling.
High Temperature Exhaust Gas Recirculation Cooler

- Its compact heat exchanger, made of a heat-resistant and corrosion-resistant stainless steel and consisting of the new S79X fin tube system
- The aquifer system case which, due to the special arrangement of the separating plate and the mounting of the heat exchanger, reduces mechanical stresses (which usually occur during thermal expansion at high temperatures) to a minimum
- The compact, customized, yet service-friendly construction, where the water and gas connections can be adjusted to the customer’s requirements and which enables a quick replacement of the heat exchanger for maintenance purposes

Low Temperature Exhaust Gas Recirculation Cooler

- Established block cooler design made of highly corrosion resistant stainless steel
- Customized connections for water, gas and condensate draining which also enables a quick replacement of the heat exchanger for maintenance purposes
- Simple disassembling of frame parts for cleaning purposes, such as sidewalls and headers, thus achieving optimal access to the heat exchanger core

Options:
- Stainless steel condensate separator
- CIP cleaning device (in development)
Low pressure loop EGR systems are used for retrofits or power plants.

In these systems the exhaust gas is discharged from downstream of the turbocharger turbine, sent through the low pressure loop EGR cooler and recirculated into the suction area of the turbocharger compressor.

Important for the low pressure loop EGR cooler is a minimum pressure drop, as well as high ratio of particles and condensate elimination. This is so as to protect the turbocharger.

The GEA low pressure loop EGR cooler is a standalone construction with an integrated high temperature and low temperature cooler, a particle filter between the two cooler stages and a condensate separator. The plug-in design of these components combines easy maintenance with a reliable low stress construction.

All parts which come into contact with exhaust gas are made of stainless steel. As a customized product the cooler is configured and designed in accordance with customer requirements.
For perfect cooling

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