

# Metso

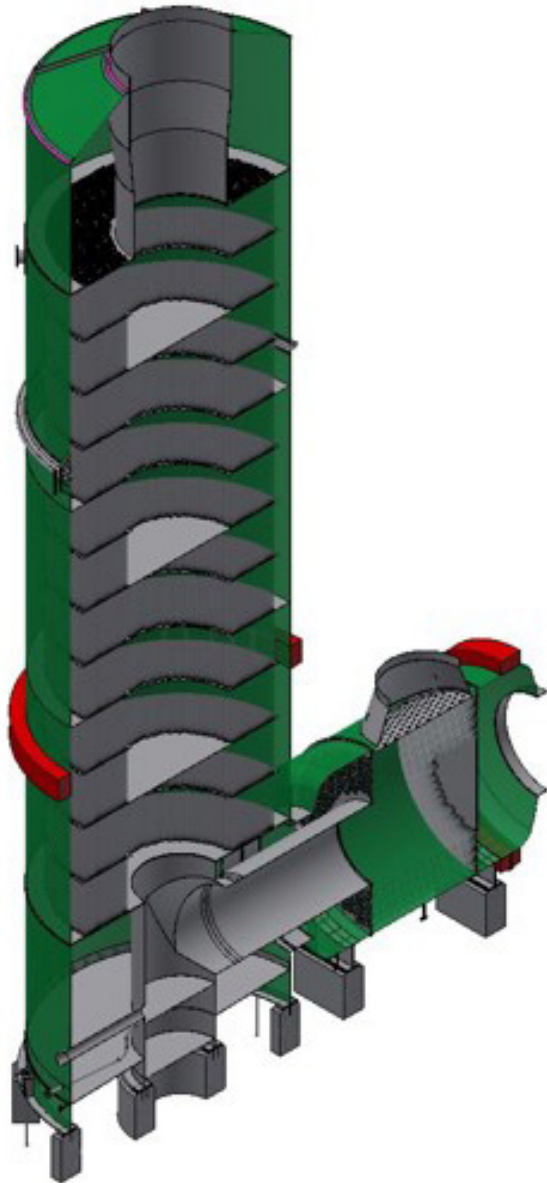
## CORD gas/gas heat exchanger





# Mastering the challenge with CORD

The improved CORD gas/gas heat exchanger represents a new phase in the development of highly critical applications for cold or cold, reheat sulphuric acid plant heat exchangers. The improved design greatly enhances reliability and performance.



The foremost focus for improving our patented CORD heat exchanger was the reduction of lifecycle costs. We managed to achieve this by reducing the investment costs for the CORD by replacing the material used on the vertical section with an inexpensive mild steel, using a smaller quantity of stainless steel for the horizontal section. This modification optimized the heat exchange split between the horizontal and the vertical section, and additionally extended the lifetime and service intervals reducing maintenance and operation costs.

The enhanced CORD heat exchanger design has been optimized for the most challenging sulfuric acid plant conditions for the cold and cold reheat heat exchanger. Leaving the drying or absorption tower, the SO<sub>2</sub>-laden gas is saturated with sulfuric acid. On its way to the gas-gas heat exchanger, acid condensation can hardly be prevented due to heat losses. Therefore, the CORD heat exchanger is designed to minimize the acid condensation on the one hand but also to enable manage the inevitable small amounts of acid condensate by its horizontal cold end design.

## Benefits

- Reduced lifecycle costs
- Enhanced design improving operating conditions and reliability for both the horizontal and vertical section
- Amended material reducing both investment costs and sensitivity to corrosion
- Improved horizontal design for easy cold end maintenance
- Cold bypass temperature remains above dew point

The solution is realized by limiting the heat exchanger surface at the horizontal end to approximately 20% while keeping the temperature increase lower than 20°C. This results in operating the vertical section permanently above the sulfuric acid dew point. Therefore, the vertical main heat exchanger section can be kept completely under non-corrosive conditions while applying only mild steel for securing longest operation times and minimal lifecycle costs.

Due to low temperature level on the small horizontal section of the heat exchanger, the use of standard acid-resistant stainless steel serves as an economical solution to cope with the corrosion protection requirements. The horizontal section of the heat exchanger is then no longer regarded as a sacrificial section.

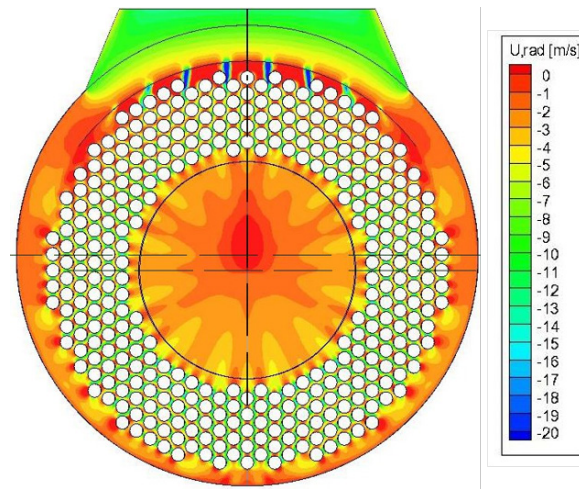
#### Step by step to the optimum

The development started in 1958 with the delivery of the first two-sectional heat exchanger for an Australian sulfuric acid plant. To ensure heat exchange efficiency and reduce pressure drop for high capacity heat exchangers as acid plants capacities grew since then, the radial flow "disc and donut" design replaced single segmental baffle design in the next step.

Because the cold end had been design as a sacrificial section in the past, the design was improved by a horizontal layout for this section to facilitate the replacement. The latest design for the horizontal section further improves the fluid dynamics. Through a computational fluid dynamics (CFD) analysis, the inlet nozzle was optimized and the tube bundle are now eccentrically positioned, resulting in a homogeneous gas flow with low pressure loss through the bundle, further increasing the heat exchange efficiency.

#### Leading the way to easy operation

The horizontal section--the most distinctive feature of the CORD heat exchanger-- not only accounts for its easy



Fluid dynamics analysis of the eccentric tube bundle for even distribution.

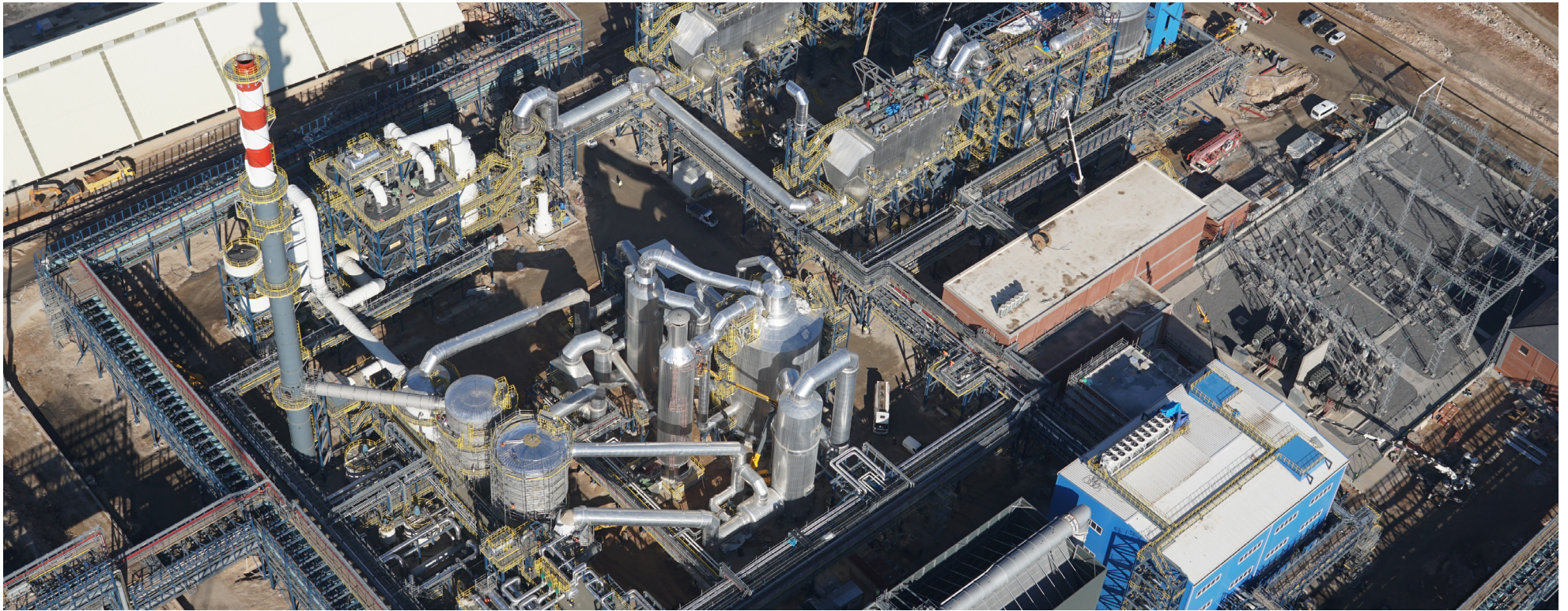
and economic replacement. Traditional heat exchanger designs condensate accumulates on the tube sheet, attacking both the tube sheet and also the tubing. Due to the thin wall thickness, the tubing is the weakest and therefore first failing part that may cause higher SO<sub>2</sub> emissions through leakages.

The CORD's cold end design with the vertical tube sheets orientation prevents acid condensate perfectly by continuously wetting the tubing. The condensates are collected at the bottom of the heat exchangers shell at temperatures of the sulfuric acid that is low enough not to corrode the heat exchanger's wall. the condensate can easily be drained from there through a bleeder valve, minimizing the service demand for the heat exchanger.

A CORD heat exchanger is targeted on the most challenging application in a sulfuric acid plant.







# CORD: the solution for your plant

The free nozzle positioning for the vertical section of the heat exchanger through radial flow design facilitates the replacement of the traditionally designed heat exchanger by the highly reliable Metso CORD solution. The result is significant savings in equipment lifecycle costs and improved equipment reliability.

## Features

- No acid condensate accumulation with sulfate build-ups in the horizontal section
- Horizontal section temperature increase only approximately 20°C, enabling the use of standard stainless steel
- Minimum amount of stainless steel material and reduced investment cost
- Vertical section operated above sulfuric acid dew point temperature, allowing mild steel usage
- Replacement solution for aged traditional designed heat exchanger
- Horizontal part with improved inlet and outlet design
- If requested, exchange of only horizontal section possible to reduce replacement costs

