

Gas/gas heat exchanger for corrosive flue gas processing



Why using gas/gas heat exchangers in flue gas processing ?

Flue gas generated by combustion of fuels or wastes incineration have to be processed in order to reduce the atmospheric pollution they may cause. This operation takes place after the primary (or sensible heat) heat recovery which is achieved in the boiler. During this operation, crossing the dew point is carefully advised in order to preserve the equipment from corrosion - usually keeping the flue gas temperature above 390°F is enough to achieve this goal. This temperature level may vary with the flue gas moisture content.

This residual energy can be used to warm up depolluted flue gas prior to be discharged to the stack or before they get further process. A gas/gas heat exchanger which cools down the non processed flue gas and warms up the partially or totally processed flue gas is used for this operation.

This heat exchanger operates at temperatures above the dew point but closed enough to this dew point therefore requiring specific design and materials of construction.

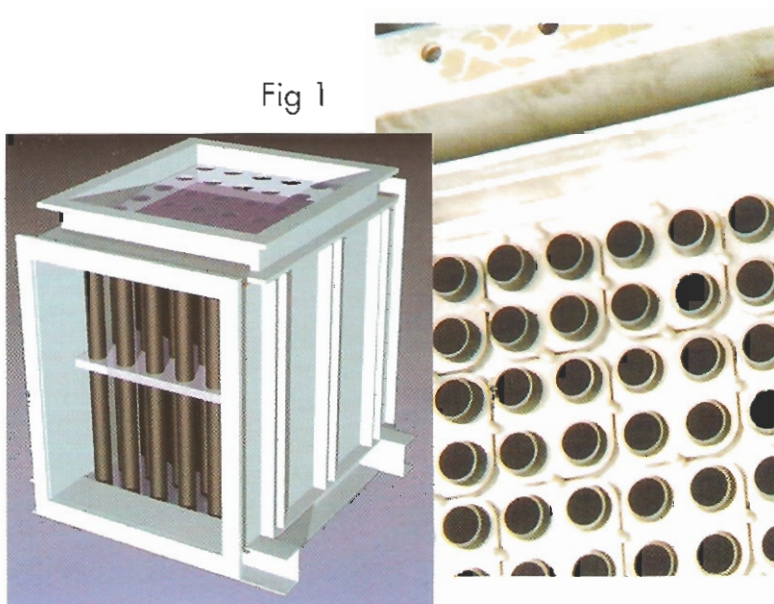
A combined expertise from two leaders in their respective field

- The CARBONE LORRAINE group has a very large cumulative experience in manufacturing equipment to be used with corrosive products and has developed a wide range of materials highly resistant to corrosion, temperature and pressure: the GRAPHILOR™ (impervious graphites which because of their unique thermal conductivity are particularly adapted to heat transfer equipment).
- LANGBEIN-ENGELBRACHT GmbH, a Germany based company, is highly knowledgeable in design and manufacture of equipment for air and gas handling.

These companies have combined their expertise and efforts to offer performing heat exchangers.

A design adapted to the specific needs of the application

The gas/gas heat exchangers are composed of a rectangular housing into which GRAPHILOR™ tubes are mounted. The raw (non depolluted) flue gas stream flows inside the tubes while cold non depolluted flue gas flow outside the tubes.



As shown on sketch no.1 the housing gets a double protection against accidental condensation:

- through by-passing part of the hot flue gas stream along the walls of the housing keeping the temperature above the dew point,
- through cladding or lining the inner surfaces in contact with the hot non depolluted flue gas. Hastelloy, P.T.F.E. or other liners can be used.

The GRAPHILOR™ BSS tubes are assembled into the housing through a system of P.T.F.E. gasketing held in place by a combination of expanded graphite POPYEX™ and metal parts stacked together.

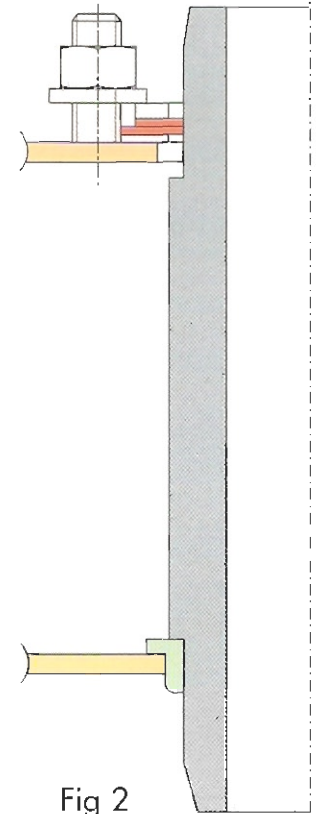
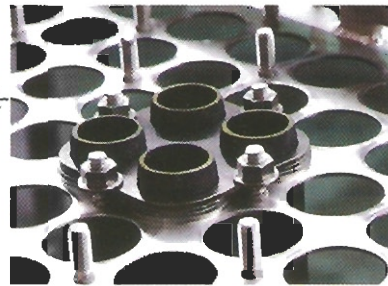
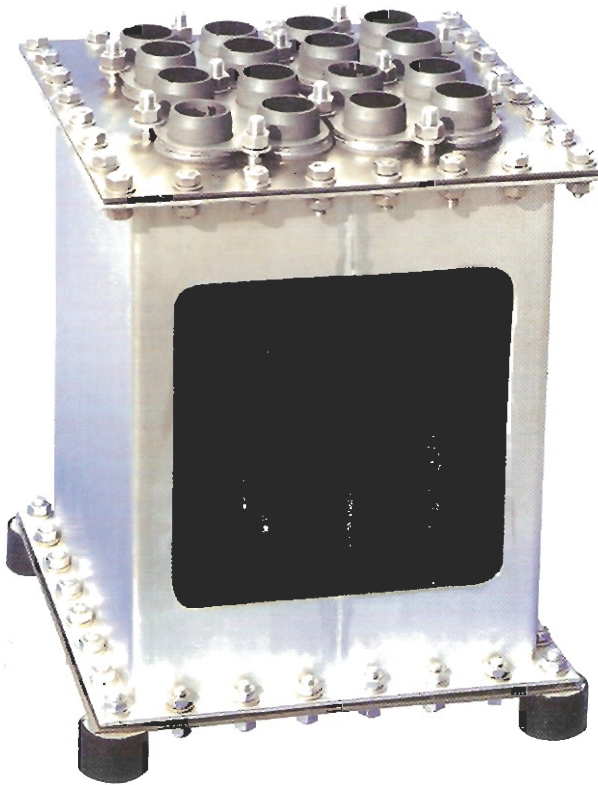







Fig 2

| | |
|----------------------------------|---|
| GRAPHILOR |  |
| PAPYEX or P.T.F.E. |  |
| Stainless steel |  |
| Alloy nickel-chromium-molybdenum |  |
| P.T.F.E. or elastomer |  |

This tightening system (fig.2) achieves:

- compensation of differential thermal expansion between tubes and housing,
- tightness between the two circuits,
- enables an easy replacement of eventual failed tube.

It also avoids:

- accidental corrosion damage because all materials used such as GRAPHILOR™, P.T.F.E., PAPYEX™ are highly corrosion resistant and temperature standing.

Adjustable dimensions and performances to installations request

The gas/gas heat exchangers are individually sized in order to comply with thermal performance requirements and pressure drops allowances as well.

The overall height of the units is determined by the maximum length of the GRAPHILOR™ tubes 54,000 mm (or 14'). Other dimensions such as width and depth (or length) are eventually conditioned by the allocable foot print for the heat exchanger, pressure drops, gas velocity. The thermal performance dictates the heat transfer area which is adjusted by assembling module in parallel or in series.

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