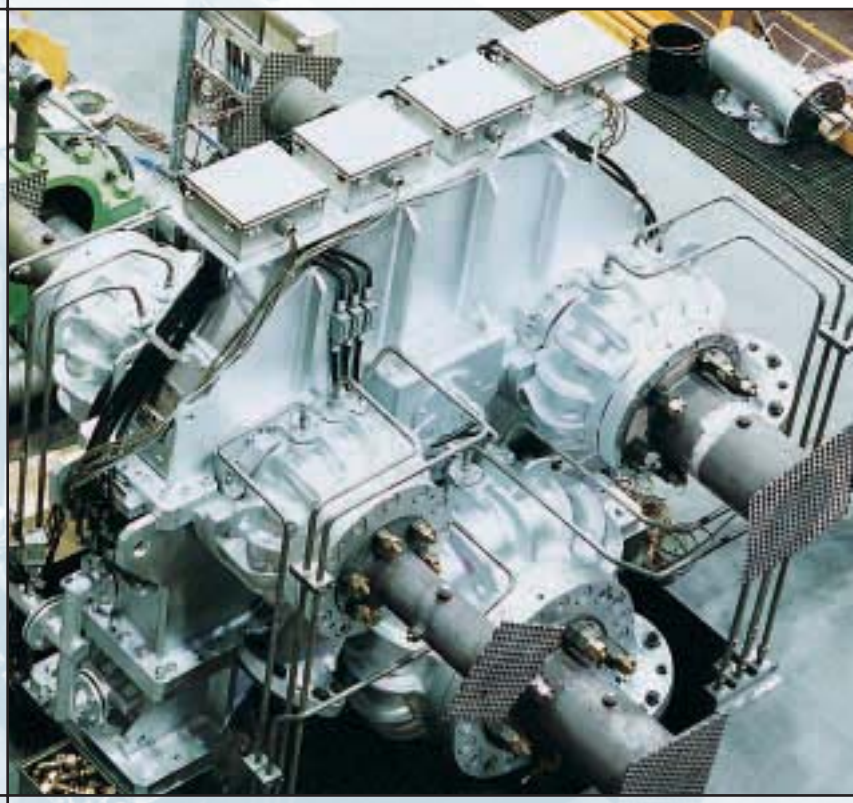
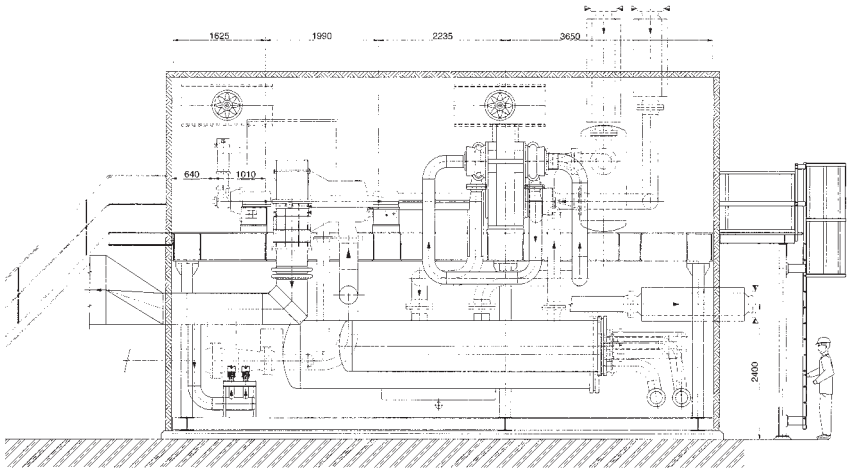
First synthesis gas compressor of integral gear design for methanol plants



In April 1995

MAN Turbomaschinen AG GHH BORSIG was awarded an order from BASF Ludwigshafen for a synthesis gas compressor of integral gear design with steam turbine drivers. The compressor is to be used in a plant for the production of methanol, and the integral gear design represents a new concept to meet the process requirements. The integral gear design provides maximum efficiencies, and, at the same time, a reduction of investment costs.



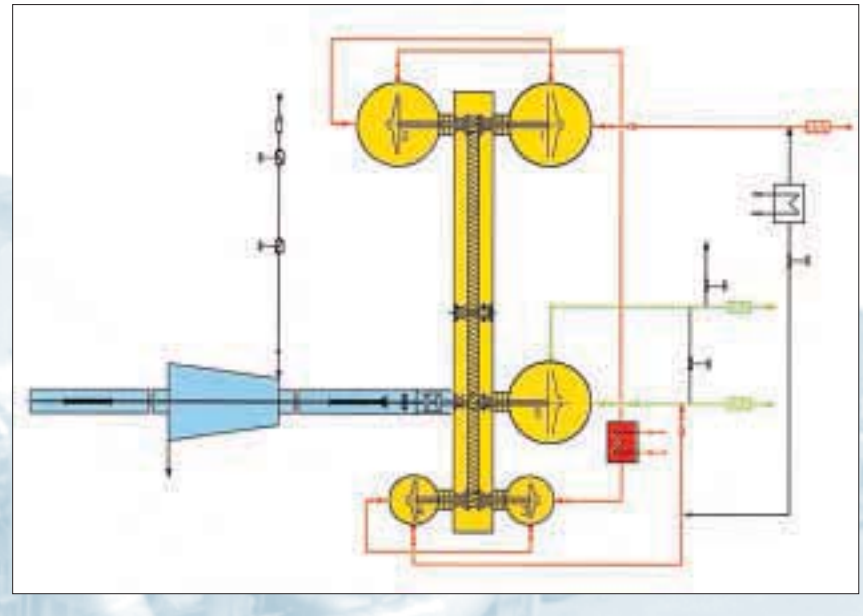
Synthesis gas is taken from an existing ammonia plant and fed into a methanol plant so that ammonia or methanol can be obtained from the existing feedstock in a flexible production process.

To this end, the synthesis gas is compressed from 27 bar (391 psi) to a maximum discharge pressure of about 77.5 bar (1123 psi). In addition, synthesis gas is used continuously in the reactor cycle so that two compression tasks have to be fulfilled by one single machine. In previous applications, this task will fulfilled by single-/multicasing, barrel-type compressors with, in most cases, the recycle-gas stage integrated in the high-pressure casing of the compressor.

In the BASF plant, a multi-shaft compressor is used for this application now. Depending on molecular weight and pressure ratio an integral gear compressor offers major advantages compared with a conventional compressor.

Such advantages are:

- maximum efficiencies because of optimum speed match and axial intake of each stage;
- possible interstage cooling after each stage;
- optimum match of recycle-gas stage because speed selection is free;
- - higher impeller tip speed (Depending on the impeller type);
- - optimum driver speed selection independent from compressor speed.



Simplified flow schematic

As a result, the number of stages and length of train may be reduced and the machine house is smaller. Consequently, investment costs are lower.

The compressor set with a weight of approximately 100 t was transported to the site as a package unit. To end to this, all ancillary equipment such as gas coolers, separators, oil supply unit, process piping, valves, etc., are arranged within the steel baseframe. At the site, the entire unit is enclosed under a noise hood to achieve the low sound emission levels required.

The compressor of the type RG 0321/05 consists of four radial stages for compression of the synthesis gas and of one recycle stage, which, for the first time, has been mounted directly on the free end of the turbine drive pinion shaft. The synthesis gas flows into the compressor through a silencer situated outside the noise hood, and through a separator. After compression in two stages, the gas is fed into the suction of the recycle-gas compressor and compressed further.

Sealing of the compressor stages against the atmosphere is by tandem gas seals. A MAN TURBO condensing steam turbine type DK050/080 serves as driver. In line with the drive concept developed by MAN TURBO, the compressor is driven directly, i.e., without intermediate gear.

Noteworthy technical features of the compressor include:

- discharge pressure 77.5 bar
- use of tandem gas seals
- direct drive concept without intermediate gear

Transport of the compressor package to the site

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Printed in Germany.
August 2001

TURBO XXX e 10011,5 ba

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