A New Generation of Ammonia Unit Coolers

Italian based LU-VE has recently carried out several tests on cooler behaviour with the aim of understanding frost formation better and improving product efficiency.

At the IIR Conference on Ammonia Refrigeration Technology, Ohrid, 2009 Stefano Filippini, LU-VE SpA, presented a paper, describing in detail the development of a new generation of coil geometry, thanks to the use of Computational Fluid Dynamics Software and extensive testing in the LU-VE laboratory.

The whole paper can now be downloaded as a PDF-file from ScanRefs website www.scanref.com.

To give an idea of the content, here is the abstract and introduction from the paper:

Traditionally, the main design criteria for NH_3 coolers have been:

1. capacity
2. air flow
3. surface
4. fin spacing
5. cooler configuration (i.e. cubic, dual discharge, fast freezer, blow through, draw through,…)

Point 5 is normally linked to the type of application and is not the subject of this analysis.

The focus of LU-VE R&D activity concentrated mainly on points 1 and 3. In fact for a certain capacity (and fin spacing) a minimum surface is very often specified. Is that the correct approach? We are not sure; in fact with a given minimum surface there is the intention to have a product, which can have a certain performance during its real operating time (i.e. during frost formation).

However the cooler configuration (coil geometry, number of rows, fin shape, air velocity, proper combination of fan with coil…) are crucial parameters characterizing product performance; it is clear for example that a unit with too many rows may actually have poor performance during frosting, if the fan cannot ensure proper air quantity while operating.

Therefore our target was clear: EFFICIENCY!! That means making products which have the highest possible efficiency in real working conditions. Thanks to the use of Computational Fluid Dynamics Software and extensive testing in the LU-VE laboratory, a new generation of coil geometry was developed, aimed at performing well under frost formation with proper use of the finned surface. The surface has several turbulators for perfect aerodynamic configuration. Particular attention was paid to their definitions and a microphotographic evaluation of frost formation on finned turbulators was made clearly showing frost growth on finned surface.

This paper describes in detail the CFD software analysis, test ring, testing activity and the results of this important development.

Introduction

The industrial series of ammonia unit coolers is the result of lengthy and intense research, both theoretical and – to a greater and more important extent – experimental, principally aimed at defining the optimum characteristics of the combination of heat exchanger coil and fan group.

The document proposes to illustrate the research guide-lines and to present the results obtained. Exchanger performance in the dry state is dealt with, as are the changes to the thermodynamic and aerodynamic behaviour of the equipment generated by frost formation on the heat exchange surfaces, highlighting the contribution of Computational Fluid Dynamics (CFD).

Stefano Filippini, LU-VE SpA

About LU-VE

LU-VE Group controls a group of companies working in the field of heat exchangers. The Group is made up of seven production facilities and eight commercial branches.

The Group in numbers:

- 1,060 skilled employees;
- 280,000 sqm. of total surface area;
- 95,000 sqm. covered surface area;
- 1,000 sqm. of R& D laboratory;
- 70% of production exported to 90 countries;
- aggregated turnover over € 210 million.

The LU-VE Group also controls eight trading companies, located throughout the world.

More at www.luve.it