IEA Heat Pump Programme

Annex 33

Compact Heat Exchangers with Small Effects on the Environment

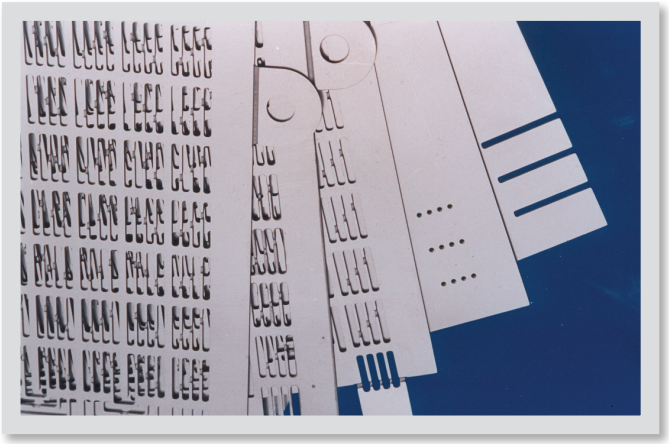

Figure 1. A compact heat transfer surface, in the form of a 'shim' used in heat exchangers produced by Chart Energy & Chemicals, Inc.

The objective of this Annex was to present a compilation of possible options for compact heat exchangers, used as evaporators, condensers and in other roles in heat pumping equipment. The aim is to minimise the direct and indirect effect on the local and global environment due to operation of, and ultimate disposal of, the equipment. The Annex report relates specifically to design data for compact heat exchangers used in heat pumping systems at the process/large commercial level, but also includes much data relevant to domestic heat pumps.

The principle goals of the Annex were to…

- … identify compact heat exchangers , that may be applied in heat pumping equipment, which decreases the working fluid inventory, minimising the environmental impact of system manufacture and disposal, and/or increasing the system performance during the equipment life.
- … identify and document reasonably accurate methods of predicting heat transfer, pressure drop and void fractions in these types of heat exchangers.
- … present listings of operating limits etc. for the different types of compact heat exchangers, e.g. maximum pressures, maximum temperatures, material compatibility, minimum diameters, etc. and of estimated manufacturing costs or possible market prices in large scale production.

Much of these data are presented within the Annex 33 final report.

Figure 2. Typical of the new compact geometries being examined for the application is the aluminium unit from KTH

Results ranging from fundamental research to selection guidelines and market data

The Annex deliverables consist of a wide variety of data ranging from fundamental research on boiling in narrow channels to guidelines for selecting and using CHEs in heat pumping systems. There are considerable market data available within the report and the cited references, and a number of novel heat exchanger concepts, including the use of new materials and the application of process intensification methods, should allow equipment manufacturers in the future to achieve the Annex aim.

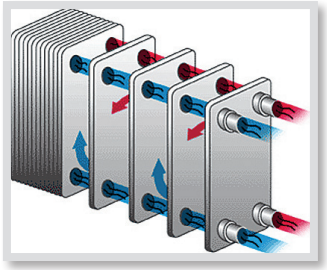

Figure 3. Plate heat exchanger

Highlights from the conclusions

1 The increasing interest in and use of, CO_2 as a working fluid. This has interesting implications in terms of the equipment used and the concepts for heat pumping that might be applied – see particularly the inputs from Austria and Japan in this Annex.

2 The growing market for domestic heat pumps, where efficiency, arising in part out of the increased use of CHEs, is critical to further sustained market growth, particularly in countries where heat pump use has been slow to materialize.

3 The vast portfolio of research on heat transfer and fluid dynamics in narrow channels in CHEs. The research highlighted in Sweden, Japan and the USA is of particular note.

4 The role heat pumps could play in industry, where reduced payback times could be aided by CHEs. The UK study highlights the market possibilities.

5 There is a need to educate the heat pump industry in the use of CHEs, their merits and limitations, and the types that are available. The use of new materials, as indicated in some of the research in the USA, could reveal new opportunities.

Experts in the field

The project has brought together many experts in the heat pump/CHE field and the Annex Report will, it is believed, be a major and constructive source of data for those interested in using CHEs in heat pumping equipment.

New project in the UK

Recently the industrial heat pump aspects have received support from the UK EPSRC with a project linking Brunel, Newcastle and Northumbria Universities to optimize the selection and placement of process heat recovery equipment (including heat exchangers and open and closed cycle heat pumps). CHEs will have a major role to play here.

Further information

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Participating countries: Austria, Japan, Sweden, the United States and the United Kingdom

Publications: Final report of Annex 33 and Executive Summary of Annex 33, available at www.heatpumpcentre.org

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