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pour le développement du froid

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IIR Working Party

Refrigerant Charge Reduction in Refrigerating Systems

TERMS OF REFERENCE

Introduction

In accordance with Article XIX of the International Agreement concerning the IIR and articles 15 to 18 of the Internal Regulations of the Science and Technology Council of the IIR, the setting up of a Working Party (WP) "Refrigerant Charge Reduction in Refrigerating Systems" is proposed.

This WP would deal with the reduction of the refrigerant charge used in refrigerating plants through suitable design of components and also with the benefits in terms of limitation of the environmental impact thanks to a reduction in the energy consumption and through the limitation of refrigerant emissions.

Refrigerant charge reduction in systems is an important issue because it falls within environmental policy regarding refrigerants' contributions to the greenhouse effect. In addition, this subject receives little coverage at an international level and the creation of such a working party within the IIR could initiate a work dynamic leading for instance to new rules for refrigerating plants design.

The following terms of Reference (ToR) further define the role of the WP.

Background

Recently, the economic, social and ecological stakes of power consumption were the subject of a debate at a global level, with in particular the ratification of the Kyoto agreements aiming to reduce greenhouse gas emissions. These concerns result in practice in new policies and strategies aiming at a more rational production and use of energy.

Let us recall that today in the industrialized countries, up to 15% of electricity consumed is used in refrigeration and air conditioning and that this sector accounts for approximately 5% of the global greenhouse gases emissions. Thus, the improvement of the performances of refrigerating plants is of major importance.

Since the Montreal Protocol (1987) leading the prohibition of CFC and HCFC refrigerants, manufacturers of refrigeration equipment use HFC refrigerants whith direct greenhouse effects. As an example, 1 kg of HFC-404A refrigerant has a radiative forcing effect equivalent to 3.2 tons of CO_2.

Beyond the direct effect of refrigerants on global warming, the total effect of the system that has to be taken into account. Thus, it appears that the proposal for innovative solutions must reconcile both aspects defined in the concept of Total Equivalent Warming Impact (TEWI): to minimize the direct contribution of the system to the greenhouse effect due to the emissions of refrigerant, and to minimize its indirect contribution due to the power consumption of the system.

The International Institute of Refrigeration estimates that the direct greenhouse effect accounts for 20% of the total effect, which clearly shows that considering only the refrigerant charge reduction or the refrigerant emissions would leave 80% of the problem intact: a complete approach should consider both aspects.

Objectives

The main objectives of the WP are to add new results to currently applied design knowledge regarding refrigerant charge reduction in refrigerating systems and to help improve these new findings by mutual exchange of know-how.

The WP would also deal with the various aspects of the reduction of the environmental impact of refrigerating systems induced by the reduction of the refrigerant charge.

One activity of the group could consist in evaluating the possible application fields of the charge reduction: fields in which considerable savings could be achieved (for instance: commercial refrigeration, air conditioning), fields in which some benefits are possible, fields with very few potential benefits (applications using very compact systems) and then to focus on the fields where the benefits are the greatest.

Regulatory aspects related to refrigerant charge could also be discussed.

Structure

It is proposed to limit the initial number of subgroups, thus allowing each group to have a sufficient critical mass to ensure satisfactory work. This is however just a proposal; the exact composition of the sub-groups would be defined by the participants and could evolve during the life of the working party. The initial subgroups could be the following:

• **Sub-group 1.** Design of plants with reduced charge: new design for the various components (liquid line, receivers…), design of new exchangers or optimized exchangers, use of innovative components, refrigerant selection, new methods for the design and dimensioning of complete systems (to combine charge reduction and to maintain energy efficiency.

• **Sub-group 2.** Heat and momentum transfers in compact heat exchangers: heat transfer and pressure losses in plate or small-channel heat exchangers, excluding micro-thermal aspects.

The working party would complement the other working parties within the IIR, for instance when dealing with subjects such as the use of new refrigerants, especially CO_2, energy efficiency of the systems…

Activities

The main stakeholders interested at an international level: researchers, technical centres, industrial firms, institutional stakeholders… will be invited to take part in this working party. It will promote the exchange of scientific and technical information in this field and to specify orientations to advance knowledge in a direction allowing the practical and industrial application of the solutions suggested.
A series of workshops and seminars will be set up with publication of proceedings that will showcase the progress of the working party's activities.
The publication of a "handbook" gathering the best articles could be planned.
A Web site will be set up in order to disseminate relevant information and to promote the activities of the working party and the IIR. It will be periodically updated under the responsibility of the President of the WP and will be maintained by the IIR's webmaster. It will be linked to the Web sites of the commissions involved and to the IIR's Web site.

The lifetime of the working party could approximately be 3 years.

Chairman and bureau

This working party could be managed by Hélène MACCHI-TEJEDA at the Cemagref-GPAN; the officers could be composed of an expert from KTH and one from the University of Illinois. However these organizations have not yet been contacted.

Membership

The main stakeholders interested at an international level: researchers, technical centres, industrial firms, institutional stakeholders,… will be invited to take part in this working party. It will promote the exchange of scientific and technical information in this field and to specify orientations to advance knowledge in a direction allowing the practical and industrial application of the solutions suggested.
The research unit GPAN at CEMAGREF has already worked on projects in this field:
- at an international level: "Division of Applied Thermodynamics and Refrigeration" of the KTH (Royal Institute of Technology) in Stockholm (Sweden), "Mechanical Department" at Toronto university (Canada), the TNO (Netherland), Alfa-Laval, Carrier, ThermoKing, Valéo.
- in France: CETHIL (Lyon), ECA-GRETh (Grenoble), Ecole des Mines de Paris, Cetiat (Lyon), CETIM (Senlis), CIAT (Lyon), Renault.

It would be helpful to associate some IIR partners who already well known for their work on these topics as C. Bullard and P. Hrnjak from the University of Illinois at Urbana Champaign, (US), P. Lundqvist (KTH, Sweden).
Members are expected to be either private members or representatives of corporate members of the IIR.

Commissions involved

The working party would involve IIR Commissions B1 (Thermodynamics and transfer processes), B2 (Refrigerating equipment), D1 (Refrigerated Storage), D2 (Refrigerated transport), E1 (Air conditioning), E2 (Heat pumps, energy recovery).