Updating the refrigeration, air-conditioning and heat pump (RACHP) safety standards
1. Introduction

This briefing note has been prepared by the Ozone Secretariat as background material for the workshop on safety standards relevant to the safe use of low-GWP alternatives to be held in Bangkok on 10th July 2017. Briefing note 2 describes the process for writing new international standards or updating existing safety standards for the refrigeration, air-conditioning and heat pump (RACHP) equipment. It includes a summary of the current activities related to the updating of various RACHP safety standards.

The information presented here is intended only as background information for the parties. It is not meant to be exhaustive nor in any way prescriptive.

2. Background to the international standards development process

The main international bodies on standards, the International Organisation for Standardisation (ISO) and the International Electrotechnical Commission (IEC), have similar steps for development and drafting of standards. The rules for drafting standards have been refined over decades and are laid out in detail within the ISO/IEC Directives:

- ISO/IEC Directives Part 1 and Consolidated ISO Supplement1 and ISO/IEC Directives Part 1 with IEC Supplement2 are the official procedures to be followed when developing and maintaining an international standard. These procedures relate specifically to ISO and IEC respectively;
- ISO/IEC Directives Part 23 lay down the principles to structure and draft documents which are intended to become international standards.

Further to these rules, there are many guides that provide further details about the development of ISO and IEC standards4. Two guides related to RACHP safety standards are IEC Guide 116 “Guidelines for safety related risk assessment and risk reduction for low voltage equipment”5 and ISO/IEC Guide 51 “Safety aspects –

1 http://isotc.iso.org/livelink/livelink?func=ll&objid=4230452&objAction=browse&sort=subtype
2 http://www.iec.ch/members_experts/refdocs/iec/isoiecdir-1-iecups%7Bed12.0%7Den.pdf
3 http://isotc.iso.org/livelink/livelink?func=ll&objid=4230456&objAction=browse&sort=subtype
4 http://isotc.iso.org/livelink/livelink?func=ll&objid=8389141&objAction=browse&sort=name
5 https://webstore.iec.ch/publication/7525&preview=1
Guidelines for their inclusion in standards (6). These guides provide a clear description of how the required material within the safety standards should be developed and established.

The development of international standards is intended to be cost-effective and timely, as well as widely recognised and generally applied. The procedures applied to the development of international standards are based on several concepts, including the following:

i. **Consensus:** It is an essential procedural principle and a necessary condition for the preparation of standards that will be accepted and used widely. Although it is necessary for the technical work to progress speedily, sufficient time is required for the discussion, negotiation and resolution of significant technical disagreements.

The concept of consensus is fundamental to the standards development process. Within the context of international standards, it is defined as: "General agreement, characterised by the absence of sustained opposition to substantial issues by any important part of the concerned interests and by a process that involves seeking to take into account the views of all parties concerned and to reconcile any conflicting arguments", with a note: "consensus need not imply unanimity." (8)

ii. **Discipline:** It requires adherence to deadlines and the preparedness of representatives of national bodies to read and digest new proposals. It requires the national bodies to formulate their opinions in a timely manner, taking into account the interests of all those involved at the national level.

iii. **Cost-effectiveness:** It means taking into account the total cost of the operation of drafting and agreeing on a standard, including direct administration costs, travel costs and the value of the time spent by experts in working groups and committees.

3. **Entities involved with ISO and IEC standards development**

The development of a standard is carried out by a Technical Committee (TC) under the control of either ISO or IEC. Each TC may operate with a number of Subcommittees (SCs) and Working Groups (WGs) or Project Teams (PTs). The...
key members of these committees and working groups are appointed by National Bodies (NBs) that represent the standards organisations in individual countries that are members to ISO or IEC (see also briefing note 1).

**National body (NB):** The principal participants in the standards development process are the National Bodies. These are referred to as Member Bodies in ISO and National Committees in IEC. Amongst the numerous countries that are members to ISO and IEC, the National Bodies conduct themselves differently. For instance, the criteria and cost for participation, subsequent member compositions, internal voting rights, decision-making processes, rules of conduct, choice and election for national representation, nomination of experts for Working Groups and Technical Committees, across the numerous National Bodies varies widely. Furthermore, the national entity responsible for ISO may be different from the national entity responsible for IEC.

ISO/IEC procedures do not (and cannot) prescribe or even influence the management of National Bodies. A proper interface is important. This means, inputs by the National Bodies are given to the International Standard Bodies and outputs from the international bodies are received back for information and further involvement of the National Bodies.

**Technical Committee (TC) and Sub-committee (SC):** The primary duty of a Technical Committee or Sub-committee is the development and maintenance of standards (see Annex for a list of TCs and SCs). A Technical Committee may be set up via several different routes. If the scope of a Technical Committee is extensive, then Sub-committees are set up. For RACHP standards, Technical Committees are already established, e.g.:

- ISO Technical Committee TC86 deals with refrigeration and air conditioning. Sub-committee ISO TC86 SC1 deals with safety and environmental requirements for RACHP systems;
- IEC Technical Committee TC61 deals with safety of household and similar appliances. Sub-committee IEC SC61C deals with safety of domestic and commercial refrigeration appliances, and Sub-committee IEC SC61D deals with safety of domestic and commercial air-conditioning appliances.

Any National Bodies may participate in the work of a Technical Committee or a Sub-committee. Their position may be as a:

- Participating (P-) member – to participate actively in the work, with an obligation to vote on all questions formally submitted for voting within the Technical Committee or Sub-committee, on new work item proposals, on enquiry drafts and final drafting of international standards;

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9 Once a standard has been developed and published, it is periodically reviewed. The process to keep the standard up to date is maintenance.

10 The number of participating and observer countries in any Technical Committee or Sub-committee differs from one Committee to another. It can be from 33 to 51.
Observing (O-) member – to follow the work as an observer and therefore to receive committee documents and to have the right to submit comments and to attend meetings.

Chairs of Technical Committees and Subcommittees are nominated by the ISO or IEC, Technical Committee or Sub-committee secretariat and can hold the position for up to six years. Chairs must act independently of national or sponsor interests and are expected to carry out a number of organisational and procedural tasks, including chairing meetings.

**Working Group (WG):** A Working Group is set up to carry out a particular task, for example, to revise an existing standard. Generally, the Working Group carries out the technical work that goes into the development of a standard. The Working Group reviews detailed technical issues, analyses data and test results, methodologies to be able to propose or support specific requirements in a draft standard. New Working Groups are proposed by a National Body, a Technical Committee or a Sub-committee.

The convenor of a Working Group is appointed by the relevant Technical Committee or a Sub-committee. The Working Group comprises a restricted number of experts individually appointed by the P-members and liaison organisations (see below) only.

Experts within the Working Group act in a personal capacity as experts and not as the official representatives of the National Body or liaison organisation or their employee. However, they are expected to feed information back to their National Body or liaison organisation as appropriate.

**Ad-hoc Groups:** Technical Committees and Sub-committees may establish Ad-hoc Groups, the purpose of which is to study a precisely defined problem on which the group reports to its parent committee at the same meeting, or at the latest at the next meeting.

Membership of an Ad-hoc Group shall be chosen from the delegates present at the meeting of the parent committee, supplemented, if necessary, by experts appointed by the committee. The parent committee shall also appoint a rapporteur. An Ad-hoc Group shall be automatically disbanded at the meeting to which it has presented its report.

**Liaison Organisations:** Liaisons may be established between a Technical Committee or a Sub-committee and other relevant entities. These may be with other committees or entities within ISO/IEC or with external organisations. Relevant documents can be shared and observers may be designated who can attend meetings and participate in discussions.

Liaisons between ISO and IEC committees that deal with similar subject matter are encouraged, especially to help avoid the possibility of overlap and duplication of efforts. Provided an external organisation has sufficient relevance and competence in the subject area then a liaison can be sought.
There are different levels of liaison which are structured in different categories:

- **Category A:** for Technical Committee or Sub-committee: Not for profit organisations that make a contribution to the work of the Technical Committee or Sub-committee. Such organizations are given access to all relevant documentation and are invited to meetings. They may nominate experts to participate in a Working Group.

- **Category B:** for Technical Committee or Sub-committee: Inter-governmental organisations that have indicated a wish to be kept informed of the work of the Technical Committee or Sub-committee. They are given access to reports on the work of the Technical Committee or Sub-committee.

- **Category C:** Reserved for ISO/IEC Joint Technical Committee.

- **Category D:** for Working Group: Not for profit organisations that make a technical contribution to and participate actively in a Working Group. These can be manufacturer associations, commercial associations, industrial consortia, user groups and professional and scientific societies.

Currently there are several liaisons within RACHP standards Technical Committees and Sub-committees, such as:

- between the committees IEC SC61C (refrigeration) and IEC SC61D (air-conditioning) and IEC SC61d and IEC SC31J (classification of hazardous areas and installation requirements);

- between the committees ISO TC86 (refrigeration and air-conditioning) and IEC SC61C (safety of appliances for household and commercial use) with bodies such as the European Committee of Domestic Equipment Manufacturers (CECED), the European Environmental Citizens Organisation for Standardisation (ECOS, which is an NGO), the International Institute of Refrigeration (IIR), the United Nations Economic Commission for Europe (UNECE), and the United Nations Environment Programme.

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### 4. Basic steps for the development of a standard

The stages required to develop or amend an international standard are summarised below. For ISO, there are 5 stages. For IEC, there is an extra stage – the approval stage.
i. **Proposal stage:** A New Work Item Proposal (NP) is submitted in the form of proposed text for either a new standard or an amendment to an existing standard. The New Work Item Proposal may be offered by a National Body, the secretariat of the relevant Technical Committee or Sub-committee, a different Technical Committee or Sub-committee, a "category A" liaison organisation or from an entity higher up the ISO or IEC organisation. The New Work Item Proposal is circulated to relevant P-members for a decision by vote and to O-members and liaison members for information. The New Work Item Proposal is accepted if a simple majority of P-members are in favour and there is sufficient commitment from National Bodies to participate in the development of the project.

ii. **Preparatory stage:** The preparatory stage leads to a working draft (WD). A Working Group or Project Team is normally set up, with experts from P-members and category A and D liaison organisations. The Working Group develops the working draft, which may include intermediate circulation of a draft to National Bodies for their review. The preparatory stage ends when a working draft is available for circulation to the members of the Technical Committee or Sub-committee as a Committee Draft (CD).

iii. **Committee stage:** During the committee stage comments from National Bodies are taken into consideration, with a view to reaching consensus on the technical content. A committee draft is circulated to all P-members and O-members for consideration over a period of 8 – 16 weeks. The National Bodies’ comments usually lead to a revised committee draft. Consideration of successive drafts continues until consensus of the P-members has been reached or a decision to abandon or defer the project has been made. The committee stage ends when all technical issues have been resolved and a committee draft is accepted for circulation as an enquiry draft.

iv. **Enquiry stage:** At enquiry stage, the draft – Draft International Standard (DIS) in ISO and Committee Draft for Vote (CDV) in IEC – is circulated to all National Bodies for a 12-week vote. Votes submitted by National Bodies can be positive, negative, or abstention. A positive vote may be accompanied by editorial or technical comments; the secretary, in consultation with the chair of the Technical Committee or Sub-committee and project leader will decide how to deal with them. If a National Body finds an enquiry draft unacceptable, it votes negatively and states the technical reasons. It may indicate that the acceptance of specified technical modifications will change its negative vote to one of approval. An enquiry draft is approved if:

- a two-thirds majority of the votes cast by the P-members of the Technical Committee or Sub-committee are in favour, and
- not more than one-quarter of the total number of votes cast are negative.
If the approval criteria are met, an ISO document proceeds directly to publication. For IEC, if no technical changes are to be made, the document proceeds directly to publication. Otherwise, a Final Draft International Standard (FDIS) is submitted. If the approval criteria are not met, a revised enquiry draft is normally developed and the procedure is being repeated. The Directives state that every attempt shall be made to resolve negative votes. When the chair has taken the decision to proceed to the approval stage or publication stage, the secretariat of the Technical Committee or Sub-committee shall prepare, within a maximum of 16 weeks after the end of the voting period and with the assistance of its editing committee, a final text of the Final Draft International Standard.

v. Approval stage (IEC only): At the approval stage, the Final Draft International Standard is distributed within 12 weeks to all National Bodies for a 6-week vote. Votes submitted by National Bodies can be positive, negative, or abstention. If a national body votes positively, it cannot submit any comments. If a National Body finds the Final Draft International Standard unacceptable, it must vote negatively and state the technical reasons. If the Final Draft International Standard is approved, it proceeds to the publication stage; otherwise the document is referred back to the Technical Committee or Sub-committee for reconsideration in the light of the technical reasons submitted. The committee may decide to resubmit a modified draft as a committee draft, enquiry draft, Final Draft International Standard or even cancel the project.

vi. Publication stage: the approved draft (from the enquiry stage for ISO or from the approval stage for IEC) is published. This should be done within 4 weeks of approval.

The process described above can take as little as 6 months or could be up to 5 years for major projects or when there are widely differing technical opinions.

Apart from standards, there are other types of documents that can be issued as part of the standards development process – Technical Specifications (TS), Publicly Available Specifications (PAS) or Technical Reports (TR) – which may arise in the event of difficulties in achieving consensus for a standard or the need to issue a document rapidly given the urgency of an issue.

At the end of the Preparatory Stage, the committee may decide to publish the final Working Draft as a Publicly Available Specification (PAS) to respond to particular market needs. A Publicly Available Specification is permitted if there is no conflict with existing International Standards and following simple majority approval of the P-members. A Publicly Available Specification shall remain valid for an initial maximum period of 3 years.

During the Committee Stage or Approval Stage, if the technical issues cannot all be resolved within the allocated time, the Technical Committee or Sub-committee may consider publishing a Technical Specification as an intermediate deliverable.
Amongst the most relevant RACHP safety standards, there are several activities presently underway that relate to extending the applicability of alternative refrigerants. The processes are dynamic and subject to continual change, so providing specific details here is inappropriate. However, table 1 provides a brief overview of the current situation.

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<thead>
<tr>
<th>STANDARD</th>
<th>PROJECTS</th>
<th>DESCRIPTION/CURRENT STAGE (MARCH 2017)</th>
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</thead>
<tbody>
<tr>
<td>IEC 60335-2-89</td>
<td>WG 4: To define the maximum flammable refrigerant amount for appliances and measures to maintain the equivalent safety level as for the present limit.</td>
<td>A revised draft for comment is being circulated for comments. The draft includes requirements to allow an increase in charge size for all flammable refrigerants.</td>
</tr>
<tr>
<td>IEC 60335-2-40</td>
<td>WG 9: Addition of coverage for A2L refrigerants</td>
<td>Committee Draft for Vote (CDV) accepted and will be submitted for another CDV or FDIS. Increase in A2L charge size; increase in A2L charge size by a factor of 10 with associated measures. It also includes alternative measures for addressing sources of ignition.</td>
</tr>
<tr>
<td>ISO 5149</td>
<td>WG 16: Address A2 and A3 refrigerants</td>
<td>Drafts for comment: (a) on &quot;releasable charge&quot;, which accounts for refrigerant charge retained within the system after a leak; and (b) on revised charge formula for when airflow mixes a leak and improved tightness in preparation.</td>
</tr>
<tr>
<td>ISO 5149</td>
<td>SC61D: Addresses carbon dioxide (R744) and similar refrigerants in potentially transcritical refrigeration systems</td>
<td>A Committee Draft for Vote on improved requirements for transcritical systems was accepted and will be submitted for Final Draft International Standard.</td>
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11 IEC 60335-2 series: Safety standards on household and similar electrical appliances
12 ISO 5149: Refrigerating systems and heat pumps
Options for interventions of interested parties

Sections 3 and 4 above summarise the main entities that are involved with standards development and identifies the numerous roles where stakeholders can participate in and influence the development process. Section 5 highlights the various stages involved for the development, adjustment and acceptance of content of a new standard, a revision or an amendment of that standard, indicating the points when stakeholders can exercise interventions.

Currently, with the development of the various RACHP safety standards, there are a relatively small number of enterprises involved throughout all the stages in the development process. Whilst there are tens of thousands of equipment manufacturers, installation and service contractors and end users of RACHP systems and equipment, current active participation in the standards development process is in the order of a few tens of stakeholder entities. This highlights the importance of participation from other interested parties as well.

There are three main reasons for the lack of widespread participation of stakeholders:

- **i.** the high investment costs involved, associated with assigning staff to continually review and comment on documents, frequent national and international travel to participate in meetings and carrying out theoretical and experimental work for the purposes of drafting and supporting proposals and counter-proposals.

  However, it is often possible to participate remotely in meetings, whether of Working Groups, Project Teams, Technical Committees or Sub-committees;

- **ii.** due to the process typically being drawn out over a period of several years, the benefit from that investment will take several years to manifest. It is deemed easier for enterprises to simply accept what other stakeholders formulate within a standard and fit new technology into the constraints arising from what is published;

- **iii.** lack of knowledge of the standards development process. There is often an assumption within enterprises that standards are developed by some discrete entity, rather than the process being potentially open to almost any stakeholder.

A number of actions or interventions can be identified for those interested parties wishing to adopt and use alternative refrigerants and associated technologies. Such parties may consider the following:
The relevant National Body could become a P-member of the applicable RACHP technical committee;

Interested enterprises or government representatives become an active member of the National Body;

The representatives from enterprises and government attend meetings of the relevant Technical Committees and Sub-committees;

Representatives become active members of the relevant Working Groups and/or Ad hoc Groups;

Enterprises actively gather data and carry out the necessary research and development activities necessary to develop the appropriate requirements and measures.

These interventions are highly demanding in terms of person-hours and financial resources. Involvement necessitates developing a detailed knowledge of the rules, procedures and workings of the process and implies substantial expenditure for travel and carrying out of the technical investigations.

ANNEX

List of Technical Committees and Sub-committees and their participating countries

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<thead>
<tr>
<th>STANDARD</th>
<th>PROJECTS</th>
<th>MEMBER COUNTRIES</th>
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