

## **Discussion of eco-design measures for high temperature chillers**

### ***Meeting notes for Friday 14 December 2012***

**Venue:** DG Enterprise, Avenue d'Auderghem, Brussels, 1049

**Timing:** 11 AM to 3PM.

**Attendees:** Ugo Miretti (DG ENTR); Jeremy Tait (Tait Consulting / CLASP Europe); Philippe Riviere (ARMINES); Hermann Renz (Bitzer); Veerle Beelaerts (Daikin); Joop Hoogkamer (Eurovent); Regis Leportier (Tecumseh); Dieter Mosemann (GEA Group); Paul DeLarminat (JCI); Hannah Herscheid (EPEE).

#### ***Introduction (Commission)***

Ugo Miretti welcomed the attendees and provided a brief overview of the status of the regulatory proposals. These proposals currently include a note that minimum requirements for high-temperature chillers are being considered but certain technical and administrative issues would need to be addressed before they could be inserted into any regulation. This will be presented to the impact assessment board on 30<sup>th</sup> of January; if the technical and administrative issues can be addressed in time, requirements for high-temperature chillers could still be inserted into the regulation. The dates of implementation are not set in stone although it would be the Commission's intention to preserve the previously drafted separation between tiers.

AOB items suggested were:

- The impact of potential F-Gas regulation banning use of R404A
- The proposed minimum requirements for condensing units at tier 2 could be particularly punishing for small units.

#### ***Overview of JIEG suggested approach to deriving minimum requirements for high temperature industrial process chillers***

- i. Hermann Renz explained the approach, beginning with the suggestion that if the 7°C water leaving temperature is applied to both air conditioning chillers and to industrial process chillers<sup>1</sup> then it can be considered that these two types of product are equivalent in their role.
- ii. Through some discussion, Jeremy Tait summarised the approach as:
  1. Starting point is the Lot 6 minimum requirements for EER as a reference threshold (the Lot 6 preparatory study proposes three scenarios of different stringency for requirements, although each has the same value of EER; only SEER changes)

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<sup>1</sup> It is currently stated in the working document that process chillers should have a 6°C leaving temperature – the JIEG has suggested that it is appropriate to modify this to 7°C.

2. Reasonable assumptions can be made for each main sub-type of chiller on the conditions imposed on the compressor by the refrigeration system and the features typical in an industrial process chiller (these include fan power, fan speed regulation method, heat rejection temperature etc) – the so called boundary conditions.
  3. Boundary conditions can be assumed that would be applicable for industrial process chillers (hours of use at the different cooling load levels as per SEPR document, typical nominal and off design condenser and evaporator refrigerant / fluid temperature differences).
  4. Expert knowledge of the market and technologies can be used to select a manageable number of base case chillers (i.e. to list the types of chiller most predominant in the market that collectively would be reasonably representative of the whole industrial process chiller market). Software modelling tools and other expert insight can be applied to each base case of chiller, taking the external conditions described above, to derive efficiency levels for the compressor/fans/pump unit in a representative sample of industrial process chiller basic cases that are equally demanding as those set under Lot 6
  5. Those efficiency levels for the compressor/fan/pump unit can then be applied within the standard SEPR calculation approach to derive an SEPR value for each base case chiller.
  6. Further expert insight can be applied to determine the technology improvement options that could be applied to those base case chillers, taking into account the economic and savings impact and so an appropriate uplift determined from the SEPR values deemed equivalent to those set under Lot 6.
  7. The range of SEPR figures thus derived can be used to judge a single SEPR figure for each capacity segment that could be adopted as the regulatory minimum requirement under Lot 1. This would include judgements on the proportion of the market made up by each base case to weight the figures.
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- iii. Clearly expert judgement plays a significant role in determining the level of the figures derived.
  - iv. The group agreed that an alternative approach based upon real products in the market should be applied to cross check the appropriateness of the theoretically derived numbers. ARMINES has been appointed by the commission to assist with that cross examination, drawing on experience gained through Lot 6 preparatory study analysis. This would be dependent upon securing data from other manufacturers – this level of detail is not generally available in product brochures and would have to be calculated and delivered by manufacturers, or could be derived from design software used by manufacturers. It was accepted by all present that both approaches have their risks and uncertainties. Professional judgement is a necessary part of both approaches.
  - v. Hermann Renz raised a query on the Lot 6 EER requirements as to whether they are based on calculations using the highest efficiency. Proposed EER MEPS in Lot 6 are based on market data: The impact of the proposed MEPS on the market is illustrated in Lot 6 study, Task 7, page 85.
  - vi. The upper and lower thresholds for each capacity range should also be considered further to ensure they are appropriate. It has been suggested to retain the same capacity thresholds as in Lot 6 for both air cooled and water cooled chillers. It has also been suggested by the JIEG

that an additional 1000 kW threshold could be necessary for water cooled chillers as this share of the market is dominated by centrifugal chillers.

**Obtaining product performance data on which to base analysis**

- i. GEA Group and Bitzer have product performance data and/or software that could be useful to this process and will make it available.
- ii. Further modelling is required to develop the necessary boundary conditions for water cooled chillers (focus so far has been on air cooled chillers)

**ACTION: The Commission** will write to chiller manufacturers requesting data to inform this process, with the proviso that in the absence of better data, the commission will derive thresholds based upon significantly more stringent performance levels than those proposed under Lot 6 (the stringency of which is justified due to the much higher average usage hours experienced by process chillers compared to air conditioning chillers).

**ACTION: ARMINES** will draft a specification for the data that could be requested from chiller manufacturers.

**ACTION: Hermann Renz** to write down and if necessary further develop the boundary conditions to be applied in the modelling, and to list out the base cases (chiller types) that are to be deemed representative of the whole market - supported by ARMINES and JIEG as required.

**ACTION: Eurovent** will provide the Commission with contact details for senior technical managers within all manufacturers that are members of the Eurovent chiller group.

**Definitions for products under Lot 1 vs. Lot 6**

- i. The Commission expressed a wish to base regulation on a clear technical definition to distinguish products due to the ambiguity that could arise if classification is only reliant upon a declaration of intended use by suppliers.
- ii. The group considered what technical features or definitions might allow clear distinction between air conditioning chillers and industrial process chillers. It was agreed that the fact that many purchases are made without clear distinction between end use conditions is a market failure (failure of availability and use of product performance information) that could usefully be addressed.
- iii. One distinguishing feature, arising due to the technologies and components employed, is that industrial process chillers can operate the whole year round, including in low ambient temperatures. Whereas air conditioning chillers often cannot operate in temperature much below -10°C (difficult to define a definite threshold, but EN14825 indicates performance requirement only above +16°C).
- iv. The group suggested that it was potentially misleading for buyers to demand that suppliers publish SEER *and* SEPR data for all chillers – as some chillers would not be capable of physically operating as set out in the SEPR calculation.
- v. The manufacturers of the group were in favour of a self-declaration of intended purpose. There was some discussion of whether a warranty could be invalidated if a product declared

as for air conditioning use was used for an industrial process application – the Commission will look into this.

- vi. After some exploration of this there was consensus that a qualitative definition could be applied that “industrial process chillers are chillers designed to operate the whole year round”. This could be accompanied by a requirement that product documentation for air conditioning chillers must include a statement that the chiller is NOT designed for year-round operation (or only above a certain ambient temperature).
- vii. One potential issue on this definition is that chillers designed for free cooling operation can in practice deliver cooling in low ambients, but the compressor is not running (and indeed it may not be possible to run the compressor in those conditions). It could possibly be stated that free cooling operation does not on its own qualify a chiller as being “designed for year-round operation”.
- viii. Another technical difference is that IPC are often designed for operation by industrial PLC controllers, instead of by proprietary controllers supplied by the manufacturer. But this is not true for all IPCs and so cannot be used as a definition.
- ix. A supplier could be free to declare performance (and show compliance) under Lot 1 and/or Lot 6. But if the chiller is designed for year-round operation it must meet the Lot 1 requirements (which are more stringent).
- x. [Further logic should be pursued, for example: If a chiller is designed to operate the whole year round, then must both SEER and SEPR data be provided?].
- xi. Chillers from one particular supplier were suggested to be almost completely indistinguishable by end use – but discussion determined that this is an exceptional situation and occurs only because the chillers are all of a premium build quality, function and reliability. It is a more usual situation that air conditioning chillers are designed for the lower operating hours and conditions usual for that end use.

### ***Other issues on chillers***

- i. Veerle Beelaerts queried how multi-functional chillers and condensing units should be covered under the regulations. This will be considered by the Commission in due course.
- ii. The group agreed that it was appropriate to adopt a threshold between capacity categories at 400kW for HT chillers and for water cooled chillers only another at 1 MW as this aligns approximately with the boundaries between technology types in general use.

**ACTION: Veerle Beelaerts** to write to the commission to flag potential issues raised by this and provide a brief definition of the products in mind (with examples - links to brochures/web page useful please).

**ACTION: ARMINES** to check the validity of the performance tolerances indicated in the working document and provide comments to the Commission and JIEG.

**ACTION: Tait Consulting** to contact all chiller suppliers who responded to the impact assessment consultation to flag this initiative and invite participation and warn that a data request is imminent from the Commission.

**Update of SEPR explanatory documentation**

- i. Update is required of the degradation coefficient definitions, especially the default values suggested. Also in how SEPR is defined under the low, medium and high temperature classes.

**ACTION: ARMINES** to review the SEPR documentation and calculation tool for technical completeness and presentation/clarity for users and provide comments back to JIEG.

**ACTION TAIT CONSULTING:** to remove the SEPR documents from the taitconsulting consultation web site and provide text and updated documents (when ready) to the Commission to make them available on a Commission web site.

**AOB: The impact of potential F-Gas regulation banning use of R404A**

- i. The F-Gas regulation is likely to be finalised in summer 2013 and the current draft is proposing to ban R404A refrigerant from [xxx? date]. This will impact the design choices of suppliers of all Lot 1 products including chillers. According to the DG CLIMA study by SKM Enviros, 60% of medium temperature chillers use R404A and close to 100% of low temperature ones (note: these figures are not necessarily applicable to industrial process chillers).
- ii. ASERCOM (EU industry association of compressor and associated products suppliers) will be meeting in January to review this situation. The group will update the Commission after that meeting.

**AOB: The proposed minimum requirements for condensing units at tier 2 could be particularly punishing for small units.**

- i. Tecumseh supply significant numbers of small condensing units to the market. Regis Leportier pointed out that the Tier 2 requirements proposed for condensing units will be particularly challenging for small units – the data set provided by the JIEG implies that 50% of products in that category will not meet the requirements.
- ii. In these small products, making use of simple low cost components, modulation control techniques are not applicable. Whilst other options exist (for example improved fans & motors, larger condensers) they are not (currently) economically attractive.
- iii. It was reported by Tait Consulting that it is not unprecedented for ecodesign regulations to remove half of the market products and that the increased costs associated with the proposed improved levels of performance are justifiable to end users in life cycle cost terms.
- iv. Tecumseh were invited to write to the Commission to provide further background and, if appropriate, explaining the particular economic or technical challenges and any alternative proposals.

**Jeremy Tait, 21 December 2012**

Tait Consulting Limited, supporting the work of CLASP and the European Commission on eco-design regulations on professional refrigeration equipment (Lot 1)

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