Technical Assistance Impact Assessment
Ecodesign and Energy Label

1st WG2 meeting 02.04.2020


The information and views set out in this study are those of the author(s) and do not necessarily reflect the official opinion of the European Commission
# 1 - Agenda

<table>
<thead>
<tr>
<th>#</th>
<th>Topics</th>
<th>Starting at approx.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(room open)</td>
<td>10:00</td>
</tr>
<tr>
<td>1</td>
<td>Opening of meeting / approval agenda / introduction of project &amp; team</td>
<td>10:30</td>
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<tr>
<td>2</td>
<td>Harmonised testing HP / presentation VHK – discussion items 2.1, 2.4</td>
<td>11:00</td>
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<tr>
<td>3</td>
<td>Harmonised testing HP / presentation BAM – discussion items 2.2, 2.3</td>
<td>11:30</td>
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<tr>
<td>4</td>
<td>Harmonised testing fuel boilers / presentation VHK – discussion 3.1, 3.2, 3.3</td>
<td>12:00</td>
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<tr>
<td></td>
<td>Lunch (12:30 – 13:30)</td>
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<tr>
<td>5</td>
<td>Verification tolerances / presentation VHK – discussion item 4</td>
<td>13:30</td>
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<tr>
<td>6</td>
<td>Third party conformity assessment / presentation VHK – discussion item 5</td>
<td>13:50</td>
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<tr>
<td>7</td>
<td>Scope extension to 1 MW / presentation VHK – discussion item 6</td>
<td>14:10</td>
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<tr>
<td>8</td>
<td>New ErP Group : Emitters and controls</td>
<td>14:30</td>
</tr>
<tr>
<td>9</td>
<td>Other:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Measurement conditions for sound power</td>
<td>15:00</td>
</tr>
<tr>
<td></td>
<td>- Temperature control factors</td>
<td>15:15</td>
</tr>
<tr>
<td>10</td>
<td>Any other business &amp; closure of meeting 15:45</td>
<td>15:45</td>
</tr>
</tbody>
</table>
1 - Team

• Primary responsible: EC, DG ENER
  • Policy officer: Veerle Beelaerts
  • Assistance: VHK
  • project leader: René Kemna
  • co-ordinator: Martijn van Elburg
  • WG leaders:
    • WG1 ('hydrogen'): René Kemna
    • WG2 ('testing'): Rob van Holsteijn
    • WG3 ('calculation'): René Kemna + Leo Wierda
    • Wg4 ('water heaters'): Martijn van Elburg
  • start Oct-Nov 2019, duration 24 months
1 - Introduction project

- **Reg. process**
- **IA project**
- **review study**
- **IA & cons. forum**
- **ISC**
- **WTO**

- **Ecodesign**
  - **Regulatory Committee**
  - **Scrutiny EP & Council**
  - **Adoption EC**
  - **Objection EP & Council**

- **Energy Labelling**
  - **Expert group MS**
  - **Adoption EC**
  - **Objection EC**

- **Voluntary Agreements procedure**
  - Notify Voluntary Agreement & report to European Parliament & Council (no right of scrutiny)
  - Adoption by European Commission of Report & VA (written procedure)
  - Publication Report & Agreement & Letter to signatories

- **open public consultation**
- **4 week Feedback mechanism**

- **prep. study**
- **ISA**

- **ECodesign Work Plan**

- **2017 - .. 2019**
- **2020**
- **2021**
- **2022**
- **2023**
- **2024**
- **Sep 2025**
- **Sep 2026 - .. 2030**

- **2 April 2020**
- **1st WG2 meeting**
# 1 - Project structure

## Part 1 of project (WG meetings until summer 2020)

<table>
<thead>
<tr>
<th>WG1 ‘Special subjects’</th>
<th>WG2 'Testing'</th>
<th>WG3 'Calculation'</th>
<th>WG4 'Water heaters'</th>
</tr>
</thead>
</table>
| **13 Feb 2020**
4 May 2020 | 2 Apr 2020
25 Jun 2020 | 10 Mar 2020
2 Jun 2020 | 20 Jan 2020
New date to be decided |
| Decarbonising the gas-grid | Tdesign 65ºC | Revised calculation Ecodesign / Labelling (a.o. hybrids) | Tech.spec. limits |
| Boiler: Oversize, bin method | | | Scope + Def's. |
| PEF (primary energy factor) | Verif.tolerances | | Storage tank |
| | | Package label | PFHRD |
| | | | |
| | | Scope 1 MW | NOx limits |
| Cogeneration | | | Solar device contribution |
| Shared chimney (B1, C4/C8) | Emitters & controls | | Single WH reg. |
| | Label design | | |

**Working Documents for CF planned:** WH June 2020, SH end of 2020

## Part 2 of project

Impact Assessment reports (internal EC, until Regulations published)
# 1 – Discussion document

<table>
<thead>
<tr>
<th>Topics</th>
<th>VHK Task 6 Report, July 2019</th>
<th>Discussion document</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harmonised test points heat pumps</td>
<td>Par. 3.3.2</td>
<td>Par. 2.1, 2.2, 2.3, 2.4</td>
</tr>
<tr>
<td>Harmonised test points fuel boilers</td>
<td>Par. 3.3.3</td>
<td>Par. 3.1, 3.2, 3.3</td>
</tr>
<tr>
<td>Verification tolerances</td>
<td>Par. 2.5</td>
<td>Par. 4</td>
</tr>
<tr>
<td>Third party conformity assessment</td>
<td>Par. 2.6</td>
<td>Par. 5</td>
</tr>
<tr>
<td>Scope extension to 1MW (testing issues)</td>
<td>Par. 2.7</td>
<td>Par. 6</td>
</tr>
<tr>
<td>New ErP group: Emitters and Controls</td>
<td>Par. 2.11</td>
<td>Par. 7</td>
</tr>
</tbody>
</table>
2 – Harmonized testing heat pumps

Item 2.1 Assessing heat pump performance

Relatively low-test temperatures compared to actual seasonal average real-life system temperatures.

Proposal is to replace the medium temperature application with the high temperature application \((max \ T_{out} = 65°C)\), which corresponds to a seasonal average system temperature of 38°C.

<table>
<thead>
<tr>
<th>EN 14825 test temperatures and related system temperatures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Application</td>
</tr>
<tr>
<td>Design temperature</td>
</tr>
<tr>
<td>Bin-weighted average (T_{sys})</td>
</tr>
<tr>
<td>(Avg \ T_{sys \ new \ built})</td>
</tr>
<tr>
<td>(Avg \ T_{sys \ existing \ dwellings})</td>
</tr>
</tbody>
</table>
Item 2.1 Assessing heat pump performance

Advantages of this approach are:

• That realistic efficiency figures are presented to the large replacement market, providing more adequate information regarding its applicability in existing buildings.

• That it creates an additional incentive for the industry to develop heat pumps with improved performance at higher system temperatures (already ongoing)

• That is points into the right direction for exploiting the huge saving potential of heat pumps in the existing building stock
2 - Harmonized testing heat pumps

Item 2.1 Assessing heat pump performance

Question 1a

• What should test temperature regimes reflect? The average real-life temperature applications or test temperatures that are optimized for the product under test? Are there alternative suggestions?

Question 1b

• If test temperatures should reflect real life situations, what are the actual seasonal average system temperatures for new built and existing dwellings? Do the differ from the ranges indicated in Table 1.
2 - Harmonized testing heat pumps

Item 2.3 Display $\eta_s$ on Energy Labels

A consequence of technology neutral energy labels for space heaters is, that the differentiation in energy efficiency between products of one technology are limited.

For that reason, different label class ratings are now used for LT- and MT- applications (with the LT classes being 25 percentage points higher). As a result, large differences in annual efficiencies are not visible on the label and therefore not emphasized.
2 - Harmonized testing heat pumps

Item 2.3 Display $\eta_s$ on Energy Label

Recommendation in review study is to show the actual seasonal efficiency on the energy label. Showing the efficiency number will help installers and consumers to know, how large the efficiency difference is and as regards MT versus LT, how much they would be saving by e.g. changing emitters and/or system controls and/or airtightness and insulation values of the dwelling.

Furthermore, including information in the product information sheet on how much the energy efficiency of space heater increases by reducing system temperatures and how this can be achieved would be beneficial.

Question 4

Do experts support the approach proposed here?
3 - Harmonised testing heat pumps

Item 2.2  Dynamic testing of heat pumps

Tests are now done with fixed compressor frequencies and not with the controls that are applied in real-life operation.

Stakeholders claim that the harmonised test standard EN 14825:2016 for testing of heat pumps:

• does not reflect real life operation due to abnormal (fixed speed) operation;
• lacks comparability of different appliances, since individual control strategies are not considered (inactive control);
• does not allow for the independent compliance verification by market surveillance authorities (as manufacturers may have to be involved in preparing the product for testing).
3 - Harmonised testing heat pumps

Item 2.2 Dynamic testing of heat pumps

PROPOSAL REVIEW STUDY
A dynamic test method is proposed instead. Further development of the method is needed before it could be adopted. Topics to be addressed:
• stability of test condition (inlet temperature and ambient conditions);
• costs related to dynamic testing;
• comparison test results (dynamic versus fixed speed);
• scope of products that can be tested.

Question 2a
Do experts in principle agree that the dynamic test method better represents the real-life performance of the heat pump?

Question 2b
Do experts agree that this dynamic test method must be further developed by standardisation bodies and eventually introduced as the new test method?
3 - Harmonised testing heat pumps

Item 2.4  Heat pumps settings

Heat pumps, including gas-electric hybrids, can be controlled in various manners, either optimising energy efficiency, reducing operating costs, minimising noise, enhancing comfort, etc.

Normally products are tested in "out-of-the-box" mode (no changes to product settings prior to testing), but this can still be misused in tests.

Consumer organisations test the energy efficiency of heating products while set in 'comfort mode', and product comfort in 'eco-modes' so that the efficiency or performance realised in real-life will not be less than tested.

**Question 3**

*Should heat pump settings be defined? Do experts agree?*

*Which conditions should be used regarding product settings according to the experts, and how to define them?*
According to the transitional method:

\[ \eta_{son} = 0.15 \times \eta_1 + 0.85 \times \eta_4 = 96.5\% . \]

\[ \eta_1 \] is the efficiency measured at 100% load and a return temperature of 60°C. 
\[ \eta_4 \] is the efficiency measured at 30% load at a return temperature of 30°C.

These test points results in an assumed average seasonal return temperature of 34.5°C. According to monitoring studies these values are not achieved in real-life; the averaged real-life seasonal return temperatures for dwellings with fuel boilers are considerably higher.
4 - Harmonised testing fuel boilers

Item 3.1 Assessing fuel boiler performance

Currently: too optimistic assumptions regarding

• Ratio of *heat load dwelling* to *emitter capacity*, leading to seasonal average system temperatures that are estimated too low

• Performance of temperature- and flow controls

• The effect of oversizing the boiler capacity vis-à-vis the heat load of the dwelling (heat pump is sized at 10 kW, the average boiler capacity 24 kW).

Given the above, and the fact that it is not logical to use different test temperature- and load conditions for different type of heat-generators, heating the same dwelling/emitter system, it is proposed to use the same harmonized test conditions.
## 4 - Harmonised testing fuel boilers

### Item 3.1 Assessing fuel boiler performance

Fossil fuel fired boiler – Test conditions for **Low temperature** applications

<table>
<thead>
<tr>
<th>Test conditions</th>
<th>Part Load Ratio in % of nominal capacity P1 (in kW on GCV @60/80 °C return/supply temperature)</th>
<th>Indoor heat exchanger return/supply temperatures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fixed outlet °C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>A</td>
<td>Osizes*88</td>
<td>n/a</td>
</tr>
<tr>
<td>B</td>
<td>Osizes*54</td>
<td>Osizes*100</td>
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<tr>
<td>C</td>
<td>Osizes*35</td>
<td>Osizes*64</td>
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<tr>
<td>D</td>
<td>Osizes*15</td>
<td>Osizes*29</td>
</tr>
<tr>
<td>G</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

*Osizes is Oversize factor where Osizes=1 for boilers with P1≤10 kW or Osizes=1/2.4 for boilers with P1>24 kW or Osizes=10/P1 for boilers with 10 kW>P1≤24 kW. Values for Average climate shall be determined by tests. Values for Warm and Cold climate may be determined by calculation.*
# 4 - Harmonised testing fuel boilers

## Item 3.1 Assessing fuel boiler performance

**Fossil fuel fired boiler – Test conditions for High temperature applications**

<table>
<thead>
<tr>
<th>Test conditions</th>
<th>Part Load Ratio in % of nominal capacity P1 (in kW on GCV @60/80 °C return/supply temperature)</th>
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<tbody>
<tr>
<td></td>
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<td></td>
<td>Osize*15</td>
</tr>
<tr>
<td>G</td>
<td></td>
<td>n/a</td>
</tr>
</tbody>
</table>

*Osize is Oversize factor where Osize=1 for boilers with P1≤10 kW or Osize=1/2.4 for boilers with P1>24 kW or Osize=10/P1 for 10 kW<P1≤24 kW. Values for Average climate shall be determined by tests. Values for Warm and Cold climate may be determined by calculation.*
4 - Harmonised testing fuel boilers

Item 3.1 Assessing fuel boiler performance

**Question 5**

Do experts agree that there is no valid argument for using different test temperatures and load conditions for assessing the energy performance of a fuel boiler to heat the same dwelling with the same emitters (compared to a heat pump heating this dwelling)?

**Question 6**

Do experts agree that a comparison between heat generators becomes more realistic and clearer for consumers and installers when harmonized test conditions are used?
4 - Harmonised testing fuel boilers

Item 3.2 Inter- and extrapolation of test points

Further to the test points introduced for LT and HT applications, it is proposed to use only 4 actual tests

- $51/61 \, ^\circ C$ and $29/34 \, ^\circ C$ at $\text{PLR}= \text{Osizes}\times88\%$
- $22/32 \, ^\circ C$ and $19/24 \, ^\circ C$ at $\text{PLR}= \text{Osizes}\times15\%$

and to calculate the efficiencies of the boiler in LT- and HT applications through inter-/extrapolation.

Compared to today, the testing costs will double, i.e. from €2000 to €4000-, but will still be half of HP test costs and have no impact on the boiler price.

**Question 7**
Is it acceptable to limit boiler testing to the suggested 4 points and derive the missing points through inter-/extrapolation? Any suggestions for alternatives?
4 - Harmonised testing fuel boilers

Item 3.3  Boiler settings

Similar to heat pumps, fuel boilers may require a certain setting to be applied or configuration to be established.

The regulations should be unambiguous as regards the configuration to be used for conformity assessment or verification of performance.

For the water heating efficiency of combination boilers, it is advised the regulation should specify the setting (often labelled 'eco' and 'comfort' whereby the latter periodically heats up the heat exchanger of instantaneous combis) used for testing.

**Question 8**

*Which conditions should be used regarding product settings according to the experts, and how to define them?*
## 5 – Verification tolerances

<table>
<thead>
<tr>
<th>Category</th>
<th>Current</th>
<th>RRT results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel boilers</td>
<td>8%</td>
<td>4% (for the future 2.5 -3% is achievable)</td>
</tr>
<tr>
<td>mCHP</td>
<td>8%</td>
<td>8% remains challenging for FC and ICE</td>
</tr>
<tr>
<td>Gas fired HP</td>
<td>8%</td>
<td>5% was found (for future 3-4% is achievable)</td>
</tr>
</tbody>
</table>
| Electric HP               |         | RRT-tests are not considered representative for market surveillance purposes due to large differences in appliance types, controls, component sizing, etc. It is recommended to match tolerances with efficiency class ranges RTT-results:  
  - Air to water HP (var. speed, 12 kW) = 16%  
  - Water to water HP (32 kW) = 8% |
| Hybrid HP                 | Not covered |                                                                                   |
| Inst. Gas WH             | 8%      | 5% (after improvements 4% achievable)                                         |
| Gas storage WH           | 15%     | 13% (after improvements 6-8% achievable)                                       |
| Dedicated HPWH           | 6%      | (broader basis needed for conclusions)                                         |
| V40                      | 3%      | 18% for 111ltr GSWH; 6% for 300ltr HPWH                                        |
| NOx                      | 20%     | Higher values are measured; it is recommended to use a tolerance expressed with an absolute part B and a relative part A: TOL=A*Measured value + B |
| Sound power              | 2 dB    | Slightly higher values were measured. Maybe apply different limit values for different technologies? 2.5 – 3 dB tolerance should be achievable. |
| Standby heat loss        | 5%      | 11.5 – 12.5 % (current values probably to low?)                               |
The preliminary results of the tests indicate that for the efficiency of gas- and oil-fired boilers and instantaneous water heaters the verification tolerances can be drastically reduced (e.g. space heating efficiency of gas/oil boilers) whereas for other types and parameters the current tolerances can be considered challenging.

**Question 9**

*What are experts opinions on the adjustments needed regarding verification tolerances?*
6 - 3rd party conformity assessment

Today’s situation:

1. Electric products: self-declaration by the manufacturers

2. Fossil fuel fired boilers: space heating efficiency only a type-test is performed under responsibility of a Notified Body (Module B) and the manufacturer declares the final product in conformity with the relevant regulations (Module C)

Mandatory third-party conformity assessment introduced under Gas Appliance Directive, and taken up in Boiler Efficiency Directive 92/42/EC
6 - 3rd party conformity assessment

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher credibility of performance and efficiency</td>
<td>Higher costs</td>
</tr>
<tr>
<td>Less risk of circumvention</td>
<td>More time-to-market for manufacturers</td>
</tr>
<tr>
<td>A level playing field especially vis-a-vis extra-EU products</td>
<td>Likely need for an expansion of laboratory capacity</td>
</tr>
<tr>
<td></td>
<td>Administrative burdens</td>
</tr>
</tbody>
</table>

Stakeholders opinions:
- Gas- and oil-fired heating boilers are in favour
- Member States are in favour but like a more thorough assessment of impacts, focusing on lab capacity, testing costs, preferences of Notified Bodies, and a discussion on which modules should be allowed/prescribed, etc.
- Certain heat pump manufacturers may accept a system with third-party conformity assessment, provide certain conditions are met (freedom in choice of module, etc.).
6 - 3rd party conformity assessment

**Question 10**
Do experts agree that third party conformity assessment should also become mandatory for the other (electric) appliances in the scope of the Ecodesign of space heating and water heating appliances?

**Question 11**
If yes, an assessment will be required (according to the Framework Directive art. 8.2) indicating that the proposed changes are duly justified and proportionate to the risk. Any suggestions from experts as to what should be evaluated and how to address this?
7 – Scope extension to 1 MW

• There is a regulatory gap at EU level for NOx limits of boilers between <400 kW (Ecodesign regulation) and >1 MW (Medium-sized Combustion Plants MCP regulation).

• Extending the scope from 400 kW to 1 MW will cover an extra 15% in energy consumption.

• In 93% of cases the replacement is like-for-like.

• Setting the scope to a rated thermal input equal to or smaller than 1 megawatt (1 MWth) also closes the gap in certain emission limits with the new Directive (EU) 2015/2193.
Most (not all) stakeholders are in favour of the proposed scope extension for space heating.

(For water heating the highest load profile would not nearly be enough to test these large appliances on that aspect.)

Differences/ possible issues:

• On-site testing due to limited laboratory availability.
• Compliance assessment in the MCPD is different.
Question 11

Do experts agree that extension of the scope to 1 MW boilers is a feasible method to address the currently not considered product group of virtually indestructible jet-burner boilers (80% oil-fired) in mainly public non-residential buildings and thereby addressing the huge saving potential in that sector?
8 - New ErP Group: Emitters and controls

*Topic Emitters is outside the scope of the study but considered relevant.*

Heat-load (HL) to emitter-capacity (EC) Ratio determines the actual design system temperature. The lower this ratio, the lower the system temperatures, the higher the generator efficiencies.

Optimising this HL/EC-Ratio results in additional savings of 10% (for boilers) and up to 50% or more (for heat pump systems) on $\eta_s$

Strategy for Existing dwellings

1. Reduce Heat-Load through building shell insulation and increasing airtightness

2. Increase emitter capacity @ low temperatures

Floor heating not always obvious in existing dwelling; furthermore available floor area may not always be enough to cover heat load
8 - New ErP Group: Emitters and controls

Example for average existing dwelling

**Heat Output steel panel radiator**

at various water temperatures

E.g. 50% reduction of **Heat Load** with insulation

Increase of **Emitter Capacity** at low temperatures in%
8 - New ErP Group: Emitters and controls

• Energy saving potential for high capacity LT-emitters in existing market is huge

• Next to high LT-capacity, flow and temperature controls play an important role (suboptimal flow and flow-temperatures through LT-emitters reduce savings)

• Focus on LT-emitters in both R&D, test standards and application is limited

• A new Preparatory Study in LT-emitters and related controls could further help identifying bottlenecks and opportunities in this field
Some examples of Heat Output of various Radiator types

@ dimensions LxHxD = 1000x500x140 mm

- Steel panel: 450, 625
- Cu/Al Convector: 475, 900
- Al Die-cast radiator: 500
- Al Extrusion panels: 500
- Numerically Optimized Al LT-emitter: 600, 1400
8 - New ErP Group: Emitters and controls

**Question 12**

Do experts agree that heat-emitters play a crucial role in achieving lower system temperatures in existing buildings and that there is insufficient knowledge and understanding as regards to how adequate radiator types and designs (including their hydraulic and temperature controls) can help lowering system temperatures?

**Question 13**

Do experts agree that a new Erp group ‘Emitters and Controls’ and related preparatory study can help further identifying bottlenecks and opportunities in achieving this large energy saving potential related to heat-emitters and their controls, for the existing building stock?
9 – Other issues

Measurement conditions for Sound Power for HP

• Regulation(s) 813/2013 & 811/2013 not specific in test conditions:
  • 813/2013, Annex III, 4.a: Sound power at *standard rating cond.*’s Table 3 (+7ºC) and *same declared capacity* (= 35% if inverter HP? 100% if fixed speed?)
  • 813/2013, Art.2, def.7: *Prated* of HPs is declared heat output at *standard rating conditions*; is reference design conditions; is -10ºC? Noise at Prated?
  • issues: Fixed speed vs.inverter, temp. at declared capacity vs. temp. in standard rating conditions? Tbiv vs. Tdesignh, LT vs. HT heat pump

• TransMethod & EN 12102-1: EN 14511-2 (+7ºC), EN 14511-3 ("set highest room temp.") + Annex A.4 for var.speed ("35% capacity at 36/28ºC" after clarification by EC)

• Eurovent Certita is testing at "full load" at +7ºC ("to maintain consistency of values")

• 'Touchy issue'?
  • What is *relevant* noise? Is it max. noise (full load?) or average noise?
  • Can *test info* for Ecodesign be used for proof of local sound *pressure* compliance?
  • Can we harmonise conditions?
9 – Other issues

**Measurement conditions for Sound Power for HP**

- **Problem:** Fixed test conditions may not be those for highest noise

- **VHK proposal for revised SH regulation** *(based on comments/positions of several stakeholders)*
  - declare max. compressor and fan rpm *(HT or LT specifies $T_{outlet}$)*
  - perform **sound test** at +7ºC
    - preferably at same rpm and Toutlet as max. above, if not possible, test at A7/W35, A7/W55 or A7/W65, whichever is loudest
    - this is the value to use for requirements, energy label, etc.
  - declare the rpm and Toutlet of this test condition, for loudest noise at +7ºC

- **Follow up:**
  - do mapping excercise: plot dB vs rpm vs $T_{outlet}$, define worst/average/best
  - indicate on label the rpm ratio (how far is known dB/rpm from 'worst' rpm) ?

- **Tonality** For some MS important. Experts say: the lower overall noise, the less relevant tonal noise; tonality is more immission related
  - Agree to put 1/3 octave info in techn.doc and let MS sort out if needed?

- **What about minimum values?**
9 – Other issues

Temperature Control factors in Regulation

Short Presentation by EHI
Thank you!

*Written comments before 2 May 2020 to*

r.van.holsteijn@vhk.nl