Walk through of standards

QUALITY PRODUCTS : OUTSTANDING CUSTOMER SERVICE : PROFIT TO OUR BUSINESS

NUAIRE: FOR THE COMPLETE VENTILATION SOLUTION.
Agenda

• Introduction.
• Background.
• The ISO Suite of Standards.
• Regulations & their influence.
• Proposed EN standards.
EN 12101-3 2015

Example of fan after an EN 12101-3 burn test.
Standards

• “A document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose. Standards can relate to anything, including definitions and classifications, manufacturing, process management or service delivery.”
History

- 1920 – Standardisation Committees.
- 1925 to 1996 - National Fan Standards.
- 1997 - 1st Ed ISO 5801.
ISO is made up of...
ISO 5801 Air Performance

- Reverting back to the three main points for fan characteristics Air Performance is probably the most critical element, this has been addressed in ISO 5801.
EN ISO 5801

Standard test configurations

A. Non-ducted.

B. Ducted on fan outlet.

C. Ducted on fan inlet.

D. Ducted on the fan inlet and outlet.
EN ISO 5801

Typical Performance curves for a forward curved centrifugal fan to different installation categories.
ISO Suite of Standards

- ISO 5801:2017 Fans - Performance testing using standardized airways.
ISO 5802: 2001

Industrial fans.
Performance testing in situ.
ISO 5802

In-situ testing.

- 6MW motor driven
  5m diameter
  Power Plant Axial
  flow ID fan
  courtesy of
  Howden Fan.
ISO 13347 Sound Measurement

Reverting back to the three main points for fan characteristics: Sound is the next characteristic of fans, which I will cover now with ISO 13347.
ISO 13347 Part 2
Reverberant Sound Cell.
ISO 13348

Tolerances, methods of conversion and technical data presentation.
ISO 13348 Tolerance Grades

- Series Produced Non Certified Fans & Non Series Produced Fans.

<table>
<thead>
<tr>
<th>Tolerance grade (air and noise)</th>
<th>Typical application</th>
<th>Material of, and manufacturing processes used for, major aerodynamic components</th>
<th>Approx. min. power kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN1</td>
<td>Mining (e.g. main fan), process engineering, power stations (e.g. exhaust fan), wind tunnels, tunnels, etc.</td>
<td>Machined in some places, cast (high accuracy)</td>
<td>&gt; 500</td>
</tr>
<tr>
<td>AN2</td>
<td>Mining, power stations, wind tunnels, tunnels, process engineering, air conditioning</td>
<td>Sheet or plastic material, partly machined, cast (medium accuracy)</td>
<td>&gt; 50</td>
</tr>
<tr>
<td>AN3</td>
<td>Process engineering, air conditioning, industrial fans, tunnels, power station fans and industrial fans for harsh (abrasive or corrosive) conditions</td>
<td>Sheet material, cast (medium to low accuracy), special surface protection (e.g. hot-dip galvanizing, moulded plastics</td>
<td>&gt; 10</td>
</tr>
<tr>
<td>AN4</td>
<td>Process engineering, ships fans, agriculture, small fans, power station fans and industrial fans for harsh (abrasive or corrosive) conditions</td>
<td>Sheet material, special surface protection (e.g. rubber coating), moulded or extruded plastics</td>
<td>__</td>
</tr>
</tbody>
</table>
ISO 13348 Tolerance Grades

Manufacturing tolerance grades.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>AN1</th>
<th>AN2</th>
<th>AN3</th>
<th>AN4</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume flow rate, $q_f$</td>
<td>±1%</td>
<td>±2.5%</td>
<td>±5%</td>
<td>±10%</td>
<td>$\Delta q_f = (q_f' - q_f)$</td>
</tr>
<tr>
<td>Fan pressure $p_F$</td>
<td>±1%</td>
<td>±2.5%</td>
<td>±5%</td>
<td>±10%</td>
<td>$\Delta p_F = (p_F' - p_F)$</td>
</tr>
<tr>
<td>Power, $P_f^{a,b}$</td>
<td>+2%</td>
<td>+3%</td>
<td>+8%</td>
<td>+16%</td>
<td>$\Delta P = (P_f' - P_f)$ Negative deviations are permissible. For small fans, $P_f$ shall be the motor input power</td>
</tr>
<tr>
<td>Efficiency, $\eta$</td>
<td>−1%</td>
<td>−2%</td>
<td>−5%</td>
<td>−12%</td>
<td>$\Delta \eta = \eta'$, i.e. the value of $\eta'$ is identical with the permissible tolerance of the efficiency. Positive deviations are permissible.</td>
</tr>
<tr>
<td>A-weighted sound power level, $L_{PA}^{c}$</td>
<td>+2 dB</td>
<td>+3 dB</td>
<td>+4 dB</td>
<td>+6 dB</td>
<td>$\Delta L_{PA} = L_{PA}'$, The value of $L_{PA}'$ is a permissible tolerance of the sound power level. Negative deviations are permissible.</td>
</tr>
</tbody>
</table>
ISO 13348

- Series produced certified programme fan tolerances.

Airflow Tolerance Curve
CFD
EN ISO 12759 – FANS - Efficiency classification for fans

Reverting back to the three main points for fan characteristics Input power is the next characteristic of fans, which I will cover now and its relevance to efficiency and EN ISO 12759.
ISO 12759


EN ISO 12759

Template for efficiency grades for fans without drives.
EN ISO 12759

- Efficiency grade template for cross flow fans.
EU 327/2011

• Regulations:


• Implementing Directive 2009/125/EC of the European Parliament and of the council with regard to the ecodesign requirements for fans driven by motors with an electric input power between 125 W and 500kW.

EU 327

Second tier minimum energy efficiency requirements for fans from 1 January 2015.

<table>
<thead>
<tr>
<th>Fan types</th>
<th>Measurement category (A-D)</th>
<th>Efficiency category (static or total)</th>
<th>Power range $P$ in kW</th>
<th>Target energy efficiency</th>
<th>Efficiency grade (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axial fan</td>
<td>A, C</td>
<td>static</td>
<td>$0,125 \leq P \leq 10$</td>
<td>$\eta_{\text{target}} = 2,74 \cdot \ln(P) - 6,33 + N$</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$10 &lt; P \leq 500$</td>
<td>$\eta_{\text{target}} = 0,78 \cdot \ln(P) - 1,88 + N$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B, D</td>
<td>total</td>
<td>$0,125 \leq P \leq 10$</td>
<td>$\eta_{\text{target}} = 2,74 \cdot \ln(P) - 6,33 + N$</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$10 &lt; P \leq 500$</td>
<td>$\eta_{\text{target}} = 0,78 \cdot \ln(P) - 1,88 + N$</td>
<td></td>
</tr>
</tbody>
</table>
FprEN 17166:2019 (E) – Compliance for fans to EU 327
FprEN 17166:2019 (E)

Mixed flow fan where the impeller, motor, mounting arrangements, housing, inlet cone and outlet guide vanes are within the boundary.

Key
1. Housing
2. Boundary
3. Impeller
4. Motor
5. Inlet cone
FprEN 17166:2019 (E)

In-line centrifugal fan where the impeller, motor, mounting arrangements, inlet cone and housing are within the boundary.
EU 1253

Regulations:

• Implementing directive 2009/125/EC of the European Parliament and of the council with regard to ecodesign requirements for ventilation units.
Ventilation units

Residential ventilation unit (RVU)

Rules SEC

EU1254

Air volume flowrate/ cu.m/h

< 250

250 < X > 1000

> 1000

Non-Residential ventilation unit (NRVU)

Manufacturer decides

UVU / BVU

UVU

BVU

No Filter

Filter/ No filter

Filter

Unit efficiency

Unit efficiency & SFPint

SFPint
SEC = \( (t_a \cdot pef \cdot q_{net} \cdot MISC \cdot CTRL^x \cdot SPI) - (t_h \cdot \Delta T_h \cdot \eta_h^{-1} \cdot c_{air} \cdot (q_{ref} - q_{net} \cdot CTRL \cdot MISC \cdot (1 - \eta_t)) + Q_{defr} \)
EU 1253

- Technical Report by the ‘Danish Technical Institute’.
- ISBN: 978-87-998971-0-0.
EU 1253

• NRVU-UVU with an impeller (boxfan).

Key
1. Impeller
2. Stator
3. Motor
4. Boundary
5. Casing
EU 1253 Annex III

• Specific ecodesign requirements for NRVUs, as referred to in Article 3(2) and 3(4).

2. From 1 January 2018:

— All ventilation units, except dual use units, shall be equipped with a multi-speed drive or a variable speed drive.

All BVUs shall have a HRS.

The HRS shall have a thermal by-pass facility.

— The minimum thermal efficiency $\eta_{,\text{run}}$ of all HRS except run-around HRS in BVUs shall be 73 % and the efficiency bonus $E = (\eta_{,\text{run}} - 0.73) \times 3000$ if the thermal efficiency $\eta_{,\text{run}}$ is at least 73 %, otherwise $E = 0$.

— The minimum thermal efficiency $\eta_{,\text{run}}$ of run-around HRS in BVUs shall be 68 % and the efficiency bonus $E = (\eta_{,\text{run}} - 0.68) \times 3000$ if the thermal efficiency $\eta_{,\text{run}}$ is at least 68 %, otherwise $E = 0$.

— 6.2 % $\times \ln(P) + 42.0$ % if $P \leq 30$ kW and

— 63.1 % if $P > 30$ kW.

— The maximum internal specific fan power of ventilation components ($SFP_{,\text{int,lim}}$) in W/(m²/s) is

— for a BVU with run-around HRS

\[ 1600 + E - 300 \times \frac{q_{,\text{run}}}{2} - F \text{ if } q_{,\text{run}} < 2 \text{ m}^3/\text{s} \text{ and} \]

\[ 1300 + E - F \text{ if } q_{,\text{run}} \geq 2 \text{ m}^3/\text{s}, \]

— 230 for an UVU intended to be used with a filter.

— If a filter unit is part of the configuration the product shall be equipped with a visual signalling or an alarm in the control system which shall be activated if the filter pressure drop exceeds the maximum allowable final pressure drop.
EU 1253

**Internal Specific Fan Power-** \( SFP_{int} \)

is the ratio between the internal pressure drop of the ventilation components and the fan (blower) efficiency for the reference configuration. Multiplied by the power ratio of the fan and unit.
Thank you

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