

BROKEN TRUST

Energy efficiency and
the refrigeration industry

Exploring the accuracy of declared
product performance data within
the European refrigeration industry

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OBJECTIVES OF THE WHITE PAPER

This White Paper aims to explore the accuracy of product performance data, with a spotlight on the European refrigeration sector. Drawing on research from Eurovent Certification, the White Paper focuses on the importance of reliable product performance data and the impact of discrepancies on all industry players.

“Broken trust: Energy efficiency and the refrigeration industry,” investigates the causes of data anomalies and the resulting impact on energy efficiency. A summary of the latest research on CO₂ heat exchangers provides a snapshot of a section of the industry. It concludes with solutions and recommendations to minimise deviations and ensure a match between data and performance.

THE ISSUE OF UNDERPERFORMANCE

THE IMPORTANCE OF PRODUCT PERFORMANCE DATA

Product performance data gives all actors in the industry vital information about the product and how it is expected to perform when installed. It is essential in comparing and selecting equipment, helping specifiers and buyers choose the correct refrigeration products for their project. This data allows designers to perfectly balance the operation of all system components to create the best solution for their clients. It improves the installer's knowledge of the system and ideal operating conditions, something crucial when installing, commissioning, maintaining and fault-finding equipment. For end users, performance data can help estimate carbon footprint, energy use and ongoing costs. For investors, product performance data can help show the viability of new technologies.

In short, all players in the refrigeration industry need access to accurate and precise product performance data.

However, declared data is not always correct. There is no legal requirement to have performance data independently or impartially verified, and so manufacturers can conduct their own product performance assessments and tests. Self-assessment testing facilities, test equipment calibration, processes and procedures can vary from manufacturer to manufacturer, allowing for bias and disparity in declared data.

CO₂: PRIMED FOR PROBLEMATIC PRODUCT PERFORMANCE

In response to changing regulations and market demands for low Global Warming Potential (GWP) refrigerants, Europe has seen a sharp rise in Carbon Dioxide (CO₂) refrigeration systems. While CO₂ is a proven refrigerant with a long history, current technology is less mature than the HFC counterparts it is replacing.

The self-assessment of expected performance and the testing of heat exchangers is complex, with a high range of variables impacting on performance. Added to this, CO₂ has its own unique properties, which require a unique testing process and correction factors to achieve accurate results. This makes CO₂ systems particularly vulnerable to discrepancies between expected and declared performance data.

DECLARED VS EXPECTED PERFORMANCE

Products that are specified based on incorrect data will not perform as advertised. It's a serious issue, as products that underperform can:

- Be non-compliant with regulations
- Not meet end user requirements
- Be more prone to faults and breakdown
- Result in complaints, penalties and litigation
- Lead to reputational damage – not just to HVAC businesses, but to CO₂ products and the industry in general.

It is vital those specifying products can trust the data. The best designed and installed systems will underperform if expected product performance does not match manufacturer claims.

CRUSHING GREEN CREDENTIALS

Crucially, even a slight underperformance can have a big impact over the lifecycle of the product. This is because the product will:

- Compensate by using more energy
- Create a larger carbon footprint
- Negatively impact on the performance and energy use of other parts of the system
- Incur much higher running costs.

Buyer beware: Any cost benefit from installing a cheaper product can be made redundant by the additional ongoing energy costs.

When it comes to decarbonisation and energy efficiency goals, selecting CO₂ refrigeration is beneficial, but not sufficient alone to guarantee performance or sustainability.

SUMMARY OF HEAT EXCHANGER RESEARCH

Table 1: Capacity range of sampled units.

| Capacity range | Sample Number of units |
|---------------------|------------------------|
| ≤50 kW | 11 |
| >50 kW and ≤100 kW | 9 |
| >100 kW and ≤150 kW | 10 |
| >150 kW and ≤200 kW | 9 |
| >200 kW and ≤250 kW | 6 |
| >250 kW | 3 |
| Overall | 48 |

* Not representative of the whole industry.

DATA SHEET ANALYSIS OF CO₂ GAS COOLERS

Eurovent Certification evaluated a sample of uncertified CO₂ Gas Coolers for which relevant data is accessible. The aim was to ascertain the deviations between the declared data and the expected performance of the selected CO₂ Gas Coolers.

Method

Using data sheet analysis, the study compared the claimed heat rejection of 48 CO₂ Gas Coolers under several market operating conditions.

Products were chosen from a sample* of uncertified manufacturers, active within the European market and with a range of capacities from ≤50 kW to >250 kW.

WHAT ARE MARKET OPERATING CONDITIONS?

Eurovent Certification evaluated the claimed heat rejection performance at Standard Condition A5 (SC20) and Conditions C5, C3 and C2. As product performance varies according to the installed environment, each condition measures expected product performance across different regions. Condition C relates to products installed in central and northern European climates.

Table 2: Market Conditions A5, C5, C3 and C2 as defined in the Technical Certification Rules of the Eurovent Certified Performance programme for Heat Exchangers.

| Condition in transcritical mode | Gas Cooler inlet pressure | Gas Cooler inlet temperature | Air inlet temperature | Gas Cooler outlet temperature | DT (temperature approach) |
|---------------------------------|---------------------------|------------------------------|-----------------------|-------------------------------|---------------------------|
| A5 (SC20) | 90 bar | 110°C | 30°C | 35°C | 5K |
| C5 | 80 bar | 100°C | 27°C | 32°C | 5K |
| C3 | 80 bar | 100°C | 29°C | 32°C | 3K |
| C2 | 80 bar | 100°C | 30°C | 32°C | 2K |

THE RESULTS

Eurovent Certification found deviations between claimed and expected performance across all capacity ranges of the sampled products. All declared heat rejection performances were higher than the heat rejection performances expected.

The lowest found deviation showed a 12% inaccuracy in expected performance. Crucially the highest found deviation indicated an 31% inaccuracy in expected performance. The average deviation across all 48 products was 23%.

100%

of capacity ranges saw deviations between claimed and expected performance

31%

The highest deviation across all units

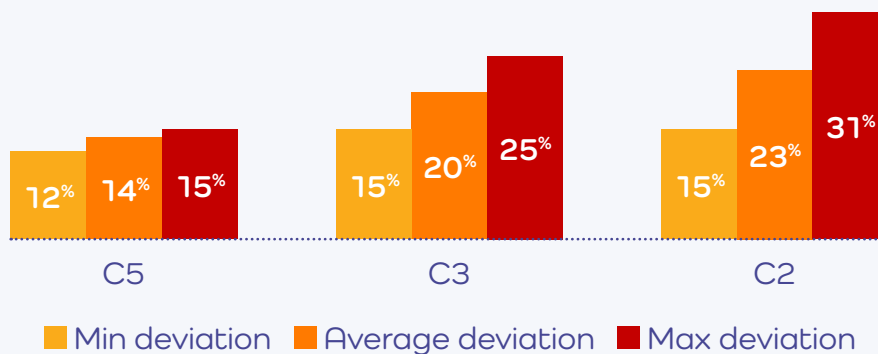
23%

The average deviation across all units

12%

The lowest deviation across all units

DEVIATIONS ACROSS THE CONDITIONS



KEY POINTS:

The research is a snapshot of one area of the non-certified sector. It does not include a large enough sample to estimate the accuracy of product performance data across the entire non-certified European refrigeration industry.

However, of the products sampled, all capacity ranges displayed deviations in data which led to inaccuracy in expected performance to the detriment of the customer.

This indicates that specifiers, buyers and HVAC professionals cannot always tell by declared data alone if a product will perform as claimed.

The problem of underperformance is not exclusive to CO₂ Gas Coolers. The issue can affect all HVAC and refrigeration products.

BUILDING TRUST

Once industry actors are aware of the potential gap between expected and claimed performance, they can take positive actions to mitigate the risks.

IDENTIFYING RELIABLE DATA

Mechanisms are well established in the sector to independently prove product performance via third-party laboratory testing or certification schemes.































Independent laboratory testing

The use of independent laboratories greatly reduces bias in the testing routine. Additionally, third-party laboratories are often at the forefront of product testing, using the latest technologies and test methodologies to calculate actual performance.

Voluntary product certification

Certification takes independent laboratory testing and adds in additional levels of evaluation. It removes direct contact between manufacturer and laboratory, offering true impartiality. Therefore, certification is often used as an identifier of high performing products.

Table 3: Example of in-house testing, independent laboratory testing and product certification under a Eurovent Certified Performance programme:

| | In-house laboratory testing | Independent laboratory testing | Product certification |
|--|---|---|---|
| Independent from manufacturer |  |  |  |
| Manufacturer has no control of the testing process |  |  |  |
| Standardised testing procedure |  |  |  |
| Laboratories must be assessed according to ISO 17025 standard |  |  |  |
| Manufacturer has no direct contact with laboratory |  |  |  |
| Manufacturer does not select products to be tested |  |  |  |
| Independent factory audits to ensure production line quality |  |  |  |
| Includes software checks / software certification |  |  |  |
| The technical credibility and continuity of all submitted data independently checked |  |  |  |
| Ongoing independent surveillance process |  |  |  |

BUILDING TRUST

Although product performance testing can be complex, with a wide range of variables contributing to inaccuracies, manufacturers cannot be forced to independently validate their product data. Third-party evaluation via an impartial laboratory or certification body is completely voluntary.

It is therefore product decision makers who need to change their actions to mitigate the risks posed by products with inaccurate performance data.

Strategies include:

- Choose products that are certified, or at the minimum, products that have been independently laboratory tested.
- Do your research. Carefully compare verified products like-for-like, to make the most informed decision.
- View systems holistically. CO₂ is not a silver bullet; the greenest refrigerant is not the only consideration. Energy performance and the impact of the product on the rest of the system must be considered.
- Purchase cost should not be the only priority. Energy performance will have a far greater impact on system efficiency, carbon footprint and long-term running costs, often making a smaller purchase price a false economy.

DID YOU KNOW?

Certification bodies provide free access to verified product data so you can search for and compare products with proven performance. To find out more about product certification visit www.eurovent-certification.com

RECOMMENDATIONS

1

The refrigeration industry must acknowledge the issue of overstated performance, and work together to reduce the risks.

2

Manufacturers should embrace independent laboratory testing and voluntary third-party certification to build trust.

3

Industry players must understand the importance of independently verified data, and be able to identify products with reliable product information.

4

To reduce risk further, key decision-makers can include certifications such as Eurovent Certified Performance as a qualifier in all refrigeration projects. This will ensure:

- Products perform as advertised
- Energy efficiency and carbon footprint targets are met.

CONCLUSION

Broken trust is detrimental to the entire industry. In a world where decarbonisation and sustainability are increasing priorities, those specifying and buying products must have certainty in product performance. Correct data is critical to the energy efficient running of refrigeration systems.

While the research referenced in this white paper has demonstrated that some products already have a significant deviation between claimed and expected performance, by contrast it builds trust for those manufacturers who strive for accuracy, and volunteer to independently verify their product performance data via third-party laboratories and certification bodies.

Most crucially, with the risk of underperformance revealed, industry actors can take positive steps to identify, compare, choose and use products with independently verified performance data.



We build trust.

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