

New challenges for heat pump certification



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There is no doubt that the heat pump technology has now reached a prominent position in Europe in the field of heating, air conditioning and hot water production and the number of marketed units is expected to keep on increasing on next years. Just as an example, in France, the biggest market in Europe at the moment regarding heat pumps, more than half of all newly built houses are equipped with heat pumps. Even though the currently low prices of oil make power driven products less competitive at first view than previously compared to other solutions relying on fossil fuels, this is more than balanced by the need to reduce the carbon print and to improve energy efficiency. This development has triggered a proliferation of new products and technologies, the performances of which it is all the more important to be able to compare and ascertain. This is the duty of product certification and moreover, the broader and more competitive the market is, the more efficient and reliable the certification must be. It is proposed in this paper to show how the different certification schemes managed by Eurovent Certita Certification are responding to the current situation and to describe some recent breakthroughs.

Product certification, what for?

Product certification is a conformity assessment whereby a third party- the certification body - issues a statement that fulfilment of specified requirements has been demonstrated for a given product [1]. Typically in the field of HVAC-R this encompasses the voluntary certification of the performances of products which are published by the certification body after implementation of a process including verification tests and assessment audits. The first aim of product certifica-

tion is to provide confidence to the market and all the stakeholders thanks to an assessment carried out by an independent third party. As a result it actually enables to compare the properties of products on the basis of the same reference standards and incentive schemes used to foster energy efficiency are often referring to certification. As far as recognition and independence are concerned, it is critical to distinguish third part certification from other schemes. Accreditation against ISO 17065 [2], the relevant international standard, is the ultimate, internationally recognized proof of the competence and impartiality of a certification body. It can be seen as the certification of certification bodies and is viewed by the European Commission as “*part of an overall system, including conformity assessment and market surveillance, designed to assess and ensure conformity with the applicable requirements*” [3].

Different certification marks for different expectations

Eurovent Certita Certification (ECC) is a top European accredited third party certification body active in the field of indoor climate, ventilation and air quality as well as refrigeration and food cold chain. We have been certifying heat pumps for years, which is shown on the market by the 2 voluntary certification marks (Figure 1).



Figure 1. The 2 certification marks granted by Eurovent Certita Certification for heat pumps.

The Eurovent Certified Performance (ECP) mark has been granted by our company since 1995 and has gained a very large international recognition: 66% of HVAC-R products sold in Europe are ECP certified.

The NF mark is a French mark of conformity owned by AFNOR, the French member of CEN and has been used for more than 60 years in the framework of hundreds of certification programmes. The programme related to heat pumps [4] has been developed and managed since its inception by ECC.

The reason for proposing different certifications for a single family of products is that the 2 schemes are responding to different market expectations. Indeed, although it is based on European product and testing standards, the NF mark is tailored to the needs and demands of the French market, including specific input for the thermal regulation. Whereas the ECP mark [5] is providing its wide international recognition on a larger market which uses the same set of European standards.

On top of that, Eurovent Certita Certification has recently developed a European Heat Pump certification programme, “**Euro Heat Pump**” which is a bridge between the NF Heat Pump programme and the ECP mark. It allows to obtain both certifications through a single entry point and using the same set of verifications. We are thus offering to manufacturers a cost effective, one stop certification.

A brief history of Heat pump certification by Eurovent Certita Certification

Recent events and breakthroughs which happened for the different programmes managed by ECC are shown on **Table 1**, with some of them being further commented elsewhere in the paper.

A world of proliferating technologies

To pay heed to various climates and respond to quite different demands related to residential buildings but also collective ones or industrial facilities, manufacturers are using the whole range of available technologies when producing and marketing heat pumps. This is seemingly a never ending process where what is at stake is increasing the versatility of products whilst improving their energy efficiency. The development of certification must follow the same pace and be in line with the evolution of technologies, lest its link with the market is severed.

Table 1. A brief history of Heat pump certification: recent milestones.

Date	Event
2007	Introducing ESEER(European seasonal energy efficiency ratio) in the Eurovent Programme for Chillers and Heat Pumps.
	Launching the NF Heat Pump programme.
2012	Extending certification to dual service heat pumps.
2013	Extending certification to gas heat pumps.
	Introducing certification of seasonal performances.
2014	First certification of hybrid systems.
2015	Extending certification to heat pumps producing collective sanitary hot water.
	Creation of the Euro Heat Pump programme, first certificates granted on spring 2015. An agreement between Eurovent Certita Certification and DIN CERTCO enables to grant up to 3 quality marks through a single entry point.

Table 2 shows the different technologies of heat pumps and related products currently covered by the certification programmes managed by Eurovent Certita Certification.

Table 2. Technologies and operation modes under the scope of programmes managed by ECC.

Technologies of heat pumps	Operation modes
Air to air	Heating and cooling modes
Air to water	Dual mode: space heating and sanitary hot water production
Water to water	
Brine to water	
Gas fired absorption and adsorption heat pumps	
Swimming pool heat pumps	
Production of collective sanitary hot water Hybrid systems using heat pumps	
Other related thermodynamic devices	
Rooftop units	
Variable refrigerant flow (VRF)	

For certification programmes to cover all these technologies or operation modes, just using the relevant standards and updating the test methods are not enough, otherwise for instance one would end up asking for an unrealistic number of verification tests. This is where the know-how of the certification body and the expertise of its network of laboratories are crucial to set up the appropriate balanced process providing confidence in the certified values on the basis of a time and cost acceptable programme. An example of such an approach is given, *infra*, for heat pumps operated in dual mode.

The Ecodesign whirl

To reduce energy consumption the European union has decided to introduce requirements for energy efficiency and to set up energy labelling with new energy classes. The corresponding general framework is given in the two European Directives 2009/125/EC [6] and 2010/30/EU[7], and requirements are further described in a number of regulations, including the Ecodesign Regulations Nos 813/2013 [8] and 814/2014[9] for space heaters and combination heaters on the one hand and water heaters and water storage tanks on the other hand. These regulations have deep consequences on the market, where the less performant products will gradually vanish.

For heat pumps one of the major changes is the introduction of seasonal performances which take into account the fact that during the whole year a thermodynamic system works according to the needs at part load conditions and for specific climates.

Thus, since 2013, nominal performances (EER for cooling mode and COP for heating mode) according to EN 14511[10] standard are gradually been replaced by seasonal performances (SEER and SCOP respectively) according to EN 14825 [11] standard.

To enable comparing results from different technologies, a seasonal energy efficiency is introduced, using a conversion coefficient CC to express it in terms of primary energy.

For instance, for heat pump space heaters and heat pumps combining space heating and hot water production, the seasonal space heating energy efficiency is expressed as:

$$\eta_s = \frac{SCOP}{CC} - \sum F(i),$$

where $CC = 0.5$ and $F(i)$ are corrective factors.

For heat pumps, the provisions related to Ecodesign and Ecolabelling have been in force since September 26th, 2015 and will be strengthened and enlarged from 2017 onwards.

Coping with these regulatory changes is a real challenge for product certification because in many cases new test methods have to be used to determine the efficiency in terms of seasonal performance.

Eurovent Certita Certification manages its certification programmes so as to anticipate regulatory evolutions and especially revise reference documents to be in line with the implementation of the Ecodesign and Ecolabelling directives.

Here are some recent examples:

- 2010: thresholds for sound power levels (indoors and outdoors) are introduced for NF Heat pumps,
- From January 1st, 2013: for ECP certified air conditioners ≤ 12 kW, SEER and SCOP have to comply with the eco-design thresholds,
- Autumn 2014: SCOP and η_i can be certified for NF Heat pumps,
- December 2014: the ECP programme for chillers and heat pumps includes the certification of SCOP and η_i .

Versatile products and hybrid systems

One of the most notable and growing current trends is the development of versatile systems achieving several different functions, for instance space heating and hot water production as in the case of dual mode heat pumps. Some of them are using different types of energy, such as typically hybrid heat pumps combining a fuel or gas boiler and a heat pump. These latter systems can in some cases be controlled so as to switch from one type of energy to another depending on the outdoors temperature or on the power cost, allowing therefore to optimize the energy efficiency and the overall operating costs. The first “NF Multi energy” certificates have been granted on November 2014

These breakthroughs offer a real challenge to product certification, because the great quantity of components (heat pumps, storage tanks, exchangers...) and of their possible combinations can result in a very large amount of marketed systems which are quite long and expensive to test. Among the array of means Eurovent Certita Certification is using to address this issue, one of the most promising is the use of predictive models.

If we take the example of certified dual mode heat pumps, the systems are first classified by ranges, depending on the technologies of the main components and on their sizes (see **Figure 2**).

For a given range of models, the performances are determined from testing one model and using simulation for the other models. Once the simulation tool has been validated on the basis of an appropriate assembly of test results, it allows to decrease dramatically the number of needed tests.

A truly European coverage

It was once said that Europe will not be actually built when all European people speak one single language, but when they all speak several European languages. To some extent it is such an approach which is followed by Eurovent Certita Certification: we promote certification at the European level while acknowledging local recognition of influential brands, in keeping with the demands of the market. It is the reason why the

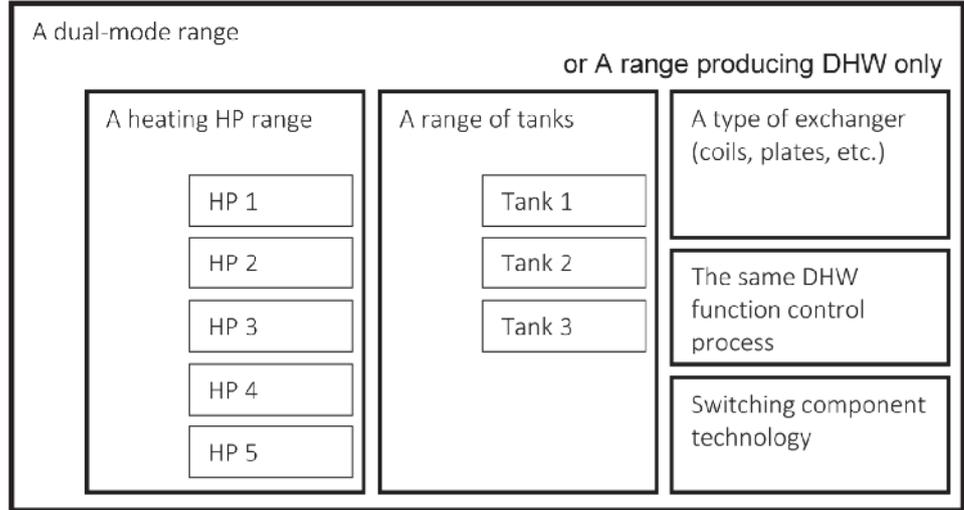


Figure 2. definition of ranges of NF certified dual mode range or domestic hot water (DHW) heat pumps.

Euro-HP programme was launched under the Eurovent Certified Performance brand on 2015, on the basis of NF Heat Pump specifications, with dozens of manufacturers having now their heat pumps performances published on our web site [5]. This is also underlying the cooperation agreement Eurovent Certita Certification has signed on 2015 with the German certification body DIN CERTCO to broaden its certification offering as summarized on **Figure 3**. In the framework of this agreement, the first DIN Plus certificates were granted on November 2015.



Figure 3. A one-stop shop for 3 certification marks.

The overall result of this continuous certification development is shown on **Table 3** where the numbers of certified models are given per technology of heat pumps.

Table 3. Models of certified heat pumps per technology (Dec.2015).

Type	Number of models certified by Eurovent Certita Certification
Space heating or cooling	
Air/air	2,860
Air/Water	13,400
Water/Water	3,660
Glycol Water/Water	305
Dual service	505
Rooftop units	470
Variable Refrigerant Flow	185
Total number	21,385

Conclusion

Product certification is a key point on the heat pump market as it is necessary to bring confidence between all stakeholders. However to deliver in a fully satisfactory way, it has to evolve in line with the development of new technologies and systems and to anticipate regulatory constraints as well as market expectations. Eurovent Certita Certification has taken up this challenge and is the leading European certification body for heat pumps on a business area where Ecodesign requirements and market surveillance are focused on transparent and reliable product performances. ■

References

- [1] ISO/IEC 17000: 2004- Conformity assessment — Vocabulary and general principles.
- [2] ISO/IEC 17065: 2012 - Conformity assessment — Requirements for bodies certifying products, processes and services.
- [3] Regulation No 756/2008 of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products and repealing Regulation No 339/93. *Official Journal of the European Union – L218, 13.8.2008 –p. 30 - 47.*
- [4] <http://www.certita.fr/en/certita-mark/nf-heat-pumps>
- [5] <http://www.eurovent-certification.com>
- [6] Directive 2009/125/EC of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products. *Official Journal of the European Union – L 285, 31.10.2009, p.10-35.*
- [7] Directive 2010/30/EU of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products. *Official Journal of the European Union – L 153, 18.6.2010, p. 1-12.*
- [8] Regulation (EU) No 813/2013 of 2 August 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for space heaters and combination heaters. *Official Journal of the European Union – L 239, 06.09.2013, p.136-161.*
- [9] Regulation (EU) No 814/2013 of 2 August 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for water heaters and hot water storage tanks. *Official Journal of the European Union – L 239, 06.09.2013, p.162-183.*
- [10] EN 14511 – 1 to -4: 2013 - Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling.
- [11] EN 14825: 2012 - Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling - Testing and rating at part load conditions and calculation of seasonal performance.

REHVA Guidebook on Active and Passive Beam Application



Active and Passive Beam Application Design Guide

The Active and Passive Beam Application Design Guide is the result of collaboration by worldwide experts to give system designers a current, authoritative guide on successfully applying active and passive beam technology. Active and Passive Beam Application Design Guide provide energy-efficient methods of cooling, heating, and ventilating indoor areas, especially spaces that require individual zone control and where internal moisture loads are moderate.

The systems are simple to operate, with low maintenance requirements. This book is an essential resource for consulting engineers, architects, owners, and contractors who are involved in the design, operation, and installation of these systems. Building on REHVA's Chilled Beam Application Guidebook, this new guide provides up-to-date tools and advice for designing, commissioning, and operating chilled-beam systems to achieve a determined indoor climate, and includes examples of active and passive beam calculations and selections. Dual units (SI and I-P) are provided throughout.