

# *European Heat Pumps*

## *performance certification program*



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# Thermodynamics 9 certification programmes

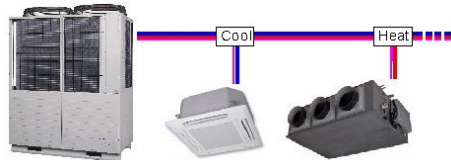
(3) Air  
conditioners



Rooftops



Variable  
refrigerant flow



Close  
control AC



Chillers  
& Heat pumps



Multi-energy



Air-to-  
water  
HP &  
boiler

- Direct expansion
  - Comfort Air Conditioner < 12 kW
  - 12-45 kW
  - 45-100 kW
- Close control AC (for IT rooms)
- Rooftops
- Variable Refrigerant Flow Systems
- Chillers & Heat Pumps
  - Electrically driven HP heating and cooling
    - Outdoor air - water
    - Water (brine) - water (brine)
    - Ground water - water
    - Ground - water
    - Ground - ground
    - Water loop - recycled air
  - Electrically for dual service (domestic hot water)
    - Outdoor air - water
    - Water (brine) - water (brine)
    - Ground water - water
  - Gaz fired absorption & adsorption
    - Outdoor air - water
  - Pool HP
    - Outdoor air - water
- Multi-energy
  - Hybrid technology  
(gas boiler or fuel boiler & HP )



NF 414



NF 462



















# Thermodynamics

## 8 independant laboratories

through Europe, accredited ISO 17025

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	Vienna	Austria		Heat pumps	Thermal
	Madrid	Spain		Air conditioners; VRF; Small chillers	Thermal & Sound
				Heat pumps	
	Lyon	France	 	Small chillers & heat pumps	Thermal & Sound
	Essen	Germany		Very large chillers & heat pumps; Rooftops	Thermal & Sound
	Amaro	Italy		Large chillers & heat pumps	Thermal & Sound
	Trappes	France		Heat pumps	Thermal & Sound
	Boras	Sweden		Heat pumps	Thermal & Sound
	Essen	Germany		Large air conditioners	Thermal & Sound

# Thermodynamics – Today

## Some key figures

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- ~50 tests/year of air conditioners for Eurovent Certified Performance
- ~75 tests/year of heat pumps for NF-PAC
  - SCOP in option from autumn 2014
- ~140 tests /year of chillers and heat pumps for Eurovent Certified Performance
  - SCOP mandatory from summer 2015
- 8 auditors for NF Heat Pumps visiting ~75 factories/year
- 1<sup>st</sup> certificate for NF Multi-energy under preparation



# Conditions & performances for French building regulation RT2012

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- Matrixes defining thermal test conditions per
  - type of heat pump
  - type of application
- Example (Air-to-water HP) – with minimum acceptable COPs

		T upstream (outdoor air) (°C)									
		-15	-7	2	7	20					
T downstream (water) (°C)											
T flow	T return (*)										
25	22							2,50		4,10	
35	30							2,10		3,40	
45	40							1,60		2,70	
55	47							1,30		2,20	
65	55							1,20		1,90	

\* obtained with flowrate found during the test at -7°C

- Certified Performances:
  - Capacity  $Ph$  [kW]
  - Electrical Power input  $Pe$  [kW]
  - Coefficient of performance  $COP$
  - Sound power level  $Lw$  [dB(A)]
  - Minimum continuous operation Load Ratio  $LR_{contmin}$  [%]
  - $COP$  at  $LR_{contmin}$
  - Performance correction coefficient at  $LR_{contmin}$   $C_{cpLR_{contmin}}$

# NF 414 option : Seasonal performances (Regulations 811/2013 & 813/2013)

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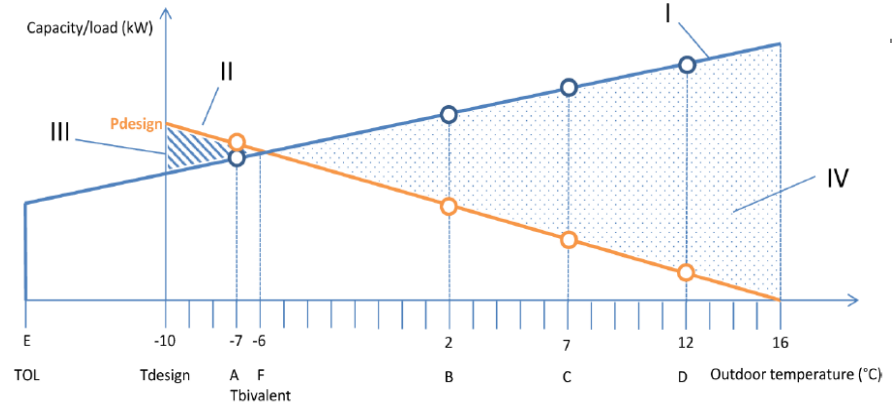
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## • Choice of conditions

- Climate:
  - Average
  - Colder
  - Warmer
- Low temperature HP:
  - +35°C
- High temperature HP:
  - +55°C
  - +35°C (option)
- 1 to 4 settings (fixed/variable):
  - Water flowrate
  - Temperature outlet

## • Certified performances

- Design capacity  $P_{design}$
- Capacity and COP at
  - A,B,C,D of EN 14825
  - Bivalent temperature F  $T_{bivalent}$
- Operational limit temperature TOL
- Sound power level(s)  $L_{wA}$  [dB(A)]



### Key

- I declared capacity line and declared capacities at conditions A, B, C and D
- II load curve and part load capacity at conditions A, B, C, D, E and F
- III electric back up heater
- IV on off cycling
- T<sub>design</sub> reference design condition
- T<sub>bivalent</sub> bivalent temperature

## ➤ Auxiliary powers

- Standby mode  $P_{sb}$
- Thermostat off  $P_{to}$
- Off mode  $P_{off}$
- Crankcase heater  $P_{ck}$

## ➤ Seasonal Coefficient of Performance

- SCOP
- Active SCOP  $SCOP_{on}$
- Net SCOP  $SCOP_{net}$

## ➤ Seasonal efficiency $\eta_s$

**European heat Pump  
Certification program  
less than 100 KW , ECO design ready.**

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**NF 414 specification with ECO  
design as option**





# European Heat Pump processes summarized in one single slide !

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- Demand :  
1 request file /range

## ➤ Registration:



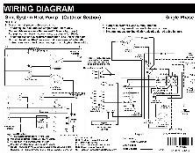
- Application for the right to use the mark (knowledge and acceptance to the rules)



- General information of the Company



- Factories & subcontracting : who does what and agreement between parties



- Electrical scheme
- Specification plate (use of NF logo is mandatory)



- Operating Manual



- Test reports



- Conformity to directives

## ➤ Admissibility

- 1 test /5 models
- Tolerances
  - -5% on capacity and COP/EER (calorimeter)
  - -10% (enthalpy) and for ground water-ground water, air-ground water and water-ground water HP
  - +2dB(A) for sound power levels
- Admission audit(s) /factory, corrective actions



## • Annual control

- 1 audit / year and / factory
  - Potential reduction (no major remark in previous audit and 2 tests ok)
- 2 machines/year, including preferentially one PAC double service (if part of the range)





# Market share of EURO-HP in Europe . % in value of equipment sold in 2013 with a Euro-HP certification less than 100 Kw

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	NF PAC	ECP	EURO-HP	Euro Heat Pump European market share in certification
Air to Water	1845	1512	3357	80 %
Brine to Water	471	300	771	51%
Direct Expansion	N.A.	19		26%
Domestic hot water	192		192	99%
Water to water	258	560	818	68%
Swimming Pool	34	0	36	100%
Gaz	6	0	6	100%
Air to Air	0	2835	2835	100%
<b>Total</b>	<b>2848</b>	<b>5165</b>	<b>8013</b>	<b>79%</b>

# Market share of EURO-HP in Europe . % in value of equipment sold in 2013 with a Euro-HP certification

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Area	Less than 50 KW	50 to 100 Kw	
EU 28	50%	54%	
Europe 5	50%	47%	
Northern Europe	17%	90%	
Eastern Europe	82%	75%	
Big Europe	49%	57%	
Total EMEA1	49%	57%	

# European Heat Pump

Certification program less than 100 KW

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*Thank you for your attention*







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# Chillers & Heat pumps Testing standards

12/19 Sept. 2014

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- Performance

- Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling  
  - EN 14511-1 to 4: Terms and definitions; conditions; methods and requirements
  - EN 14825: Testing and rating at part load conditions
- Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors - domestic hot water units 
  - EN 16147: Testing and requirements for marking
- Hot water storage systems 
  - EN 15332: Heating boilers - Energy assessment of hot water storage systems
- Direct exchange ground coupled heat pumps with electrically driven compressors for space heating and/or cooling 
  - EN 15879-1: Testing and rating : direct exchange-to-water heat pumps
- Gas-fired absorption and adsorption air-conditioning and/or heat pump appliances with a net heat input not exceeding 70 kW 
  - EN 12309-1 to 5: Safety, Terms & Definitions; Conditions, Methods; Requirements

# Chillers & Heat pumps Testing standards

13/19 Sept. 2014

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- Acoustics



- Air conditioners, heat pumps and dehumidifiers with electrically driven compressors.
    - EN 12102: Measurement of airborne noise. Determination of the sound power level.  
in conjunction with:
      - EN ISO 3741: Determination of sound power levels of noise sources – Precision methods for broad-band sources in reverberation rooms
    - or
    - EN ISO 9614: Acoustics – Determination of sound power levels of noise sources using sound intensity – Part 1: measurements by points
      - ISO Standard 3744 (if ISO 9614 is not applicable) by free field method
- For AC < 12 kW, only ISO 3741 is applicable

