

**IT Workshop for IEA-HPT ExCo Meeting**

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**Heat pumps in the context of the energy performance of buildings**

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**Heating & Cooling in Italy  
with Heat Pumps towards 2030**

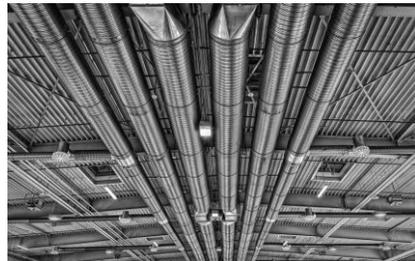
# CTI – ITALIAN THERMOTECHNICAL COMMITTEE

## Who we are:

- A **standardization body** (federated with UNI)
- Developing standards in the **thermotechnical** field
- Both **nationally** (UNI) and **internationally** (CEN – ISO)

## What we do:

- Normative activity
- Technical support to the regulatory bodies and public authorities
- Research activity
- Training activity
- Communication and dissemination activity



# CTI – ITALIAN THERMOTECHNICAL COMMITTEE

## Thematic areas:

- Energy management and **energy audits**
- Energy performance of **buildings**
- Renewable energy sources and **sustainability**
- Energy **measurement**
- **Heating** systems
- **Cooling** and ventilation systems
- Process safety in **industrial plants**
- **Systems under pressure**
- **Traditional energy** sources



# ENERGY PERFORMANCE OF BUILDINGS

## Actual framework:

### Regulations



**Directive 2010/31/UE  
Directive 2018/844/UE**

**D.Lgs 192/05 e s.m.i.  
+ Ministerial Decree**

### Technical Standards



**EN standards developed  
under Mandate M/480**

**UNI/TS 11300 series**

# HEAT PUMPS ENERGY PERFORMANCES

In the framework of energy performance of buildings, for the **heat pumps**:

## «system» standards



**UNI EN 15316-4-2** Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-2: Space heating generation systems, heat pump systems, Module M3-8-2, M8-8-2



**UNI/TS 11300-4** Energy performance of buildings - Part 4: Renewable energy and other generation systems for space heating and domestic hot water production

**Note: both of these standards are currently under review!**

## «product» standards

**UNI EN 14825** 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

## HEAT PUMPS ENERGY PERFORMANCES IN DETAIL

The energy performance of heat pumps, in particular the COP, depends on three main factors:

- the **temperature of the cold source**;
- the **temperature of the hot sink**;
- the **load factor** (Capacity Ratio, CR) of the machine.

The technical specification UNI / TS 11300-4 takes into account all three of these factors as follows:

- by first, **identifying the fully loaded COP**, by interpolation or extrapolation between the fully loaded COP data declared by the suppliers. These data are determined in correspondence with pairs of predefined values of the temperatures of the cold source and the hot well according to the specific application;
- then, **applying a correction factor of the COP at full load**, which is considered fixed and independent of the temperatures of the cold source and of the hot sink.

## HEAT PUMPS ENERGY PERFORMANCES IN DETAIL

The UNI / TS 11300-4 technical specification allows you to determine **the COP correction factor at partial loads in different ways:**

a) According to the data that suppliers publish in compliance with UNI EN 14825 on the basis of four work points A, B, C and D defined as follows:

(A) -7 °C,

(B) 2 °C,

(C) 7 °C,

(D) 12 °C.

a) According to a simplified method, which consists of a fixed correlation;

b) Using a correlation declared by the manufacturer (for absorption heat pumps).

## HEAT PUMPS ENERGY PERFORMANCES IN DETAIL

### An important clarification (using the 14825 data in the 11300-4):

The technical specification **UNI/TS 11300-4** specifies the data required for the calculation of the COP correction factor as a function of the partial load, if provided by the manufacturers data according to UNI EN 14825 used for the calculation of seasonal performance (SCOP, Seasonal COP). Among the requests, **it is specified that the temperature of the hot sink must be constant**, in particular equal to 35 ° C or 45 ° C.

The **UNI EN 14825** standard, on the other hand, allows to determine the COP at partial loads both with constant delivery temperature (“fixed outlet” option), and with variable delivery temperature. The second case (variable temperature) is allowed when the machine regulation system is able to manage a variable delivery temperature according to the external temperature (point 6.4.1).

## HEAT PUMPS ENERGY PERFORMANCES IN DETAIL

### Capacity Ration (CR) and Intermittent Ration (IR):

It is important to **distinguish between fixed power on / off heat pumps and stepped or inverter modulating heat pumps**. UNI EN 14825 allows to use the performance of the machine in correspondence with the steps closest to the required load conditions. So, for example, in the case of heat pumps with inverters that are working below the minimum continuous operation power (lower end of the modulation range), the reference point on which to calculate the load factor in intermittent operation on / off and consequently the COP correction factor is that of the minimum power in modulation.

In these cases, therefore, to better represent the on / off cycling condition between the machine off and the machine in conditions of minimum modulation, it is useful to refer to a value that can be defined as IR (Intermittency Ratio), in addition to the CR (Capacity Ratio) value.

## HEAT PUMPS ENERGY PERFORMANCES IN DETAIL

### In conclusion:

- for **on / off heat pumps**, the IR value always coincides with the CR value, therefore when calculating the corrective factor it is always necessary to refer to the maximum power of the heat pump for each temperature condition;
- for **inverter heat pumps** in conditions for which the machine load factor **CR is above the minimum** modulation range of the machine, the IR value is equal to 1 and the COP is the one defined by the supplier according to the data collected or calculated with the simplified method by applying the corrective factor equal to 1;
- for **inverter heat pumps** in conditions for which the machine load factor **CR is below the minimum** modulation range of the machine, the IR value is always less than 1 and is calculated with respect to the minimum modulation step.

# HOW TO PARTICIPATE

Do you want to know more about how technical standards are built?

[www.cti2000.it](http://www.cti2000.it)

[cti@cti2000.it](mailto:cti@cti2000.it)

Do you want to participate in the bottom-up process of creating a technical standard?



Do you have any proposals to help your industry grow?

