PRODUCT ENVIRONMENTAL PROFILE

Schneider Electric

AIR CONDITIONER FAMILY HDCV

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PEP are compliant with XP C08-100-1 :2016 The elements of the present PEP cannot be compared with elements from another program.	
Document in compliance with ISO 14025 : 2010 « Environmental labels and declarations. Type III environmental declarations »	

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1. COMPANY

Uniflair S.p.a. is a company with a sole shareholder owned and directed by Schneider Electric SE. It is specialised in precision cooling and raised technical floors, founded 25 years ago, and continues today in Schneider Electric, thanks to constant attention to innovation, product quality and technical support.

The ISO 9001, ISO 14001 and ISO 50001 certifications, in respect of the highest production and environmental standards, the care in the design of the machines, the flexibility of the solution and the simplicity of installation are the elements for which the Uniflair-Schnieider Electric cooling division has achieved a prominent position, among the world leaders in the sector, with exports to all over the world.

The synergies with Schneider Electric solutions for automation and control, physical infrastructure for Data Center, electrical distribution and energy efficiency add to the cooling division all the advantages of the integrated solution: the union of technology, functionality and design to give the data center and soul, intelligence and efficiency.

The cooling division of Schneider Electric is specialized to develop, design and assemble cooling products for datacenter and mission critical applications.

Based on the merge of multiple brands, operating since more than 40 years in the business, the cooling division has been established in 2011 and it is based on 3 global production sites, located in Italy, China and India, 4 design centers, based in USA, Italy, India and China and 4 testing areas and locations

Leveraging on the wide product ranges and the long technical expertise, Schneider Electric cooling is one of the top 3 players in mission critical business

The product has been manufacture in Conselve, Padova, Italy, by Uniflair SpA. As per Chamber of Commerce survey dated 11/06/2021 issued by the Chamber of Commerce, the Uniflair company is wholly owned by Schneider Electric.

2. PRODUCT DESCRIPTION

The document aims to present the environmental profile of the Air Conditioner homogeneous family HDCV with the reference product HDCV2900A2.

Using water as its cooling fluid, the HDCV Cooling Unit is the ideal precision air conditioner for telecommunications premises, Internet hubs, hyperscale data centers and medium to large data centers. The HDCV range specifically responds to the air conditioning needs of these workplaces characterized by a technological environment and high levels of heat dissipation.

In combination with various design solutions of the water cooling system for Data Centers, the HDCV units are available in different cooling configurations, capable of operating in very different operating conditions, offering the highest level of efficiency.

In mission critical applications and data centers, the cooling system must provide maximum cooling capacity to cool the IT load, minimizing floor space to save the maximum amount of energy possible for the IT load and leave more space to IT racks. Thanks to the large surface area of the chilled water coil, Uniflair® HDCV units deliver a very high specific cooling capacity in a small footprint, reducing the volume of the internal cooling system and leaving free space for IT equipment.

TECHNICAL CHARACTERISTICS

The product family to which the product covered by the environmental declaration is thermodynamic generator with electric compressor.

Table 1 reports the technical data of the Air conditioner HDCV2900A2, considering the typical use condition as required by the EN 14825 and the cooling capacity required by the building condition where the product will operate. The product will be distributed worldwide.

Table 1: Technical description of Air conditioner at the typical use scenario condition.

	Typical use scenario
Cooling capacity	101,9 kW
Total power absorbed	2,97 kW
SEER	41 kW/kW
Type of refrigerant	Gas free

PRODUCT COMPOSITION

Since these are complex products with a large number of components, the list of individual components and their respective functional groups is shown. A description of the cut-off criteria defined by the study to simplify the product with a lower number of components, while maintaining

a percentage of data inclusion above 95%, will be reported below. The functional groups are divided as reported in Table 2.

Table 2: Material compositions of HDCV2900A2 Air Conditioner.

Components	Materials	Amount [%]
BATTERY	Copper	0,13
	Aluminium	0,12
	Steel	0,07
METAL STRUCTURE	Steel	0,29
	Steel	0,26
	Steel	0,00
CONTROL UNIT	Electronics	0,05
PIPE SYSTEM	Copper	0,02
FANS	Copper	0,01
	Plastic	0,00
	Steel	0,03

The total mass of the reference product is 628 kg. The material composition analysed is 610 kg, that represent the 95% of the total weight. The packaging weight is 52,60 kg.

Figure 1 presents a distribution of the materials including the packaging.

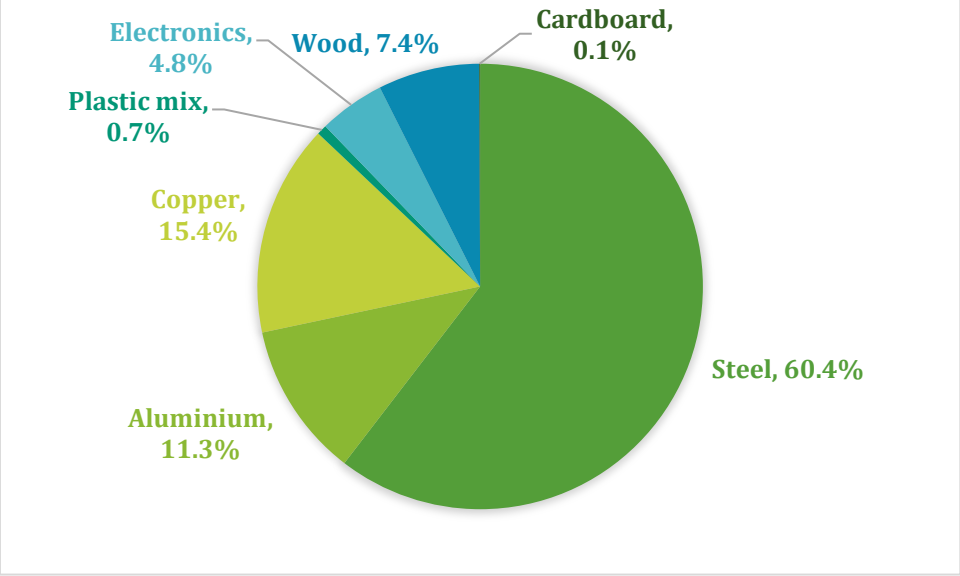

Figure 1: HDCV2900A2 Material composition.

The HDCV2900A2 machine does not contain substances classified as SVHC (Substance of Very High Concern for Authorization) in concentrations higher than the threshold limits, established in the SVHC list of substances (Candidate List of SVHC).

The product from Schneider Electric group comply with the requirements of the "RoHS" Directive (EU) 2015/863 of 31 March 2015 and 2011/65/EU of 8 June 2011 and the "REACH" regulation 1907/2006 of 18 December 2006.

3. METHODOLOGY

The methodology followed as a reference standard is that of the Life Cycle Assessment (LCA); "The LCA deals with environmental aspects and potential environmental impacts (for example the use of resources and the environmental consequences of releases) throughout the life cycle of the product from the acquisition of raw materials through manufacturing and use up to end-of-life treatment, recycling and final disposal (ie from cradle to grave). " [ISO 14040: 2021].

LCA is divided into 4 basic phases:

- PHASE 1: Definition of the objective and field of application;
- PHASE 2: Inventory analysis;
- PHASE 3: Evaluation of the impacts;
- PHASE 4: Interpretation and improvement.

Simapro 9.1.0.11 software was used to process the data and results, specifically designed to carry out life cycle analyses. This software is accompanied by a series of databases: for the study in question, Ecoinvent 3.6 was operated using one of the most up-to-date and widespread databases.

Table 3: Methodology information.

Geographic validity	Global
Referent year	The referent time period is 2020
Database:	Ecoinvent 3.6
Software:	SimaPro 9.1.0.11

FUNCTIONAL UNIT

The functional unit is the reference unit for quantifying the environmental impacts along the life cycle of the product, with reference to the type of service that the product itself provides. The main task of the functional unit is to define a reference unit to which to allocate all the inputs and outputs of the LCA study. A correct functional unit must take into account:

- The actual function of the product;
- The level of performance achieved, calculated according to standards applied to the product in question;
- The useful life of the product itself (Reference Life Time - RLT).

According to PSR-0013-ed2.0-EN-2019 12 06 (Specific Rules for thermodynamic generators with electric compression for space heating and / or cooling and / or the production of domestic hot water) the functional unit of reference must:

To produce 1 kW of cooling, calculated according to a standard scenario of use defined by EN 14825 and during the 22 reference lifetime of the product.

The reference flow includes the quantitative amount of the product, including packaging, transportation, installation process, usage and dismantling activities is used to fulfil the functional unit of 1 kW of cooling, on which all the inputs and outputs of the LCA model will be calculated for the calculation of environmental impacts.

SYSTEM BOUNDARIES

The system boundaries represent the limits that identify which processes are to be considered or excluded within the life cycle analysis. The environmental information included in the PEP cover all the stages of the life cycle, from cradle to grave.

Table 4: Life Cycle Stages included.

Manufacturing stage			Distribution stage	Installation stage	Use stage							End of life stage			
Supply of Raw Materials	Transport	Manufacture	Transport	Installation process	Use	Maintenance	Repair	Replacement	Rehabilitattion	Energy use during usage of the buikding	Water use during usage of the buikding	Demolition	Transport	Waste treatment	Disposal
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4

The recyclability rate of the product (Table 5) has been modelled considering the data published by a WEEE Italian consortium (reference of the document are reported in reference section).

Table 5: Recycling rate.

Waste code	Recycling	Incineration	Disposal
16.02.11*	90,43%	6,31%	3,26%

Manufacturing stage

The production process in Conselve, Italy is main an assembling process where the machine is assembly, the refrigerant circuit is filled and the water circuit is tested.
The company supply the energy form the Italian network, using both electrical and thermal energy.
The model has been implemented using Ecoinvent database with the following datasets:

- Electricity, medium voltage {IT}| market for | Cut-off, U
- Heat, district or industrial, natural gas {Europe without Switzerland}| heat production, natural gas, at industrial furnace >100kW | Cut-off, U

Uniflair plant in Conselve, Padova, Italy is certified by the Environmental Management System according to ISO 14001 standard, with certification number 195539-A159-UK, version: No.1, Revision date: 15-JANUARY-2021, valid until January 2023.
In addition the company is certified 50001 with certification number IND.20.9124/EN/U-27, version: No.2, Revision date: 28-September-2021, valid until August 2023.

During the manufacturing stage the information about the provenance of the components and suppliers has been gathered from the company.
The Air Conditioner is a cooling gas free technology.

Distribution stage

The transportation scenario considers the average distance between the Manufacturing plant and the construction sites where the chillers have been distributed in 2020. The average distance is calculated as 2.541 km. The country distribution in 2020 is calculated as the followed:

Table 6: Country distribution.

Country	Distribution
Austria	1,38%
Brazil	2,76%
France	11,72%
Germany	29,66%
Great Britain	22,76%
Israel	2,07%
Japan	13,79%
Sweden	0,69%
Switzerland	15,17%
Total	100,00%

The modelling in the software considered the total weight of the overall machine and the weight of the final packaging.

The Ecoinvent dataset used is:

- BY ROAD: Transport, freight, lorry 16-32 metric ton, euro4 {RER}| market for transport, freight, lorry 16-32 metric ton, EURO4 | Cut-off, U.
- BY SEA: Transport, freight, sea, container ship {GLO}| market for transport, freight, sea, container ship | Cut-off, U

Installation stage

During the installation phase, the product is moved in the final position, connected to the system and the water circuit if filled.

The handling phase has been modelled with the Ecoinvent dataset of a powerful machine used for handling activities: Machine operation, diesel, < 18.64 kW, high load factor {GLO}| market for | Cut-off, U
Once the machine is in the final position, it is connected to the circuit and filled with water. With the typical use scenario required by the EN 14825 the circuit is filled with water.
The Ecoinvent dataset used for the water is: Tap water {RER}| market group for | Cut-off, U.

Usage stage

During the usage phase the machine needs an energy consumption to guarantee the cooling capacity.
The energy consumption during the reference lifetime of the air conditioner to guarantee a cooling capacity equal to 101,9 kW at the working conditions required by the EN 14825 standard, has been calculated considering the climatic profile of Marseille. Schneider Electric uses UNICALC SOFTWARE, version 10.0.12 del 2021. The software calculate the adsorbed power considering the climate profile and the cooling capacity defined with the client and the working conditions (the machine works energy days 24 hours). The results reported a SEER equal to 41 kW/kW and a yearly energy consumption of 26.017 kWh.

- Reference LifeTime:22 years
- Cooling capacity: 101,9 kW
- Adsorbed power: 2,97 kW

The Ecoinvent dataset has been modelled using the location where the reference product has been installed. In the case of Chiller HDCV2900A2 the reference year is 2020, and the product has been installed in with the following mix:

Table 7: Energy country mix.

Country	Energy mix
Austria	1,38%
Brazil	2,76%
France	11,72%
Germany	29,66%
Great Britain	22,76%
Israel	2,07%
Japan	13,79%
Sweden	0,69%
Switzerland	15,17%
Total	100,00%

Electricity, medium voltage | market for | Cut-off, U in the list of countries.

During the usage phase the maintenance activities required by the company are related to the air filters change, three times per year. The used filters are sent to recycling plant, with a distance of 100 km.

End of Life stage

The end of life stage has been modelled using the declared input of WEEE Italian consortium (reference documents). The Italian declaration can be considered equal to the France situation because both countries follow the European legislation.
The distance for waste transportation is considered as default distance of 100 km.
The product end of life follows the WEEE disposal process:

1. Decontamination, crushing and sorting of the various materials;
2. Specific processing of the electronics components, cable;
3. Recycling of others materials (with benefits outside of the burdens – module D)
4. Incineration without energy recovery and disposal of hazardous materials.

The recycling activities has been excluded from the assessment, instead the disposal and incineration activities has been modelled with European datasets for incineration.

4. RESULTS

The PEP is drawn up under the assumption 1 kW of cooling power being supplied. The real impact of the stages of the life cycle of a product installed in an actual situation is calculated by the user of the PEP by multiplying the impact concerned by the total cooling capacity in kW.

Table 8: Environmental indicators.

Impact category	Unit	Total	Manufacturing	Distribution	Installation	Use	End of Life
Climate change GWP	Kg CO_2eq	2,65E+03	5,06E+01	0,00*	3,16E+00	2,60E+03	1,68E+00
Climate change-Fossil GWP	Kg CO_2eq	2,48E+03	5,01E+01	4,59E-01	0,00*	2,43E+03	1,65E+00
Climate change-Biogenic GWP	Kg CO_2eq	1,59E+02	4,47E-01	-1,46E+00	3,01E+00	1,57E+02	2,43E-02
Climate change-Land use and land use change GWP	Kg CO_2eq	1,24E+01	8,26E-02	0,00*	0,00*	1,23E+01	1,85E-03
Ozone depletion ODP	Kg CFC11 eq	1,53E-04	3,85E-06	2,02E-07	1,96E-08	1,49E-04	8,99E-08
Acidification AP	Mol H+ eq.	1,10E+01	1,08E+00	2,12E-03	0,00*	9,91E+00	3,76E-03
Eutrophication, freshwater EP-freshwater	Kg PO4 eq.	2,04E+00	8,83E-02	5,41E-04	2,21E-04	1,95E+00	1,46E-03
Eutrophication marine EP-marine	Kg N eq.	1,96E+00	1,11E-01	0,00*	0,00*	1,85E+00	3,10E-04
Eutrophication, terrestrial EP-terrestrial	Mol N eq.	2,27E+01	1,55E+00	5,74E-03	2,36E-03	2,12E+01	1,30E-02
Photochemical ozone formation POCP	Kg NMVOC eq.	4,96E+00	2,92E-01	2,21E-03	6,54E-04	4,66E+00	3,40E-03
Depletion of abiotic resources fossil fuels ADPF	MJ	4,26E+04	6,01E+02	7,28E+00	0,00*	4,20E+04	1,06E+01
Depletion of abiotic resources ADPE	Kg Sb eq.	9,10E-02	2,95E-02	0,00*	0,00*	6,14E-02	0,00*
Water use	m^3 world eq deprived	2,11E+02	1,60E+01	1,41E-01	4,03E-02	1,95E+02	7,67E-02

*represents less than 0,01% of the total life cycle of the reference flow.

Table 9: Additional environmental impacts.

Impact category	Unit	Total	Manufacturing	Distribution	Installation	Use	End of Life
Emissioni di particolato - Potenziale incidenza di malattie dovute alle emissioni di PM (PM)	Disease incident	5,15E-05	5,04E-06	3,72E-08	8,15E-09	4,64E-05	3,12E-08
Radiazioni ionizzanti, salute umana - Potenziale efficienza di esposizione umana rispetto a U235 (IRP)	kBq U235 eq.	9,17E+02	4,29E+00	0,00*	0,00*	9,12E+02	1,51E-01
Ecotossicità (acqua dolce) - Potenziale unità tossica comparativa per gli ecosistemi (ETP-fw)	CTUe	3,68E+04	8,66E+03	7,87E+00	0,00*	2,81E+04	1,14E+01
Tossicità umana, effetti non cancerogeni - Potenziale unità tossica comparativa per l'uomo (HTP-nc)	CTUh	9,22E-07	1,96E-07	6,88E-10	0,00*	7,26E-07	3,59E-10
Tossicità umana, cancro - Potenziale unità tossica comparativa per CTUh	CTUh	3,03E-05	9,80E-06	5,99E-09	0,00*	2,05E-05	1,10E-08
Impatti correlati all'uso del suolo / Qualità del suolo - Indice potenziale di qualità del suolo (SQP)	Pt	1,23E+04	3,10E+02	1,23E+02	0,00*	1,19E+04	4,04E+00

*represents less than 0,01% of the total life cycle of the reference flow.

Table 10: Use of resources.

Impact category	Unit	Total	Manufacturing	Distribution	Installation	Use	End of Life
PERE	MJ	9,23E+03	7,96E+01	1,78E+01	0,00*	9,14E+03	1,37E+00
PERM	MJ	3,18E+00	3,18E+00	0,00*	0,00*	0,00*	0,00*
PERT	MJ	9,24E+03	8,28E+01	1,78E+01	0,00*	9,14E+03	1,37E+00
PENRE	MJ	4,52E+04	6,38E+02	7,78E+00	0,00*	4,45E+04	1,12E+01
PENRM	MJ	3,44E+00	3,44E+00	0,00*	0,00*	0,00*	0,00*
PENRT	MJ	4,52E+04	6,41E+02	7,78E+00	0,00*	4,45E+04	1,12E+01
SM	Kg	0,00E+00	0,00E+00	0,00E+00	0,00*	0,00E+00	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00*	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00*	0,00E+00	0,00E+00
FW	m^3	3,29E+01	5,19E-01	3,94E-03	0,00*	3,24E+01	6,34E-03

*represents less than 0,01% of the total life cycle of the reference flow.

Table 11: Waste production.

Impact category	Unit	Total	Manufacturing	Distribution	Installation	Use	End of Life
HWD	kg	3,34E-02	7,86E-03	1,03E-05	0,00*	2,55E-02	1,44E-05
NHWD	kg	1,64E+02	1,13E+01	7,96E-02	2,07E-02	1,52E+02	2,83E-01
RWD	kg	2,47E-01	1,69E-03	0,00*	0,00*	2,45E-01	6,25E-05
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	1,86E+01	8,35E-01	0,00*	1,08E-01	1,20E+01	5,56E+00
MER	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

*represents less than 0,01% of the total life cycle of the reference flow.

Legend:
GWP = 100-year global warming potential;
ODP = ozone depletion potential in the stratosphere;
POCP = potential for the formation of photochemical oxidants of tropospheric ozone;
AP = potential for acidification of the soil and water;
EP = eutrophication potential;
ADPE = potential for depletion of abiotic non-fossil resources;
ADPF = potential for depletion of abiotic fossil resources.
PEARS = Use of renewable primary energy excluding primary renewable energy resources used as raw materials;
PERM = Use of renewable energy resources as raw materials;
PERT = Total use of primary renewable energy resources;
PENRE = Use of non-renewable primary energy resources excluding primary non-renewable energy resources used as raw materials;
PENRM = Use of non-renewable primary energy resources as raw materials;
PENRT = Total use of non-renewable primary energy resources;
SM = Use of secondary materials;
RSF = Use of renewable secondary fuels;
NRSF = Use of non-renewable secondary fuels;
FW = Use of fresh water.
HWD = Hazardous waste disposed of;
NHWD = Non-hazardous waste disposed of;
RWD = Radioactive waste disposed of;
CRU = Components for reuse;
MFR = Materials for recycling;
MER = Materials for energy recovery;
EEE = Electric energy exported.
EET = Thermal energy exported.

5. EXTRAPOLATION RULES

The next table reports the data used for the homogeneous family to calculate the extrapolation rules.

Table 12: Coefficient for the extrapolation rules for the reference product

	Model	Weight	Packaging	Cooling capacity	Power consumption	Energy consumption
LE CONDIZIONI SONO 18/24°C (ACQUA), 35°C (INGRESSO ARIA), 30% UMIDITA' RELATIVA	HDCV0800A2	380,0	30,8	35,3	1,2	231.264
	HDCV1400A2	435,0	27,2	55,6	1,6	310.279
	HDCV1800A2	550,0	33,1	80,8	2,4	454.819
	HDCV2500A2	555,0	41,5	78,7	2,8	529.980
	HDCV2900A2	615,0	41,5	101,9	3,0	572.378
	HDCV4600A2	790,0	39,0	140,3	4,7	901.930
	HDCV5100A2	860,0	39,0	160,2	4,8	915.420
	HDCV5300A2	860,0	39,0	179,1	6,6	1.279.661
	HDCV5500A2	1.202	66,7	187,1	6,8	1.302.787,2

Extrapolation coefficients are given for the environmental impact of the functional unit, i.e. the emission of 1 kW of cooling power. For each stage of the life cycle, the environmental impacts of the

product concerned are calculated by multiplying the impacts of the declaration corresponding to the reference product by the extrapolation coefficient. The "Total" column should be calculated by adding the environmental impacts of each stage of the life cycle.

Table 13: Extrapolation rules for the reference product

		Manufacturing stage	Distribution stage	installation	Use stage
LE CONDIZIONI SONO 18/24°C (ACQUA), 35°C (INGRESSO ARIA), 30% UMIDITA' RELATIVA	HDCV0800A2	0,63	0,63	0,74	0,40
	HDCV1400A2	0,70	0,70	0,66	0,54
	HDCV1800A2	0,89	0,89	0,80	0,79
	HDCV2500A2	0,91	0,91	1,00	0,93
	HDCV2900A2	1,00	1,00	1,00	1,00
	HDCV4600A2	1,26	1,26	0,94	1,58
	HDCV5100A2	1,37	1,37	0,94	1,60
	HDCV5300A2	1,37	1,37	0,94	2,24
	HDCV5500A2	1,93	1,93	1,61	2,28

Table 14: Extrapolation rules for the reference product per functional unit.

		Manufacturing stage	Distribution stage	installation	Use stage
LE CONDIZIONI SONO 18/24°C (ACQUA), 35°C (INGRESSO ARIA), 30% UMIDITA' RELATIVA	HDCV0800A2	2,03	2,03	2,14	1,17
	HDCV1400A2	1,42	1,42	1,20	0,99
	HDCV1800A2	1,16	1,16	1,01	1,00
	HDCV2500A2	1,20	1,20	1,29	1,20
	HDCV2900A2	1,00	1,00	1,00	1,00
	HDCV4600A2	0,89	0,89	0,68	1,14
	HDCV5100A2	0,83	0,83	0,60	1,02
	HDCV5300A2	0,75	0,75	0,53	1,27
	HDCV5500A2	0,95	0,95	0,88	1,24

6. .REFERENCE

[1] UNI EN ISO 14040: 2021, Environmental management - Life cycle assessment - Principles and reference framework.

[2] UNI EN ISO 14044: 2021, Environmental management - Life cycle assessment - Requirements and guidelines.

[3] UNI EN ISO 14025: 2010, Environmental labels and declarations - Type III environmental declarations - Principles and procedures.

[4] UNI EN 15804: 2012 + A2: 2019, Sustainability of buildings - Environmental product declarations - Key development rules by product category.

[5] PCR-ed4-EN-2021 09 06

[6] PSR-0013-ed2.0-EN-2019 12 06 (Specific Rules for thermodynamic generators with electric compression for space heating and/or cooling and/or the production of domestic hot water)

[7] PEP general instructions ed4.1 EN 2017 10 17

[8] LCA Study Analisi del ciclo di vita per prodotti di condizionamento e refrigerazione per edifici commerciali o edifici residenziali collettivi