ENVIRONMENTAL PRODUCT DECLARATION

Pexal® and Pexal® Brass

PRODUCT NAMES:	Pexal® + Pexal® Brass
SITE PLANTS:	Vestone/Vobarno
PROGRAM OPERATOR	EPDItaly
PUBLISHER	EPDItaly
DECLARATION NUMBER	2022PXB0290
REGISTRATION NUMBER	EPDITALY0290
ISSUE DATE	21/03/2022
VALID TO	21/03/2027

in compliance with ISO 14025 and EN 15804:2012+A2:2019.

MADE IN ITALY

valsir®

QUALITY FOR PLUMBING

GENERAL INFORMATION

EPD OWNER:	Valsir S.p.A., Località Merlaro, 2 25078 Vestone (BS).
PLANT INVOLVED IN THE DECLARATION:	

Vestone: Località Merlaro, 2 25078 Vestone (Brescia)

Vobarno: Via della Ferriera, 1 25079 Vobarno (Brescia)

SCOPE OF APPLICATION:	This Environmental Product Declaration (EPD) is valid for Pexal®+Pexal® Brass product. The production facilities are in Vestone and Vobarno (BS). The type of declaration is related to an average product produced partly in Vestone (PPSU fitting) and Vobarno (pexal pipe). The life cycle assessment is representative for the product introduced in the declaration for the given system boundaries.
PROGRAM OPERATOR:	EPDItaly, via Gaetano De Castillia 10, 20124 Milano, Italia.
INDIPENDENT CHECK:	This declaration has been developed referring to EPDItaly. following the General Programme Instruction; further information and the document itself are available at: www.epditaly.it. EPD document valid within the following geographical area: Italy and other countries according to sales market conditions. CEN standard EN 15804 served as the core PCR (PCR ICMQ-001/15 rev.3). PCR review was conducted by Daniele Pace. Contact via info@epditaly.it Independent verification of the declaration and data, according to EN ISO 14025:2010. Third party verifier: ICMQ SpA, via De Castillia, 10 20124 Milano (www.icmq.it) ☐ EPD process certification (Internal) ☑ EPD verification (External) Accredited by: Accredia
CPC CODE:	3632 - Tubes. pipes and hoses, and fittings therefor, of plastics
CORPORATE CONTACT:	valsir@valsir.it
TECHNICAL SUPPORT:	Sphera https://www.sphera.com
COMPARABILITY:	Environmental statements published within the same product category, but from different programs, may not be comparable. In particular, EPDs of construction products may not be comparable if they do not comply with EN 15804.
ACCOUNTABILITY:	Valsir S.p.A. relieves EPDItaly from any non-compliance with environmental legislation. The holder of the declaration will be responsible for the information and supporting evidence; EPDItaly declines all responsibility for the manufacturer's information, data and results of the life cycle assessment.
REFERENCE DOCUMENT:	This declaration has been developed following the General Programme Instruction document of EPDItaly, available at www.epditaly.it.
PRODUCT CATEGORY RULES (PCR):	PCR ICMQ-001/15 rev.3 EN 15804+A2 is the framework reference for PCRs.

COMPANY

COMPANY

Valsir was founded in 1987, on the basis of a precise industrial strategy adopted by the Silmar Group - a holding that is leader in the plumbing and heating market with a sales turnover of over 900 million Euro and 2,600 employees - with factories in Italy, in Valle Sabbia to the north of Brescia and abroad in Portugal, Poland, Russia, Romania, the Ukraine, France and South Africa.

Valsir is today a solid and expanding firm within a group whose true points of cohesion and strength lie within a strong sense of collaboration and the contribution of specific professional skills of each single component.

VALSIR - HEADQUARTERS

Location: Vestone (BS)

VALSIR - VOBARNO PRODUCTION PLANT

Location: Vobarno (BS)

VALSIR RECYCLING - CARPENEDA 1 PRODUCTION PLANT

Location: Carpeneda, Vobarno (Brescia)

VALSIR - CARPENEDA 2 PRODUCTION PLANT

Location: Carpeneda, Vobarno (Brescia)

MISSION

Our mission is to excel in the creation of innovative, environmentally sustainable and quality solutions by guaranteeing a meticulous and prompt service. Boasting deep roots within our territory and a strong commitment to internationalization, we adopt processes that are respectful of both people and the environment.

THE NUMBERS OF VALSIR (2020)

244,008 m²

total surface of which 112,130 m² indoors

562 Employees

155,844,014 €

turnover

15,754,571 €

investments

24 patents

22 product lines

236 type approvals

7,000 items

MANAGEMENT SYSTEM AND CERTIFICATIONS

QUALITY SYSTEM CERTIFICATION DNV ISO 9001

ISO 9001:2015

Quality management system

(In force since 2001)

ENERGY MANAGEMENT SYSTEM DNV·GL ISO 50001

ISO 50001:2018

Energy management system

(In force since 2017)

ENVIRONMENTAL SYSTEM CERTIFICATION DNV·GL ISO 14001

ISO 14001:2015

Environmental management systems

(In force since 2018 for the plant in Vestone)

COMPANY AWARDS

Excellence of the year for Innovation and Leadership - Best Job 2019

LE FONTI AWARDS® WINNER 2019

Singapore Green Building

SINGAPORE GREEN BUILDING COUNCIL

GOAL AND SCOPE OF EPD

The entire life cycle of the product is considered (Type of EPD: cradle to grave) and the modules described below are declared in this EPD:

- Modules **A1-A3** include those processes that provide energy and material input for the system (A1), transport up to the factory gate of the plant (A2), manufacturing processes, packaging materials as well as waste processing and emissions to air from molding and extrusion processes (A3).
- Module **A4** includes the transport from the production site to the customer or to the point of installation of the products.
- Module **A5** considers all piping systems installation steps (like screws, cement, oil use and water consumption) also packaging waste processing (recycling, incineration, disposal). Credits from energy substitution are declared in module D. During this phase an overlap of 2% has been considered.
- Module **B1** considers the use of the installed product. During the use of plastic piping systems, a scenario of zero impact is considered.
- Module **B2** includes the maintenance of the product. A scenario of zero impact is considered.
- Modules **B3-B4-B5** are related to the repair, replacement and refurbishment of the products. If the products are properly installed no repair, replacement or refurbishment processes are necessary. A scenario of zero impact is then considered.
- Modules **B6-B7** consider energy use and operational water to operate building integrated technical systems. No operational energy or water use are considered. A scenario of zero impact is then considered.
- Module **C1** considers deconstruction, including dismantling or demolition of the product from the building site. The energy consumption related to such activities is considered.
- Module **C2** considers transportation of the discarded piping system to a recycling or disposal process.
- Module **C3** considers waste processing for products recycling and incineration.
- Module **C4** includes all waste disposal processes, including pre-treatment and management of the disposal site.
- Module **D** includes benefits from all net flows in the end-of-life stage that leave the product boundary system after having passed the end-of-waste stage. Benefits from packaging incineration (electricity and thermal energy) are declared within module D.

The type of EPD is “cradle to grave” and it is an average EPD for the product Pexal® + Pexal® Brass produced in Valsir S.p.A. plants located in Vobarno (BS) and Vestone (BS) and sold worldwide. All data refer to the 2019 production and sales.

According to the PCR ICMQ-001/15 rev.3 the LCA study and the relative EPD, is “cradle to grave”. Modules included are A1, A2, A3, A4, A5, B, C and D. All manufacturing activities and packaging/auxiliary’s production are in module A3, while energy production and input materials are in A1. Transport to clients (A4) and installation (A5) are included together with end of life scenarios (benefits and loads included according to D module).

The declaration is 1b (average product from more than one plant of a specific manufacturer).

The production facilities are in Vobarno (IT) and Vestone (IT). The market range is Worldwide.

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse- Recovery- Recycling- potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

√ = modules included in the study.

Geographical validity: Worldwide

Database: GaBi Database 2021.1

Software: EPD Process Creator, implemented through GaBi professional 10 and GaBi Envision 9.0 software. The identification code of the EPD process tool used is: Valsir LCA tool - Multilayers piping systems- V.2 - 13/10/2021 developed by Sphera.

EPD realized by means of a validated algorithm:
In 2021 Valsir S.p.A. implemented and certified a Process for EPD generation by using an algorithm that has been validated and certified by ICMQ S.p.A., in agreement with EPDItaly's requirements. The process is based on an automatic data collection from different manufacturing plants that have been integrated, verified and validated in compliance with internal procedures. The validated algorithm allows the automatic calculation of the indicators reported into the current EPD coming from an LCA model implemented into the EPD process tool.

PRODUCTS DESCRIPTION

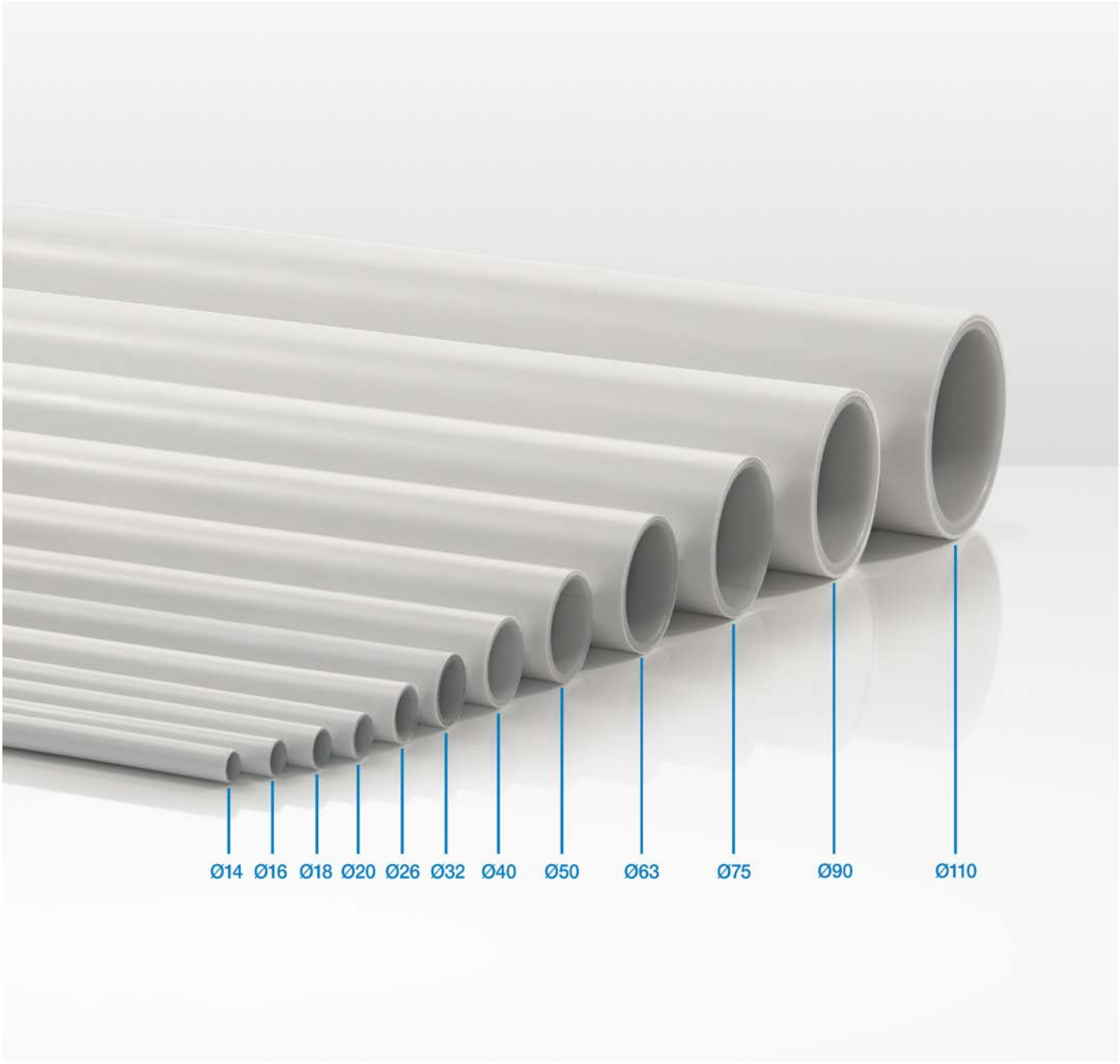
1. PEXAL® MULTILAYER PIPES

Pexal® is an innovative pipe capable of responding to different installation techniques and different applications, from hot and cold potable water distribution, to centralized distribution, from convector and radiator heating systems to floor, wall and ceiling heating and air cooling systems, from compressed air distribution systems to industrial installations.

The Pexal® multilayer pipes combine the advantages of synthetic materials and in particular of the crosslinked polyethylene such as resistance to abrasion and corrosion, chemical resistance and hygiene with those of aluminium such as resistance to high temperatures and pressures, dimensional stability, impermeability to oxygen and light, and low thermal expansion.

The result is a product consisting of different layers of materials that combined together allow excellent properties to be obtained which can not be reached by a pipe made of only one material.

Figure Pipe diameters



Technical data

Tabella Typical technical data

Features	Values
Material	Crosslinked polyethylene internal layer PE-Xb, internal bonding layer, intermediate aluminium layer, external bonding layer, crosslinked polyethylene external layer PE-Xb
Colour	RAL White 9003
Dimensions	14÷110 mm
Application	Hot and cold potable water distribution, convector and radiator heating systems, radiant heating and cooling systems, compressed air distribution systems, industrial installations.
Connections	By means of fittings Pexal® Brass, Bravopress®, Pexal® XL, Pexal® Easy e Pexal® Twist
Minimum operating temperature(1)	-60°C
Maximum temperature(2)	+95°C/+100°C
Maximum pressure	+10 bar
Density at 23°C	> 0.950 g/cm^3 (crosslinked polyethylene)
Softening temperature	135°C
Thermal expansion coefficient	0.026 mm/m·K
Thermal conductivity	0.42÷0.52 W/m·K
Internal roughness	0.007 mm
Oxygen permeability	0 mg/l
UV Resistance	Yes, if protected with UV-resistant paint
Halogen levels	Halogen-free
Reaction to fire	C-s2,d0

(1) At any rate above the freezing temperature of the transported fluid.
(2) For more details see the “Application fields” section.

2. PEXAL® BRASS TECHNOPOLYMER (PPSU) PRESS FITTINGS

Pexal® Brass is a system of press fittings suitable for a variety of applications, from hot and cold drinking water supply systems, to heating systems and industrial installations.
By using a portable pressing machine equipped with a suitable jaw, the pipe is shaped around the fitting insert. Even in the presence of temperature fluctuations, the joint remains perfectly watertight and cannot be loosened thanks to the stainless steel sleeve that covers the portion of pipe in contact with the insert. The sleeve has inspection holes to verify the correct insertion of the pipe on the fitting.

Technical data

Tabella Pexal® Brass fittings features.

Body	Brass alloy
Sleeve	AISI 304 stainless steel with inspection holes to check the correct insertion of the pipe
Seals	2 made of EPDM
Chemical/physical detachment	Through the bottom ring made of PE which prevents contact between the aluminium layer and the brass fitting
Dimensional range	14÷90 mm
Suitable pipes	Pexal®, Mixal®, Thermoline®
Equipment required	Pipe cutter, calibrator, pressing machine, lubricant

3. DESCRIPTION OF THE PRODUCTION PROCESSES OF THE PEXAL® PIPES

The Pexal® production process can be divided into different phases.
The first phase is carried out by an extruder, which is a plant fed with polyethylene particles, additives and catalysing agents which melt the mixture and push it through a mould in order to shape the internal pipe layer. The material, which has not yet solidified, passes through a vacuum-sealed calibration and cooling chamber, where it reaches the defined dimensions. In the following phase, a second extruder applies a layer of adhesive onto the surface of the pipe; this layer creates a strong permanent bond between the plastic pipe and the aluminium sheet, which will be added in the third phase. The edges of the aluminium sheet, which is supplied in coils, are cut and the sheet itself is calibrated in order to fit the circumference of the pipe onto which it has to be wrapped. After being calibrated, the sheet is progressively shaped around the pipe through a multistage process which leads to the butt-welding of the external edges by means of a TIG welding process.
Thanks to the TIG butt-welding process chosen by Valsir the thickness of the aluminium layer is the same around the whole pipe circumference, unlike the overlapping technology where the sheet edges are welded after being overlapped. Immediately after the welding phase, the pipe is warmed up in order to activate the adhesive layer and generate the bond between polyethylene and aluminium.
In the next stage a third extruder covers the aluminium with another adhesive layer, which is the fourth layer of the multilayer pipe. Finally a fourth extruder covers the pipe with a polyethylene layer (which, for Pexal® is crosslinked polyethylene) that is thick enough to obtain the final diameter of the finished pipe. During the final phases the pipe is cooled down, marked and cut into straight lengths or coils.
Product quality is verified throughout the entire production process, in particular the thickness and diameter of the plastic layers, the quality of the welding and the absence of holes in both the plastic and aluminium layers.
For Pexal® multilayer pipes, the extrusion phase is followed by a crosslinking phase, which will be analyzed in the following chapter and which guarantees the thermal and mechanical characteristics that are typical of Valsir pipes.

Figure Pipes extrusion process

4. DESCRIPTION OF THE PRODUCTION PROCESSES OF THE PEXAL® BRASS FITTINGS

The production of brass fittings begins by hot forging semi machined products or by brass rods.
Into the first stage, the brass fittings are machined with transfer center or with lathe, where the forged parts or the rods are transformed into fittings.
The machining with the transfer centre ensures measure accuracy and precision, the components are (milled, drilled, threaded etc.) processed with just one set-up. Work pieces are automatically clamped into position and are then moved, controlled by the CNC, from one tool to another.
By this process, multiple work pieces are often machined simultaneously.
The product quality is constantly monitored with several test for every batch for example are checked dimensions and mechanical stress.
The second stage in the production of Pexal® Brass fittings is the assembly of the accessories. Two O-rings are fitted in the appropriate seats on the fitting insert to ensure the pressure sealing, and then a duly marked stainless steel bushing is installed (the bushing, once pressed on the multilayer pipe, will be the one that will allow, together with the work of the O-rings previously mentioned, the sealing of the system under pressure).

Figure Fittings quality process

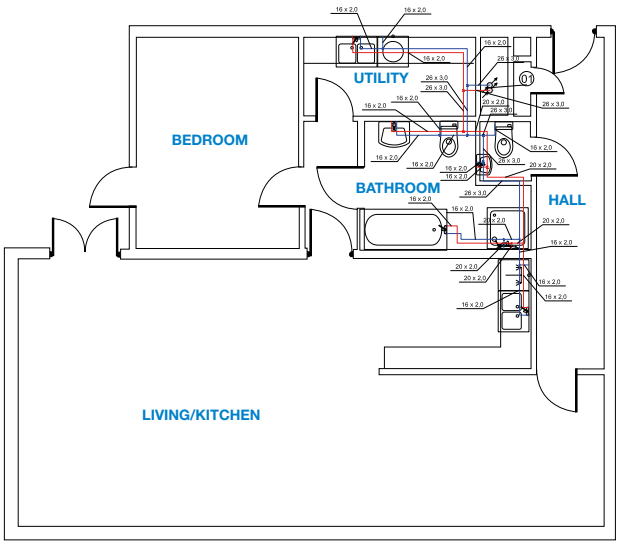
5. BASE MATERIAL AND ANCILLARY MATERIALS

Material	Pexal® pipe	Brass fitting
Aluminium	42%	/
Polyethylene	55%	1%
Additives and pigments	3%	/
Polyphenylsulfone (PPSU)	/	/
Stainless steel/galvanized steel	/	16%
EPDM	/	3%
EPE	/	/
Brass	/	80%
Natural rubber	/	/
Total	**100%**	**100%**

Service Conditions - Application classes as per EN ISO 15874 and ISO 10508.
Technical properties.

6. DESCRIPTION OF PIPING SYSTEM COMPONENTS

The environmental burdens are calculated in relation to the functional unit, which resulted for a multilayer piping system for hot and cold water in a building.
The functional unit represents 100 m² of a typical residential single-family apartment, incorporating a bathroom, a separate WC including the bidet, one kitchen and a wash-room (laundry).
The EPD is declared as the average environmental performance for Valsir families of multilayer piping systems for hot and cold water in the building, over its reference service life cycle of 50 years (being the estimated reference life time of the apartment), in accordance with EN 806, EN ISO 15874 and CEN TR 12108.
Piping system included Pexal pipes and brass fitting. No other components (tap connectors, brackets/clips) have been included.



7. PRODUCTS DISTRIBUTION

Pipes and fittings are supplied to customers in customised dimensions with appropriate protection and packaging. The product packaging is made of cardboard boxes, wooden pallets, plastic bags and caps for pipes protection.

8. INSTALLATION

Water, fast fixing cement, wall fixing metals and electricity are used during installation. No emissions are generated during installation and piping systems installations do not cause health or environmental hazards.

- **Functional unit**

The functional unit is defined as "The pressure supply and transport of hot and cold drinking water, from the entrance of a well-defined apartment to the tap, by means of multilayer (Pexal®) hot & cold drinking water pipe system installation supplying a 100 m^2 apartment, incorporating a bathroom, one kitchen and a washroom (laundry). The reference flow does not include the packaging.

Name	Value	Unit
Reference flow	13	kg/FU
Pipes	9.41	kg/FU
PPSU fittings	2.93	kg/FU
Plastic components	0.09	kg/FU
Metal components	0.57	kg/FU
Conversion factor to 1 kg	0,0769	
Conversion factor to 1 m	0,0188	
Total pipes length	53	m
Number of fittings	38	pcs

Dangerous materials: The product does not contain any substances included in the "Candidate List of Substances of Very High Concern for Authorization" compliant with /REACH/ and with EC 1272/2008.

The total mass involved is 11.32 kg of which 9.41 kg of plastic pipes, 0.74 kg of PPSU plastic fittings, 0.13 kg of plastic inserts and 1.04 of metal inserts.

- **Condition of use**

Operational use (pumping energy) is not relevant for the EPD, since it falls outside the system boundaries of the LCA project. Maintenance is not needed for the Pexal® + Pexal® Brass hot & cold pipe system.
According to /FprEN 16904/a general scenario of zero impact for plastic piping systems inside the building is considered.

- **Reference service life**

Plastic piping systems are regarded as having 50 years RSL independent of their material according to /FprEN 16904/.

- **End of life**

After the demolition and deconstruction phase, piping systems can be incinerated, sent to landfill or recycled.

LCA RESULTS

The tables below show the results of the Pexal® + Pexal® Brass LCA (Life Cycle Assessment). Additional environmental impact indicators have been calculated and included in the project report, but are not declared according to EN 15804 + A2 chapter 7.2.3.2.

Tabella Environmental impact per functional unit

Parameter - Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
GWP total [kg CO_2-eq.]	6.39E01	7.87E-01	1.86E00	1.23E00	2.47E00	0	1.47E-01	3.09E-01	3.62E00	4.23E-01	-2.80E00
GWP fossil [kg CO_2-eq.]	6.35E01	7.86E-01	1.85E00	1.23E00	2.44E00	0	1.46E-01	3.09E-01	3.62E00	4.18E-01	-2.79E00
GWP biogenic [kg CO_2-eq.]	3.18E-01	1.18E-03	5.07E-03	1.83E-03	2.55E-02	0	1.24E-03	4.65E-04	2.31E-04	4.54E-03	-8.40E-03
GWP luluc [kg CO_2-eq.]	3.73E-02	5.13E-05	2.01E-04	7.49E-05	1.85E-03	0	2.07E-04	2.01E-05	4.96E-05	5.00E-04	-1.26E-03
ODP [kg CFC-11-eq.]	5.85E-13	1.38E-16	1.07E-11	2.08E-16	1.20E-14	0	3.49E-15	5.44E-17	4.70E-16	1.11E-15	-1.68E-14
AP [mole of H^+-eq.]	2.42E-01	7.69E-04	2.07E-03	5.52E-03	8.71E-03	0	3.04E-04	2.69E-04	7.05E-04	1.55E-03	-4.75E-03
EP - freshwater [kg P eq.]	1.51E-04	1.77E-07	7.90E-05	2.76E-07	7.78E-06	0	3.91E-07	6.94E-08	1.13E-07	6.41E-05	-2.57E-06
EP - marine [kg N eq.]	3.64E-02	2.62E-04	9.34E-04	1.47E-03	1.33E-03	0	7.21E-05	8.42E-05	2.24E-04	3.70E-04	-1.19E-03
EP - terrestrial [mole of N eq.]	3.91E-01	2.91E-03	6.20E-03	1.62E-02	1.45E-02	0	7.57E-04	9.50E-04	3.20E-03	4.04E-03	-1.29E-02
POCP [kg NMVOC eq.]	1.17E-01	7.33E-04	2.20E-03	4.17E-03	4.29E-03	0	1.96E-04	2.51E-04	6.06E-04	1.16E-03	-3.73E-03
ADPF [kg Sb eq.]	1.14E03	1.06E01	1.75E01	1.65E01	3.40E01	0	2.59E00	4.18E00	7.58E-01	5.99E00	-4.37E01
ADPE [MJ]	1.16E-03	3.65E-08	1.91E-06	5.52E-08	4.30E-05	0	4.29E-08	1.44E-08	7.13E-09	3.05E-08	-2.99E-07
WDP [m^3 world eq.]	7.97E00	1.74E-03	4.38E00	2.64E-03	3.57E-01	0	2.34E-02	6.83E-04	3.60E-01	3.46E-03	-1.44E-01

GWP Global warming potential
ODP Depletion potential of the stratospheric ozone layer
AP Acidification potential of land and water
EP Eutrophication potential
POCP Formation potential of tropospheric ozone photochemical oxidants
ADPE Abiotic depletion potential for non fossil resources
ADPF Abiotic depletion potential for fossil resources
WDP Water (user) deprivation potential. deprivation-weighted water consumption

LCA RESULTS

Tabella Resource use per functional unit

Parameter - Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
PERE [MJ]	2.87E02	5.66E-02	5.97E-01	8.50E-02	9.05E00	0	1.20E00	2.23E-02	1.45E-01	4.92E-01	-6.30E00
PERM [MJ]	3.47E-03	0	1.15E-01	0	-8.76E-03	0	0	0	-5.48E-04	0	0
PERT [MJ]	2.87E02	5.66E-02	7.12E-01	8.50E-02	9.04E00	0	1.20E00	2.23E-02	1.45E-01	4.92E-01	-6.30E00
PENRE [MJ]	8.92E02	1.07E01	8.05E00	1.65E01	3.31E01	0	2.60E00	4.19E00	4.03E01	5.99E00	-4.38E01
PENRM [MJ]	2.50E02	0	9.44E00	0	9.72E-01	0	0	0	-3.95E01	0	0
PENRT [MJ]	1.14E03	1.07E01	1.75E01	1.65E01	3.41E01	0	2.60E00	4.19E00	7.58E-01	5.99E00	-4.38E01
SM [Kg]	2.76E00	0	7.43E-03	0	5.34E-02	0	0	0	0	0	0
RSF* [MJ]	0	0	0	0	0	0	0	0	0	0	0
NRSF* [MJ]	0	0	0	0	0	0	0	0	0	0	0
FW [m^3]	6.20E-01	8.15E-05	9.79E-02	1.23E-04	2.15E-02	0	1.16E-03	3.20E-05	8.46E-03	2.81E-04	-7.89E-03

* Reference to only foreground system.

PERE Use of renewable primary energy as energy carrier

PERM Use of renewable primary energy as raw materials

PERT Total use of renewable primary energy resources

PENRE Use of non-renewable primary energy as energy carrier

PENRM Use of non-renewable primary energy as raw materials

PENRT Total use of non-renewable primary energy resources

SM Use of secondary material

RSF Use of renewable secondary fuels

NRSF Use of non-renewable secondary fuels

FW Use of net fresh water

LCA RESULTS

Tabella Output flows and waste categories per functional unit

Parameter - Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
HWD [Kg]	4.23E-07	1.02E-10	6.24E-08	1.56E-10	7.13E-08	0	6.86E-10	4.01E-11	1.38E-10	1.01E-09	-7.61E-09
NHWD [Kg]	1.11E01	1.16E-03	2.67E-01	1.79E-03	6.63E-01	0	1.84E-03	4.56E-04	1.27E-01	9.58E00	-2.67E-02
RWD [Kg]	3.69E-02	1.75E-05	3.09E-04	2.64E-05	1.02E-03	0	3.86E-04	6.88E-06	3.66E-05	6.78E-05	-2.16E-03
CRU [Kg]	0	0	0	0	0	0	0	0	0	0	0
MFR [Kg]	0	0	0	0	1.53E-01	0	0	0	2.08E00	0	0
MER [Kg]	0	0	0	0	0	0	0	0	0	0	0
EEE [MJ]	0	0	0	0	6.82E-01	0	0	0	6.88E00	0	0
EET [MJ]	0	0	0	0	1.21E00	0	0	0	1.24E01	0	0

HWD Hazardous waste disposed

NHWD Non-hazardous waste disposed

RWD Radioactive waste disposed

CRU Components for re-use

MFR Materials for recycling

MER Materials for energy recovery

EEE Exported electrical energy

EET Exported thermal energy

Parameter - Unit	A1	A2	A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Biog. C in packaging [Kg]	0	0	2.92E-003	0	0	0	0	0	0	0	0
Biog. C in product [Kg]	8.77E-005	0	0	0	0	0	0	0	0	0	0

Biog. C in packaging Biogenic carbon content in packaging

Biog. C in product Biogenic carbon content in product

CALCULATION RULES

ASSUMPTIONS

Where possible, a conservative approach has been adopted, overestimating burdens to prove irrelevance. In other cases, alternatives data were selected based on scientific experience in order to improve the accuracy of the model. Where it was not possible to know the precise composition of materials in the supply chain (due to commercial or industrial confidential suppliers' reasons or due to missing datasets), these have been approximated with LCIs of similar materials, estimated by the combination of available dataset or reconstructed with literature data.

- Lead batteries have been taken into account as a conservative choice for batteries used in forklift.
- For brass recycling the steel billet recycling process has been used as conservative choice (melting temperature for recycling brass is lower than for steel).
- Where potential benefits from energy recovery in A5 and C modules are considered, for rest of world countries (other than Europe) these are calculated based on the European grid mix.
- For boilers (natural gas fed) an efficiency factor equal to 0.95 is considered.
- The functional unit is defined without packaging.
- In case of transports on truck where the payload was neither available nor conceivable, utilization factor of 0.61 has been considered (empty way back).
- For masterbatches/pigments whose exact composition was not available, a 95% of main polymer has been considered in addition to 5% pigment and in case of recycling, only the avoided burden of the polymer is considered (avoided burden of the pigment is neglected as conservative choice).
- For millings used to mill plastic scraps from internal manufacturing activities whose specific consumption was not available, an average between Bivite's and Govoni's milling consumption has been taken.
- For metal components end of life, a 60% recycling percentage has been considered based on /ISPRA/ reference, 40% is sent to landfill.
- FFor distribution the distance between Valsir warehouse and the country capital is considered and an estimated additional distance of 500 km by truck is added to the transport via ship.
- The Multilayer product containing aluminium is assumed as not recyclable at end of life.
- Distance to disposal site after demolition is assumed to be 100 km.
- For end of life scenarios, as Building&Construction (ISPRA) update percentage for Italy did only consider the overall recovery percentage, not distinguishing between recycling and energy recovery, the relative proportion has been assumed to be the same as in /PLASTIC EUROPE (2010)/ containing specific information for 2010.
- We assume that the aluminium foil used in the multilayer's pipes product is made of primary aluminium.
- For plastic systems installation scrap production an average product has been considered, taking into account a worst case approach not including the related packaging.
- For plastic fittings production several pigments are used. In case of multilayers piping systems, only grey pigments are used, while in case of waste piping systems several colouring options are possible.
- Whenever transport distances were not available (i.e. C2 module) a general 100 km has been considered.
- As CHP plant has been only partially in use in 2019, the electricity amount produced by the plant has been considered as taken from grid, as conservative choice.

CUT-OFF RULES

Only impacts that have been cut-off are internal transports between Valsir plants. Production of capital equipment. facilities and infrastructure required for manufacture are outside the scope of this assessment. The sum of the excluded material flows does not exceed 5% of mass, energy or environmental relevance.

DATA QUALITY

The data quality can be considered as good. The LCA models have been checked and most relevant flows were considered. Technological, geographical and temporal representativeness is appropriate.

EXAMINATION PERIOD

Primary data collected in the context of this study refer to 2019.

ALLOCATION - UPSTREAM DATA

Information about single datasets is documented in http://database-documentation.gabi-software.com/support/gabi/.

SCENARIOS AND ADDITIONAL TECHNICAL INFORMATION

- Module A1 refers to all raw materials impacts production with packaging included and all types of energy inputs
- Module A2 includes the raw materials (also auxiliary's and packaging) transport to the factory gate
- Module A3 comprises all production activities and waste treatment and process emissions (both to air and to water). Such activities refer to Valsir direct activities. Primary data have been used for plastic extrusion for multilayers pipes production and plastic injection moulding for PPSU fittings production.
- Module A4 takes into account the transport to the final customer/distributor. In 2019, Pexal® + Pexal® Brass product distribution scenario is shown in the table below. What is not sold neither to Europe not to Italy, is sent to the rest of the world.

			GaBi transport dataset	
Product	**IT**	**EU**	**Truck [km]**	**Ship [km]**
			Truck-trailer, Euro 6, up to 28 t gross weight / 12.4 t payload capacity	Average ship, 27500 dwt payload capacity/ocean going
Pipes	9.48%	29%	1039.15	900.62
Fittings	19.14%	49.14%	816.33	1092.83

- For Module A5 the following parameters have been taken into account:

Installation	
Material	**Pexal® + Pexal® Brass**
Scrap percentage [%]	2
Water [kg]	1
Lubricant [kg]	0.047
Fast fixing cement [kg]	0.016
Wall fixing metals	0.007
Electrical energy [kWh]	0.015
Water for cement [kg]	0.007

Moreover, following leftover end of life scenarios have been included:

	Landfill	**Incineration**	**Mechanical recycling**	**Source**
Leftover	84%	16%	0%	/FPREN 16904/
Distance to treatment	100 km	100 km	/	/FPREN 16904/

- Module B (maintenance and operational use): Operational use and Maintenance are not relevant for the piping system. According to /FprEN 16904/ a general scenario of zero impact for plastic piping systems inside the building is considered for all B modules (B1-B2-B3-B4-B5-B6-B7).

- Module C1 (Deconstruction / demolition) has been included and deconstruction impacts have been considered.
- Module C2, C3 (recycling and incineration with energy recovery) and C4 (landfilling) consider the end of life scenarios of the product, considering all components of the piping system. The percentages to the given scenarios have been suggested by /FprEN 16904/ as shown below:

Material	EoL treatment -	Source	Distances to treatment [C2]
Piping systems	84% landfilling 16% incineration 0% mechanical recycling	/F_{PR}EN 16904/	100 km
Metal components/fittings	60% recycling 40% landfilling	/ISPRA/	100 km

- Module D consists of loads and benefits beyond the system boundaries.

OTHER ADDITIONAL ENVIRONMENTAL INFORMATION

EMISSIONS TO INDOOR AIR:

No direct emissions at the building site, Valsir S.p.A. confirms that the Pexal® + Pexal® Brass piping system does not contain any substances mentioned on the REACH SVHC -list.

EMISSIONS TO SOIL AND WATER:

No direct emissions at the building site, Valsir S.p.A. confirms that the Pexal® + Pexal® Brass piping system does not contain any substances mentioned on the REACH SVHC -list.

REFERENCES

CEN/TR 15941	Sustainability of construction works - Environmental product declarations - Methodology for selection and use of generic data; CEN/TR 15941:2010
CPR	Regulation (EU) No 305/2011 of the European parliament and of the council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC
EN 15804+A2	EN 15804:2012+A2:2019: Sustainability of construction works -Environmental Product Declarations - Core rules for the product category of construction products
EN ISO 14025	EN ISO 14025:2011-10 Environmental labels and declarations - Type III environmental declarations - Principles and procedures
EN ISO 14040	EN ISO 14040:2009-11 Environmental management - Life cycle assessment - Principles and framework
EN ISO 14044	EN ISO 14044:2006-10 Environmental management - Life cycle assessment - Requirements and guidelines
GABI TS	GaBi ts dataset documentation for the software-system and databases, LBP, University of Stuttgart and Sphera, Leinfelden-Echterdingen, 2021 (http://documentation.gabi-software.com/)
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GUINÉE 2001	Guinée et al, An operational guide to the ISO-standards, Centre for Milieukunde (CML), Leiden, the Netherlands, 2001
PCR ICMQ-001/15 REV.3	PCR ICMQ-001/15 - Prodotti da costruzione e servizi per costruzioni, Rev.3 del 02.12.2019.
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ISO 15686	ISO 15686:2011-05, Buildings and constructed assets - Service life planning
ISPRA	Rapporti rifiuti speciali, ISPRA 2020
FPREN 16904	Plastics piping systems - Environmental product declarations - Product Category rules complementary to EN 15804, for plastic piping systems inside buildings.
EUROSTAT	EUROSTAT Data browser: Packaging waste by waste management operations https://ec.europa.eu/eurostat/databrowser/view/ENV_WASPAC_custom_344983/default/table?lang=en
COREPLA	https://www.corepla.it/ https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwivqNya4vjvAhVLm6QKHWJ3BOQQFjAAegQIBhAD&url=https%3A%2F%2Fwww.corepla.it%2Fdocumenti%2F060bbd18-7fbf-4b76-b9b8-d28f4a973607%2FRELAZIONE%2BSULLA%2BGESTIONE%2B2019.pdf&usg=AOvVaw2LuwjziOZqFmIdV20AvQz7

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RILEGNO	http://www.rilegno.org/rapporto-2020/
PLASTIC EUROPE (2010)	Analysis of recovery of plastic waste in the building and construction sector (2010). Recovery and disposal of plastic B&C waste in EU27+2 and by country (2010). Plastic Europe, February 2012
PLASTIC WASTE FROM B&C IN EU 2018	Final report “Plastic waste from B&C in EU 2018” . Overview plastic waste from building & construction by polymer type and by recycling, energy recovery and disposal - Building & construction post consumer plastic waste generation EU 28+2 in 2018 (kt), Plastic Europe 2018
REACH	The Candidate List of Substances of Very High Concern (SVHC). Pursuant to Article 59(10) of the REACH Regulation (EC) No 1907/2006. https://echa.europa.eu/it/candidate-list-table

WASTE SYSTEMS

SUPPLY SYSTEMS

GAS SYSTEMS

FLUSHING SYSTEMS

BATHROOM SYSTEMS

TRAPS

RADIANT SYSTEMS

DRAINAGE SYSTEMS

HRV SYSTEM

ACADEMY

SEWER SYSTEMS

WATER TREATMENT

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