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The Norwegian EPD Foundation

ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14020, ISO 14025, ISO 21930 and EN 15804

Owner of the declaration:	Paroc Panel System OY Ab
Program operator:	The Norwegian EPD Foundation
Publisher:	The Norwegian EPD Foundation
Declaration number:	NEPD-403-283-EN
Issue date:	20.01.2016
Valid to:	20.01.2021

Paroc AST S and AST S+ fire proof panels

Paroc AS

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General information

Product:
Paroc AST S and AST S+ fire proof panels

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Declaration number:
NEPD-403-283-EN

Place of production:
Parainen, Finland

ECO Platform reference number:
-

Management system:
ISO 9001:2008

This declaration is based on Product Category Rules:
CEN Standard EN 15804 serves as core PCR
PCR 010 rev1 Building Boards (12 2013)

Organisation no:
FI9183492

Statement of liability:
The owner of the declaration shall be liable for the underlying information and evidence. EPD Norway shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

Issue date:
20.01.2016

Valid to:
20.01.2021

Scope:
Cradle to Grave

Year of study:
2015-16

Declared unit:
1 m^2 of Paroc AST S 150 sandwich panels, with mass of 22,08, from raw material extraction (A1) to the factory gate (A3).

Comparability:
EPD of construction products may not be comparable if they not comply with EN 15804 and seen in a building context.

Functional unit:
1 m^2 of sandwich panel, type AST S 150, with a reference service lifetime of 50 years.

The EPD has been worked out by:
Selamawit Mamo Fufa
Reidun Dahl Schlanbusch
SINTEF

Verification:
The CEN Norm EN 15804 serves as the core PCR. Independent verification of the declaration and data, according to ISO14025:2010

☐ internal ☑ external

Third party verifier:
Martin Erlandsson
(Independent verifier approved by EPD Norway)
ivl SVENSKA MILJÖINSTITUTET

Approved
Håkon Hauan
Managing Director of EPD-Norway

Product

Product description:
Paroc fire proof panels are steel-faced sandwich panels with a core of stone wool. The panels are intended to be used as partitions, ceilings and external wall structures in industrial, commercial, residential and office buildings, hospitals, chill stores, clean rooms and in the food industry.

Product specification:
The calculations are based on the 1 m^2 of Paroc AST S 150 fire proof panels (Table 1). This EPD is valid for all variations carrying the name Paroc AST S 150 and Paroc AST S+ 150 panels.

The deviation of the LCA results for the AST S+ panels relative to the AST S panels is estimated to be less than 1%.

The panels are produced in different thicknesses. The environmental impact of the panels with different thicknesses can be estimated by multiplying the LCA result of each impact category in the environmental impact table (page 6) with the corresponding factors given in Table 2.

Technical data:
The mass of the declared unit is 22,08 kg and the thickness is 150 mm.

The panel has SINTEF Technical Approval TG 2180 (http://www.paroc.com/~/media/files/certificates/no-approval-nr-2180-ps.ashx). For U value and other technical data consult the approval.

Market
Main market areas are nordic countries and central and eastern Europe. The senarios beyond cradle-to-gate are based on Norwegian market.

Reference service life, product:
The Reference service lifetime of Paroc fire proof panels is 50 years when applied according to the product description in TG 2180.

Reference service life, building:
The Reference service lifetime of 50 years has been assumed for the building in all calculations.

Table 1. Composition of 1 m^2 of AST S 150 panel.

Materials	kg	%
Mineral wool	12,75	57,73
Metal sheet	8,73	39,53
Glue	0,59	2,64
Sealant	0,02	0,08
Sum of materials	*22,08*	*100*

Table 2. Factors for estimation of the environmental impact from different panel thicknesses. Multiply the LCA result of each impact category in the environmental impact table (page 6) with the corresponding factors.

Impact categories	Thicknesses (mm)								
	50	**80**	**100**	**120**	**150**	**175**	**200**	**240**	**300**
GWP (kg CO_2 -eqv)	0,74	0,81	0,87	0,92	1,00	1,07	1,13	1,24	1,40
ODP (kg CFC11-eqv)	0,62	0,73	0,81	0,89	1,00	1,10	1,19	1,34	1,57
POCP(kg C_2H_4 -eqv)	0,84	0,87	0,91	0,95	1,00	1,04	1,09	1,17	1,28
AP (kg SO_2 -eqv)	0,77	0,84	0,88	0,93	1,00	1,06	1,12	1,21	1,35
EP (kg PO_4^{3-}-eqv)	0,85	0,89	0,93	0,95	1,00	1,04	1,07	1,14	1,23
ADPM (kg Sb-eqv)	0,97	0,98	0,98	0,99	1,00	1,01	1,02	1,03	1,05
ADPE (MJ)	0,72	0,79	0,85	0,91	1,00	1,07	1,15	1,27	1,46
RPEE (MJ)	0,66	0,76	0,83	0,90	1,00	1,09	1,17	1,30	1,51
RPEM (MJ)	-	-	-	-	-	-	-	-	-
TPE (MJ)	0,66	0,76	0,83	0,90	1,00	1,09	1,17	1,30	1,51
NRPE (MJ)	0,68	0,77	0,84	0,90	1,00	1,08	1,16	1,29	1,49
NRPM (MJ)	0,67	0,64	0,73	0,84	1,00	1,11	1,27	1,51	1,86
TRPE (MJ)	0,68	0,77	0,84	0,90	1,00	1,08	1,16	1,30	1,50

LCA: Calculation rules

Declared unit:

1 m^2 of Paroc AST S 150, from raw material extraction (A1) to the factory gate (A3).

System boundary:

Flow chart for production (A3) of the panels is shown in Figure 1, while the system boundaries for the rest of the modules are shown on page 6.

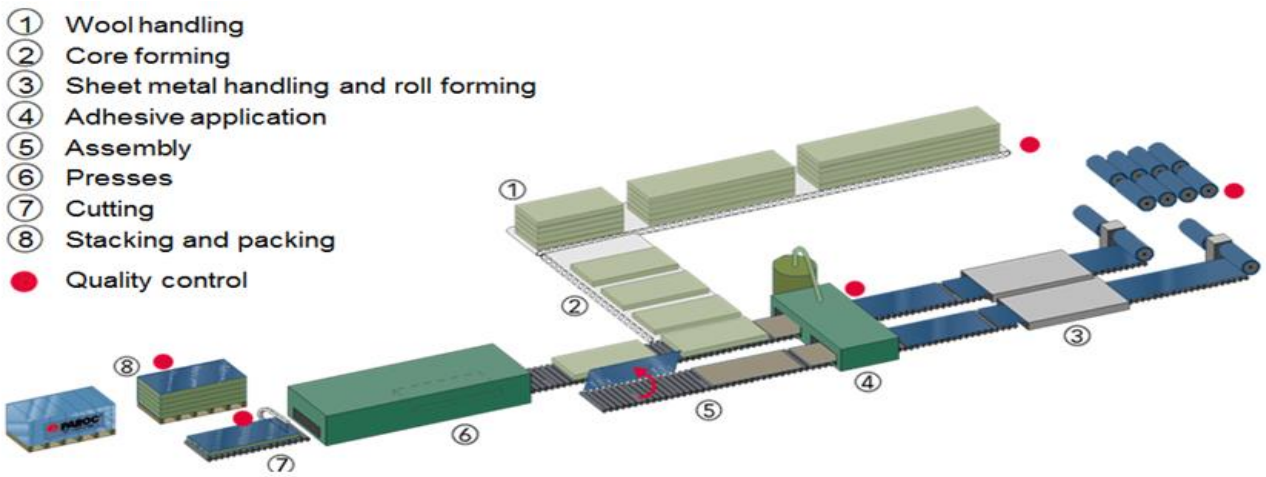

Figure 1: A flow diagram of Paroc fire proof panels production (A3).

Data quality:

The data quality requirements are according to PCR 010 rev1 Building Boards clause 7.3.6. Specific data collected from manufacturer is applied for the most important raw materials in A1. Specific data from the 2014 production at the manufacturing site is applied in A3.The production data of Paroc fire proof panels is from one production site, Parainen in Finland, so no average data has been used for different locations. Missing data were susbtituted with generic data from Ecoinvent v.3.1. No data are more than 5 years old.

Cut-off criteria:

General cut-off criteria are given in standard EN 15804 clause 6.3.5. In compliance with these criteria, all major raw materials and all the essential energy are included. The infrastructure of the manufacturing site, joint insulation and sealants used in A5 with very small amounts (<1%) are not included. This cut-off rule does not apply for hazardous materials and substances.

Allocation:

The allocation is made in accordance to EN 15804:2012+A1:2013. Energy, water and waste consumption in the factory is allocated to the FU by mass allocation. Effects of primary production of recycled materials are allocated to the main product in which the material was used. The recycling process of the metal sheet is allocated to module C3. The credit from recycling of the metal sheet is allocated to moduel D.

LCA: Scenarios and additional technical information

The following information describe the scenarios in the different modules of the EPD.

Transport from production place to user (A4)

Type	Destination	Capacity utilisation (incl. return) %**	Type of vehicle	Distance km	Fuel/Energy consumption	Value (l/t)
Truck	Turku, Finland	53	Lorry >32 tons, EURO4	26	0,02 l/tkm	0,52
Boat	Kappelskär, Sweden	65	Freight ship	229	0,003 l/tkm	0,69
Truck	Oslo, Norway	53	Lorry >32 tons, EURO4	600	0,02 l/tkm	12

The transport in A4 is a representative transport distance from production site in Finland to the building site in Norway.

Assembly (A5)

	Unit	Value
Auxiliary materials	kg	0,51
Electricity consumption	kWh	0,017
Other energy carriers	kWh	0,044
Material loss	kg	0

The installation (A5) includes the energy and materials used for unloading of the panel packages from a truck, lifting up the panels to the building frame and fixing the panels with screws and selants. Material loss is estimated to be 0.

Use (B1)

	Unit	Value
No LCA-related environmetal impacts		0

There is no environmental related impact (B1) by the panel during the service life.

Maintenance (B2)/Repair (B3)

	Unit	Value
Paint used for maintenance	kg	0,24
Detergent used for cleaning	kg	0,20
Water used for cleaning	l	7,6
Consumption of energy	MJ	2,0
Material loss	kg	0,080

Replacement (B4)/Refurbishment (B5)

	Unit	Value
Replacement cycle*	Yr	50

* Number or RSL (Reference Service Life)

The maintenance (B2) of the panels is assumed to be performed by applying two layers of paint once during the life time of the panels. Cleaning of the surface of the panels using detergent four times during the life time is also included.

In normal use scenario, it is assumed that there is no repair (B3), replacement (B4) and refubrishment (B5) is needed .

Operational energy (B6) and water consumption (B7)

	Unit	Value
Modules not relevant according to PCR 010		

B6 and B7 are not relevant according to PCR 010 rev1 Building Boards.

End of Life (C1, C3, C4)

	Unit	Value
Hazardous waste disposed	kg	
Collected as mixed construction waste	kg	
Reuse	kg	
Recycling	kg	9,23
Energy recovery	kg	
To landfill	kg	13,4

End-of-life life scenario, C1, C3 and C4, is based on materials being separated on site. The steel is assumed to be 100% recycled and the mineral wool is assumed to be 100% landfilled. Energy for deconstruction is included in C1, and activities related to steel recycling is included in C3.

Transport to waste processing (C2)

Type	Destination	Capacity utilisation (incl. return) %**	Type of vehicle	Distance km	Fuel/Energy consumption	Value (l/t)
Truck	To recycling	26,3	Lorry, 16-32 tons, EURO4	50	0,045 l/tkm	2,3
Truck	To landfill	26,3	Lorry, 16-32 tons, EURO4	50	0,045 l/tkm	2,3

The transport in C2 represents transport to recycling and disposal site in Norway.

** The capacity utilization factors for truck are calculated from Ecoinvent v3.1. Capacity utilisation factors for boat are from Ecoinvent v2.2 report 14: Transport Services (Kolle et al., 1991) (Knørr et al., 2000)

Benefits and loads beyond the system boundaries (D)

	Unit	Value
Net new steel recycling	kg	8,42

Benefits beyound the life cycle (D) is calculated as the net new steel that is recycled and replace primary steel production. 1,092 kg of recycled steel is assumed to produce 1kg of virgin steel in secondary production. Thus, 92% of the steel (in C3) is assumed to replace the virgin steel production.

LCA: Results

The calculations are based on the Paroc AST S fire proof panels. The deviation of the LCA results for the AST S+ Paroc fire proof panels product range is estimated to be less than 1%.

When interpreting the results, it is important to note that, the benefits from recycling of the steel in D is calculated based on an assumption of 100% steel recycling.

System boundaries (X=included, MND= module not declared, MNR=module not relevant)

Product stage			Assemby stage		Use stage							End of life stage				Beyond the system boundaries
Raw materials	Transport	Manufacturing	Transport	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
X	X	X	X	X	X	X	X	X	X	X	MNR	MNR	X	X	X	X	X

Environmental impact

Parameter	Unit	A1	A2	A3	A1-A3	A4	A5	B1
GWP	kg CO_2 -eqv	25,0	0,88	2,57	28,4	1,24	1,45	0
ODP	kg CFC11-eqv	2,6E-06	1,6E-07	2,6E-07	3,0E-06	2,3E-07	5,9E-08	0
POCP	kg C_2H_4 -eqv	0,010	1,7E-04	1,2E-03	0,012	2,5E-04	4,8E-04	0
AP	kg SO_2 -eqv	0,13	6,2E-03	0,011	0,14	6,1E-03	5,2E-03	0
EP	kg PO_4^{3-}-eqv	0,020	1,3E-03	1,2E-03	0,022	9,1E-04	9,3E-04	0
ADPM	kg Sb-eqv	3,0E-04	5,6E-07	7,1E-07	3,0E-04	2,7E-06	1,7E-05	0
ADPE	MJ	312	12,8	54,2	379	19,3	10,6	0

Environmental impact

Parameter	Unit	B2	B3-B5	C1	C2	C3	C4	D
GWP	kg CO_2 -eqv	2,76	0	0,015	0,19	5,0E-03	0,073	-14,3
ODP	kg CFC11-eqv	1,7E-07	0	2,7E-09	3,5E-08	2,5E-09	2,4E-08	-8,8E-07
POCP	kg C_2H_4 -eqv	1,4E-03	0	3,1E-06	3,3E-05	8,5E-07	2,7E-05	-8,4E-03
AP	kg SO_2 -eqv	0,011	0	1,1E-04	7,8E-04	1,9E-05	5,5E-04	-0,078
EP	kg PO_4^{3-}-eqv	5,9E-03	0	2,4E-05	1,3E-04	3,7E-06	9,2E-05	-0,016
ADPM	kg Sb-eqv	9,3E-06	0	1,5E-08	6,2E-07	2,4E-08	9,0E-08	-2,0E-04
ADPE	MJ	18,6	0	0,22	2,89	0,063	2,03	-156

GWP Global warming potential; ODP Depletion potential of the stratospheric ozone layer; POCP Formation potential of tropospheric photochemical oxidants; AP Acidification potential of land and water; EP Eutrophication potential; ADPM Abiotic depletion potential for non fossil resources; ADPE Abiotic depletion potential for fossil resources

INA = Indicator not assessed

Resource use

Parameter	Unit	A1	A2	A3	A1-A3	A4	A5	B1
RPEE	MJ	48,4	0,092	6,59	55,1	0,297	0,892	0
RPEM	MJ	0	0	0	0	0	0	0
TPE	MJ	48,4	0,092	6,59	55,1	0,297	0,892	0
NRPE	MJ	393	12,97	58,1	464	19,7	11,3	0
NRPM	MJ	0	0	9,86	9,86	0	0	0
TRPE	MJ	393	12,97	67,9	474	19,7	11	0
SM	kg	1,66	INA	INA	INA	INA	9,5E-02	0
RSF	MJ	INA	INA	INA	INA	INA	INA	0
NRSF	MJ	INA	INA	INA	INA	INA	INA	0
W	m^3	234	0,36	26,4	261	0,86	5,38	0

Resource use

Parameter	Unit	B2	B3-B5	C1	C2	C3	C4	D
RPEE	MJ	14,3	0	0,071	0,036	0,050	0,048	-14,2
RPEM	MJ	0	0	0	0	0	0	0
TPE	MJ	14,3	0	0,071	0,036	0,050	0,048	-14,2
NRPE	MJ	24,8	0	0,22	2,94	0,32	2,07	-166
NRPM	MJ	0	0	0	0	0	0	0
TRPE	MJ	24,8	0	0,22	2,94	0,32	2,07	-166
SM	kg	INA	0	INA	INA	INA	INA	INA
RSF	MJ	INA	0	INA	INA	INA	INA	INA
NRSF	MJ	INA	0	INA	INA	INA	INA	INA
W	m^3	4,49	0	0,028	0,11	0,302	0,065	-102

RPEE Renewable primary energy resources used as energy carrier; RPEM Renewable primary energy resources used as raw materials; TPE Total use of renewable primary energy resources; NRPE Non renewable primary energy resources used as energy carrier; NRPM Non renewable primary energy resources used as materials; TRPE 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; W Use of net fresh water

End of life - Waste

Parameter	Unit	A1	A2	A3	A1-A3	A4	A5	B1
HW	kg	INA	INA	0,050	0,050	INA	INA	0
NHW	kg	1,75	INA	1,94	3,69	INA	0,33	0
RW	kg	INA	INA	INA	INA	INA	INA	0

End of life - Waste

Parameter	Unit	B2	B3-B5	C1	C2	C3	C4	D
HW	kg	INA	0	INA	INA	INA	INA	INA
NHW	kg	0,080	0	INA	INA	9,40	13,4	INA
RW	kg	INA	0	INA	INA	INA	INA	INA

HW Hazardous waste disposed; NHW Non hazardous waste disposed; RW Radioactive waste disposed

End of life - Output flow

Parameter	Unit	A1	A2	A3	A1-A3	A4	A5	B1
CR	kg	INA	INA	INA	INA	INA	INA	0
MR	kg	INA	INA	INA	INA	INA	INA	0
MER	kg	INA	INA	INA	INA	INA	INA	0
EEE	MJ	INA	INA	INA	INA	INA	INA	0
ETE	MJ	INA	INA	INA	INA	INA	INA	0

End of life - Output flow

Parameter	Unit	B2	B3-B5	C1	C2	C3	C4	D
CR	kg	INA	0	INA	INA	INA	INA	INA
MR	kg	INA	0	INA	INA	9,4	INA	8,42
MER	kg	INA	0	INA	INA	INA	INA	INA
EEE	MJ	INA	0	INA	INA	INA	INA	INA
ETE	MJ	INA	0	INA	INA	INA	INA	INA

CR Components for reuse; MR Materials for recycling; MER Materials for energy recovery; EEE Exported electric energy; ETE Exported thermal energy

Reading example: 9,0 E-03 = $9,0*10^{-3}$ = 0,009

Additional Norwegian requirements

Greenhous gas emission from the use of electricity in the manufacturing phase
Finnish production mix from import,high Voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing prosess(A3).

Data source	Amount	Unit
Econinvent v3.1 (june 2014)	0,386	$kgCO_2$-eqv/kWh

Dangerous substances

☑ The product contains no substances given by the REACH Candidate list or the Norwegian priority list

☐ The product contains substances given by the REACH Candidate list or the Norwegian priority list that are less than 0,1 % by weight.

☐ The product contain dangerous substances, more then 0,1% by weight, given by the REACH Candidate List or the Norwegian Priority list, see table.

☐ The product contains no substances given by the REACH Candidate list or the Norwegian priority list. The product is classified as hazardous waste (Avfallsforskiften, Annex III), see table.

Indoor environment
The product meets the requirements for low emissions (M1) according to EN15251: 2007 Appendix E.

Carbon footprint
Carbon footprint has not been worked out for the product.

Bibliography

ISO 14020:2000	*Environmental labels and declarations - General principles*
ISO 14025:2010	*Environmental labels and declarations - Type III environmental declarations - Principles and procedures*
ISO 14044:2006	*Environmental management - Life cycle assessment - Requirements and guidelines*
EN 15804:2012+A1:2013	*Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products*
ISO 21930:2007	*Sustainability in building construction - Environmental declaration of building products*
EN 15251:2007	*Indoor environmental input parameters for design and assessment of energy performance of buildings*
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