ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	Türk Ytong Sanayi A.Ş.
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-YTO-20150044-IAD1-EN
Issue date	22.04.2015
Valid to	21.04.2020

Ytong® Autoclaved Aerated Concrete

TÜRK YTONG SANAYİ A.Ş.

Institut Bauen und Umwelt e.V.

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General Information

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Declaration number
EPD-YTO-20150044-IAD1-EN

This Declaration is based on the Product Category Rules:
Aerated concrete, 07.2014
(PCR tested and approved by the SVR)

Issue date
22.04.2015

Valid to
21.04.2020

Prof. Dr.-Ing. Horst J. Bossenmayer
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Dr. Burkhart Lehmann
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Ytong® Autoclaved Aerated Concrete

Owner of the Declaration
Türk Ytong Sanayi A.Ş.
Central Production Site – Pendik Factory
Pendik, 34899, Istanbul / TURKEY

Declared product / Declared unit
Autoclaved Aerated Concrete Block / 1 cubic meter (m3)

Scope:
This Life Cycle Assessment study is carried out for Autoclaved Aerated Concrete (AAC) Blocks produced in the manufacturing plant of TURK YTONG located in Pendik, Antalya, Bilecik and Trakya, Turkey.

This EPD is prepared as an average EPD for Autoclaved Aerated Concrete Blocks product group manufactured in these plants. The data used in this study is collected from four manufacturing facilities and a weighted average is calculated as an annual representative value for the year 2013.The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

Verification

The CEN Norm /EN 15804/ serves as the core PCR
Independent verification of the declaration according to /ISO 14025/
☐ internally ☒ externally

Mr Olivier Muller
(Independent verifier appointed by SVR)

Product

Product description
The products mentioned are unreinforced building blocks in various formats made of autoclaved aerated concrete /TS EN 771-4: 2011/. AAC belongs to the porous steam-cured light-weight concrete group.

The ground quartzite is mixed with gypsum, cement, quicklime and recycled AAC materials (slurry and powder) that has been reduced to small pieces, adding water and aluminum powder, in a mixer, until it becomes a watery suspension. It is then poured into a casting mould. The aluminum reacts in an alkaline milieu. Thus, gaseous hydrogen is formed which creates pores in the mass and escapes without leaving any residue. The pores usually have a diameter 0.5-1.5 mm and are filled exclusively with air. After setting once, semisolid raw blocks are created, from which the autoclaved aerated concrete building components are then cut with high precision.

The formation of the final qualities of the building component occurs during the subsequent steam-curing over 5 to 12 hours at approximately 190˚ C with approximately 12 bar pressure in steam pressure kettles or autoclaves, as they are called. The used substances create calcium hydro silicates, which correspond to the naturally occurring mineral tobermorite. The reaction of the material is complete when removed from the autoclave. Therefore, the reaction does not take as long as the hardening of concrete. Once the steaming process is complete, the steam is used for other autoclave cycles. AAC blocks are then piled onto wooden pallets and shrink-wrapped in polyethylene wrap.

Application
Unreinforced AAC building blocks are used for brick-laid, monolithic, load bearing and non-loadbearing infill walls. As intended, direct contact with ground water is avoided thanks to the constructional features.

Technical Data
AAC Ytong Blocks demonstrate the following constructional performance:

Constructional data

Name	Value	Unit
Compressive strength >=	1.5 - 5	N/mm^2
Gross density	300 - 600	kg/m^3
Tensile strength	0.24 - 1	N/mm^2
Modulus of elasticity	750 - 2250	N/mm^2
Thermal conductivity	0.085 - 0.16	W/(mK)
Water vapour diffusion resistance factor acc. to EN 4108-4	5/10	-
Moisture content at 23 °C, 80%	4	M.-%
Shrinkage as per ZA-PBP-07-01, modified EN 680 must be indicated; adherence to the shrinkage value of < 0.2 mm/m should be guaranteed	0.2	mm/m

Base materials / Ancillary materials

Name	Value	Unit
Quartzite	45-65	%
Portland cement	15-30	%
Gypsum	2-5	%
Quick Lime	6-20	%
Aluminium powder	0.05-0.15	%
Recycled Ytong Slurry	10-20	%
Recycled Ytong Powder	4-10	%

In addition, 40-60% water is used (in relation to the solid substances).

Reference service life
AAC does not change once it leaves the autoclaves. When used as intended, it is boundlessly stable. According to the Sustainable Building Guideline of IBU the average life expectancy of AAC is 100 years.

In this study Reference Life Value is not taken into consideration during the calculations, since the system boundary of this EPD is cradle to gate.

LCA: Calculation rules

Declared Unit
According to the “PCR Guidance-Texts, the functional unit for this product category is defined as 1 cubic meter (m3) of Autoclaved Aerated Concrete (AAC) Block. As a result of this, the life cycle assessment results are presented for 1 m3 of the analyzed product group.

Declared unit

Name	Value	Unit
Declared unit	1	m^3
Gross density	398	kg/m^3
Conversion factor to 1 kg	0.0025	-

System boundary
Type of the EPD: cradle to gate

The system boundaries of this life cycle assessment study are considered as cradle to gate, since all the modules except A1-A3 product stage are not declared within the scope of this study. This means the system boundary covers Ytong AAC Block products from extraction of raw material to the production of finished packed product at the factory gate (cradle to gate).

The product stage contains A1 (extraction, processing, production of raw materials), A2 (Transport to the manufacturer and internal transport) and A3 (Manufacturing operations) modules. These are declared separately.

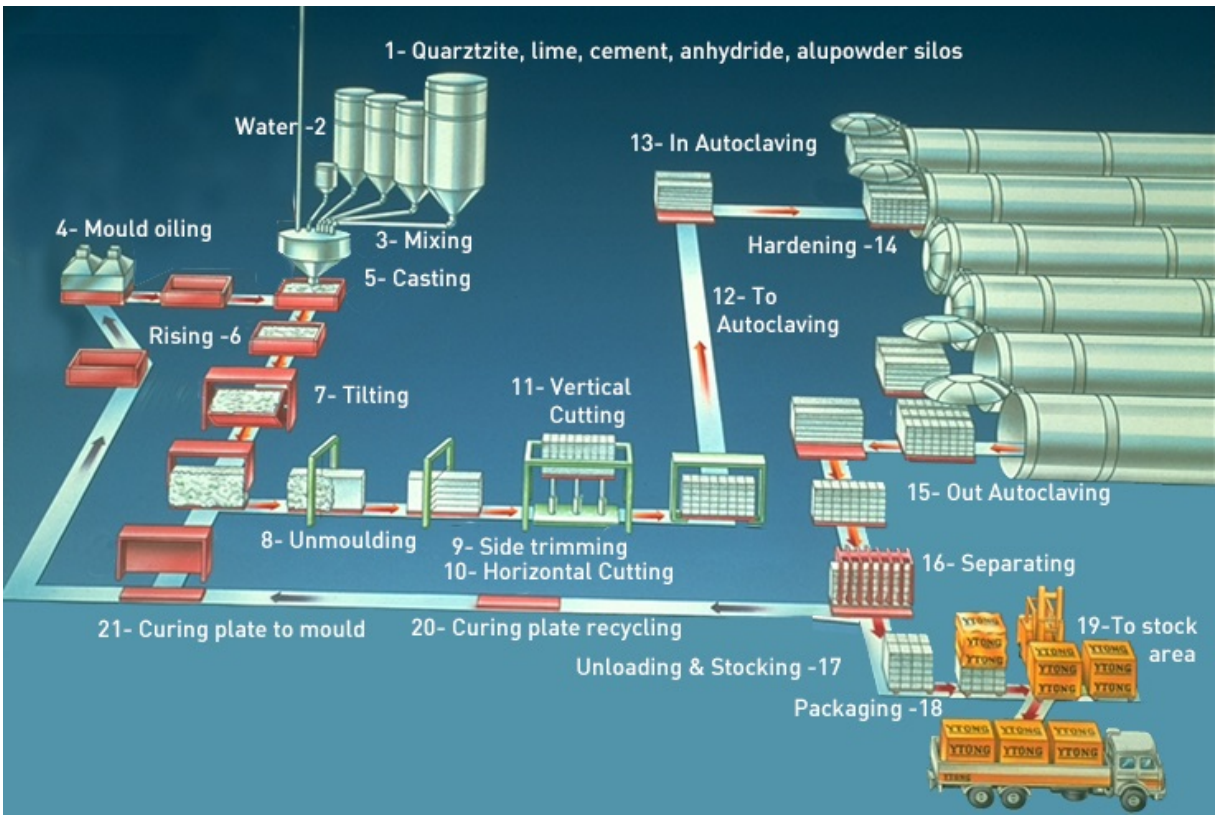

Figure 1: Process Flow of Ytong-AAC Block Production

Comparability
Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account.

LCA: Scenarios and additional technical information

As stated in the system boundary chapter above, only A1, A2 and A3 modules are declared within the scope of this study.

Therefore, there are no scenarios provided below regarding the other modules B1-B7, A4, A5, C1-C4 and D.

In this study, closed-loop recycling was used. Ytong plant utilizes recycled waste (slurry and powder) internally.

LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

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[1)]	Refurbishment[1)]	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	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: AAC Blocks /1 m3

Parameter	Unit	A1	A2	A3
Global warming potential	[kg CO_2-Eq.]	1.25E+2	4.72E+0	3.74E+1
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	5.34E-6	3.28E-7	4.25E-7
Acidification potential of land and water	[kg SO_2-Eq.]	3.23E-1	2.19E-2	1.40E-1
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	5.20E-2	4.97E-3	3.48E-2
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	2.86E-2	7.08E-4	6.59E-3
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	5.90E-5	1.08E-5	4.00E-6
Abiotic depletion potential for fossil resources	[MJ]	4.17E+2	6.95E+1	4.48E+2

RESULTS OF THE LCA - RESOURCE USE: AAC Blocks /1 m3

Parameter	Unit	A1	A2	A3
Renewable primary energy as energy carrier	[MJ]	1.21E+1	0.00E+0	0.00E+0
Renewable primary energy resources as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	1.21E+1	0.00E+0	0.00E+0
Non-renewable primary energy as energy carrier	[MJ]	7.90E+2	7.55E+1	4.65E+2
Non-renewable primary energy as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	7.90E+2	7.55E+1	4.65E+2
Use of secondary material	[kg]	-	-	-
Use of renewable secondary fuels	[MJ]	-	-	-
Use of non-renewable secondary fuels	[MJ]	-	-	-
Use of net fresh water	[m^3]	4.18E-2	1.61E-3	4.42E-1

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: AAC Blocks /1 m3

Parameter	Unit	A1	A2	A3
Hazardous waste disposed	[kg]	-	-	1.21E-1
Non-hazardous waste disposed	[kg]	-	-	4.88E-1
Radioactive waste disposed	[kg]	-	-	-
Components for re-use	[kg]	-	-	-
Materials for recycling	[kg]	-	-	-
Materials for energy recovery	[kg]	-	-	-
Exported electrical energy	[MJ]	-	-	-
Exported thermal energy	[MJ]	-	-	-

References

PCR Part B
Institut Bauen und Umwelt e.V., Berlin (pub.): Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part B: Requirements on the EPD for Aerated concrete, 12.07.2014
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EN 4108-4
Thermal insulation and energy economy in buildings - Part 4: Hygrothermal design values

TS EN 771-4: 2011
Specification for masonry units - Part 4: Autoclaved aerated concrete masonry units

EN 680: 2005 / ZA-PBP 07 01
Determination of the drying shrinkage of autoclaved aerated concrete

SUSTAINABLE BUILDING GUIDELINE
http://www.iisbe.org/iisbe/gbpn/documents/policies/guidelines/Germany_guideline_SB.pdf

TAEK
Turkish Atomic Energy Authority:
http://www.taek.gov.tr/en/home.html

TURKAK
Turkish Accredidation Agency:
http://www.turkak.org.tr/TURKAKSITE/Default_eng.aspx

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Council Directive on the Landfill of Waste /1999/31/EC/ and the related Council Decision /2003/33/EC/

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ISO 14025
DIN EN ISO 14025:2011-10: Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804
EN 15804:2012-04+A1 2013: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

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