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The Norwegian EPD Foundation

ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025, ISO 21930 and EN 15804

Owner of the declaration:	Minera Skifer AS
Program operator:	The Norwegian EPD Foundation
Publisher:	The Norwegian EPD Foundation
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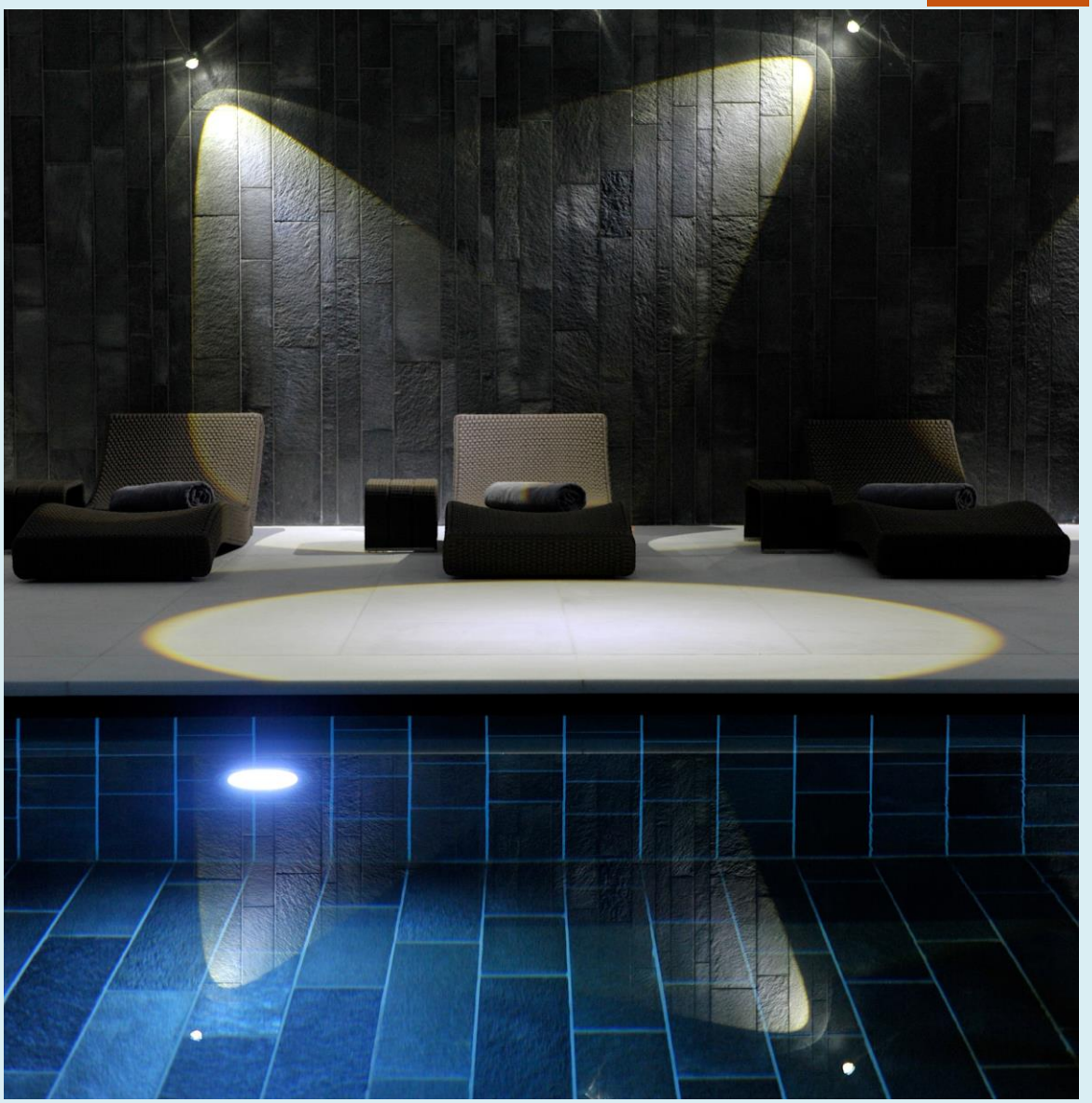
Natural stone quartzite schist, natural cleft surface, sawn edge, Offerdal

Minera Skifer AS
www.epd-norge.no



General information

Product:
Natural stone quartzite schist, natural cleft surface, sawn edge, Offerdal

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Declaration number:
NEPD-1584-609-EN

Place of production:
Finnsäter, Offerdal, Sweden

ECO Platform reference number:
-

Management system:
No

This declaration is based on Product Category Rules:
NPCR Part A: Construction products and services, v 1.0.
IBU PCR Part B: Requirements on the EPD for Dimension stone for roof, wall and floor applications, v1.6 (PCR template), v 1.0 (PCR specific).

Organisation no:
SE 556124-3212

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 or evidence.

Issue date:
06.07.2018

Issue date:
06.07.2023

Declared unit:
Production of 1 ton natural stone quartzite schist, natural cleft surface, sawn edge, Offerdal

Year of study:
Consumption data: 2017. Study preformed spring of 2018.

Declared unit with option:

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

Functional unit:
Production of 1 ton natural stone quartzite schist, natural cleft surface, sawn edge, from Offerdal, manufactured, delivered, installed, used for 60 years and disposed after end of service time.

The EPD has been worked out by:
Oddbjørn Dahlstrøm
Asplan Viak AS, Norway

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:
Lars G. F. Tellnes, Østfoldforskning
(Independent verifier approved by EPD Norway)

Approved
Håkon Hauan
Managing Director of EPD-Norway

Product

Product description:

Schist from Offerdal has a high content of quartz and feldspar. Schist from Offerdal is a hard and solid natural stone with a dark grey surface. Honed surface has varying shades of grey. Due to its high abrasion and slip resistance, it is also very suitable for use in areas with high traffic.

Product specification:

Pavement block, massive slabs, wall cladding, flooring tiles, brick, slabs, fireplace mantels, stone furniture, steps, for use in swimming pool and SPA treatment facilities.

Surface: Natural cleft surface
Edge: Sawn edge: Sawn edges are completely straight, right-angled and precise.
Even thickness: Standard thickness 30 mm. Standard thickness after thickness adjustment (calibration) 15 mm.

Materials	%
Natural stone, 1000 kg	100 %
Quartz	42 - 46 %
Glimmer	32 - 38 %
Feldspar	9 - 20 %
Epidote	6 - 7 %
Calcite	0 - 3 %
Titanite	<1 %
Apake	<1 %
Packaging: plastic strips	0,172 kg
Packaging: wood board	0,147 kg

Technical data:

Standard thickness, natural:	30mm	Even thickness	15 mm
1 ton schist equals to:	12,2 m^2		24,3 m^2

Values are mean value		Schist from Offerdal	
Petrography:	EN 12407	Quartzite schist	
Density:	EN 1936	2,74	kg/m3
Water absorption Frost resistance	EN 13755	0,1 Yes	weight%
Flexural strength	EN 12372	48,5	MPa
Compressive strength	EN 1926	306	MPa
Slip resistance, honed C220	EN 14231	58 19	SRV dry SRV wet
Abrasion resistance	EN 14157 (A)	18,0	mm

For Declaration of Performance (DoP) and complementary information, see www.mineraskifer.no

Market:

Main market is in Norway and the Nordic countries. Products are also exported to Europe and other continents.

Reference service life, product:

Reference service life is same as for buildings and normally set to 60 years. Natural stones of schist has almost unlimited life time.

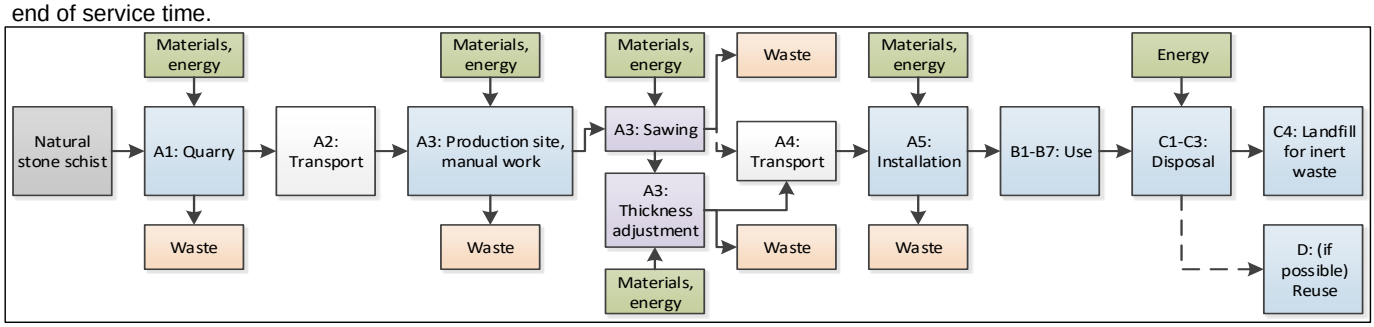
LCA: Calculation rules

Functional unit:

Production of 1 ton natural stone quartzite schist, natural cleft surface, sawn edge, from Offerdal, manufactured, delivered, installed, used for 60 years and disposed after end of service time.

System boundary:

Flow sheet for manufacturing of natural stone of schist is shown below.
Scenario A4, B1-B7, C2-C4 are similar for all products.



Data quality:

Data for (A1-A3) is based on specific consumption data for Minera Skifer Offerdal 2017. Emissions from production and detonation of explosives are derived from safety data sheets for the relevant explosive types. Generic data is from Ecoinvent v3.2, Allocation, Recycled Content (November 2015) and SimaPro v 8.2.3.0. Characterization factors from EN15804: 2012 + A1: 2013. No data is older than 5 years.

Cut-off criteria:

All major raw materials and all the essential energy is included. The production process for raw materials and energy flows that are included with very small amounts (<1%) are not included. This cut-off rule does not apply for hazardous materials or substances.

Allocation:

The allocation is made in accordance with the provisions of EN 15804. Incoming energy and water and waste production in-house (A3) is allocated equally among all products through mass allocation. Economic allocation is used upstream (A1 and A2) because machine blocks from the quarry are not subject for further processing. Price for machine blocks are significant lower compared with processed schist products (>25% difference).

Difference in material consumption, energy and waste production in the production of different products (floor tiles, slabs, roofing etc.) are considered to be marginal, as production processes are nearly the same.

The results are divided into schist products with natural cleft surface and schist products with even thickness (after thickness adjustment), as schist products with even thickness undergo an additional process after manual work and sawing.

LCA: Scenarios and additional technical information

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

Reference service life
Reference service life is same as for buildings and normally set to 60 years. Natural stones of schists has almost unlimited life time and is therefore normally not being replaced during service life.
Schist fixed with screws or nails on a façade or on a roof can be reused. Bricks installed dry (without mortar) can be changed, rebuilt and reused. Schist installed with mortar can be reused after removal of mortar. Schist installed with adhesives on floors and walls can to a minor extent be reused and must be deposed on landfill intended for inert deposal.

Transport from production place to user (A4)
All production is normally delivered directly from Offerdal to building site. As scenario a distance of 650 km delivered by lorry (>32 t) is calculated. This is corresponding to the distance from Offerdal - Oslo/Stockholm.

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption	
Lorry, 50 ton	59 %	Lorry, >32t, EURO5	650	0,016 l/tkm	10,3 l/t

Installation in the building (A5)
Products of schists can be installed in various ways, from no installation on base of gravel (paving), installation with cement based adhesives (floor tiles, crazy paving and wall cladding), installation with mortar (chimney caps, and bricks) and installation as roofing with nails or screws).

In this scenario it is calculated with installation with cement based adhesives (similar as for installation of ceramic tiles).

It is assumed 10% spillage at installation.
Waste treatment of the packaging is included in the A5.

	Unit	15 mm	30 mm
Auxiliary, mortar	kg	122	60,8
Water consumption	litre	24,3	12,2
Electricity consumption	kWh	0,76	0,38
Other energy carriers	MJ	0	0
Material loss	kg	100	100
Output materials from waste treatment	kg	0,32	0,32
Dust in the air	kg	0	0

Assume 5 kg cement mortar + 1,0 litre of water pr. m² installed schist. 20 kg of mortar mixed with an electric mixer with effect 1,5 kW for 5 min.

Use (B1 – B7)
Schists are in many cases characterized as maintenance free. Schist as roofing, crazy paving in the garden and paving on sidewalks are not being maintained. Schists installed inside are also often considered as maintenance free. Schists installed in a kitchen and a bathroom are normally impregnated with a chemical designed for this purpose. Since there are many manufacturers, products and types for surface treatment, and also the fact that some schists are not treated, impregnation of schists is not included in this scenario. This must be added where such products are considered used. All modules in the use stage (B1 – B7) are analysed, and apart from eventual application of impregnation or other types of surface treatment the schist requires no maintenance, repair or replacement during use stage. Therefore there is no effect on the environment during use stage.

End of Life (C1, C3, C4)
Installed schists are demolished in different ways, depending of type of installation. In this scenario it is assumed installation with cement based adhesive and therefore it must be demolished by chisel. Assume electric chisel hammer with effect 2 kW, using 1 min. per 1 m2 surface. The removed schist is transported 50 km to a landfill for inert disposal or used as landfill for different purpose.

	Unit	15 mm	30 mm
Electricity consumption	kWh	0,81	0,41
Hazardous waste disposed	kg	0	0
Collected as mixed construction waste	kg	0	0
Reuse	kg	0	0
Recycling	kg	0	0
Energy recovery	kg	0	0
To landfill	kg	1000	1000

Transport to waste processing (C2)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption	
Lorry	Average in Europe	Lorry >16t, average	50	0,045 l/tkm	2,25 l/t

Additional technical information
Alternation of results from per ton to per m² can be done by multiplying results with thickness in meters and density 2,74 ton/m^3.
Example:

Even thickness, 15 mm: 93,3 kg CO2 e/ton * 0,015 m * 2,74 ton/m^3 = 3,84 kg CO2 e/m^2 schist.

Natural surface, 30 mm: 49,3 kg CO2 e/ton * 0,030 m * 2,74 ton/m^3 = 4,05 kg CO2 e/m^2 schist.

LCA: Results

A1-A3, A5 and C1 is calculated separately for schist products with even thickness (after thickness adjustment). A4, B1-B7, C2-C4 is equal for all schist products from Offerdal

Nat.: Schist products with natural cleft surface, standard 30 mm thickness, sawn edge
Even: Schist products with even thickness (after thickness adjustment), standard 15 mm thickness, sawn edge

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

Product stage			Assembly 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	x	x	x	x	x	MID

Environmental impact

Parameter	Unit	A1-A3 Nat.	A1-A3 Even	A4	A5 Nat.	A5 Even	B1-B7	C1 Nat.	C1 Even	C2	C3	C4
GWP	kg CO_2-ekv	49,3	93,3	43,9	22,9	39,7	0	1,4E-02	2,9E-02	8,39	0	2,68
ODP	kg CFC11-ekv	1,3E-05	2,9E-05	8,9E-06	3,0E-06	5,2E-06	0	1,5E-09	2,9E-09	1,5E-06	0	4,6E-07
POCP	kg C_2H_4-ekv	3,1E-02	5,8E-02	8,5E-03	6,0E-03	1,1E-02	0	3,2E-06	6,5E-06	1,4E-03	0	8,8E-04
AP	kg SO_2-ekv	0,37	0,69	0,17	9,1E-02	0,16	0	6,4E-05	1,3E-04	2,8E-02	0	2,0E-02
EP	kg PO_4^{3-}-ekv	0,11	0,21	3,9E-02	2,5E-02	4,4E-02	0	3,3E-05	6,5E-05	6,2E-03	0	4,6E-03
ADPM	kg Sb-ekv	1,3E-04	2,8E-04	1,2E-04	3,6E-05	5,9E-05	0	1,8E-07	3,7E-07	2,5E-05	0	8,2E-07
ADPE	MJ	629	1 164	720	225	353	0	0,16	0,32	127	0	38,3

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

Resource use

Parameter	Unit	A1-A3 Nat.	A1-A3 Even	A4	A5 Nat.	A5 Even	B1-B7	C1 Nat.	C1 Even	C2	C3	C4
RPEE	MJ	662	1 478	13,5	81,4	177	0	1,67	3,34	1,36	0	0,24
RPEM	MJ	19,0	34,7	0	1,90	3,47	0	0	0	0	0	0
TPE	MJ	681	1 513	13,5	83,3	180	0	1,67	3,34	1,36	0	0,24
NRPE	MJ	1 427	3 126	755	323	581	0	0,19	0,39	129	0	38,6
NRPM	MJ	16,9	30,8	0	1,69	3,08	0	0	0	0	0	0
TRPE	MJ	1 444	3 157	755	325	584	0	0,19	0,39	129	0	38,6
SM	kg	6,6E-02	0,23	0	6,6E-03	2,3E-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
W	m^3	1,18	2,79	0,21	0,28	0,59	0	1,3E-02	2,5E-02	2,7E-02	0	6,4E-03

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-A3 Nat.	A1-A3 Even	A4	A5 Nat.	A5 Even	B1-B7	C1 Nat.	C1 Even	C2	C3	C4
HW	kg	8,6E-04	1,8E-03	4,7E-04	2,5E-04	4,5E-04	0	2,4E-07	4,9E-07	7,8E-05	0	1,6E-05
NHW	kg	1 531	3 617	88,3	264	474	0	1,2E-02	2,4E-02	5,95	0	1 000
RW	kg	1,7E-02	3,9E-02	5,3E-03	2,9E-03	5,8E-03	0	1,2E-06	2,3E-06	8,7E-04	0	2,6E-04

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

End of life - Output flow

Parameter	Unit	A1-A3 Nat.	A1-A3 Even	A4	A5 Nat.	A5 Even	B1-B7	C1 Nat.	C1 Even	C2	C3	C4
CR	kg	0	0	0	0	0	0	0	0	0	0	0
MR	kg	0,16	0,54	0	0,19	0,23	0	0	0	0	0	0
MER	kg	0	0	0	0	0	0	0	0	0	0	0
EEE	MJ	1,15	2,09	0	0,27	0,36	0	0	0	0	0	0
ETE	MJ	11,2	20,4	0	2,64	3,56	0	0	0	0	0	0

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

INA = Indicator not assessed

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

National production mix with import, on low voltage (included production of transmission lines, in addition to direct emissions and losses in grid) is applied for electricity in the manufacturing process (A3).
National production mix for Sweden is used for production at Offerdal (A1-A3), and national production mix for Norway is used for installation A5 and de-construction demolition C1.

Data source	Amount	Unit
Ecoinvent v3.2 (November 2015): Sweden (A1 - A3)	0,0533	kg CO_2-ekv/kWh
Ecoinvent v3.2 (November 2015): Norway (A5 and C1)	0,0358	kg CO_2-ekv/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.

Name	CAS no.	Amount

Transport

Transport from production site to a construction site according to scenario A4: 650 km

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption	
Lorry, 50 ton	59 %	Lorry, >32t, EURO5	650	0,016 l/tkm	10,3 l/t

Indoor environment

Radon measurement has been carried out in the production site at Finnsäter, Offerdal, Sweden. Measurements show the concentration of radon in the air (mean value) of 2.06 Bq / m3 to 10.0 Bq / m3. Documentation is available upon request to Minera Slate.

In Regulations on technical requirements for construction works in Norway, TEK17, there is a requirement for maximum concentration of radon: §13-5 (1) In buildings with permanent residence rooms, the annual average value of radon concentration shall not exceed 200 Bq / m³. Measurements from the Offerdal production facility are within a good margin in terms of requirements in TEK17.

Use of schist indoor (flooring, wall cladding, fire places etc.) should normally not imply increased radon concentrations exceeding the background level. This is related to the volume of schist compared to other building materials (gravel, sand) used in the building ground. It should also imply that the contribution of radon from the schist normally will have a small or no impact on the level of radon in a house. Geological survey of Norway, NGU 06.12.04.

Carbon footprint

Carbon footprint has not been worked out for the product.

Bibliography

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ISO 21930:2007	*Sustainability in building construction - Environmental declaration of building products*
NS-EN 1926:2006	*Natural stone test methods. Determination of uniaxial compressive strength*
NS-EN 1936:2006	*Natural stone test methods. Determination of real density and apparent density, and of total and open porosity*
EN 12407:2007	*Natural stone test methods. Petrographic examination*
EN 12372:2006	*Natural stone test methods. Determination of flexural strength under concentrated load*
EN 13755:2008	*Natural stone test methods. Determination of water absorption at atmospheric pressure*
EN 14157:2004	*Natural stone test methods - Determination of the abrasion resistance*
EN 14231:2003	*Natural stone test methods. Determination of the slip resistance by means of the pendulum tester*
EN ISO 14025:2010	*Environmental labels and declarations - Type III environmental declarations - Principles and procedures*
EN ISO 14044:2006	*Environmental management - Life cycle assessment - Requirements and guidelines*
EN 15804:2012+A1:2013	*Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products*
TEK17	*Direktoratet for byggkvalitet (DiBk), Regulations on technical requirements for construction works in Norway (Byggteknisk forskrift, TEK17)*

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