ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Karl Bachl Kunststoffverarbeitung GmbH & Co.KG
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-BAC-20220231-CBA1-EN
Issue date	30.11.2022
Valid to	29.11.2027

Bachl ReXPS - Extruded Polystyrene (XPS)

Karl Bachl Kunststoffverarbeitung GmbH & Co.KG

Institut Bauen und Umwelt e.V.

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ECO PLATFORM EPD VERIFIED

General Information

Karl Bachl Kunststoffverarbeitung GmbH & Co. KG

Programme holder
IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number
EPD-BAC-20220231-CBA1-EN

This declaration is based on the product category rules:
Insulating materials made of foam plastics, 01.2019
(PCR checked and approved by the SVR)

Issue date
30.11.2022

Valid to
29.11.2027

Dipl. Ing. Hans Peters
(chairman of Institut Bauen und Umwelt e.V.)

Dr. Alexander Röder
(Managing Director Institut Bauen und Umwelt e.V.))

XPS insulation panel Bachl ReXPS

Owner of the declaration
Karl Bachl Kunststoffverarbeitung GmbH & Co. KG
Deching 3
94133 Röhrnbach
Germany

Declared product / declared unit
Bachl ReXPS (extruded polystyrene) foam boards are produced by Karl Bachl Kunststoffverarbeitung GmbH & Co. KG. The EPD applies to 1 m³ of Bachl ReXPS board with a gross density of 32.7 kg/m³.

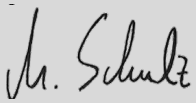
Scope:
The data have been provided by one production site based in Tittling, Germany for the year 2021.

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.

The EPD was created according to the specifications of *EN 15804+A2*. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard *EN 15804* serves as the core PCR
Independent verification of the declaration and data according to *ISO 14025:2011*
☐ internally ☒ externally



Matthias Schulz
(Independent verifier)

Product

Product description/Product definition
Bachl ReXPS is an extruded polystyrene foam (XPS) made of 100% recycled and reclaimed polystyrene, manufactured according to *EN 13164* and available in sheet form with a density range of 30-35 kg/m³. Bachl ReXPS panels are supplied with a butt edge or shiplap. The EPD only applies to an unlaminated product; Lamination and additional product treatment are not taken into account.
Regulation (EU) *No. 305/2011* (*CPR*) applies to placing the product on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland). The Product requires a declaration of performance taking into account *EN 13164:2012+A1:2015* Thermal insulation products for buildings - Factory made extruded polystyrene foam (XPS) products - Specification and CE marking. The respective national regulations apply to application and use.

Application
The variety of the performance properties of Bachl ReXPS make it suitable for use in a large number of applications such as: perimeter insulation, floor insulation including insulation of highly loaded industrial floors, insulation of thermal bridges for exterior walls, insulation of cavity walls, agricultural building ceiling insulation, prefabricated elements e.g. building sandwich panels.

Technical Data
Sound absorption coefficient and dynamic rigidity are not relevant for Bachl ReXPS because this insulation panel is not used to improve room acoustics or impact sound insulation.

For fire performance, these products except in Scandinavia achieve the fire classification Euroclass E according to *EN 13501-1*.

Constructional data

Name	Value	Unit
Gross density	30 - 35	kg/m³
Compressive strength acc. to EN 826	≥0,3	N/mm²
Tensile strength acc. to EN 1607	≥0,2	N/mm²
Modulus of elasticity	12	N/mm²

Calculation value for thermal conductivity acc. to EN 12667 and EN 13164 Annexe C	0,033	W/(mK)
Water vapour diffusion resistance factor acc. to EN 12086	150	-
Moisture content at 23 °C, 80%	-	M.-%
Creep behaviour or permanent compressive strength acc. to DIN EN 1606	0,09	N/mm²
Water absorption after diffusion acc. to EN 12088	≤3	Vol.-%
Maximum water absorption acc. to DIN EN 12091	≤2	Vol.-%

Performance data of the product in accordance with the declaration of performance with respect to its essential characteristics according to *EN 13164:2012+A1:2015* Thermal Insulation products for buildings

Base materials/Ancillary materials
Bachl ReXPS is mostly made of recycled and reclaimed polystyrene (90 to 91 % by weight in the final product - CAS 9003-53-6), foamed with DME/isobutane, carbon dioxide (CAS 124-38-9) and ethanol with a total of up to 8 % by weight in relation to the material input.

The blowing agents are partly emitted during the production process.

Raw material mass fraction:
recycled and reclaimed Polystyrene 86 - 91 %
Propellant 5 - 10 %
DME/isobutane 50 - 65 %
CO_2 propellant 25 - 32 %
Ethanol 10 - 19 %
Flame retardant 0 - 4 %

The brominated polymeric flame retardant is used to enable the foam to meet fire performance standards.

Polystyrene is transported by road.
This product contains substances listed in *the candidate list* of substances of very high concern (*ECHA* Article 95 List, prepared as of 22.09.2022) exceeding 0.1
percentage by mass: no
This product contains other Carcinogenic, Mutagenic, Reprotoxic (CMR) substances in categories 1A or 1B which are not on the candidate list, exceeding 0.1 percentage by mass: no
Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the (*EU) Ordinance on Biocide Products No. 528/2012*): no

Reference service life
A reference service life (RSL) according to *ISO 15686* cannot be declared.
The durability of Bachl ReXPS is normally at least as long as the lifetime of the building in which it is used.

LCA: Calculation rules

Declared Unit
The declared unit is 1 m³ of the Re-XPS insulation board. The density of the product is 32.7 kg/m³.

Declared unit

Name	Value	Unit
Gross density	32.7	kg/m³
Declared unit	1	m³

System boundary
Type of EPD according to *EN 15804*: "cradle to gate with options, modules C1–C4, and module D". The following modules are declared: A1–A3, C, D and additional modules: A4 + A5.

Production - Modules A1-A3
The product stage includes:
- Raw material supply (A1): polystyrene (PS) re-granulates recycled externally, polystyrene (PS) briquettes and their recycling process on-site, blowing agents, co-blowing agents, and flame retardants.
- Transport to the manufacturer (A2)
- Manufacturing (A3), including provision of all materials, products and energy, as well as waste processing up to the end-of-waste state.

Construction stage - Modules A4-A5
The construction process stage includes:
- Transport to the construction site (A4)
- Treatment of packaging material (A5) credits for potential avoided burdens due to energy substitution of electricity and thermal energy generation are declared in module D.

End-of-life stage– Modules C1-C4 and D
The end-of-life stage includes
- Manual dismantling (C1)
- Transport to EoL (C2)
- Waste processing & disposal (C) with three 100 % scenarios (scenario 1: thermal treatment (C3/1); scenario 2: Recycling (C3/2); scenario 3: landfill (C4/3))
- Reuse, recovery or recycling potential (D) - beyond system boundary. No credits were accounted from any of the EoL scenarios (C3/1, C3/2, or C4/3) in module D. The credits in D/1, D/2, and D/3 are solely accounting for the avoided burdens calculated by the inversion of electricity grid mix and thermal energy from natural gas during packaging treatment (A5).

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.

Background database: *GaBi ts*, CUP 2022.1

LCA: Scenarios and additional technical information

Characteristic product properties
Information on biogenic Carbon

Information on describing the biogenic Carbon Content at factory gate

Name	Value	Unit
Biogenic Carbon Content in product	0	kg C
Biogenic Carbon Content in accompanying packaging	0	kg C

The following technical scenario information is required for the declared modules and optional for non-declared modules.
The following technical information is a basis for the declared modules or can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND). The values refer to the declared unit of 1 m^3 Re-XPS product.

Transport to the building site (A4)

Name	Value	Unit
Litres of fuel	0.0644	l/100km
Transport distance	250	km
Capacity utilisation (including empty runs)	61	%
Gross density of products transported	32.7	kg/m^3

The transport distance can be modified project specific if required by linear scaling.

Installation into the building (A5)
The packaging thermal treatment is considered under this module. The following quantities are produced per m^3 of Re-XPS product:

Name	Value	Unit
Polyethylene foil (waste packaging to incineration)	0.237	kg
Polyethylene film (waste packaging to incineration)	0.429	kg

End of life (C1-C4)
For the End-of-Life stage three different scenarios are considered. One scenario with 100 % incineration (scenario 1: C3/1), one scenario with 100 % recycling (scenario 2: C3/2), and one scenario with 100 % landfill (scenario 3: C4/3) are calculated. The incineration of 100 % recycled XPS is assumed to result in no benefits, beyond the system boundary, for thermal energy and electricity under European conditions as a conservative approach.

The transport to End of Life (C2) is calculated with a distance of 250 km (with 61 % utilization).

Name	Value	Unit
Collected separately Re-XPS	32.7	kg
Energy recovery (Scenario 1)	32.7	kg
Recycling (Scenario 2)	32.7	kg
Landfilling (Scenario 3)	32.7	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Module D includes the credits of the thermal and electrical energy generated in Module A5 due to thermal treatment of packaging.

Avoided burdens have been calculated by the inversion of residual grid mix and thermal energy from natural gas, using European datasets.

A waste incineration plant with R1-value > 0.6 is assumed.

LCA: Results

The following tables display the environmentally relevant results according to *EN 15804* for 1 m³ Re-XPS board.
The three EoL Scenarios are represented in modules C3/1, C3/2, C4/3, D/1, D/2, and D/3.
Modules C3/1 and D/1 show the environmental results in the case of thermal treatment of Re-XPS product (for scenario 1 "thermal treatment" the values in Module D for Re-XPS are 0).
Modules C3/2 and D/2 show the environmental results in the case of recycling of Re-XPS product (for scenario 2 "Recycling" the values in Module D for Re-XPS are 0).
Module C4/2 reflects the landfilling of XPS (for scenario 2 "landfilling" the values in Module D for XPS are 0).
Hence, Modules D/1, D/2, and D/3 show only the environmental results of the packaging treatment from Module A5.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

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
X	X	X	X	X	ND	ND	MNR	MNR	MNR	ND	ND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m3 Re-XPS insulation board

Core Indicator	Unit	A1-A3	A4	A5	C1	C2	C3/1	C3/2	C4/3	D/1	D/2	D/3
GWP-total	[kg CO_2-Eq.]	5.42E+1	5.06E-1	2.09E+0	0.00E+0	4.94E-1	1.10E+2	4.72E+0	2.29E+0	-9.89E-1	-9.89E-1	-9.89E-1
GWP-fossil	[kg CO_2-Eq.]	5.36E+1	5.03E-1	2.09E+0	0.00E+0	4.92E-1	1.10E+2	4.68E+0	2.32E+0	-9.84E-1	-9.84E-1	-9.84E-1
GWP-biogenic	[kg CO_2-Eq.]	6.30E-1	1.53E-4	6.70E-5	0.00E+0	1.50E-4	3.27E-3	4.21E-2	-2.47E-2	-5.05E-3	-5.05E-3	-5.05E-3
GWP-luluc	[kg CO_2-Eq.]	2.64E-2	2.79E-3	2.20E-6	0.00E+0	2.73E-3	1.28E-4	9.90E-4	1.13E-3	-1.09E-4	-1.09E-4	-1.09E-4
ODP	[kg CFC11-Eq.]	1.72E-10	3.00E-14	8.94E-14	0.00E+0	2.93E-14	4.58E-12	6.85E-11	3.11E-12	-6.69E-12	-6.69E-12	-6.69E-12
AP	[mol H^+-Eq.]	9.27E-2	4.77E-4	2.07E-4	0.00E+0	4.66E-4	9.64E-3	1.03E-2	6.87E-3	-1.30E-3	-1.30E-3	-1.30E-3
EP-freshwater	[kg P-Eq.]	1.05E-4	1.50E-6	2.08E-8	0.00E+0	1.46E-6	1.07E-6	1.37E-5	4.33E-4	-1.36E-6	-1.36E-6	-1.36E-6
EP-marine	[kg N-Eq.]	3.37E-2	1.49E-4	4.32E-5	0.00E+0	1.45E-4	2.11E-3	2.31E-3	1.52E-3	-3.52E-4	-3.52E-4	-3.52E-4
EP-terrestrial	[mol N-Eq.]	3.76E-1	1.78E-3	9.70E-4	0.00E+0	1.74E-3	4.52E-2	2.42E-2	1.67E-2	-3.77E-3	-3.77E-3	-3.77E-3
POCP	[kg NMVOC-Eq.]	4.45E-1	4.15E-4	1.29E-4	0.00E+0	4.06E-4	6.23E-3	6.23E-3	4.89E-3	-9.84E-4	-9.84E-4	-9.84E-4
ADPE	[kg Sb-Eq.]	4.93E-6	4.19E-8	2.16E-9	0.00E+0	4.09E-8	1.11E-7	1.28E-6	1.61E-7	-1.49E-7	-1.49E-7	-1.49E-7
ADPF	[MJ]	7.86E+2	6.69E+0	2.43E-1	0.00E+0	6.54E+0	1.21E+1	8.49E+1	3.29E+1	-1.67E+1	-1.67E+1	-1.67E+1
WDP	[m^3 world-Eq deprived]	1.89E+0	4.49E-3	1.92E-1	0.00E+0	4.39E-3	8.94E+0	1.07E+0	-2.28E-2	-1.05E-1	-1.05E-1	-1.05E-1

Caption	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

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 m3 Re-XPS insulation board

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3/1	C3/2	C4/3	D/1	D/2	D/3
PERE	[MJ]	6.94E+1	3.81E-1	5.73E-2	0.00E+0	3.72E-1	2.91E+0	4.71E+1	2.70E+0	-4.62E+0	-4.62E+0	-4.62E+0
PERM	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PERT	[MJ]	6.94E+1	3.81E-1	5.73E-2	0.00E+0	3.72E-1	2.91E+0	4.71E+1	2.70E+0	-4.62E+0	-4.62E+0	-4.62E+0
PENRE	[MJ]	7.56E+2	6.71E+0	3.09E+1	0.00E+0	6.56E+0	1.22E+1	8.49E+1	3.29E+1	-1.67E+1	-1.67E+1	-1.67E+1
PENRM	[MJ]	3.06E+1	0.00E+0	-3.06E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PENRT	[MJ]	7.87E+2	6.71E+0	2.43E-1	0.00E+0	6.56E+0	1.22E+1	8.49E+1	3.29E+1	-1.67E+1	-1.67E+1	-1.67E+1
SM	[kg]	2.84E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
RSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	[m^3]	3.55E-1	4.30E-4	4.51E-3	0.00E+0	4.21E-4	2.10E-1	4.50E-2	4.26E-4	-4.44E-3	-4.44E-3	-4.44E-3

Caption	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used 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

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 m3 Re-XPS insulation board

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3/1	C3/2	C4/3	D/1	D/2	D/3
HWD	[kg]	5.99E-8	3.21E-11	2.29E-11	0.00E+0	3.14E-11	1.14E-9	7.35E-9	5.07E-9	-2.26E-9	-2.26E-9	-2.26E-9
NHWD	[kg]	1.30E+0	9.62E-4	8.27E-3	0.00E+0	9.40E-4	6.30E-1	6.40E-2	3.26E+1	-8.48E-3	-8.48E-3	-8.48E-3
RWD	[kg]	4.13E-2	8.26E-6	1.47E-5	0.00E+0	8.08E-6	7.33E-4	1.36E-2	4.04E-4	-1.33E-3	-1.33E-3	-1.33E-3
CRU	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MFR	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.27E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MER	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EEE	[MJ]	0.00E+0	0.00E+0	4.45E+0	0.00E+0	0.00E+0	1.98E+2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EET	[MJ]	0.00E+0	0.00E+0	7.91E+0	0.00E+0	0.00E+0	3.53E+2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0

Caption	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; EEE = Exported thermal energy

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional:
1 m3 Re-XPS insulation board

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3/1	C3/2	C4/3	D/1	D/2	D/3
PM	[Disease Incidence]	1.55E-6	2.88E-9	1.21E-9	0.00E+0	2.82E-9	5.61E-8	8.52E-8	6.60E-8	-1.08E-8	-1.08E-8	-1.08E-8
IRP	[kBq U235-Eq.]	3.44E+0	1.21E-3	2.41E-3	0.00E+0	1.18E-3	1.20E-1	2.30E+0	5.96E-2	-2.24E-1	-2.24E-1	-2.24E-1
ETP-fw	[CTUe]	4.01E+2	4.65E+0	1.12E-1	0.00E+0	4.54E+0	5.96E+0	3.72E+1	3.22E+1	-3.69E+0	-3.69E+0	-3.69E+0
HTP-c	[CTUh]	7.20E-9	9.37E-11	1.33E-11	0.00E+0	9.15E-11	6.00E-10	1.07E-9	1.45E-9	-1.69E-10	-1.69E-10	-1.69E-10
HTP-nc	[CTUh]	3.97E-7	4.85E-9	4.14E-10	0.00E+0	4.74E-9	1.95E-8	3.91E-8	1.21E-7	-6.49E-9	-6.49E-9	-6.49E-9
SQP	[-]	6.01E+1	2.30E+0	7.35E-2	0.00E+0	2.25E+0	3.69E+0	3.06E+1	2.37E+0	-3.00E+0	-3.00E+0	-3.00E+0

Caption	PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer 1 – for the indicator “Potential Human exposure efficiency relative to U235”.
This impact category deals mainly with the eventual impact of low-dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators “abiotic depletion potential for non-fossil resources”, “abiotic depletion potential for fossil resources”, “water (user) deprivation potential, deprivation-weighted water consumption”, “potential comparative toxic unit for ecosystems”, “potential comparative toxic unit for humans – cancerogenic”, “Potential comparative toxic unit for humans - not cancerogenic”, “potential soil quality index”.
The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

References

Standards

EN 12086
EN 12086:2013-06: Thermal insulation products for building applications - Determination of water vapour transmission properties

EN 12088
EN 12088:2013-05: Thermal insulation products for building applications - Determination of freeze-thaw resistance

EN 12091
EN 12091:2013-06: Thermal insulation products for building applications - Determination of long-term water absorption by diffusion

EN 12667
EN 12667:2001-05: Thermal insulation products for building applications - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Product of high and medium thermal resistance

EN 13164
EN 13164:2012+A1:2015 Thermal insulation products for buildings – Factory-made extruded polystyrene foam (XPS) products - Specification

EN 13501-1
EN 13501-1:2019-05: Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests

EN 15804
EN 15804+A2:2019+AC:2021, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

EN 1604
EN 1604:2013-05: Thermal insulation products for building applications - Determination of dimensional stability under specified compressive load and humidity conditions

EN 1605
EN 1605:2013-05: Thermal insulation products for building applications - Determination of deformation under specified temperature and temperature conditions

EN 1606
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