BS EN 13164:2012+A1:2015

BSI Standards Publication

Thermal insulation products for buildings — Factory made extruded polystyrene foam (XPS) products — Specification

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National foreword

This British Standard is the UK implementation of EN 13164:2012+A1:2015. It supersedes BS EN 13164:2012, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by ▌A1⟩ ⟨A1▌.

The UK participation in its preparation was entrusted to Technical Committee B/540, Energy performance of materials components and buildings.

A list of organizations represented on this committee can be obtained on request to its secretary.

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EUROPÄISCHE NORM

EN 13164:2012+A1

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Thermal insulation products for buildings - Factory made extruded polystyrene foam (XPS) products - Specification

Produits isolants thermiques pour le bâtiment - Produits manufacturés en mousse de polystyrène extrudé (XPS) - Spécification

Wärmedämmstoffe für Gebäude - Werkmäßig hergestellte Produkte aus extrudiertem Polystyrolschaum (XPS) - Spezifikation

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CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

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Foreword

This document (EN 13164:2012+A1:2015) has been prepared by Technical Committee CEN/TC 88 “Thermal insulating materials and products”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2015, and conflicting national standards shall be withdrawn at the latest by November 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes [A1⟩ EN 13164:2012 ⟨A1].

This document includes Amendment 1 approved by CEN on 2014-12-15.

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1⟩ ⟨A1].

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

[A1⟩ For relationship with EU Construction Products Regulation (CPR), see informative Annex ZA, which is an integral part of this standard. ⟨A1]

Compared with EN 13164:2008, the main changes are:

a) better harmonisation between the individual standards of the package (EN 13162 to EN 13171) on definitions, requirements, classes and levels;

b) new normative annex on multi-layered products;

c) changes of some editorial and technical content and addition of information on some specific items such as for XPS: Annex C;

d) addition to links to EN 15715, *Thermal insulation products — Instructions for mounting and fixing for reaction to fire testing — Factory made products*;

e) changes to the Annex ZA.

[A1⟩ Amendment 1 modifies EN 13164:2012 identifying those clauses of the standard which are needed for the compliance of the European Standard with the Construction Products Regulation (CPR).

This amendment introduces

f) an addition to the foreword;

g) an addition in 3.2;

h) a new subclause 4.3.10;

i) modification of Clause 7;

j) modification of Clause 8;

k) modification of Annex B;

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l) modification of Annex E;

m) a new Annex ZA. 〈A1▌

This European Standard is one of a series of standards for thermal insulation products used in buildings, but this standard may be used in other areas where appropriate.

In pursuance of resolution BT 20/1993 revised, CEN/TC 88 have proposed defining the standards listed below as a package of documents.

The package of standards comprises the following group of interrelated standards for the specifications of factory made thermal insulation products; all of which come within the scope of CEN/TC 88:

EN 13162, *Thermal insulation products for buildings — Factory made mineral wool (MW) products — Specification*

EN 13163, *Thermal insulation products for buildings — Factory made expanded polystyrene (EPS) products — Specification*

EN 13164, *Thermal insulation products for buildings — Factory made extruded polystyrene foam (XPS) products — Specification*

EN 13165, *Thermal insulation products for buildings — Factory made rigid polyurethane foam (PU) products — Specification*

EN 13166, *Thermal insulation products for buildings — Factory made phenolic foam (PF) products — Specification*

EN 13167, *Thermal insulation products for buildings — Factory made cellular glass (CG) products — Specification*

EN 13168, *Thermal insulation products for buildings — Factory made wood wool (WW) products — Specification*

EN 13169, *Thermal insulation products for buildings — Factory made expanded perlite board (EPB) products — Specification*

EN 13170, *Thermal insulation products for buildings — Factory made products of expanded cork (ICB) — Specification*

EN 13171, *Thermal insulation products for buildings — Factory made wood fibre (WF) products — Specification*

The reductions in energy used and emissions produced during the installed life of the insulation products exceeds by far the energy used and emissions made during the production and disposal processes.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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1 Scope

This European Standard specifies the requirements for factory made products of extruded polystyrene foam, with or without facings or coatings, which are used for thermal insulation of buildings. The products are manufactured in the form of boards which are also available with special edge and surface treatment (tongue & grooves, shiplap etc.).

Products covered by this standard are also used in prefabricated thermal insulating systems and composite panels; the performance of systems incorporating these products is not covered.

This standard describes product characteristics and includes procedures for testing, evaluation of conformity, marking and labelling.

The standard does not specify the required level of a given property to be achieved by a product to demonstrate fitness for purpose in a particular application. The levels required for a given application are to be found in regulations or non-conflicting standards.

Products with a declared thermal resistance lower than 0,25 m²·K/W or a declared thermal conductivity greater than 0,060 W/(m·K) at 10 °C are not covered by this standard.

This standard does not cover in situ insulation products, nor products intended to be used for the insulation of building equipment and industrial installations (covered by EN 14307), or civil engineering applications (covered by EN 14934).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 822, *Thermal insulating products for building applications — Determination of length and width*

EN 823, *Thermal insulating products for building applications — Determination of thickness*

EN 824, *Thermal insulating products for building applications — Determination of squareness*

EN 825, *Thermal insulating products for building applications — Determination of flatness*

EN 826, *Thermal insulating products for building applications — Determination of compression behaviour*

EN 1604, *Thermal insulating products for building applications — Determination of dimensional stability under specified temperature and humidity conditions*

EN 1605, *Thermal insulating products for building applications — Determination of deformation under specified compressive load and temperature conditions*

EN 1606, *Thermal insulating products for building applications — Determination of compressive creep*

EN 1607, *Thermal insulating products for building applications — Determination of tensile strength perpendicular to faces*

EN 12086:1997, *Thermal insulating products for building applications — Determination of water vapour transmission properties*

EN 12087, *Thermal insulating products for building applications — Determination of long term water absorption by immersion*

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EN 12088, *Thermal insulating products for building applications — Determination of long term water absorption by diffusion*

EN 12090, *Thermal insulating products for building applications — Determination of shear behaviour*

EN 12091, *Thermal insulating products for building applications — Determination of freeze-thaw resistance*

EN 12667, *Thermal performance of building materials and products — Determination of thermal resistance by means of guarded hot plate and heat flow meter methods — Products of high and medium thermal resistance*

EN 12939, *Thermal performance of building materials and products — Determination of thermal resistance by means of guarded hot plate and heat flow meter methods — Thick products of high and medium thermal resistance*

EN 13172:2012, *Thermal insulation products — Evaluation of conformity*

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

EN 13820, *Thermal insulating materials for building applications — Determination of organic content*

EN 13823, *Reaction to fire tests for building products — Building products excluding floorings exposed to the thermal attack by a single burning item*

EN 15715:2009, *Thermal insulation products — Instructions for mounting and fixing for reaction to fire testing - Factory made products*

EN ISO 1182, *Reaction to fire tests for products — Non-combustibility test (ISO 1182)*

EN ISO 1716, *Reaction to fire tests for products — Determination of the gross heat of combustion (calorific value) (ISO 1716)*

EN ISO 9229:2007, *Thermal insulation — Vocabulary (ISO 9229:2007)*

EN ISO 11925-2, *Reaction to fire tests — Ignitability of products subjected to direct impingement of flame — Part 2: Single-flame source test (ISO 11925-2)*

ISO 16269-6:2005, *Statistical interpretation of data — Part 6: Determination of statistical tolerance intervals*

3 Terms, definitions, symbols, units, abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 9229:2007 apply with exception or in addition of the following:

3.1.1
extruded polystyrene foam
rigid cellular plastics insulation material expanded and extruded with or without a skin, from polystyrene or one of its copolymers and which has a closed cell structure

3.1.2
level
value which is the upper or lower limit of a requirement and given by the declared value of a characteristic concerned

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3.1.3
class
combination of two levels of the same property between which the performance shall fall

3.1.4
board, slab
rigid or semi rigid insulation products of rectangular shape and cross section in which the thickness is uniform and substantially smaller than the other dimensions

Note 1 to entry: Boards are usually thinner than slabs. They may also be supplied in tapered form.

3.1.5
facing
functional or decorative surface layer with a thickness of less than 3 mm, e.g. paper, plastic film, fabric or metal foil, which is not considered as separate thermal insulation layer to be added to the thermal resistance of the product

3.1.6
coating
functional or decorative surface layer with a thickness of less than 3 mm, usually applied by painting, spraying, pouring or trowelling, which is not considered as separate thermal insulation layer to be added to the thermal resistance of the product

3.1.7
composite insulation product
product which can be faced or coated made from two or more layers bonded together by chemical or physical adhesion consisting of at least one factory made thermal insulation material layer

3.1.8
multi-layered insulation product
product which can be faced or coated made from two or more layers of a thermal insulation material from the same European Standard, which are bonded together by chemical and physical adhesion

Note 1 to entry: This standard only covers XPS multilayered insulation product board with layers perpendicular to the edges of the board, i.e. layers parallel to the surface of the final board.

3.2 Symbols, units and abbreviated terms

For the purposes of this document, the following symbols and units apply.

b	is the width	mm
d	is the thickness	mm
d_N	is the nominal thickness of the product	mm
d_S	is the thickness of test specimen	mm
$\Delta\varepsilon_b$	is the relative change in width	%
$\Delta\varepsilon_d$	is the relative change in thickness	%
$\Delta\varepsilon_l$	is the relative change in length	%
ε_{ct}	is the compressive creep	%
ε_t	is the total relative thickness reduction	%
ε_1	is the relative deformation after step A	%
ε_2	is the relative deformation after step B	%

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k	is a factor related to the number of test results available	–
l	is the length	mm
$\lambda_{90/90}$	is the 90 % fractile with a confidence level of 90 % for the thermal conductivity	W/(m·K)
$\lambda_{90/90,\ 60d}$	is the 90 % fractile with a confidence level of 90 % for the thermal conductivity of foam at 60 days	W/(m·K)
$\lambda_{90/90>60d}$	is the 90 % fractile with a confidence level of 90 % for the thermal conductivity of foam older than 60 days	W/(m·K)
λ_D	is the declared thermal conductivity	W/(m·K)
λ_i	is one test result of thermal conductivity	W/(m·K)
λ_{mean}	is the mean thermal conductivity	W/(m·K)
$\lambda_{mean,\ a}$	is the mean thermal conductivity of aged values	W/(m·K)
$\lambda_{mean,\ 60d}$	is the mean thermal conductivity of values for 60 days old foam	W/(m·K)
μ	is the water vapour diffusion resistance factor	--
n	*is the number of test results*	–
$R_{90/90}$	is the 90 % fractile with a confidence level of 90 % for the thermal resistance	m^2·K/W
$R_{90/90,\ 60d}$	is the 90 % fractile with a confidence level of 90 % for the thermal resistance of foam at 60 days	m^2·K/W
$R_{90/90>60d}$	is the 90 % fractile with a confidence level of 90 % for the thermal resistance of foam older than 60 days	m^2·K/W
R_D	is the declared thermal resistance	m^2·K/W
R_i	is one test result of thermal resistance	m^2·K/W
R_{mean}	is the mean thermal resistance	m^2·K/W
S_b	is the deviation from squareness on width or length	mm/m
S_{max}	is the deviation from flatness	mm
s_R	is the estimate of the standard deviation of the thermal resistance	m^2·K/W
s_λ	is the estimate of the standard deviation of the thermal conductivity	W/(m·K)
$s_{\lambda a}$	is the estimate of the standard deviation of the aged thermal conductivity	W/(m·K)
$s_{\lambda i}$	is the estimate of the standard deviation of the initial thermal conductivity within 90 days of production	W/(m·K)
σ_{10}	is the compressive stress at 10 % deformation	kPa
σ_c	is the declared compressive stress	kPa
σ_m	is the compressive strength	kPa
σ_{mt}	is the tensile strength perpendicular to faces	kPa
τ	is the shear strength	kPa
W_{dV}	is the water absorption by diffusion	%
W_{lt}	is the long-term water pick up by total immersion	%
W_V	is the water absorption by diffusion and by freeze-thaw	%
X_{ct}	is the compressive creep	mm
X_t	is the total thickness reduction at time $_t$	mm

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Z	is the water vapour resistance	$m^2 \cdot h \cdot Pa/mg$

$CC(i_1/i_2/y)\sigma_c$	is the symbol of the declared level for compressive creep
CS(10\Y)	is the symbol of the declared level for compressive stress or strength
DLT(1)5	is the symbol of the declared level of deformation under specified compressive load, temperature and time conditions with a maximum of 5 % deformation
DLT(2)5	is the symbol of the declared level of deformation under specified compressive load, temperature and time conditions with a maximum of 5 % deformation
DS(70,-)	is the symbol of the declared value for dimensional stability at specified temperature
DS(23,90); DS(70,90)	is the symbol of the declared value for dimensional stability under specified temperature and humidity conditions
FTCD	is the symbol of the declared level for freeze thaw resistance after water diffusion test
FTCI	is the symbol of the declared level for freeze thaw resistance after water vapour immersion test
MU	is the symbol of the declared level for water vapour diffusion resistance factor
SS	is the symbol of the declared value for shear strength
T	is the symbol of the declared class for thickness tolerances
TR	is the symbol of the declared level for tensile strength perpendicular to faces
WD(V)	is the symbol of the declared level for water absorption by diffusion
WL(T)	is the symbol of the declared level for long term water absorption by total immersion
Z	is the symbol of the declared value for water vapour resistance

Abbreviated terms used in this standard:

XPS	is e**X**truded **P**oly**S**tyrene foam
▌A1⟩ PTD	is **P**roduct **T**ype **D**etermination (previously named ITT for Initial Type Test) ⟨A1▌
FPC	is **F**actory **P**roduction **C**ontrol
RtF	is the **R**eaction **t**o **F**ire
▌A1⟩ AVCP	is **A**ssessment and **V**erification of **C**onstancy of **P**erformance (previously named attestation of conformity)
DoP	is **D**eclaration of **P**erformance
ThIB	is **T**hermal **I**nsulation for **B**uildings
VCP	is **V**erification of **C**onstancy of **P**erformance (previously named evaluation of conformity) ⟨A1▌

4 Requirements

4.1 General

Product properties shall be assessed in accordance with Clause 5. To comply with this standard, products shall meet the requirements of 4.2, and the requirements of 4.3 as appropriate.

For multi-layered products, additional requirements are given in Annex D.

One test result for a product property is the average of the measured values on the number of test specimens given in Table 9.

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NOTE Information on additional properties is given in Annex E.

4.2 For all applications

4.2.1 Thermal resistance and thermal conductivity

Thermal resistance and thermal conductivity shall be based upon measurements carried out in accordance with EN 12667 or EN 12939 for thick products.

The thermal resistance and thermal conductivity shall be determined in accordance with Annex A and Annex C and declared by the manufacturer according to the following:

— the reference mean temperature shall be 10 °C;

— the measured values shall be expressed with three significant figures;

— for products of uniform thickness, the declared thermal resistance, R_D, shall always be declared. The thermal conductivity, λ_D, shall be declared where possible. Where appropriate, for the products of non-uniform thickness (i.e. for slopped and tapered products) only the thermal conductivity, λ_D, shall be declared;

— the declared thermal resistance, R_D, and the declared thermal conductivity, λ_D, shall be given as limit values representing at least 90 % of the production, determined with a confidence level of 90 %;

— the statistical value of thermal conductivity, $\lambda_{90/90}$, shall be rounded upwards to the nearest 0,001 W/(m·K) and declared as λ_D in levels with steps of 0,001 W/(m·K);

— the declared thermal resistance, R_D, shall be calculated from the nominal thickness, d_N ,and the corresponding thermal conductivity value, $\lambda_{90/90}$; unless measured directly;

— the statistical value of thermal resistance, $R_{90/90}$, when calculated from the nominal thickness, d_N , and the corresponding thermal conductivity, $\lambda_{90/90}$, shall be rounded downwards to the nearest 0,05 m²·K/W, and declared as R_D in levels with steps of 0,05 m²·K/W;

— the statistical value of thermal resistance, $R_{90/90}$, for those products for which only the thermal resistance is measured directly, shall be rounded downwards to the nearest 0,05 m²·K/W and declared as R_D in levels with steps of 0,05 m²·K/W.

NOTE λ_U and R_U (design values) may be determined with reference to EN ISO 10456.

4.2.2 Length, width, squareness, flatness

Length, l, and width, b, shall be determined in accordance with EN 822, the deviation from squarenesses on length and width, S_b, in accordance with EN 824, and the deviation from flatness, S_{max}, in accordance with EN 825. No test result shall deviate from the nominal values by more than the tolerances given in Table 1.

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Table 1 — Tolerances of length, width, squareness and flatness

Nominal length or width mm	Tolerances		
	Length or width mm	Squareness on length and width S_b mm/m	Flatness S_{max} mm/m
l or b ≤ 1500 mm	± 8	5	6
l or b > 1500 mm	± 10	5	6

4.2.3 Thickness

Thickness, d, shall be determined in accordance with EN 823. No test result shall deviate from the nominal thickness, d_N, by more than the tolerances given in Table 2 for the declared class.

Table 2 — Classes for thickness tolerances

Class	Tolerances mm		Thickness mm
T1	-2	+2	< 50
	-2	+3	50 ≤ d_N ≤ 120
	-2	+ 6	> 120
T2	-1,5	+1,5	< 50
	-1,5	+1,5	50 ≤ d_N ≤ 120
	-1,5	+1,5	> 120
T3	-1	+1	< 50
	-1	+1	50 ≤ d_N ≤ 120
	-1	+1	> 120

NOTE T2 and T3 classes are only applicable to planed XPS products, i.e. with their extrusion skin removed.

4.2.4 Reaction to fire of the product as placed on the market

Reaction to fire classification of the product as placed on the market shall be determined in accordance with EN 13501-1 and the mounting and fixing rules given in EN 15715.

This classification is compulsory and shall always be included in the CE Marking label.

Detailed information about the test conditions and the field of application of the classification as stated in the reaction to fire classification report shall be given in the manufacturer literature.

4.2.5 Durability characteristics

4.2.5.1 General

The appropriate durability characteristics have been considered and are covered in 4.2.5.2, 4.2.5.3 and where appropriate in 4.3.6 on compressive creep.

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4.2.5.2 Durability of reaction to fire of the product as placed on the market against ageing / degradation.

Reaction to fire performance of XPS products does not change with time. This is covered by 4.2.4 Reaction to fire of the product as placed on the market.

4.2.5.3 Durability of thermal and thermal conductivity against ageing / degradation

Any change in thermal conductivity and thickness of XPS products with time is covered and considered for declaration by 4.2.1, together with Annex C for thermal conductivity and any change in thickness is covered by at least one of the 4.3.2 dimensional stability tests or the deformation test in 4.3.3 as relevant.

4.3 For specific applications

4.3.1 General

If there is no requirement for a property described in 4.3 for a product in use, then the property does not need to be determined and declared by the manufacturer.

4.3.2 Dimensional stability under specified conditions

Dimensional stability under specified temperature or under specified temperature and humidity conditions shall be determined in accordance with EN 1604. The test shall be carried out for the conditions given in Table 3.

The relative changes in length, $\Delta\varepsilon_l$, in width, $\Delta\varepsilon_b$, and the relative reduction in thickness, $\Delta\varepsilon_d$, shall not exceed the values given in Table 3 for the declared level.

Table 3 — Dimensional stability under specified conditions

Designation	Condition	Test method	Requirement (%)	
			Length $\Delta\varepsilon_l$ and width $\Delta\varepsilon_b$	thickness, $\Delta\varepsilon_d$
DS(70-)	48 h, 70 ºC	EN 1604	5	5
DS (23,90)	48 h, 23 ºC, 90 % R.H.	EN 1604	2	2
DS(70,90)	48 h, 70 ºC, 90 % R.H.	EN 1604	5	5

The tests DS(70; -) or DS (23; 90) need not to be performed when DS(70,90) is used.

4.3.3 Deformation under specified compressive load and temperature conditions

Deformation under specified compressive load and temperature conditions shall be determined in accordance with EN 1605. For each test condition the difference between the relevant deformation, ε_1, after step A and, ε_2, after step B as described in EN 1605 shall not exceed the values given in Table 4 for the declared level.

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Table 4 — Levels for deformation under specified compressive load and temperature conditions

Level	Test conditions	Requirement %
DLT(1)5	load: 20 kPa temperature: (80 ± 1) °C time: (48 ± 1) h.	≤ 5
DLT(2)5	load: 40 kPa temperature: (70 ± 1) °C time: (168 ± 1) h.	≤ 5

4.3.4 Compressive stress or compressive strength

Compressive stress at 10 % deformation, σ_{10}, or the compressive strength, σ_m, shall be determined in accordance with EN 826. No test result for either the compressive stress at 10 % deformation, σ_{10}, or the compressive strength, σ_m, whichever is the greatest, shall be less than the declared level, CS(10\Y), given in Table 5.

Table 5 — Levels for compressive stress or compressive strength

Level	Requirement kPa
CS(10\Y)100	>100
CS(10\Y)150	≥ 150
CS(10\Y)200	≥ 200
CS(10\Y)250	≥ 250
CS(10\Y)300	≥ 300
CS(10\Y)400	≥ 400
CS(10\Y)500	≥ 500
CS(10\Y)600	≥ 600
CS(10\Y)700	≥ 700
CS(10\Y)800	≥ 800
CS(10\Y)1000	≥ 1000

4.3.5 Tensile strength perpendicular to faces

Tensile strength perpendicular to faces, σ_{mt}, shall be determined in accordance with EN 1607. No test result shall be less than the value given in Table 6 for the declared level.

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