

Prefabricated reinforced components of autoclaved aerated concrete

ICS 91.100.30

National foreword

This British Standard is the UK implementation of EN 12602:2008+A1:2013. It supersedes BS EN 12602:2008, which is withdrawn.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.

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

The publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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English Version

Prefabricated reinforced components of autoclaved aerated concrete

Eléments préfabriqués armés en béton cellulaire autoclavé

Vorgefertigte bewehrte Bauteile aus dampfgehärtetem Porenbeton

This European Standard was approved by CEN on 21 March 2008 and includes Amendment 1 approved by CEN on 23 May 2013.

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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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 12602:2008+A1:2013) has been prepared by Technical Committee CEN/TC 177 “Prefabricated reinforced components of autoclaved aerated concrete or light-weight aggregate concrete with open structure”, 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of an identical text or by endorsement, at the latest by January 2014, and conflicting national standards shall be withdrawn at the latest by January 2014.

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 includes Amendment 1 approved by CEN on 23 May 2013.

This document supersedes EN 12602:2008.

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A1** **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).

For relationship with EU Directive 89/106/EEC, see informative Annex ZA, which is an integral part of this document. **A1**

This document uses the methods given in the Guidance paper L, clause 3.3, of the European Commission.

This European Standard is used together with a national application document. The national application document may only contain information on those parameters which are left open in this European Standard for national choice, known as Nationally Determined Parameters, to be used for the design of the construction products and civil engineering works to be constructed in the country concerned, i.e.:

- values and/or classes where alternatives are given in this European Standard,
- values to be used where a symbol only is given in this European Standard,
- country specific data (geographical, climatic, etc.), e.g. snow map,
- procedure to be used where alternative procedures are given in this European Standard.

It may contain:

- decisions on the application of informative annexes,
- references to non-contradictory complementary information to assist the user to apply this European Standard.

There is a need for consistency between this document for construction products and the technical rules for works. That means all the information accompanying the CE Marking of the construction products should clearly mention which Nationally Determined Parameters have been taken into account.

EN 12602 describes the design principles and requirements for safety, serviceability and durability of reinforced prefabricated components of autoclaved aerated concrete. The design of the components is based on the limit state concept used in conjunction with partial factors.

EN 12602 is intended to be used together with Eurocodes EN 1990, EN 1991 (all parts) and EN 1998.

Numerical values for partial factors and other reliability parameters are recommended as basic values that provide an acceptable level of reliability. They have been selected assuming that an appropriate level of workmanship and of quality management applies.

This European Standard gives values, procedures and classes with notes indicating where national choices may have to be made. Therefore the National Standard implementing EN 12602 should be used with a national application document containing all Nationally Determined Parameters to be used for the design of prefabricated reinforced components of autoclaved aerated concrete to be constructed in the relevant country.

National choice is allowed in EN 12602 through the following clauses:

A.3.2	A.9.4.1
A.3.3	A.10.2.2
A.4.1.2.1	A.10.3
A.4.1.3.2	B.3.2.2
A.4.1.3.3	B.3.3.2
A.5.2	B.3.3.3.2
A.5.3.3.3 (3)	Annex D
A.6.3	
A.7	
A.8	

Regulatory classes are only given for "Reaction to fire" and "Resistance to fire". All other classes used in this European Standard, i.e. density classes and strength classes, are technical classes.

Annexes A, B, C, CA,  CC, CD and G  are normative.

Annexes CB, D, E, F and ZA are informative.

This document includes a Bibliography.

According to the CEN/CENELEC Internal Regulations, the national standards organisations 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.

1 Scope

This European Standard is for prefabricated reinforced components of autoclaved aerated concrete to be used in building construction for:

a) Structural elements:

- loadbearing wall components;
- retaining wall components;
- roof components;
- floor components;
- linear components (beams and piers).

b) Non-structural elements:

- nonloadbearing wall components (partition walls);
- cladding components (without fixtures) intended to be used for external facades of buildings;
- small box culverts used to form channels for the enclosure of services;
- components for noise barriers.

Depending on the type and intended use of elements for which the components are utilised, the components can be applied - in addition to their loadbearing and encasing function - for purposes of fire resistance, sound insulation and thermal insulation indicated in the relevant clauses of this European Standard.

Components covered by this standard are only intended to be subjected to predominantly non-dynamic actions, unless special measures are introduced in the relevant clauses of this European Standard.

The term "reinforced" relates to reinforcement used for both structural and non-structural purposes.

This European Standard does not cover:

- rules for the application of these components in structures;
- joints (except their strength and integrity E of resistance to fire);
- fixtures;
- finishes for external components, such as tiling.

NOTE AAC components may be used in noise barriers if they are designed to fulfil also the requirements of EN 14388.

2 Normative references

[A1] 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. **[A1]**

EN 678, *Determination of the dry density of autoclaved aerated concrete*

EN 679, *Determination of the compressive strength of autoclaved aerated concrete*

EN 680, *Determination of the drying shrinkage of autoclaved aerated concrete*

EN 772-16, *Methods of test for masonry units — Part 16: Determination of dimensions*

EN 772-20, *Methods of test for masonry units — Part 20: Determination of flatness of faces of aggregate concrete, manufactured stone and natural stone masonry units*

EN 989, *Determination of the bond behaviour between reinforcing bars and autoclaved aerated concrete by the "Push-Out" test*

EN 990, *Test methods for verification of corrosion protection of reinforcement in autoclaved aerated concrete and lightweight aggregate concrete with open structure*

EN 991, *Determination of the dimensions of prefabricated reinforced components made of autoclaved aerated concrete or lightweight aggregate concrete with open structure*

EN 1351, *Determination of flexural strength of autoclaved aerated concrete*

EN 1352, *Determination of static modulus of elasticity under compression of autoclaved aerated concrete or lightweight aggregate concrete with open structure*

EN 1355, *Determination of creep strains under compression of autoclaved aerated concrete or lightweight aggregate concrete with open structure*

EN 1356, *Performance test for prefabricated reinforced components of autoclaved aerated concrete or lightweight aggregate concrete with open structure under transverse load*

EN 15304, *Determination of the freeze-thaw resistance of autoclaved aerated concrete*

EN 1737, *Determination of shear strength of welded joints of reinforcement mats or cages for prefabricated components made of autoclaved aerated concrete or lightweight aggregate concrete with open structure*

EN 1738, *Determination of steel stresses in unloaded reinforced components made of autoclaved aerated concrete*

EN 1739, *Determination of shear strength for in-plane forces of joints between prefabricated components of autoclaved aerated concrete or lightweight aggregate concrete with open structure*

EN 1740, *Performance test for prefabricated reinforced components made of autoclaved aerated concrete or lightweight aggregate concrete with open structure under predominantly longitudinal load (vertical components)*

EN 1741, *Determination of shear strength for out-of-plane forces of joints between prefabricated components made of autoclaved aerated concrete or lightweight aggregate concrete with open structure*

EN 1742, *Determination of shear strength between different layers of multilayer components made of autoclaved aerated concrete or lightweight aggregate concrete with open structure*

EN 1992-1-1:2004, *Eurocode 2: Design of concrete structures — Part 1-1: General rules and rules for buildings*

EN 10080, *Steel for the reinforcement of concrete — Weldable reinforcing steel — General*

EN 10088-5, *Stainless steels — Part 5: Technical delivery conditions for bars, rods, wire, sections and bright products of corrosion resisting steels for construction purposes*

EN 12269-1, *Determination of the bond behaviour between reinforcing steel and autoclaved aerated concrete by the "beam test" — Part 1: Short term test*

EN 12269-2, *Determination of the bond behaviour between reinforcing steel and autoclaved aerated concrete by the "beam test" — Part 2: Long term test*

EN 12664, *Thermal performance of building materials and products — Determination of thermal resistance by means of guarded hot plate and heat flow meter methods — Dry and moist products of medium and low thermal resistance*

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

EN 13501-2, *Fire classification of construction products and building elements — Part 2: Classification using data from fire resistance tests, excluding ventilation services*

EN 15361:2007, *Determination of the influence of the corrosion protection coating on the anchorage capacity of the transverse anchorage bars in prefabricated reinforced components of autoclaved aerated concrete*

EN ISO 140-3, *Acoustics — Measurement of sound insulation in buildings and of building elements — Part 3: Laboratory measurements of airborne sound insulation of building elements (ISO 140-3:1995)*

EN ISO 140-6, *Acoustics — Measurement of sound insulation in buildings and of buildings elements — Part 6: Laboratory measurements of impact sound insulation of floors (ISO 140-6:1998)*

EN ISO 354, *Acoustics — Measurement of sound absorption in a reverberation room (ISO 354:2003)*

EN ISO 717-1, *Acoustics — Rating of sound insulation in buildings and of building elements — Part 1: Airborne sound insulation (ISO 717-1:1996)*

EN ISO 717-2, *Acoustics — Rating of sound insulation in buildings and of building elements — Part 2: Impact sound insulation (ISO 717-2:1996)*

EN ISO 10456, *Building materials and products — Hygrothermal properties — Tabulated design values and procedures for determining declared and design thermal values (ISO 10456:2007)*

EN ISO 15630-1, *Steel for the reinforcement and prestressing of concrete — Test methods — Part 1: Reinforcing bars, wire rod and wire (ISO 15630-1)*

ISO 4356, *Bases for the design of structures — Deformations of buildings at the serviceability limit states*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply.

3.1.1

autoclaved aerated concrete

autoclaved aerated concrete (AAC) is manufactured from binders such as cement and/or lime combined with fine siliceous based material, cell generating material and water. The raw materials are mixed together and cast into moulds where the mix is allowed to rise and set into cakes. After this part of the process, the cake is cut into the required sizes of components and cured with high pressure steam in autoclaves

3.1.2

raw materials

raw materials are the constituents which combined with additives and agents, where appropriate, can be used in the manufacturing process

3.1.3

reinforcement

reinforcement is commonly composed of steel mats, cages and/or steel bars. Other types of reinforcement can be used. Depending on the function of the components, the reinforcement can be structural or non-structural

Structural reinforcement is reinforcement which is necessary for the loadbearing function of the component as part of the structure. It consists of steel.

Non-structural reinforcement is reinforcement which is necessary in order to ensure adequate resistance of the component during handling, transportation and construction. Any suitable kind of reinforcement may be used for this purposes

3.1.4

corrosion protective coating

corrosion protective coating is a coating applied on the surface of the reinforcement to protect the reinforcement against corrosion

3.1.5

declared value

value declared by a manufacturer which is derived from values under specified conditions and rules

3.1.6

pier

vertical loadbearing part of the wall between or besides openings

3.2 Symbols

3.2.1 General symbols

A	area;
b	width of component;
d	effective depth or thickness of component, diameter (e. g. of a bar);
E	modulus of elasticity;
e	eccentricity;
F	force;
f	strength;
h	depth or thickness of component;
i	radius of inertia;
I	moment of inertia;
k	coefficient, factor;
l	length, height of wall component, span length of roof or floor components;
M	bending moment;
N	axial force;
R	resistance, loadbearing capacity;
t	time;
V	shear force;
ε	strain;
γ	partial safety factor;
σ	normal stress;
τ	shear stress;
ϕ	diameter.

3.2.2 Subscripts

a	anchorage, actual;
b	bond;
c	concrete parameter, compression;
comp	component;
cr	critical;
d	design value;
dry	in the dry state
eff	effective value;
g	declared value;
h	horizontal;
k	characteristic value;
l	longitudinal;
M	material;
m	mean or mass;
pl	plastic;
R	resistance;
S	acting in the section;
s	steel parameter, shear;
t	tension;
test	in testing;
u	ultimate;
um	in the moist state;
w	welded, web;
y	yield value (for steel);
0	effective value.

3.2.3 Symbols used in this European Standard (including normative annexes, except Annex C)

A_c	- total cross-sectional area of concrete; - area of the compression zone of the cross-section; - area of AAC within the tensile zone;
A_{crit}	critical area according to A.6.2.3;
A_{c0}	loaded area according to Figure A.13;
A_{c1}	maximum distribution area according to Figure A.13;
A_k	area defined by longitudinal reinforcement according to Figure A.12;
A_s	cross-sectional area of tensile reinforcement;
A_{smin}	minimum cross-sectional area of the reinforcement;
A_{swmin}	minimum cross-sectional area of shear reinforcement within length s ;
A_{sw}	cross-sectional area of vertical or inclined shear reinforcement;
A_{sl}	- cross-sectional area of the reinforcing bar with the larger diameter of the connection

	- cross-sectional area of tension reinforcement;
a	- dimension of support perpendicular to the plane of a wall;
	- shear span;
	- larger dimension of a rectangular loaded area (see Figure A.8);
a_b	dimension of rectangular loaded area perpendicular to the span of a slab;
a_0	minimum support length;
a_1	horizontal displacement of the envelope of the design bending moment distribution (see Figure A.16);
b	- width of a component;
	- smaller dimension of a rectangular loaded area (see Figure A.8);
b'	centre distance of longitudinal reinforcement according to Figure A.12;
b_w	minimum width of the web;
c	- concrete cover;
	- a value, in Megapascals, representing the difference between the characteristic compressive strength and the permissible minimum individual value of the compressive strength;
d	- effective depth of a component;
	- design thickness of a component, for a solid wall $d = h$;
	- diameter of a circular loaded area (see Figure A.9);
$E_{c,eff}$	effective modulus of elasticity of AAC;
E_{cm}	mean value of the modulus of elasticity of AAC;
$E_{cm,eff}$	"effective" modulus of elasticity of AAC;
E_s	modulus of elasticity of reinforcing steel;
$(EI)_k$	stiffness in bending of a section in the "semi-cracked" state;
$(EI)_0$	stiffness of a section in the uncracked state, assuming $E = E_{cm}$;
$(EI)_1$	stiffness of a section in the uncracked state;
$(EI)_2$	stiffness of a section in the cracked state;
e	- distance of the axis of the transverse bars in the anchorage zone to the nearest surface of the component (see Figure A.15);
	- distance of the centroid of the longitudinal bars from the adjacent side face of the AAC component;
	- basis of natural logarithms;
e_a	additional eccentricity of the longitudinal force due to geometrical imperfections;
e_b	eccentricity in the plane of a wall, $e_b = M/N + e_N$;
e_{cr}	eccentricity e_{c0} of the vertical action including the geometrical imperfections;
e_m	first order eccentricity caused by bending due to horizontal load;
e_N	eccentricity of the vertical axial force in the plane of a wall;
e_o	eccentricity of the longitudinal force at the top of the component;
e_t	first order eccentricity perpendicular to the plane of a wall, taken as the sum of e_o and e_m ;
e_0	first order eccentricity of loads perpendicular to the plane of a component;
F_b	long term anchorage capacity;
F_c	compression force in the AAC in the direction of the longitudinal axis;
F_{ld}	design tensile force in the longitudinal reinforcement to be anchored;
F_s	tensile force in the longitudinal reinforcement;

F_{sl}	tensile force in each of the longitudinal bars;
F_{RA}	ultimate anchorage resistance due to welded cross-bars;
F_{Rdu}	concentrated compressive design force;
F_{wg}	declared shear strength of a welded joint;
f_{bd}	design bond strength;
f_{bk}	characteristic bond strength;
f_{bl}	long term bond strength;
f_{cd}	design value of the compressive strength of AAC;
$f_{c,edge}$	compressive strength of AAC at the edge of a wall component or pier;
f_{ck}	characteristic compressive strength of AAC;
$f_{ck,g}$	declared characteristic compressive strength of AAC;
f_{cflk}	characteristic flexural strength of AAC;
$f_{cflk,eff}$	"effective" characteristic flexural strength of AAC;
f_{ctk}	characteristic value of axial tensile strength of AAC;
f_{ctm}	mean value of axial tensile strength of AAC;
f_{id}	design bearing strength of AAC;
f_{st}	tensile strength of reinforcing steel;
f_y	yield strength of reinforcing steel;
f_{yd}	design value of yield strength of reinforcing steel;
f_{yk}	characteristic yield strength of reinforcing steel;
f_{ywd}	design yield strength of vertical or inclined shear reinforcement;
f_{ywk}	characteristic yield strength of the stirrups;
$f_{0,2k}$	characteristic 0,2 % proof stress of reinforcing steel;
h	overall depth of a cross-section;
h'	centre distance of longitudinal reinforcement according to Figure A.12;
h_c	distance between A_{c0} and A_{c1} ;
h_k	thickness of a fictitious box section according to Equation A.34;
h_w	(total) thickness of a wall;
I_c	moment of gyration of compression zone of a cross-section;
i_c	radius of gyration of the compression zone of the cross-section, i.e. I_c/A_c ;
K_c	factor for maximum AAC bearing strength depending on the bond class;
K_1	reduction factor in Equation (A.11) for reduced AAC cover;
K_2	spacing factor of stirrups in Equation (A.11);
K_3	factor in Equation (A.11) taking into account the type of the stirrups;
k	- a coefficient for minimum reinforcement which takes into account the nature of the stress distribution; - column factor in Annex B; - distribution coefficient given by Equations (A.45a) and (A.45b) for calculation of deflections;
k_s	column factor according to Equation (A.15);
k_1	- factor for the support strength; - reduction factor for the design bond strength taking into account geometrical influences;
k_2	reduction factor for long term and temperature effects;

k_w	is the welding strength factor, see A1 Table 5c A1 ;
L	span length between the centre points of the supports;
l	span length;
l_b	basic anchorage length of reinforcement according to 8.4 of EN 1992-1-1:2004;
$l_{b,net}$	required anchorage length of reinforcement (see Figure A.4);
$l_{h,eff}$	effective horizontal length of a wall or pier;
l_{hs}	horizontal length of a support in the plane of a wall;
l_{ht}	horizontal length of a (stiffening) transverse wall;
$l_{k,test}$	length of the component in functional testing;
l_s	shear span;
l_w	height of a wall measured between centres of restraint;
l_0	effective length of a component (with respect to buckling);
M_{cr}	cracking moment;
M_d	design value of bending capacity;
M_h	bending moment;
M_{da}	actual design value of bending moment;
M_f	bending moment under frequent combination of loading;
M_h	bending moment resulting from horizontal actions;
M_k	- bending moment under the total design load; - declared characteristic value of bending capacity;
m	factor for consideration of existing transverse compression in the anchorage zone;
N	axial force (compression positive);
N_{cr}	design axial loadbearing capacity putting the eccentricity equal to e_{cr} ;
N_d	design axial force (compression positive);
N_{Rd}	design axial loadbearing capacity;
N_{Rk}	characteristic loadbearing capacity for longitudinal forces;
$N_{Rk,test}$	declared characteristic longitudinal loadbearing capacity from performance tests according to EN 1740;
N_{Sd}	design value of axial force in a cross-section;
n	number (e.g. of test results);
n_p	number of welded transverse bars available for anchorage within the zone of transverse compression;
n_t	number of welded transverse bars in the anchorage zone;
p, p_I, p_{II}	parameters in Equation (A.44);
q_p	sum of permanent and quasi-permanent loads;
q_v	sum of variable loads;
R_{cd}	design loadbearing capacity;
R_{ck}	characteristic loadbearing capacity;
r	- radius of curvature due to bending moment; - coefficient for the calculation of effective height of door or window piers;
r_{c0}	radius of loaded area according to Figure A.13;
r_{c1}	radius of maximum distribution area according to Figure A.13;

s	- spacing of stirrups; - spacing of inclined shear reinforcement measured along the longitudinal axis of a component;
s_{l1}	centre distance of the bars of longitudinal tensile reinforcement;
s_{l2}	centre distance of the bars of required compressive reinforcement;
s_s	spacing of shear reinforcement along the longitudinal axis of the component;
s_t	centre distance of transverse reinforcing bars;
$s_{t,min}$	minimum centre distance of transverse reinforcing bars;
T_{Rd1}	resisting torsional moment of a section without torsional reinforcement;
T_{Rd3}	resisting torsional moment of a section with torsional reinforcement;
T_{Sd}	design torsional moment;
t_t	total effective length of transverse anchorage bars;
V	- shear force; - volume of component;
V_d	- design loadbearing capacity in shear of a joint; - design value of shear capacity;
V_{cd}	contribution of the concrete to shear resistance ($= V_{Rd1}$);
V_k	declared characteristic value of shear capacity;
V_{Sd}	design shear force per unit of length;
V_{wd}	contribution of shear reinforcement to shear resistance;
V_{Rd}	design shear resistance;
V_{Rd1}	design shear resistance of a section without shear reinforcement;
V_{Rd2}	maximum design shear force that can be carried without crushing of the notional concrete compressive struts;
V_{Rd3}	design shear resistance of a section with shear reinforcement;
V_{Sd}	design shear force;
W_T	section modulus for torsion;
ν	reduction factor for the design compressive strength of AAC used for the calculation of maximum design shear force V_{Rd2} that can be carried without crushing of the notional concrete compressive struts;
x	- neutral axis depth; - required increase of minimum support length a_0 in case where the concrete cover c of longitudinal reinforcement at the end face of a transversely loaded component exceeds 15 mm;
$\bar{x}$	mean value of the compressive strength of a test series;
x_{min}	minimum individual value of the compressive strength of a test series;
y_{el}	short-term deflection;
y_k	deflection under total design load, assuming a section stiffness of $(EI)_k$;
y_v	instantaneous deflection caused by variable load;
y_0	camber due to prestress;
y_1	instantaneous deflection due to loads occurring before construction of adjoining members, assuming a section in the uncracked state and $E = E_{cm}$;
y_∞	long term deflection under the quasi-permanent combination of loading;
z	lever arm of internal longitudinal forces;

α	reduction coefficient for design compressive strength of AAC taking into account long term effects;
α_s	angle of shear reinforcement with the longitudinal axis;
β	coefficient for the determination of effective height of a wall or pier, depending on the stiffness of lateral support;
γ_C	partial safety factor for concrete (AAC);
γ_{comp}	partial safety factor for component;
γ_F	partial safety factor for actions;
γ_M	partial safety factor for material properties;
γ_n	multiplication factor for the partial safety factor γ_C for AAC;
γ_S	partial safety factor for reinforcing steel;
ε_c	strain of AAC;
$\varepsilon_c(t_0)$	initial (elastic) strain of AAC;
ε_{cc}	creep strain of AAC;
ε_{cfl}	flexural (tensile or compressive) strain of AAC at the opposite side of ε_c ;
ε_{cflu}	ultimate flexural strain of AAC in the tensioned zone;
ε_{su}	elongation of reinforcing steel at maximum load;
ε_{suk}	characteristic value of elongation of reinforcing steel at maximum load;
ε_{syfl}	tensile or compressive strain of the reinforcing steel at the opposite side of ε_c ;
ε_{yd}	design yield strain of reinforcing steel;
ε_0	short-term prestrain;
η_d	conversion factor for design by testing;
θ	angle of concrete struts with the longitudinal axis;
κ	- curvature; - coefficient for determination of "effective" modulus of elasticity and "effective" flexural tensile strength of AAC; - factor taking into account increased strength of partially loaded areas;
λ_{10dry}	thermal conductivity in the dry state at a mean test temperature of 10 °C;
λ_d	design thermal conductivity in the moist state, at a moisture content μ_m ;
μ	design coefficient of friction;
μ_m	mass related moisture content;
ρ	dry density of AAC;
$\rho_{d,inf}$	design value of the density of AAC-components (including reinforcement) in the moist state, in case weight acts favourably;
$\rho_{d,sup}$	design value of the density of AAC-components (including reinforcement) in the moist state, in case weight acts unfavourably;
ρ_k	characteristic dry density of AAC (95 % - quantile);
ρ_m	mean value of the dry density of AAC;
ρ_{sound}	density to be used for the determination of acoustic behaviour;
$\rho_{T,l}$	reinforcement ratio of the longitudinal reinforcement resisting torsion;
$\rho_{T,s}$	reinforcement ratio of stirrups resisting torsion;
$\rho_{thermal}$	density to be used for the determination of thermal properties;

ρ_{trans}	density to be used for calculation of transportation weight of AAC-components;
ρ_1	reinforcement ratio;
σ_c	stress of AAC;
σ_d	design (compressive) stress;
σ_{cd}	design edge stress of AAC on the compressive side;
σ_{sid}	design tensile stress in the longitudinal torsion reinforcement;
σ_{swd}	design tensile stress in shear reinforcement;
σ_{td}	design edge stress on the tensile side;
τ_{Rd}	basic shear strength;
φ	final creep coefficient;
ϕ_d	diameter of a circular loaded area;
ϕ_{sl}	diameter of a longitudinal bar;
ϕ_{sw}	diameter of a stirrup;
ϕ_t	diameter of transverse bars in the anchorage zone.

3.3 Abbreviations

AAC	autoclaved aerated concrete;
FPC	factory production control;
NPD	Nationally Determined Parameter;
RH	relative humidity;
SLS	serviceability limit state;
ULS	ultimate limit state.

4 Properties and requirements of materials

4.1 Constituent materials of autoclaved aerated concrete

4.1.1 General

The following raw materials, combined with additives and agents, where appropriate, may be used in the manufacturing process:

a) calcareous based materials:

- 1) cement;
- 2) lime;
- 3) recycled AAC;

b) silicious based materials:

- 1) natural and/or ground sand;
- 2) fly ash (pulverized-fuel ash);
- 3) ground granulated blast furnace slag;

- c) water;
- d) cell generating materials:
 - 1) chemicals (usually aluminium powder or slurry);
 - 2) stable preformed foam;
 - 3) other cell generating agents.

Other suitable raw materials may be included.

4.1.2 Release of dangerous substances

[A1] National regulations on dangerous substances may require verification and declaration on release, and sometimes content, when construction products covered by this standard are placed on those markets.

In the absence of European harmonised test methods, verification and declaration on release/content should be done taking into account national provisions in the place of use.

NOTE An informative database covering European and national provisions on dangerous substances is available at the Construction web site on EUROPA accessed through <http://ec.europa.eu/enterprise/construction/cpd-ds/>. **[A1]**

4.2 Autoclaved aerated concrete parameters

4.2.1 General

In the following subclauses the basic material properties are presented, which may be used for general design considerations. Design values to be used in equations for numeric calculations are indicated in Annex A and Annex B.

4.2.2 Dry density

4.2.2.1 General

The dry density, determined in accordance with EN 678, shall be indicated by the manufacturer on the basis of the mean value of the last six test sets (each consisting of three test specimens), either as declared mean value and declared tolerance or as a declared density class as specified in Table 1.

4.2.2.2 Declared mean dry density

When the manufacturer declares the dry density as a mean value, this shall be within the following limits:

- mean dry density: $\rho_{m,g} \pm \Delta\rho_g$
- individual value of dry density: $\rho_{m,g} \pm 15\%$

where

$\rho_{m,g}$ is the declared mean value of the dry density;

$\Delta\rho_g$ is the declared tolerance of the dry density (not more than 10 %).

4.2.2.3 Declared density class

When the manufacturer declares the dry density in accordance with the density classes specified in Table 1, the mean value of the results of the last six test sets (each consisting of three test specimens), and the tests performed

according to EN 678, shall be within the indicated limits. Individual values may be up to 25 kg/m³ more or less than the indicated limits.

Table 1 — Density classes

Dry densities in kilograms per cubic metre

Density class	300	350	400	450	500	550	600	650
Mean dry density ρ_m	> 250 ≤ 300	> 300 ≤ 350	> 350 ≤ 400	> 400 ≤ 450	> 450 ≤ 500	> 500 ≤ 550	> 550 ≤ 600	> 600 ≤ 650
Density class	700	750	800	850	900	950	1000	
Mean dry density ρ_m	> 650 ≤ 700	> 700 ≤ 750	> 750 ≤ 800	> 800 ≤ 850	> 850 ≤ 900	> 900 ≤ 950	> 950 ≤ 1 000	

4.2.2.4 Derived density values

For the purposes of structural design, the following density values may be used unless national provisions exist:

$$\rho_{d,sup} = (\rho_{m,g} + \Delta\rho_g) \cdot (1 + \mu_m / 100) + m_s / V \quad (1)$$

$$\rho_{d,inf} = (\rho_{m,g} - \Delta\rho_g) \cdot (1 + \mu_m / 100) + m_s / V \quad (2)$$

where

$\rho_{d,sup}$ is the design value of the density of the AAC-components (including reinforcement) in the moist state (moisture content μ_m), in case weight acts unfavourably, in kilograms per cubic metre;

$\rho_{d,inf}$ is the design value of the density of the AAC-components (including reinforcement) in the moist state (moisture content μ_m), in case weight acts favourably, in kilograms per cubic metre;

$\rho_{m,g}$ is the declared mean value of dry density of AAC, in kilograms per cubic metre;

$\Delta\rho_g$ is the declared tolerance of the dry density of AAC, in kilograms per cubic metre;

μ_m is the expected mass related moisture content of AAC under service conditions, in per cent;

m_s is the mass of reinforcement, in kilograms;

V is the volume of component, in cubic metre.

In the case of declared density class, the expression $(\rho_{m,g} + \Delta\rho_g)$ shall be taken as the upper limit and the expression $(\rho_{m,g} - \Delta\rho_g)$ as the lower limit of the mean dry density, ρ_m as specified in Table 1.

For the determination of thermal insulation properties, the density values $\rho_{m,g}$ and $\rho_{90\%}$ may be used (see Figure 1). In the case of a declared density class, the upper limit of the mean dry density as specified in Table 1 may be taken to determine the thermal conductivity value λ_{10dry} from Table 4.

The determination of sound insulation properties may be based on the declared mean value $\rho_{m,g}$ of the dry density. In the case of a declared density class, the mean of the upper and the lower limit of the mean dry density according to Table 1 may be used.

For the determination of transportation weight, except for beams (see note), the following equation may be used in the absence of information from the manufacturer:

$$\rho_{\text{trans}} = 1,4 \rho_{\text{m,g}} + 40 \text{ kg/m}^3 \quad (3)$$

where

ρ_{trans} is the density to be used for calculation of transportation weight of AAC-components, in kilograms per cubic metre;

$\rho_{\text{m,g}}$ is the declared mean value of the dry density of AAC, in kilograms per cubic metre. (In case of a declared density class, $\rho_{\text{m,g}}$ may be taken as the mean of the upper and lower limit of the mean dry density ρ_{m} according to Table 1.)

NOTE In the case of beams, the amount of reinforcement can be higher than 40 kg per m³.

4.2.3 Characteristic strength values

The characteristic values f_k of strength parameters of AAC or AAC-components, as compressive strength or flexural strength of AAC or loadbearing capacity of components according to Annex B, or the bond strength between reinforcement and AAC, is defined as the 5 %-fractile of that property ($p = 0,95$) at a confidence level of $\gamma = 0,75$. For more information see Annex F (informative).

4.2.4 Compressive strength

The characteristic compressive strength of AAC shall be indicated by the manufacturer either as declared characteristic compressive strength $f_{\text{ck,g}}$ or as a declared compressive strength class as specified in **Table 2a**.

The actual characteristic compressive strength f_{ck} , determined by statistical interpretation (see 4.2.3) of results of tests carried out in accordance with EN 679, shall be equal to or greater than the declared value $f_{\text{ck,g}}$ or the value f_{ck} required in **Table 2a** for the declared strength class, respectively.

The actual minimum mean value $f_{\text{c,min}}$ of each test set of three test specimens according to EN 679 shall be at least 0,9 times the declared characteristic strength $f_{\text{ck,g}}$ or the value f_{ck} required in **Table 2a** for the declared strength class, respectively.

Table 2a — Compressive strength classes for AAC

Strengths in Megapascals

Strength class	AAC 1,5	AAC 2	AAC 2,5	AAC 3	AAC 3,5	AAC 4	AAC 4,5	AAC 5	AAC 6	AAC 7	AAC 8	AAC 9	AAC 10
f_{ck}	1,5	2,0	2,5	3,0	3,5	4,0	4,5	5,0	6,0	7,0	8,0	9,0	10,0

4.2.5 Tensile strength and flexural strength

The manufacturer shall declare the flexural strength $f_{\text{ctk,g}}$ from tests. The actual characteristic flexural strength f_{ctk} , determined by statistical interpretation (see 4.2.3) of results of tests carried out in accordance with EN 1351, shall be equal to or greater than the declared value $f_{\text{ctk,g}}$.

In the absence of test results an estimate of the tensile strength or flexural strength, respectively, may be obtained by using the following equations:

$$f_{\text{ctk}; 0,05} = 0,10 f_{\text{ck}} \quad (4a)$$

$$f_{\text{ctk}; 0,95} = 0,24 f_{\text{ck}} \quad (4b)$$

$$f_{\text{ctlk}; 0,05} = 0,18 f_{\text{ck}} \quad (5a)$$

$$f_{\text{ctlk}; 0,95} = 0,36 f_{\text{ck}} \quad (5b)$$

where

$f_{\text{ctk}; 0,05}$ is the characteristic value of 5 %-quantile of axial tensile strength, in Megapascals;

$f_{\text{ctk}; 0,95}$ is the characteristic value of 95 %-quantile of axial tensile strength, in Megapascals;

$f_{\text{ctlk}; 0,05}$ is the characteristic value of 5 %-quantile of flexural strength, in Megapascals;

$f_{\text{ctlk}; 0,95}$ is the characteristic value of 95 %-quantile of flexural strength, in Megapascals;

f_{ck} is the characteristic value of compressive strength according to 4.2.4, in Megapascals.

NOTE When declared flexural strength f_{ctlk} is used in design, a reduction factor 0,8 is used to take into account size effect.

4.2.6 Stress-strain diagram

The idealised stress-strain diagram for AAC consists of a linear relationship between stress and strain up to a compressive strain of 0,002 at design compressive strength level, continuing at a constant stress level up to the ultimate limit state for the strain of 0,003 (see A.3.2 and Figure A.2).

4.2.7 Modulus of elasticity

The modulus of elasticity E_{cm} , determined in accordance with EN 1352, shall be indicated by the manufacturer on the basis of the mean value of the last six test sets (each consisting of three test specimens) as declared mean value and declared tolerances.

The values shall be within the following limits:

— mean modulus of elasticity: $E_{\text{cm},g} \pm \Delta E_g$

— individual value of modulus of elasticity: $E_{\text{cm},g} \pm 20 \%$

where

$E_{\text{cm},g}$ is the declared mean value of the modulus of elasticity;

ΔE_g is the declared tolerance of the modulus of elasticity (not more than 10 %).

In absence of test results, a mean value of the modulus of elasticity may be obtained as follows:

$$E_{\text{cm}} = 5 (\rho_m - 150) \quad (6)$$

where

E_{cm} is the mean value of the modulus of elasticity of AAC, in Megapascals;

ρ_m is the mean value of the dry density of AAC, in kilograms per cubic metre.

4.2.8 Poisson's ratio

Poisson's ratio for elastic strains shall be taken as 0,2. If cracking is permitted in AAC in tension, Poisson's ratio may be taken as 0,0.

4.2.9 Coefficient of thermal expansion

In the absence of experimental data, the coefficient of thermal expansion shall be taken as $8 \times 10^{-6}/K$.

4.2.10 Drying shrinkage

The declared value of drying shrinkage shall be determined according to EN 680. A1 The shrinkage class as specified in Table 2b shall be declared based on the mean conventional reference value $\varepsilon_{cs,ref}$ or alternatively based on a value taking the total value of drying shrinkage $\varepsilon_{cs,tot}$ multiplied by a reduction factor 0,5. A1

NOTE The reduction factor takes into account that the dimensional changes of whole components due to drying shrinkage (or swelling in the case of wetting) depend on the size of the components, the amount and position of the reinforcement and on the initial and practical moisture content of the AAC.

A1 Table 2b — Drying shrinkage classes for AAC

Drying shrinkage class	0,15	0,20	0,25	0,30	0,35	0,40
ε_{cs}	$\leq 0,15$	$\leq 0,20$	$\leq 0,25$	$\leq 0,30$	$\leq 0,35$	$\leq 0,40$
mm per m						

A1

4.2.11 Creep

4.2.11.1 General

The creep coefficient shall be indicated by the manufacturer on the basis of results of tests according to EN 1355, either as a declared mean value or as a declared creep class.

The definition of the creep coefficient is as follows:

$$\varphi(t_0, t) = \frac{\varepsilon_{cc}(t_0, t)}{\varepsilon_c(t_0)} \quad (7)$$

where

$\varepsilon_{cc}(t_0, t)$ is the creep strain from time t_0 until time t ;

$\varepsilon_c(t_0)$ is the initial (elastic) strain at a given time t_0 .

Creep of AAC may be estimated to be proportional to the applied stress for compressive stresses not exceeding $0,45 f_{ck}$ at the age of loading t_0 .

In the absence of experimental data, the final creep coefficient $\varphi(t_0, t_\infty)$ shall be taken as 1,0.

4.2.11.2 Declared mean creep

When the manufacturer declares the creep coefficient as a mean value, this shall be within the following limits:

- mean value of the creep coefficient: $\varphi(t_0, t_\infty) + 10 \%$;
- individual value of the creep coefficient: $\varphi(t_0, t_\infty) + 20 \%$.

4.2.11.3 Declared creep class

When the manufacturer declares the creep coefficient in accordance with the creep classes specified in Table 3, the mean value of the tests performed according to EN 1355, shall be within the indicated limits.

Table 3 — Creep classes

Creep class	0,5	0,6	0,7	0,8	0,9	1,0
Mean creep coefficient $\varphi(t_0, t_\infty)$	> 0,4	> 0,5	> 0,6	> 0,7	> 0,8	> 0,9
	$\leq 0,5$	$\leq 0,6$	$\leq 0,7$	$\leq 0,8$	$\leq 0,9$	$\leq 1,0$

4.2.12 Specific heat

The specific heat of AAC shall be taken as 1 050 J/kgK.

4.2.13 Thermal conductivity

4.2.13.1 General

The thermal conductivity of AAC shall be declared for the oven-dry state expressed as $\lambda_{10\text{dry}}$ along with the dry density. Declared thermal conductivity values shall either be calculated from the results of measurements carried out on test specimens or taken from Table 4. The design thermal conductivity is the declared thermal conductivity corrected for moisture according to 5.1.4.

The declaration shall include the thermal conductivity with indication of the percentage of the production it intends to refer to (e.g. $\lambda_{10\text{dry}}(50\%)$ or $\lambda_{10\text{dry}}(90\%)$).

4.2.13.2 Procedure for determination of dry thermal conductivity by testing

Where tests are carried out, the procedure according to 4.2.13.3 to 4.2.13.6 shall be followed.

4.2.13.3 Test method

The reference test method is specified in EN 12664. For AAC the mean reference test temperature shall be 10 °C. Alternative test methods which can require test specimens of different sizes and different conditioning may be used if the correlation between the results of the reference test method and the alternative test method can be given.

4.2.13.4 Test specimens

Test specimens shall be homogeneous. Specimen sizes and requirements as to planeness will depend upon the size of apparatus used and on the thermal conductivity of the material. Test specimens shall contain no reinforcement.

4.2.13.5 Conditioning of test specimens

Test specimens shall be conditioned to constant mass in air of (23 ± 2) °C and (50 ± 5) % RH. Constant mass is considered to be obtained when the difference between two consecutive weightings 24 h apart does not exceed 0,2 %.

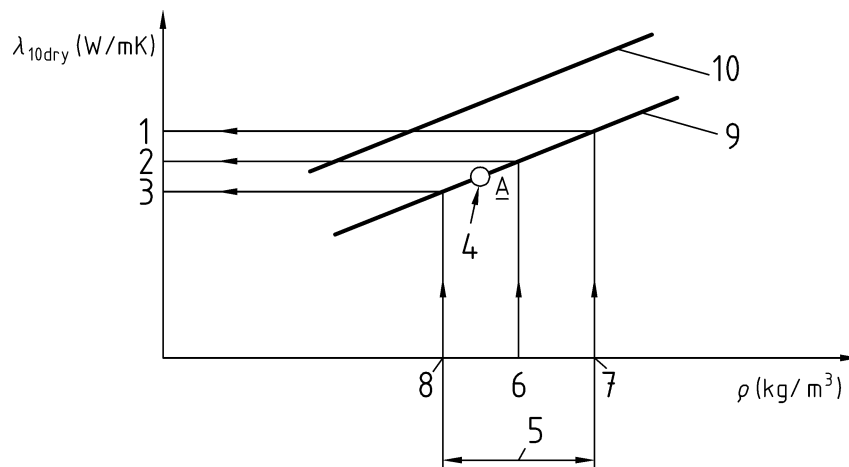
Other test conditions (e.g. oven-dry state) may be used if the correlation between the reference conditions and the alternative conditions can be given.

4.2.13.6 Determination of the dry mean value and the limit value

In order to ensure that the results are representative of current material produced, tests shall be carried out on test specimens selected from three different production batches within the stated density range of the product under

consideration. The mean value of the three test results of thermal conductivity shall be calculated and corrected to zero moisture content as indicated in 5.1.4. The dry density of each of the three test specimens shall be determined in accordance with EN 678, and the mean value of the three results shall be calculated.

A graph of thermal conductivity $\lambda_{10\text{dry}}$ (W/mK) and dry density ρ (kg/m³) is plotted using the tabulated values given in 4.2.13.7 (line 9 in Figure 1). The mean measured $\lambda_{10\text{dry}}$ value is plotted against the corresponding measured mean dry density (see point A in Figure 1). A line parallel to the line representing the tabulated values is drawn through this point (line 10 in Figure 1). From this line the mean and the limit values of the thermal conductivity shall be determined as a function of the mean dry density of the product and the 10 % and 90 % quantile of the manufactured dry product density with a confidence level of $\gamma = 90\%$ according to EN ISO 10456.



Key

- | | |
|------------------------------------|--|
| 1 Upper limit | 6 Mean manufactured dry density |
| 2 Mean value | 7 Dry density not exceeded by 90 % of production |
| 3 Lower limit | 8 Dry density not exceeded by 10 % of production |
| 4 Point A: average of test results | 9 Line representing tabulated values acc. to Table 4 |
| 5 Manufactured dry density range | 10 Line parallel to line 9 through point (A) |

Figure 1 — Determination of dry thermal conductivity $\lambda_{10\text{dry}}$

4.2.13.7 Use of tabulated values for thermal conductivity

In the absence of test results the thermal conductivity shall be based on the values given in Table 4, related to the dry density (see 4.2.2.4), for the dry state.

Table 4 — Dry thermal conductivity $\lambda_{10\text{dry}}$ of AAC for 50 % and 90 % of production with a confidence level of $\gamma = 90$ % (compiled according to EN 1745)

Mean dry density ρ^a kg/m ³	Thermal conductivity value $\lambda_{10\text{dry}}$ W/mK	
	50 %	90 %
300	0,072	0,085
400	0,096	0,110
500	0,120	0,130
600	0,150	0,160
700	0,170	0,180
800	0,190	0,210
900	0,220	0,240
1 000	0,240	0,260
NOTE 1 Intermediate values may be obtained by interpolation.		
NOTE 2 The thermal performance is obtained using the mean dry thermal conductivity $\lambda_{10\text{dry}(50\%)}$.		
^a See Figure 1.		

4.2.14 Water vapour permeability

The design value of the water vapour resistance factor shall be taken as 5 or 10, respectively. The lower value is valid for diffusion into a component (wetting) and the higher value for diffusion out of a component (drying).

More accurate values for water vapour permeability and water vapour resistance factor may be determined by tests according to EN ISO 12572.

4.2.15 Water tightness

Where water tightness is required, the components shall be protected against penetration of water, e.g. by suitable rendering, coating, cladding or finishes.

4.3 Reinforcement

4.3.1 Steel

[A1] The reinforcement consists of reinforcement steel made by smooth bars or de-coiled products according to EN 10080 or stainless steel according to EN 10088-5.

Unless specified by a harmonised product standard, it shall be demonstrated that the reinforcement purchased from the steel works to be used in prefabricated reinforced components of autoclaved aerated concrete has been subject to an initial type testing, audit testing of samples taken at the factory, initial inspection of the FPC and continuous surveillance of the FPC.

NOTE 1 Appropriate certificate will demonstrate how the manufacturing of reinforcing steel is subject to third party control covering initial type testing, audit testing of samples taken at the factory, initial inspection of the FPC and continuous surveillance of the FPC.

Unless specified by a harmonised product standard for structural stainless reinforcing steel, it shall have a diameter not greater than 12 mm.

Declared strength and ductility properties of reinforcing steel used in AAC components shall comply with the properties of steel after straightening and after autoclaving.

NOTE 2 Thermal elongation for austenitic stainless steel is higher than for normal steel and ferritic or austenitic ferritic stainless steel. ^(A1)

4.3.2 Structural reinforcement

The performance characteristics of reinforcing steel are defined in EN 10080 and shall be tested in accordance with the test methods of that European Standard.

^(A1) Table 5a together with EN 10088-5 gives the applicable stainless steel grades, their chemical composition and density.

Electrical resistance welding shall be used when connecting stainless steel bars and de-coiled products.

NOTE 1 Corrosion protection layer is often needed also with stainless reinforcing bars and de-coiled products due to autoclaving process.

Table 5a — List of steel grades for stainless reinforcing steel

Steel number	Steel name	Density [kg/dm ³] — according to EN 10088-1	Comment
1.4003	X2CrNi12	7,7	Ferritic stainless steel ^a
1.4016	X6Cr17	7,7	Ferritic stainless steel
1.4162	X2CrMnNiN21-5-1	7,8	Austenitic-ferritic steel
1.4362	X2CrNiN23-4	7,8	Austenitic-ferritic steel
1.4462	X2CrNiMoN22-5-3	7,8	Austenitic-ferritic steel
^a This steel number needs corrosion protection the efficiency of which is verified in accordance with EN 990, see 5.3.3.			

The performance characteristics of stainless steel are defined in EN 10088-5 and shall be tested in accordance with the test methods of that European Standard with the following exceptions and additional performance characteristics when used for reinforcing of AAC components:

1) Characteristic values for mechanical properties of stainless reinforcing steel

Tensile strength values of stainless reinforcing steel shall be declared as characteristic values defined as the 5% fractile of that property ($p=0,95$) at a confidence level $\gamma = 90\%$. When calculating strength values, nominal cross-section area of the product is used. This definition refers to the long term quality level of production.

2) Suitability for bending

When bent stainless reinforcing steel is used its suitability for bending shall be determined by the bend test according to EN ISO 15630-1, with a minimum angle of bend of 180°. After testing the products shall not show rupture or visible cracks. The mandrel diameter specified for the bend test shall not exceed the relevant maximum diameter specified in Table 5b.

NOTE 2 The absence of cracks visible to a person with normal or corrected vision is considered as evidence that the test piece withstood the bend test. A superficial ductile tear can occur at the base of the ribs or indentations and is not considered to be a failure. The tear can be considered superficial when the depth of the tear is not greater than the width of the tear.

Table 5b — Mandrel diameter for the bending test

Nominal diameter d (mm)	Maximum mandrel diameter
≤16	3d
>16	6d

3) Dimensions and tolerances

The permissible deviation from the nominal mass per metre shall not be more than:

$$\pm 6,0 \% \text{ on nominal diameters } 12 \text{ mm and below. } \langle A_1 \rangle$$

The reinforcement shall have adequate ductility in elongation. Adequate ductility may be assumed if the following ductility requirement is satisfied:

$$\varepsilon_{uk} > 2,5 \%$$

The declared value of the shear force of welded joints F_{wg} shall fulfil the following requirement:

$$F_{wg} \geq k_w f_{yk} A_{sl} \quad (8)$$

where

k_w is the welding strength factor, see $\langle A_1 \rangle$ Table 5c $\langle A_1 \rangle$;

f_{yk} is the characteristic tensile yield strength;

A_{sl} is the cross sectional area of the reinforcing bar with the larger diameter of the connection.

$\langle A_1 \rangle$ Table 5c $\langle A_1 \rangle$ — Welding strength classes and welding strength factors k_w

Welding strength classes	k_w
S 1	0,25
S 2	0,50

The shear strength of welded joints shall be determined in accordance with EN 1737. Welding strength classes shall be declared by the manufacturer according to $\langle A_1 \rangle$ Table 5c $\langle A_1 \rangle$.

$\langle A_1 \rangle$ NOTE 3 $\langle A_1 \rangle$ Class S1 is normally used. Class S2 should be used for steel with special properties specified by national authorities.

4.3.3 Effective diameter of coated bars

The increase of bar diameter by corrosion protection coating can be taken into account in the calculation of anchorage capacity of the transverse anchorage bars (see A.10.3) when the following conditions are met in a pull-out test according to EN 15361:

a) $\phi_{tot,m} \geq \phi_{tot,g}$

b) $f_{cb,C}/f_{cm,C} \geq 0,9 f_{cb,B}/f_{cm,B}$

where

- $\phi_{\text{tot,m}}$ is the measured mean outer diameter of the transverse bar with corrosion protection coating;
- $\phi_{\text{tot,g}}$ is the declared effective outer diameter of the transverse bar with corrosion protection coating;
- $f_{\text{cb,B}}$ is the bearing stress of the transverse bar for type B test specimens;
- $f_{\text{cb,C}}$ is the bearing stress of the transverse bar for type C test specimens;
- $f_{\text{cm,B}}$ is the compressive strength of AAC for type B test specimens;
- $f_{\text{cm,C}}$ is the compressive strength of AAC for type C test specimens.

[A1] When used in design calculations, **[A1]** the effective diameter $\phi_{\text{tot,g}}$ (equal the mean outer diameter of the transverse bars including the corrosion protection coating) shall be declared as mean value in accordance with 5.2 of EN 15361:2007.

4.3.4 Non-structural reinforcement

If required, mechanical properties of the non-structural reinforcement shall be declared by the manufacturer.

4.4 Bond

The use of bond in design according to Annex A shall be declared by the manufacturer as a bond class as specified in Table 6.

[A1] Table 6 — Bond classes

Bond class	Explanation
B1	Bond is not taken into account in design
B2-N	Bond is taken into account in design and ACC components are used in normal operational conditions
B2-T	Bond is taken into account in design and ACC components are used in operational conditions up to 50 °C

[A1]

[A1] For bond classes B2-N and B2-T the minimum characteristic bond strength f_{bk} shall be 0,20 MPa. **[A1]**

If the effect of bond is used in design (see bond class B 2), the characteristic bond strength, f_{bk} , (see A.10.2) shall be declared by the manufacturer. The short-term bond strength shall be determined by initial type testing in accordance with EN 12269-1. The actual characteristic bond strength, f_{bk} , determined by statistical interpretation (see 4.2.3) of results shall be equal to or greater than the declared value. The initial type testing shall also include testing according to EN 989 in order to establish the correlation between the two methods.

The bond strength shall be subject to factory production control testing in accordance with EN 989 taking into account the correlation factor found in the initial type testing according to EN 12269-1.

When determining design bond strength, f_{bd} , the long term effects and possible effects of temperature extremes shall be taken into account.

[A1] Long-term effects and temperature effects shall be determined according to EN 12269-2 to verify that the declared reduction factor k_2 used in design, see A.10.2, is acceptable. The reduction factor k_2 may be applied for normal operational conditions, i.e. class N, or operational conditions up to 50 °C, i.e. class T. Before long-term testing, initial short-term tests shall be performed in accordance with EN 12269-1.

The reduction factor k_2 may be considered acceptable if the long-term bond strength f_{bl} obtained in the final short-term tests after 200 000 load cycles in accordance with EN 12269-2 fulfils the following requirement:

$$f_{bl,mean} \geq 0,7 k_2 f_{bm} \quad (9)$$

where

$f_{bl,mean}$ is the mean value of the long-term bond strength according to EN 12669-2 obtained in the final short-term tests after 200 000 load cycles;

k_2 is the reduction factor taking into account the long term influences and temperature effects on the bond between reinforcing bars and AAC;

f_{bm} is the mean value of the short-term bond strength determined in accordance with EN 12269-1.

NOTE The bond strength values $f_{bl,mean}$ and f_{bm} will be determined on test specimens prepared from the same sample. $\overline{A_1}$

4.5 Thermal prestress

4.5.1 General

The use of thermal prestress in design according to Annex A shall be declared by the manufacturer as a prestress class specified in Table 7.

Table 7 — Prestress classes

Prestress Class	Explanation
P 1	Thermal prestress is not taken into account in design
P 2	Thermal prestress is taken into account in design

$\overline{A_1}$ Due to different deformation properties of AAC and steel, prestress can be generated during autoclaving and the subsequent cooling. In components where prestress might cause end cracks, see Formula (E.17), stirrups or other transverse reinforcements shall be provided to withstand splitting forces. $\overline{A_1}$

If the effect of prestress is taken into account in the design procedure in SLS, the mean value of the short-term prestrain (ε_{0m}) shall be declared by the manufacturer. In addition it shall be verified that no significant long term slip exist between reinforcement and AAC. Furthermore, it has to be demonstrated that the bond stresses between the reinforcement and the AAC in SLS do not exceed the design bond strength $f_{b,d}$ (see A.10.2.2) or the anchorage capacity F_{RA} (see A.10.3) for any loading case. The development length of the prestress shall be less than 15 % of the length of the component, at each end.

The value of short-term prestrain (ε_0) is derived from measured steel strains in unloaded components according to EN 1738, using recognised methods, e.g. such as presented in informative Annex E.

Due to creep and shrinkage of AAC and the relaxation of the steel reinforcement the prestress will diminish in the course of time. This shall be taken into account if the effect of prestress is used in design by using recognised methods, e.g. such as presented in Clause E.2 of informative Annex E.

The increase of slip between reinforcing bar and AAC during long term loading shall not be higher than 5 % of the initial slip of the long term test according to EN 12269-2.

4.5.2 Declared mean initial prestrain $\varepsilon_{0m,g}$

The manufacturer may declare the initial prestrain as a mean value which shall fulfil the following conditions:

- mean initial prestrain: $\geq \varepsilon_{0m,g} - 10 \%$;
- individual value of measured initial prestrain: $\geq \varepsilon_{0m,g} - 20 \%$;

When calculating the mean initial prestrain, the last six tests shall be considered.

5 Properties and requirements of components

5.1 General

5.1.1 Mechanical resistance

The components fulfil the requirement to mechanical resistance if they are designed in accordance with 5.2.4.

5.1.2 Acoustic properties

5.1.2.1 Airborne sound reduction

The airborne sound reduction of the components will mainly depend on the weight per surface area.

When required, the airborne sound reduction of walls, floors and roofs constructed of components shall be measured according to EN ISO 140-3 and expressed as single number quantity for rating according to EN ISO 717-1 (reference method).

For road traffic noise reducing devices the airborne sound reduction may be determined according to EN 1793-2.

Tests should be conducted in standardised end-use conditions with joints between components sealed and with no finishes except for the minimum thickness of screed on floors (if applicable). The results derived from such tests would be applicable to elements of any area having the same or better specification.

As an alternative to testing, the airborne sound reduction may be estimated according to EN 12354-1.

5.1.2.2 Impact sound insulation

When required, the impact sound insulation of floors constructed of components shall be measured according to EN ISO 140-6 and expressed as single number quantity for rating according to EN ISO 717-2 (reference method).

Tests should be conducted in standardised end-use conditions with a minimum thickness of screed (if applicable) and without a ceiling finish. The results derived from such tests would be applicable to floors having the same or better specification but of any area.

As an alternative to testing, the impact sound insulation may be estimated according to EN 12354-2.

5.1.2.3 Sound absorption

The sound absorption will mainly depend on the surface texture. When required, it shall be determined according to EN ISO 354.

For road traffic noise reducing devices the sound absorption characteristic may be determined according to EN 1793-1.

5.1.3 Reaction to fire and resistance to fire

5.1.3.1 Reaction to fire

AAC shall be tested and classified as specified in EN 13501-1. If the content of equally distributed organic material is less than 1 % by mass or volume (whichever is the more onerous), the AAC¹⁾ is classified in Euroclass A1 without the need for testing.

1) Commission Decision 96/603/EEC, Materials to be considered as reaction to fire Class A without the need for testing

5.1.3.2 Resistance to fire

When resistance to fire of AAC components is required, the fire resistance shall be declared by the manufacturer and shall be classified by testing, by using tabulated data or by calculation.

a) Classification of resistance to fire by testing shall be done in accordance with EN 13501-2.

NOTE The test methods for the different types of components are specified in EN 13501-2. These are: EN 1364-1 for testing of non loadbearing walls, EN 1365-1 for testing of loadbearing walls, EN 1365-2 for testing of floors and roofs, EN 1365-3 for testing of beams, and EN 1365-4 for testing of piers.

b) Classification of resistance to fire using tabulated data shall be done in accordance with Annex C.

c) Classification of resistance to fire by calculation methods shall be done in accordance with Annex C.

5.1.4 Design thermal resistance and design thermal conductivity

A1 The design thermal resistance can be determined in accordance with EN ISO 6946 using the design thermal conductivity λ_d to be determined according to Formula (11a):

$$\lambda_d = \lambda_{10dry} \cdot e^{f_u \cdot \mu_m} \quad (11a)$$

where **A1**

λ_d is the design thermal conductivity in the moist state, at a moisture content μ_m , in watts per metre Kelvin;

e is the basis of natural logarithms (2,718);

λ_{10dry} is the thermal conductivity in the dry state, in watts per metre Kelvin (see NOTE 2);

μ_m is the moisture content, mass by mass;

f_u is the moisture conversion coefficient, mass by mass. In the absence of test data the value of f_u shall be taken as 2,0.

NOTE 1 The moisture content is supposed to be given by the national application documents for different applications.

NOTE 2 The thermal performance is obtained by using the mean dry thermal conductivity $\lambda_{10dry(50\%)}$.

A1 Alternatively, moisture conversion coefficients and moisture conversion factors can be derived from tests, carried out at several practical moisture contents.

The design thermal resistance can then be determined according to Formula (11b):

$$\lambda_d = \lambda_{10dry} \cdot F_m \quad (11b)$$

where

λ_{10dry} is the thermal conductivity in the dry state, in watts per metre Kelvin (see NOTE 2 above);

F_m is the moisture conversion factor derived from tests. **A1**

5.2 Technical requirements and declared properties

5.2.1 Dimensions and tolerances

The essential dimensions (length or height, thickness, width, planeness and parallelism of the contact faces in the joints) determined in accordance with EN 991 or EN 772-16 or EN 772-20, respectively, and their tolerances shall be declared by the manufacturer.

The deviation of nominally rectangular components from squareness in their plane, determined in accordance with EN 991 is limited to 3 mm/0,5 m. For vertical wall components placed in a thin bed of mortar the deviation from squareness shall be limited to 0,2 mm/0,5 m.

Tighter tolerances than specified in [A1] Table 8 [A1], class T1, may be declared by the manufacturer.

The maximum deviations for components shall meet the tolerance requirements of Table 8.

Table 8 — Dimensional tolerances of components

Dimensions in millimetres

Tolerance class	T 1	T 2	T 3
Length	± 5	$\pm 3,0$	$\pm 3,0$
Height	± 3	$\pm 1,0$	$\pm 1,0$
Width	± 3	$\pm 1,5$	$\pm 1,5$
Planeness of the contact faces in the joints	No requirement	No requirement	$\leq 1,0$
Parallelism of the contact faces in the joints	No requirement	No requirement	$\leq 1,0$

Tongued and grooved edge profiles or other jointing systems may be provided.

The position of the structural reinforcement shall either be declared by the manufacturer or given in the design document for each product. The actual effective depth compared to the design value shall not be reduced by more than 5 mm. The position of the transverse reinforcing bars shall not deviate from the nominal value by more than ± 10 mm.

5.2.2 Mass of the components

The dry mass and the mass including the delivery humidity of the components may be stated as mean values (see 4.2.2.4).

5.2.3 Dimensional stability

In the absence of experimental data the values given in Table 9 shall be used for final shrinkage strain ε_{∞} in the design of AAC components.

Table 9 — Final shrinkage strains ε_{∞} for AAC components

Relative humidity %	Notional size 2 A_c/u [A1] mm [A1]	
	50	150
50	0,25 ‰	0,15 ‰
80	0,15 ‰	0,10 ‰
A_c is the cross-sectional area of AAC-component; [A1] u is the perimeter of AAC component in contact with atmosphere. [A1] Linear interpolation is permitted.		

5.2.4 Load-bearing capacity

5.2.4.1 General

A1 All relevant structural properties of a product shall be evaluated for both the ultimate and the serviceability limit states.

The design method used according to Annex A or Annex B shall be declared by the manufacturer.

The design values for the load-bearing capacities shall be determined according to one of the following methods:

- a) by calculation (see 5.2.4.2);
- b) by functional testing of components (see 5.2.4.3);
- c) by calculation and physical testing (see 5.2.4.4)

NOTE 1 For certain applications of the products in the works, either testing according to Annex B or calculation method according to Annex A might be required.

NOTE 2 Actions and safety factors for actions are subject to national regulations or other rules valid in the place of use of the product. Design loads are predefined values, depending on the intended use of the product. **A1**

5.2.4.2 Design by calculation

The evaluation of design values for the capacities obtained by calculation shall be in accordance with Annex A.

A1

5.2.4.3 Design by functional testing of components

In case of design by testing, declared values of the loadbearing capacity shall be based on functional testing of the components, in accordance with Annex B. The characteristic loadbearing capacity shall be determined by statistical interpretation of test results (see 4.2.3).

5.2.4.4 Design by calculation and physical testing **A1**

Physical testing of finished products is required to support calculation in the following cases:

- alternative design rules;
- structural arrangements with uncommon design models (uncommon modelling for structural design).

In these cases physical testing of a sufficient number of full scale specimens is needed before starting the production in order to verify the reliability of the design model assumed for the calculation. This shall be done with load-tests up to ultimate design conditions.

A1 *deleted text* **A1**

5.2.5 Deflections

The deflections of roof or floor components or beams under a given action shall be determined by calculation (see Annex A). It is also possible to determine the short-term deflections by functional testing of components (see Annex B).

5.2.6 Joint strength

When required as part of the design, the strength of joints between components shall be declared by the manufacturer on the basis of results determined from tests in accordance with EN 1739 (reference method) for in-

plane shear and in accordance with EN 1741 (reference method) for out of plane shear. Alternatively, for specific joint types the joint strength shall be determined by calculation.

5.2.7 Minimum requirements

5.2.7.1 Minimum thickness

The minimum nominal thickness of a non-structural component is 30 mm. The minimum nominal thickness of a structural component depending of the chosen thickness class is specified in Table 10.

Table 10 — Thickness classes of structural components

Thickness Classes	Minimum nominal thickness
Th 1	70
Th 2	100

5.2.7.2 Minimum requirements for structural reinforcement

5.2.7.2.1 General

The rules given in this clause apply to structural reinforcement of AAC components subjected to predominantly static loading.

The components shall contain the necessary amount of reinforcement required for:

- limiting the width of cracks from transportation, handling, and service loads (see A.9.3);
- in the case of structurally reinforced components: avoidance of brittle bending failure of the cross-sections at the formation of the first crack (see A.3.4);
- distribution of loads.

The nominal diameter of the bars shall be ≥ 4 mm and ≤ 12 mm for slabs and ≥ 4 mm and ≤ 25 mm for beams.

The anchorage of the bars shall be achieved by welded transverse bars or by means of bond, if applicable.

The concrete cover of the bars shall be at least 10 mm and not smaller than the diameter of the bar except at the ends of the component when cut surface of the reinforcement is properly protected against corrosion.

5.2.7.2.2 Spacing of the bars

a) Longitudinal bars

The tensile reinforcement shall contain at least three bars for floor components and roof components and at least 2 bars for wall components. For beams and narrow fitting pieces with a width ≤ 375 mm two tensile bars are acceptable.

The centre distance s_{11} of the bars of the required tensile reinforcement shall be such that:

- $50 \text{ mm} \leq s_{11} \leq 2d$ for floor components and roof components;
- $2,5 \phi_{s1} \leq s_{11} \leq 2d$ for beams;
- $50 \text{ mm} \leq s_{11} \leq 700 \text{ mm}$ for wall components.

where

ϕ_{sl} is the diameter of the longitudinal bar;

d is the effective depth of the cross-section.

In loadbearing overhangs (balconies etc) $\geq 4 h$ reinforcement shall contain at least two bars. The centre distance of the longitudinal bars shall not exceed $150 \text{ mm} + h/10$, where h is the slab thickness, in millimetres.

The centre distance s_{l2} of the bars of the required compressive reinforcement shall be such that

— $50 \text{ mm} \leq s_{l2} \leq 700 \text{ mm}$.

b) Transverse bars

The centre distance s_t of the transverse bars required for anchorage of longitudinal reinforcement shall be such that:

— for $b_w \leq 750 \text{ mm}$: $50 \text{ mm} \leq s_t \leq 500 \text{ mm}$;

— for $b_w > 750 \text{ mm}$: $50 \text{ mm} \leq s_t \leq 333 \text{ mm}$.

where

b_w is the width of the components

The centre distance s_t of transverse bars required for other purposes (in the central area of AAC component apart from the anchorage zone) shall be such that

— for $b \leq 750 \text{ mm}$: $50 \text{ mm} \leq s_t \leq 1200 \text{ mm}$;

— for $b > 750 \text{ mm}$: $50 \text{ mm} \leq s_t \leq 3d$

c) Shear reinforcement

The spacing s_s of required bars along the longitudinal axis of the component shall not exceed $0,9 d/\sin \alpha$,

where

d is the effective depth of the cross-sections;

α is the angle of the shear reinforcement with the longitudinal axis.

5.2.7.2.3 Permissible curvatures

The minimum diameter to which a bar is bent shall be such as to avoid crushing or splitting of the AAC inside the bend of the bar, and to avoid bending cracks in the bar.

For structural reinforcement the minimum diameter to which a bar is bent (diameter of the mandrel) shall be not less than $4\phi_s$ for bars with $\phi_s \leq 12 \text{ mm}$ and $7\phi_s$ for bars with $\phi_s > 12 \text{ mm}$.

5.2.7.3 Chases and holes

All reductions of the cross-sectional area shall be taken into account in design of the components except the following cases:

— Chases parallel to the longitudinal reinforcement, not affecting the reinforcement, with the following maximum dimensions:

depth: $\leq 30 \text{ mm}$ or one fourth of the component thickness (which one is the smallest);

width: ≤ 40 mm

distance from each other: ≥ 500 mm.

- Small individual holes and notches, not affecting the reinforcement in roof and floor components as well as the anchorage zone when the width of the hole or notch is not more than 15 % of the width of the component.

5.3 Durability

5.3.1 General

Durability in this context means that the component is able to fulfil throughout its service life its function with respect to serviceability, strength, and stability without significant reduction of utility or excessive unforeseen maintenance.

To provide the required durability it is necessary to protect the reinforcement reliably against corrosion. Furthermore, the components shall not be exposed to environmental conditions they cannot withstand for long. Under certain conditions a protection of the AAC surface can be necessary.

5.3.2 Environmental conditions

5.3.2.1 General

Environment in this context means the chemical and physical actions to which the AAC-components are exposed and which result in effects on the AAC or the reinforcement that are not considered as loads in structural design. These actions are classified as exposure classes in Table 11.

Special considerations shall be made to environmental conditions and duration of exposure during construction. The manufacturer shall state any necessary exposure limitations and protective measures to the normal use of the components.

5.3.2.2 Environmental classification

The manufacturer shall declare the exposure class(es) for the intended uses of the product according to Table 11.

Table 11 — Exposure classes and protective measures related to environmental conditions

Exposure classes ^a			Protection
Passive	AAC components inside buildings with low humidity and without chemical attack	X0 XD1	No protection required
Moderate	AAC components inside buildings with high humidity; AAC components exposed to rain and freezing or moderate level of chemical attack	XD2 XD3 XS1 XF1 XA1 XA2	Recommended protection by suitable measures
Aggressive	AAC components directly submerged in seawater or high level of chemical attack	XS2 XS3 XF2 XF3 XF4 XA3	Special protective measures are required ^b .
^a Definition of exposure classes, see EN 206-1. ^b In the case of an aggressive environment, e.g. with a high content of CO ₂ , SO ₂ or de-icing salt, special protective measures are required, e.g. applying of a special protective coating on the surface of the components. NOTE Exposure classes XC are not relevant since durability is not influenced by carbonation due to corrosion protection coating of the reinforcement			

In the case of moderate or aggressive environment the protective measures shall be coordinated to the nature of the attack. They shall be capable of avoiding impairment of the properties of the AAC underlying structural design and the building physical verifications and shall be suitable of avoiding damage of the reinforcement.

5.3.3 Corrosion protection of reinforcement

Structural reinforcement shall always be protected against corrosion by means of a coating applied on its surface, unless it consists of corrosion resistant material (e.g. stainless steel).

The efficiency of the corrosion protection shall be verified in accordance with EN 990.

The corrosion protection system is considered to be suitable for reinforced components if it passes either the short-term test according to method 2 (alternating drying and wetting cycles) of EN 990 or the short-term test according to method 3 (temperature cycles) of EN 990. In case of dispute method 2 is the reference test method.

A test is considered to have being passed:

- if the steel surface is free from corrosion or if only first signs of corrossions (no flaky rust or pitting) are visible in separate places which are approximately uniformly distributed over the bars and cover not more than 5 % of the surface of each individual bar,

or

- if the corroded surface area does not exceed by more than 5 % that observed on the bars of unexposed companion specimens which were stored in a non-corrosive atmosphere at a relative humidity ≤ 70 % until the end of the corrosion test.

Corrosion protection coating is not required for non-structural reinforcement when the concrete cover for components with characteristic compressive strength of the AAC $f_{ck} \leq 4,0$ MPa is at least 45 mm and for

components with characteristic compressive strength of the AAC $f_{ck} > 4,0$ MPa is at least 70 mm. The corrosion protection may also be dispensed with for components for partition walls under environmental conditions according to Table 11 exposure class X0, with a thickness of at least 100 mm and centric transportation reinforcement.

5.3.4 Freeze and thaw resistance

When the components are exposed to freeze and thaw conditions, the manufacturer shall declare freeze/thaw resistance according to EN 15304.

NOTE The required number of freeze/thaw cycles and any limits for mass loss and/or strength reduction should be given in the national application document.

6 Evaluation of conformity

6.1 Introduction

The scheme for the evaluation of conformity for structural components (see Clause 1) shall include the following tasks:

- a) initial type-testing (see 6.2);
- b) factory production control (see 6.3);
- c) initial inspection of the factory and of factory production control (see 6.4);
- d) continuous surveillance, assessment and approval of factory production control (see 6.5).

The scheme for the evaluation of conformity for non-structural components (see Clause 1) shall include the following tasks:

- e) initial type-testing (see 6.2);
- f) factory production control (see 6.3).

For both structural and non-structural components the manufacturer shall demonstrate that factory production control is performed, to ensure that the components that are produced conform to the requirements specified in Clauses 4 and 5 as far as the properties are applicable for the specific intended use.

For quality control purposes, test methods other than those referred to in Table 12, Table 13 and Table 14 may also be used provided that:

- relationship can be shown to exist between the results from the reference test method and those from alternative test methods;
- information, on which the relationship is based, is available for inspection.

6.2 Initial type-testing of the component

Tests previously performed in accordance with the provisions of this European Standard (same product, same characteristics, same or more onerous test method and attestation of conformity system) may be taken into account.

Appropriate initial type-testing shall be carried out at the commencement of production of a new type of product manufactured in accordance with this European Standard or whenever a significant change occurs in respect of an existing product.

Significant changes in the manufacturing process (e.g. new processing equipment, new type of raw materials) can have the consequence that an established product has to be considered as a new product that is subject to initial

type-testing. When only some of the aspects specified in this European Standard differ, then the initial type-testing may be restricted to those aspects concerned.

In the case of products differing from established products only in aspects that do not influence the properties specified in this European Standard, then these do not constitute new products and therefore are not subject to initial type-testing.

For the purpose of initial type-testing the properties in Table 12 shall be determined to demonstrate compliance with the manufacturers declared values. The results of initial type-testing shall be recorded.

The manufacturer shall declare the values for the relevant properties.

NOTE A new type of product is defined as a group of components whose essential properties are significantly different from the same properties of any other group, e.g. compressive strength and/or density for components with a certain thickness within a strength and/or density class.

6.3 Factory production control

6.3.1 General

The manufacturer shall establish and maintain a documented factory production control system including the quality objectives. The system shall enable product traceability and be capable of enabling confirmation that the products manufactured conform to this European Standard.

The factory production control system shall consist of the following written procedures and/or instructions concerning all

- a) inspections and tests and the utilisation of the results to control equipment, raw or incoming materials and the production process;
- b) inspections and tests on the finished product itself.

The results of inspection and tests shall be recorded.

The testing regime for raw material properties and finished products, including test frequencies, shall be included in the factory production control manual.

6.3.2 Process control

6.3.2.1 General

The items to be addressed in the factory production control manual relating to the system of control are given below.

6.3.2.2 Raw materials

The manufacturer shall define the acceptance criteria of raw materials (including reinforcing materials) either from tests carried out by the manufacturer or the raw materials supplier and the procedures that he operates to ensure that these are met.

All delivery notes for incoming materials shall be checked to ensure that the specification is correct. A visual inspection shall be made to ensure that the materials delivered conform to the delivery note.

6.3.2.3 Production process

Relevant features of the plant and production process shall be defined giving the frequency of the inspections and tests on equipment and on work in progress together with the values or criteria required. Actions to be taken when control values or criteria are not achieved shall be given. Weighing, measuring and production equipment shall be calibrated for accuracy. The frequency of calibration shall be given in the factory production control manual.

6.3.3 Finished products

6.3.3.1 Tests on finished products

The factory production control system incorporates a sampling plan according to the factory production control manual and Table 12 and Table 13. The results of sampling and testing shall be recorded.

The minimum frequency of sampling and testing shall be conform to Table 12 and Table 13, and a statistical analysis of test results shall be carried out.

[A1] When stainless reinforcing steel is used, the acceptance criteria of test results determined in accordance with EN 10088-5 for the characteristics 0,2 % proof strength $R_{p0,2}$, tensile strength R_m , percentage total elongation at maximum force A_{gt} and ratio tensile strength/proof strength $R_m/R_{p0,2}$ of the finished reinforcing bars or de-coiled products are given in Annex G. **[A1]**

6.3.3.2 Alternative tests

When an alternative test is used, the test and procedure together with its correlation with the reference test shall be recorded.

6.3.3.3 Test equipment

Test equipment shall be calibrated at regular intervals to ensure the required accuracy.

6.3.3.4 Identification and traceability

The stock control system of manufactured products shall be given in the factory production control manual. This shall include the methods of treating non-conforming products (see 6.5).

Delivery documentation shall allow traceability of the products.

6.4 Initial inspection of the factory and the factory production control

6.4.1 Information to be supplied

The manufacturer shall make available full details of his factory production control system. He shall provide in the case of a new factory information on the factory production control and the equipment to be used to produce the components.

6.4.2 Inspection

In the case of a new factory an initial inspection of the factory and the factory production control shall be carried out. The inspection shall

- a) confirm that the factory production control manual complies with the requirements of 6.3;
- b) assess that the production equipment is in accordance with the factory production control manual and in relation to providing the ability to meet the requirements of this European Standard;
- c) assess that the laboratory equipment is in accordance with the factory production control manual and is suitable for factory production control;
- d) confirm that the production is performed under the supervision of an adequate organisation, and that the production is performed by personal having the necessary practical and theoretical qualifications.

In the case of a new type of component in an existing factory it shall be decided, based on the importance of changes to the factory production control manual, whether a particular inspection is necessary.

6.4.3 Reports

In the event that an initial inspection is carried out, a report as specified in 6.5.3 shall be prepared.

6.5 Surveillance, assessment and acceptance of the factory production control

6.5.1 Inspection tasks

The tasks of the inspections are surveillance, assessment and acceptance of the factory production control operated by the manufacturer. Any major change in the factory production control manual shall be reported by the manufacturer within one month of its implementation.

It shall be verified that factory production control complies with the requirements of 6.3.

6.5.2 Frequency of inspections

Inspections shall normally be carried out once per year.

6.5.3 Reports

Following each inspection a confidential report shall be prepared and sent to the manufacturer.

The manufacturer shall, if appropriate, advise the body responsible for inspection of any corrective actions taken or planned to be taken following receipt of the report.

The body responsible for inspection shall then report on its final assessment to the body responsible for certification.

6.6 Actions to be taken in the event of non-conformity

The manufacturer shall immediately determine the affected quantity, take appropriate action to prevent their dispatch and inform any affected customer if such components have been released. In addition, the manufacturer shall immediately determine the causes of such non-conformity, take corrective actions and undertake a management review of all factory production control procedures. All such actions and findings shall be appropriately recorded.

The reports following surveillance, assessment, and acceptance of the factory production control (see 6.5.3) shall form the basis for any decisions and actions to be taken and shall be considered on a case by case basis.



Table 12 — Initial type-testing of the AAC components

Property	Type of testing	Type of component ^a														Reference test / inspection		Minimum number of test specimens
		Structural use										Non-structural use						
		Walls (W)						Roof (1)	Floor (2)	Beam (B)	Pier (O)	Walls (W) ^a	Cladding (C)	Box culvert (B)	For Sound (S)			
		W1	W2	W3	W4	W5	W6	RF-1	RF-2	BL	PL	W7	W8	CN	BN	SB		
Density	AAC ^f	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	EN 678	3x3
Compressive strength	AAC ^f	x	x	x	x	x	x	x	x	x	x			x	x	x	EN 679	3x3
Flexural strength	AAC ^f	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	EN 1351	3x3
Thickness of coating on the reinforcement	Component	x	x	x	x	x	x	x	x	x	x			x	x	x	Physical measurement	6
Corrosion protection	Component	x ^c	x ^c	x ^c	x ^c	x ^c	x ^c	x ^c	x ^c	x ^c	x ^c			x ^c	x ^c	x ^c	EN 990	3 ¹ +3
Diameter (bar + coating)	Component	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b						Physical measurement	6
Reinforcement cover	Component	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b						Physical measurement	6
Durability against freeze-thaw	AAC ^f	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b			x ^b	x ^b	x ^b	EN 15304 ^j	6 ¹ +6
Dimensions	Component	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	EN 991	3
parallelism of the contact faces in the joints	Component	x ^k	x ^k	x ^k	x ^k	x ^k	x ^k	x ^k	x ^k			x ^k	x ^k				EN 772-16	3
planeness of the contact faces in the joints	Component	x ^k	x ^k	x ^k	x ^k	x ^k	x ^k	x ^k	x ^k			x ^k	x ^k				EN 772-20	3
Loadbearing capacity under transverse load	Component	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b						EN 1356	3

Table 12 (continued)

Loadbearing capacity under predominantly longitudinal load	Component	x ^b	x ^b	x ^b	x ^b						x ^b							EN 1740	3
Thermal conductivity	AAC ^f	x ^e	x ^e	x ^e	x ^e	x ^e	x ^e	x ^e	x ^e	x ^e	x ^e	x ^e	x ^e	x ^e	x ^e	x ^e	EN 12664	3x3	
Resistance to fire	Component	x ^d	x ^d	x ^d	x ^d	x ^d	x ^d	x ^d	x ^d	x ^d	x ^d	x ^d	x ^d	x ^d	x ^d	x ^d	EN 13501-2	1	
Reaction to fire	Component	x ⁱ	x ⁱ	x ⁱ	x ⁱ	x ⁱ	x ⁱ	x ⁱ	x ⁱ	x ⁱ	x ⁱ	x ⁱ	x ⁱ	x ⁱ	x ⁱ	x ⁱ	EN 13501-1	1	
Airborne sound reduction	Component	x	x	x	x			x	x			x	x	x		x	EN ISO 140-3 EN ISO 717-1	1 1	
Impact sound reduction	Component							x	x								EN ISO 140-6 EN ISO 717-2	1 1	
Sound absorption coefficient	Component	x ^g	x ^g	x ^g	x ^g	x ^g	x ^g	x ^g	x ^g	x ^g	x ^g	x ^g	x ^g	x ^g	x ^g	x ^g	EN ISO 354	1	
Short term bond	Component	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b							EN 989 EN 12269-1	3 3	
Long term bond	Component	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b							EN 12269-2	3	
Pre-stress	Component	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b							EN 1738	3	
Modulus of elasticity	AAC ^f	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b						EN 1352	3x3	
Drying shrinkage	AAC ^f	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	EN 680	3x3	
Creep	AAC ^f	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b						EN 1355	3x3	
Steel/stainless steel: - yield strength - tensile strength - elongation of rupture - modulus of elasticity (only for stainless steel) - bar diameter - strength of welded joints - suitability for bending - dimensions, mass and tolerances	Steel ^f	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b	x ^b						EN 10080/ EN 10088-5/ EN 1737 EN ISO 15630-1	According to product standard 3 3 3	