

DIN EN 1520:2011-06 (E)

Prefabricated reinforced components of lightweight aggregate concrete with open structure with structural or non-structural reinforcement

Contents		Page
Foreword		7
1	Scope	10
2	Normative references	10
3	Terms, definitions, symbols and abbreviations	13
3.1	Terms and definitions	13
3.2	Symbols	13
3.2.1	General symbols	13
3.2.2	Subscripts	14
3.2.3	Symbols used in this European Standard	14
3.3	Abbreviations	19
3.4	Units	19
4	Properties and requirements of materials	20
4.1	Constituents	20
4.1.1	General	20
4.1.2	Release of dangerous substances	20
4.2	Lightweight aggregate concrete parameters	20
4.2.1	Dry density	20
4.2.2	Characteristic strength values	21
4.2.3	Compressive strength	21
4.2.4	Flexural strength and uniaxial tensile strength	23
4.2.5	Stress-strain diagram	23
4.2.6	Modulus of elasticity	24
4.2.7	Poisson's ratio	24
4.2.8	Coefficient of thermal expansion	24
4.2.9	Drying shrinkage	24
4.2.10	Creep	25
4.2.11	Thermal conductivity	25
4.2.12	Water vapour permeability	27
4.2.13	Water tightness	27
4.3	Reinforcement steel	27
5	Properties and requirements of components	28
5.1	General	28
5.1.1	Mechanical resistance	28
5.1.2	Deflections	28
5.1.3	Acoustic properties	28
5.1.4	Reaction to fire and resistance to fire	29
5.1.5	Design thermal resistance and design thermal conductivity	29
5.2	Types of components	30
5.2.1	General	30
5.2.2	Roof and floor components	31
5.2.3	Wall components	31
5.2.4	Beams and piers	31
5.2.5	Other prefabricated components	31
5.3	Detailing, technical requirements, and declared properties	31
5.3.1	Detailing	31
5.3.2	Dimensions and tolerances	31

5.3.3	Mass of the components	32
5.3.4	Deflections	32
5.3.5	Strength of joints	32
5.3.6	Minimum requirements	32
5.3.7	Reinforcement detailing	32
5.4	Additional requirements for roof and floor components and beams	33
5.4.1	Minimum dimensions	33
5.4.2	Minimum requirements for structural reinforcement	33
5.4.3	Support length	34
5.5	Additional requirements for wall components	35
5.5.1	General	35
5.5.2	Walls with non-structural reinforcement	35
5.5.3	Walls with structural reinforcement	35
5.6	Durability	36
5.6.1	General	36
5.6.2	Minimum cover with regard to bond	37
5.6.3	Exposure classes related to environmental conditions	37
5.6.4	Corrosion protection of reinforcement	38
5.6.5	Freeze-thaw resistance	40
6	Evaluation of conformity	40
6.1	Introduction	40
6.2	Initial type-testing of the component	41
6.2.1	General	41
6.2.2	Sharing of results from ITT	41
6.3	Factory production control	42
6.3.1	General	42
6.3.2	Process control	42
6.3.3	Finished products	42
6.4	Initial inspection of the factory and the factory production control	43
6.4.1	Information to be supplied	43
6.4.2	Inspection	43
6.4.3	Reports	43
6.5	Surveillance, assessment and approval of the factory production control	43
6.5.1	Inspection tasks	43
6.5.2	Frequency of inspections	43
6.5.3	Reports	44
6.6	Actions to be taken in the event of non-conformity	44
7	Basis for design	50
7.1	Design methods	50
7.2	Limit states	50
7.3	Actions	50
8	Marking, labelling and designation	51
8.1	Standard designation	51
8.2	Additional information on accompanying documents	52
Annex A (normative) Design of components by calculation		53
Annex B (informative) Design of components by testing		81
Annex C (informative) Recommended values for partial safety factor		87
Annex ZA (informative) Provisions for the CE marking of prefabricated components of lightweight aggregate concrete with open structure with structural or non-structural reinforcement under the EU Construction Product Directive		88
Bibliography		109
Figures Figure 1 -- Determination of dry thermal conductivity 10dry		26

Figure 2 -- Examples of multilayer slab, hollow core slab and solid slab (With respect to transverse reinforcement, see 5.4.2.1)	34
Figure 3 -- Support length a_0	35
Figure 4 -- Basic design of hollow core wall components	36
Figure A.1 -- Bi-linear stress-strain diagram for LAC in compression for cross-sectional design	55
Figure A.2 -- Design stress-strain diagram for reinforcement steel	56
Figure A.3 -- Possible strain diagrams in the ultimate limit state	56
Figure A.4 -- Limits of slenderness ratio S of loadbearing walls and piers	62
Figure A.5 -- Design loads for cellar walls	67
Figure A.6 -- Additional horizontal force H_{fd} due to inclination of the components and effects of second order theory	72
Figure A.7 -- Tensile splitting forces in wall components with oversail s	73
Figure A.8 -- Tensile splitting forces at the top of a hollow core wall component	74
Figure A.9 -- Tensile splitting force T due to centric loading	75
Figure A.10 -- Anchorage of smooth reinforcing bars	79
Figure A.11 -- Anchorage of ribbed reinforcing bars	79
Figure B.1 -- Definition of shear span l_s	83
Figure B.2 -- Simplified / interaction diagram of the cross-section, representing results of three test series	86
Figure ZA 1 - Example of CE marking with Method 1	101
Figure ZA 2 - Example of CE marking with Method 2	103
Figure ZA.3 - Example of CE marking with Method 3a	105
Figure ZA.4 - Example of CE marking with Method 3b	107
Figure ZA.5 -- Example of simplified label	108
Tables Table 1 -- Tolerances on declared mean dry density of LAC	20
Table 2 -- Density classes of LAC	21
Table 3 -- Determination of the characteristic strength f_k and required minimum strength f_{min}	21
Table 4 -- Statistical coefficient K_n for determination of characteristic strength	22
Table 5 -- Reduction factors for compressive strength of cores with indicated diameter and equal length of cubes	22
Table 6 -- Conversion factors for conversion of test results of cast test specimens to the strength of reference test specimens (drilled cores of 100 mm diameter and length or 100 mm cubes)	22
Table 7 -- Strength classes and strength requirements for LAC	23

Table 8 -- Dry thermal conductivity 10dry of LAC for 50 % and 90 % of production, with a confidence level = 90 % (compiled according to EN 1745)	27
Table 9 -- Basic values for moisture content and moisture conversion coefficient of LAC (compiled according to EN ISO 10456)	29
Table 10 -- Types of components	30
Table 11 -- Maximum permissible deviation from squareness in the plane of components	32
Table 12 -- Minimum percentage of reinforcement R	33
Table 13 -- Description of permissible exposure classes with respect to risk of reinforcement corrosion	37
Table 14 -- Embedding in a zone of normal concrete or LC-concrete with closed structure - Minimum concrete cover in mm	38
Table 15 -- Minimum concrete cover in mm for hot dip galvanized reinforcement steel	39
Table 16 -- Minimum concrete cover in mm with regard to durability and test method to pass by initial type-test and FPC for bars with a corrosion protective coating	40
Table 17 -- Initial type-testing of the LAC components	45
Table 18 -- Factory production control, testing of the finished product LAC components for structural uses	46
Table 19 -- Factory production control, testing of the finished product, LAC components for non-loadbearing uses	48
Table A.1 -- Minimum percentages of shear reinforcement w_{min} for reinforcement steel with $f_{yk}=500$ MPa	60
Table A.2 -- Coefficient for the determination of the buckling length l_0 at different boundary conditions (used in Equation (A. 25), $l_0 = \cdot l_w$)	64
Table A.3 -- Required dimensions of beams without verification of loadbearing capacity	71
Table A.3 -- Limits of reinforcement in roof and floor components for design by calculation (plain steel, with characteristic yield strength f_{yk} 220 MPa)	78
Table C.1 -- Partial safety factors M for material properties	87
Table C.2 -- Partial safety factors comp for components	87
Table ZA.1a -- Harmonised clauses for loadbearing wall components	89
Table ZA.1b -- Harmonised clauses for retaining wall components	90
Table ZA.1c -- Harmonised clauses for roof components	91
Table ZA.1d -- Harmonised clauses for floor components	92
Table ZA.1e -- Harmonised clauses for linear components	93
Table ZA.1f -- Harmonised clauses for non-loadbearing wall components	94
Table ZA.1g -- Harmonised clauses for cladding components	95
Table ZA.1h -- Harmonised clauses for small box culvert components	96

Table ZA.2a -- Systems of attestation of conformity	97
Table ZA.2b -- Assignment of evaluation of conformity tasks (for structural components) under system 2+	97
Table ZA.2c -- Assignment of evaluation of conformity tasks (for non structural or light structural components) under System 4	98