

A ANNEX A TEST PROGRAM AND GENERAL ASPECTS OF ASSESSMENT

A1 Test program

The test program for the assessment consists of

- Basic tension tests and basic shear tests to assess basic values of characteristic resistance and
- Any other tests to assess the characteristic resistance regarding various effects for the relevant application range according to the intended use.

Table A.1 Test program

N°	Purpose of test	Concrete	Crack width	Size	d _{cut}	n _{min}	rqd. α	Required for	Section
Resistance to steel failure under tension load									
N1	Steel capacity	-	0	All	-	5	-	All	2.2.1.1
N2	Maximum torque moment	C50/60	0	All	d _{cut,m}	5		TC, UC, DC	2.2.1.2
N3	Hydrogen induced embrittlement	C50/60	0	All	-	5	0,90	CS	2.2.1.3
Basic tension tests									
A1	Reference tension tests	C20/25	0	All	d _{cut,m}	5	-	Option 1-12	2.2.2.1
A2		C50/60	0	All		5		CS: all options as reference for N3 All other: Option 7, 9, 11 ¹⁾	
A3		C20/25	0,30	All		5		Option 1-6	
A4		C50/60	0,30	All		5		Option 1, 3, 5 ¹⁾	
Resistance to pull-out failure									
F1	Maximum crack width and large hole diameter	C20/25	0	s/m/l	d _{cut,max}	5 ³⁾	0,80	Option 7-12	2.2.2.2
			0,50	All				Option 1-6	
F2	Maximum crack width and small hole diameter	C50/60	0	s/m/l	d _{cut,min}	5 ³⁾	1,00	Option 7-12	2.2.2.3
			0,50	All				Option 1-6	
F3	crack cycling under load	C20/25	0,10-0,30	All	d _{cut,max} d _{cut,m}	5 ³⁾	0,90	Option 1-6 UC, CS Option 1-6	2.2.2.4
F4	repeated loads	C20/25	0	m	d _{cut,m}	3	1,00	DC, TC, UC Option 1-12	2.2.2.5
		C20/25		All		5		CS Option 1-12	
		C50/60		m		3		DC, TC, Option 7-12	
F5	Robustness of sleeve down type fasteners	C20/25	0	All	d _{cut,m}	5	0,80	DC	2.2.2.6
			0,50						
F6	Torqueing in low strength concrete	C20/25	0	All	d _{cut,max}	10		CS	2.2.2.7
F7	Torqueing in high strength concrete	C50/60	0	All	d _{cut,min}	10		CS	2.2.2.8
F8	Impact screw driver	C20/25	0	All	d _{cut,max}	15		CS	2.2.2.9
F9	Robustness to variation in use conditions	C20/25	0	s/m/l	d _{cut,m}	5 ³⁾	0,95	Option 7-12	2.2.4.1
		C20/25	0,30	All				UC, DC, CS Option 1-6	
		C50/60						TC Option 1-6	
F10	Robustness to contact with reinforcement	C20/25	0,30	s/m ²⁾	d _{cut,m}	5 ³⁾	0,85 0,70 0,60	Option 1-6 UC, CS	2.2.4.2

N°	Purpose of test	Concrete	Crack width	Size	d _{cut}	n _{min}	req. α	Required for	Section
F11	Minimum edge distance and spacing	C20/25	0	All	d _{cut,m}	5	-	All	2.2.5
F12	Edge distance to prevent splitting under load	C20/25	0	All	d _{cut,m}	4	-	Option 1-12	2.2.6
Characteristic Resistance to shear load									
V1	Characteristic resistance to steel failure-under shear load	C20/25	0	All	d _{cut,m}	5	-	All	2.2.7.1
V2	Characteristic resistance to pry-out failure	C20/25	0	All		5		Optional test	2.2.8

- 1) The tests may be omitted, if in the reference tension tests in concrete strength class C20/25 the failure is caused by rupture of steel.
- 2) Necessary only for undercut fasteners and concrete screws with $h_{ef} < 80$ mm to be used in concrete members with a spacing of reinforcement $s < 150$ mm as well as for concrete screws.
- 3) If fewer than three sizes of the fastener are tested together and/or the different sizes are not similar in respect of geometry, friction between cone and sleeve (internal friction) and friction between sleeve and concrete (external friction), then the number of tests shall be increased to 10 for all sizes of the fastener.

For certain test series according to Table A.1 a reduced range of tested sizes, indicated by “s/m/l”, may be used. The number of diameters to be tested in this case depends on the number of requested sizes and is given in Table A.2.

Table A.2 Reduced range of tested sizes s/m/l

Number of requested sizes	Number of diameters to be tested
≤ 5	3
≤ 8	4
≤ 11	5
> 11	6

Provisions for all test series

As far as applicable the Technical Report 048 [9] shall be followed for the test members, test setup and performance of the tests. Modifications are addressed in the following sections, which overrule conflicting provisions in the Technical Report 048 [9]. The tension tests are performed with unconfined test setup.

It is recommended that handling of tests and calibration items are performed in accordance with EN ISO/IEC 17025 [23].

If the fastener bolts are intended to be installed with more than one embedment depth, in general, the tests have to be carried out with all embedment depths. In special cases, e.g. when steel failure occurs, the number of tests may be reduced.