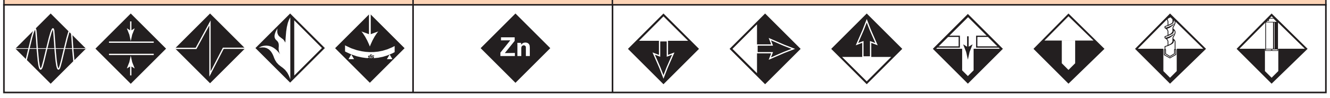
40.1 GENERAL INFORMATION

PERFORMANCE RELATED	MATERIAL	INSTALLATION RELATED



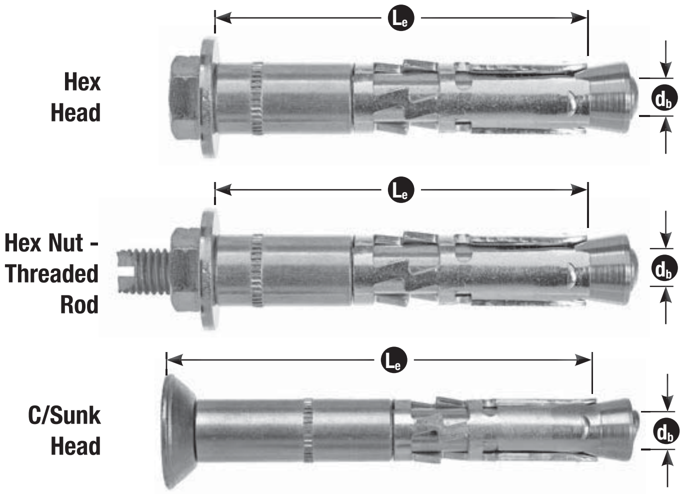
Product

Designed for use in concrete structures requiring protection under fire conditions. A high security, high performance , through fixing, torque controlled expansion anchor approved for use in cracked & non cracked concrete.
Fire tested to TR020.

Fire Tested

Benefits, Advantages and Features

- Fire rated performance up to 120 minutes
- Anchor diameters M6 to M20
- Variable concrete strengths & embedments



European Technical Approval (option 1) for mechanical anchoring - ETA-10/0276
Tested for Category 1 seismic performance in accordance with ETAG001 Annex E (Category 2 pending)

- Highest performance in cracked concrete
- High tensile capacity of Grade 8.8 Steel Bolt.
- Approved for all directions (floor, wall, overhead)
- Zinc Plated to 5µm
- Anchor diameters from M6 to M20

Suitable for structural loads:

- Safety critical loads
- Heavy duty Tension & Shear anchoring into concrete.
- Heavy duty, heat treated washer.

Improved security:

- Large expansion reserve that ensures retention in concrete if overloaded.
- Torque induced pull down closes gaps and induces preload.

Resistant to cyclic loading:

- Heavy duty sleeve with integrated pull-down section works to retain 65% of initial preload.

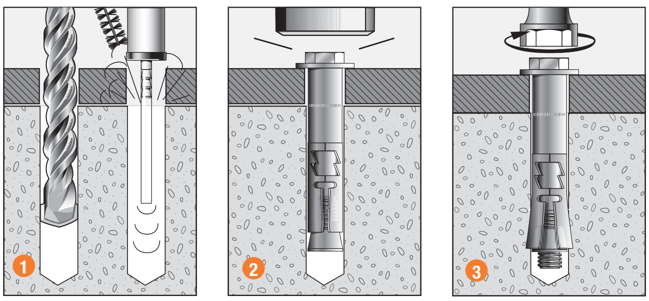
Fast installation:

- Hex nut, hex bolt & countersunk head versions available
- Through fixing eliminates marking out and repositioning of fixtures.

Principal Applications

- **Complies with European Fire test standards**
- **Anchoring into cracked & non cracked concrete**
- **Safety critical loads**
- **Steel columns & walkways**
- **Road barrier hold down**
- **Bridge refurbishment**
- **Road & Rail tunnel construction**
- **Wall Plates**
- **Safety Rails**
- **Intended working life of the anchor of 50 years**

Installation



1. Drill or core a hole to the recommended diameter and depth using the fixture as a template. Clean the hole thoroughly with a hole cleaning brush. Remove the debris with a hand pump, compressed air, or vacuum.
2. After ensuring that the anchor is assembled correctly, insert the anchor through the fixture and drive with a hammer until the washer contacts the fixture.
3. Tighten the bolt with a torque wrench to the specified assembly torque.

Installation Details

Anchor size, d_b (mm)	Drilled hole diameter, d_h (mm)	Fixture hole diameter, d_f (mm)	Anchor effective depth, h (mm)	Depth of drill hole, h_1 (mm)	Tightening torque, T_r (Nm)	Optimum dimensions*		Concrete substrate thickness, b_m (mm)
						Anchor* spacing, a_c (mm)	Edge** distance, e_c (mm)	
M6	10	12	50	70	15	200	100	100
M8	12	14	60	80	25	240	120	120
M10	15	17	70	90	50	280	140	140
M12	18	20	80	105	80	320	160	160
M16	24	26	100	131	120	400	200	200
M20	28	30	125	157	200	500	250	250

* For anchor spacings less than the optimum, please contact your local Ramset Engineer.
** If the fire attack is from more than one side,the edge distance of the anchor has to be ≥ 300mm and 2xh.

40.2 DESCRIPTION AND PART NUMBERS

Anchor size, d_b (mm)	Drilled hole diameter, d_h (mm)	Effective Length, L_e (mm)	Fixture thickness, t (mm)	ETA Designation Number	Part Number		
					Zinc (Hex Hd)	Zinc (C/Sunk Hd)	Zinc (Hex Nut -Thr'd Rod)
M6	10	55	5	V6-10/5	050673*	-	-
		70	20	V6-10/20	050674*	-	-
		100	50	E6-10/50	-	-	050675*
M8	12	70	10	V8-12/20	050679*	-	-
		76	16	TF8-12/16		050686*	-
		80	20	E8-12/20	-	-	050681*
M10	15	90	20	V10-15/20	SP10105	-	-
		97	27	TF10-15/27	-	SP10105F	-
		105	35	E10-15/35	-	-	050692*
M12	18	90	10	V12-18/10	SP12105	-	-
		105	25	V12-18/25	SP12120	-	-
		125	45	E12-18/45	-	-	050699*
M16	24	125	25	V16-24/25	SP16145	-	-
		155	55	E16-24/55	-	-	050707*
		200	100	E16-24/100	-	-	050708*
M20	28	150	25	V20-28/25	SP20170	-	-
		185	60	E20-28/60	-	-	050713*
		225	100	E20-28/100	-	-	050714*

*** Lead times apply**

40.3 ENGINEERING PROPERTIES - Carbon Steel

Anchor size, d_b (mm)	Shank diameter, d_s (mm)	Bolt stress area, A_s (mm2)	Bolt yield strength, f_y (MPa)	Bolt UTS, f_u (MPa)	Spacer area, A_s (mm2)	Spacer yield strength, f_y (MPa)	Spacer UTS, f_u (MPa)	Section modulus Z (mm^3)
M6	6.0	20.1	640	800	40.7	245	460	12.7
M8	8.0	36.6	640	800	51.1	245	460	31.2
M10	9.8	58.0	640	800	83.4	350	480	62.3
M12	11.7	84.3	640	800	119.8	330	430	109.2
M16	15.7	157.0	640	800	201.7	330	430	277.5
M20	19.7	245.0	660	800	242.5	330	430	540.9

Design Case 1 Fire resistance duration = 30 minutes

Table 1a Characteristic values of resistance to tension loads in 20 MPa to 50 MPa concrete strength for Fire resistance duration = 30 minutes

Anchor size, d_b		M6	M8	M10	M12	M16	M20
Drilled hole dia., d_h (mm)		10	12	15	18	24	28
Effective depth, h (mm)	Characteristic Resistance						
50	Steel Failure - $N_{Rk,s,fi,30}$ (kN)	**0.9**					
	Pull-out failure concrete - $N_{Rk,p,fi,30}$ (kN)	1.2					
	Concrete cone failure - $N_{Rk,c,fi,30}$ (kN)	3.2					
60	Steel Failure - $N_{Rk,s,fi,30}$ (kN)		**2.8**				
	Pull-out failure - $N_{Rk,p,fi,30}$ (kN)		3.0				
	Concrete cone failure - $N_{Rk,c,fi,30}$ (kN)		5.0				
70	Steel Failure - $N_{Rk,s,fi,30}$ (kN)			4.5			
	Pull-out failure concrete - $N_{Rk,p,fi,30}$ (kN)			**4.0**			
	Concrete cone failure - $N_{Rk,c,fi,30}$ (kN)			7.4			
80	Steel Failure - $N_{Rk,s,fi,30}$ (kN)				17.6		
	Pull-out failure - $N_{Rk,p,fi,30}$ (kN)				-		
	Concrete cone failure - $N_{Rk,c,fi,30}$ (kN)				**10.3**		
100	Steel Failure - $N_{Rk,s,fi,30}$ (kN)					32.8	
	Pull-out failure concrete - $N_{Rk,p,fi,30}$ (kN)					-	
	Concrete cone failure - $N_{Rk,c,fi,30}$ (kN)					**18.0**	
125	Steel Failure - $N_{Rk,s,fi,30}$ (kN)						51.1
	Pull-out failure - $N_{Rk,p,fi,30}$ (kN)						-
	Concrete cone failure - $N_{Rk,c,fi,30}$ (kN)						**31.4**

Note: Bold values indicates limiting load. Data in table lists all possible failure mechanisms due to fire.

Table 1b Characteristic values of resistance to shear loads in 20 MPa concrete strength for Fire resistance duration = 30 minutes

Anchor size, d_b		M6	M8	M10	M12	M16	M20
Drilled hole dia., d_h (mm)		10	12	15	18	24	28
Edge distance, e_c (mm)	Characteristic Resistance						
100	Steel Failure without lever arm - $V^0_{Rk,s,fi,30}$ (kN)	**0.9**					
	Steel Failure with lever arm - $M^0_{Rk,s,fi,30}$ (N.m)	0.9					
	Concrete edge failure - $V^0_{Rk,c,fi,30}$ (kN)	2.5					
120	Steel Failure without lever arm - $V^0_{Rk,s,fi,30}$ (kN)		**2.8**				
	Steel Failure with lever arm - $M^0_{Rk,s,fi,30}$ (N.m)		2.9				
	Concrete edge failure - $V^0_{Rk,c,fi,30}$ (kN)		3.5				
140	Steel Failure without lever arm - $V^0_{Rk,s,fi,30}$ (kN)			**4.5**			
	Steel Failure with lever arm - $M^0_{Rk,s,fi,30}$ (N.m)			5.8			
	Concrete edge failure - $V^0_{Rk,c,fi,30}$ (kN)			4.9			
160	Steel Failure without lever arm - $V^0_{Rk,s,fi,30}$ (kN)				17.6		
	Steel Failure with lever arm - $M^0_{Rk,s,fi,30}$ (N.m)				27.3		
	Concrete edge failure - $V^0_{Rk,c,fi,30}$ (kN)				**6.5**		
200	Steel Failure without lever arm - $V^0_{Rk,s,fi,30}$ (kN)					32.8	
	Steel Failure with lever arm - $M^0_{Rk,s,fi,30}$ (N.m)					69.5	
	Concrete edge failure - $V^0_{Rk,c,fi,30}$ (kN)					**10.4**	
300	Steel Failure without lever arm - $V^0_{Rk,s,fi,30}$ (kN)						51.1
	Steel Failure with lever arm - $M^0_{Rk,s,fi,30}$ (N.m)						135.5
	Concrete edge failure - $V^0_{Rk,c,fi,30}$ (kN)						**15.9**

Note: Bold values indicates limiting load. Data in table lists all possible failure mechanisms due to fire.
Note: Concrete edge failure values are based on 20 MPa concrete strength. For values in higher concrete strengths, please multiply $V^0_{Rk,c,fi,30}$ by the concrete compressive strength effect X_{nc}, as follows;

f'_c (MPa)	20	30	40	50
X_{nc}	1	1.22	1.41	1.55

Design Case 2 Fire resistance duration = 60 minutes

Table 2a Characteristic values of resistance to tension loads in 20 MPa tp 50 MPa concrete strength for Fire resistance duration = 60 minutes

Anchor size, d_b		M6	M8	M10	M12	M16	M20
Drilled hole dia., d_h (mm)		10	12	15	18	24	28
Effective depth, h (mm)	**Characteristic Resistance**						
50	Steel Failure - $N_{Rk,s,fi,60}$(kN)	**0.6**					
	Pull-out failure concrete - $N_{Rk,p,fi,60}$ (kN)	1.2					
	Concrete cone failure - $N_{Rk,c,fi,60}$ (kN)	3.2					
60	Steel Failure - $N_{Rk,s,fi,60}$ (kN)		**2.1**				
	Pull-out failure - $N_{Rk,p,fi,60}$ (kN)		3.0				
	Concrete cone failure - $N_{Rk,c,fi,60}$ (kN)		5.0				
70	Steel Failure - $N_{Rk,s,fi,60}$(kN)			**3.3**			
	Pull-out failure concrete - $N_{Rk,p,fi,60}$ (kN)			4.0			
	Concrete cone failure - $N_{Rk,c,fi,60}$ (kN)			7.4			
80	Steel Failure - $N_{Rk,s,fi,60}$ (kN)				11.4		
	Pull-out failure - $N_{Rk,p,fi,60}$ (kN)				-		
	Concrete cone failure - $N_{Rk,c,fi,60}$ (kN)				**10.3**		
100	Steel Failure - $N_{Rk,s,fi,60}$(kN)					21.3	
	Pull-out failure concrete - $N_{Rk,p,fi,60}$ (kN)					-	
	Concrete cone failure - $N_{Rk,c,fi,60}$ (kN)					**18.0**	
125	Steel Failure - $N_{Rk,s,fi,60}$ (kN)						33.2
	Pull-out failure - $N_{Rk,p,fi,60}$ (kN)						-
	Concrete cone failure - $N_{Rk,c,fi,60}$ (kN)						**31.4**

Note: Bold values indicates limiting load. Data in table lists all possible failure mechanisms due to fire.

Table 2b Characteristic values of resistance to shear loads in 20 MPa concrete strength for Fire resistance duration = 60 minutes

Anchor size, d_b		M6	M8	M10	M12	M16	M20
Drilled hole dia., d_h (mm)		10	12	15	18	24	28
Edge distance, e_c (mm)	**Characteristic Resistance**						
100	Steel Failure without lever arm - $V^0_{Rk,s,fi,60}$ (kN)	**0.6**					
	Steel Failure with lever arm - $M^0_{Rk,s,fi,60}$ (N.m)	0.6					
	Concrete edge failure - $V^0_{Rk,c,fi,60}$ (kN)	2.5					
120	Steel Failure without lever arm - $V^0_{Rk,s,fi,60}$ (kN)		**2.1**				
	Steel Failure with lever arm - $M^0_{Rk,s,fi,60}$ (N.m)		2.1				
	Concrete edge failure - $V^0_{Rk,c,fi,60}$ (kN)		3.5				
140	Steel Failure without lever arm - $V^0_{Rk,s,fi,60}$ (kN)			**3.3**			
	Steel Failure with lever arm - $M^0_{Rk,s,fi,60}$ (N.m)			4.2			
	Concrete edge failure - $V^0_{Rk,c,fi,60}$(kN)			4.9			
160	Steel Failure without lever arm - $V^0_{Rk,s,fi,60}$ (kN)				11.4		
	Steel Failure with lever arm - $M^0_{Rk,s,fi,60}$ (N.m)				17.8		
	Concrete edge failure - $V^0_{Rk,c,fi,60}$ (kN)				**6.5**		
200	Steel Failure without lever arm - $V^0_{Rk,s,fi,60}$ (kN)					21.3	
	Steel Failure with lever arm - $M^0_{Rk,s,fi,60}$ (N.m)					45.2	
	Concrete edge failure - $V^0_{Rk,c,fi,60}$(kN)					**10.4**	
300	Steel Failure without lever arm - $V^0_{Rk,s,fi,60}$ (kN)						33.2
	Steel Failure with lever arm - $M^0_{Rk,s,fi,60}$ (N.m)						88.1
	Concrete edge failure - $V^0_{Rk,c,fi,60}$ (kN)						**15.9**

Note: Bold values indicates limiting load. Data in table lists all possible failure mechanisms due to fire.
Note: Concrete edge failure values are based on 20 MPa concrete strength. For values in higher concrete strengths, please multiply $V^0_{Rk,c,fi,60}$ by the concrete compressive strength effect X_{nc}, as follows;

f'_c (MPa)	20	30	40	50
X_{nc}	1	1.22	1.41	1.55

Design Case 3 Fire resistance duration = 90 minutes

Table 3a Characteristic values of resistance to tension loads in 20 MPa to 50 MPa concrete strength for Fire resistance duration = 90 minutes

Anchor size, d_b		M6	M8	M10	M12	M16	M20
Drilled hole dia., d_h (mm)		10	12	15	18	24	28
Effective depth, h (mm)	Characteristic Resistance						
50	Steel Failure - $N_{Rk,s,fi,90}$ (kN)	**0.4**					
	Pull-out failure concrete - $N_{Rk,p,fi,90}$ (kN)	1.2					
	Concrete cone failure - $N_{Rk,c,fi,90}$ (kN)	3.2					
60	Steel Failure - $N_{Rk,s,fi,90}$ (kN)		**1.3**				
	Pull-out failure - $N_{Rk,p,fi,90}$ (kN)		3.0				
	Concrete cone failure - $N_{Rk,c,fi,90}$ (kN)		5.0				
70	Steel Failure - $N_{Rk,s,fi,90}$ (kN)			**2.1**			
	Pull-out failure concrete - $N_{Rk,p,fi,90}$ (kN)			4.0			
	Concrete cone failure - $N_{Rk,c,fi,90}$ (kN)			7.4			
80	Steel Failure - $N_{Rk,s,fi,90}$ (kN)				**5.3**		
	Pull-out failure - $N_{Rk,p,fi,90}$ (kN)				-		
	Concrete cone failure - $N_{Rk,c,fi,90}$ (kN)				10.3		
100	Steel Failure - $N_{Rk,s,fi,90}$ (kN)					**9.8**	
	Pull-out failure concrete - $N_{Rk,p,fi,90}$ (kN)					-	
	Concrete cone failure - $N_{Rk,c,fi,90}$ (kN)					18.0	
125	Steel Failure - $N_{Rk,s,fi,90}$ (kN)						**15.3**
	Pull-out failure - $N_{Rk,p,fi,90}$ (kN)						-
	Concrete cone failure - $N_{Rk,c,fi,90}$ (kN)						31.4

Note: Bold values indicates limiting load. Data in table lists all possible failure mechanisms due to fire.

Table 3b Characteristic values of resistance to shear loads in 20 MPa concrete strength for Fire resistance duration = 90 minutes

Anchor size, d_b		M6	M8	M10	M12	M16	M20
Drilled hole dia., d_h (mm)		10	12	15	18	24	28
Edge distance, e_c (mm)	Characteristic Resistance						
100	Steel Failure without lever arm - $V^0_{Rk,s,fi,90}$ (kN)	**0.4**					
	Steel Failure with lever arm - $M^0_{Rk,s,fi,90}$ (N.m)	0.4					
	Concrete edge failure - $V^0_{Rk,c,fi,90}$ (kN)	2.5					
120	Steel Failure without lever arm - $V^0_{Rk,s,fi,90}$ (kN)		**1.3**				
	Steel Failure with lever arm - $M^0_{Rk,s,fi,90}$ (N.m)		1.3				
	Concrete edge failure - $V^0_{Rk,c,fi,90}$ (kN)		3.5				
140	Steel Failure without lever arm - $V^0_{Rk,s,fi,90}$ (kN)			**2.1**			
	Steel Failure with lever arm - $M^0_{Rk,s,fi,90}$ (N.m)			2.7			
	Concrete edge failure - $V^0_{Rk,c,fi,90}$ (kN)			4.9			
160	Steel Failure without lever arm - $V^0_{Rk,s,fi,90}$ (kN)				**5.3**		
	Steel Failure with lever arm - $M^0_{Rk,s,fi,90}$ (N.m)				8.2		
	Concrete edge failure - $V^0_{Rk,c,fi,90}$ (kN)				6.5		
200	Steel Failure without lever arm - $V^0_{Rk,s,fi,90}$ (kN)					**9.8**	
	Steel Failure with lever arm - $M^0_{Rk,s,fi,90}$ (N.m)					20.9	
	Concrete edge failure - $V^0_{Rk,c,fi,90}$ (kN)					10.4	
300	Steel Failure without lever arm - $V^0_{Rk,s,fi,90}$ (kN)						**15.3**
	Steel Failure with lever arm - $M^0_{Rk,s,fi,90}$ (N.m)						40.7
	Concrete edge failure - $V^0_{Rk,c,fi,90}$ (kN)						15.9

Note: Bold values indicates limiting load. Data in table lists all possible failure mechanisms due to fire.
Note: Concrete edge failure values are based on 20 MPa concrete strength. For values in higher concrete strengths, please multiply $V^0_{Rk,c,fi,90}$ by the concrete compressive strength effect X_{nc}, as follows;

f'_c (MPa)	20	30	40	50
X_{nc}	1	1.22	1.41	1.55

Design Case 4 Fire resistance duration = 120 minutes

Table 4a Characteristic values of resistance to tension loads in 20 MPa to 50 MPa concrete strength for Fire resistance duration = 120 minutes

Anchor size, d_b		M6	M8	M10	M12	M16	M20
Drilled hole dia., d_h (mm)		10	12	15	18	24	28
Effective depth, h (mm)	Characteristic Resistance						
50	Steel Failure - $N_{Rk,s,fi,120}$ (kN)	**0.3**					
	Pull-out failure concrete - $N_{Rk,p,fi,120}$ (kN)	1.0					
	Concrete cone failure - $N_{Rk,c,fi,120}$ (kN)	2.5					
60	Steel Failure - $N_{Rk,s,fi,120}$ (kN)		**0.9**				
	Pull-out failure - $N_{Rk,p,fi,120}$ (kN)		2.4				
	Concrete cone failure - $N_{Rk,c,fi,120}$ (kN)		4.0				
70	Steel Failure - $N_{Rk,s,fi,120}$ (kN)			**1.5**			
	Pull-out failure concrete - $N_{Rk,p,fi,120}$ (kN)			3.2			
	Concrete cone failure - $N_{Rk,c,fi,120}$ (kN)			5.9			
80	Steel Failure - $N_{Rk,s,fi,120}$ (kN)				**2.2**		
	Pull-out failure - $N_{Rk,p,fi,120}$ (kN)				-		
	Concrete cone failure - $N_{Rk,c,fi,120}$ (kN)				8.2		
100	Steel Failure - $N_{Rk,s,fi,120}$ (kN)					**4.1**	
	Pull-out failure concrete - $N_{Rk,p,fi,120}$ (kN)					-	
	Concrete cone failure - $N_{Rk,c,fi,120}$ (kN)					14.4	
125	Steel Failure - $N_{Rk,s,fi,120}$ (kN)						**6.4**
	Pull-out failure - $N_{Rk,p,fi,120}$ (kN)						-
	Concrete cone failure - $N_{Rk,c,fi,120}$ (kN)						25.2

Note: Bold values indicates limiting load. Data in table lists all possible failure mechanisms due to fire.

Table 4b Characteristic values of resistance to shear loads in 20 MPa concrete strength for Fire resistance duration = 120 minutes

Anchor size, d_b		M6	M8	M10	M12	M16	M20
Drilled hole dia., d_h (mm)		10	12	15	18	24	28
Edge distance, e_c (mm)	Characteristic Resistance						
100	Steel Failure without lever arm - $V^0_{Rk,s,fi,120}$ (kN)	**0.3**					
	Steel Failure with lever arm - $M^0_{Rk,s,fi,120}$ (N.m)	0.3					
	Concrete edge failure - $V^0_{Rk,c,fi,120}$ (kN)	2.0					
120	Steel Failure without lever arm - $V^0_{Rk,s,fi,120}$ (kN)		**0.9**				
	Steel Failure with lever arm - $M^0_{Rk,s,fi,120}$ (N.m)		0.9				
	Concrete edge failure - $V^0_{Rk,c,fi,120}$ (kN)		2.8				
140	Steel Failure without lever arm - $V^0_{Rk,s,fi,120}$ (kN)			**1.5**			
	Steel Failure with lever arm - $M^0_{Rk,s,fi,120}$ (N.m)			1.9			
	Concrete edge failure - $V^0_{Rk,c,fi,120}$ (kN)			3.9			
160	Steel Failure without lever arm - $V^0_{Rk,s,fi,120}$ (kN)				**2.2**		
	Steel Failure with lever arm - $M^0_{Rk,s,fi,120}$ (N.m)				3.4		
	Concrete edge failure - $V^0_{Rk,c,fi,120}$ (kN)				5.2		
200	Steel Failure without lever arm - $V^0_{Rk,s,fi,120}$ (kN)					**4.1**	
	Steel Failure with lever arm - $M^0_{Rk,s,fi,120}$ (N.m)					8.7	
	Concrete edge failure - $V^0_{Rk,c,fi,120}$ (kN)					8.3	
300	Steel Failure without lever arm - $V^0_{Rk,s,fi,120}$ (kN)						**6.4**
	Steel Failure with lever arm - $M^0_{Rk,s,fi,120}$ (N.m)						17.0
	Concrete edge failure - $V^0_{Rk,c,fi,120}$ (kN)						12.7

Note: Bold values indicates limiting load. Data in table lists all possible failure mechanisms due to fire.
Note: Concrete edge failure values are based on 20 MPa concrete strength. For values in higher concrete strengths, please multiply $V^0_{Rk,c,fi,120}$ by the concrete compressive strength effect X_{nc}, as follows;

f'_c (MPa)	20	30	40	50
X_{nc}	1	1.22	1.41	1.55