

fischer Highbond anchor FHB II

Anchor design according to fischer specification

1. Types



FHB II-A S (gvz, A4 and C)



FHB II-A L (gvz, A4 and C)



FHB II - Resin capsule



FHB II-PF Quick Version - Resin capsule



FIS HB 345 S - Injection mortar
+ static mixer FIS S



FIS HB 150 C - Injection mortar



Features and Advantages

- European Technical Approval option 1^{*)} for cracked and non-cracked concrete.
- Fire resistance classifications according to test report independently proved gives the safety in case of fire.
- Expansion stress free anchoring guarantees a safe use with small spacing and edge distances.
- Push-through installation enables mounting without special accessories and therefore saves time and money.
- Variable embedment depth enables the application in all kind of building structures.
- The quick curing resin in the capsule (FHB II-PF) saves curing time. e.g. 2 min > 20 °C
- The FHB II anchor rod can be used with mortar or resin capsule and gives high flexibility.
- With capsule approved for under water applications.

^{*)} The conditions of use in the European Technical Approval may vary from those of the Technical Handbook.

Materials

- Anchor bolt:
- Carbon steel, zinc plated (5 µm) and passivated (gvz)
 - Stainless steel of corrosion resistance class III, e.g. A4 (1.4401 optional 1.4571, 1.4362) and according to ASTM/AISI steel grade 316
 - Highly corrosion-resistant steel of the corrosion resistance class IV, e.g. 1.4529
- Injection mortar:
- Vinylester resin (styrene-free), quartz sand and hardener
- Resin capsule:
- Vinylester resin (styrene-free), quartz sand and hardener

fischer Highbond anchor FHB II

Anchor design according to fischer specification

2. Ultimate resistances of single anchors with large spacing and large edge distance^{1) 2)}

Mean values

| Anchor type | FHB II A L M8x60 | | | FHB II A S M10x60 | | | FHB II A S M10x75 | | | FHB II A L M10x95 | | | | |
|---|--------------------|---------------------|-------|--------------------|-------|-------|--------------------|-------|-------|--------------------|-------|-------|-------|-------|
| | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | | |
| non-cracked concrete | | | | | | | | | | | | | | |
| temperature range (+80 °C / +50 °C)³⁾ | | | | | | | | | | | | | | |
| tension | C 20/25 | N _U [kN] | 23.0 | 23.0 | 23.0 | 23.0 | 23.0 | 23.0 | 23.0 | 23.0 | 36.1 | 36.1 | 36.1 | |
| shear | ≥ C 20/25 | V _U [kN] | 15.8 | 22.5 | 21.6 | 22.4 | 28.2 | 31.7 | 22.4 | 28.2 | 31.7 | 26.1 | 34.5 | 35.6 |
| cracked concrete | | | | | | | | | | | | | | |
| temperature range (+80 °C / +50 °C)³⁾ | | | | | | | | | | | | | | |
| tension | C 20/25 | N _U [kN] | 20.9 | 20.9 | 20.9 | 22.3 | 22.3 | 22.3 | 23.0 | 23.0 | 23.0 | 36.1 | 36.1 | 36.1 |
| shear | ≥ C 20/25 | V _U [kN] | 15.8 | 22.5 | 21.6 | 22.4 | 28.2 | 31.7 | 22.4 | 28.2 | 31.7 | 26.1 | 34.5 | 35.6 |
| Anchor type | FHB II A S M12x75 | | | FHB II A L M12x100 | | | FHB II A L M12x120 | | | FHB II A S M16x95 | | | | |
| | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | | |
| non-cracked concrete | | | | | | | | | | | | | | |
| temperature range (+80 °C / +50 °C)³⁾ | | | | | | | | | | | | | | |
| tension | C 20/25 | N _U [kN] | 36.1 | 36.1 | 36.1 | 52.3 | 52.3 | 52.3 | 52.3 | 52.3 | 62.2 | 62.2 | 62.2 | |
| shear | ≥ C 20/25 | V _U [kN] | 32.6 | 41.1 | 46.0 | 44.5 | 51.4 | 51.3 | 44.5 | 51.4 | 51.3 | 64.8 | 81.9 | 88.9 |
| cracked concrete | | | | | | | | | | | | | | |
| temperature range (+80 °C / +50 °C)³⁾ | | | | | | | | | | | | | | |
| tension | C 20/25 | N _U [kN] | 31.2 | 31.2 | 31.2 | 48.0 | 48.0 | 48.0 | 50.7 | 50.7 | 50.7 | 44.4 | 44.4 | 44.4 |
| shear | ≥ C 20/25 | V _U [kN] | 32.6 | 41.1 | 46.0 | 44.5 | 51.4 | 51.3 | 44.5 | 51.4 | 51.3 | 64.8 | 81.9 | 88.9 |
| Anchor type | FHB II A L M16x125 | | | FHB II A L M16x145 | | | FHB II A L M16x160 | | | FHB II A S M20x170 | | | | |
| | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | | |
| non-cracked concrete | | | | | | | | | | | | | | |
| temperature range (+80 °C / +50 °C)³⁾ | | | | | | | | | | | | | | |
| tension | C 20/25 | N _U [kN] | 93.9 | 93.9 | 93.9 | 101.4 | 101.4 | 101.4 | 101.4 | 101.4 | 101.4 | 134.9 | 134.9 | 134.9 |
| shear | ≥ C 20/25 | V _U [kN] | 76.4 | 93.7 | 96.3 | 76.4 | 93.7 | 96.3 | 76.4 | 93.7 | 96.3 | 122.1 | 140.1 | 155.8 |
| cracked concrete | | | | | | | | | | | | | | |
| temperature range (+80 °C / +50 °C)³⁾ | | | | | | | | | | | | | | |
| tension | C 20/25 | N _U [kN] | 67.1 | 67.1 | 67.1 | 83.8 | 83.8 | 83.8 | 97.1 | 97.1 | 97.1 | 106.4 | 106.4 | 106.4 |
| shear | ≥ C 20/25 | V _U [kN] | 76.4 | 93.7 | 96.3 | 76.4 | 93.7 | 96.3 | 76.4 | 93.7 | 96.3 | 122.1 | 140.1 | 155.8 |
| Anchor type | FHB II A L M20x210 | | | FHB II A S M24x170 | | | FHB II A L M24x210 | | | | | | | |
| | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | | | | | |
| non-cracked concrete | | | | | | | | | | | | | | |
| temperature range (+80 °C / +50 °C)³⁾ | | | | | | | | | | | | | | |
| tension | C 20/25 | N _U [kN] | 144.5 | 144.5 | 144.5 | 134.9 | 134.9 | 134.9 | 144.5 | 144.5 | 144.5 | | | |
| shear | ≥ C 20/25 | V _U [kN] | 122.1 | 140.1 | 155.8 | 136.4 | 159.2 | 184.5 | 136.4 | 159.2 | 184.5 | | | |
| cracked concrete | | | | | | | | | | | | | | |
| temperature range (+80 °C / +50 °C)³⁾ | | | | | | | | | | | | | | |
| tension | C 20/25 | N _U [kN] | 144.5 | 144.5 | 144.5 | 106.4 | 106.4 | 106.4 | 144.5 | 144.5 | 144.5 | | | |
| shear | ≥ C 20/25 | V _U [kN] | 122.1 | 140.1 | 155.8 | 136.4 | 159.2 | 184.5 | 136.4 | 159.2 | 184.5 | | | |

¹⁾ The loads apply to fischer FHB II anchor bolts and careful drill hole cleaning, carried out with a brush and blow-out tool and temperatures in the substrate in the area of the mortar with short term temperature T ≤ + 80 °C and long term temperature T ≤ + 50 °C (see also "Installation details, section 7").

²⁾ Values for injection mortar

³⁾ (short term temperature / long term temperature)

fischer Highbond anchor FHB II

Anchor design according to fischer specification

3. Characteristic, design and recommended resistance of single anchors with large spacing and large edge distance

3.1 Characteristic resistance ^{1) 2)}

| Anchor type | FHB II A L M8x60 | | | FHB II A S M10x60 | | | FHB II A S M10x75 | | | FHB II A L M10x95 | | | FHB II A S M12x75 | | | FHB II A L M12x100 | | | FHB II A L M12x120 | | | FHB II A S M16x95 | | |
|-------------|---------------------|----|---|----------------------|----|---|----------------------|----|---|----------------------|----|---|----------------------|----|---|-----------------------|----|---|-----------------------|----|---|----------------------|----|---|
| | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C |

non-cracked concrete

temperature range (+80 °C / +50 °C)³⁾

| tension | | | | | | | | | | | | | | | | | | | | | | | | |
|--------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--|--|------|--|--|
| C 20/25 N _{Rk} [kN] | 25.1 | | | 25.1 | | | 25.1 | | | 34.4 | | | 34.4 | | | 49.8 | | | 49.8 | | | 51.4 | | |
| shear | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥ C 20/25 V _{Rk} [kN] | 13.7 | 15.2 | 19.7 | 24.1 | 19.7 | 24.1 | 20.8 | 23.2 | 27.3 | 33.7 | 30.3 | 33.7 | 30.3 | 33.7 | 30.3 | 33.7 | 50.8 | 62.7 | | | | | | |

cracked concrete

temperature range (+80 °C / +50 °C)³⁾

| tension | | | | | | | | | | | | | | | | | | | | | | | | |
|--------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--|--|------|--|--|
| C 20/25 N _{Rk} [kN] | 16.7 | | | 16.7 | | | 23.4 | | | 33.3 | | | 23.4 | | | 36.0 | | | 47.3 | | | 33.3 | | |
| shear | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥ C 20/25 V _{Rk} [kN] | 13.7 | 15.2 | 19.7 | 24.1 | 19.7 | 24.1 | 20.8 | 23.2 | 27.3 | 33.7 | 30.3 | 33.7 | 30.3 | 33.7 | 30.3 | 33.7 | 50.8 | 66.7 | | | | | | |

| Anchor type | FHB II A L M16x125 | | | FHB II A L M16x145 | | | FHB II A L M16x160 | | | FHB II A S M20x170 | | | FHB II A L M20x210 | | | FHB II A S M24x170 | | | FHB II A L M24x210 | | |
|-------------|-----------------------|----|---|-----------------------|----|---|-----------------------|----|---|-----------------------|----|---|-----------------------|----|---|-----------------------|----|---|-----------------------|----|---|
| | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C |

non-cracked concrete

temperature range (+80 °C / +50 °C)³⁾

| tension | | | | | | | | | | | | | | | | | | | | | | | |
|--------------------------------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|--|--|-------|--|--|--|--|
| C 20/25 N _{Rk} [kN] | 77.6 | | | 96.6 | | | 96.6 | | | 123.1 | | | 137.6 | | | 123.1 | | | 137.6 | | | | |
| shear | | | | | | | | | | | | | | | | | | | | | | | |
| ≥ C 20/25 V _{Rk} [kN] | 56.3 | 62.7 | 56.3 | 62.7 | 56.3 | 62.7 | 80.3 | 97.9 | 87.9 | 97.9 | 114.2 | 124.5 | 141.0 | 126.9 | 141.0 | | | | | | | | |

cracked concrete

temperature range (+80 °C / +50 °C)³⁾

| tension | | | | | | | | | | | | | | | | | | | | | | | |
|--------------------------------|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|------|--|--|-------|--|--|--|--|
| C 20/25 N _{Rk} [kN] | 50.3 | | | 62.9 | | | 72.9 | | | 79.8 | | | 109.6 | | | 79.8 | | | 109.6 | | | | |
| shear | | | | | | | | | | | | | | | | | | | | | | | |
| ≥ C 20/25 V _{Rk} [kN] | 56.3 | 62.7 | 56.3 | 62.7 | 56.3 | 62.7 | 80.3 | 97.9 | 87.9 | 97.9 | 114.2 | 124.5 | 159.6 | 126.9 | 141.0 | | | | | | | | |

¹⁾ The loads apply to fischer FHB II anchor bolts and careful drill hole cleaning, carried out with a brush and blow-out tool and temperatures in the substrate in the area of the mortar with short term temperature T ≤ + 80 °C and long term temperature T ≤ + 50 °C (see also "Installation details, section 7").

²⁾ Values for injection mortar

³⁾ (short term temperature / long term temperature)

fischer Highbond anchor FHB II

Anchor design according to fischer specification

3.2 Design resistance ¹⁾²⁾

| Anchor type | FHB II A L M8x60 | | | FHB II A S M10x60 | | | FHB II A S M10x75 | | | FHB II A L M10x95 | | | FHB II A S M12x75 | | | FHB II A L M12x100 | | | FHB II A L M12x120 | | | FHB II A S M16x95 | | |
|-------------|---------------------|----|---|----------------------|----|---|----------------------|----|---|----------------------|----|---|----------------------|----|---|-----------------------|----|---|-----------------------|----|---|----------------------|----|---|
| | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C |

non-cracked concrete

temperature range (+80 °C / +50 °C)³⁾

tension

| | | | | | | | | |
|------------------------------|------|------|------|------|------|------|------|------|
| C 20/25 N _{Rd} [kN] | 16.7 | 16.7 | 16.7 | 22.9 | 22.9 | 33.2 | 33.2 | 34.4 |
|------------------------------|------|------|------|------|------|------|------|------|

shear

| | | | | | | | | | | | | | | | | |
|--------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| ≥ C 20/25 V _{Rd} [kN] | 11.0 | 12.2 | 15.8 | 19.3 | 15.8 | 19.3 | 16.6 | 18.6 | 21.8 | 27.0 | 24.2 | 27.0 | 24.2 | 27.0 | 40.6 | 50.2 |
|--------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|

cracked concrete

temperature range (+80 °C / +50 °C)³⁾

tension

| | | | | | | | | |
|------------------------------|------|------|------|------|------|------|------|------|
| C 20/25 N _{Rd} [kN] | 11.2 | 11.2 | 15.6 | 22.2 | 15.6 | 24.0 | 31.5 | 22.2 |
|------------------------------|------|------|------|------|------|------|------|------|

shear

| | | | | | | | | | | | | | | | | |
|--------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| ≥ C 20/25 V _{Rd} [kN] | 11.0 | 12.2 | 15.8 | 19.3 | 15.8 | 19.3 | 16.6 | 18.6 | 21.8 | 27.0 | 24.2 | 27.0 | 24.2 | 27.0 | 40.6 | 44.4 |
|--------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|

| Anchor type | FHB II A L M16x125 | | | FHB II A L M16x145 | | | FHB II A L M16x160 | | | FHB II A S M20x170 | | | FHB II A L M20x210 | | | FHB II A S M24x170 | | | FHB II A L M24x210 | | |
|-------------|-----------------------|----|---|-----------------------|----|---|-----------------------|----|---|-----------------------|----|---|-----------------------|----|---|-----------------------|----|---|-----------------------|----|---|
| | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C |

non-cracked concrete

temperature range (+80 °C / +50 °C)³⁾

tension

| | | | | | | | |
|------------------------------|------|------|------|------|------|------|------|
| C 20/25 N _{Rd} [kN] | 51.8 | 64.4 | 64.4 | 82.1 | 91.7 | 82.1 | 91.7 |
|------------------------------|------|------|------|------|------|------|------|

shear

| | | | | | | | | | | | | | | | |
|--------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|
| ≥ C 20/25 V _{Rd} [kN] | 45.0 | 50.2 | 45.0 | 50.2 | 45.0 | 50.2 | 64.2 | 78.3 | 70.3 | 78.3 | 91.4 | 99.6 | 112.8 | 101.5 | 112.8 |
|--------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|

cracked concrete

temperature range (+80 °C / +50 °C)³⁾

tension

| | | | | | | | |
|------------------------------|------|------|------|------|------|------|------|
| C 20/25 N _{Rd} [kN] | 33.5 | 41.9 | 48.6 | 53.2 | 73.0 | 53.2 | 73.0 |
|------------------------------|------|------|------|------|------|------|------|

shear

| | | | | | | | | | | | | | | | |
|--------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|
| ≥ C 20/25 V _{Rd} [kN] | 45.0 | 50.2 | 45.0 | 50.2 | 45.0 | 50.2 | 64.2 | 78.3 | 70.3 | 78.3 | 91.4 | 99.6 | 106.4 | 101.5 | 112.8 |
|--------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|

¹⁾ The loads apply to fischer FHB II anchor bolts and careful drill hole cleaning, carried out with a brush and blow-out tool and temperatures in the substrate in the area of the mortar with short term temperature T ≤ + 80 °C and long term temperature T ≤ + 50 °C (see also "Installation details, section 7").

²⁾ Values for injection mortar

³⁾ (short term temperature / long term temperature)

fischer Highbond anchor FHB II

Anchor design according to fischer specification

3.3 Recommended resistance ^{1) 2) 3)}

| Anchor type | FHB II A L M8x60 | | | FHB II A S M10x60 | | | FHB II A S M10x75 | | | FHB II A L M10x95 | | | FHB II A S M12x75 | | | FHB II A L M12x100 | | | FHB II A L M12x120 | | | FHB II A S M16x95 | | |
|-------------|---------------------|----|---|----------------------|----|---|----------------------|----|---|----------------------|----|---|----------------------|----|---|-----------------------|----|---|-----------------------|----|---|----------------------|----|---|
| | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C |

non-cracked concrete

temperature range (+80 °C / +50 °C)⁴⁾

tension

| | | | | | | | | | | | | |
|-----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| C 20/25 N _R [kN] | 12.0 | 12.0 | 12.0 | 16.4 | 16.4 | 16.4 | 23.7 | 23.7 | 23.7 | 24.4 | 24.4 | 24.4 |
|-----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|

shear

| | | | | | | | | | | | | | | | | | | |
|-------------------------------|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| ≥ C 20/25 V _R [kN] | 7.8 | 8.7 | 11.3 | 13.8 | 13.8 | 13.8 | 11.9 | 13.3 | 15.6 | 19.3 | 17.3 | 19.3 | 17.3 | 19.3 | 29.0 | 35.8 | 35.8 | 35.8 |
|-------------------------------|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|

cracked concrete

temperature range (+80 °C / +50 °C)⁴⁾

tension

| | | | | | | | | | | | | |
|-----------------------------|-----|-----|-----|------|------|------|------|------|------|------|------|------|
| C 20/25 N _R [kN] | 8.0 | 8.0 | 8.0 | 11.1 | 11.1 | 11.1 | 15.9 | 11.1 | 11.1 | 17.1 | 22.5 | 15.9 |
|-----------------------------|-----|-----|-----|------|------|------|------|------|------|------|------|------|

shear

| | | | | | | | | | | | | | | | | | | |
|-------------------------------|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| ≥ C 20/25 V _R [kN] | 7.8 | 8.7 | 11.3 | 13.8 | 13.8 | 13.8 | 11.9 | 13.3 | 15.6 | 19.3 | 17.3 | 19.3 | 17.3 | 19.3 | 29.0 | 31.7 | 31.7 | 31.7 |
|-------------------------------|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|

| Anchor type | FHB II A L M16x125 | | | FHB II A L M16x145 | | | FHB II A L M16x160 | | | FHB II A S M20x170 | | | FHB II A L M20x210 | | | FHB II A S M24x170 | | | FHB II A L M24x210 | | |
|-------------|-----------------------|----|---|-----------------------|----|---|-----------------------|----|---|-----------------------|----|---|-----------------------|----|---|-----------------------|----|---|-----------------------|----|---|
| | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C |

non-cracked concrete

temperature range (+80 °C / +50 °C)⁴⁾

tension

| | | | | | | | | | | | | |
|-----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| C 20/25 N _R [kN] | 37.0 | 46.0 | 46.0 | 46.0 | 58.6 | 58.6 | 65.5 | 58.6 | 65.5 | 65.5 | 58.6 | 65.5 |
|-----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|

shear

| | | | | | | | | | | | | | | | |
|-------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| ≥ C 20/25 V _R [kN] | 32.2 | 35.8 | 32.2 | 35.8 | 32.2 | 35.8 | 45.9 | 55.9 | 50.2 | 55.9 | 65.3 | 71.1 | 80.6 | 72.5 | 80.6 |
|-------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|

cracked concrete

temperature range (+80 °C / +50 °C)⁴⁾

tension

| | | | | | | | | | | | | |
|-----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| C 20/25 N _R [kN] | 24.0 | 29.9 | 34.7 | 38.0 | 52.2 | 38.0 | 52.2 | 38.0 | 52.2 | 52.2 | 38.0 | 52.2 |
|-----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|

shear

| | | | | | | | | | | | | | | | |
|-------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| ≥ C 20/25 V _R [kN] | 32.2 | 35.8 | 32.2 | 35.8 | 32.2 | 35.8 | 45.9 | 55.9 | 50.2 | 55.9 | 65.3 | 71.1 | 76.0 | 72.5 | 80.6 |
|-------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|

¹⁾ The loads apply to fischer FHB II anchor bolts and careful drill hole cleaning, carried out with a brush and blow-out tool and temperatures in the substrate in the area of the mortar with short term temperature T ≤ +80 °C and long term temperature T ≤ +50 °C (see also "Installation details, section 7").

²⁾ Material safety factor γ_M and safety factor for action γ_L = 1.4 are included. Material safety factor γ_M depends on failure mode of the anchor.

³⁾ Values for injection mortar

⁴⁾ (short term temperature / long term temperature)

fischer Highbond anchor FHB II

Anchor design according to fischer specification

4. Calculation of tension resistance

The decisive design resistance in tension is the lowest value of following failure modes:

Steel failure:

$$N_{Rd,s}$$

Pull-out / pull-through failure:

$$N_{Rd,p} = N^o_{Rd,p} \cdot f_{b,N}$$

Concrete cone failure:

$$N_{Rd,c} = N^o_{Rd,c} \cdot f_{b,N} \cdot f_{s1} \cdot f_{s2} \cdot f_{s3} \cdot f_{c1,A} \cdot f_{c1,B} \cdot f_{c2}$$

Concrete splitting failure:

$$N_{Rd,sp} = N^o_{Rd,c} \cdot f_{b,N} \cdot f_{s1,sp} \cdot f_{s2,sp} \cdot f_{s3,sp} \cdot f_{c1,sp,A} \cdot f_{c1,sp,B} \cdot f_{c2,sp} \cdot f_h$$

4.1 Steel failure of the highest loaded anchor

Design resistance of single anchor

| Anchor type | FHB II A L M8x60 | FHB II A S M10x60 | FHB II A S M10x75 | FHB II A L M10x95 | FHB II A S M12x75 | FHB II A L M12x100 | FHB II A L M12x120 | FHB II A S M16x95 |
|-----------------------------------|---------------------|----------------------|----------------------|----------------------|----------------------|-----------------------|-----------------------|----------------------|
| Design resistance $N_{Rd,s}$ [kN] | 16.7 | 16.7 | 16.7 | 22.9 | 22.9 | 33.2 | 33.2 | 41.1 |

| Anchor type | FHB II A L M16x125 | FHB II A L M16x145 | FHB II A L M16x160 | FHB II A S M20x170 | FHB II A L M20x210 | FHB II A S M24x170 | FHB II A L M24x210 |
|-----------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Design resistance $N_{Rd,s}$ [kN] | 64.4 | 64.4 | 64.4 | 85.7 | 91.7 | 85.7 | 91.7 |

4.2 Pull-out/pull-through failure of the highest loaded anchor

$$N_{Rd,p} = N^o_{Rd,p} \cdot f_{b,N}$$

Design resistance of single anchor

| Anchor type | FHB II A L M8x60 Injek. | FHB II A L M8x60 Patro. | FHB II A S M10x60 Injek. | FHB II A S M10x60 Patro. | FHB II A S M10x75 | FHB II A L M10x95 | FHB II A S M12x75 | FHB II A L M12x100 | FHB II A L M12x120 |
|-------------|-------------------------------|-------------------------------|--------------------------------|--------------------------------|----------------------|----------------------|----------------------|-----------------------|-----------------------|
|-------------|-------------------------------|-------------------------------|--------------------------------|--------------------------------|----------------------|----------------------|----------------------|-----------------------|-----------------------|

non-cracked concrete

temperature range (+80 °C / +50 °C)¹⁾

| | | | | | | | | | |
|-------------------|------|------|------|------|------|------|------|------|------|
| $N^o_{Rd,p}$ [kN] | 17.2 | 14.3 | 17.2 | 14.3 | 24.1 | 34.3 | 24.1 | 37.0 | 48.7 |
|-------------------|------|------|------|------|------|------|------|------|------|

cracked concrete

temperature range (+80 °C / +50 °C)¹⁾

| | | | | | | | | | |
|-------------------|------|-----|------|-----|------|------|------|------|------|
| $N^o_{Rd,p}$ [kN] | 11.2 | 9.3 | 11.2 | 9.3 | 15.6 | 22.2 | 15.6 | 24.0 | 31.5 |
|-------------------|------|-----|------|-----|------|------|------|------|------|

| Anchor type | FHB II A S M16x95 | FHB II A L M16x125 | FHB II A L M16x145 | FHB II A L M16x160 | FHB II A S M20x170 | FHB II A L M20x210 | FHB II A S M24x170 | FHB II A L M24x210 |
|-------------|----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|-------------|----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|

non-cracked concrete

temperature range (+80 °C / +50 °C)¹⁾

| | | | | | | | | |
|-------------------|------|------|------|------|------|-------|------|-------|
| $N^o_{Rd,p}$ [kN] | 34.3 | 51.8 | 64.7 | 75.0 | 82.1 | 112.7 | 82.1 | 112.7 |
|-------------------|------|------|------|------|------|-------|------|-------|

cracked concrete

temperature range (+80 °C / +50 °C)¹⁾

| | | | | | | | | |
|-------------------|------|------|------|------|------|------|------|------|
| $N^o_{Rd,p}$ [kN] | 22.2 | 33.5 | 41.9 | 48.6 | 53.2 | 73.0 | 53.2 | 73.0 |
|-------------------|------|------|------|------|------|------|------|------|

¹⁾ (short term temperature / long term temperature)

fischer Highbond anchor FHB II

Anchor design according to fischer specification

4.3 Concrete cone failure and splitting of the most unfavourable anchor

Concrete cone failure: $N_{Rd,c} = N^p_{Rd,c} \cdot f_{b,N} \cdot f_{s1} \cdot f_{s2} \cdot f_{s3} \cdot f_{c1,A} \cdot f_{c1,B} \cdot f_{c2}$

Concrete splitting failure: $N_{Rd,sp} = N^p_{Rd,c} \cdot f_{b,N} \cdot f_{s1,sp} \cdot f_{s2,sp} \cdot f_{s3,sp} \cdot f_{c1,sp,A} \cdot f_{c1,sp,B} \cdot f_{c2,sp} \cdot f_h$

Proof of splitting failure is only necessary if all of the following conditions are met:

- non-cracked concrete
- $c_{cr,sp} > c_{cr,N}$
- $c < 1.2 \cdot c_{cr,sp}$

Design resistance of single anchor

| Anchor type | FHB II A L M8x60 | FHB II A S M10x60 | FHB II A S M10x75 | FHB II A L M10x95 | FHB II A S M12x75 | FHB II A L M12x100 | FHB II A L M12x120 | FHB II A S M16x95 |
|--|---------------------|----------------------|----------------------|----------------------|----------------------|-----------------------|-----------------------|----------------------|
| non-cracked concrete | | | | | | | | |
| temperature range (+80 °C / +50 °C) | | | | | | | | |
| Design resistance $N^p_{Rd,c}$ [kN] | 17.2 | 17.2 | 24.1 | 34.3 | 24.1 | 37.0 | 48.7 | 34.3 |
| cracked concrete | | | | | | | | |
| temperature range (+80 °C / +50 °C) | | | | | | | | |
| Design resistance $N^p_{Rd,c}$ [kN] | 11.2 | 11.2 | 15.6 | 22.2 | 15.6 | 24.0 | 31.5 | 22.2 |

| Anchor type | FHB II A L M16x125 | FHB II A L M16x145 | FHB II A L M16x160 | FHB II A S M20x170 | FHB II A L M20x210 | FHB II A S M24x170 | FHB II A L M24x210 |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| non-cracked concrete | | | | | | | |
| temperature range (+80 °C / +50 °C) | | | | | | | |
| Design resistance $N^p_{Rd,c}$ [kN] | 51.8 | 64.7 | 75.0 | 82.1 | 112.7 | 82.1 | 112.7 |
| cracked concrete | | | | | | | |
| temperature range (+80 °C / +50 °C) | | | | | | | |
| Design resistance $N^p_{Rd,c}$ [kN] | 33.5 | 41.9 | 48.6 | 53.2 | 73.0 | 53.2 | 73.0 |

4.3.1 Influence of concrete strength for tension

$$f_{b,N} = \sqrt{\frac{f_{ck, cube}}{25}} = \sqrt{\frac{f_{ck, cyl}}{20}}$$

| Concrete strength class | C 12/15 | C 16/20 | C 20/25 | C 25/30 | C 30/37 | C 35/45 | C 40/50 | C 45/55 | C 50/60 |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| cylinder compressive strength $f_{ck,cyl}$ [N/mm ²] | 12 | 16 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
| cube compressive strength $f_{ck,cube}$ [N/mm ²] | 15 | 20 | 25 | 30 | 37 | 45 | 50 | 55 | 60 |
| influence factor $f_{b,N}$ [-] | 0.77 | 0.89 | 1.00 | 1.10 | 1.22 | 1.34 | 1.41 | 1.48 | 1.55 |

4.3.2 Concrete cone failure

Characteristic values for design

| Anchor type | FHB II A L M8x60 | FHB II A S M10x60 | FHB II A S M10x75 | FHB II A L M10x95 | FHB II A S M12x75 | FHB II A L M12x100 | FHB II A L M12x120 | FHB II A S M16x95 |
|-----------------|---------------------|----------------------|----------------------|----------------------|----------------------|-----------------------|-----------------------|----------------------|
| $s_{cr,N}$ [mm] | 180 | 180 | 225 | 285 | 225 | 300 | 360 | 285 |
| $c_{cr,N}$ [mm] | 90 | 90 | 113 | 143 | 113 | 150 | 180 | 143 |

| Anchor type | FHB II A L M16x125 | FHB II A L M16x145 | FHB II A L M16x160 | FHB II A S M20x170 | FHB II A L M20x210 | FHB II A S M24x170 | FHB II A L M24x210 |
|-----------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| $s_{cr,N}$ [mm] | 375 | 435 | 480 | 510 | 630 | 510 | 630 |
| $c_{cr,N}$ [mm] | 188 | 218 | 240 | 255 | 315 | 255 | 315 |

fischer Highbond anchor FHB II

Anchor design according to fischer specification

4.3.2.1 Influence of spacing / concrete cone failure

$$f_{s1} = f_{s2} = f_{s3} = \left(1.0 + \frac{s}{s_{cr,N}} \right) \cdot 0.5 \leq 1.0$$

| | | | | | | | | | | | | | | | | | | | |
|---------------------|------|------|-----|------|------|------|-----|------|------|------|-----|------|------|------|-----|------|------|------|------|
| s/s _{cr,N} | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.35 | 0.4 | 0.45 | 0.5 | 0.55 | 0.6 | 0.65 | 0.7 | 0.75 | 0.8 | 0.85 | 0.9 | 0.95 | ≥1.0 |
| f _{s1} | 0.55 | 0.58 | 0.6 | 0.63 | 0.65 | 0.68 | 0.7 | 0.73 | 0.75 | 0.78 | 0.8 | 0.83 | 0.85 | 0.88 | 0.9 | 0.93 | 0.95 | 0.98 | 1.0 |

4.3.2.2 Influence of edge distance / concrete cone failure

$$f_{c1,A} = 0.7 + 0.3 \cdot \frac{c}{c_{cr,N}} \leq 1.0 \qquad f_{c1,B} = f_{c2} = \left(1.0 + \frac{c}{c_{cr,N}} \right) \cdot 0.5 \leq 1.0$$

| | | | | | | | | | | | | | | | | | | | |
|---------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| c/c _{cr,N} | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.35 | 0.4 | 0.45 | 0.5 | 0.55 | 0.6 | 0.65 | 0.7 | 0.75 | 0.8 | 0.85 | 0.9 | 0.95 | ≥1.0 |
| f _{c1,A} | 0.73 | 0.75 | 0.76 | 0.78 | 0.79 | 0.81 | 0.82 | 0.84 | 0.85 | 0.87 | 0.88 | 0.9 | 0.91 | 0.93 | 0.94 | 0.96 | 0.97 | 0.99 | 1.0 |
| f _{c1,B} | 0.55 | 0.58 | 0.6 | 0.63 | 0.65 | 0.68 | 0.7 | 0.73 | 0.75 | 0.78 | 0.8 | 0.83 | 0.85 | 0.88 | 0.9 | 0.93 | 0.95 | 0.98 | 1.0 |
| f _{c2} | 0.55 | 0.58 | 0.6 | 0.63 | 0.65 | 0.68 | 0.7 | 0.73 | 0.75 | 0.78 | 0.8 | 0.83 | 0.85 | 0.88 | 0.9 | 0.93 | 0.95 | 0.98 | 1.0 |

4.3.3 Concrete splitting failure

Characteristic values for design

| Anchor type | | FHB II A L M8x60 | FHB II A S M10x60 | FHB II A S M10x75 | FHB II A L M10x95 | FHB II A S M12x75 | FHB II A L M12x100 | FHB II A L M12x120 | FHB II A S M16x95 |
|----------------------|-------------------------|---------------------|----------------------|----------------------|----------------------|----------------------|-----------------------|-----------------------|----------------------|
| eff. anchorage depth | h _{ef} [mm] | 300 | 300 | 300 | 480 | 300 | 380 | 600 | 340 |
| | s _{cr,sp} [mm] | 150 | 150 | 150 | 240 | 150 | 190 | 300 | 170 |
| | c _{cr,sp} [mm] | 100 | 100 | 120 | 140 | 120 | 140 | 170 | 150 |
| | h _{min} [mm] | | | | | | | | |

| Anchor type | | FHB II A L M16x125 | FHB II A L M16x145 | FHB II A L M16x160 | FHB II A S M20x170 | FHB II A L M20x210 | FHB II A S M24x170 | FHB II A L M24x210 |
|----------------------|-------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| eff. anchorage depth | h _{ef} [mm] | 375 | 500 | 580 | 510 | 630 | 510 | 630 |
| | s _{cr,sp} [mm] | 188 | 250 | 290 | 255 | 315 | 255 | 315 |
| | c _{cr,sp} [mm] | 170 | 190 | 220 | 240 | 280 | 240 | 280 |
| | h _{min} [mm] | | | | | | | |

4.3.3.1 Influence of spacing / concrete splitting failure

$$f_{s1,sp} = f_{s2,sp} = f_{s3,sp} = \left(1.0 + \frac{s}{s_{cr,sp}} \right) \cdot 0.5 \leq 1.0$$

| | | | | | | | | | | | | | | | | | | | |
|----------------------|------|------|-----|------|------|------|-----|------|------|------|-----|------|------|------|-----|------|------|------|------|
| s/s _{cr,sp} | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.35 | 0.4 | 0.45 | 0.5 | 0.55 | 0.6 | 0.65 | 0.7 | 0.75 | 0.8 | 0.85 | 0.9 | 0.95 | ≥1.0 |
| f _{s,sp} | 0.55 | 0.58 | 0.6 | 0.63 | 0.65 | 0.68 | 0.7 | 0.73 | 0.75 | 0.78 | 0.8 | 0.83 | 0.85 | 0.88 | 0.9 | 0.93 | 0.95 | 0.98 | 1.0 |

4.3.3.2 Influence of edge distance / splitting failure

$$f_{c1,sp,A} = 0.7 + 0.3 \cdot \frac{c}{c_{cr,sp}} \leq 1.0 \qquad f_{c1,sp,B} = f_{c2,sp} = \left(1.0 + \frac{c}{c_{cr,sp}} \right) \cdot 0.5 \leq 1.0$$

| | | | | | | | | | | | | | | | | | | | |
|----------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| c/c _{cr,sp} | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.35 | 0.4 | 0.45 | 0.5 | 0.55 | 0.6 | 0.65 | 0.7 | 0.75 | 0.8 | 0.85 | 0.9 | 0.95 | ≥1.0 |
| f _{c1,sp,A} | 0.73 | 0.75 | 0.76 | 0.78 | 0.79 | 0.81 | 0.82 | 0.84 | 0.85 | 0.87 | 0.88 | 0.9 | 0.91 | 0.93 | 0.94 | 0.96 | 0.97 | 0.99 | 1.0 |
| f _{c1,sp,B} | 0.55 | 0.58 | 0.6 | 0.63 | 0.65 | 0.68 | 0.7 | 0.73 | 0.75 | 0.78 | 0.8 | 0.83 | 0.85 | 0.88 | 0.9 | 0.93 | 0.95 | 0.98 | 1.0 |
| f _{c2,sp} | 0.55 | 0.58 | 0.6 | 0.63 | 0.65 | 0.68 | 0.7 | 0.73 | 0.75 | 0.78 | 0.8 | 0.83 | 0.85 | 0.88 | 0.9 | 0.93 | 0.95 | 0.98 | 1.0 |

fischer Highbond anchor FHB II

Anchor design according to fischer specification

4.3.3.3 Influence of concrete thickness / concrete splitting failure

$$f_h = \left(\frac{h}{h_{min}} \right)^{2/3} \leq 1.5$$

| | | | | | | | | | | | | | | | | | | |
|--------------------|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| h/h _{min} | 1.0 | 1.05 | 1.1 | 1.15 | 1.2 | 1.25 | 1.3 | 1.35 | 1.4 | 1.45 | 1.5 | 1.55 | 1.6 | 1.65 | 1.7 | 1.75 | 1.8 | ≥1.84 |
| f _h | 1.0 | 1.03 | 1.07 | 1.1 | 1.13 | 1.16 | 1.19 | 1.22 | 1.25 | 1.28 | 1.31 | 1.34 | 1.37 | 1.4 | 1.42 | 1.45 | 1.48 | 1.5 |

5. Calculation of shear resistance

The decisive design resistance in shear is the lowest value of the following failure modes:

Steel failure: $V_{Rd,s}$

Pryout failure: $V_{Rd,cp} = N_{Rd,c} \cdot k$

Concrete edge failure: $V_{Rd,c} = V_{Rd,c}^o \cdot f_b \cdot V \cdot f_{\alpha,V} \cdot f_{s1,V} \cdot f_{s2,V} \cdot f_{c2,V} \cdot f_h \cdot V \cdot f_m$

5.1 Steel failure for the highest loaded anchor

Design resistance of single anchor

| Anchor type | FHB II A L M8x60 | | FHB II A S M10x60 | | FHB II A S M10x75 | | FHB II A L M10x95 | | FHB II A S M12x75 | | FHB II A L M12x100 | | FHB II A L M12x120 | | FHB II A S M16x95 | |
|-----------------------------------|---------------------|------|----------------------|------|----------------------|------|----------------------|------|----------------------|------|-----------------------|------|-----------------------|------|----------------------|------|
| | gvz | A4/C | gvz | A4/C | gvz | A4/C | gvz | A4/C | gvz | A4/C | gvz | A4/C | gvz | A4/C | gvz | A4/C |
| Design resistance $V_{Rd,s}$ [kN] | 11.0 | 12.2 | 15.8 | 19.3 | 15.8 | 19.3 | 16.6 | 18.6 | 21.8 | 27.0 | 24.2 | 27.0 | 24.2 | 27.0 | 40.6 | 50.2 |

| Anchor type | FHB II A L M16x125 | | FHB II A L M16x145 | | FHB II A L M16x160 | | FHB II A S M20x170 | | FHB II A L M20x210 | | FHB II A S M24x170 | | | FHB II A L M24x210 | |
|-----------------------------------|-----------------------|------|-----------------------|------|-----------------------|------|-----------------------|------|-----------------------|------|-----------------------|------|-------|-----------------------|-------|
| | gvz | A4/C | gvz | A4/C | gvz | A4/C | gvz | A4/C | gvz | A4/C | gvz | A4 | C | gvz | A4/C |
| Design resistance $V_{Rd,s}$ [kN] | 45.0 | 50.2 | 45.0 | 50.2 | 45.0 | 50.2 | 64.2 | 78.3 | 70.3 | 78.3 | 91.4 | 99.6 | 112.8 | 101.5 | 112.8 |

5.2 Pryout failure for the most unfavourable anchor

$$V_{Rd,cp} = k \cdot N_{Rd,c}$$

k-factor

| Anchor type | FHB II M8 to FHB II M24 |
|-------------|-------------------------|
| k | 2.0 |

fischer Highbond anchor FHB II

Anchor design according to fischer specification

5.3 Concrete edge failure for the most unfavourable anchor

$$V_{Rd,c} = V_{Rd,c}^0 \cdot f_{cr} \cdot f_{b,V} \cdot f_{\alpha,V} \cdot f_{s1,V} \cdot f_{s2,V} \cdot f_{c2,V} \cdot f_{h,V} \cdot f_m$$

Proof of concrete edge failure is only necessary if the following condition is met:

- $c < \max(10 h_{ef}; 60 d)$ with d = nominal anchor diameter

Design resistance of single anchor in concrete C 20/25 dependent on edge distance c_1

| Edge Distance [mm] | $V_{Rd,c}^0$ [kN] | | | | | | | | | |
|-----------------------|-------------------------|---------------------|-------------------------|---------------------|-------------------------|---------------------|-------------------------|---------------------|-------------------------|---------------------|
| | FHB II A L M8x60 | | FHB II A S M10x60 | | FHB II A S M10x75 | | FHB II A L M10x95 | | FHB II A S M12x75 | |
| | non-cracked concrete | cracked concrete | non-cracked concrete | cracked concrete | non-cracked concrete | cracked concrete | non-cracked concrete | cracked concrete | non-cracked concrete | cracked concrete |
| 40 | 3.5 | 2.5 | 3.7 | 2.6 | 3.8 | 2.7 | 4.1 | 2.9 | 4.0 | 2.8 |
| 45 | 4.1 | 2.9 | 4.3 | 3.0 | 4.5 | 3.2 | 4.7 | 3.3 | 4.6 | 3.3 |
| 50 | 4.7 | 3.3 | 4.9 | 3.5 | 5.1 | 3.6 | 5.4 | 3.8 | 5.3 | 3.8 |
| 55 | 5.4 | 3.8 | 5.6 | 3.9 | 5.8 | 4.1 | 6.1 | 4.3 | 6.0 | 4.2 |
| 60 | 6.0 | 4.3 | 6.2 | 4.4 | 6.5 | 4.6 | 6.8 | 4.8 | 6.7 | 4.8 |
| 65 | 6.7 | 4.7 | 6.9 | 4.9 | 7.2 | 5.1 | 7.6 | 5.4 | 7.4 | 5.3 |
| 70 | 7.4 | 5.2 | 7.7 | 5.4 | 8.0 | 5.6 | 8.3 | 5.9 | 8.2 | 5.8 |
| 75 | 8.1 | 5.8 | 8.4 | 5.9 | 8.7 | 6.2 | 9.1 | 6.5 | 9.0 | 6.4 |
| 80 | 8.9 | 6.3 | 9.2 | 6.5 | 9.5 | 6.7 | 9.9 | 7.0 | 9.8 | 6.9 |
| 85 | 9.6 | 6.8 | 9.9 | 7.0 | 10.3 | 7.3 | 10.8 | 7.6 | 10.6 | 7.5 |
| 90 | 10.4 | 7.4 | 10.7 | 7.6 | 11.1 | 7.9 | 11.6 | 8.2 | 11.4 | 8.1 |
| 95 | 11.2 | 7.9 | 11.5 | 8.2 | 12.0 | 8.5 | 12.5 | 8.8 | 12.3 | 8.7 |
| 100 | 12.0 | 8.5 | 12.4 | 8.8 | 12.8 | 9.1 | 13.3 | 9.5 | 13.2 | 9.3 |
| 120 | 15.5 | 10.9 | 15.9 | 11.2 | 16.4 | 11.6 | 17.0 | 12.1 | 16.8 | 11.9 |
| 130 | 17.3 | 12.2 | 17.7 | 12.5 | 18.3 | 13.0 | 19.0 | 13.4 | 18.7 | 13.3 |
| 135 | 18.2 | 12.9 | 18.7 | 13.2 | 19.3 | 13.6 | 20.0 | 14.1 | 19.7 | 14.0 |
| 140 | 19.1 | 13.6 | 19.6 | 13.9 | 20.2 | 14.3 | 21.0 | 14.8 | 20.7 | 14.7 |
| 160 | 23.0 | 16.3 | 23.6 | 16.7 | 24.3 | 17.2 | 25.1 | 17.8 | 24.8 | 17.6 |
| 180 | 27.1 | 19.2 | 27.8 | 19.7 | 28.6 | 20.2 | 29.5 | 20.9 | 29.2 | 20.7 |
| 200 | 31.4 | 22.3 | 32.1 | 22.8 | 33.0 | 23.4 | 34.1 | 24.1 | 33.7 | 23.9 |
| 250 | 43.0 | 30.5 | 43.9 | 31.1 | 45.0 | 31.9 | 46.3 | 32.8 | 45.8 | 32.5 |
| 300 | 55.6 | 39.4 | 56.7 | 40.2 | 58.0 | 41.1 | 58.6 | 42.2 | 59.1 | 41.8 |
| 350 | 69.2 | 49.0 | 70.5 | 49.9 | 72.0 | 51.0 | 73.9 | 52.3 | 73.2 | 51.9 |
| 400 | 83.7 | 59.3 | 85.1 | 60.3 | 86.9 | 61.6 | 89.0 | 63.1 | 88.3 | 62.5 |
| 450 | 98.9 | 70.1 | 100.6 | 71.2 | 102.6 | 72.7 | 105.0 | 74.4 | 104.2 | 73.8 |
| 500 | 115.0 | 81.4 | 116.8 | 82.7 | 119.1 | 84.4 | 121.8 | 86.3 | 120.9 | 85.6 |
| 550 | 131.8 | 93.3 | 133.8 | 94.8 | 136.4 | 96.6 | 139.3 | 98.7 | 138.3 | 97.9 |
| 600 | 149.2 | 105.7 | 151.5 | 107.3 | 154.3 | 109.3 | 157.5 | 111.6 | 156.4 | 110.8 |
| 650 | | | | | 172.9 | 122.5 | 176.4 | 125.0 | 175.2 | 124.1 |
| 700 | | | | | 192.1 | 136.1 | 195.9 | 138.8 | 194.6 | 137.9 |
| 750 | | | | | 212.0 | 150.2 | 216.1 | 153.1 | 214.7 | 152.1 |
| 800 | | | | | | | 236.9 | 167.8 | | |
| 850 | | | | | | | 258.2 | 182.9 | | |
| 900 | | | | | | | 280.1 | 198.4 | | |
| 950 | | | | | | | 302.6 | 214.3 | | |

continued next pages

fischer Highbond anchor FHB II

Anchor design according to fischer specification

Design resistance of single anchor in concrete C 20/25 dependent on edge distance c_1

| Edge Distance [mm] | $V_{Rd,c}$ [kN] | | | | | | | | | |
|-----------------------|-------------------------|---------------------|-------------------------|---------------------|-------------------------|---------------------|-------------------------|---------------------|-------------------------|---------------------|
| | FHB II A L M12x100 | | FHB II A L M12x120 | | FHB II A S M16x95 | | FHB II A L M16x125 | | FHB II A L M16x145 | |
| | non-cracked concrete | cracked concrete | non-cracked concrete | cracked concrete | non-cracked concrete | cracked concrete | non-cracked concrete | cracked concrete | non-cracked concrete | cracked concrete |
| 50 | 5.7 | 4.0 | 6.0 | 4.2 | 6.0 | 4.2 | | | | |
| 55 | 6.4 | 4.5 | 6.7 | 4.7 | 6.7 | 4.7 | 7.2 | 5.1 | | |
| 60 | 7.2 | 5.1 | 7.5 | 5.3 | 7.5 | 5.3 | 8.0 | 5.7 | 8.4 | 5.9 |
| 65 | 7.9 | 5.6 | 8.3 | 5.9 | 8.3 | 5.9 | 8.9 | 6.3 | 9.2 | 6.5 |
| 70 | 8.7 | 6.2 | 9.1 | 6.4 | 9.1 | 6.4 | 9.7 | 6.9 | 10.1 | 7.2 |
| 75 | 9.5 | 6.7 | 9.9 | 7.0 | 9.9 | 7.0 | 10.6 | 7.5 | 11.0 | 7.8 |
| 80 | 10.4 | 7.3 | 10.8 | 7.6 | 10.8 | 7.6 | 11.5 | 8.1 | 11.9 | 8.4 |
| 85 | 11.2 | 7.9 | 11.6 | 8.2 | 11.6 | 8.2 | 12.4 | 8.8 | 12.9 | 9.1 |
| 90 | 12.1 | 8.6 | 12.5 | 8.9 | 12.5 | 8.9 | 13.3 | 9.4 | 13.8 | 9.8 |
| 95 | 13.0 | 9.2 | 13.4 | 9.5 | 13.4 | 9.5 | 14.3 | 10.1 | 14.8 | 10.5 |
| 100 | 13.9 | 9.8 | 14.4 | 10.2 | 14.4 | 10.2 | 15.2 | 10.8 | 15.8 | 11.2 |
| 120 | 17.6 | 12.5 | 18.2 | 12.9 | 18.2 | 12.9 | 19.3 | 13.7 | 19.9 | 14.1 |
| 130 | 19.6 | 13.9 | 20.3 | 14.4 | 20.3 | 14.4 | 21.4 | 15.1 | 22.0 | 15.6 |
| 135 | 20.6 | 14.6 | 21.3 | 15.1 | 21.3 | 15.1 | 22.5 | 15.9 | 23.1 | 16.4 |
| 140 | 21.7 | 15.3 | 22.4 | 15.8 | 22.4 | 15.8 | 23.5 | 16.7 | 24.3 | 17.2 |
| 160 | 25.9 | 18.4 | 26.7 | 18.9 | 26.7 | 18.9 | 28.1 | 19.9 | 28.9 | 20.4 |
| 180 | 30.4 | 21.5 | 31.3 | 22.1 | 31.3 | 22.2 | 32.8 | 23.2 | 33.7 | 23.9 |
| 200 | 35.1 | 24.8 | 36.0 | 25.5 | 36.1 | 25.5 | 37.7 | 26.7 | 38.7 | 27.4 |
| 250 | 47.6 | 33.7 | 48.8 | 34.5 | 48.8 | 34.6 | 50.8 | 36.0 | 52.1 | 36.9 |
| 300 | 61.1 | 43.3 | 62.6 | 44.3 | 62.6 | 44.3 | 65.0 | 46.1 | 66.5 | 47.1 |
| 350 | 75.6 | 53.6 | 77.3 | 54.8 | 77.4 | 54.8 | 80.2 | 56.8 | 81.9 | 58.0 |
| 400 | 91.1 | 64.5 | 93.0 | 65.9 | 93.1 | 65.9 | 96.3 | 68.2 | 98.2 | 69.6 |
| 450 | 107.3 | 76.0 | 109.5 | 77.6 | 109.6 | 77.6 | 113.2 | 80.2 | 115.4 | 81.7 |
| 500 | 124.4 | 88.1 | 126.8 | 89.8 | 126.9 | 89.9 | 130.9 | 92.8 | 133.3 | 94.5 |
| 550 | 142.1 | 100.7 | 144.8 | 102.6 | 144.9 | 102.7 | 149.4 | 105.8 | 152.1 | 107.7 |
| 600 | 160.6 | 113.8 | 163.6 | 115.9 | 163.7 | 115.9 | 168.6 | 119.4 | 171.5 | 121.5 |
| 650 | 179.8 | 127.4 | 183.0 | 129.6 | 183.1 | 129.7 | 188.5 | 133.5 | 191.6 | 135.7 |
| 700 | 199.6 | 141.4 | 203.1 | 143.8 | 203.2 | 144.0 | 209.0 | 148.0 | 212.4 | 150.4 |
| 750 | 220.1 | 155.9 | 223.8 | 158.5 | 224.0 | 158.6 | 230.1 | 163.0 | 233.7 | 165.6 |
| 800 | 241.1 | 170.8 | 245.1 | 173.6 | 245.3 | 173.7 | 251.9 | 178.4 | 255.8 | 181.2 |
| 850 | 262.7 | 186.1 | 267.0 | 189.1 | 267.2 | 189.3 | 274.2 | 194.3 | 278.4 | 197.2 |
| 900 | 284.9 | 201.8 | 289.4 | 205.0 | 289.7 | 205.2 | 297.2 | 210.5 | 301.5 | 213.6 |
| 950 | 307.7 | 217.9 | 312.4 | 221.3 | 312.7 | 221.5 | 320.6 | 227.1 | 325.3 | 230.4 |
| 1000 | 331.0 | 234.4 | 336.0 | 238.0 | | | 344.6 | 244.1 | 349.5 | 247.6 |
| 1100 | | | 384.6 | 272.5 | | | 394.2 | 279.2 | 399.6 | 283.1 |
| 1200 | | | 435.3 | 308.3 | | | 445.8 | 315.8 | 451.7 | 320.0 |
| 1300 | | | | | | | 499.3 | 353.7 | 505.7 | 358.2 |
| 1400 | | | | | | | | | 561.6 | 397.8 |
| 1500 | | | | | | | | | 619.2 | 438.6 |
| 1400 | | | | | | | | | 561.6 | 397.8 |
| 1500 | | | | | | | | | 619.2 | 438.6 |

continued next page

fischer Highbond anchor FHB II

Anchor design according to fischer specification

Design resistance of single anchor in concrete C 20/25 dependent on edge distance c_1

| Edge Distance [mm] | $V_{Rd,c}$ [kN] | | | | | | | | | |
|-----------------------|-------------------------|---------------------|-------------------------|---------------------|-------------------------|---------------------|-------------------------|---------------------|-------------------------|---------------------|
| | FHB II A L M16x160 | | FHB II A S M20x170 | | FHB II A L M20x210 | | FHB II A S M24x170 | | FHB II A L M24x210 | |
| | non-cracked concrete | cracked concrete | non-cracked concrete | cracked concrete | non-cracked concrete | cracked concrete | non-cracked concrete | cracked concrete | non-cracked concrete | cracked concrete |
| 70 | 10.4 | 7.4 | | | | | | | | |
| 75 | 11.3 | 8.0 | | | | | | | | |
| 80 | 12.2 | 8.7 | 13.1 | 9.3 | | | 13.6 | 9.6 | | |
| 85 | 13.2 | 9.3 | 14.1 | 10.0 | | | 14.6 | 10.4 | | |
| 90 | 14.2 | 10.0 | 15.1 | 10.7 | 16.0 | 11.4 | 15.7 | 11.1 | 16.7 | 11.9 |
| 95 | 15.1 | 10.7 | 16.1 | 11.4 | 17.1 | 12.1 | 16.7 | 11.9 | 17.8 | 12.6 |
| 100 | 16.2 | 11.4 | 17.2 | 12.2 | 18.2 | 12.9 | 17.8 | 12.6 | 19.0 | 13.4 |
| 120 | 20.3 | 14.4 | 21.5 | 15.2 | 22.7 | 16.1 | 22.3 | 15.8 | 23.6 | 16.7 |
| 130 | 22.5 | 16.0 | 23.8 | 16.8 | 25.1 | 17.8 | 24.6 | 17.4 | 26.0 | 18.4 |
| 135 | 23.6 | 16.7 | 24.9 | 17.7 | 26.3 | 18.6 | 25.8 | 18.3 | 27.2 | 19.3 |
| 140 | 24.8 | 17.5 | 26.1 | 18.5 | 27.5 | 19.5 | 27.0 | 19.1 | 28.5 | 20.2 |
| 160 | 29.4 | 20.8 | 30.9 | 21.9 | 32.5 | 23.0 | 31.9 | 22.6 | 33.6 | 23.8 |
| 180 | 34.3 | 24.3 | 36.0 | 25.5 | 37.7 | 26.7 | 37.1 | 26.3 | 38.9 | 27.6 |
| 200 | 39.4 | 27.9 | 41.2 | 29.2 | 43.1 | 30.5 | 42.4 | 30.1 | 44.5 | 31.5 |
| 250 | 52.9 | 37.5 | 55.2 | 39.1 | 57.5 | 40.7 | 56.7 | 40.1 | 59.1 | 41.9 |
| 300 | 67.5 | 47.8 | 70.2 | 49.7 | 72.9 | 51.6 | 72.0 | 51.0 | 74.9 | 53.0 |
| 350 | 83.1 | 58.9 | 86.2 | 61.1 | 89.3 | 63.3 | 88.3 | 62.5 | 91.6 | 64.9 |
| 400 | 99.6 | 70.5 | 103.2 | 73.1 | 106.7 | 75.6 | 105.5 | 74.7 | 109.3 | 77.4 |
| 450 | 116.9 | 82.8 | 120.9 | 85.7 | 124.8 | 88.4 | 123.6 | 87.5 | 127.8 | 90.5 |
| 500 | 135.0 | 95.6 | 139.5 | 98.8 | 143.8 | 101.9 | 142.4 | 100.9 | 147.1 | 104.2 |
| 550 | 153.9 | 109.0 | 158.8 | 112.5 | 163.6 | 115.9 | 162.0 | 114.8 | 167.1 | 118.4 |
| 600 | 173.5 | 122.9 | 178.9 | 126.7 | 184.0 | 130.4 | 182.4 | 129.2 | 187.9 | 133.1 |
| 650 | 193.8 | 137.2 | 199.6 | 141.4 | 205.2 | 145.3 | 203.4 | 144.1 | 209.4 | 148.3 |
| 700 | 214.7 | 152.1 | 221.0 | 156.5 | 227.0 | 160.8 | 225.1 | 159.4 | 231.5 | 164.0 |
| 750 | 236.3 | 167.4 | 243.0 | 172.1 | 249.5 | 176.7 | 247.4 | 175.3 | 254.3 | 180.1 |
| 800 | 258.4 | 183.1 | 265.7 | 188.2 | 272.5 | 193.0 | 270.4 | 191.5 | 277.7 | 196.7 |
| 850 | 281.2 | 199.2 | 288.9 | 204.6 | 296.2 | 209.8 | 293.9 | 208.2 | 301.7 | 213.7 |
| 900 | 304.6 | 215.7 | 312.7 | 221.5 | 320.4 | 227.0 | 318.0 | 225.3 | 326.3 | 231.1 |
| 950 | 328.5 | 232.7 | 337.1 | 238.8 | 345.3 | 244.6 | 342.7 | 242.8 | 351.4 | 248.9 |
| 1000 | 352.9 | 250.0 | 362.0 | 256.4 | 370.6 | 262.5 | 367.9 | 260.6 | 377.1 | 267.1 |
| 1100 | 403.3 | 285.7 | 413.4 | 292.8 | 422.9 | 299.5 | 420.0 | 297.5 | 430.1 | 304.6 |
| 1200 | 455.8 | 322.9 | 466.9 | 330.7 | 477.2 | 338.0 | 474.0 | 335.8 | 485.1 | 343.6 |
| 1300 | 510.2 | 361.4 | 522.2 | 369.9 | 533.4 | 377.8 | 530.0 | 375.4 | 542.0 | 383.9 |
| 1400 | 566.4 | 401.2 | 579.4 | 410.4 | 591.5 | 419.0 | 587.9 | 416.4 | 600.8 | 425.5 |
| 1500 | 624.4 | 442.3 | 638.4 | 452.2 | 651.4 | 461.4 | 647.5 | 458.6 | 661.3 | 468.5 |
| 1600 | 684.1 | 484.5 | 699.1 | 495.2 | 713.0 | 505.0 | 708.9 | 502.1 | 723.7 | 512.6 |
| 1700 | | | 761.4 | 539.4 | 776.2 | 549.8 | 771.9 | 546.7 | 787.6 | 557.9 |
| 1800 | | | | | 841.1 | 595.8 | | | 853.2 | 604.4 |
| 1900 | | | | | 907.6 | 642.9 | | | 920.4 | 652.0 |
| 2000 | | | | | 975.5 | 691.0 | | | 989.1 | 700.6 |
| 2100 | | | | | 1045.0 | 740.2 | | | 1059.3 | 750.3 |

fischer Highbond anchor FHB II

Anchor design according to fischer specification

5.3.1 Influence of concrete strength for shear

$$f_{b,V} = \sqrt{\frac{f_{ck, cube}}{25}} = \sqrt{\frac{f_{ck, cyl}}{20}}$$

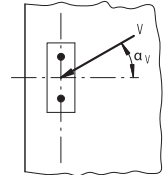
| Concrete strength class | | C 12/15 | C 16/20 | C 20/25 | C 25/30 | C 30/37 | C 35/45 | C 40/50 | C 45/55 | C 50/60 |
|-------------------------------|------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Cylinder compressive strength | $f_{ck,cyl}$ [N/mm ²] | 12 | 16 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
| Cube compressive strength | $f_{ck,cube}$ [N/mm ²] | 15 | 20 | 25 | 30 | 37 | 45 | 50 | 55 | 60 |
| Influence factor | $f_{b,V}$ [-] | 0.77 | 0.89 | 1.00 | 1.10 | 1.22 | 1.34 | 1.41 | 1.48 | 1.55 |

5.3.2 Influence of load direction

$$f_{\alpha,V} = \sqrt{\frac{1}{(\cos \alpha_V)^2 + \left(\frac{\sin \alpha_V}{2.5}\right)^2}} \leq 2.5$$

| | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
|----------------|------|------|------|------|------|------|------|------|------|------|
| $f_{\alpha,V}$ | 1.00 | 1.01 | 1.05 | 1.13 | 1.24 | 1.40 | 1.64 | 1.97 | 2.32 | 2.50 |

For angle $\alpha \geq 90^\circ$ the component of the shear load acting away from the edge may be neglected and the proof may be done with the component of the load acting parallel to the edge.



5.3.3 Influence of spacing

$$f_{s1,V} = f_{s2,V} = \frac{1}{6} \cdot \frac{s}{c_1} + \frac{1}{2} \leq 1.0$$

| s/c ₁ | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 1.2 | 1.4 | 1.6 | 1.8 | 2.0 | 2.2 | 2.4 | 2.6 | 2.8 | ≥ 3.0 |
|------------------|------|-----|------|------|------|------|-----|------|------|-----|------|------|-----|------|------|------------|
| $f_{s1,V}$ | 0.58 | 0.6 | 0.62 | 0.63 | 0.65 | 0.67 | 0.7 | 0.73 | 0.77 | 0.8 | 0.83 | 0.87 | 0.9 | 0.93 | 0.97 | 1.0 |

5.3.4 Influence of edge distance

Distance to second edge; $c_1 < c_2$

$$f_{c2,V} = \left(\frac{1}{2} + \frac{1}{3} \cdot \frac{c_2}{c_1} \right) \cdot \left(0.7 + 0.3 \cdot \frac{c_2}{1.5 \cdot c_1} \right) \leq 1.0$$

| c ₂ /c ₁ | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | ≥ 1.5 |
|--------------------------------|------|-----|------|-----|------|------------|
| $f_{c2,V}$ | 0.75 | 0.8 | 0.85 | 0.9 | 0.95 | 1.0 |

5.3.5 Influence of member thickness

$$f_{h,V} = \left(\frac{h}{1.5 \cdot c_1} \right)^{0.5} \leq 1.0$$

| h/c ₁ | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 1.2 | 1.3 | 1.4 | ≥ 1.5 |
|------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------------|
| $f_{h,V}$ | 0.26 | 0.37 | 0.45 | 0.52 | 0.58 | 0.63 | 0.68 | 0.73 | 0.77 | 0.82 | 0.89 | 0.93 | 0.97 | 1.0 |

5.3.6 Influence of group with ≥ 4 anchors in a row at the edge

$$f_m$$

| s/c ₁ | 0.25 | 0.5 | 1.0 | ≥ 2.0 |
|------------------|------|-----|------|------------|
| f_m | 0.3 | 0.5 | 0.75 | 1.0 |

fischer Highbond anchor FHB II

Anchor design according to fischer specification

6. Summary of required proof:

6.1 Tension: $N_{Sd} \leq N_{Rd} = \text{lowest value of } N_{Rd,s}; N_{Rd,p}; N_{Rd,c}; N_{Rd,sp}$

6.2 Shear: $V_{Sd} \leq V_{Rd} = \text{lowest value of } V_{Rd,s}; V_{Rd,cp}; V_{Rd,c}$

6.3 Combined tension and shear load:

$$\frac{N_{Sd}}{N_{Rd}} + \frac{V_{Sd}}{V_{Rd}} \leq 1.2$$

$N_{Sd}; V_{Sd}$ = tension/shear component of the design load acting on the most unfavourable single anchor

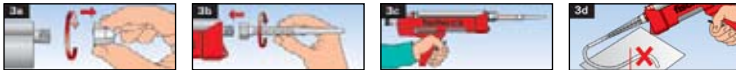
$N_{Rd}; V_{Rd}$ = tension/shear design resistance including safety factors of the most unfavourable single anchor

7. Installation details

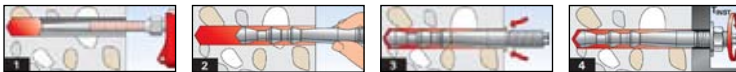
Drill a hole



Preparation injection mortar



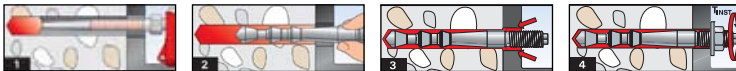
Pre-positioned installation with injection mortar



Pre-positioned installation with resin capsule



Push-through installation with injection mortar



Push-through installation with resin capsule



fischer Highbond anchor FHB II

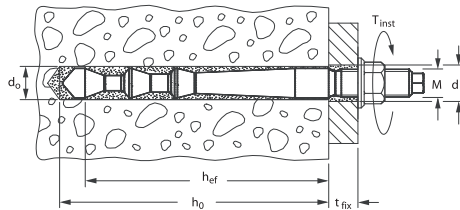
Anchor design according to fischer specification

8. Anchor characteristics

| Anchor type | FHB II A L | | FHB II A S | | FHB II A L | | FHB II A L | | FHB II A S | |
|--|-----------------|--------|------------|--------|------------|---------|------------|---------|------------|------|
| | M8x60 | M10x60 | M10x75 | M10x95 | M12x75 | M12x100 | M12x120 | M12x120 | M16x95 | M16 |
| diameter of thread | M 8 | M 10 | M 10 | M 10 | M 12 | M 12 | M 12 | M 12 | M 16 | M 16 |
| nominal drill hole diameter | d_0 [mm] | 10 | 10 | 10 | 12 | 12 | 14 | 14 | 16 | 16 |
| drill depth | h_0 [mm] | 75 | 75 | 90 | 110 | 90 | 115 | 135 | 110 | 110 |
| effective anchorage depth | h_{ef} [mm] | 60 | 60 | 75 | 95 | 75 | 100 | 120 | 95 | 95 |
| clearance-hole in fixture to be attached pre-positioned installation | d_f [mm] | ≤ 9 | ≤ 12 | ≤ 12 | ≤ 12 | ≤ 14 | ≤ 14 | ≤ 14 | ≤ 18 | ≤ 18 |
| clearance-hole in fixture to be attached push-through installation ¹⁾ | d_f [mm] | ≤ 11 | ≤ 12 | ≤ 12 | ≤ 14 | ≤ 14 | ≤ 16 | ≤ 16 | ≤ 18 | ≤ 18 |
| wrench size | SW [mm] | 13 | 17 | 17 | 17 | 19 | 19 | 19 | 24 | 24 |
| required torque | T_{inst} [Nm] | 15 | 15 | 15 | 20 | 30 | 40 | 40 | 50 | 50 |
| minimum thickness of concrete member | h_{min} [mm] | 100 | 100 | 120 | 140 | 120 | 140 | 170 | 150 | 150 |
| minimum spacing | s_{min} [mm] | 40 | 40 | 40 | 40 | 40 | 50 | 50 | 50 | 50 |
| minimum edge distances | c_{min} [mm] | 40 | 40 | 40 | 40 | 40 | 50 | 50 | 50 | 50 |
| mortar filling quantity | [scale units] | 3 | 3 | 4 | 5 | 4 | 7 | 7 | 8 | 8 |

| Anchor type | FHB II A L | | FHB II A L | | FHB II A L | | FHB II A S | | FHB II A L | |
|--|-----------------|---------|------------|---------|------------|---------|------------|---------|------------|------|
| | M16x125 | M16x145 | M16x160 | M20x170 | M20x210 | M20x210 | M24x170 | M24x210 | M24x210 | M24 |
| diameter of thread | M 16 | M 16 | M 16 | M 20 | M 20 | M 20 | M 24 | M 24 | M 24 | M 24 |
| nominal drill hole diameter | d_0 [mm] | 18 | 18 | 18 | 25 | 25 | 25 | 25 | 25 | 25 |
| drill depth | h_0 [mm] | 140 | 160 | 175 | 190 | 235 | 190 | 235 | 235 | 235 |
| effective anchorage depth | h_{ef} [mm] | 125 | 145 | 160 | 170 | 210 | 170 | 210 | 210 | 210 |
| clearance-hole in fixture to be attached pre-positioned installation | d_f [mm] | ≤ 18 | ≤ 18 | ≤ 18 | ≤ 22 | ≤ 22 | ≤ 26 | ≤ 26 | ≤ 26 | ≤ 26 |
| clearance-hole in fixture to be attached push-through installation ¹⁾ | d_f [mm] | ≤ 20 | ≤ 20 | ≤ 20 | ≤ 26 | ≤ 26 | ≤ 26 | ≤ 26 | ≤ 26 | ≤ 26 |
| wrench size | SW [mm] | 24 | 24 | 24 | 30 | 30 | 36 | 36 | 36 | 36 |
| required torque | T_{inst} [Nm] | 60 | 60 | 60 | 100 | 100 | 100 | 100 | 100 | 100 |
| minimum thickness of concrete member | h_{min} [mm] | 170 | 190 | 220 | 240 | 280 | 240 | 280 | 280 | 280 |
| minimum spacing | s_{min} [mm] | 55 | 60 | 70 | 80 | 90 | 80 | 90 | 90 | 90 |
| minimum edge distances | c_{min} [mm] | 55 | 60 | 70 | 80 | 90 | 80 | 90 | 90 | 90 |
| mortar filling quantity | [scale units] | 11 | 13 | 13 | 26 | 33 | 26 | 33 | 33 | 33 |

¹⁾ Hole clearance in base plate has to be filled with excess mortar



fischer Highbond anchor FHB II

Anchor design according to fischer specification

8.1 Gelling and curing times for installation with cartridges

| Temperature at anchoring base | Max. processing time | Temperature at anchoring base | Curing time |
|-------------------------------|----------------------|-------------------------------|-------------|
| | | - 5 °C | 360 min. |
| | | ± 0 °C | 180 min. |
| + 5 °C | 15 min. | + 5 °C | 90 min. |
| + 20 °C | 6 min. | +20 °C | 35 min. |
| + 30 °C | 4 min. | +30 °C | 20 min. |
| + 40 °C | 2 min. | ≥ +40 °C | 12 min. |

The above times apply for dry concrete from the moment of contact between resin and hardener in the static mixer. For installation, the cartridge temperature must be at least + 5 °C. In wet concrete curing time has to be doubled. For longer installation times, i.e. when interruptions occur in work, the static mixer shall be replaced.

8.2 Gelling and curing times for installation with capsules

| Temperature at anchoring base | Curing time | |
|-------------------------------|-------------|-----------|
| | FHB II-P | FHB II-PF |
| - 5 °C | 240 min. | 8 min. |
| ± 0 °C | 45 min. | 6 min. |
| + 10 °C | 20 min. | 4 min. |
| ≥ 20 °C | 10 min. | 2 min. |

The above times apply for dry concrete. In wet concrete the curing time has to be doubled.

9. Mechanical characteristics

| Anchor type | FHB II A L M8x60 | | FHB II A S M10x60 | | FHB II A S M10x75 | | FHB II A L M10x95 | | FHB II A S M12x75 | | FHB II A L M12x100 | | FHB II A L M12x120 | | FHB II A S M16x95 | |
|---|---------------------|------|----------------------|------|----------------------|------|----------------------|------|----------------------|-------|-----------------------|-------|-----------------------|-------|----------------------|-------|
| | gvz | A4 C | gvz | A4 C | gvz | A4 C | gvz | A4 C | gvz | A4 C | gvz | A4 C | gvz | A4 C | gvz | A4 C |
| stressed cross sectional area anchor rod A_s [mm ²] | 37 | 58 | 58 | 58 | 84 | 84 | 84 | 84 | 157 | 157 | 157 | 157 | 157 | 157 | 157 | 157 |
| section modulus W [mm ³] | 31 | 62 | 62 | 62 | 109 | 109 | 109 | 109 | 277 | 277 | 277 | 277 | 277 | 277 | 277 | 277 |
| design value of bending moment $M_{Rd,s}^b$ [Nm] | 24.8 | 49.6 | 49.6 | 49.6 | 84.0 | 84.0 | 84.0 | 84.0 | 212.8 | 212.8 | 212.8 | 212.8 | 212.8 | 212.8 | 212.8 | 212.8 |
| yield strength anchor rod f_{yk} [N/mm ²] | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 |
| tensile strength anchor rod f_{uk} [N/mm ²] | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 |

| Anchor type | FHB II A L M16x125 | | | FHB II A L M16x145 | | | FHB II A L M16x160 | | | FHB II A S M20x170 | | | FHB II A L M20x210 | | | FHB II A S M24x170 | | | FHB II A L M24x210 | | |
|---|-----------------------|-------|-------|-----------------------|-------|-------|-----------------------|-------|-------|-----------------------|-------|-------|-----------------------|-------|-------|-----------------------|-------|-------|-----------------------|-------|-------|
| | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C | gvz | A4 | C |
| stressed cross sectional area anchor rod A_s [mm ²] | 157 | 157 | 157 | 157 | 157 | 157 | 245 | 245 | 245 | 245 | 245 | 245 | 245 | 245 | 245 | 245 | 245 | 245 | 245 | 245 | 245 |
| section modulus W [mm ³] | 277 | 277 | 277 | 277 | 277 | 277 | 541 | 541 | 541 | 541 | 541 | 541 | 541 | 541 | 541 | 541 | 541 | 541 | 541 | 541 | 541 |
| design value of bending moment $M_{Rd,s}^b$ [Nm] | 212.8 | 212.8 | 212.8 | 212.8 | 212.8 | 212.8 | 415.2 | 415.2 | 415.2 | 415.2 | 415.2 | 415.2 | 415.2 | 415.2 | 415.2 | 415.2 | 415.2 | 415.2 | 415.2 | 415.2 | 415.2 |
| yield strength anchor rod f_{yk} [N/mm ²] | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 | 640 |
| tensile strength anchor rod f_{uk} [N/mm ²] | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 |