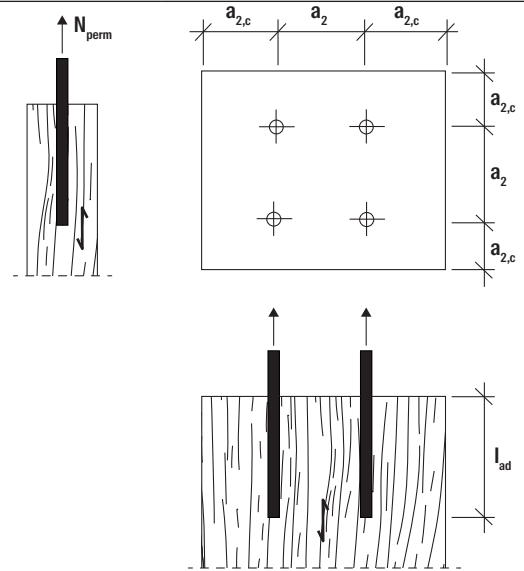




#### Injection system FIS EM Plus with anchor rod FIS A

Permissible tensile loads of a single anchor rod in glued laminated timber components  $\geq$  GL24h

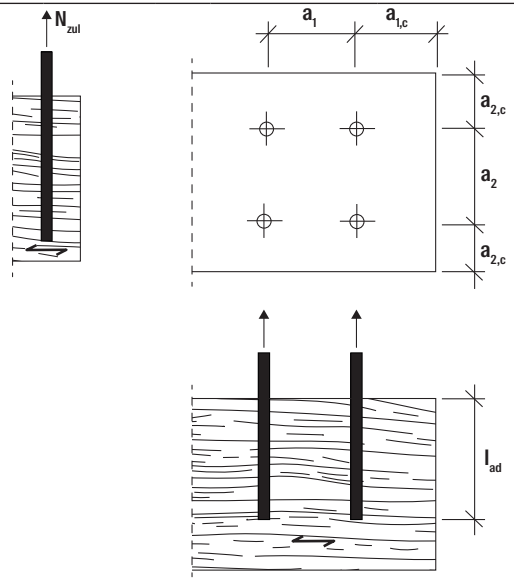
Anchor rods glued in parallel to the grain direction of the timber component

For the design, the entire approval Z-9.1-914 and DIN EN 1995-1-1:2010-12 / NA must be observed.

| Type       | Material/surface<br>[-] | Gluing length<br>in timber component<br>$l_{ad}$<br>[mm] | Permissible tensile<br>load<br>$N_{perm}$<br>[kN] | Minimum spacing<br>$a_2$<br>[mm] | Minimum edge<br>distance<br>$a_{2,c}$<br>[mm] | Minimum component<br>dimensions<br>$b = d$<br>[mm] |
|------------|-------------------------|----------------------------------------------------------|---------------------------------------------------|----------------------------------|-----------------------------------------------|----------------------------------------------------|
| FIS A M 6  | 5.8                     | 100                                                      | 3.7                                               | 30                               | 15                                            | 30                                                 |
|            | 5.8                     | 240                                                      | 4.8                                               | 30                               | 15                                            | 30                                                 |
|            | 8.8                     | 100                                                      | 3.7                                               | 30                               | 15                                            | 30                                                 |
|            | 8.8                     | 240                                                      | 7.4                                               | 30                               | 15                                            | 30                                                 |
|            | R-70                    | 100                                                      | 3.7                                               | 30                               | 15                                            | 30                                                 |
|            | R-70                    | 240                                                      | 5.2                                               | 30                               | 15                                            | 30                                                 |
| FIS A M 8  | 5.8                     | 100                                                      | 5.0                                               | 40                               | 20                                            | 40                                                 |
|            | 5.8                     | 320                                                      | 8.8                                               | 40                               | 20                                            | 40                                                 |
|            | 8.8                     | 100                                                      | 5.0                                               | 40                               | 20                                            | 40                                                 |
|            | 8.8                     | 320                                                      | 13.4                                              | 40                               | 20                                            | 40                                                 |
|            | R-70                    | 100                                                      | 5.0                                               | 40                               | 20                                            | 40                                                 |
|            | R-70                    | 320                                                      | 9.4                                               | 40                               | 20                                            | 40                                                 |
| FIS A M 10 | 5.8                     | 100                                                      | 6.2                                               | 50                               | 25                                            | 50                                                 |
|            | 5.8                     | 400                                                      | 13.9                                              | 50                               | 25                                            | 50                                                 |
|            | 8.8                     | 100                                                      | 6.2                                               | 50                               | 25                                            | 50                                                 |
|            | 8.8                     | 400                                                      | 20.2                                              | 50                               | 25                                            | 50                                                 |
|            | R-70                    | 100                                                      | 6.2                                               | 50                               | 25                                            | 50                                                 |
|            | R-70                    | 400                                                      | 14.9                                              | 50                               | 25                                            | 50                                                 |
| FIS A M 12 | 5.8                     | 120                                                      | 8.9                                               | 60                               | 30                                            | 60                                                 |
|            | 5.8                     | 480                                                      | 20.2                                              | 60                               | 30                                            | 60                                                 |
|            | 8.8                     | 120                                                      | 8.9                                               | 60                               | 30                                            | 60                                                 |
|            | 8.8                     | 480                                                      | 25.5                                              | 60                               | 30                                            | 60                                                 |
|            | R-70                    | 120                                                      | 8.9                                               | 60                               | 30                                            | 60                                                 |
|            | R-70                    | 480                                                      | 21.7                                              | 60                               | 30                                            | 60                                                 |

| Type       | Material/surface<br>[-] | Gluing length<br>in timber component<br>$l_{ad}$<br>[mm] | Permissible tensile<br>load<br>$N_{perm}$<br>[kN] | Minimum spacing<br>$a_2$<br>[mm] | Minimum edge<br>distance<br>$a_{2,c}$<br>[mm] | Minimum component<br>dimensions<br>$b = d$<br>[mm] |
|------------|-------------------------|----------------------------------------------------------|---------------------------------------------------|----------------------------------|-----------------------------------------------|----------------------------------------------------|
| FIS A M 16 | 5.8                     | 160                                                      | 15.9                                              | 80                               | 40                                            | 80                                                 |
|            | 5.8                     | 640                                                      | 37.7                                              | 80                               | 40                                            | 80                                                 |
|            | 8.8                     | 160                                                      | 15.9                                              | 80                               | 40                                            | 80                                                 |
|            | 8.8                     | 640                                                      | 40.4                                              | 80                               | 40                                            | 80                                                 |
|            | R-70                    | 160                                                      | 15.9                                              | 80                               | 40                                            | 80                                                 |
|            | R-70                    | 640                                                      | 40.4                                              | 80                               | 40                                            | 80                                                 |
| FIS A M 20 | 5.8                     | 200                                                      | 24.9                                              | 100                              | 50                                            | 100                                                |
|            | 5.8                     | 800                                                      | 57.2                                              | 100                              | 50                                            | 100                                                |
|            | 8.8                     | 200                                                      | 24.9                                              | 100                              | 50                                            | 100                                                |
|            | 8.8                     | 800                                                      | 57.2                                              | 100                              | 50                                            | 100                                                |
|            | R-70                    | 200                                                      | 24.9                                              | 100                              | 50                                            | 100                                                |
|            | R-70                    | 800                                                      | 57.2                                              | 100                              | 50                                            | 100                                                |
| FIS A M 24 | 5.8                     | 240                                                      | 35.8                                              | 120                              | 60                                            | 120                                                |
|            | 5.8                     | 960                                                      | 73.7                                              | 120                              | 60                                            | 120                                                |
|            | 8.8                     | 240                                                      | 35.8                                              | 120                              | 60                                            | 120                                                |
|            | 8.8                     | 960                                                      | 73.7                                              | 120                              | 60                                            | 120                                                |
|            | R-70                    | 240                                                      | 35.8                                              | 120                              | 60                                            | 120                                                |
|            | R-70                    | 960                                                      | 73.7                                              | 120                              | 60                                            | 120                                                |
| FIS A M 30 | 5.8                     | 300                                                      | 52.4                                              | 150                              | 75                                            | 150                                                |
|            | 5.8                     | 1000                                                     | 93.2                                              | 150                              | 75                                            | 150                                                |
|            | 8.8                     | 300                                                      | 52.4                                              | 150                              | 75                                            | 150                                                |
|            | 8.8                     | 1000                                                     | 93.2                                              | 150                              | 75                                            | 150                                                |
|            | R-70                    | 300                                                      | 52.4                                              | 150                              | 75                                            | 150                                                |
|            | R-70                    | 1000                                                     | 93.2                                              | 150                              | 75                                            | 150                                                |

Notes:  
 Drill diameter in the wood 4 mm larger than the outer diameter of the steel rods.  
 Steel failure in the stress cross-section against the yield strength, composite failure in the lateral surface and tensile failure of the net timber cross-section are taken into account.  
 Partial safety factors  $\gamma_{M,H} = 1.3$ ;  $\gamma_{M,S} = 1.25$ ;  $\gamma_{F,global} = 1.4$  and  $k_{mod} = 0.9$  from KLED short and NKL 1+2 taken into account.  
 Values valid for glued laminated timber  $\geq$  GL24h. Higher load-bearing capacities may be possible for higher strength classes. For groups of steel bars, as well as for combined loading from tensile and shear loads, as well as for bending stress, see Z-9.1-914 and DIN EN 1995-1-1 / NA.  
 For groups of steel bars glued in parallel to the grain of the timber components, which are subjected to tensile stress in the grain direction, a verification of the connection for block shear failure according to EOTA Technical Report TR 070, Section 4.1.7., is required.  
 All mechanical values given must be considered in relation to the assumptions made and are examples of dimensioning.  
 This is a planning aid. Projects must be dimensioned exclusively by structural engineers!  
 All values are subject to typesetting and printing errors.



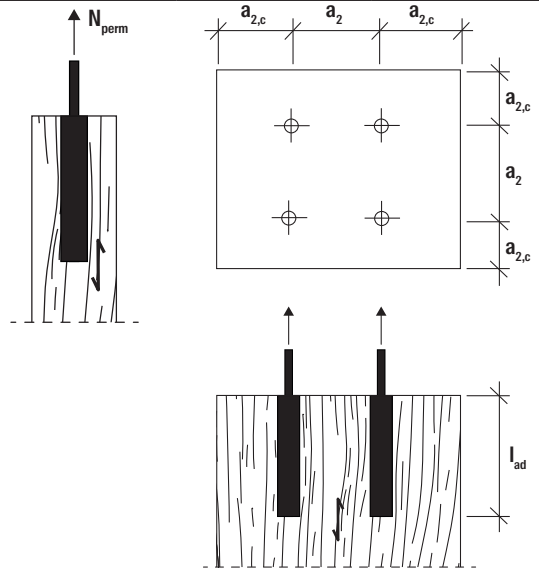
# Injection system FIS EM Plus with anchor rod FIS A

Permissible tensile loads of a single anchor rod in glued laminated timber components  $\geq$  GL24h  
 Anchor rods glued in perpendicular to the grain direction of the timber component  
 For the design, the entire approval Z-9.1-914 and DIN EN 1995-1-1:2010-12 / NA must be observed.

| Type       | Material/surface<br>[-] | Gluing length in<br>timber component<br>$l_{ad}$<br>[mm] | Permissible<br>tensile load<br>$N_{perm}$<br>[kN] | Minimum spacing<br>$a_1 = a_2$<br>[mm] | Minimum<br>edge distance<br>$a_{1,c} = a_{2,c}$<br>[mm] | Minimum<br>component width<br>$b$<br>[mm] | Minimum<br>component height<br>$h$<br>[mm] |
|------------|-------------------------|----------------------------------------------------------|---------------------------------------------------|----------------------------------------|---------------------------------------------------------|-------------------------------------------|--------------------------------------------|
| FIS A M 6  | 5.8                     | 100                                                      | 3.7                                               | 24                                     | 15                                                      | 30                                        | 120                                        |
|            | 5.8                     | 240                                                      | 4.8                                               | 24                                     | 15                                                      | 30                                        | 260                                        |
|            | 8.8                     | 100                                                      | 3.7                                               | 24                                     | 15                                                      | 30                                        | 120                                        |
|            | 8.8                     | 240                                                      | 7.4                                               | 24                                     | 15                                                      | 30                                        | 260                                        |
|            | R-70                    | 100                                                      | 3.7                                               | 24                                     | 15                                                      | 30                                        | 120                                        |
|            | R-70                    | 240                                                      | 5.2                                               | 24                                     | 15                                                      | 30                                        | 260                                        |
| FIS A M 8  | 5.8                     | 100                                                      | 5.0                                               | 32                                     | 20                                                      | 40                                        | 120                                        |
|            | 5.8                     | 320                                                      | 8.8                                               | 32                                     | 20                                                      | 40                                        | 340                                        |
|            | 8.8                     | 100                                                      | 5.0                                               | 32                                     | 20                                                      | 40                                        | 120                                        |
|            | 8.8                     | 320                                                      | 13.4                                              | 32                                     | 20                                                      | 40                                        | 340                                        |
|            | R-70                    | 100                                                      | 5.0                                               | 32                                     | 20                                                      | 40                                        | 120                                        |
|            | R-70                    | 320                                                      | 9.4                                               | 32                                     | 20                                                      | 40                                        | 340                                        |
| FIS A M 10 | 5.8                     | 100                                                      | 6.2                                               | 40                                     | 25                                                      | 50                                        | 120                                        |
|            | 5.8                     | 400                                                      | 13.9                                              | 40                                     | 25                                                      | 50                                        | 420                                        |
|            | 8.8                     | 100                                                      | 6.2                                               | 40                                     | 25                                                      | 50                                        | 120                                        |
|            | 8.8                     | 400                                                      | 20.2                                              | 40                                     | 25                                                      | 50                                        | 420                                        |
|            | R-70                    | 100                                                      | 6.2                                               | 40                                     | 25                                                      | 50                                        | 120                                        |
|            | R-70                    | 400                                                      | 14.9                                              | 40                                     | 25                                                      | 50                                        | 420                                        |
| FIS A M 12 | 5.8                     | 120                                                      | 8.9                                               | 48                                     | 30                                                      | 60                                        | 140                                        |
|            | 5.8                     | 480                                                      | 20.2                                              | 48                                     | 30                                                      | 60                                        | 500                                        |
|            | 8.8                     | 120                                                      | 8.9                                               | 48                                     | 30                                                      | 60                                        | 140                                        |
|            | 8.8                     | 480                                                      | 25.5                                              | 48                                     | 30                                                      | 60                                        | 500                                        |
|            | R-70                    | 120                                                      | 8.9                                               | 48                                     | 30                                                      | 60                                        | 140                                        |
|            | R-70                    | 480                                                      | 21.7                                              | 48                                     | 30                                                      | 60                                        | 500                                        |
| FIS A M 16 | 5.8                     | 160                                                      | 15.9                                              | 64                                     | 40                                                      | 80                                        | 180                                        |
|            | 5.8                     | 640                                                      | 37.7                                              | 64                                     | 40                                                      | 80                                        | 660                                        |
|            | 8.8                     | 160                                                      | 15.9                                              | 64                                     | 40                                                      | 80                                        | 180                                        |
|            | 8.8                     | 640                                                      | 40.4                                              | 64                                     | 40                                                      | 80                                        | 660                                        |
|            | R-70                    | 160                                                      | 15.9                                              | 64                                     | 40                                                      | 80                                        | 180                                        |
|            | R-70                    | 640                                                      | 40.4                                              | 64                                     | 40                                                      | 80                                        | 660                                        |

| Type       | Material/surface<br>[-] | Gluing length in<br>timber component<br>$l_{ad}$<br>[mm] | Permissible<br>tensile load<br>$N_{perm}$<br>[kN] | Minimum spacing<br>$a_1 = a_2$<br>[mm] | Minimum<br>edge distance<br>$a_{1,c} = a_{2,c}$<br>[mm] | Minimum<br>component width<br>$b$<br>[mm] | Minimum<br>component height<br>$h$<br>[mm] |
|------------|-------------------------|----------------------------------------------------------|---------------------------------------------------|----------------------------------------|---------------------------------------------------------|-------------------------------------------|--------------------------------------------|
| FIS A M 20 | 5.8                     | 200                                                      | 24.9                                              | 80                                     | 50                                                      | 100                                       | 220                                        |
|            | 5.8                     | 800                                                      | 57.2                                              | 80                                     | 50                                                      | 100                                       | 820                                        |
|            | 8.8                     | 200                                                      | 24.9                                              | 80                                     | 50                                                      | 100                                       | 220                                        |
|            | 8.8                     | 800                                                      | 57.2                                              | 80                                     | 50                                                      | 100                                       | 820                                        |
|            | R-70                    | 200                                                      | 24.9                                              | 80                                     | 50                                                      | 100                                       | 220                                        |
|            | R-70                    | 800                                                      | 57.2                                              | 80                                     | 50                                                      | 100                                       | 820                                        |
| FIS A M 24 | 5.8                     | 240                                                      | 35.8                                              | 96                                     | 60                                                      | 120                                       | 260                                        |
|            | 5.8                     | 960                                                      | 73.7                                              | 96                                     | 60                                                      | 120                                       | 980                                        |
|            | 8.8                     | 240                                                      | 35.8                                              | 96                                     | 60                                                      | 120                                       | 260                                        |
|            | 8.8                     | 960                                                      | 73.7                                              | 96                                     | 60                                                      | 120                                       | 980                                        |
|            | R-70                    | 240                                                      | 35.8                                              | 96                                     | 60                                                      | 120                                       | 260                                        |
|            | R-70                    | 960                                                      | 73.7                                              | 96                                     | 60                                                      | 120                                       | 980                                        |
| FIS A M 30 | 5.8                     | 300                                                      | 52.4                                              | 120                                    | 75                                                      | 150                                       | 320                                        |
|            | 5.8                     | 1000                                                     | 93.2                                              | 120                                    | 75                                                      | 150                                       | 1020                                       |
|            | 8.8                     | 300                                                      | 52.4                                              | 120                                    | 75                                                      | 150                                       | 320                                        |
|            | 8.8                     | 1000                                                     | 93.2                                              | 120                                    | 75                                                      | 150                                       | 1020                                       |
|            | R-70                    | 300                                                      | 52.4                                              | 120                                    | 75                                                      | 150                                       | 320                                        |
|            | R-70                    | 1000                                                     | 93.2                                              | 120                                    | 75                                                      | 150                                       | 1020                                       |

Notes:  
 Drill diameter in the wood 4 mm larger than the outer diameter of the steel rods.  
 Steel failure in the stress cross-section against the yield point and composite failure in the lateral surface are taken into account.  
 Any failure of the timber cross-section such as transverse tensile failure and block shear failure must be checked separately!  
 Partial safety factors  $\gamma_{M,H} = 1.3$ ;  $\gamma_{M,S} = 1.25$ ;  $\gamma_{F,global} = 1.4$  and  $k_{mod} = 0.9$  from KLED short and NKL 1+2 taken into account.  
 Values valid for glued laminated timber  $\geq$  GL24h. Higher load-bearing capacities may be possible for higher strength classes.  
 For groups of steel bars, as well as for combined loading from tensile and shear loads, as well as for bending stress, see Z-9.1-914 and DIN EN 1995-1-1 / NA.  
 All mechanical values given must be considered in relation to the assumptions made and are examples of dimensioning.  
 This is a planning aid. Projects must be dimensioned exclusively by structural engineers!  
 All values are subject to typesetting and printing errors.



# Injection system FIS EM Plus with internal threaded anchor FIS IG

Permissible tensile loads of a single internally threaded anchor in glued laminated timber components  $\geq$  GL24h

Internally threaded anchor glued in parallel to the grain direction of the timber component

For the design, the entire approval Z-9.1-914 and DIN EN 1995-1-1:2010-12 / NA must be observed.

| Type        | Steel grade of the screw<br>[-] | Gluing length in timber component<br>$l_{ad}$<br>[mm] | Permissible tensile load<br>$N_{perm}$<br>[kN] | Minimum spacing<br>$a_2$<br>[mm] | Minimum edge distance<br>$a_{2,c}$<br>[mm] | Minimum component dimensions<br>$b = d$<br>[mm] |
|-------------|---------------------------------|-------------------------------------------------------|------------------------------------------------|----------------------------------|--------------------------------------------|-------------------------------------------------|
| FIS IG M 8  | 5.8                             | 120                                                   | 8.8                                            | 60                               | 30                                         | 60                                              |
|             | 8.8                             | 120                                                   | 8.9                                            | 60                               | 30                                         | 60                                              |
|             | R-70                            | 120                                                   | 8.9                                            | 60                               | 30                                         | 60                                              |
| FIS IG M 10 | 5.8                             | 160                                                   | 13.9                                           | 80                               | 40                                         | 80                                              |
|             | 8.8                             | 160                                                   | 15.9                                           | 80                               | 40                                         | 80                                              |
|             | R-70                            | 160                                                   | 14.9                                           | 80                               | 40                                         | 80                                              |
| FIS IG M 12 | 5.8                             | 200                                                   | 20.2                                           | 100                              | 50                                         | 100                                             |
|             | 8.8                             | 200                                                   | 24.9                                           | 100                              | 50                                         | 100                                             |
|             | R-70                            | 200                                                   | 21.7                                           | 100                              | 50                                         | 100                                             |
| FIS IG M 16 | 5.8                             | 240                                                   | 35.8                                           | 120                              | 60                                         | 120                                             |
|             | 8.8                             | 240                                                   | 35.8                                           | 120                              | 60                                         | 120                                             |
|             | R-70                            | 240                                                   | 35.8                                           | 120                              | 60                                         | 120                                             |
| FIS IG M 20 | 5.8                             | 300                                                   | 52.4                                           | 150                              | 75                                         | 150                                             |
|             | 8.8                             | 300                                                   | 52.4                                           | 150                              | 75                                         | 150                                             |
|             | R-70                            | 300                                                   | 52.4                                           | 150                              | 75                                         | 150                                             |

## Notes:

Drill diameter in the wood 4 mm larger than the outer diameter of the internal threaded anchor FIS IG.

Steel failure in the stress cross-section of the FIS IG and the bolt against the yield strength, composite failure in the lateral surface and tensile failure of the net timber cross-section are taken into account.

Only use non-corroding FIS IG with non-corroding screws and FIS IG made of gvz. with screws made of gvz..

Minimum screw-in depth of the screws in the FIS IG in accordance with Z-9.1-914.

Partial safety factors  $\gamma_{M,H} = 1.3$ ;  $\gamma_{M,S} = 1.25$ ;  $\gamma_{F,global} = 1.4$  and  $k_{mod} = 0.9$  from KLED short and NKI 1+2 taken into account.

Values valid for glued laminated timber  $\geq$  GL24h. Higher load-bearing capacities may be possible for higher strength classes.

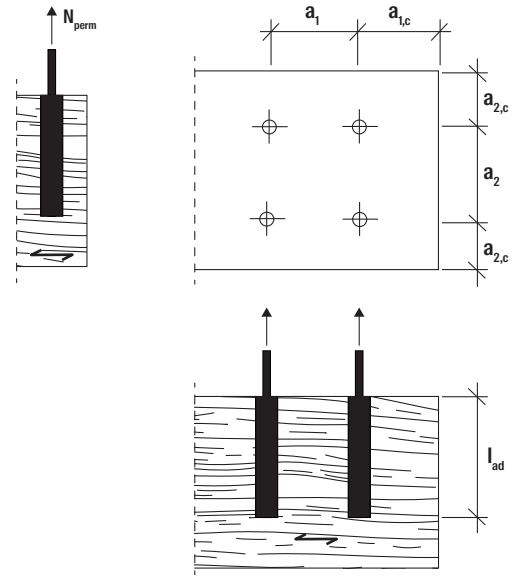
For groups of steel bars, as well as for combined loading from tensile and shear loads, as well as for bending stress, see Z-9.1-914 and DIN EN 1995-1-1 / NA.

For groups of FIS IG glued in parallel to the grain of the timber components, which are subjected to tensile stress in the direction of the grain, the connection must be verified for block shear failure in accordance with EOTA Technical Report TR 070, Section 4.1.7.

All mechanical values given must be considered in relation to the assumptions made and are examples of dimensioning.

This is a planning aid. Projects must be dimensioned exclusively by structural engineers!

All values are subject to typesetting and printing errors.



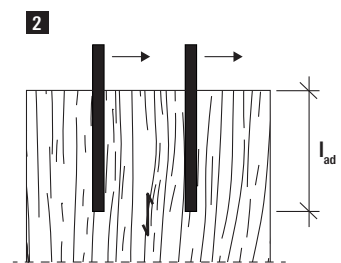
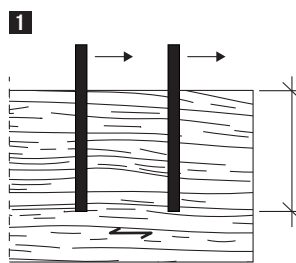
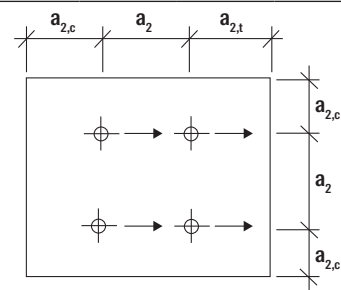
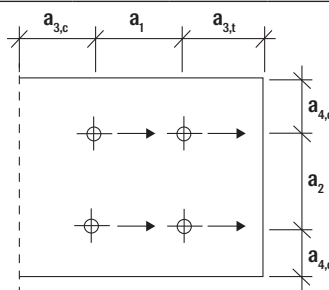
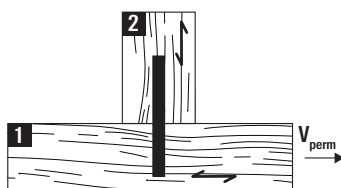
# Injection system FIS EM Plus with internally threaded anchors FIS IG

Permissible tensile loads of a single internally threaded anchor in glued laminated timber components  $\geq$  GL24h  
 Internally threaded anchor glued in perpendicular to the grain direction of the timber component  
 For the design, the entire approval Z-9.1-914 and DIN EN 1995-1-1:2010-12 / NA must be observed.

| Type        | Steel grade of the screw<br>[-] | Gluing length in timber component<br>$l_{ad}$<br>[mm] | Permissible tensile load<br>$N_{perm}$<br>[kN] | Minimum spacing<br>$a_1 = a_2$<br>[mm] | Minimum edge distance<br>$a_{1c} = a_{2c}$<br>[mm] | Minimum component width<br>$b$<br>[mm] | Minimum component height<br>$h$<br>[mm] |
|-------------|---------------------------------|-------------------------------------------------------|------------------------------------------------|----------------------------------------|----------------------------------------------------|----------------------------------------|-----------------------------------------|
| FIS IG M 8  | 5.8                             | 120                                                   | 8.8                                            | 48                                     | 30                                                 | 60                                     | 140                                     |
|             | 8.8                             | 120                                                   | 8.9                                            | 48                                     | 30                                                 | 60                                     | 140                                     |
|             | R-70                            | 120                                                   | 8.9                                            | 48                                     | 30                                                 | 60                                     | 140                                     |
| FIS IG M 10 | 5.8                             | 160                                                   | 13.9                                           | 64                                     | 40                                                 | 80                                     | 180                                     |
|             | 8.8                             | 160                                                   | 15.9                                           | 64                                     | 40                                                 | 80                                     | 180                                     |
|             | R-70                            | 160                                                   | 14.9                                           | 64                                     | 40                                                 | 80                                     | 180                                     |
| FIS IG M 12 | 5.8                             | 200                                                   | 20.2                                           | 80                                     | 50                                                 | 100                                    | 220                                     |
|             | 8.8                             | 200                                                   | 24.9                                           | 80                                     | 50                                                 | 100                                    | 220                                     |
|             | R-70                            | 200                                                   | 21.7                                           | 80                                     | 50                                                 | 100                                    | 220                                     |
| FIS IG M 16 | 5.8                             | 240                                                   | 35.8                                           | 96                                     | 60                                                 | 120                                    | 260                                     |
|             | 8.8                             | 240                                                   | 35.8                                           | 96                                     | 60                                                 | 120                                    | 260                                     |
|             | R-70                            | 240                                                   | 35.8                                           | 96                                     | 60                                                 | 120                                    | 260                                     |
| FIS IG M 20 | 5.8                             | 300                                                   | 52.4                                           | 120                                    | 75                                                 | 150                                    | 320                                     |
|             | 8.8                             | 300                                                   | 52.4                                           | 120                                    | 75                                                 | 150                                    | 320                                     |
|             | R-70                            | 300                                                   | 52.4                                           | 120                                    | 75                                                 | 150                                    | 320                                     |

Notes:  
 Drill diameter in the wood 4 mm larger than the outer diameter of the internal threaded anchor FIS IG.  
 Steel failure in the stress cross-section of the FIS IG and the bolt against the yield point and composite failure in the lateral surface are taken into account.  
 Any failure of the timber cross-section, e.g. transverse tensile failure, must be checked separately.  
 Only use non-corroding FIS IG with non-corroding screws and FIS IG made of gvz. with screws made of gvz.  
 Minimum screw-in depth of the screws in the FIS IG in accordance with Z-9.1-914.  
 Partial safety factors  $\gamma_{M,H} = 1.3$ ;  $\gamma_{M,S} = 1.25$ ;  $\gamma_{F,global} = 1.4$  and  $k_{mod} = 0.9$  from KLED short and NK1 1+2 taken into account.  
 Values valid for glued laminated timber  $\geq$  GL24h. Higher load-bearing capacities may be possible for higher strength classes.  
 For groups of steel bars, as well as for combined loading from tensile and shear loads, as well as for bending stress, see Z-9.1-914 and DIN EN 1995-1-1 / NA.  
 All mechanical values given must be considered in relation to the assumptions made and are examples of dimensioning.  
 This is a planning aid. Projects must be dimensioned exclusively by structural engineers!  
 All values are subject to typesetting and printing errors.

# Loads FIS EM Plus under shear load



## Injection system FIS EM Plus with anchor rod FIS A

Permissible shear loads of a single anchor rod in glued laminated timber components  $\geq$  GL24h in a wood-/wood-connection

Anchor rods glued in parallel on one side (component 2) and perpendicular to the grain direction of the timber component (component 1) on the other side

For the design, the entire approval Z-9.1-914 and DIN EN 1995-1-1:2010-12 / NA must be observed.

| Type       | Material/<br>surface | Gluing<br>length in<br>component<br>1<br>(perpen-<br>dicular to<br>the fiber)<br><br>$l_{ad,1}$<br>[mm] | Gluing<br>length in<br>component<br>2<br>(parallel<br>to the<br>fiber)<br><br>$l_{ad,2}$<br>[mm] | Permissi-<br>ble shear<br>load<br><br>$V_{perm}$<br>[kN] | Minimum<br>spacing<br><br>$a_1 = a_2$<br>[mm] | Minimum<br>edge<br>distance<br>(unloa-<br>ded) Compo-<br>nent 2<br><br>$a_{2,c}$<br>[mm] | Minimum<br>edge<br>distance<br>(loaded)<br>Compo-<br>nent 2<br><br>$a_{2,t}$<br>[mm] | Minimum<br>lateral<br>edge<br>distance<br>(unloa-<br>ded) Compo-<br>nent 1<br><br>$a_{4,c}$<br>[mm] | Minimum<br>endgrain<br>edge<br>distance<br>(unloa-<br>ded) Compo-<br>nent 1<br><br>$a_{3,c}$<br>[mm] | Minimum<br>endgrain<br>edge<br>distance<br>(loaded)<br>Compo-<br>nent 1<br><br>$a_{3,t}$<br>[mm] | Minimum<br>compo-<br>nent di-<br>mensions<br>Compo-<br>nent 1<br><br>$b_1 / d_1$<br>[mm] | Minimum<br>compo-<br>nent di-<br>mensions<br>Compo-<br>nent 2<br><br>$b_2 / d_2$<br>[mm] |
|------------|----------------------|---------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| FIS A M 6  | 5.8                  | 100                                                                                                     | 240                                                                                              | 0.7                                                      | 30                                            | 15                                                                                       | 24                                                                                   | 18                                                                                                  | 40                                                                                                   | 80                                                                                               | 36 / 120                                                                                 | 30 / 39                                                                                  |
|            | 8.8                  | 100                                                                                                     | 240                                                                                              | 0.9                                                      | 30                                            | 15                                                                                       | 24                                                                                   | 18                                                                                                  | 40                                                                                                   | 80                                                                                               | 36 / 120                                                                                 | 30 / 39                                                                                  |
|            | R-70                 | 100                                                                                                     | 240                                                                                              | 0.8                                                      | 30                                            | 15                                                                                       | 24                                                                                   | 18                                                                                                  | 40                                                                                                   | 80                                                                                               | 36 / 120                                                                                 | 30 / 39                                                                                  |
| FIS A M 8  | 5.8                  | 100                                                                                                     | 320                                                                                              | 1.1                                                      | 40                                            | 20                                                                                       | 32                                                                                   | 24                                                                                                  | 40                                                                                                   | 80                                                                                               | 40 / 120                                                                                 | 40 / 52                                                                                  |
|            | 8.8                  | 100                                                                                                     | 320                                                                                              | 1.4                                                      | 40                                            | 20                                                                                       | 32                                                                                   | 24                                                                                                  | 40                                                                                                   | 80                                                                                               | 40 / 120                                                                                 | 40 / 52                                                                                  |
|            | R-70                 | 100                                                                                                     | 320                                                                                              | 1.3                                                      | 40                                            | 20                                                                                       | 32                                                                                   | 24                                                                                                  | 40                                                                                                   | 80                                                                                               | 40 / 120                                                                                 | 40 / 52                                                                                  |
| FIS A M 10 | 5.8                  | 100                                                                                                     | 400                                                                                              | 1.7                                                      | 50                                            | 25                                                                                       | 40                                                                                   | 30                                                                                                  | 40                                                                                                   | 80                                                                                               | 50 / 120                                                                                 | 50 / 65                                                                                  |
|            | 8.8                  | 100                                                                                                     | 400                                                                                              | 2.1                                                      | 50                                            | 25                                                                                       | 40                                                                                   | 30                                                                                                  | 40                                                                                                   | 80                                                                                               | 50 / 120                                                                                 | 50 / 65                                                                                  |
|            | R-70                 | 100                                                                                                     | 400                                                                                              | 1.9                                                      | 50                                            | 25                                                                                       | 40                                                                                   | 30                                                                                                  | 40                                                                                                   | 80                                                                                               | 50 / 120                                                                                 | 50 / 65                                                                                  |
| FIS A M 12 | 5.8                  | 120                                                                                                     | 480                                                                                              | 2.3                                                      | 60                                            | 30                                                                                       | 48                                                                                   | 36                                                                                                  | 42                                                                                                   | 84                                                                                               | 60 / 140                                                                                 | 60 / 78                                                                                  |
|            | 8.8                  | 120                                                                                                     | 480                                                                                              | 2.8                                                      | 60                                            | 30                                                                                       | 48                                                                                   | 36                                                                                                  | 42                                                                                                   | 84                                                                                               | 60 / 140                                                                                 | 60 / 78                                                                                  |
|            | R-70                 | 120                                                                                                     | 480                                                                                              | 2.6                                                      | 60                                            | 30                                                                                       | 48                                                                                   | 36                                                                                                  | 42                                                                                                   | 84                                                                                               | 60 / 140                                                                                 | 60 / 78                                                                                  |
| FIS A M 16 | 5.8                  | 160                                                                                                     | 640                                                                                              | 3.7                                                      | 80                                            | 40                                                                                       | 64                                                                                   | 48                                                                                                  | 56                                                                                                   | 112                                                                                              | 80 / 180                                                                                 | 80 / 104                                                                                 |
|            | 8.8                  | 160                                                                                                     | 640                                                                                              | 4.5                                                      | 80                                            | 40                                                                                       | 64                                                                                   | 48                                                                                                  | 56                                                                                                   | 112                                                                                              | 80 / 180                                                                                 | 80 / 104                                                                                 |
|            | R-70                 | 160                                                                                                     | 640                                                                                              | 4.2                                                      | 80                                            | 40                                                                                       | 64                                                                                   | 48                                                                                                  | 56                                                                                                   | 112                                                                                              | 80 / 180                                                                                 | 80 / 104                                                                                 |
| FIS A M 20 | 5.8                  | 200                                                                                                     | 800                                                                                              | 5.2                                                      | 100                                           | 50                                                                                       | 80                                                                                   | 60                                                                                                  | 70                                                                                                   | 140                                                                                              | 100 / 220                                                                                | 100 / 130                                                                                |
|            | 8.8                  | 200                                                                                                     | 800                                                                                              | 6.5                                                      | 100                                           | 50                                                                                       | 80                                                                                   | 60                                                                                                  | 70                                                                                                   | 140                                                                                              | 100 / 220                                                                                | 100 / 130                                                                                |
|            | R-70                 | 200                                                                                                     | 800                                                                                              | 6.1                                                      | 100                                           | 50                                                                                       | 80                                                                                   | 60                                                                                                  | 70                                                                                                   | 140                                                                                              | 100 / 220                                                                                | 100 / 130                                                                                |
| FIS A M 24 | 5.8                  | 240                                                                                                     | 960                                                                                              | 7.0                                                      | 120                                           | 60                                                                                       | 96                                                                                   | 72                                                                                                  | 84                                                                                                   | 168                                                                                              | 120 / 260                                                                                | 120 / 156                                                                                |
|            | 8.8                  | 240                                                                                                     | 960                                                                                              | 8.6                                                      | 120                                           | 60                                                                                       | 96                                                                                   | 72                                                                                                  | 84                                                                                                   | 168                                                                                              | 120 / 260                                                                                | 120 / 156                                                                                |
|            | R-70                 | 240                                                                                                     | 960                                                                                              | 8.1                                                      | 120                                           | 60                                                                                       | 96                                                                                   | 72                                                                                                  | 84                                                                                                   | 168                                                                                              | 120 / 260                                                                                | 120 / 156                                                                                |
| FIS A M 30 | 5.8                  | 300                                                                                                     | 1000                                                                                             | 9.8                                                      | 150                                           | 75                                                                                       | 120                                                                                  | 90                                                                                                  | 105                                                                                                  | 210                                                                                              | 150 / 320                                                                                | 150 / 195                                                                                |
|            | 8.8                  | 300                                                                                                     | 1000                                                                                             | 12.1                                                     | 150                                           | 75                                                                                       | 120                                                                                  | 90                                                                                                  | 105                                                                                                  | 210                                                                                              | 150 / 320                                                                                | 150 / 195                                                                                |
|            | R-70                 | 300                                                                                                     | 1000                                                                                             | 11.3                                                     | 150                                           | 75                                                                                       | 120                                                                                  | 90                                                                                                  | 105                                                                                                  | 210                                                                                              | 150 / 320                                                                                | 150 / 195                                                                                |

### Notes:

Drill diameter in the wood 4 mm larger than the outer diameter of the steel rods.

Partial safety factors  $\gamma_{M,H} = 1.3$ ;  $\gamma_{M,S} = 1.25$ ;  $\gamma_{F,global} = 1.4$  and  $k_{mod} = 0.9$  from KLED short and NK 1+2 taken into account.

Values valid for glued laminated timber  $\geq$  GL24h. Higher load-bearing capacities may be possible for higher strength classes.

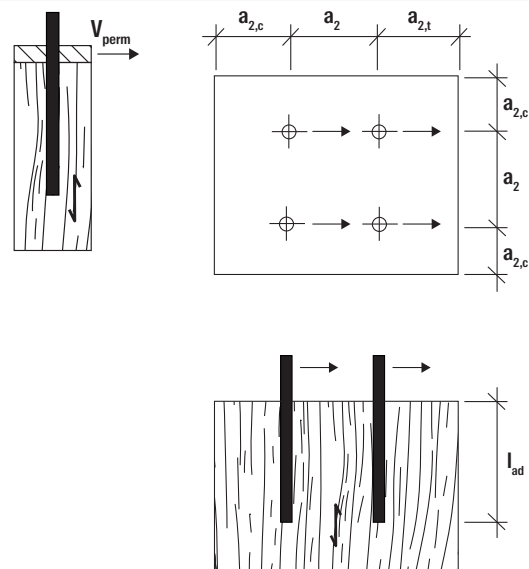
Possible failure of the timber cross-section such as transverse tensile failure and block shear failure must be checked separately!

For groups of steel bars, as well as for combined loading from tensile and shear loads, as well as for bending loads, see Z-9.1-914 and DIN EN 1995-1-1 / NA.

All specified mechanical values must be considered depending on the assumptions made and represent design examples.

This is a planning aid. Projects must be dimensioned exclusively by structural engineers!

All values are subject to typesetting and printing errors.



# Injection system FIS EM Plus with anchor rod FIS A

Permissible shear loads of a single anchor rod in glued laminated timber components  $\geq$  GL24h in a steel / timber connection

Anchor rods glued in parallel to the grain direction of the timber component

For the design, the entire approval Z-9.1-914 and DIN EN 1995-1-1:2010-12 / NA must be observed.

| Type       | Material/surface<br>[-] | Gluing length<br><br>$l_{ad}$<br>[mm] | Permissible<br>shear load (thin<br>steel attachment<br>part)<br>$t \leq 0,5 \cdot d$<br><br>$V_{perm}$<br>[kN] | Permissible<br>shear load (thick<br>steel attachment<br>part)<br>$t \geq d^0$<br><br>$V_{perm}$<br>[kN] | Minimum<br>spacing<br><br>$a_2$<br>[mm] | Minimum<br>edge distance<br>(unloaded)<br><br>$a_{2,c}$<br>[mm] | Minimum<br>edge distance<br>(loaded)<br><br>$a_{2,t}$<br>[mm] | Minimum<br>component<br>dimensions<br><br>$b / d$<br>[mm] |
|------------|-------------------------|---------------------------------------|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------------------------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------|
| FIS A M 6  | 5.8                     | 100                                   | 0.4                                                                                                            | 0.7                                                                                                     | 30                                      | 15                                                              | 24                                                            | 30 / 39                                                   |
|            | 5.8                     | 240                                   | 0.6                                                                                                            | 0.9                                                                                                     | 30                                      | 15                                                              | 24                                                            | 30 / 39                                                   |
|            | 8.8                     | 100                                   | 0.4                                                                                                            | 0.8                                                                                                     | 30                                      | 15                                                              | 24                                                            | 30 / 39                                                   |
|            | 8.8                     | 240                                   | 0.8                                                                                                            | 1.1                                                                                                     | 30                                      | 15                                                              | 24                                                            | 30 / 39                                                   |
|            | R-70                    | 100                                   | 0.4                                                                                                            | 0.8                                                                                                     | 30                                      | 15                                                              | 24                                                            | 30 / 39                                                   |
|            | R-70                    | 240                                   | 0.7                                                                                                            | 1.0                                                                                                     | 30                                      | 15                                                              | 24                                                            | 30 / 39                                                   |
| FIS A M 8  | 5.8                     | 100                                   | 0.6                                                                                                            | 1.0                                                                                                     | 40                                      | 20                                                              | 32                                                            | 40 / 52                                                   |
|            | 5.8                     | 320                                   | 1.0                                                                                                            | 1.4                                                                                                     | 40                                      | 20                                                              | 32                                                            | 40 / 52                                                   |
|            | 8.8                     | 100                                   | 0.6                                                                                                            | 1.2                                                                                                     | 40                                      | 20                                                              | 32                                                            | 40 / 52                                                   |
|            | 8.8                     | 320                                   | 1.3                                                                                                            | 1.8                                                                                                     | 40                                      | 20                                                              | 32                                                            | 40 / 52                                                   |
|            | R-70                    | 100                                   | 0.6                                                                                                            | 1.1                                                                                                     | 40                                      | 20                                                              | 32                                                            | 40 / 52                                                   |
|            | R-70                    | 320                                   | 1.2                                                                                                            | 1.7                                                                                                     | 40                                      | 20                                                              | 32                                                            | 40 / 52                                                   |
| FIS A M 10 | 5.8                     | 100                                   | 0.7                                                                                                            | 1.4                                                                                                     | 50                                      | 25                                                              | 40                                                            | 50 / 65                                                   |
|            | 5.8                     | 400                                   | 1.5                                                                                                            | 2.1                                                                                                     | 50                                      | 25                                                              | 40                                                            | 50 / 65                                                   |
|            | 8.8                     | 100                                   | 0.7                                                                                                            | 1.7                                                                                                     | 50                                      | 25                                                              | 40                                                            | 50 / 65                                                   |
|            | 8.8                     | 400                                   | 1.9                                                                                                            | 2.7                                                                                                     | 50                                      | 25                                                              | 40                                                            | 50 / 65                                                   |
|            | R-70                    | 100                                   | 0.7                                                                                                            | 1.6                                                                                                     | 50                                      | 25                                                              | 40                                                            | 50 / 65                                                   |
|            | R-70                    | 400                                   | 1.8                                                                                                            | 2.5                                                                                                     | 50                                      | 25                                                              | 40                                                            | 50 / 65                                                   |
| FIS A M 12 | 5.8                     | 120                                   | 1.0                                                                                                            | 2.0                                                                                                     | 60                                      | 30                                                              | 48                                                            | 60 / 78                                                   |
|            | 5.8                     | 480                                   | 2.1                                                                                                            | 3.0                                                                                                     | 60                                      | 30                                                              | 48                                                            | 60 / 78                                                   |
|            | 8.8                     | 120                                   | 1.0                                                                                                            | 2.4                                                                                                     | 60                                      | 30                                                              | 48                                                            | 60 / 78                                                   |
|            | 8.8                     | 480                                   | 2.6                                                                                                            | 3.7                                                                                                     | 60                                      | 30                                                              | 48                                                            | 60 / 78                                                   |
|            | R-70                    | 120                                   | 1.0                                                                                                            | 2.2                                                                                                     | 60                                      | 30                                                              | 48                                                            | 60 / 78                                                   |
|            | R-70                    | 480                                   | 2.4                                                                                                            | 3.5                                                                                                     | 60                                      | 30                                                              | 48                                                            | 60 / 78                                                   |



| Type       | Material/surface<br>[-] | Gluing length<br><br>l <sub>ad</sub><br>[mm] | Permissible<br>shear load (thin<br>steel attachment<br>part)<br>t ≤ 0,5 · d<br><br>V <sub>perm</sub><br>[kN] | Permissible<br>shear load (thick<br>steel attachment<br>part)<br>t ≥ d <sup>1)</sup><br><br>V <sub>perm</sub><br>[kN] | Minimum<br>spacing<br><br>a <sub>2</sub><br>[mm] | Minimum<br>edge distance<br>(unloaded)<br><br>a <sub>2,c</sub><br>[mm] | Minimum<br>edge distance<br>(loaded)<br><br>a <sub>2,t</sub><br>[mm] | Minimum<br>component<br>dimensions<br><br>b / d<br>[mm] |
|------------|-------------------------|----------------------------------------------|--------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|------------------------------------------------------------------------|----------------------------------------------------------------------|---------------------------------------------------------|
| FIS A M 16 | 5.8                     | 160                                          | 1.8                                                                                                          | 3.4                                                                                                                   | 80                                               | 40                                                                     | 64                                                                   | 80 / 104                                                |
|            | 5.8                     | 640                                          | 3.5                                                                                                          | 4.9                                                                                                                   | 80                                               | 40                                                                     | 64                                                                   | 80 / 104                                                |
|            | 8.8                     | 160                                          | 1.8                                                                                                          | 3.9                                                                                                                   | 80                                               | 40                                                                     | 64                                                                   | 80 / 104                                                |
|            | 8.8                     | 640                                          | 4.3                                                                                                          | 6.1                                                                                                                   | 80                                               | 40                                                                     | 64                                                                   | 80 / 104                                                |
|            | R-70                    | 160                                          | 1.8                                                                                                          | 3.8                                                                                                                   | 80                                               | 40                                                                     | 64                                                                   | 80 / 104                                                |
|            | R-70                    | 640                                          | 4.0                                                                                                          | 5.7                                                                                                                   | 80                                               | 40                                                                     | 64                                                                   | 80 / 104                                                |
| FIS A M 20 | 5.8                     | 200                                          | 2.7                                                                                                          | 5.0                                                                                                                   | 100                                              | 50                                                                     | 80                                                                   | 100 / 130                                               |
|            | 5.8                     | 800                                          | 5.1                                                                                                          | 7.2                                                                                                                   | 100                                              | 50                                                                     | 80                                                                   | 100 / 130                                               |
|            | 8.8                     | 200                                          | 2.7                                                                                                          | 5.8                                                                                                                   | 100                                              | 50                                                                     | 80                                                                   | 100 / 130                                               |
|            | 8.8                     | 800                                          | 6.3                                                                                                          | 9.0                                                                                                                   | 100                                              | 50                                                                     | 80                                                                   | 100 / 130                                               |
|            | R-70                    | 200                                          | 2.7                                                                                                          | 5.6                                                                                                                   | 100                                              | 50                                                                     | 80                                                                   | 100 / 130                                               |
|            | R-70                    | 800                                          | 5.9                                                                                                          | 8.4                                                                                                                   | 100                                              | 50                                                                     | 80                                                                   | 100 / 130                                               |
| FIS A M 24 | 5.8                     | 240                                          | 3.7                                                                                                          | 6.9                                                                                                                   | 120                                              | 60                                                                     | 96                                                                   | 120 / 156                                               |
|            | 5.8                     | 960                                          | 6.9                                                                                                          | 9.8                                                                                                                   | 120                                              | 60                                                                     | 96                                                                   | 120 / 156                                               |
|            | 8.8                     | 240                                          | 3.8                                                                                                          | 8.0                                                                                                                   | 120                                              | 60                                                                     | 96                                                                   | 120 / 156                                               |
|            | 8.8                     | 960                                          | 8.6                                                                                                          | 12.2                                                                                                                  | 120                                              | 60                                                                     | 96                                                                   | 120 / 156                                               |
|            | R-70                    | 240                                          | 3.8                                                                                                          | 7.6                                                                                                                   | 120                                              | 60                                                                     | 96                                                                   | 120 / 156                                               |
|            | R-70                    | 960                                          | 8.1                                                                                                          | 11.4                                                                                                                  | 120                                              | 60                                                                     | 96                                                                   | 120 / 156                                               |
| FIS A M 30 | 5.8                     | 300                                          | 5.5                                                                                                          | 10.0                                                                                                                  | 150                                              | 75                                                                     | 120                                                                  | 150 / 195                                               |
|            | 5.8                     | 1000                                         | 10.0                                                                                                         | 14.2                                                                                                                  | 150                                              | 75                                                                     | 120                                                                  | 150 / 195                                               |
|            | 8.8                     | 300                                          | 5.5                                                                                                          | 11.5                                                                                                                  | 150                                              | 75                                                                     | 120                                                                  | 150 / 195                                               |
|            | 8.8                     | 1000                                         | 12.5                                                                                                         | 17.6                                                                                                                  | 150                                              | 75                                                                     | 120                                                                  | 150 / 195                                               |
|            | R-70                    | 300                                          | 5.5                                                                                                          | 11.0                                                                                                                  | 150                                              | 75                                                                     | 120                                                                  | 150 / 195                                               |
|            | R-70                    | 1000                                         | 11.7                                                                                                         | 16.5                                                                                                                  | 150                                              | 75                                                                     | 120                                                                  | 150 / 195                                               |

<sup>1)</sup> Tolerance of the hole diameter in the steel part must be ≤ 0.1 · d in accordance with DIN EN 1995-1-1

#### Notes:

Drill diameter in the wood 4 mm larger than the outer diameter of the steel rods.

Partial safety factors  $\gamma_{M,H} = 1.3$ ;  $\gamma_{M,S} = 1.25$ ;  $\gamma_{F,global} = 1.4$  and  $k_{mod} = 0.9$  from KLED short and NKL 1+2 taken into account.

Values valid for glued laminated timber ≥ GL24h. Higher load-bearing capacities may be possible for higher strength classes.

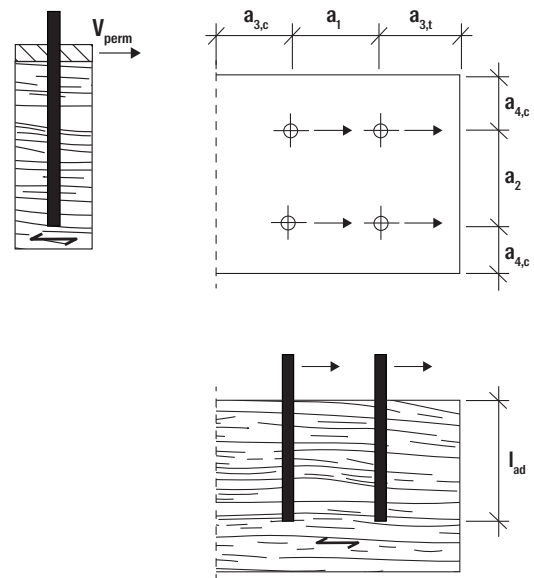
Possible failure of the timber cross-section such as transverse tensile failure and block shear failure must be checked separately!

For groups of steel bars, as well as for combined loading from tensile and shear loads, as well as for bending loads, see Z-9.1-914 and DIN EN 1995-1-1 / NA.

All specified mechanical values must be considered depending on the assumptions made and represent design examples.

This is a planning aid. Projects must be dimensioned exclusively by structural engineers!

All values are subject to typesetting and printing errors.



# Injection system FIS EM Plus with anchor rod FIS A

Permissible shear loads of a single anchor rod in glued laminated timber components  $\geq$  GL24h in a steel / timber connection

Anchor rods bonded perpendicular to the grain direction of the timber component

For the design, the entire approval Z-9.1-914 and DIN EN 1995-1-1:2010-12 / NA must be observed.

| Type       | Material/<br>surface | Gluing<br>length<br><br>$l_{ad}$<br>[mm] | Permissible<br>shear load<br>(thin steel<br>attachment<br>part)<br>$t \leq 0,5 \cdot d$<br><br>$V_{perm}$<br>[kN] | Permissible<br>shear load<br>(thick steel<br>attachment<br>part)<br>$t \geq d^{(1)}$<br><br>$V_{perm}$<br>[kN] | Minimum<br>spacing<br>in fiber<br>direction<br><br>$a_1$<br>[mm] | Minimum<br>spacing<br>perpendicular<br>to the<br>fiber<br><br>$a_2$<br>[mm] | Minimum<br>lateral edge<br>distance<br>(unloaded)<br><br>$a_{4,c}$<br>[mm] | Minimum<br>edge distance<br>end grain<br>(loaded)<br><br>$a_{3,t}$<br>[mm] | Minimum<br>edge distance<br>end grain<br>(unloaded)<br><br>$a_{3,ct}$<br>[mm] | Minimum<br>component<br>dimensions<br><br>$b / d$<br>[mm] |
|------------|----------------------|------------------------------------------|-------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|-----------------------------------------------------------------------------|----------------------------------------------------------------------------|----------------------------------------------------------------------------|-------------------------------------------------------------------------------|-----------------------------------------------------------|
| FIS A M 6  | 5.8                  | 100                                      | 1.9                                                                                                               | 2.7                                                                                                            | 30                                                               | 30                                                                          | 18                                                                         | 80                                                                         | 40                                                                            | 36 / 120                                                  |
|            | 5.8                  | 240                                      | 1.9                                                                                                               | 2.7                                                                                                            | 30                                                               | 30                                                                          | 18                                                                         | 80                                                                         | 40                                                                            | 36 / 260                                                  |
|            | 8.8                  | 100                                      | 2.4                                                                                                               | 3.4                                                                                                            | 30                                                               | 30                                                                          | 18                                                                         | 80                                                                         | 40                                                                            | 36 / 120                                                  |
|            | 8.8                  | 240                                      | 2.4                                                                                                               | 3.4                                                                                                            | 30                                                               | 30                                                                          | 18                                                                         | 80                                                                         | 40                                                                            | 36 / 260                                                  |
|            | R-70                 | 100                                      | 2.2                                                                                                               | 3.2                                                                                                            | 30                                                               | 30                                                                          | 18                                                                         | 80                                                                         | 40                                                                            | 36 / 120                                                  |
|            | R-70                 | 240                                      | 2.2                                                                                                               | 3.2                                                                                                            | 30                                                               | 30                                                                          | 18                                                                         | 80                                                                         | 40                                                                            | 36 / 260                                                  |
| FIS A M 8  | 5.8                  | 100                                      | 3.2                                                                                                               | 4.6                                                                                                            | 40                                                               | 36                                                                          | 24                                                                         | 80                                                                         | 40                                                                            | 48 / 120                                                  |
|            | 5.8                  | 320                                      | 3.2                                                                                                               | 4.6                                                                                                            | 40                                                               | 36                                                                          | 24                                                                         | 80                                                                         | 40                                                                            | 48 / 340                                                  |
|            | 8.8                  | 100                                      | 4.0                                                                                                               | 5.7                                                                                                            | 40                                                               | 36                                                                          | 24                                                                         | 80                                                                         | 40                                                                            | 48 / 120                                                  |
|            | 8.8                  | 320                                      | 4.0                                                                                                               | 5.7                                                                                                            | 40                                                               | 36                                                                          | 24                                                                         | 80                                                                         | 40                                                                            | 48 / 340                                                  |
|            | R-70                 | 100                                      | 3.8                                                                                                               | 5.3                                                                                                            | 40                                                               | 36                                                                          | 24                                                                         | 80                                                                         | 40                                                                            | 48 / 120                                                  |
|            | R-70                 | 320                                      | 3.8                                                                                                               | 5.3                                                                                                            | 40                                                               | 36                                                                          | 24                                                                         | 80                                                                         | 40                                                                            | 48 / 340                                                  |
| FIS A M 10 | 5.8                  | 100                                      | 4.8                                                                                                               | 6.8                                                                                                            | 50                                                               | 42                                                                          | 30                                                                         | 80                                                                         | 40                                                                            | 60 / 120                                                  |
|            | 5.8                  | 400                                      | 4.8                                                                                                               | 6.8                                                                                                            | 50                                                               | 42                                                                          | 30                                                                         | 80                                                                         | 40                                                                            | 60 / 420                                                  |
|            | 8.8                  | 100                                      | 6.0                                                                                                               | 8.3                                                                                                            | 50                                                               | 42                                                                          | 30                                                                         | 80                                                                         | 40                                                                            | 60 / 120                                                  |
|            | 8.8                  | 400                                      | 6.0                                                                                                               | 8.4                                                                                                            | 50                                                               | 42                                                                          | 30                                                                         | 80                                                                         | 40                                                                            | 60 / 420                                                  |
|            | R-70                 | 100                                      | 5.6                                                                                                               | 7.9                                                                                                            | 50                                                               | 42                                                                          | 30                                                                         | 80                                                                         | 40                                                                            | 60 / 120                                                  |
|            | R-70                 | 400                                      | 5.6                                                                                                               | 7.9                                                                                                            | 50                                                               | 42                                                                          | 30                                                                         | 80                                                                         | 40                                                                            | 60 / 420                                                  |
| FIS A M 12 | 5.8                  | 120                                      | 6.6                                                                                                               | 9.4                                                                                                            | 60                                                               | 48                                                                          | 36                                                                         | 84                                                                         | 42                                                                            | 72 / 140                                                  |
|            | 5.8                  | 480                                      | 6.6                                                                                                               | 9.4                                                                                                            | 60                                                               | 48                                                                          | 36                                                                         | 84                                                                         | 42                                                                            | 72 / 500                                                  |
|            | 8.8                  | 120                                      | 8.2                                                                                                               | 11.6                                                                                                           | 60                                                               | 48                                                                          | 36                                                                         | 84                                                                         | 42                                                                            | 72 / 140                                                  |
|            | 8.8                  | 480                                      | 8.3                                                                                                               | 11.7                                                                                                           | 60                                                               | 48                                                                          | 36                                                                         | 84                                                                         | 42                                                                            | 72 / 500                                                  |
|            | R-70                 | 120                                      | 7.7                                                                                                               | 10.9                                                                                                           | 60                                                               | 48                                                                          | 36                                                                         | 84                                                                         | 42                                                                            | 72 / 140                                                  |
|            | R-70                 | 480                                      | 7.7                                                                                                               | 10.9                                                                                                           | 60                                                               | 48                                                                          | 36                                                                         | 84                                                                         | 42                                                                            | 72 / 500                                                  |

| Type       | Material/<br>surface | Gluing<br>length<br><br>$l_{ad}$<br>[mm] | Permissible<br>shear load<br>(thin steel<br>attachment<br>part)<br>$t \leq 0,5 \cdot d$<br><br>$V_{perm}$<br>[kN] | Permissible<br>shear load<br>(thick steel<br>attachment)<br>$t \geq d^{1)}$<br><br>$V_{perm}$<br>[kN] | Minimum<br>spacing<br>in fiber<br>direction<br><br>$a_1$<br>[mm] | Minimum<br>center<br>distance<br>perpendicular<br>to the<br>fiber<br><br>$a_2$<br>[mm] | Minimum<br>lateral edge<br>distance<br>(unloaded)<br><br>$a_{4,c}$<br>[mm] | Minimum<br>edge distance<br>end grain<br>(loaded)<br><br>$a_{3,l}$<br>[mm] | Minimum<br>edge distance<br>end grain<br>(unloaded)<br><br>$a_{3,ct}$<br>[mm] | Minimum<br>component<br>dimensions<br><br>$b / d$<br>[mm] |
|------------|----------------------|------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|----------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----------------------------------------------------------------------------|-------------------------------------------------------------------------------|-----------------------------------------------------------|
| FIS A M 16 | 5.8                  | 160                                      | 11.0                                                                                                              | 15.5                                                                                                  | 80                                                               | 60                                                                                     | 48                                                                         | 112                                                                        | 56                                                                            | 96 / 180                                                  |
|            | 5.8                  | 640                                      | 11.0                                                                                                              | 15.5                                                                                                  | 80                                                               | 60                                                                                     | 48                                                                         | 112                                                                        | 56                                                                            | 96 / 660                                                  |
|            | 8.8                  | 160                                      | 13.6                                                                                                              | 19.3                                                                                                  | 80                                                               | 60                                                                                     | 48                                                                         | 112                                                                        | 56                                                                            | 96 / 180                                                  |
|            | 8.8                  | 640                                      | 13.6                                                                                                              | 19.3                                                                                                  | 80                                                               | 60                                                                                     | 48                                                                         | 112                                                                        | 56                                                                            | 96 / 660                                                  |
|            | R-70                 | 160                                      | 12.8                                                                                                              | 18.1                                                                                                  | 80                                                               | 60                                                                                     | 48                                                                         | 112                                                                        | 56                                                                            | 96 / 180                                                  |
|            | R-70                 | 640                                      | 12.8                                                                                                              | 18.1                                                                                                  | 80                                                               | 60                                                                                     | 48                                                                         | 112                                                                        | 56                                                                            | 96 / 660                                                  |
| FIS A M 20 | 5.8                  | 200                                      | 16.1                                                                                                              | 22.8                                                                                                  | 100                                                              | 72                                                                                     | 60                                                                         | 140                                                                        | 70                                                                            | 120 / 220                                                 |
|            | 5.8                  | 800                                      | 16.1                                                                                                              | 22.8                                                                                                  | 100                                                              | 72                                                                                     | 60                                                                         | 140                                                                        | 70                                                                            | 120 / 820                                                 |
|            | 8.8                  | 200                                      | 20.0                                                                                                              | 28.3                                                                                                  | 100                                                              | 72                                                                                     | 60                                                                         | 140                                                                        | 70                                                                            | 120 / 220                                                 |
|            | 8.8                  | 800                                      | 20.0                                                                                                              | 28.3                                                                                                  | 100                                                              | 72                                                                                     | 60                                                                         | 140                                                                        | 70                                                                            | 120 / 820                                                 |
|            | R-70                 | 200                                      | 18.8                                                                                                              | 26.5                                                                                                  | 100                                                              | 72                                                                                     | 60                                                                         | 140                                                                        | 70                                                                            | 120 / 220                                                 |
|            | R-70                 | 800                                      | 18.8                                                                                                              | 26.6                                                                                                  | 100                                                              | 72                                                                                     | 60                                                                         | 140                                                                        | 70                                                                            | 120 / 820                                                 |
| FIS A M 24 | 5.8                  | 240                                      | 21.9                                                                                                              | 31.0                                                                                                  | 120                                                              | 84                                                                                     | 72                                                                         | 168                                                                        | 84                                                                            | 144 / 260                                                 |
|            | 5.8                  | 960                                      | 22.0                                                                                                              | 31.1                                                                                                  | 120                                                              | 84                                                                                     | 72                                                                         | 168                                                                        | 84                                                                            | 144 / 980                                                 |
|            | 8.8                  | 240                                      | 27.3                                                                                                              | 38.6                                                                                                  | 120                                                              | 84                                                                                     | 72                                                                         | 168                                                                        | 84                                                                            | 144 / 260                                                 |
|            | 8.8                  | 960                                      | 27.3                                                                                                              | 38.6                                                                                                  | 120                                                              | 84                                                                                     | 72                                                                         | 168                                                                        | 84                                                                            | 144 / 980                                                 |
|            | R-70                 | 240                                      | 25.6                                                                                                              | 36.2                                                                                                  | 120                                                              | 84                                                                                     | 72                                                                         | 168                                                                        | 84                                                                            | 144 / 260                                                 |
|            | R-70                 | 960                                      | 25.6                                                                                                              | 36.2                                                                                                  | 120                                                              | 84                                                                                     | 72                                                                         | 168                                                                        | 84                                                                            | 144 / 980                                                 |
| FIS A M 30 | 5.8                  | 300                                      | 31.7                                                                                                              | 44.8                                                                                                  | 150                                                              | 102                                                                                    | 90                                                                         | 210                                                                        | 105                                                                           | 180 / 320                                                 |
|            | 5.8                  | 1000                                     | 31.7                                                                                                              | 44.9                                                                                                  | 150                                                              | 102                                                                                    | 90                                                                         | 210                                                                        | 105                                                                           | 180 / 1020                                                |
|            | 8.8                  | 300                                      | 39.4                                                                                                              | 55.7                                                                                                  | 150                                                              | 102                                                                                    | 90                                                                         | 210                                                                        | 105                                                                           | 180 / 320                                                 |
|            | 8.8                  | 1000                                     | 39.4                                                                                                              | 55.8                                                                                                  | 150                                                              | 102                                                                                    | 90                                                                         | 210                                                                        | 105                                                                           | 180 / 1020                                                |
|            | R-70                 | 300                                      | 36.9                                                                                                              | 52.2                                                                                                  | 150                                                              | 102                                                                                    | 90                                                                         | 210                                                                        | 105                                                                           | 180 / 320                                                 |
|            | R-70                 | 1000                                     | 37.0                                                                                                              | 52.3                                                                                                  | 150                                                              | 102                                                                                    | 90                                                                         | 210                                                                        | 105                                                                           | 180 / 1020                                                |

<sup>1)</sup> Tolerance of the hole diameter in the steel part must be  $\leq 0.1 \cdot d$  in accordance with DIN EN 1995-1-1

#### Notes:

Drill diameter in the wood 4 mm larger than the outer diameter of the steel rods.

Partial safety factors  $\gamma_{M,H} = 1.3$ ;  $\gamma_{M,S} = 1.25$ ;  $\gamma_{F,global} = 1.4$  and  $k_{mod} = 0.9$  from KLED short and NKL 1+2 taken into account.

Values valid for glued laminated timber  $\geq$  GL24h. Higher load-bearing capacities may be possible for higher strength classes.

Possible failure of the timber cross-section such as transverse tensile failure and block shear failure must be checked separately!

For groups of steel bars, as well as for combined loading from tensile and shear loads, as well as for bending loads, see Z-9.1-914 and DIN EN 1995-1-1 / NA.

All specified mechanical values must be considered depending on the assumptions made and represent design examples.

This is a planning aid. Projects must be dimensioned exclusively by structural engineers!

All values are subject to typesetting and printing errors.