

KKF AISI410

PAN HEAD SCREW

PAN HEAD

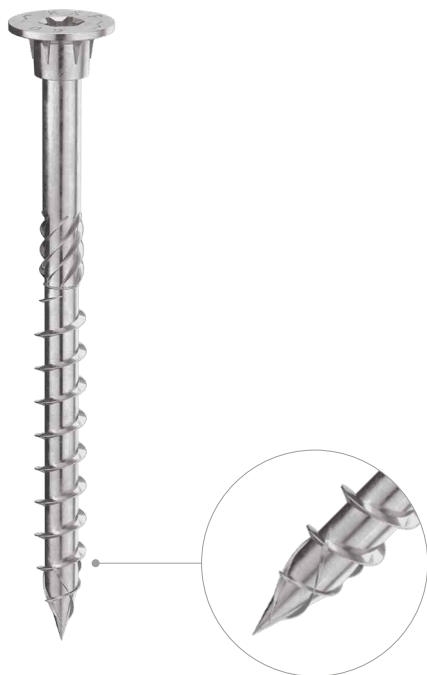
The flat under-head accompanies absorption of the shavings, preventing the wood from cracking and thus ensuring excellent surface finish.

LONGER THREAD

Special asymmetric "umbrella" thread with increased length (60%) for higher grip. Fine thread for the utmost precision when tightening is complete.

OUTDOOR APPLICATIONS ON ACID WOOD

Martensitic stainless steel. This stainless steel offers higher mechanical performance compared to the other available stainless steels. Suitable for outdoor applications and on acid wood, but away from corrosive agents (chlorides, sulphides, etc.).



DIAMETER [in]

0.14 **0.16** 0.24 0.32

LENGTH [in]

13/16 **13/16** 4 3/4 12 5/8

EXPOSURE CONDITION



ATMOSPHERIC CORROSIVITY



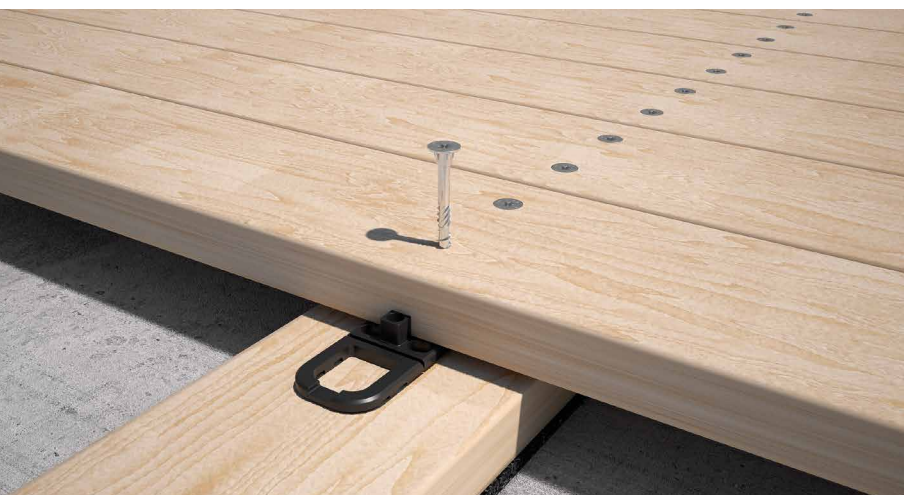
WOOD CORROSIVITY



MATERIAL



AISI410 martensitic stainless steel



FIELDS OF USE

Outdoor use.
Wooden boards with density < 780 kg/m³
[G = 0.92] (without pre-drill).
WPC boards (with pre-drill).

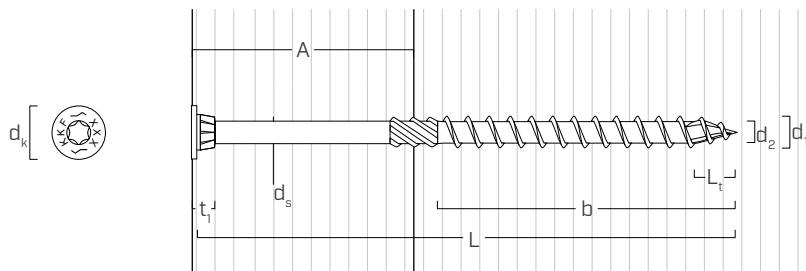
CODES AND DIMENSIONS

| d ₁ [mm] [in] | CODE | L | | b | | A | pcs |
|--------------------------------|------------|------|---------|------|--------|------|-----|
| | | [mm] | [in] | [mm] | [in] | [in] | |
| 4 0.16 #7 TX 20 | KKF430 | 30 | 1 3/16 | 18 | 11/16 | 3/8 | 500 |
| | KKF435 | 35 | 1 3/8 | 20 | 13/16 | 1/2 | 500 |
| | KKF440 | 40 | 1 9/16 | 24 | 15/16 | 1/2 | 500 |
| | KKF445 | 45 | 1 3/4 | 30 | 1 3/16 | 1/2 | 200 |
| | KKF450 | 50 | 1 15/16 | 30 | 1 3/16 | 3/4 | 200 |
| 4,5 0.18 #9 TX 25 | KKF4520(*) | 20 | 13/16 | 15 | 9/16 | 1/8 | 200 |
| | KKF4540 | 40 | 1 9/16 | 24 | 15/16 | 1/2 | 200 |
| | KKF4545 | 45 | 1 3/4 | 30 | 1 3/16 | 1/2 | 200 |
| | KKF4550 | 50 | 1 15/16 | 30 | 1 3/16 | 3/4 | 200 |
| | KKF4560 | 60 | 2 3/8 | 35 | 1 3/8 | 3/4 | 200 |
| | KKF4570 | 70 | 2 3/4 | 40 | 1 9/16 | 1 | 200 |

| d ₁ [mm] [in] | CODE | L | | b | | A | pcs |
|--------------------------------|---------|------|---------|------|---------|-------|-----|
| | | [mm] | [in] | [mm] | [in] | [in] | |
| 5 0.20 #11 TX 25 | KKF540 | 40 | 1 9/16 | 24 | 15/16 | 1/2 | 200 |
| | KKF550 | 50 | 1 15/16 | 30 | 1 3/16 | 3/4 | 200 |
| | KKF560 | 60 | 2 3/8 | 35 | 1 3/8 | 3/4 | 200 |
| | KKF570 | 70 | 2 3/4 | 40 | 1 9/16 | 1 | 100 |
| | KKF580 | 80 | 3 1/8 | 50 | 1 15/16 | 1 | 100 |
| 6 0.24 #14 TX 30 | KKF590 | 90 | 3 1/2 | 55 | 2 3/16 | 1 1/4 | 100 |
| | KKF5100 | 100 | 4 | 60 | 2 3/8 | 1 1/2 | 100 |
| | KKF680 | 80 | 3 1/8 | 40 | 1 9/16 | 1 1/2 | 100 |
| | KKF6100 | 100 | 4 | 50 | 1 15/16 | 1 3/4 | 100 |
| | KKF6120 | 120 | 4 3/4 | 60 | 2 3/8 | 2 1/4 | 100 |

(*)Not holding CE marking.

GEOMETRY AND MECHANICAL CHARACTERISTICS



GEOMETRY

| Nominal diameter | d ₁ | [in] ⁽¹⁾ | 0.16 | 0.18 | 0.20 | 0.24 |
|---|--------------------------|---------------------|-------|-------|-------|-------|
| | | [mm] | 4 | 4,5 | 5 | 6 |
| Outer thread diameter | d ₁ | [in] | 0.157 | 0.177 | 0.197 | 0.236 |
| Head diameter | d _K | [in] | 0.303 | 0.343 | 0.380 | 0.459 |
| Root diameter | d ₂ | [in] | 0.102 | 0.120 | 0.128 | 0.159 |
| Shank diameter | d _S | [in] | 0.114 | 0.132 | 0.142 | 0.169 |
| Head thickness | t ₁ | [in] | 0.197 | 0.197 | 0.236 | 0.276 |
| Tip length | L _t | [in] | 0.157 | 0.177 | 0.197 | 0.236 |
| Pre-drilling hole diameter ⁽²⁾ | d _{V,G≤0.55} | [in] | - | - | 1/8 | 5/32 |
| Pre-drilling hole diameter ⁽³⁾ | d _{V,G>0.55} | [in] | - | - | 9/64 | 5/32 |

⁽¹⁾The nominal diameter of the screw is converted into imperial units and rounded up to the nearest decimal point.

⁽²⁾Pre-drilling applies to wood elements with G≤0.55.

⁽³⁾Pre-drilling applies to wood elements with G>0.55.

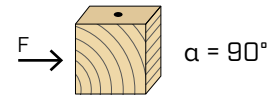
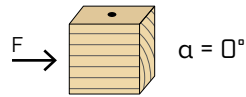
MECHANICAL PARAMETERS

| Nominal diameter | d ₁ | [in] | 0.16 | 0.18 | 0.20 | 0.24 |
|------------------------------------|-------------------|-------|--------|--------|--------|--------|
| Tensile strength (allowable) | f _{tens} | [lbf] | 480 | 740 | 810 | 1170 |
| Bending yield strength (specified) | F _{y,b} | [psi] | 179000 | 185000 | 164000 | 150000 |

| Nominal diameter | d ₁ | [in] | 0.16 | 0.18 | 0.20 | 0.24 |
|------------------------------|-----------------|----------|-------|--------|--------|--------|
| Withdrawal (design value) | W ₉₀ | [lbf/in] | | | | |
| | | G = 0.35 | 86 | 86 | 103 | 131 |
| | | G = 0.42 | 99 | 99 | 119 | 151 |
| | | G = 0.49 | 111 | 111 | 133 | 171 |
| | | G = 0.55 | 121 | 121 | 146 | 188 |
| minimum embedded length | | [in] | 15/16 | 1 1/16 | 1 3/16 | 1 7/16 |

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

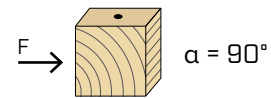
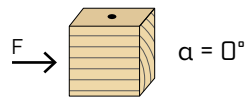
screws inserted **WITHOUT** pre-drilled hole $G \leq 0.48$



| d_1 | [in] | | 0.16 | 0.18 | 0.20 | 0.24 |
|-----------|------|-------------|--------|---------|---------|--------|
| | [mm] | | 4 | 4,5 | 5 | 6 |
| a_1 | [in] | 15·d | 2 3/8 | 2 11/16 | 2 15/16 | 3 1/2 |
| a_2 | [in] | 5·d | 13/16 | 7/8 | 1 | 1 3/16 |
| $a_{3,t}$ | [in] | 15·d | 2 3/8 | 2 11/16 | 2 15/16 | 3 1/2 |
| $a_{3,c}$ | [in] | 10·d | 1 9/16 | 1 3/4 | 1 15/16 | 2 3/8 |
| $a_{4,t}$ | [in] | 10·d | 1 9/16 | 1 3/4 | 1 15/16 | 2 3/8 |
| $a_{4,c}$ | [in] | 5·d | 13/16 | 7/8 | 1 | 1 3/16 |

| | | 0.16 | 0.18 | 0.20 | 0.24 |
|-------------|--|--------|---------|---------|--------|
| | | 4 | 4,5 | 5 | 6 |
| 10·d | | 1 9/16 | 1 3/4 | 1 15/16 | 2 3/8 |
| 5·d | | 13/16 | 7/8 | 1 | 1 3/16 |
| 15·d | | 2 3/8 | 2 11/16 | 2 15/16 | 3 1/2 |
| 10·d | | 1 9/16 | 1 3/4 | 1 15/16 | 2 3/8 |
| 10·d | | 1 9/16 | 1 3/4 | 1 15/16 | 2 3/8 |
| 5·d | | 13/16 | 7/8 | 1 | 1 3/16 |

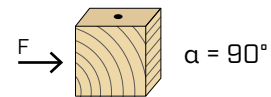
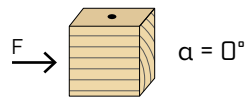
screws inserted **WITHOUT** pre-drilled hole $0.48 < G \leq 0.50$



| d_1 | [in] | | 0.16 | 0.18 | 0.20 | 0.24 |
|-----------|------|-------------|--------|---------|---------|--------|
| | [mm] | | 4 | 4,5 | 5 | 6 |
| a_1 | [in] | 15·d | 2 3/8 | 2 11/16 | 2 15/16 | 3 1/2 |
| a_2 | [in] | 5·d | 13/16 | 7/8 | 1 | 1 3/16 |
| $a_{3,t}$ | [in] | 15·d | 2 3/8 | 2 11/16 | 2 15/16 | 3 1/2 |
| $a_{3,c}$ | [in] | 10·d | 1 9/16 | 1 3/4 | 1 15/16 | 2 3/8 |
| $a_{4,t}$ | [in] | 10·d | 1 9/16 | 1 3/4 | 1 15/16 | 2 3/8 |
| $a_{4,c}$ | [in] | 5·d | 13/16 | 7/8 | 1 | 1 3/16 |

| | | 0.16 | 0.18 | 0.20 | 0.24 |
|-------------|--|--------|---------|---------|--------|
| | | 4 | 4,5 | 5 | 6 |
| 10·d | | 1 9/16 | 1 3/4 | 1 15/16 | 2 3/8 |
| 5·d | | 13/16 | 7/8 | 1 | 1 3/16 |
| 15·d | | 2 3/8 | 2 11/16 | 2 15/16 | 3 1/2 |
| 10·d | | 1 9/16 | 1 3/4 | 1 15/16 | 2 3/8 |
| 10·d | | 1 9/16 | 1 3/4 | 1 15/16 | 2 3/8 |
| 5·d | | 13/16 | 7/8 | 1 | 1 3/16 |

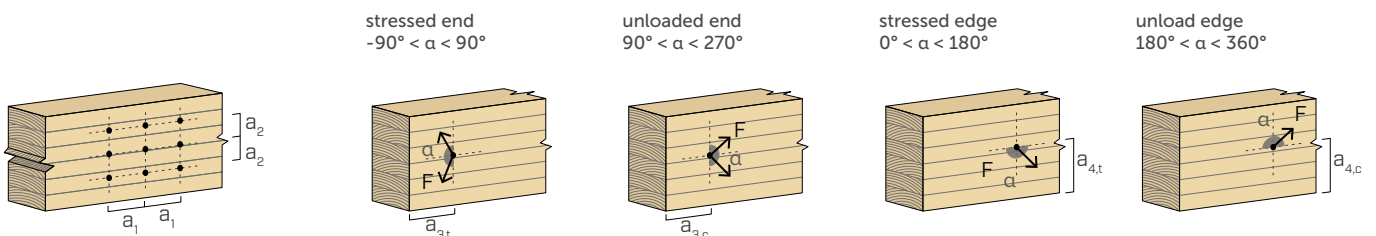
screws inserted **WITHOUT** pre-drilled hole $G > 0.50$



| d_1 | [in] | | 0.16 | 0.18 | 0.20 | 0.24 |
|-----------|------|-------------|-------|---------|---------|---------|
| | [mm] | | 4 | 4,5 | 5 | 6 |
| a_1 | [in] | 15·d | 2 3/8 | 2 11/16 | 2 15/16 | 3 1/2 |
| a_2 | [in] | 7·d | 1 1/8 | 1 1/4 | 1 3/8 | 1 5/8 |
| $a_{3,t}$ | [in] | 20·d | 3 1/8 | 3 1/2 | 4 | 4 3/4 |
| $a_{3,c}$ | [in] | 15·d | 2 3/8 | 2 11/16 | 2 15/16 | 3 1/2 |
| $a_{4,t}$ | [in] | 12·d | 1 7/8 | 2 1/8 | 2 3/8 | 2 13/16 |
| $a_{4,c}$ | [in] | 7·d | 1 1/8 | 1 1/4 | 1 3/8 | 1 5/8 |

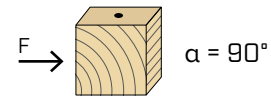
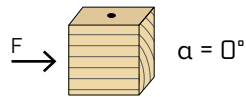
| | | 0.16 | 0.18 | 0.20 | 0.24 |
|-------------|--|--------|---------|---------|---------|
| | | 4 | 4,5 | 5 | 6 |
| 10·d | | 1 9/16 | 1 3/4 | 1 15/16 | 2 3/8 |
| 7·d | | 1 1/8 | 1 1/4 | 1 3/8 | 1 5/8 |
| 20·d | | 3 1/8 | 3 1/2 | 4 | 4 3/4 |
| 15·d | | 2 3/8 | 2 11/16 | 2 15/16 | 3 1/2 |
| 12·d | | 1 7/8 | 2 1/8 | 2 3/8 | 2 13/16 |
| 7·d | | 1 1/8 | 1 1/4 | 1 3/8 | 1 5/8 |

α = load-to-grain angle
 $d = d_1$ = nominal diameter of the screw





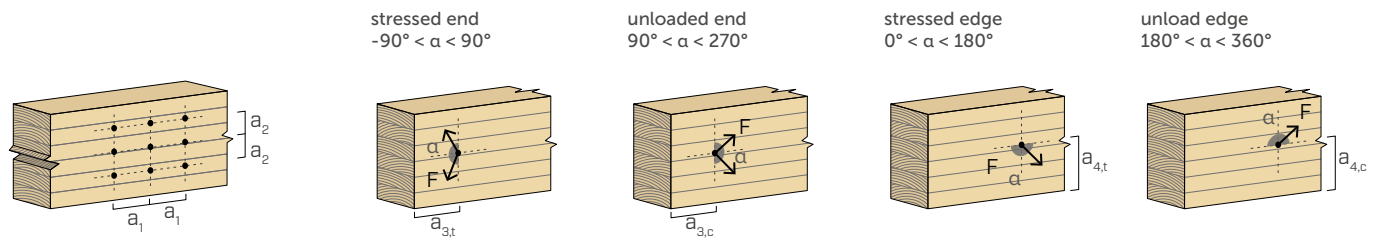
screws inserted **WITH pre-drilled hole**



| d_1 | [in] | 0.16 | 0.18 | 0.20 | 0.24 | | 0.16 | 0.18 | 0.20 | 0.24 |
|-----------|------|-------------|--------|-------|---------|---------|-------------|-------|-------|-------------|
| | [mm] | 4 | 4,5 | 5 | 6 | | 4 | 4,5 | 5 | 6 |
| a_1 | [in] | 10·d | 1 9/16 | 1 3/4 | 1 15/16 | 2 3/8 | 5·d | 13/16 | 7/8 | 1 1 3/16 |
| a_2 | [in] | 4·d | 5/8 | 11/16 | 13/16 | 15/16 | 4·d | 5/8 | 11/16 | 13/16 15/16 |
| $a_{3,t}$ | [in] | 12·d | 1 7/8 | 2 1/8 | 2 3/8 | 2 13/16 | 12·d | 1 7/8 | 2 1/8 | 2 13/16 |
| $a_{3,c}$ | [in] | 7·d | 1 1/8 | 1 1/4 | 1 3/8 | 1 5/8 | 7·d | 1 1/8 | 1 1/4 | 1 3/8 1 5/8 |
| $a_{4,t}$ | [in] | 7·d | 1 1/8 | 1 1/4 | 1 3/8 | 1 5/8 | 7·d | 1 1/8 | 1 1/4 | 1 3/8 1 5/8 |
| $a_{4,c}$ | [in] | 3·d | 1/2 | 9/16 | 9/16 | 11/16 | 3·d | 1/2 | 9/16 | 9/16 11/16 |

α = load-to-grain angle

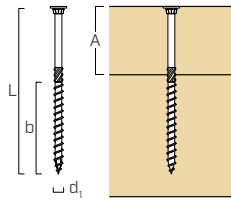
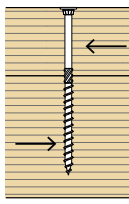
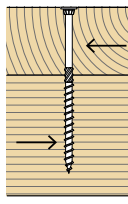
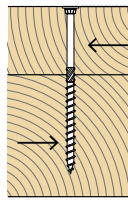
$d = d_1$ = nominal diameter of the screw



NOTES

- Values in blue are from Table 10 of ESR-4645 (REDUCED CONNECTION GEOMETRY REQUIREMENTS BASED ON TESTING);
- The minimum spacing and distances comply with ESR-4645, where d refers to the nominal diameter of the screw, and are valid for screw installed into sawn lumber, structural glued laminated timber and cross laminated timber;
- Wood member stresses must be checked in accordance with the corresponding Sections of the NDS; end distances, edge distances and fastener spacing may need to be increased accordingly.

REFERENCE LATERAL DESIGN VALUES (Z) | WOOD-TO-WOOD

| geometry | | | | $Z_{ }$ | | | | $Z_{\perp/ }$ | | | | Z_{\perp} | | | |
|---|------|------------------------|---------|---|-------|-------|-------|--|-------|-------|-------|---|-------|-------|-------|
|  | | | |  | | | |  | | | |  | | | |
| d_1 | L | | b | G | | | | G | | | | G | | | |
| | | | | 0.35 | 0.42 | 0.49 | 0.55 | 0.35 | 0.42 | 0.49 | 0.55 | 0.35 | 0.42 | 0.49 | 0.55 |
| [mm] [in] | [mm] | [in] | [in] | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] |
| 4 0.16 | 30 | 1 3/16 ⁽¹⁾ | 11/16 | 47 | 55 | 61 | 67 | 43 | 50 | 56 | 61 | 14 | 16 | 18 | 20 |
| | 35 | 1 3/8 ⁽¹⁾ | 13/16 | 54 | 62 | 70 | 76 | 49 | 57 | 64 | 69 | 16 | 19 | 21 | 23 |
| | 40 | 1 9/16 ⁽¹⁾ | 15/16 | 68 | 78 | 87 | 95 | 62 | 71 | 80 | 87 | 20 | 23 | 26 | 29 |
| | 45 | 1 3/4 ⁽²⁾ | 1 3/16 | 88 | 101 | 114 | 124 | 80 | 92 | 103 | 113 | 26 | 30 | 34 | 37 |
| | 50 | 1 15/16 ⁽²⁾ | 1 3/16 | 88 | 101 | 114 | 124 | 80 | 92 | 103 | 113 | 26 | 30 | 34 | 37 |
| 4,5 0.18 | 20 | 13/16 ⁽¹⁾ | 9/16 | 36 | 41 | 46 | 50 | 32 | 37 | 42 | 46 | 11 | 12 | 14 | 15 |
| | 40 | 1 9/16 ⁽¹⁾ | 15/16 | 66 | 76 | 85 | 93 | 60 | 69 | 78 | 85 | 20 | 23 | 26 | 28 |
| | 45 | 1 3/4 ⁽¹⁾ | 1 3/16 | 86 | 99 | 111 | 121 | 79 | 90 | 101 | 111 | 26 | 30 | 33 | 36 |
| | 50 | 1 15/16 ⁽¹⁾ | 1 3/16 | 86 | 99 | 111 | 121 | 79 | 90 | 101 | 111 | 26 | 30 | 33 | 36 |
| | 60 | 2 3/8 ⁽²⁾ | 1 3/8 | 103 | 119 | 133 | 145 | 94 | 108 | 121 | 132 | 31 | 36 | 40 | 44 |
| 5 0.20 | 70 | 2 3/4 ⁽²⁾ | 1 9/16 | 120 | 138 | 155 | 169 | 109 | 126 | 141 | 154 | 36 | 42 | 47 | 51 |
| | 40 | 1 9/16 ⁽¹⁾ | 15/16 | 77 | 89 | 99 | 109 | 70 | 81 | 91 | 99 | 23 | 27 | 30 | 33 |
| | 50 | 1 15/16 ⁽¹⁾ | 1 3/16 | 101 | 117 | 131 | 144 | 92 | 107 | 119 | 131 | 30 | 35 | 39 | 43 |
| | 60 | 2 3/8 ⁽¹⁾ | 1 3/8 | 122 | 141 | 157 | 172 | 111 | 128 | 143 | 157 | 36 | 42 | 47 | 52 |
| | 70 | 2 3/4 ⁽²⁾ | 1 9/16 | 142 | 164 | 183 | 201 | 129 | 149 | 167 | 183 | 43 | 49 | 55 | 60 |
| 6 0.24 | 80 | 3 1/8 | 1 15/16 | 182 | 211 | 236 | 259 | 166 | 192 | 214 | 235 | 55 | 63 | 71 | 78 |
| | 90 | 3 1/2 | 2 3/16 | 203 | 234 | 262 | 287 | 185 | 213 | 238 | 262 | 61 | 70 | 79 | 86 |
| | 100 | 4 | 2 3/8 | 223 | 258 | 288 | 316 | 203 | 234 | 262 | 288 | 67 | 77 | 86 | 95 |
| | 80 | 3 1/8 ⁽¹⁾ | 1 9/16 | 175 | 202 | 229 | 252 | 160 | 184 | 208 | 229 | 53 | 61 | 69 | 75 |
| | 100 | 4 ⁽²⁾ | 1 15/16 | 227 | 262 | 296 | 326 | 207 | 238 | 270 | 296 | 68 | 78 | 89 | 98 |
| | 120 | 4 3/4 | 2 3/8 | 279 | 321 | 364 | 400 | 253 | 292 | 331 | 364 | 84 | 96 | 109 | 120 |

⁽¹⁾ The embedded thread length does not comply with the minimum requirement of ESR-4645 (6 times the outer thread diameter for screws installed at 90° to the grain and 8 times the outer thread diameter for screws installed at an angle 0° ≤ α < 90° to the grain).

⁽²⁾ The embedded thread length does not comply with the minimum requirement of ESR-4645 (8 times the outer thread diameter for screws installed at an angle 0° ≤ α < 90° to the grain).

THREAD WITHDRAWAL (W) | WOOD

| geometry | | | | thread withdrawal $\alpha = 90^\circ$ | | | | thread withdrawal $\alpha = 45^\circ$ | | | | thread withdrawal $\alpha = 0^\circ$ | | | |
|--------------|--------------|------------------------|---------|---------------------------------------|-------|-------|-------|---------------------------------------|-------|-------|-------|--------------------------------------|-------|-------|-------|
| | | | | | | | | | | | | | | | |
| d_1 | L | b | | G | | | | G | | | | G | | | |
| | | | | 0.35 | 0.42 | 0.49 | 0.55 | 0.35 | 0.42 | 0.49 | 0.55 | 0.35 | 0.42 | 0.49 | 0.55 |
| [mm] [in] | [mm] [in] | [in] | [in] | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] |
| 0.16 | 30 | 1 3/16 ⁽¹⁾ | 11/16 | 47 | 55 | 61 | 67 | 43 | 50 | 56 | 61 | 14 | 16 | 18 | 20 |
| | 35 | 1 3/8 ⁽¹⁾ | 13/16 | 54 | 62 | 70 | 76 | 49 | 57 | 64 | 69 | 16 | 19 | 21 | 23 |
| | 40 | 1 9/16 ⁽¹⁾ | 15/16 | 68 | 78 | 87 | 95 | 62 | 71 | 80 | 87 | 20 | 23 | 26 | 29 |
| | 45 | 1 3/4 ⁽²⁾ | 1 3/16 | 88 | 101 | 114 | 124 | 80 | 92 | 103 | 113 | 26 | 30 | 34 | 37 |
| | 50 | 1 15/16 ⁽²⁾ | 1 3/16 | 88 | 101 | 114 | 124 | 80 | 92 | 103 | 113 | 26 | 30 | 34 | 37 |
| 0.18 | 20 | 13/16 ⁽¹⁾ | 9/16 | 36 | 41 | 46 | 50 | 32 | 37 | 42 | 46 | 11 | 12 | 14 | 15 |
| | 40 | 1 9/16 ⁽¹⁾ | 15/16 | 66 | 76 | 85 | 93 | 60 | 69 | 78 | 85 | 20 | 23 | 26 | 28 |
| | 45 | 1 3/4 ⁽¹⁾ | 1 3/16 | 86 | 99 | 111 | 121 | 79 | 90 | 101 | 111 | 26 | 30 | 33 | 36 |
| | 50 | 1 15/16 ⁽¹⁾ | 1 3/16 | 86 | 99 | 111 | 121 | 79 | 90 | 101 | 111 | 26 | 30 | 33 | 36 |
| | 60 | 2 3/8 ⁽²⁾ | 1 3/8 | 103 | 119 | 133 | 145 | 94 | 108 | 121 | 132 | 31 | 36 | 40 | 44 |
| 0.20 | 70 | 2 3/4 ⁽²⁾ | 1 9/16 | 120 | 138 | 155 | 169 | 109 | 126 | 141 | 154 | 36 | 42 | 47 | 51 |
| | 40 | 1 9/16 ⁽¹⁾ | 15/16 | 77 | 89 | 99 | 109 | 70 | 81 | 91 | 99 | 23 | 27 | 30 | 33 |
| | 50 | 1 15/16 ⁽¹⁾ | 1 3/16 | 101 | 117 | 131 | 144 | 92 | 107 | 119 | 131 | 30 | 35 | 39 | 43 |
| | 60 | 2 3/8 ⁽¹⁾ | 1 3/8 | 122 | 141 | 157 | 172 | 111 | 128 | 143 | 157 | 36 | 42 | 47 | 52 |
| | 70 | 2 3/4 ⁽²⁾ | 1 9/16 | 142 | 164 | 183 | 201 | 129 | 149 | 167 | 183 | 43 | 49 | 55 | 60 |
| 0.24 | 80 | 3 1/8 | 1 15/16 | 182 | 211 | 236 | 259 | 166 | 192 | 214 | 235 | 55 | 63 | 71 | 78 |
| | 90 | 3 1/2 | 2 3/16 | 203 | 234 | 262 | 287 | 185 | 213 | 238 | 262 | 61 | 70 | 79 | 86 |
| | 100 | 4 | 2 3/8 | 223 | 258 | 288 | 316 | 203 | 234 | 262 | 288 | 67 | 77 | 86 | 95 |
| | 80 | 3 1/8 ⁽¹⁾ | 1 9/16 | 175 | 202 | 229 | 252 | 160 | 184 | 208 | 229 | 53 | 61 | 69 | 75 |
| | 100 | 4 ⁽²⁾ | 1 15/16 | 227 | 262 | 296 | 326 | 207 | 238 | 270 | 296 | 68 | 78 | 89 | 98 |
| | 120 | 4 3/4 | 2 3/8 | 279 | 321 | 364 | 400 | 253 | 292 | 331 | 364 | 84 | 96 | 109 | 120 |

(1) The embedded thread length does not comply with the minimum requirement of ESR-6465 (8 times the outer thread diameter for screws installed at 90° to the grain and 8 times the outer thread diameter for screws installed at an angle $0^\circ \leq \alpha < 90^\circ$ to the grain).

(2) The embedded thread length does not comply with the minimum requirement of ESR-6465 (8 times the outer thread diameter for screws installed at an angle $0^\circ \leq \alpha < 90^\circ$ to the grain).

GENERAL PRINCIPLES

- Tabulated values comply with NATIONAL DESIGN SPECIFICATION FOR WOOD CONSTRUCTION in accordance with ESR-4645.
- To determine allowable loads for use with ASD, design loads for use with LRFD or both, tabulated values must be multiplied by all adjustment factors included in the NDS for dowel-type fasteners. The design of connection with steel side plate must comply with Section 11.2.3 of the NDS.
- As part of the connection design, the structural wood members, the steel plates must be sized and verified in accordance with the corresponding Section of the NDS and must be done separately by the designer.
- Connections with multiple screws must be designed in accordance with the corresponding Sections of the NDS and ESR-4645.
- KKF AISI410 screws must be installed and used in dry in-service conditions in accordance with the NDS (wet service factor for connection CM is 1.0).
- KKF AISI410 screws must be positioned in accordance with the minimum distances.

REFERENCE LATERAL DESIGN VALUES

- Tabulated values are determined from the yield model equations in the corresponding Section of the NDS.
- Unless otherwise noted, the threaded part of the screw is fully inserted in the main member.
- The screw penetration into the main member is minimum 6 times the outer thread diameter unless otherwise noted.
- The reference lateral design values may be determined for other connection configurations in accordance with the corresponding Section of NDS and ESR-4645.
- The reference lateral design values are calculated for screws inserted without pre-drilling hole. In the case of screws inserted with pre-drilling hole, greater resistance values can be obtained.

WOOD-TO-WOOD

- The wood main member thickness must be greater than the screw length minus the thickness of the wood side member.
- The tabulated lateral design values are based on both wood members having the same specific gravity G.

STEEL-TO-WOOD

- The steel side member must have a minimum tensile strength equal to 58 ksi (400 MPa) and comply with the minimum requirements of ASTM A36.
- The wood main member thickness must be greater than the screw length minus the thickness of the steel side member.
- In case of steel-to-wood connection with a thick plate, it is necessary to assess the effects of wood deformations and install the connectors according to the assembly instructions.

REFERENCE WITHDRAWAL DESIGN VALUES

- The reference withdrawal design values (W_{ref}) expressed in pounds-force per inch of thread penetration into the main member for screws installed at an angle of 90° to the grain can be found in the ESR-4645.
- The values for screws installed at an angle α to the grain are determined by multiplying the reference withdrawal design values with the effective thread penetration L_{eff} of the screw in the wood member and with the factor k_a :

$$W_a = W_{ref} \cdot k_a \cdot L_{eff}$$

Where:

- W_{ref} is the reference withdrawal design value for screws installed at an angle of 90° to the grain, as shown in the table on the left;
- k_a factor is calculated as:

$$k_a = \begin{cases} 35^\circ < \alpha \leq 90^\circ & \frac{1}{1.2 \cdot \cos^2(\alpha) + \sin^2(\alpha)} \\ 0^\circ \leq \alpha \leq 35^\circ & \frac{0.3 + 0.7 \cdot \alpha}{45} \end{cases}$$

- α is the angle between the grain direction and screw axis.

Tabulated values at page 381 are valid for L_{eff} equal to the screw thread length b minus the tip length L_t and $k_a = 1$ for $\alpha = 90^\circ$, $k_a = 0.91$ for $\alpha = 45^\circ$, $k_a = 0.3$ for $\alpha = 0^\circ$.

- The minimum embedded thread length is 6 times the outer thread diameter for screws installed at 90° to the grain, unless otherwise noted.
- The minimum embedded thread length for screws installed at an angle $0^\circ \leq \alpha < 90^\circ$ to the grain is 8 times the outer thread diameter, unless otherwise noted.
- At least four screws must be used in a connection with screws installed in the wood member with an angle between the grain direction and screw axis $\alpha \leq 15^\circ$.
- The reference withdrawal design values must be inferior to f_{tens} of the screw.

REFERENCE HEAD PULL-THROUGH DESIGN VALUES

While designing a connection the head pull-through values must be compared with the tensile resistance of the screw and, if necessary, thread withdrawal. The lower value is the governing one.