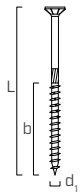
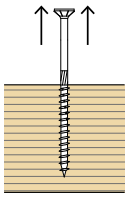
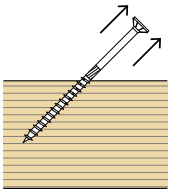
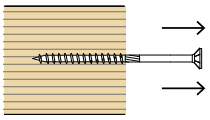
## THREAD WITHDRAWAL (W) | WOOD

| geometry | | | | thread withdrawal α = 90° | | | | thread withdrawal α = 45° | | | | thread withdrawal α = 0° | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | | | |  | | | |  | | | |  | | | |
| $d_1$ | 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] |
| 3,5 **0.14** | 40 | 1 9/16(1) | 11/16 | 49 | 57 | 63 | 69 | 45 | 51 | 58 | 63 | 15 | 17 | 19 | 21 |
| | 45-50 | 1 3/4 - 1 15/16(1) | 15/16 | 69 | 80 | 90 | 98 | 63 | 73 | 82 | 89 | 21 | 24 | 27 | 29 |
| 4 **0.16** | 30-35 | 1 3/16 - 1 3/8(1) | 11/16 | 47 | 55 | 61 | 67 | 43 | 50 | 56 | 61 | 14 | 16 | 18 | 20 |
| | 40 | 1 9/16(1) | 15/16 | 68 | 78 | 87 | 95 | 62 | 71 | 80 | 87 | 20 | 23 | 26 | 29 |
| | 45-50 | 1 3/4 - 1 15/16(2) | 1 3/16 | 88 | 101 | 114 | 124 | 80 | 92 | 103 | 113 | 26 | 30 | 34 | 37 |
| | 60 | 2 3/8(2) | 1 3/8 | 105 | 121 | 135 | 148 | 96 | 110 | 123 | 134 | 31 | 36 | 41 | 44 |
| | 70-80 | 2 3/4 - 3 1/8 | 1 9/16 | 122 | 140 | 157 | 171 | 111 | 128 | 143 | 156 | 37 | 42 | 47 | 51 |
| 4,5 **0.18** | 40 | 1 9/16(1) | 15/16 | 66 | 76 | 85 | 93 | 60 | 69 | 78 | 85 | 20 | 23 | 26 | 28 |
| | 45-50 | 1 3/4 - 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 |
| | 70-80 | 2 3/4 - 3 1/8(2) | 1 9/16 | 120 | 138 | 155 | 169 | 109 | 126 | 141 | 154 | 36 | 42 | 47 | 51 |
| 5 **0.20** | 40-50 | 1 9/16 - 1 15/16(1) | 15/16 | 77 | 89 | 99 | 109 | 70 | 81 | 91 | 99 | 23 | 27 | 30 | 33 |
| | 60 | 2 3/8(1) | 1 3/16 | 101 | 117 | 131 | 144 | 92 | 107 | 119 | 131 | 30 | 35 | 39 | 43 |
| | 70 | 2 3/4(1) | 1 3/8 | 122 | 141 | 157 | 172 | 111 | 128 | 143 | 157 | 36 | 42 | 47 | 52 |
| | 80 | 3 1/8(2) | 1 9/16 | 142 | 164 | 183 | 201 | 129 | 149 | 167 | 183 | 43 | 49 | 55 | 60 |
| | 90 | 3 1/2(2) | 1 3/4 | 162 | 187 | 209 | 230 | 148 | 171 | 191 | 209 | 49 | 56 | 63 | 69 |
| | 100 | 4 | 1 15/16 | 182 | 211 | 236 | 259 | 166 | 192 | 214 | 235 | 55 | 63 | 71 | 78 |
| | 120 | 4 3/4 | 2 3/8 | 223 | 258 | 288 | 316 | 203 | 234 | 262 | 288 | 67 | 77 | 86 | 95 |
| 6 **0.24** | 40-50 | 1 9/16 - 1 15/16(1) | 1 3/8 | 150 | 172 | 195 | 215 | 136 | 157 | 178 | 195 | 45 | 52 | 59 | 64 |
| | 60 | 2 3/8(1) | 1 3/16 | 124 | 143 | 162 | 178 | 113 | 130 | 147 | 162 | 37 | 43 | 48 | 53 |
| | 70-80 | 2 3/4 - 3 1/8(1) | 1 9/16 | 175 | 202 | 229 | 252 | 160 | 184 | 208 | 229 | 53 | 61 | 69 | 75 |
| | 90-100 | 3 1/2 - 4(2) | 1 15/16 | 227 | 262 | 296 | 326 | 207 | 238 | 270 | 296 | 68 | 78 | 89 | 98 |
| | 110-130 | 4 3/8 - 5 1/8 | 2 3/8 | 279 | 321 | 364 | 400 | 253 | 292 | 331 | 364 | 84 | 96 | 109 | 120 |
| | 140-400 | 5 1/2 - 15 3/4 | 2 15/16 | 356 | 410 | 465 | 511 | 324 | 373 | 423 | 465 | 107 | 123 | 139 | 153 |
| 8 **0.32** | 80-100 | 3 1/8 - 4(1) | 2 1/16 | 298 | 345 | 390 | 428 | 271 | 314 | 355 | 389 | 89 | 103 | 117 | 128 |
| | 120-140 | 4 3/4 - 5 1/2(2) | 2 3/8 | 352 | 407 | 461 | 506 | 320 | 371 | 419 | 460 | 106 | 122 | 138 | 152 |
| | 160-280 | 6 1/4 - 11 | 3 1/8 | 488 | 564 | 638 | 700 | 444 | 513 | 580 | 637 | 146 | 169 | 191 | 210 |
| | 300-600 | 11 3/4 - 23 5/8 | 4 | 623 | 721 | 815 | 895 | 567 | 656 | 742 | 814 | 187 | 216 | 244 | 268 |
| 10 **0.40** | 80-100 | 3 1/8 - 4(1) | 2 1/16 | 341 | 395 | 446 | 489 | 310 | 360 | 406 | 445 | 102 | 119 | 134 | 147 |
| | 120-140 | 4 3/4 - 5 1/2(1) | 2 3/8 | 406 | 470 | 531 | 583 | 369 | 428 | 484 | 530 | 122 | 141 | 159 | 175 |
| | 160-280 | 6 1/4 - 11(2) | 3 1/8 | 568 | 659 | 744 | 816 | 517 | 599 | 677 | 742 | 170 | 198 | 223 | 245 |
| | 300-600 | 11 3/4 - 23 5/8 | 4 | 730 | 847 | 957 | 1049 | 664 | 771 | 871 | 954 | 219 | 254 | 287 | 315 |
| 12 **0.48** | 120-280 | 4 3/4 - 11(1) | 3 1/8 | 589 | 683 | 771 | 846 | 536 | 621 | 702 | 770 | 177 | 205 | 231 | 254 |
| | 320-1000 | 12 5/8 - 39 3/8 | 4 3/4 | 935 | 1084 | 1225 | 1344 | 851 | 987 | 1114 | 1223 | 281 | 325 | 367 | 403 |

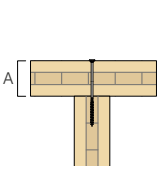
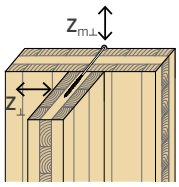
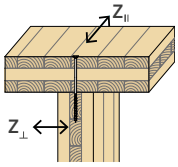
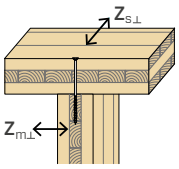
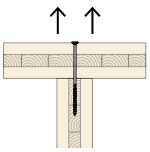
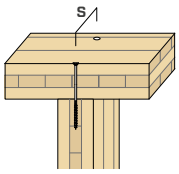
(1) The embedded thread length does not comply with the minimum requirement of ESR-4645 (6 times the outer thread diameter for screws installed at 90° to the grain and 8 times the outer thread diameter for screws installed at an angle 0°≤ α <90° to the grain).
(2) The embedded thread length does not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

## HEAD PULL-THROUGH ($W_H$) | WOOD

| geometry | | | head pull through 90° ≤ α ≤ 30° | | | |
|---|---|---|---|---|---|---|
| $d_1$ | | $d_k$ | G | | | |
| | | | 0.35 | 0.42 | 0.49 | 0.55 |
| [mm] | [in] | [in] | [lbf] | [lbf] | [lbf] | [lbf] |
| 3,5 | 0.14 | 0.28 | 51 | 59 | 67 | 73 |
| 4 | 0.16 | 0.31 | 75 | 87 | 98 | 108 |
| 4,5 | 0.18 | 0.35 | 95 | 110 | 124 | 136 |
| 5 | 0.20 | 0.39 | 117 | 136 | 153 | 168 |
| 6 | 0.24 | 0.47 | 142 | 165 | 186 | 204 |
| 8 | 0.32 | 0.57 | 220 | 264 | 298 | 327 |
| 10 | 0.40 | 0.72 | 273 | 316 | 357 | 392 |
| 12 | 0.48 | 0.82 | 392 | 453 | 513 | 562 |

NOTES and GENERAL PRINCIPLES on page 50.

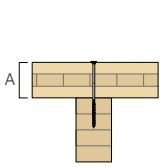
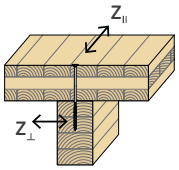
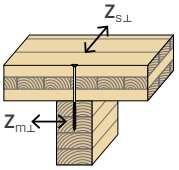
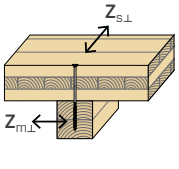
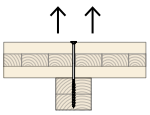
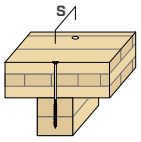
# CLT | WALL-TO-WALL | FLOOR-TO-WALL

| | | | | | SHEAR | | | | | | TENSION | SPACING | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| geometry | | | | | wall-to-wall | | floor-to-wall orientation 1 | | floor-to-wall orientation 2 | | withdrawal / head pull-through | fastener in a row | |
| | | | | |  | |  |  |  |  |  | | |
| side member thickness (wall/floor) = A | | suggested screw | | | $Z_{\perp}$ | $Z_{m\perp}$ | $Z_{\perp}$ | $Z_{\parallel}$ | $Z_{m\perp}$ | $Z_{s\perp}$ | W(*) | minimum | typical |
| [mm] | [in] | CODE | | | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] | [in] | [in] |
| 3 PLY | 60 | 2 3/8 | HBS6120 | or longer | 110 | 110 | 110 | 110 | 110 | 110 | 165 | 3 1/2 | 6 |
| | | | HBS8120 | | 131 | 131 | 131 | 164 | 131 | 131 | 264 | 3 1/8 | 6 |
| | | | HBS10120 | | 122 | 145 | 122 | 208 | 145 | 143 | 316 | 4 | 8 |
| | | | HBS12160 | | 158 | 189 | 158 | 258 | 189 | 168 | 453 | 4 3/4 | 10 |
| | 79 | 3 1/8 | HBS6160 | | 110 | 110 | 110 | 110 | 110 | 110 | 165 | 3 1/2 | 6 |
| | | | HBS8160 | | 131 | 131 | 131 | 164 | 131 | 131 | 264 | 3 1/8 | 6 |
| | | | HBS10160 | | 155 | 167 | 155 | 226 | 167 | 167 | 316 | 4 | 8 |
| | | | HBS12160 | | 167 | 188 | 167 | 259 | 188 | 189 | 453 | 4 3/4 | 10 |
| | 105 | 4 1/8 | HBS6180 | | 110 | 110 | 110 | 110 | 110 | 110 | 165 | 3 1/2 | 6 |
| | | | HBS8200 | | 131 | 131 | 131 | 164 | 131 | 131 | 264 | 3 1/8 | 6 |
| | | | HBS10200 | | 155 | 167 | 155 | 226 | 167 | 167 | 316 | 4 | 8 |
| | | | HBS12200 | | 175 | 189 | 175 | 259 | 189 | 189 | 453 | 4 3/4 | 10 |
| | 120 | 4 3/4 | HBS6200 | | 110 | 110 | 110 | 110 | 110 | 110 | 165 | 3 1/2 | 6 |
| | | | HBS8200 | | 131 | 131 | 131 | 164 | 131 | 131 | 264 | 3 1/8 | 6 |
| | | | HBS10200 | | 155 | 167 | 155 | 226 | 167 | 167 | 316 | 4 | 8 |
| | | | HBS12200 | | 175 | 189 | 175 | 259 | 189 | 189 | 453 | 4 3/4 | 10 |
| 5 PLY | 100 | 3 15/16 | HBS6180 | | 110 | 110 | 110 | 110 | 110 | 110 | 165 | 3 1/2 | 6 |
| | | | HBS8180 | | 131 | 131 | 131 | 164 | 131 | 131 | 264 | 3 1/8 | 6 |
| | | | HBS10180 | | 155 | 167 | 155 | 226 | 167 | 167 | 316 | 4 | 8 |
| | | | HBS12200 | | 175 | 189 | 175 | 259 | 189 | 189 | 453 | 4 3/4 | 10 |
| | 140 | 5 1/2 | HBS6220 | | 110 | 110 | 110 | 110 | 110 | 110 | 165 | 3 1/2 | 6 |
| | | | HBS8220 | | 131 | 131 | 131 | 164 | 131 | 131 | 264 | 3 1/8 | 6 |
| | | | HBS10220 | | 155 | 167 | 155 | 226 | 167 | 167 | 316 | 4 | 8 |
| | | | HBS12240 | | 175 | 189 | 175 | 259 | 189 | 189 | 453 | 4 3/4 | 10 |
| | 175 | 6 7/8 | HBS6260 | | 110 | 110 | 110 | 110 | 110 | 110 | 165 | 3 1/2 | 6 |
| | | | HBS8260 | | 131 | 131 | 131 | 164 | 131 | 131 | 264 | 3 1/8 | 6 |
| | | | HBS10260 | | 155 | 167 | 155 | 226 | 167 | 167 | 316 | 4 | 8 |
| | | | HBS12280 | | 175 | 189 | 175 | 259 | 189 | 189 | 453 | 4 3/4 | 10 |
| | 200 | 7 7/8 | HBS6280 | | 110 | 110 | 110 | 110 | 110 | 110 | 165 | 3 1/2 | 6 |
| | | | HBS8280 | | 131 | 131 | 131 | 164 | 131 | 131 | 264 | 3 1/8 | 6 |
| | | | HBS10280 | | 155 | 167 | 155 | 226 | 167 | 167 | 316 | 4 | 8 |
| | | | HBS12280 | | 175 | 188 | 175 | 259 | 188 | 189 | 453 | 4 3/4 | 10 |
| 7 PLY | 140 | 5 1/2 | HBS6220 | | 110 | 110 | 110 | 110 | 110 | 110 | 165 | 3 1/2 | 6 |
| | | | HBS8220 | | 131 | 131 | 131 | 164 | 131 | 131 | 264 | 3 1/8 | 6 |
| | | | HBS10220 | | 155 | 167 | 155 | 226 | 167 | 167 | 316 | 4 | 8 |
| | | | HBS12240 | | 175 | 189 | 175 | 259 | 189 | 189 | 453 | 4 3/4 | 10 |
| | 191 | 7 1/2 | HBS6280 | | 110 | 110 | 110 | 110 | 110 | 110 | 165 | 3 1/2 | 6 |
| | | | HBS8280 | | 131 | 131 | 131 | 164 | 131 | 131 | 264 | 3 1/8 | 6 |
| | | | HBS10280 | | 155 | 167 | 155 | 226 | 167 | 167 | 316 | 4 | 8 |
| | | | HBS12280 | | 175 | 189 | 175 | 259 | 189 | 189 | 453 | 4 3/4 | 10 |
| | 244 | 9 5/8 | HBS6320 | | 110 | 110 | 110 | 110 | 110 | 110 | 165 | 3 1/2 | 6 |
| | | | HBS8360 | | 131 | 131 | 131 | 164 | 131 | 131 | 264 | 3 1/8 | 6 |
| | | | HBS10360 | | 155 | 167 | 155 | 226 | 167 | 167 | 316 | 4 | 8 |
| | | | HBS12400 | | 175 | 189 | 175 | 259 | 189 | 189 | 453 | 4 3/4 | 10 |
| | 280 | 11 | HBS6360 | | 110 | 110 | 110 | 110 | 110 | 110 | 165 | 3 1/2 | 6 |
| | | | HBS8380 | | 131 | 131 | 131 | 164 | 131 | 131 | 264 | 3 1/8 | 6 |
| | | | HBS10380 | | 155 | 167 | 155 | 226 | 167 | 167 | 316 | 4 | 8 |
| | | | HBS12400 | | 175 | 189 | 175 | 259 | 189 | 189 | 453 | 4 3/4 | 10 |

(*) Minimum between head pull-through and withdrawal resistance

NOTES and GENERAL PRINCIPLES on page 50.

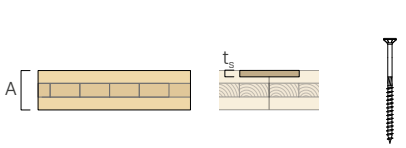
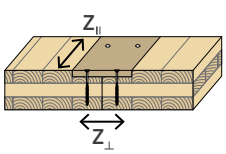
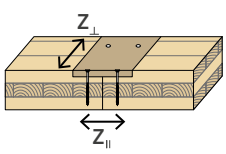
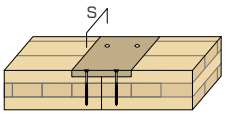
# CLT | FLOOR-TO-BEAM

| geometry | | | SHEAR | | | | | | | | TENSION | SPACING | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | floor-to-beam orientation 1 | | floor-to-beam orientation 2 | | floor-to-double lumber 2" orientation 1 | | floor-to-double lumber 2" orientation 2 | | withdrawal / head pull-through | fastener in a row | |
| | | |  | |  | |  | |  | |  |  | |
| side member thickness (wall/floor) = A | | suggested screw | $Z_{\perp}$ | $Z_{\parallel}$ | $Z_{m\perp}$ | $Z_{s\perp}$ | $Z_{\perp}$ | $Z_{\parallel}$ | $Z_{m\perp}$ | $Z_{s\perp}$ | W(*) | minimum | typical |
| [mm] | [in] | CODE | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] | [lbf] | [in] | [in] |
| 5 PLY | | | | | | | | | | | | | |
| 100 | 3 15/16 | HBS6180 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 3 1/2 | 6 |
| | | HBS8180 | 196 | 245 | 196 | 196 | 196 | 245 | 196 | 196 | 264 | 3 1/8 | 6 |
| | | HBS10180 | 232 | 338 | 249 | 249 | 232 | 338 | 167 | 249 | 316 | 4 | 8 |
| | | HBS12200 | 261 | 387 | 282 | 282 | 261 | 387 | 282 | 282 | 453 | 4 3/4 | 10 |
| 140 | 5 1/2 | HBS6220 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 3 1/2 | 6 |
| | | HBS8220 | 196 | 245 | 196 | 196 | 196 | 245 | 196 | 196 | 264 | 3 1/8 | 6 |
| | | HBS10220 | 232 | 338 | 249 | 249 | 232 | 338 | 249 | 249 | 316 | 4 | 8 |
| | | HBS12240 | 261 | 387 | 282 | 282 | 261 | 387 | 282 | 282 | 453 | 4 3/4 | 10 |
| 175 | 6 7/8 | HBS6260 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 3 1/2 | 6 |
| | | HBS8260 | 196 | 245 | 196 | 196 | 196 | 245 | 196 | 196 | 264 | 3 1/8 | 6 |
| | | HBS10260 | 232 | 338 | 167 | 249 | 232 | 338 | 167 | 249 | 316 | 4 | 8 |
| | | HBS12240 | 237 | 387 | 252 | 282 | 237 | 387 | 252 | 282 | 453 | 4 3/4 | 10 |
| | | HBS12280 | 261 | 387 | 282 | 282 | - | - | - | - | 453 | 4 3/4 | 10 |
| 200 | 7 7/8 | HBS6280 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 3 1/2 | 6 |
| | | HBS8280 | 196 | 245 | 196 | 196 | 196 | 245 | 196 | 196 | 264 | 3 1/8 | 6 |
| | | HBS10280 | 232 | 338 | 249 | 249 | 232 | 338 | 249 | 249 | 316 | 4 | 8 |
| | | HBS12280 | 261 | 387 | 281 | 282 | 261 | 387 | 281 | 282 | 453 | 4 3/4 | 10 |
| 7 PLY | | | | | | | | | | | | | |
| 140 | 5 1/2 | HBS6220 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 3 1/2 | 6 |
| | | HBS8220 | 196 | 245 | 196 | 196 | 196 | 245 | 196 | 196 | 264 | 3 1/8 | 6 |
| | | HBS10220 | 232 | 338 | 249 | 249 | 232 | 338 | 249 | 249 | 316 | 4 | 8 |
| | | HBS12240 | 261 | 387 | 282 | 282 | 261 | 387 | 282 | 282 | 453 | 4 3/4 | 10 |
| 191 | 7 1/2 | HBS6280 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 3 1/2 | 6 |
| | | HBS8280 | 196 | 245 | 196 | 196 | 196 | 245 | 196 | 196 | 264 | 3 1/8 | 6 |
| | | HBS10280 | 232 | 338 | 249 | 249 | 232 | 338 | 249 | 249 | 316 | 4 | 8 |
| | | HBS12280 | 261 | 387 | 282 | 282 | 261 | 387 | 282 | 282 | 453 | 4 3/4 | 10 |
| 244 | 9 5/8 | HBS6320 | 165 | 165 | 110 | 165 | 165 | 165 | 110 | 165 | 165 | 3 1/2 | 6 |
| | | HBS8340 | 196 | 245 | 196 | 196 | 196 | 245 | 196 | 196 | 264 | 3 1/8 | 6 |
| | | HBS8360 | 196 | 245 | 131 | 196 | - | - | - | - | 264 | 3 1/8 | 6 |
| | | HBS10340 | 232 | 338 | 249 | 249 | 232 | 338 | 249 | 249 | 316 | 4 | 8 |
| | | HBS10360 | 232 | 338 | 249 | 249 | - | - | - | - | 316 | 4 | 8 |
| | | HBS12320 | 258 | 387 | 183 | 282 | 258 | 387 | 183 | 282 | 453 | 4 3/4 | 10 |
| | | HBS12400 | 261 | 387 | 282 | 282 | - | - | - | - | 453 | 4 3/4 | 10 |
| 280 | 11 | HBS6360 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 3 1/2 | 6 |
| | | HBS8380 | 196 | 245 | 196 | 196 | 196 | 245 | 196 | 196 | 264 | 3 1/8 | 6 |
| | | HBS10380 | 232 | 338 | 167 | 249 | 232 | 338 | 167 | 249 | 316 | 4 | 8 |
| | | HBS12360 | 261 | 387 | 282 | 282 | 261 | 387 | 282 | 282 | 453 | 4 3/4 | 10 |
| | | HBS12400 | 261 | 387 | 282 | 282 | - | - | - | - | 453 | 4 3/4 | 10 |
| 9 PLY | | | | | | | | | | | | | |
| 180 | 7 1/16 | HBS6260 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 3 1/2 | 6 |
| | | HBS8260 | 196 | 245 | 196 | 196 | 196 | 245 | 196 | 196 | 264 | 3 1/8 | 6 |
| | | HBS10260 | 232 | 338 | 249 | 249 | 232 | 338 | 249 | 249 | 316 | 4 | 8 |
| | | HBS12280 | 261 | 387 | 282 | 282 | 261 | 387 | 282 | 282 | 453 | 4 3/4 | 10 |
| 267 | 10 1/2 | HBS6360 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 3 1/2 | 6 |
| | | HBS8360 | 196 | 245 | 196 | 196 | 196 | 245 | 196 | 196 | 264 | 3 1/8 | 6 |
| | | HBS8380 | 196 | 245 | 196 | 196 | - | - | - | - | 264 | 3 1/8 | 6 |
| | | HBS10360 | 232 | 338 | 249 | 249 | 232 | 338 | 249 | 249 | 316 | 4 | 8 |
| | | HBS10380 | 232 | 338 | 249 | 249 | - | - | - | - | 316 | 4 | 8 |
| | | HBS12360 | 261 | 387 | 282 | 282 | 261 | 387 | 282 | 282 | 453 | 4 3/4 | 10 |
| | | HBS12400 | 261 | 387 | 189 | 282 | - | - | - | - | 453 | 4 3/4 | 10 |

(*)Minumum between head pull-through and withdrawal resistance

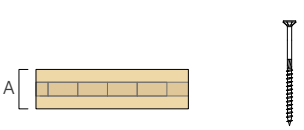
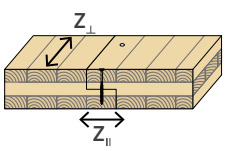
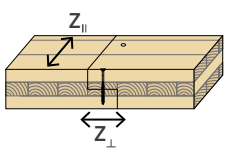
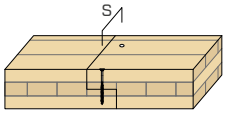
NOTES and GENERAL PRINCIPLES on page 50.

# CLT | SPLINE JOINT

| | | | | SHEAR | | | | SPACING | |
|---|---|---|---|---|---|---|---|---|---|
| geometry | | | | spline joint orientation 1 | | spline joint orientation 2 | | fastener in a row | |
|  | | | |  | |  | |  | |
| panel thickness (wall/floor) = A | | spline thickness = $t_s$ | suggested screw | $Z_{\parallel}$ | $Z_{\perp}$ | $Z_{\parallel}$ | $Z_{\perp}$ | minimum | typical |
| [mm] | [in] | [in] | CODE | [lbf] | [lbf] | [lbf] | [lbf] | [in] | [in] |
| 3 PLY | 79 | 3 1/8 | 1/2 | HBS550 | 91 | 91 | 91 | 91 | 2 15/16 | 3 |
| | | | | HBS650 | 107 | 107 | 107 | 107 | 3 1/2 | 4 |
| | | | 3/4 | HBS560 | 95 | 95 | 95 | 95 | 2 15/16 | 3 |
| | | | | HBS660 | 120 | 120 | 120 | 120 | 3 1/2 | 4 |
| | | | 1 | HBS570 | 103 | 103 | 103 | 103 | 2 15/16 | 3 |
| | | | | HBS670 | 128 | 128 | 128 | 128 | 3 1/2 | 4 |
| | 86 | 3 3/8 | 1/2 | HBS560 | 91 | 91 | 91 | 91 | 2 15/16 | 3 |
| | | | | HBS660 | 116 | 116 | 116 | 116 | 3 1/2 | 4 |
| | | | 3/4 | HBS570 | 95 | 95 | 95 | 95 | 2 15/16 | 3 |
| | | | | HBS670 | 120 | 120 | 120 | 120 | 3 1/2 | 4 |
| | | | 1 | HBS680 | 128 | 128 | 128 | 128 | 3 1/2 | 4 |
| | | | | HBS880 | 179 | 143 | 179 | 143 | 3 1/8 | 4 |
| | 105 | 4 1/8 | 1/2 | HBS670 | 91 | 91 | 91 | 91 | 2 15/16 | 3 |
| | | | | HBS870 | 116 | 116 | 116 | 116 | 3 1/2 | 4 |
| | | | 3/4 | HBS680 | 120 | 120 | 120 | 120 | 3 1/2 | 4 |
| | | | | HBS880 | 173 | 139 | 173 | 139 | 3 1/8 | 4 |
| | | | 1 | HBS690 | 128 | 128 | 128 | 128 | 3 1/2 | 4 |
| | | | | HBS890 | 179 | 143 | 179 | 143 | 3 1/8 | 4 |
| 5 PLY | 130 | 5 1/8 | 3/4 | HBS680 | 120 | 120 | 120 | 120 | 3 1/2 | 4 |
| | | | | HBS880 | 173 | 139 | 173 | 139 | 3 1/8 | 4 |
| | | | 1 | HBS690 | 128 | 128 | 128 | 128 | 3 1/2 | 4 |
| | | | | HBS880 | 179 | 143 | 179 | 143 | 3 1/8 | 4 |
| | | | | HBS1080 | 202 | 128 | 202 | 128 | 4 | 6 |
| | 140 | 5 1/2 | 3/4 | HBS690 | 120 | 120 | 120 | 120 | 3 1/2 | 4 |
| | | | | HBS8100 | 173 | 139 | 173 | 139 | 3 1/8 | 4 |
| | | | 1 | HBS6100 | 128 | 128 | 128 | 128 | 3 1/2 | 4 |
| | | | | HBS8100 | 179 | 143 | 179 | 143 | 3 1/8 | 4 |
| | | | | HBS10100 | 211 | 164 | 211 | 164 | 4 | 6 |
| | 175 | 6 7/8 | 3/4 | HBS6100 | 120 | 120 | 120 | 120 | 3 1/2 | 4 |
| | | | | HBS8100 | 173 | 139 | 173 | 139 | 3 1/8 | 4 |
| | | | 1 | HBS6120 | 128 | 128 | 128 | 128 | 3 1/2 | 4 |
| | | | | HBS8120 | 179 | 143 | 179 | 143 | 3 1/8 | 4 |
| | | | | HBS10120 | 211 | 164 | 211 | 164 | 4 | 6 |
| 7 PLY | 191 | 7 1/2 | 3/4 | HBS690 | 120 | 120 | 120 | 120 | 3 1/2 | 4 |
| | | | | HBS890 | 173 | 139 | 173 | 139 | 3 1/8 | 4 |
| | | | 1 | HBS6100 | 128 | 128 | 128 | 128 | 3 1/2 | 4 |
| | | | | HBS8100 | 179 | 143 | 179 | 143 | 3 1/8 | 4 |
| | | | | HBS10120 | 211 | 164 | 211 | 164 | 4 | 6 |
| | 220 | 8 5/8 | 3/4 | HBS6100 | 120 | 120 | 120 | 120 | 3 1/2 | 4 |
| | | | | HBS8100 | 173 | 139 | 173 | 139 | 3 1/8 | 4 |
| | | | 1 | HBS6120 | 128 | 128 | 128 | 128 | 3 1/2 | 4 |
| | | | | HBS8120 | 179 | 143 | 179 | 143 | 3 1/8 | 4 |
| | | | | HBS10140 | 211 | 164 | 211 | 164 | 4 | 6 |
| | 244 | 9 5/8 | 3/4 | HBS6120 | 120 | 120 | 120 | 120 | 3 1/2 | 4 |
| | | | | HBS8120 | 173 | 139 | 173 | 139 | 3 1/8 | 4 |
| | | | 1 | HBS6140 | 128 | 128 | 128 | 128 | 3 1/2 | 4 |
| | | | | HBS8140 | 179 | 143 | 179 | 143 | 3 1/8 | 4 |
| | | | | HBS10140 | 211 | 164 | 211 | 164 | 4 | 6 |

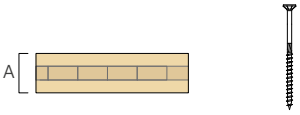
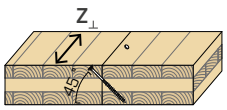
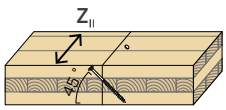
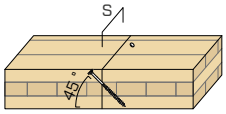
NOTES and GENERAL PRINCIPLES on page 50.

# CLT | HALF LAP

| | | | | SHEAR | | | | SPACING | |
|---|---|---|---|---|---|---|---|---|---|
| geometry | | | | half lap orientation 1 | | half lap orientation 2 | | fastener in a row | |
| | | | |  | |  |  |  | |
| | panel thickness (wall/floor) = A | | suggested screw | $Z_{\perp}$ | $Z_{\parallel}$ | $Z_{\perp}$ | $Z_{\parallel}$ | minimum | typical |
| | [mm] | [in] | CODE | [lbf] | [lbf] | [lbf] | [lbf] | [in] | [in] |
| 3 PLY | 105 | 4 1/8 | HBS690 | 144 | 144 | 144 | 144 | 3 1/2 | 6 |
| | | | HBS8100 | 174 | 218 | 174 | 218 | 3 1/8 | 6 |
| | | | HBS10100 | 153 | 261 | 153 | 261 | 4 | 8 |
| | 120 | 4 3/4 | HBS6110 | 165 | 165 | 165 | 165 | 3 1/2 | 6 |
| | | | HBS8100 | 160 | 200 | 160 | 200 | 3 1/8 | 6 |
| | | | HBS10100 | 160 | 272 | 160 | 272 | 4 | 8 |
| 5 PLY | 100 | 3 15/16 | HBS690 | 149 | 149 | 149 | 149 | 3 1/2 | 6 |
| | | | HBS880 | 143 | 179 | 143 | 179 | 3 1/8 | 6 |
| | | | HBS1080 | 129 | 220 | 129 | 220 | 4 | 8 |
| | 140 | 5 1/2 | HBS6130 | 165 | 165 | 165 | 165 | 3 1/2 | 6 |
| | | | HBS8120 | 178 | 222 | 178 | 222 | 3 1/8 | 6 |
| | | | HBS10120 | 189 | 301 | 189 | 301 | 4 | 8 |
| | | | HBS12120 | 194 | 329 | 194 | 329 | 4 3/4 | 10 |
| | 175 | 6 7/8 | HBS6160 | 165 | 165 | 165 | 165 | 3 1/2 | 6 |
| | | | HBS8160 | 196 | 245 | 196 | 245 | 3 1/8 | 6 |
| | | | HBS10160 | 232 | 338 | 232 | 338 | 4 | 8 |
| | | | HBS12160 | 248 | 387 | 248 | 387 | 4 3/4 | 10 |
| | 200 | 7 7/8 | HBS6180 | 165 | 165 | 165 | 165 | 3 1/2 | 6 |
| | | | HBS8180 | 196 | 245 | 196 | 245 | 3 1/8 | 6 |
| | | | HBS10180 | 232 | 338 | 232 | 338 | 4 | 8 |
| | | | HBS12160 | 221 | 357 | 221 | 357 | 4 3/4 | 10 |
| 7 PLY | 140 | 5 1/2 | HBS6130 | 165 | 165 | 165 | 165 | 3 1/2 | 6 |
| | | | HBS8120 | 178 | 222 | 178 | 222 | 3 1/8 | 6 |
| | | | HBS10120 | 189 | 301 | 189 | 301 | 4 | 8 |
| | | | HBS12120 | 194 | 328 | 194 | 328 | 4 3/4 | 10 |
| | 191 | 7 1/2 | HBS8180 | 196 | 245 | 196 | 245 | 3 1/8 | 6 |
| | | | HBS10180 | 232 | 338 | 232 | 338 | 4 | 8 |
| | | | HBS12160 | 231 | 376 | 231 | 376 | 4 3/4 | 10 |
| | 244 | 9 5/8 | HBS8220 | 196 | 245 | 196 | 245 | 3 1/8 | 6 |
| | | | HBS10220 | 232 | 338 | 232 | 338 | 4 | 8 |
| | | | HBS12240 | 261 | 387 | 261 | 387 | 4 3/4 | 10 |
| | 280 | 11 | HBS8260 | 196 | 245 | 196 | 245 | 3 1/8 | 6 |
| | | | HBS10260 | 232 | 338 | 232 | 338 | 4 | 8 |
| | | | HBS12240 | 261 | 387 | 261 | 387 | 4 3/4 | 10 |
| 9 PLY | 180 | 7 1/16 | HBS6160 | 165 | 165 | 165 | 165 | 3 1/2 | 6 |
| | | | HBS8160 | 196 | 245 | 196 | 245 | 3 1/8 | 6 |
| | | | HBS10160 | 228 | 338 | 228 | 338 | 4 | 8 |
| | | | HBS12160 | 242 | 387 | 242 | 387 | 4 3/4 | 10 |
| | 267 | 10 1/2 | HBS8260 | 196 | 245 | 196 | 245 | 3 1/8 | 6 |
| | | | HBS10260 | 232 | 338 | 232 | 338 | 4 | 8 |
| | | | HBS12240 | 261 | 387 | 261 | 387 | 4 3/4 | 10 |
| | 314 | 12 3/8 | HBS8300 | 196 | 245 | 196 | 245 | 3 1/8 | 6 |
| | | | HBS10300 | 232 | 338 | 232 | 338 | 4 | 8 |
| | | | HBS12280 | 261 | 387 | 261 | 387 | 4 3/4 | 10 |
| | 360 | 14 3/16 | HBS8340 | 196 | 245 | 196 | 245 | 3 1/8 | 6 |
| | | | HBS10340 | 232 | 338 | 232 | 338 | 4 | 8 |
| | | | HBS12320 | 261 | 387 | 261 | 387 | 4 3/4 | 10 |

NOTES and GENERAL PRINCIPLES on page 50.

# CLT | BUTT JOINT

| | | | | SHEAR | | SPACING | |
|---|---|---|---|---|---|---|---|
| geometry | | | | butt joint orientation 1 | butt joint orientation 2 | fastener in a row | |
| | | | |   |   |   |   |
| | panel thickness (wall/floor) = A | | suggested screw | $Z_\perp$ | $Z_\parallel$ | minimum | typical |
| | [mm] | [in] | CODE | [lbf] | [lbf] | [in] | [in] |
| 3 PLY | 105 | 4 1/8 | HBS6120 | 110 | 110 | 3 1/2 | 6 |
| | | | HBS8120 | 131 | 164 | 3 1/8 | 6 |
| | | | HBS10120 | 122 | 208 | 4 | 8 |
| | | | HBS12120 | 125 | 220 | 4 3/4 | 10 |
| | 120 | 4 3/4 | HBS6150 | 110 | 110 | 3 1/2 | 6 |
| | | | HBS8140 | 131 | 164 | 3 1/8 | 6 |
| | | | HBS10140 | 143 | 226 | 4 | 8 |
| | | | HBS12160 | 167 | 259 | 4 3/4 | 10 |
| 5 PLY | 100 | 3 15/16 | HBS6120 | 110 | 110 | 3 1/2 | 6 |
| | | | HBS8120 | 131 | 164 | 3 1/8 | 6 |
| | | | HBS10120 | 122 | 208 | 4 | 8 |
| | | | HBS12120 | 125 | 220 | 4 3/4 | 10 |
| | 140 | 5 1/2 | HBS6180 | 110 | 110 | 3 1/2 | 6 |
| | | | HBS8180 | 131 | 164 | 3 1/8 | 6 |
| | | | HBS10180 | 155 | 226 | 4 | 8 |
| | | | HBS12160 | 167 | 259 | 4 3/4 | 10 |
| | 175 | 6 7/8 | HBS6220 | 110 | 110 | 3 1/2 | 6 |
| | | | HBS8220 | 131 | 164 | 3 1/8 | 6 |
| | | | HBS10220 | 155 | 226 | 4 | 8 |
| | | | HBS12200 | 175 | 259 | 4 3/4 | 10 |
| | 200 | 7 7/8 | HBS6260 | 110 | 110 | 3 1/2 | 6 |
| | | | HBS8260 | 131 | 164 | 3 1/8 | 6 |
| | | | HBS10260 | 155 | 226 | 4 | 8 |
| | | | HBS12240 | 175 | 259 | 4 3/4 | 10 |
| 7 PLY | 140 | 5 1/2 | HBS6180 | 110 | 110 | 3 1/2 | 6 |
| | | | HBS8180 | 131 | 164 | 3 1/8 | 6 |
| | | | HBS10180 | 155 | 226 | 4 | 8 |
| | | | HBS12160 | 167 | 259 | 4 3/4 | 10 |
| | 191 | 7 1/2 | HBS6240 | 110 | 110 | 3 1/2 | 6 |
| | | | HBS8240 | 131 | 164 | 3 1/8 | 6 |
| | | | HBS10240 | 155 | 226 | 4 | 8 |
| | | | HBS12240 | 175 | 259 | 4 3/4 | 10 |
| | 244 | 9 5/8 | HBS8320 | 131 | 164 | 3 1/8 | 6 |
| | | | HBS10320 | 155 | 226 | 4 | 8 |
| | | | HBS12320 | 175 | 259 | 4 3/4 | 10 |
| | 280 | 11 | HBS8380 | 131 | 164 | 3 1/8 | 6 |
| | | | HBS10380 | 155 | 226 | 4 | 8 |
| | | | HBS12360 | 175 | 259 | 4 3/4 | 10 |
| 9 PLY | 180 | 7 1/16 | HBS6240 | 110 | 110 | 3 1/2 | 6 |
| | | | HBS8240 | 131 | 164 | 3 1/8 | 6 |
| | | | HBS10240 | 155 | 226 | 4 | 8 |
| | | | HBS12240 | 175 | 259 | 4 3/4 | 10 |
| | 267 | 10 1/2 | HBS8360 | 131 | 164 | 3 1/8 | 6 |
| | | | HBS10360 | 155 | 226 | 4 | 8 |
| | | | HBS12360 | 175 | 259 | 4 3/4 | 10 |
| | 314 | 12 3/8 | HBS6400 | 110 | 110 | 3 1/2 | 6 |
| | | | HBS8400 | 131 | 164 | 3 1/8 | 6 |
| | | | HBS10400 | 155 | 226 | 4 | 8 |
| | | | HBS12400 | 175 | 259 | 4 3/4 | 10 |

NOTES and GENERAL PRINCIPLES on page 50.