

Example Problem 1. Figure 4. Double shear. Sides S4S 2x10, Main S4S 3x10
Job 3/4" A307 bolts @ 3' o.c. in row. 2 rows, 3 per row
Notes angle load to grain: main member = 0, side member = 0
snow load No.. 1 Doug Fir-Larch

Fill in yellow cells below

Fill in turquoise cells if needed

Red cells are calculated

Light green cells are tables

Except for the yellow and turquoise cells, this spreadsheet is protected to prevent accidental loss of the formulas.

Engineering Properties of Selected Wood Species (Ref. 3, Ref. 4)

| Species | Density (G) | Mod. Of Elasticity | | Tensile (F _t) | |
|-----------------|----------------|--------------------|-----------|---------------------------|--------|
| | | No. 1 | No. 2 | No. 1 | No. 2 |
| Doug Fir-Larch | .50 | 1,700,000 | 1,600,000 | 675 | 575 |
| Eastern Hemlock | .41 | 1,100,000 | 1,100,000 | 350 | 275 |
| Eastern Spruce | .41 | 1,100,000 | 1,100,000 | 350 | 275 |
| Hem-Fir | .43 | 1,500,000 | 1,300,000 | 625 | 525 |
| Red Oak | .67 | 1,300,000 | 1,200,000 | 500 | 475 |
| South'n Pine | .55 | 1,700,000 | 1,600,000 | varies see | refer. |
| Westn Cedar | .36 | 1,000,000 | 1,000,000 | 425 | 425 |
| Westn Hemlock | .47 | 1,200,000 | 1,000,000 | 300 | 300 |
| White Oak | .73 | 1,000,000 | 900,000 | 500 | 500 |

specific gravity (g) or dowel bearing (b)
single shear (s) or double shear (d)
side members wood (w) or steel (s)
main members wood (w) or masonry (m)
bolt diameter (inches) =
dowel bending yield (psi) =
side member thickness (inches) =
main member thickness (inches) =
side member specific gravity =
main member specific gravity =
load to grain side member ° =
load to grain main member ° =

g
d
w
w
D = 0.75
F_{yb} = 45000
L_s = 1.50
L_m = 2.50
G_s = 0.5
G_m = 0.5
s = 0
m = 0

Fill in turquoise column with dowel bearing strengths if they are to be used instead of specific gravities

side member dowel bearing = F_{es} 5600 psi
side member dowel bearing = F_{es} 2600 psi
side member dowel bearing = F_{es} 5600 ##### psi
main member dowel bearing = F_{em} 5600 psi
main member dowel bearing = F_{em} 2600 psi
main member dowel bearing = F_{em} 5600 ##### psi

used F_{es} = 5600
used F_{em} = 5600

k₁ = 0.5815
k₂ = 1.3338
k₃ = 1.8316
K = 1

R_e = 1 R_t = 1.67

Load Duration Factors, C_D (Ref. 3)

| | |
|----------------|------|
| permanent | 0.9 |
| occupancy live | 1 |
| snow | 1.15 |
| construction | 1.25 |
| wind, quake | 1.6 |

Yield Mode I_m Z = 2630 pounds
Yield Mode I_s Z = 3150 pounds
Yield Mode I I Z = N.A. pounds
Yield Mode I I I_m Z = N.A. pounds
Yield Mode I I I_s Z = 2400 pounds
Yield Mode IV Z = 3220 pounds

BASIC DESIGN VALUE 2400 pounds

Number of Bolts in Joint = 6
Load Duration Factor, C_D = 1.15
Wet Conditions Factor, C_M = 1.00
Temperature Factor, C_t = 1.00
Bolt Group Factor, C_g = 1.00

Bolt Group Action Factor Information

number of rows = 2
number bolts in a row = 3
bolt spacing in row (inches) = 3.0
main member mod. of elast (x10⁶ psi) = 1.7
side member mod. of elast (x10⁶ psi) = 1.6
main member gross area (sq. in.) = 23.12
side member gross area (sq. in.) = 27.75
θ = 180000
u = 1.00841
m = 0.87843
R_{EA} = 0.88523

Design Value per Bolt = 2760 pounds
Total all Bolts = 16490 pounds

NET SECTION CALCULATIONS FOR ALLOWABLE TENSION LOAD

Tensile Stress Main Member, F_t = 675 psi
Tensile Stress Side Member, F_t = 575 psi
Size Factor Main Member, C_t = 1.1
Size Factor Side Member(s), C_t = 1.1
Temperature Factor, C_t = 1.0

Tension Load Information

actual width of main member = 9.25 inches
actual width of side member = 9.25 inches
net area main member = 19.06 sq. in.
net area side member(s) = 22.88 sq. in.

Design Value for Main Member = 16280 pounds tension
Design Value for Side Member(s) = 16640 pounds tension

Size Factors, C_t (Ref. 4)

| width (inches) | factor |
|----------------|--------|
| 2,3,4 | 1.5 |
| 5 | 1.4 |
| 6 | 1.3 |
| 8 | 1.2 |
| 10 | 1.1 |
| 12 | 1.0 |
| All So. Pine | 1.0 |

FINAL DESIGN VALUE FOR JOINT = 16280 pounds

This spreadsheet is provided for illustrative teaching purposes only, and is not intended for use in any specific project. Anyone making use of the information contained in this spreadsheet does so at his/her own risk and assumes any and all resulting liability arising therefrom.