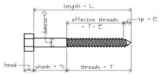
DESIGN OF LAG SCREW CONNECTIONS© also see the accompanying discussion

LAGUP©

Example Problem 1. Figure 2. Single shear. Side S4S 2x10, Main S4S 3x10
Job 3/8" x 4" lags @ 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 No. 1	Mod. Of Elasticity No. 2	Tensile (F_t) No. 1	Tensile (F_t) 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

Standard Lag Screw Sizes					
Length	1",1 1/2"	2",2 1/2"	3"	4" - 12"	
Diameter	1/4" - 1/2"	1/4" - 5/8	1/4" -1"	1/4"-1	1/4"

load: lateral (L), withdrawal (W), combined ((: l
load in side grain (s) or end grain (e): s
specific gravity (g) or dowel bearing (b): g
side member wood (w) or steel (s): w
standard lag screw (s) or threaded full length: s
lag screw shank diameter (inche: D = 0.375
lag screw length (inches): L = 4.00
if W or C in E24, threaded penetration: t =
if C in E24, total penetration: p =
dowel bending yield (psi): F_{yb} = 45000
side member thickness (inches): L_s = 1.50
main member thickness (inches): L_m = 2.50
side member specific gravity: G_s = 0.5
main member specific gravity: G_m = 0.5
load to grain side member °: $_s$ = 0
load to grain main member °: $_m$ = 0
load to wood surface °: â = 0
of lag axis and wood surface °: â = 90
washer thickness if used: w = 0.125
length of tip: 0.219
effective total penetration: 2.156
effective threaded lengt: 2.281
effective screw length: 2.156
root diameter: 0.265
diameter for lateral formulas: 0.265

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}	3650	psi
side member dowel bearing	=	F_{es}	5600	###### psi
main member dowel bearing	=	F_{em}	5600	psi
main member dowel bearing	=	F_{em}	3650	psi
main member dowel bearing	=	F_{em}	5600	###### psi

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

C_{eg} = 1.00 (lateral)
C_{eg} = 1.00 (withdrawal)
C_d = 0.72

R_e = 1 R_t = 1.667

k = 1.122
K = 1

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_s Z = 560 pounds
Yield Mode $I I I_s$ Z = 260 pounds
Yield Mode IV Z = 200 pounds

BASIC LATERAL DESIGN VALU: 200 pounds

DATA IN BOX BELOW APPLIES TO LATERAL LOAD ONLY

Number of Lags 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
Geometry Factor, C_{gf} = 1.00

Lag Screw Group Action Factor Information

number of rows =	2
number lags in a row =	3
lag spacing in row (inches) =	3.0
main member mod. of elast ($x10^6$ psi) =	1.7
side member mod. of elast ($x10^6$ psi) =	1.7
main member gross area (sq. in.) =	23.12
side member gross area (sq. in.) =	13.87

ë = 41335
u = 1.00421
m = 0.91238
R_{EA} = 0.59991

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

Lateral Design Value One Lag 170 pounds
Lateral Design Value All Lags 1020 pounds

NET SECTION CALCULATIONS FOR ALLOWABLE TENSION LOAD

Tensile Stress Main Member, F_t = 675 psi
Tensile Stress Side Member, F_t = 675 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 =	21.34	sq. in.
net area side member =	12.75	sq. in.

Design Value for Main Member = 15850 pounds tension
Design Value for Side Member = 9470 pounds tension

Basic Withdrawal Capacity for One Lag = N.A. pounds
Factored Withdrawal Capacity for Lags = N.A. pounds

Tensile Capacity of Lags = N.A. pounds

FINAL DESIGN VALUE FOR JOINT = 1020 pounds