

Seismic Design Data for Lag Screws

Introduction:

Lag screws are used for connections and attachments to wooden structures. Care must be taken when using **Lag Screws** for critical installations because the effective strength of the connection will depend on the type, grade, and condition of the wood used in the structure to which the connection is being made. This document will assume that the wood is an **Eastern Soft Woods (Spruce-Pine-Fir(s)), Western Cedars, or Western Woods** with a **Specific Gravity of 0.36**. The tabulated values of allowable shear load, Z_S , will be based on single shear with the load being perpendicular to the grain of the wood, and on the use of a **1/4"** thick side plate. This will produce the most conservative allowable values.

Lag Screw Basic Data:

A typical **Hex Head Lag Screw** is shown in Figure A7.3-1. The basic information is tabulated in Table A7.3-1.

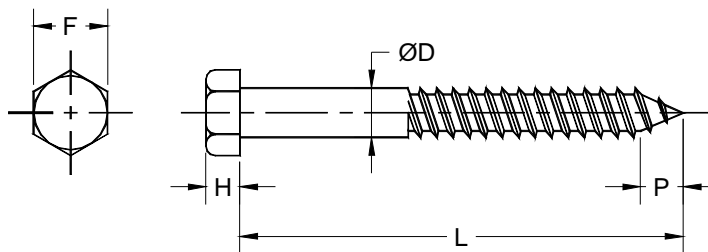


Figure A7.3-1; Typical Hex Head Lag Screw.

Table A7.3-1; Hex Head Lag Screw Dimensional Data.

| Lag Screw Size ΦD (in) | Width Across Flats F (in) | Head Height H (in) | Point Length P (in) |
|------------------------------------|-----------------------------------|----------------------------|-----------------------------|
| 1/4 | 3/8 | 0.172 | 0.217 |
| 5/16 | 1/2 | 0.219 | 0.271 |
| 3/8 | 9/16 | 0.250 | 0.325 |
| 1/2 | 3/4 | 0.344 | 0.433 |
| 5/8 | 15/16 | 0.422 | 0.541 |
| 3/4 | 1-1/8 | 0.500 | 0.650 |

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Lag Screw Installation Data:

The **Basic Rules & Data** for installing **Lag Screws** are illustrated in Figure A7.3-2 and Table A7.3-2. **Do not install Lag Screws in the End Grain of a piece of wood for seismic applications!**

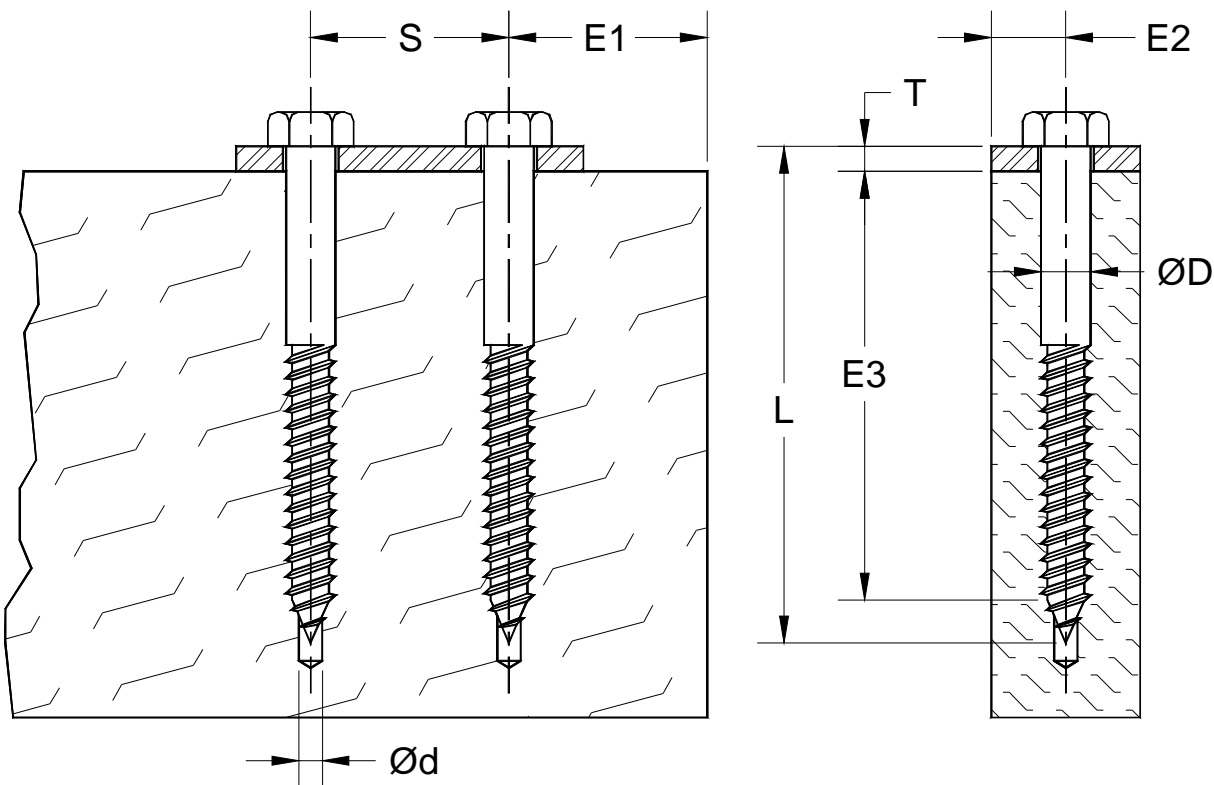


Figure A7.3-2; Typical Lag Screw Installation Guide.

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Table A7.3-2; Lag Screw Installation Data.

| Lag Size ϕD (in) | Min. Spacing S (in) | Min. End Dist. $E1$ (in) | Min. Edge Dist. $E2$ (in) | Embed. Depth $E3$ (in) | Mtg. Plate Thick. T (in) | Screw Length L (in) | Soft Wood Pilot Drill ϕd (in) | Hard Wood Pilot Drill ϕd (in) |
|------------------------------|-----------------------------|--------------------------------|---------------------------------|------------------------------|----------------------------------|-----------------------------|---|---|
| 1/4 | 1.00 | 1.00 | 0.375 | 2.00 | 0.125 | 2.50 | 1/8 | 5/32 |
| | | | | | 0.250 | 2.50 | | |
| | | | | | 0.375 | 3.00 | | |
| | | | | | 0.500 | 3.00 | | |
| 5/16 | 1.25 | 1.25 | 0.469 | 2.50 | 0.125 | 3.00 | 9/32 | 13/64 |
| | | | | | 0.250 | 3.50 | | |
| | | | | | 0.375 | 3.50 | | |
| | | | | | 0.500 | 3.50 | | |
| 3/8 | 1.50 | 1.50 | 0.563 | 3.00 | 0.125 | 3.50 | 3/16 | 1/4 |
| | | | | | 0.250 | 4.00 | | |
| | | | | | 0.375 | 4.00 | | |
| | | | | | 0.500 | 4.00 | | |
| 1/2 | 2.00 | 2.00 | 0.75 | 4.00 | 0.125 | 5.00 | 15/64 | 21/64 |
| | | | | | 0.250 | 5.00 | | |
| | | | | | 0.375 | 5.00 | | |
| | | | | | 0.500 | 5.00 | | |
| 5/8 | 2.50 | 2.50 | 0.938 | 5.00 | 0.125 | 6.00 | 19/64 | 13/32 |
| | | | | | 0.250 | 6.00 | | |
| | | | | | 0.375 | 6.00 | | |
| | | | | | 0.500 | 7.00 | | |
| 3/4 | 3.00 | 3.00 | 1.125 | 6.00 | 0.125 | 7.00 | 23/64 | 31/64 |
| | | | | | 0.250 | 7.00 | | |
| | | | | | 0.375 | 8.00 | | |
| | | | | | 0.500 | 8.00 | | |

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Lag Screw Allowable Load Data:

The **Basic Allowable Load Data** for **Lag Screws** with an embedment equal to eight (8) times the basic diameter, not including the point, are given in Figure A7.3-3 and Table A7.3-3. The basic allowable loads have been increased by a **Duration Factor** of 1.6 for seismic and wind loading. For an embedment of less than eight (8) times the basic diameter, the values in Table A7.3-3 may be multiplied by the ratio of the actual embedment divided by eight (8) times the basic diameter.

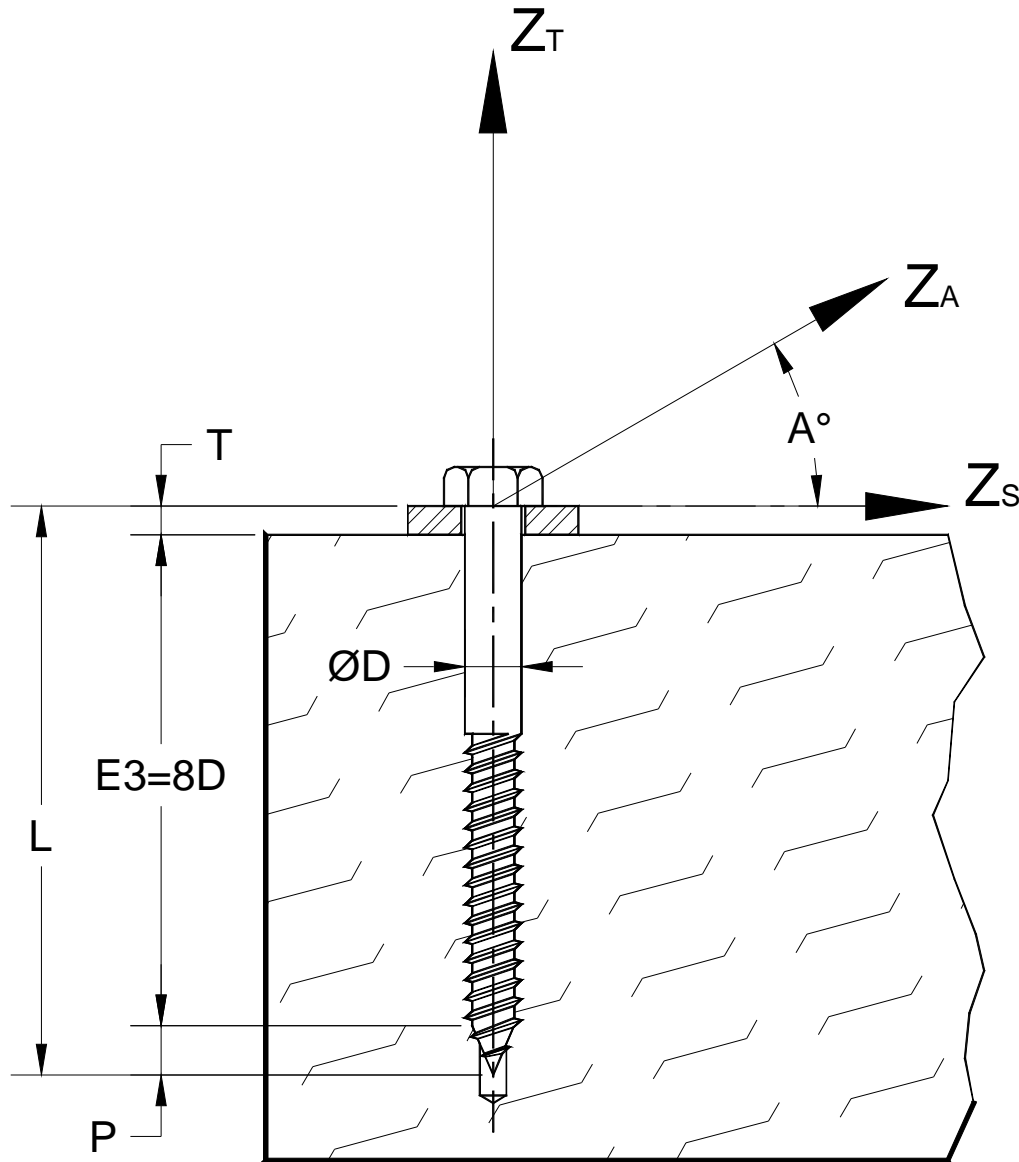


Figure A7.3-3; Typical Lag Screw in Combined Tension and Shear.

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Table A7.3-3; Lag Screw Allowable Load Data.

| Lag Size ϕD (in) | Embedment Depth $8D$ (in) | Allowable Tensile Load Z_T (lbs) | Allowable Shear Load Z_S (lbs) | Load Angle A (deg) | Allowable Combined Load Z_A (lbs) |
|------------------------------|------------------------------------|--|--|-------------------------------|---|
| 1/4 | 2.00 | 438 | 272 | 0 | 272 |
| | | | | 30 | 301 |
| | | | | 45 | 336 |
| | | | | 60 | 380 |
| 5/16 | 2.50 | 652 | 368 | 0 | 368 |
| | | | | 30 | 413 |
| | | | | 45 | 470 |
| | | | | 60 | 547 |
| 3/8 | 3.00 | 893 | 432 | 0 | 432 |
| | | | | 30 | 496 |
| | | | | 45 | 582 |
| | | | | 60 | 705 |
| 1/2 | 4.00 | 1,478 | 624 | 0 | 624 |
| | | | | 30 | 729 |
| | | | | 45 | 878 |
| | | | | 60 | 1,101 |
| 5/8 | 5.00 | 2,184 | 880 | 0 | 880 |
| | | | | 30 | 1,034 |
| | | | | 45 | 1,255 |
| | | | | 60 | 1,594 |
| 3/4 | 6.00 | 3,005 | 1,168 | 0 | 1,168 |
| | | | | 30 | 1,379 |
| | | | | 45 | 1,682 |
| | | | | 60 | 2,157 |

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