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Connecting Garage Door Jambs to Building Framing

Introduction

The members of DASMA recognize that connecting garage doors to building framing is as important as the design of garage doors themselves. The following series of “Garage Door Frame Connection Schedules”, included in this Technical Data Sheet constitutes a basic introduction to some of the concepts of garage door framing:

<u>Fastener Type</u>	<u>Schedule</u>
• 1/4-inch diameter Self Tapping Concrete Anchors	TDS-161a
• 3/8-inch diameter by 3 inch length Sleeve Anchors	TDS-161b
• 3/8-inch diameter by 3-1/2 inch length Expansion Anchors	TDS-161c
• 7/16-inch diameter by 8 inch length Galvanized “L-Bolt” Anchors	TDS-161d
• 3/8-inch diameter by 3 inch length Lag Screws w/1-1/8” Diameter Washers	TDS-161e
• 16d by 3 1/2-inch length Common Wire Nails	TDS-161f
• 0.100” x 1” Long Fillet Weld (E60xx Electrodes Min.)	TDS-161g
• 1/4” x 3/4” Self-Tapping Screws into steel	TDS-161h

A rationale document has also been prepared in the following pages, including an explanation of methods used, loads and source data, and calculation methods.

The information contained in this Technical Data Sheet is presented to equip the reader to engage in an educated discussion about the requirements and limitations of some of the methods of attaching garage door jambs to structural members of various buildings. Professional engineering advice should be obtained when considering the attachment of garage door jambs to a structure and to ensure that forces resulting from wind can be withstood by the structure and the garage door while maintaining the integrity of the building envelope.

Directions on using the charts, along with other important information, can be found on the next page.

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Using The Charts

1. Determine the door width, in feet.
2. Determine the positive wind load for a particular door. The positive wind load is the wind load that acts to push the door inward toward the garage and away from the garage door framing. This load determination can be achieved through one of these methods:
 - Use of the relevant DASMA Wind Load Guide (see TDS-155).
 - Job-specific calculation.
 - Conservative design pressure obtained from a local building department.
3. If the framing is made of wood, determine the type of lumber used. The charts include southern-pine and spruce-pine-fir.
4. Determine fastener to be used, from the alternatives listed in this Technical Data Sheet.
5. Find the appropriate Schedule to use.
6. For a given door load, door width and jamb type (if applicable), obtain the maximum fastener spacing per jamb from the appropriate Schedule.
7. Review the notes at the bottom of the Schedule used.
8. Review the detail referred to in the Schedule.

Information for Installers

Establish location of reinforcements in concrete-filled masonry units, poured concrete walls, tilt-up concrete walls, etc. Use care to ensure that reinforcement will not interfere with jamb fasteners. If door jamb mounting or alternate door size cannot be accomplished without interference with reinforcement, then consult a structural engineer to determine a workable solution. Do not drill through or damage reinforcement.

Existing Construction

DASMA suggests that installers consider the following in locating reinforcement:

- *If the building has structural drawings*, obtain these drawings and have an engineer review the drawings to determine where reinforcement is located in the vicinity of the jambs. The engineer should compare the reinforcement location with where the door jamb fasteners are to be located.
- *If the building's structural plans cannot be obtained*, during the field inspection process, where existing wall opening dimensions are obtained, either drill representative "pilot holes" or use a device similar to an electronic wood stud locator to determine the steel reinforcement locations.

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Rationale

Explanation of Methods Used

The jamb attachment information in this document is presented in such a way as to provide a clear and accurate presentation of the connection schedule for wind loads from 10 PSF to 60 PSF for the following anchors as specified:

- | | |
|---|----------|
| • 1/4" diameter Self-Tapping Concrete Anchors | TDS-161a |
| • 3/8" diameter by 3" length Sleeve Anchors | TDS-161b |
| • 3/8" diameter by 3-1/2" length Expansion Anchors | TDS-161c |
| • 7/16" diameter by 8" length "L-Bolt Anchors | TDS-161d |
| • 3/8" diameter by 3" length Lag Screws | TDS-161e |
| • 16d" by 3-1/2" length Common Wire Nails | TDS-161f |
| • .100" x 1" long fillet weld (E60xx Electrodes Min.) | TDS-161g |
| • 1/4" diameter by 3/4" length self-tapping screws | TDS-161h |

The connection schedule is presented here as the minimum spacing required between anchors for a particular design wind load, as opposed to a minimum number of anchors required for a certain force applied to the jamb. The anchor schedule can be quickly determined by looking up the wind load and door width in the appropriate table for the particular anchor to be used.

All calculations used in determining the connection schedule are provided. All relevant notes from previous drafts of TDS-161 are provided for the attachment schedules. Due to the different format presented here, notes have been added and omitted where necessary.

Loads and Source Data

Information presented in this document is based on recent published loads from the fastener manufacturers. However other sources were investigated and it is evident that performance data for an individual anchor type varies greatly among publications. Selected comparisons of published data from manufacturers and test reports for self-tapping concrete anchors and sleeve anchors are included (see Tables 1 and 2) to illustrate the variety of results that can be obtained. When presented with conflicting performance data, the calculations were made using a major fastener manufacturer's general published values.

The information in the following tables is published allowable loads. If only ultimate loads were provided, a safety factor was applied per the referenced source's recommendations, or if no recommendations were supplied, a 4:1 safety factor was used.

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Table 1 - Sample Published Data for 1/4'' x 3'' Self-Tapping Concrete Anchors – Allowable Load

Publication	3000 psi concrete	C-90 Block
ITW Online Performance Data	380 lb. (4:1 SF)	154 lb. (4:1 SF)
ITW Miami-Dade NOA#02-3111.03	575 lb. (3192 psi; 1-3/4'' embed)	195 lb.
ITW SBCCI Report #9759	349 lb. (wsi); 174 lb. (wosi)	128 lb. (wsi); 64 lb. (wosi)
ITW ICBO Report ER-3370	380 lb. (wsi); 190 lb. (wosi)	N/A
Elco Textron Miami-Dade NOA #02-0503.07	661 lb. (3513 psi; 1-3/4'' emb; 5/16'' dia)	286 lb. (5/16'' dia)
Elco Textron SBCCI Report #2040	424 lb. (wsi); 212 lb. (wosi)	338 lb. (wsi); 169 lb. (wosi)

Table 2 - Sample Published Data for 3/8'' x 3'' Sleeve Anchors – Allowable Load

Publication	2000 psi concrete	C-90 Block
Simpson Strong-Tie Sleeve-All Online Performance Data	336 lb. (3'' edge dist.)	435 lb. (min 12'' edge dist.)
Simpson Strong-Tie Sleeve-All Miami-Dade NOA #01-0820.06	406 lb.	N/A
Simpson Strong-Tie Sleeve-All ICBO Report ER-3631	400 lb. (wsi), 220 lb. (wosi)	N/A
Powers Lok/Bolt Online Performance Data	612 lb.	425 lb. (min 4-1/2'' edge dist.)
ITW Trubolt Online Performance Data	530 lb.	N/A
Hilti HLC Sleeve Anchor Online Performance Data	450 lb.	438 lb. (min 2-1/4'' edge dist.)

Calculations

General Formula for Anchor Spacing:

$$\frac{(12 \text{ in/ft})(F \text{ lb/anchor})}{\frac{1}{2}(P \text{ lb/ft}^2)(W \text{ ft})} = S \text{ in/anchor}$$

P = Door Design Load (pressure in PSF)

W = Opening Width (ft.)

F = Allowable Load per Anchor (lb.)

S = Anchor Spacing (in.)

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Load Calculations and Reference:**TDS-161a**

ITW Ramset/Redhead Tapcon Self-Tapping Concrete Anchors (1-1/2" Min. Embed)

Ref: [http://www.ramset-redhead.com/Performance Data](http://www.ramset-redhead.com/PerformanceData)C-90 Block: $F = 615 \text{ lb.} * \frac{1}{4} \text{ S.F.} = 154 \text{ lb.}$ Allowable Load2000 psi min. concrete: $F = 1,120 \text{ lb.} * \frac{1}{4} \text{ S.F.} = 280 \text{ lb.}$ Allowable Load3000 psi min. concrete: $F = 1,520 \text{ lb.} * \frac{1}{4} \text{ S.F.} = 380 \text{ lb.}$ Allowable Load4000 psi min. concrete: $F = 1,600 \text{ lb.} * \frac{1}{4} \text{ S.F.} = 400 \text{ lb.}$ Allowable Load

Note: Load calculated for minimum edge distance of 10 diameters or 2-1/2".

TDS-161b

3/8" x 3" Simpson Strong-Tie Sleeve-All Sleeve Anchors (1-1/2" Min. Embed)

Ref: [http://www.strongtie.com/products/anchorsystems/Load Tables](http://www.strongtie.com/products/anchorsystems/LoadTables),

ANSI / AF&PA NDS-2005 for Wood Construction, p. 22, 28; ANSI / AF&PA NDS-2005 Supplement, p. 42

Pullout Force in Concrete per Simpson Strong-Tie Online Performance Data:2000 psi concrete: $F = 400 \text{ lb.} * .84$ (edge distance adjustment factor) = 336 lb. Allowable Load3000 psi concrete: $F = 535 \text{ lb.} * .84 = 449 \text{ lb.}$ Allowable Load4000 psi concrete: $F = 670 \text{ lb.} * .84 = 563 \text{ lb.}$ Allowable Load

Note: Loads calculated for a minimum edge distance of 3". C-90 Block not an option for Simpson sleeve and expansion anchors due to edge distance requirements (min. 12"). For other brands, see individual manufacturer's specifications for allowable loads.

Bearing on Wood of Washer Provided by Manufacturer (7/8" O.D. Provided by Simpson Strong-Tie):Bearing Area, $A = \pi(7/16 \text{ in})^2 - \pi(7/32 \text{ in})^2 = .451 \text{ in.}^2$ Bearing Area Factor, $C_b = 1.43$ (NDS p. 22)Allowable Load, $F_{All} = F * C_b$ where $F = F_c * A$; therefore $F_{All} = F_c * A * C_b$ Where: $F_c =$ Allowable compression (psi); $F =$ applied force (lb.)Southern Pine ($F_c = 565 \text{ psi}$): $F_{All} = 565 \text{ lb/in}^2 * .451 \text{ in}^2 * 1.43 = 364 \text{ lb.}$ Allowable Load

Note: Published allowable load for S.Y.P. will be limited to 336 lb. (max. for 2000 psi concrete).

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Spruce Pine Fir ($F_c = 425$ psi): $F_{All} = 425 \text{ lb/in}^2 * .451 \text{ in}^2 * 1.43 = 274 \text{ lb}$. Allowable Load

Note: Tabulated values for F_c (*NDS Supplement p. 42, Table 4C*) are species group average values associated with a deformation of 0.04" per ASTM D2555, D245.

TDS-161c

3/8" x 3-1/2" Simpson Strong-Tie Wedge-All Expansion (Wedge) Anchors (1-3/4" Min. Embed)

Ref: <http://www.strongtie.com/products/anchorsystems/> Load Tables, ANSI / AF&PA NDS-2005 for Wood Construction, p. 22, 28; ANSI / AF&PA NDS-2005 Supplement, p. 42

Pullout Force in Concrete per Simpson Strong-Tie Online Performance Data:

Allowable loads increased by a 33.3% adjustment factor for short term loading (see Simpson Strong-Tie online data).

2000 psi concrete: $F = 390 \text{ lb.} * .90$ (edge dist. factor) $* 1.333$ (adjustment factor) = 468 lb. Allow. Load

3000 psi concrete: $F = 555 \text{ lb.} * .90 * 1.333 = 666$ Allowable Load

4000 psi concrete: $F = 720 \text{ lb.} * .90 * 1.333 = 864$ lb. Allowable Load

Note: Loads calculated for a minimum edge distance of 3". C-90 Block not an option for Simpson sleeve and expansion anchors due to edge distance requirements (min. 16"). For other brands, see individual manufacturer's specifications for allowable loads.

Bearing on Wood of Washer Provided by Manufacturer (7/8" O.D. Provided by Simpson Strong-Tie):

Bearing Area, $A = \pi(7/16 \text{ in.})^2 - \pi(7/32 \text{ in.})^2 = .451 \text{ in.}^2$

Bearing Area Factor, $C_b = 1.43$ (*NDS p. 22*)

Allowable Load, $F_{All} = F * C_b$ where $F = F_c * A$; therefore $F_{All} = F_c * A * C_b$

Where: $F_c =$ Allowable compression (psi); $F =$ applied force (lb.)

Southern Pine ($F_c = 565$ psi): $F_{All} = 565 \text{ lb/in}^2 * .451 \text{ in}^2 * 1.43 = 364 \text{ lb}$. Allowable Load

Spruce Pine Fir ($F_c = 425$ psi): $F_{All} = 425 \text{ lb/in}^2 * .451 \text{ in}^2 * 1.43 = 274 \text{ lb}$. Allowable Load

Note: Tabulated values for F_c (*NDS Supplement p. 42, Table 4C*) are species group average values associated with a deformation of 0.04" per ASTM D2555, D245.

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TDS-161d

7/16" x 8" Galvanized "L-Bolt" Anchors

ASTM A307, Grade C with 1-5/8" min. O.D. Washers

Stress area, $A = .1063 \text{ in.}^2$; tensile yield, $\sigma = 36 \text{ ksi}$, Safety Factor, $s = 4$

Allowable Load, $F = \sigma * A / s = (36,000 \text{ lb/in.}^2)(.1063 \text{ in.}^2)/4 = 957 \text{ lbs./L-bolt}$

Note: Load calculated for minimum edge distance of 6 diameters or 2-3/4".

TDS-161e

3/8" x 3" Lag Screws (1-1/2" Min. Embed)

Ref: ANSI / AF&PA NDS-2005 for Wood Construction, p. 9, 59, 68, 74, 166

Pullout force $W' = (W)(C_D)(C_M)(C_t)(L)$, where

W = lag screw withdrawal design value (lbs./in.) (see NDS p. 68, Table 11.2A)

C_D = load duration factor = 1.6 for wind load (p. 9)

C_M = wet service factor for dry conditions = 1.0 (p. 59)

C_t = temperature factor for $<100^\circ\text{F}$ = 1.0 (p. 9)

L = actual thread penetration = 1.5 in. nominal length - .219 in. ineffective thread = 1.281 in. (p. 166)

The lag screw maximum tensile load $P = (S)(A_s)/k$, where

S = material tensile strength = 60,000 psi for Grade A fasteners (ASTM A 307, Section 1)

k = safety factor = 4

A_s = stress area = $0.7854[D - (0.9743/n)]^2$ (ASTM A 307, Section 6), where

D = nominal diameter of the screw = 0.375

n = the number of threads per inch = 7 (IFI Fastener Standards 6th Ed., p. C-18)

$A_s = 0.7854[0.375 - (0.9743/7)]^2 = 0.0437 \text{ in}^2$

$P = (60,000 \text{ psi})(0.0437 \text{ in}^2)/4 = 655 \text{ lb}$ Maximum Tensile Load

Southern Pine (Specific Gravity = 0.55):

$W' = (352 \text{ lb./in})(1.6)(1.0)(1.0)(1.281 \text{ in.}) = 721 \text{ lb.}$ Allowable Load

This is greater than the maximum tensile load; therefore the Allowable Load is 655 lb

Spruce Pine Fir (Specific Gravity = .42):

$W' = (235 \text{ lb./in})(1.6)(1.0)(1.0)(1.281) = 482 \text{ lb.}$ Allowable Load

Note: Safety factor of 5:1 used to calculate nominal withdrawal values provided in the NDS.

Note: Load calculated for minimum edge distance of 4 diameters or 1-1/2".

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TDS-161f

16d (.162" Dia.) x 3-1/2" Common Wire Nails (2" Min. Embed)

Ref: 2005 NDS for Wood Construction, p. 9, 59, 70, 74, 167

Pullout force $W' = (W)(C_D)(C_M)(C_t)(L)$, where

W = nail withdrawal design value (lbs./in.) (*see NDS p. 70, Table 11.2C*)

C_D = load duration factor = 1.6 for wind load (*p. 9*)

C_M = wet service factor for dry conditions = 1.0 (*p. 59*)

C_t = temperature factor for $<100^{\circ}\text{F}$ = 1.0 (*p. 9*)

L = length of embedment

Southern Pine (Specific Gravity = 0.55):

$W' = (50 \text{ lb./in.})(1.6)(1.0)(1.0)(2 \text{ in.}) = 160 \text{ lb. Allowable Load}$

Spruce Pine Fir (Specific Gravity = .42):

$W' = (26 \text{ lb./in.})(1.6)(1.0)(1.0)(2 \text{ in.}) = 83 \text{ lb. Allowable Load}$

TDS-161g

.100" x 1" Long Fillet Weld (E60xx Electrodes Min.)

Ref. AISC Manual of Steel Construction Allowable Stress Design (9th Edition)

Design criteria from AISC manual:

- 1) The effective area of fillet welds shall be taken as the effective length times the effective throat thickness. (p. 5-67)
- 2) The effective length of fillet welds, except fillet welds in holes and slots, shall be the overall length of full-size fillets. (p. 5-67)
- 3) The effective throat thickness of a fillet weld shall be the shortest distance from the root of the joint to the face of the diagrammatic weld. (p. 5-67)
- 4) Maximum size of fillet weld (if welded along edge(s) of connecting parts) shall be not greater than the thickness of the material. (p. 5-67)
- 5) Allowable fillet weld shear stress (based on effective area) = 30% of nominal tensile strength of weld metal. (p. 5-70, Table J2.5)

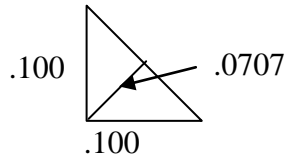
Assumptions:

- 1) 0.100" (12 gauge) steel angle attached to steel jambs of at least greater thickness.

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2) Use E60xx Electrode minimum. This electrode has a yield strength of 60 ksi.



Calculation:

Effective throat thickness: $(0.100^2 + 0.100^2)^{1/2}/2 = 0.0707$ in

Effective length of fillet weld: 1.00 in

Effective area of weld: $(0.0707 \text{ in})(1.00 \text{ in}) = 0.0707 \text{ in}^2$

Allowable fillet weld stress: $F = (60,000 \text{ lb/in}^2)(30\%)(0.0707 \text{ in}^2) = 1,272 \text{ lb}$.

TDS-161h

1/4" x 3/4" self-tapping screws into 12 gauge or 3/16" steel

Ref: <http://www.itwbuildex.com> Performance Data

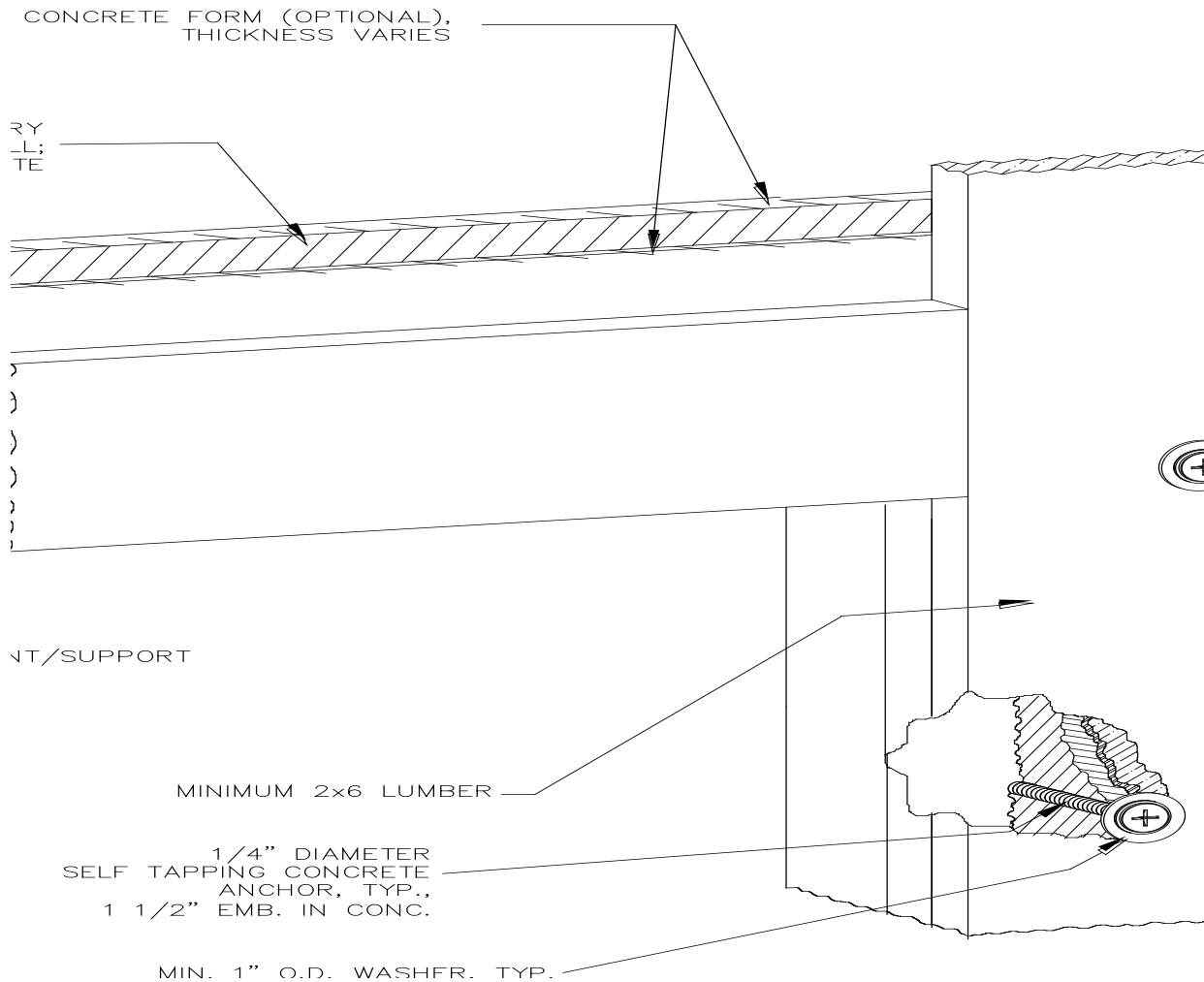
For 1/4" self-tapping screws the ultimate pullout ranges from 1678 lb. to 1858 lb. for 12 gauge steel and from 3554 lb. to 4693 lb. for 3/16" steel. Use the least pullout value and an 8:1 safety factor.

12 gauge steel: $F = (1678 \text{ lb.})/8 = 209 \text{ lb}$. Allowable Load

3/16" steel: $F = (3554 \text{ lb.})/8 = 444 \text{ lb}$. Allowable Load

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TDS-161a**1/4" DIAMETER SELF-TAPPING CONCRETE ANCHORS (1-1/2" EMBED)****Notes:**

- Alternate design may be approved by a registered professional engineer.
- Wood jambs may be counterbored up to 3/8" deep at each self tapping concrete anchor location.
- Self tapping concrete anchors shall have a minimum edge distance of 2-1/2" for maximum holding power.
- Spring pad connection not included.

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1/4" Diameter Self Tapping Concrete Anchors (1-1/2" Embed)
Reference: ITW Ramset/Redhead Tapcon Online Performance Data,
<http://www.ramset-redhead.com>

Grout-Filled CMU Block (1-1/4" Max. Embed for CMU Block)
 154 lb/anchor allowable load

	Maximum Spacing (INCHES)						
Door Width (ft) => Design Load	9'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
10 PSF	24	24	24	24	23	21	18
15 PSF	24	24	21	18	15	14	12
20 PSF	21	18	15	13	12	10	9
25 PSF	16	15	12	11	9	8	7
30 PSF	14	12	10	9	8	7	6
35 PSF	12	11	9	8	7	6	
40 PSF	10	9	8	7	6		
45 PSF	9	8	7	6			
50 PSF	8	7	6				
55 PSF	7	7	6				
60 PSF	7	6					

Min. 2000 PSI Concrete
 280 lb/anchor allowable load

	Maximum Spacing (INCHES)						
Door Width (ft) => Design Load	9'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	24	24	22
20 PSF	24	24	24	24	21	19	17
25 PSF	24	24	22	19	17	15	13
30 PSF	24	22	19	16	14	12	11
35 PSF	21	19	16	14	12	11	10
40 PSF	19	17	14	12	11	9	8
45 PSF	17	15	12	11	9	8	7
50 PSF	15	13	11	10	8	7	7
55 PSF	14	12	10	9	8	7	6
60 PSF	12	11	9	8	7	6	6

SEE NOTES ON PAGE 13

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Min. 3000 PSI Concrete
380 lb/anchor allowable load

	Maximum Spacing (INCHES)						
Door Width (ft) => Design Load	9'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	24	24	24
20 PSF	24	24	24	24	24	24	23
25 PSF	24	24	24	24	23	20	18
30 PSF	24	24	24	22	19	17	15
35 PSF	24	24	22	19	16	14	13
40 PSF	24	23	19	16	14	13	11
45 PSF	22	20	17	14	13	11	10
50 PSF	20	18	15	13	11	10	9
55 PSF	18	17	14	12	10	9	8
60 PSF	17	15	13	11	9	8	8

Min. 4000 PSI Concrete
400 lb/anchor allowable load

	Maximum Spacing (INCHES)						
Door Width (ft) => Design Load	9'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	24	24	24
20 PSF	24	24	24	24	24	24	24
25 PSF	24	24	24	24	24	21	19
30 PSF	24	24	24	23	20	18	16
35 PSF	24	24	23	20	17	15	14
40 PSF	24	24	20	17	15	13	12
45 PSF	24	21	18	15	13	12	11
50 PSF	21	19	16	14	12	11	10
55 PSF	19	17	15	12	11	10	9
60 PSF	18	16	13	11	10	9	8

SEE NOTES ON PAGE 13

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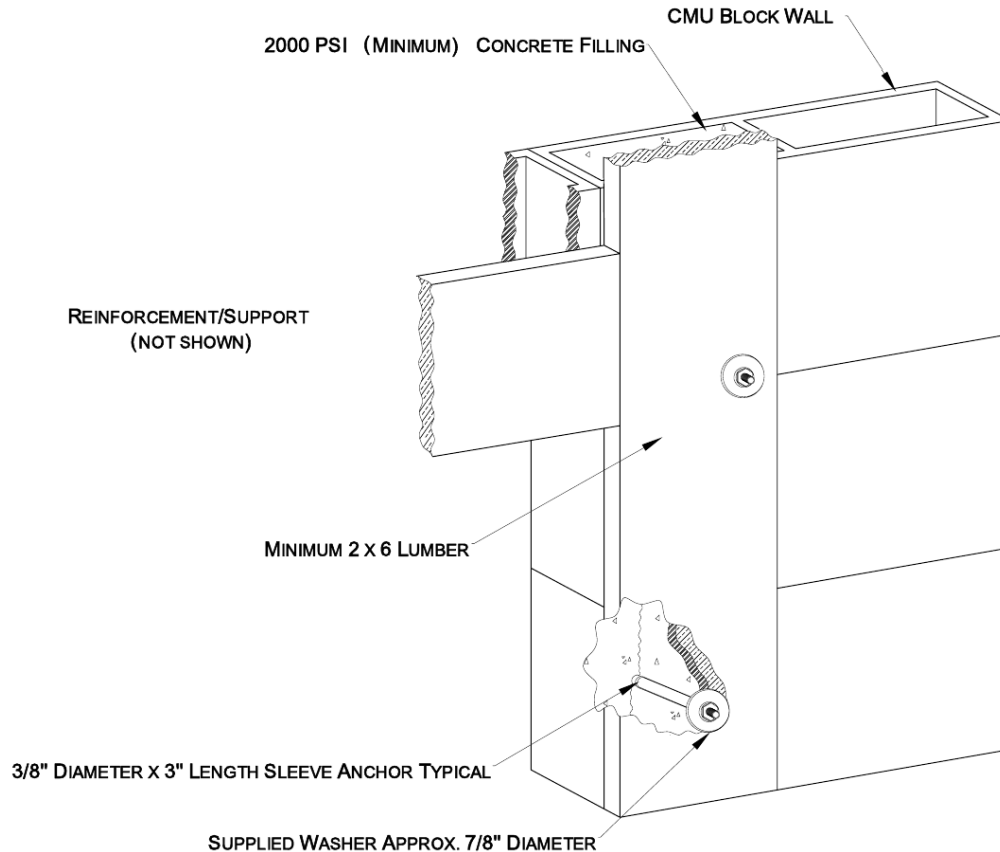
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Notes:

1. Anchors to be evenly spaced between the header and the floor.
2. First (bottom) anchor starting at no more than half of the maximum on-center distance. Highest anchor installed at least as high as the door opening.
3. Minimum edge distance of 2.5" required.
4. Anchor spacing calculated from loads per ITW Ramset/Redhead online performance data.
5. Vertical jambs shall be minimum 2 x 6 lumber, free of cracks, splits and knots in the area of attachment fasteners.
6. Use with 1" min. O.D. washers.
7. See figure for detail.
8. Special requirements for garage doors with center post systems. See manufacturer instructions for details.
9. Safety factor of 4:1 used to calculate allowable load per anchor.
10. Supporting structural elements shall be designed by a registered professional engineer for wind loads in addition to other loads.

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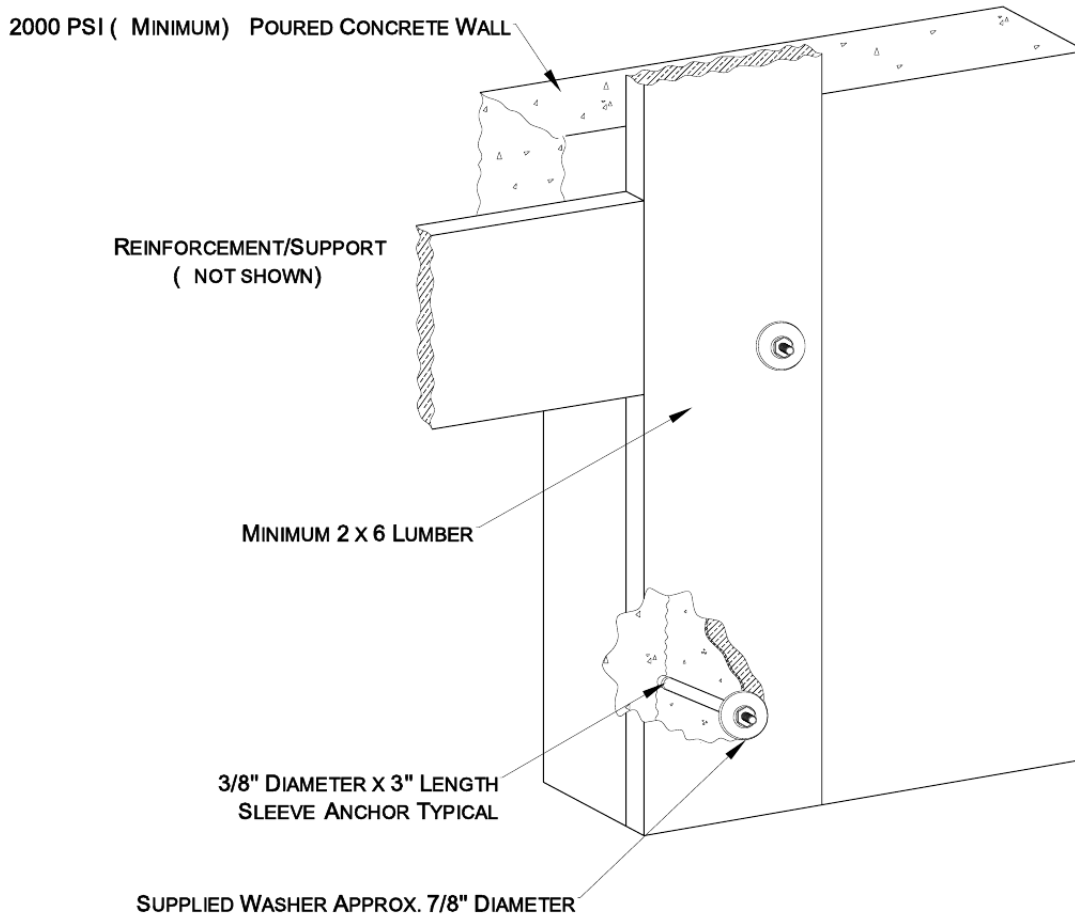
TDS-161b**3/8" X 3" SLEEVE ANCHORS (1-1/2" EMBED)**

Notes:

- Alternate design may be approved by a registered professional engineer.
- Wood jambs may be counterbored up to 3/8" deep at each sleeve anchor location.
- Sleeve anchors shall have a minimum edge distance of 3" for maximum holding power.
- Spring pad connection not included.

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Notes:

- Alternate design may be approved by a registered professional engineer.
- Wood jambs may be counterbored up to 3/8" deep at each sleeve anchor location.
- Sleeve anchors shall have a minimum edge distance of 3" for maximum holding power.
- Spring pad connection not included.

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3/8" x 3" Sleeve Anchors (1-1/2" Embed)

Reference: Simpson Strong-Tie Online Load Tables, www.simpsonanchors.com,

ANSI / AF&PA NDS-2005 for Wood Construction, p. 22, 28, 74

Southern Pine Jamb (Specific Gravity = 0.55), 2000 psi Min. Concrete
336 lb/anchor allowable load

Door Width (ft) => Design Load	Maximum Spacing (INCHES)						
	9'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	24	24	24
20 PSF	24	24	24	24	24	22	20
25 PSF	24	24	24	23	20	18	16
30 PSF	24	24	22	19	17	15	13
35 PSF	24	23	19	16	14	13	12
40 PSF	22	20	17	14	13	11	10
45 PSF	20	18	15	13	11	10	9
50 PSF	18	16	13	12	10	9	8
55 PSF	16	15	12	10	9	8	7
60 PSF	15	13	11	10	8	7	7

Spruce Pine Fir Jamb (Specific Gravity = 0.42), 2000 psi Min. Concrete
274 lb/anchor allowable load

Door Width (ft) => Design Load	Maximum Spacing (INCHES)						
	9'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	24	24	22
20 PSF	24	24	24	23	21	18	16
25 PSF	24	24	22	19	16	15	13
30 PSF	24	22	18	16	14	12	11
35 PSF	21	19	16	13	12	10	9
40 PSF	18	16	14	12	10	9	8
45 PSF	16	15	12	10	9	8	7
50 PSF	15	13	11	9	8	7	7
55 PSF	13	12	10	9	7	7	6
60 PSF	12	11	9	8	7	6	6

SEE NOTES ON FOLLOWING PAGE

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Notes:

1. Anchors to be evenly spaced between the header and the floor.
2. First (bottom) anchor starting at no more than half of the maximum on-center distance. Highest anchor installed at least as high as the door opening.
3. Min edge distance of 3" required.
4. Anchor spacing calculated from loads per Simpson Strong-Tie online performance data and ANSI / AF&PA NDS-2005 for Wood Construction.
5. Vertical jambs shall be minimum 2 x 6 lumber, free of cracks, splits and knots in the area of attachment fasteners.
6. Use washers provided by sleeve anchor manufacturer.
7. See figure for detail.
8. Special requirements for garage doors with center post systems. See manufacturer instructions for details.
9. Supporting structural elements shall be designed by a registered professional engineer for wind loads in addition to other loads.
10. **SPACING LESS THAN 6 INCHES NOT RECOMMENDED**

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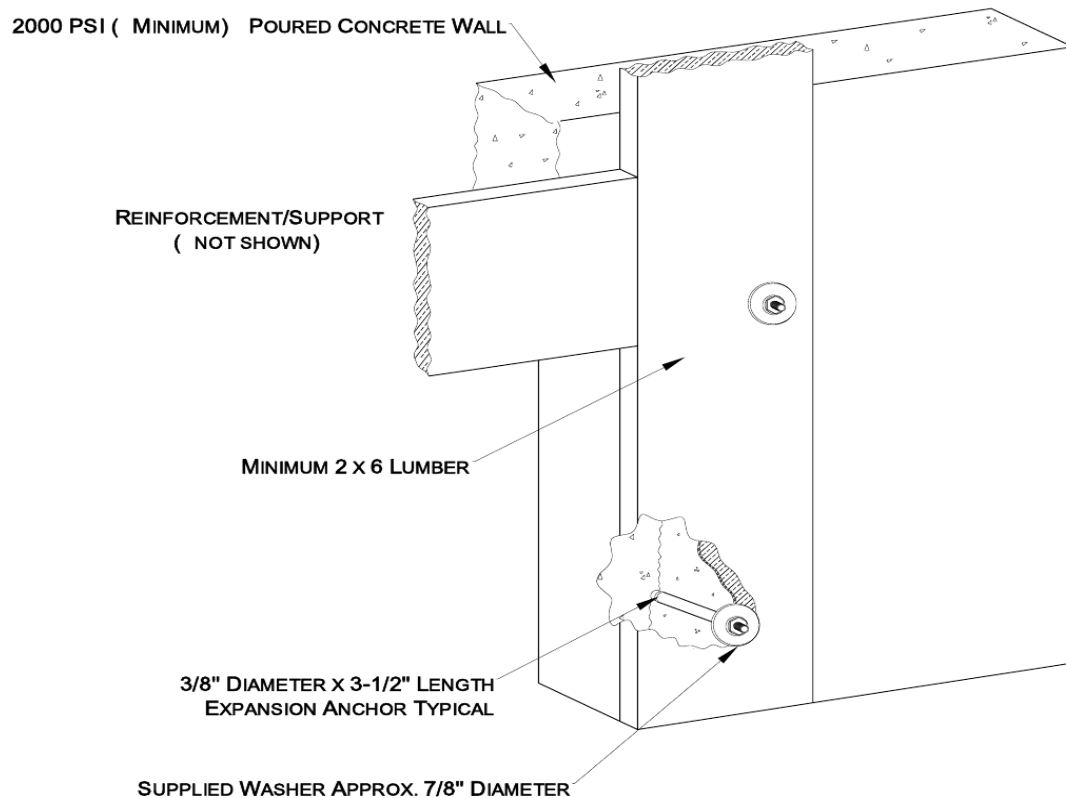
TDS-161c**3/8" X 3-1/2" EXPANSION (WEDGE) ANCHORS (1-1/2" EMBED)**

FIGURE 161c

Notes:

- Alternate design may be approved by a registered professional engineer.
- Wood jambs may be counterbored up to 3/8 deep at each wedge anchor location.
- Wedge anchors shall have a minimum edge distance of 3" for maximum holding power.
- Spring pad connection not included.

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3/8" x 3-1/2" Expansion (Wedge) Anchors (1-1/2" Embed)

Reference: Simpson Strong-Tie Online Load Tables, www.simpsonanchors.com,

ANSI / AF&PA NDS-2005 for Wood Construction, p. 22, 28, 74

Southern Pine Jamb (Specific Gravity = 0.55), 2000 psi Min. Concrete
364 lb/anchor allowable load

Door Width (ft) => Design Load	Maximum Spacing (INCHES)						
	9'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	24	24	24
20 PSF	24	24	24	24	24	24	22
25 PSF	24	24	24	24	22	19	17
30 PSF	24	24	24	21	18	16	15
35 PSF	24	24	21	18	16	14	12
40 PSF	24	22	18	16	14	12	11
45 PSF	22	19	16	14	12	11	10
50 PSF	19	17	15	12	11	10	9
55 PSF	18	16	13	11	10	9	8
60 PSF	16	15	12	10	9	8	7

Spruce Pine Fir Jamb (Specific Gravity = 0.42), 2000 psi Min. Concrete
274 lb/anchor allowable load

Door Width (ft) => Design Load	Maximum Spacing (INCHES)						
	9'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	24	24	22
20 PSF	24	24	24	23	21	18	16
25 PSF	24	24	22	19	16	15	13
30 PSF	24	22	18	16	14	12	11
35 PSF	21	19	16	13	12	10	9
40 PSF	18	16	14	12	10	9	8
45 PSF	16	15	12	10	9	8	7
50 PSF	15	13	11	9	8	7	7
55 PSF	13	12	10	9	7	7	6
60 PSF	12	11	9	8	7	6	

SEE NOTES ON FOLLOWING PAGE

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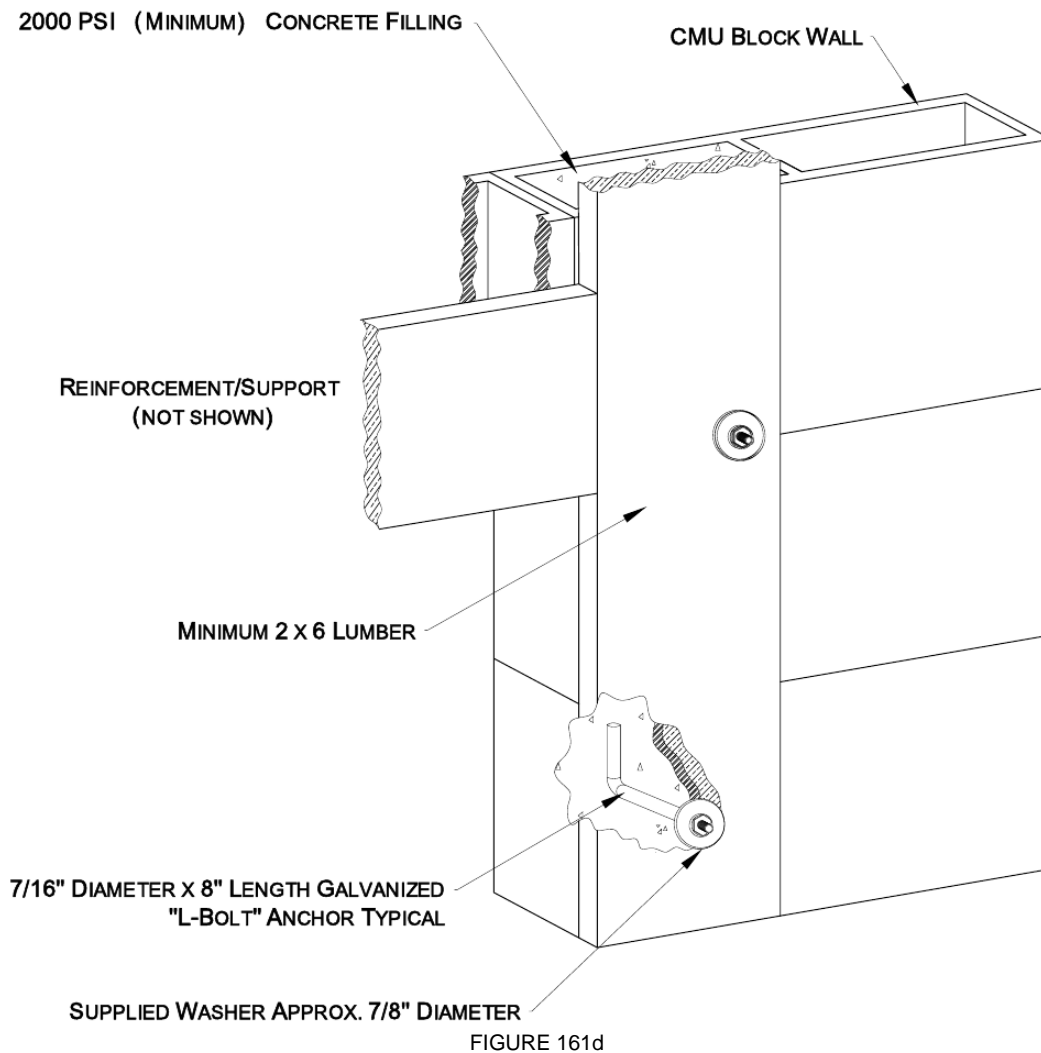
Notes:

1. Anchors to be evenly spaced between the header and the floor.
2. First (bottom) anchor starting at no more than half of the maximum on-center distance. Highest anchor installed at least as high as the door opening.
3. Min edge distance of 3" required.
4. Anchor spacing calculated from loads per Simpson Strong-Tie online performance data and ANSI / AF&PA NDS-2005 for Wood Construction.
5. Vertical jambs shall be minimum 2 x 6 lumber, free of cracks, splits and knots in the area of attachment fasteners.
6. Use washers provided by expansion anchor manufacturer.
7. See figure for detail.
8. Special requirements for garage doors with center post systems. See manufacturer instructions for details.
9. Supporting structural elements shall be designed by a registered professional engineer for wind loads in addition to other loads.
10. **SPACING LESS THAN 6 INCHES NOT RECOMMENDED.**

Note: Technical Data Sheets are information tools only and should not be used as substitutes for instructions from individual manufacturers. Always consult with individual manufacturers for specific recommendations for their products and check the applicable local regulations.

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TDS-161d
7/16" X 8" GALVANIZED L-BOLT ANCHORS



Notes:

- Alternate design may be approved by a registered professional engineer.
- Wood jambs may be counterbored up to 3/8 deep at each anchor location
- L-bolts shall have a minimum edge distance of 2-3/4" for maximum holding power.
- Spring pad connection not included.

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7/16" x 8" Galvanized L-Bolt Anchors**Reference: ANSI / AF&PA NDS for Wood Construction, p. 22, 28, 74**

957 lb/anchor allowable load

Door Width (ft) => Design Load	Maximum Spacing (INCHES)						
	9'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
10 PSF	36	36	36	36	36	36	36
15 PSF	36	36	36	36	36	36	36
20 PSF	36	36	36	36	36	36	36
25 PSF	36	36	36	36	36	36	36
30 PSF	36	36	36	36	36	36	36
35 PSF	36	36	36	36	36	36	33
40 PSF	36	36	36	36	36	32	29
45 PSF	36	36	36	36	32	28	26
50 PSF	36	36	36	33	29	26	23
55 PSF	36	36	35	30	26	23	21
60 PSF	36	36	32	27	24	21	19

Notes:

1. Anchors to be evenly spaced between the header and the floor.
2. First (bottom) anchor starting at no more than half of the maximum on-center distance. Highest anchor installed at least as high as the door opening.
3. Minimum of 3 anchors per jam allowed.
4. Anchor spacing calculated from loads per ASTM A307 and ANSI / AF&PA NDS-2005 for Wood Construction.
5. 8" CMU block walls shall be of sufficient strength to resist loads.
6. L-bolts shall be anchored in poured concrete wall (2000 psi min.), or CMU block filled with 2000 psi concrete.
7. Use with 1-5/8" min. O.D. or 2" min. square washers.
8. See figure for detail.
9. Special requirements for garage doors with center post systems. See manufacturer instructions for details.
10. Supporting structural elements shall be designed by a registered professional engineer for wind loads in addition to other loads.
11. 7/16" diameter mounting holes to be drilled in 2 x 6 to match bolt pattern.

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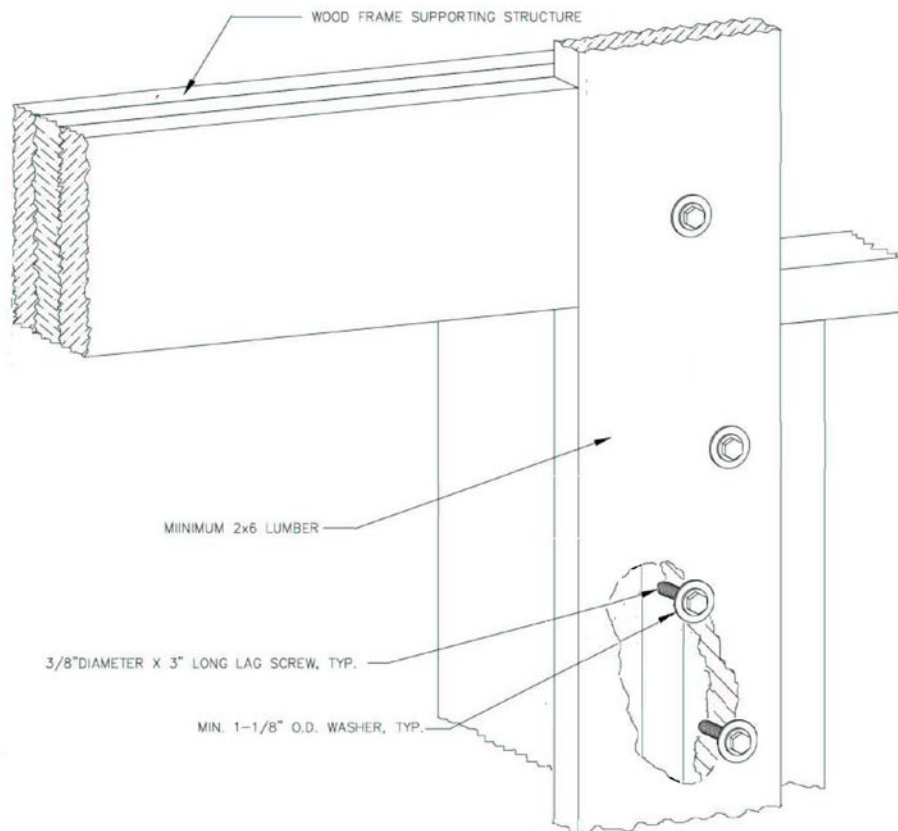
TDS-161e**3/8" X 3" LAG SCREW W/ 1-1/8" DIA. WASHER (1-1/2" EMBED)**

FIGURE 161e

Notes:

- Alternate design may be approved by a registered professional engineer.
- Wood jambs may be counterbored up to 1/2" deep at each lag screw location to provide a flush mounting surface.
- Wood jamb width should allow connection to as many full length vertical framing members as possible.
- Lag screws should have a minimum edge distance of 1-1/2" from alternating vertical jamb edges, for maximum holding power and to minimize jamb cross-grain bending.
- Lag screws should connect vertical jamb to full-height vertical framing members at door opening, and should be located away from framing member edges.
- Spring pad connection not included.

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3/8" x 3" Lag Screw W/ 1-1/8" Dia. Washer (1-1/2" Embed)

Reference: ANSI / AF&PA NDS-2005 for Wood Construction, p. 9, 59, 68, 74, 166

Southern Pine, Specific Gravity = 0.55
655 lb/anchor allowable load

Door Width (ft) => Design Load	Maximum Spacing (INCHES)						
	9'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	24	24	24
20 PSF	24	24	24	24	24	24	24
25 PSF	24	24	24	24	24	24	24
30 PSF	24	24	24	24	24	24	23
35 PSF	24	24	24	24	24	24	22
40 PSF	24	24	24	24	24	22	20
45 PSF	24	24	24	24	22	19	17
50 PSF	24	24	24	22	20	17	16
55 PSF	24	24	24	20	18	16	14
60 PSF	24	24	22	19	16	15	13

Spruce Pine Fir, Specific Gravity = 0.42
482 lb/anchor allowable load

Door Width (ft) => Design Load	Maximum Spacing (INCHES)						
	9'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	24	24	24
20 PSF	24	24	24	24	24	24	24
25 PSF	24	24	24	24	24	24	23
30 PSF	24	24	24	24	24	21	19
35 PSF	24	24	24	24	21	18	17
40 PSF	24	24	24	21	18	16	14
45 PSF	24	24	21	18	16	14	13
50 PSF	24	23	19	17	14	13	12
55 PSF	23	21	18	15	13	12	11
60 PSF	21	19	16	14	12	11	10

SEE NOTES ON FOLLOWING PAGE

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Notes:

1. Anchors to be evenly spaced between the header and the floor or between jambs.
2. First (bottom) anchor starting at no more than half of the maximum on-center distance. Highest anchor installed at least as high as the door opening.
3. Minimum end distance of 1.5" required.
4. Anchor spacing calculated from loads per ANSI / AF&PA NDS-2005 for Wood Construction.
5. Vertical jambs shall be minimum 2 x 6 lumber, free of cracks, splits and knots in the area of attachment fasteners.
6. Use with 1-1/8" min. O.D. washers.
7. See figure for detail.
8. Special requirements for garage doors with center post systems. See manufacturer instructions for details.
9. Supporting structural elements shall be designed by a registered professional engineer for wind loads in addition to other loads.
10. Pre-drill 1/4" diameter holes.
11. Lag screws must conform to ANSI/ASME Standard B18.2.1.

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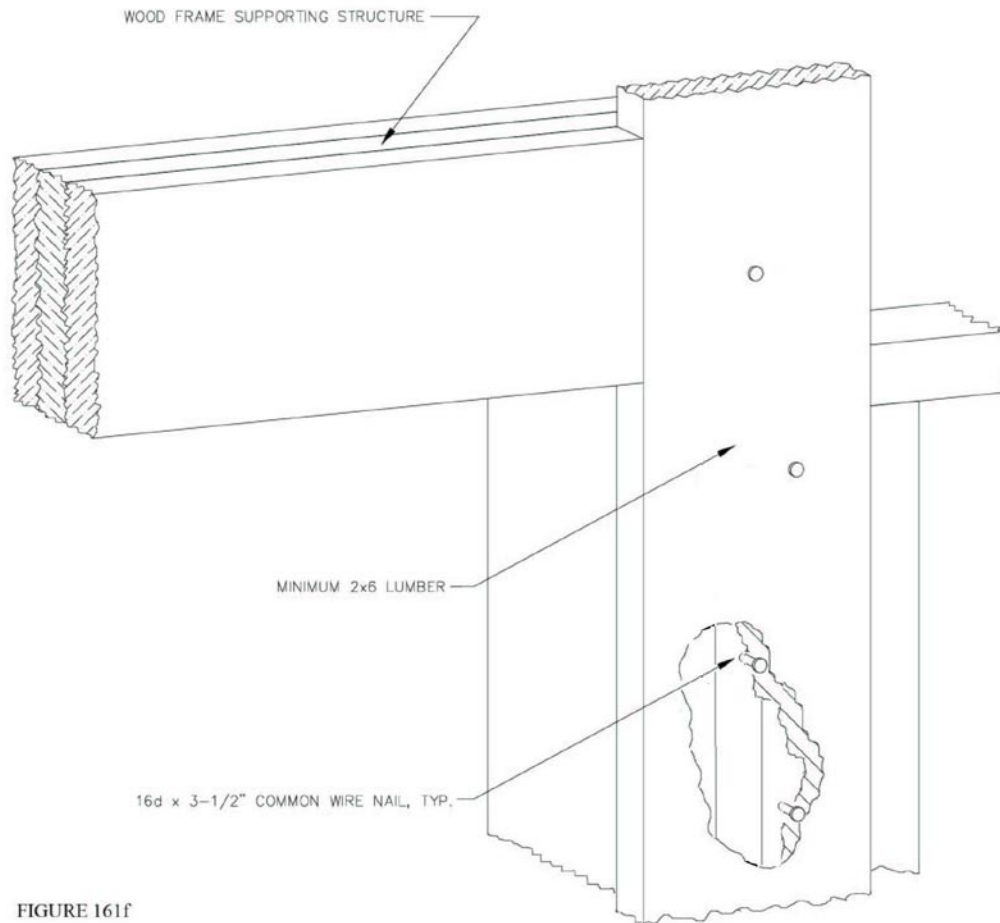
TDS-161f**16D x 3-1/2" COMMON WIRE NAILS (2" MIN. EMBED)**

FIGURE 161f

Notes:

- Alternate design may be approved by a registered professional engineer.
- Wood jamb width should allow connection to as many full length vertical framing members as possible
- Nails should have a minimum edge distance of 1-1/2" from alternating vertical jamb edges, for maximum holding power and to minimize jamb cross-grain bending.
- Nails should connect vertical jamb to full-height vertical framing members at door opening, and should be located away from framing member edges.
- Spring pad connection not included.

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16d x 3-1/2" Common Wire Nails (2" Min. Embed)

Reference: 2005 NDS-2005 for Wood Construction, p. 9, 59, 70, 74, 167)

Southern Pine, Specific Gravity = 0.55
160 lb/anchor allowable load

Door Width (ft) => Design Load	Maximum Spacing (INCHES)						
	9'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
10 PSF	24	24	24	24	24	21	19
15 PSF	24	24	21	18	16	14	13
20 PSF	21	19	16	14	12	11	10
25 PSF	17	15	13	11	10	9	8
30 PSF	14	13	11	9	8	7	6
35 PSF	12	11	9	8	7	6	
40 PSF	11	10	8	7	6		
45 PSF	9	9	7	6			
50 PSF	9	8	6				
55 PSF	8	7	6				
60 PSF	7	6					

Spruce Pine Fir, Specific Gravity = 0.42
83 lb/anchor allowable load

Door Width (ft) => Design Load	Maximum Spacing (INCHES)						
	9'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
10 PSF	22	20	17	14	12	11	10
15 PSF	15	13	11	9	8	7	7
20 PSF	11	10	8	7	6	6	
25 PSF	9	8	7	6			
30 PSF	7	7	6				
35 PSF	6	6					
40 PSF	6						
45 PSF							
50 PSF							
55 PSF							
60 PSF							

SEE NOTES ON FOLLOWING PAGE

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This Technical Data Sheet was prepared by the members of DASMA's Commercial & Residential Garage Door Division Technical Committee. DASMA is a trade association comprising manufacturers of rolling doors, fire doors, grilles, counter shutters, sheet doors, and related products; upward-acting residential and commercial garage doors; operating devices for garage doors and gates, sensing devices, and electronic remote controls for garage doors and gate operators; as well as companies that manufacture or supply either raw materials or significant components used in the manufacture and installation of the Active Members' products.

Notes:

1. Anchors to be evenly spaced between the header and the floor.
2. First (bottom) anchor starting at no more than half of the maximum on-center distance. Highest anchor installed at least as high as the door opening.
3. Anchor spacing calculated from loads per ANSI / AF&PA NDS2005 for Wood Construction.
4. Vertical jambs shall be minimum 2 x 6 lumber, free of cracks, splits and knots in the area of attachment fasteners.
5. See figure for detail.
6. Special requirements for garage doors with center post systems. See manufacturer instructions for details.
7. Supporting structural elements shall be designed by a registered professional engineer for wind loads in addition to other loads.
8. Nails must conform to ASTM F1667.
9. **SPACING LESS THAN 6 INCHES NOT RECOMMENDED.**

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TDS-161g
0.100" X 1" LONG FILLET WELD (E60XX ELECTRODES MIN.)
INTO 1/8" MIN. STEEL JAMBS

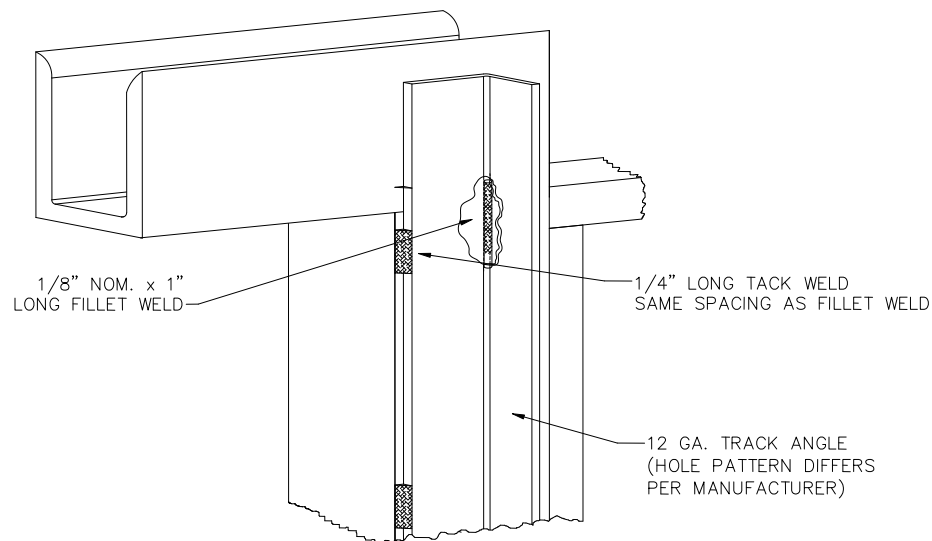


FIGURE 161g

Note:

- Alternate design may be approved by a registered professional engineer.
- Spring pad connection not included.

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.100" x 1" Long Fillet Weld (E60xx Electrodes Min.)

Reference: AISC Manual of Steel Construction Allowable Stress Design (9th Edition) p. 5-67, 5-70.

1,272 lb/anchor allowable load

Door Width (ft) => Design Load	Maximum Spacing (INCHES)						
	9'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	24	24	24
20 PSF	24	24	24	24	24	24	24
25 PSF	24	24	24	24	24	24	24
30 PSF	24	24	24	24	24	24	24
35 PSF	24	24	24	24	24	24	24
40 PSF	24	24	24	24	24	24	24
45 PSF	24	24	24	24	24	24	24
50 PSF	24	24	24	24	24	24	24
55 PSF	24	24	24	24	24	24	24
60 PSF	24	24	24	24	24	24	24

Notes:

- Most garage door industry track is galvanized steel. Use all necessary precautions when welding galvanized steel.**
- Welds to be evenly spaced between the header and the floor.
- First (bottom) weld starting at no more than half of the maximum on-center distance. Highest weld at least as high as the door opening.
- All welds should be performed by a Certified Welder or inspected by a Certified Welding Inspector to verify the integrity of the welds.
- Fillet welds to have a straight or convex face surface.
- Tack weld toe of angle at same spacing to prevent rotation of track angle.
- Cracks and blemishes shall be ground to a smooth contour and checked to ensure soundness.
- See figure for detail.
- Special requirements for garage doors with center post systems. See manufacturer instructions for details.
- Supporting structural elements shall be designed by a registered professional engineer for wind loads in addition to other loads.

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TDS-161h
1/4" X 3/4" SELF-TAPPING SCREWS INTO STEEL

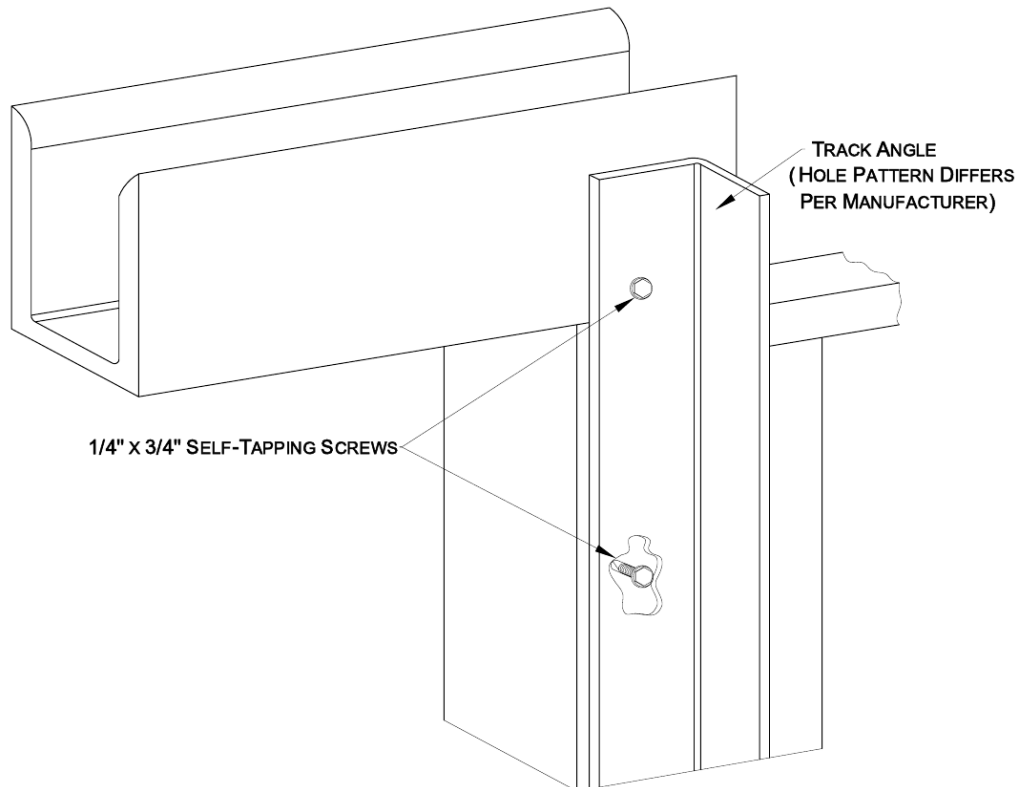


FIGURE 161h

Note:

- Alternate design may be approved by a registered professional engineer.
- Spring pad connection not included.

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1/4" x 3/4" Self-Tapping Screws

Reference: ITW Buildex Online Performance Data, www.itwbuildex.com

12 ga. Steel Jambs
209 lb/screw allowable load

Door Width (ft) => Design Load	Maximum Spacing (INCHES)						
	9'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	21	19	17
20 PSF	24	24	21	18	16	14	12
25 PSF	22	20	17	14	12	11	10
30 PSF	19	17	14	12	10	9	8
35 PSF	16	14	12	10	9	8	7
40 PSF	14	12	10	9	8	7	6
45 PSF	12	11	9	8	7	6	6
50 PSF	11	10	8	7	6	6	
55 PSF	10	9	8	6	6		
60 PSF	9	8	7	6			

3/16" Steel Jambs
444 lb/screw allowable load

Door Width (ft) => Design Load	Maximum Spacing (INCHES)						
	9'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	24	24	24
20 PSF	24	24	24	24	24	24	24
25 PSF	24	24	24	24	24	24	21
30 PSF	24	24	24	24	22	20	18
35 PSF	24	24	24	22	19	17	15
40 PSF	24	24	22	19	17	15	13
45 PSF	24	24	20	17	15	13	12
50 PSF	24	21	18	15	13	12	11
55 PSF	21	19	16	14	12	11	10
60 PSF	20	18	15	13	11	10	9

Notes:

1. Screws to be evenly spaced between the header and the floor.
2. First (bottom) screw starting at no more than half of the maximum on-center distance. Highest screw installed at least as high as the door opening.
3. See figure for detail.
4. Special requirements for garage doors with center post systems. See manufacturer instructions for details.
5. Supporting structural elements shall be designed by a registered professional engineer for wind loads in addition to other loads.

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