

SHEET METAL SCREWS THROUGH GYPSUM BOARD WALL SHEATHING

The allowable tension and shear values that have been suggested by OSHPD since August 16, 1994 were determined in accordance with a set of AISI Specification provisions which were proposed at the time. Those provisions were subsequently adopted and the values in the document dated August 16, 1994 have been accepted to date, for steel to steel connections. Table 1 represents updated allowable tension and shear values that are suggested for non-proprietary sheet metal screws for steel to steel connections. These suggested values are based upon the AISI Specifications 2001 edition with the associated 2004 supplement and are limited by actual tested strength of the screws in tension and shear.

However, equipment is often mounted on walls with one or two layers of 5/8" gypsum board sheathing between the back of the equipment and the sheet metal stud or backing bar. To date, we are not aware of any recognized values for sheet metal screws in such an application.

Recently, a very limited set of informal tests have been conducted to investigate the effects of gypsum board sheathing separating the fastener and the connected elements. The test assembly utilized #14 sheet metal screws through one and two layers of 5/8" gypsum board. The testing mechanism involved intermediate framing where forces were applied 1-5/8" from the face of the gypsum board parallel and perpendicular to the lengths of the studs in separate tests.

As expected, the results of the tests revealed that the allowable shears for these conditions are less than for the metal to metal case. In cases where the load was directed perpendicular to the length of the stud, and where induced prying occurs through intermediate frame loading, the allowable shears for this case are significantly lower.

As a result of the tests and until more detailed test results are obtained, OSHPD recommends the use of the suggested allowable shear and tension values in the following tables unless data is provided to substantiate the use of other values. In order to use the values in Tables 1, 2, and 3, the attachments must be detailed in such a way as to avoid prying and the studs must be stabilized with full-depth blocking with continuous straps along the flanges or with backing bars. If the attachment details result in prying with a moment arm not to exceed 1-5/8", the values in Table 4 may be used. If the attachment details result in prying with a moment arm that exceeds 1-5/8", the Professional in responsible charge of the project shall determine the allowable values and submit substantiation for them to OSHPD for review.

Interaction of shear and tension shall be based on $\frac{T}{T_{all}} + \frac{V}{V_{all}} \leq 1.0$.

Table 1 - DRAFT Suggested Capacity for Screw Connecting Steel to Steel											
F _y (ksi)	Steel Gage	Fastener Size									
		No. 14		No. 12		No. 10		No. 8		No.6	
		0.250 in.		0.216 in.		0.190 in.		0.164 in.		0.138 in.	
		Shear	Tension	Shear	Tension	Shear	Tension	Shear	Tension	Shear	Tension
50	12	813	468	627	405						
	14	813	328	627	284	405	249				
	16	613	261	569	225	405	198	336	171		
33	18	302	144	280	124	263	109	244	94	165	79
	20					177	84	164	72	151	61

Notes:

1. Suggested capacities are based upon the least of the average tested tensile and shear strengths tabulated from ICC ESR's 1976, 2196, 1730, 1408. These tables apply to non-proprietary fastener types and sizes, and does not endorse a specific manufacturer. Where proprietary fasteners are specified, no exceptions are taken to the use of manufacturer specific values that are based upon the 2001 AISI, Section E4 including the 2004 supplement. All screw fasteners shall satisfy AC118 – Acceptance criteria for tapping screw fasteners.
2. Penetration of screws through joined material should not be less than 3 exposed threads.
3. Allowable fastener values are based upon the 2001 Edition of the AISI – section E4 including the 2004 supplement.
4. Design thicknesses are based upon the 2001 Edition of the AISI as follows: 12 ga/97 mils/0.1017", 14 ga/68 mils/0.0713", 16ga/54 mils/0.0566", 18 ga/43 mils./0.0451", 20 ga/33 mils./0.0346".
5. Steel thicknesses joined are assumed to be the same. If dissimilar thicknesses are being connected, the value for the thinner part joined shall be used.
6. The minimum spacing between centers of fasteners shall not be less than 3 x fastener diameter. The minimum edge distance from the center of a fastener to the edge of any part shall not be less than 1.5 x fastener diameter. Where the end distance is parallel to the force on the fastener, the nominal shear strength shall be limited by Section E4.3.2 of the AISI.
7. Where values are not given, such combinations of screw sizes & material thickness are not recommended.
8. Galvanized metal studs, track and sheet steel shall conform to ASTM A653 material (or other equivalent ASTM listed materials in the 2001 Edition of the AISI-NAS, Section A2.1) with a minimum yield strength of 33 ksi for 18 gage and lighter, and minimum yield strength of 50 ksi for 16 gage & heavier.
9. Where one or two layers of gyp board occurs between steel surfaces, the suggested capacities of Table 2 & 3 shall be used.
10. Allowable values do not account for effects from prying. The Professional in responsible charge of the project shall provide adequate blocking/restraint to prevent prying action. Where prying occurs, the values and constraints of Table 4 shall be used.

Table 2 - DRAFT^{1,2}Suggested Capacity for Screw Connection where **One layer 5/8" Gyp Board occurs** between steel surfaces. **(Non-Prying Condition)**

F _y (ksi)	Steel Gage	Fastener Size									
		No. 14		No. 12		No. 10		No. 8		No.6	
		0.250 in.		0.216 in.		0.190 in.		0.164 in.		0.138 in.	
		Shear	Tension	Shear	Tension	Shear	Tension	Shear	Tension	Shear	Tension
50	12	226	468	180	405						
	14	226	329	180	284	140	249				
	16	226	261	180	225	140	198	120	171		
33	18	226	144	180	124	140	109	120	94	60	79
	20					100	84	80	72	60	61

Notes:

1. Refer to Notes from Table 1.
2. Allowable values do not account for effects from prying. Designer to provide adequate blocking/restraint to prevent prying action. Where prying occurs, the values and constraints of Table 4 shall be used.

Table 3 - DRAFT^{1,2}Suggested Capacity for Screw Connection where **Two layers 5/8" Gyp Board occurs** between steel surfaces. **(Non-Prying Condition)**

F _y (ksi)	Steel Gage	Fastener Size									
		No. 14		No. 12		No. 10		No. 8		No.6	
		0.250 in.		0.216 in.		0.190 in.		0.164 in.		0.138 in.	
		Shear ³	Tension	Shear ⁴	Tension	Shear ⁴	Tension	Shear ⁴	Tension	Shear ⁴	Tension
50	12	166	468	130	405						
	14	166	329	130	284	100	249				
	16	166	261	130	225	100	198	80	171		
33	18	166	144	130	124	100	109	80	94	50	79
	20					70	84	50	72	40	61

Notes:

1. Refer to Notes from Table 1.
2. Allowable values do not account for effects from prying. Designer to provide adequate blocking/restraint to prevent prying action. Where prying occurs, the values and constraints of Table 4 shall be used.

Table 4 - DRAFTSuggested Capacity for Screw Connection where **One or Two layers 5/8" Gyp Board occurs** between steel surfaces. **(Prying Occurs)**

F _y (ksi)	Steel Gage	Fastener Size									
		No. 14		No. 12		No. 10		No. 8		No. 6	
		0.250 in.		0.216 in.		0.190 in.		0.164 in.		0.138 in.	
		Shear	Tension	Shear	Tension	Shear	Tension	Shear	Tension	Shear	Tension
50	12	40	468	30	405						
	14	40	329	30	284	25	249				
	16	40	261	30	225	25	198	20	171		
33	18	40	144	30	124	25	109	20	94	10	79
	20					15	84	15	72	10	61

Notes:

1. Refer to Notes from Table 1.
2. Where the effects of prying occurs, the suggested capacities of table 4 shall be used.
3. The capacities listed in Table 4 are based upon a limited test assembly where the origin and direction of the load results in prying upon the fastener. The magnitude of this prying effect shall be limited to a moment arm of 1 5/8" from the fastener.