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2

DAVE W
ERIC
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STRUCTURAL CALCULATIONS

FOR

INTERIOR GLASS ENTRY

MICRO

11-183710 DFS 01 FA

VSP TENANT IMPROVEMENT
1120 N.W. COUCH STREET
PORTLAND, OREGON

STRUCTURAL
REGISTERED PROFESSIONAL
ENGINEER
16310
OREGON
DEC. 1, 1992
JOHN ANTHONY TESNER JR.

EXPIRES: 6/30/2012

City of Portland
REVIEWED FOR CODE COMPLIANCE
NOV 01 2011
11-183710-
Permit Number
DFS-01-FA

B1

Project: VSP TENANT IMPROVEMENT	Proj. No.:
INTERIOR GLASS ENTRY	By: JAT
Client: CULVER GLASS	Date: OCT. 2011 Sheet No.: COVER

TESNER STRUCTURAL ENGINEERS

1534 Southeast 25th Avenue Portland, OR 97214 Phone 503-239-9119 Fax 503-239-9122

INTERIOR GLASS ENTRY

DESIGN FOR 5 PSF HORIZONTAL LOAD PER 2010 OSSC SECTION 1607.13

GLASS SPAN (HEIGHT): 102 1/4" (8.52')

SUPPORTED LATERALLY ALONG TWO OPPOSITE SIDES

CHECK 1/2" FULLY TEMPERED (FT) PER ASTM E1300 (SEE ATTACHED)

FROM FIG. A1.25 UPPER

$NFL \approx 9.6$ PSF

$GTF = 4.0$ FOR TYPE FT (TABLE 1)

LR = LOAD RESISTANCE

$= NFL \times GTF$

$= (9.6)(4.0)$

$= 38.4$ PSF

$\gg 5$ PSF OK

CHECK APPROXIMATE MAXIMUM LATERAL DEFLECTION PER FIG. A1.25 LOWER

LOAD $\times L^4$ (KIP. FT^2)

$= \left(\frac{5}{1000} \text{ KSF}\right)(8.52 \text{ FT})^4$

$= 26.4$ KIP. FT^2

CONT'D

$\Delta_{MAX} \approx 0.56"$ OK

1/2" FULLY TEMPERED GLASS OK

SILL & HEAD CONNECTIONS

ω = LOAD PER FOOT

$= \left(\frac{8.52}{2}\right)(5)$

$= 21.3$ PLF

AT SILL, TRY #12 SCREW IN FISCHER S7 NYLON PLUG - SAY ONE SCREW 3" IN FROM EACH END AND ONE SCREW IN BETWEEN

$\text{SPACING} = \frac{46.625-(2)(3)}{2}$

$= 20.3125"$ MAX

SAY 24" O.C.

CHECK ALLOWABLE SHEAR LOAD FOR BEARING OF SCREW ON 1/8" ALUMINUM CHANNEL (USE VALUE FOR 6063-T5 ALUMINUM)

$V = \left(\frac{24}{12}\right)(21.3)$

$= 42.6$ #

$V_{ALLOW} = 432\# \gg 42.6$

FOR SAE GRADE 2 SCREW

$V_{ALLOW} = 366\# \gg 42.6$

CONT'D

CONSERVATIVELY CHECK PULLOUT -

$T \approx \frac{(42.6)(0.875)}{(2/3)(0.5)}$

$= 112$ #

CONSIDER FACTOR OF SAFETY OF 4.0

$T_{ALLOW} = \frac{1200}{4.0} = 300\#$

$> 112\#$

NOTE: ANALYSIS IGNORES DEAD LOAD RESISTANCE TO PULLOUT (CONSERVATIVE)

FOR HEAD, TRY #12 SCREW IN 18 GAUGE (43 MILS) METAL STUD FRAMING

$V_{ALLOW} = 280\#$

$T_{ALLOW} = 124\#$

FOR PULLOUT, USE

$V = 21.3$ PLF

$T \approx \frac{(21.3)(1.875)}{(2/3)(0.5)}$

$= 120\# < 124\#$

SPACE SCREWS AT 12" O.C. AT HEAD

Project: VSP TENANT IMPROVEMENT
INTERIOR GLASS ENTRY

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Date: OCT. 2011

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INTERIOR GLASS ENTRY

FOR DOOR PIVOT AT HEAD, PROVIDE CONCENTRATION OF SCREWS TO RESIST 100% OF LOAD ON DOOR (CONSV.)

R = REACTION AT HEAD PIVOT

$= (5)(3)\left(\frac{8.52}{2}\right)$

$= 64\#$

TRY TWO SCREWS -

$T \approx \frac{(64)(1.75 + 0.375)}{(2)(2/3)(1.5)}$

$= 68\# < 124\#$ OK

Project: HEALTH AND BIO SCIENCE ACADEMY
EVERGREEN SCHOOL DISTRICT
Client: CULVER GLASS

Proj. No.:
By: JAT
Date: OCT. 2011
Sheet No.: 2

Designation: E 1300 – 07$^{\epsilon 1}$

Standard Practice for Determining Load Resistance of Glass in Buildings[1]

This standard is issued under the fixed designation E 1300; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

ϵ^1 NOTE—Editorially corrected figure references in October 2007

1. Scope

1.1 This practice describes procedures to determine the load resistance of specified glass types, including combinations of glass types used in a sealed insulating glass unit, exposed to a uniform lateral load of short or long duration, for a specified probability of breakage.

1.2 This practice applies to vertical and sloped glazing in buildings for which the specified design loads consist of wind load, snow load and self-weight with a total combined magnitude less than or equal to 10 kPa (210 psf). This practice shall not apply to other applications including, but not limited to, balustrades, glass floor panels, aquariums, structural glass members and glass shelves.

1.3 This practice applies only to monolithic, laminated, or insulating glass constructions of rectangular shape with continuous lateral support along one, two, three or four edges. This practice assumes that (*1*) the supported glass edges for two, three and four sided support conditions are simply supported and free to slip in plane (*2*) glass supported on two sides acts as a simply supported beam, and (*3*) glass supported on one side acts as a cantilever.

1.4 This practice does not apply to any form of wired, patterned, etched, sandblasted, drilled, notched or grooved glass with surface and edge treatments that alter the glass strength.

1.5 This practice addresses only the determination of the resistance of glass to uniform lateral loads. The final thickness and type of glass selected also depends upon a variety of other factors (see 5.3).

1.6 Charts in this practice provide a means to determine approximate maximum lateral glass deflection. Appendix X1 and Appendix X2 provide additional procedures to determine maximum lateral deflection for glass simply supported on four sides. Appendix X3 presents a procedure to compute approximate probability of breakage for annealed monolithic glass lites simply supported on four sides.

1.7 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only. For conversion of quantities in various systems of measurements to SI units refer to SI 10.

1.8 Appendix X4 lists the key variables used in calculating the mandatory type factors in Tables 1-3 and comments on their conservative values.

1.9 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:* [2]

C 1036 Specification for Flat Glass

C 1048 Specification for Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass

C 1172 Specification for Laminated Architectural Flat Glass

D 4065 Practice for Plastics: Dynamic Mechanical Properties: Determination and Report of Procedures

E 631 Terminology of Building Constructions

SI 10 Practice for Use of the International System of Units (SI) (the Modernized Metric System)

3. Terminology

3.1 *Definitions:*

3.1.1 Refer to Terminology E 631 for additional terms used in this practice.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *aspect ratio (AR), n*—for glass simply supported on four sides, the ratio of the long dimension of the glass to the short dimension of the glass is always equal to or greater than 1.0. For glass simply supported on three sides, the ratio of the length of one of the supported edges perpendicular to the free edge, to the length of the free edge, is equal to or greater than 0.5.

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[1] This practice is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.51 on Performance of Windows, Doors, Skylights and Curtain Walls.

Current edition approved Sept. 1, 2007. Published October 2007. Originally approved in 1989. Last previous edition approved in 2004 as E 1300 – 04$^{\epsilon 1}$.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

TABLE 1 Glass Type Factors (GTF) for a Single Lite of Monolithic or Laminated Glass

Glass Type	GTF: Short Duration Load (3 sec)	GTF: Long Duration Load (30 day)
AN	1.0	0.43
HS	2.0	1.3
FT	4.0	3.0

TABLE 2 Glass Type Factors (GTF) for Insulating Glass (IG), Short Duration Load

Lite No. 1 Monolithic Glass or Laminated Glass Type	Lite No. 2 Monolithic Glass or Laminated Glass Type: AN GTF1	AN GTF2	HS GTF1	HS GTF2	FT GTF1	FT GTF2
AN	0.9	0.9	1.0	1.9	1.0	3.8
HS	1.9	1.0	1.8	1.8	1.9	3.8
FT	3.8	1.0	3.8	1.9	3.6	3.6

TABLE 3 Glass Type Factors (GTF) for Insulating Glass (IG), Long Duration Load (30 day)

Lite No. 1 Monolithic Glass or Laminated Glass Type	Lite No. 2 Monolithic Glass or Laminated Glass Type: AN GTF1	AN GTF2	HS GTF1	HS GTF2	FT GTF1	FT GTF2
AN	0.39	0.39	0.43	1.25	0.43	2.85
HS	1.25	0.43	1.25	1.25	1.25	2.85
FT	2.85	0.43	2.85	1.25	2.85	2.85

3.2.2 *glass breakage, n*—the fracture of any lite or ply in monolithic, laminated, or insulating glass.

3.2.3 *Glass Thickness*:

3.2.3.1 *thickness designation for monolithic glass, n*—a term that defines a designated thickness for monolithic glass as specified in Table 4 and Specification C 1036.

3.2.3.2 *thickness designation for laminated glass (LG), n*—a term used to specify a LG construction based on the combined thicknesses of component plies.

(*a*) Add the minimum thicknesses of the individual glass plies and the interlayer thickness. If the sum of all interlayer thicknesses is greater than 1.52 mm (0.060 in.) use 1.52 mm (0.060 in.) in the calculation.

TABLE 4 Minimum Glass Thicknesses

Nominal Thickness or Designation, mm (in.)	Minimum Thickness, mm (in.)
2.5 (3/32)	2.16 (0.085)
2.7 (lami)	2.59 (0.102)
3.0 (1/8)	2.92 (0.115)
4.0 (5/32)	3.78 (0.149)
5.0 (3/16)	4.57 (0.180)
6.0 (1/4)	5.56 (0.219)
8.0 (5/16)	7.42 (0.292)
10.0 (3/8)	9.02 (0.355)
12.0 (1/2)	11.91 (0.469)
16.0 (5/8)	15.09 (0.595)
19.0 (3/4)	18.26 (0.719)
22.0 (7/8)	21.44 (0.844)

(*b*) Select the monolithic thickness designation in Table 4 having the closest minimum thickness that is equal to or less than the value obtained in 3.2.3.2 (*a*).

(*c*) Exception: The construction of two 6 mm (1/4 in.) glass plies plus 0.76 mm (0.030 in.) interlayer shall be defined as 12 mm (1/2 in.).

3.2.4 *Glass Types*:

3.2.4.1 *annealed (AN) glass, n*—a flat, monolithic, glass lite of uniform thickness where the residual surface stresses are nearly zero as defined in Specification C 1036.

3.2.4.2 *fully tempered (FT) glass, n*—a flat, monolithic, glass lite of uniform thickness that has been subjected to a special heat treatment process where the residual surface compression is not less than 69 MPa (10 000 psi) or the edge compression not less than 67 MPa (9700 psi) as defined in Specification C 1048.

3.2.4.3 *heat strengthened (HS) glass, n*—a flat, monolithic, glass lite of uniform thickness that has been subjected to a special heat treatment process where the residual surface compression is not less than 24 MPa (3500 psi) or greater than 52 MPa (7500 psi) as defined in Specification C 1048.

3.2.4.4 *insulating glass (IG) unit, n*—any combination of two glass lites that enclose a sealed space filled with air or other gas.

3.2.4.5 *laminated glass (LG), n*—a flat lite of uniform thickness consisting of two or more monolithic glass plies bonded together with an interlayer material as defined in Specification C 1172. *Discussion*—Many different interlayer materials are used in laminated glass. The information in this practice applies only to polyvinyl butyral (PVB) interlayer or those interlayers that demonstrate equivalency according to Appendix X10.

3.2.5 *glass type (GT) factor, n*—a multiplying factor for adjusting the load resistance of different glass types, that is, annealed, heat-strengthened, or fully tempered in monolithic, LG or IG constructions.

3.2.6 *lateral, adj*—perpendicular to the glass surface.

3.2.7 *load, n*—a uniformly distributed lateral pressure.

3.2.7.1 *specified design load, n*—the magnitude in kPa (psf), type (for example, wind or snow) and duration of the load given by the specifying authority.

3.2.7.2 *load resistance (LR), n*—the uniform lateral load that a glass construction can sustain based upon a given probability of breakage and load duration.

(*a*) *Discussion*—Multiplying the non-factored load from figures in Annex A1 by the relevant GTF and load share (LS) factors gives the load resistance associated with a breakage probability less than or equal to 8 lites per 1000.

3.2.7.3 *long duration load, n*—any load lasting approximately 30 days. *Discussion*—For loads having durations other than 3 s or 30 days, refer to Table X6.1.

3.2.7.4 *non-factored load (NFL), n*—three second duration uniform load associated with a probability of breakage less than or equal to 8 lites per 1000 for monolithic annealed glass as determined from the figures in Annex A1.

3.2.7.5 *glass weight load, n*—the dead load component of the glass weight.

3.2.7.6 *short duration load, n*—any load lasting 3 s or less.

3.2.8 *load share (LS) factor, n*—a multiplying factor derived from the load sharing between the two lites, of equal or different thicknesses and types (including the layered behavior of laminated glass under long duration loads), in a sealed IG unit.

3.2.8.1 *Discussion*—The LS factor is used along with the glass type factor (GTF) and the non-factored load (NFL) value from the non-factored load charts to give the load resistance of the IG unit, based on the resistance to breakage of one specific lite only.

3.2.9 *probability of breakage* (P_b), *n*—the fraction of glass lites or plies that would break at the first occurrence of a specified load and duration, typically expressed in lites per 1000.

3.2.10 *specifying authority, n*—the design professional responsible for interpreting applicable regulations of authorities having jurisdiction and considering appropriate site specific factors to determine the appropriate values used to calculate the specified design load, and furnishing other information required to perform this practice.

4. Summary of Practice

4.1 The specifying authority shall provide the design load, the rectangular glass dimensions, the type of glass required, and a statement, or details, showing that the glass edge support system meets the stiffness requirement in 5.2.4.

4.2 The procedure specified in this practice shall be used to determine the uniform lateral load resistance of glass in buildings. If the load resistance is less than the specified load, then other glass types and thicknesses may be evaluated to find a suitable assembly having load resistance equal to or exceeding the specified design load.

4.3 The charts presented in this practice shall be used to determine the approximate maximum lateral glass deflection. Appendix X1 and Appendix X2 present two additional procedures to determine the approximate maximum lateral deflection for a specified load on glass simply supported on four sides.

4.4 An optional procedure for determining the probability of breakage at a given load is presented in Appendix X3.

5. Significance and Use

5.1 This practice is used to determine the load resistance of specified glass types and constructions exposed to uniform lateral loads.

5.2 Use of this practice assumes:

5.2.1 The glass is free of edge damage and is properly glazed,

5.2.2 The glass has not been subjected to abuse,

5.2.3 The surface condition of the glass is typical of glass that has been in service for several years, and is weaker than freshly manufactured glass due to minor abrasions on exposed surfaces,

5.2.4 The glass edge support system is sufficiently stiff to limit the lateral deflections of the supported glass edges to no more than 1⁄175 of their lengths. The specified design load shall be used for this calculation.

5.2.5 The center of glass deflection will not result in loss of edge support.

NOTE 1—This practice does not address aesthetic issues caused by glass deflection.

5.3 Many other factors shall be considered in glass type and thickness selection. These factors include but are not limited to: thermal stresses, spontaneous breakage of tempered glass, the effects of windborne debris, excessive deflections, behavior of glass fragments after breakage, seismic effects, heat flow, edge bite, noise abatement, potential post-breakage consequences, and so forth. In addition, considerations set forth in building codes along with criteria presented in safety glazing standards and site specific concerns may control the ultimate glass type and thickness selection.

5.4 For situations not specifically addressed in this standard, the design professional shall use engineering analysis and judgment to determine the load resistance of glass in buildings.

6. Procedure

6.1 Select a glass type, thickness, and construction for load-resistance evaluation.

6.2 *For Monolithic Single Glazing Simply Supported Continuously Along Four Sides:*

6.2.1 Determine the non-factored load (NFL) from the appropriate chart in Annex A1 (the upper charts of Figs A1.1–A1.12) for the glass thickness and size.

6.2.2 Determine the glass type factor (GTF) for the appropriate glass type and load duration (short or long) from Table 1.

6.2.3 Multiply NFL by GTF to get the load resistance (LR) of the lite.

6.2.4 Determine the approximate maximum lateral (center of glass) deflection from the appropriate chart in Annex A1 (the lower charts of Figs. A1.1–A1.12) for the designated glass thickness, size, and design load. If the maximum lateral deflection falls outside the charts in Annex A1, then use the procedures outlined in Appendix X1 and Appendix X2.

6.3 *For Monolithic Single Glazing Simply Supported Continuously Along Three Sides:*

6.3.1 Determine the non-factored load (NFL) from the appropriate chart in Annex A1 (the upper charts of Figs. A1.13–A1.24) for the designated glass thickness and size.

6.3.2 Determine the GTF for the appropriate glass type and load duration (short or long) from Table 1.

6.3.3 Multiply NFL by GTF to get the LR of the lite.

6.3.4 Determine the approximate maximum lateral (center of unsupported edge) deflection from the appropriate chart in Annex A1 (the lower charts in Figs A1.13–A1.24) for the designated glass thickness, size, and design load.

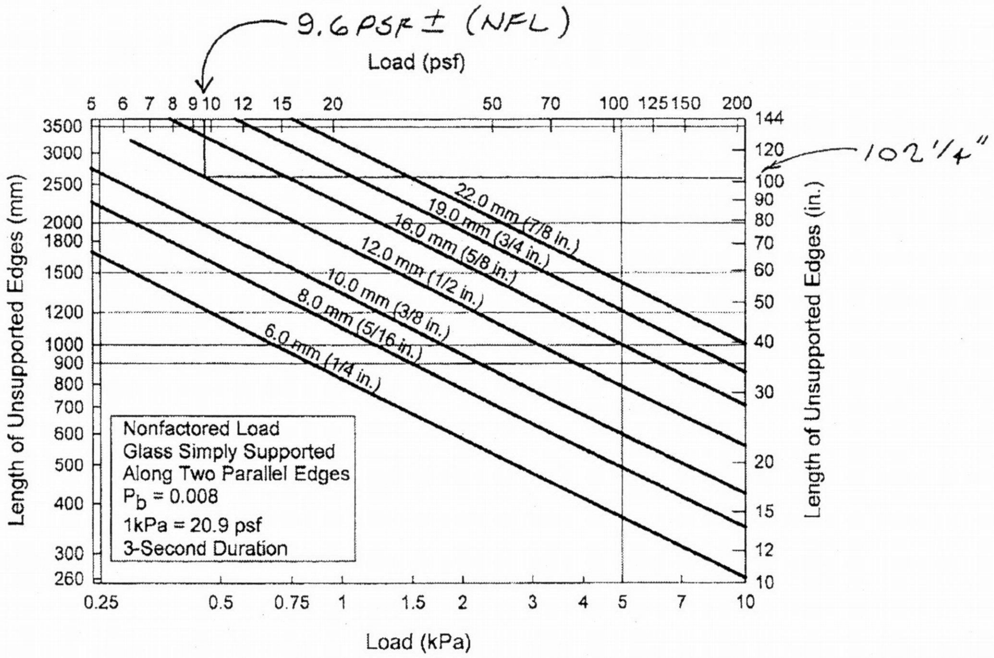
6.4 *For Monolithic Single Glazing Simply Supported Continuously Along Two Opposite Sides:*

6.4.1 Determine the NFL from the upper chart of Fig. A1.25 for the designated glass thickness and length of unsupported edges.

6.4.2 Determine the GTF for the appropriate glass type and load duration (short or long) from Table 1.

6.4.3 Multiply NFL by GTF to get the LR of the lite.

6.4.4 Determine the approximate maximum lateral (center of an unsupported edge) deflection from the lower chart of Fig. A1.25 for the designated glass thickness, length of unsupported edge, and design load.



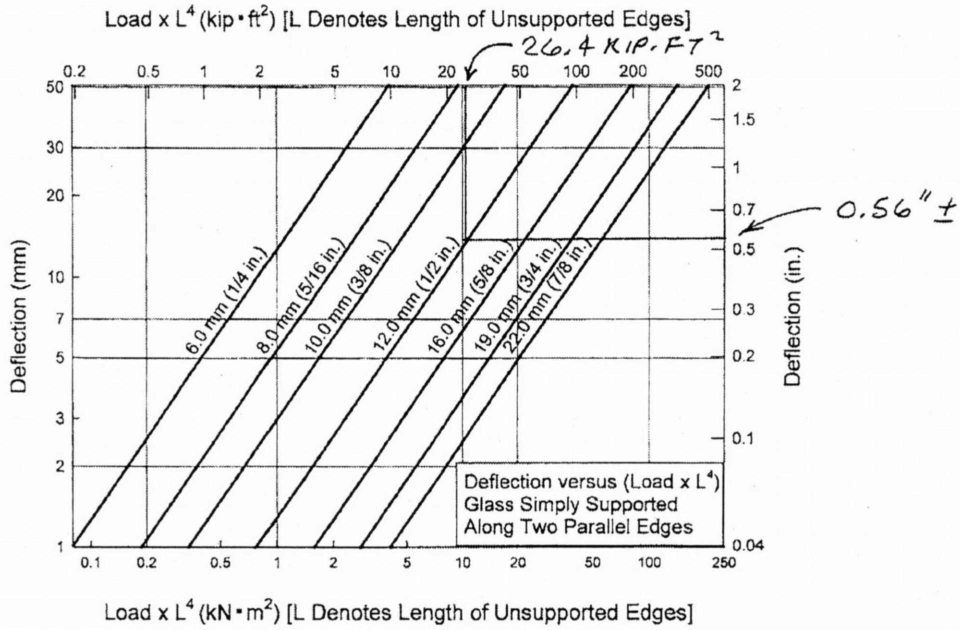


FIG. A1.25 (upper chart) Nonfactored Load Chart for Glass Simply Supported Along Two Parallel Edges (lower chart) Deflection Chart for Glass Simply Supported Along Two Parallel Edges

19. FASTENER LOAD TABLES

B. Unified Coarse Threads

TABLE 5

SAE Grade 2 Steel for Diameters Up thru 9/16"
ASTM A 307 Steel for Diameters 5/8" and Over

Nominal Thread Diameter & Thread/Inch	D Nominal Thread Diameter (Inch)	A(S) Tensile Stress Area (Sq. In.)	A(R) Thread Root Area (Sq. In.)	Allowable Tension (Pounds)	Allowable Shear		Bearing (Pounds)			Minimum Material Thickness to Equal Tensile Capacity of Fastener (In.)		
					Single (Pounds)	Double (Pounds)	1/8" St. A36	1/8" Al. 6063-T5	1/8" Al. 6063-T6	A36	6063-T5	6063-T6
#6-32	0.1380	0.0091	0.0078	269	133	267	1201	276	414	0.101	0.211	0.154
#8-32	0.1640	0.0140	0.0124	414	212	424	1427	328	492	0.128	0.280	0.202
#10-24	0.1900	0.0175	0.0152	518	260	520	1653	380	570	0.136	0.286	0.209
#12-24	0.2160	0.0242	0.0214	716	366	731	1879	432	648	0.159	0.344	0.248
1/4-20	0.2500	0.0318	0.0280	941	479	957	2175	500	750	0.180	0.385	0.279
5/16-18	0.3125	0.0524	0.0469	1551	802	1603	2719	625	938	0.225	0.492	0.354
3/8-16	0.3750	0.0775	0.0699	2294	1195	2389	3262	750	1125	0.268	0.637	0.425
7/16-14	0.4375	0.1063	0.0961	3146	1642	3285	3806	875	1313	0.311	0.740	0.494
1/2-13	0.5000	0.1419	0.1292	4200	2208	4416	4350	1000	1500	0.357	0.860	0.571
9/16-12	0.5625	0.1819	0.1664	5384	2844	5687	4894	1125	1688	0.399	0.965	0.640
5/8-11	0.6250	0.3068	0.2071	6136	3068	6136	5437	1250	1875	0.411	0.985	0.655
3/4-10	0.7500	0.4418	0.3091	8836	4418	8836	6525	1500	2250	0.484	1.170	0.766
7/8-9	0.8750	0.6013	0.4286	12026	6013	12026	7612	1750	2625	0.555	1.348	0.892
1-8	1.0000	0.7854	0.5630	15708	7854	15708	8700	2000	3000	0.627	1.526	1.010

	SAE GRADE 2	ASTM A 307
F_u (Min. Ultimate Tensile Strength)	74,000 psi	60,000 psi*
F_t (Allowable Tensile Stress)	29,600 psi	20,000 psi*
F_v (Allowable Shear Stress)	17,090 psi	10,000 psi*

For Diameters up thru 9/16":

$$A(R) = 0.7854\left(D - \frac{1.2269}{N}\right)^2$$

$$A(S) = 0.7854\left(D - \frac{0.9743}{N}\right)^2$$

$$F_t = 0.40F_u$$

Allowable tension = $0.40F_u\,[A(S)]$

$$F_v = \frac{0.40}{\sqrt{3}}F_u$$

Allowable shear (Single) = $\frac{0.40}{\sqrt{3}}F_u[A(R)]$

TABLE 6

SAE Grade 5 Steel for Diameters Up thru 9/16"
ASTM A 449 Steel for Diameters 5/8" and Over

Nominal Thread Diameter & Thread/Inch	D Nominal Thread Diameter (Inch)	A(S) Tensile Stress Area (Sq. In.)	A(R) Thread Root Area (Sq. In.)	Allowable Tension (Pounds)	Allowable Shear		Bearing (Pounds)			Minimum Material Thickness to Equal Tensile Capacity of Fastener (In.)	
					Single (Pounds)	Double (Pounds)	1/8" St. A36	1/8" Al. 6063-T5	1/8" Al. 6063-T6	A36	6063-T6
#6-32	0.1380	0.0091	0.0078	437	216	432	1201	276	414	0.144	0.231
#8-32	0.1640	0.0140	0.0124	672	344	687	1427	328	492	0.188	0.308
#10-24	0.1900	0.0175	0.0152	840	421	842	1653	380	570	0.195	0.313
#12-24	0.2160	0.0242	0.0214	1162	593	1186	1879	432	648	0.232	0.377
1/4-20	0.2500	0.0318	0.0280	1526	776	1552	2175	500	750	0.261	0.422
5/16-18	0.3125	0.0524	0.0469	2515	1300	2599	2719	625	938	0.330	0.539
3/8-16	0.3750	0.0775	0.0699	3720	1937	3874	3262	750	1125	0.396	0.651
7/16-14	0.4375	0.1063	0.0961	5102	2663	5326	3806	875	1313	0.460	0.756
1/2-13	0.5000	0.1419	0.1292	6811	3580	7161	4350	1000	1500	0.532	0.878
9/16-12	0.5625	0.1819	0.1664	8731	4611	9223	4894	1125	1688	0.596	0.986
5/8-11	0.6250	0.3068	0.2071	12149	6259	12517	5437	1250	1875	0.732	1.220
3/4-10	0.7500	0.4418	0.3091	17495	9013	18025	6525	1500	2250	0.867	1.452
7/8-9	0.8750	0.6013	0.4286	23811	12267	24533	7612	1750	2625	0.998	1.674
1-8	1.0000	0.7854	0.5630	31102	16022	32044	8700	2000	3000	1.129	1.894

	SAE GRADE 5	ASTM A 449
F_u (Min. Ultimate Tensile Strength)	120,000 psi	120,000 psi*
F_t (Allowable Tensile Stress)	48,000 psi	39,600 psi*
F_v (Allowable Shear Stress)	27,713 psi	20,400 psi*

For Diameters up thru 9/16":

$$A(R) = 0.7854\left(D - \frac{1.2269}{N}\right)^2$$

$$A(S) = 0.7854\left(D - \frac{0.9743}{N}\right)^2$$

$$F_t = 0.40F_u$$

Allowable tension = $0.40F_u\,[A(S)]$

$$F_v = \frac{0.40}{\sqrt{3}}F_u$$

Allowable shear (Single) = $\frac{0.40}{\sqrt{3}}F_u[A(R)]$

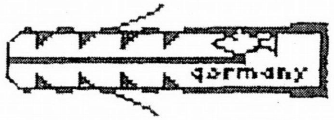
For Diameters 5/8" and over: $A(S) = 0.7858D^2$*

*For fasteners 5/8" diameter and greater, values, formulas and procedures used are taken from the AISC, "Manual of Steel Construction," 9th Edition.
(See page #24 for additional notes.)

Fischer S-plug Nylon Anchors

Ultimate Pullout Values

Why nylon? Nylon provides the best possible technical features. Exceptional high tensile and impact strength, even at temperatures of -40 to +100 degrees C (-40 to +212 degrees F). Weather and age resistant, rust and rot proof.



Size of wallplug	S4	S5	S6	S7	S8	S10	S12	S14	S16	S20
Drill hole diameter - inch	5/32"	3/16"	1/4"	1/4"	5/16"	3/8"	1/2"	9/16"	5/8"	3/4"
Screw sizes	#2 - #5	#4 - #8	#6 - #10	#8 #12	#10 - #14	#14 - #18	5/16" - 3/8"	3/8" - 7/16"	7/16" - 1/2"	1/2" - 5/8"
length of wallplug - inch	3/4"	1"	1 3/16"	1 3/16"	1 5/8"	2"	2 3/8"	2 3/4"	3 3/16"	4"
Cinder Block	75	175	265	330	465	530	880	designed for heavy duty fastenings into concrete using lag screws		
Hollow Brick	90	265	485		660	1020	1455			
Sandstone	105	395	860		990	2050	2520			
Solid Brick	113	550	860	1100	1700	2070	3065			
Concrete	180	505	880	1200	1960	2560	4250	4400	4600	10800

For answers regarding application or for technical assistance,
please call Fischer Fastenings: (800) 631-7131 WWW. FISCHERWERKE . DE

Note: All load values listed are ultimate loads. Please apply appropriate safety factor to determine allowable load values.

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Fasteners (Screws and Welds)

Screw Table Notes

1. Screw spacing and edge distance shall not be less than 3 x d. (d = Nominal screw diameter)
2. The allowable loads are based on the steel properties of the members being connected, per AISI section E4.
3. When connecting materials of different steel thicknesses or tensile strength (F_u), the lowest applicable values should be used.
4. The nominal strength of the screw must be at least 3.75 times the allowable loads.
5. Values include a 3.0 factor of safety.
6. Applied loads may be multiplied by 0.75 for seismic or wind loading, per AISI A 5.1.3.
7. Penetration of screws through joined materials should not be less than 3 exposed threads. Screws should be installed and tightened in accordance with screw manufacturer's recommendations.

Allowable Loads for Screw Connections (lbs/screw)

Steel Mils	Thickness Design (in)	Steel Properties Fy (ksi)	Fu (ksi)	No. 12 Dia. = 0.216 (in) Shear	Pullout	No. 10 Dia. = 0.190 (in) Shear	Pullout	No. 8 Dia. = 0.164 (in) Shear	Pullout	No. 6 Dia. = 0.138 (in) Shear	Pullout
18	0.0188	33	45					66	39	60	33
27	0.0283	33	45					121	59	111	50
30	0.0312	33	45			151	76	141	65	129	55
33	0.0346	33	45			177	84	164	72	151	61
43	0.0451	33	45	280	124	263	109	244	94	224	79
54	0.0566	33	45	394	156	370	137	344	118		
68	0.0713	33	45	557	196	523	173				

Weld Table Notes

1. Weld capacities based on AISI, section E2
2. When connecting materials of different steel thicknesses or tensile strength (F_u), the lowest applicable values should be used.
3. Values include a 2.5 factor of safety.
4. Based on the minimum allowance load for fillet or flare groove welds, longitudinal or transverse loads.
5. Allowable loads based on E60xx electrodes.
6. For material less than or equal to .1242" thick, drawings show nominal weld size. For such material, the effective throat of the weld shall not be less than the thickness of the thinnest connected part.

Allowable Loads for Fillet Welds and Flare Groove Welds

Steel Mils	Thickness Design (in)	Steel Properties Fy (ksi)	Fu(ksi)	Nominal Weld Size	Allowable Load (lb/in)
43	0.0451	33	45	1/16	609
54	0.0566	33	45	3/32	764
68	0.0713	33	45	1/8	963
97	0.1017	33	45	1/8	1373
118	0.1242	33	45	1/8	1677
54	0.0566	50	65	3/32	1104
68	0.0713	50	65	1/8	1390
97	0.1017	50	65	1/8	1983
118	0.1242	50	65	1/8	2422