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STUD WELDING
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SECTION 2

ARC STUD WELDING — GENERAL & TECHNICAL DETAILS

FOR INQUIRIES, TO PLACE ORDERS,
SERVICE AND TECHNICAL SUPPORT CONTACT
ANY OF THE FOLLOWING:

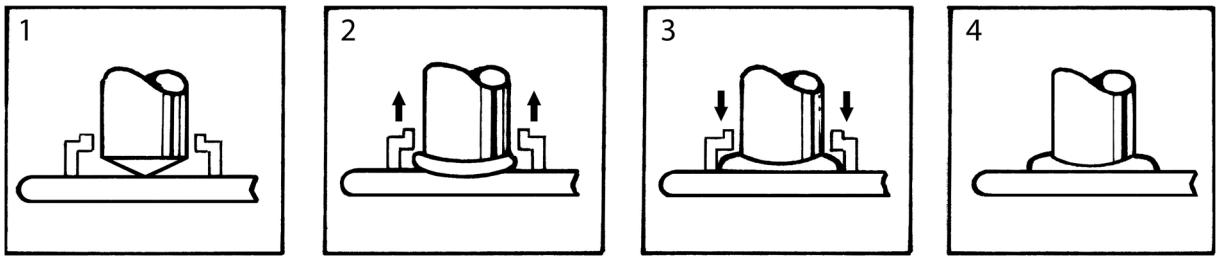
OFFICE: 216.904.4008

EMAIL: SALES@COMPLETESTUDWELD.COM

ARC STUD WELDING PROCESS DESCRIPTION

Arc Stud Welding is generally used to weld large diameter fasteners to rougher and thicker base metals. Arc studs may be almost any shape and there are literally hundreds; however, they must have one end of the fastener designed for arc welding. Mild steel, stainless steel, and aluminum are applicable materials for arc stud welding.

Arc Stud Welding is a split second, one sided, no hole process producing a weld stronger than the base material and the stud itself.



1) The weld gun is positioned over the base material and the main gun spring is partially compressed.

2) The trigger is pressed and the stud lifts off the base material drawing an arc. The arc melts the end of the weld stud and the base material below. The arc shield (ferrule) concentrates the heat below the weld stud and contains the molten metal within the weld zone.

3) The main spring plunges the weld stud down into the molten pool of metal in the base material. The cycle is completed in less than a second and the resulting weld bond develops the full strength of the fastener in the weld zone.

4) The weld gun is withdrawn from the weld stud leaving the ferrule. The ferrule is then broken away and discarded.

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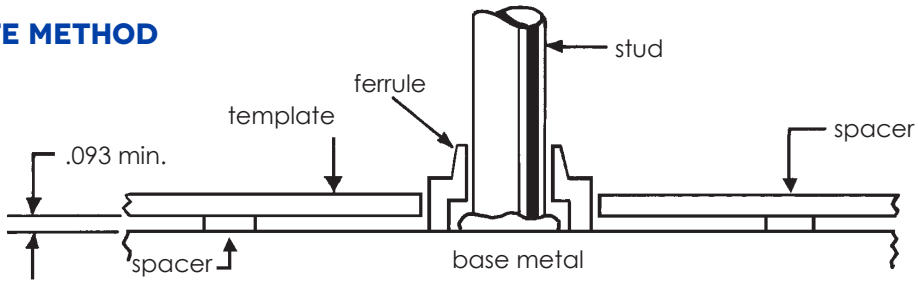
ARC STUD LOCATING: CENTER PUNCH, TEMPLATE & BUSHING DESIGN

CENTER PUNCH METHOD

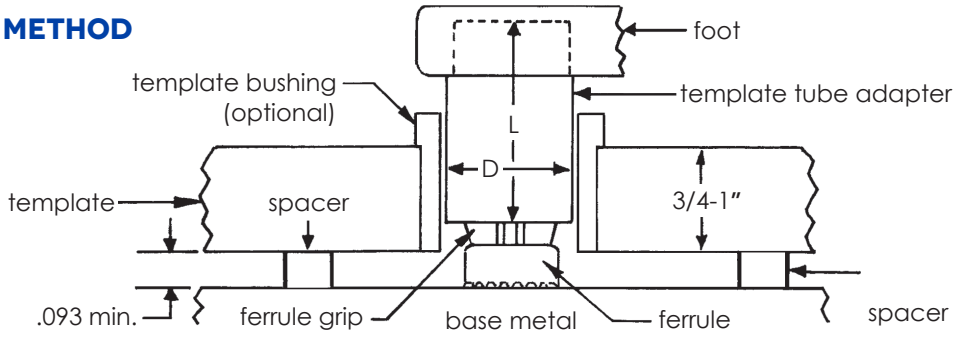
By making a center punch mark in the base material the operator can place the fluxed tip of the stud into the punch mark for locating the ARC Stud. Contact your **Complete Stud Welding** Sales Representative for proper set-up of the stud welding gun for welding with a center punch.

TEMPLATE METHOD



This method of templating is recommended by **Complete Stud Welding** for use with ferrules. The template is usually a steel plate 3/32" to 3/16" thick. Spacers are required to allow the gases to escape during the welding cycle. The ferrule can be held by a standard ferrule grip or where clearance is prohibitive a tube type set-up can be used. The recommended hole size on the template to locate the ferrules should equal the maximum outside diameter of the ferrule plus 1/32". Holes may be drilled or bored at required locations. See stud specification sheets for ferrule details. For further assistance contact your **Complete Stud Welding** representative.

BUSHING METHOD



This method of templating is recommended by **Complete Stud Welding** for use with all arc stud styles. The design makes it possible to accurately hold angular alignment of the studs as well as stud location. The template should be made of ebonite or masonite of a thickness sufficient to afford good alignment. Template bushings may be used to insure greater accuracy and extend the life of the template. Standard ferrule grips are used with the tube adapter. This permits standardization of templates since it is only necessary to change the ferrule grip to weld studs of different diameters. The hole diameter of the bushing or template should be approximately .010 larger than the maximum outside diameter of the template tube adapter.

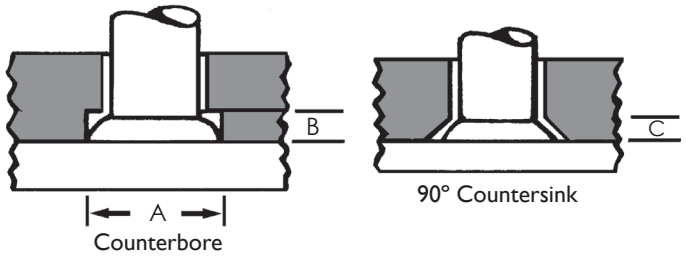
ARC Template Tube Adapters

Part Number	Stud Size	D	L
MT-0008	1/2" and under	1.250	2.000
MT-0012	5/8" and 3/4"	1.562	2.500
MT-0016	7/8" and larger	2.125	2.500

ACCOMMODATING THE FILLET

Stud Size (in.)	Counterbore (in.)		90° Countersink
	A	B	C
1/4	.0437	0.125	0.125
5/16	0.500	0.125	0.125
3/8	0.593	0.125	0.125
7/16	0.656	0.187	0.125
1/2	0.750	0.187	0.187
5/8	0.875	0.218	0.187
3/4	1.125	0.312	0.187

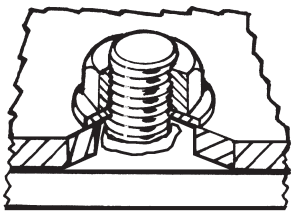
Fillet clearance for Full Base Studs



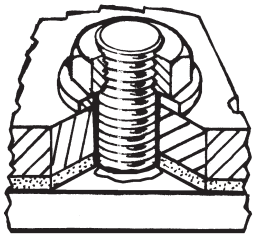
When the arc stud is welded, a fillet forms around its base with the dimensions being closely controlled by the design of the ferrule. Since the diameter of the fillet is generally larger than the diameter of the stud, some consideration is required in the design of mating parts. Counterbore and countersink methods are commonly used. Dimensions will vary with studs and ferrules.

ADDITIONAL METHODS OF ACCOMMODATING THE FILLET

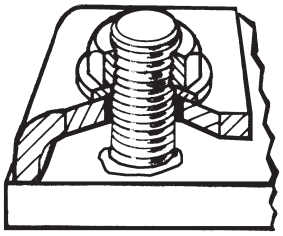
Additional methods of accommodating the fillet include oversized clearance holes, use of a dog-type construction or use of a gasket material around the fillet.



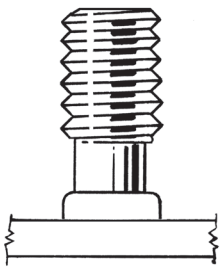
A) Oversize clearance hole



B) Gasket material



C) Dog clamp



Reduced Base Studs are designed so that the weld fillet does not exceed the maximum diameter of the fastener. This design is not recommended if full thread diameter fastener strength is required.

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RECOMMENDED MINIMUM BASE METAL THICKNESS

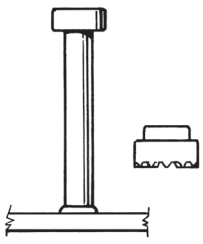
Stud Weld Base Dia. (in.)	Steel		Aluminum	
	Without Backup (in.)	(gage)	Without Backup (in.)	With Backup (in.)
0.187	0.0359	20	0.125	0.125
0.250	0.0478	18	0.125	0.125
0.312	0.0598	16	0.187	0.125
0.375	0.0747	14	0.187	0.187
0.437	0.0897	13	0.250	0.187
0.500	0.1196	11	0.250	0.250
0.625	0.148	9		
0.750	0.187			
0.875	0.250			
1.000	0.375			

SHIELDING THE WELD

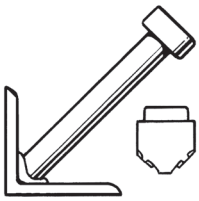
In arc stud welding we either shield the weld utilizing gas or ferrules. Gas shielding is primarily used in industrial applications requiring a stud diameter of 1/2" or less. Please contact your **Complete Stud Welding** representative for suggestions on the best gas mixes to utilize.

Ferrules are commonly used in industrial and construction applications requiring weld studs from 1/4" to 1" diameter. Specially designed ferrules are needed for some applications. This would include the need to weld to contoured surfaces and welding at angles to the work. Standard ferrules are available for welding to flat, vertical, inside angle, outside angle and thru-deck surfaces. These are shown below:

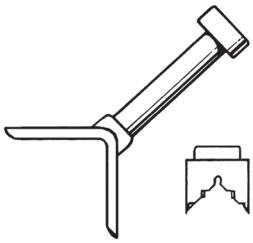
Flat Surface (F)



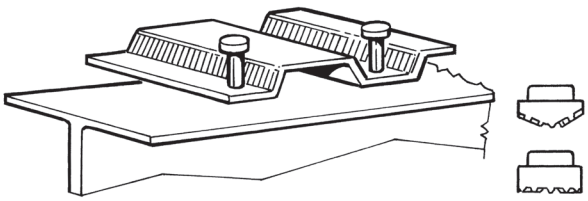
Inside Angle (IA)



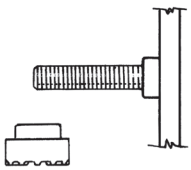
Outside Angle (OA)



Thru Deck (TD)



Vertical Surface (V)



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THREADED & NO THREAD WELD STUDS – TECHNICAL DETAILS

Threaded & No Thread Weld Studs: **Complete Stud Welding** has various types of externally and internally threaded weld studs and No Thread weld studs. These weld studs are used in many industrial and construction applications.

Specifications: **Complete Stud Welding** studs are commonly produced to AWS Specifications D1.1, D1.5 and or D1.6. Threaded weld studs and No Thread weld studs are available upon request to various international specifications. Should Certifications be required, please request these as part of the quotation details and at the time of order.

Threads: The chart below depicts the thread standards for imperial and metric external and internal threads. Unless requested or quoted otherwise, threads will be quoted based on these common thread standards.

Unless indicated or quoted otherwise, external threads will be a rolled type thread. The strength and surface finish of rolled threads are considered to be superior to cut type threads.

Thread Type	External Threads	Internal Threads
Imperial Threads - Coarse	UNC-2A	UNC-2B
Imperial Threads - Fine	UNF-2A	UNF-2B
Metric Threads	Class 6g	Class 6H

Flux: All Standard Arc Welding Studs are flux loaded for diameters greater than 3/16".

Length: The length dimension (L) indicated throughout these specifications is the overall length of the stud Before Weld (BW). The After Weld (AW) length will be shorter based on the stud diameter as depicted in the chart below:

Stud Diameter	Approximate Length Reduction
3/16" thru 1/2"	1/8" or 0.125"
5/8" thru 7/8"	3/16" or 0.188"
1" and larger	1/4" or 0.250"
1/8" thick rectangular	1/8" or 0.125"

Material: Low Carbon Steel weld studs are available in ASTM A108 / A29, Grade C1010 to C1020 material per AWS D1.1. In Stainless Steel, ASTM A-276 / A-493 Grades 302, 304, 310, 316, 321 are options. Stainless threaded weld studs are mostly stocked in grade 302HQ / 30430.

Mechanical Properties		
Parameter	Standard Mild Steel Studs, Type A, Per AWS D1.1	Standard Stainless Steel Studs Per AWS D1.6
Tensile Strength	61,000 PSI Min.	70,000 PSI Min.
Yield Strength (0.2% offset)	49,000 PSI Min.	35,000 PSI Min.
Elongation (% in 2 inch)	17% Min.	40% Min.
Elongation (% in 5x dia.)	14% Min.	—
Reduction of area	50% Min.	N/A

THREADED & NO THREAD WELD STUDS – TECHNICAL DETAILS . . . CONTINUED

Plating: All CSW ARC Weld Studs are supplied with a plain finish / unplated condition. Upon request, CSW can provide Zinc Plating, Nickel Plating and Copper Plating. Zinc plated studs must be capped on the weld end to preclude the plating from compromising the weld quality.

Annealing: Standard in stock product is not post annealed. Low carbon steel and stainless steel studs can be annealed to a maximum of 75 Rockwell B hardness and 85 Rockwell B hardness, respectively.

Ferrules: The standard ferrule shipped for each thread diameter is listed on the specification page for each type of threaded weld stud. If other ferrules are desired, please specify at time of order. For other ferrule options please see General Ferrule Specification or contact your CSW representative for assistance.

Accessories: For required accessories, please see each specification page or contact your CSW representative for assistance.

Tensile and Torque Strengths: The 2 charts – Standard ARC Welding Studs – Tensile / Torque Strengths can be found under ARC Stud Welding - General Information.

The data was calculated based on the formulas shown below.

Tensile Load	**L = SA**
Torque	**T= 0.2 x D x L**
META*	**A= Pi/4 x [D - (0.9743/N)]**

A = Mean Effective Thread Area (META)*
L = Tensile Load Pounds
S = Tensile Stress in PSI
D = Nominal Thread Diameter
N = Threads Per Inch
T = Torque in Inch Pounds

*META is used instead of root area in calculating screw strengths because of closer correlation with actual tensile strength. META is based on mean diameter, which is the diameter of an imaginary coaxial cylinder whose surface would pass through the thread profile approximately midway between the minor and pitch diameters.

**Please note, in actual practice a stud should not be used at its yield load. A factor of safety must be applied. It is generally recommended that studs be used at no more than 60% of yield. However the factor of safety may vary up or down, depending on the application. The user will determine the appropriate safety factor.

***Please note, Torque figures based on assumption that excessive deformation of thread has not taken relationship between torque/tension out of its proportional range. All torque figures are shown in foot pounds (ft lbs).

Shear values were calculated at 75% of the Ultimate Tensile Load of the stud.

ARC STUD WELDING GUIDELINES & SETTING

- Keep weld studs and ferrules clean and dry.
- See chart below for approximate settings for proper equipment setup.

Stud Base Diameter			Welding Downhand				Welding Overhead				Welding to a Vertical Surface			
in.	mm	Area in.	Welding Current A	Weld Time Seconds	Lift in.	Plunge in.	Welding Current A	Weld Time Seconds	Lift in.	Plunge in.	Welding Current A	Weld Time Seconds	Lift in.	Plunge in.
1/4	6.4	0.0491	450	.17	0.062	0.125	450	.17	0.062	0.125	450	.17	0.062	0.125
5/16	7.9	0.0767	500	.25	0.062	0.125	500	.25	0.062	0.125	500	.25	0.062	0.125
3/8	9.5	0.1105	550	.33	0.062	0.125	550	.33	0.062	0.125	600	.33	0.062	0.125
7/16	11.1	0.1503	675	.42	0.062	0.125	675	.42	0.062	0.125	750	.33	0.062	0.125
1/2	12.7	0.1964	800	.55	0.062	0.125	800	.55	0.062	0.125	875	.46	0.062	0.125
5/8	15.9	0.3068	1200	.67	0.093	0.187	1200	.67	0.062	0.187	1275	.60	0.062	0.187
3/4	19.1	0.4418	1500	.84	0.093	0.187	1500	.84	0.062	0.187	Consult CSW Sales Representative			
7/8	22.2	0.6013	1700	1.00	.0125	0.250	1700	1.00	0.062	0.250				
1	25.4	0.7854	1900	1.40	0.125	0.250	2050	1.20	0.062	0.250				

- Make sure the negative polarity is to the weld stud gun and ensure a good, clean ground connection.
- Align accessories so they are centered and adjust legs so that 1/8" to 1/4" of the stud protrudes beyond the ferrule.
- Make sure work surface is relatively clean so impurities do not affect weld quality.
- Visually inspect all welds for 360° weld flash and for weld flash color (silver, blue & shiny).
- Check height of welded stud - length reduction equals 1/8"- 3/8".

Stud Diameter	Approximate Length Reduction
3/16" thru 1/2"	1/8" or 0.125"
5/8" thru 7/8"	3/16" or 0.188"
1" and larger	1/4" or 0.250"
1/8" thick rectangular	1/8" or 0.125"

- Test the welds at the beginning of each shift or change in stud size. Torque or bend two studs 30 degrees after cooling (AWS Bend Test). See charts for tensile and torque values.

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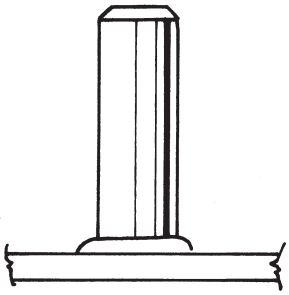
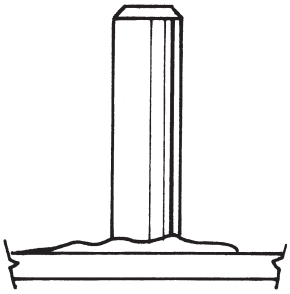
ARC STUD WELD VISUAL INSPECTION

The **Complete Stud Welding** ARC stud weld can be visually inspected by observing the fillet at the base of the stud. The illustrations and comments below will assist you in visually judging the quality of the weld.



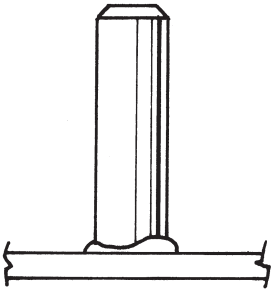
Good Weld

Full, even, shiny fillet all around stud.



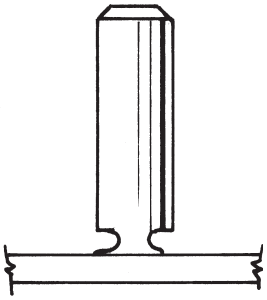
Hot Weld

Very shiny, low profile fillet extending beyond outside of ferrule.



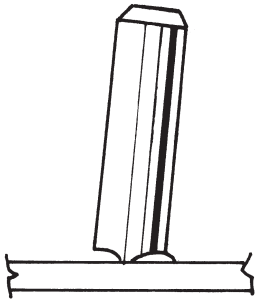
Cold Weld

Small, uneven, dull gray appearing fillet with fingers of metal extending through vents of ferrule.



Short Plunge or Hang-Up

No fillet, no stud burn-off, or undercut base.



Misalignment

Partial or no fillet, undercut, stud not perpendicular to base metal.

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TENSILE AND TORQUE STRENGTHS

The following 2 charts are Standard ARC Welding Studs –
Tensile / Torque Strengths.

The data was calculated based on the formulas shown below.

Tensile Load	**L = SA**
Torque	**T= 0.2 x D x L**
META*	**A= Pi/4 x [D - (0.9743/N)]**

A = Mean Effective Thread Area (META)*
L = Tensile Load Pounds
S = Tensile Stress in PSI
D = Nominal Thread Diameter
N = Threads Per Inch
T = Torque in Inch Pounds

*META is used instead of root area in calculating screw strengths because of closer correlation with actual tensile strength. META is based on mean diameter, which is the diameter of an imaginary coaxial cylinder whose surface would pass through the thread profile approximately midway between the minor and pitch diameters.

**Please note, in actual practice a stud should not be used at its yield load. A factor of safety must be applied. It is generally recommended that studs be used at no more than 60% of yield. However the factor of safety may vary up or down, depending on the application. The user will determine the appropriate safety factor.

***Please note, Torque figures based on assumption that excessive deformation of thread has not taken relationship between torque/tension out of its proportional range. All torque figures are shown in foot pounds (ft lbs).

Shear values were calculated at 75% of the Ultimate Tensile Load of the stud.

See next 2 pages for charts on Tensile and Torque Strengths.

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Standard Arc Welding Studs - Tensile / Torque Strengths

Low Carbon Steel - 61,000 PSI Min. Tensile, 49,000 PSI Min. Yield

Thread Size	Thread Diameter (in)	META (In) 2 *	Yield Load (Lbs)**	Ultimate Tensile Load (Lbs)	Yield Torque (ft lbs)***	Ultimate Torque (ft lbs)***	Shear Strength (60% of Tensile Load))
10-24	0.1875	0.017	853	1,061	2.7	3.3	637
10-32	0.1875	0.020	975	1,214	3.0	3.8	728
1/4-20	0.2500	0.032	1,553	1,934	6.5	8.1	1,160
1/4-28	0.2500	0.036	1,774	2,208	7.4	9.2	1,325
5/16-18	0.3125	0.032	1,578	1,964	8.2	10.2	1,179
5/16-24	0.3125	0.058	2,837	3,532	14.8	18.4	2,119
3/8-16	0.3750	0.077	3,788	4,715	23.7	29.5	2,829
3/8-24	0.3750	0.088	4,292	5,344	26.8	33.4	3,206
7/16-14	0.4375	0.106	5,194	6,466	37.9	47.1	3,880
7/16-20	0.4375	0.119	5,807	7,229	42.3	52.7	4,337
1/2-13	0.5000	0.142	6,938	8,638	57.8	72.0	5,183
1/2-20	0.5000	0.160	7,825	9,742	65.2	81.2	5,845
5/8-11	0.6250	0.226	11,054	13,762	115.2	143.4	8,257
5/8-18	0.6250	0.256	12,520	15,586	130.4	162.3	9,351
3/4-10	0.7500	0.334	16,366	20,374	204.6	254.7	12,224
3/4-16	0.7500	0.372	18,248	22,716	228.1	284.0	13,630
7/8-9	0.8750	0.461	22,599	28,133	329.6	410.3	16,880
7/8-14	0.8750	0.509	24,931	31,037	363.6	452.6	18,622
1-8	1.0000	0.605	29,650	36,911	494.2	615.2	22,147
1-14	1.0000	0.679	33,276	41,425	554.6	690.4	24,855
M5 - 0.80	0.1969	0.022	1,062	1,322	3.5	4.3	793
M6 - 1.00	0.2362	0.031	1,506	1,875	5.9	7.4	1,125
M8 - 1.25	0.3150	0.056	2,744	3,416	14.4	17.9	2,050
M10 - 1.50	0.3937	0.089	4,348	5,413	28.5	35.5	3,248
M12 - 1.75	0.4724	0.129	6,322	7,870	49.8	62.0	4,722
M16 - 2.00	0.6299	0.240	11,778	14,662	123.6	153.9	8,797
M20 - 2.50	0.7874	0.376	18,402	22,909	241.5	300.6	13,745
M22 - 2.50	0.8661	0.466	22,832	28,424	329.6	410.3	17,054
M24 - 3.0	0.9449	0.541	26,494	32,983	417.2	519.4	19,790

Please refer to first previous page for explanatory notes and formulas used to calculate the above data.
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COMPLETE STUD WELDING
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Standard Arc Welding Studs - Tensile / Torque Strengths

Stainless Steel - 70,000 PSI Min. Tensile, 35,000 PSI Min. Yield

Thread Size	Thread Diameter (in)	META (In) 2 *	Yield Load (Lbs)**	Ultimate Tensile Load (Lbs)	Yield Torque (ft lbs)***	Ultimate Torque (ft lbs)***	Shear Strength (60% of Tensile Load)
10-24	0.1875	0.017	609	1,218	1.9	3.8	731
10-32	0.1875	0.020	697	1,393	2.2	4.4	836
1/4-20	0.2500	0.032	1,110	2,219	4.6	9.2	1,331
1/4-28	0.2500	0.036	1,267	2,534	5.3	10.6	1,520
5/16-18	0.3125	0.052	1,827	3,654	9.5	19.0	2,192
5/16-24	0.3125	0.058	2,027	4,053	10.6	21.1	2,432
3/8-16	0.3750	0.077	2,706	5,411	16.9	33.8	3,247
3/8-24	0.3750	0.088	3,066	6,132	19.2	38.3	3,679
7/16-14	0.4375	0.106	3,710	7,420	27.1	54.1	4,452
7/16-20	0.4375	0.119	4,148	8,295	30.2	60.5	4,977
1/2-13	0.5000	0.142	4,956	9,912	41.3	82.6	5,947
1/2-20	0.5000	0.160	5,590	11,179	46.6	93.2	6,707
5/8-11	0.6250	0.226	7,896	15,792	82.3	164.5	9,475
5/8-18	0.6250	0.256	8,943	17,885	93.2	186.3	10,731
3/4-10	0.7500	0.334	11,690	23,380	146.1	292.3	14,028
3/4-16	0.7500	0.372	13,034	26,068	162.9	325.9	15,641
7/8-9	0.8750	0.461	16,142	32,284	235.4	470.8	19,370
7/8-14	0.8750	0.509	17,808	35,616	259.7	519.4	21,370
1-8	1.0000	0.605	21,179	42,357	353.0	706.0	25,414
1-14	1.0000	0.679	23,769	47,537	396.1	792.3	28,522
M5 - 0.80	0.1969	0.022	759	1,518	2.5	5.0	911
M6 - 1.00	0.2362	0.031	1,076	2,152	4.2	8.5	1,291
M8 - 1.25	0.3150	0.056	1,960	3,920	10.3	20.6	2,352
M10 - 1.50	0.3937	0.089	3,106	6,212	20.4	40.8	3,727
M12 - 1.75	0.4724	0.129	4,516	9,031	35.6	71.1	5,419
M16 - 2.00	0.6299	0.240	8,413	16,825	88.3	176.6	10,095
M20 - 2.50	0.7874	0.376	13,145	26,289	172.5	345.0	15,774
M22 - 2.50	0.8661	0.466	16,309	32,617	235.4	470.9	19,570
M24 - 3.0	0.9449	0.541	18,925	37,849	298.0	596.0	22,709

Please refer to second previous page for explanatory notes and formulas used to calculate the above data.
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COMPLETE STUD WELDING
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THREADED & NO THREAD WELD STUDS – TECHNICAL DETAILS
WEIGHT CHART – THREADED WELD STUDS

Approximate Weights in Pounds Per 1000 Pieces									
	Stud Diameter								
Stud Length	3/16"	1/4"	5/16"	3/8"	7/16"	1/2"	5/8"	3/4"	7/8"
3/4	4.6	8.3	12.8	18.8	25.5	34.5			
1	6.1	11.0	17.0	25.0	34.0	46.0	70.0		
1 1/4	7.6	13.8	21.3	31.3	42.5	57.5	87.5	133.8	
1 1/2	9.2	16.5	25.5	37.5	51.0	69.0	105.0	160.5	243.8
1 3/4	10.7	19.3	29.8	43.8	59.5	80.5	122.5	187.3	284.4
2	12.2	22.0	34.0	50.0	68.0	92.0	140.0	214.0	325.0
2 1/4	13.7	24.8	38.3	56.3	76.5	103.5	157.5	240.8	365.6
2 1/2	15.3	27.5	42.5	62.5	85.0	115.0	175.0	267.5	406.3
2 3/4	16.8	30.3	46.8	68.8	93.5	126.5	192.5	294.3	446.9
3	18.3	33.0	51.0	75.0	102.0	138.0	210.0	321.0	487.5
3 1/4	19.8	35.8	55.3	81.3	110.5	149.5	227.5	347.8	528.1
3 1/2	21.4	38.5	87.5	119.0	161.0	245.0	374.5	568.8	595.0
3 3/4	22.9	41.3	93.8	127.5	172.5	262.5	401.3	609.4	637.5
4	24.4	44.0	68.0	100.0	136.0	184.0	280.0	428.0	650.0
4 1/4	25.9	46.8	72.3	106.3	144.5	195.5	297.5	454.8	690.6
4 1/2	27.5	48.5	76.5	112.5	153.0	207.0	315.0	481.5	731.3
4 3/4	29.0	52.3	80.8	118.8	161.5	218.5	332.5	508.3	771.9
5	30.5	55.0	85.0	125.0	170.0	230.0	350.0	535.0	850.0
Each Additional Inch	6.1	11.0	17.0	25.0	34.0	46.0	70.0	107.0	162.5
Ferrule	2.0	2.9	4.3	5.0	5.2	7.5	9.0	28.0	38.0

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THREADED & NO THREAD WELD STUDS – TECHNICAL DETAILS . . . CONTINUED
WEIGHT CHART – NO THREADED WELD STUDS

Approximate Weights in Pounds Per 1000 Pieces									
	Stud Diameter								
Stud Length	3/16"	1/4"	5/16"	3/8"	7/16"	1/2"	5/8"	3/4"	7/8"
3/4	6.0	10.5	16.4	23.5	31.9	41.7			
1	8.0	14.0	21.8	31.3	42.5	55.6	86.6		
1 1/4	10.0	17.5	27.3	39.1	53.1	69.5	108.3	156.0	
1 1/2	12.0	21.0	32.7	47.0	63.8	83.4	129.9	187.2	255.0
1 3/4	14.0	24.5	38.2	54.8	74.4	97.3	151.6	218.4	297.5
2	16.0	28.0	43.6	62.6	85.0	111.2	173.2	249.6	340.0
2 1/4	18.0	31.5	49.1	70.4	95.6	125.1	194.9	280.8	382.5
2 1/2	20.0	35.0	54.5	78.3	106.3	139.0	216.5	312.0	425.0
2 3/4	22.0	38.5	60.0	86.1	116.9	152.9	238.2	343.2	467.5
3	24.0	42.0	65.4	93.9	127.5	166.8	259.8	374.4	510.0
3 1/4	26.0	45.5	70.9	101.7	138.1	180.7	281.5	405.6	552.5
3 1/2	28.0	49.0	76.3	109.6	148.8	194.6	303.1	436.8	595.0
3 3/4	30.0	52.5	81.8	117.4	159.4	208.5	324.8	468.0	637.5
4	32.0	56.0	87.2	125.2	170.0	222.4	346.4	499.2	680.0
4 1/4	34.0	59.5	92.7	133.0	180.6	236.3	368.1	530.4	722.5
4 1/2	36.0	63.0	98.1	140.9	191.3	250.2	389.7	561.6	765.0
4 3/4	38.0	66.5	103.6	148.7	201.9	264.1	411.4	592.8	807.5
5	40.0	70.0	109.0	156.5	212.5	278.0	433.0	624.0	850.0
Each Additional Inch	8.0	14.0	21.8	31.3	42.5	55.6	86.6	124.8	170.0
Ferrule	2.0	2.9	4.3	5.0	5.2	7.5	9.0	28.0	38.0

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