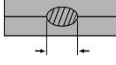
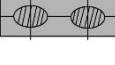
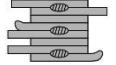




APPLICATION DATA SHEET

Spot Welding Data

Optimum Conditions Schedules For Spot Welding Low Carbon Steel – SAE 1010

Thickness of Thinnest Piece (Inches)	Electrode Diameters and Shape*			Recommended Minimum Standard Electrode Size	Weld Force (Lbs.)	Weld Time (Cycles) (60 Cycles per Sec.)	Hold Time (Cycles) Min.	Welding Current (Amps.) (Approx.)	Weld Shear Strength (For Steels Having Ultimate Tensile Strength of 90,000 psi and below) Minimum Strength (Lbs/Weld)	Diameter of Fused Zone (Approx.)  Dw (Inches)	Minimum Weld Spacing  S (Inches)	Minimum Contacting Overlap  L (inches)
	Flat Face		Radius Face									
	Max. d (Inches)	Min. D (Inches)	Radius R (Inches)									
0.010	0.125	1/2	2	4RW 1MT	160	4	5	4,000	130	0.113	1/4	3/8
0.021	0.187	1/2	2	4RW 1MT	244	6	8	6,500	300	0.139	3/8	7/16
0.031	0.187	1/2	2	4RW 1MT	326	8	10	8,000	530	0.161	1/2	7/16
0.040	0.250	5/8	3	5RW 2MT	412	10	12	8,800	812	0.181	3/4	1/2
0.050	0.250	5/8	3	5RW 2MT	554	14	16	9,600	1,195	0.210	7/8	9/16
0.062	0.250	5/8	3	5RW 2MT	670	18	20	10,600	1,717	0.231	1	5/8
0.078	0.312	5/8	3	5RW 2MT	903	25	30	11,800	2,365	0.268	1-1/8	11/16
0.094	0.312	5/8	4	7RW 3MT	1,160	34	35	13,000	3,054	0.304	1-1/4	3/4
0.109	0.375	7/8	4	7RW 3MT	1,440	45	40	14,200	3,672	0.338	1-5/16	13/16
0.125	0.375	7/8	4	7RW 3MT	1,760	60	45	15,600	4,300	0.375	1-1/2	7/8
0.156	0.500	7/8	6	Male or Female Threaded	2,500	93	50	18,000	6,500	0.446	1-3/4	1
0.187	0.625	1	6	Male or Female Threaded	3,340	130	55	20,500	9,000	0.516	2	1-1/2
0.250	0.750	1-1/4	6	Male or Female Threaded	5,560	230	60	26,000	18,000	0.660	4	1-1/2

PERMISSIBLE SCHEDULE VARIATIONS FOR SPOT WELDING LOW CARBON STEEL

Low Carbon Steel Spot Welding Data Chart – Single Impulse Welding

DATA COMMON TO ALL CLASSES OF SPOT WELDS				WELDING SET-UP FOR BEST QUALITY – CLASS A WELDS					WELDING SET-UP FOR MEDIUM QUALITY – CLASS B WELDS					WELDING SET-UP FOR GOOD QUALITY – CLASS C WELDS					
Thickness of Each of the Two Work Pieces (Inches)	Electrode Dia. & Shape		Min. Weld Spacing (Note 4) (Inches)	Min. Contacting Overlap (Note 6) (Inches)	Weld Time (Note 7) (Cycles)	Electrode Force (Pounds)	Welding Current (Amps.)	Dia. Of Fused Zone (Inches)	Average Tensile Shear Strength +/-14% (Pounds)	Weld Time (Note 7) (Cycles)	Electrode Force (Pounds)	Welding Current (Amps.)	Dia. Of Fused Zone (Inches)	Average Tensile Shear Strength +/-17% (Pounds)	Weld Time (Note 7) (Cycle)	Electrode Force (Pounds)	Welding Current (Amps.)	Dia. Of Fused Zone (Inches)	Average Tensile Shear Strength +/-20% (Pounds)
	Min. D (Inches)	Max. d (Inches)																	
.010	1/2	1/8	1/4	3/8	4	200	4000	.13	235	5	130	3700	.12	200	15	65	3000	.11	160
.021	1/2	3/16	3/8	7/16	6	300	6100	.17	530	10	200	5100	.16	460	22	100	3800	.14	390
.031	1/2	3/16	1/2	7/16	8	400	8000	.21	980	15	275	6300	.20	850	29	135	4700	.18	790
.040	5/8	1/4	3/4	1/2	10	500	9200	.23	1305	21	360	7500	.22	1230	38	180	5600	.21	1180
.050	5/8	1/4	7/8	9/16	12	650	10300	.25	1820	24	410	8000	.23	1700	42	205	6100	.22	1600
.062	5/8	1/4	1	5/8	14	800	11600	.27	2350	29	500	9000	.26	2150	48	250	6800	.25	2050
.078	5/8	5/16	1-1/8	11/16	21	1100	13300	.31	3225	36	650	10400	.30	3025	58	325	7900	.28	2900
.094	5/8	5/16	1-1/4	3/4	25	1300	14700	.34	4100	44	790	11400	.33	3900	66	390	8800	.31	3750
.109	7/8	3/8	1-5/16	13/16	29	1600	16100	.37	5300	50	960	12200	.36	5050	72	480	9500	.35	4850
.125	7/8	3/8	1-1/2	7/8	30	1800	17500	.40	6900	60	1140	12900	.39	6500	78	570	10000	.37	6150

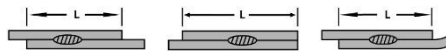
NOTES:

- Low Carbon Steel has hot rolled, pickled and slightly oiled with an ultimate strength of 42,000 to 45,000 PSI Similar to SAE 1005 – SAE 1010.
- Electrode Material is Class 2.
- Surface of steel is lightly oiled but free from grease, scale or dirt.
- Minimum weld spacing is that distance for which no increase in welding current is necessary to compensate for the shunted current effect in adjacent welds.

5. Radius Face electrodes may be used:


- 0.010 to 0.031 – 2" Radius
- 0.031 to 0.078 – 3" Radius
- 0.078 to 0.125 – 4" Radius

6.



- 7. Weld time is indicated in cycles of 60 cycle frequency.**

8. Tensile shear strength values are based on recommended test sample sizes:

Direction of Force	Thickness	Width	Length
	.000" to .029"	5/8"	3"
	.030" to .058"	1"	4"
	.059" to .115"	1-1/2"	5"
	.116" to .190"	2"	6"

9. Tolerance for machining of electrode diameter "d" is +/- .015" of specified dimension.

- 10. Electrode force does not provide for force to press ill-fitting parts together.**



APPLICATION DATA SHEET

Schedule for Spot Welding Stainless Steel

Thickness "T" of Thinnest Outside Piece (See Notes 1, 2, 3 & 4 Below) (Inches)	Electrode Diameter and Shape (See Note 5)		Electrode Force (Lbs.)	Weld Time Cycles (60 Per Sec.)	Welding Current (Approx.) (Amps)		Minimum Contacting Overlap (Inches)	Minimum Weld Spacing (See Note 6 Below) (Inches)	Diameter of Fused Zone (Approx.) (Inches)	Minimum Shear Strength (Lbs.)		
	Min. D (Inches)	Max. d (Inches)			Tensile Strength Below 150000 Psi	Tensile Strength 150000 Psi and Higher				Ultimate Tensile Strength of Metal		
										70000 Up to 90000 Psi	90000 Up to 150000 Psi	150000 Psi and Higher
0.006	3/16	3/32	180	2	2000	2000	3/16	3/16	0.045	60	70	85
0.008	3/16	3/32	200	3	2000	2000	3/16	3/16	0.065	150	170	210
0.012	1/4	1/8	260	3	2100	2000	1/4	1/4	0.076	185	210	250
0.014	1/4	1/8	300	4	2500	2200	1/4	1/4	0.082	240	250	320
0.016	1/4	1/8	330	4	3000	2500	1/4	5/16	0.088	280	300	380
0.018	1/4	1/8	380	4	3500	2800	1/4	5/16	0.093	320	360	470
0.021	1/4	5/32	400	4	4000	3200	5/16	5/16	0.100	370	470	500
0.025	3/8	5/32	520	5	5000	4100	3/8	7/16	0.120	500	600	680
0.031	3/8	3/16	650	5	6000	4800	3/8	1/2	0.130	680	800	930
0.034	3/8	3/16	750	6	7000	5500	7/16	9/16	0.150	800	920	1100
0.040	3/8	3/16	900	6	7800	6300	7/16	5/8	0.160	1000	1270	1400
0.044	3/8	3/16	1000	8	8700	7000	7/16	11/16	0.180	1200	1450	1700
0.050	1/2	1/4	1200	8	9500	7500	1/2	3/4	0.190	1450	1700	2000
0.056	1/2	1/4	1350	10	10300	8300	9/16	7/8	0.210	1700	2000	2450
0.062	1/2	1/4	1500	10	11000	9000	5/8	1	0.220	1950	2400	2900
0.070	5/8	1/4	1700	12	12300	10000	5/8	1-1/8	0.250	2400	2800	3550
0.078	5/8	5/16	1900	14	14000	11000	11/16	1-1/4	0.275	2700	3400	4000
0.094	5/8	5/16	2400	16	15700	12700	3/4	1-1/2	0.290	3550	4200	5300
0.109	3/4	3/8	2800	18	17700	14000	13/16	1-1/2	0.290	4200	5000	6400
0.125	3/4	3/8	3300	20	18000	15500	7/8	2	0.300	5000	6000	7600

- NOTES:**
- Types of Steel – 301, 302, 303, 304, 308, 309, 310, 316, 317, 321, 347 and 349.
 - Material should be free from scale, oxides, paint, grease and oil.
 - Welding conditions determined by thickness of thinnest outside piece "T".
 - Data for total thickness of pile-up not exceeding 4 "T". Maximum ratio between two thicknesses 3 to 1.
 - Electrode Material, CL2, CL3 or CL11.
 - Minimum weld spacing is that spacing for two pieces for which no special precautions need to be taken to compensate for shunted current effect of adjacent welds. For three pieces increase spacing 30%.

Design and Welding Data for Projection Welding Low Carbon Steels

Thickness of Thinnest Outside Piece (Inches)	PROJECTION DESIGN		ELECTRODE DIAMETERS		Electrode Force (Lbs.)	Weld Time (Cycles) (60 Cycles per sec.)	Hold Time (Cycles) Min	Welding Current (Amps.) (Approx.)	Diameter of Fused Zone Dw (Inches)	Minimum Shear Strength (Single Projection Only) (For Steels Having Strength of 100,000 psi and below) (Lbs.)	Minimum Contacting Overlap (Inches)
	Base Diameter of Projection Dp (Inches)	Height of Projection H (Inches)	(d=2x Projection Diameter)								
			Min d (Inches)	Min D (Inches)							
0.010	0.055	0.015	0.125	1/2	50	3	3	2800	0.112	150	1/8
0.012	0.055	0.015	0.125	1/2	80	3	3	3100	0.112	200	1/8
0.014	0.055	0.015	0.125	1/2	100	3	3	3400	0.112	250	1/8
0.016	0.067	0.017	0.187	1/2	115	4	4	3600	0.112	285	5/32
0.021	0.067	0.017	0.187	1/2	150	6	6	4000	0.140	380	5/32
0.025	0.081	0.020	0.187	1/2	200	6	8	4500	0.140	525	3/16
0.031	0.094	0.022	0.187	1/2	300	8	8	5100	0.169	740	7/32
0.034	0.094	0.022	0.187	1/2	350	10	10	5400	0.169	900	7/32
0.044	0.119	0.028	0.250	5/8	480	13	14	6500	0.169	1080	9/32
0.050	0.119	0.028	0.250	5/8	580	16	16	7100	0.225	1500	9/32
0.062	0.156	0.035	0.312	7/8	750	21	20	8400	0.225	2100	3/8
0.070	0.156	0.035	0.312	7/8	900	24	24	9200	0.281	2550	3/8
0.078	0.187	0.041	0.375	7/8	1050	26	30	10500	0.281	2950	7/16
0.094	0.218	0.048	0.500	7/8	1300	32	30	11800	0.281	3700	1/2
0.109	0.250	0.054	0.500	7/8	1650	38	36	13300	0.338	4500	5/8
0.125	0.281	0.060	0.500	7/8	1800	45	40	15000	0.338	5200	11/16
0.140	0.312	0.066	0.625	1	2300	60	45	17500	0.437	6000	3/4
0.156	0.343	0.072	0.625	1	2800	80	50	17250	0.500	7500	13/16
0.171	0.375	0.078	0.750	1	3300	105	50	18600	0.562	8500	7/8
0.187	0.406	0.085	0.750	1	3800	125	50	20000	0.562	10000	15/16
0.203	0.437	0.091	0.875	1-1/4	4500	145	55	21500	0.625	12000	1
0.250	0.531	0.110	1.000	1-1/4	6600	230	60	26000	0.687	15000	1-1/4

- NOTES:**
- Type of Steel – Low Carbon SAE 1010 – 0.15% Carbon Maximum.
 - Material free of scale, oxide, paint dirt, etc.
 - Size of projection determined by thickness of thinnest piece and projection should be on thickest piece.
 - Data is based on thickness of thinnest sheet for two thicknesses only. Maximum ratio between two thicknesses = 3 to 1.
 - See TABLE BELOW for design of punch and die for making projections.
 - Contacting overlap does not include any radii form forming.
 - Projection should be located in center of overlap.
 - Tolerance for Projection Dimensions:
- | | | | |
|--------------------|-----------|---------------------------|--------------------------|
| | Dimension | Thickness
Up to 0.050" | Thickness
Over 0.050" |
| Diameter "D" | | +/- 0.003" | +/- 0.007" |
| Height "H" | | +/- 0.002" | +/- 0.005" |