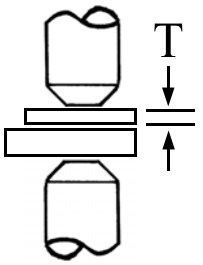
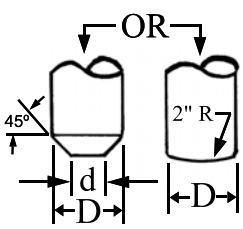
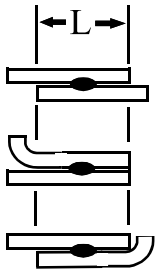
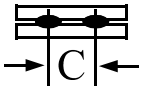
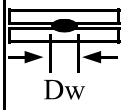
# RECOMMENDED PRACTICES FOR SINGLE-PULSE SPOT WELDS IN LOW CARBON STEEL

| Thickness of Thinnest Outside Piece | | Electrode Major Diameter and Shape | | Net Electrode Force | Weld Time (Single pulse) | Welding Current* | Minimum Contacting Overlap | Minimum Weld Spacing | Diameter of Fused Zone | Minimum Tensile-Shear Strength |
|---|---|---|---|---|---|---|---|---|---|---|
|  | |  | | | | |  |  |  |  |
| MFG GAUGE | THICKNESS Inch (mm) | D. MIN. Inch | d. MAX. Inch | POUNDS | CYCLES (60 HZ) | AMPERES (approx.) | INCH | INCH | INCH (approx.) | POUNDS |
| 32 | .010 (0.25) | 1/2 | 1/8 | 200 | 4 | 4,000 | 3/8 | 1/4 | .13 | 235 |
| 25 | .021 (0.53) | 1/2 | 3/16 | 300 | 6 | 6,100 | 7/16 | 3/8 | .17 | 530 |
| 22 | .030 (0.76) | 1/2 | 1/4 | 400 | 8 | 8,000 | 7/16 | 1/2 | .21 | 980 |
| 20 | .036 (0.91) | 1/2 | 1/4 | 500 | 10 | 9,200 | 1/2 | 3/4 | .23 | 1,350 |
| 18 | .048 (1.22) | 1/2 | 1/4 | 650 | 12 | 10,300 | 9/16 | 7/8 | .25 | 1,820 |
| 16 | .060 (1.52) | 5/8 | 5/16 | 800 | 14 | 11,600 | 5/8 | 1-1/16 | .27 | 2,350 |
| 14 | .075 (1.91) | 5/8 | 5/16 | 1,100 | 21 | 13,300 | 11/16 | 1-3/8 | .31 | 3,225 |
| 13 | .090 (2.29) | 5/8 | 3/8 | 1,300 | 25 | 14,700 | 3/4 | 1-5/8 | .34 | 4,100 |
| 12 | .105 (2.67) | 5/8 | 3/8 | 1,600 | 29 | 16,100 | 13/16 | 1-13/16 | .37 | 5,300 |
| 11 | .120 (3.05) | 5/8 | 7/16 | 1,800 | 30 | 17,500 | 7/8 | 2 | .40 | 6,900 |

* **Starting values** shown are based on industry experience. Adjust these values as needed to reach required weld quality.

- Type of steel: **SAE 1008-1010**
- Table is for a 3:1 maximum ratio of thickest to thinnest piece, and a maximum stackup thickness of 4"T"
- Material should be free from scale oxides, paint, grease, and heavy oil
- Electrode material: **RWMA CLASS 2**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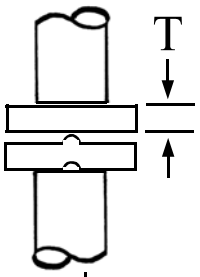
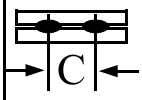
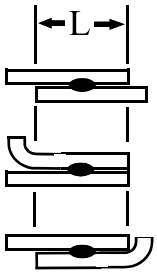
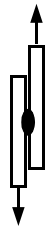
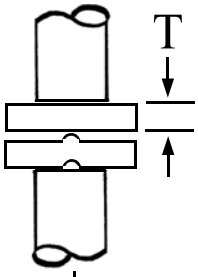
# RECOMMENDED PRACTICES FOR PROJECTION WELDS IN LOW CARBON STEEL

| DATA COMMON TO ALL CLASSES OF PROJECTION WELDS | | | | | | WELDING SCHEDULE A FOR A SINGLE PROJECTION | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Thickness** | | **Projection Size** | | **Minimum Weld Spacing** | **Minimum Contacting Overlap** | **Weld Time** | **Net Electrode Force** | **Welding Current*** | **Minimum Tensile-Shear Strength** |
|   | | | |   |   | | | |  |
| MFG. GAUGE | THICKNESS Inch (mm) | Diameter. Inch | Height. Inch | INCH | INCH | CYCLES (60 HZ) | POUNDS | AMPERES (approx.) | POUNDS |
| 25 | .021 (0.53) | .090 | .025 | 0.38 | 0.25 | 3 | 150 | 4,400 | 370 |
| 23 | .027 (0.69) | .090 | .025 | 0.38 | 0.25 | 3 | 195 | 5,500 | 500 |
| 21 | .033 (0.84) | .110 | .035 | 0.50 | 0.38 | 3 | 240 | 6,600 | 700 |
| 19 | .042 (1.07) | .110 | .035 | 0.50 | 0.38 | 5 | 330 | 8,000 | 1,060 |
| 18 | .048 (1.22) | .140 | .038 | 0.75 | 0.50 | 8 | 400 | 8,800 | 1,300 |
| 16 | .060 (1.52) | .150 | .042 | 0.75 | 0.50 | 10 | 550 | 10,300 | 1,800 |
| 14 | .075 (1.91) | .180 | .048 | 0.88 | 0.50 | 14 | 800 | 1,800 | 2,425 |
| 13 | .090 (2.29) | .210 | .050 | 1.06 | 0.62 | 16 | 1,020 | 13,150 | 3,250 |
| 12 | .105 (2.67) | .240 | .055 | 1.25 | 0.75 | 19 | 1,250 | 14,100 | 3,850 |
| 11 | .120 (3.04) | .270 | .058 | 1.50 | 0.81 | 22 | 1,500 | 14,800 | 4,800 |
| 10 | .135 (3.43) | .300 | .062 | 1.63 | 0.88 | 24 | 1,650 | 15,300 | 5,500 |

| WELDING SCHEDULE B FOR 2 – 3 PROJECTIONS | | | | | | WELDING SCHEDULE C FOR 4 OR MORE PROJECTIONS | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Thickness** | | **Total Weld Time** Do not mult. Per projection | **Net Electrode Force** per each projection | **Welding Current*** per each projection | **Min. Tensile-Shear** per each projection | **Total Weld Time** Do not mult. Per projection | **Net Electrode Force** per each projection | **Welding Current*** per each projection | **Min. Tensile-Shear** per each projection |
|   | | | | |  | | | |  |
| MFG GAUGE | THICKNESS Inch (mm) | CYCLES (60 HZ) | POUNDS | AMPERES (approx.) | POUNDS | CYCLES (60 HZ) | POUNDS | AMPERES (approx.) | POUNDS |
| 25 | .021 (0.53) | 6 | 150 | 3,850 | 325 | 6 | 80 | 2,900 | 290 |
| 23 | .027 (0.69) | 6 | 150 | 4,450 | 425 | 8 | 100 | 3,300 | 340 |
| 21 | .033 (0.84) | 6 | 150 | 5,100 | 525 | 11 | 125 | 3,800 | 425 |
| 19 | .042 (1.07) | 10 | 210 | 6,000 | 875 | 15 | 160 | 4,300 | 720 |
| 18 | .048 (1.22) | 16 | 270 | 6,500 | 1,100 | 19 | 220 | 4,400 | 875 |
| 16 | .060 (1.52) | 20 | 365 | 7,650 | 1,575 | 25 | 330 | 5,400 | 1,225 |
| 14 | .075 (1.91) | 28 | 530 | 8,850 | 2,150 | 34 | 470 | 6,400 | 1,750 |
| 13 | .090 (2.29) | 32 | 680 | 9,750 | 2,800 | 42 | 610 | 7,200 | 2,325 |
| 12 | .105 (2.67) | 38 | 830 | 10,600 | 3,450 | 50 | 740 | 8,300 | 2,900 |
| 11 | .120 (3.04) | 45 | 1,000 | 11,300 | 4,200 | 60 | 900 | 9,200 | 3,600 |
| 10 | .135 (3.43) | 48 | 1,100 | 11,850 | 4,850 | 66 | 1,000 | 9,900 | 4,250 |

* **Starting values** shown are based on industry experience. Adjust these values as needed to reach required weld quality.

- Material should be free from scale oxides, paint, grease and heavy oil
- Electrode Material: **RWMA CLASS 3 or 11**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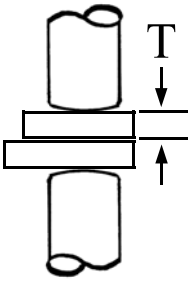
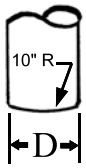
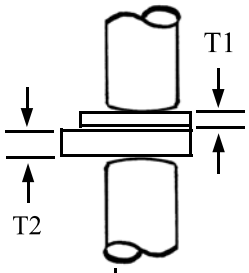
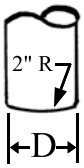
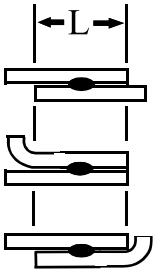
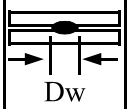
## LOW CARBON STEEL SPOT WELDING DATA
## FOR SINGLE-PULSE WELDS IN HEAVY PLATES

| Plate Thickness | Electrode Major Diameter and Shape | Net Electrode Force | Net Forge Force | Weld Time (Single pulse) | Welding Current* | Minimum Tensile-Shear Strength |
|---|---|---|---|---|---|---|
|  |  | | | | |  |
| THICKNESS Inch (mm) | D. MIN. Inch | POUNDS | POUNDS | CYCLES (60 HZ) | AMPERES (approx.) | POUNDS |
| 1/8 (3.18) | 5/8 | 6,000 | 6,000 | 45 | 27,300 | 9,850 |
| 3/16 (4.75) | 3/4 | 6,000 | 10,000 | 60 | 29,400 | 13,960 |
| 1/4 (6.35) | 7/8 | 6,000 | 12,500 | 240 | 25,800 | 22,800 |
| 3/8 (9.52) | 1 | 6,500 | 13,500 | 360 | 26,000 | 33,780 |
| 1/2 (12.70) | 1-1/4 | 6,500 | 13,500 | 400 | 31,100 | 45,600 |

* **Starting values** shown are based on experience of member companies. Adjust this value as needed to reach required weld quality

- Type of steel: **SAE 1018-1010**
- Material should be free from scale oxides, paint, grease and heavy oil
- Minimum weld spacing: 1/8” to 3/16” plate = 2”, 1/4” to 1/2” plate = 4”
- Electrode material: **RWMA CLASS 2**

## LOW CARBON STEEL SPOT WELDING DATA
## FOR MULTIPLE-PULSE WELDS IN HEAVY PLATES

| Combination Of Thick-nesses To Be Welded | | Electrode Major Diameter and Shape | Net Electrode Force | For Each Pulse Weld Time \| Cool Time 20 Cycles (60 Hz) 5 Cycles | | | Welding Current* | Minimum Contacting Overlap | Diameter of Fused Zone | Minimum Tensile-Shear Strength |
|---|---|---|---|---|---|---|---|---|---|---|
|  | |  | | NUMBER OF PULSES | | | |  |  |  |
| | | | | First Weld | Additional Welds Distance To Adjacent Weld | | | | | |
| T1 Inch (mm) | T2 Inch (mm) | D. MIN Inch | POUNDS | | 1 inch to 2 inches | 2 inches to 4 inches | AMPERES (approx.) | INCH | INCH (approx.) | POUNDS |
| 1/8 (3.18) | 1/8 (3.18) | 1 | 1,800 | 3 | 5 | 4 | 18,000 | 7/8 | 3/8 | 5,000 |
| 1/8 (3.18) | 3/16 (4.75) | 1 | 1,800 | 3 | 5 | 4 | 18,000 | 7/8 | 3/8 | 5,000 |
| 1/8 (3.18) | 1/4 (6.35) | 1 | 1,800 | 3 | 5 | 4 | 18,000 | 7/8 | 3/8 | 5,000 |
| 3/16 (4.75) | 3/16 (4.75) | 1-1/4 | 1,950 | 6 | 20 | 14 | 19,500 | 1-1/8 | 9/16 | 10,000 |
| 3/16 (4.75) | 1/4 (6.35) | 1-1/4 | 1,950 | 6 | 20 | 14 | 19,500 | 1-1/8 | 9/16 | 10,000 |
| 3/16 (4.75) | 5/16 (7.92) | 1-1/4 | 1,950 | 6 | 20 | 14 | 19,500 | 1-1/8 | 9/16 | 10,000 |
| 1/4 (6.35) | 1/4 (6.35) | 1-1/4 | 2,150 | 12 | 24 | 18 | 21,500 | 1-3/8 | 3/4 | 15,000 |
| 1/4 (6.35) | 5/16 (7.92) | 1-1/4 | 2,150 | 12 | 24 | 18 | 21,500 | 1-3/8 | 3/4 | 15,000 |
| 5/16 (7.92) | 5/16 (7.92) | 1-1/2 | 2,400 | 15 | 30 | 23 | 24,000 | 1-1/2 | 7/8 | 20,000 |

* **Starting values** shown are based on experience of member companies. Adjust these values as needed to reach required weld quality.

- Type of steel: **SAE 1008-1010**
- Material should be free from scale oxides, paint, grease, and heavy oil
- Minimum weld spacing: 1/8” to 3/16” plate = 2”, 1/4” to 5/16” plate = 4”
- Electrode material: **RWMA CLASS 2**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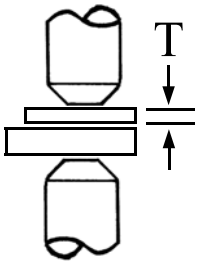
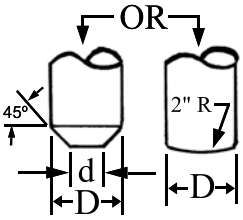
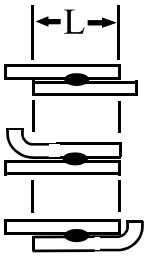
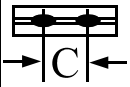
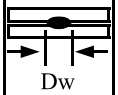
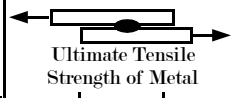
# RECOMMENDED PRACTICES FOR SINGLE-PULSE SPOT WELDS IN STAINLESS STEEL

| Thickness of Thinnest Outside Piece | | Electrode Major Diameter and Shape | | Net Electrode Force | Weld Time (Single pulse) | Welding Current* | | Minimum Contacting Overlap | Minimum Weld Spacing[1] | Diameter of Fused Zone | Minimum Tensile-Shear Strength | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | |  | | | | FOR MATERIAL WITH TENSILE STRENGTH | |  |  |  |  | | |
| | | | | | | Below (150 kpsi) | Above (150 kpsi) | | | | From 70 to 90 kpsi | From 90 to 150 kpsi | 150 kpsi & up |
| MFG. GAUGE | THICKNESS Inch (mm) | D. MIN. Inch | d. MAX. Inch | POUNDS | CYCLES (60 HZ) | AMPS (approx.) | AMPS (approx.) | INCH | INCH | INCH (approx.) | LBS | LBS | LBS |
| 38 | .006 (0.15) | 3/16 | 3/32 | 180 | 2 | 2,000 | 2,000 | 3/16 | 3/16 | .045 | 60 | 70 | 85 |
| 34 | .008 (0.20) | 3/16 | 3/32 | 200 | 3 | 2,000 | 2,000 | 3/16 | 3/16 | .055 | 100 | 130 | 145 |
| 33 | .009 (0.23) | 3/16 | 1/8 | 230 | 3 | 2,000 | 2,000 | 3/16 | 3/16 | .065 | 150 | 170 | 210 |
| 30 | .012 (.030) | 1/2 | 1/8 | 260 | 3 | 2,100 | 2,000 | 1/4 | 1/4 | .076 | 185 | 210 | 250 |
| 29 | .013 (0.33) | 1/2 | 1/8 | 300 | 4 | 2,500 | 2,200 | 1/4 | 1/4 | .082 | 240 | 250 | 320 |
| 28 | .015 (0.39) | 1/2 | 1/8 | 330 | 4 | 3,000 | 2,500 | 1/4 | 5/16 | .088 | 280 | 300 | 380 |
| 26 | .018 (0.46) | 1/2 | 1/8 | 380 | 4 | 3,500 | 2,800 | 1/4 | 5/16 | .093 | 320 | 360 | 470 |
| 25 | .021 (0.53) | 1/2 | 5/32 | 400 | 4 | 4,000 | 3,200 | 5/16 | 5/16 | .100 | 370 | 470 | 500 |
| 24 | .024 (0.60) | 1/2 | 5/32 | 520 | 5 | 5,000 | 4,100 | 3/8 | 7/16 | .120 | 500 | 600 | 680 |
| 22 | .030 (0.76) | 1/2 | 3/16 | 650 | 5 | 6,000 | 4,800 | 3/8 | 1/2 | .130 | 680 | 800 | 930 |
| 21 | .033 (0.84) | 1/2 | 3/16 | 750 | 6 | 7,000 | 5,500 | 7/16 | 9/16 | .150 | 800 | 920 | 1,100 |
| 20 | .036 (0.91) | 1/2 | 3/16 | 900 | 6 | 7,800 | 6,300 | 7/16 | 5/8 | .160 | 1,000 | 1,270 | 1,400 |
| 19 | .042 (1.07) | 1/2 | 3/16 | 1,000 | 8 | 8,700 | 7,000 | 7/16 | 11/16 | .180 | 1,200 | 1,450 | 1,700 |
| 18 | .048 (1.22) | 1/2 | 1/4 | 1,200 | 8 | 9,500 | 7,500 | 1/2 | 3/4 | .190 | 1,450 | 1,700 | 2,000 |
| 17 | .054 (1.37) | 1/2 | 1/4 | 1,350 | 10 | 10,300 | 8,300 | 9/16 | 7/8 | .210 | 1,700 | 2,000 | 2,450 |
| 16 | .060 (1.52) | 1/2 | 1/4 | 1,500 | 10 | 11,000 | 9,000 | 5/8 | 1 | .220 | 1,950 | 2,400 | 2,900 |
| 15 | .067 (1.70) | 5/8 | 1/4 | 1,700 | 12 | 12,300 | 10,000 | 5/8 | 1-1/8 | .250 | 2,400 | 2,800 | 3,550 |
| 14 | .075 (1.91) | 5/8 | 5/16 | 1,900 | 14 | 14,000 | 11,000 | 11/16 | 1-1/4 | .275 | 2,700 | 3,400 | 4,000 |
| 13 | .090 (2.29) | 5/8 | 5/16 | 2,400 | 16 | 15,700 | 12,700 | 3/4 | 1-3/8 | .285 | 3,550 | 4,200 | 5,300 |
| 12 | .105 (2.67) | 3/4 | 3/8 | 2,800 | 18 | 17,700 | 14,000 | 13/16 | 1-1/2 | .290 | 4,200 | 5,000 | 6,400 |
| 11 | .120 (3.05) | 3/4 | 3/8 | 3,300 | 20 | 18,000 | 15,500 | 7/8 | 2 | .300 | 5,000 | 6,000 | 7,600 |

* **Starting values** shown are based on industry experience. Adjust this value as needed to reach required weld quality.

**1.** Minimum spacing shown is for the welding of two pieces. Increase spacing by 30% when welding three pieces. Smaller minimum spacing requires higher current. Electrode material: **RWMA CLASS 2 or CLASS 3**

- Type of steel: **AISI 301, 302, 303, 304, 308, 316, 317, 321, 349**
- Material should be free from scale oxides, paint, grease, and heavy oil
- Table is for a 3:1 maximum ratio of thickest to thinnest piece, and a maximum stackup thickness of 4“T”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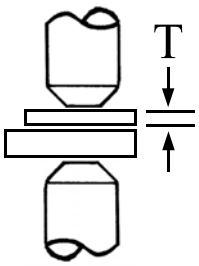
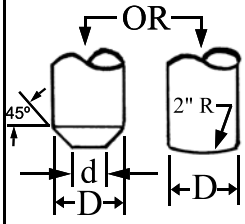
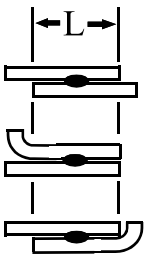
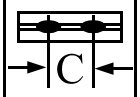
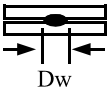
# RECOMMENDED PRACTICES FOR MULTIPLE-PULSE SPOT WELDS IN STAINLESS STEEL

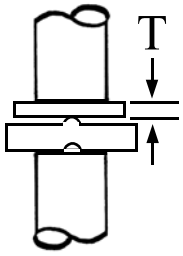
| Thickness of Thinnest Outside Piece | Electrode Major Diameter and Shape | | Net Electrode Force | Weld Time | | Welding Current* | | Minimum Contacting Overlap | Minimum Weld Spacing[1] | Diameter of Fused Zone | Minimum Tensile-Shear Strength | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|   |   | | | HEAT 15 CYCLES | COOL 2 CYCLES | FOR MATERIAL WITH TENSILE STRENGTH | |   |   |   |  Ultimate Tensile Strength of Metal | |
| | | | | | | Below (150 kpsi) | Above (150 kpsi) | | | | From 90 to 150 kpsi | 150 kpsi & up |
| THICKNESS Inch (mm) | D. MIN. Inch | d. MAX. Inch | POUNDS | NUMBER OF PULSES | | AMPS (approx.) | AMPS (approx.) | INCH | INCH | INCH (approx.) | LBS | LBS |
| 5/32 (3.96) | 1 | 1/2 | 4,000 | 4 | | 20,700 | 17,500 | 1-1/4 | 1-7/8 | .440 | 7,600 | 10,000 |
| 3/16 (4.75) | 1 | 1/2 | 5,000 | 5 | | 21,500 | 18,500 | 1-1/2 | 2 | .500 | 9,750 | 12,300 |
| 13/64 (5.16) | 1 | 5/8 | 5,500 | 6 | | 22,000 | 19,000 | 1-5/8 | 2-1/8 | .530 | 10,600 | 13,000 |
| 1/4 (6.35) | 1 | 5/8 | 7,000 | 7 | | 25,000 | 20,000 | 1-3/4 | 2-3/8 | .600 | 13,500 | 17,000 |

* **Starting values** shown are based on industry experience. Adjust this value as needed to reach required weld quality.

**1.** Minimum spacing shown is for the welding of two pieces. Increase spacing by 30% when welding three pieces. Smaller minimum spacing requires higher current.

- Electrode material: **RWMA CLASS 3**
- Type of steel: **AISI 301, 302, 303, 304, 308, 316, 317, 321, 349**
- Material should be free from scale oxides, paint, grease, and heavy oil
- Table is for a 3:1 maximum ratio of thickest to thinnest piece, and a maximum stackup thickness of 4"T"

# MANUFACTURING DATA FOR PROJECTION WELDS IN STAINLESS STEEL

| Thickness of Thinnest Outside Piece | | Net Electrode | Weld Time (Single | Welding Current* | Hold Time |
|---|---|---|---|---|---|
|   | | | | | |
| MFG GAUGE | THICKNESS Inch (mm) | POUNDS | CYCLES (60 HZ) | AMPERES (approx.) | CYCLES (60 HZ) |
| 28 | .014 (0.36) | 300 | 7 | 4,500 | 15 |
| 25 | .021 (0.53) | 500 | 10 | 4,750 | 15 |
| 22 | .030 (0.76) | 700 | 15 | 5,750 | 15 |
| 19 | .042 (1.07) | 700 | 20 | 6,000 | 15 |
| 16 | .060 (1.52) | 1,200 | 25 | 7,500 | 15 |
| 14 | .075 (1.91) | 1,900 | 30 | 10,000 | 30 |
| 13 | .090 (2.29) | 1,900 | 30 | 10,000 | 30 |
| 12 | .105 (2.67) | 2,800 | 30 | 13,000 | 45 |
| 11 | .120 (3.05) | 2,800 | 30 | 14,000 | 45 |

* **Starting values** shown are based on industry experience. Adjust this value as needed to reach required weld quality.

* Electrode material: **RWMA CLASS 3 or CLASS 11**

- Type of steel: **AISI 301, 302, 303, 304, 308, 316, 317, 321, 349**
- Material should be free from scale oxides, paint, grease, and heavy oil
- Projection geometry should be similar to chart on PROJECTION WELDS IN LOW CARBON STEEL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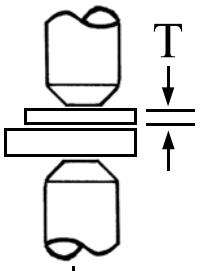
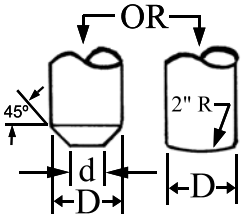
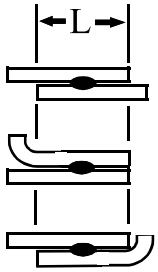
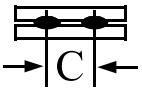
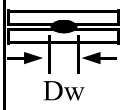
# RECOMMENDED PRACTICES FOR SPOT WELDS IN HIGH STRENGTH LOW ALLOY (HSLA) STEEL

| Thickness of Thinnest Outside Piece[1] | | Electrode Major Diameter and Shape[2] | | Net Electrode Force | Weld Time (Single pulse) | Welding Current* | Minimum Contacting Overlap | Minimum Weld Spacing | Diameter of Fused Zone | Minimum Tensile-Shear Strength |
|---|---|---|---|---|---|---|---|---|---|---|
|  | |  | | | | |  |  |  |  |
| MFG GAUGE | THICKNESS Inch (mm) | D. MIN. Inch | d. MAX. Inch | POUNDS | CYCLES (60 HZ) | AMPERES (approx.) | INCH | INCH | INCH (approx.) | POUNDS |
| 32 | .010 (0.25) | 1/2 | 1/8 | 250 | 4 | 4,000 | 3/8 | 1/4 | .14 | 680 |
| 25 | .021 (0.53) | 1/2 | 3/16 | 490 | 6 | 6,100 | 7/16 | 3/8 | .18 | 690 |
| 22 | .030 (0.76) | 1/2 | 1/4 | 560 | 8 | 6,700 | 7/16 | 1/2 | .18 | 1,270 |
| 20 | .036 (0.91) | 1/2 | 1/4 | 720 | 10 | 8,000 | 1/2 | 3/4 | .25 | 1,750 |
| 18 | .048 (1.22) | 1/2 | 1/4 | 910 | 12 | 9,700 | 9/16 | 7/8 | .25 | 2,360 |
| 16 | .060 (1.52) | 5/8 | 5/16 | 1,200 | 17 | 12,000 | 5/8 | 1-1/16 | .25 | 3,050 |
| 14 | .075 (1.91) | 5/8 | 5/16 | 1,550 | 21 | 12,500 | 11/16 | 1-3/8 | .31 | 4,190 |
| 13 | .090 (2.29) | 5/8 | 3/8 | 1,730 | 27 | 13,200 | 3/4 | 1-5/8 | .31 | 5,330 |
| 12 | .105 (2.67) | 5/8 | 3/8 | 1,900 | 32 | 13,900 | 13/16 | 1-13/16 | .35 | 6,890 |
| 11 | .120 (3.04) | 5/8 | 7/16 | 2,300 | 42 | 15,100 | 7/8 | 2 | .35 | 8,970 |

* **Starting values** shown are based on experience of member companies. Adjust this value as needed to reach required weld quality. When using radiussed electrodes, increase welding current approximately 10% over values shown.

**1** Table is for a 3:1 maximum ratio of thickest to thinnest piece, and a maximum stackup thickness of 4"T"

**2** Electrode material: **RWMA CLASS 2**

- Material should be pickled or otherwise cleaned to obtain a surface contact resistance not exceeding 200 microhms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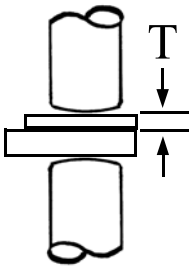
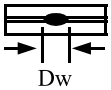
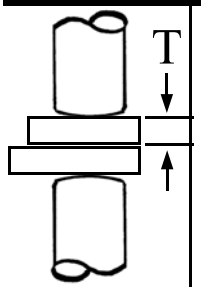
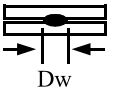
# RECOMMENDED PRACTICES FOR SPOT WELDING ALUMINUM ALLOYS ON SINGLE PHASE MACHINES

| Thickness of Thinnest Outside Piece | Electrode Major Diameter and Shape | | Net Electrode Force | Weld Time (Single pulse) | Welding Current* | Diameter of Fused Zone | Minimum Tensile-Shear Strength | | |
|---|---|---|---|---|---|---|---|---|---|
|  |  | | | | |  |  Ultimate Tensile Strength of Metal | | |
| THICKNESS Inch (mm) | D. MIN. Inch | R. MAX. Inch | POUNDS | CYCLES (60 HZ) | AMPS (approx.) | INCH (approx.) | From 19.5 to 28 kpsi LBS | From 28 to 56 kpsi LBS | 56 kpsi & up LBS |
| .016 (0.40) | 5/8 | 1-Flat | 320 | 4 | 15,000 | .110 | 95 | 130 | 145 |
| .020 (0.51) | 5/8 | 1-Flat | 340 | 5 | 18,000 | .125 | 135 | 175 | 190 |
| .025 (0.64) | 5/8 | 2-Flat | 390 | 6 | 21,800 | .140 | 195 | 235 | 250 |
| .032 (0.81) | 5/8 | 2-Flat | 500 | 6 | 26,000 | .160 | 280 | 315 | 350 |
| .040 (1.02) | 5/8 | 3-Flat | 600 | 8 | 30,700 | .180 | 400 | 415 | 460 |
| .050 (1.27) | 5/8 | 3-Flat | 660 | 8 | 33,000 | .210 | 550 | 590 | 640 |
| .063 (1.60) | 5/8 | 3-Flat | 750 | 10 | 35,900 | .250 | 755 | 835 | 920 |
| .071 (1.80) | 5/8 | 4-4 | 800 | 10 | 38,000 | .275 | 875 | 980 | 1,130 |
| .080 (2.03) | 7/8 | 4-4 | 860 | 10 | 41,800 | .300 | 1,035 | 1,155 | 1,400 |
| .090 (2.29) | 7/8 | 6-6 | 950 | 12 | 46,000 | .330 | 1,175 | 1,355 | 1,700 |
| .100 (2.54) | 7/8 | 6-6 | 1,050 | 15 | 56,000 | .360 | 1,270 | 1,600 | 2,050 |
| .125 (3.18) | 7/8 | 6-6 | 1,300 | 15 | 76,000 | .425 | 1,400 | 2,170 | 2,830 |

* **Starting values** shown are based on industry experience. Adjust this value as needed to reach required weld quality.

- This table is for commercial welding. See table below for single phase welding to meet more rigid requirements.
- Table is for alloys: **2014-T3-T4-T6, 2024-T3-T4, and 7075-T6**. Somewhat lower values can be used for alloys such as **5053, 6061, 6009, 6010, 5182, and 2036**
- Electrode material: **RWMA CLASS 1**

# RECOMMENDED PRACTICES FOR SPOT WELDING ALUMINUM ALLOYS ON SINGLE PHASE MACHINES WITH SLOPE

| Thickness of Thinnest Outside Piece | Electrode Major Diameter and Shape | | Net Electrode Force | | Heat Time | | | Current* | | | Minimum Tensile Shear Strength | Diameter of Fused Zone |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  | | | | | | | | | |  |  Dw |
| THICKNESS Inch (mm) | D. MIN. Inch | R. MAX. Inch | WELD POUNDS | FORGE POUNDS | UPSLOPE CYCLES (60 HZ) | WELD HEAT CYCLES (60 HZ) | DOWN SLOPE CYCLES (60 HZ) | INITIAL AMPS (approx.) | WELD AMPS (approx.) | FINAL AMPS (approx.) | POUNDS | POUNDS |
| .016 (0.40) | 7/8 | 3 | 500 | 1,200 | 1 | 0 | 1 | 5,500 | 17,700 | 0 | 167 | .134 |
| .020 (0.51) | 7/8 | 3 | 500 | 1,200 | 1 | 1 | 2 | 8,500 | 19,800 | 11,300 | 228 | .143 |
| .040 (1.02) | 7/8 | 3 | 700 | 1,600 | 1 | 2 | 5 | 10,800 | 28,300 | 10,600 | 578 | .156 |
| .063 (1.60) | 7/8 | 6 | 1,180 | 2,750 | 3 | 5 | 11 | 16,850 | 34,500 | 18,700 | 1,126 | .281 |
| .090 (2.29) | 7/8 | 6 | 1,700 | 4,300 | 4 | 8 | 17 | 17,700 | 46,500 | 33,200 | 2,039 | .334 |

* **Starting values** shown are based on industry experience. Adjust this value as needed to reach required weld quality.

- Table is for alloys: **2014-T3-T4-T6, 2024-T3-T4, and 7075-T6**. Somewhat lower values can be used for alloys such as **5053, 6061, 6009, 6010, 5182, and 2036**
- Electrode material: **RWMA CLASS 1**
- This table is for more rigid welding requirements. See table above for single phase welding to meet less rigid commercial requirements.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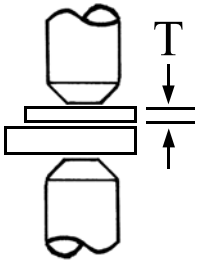
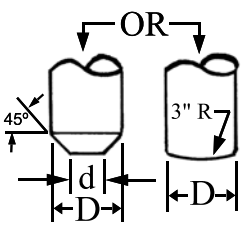
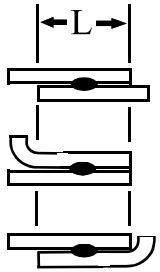
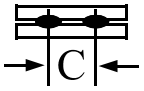
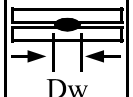
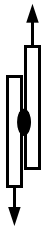
# RECOMMENDED PRACTICES FOR SINGLE-PULSE SPOT WELDS IN GALVANIZED STEEL

The following **GALVANIZED STEEL** schedule uses a **PREHEAT— COOL TIME — WELD** sequence and can only be used with welding controls having this ability.

A. The PREHEAT liquefies the galvanized coating but does not have enough current to start the weld.

B. The COOL TIME allows time for a majority of the liquefied galvanized coating to be “squeezed” away from the weld zone and from under the electrodes.

C. The WELD TIME does the actual welding with minimal interference of the galvanized coating.

| Thickness of Thinnest Outside Piece | | Electrode Major Diameter and Shape | | Net Electrode Force | Weld Time (Single pulse) | Welding Current* | Preheat Time (Single Pulse) | Preheat Current* | Cool Time⊥ | Minimum Contacting Overlap | Minimum Weld Spacing | Diameter of Fused Zone | Minimum Tensile-Shear Strength |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | |  | | | | | | | |  |  |  |  |
| MFG GAUGE | THICKNESS Inch (mm) | D. MIN. Inch | d. MAX. Inch | POUNDS | CYCLES (60 HZ) | AMPERES (approx.) | CYCLES (60 HZ) | AMPERES (approx.) | CYCLES (60 HZ) | INCH | INCH | INCH (approx.) | POUNDS |
| 26 | .022 (0.50) | 1/2 | .193 | 350 | 8 | 12,500 | 6 | 6,200 | 3 | 3/8 | 1/4 | .156 | 510 |
| 24 | .028 (0.71) | 1/2 | .193 | 450 | 10 | 12,760 | 6 | 6,300 | 3 | 7/16 | 3/8 | .162 | 660 |
| 22 | .034 (0.86) | 1/2 | .250 | 550 | 12 | 13,000 | 6 | 6,500 | 3 | 7/16 | 1/2 | .193 | 1,050 |
| 20 | .040 (1.02) | 5/8 | .250 | 710 | 13 | 13,500 | 8 | 6,700 | 4 | 1/2 | 3/4 | .218 | 1,310 |
| 18 | .052 (1.32) | 5/8 | .250 | 780 | 18 | 14,000 | 8 | 7,000 | 4 | 9/16 | 7/8 | .220 | 1,730 |
| 16 | .064 (1.63) | 5/8 | .250 | 910 | 22 | 15,000 | 8 | 7,500 | 4 | 5/8 | 1-1/16 | .240 | 2,000 |
| 14 | .078 (1.98) | 5/8 | .312 | 1,300 | 24 | 18,600 | 8 | 9,300 | 5 | 11/16 | 1-3/8 | .281 | 2,950 |
| 13 | .093 (2.36) | 5/8 | .380 | 1,400 | 30 | 19,500 | 11 | 9,700 | 5 | 3/4 | 1-5/8 | .340 | 4,000 |
| 12 | .108 (2.74) | 5/8 | .380 | 1,900 | 37 | 19,600 | 12 | 9,800 | 6 | 13/16 | 1-13/16 | .400 | 5,200 |
| 11 | .123 (3.10) | 5/8 | .380 | 2,100 | 42 | 19,700 | 15 | 9,800 | 6 | 7/8 | 2 | .480 | 6,800 |

* **Starting values** shown are based on industry experience. Adjust these values as needed to reach required weld quality.

⊥ COOL TIME is the delay time between the last cycle of PREHEAT and the first cycle of WELD

- Type of steel: **Galvanized G90**
- Table is for a 3:1 maximum ratio of thickest to thinnest piece, and a maximum stackup thickness of 4”T”
- Material should be free from scale oxides, paint, grease, and heavy oil
- Electrode material: **RWMA CLASS 2**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