A/SP STARTING RESISTANCE SPOT WELD SCHEDULES FOR AHSS

AC-Uncoated Steel Starting Weld Schedules
For Uncoated IISI Group 3 and Group 4 Steels
Electrodes: Ball Nose with a 4.8 mm Face Diameter (See D_2 in Figure 1)

GMT Range (mm)	Electrode Force N (lbs)	Weld Time (cycles)	Cool Time (cycles)	Number Of Pulses	Weld Sequence (cycles)	Hold Time (cycles)	Weld Current (kA)	Electrode Shank Diameter (See D_1 in Figure 1) (mm)
0.70- 0.79	2140 (480)	9	0	1	9	2	8.0	16
0.80- 0.99	2980 (670)	9	0	1	9	2	8.0	16
1.00- 1.29	2980 (670)	10	0	1	10	2	9.0	16
1.30- 1.59	4230 (950)	12	0	1	12	2	10.0	16
1.60- 1.89	5340 (1200)	7	1	2	7-1-7	5	10.5	19
1.90- 2.29	7390 (1660)	7	1	3	7-1-7-1-7	5	11.5	19
2.30- 2.69	7390 (1660)	8	2	3	8-2-8-2-8	10	12.0	19
2.70- 3.00	8450 (1900)	8	2	3	8-2-8-2-8	10	12.5	19

AC-Coated Steel Starting Weld Schedules
For Coated IISI Group 3 and Group 4 Steels
Electrodes: Ball Nose with a 4.8 mm Face Diameter (See D_2 in Figure 1)

GMT Range (mm)	Electrode Force N (lbs)	Weld Time (cycles)	Cool Time (cycles)	Number Of Pulses	Weld Sequence (cycles)	Hold Time (cycles)	Weld Current (kA)	Electrode Shank Diameter (See D_1 in Figure 1) (mm)
0.70- 0.79	2140 (480)	14	0	1	14	2	9.0	16
0.80- 0.99	2980 (670)	14	0	1	14	2	9.5	16
1.00- 1.29	2980 (670)	16	0	1	16	2	10.0	16
1.30- 1.59	4230 (950)	7	1	3	7-1-7-1-7	5	11.0	16
1.60- 1.89	5340 (1200)	8	2	3	8-2-8-2-8	5	11.5	19
1.90- 2.29	7390 (1660)	8	2	4	8-2-8-2-8-2-8	5	12.5	19

Note 1: Weld Schedules will produce at least a Minimum Weld Size. Weld schedule adjustments may be required in production.
Note 2: Cycles based on 60 Hz.
Note 3: Maximum 2 thickness stack-up ratio is 1:2.5. Maximum 3 thickness stack-up ratio of adjacent sheets and outer sheets is 1:2.5.
Note 4: 3 thickness total stack-up not to exceed 6.0 mm.
Note 5: A weld sequence of x-y-x describes a pulsed weld schedule where x is the weld time and y is the cool time. For example, 7-1-7-1-7 describes 3 pulses of 7 cycles weld time with 1 cycle of cool time between the pulses.

MFDC-Uncoated Steel Starting Weld Schedules
For Uncoated IISI Group 3 and Group 4 Steels
Electrodes: ISO 5821 Type B with a 6 or 8 mm Face Diameter (See d_2 in Figure 2)

GMT Range (mm)	Electrode Force N (lbs)	Weld Time (ms)	Hold Time (ms)	Weld Current (kA)	Electrode Face Diameter (mm) (See d_2 in Figure 2)	Electrode Shank Diameter (mm) (See d_1 in Figure 2)
0.70- 0.79	2800 (630)	210	105	6.5	6	16
0.80- 0.99	3400 (770)	210	105	7.6	6	16
1.00- 1.29	4400 (990)	270	135	9.3	6	16
1.30- 1.59	5300 (1190)	350	175	10.6	8	20
1.60- 1.89	6400 (1440)	440	220	11.2	8	20
1.90- 2.29	7700 (1730)	560	280	12.0	8	20
2.30- 2.69	8500 (1910)	670	335	12.5	8	20
2.70- 3.00	10200 (2300)	880	440	13.6	8	20

MFDC-Coated Steel Starting Weld Schedules
For Coated IISI Group 3 and Group 4 Steels
Electrodes: ISO 5821 Type B with a 6 or 8 mm Face Diameter (See d_2 in Figure 2)

GMT Range (mm)	Electrode Force N (lbs)	Weld Time (ms)	Hold Time (ms)	Weld Current (kA)	Electrode Face Diameter (mm) (See d_2 in Figure 2)	Electrode Shank Diameter (mm) (See d_1 in Figure 2)
0.70- 0.79	2800 (630)	230	115	7.8	6	16
0.80- 0.99	3400 (770)	250	125	8.5	6	16
1.00- 1.29	4400 (990)	310	155	10.1	6	16
1.30- 1.59	5300 (1190)	400	200	11.5	8	20
1.60- 1.89	6400 (1440)	480	240	12.4	8	20
1.90- 2.29	7700 (1730)	600	300	13.2	8	20

Note 1: Weld Schedules will produce at least a Minimum Weld Size. Weld schedule adjustments may be required in production.
Note 2: Maximum 2 thickness stack-up ratio is 1:2.5. Maximum 3 thickness stack-up ratio of adjacent sheets and outer sheets is 1:2.5.
Note 3: 3 thickness total stack-up not to exceed 6.0 mm.

IISI Classification of Steels for Resistance Spot Welding Purposes (AWS D8.1M:2007, Table 1)

Group:	1. Low Strength	2. Intermediate Strength	3. High Strength	4. Ultra High Strength
Tensile Strength (MPa):	<350	350-500	>500-800	>800

Stack-up	Definition of GMT (Governing Metal Thickness)
Two Thickness (2T)	• The GMT is the thinnest sheet. • If 2 steels are the same thickness, that thickness is the GMT.
Three Thickness (3T)	• GMT is the median (middle) gauge of the 3 thicknesses being welded, regardless of its position in the stack-up. • If 2 of the 3 steels are the same thickness, that thickness is the GMT.

Minimum Weld Size (AWS D8.1M:2007, Table 2)

GMT (mm)	Weld Size	GMT (mm)	Weld Size
0.60-0.79	3.5 mm	1.60-1.89	5.5 mm
0.80-0.99	4.0 mm	1.90-2.29	6.0 mm
1.00-1.29	4.5 mm	2.30-2.69	6.5 mm
1.30-1.59	5.0 mm	2.70-3.09	7.0 mm

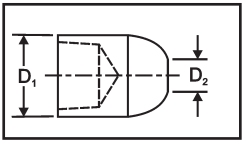

Figure 1 - Ball Nose

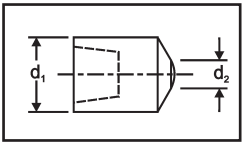

Figure 2 - ISO 5821

The Auto/Steel Partnership (A/SP) has developed these starting spot weld schedules for initial set-up only. The weld schedules are specific for the indicated electrode geometries and tip diameters to produce at least a Minimum Weld Size. A/SP does not warranty results. Specific conditions may vary with each application. For more information regarding OEM requirements, please see individual OEM engineering specifications.

For more detailed information, please visit www.a-sp.org

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