

AEROSPACE MATERIAL SPECIFICATION



AMS-W-6858B

Issued	1999-07
Revised	2000-04
Reaffirmed	2005-10
Cancelled	2007-11

Superseded by AWS D.17.2

Welding, Resistance: Spot and Seam

RATIONALE

AMS-W-6858A has been cancelled and superseded because equivalent technical requirements are provided by AWS D.17.2.

CANCELLATION NOTICE

This specification has been declared "CANCELLED" by the Aerospace Materials Division, SAE, as of November, 2007, and has been superseded by AWS D17.2. The requirements of the latest issue of AWS D17.2 shall be fulfilled whenever reference is made to the cancelled AMS-W-6858A. By this action, this document will remain listed in the Numerical Section of the Index of Aerospace Material Specifications, noting that it has been superseded by AWS D17.2, Resistance Welding for Aerospace Applications.

Cancelled specifications are available from SAE.

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NOTICE

This document has been taken directly from U.S. Military Specification MIL-W-6858D, Notice 1, Amendment 1 and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards. The initial release of this document is intended to replace MIL-W-6858D, Notice 1, Amendment 1. Any part numbers established by the original specification remain unchanged.

The original Military Specification was adopted as an SAE standard under the provisions of the SAE Technical Standards Board (TSB) Rules and Regulations (TSB 001) pertaining to accelerated adoption of government specifications and standards. TSB rules provide for (a) the publication of portions of unrevised government specifications and standards without consensus voting at the SAE Committee level, and (b) the use of the existing government specification or standard format.

Under Department of Defense policies and procedures, any qualification requirements and associated qualified products lists are mandatory for DOD contracts. Any requirement relating to qualified products lists (QPL's) has not been adopted by SAE and is not part of this SAE technical document.

1. SCOPE:

1.1 Scope:

This specification covers requirements for resistance spot and seam welding of the following metals and their alloys.

Group 1 - Aluminum and magnesium

Group 2 - Iron, nickel, and cobalt

Group 3 - Titanium

1.2 Classification:

Classification is based on function and use of the welded joint, rather than certain average levels of strength. Therefore, reliability is the key underlying quality distinguishing the work for each class. The criteria described herein are intended to prevent larger variations in weld strength and quality than are compatible with the intended use.

Class A A welded joint, whose failure during any operating condition would cause loss of the equipment or system or one or its major components, loss of control, unintentional release or inability to release any armament score, failure of gun installation components; or which may cause significant injury to occupants of manned systems.

Class B A welded joint whose failure would reduce the overall strength of the equipment or system or preclude the intended functioning or use of equipment.

Class C A welded joint which is considered non-critical and for which no stress analysis is considered.

1.2.1 The classification of welds in foil thickness is limited to Class A and Class C.

2. APPLICABLE DOCUMENTS:

The following documents of the issue in effect on date of invitation for bids, or request for proposal, form a part of this specification.

2.1 American Welding Society (AWS) Publications:

Available from American Welding Society Inc., 2501 N.W. 7th Street, Miami, Florida 33125)

AWS A3.0 Terms and Definitions

AWS C1.1 Recommended Practices for Resistance Welding

3. REQUIREMENTS:

3.1 Design requirements:

3.1.1 Definition of terms used in this specification shall be in accordance with AWS A3.0, and as shown in 6.2 herein.

3.1.2 The class of welding shall be designated on the item specification or drawing. The design of Class A resistance welded joints shall require the specific approval of the procuring activity who may approve if satisfactory resistance welded prototypes exist, or upon evidence of the adequacy of the design and pattern of spot welding or upon the satisfactory performance of suitable static and repeated loading testing of the design or applicable prototype.

3.1.3 There shall be two methods of certification for spot welds. The Standard Certification method shall be for a weld schedule that certifies that the requirements of Tables I through III or IV, and all other applicable weld property requirements have been met. The Design Allowable Certification method shall be a weld schedule that certifies a guaranteed strength value has been met.

TABLE I. Shear strength requirements for spot weld sheet specimens

GROUP 1 ALLOYS								
Nominal Thickness of Thinner Sheet, inch	Ultimate Strength 56,000 psi and above		Ultimate Strength 35,000 to 55,999 psi		Ultimate Strength 19,500 to 34,999 psi		Ultimate Strength below 19,500 psi	
	lb per spot		lb per spot		lb per spot		lb per spot	
	min	min avg	min	min avg	min	min avg	min	min avg
0.010	60	75	50	65	—	—	—	—
0.012	75	95	65	85	30	40	20	25
0.016	110	140	100	125	70	90	50	65
0.018	125	160	115	145	85	110	65	85
0.020	140	175	135	170	100	125	80	100
0.022	160	200	155	195	120	150	95	120
0.025	185	235	175	200	145	185	110	140
0.028	215	270	205	260	175	220	135	170
0.032	260	325	235	295	210	265	165	210
0.036	305	385	275	345	255	320	195	245
0.040	345	435	310	390	300	375	225	285
0.045	405	510	370	465	350	440	260	325
0.050	465	585	430	540	400	500	295	370
0.056	555	670	515	645	475	595	340	425
0.063	670	840	610	765	570	715	395	495
0.071	825	1,035	720	900	645	810	450	565
0.080	1,025	1,285	855	1,070	765	960	525	660
0.090	1,255	1,570	1,000	1,250	870	1,090	595	745
0.100	1,490	1,865	1,170	1,465	940	1,175	675	845
0.112	1,780	2,225	1,340	1,675	1,000	1,255	735	920
0.125	2,120	2,650	1,625	2,035	1,050	1,315	785	985
0.140	2,525	3,160	1,920	2,400	—	—	—	—
0.160	3,120	3,900	2,440	3,050	—	—	—	—
0.180	3,725	4,660	3,000	3,750	—	—	—	—
0.190	4,035	5,045	3,240	4,050	—	—	—	—
0.250	7,350	9,200	6,400	8,000	—	—	—	—

TABLE I(SI)*. Shear strength requirements for spot weld sheet specimens

GROUP 1 ALLOYS								
Nominal Thickness of Thinner Sheet millimeters	Ultimate Strength 386 MPa and above		Ultimate Strength 240 to 385.9 MPa		Ultimate Strength 135 to 239.9 MPa		Ultimate Strength below 135 MPa	
	N per spot		N per spot		N per spot		N per spot	
	min	min avg	min	min avg	min	min avg	min	min avg
0.25	265	335	225	290	---	---	---	---
0.30	335	425	290	380	135	175	90	110
0.40	490	625	445	555	310	400	225	290
0.45	555	710	510	645	380	490	290	380
0.50	625	780	600	755	445	555	355	445
0.55	710	890	690	865	535	655	425	535
0.65	825	1,045	780	890	645	825	490	625
0.70	955	1,200	910	1,155	780	980	600	755
0.80	1,155	1,445	1,045	1,310	935	1,180	735	935
0.90	1,355	1,710	1,225	1,535	1,135	1,425	865	1,090
1.00	1,535	1,935	1,380	1,735	1,335	1,670	1,000	1,270
1.10	1,800	2,270	1,645	2,070	2,555	2,955	1,155	1,445
1.30	2,070	2,600	1,910	2,400	1,780	2,225	1,310	1,645
1.40	2,470	2,980	2,290	2,870	2,110	2,645	1,510	1,890
1.60	2,980	3,635	2,715	3,400	2,535	3,180	1,755	2,200
1.80	3,570	4,605	3,200	4,005	2,780	3,600	2,000	2,515
2.00	4,560	5,715	3,805	4,760	3,400	4,270	2,335	2,935
2.30	5,580	6,985	4,450	5,560	3,870	4,850	2,645	3,315
2.50	6,630	8,295	5,205	6,515	4,180	5,225	3,000	3,660
2.80	7,915	9,895	5,960	7,450	4,450	5,580	3,270	4,090
3.20	9,430	11,785	7,228	9,050	4,670	5,850	3,490	4,380
3.60	11,230	14,055	8,540	10,675	---	---	---	---
4.10	13,880	17,345	10,585	13,565	---	---	---	---
4.60	16,570	20,730	13,345	16,680	---	---	---	---
4.80	17,950	22,440	14,410	18,015	---	---	---	---
6.40	32,695	40,920	28,465	35,585	---	---	---	---

*(SI) - International System of Unit.

TABLE II. Shear strength requirements for spot weld sheet specimens

GROUP 2 ALLOYS								
Nominal Thickness of Thinner Sheet	Ultimate Strength above 185,000 psi		Ultimate Strength 150,000 to 185,000 psi		Ultimate Strength 90,000 to 149,000 psi		Ultimate Strength below 90,000 psi	
	lb per spot		lb per spot		lb per spot		lb per spot	
	min	min avg	min	min avg	min	min avg	min	min avg
0.009	200	245	175	210	150	160	100	125
0.010	245	305	205	255	160	195	115	140
0.012	350	410	275	340	200	245	150	185
0.016	480	595	400	495	295	365	215	260
0.018	590	725	490	600	340	415	250	305
0.020	635	785	530	655	390	480	280	345
0.022	730	905	610	755	450	550	330	405
0.025	870	1,075	725	895	530	655	400	495
0.028	1,025	1,260	855	1,055	635	785	465	575
0.032	1,250	1,545	1,045	1,280	775	955	565	695
0.036	1,500	1,850	1,255	1,545	920	1,140	690	860
0.040	1,750	2,150	1,460	1,865	1,065	1,310	815	1,000
0.045	2,100	2,600	1,795	2,210	1,285	1,585	1,005	1,240
0.050	2,450	3,000	2,125	2,620	1,505	1,855	1,195	1,475
0.056	2,880	3,550	2,550	3,145	1,770	2,185	1,460	1,800
0.063	3,550	4,375	3,090	3,815	2,110	2,595	1,760	2,170
0.071	4,200	5,150	3,730	4,595	2,535	3,125	2,080	2,560
0.080	4,850	6,000	4,410	5,440	3,005	3,705	2,455	3,025
0.090	5,600	6,900	5,090	6,275	3,515	4,335	2,885	3,560
0.100	6,300	7,750	5,720	7,050	4,000	4,935	3,300	4,070
0.112	7,000	8,600	6,365	7,855	4,545	5,610	3,795	4,675
0.125	7,785	9,600	7,080	8,730	5,065	6,250	4,300	5,310

TABLE II(SI)*. Shear strength requirements for spot weld sheet specimens

GROUP 2 ALLOYS								
Nominal Thickness of Thinner Sheet millimeters	Ultimate Strength above 1275 MPa		Ultimate Strength 1034 to 1275 MPa		Ultimate Strength 620 to 1033.9 MPa		Ultimate Strength below 620 MPa	
	N per spot		N per spot		N per spot		N per spot	
	min	min avg	min	min avg	min	min avg	min	min avg
0.22	890	1,090	780	935	580	710	440	555
0.25	1,090	1,355	910	1,135	710	865	510	625
0.30	1,555	1,825	1,225	1,510	890	1,090	665	825
0.40	2,135	2,645	1,780	2,200	1,310	1,625	955	1,155
0.45	2,625	3,225	2,200	2,670	1,510	1,845	1,110	1,355
0.50	2,825	3,490	2,355	2,915	1,735	2,135	1,245	1,535
0.55	3,245	4,025	2,715	3,360	2,000	2,445	1,470	1,800
0.65	3,870	4,780	3,225	3,980	2,355	2,915	1,780	2,200
0.70	4,560	4,605	3,805	4,690	2,825	3,400	2,070	2,555
0.80	5,560	6,870	4,650	5,695	3,445	4,250	2,515	3,090
0.90	6,670	8,230	5,582	6,870	4,090	5,070	3,070	3,825
1.00	7,785	9,565	6,495	8,005	4,735	5,825	3,625	4,450
1.10	9,340	8,895	7,985	9,830	5,715	7,050	4,470	5,515
1.30	10,900	13,345	9,450	11,655	6,695	8,250	5,315	6,560
1.40	12,810	15,790	11,340	13,990	7,875	9,720	6,495	8,005
1.60	15,790	19,460	13,745	16,970	9,385	11,545	7,830	9,650
1.80	18,680	22,905	16,590	20,440	11,275	13,900	9,250	11,325
2.00	21,575	26,690	19,615	24,195	13,365	16,480	10,920	13,455
2.30	24,910	30,690	22,640	27,910	15,635	19,280	12,830	15,835
2.50	28,020	34,470	25,445	31,360	17,790	21,950	14,680	18,105
2.80	31,135	38,255	28,310	34,940	20,215	24,955	16,880	20,795
3.20	34,630	42,700	31,490	38,830	22,530	27,800	19,125	23,620

*(SI) - International System of Unit.

TABLE III. Shear strength requirements for spot weld sheet specimens

GROUP 3 ALLOYS				
Nominal Thickness of Thinner Sheet inch	Ultimate Strength above 100,000 psi lb per spot		Ultimate Strength 100,000 psi and below lb per spot	
	min avg		min avg	
	min	min avg	min	min avg
0.010	205	265	160	210
0.012	275	360	200	260
0.016	400	520	295	385
0.018	490	635	340	445
0.020	530	690	390	510
0.022	610	795	450	585
0.025	725	945	530	690
0.028	855	1,110	635	825
0.032	1,045	1,360	775	1,000
0.036	1,255	1,630	920	1,200
0.040	1,460	1,900	1,065	1,385
0.045	1,795	2,340	1,285	1,670
0.050	2,125	1,760	1,505	1,910
0.056	2,550	3,320	1,770	2,300
0.063	3,000	3,900	2,110	2,730
0.071	3,380	4,400	2,395	3,115
0.080	3,810	4,960	2,700	3,510
0.090	4,290	5,570	3,040	3,955
0.100	4,760	6,170	3,380	4,395
0.112	5,320	6,800	3,785	4,925
0.125	5,950	7,700	4,220	5,490

TABLE III(SI)*. Shear strength requirement for spot weld sheet specimens

GROUP 3 ALLOYS				
Nominal Thickness of Thinner Sheet millimeters	Ultimate Strength above 689.5 MPa N per spot		Ultimate Strength 689.5 MPa and below N per spot	
	min avg		min avg	
	min	min avg	min	min avg
0.25	910	1,180	710	935
0.30	1,225	1,600	890	1,155
0.40	1,780	2,310	1,310	1,710
0.45	2,180	2,825	1,510	1,980
0.50	2,355	3,070	1,735	2,270
0.55	2,715	3,535	2,000	2,600
0.65	3,225	4,205	2,355	3,070
0.70	3,805	4,940	3,380	3,670
0.80	4,515	6,050	3,445	4,450
0.90	5,580	7,250	4,090	5,340
1.00	6,495	8,450	4,735	6,160
1.10	7,985	10,410	5,715	7,430
1.30	9,450	12,275	6,695	8,495
1.40	11,340	14,765	7,875	10,230
1.60	13,345	17,345	9,385	12,145
1.80	15,035	19,570	10,625	13,855
2.00	16,945	22,060	12,010	15,610
2.30	19,080	24,775	13,520	17,590
2.50	21,170	27,445	15,035	19,550
2.80	23,665	30,245	16,835	21,905
3.20	26,465	34,250	18,770	24,420

*(SI) - International System of Unit

TABLE IV. Shear strength requirements for spot welds in foil

Thickness of Outer Sheet inch	Defined Standard (Spots per Inch) No	Group 1 Alloys		Group 2 & 3 Alloys			
		Ultimate Strength		Ultimate Strength			
		Above 56 ksi	Up to 56 ksi	Above 185 ksi	150 to 185 ksi	90 to 149 ksi	Up to 90 ksi
		Minimum Shear Strength, Pounds Per Inch, So					
0.001	40	30	20	90	80	65	45
0.002	20	60	40	180	160	130	90
0.003	12	100	65	300	260	205	150
0.004	10	135	90	405	350	285	190
0.005	9	165	115	490	425	340	235
0.006	7	185	125	540	475	380	275
0.007	6	210	140	630	550	440	320
0.008	5	235	160	690	610	490	355

TABLE IV(SI). Shear strength requirements for spot welds in foil

Thickness of Outer Sheet milli- meters	Defined Standard (Spots per 25mm) No	Group 1 Alloys		Group 2 & 3 Alloys			
		Ultimate Strength		Ultimate Strength			
		386 MPa and over	Up to 386 MPa	Above 1275 MPa	1034 to 1275 MPa	620 to 1033.9 MPa	Below 620
		Minimum Shear Strength, N/mm, So					
0.03	40	5.25	3.50	15.8	14.0	11.3	7.88
0.05	20	10.5	7.00	31.5	28.0	22.8	15.8
0.08	12	17.5	11.3	52.5	45.5	35.9	26.3
0.10	10	23.6	15.8	70.9	61.3	49.9	33.3
0.12	9	28.9	20.1	85.8	74.4	59.5	41.1
0.16	7	32.4	21.9	94.6	83.2	66.5	48.2
0.18	6	36.8	24.5	110.3	96.3	77.0	56.0
0.20	5	41.1	28.0	120.8	106.8	85.8	62.2

NOTES: 1. When the number of spots in a production part (N_p) or representative specimen is less than $0.85N_0$, the minimum shear strength shall be equal to:

$$\frac{N_p}{N_0} \times (1.15) S_0$$

2. When the number of spots in a production part (N_p) or representative specimen is more than $1.15N_0$, the minimum shear strength shall be equal to:

$$\frac{N_p}{N_0} \times (0.90) S_0$$

- 3.1.3.1 The Design Allowable Certification method is intended to routinely permit the design and use of smaller welds where the design stress permits and space or equipment or material conditions compel; or to permit the design and use of stronger welds where they are wanted and the weld conditions are able to provide them. For a given joint a guaranteed strength value and weld class must be specified on the drawing.
- 3.1.3.2 The provisions of the Design Allowable Certification method may be used to certify a weld schedule when unusual conditions apply. For example, when welds are made through adhesives or through protective finishes or when it is desirable to use diffusion welds as integral reinforcements to nuggets or in lieu of nuggets.
- 3.1.4 When conditions are encountered which cause any of the requirements of this specification to be inapplicable, the contractor shall submit alternate procedures and requirements for approval by the procuring activity. The request for approval shall include a description of the conditions which render the requirements inapplicable, such as reduced flange widths and space limitations; and shall include data to indicate that the alternate procedures and requirements are adequate for the given application.
- 3.1.4.1 Granted approvals of alternate procedures shall remain in effect as complying with this specification until the contractor is notified otherwise by the procuring activity.

3.2 Materials and methods of preparation:

3.2.1 Material combinations:

3.2.1.1 Combinations not requiring specific approval: The metals listed below may be welded in any combination within each lettered grouping.

- a. Aluminum and its alloys
- b. Magnesium and its alloys
- c. Titanium and its alloys
- d. Plain carbon steels of less than 0.15 percent carbon
- e. Austenitic steels; precipitation hardening steels; nickel and cobalt base alloys.

3.2.1.2 Combinations requiring approval: Use of the following metals requires specific approval of the procuring activity: Clad 7075 aluminum alloy in thicknesses less than 0.020 inch or 0.51 millimeter (mm); any aluminum alloy in the 2000 or 7000 series which is unclad; or any magnesium alloy which will be exposed to accelerating corrosion conditions like a marine environment.

3.2.1.3 Special requirements: Metal combinations not included in 3.2.1.1 shall require the following establishment of weld ductility. The average tensile (normal to spot plane) strength of twenty spot welded specimens shall be greater than 0.25 times the minimum average shear strength in Tables I through IV applicable to the subject alloy or as established for the Design Allowable Certification. This test may be conducted on specimens, as welded, or after subsequent heat treatment. Heat treatment is a later manufacturing operation and not the post weld current provided through welder electrodes. The production process shall specify the certified weld schedule plus the subsequent heat treatment used to demonstrate the weld ductility required herein.

3.2.2 Surface conditions: The surface of the parts to be welded shall be free from objectionable films such as heavy oxides, scale, ink, grease, dirt, or other substances or surface conditions detrimental to the welding process.

3.2.2.1 Group I materials:

3.2.2.1.1 Oxide coatings may be removed by mechanical treatment (such as sanding or wire brushing) or by chemical treatment.

3.2.2.1.2 The ability of a cleaning procedure to effectively prepare Group I materials for welding shall be demonstrated by ability of materials cleaned by the process to be welded in compliance with the Certification requirements of this specification. The cleaning procedure is a necessary component of the Certification weld schedule.

3.2.2.1.3 Conformity of test and production materials surfaces to those produced by the normal cleaning procedure shall be checked by surface resistance readings. Maximum values for test and production materials shall be established as indications of the conformity required for welding in compliance with this specification.

- 3.2.2.1.4 The minimum and maximum time span that is permitted between parts cleaning and parts welding shall be established by the contractor. The contractor shall demonstrate that no deterioration of surface conditions take place during typical holding or storage conditions during that span. Deterioration shall be excessive when high values lead to inability to meet Certification requirements. Conditions and limitations may be applied generally as to a standard process, or specifically as to an exceptional assembly or material combination where warranted.
- 3.2.2.1.5 When a cleaning procedure is changed, if the contractor can demonstrate that the new procedure produces the same results as the old procedure, recertification of weld schedules shall not be required. This conformity will be shown by (1) producing the same weld results as made during Qualification tests (with Certification quantities) with a weld heat change within ± 10 percent of the established value and (2) showing a surface resistance average that is no more than 1.05 times that achieved by the replaced procedure.
- 3.2.2.1.6 Coatings which improve the corrosion resistance or sealing characteristics without affecting the weld properties may be applied prior to welding. Such finishes must be considered as final steps of the cleaning procedure and necessary conditions specified on the Certified weld schedule.
- 3.2.3 Joint thickness: Joint thicknesses are only limited to those thicknesses or combination of thicknesses on which Certification weld schedule can be established and production parts can be made to meet the production requirements of this specification.
- 3.2.4 Fitup: Mating parts assembled for welding shall be designed and processed to fit so that before the first and each successive weld is made the surfaces to be joined by the weld are in contact with each other or can be made to contact each other with manual pressure.
- 3.3 Equipment requirements:
- 3.3.1 Welding machines: The welding machine shall consist of a suitable source of electrical energy, means of adequately cooling the electrodes, and a means of reliably controlling and indicating the relative magnitude of the current, the welding force, and the time of current flow; to fulfill the requirements specified herein. The force and current controls shall operate so that no current can flow until the welding force is applied by the welding electrodes. It shall not be possible to reduce electrode force before current is terminated.
- 3.3.2 Electrodes: Suitable electrode material and shapes shall be used to perform welding in conformance with this specification.
- 3.3.3 Shear testing machines: The contractor shall provide spot weld shear testing machines as required. All shear testing machines shall be accurate within ± 2 percent of the indicated reading. Portable spot weld shear test machines shall be checked for accuracy at intervals not to exceed 2 months.

- 3.3.4 Surface resistance indicators: The contractor shall provide one or more surface resistance indicators for checking the effectiveness of cleaning solutions and procedures engaged in preparing Group I metals for spot welding. Surface resistance indicators shall be checked for accuracy and recalibrated as necessary.
- 3.3.5 Jigs and fixtures: All tooling that is required to locate welds or assist in the assembly of welded parts that passes through the magnetic field during the molding operation, shall be made of nonmagnetic materials insofar as possible. Jigs and fixtures must be so designed that no welding current can shunt through them instead of passing through the work pieces.
- 3.3.6 Maintenance of equipment: Unless otherwise specified, each item of equipment shall be inspected periodically as recommended by the manufacturer. Adequate preventative maintenance shall be furnished. Defective equipment parts affecting machine operation shall be replaced before production welding is resumed.
- 3.4 Qualification of welding machines:
- 3.4.1 Qualification approval: Qualification is performed on a distinctive resistance spot or seam welding machine to determine the ability and consistency of operation of a machine type at a facility. Qualification has as a purpose to identify and verify the range of welding that a facility may, for contractual purposes, be considered capable. To have his equipment qualified and approved for use the contractor shall perform the tests specified herein under the surveillance of the procuring activity. Weld conditions shall be documented on a Machine Qualification Test Report. Typical examples of report forms are given in AWS C1.1. Such forms may be modified or expanded as required. Weld conditions and test results shall be submitted with an application for approval to the procuring activity. After approval is indicated, these reports shall be posted near the machine so as to be available to contractor operators and inspectors, and agents of the procuring activity.
- 3.4.1.1 Qualification by one procuring activity of the Department of Defense shall be Qualification for all DOD procuring activities and for those other governmental agencies who elect to subscribe to this specification.
- 3.4.2 Machine qualification scope: Machines shall be qualified to meet the weld requirements for the highest classification in a metal group for which it is intended to be used in production. A machine qualified to weld to the requirements of one weld classification in a group shall be automatically considered qualified for lower weld classifications. When one machine of a distinctive type in a plant site passes the Qualification tests all other machines of the same type shall be considered qualified. Machines used for Class C foil welding are qualified just by establishing a weld schedule Certification. Machines qualified to a class for seam welding shall be considered qualified for roll spot welding to the same class.

- 3.4.2.1 Types of equipment: Distinctive types of equipment must include those differing in any of the following respects:
- a. Manufacturer of machine
 - b. Manufacturer of control panel
 - c. Type of machine, or model number
 - d. Electrical rating or capacity
 - e. Type of electrical energy
 - f. Type of pressure application.
- 3.4.2.2 Test conduct: No maintenance work and no control adjustments are permitted during the welding of a set of test specimens.
- 3.4.2.3 Test materials: The test materials for a Group I Qualification shall be any aluminum alloy commonly used in resistance welded products. For Groups 2 and 3 qualification test material shall be any steel commonly used in resistance welded products.
- 3.4.2.4 Combination selection: For each group of alloys, two test sets shall be required. One at the highest, one at the lowest end of the range for which the Qualification is desired. This normally means that the thickest to thickest metal combination on one end and the thinnest to thinnest on the other end.
- 3.4.2.4.1 Except that when a Qualification is achieved on one combination of foil thicknesses, the equipment shall be considered qualified for all thicker foils welded to foils.
- 3.4.2.5 Test specimen requirements: Weld test and examination requirements are shown in Table V.
- 3.4.2.6 Weld machine requalification: When the equipment has once been qualified, it need not be requalified for other contracts or production lots. A change of location within a plant, not involving a change in power source, or maintenance, or parts replacement does not necessitate requalification. Requalification shall be required if the machine is rebuilt or if significant operational changes are made in it. Existing machine Qualifications made under superseded revision of this specification shall be honored.
- 3.5 Weld schedule certification:
- 3.5.1 Certification: Tests shall be conducted to determine if a particular machine, in combination with a specific weld schedule and other specific conditions, will produce on a given set of materials resistance welds that conform to the requirements of specification. Documentation of these tests will be contained in a completed Certification Test Report that will be available to agents of the procuring activity. In addition, the weld schedule shall be posted near the machine and be available to machine operators, inspectors, and agents of the procuring activity.