



NATIONAL AEROSPACE STANDARD

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FED. SUPPLY CLASS

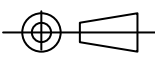
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AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.
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REVISION DATE:

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FORM 09-01

THIRD ANGLE PROJECTION		CUSTODIAN ENGINEERING MANAGEMENT COMMITTEE	REVISION 4
PROCUREMENT SPECIFICATION NONE	TITLE RESISTANCE SPOT WELDING EQUIPMENT 3 PHASE	CLASSIFICATION SPECIFICATION NAS967	SHEET 1 OF 24



1.0 SCOPE

1.1 Purpose

This specification provides a standard for the manufacture, performance, reliability, inspection, and procurement of a series of standard resistance spot welding machines. This standard lists minimum requirements and is not to limit design advances.

1.2 Classification

The machines shall be of the following type, sizes, and classes.

1.2.1 Type

Press

1.2.2 Size

0
1
2
3
4

1.2.3 Class

Standard

1.3 Intended Use

The machines described by this specification are intended for use within the aerospace industry for efficiently producing optimum quality spot welds on ferrous and non-ferrous alloys.

LIST OF CURRENT SHEETS

NO.	REV.	NO.	REV.	NO.	REV.	NO.	REV.
1	3	7	1	13	1	19	2
2	3	8	1	14	2	20	1
3	1	9	1	15	2	21	2
4	1	10	1	16	1	22	1
5	1	11	1	17	1	23	NEW
6	1	12	1	18	2		

CUSTODIAN: MANUFACTURING COMMITTEE

PROCUREMENT
SPECIFICATION

NONE

TITLE

RESISTANCE SPOT WELDING EQUIPMENT
3 PHASE

CLASSIFICATION
SPECIFICATION

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2.0 APPLICABLE SPECIFICATIONS, CODES, AND STANDARDS

The latest revision of the following specifications, codes, and standards are included as a portion of this specification. Detail requirements of this specification shall override any contradictory portions of the following specifications, codes, and standards.

- 2.1 American Welding Society (AWS) Standards.
- 2.2 Resistance Welding Manufacturer's Association (RWMA) Standards. (3.2)
- 2.3 Electronic Industries Association (EIA) Standards for Electronic Wiring and Components. (3.3.2)
- 2.4 The Joint Industrial Council (JIC) Hydraulic and Pneumatic Standards for Industrial Equipment. (3.6)
- 2.5 National Electrical Manufacturer's Association (NEMA) Standards. (3.5)
- 2.6 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section VIII. (3.10)
- 2.7 Military Specification MIL-W-6858 Welding Resistance: Aluminum, Magnesium, Non-Hardening Steels or Alloys, Nickel Alloys, Heat Resisting Alloys, and Titanium; Spot and Seam. (3.2) (4.3.3.1)
- 2.8 National Aerospace Standard (NAS) 938, Machine Axis and Motion Nomenclature. (3.3.2.5)
- 2.9 National Aerospace Standard 953, Numerical Control Systems (Reference Only). (3.3.2.5)
- ③ 2.10 National Aerospace Standard 955, Interchangeable Perforated Tape Standards Variable Block Format for Numerically Controlled Equipment. (3.3.2.5)
- 2.11 National Electrical Code (NEC). (3.5)
- 2.12 Occupational Safety and Health Standards, Part 1910 of Chapter XVII of Title 29 of the Code of Federal Regulations. Reference: Occupational Safety and Health Act (OSHA) - 1970. (3.8)
- 2.13 State and Local Safety and Electrical Codes. (3.5) (3.8)

3.0 REQUIREMENTS

3.1 Design

The manufacturer has the choice of configuration and the functional operation of the machine, except where specifically stated in this specification.

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3.1.1 All parts shall be constructed such that longevity and easy maintenance are assured. The frame and base of the machine shall be rigid box construction, sufficiently braced to maintain original alignment. Access to the interior shall be provided to permit making adjustments and repairs to the equipment.

3.1.2 The machine shall be furnished complete with all air, water, electrical controls suitable for operation from a 90 psig air supply, 30 to 40 psig water supply and 460 volts (+ 10%) 3-phase, 60-hertz electrical supply.

3.2 Type, Size, Class

TABLE I

	<u>Machine Size</u>					
	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	
<u>Throat depth</u> (customer option)	36", 48" or 60" all sizes					
<u>Electrode Force Range - lbs.</u> (Obtainable at 80 PSI Facility Pressure)	175- 1500	400- 3000	562- 4500	812- 6500	1130- 9100	
<u>KVA Rating</u> (50% Duty Cycle)	(Proposal to be made by Mfg.)					
<u>Welding Range</u> (Single Sheet Thickness) (1)	Min.	.012	.016	.020	.030	.040
Al (clad) & Mg (bare) alloys w/weldability comparable to 2024-T3.	Max.	.025	.064	.081	.102	.125
Stainless steel alloys w/weldability comparable to Type 321 or 347 and Ti alloys w/weldability similar to Ti-6AL-4V Ti.	Min.	.001	.005	.010	.020	.040
	Max.	.040	.075	.109	.170	.210
Low carbon steel alloys w/weldability comparable to SAE 1010, alloy steels w/weldability comparable to SAE 4130.	Min.	.006	.010	.016	.030	.040
	Max.	.062	.090	.140	.187	.250
Ni & Co base alloys w/weldability comparable to Rene 41, H.S. 25, and Hastelloy X.	Min.	.006	.006	.008	.010	.020
	Max.	.016	.032	.040	.064	.100
Duty Cycle (2)	4½% All Machines					

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	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
<u>Lower Arm</u>					
Vertical adjustment by lifting device	11"	11"	11"	11"	11"
Circular horn diameter	2"	3"	3 $\frac{1}{2}$ "	5"	6"
Electrode holder diameter (3)	1"	1 $\frac{1}{2}$ "	1 $\frac{1}{2}$ "	2"	2"
<u>Upper Arm and Head Assembly</u>					
Working stroke	Maximum natural stroke of diaphragm (not less than $\frac{1}{2}$ ")				
Total retraction	4"	4"	4"	5"	5"
<u>Weld to Forge Ratio (lbs) (4)</u>					
500/1500	12		Max. time rise		
1000/3000		12	in milliseconds.		
1500/4500			20		
2166/6500				20	
3330/9100					30

NOTES

- (1) In two sheet equal thickness combinations of the alloys and thicknesses listed and unequal sheet combinations within the thickness ratio limitations of the latest revision of MIL-6858.
- (2) As defined in RWMA standard, Bulletin No. 16, "Resistance Welding Equipment Standards."
- (3) Customer option to specify electrode holder length and taper.
- (4) At a 3:1 weld-to-forge ratio, time of rise from weld force to 75% of maximum forge force of machine.

3.3

Machine Sub-Assemblies

3.3.1

Force System

The force system shall be capable of applying constant and variable forces and shall, at the option of the customer, be a low inertia pneumatic frictionless diaphragm(s) system or an electro magnetic system. The pneumatic system, when specified, shall be capable of providing and maintaining consistent and resettable forces within plus or minus 1% of the set force, over the entire force range, at all electrode spacings within the working stroke with a supply pressure of $\pm 20\%$ of the nominal in-plant air pressure specified by the customer.

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- 3.3.1.1 The force system shall be capable of producing the following force applications - Constant Low, Constant High, and Variable Force.
- 3.3.1.2 The variable force sequence shall consist of squeeze, weld force and forge force. The squeeze force may equal the forge force.
- 3.3.1.3 The ratio between weld and forge forces shall be continuously adjustable within the limits of the machine.
- 3.3.1.4 The pneumatic force system shall include all necessary regulators, valves, solenoids, and gauges of the precision type joined to the system by connectors to provide for quick and easy replacement. The main air intake line shall be fitted with a suitable air strainer, filter and oil lubricator.
- 3.3.1.5 Air pressure supplied to the diaphragm heads shall be regulated by precision air-loaded, self-stabilizing by aspirator action pressure regulators which shall be mounted on the right-hand side of the upper arm of the machine. The regulators and dial gauges shall be convenient to the operator and at the proper parallax.
- 3.3.1.6 All dial air pressure gauges shall have a $4\frac{1}{2}$ " minimum face diameter and be calibrated directly in pounds of electrode force with a supplementary and corresponding dial reading of PSI from 0 to 100 in increments of two PSI over 270 degrees of rotation. The gauges shall be internally shock dampened, accuracy shall be plus or minus $\frac{1}{2}\%$ of full scale reading.
- 3.3.1.7 Some means shall be employed to prevent electrode hammering and to provide shockless operation of the welding stroke (i.e., flow valve).
- 3.3.1.8 A "Contact Gauge Switch", provided in series with the contact gauge or deflection firing micro-switch, shall be provided to prevent the welding current from being initiated until pressures within 2% of the preset electrode welding and/or forging pressures have been applied. No switch shall be wired to by-pass the protective device.

3.3.2 Machine Controls

The machine shall be equipped with an electronic control system which shall have synchronous precision timing as required for timing functions. Relays may be used for initiation of mechanical functions, other than force, and for switching functions on or off, but once the squeeze time is initiated, the control shall be fully electronic and no relays shall operate. Relays shall be plug-in type wherever practical.

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3.3.2.1

The following welding functions shall be synchronous preset counting type over the entire range of adjustment. The control dials shall be graduated in cycles of line frequency based on 60 hertz: (Minimum time other than those tabulated customer option).

<u>Function</u>	<u>Increment of Adjustment</u>	<u>Range (minimum)</u>
Pre-compression Time	1 cycle	1-9 cycles
Squeeze Time	1 cycle	1-99 cycles
Pre-heat Heat Time*	1 cycle	1-9 cycles
Pre-heat Cool Time*	1 cycle	1-9 cycles
Weld Heat Time*	1 cycle	1-9 cycles
Weld Cool Time*	1 cycle	1-9 cycles
Current Decay Time	1 cycle	1-9 cycles
Quench Time	1 cycle	1-99 cycles
Temper Heat Time*	1 cycle	1-9 cycles
Temper Cool Time*	1 cycle	1-9 cycles
Forge Delay Time	0.1 cycle	0.1-999 cycles
Hold Time	1 cycle	1-99 cycles
Off Time	1 cycle	1-99 cycles

*Optional

Each function shall be uniform in amplitude and time duration. The manufacturer shall specify in bidding documents the tolerances guaranteed with the machine being purchased.

3.3.2.2

The following functions shall count impulses (alternate Heat-Cool functions) over the entire range of adjustment:

<u>Function</u>	<u>Increment of Adjustment</u>	<u>Min. Count Range</u>
Pre-heat Impulses	1 impulse	1-99
Weld Impulses	1 impulse	1-99
Temper Impulses	1 impulse	1-99

3.3.2.3

The forge delay selector shall be capable of initiating the forge delay timing at any of three events:

- (1) Start of weld interval
- (2) End of weld interval
- (3) Start of temper interval

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- 3.3.2.4 An emergency mushroom-type button shall be provided within close reach of the operator for instantly terminating the weld sequence.
- 3.3.2.5 At the option of the customer the machine shall be equipped with an AIA Class III numerical control system for controlling all machine and positioning functions.
- 3.3.2.6 Power Control
- A three-phase welding power system using ignitrons, silicon-controlled rectifiers, or equivalent shall be provided. Each cycle or pulse of secondary welding current shall be uniform in amplitude and time duration as adjusted and the welding current shall be completely reproducible over short and long periods of time and be unaffected by temperature changes or aging of power rectifiers and associated power control components.
- 3.3.2.6.1 Means shall be provided to adjust the firing angles of the individual ignitrons or SCR's.
- 3.3.2.6.2 A linear welding current phase shift control adjustable from 10% to 100% of maximum secondary welding current shall be provided for each individual function as applicable including pre-heat, weld, post heat and temper. The control may consist of a tap switch coarse control in increments of 10% and a linear fine control continuously variable to provide vernier adjustments between any two taps on the coarse control.
- 3.3.2.6.3 An automatic voltage compensator (AVC) control shall be provided to correct the secondary welding current within plus or minus 2% for line voltage variations of plus or minus 10%. Full compensation shall be accomplished within six milliseconds. Correction shall be applicable to all current functions and effective from minimum to maximum phase shift. (Customer Option.)
- 3.3.2.6.4 An automatic voltage differential indicator and cutout unit shall be provided. The welding current and control shall lock out (become inoperative) when the input line voltage varies above or below a predetermined adjustable set of limits with a low sensitivity capability of plus or minus 2%. Indicator lights shall indicate the over or under condition and a reset button shall be the only means of resetting the machine for resumption of operation. (Customer option.)
- 3.3.2.6.5 An automatic pressure differential cutout system and indicating lights shall be provided. The welding current and control shall lock out when the line air pressure varies below a predetermined adjustable limit within 1%. An indicator light shall indicate that a pressure variation exists and a reset button shall be the only means of resetting the machine for resumption of operation. (Customer option.)

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