

MIL-D-4725C
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MILITARY SPECIFICATION

DIMPLING MACHINES, HOT AND COLD PROCESS, PORTABLE

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers portable dimpling machines complete with tooling, accessories, and the controls necessary for automatic regulation of temperature, pressure, and dwell time for dimpling aircraft structural alloys.

1.2 Classification. Dimpling machines furnished under this specification shall be of the following types. The type to be furnished shall be as specified (see 6.2.1).

- Type I - Squeeze type with control unit
- Type II - Impact type with control unit
- Type III - Blind pull type with control unit

2. APPLICABLE DOCUMENTS

2.1 Government Documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards and handbooks of the issue listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation, form a part of this specification to the extent specified herein.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Industrial Plant Equipment Center, Memphis, TN 38114, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

SPECIFICATIONS

MILITARY

MIL-M-18058 - Machinery, Metal and Woodworking, Packaging of

STANDARDS

FEDERAL

FED-STD-H28 - Screw Thread Standards for Federal Services

MILITARY

MS - 20426 Rivet, Solid, Countersunk 100 Degrees Precision Head,
Aluminum and Aluminum Alloy

MS - 24694 Screw, Machine, Flat, Countersunk Head, 100 Degrees
Structural, Cross Recessed, UNC - 3A and UNF - 3A

(Copies of standards and drawings, required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

* 2.1.2 Other Government documents, drawings and publications. The following other Government documents, drawings, and publications from a part of this specification to the extent specified herein.

U. S. DEPARTMENT OF LABOR

OSHA 2206 - General Industry, OSHA Safety and Health Standards
(29 CFR 1910)

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, DC 20402.)

(Copies of specifications, standards, handbooks, drawings, and publications required by the manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.

* 2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. The issue of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM D3951 - Commercial Packaging, Standard Practice for

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ICS - Industrial Controls and Systems

(Application for copies should be addressed to the National Electrical Manufacturers Association, 2101 L Street, NW, Washington, DC 20037.)

JOINT INDUSTRIAL COUNCIL

JIC -P - 1 - Pneumatic Standards for Industrial Equipment and
General Purpose Tools

(Applications for copies should be addressed to the Joint Industrial Council, 7901 Westpark Drive, McLean, VA 22101.)

AMERICAN NATIONAL STANDARDS INSTITUTE

ANSI - IEEE-268 - Metric Practice (ASTM-E-380)

(Application for copies should be addressed to the American National Institute, ATTN: Sales Dept., 1430 Broadway, New York, NY 10018.)

2.3 Order of precedence. In the event of conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 First article. When specified, (see 6.2.1) a sample shall be subjected to first article inspection (see 4.2 and 6.3).

3.2 Design. The machine shall be new and one of the manufacturer's current models, capable of forming dimples in accordance with the requirements herein. The machine shall include all features necessary to meet the performance requirements specified herein. All parts subject to wear, breakage, or distortion shall be accessible for adjustment, repair and replacement.

* 3.2.1 Materials. All materials used in fabricating the machine shall be compatible with, and non-reactive to, titanium and titanium alloys (see 6.5).

* 3.2.2 Reclaimed materials. The machine may contain reclaimed materials provided such materials will not jeopardize the machine's intended use and performance. The reclaimed materials shall have been reprocessed, remanufactured or recycled in a manner which will restore them to the same chemical composition and physical properties as the materials originally selected from use on the machine.

* 3.2.3 Safety and health requirements. Covers, guards, or other safety devices shall be provided for all parts of the machine that present safety hazards. The safety devices shall prevent unintentional contact with the guarded part, and shall be removable to facilitate inspection, maintenance and repair of the parts. All machine parts, components, mechanisms, and assemblies furnished on the machine, whether or not specifically required herein, shall comply with all requirements of OSHA 2206 that are applicable to the machine itself. Additional safety and health requirements shall be as specified (see 6.2.1 and 6.4).

3.2.4 Lubrication. Means shall be provided to insure adequate lubrication for all moving parts. All oil holes, grease fittings and filler caps shall be accessible.

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3.3 Construction. The machine shall be constructed of parts which are new, without defects and free of repairs. The structure shall be capable of withstanding all forces encountered during operation of the machine to its maximum rating and capacity without permanent distortion.

3.3.1 Castings and forgings. All castings and forgings shall be free of scale and mismatching. No process such as welding, peening, plugging, or filling with solder or paste shall be used for reclaiming any defective parts.

3.3.2 Welding, brazing, or soldering. Welding, brazing, or soldering shall be employed only where specified in the original design. None of these operations shall be employed as a repair measure for any defective parts.

3.3.3 Fastening devices. All screws, pins, bolts and other fasteners shall be installed in a manner that prevents change of tightness. Those subject to removal or adjustment shall not be swaged, peened, staked or otherwise permanently installed.

3.3.4 Surfaces. All surfaces shall be cleaned and free of sand, dirt, fins, sprues, flash, scale, flux and other harmful or extraneous materials. All edges shall be either rounded or beveled unless sharpness is required to perform a necessary function. Except as otherwise specified herein, the condition and finish of all surfaces shall be in accordance with the manufacturer's commercial practice.

3.3.5 Painting. Unless otherwise specified (see 6.2.1), painting shall be in accordance with the manufacturer's commercial practice.

3.3.6 Threads. All threaded parts used on the machine and its related attachments and accessories shall conform to FED-STD-H28 and the application "Detailed Standard" Section referenced therein.

3.3.7 Plates. All words on instruction and indicating plates shall be in the English language. Characters shall be engraved, etched, embossed or stamped in bold face on a contrasting background and the plate shall be securely affixed to the machine.

* 3.3.8 Measurement systems. Unless otherwise specified, either the U.S. Customary System of Units (US) or the International System of Units (SI) system of measurement is acceptable. The particular system required shall be as specified (see 6.2.1). In this specification, all measurements, dimensions, sizes and capacities are given in the U. S. Customary System of Units (US). These measurements may be converted to the International System of Units (SI) through the use of the conversion factors and methods specified in ANSI-IEEE-268.

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3.4 Components. Dimpling machines covered by this specification shall consist essentially of the gun described in 3.4.1, 3.4.2, and 3.4.3 as applicable and components in 3.4.4 through 3.4.11. Any additional components necessary to enable the machine to comply with all the requirements herein shall be furnished to the manufacturer's standard design and specification.

3.4.1 Squeeze type gun. Type I machines shall include a portable squeeze dimpler with a throat depth not less than 1.2 or 4 inches as specified (see 6.2.1). The dimpling gun shall be capable of hot or cold dimpling. The gun shall be equipped with a individual die heater for both male female dies. The gun shall be complete with all switches, connectors, components, gap adjustments, and accessories necessary to form dimples for all the fastener types and sizes and in the material types and thicknesses shown in Table I, when used with a control unit meeting the requirements of 3.4.4.

3.4.2 Impact type gun. Type II machines shall include a portable impact dimpling gun, hand held dolly, or buck bar with provision for holding self-aligning die shanks. The gun shall be capable of dimpling. The gun shall be equipped with a die heater for the male die only. The gun shall be complete with all switches, connectors, components, adjustments, and accessories necessary to form dimples for all the fastener types and size and in the material types and thicknesses shown in Table II, when used with a control unit meeting the requirements of 3.4.4.

3.4.3 Blind pull type gun. Type III machines shall include a portable blind pull type gun capable of hot or cold dimpling. The gun shall be equipped with a die heater for the male die only. The gun shall be complete with all switches, connectors, components, adjustments, and accessories necessary to form dimples for all the fastener types and sizes and in the material types and thicknesses shown in Table II, when used with a control unit meeting the requirements of 3.4.4.

3.4.4. Control unit. Each machine shall include a portable control unit. The control unit shall include all switches, indicators, regulators, timers, and other components necessary to preset, indicate, regulate, and automatically control dimple die temperatures, pre-pressure, dwell time, heating sequence, and final forming pressure for the dimpling machine. The control unit shall have a die heater control system meeting the following requirements. Means shall be provided for cold dimpling or with one die heater or both die heaters in operation. Each die heater shall have an individual temperature control device that allows the die temperature to be manually preselected and automatically controlled for two preset temperatures over a range of 250°F, or more. The devices shall maintain the preselected die temperatures to an accuracy of +25°F throughout the stated temperature range, under all operating conditions. The system shall have devices that provide a visual indication of whether or not each die heater is at its preselected temperature. The devices may be either signal lights or thermocouple-pyrometer devices that continually provide a visual indication of the actual temperature of the dies.

To prevent the formation of damage or incorrectly formed dimple due to low material temperature, the system shall have a manually adjustable control that will stop the dimple cycle if the die temperature fall below the preselected value. The control unit shall have an adjustable, automatic reset type dwell timer that regulates the time period of the heating cycle in the pre-pressure stage of the dimpling process. The control unit shall allow preselection of the time period of the event in 1/4 second increments over the range of 0 to 15, or more, seconds. A pressure regulator and control device to permit operator control of the dimpling pressure shall be provided.

3.4.5 Die holders. The dimpling machines shall have die holders that allow the dies to be easily changed and shall hold the dies in alignment during the dimpling process. The holders shall accommodate all dies required for forming dimples for all the fastener types and sizes shown in Table I, II or III, as applicable. The holders shall have all necessary adjustments for adjusting the dies for all metal thicknesses as shown in Table I, II or III. If special aligning tools are required for adjusting die alignment, the aligning tools shall be furnished with each machine.

3.4.6 Die heaters. Type I dimpling machines shall be equipped with die heaters for independently heating the male and female dies. The heating elements shall surround or contact both dies and maintain them at a preset temperature as selected on the control unit. Types II and III dimpling machines shall be equipped with a die heater for heating the male die only. All die heaters shall operate on 115 volt, single phase, 60 Hz and have sufficient wattage to meet all the requirements specified herein. The die heaters shall be capable of heat adjustments of 250 degrees F, or less, to 800 degrees F, or more. All dies heaters shall be removable for repair or replacement. If special tools are required for installation and removal of die heaters, the special tools shall be furnished with each machine.

3.4.7 Die sets. Unless otherwise specified (see 6.2.1), each machine shall be furnished with one set of punches and dies for each fastener type and size shown in Table I or II, as applicable to type of dimple machine procured. All die sets shall be made of carbide or machined from a wear resistant alloy steel that is heat treated to impart the necessary hardness and toughness. The die sets shall be suitable for both hot and cold dimpling.

3.4.8 Equipment cart. A rugged storage and transporting cart shall be furnished with each dimpling machine. The cart shall be designed for orderly storage and transporting of dimpling gun, control unit, cables, hoses, dies, and all other equipment and accessories necessary for operation of the dimpling machine. The cart shall be fabricated of material having adequate strength to support and transport all equipment without damage to the equipment or the cart itself, when subjected to the rough usage normally encountered in fabrication and maintenance shops. The cart shall be designed so that only one person is required for transporting the fully equipped cart. The cart shall be capable of meeting the test requirements as specified in 4.5.5.

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3.4.9 Hoses and power cables. Each machine shall have not less than 12 feet of air hose and power cable for interconnecting the dimpling gun and control unit. In addition, each machine shall have no less than 20 feet of air hose and power cable for supplying input air and electrical power to the control unit. The casings of all hoses and cables shall be oil resistant and shall also be designed to withstand rough handling without damage to hoses or enclosed power cables.

3.4.10 Pneumatic system. The pneumatic system shall operate on an air supply pressure of 90 to 120 psi. The system shall include all devices such as pressure regulators, pressure reducers, solenoid valves, and check valves that are necessary to enable the machine to meet all requirements specified herein.

3.4.11 Electrical system. Unless otherwise specified (see 6.2.1), all electrical equipment shall conform to the requirements of NEMA ICS. The machine shall operate from a 115 volt, single phase, 60 hz power source. The machine's electrical system shall include all devices that are necessary to enable the machine to draw all of its electrical power from a single set of input leads fed through a safety disconnect switch.

3.5 Sizes and capacities. Type I machines shall be capable of forming dimples for fastener types and sizes, and in the metal thickness ranges as shown in Table I. Types II and III machines shall be capable for forming dimples for fastener types and sizes and in the metal thickness ranges as shown in Table II. When specified fastener types and sizes listed in Table III shall be furnished as specified (see 6.2.1).

TABLE I. Sizes and capacities.

Fastener Types and Sizes	TYPE I - PORTABLE SQUEEZE TYPE													
	METAL THICKNESS RANGE, INCH											Alloy: Ti-8Mn		
	Aluminum Alloys	Magnesium Alloys		Corros. Resist. Steel		Titanium		Titanium		Alloy: Ti-8Mn				
		Min.	Max.	Min.	Max.	Annealed	1/2 Hard	Comm. Pure	Comm. Pure	Min.	Max.			
MS-20426 Rivet 3/32 1/8 5/32 3/16 1/4	.020	.064	.020	.051	.020	.050	.020	.050	.016	.050	.016	.050	.020	.050
	.020	.072	.020	.064	.020	.063	.020	.050	.016	.063	.016	.063	.020	.050
	.025	.072	.025	.072	.025	.063	.025	.036	.020	.063	.020	.063	.020	.036
	.025	.072	.025	.081	.025	.050	.025	.032	.025	.050	.025	.050	.025	.032
	.032	.072	.032	.091	.032	.043	.032	.043	.032	.040	.032	.040	.032	.040
MS-24694 Screw #8 #10 1/4	.020	.072	.025	.081	.016	.050	.016	.036	.016	.050	.016	.050	.016	.035
	.020	.072	.025	.072	.025	.050	.020	.025	.020	.032	.020	.032	.020	.025
	.032	.072	.032	.081	.025	.064	.025	.064	.020	.050	.020	.050	.025	.043
Hi-Shear Rivet 3/16 1/4 5/16	.020	.064	.025	.072	.020	.050	.020	.032	.020	.050	.020	.050	.020	.032
	.032	.072	.025	.072	.025	.050	.025	.043	.025	.051	.025	.051	.025	.043
	.025	.072	.025	.064	.025	.064	.025	.064	.025	.064	.025	.064	.025	.064
#8 Drill Lok Screws #10 Drill Lok Screws #6 Rivnuts #8 Rivnuts #10 Rivnuts #2 Rivnuts #5 Airlock	.025	.040	.020	.040	.020	.040	.020	.040	.020	.040	.020	.040	.020	.040
	.020	.051	.020	.051	.020	.051	.020	.051	.020	.051	.020	.051	.020	.051
	.032	.040	.020	.040	.020	.040	.020	.040	.020	.040	.020	.040	.020	.040
	.025	.051	.020	.051	.020	.051	.020	.051	.020	.051	.020	.051	.020	.051
	.025	.064	.025	.064	.025	.064	.025	.064	.025	.064	.025	.064	.025	.064
FA-3 1/2 Dzus	.025	.051	.020	.051	.020	.051	.020	.051	.020	.051	.020	.051	.020	.051
	.025	.051	.020	.051	.020	.051	.020	.051	.020	.051	.020	.051	.020	.051
	.016	.040	.020	.040	.020	.040	.020	.040	.020	.040	.020	.040	.020	.040

NOTE: The required metal thickness range is from the smaller number shown, or thinner, to the larger number shown, or thicker.

TABLE II. Sizes and capacities.

Fastener Types and Sizes	TYPE II - PORTABLE IMPACT TYPE TYPE III - PORTABLE BLIND FULL TYPE METAL THICKNESS RANGE, INCH									
	Aluminum Alloys		Magnesium Alloys			Titanium Com Pure		Alloy: Ti 8Mn Max.		
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
MS-20426 Rivet 3/32 1/8 5/32 3/16 1/4	.020	.051	.015	.051	.040	.032	.032	.032	.040	.032
	.020	.064	.020	.064	.040	.032	.032	.040	.032	.032
	.025	.072	.025	.072	.051	.032	.032	.051	.032	.032
	.025	.091	.025	.091	.051	.032	.032	.051	.040	.032
	.032	.091	.032	.102	.051	.032	.032	.051	.040	.032
MS-24694 Screw #8 #10 1/4	.025	.064	.025	.064	.032	.032	.032	.032	.032	.032
	.032	.081	.032	.081	.032	.032	.032	.032	.032	.032
	.032	.091	.032	.091	.032	.032	.032	.032	.032	.032
	.040	.081	.040	.102	.032	.032	.032	.032	.032	.040
HI-Shear Rivet 3/16 1/4 5/16	.020	.091	.020	.091	.032	.032	.032	.032	.032	.032
	.025	.091	.025	.102	.032	.032	.032	.032	.032	.032
	.032	.091	.032	.091	.032	.032	.032	.032	.032	.040
Owl Fastener #2 Airlock #5 Airlock #7 Airlock	.025	.091	.025	.091	.032	.032	.032	.032	.032	.032
	.032	.091	.032	.091	.032	.032	.032	.032	.032	.032
	.032	.081	.032	.091	.032	.032	.032	.032	.032	.032

NOTE: The required metal thickness range is from the smaller number shown, or thinner, to larger number shown, or thicker.

TABLE III. Sizes and capacities.

Fastener Types and Sizes	TYPE I, II and III - PORTABLE SQUEEZE TYPE METAL THICKNESS RANGE, INCH											
	Aluminum Alloys		Magnesium Alloys		Corros. Resist. Steel		Titanium		Alloy: Ti-8Mn			
	Annealed		1/2 Hard		Comm. Pure							
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
#7 Airlock	.025	.064	.025	.064	.025	.064	.025	.064	.025	.064	.025	.064
Camloc	.020	.040	.020	.040	.020	.040	.020	.040	.020	.040	.020	.040
FA-5 Dzus Stud	.025	.051	.020	.051	.020	.051	.020	.051	.020	.051	.020	.051
FA-6 1/2 Dzus Stud	.032	.064	.025	.064	.025	.064	.025	.064	.025	.064	.025	.064
FA-5 Dzus Spring	.020	.051	.020	.051	.020	.051	.020	.051	.020	.051	.020	.051
FA-6 1/2 Dzus Spring	.025	.064	.025	.064	.025	.064	.025	.064	.025	.064	.025	.064

NOTE: The required metal thickness range is from the smaller number shown, or thinner, to the number shown, or thicker.

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3.6 Performance. The machines covered herein shall be capable of forming dimples of the types and sizes and in materials within the thickness ranges shown in Tables herein, as applicable to the type being furnished. Tool face temperature shall rise from an ambient room temperature to the required temperature for operation in not more than ten minutes. The machine shall maintain temperatures during continuous or intermittent operation without slowdown or stoppage to regain temperature. Continuous operation shall be governed by the speed at which the operator can position the equipment. The workpiece stretch, distortion, contour, geometry, and visual defects shall conform to 3.6.1 through 3.6.3.

3.6.1 Workpiece stretch and distortion. When tested in accordance with 4.5, the stretch of the workpiece shall not exceed 0.020 inch. The distortion of the workpiece, as measured by its concavity or convexity, shall not exceed 0.015 inch.

3.6.2 Contour and geometry. The formed dimple shall have the proper contour and geometry to allow the applicable type of fastener to seat in the dimple, with the conical surface of the head properly contacting the dimpling and the top surface flush within plus or minus 0.005 inch of the surrounding metal.

3.6.3 Visual defects. When examined with a 30 power magnifier, there shall be no evidence of cracks or any other visual defects on the dimple.

3.7 Standard equipment. Unless otherwise specified (see 6.2.1), the following equipment shall be furnished with each machine:

One set of hand tools and die alignment fixtures normally furnished by the manufacturer with his commercial machines.

3.8 Fungus control. When required (see 6.2.1), fungus proofing shall be as specified.

3.9 Lubrication chart or plate. Unless otherwise specified (see 6.2.1), a lubrication chart or plate shall be permanently and securely attached to each machine. If a chart is furnished, it shall be placed in a transparent plastic folder, or permanently sealed between clear plastic sheets, with suitable means for mounting. The following information shall be furnished on the chart or plate:

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Points of lubrication application
 Service interval
 Type of lubricant
 Viscosity
 Military or Federal Specification Number covering required
 lubricants

If there are no points on the machine requiring lubrication, the chart or plate shall be inscribed "No lubrication necessary" in lieu of the above required information.

3.10 Nameplate. A corrosion-resistant metal nameplate shall be securely attached to each machine. The nameplate shall contain the information listed below. If the machine is a special model, the model designation shall include the model of the basic standard machine and a suffix identified to the manufacturer's permanent records.

Nomenclature
 Manufacturer's name
 Manufacturer's model designation
 Manufacturer's serial number
 Power input (volts, amps, phase, frequency)
 Contract or Order number
 National Stock Number or Plant Equipment Code
 Date of manufacture
 U S

3.11 Technical data. Technical data shall be furnished as specified (see 6.2.2).

* 3.12 Workmanship. Workmanship of the machine and accessories shall be of a quality equal to that of the manufacturer's commercial equipment of the type specified herein.

4. QUALITY ASSURANCE

4.1 Responsibility of inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of the inspection requirements specified herein. Except as otherwise specified in the contract or order, the contractor may use his own or any other facilities suitable for the performance of the inspections set forth in the specification when such action is deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 First article inspection. When first article approval is required under 3.1, first article inspection shall be performed. Unless otherwise specified (see 6.2.1), first article inspection shall comprise the examination in 4.4 and the tests in 4.5.1 thru 4.5.2.4 for the dimpling

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machine, and shall consist of tests and examination as specified in 4.5.4 thru 4.5.4.3 for the cart assembly. Failure of the dimpling machine or the cart to pass any examination or test shall be cause for rejection.

4.3 Quality conformance inspection. Each dimpling machine shall be subjected to quality conformance inspection prior to being offered for acceptance. Unless otherwise specified (see 6.2.1), quality conformance inspection shall consist of the examinations in 4.4, tests in 4.5.1 and 4.5.2 and the inspection in 4.6. Failure of the item to pass any examination, test or inspection shall be cause for rejection.

4.4 Examination. The machine and equipment shall be examined to determine compliance with the requirements in 3.2 through 3.5 and 3.7 through 3.14.

4.5 Tests.

4.5.1 Operational tests. The machine shall be operated, without forming dimples, for not less than 30 minutes. Proper operation of all indicators, controls, adjusting mechanisms and accessories shall be verified during the trial period.

4.5.2 Performance tests. A flat piece of 3" x 12" alloy 7075-T6 aluminum sheet, of 0.051 inch nominal thickness, shall be used for the workpiece. A straight line shall be scribed along one long side of the piece 3/8" from the edge. The scribed line shall be centerpunched for fourteen dimples uniformly spaced and symmetrical to the 3" axis. Pilot holes of the proper diameter for forming dimples for #10 x 32 screws conforming to MS-24694 shall be drilled. The proper dies for forming dimples for #10 x 32 screws shall be installed and properly aligned. All machine controls shall be adjusted in accordance with instructions in the manufacturer's operation manual. Prior to forming the dimples, the length of the test piece, along the scribed centerline, shall be measured and recorded for comparison with the same dimension after the test. The method of making these measurements shall be at the option of the manufacturer provided that the measurement is to an accuracy of ± 0.001 inch. The following tests shall be performed:

4.5.2.1 Stretch test. A dimple shall be formed for a #10 x 32 screw in each of the fourteen holes in the workpiece. After all dimples have been formed, the length of the workpiece shall be measured along the scribed centerline. This measurement shall be compared to the same measurement taken before the test. The stretch of the workpiece shall not exceed 0.020 inch.

4.5.2.2 Distortion. The test piece produced during the stretch test shall be measured for convexity or concavity. The convexity or concavity of the sample, measured across the 12" span, shall not exceed 0.015 inch.

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4.5.2.3 Contour and geometry. All of the dimples shall be inspected for contour and geometry in accordance with accepted industry practice. All dimples shall meet accepted industry standards for contour and geometry.

4.5.2.4 Cracks and other visual defects. All of the dimples shall be examined under a 30 power magnifier for evidence of cracks, fractures, or other visual defects. There shall be no visible evidence of these defects in any of the dimples.

4.5.3 Optional performance tests. When specified (see 6.2.1), the following additional tests shall be performed. A dimple shall be formed for the smallest and largest size for each type of fastener and for both minimum and maximum thicknesses of each of the materials as specified in Tables I, II, and III. Each formed dimple shall conform to the requirements of 3.6.2. The dimpled test pieces shall be tested in accordance with 4.5.2.4 and 4.5.2.5.

4.5.4 Cart tests and examination. By using simulated weights of the dimpling machine and its accessories loaded onto the cart, testing and examination of the cart shall be accomplished as follows:

4.5.4.1 Tip-over test. From an upright standing position, the cart shall be tipped over so that it will fall onto its side. This test shall be done not less than three falls onto each side.

4.5.4.2 Cart examination. After conclusion of the drop and tip-over tests, the simulated weights shall be removed and the cart assembly shall be visually examined. Any evidence of failure or deformation shall be cause for rejection.

4.6 Packaging inspection. Packaging shall be inspected to determine compliance with the requirements of Section 5.

5. PACKAGING

* 5.1 Preservation, packing and marking. Unless otherwise specified (see 6.2.1) preservation, packing and marking shall be in accordance with ASTM D-3951. When required, level "A" packing and level "A" or "B" packing and marking shall be in accordance with the applicable requirements of MIL-M-18058. The required levels and special marking, if required, shall be as specified (see 6.2.1).

6. NOTES

6.1 Intended use. Dimpling machines are intended to be used primarily for dimpling aircraft grades of aluminum and magnesium, and are also capable of dimpling the more readily formed grades of stainless steels, titanium, and titanium alloy.

6.2 Ordering data.

6.2.1 Procurement requirements. Purchasers should specify their requirements in procurement documents, including whether each choice is required or not required, by entering an appropriate statement identified to each of the following:

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- a. Title, number, and date of this specification.
- b. Type of machine required (see 1.2).
- c. First article approval, if required (see 3.1).
- d. Exceptions and additional safety and health requirements (see 3.2.3 and 6.4).
- e. Painting, if different (see 3.3.5).
- f. Measurement systems, if different (see 3.3.8).
- g. Throat depth of squeeze type gun (see 3.4.1).
- h. Quantity of die sets, if different (see 3.4.7)
- i. Fasteners, if required, specify types sizes and quantity required (see 3.5).
- j. Electrical system, if different (see 3.4.11).
- k. Standard equipment, if different (see 3.7).
- l. Measurement systems, if different (see 3.3.8).
- m. Type fungus proofing, if required (see 3.8).
- n. Lubrication chart, if different (see 3.9).
- o. Nameplate, if different (see 3.10).
- p. First article inspection, if different (see 4.2).
- q. Quality conformance inspection, if different (see 4.3).
- r. Optional performance test, if required (see 4.5.3).
- s. Level of preservation, packing and special marking if different (see 5.1).
- t. Optional equipment required; fully described (see 3.5).

6.2.2 Contract data requirements. Required technical data, such as operator manuals, parts lists, wiring diagrams, and other instruction for operation and maintenance as identified on numbered DD Form 1664 should be specified on DD Form 1423 incorporated into the contract.

6.3 First article. When a first article inspection is required, the end item will be tested and should be either a first article sample or a standard production sample from the contractors current inventory. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examination and test approval of the document first article.

* **6.4 Safety and health requirements.** Paragraph 3.2.4 requires compliance only with those OSHA requirements that concern the machine itself. It does not require compliance with those OSHA requirements that concern "the machine in its operating environment" such as noise levels, radiation levels, electromagnetic emissions, noxious vapors, air contaminants, heat, etc. Since OSHA limits the total hazard level of these hazards in the environment (and does not limit the hazard level of individual machines in the environment) the requesting activity is advised to analyze the existing hazard levels in the proposed operating environment, and specify additional machine requirements that will integrate the new machine into its future operating environment. If specific point-of-operation guarding is required, the requesting activity should specify exact configuration of the guard required, as in most cases, the guard configuration is dependent on the size and configuration of the workpieces. The above, and any other additional safety and health requirements should be specified in detail under 6.2.1(d).

* 6.5 Cadmium plated tools. Cadmium may adversely affect the strength of titanium. For example, cadmium plated tools may deposit sufficient amounts of cadmium to cause an interaction of the metals and to seriously weaken the titanium part. Therefore, do not use cadmium plated tools in any area of the aircraft that contains titanium.

6.6 Revision asterisks. The margins of this specification are marked with asterisks to indicate where changes (additions, modification, corrections, and deletions) from the previous issue were made. This was done as a convenience only, and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodian:
Navy - SH

Preparing Activity:
DLA - IP

Review Activities:
Navy - AS, OS, MC
Air Force - 84
DLA - GS

Project Number:
3448-0006

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION <i>(Mark one)</i>
b. ADDRESS <i>(Street, City, State, ZIP Code)</i>	<input type="checkbox"/> VENDOR <input type="checkbox"/> USER <input type="checkbox"/> MANUFACTURER <input type="checkbox"/> OTHER <i>(Specify):</i> _____
5. PROBLEM AREAS	
a. Paragraph Number and Wording:	
b. Recommended Wording:	
c. Reason/Rationale for Recommendation:	
6. REMARKS	
7a. NAME OF SUBMITTER <i>(Last, First, MI) – Optional</i>	b. WORK TELEPHONE NUMBER <i>(Include Area Code) – Optional</i>
c. MAILING ADDRESS <i>(Street, City, State, ZIP Code) – Optional</i>	8. DATE OF SUBMISSION <i>(YYMMDD)</i>