

MIL-C-22909B

4 December 1972

Superseding

MIL-C-22909A (ASG)

14 February 1964

MILITARY SPECIFICATION

**CRIMPING TOOL, TERMINAL AND CONNECTOR CONTACT,
HYDRAULIC OPERATED**

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

1. SCOPE

1.1 This specification covers design requirements and performance requirements for procurement of a hydraulic crimping tool and associated accessories for the crimping of aircraft and missile wire terminals, and crimp type electric connector contacts.

1.2 Classification. Hydraulic crimping tools covered by this specification shall be capable of crimping wire barrels specified in the applicable Military Standard (MS). The resultant crimped joint shall meet the requirements of this specification.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

SPECIFICATIONS

Federal

J-C-580

**Cord, Flexible, and Wire, Fixture (Electrical,
0 to 600 Volt Service)**

FSC - 51GP

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W-C-596	Connector, Plug, Electrical; Connector, Receptacle, Electrical, Plate, Wall Electrical
QQ-C-320	Chromium Plating (Electrodeposited)
QQ-N-290	Nickel Plating (Electrodeposited)

Military

MIL-D-1000	Drawings, Engineering and Associated Lists
MIL-C-5541	Chemical Films and Chemical Film Material for Aluminum and Aluminum Alloys
MIL-H-5606	Hydraulic Fluid, Petroleum Base; Aircraft, Missile and Ordnance
MIL-S-6872	Soldering Process, General Specification for
MIL-P-6906	Plates, Identification, Aircraft
MIL-T-7928	Terminals, Lug: Splices, Conductor: Crimp Style, Copper, General Specification for
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys

STANDARDS**Military**

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-130	Identification Marking of US Military Property
MIL-STD-143	Standards and Specifications, Order of Precedence for the Selection of
MIL-STD-202	Test Methods for Electronic and Electrical Component Parts
MIL-STD-794	Parts and Equipment, Procedures for Packaging and Packing of

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MIL-STD-889 Dissimilar Metals

(For applicable MS standards see Supplement 1).

FederalFed. Test Method Rubber: Sampling and Testing
Std. No. 601

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the Contracting Officer).

3. REQUIREMENTS

3.1 Precedence. Detail requirements shall be as specified herein or in the applicable MS. In the event of any conflict between the requirements of this specification and the MS, the MS shall govern.

* 3.2 First article. The tools furnished under this specification shall be a product which has been tested and has passed the first article tests specified herein.

3.3 Data. Unless otherwise specified in the contract or order, no data are required by this specification or any of the documents referenced in section 2 herein (see 6.2).

3.4 Materials. Materials shall conform to applicable specifications and shall be as specified herein. Materials for which there are no applicable specifications or which are not specifically described herein, shall be of the best quality, of the lightest practicable weight, and suitable for the purpose intended.

3.4.1 Metals. Metals shall be corrosion resistant or shall be suitably protected, as specified herein, to resist corrosion due to salt spray or atmospheric conditions to which the hydraulic crimping tool and accessories may be subjected when in storage or during normal service life.

* 3.4.1.1 Dissimilar metals. Unless suitably protected against electrolytic corrosion, dissimilar metals as defined in MIL-STD-889 shall not

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be used in intimate contact with each other.

3.5 Design and construction.

3.5.1 Hydraulic crimping tool. The hydraulic crimping tool shall consist of a 12-ton hydraulic head, an electric or manual hydraulic pump, the necessary hydraulic hose assembly, and an integrated control switch to be used with electric hydraulic pump. It shall be constructed to withstand the normal strains, jars, vibrations, and such other conditions as are incident to shipping, storage, installation, and service.

3.5.1.1 Hydraulic head. The hydraulic head shall be as specified in MS25441 consisting of a swivel yoke, which is capable of rotating 180 degrees relative to the handle, a 12-ton hydraulic ram, a hydraulic coupler, and a dust cap. The head shall have a working pressure of $9,700 \pm 200$ pounds per square inch (psi), and have provision for inserting and removing the specified dies. The ram shall have a minimum ram stroke of $21/32$ inch.

3.5.1.1.1 The hydraulic head handle shall be provided with a suitable means for attaching the head to a work bench vise for operation.

3.5.1.1.2 The weight of the hydraulic head shall not exceed 9 pounds.

3.5.1.2 Electric hydraulic pump. The electric hydraulic pump shall operate on an input power of 110 volts, 60 Hertz, single phase current. It shall utilize MIL-H-5606 hydraulic fluid, and incorporate an automatic pressure safety release valve calibrated to release at $9,700 \pm 200$ psi. An automatic control shall also be incorporated into the pump to automatically release pressure and retract dies when dies are in fully closed position. This control shall have provisions so that resetting may be achieved externally (see paragraph 3.5.1.5). The control shall also allow for stopping of the crimping operation without resetting or retracting dies. The power input switch shall be as close to the power input cord as practical.

3.5.1.3 Manual hydraulic pump. The manual hydraulic pump shall have provisions for foot operation. The foot pump shall produce a working pressure of $9,700 \pm 200$ psi. The pump shall incorporate a hydraulic fitting capable of mating with the hydraulic coupler of the hose, and shall give audible recognition of the release of working pressure, or automatically release pressure on the dies (see MS25441).

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3.5.1.4 Hydraulic hose assembly. The hydraulic hose assembly shall be used between the electric hydraulic pump or the manual hydraulic pump and the hydraulic head. It shall be constructed of hydraulic hose conforming to the requirements listed in table I, and have the necessary hydraulic couplings on each end to mate with each section or with the head or pump (see MS25441).

TABLE I

Physical Requirements of Hydraulic Hose

Proof test	Requirement
Pressure, psi (min)	15,000
Bend radius in. (min)	5

3.5.1.5 Control switch. The control switch shall be incorporated into the control handle. It shall have two recessed control buttons and shall operate on 12V, 60 Hertz, single phase current. One button shall actuate the pump and the other button shall be for releasing the hydraulic pressure and resetting the control circuit.

3.5.1.5.1 Switch relays. The control switch shall operate relays incorporated into an automatic control housing. The relays shall be capable of operation on 12V, 60 Hertz, single phase current (see MS25441).

3.5.1.6 Control housing. The control housing shall have the general configuration as specified in MS25441 and shall house all electrical controls and pump mechanism. It shall be mounted on a dolly as specified in MS25441 and have provisions for storing all necessary dies.

3.5.1.6.1 Power input and control cords. The power input and control cords to the control housing shall be in accordance with J-C-580 Type SJO. The power input cord shall have a minimum length of 25 feet. The control cord shall consist of six 11-foot lengths.

3.5.1.6.2 Plugs and receptacles.

3.5.1.6.2.1 Power input cords. The power input cord shall utilize a grounded polarized plug, style L22 of W-C-596.

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3.5.1.6.2.2 Control input receptacle. The control input receptacle shall be in accordance with style M2 of W-C-596.

3.5.1.6.2.3 Control cord. Each 11-foot length of control cord shall be provided with a male plug conforming to style M24 of W-C-596 and a female plug conforming to style M42 of W-C-596.

3.5.1.6.3 Hydraulic pressure gage. The hydraulic pressure gage shall have a full scale reading of 20,000 psi. The working pressure area of 9,500 to 9,900 psi on the gage shall be green. The gage shall be located as shown on MS25441.

3.5.2 Accessories.

3.5.2.1 Crimping dies. The crimping dies shall be as specified on the applicable MS standard (see 1.2). The dies shall be easily inserted and removed from the hydraulic head without the use of special tools.

3.5.2.2 Check gages. GO and NO-GO gages as specified on the applicable MS standard (see 1.2) shall be used to check each set of dies.

3.5.3 Maintenance. The design of the hydraulic crimping tool shall be such as to accommodate to the greatest possible extent, disassembly, reassembly, and service maintenance by those tools and items of maintenance equipment which are normally available as standard commercial items.

3.6 Performance test.

3.6.1 Crimping operation. The hydraulic crimping tool shall satisfactorily reshape the applicable terminals with the dies specified. After the reshaping operation, the terminals shall satisfactorily meet the performance characteristics of the terminal procurement specification.

3.6.1.1 Time. The time to complete the crimping operation with the electric hydraulic pump shall not exceed 10 seconds with a maximum length of 10 feet of hydraulic hose. The crimping operation with the manual hydraulic pump shall not exceed 2 minutes with a maximum length of 10 feet of hydraulic hose.

3.6.1.2 Maximum satisfactory crimp. A satisfactory crimp shall be obtained when a maximum of 60 feet (six 10-foot lengths) of hydraulic hose assembly is used between the electric hydraulic pump and hydraulic head.

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3.6.1.3 Maximum number of crimping operations. The crimping tool shall satisfactorily reshape aluminum terminal sizes 8 through 00 to the corresponding wire size with one crimp and terminal sizes 000 and 0000 with two crimps. Copper terminal sizes 8 through 0000 shall be installed to the corresponding wire size with one crimp.

3.6.2 Life cycle test. The hydraulic crimping tool shall pass the life cycle test as specified in 4.6.7 without changing the pump packing or performing other necessary maintenance to the head or electrical system, and be capable of making the specified crimping operation.

3.7 Physical requirements.

3.7.1 Finish. Protective coatings and finishes which will crack, chip or scale during normal service life or due to extremes of atmospheric conditions shall not be used.

3.7.2 Aluminum alloy parts. Where practicable, aluminum alloy parts shall be covered with an anodic film conforming to MIL-A-8625. Aluminum alloys which do not anodize satisfactorily shall be coated with a chemical film in accordance with MIL-C-5541.

* 3.7.3 Iron and steel parts. Where practicable, iron and steel parts shall be chromium or nickel plated in accordance with QQ-C-320, and QQ-N-290, respectively.

3.7.4 Soldering. Soldering shall be performed in accordance with MIL-S-6872.

* 3.8 Interchangeability. All parts having the same manufacturer's part number shall be directly and completely interchangeable with each other with respect to installation and performance. Changes in manufacturer's part number shall be governed by the drawing number requirements of MIL-D-1000.

3.9 Identification of product. A nameplate conforming to MIL-P-6906 shall be securely attached to the crimping tool head, electric hydraulic pump and manual hydraulic pump, and shall be marked in accordance with MIL-STD-130.

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3.10 Workmanship. The hydraulic crimping tool and accessories shall be constructed and finished to produce a tool free from all defects which would affect proper functioning in service. Particular attention shall be given to neatness and thoroughness of soldering, assemblies, welding and brazing, painting, riveting, machine-screw assemblies, and freedom of parts from burrs and sharp edges.

4. QUALITY ASSURANCE PROVISIONS

* 4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Test equipment and inspection facilities. Test equipment and inspection facilities shall be of sufficient accuracy, quality, and quantity to permit performance of the required tests. The manufacturer or independent testing laboratory shall establish adequate calibration of test equipment to the satisfaction of the Government.

4.2 Classification of tests. The inspection and testing of the hydraulic crimping tool and accessories shall be classified:

(a) First article inspection (4.3)

(b) Quality conformance inspection (4.4)

* 4.3 First article inspection. First article inspection shall be made on hydraulic crimping tools representative of the production tools to be supplied under the contract. First article inspections shall be made using the test procedures of 4.6. The government inspector and the procuring activity shall be advised when the inspections are to be conducted so that a representative may be designated to witness or supervise the inspections when so desired. Contractors not having adequate facilities to conduct all required inspections shall obtain the services of a commercial testing laboratory acceptable to the procuring activity.

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- * 4.3.1 First article inspection data. The contractor shall submit all data collected in conducting these inspections to the procuring activity for review and approval.
- * 4.3.2 First article inspection samples. First article inspection samples shall consist of one complete hydraulic crimping tool with six lengths of hydraulic hose or a complete set of accessories (dies and gages) of each type representative of the production item.
- * 4.4 Quality conformance inspection. The contractor shall furnish all samples and shall be responsible for accomplishing all inspections. Quality conformance inspection shall be under the supervision of the government quality control representative. Quality conformance inspection shall consist of the following tests:
 - (a) Sampling plan A inspections (4.4.2)
 - (b) Sampling plan B inspections (4.4.3)
 - (c) Inspection of preparation for delivery (4.4.4)
- 4.4.1 Inspection lot. An inspection lot shall consist of all tools and accessories (dies and gages) manufactured under essentially the same conditions and submitted for acceptance at the same time. The lot size shall be expressed in terms of tools, dies and gages.
- 4.4.2 Sampling plan A.
 - 4.4.2.1 Sampling - tools, dies, and gages. Samples shall be selected in accordance with MIL-STD-105, inspection level III, AQL of 0.25 for major defects and inspection level I, AQL of 10 for minor defects. The inspections required and classification of defects shall be as specified in table II.

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TABLE II. CLASSIFICATION OF DEFECTS

Inspect for	Major	Minor
<u>Tools:</u>		
Snap fasteners for dies not operable, or missing.		X
Unsightly defects in finishing.		X
Electrical plugs and receptacles not operable, missing, or not as specified.		X
Pump not operating.	X	
Electrical system not operable.	X	
Dimension not within tolerance.	X	
Switch not operable.	X	
Hydraulic couplers missing or not as specified.	X	
Hydraulic coupler dust caps missing or not as specified.		X
Hydraulic hose not as specified.	X	
Foot operated pump not operable.	X	
Hydraulic pressure gage not operable.	X	
Safety release valve not operating	X	
Resetting of head not operable.	X	
Power input or control cord unsightly.		X
<u>Dies:</u>		
Not as specified on applicable MS.	X	
<u>Gages:</u>		
Not as specified on applicable MS.	X	

4.4.3 Sampling plan B. Tools and crimping dies shall be selected in accordance with MIL-STD-105, inspection level II, with an acceptance number of zero, and subjected to:

(a) Gaging (4.6.2)

(b) Tensile strength (of component) (4.6.4)

* 4.4.4 Inspection of preparation for delivery. Samples from a quantity of shipping containers fully prepared for delivery, just prior to closure, shall be selected at random from each lot in accordance with MIL-STD-105 at Inspection Level S-2. The lot size shall be the number of shipping containers in the lot. Each sample selected shall be examined for defects and to determine conformance to all the applicable requirements of Section 5 of this specification. If the number of defective shipping containers exceeds the Acceptable Quality Level of 4.0, the lot represented by the sample shall be rejected.

4.5 Inspection conditions. Unless otherwise specified, inspections required by this specification shall be made under combinations of conditions within the following ranges: temperature 20° to 30°C, relative humidity 30 to 80 percent, and a barometric pressure of 24 to 31 inches of mercury. The test area shall be free from drafts.

4.6 Inspection methods.

4.6.1 Examination of product. Each item shall be examined to determine conformance with the requirements of this specification not covered by first article tests. This shall include compliance with the applicable MS.

4.6.2 Gaging. The crimping dies shall be gaged with the gages shown on the applicable MS.

4.6.2.1 GO gaging. With crimping dies positioned properly in the hydraulic head, close the tool to fully closed position. Insert the GO gage pin in the crimping dies opening. The gage pin shall freely enter the crimping area.

4.6.2.2 NO-GO gaging. Close tool to fully closed position. The NO-GO gage pin shall not enter the crimping dies opening.

4.6.3 Voltage drop. The hydraulic crimping tool shall be fitted with a set of proper crimping dies and shall be used to crimp a minimum of 4 terminals to the proper size wire 12 inches in length. The specimens shall be subjected to and comply with the voltage drop test specified in the applicable terminal specification, followed by the tensile strength test (4.6.4).

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4.6.4 Tensile strength. The tensile strength values of the crimped component-wire assembly shall comply with the values specified in the applicable specification. The crimped samples shall be placed in a tensile testing device and sufficient force applied to pull the wire or cable out of the component or break the wire (cable) or component. The crimped barrel of the component shall not break or become distorted to the extent it is unfit for further use before the minimum tensile strength specified in the applicable specification is reached. The speed of head travel of the tensile testing device shall be $1 \pm 1/4$ inch per minute. The holding surface of the tensile testing device clamp may be serrated to provide sufficient gripping or holding strength.

4.6.5 Corrosion. One tool shall be subjected to a salt spray (corrosion) test in accordance with MIL-STD-202, Method 101, condition A. Immediately upon removal of the sample from the salt spray chamber, the exterior of the tool shall be wiped with a clean damp cloth. The tool shall then be dried for 12 hours in a circulating air oven at a temperature of $38^\circ \pm 3^\circ\text{C}$. Upon removal from the oven the crimping tool shall comply with 4.6.2, 4.6.3, and 4.6.4.

* 4.6.6 Low temperature crimp. The crimping tool, dies, 4 of each size terminals, and 2 each of 6-inch lengths of the proper size wire shall be maintained at a temperature of $-15^\circ \pm 2^\circ\text{C}$ for a period of 1 hour. At the end of this time period the terminals shall be crimped to their proper size wire with the applicable crimping dies while still at this temperature. The mechanical performance of the tool and the actual crimping operation shall be satisfactory during and after this test. The crimped samples shall then be subjected to the tensile strength test (4.6.4) and the dielectric withstanding voltage test (4.8.3) of MIL-T-7928 if the terminals used are Type II.

4.6.7 Life cycle. The electric hydraulic crimping tool shall be cycled at a rate of 1 cycle per minute through 1,000 actual pressure cycles. The manual hydraulic crimping tool shall be cycled at a rate of 1 cycle per 2 minutes through 100 actual pressure cycles. The cycles shall be conducted with crimping dies fitted in the hydraulic head. Each cycle shall consist of creating the $9,700 \pm 200$ psi working pressure at the pump and automatic release. Faulty pressure release, hydraulic oil leakage, control switch malfunction, or electrical system breakdown will be cause for rejection. At the conclusion of the specified number of cycles, using six 10-foot lengths of hydraulic hose, the pump shall be capable of satisfactorily crimping a size 4/0 terminal to the appropriate wire size.

4.6.8 Hydraulic hose physical requirements.

4.6.8.1 Proof pressure. This test shall be performed in accordance with Method 10211 of Fed. Test Method Std. No. 601.

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4.6.8.2 Bend radius. The hydraulic hose shall be capable of being bent around a 5-inch mandrel without exhibiting any failure to the hose.

5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging, packing, and marking. Crimping tools and associated accessories shall be preserved and packaged in accordance with level A or C of MIL-STD-794, as specified (see 6.2). They shall be packed in accordance with level A, B, or C, as specified (see 6.2), and marked in accordance with MIL-STD-794.

6. NOTES

6.1 Intended use. The hydraulic crimping tools and accessories are intended for use in the crimping of terminals and connector contacts to electrical wire.

6.1.1 The hydraulic crimping tool will accommodate the following crimping dies: MS25442 for aluminum aircraft terminals covered by MIL-T-7099, MS23002 and MS90485 for copper aircraft terminals covered by MIL-T-7928, and MS3150 for Type B contact wire barrels covered by MIL-C-22520.

6.1.2 Gages for the above dies are covered in MS25472, MS23003, MS90486 and MS3151.

* 6.2 Ordering data. Procurement documents should specify the following:

6.2.1 Procurement requirements.

- (a) Title, number, and date of this specification.
- (b) Item desired and MS part number if applicable (see 1.2).
- (c) Quantity of each item desired.
- (d) Level of packing and packaging desired (see 5.1).
- (e) Whether test reports and data are required (see 3.2 and 4.3.2).

6.2.2 Contract data requirements. Data conforming to Data Item Description DI-M-4022 or DI-M-6153 will usually be required for delivery in connection with this specification. When so required, such data will be specified for delivery on a DD Form 1423 included in the contract.

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6.3 Marginal indicia. The margins of this specification are marked to indicate where changes, deletions, or additions to the previous issue have been made. This is done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Figures are not so marked. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content as written irrespective of the marginal notations and relationship to the last previous issue.

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Navy - AS
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Preparing activity:

Navy - AS

Project No. 51GP-0005

Reviewer activity:

Navy - EC
Air Force - 69
Army - GL

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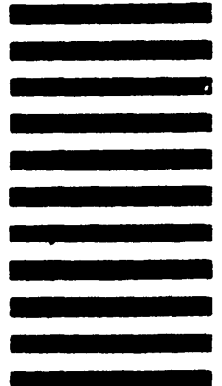
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