

MIL-C-22263B

28 June 1972

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Superseding

MIL-C-22263A (ASG)

27 July 1964

## MILITARY SPECIFICATION

COUPLINGS FUEL LINE, FLEXIBLE, 125 PSI,  
GENERAL SPECIFICATION FOR

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

## 1. SCOPE

1.1 Scope - This specification covers flexible couplings for joining tubing in aircraft fuel systems.

1.2 Classification - The couplings shall be of the following types and classes, as specified (see 6.2):

<u>Type</u>	<u>For connecting</u>
I	Two MS33660 type A rolled bead tube ends
II	Two swaged ferrules per MIL-C-22263/3
<u>Sizes</u>	Couplings shall be of the following nominal sizes: 0.75, 1.00, 1.25, 1.50, 1.75, 2.00, 2.50, 3.00, 3.50, 4.00, 5.00, 5.50, 6.00
<u>Class</u>	
A	All aluminum
B	Aluminum body end nut, CRES steel retainer
C	All steel (CRES)

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## 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

QQ-P-416	Plating, Cadmium (Electrodeposited)
TT-S-735	Standard Test Fluids, Hydrocarbon

Military

MIL-P-116	Preservation, Methods of
MIL-D-1000	Drawings, Engineering and associated data
MIL-S-6855	Synthetic Rubber Sheets, Strips, Molded or Extruded Shapes
MIL-S-7742	Screw Threads, Standard, Optimum Selected Series, General Specification for
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-S-8879	Screw Threads, Controlled Radius Root with Increased Minor Diameter, General Specification for
MIL-R-25988	Rubber, Silicone, Oil and Fuel Resistant

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## STANDARDS

Military

MIL-STD-130	Identification Marking of US Military Property
MIL-STD-143	Specifications and Standards, Order of Precedence for the Selection of
MIL-STD-794	Parts and Equipment, Aeronautical, Preparation for Delivery
MIL-STD-889	Metals, Definition of Dissimilar
MS20995	Wire, Safety or Lock
MS33540	Safety Wiring and Cotter Pinning, General Practices for
MS33660	Tubing End, Hose Connection, Standard Dimensions for
MS33784	Wrenching Features for Cylindrical Nut, Design Standard for

## SPECIFICATIONS SHEETS

MIL-C-22263/1	Coupling, Fluid Line, Flexible, Maximum Envelope and Weight
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## SPECIFICATION SHEETS (Continued)

MIL-C-22263/2	Coupling, Fluid Line, Swaged Ferrule Connecting, Max. Envelope and Weight
MIL-C-22263/3	Swaged End Ferrule, Variable Cavity

Air Force-Navy Aeronautical

AND10104	Tubing, Steel, Corrosion-Resistant, Round, Standard Dimensions for
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(When requesting applicable documents, refer to both title and number. Copies of unclassified documents may be obtained from the Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Penna., 19120. Requests for copies of classified documents should be addressed to the Naval Publications and Forms Center, via the cognizant Government representative.)

## 3. REQUIREMENTS

3.1 Specification Sheets - The individual item requirements shall be as specified herein and in accordance with the applicable specification sheets.

3.2 First article - The couplings furnished under this specification shall be products which have been inspected and have passed the first article inspection specified herein.

3.3 Selection of specifications and standards - Specifications and standards for all materials, parts, and Government certification and approval of processes and equipment, which are specifically designated herein and which are necessary for the execution of this specification, shall be selected in accordance with MIL-STD-143, except as provided in the following paragraph.

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3.4 Materials - Materials shall conform to applicable specifications and shall be as specified herein. Materials which are not covered by applicable specifications, or which are not specifically described herein shall be suitable for the purpose intended and of the lightest practicable weight.

3.4.1 Metals - Metals shall be of a corrosion-resisting type or shall be suitably treated to resist corrosion when exposed to climatic and environmental conditions encountered during the service life of the equipment. The use of any protective coating that will crack, chip, or scale with age or extremes of climatic and environmental conditions shall be avoided.

3.4.2 Aluminum alloy parts - Where practicable, all aluminum alloy parts shall be anodized in accordance with MIL-A-8625.

3.4.3 Steel parts - Non-corrosion-resistant steel parts shall not be used.

3.4.4 Fungus-proof materials - Materials which are not nutrients for fungi shall be used to the greatest extent practicable. In cases where materials that are nutrients for fungi must be used, such materials shall be treated with a fungicidal agent as approved by the procuring activity.

3.4.5 Dissimilar metals - Combinations of tubing and all coupling parts shall be compatible, in accordance with MIL-STD-889.

3.5 Design - The coupling shall be designed to connect lengths of standard tubing when used in aircraft powerplant fuel systems. Couplings shall meet the requirements of MIL-C-22263/1 and MIL-C-22263/2 for Types I and II respectively. The construction of the coupling shall be such as to withstand the strains, jars, vibrations and other conditions incident to aircraft installations and service usage.

3.5.1 Threads - Machine screw threads shall conform to MIL-S-8879 or MIL-S-7742. All external or internal threaded parts shall be securely locked in such a manner as to prevent loosening under test conditions specified herein and under normal service usage. Provisions for safety wiring shall be provided. Safety wires shall be installed in accordance with MS33540 and shall conform to MS20995.

Wrenching features shall conform to MS33784. Critical torquing is not required.

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3.5.2 Angular misalignment - The coupling shall be capable of being installed with a maximum tubing or ferrule installation misalignment of 3 degrees in any direction.

3.5.3 Flexure - The coupling shall provide for one degree flexure in any direction from any installed position. The connector shall provide for a variation in space between tubing or ferrules of 0.062 to 0.188 inch.

3.5.4 Permanent deformation - Installation of the coupling on tubing ends under conditions specified herein shall not produce a permanent deformation of the tubing or fitting.

3.5.5 Tubing - The couplings shall be capable of joining tubing in accordance with dimensions shown on AND 10104, for steel tubing, and in accordance with Table I for aluminum tubing.

TABLE I. ALUMINUM TUBE SIZE AND WALL THICKNESS

Tube O. D (inches)	Minimum Wall Thickness
3/4"	.035"
1"	.035"
1 1/4"	.035"
1 1/2"	.035"
2"	.035"
2 1/2"	.042"
3"	.042"
3 1/2"	.049"
4"	.049"
4 1/2"	.065"
5"	.065"
5 1/2"	.065"
6"	.065"

3.6 Seal - The seal used for testing purposes shall be in accordance with MIL-R-25988, of the applicable size specified on MIL-C-22263 /1. The seals shall be readily replaceable with no damage and a minimum of disturbance or displacement of the installed tubing or fitting. The seals shall not be subjected to end loads of tubing under pressure. (See 6.2)

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3.7 Performance - The coupling, when installed in any position (attitude), shall meet all the performance requirements specified in Section 4.

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 numbers shall be governed by the drawing number requirements of MIL-D-1000.

3.9 Identification of product - Equipment, assemblies and parts shall be marked for identification in accordance with MIL-STD-130 and shall have color identification in accordance with MIL-F-8615. In addition, special markings shall be added, as follows:

Specification Number \_\_\_\_\_  
 Size \_\_\_\_\_  
 Type \_\_\_\_\_  
 Class \_\_\_\_\_

3.10 Workmanship - The couplings shall be made in a thoroughly workmanlike manner. Particular attention shall be given to neatness and freedom from burrs and sharp edges. Where dimensions and tolerances may affect interchangeability, they shall be held or limited accordingly.

#### 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.

4.2 Classification of inspection - The inspection and testing of couplings shall be classified as:

- (a) First article inspection (4.3)
- (b) Quality conformance inspection (4.4)

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4.3 First article inspection - First article inspection shall consist of all the inspections of this specification.

4.3.1 Sampling for first article inspection - Two couplings of each size and type shall be subjected to the first article tests by the manufacturer. The tested couplings, together with a like quantity of untested samples, shall be submitted to the procuring activity for final approval. Two complete sets of detail and assembly drawings and a complete test report showing results of the manufacturer's test shall be submitted with the samples.

4.4 Quality conformance inspection - Quality conformance inspection shall consist of:

(a) Individual inspection (4.4.1)

(b) Sampling inspections (4.4.2)

4.4.1 Individual inspection - Each coupling shall be subjected to examination of product as specified in 4.6. Any coupling failing to pass the examination shall be rejected.

4.4.2 Sampling inspection - One coupling shall be selected from each lot of 500 couplings or fraction thereof and subjected to the proof pressure test (4.6.1.2). If the sample fails to pass this test, the lot represented by this sample shall be rejected.

4.5 Test conditions -

4.5.1 Pressure and temperatures - The pressures and temperatures specified in Table II shall apply to all tests required by this specification.

TABLE II. TEMPERATURES AND PRESSURES

Fluid	Temp. ( $^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ) fluid and ambient	Pressure ( $\pm 5$ psi)		
		operating	Proof	Burst
TT-S-735 Types I & III	-65 to + 200	125	250	375

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4.5.2 Test assembly - Seals in accordance with 3.6 shall be furnished by the contractor for test purposes. The coupling shall be installed on tubing. The ends shall be mounted so that they are restrained at the maximum angular misalignment specified and in such a manner that they are free to move axially to accomodate end loads due to internal pressure.

4.5.3 Vibration test setup - The test assembly shall be mounted to a vibration table with an angular displacement of 3 degrees between tube center lines. The distance between test assembly table supports, with the coupling located in the center of the assembly, shall be 20 inches for all sizes. The major axis of the test assembly shall be perpendicular to the direction of vibration and parallel to the vibration table.

The vibration shall be 55 cps with a double amplitude of 0.060 inches.

4.5.4 Test fluids - The test fluids shall be in accordance with TT-S-735, Types I and III.

4.5.5 Tubing wall thickness - The tubing used in testing the coupling shall have wall thicknesses of the minimum standard values specified in AND10104 and Table I.

4.6 Inspection methods -

4.6.1 Examination of product - The coupling shall be examined to determine conformance to this specification and MIL-C-22263/1 and MIL-C-22263/2 with respect to all the requirements not covered by tests specified herein.

4.6.1.1 Examination of preparation for delivery - The coupling shall be examined to ascertain that the preparation for delivery conforms to Section 5 of this specification.

4.6.1.2 Proof pressure - The test assembly shall be subjected to the proof pressure specified in 4.5.1 for a period of 5 minutes. Any rupture, permanent set, permanent deformation or damage of any part of the test coupling shall be cause for rejection.

4.6.2 Fuel resistance test -

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4.6.2.1 Phase I - high temperature fuel aging - Type III test fluid shall be circulated through the test assembly at the operating pressure of 125 psi and at a temperature of 100°F. The fluid flow shall be in one direction for one hour, and then reversed for a second hour. No indication of flow restriction or blockage due to the coupling shall be indicated.

The fluid flow, in one direction, shall then be circulated through the test assembly at a pressure of 125 psi and a temperature of 160°F. The fluid temperature shall be maintained at 160°F for 72 hours. During the final 8 hours of this test, the assembly shall be vibrated in accordance with 4.5.3. Upon completion of this test, the assembly shall be proof tested at 250 psi at a temperature of 160°F, to be held for a minimum of one minute.

There shall be no evidence of leakage or deformation of the coupling.

4.6.2.2 Phase II - High temperature fuel aging - Type I test fluid shall be circulated for 72 hours while at 160°F and 125 psi. During the final 8 hours of this test, the assembly shall be vibrated in accordance with 4.5.3. Upon completion, the assembly shall be proof tested at 250 psi and 160°F with the pressure to be held for a minimum of one minute. There shall be no evidence of leakage or deformation of the coupling.

4.6.2.3 Low temperature fuel aging - Type I test fluid shall be circulated for 72 hours while at 125 psi and -65°F. During the final 8 hours of this test, the assembly shall be vibrated in accordance with 4.5.3. Upon completion, the assembly shall be proof tested at 250 psi and at -65°F with the pressure to be held for a minimum one minute. There shall be no evidence of leakage or deformation of the coupling.

4.6.2.4 Air dry out - Upon completion of the low temperature test, the assembly shall be drained and placed in an air oven for 168 hours at 160°F. The low temperature test of 4.6.2.3 shall be repeated upon completion of dry out.

4.7 Flexure - The tubing on one side of the coupling shall be rigidly fixed while the other tube shall be mounted eccentrically on a power driven spindle. The test setup shall provide 1/2° flexure in any direction with an initial 3° misalignment between the centerlines.

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Type I fluid shall be used at a pressure of 125 psi. The test fluid temperature shall be 160°F for the first 4 hour test period and -65°F during the second 4 hour test period.

The test assembly shall be flexed for 8 hours at a frequency of 60 cycles per minute.

At the conclusion of this test, a pressure test shall be conducted at the proof pressure of 250 psi and -65°F and a pressure test shall be conducted at the burst pressure of 375 psi and -65°F.

There shall be no evidence of leakage or deformation of the coupling during any phase of the specified test.

#### 4.8 Cycle surge pressure test -

4.8.1 Test setup - Two 2" couplings shall be assembled with three lengths of 2" O. D. x .035" wall thickness, type 6061-T4 tubing to make up a surge cycle pressure test assembly. Two assemblies shall be used, as shown in Figure 1.

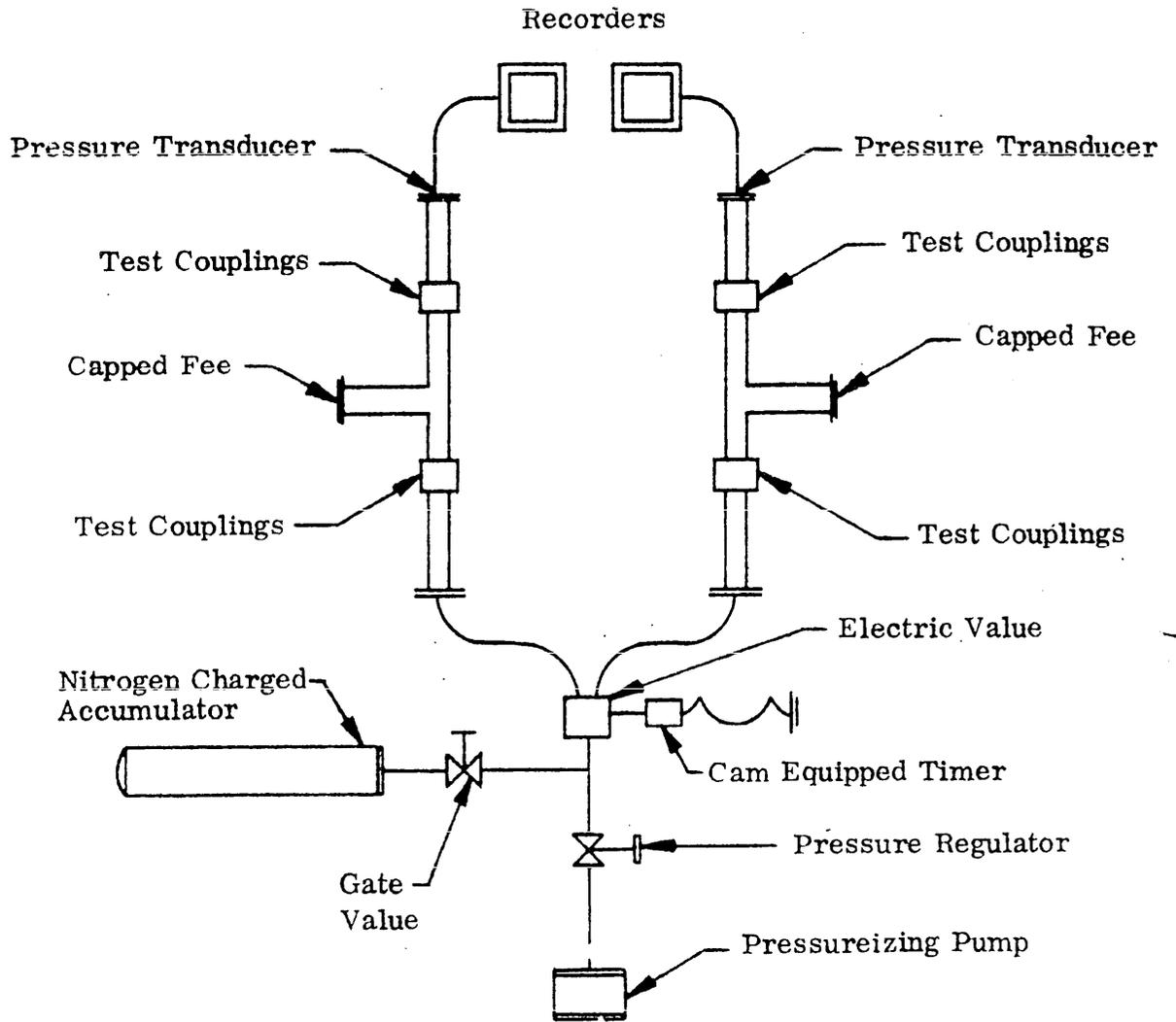
The middle section of each multiple tube assembly shall be in the form of a capped or plugged tee. One end of each assembly shall be capped and ported to provide for filling and pressurization. The other end shall be capped and ported to accept a pressure transducer with a response on the order of 30 milliseconds. (See Figure 2)

Each assembly shall be filled with Type I test fluid and mounted so that movement of tube assemblies shall not be restricted.

4.8.2 Pressurization source - The pressurization source shall be designed to impose a pressure of 0 to 180 to 0 psig in a time period of 60 milliseconds, with a rate of cycling of one cycle every two seconds. Means shall be provided to vary this pressure to each assembly in alternate operation.

The pressurizing system shall also include means to insure a constant pressure being delivered to the assemblies at each cycle.

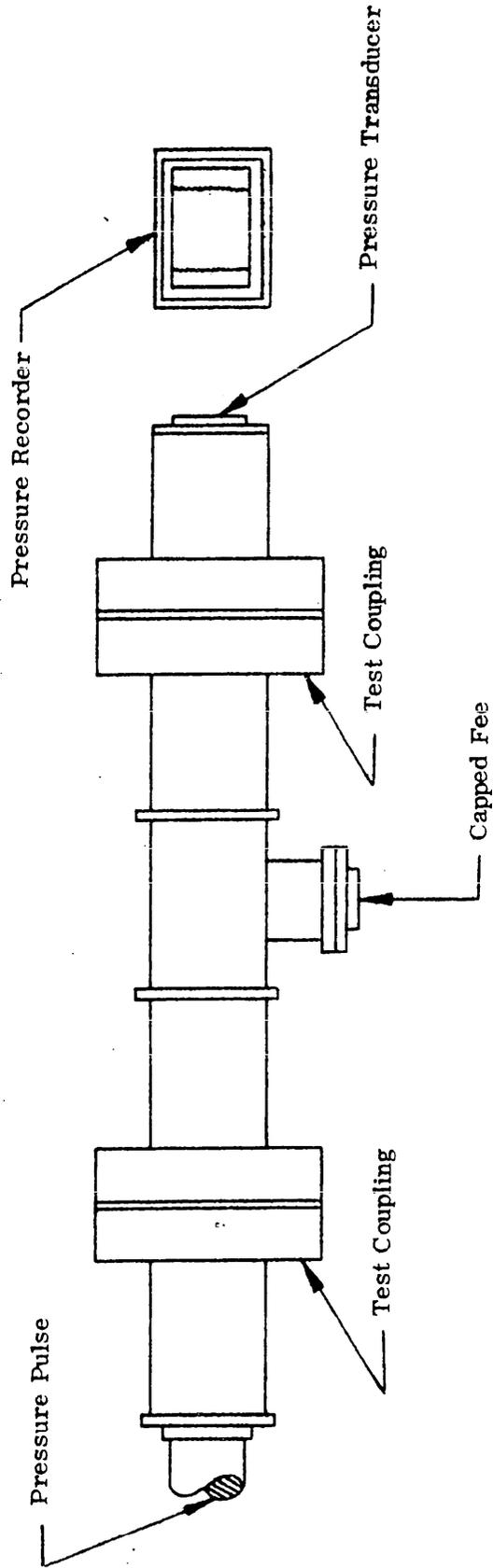
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SURGE PRESSURE TEST SYSTEM

FIGURE 1

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TEST SETUP - SURGE PRESSURE

FIGURE 2

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4.8.3 Instrumentation - Each test assembly shall have its pressure transducer connected to a pressure recorder equipped with a galvanometer and electronic counter to record the cycling pressure of each assembly.

4.8.4 Test procedure - Coupling assemblies shall be pressurized by starting the pumping system. The accumulator gate valve shall be adjusted to control the pressure and rise time in conjunction with the pump pressure regulator and the accumulator nitrogen charge.

The timer on the electrically operated multiport valve shall be adjusted to produce a pressure surge of 0 to 180 psig to 0 psig in 2 second intervals with the pressure surge peaking to be measured in seconds or fractions of a second.

The assemblies shall be subjected to 500,000 cycles. There shall be no evidence of leakage or malfunction from any coupling during the cycle surge pressure test.

4.9 Disassembly and inspection - Upon completion of all tests, the couplings shall be disassembled and each part and tubing end examined.

## 5. PREPARATION FOR DELIVERY

### 5.1 Preservation and packaging -

5.1.1 Level A - When this level is specified, the couplings shall be packaged in accordance with MIL-STD-794. The method of protection shall be method III of MIL-P-116.

5.1.2 Level C - When this level is specified, the couplings shall be packaged in accordance with standard commercial practice.

### 5.2 Packing -

5.2.1 Level A or B - When level A or B is specified, packaged items shall be packed for overseas or domestic shipment, respectively, to comply with MIL-STD-794.

5.2.2 Level C - When this level is specified, packaged items shall be prepared for shipment to comply with the latest standard commercial practice.

5.3 Marking - Marking of interior and exterior shipping containers shall conform to MIL-STD-794.

## 6. NOTES

6.1 Intended use - The flexible couplings are intended for use in aircraft power plant fuel systems to connect tubing outside the aircraft fire zones where operating temperatures and pressures are within the limits specified in Table I.

6.2 Information for contracting officer - Contracts or orders should specify the following:

- (a) Title, number and date of this specification
- (b) Size type and class of coupling required
- (c) Selection of applicable level of cleaning, preservation, packaging and packing required (See 5.0)
- (d) Items of data required

6.2.1 Procurement requirements - Contracts or orders should specify the following provisions for first article inspection.

6.2.1.1 Whether first article inspection is required. When a contractor is in continuous production of couplings from contract to contract, consideration should be given to waive the first article inspections. If inspection is required, indicate:

- (a) Where the first article inspection is to be conducted (at the contractor's plant or Government or commercial laboratory). If first article tests are conducted at the contractor's plant or a commercial laboratory, sample couplings and a test report shall be forwarded for verification to the Commanding Officer, Naval Air Propulsion Test Center (Attn: Code AEF-3-AED), Phila., Pa. 19112.
- (b) That the approval of first article samples or the waiving of the first article inspection shall not relieve the contractor

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of his obligation to fulfill all other requirements of the specification and contract.

6.2.2 Contract data requirements - Items of deliverable data required by this specification are cited in the following paragraphs:

<u>Paragraph</u>	<u>Data Requirement</u>	<u>Applicable DID</u>
4.3.1	Drawings and test report	
6.3.1	First article data	

Such data will be delivered as described on approved (numbered) DID's (Data Item Description/DD Form 1664) when specified on DD Form 1423 (Contract Data Requirements List) and incorporated into the applicable contract.

6.3 Data - For the information of contractors and Contracting Officers, any of the data specified in (a) subparagraphs below, (b) applicable documents listed in Section 2 of this specification, or (c) referenced lower-tier documents need not be prepared for the Government and shall not be furnished to the Government unless specified in the contract or order. The data to be furnished shall be listed in DD Form 1423 (Contractor Data Requirements List), which shall be attached to an made part of the contract or order.

6.3.1 First article data - When first article samples are submitted (see 6.2) they should be accompanied by a complete inspection report showing the results of the contractor's inspections. The inspection report should include the following:

- (a) Report of all inspections graphically presented when possible, together with a detailed statement indicating compliance or extent of noncompliance with all the requirements of this specification and applicable specification sheet referring specifically to paragraph numbers. Whenever a requirement is considered to be not applicable, the report should so state.

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- (b) Diagrams of inspection setups. A complete description of inspection equipment and inspection procedures.
- (c) Reproducible outline and description of inspection conditions. Where inspections specified in this specification are not considered applicable, the reason, and the substituted inspection should be clearly described.
- (d) Copies of inspection log sheets
- (e) Photographs when available

**Custodians:**

Navy-AS  
AF-11  
Army-AV

**Preparing Activity:**

Navy-AS

Project No. 4730-1128

**Review activities:**

Navy-AS  
AF-11  
Army-AV



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