

MIL-F-85720(AS)
17 June 1985

MILITARY SPECIFICATION

FITTINGS, TUBE, FLUID SYSTEMS, SEPARABLE, HIGH PRESSURE, DYNAMIC BEAM SEAL, GENERAL SPECIFICATION FOR

This specification is approved for use by the Naval Air Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the basic test and design requirements for one style separable high pressure beam seal fittings including boss or port seal connectors for use in 5000/8000 psi aerospace fluid systems. Definitions of fitting and related terms are included in 6.4.

1.2 Classification. Fittings shall be of the following types:

| | |
|----------|---------------------------------|
| Type II | -65 to +275°F Temperature Range |
| Type III | -65 to +450°F Temperature Range |

2. APPLICABLE DOCUMENTS

2.1 Government Documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications and standards of the issue listed in that 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: Naval Air Engineering Center, Systems Engineering and Standardization Department (Code 93), Lakehurst, NJ 08733-5100, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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SPECIFICATIONS

Federal

PPP-B-601 Boxes, Wood, Cleated-Plywood

PPP-B-636 Boxes, Shipping, Fiberboard

Military

MIL-P-116 Preservation, Methods of

MIL-C-5501 Caps and Plugs, Protective, Dust and Moisture Seal

MIL-S-8879 Screw Threads, Controlled Radius Root with Increased Minor Diameter; General Specification for

MIL-L-8937 Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting, NATO Code Number S-1738

MIL-B-43666 Boxes, Shipping, Consolidation

MIL-H-83282 Hydraulic Fluid, Fire-Resistant, Synthetic Hydrocarbon Base, Aircraft

MIL-F-85720/1 Fittings, Tube, Fluid Systems, Separable, High Pressure, Dynamic Beam Seal, Design Standard for Male End

STANDARDS

Federal

FED-STD-151 Metal; Test Methods

Military

DOD-STD-100 Engineering Drawing Practice

MIL-STD-105 Sampling Procedure and Tables for Inspection by Attribute

MIL-STD-129 Marking for Shipment and Storage

MIL-STD-143 Standards and Specifications, Order of Precedence for the Selection of

MIL-STD-280 Definitions of Item Levels, Item Exchangeability, Models and Related Terms

MIL-STD-794 Parts and Equipment, Procedure for Packaging and Packing of

MIL-STD-831 Test Reports, Preparation of

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MS33649

Bosses, Fluid Connection - Internal Straight Thread

(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.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. The issues 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 National Standards Institute (ANSI)

B46.1 Surface Texture

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018).

American Society for Testing and Materials (ASTM)

D3951 Commercial Packaging, Practice for

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

Society of Automotive Engineers (SAE)

ARP 603 Impulse Testing of Hydraulic Hose Assemblies, Tubing, and Fittings

AS 1055 Fire Testing of Flexible Hose, Tube Assemblies, Coils, Fittings and Similar System Components

ARP 1185 Flexure Testing of Hydraulic Tubing Joints and Fittings

AIR 1377 Fire Test Equipment for Flexible Hose and Tube Assemblies

AMS 4921 Titanium Bars, Forgings, and Rings, Annealed, 70,000 psi (483 MPa) Yield Strength

AMS 4944 Titanium Alloy Tubing, Seamless, Hydraulic - 3.0Al 2.5V, Cold Worked, Stress Relieved

AMS 4965 Titanium Alloy Bars, Forgings, and Rings - 6Al 4V, Sol. & Precip. Heat Treated

AMS 5561 Steel Tubing, Welded and Drawn - 9.0Mn 20Cr 6.5Ni 0.28N, High-Pressure Hydraulic

AMS 5637 Steel Bars, Corrosion Resistant 18Cr - 9.0Ni

AMS 5643 Steel Bars, Forgings, Tubing, and Rings, Corrosion Resistant

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- AMS 5656 Steel Bars, Forgings, and Rings, Corrosion Resistant 9.0 Mn - 20 Cr - 6.5 Ni - 0.27N
- AMS 5659 Steel Bars, Forgings, Rings, and Extrusions, Corrosion Resistant, 15Cr 4.5Ni 0.30 (Cb + Ta) 3.5Cu, Con. Elect. Melted

(Copies of SAE publications may be obtained from the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15098.)

(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, Pennsylvania 19120. Request for copies of classified documents should be addressed to the Naval Publications and Forms Center, via the cognizant Government representative.)

3. REQUIREMENTS

3.1 First article. Each fitting or component furnished under this specification shall be a product containing separable or attachment end configurations identical to that which has been inspected and passed the first article inspection specified herein (see 4.3). If machined shapes are used for first article inspection and forgings are subsequently supplied in fulfillment of the contract, a repeat test of Inspection Samples 1 through 4 must be made and a new test report submitted and accepted prior to shipment of any machined forgings. The procuring activity shall be responsible for granting first article approval based on MIL-F-85720 and other documents prepared by the original contractor. The contractor-approved first article test in compliance with this specification for the specific fitting and tube attachment method used on a specific fluid system shall be acceptable for use on other fluid systems without additional testing, providing the tubing material and wall thickness as well as the operating temperature and pressure are within the same limits.

3.2 Classification of requirements. The requirements for the product are classified herein as follows:

| <u>Requirement</u> | <u>Paragraph</u> |
|---------------------------|------------------|
| Material | 3.3 |
| Design and construction | 3.4 |
| Performance | 3.5 |
| Part numbering | 3.6 |
| Dimensions | 3.7 |
| Identification of product | 3.8 |
| Workmanship | 3.9 |

3.3 Material.

3.3.1 Fittings. The material used shall be titanium alloys or corrosion resistant steels as specified in table I. The material shall be heat treated, as required, and have suitable surface protection to meet the requirements of this specification.

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TABLE I. Fitting and tubing materials.

| | Titanium | CRES |
|-------------------------|------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| Male Connectors Nuts | Ti 6Al-4V per AMS 4965 | AMS 5643-Condition H1075 or AMS 5659- Condition H1075 |
| Female Shoulders | Ti 6Al-4V per AMS 4965 or Ti per AMS 4921 | AMS 5656 or AMS 5643 - Condition H1075 or AMS 5659 - Condition H1075 |
| Swivel Wires | CRES 302 per AMS 5637 protected with solid film lubricant per MIL-L-8937. | |
| Tubing | Ti 3Al-2.5V per AMS 4944 | 21-6-9 per AMS 5561 |

TABLE II. Fitting and tubing for test assemblies and flexure test levels.

| Fitting Size | Flexure Test Assembly Length | Ti Fitting Ti Tubing | | CRES Fitting CRES Tubing | |
|-----------------|---------------------------------------|-------------------------|--------------|-----------------------------|--------------|
| | | Tubing Wall | Stress (psi) | Tubing Wall | Stress (psi) |
| 03 | 5 | 0.020 | 20,000 | 0.020 | 24,000 |
| 04 | 6 | 0.026 | 20,000 | 0.023 | 24,000 |
| 05 | 7 | 0.032 | 20,000 | 0.029 | 24,000 |
| 06 | 7.5 | 0.038 | 19,000 | 0.034 | 22,000 |
| 07 | 9 | 0.045 | 18,500 | 0.040 | 21,000 |
| 08 | 9 | 0.051 | 18,000 | 0.046 | 20,000 |
| 09 | 10 | 0.058 | 17,500 | 0.051 | 19,000 |
| 10 | 10 | 0.064 | 17,000 | 0.057 | 18,000 |
| 11 | 11 | 0.070 | 16,500 | 0.062 | 17,000 |
| 12 | 11 | * 0.042 | 16,000 | * 0.037 | 16,000 |
| 14 | 12 | * 0.049 | 15,000 | * 0.043 | 15,500 |
| 16 | 12 | * 0.056 | 14,500 | * 0.050 | 15,000 |
| 20 | 14 | * 0.071 | 14,000 | * 0.062 | 15,000 |

Notes: 1. All test assembly lengths and wall thicknesses expressed in inches.

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Notes: (Cont'd)

2. Stress specified is the minimum bending stress for the Flexure Test per 4.6.6.
3. For test purposes, tubing diameters and wall thicknesses shall be per table II. Fittings can be used for other tubing wall thicknesses. For use of tubing wall less than .020 inch, special approval must be obtained.
4. Tubing wall thicknesses are for 8000 psi operating systems and internal test pressure of 8000 psi. For tubing wall thicknesses for 5000 psi systems, see table III.

* Indicates tubing intended for return line pressure only.

3.3.2 Tubing. The tubing used for the fabrication of the test assemblies shall be in accordance with table II.

3.4 Design and construction.

3.4.1 Styles and dimensions. The styles and dimensions shall conform to the design requirements specified herein and applicable drawings as approved by the procuring activity.

3.4.2 Drill offset. On fittings where the fluid passage is drilled from each end, the offset between the drilled holes at the meeting point of the drills shall not exceed .015 inch. Angular misalignment shall not exceed two degrees.

TABLE III. Tubing wall thicknesses for 5000 psi systems.

| Fitting Size | Tubing Wall | | Fitting Size | Tubing Wall | |
|--------------|-------------|----------|--------------|-------------|----------|
| | CRES | Titanium | | CRES | Titanium |
| 03 | 0.020 | 0.020 | 10 | 0.049 | 0.054 |
| 04 | 0.020 | 0.022 | 11 | 0.053 | 0.061 |
| 05 | 0.025 | 0.027 | 12 | 0.058 | 0.065 |
| 06 | 0.030 | 0.032 | 14 | 0.068 | 0.077 |
| 07 | 0.034 | 0.038 | 16 | 0.078 | 0.088 |
| 08 | 0.039 | 0.043 | 20 | * 0.040 | * 0.046 |
| 09 | 0.044 | 0.048 | | | |

* Indicates tubing wall thickness for return line pressure only.

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3.4.3 Reduction in fluid passage (bore) cross-section. It shall be possible to pass through the passage a ball whose diameter is 0.020 less than the minimum diameter specified for the passage (bore). On angle joints or reducers, the cross-sectional area at the junction of the fluid passages shall in no case be smaller than the cross-sectional area of the smallest passage.

3.4.4 Tube attachment. The method of joining the tubing to the end fitting (brazing, welding, mechanical attachment, swaging, etc.) shall not adversely affect the properties, strength, or geometry of the tubing or end fitting to the extent that performance would be impaired. The joint shall be of a quality compatible with the design and performance requirements of this specification, and shall be inspectable by direct measurement, x-ray, or other means. The method of tubing attachment of the test assemblies shall be as specified or as approved by the procuring activity.

3.4.5 Installation tooling. Size of tool envelope required to install fittings on tubing in the vehicle system, to effect repair of the system, or to replace fittings within the system shall be kept to a minimum. The wrench flats or pads of the fittings shall permit use of the standard wrenches.

3.4.6 Heat generation. Fittings attached by thermal process shall be attached by tooling designed to permit installation in vehicles without damage to adjacent structure or components.

3.4.7 Connector design. Connectors shall be designed to prevent failure of sealing surfaces. The sealing interface shall be integral with the fitting. No removable seals are permitted.

3.4.8 Connector interface. All female fittings shall be tested using male connectors with dimensions conforming to MIL-F-85720/1. All male fittings tested shall be interchangeable with male connectors dimensioned per MIL-F-85720/1.

3.4.9 Threads. All threads shall be in accordance with MIL-S-8879, with the surface finish of the thread flanks being 62Ra maximum. All threads shall be coated with solid film lubricant per MIL-L-8937.

3.4.10 Selection of specifications and standards. Specifications and standards for necessary commodities and services shall be selected in accordance with MIL-STD-143.

3.5 Performance. The fitting assemblies shall meet the following performance requirements. Operating and test requirements are specified in 4.5.1.

3.5.1 Proof pressure. The fitting assembly shall withstand pressure equal to twice the nominal operating pressure of the system for five minutes without leakage, evidence of permanent deformation, or other malfunction that would affect assembly or disassembly using the specified range of torque values when tested in accordance with 4.6.2.

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3.5.2 Burst pressure. The fitting assembly shall not rupture or show evidence of leakage at any pressure less than three times the nominal operating pressure when tested in accordance with 4.6.3. Tubing expansion is permissible. The fitting assembly need not meet any disassembly or assembly requirements after this test. It is not essential that the assembly actually be burst but it must be able to maintain three times the nominal system operating pressure for a minimum of five minutes.

3.5.3 Thermal shock. The fitting assembly shall not leak or burst during temperature and pressure cycling from the minimum system temperature to the maximum system temperature when tested in accordance with 4.6.4.

3.5.4 Impulse. The fitting assembly shall withstand 200,000 impulse pressure cycles without leakage from the fitting or the fitting-tube junction when tested in accordance with 4.6.5.

3.5.5 Flexure. The fitting assembly shall not exhibit leakage from the fitting or the fitting-tube junction prior to the completion of 10 million cycles at the test stress level specified when tested in accordance with 4.6.6.

3.5.6 Repeated assembly. The fitting assembly shall withstand 25 repeated connections at the minimum and maximum torque values specified in table V when tested in accordance with 4.6.7, without:

- a. Leakage at any tests of 4.6.7.
- b. Inability to assemble the fitting to the point of interface by hand.
- c. Nut deformation preventing engagement of nut hex with open end wrench.

3.5.7 Stress corrosion. The fitting assembly shall withstand 50 hours of salt spray exposure when tested in accordance with 4.6.8 without:

- a. Indication of cracking or pitting of the exposed surfaces of fittings and tubings within one diameter of end fitting greater than that exhibited on the balance of the tubing when visually examined with 10 power magnification.
- b. Leakage or burst at a value less than three times the nominal operating pressure.
- c. Indications of interior transgranular corrosive attack during metallurgical examination of longitudinal and transverse sections of the fitting and fitting-tube junction.

3.5.8 Pneumatic leakage. The fitting assembly shall withstand pneumatic pressure equal to the maximum operating pressure for five minutes at room temperature without any visible bubbles starting after one minute at pressure or other malfunction that would affect assembly or disassembly using the range of torque values specified when tested in accordance with 4.6.9.

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3.5.9 Fire. The fitting assembly shall withstand a 2000°F (1093°C), 4500 BTU/HR (1320 watts) flame for 15 minutes when tested in accordance 4.6.10. Heat input shall be measured by a 1/2-inch (12.7-mm) copper tube per AIR 1377. There shall be no leakage detected by visual observation or failure of the test assembly prior to the specified time.

3.6 Part numbering of interchangeable parts. All parts having the same design activity FSCM (Federal Supply Code for Manufacturers) and part number shall be interchangeable as defined in MIL-STD-280. The item identification and part number requirements of DOD-STD-100 shall govern the design activity part numbers and changes thereto.

3.7 Dimensions and tolerances. All pertinent dimensions, threads, and tolerances, where interchangeability, operation, or performance of the fitting may be affected, shall be as specified on detail drawings.

3.8 Identification of product. All fittings shall be identified in accordance with the following instructions.

3.8.1 Marking method. Marking shall be impressed, embossed, or electro-chemically etched in a location and in a manner not detrimental to the fitting. Where practical, markings shall remain visible after the fitting is installed.

3.8.2 Marking. All end fittings (see 6.4.2) and connectors (see 6.4.3) shall be marked with the manufacturer's name or trademark, an appropriate material identification code and the dash size (mating tube) of the fitting as a minimum. If space permits, the manufacturer's part number, or standard part number (or as much of the part number as a space permits) and the manufacturer's FSCM shall be marked to insure that positive identification can be made. The package shall contain the complete part number.

3.9 Workmanship. Remove all burrs and break all sharp edges. Sealing surfaces shall be free of detrimental longitudinal and spiral tool marks. Unless a finer finish is specified on applicable drawings, sealing surfaces shall be smooth to a finish of 45Ra, except that annular tool marks up to 45Ra, as defined in ANSI B46.1, will be acceptable. All other machined surfaces shall be smooth to a 125Ra maximum and free of burrs and sharp edges. Unmachined surfaces, such as forging surfaces and bar stock flats shall be free of cracks, laps, and seams.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor 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.

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4.2 Lot. A lot shall consist of all parts of a given part number made and presented for inspection at essentially the same time.

4.2.1 Record maintenance. The supplier shall maintain record of inspections for a minimum period of seven years.

4.2.2 Material certification. Records of chemical analysis and mechanical property tests showing conformance to the applicable material specification shall be made available upon request. Material heat treat, certification, and inspection records on the material shall be retained for a minimum period of seven years from the date of raw material procurement by the manufacturer. Conformance to the applicable material specifications shall be made before releasing material for further production.

4.3 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.4)
- b. Quality conformance inspection (see 4.5)

4.4 First article inspection. The first article inspection shall consist of the inspections of this specification conducted in the order shown in table IV for the applicable assembly style and numbers.

4.4.1 Sampling for first article inspection. A random sample shall be selected consisting of test assemblies specified in table IV for each size, each fitting material and each tubing material for which inspection is desired. It is permissible to run each test on separate samples in the quantities indicated when specified or approved by the procuring activity. Threaded fittings designed for permanent attachment to adjacent tubing shall be assembled as fitting assemblies in accordance with the joint design feature (swage, braze, or weld).

4.4.2 First article test report. The contractor shall prepare a report of the first article test (see 6.2.2) showing that the assemblies tested conform to this specification. The format of the report shall be in accordance with MIL-STD-831. Two copies shall be furnished to the procuring activity. Two additional copies shall be forwarded with verification test samples.

4.4.3 Verification test assemblies for the procuring activity. The contractor shall submit to the agency supplied in 6.2 (d), together with the first article test report, seventeen new untested sample assemblies for each size and tubing type in accordance with table IV to be used as follows:

- a. For a review of the mechanical construction of the product.
- b. To perform any tests included in the specification, after reviewing the contractor's test report.

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TABLE IV. Inspection Samples.

| Assembly Numbers | 1 - 4 | 5 - 6 | 7 - 9 | 10 - 15 | 16 - 17 |
|----------------------------------------|-------------------------------------------|----------------------------------|-------------------------|-------------------------|--------------------------|
| Assembly style (See Fig. 1) | C | A | B | A | A |
| Assembly length (L) (See Fig. 1) | 9" | 9" | 6" | Per Table II | 9" |
| Inspection sequence | 4.6.1 4.6.2 4.6.7 4.6.5 4.6.3 | 4.6.1 4.6.9 4.6.2 4.6.4 | 4.6.1 4.6.2 4.6.8 | 4.6.1 4.6.2 4.6.6 | 4.6.1 4.6.2 4.6.10 |

4.5 Quality conformance inspection. A sample of each lot of fittings per MIL-STD-105, 1% AQL, Level II shall pass the examination of product when examined in accordance with 4.6.1.

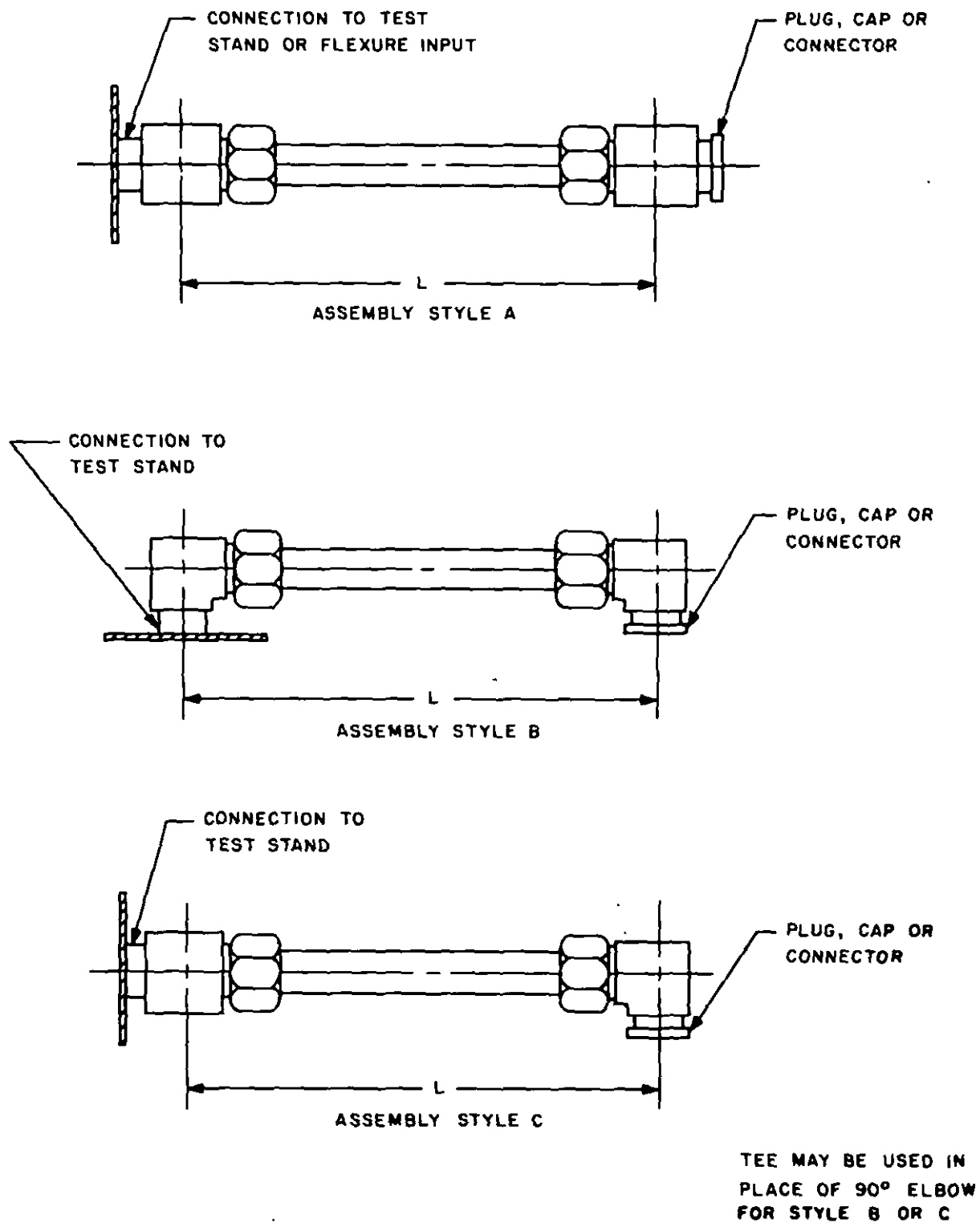
4.5.1 Test conditions.

4.5.1.1 Test pressures. All testing shall be performed using a system operating pressure of 8000 psi. Proof pressure shall be 16,000 psi and burst pressure shall be 24,000 psi.

4.5.1.2 Test fluids. The test fluids used shall be MIL-H-83282 or other suitable fluid compatible with the fluid system temperature range and materials used.

4.5.1.3 Temperature. Except where otherwise specified, the tests shall be conducted at a room temperature of approximately 60 to 100°F and a fluid temperature of 60 to 170°F. Testing shall be conducted at maximum rated temperature $\pm 10\%$, when required.

4.5.1.4 Torque. One end of each assembly (except flexure and impulse) shall be torqued to the minimum torque value and the other end torqued to the maximum torque value without application of any additional lubricant beyond that supplied by the manufacturer. If the boss fitting is being tested, at least 50% of the samples will be torqued to the minimum torque and the balance to the maximum torque. Torque values for Titanium and CRES fittings shall be per table V.

Figure 1. Assembly style

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TABLE V. Torque requirements.

| Fitting size | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 14 | 16 | 20 |
|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| Minimum (in-lbs) | 60 | 120 | 120 | 180 | 252 | 360 | 396 | 492 | 552 | 720 | 864 | 1200 | 1440 |
| Maximum (in-lbs) | 108 | 168 | 192 | 300 | 372 | 480 | 540 | 660 | 756 | 840 | 1020 | 1380 | 1680 |

4.6 Inspection methods.

4.6.1 Examination of product. All fitting assemblies and components shall be inspected for compliance with the workmanship, material, heat treat and marking requirements specified herein, and shall meet the dimensions and tolerances on the applicable inspection drawings.

4.6.1.1 Preparation for delivery. All fittings and components shall be examined to ascertain that their preparation for delivery conforms to this specification.

4.6.2 Proof pressure test. Test assemblies shall be connected to a source of pressure with one end free to move and proof pressure tested at a value equal to two times the nominal operating pressure for a minimum period of five minutes. Rate of pressure rise shall be 20,000 \pm 5000 psi per minute. The test fluid may be water or suitable hydraulic fluid.

4.6.3 Burst pressure test. Test assemblies shall be connected to a source of pressure with one end free to move and burst tested at the value equal to three times the nominal operating pressure. The pressure shall be increased at a rate of 20,000 \pm 5000 psi per minute until the assembly bursts, leaks, or three times the operating pressure is reached. Two assemblies shall be tested at room temperature per 4.5.1.3 and two assemblies shall be tested at maximum rated temperature.

4.6.4 Thermal shock test:

- a. One fitting assembly of each size shall be subjected to this test. The assemblies shall be subjected to the proof pressure specified (see 4.6.2).
- b. The test assemblies shall then be mounted in a high temperature test setup (typical setup shown in figure 2) and filled with a suitable hydraulic fluid. The ambient temperature shall be reduced to -65 \pm 2°F for a minimum of 2 hours. At the end of this period, while still at -65°F, high temperature test fluid at the maximum rated temperature specified for each classification shall be

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suddenly introduced at a minimum pressure of 50 psi. Immediately after the hot oil has filled the assembly, the pressure shall be raised to the proof pressure (see 4.5.1.1) for a minimum of 5 minutes. Not more than 15 seconds shall elapse between the introduction of the high temperature oil at 50 psi and raising the pressure to proof pressure.

- c. Any leakage from the test fitting, fitting blow-off, burst, or other evidence of malfunction shall constitute failure.

4.6.5 Impulse test. Test assemblies shall be tested in accordance with ARP 603 with the following conditions:

- a. Duration of test. 200,000 cycles minimum.
b. Temperature.

Maximum rated for 80,000 cycles; then
Minimum rated (-65°F) for 40,000 cycles; then
Maximum rated for 80,000 cycles.

Note: Test assembly must be stabilized at each temperature before beginning that portion of test.

- c. Rate of rise. 75,000 to 650,000 psi/second.
d. Cycling rate. 70 \pm 5 cycles per minute.
e. Wave form. Per ARP 603.
f. Surge Peaks. 130 to 140% of nominal operating pressure.
g. Assembly torque. Minimum torque value per table V.

4.6.6 Flexure test. Test assemblies shall be tested in accordance with the flexure test procedure of ARP 1185 except as noted herein. Test assemblies shall be tested to a minimum bending stress indicated in table II at maximum rated temperature with static internal pressure equal to nominal operating pressure maintained. The bending stress shall be measured with suitable strain gages on each tube assembly.

Note: If it is desired to express the stress in terms of combined stress, the pressure axial stress caused by the internal pressure shall be calculated by the following formula and added to the bending stress:

$$\sigma_x = P \frac{D_o^2 - D_i^2}{D_o^2 - D_i^2}$$

where: σ_x = axial stress
P = operating pressure
 D_i = internal diameter
 D_o = external diameter

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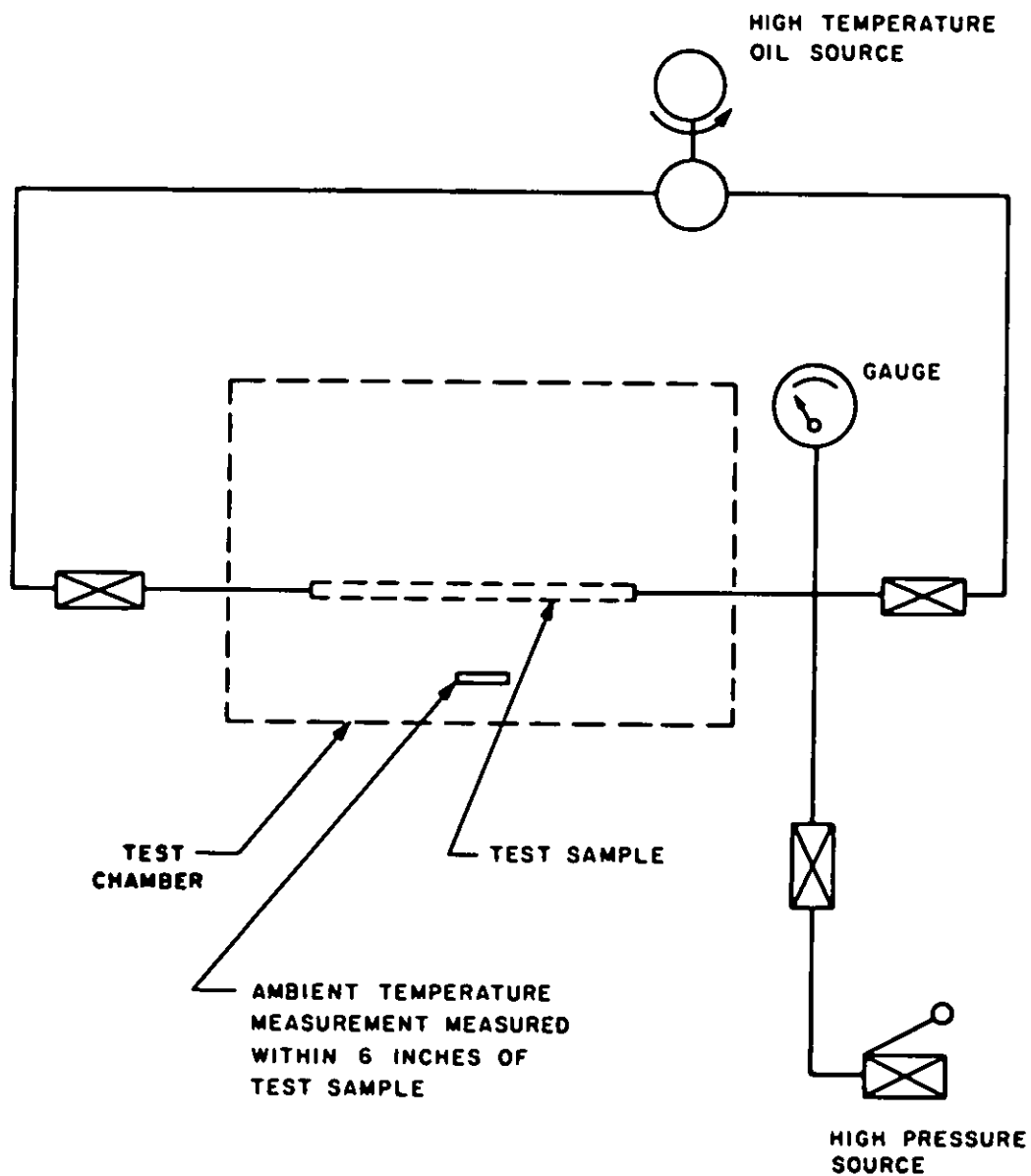


Figure 2. Typical setup for thermal shock testing.

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4.6.7 Repeated assembly test. The test assemblies shall be tested with one end torqued to maximum torque and the other end torqued to minimum torque with no additional lubricant permitted for the first tightening. Each connection shall then be disassembled, with the sealing face then rotated 60 to 90 degrees, the fitting then lubricated with MIL-H-83282 hydraulic fluid and retorqued to the original torque a total of 25 times. After each fifth and the final tightening operation, the assembly shall be subjected to the pneumatic test with the specimen submerged under water. No evidence of leakage shall be allowed. Every sixth cycle the connectors shall be interchanged. No additional lubricant other than MIL-H-83282 is permitted. The test fixture shall be such as to assure that all forces to join the assembly are induced into the joint assembly.

4.6.8 Stress corrosion test. The test assembly shall be installed in a test fixture which imposes a calculated stress level (using nominal tube dimensions) equal to 85 \pm 5% of tubing yield strength (minimum per applicable tube specification) at the tubing-fitting assembly interface. The test assembly, pressurized to an internal pressure equal to the nominal system operating pressure, shall then be subjected to the standard salt spray test per FED-STD-151 Method 811.1 without removing the bending stress. After 50 hours exposure, the assembly shall be subjected to the burst pressure test at room temperature. The fittings shall then be cleaned and metallurgically examined, including sectioning of fitting and tubing.

4.6.9 Pneumatic test. The test assemblies shall be pressure tested at room temperature at the nominal operating pressure for a minimum period of five minutes. The test fluid shall be dry compressed air or nitrogen. The test assemblies shall be prepared without use of oil during assembly or prior to testing. Any oil or grease used for tubing attachment shall be completely removed before test.

4.6.10 Fire test. The assembly shall be mounted in a horizontal plane that lies on the axis of the burner. The portion of the flame in which the assembly is to be tested shall deliver a minimum heat output of 4500 BTU per hour (1320 watts) as measured by a 1/2 inch (12.7 mm) copper tube mounted per AIR 1377. Width of the flame shall be such that the 2000°F (1100°C) temperature shall occur (as measured by thermocouple) for a minimum distance of 8 inches (203 mm). The entire fitting connection plus a length of tubing shall be subjected to the flame. During the test, the end connection subjected to the flame shall be subjected to inline vibration at the rate of 2000 cycles per minute through a total amplitude of not less than 1/8 inch (3.2 mm); i.e., a displacement of 1/16 inch (1.6 mm) each side of the neutral position. The assembly shall be subjected to SAE No. 20 oil at a pressure equal to the rated system pressure and at an oil temperature of 200-230°F (93-110°C). The flow rate shall be flow in gallons per minute equal to 1 x the ID ² measured in inches. For tolerances and details of test refer to AS 1055 and AIR 1377.

5. PACKAGING

5.1 Preservation. Preservation shall be Level A or Commercial as specified (see 6.2).

5.1.1 Level A.

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5.1.1.1 Cleaning. All parts shall be free from grease, oil, dirt, or any other foreign matter. Any process or combination of processes that will accomplish thorough cleaning without damage to the parts shall be acceptable.

5.1.1.2 Preservative. No preservative shall be used.

5.1.1.3 Unit packing. The unit pack shall be preserved in accordance with Method 1C-10 or Method 1C-3 as specified in MIL-P-116. The threaded ends of the fittings shall be protected with aluminum alloy or rigid plastic caps in accordance with MIL-C-5501. The surface area of the backing board to be used in Method 1C-10 shall be 15" by 12". The backing board shall be preprinted or a label enclosed in the unit pack with identification in accordance with MIL-STD-129. The waterproof bag used in Method 1C-3 shall be preprinted or a label enclosed with identification in accordance with MIL-STD-129. The number of items in a unit pack shall be as specified in the contract order (see 6.2) or shall be determined in accordance with Appendix F in MIL-STD-794.

5.1.1.4 Intermediate container. Unless otherwise specified, the unit packs shall be packed in intermediate containers in accordance with MIL-STD-794 (see 6.2).

5.1.2 Commercial. Commercial preservation shall be in accordance with ASTM D3951.

5.2 Packing. Packing shall be Level A, Level B, or Commercial.

5.2.1 Level A. Unit packs preserved as indicated in 5.1.1.3 and packed in intermediate containers shall be packed in wooden containers conforming to MIL-B-43666 types I and II or PPP-B-601 overseas type.

5.2.2 Level B. Unit packs preserved as indicated in 5.1.1.3 and packed in intermediate containers shall be packed in fiberboard containers conforming to PPP-B-636 weather-resistant type.

5.2.3 Commercial. Unit packs preserved as indicated in 5.1.2 and packed in intermediate containers in accordance with ASTM D3951 shall be packed in outer containers in accordance with ASTM D3951.

5.3 Marking. Unit packs, intermediate containers, and shipping containers shall be marked in accordance with MIL-STD-129. In addition to the requirements of MIL-STD-129, the unit packs, intermediate containers, and shipping containers shall include the following information:

- Manufacturer's name or trademark
- Manufacturer's part number or Standard part number or FSCM
- Acquiring activity's part number (if applicable)
- Type and system pressure
- Fitting material
- Date of package

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6. NOTES

6.1 Intended use. The fittings or components covered by this specification are intended for use in high pressure aerospace fluid systems under the condition specified herein.

6.2 Ordering data. Procurement documents should specify the following:

- a. Title, number and date of this specification.
- b. Manufacturer's, Military Standard Part Number or FSCM number, if available.
- c. Sampling instructions for tests and when applicable, additional testing of fitting styles (such as tees, reducers, etc.) not included in the test samples (see 4.4.1).
- d. Where the first article verification test samples (see 4.4.3) should be sent and instructions concerning the submittal of the test reports (see 4.4.2).
- e. Applicable levels of preservation, packaging, and packing (see 5.1).

6.2.1 First article and sampling. Procurement documents should specify whether first article or sampling inspection is required. When a contractor is in continuous production of the fitting from contract to contract, consideration should be given to waive the first article and/or sampling inspections. If first article inspection is required, indicate:

- a. Where the first article inspection is to be conducted (at the contractor's plant or Government or commercial laboratory).
- b. That the approval of first article samples or the waiving of the first article inspection shall not relieve the contractor 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 of the Data Item Description (DID) Specification.

| <u>Paragraph</u> | <u>Data Requirements</u> | <u>Applicable DID</u> |
|------------------|---------------------------------|-----------------------|
| 4.4.2 | First Article Test Report | DI-T-5329 |
| 4.5 | Quality Conformance Test Report | DI-T-5329 |

6.2.3 Sample test assemblies. Sample test assemblies subjected to the first article inspection shall not be considered, accepted, or shipped as part of the contract or order.

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6.3 Data. For the information of Contractors and Contracting Officers, any of the data specified in (a) applicable documents listed in Section 2 of this specification, or (b) 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 required to be furnished shall be listed on DD Form 1423 (Contractor Data Requirements List), which shall be attached to and made a part of the contract or order.

6.4 Definitions. Definitions listed herein pertain only to those items peculiar to this specification.

6.4.1 Fitting assembly. The end fittings attached to the appropriate tubing with necessary connectors to conform to the proper test sample (see 3.4.4 and table IV).

6.4.2 End fitting. The component or components which become permanently attached to the tubing end. This end fitting consists of an internally threaded nut with other components as necessary and is defined as a female, or a single fitting with a threaded end defined as a male fitting.

6.4.3 Connector. The replaceable component which connects end fittings or bosses or ports one with another by means of threads. Normally, these components are unions, boss adapters, 45 and 90 degree elbows, tees, and crosses.

6.4.4 Leakage. The escape of fluid (gaseous or liquid) from any point of the fitting assembly including the fitting-tube junction. This junction is defined to include one tube outside diameter in length beyond the fitting envelope. The envelope is the area from free parent tube material to free parent tube material or boss.

6.4.5 Failure. Any deformation that would contribute to seal leakage or would promote premature fatigue breakage, unless otherwise determined to be due to a tubing defect.

6.4.6 Torque. Torque, as used herein is defined as the necessary loads (or assembly stresses) to assure the sealing of the end fitting to the connector.

6.4.7 Boss fitting. Boss fitting as used herein is defined as the fitting that connects to an MS33649 (or equivalent) boss.

Preparing activity
Navy - AS
Project No. 4730-N667

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

| | | | |
|---------------------------------------------------------------|--|---------------------------------------------------------------------------------------------------------------------------|--|
| 1. DOCUMENT NUMBER MIL-F-85720 (AS) | | 2. DOCUMENT TITLE FITTINGS, TUBE, FLUID SYSTEMS, SEPARABLE, HIGH PRESSURE, DYNAMIC BEAM SEAL, GENERAL SPEC FOR | |
| 3a. NAME OF SUBMITTING ORGANIZATION | | 4. TYPE OF ORGANIZATION (Mark one) | |
| b. ADDRESS (Street, City, State, ZIP Code) | | <input type="checkbox"/> VENDOR | |
| | | <input type="checkbox"/> USER | |
| | | <input type="checkbox"/> MANUFACTURER | |
| | | <input type="checkbox"/> OTHER (Specify): _____ | |
| 5. PROBLEM AREAS | | | |
| a. Paragraph Number and Wording | | | |
| b. Recommended Wording. | | | |
| c. Reason/Rationale for Recommendation. | | | |
| 6. REMARKS | | | |
| 7a. NAME OF SUBMITTER (Last, First, MI) - Optional | | 7b. WORK TELEPHONE NUMBER (Include Area Code) - Optional | |
| 8. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional | | 8. DATE OF SUBMISSION (YYMMDD) | |