

DD-G-511E  
September 15, 1983  
 SUPERSEDING  
 Fed. Spec. DD-G-511D  
 May 17, 1966  
 (See 6.4)

## FEDERAL SPECIFICATION

### GLASS TUBING, ROUND

This specification was approved by the Assistant Administrator, Office of Federal Supply and Services, General Services Administration, for the use of all Federal agencies.

#### 1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers heat-resistant, high pressure glass tubing for use in liquid level gages on low pressure boilers (250 pounds per square inch (lb/in<sup>2</sup>) maximum) and hot water tanks.

#### 1.2 Classification.

1.2.1 Sizes. Glass tubing shall be of the following outside diameters (o.d.) as specified (see 3.5 and 6.2.1):

Outside diameters - 3/8-, 1/2-, 5/8-, 3/4-, 7/8-, and 1-inch.

#### 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:

##### Federal Specifications

PPP-B-566 - Boxes, Folding, Paperboard.  
 PPP-B-601 - Boxes, Wood, Cleated-Plywood.  
 PPP-B-621 - Boxes, Wood, Nailed and Lock-Corner.  
 PPP-B-636 - Boxes, Shipping, Fiberboard.  
 PPP-P-291 - Paperboard, Wrapping and Cushioning.

##### Federal Standard

FED-STD-123 - Marking for Shipment (Civil Agencies).

(Activities outside the Federal Government may obtain copies of Federal specifications, standards, and commercial item descriptions as outlined under General Information in the Index of Federal Specifications, Standards and Commercial Item Descriptions. The Index, which includes cumulative bimonthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

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(Single copies of this specification, and other Federal specifications and commercial item descriptions required by activities outside the Federal Government for bidding purposes are available without charge from General Services Administration Business Service Centers in Boston; New York; Philadelphia; Washington, DC; Atlanta; Chicago; Kansas City, MO; Fort Worth; Houston; Denver; San Francisco; Los Angeles; and Seattle, WA.

(Federal Government activities may obtain copies of Federal standardization documents and the Index of Federal Specifications, Standards and Commercial Item Descriptions from established distribution points in their agencies.)

### Military Standards

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.  
MIL-STD-129 - Marking for Shipment and Storage.

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

### 3. REQUIREMENTS

3.1 First article. When specified (see 6.2.1), the contractor shall furnish sample unit(s) for first article inspection and approval (see 4.3 and 6.3).

3.2 Material. Tubing shall be manufactured of annealed borosilicate transparent glass. Tubing ends shall be as specified (see 6.2.1).

3.2.1 Recovered materials. Unless otherwise specified herein, all equipment, material, and articles incorporated in the products covered by this specification shall be new and shall be fabricated using materials produced from recovered materials to the maximum extent practicable without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification unless otherwise specifically specified.

3.3 Thermal shock. Glass tubes shall be tested in accordance with 4.6.1 and shall withstand a sudden temperature change from 212 to 43 degrees Fahrenheit (°F), except that the 7/8- and 1-inch diameter sizes shall withstand temperature changes from 150 to 43°F, without spalling or cracking.

3.4 Hydrostatic pressure. Glass tubing shall be tested in accordance with 4.6.2 and shall withstand sudden gage pressure changes of 300 pounds force per square inch (lbf/in<sup>2</sup>), from 0 lbf/in<sup>2</sup> without evidence of cracking or breaking.

3.5 Dimensions. Nominal diameter and cut length of glass tubing shall be as specified (see 6.2.1). Length shall not be over 24 inches and shall be within plus or minus 1/8 inch of required length. O.d. shall be within plus or minus 3/64 inch of required diameter. Wall thickness shall be as follows:

Outside diameter (inch)	Minimum wall thickness (inch)	Maximum wall thickness (inch)
3/8	1/16	5/32
1/2	1/16	5/32
5/8	5/64	5/32
3/4	3/32	5/32
7/8	3/32	5/32
1	3/32	5/32

3.6 Workmanship. Glass tubing shall be free of imperfections such as cracks, breaks, bulges, blisters or scratches. Tubing shall be free of warp or twist. Bow tolerance shall be a maximum of 0.016 inch for lengths up to 14.9 inches. Above this length, the maximum acceptable bow tolerance shall be 0.032 inch. Ends shall be cut square within 1/16 inch and shall be free of rough or chipped edges. Tubing out-of-roundness shall be within 2 percent of the nominal o.d.

#### 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.

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

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

4.3 First article inspection. First article inspection shall consist of the examination of 4.5 and tests specified in 4.6.1 and 4.6.2. Failure of the first article to pass any examination or test shall be cause for rejection.

4.4 Quality conformance inspection. Glass tubing samples shall be examined as specified in 4.5 and tested as specified in 4.6.1 and 4.6.2.

##### 4.4.1 Sampling.

4.4.1.1 Unit of sample. A unit of sample is defined as a glass tube of specified diameter. For purposes of sampling, a lot shall consist of all glass tubes of one size produced under essentially the same conditions and offered for delivery at one time.

4.4.1.2 Sampling for examination. Sampling for examination shall be in accordance with MIL-STD-105, with an acceptable quality level (AQL) of 1.5 percent defective for major defects and 2.5 percent defective for minor defects.

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4.4.1.3 Sampling for tests. Sampling for tests shall be in accordance with MIL-STD-105, inspection level S-1, with an AQL of 6.5 percent defective. If any sample fails to conform to this specification, this shall be cause for rejection of the lot.

4.5 Examination. Samples selected in accordance with 4.4.1.2 shall be examined for defects as specified in table I.

TABLE I. Classification of defects.

Critical	None defined
Major	
101	Condition of ends not as specified.
102	Outside diameter exceeds tolerance.
103	Length and bow exceeds tolerance.
104	Tubing has crack, break, bulges, blisters or scratches.
105	Tubing is warped or twisted.
106	Wall thickness not as specified.
107	Tubing is not both clear and transparent.
Minor	
201	Tubing has chipped or rough end.

#### 4.6 Test methods.

4.6.1 Thermal shock. Glass tubing shall be tested as follows: Place sample lengths in boiling water at  $212 \pm 2^\circ\text{F}$  and heat for 2 minutes. For the larger 7/8- and 1-inch diameter tubes, temperature shall be  $150 \pm 2^\circ\text{F}$ . At the end of the 2-minute period and while at  $212^\circ\text{F}$ , or  $150^\circ\text{F}$  for the larger tubes, remove same tubing from the heated water and immediately quench it in water at  $43 \pm 2^\circ\text{F}$ . Repeat this procedure (boiling at  $212^\circ\text{F}$  or heating to  $150^\circ\text{F}$ , then quenching at  $43^\circ\text{F}$ ) seven more times. Evidence of spalling, cracking or breaking (during or at the end of the test) of any glass tubing shall constitute a failure.

4.6.2 Hydrostatic pressure. Glass tubing shall be tested as follows: Install tubing in a liquid level gage mount, fill with water at  $75 \pm 5^\circ\text{F}$  and connect a 300 lbf/in<sup>2</sup> gage pressure supply of water, air or nitrogen gas to the upper fitting and pressurize for 5 minutes. To protect personnel from injury by flying glass particles, in the event of breakage, a heavy wire screen guard shall be clamped onto the gage fittings and a safety shield protector placed in front of the screened liquid level gage. After 5 minutes of pressurization, close-off and release pressure. This procedure shall be repeated two more times. Evidence of cracking or breaking of any glass shall constitute a failure.

4.7 Packaging inspection. Sample packages and packs, and inspection of packaging, packing, and marking for shipment and storage shall be in accordance with the requirements of section 5 of this specification.

4.7.1 Unit of sample. For the purpose of inspection, a completed pack prepared for shipment shall be considered a unit of product.

4.7.2 Sampling. Sampling for examination shall be in accordance with MIL-STD-105.

4.7.3 Examination. Samples selected in accordance with 4.7.2 shall be examined for the defects specified in table II. AQL shall be 2.5 percent defective.

TABLE II. Classification of defects (packaging).

Critical	None defined
Major	
101	Materials and containers not as specified for levels A and B. Each incorrect material and each incorrect container shall constitute one defect.
102	Each glass tubing not completely wrapped with paperboard cushioning for level A.
103	Intermediate packaging not as specified for level A.
104	Strapping not zinc coated for level A.
105	Marking illegible, incomplete, or incorrect.
Minor	None defined

## 5. PREPARATION FOR DELIVERY

(The preparation for delivery requirements specified herein apply only for direct Government procurements.)

5.1 Preservation. Preservation shall be level A, B, or C, as specified (see 6.2.1).

5.1.1 Level A. Each glass tubing shall be completely wrapped, including the ends, with cushioning material conforming to type I, style 1, of PPP-P-291. Cushioned glass tubing shall be packed in a box conforming to style II of PPP-B-566.

5.1.1.1 Intermediate pack. Packed glass tubing of like size shall be intermediate packed, in quantities not to exceed the weight limitation of the box, in boxes conforming to grade W6c, style optional of PPP-B-636, and appendix thereto.

5.1.2 Level B. Glass tubing shall be packed as specified for level A, except that the intermediate boxes shall be type CF, domestic class, variety SW, grade 275.

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5.1.3 Level C. Glass tubing shall be packed to afford protection against deterioration and physical damage during shipment from the supply source to the first receiving activity for immediate use. The contractor's normal retail or wholesale packaging methods may be used when such meet the requirements of this level.

5.2 Packing. Packing shall be level A, B, or C, as specified (see 6.2.1).

5.2.1 Level A. Glass tubing, packed as specified in 5.1, shall be packed in quantities not to exceed 200 pounds gross weight in boxes conforming to class 2, style optional of PPP-B-621, or overseas type, style optional of PPP-B-601. Boxes shall be closed and strapped in accordance with the appendix to the applicable box specification. Strapping shall be zinc coated.

5.2.2 Level B. Glass tubing, packed as specified in 5.1, shall be packed in quantities not to exceed the weight limitation of the box, in boxes conforming to grade V3c, style optional of PPP-B-636. Box closure, waterproofing, and reinforcing shall be in accordance with method V of the appendix to the box specification.

5.2.3 Level C. Glass tubing, packed as specified in 5.1, shall be packed in containers that will assure carrier acceptance and safe delivery at lowest rates in compliance with rules and regulations applicable to the mode of transportation selected.

5.3 Marking.

5.3.1 Civil agencies. In addition to any special marking required by the contract (see 6.2.1), interior packs and shipping containers shall be marked in accordance with FED-STD-123.

5.3.2 Military agencies.

5.3.2.1 Level A and B packaging and packing. In addition to any special markings required (see 6.2.1), interior (unit and intermediate) packs and exterior shipping containers shall be marked in accordance with MIL-STD-129, including "FRAGILE" markings.

5.3.2.2 Level C preservation and packing. Unit intermediate (when provided) packs and exterior packs shall, as a minimum, be marked as follows by any means which provides legibility and durability:

- (a) National Stock Number (NSN) or part number when NSN is not available.
- (b) Noun nomenclature.
- (c) Quantity and unit of issue.
- (d) Contract, purchase order, or delivery order number.
- (e) Additional markings as may be required (see 6.2.1).
- (f) Exterior shipping containers shall be marked with the appropriate address and caution marking except for full carloads or full truckloads to a single CONUS consignee.

- (g) One copy of the shipping documents and contract documentation shall be attached to the outside in an envelope or placed inside the container.
- (h) "FRAGILE" labels or markings such as "GLASS - DO NOT DROP OR THROW" or "GLASS - HANDLE WITH CARE".

## 6. NOTES

6.1 Intended use. Glass tubing is intended for use on low pressure boiler (250 lb/in maximum) and hot water tank gage glasses.

### 6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) When a first article is required for inspection and approval (see 3.1).
- (c) Condition of tubing ends required (e.g., firepolished, ground or as cut) (see 3.2).
- (d) Nominal diameter and length required (see 3.5).
- (e) Level of preservation and packing required (see 5.1 and 5.2).
- (f) Special markings required (see 5.3.1, 5.3.2.1, 5.3.2.2).

6.3 First article inspection. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection as to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.

6.4 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

#### MILITARY INTERESTS:

##### Custodians

Army - ME  
Navy - SH  
Air Force - 99

##### Review Activities

Air Force - 84  
DLA - GS

##### User Activities

Army - CE  
Navy - YD

#### CIVIL AGENCY COORDINATING ACTIVITIES:

GSA - FSS  
USDA - AFS

#### PREPARING ACTIVITY:

Navy - SH  
(Project 9340-0058)