Designation: A 822/A 822M – 04

# Standard Specification for Seamless Cold-Drawn Carbon Steel Tubing for Hydraulic System Service[1]

This standard is issued under the fixed designation A 822/A 822M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

## 1. Scope*

1.1 This specification covers nominal wall thickness, seamless, cold-drawn carbon steel tubing intended for use in hydraulic systems and in other similar applications where forming operations require tight radius bending and flaring.

1.2 Tubing sizes and thicknesses usually furnished to this specification are ⅛ to 3½ in. [3.2 to 88.9 mm] in outside diameter and 0.035 to 0.134 in. [0.9 to 3.4 mm] inclusive, in nominal wall thickness. Tubing having other dimensions may be furnished, provided such tubing complies with all other requirements of this specification.

1.3 Mechanical property requirements do not apply to tubing smaller than ⅛ in. [3.2 mm] in inside diameter or 0.015 in. [0.4 mm] in thickness.

1.4 Optional supplementary requirements are provided and, when desired, shall be so stated in the order.

1.5 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

## 2. Referenced Documents

2.1 *ASTM Standards:* [2]

A 450/A 450M Specification for General Requirements for Carbon, Ferritic Alloy, and Austenitic Alloy Steel Tubes

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

## 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *lot—for tension and hardness test requirements*—the term "lot" applies to all tubes, prior to cutting, of the same nominal diameter and wall thickness which are produced from the same heat of steel. When final heat treatment is in a batch-type furnace, a lot shall include only those tubes of the same size and the same heat which are heat treated in the same furnace charge. When the final heat treatment is in a continuous furnace, a lot shall include all tubes of the same size and heat, heat treated in the same furnace at the same temperature, time at heat, and furnace speed.

## 4. Ordering Information

4.1 Orders for material to this specification should include the following, as required, to describe the desired material adequately:

4.1.1 Quantity (feet, metres, or number of lengths),

4.1.2 Name of material (seamless tubing),

4.1.3 Manufacture (cold-drawn),

4.1.4 Tube size (outside diameter and nominal wall thickness),

4.1.5 Length (specific or random),

4.1.6 Test report required (see Certified Test Report section in Specification A 450/A 450M),

4.1.7 Specification designation, and

4.1.8 End use of material.

## 5. General Requirements

5.1 Material furnished under this specification shall conform to the applicable requirements of the latest edition of Specification A 450, unless otherwise provided herein.

## 6. Manufacture

6.1 Tubes shall be made by the seamless process and shall be cold drawn to size.

## 7. Heat Treatment

7.1 Tubes shall be heated after the final cold working operation to a temperature of at least 1200°F [650°C].

[1] This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel, and Related Alloys and is the direct responsibility of Subcommittee A01.09 on Carbon Steel Tubular Products.

Current edition approved March 1, 2004. Published March 2004. Originally approved in 1984. Last previous edition approved in 2000 as A 822–90 (2000).

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

***A Summary of Changes section appears at the end of this standard.**

Copyright © ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States.



Copyright ASTM International
Reproduced by IHS under license with ASTM
No reproduction or networking permitted without license from IHS
Not for Resale

## 8. Chemical Composition

8.1 Steel shall conform to the chemical composition requirements prescribed in Table 1.

## 9. Mechanical Properties

9.1 *Tensile Properties*—Material shall conform to the tensile properties prescribed in Table 2.

9.2 *Hardness Requirements*—Finished tubes shall have a hardness not exceeding 65 HRB. The hardness test shall not be required on tubing having a nominal wall thickness of less than 0.065 in. [1.7 mm].

9.3 *Flattening Test*—A section of finished tubing, not less than 3 in. [75 mm] in length shall not crack or exhibit flaws when flattened between parallel plates to a distance equal to three times the tubing nominal wall thickness. Superficial ruptures resulting from minor surface imperfections shall not be considered cause for rejection.

## 10. Permissible Variations in Dimensions

10.1 Permissible variations in the outside diameter of the tubing shall not exceed the values given in Table 3.

10.2 Permissible variations in the wall thickness of the tubing shall not exceed ±10 % for tubing having 0.50 in. [12.7 mm] or larger nominal outside diameter or more than ±15 % for tubing having a smaller nominal outside diameter.

## 11. Workmanship, Finish, and Appearance

11.1 Finished tubes shall be free of scale but may have a superficial oxide film on the surfaces.

11.2 Finished tubes shall be reasonably straight and have smooth ends free of burrs. Tubes shall have a workmanlike finish and shall be free of surface imperfections that cannot be removed within the allowable wall tolerances. Removal of surface imperfections, such as handling marks, straightening marks, light mandrel and die marks, shallow pits, and scale pattern, will not be required provided they are within the allowable tolerances.

11.3 Finished tubes shall be protected both on the outside and the inside diameter to prevent corrosion in transit. If a corrosion preventive compound is applied, it shall be such that after normal storage periods it can be readily removed by cleaning.

**TABLE 1 Chemical Requirements**

| Element | Composition, % |
|---|---|
| Carbon | 0.18 max |
| Manganese | 0.27 to 0.63 |
| Phosphorus | 0.048 max |
| Sulfur | 0.058 max |

**TABLE 2 Tensile Requirements**

| | |
|---|---|
| Tensile strength, min., ksi [MPa] | 45 [310] |
| Yield strength, min., ksi [MPa] | 25 [170] |
| Elongation, in 2 in. [or 50 mm], min., % | 35 |

**TABLE 3 Tubing Outside Diameter Tolerances**

| Nominal Tubing Outside Diameter,[A] in. [mm] | Outside Diameter Tolerance, in. [mm] |
|---|---|
| Up to 1 [25] | ±0.004 [0.10] |
| 1 to 1½ [25 to 38] | ±0.006 [0.15] |
| Over 1½ to 2 [38 to 50], inclusive | ±0.008 [0.20] |
| Over 2 to 3½ [50 to 90], inclusive | ±0.010 [0.25] |

[A] The actual outside diameter shall be the average of the maximum and minimum outside diameters as determined at any one cross-section through the tubing.

## 12. Number of Tests

12.1 One tension test, flaring test, flattening test, and hardness test shall be made on each lot of tubes.

## 13. Hydrostatic Proof Test

13.1 Tubing supplied under this specification shall have been tested hydrostatically, with no evidence of failure or permanent deformation, at a pressure that will subject the material to a hoop stress of 20 000 psi [140 MPa]. Test pressures shall be determined as follows:

$$P = \frac{2TS}{D}$$

where:

$D$ = outside diameter of tubing, in. [mm],
$P$ = hydrostatic pressure, psi [MPa],
$S$ = allowable stress = 20 000 psi [140 MPa], and
$T$ = minimum wall thickness of tubing, in. [mm].

13.2 No tube shall be tested beyond a hydrostatic pressure of 5000 psi [35 MPa], unless so specified on the purchase order.

## 14. Packaging and Package Marking

14.1 Tubing shall be packaged or bundled in such a manner as to prevent damage in ordinary handling and transportation.

14.2 Tubing shall be identified by a tag with the name of the manufacturer, purchase order number, specification designation, and size.

## 15. Keywords

15.1 carbon; pressure-containing parts; seamless steel tube; steel tube



Copyright ASTM International
Reproduced by IHS under license with ASTM
No reproduction or networking permitted without license from IHS
Not for Resale

## SUPPLEMENTARY REQUIREMENTS

The following supplementary requirement may become a part of the specification when specified in the inquiry or invitation to bid, and purchase order or contract. These requirements shall not be considered, unless specified in the order, in which event the necessary tests shall be made by the manufacturer prior to shipment of the tubing.

### S1. Product Analysis

S1.1 Product analysis shall be made by the supplier from one tube per heat of steel. If the original test for product analysis fails, retests of two additional lengths of tubes shall be made. Both retests shall meet the requirements of this specification for the elements in question; otherwise, all remaining material in the heat shall be rejected or, at the option of the producer, each length of tube may be individually tested for acceptance. Lengths of tubes which do not meet the requirements of this specification shall be rejected.

## SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (A 822–90 (2000)) that may impact the use of this standard.

*(1)* Revised standard text and tables to include rationalized SI units and create a combined standard.

*ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

*This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.*

*This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).*



Copyright ASTM International
Reproduced by IHS under license with ASTM
No reproduction or networking permitted without license from IHS
Not for Resale