



Designation: **F29–97 (Reapproved 2012) F29 – 97 (Reapproved 2017)**

Standard Specification for Dumet Wire for Glass-to-Metal Seal Applications¹

This standard is issued under the fixed designation F29; 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 round, copper-coated 42 % nickel-iron wire, commonly known as dumet, intended primarily for sealing to soft glass.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

[B170 Specification for Oxygen-Free Electrolytic Copper—Refinery Shapes](#)

[D1535 Practice for Specifying Color by the Munsell System](#)

[D1729 Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials](#)

[E3 Guide for Preparation of Metallographic Specimens](#)

[E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications](#)

[E53 Test Method for Determination of Copper in Unalloyed Copper by Gravimetry](#)

[E228 Test Method for Linear Thermal Expansion of Solid Materials With a Push-Rod Dilatometer](#)

[F14 Practice for Making and Testing Reference Glass-Metal Bead-Seal](#)

3. Ordering Information

3.1 The wire is usually supplied with a surface coating consisting of a mixture of copper oxides and fused sodium tetraborate (borax) which retards oxidation of the wire during sealing in glass and further aids wetting of the wire by the glass. The composite wire may also be purchased as bare wire for specific applications.

3.2 The size of the wire, if applicable, the borate color range designated as light, medium (regular), or dark, shall be specified on each purchase order.

3.3 Package sizes shall be agreed upon between the purchaser and the seller.

4. Chemical Composition

4.1 The copper used in the manufacture of dumet shall be 99.90 % minimum copper. Silver shall be included with the copper. The material shall be free of reducible oxides.

4.2 The chemical composition of the nickel-iron core shall be as shown in [Table 1](#).

¹ This specification is under the jurisdiction of ASTM-Committee F01 on Electronics and is the direct responsibility of Subcommittee F01.03 on Metallic Materials. Current edition approved July 1, 2012/June 1, 2017. Published August 2012/June 2017. Originally approved in 1963. Last previous edition approved in 2009/2012 as F29 – 97(2009); F29 – 97(2012). DOI: 10.1520/F0029-97R12; 10.1520/F0029-97R17.

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.

TABLE 1 Chemical Requirements: Core Material

Element	Composition, %
Nickel	41 to 43
Manganese	0.75 to 1.25
Silicon, max	0.30
Carbon, max	0.10
Sulfur, max	0.02
Phosphorus, max	0.02
Iron (by difference)	remainder

TABLE 2 Color Ranges and Limits

Dark Range	Medium (Regular) Range	Light Range
Colors darker than chip 3.5R 3.94/8.0	3.5R 3.94/8.0 to 6.5R 4.06/8.0, incl	7.5R 4.22/8.0 to 0.5YR 4.56/8.0 incl

TABLE 3 Dimensional Tolerances

Diameter, in. (mm)	Tolerance, in. (mm)
0.007 to 0.013 (0.18 to 0.33)	±0.0003 (±0.008)
Over 0.013 to 0.018 (0.33 to 0.46)	±0.0004 (±0.010)
Over 0.018 (0.46)	±0.0005 (±0.013)

5. Oxide Coating

5.1 The primary standards for the entire range of colors are divided into three groups covering light, medium (regular), and dark as shown, with their respective limits, in Fig. 1 and Table 2 (Note 1). The color range of the specimens shall be determined in accordance with 9.2.

NOTE 1—Color chip 2.5R 3.90/8.0 may be included in the dark range merely to extend the color series for assisting the viewer in making a better decision regarding the cut-off point between medium (regular) and dark dumet.

6. Thermal Expansion

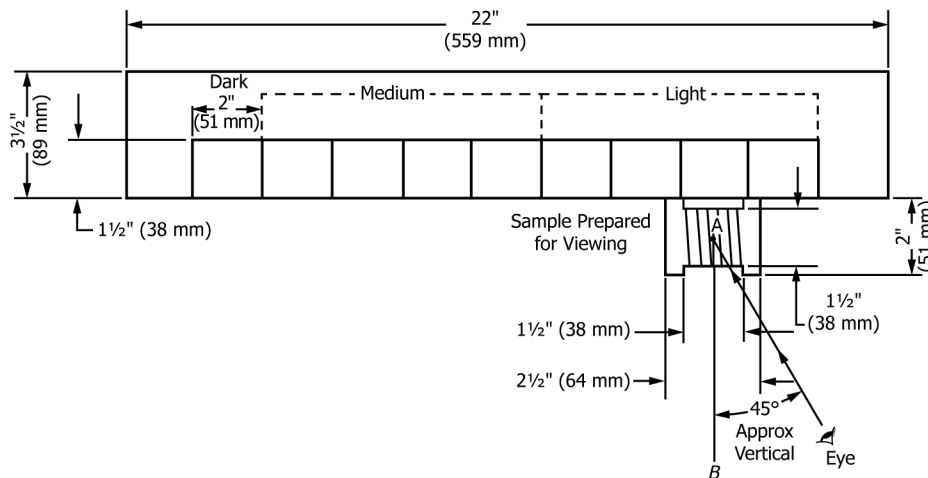
6.1 The nominal values for the average coefficient of linear thermal expansion shall be as follows when determined in accordance with 9.1:

6.1.1 *Core*— $63 \text{ to } 72 \times 10^{-7} \text{ in./in.}\cdot\text{deg } ^\circ\text{C}$ (mm/mm-deg °C) over the temperature range of 30 to 400°C.

6.1.2 *Copper*— $177 \pm 3.5 \times 10^{-7} \text{ in./in.}\cdot^\circ\text{C}$ (mm/mm-deg °C) over the temperature range of 30 to 300°C.

7. Dimensional Tolerances

7.1 The specified diameters shall conform to the tolerances given in Table 3.



NOTE 1—Wire winding shall be in the same plane as shown and the specimen in the same plane as the color chips. The specimen shall be viewed along direction AB at an inclined angle as illustrated.

FIG. 1 Arrangement of Color Chips for Specimen Comparison