



Designation: B467 – 14 (Reapproved 2022)

Standard Specification for Welded Copper-Nickel Pipe¹

This standard is issued under the fixed designation B467; 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 establishes the requirements for welded copper-nickel alloy pipe for general engineering purposes. The following alloys are covered:²

Copper Alloy UNS No. ²	Type of Metal
C70600	90-10 copper-nickel
C70620	90-10 copper-nickel (Modified for Welding)
C71500	70-30 copper-nickel
C71520	70-30 copper-nickel (Modified for Welding)

1.2 *Units*—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 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:³

- [B153 Test Method for Expansion \(Pin Test\) of Copper and Copper-Alloy Pipe and Tubing](#)
- [B601 Classification for Temper Designations for Copper and Copper Alloys—Wrought and Cast](#)
- [B846 Terminology for Copper and Copper Alloys](#)
- [B950 Guide for Editorial Procedures and Form of Product Specifications for Copper and Copper Alloys](#)
- [B968/B968M Test Method for Flattening of Copper and Copper-Alloy Pipe and Tube](#)
- [E8/E8M Test Methods for Tension Testing of Metallic Materials](#)
- [E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications](#)
- [E54 Test Methods for Chemical Analysis of Special Brasses and Bronzes \(Withdrawn 2002\)⁴](#)
- [E62 Test Methods for Chemical Analysis of Copper and Copper Alloys \(Photometric Methods\) \(Withdrawn 2010\)⁴](#)
- [E243 Practice for Electromagnetic \(Eddy Current\) Examination of Copper and Copper-Alloy Tubes](#)
- [E255 Practice for Sampling Copper and Copper Alloys for the Determination of Chemical Composition](#)
- [E478 Test Methods for Chemical Analysis of Copper Alloys](#)

¹ This specification is under the jurisdiction of ASTM Committee B05 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.04 on Pipe and Tube.

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² The UNS system for copper and copper alloys is a simple expansion of the former standard designation system accomplished by the addition of a prefix “C” and a suffix “00.” The suffix can be used to accommodate composition variations of the base alloy.

³ 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.

- [2.2 ASME Code:⁵](#)
- [ASME Boiler and Pressure Vessel Code Application](#)
- [2.3 AWS Standards:⁶](#)
- [A5.6/A5.6M Specification for Copper and Copper - Alloy Electrodes for Shielded Metal Arc Welding](#)
- [A5.7/A5.7M Specification for Copper and Copper - Alloy Bare Welding Rods and Electrodes](#)

3. Terminology

3.1 For the definitions of terms related to copper and copper alloys, refer to Terminology [B846](#).

4. Types of Welded Pipe

4.1 *As-Welded*—Pipe that has been welded with no further work performed other than straightening or cutting to length, or both.

4.2 *Welded and Annealed*—Welded pipe that has been annealed to produce a uniform grain size appropriate to the specified annealed temper.

⁴ The last approved version of this historical standard is referenced on www.astm.org.

⁵ Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

⁶ Available from American Welding Society (AWS), 8669 NW 36th Street, #130, Miami, FL 33166, <http://www.aws.org>.

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

4.3 *Welded and Cold Drawn*—Welded pipe with internal flash removed by scarfing, and subsequently cold drawn to conform to the specified temper.

4.4 *Fully Finished*—Welded pipe with internal and external flash removed by scarfing and the pipe or tube subsequently cold drawn over a mandrel and annealed as necessary to conform to the specified temper.

5. Ordering Information

5.1 Include the following specified choices when placing orders for product under this specification, as applicable.

- 5.1.1 ASTM designation and year of issue,
- 5.1.2 Copper Alloy UNS No. (Section 1 and Table 1),
- 5.1.3 Temper (Section 8),
- 5.1.4 Dimensions: diameter and wall thickness (12.2 and 12.3),
- 5.1.5 Lengths: whether specific or stock (12.4),
- 5.1.6 Quantity of each size,
- 5.1.7 If the product is to be subsequently welded,
- 5.1.8 Packaging and Package Marking (Section 23), and
- 5.1.9 Intended application.

5.2 The following options are available but may not be included unless specified at the time of placing the order when required.

- 5.2.1 Heat identification or traceability requirements, or both (see 14.2.1.4).
- 5.2.2 Certifications (see Section 21).
- 5.2.3 Test report (see Section 22).
- 5.2.4 Radiographic examination: whether or not required (see Section 11),
- 5.2.5 Source inspection: whether or not required (19.2),
- 5.2.6 Hydrostatic test (see 11.3),
- 5.2.7 When product is ordered for *ASME Boiler and Pressure Vessel Code Application*,
- 5.2.8 Type of *flash* to be furnished (6.3),
- 5.2.9 Pneumatic Test (see 11.3.2).

6. Materials and Manufacture

6.1 Material:

6.1.1 The material of manufacture shall be strip of one of the Copper Alloy UNS Nos. listed in 1.1 of such purity and soundness as to be suitable for processing into the products prescribed herein.

6.1.2 In the event heat identification or traceability is required, the purchaser shall specify the details desired.

6.2 Manufacture:

6.2.1 The product shall be manufactured by forming the material into a tubular shape and welded on a suitable forming mill.

6.3 Flash:

6.3.1 If the pipe is made by the high-frequency welding process, the external flash shall always be removed. The internal flash shall be treated as one of the following:

6.3.1.1 *IFI*—Internal flash to remain in the “as-welded” condition,

6.3.1.2 *IFR*—Internal flash to be removed by scarfing, or

6.3.1.3 *IFD*—Internal flash to be displaced.

6.3.2 Unless otherwise specified, the IFI condition will be furnished.

6.4 Filler Material:

6.4.1 Filler material, if used in the welding process, shall conform to Classification ECuNi of AWS Specification A5.6/A5.6M or RCuNi of AWS Specification A5.7/A5.7M.

7. Chemical Composition

7.1 The material shall conform to the chemical requirements specified in Table 1.

7.2 These specification limits do not preclude the presence of other elements. Limits for unnamed elements may be established by agreement between manufacturer or supplier and purchaser.

7.2.1 For copper alloys in which copper is specified as the remainder, copper may be taken as the difference between the sum of all the elements analyzed and 100 %.

7.2.1.1 When all the elements in Table 1 are analyzed, their sum shall be 99.5 % minimum.

8. Temper

8.1 Tempers, as defined in Classification B601 and this specification, are as follows:

8.1.1 The pipe shall be supplied in any one of the following tempers as specified and shall meet the mechanical requirements of Table 2, Table 3, or Table 4:

8.1.1.1 As welded from annealed sheet, strip, or plate (WM50),

8.1.1.2 As welded from cold-worked sheet, strip, or plate (WM00, WM01, WM02, etc.).

8.1.1.3 Welded and light annealed (WO50),

TABLE 1 Chemical Requirements

Element	Composition, %						Other Named Alloys
Copper or Copper Alloy by UNS No	Copper (incl silver)	Nickel (incl Cobalt)	Lead, max	Iron	Zinc, max	Manganese	
C70600 ^A	Remainder	9.0–11.0	0.05	1.0–1.8	1.0	1.0	
C70620 ^A	86.5 min	9.0–11.0	.02	1.0–1.8	.50	1.0	C .05 max P .02 max S .02 max
C71500 ^A	Remainder	29.0–33.0	0.05	.40–1.0	1.0	1.0	
C71520 ^A	65.0 min	29.0–33.0	.02	.40–1.0	.50	1.0	C .05 max P .02 max S .02 max

^A Cu + Sum of Named Elements, 99.5 % min.

TABLE 2 Mechanical Requirements of As-Welded and Fully Finished Pipe When Furnished in the Annealed Temper (WO61)

Copper Alloy UNS No.	Outside Diameter, in. (mm)	Tensile Strength, min, ksi ^A (MPa) ^B	Yield	Elongation in 2 in. (50.8 mm), min, %
			Strength at 0.5 % Extension Under Load, min, ksi ^A (MPa) ^B	
C70600	up to 4½ (114), incl	40 (275)	15 (105)	25.0
	over 4½ (114)	38 (260)	13 (90)	25.0
C70620	up to 4½ (114), incl	40 (275)	15 (105)	25.0
	over 4½ (114)	38 (260)	13 (90)	25.0
C71500	up to 4½ (114), incl	50 (345)	20 (140)	30.0
	over 4½ (114)	45 (310)	15 (105)	30.0
C71520	up to 4½ (114), incl	50 (345)	20(140)	30.0
	over 4½ (114)	45 (310)	15 (105)	30.0

^A ksi = 1000 psi.

^B See Appendix X2.

TABLE 3 Mechanical Requirements of Welded and Cold-Drawn and Fully Finished Pipe in Drawn Tempers

Copper Alloy UNS No.	Outside Diameter, in. (mm)	Tensile Strength, min, ksi ^A (MPa) ^B	Yield	Elongation in 2 in. (50.8 mm), min, %
			Strength at 0.5 % Extension Under Load, min, ksi ^A (MPa) ^B	
C71500	up to 2 (50.8), incl, for wall thicknesses up to 0.048 (1.21 mm), incl.	72 (495)	50 (345)	12.0
	for wall thicknesses over 0.048 in. (1.21 mm)	72 (495)	50 (345)	15.0
C71520	up to 2 (50.8), incl, for wall thicknesses up to 0.048 (1.21 mm), incl.	72 (495)	50 (345)	12.0
	for wall thicknesses over 0.048 in. (1.21 mm)	72 (495)	50 (345)	15.0

^A ksi = 1000 psi.

^B See Appendix X2.

TABLE 4 Mechanical Requirements of As-Welded Pipe

Copper Alloy UNS No.	Condition	Outside Diameter, in. (mm)	Tensile	Yield
			Strength, min, ksi (MPa)	Strength at 0.5 % Extension Under Load, min, ksi (MPa)
C70600	welded from annealed strip	up to 4½ (114), incl	45 (310)	30 (205)
	welded from cold-rolled strip	up to 4½ (114), incl	54 (375)	45 (310)
C70620	welded from annealed strip	up to 4½ (114), incl	45 (310)	30 (205)
	welded from cold-rolled strip	up to 4½ (114), incl	54 (375)	45 (310)

8.1.1.4 Welded and cold drawn in either light drawn, eight hard (Copper Alloy UNS No. C70600 and C70620 only) or hard drawn and stress relieved (WR00), (WR04), or

8.1.1.5 Fully finished welded and annealed (WO61).

9. Mechanical Property Requirements

9.1 Tensile Strength Requirements:

9.1.1 Product furnished under this specification shall conform to the tensile and yield strength requirements prescribed

in Table 2, Table 3, or Table 4 when tested in accordance with Test Methods E8/E8M.

10. Performance Requirements

10.1 Expansion Test Requirements:

10.1.1 The annealed pipe shall be capable of (see 8.1.1.1 and 8.1.1.3) being expanded in accordance with Test Method B153 to 30 % of its outside diameter. Pipe supplied in the “as welded” condition shall be expanded to 20 % of its outside diameter.

10.1.2 The annealed ends of pipe furnished end annealed shall be capable of being expanded 30 % of its outside diameter in accordance with Test Method B153.

10.1.3 The expanded tube area shall be free of defects, but blemishes of a nature that do not interfere with the intended application are acceptable.

10.1.4 Pipe furnished in other tempers is not subject to this test

10.2 Flattening Test Alternative:

10.2.1 As an alternative to the expansion test for product over 4 in. (102 mm) in diameter, the flattening test described in the Test Method section in Test Method B968/B968M may be performed.

11. Nondestructive Tests for Pipe

11.1 Radiographic Examination—Radiographic examination of the welds shall be as agreed upon.

11.2 Eddy-Current Test—Each pipe of nominal outside diameter within the capabilities of the eddy-current tester shall be subjected to an eddy-current test. Testing shall follow the procedures of Practice E243. The pipe shall be passed through an eddy-current testing unit adjusted to provide information on the suitability of the material for the intended application.

11.2.1 Notch depth standards rounded to the nearest 0.001 in. (0.025 mm) shall be 22 % of the nominal wall thickness. The notch depth tolerance shall be ±0.0005 in. (0.013 mm).

11.2.1.1 Pipe that does not actuate the signaling device of the eddy-current tester shall be considered as conforming to the requirements of this test. Pipe with discontinuities indicated by the testing unit may be reexamined or retested, at the option of the manufacturer, to determine whether the discontinuity is cause for rejection. Signals that are found to have been caused by minor mechanical damage, soil, or moisture, shall not be cause for rejection of the pipe, provided the dimensions are still within prescribed limits and the pipe is suitable for its intended application.

11.2.2 As an alternate to the Eddy Current test, the manufacturer shall have the option to perform a Hydrostatic Test (11.3.1).

11.3 Hydrostatic Test Alternative—As an alternative to the eddy current test for tubes above 2.000 in. (50.8 mm), the manufacturer shall have the option to perform the hydrostatic test to the tests described in 11.3.1 and 11.3.2.

11.3.1 Hydrostatic Test—When specified, the pipe shall withstand, without showing weakness or defects, an internal hydrostatic pressure sufficient to subject the material to a fiber stress of 7000 psi (48 MPa), determined by the following equation for thin hollow cylinders under tension. The pipe need