



Designation: B 474 – 99

Standard Specification for Electric Fusion Welded UNS N08020, UNS N08024, and UNS N08026 Nickel Alloy Pipe¹

This standard is issued under the fixed designation B 474; 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 electric fusion welded UNS N08020, UNS N08026, and UNS N08024* pipe suitable for high-temperature or corrosive service. (Although no restrictions are placed on the sizes of pipe that may be furnished under this specification, commercial practice is commonly limited to sizes not less than 8 in. (203 mm) nominal diameter.)

1.2 Two types of pipe are covered as follows:

1.2.1 *Type I*—All welded joints to be completely examined by radiography.

1.2.2 *Type II*—No radiographic examination required.

1.3 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

2. Referenced Documents

2.1 *ASTM Standards*:

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products²

B 463 Specification for UNS N08020, UNS N08026, and UNS N08024 Alloy Plate, Sheet, and Strip³

E 8 Test Methods for Tension Testing of Metallic Materials⁴

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications⁵

E 1473 Test Method for Chemical Analysis of Nickel, Cobalt, and High Temperature Alloys⁶

2.2 *American Society of Mechanical Engineers Standard*: ASME Boiler and Pressure Vessel Code, Section IX⁷

2.3 *American Welding Society Standards*:

A5.4 Corrosion-Resisting Chromium and Chromium Nickel

Steel Covered Welding Electrodes⁸

A5.9 Corrosion-Resisting Chromium and Chromium Nickel Steel Welding Rods and Bare Electrodes⁸

A5.11 Nickel and Nickel Alloy Covered Welded Electrodes⁸

A5.14 Nickel and Nickel Alloy Bare Welding Rods and Electrodes⁸

3. Ordering Information

3.1 It is the responsibility of the purchaser to specify all requirements that are necessary for the safe and satisfactory performance of material ordered under this specification. Examples of such requirements include, but are not limited to, the following:

3.1.1 Quantity (feet or number of lengths),

3.1.2 Name of material or UNS number,

3.1.3 Type (1.2),

3.1.4 Size (outside diameter and minimum wall thickness),

3.1.5 Length (specific or random),

3.1.6 ASTM designation and year of issue,

3.1.7 Authorization for repair of plate defects by welding without prior approval if such is intended (see 8.4),

3.1.8 Circumferential weld permissibility (see 7.3.2), and

3.1.9 Supplementary requirements.

4. Materials and Manufacture

4.1 *Materials*—The plate material shall conform to the requirements of Specification B 463.

4.2 *Manufacture*:

4.2.1 The joints shall be double-welded, full-penetration welds made in accordance with procedures and by operators qualified in accordance with the ASME Boiler and Pressure Vessel Code, Section IX.

4.2.2 The welds shall be made either manually or automatically by an electric process involving the deposition of filler metal.

4.2.3 The weld surface on either side of the weld shall be flush with the base plate or shall have a reasonably uniform crown, not to exceed 1/8 in. (3.2 mm). Any weld reinforcement may be removed at the manufacturer's option or by agreement

¹ This specification is under the jurisdiction of ASTM Committee B-2 on Nonferrous Metals and Alloys and is the direct responsibility of Subcommittee B02.07 on Refined Nickel and Cobalt and Their Alloys.

Current edition approved May 10, 1999. Published June 1999. Originally published as B 474 – 68. Last previous edition B 474 – 94.

* New designation established in accordance with ASTM E 527 and SAE J 1086, Practice for Numbering Metals and Alloys (UNS).

² *Annual Book of ASTM Standards*, Vol 01.03.

³ *Annual Book of ASTM Standards*, Vol 02.04.

⁴ *Annual Book of ASTM Standards*, Vol 03.01.

⁵ *Annual Book of ASTM Standards*, Vol 14.02.

⁶ *Annual Book of ASTM Standards*, Vol 03.06.

⁷ Available from the American Society of Mechanical Engineers, 345 E. 47th St., New York, NY 10017.

⁸ Available from the American Welding Society, 2501 N.W. Seventh St., Miami, FL 33125.



between the manufacturer and purchaser. The contour of the reinforcement shall be reasonably smooth and free of irregularities. The deposited metal shall be fused uniformly into the plate surface. No concavity of contour is permitted unless the resulting thickness of weld metal is equal to or greater than the minimum thickness of the adjacent base metal.

4.2.4 Weld defects shall be repaired by removal to sound metal and rewelding. Subsequent heat treatment and inspection shall be as required on the original welds.

4.3 *Heat Treatment*— The product of UNS N08020 alloy shall be furnished in the stabilized-annealed condition. The product of UNS N08026 alloy shall be furnished in the solution-annealed condition. The product of UNS N08024 alloy shall be furnished in the annealed condition.

NOTE 1—The recommended annealing temperatures all followed by quenching in water or rapidly cooling by other means are as follows: 1700 to 1850°F (927 to 1010°C) for UNS N08020, 2050 to 2200°F (1121 to 1204°C) for UNS N08026, and 1925 to 1975°F (1052 to 1079°C) for UNS N08024.

5. Chemical Composition

5.1 The chemical composition of the pipe shall conform to the requirements in Table 1 of Specification B 463.

5.2 For UNS N08020 pipe, the alloy content of the deposited weld metal shall conform to that required for the plate or the welding electrodes as shown in Specification AWS A5.4 for E-320, or E-320LR and in Specification AWS 5.9 for ER-320 or ER-320LR. For UNS N08026, the alloy content of the deposited weld metal shall conform to that required for the plate or the welding electrodes as shown in Specification AWS A5.11 for E-Ni-Cr-Mo-3 and in Specification AWS 5.14 for Er-Cr-Ni-Mo-3. For UNS N08024, the alloy content of the deposited weld metal shall conform to that required for the plate.

5.3 If product analysis is made of the plate or weld metal by the purchaser, the chemical composition thus determined shall conform to the requirements specified in 5.1 and 5.2 subject to the permissible tolerances in Table 2 of Specification B 463.

6. Mechanical and Other Properties

6.1 Mechanical Properties:

6.1.1 The mechanical properties of the plate shall be in accordance with Table 1. Tension tests made by the plate manufacturer shall qualify the plate material.

6.1.2 Transverse tension tests taken across the welded joint shall have the same minimum ultimate tensile strength as the specified minimum ultimate tensile strength of the plate.

6.2 *Transverse Guided Weld Bend Test Requirements*— Bends made in accordance with Fig. 2 shall be acceptable if no cracks or other imperfections exceeding $\frac{1}{8}$ in. (3.2 mm) in any

direction are present in the weld metal or between the weld and the pipe metal after bending. Cracks that originate along the edges of the specimen during testing, and that are less than $\frac{1}{4}$ in. (6.3 mm) measured in any direction shall not be considered.

6.3 *Pressure Test*— Any pipe that shows leaks during the pressure test conducted in accordance with 12.4 shall be rejected but any leaking areas may be cut out and the pipe retested as above.

6.4 *Radiographic Examination*—Type I welded joints shall be completely examined by radiography.

7. Dimensions and Permissible Variations

7.1 Permissible variations in dimensions at any point in a length of pipe shall not exceed the following:

7.1.1 *Outside Diameter*— Based on circumferential measurement, ± 0.5 % of the nominal outside diameter.

7.1.2 *Out-of-Roundness*— Differences between major and minor outside diameters, 1.0 % of the specified outside diameter.

7.1.3 *Alignment (Camber)*—Using a 10-ft (3-m) straight-edge placed so that both ends are in contact with the pipe, the camber shall not be more than $\frac{1}{8}$ in. (3.17 mm).

7.2 *Thickness*—The minimum wall thickness at any point in the pipe shall not be more than 0.01 in. (0.25 mm) under the nominal thickness.

7.3 Lengths:

7.3.1 The lengths required shall be specified in the orders.

7.3.2 Circumferentially welded joints of the same quality as the longitudinal joints shall be permitted by agreement between the manufacturer and the purchaser.

8. Workmanship, Finish, and Appearance

8.1 Pipe shall be furnished with smooth ends, free of burrs.

8.2 The finished pipe shall be free of injurious defects and shall have a workmanlike finish.

8.3 *Repair of Plate Defects by Machining or Grinding*— Pipe showing moderate slivers may be machined or ground inside or outside to a depth that shall ensure the removal of all included scale and slivers, provided the wall thickness is not reduced below the specified minimum wall thickness. Machining or grinding shall follow inspection of the pipe as rolled and shall be followed by supplementary visual inspection.

8.4 *Repair of Plate Defects by Welding*—Repair of injurious defects shall be permitted only with the approval of the purchaser. Defects shall be thoroughly chipped out before welding. The repairs shall be radiographed and if the pipe itself has already been heat treated, it shall then be heat treated again except in the case of small welds that, in the estimation of the purchaser's inspector, do not require heat treatment. Each length of pipe repaired in this manner shall be hydrostatically tested after being repaired.

8.5 The pipe shall be sandblasted or pickled to remove all scale and then passivated.

9. Sampling

9.1 *Lots for Chemical Analysis and Mechanical Testing:*

9.1.1 *Heat Analysis*— A lot shall consist of one heat.

9.1.2 *Mechanical Testing*—A lot shall consist of the material of the same nominal size from one heat and

TABLE 1 Mechanical Property Requirements

Tensile Strength, min		Yield Strength, ^A min		Elongation in 2 in. or 50 mm, min, %
ksi	MPa	ksi	MPa	
80	551	35	241	30.0

^A Yield strength shall be determined by the offset method at 0.2 % limiting permanent set in accordance with Test Methods E 8. An alternative method of determining yield strength may be based on a total extension under load of 0.5 %.