



Designation: A 523 – 96 (Reapproved 2001)

## Standard Specification for Plain End Seamless and Electric-Resistance-Welded Steel Pipe for High-Pressure Pipe-Type Cable Circuits<sup>1</sup>

This standard is issued under the fixed designation A 523; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This specification covers seamless and electric-resistance-welded steel pipe used as conduit for the installation of high-pressure pipe-type electrical cables in NPS 4 to NPS 12, inclusive, with nominal (average) wall thicknesses 0.219 to 0.562 in., depending on size. Pipe having other dimensions (Note 2) may be furnished, provided such pipe complies with all other requirements of this specification.

NOTE 1—The dimensionless designator NPS (nominal pipe size) has been substituted in this standard for such traditional terms as “nominal diameter,” “size,” and “nominal size.”

NOTE 2—A comprehensive listing of standardized pipe dimensions is contained in ANSI B36.10.

1.2 Pipe ordered under this specification is suitable for welding and for forming operations involving flaring, belling, and bending.

1.3 Pipe for this purpose shall be furnished in Grade A or Grade B as specified in the purchase order. Grade A is more suitable for forming operations involving bending, flaring, or belling and this grade is normally preferred. This provision is not intended to prohibit the cold bending, flaring, or belling of Grade B pipe.

1.4 The values stated in inch-pound units are to be regarded as the standard.

1.5 The following hazard caveat applies to the test method portion, Section 20, of this specification: *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.*

### 2. Referenced Documents

#### 2.1 ASTM Standards:

<sup>1</sup> 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 Oct. 10, 1996. Published November 1997. Originally published as A 523 – 64. Last previous edition A 523 – 93.

This specification was initiated by the IEEE Insulated Conductors Committee in recognition of the need for a specification embodying the special requirements of pipe for high-voltage electrical circuits. It was prepared for acceptance as an ASTM specification by a task group of Subcommittee A01.09 of ASTM Committee A-1.

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products<sup>2</sup>

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products<sup>2</sup>

E 59 Method of Sampling Steel and Iron for Determination of Chemical Composition<sup>3</sup>

2.2 *ANSI Standard:*

B36.10 Welded and Seamless Wrought Steel Pipe<sup>4</sup>

### 3. Ordering Information

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

3.1.1 Quantity (feet or number of lengths),

3.1.2 Name of material (steel pipe),

3.1.3 Method of manufacture (seamless or electric-resistance-welded),

3.1.4 Grade (Table 1),

3.1.5 Size (outside diameter and nominal wall thickness or weight per foot),

3.1.6 Length when other than specified in Section 13,

3.1.7 End finish (Section 16),

3.1.8 Skelp for tension tests, if permitted 20.2, 962001

3.1.9 When mill applied coating is required (Section 10), and

3.1.10 ASTM specification number.

### 4. Process

4.1 The steel shall be made by one or more of the following processes: open-hearth, basic-oxygen, or electric-furnace.

4.2 Steel may be cast in ingots or may be strand cast. When steels of different grades are sequentially strand cast, identification of the resultant transition material is required. The producer shall remove the transition material by any established procedure that positively separates the grades.

### 5. Chemical Composition

5.1 The steel shall conform to the requirements as to chemical composition prescribed in Table 2 and the chemical

<sup>2</sup> *Annual Book of ASTM Standards*, Vol 01.03.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 03.05.

<sup>4</sup> Available from American National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036.



**TABLE 1 Tensile Requirements**

	Grade A	Grade B
Tensile strength, min, ksi (MPa)	48 (330)	60 (415)
Yield strength, min, ksi (MPa)	30 (205)	35 (240)
Elongation in 2 in. or 50 mm, %:		
Basic minimum elongation for walls 5/16 in. (7.94 mm) and over in thickness, longitudinal strip tests, and for small sizes tested in full section.	35	30
When standard round 2-in. or 50-mm gage length test specimen is used	28	22
For longitudinal strip tests, the width of the gage section shall be 1 1/2 in. (38.1 mm) and a deduction for each 1/32 in. (0.79 mm) decrease in wall thickness below 5/16 in. (7.94 mm) from the basic minimum elongation of the following percentage points	1.75 <sup>A</sup>	1.50 <sup>A</sup>

<sup>A</sup> The following table<sup>B</sup> gives the minimum computed values:

Wall Thickness		Elongation in 2 in. or 50 mm, min, %	
in.	mm	Grade A	Grade B
5/16 (0.312)	7.94	35.0	30.0
3/32 (0.281)	7.14	33.2	28.5
1/4 (0.250)	6.35	31.5	27.0
7/32 (0.219)	5.56	29.8	25.5
3/16 (0.188)	4.76	28.0	24.0
5/32 (0.156)	3.97	26.2	22.5
1/8 (0.125)	3.18	24.5	21.0
3/32 (0.094)	2.38	22.8	19.5
1/16 (0.062)	1.59	21.0	18.0

<sup>B</sup> This table gives the computed minimum elongation values for each 1/32 in. (0.79 mm) decrease in wall thickness. Where the wall thickness lies between two values shown above, the minimum elongation value shall be determined by the following equation:

Grade	Equation
A	$E = 56t + 17.50$
B	$E = 48t + 15.00$

where:

$E$  = elongation in 2 in. or 50 mm, %, and  
 $t$  = actual thickness of specimen, in.

**TABLE 2 Chemical Requirements**

	Composition, %								
	Carbon, max		Manganese, max		Phosphorus, max		Sulfur, max		
	Heat	Product	Heat	Product	Heat	Product	Heat	Product	
Grade A									
Seamless	0.22	0.25	0.90	0.95	0.035	0.045	0.050	0.060	
E.R.W. <sup>A</sup>	0.21	0.25	0.90	0.95	0.035	0.045	0.050	0.060	
Grade B									
Seamless	0.27	0.30	1.15	1.20	0.035	0.045	0.050	0.060	
E.R.W. <sup>A</sup>	0.26	0.30	1.15	1.20	0.035	0.045	0.050	0.060	

<sup>A</sup> Electric-Resistance-Welded pipe.

analysis shall be in accordance with Test Methods, Practices, and Terminology A 751.

**6. Heat Analysis**

6.1 When specified in the purchase order, the manufacturer shall report the heat analysis of each heat of steel used in the manufacture of pipe to this specification. The analysis shall conform to the requirements specified in Section 5 for the grade of pipe ordered.

**7. Product Analysis**

7.1 When specified in the purchase order, a product analysis report shall be furnished by the manufacturer on two pipes from each lot of 400 lengths, or fraction thereof, of 4 1/2-in. outside diameter and 5 9/16-in. outside diameter sizes and from each lot of 200 lengths, or fraction thereof, of each size 6 5/8-in. outside diameter through 12 3/4-in. outside diameter pipe. Samples for chemical analysis, except for spectrographic analysis, shall be taken in accordance with Method E 59. The chemical composition thus determined shall conform to the requirements specified in Section 5.

7.2 *Product Analysis Retests*—If both lengths of pipe representing the lot fail the specified product analysis, the lot shall be rejected, or at the option of the manufacturer, all of the remaining lengths of the lot shall be tested individually for conformance to the specified requirements. If only one of the lengths of pipe representing the lot fails the specified check analysis, the lot shall be rejected or, at the option of the manufacturer, two retest analyses shall be made on two additional lengths selected from the same lot. If both of these retest analyses conform to the specified requirements, the lot shall be accepted except for the length which failed on the initial analysis. If one or both of the retest analyses fail the specified requirements, the entire lot shall be rejected, or, at the option of the manufacturer, each of the remaining lengths shall be tested individually. Only analysis of the rejecting element or elements is necessary in checking the remaining lengths.

**8. Tensile Requirements**

8.1 The material shall conform to the requirements as to tensile properties prescribed in Table 1.

8.2 The yield point shall be determined by the drop of the beam or by the halt in the gage of the testing machine, by the use of dividers, or by other approved methods. When a definite yield point is not exhibited, the yield strength corresponding to a permanent offset of 0.2 % of the gage length of the specimen or to a total extension of 0.5 % of the gage length of the specimen under load shall be determined.

8.3 The test specimen taken across the weld shall show a tensile strength not less than the minimum tensile strength specified for the grade of pipe ordered. This test will not be required for pipe under NPS 8.

**9. Flattening Test Requirements**

9.1 *Seamless Pipe*—For seamless pipe, a section not less than 2 1/2 in. (63.5 mm) in length shall be flattened cold between parallel plates in two steps. During the first step, which is a test for ductility, no cracks or breaks on the inside or outside or end surfaces, except as provided for in 9.5, shall occur until the distance between the plates is less than the value of  $H$  calculated by the following equation:

$$H = \frac{(1+e)t}{e + \frac{t}{D}} \tag{1}$$

where:

$H$  = distance between flattening plates, in. (mm),