



Designation: ~~A587–96 (Reapproved 2019)~~ A587 – 22

## Standard Specification for Electric-Resistance-Welded Low-Carbon Steel Pipe for the Chemical Industry<sup>1</sup>

This standard is issued under the fixed designation A587; 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 ~~Scope~~\*

1.1 This specification<sup>2</sup> covers electric-resistance-welded low-carbon steel pipe intended for use as process lines.

1.2 Pipe ordered under this specification shall be suitable for severe forming operations involving flanging in all sizes and bending to close radii up to and including NPS ~~4–4~~ [DN 100].

1.3 This specification covers NPS  $\frac{1}{2}$  ~~through 10~~, [DN 15] through NPS 10 [DN 250], plus additional sizes. The corresponding outside diameters and wall thicknesses for NPS  $\frac{1}{2}$  [DN 15] through 10 [DN 250] are listed in **Table 1**, as are the dimensions for the additional sizes.

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

1.4 Units—This specification is expressed in both inch-pound units and in SI units; however, unless the purchase order or contract specifies the applicable M specification designation (SI units), the inch-pound units shall apply. The values stated in ~~inch-pound units either inchpound units or SI 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 separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system may not be 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.~~

1.5 The following precautionary caveat pertains only to the test method portion, Sections ~~67, 1213, and 1314~~, 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *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.*

<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.

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<sup>2</sup> For ASME Boiler and Pressure Vessel Code applications see related Specification SA-587 in Section II of that Code.

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

TABLE 1 Tolerance for Outside Diameter and Wall Thickness

NPS Designator	Outside Diameter	Wall Thickness						
		Min	Nom	Max	Min	Nom	Max	
		Inches						
—	0.8125 ± 0.004	0.095			0.103		0.111	0.1200-1400.14
1/2	0.840 ± 0.006	0.095	0.103	0.111	0.125	0.140	0.154	
1/2	1.050 ± 0.006	0.099	0.108	0.117	0.135	0.147	0.159	
—	1.0625 ± 0.006	0.099	0.108	0.117	0.135	0.147	0.159	
—	1.3125 ± 0.006	0.116	0.126	0.136	0.157	0.174	0.185	
1	1.315 ± 0.006	0.116	0.126	0.136	0.157	0.171	0.185	
1 1/4	1.660 ± 0.007	0.124	0.132	0.143	0.167	0.182	0.197	
—	1.875 ± 0.008	0.127	0.138	0.149	0.175	0.190	0.205	
1 1/2	1.900 ± 0.008	0.127	0.158	0.149	0.175	0.190	0.205	
2	2.375 ± 0.010	0.135	0.147	0.159	0.191	0.208	0.225	
3	3.500 ± 0.015	0.189	0.206	0.223	0.262	0.286	0.310	
4	4.500 ± 0.017	0.207	0.226	0.245	0.295	0.322	0.349	
6	6.625 ± 0.030	0.245	0.267	0.289	0.378	0.412	0.446	
8	8.625 ± 0.040	0.282	0.308	0.334	0.438	0.478	0.518	
10	10.750 ± 0.050	0.319	0.348	0.377	0.520	0.567	0.614	
		Millimetres						
—	20.64 ± 0.10	2.41	2.41	2.62	2.82	3.28	3.56	3.84
1/2	21.30 ± 0.15	2.41	2.62	2.82	3.28	3.56	3.84	
3/4	26.70 ± 0.15	2.51	2.74	2.97	3.43	3.73	4.04	
—	26.99 ± 0.15	2.51	2.74	2.97	3.43	3.73	4.04	
—	33.34 ± 0.15	2.95	3.20	3.45	3.99	4.34	4.70	
1	33.40 ± 0.15	2.95	3.20	3.45	3.99	4.34	4.70	
1 1/4	42.16 ± 0.18	3.07	3.35	3.63	4.24	4.62	5.00	
—	47.63 ± 0.20	3.22	3.51	3.78	4.45	4.83	5.21	
1 1/2	48.30 ± 0.020	3.22	3.51	3.78	4.45	4.83	5.21	
2	60.33 ± 0.25	3.43	3.73	4.04	4.85	5.28	5.72	
3	88.90 ± 0.38	4.80	5.23	5.66	6.66	7.26	7.87	
4	114.30 ± 0.43	5.26	5.74	6.22	7.49	8.18	8.87	
6	168.28 ± 0.76	6.22	9.32	7.34	9.60	10.47	11.33	
8	219.08 ± 1.02	7.16	7.82	8.48	11.13	12.14	13.16	
10	273.05 ± 1.27	8.10	8.84	9.58	13.21	14.40	15.60	

TABLE 1 Tolerance for Outside Diameter and Wall Thickness<sup>A</sup>

NPS	DN	Outside Diameter		A Thickness			B Thickness		
		Inch	[mm]	Min	Nom	Max	Min	Nom	Max
1/2	15	0.840 ± 0.006	[21.3 ± 0.15]	0.095 [2.62]	0.103 [2.62]	0.111 [2.82]	0.125 [3.18]	0.140 [3.56]	0.151 [3.84]
3/4	20	1.050 ± 0.006	[26.7 ± 0.15]	0.099 [2.51]	0.108 [2.74]	0.117 [2.97]	0.135 [3.42]	0.147 [3.73]	0.159 [4.04]
1	25	1.315 ± 0.006	[33.4 ± 0.15]	0.116 [2.95]	0.126 [3.20]	0.136 [3.25]	0.157 [3.99]	0.171 [4.34]	0.185 [4.70]
1 1/4	32	1.660 ± 0.007	[42.2 ± 0.17]	0.121 [3.07]	0.132 [3.35]	0.143 [3.63]	0.167 [4.24]	0.182 [4.62]	0.197 [5.00]
1 1/2	40	1.900 ± 0.008	[48.3 ± 0.20]	0.127 [3.22]	0.138 [3.51]	0.149 [3.78]	0.175 [4.45]	0.190 [4.83]	0.205 [5.21]
2	50	2.375 ± 0.010	[60.3 ± 0.25]	0.135 [3.43]	0.147 [3.78]	0.159 [4.04]	0.191 [4.85]	0.208 [5.28]	0.225 [5.72]
3	90	3.500 ± 0.015	[101.6 ± 0.38]	0.189 [4.80]	0.206 [5.23]	0.223 [5.66]	0.262 [6.65]	0.286 [7.26]	0.310 [7.87]
4	100	4.500 ± 0.017	[114.3 ± 0.43]	0.207 [5.26]	0.226 [5.74]	0.245 [6.22]	0.295 [7.49]	0.322 [8.18]	0.349 [8.86]

6	150	6.625 ± 0.030	[168.3 ± 0.76]	0.245 [6.22]	0.267 [6.78]	0.289 [7.34]	0.378 [9.60]	0.412 [10.46]	0.446 [11.33]
8	200	8.625 ± 0.040	[219.1 ± 1.02]	0.282 [7.16]	0.308 [7.82]	0.334 [8.48]	0.438 [11.13]	0.478 [12.14]	0.518 [13.16]
10	250	10.750 ± 0.050	[273.0 ± 1.27]	0.319 [8.10]	0.348 [8.84]	0.377 [9.58]	0.520 [13.46]	0.567 [14.40]	0.614 [15.60]
Additional Sizes									
...	...	0.8125 ± 0.004	[20.6 ± 0.10]	0.095 [2.62]	0.103 [2.62]	0.111 [2.82]	0.129 [3.28]	0.140 [3.56]	0.151 [3.84]
...	...	1.0625 ± 0.006	[27.0 ± 0.15]	0.099 [2.51]	0.108 [2.74]	0.117 [2.97]	0.135 [3.42]	0.147 [3.73]	0.159 [4.04]
...	...	1.3125 ± 0.006	[33.3 ± 0.15]	0.116 [2.95]	0.126 [3.20]	0.136 [3.25]	0.157 [3.99]	0.171 [4.34]	0.185 [4.70]
...	...	1.875 ± 0.008	[47.6 ± 0.20]	0.127 [3.22]	0.138 [3.51]	0.149 [3.78]	0.175 [4.45]	0.190 [4.83]	0.205 [5.21]

<sup>A</sup> Additional sizes noted in 1.3.

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>3</sup>

- [A53/A53M Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless](#)
- [A370 Test Methods and Definitions for Mechanical Testing of Steel Products](#)
- [A530/A530M Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe](#)
- [A751 Test Methods and Practices for Chemical Analysis of Steel Products](#)
- [A941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys](#)
- [E213 Practice for Ultrasonic Testing of Metal Pipe and Tubing](#)
- [E273 Practice for Ultrasonic Testing of the Weld Zone of Welded Pipe and Tubing](#)
- [E309 Practice for Eddy Current Examination of Steel Tubular Products Using Magnetic Saturation](#)
- [E570 Practice for Flux Leakage Examination of Ferromagnetic Steel Tubular Products](#)

## 3. Terminology

3.1 *Definitions*—For definitions of terms used in this specification, refer to Terminology [A941](#).

## 4. Ordering Information

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

4.1.1 Quantity (feet or number of pieces),

4.1.2 Name of material (electric-resistance-welded steel pipe),

4.1.3 Size (NPS [DN] or outside diameter and wall thickness),

4.1.4 Length (definite cut length or random),

4.1.5 Test report required (see [4.215.2](#)),

4.1.6 Specification designation A587 and year of issue,

4.1.7 Nondestructive testing practice required ([E213](#), [E273](#), [E309](#), or [E570](#)), if applicable (see [14.2](#)),

4.1.8 ~~Specification number~~; Special requirements, and

4.1.9 ~~Special requirements~~—Supplementary Requirements S1 through S3, if applicable.

## 5. Materials and Manufacture

5.1 *Process*—The steel shall be aluminum killed steel made by one or more of the following processes: ~~open-hearth~~, basic-oxygen, or ~~electric-furnace~~. electric-furnace, or any other commercially viable process.

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

5.2 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.

5.3 *Manufacture*—The pipe shall be made by electric resistance welding.

5.4 *Heat Treatment*—Pipe furnished in the as-welded condition shall be normalized at a temperature above the upper critical temperature. Cold-drawn pipe shall be normalized after the final cold-draw pass.

## 6. Chemical Composition

6.1 *Heat Analysis*—An analysis of each heat of steel shall be made to determine the percentages of the elements specified. The chemical composition thus determined shall conform to the requirements specified in **Table 2** and the chemical analysis shall be in accordance with Test Methods, Practices, and Terminology **A751**.

6.2 *Product Analysis*—When requested on the purchase order, a product analysis shall be made by the supplier from one pipe or coil of steel per heat. The chemical composition thus determined shall be reported to the purchaser or the purchaser’s representative and shall conform to the requirements specified in **Table 2**.

6.3 *Retests*—If the original test for product analysis fails, retests of two additional lengths of flat-rolled stock or pipe shall be made. Both retests for the elements in question shall meet the requirements of the specification; otherwise, all remaining material in the heat shall be rejected or, at the option of the producer, each length of flat-rolled stock or pipe may be individually tested for acceptance. Lengths of flat-rolled stock or pipe which do not meet the requirements of the specification shall be rejected.

6.4 Supplying an alloy grade of steel that specifically requires the addition of any element other than those listed in **Table 2** is not permitted.

## 7. Mechanical Requirements

### 7.1 *Tensile Properties:*

7.1.1 The material shall conform to the requirements as to tensile properties prescribed in **Table 3**.

7.1.2 The yield strength shall be determined by the drop of the beam, by the halt in the gauge 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 gauge length of the specimen, or to a total extension of 0.5 % of the gauge length under load, shall be determined.

7.1.3 If the percentage of elongation of any test specimen is less than that specified and any part of the fracture is more than  $\frac{3}{4}$  in. (~~19 mm~~)[19 mm] from the center of the gauge length, as indicated by scribe marks on the specimen before testing, a retest shall be allowed.

### 7.2 *Flattening Test:*

7.2.1 A section of pipe not less than 4 in. (~~102 mm~~)[100 mm] in length shall be flattened cold between parallel plates in two steps. The weld shall be placed 90° from the direction of the applied force. During the first step, which is a test for ductility, no cracks

**TABLE 2 Chemical Composition Requirements**

Element	Composition, %
Carbon, max	0.15
Manganese	0.27–0.63
Phosphorus, max	0.035
Sulfur, max	0.035
Aluminum	0.02–0.100

**TABLE 3 Tensile Requirements**

Tensile strength, min, psi (MPa)	48 000 (331)
Yield strength, min, psi (MPa)	30 000 (207)
Elongation in 2 in. or 50 mm, min, %	40

**TABLE 3 Tensile Requirements**

Tensile strength, min, psi [MPa]	48 000 [330]
Yield strength, min, psi [MPa]	30 000 [205]
Elongation in 2 in. [50 mm], min, %	40

or breaks, except as provided for in [6.2.57.2.5](#), shall occur on the inside or outside surfaces until the distance between the plates is less than the value of  $H$ , calculated by the following equation:

$$H = [(1+e)t]/[e+t/D] \quad (1)$$

where:

- $H$  = distance between flattening plates, in.,
- $\underline{H}$  = distance between flattening plates, in. [mm],
- $t$  = specified wall thickness of the pipe, in.,
- $\underline{t}$  = specified wall thickness of the pipe, in. [mm],
- $\bar{D}$  = specified outside diameter of the pipe, in., and
- $\underline{D}$  = specified outside diameter of the pipe, in. [mm], and
- $e$  = deformation per unit length (0.09 for low-carbon steel).

7.2.2 During the second step, which is a test for soundness, the flattening shall be continued until the specimen breaks or the opposite walls of the pipe meet. Evidence of laminated or unsound material, or of incomplete weld that is revealed during the entire flattening test shall be cause for rejection.

7.2.3 Surface imperfections in the test specimens before flattening, but revealed during the first step of the flattening test, shall be judged in accordance with the finish requirements.

7.2.4 Superficial ruptures resulting from surface imperfections shall not be cause for rejection.

7.2.5 When low  $D$ -to-  $t$  ratio tubulars are tested, because the strain imposed due to geometry is unreasonably high on the inside surface at the 6 and 12 o'clock locations, cracks at these locations shall not be cause for rejection if the  $D$ -to- $t$  ratio is less than 10.

7.3 *Reverse Flattening Test*—A section 4 in. (~~102 mm~~)[100 mm] in length of pipe in sizes down to and including  $1\frac{3}{16}$  in. (~~20.6 mm~~)[20.6 mm] in outside diameter shall be split longitudinally 90° on each side of the weld and the sample opened and flattened with the weld at the point of maximum bend. There shall be no evidence of cracks or lack of penetration or overlaps resulting from flash removal in the weld.

7.4 *Flange Test*—A section of pipe not less than 4 in. (~~102 mm~~)[100 mm] in length shall be capable of having a flange turned over at a right angle to the body of the pipe without cracking or showing flaws. This flange, as measured from the outside of the pipe, shall be not less than  $\frac{1}{8}$  in. (~~3.2 mm~~)[3 mm] nor more than  $\frac{1}{2}$  in. (~~12.7 mm~~)[13 mm]. Within these limits, the width of the flange shall be not less than the percentages specified in [Table 4](#).

## 8. Dimensions and Permissible Variations

8.1 *Permissible Variations in Outside Diameter and Wall Thickness*—The outside diameter and wall thickness variations shall not exceed the limits prescribed in [Table 1](#).

8.2 *Permissible Variations in Straightness*—Each pipe shall be straight within 0.030 in. (~~0.76 mm~~)[0.76 mm] maximum deflection in any 3 ft (~~0.91 m~~)[0.91 m] length to 8 NPS—NPS [DN 200]. For 8 NPS [DN 200] and above, pipe shall be straight within 0.060 in. (~~1.52 mm~~)[1.52 mm] maximum deflection in any 3 ft (~~0.91 m~~)[0.91 m] length. Galvanized pipe shall be reasonably straight.

8.3 *Lengths*:

**TABLE 4 Flange Requirements**

Outside Diameter of Pipe, in.	Width of Flange, % of OD
Over ¾ to 2½, incl	15
Over 2½ to 3¾, incl	12½
Over 3¾ to 4½, incl	10
Over 4½ to 6⅝, incl	7½
Over 6⅝	5

**TABLE 4 Flange Requirements**

inches	[millimeters]	Width of Flange, % of OD
Over ¾ to 2½, Incl.	Over 20 to 65 Incl.	15
Over 2½ to 3¾, Incl.	Over 65 to 95 Incl.	12½
Over 3¾ to 4½, Incl.	Over 95 to 115 Incl.	10
Over 4½ to 6⅝, Incl.	Over 115 to 170 Incl.	7½
Over 6⅝	Over 170	5

8.3.1 Pipe may be ordered in definite cut lengths or in random lengths as provided herein.

8.3.2 When ordered in definite cut lengths, the variation in length shall not exceed the amounts prescribed in **Table 5**.

8.3.3 If definite lengths are not required, pipe may be ordered in single random lengths of 16 to 22 ft (4.9[5 to 6.7 m]6.5 m] with 5 % 12 to 16 ft (3.7[3.5 to 4.9 m]5 m], or in double random lengths with a minimum average of 35 ft (10.7 m)[10.5 m] and a minimum length of 22 ft (6.7 m)[6.5 m] with 5 % 16 to 22 ft (4.9[5 to 6.7 m]6.5 m].

## 9. Workmanship, Finish, and Appearance

9.1 The finished pipe shall be free of injurious defects and shall have a workman-like finish. Minor defects may be removed by grinding, provided the wall thickness is not reduced to less than the minimum thickness permitted for the ordered nominal wall thickness.

9.2 The pipe shall have smooth ends free of burrs and free of scale except that the pipe may have a superficial “blue” oxide film on the surfaces.

9.3 For NPS ½ [DN 15] to 1½ [DN 40] inclusive, the inside diameter welding flash shall be removed so that the remaining flash does not exceed 0.006 in. (0.15 mm)[0.15 mm]. For NPS over 1½, [DN 40], the remaining inside diameter welding flash shall not exceed 0.010 in. (0.25 mm)[0.25 mm].

9.4 For all nominal sizes, the outside diameter welding flash shall be removed flush with the outside diameter contour.

9.5 Undercut flash must be smoothly blended into the pipe wall.

**TABLE 5 Permissible Variations in Length<sup>A</sup>**

Outside Diameter, in.	Cut Length, in. (mm)	
	Over	Under
Under 2	⅛ (3.2)	0
2 and over	¾ (4.8)	0

**TABLE 5 Permissible Variations in Length<sup>A</sup>**

Outside Diameter, in. [mm]	Cut Length, in. [mm]	
	Over	Under
Under 2 [50]	⅛ [3]	0
2 and over [50 and over]	¾ [5]	0

<sup>A</sup> These permissible variations in length apply to pipe before bending. They apply to cut lengths up to and including 24 ft (7.3 m)[7.3 m]. For lengths over 24 ft, ft [7.3 m], an additional over-tolerance of ⅛ in. [3 mm] for each 10 ft (3.0 m)[3.0 m] or fraction thereof shall be permissible, up to a maximum of ½ in. (12.7 mm)[13 mm].

9.6 The intent of the flash conditions as prescribed in [8-39.3](#), [8-49.4](#), and [8-59.5](#) is to obtain a surface contour suitable for flanging.

## 10. Number of Tests

10.1 Two tensile tests as specified in [6-17.1](#) shall be made from each heat.

10.2 The flattening test as specified in [6-27.2](#) shall be made on two lengths of pipe from each lot of 250 lengths or fraction thereof.

10.3 The reverse flattening test specified in [6-37.3](#) shall be made on 1 length of pipe from each lot of 250 lengths or fraction thereof.

10.4 The flange test as specified in [6-47.4](#) shall be made on specimens from 2 lengths of pipe from each lot of 250 lengths or fraction thereof.

## 11. Retests

11.1 If the results of the mechanical tests of any heat or lot do not conform to the requirements specified, retests may be made on additional pipe of double the original number from the same heat or lot, each of which shall conform to the requirements specified.

## 12. Retreatment

12.1 If a heat or lot fails to conform to the test requirements, that heat or lot may be reheat treated and resubmitted for tests. Not more than one reheat treatment shall be permitted.

## 13. Test Specimens and Methods of Testing

13.1 The test specimens and the tests required by this specification shall conform to those described in Test Methods and Definitions [A370](#).

13.2 Test specimens shall be taken from the ends of finished pipe prior to upsetting, swaging, expanding, or other forming operations, or being cut to length. They shall be smooth on the ends and free from burrs and flaws.

13.3 If any test specimen shows flaws or defective machining, it may be discarded and another specimen substituted.

## 14. Nondestructive Test

14.1 The As an alternate to the hydrostatic test and when accepted by the purchaser, a nondestructive test shall be made instead of the hydrostatic test.

14.1.1 The test shall provide a 360° inspection for sizes up to and including 3½ in. (~~88.9 mm~~)[90 mm] outside diameter.

14.1.2 For pipe larger than 3½ in. (~~88.9 mm~~)[90 mm] outside diameter, nondestructive inspection of the weld and heat affected zone is required.

14.2 Each pipe shall be tested with a nondestructive test in accordance with Practices [E213](#), [E273](#), [E309](#), or [E570](#). Except as provided in [13-6.214.6.2](#), it is the intent of this test to reject pipe with imperfections that produce test signals equal to or greater than that of the calibration standard. In order to accommodate the various types of nondestructive testing equipment and techniques in use, and manufacturing practices employed, any one of the following calibration standards may be used, at the option of the producer, to establish a minimum sensitivity level for rejection:

14.3 For eddy-current testing, the calibration pipe shall contain, at the option of the producer, any one of the following discontinuities to establish a minimum sensitivity level for rejection. For welded pipe, they shall be placed in the weld if visible.