



Standard Specification for Welded and Seamless Steel Pipe Piles¹

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1. Scope

1.1 This specification covers nominal (average) wall steel pipe piles of cylindrical shape and applies to pipe piles in which the steel cylinder acts as a permanent load-carrying member, or as a shell to form cast-in-place concrete piles.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions of the values in inch-pound units to values in SI units.

1.3 The text of this specification contains notes and footnotes that provide explanatory material. Such notes and footnotes, excluding those in tables and figures, do not contain any mandatory requirements.

1.4 The following precautionary caveat pertains only to the test method portion, Section 16 of this specification. *This standard does not purport to address all of the safety problems, 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:

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

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products²

A 941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys³

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications⁴

3. Terminology

3.1 *Definitions*—Definitions of terms used in this specification shall be in accordance with Terminology A 941.

3.1.1 *defect*—an imperfection of sufficient size or magnitude to be cause for rejection.

3.1.2 *imperfection*—any discontinuity or irregularity found in the pipe.

4. Ordering Information

4.1 Orders for material under this specification shall contain information concerning as many of the following items as are required to describe the desired material adequately:

4.1.1 Quantity (feet or number of lengths),

4.1.2 Name of material (steel pipe piles),

4.1.3 Method of manufacture (seamless or welded),

4.1.4 Grade (Tables 1 and 2),

4.1.5 Size (outside diameter and nominal wall thickness),

4.1.6 Lengths (single random, double random, or uniform) (see Section 13),

4.1.7 End finish (Section 15), and

4.1.8 ASTM specification designation and year of issue,

4.1.9 Location of purchaser's inspection (see 19.1), and

4.1.10 Bar coding (see 22.2).

5. Materials and Manufacture

5.1 The piles shall be made by the seamless, electric resistance welded, flash welded, or fusion welded process. The seams of welded pipe piles shall be longitudinal, helical-butt, or helical-lap.

NOTE 1—For welded pipe piles, the weld should not fail when the product is properly fabricated and installed and subjected to its intended end use.

6. Process

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

7. Chemical Composition

7.1 The steel shall contain no more than 0.050 % phosphorus.

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² Annual Book of ASTM Standards, Vol 01.03.

³ Annual Book of ASTM Standards, Vol 01.01.

⁴ Annual Book of ASTM Standards, Vol 14.02.

TABLE 1 Tensile Requirements

NOTE—Where an ellipsis (...) appears in this table, there is no requirement.

	Grade 1	Grade 2	Grade 3
Tensile strength, min, psi (MPa)	50 000 (345)	60 000 (415)	66 000 (455)
Yield point or yield strength, min, psi (MPa)	30 000 (205)	35 000 (240)	45 000 (310)
Basic minimum elongation for nominal wall thicknesses $\frac{5}{16}$ in. (7.9 mm) or more:			
Elongation in 8 in. (203.2 mm), min, %	18	14	...
Elongation in 2 in. (50.8 mm), min, %	30	25	20
For nominal wall thicknesses less than $\frac{5}{16}$ in. (7.9 mm), the deduction from the basic minimum elongation in 2 in. (50.08 mm) for each $\frac{1}{32}$ - in. (0.8 mm) decrease in nominal wall thickness below $\frac{5}{16}$ in. (7.9 mm), in percentage points	1.50 ^A	1.25 ^A	1.0 ^A

^A Table 2 gives the computed minimum values:

TABLE 2 Calculated Minimum Elongation Values^A

Nominal Wall Thickness		Elongation in 2 in. (50.8 mm), min, %		
in.	mm	Grade 1	Grade 2	Grade 3
$\frac{5}{16}$ or 0.312	7.9	30.00	25.00	20.00
$\frac{9}{32}$ or 0.281	7.1	28.50	23.75	19.00
$\frac{1}{4}$ or 0.250	6.4	27.00	22.50	18.00
$\frac{7}{32}$ or 0.219	5.6	25.50	21.25	17.00
$\frac{3}{16}$ or 0.188	4.8	24.00	20.00	16.00
$\frac{11}{64}$ or 0.172	4.4	23.25	19.50	15.50
$\frac{5}{32}$ or 0.156	4.0	22.50	18.75	15.00
$\frac{9}{64}$ or 0.141	3.6	21.75	18.25	14.50
$\frac{1}{8}$ or 0.125	3.2	21.00	17.50	14.00
$\frac{7}{64}$ or 0.109	2.8	20.25	16.75	13.50

^A The above table gives the calculated minimum elongation values for various nominal wall thicknesses. Where the specified nominal wall thickness is intermediate to those shown above, the minimum elongation value shall be determined as follows:

Grade	
1	$E = 48t + 15.00$
2	$E = 40t + 12.50$
3	$E = 32t + 10.00$

where:

E = elongation in 2 in., %, and
 t = specified nominal wall thickness, in.

8. Heat Analysis

8.1 Each heat analysis shall conform to the requirement specified in 7.1. When requested by the purchaser, the applicable heat analyses shall be reported to the purchaser or the purchaser's representative.

9. Product Analysis

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

9.2 It shall be permissible for the purchaser to make product analyses using samples from lots of pipe piles as follows:

Pipe Size Outside Diameter, in. (mm)	Number of Samples and Size of Lot
Under 14 (355.6)	2 from 200 pipe or fraction thereof
14 to 36, incl (355.6 to 914)	2 from 100 pipe or fraction thereof
Over 36 (914)	2 from 3000 ft (914 m) or fraction thereof

The product analyses shall conform to the requirement in 7.1.

9.3 If the chemical compositions of both of the samples representing a lot fail to conform to the specified requirement, the lot shall be rejected or analyses of four additional samples selected from the lot shall be made, and each shall conform to the specified requirement. If the chemical composition of only one of the samples representing a lot fails to conform to the

specified requirement, the lot shall be rejected or analyses of two additional samples selected from the lot shall be made, and each shall conform to the specified requirement.

10. Tensile Requirements

10.1 The material shall conform to the requirements as to tensile properties prescribed in Tables 1 and 2.

10.2 The yield point shall be determined by the drop of the beam, 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 under load shall be determined.

11. Weights Per Unit Length

11.1 The weights per unit length for various sizes of pipe piles are listed in Table 3.

11.2 For pipe pile sizes not listed in Table 3, the weight per unit length shall be calculated as follows:

$$W = 10.69(D - t)t \tag{1}$$

where:

W = weight per unit length, lb/ft,
 D = specified outside diameter, in., and
 t = specified nominal wall thickness, in.

12. Permissible Variations in Weights and Dimensions

12.1 *Weight*—Each length of pipe pile shall be weighed separately and its weight shall not vary more than 15 % over or 5 % under its theoretical weight, calculated using its length and its weight per unit length (see Section 11).

12.2 *Outside Diameter*—The outside diameter of pipe piles shall not vary more than $\pm 1\%$ from the specified outside diameter.

12.3 *Wall Thickness*—The wall thickness at any point shall not be more than 12.5 % under the specified nominal wall thickness.

NOTE 2—The minimum permissible wall thickness on inspection is

shown in Table X1.1 (see Appendix) for various nominal wall thicknesses.

13. Lengths

13.1 Pipe piles shall be furnished in single random lengths, double random lengths, or in uniform lengths as specified in the purchase order, in accordance with the following limits:

Single random lengths	16 to 25 ft (4.88 to 7.62 m), incl
Double random lengths	over 25 ft (7.62 m) with a minimum average of 35 ft (10.67 m)
Uniform lengths	length as specified with a permissible variation of ± 1 in.

13.2 Lengths that have been spliced at the mill by welding shall be acceptable as the equivalent of unspliced lengths provided tension test specimens cut from sample splices conform to the tensile strength requirements prescribed in Tables 1 and 2. The welding bead shall not be removed for this test. Such specimens shall be made in accordance with the provisions specified in Sections 16-18.

TABLE 3 Common Sizes and Weights Per Unit Length^A

Outside Diameter, in.	Nominal Wall Thickness, in. ^B	Weight per Unit Lengths, lb/ft ^C	Outside Diameter, in. ^B	Nominal Wall Thickness, in. ^B	Weight per Unit Lengths, lb/ft ^C	
6	0.134	8.40	12	0.134	17.00	
	0.141	8.83		0.141	17.87	
	0.156	9.75		0.150	19.00	
	0.164	10.23		0.164	20.75	
	0.172	10.72		0.172	21.75	
8	0.141	11.85	12 $\frac{1}{4}$	0.179	22.62	
	0.172	14.39		0.188	23.74	
	8 $\frac{5}{8}$	0.109		9.92	0.203	25.60
0.141		12.79	0.219	27.58		
0.172		15.54	0.230	28.94		
0.188		16.96	0.250	31.40		
0.203		18.28	0.281	35.20		
0.219		19.68	0.312	38.98		
0.250		22.38	14	0.109	14.73	
0.277		24.72		0.134	18.07	
0.312		27.73		0.141	19.01	
0.322		28.58		0.150	20.20	
0.344		30.45		0.164	22.07	
0.375		33.07		0.172	23.13	
0.438	38.33	0.179		24.05		
0.500	43.43	0.188		25.25		
10	0.109	11.53		0.203	27.23	
	0.120	12.67		0.219	29.34	
	0.134	14.13		0.230	30.78	
	0.141	14.86		0.250	33.41	
	0.150	15.79	0.281	37.46		
	0.164	17.24	0.312	41.48		
	0.172	18.07	0.330	43.81		
	0.179	18.79	0.344	45.62		
	0.188	19.72	0.375	49.61		
	0.203	21.26	0.438	57.65		
	0.219	22.90	0.500	65.48		
	10 $\frac{3}{4}$	0.230	24.02	14	0.134	19.86
0.250		26.06	0.141		20.89	
10 $\frac{3}{4}$		0.109	12.40		0.150	22.21
		0.120	13.64		0.164	24.26
		0.134	15.21		0.172	25.43
		0.141	15.99		0.179	26.45
		0.150	17.00		0.188	27.76
		0.164	18.56		0.203	29.94
		0.172	19.45		0.219	32.26
		0.179	20.23		0.230	33.86
		0.188	21.23		0.250	36.75
		0.203	22.89		0.281	41.21
	0.219	24.65	0.312	45.65		
			0.344	50.22		
		0.375	54.62			

TABLE 3 *Continued*

Outside Diameter, in.	Nominal Wall Thickness, in. ^B	Weight per Unit Lengths, lb/ft ^C	Outside Diameter, in. ^B	Nominal Wall Thickness, in. ^B	Weight per Unit Lengths, lb/ft ^C			
16	0.230	25.87	16	0.438	63.50			
	0.250	28.06		0.469	67.84			
	0.279	31.23		0.500	72.16			
	0.307	34.27		0.134	22.73			
	0.344	38.27						
	0.141	23.90						
	0.150	25.42						
	0.164	27.76						
	18	0.172		29.10	18	20	0.188	31.78
		0.179		30.27			0.219	46.31
		0.188		30.61			0.250	52.78
				34.28			0.281	59.23
				36.95			0.312	65.66
				38.77			0.344	72.28
42.09			0.375	78.67				
47.22			0.438	91.59				
52.32			0.469	97.92				
57.57			0.500	104.23				
62.64			0.172	40.13				
72.86				0.188			43.84	
77.87				0.219			50.99	
82.85		0.250	58.13					
20	0.141	26.92	20	24	0.281	65.24		
	0.172	32.78			0.312	72.34		
	0.188	35.80			0.375	86.69		
	0.219	41.63			0.438	100.96		
	0.230	43.69			0.469	107.95		
	0.250	47.44			0.500	114.92		
	0.281	53.23			0.172	43.81		
	0.312	58.99				0.188	47.86	
	0.344	64.93				0.219	55.67	
	0.375	70.65				0.250	63.47	
	0.438	82.23				0.281	71.25	
	0.469	87.89				0.312	79.01	
	0.500	93.54				0.375	94.71	
	0.438	29.93			110.32			
0.469			117.98					
0.500			125.62					

^A Subject to agreement between the manufacturer and the purchaser, sizes and weights per unit length other than those listed shall be permitted.

^B 1 in. = 25.4 mm

^C 1 lb/ft = 1.49 kg/m.

14. Workmanship, Finish, and Appearance

14.1 The finished pipe piles shall be reasonably straight and shall not contain imperfections in such number or of such character as to render the pipe unsuitable for pipe piles.

14.2 Surface imperfections having a depth not in excess of 25 % of the specified nominal wall thickness shall be acceptable. It shall be permissible to establish the depth of such imperfections by grinding or filing.

14.3 Surface imperfections having a depth in excess of 25 % of the specified nominal wall thickness shall be considered to be defects. It shall be permissible for defects not deeper than 33 1/3 % of the specified nominal wall thickness to be repaired by welding, provided that the defect is completely removed prior to welding.

15. Ends

15.1 Pipe piles shall be furnished with plain ends. Unless otherwise specified, pipe piles shall have either flame-cut or machine-cut ends, with the burrs at the ends removed. Where ends are specified to be beveled, they shall be beveled to an

angle of 30 +5, -0°, measured from a line drawn perpendicular to the axis of the pipe pile.

16. Number of Tests

16.1 One tension test shall be made on one length or fraction thereof of each size, or one piece of skelp representing each lot of 200 lengths or fraction thereof of each size.

16.2 A retest shall be allowed if the percentage of elongation of any test tension specimen is less than that prescribed in Tables 1 and 2 and any part of the fracture is more than 3/4 in. (19 mm) from the center of the gage length for test specimens having a 2-in. (50 mm) gage length, or is outside of the middle third of the gage length for test specimens having an 8-in. (200 mm) gage length, as indicated by scribe scratches marked on the specimen before testing. A retest shall also be allowed if any part of the fracture is in an inside or outside surface imperfection.

16.3 It shall be permissible to discard any test specimen that shows defective machining or develops imperfections and substitute another test specimen.

17. Retests

17.1 If the results of the tension test representing any lot fail to conform to the applicable requirements prescribed in Tables 1 and 2, the lot shall be rejected or retested using two additional lengths from the lot, with each such test being required to conform to such specified requirements.

18. Test Specimens and Test Methods

18.1 The tension test specimens and test methods shall be in accordance with Test Methods and Definitions A 370, especially Annex A2.

18.2 At the option of the manufacturer, the tension test specimens shall be longitudinal or transverse strip test specimens, with a gage length of 2 in. (50 mm) or 8 in. (200 mm), taken from the pipe or the skelp. Within their gage length, longitudinal strip test specimens shall be nominally 1½ in. (38 mm) wide, non-flattened, and with parallel sides.

18.3 For welded pipe piles, the tension test specimens shall be taken as follows:

18.3.1 For longitudinal-seam pipe piles, any longitudinal strip test specimens shall be taken from the pipe parallel to the pipe axis and 90° from the weld, or from the skelp at a corresponding location and orientation, and any transverse strip test specimens shall be taken from the pipe 90° to the pipe axis and 180° from the weld, or from the skelp at a corresponding location and orientation.

18.3.2 For helical-seam pipe piles, any longitudinal strip test specimens shall be taken from the pipe parallel to the pipe axis and at such a location that the center of the specimen is located at least a quarter of the distance between adjacent weld convolutions, or from the skelp at a corresponding location and orientation; and transverse specimens shall be taken from the pipe 90° to the pipe axis and at such a location that the center of the specimen is located approximately half the distance between adjacent weld convolutions, or from the skelp at a corresponding location and orientation.

18.4 Specimens shall be tested at room temperature.

19. Inspection

19.1 The inspector representing the purchaser shall have entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works that concern the manufacture of the material ordered. The manufacturer shall afford the inspector all reasonable facilities to satisfy the inspector that the material is being furnished in accordance with the requirements of this specification and any other requirements specified in the purchase order. All tests and inspections shall be made at the place of manufacture prior to shipment, unless otherwise specified in the purchase order, and

shall be so conducted as not to interfere unnecessarily with the operation of the works.

20. Rejection

20.1 It shall be permissible for the purchaser inspect the pipe piles received from the manufacturer and reject any pipe pile that does not meet the requirements of this specification and the purchase order, based upon the applicable inspection and test methods. The purchaser shall notify the manufacturer of any pipe pile that has been rejected, and the disposition of such pipe piles shall be subject to agreement between the manufacturer and the purchaser.

20.2 It shall be permissible for the purchaser to set aside any pipe pile that is found in fabrication or installation within the scope of this specification to be unsuitable for the intended end use, based on the requirements of this specification. The purchaser shall notify the manufacturer of any pipe pile that has been set aside. Such pipe piles shall be subject to mutual investigation as to the nature and severity of the deficiency and the forming or installation, or both, conditions involved. The disposition of such pipe piles shall be subject to agreement between the manufacturer and the purchaser.

21. Certification

21.1 Where specified in the purchase order, the manufacturer shall furnish a certificate of compliance stating that the pipe pile was manufactured, tested, and inspected in accordance with the requirements of this specification (including year date) and any requirements specified in the purchase order, and was found to meet such requirements, and shall furnish a test report containing the results of the applicable heat analyses, product analyses, and tension tests.

22. Product Marking

22.1 Each length of pipe pile shall be legibly marked by stenciling, stamping, or rolling to show: the name or brand of the manufacturer; the heat number; the process of manufacture (seamless, flash welded, fusion welded, or electric resistance welded), the type of helical seam (helical-lap or helical-butt), if applicable; the outside diameter, nominal wall thickness, length, and weight per unit length; the specification designation (year date not required); and the grade.

22.2 *Bar Coding*—In addition to the requirements in 22.1, it shall be permissible for bar coding to be used as a supplementary identification method; when a specific bar coding system is specified in the purchase order, that system shall be used.

23. Keywords

23.1 seamless steel pipe; steel piles; steel pipe; welded steel pipe

APPENDIX

(Nonmandatory Information)

X1. Minimum Permissible Pipe Wall Thicknesses on Inspection

X1.1 See Table X1.1 for minimum wall thicknesses.



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TABLE X1.1 Table of Minimum Wall Thicknesses on Inspection for Nominal (Average) Pipe Wall Thicknesses

NOTE 1—The following equation, upon which this table is based, may be applied to calculate minimum wall thickness from nominal (average) wall thickness:

$$t_n \times 0.875 = t_m$$

where:

t_n = nominal wall thickness, in., and

t_m = minimum permissible wall thickness, in.

The wall thickness is expressed to three decimal places, with rounding being in accordance with Practice E 29.

NOTE 2—This table is a master table covering some of the nominal wall thicknesses available in the purchase of different classifications of pipe, but it is not meant to imply that all of these nominal wall thicknesses are necessarily obtainable.

Nominal Wall Thickness (t_n), in. ^A	Minimum Permissible Wall Thickness on Inspection (t_m), in. ^A	Nominal Wall Thickness (t_n), in. ^A	Minimum Permissible Wall Thickness on Inspection (t_m), in. ^A	Nominal Wall Thickness (t_n), in. ^A	Minimum Permissible Wall Thickness on Inspection (t_m), in. ^A
0.068	0.060	0.276	0.242	0.674	0.590
0.088	0.077	0.277	0.242	0.687	0.601
0.091	0.080	0.279	0.244	0.719	0.629
0.095	0.083	0.280	0.245	0.750	0.656
0.109	0.095	0.281	0.246	0.812	0.710
0.113	0.099	0.294	0.257	0.843	0.738
0.119	0.104	0.300	0.262	0.864	0.756
0.120	0.105	0.307	0.269	0.875	0.766
0.125	0.109	0.308	0.270	0.906	0.793
0.126	0.110	0.312	0.273	0.937	0.820
0.133	0.116	0.318	0.278	0.968	0.847
0.134	0.117	0.322	0.282	1.000	0.875
0.140	0.122	0.330	0.289	1.031	0.902
0.141	0.123	0.337	0.295	1.062	0.929
0.145	0.127	0.343	0.300	1.093	0.956
0.147	0.129	0.344	0.301	1.125	0.984
0.150	0.131	0.358	0.313	1.156	1.012
0.154	0.135	0.365	0.319	1.218	1.066
0.156	0.136	0.375	0.328	1.250	1.094
0.164	0.143	0.382	0.334	1.281	1.121
0.172	0.150	0.400	0.350	1.312	1.148
0.179	0.157	0.406	0.355	1.343	1.175
0.187	0.164	0.432	0.378	1.375	1.203
0.188	0.164	0.436	0.382	1.406	1.230
0.191	0.167	0.437	0.382	1.438	1.258
0.200	0.175	0.438	0.383	1.500	1.312
0.203	0.178	0.469	0.410	1.531	1.340
0.216	0.189	0.500	0.438	1.562	1.367
0.218	0.191	0.531	0.465	1.593	1.394
0.219	0.192	0.552	0.483	1.750	1.531
0.226	0.198	0.562	0.492	1.781	1.558
0.230	0.201	0.593	0.519	1.812	1.586
0.237	0.207	0.600	0.525	1.968	1.722
0.250	0.219	0.625	0.547	2.062	1.804
0.258	0.226	0.656	0.574	2.343	2.050

^A 1 in. = 25.4 mm

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