



# Standard Specification for Tracking and Traceability Encoding System of Natural Gas Distribution Components (Pipe, Tubing, Fittings, Valves, and Appurtenances)<sup>1</sup>

This standard is issued under the fixed designation F2897; 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 defines requirements for the data used in the tracking and traceability base-62 encoding system and the format of the resultant code to characterize various components used in fuel gas piping systems.

1.2 The final output of this specification is a 16 digit alpha-numeric code that defines a standardized approach or methodology for encoding certain characteristics of components that have been established based on consensus recommendations from the respective stakeholder group members. The means of marking or affixing the code to the components, and the means of reading and/or transferring the data or codes are outside the scope of this specification.

NOTE 1—To facilitate compliance with this specification, a web based application has been developed to manage and maintain unique manufacturer identification numbers. The URL for the website is: <http://www.componentid.org>.

1.3 The web based application is only intended to serve as a useful resource for managing the respective manufacturer identification numbers, codes, and other identifiers as per this specification. Any changes to the contents of the web based application are contingent upon subsequent changes to this specification. This specification shall have primacy.

1.4 *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:<sup>2</sup>

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.60 on Gas.

Current edition approved July 1, 2023. Published July 2023. Originally approved in 2011. Last previous edition approved in 2021 as F2897–21. DOI: 10.1520/F2897–23

<sup>2</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.

[A53/A53M Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless](#)

[A106/A106M Specification for Seamless Carbon Steel Pipe for High-Temperature Service](#)

[D1600 Terminology for Abbreviated Terms Relating to Plastics](#)

[D2513 Specification for Polyethylene \(PE\) Gas Pressure Pipe, Tubing, and Fittings](#)

[F412 Terminology Relating to Plastic Piping Systems](#)

2.2 [API Standards](#):<sup>3</sup>

[API 5L Specification for Line Pipe](#)

2.3 [ANSI Standards](#):<sup>4</sup>

[B31.8 Gas Transmission and Distribution Piping System](#)

[B1.20.1 1983 Pipe Threads, General Purpose, Inch](#)

[B109.1 Diaphragm-Type Gas Displacement Meters \(Under 500 Cubic-foot-per-hour Capacity\)](#)

[B109.2 Diaphragm-Type Gas Displacement Meters \(500 Cubic-foot-per-hour Capacity\)](#)

[B109.3 Rotary Type Gas Displacement Meters](#)

[B109.4 Self-Operated Diaphragm Type Natural Gas Service Regulators](#)

2.4 [CFR Standards](#):<sup>5</sup>

[49 CFR Part 192 Pipeline Safety Requirements](#)

## 3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminology F412, and abbreviations are in accordance with Terminology D1600, unless otherwise specified.

3.2 The gas industry terminology used in this specification is in accordance with ANSI B31.8 or 49 CFR Part 192, unless otherwise indicated.

3.3 *character, n*—an integer from zero (0) to nine (9) or a letter that is upper case and/or lower case from a to z or A to Z.

<sup>3</sup> Available from American Petroleum Institute (API), 1220 L. St., NW, Washington, DC 20005-4070, <http://www.api.org>.

<sup>4</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

<sup>5</sup> Available from U.S. Government Publishing Office (GPO), 732 N. Capitol St., NW, Washington, DC 20401, <http://www.gpo.gov>.

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

3.4 *component, n*—pipe, tubing, fittings, valves, and appurtenances unless specifically stated otherwise.

3.5 *digit, n*—an integer from zero (0) to nine (9).

3.6 *FPT, n*—internal taper thread as defined under ANSI/ASME B1.20.1, or commonly referred to as “female pipe thread”.

3.7 *MPT, n*—external taper thread as defined under ANSI/ASME B1.20.1, or commonly referred to as “male pipe thread”.

3.8 *traceability, n*—identify the origin of materials and parts used to manufacturer a given component; and/or the product processing or manufacturing history.

3.9 *tracking, v*—knowing, documenting, and/or collecting information related to the distribution and location of a given component after delivery from the manufacturer or supplier.

**4. Gas Distribution Component Traceability Identifier**

4.1 *General*—The gas distribution component traceability identifier shall be comprised of sixteen (16) alphanumeric characters that specify respective attributes (data set) for a given component.

4.1.1 The specified number of characters and order for each data set shall conform to **Table 1**.

4.1.2 The specified number of characters shall be developed using the base-62 encoding system per section 4.9 and the initial input data requirements per Section 5.

4.1.3 The gas distribution component traceability identifier shall be in a format suitable for downloading the character codes into database systems owned and maintained by the end user.

NOTE 2—An illustrative example is provided in **Appendix X2**.

4.2 *Identification of Component Manufacturer*—Each component manufacturer shall be identified by a unique two character code which shall be assigned after completing the required registration and activated by the webmaster of the website <http://www.componentid.org>. The manufacturer identification code shall be unique to that particular company and can only be used by that respective manufacturer/supplier.

4.3 *Identification of Component Manufacturer’s Lot Code*—The component manufacturer’s lot code shall be identified by a four character code that is developed using the base-62 encoding system per 4.9. The four character code shall be

unique in a manner to help ascertain information related to the origin of materials, product processing history, and other information that is agreed upon between the manufacturer and end user.

4.4 *Identification of Component Production Date*—The production date code shall be identified by a three character code that is developed using the base-62 encoding system per 4.9.

4.5 *Identification of Component Material*—The primary material used to manufacture the pipe or component shall be identified by a single character code per 5.5.

4.6 *Identification of Component Type*—Each component type shall be identified by a two character code per 5.6.

4.7 *Identification of Component Size*—Each component size shall be identified by a three character code that is developed using the sizing calculation outlined in 5.7 and the base-62 encoding system per 4.9.

4.8 *Identification of Base 62 Index*—Each component type shall be identified by a single character code per 5.1.

4.9 *Base-62 Encoding System:*

4.9.1 The base-62 positional encoding system shall utilize integer values between zero and nine and both uppercase and lowercase alphabet characters with the assigned place values as shown in **Table 2**.

**TABLE 2 Positional Values for Base-62 Encoding System**

Positional Value	Character	Positional Value	Character
0	0	36	A
1	1	37	B
2	2	38	C
3	3	39	D
4	4	40	E
5	5	41	F
6	6	42	G
7	7	43	H
8	8	44	I
9	9	45	J
10	a	46	K
11	b	47	L
12	c	48	M
13	d	49	N
14	e	50	O
15	f	51	P
16	g	52	Q
17	h	53	R
18	i	54	S
19	j	55	T
20	k	56	U
21	l	57	V
22	m	58	W
23	n	59	X
24	o	60	Y
25	p	61	Z
26	q		
27	r		
28	s		
29	t		
30	u		
31	v		
32	w		
33	x		
34	y		
35	z		

**TABLE 1 Specified Number of Characters and Order for Gas Distribution Component Traceability Identifier**

Data	Number of Character(s) <sup>A</sup>
Component manufacturer	2
Component manufacturer’s lot code	4
Component production date	3
Component material	1
Component type	2
Component size	3
Base 62 Index	1

<sup>A</sup> The total number of characters is based on the final resultant after applying the base-62 encoding system in this specification. For different initial input data, the requirements and format are in Section 5 of this specification.

4.9.2 The assigned place values shown in Table 2 shall be used to convert the initial input data into the final alphanumeric code.

NOTE 3—Detailed examples of converting an initial integer string to a corresponding base-62 alphanumeric character string and vice-versa can be found in Appendix X1.

NOTE 4—The positional value is the value corresponding to the respective character. For example, the positional value corresponding to the character “r” is 27. The positional value corresponding to the character “T” is 55.

5. Input Data String

5.1 Base 62 Index—Each component manufacturer shall determine and establish a single character base 62 index code per Table 3 based on their specific component physical properties.

5.1.1 Unless otherwise specified, the sixteenth character shall be a null value of “0”.

NOTE 5—The base 62 index is a reference value that allows for alternative alphanumeric identifiers. The Annex A1 has been added to allow component manufacturers with additional coefficients corresponding to thicker wall sizes that are not listed in the main body of this specification.

5.2 Component Manufacturer—Each component manufacturer shall establish a unique two (2) digit identifier by completing the required registration and activated by the webmaster of the website <http://www.componentid.org>. The manufacturer identification code shall be unique to that particular company and can only be used by that company. In cases where the company undergoes a change in name, acquired, merged with another company, new two (2) digit identifier must be registered and activated if the “acquiring” or “merged with” company does not already have a registered identifier.

5.3 Component Manufacturer’s Lot Code—Each component manufacturer shall establish a unique seven (7) digit number for their lot code which shall be used as the input into the base-62 encoding system per 4.9. The 7 digit number shall consist of only integer values and cannot contain any other characters such as alphabetic or ASCII characters.

NOTE 6—The 7 digit code can be developed freely by the manufacturer to define individual production lots in a unique way. Elements of the 7 digit code may possibly include production site, extrusion line, injection molding equipment number, operator, shift, etc. The 7 digit code should be capable of providing pertinent traceability information upon request.

5.4 Component Production Date—Each component manufacturer shall provide the production date of the respective component consisting of five (5) digits as input into the base-62 encoding system per 4.9.

5.4.1 The first three digits shall correspond to the particular day of the year.

5.4.2 The final two digits shall correspond to the last two digits of the year.

TABLE 3 List of base 62 Index Values

Type	Code
Default	0
Annex A1	1

NOTE 7—For example, the date input represented by 23410 implies the 234th day of 2010.

5.5 Component Material—Each component manufacturer shall assign a single character code for the primary material used to manufacture the respective component from Table 4.

NOTE 8—Additional material code numbers are reserved for future use and will be activated upon revision of this specification.

NOTE 9—The “Grade” designation for steel materials will vary based on the standard to which it is manufactured. The user should verify the chemical and mechanical properties in accordance to the specific standard that they are utilizing before making their final selection.

5.5.1 For pipe and tubing made from a single material, the code shall be assigned from the list shown in Table 4.

5.5.2 For multi-layer pipe and tubing, the inner most layer which is in contact with the natural gas shall be assigned from the list shown in Table 4.

5.5.3 For factory assembled transition fittings and risers and transition tees intended to facilitate a change between metallic and non-metallic piping systems, the non-metallic portion shall be identified.

5.5.4 For all components other than factory assembled transition fittings and risers and transition tees, the material code shall correspond to the outer shell or body of the respective component regardless of the piping system to which it is intended to be installed.

5.5.5 For fittings intended to facilitate a change between PE to another thermoplastic piping systems, the material code

TABLE 4 List of Material Types

Type	Code
PE2406	A
PE2708	B
PE2708 PLUS	d
PE3408	C
PE3608	D
PE3708	E
PE3710	F
PE4608	G
PE4710	H
PE4710 PLUS	e
PE80	W
PE100	Z
Poly (Vinyl Chloride) – PVC	J
Polyamide 11 – PA11	K
Polyamide 12 – PA12	L
PEX	Y
Steel	M
Stainless Steel	N
Cast Iron	O
Copper	P
Brass	Q
Malleable Iron	R
Ductile Iron	S
Reinforced Epoxy Resin	T
Nylon	U
Glass Filled Nylon	V
Other	X
Steel – GRADE A	0
Steel – GRADE B	1
Steel – GRADE C	2
Steel – GRADE X42	3
Steel – GRADE X46	4
Steel – GRADE X52	5
Steel – GRADE X56	6
Steel – GRADE X60	7
Steel – GRADE X65	8
Steel – GRADE X70	9

shall correspond to the outer shell or body of the respective component connecting to the PE pipe.

NOTE 10—In previous editions of Specification **D2513** various thermoplastic materials were approved for use under 49 CFR Part 192 requirements. For those other materials which have subsequently been deleted but still allowed to be used for repair purposes only, for example, PVC, then PE will take precedence.

5.6 *Component Type*—Each component manufacturer shall assign a two (2) character code for their respective component type from **Table 5**.

NOTE 11—Additional component type code numbers are reserved for future use and will be activated upon revision of this specification.

5.7 *Component Size*—Each component manufacturer shall develop a unique dimensional code,  $D$ , corresponding to the size of the respective item. The dimensional code shall be used as input into the base-62 encoding system per **4.9**.

5.7.1 The dimensional code shall be calculated using **Eq 1** based on the factors from **Tables 6-8** corresponding to the dimensions for a given component:

$$D = (C_1 * 378) + C_2 + 1 \quad (1)$$

where:

$C_1$  = factor corresponding to the first dimension,  $D_1$ , and

$C_2$  = factor corresponding to the second dimension,  $D_2$ .

5.7.1.1 The second dimension,  $D_2$ , shall always be the larger dimension for a given component as shown in **Eq 2**:

$$D_2 > D_1 \quad (2)$$

5.7.2 Only for the case of a pipe, tubing, or other components where either  $C_1$  or  $C_2$  cannot be ascertained from **Table 5-7** corresponding to the dimensions of a given component, then the dimensional code,  $D$ , shall be set equal to 0 and the resultant base62 dimensional code shall be set equal to 000.

5.7.3 For the case of a pipe, tubing, or other in-line components where there is no dimensional change, then  $D_1 = D_2$  and  $C_1 = C_2$ .

5.7.4 For components other than various risers and transition fittings or other using metallic parts, the second dimension,  $D_2$ , shall be expressed by the connection to the main.

5.7.5 In the case of various types of risers and transition fittings or others using metallic parts, the second dimension,  $D_2$ , shall be expressed by the metallic size, for example, MPT or FPT.

NOTE 12—For the case of a 2" IPS SDR9.33 pipe,  $D_1 = D_2$  and  $C_1 = C_2 = 37$ . Then from **Eq 1**, the resulting value for  $D = (37 * 378) + 37 + 1 = 14024$ .

NOTE 13—For the case of a 2" IPS SDR9.33 × ½" CTS 0.090 saddle fitting (electrofusion, molded saddle fusion, mechanical),  $D_2 = 2$ " IPS with  $C_2 = 37$ ;  $D_1 = ½$ " CTS 0.090 with  $C_1 = 4$ . Then from **Eq 1**, the resulting value for  $D = (4 * 378) + 37 + 1 = 1550$ .

## 6. Keywords

6.1 base-62 encoding system; component; gas distribution; marking; pipe; traceability; tracking

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**TABLE 5 List of Component Types**

Category Type-General	Subcategory Type	Character
Pipe	Other	10
	Straight	11
	Coiled	12
	Casing	13
	Seamless Line Pipe, API 5L, PSL1, Single Coat	1A
	Seamless Line Pipe, API 5L, PSL1, Dual Coat	1B
	Seamless Line Pipe, API 5L, PSL2, Single Coat	1C
	Seamless Line Pipe, API 5L, PSL2, Dual Coat	1D
	Electric Resistance Weld, API 5L, PSL1, Single Coat	1E
	Electric Resistance Weld, API 5L, PSL1, Dual Coat	1F
	Electric Resistance Weld, API 5L, PSL2, Single Coat	1G
	Electric Resistance Weld, API 5L, PSL2, Dual Coat	1H
	Seamless and Welded, ASTM <b>A53/A53M</b>	1J
	Seamless Carbon Steel, ASTM <b>A106/A106M</b>	1K
	High Frequency Weld, API 5L, PSL2, Single Coat	1L
	High Frequency Weld, API 5L, PSL2, Dual Coat	1M
Coupling	Other	20
	Socket fusion	21
	Socket fusion with EFV	22
	Electrofusion	23
	Electrofusion with EFV	24
	Mechanical compression or nut follower	25
	Mechanical compression or nut follower with EFV	26
	Mechanical stab	27
	Mechanical stab with EFV	28
	Mechanical interference fit	29
	Mechanical interference fit with EFV	2A
	Welded	2B
	Threaded	2C
	Flanged	2D
Adapter Coupling	Other	30
	Compression by male pipe thread	31
	Compression by female pipe thread	32
	Compression by butt fusion	33
	Compression by butt welded	34
	Compression by solvent welded	35
	Compression by stab	39
	Stab by male pipe thread	36
	Stab by female pipe thread	37
	Stab by solvent welded	38
End caps	Other	40
	Butt fusion	41
	Socket fusion	42
	Electrofusion	43
	Mechanical compression or nut follower	44
	Mechanical stab	45
	Mechanical interference fit	46
	Welded	47
	Threaded	48
	Fabricated	49
Elbows	Other	50
	Butt fusion 90	51
	Socket fusion 90	52
	Electrofusion 90	53
	Mechanical compression or nut follower 90	54
	Mechanical stab 90	55
	Mechanical interference fit 90	56
	Welded 90	57
	Threaded 90	58
	Fabricated 90	59
	Butt fusion 45	5A
	Socket fusion 45	5B
	Electrofusion 45	5C
	Mechanical compression or nut follower 45	5D
	Mechanical stab 45	5E
	Mechanical interference fit 45	5F
	Welded 45	5G
	Threaded 45	5H
Fabricated 45	5J	
3-way tees	Other	60
	Butt fusion	61
	Socket fusion	62
	Electrofusion	63
	Mechanical compression or nut follower	64
	Mechanical stab	65



**TABLE 5** *Continued*

Category	Type-General	Subcategory Type	Character
Reducer		Mechanical interference fit	66
		Welded	67
		Threaded	68
		Fabricated	69
		Other	70
		Butt fusion	71
		Socket fusion	72
		Electrofusion	73
		Mechanical compression or nut follower	74
		Mechanical stab	75
		Mechanical interference fit	76
		Butt Fusion with EFV	7A
		Socket Fusion with EFV	7B
		Electrofusion with EFV	7C
		Mechanical compression or nut follower with EFV	7D
		Mechanical Stab with EFV	7E
		Mechanical interference fit with EFV	7F
		Welded	77
	Tapping tees		Threaded
		Fabricated	79
		Other	80
		Saddle heat fusion by butt fusion outlet	81
		Saddle heat fusion by butt fusion outlet with EFV	82
		Saddle heat fusion by socket outlet	83
		Saddle heat fusion by socket outlet with EFV	84
		Saddle heat fusion by mechanical compression outlet	85
		Saddle heat fusion by mechanical compression outlet with EFV	86
		Saddle heat fusion by stab outlet	87
		Saddle heat fusion by stab outlet with EFV	88
		Electrofusion by butt fusion outlet	89
		Electrofusion by butt fusion outlet with EFV	8A
		Electrofusion by socket outlet	8B
		Electrofusion by socket outlet with EFV	8C
		Electrofusion by mechanical compression outlet	8D
		Electrofusion by mechanical compression outlet with EFV	8E
		Electrofusion by stab outlet	8F
		Electrofusion by stab outlet with EFV	8G
		Mechanical by butt fusion outlet	8H
		Mechanical by butt fusion outlet with EFV	8J
		Mechanical by socket outlet	8K
		Mechanical by socket outlet with EFV	8L
		Mechanical by mechanical compression outlet	8M
		Mechanical by mechanical compression outlet with EFV	8N
		Mechanical by stab outlet	8P
		Mechanical by stab outlet with EFV	8Q
		Mechanical by mechanical interference fit	8R
		Mechanical by mechanical interference fit with EFV	8S
High Volume Tapping Tees		Other	90
		Electrofusion by butt fusion	91
		Saddle heat fusion by butt fusion	92
		Mechanical by compression outlet	93
		Electrofusion by socket outlet	94
		Saddle heat fusion by socket outlet	95
		Mechanical by stab outlet	96
Branch Saddle		Mechanical by mechanical interference fit	97
		Other	B0
		Electrofusion	B1
Mechanical saddle		Saddle heat fusion	B2
		Mechanical	B3
Service tee or Valve tee		No outlet	S1
		Other	D0
		Welded by welded	D1
		Welded by butt fusion	D2
		Welded by thread	D3
		Welded by compression or nut follower	D4
		Welded by mechanical interference fit	D5
		Welded by stab	DD
		Thread by welded	D6
		Thread by compression or nut follower	D7
		Thread by mechanical interference fit	DE
		Thread by stab	DF
		Thread by thread	DG
		Thread by butt fusion	DH
		Mechanical saddle by welded	D8
		Mechanical saddle by Butt fusion	D9

**TABLE 5** *Continued*

Category	Type-General	Subcategory Type	Character
Service saddles		Mechanical saddle by thread	DA
		Mechanical saddle by compression or nut follower	DB
		Mechanical saddle by mechanical interference fit	DC
		Mechanical saddle by stab	DJ
		Other	E0
Flanges		Single strap	E1
		Double strap	E2
		Other	FH
		Blind	FB
		Lap-Joint	FL
Transition Fitting		Socket Weld	FX
		Slip-On	FS
		Threaded	FT
		Weld-Neck	FW
		PE Flange Adapter Assembly	FP
		Other	T0
		Welded end	T1
		Thread end	T2
		Flanged end	T3
		Socket weld by butt fusion	TX
Riser		Other	R0
		Factory Assembled, Anodeless	R1
		Factory Assembled, Anodeless, Flexible	R2
		Factory Assembled, Non-Anodeless	R3
		Field Assembled, Anodeless	R4
		Field Assembled, Anodeless, Flexible	R5
		Field Assembled, Non-Anodeless	R6
Valve		Other	V0
		Ball valve	V1
		Butterfly valve	V2
		Check valve	V3
		Relief valve	V4
		Gate valve	V5
		Needle valve	V6
		Plug valve	V7
		Excess flow valve	EF
		Other	M0
Excess Flow Valve Meter set assembly and components		Diaphragm meter	M1
		Rotary meter	M2
		Meter set assembly	M3
		Meter bar	M4
		Meter swivel	M5
		Meter nut	M6
		Ultrasonic meter	M7
		Turbine meter	M8
		Remote shut off meter	M9
		Other	RX
Regulator		Pilot	RP
		Service	RS
		Relief	RR
		Other	F0
Filter		Pilot	F1
		Service and mains	F2
		Strainer	F3
Anode		Other	A0
		Cast iron	A1
		Graphite	A2
		Magnesium	A3
		Zinc	A4
Pressure control fitting		Other	P0
		Split repair	P1
		Bottom out	P2
		Top tap	P3
Union		Non-insulated	U1
		Insulated	UX
		Other	C0
Repair clamp		Repair clamps	C1

**TABLE 6 C<sub>1</sub> and C<sub>2</sub> Factors Corresponding to Standard Dimensions (D<sub>1</sub> or D<sub>2</sub>) for CTS and IPS Sizes, in. (mm)**

D <sub>1</sub> or D <sub>2</sub>			Factor C <sub>1</sub> or C <sub>2</sub>	D <sub>1</sub> or D <sub>2</sub>			Factor C <sub>1</sub> or C <sub>2</sub>
Diameter	SDR	Wall Thickness in. (mm)		Diameter	SDR	Wall Thickness in. (mm)	
¼ in. CTS	—	0.062 (1.58)	1	2 in. IPS	9.33	0.255 (6.48)	37
⅜ in. CTS	—	0.062 (1.58)	2	2 in. IPS	11	0.216 (5.49)	38
½ in. CTS	—	0.062 (1.58)	3	2 in. IPS	13.5	0.176 (4.47)	39
½ in. CTS	—	0.090 (2.27)	4	3 in. IPS	11	0.318 (8.08)	40
½ in. CTS	—	0.104 (2.64)	5	3 in. IPS	11.5	0.304 (7.72)	41
¾ in. CTS	—	0.062 (1.58)	6	3 in. IPS	13.5	0.259 (6.58)	42
¾ in. CTS	—	0.077 (1.95)	7	4 in. IPS	9.33	0.482 (12.24)	43
¾ in. CTS	—	0.090 (2.27)	8	4 in. IPS	11	0.409 (10.39)	44
1 in. CTS	—	0.062 (1.58)	9	4 in. IPS	11.5	0.391 (9.93)	45
1 in. CTS	—	0.090 (2.27)	10	4 in. IPS	13.5	0.333 (8.46)	46
1 in. CTS	—	0.099 (2.51)	11	4 in. IPS	15.5	0.290 (7.37)	47
1 in. CTS	—	0.101 (2.56)	12	4 in. IPS	17	0.265 (6.73)	48
1 in. CTS	—	0.121 (3.07)	13	6 in. IPS	11	0.602 (15.29)	49
1¼ in. CTS	—	0.062 (1.58)	14	6 in. IPS	11.5	0.576 (14.63)	50
1¼ in. CTS	—	0.090 (2.27)	15	6 in. IPS	13.5	0.491 (12.47)	51
1¼ in. CTS	—	0.121 (3.07)	16	6 in. IPS	17	0.390 (9.91)	52
1¾ in. CTS	—	0.062 (1.58)	17	6 in. IPS	21	0.315 (8.00)	53
½ in. IPS	9.33	0.090 (2.29)	18	8 in. IPS	11	0.784 (19.91)	54
½ in. IPS	11	0.076 (1.93)	19	8 in. IPS	11.5	0.750 (19.05)	55
¾ in. IPS	11	0.095 (2.41)	20	8 in. IPS	13.5	0.639 (16.23)	56
¾ in. IPS	D	0.090 (2.29)	21	8 in. IPS	17	0.507 (12.90)	57
1 in. IPS	9.33	0.140 (3.56)	22	8 in. IPS	21	0.411 (10.44)	58
1 in. IPS	9.9	0.133 (3.38)	23	10 in. IPS	11	0.977 (24.82)	59
1 in. IPS	11	0.120 (3.05)	24	10 in. IPS	11.5	0.935 (23.75)	60
1 in. IPS	13.5	0.097 (2.46)	25	10 in. IPS	13.5	0.796 (20.22)	61
1 in. IPS	D	0.090 (2.29)	26	10 in. IPS	17	0.632 (16.05)	62
1¼ in. IPS	9.33	0.178 (4.52)	27	10 in. IPS	21	0.512 (13.00)	63
1¼ in. IPS	10	0.166 (4.22)	28	12 in. IPS	11	1.159 (29.44)	64
1¼ in. IPS	11	0.151 (3.84)	29	12 in. IPS	11.5	1.109 (28.17)	65
1¼ in. IPS	13.5	0.123 (3.12)	30	12 in. IPS	13.5	0.944 (23.98)	66
1¼ in. IPS	17	0.098 (2.49)	31	12 in. IPS	17	0.750 (19.05)	67
1¼ in. IPS	D	0.090 (2.29)	32	12 in. IPS	21	0.607 (15.42)	68
1½ in. IPS	11	0.173 (4.39)	33	14 in. IPS	11	1.273 (32.33)	69
1½ in. IPS	13.5	0.141 (3.58)	34	14 in. IPS	13.5	1.037 (26.34)	70
1½ in. IPS	17	0.112 (2.85)	35	14 in. IPS	17	0.824 (20.93)	71
1½ in. IPS	D	0.090 (2.29)	36	14 in. IPS	21	0.667 (16.94)	72
				16 in. IPS	11	1.455 (36.96)	73
				16 in. IPS	13.5	1.185 (30.10)	74
				16 in. IPS	17	0.941 (23.90)	75
				16 in. IPS	21	0.762 (19.35)	76
				18 in. IPS	11	1.636 (41.55)	77
				18 in. IPS	13.5	1.333 (33.86)	78
				18 in. IPS	17	1.059 (26.90)	79
				18 in. IPS	21	0.857 (21.77)	80
				20 in. IPS	11	1.818 (46.18)	81
				20 in. IPS	13.5	1.481 (37.62)	82
				20 in. IPS	17	1.176 (29.87)	83
				20 in. IPS	21	0.952 (24.18)	84
				22 in. IPS	11	2.000 (50.8)	85
				22 in. IPS	13.5	1.630 (41.40)	86
				22 in. IPS	17	1.294 (32.87)	87
				22 in. IPS	21	1.048 (26.62)	88
				24 in. IPS	11	2.182 (55.43)	89
				24 in. IPS	13.5	1.778 (45.16)	90
				24 in. IPS	17	1.412 (35.86)	91
				24 in. IPS	21	1.143 (29.03)	92



**TABLE 7 C<sub>1</sub> and C<sub>2</sub> Factors Corresponding to Dimensions (D<sub>1</sub> or D<sub>2</sub>) for MPT and FPT Sizes**

D <sub>1</sub> or D <sub>2</sub>	Factor C <sub>1</sub> or C <sub>2</sub>	D <sub>1</sub> or D <sub>2</sub>	Factor C <sub>1</sub> or C <sub>2</sub>
½ in. MPT	101	½ in. FPT	121
¾ in. MPT	102	¾ in. FPT	122
1 in. MPT	103	1 in. FPT	123
1¼ in. MPT	104	1¼ in. FPT	124
1½ in. MPT	105	1½ in. FPT	125
2 in. MPT	106	2 in. FPT	126
3 in. MPT	107	3 in. FPT	127
4 in. MPT	108	4 in. FPT	128
6 in. MPT	109	6 in. FPT	129
8 in. MPT	110	8 in. FPT	130
10 in. MPT	111	10 in. FPT	131
12 in. MPT	112	12 in. FPT	132

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**TABLE 8 C1 and C2 Factors Corresponding to Dimensions (D1 or D2) for Steel NPS Sizes**

NPS Designator	Specified Wall Thickness, in. (mm)	Factor C <sub>1</sub> or C <sub>2</sub>
1/8 in.	0.068 (1.73)	151
	0.095 (2.41)	152
1/4 in.	0.088 (2.24)	153
	0.119 (3.02)	154
3/8 in.	0.091 (2.31)	155
	0.126 (3.20)	156
1/2 in.	0.109 (2.77)	157
	0.147 (3.73)	158
3/4 in.	0.113 (2.87)	159
	0.154 (3.91)	160
1 in.	0.133 (2.87)	161
	0.179 (4.55)	162
1 1/4 in.	0.140 (3.56)	163
	0.191 (4.85)	164
1 1/2 in.	0.145 (3.68)	165
2 in.	0.154 (3.91)	167
	0.218 (5.54)	168
3	0.188 (4.78)	169
	0.216 (5.49)	170
4	0.156 (3.91)	171
	0.188 (4.78)	172
	0.237 (6.02)	173
6	0.188 (4.78)	175
	0.219 (5.56)	176
	0.250 (6.35)	177
	0.280 (7.11)	178
8	0.188 (4.78)	181
	0.219 (5.56)	182
	0.250 (6.35)	183
	0.322 (8.18)	184
10	0.188 (4.78)	187
	0.203 (5.16)	188
	0.219 (5.56)	189
	0.279 (7.09)	190
	0.365 (9.27)	191
12	0.219 (5.56)	193
	0.250 (6.35)	194
	0.312 (7.92)	195
	0.375 (9.52)	196
14	0.209 (5.30)	197
	0.250 (6.35)	198
	0.375 (9.53)	199
	0.625 (15.88)	200
	0.687 (17.45)	201
	0.938 (23.83)	202
15	0.209 (5.30)	203
	0.250 (6.35)	204
16	0.188 (4.78)	205
	0.219 (5.56)	206
	0.225 (5.72)	207
	0.243 (6.17)	208
	0.250 (6.35)	209
	0.260 (6.60)	210
	0.270 (6.86)	211
	0.280 (7.11)	212
	0.312 (7.93)	213
	0.325 (8.26)	214

**TABLE 8** *Continued*

NPS Designator	Specified Wall Thickness, in. (mm)	Factor $C_1$ or $C_2$
	0.345 (8.76)	215
	0.357 (9.07)	216
	0.365 (9.27)	217
	0.375 (9.53)	218
	0.406 (10.31)	219
	0.500 (12.70)	220
	0.530 (13.46)	221
	0.550 (13.97)	222
	0.560 (14.22)	223
	0.625 (15.88)	224
	0.656 (16.66)	225
	0.843 (21.41)	226
	1.039 (26.39)	227
	1.125 (28.58)	228
	1.218 (30.94)	229
	1.438 (36.53)	230
	1.594 (40.49)	231
18	0.219 (5.56)	232
	0.250 (6.35)	233
	0.312 (7.93)	234
	0.344 (8.73)	235
	0.375 (9.53)	236
	0.406 (10.31)	237
	0.500 (12.70)	238
	0.750 (19.05)	239
	0.938 (23.83)	240
	1.125 (28.58)	241
	1.156 (29.36)	242
	1.375 (34.93)	243
	2.100 (53.34)	244
20	0.219 (5.56)	245
	0.234 (5.94)	246
	0.250 (6.35)	247
	0.265 (6.73)	248
	0.281 (7.14)	249
	0.288 (7.32)	250
	0.312 (7.93)	251
	0.328 (8.33)	252
	0.344 (8.74)	253
	0.375 (9.53)	254
	0.406 (10.31)	255
	0.438 (11.13)	256
	0.469 (11.91)	257
	0.500 (12.70)	258
22	0.219 (5.56)	259
	0.237 (6.02)	260
	0.250 (6.35)	261
	0.281 (7.14)	262
	0.312 (7.93)	263
	0.344 (8.74)	264
	0.371 (9.42)	265
	0.375 (9.53)	266
	0.432 (10.97)	267
	0.438 (11.13)	268
	0.500 (12.70)	269
	0.562 (14.28)	270
	0.625 (15.88)	271
24	0.250 (6.35)	272
	0.265 (6.73)	273
	0.271 (6.88)	274
	0.281 (7.14)	275
	0.289 (7.34)	276
	0.307 (7.80)	277
	0.312 (7.93)	278
	0.320 (8.13)	279
	0.344 (8.74)	280
	0.375 (9.53)	281
	0.382 (9.70)	282
	0.391 (9.93)	283
	0.406 (10.31)	284

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