Designation: F2897 - 23a

An American National Standard

# 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  $(\varepsilon)$  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>

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:4

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-feet-per-hour Capacity)

B109.2 Diaphragm-Type Gas Displacement Meters (500 Cubic-feet-per-hour Capacity)

B109.3 Rotary Type Gas Displacement Meters

B109.4 Self-Operated Diaphragm Type Natural Gas Service

Regulators \_\_007b702d7186/astm\_0807\_23a

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>&</sup>lt;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.

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<sup>&</sup>lt;sup>2</sup> For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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

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

- 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

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>&</sup>lt;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.

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	Α
1	1	37	В
2	2	38	С
7-23a 3	3	39	D
2f5-4566- <mark>\$</mark> 0d1-e0	71 740 171	40	E
		86/astn <sub>41</sub> f <sub>2</sub> 897-2	
6	6	42	G
7	7	43	Н
8	8	44	I
9	9	45	J
10	а	46	K
11	b	47	L
12	С	48	M
13	d	49	N
14	е	50	0
15	f	51	Р
16	g	52	Q
17	h	53	R
18	i	54	S
19	j	55	T
20	k	56	U
21	1	57	V
22	m	58	W
23	n	59	X
24	0	60	Υ
25	р	61	Z
26	q		
27	r		
28	S		
29	t		
30	u		
31	V		
32	W		
33	Х		
34	у		
35	Z		

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

Туре	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** 

Туре	Code
PE2406/	A
PE2708	В
PE2708 PLUS	d
PE3408	С
PE3608	D
PE3708	5/astm-f289 <mark>F</mark> -23a
5 PE3710 - 80d1-e07b792d7186	·
PE4608	G
PE4710	Н
PE4710 PLUS	е
PE80	W
PE100	Z
Poly (Vinyl Chloride) – PVC	J K
Polyamide 11 – PA11	K L
Polyamide 12 – PA12 PEX	L Y
Steel	M
Stainless Steel	N
Cast Iron	0
Copper	P
Brass	Q
Malleable Iron	Ř
Ductile Iron	S
Reinforced Epoxy Resin	Ť
Nylon	Ü
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 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:

$$D = (C_1 * 378) + C_2 + 1 \tag{1}$$

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:

$$D_2 > D_1 \tag{2}$$

- 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 ×  $\frac{1}{2}$ " CTS 0.090 saddle fitting (electrofusion, molded saddle fusion, mechanical),  $D_2=2$ " IPS with  $C_2=37$ ;  $D_1=\frac{1}{2}$ " 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

Pipe   Other	Category Type-General	Subcategory Type	Character
Straight   11   12   13   14   15   15   15   15   15   15   15			
Colled   Casing   12	Pipe		
Casing         Samiless Line Pipe, API SL, PSL1, Single Coat         13           Seamless Line Pipe, API SL, PSL1, Single Coat         18           Seamless Line Pipe, API SL, PSL2, Dual Coat         10           Seamless Line Pipe, API SL, PSL2, Dual Coat         11           Electric Resistance Weld, API SL, PSL2, Dual Coat         11           Electric Resistance Weld, API SL, PSL2, Dual Coat         11           Electric Resistance Weld, API SL, PSL2, Dual Coat         11           Electric Resistance Weld, API SL, PSL2, Single Coat         11           Electric Resistance Weld, API SL, PSL2, Dual Coat         11           High Frequency Weld, API SL, PSL2, Single Coat         11           High Frequency Weld, API SL, PSL2, Single Coat         11           High Frequency Weld, API SL, PSL2, Single Coat         11           High Frequency Weld, API SL, PSL2, Single Coat         11           Electrousion         22           Scheet fusion         22           Scheet fusion         23           Electrousion         23           Mechanical stab will EFV         24           Mechanical stab will EFV         27           Mechanical stab will EFV         28           Mechanical stab will be pipe thread         20           Compression by solvent welded			
Seamises Line Pipe, API El, PSI 1, Single Coat			
Seamloss Line Pipe, API 5L, PSL1, Dual Coat   16   17   18   18   18   18   18   18   18		· ·	
Seamless Line Pipe, API 5L, PSL2, Single Coat   10			
Seamless Line Pipe, API 5L, PSL2, Dual Coat   15			
Electric Resistance Weld, API SL, PSL1, Single Coat   Electric Resistance Weld, API SL, PSL1, Diaul Coat   F   F   F   F   F   F   F   F   F		· · · · · · · · · · · · · · · · · · ·	
Electric Resistance Wold, API SL, PSL2, Single Coat			
Electric Resistance Weld, API SL, PSIL2, Dual Coat		Electric Resistance Weld, API 5L, PSL1, Single Coat	
Electric Resistance Weld, APISL, PSL2, Dual Coat			
Seamless and Welded, ASTM ASS/ASSM         11, 14, 14, 14, 14, 14, 14, 14, 14, 14,			
Seamless Carbon Sueal, ASTM A106A106M   1K   1K   1K   1K   1K   1K   1K   1			
High Frequency Weld, API 5L, PSL2, Single Coat   14   14   14   14   14   14   14   1			
Coupling         High Frequency Weld, API SL, PSL2, Dual Coat         1M           Coupling         Socket tusion         21           Socket tusion with EFV         22           Electrofusion         25           Electrofusion with EFV         26           Mechanical compression or nut follower         26           Mechanical stab         27           Mechanical stab with EFV         28           Mechanical interference fit         28           Mechanical interference fit with EFV         28           Welded         18           Prized         20           Compression by mechanical interference fit with EFV         20           Welded         18           Flanged         20           Compression by mechanical interference fit with EFV         30           Compression by mechanical pit fread         30           Compression by pit med pipe thread         31           Compression by solvent welded         31           Compression by solvent welded         31           Compression by solvent welded         32           Compression by solvent welded         38           Elbows         40           Elbows         40           Mechanical stab			
Coupling         Other         20           Coupling         Socket fusion with EFV         22           Electrofusion with EFV         23           Electrofusion with EFV         24           Mechanical compression or nut follower         25           Mechanical compression or nut follower with EFV         26           Mechanical stab with EFV         28           Welded         7           Welded         20           Threaded         20           Flanged         20           Compression by male pipe thread         30           Compression by female pipe thread         31           Compression by but the wilded         33           Compression by solvent welded         34           Compression by solvent welded         33           End caps         Other         36           End caps         Other         36           End caps         Other         40           With well well well well well well well wel			
Socket fusion with EFV   22   23   23   24   24   24   24   24	0 "		
Socket fusion with EFV   22	Coupling		
Electrofusion with EFV   Mechanical compression or nut follower   Mechanical stab   Mechanical stab			
Electrotison with EFV   24			
Mechanical compression or nut follower with EFV			
Mechanical compression or nut follower with EFV   26   27     Mechanical stab   Mechanical stab   27   28   29     Mechanical interference fit   29   28   28   28     Mechanical interference fit with EFV   28   28   28   28     Mechanical interference fit with EFV   28   28   28   28   28   28     Mechanical interference fit with EFV   28   28   28   28   28   28   28   2			
Mechanical stab   Mechanical stab   Mechanical stab   Mechanical interference fit   Mechanical		·	
Mechanical stab with EFV   28		·	
Mechanical interference fit with EFV   28   28   28   28   28   29   29   29			
Mechanical interference fit with EFV   Melded   2B			
Melded   Threaded   2B   Threaded   2D   Threaded   3D   Thr			
Adapter Coupling		Mechanical interference fit with EFV	
Adapter Coupling			
Adapter Coupling         Other         30           Compression by male pipe thread         31           Compression by butt fusion         33           Compression by butt welded         34           Compression by solvent welded         35           Compression by solvent welded         36           Stab by male pipe thread         36           Stab by male pipe thread         38           Stab by solvent welded         38           Butt fusion         41           Socket fusion         41           Socket fusion         42           Electrofusion         43           Mechanical stab         45           Mechanical stab         45           Mechanical stab         46           Welded         47           Threaded         48           Fabricated         49           Elbows         50           Elbit fusion 90         51           Socket fusion 90         52           Electrofusion 90         52           Mechanical interference fit 90         56           Mechanical stab 90         55           Mechanical interference fit 90         56           Mechanical stab 90         56 <td></td> <td></td> <td></td>			
Compression by male pipe thread Compression by female pipe thread Compression by female pipe thread Compression by butt fusion 33		Flanged	
Compression by butt welded   Compression by butt welded   Compression by butt welded   Compression by solvent welded   Compression by solvent welded   Compression by solvent welded   Compression by stab   Stab by male pipe thread   Stab by female pipe thread   Stab by female pipe thread   Stab by solvent welded   Stab by solvent fusion   Stab	Adapter Coupling	Other	
Compression by butt welded   Compression by butt welded   Compression by butt welded   Compression by solvent welded   Compression by solvent welded   Compression by solvent welded   Compression by stab   Stab by male pipe thread   Stab by female pipe thread   Stab by female pipe thread   Stab by solvent welded   Stab by solvent fusion   Stab		Compression by male pipe thread	
Compression by butt welded Compression by solvent welded Compression by solvent welded Compression by stab 35   39   39   39   39   39   39   39		Compression by female pipe thread	
Compression by stab   Stab by male pipe thread   Stab by male pipe thread   Stab by female pipe thread   Stab by solvent welded   At the solvent fusion   ASTM F2897-23a   42		Compression by butt fusion	
Compression by stab   Stab by male pipe thread   Stab by male pipe thread   Stab by female pipe thread   Stab by solvent welded   At the solvent fusion   ASTM F2897-23a   42		Compression by butt welded	34
Compression by stab   Stab by male pipe thread   Stab by male pipe thread   Stab by female pipe thread   Stab by solvent welded   At the solvent fusion   ASTM F2897-23a   42		Compression by solvent welded	35
Stab by female pipe thread   37		Compression by stab	
Stab by solvent welded   38   40		Stab by male pipe thread	
Stab by solvent welded   38   40		Stab by female pipe thread	37
Butt fusion   ASTM F2897-23a   42		Stab by solvent welded	38
Socket fusion   ASTM F2897-23a   42   43   43   44   45   45   45   45   45	End caps	Other	40
Electrofusion   Mechanical compression or nut follower   15 183 - 15 2 15 - 15 6 6 - 80 d 1 - 20 7 15 7 3 4 4 6 6 8 1		Butt fusion	41
Mechanical compression or nut follower   15183-b215-4566-80d1-e07b792d   44   6/astm-12897-23a     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   50     Socket fusion 45   50     Socket fusion 45   58     Socket fusion 45			42
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	
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		Mechanical compression or nut follower	4480/astm-1289/-23a
Welded       47         Threaded       48         Fabricated       49         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		Mechanical stab	45
Threaded		Mechanical interference fit	
Elbows       Fabricated       49         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		Welded	47
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		Threaded	48
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		Fabricated	49
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	Elbows	Other	50
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		Butt fusion 90	51
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		Socket fusion 90	52
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			
Mechanical interference fit 90       56         Welded 90       57         Threaded 90       58         Fabricated 90       59         Butt fusion 45       5A         Socket fusion 45       5B		Mechanical compression or nut follower 90	
Welded 90       57         Threaded 90       58         Fabricated 90       59         Butt fusion 45       5A         Socket fusion 45       5B		Mechanical stab 90	55
Threaded 90       58         Fabricated 90       59         Butt fusion 45       5A         Socket fusion 45       5B		Mechanical interference fit 90	56
Fabricated 90 59 Butt fusion 45 5A Socket fusion 45 5B		Welded 90	57
Butt fusion 45 5A Socket fusion 45 5B			
Socket fusion 45 5B		Fabricated 90	59
		Butt fusion 45	5A
Electrofusion 45 5C		Socket fusion 45	5B
		Electrofusion 45	5C
Mechanical compression or nut follower 45 5D		Mechanical compression or nut follower 45	5D
Mechanical stab 45 5E			
Mechanical interference fit 45 5F		Mechanical interference fit 45	5F
Welded 45 5G		Welded 45	5G
Threaded 45 5H		Threaded 45	5H
Fabricated 45 5J		Fabricated 45	5J
3-way tees Other 60	3-way tees	Other	60
Butt fusion 61	-	Butt fusion	61
Socket fusion 62		Socket fusion	62
Electrofusion 63		Electrofusion	63
Mechanical compression or nut follower 64		Mechanical compression or nut follower	64
Mechanical stab 65			65



## TABLE 5 Continued

Category Type-General         Subcategory Type         Character           Weidled         67           Weidled         67           Treaded         68           Christed         72           Christed         77           Christed         72           Electrobasion         72           Mechanical compression or nut follower         74           Mechanical stab         75           Mechanical stab         75           Mechanical stab with EFV         7A           Mechanical stab with EFV         7A           Mechanical stab with EFV         77           Weided         77           Tapping tees         Fabricated         78           Tapping tees         Saddle heat fusion by socket outlet         83           Saddle heat fusion by mechanical compression outlet with EFV         82           Saddle heat fusion by mechanical compression outlet with EFV         88		IADLE 3 Continued	
Medication	Category Type-General	Subcategory Type	Character
Medication		Mechanical interference fit	66
Principate     Pri			
Reducer         Fabricated         60           Butt fusion         70           Butt fusion         72           Butt fusion         72           Bectoriusion         73           Mechanical compression or nut follower         74           Mechanical stabl         76           Mechanical Stabl         76           Sockel Fusion with EFV         76           Electrofusion with EFV         76           Hechanical Compression or nut follower with EFV         77           Mechanical stabl with EFV         77           Mediced         77           Triesaded         78           Saddle heat fusion by butt fusion outled         81           Saddle heat fusion by socket outlet with EFV         83           Saddle heat fusion by wechanical compression outlet         84           Bectoriusion by but fusion outlet with EFV         88           Saddle heat fusion by wechanical compression outlet         88           Bectoriusion by butt fusion outlet with EFV         80           Be			
Reducer         Other         70           But tusion         71           Scoket fusion         72           Electrotusion         73           Mechanical compression or nut follower         75           Mechanical station         75           Mechanical strain         76           Mechanical interference fit         77           Scoket Fusion with EFV         70           Mechanical interference fit with EFV         70           Mechanical interference fit with EFV         70           Mechanical interference fit with EFV         70           Welded         77           Traepid         78           Saddle heat fusion by but fusion outlet         80           Saddle heat fusion by but fusion outlet with EFV         80           Saddle heat fusion by but fusion outlet with EFV         80           Saddle heat fusion by but fusion outlet with EFV         80           Saddle heat fusion by socket outlet with EFV         80           Saddle heat fusion by sab outlet with EFV         80           Saddle heat fusion by sab outlet with EFV         80           Saddle heat fusion by sab outlet with EFV         80           Saddle heat fusion by sab outlet with EFV         80           Electrofusio			
But fusion   72	Dadusar		
Schef tusion	neducei		
Electrolusion   74     Mechanical stab   75     Mechanical stab   76     Mechanical stab   76     Mechanical interference fit   80     Mechanical interference fit   80     Mechanical interference fit   80     Mechanical interference fit   80     Mechanical stab   76     Mechanical stab   77     Mechanical stab   77     Mechanical stab   77     Mechanical stab   77     Mechanical interference fit with EFV   75     Mechanical interference fit with EFV   76     Mechanical interference fit with EFV   77     Wolded   77     Traeaded   78     Fabricated   78     Fabricated   78     Saddle heat fusion by but fusion outlet   81     Saddle heat fusion by socket outlet   81     Saddle heat fusion by socket outlet   81     Saddle heat fusion by mechanical compression outlet   81     Saddle heat fusion by mechanical compression outlet   81     Saddle heat fusion by socket outlet   82     Saddle heat fusion by mechanical compression outlet   83     Saddle heat fusion by socket outlet   84     Saddle heat fusion by socket outlet   84     Saddle heat fusion by stab outlet   87     Electrolusion by socket outlet   87     Mechanical by rechanical compression outlet   87     Mechanical by rechanical compression outlet   87     Mechanical by rechanical interference   87     Mechanic			
Mechanical stable of the Mechanical Stable			
Mechanical stab			
Mechanical Interference It   76   76   76   76   76   76   76   7		·	
But Fusion with EFV			
Socket Pusion with EFV   76			
Electrolusion with EPV   70   70		Butt Fusion with EFV	
Mechanical compression or nut follower with EFV         70           Mechanical interference fit with EFV         77           Wolclad         77           Threaded         78           Fabricated         79           Other         80           Saddle heart fusion by but fusion outlet         80           Saddle heart fusion by but fusion outlet with EFV         82           Saddle heart fusion by but fusion outlet with EFV         83           Saddle heart fusion by but fusion outlet with EFV         85           Saddle heart fusion by but fusion outlet with EFV         86           Saddle heart fusion by socket outlet with EFV         86           Saddle heart fusion by stab outlet with EFV         86           Saddle heart fusion by stab outlet with EFV         88           Electrofusion by but fusion outlet with EFV         88           Electrofusion by socket outlet         89           Electrofusion by socket outlet with EFV         80           Electrofusion by mechanical compression outlet with EFV         80           Electrofusion by stab outlet with EFV         80           Electrofusion by stab outlet with EFV         81           Mechanical by worker and any stab outlet with EFV         82           Mechanical by stab outlet with EFV         84 </td <td></td> <td>Socket Fusion with EFV</td> <td>7B</td>		Socket Fusion with EFV	7B
Mechanical Stab with EFV         7E           Mechanical interference fit with EFV         77           Welded         78           Threaded         78           Fabricated         79           Other         80           Saddle heat fusion by but fusion outlet with EFV         82           Saddle heat fusion by both tusion outlet with EFV         83           Saddle heat fusion by socket outlet with EFV         85           Saddle heat fusion by mechanical compression outlet         85           Saddle heat fusion by sab outlet with EFV         86           Saddle heat fusion by stab outlet with EFV         86           Saddle heat fusion by stab outlet with EFV         88           Electrofusion by but fusion outlet with EFV         88           Electrofusion by socket outlet with EFV         88           Electrofusion by socket outlet with EFV         88           Electrofusion by socket outlet with EFV         80           Electrofusion by socket outlet with EFV         86           Electrofusion by stab outlet with EFV         86           Mechanical by but fusion outlet with EFV         87           Mechanical by object outlet with EFV         88           Mechanical by mechanical compression outlet with EFV         80 <td< td=""><td></td><td>Electrofusion with EFV</td><td>7C</td></td<>		Electrofusion with EFV	7C
Mechanical interference fit with EFV         7F           Weldled         77           Trapping tees         78           Tapping tees         79           Tapping tees         80           Saddle heat fusion by butf fusion outlet         81           Saddle heat fusion by both fusion outlet with EFV         82           Saddle heat fusion by socket outlet with EFV         83           Saddle heat fusion by socket outlet with EFV         86           Saddle heat fusion by stab outlet         86           Saddle heat fusion by stab outlet with EFV         86           Saddle heat fusion by stab outlet with EFV         88           Electrofusion by but fusion outlet with EFV         88           Electrofusion by but fusion outlet with EFV         88           Electrofusion by scoket outlet with EFV         88           Electrofusion by scoket outlet with EFV         88           Electrofusion by mechanical compression outlet with EFV         86           Electrofusion by stab outlet with EFV         86           Electrofusion by stab outlet with EFV         86           Mechanical by by teth fusion outlet with EFV         86           Mechanical by mechanical compression outlet with EFV         81           Mechanical by mechanical compression outlet with EFV		Mechanical compression or nut follower with EFV	7D
Value		Mechanical Stab with EFV	7E
Tapping tees         Threaded         78           Fabricated         99           Other         Saddle heat fusion by but fusion outlet         80           Saddle heat fusion by but fusion outlet with EFV         82           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         88           Electrofusion by but fusion outlet with EFV         88           Saddle heat fusion by stab outlet with EFV         88           Electrofusion by but fusion outlet with EFV         88           Electrofusion by socket outlet with EFV         88           Electrofusion by socket outlet with EFV         88           Electrofusion by stab outlet with EFV         86           Because by but fusion outlet         88           Because by but fusion outlet with EFV         86           Because by but fusion outlet with EFV         86           Because by but fusion outlet with EFV         86           Because by but fusion outlet with EFV         88           Because by socket outlet with EFV         88		Mechanical interference fit with EFV	7F
Tapping tees         Threaded         78           Fabricated         99           Other         Saddle heat fusion by but fusion outlet         80           Saddle heat fusion by but fusion outlet with EFV         82           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         88           Electrofusion by but fusion outlet with EFV         88           Saddle heat fusion by stab outlet with EFV         88           Electrofusion by but fusion outlet with EFV         88           Electrofusion by socket outlet with EFV         88           Electrofusion by socket outlet with EFV         88           Electrofusion by stab outlet with EFV         86           Because by but fusion outlet         88           Because by but fusion outlet with EFV         86           Because by but fusion outlet with EFV         86           Because by but fusion outlet with EFV         86           Because by but fusion outlet with EFV         88           Because by socket outlet with EFV         88		Welded	77
Tapping tees         Fabricated         79           Other         Saddle heat fusion by butt fusion outlet         80           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 with EFV         86           Saddle heat fusion by the buttle fusion by the buttle fusion by the buttle fusion by the buttle fusion outlet         87           Saddle heat fusion by butt fusion outlet with EFV         88           Electrofusion by butt fusion outlet with EFV         88           Electrofusion by butt fusion outlet with EFV         8A           Electrofusion by socket outlet with EFV         8A           Electrofusion by mechanical compression outlet with EFV         8C           Electrofusion by mechanical compression outlet with EFV         8F           Electrofusion by stab outlet with EFV         8F           Mechanical by but fusion outlet with EFV         8F           Mechanical by but fusion outlet with EFV         8C           Electrofusion by stab outlet with EFV         8C           Mechanical by buttfusion outlet with EFV         8C           Mechanical by mechanical compression outlet         8N           Mechanical by mec			
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High Volume Tapping Tees Other Other Electrofusion by socket outlet Saddle heat fusion by socket outlet Mechanical by mechanical interference fit with EFV 85  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  Mechanical by mechanical interference fit 97  Paranch Saddle 96  Electrofusion 97  Saddle heat fusion 98  Electrofusion 98  Mechanical by mechanical interference fit 97  Saddle heat fusion 98  Electrofusion 98  Electrofusion 98  B1  Saddle heat fusion 98		Mechanical by stab outlet	1006/astm_f2897_23a
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   Mechanical by mechanical interference fit   97   Branch Saddle   Other   80   Electrofusion   81   Saddle heat fusion   82   Electrofusion   81   Saddle heat fusion   82   Electrofusion   83   Electrofusion   84   Electrofusion   85   Electro			
High Volume Tapping Tees   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   Mechanical by stab outlet   96   Mechanical by mechanical interference fit   97   Pranch Saddle   Other   80   Electrofusion   81   Saddle heat fusion   82   Saddle heat fusion   82   Saddle heat fusion   82   Saddle heat fusion   83   Saddle heat fusion   84   Saddle heat fusion   85   Saddle heat fusion   85   Saddle heat fusion   85   Saddle heat fusion   85   Saddle heat fusion   86   Saddle heat fusion			
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     Mechanical by mechanical interference fit   97     Branch Saddle   Other   80     Electrofusion   81     Saddle heat fusion   82	11: 1 X 1		
Saddle heat fusion by butt fusion  Mechanical by compression outlet  Electrofusion by socket outlet  Saddle heat fusion by socket outlet  Saddle heat fusion by socket outlet  Saddle heat fusion by socket outlet  Mechanical by stab outlet  Mechanical by mechanical interference fit  Other  Electrofusion  Saddle heat fusion  B1  Saddle heat fusion	High volume Tapping Tees		
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Saddle heat fusion by socket outlet 95 Mechanical by stab outlet 96 Mechanical by mechanical interference fit 97  Branch Saddle Other B0 Electrofusion B1 Saddle heat fusion B2			
Mechanical by stab outlet 96 Mechanical by mechanical interference fit 97  Branch Saddle Other B0 Electrofusion B1 Saddle heat fusion B2			
Mechanical by mechanical interference fit 97 Branch Saddle Other B0 Electrofusion B1 Saddle heat fusion B2			
Branch Saddle Other B0 Electrofusion B1 Saddle heat fusion B2		•	
Electrofusion B1 Saddle heat fusion B2		Mechanical by mechanical interference fit	97
Saddle heat fusion B2	Branch Saddle		B0
		Electrofusion	B1
Machanical		Saddle heat fusion	B2
меспапісаі ВЗ		Mechanical	B3
Mechanical saddle No outlet S1	Mechanical saddle		
Service tee or Valve tee 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		, ,	
,			
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		Thread by butt fusion	DH
Mechanical saddle by welded D8			
Mechanical saddle by Butt fusion D9		Mechanical saddle by Butt fusion	D9



## TABLE 5 Continued

	TABLE 5 Continued	
Category Type-General	Subcategory Type	Character
	Mechanical saddle by thread	DA
	Mechanical saddle by compression or nut follower	DB
		DC
	Mechanical saddle by mechanical interference fit	DJ
Carrias acadalas	Mechanical saddle by stab	
Service saddles	Other	E0
	Single strap	E1
El.	Double strap	E2
Flanges	Other	FH
	Blind	FB
	Lap-Joint Cap-Joint Cap-Jo	FL
	Socket Weld	FX
	Slip-On	FS
	Threaded	FT
	Weld-Neck	FW
	PE Flange Adapter Assembly	FP
Transition Fitting	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
		V7
Excess Flow Valve	Plug valve Excess flow valve  Standard	EF .
Meter set assembly and	Other	MO
components		IVIO
components	Diaphragm meter Ocument Preview	M1
	Rotary meter	M2
	Meter set assembly	M3
	Meter bar	M4
		M5
	Meter swivel ASTM F2897-23a Meter nut	M6
	Ultrasonic meter tandards/sist/da3f5f83-b2f5-4566-80d1-e07b792d	17 M7 6/astm-f2897-23a
	Turbine meter	M8
Descriptor	Remote shut off meter	M9
Regulator	Other	RX
	Pilot	RP
	Service	RS
=	Relief	RR
Filter	Other	F0
	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	CO
Repair clamp	Repair clamps	C1
process type	The state of the s	

TABLE 6  $C_1$  and  $C_2$  Factors Corresponding to Standard Dimensions ( $D_1$  or  $D_2$ ) for CTS and IPS Sizes, in. (mm)

	D <sub>1</sub> or	$D_2$			$D_1$ or $D_2$		Factor
Diameter	SDR	Wall Thickness in. (mm)	Factor C <sub>1</sub> or C <sub>2</sub>	Diameter	SDR	Wall Thickness in. (mm)	C <sub>1</sub> or C <sub>2</sub>
1/4 in. CTS	_	0.062 (1.58)	1	2 in. IPS	9.33	0.255 (6.48)	37
3/8 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
3/4 in. CTS	_	0.062 (1.58)	6	3 in. IPS	13.5	0.259 (6.58)	42
3/4 in. CTS	_	0.077 (1.95)	7	4 in. IPS	9.33	0.482 (12.24)	43
3/4 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
11/4 in. CTS	_	0.062 (1.58)	14	6 in. IPS	11.5	0.576 (14.63)	50
11/4 in. CTS	_	0.090 (2.27)	15	6 in. IPS	13.5	0.491 (12.47)	51
11/4 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	9.3	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
11/4 in. IPS	9.33	0.178 (4.52)	27	10 in IPS	21	0.512 (13.00)	63
11/4 in. IPS	10	0.166 (4.22)	28	12 in. IPS		1.159 (29.44)	64
11/4 in. IPS	11	0.151 (3.84)	29	12 in. IPS	11.5	1.109 (28.17)	65
11/4 in. IPS	13.5	0.123 (3.12)	30	12 in. IPS	13.5	0.944 (23.98)	66
11/4 in. IPS	17	0.098 (2.49)	31	12 in. IPS	17	0.750 (19.05)	67
11/4 in. IPS	D	0.090 (2.29)	32	12 in. IPS	rde ital <sup>21</sup>	0.607 (15.42)	68
1½ in. IPS	11 13.5	0.173 (4.39)	0 \$ 33 \$ 1	14 in. IPS 14 in. IPS	(ds.1ter <sub>13.5</sub> al)	1.273 (32.33) 1.037 (26.34)	69 70
1½ in. IPS 1½ in. IPS	17	0.141 (3.58) 0.112 (2.85)	35	14 in. IPS	17	0.824 (20.93)	70 71
1½ in. IPS	D	0.090 (2.29)	36	14 in. IPS	roviov21	0.667 (16.94)	71
172 111. 11-3	D	0.090 (2.29)		16 in. IPS	review,	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	· <u>23a</u> 11	1.636 (41.55)	77
					5-4566-8041 13.576792471	26/act 1.333 (33.86) 2	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  $C_1$  and  $C_2$  Factors Corresponding to Dimensions ( $D_1$  or  $D_2$ ) 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	3/4 in. FPT	122
1 in. MPT	103	1 in. FPT	123
11/4 in. MPT	104	11/4 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 $C_1$ or $C_2$
1/ <sub>8</sub> in.	0.068 (1.73) 0.095 (2.41)	151 152
½ in.	0.088 (2.24) 0.119 (3.02)	153 154
% in.	0.091 (2.31) 0.126 (3.20)	155 156
½ in.	0.109 (2.77) 0.147 (3.73)	157 158
3⁄4 in.	0.113 (2.87) 0.154 (3.91)	159 160
1 in.	0.133 (2.87) 0.179 (4.55)	161 162
1¼ in.	0.140 (3.56) 0.191 (4.85)	163 164
1½ in.	0.145 (3.68)	165
2 in.	0.154 (3.91) 0.218 (5.54)	167 168
3	0.188 (4.78) 0.216 (5.49)	169 170
4	0.156 (3.91) 0.188 (4.78) 0.237 (6.02)	171 172 173
6	0.188 (4.78) 0.219 (5.56) 0.250 (6.35) 0.280 (7.11)	175 176 177 178
8	0.188 (4.78) 0.219 (5.56) 0.250 (6.35) ASTM 0.322 (8.18)	181 182 183 184
https://standards.10 h.ai/	catalog/standards/sist/da3f5 (0.188 (4.78) 4566-80d1-e07 (0.203 (5.16) (0.219 (5.56) (0.279 (7.09) (0.365 (9.27)	b792d7186/ast <sub>187</sub> /2897-23a 188 189 190 191
12	0.219 (5.56) 0.250 (6.35) 0.312 (7.92) 0.375 (9.52)	193 194 195 196
14	0.209 (5.30) 0.250 (6.35) 0.375 (9.53) 0.625 (15.88) 0.687 (17.45) 0.938 (23.83)	197 198 199 200 201 202
15	0.209 (5.30) 0.250 (6.35)	203 204
16	0.188 (4.78) 0.219 (5.56) 0.225 (5.72) 0.243 (6.17) 0.250 (6.35) 0.260 (6.60) 0.270 (6.86) 0.280 (7.11) 0.312 (7.93) 0.325 (8.26)	205 206 207 208 209 210 211 212 213 214