

# Gas Industry Standard

GIS/DAT6: 2019

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Specification for

## **STANDARD SIZES OF CARBON AND CARBON MANGANESE STEEL PIPE FOR OPERATING PRESSURES GREATER THAN 7 BAR**

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## Foreword

Gas Industry Standards (GIS) are revised, when necessary, by the issue of new editions. Users should ensure that they are in possession of the latest edition. Contractors and other users external to Gas Transporters should direct their requests for copies of a GIS to the department or group responsible for the initial issue of their contract documentation.

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This standard calls for the use of procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Compliance with this engineering document does not confer immunity from prosecution for breach of statutory or other legal obligations.

## Mandatory and non-mandatory requirements

For the purposes of a GIS the following auxiliary verbs have the meanings indicated:

**can** indicates a physical possibility;

**may** indicates an option that is not mandatory;

**shall** indicates a GIS requirement;

**should** indicates best practice and is the preferred option. If an alternative method is used then a suitable and sufficient risk assessment needs to be completed to show that the alternative method delivers the same, or better, level of protection.

## Disclaimer

This engineering document is provided for use by Gas Transporters and such of their contractors as are obliged by the terms of their contracts to comply with this engineering document. Where this engineering document is used by any other party, it is the responsibility of that party to ensure that the engineering document is correctly applied.

## Brief history

First published as BG/PS/DAT6	1970
Second update published as BG/PS/DAT6	1988
Third update published as GBE/DAT6	February 1994
Fourth update published as T/SP/DAT/6	October 2003
Editorial update to comply with GRM	August 2004
Revised and re-issued as SGN/SP/DAT/6	December 2011
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## 1. Scope

**1.1** This Gas Industry Standard gives details of standard dimensions, material grades and pressures for specific design factors for carbon and carbon manganese steel pipe for operating pressures greater than 7 bar.

**1.2** The dimensions, materials and pressures given in this Standard are intended to provide general guidance for operating temperatures between -20 °C and +60 °C. The limiting operating condition for each pipe must be determined with reference to the design specification appropriate for the application concerned.

## 2. Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

### 2.1 British and European standards

BS EN ISO 3183, *Petroleum and natural gas industries. Steel pipes for pipelines transportation systems*

ISO 4200, *International Standard – Plain end steel tubes, welded and seamless – General tables of dimensions and masses per unit length.*

BS EN 10208-2, *Steel pipes for pipelines for combustible fluids - Technical delivery conditions Part 2: Pipes of requirement class B (superseded).*

BS EN 10220, *Seamless and welded steel tubes. Dimensions and masses per unit length.*

### 2.2 Institution of Gas Engineers and Managers Standards

IGEM/TD/1, *Steel pipelines and associated installations for high-pressure gas transmission.*

IGE/TD/12, *Pipework stress analysis for gas industry plant.*

IGEM/TD/13, *Pressure Regulating Installations for transmission and distribution systems.*

### 2.3 American Petroleum Institute (API) Standard

API 5L, *API Specification 5L – Specification for line pipe.*

### 2.4 Gas Transporter Specifications and former standards

BG/PS/DAT6:1998, *British Gas Engineering Standard Data sheet, Carbon and Carbon Manganese steel pipe for operating pressure greater than 7 bar. Earliest version of DAT/6 issued in January 1988.*

BGSE/DAT6:1994, *British Gas Engineering Data sheet, Carbon and Carbon Manganese steel pipe for operating pressure greater than 7 bar. Version of DAT/6 issued in 1994.*

DAT/23:June 1993, *Gas Business Engineering Data Sheet – Carbon steel pipe of nominal diameter size 15mm, 20mm and 25mm.*

T/SP/DAT6:2004, *Transco version of specification DAT/6 issued in 2004.*

LX1: September 1993, *Gas Business Engineering – Technical Specification for Submerged- arc welded pipe 400mm to 1400mm inclusive nominal size for operating pressures greater than 7 bar.*

LX4: April 1993, *Gas Business Engineering – Technical Specification for Seamless pipe 150mm to 450mm inclusive nominal size for operating pressures greater than 7 bar.*

LX5: September 1993, *Gas Business Engineering – Technical Specification for Electric- Welded pipe 150mm to 450mm inclusive nominal size for operating pressures greater than 7 bar.*

**NOTE**

Where no date is shown, the latest edition of each standard and specification shall apply.

- Gas Transporters will each have their own specifications normally in the referenced format \*/SP/XX/No, where \* is replaced by the Gas Transporters reference e.g. T for National Grid, or SGN, WWU etc. followed by the specification initials and number reference.

**3. Terms and Definitions**

For the purposes of this document, the following definitions apply.

**3.1 DAT6**

This term has been used to refer to all versions of the specifications e.g. BGES/DAT/6\*/SP/DAT/6.

**3.2 Yield stress**

The stress level at which a metal or other material ceases to behave elastically

**3.3 Material grade**

Classification of Steel pipe by its composition and physical properties

**3.4 Design factor**

Stress safety factor used in pipe wall thickness calculations.

**4. Conformance**

**4.1 Units of measurement**

In this standard, for data expressed in both SI and USC units, a dot (on the line) is used as the decimal separator, and no comma or space is used as the thousands separator, in order to be consistent with other Gas Transporter specifications.

**5. Pipe Data Sources**

**5.1 Table 1**

**5.1.1** The values of minimum wall thickness used to calculate the pressures given in Tables 2a and 2b are the nominal wall thickness values given in the table, minus the relevant under-thickness tolerances specified in Table M4 of BS EN ISO 3183 and reproduced in Table 1.

**5.2 Tables 2a and 2b**

**5.2.1** New Pipe data contained in tables 2a and 2b has been sourced from table 2 of ISO 4200. This table generally matches pipe data tables in BS EN 10208-1, BS EN 10208-2 (now withdrawn) and BS EN 10220. This data provides modern, metric and European data.

**5.3 Historical pipe data**

**5.3.1** Data relating to earlier versions of DAT/6 is provided in Annex A, some pipe manufacturers may still be willing to provide pipes to these requirements.

**6. General Information**

**6.1** The values of design factor (f) used in Tables 2 and C2 are the maximum values specified for various applications of pipe in IGEM/TD/1, IGE/TD/12, and IGEM/TD/13.



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The values of pressure P (in bar) given in Table 2.

$$P = \frac{20 f t s}{D}$$

Where f = design factor

t = minimum wall thickness of the pipe (in mm).

s = specified minimum yield stress of the pipe (in MPa or N/mm<sup>2</sup>)

D = outside diameter of the pipe (in mm) as given in Table 2.

The pressure data given under the various design factor columns in Tables 2 and C2 should be taken as indicative only. It is supplied to provide initial pressure / duty pipe selection advice. It is the responsibility of the system designer to confirm final material selection by appropriate calculations combined with any other influences upon the design.

These values apply to operating temperatures between -20 °C and +60 °C. For higher temperatures, reference should be made to the design standard appropriate for the application concerned.

**6.2** The probability of minimum wall thickness and minimum yield stress occurring together is regarded as small. In the majority of applications therefore, the actual pressures for each design factor will be greater than the values given in Tables 2a and 2b.

**6.3** Each size of pipe given in Table 2a and 2b may be identified by stating the nominal wall thickness and either the nominal size or outside diameter.

**6.4** Approximately equivalent API 5L pipe grades, based on yield strength, corresponding to those of ISO 3183 are included in Tables 2a and 2b.

## 7. API Standards

The following statement has been taken from the American Petroleum website.

*“The American Petroleum Institute specification API 5L addresses seamless and welded steel line pipe for pipeline transportation systems in the petroleum and natural gas industries. API 5L is suitable for conveying gas, water, and oil.*

*Specifications for API 5L adhere to the International Organization for Standardization ISO 3183, standardizing pipeline transportation systems within the materials, equipment and offshore structures for natural gas, petroleum, and petrochemical industries. When authoring the standards, the technical committee recognized that there are two basic Product Specifications Levels (PSL) of technical requirements and therefore developed PSL 1 and PSL 2. PSL 1 is a standard quality for line pipe where PSL 2 contains additional chemical, mechanical properties, and testing requirements.*

*Grades covered by this specification are A25, A, B and "X" Grades X42, X46, X52, X56, X60, X65, X70, and X80. The two digit number following the "X" indicates the Minimum Yield Strength (in 000's psi) of pipe produced to this grade”.*

**Table 1 - Tolerances on Wall Thickness (from table M4 of BS EN ISO 3183)**

Wall Thickness t mm	Permissible Tolerance - mm
<b>Seamless Pipe:</b>	
≤ 4	+0.6mm / -0.5mm
> 4 to 25	+15% t / - 12.5% t
≥ 25	+ 3.7mm or + 10% t, whichever is the greater - 3.0mm or - 10% t, whichever is the greater
<b>Welded Pipe:</b>	
≤ 5	± 0.5mm
>5 to 10	± 10% t
>10 to <15	+ 10% t / -5% t
>15 to <20	+1.5mm / - 5% t
≥ 20	+ 1.5mm / -1.0mm

**Table 2a - DIMENSIONS, MATERIALS AND PRESSURES FOR STEEL PIPE – SEAMLESS PIPE**

Calculations based on pipe data from ISO 4200 Table 2 and tolerances from Table 1

Nominal Size mm	Outside Diameter mm	Nominal Wall Thickness mm	Material Grade	Corresponding API 5L steel grade	Pipe Type	Pressure for Design Factor (f) bar				
						f=0.3	f=0.5	f=0.67	f=0.72	f=0.8
15	21.3	3.6	L245NE	B	S	213	356	477	513	570
20	26.9	4.0	L245NE	B	S	191	318	427	459	510
25	33.7	4.5	L245NE	B	S	171	286	383	412	458
40	48.3	5.0	L245NE	B	S	133	221	297	319	355
50	60.3	5.4	L245NE	B	S	115	191	257	276	307
80	88.9	5.4	L245NE	B	S	78	130	174	187	208
100	114.3	5.0	L245NE	B	S	56	93	125	135	150
		6.3	L245NE	B	S	70	118	158	170	189
		12.5	L245NE	B	S	140	234	314	337	375
150	168.3	5.6 <sup>1</sup>	L290NE	X42	S	50	84	113	121	135
		6.3	L290NE	X42	S	56	94	127	136	151
		7.1 <sup>1</sup>	L290NE	X42	S	64	107	143	154	171
		8.0	L290NE	X42	S	72	120	161	173	192
		11.9 <sup>1</sup>	L290NE	X42	S	107	179	240	258	287
		12.5	L290NE	X42	S	113	188	252	271	301
200	219.1	6.3	L290NE	X42	S	43	72	97	105	116
		8.0	L290NE	X42	S	55	92	124	133	148
		12.5	L290NE	X42	S	86	144	193	208	231
250	273	6.3	L360NE	X52	S	43	72	97	104	116
		8.8	L360NE	X52	S	60	101	136	146	162
		12.5	L360NE	X52	S	86	144	193	207	230
300	323.9	7.1	L360NE	X52	S	41	69	92	99	110
		10.0	L360NE	X52	S	58	97	130	140	155
		12.5	L360NE	X52	S	72	121	162	175	194
400	406.4	9.5	L360NE	X52	S	44	73	98	106	117
		10.3	L360NE	X52	S	47	79	106	114	127
		14.3	L360NE	X52	S	66	110	148	159	177
450	457.0	9.5	L360NE	X52	S	39	65	87	94	104
		11.9	L360NE	X52	S	49	82	109	118	131
		15.9	L415NE	X60	S	75	126	169	181	202

Note 1: Additional values have been inserted to provide comparable values to the original DAT/6 document dated 1994 for completeness.

**TABLE 2b - DIMENSIONS, MATERIALS AND PRESSURES FOR STEEL PIPE – SEAM WELDED PIPE**

Calculations based on pipe data from ISO 4200 Table 2 and tolerances from Table 1

Nominal Size mm	Outside Diameter mm	Nominal Wall Thickness mm	Material Grade	Corresponding API 5L steel grade	Pipe Type	Pressure for Design Factor (f) bar				
						f=0.3	f=0.5	f=0.67	f=0.72	f=0.8
150	168.3	5.6	L290ME	X42	HFW	48	80	108	116	129
		7.1	L290ME	X42	HFW	64	106	143	153	170
		12.5	L290ME	X42	HFW	122	204	274	294	327
200	219.1	6.3	L290ME	X42	HFW	42	71	95	102	114
		8.0	L290ME	X42	HFW	56	93	125	135	150
		12.5	L290ME	X42	HFW	94	157	210	226	251
250	273	6.3	L360ME	X52	HFW	42	71	95	102	113
		8.8	L360ME	X52	HFW	62	104	139	150	166
		12.5	L360ME	X52	HFW	93	156	209	225	250
300	323.9	7.1	L360ME	X52	HFW	41	68	92	99	110
		10.0	L360ME	X52	HFW	60	101	135	145	161
		12.5	L360ME	X52	HFW	79	131	176	190	211
		12.5 <sup>2</sup>	L415ME	X60	HFW	91	152	203	219	243
400	406.4	8.8	L360ME	X52	HFW/L/H	41	69	93	100	111
		10.0	L360ME	X52	HFW/L/H	47	79	106	114	127
		14.2	L360ME	X52	HFW/L/H	71	119	160	172	191
		14.2 <sup>2</sup>	L450ME	X65	HFW/L/H	89	149	200	215	238
450	457	10.0	L360ME	X52	HFW/L/H	43	71	96	103	114
		12.5	L360ME	X52	HFW/L/H	56	93	125	134	149
		16.0	L415ME	X60	HFW/L/H	82	138	184	198	220
600	610	10.0	L360ME	X52	L/H	32	53	71	77	85
		14.2	L360ME	X52	L/H	47	79	106	114	127
		20.0	L415ME	X60	L/H	77	129	173	186	206
750	762	12.5	L360ME	X52	L/H	33	56	75	80	89
		16.0	L415ME	X60	L/H	49	82	110	119	132
		20.0	L415ME	X60	L/H	62	103	138	149	165
		22.2	L415ME	X60	L	69	115	154	166	184
900	914	12.5	L415ME	X60	L/H	32	53	72	77	86
		16.0	L450ME	X65	L/H	44	74	100	107	119
		20.0	L415ME	X60	L/H	51	86	115	124	138
		25.0	L450ME	X65	L	70	118	158	170	189
1050	1067	14.2	L415ME	X60	L/H	31	52	70	75	83
		17.5	L450ME	X65	L/H	42	70	93	100	112
		20.0	L450ME	X65	L/H	48	80	107	115	128
		28.0	L450ME	X65	L/H	68	113	152	163	182

Nominal Size mm	Outside Diameter mm	Nominal Wall Thickness mm	Material Grade	Corresponding API 5L steel grade	Pipe Type	Pressure for Design Factor (f) bar				
						f=0.3	f=0.5	f=0.67	f=0.72	f=0.8
1200	1219	16.0	L450ME	X65	L/H	33	56	75	80	89
		20.0	L450ME	X65	L/H	42	70	93	101	112
		22.2	L450ME	X65	L	46	78	104	112	125
		25.0	L450ME	X65	L	53	88	118	127	141
		16.0	L555ME	X80	L	41	69	92	99	110
		20.0	L555ME	X80	L	51	86	115	124	138
		22.2	L555ME	X80	L	57	96	129	138	154
		25.0	L555ME	X80	L	65	109	146	157	174
1400 <sup>2</sup>	1422	16.0	L555ME	X80	L	35	59	79	85	94
		20.0	L555ME	X80	L	44	74	99	106	118
		22.2	L555ME	X80	L	49	82	110	119	132
		25.0	L555ME	X80	L	56	93	125	134	149

Note 1: Additional values have been inserted to provide comparable values to the original DAT/6 document dated 1994 for completeness.

Note 2: Two additional values have been added to this table:

- 1) 300mm L415ME X60 pipe with a wall thickness of 12.7mm.
- 2) 400mm L450ME X65 pipe with a wall thickness of 14.3mm

Note 3: Pipe Types:

L = Submerged Arc Welded Longitudinal Seam

H = Submerged Arc Welded Helical Seam

HFW = High Frequency Welded

## Annex - A Historical Pipe Data

- A.1** The values of minimum wall thickness used to calculate the pressures given in Table C2a and C2b are the nominal wall thickness values given in the table, minus the relevant under-thickness tolerances specified in Table 10 of BS EN 10208-2 and reproduced in Table C1.
- A.2** Pipe data contained in tables C2a and C2b has been largely sourced from earlier versions of DAT/6 e.g. BG/PS/DAT/6:1988, BGES/DAT6:1994 both of which relied upon data from DAT/23, LX1, LX4 and LX5. These data values generally match those contained in Table 1 of TS-C4GAS-PIPO and API-5L Appendix E. Values contained in ASME B36.10M are broadly equivalent to those shown in Tables 2a and 2b if allowance is made for rounding of values.
- A.3** Seamless pipe values for 150mm contained in earlier versions of DAT/6 differ to those provided in T/SP/DAT/6 and subsequent revisions. For completeness these values have been reinserted in this standard.
- A.4** Seamless Pipe values 400 and 450mm provided in earlier versions of DAT/6 and subsequently omitted in recent DAT/6 versions have been included in this revision in table 2a.
- A.5** The values of specified minimum yield stress used to calculate the pressures given in Table C2a and C2b are given in BS EN 10208-2.

**Table C1 - Tolerances on Wall Thickness (from table 10 of BS EN 10208-2)**

Wall Thickness t mm	Permissible Tolerance
<b>Seamless Pipe:</b>	
$t \leq 4$	+0.6 mm / -0.5 mm
$4 < t < 25$	+15 % t / - 12.5 % t
$t \geq 25$	+ 3.75mm or +10% t / - 3.0 mm or + / - 10% t (whichever is the greater)
<b>Welded Pipe:</b>	
$t \leq 10$	+1.0 mm / -0.5 mm
$10 < t < 20$	+10 % / -5 %
$t \geq 20$	+2.0 mm / - 1.0 mm

**TABLE C2a - DIMENSIONS, MATERIALS AND PRESSURES FOR STEEL PIPE – SEAMLESS PIPE**

Note: Pipe Type: S = Seamless, 1- These values were stated in original versions of DAT6 only.

Nominal Size mm	Outside Diameter mm	Nominal Wall Thickness mm	Material Grade	Corresponding API 5L steel grade	Pipe Type	Pressure for Design Factor (f) bar				
						f=0.3	f=0.5	f=0.67	f=0.72	f=0.8
15	21.3	3.7	L245NB	B	S	220	368	493	530	588
20	26.7	3.9	L245NB	B	S	187	311	418	449	499
25	33.4	4.5	L245NB	B	S	173	288	387	415	462
40	48.3	5.1	L245NB	B	S	135	226	303	325	362
50	60.3	5.5	L245NB	B	S	117	195	262	281	312
80	88.9	5.5	L245NB	B	S	79	132	177	190	212
100	114.3	4.8	L245NB	B	S	54	90	120	129	144
		6.0	L245NB	B	S	67	112	150	162	180
		11.9	L245NB	B	S	133	223	299	321	357
150	168.3	5.6 <sup>1</sup>	L290NB	X42	S	51	84	113	122	No data
		6.4	L290NB	X42	S	57	96	129	138	154
		7.1 <sup>1</sup>	L290NB	X42	S	64	107	143	154	No data
		8.2	L290NB	X42	S	74	123	165	178	197
		11.9 <sup>1</sup>	L290NB	X42	S	107	179	240	258	No data
		12.7	L290NB	X42	S	114	191	256	275	306
200	219.1	6.4	L290NB	X42	S	44	74	99	106	118
		8.2	L290NB	X42	S	56	94	127	136	151
		12.7	L290NB	X42	S	88	147	197	211	235
250	273.1	6.4	L360NB	X52	S	44	73	98	106	118
		8.7	L360NB	X52	S	60	100	134	144	160
		12.7	L360NB	X52	S	87	146	196	210	234
300	323.9	7.1	L360NB	X52	S	41	69	92	99	110
		9.5	L360NB	X52	S	55	92	123	133	147
		12.7	L360NB	X52	S	74	123	165	177	197

Note 1: Additional values have been inserted to provide comparable values to the original DAT/6 document dated 1994 for completeness.

**TABLE C2b - DIMENSIONS, MATERIALS AND PRESSURES FOR STEEL PIPE Seam Welded Pipe**

Nominal Size mm	Outside Diameter mm	Nominal Wall Thickness mm	Material Grade	Corresponding API 5L steel grade	Pipe Type	Pressure for Design Factor (f) bar				
						f=0.3	f=0.5	f=0.67	f=0.72	f=0.8
150	168.3	5.6	L290MB	X42	HFW	52	87	117	126	140
		7.1	L290MB	X42	HFW	68	113	152	163	181
		11.9	L290MB	X42	HFW	116	194	261	280	311
200	219.1	6.4	L290MB	X42	HFW	46	78	104	112	124
		8.7	L290MB	X42	HFW	61	101	136	146	163
		12.7	L290MB	X42	HFW	95	159	213	229	255
250	273	6.4	L360MB	X52	HFW	46	77	104	111	117
		8.7	L360MB	X52	HFW	64	108	144	155	172
		12.7	L360MB	X52	HFW	95	159	213	229	254
300	323.9	7.1	L360MB	X52	HFW	44	73	98	105	117
		9.5	L360MB	X52	HFW	60	100	134	144	160
		12.7	L360MB	X52	HFW	80	134	179	193	214
		12.7 <sup>2</sup>	L415MB	X60	HFW	92	154	207	222	247
400	406.4	8.7	L360MB	X52	HFW/L/H	43	72	97	104	116
		10.3	L360MB	X52	HFW/L/H	52	86	116	124	138
		14.3	L360MB	X52	HFW/L/H	72	120	161	173	192
		14.3 <sup>2</sup>	L450MB	X65	HFW/L/H	90	150	201	216	240
450	457	9.5	L360MB	X52	HFW/L/H	42	70	95	102	113
		11.9	L360MB	X52	HFW/L/H	53	89	119	128	142
		15.9	L415MB	X60	HFW/L/H	82	137	183	197	219
600	610	9.5	L360MB	X52	L/H	31	53	71	76	84
		14.3	L360MB	X52	L/H	48	80	107	115	128
		19.1	L415MB	X60	L/H	74	123	165	177	197
750	762	11.9	L360MB	X52	L/H	32	53	71	76	85
		15.9	L415MB	X60	L/H	49	82	110	118	131
		19.1	L415MB	X60	L/H	59	98	132	142	158
		22.2	L415MB	X60	L	69	115	154	166	184
900	914	12.7	L415MB	X60	L/H	32	54	73	78	87
		15.9	L450MB	X65	L/H	44	74	99	107	118
		19.1	L415MB	X60	L/H	49	82	110	118	131
		25.4	L450MB	X65	L	72	120	160	172	192
1050	1067	14.3	L415MB	X60	L/H	31	52	70	76	84
		17.5	L450MB	X65	L/H	42	70	93	100	112
		19.1	L450MB	X65	L/H	45	76	102	110	122



Nominal Size mm	Outside Diameter mm	Nominal Wall Thickness mm	Material Grade	Corresponding API 5L steel grade	Pipe Type	Pressure for Design Factor (f) bar				
						f=0.3	f=0.5	f=0.67	f=0.72	f=0.8
		28.7	L450MB	X65	L/H	70	116	156	168	186
1200	1219	15.9	L450MB	X65	L/H	33	55	74	80	89
		19.1	L450MB	X65	L/H	40	66	89	96	107
		22.4	L450MB	X65	L	47	78	105	113	126
		25.4	L450MB	X65	L	54	90	120	129	144
		14.3	L555MB	X80	L	37	61	82	89	98
		15.9	L555MB	X80	L	41	68	92	99	110
		20.6	L555MB	X80	L	53	89	119	128	142
		22.9	L555MB	X80	L	59	99	133	143	159

Note 1: Additional values have been inserted to provide comparable values to the original DAT/6 document dated 1994 for completeness.

Note 2: Two additional values have been added to this table:

- 1) 300mm L415MB X60 pipe with a wall thickness of 12.7mm.
- 2) 400mm L450MB X65 pipe with a wall thickness of 14.3mm

Note 3: Pipe Types:

L = Submerged Arc Welded Longitudinal Seam

H = Submerged Arc Welded Helical Seam

HFW = High Frequency Welded