

INTRODUCTION

ENIPROM Gas & Oilfield Equipment & Services, L.L.C. is a leading National Stockist of seamless and welded pipes in both carbon and alloy steel.

These pipes are used in a diverse range of fluid handling and structural applications from Petroleum and Chemical Processing to the Mining and allied industries. The general stock range for seamless and welded carbon steel pipes is 8mm to 600mm nominal diameter.

ASME B36.10. WELDED AND SEAMLESS WROUGHT STEEL PIPE

ASME B36.10 covers the standardization of dimensions of welded and seamless wrought steel pipe. It shows both imperial and metric units, the metric units being **soft conversions** of the imperial units.

On pages 4 and 5 we have shown only metric dimensions to ASME B36.10 for the more popular size range. We have also included inside diameter (I.D.) and metric nominal size (DN) which are not shown in ASME B36.10. (The British equivalent Standard is BS 1600 Part 2).

- 1. NOMINAL SIZE** – May be expressed in S.I. metric (mm) or imperial (inch) units.
- 2. OUTSIDE DIAMETER** – is shown to the nearest 0.1mm for outside diameters which are 406.4mm O.D. and smaller and to the nearest 1.0mm for outside diameters larger than 406.4mm O.D. We have shown the equivalent inch size underneath in brackets – ().
- 3. WALL THICKNESS** – is shown rounded to the nearest 0.01mm.
- 4. INSIDE DIAMETER** – is not shown in ASME B36.10, however, by using the inch measurements in ASME B36.10, we have calculated the **inside diameter** (I.D.) in inches and used the factor 25.4 to convert to millimetres to the nearest 0.1mm
- 5. MASS (WEIGHT)** – is shown in kilograms per meter (kg/m) for plain end pipes. These are calculated values using the formula shown at the bottom of page 13 (taken from B36.10).
- 6. WALL THICKNESS DESIGNATIONS** – The wall thickness designations “Standard WT”, “Extra Strong” and “Double Extra-Strong”, have been commercially used designations for many years. Schedule numbers were added as a convenient designation for use in ordering pipe. Standard WT and Schedule 40 are identical for sizes up to NPS 10 inclusive. All larger sizes of Standard WT have 9.53mm wall thickness. Extra-Strong and Schedule 80 are identical for sizes up to NPS 8 inclusive. All larger sizes of Extra-Strong have 12.70mm wall thickness.

INTRODUCTION

- 7. PIPE ENDS** – Unless otherwise specified pipe ends are normally supplied as below:-
- (a) Up to and including 48.3mm O.D. size are supplied with plain ends cut square.
 - (b) Above 48.3mm O.D. sizes (except for Double Extra-Strong pipe) are supplied with plain ends bevelled.
 - (c) All Double Extra-Strong pipes is supplied with plain ends cut square.
- 8. END PREPARATION**
- (a) Bevelled ends for API steel linepipe are normally to API specification i.e. Angle $30^{\circ}+5^{\circ}-0^{\circ}$
 - (b) Bevelled ends for steel pipe to ASTM specifications are normally to ASME B16.25 i.e. Angle $30^{\circ}+5^{\circ}-0^{\circ}$
- 9. DIMENSIONAL STANDARDS** – The dimensional standards for pipe to ASME B36.10 includes products covered by the following material specifications:
- ASTM – A53, A106, A134, A135, A139, A333, A335, A369, A376, A381, A409M, A426, A523, A524 and A530
 - API – 5L, 5LX and 5LS

METRIC CONVERSION TERMINOLOGY

Soft conversion is an exact mathematical equivalent using known conversion factors from imperial to metric. e.g. Inch to millimetres (mm) = 1×25.4 . Therefore $12 \frac{3}{4}$ inch $\times 25.4 = 323.85$ mm. Soft conversion can only be applied to actual measurement, it cannot be applied to nominal sizes.

Hard conversion is where pipe manufactured to imperial sizes (O.D. x WT in actual inches) is replaced by pipe manufactured to metric sizes (O.D. x WT in actual millimetres [mm]).

Pipe is only quoted as a typical material example.

METHODS OF MANUFACTURE

SPECIFICATIONS

API 5L 5LX
ASTM A53
ASTM A106
ASTM A333
ASTM A335

SIZES

UP TO 762mm O.D.

SEAMLESS PIPE

In the seamless pipe-making process tube rounds are heated in a furnace, after which they are pierced, then rolled by the **Mandrel** or **Plug-Mill** process into pipes and tubes of specified diameters and wall thicknesses.

Seamless tubular products are generally hot-rolled, but can also be supplied cold-drawn (up to 273mm O.D.) when required.

The “Push-Bench” process can also be used in the manufacture of seamless pipe. In this process, a steel billet is furnace heated to the plastic state and partly punched at one end to take a mandrel. The billet is then forced by the mandrel through a series of gradually reducing dies, until the required outside diameter has been attained, the I.D. being determined by the size of the mandrel.

ELECTRIC-RESISTANCE WELDED PIPE (E.R.W.)

In Australia, as in modern installations overseas, ERW Linepipe has gained increased acceptance, where Seamless Pipe was once considered essential, because of its uniform quality and dimensions, and its cost advantage.

The ERW manufacturing process is described below:

At the pipe mill the strip is uncoiled, levelled and crop-sheared. It is then trimmed on both sides simultaneously to correct width and immediately fed into the forming and welding line. During the process, the strip is closely checked for surface defects.

A series of cold forming rolls changes the strip progressively into tubular form with abutting edges on top. The longitudinal edges are joined by high frequency electric resistance welding. The weld is then heat treated electrically. Special devices remove inside and outside flash from the weld to give uniform wall thickness of the pipe. The welded part is then heat-treated by post annealing to ensure adequate ductility at the weld and adjacent zone. The pipe is passed through a series of cold sizing rolls to progressively reduce the diameter to accurate size. This operation also increases strength and improves surface condition.

SPECIFICATIONS

API 5L & 5LX
ASTM A53, A135,
ASTM A252, A333

SIZES

UP TO 610mm O.D.

METHODS OF MANUFACTURE



The pipe is then cut to specified length by a flying cut-off machine. After the straightening operation, ends of the pipe are cropped, then squared or bevelled depending on end finish requirements. The pipe is then hydrostatically tested to specified pressure. Also test specimens are taken during the process to check chemical and mechanical properties.

Each length of pipe is inspected by the ultrasonic method on the weld and checked as to diameter, wall thickness, surfaces, end finish, camber and concentricity. The length and weight of pipe is measured and recorded and protective coating is applied on the outside surface.

U.O.E. DOUBLE SUBMERGED ARC WELDED PIPE

SPECIFICATIONS

API 5L 5LX & 5LU
ASTM A53

SIZES

UP TO 1820mm O.D.

Steel plates are first U-shaped then O-formed by a hydraulic press. The seam is welded from inside and outside automatically by the submerged-arc process. Hydraulic expansion gives the pipe precise diameter and roundness and relieves residual stresses caused by forming and welding.

BUTTWELD PIPE

The Pipe is made continuously from skelp. Skelp is heated while passing through a tunnel-type furnace and, emerging, is formed and rolled into an endless pipe, which is then cut into desired lengths.

This, the continuous-welded process, is an economical way of producing pipe used in general industrial and domestic services, where the highest pressures and temperatures are not encountered.

SPECIFICATIONS

API 5L GRADE A25
ASTM A53 GRADE F

SIZES

UP TO 1820mm O.D.



SUMMARY OF SPECIFICATIONS

API 5L LINE PIPE

Welded and seamless steel line pipe commonly used to convey gas, water and oil in the petroleum and natural gas industries. API 5L Pipe is normally stocked in Grade "B".

API 5LX HIGH TEST LINE PIPE

Covers welded and seamless steel line pipe having greater tensile and yield strengths than pipe manufactured under Specification 5L.

Only authorized manufacturers may use the API monogram and then only for sizes and wall thicknesses as in the API specifications.

ASTM A106

Black seamless (welded not permitted) fully killed Carbon steel pipe for high-temperature, high-pressure service in three grades of seamless pipe of varying tensile strength.

Although the physical and chemical properties for Grades A and B are comparable to those for A53 pipe, and the types of testing required by both specifications are similar, the tests prescribed for A106 are more stringent and are applied to smaller lots of pipe. Therefore, A106 is preferred for exacting services.

Grades A and B are obtainable in most sizes and schedule numbers. Grade B permits higher carbon and manganese contents than Grade A, however most of the A106 Grade B supplied by ENIPROM Gas & Oilfield Equipment & Services, L.L.C. has a maximum carbon content of 0.23%. Grade C, with maximum carbon content of 0.35%, is available only by special agreement with the mill.

ASTM A53

This pipe can be obtained either black or galvanised, in Seamless and Welded Grades A & B and Furnace Butt Welded Grade F up to 114.3mm OD.

When seamless or ERW pipe is ordered for close coiling, cold bending and for forge welding, Grade A should be specified, as Grade B is not intended for these purposes.

Tensile strength, yield-point and elongation requirements of A53 steel pipe are generally similar to the API 5L Specification. It is often difficult to procure A53 heavier than extra strong, and A106 pipe is generally stipulated for the heavier wall thicknesses.

SUMMARY OF SPECIFICATIONS

ULTRAPIPE®

Ultrapipe is a new concept in line pipe supply, is the all-encompassing steel pipe that brings structural and pressure pipe together in one product.

Pressure Pipe: Oil Pipeline, Gas Pipeline, Compressed Air, Steam Chemicals, Water and other process pipework.

Structures: Buildings, Bridges, Piling etc. Ultrapipe has been designed and manufactured to meet the normal pipe specifications for these applications.

UltraPipe is tested to and complies with specifications API 5L (Grade B and X42). American specification for pressure pipe. Also used internationally by the Oil and Gas Industry. Grade X42 allows an increased operating pressure, or thinner wall (and therefore cheaper product) for the same pressure.

ASTM A53 (Grade B) American specification for pressure pipe.

AS1163 (Grade C350) Australian Standard for Structural pipe.

All pipe is pressure tested to specification requirements or above, at pressures up to 20.7 MPa. The Carbon Equivalent (C.E) is held at 0.36 max, which means all Ultrapipe is easily weldable.

Normal Size Range: 88.9 OD to 457.0mm OD in a range of standard wall thicknesses.

**Please consult
ENIPROM Gas &
Oilfield Equipment &
Services, L.L.C. for full
details of size range
and pressure ratings.**

MATERIAL SPECIFICATIONS FOR PIPING COMPONENTS

PIPING COMPONENT SPECIFICATIONS

This page shows comparable ASTM and API specifications for the basic components of welded piping systems. Specification numbers and material grades are shown; for example, ASTM specification A106 Grade B is indicated in the table as A106-B. Other specifications exist and may be required for special piping systems. Materials shown are those most frequently used today.

Also tabulated are the permissible raw material specifications which are used in the manufacture of welding fittings. Selection from these is at the discretion of the fitting manufacturer.

MATERIAL		PIPING COMPONENTS				RAW MATERIAL FOR			
		Pipe	Tubing	Welding	Flanges	WELDING FITTINGS			
				Fittings*		Pipe	Plate	Forgings	Bar
Carbon Steel	Grade A	A53-A A106-A A135-A A139-A A155-C50, C55 API-5L-A	A192 A161 A178-A - - A226	A234-WPA	A105	A106-A	A285-C	A105	A576 (1008 to 1022) †
	Grade B	A53-B A106-B A135-B A139-B A155-KC65, KC70 API-5L-B	A178-C A210-A A178-C - - -	A234-WPB	A105	A106-B	A151-70	A105	A576 (1025 to 1030) †
	Grade C	A106-C	A210-C	A234-WPC	A105	A106-C	†	†	†
	Low Temp.	A333-6	A334-6	A420-WPL6	A350-LF2	A333-6	A516-65	A350-LF2	
	High Yield	A381-35 API-5LX-X42, X46, X52	- - -	Grade WPY35 § II Grade WPY42 § II Grade WPY52 § II	A105 A182-F1 -	A106-B A381-42 A381-52	A515-65 A242 A441	A105 182-F1 -	
Carbon Moly. Steel	½ Mo.	A155-CM70	A209-T1a, A250-T1a	A234-WP1	A182-F1	A335-F1	A204-B	A182-F1	
		A335-P1 A369-FP1	A161-T1						
Chrome Moly Steel	½Cr-½Mo	A155-½CR A335-P2 A369-FP2	A213-T2	Grade WP2 §	A182-F2	A335-P2	A387-A	A182-F2	
		A155-1CR A335-P12 A369-FP12	A213-T12	A234-WP12	A182-F12	A335-P12	A387-B	A182-F12	
	1½Cr-½Mo	A155-1½CR A335-P11 A369-FP11	A213-T11	A234-WP11	A182-F11	A335-P11	A387-C	A182-F11	
	2½Cr-1Mo	A155-2½CR A335-P22 A369-FP22	A213-T22	A234-WP22	A182-F22	A335-P22	A387-D	A182-F22	
	5Cr-½Mo	A155-5CR A335-P5 A369-FP5	A213-T5	A234-WP5	A182-F5	A335-P5	A357	A182-F5	
	7Cr-½Mo	A335-P7 A369-FP7	A213-T7	Grade WP7	A182-F7	A335-P7	†	A182-F7	
	9Cr-1Mo	A335-P9 A369-FP9	A213-T9	Grade WP9	A182-F9	A335-P9	†	A182-F9	
	Low Temp Ferritic Steel	3½Ni	A333-3	A334-3	A420-WPL3	A350-LF3	A333-3	A203-D	A350-LF3
Cu-Ni Low Alloy Steel		A333-9	A334-9	A420-WPL9	A350-LF9	A333-9	-	A350-LF9	

MATERIAL SPECIFICATIONS FOR PIPING COMPONENTS

- * When fittings are of welded construction, the fitting manufacturer shall supplement the grade symbol marking with the letter "W".
- ** A5 refers to American Welding Society (A.W.S.) Specification. AS refers to Australian Standard Specification.
- † Bar Steel may be used for 50mm NPS and smaller fittings and must be of open-hearth quality. In Australia AS1442 Grade CS1020 carbon steel bar is regularly supplied for piping components machined from bar to match carbon steel pipes grades A & B.
- ‡ No ASTM specification has been written. However, materials having chemical and physical properties comparable to the other materials listed may be used.
- § No ASTM specification has been written. The welding fitting grade symbol is that recommended by MSS Standard SP-25, and the raw materials shown are those commonly used.
- || The numerals in these grade symbols are the first two numbers of the minimum guaranteed yield strength of the fittings. Fittings having other minimum yield strengths may be similarly designated by using the applicable numerals.

ALLOY STEEL PIPE - SPECIFICATIONS

SUMMARY OF PIPE SPECIFICATIONS

HIGH TEMPERATURE GRADES

ASTM A335

SEAMLESS

This specification covers nominal (average) wall Seamless Alloy-Steel Pipe intended for high-temperature service. Twelve Grades are listed in ASTM A335 with tensile and chemical requirements as follows.

ELECTRIC-FUSION-WELDED STEEL PIPE FOR HIGH-PRESSURE SERVICE

ASTM A671

Electric-fusion-welded Steel Pipe for **Atmospheric and Lower Temperature.**

ASTM A672

Electric-fusion-welded Steel Pipe for High Pressure Service at **Moderate Temperature.**

ASTM A691

Carbon and Alloy Steel Pipe, Electric Fusion-Welded, for High Pressure Service at **High Temperature.**

The above specifications nominally cover pipes 406.4mm O.D. and larger with wall thickness up to 76.2mm.

Several grades and classes of pipes are provided.

LOW TEMPERATURE GRADES

This Specification covers nominal (average) wall seamless and welded carbon and alloy steel pipe for use at low temperatures Nine Grades are listed in ASTM A333.

OTHER PIPE SPECIFICATIONS IN REGULAR USE

ASTM A312

Seamless and Welded Austenitic Stainless Steel Pipe for high Temperature and general corrosive service. Austenitic Stainless Steels are usually accepted for service temperatures as low as -196°C without impact testing

Grade TP 304, 304L and 347 are suitable for temperature as low as -254°C - Refer ASTM 312,

ASTM A135

ERW Steel Pipe, 20 to 750mm, in 2 Grades (A and B).

ASTM A139

EFW Steel Pipe, 100 to 2250mm, in 5 Grades, straight or spiral-seam construction.

ASTM A358

200mm and above. EFW Austenitic Chromium-Nickel Alloy Steel Pipe for high-temperature service. 5 Classes and 19 Grades of steel are

ASTM A524

Seamless Carbon Steel Pipe for atmospheric and lower temperatures, 6 to 25mm in 2 Grades (I & II)

ASTM A530

General requirements for specialised carbon and alloy steel pipe. Covers a group of requirements which, with few exceptions, are mandatory requirements to all the ASTM pipe specifications

