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PIPE

ASME

B36.10 / B36.19



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INDUSTRIAL TECHNICAL EQUIPMENT

INTRODUCTION



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I.T.E. is specialized also on tailor-made solutions, on request complete packages can be provided to meet customer's needs.

I.T.E. is a flexible and customer oriented company, the manufacturing plant is equipped with different CNC machines, automatic welding machines and an automatic warehouse with different semi-finished standard products, this structure allows us to be reliable partner with a fast response to the customer needs.

I.T.E. products are 100% engineered, manufactured, assembled and tested in Italy, all the products have the traceability system so that we are able to provide the best assistance to customers also specially during maintenance activities providing the right product/component.



FAILURE, IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

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FEATURES

This catalogue covers the general technical features, tolerances, and dimensional criteria of industrial wrought steel pipes in accordance with international standards ASME B36.10M and ASME B36.19M. The product range includes both seamless and welded execution pipes, engineered to ensure maximum reliability under severe pressure and temperature conditions within chemical, petrochemical, and process plants. The data and parametric matrices provided herein serve as an essential guide for the correct geometric and metallurgical selection of components within piping systems.

PRODUCT OVERVIEW AND DEFINITION

Definition of "Pipe" and Distinction from "Tube"

Within the international ASME standard system, the term Pipe (identified in the corporate coding system by the acronym PIP) specifically defines cylindrical tubular products intended for fluid conveyance and engineered for integration into pipelines and industrial piping systems. A Pipe is strictly distinguished from a Tube (structural or instrumentation tubing) based on fundamental geometric criteria:

- NPS 12 and smaller: All pipes with a nominal size of NPS 12 and below feature an actual outside diameter (OD) that is numerically larger than the nominal size number (e.g., a 2" pipe has an OD of 60.32 mm).
- Tubes: In contrast, tubes maintain an outside diameter that is perfectly identical to the nominal size value across all dimensions (e.g., a 2" tube measures exactly 50.80 mm OD).

MANUFACTURING PROCESSES: SEAMLESS (S) VS WELDED (W) PIPE

The selection of the pipe manufacturing technology strictly dictates the ultimate mechanical performance, pressure rating, and structural reliability of the entire piping system. This catalog segregates tubular products into two distinct manufacturing executions:

1. Seamless Pipe (Identification Code: "S")

Manufacturing Process: Manufactured from a solid cylindrical steel billet, heated to extreme temperatures and subsequently pierced, drawn, or hot-rolled. The resulting cylinder is a single, continuous body, completely free of any longitudinal or circumferential weld seams.

Features and Advantages: The native absence of a weld seam eliminates any potential point of structural or metallurgical weakness. It ensures uniform tensile and internal pressure resistance across 360°, making it the mandatory and safest technical choice for severe pressure and temperature conditions, corrosive fluids, steam lines, and critical services typical of the Oil & Gas sector.

2. Welded Pipe (Identification Code: "W")

Manufacturing Process: Produced from a steel strip (coil) or flat plate that undergoes cold-forming through progressive rollers into a cylindrical shape. The two longitudinal edges are permanently joined via an automatic high-frequency welding (ERW) or submerged arc welding (SAW) process, typically without the addition of filler metal or through specific qualified procedures.

Features and Advantages: Provides excellent control and extreme uniformity of wall thickness along the entire length, alongside significantly lower manufacturing and procurement costs compared to seamless pipes (especially on larger dimensional sizes).

Essential Quality Requirement (Bead Conditioned): The historical limitation of welded pipe lies in the turbulence or localized corrosion phenomena that the internal weld seam can trigger. To completely eliminate this risk, the specifications of this catalog mandate that for materials where welded execution is permitted (e.g., Stainless Steels), the internal weld bead must be fully removed, rolled, or scraped (bead conditioned) to ensure a perfectly smooth and flat internal pipe wall.



FEATURES

REFERENCE STANDARDS: ASME B36.10M VS ASME B36.19M

Industrial steel pipes regulated by the American standard system are strictly divided into two complementary dimensional standards, segregated primarily by the metallurgical family of the material:

ASME B36.10M: This standard covers the dimensions, outside diameters, and wall thicknesses of welded and seamless wrought steel pipes in carbon and alloy steel. It serves as the reference standard for high or low temperature and pressure applications requiring high structural integrity or sacrificial corrosion allowances.

ASME B36.19M: This specification strictly covers the standardization of dimensions of welded and seamless wrought stainless steel, superaustenitic, duplex, and superduplex pipes.

The fundamental difference lies in the management of wall thickness. Since stainless steel possesses high intrinsic corrosion resistance, it does not require the heavy wall thicknesses typical of carbon steel. For this reason, the ASME B36.19M standard introduces the letter "S" after the Schedule number (e.g., 5S, 10S, 40S, 80S) to uniquely differentiate stainless steel pipes from those governed by B36.10M.

Schedules 5S and 10S offer ultra-light wall thicknesses exclusive to the stainless steel industry, designed to optimize weight and reduce material costs in process lines. Schedules 40S and 80S are designed to ensure structural interchangeability with the carbon steel system, but they feature a key geometric divergence on larger pipe diameters.

Interchangeability and Special Thicknesses (The Regulatory Crossover)

As officially stated within the scope of the ASME B36.19M standard, stainless steel material is not confined strictly to the four schedules designated with the letter "S". Should the operating conditions of the piping system require wall thicknesses that are heavier or intermediate compared to those listed in the stainless standard (such as SCH 60, 100, 120, 140, 160, or the extreme XXS weight), the standard officially authorizes the procurement and use of stainless steel pipes manufactured to the geometric dimensions of ASME B36.10M.

MATERIAL SELECTION GUIDE

The metallurgical range is optimized into 4 macro-families based on temperature, pressure, and fluid corrosion levels:

Carbon & Alloy Steels: Cover general non-corrosive utilities, cryogenic applications down to -45°C and high-temperature/high-pressure steam and refining services.

Stainless Steels: Standard low-carbon austenitic and highly alloyed superaustenitic grades. Engineered for corrosive fluids, acidic environments, and chloride pitting prevention.

Duplex & Superduplex: Dual-phase structure providing double the mechanical strength of standard stainless and total immunity to Stress Corrosion Cracking (SCC). Ideal for offshore plants, seawater, and sour services (NACE).

High-Performance Nickel Alloys: Elite materials for extreme chemical conditions. Maximum resistance against pure acids, free chlorine, hydrogen, and exceptional temperatures.



FEATURES

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REFERENCE STANDARDS: ASME B36.10M VS ASME B36.19M

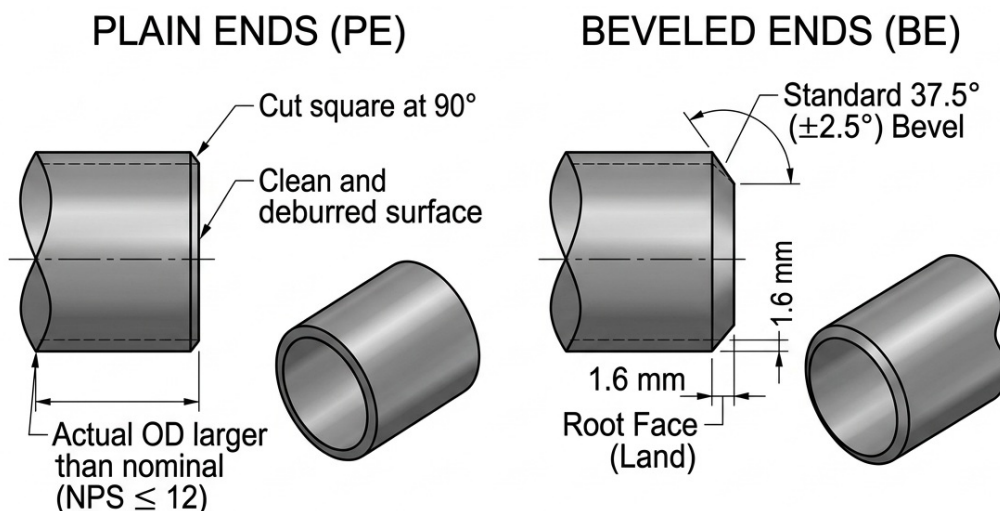
In accordance with ASTM/ASME manufacturing standards, industrial pipes must comply with strict geometric tolerance criteria to ensure optimal mating with flanges and fittings, as well as the accuracy of structural calculations.

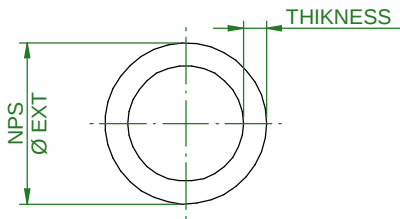
- **Outside Diameter (OD) Tolerance:** Varies based on the nominal pipe size (NPS). For the most common sizes (from NPS 1"1/2 to 4"), the maximum allowable variance on the outside diameter is +1.59 mm / -0.79 mm.
- **Wall Thickness Tolerance:** For any nominal Schedule or Std/XS thickness, the minimum wall thickness at any point of the pipe must not be lower than -12.5% of the specified nominal wall.
- **Weight Tolerance:** The weight of any individual pipe length shall not vary more than +10% / -3.5% from its theoretical calculated standard weight.

PIPE END PREPARATIONS

The configuration of the pipe ends dictates the joining method of the component within the piping system and is governed by the nominal wall thickness:

- **Plain Ends (PE):** The ends are cut square at 90° to the pipe axis, thoroughly deburred and cleaned. This is the standard execution for small diameter pipes intended for socket-weld fittings or low-pressure utility lines.
- **Beveled Ends (BE):** The pipe ends are machined with a standard 37.5° ($\pm 2.5^\circ$) bevel angle and a 1.6 mm root face (land) in compliance with the ASME B16.25 standard. This execution is mandatory for all pipes with a wall thickness of 3 mm and above intended for butt-welding.





NPS	Ø EXT (mm)	STD	XS	XXS	SCH.10	SCH.20	SCH.30	SCH.40	SCH.60	SCH.80	SCH.100	SCH.120	SCH.140	SCH.160
1/4"	13,72	2,23	3,02	—	—	—	—	2,23	—	3,02	—	—	—	—
3/8"	17,14	2,31	3,2	—	—	—	—	2,31	—	3,2	—	—	—	—
1/2"	21,34	2,77	3,73	7,47	—	—	—	2,77	—	3,73	—	—	—	4,75
3/4"	26,67	2,87	3,91	7,82	—	—	—	2,87	—	3,91	—	—	—	5,54
1"	33,4	3,38	4,55	9,09	—	—	—	3,38	—	4,55	—	—	—	6,35
1 1/4"	42,16	3,56	4,85	9,7	—	—	—	3,56	—	4,85	—	—	—	6,35
1 1/2"	48,26	3,68	5,08	10,16	—	—	—	3,68	—	5,08	—	—	—	7,14
2"	60,32	3,91	5,54	11,07	—	—	—	3,91	—	5,54	—	—	—	8,71
2 1/2"	73,02	5,16	7,01	14,02	—	—	—	5,16	—	7,01	—	—	—	9,52
3"	88,9	5,49	7,62	15,24	—	—	5,49	5,49	7,62	7,62	—	—	—	11,12
3 1/2"	101,6	5,74	8,08	—	—	—	—	5,74	—	8,07	—	—	—	—
4"	114,3	6,02	8,56	17,12	—	—	—	6,02	—	8,56	—	11,12	—	13,49
5"	141,3	6,55	9,52	19,05	—	—	—	6,55	—	9,52	—	12,7	—	15,87
6"	168,27	7,11	10,97	21,94	—	—	—	7,11	—	10,97	—	14,27	—	18,24
8"	219,07	8,18	12,7	22,22	—	6,35	7,04	8,18	10,31	12,7	15,06	18,24	20,62	23,01
10"	273,05	9,27	12,7	—	—	6,35	7,8	9,27	12,7	15,06	18,24	21,41	25,4	28,57
12"	323,85	9,52	12,7	—	—	6,35	8,38	10,31	14,27	17,45	21,41	25,4	28,57	33,32
14"	355,6	9,52	12,7	—	6,35	7,92	9,52	11,12	15,06	19,05	23,8	27,76	31,75	35,71
16"	406,4	9,52	12,7	—	6,35	7,92	9,52	12,7	16,66	21,41	26,19	30,94	36,52	40,46
18"	457,2	9,52	12,7	—	6,35	7,92	11,12	14,27	19,05	23,8	29,36	34,92	39,67	45,24
20"	508	9,52	12,7	—	6,35	9,52	12,7	15,06	20,62	26,19	32,54	38,1	44,45	49,99

GENERAL NOTES TO THE TABLE (ASME B36.10M)

STD (Standard) & sch.40 Alignment: The STD weight and sch.40 wall thicknesses are perfectly identical for all sizes up to and including NPS 10". From NPS 12" onwards, the STD column thickness remains locked at the conventional value of 9.52 mm, whereas sch.40 designators continue to increase as the pipe diameter grows.

XS (Extra-Strong) & sch.80 Alignment: The XS weight and sch.80 wall thicknesses are perfectly identical for all sizes up to and including NPS 8". From NPS 10" onwards, the XS column thickness remains locked at the conventional value of 12.70 mm, whereas sch.80 designators continue to increase as the pipe diameter grows.

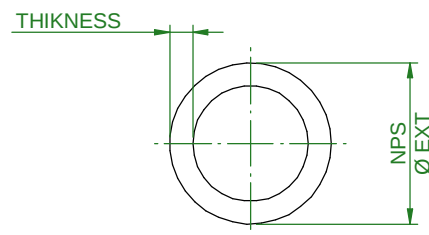
XXS (Double Extra-Strong) Designation: Identifies the historical millimeter series featuring maximum structural wall thicknesses, independent of traditional numerical schedules.

Commercial Availability in Stainless Steel/Alloys: All wall thicknesses and pure numerical schedules governed by this standard (including high-pressure series such as sch.120, sch.160, and XXS) are fully applicable and commercially available in stainless steel (e.g., AISI 316L, Duplex) or nickel alloys should the project's pressure design require it.



ASME B36.19M

DIMENSION



NPS	Ø EXT (mm)	SCH.5S	SCH.10S	SCH.40S	SCH.80S
1/4"	13,72	1,24	1,65	2,23	3,02
3/8"	17,14	1,24	1,65	2,31	3,2
1/2"	21,34	1,65	2,11	2,77	3,73
3/4"	26,67	1,65	2,11	2,87	3,91
1"	33,4	1,65	2,77	3,38	4,55
1"1/4	42,16	1,65	2,77	3,56	4,85
1"1/2	48,26	1,65	2,77	3,68	5,08
2"	60,32	1,65	2,77	3,91	5,54
2"1/2	73,02	2,11	3,05	5,16	7,01
3"	88,9	2,11	3,05	5,49	7,62
3"1/2	101,6	2,11	3,05	5,74	8,08
4"	114,3	2,11	3,05	6,02	8,56
5"	141,3	2,77	3,4	6,55	9,52
6"	168,27	2,77	3,4	7,11	10,97
8"	219,07	2,77	3,76	8,18	12,7
10"	273,05	3,4	4,19	9,27	12,7
12"	323,85	3,96	4,57	9,52	12,7
14"	355,6	3,96	4,78	9,52	12,7
16"	406,4	4,19	4,78	9,52	12,7
18"	457,2	4,19	4,78	9,52	12,7
20"	508	4,78	5,54	9,52	12,7

GENERAL NOTES TO THE TABLE (ASME B36.10M)

Threading Restrictions (sch. 5S / 10S): Nominal wall thicknesses for Schedule 5S and 10S are ultra-light and do not structurally permit threading in accordance with ANSI/ASME B1.20.1. For these schedules, pipe ends must be strictly ordered as plain ends (PE) or intended solely for welding purposes.

Geometric Non-Conformance to ASME B36.10M: As highlighted by the matrix cross-references, the wall thicknesses for NPS 14 through 22 of Schedule 10S, NPS 12 of Schedule 40S, and NPS 10 and 12 of Schedule 80S do not conform to the standard carbon steel values of ASME B36.10M. The "S" suffix in the schedule number is used specifically in procurement to differentiate these dedicated stainless steel pipe dimensions.

Regulatory Crossover for High Pressure: The ASME B36.10M standard includes alternative wall thicknesses (such as sch. 60, 100, 120, 140, 160, or XXS weight) that are not natively listed within the B36.19M table. However, these thicknesses are fully standardized, commercially available, and specifiable with stainless steel or nickel alloy materials if required by piping pressure design.



GENERAL REQUIREMENTS (Applicable to ALL Pipe Categories)

Any supply of industrial piping to ASME specifications must strictly comply with the following minimum quality requirements, regardless of the material grade selected:

Traceability and Certification: Materials must be accompanied by an original mill test certificate in accordance with EN 10204 type 3.1. The certificate must explicitly report the chemical analysis, mechanical testing results, and the corresponding heat number.

Legal Marking: Each individual pipe length must feature a continuous and indelible marking (stenciling) along its entire length. This marking must clearly state the manufacturer's logo or trademark, the ASME dimensional standard, the specific ASTM specification and grade, the Nominal Pipe Size (NPS), the Schedule thickness, and the unique heat number.

Length of Pipes: Unless otherwise specified in writing or explicitly ordered as custom fixed lengths, pipes must be supplied in standard commercial Single Random Lengths (SRL), with individual bars measuring between 4.8 and 6.7 meters. Short remnants or random crop ends are strictly rejected.

End Preparation: For wall thicknesses equal to or greater than 3 mm intended for butt-welding, the ends must be supplied pre-beveled in accordance with ASME B16.25 (Beveled Ends - BE). For wall thicknesses below 3 mm or pipes intended for socket-weld/threaded configurations, the ends must be supplied square-cut and completely free of burrs (Plain Ends - PE).

REQUIREMENTS BY MATERIAL CATEGORY - Carbon Steel and Alloy Steel

Manufacturing Process: Pipes must be supplied strictly in SEAMLESS (SMLS) execution in accordance with ASTM A106, ASTM A333, or ASTM A335. Welded execution is absolutely prohibited for these grades.

Surface Protection: The pipes must be externally protected against atmospheric corrosion by applying a light layer of protective mill oil or a temporary black rust-preventive varnish (Mill Oiled / Mill Varnished).

End Protection: Both ends of each pipe must be securely fitted with plastic end caps to prevent the entry of foreign debris and to fully preserve the integrity of the machined bevel face.

REQUIREMENTS BY MATERIAL CATEGORY - Austenitic and Superaustenitic Stainless Steel

Supply Condition: Pipes must be supplied in the fully heat-treated Solution Annealed and Pickled (Pickled & Annealed) condition. Both internal and external surfaces must be perfectly clean and entirely free of mill scale.

Preservation and Contamination: During storage, handling, and transportation, a total absence of direct contact with carbon steel equipment, tools, or materials must be strictly guaranteed to prevent iron particle contamination, which triggers localized corrosion. Forklift forks and lifting straps must be adequately covered or padded with protective materials.

Welded Specification (If Welded): Whenever the purchase order permits a welded execution (WLD), the internal weld seam must be completely removed, rolled, or scraped (Bead Conditioned) to guarantee absolute flatness and smoothness of the internal pipe wall.



TECHNICAL PURCHASE SPECIFICATIONS AND SUPPLY CONDITIONS

REQUIREMENTS BY MATERIAL CATEGORY - Duplex and Superduplex Stainless Steel

Metallurgical Controls: In addition to standard testing, the manufacturer must guarantee and certify a balanced dual-phase microstructure, with a ferrite content restricted between 40% and 60%.

Intermetallic Phase Testing: A mandatory control test to detect detrimental intermetallic phases must be performed and certified in accordance with ASTM A923 Method C.

Heat Treatment: Pipes must be strictly supplied in the solution-annealed state (Solution Annealed) followed by rapid water quenching (Water Quenched).

Sour Service Compliance: When explicitly specified for Oil & Gas projects, the material must fully comply with the structural, hardness, and microstructural limits mandated by the NACE MR0175 / ISO 15156 standard for sour environments.

REQUIREMENTS BY MATERIAL CATEGORY - Nickel Alloys and Exotic Materials

Material Integrity: As high-performance superalloys designated for extreme chemical environments, the pipes must be supplied in the maximum soft-annealed state specified by the reference ASTM standard (e.g., ASTM B444 / B622) and must be entirely free from residual cold-drawing stresses.

Extreme Cleanliness: The piping surfaces must show no traces of manufacturing lubricants, drawing compounds, grease, or markings containing sulfur, lead, or other low-melting-point metals. These elements could severely compromise the metallurgical integrity of the material during subsequent fabrication and welding operations in the workshop.

COMMERCIAL SUPPLY SPECIFICATIONS

Commercial Pipe Length Categories Unlike discrete components such as flanges, pipes are manufactured and procured in linear lengths regulated by standard international steel mill practices. In procurement documents and material master data, lengths are classified into three distinct categories:

SRL (Single Random Length): Pipes must be supplied in standard commercial lengths, with individual bars measuring randomly between 4.8 and 6.7 meters. Short remnants or random crop ends below this threshold are strictly rejected. This represents the standard warehouse stock configuration for the majority of process piping.

DRL (Double Random Length): Individual bars featuring lengths ranging randomly between 10.7 and 12.8 meters. This execution is primarily utilized for long-distance transfer lines (pipelines) to drastically reduce the total number of circumferential field weld joints.

Cut to Length (Fixed Length): Custom pipe spools or sections processed and supplied to a strict fixed millimeter length specified on the engineering drawings (typically featuring a tight tolerance, e.g., $\pm 5 \text{ mm}$), widely used for shop pre-fabrication.



HOW TO ORDER

TYPE		MANUFACTURING		DIMENSIONE NPS		THICKNESS ASME B36.10M		THICKNESS ASME B36.19M (* - ONLY FOR)		MATERIAL	
PIP	TUBO	S	SEAMLESS	004	1/4"	010	SCH 10	05S	SCH 5S	A1	ASTM A335 GR. P11
		W	WELDED	006	3/8"	020	SCH 20	10S	SCH 10S	A2	ASTM A335 GR. P22
				008	1/2"	030	SCH 30	40S	SCH 40S	A3	ASTM A335 GR. P91
				012	3/4"	040	SCH 40	80S	SCH 80S	C1	ASTM A106 GR. B CARBON STEEL
				016	1"	060	SCH 60			C2	ASTM A333 GR. 6 LOW TEMPERATURE CS
				020	1 1/4"	080	SCH 80			D1*	ASTM A790 GR. UNS S31803 (DUPLEX)
				024	1 1/2"	100	SCH 100			D2*	ASTM A790 GR. UNS S32750 (SUPERDUPLEX)
				032	2"					D3*	ASTM A790 GR. UNS S32760 (SUPERDUPLEX)
				040	2 1/2"					N1*	ASTM B444 UNS N06625
				048	3"					N2*	ASTM B165 UNS N04400
				056	3 1/2"					N3*	ASTM B622 UNS N10276
										N6*	ASTM A312 UNS S31254 (6Mo / 254 SMO)
										S1*	ASTM A312 GR. TP316/TP316L DUAL CERTIFIED
										S2*	ASTM A312 GR. TP304/TP304L DUAL CERTIFIED





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