

Fittings: Elbows, Tees and Reducers



Fittings, part of an integral solution

Scope

TenarisTamsa, Tenaris's Industrial Center in Mexico, is a leading manufacturer of steel pipes for the energy industry. Located in Veracruz, it helps major companies face the challenges posed by the most demanding environments in oil and gas exploration and production.

Monterrey has a production center for weldable connections in which elbows, tees and reductions are produced from pipe manufactured at TenarisTamsa Industrial Center, for the national and international market.

TenarisTamsa offers seamless carbon steel fittings for applications with moderate pressure and temperature.

Some of these applications are:

- Gas transport
- Hydrocarbon transport
- Boilers
- Construction industry

Chemical analysis and mechanical properties

Next, we present the tables of chemical analysis and mechanical properties of the fittings.



Chemical analysis

ASTM	STEEL GRADES	CHEMICAL COMPOSITION								
		C	Mn	P	S	Si	Cr	Mo	Ni	Others
		[%]								
A-234	WPB	0.3 máx	0.29 -1.06	0.05 máx	0.058 máx	0.1 min	0.4	0.15	0.4	Cu 0.4
		0.3 máx	0.29 -1.06	0.05 máx	0.058 máx	0.1 min	0.4	0.15	0.4	V 0.08
		0.3 máx	0.29 -1.06	0.05 máx	0.058 máx	0.1 min	0.4	0.15	0.4	Cb 0.02

Mechanical properties

ASTM	STEEL GRADES	MECHANICAL PROPERTIES			
		Yield Strength MPA	UTS MPA	Elongation min[%] in 2"	
				Longitudinal	Transversal
A-234	WPB	240	415-655	30	20

NOTE: For fittings with ASTM A-234 WPC grade, please contact a sales representative.

Quality controls

Fittings are manufactured under the following standards:

- AE 250 NF A 49-281
- ANSI B 16.9
- ASME SA 234 WPB, WPC and WPL6
- ASME B 16.9
- ASME II Part D Table Y1
- ASTM A 234 WPB and WPC
- NACE MR 0175 / ISO 15156-1 (hardness)
- PED 97/23/EC Annex I Paragraph 7.5

The certification of the fittings meets the requirements of the standards: DIN EN 10204 3.1.B and ISO 10474 3.1.B. To ensure the quality of the fittings, the following tests are carried out:

1. IN THE RAW MATERIAL

- Chemical analysis of the casting process
- Stress test
- Electromagnetic inspection
- Visual and dimensional inspection
- Hydrostatic test

2. IN THE FITTING

- Visual and dimensional inspection
- Mechanical tests (casting)

If there is any other type of inspection and/or analysis not mentioned in the above list, Tenaris can reach an agreement with the customer to conduct them before the manufacturing begins. The mill has a complete mechanical-metallurgical laboratory to support customers with this kind of special requirements.

Labeling and packaging

Fittings are grouped according to the dimensions of the pieces and the quantities in cardboard boxes and/or wooden pallets reinforced with steel sheets and a plastic cover following plant procedures. If required, a copy of the procedure can be delivered.

Fittings identification is performed mechanically according to the ASTM A 234 standard on the external surface of the fittings with the following information:

- Manufacturer identification
- Dimensions (diameter and thickness)
- Manufacturing standard (WPB)
- Number of the casting procedure
- Made in Mexico

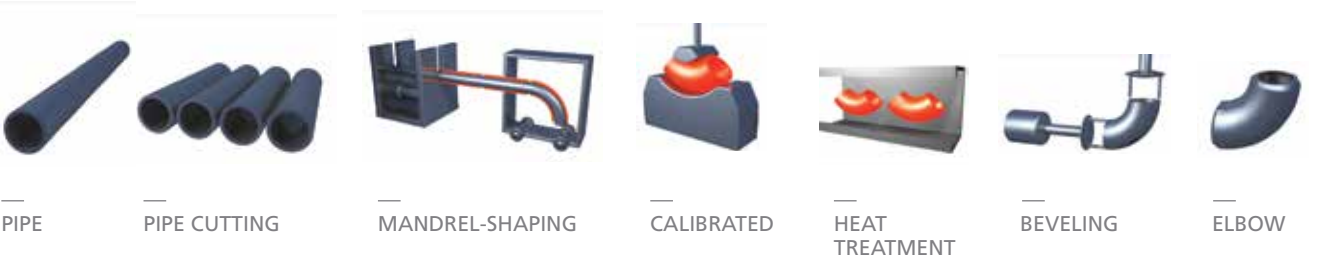
Reducers of steel in carbon seamless.



Manufacturing process

Next, we show the different processing routes followed to manufacture each one of the products: elbows, tees and reducers.

ELBOWS



TEES



REDUCERS



Dimensions

Tables 1, 2, 3 and 4 include the list of measures with the final dimensions.
TenarisTamsa manufactures diameters up to 16".

Elbows and Tees

NPS (")	OUTSIDE DIAMETER	CENTER - TO - FACE					LENGTH		CENTER TO END
							E *		
	D	A	A1	O	O1	B	< = XS	XS >	C - M
1"	33.40	38.00	25.00	76.00	51.00	22.00	38.00	38.00	38
1 1/4"	42.16	48.00	32.00	95.00	64.00	25.00	38.00	38.00	48
1 1/2"	48.26	57.00	38.00	114.00	76.00	29.00	38.00	38.00	57
2"	60.32	76.00	51.00	152.00	102.00	35.00	38.00	44.00	64
2 1/2"	73.02	95.00	64.00	191.00	127.00	44.00	38.00	51.00	76
3"	88.90	114.00	76.00	22900	152.00	51.00	51.00	64.00	86
3 1/2"	101.60	133.00	89.00	267.00	178.00	57.00	64.00	16.00	95
4"	114.30	152.00	102.00	305.00	203.00	64.00	64.00	76.00	105
5"	141.30	190.00	127.00	381.00	254.00	79.00	76.00	89.00	124
6"	168.27	229.00	152.00	457.00	305.00	95.00	89.00	102.00	143
8"	219.07	305.00	203.00	610.00	406.00	127.00	102.00	127.00	178
10"	273.05	381.00	254.00	762.00	508.00	159.00	127.00	152.00	216
12"	323.85	475.00	305.00	914.00	610.00	190.00	152.00	178.00	254
14"	355.60	533.00	356.00	1067.00	711.00	222.00	165.00	191.00	279
16"	406.40	610.00	406.00	1219.00	813.00	254.00	178.00	203.00	305

TABLE 1.

- All the dimensions are expressed in millimeters, except the NPS ones, which are expressed in inches.
- Dimensions under ASME B 16.9 standard.

ELBOW 45° LARGE RADIUS



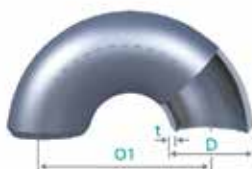
ELBOW 90° SHORT RADIUS



ELBOW 90° LARGE RADIUS



ELBOW 180° SHORT RADIUS



ELBOW 180° LARGE RADIUS



Table 2 shows the wall thickness according to ASME B 36.10 and ASME B16.9 specifications.

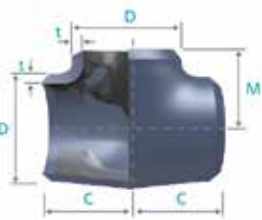
Wall thickness

NPS (")	OUTSIDE DIAMETER	ASME STANDARD B 36.10 NOMINAL WALL THICKNESS (mm)																
		Schedule																
		10	20	30	STD	40	60	XS	80	100	120	140	160	XXS	5S	10S	40S	80S
1/2"	21.34	-	-	-	2.77	2.77	-	3.73	3.73	-	-	-	4.78	7.47	1.65	2.11	2.77	3.73
3/4"	26.67	-	-	-	2.87	2.87	-	3.91	3.91	-	-	-	5.56	7.82	1.65	2.11	2.87	3.91
1"	33.40	-	-	-	3.38	3.38	-	4.55	4.55	-	-	-	6.35	9.09	1.65	2.77	3.38	4.55
1 1/4"	42.16	-	-	-	3.56	3.56	-	4.85	4.85	-	-	-	6.35	9.70	1.65	2.77	3.56	4.85
1 1/2"	48.26	-	-	-	3.68	3.68	-	5.08	5.08	-	-	-	7.14	10.16	1.65	2.77	3.68	5.08
2"	60.32	-	-	-	3.91	3.91	-	5.54	5.54	-	-	-	8.74	11.07	1.65	2.77	3.91	5.54
2 1/2"	73.02	-	-	-	5.16	5.16	-	7.01	7.01	-	-	-	9.52	14.02	2.11	3.05	5.16	7.01
3"	88.90	-	-	-	5.49	5.49	-	7.62	7.62	-	-	-	11.13	15.24	2.11	3.05	5.49	7.62
3 1/2"	101.60	-	-	-	5.74	5.74	-	8.08	8.08	-	-	-	-	-	2.11	3.05	5.74	8.08
4"	114.30	-	-	-	6.02	6.02	-	8.56	8.56	-	11.13	-	13.49	17.12	2.11	3.05	6.02	8.56
5"	141.30	-	-	-	6.55	6.55	-	9.52	9.52	-	12.70	-	15.88	19.05	2.77	3.40	6.55	9.52
6"	168.27	-	-	-	7.11	7.11	-	10.97	10.97	-	14.27	-	18.26	21.95	2.77	3.40	7.11	10.97
8"	219.07	6.35	-	7.04	8.18	8.18	10.31	12.70	12.70	15.09	18.26	20.62	23.01	22.22	2.77	3.76	8.18	12.70
10"	273.05	6.35	-	7.80	9.27	9.27	12.70	12.70	15.09	18.26	21.44	25.40	28.58	25.40	3.40	4.19	9.27	12.70
12"	323.85	6.35	-	8.38	9.52	10.31	14.27	12.70	17.48	21.44	25.40	28.58	33.32	25.40	3.96	4.57	9.52	12.70
14"	355.60	7.92	6.35	9.52	9.52	11.13	15.09	12.70	19.05	23.83	27.79	31.75	35.71	-	3.96	4.77	-	-
16"	406.40	7.92	6.35	9.52	9.52	12.70	16.66	12.70	21.44	26.19	30.96	36.53	40.49	-	4.19	4.77	-	-

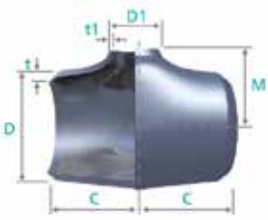
TABLE 2.

• All the dimensions are expressed in millimeters, except the NPS ones, which are expressed in inches.

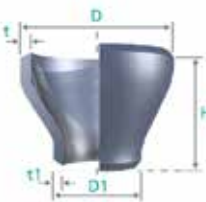
STRAIGHT TEE



TEE REDUCED



CONCENTRIC REDUCTION



Reductions 2" x 1" to 5" x 4"

NPS (")	DIMENSIONS				
	External diameter		Center to end		Length
	D	D1	C	M	H
2" x 1"	60.00	33.00	64.00	51.00	76.00
2" x 1 1/4"	60.00	42.00	64.00	57.00	76.00
2" x 1 1/2"	60.00	48.00	64.00	60.00	76.00
2 1/2" x 1"	73.00	33.00	76.00	57.00	89.00
2 1/2" x 1 1/4"	73.00	42.00	76.00	64.00	89.00
2 1/2" x 1 1/2"	73.00	48.00	76.00	67.00	89.00
2 1/2" x 2"	73.00	60.00	76.00	70.00	89.00
3" x 1 3/4"	89.00	42.00	86.00	70.00	89.00
3" x 1 1/2"	89.00	48.00	86.00	73.00	89.00
3" x 2"	89.00	60.00	86.00	76.00	89.00
3" x 2 1/2"	89.00	73.00	86.00	83.00	89.00
3 1/2" x 1 1/2"	102.00	48.00	95.00	79.00	102.00
3 1/2" x 2"	102.00	60.00	95.00	83.00	102.00
3 1/2" x 2 1/2"	102.00	73.00	95.00	89.00	101.00
3 1/2" x 3"	102.00	89.00	95.00	92.00	101.00
4" x 1/2"	114.00	48.00	105.00	86.00	102.00
4" x 2"	114.00	60.00	105.00	89.00	102.00
4" x 2 1/2"	114.00	73.00	105.00	95.00	102.00
4" x 3"	114.00	89.00	105.00	98.00	102.00
4" x 3 1/2"	114.00	102.00	105.00	102.00	102.00
5" x 2"	141.00	60.00	124.00	105.00	127.00
5" x 2 1/2"	141.00	73.00	124.00	108.00	127.00
5" x 3"	141.00	89.00	124.00	110.00	127.00
5" x 3 1/2"	141.00	102.00	124.00	114.00	127.00
5" x 4"	141.00	114.00	124.00	117.00	127.00

TABLE 3.

- Dimensions under current ASME B 16.9 specification.
- All the dimensions are expressed in millimeters, except the NPS ones, which are expressed in inches.

Reductions 6" x 2 1/2" to 16" x 14"

NPS (")	DIMENSIONS				
	External diameter		Center to end		Length
	D	D1	C	M	H
6" x 2 1/2"	168.00	73.00	143.00	121.00	140.00
6" x 3"	168.00	89.00	143.00	124.00	140.00
6" x 3 1/2"	168.00	102.00	143.00	127.00	140.00
6" x 4"	168.00	114.00	143.00	130.00	140.00
6" x 5"	168.00	141.00	143.00	137.00	140.00
8" x 3 1/2"	219.00	102.00	178.00	152.00	152.00
8" x 4"	219.00	114.00	178.00	156.00	152.00
8" x 5"	219.00	141.00	178.00	162.00	152.00
8" x 6"	219.00	168.00	178.00	168.00	152.00
10" x 4"	273.00	114.00	216.00	184.00	178.00
10" x 5"	273.00	141.00	216.00	191.00	178.00
10" x 6"	273.00	168.00	216.00	164.00	178.00
10" x 8"	273.00	219.00	216.00	203.00	178.00
12" x 5"	324.00	141.00	254.00	216.00	203.00
12" x 6"	324.00	168.00	254.00	219.00	203.00
12" x 8"	324.00	219.00	254.00	229.00	203.00
12" x 10"	324.00	273.00	254.00	241.00	203.00
14" x 6"	356.00	168.00	279.00	238.00	330.00
14" x 8"	356.00	219.00	279.00	248.00	330.00
14" x 10"	356.00	273.00	279.00	257.00	330.00
16" x 6"	406.00	168.00	305.00	264.00	356.00
16" x 8"	406.00	219.00	305.00	273.00	356.00
16" x 10"	406.00	273.00	305.00	283.00	356.00
16" x 12"	406.00	324.00	305.00	295.00	356.00
16" x 14"	406.00	356.00	305.00	305.00	356.00

TABLE 4.

- Dimensions under current ASME B 16.9 specification.
- All the dimensions are expressed in millimeters, except the NPS ones, which are expressed in inches.

Tolerances

Table 5 shows the dimensional tolerances, according to ASME B16.9 specifications.

Dimensionals

NPS (")	ALL THE FITTINGS		ELBOW 90° AND 45°, TEES	REDUCTIONS	RETURNS 180°		
	Outside diameter to bevel (1)	Internal diameter to end (2)	Center to end A-B-C-M	Total length H	Center to center	Shoulder to face	Alignment of the ends
1" to 2 1/2"	+1.6 -0.8	± 0.8	± 2.0	± 2.0	± 6.0	± 6.0	± 1.0
3" to 3 1/2"	± 1.6	± 1.6	± 2.0	± 2.0	± 6.0	± 6.0	± 1.0
4"	± 1.6	± 1.6	± 2.0	± 2.0	± 6.0	± 6.0	± 1.0
5" to 6"	+2.4 -1.6	± 1.6	± 2.0	± 2.0	± 6.0	± 6.0	± 1.0
8"	+2.4 -1.6	± 1.6	± 2.0	± 2.0	± 6.0	± 6.0	± 1.0
10"	+4.0 -3.2	± 3.2	± 2.0	± 2.0	± 10.0	± 6.0	± 2.0
12" to 16"	+4.0 -3.2	± 3.2	± 2.0	± 2.0	± 10.0	± 6.0	± 2.0

TABLE 5.

- All the dimensions are expressed in millimeters, except the NPS ones, which are expressed in inches.
- Wall thickness not less than 87.5% of the nominal thickness.
- (1) It is the addition of the absolute values and the minimum tolerance.
- (2) The internal diameter in the end and the nominal thickness must be specified by the customer.
- Revised according to ASME B16.9 specifications.

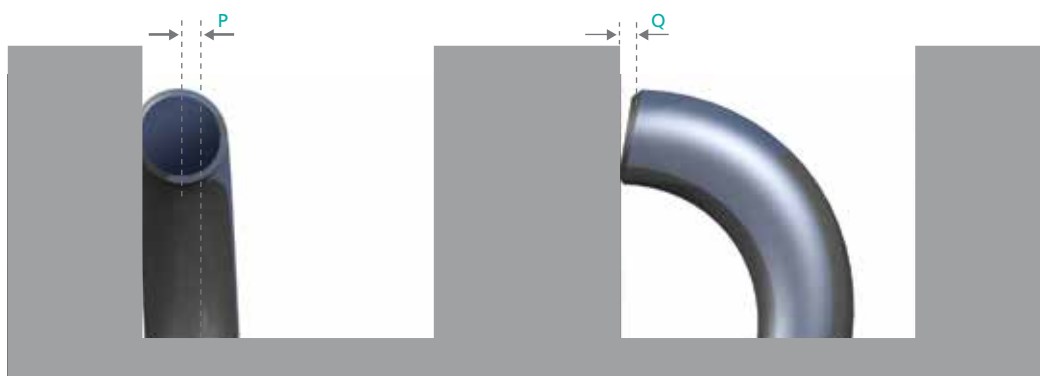
Table 6 shows the angular tolerances.

Angulars

NPS (")	OUT OF PLANE P	OFF ANGLE Q
1" to 4"	± 2	± 1
5" to 8"	± 4	± 2
10" to 12"	± 5	± 3
14" to 16"	± 6	± 3

TABLE 6.

- All the dimensions are expressed in millimeters, except the NPS ones, which are expressed in inches.





Additional information please contact:

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