

Definition and Details of GEE PIPE Flanges - Materials -

## ASTM Grades

Dimensions from carbon steel and stainless steel flanges are defined in the ASME B16.5 standard. The material qualities for these flanges are defined in the ASTM standards.

These ASTM standards, define the specific manufacturing process of the material and determine the exact chemical composition of pipes, fittings and flanges, through percentages of the permitted quantities of carbon, magnesium, nickel, etc., and are indicated by "Grade".

For example, a carbon steel flange can be identified with Grade F9 or F11, a stainless-steel flange with Grade F316 or Grade F321 etc..

Below you will find as an example a table with chemical requirements for fittings ASTM A403 Grade WP304, WP304L, WP316L and a table with frequent Grades, arranged on pipe and pipe-components, which belong together as a group.

As you may be have noted, in the table below, ASTM A105 has no Grade. Sometimes ASTM A105N is described;

"N" stands not for Grade, but for normalized. Normalizing is a type of heat treatment, applicable to ferrous metals only. The purpose of normalizing is to remove the internal stresses induced by heat treating, casting, forming etc..

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Chemical requirements composition, %

	Grade F304 (A)	Grade F304L (A)	Grade F316L (A-B)
Carbon, max	0.08	0.035	0.035
Manganese, max	2.00	2.00	2.00
Phosphorus, max	0.045	0.045	0.045
Sulfur, max	0.030	0.030	0.030
Silicon, max	1.00	1.00	1.00
Nickel	8 - 11	8 - 13	10 - 15
Chrome	18 - 20	18 - 20	16 - 18
Molybdenum	-	-	2.00-3.00

(A) Carbon 0.040% max. is necessary where many drawing passes are required, as with outside diameter <0.5 inch (12.7 mm), or nominal wall thickness <0.049 inch (1.2 mm).

(B) On pierced tube, Nickel may be 11 - 16.00%.

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ASTM Grades					
Material	Pipes	Fittings	Flanges	Valves	Bolts & Nuts
Carbon Steel	A106 Gr A	A234 Gr WPA	A105	A216 Gr WCB	A193 Gr B7
	A106 Gr B	A234 Gr WPB	A105	A216 Gr WCB	A194 Gr 2H
	A106 Gr C	A234 Gr WPC	A105	A216 Gr WCB	
Carbon Steel Alloy High-Temp	A335 Gr P1	A234 Gr WP1	A182 Gr F1	A217 Gr WC1	A193 Gr B7 A194 Gr 2H
	A335 Gr P11	A234 Gr WP11	A182 Gr F11	A217 Gr WC6	
	A335 Gr P12	A234 Gr WP12	A182 Gr F12	A217 Gr WC6	
	A335 Gr P22	A234 Gr WP22	A182 Gr F22	A217 Gr WC9	
	A335 Gr P5	A234 Gr WP5	A182 Gr F5	A217 Gr C5	
	A335 Gr P9	A234 Gr WP9	A182 Gr F9	A217 Gr C12	
Carbon Steel Alloy Low-Temp	A333 GR 6	A420 Gr WPL6	A350 Gr LF2	A352 Gr LCB	A320 Gr L7 A194 Gr 7
	A333 Gr 3	A420 Gr WPL3	A350 Gr LF3	A352 Gr LC3	
Austenitic Stainless Steel	A312 Gr TP304	A403 Gr WP304	A182 Gr F304	A182 Gr F304	A193 Gr B8 A194 Gr 8
	A312 Gr TP316	A403 Gr WP316	A182 Gr F316	A182 Gr F316	
	A312 Gr TP321	A403 Gr WP321	A182 Gr F321	A182 Gr F321	
	A312 Gr TP347	A403 Gr WP347	A182 Gr F347	A182 Gr F347	

### ASTM Materials

#### Pipes

- A106 = This specification covers carbon steel pipe for high-temperature service.
- A335 = This specification covers seamless ferritic alloy-steel pipe for high-temperature service.
- A333 = This specification covers wall seamless and welded carbon and alloy steel pipe intended for use at low temperatures.

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- A312 = Standard specification for seamless, straight-seam welded, and cold worked welded austenitic stainless steel pipe intended for high-temperature and general corrosive service.

### **Fittings**

- A234 = This specification covers wrought carbon steel and alloy steel fittings of seamless and welded construction.
- A420 = Standard specification for piping fittings of wrought carbon steel and alloy steel for low-temperature service.
- A403 = Standard specification for wrought austenitic stainless steel piping fittings.

### **Flanges**

- A105 = This specification covers standards for forged carbon steel piping components, that is, flanges, fittings, Valves, and similar parts, for use in pressure systems at ambient and higher-temperature service conditions.
- A182 = This specification covers forged or rolled alloy and stainless steel pipe flanges, forged fittings, and Valves and parts for high-temperature service.
- A350 = This specification covers several grades of carbon and low alloy steel forged or ring-rolled flanges, forged fittings and Valves for low-temperature service.

### **Valves**

- A216 = This specification covers carbon steel castings for Valves, flanges, fittings, or other pressure-containing parts for high-temperature service and of quality suitable for assembly with other castings or wrought-steel parts by fusion welding.

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- A217 = This specification covers steel castings, martensitic stainless steel and alloys steel castings for Valves, flanges, fittings, and other pressure-containing parts intended primarily for high-temperature and corrosive service.
- A352 = This specification covers steel castings for Valves, flanges, fittings, and other pressure-containing parts intended primarily for low-temperature service.
- A182 = This specification covers forged or rolled alloy and stainless steel pipe flanges, forged fittings, and Valves and parts for high-temperature service.

### **Bolds & Nuts**

- A193 = This specification covers alloy and stainless steel bolting material for pressure vessels, Valves, flanges, and fittings for high temperature or high pressure service, or other special purpose applications.
- A320 = Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for Low-Temperature Service.
- A194 = Standard specification for nuts in many different material types.