

STAINLESS STEEL MATERIAL FLANGES

USAGE OF SS FLANGES(304/316)

Stainless steel flanges are chosen for their corrosion resistance, durability, and ability to maintain integrity under both high and low temperatures. These flanges are used across a wide range of applications, particularly in environments where exposure to corrosive elements is a concern. Stainless steel flanges are used in conjunction with stainless steel pipes ATSM A312.



Here are several scenarios where stainless steel flanges are the preferred choice:

1. Corrosive Environments

Stainless steel, with its high chromium content, offers excellent resistance to corrosion caused by a variety of chemical media, including acids, alkalis, and salts. This makes stainless steel flanges ideal for use in chemical processing plants, pulp and paper manufacturing, and wastewater treatment facilities where exposure to corrosive substances is common.

2. Food and Beverage Industry

The non-reactive properties of stainless steel make it suitable for applications involving food and beverage processing. Stainless steel flanges can withstand repeated cleaning and sterilization processes without corroding or leaching into the product, ensuring safety and hygiene.

3. Pharmaceutical and Biotech Industries

Similar to the food and beverage industry, the pharmaceutical and biotech sectors require materials that maintain purity and resist contamination. Stainless steel flanges are used in these industries for their corrosion resistance and ability to maintain cleanliness, crucial for process integrity and product quality.

4. High-Temperature Applications

Certain grades of stainless steel, such as 316, 310, and 321, can withstand high temperatures, making them suitable for heat exchangers, boilers, and exhaust systems. These flanges maintain structural integrity and resist scaling at elevated temperatures.

5. Cryogenic Applications

Some stainless steel alloys, like Austenitic stainless steels, exhibit excellent toughness at cryogenic temperatures, making them suitable for use in applications involving liquefied natural gas (LNG) and other low-temperature processes.

6. Marine and Coastal Applications

The marine environment is particularly harsh, with exposure to saltwater and high humidity. Stainless steel flanges offer superior resistance to saltwater corrosion, making them suitable for shipbuilding, offshore oil rigs, and coastal facilities.

Key Considerations:

- **Grade Selection:** Different grades of stainless steel are available, each offering varying levels of corrosion resistance, strength, and temperature tolerance. Selecting the appropriate grade (e.g., 304, 316, 317) based on the specific environmental conditions and media involved is crucial.
- **Cost:** Stainless steel flanges are generally more expensive than carbon steel or alloy steel flanges. Their use should be justified by the need for corrosion resistance, temperature tolerance, or sanitary conditions.
- **Fabrication:** Stainless steel requires specific handling and fabrication techniques to avoid issues such as contamination or weld decay. Proper procedures must be followed to ensure the integrity of the flange connection.

Nickel, Chrome, and Moly LME Prices

The key elements that differentiate stainless steel materials for flanges, compared to other grades, are the Nickel (Ni), Chrome (Cr), and Molybdenum content (Mo). The price for these metals fluctuates daily on the London Metal Exchange (Nickel, Moly) and on the ferroalloy market (ferrochrome).

CHEMICAL COMPOSITION ASTM A182 F304/F316/F321

ASTM A182 Stainless Steel Flanges Materials Composition, %											
ASTM A182 GRADE	C	Mn	P	S	Si	Ni	Cr	Mo	Nb	Ti	Others
F304(1)	0.08	2.0	0.045	0.030	1.0	8.0-11.0	18.0-20.0				
F304H	0.04-0.10	2.0	0.045	0.030	1.0	8.0-11.0	18.0-20.0				
F304L(1)	0.030	2.0	0.045	0.030	1.0	8.0-13.0	18.0-20.0				
F304N(2)	0.08	2.0	0.045	0.030	1.0	8.0-10.5	18.0-20.0				
F304LN(2)	0.030	2.0	0.045	0.030	1.0	8.0-10.5	18.0-20.0				
F309H	0.04-0.10	2.0	0.045	0.030	1.0	12.0-15.0	22.0-24.0				
F310	0.25	2.0	0.045	0.030	1.0	19.0-22.0	24.0-26.0				
F310H	0.04-0.10	2.0	0.045	0.030	1.0	19.0-22.0	24.0-26.0				
F310MoLN	0.030	2.0	0.030	0.015	0.40	21.0-23.0	24.0-26.0	2.0-3.0			N 0.10-0.16
F316	0.08	2.0	0.045	0.030	1.0	10.0-14.0	16.0-18.0	2.0-3.0			
F316H	0.04-0.10	2.0	0.045	0.030	1.0	10.0-14.0	16.0-18.0	2.0-3.0			
F316L(1)	0.030	2.0	0.045	0.030	1.0	10.0-15.0	16.0-18.0	2.0-3.0			
F316LN(2)	0.030	2.0	0.045	0.030		11.0-14.0	16.0-18.0	2.0-3.0			
F316Ti	0.08	2.0	0.045	0.030		10.0-14.0	16.0-18.0	2.0-3.0		(3)	N 0.10 max
F317	0.08	2.0	0.045	0.030		11.0-15.0	18.0-20.0	3.0-4.0			
F317L	0.030	2.0	0.045	0.030		11.0-15.0	18.0-20.0	3.0-4.0			
F321	0.08	2.0	0.045	0.030	1.0	9.0-12.0	17.0-19.0			(4)	
F321H	0.04-0.10	2.0	0.045	0.030	1.0	9.0-12.0	17.0-19.0			(5)	
F347	0.08	2.0	0.045	0.030	1.0	9.0-13.0	17.0-20.0		(6)		
F347H	0.04-0.10	2.0	0.045	0.030	1.0	9.0-13.0	17.0-20.0		(7)		
F348	0.08	2.0	0.045	0.030	1.0	9.0-13.0	17.0-20.0		(6)		Co 0.20 Ta 0.10
F348H	0.04-0.10	2.0	0.045	0.030	1.0	9.0-13.0	17.0-20.0		(7)		Co 0.20 Ta 0.10

Notes:

1. Grades F304, F304L, F316, and F316L shall have a maximum Nitrogen of 0.10%.
2. Grades F304N, F316N, F304LN, and F316LN shall have a Nitrogen of 0.10 to 0.16%.
3. Grade F316Ti shall have a Titanium content five times above the Carbon plus Nitrogen and not more than 0.70%.
4. Grade F321 shall have a Titanium content five times above the Carbon and not more than 0.70%.
5. Grade F321H shall have a Titanium content four times above the Carbon and not more than 0.70%.
6. Grades F347 and F348 shall have a Niobium content ten times above the Carbon and not more than 1.10%.
7. Grades F347H and F348H shall have a Niobium content above than eight times the Carbon and not more than 1.10%.

MECHANICAL PROPERTIES A182 F304/F316/F321

ASTM A182 Grade	Minimum Tensile Strength in MPa	Minimum Yield point in Mpa	Minimum Elongation in %	Minimum Reduction of in min, %
ASTM A182 F304	515	205	30	50
ASTM A182 F304L	485	170	30	50
ASTM A182 F316	515	205	30	50
ASTM A182 F316L	485	170	30	50
ASTM A182 F321	515	205	30	50

Recommended service for stainless steel flange materials:

MATERIAL	MATERIAL GROUP	RECOMMENDED SERVICE
A182-F304	18% Cr, 8% Ni Stainless Steel	Corrosive services and atmospheres from -450°F to 1000°F (-268°C to 537°C)
A182-F316	18% Cr, 8% Ni, 2% Mo Stainless Steel	High resistance to corrosion from -450°F to 1000°F (-268°C to 537°C).

ASTM Vs. EN STAINLESS STEEL FLANGE MATERIALS

Flanges Material Grades: Comparison of European and American Standards		
Material number	EN	ASTM
Stainless Steel Flange Materials		
1.4541 X 6 CrNiTi 18 10	X6CrNiTi18-10	A 182 Grade F321
1.4571 X 6 CrNiMoTi 17 12 2	X6CrNiMoTi17-12-2	A 182 Grade F316Ti
1.4301 X 5 CrNi 18 10	X5CrNi18-10	A 182 Grade F304
1.4306 X 2 CrNi 19 11	–	A 182 Grade F304L
1.4307 –	X2CrNi18-9	A 182 Grade F304L
1.4401 X 5 CrNiMo 17 12 2	X5CrNiMo17-12-2	A 182 Grade F316
1.4404 X 2 CrNiMo 17 13 2	X2CrNiMo17-12-2	A 182 Grade F316L
1.4462 X 2 CrNiMoN 22 5 3	X2CrNiMoN22-5-3	A 182 Grade F51 (Duplex)
1.4529 X 1 NiCrMoCuN 25 20 6	X1NiCrMoCuN25-20-7	UNS N 08926
1.4539 X 1 NiCrMoCuN 25 20 5	X1NiCrMoCu25-20-5	A 182 Grade F904L
1.4547 –	X1CrNiMoCuN20-18-7	UNS S 3125

