

CARBON STEEL MATERIAL FLANGES

USAGE OF CS FLANGES

Carbon steel flanges are widely used in various industrial applications due to their strength, durability, and cost-effectiveness. Understanding when to use carbon steel flanges involves considering the specific requirements of the application, including the operating conditions, the nature of the fluids being handled, and budget constraints.



Here are several scenarios where carbon steel flanges are typically the preferred choice:

1. Moderate to High-Pressure Systems

Carbon steel flanges are suitable for applications that operate under moderate to high-pressure conditions. Their robustness makes them ideal for pipelines, process plants, and equipment that need to withstand substantial pressure without compromising the integrity of the flanged connection.

2. Ambient to High-Temperature Applications

These flanges can handle a wide range of temperatures, making them suitable for systems that operate at ambient temperatures up to those that require high-temperature resistance. Carbon steel maintains its structural integrity under elevated temperatures, though the specific grade of carbon steel will determine its maximum temperature limit.

3. Non-corrosive or Mildly Corrosive Environments

Carbon steel flanges are best used in environments where the risk of corrosion is low to moderate. They can handle exposure to water and some chemicals, but they are not suitable for highly corrosive substances like strong acids or chloride-bearing environments, where stainless steel or alloy flanges would be more appropriate.

4. Cost-Sensitive Projects

One of the significant advantages of carbon steel flanges is their cost-effectiveness compared to stainless steel or alloy flanges. In projects where budget constraints are a critical consideration, carbon steel flanges offer a reliable solution without a significant financial investment.

5. Industrial and Utility Piping

Carbon steel flanges are commonly used in industrial settings, including oil and gas, petrochemical, water treatment, and manufacturing facilities, as well as in utility systems such as steam, water, and gas distribution networks. Their versatility and durability make them well-suited to the rigorous demands of these applications.

6. Structural Applications

In addition to piping systems, carbon steel flanges can also be used in structural applications where components need to be joined securely. Their high strength and ability to be welded make them suitable for constructing frames, supports, and other structural elements.

Key Considerations:

- **Corrosion Protection:** While carbon steel flanges are not inherently resistant to corrosion, protective coatings or treatments, such as painting or galvanizing, can extend their life in corrosive environments.
- **Material Compatibility:** Ensure that the flange material is compatible with the fluid being handled and the connecting piping or equipment materials to prevent galvanic corrosion or other compatibility issues.

The following tables show the chemical composition and the mechanical properties of the **three main carbon steel flanges material grades**:

- [ASTM A105](#) (high-temperature carbon steel) to match A53, A106, API 5L carbon steel pipes
- [ASTM A350](#) LF1, LF2, LF3 (low-temperature carbon steel) to match ASTM A333 pipes
- ASTM A694 F42, F52, F60, F65 (high-yield carbon steel to match API 5L X42, X52, X60, and X65 steel pipes

CHEMICAL COMPOSITION ASTM A105, A350, A694

ASTM A105 (High-temperature carbon steel flange material)

	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	V
A105	–	0.60	–	–	0.10	–	–	–		
	0.35	1.05	0.035	0.040	0.35	0.40	0.40	0.30	0.12	0.08

ASTM A350 (Low-Temperature carbon steel flange material)

	C%	Mn%	Si%	S%	P%	Cr%	Ni%
A350 LF1	0.30 max	0.6/1.35	.15/.30	.040 max	.035 max	0.30 max	0.40 max
A350 LF2	0.30 max	0.6/1.35	.15/.30	.040 max	.035 max	0.30 max	0.40 max
A350 LF3	0.20 max	0.9	.20/.35	.040 max	.035 max	0.30 max	3.3/3.7

ASTM A694 (High-yield carbon steel flanges)

	C	Mn	P	S	Si
ASTM A694 F42	0.26-0.265	1.60-1.64	0.025-0.030	0.025-0.030	0.15-0.35
ASTM A694 F52	0.26-0.265	1.60-1.64	0.025-0.030	0.025-0.030	0.15-0.35
ASTM A694 F60	0.26-0.265	1.60-1.64	0.025-0.030	0.025-0.030	0.15-0.35
ASTM A694 F65	0.26-0.265	1.60-1.64	0.025-0.030	0.025-0.030	0.15-0.35

MECHANICAL PROPERTIES A105, A350, A694

ASTM A105 (High-temperature carbon steel flange material)

Property	ASTM A105	ASTM A350-LF2
Tensile Strength Min, psi	70,000	70,000-95,000
Tensile Strength Min, N/mm ²	485	485-655
Yield Strength Min, psi	36,000	36,000
Yield Strength Min, N/mm ²	250	250
Elongation (%)	22	22
Reduction of Area (%)	30	30
Hardness, maximum	187	15/12 ft-lbs
CVN at -50°F		20/16 joules

ASTM A694 (High-yield carbon steel flanges)

ASTM A694 Flange Material Grade	Min Yield Strength (0.2 % Offset), in ksi [MPa]	MinTensile Strength in ksi [MPa]	Elongation in 2 in. or 50 mm, min %
A694 F42	42 [290]	60 [415]	20
A694 F46	46 [315]	60 [415]	20
A694 F48	48 [330]	62 [425]	20
A694 F50	50 [345]	64 [440]	20
A694 F52	52 [360]	66 [455]	20
A694 F56	56 [385]	68 [470]	20
A694 F60	60 [415]	75 [515]	20
A694 F65	65 [450]	77 [530]	20
A694 F70	70 [485]	82 [565]	18

