

VALVE MATERIALS & SERVICE CONSIDERATIONS

1. Introduction

Valve material selection is critical to ensure safe operation, long service life, and compliance with project specifications. Materials must be suitable for pressure, temperature, corrosion resistance, and mechanical strength requirements.

2. Valve Body Materials

2.1 Carbon Steel

Commonly used for general service applications where corrosion risk is low.

- Suitable for moderate pressure and temperature
- Economical and widely available
- Limited corrosion resistance without coatings or linings

Typical standards: ASTM A216 WCB, ASTM A105

2.2 Low-Temperature Carbon Steel

Used for low-temperature or cryogenic services.

- Improved impact toughness
- Suitable for LNG and low-temperature hydrocarbons

Typical standards: ASTM A352 LCB / LCC

2.3 Stainless Steel

Selected for corrosive environments and higher temperature resistance.

- Good corrosion and oxidation resistance
- Suitable for chemical and petrochemical services

Typical grades: ASTM A351 CF8, CF8M, CF3, CF3M

2.4 Alloy Steel

Used in high-pressure and high-temperature applications.

- Enhanced strength and creep resistance
- Suitable for power plants and refineries

Typical grades: ASTM A217 WC6, WC9, C5, C12

3. Trim Materials

Valve trim (disc, seat, stem) is directly exposed to service media and flow conditions.

Common trim materials include:

- Stainless steel
- Hardened alloys
- Stellite or equivalent hard facing materials

Trim selection depends on:

- Erosion resistance
 - Corrosion resistance
 - Required shutoff class
 - Temperature limits
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4. Seat & Sealing Materials

4.1 Soft Seats

- PTFE, RPTFE, elastomers
- Suitable for low to moderate temperature
- Provide bubble-tight shutoff

4.2 Metal Seats

- Used for high temperature, abrasive, or erosive service
 - Longer service life in severe conditions
 - Typically, Class IV or V shutoff
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5. Packing & Gasket Materials

Packing and gaskets must maintain sealing under operating pressure and temperature.

Common packing materials:

- Graphite
- PTFE-based packing
- Live-loaded systems for fugitive emission control

Selection must consider environmental regulations and leakage limits.

6. Service Compatibility

Material compatibility with service media must be verified to avoid:

- Stress corrosion cracking
 - Hydrogen embrittlement
 - Sulfide stress cracking (H_2S service per NACE / ISO requirements)
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7. Conclusion

Proper valve material and service condition matching is essential to ensure operational reliability, safety, and compliance with international standards. Final selection should always be validated against project specifications and applicable codes.