

Basic Material

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A) Carbon Steel

- General
 - Using within min. -29 °C to max. 425 °C
 - The Carbon Equivalent (CE) for carbon steel intended for welding shall not exceed 0.43% based on the long formula: $CE = C + Mn / 6 + (Cr + Mo + V) / 5 + (Cu + Ni) / 15$
- Applications
 - Service Non-corrosive piping system (fresh water, plant air, nitrogen, fuel gas, etc.)
 - Pipes ASTM A106 Gr.B, API 5L Gr.B
 - Fittings ASTM A234 Gr.WPB
 - Forgings ASTM A105

B) Low Temp Carbon Steel

- General
 - Using if the minimum service temperature is below -29 °C
- Applications
 - Service Low temperature non-corrosive piping system (flare system)
 - Pipes ASTM A333 Gr.6
 - Fittings ASTM A420 Gr.WPL6
 - Forgings ASTM A350 Gr.LF2

C) Austenitic Stainless Steel

- General
 - The use of austenitic stainless steel in offshore is limited to a maximum service temperature of 60 °C
 - Using when the corrosion rate is too high to use carbon steel (typical more than 3mm or 6mm max. corrosion allowance for the design life)
 - Any hydrostatic testing of austenitic stainless steel shall be conducted with water containing less than 2 mg/kg chlorides, and any open ends sealed after drying to ensure no moisture ingress.
- Application
 - Service Fuel gas, chemical injection, instrument air, wet hydrocarbon (corrosive).
 - Pipes ASTM A312 Gr.TP304/304L, ASTM A312 Gr.TP316/316L
 - Fittings ASTM 403 Gr.WP304/304L, ASTM 403 Gr.WP316/316L
 - Forgings ASTM A182 Gr.F304/304L, ASTM A 182 Gr.F316/316L

D) Duplex Stainless Steel

- General
 - Using when the design condition is exceed the limit do SS316
 - Any hydrostatic testing of austenitic stainless steel shall be conducted with water containing less than 2 mg/kg chlorides, and any open ends sealed after drying to ensure no moisture ingress.
- Application
 - Service
 - Pipes ASTM A790 UNS S31803
 - Fittings ASTM A815 UNS S31803
 - Forgings ASTM A182 Gr.F51

E) Alloy Steel

- Elevated Temperature Services
 - General
 - Cr-Mo heat resistant steel contain 0.5-9% Cr and 0.5-1.0% Mo. Carbon content max 0.20%
 - Supplied in normalized and tempered, quenched and tempered or annealed condition
 - These Alloy Steels are used up to max temperature about 650 °C
 - Application
 - Pipes ASTM A 335 Gr.P11, A335 Gr.P22
 - Fittings ASTM A234 Gr.WP11, A234 Gr.WP22
 - Forgings ASTM A182 Gr.F11, A182 Gr.F22
- Low Temperature Services
 - General
 - Application with temperature from 0 °C to -195°C. Nickel steels is typically used
 - Application
 - Pipes ASTM A 333 Gr.3
 - Fittings ASTM A420 Gr.WPL3
 - Forgings ASTM A350 Gr.LF3

I) Elastomeric

- Natural Rubber->NR
- Styrene Butadiene Rubber->SBR
- Neoprene Rubber->CR
- Butyl Rubber->IIR
- Chlorosulphonated polyethylene->CSM
- Nitrile Butadiene Rubber->NBR, HNBR
- Ethylene Propylene Rubber->EPDM
- Fluoroelastomers->FKM
- Perfluoro Polymer->FFKM
- Fluor-Silicone Rubbers->VMQ, PMQ, FMQ
- Polyurethane Rubbers->AU,EU

H) Non-Metallic

- Glassfibre Reinforced Epoxy->GRE
- Glassfibre Reinforced Vinylster->GRV
- No use in hydrocarbon and methanol system
- Maxintemal design temperature 20 bargs
- Design temperature range for -40 °C up to 95 °C for epoxy and up to 80 °C for vinylster
- Commonly used for the sea water system in offshore
- Glassfibre Reinforced Plastic->GRP

G) Thermoplastic

- Plasticised Polyvinyl chloride->PVC
- Unplasticised PVC->UPVC
- Polyethylene->PE
- Polyamide->PA
- Polypropylene->PP
- Fluoropolymers
 - PolyTetraFluoroEthylene->PTFE
 - Polychlorotrifluoroethylen->PCTFE
 - Perfluoroalkoxy->PFE
 - Fluorinated ethylene propylene->FEP
 - Polyvinylidene fluoride->PVDF
- Polyphenylenesulphone->PPS
- Cross-linked Polyethylene->PEX
- Polyketone->PK
- Polyetheretherketone->PEEK

F) Non-Ferrous Alloy

- Nickel Alloys
 - Including Inconel and incoloy
 - Commonly used because of the high ppm
- Monel
 - Monel is a nickel-copper alloy, 10%-90% commonly used
 - Service: sea water
- Copper-Nickel
 - Cu-Ni 90/10, Cu-Ni 70/30
 - Services: sea water piping system
- Titanium
 - Non-Alloyed grade
 - Good corrosion resistance, especially chlorite induced pitting and stress-corrosion cracking
 - Alloyed grade
 - Good resistance to oxidizing media, e.g. nitric acid
 - Resistance to reducing media superior to non-alloyed titanium