Piping Material Selection

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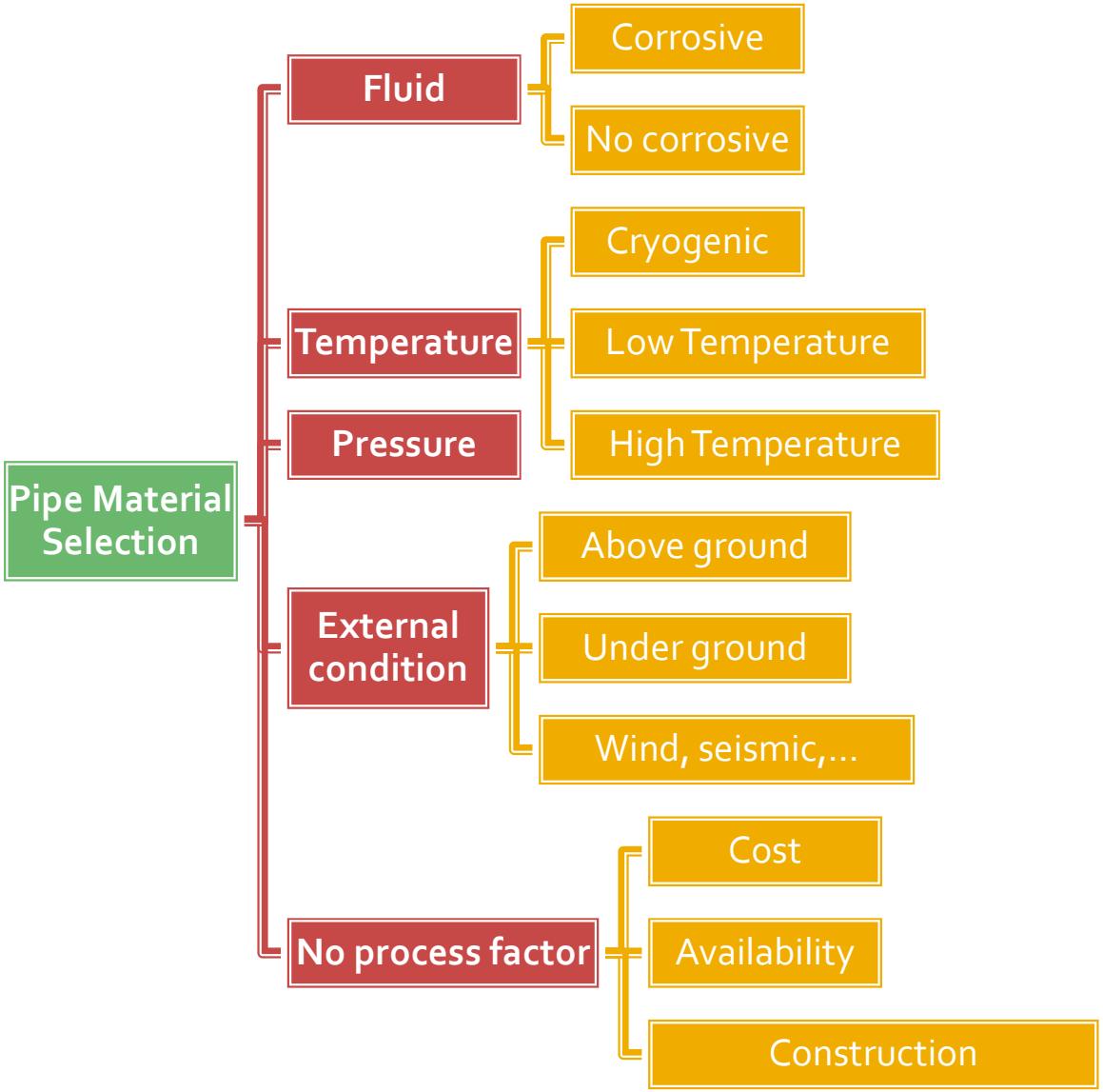
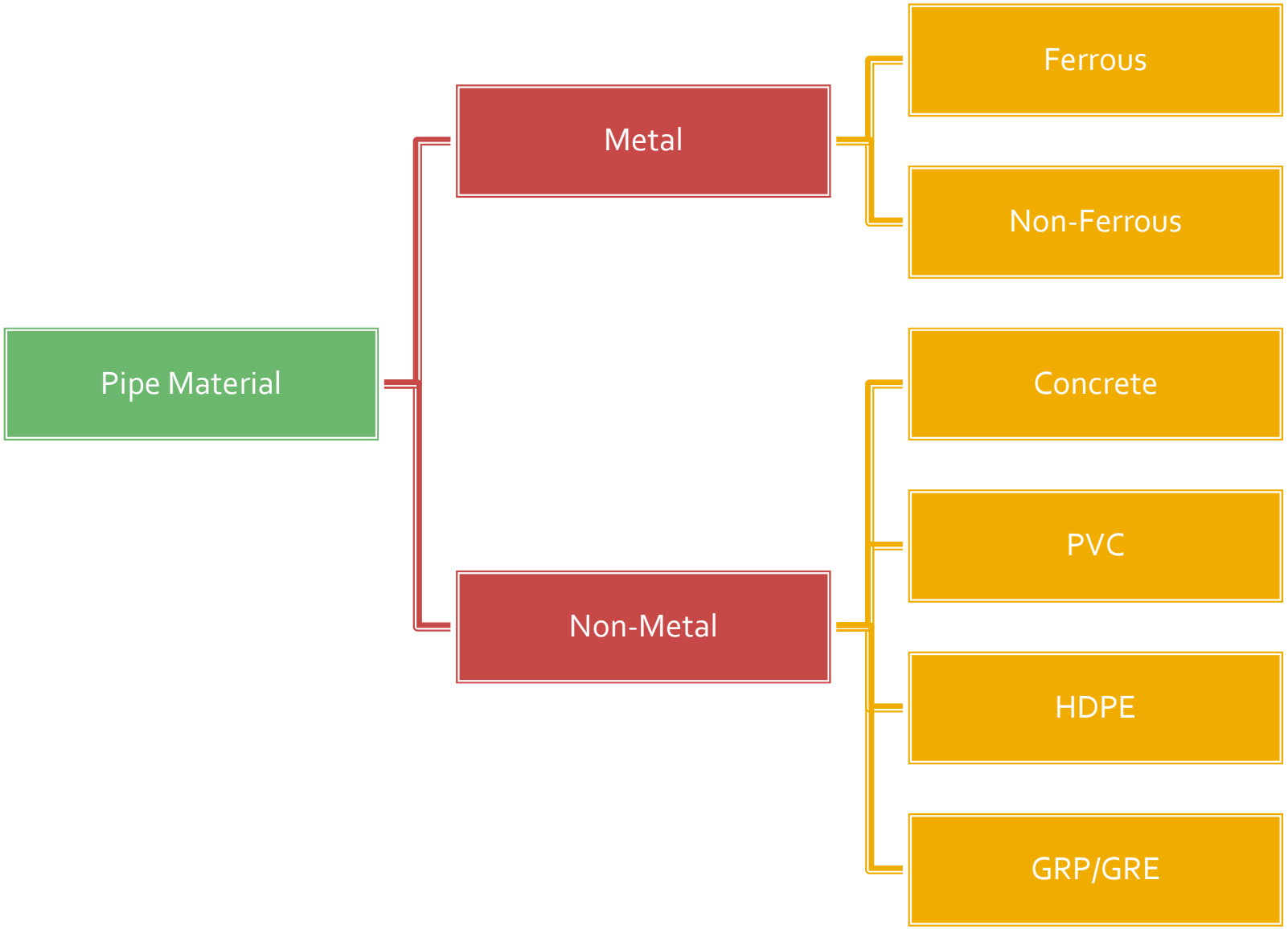
Spain Chapter

Pipe Material Selection



Pipe Material Selection



Pipe Material Selection - Metal

Cast Iron (Hierro fundido)

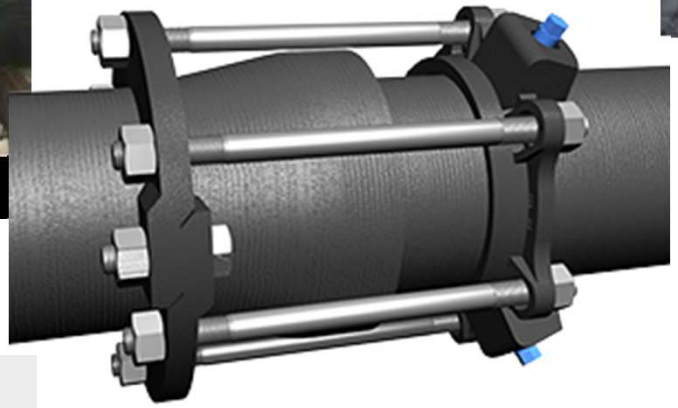
- Ferrous metal ≥2% of Carbon
- It is hard and brittle material, so not useful for process piping
- However, ductile iron pipes are widely used in water distribution network because its good corrosion resistant property
- It used in Manhole covers for the drainage

Cast Steel (Fundición de acero)

- Ferrous metal < 2% Carbon.
- It used in manufacturing of valve body and cast fittings in process industries

Pipe Material Selection - Metal

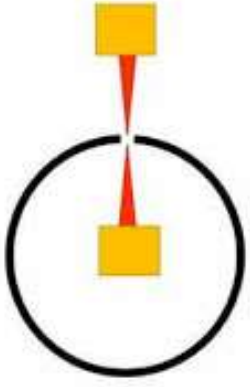
Cast Iron Joints

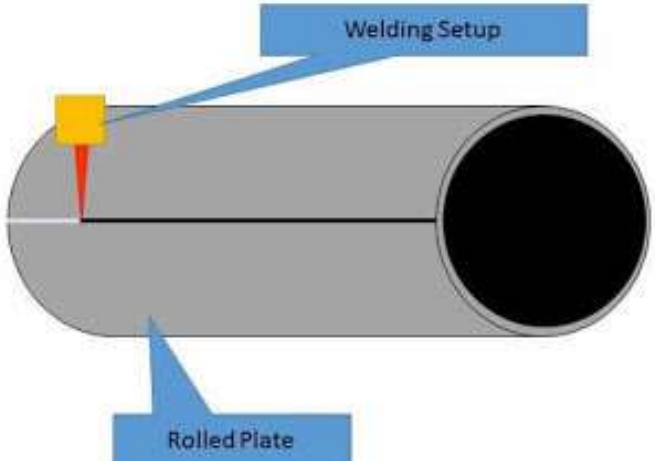


Pipe Material Selection - Metal

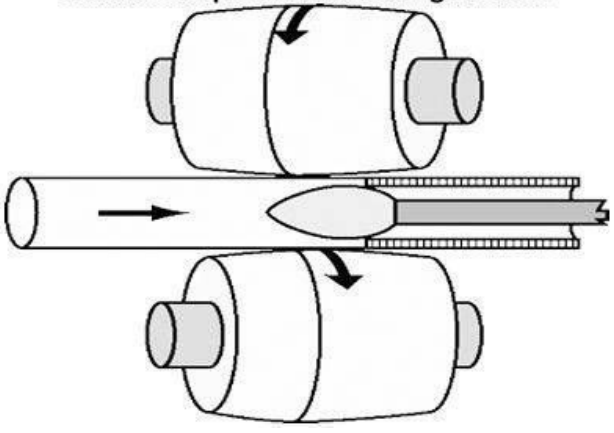
Carbon Steel

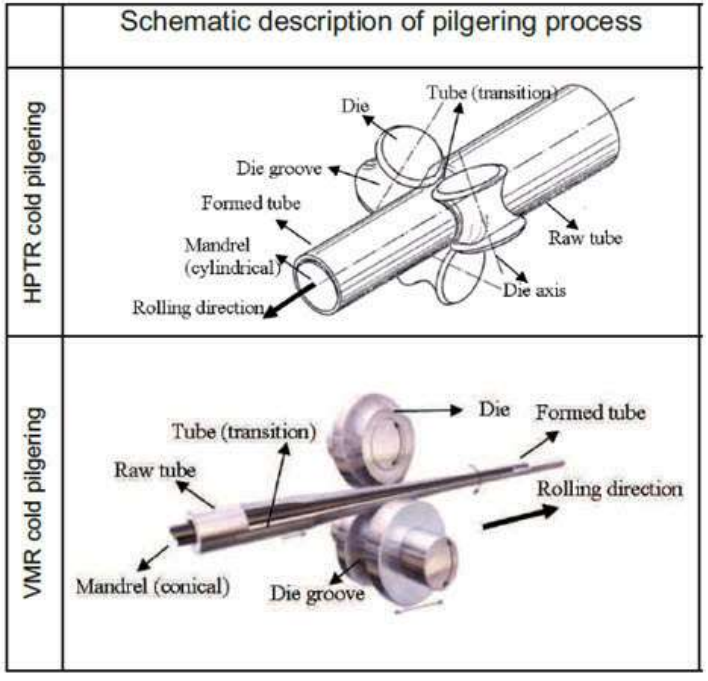
- < 2% Carbon.
- Same composition cast steel
- Manufactured by rolling, forging and drawing methods.





Seamless Pipe Manufacturing Process





Pipe Material Selection - Metal

Carbon Steel Joint

Buttweld

Threaded

Socket

Flange

Pipe Material Selection - Metal

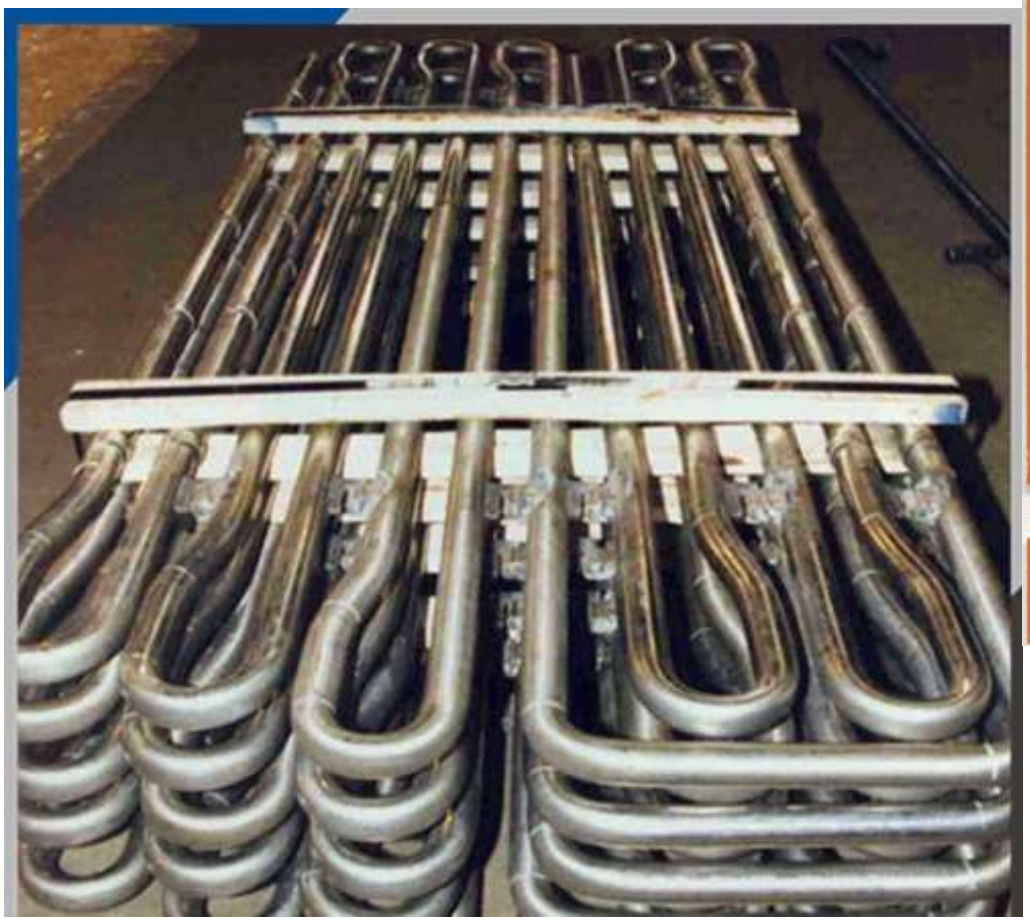
Alloy steel can further classify as

- **Low alloy steels**: in which the sum of total Alloying elements is < 5%
- **High alloy steels**: in which sum of total Alloying elements is > 5%
- Additional elementals: Chromium, Nickel, Molybdenum, Manganese ,Vanadium, Titanium, Silicon, Boron, Cobalt, Tungsten
- Improve corrosion resistance, high or low temperature stability,…

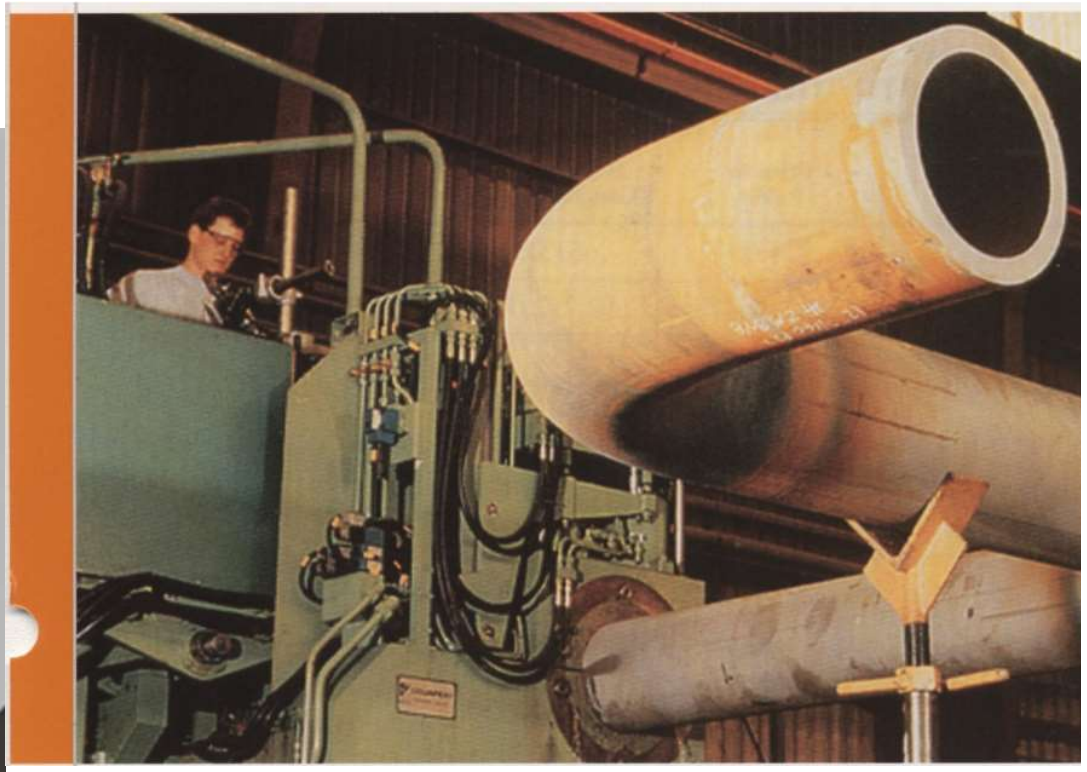
Pipe Material Selection - Metal

Use of **Alloy Steel**

Coils Power Boiler



Main steam Pipe



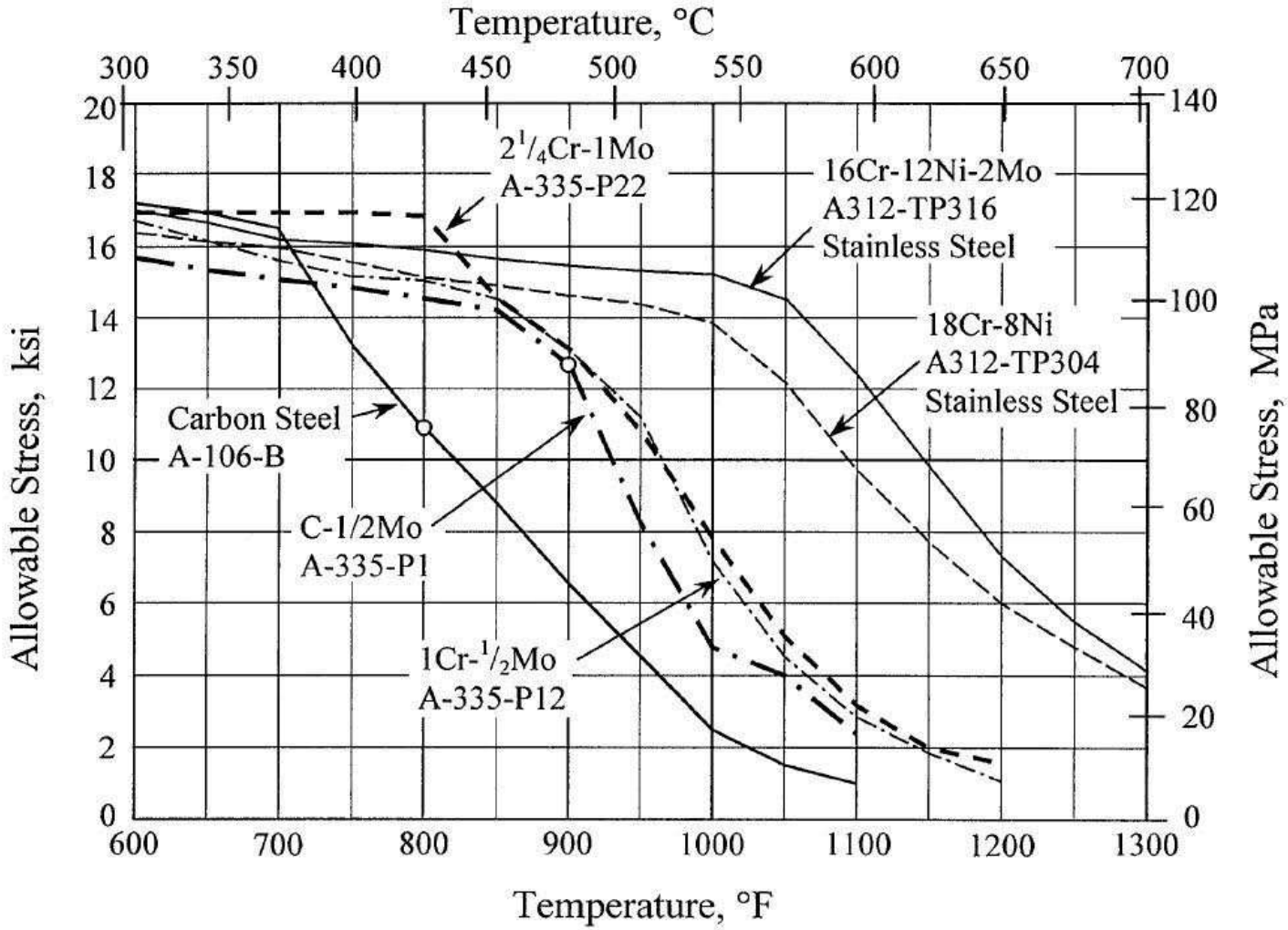
Pipe Material Selection - Metal

- **Stainless Steel (SS)**
- Is an alloy steel with Cr ≥ 10.5 and C ≤ 1.20%.
- SS has excellent resistance to corrosion and good ductility.
- Stainless steel becomes corrosion resistive due to the formation of non-reactive chromium oxide (Cr_2O_3) film that adheres tightly to the surface of metal. This film acts as a barrier and protects metal against corrosion.

Pipe Material Selection - Metal

Austenitic stainless steel

Pipe Material Selection - Metal



Pipe Material Selection - Metal

Copper and Copper Alloys

- Good thermal conductivity and good corrosion resistance
- Heat exchanger tubing and sea water application
- Cladding material with carbon steel in heat exchanger tube sheets.
- Hot and cold-water distribution (plumbing)
- Special care shall be taken with galvanic corrosion

Pipe Material Selection - Metal

Aluminum and Aluminum Alloys

- Good thermal conductivity
- It is most workable metal
- Highly resistant to atmospheric conditions
- Loses strength rapidly above 175°C
- It is used as an external cladding material to protect the insulation from water ingress.

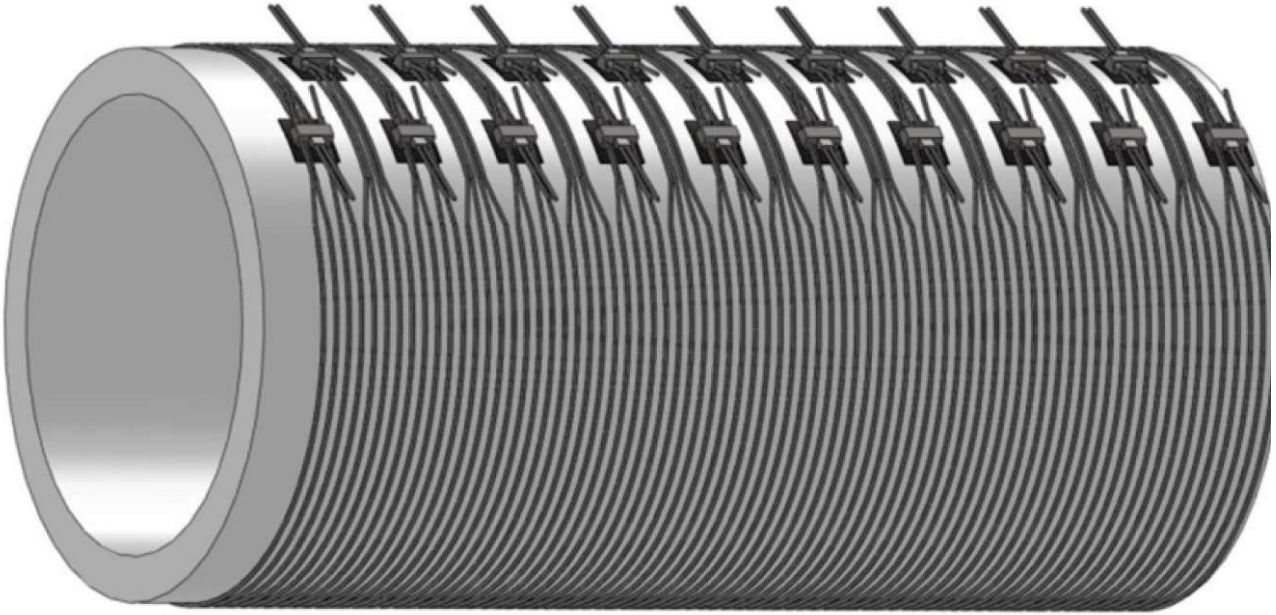
Pipe Material Selection – Non-Metal

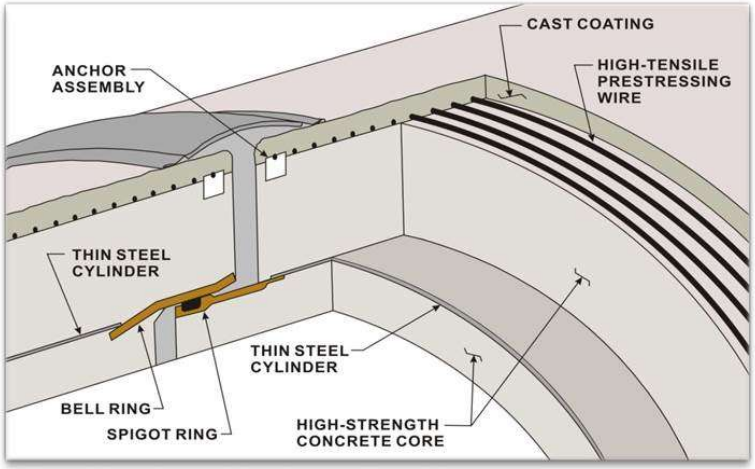
Concrete Pipes

- No for any process applications
- Storm water and gravity services
- Culverts and irrigation application

Pipe Material Selection – Non-Metal

Concrete Pipes (Cement)- Prestressed with steel cylinder





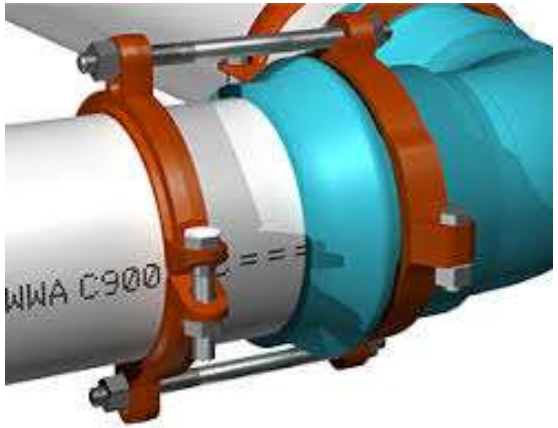
Pipe Material Selection – Non-Metal

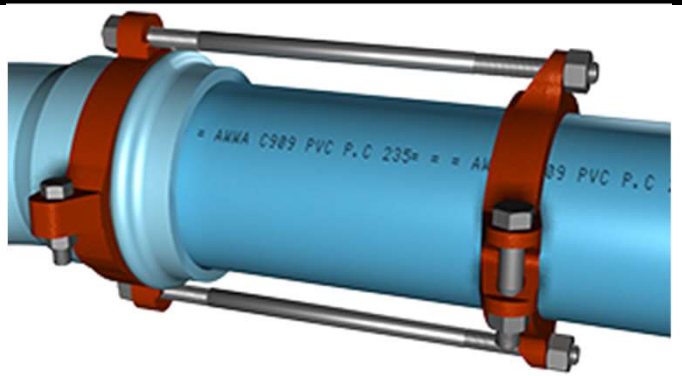
PVC / CPVC

- PVC – is Polyvinyl Chloride
- CPVC – Chlorinated Polyvinyl Chloride (that is having a higher strength at elevated temperatures than PVC < 80°C)
- Exceptionally resistant to chemical attack
- Protection from ultraviolet exposure if installed outdoor and start softening when subjected to high temperature.
- Pipes are made by Extrusion process
- Fittings, flanges and valves are manufactured by injection molding method

Pipe Material Selection – Non-Metal

PVC Joint





Pipe Material Selection – Non-Metal

PE/HDPE

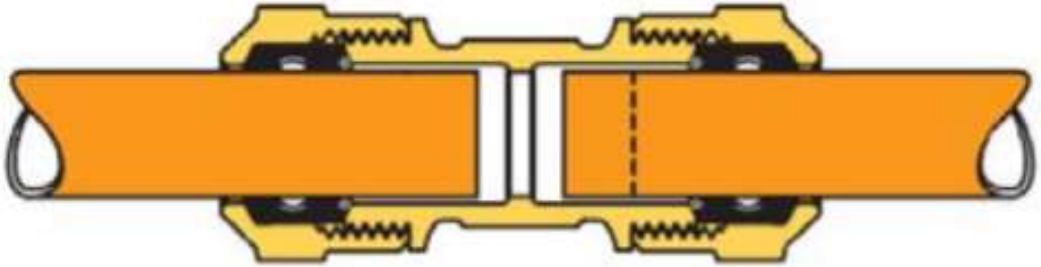
- HDPE has improved tensile strength than PVC
- Improved low-temperature brittleness
- Higher softening point
- Higher chemical resistance
- Manufactured by extrusion process
- Water distribution
- Low-pressure natural gas services
- Lined material with carbon steel pipe

Pipe Material Selection – Non-Metal

PE/HDPE Joint

Figure 17 – Compression Type Mechanical Couplings

17a – Compression Fitting



17b – Reinforced Gasket Style

17c – Split Clamp

17d – Compression Nut Style

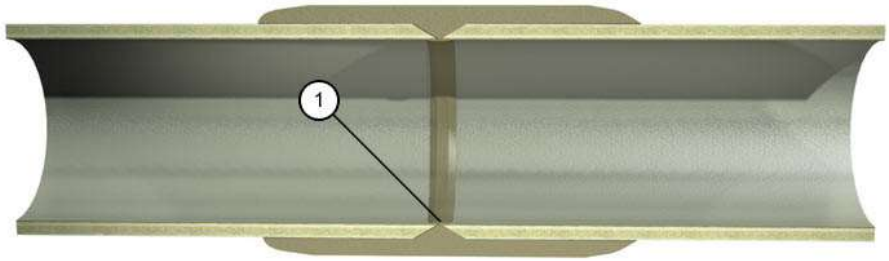
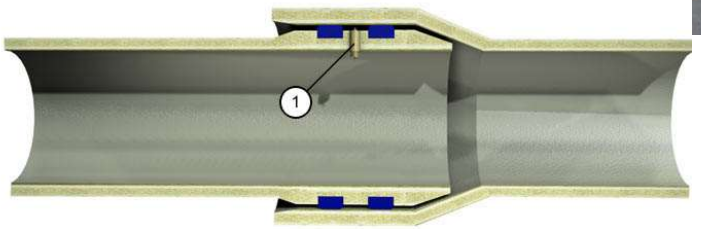
Pipe Material Selection – Non-Metal

PE/HDPE Joint

Pipe Material Selection – Non-Metal

- GRP that is Glassfibre reinforced plastic are used in
  - Water supply application Wastewater / Sewerage collection
  - Sea water transport application
- GRE that is Glassfibre reinforced epoxy
  - Higher temperature compare to GRP pipe, Industrial application (≈149°C)
  - Offshore platform Water treatment plant to handle salty water.
- Due to Excellent chemical and corrosion resistance it also used as lining material in sewage effluent tank

Pipe Material Selection – Non-Metal

GRP/GRE pipes are manufactured using the filament winding process.

Pipe Material Selection – Non-Metal