

**The Importance of
Manufacturing/Labeling/Shipping &
Installing the correct Material Grade of
Forgings**



What are the chances of a Material Mix?

The following statistics are factual and current:

A) Gulf Coast Petrochemical Plant found:

- **Wrong electrodes used on 72 welds of pipe**
- **Carbon Steel drain valves installed on Alloy Pipe**
- **Alloy Steel Heat Exchanger had Carbon Flanges stamped with an Alloy Grade**

B) West Coast Ammonia Plant found:

- **5,480 items for installation (1.8 % of the total) were of the wrong material grade**
- **An additional 2,750 roof hangers of the wrong alloy grade**

A Purchasing/Sales order entry Disaster

Carbon Steel is supplied because the Purchase Order showed someone's hand writing as CS instead of C5 which is a 5% Cr; 1-1/2% Mo; 1% W

OR

Carbon Steel is supplied, because the Purchase Order showed someone's hand writing as FS instead of F5 which is a 5% Cr; 1/2% Mo

The following are examples of why no one should assume a "HIGHER" quality material substitution is always Better:

- Higher Chemistry Substitutions do not always do or hold up well in various applications**
- Higher Chemistry in many situations yield higher hardness of a material**
- Higher Chemistry means a different welding procedure and post-weld heat treatment**
- Certain Chemical Elements in high concentrations may cause explosive reactions with processing chemicals**

The following two occurrences are examples of how a catastrophic accident can happen from the installation of incorrect material grades:

- **Mexico City, Mexico (1984) - Chemical Plant**
500 people died from the fire and explosion
- **Sao Paulo, Brazil (1984) - Gasoline Refinery**
508 people, mostly children, died when a 2 ft diameter pipe ruptured spreading 700 tons of gasoline across a village

Carbon Steel Valve Substitution (1993)

Accident: Major Line break and Refinery Downtime

Cause: A Carbon Steel Valve painted with Aluminum Paint was installed instead of a Stainless Steel Valve.

Result: The Valve corroded within a few days of use. The valve split, causing a hazardous chemical spill in a processing plant.



U.S. Petrochemical Plant Accident (1984)

Accident: Explosion from Ammonia under Pressure

Cause: Carbon Steel Pipe installed instead of 1-1/4% Cr and 1/2% Mo (P11)

Result: High Pressure Ammonia Converter involved. Hydrogen Attack on the Carbon Steel Pipe caused the gas to leak, resulting in a massive explosion knocking the converter to the ground

A Flange Manufacturer had an order for 20 flanges. They had 19 Carbon Steel Flanges in stock, but needed an additional flange to fill the order.

1 Flange was supplied in 2-1/4 CR (F22), which they thought this was a better alloy than carbon steel

The Net Effect:

The F22 Flange was welded to a carbon steel weld procedure; hence , never post-weld heat treated and cracked in service from being too hard

Valve Manufacturer made a Nickel Alloy Plug Substitution on a F304L Valve

The Cause:

An F304L Plug Valve was supplied with a Nickel 200 Plug instead of F304L from which the Valve Body was made. The supplier thought a high nickel alloy plug was a superior substitution.

The Net Effect:

The Valve was installed on a Nitric Acid line. Five hours later the plug disappeared and acid leaked out causing a disaster at the processing plant.

Flange Material Mix Accident (1991)

Accident: Chlorine Gas Fire inside the Plant

Cause: Titanium Flanges were marked "Hastelloy". After only one hour of processing, the Dry Chlorine in the line ignited the Titanium Flanges which burned rapidly setting a off a chlorine gas fire

Result: A damaged plant. If the plant was not evacuated, personnel would have inhaled the gas & would have died from the hydrochloric acid in their lungs.

**Louisiana Refinery Cracker Unit
catastrophically fails
because of hot sulfide stress corrosion
(1993)**

**Reason: A Socket-Weld 90 elbow fitting was supplied
in Carbon Steel instead of F5 Material**

Piper Alpha Oil Platform in the North Sea (1988)

Accident: Explosion and Fire

Cause: Wrong Substitution of a Valve

Result: 163 People on the platform killed

The previous accidents were factual and showed the catastrophic failure which can occur when the wrong material was installed.

We are all at fault:

- It was ordered wrong!**
- It was manufactured wrong!**
- It was labeled wrong!**
- It was shipped wrong!**
- It was installed wrong!**



AN OUNCE OF PREVENTION

- Reverify that the material ordered is the correct material for the application
- If someone has poor spelling or their hand writing is unclear, then stop and question what material is intended to be procured
- Always check item material markings and verify they agree with what was procured
- Magnets for receiving inspection are the poorest metal identification device. Don't use them

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