

LOW-ALLOY MATERIAL(A387-Gr.12-CI.2) Vs S.S 316L

1. INTRODUCTION

Most of the pressure vessel such as Reactor, Column, Drum in petro-chemical plant is equipped with internals where supported by internal support clip or bracket. And the material of internal support clip is of Carbon Steel, Low-Alloy or Stainless Steel to be decided by its life cycle of endurance. However, when this kind of support clip material is of Carbon Steel. It should be necessary for considering Stress Corrosion Cracking between Base metal and support clip due to Creep stress and corrosion especially, here, we need to consider how to affect corrosion at support clip where attached by welding to base metal.

Generally, material corrosion in petro-chemical occurs in major of two corrosion manner. The first one is of ionization of Ferrous material ($Fe^{+2} + O_3 \rightarrow Fe_2O_3$, or Fe_3O_4) for Oxidation Reduction Potential. Secondly, galvanic corrosion will be followed as various erosion and corrosion condition.

Here, the characteristic of galvanic corrosion is generally described as Anode reaction which occurs between two different material, temperature and acidity in its potential difference. Galvanic corrosion take places in lower electric potential as high temperature and low acidity etc. When we place Carbon Steel into a smaller of surface area adjacent to Stainless Steel, Carbon Steel will be of Anode reaction against Cathode reaction of Stainless Steel, In this case we call this corrosion as galvanic corrosion. Accordingly The surface area of Carbon Steel should be larger than its Stainless Steel otherwise, change Carbon Steel material to same as Stainless Steel.

In this theory and practice, how to affect that Low-alloy (Cr-Mo) material(ASTM A387-Gr.12-CI2) or Carbon Steel of support clip attached to larger area of base metal (ASTM A387-Gr.12-CI2) each of metal chemical composition is little be different and moreover, its surface area is much different. Clearly, smaller surface of material will be corroded as anode reaction side and the other side will be of anticorrosion.

For example, we can see that the electric potential of welding rod is more high against of base material due to this galvanic corrosion.

Therefore, when we select any kind of material in using petro-chemical plant especially, it is necessary for consideration of this galvanic corrosion along with mechanical properties even though their equipment system is well protected with cathodic protection system.

2. GALVANIC CORROSION CHARACTER BETWEEN Cr-Mo Low-Alloy AND C.S Steel or Cr-Mo Low-Alloy

2-1 Cr-Mo Low-Alloy for Base Metal To C.S Steel for support clip

(1) Cr-Mo Low Alloy of base metal protected from corrosion in a Cathode reaction

Therefore, C.S Steel of support clip will be corroded.

2-2 Cr-Mo Low-Alloy for Base Metal To Stainless Steel (A240-316L) for support clip

(1) Stainless Steel (A240-316L) for support clip protected from corrosion in a

Cathode reaction. Therefore, both metal of ORP will be equivalent because the area of base metal is larger than support clip.

3. CONCLUSION

As per industrial practice, the material of internal support clip is as same base material as possible because of mechanical character of welding. However, when this equipment is for high temperature service, we need to consider additional requirement of galvanic corrosion as well as Creep stress because Anode reaction is subject to High temperature rater than Low Temperature.

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