TECHNICAL CIRCULAR No. 527 of 09th December 2018

To:	All Surveyors/Auditors
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	Considerations to Prevent Corrosion
Reference:	Corrosion

The 5 Key Considerations to Prevent Corrosion

Corrosion can have devastating effects on the integrity of structures and components. Corrosion, if not accounted for, can leave even the best designs useless by compromising the mechanical and chemical properties of many different materials. With proper consideration, however, corrosion can be limited and even prevented almost entirely. There are many different ways that the risk of corrosion can be reduced. This article highlights several of these key areas.

Applied and Residual Stresses

Stress has been known to increase the risk and rate of corrosion. Dynamic stresses in a corrosive environment can cause failures such as fretting to occur much more rapidly. Materials that are subject to static stresses can possibly be affected by stress corrosion cracking.

Since stress combined with corrosion can decrease the time to material failure, both applied and residual stresses should be considered and monitored to prevent this from happening. Stress relieving a material is a good way to remove residual stresses. Applied stresses may be reduced or dispersed over a wide area with proper design techniques.

Environment

The environment is perhaps one of the most important considerations when designing for corrosion prevention. The environmental factors that can increase the risk of corrosion can vary

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widely. For instance, a material could be subjected to a marine environment or an underground environment. These two examples could vary even further. Is the marine environment comprised of saltwater and rich in chlorine? Is the soil of the underground environment acidic?

Another important consideration is whether the environment that the material is in undergoes a lot of movement. For instance, a pipeline carrying contents that are corrosive could have an increased rate of corrosion if the flow of the contents is increased or becomes more turbulent. Part of the reason for this is that the flow of the contents erodes the already oxidized surface material and exposes new, unoxidized surface material to the corrosive contents.

Temperature is another environmental factor that can have a catalytic effect on corrosion. Higher temperatures will cause increased oxidation rates. These increased oxidation rates will, in turn, have the potential to more rapidly compromise the integrity of a material by way of excessive corrosion. Care should be taken to avoid placing materials near heat sources to prevent increased corrosion rates. However, if the temperature is high enough that it creates an arid environment, then that may slow corrosion since oxidation typically requires the presence of a liquid.

All of this and more comes into play when determining the environment that a material will be subjected to. It is best to prevent these environmental inducers of corrosion if reasonably possible. Once there is an understanding of the environment to which the application will be subjected then an informed decision may be made regarding material selection.

Geometry

Structure or component geometry can play a major role in corrosion and the corrosion rate. The shape of a material may encourage a localized collection of certain substances. For example, the sharp groove that is present when undercut is found on a weld may be a collecting area for chlorine molecules; this could result in crevice corrosion.

Pooling of liquids may occur if part or structural geometry is not considered. Liquids are typically a necessary ingredient for corrosion to occur and accelerate the corrosion rate.

If some of the surface geometry is covered and some is uncovered, then that may also promote corrosion.

There are several ways to prevent corrosion due to geometrical features. One way is to ensure proper drainage and prevent the accumulation of liquids when possible. Another method to discourage corrosion due to geometry is to avoid differences in coating coverage. Sharp notches should be avoided when designing for corrosion avoidance.

Protective Coatings

Protecting coatings are another popular way to prevent corrosion because they minimize the amount of oxygen that is brought into contact with the underlying base material. Coatings can also help limit the temperature and ultraviolet exposure that the base material might otherwise be subjected to.

Coating a material is an extremely popular option to prevent corrosion because of its relative affordability. Rather than having to purchase an expensive, corrosion-resistant material, coating makes it possible to prevent corrosion by simply placing a protective layer on a more affordable material that may be more susceptible to corrosion. That are many substances that coatings can be made out of; popular coating materials include ceramics, polymers, and metals.

Material Incompatibility

Some materials are more reactive than others are. Reactive materials will be more prone to oxidize than less reactive materials, especially when they are in contact with one another due to dissimilar metal corrosion. Therefore, if corrosion is not desired on a certain material, then it is crucial not to place it into contact with a less reactive material. For example, carbon steel should not be placed in contact with aluminum in a corrosive environment because it will be far more likely to corrode. On the other hand, reactive materials are often used in a sacrificial manner. Zinc is often used as a means to protect steel. For this to work, the zinc is applied as a coating on the steel. Even when the zinc coating is damaged and the steel is exposed to the environment, the steel is still unlikely to corrode because most of the oxidation will occur to the remainder of the zinc coating.

REFERENCES:

- Steel Corrosion

- ATTACHMENTS: No.

Kindest Regards,

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