1:3 Design principles for corrosion prevention

Proper planning and careful attention to protection at the design stage is essential to minimise corrosion and simplify future maintenance. Without this planning an arbitrarily chosen system may prove expensive by causing heavy maintenance costs or even the shut down of a plant. A structure, which is designed with corrosion prevention in mind, avoids sharp edges, crevices, rough welds, corners, depressions and pockets. Whilst it is realised that some types of structures will provide difficult areas for coating after erection, the design authority should be mindful of painting before erection.

The engineer should avoid all details, which would make it possible for water or foreign matter to accumulate and therefore accelerate the failure of coatings. Where this is not possible drainage holes should be provided. The structure should be designed to facilitate the application of maintenance coatings in the future. Some details of structures can make it virtually impossible to apply a continuous coating.

Structural steel shapes
The outside of an angle always presents a problem, being difficult to coat because coatings tend to pull away from a point or sharp edge. The interior of a square angle is difficult to coat as dirt accumulates here and it is often a difficult area to reach by spray or brush.

Sharp edges
Sharp edges should be eliminated wherever possible. Remember coating materials tend to run away from an edge. If the coating is applied by brush and the applicator brushes away from the edge, the coating is invariably brushed off, leaving a thin area. Brushing should be towards an edge. When spraying, double coating of edges should take place where possible.

Welded joints
Welds must be given special attention when coatings are specified. One of the major difficulties along the welds occurs because of weld splatter. Weld splatter should be carefully removed by blasting or chipping. Where resistance to corrosion is required, all rough welding should be ground smooth. All welds should, if possible, be double coated.

Brackets
Brackets and other temporary fabricating aids are frequently welded on the surface of structures during construction. They are sometimes left in place after the job is completed. If the brackets are cut from the surface a rough spot usually remains, thus starting a corrosion problem. If left in situ and even though thoroughly cleaned by blasting, these fixtures are extremely difficult to coat properly. All brackets and extra metal should be removed and previous contact areas ground smooth.

Discontinuous, tack or skip welds
In a corrosive atmosphere these welds are vulnerable since they cannot be properly coated. Skip welding consists of welding a 5cm bead and then skipping from 5cm to 30cm before welding another 5cm bead. Skip welding is used mainly for reinforcing purposes when a continuous weld is not considered necessary. Structures, which will be exposed to a corrosive environment, should have continuous welds.

Lap welds
Lap welding consists of continuous welding on the outside surfaces only, leaving the steel plates lapped on the inside thus forming crevices, which are difficult to coat properly. If a coating is to give best results, all joints should be completely sealed.

Steel angles
Steel angles placed back to back are often used to form trusses. These angles are usually separated by washers or other members of the truss. The resultant gap is difficult to protect in a corrosive atmosphere. Trusses should be designed with a minimum of crevices between steel members or alternatively adequately coated before joining.

Weld flux
Weld flux is a hygroscopic material. Left on a weld it absorbs moisture and creates a spot where early coating failure can be anticipated. Specifications should ensure complete removal of all weld flux, by wire brushing and washing with copious quantities of fresh water.

Pipeline design
Pipe supports, flanges, threaded joints and pipe hangers are all potential points of corrosion. Crevices are formed in threaded couplings, which allow the penetration of moisture. Pipe hangers and supports cause local areas of severe corrosion since the ring of the hanger or support never fits accurately enough to prevent a crevice.

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