Alternative paint systems

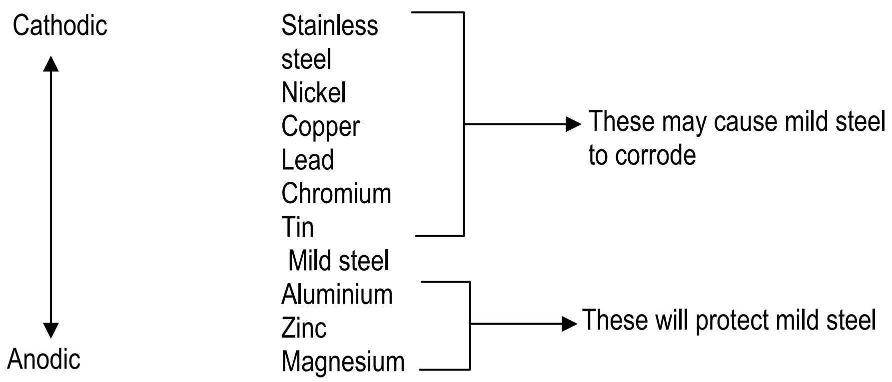
Available paints change as the paint industry develops new products, therefore the paint suppliers should be consulted before specifying a paint system for a particular project. For this reason, only a limited generic range of paints is mentioned in this section.

For non-exposed steel in a fully protected environment, painting is unnecessary and has been omitted on many such projects. However, steel in a protected environment is often specified to be painted for aesthetic reasons that include the avoidance of surface rust and the run-off of rusty water onto other surfaces during construction. An appropriate paint for these environments is zinc phosphate, with a dry film thickness of 50 or 75 microns. (Specify 50 microns for beams that are to have site welded shear studs. A thicker paint film may compromise the weld quality, and even with 50 microns, strict quality control will be necessary to detect faulty welds until it has been verified that defective welds are no more common than for an unpainted beam.)

For exposed steel in a non-marine environment, inorganic zinc silicate is an appropriate choice, either as the sole protective coating or as a priming coat for a multi-coat system. A dry film thickness (DFT) of 75 microns is normally considered to be the minimum thickness except where site welded shear studs are to be attached. In this case, the paint on the surface to have the studs attached (usually the top of the top flange of a beam) should be limited to a DFT of 50 microns. The DFT should always be regularly checked at the paint shop using a suitable DFT gauge and remedial measures should be taken when the thickness does not meet that specified. Paint must be applied before rust starts to discolour the cleaned surface. The steel must be neither too hot nor too cold and the surface must be at least 3 degrees above the dew point to avoid it becoming damp. Any on-site touching up of the painted surface should be done using an organic zinc silicate.

1.2 Galvanising

Galvanising is a method of corrosion protection where a sacrificial metal coating (usually zinc or zinc-aluminium alloy) is applied to the steel surface. It is particularly cost-effective for members with a high surface-to-mass ratio. (Painting is often more economical for heavy sections.) In the presence of an electrolyte – usually water with traces of dissolved salts – galvanic action occurs where one metal (the anode) corrodes at the expense of another metal (the cathode). The galvanic series is used to determine the likelihood of galvanic action occurring. The following is an example of a galvanic series relevant to the building construction industry.



Prior to galvanising, all scale, paint, oil, etc, must be removed from the surface by abrasive blasting or (more commonly) by pickling in hydrochloric or sulphuric acid. Following cleaning, the steel is rinsed and immersed in a flux solution before galvanising.

A number of design issues need to be considered before specifying galvanising, for example:

- The dimensions of the member to be galvanised – check the size of the galvanising bath likely to be used and, if the member is too long or too deep to be fully galvanised by double end dipping, break it down into two or more bolted components (or specify painted protection).
- Enclosed spaces – provide air vents and drainage holes to avoid rupture from expanding entrapped air.
- Stiffeners – cope attached corners to prevent zinc becoming trapped as the member is lifted from the bath.
- Unsymmetrical welded sections – the member will deform due to the release of locked-in stresses when heated in the galvanising bath.
- Steel having a high silicon and/or phosphorous content – causes an excessive zinc build-up.
- Site welding to galvanised steel – the galvanising will need to be ground off for isolated fixtures, but for beams with site welded shear studs, it may be possible to treat a strip down the middle of the top flange to prevent adherence of the zinc during galvanising. (Check with your local galvaniser.)
- Shop weld shear studs prior to galvanising for beams where steel decking is not continuous across the beam.
- The thickness of the zinc coating – usually dependent on the thickness of the steel. It is usually quoted in grams per square metre, eg. over 5mm, 600 g / mm^2; under 2mm, 350 g / mm^2. (Note that the quoted value for sheet steel products such as roofing and structural decking for composite floor slabs is the combined weight of zinc on both sides of the sheet.)

Painting galvanised steel

Painting of galvanised steel is not recommended due to the difficulty of achieving sufficient adherence. However, paint can increase the service life of a galvanised surface and painting is sometimes specified for aesthetic reasons. When a galvanised surface is to be painted, the surface (unless it is a weathered surface) must be first painted with a suitable etching primer.

1.3 Concrete encasing

Structural steel below ground is usually concrete encased. A minimum cover to the steel of 50mm is commonly used although site conditions may dictate more. A light reinforcing mesh is wrapped around the steel member to control cracking of the concrete. As the concrete must also protect the base plate of a column, the overall size of the encasing may be determined by the size of the base plate.

As concrete is a more economical material than structural steel for columns in high-rise buildings, light “erection columns” are often used to support the erected steelwork and subsequently encased in a much larger reinforced concrete column. These erection columns will form an integral part of the final column. As such, they must not be painted and splices must be detailed in such a way that voids will not be created in the concrete. (Air pockets beneath base plates, stiffeners and beam flanges will reduce the effective cross-section area of the concrete column.)

1.4 Protective wrapping

The major application of protective wrapping is for buried steel pipes, but this form of corrosion protection is sometimes used for light steel members that extend below ground in situations where concrete encasement is not preferred. A number of products are available, one well known one is Densotape.

1.5 Cathodic protection

Cathodic protection is most often used for ships and in marine works, where a high level of protection is required for structural steel and reinforcing steel in concrete. There are two methods of cathodic protection – galvanic and impressed current. Galvanic cathodic protection is used for relatively small structures and impressed current cathodic protection is used for large structures where the galvanic current is too weak to provide full protection, or for structures not submerged in an electrolyte (eg wharf decks and bridge piers).

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