



**Coated steel or aluminium piecework must withstand a variety of environmental influences. GSB Quality Seals provide internationally accredited product assurance.**

## Editorial

### Quality of Steel Coating



The GSB International Quality Regulations QR AL 631 for the Aluminum sector are well established within the coating industry. However the fact that the GSB Quality Regulations GSB ST 663 are setting high quality standards relevant to the hot-dip galvanization

and coating of steel is as yet little known.

Hot-dip galvanizing is well established as an effective and economical protection against corrosion. Additional colour design options for steel are provided by so called Duplex systems (Zinc and Lacquer), whereby Zinc is rather difficult to coat. However, a professional application will provide in a higher degree of corrosion protection than can be achieved by a Zinc and Lacquer combination.

The high standards set by our Quality Regulations must be met by all members licensed to carry the GSB Quality Label of „Approved Coated Steel“, which for the customer serves as a definitive quality assurance at the highest level. For principals the label is a convincing proof of adhering to strict quality requirements. Therefore GSB International is a reliable partner for builders, architects and metal workers in the field of surface coating – both in the Aluminium and in the Steel sector.

The following pages are designed as an introduction to our Quality led activity within the Steel sector and the example of a current round robin test project illustrates the GSB research and development work in the area of corrosion protection.

Further information and material are available from the GSB International Head Office, who will be delighted to advise you.

Willem Beljaars  
Chairman of the Technical Commission Steel and Board Member representing the Steel Sector

## Requirements relevant to the coating of Zinc and Steel Substrates

### Pre-treatment and Coating in accordance with the GSB International Quality Regulations Steel (GSB ST 663) and the currently applicable framework of standards

The currently applicable framework relevant to the coating of steel construction parts covers the following standards: DIN EN ISO 1461 „Hot-dip Galvanized Zinc Coatings on Steel“, DIN EN ISO 55633 „Coating Materials – corrosion protection of steel construction parts through powder coating systems“, DIN EN ISO 12944 „Coating Materials – corrosion protection of steel construction parts through coating systems“. The GSB Quality Regulations GSB ST 663 build on the entirety of this framework whilst setting their own highest quality standards for the piecework coating used in the steel construction industry which are unrivalled throughout Europe in projects such as building facades, train stations, football stadia, public and municipal buildings to name but a few.

There are many facets to hot galvanizing which offers the best possible protection against corrosion for heavy duty application without particular requirements on colour. Whether used for architectural, steel construction or craft related projects hot-dip galvanizing delivers maximum durability, is highly economical and environmentally friendly and absolutely unique. However, as soon as particular requirements are placed on either the aspect of colour or the degree of protection against corrosion in the most difficult of circumstances, hot galvanizing shows its limitations. Duplex systems which are a combination of hot-dip galvanizing and colour coating, reach the best possible standards of protection from corrosion in virtually all climatic conditions, whilst meeting any architectural requirements at the same time.

Just as the Duplex systems modern double

layer systems have started to recommend themselves as reliable solutions to effectively protecting coloured designs against corrosion, whereby a densely cross linked epoxy resin is applied as a base coat prior to powder coating with highly UV resistant Polyester resin powders. An accumulative layer thickness of at least 160 µm generates a level of corrosive protection comparable to that of conventional Duplex Systems

### Qualitative Coating Requirements relevant to hot-dip galvanized surfaces

The surface to be coated must comply with DIN EN ISO 1461, which stipulates the existence of a closed Zinc layer at a specified thickness (which is dependent on the strength of the relevant material). Over and above the DIN framework, imperfections, rough surfaces, zinc tips, unevenness and ash residue are not permitted for subsequent coating. Therefore prior to coating all hot galvanized surfaces should be mechanically treated (sweeping and buffing) to even out the surface and remove any oxide layers.

#### NB

- hot galvanised surfaces should always be polished/swept mechanically prior to powder coating
- zinc surfaces must be even and all zinc oxide layers, white rust and temporary corrosion protection must be removed

### Qualitative Coating Requirements relevant to steel surfaces

Hot rolled steel construction parts show a rough, pitted rust red surface with runes and marks as a result of the

rolling process. Such surfaces must always be jet washed and brought to the standardized level of Sa 2.5.

Cold rolled profiles, square and rectangular tubing or particularly low carriers are often difficult to deal with, as they are prone to visible and partly invisible thin layers of tinder, which must be removed without fail. Technological ductile fats and at times temporarily applied pacifiers are often particularly resistant and difficult to shift but can be removed either mechanically or by plunge pickling.

Steel surface with adhering tinder largely rust free



Steel surface with tinder starting to flake and first stages of rust infiltration



Steel surface with tinder that has either rusted away completely or can be scraped off, yet only showing few signs or rust that is visible to the naked eye



Required Level of Standard 2½:

Rolling film residues, tinder, rust and other impurities are removed. Residual traces are presenting a slight spotting or streaky shadows.



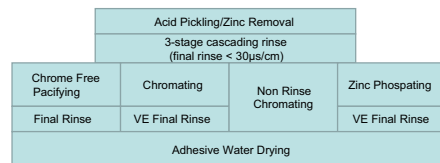
### Which additional requirements must be met to comply with GSB approved coated steel components?

Just as band- or galvanized surfaces, hot-dip galvanized surfaces nowadays often have a temporary corrosion protection. Such pacifiers or chromating layers must always be removed prior to coating, as they are not adjusted to coating systems and are likely to prevent adequate ad-

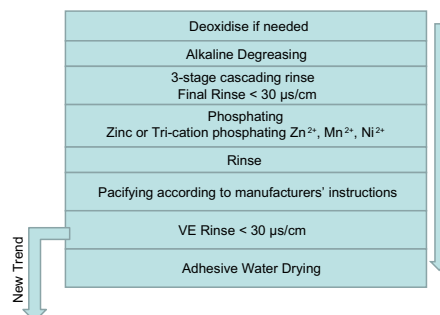
herence of the powder coat. Process related unevenness of Zinc surfaces must be removed mechanically, whereby the parameters for jet sweeping set in accordance with DIN and the GSB Quality Regulations must be observed. The "smoothness" of the surface should always be pre-agreed with the customer.

To ensure adequate adherence of the powder on both substrates, they must be free from all impurities and metallically blank. The following chemical pre-treatment process applies to achieve the best possible protection against corrosion:

#### Chemical Pre-Treatment:



Steel surfaces must reach the standardized level of Sa 2.5, then and only then can a direct coating be applied. A wet chemical pre-treatment should be applied to ensure best possible protection against corrosion.



#### New Steel Construction Trend for optimum Corrosion Protection

- KTL (CDL) – Cationic Dip Lacquering ~30 µm as base lacquer for powder coatings

On the proviso that the coating has been professionally applied, GSB approved powders will exceed 1000h for both Duplex and Double Layer Systems on steel carriers in a neutral salt spray test. But how does this translate into a practical environment?

#### The durability of protection is regulated in DIN EN ISO 12944-1

The projected term of protection does not guarantee the coating system, but simply determines the time frame for a necessary maintenance program. The following terms of durability are set:

- **Low (L-low)**  
2-5 years to red rust level Ri 3
- **Medium (M- medium)**  
5-15 years to red rust level Ri 3
- **High (H- high) in excess**  
of 15 years to red rust level Ri 3

Maintenance of the coated surfaces may become necessary prior to the expiry of the set durability terms if surfaces show a loss of gloss, fading, pollution or other forms of wear and tear. For this reason the planning for surface treatment and protection against corrosion starts at the conception stages of the project.

The location of the architectural steel construction is of primary importance. Will the project be located at the North Sea coast or in a rural alpine environment? Will the construction be exposed to excessive UV radiation or are there high levels of Chloride in the atmosphere? Does the construction need to withstand a high degree of abrasive stress?

For planning purposes powder coating systems are classified into 5 corrosion categories depending on specific environmental factors in accordance with DIN EN ISO 55633.

Hot-dip Galvanizers and Powder Coaters each have only limited degrees of influence in the treatment process. Both processes involve either dipping and/or spraying and hollow carriers need to have suitable openings to either admit or emit the relevant pre-treatment media.

These are merely incomplete notes which have been compiled to demonstrate the importance of adequate pre-planning and discussion between the contractors and the client of all individual aspects relevant to a project to facilitate and ensure that the coating process complies with GSB Quality standards.

#### In Summary

If carried out professionally and to a high qualitative standard, hot-dip galvanizing and powder coating deliver protection against corrosion and versatility of design with both perspective and future. Continuous innovation and the development of new technology assure the progress of both these processes, with hot-dip galvanizing excelling as a robust and resistant solution for modern, weather-proof and UV stable powder coating systems. Both technologies are extremely environmentally friendly and highly durable, and constantly improving powder systems guarantee virtually maintenance free surfaces. Hot-dip galvanizing carried out in accordance with DIN EN ISO 1461 and powder coating performed to the highest quality standard in compliance with GSB ST 663 assures the best possible protection against corrosion coupled with optimum durability of surface design. Therefore the GSB quality label presents a convincing quality assessment having regard to the relative requirements of the concrete object and offers a high level of reliability.

# Corrosive Protection of hot galvanized Steel –

## Evaluation of Salt Spray Testing

Since the conception of GSB ST 663 Salt Spray testing in accordance with DIN EN ISO 9227 NSS (formerly DIN 50021) has been the preferred test method to evaluate the degree of corrosive protection and in general is accepted for the evaluation of lacquer coating. More often than not this test method is put into question and deemed as inconclusive in relation to hot galvanized substrates. In order to establish the relevance of this sweeping statement and following a brief research exercise and subsequent discussion, the GSB Technical Committee for Steel decided to commission a round robin test exercise aimed at clarifying specific test periods to be defined within the Quality Regulations.

The round robin test was divided in two key parts. For the first test hot galvanized and powder coated steel sheets provided by 5 different hot galvanizers were tested by inspectors from the “Institut für Oberflächentechnik GmbH” parallel to regular GSB surveillance test procedures. These samples were simultaneously exposed to salt spray testing for a period of 720 hours, which produced significant differences in the infiltration of the powder coating system (see diagramme 1). Based on these test data the Technical Commission attempted to evaluate the result and conclusions were drawn as follows:

- A second ring test should exclude relevant influencing factors to facilitate a more conclusive test result.
- Additionally, the test period was set at 480 hours with a maximum permissible infiltration level of 5 mm from scratch and defined accordingly in the latest test regulations.

For the second part of the ring test the substrates were provided by one particular galvanizer. These were partly taped up in the normal way using thermal resistant tape and coated by 6 different coaters who are members of GSB Steel using the same coating material as single and duplex layer construction.

The samples were then posted to the “Institut für Oberflächentechnik GmbH” where they were simultaneously exposed to salt spray testing. The tape (see picture 1) was removed 24 hours prior to testing and all samples were simultaneously tested in an identical environment for 480 hours in accordance with DIN EN ISO 9227 NSS. The samples were then rinsed with de-mineralised water and dried.

Results were assessed following the removal of the loosely attached lacquer surface. Using slide gauge the maximum infiltration was measured at the borders of the previously taped up surface areas.

*Medium infiltration values of 3 samples after 480h of salt spray testing in accordance with DIN EN ISO 9227 NSS*

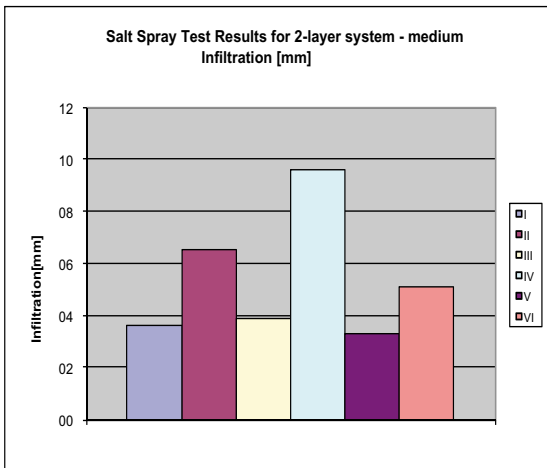


Diagramme 1

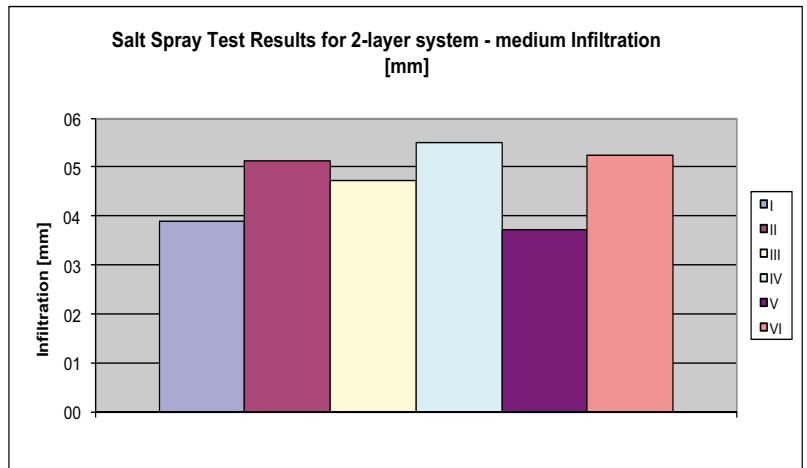
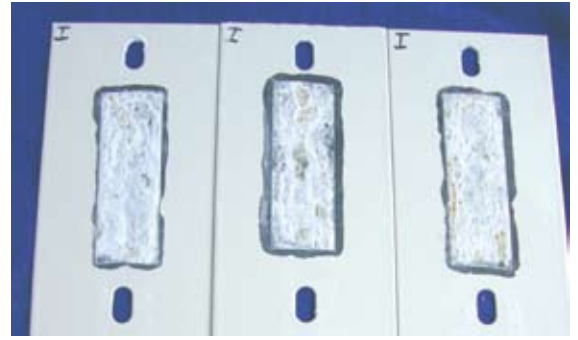


Diagramme 2



Picture 1 – taped sample sheets to avoid scarring



Picture 2 – Samples after 480h of salt spray testing

The results (see diagram 2) showed distinct variations in the quality of corrosive protection on account of the chemical pre-treatment, which was shown in the first part of ring test, when permissible limits of absolute infiltration were set at < 5 mm. This proves that salt spray testing in accordance with DIN EN ISO 9227 NSS is a valid method of assessing corrosive protection of hot galvanized and powder coated steel substrates.

To further support this argument with additional findings and data, a further ring test comparing different pre-treatment methods should be carried out.

This example illustrates the intensive research and development work undertaken by the GSB which is set to continue into the future as a specific focus area.

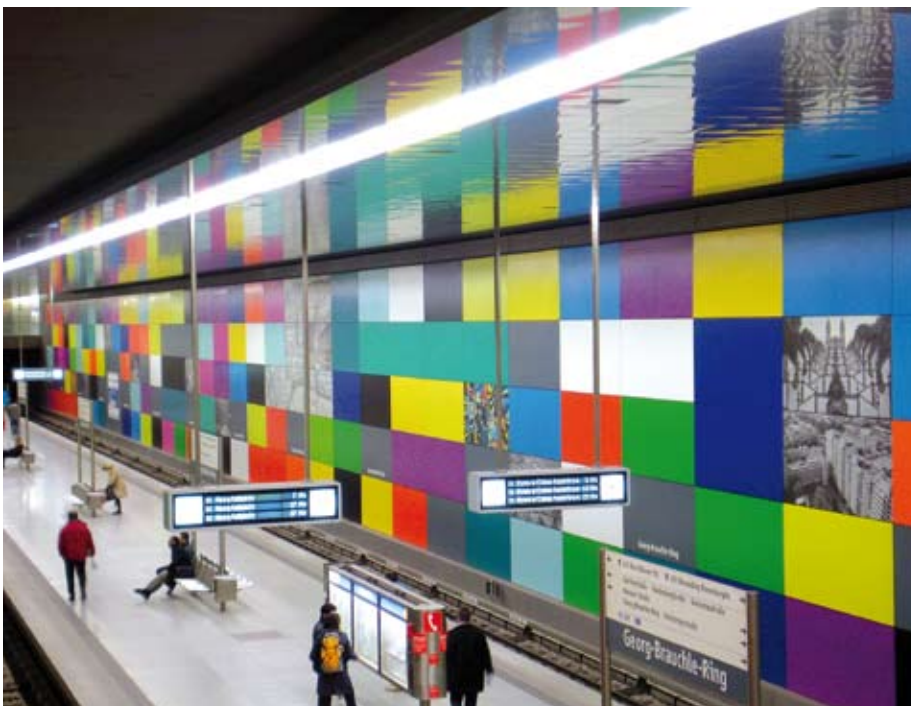
### GSB International – the network for the coating industry

Since its conception in 1974 GSB has successfully focused on improving the quality of coating on Aluminum and Steel to incorporate the latest, most up to date technology. This requires the regular exchange of ideas and opinions between all parties relevant to the coating industry whereby the GSB International network provides the perfect medium.

The GSB technical committees for Aluminum and Steel meet continually to assess concluded test programs on the basis of the GSB Quality Regulations and to develop these in line with cutting edge technological advances. Certified training courses and seminars in German and English are sche-

duled on a regular basis and serve to educate personnel working within the industry. In 2010 the GSB will once again offer two training courses which are open to non members. Additionally, regional work groups meet regularly to communicate the latest GSB developments. As such on 4th and 5th December 2009 the South East Asia Work Group will meet at Thessaloniki, and on 29th September coating material manufacturers met at Landshut for an open forum exchange of opinions and ideas.

Such intensive technical and professional input enables the GSB International to continually review and adjust the quality standards required of coating to the ever changing demands of the market and excel as a reliable partner to building contractors, architects and metal construction companies.



#### Imprint

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