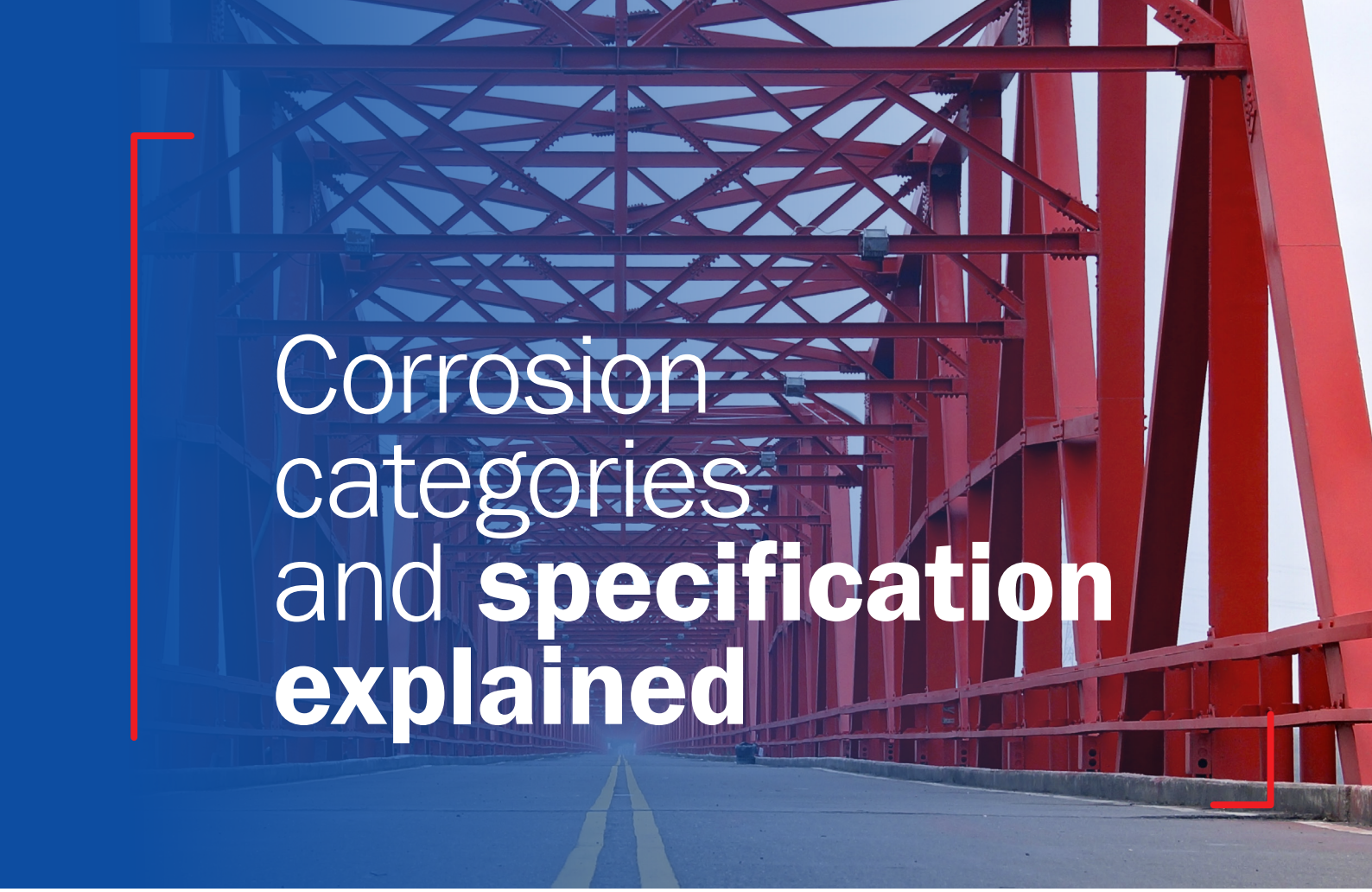
HEMPEL
Trust is earned

How to specify

for corrosion protection

Specified to **Last**



Corrosion categories and **specification explained**

Introduction

Protective coatings are pivotal in safeguarding steel structures – such as airports, stadiums, or shopping malls – against corrosion, which can threaten their strength and durability. These coatings act as critical barriers, shielding the structures from environmental factors and stressors, fortifying structural integrity. Moreover, research suggests that when these coatings are specified and applied properly, they can significantly reduce maintenance costs by up to 50%, offering not only protection but also economic incentives.

A key component of effective corrosion protection is anchored in the specification process. A thorough specification process is crucial to avoid both overspecification, which leads to unnecessary additional costs, and underspecification, which can jeopardize the integrity of steel structures. The specification of protective coatings requires the meticulous expertise and attention of engineers. Rushed decisions, often driven by strict schedules and budget constraints, can lead to shortcuts that undermine the long-term benefits of proper protection.

In this paper, we will guide you to make a conscious choice for your specifications, supporting structural strength, longevity, sustainability, and safety.

Understanding corrosion categories

Corrosion affects materials and steel structures differently, depending on the environment. ISO 12944, which is the international standard for corrosion protection of steel structures by protective paint systems, provides a systematic approach by categorising environments based on their corrosivity. This categorisation guides engineers to select the most appropriate coatings tailored to specific conditions.

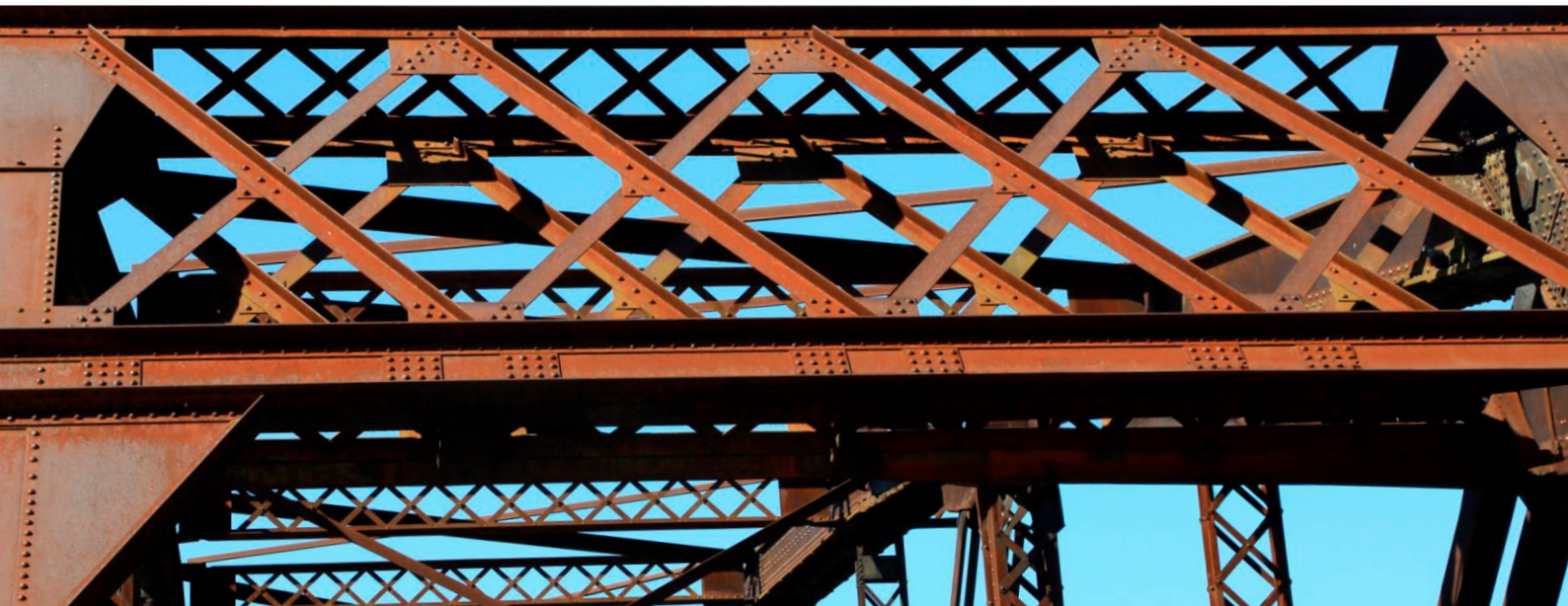
Each category reflects the intensity of the corrosive environment and helps in pinpointing the precise type of protective measure needed for a steel structure – from the relatively benign conditions of heated indoor spaces to the harsh realities of industrial or coastal areas.

However, specifying the corrosivity category is not a task that can be completed in a few minutes. It requires careful consideration of multiple factors. For instance, the project's geographical location may fall into a C2 category, but local factors can change this. As an example, poor indoor ventilation can increase condensation, leading to a more corrosive environment. In this scenario, despite being indoors, the asset's corrosivity category could shift from a lower category to a higher one due to the presence of poor ventilation and high humidity.

Therefore, when determining corrosivity categories for projects, it's essential to consider not only the geographical location but also local factors such as ventilation, humidity levels, and proximity to corrosive agents or pollutants.

The atmospheric corrosivity categories

C1	Very Low	Inside heated buildings like offices, shops, or schools. Here, the air is clean, and corrosion is minimal.
C2	Low	In rural areas or unheated buildings like storage rooms, there's a bit more air contamination or condensation. These places are less likely to see corrosion.
C3	Medium	Urban or industrial areas with some air pollution, or near the coast with low salt. Places like food factories or laundries face medium corrosion.
C4	High	Heavier industrial areas or coastal spots with more salt in the air. Power plants, chemical plants and shipyards see high corrosion.
C5	Very High	The toughest environments, like industrial zones with lots of humidity and pollution, or coastal areas with lots of salt. These areas face very high corrosion.
CX	Extreme	Special cases like offshore structures in the sea or places with extreme humidity and pollution. These face the most severe corrosion.



The durability categories

Durability categories in ISO 12944 help predict how long a coating will protect against corrosion and ensure that the protective coating meets the expected lifespan of the structure. They range from low (short-term protection) to very high (long-term protection), based on the environment and coating system used.

Low (L)	up to 7 years
Medium (M)	7 to 15 years
High (H)	15 to 25 years
Very high (VH)	more than 25 years

Choosing the right coating system involves understanding these categories and selecting materials that match the corrosion risk and desired durability.

When and why choose lower durability?

Opting for a lower durability class could be justified in cases where a structure's anticipated service life is short, or when budget constraints restrict the feasibility of long-term protection solutions. Conversely, a higher durability category is advisable when prioritising the structure's longevity and sustainability, or in instances where downtime is costly or impractical.

By understanding these categories, engineers can tailor their specifications to effectively shield their projects from the insidious creep of corrosion.

Protective coating **specifications**

Choosing the right protective coating is about finding the best match for your project's environment. The ISO 12944 standard helps us understand different corrosive environments and choose coatings that provide the right protection. For example, a building near the sea needs a different coating than a factory dealing with chemicals.

Diving deeper into the technical side, protective coatings mainly work in three ways. First, they create a physical barrier, stopping corrosive elements like water and oxygen from touching the surface. Second, some coatings have chemicals that slow down the corrosion process. And third, certain coatings can repair themselves if they get scratched, keeping the surface protected and preventing corrosion from spreading.

In areas where damage is likely, choosing a coating with a strong self-repair ability is key. This ensures that even if the coating gets scratched, the protection continues, keeping the structure safe and extending its life.

Six steps in creating effective specifications

When it comes to corrosion protection, the right specification can save both time and money, while ensuring longevity and structural integrity. With a practical, ready-to-use specification tailored to each corrosivity category, the process becomes streamlined and secure. Here's how to specify protective coatings for different environments:

1.	**Identify** the corrosivity category	Assess the environmental conditions your structure will face, from C1 (very low risk) to CX (extremely high risk). For instance, C1 might apply to heated interiors with clean air, while C5 is for industrial areas with high humidity and aggressive atmospheres.
2.	**Specify** the lifetime of the structure	Determine the desired durability, from low (L), medium (M), to high (H) or very high (VH), which correlates with the maintenance cycles and overall cost-effectiveness.
3.	**Choose** the right coating system	For C1 environments, a single-layer system may suffice, but for C5, a multi-layer system with activated zinc-rich epoxy primer, epoxy intermediate, and polyurethane topcoat may be essential. If you're in doubt, always feel free to contact us for a second opinion.
4.	**Consider** application conditions	Ensure the coating can be applied under the project's specific conditions, whether in a controlled shop setting or on-site with variable weather.
5.	**Detail** the surface preparation	Specify the degree of cleaning and roughness required for optimal coating adhesion.
6.	**Include** quality assurance measures	Define inspection stages and testing methods to maintain coating integrity, such as dry film thickness checks and adhesion tests.

By following these guidelines and utilising the provided specification examples, engineers can confidently address corrosion protection in their projects, ensuring safety and longevity with cost-effective solutions.

Specification examples

Example Specification for

C2 Environment

Primer	One coat of epoxy zinc phosphate, 75 microns DFT
Topcoat	One coat of UV-resistant polyurethane, 50 microns DFT
Total system DFT	125 microns
Durability	High (H) with an expected lifetime of up to 25 years before major maintenance

Example Specification for

C3 Environment

Primer	One coat of epoxy zinc phosphate, 120 microns DFT
Topcoat	One coat of UV-resistant polyurethane, 60 microns DFT
Total system DFT	180 microns
Durability	High (H) with an expected lifetime of up to 25 years before major maintenance

Example Specification for

C4 Environment

Primer	One coat of activated zinc-rich epoxy, 50 microns DFT
Intermediate	One coat of fast-drying epoxy, 100 microns DFT
Topcoat	One coat of UV-resistant polyurethane, 50 microns DFT
Total system DFT	200 microns
Durability	High (H) with an expected lifetime of up to 25 years before major maintenance

Example Specification for

C5 Environment

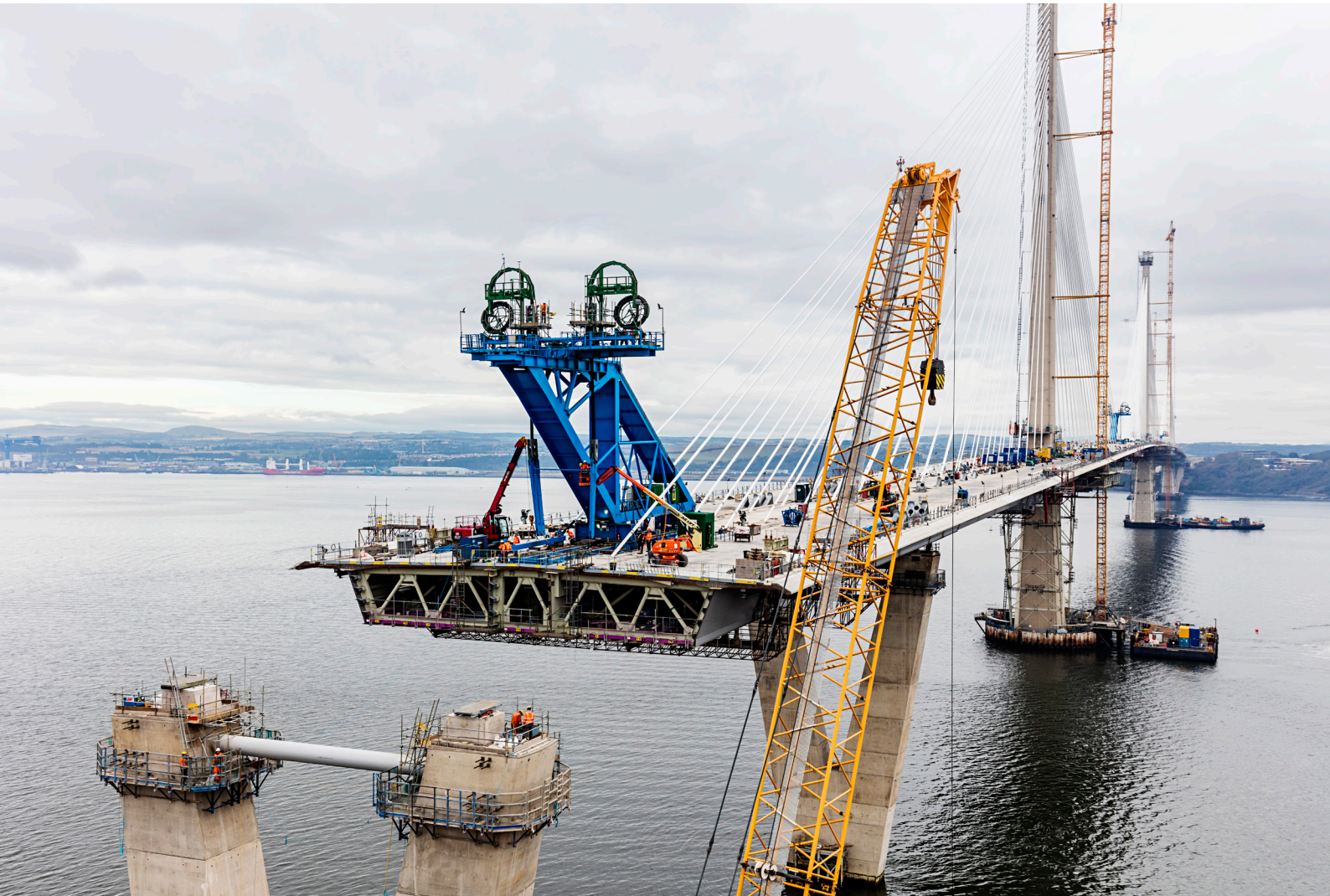
Primer	One coat of activated zinc-rich epoxy, 50 microns DFT
Intermediate	One coat of fast-drying epoxy, 150 microns DFT
Topcoat	One coat of UV-resistant polyurethane, 60 microns DFT
Total system DFT	260 microns
Durability	High (H) with an expected lifetime of up to 25 years before major maintenance

Conclusion

In navigating the complexities of corrosion protection, this guide has offered structural engineers a path for specifying protective coatings with confidence.

However, the main point is that corrosion protection specifications are not a one-size-fits-all process; it requires careful consideration of environmental factors, material properties, and the intended lifespan of the steel structure.

As you move forward, let this guide serve as your compass in the specification jungle. The correct application of corrosion specifications will not only safeguard your structures but also bolster your reputation for quality and reliability. With Hempel's expertise at your disposal, you can rest assured that your projects are protected against the forces of corrosion, ensuring longevity and performance for years to come.



Contact us for more insights

If you have further questions or encounter complex situations not covered in our guide, feel free to contact us. Our team is ready to assist you with your corrosion specification needs at hand.

Hempel Paints (Emirates) LLC.

Interchange No 08, Sajja Area,
Plot No 698/G Al Dhaid Road,
P.O.Box 2000
United Arab Emirates

Tel: +971 65310140
www.hempel.com