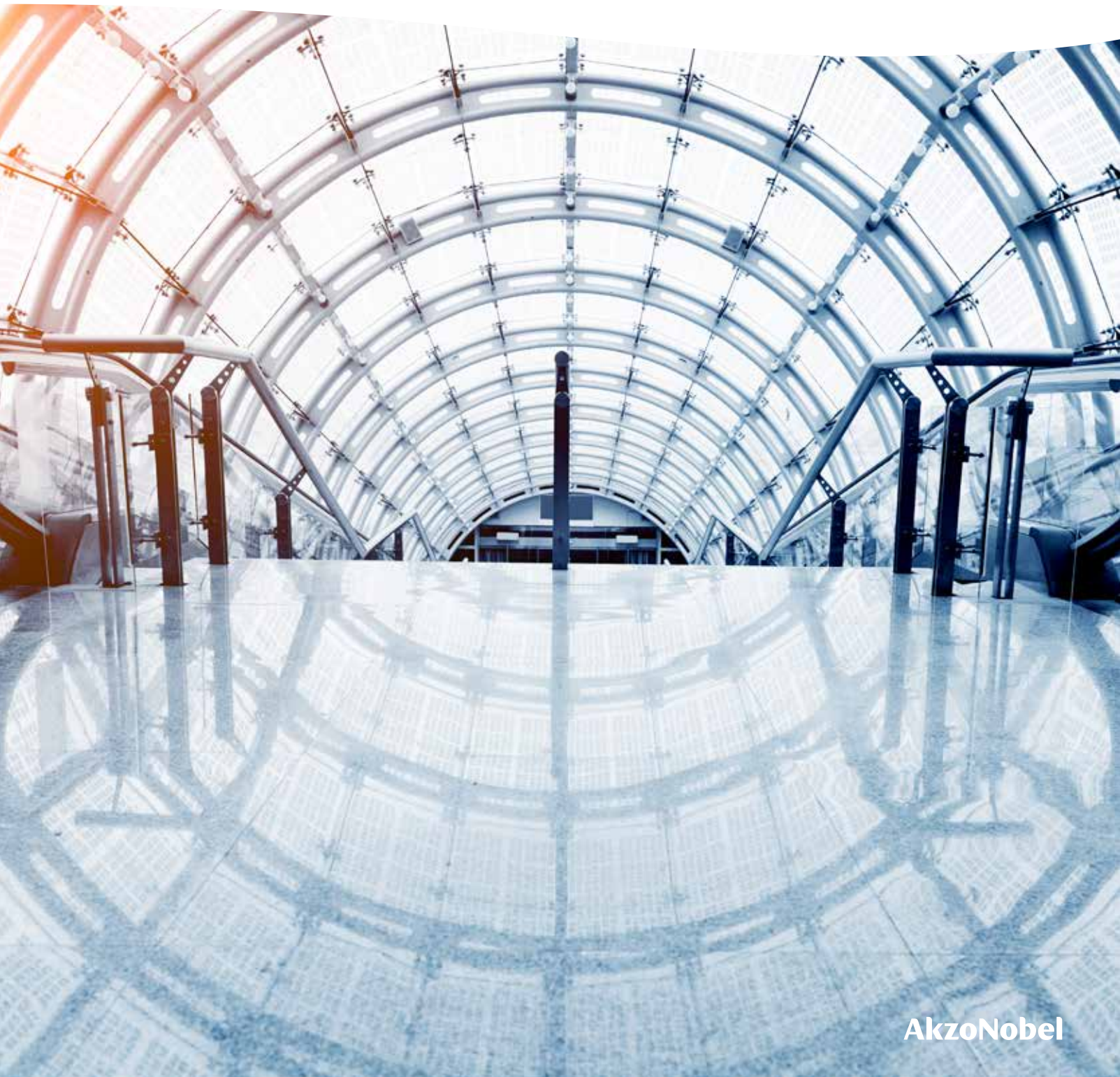


ISO12944

Corrosion protection of steel structures
by protective paint systems



What is ISO12944?

ISO12944 is the industry standard for corrosion protection of steel structures by protective paint systems. Originally released in 1998, the standard is put together by representatives from key countries and companies involved in the protection of steel structures to build a mutually beneficial standard.

The standard is designed to provide guidance to architects, engineers, specifiers, applicators and other parties in the application of coatings to steel.

The standard covers 9 parts with key components of the standard covering environment classification, protective paint systems, laboratory test methods and systems and test methods for offshore structures.

What has changed in the 2018 edition of the standard?

In the latest release there are a number of significant changes to the standard. These changes are:

- Changes to corrosion categories** The old C5-I and C5-M categories have been replaced with C5 for harsh onshore categories and by CX for offshore categories. CX is taken care of in a new Part 9. There is also the addition of a fourth immersion category, IM4, which covers immersed structures in sea or brackish water which are protected by cathodic protection

Category	Corrosivity	12944:1998	12944:2018
C1	Very Low	Heated buildings	Dry or cold with very low pollution
C2	Low	Low levels of pollution	Temperate low pollution
C3	Medium	Urban and industrial atmospheres, moderate pollution or low salinity	Temperate, medium pollution, tropical low pollution
C4	High	Industrial areas or coastal areas with moderate salinity	Temperate with high pollution, tropical with moderate pollution
C5-I	Very High	Industrial, high humidity, aggressive atmosphere	N/A
C5-M	Very High	Coastal and offshore areas with high salinity	N/A
C5	Very High	N/A	Temperate and subtropical with very high pollution and/or significant chloride effects
CX	Extreme	N/A	Extreme industrial areas, offshore areas, salt spray
IM1	Fresh water	River installations and hydro plants	River installations and hydro plants
IM2	Sea or brackish water	Harbour areas with structures and offshore structures	Immersed structures without cathodic protection
IM3	Soil	Buried structures	Buried structures
IM4	Sea or brackish water with cathodic protection	N/A	Immersed structures with cathodic protection

2 Changes to durability categories

The low, medium and high categories remain but they are joined by very high. The durations which these categories relate to have also changed with low durability now up to 7 years and the new very high category relating to 25 years plus.

Durability Category	12944:1998	12944:2018
Low (L)	2-5 years	Up to 7 years
Medium (M)	5-15 years	7-15 years
High (H)	More than 15 years	15-25 years
Very High (VH)	-	More than 25 years



3 Changes to paint systems

The dry film thicknesses and paint systems now include minimum number of coats per coating type or technology and specify a minimum dry film thickness for the total system per corrosion category. See the coatings systems on page 5 or 6 to see which systems to specify. The standard now also includes the capacity to accept new innovative coating technologies if performance can be demonstrated by 3rd party testing and field trials.

4 Changes to laboratory test methods

Up to C4 high the test methods have not changed. However for C4 very high, C5 high and C5 very high, cyclic testing has been introduced to better replicate in-field conditions.

Category	Low (<7 yrs)	Med (7-15 yrs)	High (15-25 yrs)	Very High (25+ yrs)
C2	Non-cyclic Testing Durations as 1998(E) revision ISO 6270 / ISO 9227			Non-cyclic Testing: Linear Durations TBC ISO 6270 / ISO 9227
C3				
C4				As C5 High. Phased cyclic testing: 10 cycles
C5	Non-cyclic Testing Durations as 1998 (E)	Phased introduction of ISO 12944-9 Cyclic Testing: 10 cycles Non-cyclic Testing valid for 5 years		Immediate introduction of Cyclic Testing: 16 Cycles ISO 12944-9



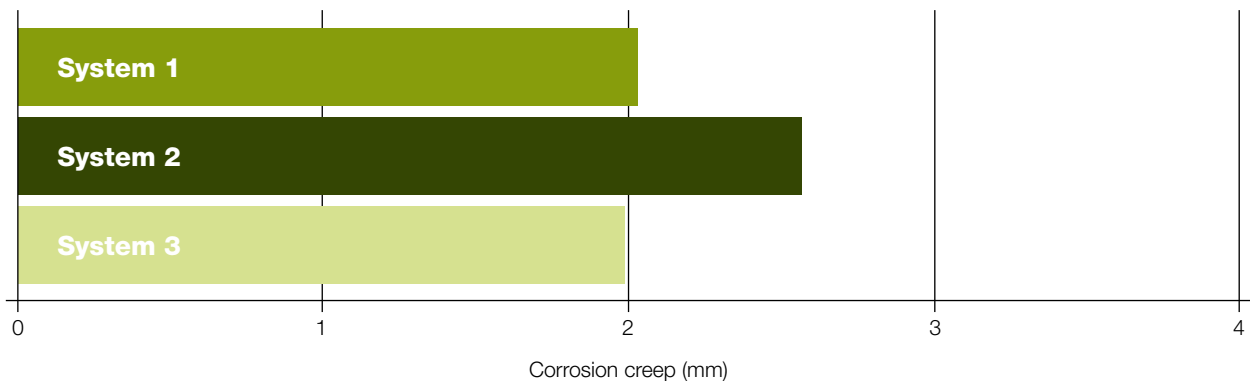
Why has cyclic testing been introduced?

One of the major changes in the newest revision is the addition of cyclic testing for systems operating in environments of C4 very high and above. AkzoNobel welcomes this addition to the standard, having found over many years that cyclic testing is more representative of real-world corrosion conditions.

The following charts show testing of three coating systems on long-term static salt fog testing and on a range of cyclic test methods against an in-service field trial. As can be seen from the graphs, systems performing well on salt fog testing do not show equivalent performance to those on cyclic testing or under real world conditions. For real world conditions we used our external weathering site at Blyth, UK

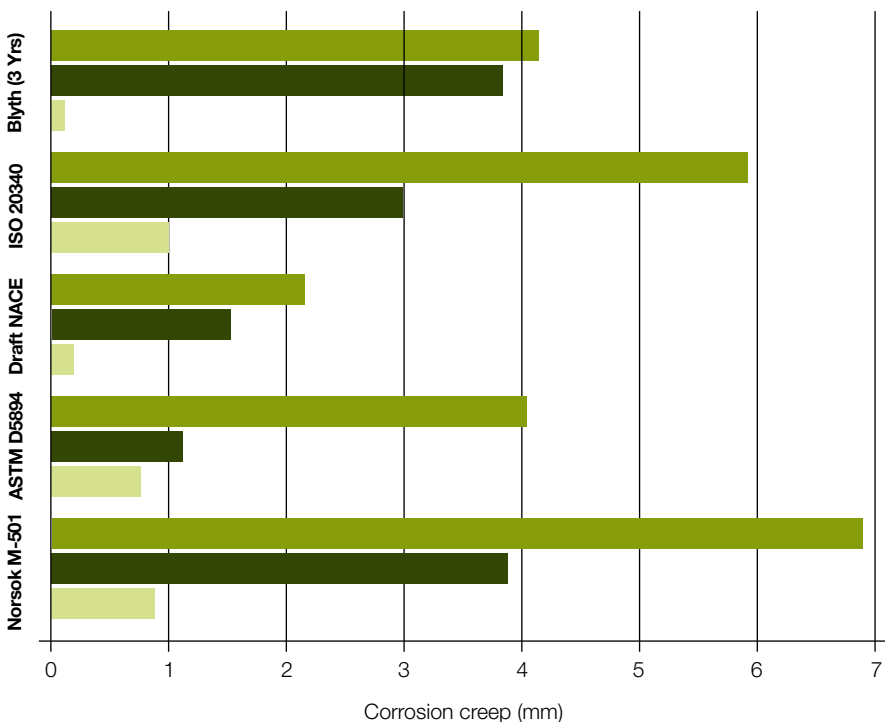
Corrosion creep of zinc-rich primed systems

Using salt fog test (4032hrs)



Corrosion creep comparison of zinc-rich primed systems

Using cyclic testing methods



A selection of our third-party certified systems

In conjunction with extensive in-field performance assessment, AkzoNobel commissions testing programs at third-party houses to certify systems for use in the most commonly specified environments. In addition to the systems listed below we have tested a range of new and innovative products to the new revision of the standard. To gain a full listing of third-party certified systems please contact your local AkzoNobel representative.

C3

Environment	Coat 1	Coat 2
C3 Medium	Intercure 4500 @ 150µm	
C3 High	Intergard 251HS @ 130µm	Interthane 990 @ 50µm
C3 High	Intergard 251HS @ 150µm	Interthane 990 @ 50µm
C3 High	Intercure 4500 @ 180µm*	
C3 Very High	Intergard 251HS @ 190µm	Interthane 990 @ 50µm
C3 Very High	Intercure 4500 @ 240µm*	

C4

Environment	Coat 1	Coat 2	Coat 3
C4 Medium	Intergard 251HS @ 130µm	Interthane 990 @ 50µm	
C4 Medium	Intercure 4500 @ 180µm*		
C4 High	Interzinc 52 @ 60µm	Intergard 475HS @ 90µm	Interthane 990 @ 50µm
C4 High	Intergard 251HS @ 190µm	Interthane 990 @ 50µm	
C4 Very High	Intergard 251HS @ 240µm	Interthane 990 @ 60µm	

C5

Environment	Coat 1	Coat 2	Coat 3
C5 Medium	Intergard 251HS @ 190µm	Interthane 990 @ 50µm	
C5 High	Interzinc 52 @ 60µm	Intergard 345 @ 160µm	Interthane 990 @ 60µm
C5 High	Interzinc 52 @ 50µm	Intercure 4500 @ 200µm*	
C5 High	Interzinc 52 @ 60µm	Intergard 475HS @ 140µm	Interthane 990 @ 60µm
C5 High	Interzinc 52 @ 50µm	Intercure 4500 @ 210µm*	
C5 High	Intergard 251HS @ 240µm	Interthane 990 @ 60µm	
C5 Very High	Intershield 4000USP @ 150µm	Intergard 475HS @ 150µm	Interthane 990 @ 60µm
C5 Very High	Interzinc 52 @ 60µm	Intergard 475HS @ 200µm	Interthane 990 @ 60µm
C5 Very High	Interzinc 52 @ 70µm	Intercure 4500 @ 250µm*	

* System tested with reduced coats as per innovative coatings technologies clause

Part 9

The introduction of Part 9 to the ISO12944 standard introduces the old ISO20340 standard into ISO12944. Part 9 mandates the use of cyclic testing for offshore structures. In previous editions of the standard offshore structures were referred to as C5-M however a new environmental category, CX, has now been introduced for all offshore structures.

All offshore systems must continue to go through 4,200 hours of cycling testing, which equates to 25 weeks.

Part 9 sets both the minimum number of coats and minimum film thickness per system, with some changes from the previous standard's requirements for C5-M. The table below outlines the requirements for steel substrates.

Category	CX		Splash & tidal zones			IM4	
Primer coat	Zinc (R)	Other primers	Zinc (R)	Other primers		Other primers	
NDFT (µm)	≥40	≥60	≥40	≥60	≥200	-	≥150
MNOC	3	3	3	3	2	1	2
NDFT of system (µm)	≥280	≥350	≥450	≥450	≥600	≥800	≥350

One of the main changes in ISO12944 Part 9 from ISO20340 is in the performance criteria on corrosion creep – this now states that coating systems for high impact areas shall be less than or equal to 8.0mm and all other CX applications less than or equal to 3.0mm. Sea water immersion now states 6.0mm pass criteria and there are slight changes to adhesion as well.

Please contact your local AkzoNobel representative for ISO12944 Part 9 systems.

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This document is not intended to be a comprehensive review of all changes to the standard, contact your local AkzoNobel representative for additional detail.

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