

## 01 EN ISO 12944 NORM

### a) CLASSIFICATION OF ENVIRONMENTS

The norm deals with:

Six corrosivity categories for atmospheric environments.

Three categories for structures immersed in water or buried soil.

#### ATMOSPHERIC- CORROSIVITY CATEGORIES AND EXAMPLES OF TYPICAL ENVIRONMENTS

Corrosivity category	Mass loss per unit surface/ thickness loss (after first year of exposure)				Examples of typical environments in a temperate climate (informative only)	
	LOW CARBON STEEL		ZINC		EXTERIOR	INTERIOR
	Mass loss g/m <sup>2</sup>	Thickness loss µm	Mass loss g/m <sup>2</sup>	Thickness loss µm		
C1 very low	≤10	≤1,3	≤0,7	≤0,1		Heated buildings with clean atmospheres, e.g. offices, shops, schools, hotels.
C2 low	>10 y to 200	>1,3 y to 25	>0,7 y to 5	>0,1 y to 0,7	Atmospheres with low level of pollution. Mostly rural areas.	Unheated buildings where condensation may occur, e.g. depots, sport halls.
C3 medium	>200 y to 400	>25 y to 50	>5 y to 15	>0,7 y to 2,1	Urban and industrial atmospheres, moderate sulfur dioxide pollution. Coastal areas with low salinity.	Production rooms with high humidity and some air pollution, e.g. food-processing plants, laundries, breweries, dairies...
C4 high	>400 y to 650	>50 y to 80	>15 y to 30	>2,1 y to 4,2	Industrial areas and coastal areas with moderate salinity.	Chemical plants, swimming pools, coastal ship-and boatyards.
C5-I very high (industrial)	>650 y to 1,500	>80 y to 200	>30 y to 60	>4,2 y to 8,4	Industrial areas with high humidity and aggressive atmosphere.	Buildings or areas with almost permanent condensation and with high pollution.
C5-M very high (marine)	>650 y to 1,500	>80 y to 200	>30 y to 60	>4,2 y to 8,4	Coastal and offshore areas with high salinity.	Buildings or areas with almost permanent condensation and with high pollution.



ISO 12944. Corrosivity category C2.



ISO 12944. Corrosivity category C3.



ISO 12944. Corrosivity category C5.

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### a) CLASSIFICATION OF ENVIRONMENTS

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#### THREE CATEGORIES FOR WATER AND SOIL

CATEGORY	ENVIRONMENT	EXAMPLES OF ENVIRONMENTS AND STRUCTURES
IM1	Fresh water	River installations, hydro- electric power plants
IM2	Sea or brackish water	Harbour areas with structures like sluice gates, locks, jetties; offshore structures
IM3	Soil	Buried tanks, steel piles, steel pipes

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### b) SURFACE PREPARATION

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#### SURFACE PREPARATION METHODS:

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Water, solvent and chemical cleaning.

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Mechanical cleaning (including blast cleaning).

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Flame cleaning.

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The Norm defines the surface preparation methods, but does not establish any requirements about the previous state of the substrate.

Standard preparation grades for primary (overall) surface preparation: Sa, St, Fl y Be.

**Sa** (Blast cleaning).

**St** (Hand or Power Tool cleaning).

**Fl** (Flame cleaning).

**Be** (Acid pickling) .

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### b) SURFACE PREPARATION

#### ANNEX A (Normative)

#### STANDARD PREPARATION GRADES FOR PRIMARY (OVERALL) SURFACE PREPARATION

Standard preparation grade <sup>1)</sup>	Surface preparation method	Representative photographic samples in ISO 8501-1 <sup>2) 3) 4)</sup>	Essential features of prepared surfaces For further details, including treatment prior to and after surface preparation (column 2), see ISO 8501-1.	Field of application
Sa 1	Blast- cleaning <sup>6)</sup>	B Sa 1 C Sa 1 D Sa 1	Poorly adhering mill scale, rust and painting coatings and foreign matter are removed <sup>5)</sup> .	The surface preparation of :  a) uncoated steel surfaces;  b) coated steel surfaces, if the coatings are removed to the extent that the specified preparation grade is achieved.
Sa 2		B Sa 2 C Sa 2 D Sa 2	Most of the mill scale, rust, paint coatings and foreign matter is removed. Any residual contamination shall be firmly adhering.	
Sa 2½		A Sa 2½ B Sa 2½ C Sa 2½ D Sa 2½	Mill scale, rust, paint coatings and foreign matter are removed. Any remaining traces of contamination shall show only as slight stains in the form of spots or stripes.	
Sa 3 <sup>6)</sup>		A Sa 3 B Sa 3 C Sa 3 D Sa 3	Mill scale, rust, paint coatings and foreign matter are removed. The surface shall have a uniform metallic colour.	
St 2	Hand or power tool cleaning	B St 2 C St 2 D St 2	Poorly adhering mill scale, rust, paint coatings and foreign matter are removed <sup>5)</sup> .	
St 3		B St 3 C St 3 D St 3	Poorly adhering mill scale, rust, paint coatings and foreign matter are removed <sup>5)</sup> . However, the surface shall be treated much more thoroughly than for St 2 to give a metallic sheen arising from the metal substrate.	
F1	Flame cleaning	A F1 B F1 C F1 D F1	Mill scale, rust, paint coatings and foreign matter are removed. Any remaining residues shall show only as a discoloration of the surface (shades of different colours).	
Be	Acid pickling		Mill scale, rust and residues from paint coatings are removed completely. Paint coatings shall be removed prior to acid pickling by suitable means.	Prior to hot- dip- galvanizing example.

1) Key to symbols used.

Sa = blast cleaning (ISO 8501-1).

St = hand tool or power- tool cleaning (ISO 8501-1).

F1 = flame cleaning (ISO 8501-1).

Be = acid pickling.

2) A, B, C and D are initial conditions of uncoated steel surfaces (see ISO 8501- 1).

3) The representative photographic examples show only surfaces or surface areas that were previously uncoated.

4) In the case of steel surfaces with painted or unpainted metal coatings, an analogous application of certain standard preparation grades might be agreed, provided that these are technically feasible under the given conditions.

5) Mill scale is considered to be poorly adhering if it can be removed by lifting with a blunt putty knife.

6) This surface preparation grade can only be achieved and maintained under certain conditions which it may not be possible to produce on site.

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### c) DURABILITY OF THE PAINT SYSTEM

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The durability of a protective paint system depends on the type of paint system, the design of the structure, conditions of the substrate before preparation, effectiveness of the surface preparation, standard of the application work, conditions during application and the exposure conditions after application.

Therefore, the durability is a technical consideration that can help the owner set up a maintenance program, but can never be taken as a guarantee time.

In this standard, durability is expressed in terms of three ranges:

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Low (L) 2 to 5 years

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Medium (M) 5 to 15 years

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High (H) more than 15 years

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### d) LABORATORY PERFORMANCE TEST METHODS

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EN ISO 12944 NORM specifies laboratory test methods that are to be used when the performance of protective paint systems against

corrosion is to be assessed. This covers testing of paint systems designed for:

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Steel prepared by blast cleaning

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Hot dip galvanized steel

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Thermally sprayed metallic coatings

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This norm does not apply on following substrates:

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Electroplating steel

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Painted steel

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The tests and the duration of these are shown on following tables:

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Table Nr 1 for Paint Systems applied on steel substrates.

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Table Nr 2 for Paint Systems applied on zinc coated steel substrates.

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The test panels shall be made of the same type of steel (or zinc- coated steel) as used in practice, unless otherwise agreed. The minimum panel size shall be 150 x 70mm The panel thickness will depend on the test, but shall be

2mm at least.

The test panels will be compliant with the preparation and surface roughness as described on EN ISO 12944-6 1999:

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Shotblasted steel to grade Sa 2½, Sa 3.

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Zinc- coated steel surfaces. Surface preparation shall be agreed between the interested parties.

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### d) LABORATORY PERFORMANCE TEST METHODS

**TABLE 1**  
**TEST PROCEDURES FOR PAINT SYSTEMS APPLIED TO STEEL**

Corrosivity category as defined in ISO 12944-2	Durability ranges	ISO 2812-1 <sup>1)</sup> (chemical resistance) h	ISO 2812-2 (water immersion) h	ISO 6270 (water condensation) h	ISO 7253 (neutral salt spray) h
C2	Low	-	-	48	-
	Medium	-	-	48	-
	High	-	-	120	-
C3	Low	-	-	48	120
	Medium	-	-	120	240
	High	-	-	240	480
C4	Low	-	-	120	240
	Medium	-	-	240	480
	High	-	-	480	720
C5-I	Low	168	-	240	480
	Medium	168	-	480	720
	High	168	-	720	1,440
C5-M	Low	-	-	240	480
	Medium	-	-	480	720
	High	-	-	720	1,440
Im1	Low	-	-	-	-
	Medium	-	2,000	720	-
	High	-	3,000	1,440	-
Im2	Low	-	-	-	-
	Medium	-	2,000	-	720
	High	-	3,000	-	1,440
Im3	Low	-	-	-	-
	Medium	-	2,000	-	720
	High	-	3,000	-	1,440

1) The purpose of the chemical resistance test is not the assessment of corrosion protection properties but to assess the ability of a system to withstand highly industrial environments. Thus, the test duration remains the same whatever the durability range is.

For corrosivity category C5-I ISO 2812-1 procedure can be replaced or supplemented by the ISO 3231 test (10 cycles, 240h for "low" durability, 20 cycles, 480h for "medium" durability; and 30 cycles, 720h for "high" durability).

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### d) LABORATORY PERFORMANCE TEST METHODS

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**TABLE 2**  
**TEST PROCEDURE FOR TESTING ADHESION OF PAINT SYSTEMS**  
**APPLIED TO ZINC- COATED STEEL**

<b>Corrosivity category as defined in ISO 12944-2</b>	<b>Durability ranges</b>	<b>ISO 6270</b> (water condensation) h
C2	Low Medium High	240 240 240
C3	Low Medium High	240 240 240
C4	Low Medium High	240 240 480
C5-I	Low Medium High	240 480 720
C5-M	Low Medium High	240 480 720