SELEMIX ISO 12944 RECOMMENDATIONS

Milan, July 2016

We commissioned to external laboratories to carry out testing of the main 2K Selemix paint cycles based on the **International standard ISO 12944 (Paint and varnishes – Corrosion protection of steel structures by protective paint systems)** qualifying them in the corrosivity categories and durability ranges in accordance with ISO 12944-6 (Laboratory performance test methods).

The purpose is to provide to the LIC technicians and experts a guide to select the most suitable Selemix paint cycles for paint works who require ISO specifications in terms of durability and corrosion protection of steel structures.

Why Selemix ISO 12944 specifications?

ISO 12944 was published in 1998 as both a European and International standard and it is the highest world-wide and qualified standard reference for corrosion protection of steel structures. It covers protective paint systems designed for application to uncoated steel, hot-dip-galvanized steel and steel surfaces with thermally sprayed zinc coatings.
ISO 12944 includes 8 different sections covering issues such as the measurements of the corrosivity of various environments, surface preparation and laboratory testing procedures.

Of particular interest in the industrial market is the evaluation of the durability of a paint system. Durability depends on many external factors such as the environment, the design of the structure, the surface preparation, the application and drying process. The durability is also linked to the chemical and physical characteristics of the system i.e. the type of binder, the dry film thickness. These characteristics are evaluated as defined in ISO 12944-6 by artificial-ageing tests to measure the paint cycles resistance to water or moisture and to salt spray as an indication of wet adhesion and barrier properties.
The ageing tests have the aim of ensuring with a high probability that a paint system really has the characteristics needed for the durability required in the intended application.

Selemix paint cycle specifications that comply with ISO12944 provide us:

- confidence in the performances of Selemix products
- a universally accepted quality standard
- an objective approach to a paint cycle selection

Classification of environments

For better understanding the test results it is necessary to identify the most appropriate classification of corrosive environment.
ISO 12944-2 provides a table of corrosion classes with typical environments for both atmospheric and immersion conditions. These environments are to be considered as an indication of the circumstances that the paint cycle is design to resist for extended periods.

SELEMIX ISO 12944 RECOMMENDATIONS

CORROSION CLASSES	Typical Exterior Environments	Typical Interior Environments
C1	-	Heated buildings with clean atmospheres e.g. Offices, schools, shops, hotels
C2	Atmospheres with low level of pollution. Mostly rural areas.	Unheated buildings where condensation may occur e.g. depots, warehouses, sports halls
C3	Urban and industrial atmospheres, moderate sulfur dioxide pollution. Coastal areas with low salinity.	Production rooms with high humidity and some air pollution (food processing plants, laundries, breweries, diaries)
C4	Industrial areas and coastal areas with moderate salinity.	Chemical plants, swimming pools, coastal shipyards.
C5-I	Industrial areas with high humidity and aggressive atmosphere.	Buildings or areas with almost permanent condensation and high pollution
C5-M	Coastal and offshore areas with high salinity.	Buildings or areas with almost permanent condensation and high pollution

Then we have to decide the needs in terms of durability of the coating system.
Approximately durability periods is categorized as follows:
High = over 15 years
Medium = 5-15 years
Low = 2-5 years

The durability ranges provide an indication of the lifetime of the system before the first major maintenance work is required.

NOTE: These durability ranges are not "guarantee times". They should be considered as a technical consideration that can help to set up a maintenance programme on corrosion protection.

Test procedures for Selemix paint cycles

In accordance with ISO 12944-6, after 21 days of conditioning in standard atmosphere (20+/-2)°C and 65+/-5% of relative humidity, the laboratories have evaluated the Selemix paint cycles by the following artificial ageing tests:

- neutral salt spray (ISO 7253) and water condensation (ISO 6270) for the paint system applied to steel
- water condensation (ISO 6270) for the paint system applied to zinc-coated steel

Three panels for each test were provided and painted following the Selemix technical data sheets instructions.

- Sand-blasted steel panels were prepared in accordance with ISO 8503-1.
- Zinc-coated steel panels were prepared in accordance with ISO 12944-4.

Details are provided in the following tables.

SELEMIX ISO 12944 RECOMMENDATIONS

Table 1 — Test procedures for paint systems applied to steel

Corrosivity category as defined in ISO 12944-2	Durability ranges	ISO 2812-1 [1] (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) Use method 1 (see 5.6 for the chemicals used). 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, the ISO 2812-1 procedure can be replaced or supplemented by the ISO 3231 test (10 cycles, 240 h for "low" durability; 20 cycles, 480 h for "medium" durability; and 30 cycles, 720 h for "high" durability).

SELEMIX ISO 12944 RECOMMENDATIONS

Table 2 — Test procedure for testing adhesion of paint systems applied to zinc-coated steel

Corrosivity category as defined in ISO 12944-2	Durability ranges	ISO 6270 (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

For example:

1) A system is qualified as “HIGH” for corrosivity category “C3” **on steel** if, for at least two of the three panels:

a) after 480 hours of salt spray (ISO 7253) it has no defect in terms of blistering, rusting, cracking and flaking in accordance with ISO 4628-2 to 4628-5 and the corrosion of the substrate from the scratch does not exceed 1 mm.

And

b) after 240 hours of continuous condensation (ISO 6270) it has no defect when assessed in accordance to ISO 4628-2 to 4628-5.

Crossing these data in the above table you will find the corrosivity class and the durability range for the relevant paint cycle (C3-High)

2) A system is qualified as “HIGH” for corrosivity category “C3” **on zinc coated steel** if, for at least two of the three panels:
a) after 240 hours of continuous condensation (ISO 6270) it has no damage.