SABA
PROTECTIVE COATINGS

HOW TO SELECT A COATING SYSTEM

Guide to industrial coatings in accordance with ISO 12944

SABA SHIMI ARYA

Coatings Prolong Asset Lifetime & Prevent Downtime

INTRODUCTION

Saba Shimi Arya Company, with more than 20 years of experience in producing all kinds of protective coatings with SABA brand, has one of the most equipped R&D and product quality control laboratories.

Being a member of the Iranian Oil Ministry's approved vendor list (AVL), this company has continuous cooperation with the oil, gas, petrochemical and steel industries to provide all kinds of protective coatings with the highest possible quality in accordance with the international standards and technical requirements of customers.

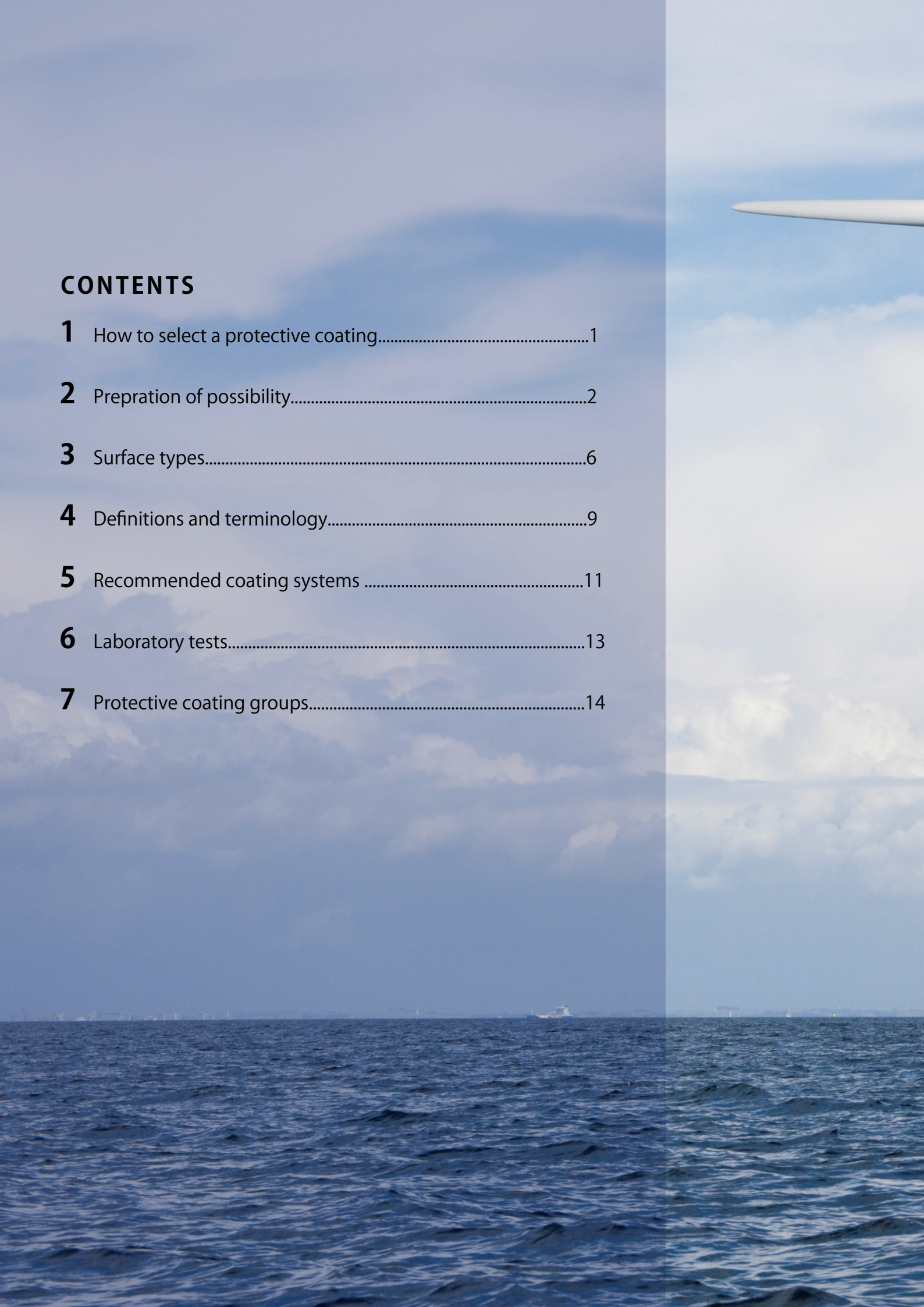
The purpose of this guide is to provide assistance in choosing the industrial coating system SABA to protect various structures, installations and equipments from corrosion. In this brochoure we have collected important information regarding protective coating technologies, criteria for correct coating selection and surface preparation requirements.

The manual has been prepared in accordance with the latest edition of the international standard ISO 12944 “Paint and Varnishes: Corrosion Protection for steel structures by protective paint systems”.

It also includes recommendations from specialists and technologists from the SABA paints plant regarding protective coatings. This document contains a number of recommendations and provides an overview of the changes made to the ISO 12944 standard. It does not in any way create any legal obligations.

If you require specific information about your project, please contact our technical specialist.

Sincerely,
SABA paint team



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We Protect Property by
Providing **Premium**
Coating solutions

1 HOW TO SELECT A COATING SYSTEM

To ensure optimum cost effectiveness and efficiency, a number of criteria must be taken into account when selecting the appropriate coating system for corrosion protection. Below are the most important factors that must be considered in each specific case selecting a protective coating.

1.Corrosive category of the environment

It is very important to determine the conditions under which structures, equipment or installations will be operated. To determine the corrosive effects of the external environment, the following factors must be taken into account:

- Humidity and temperature (operating temperature and temperature changes)
- Presence of UV radiation
- Chemical exposure (e.g. specific exposure in industrial installations)
- Mechanical impact (shock loads, abrasive wear, etc.)

For structures buried in the soil, it is necessary to take into account the porosity and characteristics of the soil to which they are exposed. The moisture and PH value of the soil, as well as the biological effects of bacteria and microorganisms, are critical. When immersed in water, it's type and chemical composition are also important.

Depends on the corrosiveness of the environment :

- Type of paint used for protection
- Total thickness of coating system
- Required surface preparation
- Minimum and maximum overcoating intervals

It should be noted that the more aggressive the external environment, the more thorough surface preparation is required. The overcoating intervals must also be strictly observed. Part 2 of ISO 12944 provides a classification of corrosivity categories for weather, soil and water. This standard gives a general rating based on corrosion time for carbon steel and zinc. It does not reflect specific chemical, mechanical or temperature effects. However, the provisions of the standard can be taken as a reliable basis for design of coating systems in general.

Table 1.1 Corrosion category (ISO 12944-2)

Corrosion category	Example of environment	
	External	Internal
C1(very low)	-	Heated buildings in rural areas such as offices, hotels, public buildings
C2 (low)	Rural areas with low level of pollution.	Unheated buildings where condensation may occur such as warehouses.
C3 (medium)	Urban and industrial areas with moderate sulphur dioxide pollution. Coastal areas with low salinity.	Industrial facilities with high humidity such as food processing industries, breweries.
C4 (high)	Industrial and/or coastal areas with moderate salinity.	Chemical plants, swimming pools, boat yards, ship interiors.
C5 (very high)	Industrial areas prone to high humidity and chemical attack. Coastal areas with high salinity.	Facilities exposed to permanent condensation and chemicals.
CX (extreme)	Offshore areas with high salinity. Industrial areas exposed to extreme humidity, aggressive atmosphere and tropical areas.	Facilities exposed to extreme humidity and aggressive atmosphere.

Note: in previous versions of ISO 12944, the C5 category was split in Marine (C5M) and Industrial (C5I), part 6 requiring additional tests for the industrial (chemical) exposure. Therefore, in older documents C5 M may not refer to C5 medium durability and C5I should not be misread as C5 low durability (C5 L, using the capital letter L instead of lower-case l).

Table 1.2 Corrosivity categories for structures immersed in water or soil (ISO 12944-2)

Corrosion category	Environment	Example of environments and structures
Im1	Fresh water	River installations, hydro-electrical power plants
Im2	Sea or brackish water	Immersed structures **without** cathodic protection (e.g. harbour areas with structures like sluice gates, locks or jetties)
Im3	Soil	Buried tanks, steel piles, steel pipes
Im4	Sea or brackish water	Immersed structures **with** cathodic protection (e.g. offshore structures)

Note: for corrosivity category Im1 and Im3, cathodic protection can be used with a paint system that has been tested accordingly.

2.Type of surface to be protected

The question of choosing a coating system usually arises in relation to such structural materials as carbon, hot-dip galvanized or metal-sprayed steel, aluminum or stainless steel. It is the type of structural material to which the coating is applied that largely determines the surface preparation process, the paint and varnishes used (especially the primer) and the overall thickness of the system.

3.Service life of the coating system

The service life of a coating system defined as the period of time from time that coating is applied until the first repair of the painted surface is required. Based on this, ISO 12944-2 defines four time-intervals for service life of a coating system:

Low (L)	<7 years
Medium (M)	7-15 years
High (H)	15-25 years
Very high (VH)	>25 years

4.Planning the coating application process

The method and time of application of paints and varnishes are determined taking into account the stages of construction of a specific object. It's necessary to take into account the condition of the coating at the stage of manufacturing prefabricated structures, when assembling elements both outside the construction site and directly on site, as well as upon completion of construction stages.

Surface preparation work must be planned taking into account the effects of ambient temperature and air humidity, as these factors affect the drying/curing time of the coating. In addition, if one phase of construction is carried out in a protected workshop and the second phase s carried out directly on the construction site, overcoating intervals must be taken into account.

2 PREPARATION OF POSSIBILITY

1.Degrees of surface preparation according to ISO 8501-1 standard

Surface preparation by blast-cleaning is designated by the letters "Sa". Descriptions of the blast-cleaning grades are given in Table 2.1. Prior to blast-cleaning, any heavy layers of rust shall be removed by chipping. Visible oil, grease and dirt shall also be removed. After blast-cleaning, the surface shall be cleaned from loose dust and debris.

Table 2.1. Blast-cleaning grades

Sa 1	**Light blast-cleaning**	When viewed without magnification, the surface shall be free from visible oil, grease and dirt, and from poorly adhering mill scale, rust, paint coatings and foreign matter[1].
Sa 2	**Thorough blast-cleaning**	When viewed without magnification, the surface shall be free from visible oil, grease and dirt, and from most of the mill scale rust, paint coatings and foreign matter[1]. Any residual contamination shall be firmly adhering[2].
Sa 2½	**Very thorough blast-cleaning**	When viewed without magnification, the surface shall be free from visible oil, grease and dirt, and from mill scale, rust, paint coatings and foreign matter[1]. Any remaining traces of contamination shall show only as slight stains in the form of spots or stripes.
Sa 3	**Blast-cleaning to visually clean steel**	When viewed without magnification, the surface shall be free from visible oil, grease and dirt, and shall be free from mill scale rust, paint coatings and foreign matter[1]. It shall have a uniform metallic colour.

Note :
1- Foreign matter also includes water-soluble salts and welding residues. These contaminants can't always removed by dry blasting, manual or mechanical cleaning. In some cases, hydro jetting may be required.
2- Mill scale, rust or paint is considered to be flaking if it can be easily removed with a blunt putty knife.

Surface preparation by hand and power tool cleaning, such as scraping, wire-brushing, machine-brushing and grinding, is designated by the letters "St". Descriptions of the hand and power tool cleaning grades are given in Table 2.2. Prior to hand and power tool cleaning, any heavy layers of rust shall be removed by chipping. Visible oil, grease and dirt shall also be removed.

Table 2.2. Hand and power tool cleaning grades

St 2	**Thorough cleaning with hand and power tools.** When viewed without magnification, the surface shall be free from visible oil, grease and dirt and from most of the mill scale, rust, paint coatings and foreign matter.
St 3	**Very thorough cleaning with hand and power tools.** It's similar to St 2, however the surface must be treated more thoroughly to ensure a uniform metallic shiny surface without magnification.

2.Surface preparation levels using water jet-cleaning according to ISO 8501-4 standard

Surface preparation grades by water-jetting include not only the degree of cleanliness but also the degree of secondary rusting, as the latter may occur on cleaned steel during drying. There are several approaches to classifying the degrees of steel surface preparation after water-jetting.

This guide recommends the use of the ISO 8501-4 surface preparation grade standard for water jet-cleaning: "Original surface condition, preparation quality and rusting grade by high-pressure water jet-cleaning".

Surface preparation grades by waterjet cleaning is designated by the letters **"Wa"**. Four preparation grades, designated Wa 1, Wa 2, Wa 2½ and Wa 3, indicating the degree of cleaning, are specified.

The descriptions of the surface appearance are given in Table 2.3.

Table 2.3. Water jet-cleaning preparation grades

Wa 1	**Light water jetting** When viewed without magnification, the surface shall be free from visible oil, grease and dirt loose or defective paint coatings, loose rust and other foreign matter. Any residual contamination shall be dispersed and can consist of firmly adherent coatings, firmly adherent foreign matter and firmly adherent rust.
Wa 2	**Thorough water jetting** When viewed without magnification, the surface shall be free from visible oil, grease and dirt, and most of the rust, previous paint coatings and other foreign matter. Any residual contamination shall be dispersed and can consist of firmly adherent coatings, firmly adherent other foreign matter and firmly adherent traces of rust.
Wa 2½	**Very thorough water jetting** When viewed without magnification, the surface shall be free from all visible rust, oil, grease and dirt. Slight traces of firmly adherent thin previous rust; slight traces of firmly adherent thin paint coatings and slight traces of other foreign matter can remain. Any residual contamination shall be dispersed. Discoloration of the surface can be present where the original coating was not intact.
Wa 3	**Water jetting to bare substrate** When viewed without magnification, the surface shall be free from all visible previous rust, oil, grease, dirt, previous paint coatings, and from all other foreign matter. The steel surface can or cannot, appear uniform. Discoloration of the surface can be present where the original coating was not intact.

Table 2.4. Description of the surface type in accordance with the degrees of secondary rusting

L	**Light flush rusting:** A surface which when viewed without magnification exhibits small quantities of a yellow/brown rust layer through which the steel substrate can be seen. The rust (seen as a discoloration) can be evenly distributed or present in patches, but it will be tightly adherent and not easily removed by gentle wiping with a cloth.
M	**Medium flash rust:** A surface which when viewed without magnification exhibits a layer of yellow/brown rust that obscures the original steel surface. The rust layer can be evenly distributed or present in patches, but it will be reasonably well adherent and it will lightly mark a cloth that is gently wiped over the surface.
H	**Heavy flash rust:** A surface which when viewed without magnification exhibits a layer of red-yellow/brown rust that obscures the original steel surface and is loosely adherent. The rust layer evenly distributed or present in patches and it will readily mark a cloth that is gently wiped over the surface.

3 SURFACE TYPES

To ensure the coating system provides long-lasting protection, before application paint, the surface must be properly prepared. To do this, it's necessary to assess the initial state of the surface of the steel structure.
In general, the condition of a steel surface before painting falls into one of the following two categories:

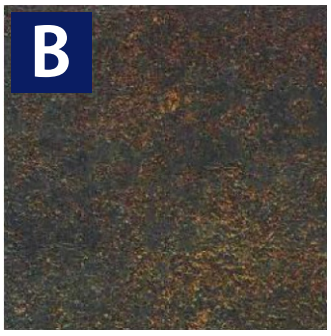
- Steel surface without coating
- Steel surface with a coating that needs to be repaired

Steel surfaces that have not had a protective coating applied may be covered to varying degrees with rust, mill scale and other contaminants (dust, grease, water soluble salts, deposits, etc.). The initial condition of such surfaces is determined by ISO 8501-1 :"Preparation of steel surfaces before the application of paints and similar coatings. Visual assessment of surface cleanliness."

1.Uncoated steel surface

The ISO 8501-1 standard defines four initial states of steel – A, B, C, D.

The surface of the steel is completely covered with mill scale, showing little or no signs of any rust or oxidisation, and no pitting.

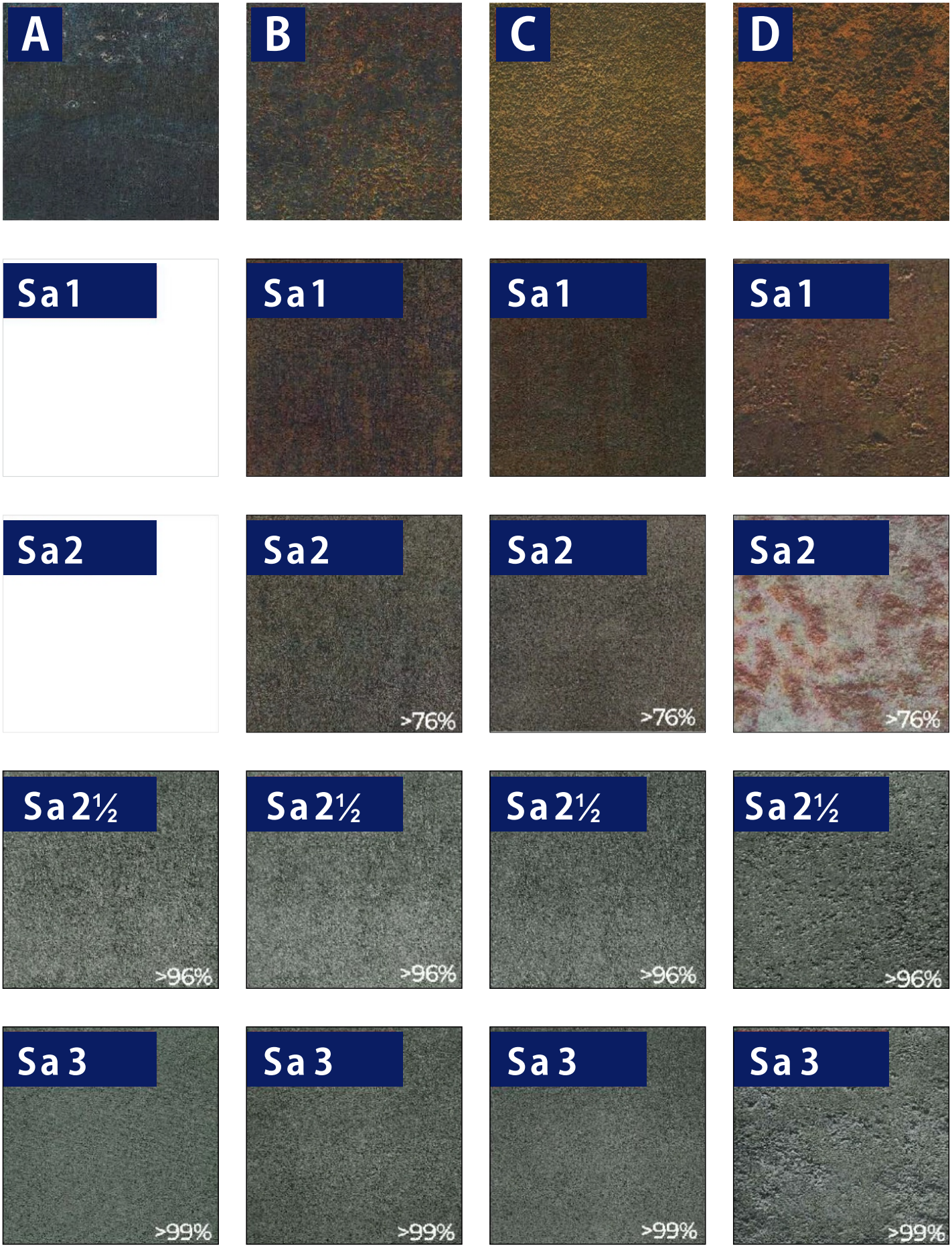


The surface of the steel has been exposed to the elements and shows signs of rusting, with the mill scale beginning to flake.

The mill scale has rusted away from the surface of the steel, due to prolonged exposure to the elements. Any remaining mill scale can be simply scraped off, and early signs of surface pitting may be visible.

Steel surface on which the mill scale has rusted away and general pitting is visible under normal vision.

Surface preparation by sandblasting (designed by the letters “Sa” and described in Table 2.1.)



2.Steel surface with a coating that needs to be repaired

The steel surface that already has a coating should be evaluated with ISO 4628 standard in every repair. It should also be determined if it is necessary to completely remove the previous coating or if parts of it can be kept.

3.Hot-dip galvanized steel, stainless steel and aluminum

In addition to standard steel, non-ferrous material such as hot-dip galvanized steel, or high-alloy steel may be used in construction. All of these require special considerations in terms of surface preparation and choice of coating system.

Hot-dip galvanized steel: When galvanized steel is exposed to the atmosphere, zinc oxide formation occurs on the surface. The composition and adhesion of these products may vary, affecting the adhesion properties of coating systems. It's considered that the best time for paint application is within a few hours of the galvanizing process. At intermediate stages, it's recommended to remove zinc corrosion products by washing the surface with an alkaline cleaner. If necessary, washing can be done with high pressure water or combined with mechanical cleaning using a special stiff nylon brush, sandpaper or abrasives (glass beads, sand, etc.).

Aluminum and stainless steel: The surface of aluminum or stainless steel should be cleaned with clean water and detergent, then rinsed thoroughly with fresh water under pressure. To improve the adhesion properties of the coating system, it's recommended to perform blast cleaning using mineral abrasives or special brushes.

4 DEFINITIONS & TERMINOLOGY

Several terms necessary for working with paints and varnishes:

Theorical coverage, m^2/lit

The theoretical coverage is a function of volume solid and dry film thickness (DFT) and is calculated by the following formula:

$$m^2/lit = \frac{10 \times volume\ solid(\%)}{DFT\ (\mu m)}$$

Actual coverage, m^2/lit

The actual coverage (the amount of actual paint consumption) according to the implementation and operational conditions of each project is influenced by several factors such as geometric shape of the structure, surface texture, method of applying the paint, roughness of the substrate, conditions of the execution environment (external or internal surfaces), wind speed, skill of the executive team, etc. are determined.

Drying time

Paint drying in 3 stages occurs; on surface (Touch dry), deeply (Dry to handle) and completely (Full cure), and factors such as the thickness of the dry film, ventilation, temperature and relative humidity of the environment affect this time.

Recoating interval

In order to achieve the best adhesion results and the highest performance in a coating system, for each product an optimal time period called recoating interval is defined for applying the next layer.

Mixing ratio

Performance and quality properties of multi-component paints are completely influenced by the accurate and correct mixing ratio of the coating components and are presented by volume or weight in the technical specifications of the products.

Pot life

It refers to the time that multi-component paints have time to apply on the surface after mixing.

Shelf life

The duration of product storage in the warehouse under standard conditions (temperature of 5-30 °C) by keeping the original packaging of the manufacturer.

Wet film thickness (WFT)

Measuring wet film thickness, makes it easier to obtain the dry film thickness. This avoids problems such as applying paint with a high thickness (resulting in increasing coating consumption) and low thickness (resulting in a lack of complete protection of the substrate).

Dry film thickness (DFT)

The thickness of the liquid coating that remains on the substrate after drying and is measured according to the requirements of the technical specifications of each project based on one of the SSPC-PA2, ISO 2808 or ISO 19840 standards.

Density, gr/cm^3

This parameter is measured based on the ASTM 1475 standard and using a pycnometer.

Solids content (%)

The percentage of solids content is measured according to the ASTM D2369 standard.

Volume solid (%)

The amount of paint volume that forms a paint film after the evaporation of volatile components. The percentage of volume solid is measured according to the ASTM D2697 standard. It is also possible to determine the volume solid from the following formula: DFT/WFT

5 RECOMMENDED COATING SYSTEM

Below are SABA recommendations for selecting an industrial coating system depending on the type of surface, operating conditions and degree of corrosion category according to ISO 12944 standard:

Table 5.1. Metal structures for various purposes

Environment/ Durability	Low (L)	Medium (M)	High (H)	Very high (VH)
C2	Note 1	• P1510/T1510 + T1510 (100)	• P3101 + T4110 (120)	• P3103 + T4110 (160) • P3101/EX3204 + T4110 (180)
C3	• P1510/T1510 + T1510 (100)	• P3101 + T4110 (120) • P1101/P1510 /T1510 + T1510 (160)	• P3103 + T4110 (160) • P3101/EX3204 + T4110 (180)	• P3103 +I3104 + T4110 (200) • P3101/EX3204 + T4110 (240)
C4	• P3101+T4110 (120)	• P3103 + T4110 (160) • P3101/EX3204 + T4110 (180)	• P3103 +I3104 + T4110 (200) • P3101/EX3204 + T4110 (240)	• P6203 + EX3204 + T4110 (260) • XF3209 + T4110 (300)
C5	• P3103+T4110 (160) • P3101/EX3204 + T4110 (180)	• P3103 +I3104 + T4110 (200) • P3101/EX3204 + T4110 (240)	• P6203 + EX3204 + T4110 (260) • XF3209 + T4110 (300)	• P6203 + EX3204 + T4110 (360) • XF3209 + T4110 (360)
CX	Not applicable	Not applicable	• P6203 + EX3204 + T4110 (360) • XF3209 + T4110 (360)	Not applicable

Note:

1-if a coating is desired (for C2-low), use a system for higher corrosivity category or durability, e.g. C2-high or C3-medium.

2-Numbers in brackets are the nominal dry film thickness in microns.

3-The / means "or", for example P1510/T1510 means P1510 "or" T1510.

Table 5.2. Structure submerged in water or buried in soil

Environment/Durability	High (H)	Very High (VH)
Im 1	• EX3204 (2*190) • P3101 (2*200)	• EX3204 (2*270)
Im 2	• XF3209 (2*190)	• XF3209 (2*270)
Im 3	• XF3201 (2*200) • X3710/X3810 (2*200)	• XF3201 (2*300) • X3710/X3810 (2*300)
Im 4	• XF3201/XF3209 (2*350)	Not applicable

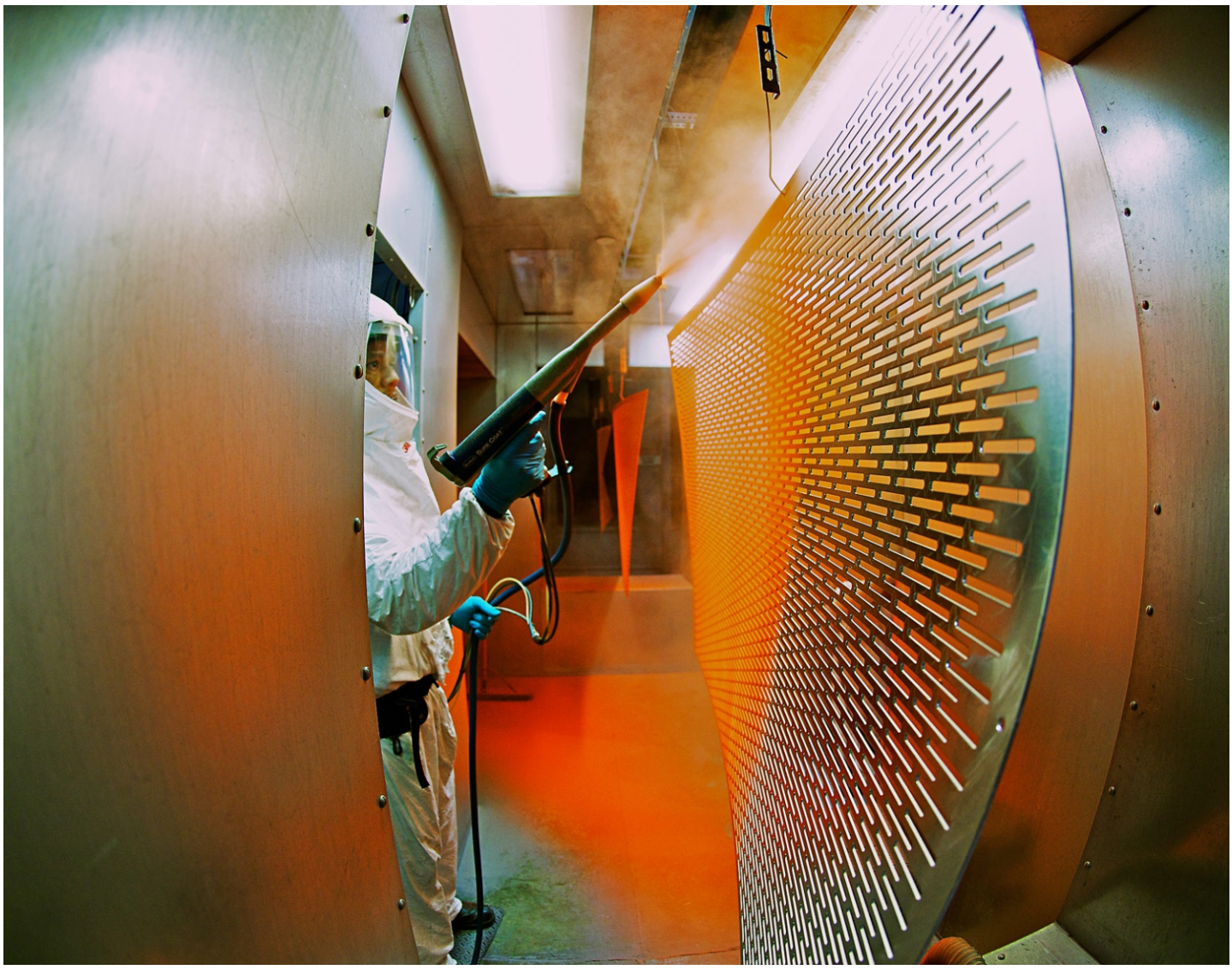
Table 5.3. Other coating functionality

Coating functionality	Very High (VH)
Internal surfaces of pipelines and tanks for transportation of oil and petroleum products [1]	• P3101 (2*150) • X3710/X3810 (2*150) • T3410 (2*150)
Structure submerged in drinking water [2]	• Xh3210 (2*200)
Heat resistant structures (Up to 400 °C)	• P6203 + T5305 (60 + 2*25)
Heat resistant structures (Up to 600 °C)	• T5105 (2*25)

Note:

1-Chemical resistant linings are designed for use in contact with for instance crude oil, jet-fuel and/or other chemicals. Specific certifications exist for some of these exposures. They can also be specified for use for immersion exposure as described in ISO 12944 (Im1, Im2, Im3 or Im4), check with your SABA coatings representative which lining is suitable for the specific steel protection scenario you require.

2-In accordance with the requirements of international standards AWWA C210 and BS 6920



6 LABORATORY TESTS

ISO 12944 parts 6 and 9 define laboratory tests to back up the expected durability for coating systems meeting the DFT requirements on the previous section. In the tests, different scenarios are created that are known to affect the corrosion speed of (coated) steel. Some tests are relevant for all coating systems in the standard, others only for immersion or off-shore systems. By extending the test duration periods, higher durability classes are mimicked. After the exposure, the panels are reviewed for corrosion in the coated area and from the scribe through the coating and in combination with adhesion testing before and after the test to classify them as passing the requirements (or not).

Test panels are exposed to (combinations of):

- Water condensation (ISO 6270)
- Neutral salt spray (ISO 7253)
- Immersion (ISO 2812-2)
- Cyclic accelerated weathering: neutral salt spray, freezer, UV-A(340nm) / condensation

Testing compatibility with cathodic protection systems, 4200hrs of cathodic disbonding testing is a specific requirement for Im4 and some of the buried Im3 and CX scenarios. Immersion testing in (salt) water, is a requirement for the Im1, 2 and Im3 systems, 3000hrs for high durability or 4000hrs for very high durability. For Im4 (high only), the test duration is 4200hrs.

Test	Duration (hours)									
Categories	Durability / Environment	C2	C3	C4	C5	CX	Im1	Im 2	Im 3	Im 4
Water condensation (ISO 6270)	L	48	48	120	240	-	-	-	-	-
	M	48	120	240	480	-	-	-	-	-
	H	120	240	480	720	-	-	-	-	-
	VH	240	480	720	-	-	-	-	-	-
Neutral salt spray (ISO 7253)	L	-	-	-	480	-	-	-	-	-
	M	-	-	480	720	-	-	-	-	-
	H	-	480	720	1440	-	-	-	-	-
	VH	480	720	1440	-	-	-	-	-	-
Immersion (ISO 2812-2)	H	-	-	-	-	-	3000	3000	3000	4200
	VH	-	-	-	-	-	4000	4000	4000	-
Cyclic accelerated weathering(*)	H	-	-	-	1680	4200	-	-	-	-
	VH	-	-	1680	2688	-	-	-	-	-

*Cyclic accelerated weatherin is repeated for every week (7 days) as follows: (a) 3 days UV / Condensation cycle according to ISO 1674-3 [4 hrs UVA 340nm at 60°C, 4 hrs condensation at 50°C] – (b) 3 days Neutral salt spray according to ISO 9227, 5% NaCl at 35°C – (c) 1 day Low temperature at -20°C.

7 PROTECTIVE COATING GROUPS

Protective coatings can be divided according to the type of binder base, application or curing. SABA protective coating products division is as below:

- Epoxy coatings
- Heat resistant coatings
- Flooring coatings
- Polyurethane coatings
- Alkyd coatings
- Other protective coatings

1.Epoxy coatings group

SABA two-component solvent-based/free liquid epoxy coatings are designed and formulated based on epoxy resin and polyamide or polyamine curing agents with different characteristics. The formulation of this coatings group is designed by using a variety of auxiliary anti-corrosion pigments such as zinc, zinc-phosphate, zinc-chromate, iron-oxide, glass flake, aluminum flake, etc., in accordance with international standards as SSPC, AWWA C210, BS 6920. It is also possible to improve the properties through combination with other resins.

The use of this product group is to cover all types of industrial and marine metal and concrete structures in accordance with ISO 12944 standard in atmospheric, submerged and buried in corrosive environments. Among the places of use of these coatings, structures, pipes, internal and external surfaces of tanks and equipment of petrochemical industries, refineries, power plants, factories, drilling rigs, oil platforms, marine industries such as docks and vessels, machinery, bridges and other industrial facilities can be mentioned.

Special advantages of this product group are excellent adhesion to all types of surfaces, resistance to water, moisture, chemicals and acidic and alkaline environments, abrasion resistance and durability.

Product	Technical Code	Curing agent	Application
Zinc-Phosphate Epoxy Primer	P3101	Polyamide	The anti-corrosion mechanism of this primer is Active type and is used to protect metal structures in submerged and atmospheric C2, C3, C4 and C5 environments.
Zinc-Chromate Epoxy Primer	P3102	Polyamide	The anti-corrosion mechanism of this primer is Active type and is used to protect metal structures in atmospheric C2, C3, C4 and C5 environments.
Zinc-Rich Epoxy Primer	P3103	Polyamide	The anti-corrosion mechanism of this primer is of sacrificial anode protection and according to the percentage of zinc in the product's dry film, it is used as the first layer on steel surfaces in C2, C3, C4 and C5 atmospheric environments.
Iron Oxide Epoxy Primer	P3106	Polyamide	The anti-corrosion mechanism of this primer is Active type and is used to protect construction facilities and metal structures in atmospheric C2, C3, C4 and C5 environments.
Phenolic Epoxy Primer	P3410	Polyamine	This primer, with high anti-corrosion properties and chemical resistance, can be used for the internal and external surfaces of all types of structures in the refinery, petrochemical, crude oil, gasoline, dilute alkali and acid solution tanks, anti-ice, hot water and some aliphatic solvents
Epoxy Sealer	S3106	Polyamide	This coating can be used as a sealer/tie coat in industrial and marine systems on all kinds of epoxy and zinc silicate primers, and due to its ability to be applied in thin thicknesses, it prepares the porous surface of the lining for applying of middle coat. Due to the absence of metal pigments, this coating can also be used as a suitable primer for stainless steel surfaces.
Surface tolerant Epoxy Primer/Coating	EX3204	Polyamine	The formulation of this product is designed based on Masterbond/ Surface tolerant technology and its special application is for surfaces that cannot be properly prepared by roughing with abrasive particles (blasting method). Other features include proper drying and adhesion on wet surfaces.
High Build Epoxy Primer/Coating (For drinking water)	XH3210	Polyamine	This product has high chemical, abrasion and moisture resistance and shows good resistance against cathodic separation in systems that are under cathodic protection. Not affecting the taste of drinking water is one of the other properties of this product
High Build Epoxy Primer/Coating	E3203	Polyamine	This product can be applied in a dry film thickness of 200 microns to cover all types of metal and concrete surfaces, including structures, pipes, internal surfaces of tanks and equipment in petrochemical industries, refineries, power plants, factories, drilling rigs, oil platforms, Marine industries and other industrial facilities are used.
Epoxy Primer/Enamel	EH3110	Polyamide	This product can be used on all types of metal and concrete surfaces, has excellent abrasion, mechanical and chemical resistance and protects the surfaces from corrosive agents. This product is a self-primer and can be produced in various colors and glossiness.
Phenolic Epoxy Primer/Enamel	T3410	Polyamine	This product with high chemical resistance and anti-corrosion properties, can be applied on metal structures, concrete and internal and external surfaces of all types of structures in refinery, petrochemical, crude oil tanks, gasoline, alkali solution, dilute acid, anti-ice, hot water and some aliphatic solvents.
High Build Epoxy Middle Coating	IH3110	Polyamide	This product can be used as an intermediate layer in industrial and marine systems on all kinds of epoxy and zinc silicate primers, and due to its ability to be applied in high thicknesses, in addition to protecting the primer layer by creating a barrier effect, it prolongs the life of the paint system.
MIO Pigmented Epoxy Coating, HB	I3104	Polyamide	Using MIO flake pigments in this coating creates barrier properties against moisture, oxygen and corrosive factors, and also increases wear resistance, resistance to erosion factors and mechanical stresses.
Coal tar Epoxy Primer/Coating	X3710	Polyamide	This self-primer product, after complete curing, creates a film with very high chemical resistance, which protects the substrate against chemical and atmospheric corrosive factors. One of the important properties of this product is excellent adhesion, resistance to humidity and environments immersed in sea water and chemicals, buried in soil, as well as high hardness and flexibility.
Coal tar Epoxy Primer/Coating	X3810	Polyamine	This self-primer product, after complete curing, creates a film with very high chemical resistance, which protects the substrate against chemical and atmospheric corrosive factors. One of the main properties of this product is its application in high thicknesses up to 500 microns in a single layer.
Glass flake Epoxy Primer/ Coating	XF3209	Polyamine	In this product, due to the use of glass flake pigment, the barrier property is very high,and therefore, resistance to moisture penetration is one of the main features of this product. Another outstanding property of this coating is its excellent chemical resistance against all kinds of solvents and alkalis, dilute mineral acids, non-acidic monomers, crude oil, fuels and other chemicals.
Epoxy Ceramic Primer/ Coating	XF3211	Polyamine	Using ceramic particles in the formulation of this product has led to the production of coating with excellent wear and mechanical resistance. Another advantage of this coating is the possibility of application in high thickness up to 800 microns.
Solvent-free Epoxy Primer / Coating	XF3201	Polyamine	This self-primer product is solvent-free and is suitable for immersion service in salt and fresh water and chemicals. It has been designed for the protection of storage tanks and buried pipelines where durability is required. It can be applied in high thicknesses (up to 800 microns) as a single layer. The features of this product include: excellent resistance to cathodic disbanding, excellent adhesion to steel surfaces and fusion bond epoxy (FBE), excellent chemical, abrasion and impact resistance, good wetting properties and low water permeability.

2.Heat resistant coatings group

SABA's heat-resistant coating group is designed and formulated based on heat-resistant mineral resins such as silicate, silicone, acrylic silicone and protective pigments of aluminum and zinc.

These product's application is to protect steel structures exposed to temperatures of 120 to 650 degrees Celsius, such as the body of furnaces, chimneys, boilers, piping thermal lines, chemical plant facilities, refineries and power plants.

The special advantages of this product group are fast drying and the ability to move painted parts, high resistance to atmospheric conditions and ultraviolet light (UV).

Product	Technical Code	Application
Zinc silicate primer (up to 420°C)	P6203	The formulation design of this product is based on ethyl silicate mineral resin and the highest amount of anti-corrosion zinc pigment and is used as one of the best anti-corrosion primers to protect steel structures in corrosive industrial and marine environments. The main advantage of this primer compared to zinc-rich epoxy is UV resistance.
Silicone zinc primer (up to 400°C)	P5105	This product is used as an anti-corrosion primer using zinc pigments to protect all types of metal structures with an operating temperature of up to 450°C, such as the body of furnaces and chimneys, converters, boilers and other thermal installations. Another use of this product is to touch up ethyl silicate primer.
Acrylic silicone primer/ coating (up to 250°C)	T5305/20	Heat-resistant acrylic silicone coating up to 250°C is a type of self-primer and is used to protect all types of structures such as the body of furnaces and chimneys converters, boilers and other thermal installations.
Acrylic silicone primer/ coating (up to 450°C)	T5305/40	Heat-resistant silicone acrylic coating up to 450°C is a type of self-primer and is formulated using protective and heat-resistant aluminum pigment, and it is used to protect all types of structures such as the body of furnaces and chimneys , converters, boilers and other thermal installations.
Silicone primer/ coating (up to 650°C)	T5105/60	Heat-resistant silicone coating up to 650°C is a type of self-primer and is formulated using protective and heat-resistant aluminum pigment, and it is used to protect all types of structures such as the body of furnaces and chimneys, converters, boilers and other thermal installations.
Alkyd primer/ coating (up to 200°C)	T1105/20	This product is formulated on the basis of short-oil alkyd resin, using protective and heat-resistant aluminum pigment. It is used as heat-resistant coating for continuous temperature of 200°C and non-continuous 250°C to protect all types of metal structures.

3.Flooring coatings group

Saba's flooring coatings group is divided into two groups.

The first one, is designed and formulated based on epoxy resin and solvent-free polyamine hardener.

This products group is ideal for covering floors of workshops or warehouses in food industries, chemical industries, textile and pharmaceutical industries, electrical industries, military industries, hospitals, airports, factories, sports halls and other industrial environments.

Advantages of this products group: self-leveling, good adhesiveness on the concrete surface, beautiful surfaces and ease of cleaning, suitable abrasion and mechanical resistance, stability against all kinds of chemicals, hydraulic oils, diesel, acids, alkalis and water.

The second one, is designed and formulated based on methyl methacrylate resin (MMA).

This product is an ideal flooring coating for places that have very high temperature fluctuations and stress, high traffic, and cannot stop or shut down.

Advantages of this products group: very fast curing (20-30 minutes), application at low temperatures (even negative) low maintenance cost, stability against UV, very high adhesion to surfaces, resistance to abrasion, pressure and temperature, minimum shrinkage during curing and as a result reducing possible cracks in the surface.

Product	Technical Code	Application
Polyamide epoxy primer (special for concrete surfaces)	L3100	This product is used to saturate the porous concrete surfaces and while protecting the concrete, it increases the adhesion of the next layers of the flooring system.
Polyamine epoxy mastic	Xf3210	This product is applying on concrete primer and is used for infrastructure operations such as filling concrete cracks and voids up to 5 mm deep and masticating surfaces.
Polyamine epoxy middle flooring coating	FIF3210	This product has the general properties of epoxy flooring, such as abrasion, mechanical and chemical resistance, and is designed in such a way that its purpose is to make the implementation of flooring cost-effective.
Polyamine epoxy top flooring coating	FF3210	In addition to making the surface beautiful and easy to clean, this product prevents the creation of pollution and dust caused by the wear of concrete surfaces and is also very resistant to chemical corrosive agents, mechanical stresses and temperature changes.
Phenolic epoxy flooring coating	FF3410	Due to its excellent resistance to chemicals, this product is a suitable choice for concrete floors of workshops or warehouses of chemical industries, textile and pharmaceutical industries and other industrial environments.
Polyamide antistatic epoxy primer	P3110	This product is used to establish the copper tape network and strengthen the transfer of electric charge before applying antistatic flooring.
Polyamide antistatic epoxy top coat	FAF3210	The special feature of this flooring is the non-accumulation of static electric charge and discharge to the earth in order to establish safety in environments such as production halls and warehouses of food, chemical, electronic industries gas stations, etc., where there is a possibility of sparking due to static electricity
MMA primer flooring coating	MKP	This product is used to saturate the porous concrete surfaces and while protecting the concrete, it increases the adhesion of the next layers of the flooring system.
MMA middle flooring coating	MKM	This product, having the general properties of MMA flooring, is used as a thickener and filler for seams and voids on the surface.
MMA top flooring coating	MKT	In addition to making the surface beautiful and easy to clean, this product prevents the creation of pollution and dust caused by the wear of concrete surfaces and is also very resistant to chemical corrosive agents, mechanical stresses and temperature changes.

4.Polyurethane coatings group

Saba's polyurethane coatings group is designed and formulated based on acrylic polyol resin and isocyanate hardener according to SSPC-Paint36 and ISO 12944 international standards.
This product is used as a top coat in the covering system of atmospheric environments exposed to sunlight and can be applied on a wide range of primers and intermediate coatings.
The special advantages of this product group include excellent resistance to weathering, UV, rain and wet-dry cycles, excellent abrasion and chemical resistance, protection of the underlying anti-corrosion layers and high flexibility.

Product	Technical Code	Application
Polyurethane top coat (Matte)	T4110-M	This product group is used as a top coat (enamel) on a wide rangeof primers and intermediate coatings in coating systems exposed to different weather conditions. It is also possible to produce this product in various colors according to RAL K7 and glossiness and different drying times (normal and fast dry).
Polyurethane top coat (Semi-matte)	T4110-SM	
Polyurethane top coat (Semi-gloss)	T4110-SG	
Polyurethane top coat (Gloss)	T4110-G	
Polyurethane top coat (High-gloss)	T4110-HG	
Polyurethane tint base A	T4110-BA	This product is used as a base material for the production of polyurethane top coat (enamel) mostly for bright colors, which is colorless and can be produced in different glossiness. In order to produce the desired polyurethane color according to Ral K7, this product is tinted with Saba polyurethane pastes according to the special formulation provided
Polyurethane tint base C	T4110-BC	This product is used as a base material for the production of polyurethane top coat (enamel) mostly for dark colors, which is colorless and can be produced in different glossiness. In order to produce the desired polyurethane color according to Ral K7, this product is tinted with Saba polyurethane pastes according to the special formulation provided.
Polyurethane paste	T4110-P	As a pigment agent, this product is available in different colors and is used to tint with polyurethane base A or C with a special formulation ratio in order to achieve the desired color according to Ral K7.

5.Alkyd coatings group

This product group is designed and formulated based on alkyd resin, and in addition to decorative uses, it has properties such as resistance to medium corrosive environments and color stability, and therefore it can be a suitable option for covering all types of metal structures and equipment. Among the other special advantages of this product, we can mention things such as different glossiness, economic price, ease of apply and proper drying.

Product	Technical Code	Application
Iron oxide alkyd primer	P1106	It is used as a primer for the protection of construction and industrial metal facilities in C1, C2 and C3 corrosive environments, and in order to provide proper protection, it is covered with alkyd enamel.
Zinc phosphate alkyd primer	P1101	It is used as a primer for the protection of construction and industrial metal facilities in C2, C3 and C4 corrosive environments, and in order to provide proper protection, it is covered with alkyd enamel.
Zinc chromate alkyd primer	P1102	It is used as a primer for the protection of construction and industrial metal facilities in C3 and C4 corrosive environments, and in order to provide proper protection, it is covered with alkyd enamel.
Alkyd enamel	T1110	This coating can be used as a top coat in desired colors and glossiness, and according to the type of use, it can be used in construction facilities and metal structures.
Alkyd primer – enamel (Matte)	T1510-M	This coating with matte glossiness can be used both as a primer and top coat in desired colors and according to the type of use, it can be used in construction facilities and metal structures.
Alkyd primer – enamel (Semi-matte)	T7210-SM	This coating with semi-matte glossiness can be used both as a primer and top coat in desired colors and according to the type of use, it can be used in construction facilities and metal structures.
Alkyd primer – enamel (Semi-gloss)	T7210-SG	This coating with semi-gloss glossiness can be used both as a primer and top coat in desired colors and according to the type of use, it can be used in construction facilities and metal structures.

6.Other protective coatings

Product	Technical Code	Application
Vinyl wash primer	P8102	This product is formulated based on polyvinyl butyral resin (PVB), zinc chromate and phosphoric acid and can be recoated with a wide range of paints. Due to its excellent adhesion properties, this product is also used as a tie coat on zinc-rich ethyl silicate coatings.This product is used as a wash /etch primer to cover steel structures as well as aluminum, galvanized and stainless-steel surfaces that are placed in corrosive atmospheric environments.
Melamine alkyd paint	T1300	This paint is designed and formulated on the basis of alkyd-melamine resin and is baked at the temperature of the furnace. Among the properties of this product after baking in the oven, we can mention its glossiness and very good appearance , excellent resistance to yellowing, thermal stability, water resistance, abrasion resistance, adhesion and excellent color stability.
Polyamine epoxy varnish	LF3200	This product is designed based on epoxy resin and polyamine curing agent in solvent-free, transparent and colorless form. The adhesion properties of epoxy varnish are very high and it has good resistance to corrosion, stresses, impact and scratches.Features and usage: reducing the rate of erosion of concrete against environmental corrosion, washable, mechanical shock strength, excellent compressive strength and transparent appearance.
Polyurethane varnish	L4100	This product is designed based on acrylic polyol resin and isocyanate hardener in such a way that it has excellent adhesion on various concrete, stone and wooden surfaces. Features and usage: To protect the background patterns and designs, excellent resistance to weathering, UV, rain and wet-dry cycles, high flexibility and excellent abrasion and chemical resistance.

NOTE

SABA

PROTECTIVE COATINGS

SABA SHIMI ARYA

Road Markings, Protective coatings

Architectural Paints

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