

# Marine Coatings

## Underground Preparation

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# Contents

- Introduction
- Underground pre-treatment in general
- Underground pre-treatment methods
  - Derusting
  - Abrasive blasting
  - Pickling, cleaning, de-greasing
    - Zinc substrates
    - Aluminium substrates

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# Introduction

The preparation of the surface is of great importance for the quality of the coating!!!

Quality is dependent on the adhesion of the coating to the underground

→ the better the preparation, the better the paint adhesion, and therefore the higher the quality of the coating

# Underground Preparation in General

The preparation can be divided into cleaning and preparation.

Substrate	Pollution	Cleaning	Preparation
Metals	Metal Shavings, Oils, Grease, Scale, Rust, Oxides, Flash Rust, Dust, Silicone, Old Coatings	Mechanical: Wiping, Grinding, Polishing, Brushing, Abrasive Blasting	Primers (Wash-, Shop- Primers), Phosphating, , Chromatising, Priming
		Thermal: Flame Blasting	
		Chemical: Pickling, Cleaning with Solvents or Aqueous Cleaners	
Plastics	Grease, Oils, Separation Agents, Dust, Hand Sweat	Mechanical: Rubbing, Blowing, Rinsing	Flaming, Plasma-Process, Corona-Discharge, Fluorination, Adhesion Primer
		Chemical: Solvents or Aqueous Cleaners	

# Underground Preparation in General

## Directives for Underground Preparation

- DIN EN ISO 12944, Part 4 und Supplement 1 & 2  
Corrosion protection of steel structures by coatings and sealants – Preparation and examination of the surfaces
- STG-Directive No. 2215  
Corrosion protection for ships and sea constructions

# Underground Preparation in General

## Standard Purity Level according to DIN EN ISO 12944 T 4

- Partial

Surface Preparation Level	Condition of the Prepared Surface
<b>P Sa 2</b>	Nearly all mill scale/rolling skin, rust, loose coatings and atypical materials have been removed. All remaining residues must adhere firmly.
<b>P Sa 2 1/2</b>	Adhered coatings have to be intact. Remaining traces can only be recognised as a shading.
<b>P Sa 3</b>	Adhered coatings have to be intact. The surface has to have a uniform metallic appearance.
<b>P Ma</b>	Adhered coatings have to be intact. Remaining traces can only be recognised as shading.

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# Underground Preparation in General

Standard Purity Level according to  
DIN EN ISO 12944 T 4

Manual Derusting

Surface Preparation Level	Condition of the Prepared Surface
<b>St 2</b>	Loose mill scale/rolling skin, rust, loose coatings and loose atypical pollutions have been removed.
<b>St 3</b>	Loose mill scale/rolling skin, loose rust, loose coatings and loose atypical pollution have been removed. The surface must have a metal based shine.
<b>FI</b>	Mill scale/rolling skin, rust, coatings and all atypical pollution have been removed. Remaining traces are only recognisable as shading of the surface in various colours.
<b>Be</b>	Mill scale/rolling skin, rust, coatings and all atypical pollution have been removed. Coatings must have been previously removed by suitable means.

# Underground Preparation in General

Standard Purity Level according to  
DIN EN ISO 12944 T 4

Blasting

Surface Preparation Level	Condition of the Prepared Surface
<b>Sa 1</b>	Loose mill scale/rolling skin, loose rust, loose coatings and atypical pollution have been removed.
<b>Sa 2</b>	Nearly all mill scale/rolling skin, rust, coatings and atypical pollution have been removed. All remaining residues must adhere firmly.
<b>Sa 2 1/2</b>	Mill scale/rolling skin, rust, coatings and all atypical pollution have been removed. Remaining traces are only recognisable as shading.
<b>Sa 3</b>	Mill scale/rolling skin, rust, coatings and all atypical pollution have been removed. The surface must have a uniformly metallic appearance.



# Underground Preparation in General

Sa 2½



P Sa 2½



Sa 3



P Sa 3



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# Underground Preparation Methods, Derusting

## ***Manual Derusting, Tools :***

Chipping Hammer, Scraper, Wire Brush, Grinding Block, etc.

**Problem:** very solid layers, can hardly be removed

## ***Mechanical Derusting:***

Rotating Wire Brushes, Rotating Grinding Discs (Angle Grinder),  
Compressed Air Tapper, Needle Gun



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# Underground Preparation Methods, Blasting

**Blasting**, Blasting abrasives are guided with high speed onto resp. over the surface.

The most important blasting processes are:

- **Dry Blasting**
  - The abrasives are blasted over the surfaces by compressed air
- **Damp Blasting (Getoff Company)**
- **Wet Blasting**
  - Water is sprayed with or without abrasives and with or without compressed air under pressure (200 bar) over the object.



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# Underground Preparation Methods, Blasting

## Special Forms of Blasting:

### Blasting Systems:

- Modern blasting systems lead abrasives in a continual circulation during which the abrasives are cleaned.
- Blasting is carried out in closed housings, cabins or halls.

### Flame Blasting:

- The reduced flow of an Acetylene-Oxygen-Flame is guided over the surface.
- Organical layers and impurities are sulphurised/burnt.
- Rust is decomposed, becomes loose/flakes off.

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# Underground Preparation Methods, Blasting

Process	Application	Parameter	Process Data		
			Material Removal after 40 s	Change in the Surface Roughness $R_t$ for Steel	
				before	after
Wet Blasting with $Al_2O_3$	Rust removal from surfaces, preparation for painting with low metal abrasion	Abrasive $Al_2O_3$ $d = 90-150 \mu m/H_2O$ Pressure 300-600 kPa	4 $\mu m$	3,0	5,5
Wet Blasting with Glass Beads	Removal of thin impurity layers, cleaning and smoothing with lowest metal abrasion	Abrasive Glass Beads, $d=150-200 \mu m/H_2O$ Pressure 300-600 kPa	2 $\mu m$	0,9	1,7
Dry Blasting with $Al_2O_3$	Removal of corrosion products, roughening for following painting	Abrasive $Al_2O_3$ $d = 90-150 \mu m$ Pressure 50-600 kPa	$\approx 50 \mu m$	4,5	7,5
Dry Blasting with Steel Shot	Removal of thick scale and old paint layers with considerable metal abrasion	Abrasive angular steel shot $d= 200-$ Pressure 300 kPa	$\approx 25 \mu m$	3,5	8,5

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# Underground Preparation Methods, Abrasives

	<b>Glass Beads:</b>	Gentle cleaning of sensitive surfaces (moulds, tools, engine parts, turbine blades), compacting of non-ferrous metal surfaces , surface finish of metal and glass workpieces, matting of stainless steel.
	<b>Broken Glass:</b>	Cleaning of casting moulds, wood working, roughening of aluminium and non-ferrous metals.
	<b>Ceramic:</b>	Gentle cleaning of sensitive surfaces (moulds, tools, engine parts, turbine blades), compacting of metal surfaces, surface finish.
	<b>Corundum, Pure:</b>	For blasting tasks, for which iron-based blasting means are not permissible due to the related risk of rust and magnetisation, and for extremely hard workpieces.
	<b>Corundum, Mixed:</b>	Cleaning by blasting, blasting out, surface matting, iron content approx.. 0.2%.
	<b>Corundum, Normal:</b>	Cleaning by blasting, blasting out, surface matting, iron content approx.. 0.15%.
	<b>Cast Steel:</b>	De-burring and compacting of light metal surfaces.
	<b>Chilled Cast Iron, round:</b>	Shot cleaning, filling from behind in foundry moulds, shielding material in nuclear power plant sector.
	<b>Chilled Cast Iron, angular:</b>	fettling, descaling, derusting, roughening of iron and steel parts prior to coating.
	<b>Shell Granules:</b>	Gentle cleaning, deburring of sensitive surfaces, mould cleaning.
	<b>Synthetic Abrasives:</b>	cleaning of extruding dies in plastic processing, paint removal, deburring of plastic parts, cleaning of monuments, sculptures and antiques..

# Underground Preparation Methods, Pickling, Cleaning, Degreasing

## ***Pickling***

Chemical dissolvment of oxide coatings and other corrosion products on metal.

## ***Pickling Agents***

Diluted sulphuric acid, hydrochloric acid, phosphoric acid.

## ***Cleaning and Degreasing***

Removal of all foreign substances (oils, grease, salts, dust etc.) from the substrate surface.

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# Underground Preparation Methods, Pickling, Cleaning, Degreasing

Classification	pH-Value	Ingredients	Application Areas
Highly alkaline	10,5 - 13	<ul style="list-style-type: none"> <li>• Alkalis</li> <li>• Silicates</li> <li>• Phosphates</li> <li>• Complexing agents</li> <li>• Tensides</li> </ul>	<ul style="list-style-type: none"> <li>• Steel</li> <li>• High pollution</li> <li>• High cleaning requirements</li> </ul>
Weak alkaline	8 - 10	<ul style="list-style-type: none"> <li>• Phosphates</li> <li>• Borates</li> <li>• Carbonates</li> <li>• Activating agents</li> </ul>	<ul style="list-style-type: none"> <li>• Steel, Zinc, Aluminium, and alloys</li> <li>• High cleaning requirements</li> </ul>
Neutral	7 - 9,5	<ul style="list-style-type: none"> <li>• Tensides</li> <li>• Corrosion inhibitors</li> <li>• Phosphates</li> <li>• Solubilisor agents</li> </ul>	<ul style="list-style-type: none"> <li>• Steel, Zinc</li> <li>• Pre-Cleaning and corrosion protection</li> </ul>
Weakly acidic	3,5 – 5,5	<ul style="list-style-type: none"> <li>• Acidic alkali phosphate</li> <li>• Tensides</li> <li>• Accelerators</li> </ul>	<ul style="list-style-type: none"> <li>• Cleaning and phosphating of steel and zinc</li> <li>• Cleaning of aluminium</li> </ul>

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# Underground Preparation Methods, Zinc Coated Surfaces

## Problem:

The zinc plating is only a few  $\mu\text{m}$  thick

- Hot Dip Galvanising 80-120  $\mu\text{m}$
- Zinc Electroplating 2-20  $\mu\text{m}$

→ not all mechanical processes are suitable

## *Suitable Surface Preparation Methods:*

- Ammoniacial wetting
- Steam Blasting, Highpressure Cleaning (+Cleaning Agent)
- The use of Corundum-Plastic-Fleece (by hand)
- Light Blasting (Sweeping)

# Underground Preparation Methods, Aluminium Surfaces

## Problem:

In a bright metallic condition, aluminium is always covered by a thin, but dense protective oxide coating.

→ very poor adhesion for following paint coatings.

## *Suitable Surface Preparation Methods:*

- Removal of existing oil coatings with a suitable cleaner.
- Phosphoric acid steam-blast cleaning.
- Roughening of the surface e.g. with Nylon fleece.
- Possibly powder/dust blasting, surface roughness 4-6  $\mu\text{m}$ .

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