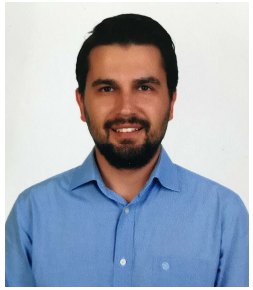
Coating on Marine Environment

Sertac Kesebol

14.05.2024



Certificate of Achievement
Level II

This is to certify that:

Sertac Kesebol

has successfully completed the

Corrodere / PPG Protective and Marine Coatings Inspector Training Programme in association with MPI

Education :

2005 – 2011	**Anadolu University (Eskisehir)**
	Business, Bachelor Degree, 70/100
2019 –	**Yildiz Technical University (Istanbul)**
	Naval Architecture and Marine Engineering, PhD.
2008 – 2012	**Yildiz Technical University (Istanbul)**
	Naval Architecture and Marine Engineering, Master Degree, 3,70/4,00
Thesis	:(Breakdown and Reasons in Dynamic Parts of Marine Diesel Engines)
2003 – 2007	**Yildiz Technical University (Istanbul)**
	Naval Architecture and Marine Engineering, Bachelor Degree, 3,27/4,00
Thesis	:(Paint to be used on Vessels/Ships and Antifouling Paints)
2002 – 2003	**Yildiz Technical University (Istanbul)**
	English School of University
1998 – 2002	**Tuglacılar High School (English) (Tekirdag)**
	High School

Experience :

November 2021 –	**SGMCOATING YUZEY TEKNOLOJILERI SAN. TIC. LTD. STI.** Managing Director
March 2011 - November 2021	**PPG INDUSTRIES KIMYA SANAYI VE TIC. A.S.** PPG/SIGMA Marine Key Account Manager
February 2008 - July 2009	**UNISERVICE TURKIYE** Executive for Sales, Marketing, Purchasing and Supply
November 2007 - February 2008	**UNISERVICE TURKIYE** PPG/Ameron Technical Advisor for Paint - According to technical specification and current issues, controlling the surface preperation, paint applications, checking the conditions after application and reporting the results.

Internship :

August 2009 - March 2010	**ARKAS DENIZCILIK NAKLIYAT A.S.** Engine Staff on MV Tomriz A

1. Corrosion
2. Surface Preparation Methods
3. Paint Technology
4. Paint Application Methods
5. Paint Defects
6. Dry-dock Operations

1. CORROSION

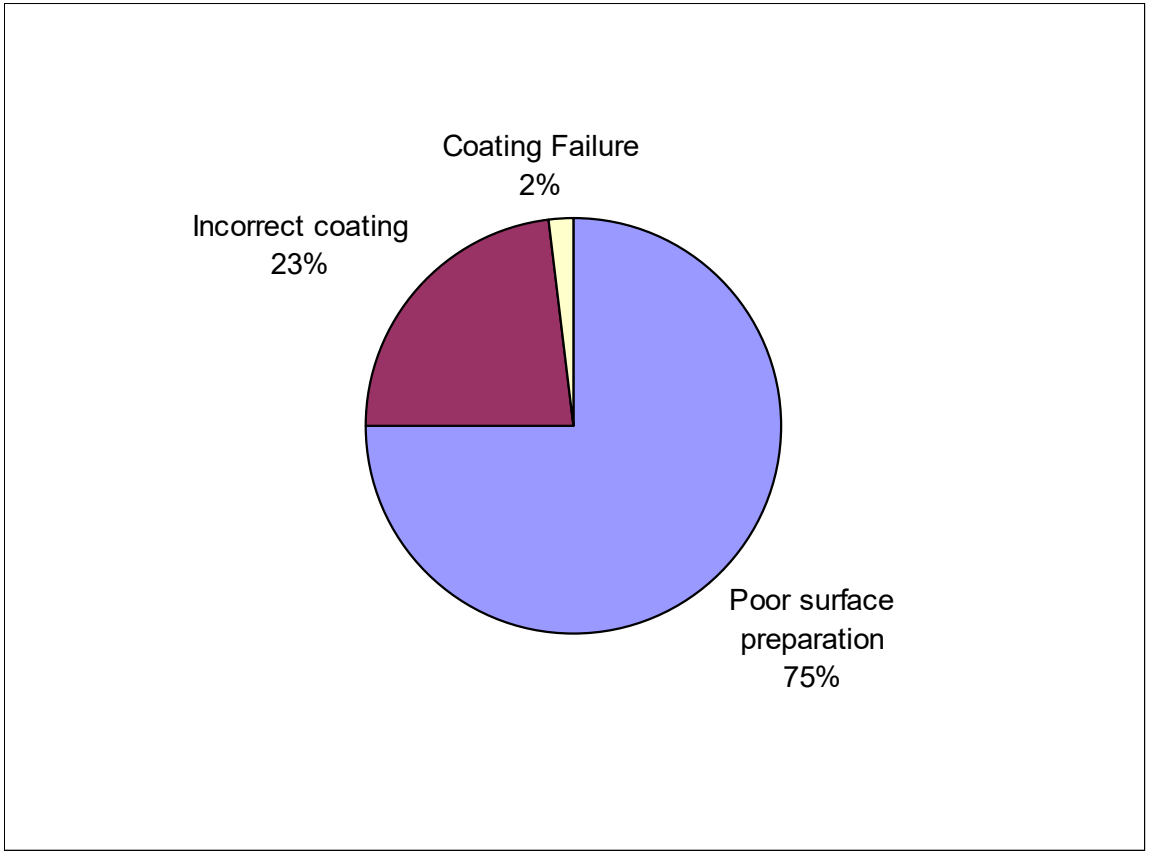
- Corrosion is a reaction between a metal and the surrounding environment.
  - Atmospheric
  - Immersed
  - Chemical
- The corrosion rate depends on the properties of the metal and the corrosivity of the environment.
  - High Humidity
  - Saline condition
- Corrosion is dissolution of metal, involving release of electrons:

$$Fe \rightarrow Fe^{2+} + 2e^{-}$$

Types of corrosion

1. High temperature corrosion
2. Chemical corrosion
3. Electrochemical corrosion
4. Galvanic corrosion
5. Crevice corrosion
6. Pitting corrosion
7. Corrosion under mill scale
8. Microbiological corrosion
9. Stress corrosion (e.g. by chloride, sulphur)
10. Etc

2. SURFACE PREPERATION METHODS



Cleanliness:

Removal of contaminants

- Visible items (rust, old paint, grease, mill scale, weld spatters etc)
- Non-visible item (chloride, dust, etc)

Surface profile:

- Anchor pattern

Blisters caused by chlorides

Detachment due to mill scale

Lack of anchor profile

Damage due to sharp edge (low dft, easy to damage)

Irregularity	Problem	Correction
 Sharp corners / edges	 Insufficient thickness, cracks	 Grind to radius of 2 mm
 Spatters / laminations	 Insufficient thickness, cracks	 Grind flush
 Undercuts, bad welds	 Entrapped air	 Fill with weld metal & grind flush

See also ISO 8501-3

Chemical treatment

- Solvent cleaning (organic solvents, emulsion)
- Acid pickling

Mechanical cleaning

- Hand and power tool cleaning (Small areas, steelwork)
- Abrasive blasting
- Water jetting

Thermal cleaning:

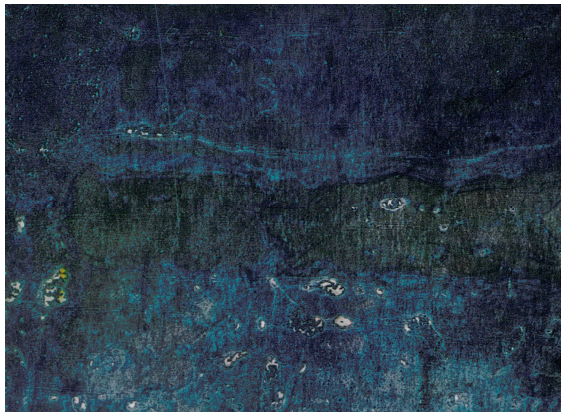
- Steam
- Flame

- Best performance can be obtained by use of abrasive blasting
  - Different methods depending on location, equipment etc.
  - Used standard is mainly ISO 8501-1 but also SSPC
  - Advantage
    - Can remove mill scale and all other hard residues
    - Creates profile
    - High performance of the applied coating system can be achieved depending on cleanliness (Sa 2½ or better)
  - Disadvantage
    - Lot of chemical waste
    - Dust formation

(ISO 8501-1 / SSPC)

ISO	SSPC	Description
Sa 1	SP-7	Brush off
Sa 2	SP-6	Commercial
Sa 2½	SP-10	Near white
Sa 3	SP-5	White

A



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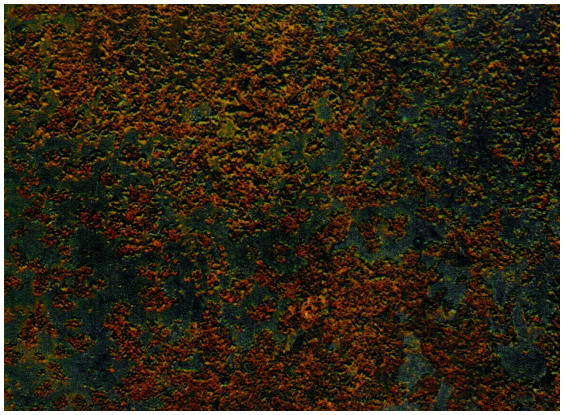
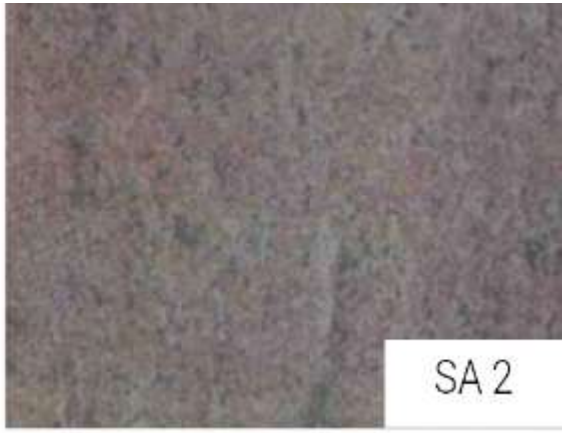


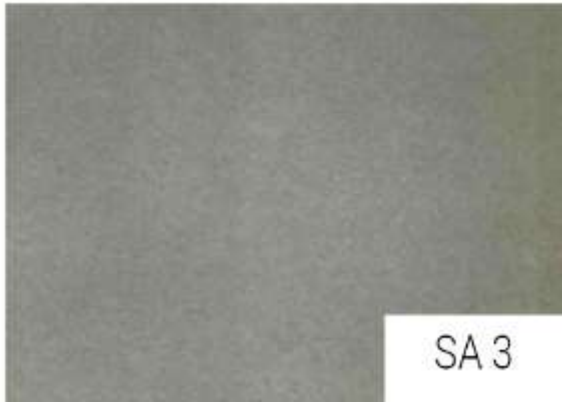
C

D


SA 1


SA 2


SA 2.5


SA 3

- Hand and powertool cleaning:
  - Rust and other contamination could still be present, therefore a Surface Tolerant coating is recommended.
- Blast cleaning
  - Atmospheric:
    - If blasted till Sa 2½ is achieved, zinc epoxy and zinc-silicate primers and other non surface tolerant but also surface tolerant.
    - If Sa 2½ is not achieved a surface tolerant is recommend
  - Immersed:
    - Non-surface tolerant and surface tolerant. NO zinc.
- Water jetting:
  - Surface Tolerant only since the substrate is always flash rusted

3. PAINT TECHNOLOGY

Paint consists of 4 main ingredients

- Binder (resin)
- Pigment
- Solvent
- Additives

BINDERS

- The main ingredient
- Generically how the paint is named
  - Alkyd
  - Epoxy
  - Polyurethane
  - Chlorinated rubber
  - Acrylic
  - Polysiloxane
  - Silicate
- Dictates coating properties

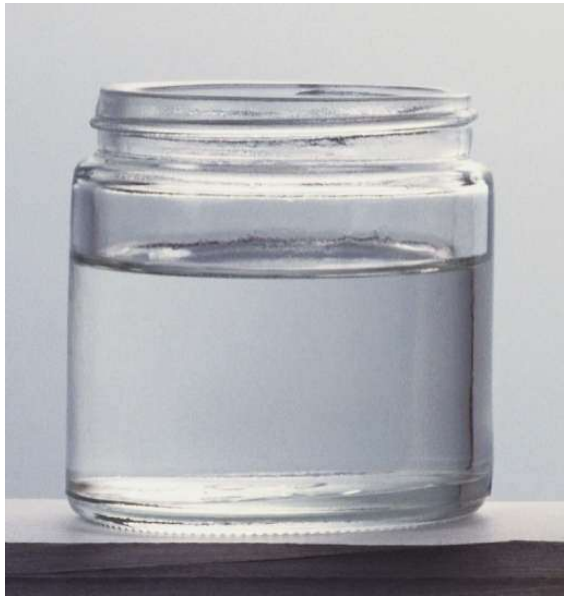
PIGMENTS

Many different types & functions

- Anti corrosive
  - Zinc dust
  - Zinc phosphate
- Colour
  - Titanium dioxide
  - Red oxide (iron oxides)
- Fillers
  - Talc
  - China clay
- Barrier
  - MIO
  - Aluminium

SOLVENTS

- Acts a transport medium
- Enable application
- Effect drying & curing
- Types are
  - Hydrocarbon (white spirit)
  - Alcohols
  - Ketones
  - Aromatics – xylene
  - Water



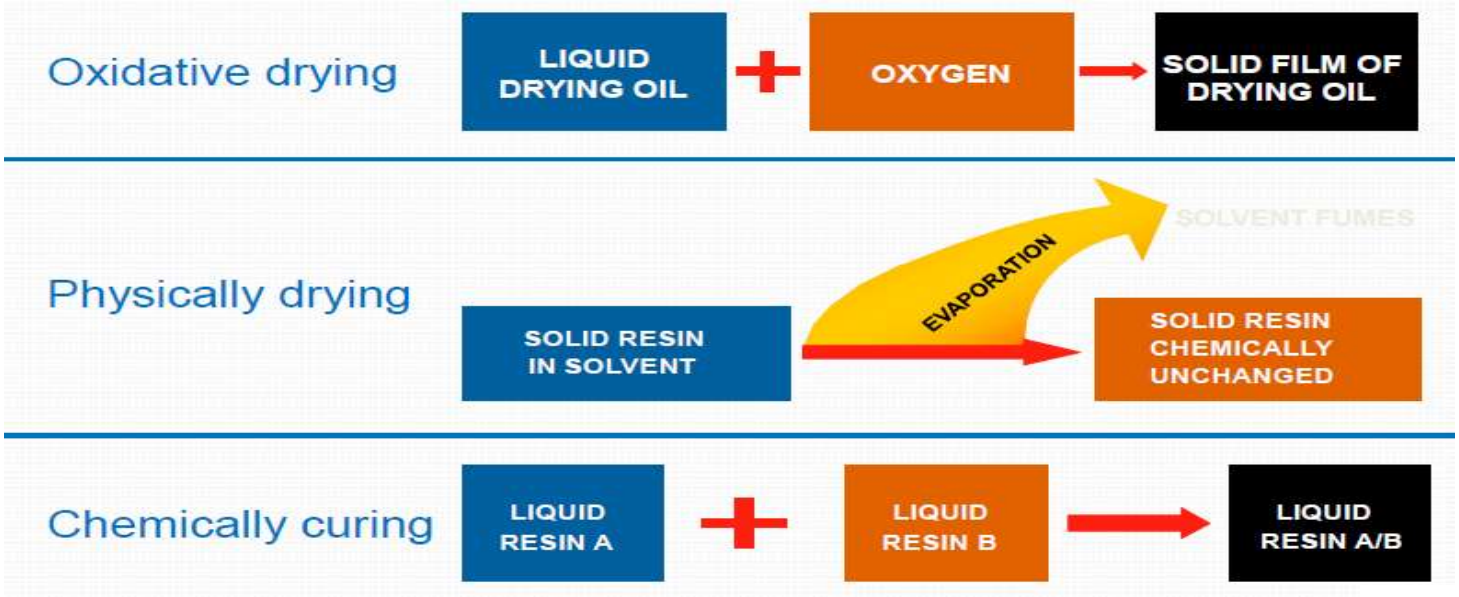
ADDITIVES

Used to offer a range of properties

- Aid dispersion
- Prevent bubbles
- Aid application
- Aid surface wetting (adhesion)
- Structuring agents

3 main methods and categories:

1. Physically drying – Chlorinated Rubber, Epoxy, PU, Acrylic
2. Oxidative curing – Alkyds, Silicates, Polysiloxane
3. Chemically curing – Epoxy , Polyurethane , Polysiloxane



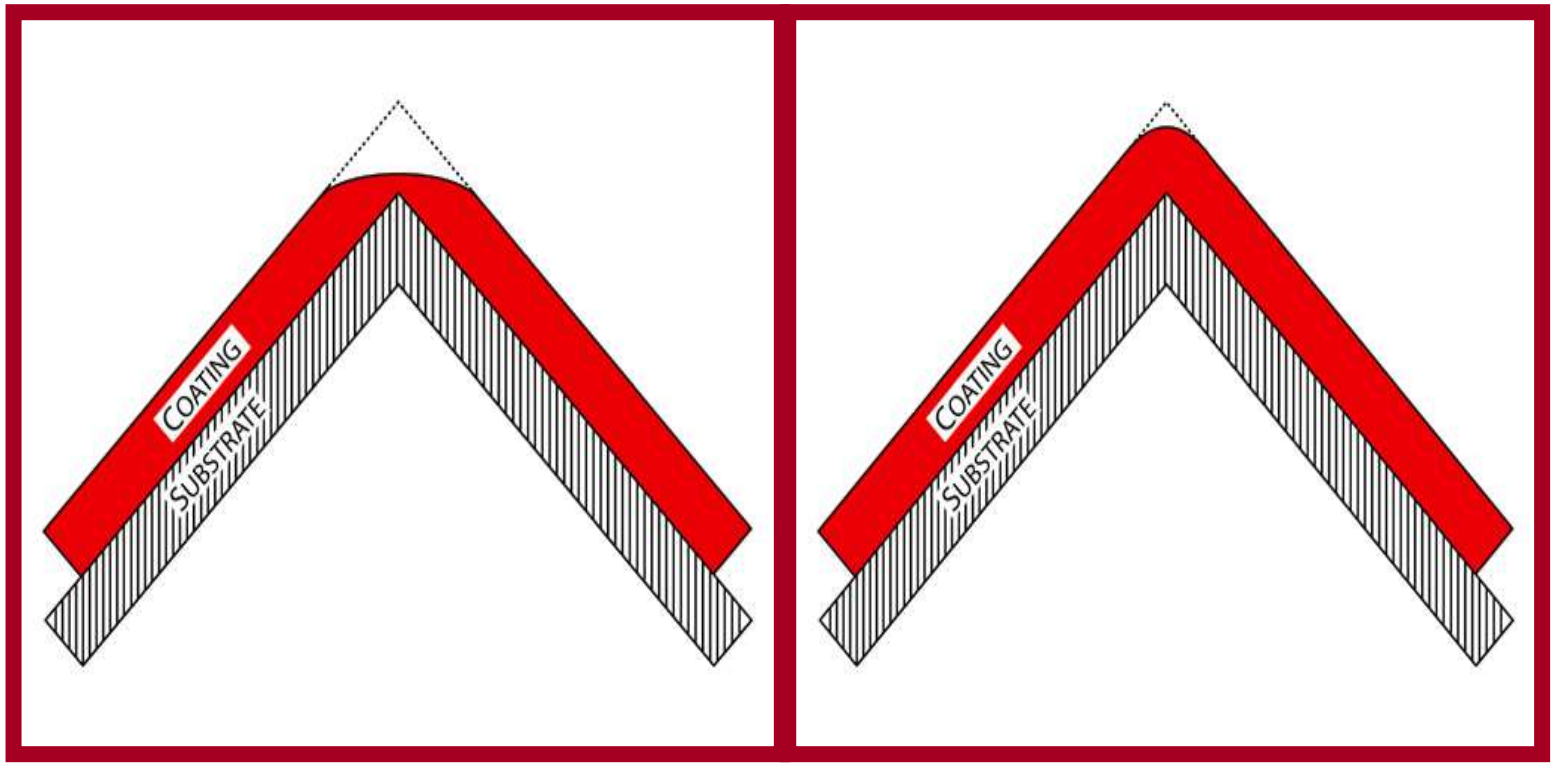
4. PAINT APPLICATION METHOD

- Mixing
- Equipment (spray, brush, roller)
- Wet film thickness
- Dry film thickness
- Film integrity (holiday testing)

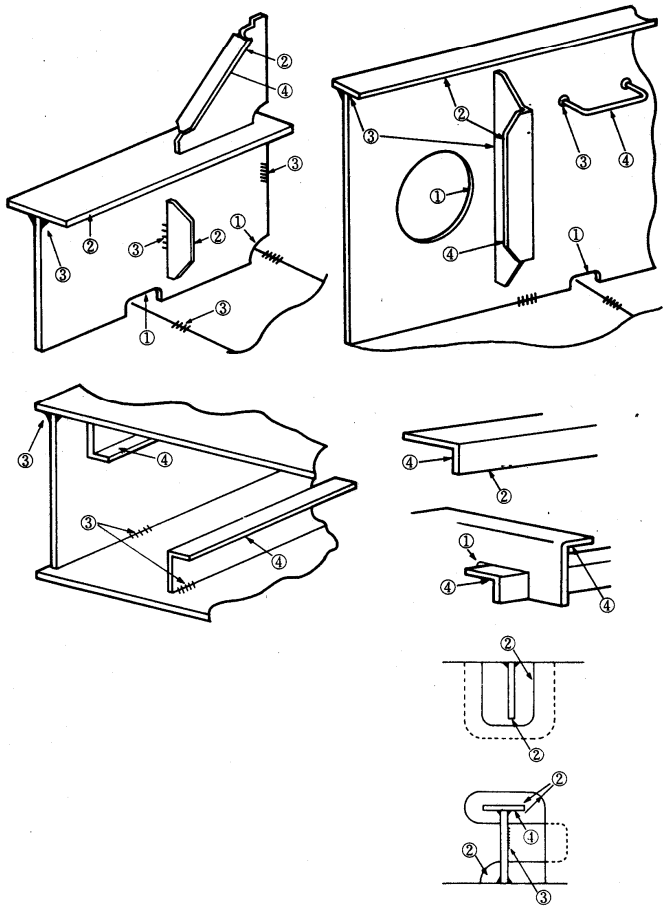
PAINT TEMPERATURE ≥ 15° C

Mixing correct?

- Why Stripe coat



No.	Item	Explanation
㊴	**Stripe coating**	Where airless spraying is difficult and the film thickness can not be kept well, apply stripe coating with a brush before or after the spraying. Stripe coating applied locations are as follows: (a) Inside and edges of holes. . . . . ① (b) Free edges . . . . . ② (c) Manual welding beads. . . . . ③ (d) Where painting is difficult. . . . ④



Stripe coating

Stripe Coating

Enviromental Conditions

Critical Conditions during surface preparation, application and curing are:

- Temperatures
  - Air
  - Steel
  - Material
- Relative humidity
- Dew point

Coating Inspection Equipments

Relative Humidity & Dew Point

Steel Surface Profile comparator

Steel Temperature gauge

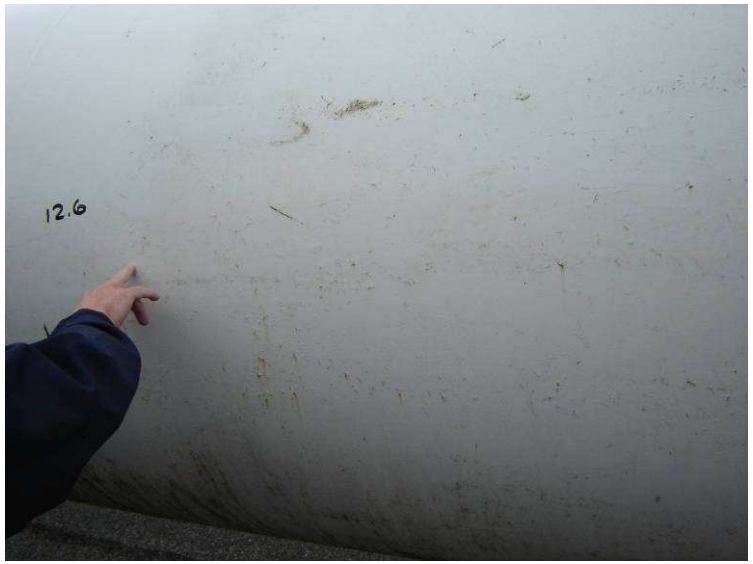
Chlorides / Conductivity meter

5. PAINT DEFECTS

Defects:

- Blistering
- Corrosion
- Pin point rusting
- Delamination
- High / low dft
- etc

- Poor surface preparation
  - Contaminations (e.g. soluble salts)
- Solvent retention
  - Film thickness
  - Overcoating times
  - Ventilation
- Compatibility existing coating system
  - Physical drying products
- Chemical resistance
  - Coating not resistance to cargo
- Other causes like cathodic protection, osmoses etc



Blistering

Pin Point Rusting

In general caused by:

- Non closed film
- Dry spray
- Popping

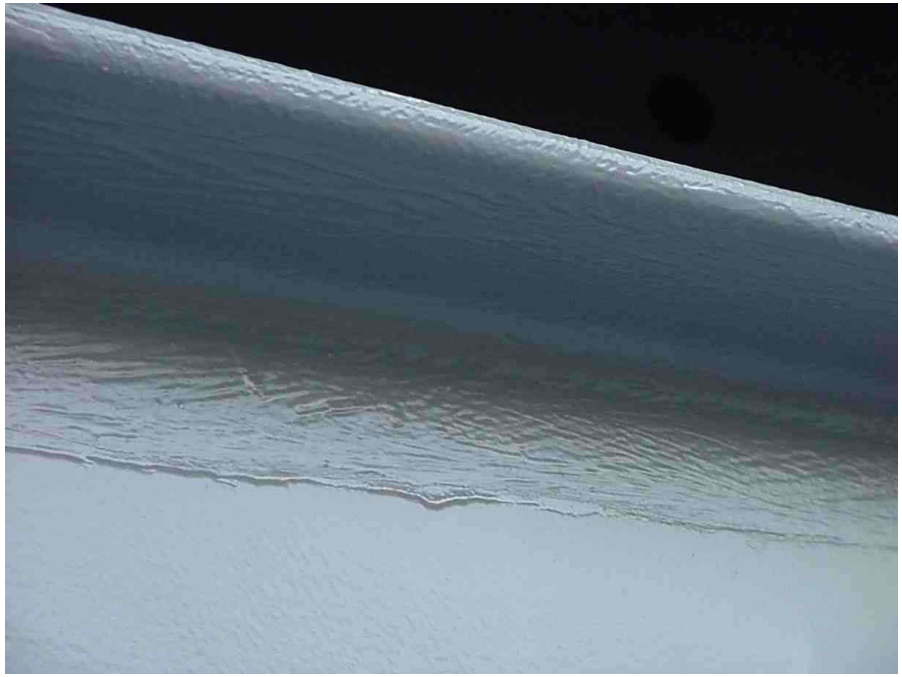
Corrosion

- See “blistering”
- Application
  - Surface preparation
  - Film thickness
  - Stripe coating
- Galvanic action
- Mechanical damages

Delamination

- Surface preparation
- Application
  - Environmental conditions
  - Film thicknesses
  - Ventilation
  - Overcoating times
- Corrosion

High DFT (Dry Film Thickness)



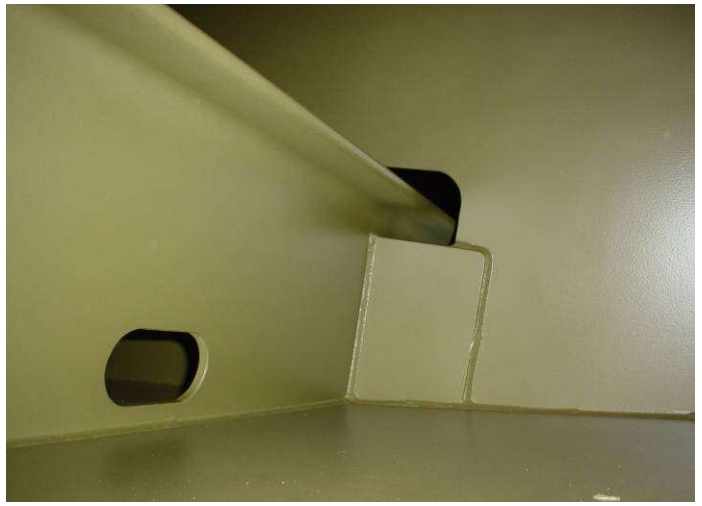
Low DFT (Dry Film Thickness)

Welding

Cracking

Chalking / Discoloration

Bad coating practice



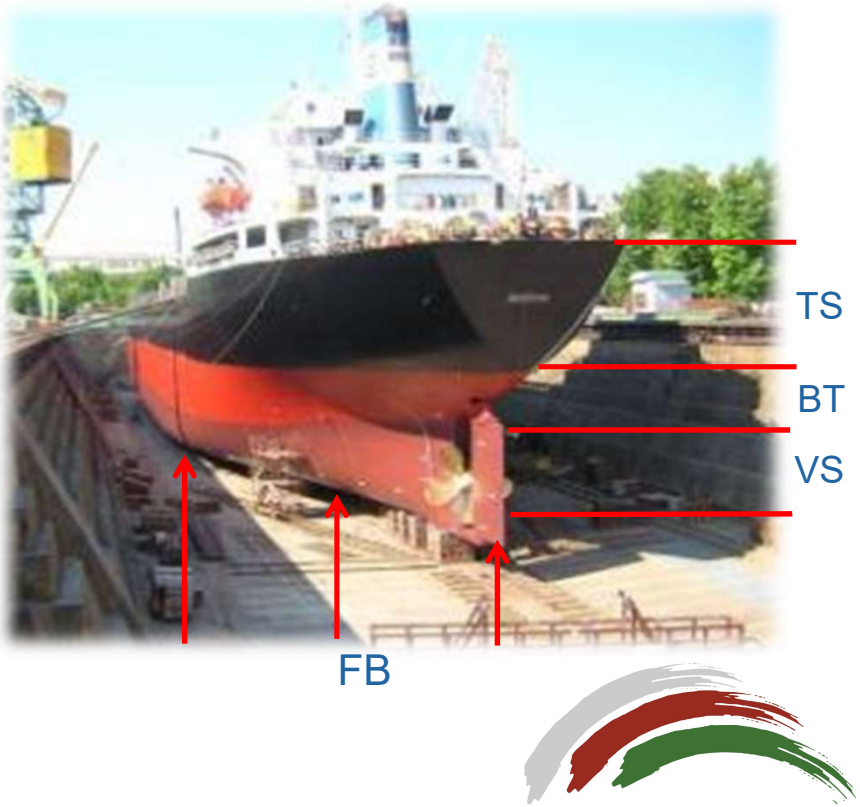
Good coating practice

5. DRY-DOCKING PROCESS

Coating Application & Common Working Practices

Dry-Docking

- Sea going ships need to go in dry-dock for technical inspection by the classification society, every 3 years (36 months).
- For new ships this can be extended to 5 years or even 7,5 years (90 months).
  - **Usually:**
    - Spot repairs on damaged coating
    - Refresher coats (on TS)
    - New antifouling protection
  - **Typical areas:**
    - Ship's sides (TS and BT)
    - Under water hull (VS and FB)
  - **Occasionally:**
    - Seawater Ballast Tanks
    - Potable Water Tanks
    - Cargo Holds / Tanks



Coating Application & Common Working Practices

Dry-Docking – Critical Stages & Challenges:

- **Pre-Docking Preparation**
  - Pre-Docking Survey
  - Last Dry-Docking & Sea-Stock Report
  - Adequate & Compatible Materials Supply?
  - Statistical Local Weather for the season
- **In-Dock Condition Inspection**
  - **Timely & Qualified Survey**
  - **Realistic Estimations**
  - DD Activities & Facilities Planning
- **Surface Preparation & Paint Application**
  - Activities & Procedures Compatibility
  - Drying, Curing & Over-Coating Times
  - Damage & Contamination Prevention
- **Out-Docking & Service**
  - Full Cure / Ready for Service Coatings
  - M&R Procedures & materials

Coating Application & Common Working Practices

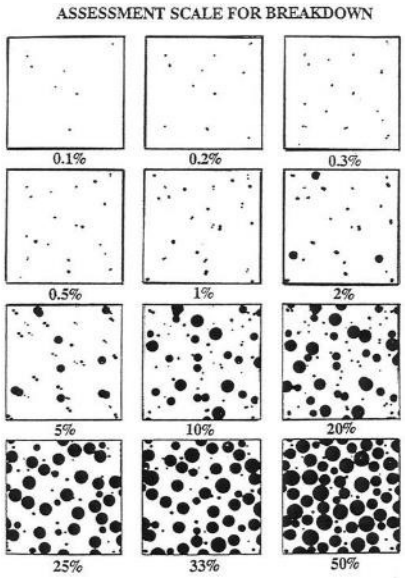
Dry-Docking – Challenges:

- **Logistics:**
  - Locations of the Flagship, Paint Supply & Dry-Docking may be different
  - Local Regulations for Import, Export, Selling & Application may vary
  - Transportation & Storage of Paints in Extreme Weather Conditions.
- **Technological:**
  - Vessels do not go to Dry-Dock for re-coating only!
  - Simultaneous jobs may not be always compatible
  - Critically important equipment may not always be available
- **Weather & Ambient Conditions**
  - Different areas of the hull will be differently exposed to the elements
  - In low wind Dry-Dock may contain microclimate different than outside
  - Water residue on the bottom of the dock may maintain RH higher than outside
  - Strong wind may blow considerable quantities of paint away
  - Paint & Thinners Consumption may considerably be influenced by weather

Coating Application & Common Working Practices

Dry-Docking – Challenges:

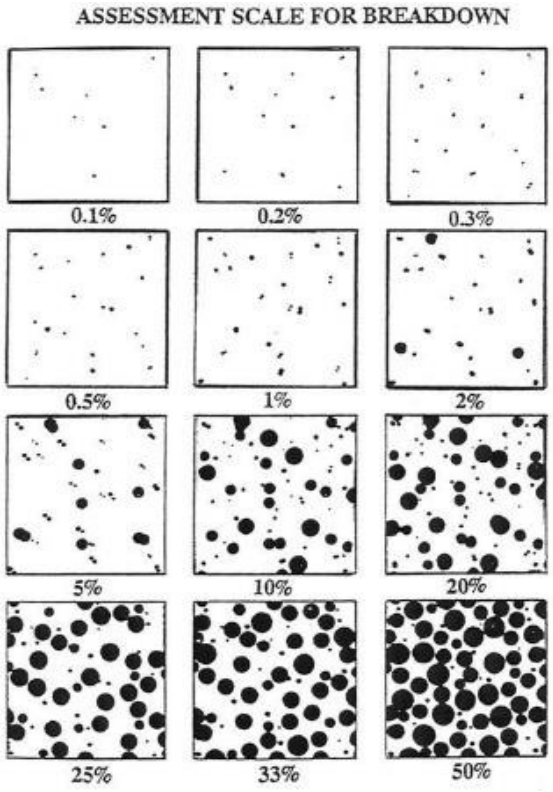
- **Practical assessment of:**
  - Rust damages?
  - Area to Blast-Clean?!
  - Area to Sweep-Clean?!
  - Area to Cover with Paint?!

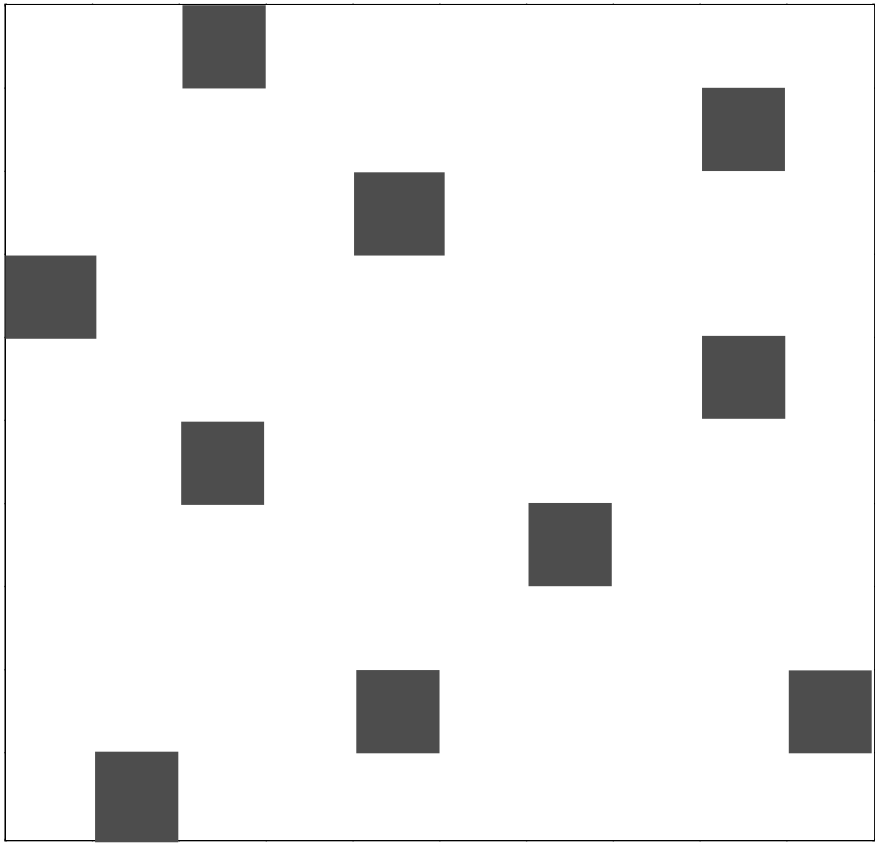


Coating Application & Common Working Practices

Dry-Docking – Challenges:

- **Practical assessment of scattered:**
  - Contamination,
  - Damages,
  - Rust, etc.





Coating Application & Common Working Practices

Dry-Docking – Most Typical Activities









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