Importance of Surface Preparation

• It has been found that about 90% of paint failures are due to poor surface preparation, hence:
  • Surface Preparation is vital.
  • For longer Coating life one requires
    – Not only Clean surface but also
    – Suitable roughness with a definite anchor profile
What are the materials on which surface Preparation is required?

- Steel
- Al, Zn, Cu
- Stainless Steel
- Concrete
- Wood
- Plastic
Sequence of Surface Preparation Activity

- Assessment of surface condition
- Pre-cleaning
- Remedying design or fabrication defects
- Inspection/documentation of cleaning
- Surface Preparation
Factors affecting the life of coating making surface preparation an essential step

- Residual Oil, grease and soil
- Residues of chemical salts
- Rust on the surface
- Loose broken Mill scale
- Anchor pattern too high (too rough surface) or too low (too smooth surface)
- Old coating / existing coating
## Surface Preparation Standards

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<tr>
<th>System</th>
<th>SSPC Codes</th>
<th>NACE</th>
<th>CDN. Govt. (CGSB)</th>
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Solvent Cleaning

• SSPC SP-1
  – Cleaning can be done with wiping with cloth or rag, solvent spray, vapor degreasing, emulsion etc.

• Organic Solvents – oil and grease
  – Kerosene, Toluol etc.

• Alkaline – NaOH, Trisodium Phosphate

• Acid Cleaning: Organic Acids – remove soils by chemical reaction.
Solvent Cleaning

Water Wash

Alkali wash
Manual hand Cleaning

• Remove Loose Mill Scale, rust, paint
• SSPC –SP2 and ISO 8501 S12 or S13
• Tools used are: Wire Brush, scrapers, chisel, knife, chipping hammer
Manual hand Cleaning
Manual hand Cleaning
Power Tool Cleaning

- SSPC SP-11 using which surface profile is also achieved using special tools
- Grinding Wheels
- Vibrating wire brush
- Sand wheel
Power Tool Cleaning
Power Tool Cleaning
Blast Cleaning

- NACE No.1/SSPC-SP5 – Full white metal
- NACE No.2/SSPC-SP10 – Near white metal
- NACE No.3/SSPC-SP6 – Commercial Blast cleaning
- NACE No.4/SSPC-SP7 – Brush cleaning
- ISO 8501 Sa1 - Virtually Clean metal
  - Sa2 - Light Blast Cleaning
  - Sa2½ - Near while Metal
  - Sa3 - Thoroughly clean metal
Blast Cleaning Equipments

- Pressure Blasting
- Centrifugal Blasting
- Airless Blasting

Surface Cleanliness

- Must be free from oil and grease
- NaCl
- Standard to be followed SSPC
- ISO 8501-1 1998
Pressure Blasting System
Mositure Separator

Pressure Blasting Equipment
Centrifugal Blast Cleaning

Typical wheel assembly throwing abrasives

Control cage setting and Typical blast pattern
Pressure Blast Cleaning
Pressure Blast Cleaning
SWEDISH STANDARDS

ISO 8501-1 Sa1

ISO 8501-1 Sa2

ISO 8501-1 Sa2½

ISO 8501-1 Sa3
Grades of various kind of rust

Grade A

Grade B

Grade C

Grade D
Blast Cleaning Apparatus for Industrial Applications
Site Blasting Equipment
Blasting Efficiency

• Condition of the material influences speed and velocity
• Quality of surface to be blasted – difficult surfaces require heavier grit and high blasting pressure

Air pressure efficiency

• 100 psi at nozzle gives 100% efficiency.
• 80 psi at nozzle gives 66% efficiency
• 66 psi at nozzle gives 50% efficiency
### Compressed Air and Abrasive consumption

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Rate of Cleaning is affected by

- Air availability
- Nozzel size and type
- Type of equipment used
- Condition of surface to be cleaned
- Surface Cleanliness standard to be required
- Distance of nozzel from the surface.
Type of Abrasives

• **Chilled iron grit or shots**
  – Widely used, variety of grades, excellent for general purpose, very hard

• **Crushed slag – Cu Slag, Al Slag, coal slag**
  – Once only used, Cheap,
  – Cu Slag – $\text{SiO}_2(38\%), \text{Al}_2\text{O}_3$, $\text{TiO}_2$, $\text{Fe}_2\text{O}_3$, FeO(42%), MnO, MgO, CuO is only 0.47%

• **Naturally Occurring Grits**

• **Ceramic Grits**
  – Expensive, effective cutting action, effective at lower pressure, reusable.
Abrasive Types

Chilled iron grit

Crushed Slag
Ceramic Grid

Expensive, better control on profile, thin film blasting
Surface Profile measurement

• Comparing standard coupons
  – Available in 12-75 um

• Replica Tapes

• Dial gauge to measure the depth
Coupon Comparator
Replica Tapes

HOW REPLICA TAPE WORKS:

1. Before burnishing
2. During burnishing
3. After burnishing
Surface Profile Measurement

Dial Gauge

Surface Profilometer
Factors affecting Surface Finish

- Temperature
- Relative humidity
- Dew Point
- Environmental exposure
Water Blast Cleaning

- Water dumps down dust emission
- Water washes away soluble contaminants
- Water Jetting
  - Water alone at High Pressure
- Water Blast
  - Abrasive is used with water
- Problem Use of inhibitors is required in order to prevent rusting of blasted surface
Classification of various Water Jetting /Blasting Methods

- **Low pressure water cleaning (LPWC)**
  - Water pressure below 5000 psi (34 MPa)

- **High Pressure water cleaning (HPWC)**
  - Water pressure between 5000 – 10,000 psi (34-70 MPa)

- **High Pressure Water Jetting (HPWJ)**
  - Water Pressure between 10000-25,000 psi (70-170 MPa)

- **Ultra High Pressure Water Jetting (UHPWJ)**
  - Water Pressure above 25,000 psi (above 170 Mpa)

- **Sand Injected water Blasting** – Water is used as shrouding for sand.

- **Slurry Blasting** – water and sand are mixed together at pot.
Advantages of Water Blasting/Jetting

- **LPWB**
  - Usually a washing technique,
  - removes soluble matter,
  - cleans marine growth below the ship.

- **HPWB**
  - Used to prepare Concrete Surfaces,
  - can cut steel plates,
  - production rate is low,
  - only lose contaminants are removed

- **HPWAJ**
  - Rarely used – as not much benefit from HPLC
  - Production rate is not cost effective

- **UHPWJ – 30,000 – 35,000 psi**
  - Great care is required
  - Efficient cleaning with little water as 8l/min.
  - Optimum distance of Blast 2 inch
Water Jetting
Use of Water Jetting to Remove Thick Scales

Ultra High Pressure Water Jetting
Ship under Hull Cleaning by Water Jetting
Slurry Blast Cleaning

Slurry Water Blasting

Water shrouded Abrasive Blasting
Approaches to Surface Finish

• For an unpainted surface
  – Need to remove the mill scale
  – Blast cleaning the most effective method
  – For Al, Zn chemical cleaning followed by acid etch
    primer is required

• Corroded surface
  – Hand or power tool cleaning
  – Blast Cleaning
  – Water jetting

• Galvanized Surface

• Passive ZnO or ZnCO$_3$ to be removed

• Light Blast cleaning or acid based solution
THANK YOU
FOR YOUR PATIENCE HEARING