Marine Coatings

Application of Coating Materials

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Contents

Introduction

There are a number of various existing procedures to transfer the preliminary paint product into the end product of a paint coating.

Ideal Paint Coating:

- Careful pre-treatment of the underground
- Selection of the correct application process
- Drying

Overview of Application Processes

Application Process	Surface Quality	Restrictions			Working Speed	Solvent Emissions	Application Efficiency
		Dimensions	Geometry	Others			
Brushing	medium to good	Small Areas	-	-	very good	low	very good
Rolling	good		Accessibility	-	medium	low	very good
Pouring	very good	Working width restricted	Nearly level surface	-	high	low	very good
Rolling/ Coil Coating	medium to good	Working width limited	Level surface	-	very high	low	very good
Conventional Dipping	medium	Object volume limited	No scooping parts	Edge Thinning	high	low	very good
Flooding	medium	Object volume limited	No scooping parts	Edge Thinning	high	low	very good
Electro-Immersion	low	Object volume limited	No scooping parts	-	high	low	very good
Air-Atomisation Low Pressure	good	-	-	-	small	high	low
Air-Atomisation High Pressure	excellent	-	-	-	small to medium	Very high	very low
Air-Atomisation HVLP	very good	-	-	-	low	high	low
Airless Atomisation	medium	-	-	-	high	medium	good
Airmix Atomisation	good	-	-	-	medium	high	medium
Electrostatically supported Atomisation	very good	-	No Faraday Cage	Conductive substrate	medium	high	good
High rotation Atomisation	very good	-	No Faraday Cage	Conductive substrate	medium	high	good
Powderspraying	good	-	-	Conductive subs.	medium	nearly none	medium

Overview Application Processes

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Airmix Atomisation	good	-	-	-	medium	high	mediuml
Elektrostatically supported Atomisation	very good	-	No Farady Cage	Conductive Substrate	medium	high	good
High Rotation Atomisation	very good	-	No Farady Cage	Conductive Substrate	medium	high	good
Powderspraying	good	-	-	Conductive	medium	nearly none	medium

Application Procedures, Rolling and Brushing

Brushing

- Paint application carried out with a brush
- Suitable für small surface areas or for spot improvement

Advantages

\+ Can be used nearly everywhere
\+ Good coverage, also for deep-pored undercoats
\+ Unproblematic coverage of defective surfaces
\+ Low paint loss

Disadvantages

\- High level of manual labour required
\- Critical application method (Brush ridges)
\- Regular film thickness is difficult to achieve

Application Procedures, Rolling and Brushing

Rolling

- Paint application is carried out by roller
- Surface quality is dependent upon the roller selection

Rolling has the following advantages and disadvantages in comparison to brushing

Advantages

+ The labour needed is considerably lower
+ Even film thickness
+ Smoother surface

Disadvantages

- The underground should be even
- Underground wetting is poorer

Application Procedures, Rolling and Brushing

The selection of the roller is dependent on:

- The desired surface quality
- The type of paint material (primer, finishing coat etc.)
- The viscosity of the paint material

Generally valid is:

- Plush roller, lambskin roller for structured surfaces (Industrial quality)
- Flockfibre or neoprene roller for smooth high quality surfaces

Disadvantages of the neoprene roller compared to the flockfibre roller

- Air pockets in the surface
- Less resistant to solvents

Application Procedures, Pneumatical Application

Atomisation of the paint material is achieved by mechanical force, the effect of the speed of the air jet is used

Compressed air guns are widely used and offer the following advantages and disadvantages

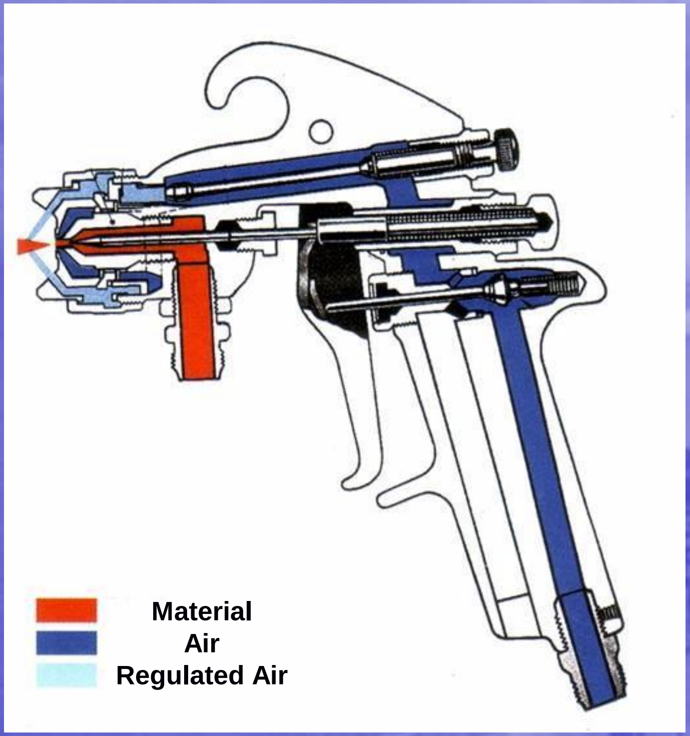
Advantages

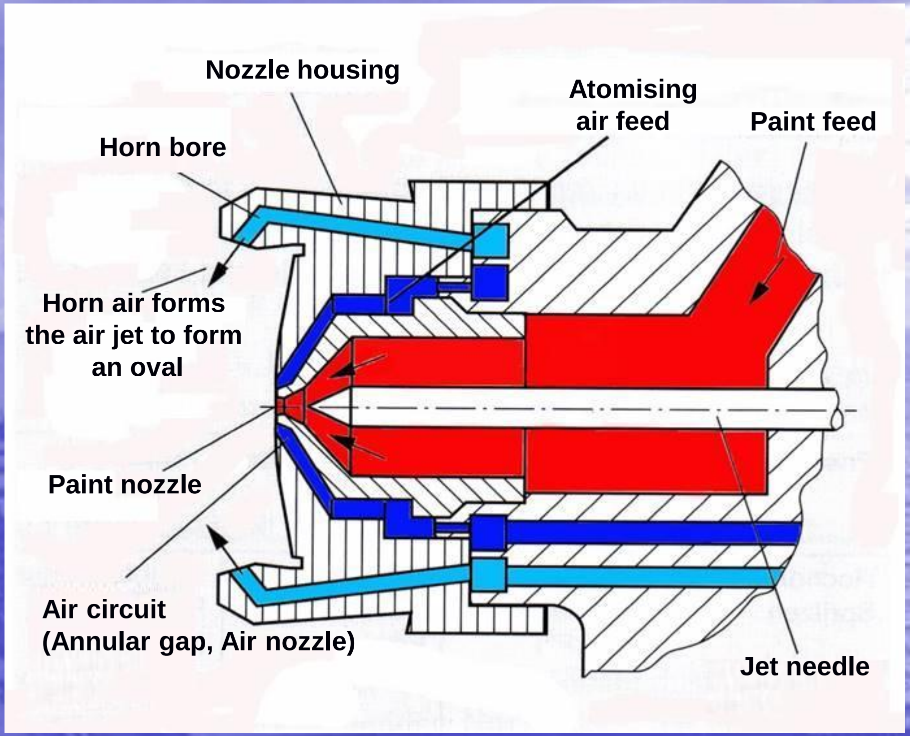
+ Very good and fine atomisation
+ Usually a high surface quality
+ Even film thickness
+ Nearly structure-free surface
+ Good coverage of complex formed parts

Disadvantages

- High material loss (overspray)
- High emission of volatile paint components
- Danger of surface destruction by spray mist

Construction of a Compressed Air Spraygun





Application Procedures, Pneumatical Application

Evaluation of Spray Parameters

Jet Diameter	**large**	**small**
Medium Droplet Size	**large**	**small**
Paint Viscosity	**high**	**low**
Spray Pressure	**low**	**high**

These changes to the spray parameters have the following effect on the result of the paint coating:

Overspray-Portion	**low**	**large**
Surface Quality	**low**	**excellent**
Painting Speed	**large**	**low**

Application Procedures, Pneumatical Application

Paint Supply

The following systems have proved themselves

- Gravityfeed Flowcup
- Suctioncup seated under the spraygun
- Pressurecup seated above or below the spraygun
- Separate Pressure Tank for processing larger paint quantities

Application Procedures, Pneumatical Application

Gravity Cup

Suction Cup

Pressure Cup

Pressure Tank

Application Procedures, Airless Application

The atomisation of the paint material is carried out by mechanical force, the effect of the speed of the paint flow itself is used, i.e.

- Paint material is pressed (according to it's viscosity and paint type) through a nozzle at betwen 150 – 600 bar
- because of the extreme turbulences and high speed, the paint spray is torn apart and atomised after leaving the nozzle

Appliation Procedures, Airless Application

Advantages and Disadvantages of Airless Application

Advantages

+ Low spray mist formation
+ Paint with a high viscosity can be processed
+ Greater material flow (2 – 10 l/min) ↳ high working speed

Disadvantages

- Poor atomisation ↳ uneven surface
- Sharply defined borders of the spray jet
- No quantity regulation during the application

Application Procedures, Airless Application

Special Forms of Airless Application,

are the Airmix, Aircoat, and „Airless with air suport" processes

A combination of pneumatical and airless application

Advantages compared to a pure Airless application

- Better surface
- Softer transition of the spray jet
- Lower paint pressure

Drying

Optimal Drying

- the higher the rate of air movement over the work piece, the better and quicker the drying of it

Influencing Factors

The following factors influence the quality of the finished coating

- Wet Coat Layer Thickness
- Temperature
- Air Humidity
- Temperature + Air Humidity = Dew Point

Influencing Factors

Dew Point

Is the temperature at which an air packet has to be cooled down to, so that condensation occurs.

At the dew point:

Air humidity is = 100 %

The external temperature has to be at least 5°c above the dew point

T [°C]	Air Humidity [%]													
	30	35	40	45	50	55	60	65	70	75	80	85	90	95
30	10,5	12,9	14,9	16,8	18,4	20	21,4	22,7	23,9	25,1	26,2	27,2	28,2	29,1
29	9,7	12	14	15,9	17,5	19	20,4	21,7	23	24,1	25,2	26,2	27,2	28,1
28	8,8	11,1	13,1	15	16,6	18,1	19,5	20,8	22	23,2	24,2	25,2	26,2	27,1
27	8	10,2	12,2	14,1	15,7	17,2	18,6	19,9	21,1	22,2	23,3	24,3	25,2	26,1
26	7,1	9,4	11,4	13,2	14,8	16,3	17,6	18,9	20,1	21,2	22,3	23,3	24,2	25,1
25	6,2	8,5	10,5	12,2	13,9	15,3	16,7	18	19,1	20,3	21,3	22,3	23,2	24,1
24	5,4	7,6	9,8	11,3	12,9	14,4	15,8	17	18,2	19,3	20,3	21,3	22,3	23,1
23	4,5	6,7	8,7	10,4	12	13,5	14,8	16,1	17,2	18,3	19,4	20,3	21,3	22,2
22	3,6	5,9	7,8	9,5	11,1	12,5	13,9	15,1	16,3	17,4	18,4	19,4	20,3	21,3
21	2,8	5	6,9	8,6	10,2	11,6	12,9	14,2	15,3	16,4	17,4	18,4	19,3	20,2
20	1,9	4,1	6	7,7	9,3	10,7	12	13,2	14,4	15,4	16,4	17,4	18,3	19,2
19	1	3,2	5,1	6,8	8,3	9,8	11,1	12,3	13,4	14,5	15,5	16,4	17,3	18,2
18	0,2	2,3	4,2	5,9	7,4	8,8	10,1	11,3	12,5	13,5	14,5	15,4	16,3	17,2
17	-0,6	1,4	3,3	5	6,5	7,9	9,2	10,4	11,5	12,5	13,5	14,5	15,3	16,2
16	-1,4	0,5	2,4	4,1	5,6	7	8,2	9,4	10,5	11,6	12,6	13,5	14,4	15,2
15	-2,2	-0,3	1,5	3,2	4,7	6,1	7,3	8,5	9,6	10,6	11,6	12,5	13,4	14,2
14	-2,9	-1	0,6	2,3	3,7	5,1	6,4	7,5	8,6	9,8	10,6	11,5	12,4	13,2
13	-3,7	-1,9	-0,1	1,3	2,8	4,2	5,5	6,6	7,7	8,7	9,6	10,5	11,4	12,2
12	-4,5	-2,6	-1	0,4	1,9	3,2	4,5	5,7	6,7	7,7	8,7	9,6	10,4	11,2
11	-5,2	-3,4	-1,8	-0,4	1	2,3	3,5	4,7	5,8	6,7	7,7	8,6	9,4	10,2
10	-6	-4,2	-2,6	-1,2	0,1	1,4	2,6	3,7	4,8	5,8	6,7	7,6	8,4	9,2

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28	8,8	11,1	13,1	15	16,6	18,1	19,5	20,8	22	23,2	24,2	25,2	26,2	27,1
27	8	10,2	12,2	14,1	15,7	17,2	18,6	19,9	21,1	22,2	23,3	24,3	25,2	26,1
26	7,1	9,4	11,4	13,2	14,8	16,3	17,6	18,9	20,1	21,2	22,3	23,3	24,2	25,1
25	6,2	8,5	10,5	12,2	13,9	15,3	16,7	18	19,1	20,3	21,3	22,3	23,2	24,1
24	5,4	7,6	9,8	11,3	12,9	14,4	15,8	17	18,2	19,3	20,3	21,3	22,3	23,1
23	4,5	6,7	8,7	10,4	12	13,5	14,8	16,1	17,2	18,3	19,4	20,3	21,3	22,2
22	3,6	5,9	7,8	9,5	11,1	12,5	13,9	15,1	16,3	17,4	18,4	19,4	20,3	21,3
21	2,8	5	6,9	8,6	10,2	11,6	12,9	14,2	15,3	16,4	17,4	18,4	19,3	20,2
20	1,9	4,1	6	7,7	9,3	10,7	12	13,2	14,4	15,4	16,4	17,4	18,3	19,2
19	1	3,2	5,1	6,8	8,3	9,8	11,1	12,3	13,4	14,5	15,5	16,4	17,3	18,2
18	0,2	2,3	4,2	5,9	7,4	8,8	10,1	11,3	12,5	13,5	14,5	15,4	16,3	17,2
17	-0,6	1,4	3,3	5	6,5	7,9	9,2	10,4	11,5	12,5	13,5	14,5	15,3	16,2
16	-1,4	0,5	2,4	4,1	5,6	7	8,2	9,4	10,5	11,6	12,6	13,5	14,4	15,2
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12	-4,5	-2,6	-1	0,4	1,9	3,2	4,5	5,7	6,7	7,7	8,7	9,6	10,4	11,2
11	-5,2	-3,4	-1,8	-0,4	1	2,3	3,5	4,7	5,8	6,7	7,7	8,6	9,4	10,2
10	-6	-4,2	-2,6	-1,2	0,1	1,4	2,6	3,7	4,8	5,8	6,7	7,6	8,4	9,2

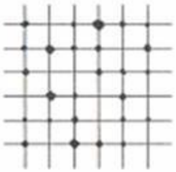
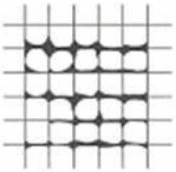
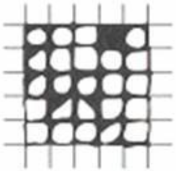
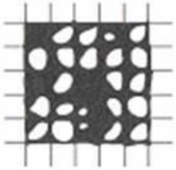
Test Methods

- Wet-Layer Thickness
  - Thickness Gauge
- Dry-Layer Thickness
  - Eddy Current Technique
- Gloss
  - Tri-Gloss (20°, 60°, 85)
- Adhesive Strength
  - Cross-Cut Test
  - The pull-off test

Test Methods

Evaluation

Cross-Cut Test

Cross-Cut-Parameter	Description	Image
Gt. 0	The cut edges are completely smooth, no part of the coating has been chipped off.	—
Gt. 1	No coating splitters have been chipped of at the intersections of the squares; Chipped off area about 5% of the part piece	
Gt. 2	The paint is chipped off along the cut edges and/or at the intersections; Chipped off area about 15% of the part piece	
Gt. 3	The paint has been chipped away in wide strips along the cut edges and/or the coating has been completely or partially chipped away from individual parts; Chipped off area about 35% of the part piece	
Gt. 4	The paint has been chipped off in broad strips along the cut edges and/or chipped off wholly or in part from individual parts Chipped area about 65% of the part piece	
Gt. 5	Chipped off area is more than 65% of the part piece	—