Lower costs and improve quality in valve coating procedures: The Universal Pipe Coating approach to paint specification

Adam Ovington
AkzoNobel – International Paint

INDUSTRIALVALVESUMMIT

Overview

- Protective Coatings for Valve applications: the current state of play
- Limitations of the incumbent approach
  - The specifications
  - The coatings
    - Conventional ambient temperate anticorrosive systems
    - Zinc silicates
    - Epoxy phenolic
    - High temperature silicones and silicone acrylics

- Reduce complexity, improve quality, lower cost

Introduction

- Protective coatings are applied to valves to protect against a wide variety of end use environments:
  - Extreme temperatures -196-650C
  - Insulated and uninsulated service
  - Stainless and carbon steel substrates
  - Constant and cyclic temperature operation
  - Onshore and offshore environments

Introduction

- The practical application of coating valves is not straight forward
  - Multiple items to coat, to the same standard every time
  - Small intricate parts
  - Tight angles and sharp edges
  - Paint shop pressures of moving, turning and throughput
  - Final touch up and packaging

The Specifications

- The wide variety end use environments has been addressed by the inclusion of various specific coating schemes – producing specifications such as these:

TABLE B3-1 - COATING SCHEDULI

Surface Description and No
CS Equipment and Piping, Shop Fabricate
Non-insulated, to 100 (Flex to 121)
Non-insulated, 101 to 260 (Flex to 260)
Non-insulated, 261 to 400 (Flex to 400)
Non-insulated, sub-ambient (sweating servi
Insulated, -46 to 150 (Flex to 204)
Insulated, 151 to 260 (Flex to 260)
Insulated, 261 to 400 (Flex to 400)
Fireproofed equipment supports
Personnel Protection – same as uninsulate
Heat Traced – same as insulated
SS, High Alloy Equipment and Piping, Sho
Non-insulated, to 100 (Flex to 121)
Non-insulated, 101 to 260 (Flex to 260)
Insulated, -200 to 150 (Flex to 204)
Insulated, 151 to 260 (Flex to 260)
Fireproofed equipment supports

Scope	Specification	System
Non-insulated C.S. ambient temp to 120°C	Surface prep. : abrasive blast cleaning to ISO Sa 2.5 (R_Z = 50-75 µm) Primer : 75µm of 2-pack Epoxy zinc rich (organic zinc) Intermediate : 150µm of 2-pack epoxy MIO Finish : 50µm of 2-pack acrylic polyurethane	A
Non-insulated C.S. 121°C to 200°C	Surface prep. : abrasive blast cleaning to ISO Sa 2.5 (R_Z = 30-75 µm) Primer : 75µm of 2-pack ethyl zinc silicate (inorganic zinc) Finish : 2 x 30µm of silicone acrylic coating	B
Non-insulated C.S. 201°C to 400°C	Surface prep. : abrasive blast cleaning to ISO Sa 2.5 (R_Z = 30-75 µm) Primer : 75µm of 2-pack ethyl zinc silicate (inorganic zinc) Finish : 2 x 25µm of single pack silicone-based coating	C
Non-insulated C.S. 401°C to 540°C	Surface prep. : abrasive blast cleaning to ISO Sa 2.5 (R_Z = 30-75 µm) Coating : 2 x 25µm of single pack silicone based coating	D
Non-insulated C.S. vessels and cyclic temperature piping. Ambient to 400 °C	Surface prep. : abrasive blast cleaning to ISO Sa 2.5 (R_Z = 50-75 µm) Coating : 2 x 100µm of Titanium Modified Inorganic Co-Polymer.	P
Non-insulated C.S. Constant operating temperature piping. Ambient to 565 °C	Surface prep. : abrasive blast cleaning to ISO Sa 2.5 (R_Z = 50-75 µm) Coating : 1 x 175µm of Titanium Modified Inorganic Co-Polymer.	Q (Note 1)
Non-insulated Stainless.Steel. -196 °C to 200°C	Surface prep. : Light abrasive blast cleaning (R_Z = 30-50 µm) Primer : 100 µm of 2 pack epoxy phenolic primer Finish : 100 µm of 2 pack epoxy phenolic finish	E (Note 2)
Non-insulated/ non-fireproofed galvanized steel ambient temperature (in case of color coding)	surface prep. : light abrasive blast cleaning (R_Z = 30-50 µm) or treatment with mordant/etching solution primer : 75µm of 2-pack zinc-free epoxy finish : 50µm of 2-pack acrylic polyurethane	F

SURFACES TO BE PAINTED : CARBON STEEL AND LOW ALLOY STEEL BARE (UNINSULATED)
(Structural steel, piping, vessel, tanks, exchangers, heaters, stacks, etc.)

CICLE N°	OPER. TEMP.	SURF. PREP.	DESCRIPTION	THK. MICR.S (4)	PAINT TYPE
2-1	Below 120°C	Sa 2,5	primer : INORGANIC ZINC intermediate : POLYAMIDE EPOXY finish : ALIPHATIC ACRILIC POLIURETHANE	75 125 50	101 201 204
2-2	121°C to 200°C	Sa 2,5	primer : INORGANIC ZINC intermediate : SILICONE ACRYLIC finish: : SILICONE ACRYLIC	75 40 40	101 202 202
2-3	201°C to 400°C	Sa 2,5	primer : INORGANIC ZINC intermediate : SILICONE ALUMINUM finish : SILICONE ALUMINUM	75 25 25	101 203 203
2-4	401°C to 540°C	Sa 2,5 (Note 1)	primer : SILICONE PRIMER intermediate : ------------------------- finish : SILICONE ALUMINUM	25 -- 25	102 --- 203

SURFACES TO BE PAINTED: CARBON STEEL AND LOW ALLOY STEEL INSULATED FOR HEAT/COLD CONSERVATION OR PERSONNEL PROTECTION
(piping, vessel, tanks, exchangers operating discontinuously)
(Note 2)

CICLE N°	OPER. TEMP.	SURF. PREP.	DESCRIPTION	THK. MICR.S (4)	PAINT TYPE
2-6 (Note7)	150°C to 200°C	Sa 2,5 (Note 1)	primer : SILICONE ACRYLIC intermediate : ------------------------- finish : SILICONE ACRYLIC	40 -- 40	202 --- 202
2-7	200°C to 540°C	Sa 2,5 (Note 1)	primer : SILICONE PRIMER intermediate : ------------------------- finish : SILICONE ALUMINUM	25 -- 25	102 --- 203

The specifications

- In some cases up to 10 different coating schemes
  - Each with a specific dry film thickness to achieve
  - Each with a different composition and application considerations



- Possibility of an item having an unsuitable coating applied?
- Possibility of the coating in question being applied incorrectly?
- Possibility of the coating being outside of QC requirements?

The Products

- A number of coating technologies or systems dominate most valve and piping specifications

Epoxy Phenolic Systems

Modified Silicone Systems

Conventional ambient temperate anticorrosive systems

Zinc Silicate primed Systems

Aluminium Silicone Systems

- While each perform well within there specific target areas, each has limitation around end use area or application flexibility

Conventional ambient temperate anticorrosive systems

Pros

- Same as
  on site.
  - Ease c
  - Readil
- High deg
- Unlikely t
  applicato
- Range of
- Primer ch
  optimised

5°C and 120°C

use beneath

use on

ems requiring

erials

Zinc silicates

Pros

- Excellent corrosion protection up to 540°C for uninsulated carbon steel

- vorld.
-

Cons

- Unsuitable for use beneath thermal insulation
- U teel.
- R
  c coat
  ti
- L .

Epoxy phenolics

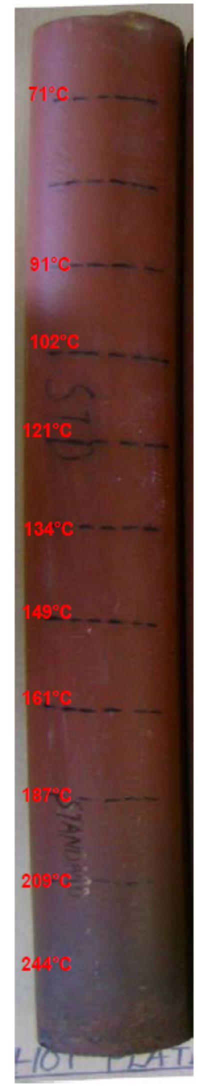
Pros

- Excellent when used beneath insulation
  - Capable of withstanding the wet, elevated te in insulated s

- Maxim of this techno 0°C
- Mostly ss steel items agains ed stress corrosi
- Widely aight forward to store and apply provided they are used within specification.

Cons

- Limited atmo n protection
  - Limited b
  - Lower pe nc
- Lack of UV d
- Limited topco
- Limited tolera ion thickness.
- Increases the or subsequent cracking and re in the field.



High temperature silicones and silicone acrylics

Pros

- Temperature resistance up to 540°C
- Option of a zinc silicate primer for uninsulated carbon steel end uses,
- Blended acrylic resins can offer colours up to 260°C
- Widely used in some specifications for constant, elevated operating temperatures

Cons

- Thin films and limited barrier performance contribute to a lack of long term corrosion protection
- Unsuitable for services which will spend any amount of time a ambient temperature
- Unsuitable for use beneath insulation
- Questionable suitability for use protecting stainless, direct to metal

Limitations of conventional systems

	Conventional anticorrosive scheme	Zinc silicates	Epoxy phenolics	Silicones and silicone acrylics
Suitability for use on stainless steel	No	No	Yes	Yes
Suitability for use beneath insulation	No	No	Yes	Sometimes
Suitability of use at ambient temperature	Yes	Yes	Sometimes	No
Very sensitive to film build?	No	Yes	Yes	No
Cure time and recoating restrictions	No	Yes	Yes	Yes

Summary

- The current landscape for valve coatings is populated by:
  - Long and complex specification documents
  - Numerous coating products, some of which have very demanding application characteristics.
- This approach:
  - Increases the risk of incorrect coating application
    - Incorrect product applied to a certain area
    - Right product, incorrectly applied
  - Costs time and money
    - Segregating items and equipment correctly
    - Varying QC requirements
    - Rectifying inevitable mistakes

The path forward…..

- Simplicity

  » Fewer products
  » Product that are easy to use

- Less segregation
- Less error

  » Improved quality
  » Reduced cost

The Solution

- Looking at the current technology available there **IS** scope to achieve this.
  - Using an organic based material for all requirements up to c.200C
  - Using an inorganic material for all requirements from 200C to 650C

- The challenge….
  - The incumbent systems, although complicated, perform well in the specific area
  - Any new approach must be able to demonstrate equal or better performance across a range of environments

Key performance criteria

- Ambient temperature corrosion protection comparable to a traditional 3 coat system
- Equal corrosion under insulation protection to an epoxy phenolic
- Suitability of use on stainless
- Ease of application in line with conventional ambient temperature systems
- Film build tolerance well in excess of epoxy phenolic and zinc silicate chemistry

Simplified approach

- Given this performance criteria valve, piping and OEM specifications could feasibly be reduced to the following two systems

Scope	Specification	
Insulated and Non-insulated Carbon Steel and Stainless Steel to 200°C	1st Coat 2^{nd} Coat	≈175µm Organic Based Coating ≈175µm Organic Based Coating
Insulated and Non-insulated Carbon Steel and Stainless Steel 200°C to 650°C	1st Coat 2^{nd} Coat	≈100µm Inorganic Based Coating ≈100µm Inorganic Based Coating

The Benefits

- Fewer products to stock and manage
- Higher productivity
- Greater painter proficiency
- Less cleaning of equipment and lines
- Reduced risk of error
- Easier on site maintenance and hook up

Thanks for your time

Adam Ovington
Temperature Resistant Market Manager
International Paint AkzoNobel