



IGP Pulvertechnik AG
Ringstrasse 30
9500 Wil
Schweiz
Telefon +41 (0)71 929 81 11
Telefax +41 (0)71 929 81 81
info@igp-powder.com
www.igp-powder.com

Ein Unternehmen der DOLD GROUP

Customer	DTL Pulverlakering ApS
Project	CORROSION TESTS
Substrate	Steel
Pretreatment	SA2½ shot blasted steel Half of test panels: metallized
Coating System	Primer: 1001A70474V00 Primer: 6007A70404O00 Topcoat: 7909A7A115A00
Investigation	IGP-Standard AA341.12
Expectation	Minimum corrosion class C4H/CM5 - 720 hours NSST

INTRODUCTION

DTL Pulverlakering ApS is keen to investigate the quality of corrosion resistance of coated steel to inform their customers about the durability of the total coating system.

This test method gives an indication of the quality and durability of the total system (pre-treatment and coating) on steel in an atmospheric corrosive environment and when the total system should undergo the first major maintenance painting.

This standard sustainability is expressed in 4 terms:

low (L)	medium (M)	high (H)	very high (VH)
2-5 years	5-15 years	15-25 years	over 25 years

Category	Requirement
Blistering (ISO 4628-2)	S0
Rusting (ISO 4628-3)	Ri 0
Cracking (ISO 4628-4)	0 (S0)
Flaking (ISO 4628-5)	0 (S0)
Delamination (ISO 4628-8)	d ≤ 3 mm on steel; d ≤ 8 mm on zinc substrates
Corrosion (ISO 4628-8)	≤ 1mm (voor C5 ≤ 2mm)
Adhesion (ISO 2409)	Gt 0 or 1

Table 1. Requirements IGP/Qualisteelcoat

Corrosion class	Duration (based on ISO 12944-6)
C1-high	Not applicable
C2-high	240 hours (10 days)
C3-high	480 hours (20 days)
C4-high	720 hours (30 days)
C5-high	1440 hours (60 days) alternative 1680-hour cyclic ageing test

Table 2. Test duration per corrosion class (based on ISO 12944-6)

Corrosion class	Example (exterior)	Example (interior)
C1		Heated buildings with neutral atmosphere, e.g. offices, sales areas, schools, hotels
C2	Atmosphere with low pollution level: mostly rural areas	Unheated buildings where condensation may occur, e.g. warehouses, sports halls
C3	Urban and industrial atmospheres with moderate sulphur dioxide load; coastal atmosphere with low salt load	Production areas with high humidity and some air pollution, e.g. food processing plants, laundries, breweries, dairies
C4	Industrial and coastal atmospheres with moderate salt loading	Chemical plants, swimming pools, offshore shipyards and boat docks
C5	Industrial areas with high humidity and aggressive atmosphere and coastal atmosphere with high salt load	Buildings or areas with almost constant condensation and severe contamination

Table 3. Description corrosion classes



GOAL:

At DTL's request, 2 different coating systems on blasted steel (with rounded or sharp edges) were tested for corrosion resistance according to IGP standard AA341.12 in neutral salt spray atmosphere (NSS) according to DIN_EN_ISO_9227 and analysed according to EN_ISO_4628-8. Half of these blasted panels underwent additional metallization step by zinc thermal spraying.

TEST SET-UP NSST:

- 21 Sa-2½ steel panels were coated by DTL. Half of the panels underwent additional pre-treatment with metallisation after blasting before being coated.
- A 1 mm scratch was made through the entire coating system using a Sikkens scratch pen.
- According to schedule, after subjecting the panels to the neutral salt spray atmosphere for 720 hours or 1440 hours, they were taken out and assessed according to QUALISTEELCOAT
- Assessment of blistering and creep of corrosion under the coating from the damage, is carried out according to DIN EN ISO 4628-8.
- Assessment of the test according to the IGP standard; creep: $d \leq 3$ mm on steel and $d \leq 8$ mm on galvanised steel.
- The test is passed if at least 2 out of 3 panels per corrosion class meet the requirements.

RESULTS:

Set/Panel	Edge finishing	Metallized / Zinc thermal spraying	Rz value (µm) (measured by DTL)	Primer	Midcoat	Topcoat	Average total layer thickness (µm)	Duration Neutral Salt Spray Test (hours) / Corrosion class	Delamination coating from a damage: $d \leq 3$ mm (on steel) and $d \leq 8$ mm on galvanised steel	Blister formation (ISO 4628-2)	Test Pass	Approved corrosion class according to IGP/QUALISTEELCOAT ¹												
2-layers coatings system on blasted steel																								
1.1	Round	X	40	1001A70474V00		7909A7A115A00	160	720H / C4H	0.7	0		C4H												
1.2							200		0.7	0														
1.3							160		0.7	0														
3.1							Round	X	40	1001A70474V00		7909A7A115A00	260	1440H / C5H	1.6	0		C5H						
3.2													230		0.2	0								
3.3													260		0.2	0								
2.1													Round		40	1001A70474V00		7909A7A115A00	180	1440H / C5H	2.7	0		C4H ¹
2.2																			200		2.0	0		
2.3																			210		1.7	0		
4.1	Round	X	40	1001A70474V00		7909A7A115A00	210	1440H / C5H	0	0		C5H												
4.2							220		0	0														
4.3							240		7.5	0														
8.1	Sharp		40	1001A70474V00		7909A7A115A00	200	1440H / C5H	1.8	0		C4H ¹												
8.2							220		1.7	0														
8.3							220		2.2	0														
3-layers coatings system on blasted steel																								
5.1	Round	X	40	1001A70474V00	6007A70404O00	7909A7A115A00	470	1440H / C5H	0	0		C5H												
5.2							400		7.2	0														
5.3							445		7.8	0														
7.1	Sharp		40	1001A70474V00	6007A70404O00	7909A7A115A00	320	1440H / C5H	0.5	0		C4H ¹												
7.2							350		0.1	0														
7.3							345		0.8	0														

Table 4. Results NSST

¹ The table contains indications about the potential corrosivity category for which the system can be approved. Systems can also be approved for lower corrosivity categories, but not for higher ones than mentioned in the table, even if this would be theoretically possible per the results of the laboratory tests.



CONCLUSION:

- Test panels comply with IGP-Standard and QUALISTEELCOAT standard:
 - Corrosion class C4H for 2-layers coating system on blasted steel.
 - Corrosion class C5H for 2-layers coating system on metallized blasted steel
 - Corrosion class C5H for 3-layers coating system.
 - Corrosion class C5H for 3-layers coating system on metallized blasted steel
- The 2-layers coating system on blasted steel panels tested, complies with corrosion class C4H/C5M.
- The 2-layers coating system on blasted steel panels tested, complies with corrosion class C5H.
- The 2-layers coating system on metallized blasted steel panels tested, complies with corrosion class C5H.
- The 3-layers coating system on blasted steel panels tested, complies with corrosion class C5H.
- The 3-layers coating system on metallized blasted steel panels tested, complies with corrosion class C5H.
- No blisters visible on all panels.
- Differences in corrosion protection noticed between sharp and rounded edges on 2-layers coating system.
- Some corrosion noticed on panel with sharp edges.

DISCUSSION:

- The test panels with a 2-layers coating system on blasted steel meet a higher corrosion class than IGP and QUALISTEELCOAT standard. This does not mean that in practice coated complex steel structures are suitable for this corrosion class. The corrosion protection depends partly on the type of steel, the quality of pre-treatment (blasting with/without chemical post-treatment), the design of constructions (e.g. sharp edges due to laser cut), layer thickness of the coating and the environment/atmosphere in which they are placed.
- Total layer thickness of the 3-layers coating system is an advantage for corrosion protection (better edge coverage) but reduces the flexibility of the overall system compared with a 2-layers coating system.
- Some panels that are first metallised and then coated with a 2- or 3-layer coating system show more delamination of the coating system than other comparable metallised panels. Extra attention must be paid to this pre-treatment step. If the distance during metallisation is too great, the zinc particles cannot adhere to each other sufficiently. As a result, the zinc can become loose over time and the coating system can peel off.