Filiform corrosion test and acetic acid salt spray test acc. to Qualicoat-specifications, incl. analysis of material composition

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1| Introduction

This report presents the results of a filiform corrosion test and acetic acid salt spray test, executed according to §6 of Vol. 1 of the Qualicoat specification (v01, 2025-01-01).

The test has been performed on the following 3 sample types:

- Profile with 1 hole (sample 1): Treated according to Qualicoat Seaside
- Profile with 2 holes (sample 2): “PreDura” pré-treatment method
- Profile with 3 holes (sample 3): Treated with a pré-ano layer

The material composition of the aluminium base profile is determined based on Spark OES.

2| Received samples

The test samples received on 10/10/2025 (internal reference code 00224) are shown in Table 1 and Table 2.

Note: The included Figure references of the received samples are included in Appendix 3 concerning the filiform corrosion test, and in Appendix 4 concerning the acetic acid salt spray test.

Also an uncoated profile type was received to perform the Spark OES analysis.

Table 1: Received samples, applied for filiform corrosion test

Sample type name	Sample code	Initial condition of the received samples
QC Seaside	1	Fig. 1
PreDura	2	Fig. 2
PréAno	3	Fig. 3

Table 2: Received samples, applied for acetic acid salt spray test

Sample type name	Sample code	Dry film thickness (µm)		
		Average	St. Dev.	
QC Seaside	1	190	17	Fig. 7
PreDura	2	201	5	Fig. 8
PréAno	3	257	7	Fig. 9

(B)

Method : Dry film thickness acc. to ISO 2360, average of 5 measurements (MP 4.5.14). Instrument: MI-M-070/01. LOD: 12µm

Test results marked with (B) are under BELAC scope 742-TEST. Measurement uncertainty can be presented on request.

3| Filiform corrosion test

3.1 Test conditions

The test has been performed in accordance with the §6.4 of the Qualicoat specification. This method is based on the standard ISO 4623-2 with following differences:

- A horizontal as well as a vertical scribe of about 10 cm length is made. If the sample width is <50 mm, no horizontal scribe shall be made.
- HCl (37%, 1.18 g/cm³ density) is dripped for 1 min. on top of the scratches after which the acid is removed carefully with lab paper.

After 1 hour at laboratory conditions the profiles are exposed during 1000 hours in a climate cabinet at 40±2°C and 82±5% relative humidity. The evaluation after completion of the exposure test is carried out according to ISO 4628-10.

The Qualicoat requirements are:

- L (longest filament) ≤ 4 mm
- M (average length of the filaments) ≤ 2 mm

Only one sample per sample type is tested.

Further test parameters and sample treatment procedures are presented in Appendix 1.

3.2 Test results

The results of the performed evaluations acc. to ISO 4628-10 are presented in Table 3. The evaluation of the Qualicoat acceptance limits for filiform corrosion test are presented in Table 4.

Macro photographs, referenced in the result tables, are presented in the photo report in Appendix 2.

Note: The specified Qualicoat acceptance limits for filiform corrosion tests are related to the L and M value calculated as the average of both sides of the scribe. If 2 scribes are applied, the worst average L and M result of both scribes is evaluated. The number of filaments is not considered for the Qualicoat evaluation. All measurements are performed with a caliper up to 0.1 mm. The evaluated final L and M test result must be rounded to the nearest integer.

Table 3: Filiform corrosion test results, evaluated acc. to ISO 4628-10

Sample type name	Sample code	Max. filament length in rolling direction (mm) Side 1	Max. filament length in rolling direction (mm) Side 2	Average max. filament length of 2 sides in rolling direction (L, mm)	Max. filament length in other direction (mm) Side 1	Max. filament length in other direction (mm) Side 2	Average max. filament length of 2 sides in other direction (L, mm)	Average filament length in rolling direction (mm) Side 1	Average filament length in rolling direction (mm) Side 2	Average filament length of 2 sides in rolling direction (M, mm)	Average filament length in other direction (mm) Side 1	Average filament length in other direction (mm) Side 2	Average filament length of 2 sides in other direction (M, mm)	ISO 4628-10 rating in rolling direction	ISO 4628-10 rating in other direction	
QC Seaside	1	1.3	1.4	1.4	3.5	3.0	3.3	1.1	1.2	1.2	1.5	1.7	1.6	L1/M1	L3/M2	Fig. 4
PreDura	2	1.3	0.0	0.7	1.3	0.0	0.7	1.3	0.0	0.7	1.3	0.0	0.7	L1/M1	L1/M1	Fig. 5
PréAno	3	2.5	1.6	2.1	3.8	2.5	3.2	1.5	1.4	1.5	1.4	1.4	1.4	L2/M2	L3/M1	Fig. 6

(B)

Method : Applied procedure: MP 4.5.22. The coating was not stripped before the evaluation.

(B) Test results marked with (B) are under BELAC scope 742-TEST. Measurement uncertainty can be presented on request.

Table 4: Evaluation of filiform test result acc. to Qualicoat evaluation criteria

Sample type name	Sample code	Max. observed L value (max. 4 mm)	Max. observed M value (max. 2 mm)	Qualicoat pass/fail evaluation per sample
QC Seaside	1	3	2	Pass
PreDura	2	1	1	Pass
PréAno	3	3	2	Pass

4| Acetic acid salt spray test

4.1 Test conditions

The received samples were exposed to acetic acid salt spray test conditions according to ISO 9227 AASS (continuous exposure to an acidified 5% NaCl salt fog at 35°C). The test has been executed for a period of 1000 hours. A X-shape scribe with a width of 1 mm is made to cut the organic coating down to the substrate.
Further test parameters and sample treatment procedures are presented in Appendix 3.

The exposed test samples have been evaluated in accordance with §6.2 of the Qualicoat Specification (max. infiltration length and infiltrated surface area around the scribe).

The Qualicoat requirements are:

- Max. infiltration length: ≤ 3 mm
- Infiltrated surface area: ≤ 16 mm²/10cm
- No blistering in excess of 0(S0) acc. to ISO 4628-2

Only one sample per sample type is tested.

4.2 Test results

The results of the performed tests are presented in Table 5. Macro photographs, referenced in the result tables, are presented in the photo report in Appendix 4.

Table 5: Acetic acid salt spray test results, evaluated acc. to Qualicoat specifications (§6.2)

Sample type name	Sample code	Blistering acc. to ISO 4628-2 (max. 0(S0))	Max. infiltration length (mm), rounded to nearest 0.5 mm	Evaluation for max. infiltration (≤3mm)	Infiltrated surface area (mm²)	Total scratch length (cm)	Infiltrated surface area (mm²/10cm)	Evaluation for infiltrated surface (≤16mm²)	Rating acc. to Qualicoat spec. (per sample)	Figure Ref.
QC Seaside	1	0	1.0	Pass	3	11	3	Pass	Pass	Fig. 10
PreDura	2	0	0.0	Pass	0	10	0	Pass	Pass	Fig. 11
PréAno	3	0	0.0	Pass	0	12	0	Pass	Pass	Fig. 12

5| Material analysis

Analysis method: Spark OES (performed by an external partner)

The analysis is related to the base material of the tested profiles.

The material composition of the analyzed alloying elements (typical for aluminum alloys) is determined and converted to mass-%. The average value of at least 2 measurements is presented in Table 6.

Table 6: Material composition (in mass-%), based on Spark OES analysis

	Mg	**Si**	**Fe**	**Zn**	**Mn**	**Ti**	**Cu**	**Cr**	**Al**
Sample 1 (bulk material)	0.45	0.54	0.19	0.007	0.053	0.023	0.023	0.002	Base
	Ni	**Pb**	**Sn**	**V**	**Zr**				
Sample 1 (bulk material)	0.003	0.001	<0.001	0.004	0.001				

6| Conclusions

Based on the performed tests the following conclusions can be drawn:

- All reported test results concerning the individual test panels meet the Qualicoat specifications concerning the resistance against filiform corrosion and concerning the acetic acid salt spray test.

Note: Only one sample (per sample type) is available for each test. A Qualicoat A-B-C-D rating can therefore not be assigned, because 3 duplicate samples are needed per test.

APPENDIX 1 : Test Parameters - Filiform corrosion test acc. to Qualicoat specifications

Applied standard :	QC Filiform Test	Method : MP 4.5.21	**(B)**
Applied climate Chamber :	Espec LHU-212	According to specification?	
Exposure conditions :	Exposure to controlled humidity at 82±5%	OK	
	and a temperature of 40±2°C	OK	
	Sample pretreatment acc. to Qualicoat spec. §2.19:		
	- Scratches in 2 directions, if possible	Avg. temp. (°C)	
	- HCl 37% is dripped along the scratches (1 min.)	39.9	(*)
	- Excess acid is removed from the scratch.		
	- Humidity test is started after 1h at 23±2°C.		
Note :	A manual scribing tool with rectangular cutting edges is applied (scratch width: 1 mm)		

Time of 1 test cycle :	1000h	Number of test hours :	~1000
Start date :	21/10/25	End date :	2/12/25
Registration of received samples :	Box Code 00224	Received on :	10/10/25
Pretreatment of the samples :	Preconditioning & HCl-dripping pretreatment acc. to QC (1min)		
Application of a scratch :	2 scratches on each sample (w: 1mm, cfr. QC FFC test)		
Relevant test surface :	Plate surface, excl. edges		
Angle of exposure :	Horizontal position		
Test program :	Specific		

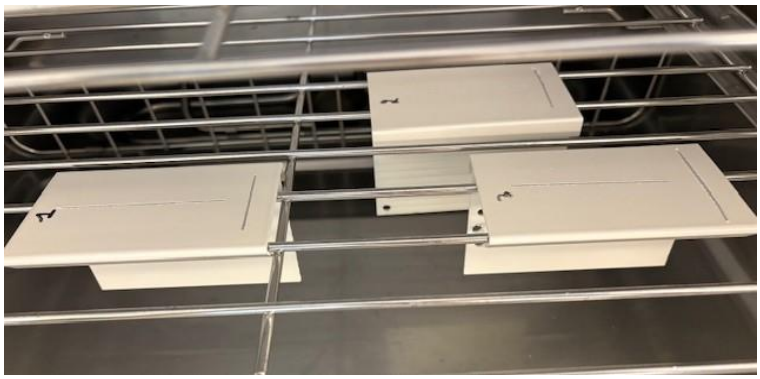

Figure : Exposed samples in climate chamber

(*) The avg. temp. relates to a verification of stable exposure conditions max. 3 months before test end date.

Test results marked with (B) are under BELAC scope 742-TEST.

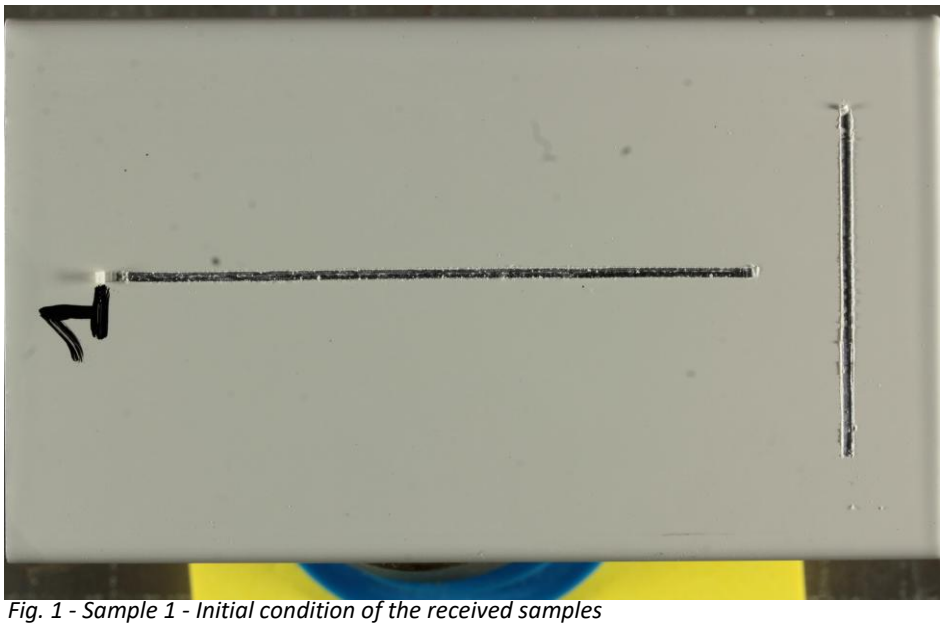

Fig. 1 - Sample 1 - Initial condition of the received samples

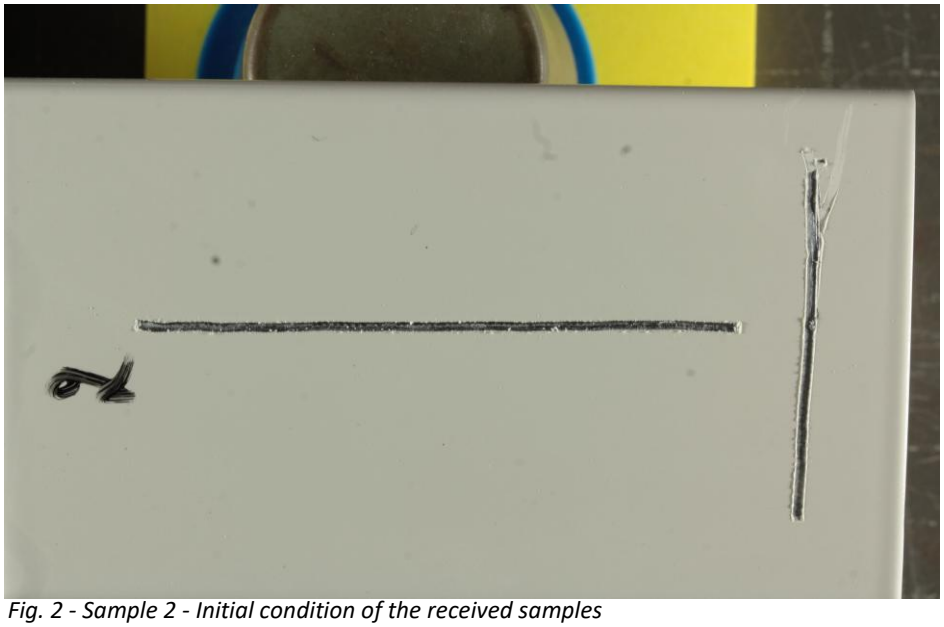

Fig. 2 - Sample 2 - Initial condition of the received samples

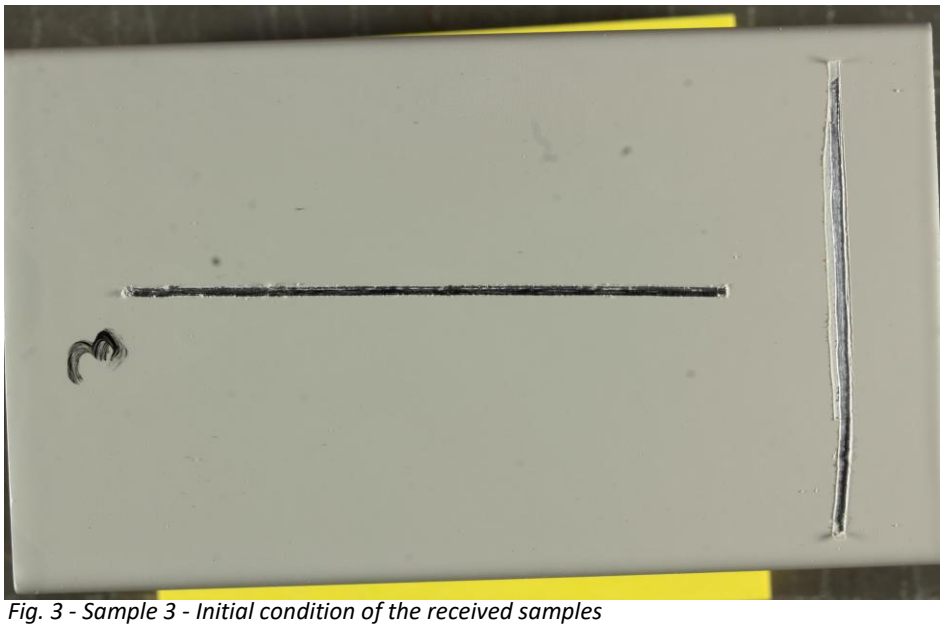

Fig. 3 - Sample 3 - Initial condition of the received samples

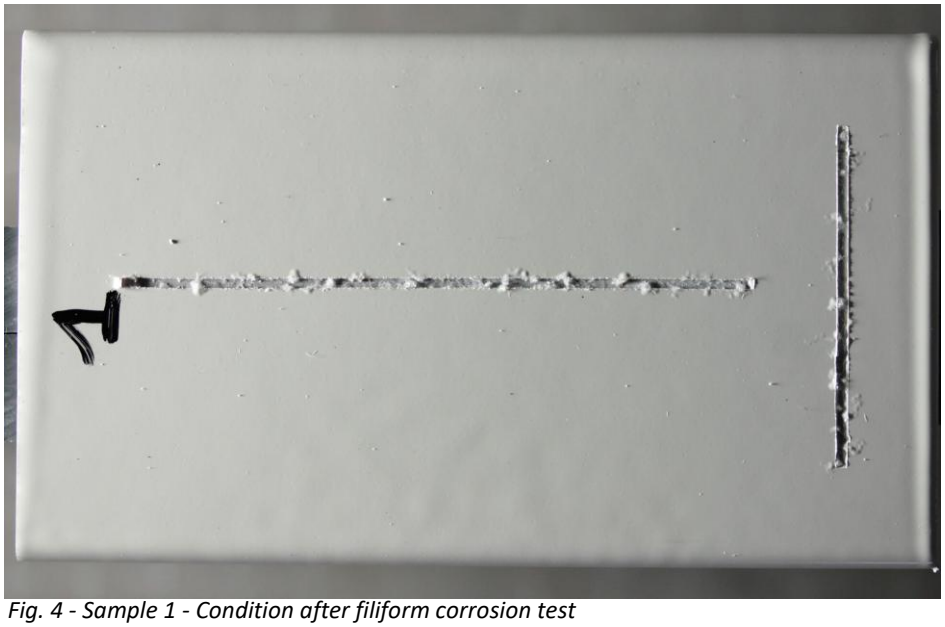

Fig. 4 - Sample 1 - Condition after filiform corrosion test

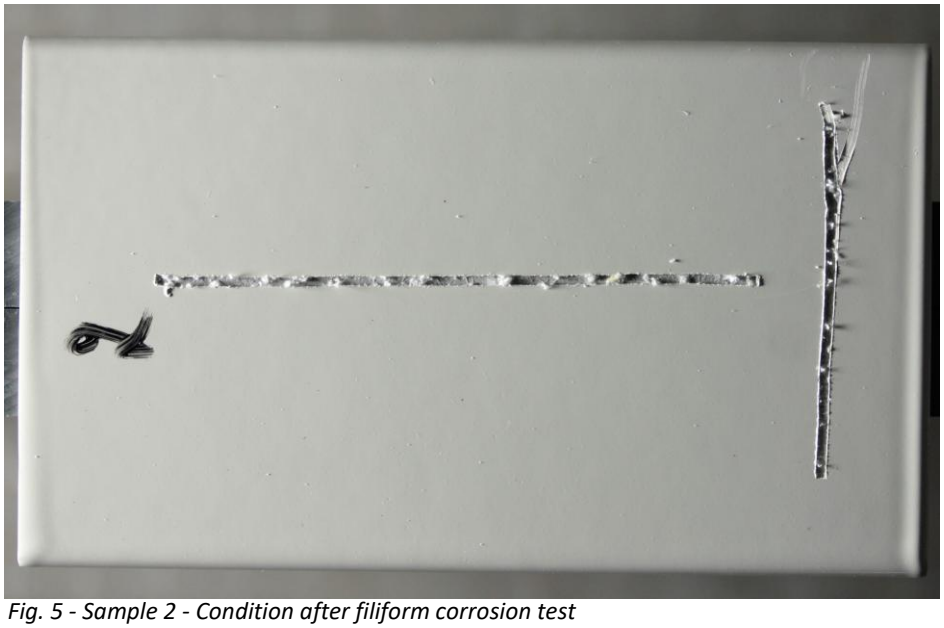

Fig. 5 - Sample 2 - Condition after filiform corrosion test

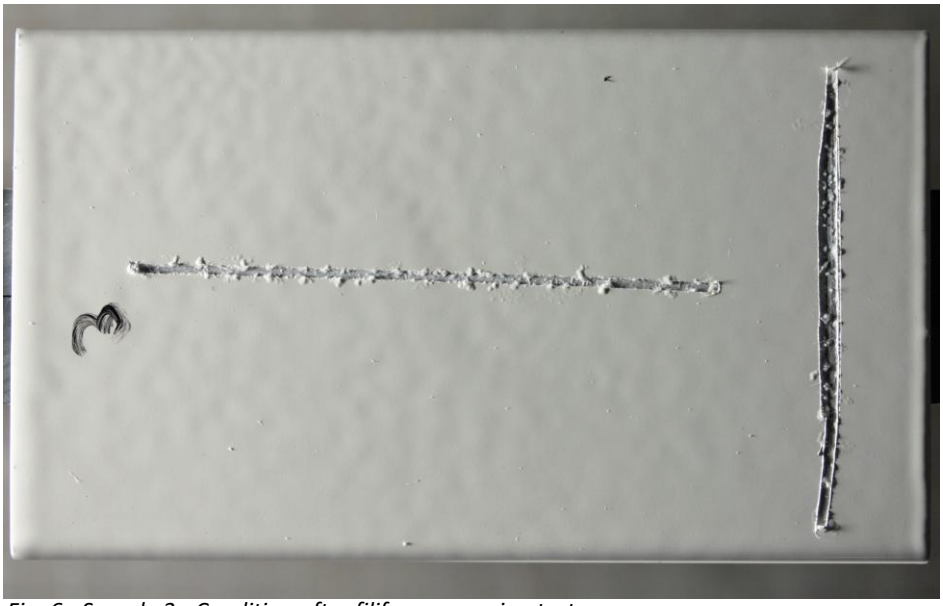

Fig. 6 - Sample 3 - Condition after filiform corrosion test

APPENDIX 3 : Test Parameters - Acetic acid salt spray testing acc. to ISO 9227 AASS

Applied standard :	ISO 9227 AASS	Method : MP 4.5.12		**(B)**
Applied climate Chamber :	Ascott CC1000xp (MI-E-021)		According to specification?	
Exposure conditions :	Temp.: 35°C ±2°C		OK	
	Continuous salt fog deposition: 1 - 2 ml/h.80cm²		OK	
	pH of collected salt: 3.1 - 3.3 (25°C)		OK	
	Density of collected salt: 1.026 - 1.038 (RT)		OK	
	Corrosivity control (C-steel): 40 ±10 g/m².24h		69-7 - 75-2	(*)
	(*) Reported corrosivity values (min. - max., in g/m².24h) are based on the last available data (max. 3 months before test end date)			
Note :	5 ±0.5 m% NaCl (free of Ni & Cu, <0.1 m% NaI, <0.3 m% total impurities) pH of applied salt solution: 3.1 - 3.3 (adjusted with HOAc)			
	Air supply: Free of oil and dirt, 69-172 kPa/m² or 10-25 psi			
Time of 1 test cycle :	>24h	Number of test hours :	~1000	
Start date :	21/10/25	End date :	2/12/25	
Registration of received samples :	Box Code 00224	Received on :	10/10/25	
Pretreatment of the samples :	Exposed in the received condition			
Application of a scratch :	1 X-cut scratch on each sample (L: 2x10cm, w: 1mm, cfr. QC)			
Relevant test surface :	Plate surface, excl. edges			
Angle of exposure :	15-25° vs. vertical line			
Test program :	Specific			

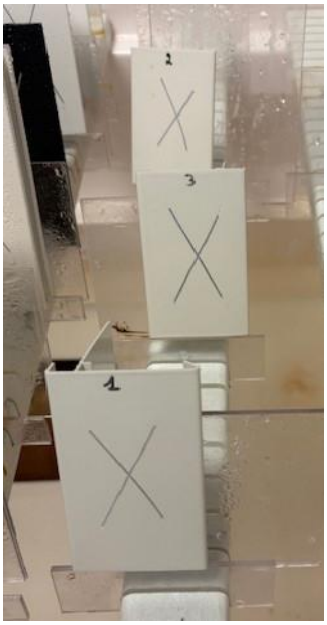

Figure : Exposed samples in climate chamber

Test results marked with (B) are under BELAC scope 742-TEST.

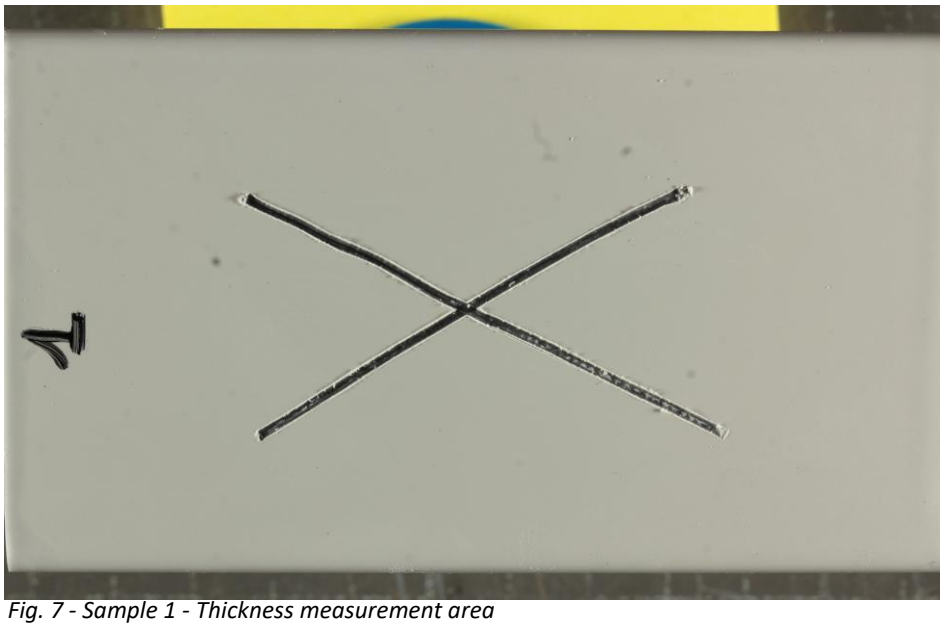

Fig. 7 - Sample 1 - Thickness measurement area

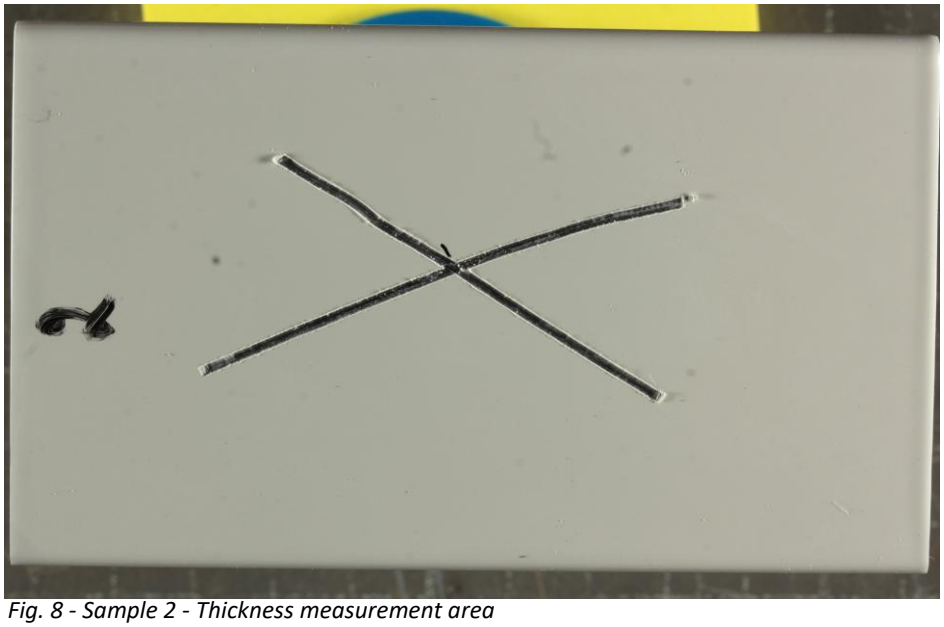

Fig. 8 - Sample 2 - Thickness measurement area

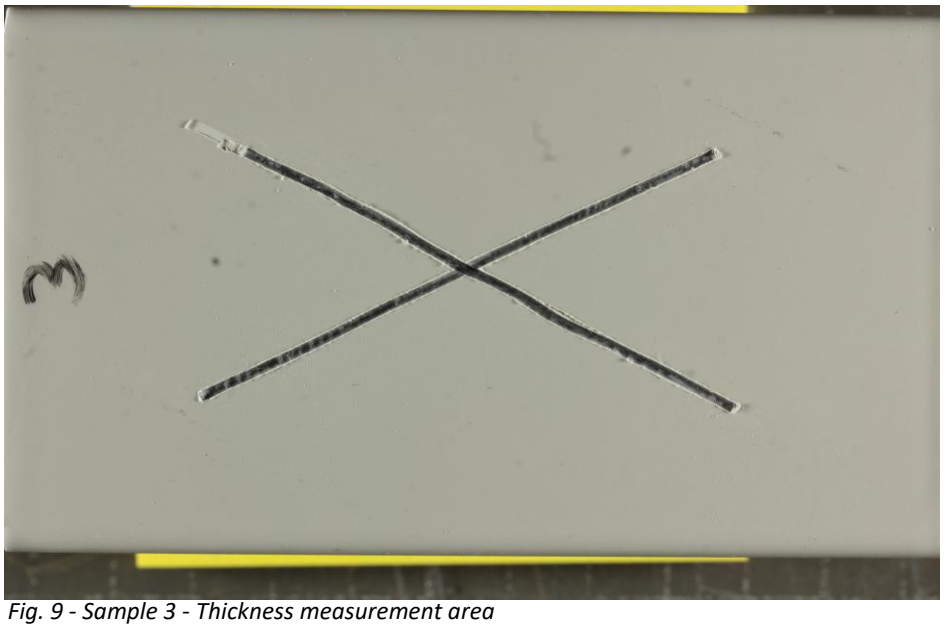

Fig. 9 - Sample 3 - Thickness measurement area

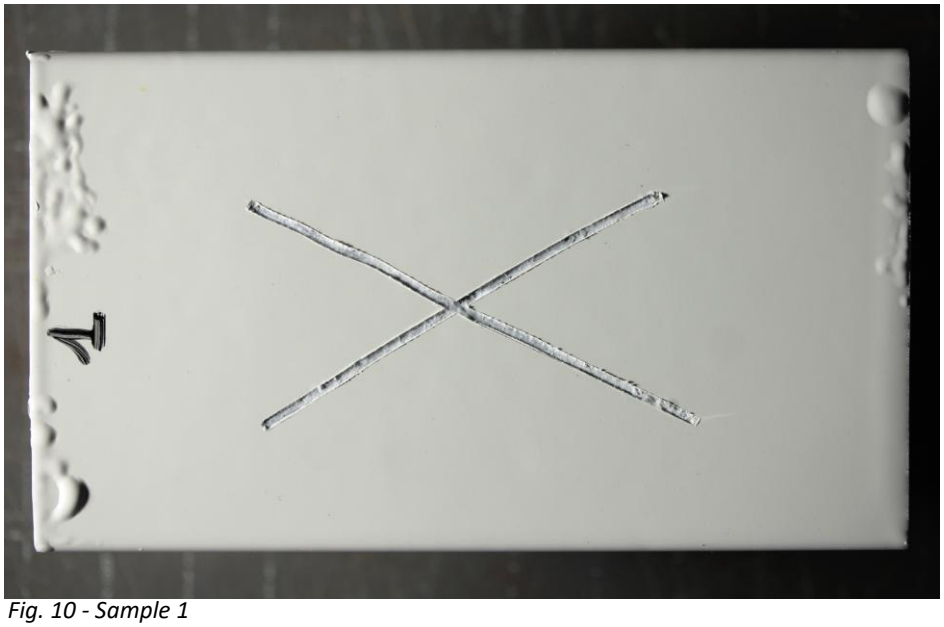

Fig. 10 - Sample 1

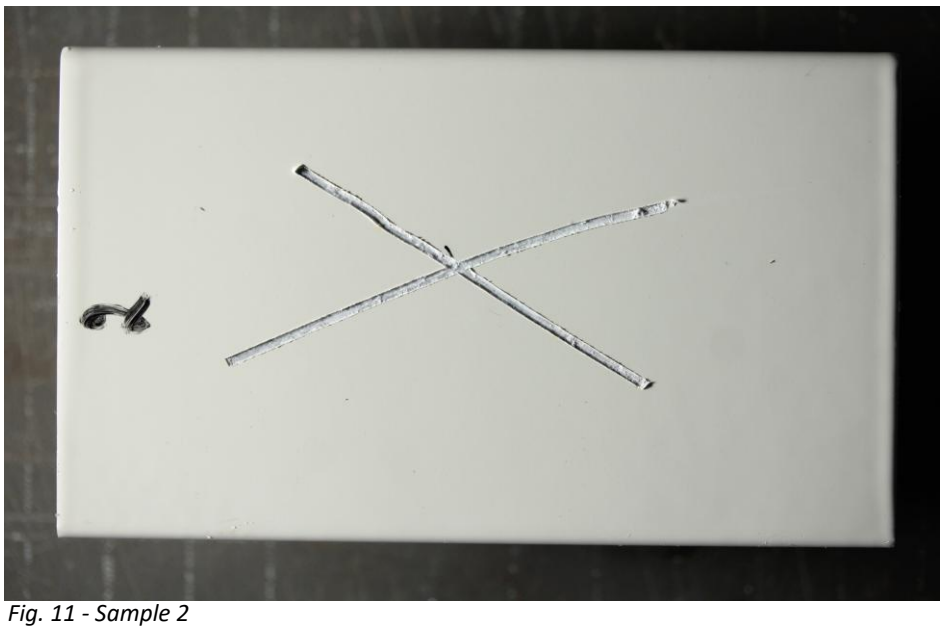

Fig. 11 - Sample 2

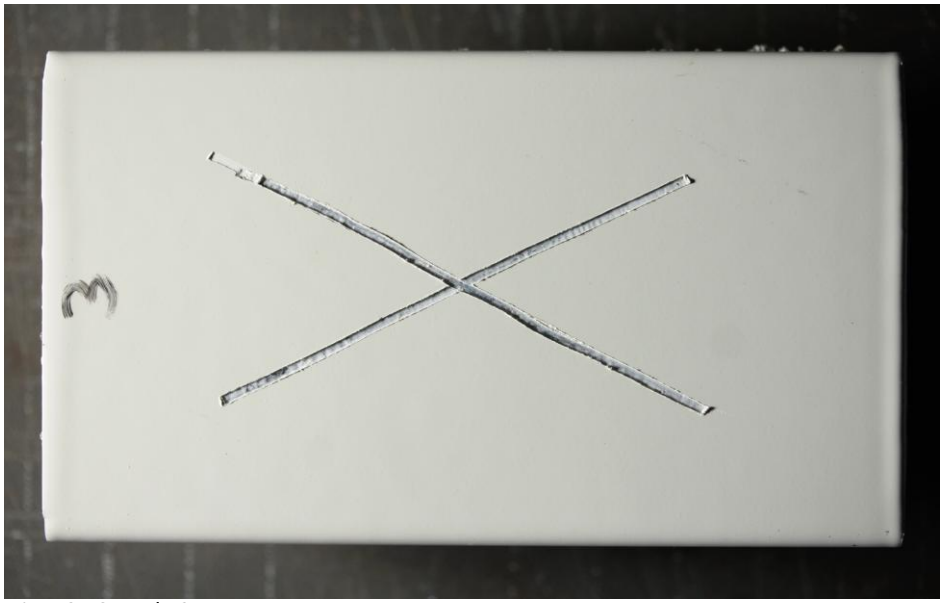

Fig. 12 - Sample 3

All tests are performed in the TUV AUSTRIA Belgium test lab, located in Wingepark 43 – 3110 Rotselaar – Belgium. TUV AUSTRIA Belgium assures the correctness of the expertise work on the pieces involved and garantees the validity of its research, for which it can not be held accountable.

Test condition datalogs and measurement uncertainty of test results under ISO 17025 scope can be provided on request.

Any conformity assessments, opinions or interpretations within the report are not issued under accreditation.

The results of the investigations are presented in this report. The conclusions in this report are based on these investigations as well as on information received from the client. Based upon this report no conclusions can be drawn concerning the general safety and usability of the investigated installation. When TÜV AUSTRIA Belgium nv has not performed sampling, samples are treated in the as-received state.

TÜV AUSTRIA Belgium nv confidential information.

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