

Prüfbericht-Nr.: <i>Test report no.:</i>	DE25I4ZS 001	Auftrags-Nr.: <i>Order no.:</i>	30010 2513	Seite 1 von 17 Page 1 of 17
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	1386441	Auftragsdatum: <i>Order date:</i>	2024-12-10	
Auftraggeber: <i>Client:</i>	PolyureaTec GmbH (for add. information see page 3)			
Prüfgegenstand: <i>Test item:</i>	Surface coating (for caravan)			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	HailGuard Pro R on Glass-fiber laminate [GFK]			
Auftrags-Inhalt: <i>Order content:</i>	Hail Impact Test			
Prüfgrundlage: <i>Test specification:</i>	following VKF - Prüfbestimmung *** No. 11 "Kunststoffplatten" 1.04 (01/07/2015) No. 20 "Sandwichelemente" 1.02 (01/06/2014)			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2025-01-07			
Prüfmuster-Nr.: <i>Test sample no.:</i>	see "List of test samples"			
Prüfzeitraum: <i>Testing period:</i>	2025-01-16 – 2025-01-21			
Ort der Prüfung: <i>Place of testing:</i>	Am Grauen Stein, 51105 Köln, Cologne			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland Solar GmbH			
Prüfergebnis*: <i>Test result*:</i>	Siehe Sonstiges / See Other			
geprüft von: <i>tested by:</i>		genehmigt von: <i>authorized by:</i>		
Datum: <i>Date:</i>	2025-03-07 Signiert von: Juergen Sommer	Ausstellungsdatum: <i>Issue date:</i>	2025-03-07 Signiert von: Ulrich Fritsch	
Stellung / Position:	Sachverständige(r)/Expert	Stellung / Position:	Sachverständige(r)/Expert	
Sonstiges / Other:	Only recommendation of hail withstand class *** VKF (Vereinigung Kantonalen Feuerversicherungen) Add. spec.: Prüfbestimmung Nr 00a – Allgemeiner Teil A & Nr 00b – Allgemeiner Teil B			
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>	Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>			
* Legende: P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet				
* Legend: P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

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Anmerkungen
Remarks

A	Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben. Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden. <i>The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system.</i> <i>Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.</i>																				
B	Wie vertraglich vereinbart, wurde dieses Dokument nur digital unterzeichnet. Der TÜV Rheinland hat nicht überprüft, welche rechtlichen oder sonstigen diesbezüglichen Anforderungen für dieses Dokument gelten. Diese Überprüfung liegt in der Verantwortung des Benutzers dieses Dokuments. Auf Verlangen des Kunden kann der TÜV Rheinland die Gültigkeit der digitalen Signatur durch ein gesondertes Dokument bestätigen. Diese Anfrage ist an unseren Vertrieb zu richten. Eine Umweltgebühr für einen solchen zusätzlichen Service wird erhoben. <i>As contractually agreed, this document has been signed digitally only. TUV Rheinland has not verified and unable to verify which legal or other pertaining requirements are applicable for this document. Such verification is within the responsibility of the user of this document. Upon request by its client, TUV Rheinland can confirm the validity of the digital signature by a separate document. Such request shall be addressed to our Sales department. An environmental fee for such additional service will be charged.</i>																				
C	Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben. Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt. <i>Test clauses with remark of * are subcontracted to qualified subcontractors and described under the respective test clause in the report.</i> <i>Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.</i>																				
D	Die Entscheidungsregel für Konformitätserklärungen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC GC8:2019 und IEC Guide 115:2021, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. <i>The decision rule for statements of conformity in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance to ILAC GC8:2019 and IEC Guide 115:2021, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report.</i>																				
E	Wenn auf dem Bericht kein Akkreditierungshinweis aufgebracht ist, wurde der Bericht nicht im akkreditierten Bereich erstellt und ist folglich auch nicht vom EA MLA abgedeckt. Unabhängig davon wurde der Bericht auf Basis der allgemeinen Regeln der ISO/IEC 17000er Reihe erstellt. Mit "#" gekennzeichnete Prüfungen sind nicht Bestandteil der Akkreditierung D-PL-22040-01-00. <i>If there is no accreditation notice on the report, the report has not been produced in the accredited area and is consequently not covered by the EA MLA. Regardless of this, the report has been prepared based on the general rules of the ISO/IEC 17000 series. Tests marked with "#" are not covered by the accreditation D-PL-22040-01-00.</i>																				
F	<table><tr><th colspan="4">Revision History</th></tr><tr><th>Revision</th><th>Date</th><th>Nature of changes</th><th>Page</th></tr><tr><td>-</td><td>2025-03-07</td><td>Original issue</td><td></td></tr><tr><td>-</td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr></table>	Revision History				Revision	Date	Nature of changes	Page	-	2025-03-07	Original issue		-							
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-	2025-03-07	Original issue																			
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Produktbeschreibung
Product description

1	Auftraggeber <i>Client</i>	PolyureaTec GmbH Jakob-Kaiser-Str. 8 47877 Willich Germany	
2	Produktdetails <i>Product details</i>	Allgemeine Informationen ; General Information	
		Brand name	PolyureaTec
		Type name	HailGuard Pro R
		Product category	(Caravan) surface coating
		Year of production	2024
		Coating material	Polyurea
		Top coating	none Raptor
		Layer thickness [mm]	2.0 2.0 (+ 150-200 µm)
		Base layer material	Glass-fiber laminate [GFK]
		Base layer thickness [mm]	2.0
		Dimensionen ; Dimension	
		Dimension (l / w / h) [mm]	1000 / 1000 / 32
		Split to [mm]	1000 / 500 1000 / 500
		Gross area [m²]	0.5 0.5
		Thickness [mm]	34.0 ; incl. coating 34.2 ; incl. coating
3	Technische Dokumentation <i>Technical documentation</i>	Technical Data Sheet – “RLW-TDS-GER” for Raptor “DE 4400N” for Primer	
4	Hersteller <i>Manufacturer</i>	PolyureaTec GmbH (see Point 1)	
5	Distributor <i>Distributor</i>	-	
6	Sonstiges <i>Other</i>	Both versions, with and without top coating, were provided on one sample only	
7	Prüfmusterbereitstellung: <i>Test sample obtaining</i>	☒ Sending by customer ☐ Sampling by TÜV Rheinland Group ☐ others:	

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Produktbeschreibung
Product description

Set-up and mounting situation (example)



Set-up and mounting situation (example)



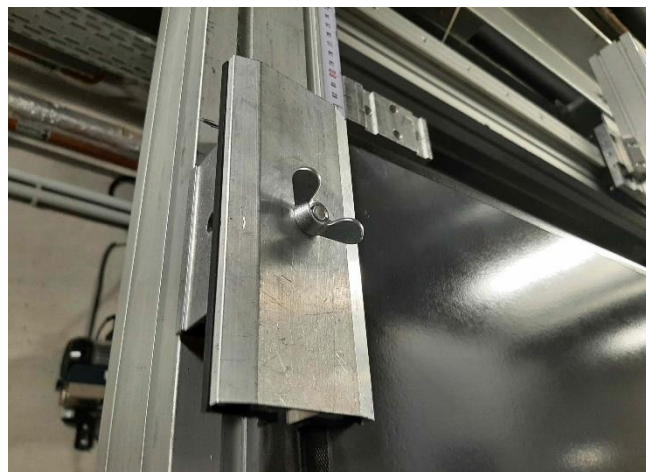
Marking (example)



Example of mounting



Example of mounting



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-	Result summary table		
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Test	Date [DD Month YYYY]		Summary of main test results	—
	Start / 1 st	End / 2 nd		
Impact resistance (various ice ball diameter)	16 January 2025	17 January 2025	See <i>Final evaluation</i> and <i>Final inspection</i>	N/A*
Final inspection	21 January 2025			N/A*

Supplementary information:

*because of various results no clear information could be given; see also *Final evaluation* and *Final inspection*

-	Final evaluation		
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In four-eyes principle; by	J. Sommer U. Fritzsche				—
Overview of single evaluation results					
Evaluation of hail withstand (only recommendation)					
Properties of component	Hail withstand class and Ice ball diameter				
Thickness of surface [mm]	GFK + HailGuard Pro R		GFK + HailGuard Pro R + TC		
Visual nature / look (>5 m)	HW4	40 mm	HW4	40 mm	
Visual nature / look (<0.5 m)	HW4	40 mm	HW4	40 mm	
Water tightness	HW4*	40 mm*	HW4*	40 mm*	
Mechanics / structure	HW4*	40 mm*	HW4*	40 mm*	

Supplementary information: see also *Final inspection*

*GFK-layer is broken, but coating is still intact and water tight; also at HW5/50 mm

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-	List of test samples		
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Test Sample Picking (randomly)		Date [YYYY-MM-DD]	by	—
		-	-	
Sample No.	Sample S/N	Type	Remarks /constructional characteristics	
HV2025000041	-	GFK; without top coating	further called "GFK"	
		GFK; with top coating	further called "GFK-TC"	

Setup of coating-system:

- Primer: Permafleet EP Grundierfüller 4400 (approx. 60 µm)
- Sealing/Protection: HailGuard Pro R (approx. 2.0 mm)
- Varnish/Top Coating: Raptor (approx. 150 – 200 µm)

-	Visual inspection (Initial)		
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Test date [YYYY-MM-DD]		2025-01-16	—
Sample No.	Nature and position of initial findings		
HV2025000041	Several pre-marked surface damages		

Initial inspection – Marking - GFK		Final inspection – marking – GFK-TC	
			

Supplementary information: -

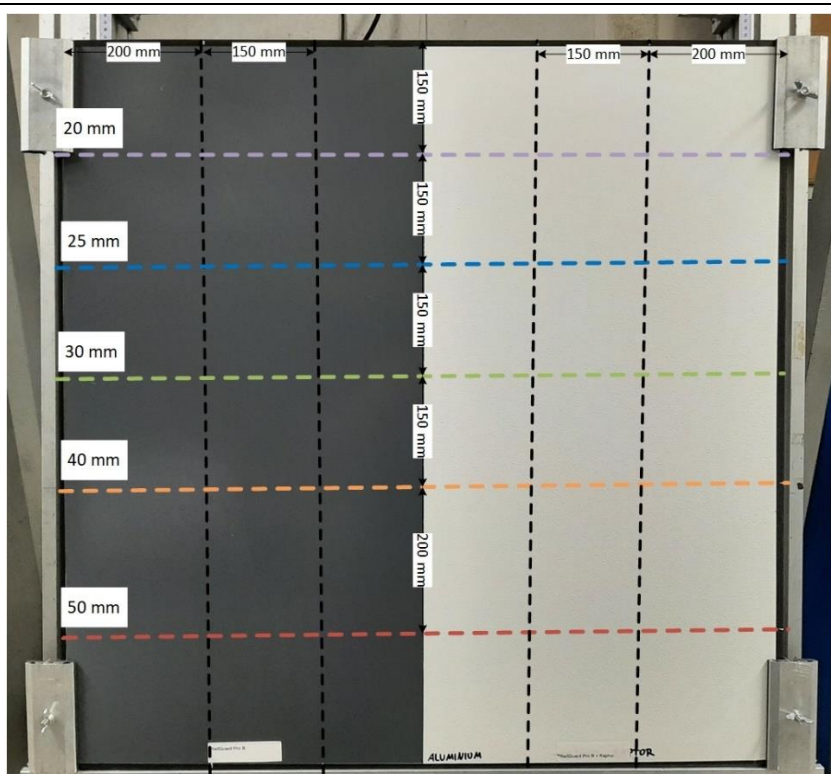
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-	Impact resistance test (general)				
Test date [YYYY-MM-DD] Day code	2025-01-16 ^a				
Sample-No. ID code	HV2025000041#GFK ; HV2025000041#GFK-TC				
Method used for impact resistance (following)	Nr. 11 "Kunststoffplatten" & Nr. 20 "Sandwichelemente"				
Surface conditioning	none				
Sample tilt angle [° from horizontal]	90				
Direction of shoot [°]	0 (horizontal)				
Impact angle [° from sample surface]	90				
Distance (sample to center of v ₀ -meas.) [mm]	500 to 700				
Ice ball production [week of the year]	2 (hermetically sealed)				
Storage temperature of ice ball [°C]	-20				
Ambient conditions (mean) [°C and % RH]	^a 23.1 and 41.3				
Diameter of ice ball [mm]	20	25	30	40	50
Weight of ice ball [g]; mean	3.8	7.3	12.7	30.0	58.6
Velocity of ice ball [m/s]; mean	19.5	22.4	23.9	27.5	30.8
Impact energy (at least) [J]	0.7	1.7	3.5	11.1	27.0

Description of impact location



Supplementary information: Cross-points of lines are impact locations with remarked ice diameter

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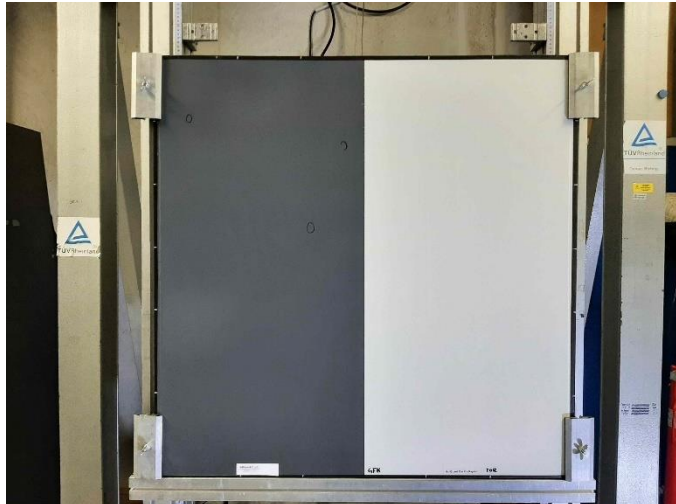
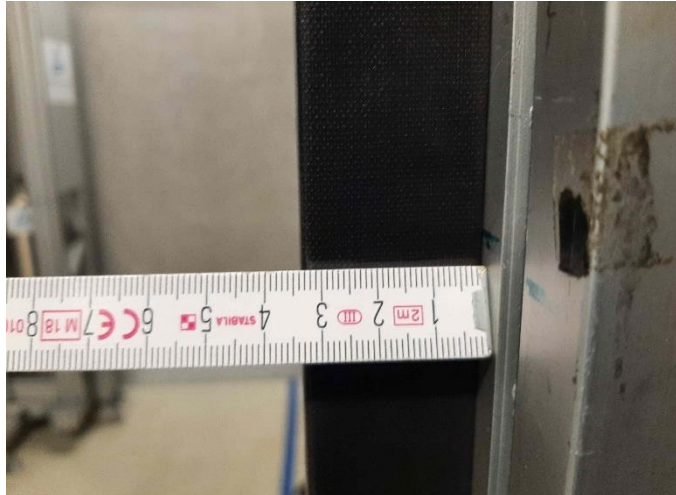
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-	Final inspection (general)				
Test date [YYYY-MM-DD]			2025-01-21		—
Sample-No.	Potential problem	Evaluation			
		GFK	GFK-TC		
HV2025000041	Technical problems	HW 4 passed ; <u>with 40 mm</u> NO cracks visible under use of magnifier NO structural damages detectable	HW 4 passed ; <u>with 40 mm</u> NO cracks visible under use of magnifier NO structural damages detectable	N/A*	
	Additional technical remark	Generally water tight ; Even if GFK-layer is broken, base coating is still water tight (up to <u>50 mm/HW5</u>)	Generally water tight ; Even if GFK-layer is broken, complete coating is still water tight (up to <u>50 mm/HW5</u>)	—	
	Visual problems (distance; 5 m)	HW 4 passed ; <u>with 40 mm</u> NO cracks visible NO dents visible HW 5 failed ; <u>with 50 mm</u>	HW 4 passed ; <u>with 40 mm</u> NO cracks visible NO dents visible HW 5 failed ; <u>with 50 mm</u>	N/A*	
	Visual problems (near; < 0.5 m)	HW 2 passed ; <u>with 20 mm</u> NO cracks visible (under use of magnifier) Dents partial visible depending on light and point of view	HW 4 passed ; <u>with 40 mm</u> NO cracks visible (under use of magnifier) Dents partial visible depending on light and point of view	N/A*	
	Individual additional remarks: All results are related to the tested samples (carrier sandwich and coating) ; further, without any correlation of long term effects. * see Final evaluation and Annex : Additional photo documentation				—
	Supplementary information: -				

-	General remarks and subplementary information	
Measuring uncertainties		—
All results only refer to the test samples that were subjected to testing. The extended total measuring uncertainty is: $u(k=2) \leq \pm 2.5 \%$		

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-	Annex: Additional photo documentation		
Setup – GFK and GFK-TC		Setup – GFK and GFK-TC	
			
Mounting – GFK and GFK-TC		Mounting – GFK and GFK-TC	
			
Thickness – GFK and GFK-TC		Thickness – GFK and GFK-TC	
			

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-	Annex: Additional photo documentation		
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GFK	Example of impact – 30 mm	GFK-TC
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GFK	Example of impact – 40 mm	GFK-TC
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GFK	Example of impact – 50 mm	GFK-TC
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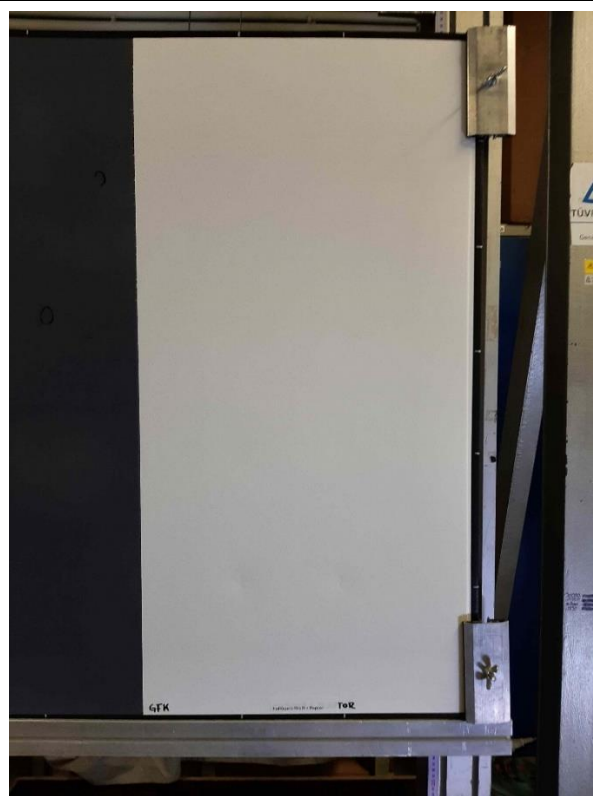
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-	Annex: Additional photo documentation		
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GFK	Example of impact – 20 mm	GFK-TC
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GFK	Damage of impact – 20 mm	GFK-TC
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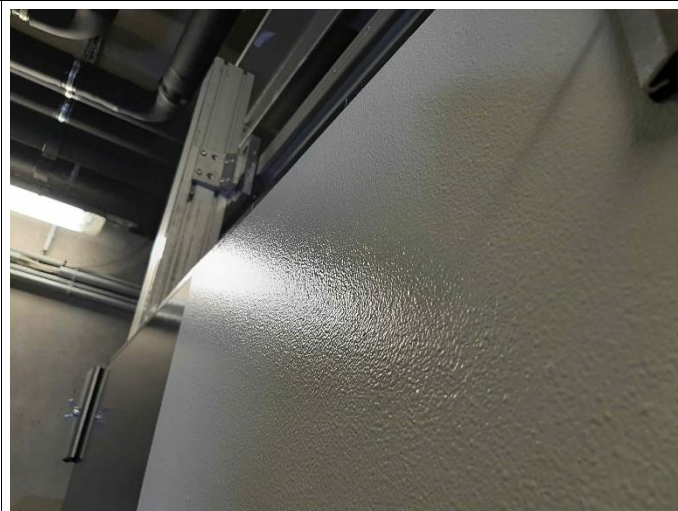
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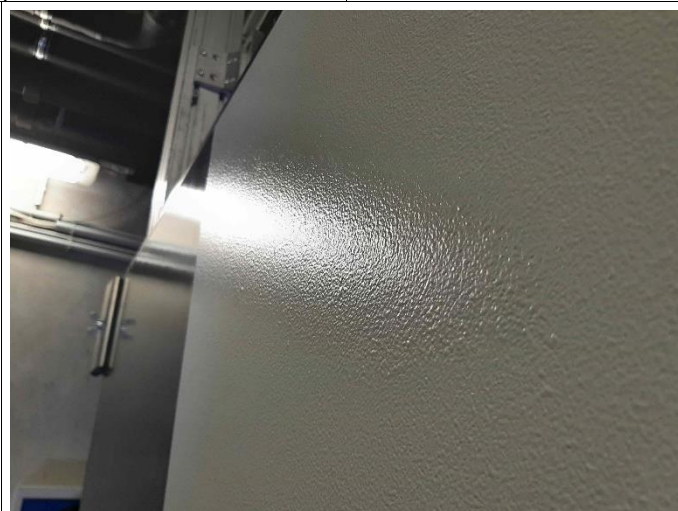
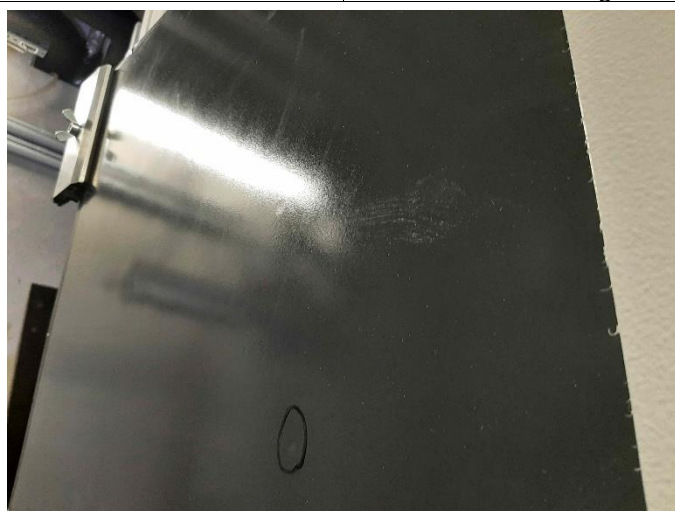
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-	Annex: Additional photo documentation		
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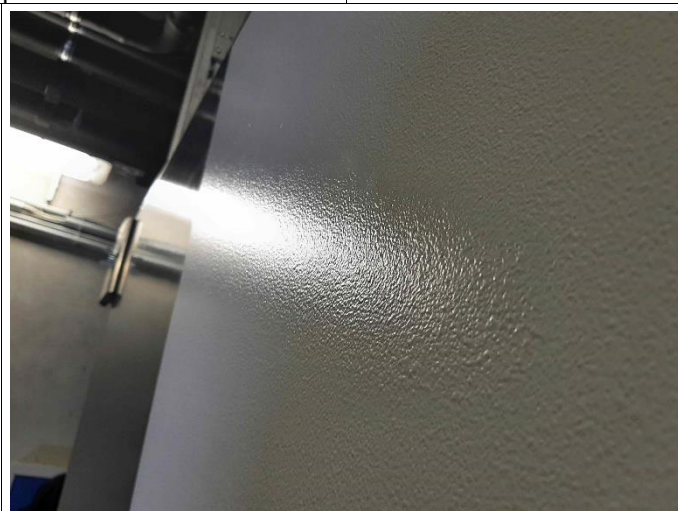
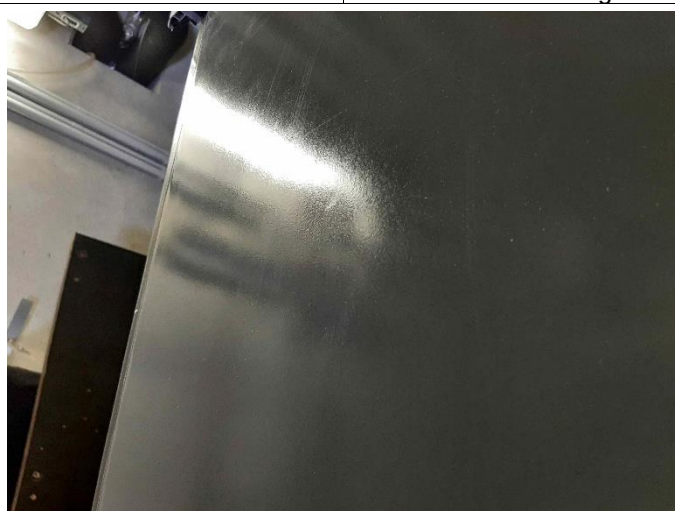
GFK	Damage of impact – 20 mm	GFK-TC
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GFK	Damage of impact – 25 mm	GFK-TC
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GFK	Damage of impact – 30 mm	GFK-TC
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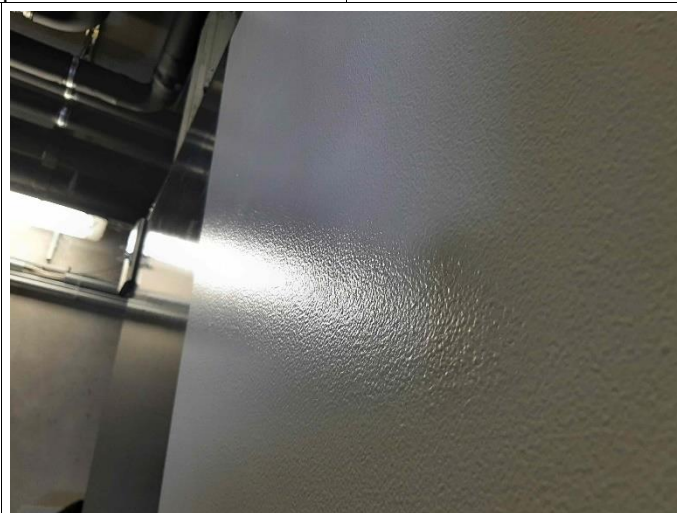
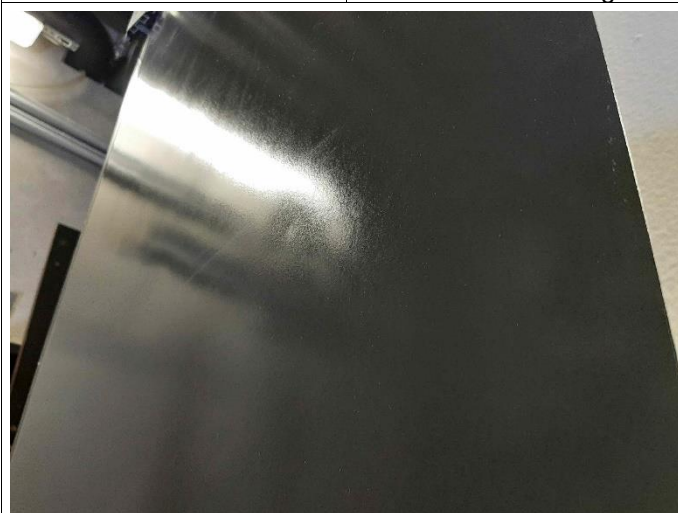
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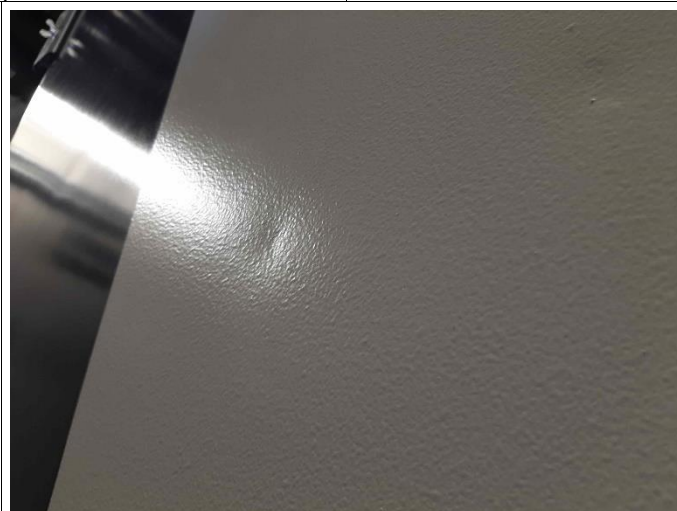
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-	Annex: Additional photo documentation		
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GFK	Damage of impact – 40 mm	GFK-TC
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GFK	Damage of impact – 50 mm	GFK-TC
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GFK	Damage of impact – 50 mm	GFK-TC
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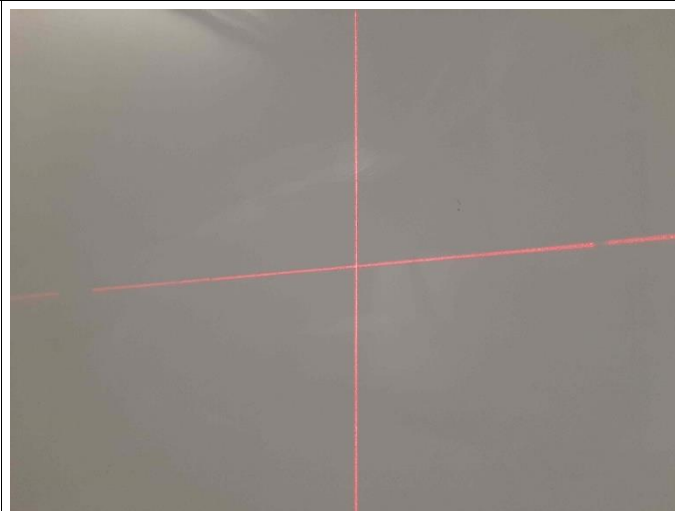
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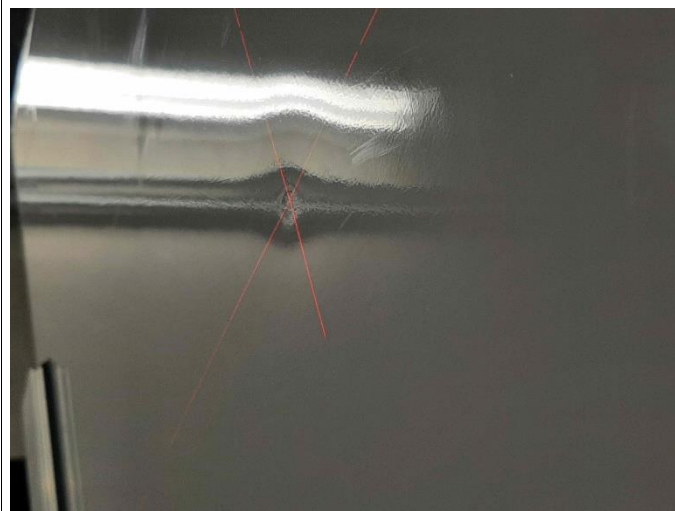
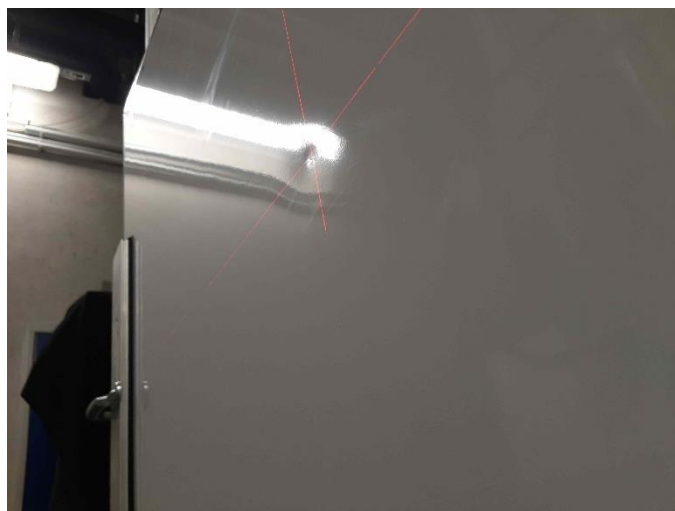
- Annex: Additional photo documentation

Comparable Damage of impact – 30 mm

Comparable impacts on un-coated GFK surface.



Comparable Damage of impact – 40 mm



Comparable Damage of impact – 50 mm



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