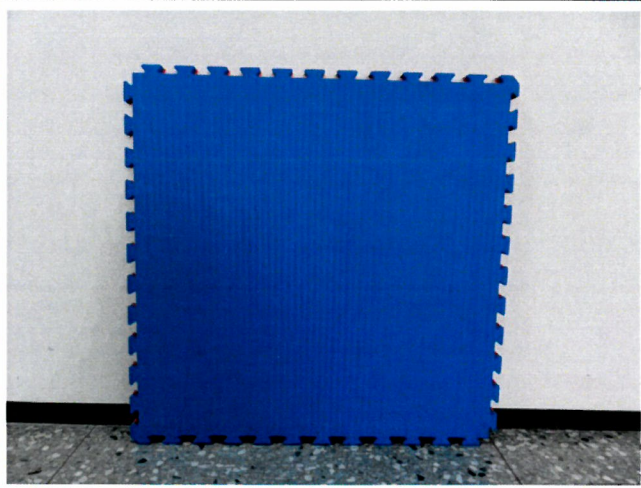
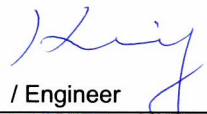


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Kunden-Referenz-Nr.: Client Reference No.:	12093307	Auftragsdatum: Order date:	08.Nov.2016		
Auftraggeber: Client:	Jen Yau Enterprise Co., Ltd. No. 8, Lu Kong South-2 Road, TW-50544 Lu Kang Town, Chang Hua Taiwan, R. O. C.				
Prüfgegenstand: Test item:	EVA Foam Mat				
Bezeichnung / Typ-Nr.: Identification / Type No.:	MT1004A				
Auftrags-Inhalt: Order content:	Mechanical test and issue of test report				
Prüfgrundlage: Test specification:	EN 1177:2008 Stoßdämpfende Spielplatzböden – Bestimmung der kritischen Fallhöhe; Impact attenuating playground surfacing - Determination of critical fall height				
Wareneingangsdatum: Date of receipt:	07.Nov.2016				
Prüfmuster-Nr.: Test sample No.:	A000452404				
Prüfzeitraum: Testing period:	22.Nov.2016 - 22.Nov.2016				
Ort der Prüfung: Place of testing:	TÜV Rheinland Taiwan Ltd., Taichung Laboratory				
Prüflaboratorium: Testing laboratory:	TÜV Rheinland Taiwan Ltd.				
Prüfergebnis*: Test result*:	Siehe Sonstiges / See Other				
geprüft von / tested by:  <u>23. Nov. 2016</u> Mac F. Y. Kung / Engineer		kontrolliert von / reviewed by:  <u>23. Nov. 2016</u> Bryan Y. M. Lee / Reviewer			
Datum Date	Name / Stellung Name / Position	Unterschrift Signature	Datum Date	Name / Stellung Name / Position	Unterschrift Signature
Sonstiges / Other: -The test result please refer page 12. -According to client's requirement, the drop height is 1000mm.					
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:		Prüfmuster vollständig und unbeschädigt Test item complete and undamaged			
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor 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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Liste der verwendeten Prüfmittel
List of used test equipment

[illegible]

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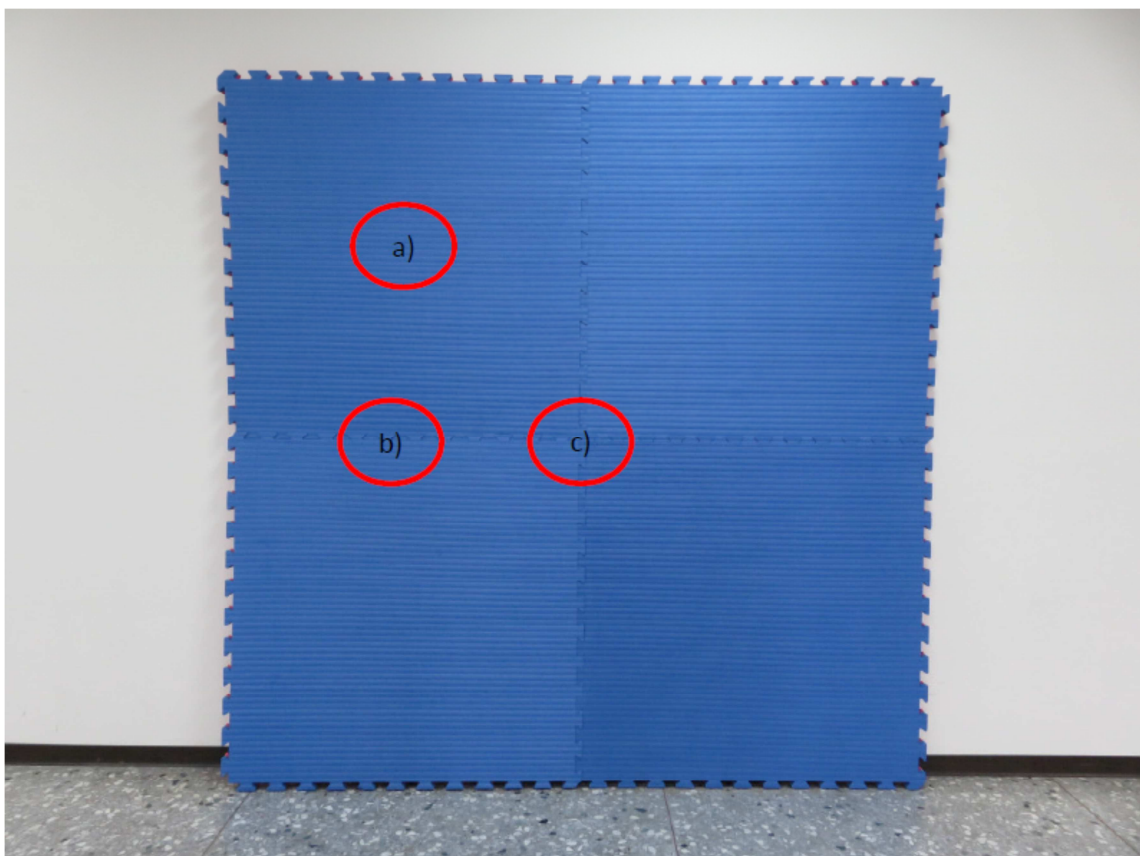
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Produktbeschreibung
Product description

1	Produktdetails <i>Product details</i>	Drop height: 1000mm
2	Maße / Gewicht <i>Dimensions / Weight</i>	Dimension: (L x W x H in mm) / Net weight: (kg) Dimension: 1020 x 1020 x 45 / 3.9
3	Bedienelemente <i>Operating elements</i>	N/A
4	Ausstattung / Zubehör <i>Equipment / Accessories</i>	N/A
5	Verwendete Materialien <i>Used materials</i>	EVA Foam
6	Sonstiges <i>Other</i>	Test positions as below picture.

Test positions:

- a) in the centre of the samples.
- b) in the centre of a joint between two adjoining samples.
- c) at the junction where the greatest number of samples meet.



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1	Scope This European Standard specifies a method for determining the impact attenuation of playground surfacing. It defines a "Critical Fall Height" (see 3.2) for surfacing, which represents the upper limit of its effectiveness in reducing head injury when using playground equipment conforming to EN 1176. The test methods described in the European Standard are applicable for tests carried out in a laboratory and for tests on site.
2	Normative references
3	Terms and definitions
4	Test method
4.1	Principle Test specimens or installed areas of the impact attenuating material under test are struck by an instrumented headform in a defined series of impacts from different drop heights. The signal emitted by an accelerometer (see Figure B.1) in the headform during each impact is processed to yield a severity from the measured impact energy, defined as head injury criterion (HIC). The HIC of each impact is plotted and the critical fall height is determined as the lowest drop height producing a HIC value of 1 000 (see Figure B.2).
4.2	Apparatus
4.2.1	Test rig , comprising a headform with accelerometer (4.2.2), optionally with a charge amplifier (4.2.3) and, if using a uniaxial accelerometer, a guidance system (4.2.4) and impact measuring equipment (4.2.8), as shown in Figure A.1.
4.2.2	Headform, consisting of either a) an aluminium alloy ball; or b) a hemispherical ended aluminium alloy missile. It shall have a diameter of 160 mm $\pm$ 5 mm, a mass of 4,6 kg $\pm$ 0,05 kg, with a maximum deviation from the hemispheric surface of 0,5 mm, incorporating an accelerometer as follows: c) triaxial accelerometer for free falling headforms, mounted in the centre of gravity of the headform; or d) uniaxial accelerometer for guided headforms, aligned to measure in the vertical axis $\pm$ 5° and located directly above the centre of mass. The impacting part of the headform between the lower boundary and accelerometer shall be homogeneous and free from voids.
4.2.3	Charge amplifier (optional)
4.2.4	Guidance system , to guide the headform when using a uniaxial accelerometer, including a means to measure the velocity of the headform immediately prior to impact.
4.2.5	Length measuring equipment, such that for the free-fall impact test, the drop height can be measured directly prior to release of the headform. NOTE Calculating the drop height from the measured time between release and contact of the missile

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	with the surface may be not sufficient because of possible time differences between the start of time measurement and the effective release of the headform (e.g. caused by permanent magnetism in a magnetic release system). In all cases, the drop height shall be measured with an uncertainty of not greater than 1 %.		
4.2.6	Velocity measuring equipment , such that for the guided impact test, the theoretical drop height can be calculated by measuring the velocity of the headform immediately prior to the impact. In all cases, the velocity shall be measured with an uncertainty of not more than ± 1 %. NOTE To allow for frictional losses, the velocity of the headform immediately prior to impact is recorded in order to calculate the equivalent drop height as if the headform had been in free fall.		
4.2.7	Release system , such that for the free-fall impact test, it does not create a rotation moment or any other forces on the headform, when released. NOTE A rotation moment or other forces on the headform would cause additional accelerations after impact in the triax, leading to an uncontrollable error of the resultant for the vertical measurement.		
4.2.8	Impact measuring equipment , consisting of an accelerometer measurement system (4.2.9), a recording device (4.2.10) and a HIC calculation program (4.2.11).		
4.2.9	Accelerometer measurement system , capable of measuring all frequencies in the range 0,3 Hz to 1 000 Hz and having a sufficient response at all frequencies to keep amplitude errors below 5 %, in accordance with ISO 6487. It shall be capable of measuring, recording and displaying the acceleration and time duration of each complete impact. NOTE For a sufficient response at low frequencies, the - 3 dB lower limiting frequency should be less than or equal to 0,3 Hz to reduce the error by overshooting the baseline after the impact and underestimating the g-max. and HIC score, particularly for longer pulse durations (see frequency response diagram in ISO 6487:2002, Figure 1). An accelerometer with a time constant of 2 s or greater and appropriate signal conditioning will generally meet this requirement.		
4.2.10	Recording device , capable of capturing and recording the acceleration time signals produced during an impact with a minimum sampling rate of 10 kHz. Signal conditioning and filtering shall be compatible with the accelerometer and the data channel specified and shall conform to ISO 6487. NOTE According to ISO 6487 the analogue anti-aliasing filters should have an attenuation of at least 30 dB at half the sampling rate.		
4.2.11	Program for calculating the HIC value for the recorded acceleration time history of each impact, in accordance with 4.6.		
4.3	Accuracy of tests		
4.3.1	Apparatus shall be equipped with calibrated measuring devices. The impact measuring system, including the signal processing equipment and the measuring of drop height, shall be validated at least annually by a competent laboratory in accordance with EN ISO/IEC 17025. NOTE For on-site testing, it is recommended that the frequency of equipment validation be increased.	Checked.	P ☒ F ☐ N/A ☐ N/T ☐

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4.3.2	Accelerometers shall be calibrated for the whole frequency range. Recalibration shall be carried out at time intervals recommended by the manufacturer of the accelerometer or at least every two years. Accelerometers shall have an uncertainty not greater than 5 %.	Checked.	P ☒ F ☐ N/A ☐ N/T ☐
4.3.3	Velocity measurement systems shall be calibrated for the whole velocity range (up to 3 m dropheight).	Checked.	P ☒ F ☐ N/A ☐ N/T ☐
4.3.4	The computer algorithm used for the calculation shall be checked by imposing a half-sine curve and the result, when compared with an independent mathematical calculation of this curve, shall not deviate by more than ± 1 %.	Checked.	P ☒ F ☐ N/A ☐ N/T ☐
4.3.5	Reactions from the release system on the headform shall be tested by a series of at least three consecutive drop tests on a defined reference surface with constant properties. The HIC values obtained shall not differ more than ± 5 %. NOTE 1 These tests are for checking any deviations or anomalies in the components and neither replace calibration nor the validation for compliance of the apparatus with this European Standard. NOTE 2 Experience has shown that comparative testing on defined surfaces might not be sufficient and that an external calibration of the measuring device is required.	Checked.	P ☒ F ☐ N/A ☐ N/T ☐
4.4	Conditions for testing		
4.4.1	Testing in the laboratory		
4.4.1.1	Testing shall be carried out at a temperature of 23 °C $\pm$ 5 °C.	24.3 °C, 50 RH%	P ☒ F ☐ N/A ☐ N/T ☐
4.4.1.2	Testing shall be carried out on a flat, rigid concrete, or equivalent substrate of sufficient mass, density and thickness that its deformation during the test makes no significant contribution to the test result.	Testing on a rigid surface.	P ☒ F ☐ N/A ☐ N/T ☐
4.4.1.3	For testing particulate material, a test frame without a base shall be used, having internal dimensions not less than 1 m 1 m, and capable of containing the material to the depth specified by the supplier. NOTE 1 The dimensions given usually reduce the influence of containment on particulate materials. Particulate materials shall be placed in the test frame above the flat rigid substrate and uniformly distributed	Not particulate material.	P ☐ F ☐ N/A ☒ N/T ☐

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	within the frame, without compaction, to a depth specified by the supplier. NOTE 2 The depth can be determined by laying a 1 m 1 m 10 mm sheet of plywood on the material and measuring the thickness of the layer below the plywood.		
4.4.1.4	For testing tiles, at least four tiles with a minimum total dimension of 1 m x 1 m shall be installed on a flat, rigid substrate (4.4.1.2) according to the manufacturer's instructions, including all connecting and site fixing elements used for installation in the playground.	Checked.	P ☒ F ☐ N/A ☐ N/T ☐
4.4.1.5	For testing surfacing intended to be manufactured on site, either of the following shall be prepared without seams or joints: a) at least one test specimen with a minimum total dimension of 1 m 1 m, placed on a rigid substrate (4.4.1.2) in accordance with the manufacturer's instructions; or b) at least nine separate specimens, each not less than 500 mm 500 mm, laid in turn on a flat rigid substrate (4.4.1.2) in accordance with the manufacturer's instructions.	Not on site testing.	P ☐ F ☐ N/A ☒ N/T ☐
4.4.1.6	For products intended to be laid over another layer, the entire system, surfacing with under layer, shall be tested on the flat rigid substrate (4.4.1.2) and reported as a composite product. NOTE Substrates other than the flat, rigid substrate (4.4.1.2) are likely to contribute to the impact attenuation of the material being tested.	Composite product.	P ☒ F ☐ N/A ☐ N/T ☐
4.4.1.7	If it is suspected that the impact attenuation of the material could be influenced by moisture (e.g. sand), the moisture content at the time of testing shall be measured and reported together with the test method used. NOTE 1 The impact attenuation of some loose particulate material can be significantly influenced by its moisture content. NOTE 2 Products intended to be installed in combination with a natural substrate (e.g. lawn, grass, natural turf, sand) cannot be meaningfully tested in the laboratory and cannot be subject to a test report according to EN ISO/IEC 17025. The critical fall height of such products can only be determined individually by an on-site test, on a mature, fully established installation.		P ☐ F ☐ N/A ☒ N/T ☐

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4.4.2	Testing on site		
4.4.2.1	Testing on site shall be carried out and reported generally as described for laboratory testing, except that other relevant climatic conditions shall be identified (temperature, moisture, etc.), measured and reported when carrying out the test.	Not on site testing.	P ☐ F ☐ N/A ☒ N/T ☐
4.4.2.2	Testing on site cannot be used for product certification and an individual test report conforming to 4.7.2 shall be issued prefaced by the statement in 4.7.3. NOTE As the performance of some materials is greatly affected by temperature, moisture and other factors, the test will only determine a critical fall height in the actual situation at the time of the test.	Not on site testing.	P ☐ F ☐ N/A ☒ N/T ☐
4.5	Procedure		
4.5.1	Time/acceleration trace Display the time/acceleration trace for each impact and examine it for any anomalies before being processed and evaluated. If high frequency components appear in the signal obtained from a drop test using the headform described in this test method, it is very likely that some mechanical fault is present in the apparatus. Check to ensure that no component of the headform is loose, in particular the accelerometer. If high frequency components appear as a consequence of vibrations of the drop test headform, filtration of signals with a standardized filter will be necessary. Measure both with and without the filter and compare the HIC values.	Checked.	P ☒ F ☐ N/A ☐ N/T ☐
4.5.2	Selection and definition of the test position		
4.5.2.1	For each selected drop height, carry out the impact measurement in all relevant test positions of the test pieces or test material, as far as is practical, to determine the test position of the critical fall height.	According to client's requirement, the drop height is 1000mm. The test result please refer to page 12.	P ☒ F ☐ N/A ☐ N/T ☐
4.5.2.2	Ensure that the distance between any two test positions is not less than 250 mm and that no position is closer than 250 mm from the edge of the test specimen, assembly or test frame. NOTE These distances are to avoid influences on the test position from previous tests and from the edges at the perimeter of the test specimen.	Checked.	P ☒ F ☐ N/A ☐ N/T ☐

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4.5.2.3	For all tests, ensure that the location of each test position where the critical fall height is measured is referenced to the test specimens or material and is related to the structure and/or geometry of the surfacing. Indicate this in the test report.	Checked.	P ☒ F ☐ N/A ☐ N/T ☐
4.5.2.4	When site tests are carried out, ensure that the location of each test position where the critical fall height is measured is also referenced to the playground equipment. Indicate this in the test report.	Not on site test.	P ☐ F ☐ N/A ☒ N/T ☐
4.5.2.5	For loose particulate materials and natural surfacing, locate the test position for each drop height at a new (untested) ground position. NOTE Loose particulate materials and natural surfacing include topsoil and sand.	Not loose particulate material.	P ☐ F ☐ N/A ☒ N/T ☐
4.5.2.6	Do not test falling areas if they are inclined at more than 10° to the horizontal.	Testing on a flat surface.	P ☒ F ☐ N/A ☐ N/T ☐
4.5.2.7	If different types of ground and/or surfacing are used in the impact area, test each type of area separately.	Testing on a flat surface.	P ☒ F ☐ N/A ☐ N/T ☐
4.5.3	Procedures for specific types of product		
4.5.3.1	Fabricated surfacing products		
4.5.3.1.1	Testing in the laboratory For tiles, slabs or other fabricated surfacing products, conduct at least nine drop tests, each at a different test position on the test specimens (see 4.4.1.4 and 4.4.1.5). For tiles, conduct a drop test (minimum four drop heights) in the following positions: a) in the centre of the tiles; b) in the centre of a joint between two adjoining tiles; c) at the junction where the greatest number of tiles meet; and d) at any other point of inhomogeneity or discontinuity, to obtain the lowest value for the critical fall height anywhere on the assembly. Ensure that each drop test is completed within 15 min. Record each HIC value.	Testing positions please refer to page 3.	P ☒ F ☐ N/A ☐ N/T ☐
4.5.3.1.2	Testing on site Use the procedure described in 4.5.3.1.1, except that all drop heights shall be at the relevant maximum free height of fall of the equipment for that position.	Testing in the laboratory.	P ☐ F ☐ N/A ☒ N/T ☐

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4.5.3.2	Loose particulate materials and natural surfaces		
4.5.3.2 .1	General For loose particulate materials, conduct at least three drop tests as described in 4.5.3.2.2 or 4.5.3.2.3, as appropriate.	Not loose particulate material.	P ☐ F ☐ N/A ☒ N/T ☐
4.5.3.2 .2	Testing in the laboratory Locate the first test position, which shall be not less than 250 mm from the frame, and conduct three consecutive impacts with the headform from the same drop height in the same test position without redistribution of the material (see 4.4.1.3). Record each result. NOTE This procedure allows for possible effects of compaction of the material and is likely to give progressively higher values. Redistribute the material in the frame and re-level it to the same test thickness. Drop the headform from the second (incrementally higher) drop height, three times without re-distribution, as before. Re-distribute the material in the frame and re-level it to the same test thickness. Repeat the procedure until all necessary drop heights (minimum of four) have been tested. Record each HIC value. To measure HIC values for the same product, installed at a different layer thickness, remove all the material from the frame and replace it with fresh material before testing at a new thickness. For materials that are likely to be significantly influenced by their moisture content (e.g. sand), measure the moisture content at the time of testing and record the method used and the result. When testing sand or gravel, determine the particle size distribution by carrying out a sieve test in accordance with EN 933-1.	Not loose particulate material.	P ☐ F ☐ N/A ☒ N/T ☐
4.5.3.2 .3	Testing on site For testing on site, carry out the procedure as described in 4.5.3.2.2 for each drop height (minimum of four), using a separate position for each drop height, ensuring that the material is present at the same layer depth at each test position. From each drop height, drop the headform three times on the same test position without redistribution and record the highest value for HIC from the three drops. Carry out the test at the next drop height on a different part of the surface, at least 250 mm	Not on site testing.	P ☐ F ☐ N/A ☒ N/T ☐

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	away. Record each HIC value. When testing on site, a variety of test positions shall be selected to ensure the worst case situation is included (e.g. access position). When testing sand or gravel on site, it is not necessary to determine the particle size distribution.		
4.5.4	Selection of data for determination of critical fall height Select the lowest drop height equivalent to a HIC of 1 000 from any of the drop tests conducted in accordance with 4.5.3, using impact measurements with at least two values giving HIC values below and at least two giving HIC values above 1 000 (see Figure B.2). Two of the drop heights shall be within 500 mm below the critical fall height, and two within 500 mm above the critical fall height. This does not apply for materials giving HIC values lower than 1 000 at the maximum test height.	According to client's requirement, the drop height is 1000mm. The test result please refer to page 12.	P ☒ F ☐ N/A ☐ N/T ☐
4.6	Calculation of results		
4.6.1	Calculate the head injury criterion (HIC) value for each time/ acceleration curve from the formula $HIC = \left[\left(\frac{\int_{t_1}^{t_2} a \times dt}{t_2 - t_1} \right)^{2.5} \times (t_2 - t_1) \right]_{\max.}$ for all time intervals (t1 ,t2) with a minimum sampling rate of 8 000 Hz between tstart and tend where t_{start} is the time, at the start of an impact event, when the acceleration of the headform equals or exceeds zero; t_{end} is the time, at the end of an impact event, when the acceleration of the headform first equals or falls below zero a is the acceleration experienced by the headform and expressed in g (acceleration due to gravity); t₁, t₂ are any two intermediate values of t between tstart and tend, t being the time expressed in milliseconds [ms]. This procedure is only valid for impact events with a HIC duration of more than 3 ms, i.e. (t₂ - t₁) 3 ms.	According to client's requirement, the drop height is 1000mm.	P ☐ F ☐ N/A ☒ N/T ☐
4.6.2	To calculate the critical fall height, produce one curve from all selected heights (4.5.4), in which the HIC values are plotted against the corresponding drop heights obtained. Interpolate the curve to obtain the drop height equivalent to a HIC of 1 000. If any single drop test gives an anomalous result, repeat		P ☐ F ☐ N/A ☒ N/T ☐

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	this test on a new test position and investigate further by adding further drop tests for the part of the curve in question. NOTE An example of a correct curve is illustrated in Figure B.2.		
4.6.3	Determine the critical fall height as the lowest drop height producing HIC of 1 000 obtained from any of the drop tests.		P ☐ F ☐ N/A ☒ N/T ☐

Test result:

EVA Foam (Blue side)			
	Position 1	Position 2	Position 3
1st impact (g-max/HIC) 1.5min	86.16 / 303.2	79.98 / 268.6	79.63 / 264.7
2nd impact(g-max/HIC) 1.5min	92.79 / 336.6	92.06 / 329.0	93.0 / 328.1
3rd impact (g-max/HIC) 1.5min	98.41 / 363.9	97.68 / 356.3	98.44 / 353.4
Average of 2nd and 3rd impact (g-max/HIC)	92.45 / 334.6	89.9 / 318.0	90.36 / 315.4
Environment condition	24.3 °C, 50 RH%		
Drop height (mm)	1000		