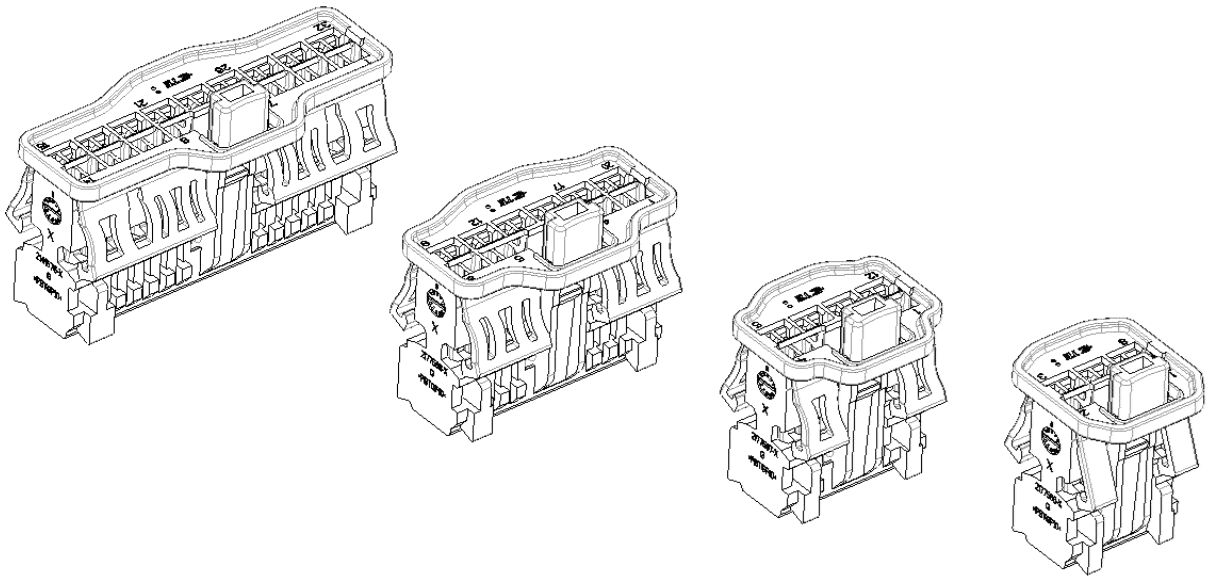
Class 1

NANO MQS LS TOP LATCH SERIES



LTR	REVISION RECORD	DWN	APP	DATE
A	PRELIMINARY ISSUE	Lovera, I.	Briccarello, A.	09DEC2010
A1	Updated	I.L.	A.B.	20APR2011
A2	Updated	I.L.	A.B.	03MAY2011
A3	Update	A.B.	A.G.	28JUN2011
A4	Test sequence updated	A.B.	A.G.	07MAR2012
A5	Error and omission update	A.B.	A.G.	29MAR2012
A6	New secondary lock design introduction	A.B.	M.G.	19NOV2013
A7	Drafting update	A.B.	M.G.	06FEB2014
A8	Drafting update	A.B.	M.G.	20FEB2014
A9	Update – Design Objective removed	A.B.	M.G.	15SEP2014
B	Update – Rate/Values acc. to OEM-Standard Spec.	Mahnke, B.	Schoellhammer, S.	27JUL2021

| Indicates Change

1.0 SCOPE

This specification covers the requirements for product performances, test methods and quality assurance provisions of:

TE Part Number	"Trade Mark" Description	Wire range	Insulation
2177586-X	8 POS HOUSING LS TOP LATCH	0.13÷0.35mm^2	Max. insulation diameter Ø 1.3 mm
2177587-X	12 POS HOUSING LS TOP LATCH		
2177588-X	20 POS HOUSING LS TOP LATCH		
2141576-X	32 POS HOUSING LS TOP LATCH		

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2.0 APPLICABLE DOCUMENTS

The following documents form a part of this specification to the extent specified herein. In the events of conflict between the requirements of this specification and the product drawing the product drawing shall take precedence. In the event of conflict between the requirements of this specification and the referenced documents, this specification shall take precedence.

2.1 TE SPECIFICATIONS

TE SPEC	Description
108-94099	NANO MQS Product specification
114-18858	NANO MQS Application specification
114-20160	Interface drawing
411-…	Instruction sheet
501-…	Test report
107-…	Packaging specification

2.2 General SPECIFICATIOS (for ref. only):

Standard	Description
DIN IEC 60512-1-1	General examination
DIN IEC 60512-2-1	Contact resistance
DIN IEC 60512-3-1	Insulation tests
DIN IEC 60512-8	Mechanical test
DIN IEC 60068-2-2	Environmental testing - Test B: Dry heat
DIN IEC 60068-2-6	Environmental testing - Vibration
DIN IEC 60068-2-14	Environmental testing - Change of temperature
DIN IEC 60068-2-27	Environmental testing - Mechanical Shock
DIN IEC 60068-2-31	Environmental testing - Rough handling shocks
DIN IEC 60068-2-52	Environmental testing - Salt mist, cyclic

REQUIREMENTS

3.0 Design and Construction

Product shall comply with the design, construction and physical dimensions specified in the applicable product drawing.

3.1 CONNECTOR RATING

Characteristic (*Caratteristica*)	**Value** (*Valore*)	**Notes** (*Note*)
Continuous Current	Max 1 A	With 0.13 mm² wire section at 23°C According to spec. 108-94099
	Max 3 A	With 0.22-0.35 mm² wire section at 23°C According to spec. 108-94099
Working temperature	Environment -40/105°C	With contact tin plated. According to spec. 108-94099
	Environment -40/125°C	With contact silver plated. According to spec. 108-94099
Vibration level	Random vibration with temperature cycle (-40;105°C): 8 hrs per axis RMS Acceleration 19.7 m/s²	See Attachment 2
Operating Voltage	1.1. 12 ÷ 24 V d.c.	For application with other type of voltage please contact TE Connectivity.

3.2 MATERIALS

Components	Material	Finish, for contacts only
Housings	PBT	
Contacts	Copper alloy	Tin plated / Silver plated

3.3 QUALITY ASSURANCE PROVISION

A. Sample preparation:

The test samples to be used for the tests shall be prepared by randomly selecting them from the definitive tool, and the contact shall be crimped in accordance with the relevant Application Spec.

B. Test Conditions:

All the tests shall be performed under the combination of the following test conditions, unless otherwise specified.

Room temperature: 23 ± 5°C

Relative Humidity: 45 ÷ 75%

Atmospheric Pressure: 860 ÷ 1060 mbar

3.4 SECONDARY LOCK FUNCTIONALITY

Secondary lock performance is assured in combination with recommended hardness check table according to drawing shown in attachment 6

4.0 TEST REQUIREMENTS AND PROCEDURES SUMMARY

DRAWING CONFORMITY			
Par.	**Test Items**	**Requirements**	**Procedures**
4.1.0	Visual examination.	Product shall be in accordance with the requirements of applicable product drawing and application specification. No visible damage, cracking or defect when the product is new and even after environmental, mechanical and electrical tests. The basic mechanical functions of the connectors are to be inspected within the framework of the visual inspection.	The visual examination shall be carried out by naked eye and magnification. These are the features to examine: • Workmanship and finish; • Marking; • Material; • Surface finish; • Cavities According to DIN IEC 60512-1-1 TEST 1-a
4.1.1	Dimensions.	Product dimensions shall be in accordance with the drawing dimensions and notes.	According to drawing, measure all dimensions with identified notes, and make a report with all values. Check minimum 5 samples for each mould cavity.
4.1.2	Contact engagement length measurement on cross section	Min 1.0 mm overlap is required.	See attachment 1 for theoretical overlapping study in worst case condition.

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CONNECTOR ELECTRICAL REQUIREMENTS			
Par.	**Test Items**	**Requirements**	**Procedures**
4.2.0	Insulation resistance	R > 100 MΩ	The insulation resistance shall be measured between two adjacent terminations having a minimum spacing, using the 500V ± 50V test voltage applied per 60 s. According to DIN IEC 60512-3-1 TEST 3a method C
4.2.1	Dielectric breakdown resistance	No electric breakdown or flashes admitted.	Between two adjacent contacts apply voltage of 500V eff per 1 minute.
4.2.2	Contact Resistance	$R_k + R_{crimp} < 30$ mΩ After environmental and vibration tests for Sn plated contact with base material CuSn 8 $R_k + R_{crimp} < 10$ mΩ At new for Sn plated contact with base material CuSn 8 (Accoding to 108-94099)	Measuring cycle consists of a) application of the voltage; b) measurement with current flowing in one direction; c) measurement with current flowing in the opposite direction; Test current 100mA applied like shown in Attachment 3 The contact resistance must be measured between points D & E According to DIN IEC 60512-2-1
4.2.3	Housing influence on the derating	Performance must be documented	Perform derating curve of contact into the housing located in a central position of the connector. Connector must be fully loaded with contact and with n° 6 adjacent electrical ways supplied at the same time. Test current supply value can be selected according to contact derating curve without housing for each type of wire section. One curve must be made for each type of contact plating.

CONNECTOR MECHANICAL REQUIREMENTS			
Par.	**Test Items**	**Requirements**	**Procedures**
4.3.0	Contact insertion force into the housing	$F \leq 5$ N	An axial force shall be applied to insert contacts. The force shall be applied with rate of 50 mm/min According to DIN IEC 60512-8 test 15 b
4.3.1	Contact pull-out force from housing with primary lock only.	$F \geq 25$ N	An axial force shall be applied to pull-out contacts. The force shall be applied with rate of 50 mm/min. According to DIN IEC 60512-8 test 15 b
4.3.2	Contact pull-out force from housing with secondary lock only.	$F \geq 35$ N	An axial force shall be applied to pull-out contacts. The force shall be applied with rate of 50 mm/min. According to DIN IEC 60512-8 test 15 b
4.3.3	Secondary lock closing force for hinge.	$F_s \leq 50$ N for hinge length ≤ 15mm $F_s \leq 75$ N for hinge length > 15mm	Apply a force in secondary lock closure direction. Perform test on new housings in each case. The force shall be applied with rate of 50 mm/min.
4.3.4	Secondary lock closing force with one contact not completely inserted	$F_{s\ n.i.c.} > F_s + 25$ N	Apply a force in secondary lock closure direction. Perform test on new housings in each case. The force shall be applied with rate of 50 mm/min.
4.3.5	Secondary lock opening force	$F = 10 \div 50$ N	Apply a force in secondary lock open direction. Perform test on new housings in each case. The force shall be applied with rate of 50 mm/min.

4.3.6	Mating force with relative counterpart.	F ≤ 60 N On 32 pos part only F ≤ 80N	Mate the part with counterpart with uniform ratio of 50 mm/min until fully engagement.
4.3.7	Un-mating force	F ≤ 100 N	Apply a load parallel to insertion direction with uniform ratio of 50 mm/min. Unlock before to apply a load.
4.3.8	Connector pull-out force with locking device system locked	F ≥ 60 N	Apply a load to wire cables parallel to insertion direction with uniform ratio of 50 mm/min.
4.3.9	Connector retention force on relative counterpart	F ≥ 40 N Without any electrical discontinuity	Use connector full loaded with all contact inserted into the cavities and locked with primary and secondary lock. Pull each samples from all wire cable in all direction shown in the Attachment 5 During the test the electrical continuity of all ways must be checked by a multimeter.
4.3.10	Coding effectiveness check. Mating force with wrong coding counterpart	F ≥ 70 N For 20 + 32 pos only F ≥ 80 N	Apply a load parallel to insertion direction with uniform ratio at 50 mm/min until to force suitable into requirements. Check that there isn't any electrical contact during this operation.
4.3.11	Mating force with connector rotated of 180° on relative counterpart	F ≥ 80 N	Apply a load parallel to insertion direction with uniform ratio at 50 mm/min until to force suitable into requirements. Check that there isn't any electrical contact during this operation.

4.3.12	Drop test (on new parts)	No functional breaking or damage after test	Samples without wire cable. Drop the sample from 1.0 m in free position for 50 times. Impact surface must be a steel plate of 3 mm thickness, backed by hardwood of between 10 mm and 19 mm thickness (According to DIN IEC 60068-2-31 par. 5.3)
4.3.13	Mechanical shock	No functional breaking or damage after test	Make the test with following conditions: A = 30 g T = 6 ms sinusoidal half-sine pulse No. of shocks = 6000 for each axis According to DIN IEC 60068-2-27 See attachment 2 for fixing fixtures condition.

ENVIRONMENTAL TESTS			
Par.	**Test Items**	**Requirements**	**Procedures**
4.4.0	Thermal shock	No breaking or damage admitted after thermal shock. Circuit interruption monitoring takes place during the test. Permissible circuit interruption <1µs. The circuit is considered interrupted when the contact resistance exceeds 7 Ω. Interruptions are not permissible.	The sample is exposed to rapid changes of temperature by alternate exposure to low temperature and to high temperature. -40°C to 105 °C 15 min. each 144 cycles with max 10 s change-over time. Thermal shock procedure according to DIN IEC 60068-2-14 test Na.
4.4.1	Change of temperature	No breaking or damage admitted after thermal shock. Circuit interruption monitoring takes place during the test. Permissible circuit interruption <1µs. The circuit is considered interrupted when the contact resistance exceeds 7 Ω. Interruptions are not permissible. Contact resistance according to par 4.2.2	The sample is exposed to changes of temperature in air by exposure in a chamber to prescribed temperatures varied at a controlled rate. -40°C to 105°C for 3 hours each with max 2 hours as time for temperature change Repeat for 20 cycle One chamber able to change temperature from low to high and vice versa Thermal shock procedure according to DIN IEC 60068-2-14 test Nb.
4.4.2	Thermal aging	No breaking or damage admitted after thermal aging. Contact resistance according to par 4.2.2	120 hrs at 120°C Thermal aging according to DIN EN 60068-2-2.

4.4.3	Locking noise test. (On parts at new)	Audible click . No limit indication. Performance must be documented	Insert female into male counterpart and measure audible click in dB(C) in a measuring room by microphone. Put the microphone at distance to connector of 600 ± 50 mm. See room configuration in attachment 4.
4.4.4	Vibration test	No function-relevant damage must occur. Circuit interruption monitoring takes place during the test. Permissible circuit interruption <1µs. The circuit is considered interrupted when the contact resistance exceeds 7 Ω. Interruptions are not permissible.	Sample must be tested with temperature cycle (-40÷105°C). 8 hrs. per axis. RMS Acceleration 19.7 m/s² in vibration machine. See attachment 2 Test according to DIN IEC 60068-2-6.
4.4.5	Salt spray cyclic	Contact resistance according to par 4.2.2	Use 5 % sodium chloride (NaCl) solution. Chamber temperature 35°C and flow of 1 l/h. One test cycle consisting of: four spray periods, each of 2 h, with a next storage period for each cycle of 22 h at 40°C and RH of 93%; At the end of all cycles one storage period of three days under a standard atmosphere at 23 °C ± 2 °C and 45 % to 55 % humidity. According to DIN IEC 60068-2-52 Severity 3.
4.4.6	Long-term temperature aging	After completion of the test, there must be not permitted cracking. Contact resistance according to par 4.2.2	1000 hrs. at 130 °C and 48 hrs. at Room Temperature according to DIN IEC 60068-2-2 test B Samples must be equipped with max wire section only (0.35 mm²).

4.4.7	Chemical resistance	No damages signs of chemicals attack, no deformations, no cracking breakage on body connector.	Dip the samples fully into each fluid listed below for 60 min, except for battery acid. For this last fluid, dip the samples 3 times for 1 min each time. • Brake fluid at 50°C; • Engine oil at 85°C; • Fuel ASTM or unleaded gasoline at 25°C; • Antifreeze fluid at 100°C; • Oil for transmission and power steering system at 85°C; • Liquid detergent at 25°C; • Diesel fluid at 25°C; • Battery fluid 23°C; Note: ✓ Test must be not performed in cumulative way, each samples group is tested in one fluid only. ✓ Dip samples in each type of fluid, but warning do not put in contact with any other. At the end of the tests do not stir excess fluid, if any, do not spray fluid where not required. Do not clean samples with water. Then wait enough time for the samples to dry for testing without contaminating the testing equipment. The samples must be checked with a 10x to 40x magnification.

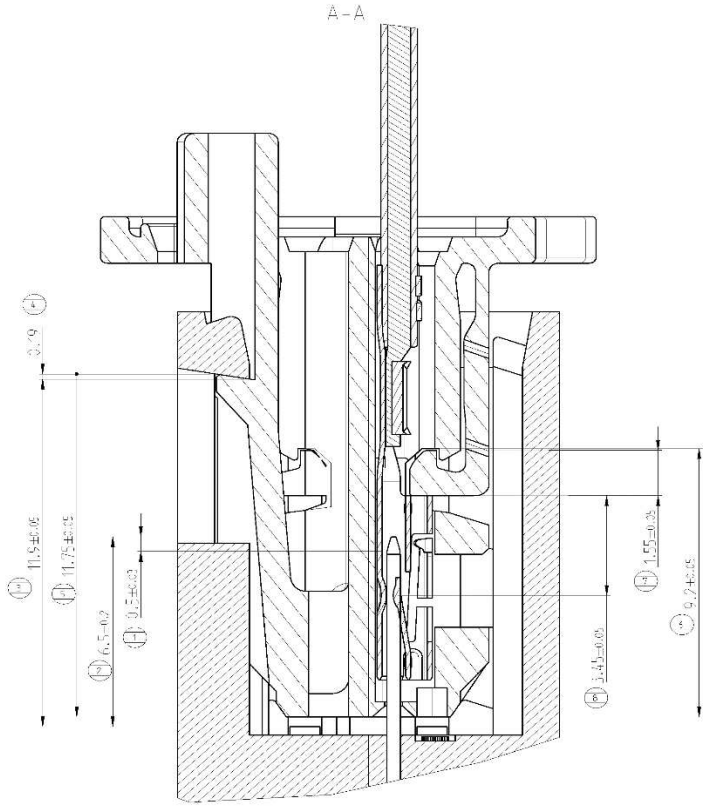
5.0 PRODUCT QUALIFICATION TEST SEQUENCE

Test Items	Test group											
	A	B	C	D	E	F	G	H	I	L	M	N
Number of samples needed	5 for each cavity mould	5	5	5	10	10	10	5	5	10	10	10
Visual inspection	1	1	1	1	1	1,6	1,4	1,4	1,4	1,6	1,4	1,9
Dimensions	2	2	2	2	2	2	2	2	2	2	2	2
Cnt engagement length measurement on cross section	3											
Cnt insertion force into the hsg		3										
Cnt pull-out force from hsg with p.l. only		4										
Cnt pull-out force from hsg with p.l. and s.l.			3									
S.I. closing force				3								
S.I. closing force with one contact not comp. inserted					3							
S.I. opening force				4								
Mating force						3						
Un-Mating force						4						
Connector pull out force with locking device system locked							3					
Connector retention force on relative counterpart									3			
Polarization effectiveness check with wrong counterpart.						5						
Mating force with connector rotated of 180° on relative counterpart											3	
Drop test								3				
Mechanical shock										4		
Insulation resistance												4
Dielettric breakdown												
Contact resistance										3,5		3,6 ,8
Housing influence on the derating curve												
Thermal shock												5
Change of temperature												
Thermal aging												7
Locking noise test												
Vibration test												
Salt spray cyclic												
Long term temperature aging												
Chemical resistance												

Test Items	Test group									
	O(*)	P(*)	Q	R	S	T(*)	U	V(*)	W	
Number of samples needed	5	5	10	5	10	10	10	16		156
Visual inspection	**1,4**	**1.4**	**1,10**	**1,4**	**1,6**	**1,6**	**1,6**	**1**		**Total samples needed**
Dimensions	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**		
Cnt engagement length measurement on cross section										
Cnt insertion force into the hsg										
Cnt pull-out force from hsg with p.l. only										
Cnt pull-out force from hsg with p.l.. and s.l.										
S.l. closing force										
S.l. closing force with one contact not comp. inserted										
S.l. opening force										
Mating force								**5**		
Un-Mating force								**4**		
Connector pull out force with locking device system locked										
Connector retention force on relative counterpart										
Polarization effectiveness check with wrong counterpart.										
Mating force with connector rotated of 180° on relative counterpart										
Drop test										
Mechanical shock										
Insulation resistance										
Dielettric breakdown	**3**									
Contact resistance			**3,5,7 ,9**		**3,5**	**3,5**	**3,5**			
Housing influence on the derating curve		**3**								
Thermal shock			**4**							
Change of temperature			**6**							
Thermal aging			**8**							
Locking noise test				**3**						
Vibration test					**4**					
Salt spray cycling						**4**				
Long term temperature aging							**4**			
Chemical resistance								**3**		

(*) Tests performed unatantum and valid for all connector family.

Attachment 1



Item	Description	Coeff	Dimension	Tolerance +	Tolerance -	Nominal Dim
1	Balloon 1	-1	0,5000	0,0300	0,0300	-0,5000
2	Balloon 2	1	6,5000	0,2000	-0,2000	6,5000
3	Balloon 3	-1	11,9000	0,0500	-0,0500	-11,9000
4	Balloon 4	-1	0,1900	0,0000	0,0000	-0,1900
5	Balloon 5	1	11,7500	0,0500	-0,0500	11,7500
6	Balloon 6	-1	9,2000	0,0500	-0,5000	-9,2000
7	Balloon 7	1	1,5500	0,0300	-0,0300	1,5500
8	Balloon 8	1	3,4500	0,0500	-0,0500	3,4500

Results		Safety Factor SF =	1,0	1,3	1,67
Nominal =	1,4500	Nominal =	1,655		
Worst Case Tolerance (+) =	0,8500	SF *RSS Tol (+) =	0,353	0,459	0,590
Worst Case Tolerance (-) =	-0,4600	SF *RSS Tol (-) =	-0,353	-0,459	-0,590
Worst Case Max =	2,3100	RSS Max =	2,008	2,114	2,245
Worst Case Min =	1,0000	RSS Min =	1,302	1,196	1,065

PAGE	Min
	1,0000

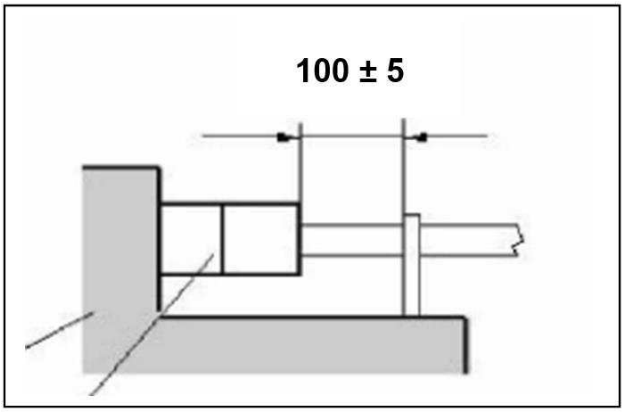
Attachment 2

Random vibration profile

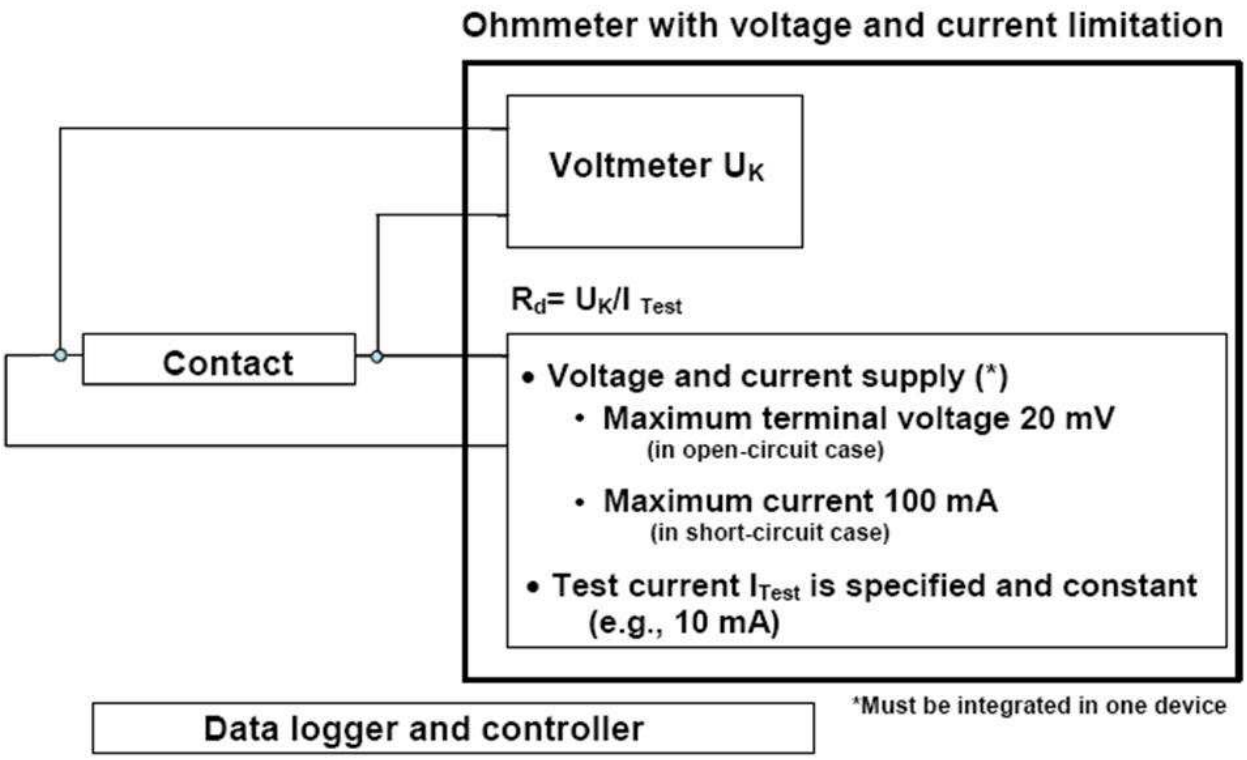
Hz	$(m/s^2)^2/Hz$
10	10
55	3,25
180	0,125
300	0,125
360	0,07
1000	0,07

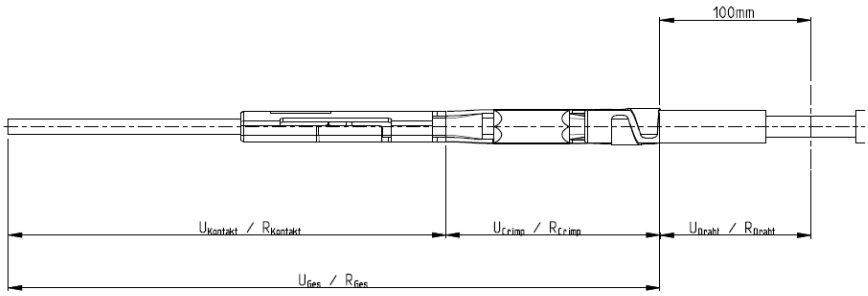
Temperature cycle

Time [min]	Temperature [°C]
0	+20
60	-40
150	-40
300	+105
420	+105
480	+20



Attachment 3





Attachment 4

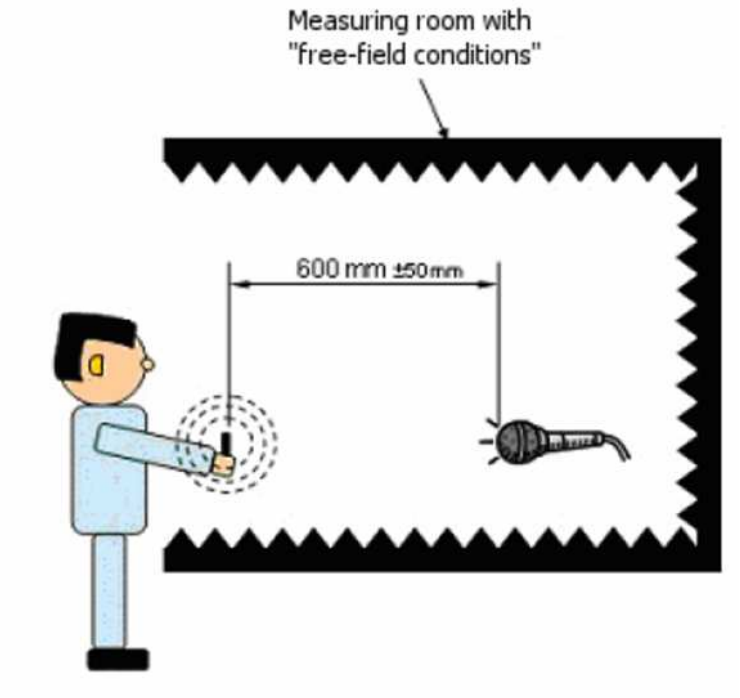
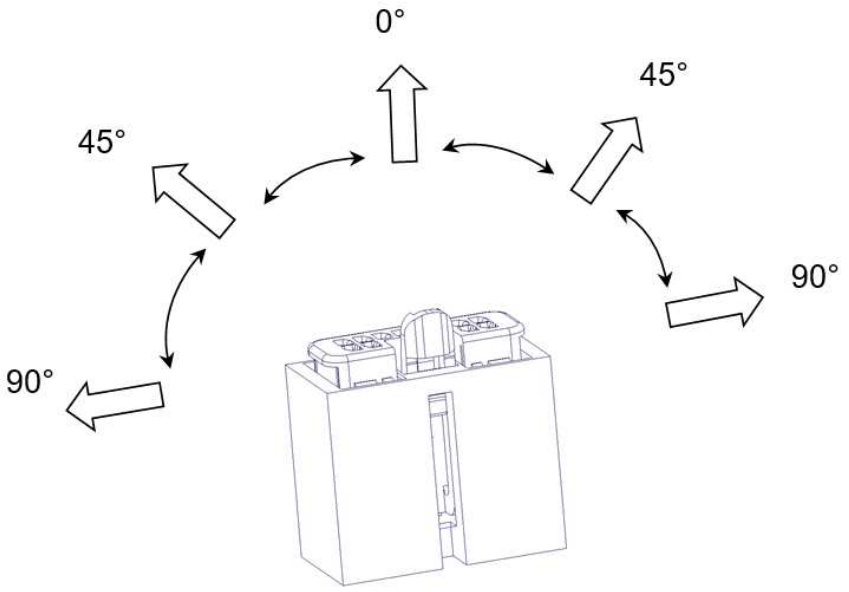
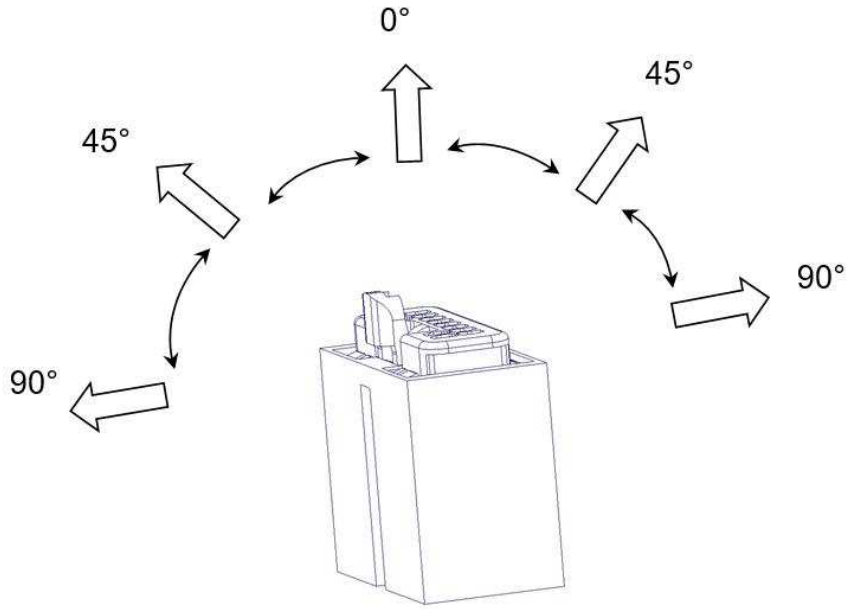


Figure 9 Schematic of the measurement setup "volume measurement"

Attachment 5





Attachment 6

Hardness check table

T.B.D.