TEST REPORT

PRODUCT ENGINEERING LABORATORY	RL. 140175	REVISION: 1

Material / Parts description:	PN:	REVISION:
WIRE DRESS 7POS_VW	**2133881-1**	**1**
ASSY, 7 POSN., MCP/MQS, REC	**2133882-1**	**2**
MQS 1.5, SOCKET CONTACT	**1355556-1**	**A4**
AMP MCP 6.3/4.8K FLATCONTACT	**1241404-1**	**A6**

Requester:	Dept:
BRUNO RIGHETO	EPA

Customer:	Supplier:
VW	**TE CONNECTIVITY**

Confidentiality:

( ) 1- CONFIDENTIAL
( ) 2- TE RESTRICTED
(X) 3- ADDRESSED CUSTOMER
( )

Distribution:

(X) REQUESTER
(X) DMTEC
( )
( )

Purpose:	History:
1 - NEW RAW MATERIAL	DEVELOPMENT FOR VW CUSTOMER (BMG)

Test(s) Made :	Specification (s):
ACCORDING TO TEST PLAN ATTACHED.	VW 75174.

Conclusion:

Please see individual tests results.

Feb 10, 2014.	*Signature on file	*Signature on file
Date	Executed by	Responsible
	DIOGO BIASETTO ROJAS	PAULO S. ALMEIDA
	TEST ENGINEER	LABORATORY COORDINATOR

Accomplished tests according to attached Test Plan:

Samples Identification

100 parts of WIRE DRESS 7POS_VW PN: 2133881-1.
100 parts of 7 POSN., MCP/MQS, REC PN: 2133883-1.
100 parts of MQS 1.5, SOCKET CONTACT PN:1355556-1.
100 parts of AMP MCP 6.3/4.8K FLATCONTACT PN: 1241404-1.
100 parts of CPA, 7 POSN.,MCP/MQS, REC. PN: 2133884-1.
100 parts of ASS'Y 7 POSN., MCP/MQS, REC PN: 2133882-1.
100 Counterpart VW, PN: 6C0.905.865.

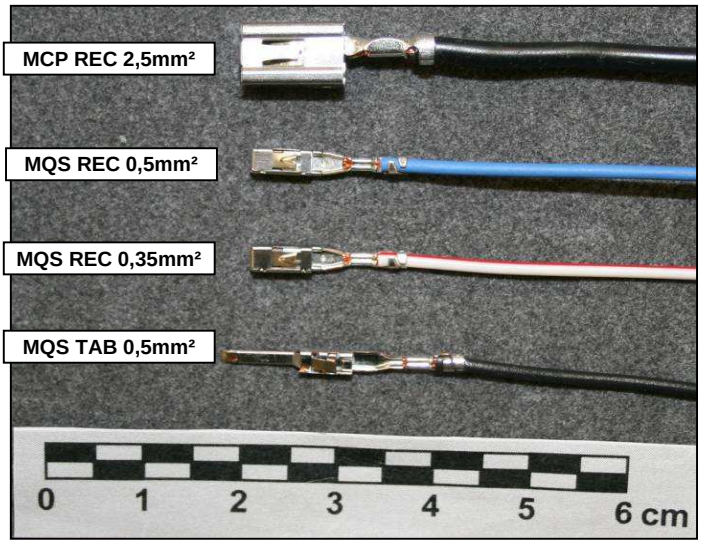


Photo 1 - TERMINALS

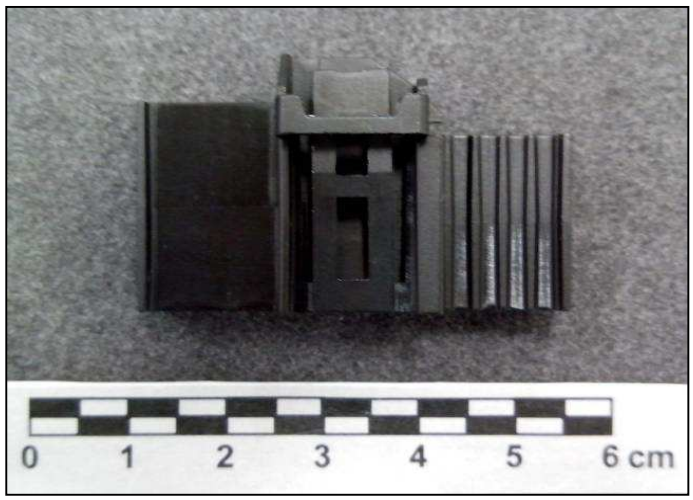


Photo 2 - 7 POSN MCP/MQS, REC PN: 2133883-1

Photo 3 - WIRE DRESS, 7 POSN.,MCP/MQS, REC. PN: 2133881-1

Photo 4 - CPA, 7 POSN.,MCP/MQS, REC. PN: 2133884-1

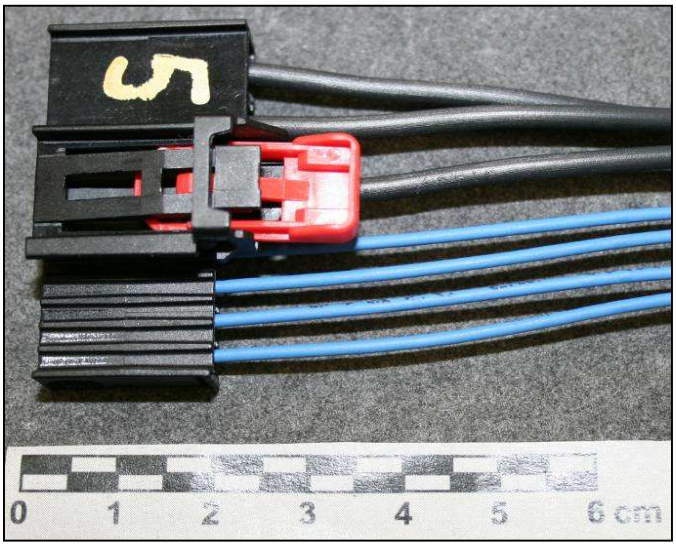


Photo 5 - ASS'Y 7POSN, MCP/MQS, REC PN: 2133882 with terminals connected

Photo 6 - VW COUNTERPART

PG7- HANDLING AND FUNCTIONAL RELIABILITY OF THE HOUSING:

E 7.2 Retention force of the housing latch/lock;

E 7.3 CPA Functional test;

E 7.4 Insertion force for insertion and removal aids;

Samples:
Samples number 1 to 10.

Equipment:
Digital dynamometer IMADA, nr. 92-339017-076.
Universal tensile strength machine VERSATEST with digital dynamometer Mecmesin AFG 2500N, nr. 92-339017-090.

Procedure:
E7.2:
Measure the retention force from housing to counterpart. The maximum force of the first displacement milimeter is defined as the retention force.
E7.3:
CPA functional test.
Measure the CPA actuation with the locked housing.
E7.4:
Measure housing to counterpart insertion force.

Requirements:

E7.2:
Retention force must be more than 80N.
E7.3:
CPA functional test.
CPA actuation force with the housing locked: between 5N and 30N.
E7.4:
Max. Insertion force of fully equipped hsg 75N.

Results:

E7.2:
Retention force with CPA closed:

Sample	Retention force [N]
1	106,57
2	97,98
3	106,38
4	106,01
5	94,93
Minimum	94,93
Average	102,37
Maximum	106,57

Retention force with CPA opened:

Sample	Retention force [N]
6	101,38
7	100,33
8	96,47
9	101,4
10	96,26
Minimum	96,26
Average	99,17
Maximum	101,40

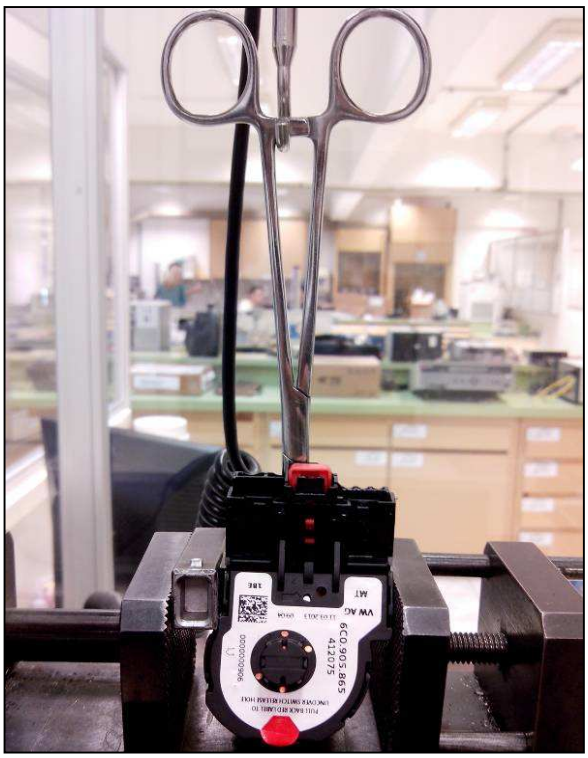


Photo 7 - Connector retention force from counterpart

E7.3:
CPA functional test - OK.
CPA actuation with the locked housing:

Sample	Actuation force [N]
1	**2,5**
2	5,5
3	**2,5**
4	**2,5**
5	5,0
6	**3,0**
7	**2,0**
8	**2,0**
9	**2,5**
10	**2,5**
Minimum	2,00
Average	3,00
Maximum	5,50

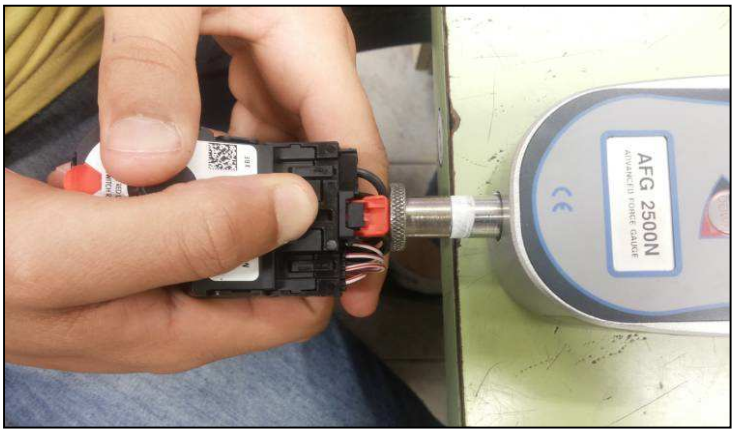


Photo 8 - CPA actuation with the locked housing

***Note:** Bold values are under specification.

Comments:
The design of this connector do not allow that the CPA actuates from pre to final position without be matted to the counterpart.
All samples met the specification of max of 30N and 8 samples did not meet the min of 5N.

E7.4:
Max. Insertion force of fully equiped hsg 75N.

Sample	Insertion force [N]
1	57,1
2	49,5
3	62,0
4	63,0
5	67,5
6	56,0
7	64,0
8	68,5
9	57,0
10	62,0
Minimum	49,5
Average	60,7
Maximum	68,5

Photo 9 - Connector insertion force to counterpart

Conclusion:
Some values of test E7.3 are under specification. All other tests met the requirements.

PG8 - INSERTION AND RETENTION FORCES OF THE CONTACT PARTS IN THE HOUSING:

Samples:
Samples number 11 to 28.

Equipment:
Digital dynamometer IMADA, nr. 92-339017-076.
Universal tensile strength machine VERSATEST with digital dynamometer Mecmesin AFG 2500N, nr. 92-339017-090.

Procedure:
a)2 fully equipped housings per mold cavity:
Visual inspection;
Determination of the contact insertion force;
Measure contact removal force from the housing, primary lock only;
Measure contact removal force from the housing, secondary lock only;
Visual inspection.

b)1 fully equipped housings per mold cavity:
Visual inspection;
Removal of the contacts three times with original release tools;
Contact pullout force from the housing, primary lock only.
Visual inspection.
(At least 10 contacts with the lowest values from item a).

Requirements:
Instertion force = informative values.
Retention force primary lock only > 80N.
Note: Terminal developed to meet minimum force 60N in accordance to TE-MQS terminal product specification (108-18030_A1).
Retention force secondary lock only > 80N.
Test (b) must be performed only for information.

Results:

a)2 fully equipped housings per mold cavity:

Connector Way	Insertion force [N]							
	Cavity 1				Cavity 2			
	Sample 11	Sample 12	Sample 13	Sample 14	Sample 15	Sample 16	Sample 17	Sample 18
1 (MCP)	3,75	3,11	2,98	2,98	3,67	3,20	3,95	3,39
2 (MCP)	3,14	3,62	3,40	3,97	3,50	2,97	3,30	4,03
3 (MCP)	3,90	3,49	3,40	3,17	3,71	3,96	3,67	3,38
Minimum	3,14	3,11	2,98	2,98	3,50	2,97	3,30	3,38
Average	3,60	3,41	3,26	3,37	3,63	3,38	3,64	3,60
Maximum	3,90	3,62	3,40	3,97	3,71	3,96	3,95	4,03

Connector Way	Insertion force [N]							
	Cavity 1				Cavity 2			
	Sample 11	Sample 12	Sample 13	Sample 14	Sample 15	Sample 16	Sample 17	Sample 18
4 (MQS)	1,55	1,84	1,38	1,51	1,78	1,75	1,60	1,51
5 (MQS)	1,54	1,46	1,58	1,74	1,71	1,82	1,60	1,75
6 (MQS)	1,56	1,54	1,72	1,65	1,46	1,61	1,67	1,78
7 (MQS)	1,73	1,09	1,94	1,91	1,41	1,66	1,79	1,76
Minimum	1,54	1,09	1,38	1,51	1,41	1,61	1,60	1,51
Average	1,60	1,48	1,66	1,70	1,59	1,71	1,67	1,70
Maximum	1,73	1,84	1,94	1,91	1,78	1,82	1,79	1,78

Connector Way	Retention force [N]							
	Cavity 1				Cavity 2			
	Primary lock only		Secondary lock only		Primary lock only		Secondary lock only	
	Sample 11	Sample 12	Sample 13	Sample 14	Sample 15	Sample 16	Sample 17	Sample 18
1 (MCP)	147,5	160,0	Not apllicable	Not apllicable	170,5	162,5	Not apllicable	Not apllicable
2 (MCP)	165,0	170,0	Not apllicable	Not apllicable	159,0	156,0	Not apllicable	Not apllicable
3 (MCP)	162,0	166,5	Not apllicable	Not apllicable	163,0	152,5	Not apllicable	Not apllicable
Minimum	147,50	160,00	-	-	159,00	152,50	-	-
Average	158,17	165,50	-	-	164,17	157,00	-	-
Maximum	165,00	170,00	-	-	170,50	162,50	-	-

Connector Way	Retention force [N]							
	Cavity 1				Cavity 2			
	Primary lock only		Secondary lock only		Primary lock only		Secondary lock only	
	Sample 11	Sample 12	Sample 13	Sample 14	Sample 15	Sample 16	Sample 17	Sample 18
4 (MQS)	82,0	80,0	93,0	91,5	**77,0**	**79,5**	94,5	97,0
5 (MQS)	80,0	81,0	117,5	119,5	**75,5**	**79,0**	120,5	118,0
6 (MQS)	**77,5**	80,0	130,0	124,5	**72,0**	**73,0**	125,5	125,5
7 (MQS)	**72,0**	**70,0**	120,0	119,0	**75,5**	**74,5**	126,5	117,0
Minimum	72,0	70,0	93,0	91,5	72,0	73,0	94,5	97,0
Average	77,9	77,8	115,1	113,6	75,0	76,5	116,8	114,4
Maximum	82,0	81,0	130,0	124,5	77,0	79,5	126,5	125,5

b)1 fully equipped housings per mold cavity:
After removal of the contacts three times with original release tools (only for information).

Sample	Retention force [N] (primary lock only)			
	Cavity 1		Cavity 2	
	Way 1	Way 7	Way 2	Way 6
19	130,5	64,5	144,0	66,0
20	110,5	51,5	134,0	68,0
21	126,0	68,0	125,5	59,5
22	124,0	70,0	133,0	64,0
23	127,0	65,0	127,0	47,5
24	118,0	66,5	130,0	55,5
25	123,5	65,0	132,0	56,5
26	122,4	68,6	140,0	58,0
27	115,5	70,5	130,5	60,0
28	120,0	55,5	132,5	62,0
Minimum	110,5	51,5	125,5	47,5
Average	121,7	64,5	132,9	59,7
Maximum	130,5	70,5	144,0	68,0

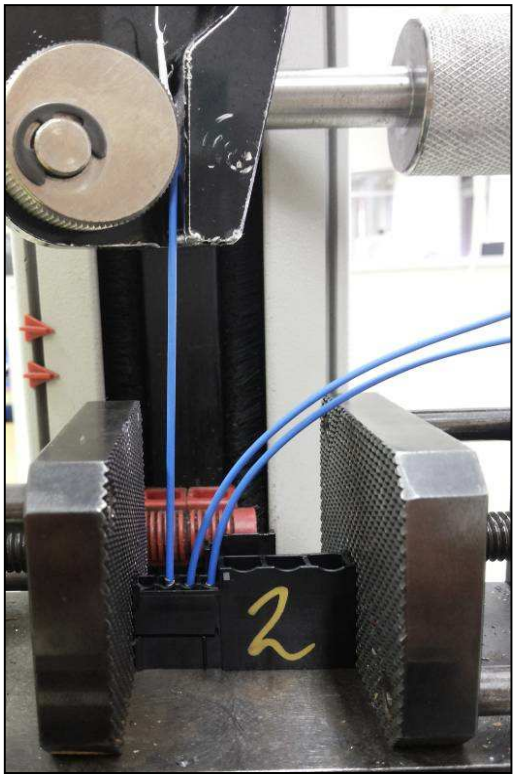


Photo 10 - Terminal retention force from connector

Conclusion:
Retention force with primary lock only didn't met the requirements. All other tests met the requirements.

PG13- HOUSING INFLUENCE ON THE DERATING:

Samples:
Samples number 1 to 12.

Equipment:
HP Digital Multimeter, model 34401A, nr. 93-339033-030.
PAK 20-36A DC POWER SUPPLY nr. 02703.
Data acquisition AGILENT, model 34972A, nr. 93-339048-872.

Procedure:
-Visual inspection;
-Voltage drop measurement;
-Derating with housing
-Visual inspection.

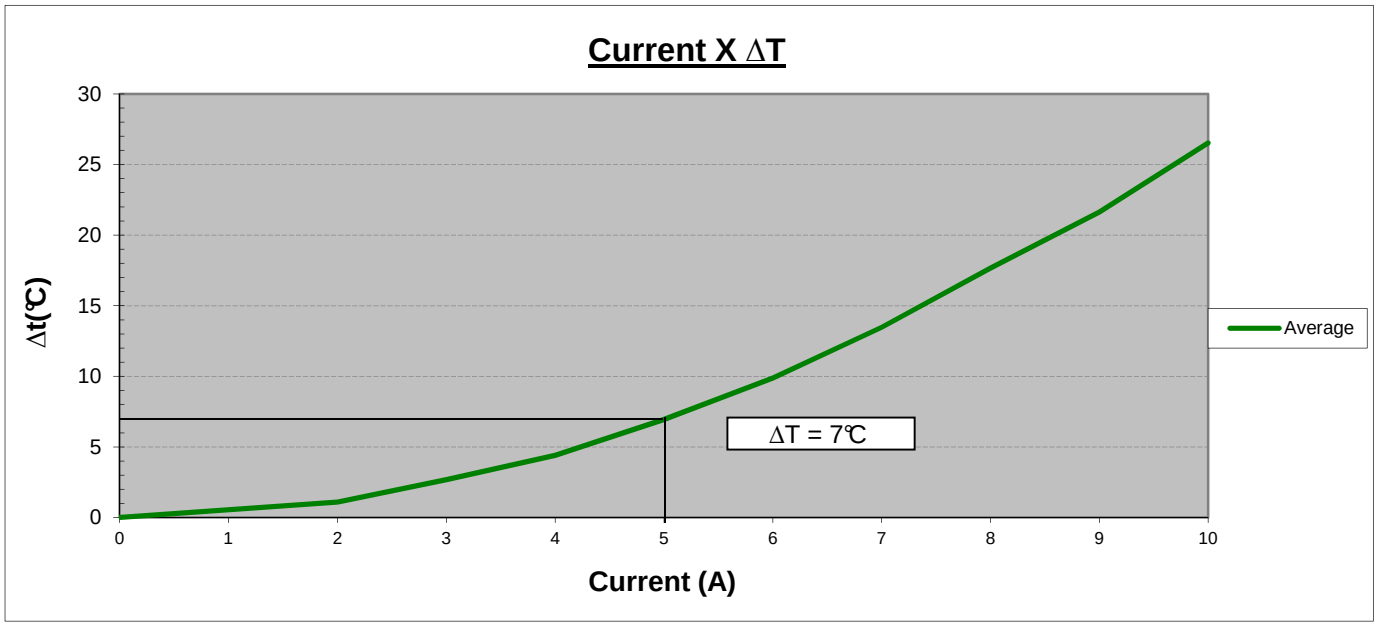
Requirements:
The measured values must correspond to the manufacturer's specifications.
Contact resistance ≤ 15mΩ (MQS).

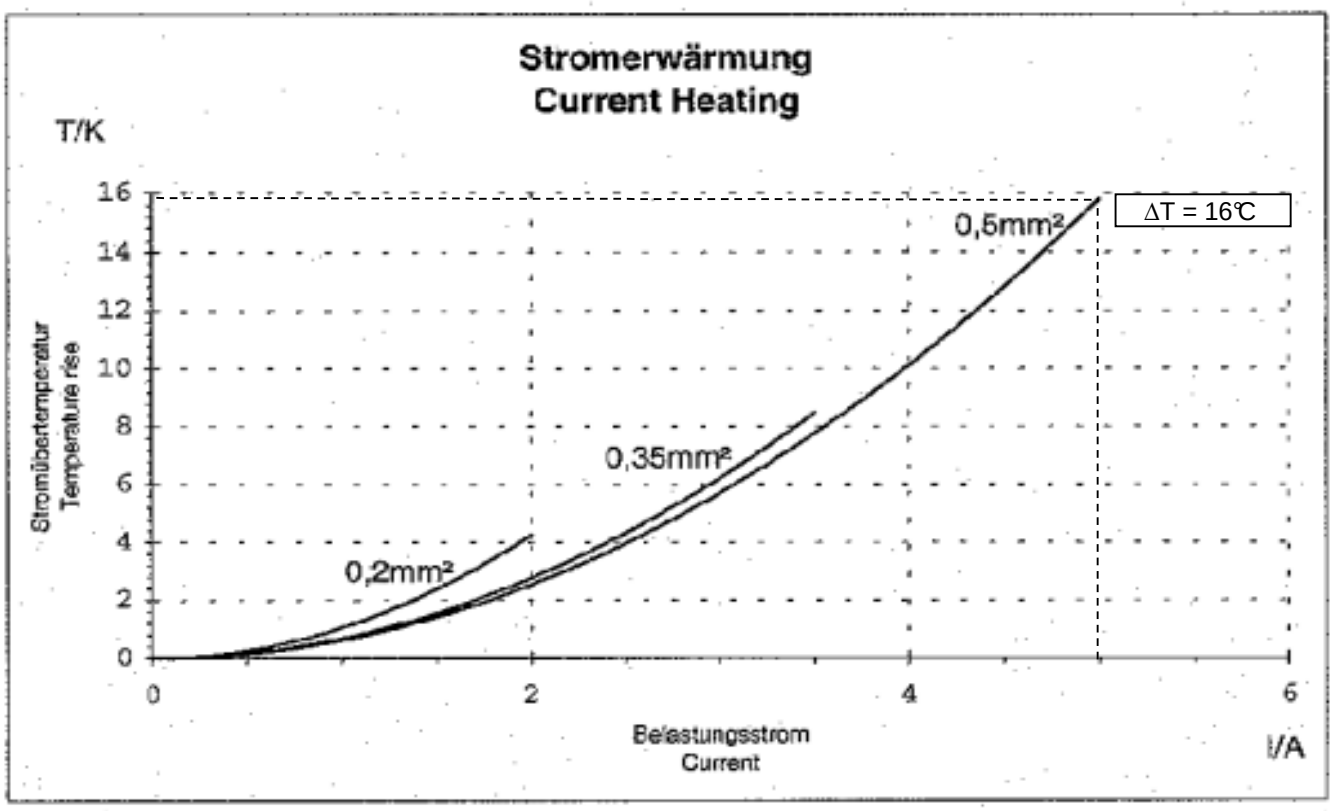
Results:

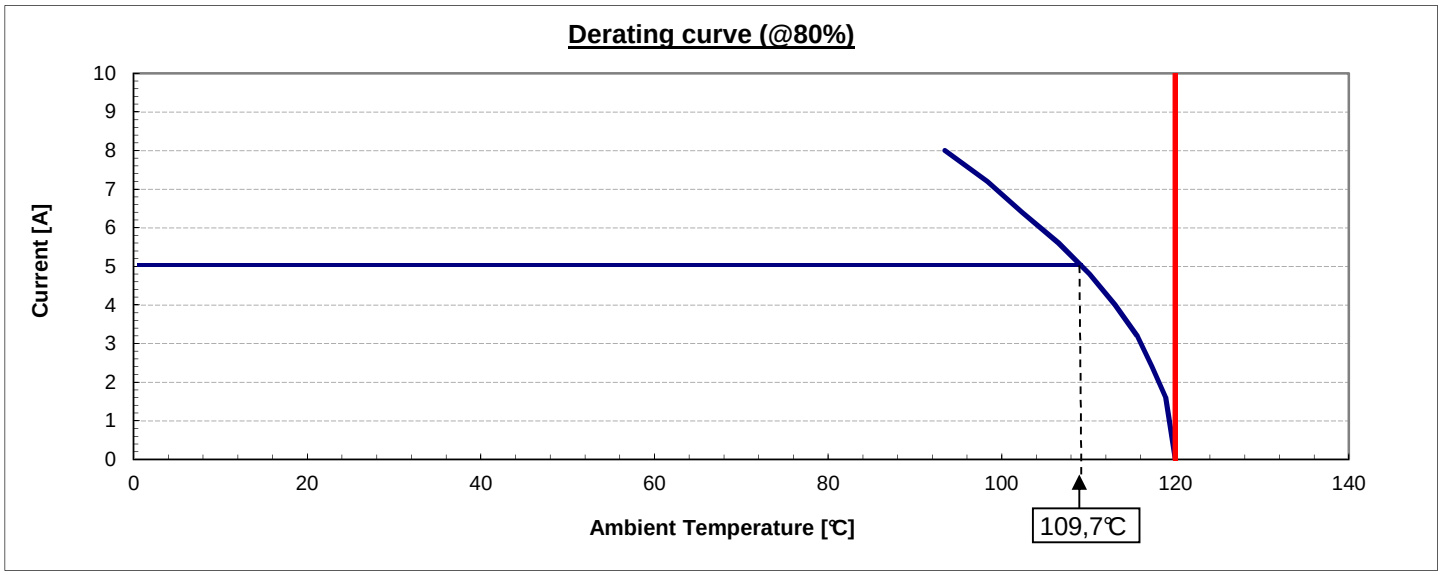
Sample	Contact resistance [mΩ]
1	1,29
2	1,19
3	1,28
4	1,24
5	1,15
6	1,20
7	1,21
8	1,20
9	1,39
10	1,37
11	1,36
12	1,35
Minimum	0,90
Average	0,98
Maximum	1,05

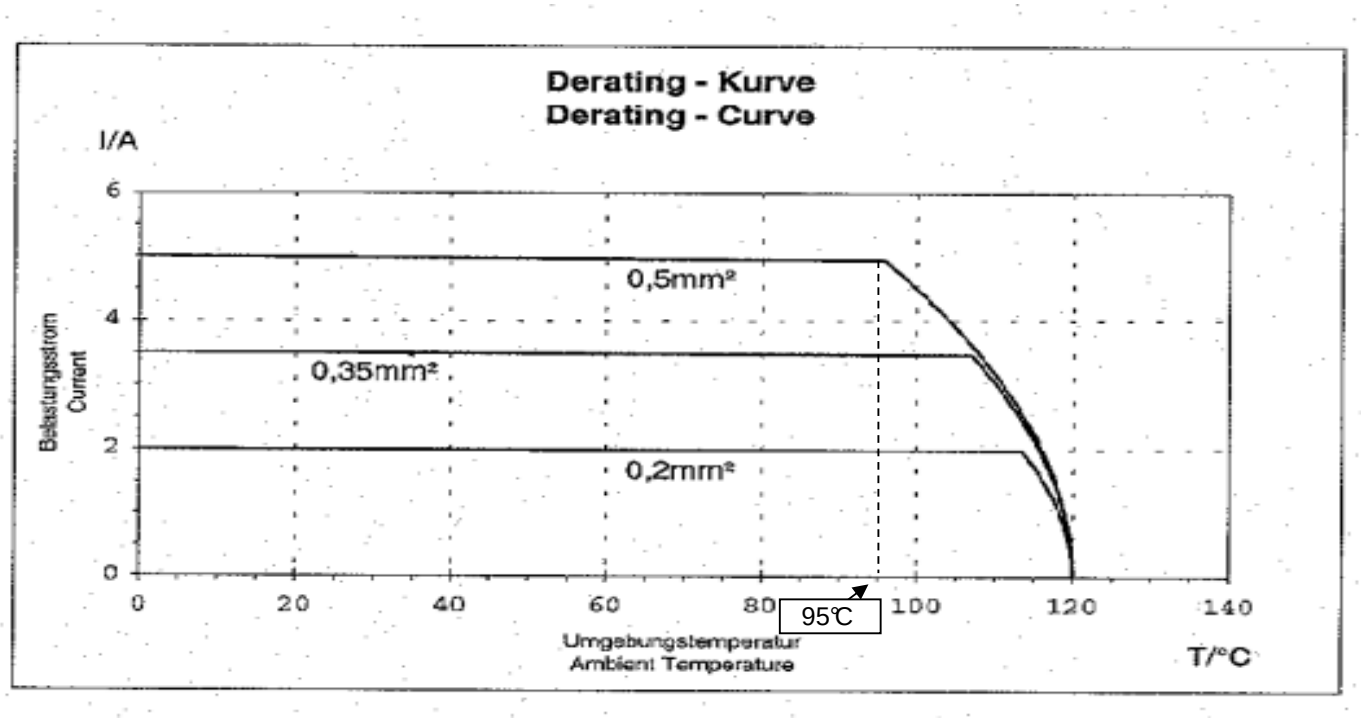
Derating:

Current (A)	Temperature Rise (°C)												Room Temp.
	Terminal 1	Terminal 2	Terminal 3	Terminal 4	Terminal 5	Terminal 6	Terminal 7	Terminal 8	Terminal 9	Terminal 10	Terminal 11	Terminal 12	
0	0	0	0	0	0	0	0	0	0	0	0	0	25,9
1,0	0,7	0,2	0,2	0,4	0,6	0,8	0,9	1,0	0,4	0,4	0,3	0,8	25,9
2,0	1,1	0,8	0,8	1,0	1,3	1,6	1,6	1,6	0,8	1,0	0,8	0,8	26,3
3,0	3,6	2,3	2,4	2,5	2,8	3,2	3,2	3,0	2,3	2,6	2,5	1,9	26,4
4,0	6,5	3,9	4,0	4,0	4,5	5,1	4,8	4,4	4,0	4,4	4,1	3,1	26,8
5,0	9,8	6,5	6,5	6,4	6,9	7,7	7,5	6,7	6,2	7,3	6,9	4,8	26,7
6,0	12,5	9,7	9,7	9,4	9,6	10,7	10,4	9,2	9,1	10,6	10,3	7,2	26,7
7,0	15,2	13,5	13,5	13,0	12,9	14,4	13,9	12,3	12,6	14,8	14,4	11,1	26,6
8,0	19,6	18,1	18,2	17,4	16,8	18,7	17,9	15,7	16,2	19,2	18,9	15,2	26,6
9,0	24,4	22,1	22,1	21,3	20,7	23,0	21,8	19,1	19,8	23,3	23,0	18,9	26,9
10,0	29,5	27,2	27,3	26,0	25,2	28,0	26,7	23,2	24,4	28,8	28,4	23,7	27,1


Current X ΔT
Δt(℃)
30
25
20
15
10
5
0
0
1
2
3
4
5
6
7
8
9
10
Current (A)
ΔT = 7℃
Average


Stromerwärmung
Current Heating
T/K
Stromübertemperatur
Temperature rise
16
14
12
10
8
6
4
2
0
0
2
4
6
Belastungsstrom
Current
I/A
0,5mm²
0,35mm²
0,2mm²
ΔT = 16℃





Note: Graph extracted from 108-18030_A1 MQS Product Spec.

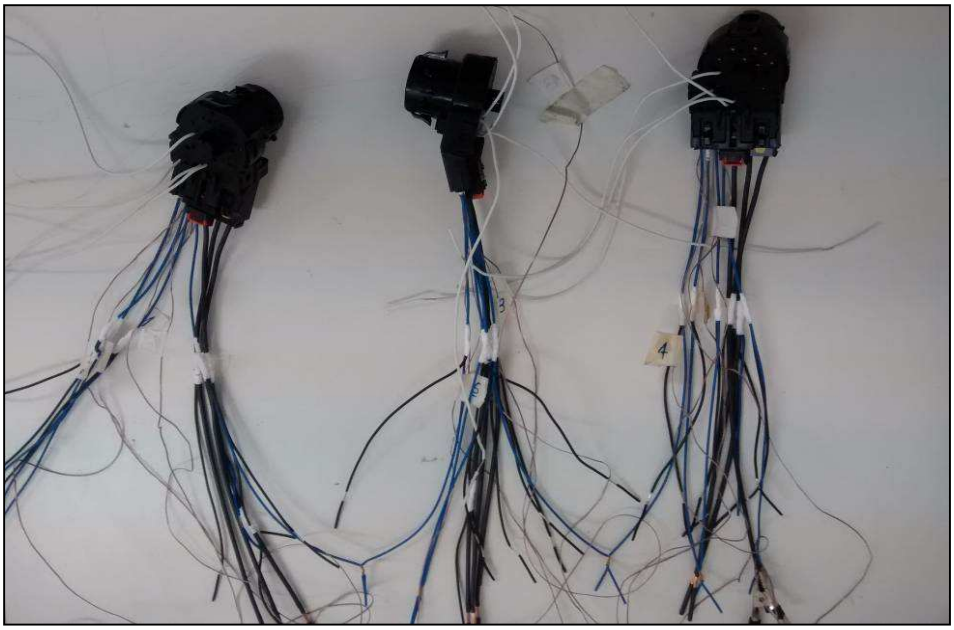


Photo 11 - Test overview

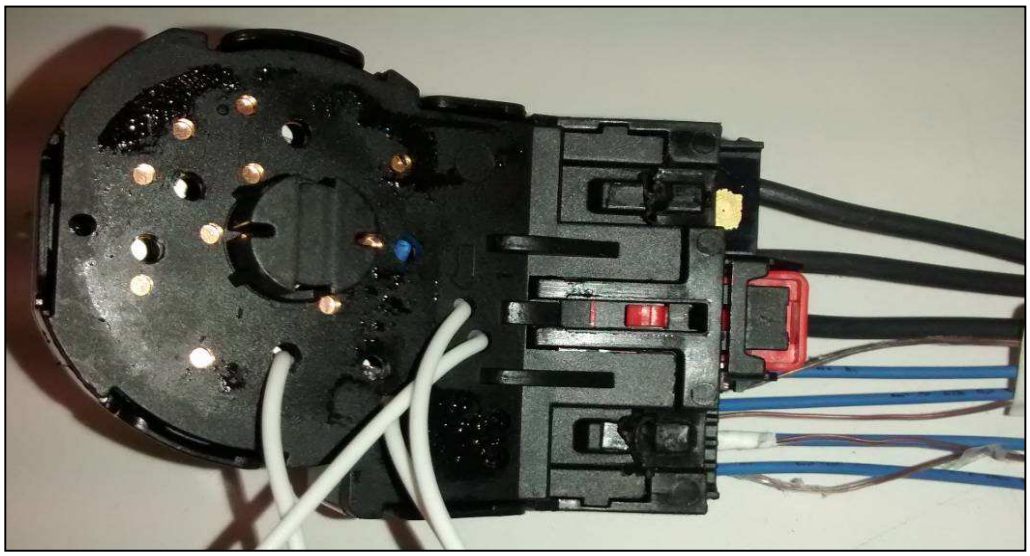


Photo 12 - Contact detail (thermocouple attached to MQS 1.5 SOCKET CONTACT

Conclusion:

All samples met the requirements.

PG14 - THERMAL TIME CONSTANT:

Samples number 1 to 3.

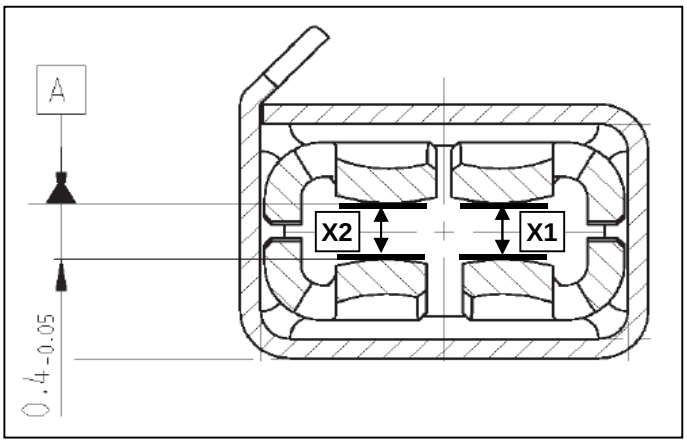
Equipment:
HP Digital Multimeter, model 34401A, nr. 93-339033-030.
PAK 20-36A DC POWER SUPPLY nr. 02703.
Thermocouples type "T".

Procedure:
-Visual inspection;
-Voltage drop measurement;
-Contact opening dimensions;
-Thermal time contant;
-Visual inspection;
-Contact opening dimensions;

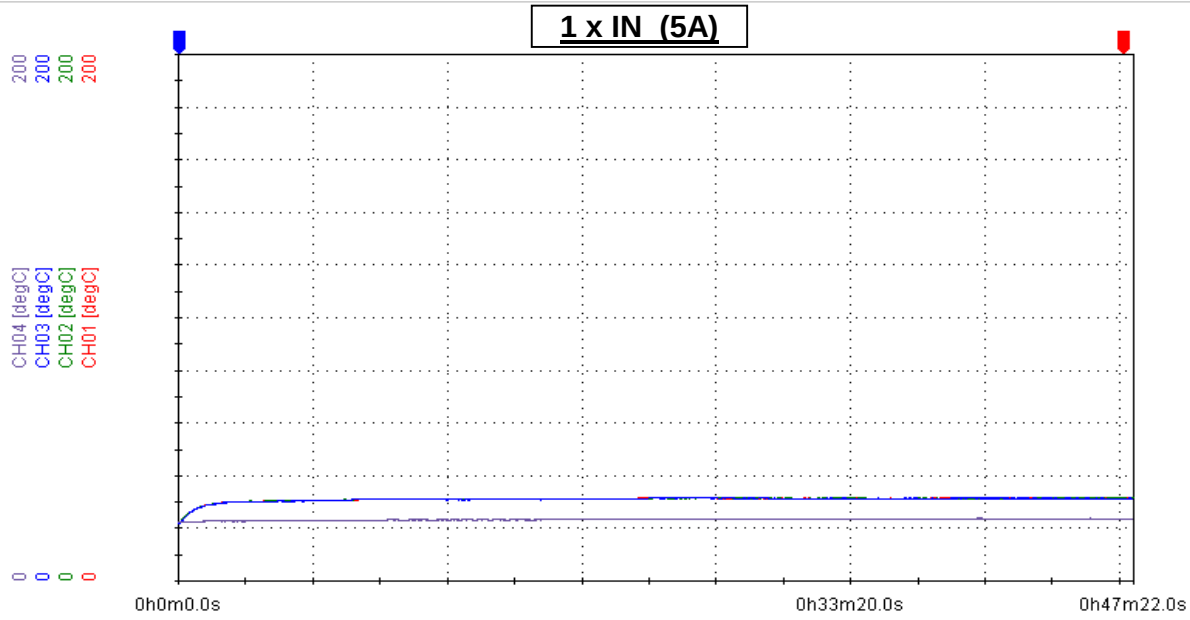
Requirements:
The contacts must still be fully functional after the test;
The visual inspection may show no damage at contact or conductor;
Documentation: the graph "current over time" must be provided.

Results:

Sample	Initial contact opening dimensions [mm]		After thermal time contact opening dimensions [mm]	
	X1	X2	X1	X2
1	0,355	0,370	0,425	0,425
2	0,393	0,399	0,423	0,437
3	0,395	0,387	0,425	0,431
Minimum	0,355	0,370	0,423	0,425
Average	0,381	0,385	0,424	0,431
Maximum	0,395	0,399	0,425	0,437

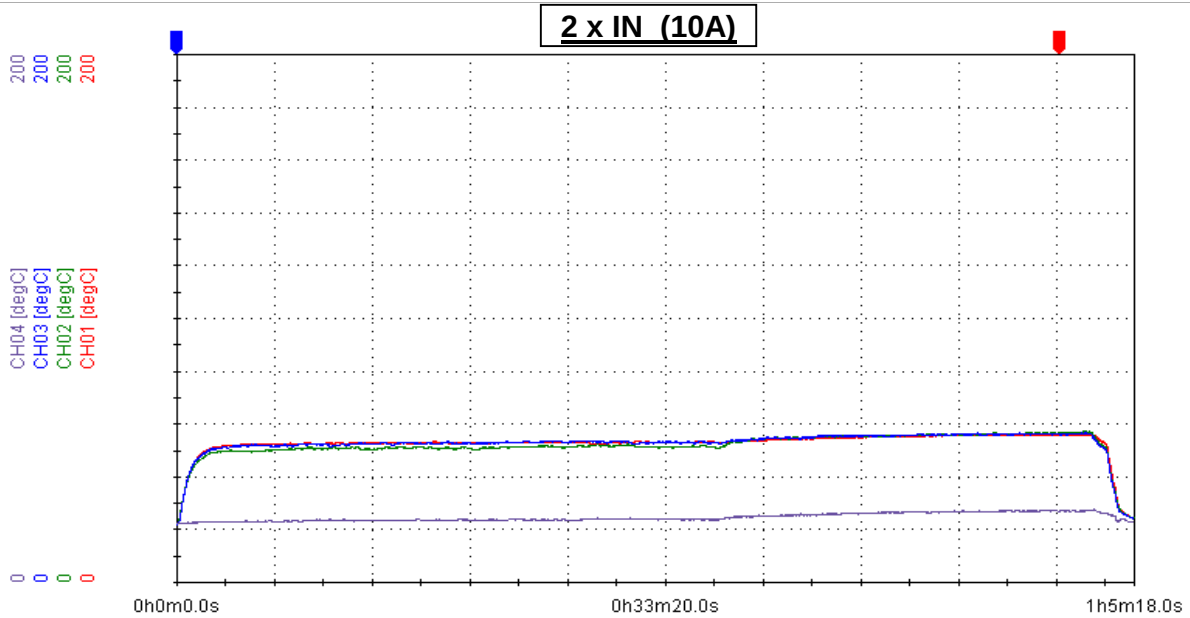


1 x IN (5A)



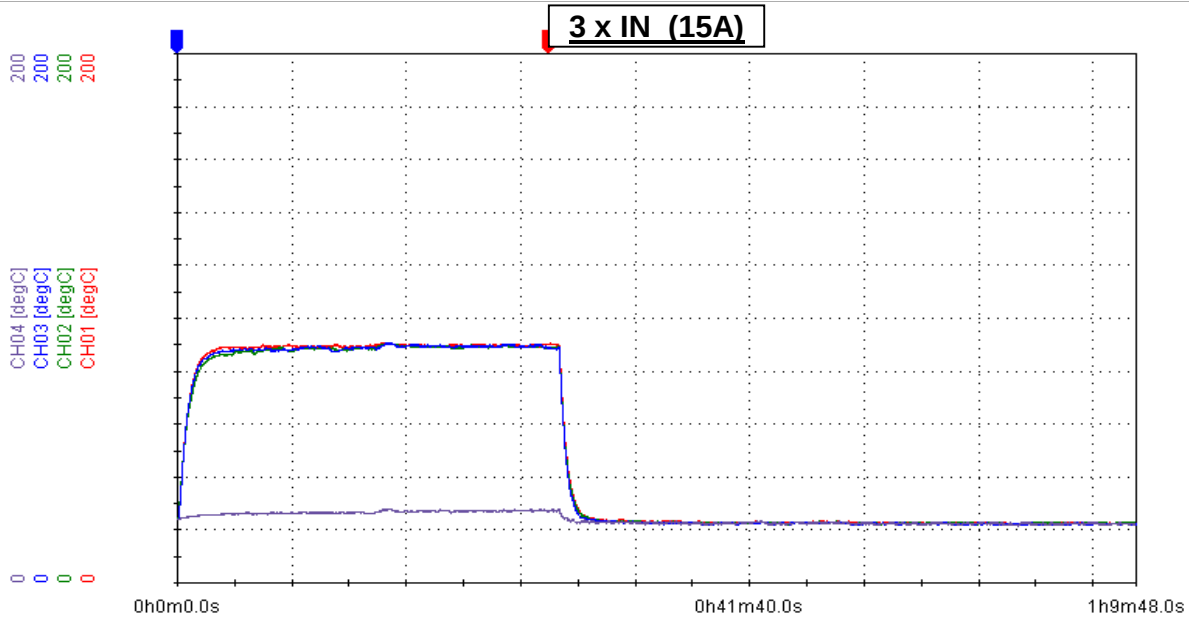
CH	Mode	Range	Scaling	Tag name	Position(%)	Zoom	A	B	B-A
CH01 [degC]	TC	T	OFF	SAMPLE1	50	1,0	22,3	31,6	9,299999
CH02 [degC]	TC	T	OFF	SAMPLE2	50	1,0	22,4	31,5	9,1
CH03 [degC]	TC	T	OFF	SAMPLE3	50	1,0	22,2	31,2	9
CH04 [degC]	TC	T	OFF	ROOM_T	50	1,0	22,2	23,5	1,299999

2 x IN (10A)



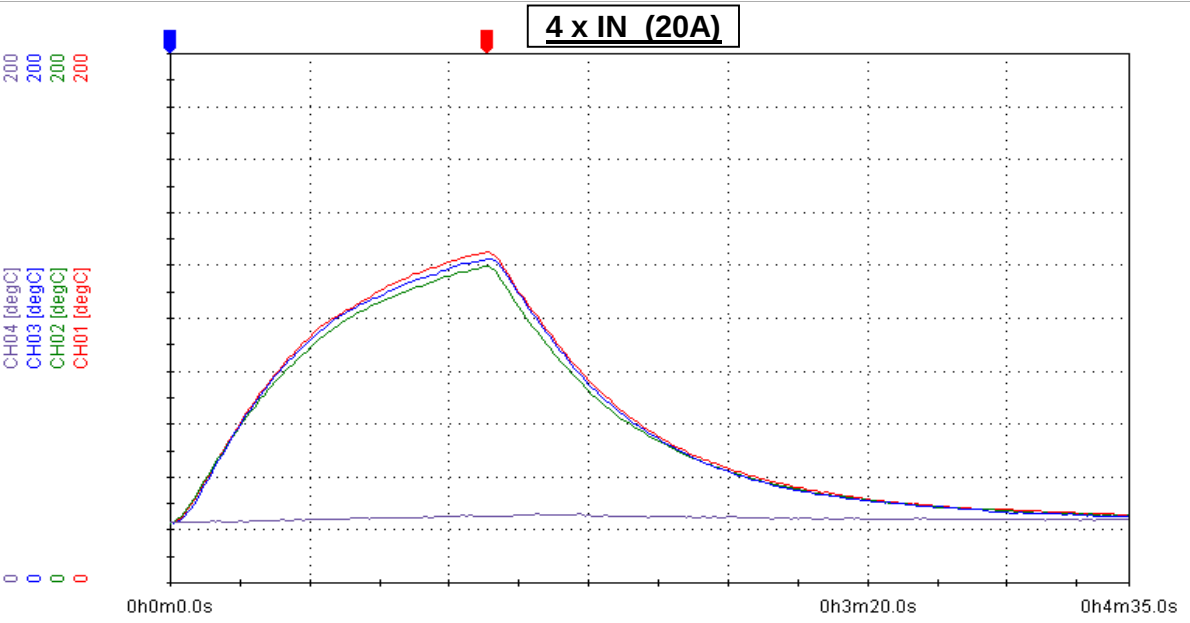
CH	Mode	Range	Scaling	Tag name	Position(%)	Zoom	A	B	B-A
CH01 [degC]	TC	T	OFF	SAMPLE1	50	1,0	22,4	55,8	33,4
CH02 [degC]	TC	T	OFF	SAMPLE2	50	1,0	22,3	56,7	34,4
CH03 [degC]	TC	T	OFF	SAMPLE3	50	1,0	22,2	56	33,8
CH04 [degC]	TC	T	OFF	ROOM_T	50	1,0	22,3	27,1	4,799999

3 x IN (15A)

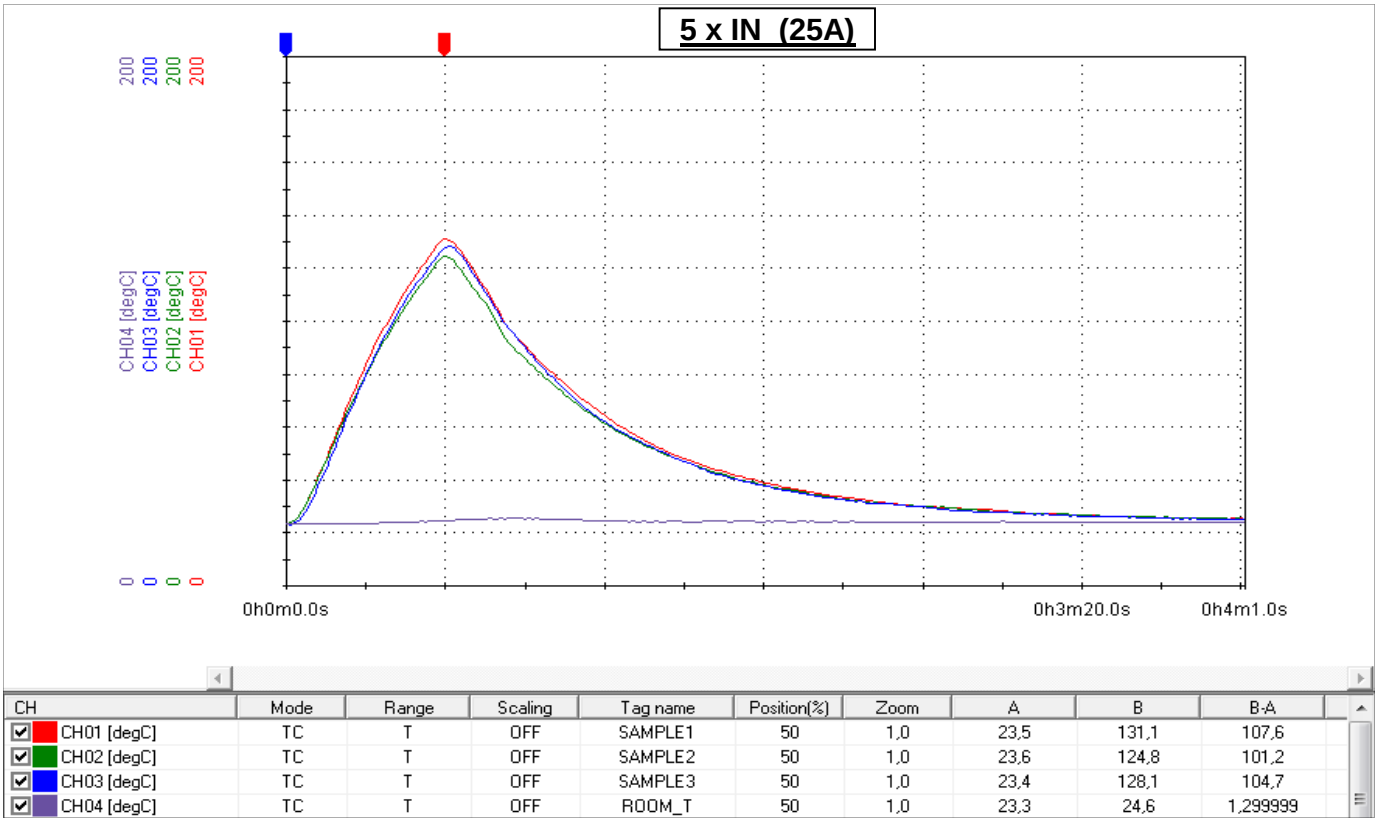


CH	Mode	Range	Scaling	Tag name	Position(%)	Zoom	A	B	B-A
CH01 [degC]	TC	T	OFF	SAMPLE1	50	1,0	24,1	90,2	66,10001
CH02 [degC]	TC	T	OFF	SAMPLE2	50	1,0	24,5	88,6	64,1
CH03 [degC]	TC	T	OFF	SAMPLE3	50	1,0	24	88,8	64,8
CH04 [degC]	TC	T	OFF	ROOM_T	50	1,0	23,9	27	3,1

4 x IN (20A)



CH	Mode	Range	Scaling	Tag name	Position(%)	Zoom	A	B	B-A
CH01 [degC]	TC	T	OFF	SAMPLE1	50	1,0	22,7	125,1	102,4
CH02 [degC]	TC	T	OFF	SAMPLE2	50	1,0	22,6	119,7	97,10001
CH03 [degC]	TC	T	OFF	SAMPLE3	50	1,0	22,7	122,3	99,60001
CH04 [degC]	TC	T	OFF	ROOM_T	50	1,0	22,8	25,1	2,299999



CH	Mode	Range	Scaling	Tag name	Position(%)	Zoom	A	B	B-A
CH01 [degC]	TC	T	OFF	SAMPLE1	50	1,0	23,5	131,1	107,6
CH02 [degC]	TC	T	OFF	SAMPLE2	50	1,0	23,6	124,8	101,2
CH03 [degC]	TC	T	OFF	SAMPLE3	50	1,0	23,4	128,1	104,7
CH04 [degC]	TC	T	OFF	ROOM_T	50	1,0	23,3	24,6	1,299999

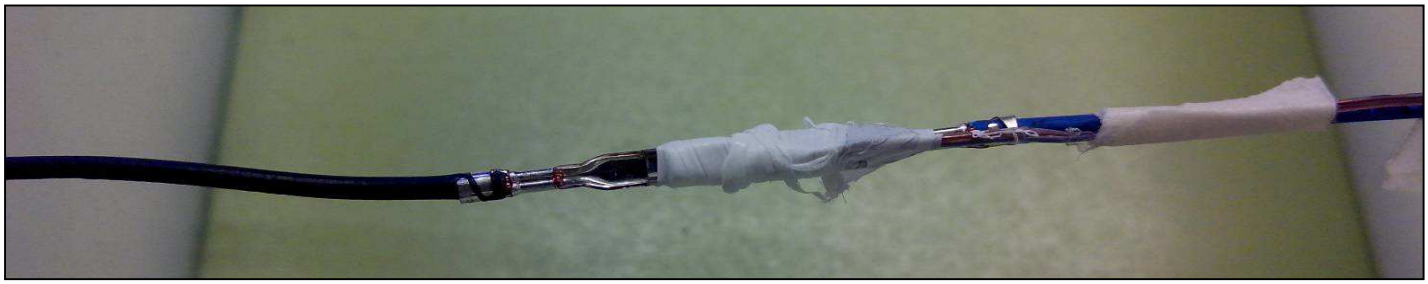


Photo 13 - Thermocouple attached to the terminal

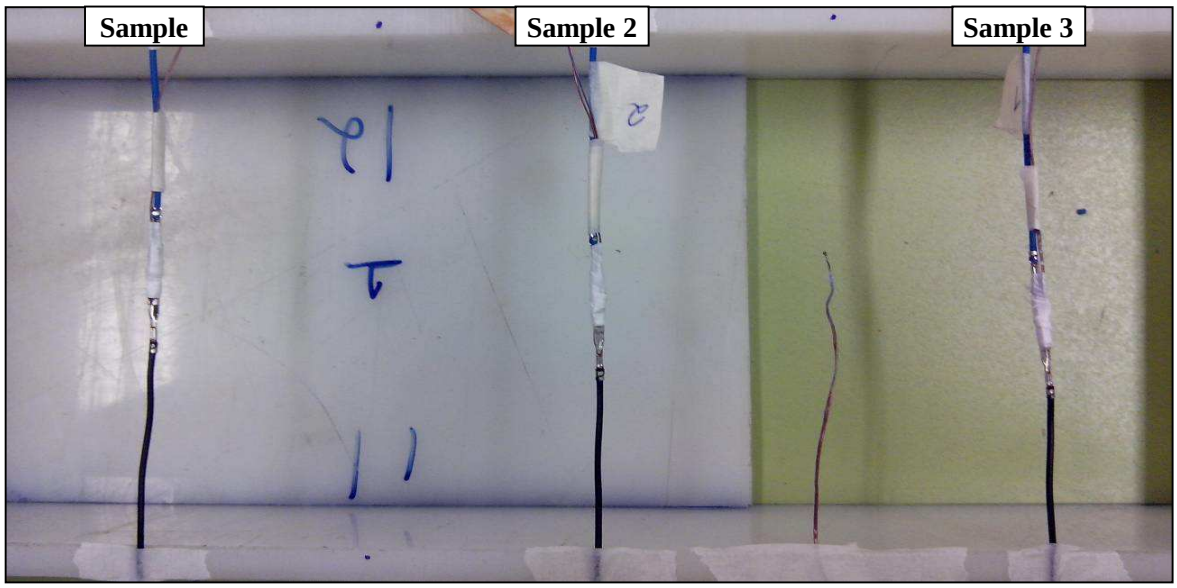


Photo 14 - Test overview

Conclusion:

No evidence of physical damage on contact and conductor visible.

All samples met the requirements.

PG15 - ELECTRICAL STRESS TEST:

Samples:
Samples number 1 to 10.

Equipment:
HP Digital Multimeter, model 34401A, nr. 93-339033-030.
AGILENT E 3641A DC POWER SUPPLY nr. 93-339036-019.
Data acquisition AGILENT, model 34972A, nr. 93-339048-872.
Salt spray chamber BASS. nr. 92-339032-001.
ACS angelantoni climatic systems, type DCTC 1300 nr. 92-339032-009.

Procedure:
-Visual inspection;
-Contact oppening dimension;
-Insert the DUTs twice;
-Contact oppening dimension;
-Contact resistance;
-Derating (3 DUTs woth the greatest contact resistance);
-Contact resistance;
-Temperature cycle endurance test/current cycle endurance test (please see CPqD test report nr. PD.12.AT.ENS.4055A/RE-01-AA);
-Humid heat, cyclic (please see CPqD test report nr. PD.12.AT.ENS.4055A/RE-01-AA attached);
-Contact resistance;
-Temperature cycle endurance test/current cycle endurance test (please see CPqD test report nr. PD.12.AT.ENS.4055A/RE-01-AA);
-Contact resistance;
-Derating;
-Contact opening dimension;
-Visual inspection.

Requirements:
Contact oppening dimension must be documented;
Contact resistance $\leq$ 15mΩ (MQS);
Contact resistance $\leq$ 8mΩ (MCP);
For the derating before and after the test, the current carrying capacity at 80°C ambient temperature may change at most by 20% relative to the derating at the start of the PG.

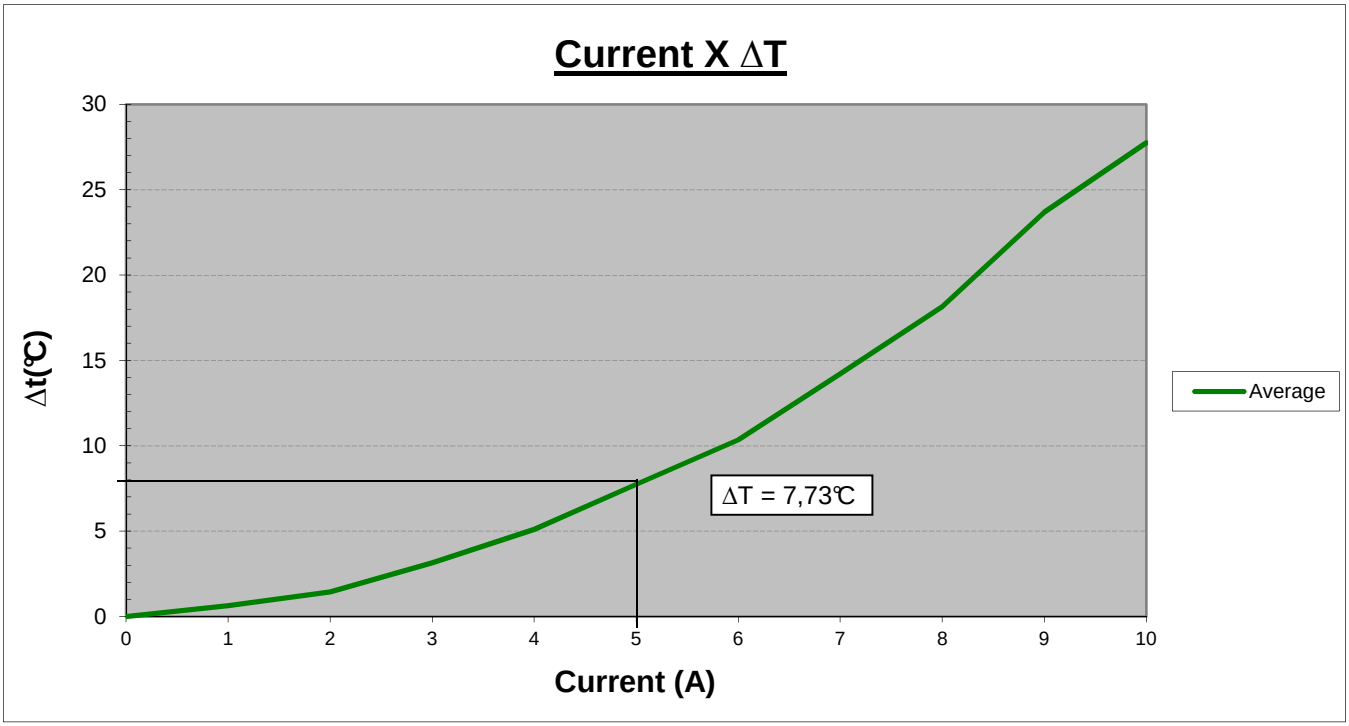
Results:

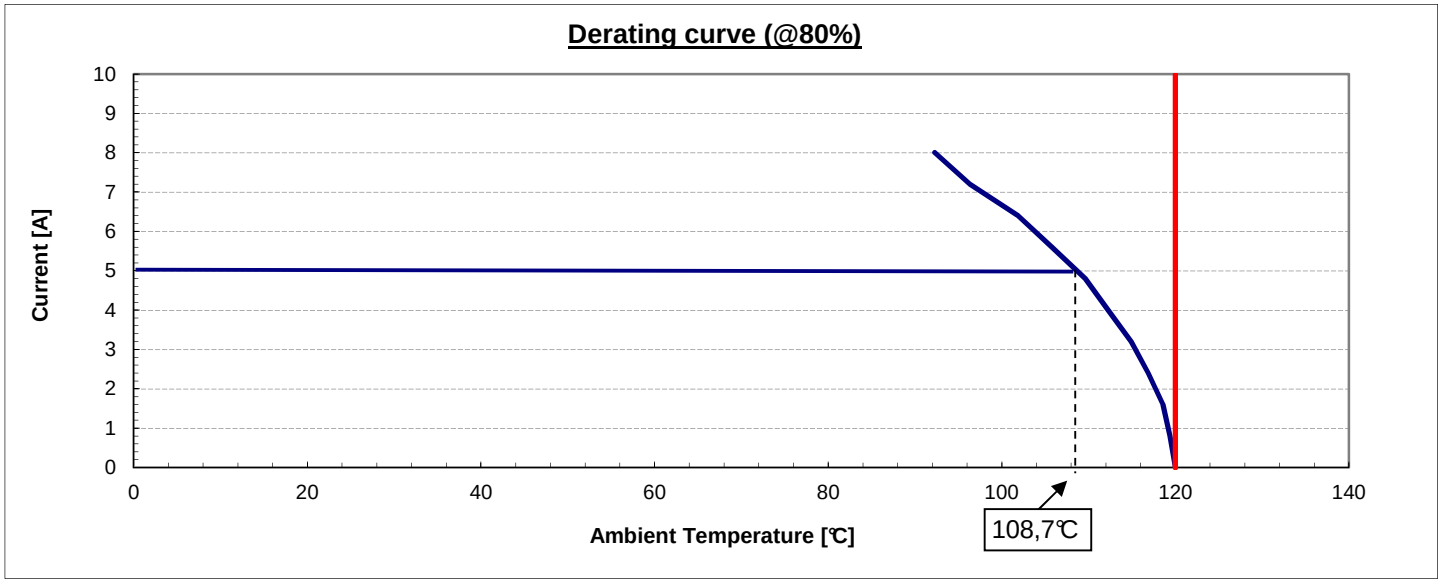
Contact opening dimensions						
Sample	**Initial [mm]**		**After insert terminals twice [mm]**		**At the end of test [mm]**	
	X1	**X2**	**X1**	**X2**	**X1**	**X2**
1	0,392	0,387	0,428	0,415	0,482	0,468
2	0,387	0,387	0,426	0,419	0,457	0,465
3	0,401	0,393	0,425	0,424	0,433	0,422
4	0,382	0,385	0,418	0,419	0,48	0,435
5	0,386	0,401	0,413	0,421	0,468	0,483
6	0,405	0,414	0,42	0,425	0,493	0,428
7	0,388	0,395	0,419	0,435	0,462	0,481
8	0,386	0,394	0,426	0,426	0,449	0,453
9	0,388	0,399	0,424	0,429	0,44	0,452
10	0,378	0,37	0,42	0,415	0,459	0,453
Minimum	0,378	0,370	0,413	0,415	0,433	0,422
Average	0,389	0,393	0,422	0,423	0,462	0,454
Maximum	0,405	0,414	0,428	0,435	0,493	0,483

Contact resistance [mΩ]					
Sample	**Initial**	**After Derating**	**After Temp. cycle end. Test**	**After Humid heat, cyclic**	**After Temp. cycle end. Test**
1	0,91	1,13	4,48	4,79	6,89
2	1,04	2,40	4,13	4,27	6,49
3	0,96	1,60	3,89	4,13	6,56
4	0,98	1,80	3,08	3,21	5,53
5	1,02	2,21	3,77	3,92	5,53
6	1,05	2,48	4,19	4,51	6,03
7	0,98	1,75	2,94	3,09	3,58
8	0,99	1,93	3,23	3,38	4,94
9	0,94	1,35	2,27	2,04	4,23
10	0,90	1,00	2,66	2,85	4,90
Minimum	0,90	1,00	2,27	2,04	3,58
Average	0,98	1,77	3,46	3,62	5,47
Maximum	1,05	2,48	4,48	4,79	6,89

Initial Derating:

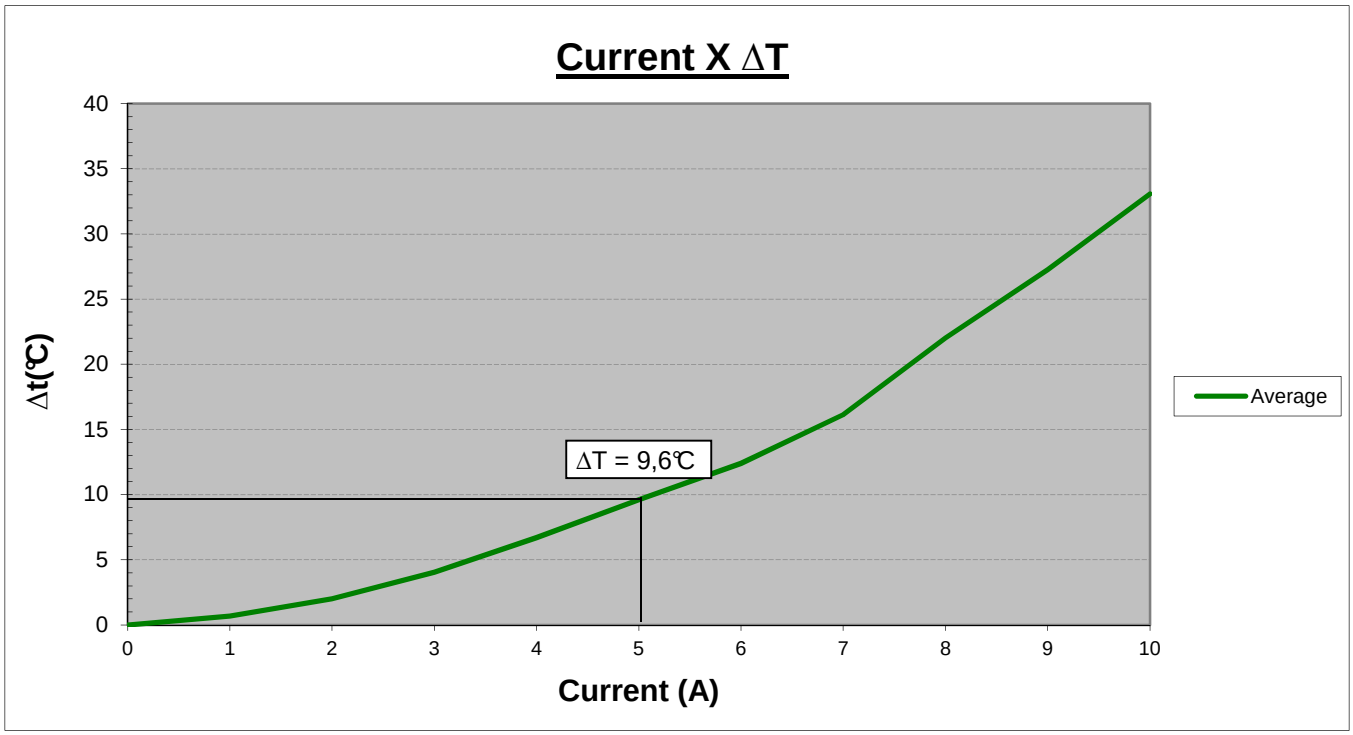
Current (A)	Temperature Rise (°C)		
	Terminal 1	Terminal 9	Terminal 10
0	0	0	0
1,0	0,6	0,6	0,6
2,0	1,5	1,4	1,4
3,0	3,4	3,0	3,0
4,0	5,6	4,9	4,8
5,0	8,5	7,4	7,3
6,0	11,3	9,8	10,0
7,0	15,2	14,0	13,5
8,0	19,4	17,7	17,4
9,0	24,5	23,8	22,7
10,0	28,6	27,6	26,9

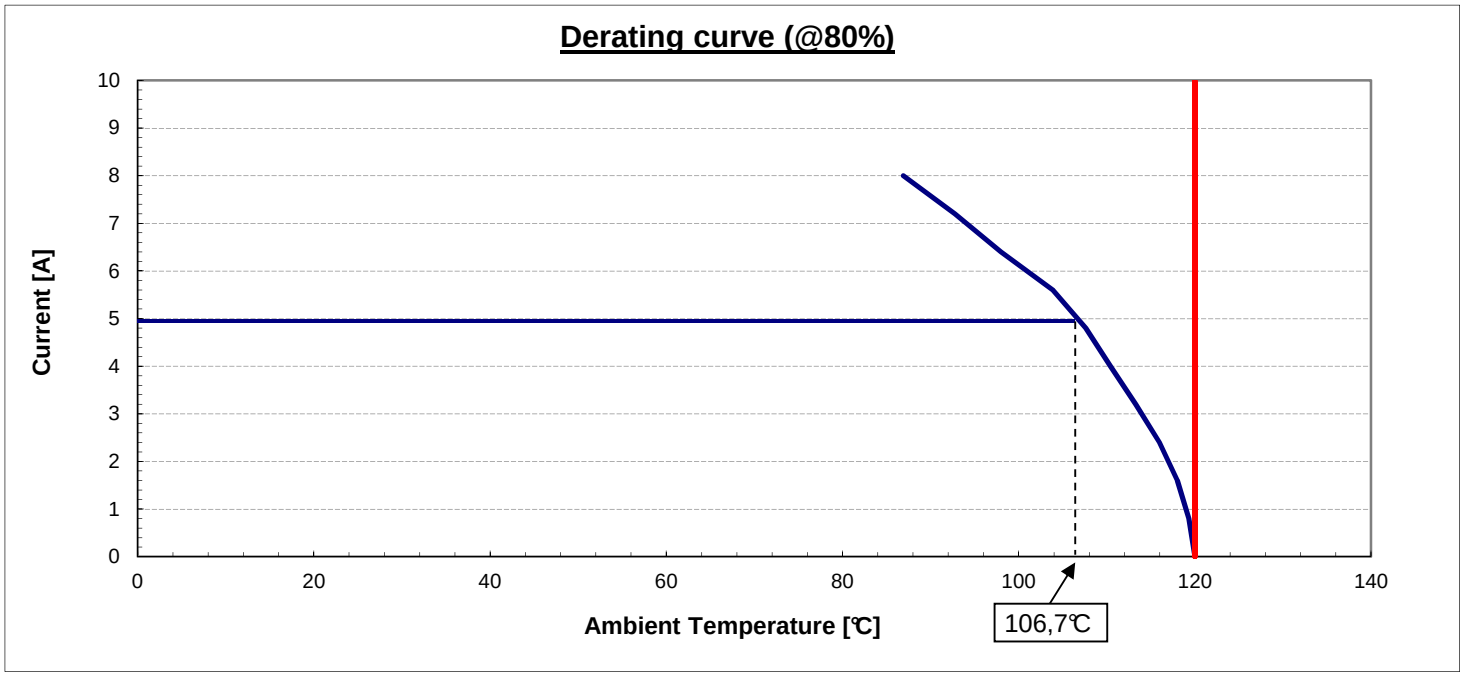




-Derating after temperature cycle test:

Current (A)	Temperature Rise (°C)		
	Terminal 1	Terminal 9	Terminal 10
0	0	0	0
1,0	0,9	0,2	0,9
2,0	2,1	1,9	2,0
3,0	4,2	4,0	4,0
4,0	7,0	6,5	6,6
5,0	10,7	8,2	9,8
6,0	13,8	11,1	12,3
7,0	18,0	13,6	16,7
8,0	24,9	19,0	22,2
9,0	30,5	24,6	26,6
10,0	38,9	27,6	32,7





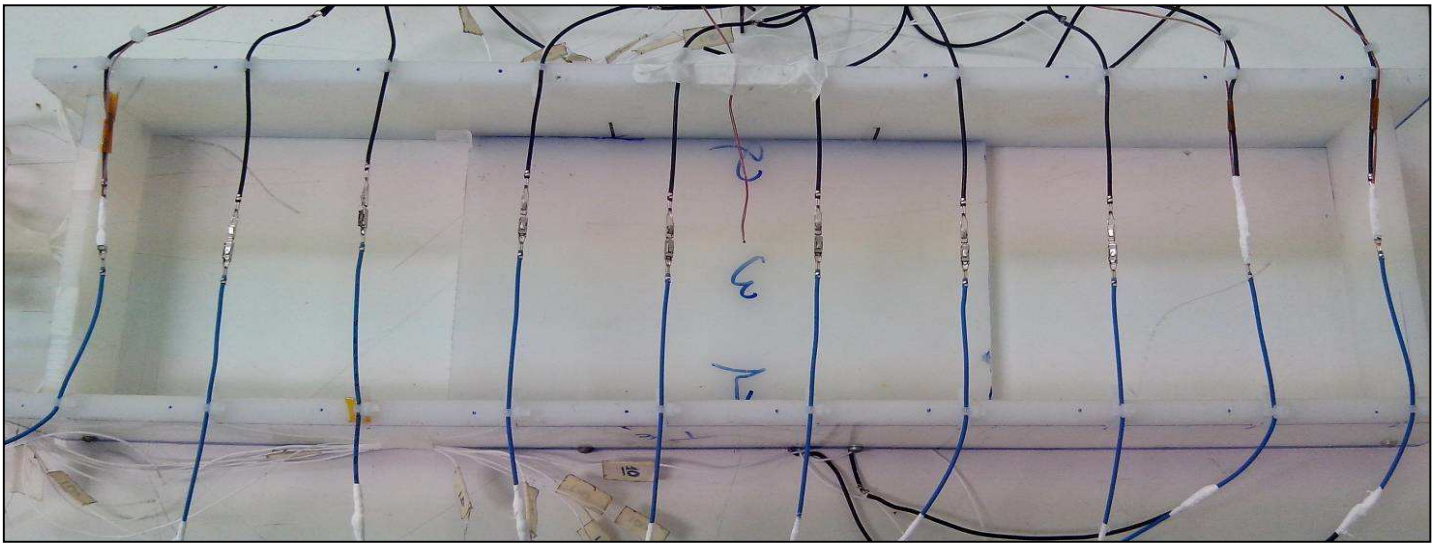


Photo 15 - Test overview

Conclusion:
All samples met the requirements.

PG18A - COASTAL CLIMATE LOAD:

Samples:
Samples number 44 to48.

Equipment:
HP Digital Multimeter, model 34401A, nr. 93-339033-030.
AGILENT E 3641A DC POWER SUPPLY nr. 93-339036-019.
Data acquisition AGILENT, model 34972A, nr. 93-339048-872.
Salt spray chamber BASS. nr. 92-339032-001.
ACS angelantoni climatic systems, type DCTC 1300 nr. 92-339032-009.

Procedure:
-Visual inspection;
-Insert the DUTs twice;
-Contact resistance;
-Salt spray cyclic (severity 3);
-Contact resistance;
-Visual inspection.

Salt spray procedure:
Four salt spray periods, each 2 hours, with a humidity storage between 20 hours and 22 hours after each; Afterwards one storage period of three days under a standard atmospfere for testing at 23°C ± 2°C and 45% to 55% humidity.

Requirements:
Contact resistance ≤ 15mΩ (MQS).
Contact resistance ≤ 8mΩ (MCP).

Results:

Initial contact resistance:

Way	Contact resistance [mΩ]				
	Sample 44	Sample 45	Sample 46	Sample 47	Sample 48
1 (MCP)	0,44	0,39	0,42	0,34	0,33
2 (MCP)	0,32	0,36	0,45	0,37	0,33
3 (MCP)	0,40	0,50	0,60	0,57	0,32
4 (MQS)	1,06	1,17	1,43	1,16	1,23
5 (MQS)	1,12	1,21	1,36	1,29	1,33
6 (MQS)	0,94	1,13	1,57	1,12	1,33
7 (MQS)	0,98	1,07	1,65	1,16	1,31

After Salt spray cyclic:

Way	Contact resistance [mΩ]				
	Sample 44	Sample 45	Sample 46	Sample4 7	Sample 48
1 (MCP)	0,42	0,37	0,37	0,37	0,49
2 (MCP)	0,33	0,41	0,53	0,45	0,48
3 (MCP)	0,41	0,40	0,43	0,39	0,39
4 (MQS)	1,21	1,08	1,16	1,28	1,28
5 (MQS)	1,65	1,19	1,05	1,30	1,18
6 (MQS)	2,02	1,08	1,25	1,83	2,58
7 (MQS)	2,20	2,00	1,31	1,33	1,96

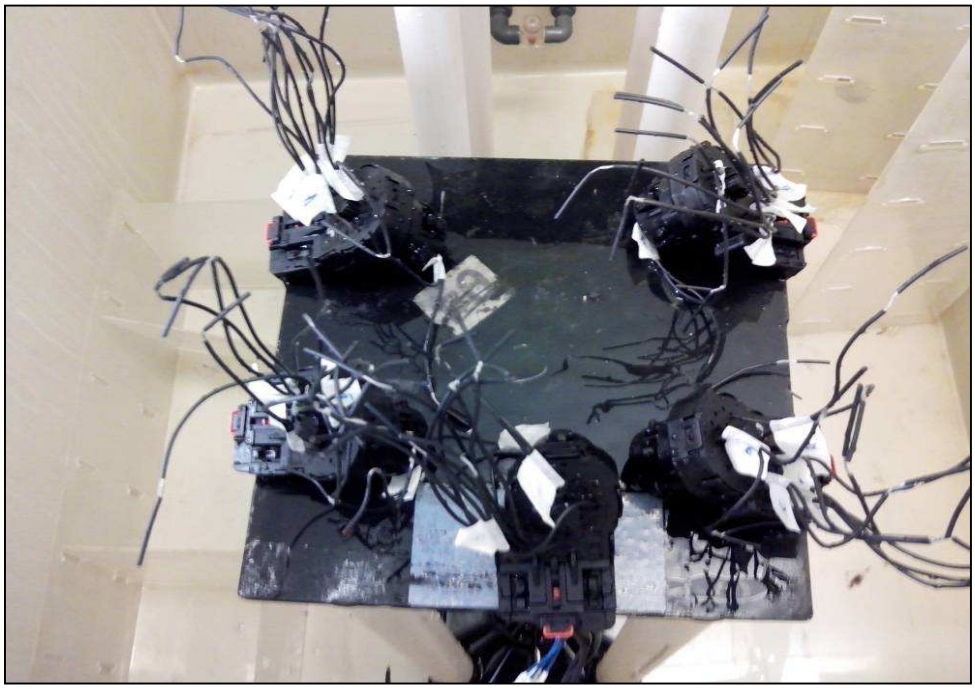


Photo 16- Samples inside the chamber

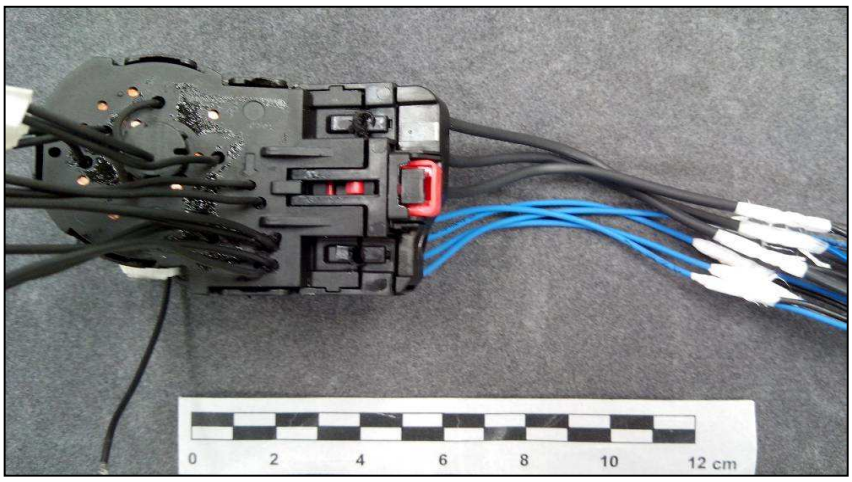


Photo 17 - Connector after test

Conclusion:
All samples met the requirements.

PG19 - ENVIRONMENTAL SIMULATION:

Samples:
3 groups with at least 10 contact parts per group.

Table 8 Description of the 3 groups

	Group 1	Group 2	Group 3
Batch size	10	10	10
Insertions before the loads	1x	1x	**10x**
During load	Unplugged	Plugged	Plugged

It was assembled 3 connectors with 4 MQS terminals each one, for each group.
Group 1: It was assembled 3 connectors (nr. 1, 2 and 3) with 4 MQS terminals each one, nr. 1 to 12.
Group 2: It was assembled 3 connectors (nr. 5, 6 and 7) with 4 MQS terminals each one, nr. 13 to 24.
Group 3: It was assembled 3 connectors (nr. 9, 10 and 11) with 4 MQS terminals each one, nr. 25 to 36.

Equipment:
Fanem Oven mod. 320E nr. 92-339031-12-31.
AGILENT E 3641A DC POWER SUPPLY nr. 93-339036-019.
Data acquisition AGILENT, model 34972A, nr. 93-339048-872.

Procedure:
-Visual inspection;
-Contact resistance;
-Insert and removing the DUTs 10 times (only group 3);
-Contact resistance (groups 2 and 3);
-Temperature shock (all groups) test performed at CTI laboratory, please see test report DAPE 2k13 / 222 attached;
-Contact resistance (groups 2 and 3);
-Temperature cycle (all groups) test performed at CTI laboratory, please see test report DAPE 2k13 / 235 attached;
-Contact resistance (groups 2 and 3);
-Aging in dry heat (all groups);
-Visual inspection (all groups);
-Industrial climate (multi-component climate) (all groups);
-Humid heat, constant (all groups);
-Visual inspection (all groups);
-Contact resistance (groups 2 and 3);
-Dynamic load (groups 2 and 3) test performed at Magneti Marelli laboratory, please see test report LTC/P&D-DFI062/13 attached;

Procedure:
-Contact resistance (groups 2 and 3);
-Mechanical shocks (all groups) test performed at Magneti Marelli laboratory, please see test report LTC/P&D-DFI062/13 attached;
-One-time disconnection and insertion (all groups)
-Contact resistance (all groups);
-Visual inspection (all groups).

Requirements:
Contact resistance ≤ 15mΩ (MQS).

Results:

Group	Contact resistance [mΩ]									
	Sample	Initial	After insert and removing 10 times	After Temperature shock	After Temperature cycle	After Aging in dry heat	After Industrial climate	After Humid heat	After Dynamic load	After One-time disc.
1	1	1,28	NA	NA	NA	NA	NA	NA	NA	1,47
	2	1,09	NA	NA	NA	NA	NA	NA	NA	1,33
	3	1,18	NA	NA	NA	NA	NA	NA	NA	1,30
	4	1,15	NA	NA	NA	NA	NA	NA	NA	1,38
	5	1,22	NA	NA	NA	NA	NA	NA	NA	1,85
	6	1,10	NA	NA	NA	NA	NA	NA	NA	1,65
	7	1,27	NA	NA	NA	NA	NA	NA	NA	1,51
	8	1,15	NA	NA	NA	NA	NA	NA	NA	1,33
	9	1,25	NA	NA	NA	NA	NA	NA	NA	3,08
	10	1,18	NA	NA	NA	NA	NA	NA	NA	3,88
	11	1,51	NA	NA	NA	NA	NA	NA	NA	2,25
	12	1,38	NA	NA	NA	NA	NA	NA	NA	2,66
2	13	2,08	NA	5,59	4,47	4,41	4,13	5,10	2,89	2,76
	14	1,78	NA	4,77	3,90	3,82	1,93	2,10	2,96	2,45
	15	1,49	NA	3,13	2,50	2,45	1,56	1,83	2,13	2,19
	16	2,01	NA	4,91	3,75	3,68	1,98	2,45	3,74	3,38
	17	2,75	NA	5,44	3,42	3,36	2,02	2,35	3,15	2,98
	18	1,62	NA	3,18	1,74	1,70	1,50	1,76	2,02	3,70
	19	1,71	NA	3,38	2,31	2,26	1,24	1,58	2,30	2,13
	20	2,33	NA	3,20	2,87	2,81	2,59	3,04	2,27	2,59
	21	4,16	NA	13,50	1,67	7,82	3,59	4,31	4,99	4,25
	22	2,25	NA	3,89	2,42	2,16	3,31	3,63	1,98	2,24
	23	1,45	NA	3,21	2,27	1,62	2,14	2,75	1,53	1,63
	24	1,60	NA	3,60	1,70	2,38	4,08	4,91	1,99	2,39
3	25	2,07	2,06	4,21	3,20	3,15	2,66	3,02	2,44	2,57
	26	1,31	1,30	2,07	1,40	1,36	1,24	1,47	1,33	1,65
	27	1,35	1,31	2,33	1,69	1,65	1,54	1,78	1,40	1,78
	28	2,60	2,49	4,04	3,48	3,39	2,86	3,43	2,08	2,24
	29	2,43	2,33	2,81	2,11	2,06	2,61	2,89	2,54	2,28
	30	1,25	1,20	1,86	1,58	1,53	1,56	1,97	1,69	2,29
	31	1,42	1,38	2,44	1,86	1,77	1,70	2,20	1,83	3,17
	32	2,52	2,39	2,41	2,28	2,21	2,40	2,96	2,66	3,16
	33	2,74	2,70	5,62	3,35	3,27	2,76	3,01	2,68	2,74
	34	1,42	1,37	2,38	10,80	1,83	1,93	2,12	2,26	3,95
	35	1,67	1,62	3,29	3,65	2,17	1,80	2,19	1,79	2,05
	36	2,14	2,06	4,05	11,46	2,25	2,92	3,15	2,75	2,93
Minimum		1,09	1,20	1,86	1,40	1,36	1,24	1,47	1,33	1,30
Average		1,75	1,85	3,97	3,33	2,71	2,33	2,75	2,39	2,42
Maximum		4,16	2,70	13,50	11,46	7,82	4,13	5,10	4,99	4,25

Conclusion:
All samples met the requirements.

PG20 - CLIMATE LOAD OF THE HOUSING:

Samples:
Samples number 49 to 53.

Equipment:
Fanem Oven mod. 320E nr. 92-339031-12-31.
Freezer Indrel mod. IULT 304D nr. 93-339032-008.
ACS angelantoni climatic systems, type DCTC 1300 nr. 92-339032-009.
Hypot ULTRA III Associated Research, Inc Serial number 9373007.

Procedure:
-Visual inspection;
-Insulation resistance;
-Contact resistance;
-Aging in dry heat;
-Humid heat, constant;
-Insulation resistance (must be measured between 30 and 60 minutes after the Humid Heat test);
-Visual inspection;
-Low-temperature aging;
-Removal and insertion at -20°C;
-Visual inspection;
-Aging in dry heat;
-Visual inspection.

Requirements:
After completion of the tests, no function deviations must have occurred;
It must be possible to opne and re-close the connector even at -20°C;
Any film hinges and latch elements present must break off or crack upon actuation;
The drop test must cause no damage to the specimens impairing their function. Locks must not open.
Insulation resistance > 100MΩ.

Results:

Insulation resistance:

V = 500VDC for 60 seconds.
State 1: Test performed with the connector assembled to the counterpart.
State 2: Test performed without the conunterpart.

Sample	Insulation resistance		
	Initial (State 1)	After Humid heat	
		State 1	State 2
49	603,3MΩ	**0**	208,3MΩ
50	816MΩ	**0**	>50GΩ
51	672MΩ	**0**	33,73GΩ
52	693,3MΩ	**0**	>50GΩ
53	570,1MΩ	**0**	>50GΩ

Note: Bold values are under specification.
After the Humid heat test all counterparts had water ingress, please see photos 18 and 19 below.

Photo 18 - State 1

Photo 19 - State 2

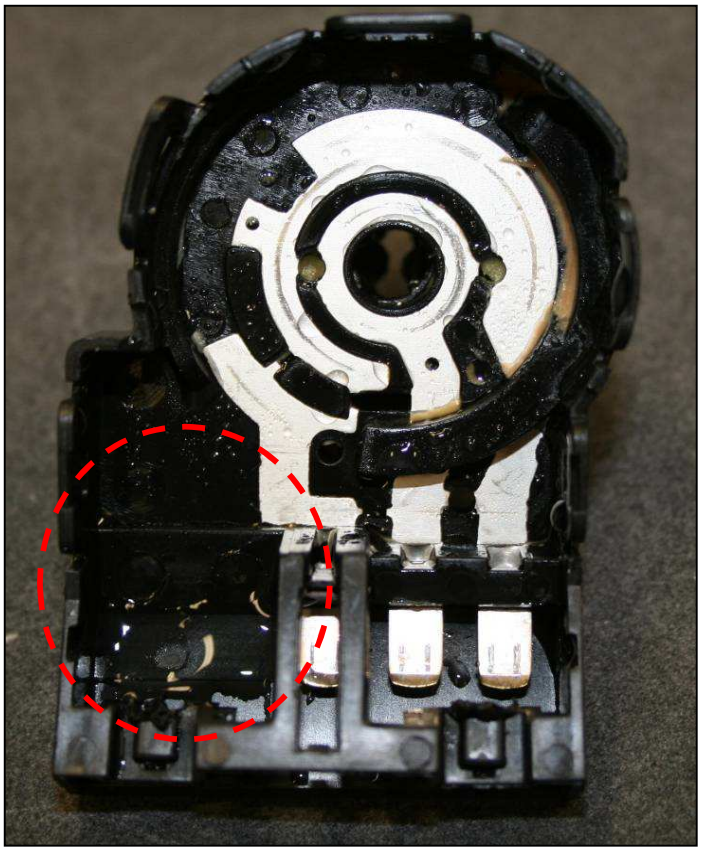


Photo 20 - Water penetration inside the counterpart

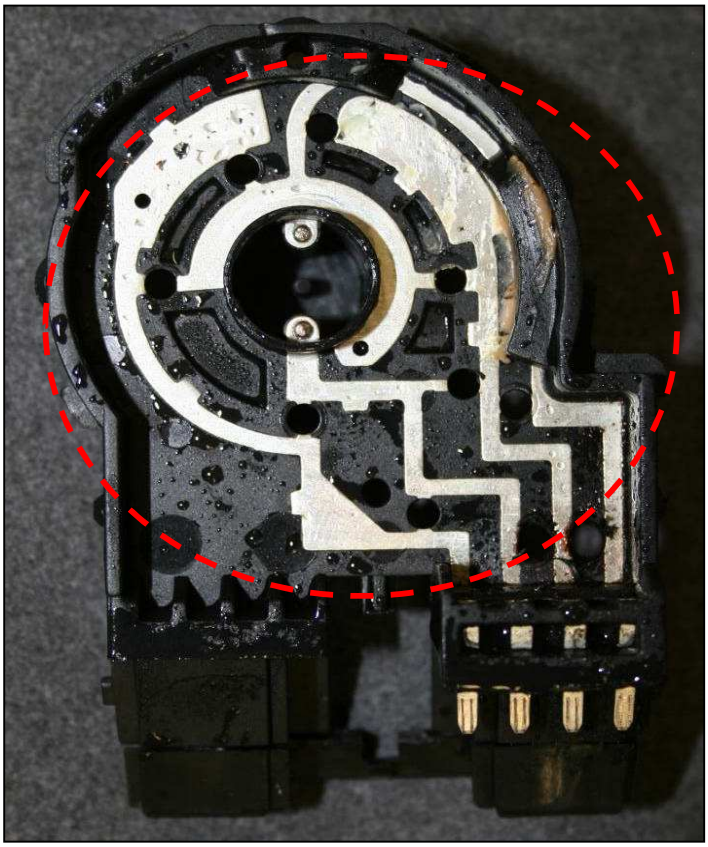


Photo 21 - Water penetration inside the counterpart

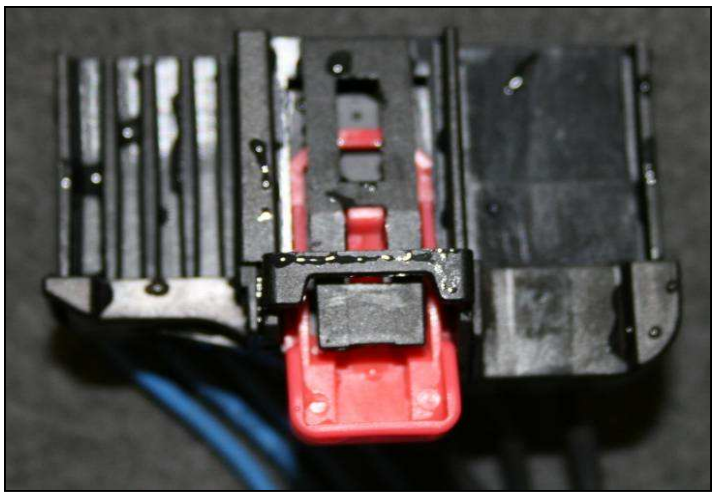


Photo 22 - Parts with water

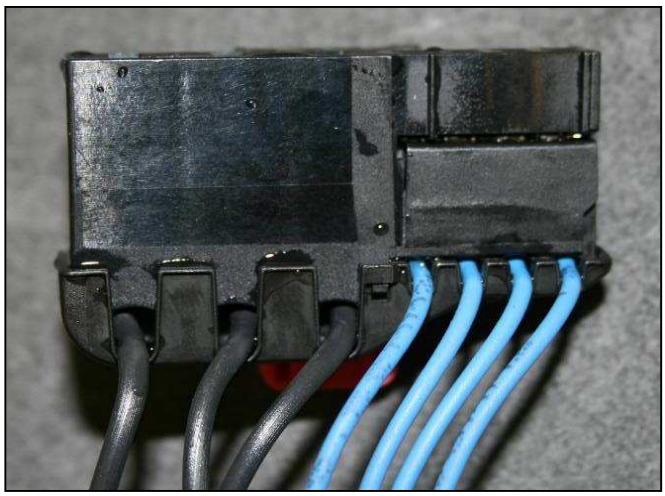


Photo 23 - Parts with water

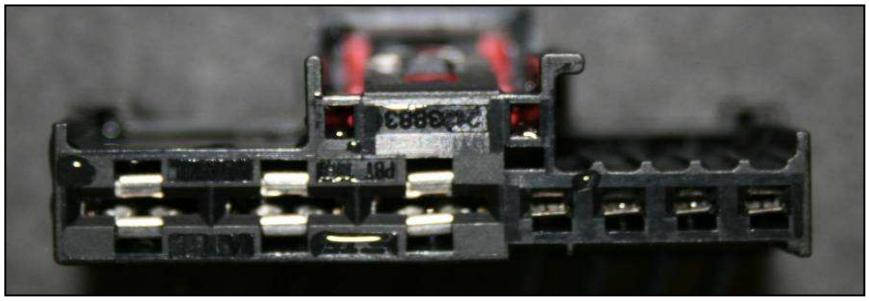


Photo 24 - Parts with water

Conclusion:
All samples met the requirements.

PG21 - LONG-TERM TEMPERATURE AGING:

Samples:
Samples number 49 to 59.

Group 1 (sample nr. 49 to 53) - unequipped;
Group 2 (sample nr. 54 to 59) - equipped.

Equipment:
Fanem Oven mod. 320E nr. 92-339031-12-31.
HP Digital Multimeter, model 34401A, nr. 93-339033-030.
AGILENT E 3641A DC POWER SUPPLY nr. 93-339036-019.

Procedure:
-Visual inspection (all groups);
-Contact resistance (group 2 only);
-Long-term aging in dry heat (all parts);
Duration: 1000h
Temperature: 130°C
Subsequent aging: 48h at room temp.
-Contact resistance (group 2 only);
-Functional test with both groups;
-Contact pull-out forces of all contacts of group 2);
-Visual inspection (all groups).

Requirements:
Contact resistance $\leq$ 15mΩ (MQS).
Contact resistance $\leq$ 8mΩ (MCP).
Contact pull-out force:
Retention force > 80N.

Results:

Way	Initial - Contact resistance [mΩ]					
	Sample 54	Sample 55	Sample 56	Sample 57	Sample 58	Sample 59
1 (MCP)	0,41	0,43	0,33	0,47	1,50	0,38
2 (MCP)	0,47	0,40	0,36	0,40	0,48	0,33
3 (MCP)	0,54	0,42	0,33	0,41	0,40	0,41
4 (MQS)	1,45	1,31	1,40	1,62	1,34	1,06
5 (MQS)	1,63	1,47	1,38	1,32	1,26	1,16
6 (MQS)	1,60	2,00	1,37	1,44	1,27	1,16
7 (MQS)	1,38	1,44	1,61	1,59	1,20	1,07

Way	After conditionig - Contact resistance [mΩ]					
	Sample 54	Sample 55	Sample 56	Sample 57	Sample 58	Sample 59
1 (MCP)	0,42	0,51	0,41	0,69	1,56	0,40
2 (MCP)	0,56	0,51	0,43	0,52	0,62	0,41
3 (MCP)	0,52	0,43	0,38	0,59	0,47	0,44
4 (MQS)	2,03	1,63	2,98	1,40	1,30	1,36
5 (MQS)	1,42	1,34	1,62	1,48	1,45	1,27
6 (MQS)	1,34	1,44	1,57	1,39	1,55	1,37
7 (MQS)	1,57	1,78	1,58	1,93	2,16	1,49

Connector Way	Retention force [N]					
	Cavity 1			Cavity 2		
	Sample 54	Sample 55	Sample 56	Sample 57	Sample 58	Sample 59
1 (MCP)	135,5	130,0	132,0	160,5	127,5	130,0
2 (MCP)	174,0	148,0	140,0	157,0	143,0	156,0
3 (MCP)	165,0	153,0	150,0	170,5	132,5	140,0
4 (MQS)	105,5	108,5	105,5	119,0	104,5	110,5
5 (MQS)	105,0	109,5	105,0	109,5	106,5	107,5
6 (MQS)	104,0	108,5	102,0	108,5	106,0	111,0
7 (MQS)	103,0	104,0	103,0	109,0	109,0	111,5
Minimum	103,0	104,0	102,0	108,5	104,5	107,5
Average	127,4	123,1	119,6	133,4	118,4	123,8
Maximum	174,0	153,0	150,0	170,5	143,0	156,0

Conclusion:
All samples met the requirements.

PG22A - CHEMICAL RESISTANCE:

Samples:
Samples number 60 to 69

Equipment:
Fanem Oven mod. 320E nr. 92-339031-12-31.
Dielectric analyser Associated research Inc, nr. 93-339033-734.

Procedure:
-Visual inspection;
-Insulation resistance;
-Resistance to agents;
-Insulation resistance;
-Visual inspection.

Sample	Chemical agents	Application	Aging temp.
60 / 61	Cold-cleaning agent/cockpit cleaning agent	Spraying	48h / 50°C
62 / 63	Penetrating oil	Spraying	48h / 50°C
64 / 65	Undilluted washer fluid anti-freeze	Dousing	48h / 50°C
66 / 67	Isopropanil	Dousing	Room temp.
68 / 69	Grease	Rubbing	48h / 50°C

Requirements:
No functionally significant structural change;
Insulation resistance > 100MΩ.
The DUT must remain fully funtional.

Results:

Sample	Insulation resistance [MΩ]	
	Initial	**After test**
60	796,7	553,2
61	1242,0	390,2
62	807,4	1266
63	1037,0	1415
64	1140,0	575
65	1182,0	701,4
66	911,1	872
67	1109,0	1014
68	1157,0	1293
69	879,9	1165

Conclusion:
All samples met the requirements.