

TESTREPORT – LIFETIME

Multimec switch 5ETH935

Test no. 1204100 - April 2012

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IDENTIFICATION

Test no. 1204100

Title: Lifetime test pushbutton switch type 5ETH935

Test period: March-April

Test engineer: Emir Vilic

Signature: _____

DESCRIPTION

The purpose of the test is to verify that the switches complies with the specification, before under and after being exposed to 10 million operations.

The test is made as an accelerated lifetime test, running at a test cycle speed of 60 cycles/min. One test cycle is defined as one activation and one de-activation of the switch actuator.

This test is a subset of mec reliability test standard and is carried out as an internal test.

TEST SETUP

Initial inspection and measurement.

For each 1 million cycles the following parameters are measured:

1. Activation force (ON-click)
2. De-activation force (OFF-click)
3. Travel [mm]
4. Contact resistance [ohm]
5. Contact bounce [mS]
6. Force/travel characteristic
7. Visual inspection

After test completion the switches are disassembled and thoroughly examined.

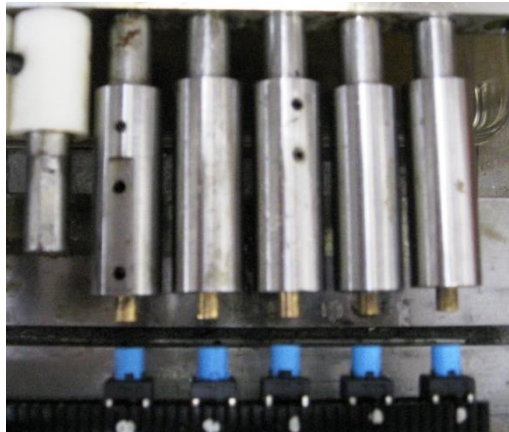
Test object: Multimec 5ETH935, SPC samples from wk05/12

Test jig: MEC LTT-01, Automatic motorized test system

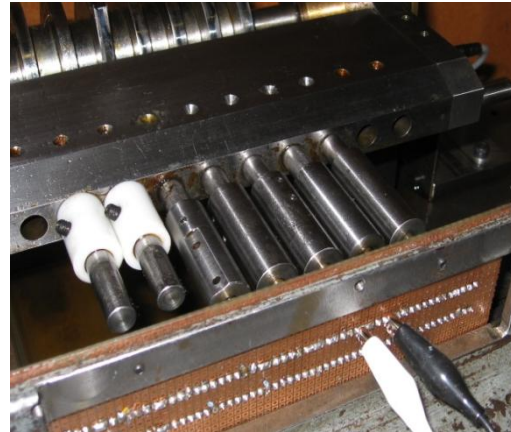
Equipment: Mecmessin advanced force gauge

Metra Ohmmeter

Pico USB scope



• Pic 1



• Pic 2

CONCLUSION:

All switches – 5ETH935 passes the lifetime test and are fully functional after 10million activations. All the tests are passed and are within the requirement limits.

During the test there has been no signs of temporary non functional misbehavior, which indicate high reliability level.

After completion the switches were disassembled and thoroughly examined for wear marks, micro cracks and other signs of wear.

As illustrated at page 11 – the only irregular finding is the residual from oil vapor penetration that is caused by a fault/leakage in the gearbox in the test system.

All switches carry no or very minor signs of wear, which indicate very high reliability and endurance level.

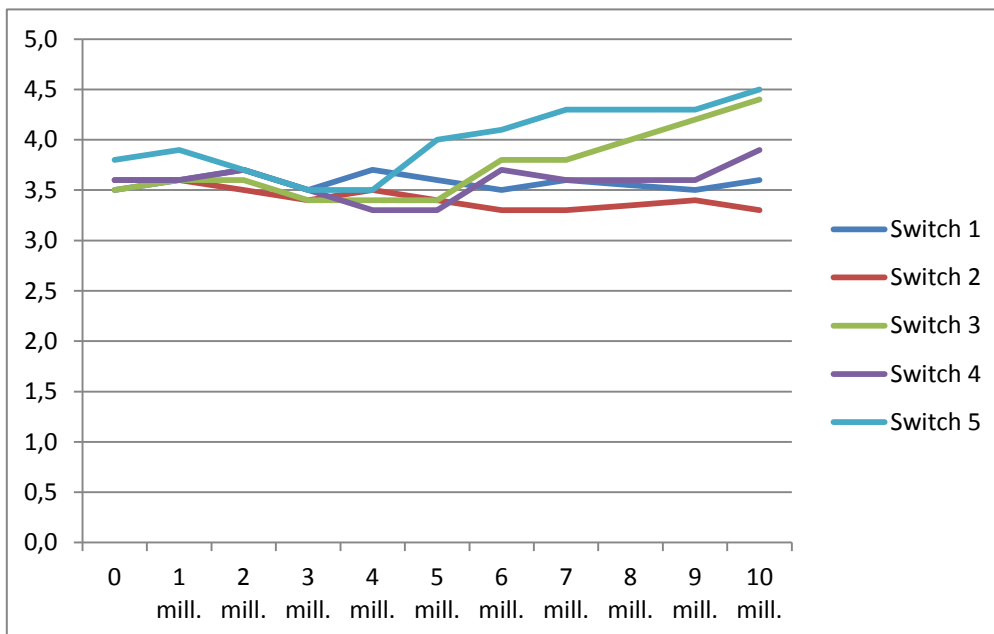
ACTIVATION FORCE:

Requirement:

Type:5ETH935	F[N]
Min.	3,5
Max.	4,3
Delta F	≥1

Measurements:

Activation force	F[N]					
	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	mean
0	3,5	3,6	3,5	3,6	3,8	3,6
1 mill.	3,6	3,6	3,6	3,6	3,9	3,7
2 mill.	3,7	3,5	3,6	3,7	3,7	3,6
3 mill.	3,5	3,4	3,4	3,5	3,5	3,5
4 mill.	3,7	3,5	3,4	3,3	3,5	3,5
5 mill.	3,6	3,4	3,4	3,3	4,0	3,5
6 mill.	3,5	3,3	3,8	3,7	4,1	3,7
7 mill.	3,6	3,3	3,8	3,6	4,3	3,7
8 mill.	3,6	3,4	4,0	3,6	4,3	3,8
9 mill.	3,5	3,4	4,2	3,6	4,3	3,8
10 mill.	3,6	3,3	4,4	3,9	4,5	3,9
						3,7



Result:

Test PASSED, 5/5 are within limits after 10 million activations.

Note: there is a slight trend that the activation force increases over time.

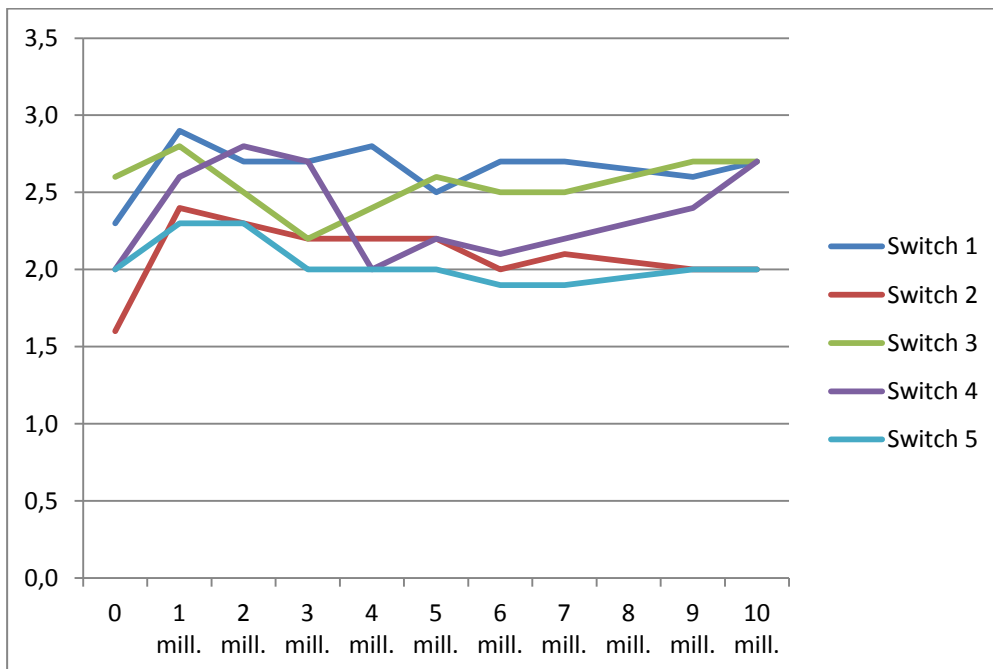
DE-ACTIVATION FORCE:

Requirement:

Type: 5ETH935	F[N]
Min.	≥1

Measurements:

De-activation	F(N)					
	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	
0	2,3	1,6	2,6	2,0	2,0	2,1
1 mill.	2,9	2,4	2,8	2,6	2,3	2,6
2 mill.	2,7	2,3	2,5	2,8	2,3	2,5
3 mill.	2,7	2,2	2,2	2,7	2,0	2,4
4 mill.	2,8	2,2	2,4	2	2,0	2,3
5 mill.	2,5	2,2	2,6	2,2	2,0	2,3
6 mill.	2,7	2,0	2,5	2,1	1,9	2,2
7 mill.	2,7	2,1	2,5	2,2	1,9	2,3
8 mill.	2,7	2,1	2,6	2,3	2,0	2,3
9 mill.	2,6	2,0	2,7	2,4	2,0	2,3
10 mill.	2,7	2,0	2,7	2,7	2,0	2,4
						2,3



Result:

Test PASSED, 5/5 are within limits after 10 million activations.

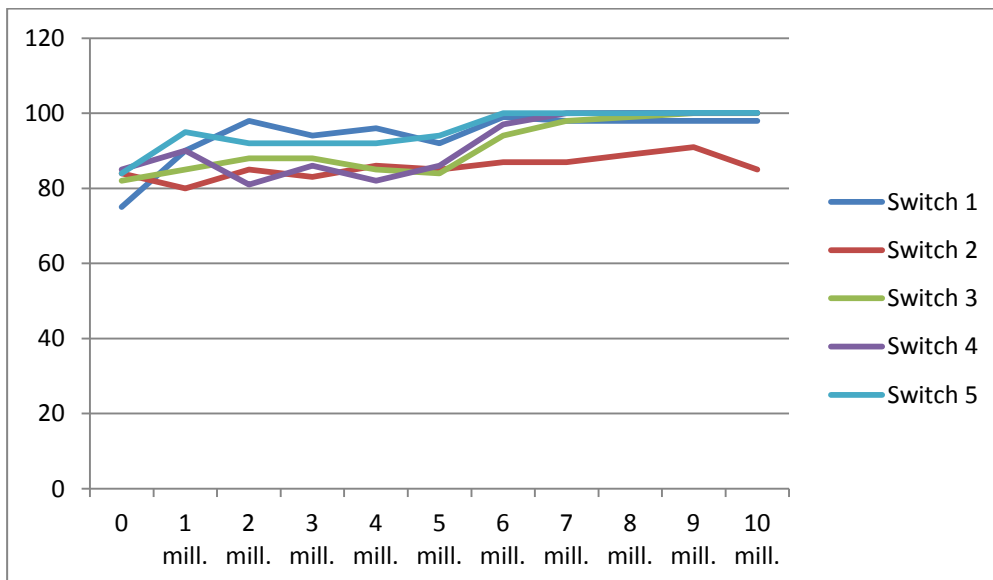
ACTIVATION TRAVEL:

Requirement:

Type:5ETH935	S[μ m]
Nominal	100

Measurements:

Activation travel	[μ m]					
	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	
0	75	84	82	85	84	82,0
1 mill.	90	80	85	90	95	88,0
2 mill.	98	85	88	81	92	88,8
3 mill.	94	83	88	86	92	88,6
4 mill.	96	86	85	82	92	88,2
5 mill.	92	85	84	86	94	88,2
6 mill.	99	87	94	97	100,01	95,4
7 mill.	98	87	98	100,01	100,02	96,6
8 mill.	98	89	99	100,06	100,04	97,2
9 mill.	98	91	100,01	100,1	100,10	97,8
10 mill.	98	85	100,02	100,1	100,09	96,6
						91,6



Result:

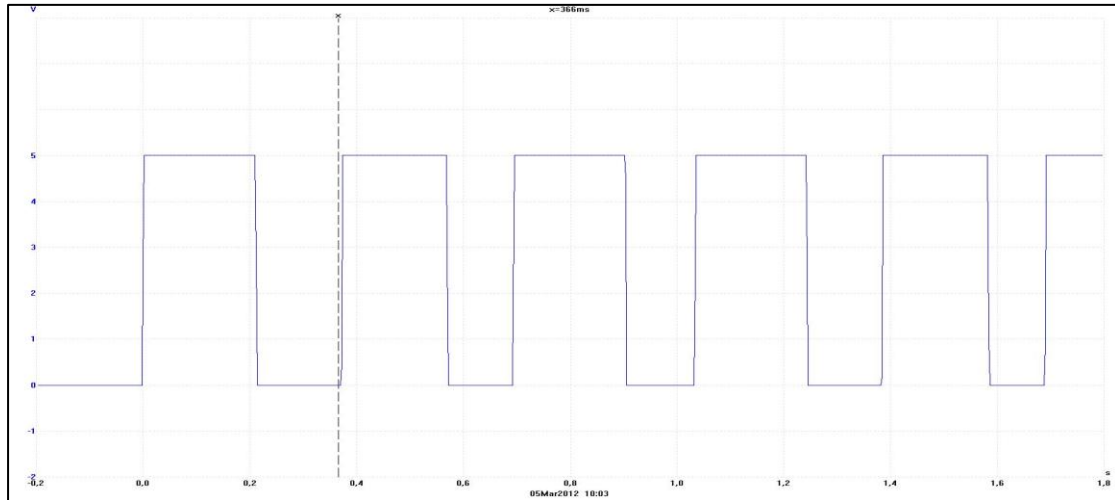
Test PASSED, 5/5 are within limits after 10 mill. activations.

CONTACT BOUNCE:

Requirement:

Type:5ETH935	[mS]
Nominal	≤2

Measurements:



Result:

Test PASSED, 5/5 are within limits after 10 mill. activations.

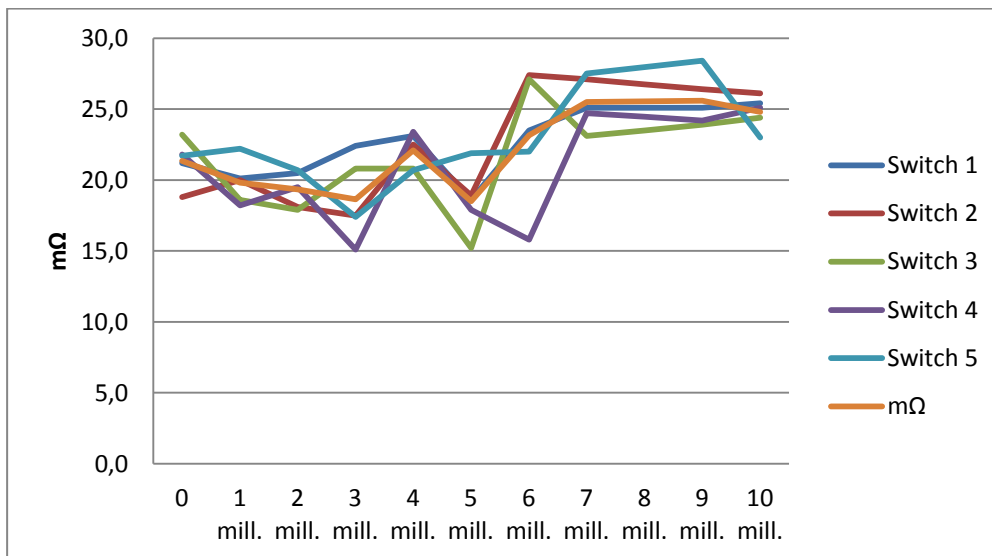
CONTACT RESISTANCE:

Requirement:

Type: 5ETH935	R[mΩ]
Nominal	≤30

Measurements:

Contact resistance [mΩ]						
	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	mΩ
0	21,2	18,8	23,2	21,8	21,7	21,3
1 mill.	20,1	20,0	18,6	18,2	22,2	19,8
2 mill.	20,5	18,1	17,9	19,5	20,7	19,3
3 mill.	22,4	17,5	20,8	15,1	17,4	18,6
4 mill.	23,1	22,5	20,8	23,4	20,7	22,1
5 mill.	18,6	18,9	15,2	17,9	21,9	18,5
6 mill.	23,5	27,4	27,1	15,8	22,0	23,2
7 mill.	25,1	27,1	23,1	24,7	27,5	25,5
8 mill.	25,1	26,8	23,5	24,5	28,0	25,6
9 mill.	25,1	26,4	23,9	24,2	28,4	25,6
10 mill.	25,4	26,1	24,4	25,1	23,0	24,8



Result:

Test PASSED, 5/5 are within limits after 10 mill. activations.

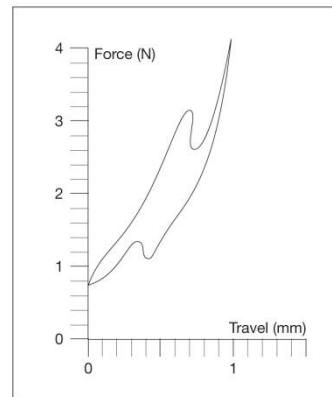
Note: Contact resistance slightly increased over time

FORCE/TRAVEL:

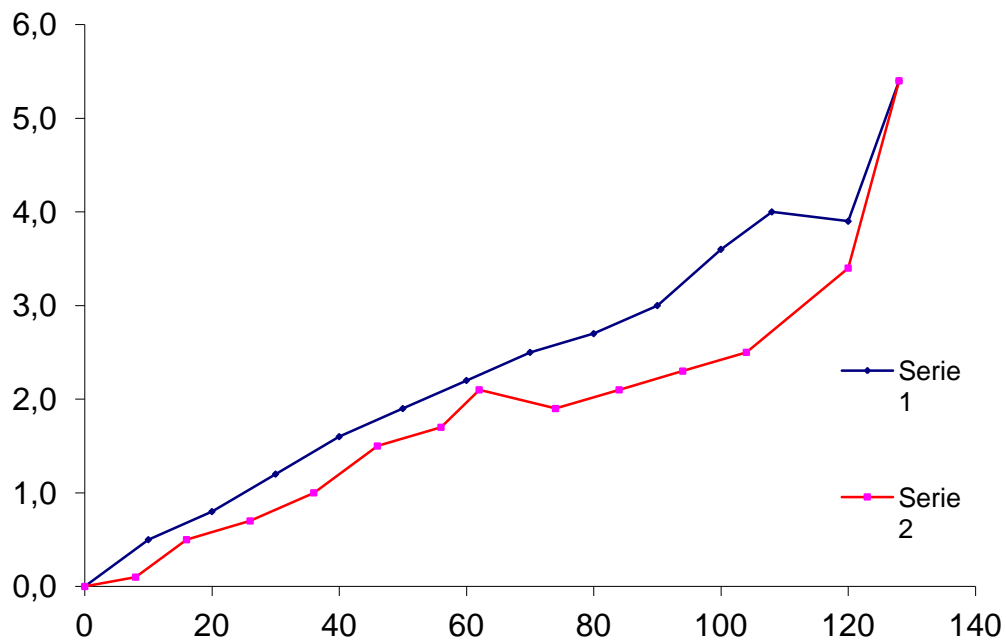
Requirement:

The operating force has to follow the typical* characteristic for a dome based switch,
* clear indication of the on-click and off-click

(typical example)



Measurement: (data plot)

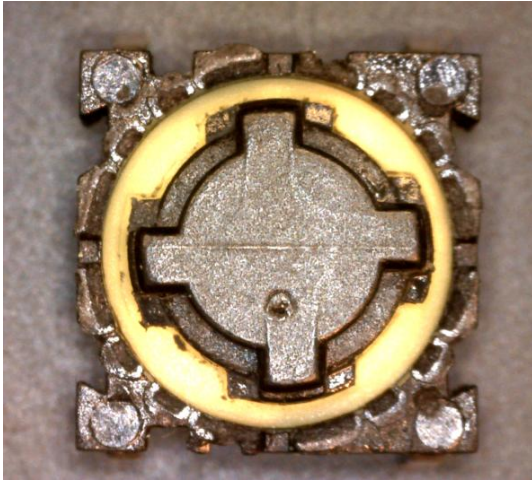


Result:

Test PASSED, clear indication of on & off-click.

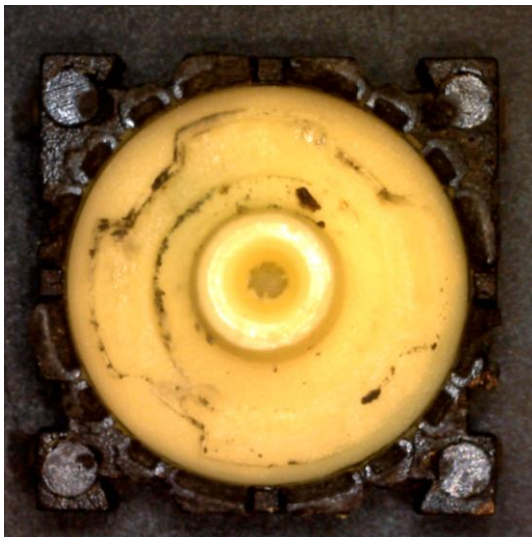
FINAL INSPECTION

After completion of the lifetime test , one switch was disassembled and examined for irregularities , wear marks , cracks and other signs that could indicate wear or damage.



pic.1 illustrates topview of switch housing with removed lid

Note lid & house is assembled by USW which explains the uneven surface of the housing.



Pic.2 illustrates top view of housing , with removed actuator.

Note Small amount of Oil smudge is found on the top part of the rubber plunger



pic.3 illustrates bottom view of the actuator.

Note the residue is oily/grease caused by a leak in the gearbox system in the LTT-01 – causing penetration into the switch



pic.4 Illustrates inside of the rubber plunger

Note the indications of residual and their location could indicate high concentrations of oil fog in the test environment



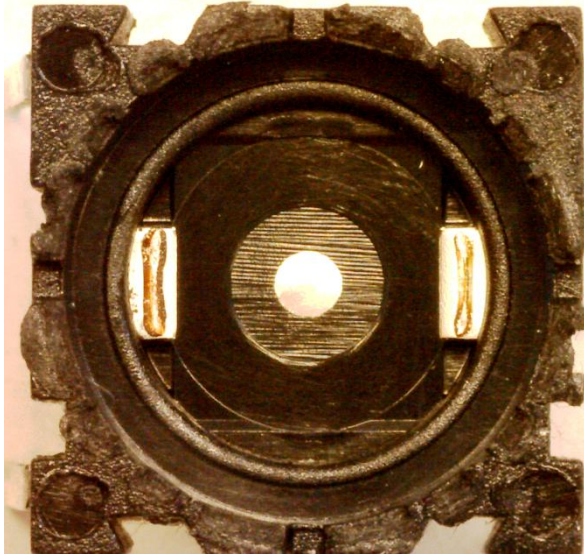
pic.5 illustrated topside of dome

Note clear indication of where the rubber plunger aligns to the dome.

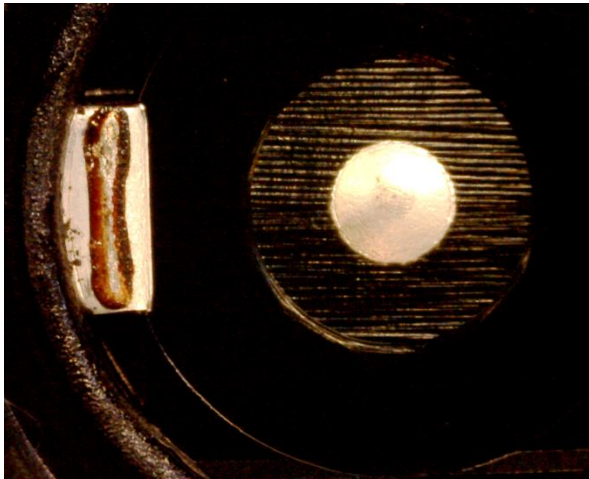


pic.6 illustrates the bottomside of the dome

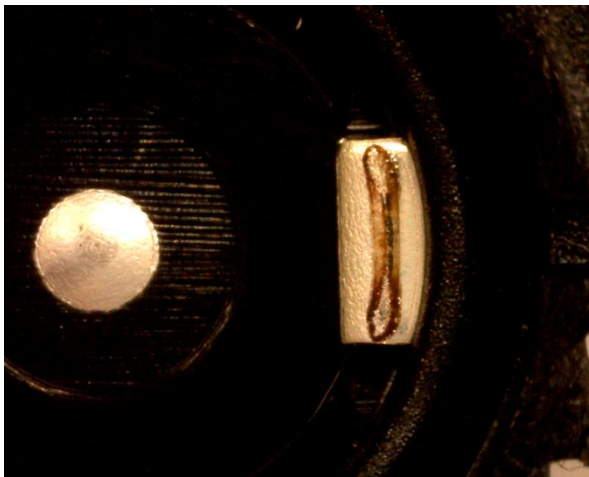
Note clear indications of the terminal points and the centercontact, but no functional/electrical impact measured



pic.7 illustrates top view of switchhouse without contact elements.
Note clear indications of the terminal points, but no functional/electrical impact measured



pic.8 illustrates contactpoint leftside and centerterminal.



pic.9 illustrates contactpoint rightside and centerterminal.