

MEC A/S

Solderability Test

of

Unimec Switches for Through Hole mount

Title **Solderability Test of Unimec Switches for Through Hole mount**

Project No. 0514a Solderability Test of Unimec TH Switch

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Report Concerning Project No.

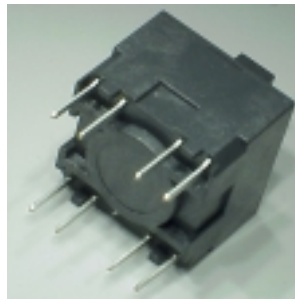
0514a Solderability Test of Unimec TH Switch

1. Problem Description

The scope of this report is to verify the solderability of a Lead-Free and RoHS compatible Unimec switches, low and high temperature version.

For the purpose of verifying backward compatibility a lead-free component has been tested in a SnPb solderability test process.

The solderability test temperatures have been chosen according to EN/IEC 60068-2-54.



The Components with Lead-free Terminations are tested with SnPb solder at 235°C, furthermore they have been tested with a Lead-free Solder at 265°C.

2. Applicable Documents

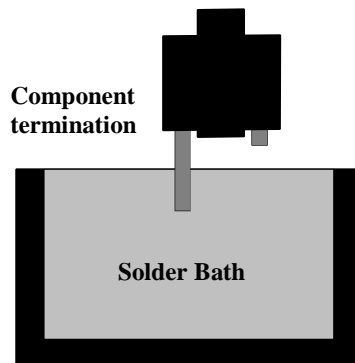
- EN/IEC 60068-2-54

3. Test parameters for Multicore MUST II

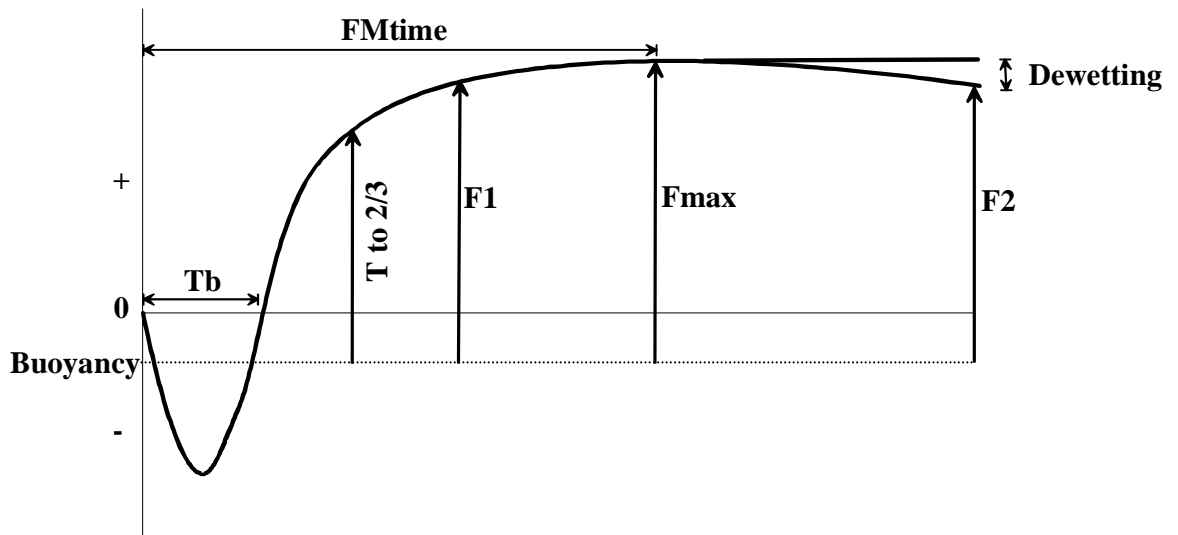
Depth:	1,77	Durn:	5	Clips:	1	Recpt:	Bath
Lead:	1	Space:	----	Temp:	se *	Range:	+/-1mN
-----	----	-----	----	X-Section:	Rect	Diam:	-----
Width:	0,60	Thick:	0,25	TimeZero:	5,0	TimeBuoy:	5,0
Time 1:	2,0	Force 1:	0,16	Time 2:	5,0	Force 2:	0,14
Speed:	20	Solder:	se *	T to 2/3 Fmax:	5,0	Flux:	Rosin SM/NA

*Test Temp/Solder: 235°C with Sn60Pb40 and 265°C with Lead Free Sn99.3Cu0.7Ni (SN100C)

4. Definition of Solderability Test



A Through Hole (TH) test object is dipped vertical into a solder Bath.
 The solderability can be defined from the wetting force according to EN/IEC 60068-2-54.



- F1: wetting force after 2 sec.
- F2: Wetting force at the end of test (5 sec.).
- Tb: Time to F=0 (Test start).
- Ta: Time to Buoyancy (Contact angle 90°)
- Fmax: Maximum wetting force.
- FMtime: Time t maximum wetting force.
- T to 2/3: Time to 2/3 of maximum wetting force (MIL-STD)
- Dewetting: EN/IEC 60068-2-54 allows 20% dewetting (F2 20% < F1)

5. Work Description

For Verification of the Solderability the following has been carried out in section 6:

- 6.1 Solderability Test according to EN/IEC 60068-2-54 of Components with **Lead-free** plated Terminations on Unimec low temperature switch.

*20 Components have been tested at 265°C with Lead-free Solder in Bath (Sn99.3Cu0.7Ni).
See Appendix A.1*

- 6.2 Solderability Test according to EN/IEC 60068-2-54 of Components with **Lead-free** plated Terminations on Unimec low temperature switch.

*20 components have been tested at 235°C with Tin/Lead Solder in Bath (Sn60Pb40).
See Appendix A.2*

- 6.3 Solderability Test according to EN/IEC 60068-2-54 of Components with **Lead-free** plated Terminations on Unimec high temperature switch.

*20 Components have been tested at 265°C with Lead-free Solder in Bath (Sn99.3Cu0.7Ni).
See Appendix A.3*

- 6.4 Solderability Test according to EN/IEC 60068-2-54 of Components with **Lead-free** plated Terminations on Unimec high temperature switch.

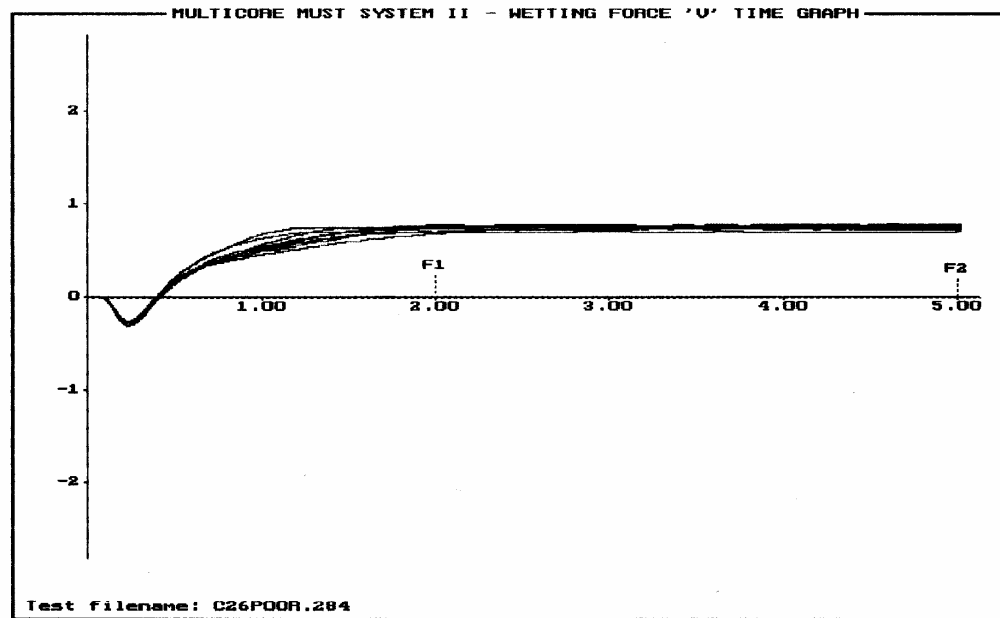
*20 components have been tested at 235°C with Tin/Lead Solder in Bath (Sn60Pb40).
See Appendix A.4*

- 6.5 Summary Conclusion

6. Test results

6.1 Graphic Representation of 10 Tests of Through Hole Components with Sn plated terminations on low temperature switch. (Test Temperature 265°C)

Graphic Representation of 10 Tests selected from the Solderability Test.



MULTICORE MUST SYSTEM II - Pass Fail Data

Component: Blyfri/blyholdigt
 Parameter: MEC HMD
 Filenames: C26P00R
 Time: Thu Apr 07 19:08:40 2005

Test Limits
 Ta = 5.5 F1 = 0.272 mN at 2.0s 5.5s to 2/3 FMax
 Tb = 5.5 F2 = 0.238 mN at 5.0s Buoyancy= -0.01

Test Date	Test No	Ta	Tb	F1	F2	T to 2/3	Dewetting	Result
07:04:05	266	0.386	0.394	0.77	0.73	0.949	5	PASS
07:04:05	268	0.400	0.409	0.69	0.76	1.170	2	PASS
07:04:05	270	0.389	0.400	0.76	0.76	0.895	0	PASS
07:04:05	271	0.384	0.391	0.71	0.71	0.712	0	PASS
07:04:05	274	0.405	0.412	0.77	0.78	1.100	0	PASS
07:04:05	276	0.381	0.390	0.75	0.74	0.983	0	PASS
07:04:05	278	0.397	0.413	0.75	0.78	0.926	1	PASS
07:04:05	280	0.388	0.394	0.71	0.76	0.974	0	PASS
07:04:05	282	0.391	0.398	0.79	0.80	1.016	0	PASS
07:04:05	284	0.384	0.393	0.75	0.76	0.777	1	PASS

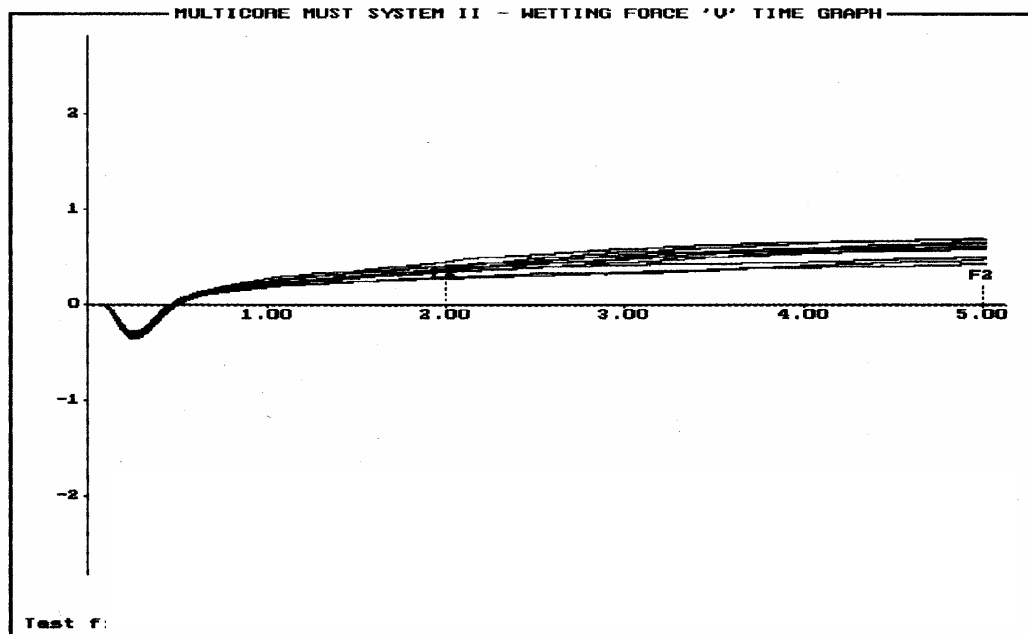
Mean : 0.390 0.399 0.75 0.76 0.950 0
 Std Dev: 0.007 0.008 0.02 0.02 0.129 1.513

There are 0 failures in 10 tests The failure rate is 0%
 Flux : Pure Rosin SM/NA
 Temperature : 265.0
 Comment : MEC HMD LAVTEMPERATUR SWITCH (BLYFRI TEST VED 265°C)

6.2 Graphic Representation of 10 Tests of Through Hole Components with Sn plated terminations on low temperature switch.

(Test Temperature 235°C)

Graphic Representation of 10 Tests selected from the Solderability Test.



MULTICORE MUST SYSTEM II - Pass Fail Data

Component: Blyfri/blyholdigt
 Parameter: MEC HMD
 Filenames: C26P00R
 Time: Thu Apr 07 18:08:45 2005

Test Limits
 Ta = 5.5 F1 = 0.272 mN at 2.0s 5.5s to 2/3 FMax
 Tb = 5.5 F2 = 0.238 mN at 5.0s Buoyancy= -0.01

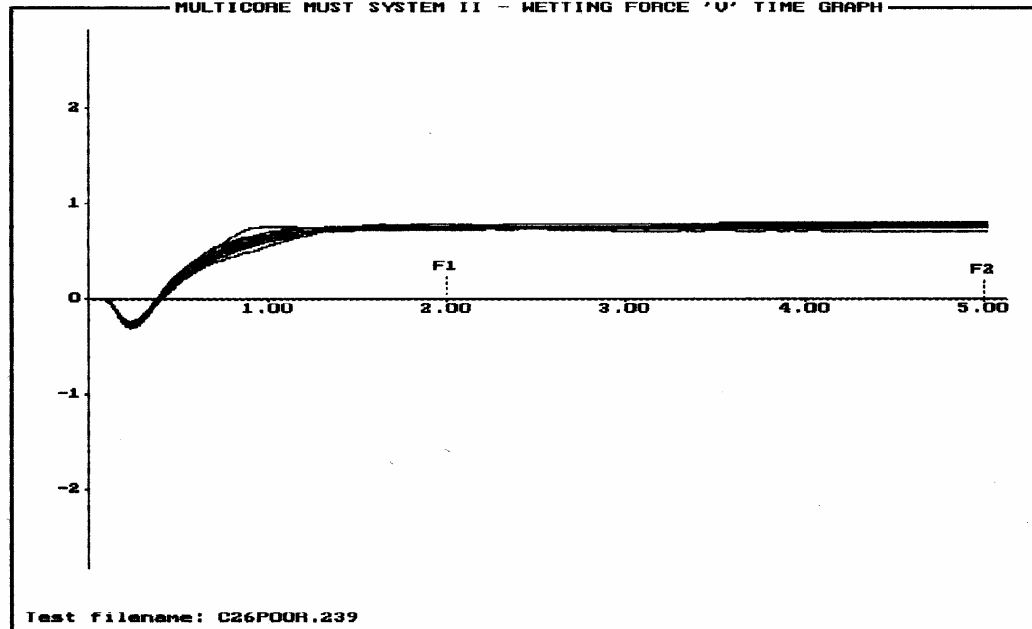
Test Date	Test No	Ta	Tb	F1	F2	T to 2/3	Dewetting	Result
05:04:05	198	0.477	0.494	0.37	0.67	2.446	0	PASS
05:04:05	200	0.462	0.473	0.42	0.62	1.967	0	PASS
05:04:05	201	0.488	0.503	0.46	0.69	2.011	0	PASS
05:04:05	202	0.474	0.488	0.39	0.60	2.114	0	PASS
05:04:05	204	0.442	0.455	0.38	0.66	2.413	0	PASS
05:04:05	205	0.467	0.482	0.36	0.62	2.657	0	PASS
05:04:05	206	0.488	0.505	0.30	0.44	2.005	0	PASS
05:04:05	208	0.456	0.468	0.36	0.51	1.874	0	PASS
05:04:05	210	0.469	0.484	0.29	0.49	2.711	0	PASS
05:04:05	214	0.472	0.484	0.42	0.70	2.365	0	PASS

 Mean : 0.469 0.483 0.38 0.60 2.256 0
 Std Dev: 0.013 0.014 0.05 0.08 0.285 0.000

There are 0 failures in 10 tests The failure rate is 0%
 Flux : Pure Rosin SM/NA
 Temperature : 235.0
 Comment : MEC HMD LAVTEMPERATUR SWITCH (BLYHOLDIG TEST VED 235°C)

6.3 **Graphic Representation of 10 Tests of Through Hole Components with Sn plated terminations on high temperature switch. (Test Temperature 265°C)**

Graphic Representation of 10 Tests selected from the Solderability Test.



MULTICORE MUST SYSTEM II - Pass Fail Data

Component: Blyfri/blyholdigt
 Parameter: MEC HMD
 Filenames: C26P00R
 Time: Thu Apr 07 19:14:19 2005

Ta = 5.5	F1 = 0.272 mN at 2.0s	5.5s to 2/3 FMax
Tb = 5.5	F2 = 0.238 mN at 5.0s	Buoyancy = -0.01

Test Date	Test No	Ta	Tb	F1	F2	T to 2/3	Dewetting	Result
05:04:05	221	0.395	0.401	0.77	0.76	0.775	3	PASS
05:04:05	223	0.381	0.387	0.74	0.72	0.708	4	PASS
05:04:05	225	0.368	0.378	0.73	0.76	0.775	0	PASS
05:04:05	227	0.388	0.395	0.77	0.78	0.792	0	PASS
05:04:05	229	0.391	0.400	0.80	0.83	0.852	0	PASS
05:04:05	231	0.379	0.384	0.76	0.78	0.682	0	PASS
05:04:05	233	0.379	0.391	0.75	0.77	0.721	0	PASS
05:04:05	235	0.395	0.403	0.77	0.79	0.854	0	PASS
05:04:05	237	0.391	0.406	0.77	0.79	0.948	0	PASS
05:04:05	239	0.377	0.384	0.76	0.78	0.696	0	PASS

Mean :	0.384	0.392	0.76	0.78	0.780	0
Std Dev:	0.008	0.009	0.01	0.02	0.080	1.417

There are 0 failures in 10 tests The failure rate is 0%

Flux : Pure Rosin SM/NA

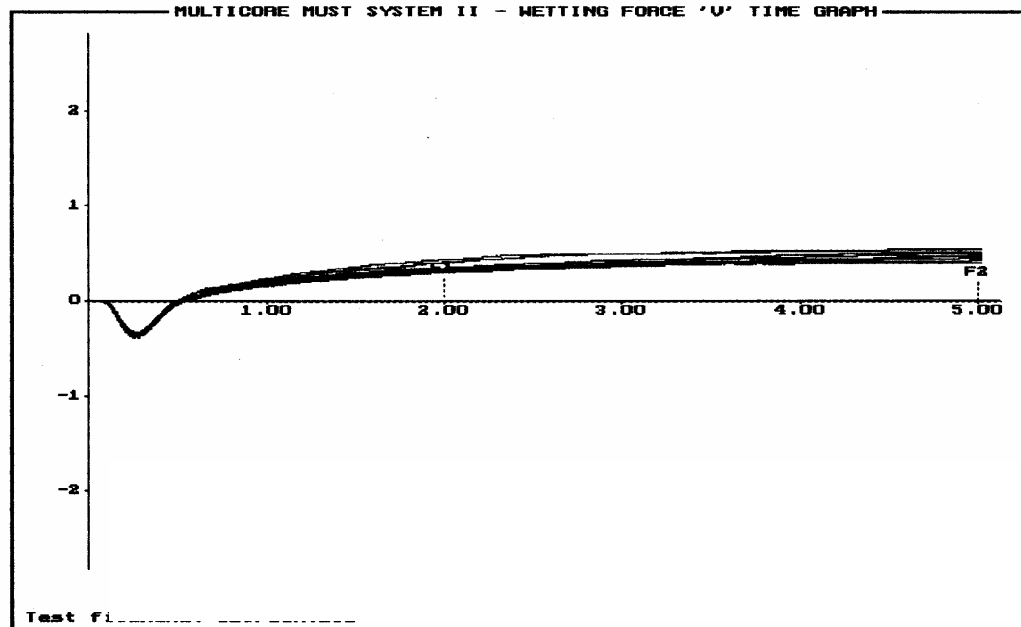
Temperature : 265.0

Comment : MEC HMD HOEJTEMPERATUR SWITCH (BLYFRI TEST VED 265°C)

6.4 Graphic Representation of 10 Tests of Through Hole Components with Sn plated terminations on high temperature switch.

(Test Temperature 235°C)

Graphic Representation of 10 Tests selected from the Solderability Test.



MULTICORE MUST SYSTEM II - Pass Fail Data

Component: Blyfri/blyholdigt
 Parameter: MEC HMD
 Filenames: C26P00R
 Time: Thu Apr 07 17:41:44 2005

Ta = 5.5 Test Limits
 Tb = 5.5 F1 = 0.272 mN at 2.0s 5.5s to 2/3 FMax
 F2 = 0.238 mN at 5.0s Buoyancy= -0.01

Test Date	Test No	Ta	Tb	F1	F2	T to 2/3	Dewetting	Result
07:04:05	243	0.509	0.530	0.45	0.53	1.458	2	PASS
07:04:05	245	0.485	0.500	0.36	0.48	1.620	0	PASS
07:04:05	247	0.479	0.496	0.33	0.44	1.638	0	PASS
07:04:05	249	0.507	0.530	0.36	0.52	1.941	1	PASS
07:04:05	251	0.509	0.532	0.34	0.47	1.808	0	PASS
07:04:05	253	0.488	0.510	0.42	0.55	1.691	0	PASS
07:04:05	255	0.493	0.510	0.32	0.49	2.220	0	PASS
07:04:05	257	0.519	0.546	0.34	0.52	2.124	0	PASS
07:04:05	259	0.521	0.543	0.35	0.42	1.367	0	PASS
07:04:05	261	0.490	0.512	0.34	0.49	1.954	0	PASS

 Mean : 0.500 0.520 0.36 0.49 1.782 0
 Std Dev: 0.014 0.016 0.04 0.03 0.263 0.640

There are 0 failures in 10 tests The failure rate is 0%
 Flux : Pure Rosin SM/NA
 Temperature : 235.0
 Comment : MEC HMD HOEJTEMPERATUR SWITCH (BLYHOLDIG TEST VED 235°C)

6.5 Summary Conclusion

The test has been conducted with a non-activated flux (SM/NA) and all the tested Through Hole components show acceptable wetting according to EN/IEC 60068-2-54 for Lead Free soldering, but indicated lower wetting at SnPb soldering at 235°C on the low temperature switch (See Appendix A2).

The solderability on the Lead-Free plating has been verified to a level comparable with the conventional tin-lead plating in a conventional tin-lead solderability process.

7. Appendix A

Appendix A.1

Test Data for Through Hole Components with Sn plated terminations on Unimec low temperature switch.

(Test Temperature 265°C)

MULTICORE MUST SYSTEM II - Pass Fail Data

Component: Blyfri/blyholdigt
 Parameter: MEC HMD
 Filenames: C26P00R
 Time: Thu Apr 07 19:10:26 2005

Test Limits
 Ta = 5.5 F1 = 0.272 mN at 2.0s 5.5s to 2/3 FMax
 Tb = 5.5 F2 = 0.238 mN at 5.0s Buoyancy= -0.01

Test Date	Test No	Ta	Tb	F1	F2	T to 2/3	Dewetting	Result
07:04:05	266	0.386	0.394	0.77	0.73	0.949	5	PASS
07:04:05	267	0.391	0.404	0.77	0.73	0.944	4	PASS
07:04:05	268	0.400	0.409	0.69	0.76	1.170	2	PASS
07:04:05	269	0.379	0.388	0.71	0.69	0.695	6	PASS
07:04:05	270	0.389	0.400	0.76	0.76	0.895	0	PASS
07:04:05	271	0.384	0.391	0.71	0.71	0.712	0	PASS
07:04:05	272	0.284	0.293	0.86	0.88	1.166	3	PASS
07:04:05	273	0.388	0.393	0.75	0.76	0.967	0	PASS
07:04:05	274	0.405	0.412	0.77	0.78	1.100	0	PASS
07:04:05	275	0.356	0.364	0.75	0.76	0.710	0	PASS
07:04:05	276	0.381	0.390	0.75	0.74	0.983	0	PASS
07:04:05	277	0.370	0.382	0.76	0.79	0.734	0	PASS
07:04:05	278	0.397	0.413	0.75	0.78	0.926	1	PASS
07:04:05	279	0.395	0.404	0.75	0.75	1.052	1	PASS
07:04:05	280	0.388	0.394	0.71	0.76	0.974	0	PASS
07:04:05	281	0.400	0.409	0.72	0.79	1.285	0	PASS
07:04:05	282	0.391	0.398	0.79	0.80	1.016	0	PASS
07:04:05	283	0.386	0.396	0.76	0.76	0.998	1	PASS
07:04:05	284	0.384	0.393	0.75	0.76	0.777	1	PASS
07:04:05	285	0.393	0.404	0.77	0.79	0.974	0	PASS

 Mean : 0.382 0.391 0.75 0.76 0.951 1
 Std Dev: 0.024 0.025 0.03 0.03 0.159 1.805

There are 0 failures in 20 tests The failure rate is 0%
 Flux : Pure Rosin SM/NA
 Temperature : 265.0
 Comment : MEC HMD LAVTEMPERATUR SWITCH (BLYFRI TEST VED 265°C)

Appendix A.2

Test Data for Through Hole Components with Sn plated terminations on Unimec low temperature switch.

(Test Temperature 235°C)

MULTICORE MUST SYSTEM II - Pass Fail Data

Component: Blyfri/blyholdigt
 Parameter: MEC HMD
 Filenames: C26P00R
 Time: Thu Apr 07 18:04:45 2005

Test Limits
 Ta = 5.5 F1 = 0.272 mN at 2.0s 5.5s to 2/3 FMax
 Tb = 5.5 F2 = 0.238 mN at 5.0s Buoyancy= -0.01

Test Date	Test No	Ta	Tb	F1	F2	T to 2/3	Dewetting	Result
05:04:05	196	0.474	0.487	0.26	0.38	1.926	0	FAIL
05:04:05	197	0.465	0.481	0.33	0.60	2.536	0	PASS
05:04:05	198	0.477	0.494	0.37	0.67	2.446	0	PASS
05:04:05	199	0.488	0.512	0.31	0.55	2.516	0	PASS
05:04:05	200	0.462	0.473	0.42	0.62	1.967	0	PASS
05:04:05	201	0.488	0.503	0.46	0.69	2.011	0	PASS
05:04:05	202	0.474	0.488	0.39	0.60	2.114	0	PASS
05:04:05	203	0.474	0.489	0.26	0.52	2.921	0	FAIL
05:04:05	204	0.442	0.455	0.38	0.66	2.413	0	PASS
05:04:05	205	0.467	0.482	0.36	0.62	2.657	0	PASS
05:04:05	206	0.488	0.505	0.30	0.44	2.005	0	PASS
05:04:05	207	0.474	0.490	0.23	0.31	1.465	0	FAIL
05:04:05	208	0.456	0.468	0.36	0.51	1.874	0	PASS
05:04:05	209	0.479	0.500	0.24	0.47	3.060	0	FAIL
05:04:05	210	0.469	0.484	0.29	0.49	2.711	0	PASS
05:04:05	211	0.463	0.474	0.32	0.47	2.039	0	PASS
05:04:05	212	0.472	0.490	0.26	0.51	2.761	0	FAIL
05:04:05	213	0.474	0.493	0.33	0.63	2.594	0	PASS
05:04:05	214	0.472	0.484	0.42	0.70	2.365	0	PASS
05:04:05	215	0.476	0.494	0.36	0.59	2.357	0	PASS

Mean : 0.471 0.487 0.33 0.55 2.336 0
 Std Dev: 0.010 0.012 0.06 0.10 0.392 0.000

There are 5 failures in 20 tests The failure rate is 25%
 Flux : Pure Rosin SM/NA
 Temperature : 235.0
 Comment : MEC HMD LAVTEMPERATUR SWITCH (BLYHOLDIG TEST VED 235°C)

Appendix A.3

Test Data for Through Hole Components with Sn plated terminations on Unimec high temperature switch.

(Test Temperature 265°C)

MULTICORE MUST SYSTEM II - Pass Fail Data

Component: Blyfri/blyholdigt
 Parameter: MEC HMD
 Filenames: C26P00R
 Time: Thu Apr 07 19:15:09 2005

Test Limits
 Ta = 5.5 F1 = 0.272 mN at 2.0s 5.5s to 2/3 FMax
 Tb = 5.5 F2 = 0.238 mN at 5.0s Buoyancy= -0.01

Test Date	Test No	Ta	Tb	F1	F2	T to 2/3	Dewetting	Result
05:04:05	221	0.395	0.401	0.77	0.76	0.775	3	PASS
05:04:05	222	0.360	0.367	0.74	0.73	0.619	3	PASS
05:04:05	223	0.381	0.387	0.74	0.72	0.708	4	PASS
05:04:05	224	0.370	0.382	0.75	0.76	0.760	0	PASS
05:04:05	225	0.368	0.378	0.73	0.76	0.775	0	PASS
05:04:05	226	0.391	0.397	0.76	0.77	0.864	1	PASS
05:04:05	227	0.388	0.395	0.77	0.78	0.792	0	PASS
05:04:05	228	0.425	0.436	0.76	0.75	0.868	3	PASS
05:04:05	229	0.391	0.400	0.80	0.83	0.852	0	PASS
05:04:05	230	0.382	0.395	0.74	0.76	0.842	0	PASS
05:04:05	231	0.379	0.384	0.76	0.78	0.682	0	PASS
05:04:05	232	0.391	0.397	0.75	0.76	0.684	0	PASS
05:04:05	233	0.379	0.391	0.75	0.77	0.721	0	PASS
05:04:05	234	0.388	0.393	0.77	0.76	0.718	2	PASS
05:04:05	235	0.395	0.403	0.77	0.79	0.854	0	PASS
05:04:05	236	0.381	0.390	0.76	0.77	0.833	1	PASS
05:04:05	237	0.391	0.406	0.77	0.79	0.948	0	PASS
05:04:05	238	0.391	0.397	0.77	0.82	0.809	0	PASS
05:04:05	239	0.377	0.384	0.76	0.78	0.696	0	PASS
05:04:05	240	0.393	0.407	0.79	0.81	1.107	0	PASS

Mean : 0.385 0.394 0.76 0.77 0.795 0
 Std Dev: 0.012 0.013 0.01 0.02 0.106 1.314

There are 0 failures in 20 tests The failure rate is 0%
 Flux : Pure Rosin SM/NA
 Temperature : 265.0
 Comment : MEC HMD HOEJTEMPERATUR SWITCH (BLYFRI TEST VED 265°C)

Appendix A.4

Test Data for Through Hole Components with Sn plated terminations on Unimec high temperature switch.

(Test Temperature 235°C)

MULTICORE MUST SYSTEM II - Pass Fail Data

Component: Blyfri/blyholdigt
 Parameter: MEC HMD
 Filenames: C26P00R
 Time: Thu Apr 07 17:42:56 2005

Test Limits
 Ta = 5.5 F1 = 0.272 mN at 2.0s 5.5s to 2/3 FMax
 Tb = 5.5 F2 = 0.238 mN at 5.0s Buoyancy= -0.01

Test Date	Test No	Ta	Tb	F1	F2	T to 2/3	Dewetting	Result
07:04:05	243	0.509	0.530	0.45	0.53	1.458	2	PASS
07:04:05	244	0.504	0.524	0.31	0.47	2.089	0	PASS
07:04:05	245	0.485	0.500	0.36	0.48	1.620	0	PASS
07:04:05	246	0.504	0.527	0.34	0.43	1.527	0	PASS
07:04:05	247	0.479	0.496	0.33	0.44	1.638	0	PASS
07:04:05	248	0.513	0.529	0.49	0.57	1.261	0	PASS
07:04:05	249	0.507	0.530	0.36	0.52	1.941	1	PASS
07:04:05	250	0.513	0.533	0.43	0.55	1.485	0	PASS
07:04:05	251	0.509	0.532	0.34	0.47	1.808	0	PASS
07:04:05	252	0.497	0.521	0.32	0.48	2.061	0	PASS
07:04:05	253	0.488	0.510	0.42	0.55	1.691	0	PASS
07:04:05	254	0.492	0.510	0.32	0.53	2.449	0	PASS
07:04:05	255	0.493	0.510	0.32	0.49	2.220	0	PASS
07:04:05	256	0.483	0.498	0.31	0.47	2.040	0	PASS
07:04:05	257	0.519	0.546	0.34	0.52	2.124	0	PASS
07:04:05	258	0.486	0.498	0.34	0.47	1.813	0	PASS
07:04:05	259	0.521	0.543	0.35	0.42	1.367	0	PASS
07:04:05	260	0.495	0.514	0.36	0.48	1.647	0	PASS
07:04:05	261	0.490	0.512	0.34	0.49	1.954	0	PASS
07:04:05	262	0.499	0.522	0.34	0.52	2.146	0	PASS

 Mean : 0.499 0.519 0.36 0.49 1.816 0
 Std Dev: 0.012 0.014 0.04 0.03 0.310 0.476

There are 0 failures in 20 tests The failure rate is 0%
 Flux : Pure Rosin SM/NA
 Temperature : 235.0
 Comment : MEC HMD HOEJTEMPERATUR SWITCH (BLYHOLDIG TEST VED 235°C)