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Dr. W. R. McElroy, President
Action Products Inc.
22 N. Mulberry Street
Hagerstown, MD 21740

Dear Dr. McElroy:

This letter will describe the results and conclusions obtained as the results of our tests of the Action Products operating table mats made during the last few weeks. I will also try to relate these results to the test carried out in the West German Republic, as described in the reports you sent me.

Our tests of the mats involved (a) exposing the mats to a laboratory CO_2 (10.6 micron) infrared laser, (b) measurements of static charge accumulated on the surface after rubbing with cotton cloth, and (b) measurement of the surface resistance of the mats.

(a) Laser tests: The sample (clear) plastic container containing the viscoelastic polymer was subject to the action of a 10 watt, 1mm. diameter continuous power laser beam at 10.6 micron for a period of 10 seconds. The plastic melted through and a crater approximately 5mm. in diameter at the surface and about 5mm. deep was melted into the viscoelastic polymer. Some white smoke and a sweetish odor was observed. Some of the viscoelastic polymer ran out the sides of the crater as a sticky fluid which appeared to harden after a few days. There was no fire. It should be observed that surgical lasers operate at somewhat higher powers than the laboratory device used in this test. There is no apparent special risk from incidental contact of the mat with the laser beam, other than damage to the mat.

(b) Static charge accumulations: The static charge density accumulated on each pad after vigorous rubbing with cotton or wool cloths for approximately 20 seconds was measured using a Keithley Model 610B Electrometer and a 1.5 cm. diameter copper electrode. The results of a series of five measurements for each case are shown in the attached table, along with the calculated mean values. The measurements did not yield consistent values, especially for the clear plastic pad.

This may, of course, be ascribed to the variation of ambient conditions, but more importantly to the variations that occurred as a result of rubbing the pad by hand. The most significant conclusions may be that (1) the white plastic covered pad consistently yielded the lowest charge accumulations, and (2) that none of the surface charge densities appear capable of producing the field strengths necessary to create a spark, whatever the geometry of a grounded conductor brought near the mat. Air breakdowns require potential gradients of the order of several kilovolts per centimeter. Even in the point/plane geometry, which creates the highest electrical stress, it does not appear that a spark, which involves air breakdown, will be created these levels. Some ionization streamers from the point ground to the mat plane may occur, however, even at these lower levels.

(c) A few measurements of surface resistivity were also made using the Keithley. These measurements all yield values of the order of 10^9 ohms, consistent with the measurements made in West Germany which are discussed below.

The measurements of resistance through the mat and of the surface resistivity of the mat made by the Fachhochschule Hamburg demonstrated resistances of the order of 10^6 ohms through the mats at selected points, varying with pressure on the mat. It also revealed surface resistances of the order of 10^9 ohms between typical points on the mat. There was no dependence of resistance on test potentials.

The results of the Hamburg Fahhochschule tests were discussed by Mr. Gminder of the Technischer Uberwachsungs-Verein in terms of two West German regulatory guidelines, the first relative to the use of RF electrosurgical devices and the second relative to avoiding the danger of sparks due to electrostatic charges. The language of the memo is somewhat turgid, but it points out that because the mats are highly resistive it will be necessary to avoid the danger of sparks when anesthetic gases are being used by covering the mats with sheets with a lower surface resistance in accordance with the cited regulation. (Presumably, the use of non-explosive gases obviates any danger from this source.) Also, because the electric isolation of the patient is increased by the mat it is necessary to be even more certain that the patient will not be burned by the RF currents exiting (through the electrosurgical butt plate) to the ground and to carefully follow the RF surgery regulatory document (which presumably provides the guidelines to be followed in grounding the patient adequately).

Hopefully this information will be useful to your company.

Sincerely,

Leonard S. Taylor, Ph.D.
Professor of Electrical Engineering
& Radiation Oncology

STATIC CHARGE TESTS OF VISCOELASTIC POLYMER MATS
University of Maryland, June 1988

A. Mat covering: Clear plastic

Test No.:	Test condition:	Measured surface charge, nC:
1	Not rubbed	1.2
2	"	6.0
3	"	2.2
4	"	2.0
5	"	10.0
	Mean surface charge density (1-5): 2.4nC/cm^2	
6	Rubbed with cotton cloth	2.0
7	"	-10.5
8	"	20.0
9	"	7.9
10	"	-0.4
	Mean absolute surface charge density (6-10): 4.6nC/cm^2	
11	Rubbed with wool cloth	6.4
12	"	-1.2
13	"	2.4
14	"	4.4
15	"	-2.2
	Mean absolute surface charge density (11-15): 1.8nC/cm^2	

B. Mat covering: White plastic

Test No.:	Test condition:	Measured surface charge, nC:
16	Not rubbed	-0.1
17	"	0.2
18	"	0.2
19	"	0.2
20	"	0.2
	Mean absolute surface charge density (16-20): 0.1nC/cm^2	
21	Rubbed with cotton cloth	-0.2
22	"	-0.1
23	"	-0.3
24	"	-0.2
25	"	-0.2
	Mean absolute surface charge density (21-25): 0.1nC/cm^2	
26	Rubbed with wool cloth	-0.3
27	"	-4.6
28	"	-0.4
29	"	-1.5
30	"	-1.5
	Mean absolute surface charge density (26-30): 0.9nC/cm^2	

C. Mat covering: Gray plastic

Test No.:	Test condition:	Measured surface charge, nC:
31	Not rubbed	-0.9
32	"	-0.5
33	"	-0.3
34	"	-0.7
35	"	-0.3
Mean absolute surface charge density (31-35): 0.3nC/cm^2		
36	Rubbed with cotton cloth	-2.6
37	"	-1.6
38	"	-4.9
39	"	-4.2
40	"	-1.0
Mean absolute surface charge density (36-40): 1.6nC/cm^2		
41	Rubbed with wool cloth	-2.2
42	"	-6.0
43	"	-9.6
44	"	-3.2
45	"	-0.9
Mean absolute surface charge density (41-45): 2.5nC/cm^2		