Instrument: Ludlum Model 4

Serial Number: 172093

Input: Ludlum Model 500 Pulser

Test Dates (inclusive): 11/15/04 – 12/02/04

Test Performed: ANSI N42.17A-1989.

Testing for Compliance with ANSI A Standards should meet the requirements listed below.
N/A = Not Applicable

General Characteristics

4.1	Units of Readout	Passed
4.2	Scaling Factor	Passed
4.3	Ease of Decontamination	Passed
4.4	Moisture Protection	Passed*
4.5	Alarm Threshold	N/A
4.6	Markings	Passed
4.7	Battery Status Indication	Passed
4.8	Protection of Switches	Passed
4.9	Zero Set	Passed
4.10	AC Power	N/A
4.11	Battery Power	Passed
4.12	Battery Power Indicator	N/A
4.13	AC Powered Instruments With Battery Backup	N/A

Electronic and Mechanical Requirements

5.1	Check Circuits	Passed
5.2	Alarms	N/A
5.3	Stability	Passed
5.4	Geotropism	Passed
5.5	Response Time	Passed
5.6	Coefficient of Variation	N/A Electronics only
5.7	Line Noise Susceptibility	N/A

Radiation Response

6.1	Accuracy	N/A Electronics only
6.2	Probe Surface Sensitivity	N/A Electronics only
6.3	Photon Energy Dependence	N/A Electronics only
6.4	Beta Energy Dependence	N/A Electronics only
6.5	Neutron Energy Dependence	N/A Electronics only
6.6	Photon Radiation Overload	N/A Electronics only
6.7	Angular Dependence	N/A Electronics only

Interfering Response

7.1	Extra cameral Response	Passed
7.2	Radio Frequency Fields	Not Tested
7.3	Microwave Fields	Not Tested
7.4	Electric Fields	Passed
7.5	Magnetic Fields	Passed
7.6	Interfering Ionizing Radiation	N/A Electronics only

Environmental Factors

8.1	Temperature	Passed
8.2	Temperature Shock	Passed
8.3	Humidity	Not Tested
8.4	Mechanical Shock	Passed
8.5	Vibration	Not Tested
8.6	Ambient Pressure	Passed
8.7	Splash proof	Passed

***Note**: *Section 4.4*- Statement missing in instrument manual.

ANSI 42.17A TESTS PERFORMED

Characteristics Under Test	Range of Values	Limits of Variation	Section
	GENERAL CHARACTERISTICS		
AC power	102-132 or 178-238 V	5%	4.10.2
Battery power	0-100 h	10%	4.11.2
Battery power indicator	Test at voltage that triggers battery failure indication	10% reference voltage produced by fresh batteries	4.12.2
AC-powered instruments with battery backup	Markings for units with rechargeable batteries	_	4.13.2
	Test when battery condition indicator first shows failure	10%	4.13.2
	ELECTRONICS AND MECHANICAL TESTS		
Check circuits	Per manufacturer's recommendations	_	5.1.2
Alarms, reset	Dose rate to activate alarm	See 5.2.1	5.2.2.1
Alarms, delay	Dose rate to activate alarm	1 s to 60 s (see 5.2.1)	5.2.2.2
Alarms, threshold drift	Dose rate to activate alarm	10% over 500 h	5.2.2.3
Stability	Battery powered: 3h	6% reference initial reading	5.3.2
	AC-powered: 24 h	6% reference initial reading	5.3.2
	AC-powered: 500 h	15% reference initial reading	5.3.2
Geotropism	Test in all spatial orientations	6% reference standard orientation	5.4.2
Response time	See standard	See standard	5.5.2
Coefficient of variation	≥ 1 mR/h, 1mrd/h, 10 mrem/h 2000 dpm	10%	5.6.2
Line noise susceptibility	See standard	15% from reference	5.7.2

Characteristics Under Test	Range of Values	Limits of Variation	Section
	RADIATION RESPONSE		
Accuracy, photon dose rate	0.1 mrd/h-1000 rd/h	±15% from conventionally true value	6.1.2.1
Accuracy, count rate and contamination monitors	50 dpm/cm^2-10^4 dpm/cm^2	±15% from conventionally true value	6.1.2.2
Accuracy, beta or neutron dose rate	0.1 mrem/h-1000 rem/h	±15% from conventionally true value	6.1.2.3
Probe surface sensitivity	Stated by manufacturer	_	6.2.2
Photon energy dependance	(1) 80 keV to 1.25 MeV	_	6.3.2
	(2) 20 keV to 3.0 MeV	_	6.3.2
Beta energy dependance	(1) 0.5 MeV to 3.5 MeV (E_{max})	_	6.4.2
	(2) 0.2 MeV to 3.5 MeV (E_{max})	_	6.4.2
Neutron energy dependance	0.025 eV to 14 MeV	_	6.5.2
Photon radiation overload	100 times upper limit ≤ 10 rd/h	Correct response within 2 min	6.6.2
Angular dependance	0-45° (photon) 45-90°	<20% change in reading <50% change in reading	6.7.2
	0-45° (beta)	<50% change in reading	6.7.2
	INTERFERING RESPONSE		
Extracameral response	Range of instrument	5% reference standare orientation	7.1.2
RF fields	(1) Per user requirements	15% reference standard conditions	7.2.2
	(2) 100 V/m, 0.3 to 35 MHz	15% reference standard conditions	7.2.2.1
	(3) 100 V/m at ~140 MHz	15% reference standard conditions	7.2.2.2
Microwave fields	(1) Per user requirements	15% reference standard conditions	7.3.2
	(2) 100 W/m^2 at 915 MHz, 2450 MHz	15% reference standard conditions	7.3.2

Characteristics Under Test	Range of Values	Limits of Variation	Section
	INTERFERING RESPONSE (*continued*)		
Electrical fields	(1) 500 V/m	15% reference standard conditions	7.4.2.1
	(2) 100 V/m at 60 Hz, 400 Hz	15% reference standard conditions	7.4.2.2
Magnetic Fields	800 A/m	15% reference standard conditions	5.5.2
Interfering radiation	See standard	See standard	5.6.2
	ENVIRONMENTAL FACTORS		
Temperature	(1) 0-40 °C	15% reference 22 °C	8.1.2
	(2) -10-50 °C	20% reference 22 °C	8.1.2
Temperature shock	(1) -10 °C from / to 22 °C	15% reference 22 °C	8.2.2
	(2) 50 °C from / to 22 °C	15% reference 22 °C	8.2.2
Humidity	40% RH to 95% RH (T = 22 °C ± 2 °C)	15% reference, 40% RH	8.3.2
Mechanical shock	50 g acceleration of 18 ms, half sine wave, test on 3 orthogonal axes, 10 times	15% reference standard conditions	8.4.2
Vibration	2 g acceleration, frequency range of 10-33 Hz, test on 3 orthogonal axes for 15 min	15% reference standard conditions	8.5.2
Ambient pressure	70-106 kPa	15% reference, 101 kPa	8.6.2
Splashproof	2 min fine spray (4 L/min 2 m from nozzle)	15% reference standard conditions	8.7.2

Instrument: Ludlum Model 4

Serial Number: 172093

Input: Ludlum Model 500 Pulser

Test Dates (inclusive): 11/15/04 – 12/02/04

Test Performed: ANSI N42.17C-1989.

Testing for Compliance with ANSI C Standards should meet the requirements listed below, as well as meeting ANSI A standards.
N/A = Not Applicable

General Characteristics

4.1	General	Passed
4.2	Markings	Passed
4.3	Operability of Controls	Passed
4.4	Battery Power	Passed
4.5	Battery Power Indicator	N/A

Electronic and Mechanical Requirements

5.1	Check Circuits	N/A
5.2	Stability	Passed
5.3	Response Time	Passed
5.4	Line Noise Susceptibility	N/A

Radiation Response

6.1	Accuracy	N/A
6.2	High Energy Photons	N/A

Interfering Response

7.1	Non-Ionizing Electromagnetic Radiations	Not Tested

Environmental Factors

8.1	Temperature	Passed
8.2	Extreme Temperature Shock	Not Tested
8.3	Temperature Shock	Passed
8.4	Humidity and Temperature	Not Tested
8.5	Mechanical Shock	Passed
8.6	Vibration	Not Tested
8.7	Ambient Pressure	Passed
8.8	Condensing Atmospheres	Not Tested
8.9	Instrument Durability	Not Tested
8.10	Radiation Resistance	Not Tested
8.11	Drop Test	Passed
8.12	Moisture Exposure (Rain Conditions)	Passed
8.13	Moisture Exposure (Fog Conditions)	Passed