STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
3rd Floor, L & C Annex
401 Church Street
Nashville, TN 37243-1532

May 6, 2004

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RECEIVED
REGION 1

U. S. Nuclear Regulatory Commission
Region 1
475 Allendale Road
King of Prussia, PA 19406

Attention: Duncan White

Dear Mr. White:

This is a follow-up to our letter to you dated March 29, 2004, concerning vibration testing performed for the Berthold Technologies, U.S.A., LLC Model LB 7400 Series. After further review, including applicable NRC registrations, we now realize that there is no ANSI or NRC standard test for device vibration.

After further consideration, we believe the vibration tests conducted for the Berthold Technologies, U.S.A., LLC LB 7400 devices are acceptable for an examination of device integrity including the welds. However, their request that states "The device may not be mounted to a process location if temporary, transient, or continuous vibration at the mounting location would cause the mounted device to exceed a total spatial excursion of 1 inch at any frequency and in any axis" is unacceptable because of the amount of spatial excursion and the unlimited frequency.

For backup information, please note the attached letter dated April 26, 2004, from Berthold in which they use 32.101 B as a comparable framework for the tests. They chose a double amplitude of 1 inch which is much greater than that in Figure 1.

We will propose that the limitations of vibration not exceed 200 Hz with the corresponding double amplitudes in Figure 1. **Would the NRC concur with this limitation?**

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We have decided to accept a visual examination of both device welds.

Thank you for any assistance you may be able to provide.

Sincerely,

Charles Arnott

Charles Arnott
Health Physicist
Division of Radiological Health

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Mr. Charles Arnott
Division of Radiological Health
Department of Environment and Conservation
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April 26, 2004

Dear Mr. Arnott,
With reference to your recent letter dated April 23, 2004 about our vibration test reports I would like to further clarify and define the previous correspondence and statements.

During the year 1999, I was asked to provide guidelines for the vibration testing of Berthold shieldings which would ensure trouble-free operation in the types of industrial applications known to us. After an exhaustive search of USNRC and related documents, I found 10CFR 32.101 Schedule B "Prototype tests for luminous safety devices for use in aircraft." This procedure applies to items of equipment (including vibration isolating assemblies) mounted directly on the structure of an aircraft powered by reciprocating, turbojet or turbo-propeller engines or mounted directly on gas-turbine engines.

The test asks for the device to be mounted on apparatus dynamically similar to severe conditions likely to be encountered in normal use and for inspection for possible damage at the end of the test. A copy of this document is enclosed for convenience.

I decided that this type of test forms an excellent basis for our purposes with the following adaptations:

The upper frequency limit was reduced from 500 Hz to 200 Hz, being deemed to be more in line with industrial processes.

The test duration is comparable at 49 minutes per sweep (1h 48mins per axis)

The drive amplitude at 5-5.45 Hz is 12.5 mm peak and then at 1.5 G

It is not known to what the hand written reference to ANSI refers to but I suggest that knowing the roots of the test as "USNRC" our German colleagues transposed this to be "ANSI". I am not aware of any direct ANSI vibration specification applicable to shieldings. N542 does of course specify vibration tests for Sealed Sources, where the higher accelerations are consistent with typically lower masses of Sealed Source capsules. (Lower than shieldings)

Berthold Technologies has undertaken to NOT mount models LB 7442 CR and LB 7440 CR (or LB 7444 CR) devices in conditions of vibration which approach their tested vibration integrity and believe these conditions to be sound and proper vibration limits for these device designs.

We wish to re-emphasize that the single welded shutter is considered to be a manufacturing defect and we have undertaken to replace ALL single welded shutters previously shipped in LB 7440 CR, LB 7442 CR and LB 7444 CR devices with properly manufactured double-welded shutters, as used during our vibration testing.

We are completely convinced that the incident at Monsanto would have been prevented, had the following conditions NOT existed at the time:

1. The particular centrifuge had an "event" of gross vibration.
2. The device mounted directly to it had a single welded shutter.
3. The parting of the shaft from the shutter removed the safety feature which prevents the source holder exiting the shielding.

I submit that we have taken all necessary steps to remove any likelihood that a similar incident could be repeated in the future. Your comments will be appreciated as always,

Sincerely,

Martin (Gus) Norton
Independent Consultant

Attachments:
US NRC 32.101 Schedule B

§ 32.101 Schedule B--prototype tests for luminous safety device use in aircraft.

An applicant for a license pursuant to § 32.53 shall conduct prototype tests on each of five prototype luminous devices for use in aircraft as follows:

(a) *Temperature-altitude test.* The device shall be placed in a test chamber as it would be used in service. A te altitude condition schedule shall be followed as outlined in the following steps:

Step 1. The internal temperature of the test chamber shall be reduced to -62° C. (-80° F.) and the device shal maintained for at least 1 hour at this temperature at atmospheric pressure.

Step 2. The internal temperature of the test chamber shall be raised to -54° C. (-65° F.) and maintained until temperature of the device has stabilized at -54° C. at atmospheric pressure.

Step 3. The atmospheric pressure of the chamber shall be reduced to 83 millimeters of mercury absolute press chamber temperature is maintained at -54° C.

Step 4. The internal temperature of the chamber shall be raised to -10° C. (+14° F.) and maintained until the of the device has stabilized at -10° C., and the internal pressure of the chamber shall then be adjusted to atm pressure. The test chamber door shall then be opened in order that frost will form on the device, and shall rem until the frost has melted but not long enough to allow the moisture to evaporate. The door shall then be close

Step 5. The internal temperature of the chamber shall be raised to +85° C. (185° F.) at atmospheric pressure. temperature of the device shall be stabilized at +85° C. and maintained for 2 hours. The device shall then be v inspected to determine the extent of any deterioration.

Step 6. The chamber temperature shall be reduced to +71° C. (160° F.) at atmospheric pressure. The temper device shall be stabilized at +71° C. for a period of 30 minutes.

Step 7. The chamber temperature shall be reduced to +55° C. (130° F.) at atmospheric pressure. The temper device shall be stabilized at this temperature for a period of 4 hours.

Step 8. The internal temperature of the chamber shall be reduced to +30° C. (86° F.) and the pressure to 138 of mercury absolute pressure and stabilized. The device shall be maintained under these conditions for a perio

Step 9. The temperature of the test chamber shall be raised to +35° C. (95° F.) and the pressure reduced to 8 of mercury absolute pressure and stabilized. The device shall be maintained under these conditions for a perio minutes.

Step 10. The internal pressure of the chamber shall be maintained at 83 millimeters of mercury absolute press temperature reduced to +20° C. (68° F.) and stabilized. The device shall be maintained under these conditions of 4 hours.

(b) *Vibration tests.* This procedure applies to items of equipment (including vibration isolating assemblies) inte mounted directly on the structure of aircraft powered by reciprocating, turbojet, or turbo-propeller engines or mounted directly on gas-turbine engines. The device shall be mounted on an apparatus dynamically similar to

severe conditions likely to be encountered in normal use. At the end of the test period, the device shall be insp thoroughly for possible damage. Vibration tests shall be conducted under both resonant and cycling conditions

Vibration Test Schedule-Table I
[Times shown refer to one axis of vibration]

Type	Vibration at room temperature (minutes)	Vibration at 160° F. (71C.) (minutes)	Vibration a (-54C.)(m
Resonance	60	15	
Cycling	60	15	

(1) *Determination of resonance frequency*. Individual resonance frequency surveys shall be conducted by appl to each device along each of any set of three mutually perpendicular axes and varying the frequency of applie slowly through a range of frequencies from 5 cycles per second to 500 cycles per second with the double ampl vibration not exceeding that shown in Figure 1 for the related frequency.

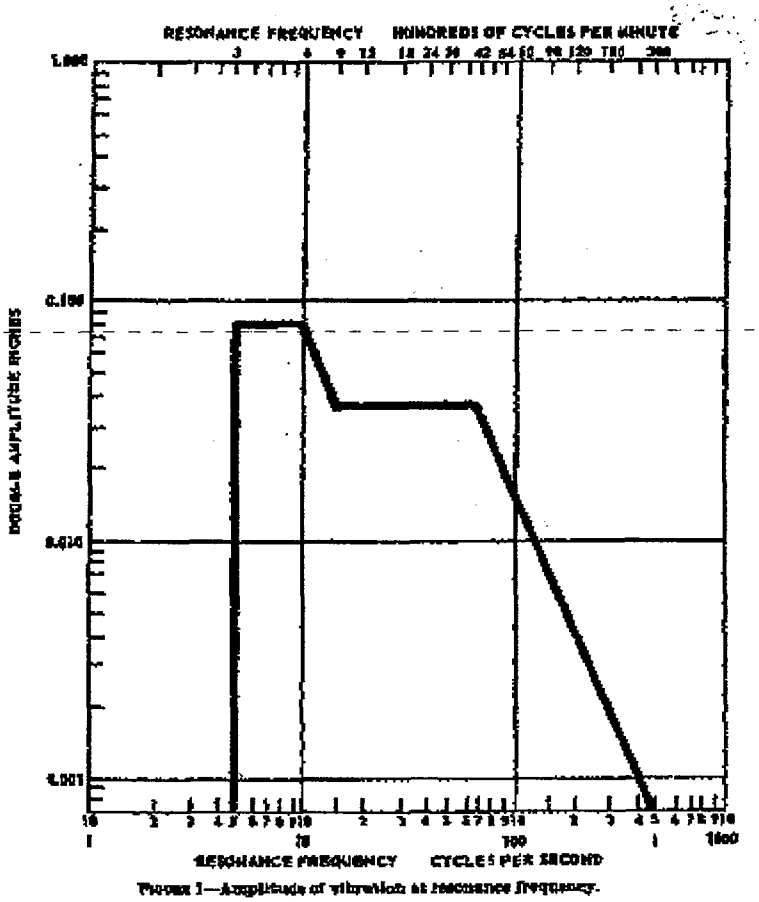

Figure 1—Amplitude of vibration at resonance frequency.

(2) *Resonance tests*. The device shall be vibrated at the determined resonance frequency for each axis of vibra periods and temperature conditions shown in Table I and with the applied double amplitude specified in Figure resonance frequency. When more than one resonant frequency is encountered with vibration applied along an the test period may be accomplished at the most severe resonance or the period may be divided among the re frequencies, whichever is considered most likely to produce failure. When resonant frequencies are not appare specified frequency range, the specimen shall be vibrated for periods twice as long as those shown for resonar at a frequency of 55 cycles per second and an applied double amplitude of 0.060 inch.

(3) *Cycling*. Devices to be mounted only on vibration isolators shall be tested by applying vibration along each mutually perpendicular axes of the device with an applied double amplitude of 0.060 inch and the frequency c

between 10 and 55 cycles per second in 1-minute cycles for the periods and temperature conditions shown in
Devices to be installed in aircraft without vibration isolators shall be tested by applying vibration along each of
mutually perpendicular axes of the device with an applied double amplitude of 0.036 inch or an applied acceler
whichever is the limiting value, and the frequency cycling between 10 and 500 cycles per second in 15-minute
periods and temperature conditions shown in Table I.

(c) *Accelerated weathering tests.* The device shall be subjected to 100 hours of accelerated weathering in a su
weathering machine. Panels of Corex D glass shall surround the arc to cut off the ultraviolet radiation below a
of 2,700 angstroms. The light of the carbon arcs shall fall directly on the face of the device. The temperature a
shall be maintained at 50°C. plus or minus 3°C. Temperature measurements shall be made with a black panel
thermometer.

(d) *Shock test.* The device shall be dropped upon a concrete or iron surface in a 3-foot free gravitational fall, o
subjected to equivalent treatment in a test device simulating such a free fall. The drop test shall be repeated 1
from random orientations.

(e) *Hermetic seal and waterproof test.* On completion of all other tests prescribed by this section, the device sl
immersed in 30 inches of water for 24 hours and shall show no visible evidence of water entry. Absolute press
above the water shall then be reduced to 1 inch of mercury. Lowered pressure shall be maintained for 1 minut
bubbles cease to be given off by the water, whichever is the longer. Pressure shall then be increased to norma
pressure. Any evidence of bubbles emanating from within the device, or water entering the device, shall be co
leakage.

(f) *Observations.* After each of the tests prescribed by this section, each device shall be examined for evidence
damage and for loss of tritium or promethium-147. Any evidence of damage to or failure of any device which c
containment of the tritium or promethium-147 shall be cause for rejection of the design if the damage or failur
attributable to a design defect. Loss of tritium or promethium-147 from each tested device shall be measured
with filter paper an area of at least 100 square centimeters on the outside surface of the device, or by wiping t
surface area if it is less than 100 square centimeters. The amount of tritium or promethium-147 in the water u
hermetic seal and waterproof test prescribed by test paragraph (e) of this section shall also be measured. Mea
shall be made in an apparatus calibrated to measure tritium or promethium-147, as appropriate. The detectior
paper of more than 2,200 disintegrations per minute of tritium or promethium-147 per 100 square centimeter
wiped or in the water of more than 0.1 percent of the original amount of tritium or promethium-147 in any de
cause for rejection of the tested device.

[30 FR 8192, June 26, 1965]