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'04 APR -2 P1 :09

STATE OF TENNESSEE
**DEPARTMENT OF ENVIRONMENT AND CONSERVATION**

3rd Floor, L & C Annex
401 Church Street
Nashville, TN 37243-1532

March 29, 2004

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

Attention: Duncan White

Dear Mr. White:

We are requesting the technical assistance of the Nuclear Regulatory Commission in our consideration of vibration testing performed for one of our distributors, Berthold Technologies U.S.A., LLC. This testing was performed on two of the models of the LB 74000 Series devices that are registered under TN-1031-D-101-B. This matter is the result of the incident at Monsanto in Louisiana in 2003 in which a model of this series lost a source due to separation of the shutter handle from the device. The single weld between the shutter handle shaft and the shutter cup failed. The device was installed in a significant centrifuge vibration environment.

We have enclosed a copy of letters dated February 16, 2004, with attachments, and March 25, 2004, with attachments, from Berthold that provides the results of their vibration tests, and proposes changes in wording to their registration. Note that an English translation for German is submitted with the March letter. We request any assistance you may provide for the following:

1. Are the vibration testing parameters sufficient to support the requested change in the description of the device installation location, i.e. not to exceed a total spatial excursion of 1 inch at any frequency and in any axis? Do these parameters meet any ANSI standard for vibration?

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



2. In the original vibration test report, there was no apparent examination of the stainless steel welds. After we asked the distributor about this, Amendment 1 to the examination report was submitted. Is there any particular method of weld evaluation required or recommended, or is visual sufficient? The distributor stated that the lead shielding of the device would have to be melted in order to observe the inner weld. Should this be required?

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

Sincerely,

Charles Arnott

Charles Arnott
Health Physicist
Division of Radiological Health

CWA

Berthold Technologies USA, LLC
99 Midway Lane
Oak Ridge, TN 37831-0895 USA
Phone: 865-483-1488
Fax: 865-425-4309
www.berthold-us.com

BERTHOLD TECHNOLOGIES

2004 MAR 26 AM 10:45
REC'D
RADIOLOGICAL HEALTH

Thursday, March 25, 2004

Mr. Charles Arnott
Division of Radiological Health
Department of Environment and Conservation
401 Church Street
L and C Annex, 3rd Floor
Nashville, TN 37243-1532

Reference: TN-1031-D-101-B LB 7400 Series

Dear Mr. Arnott,

Per our recent phone conversation, I am resubmitting the vibration test report which includes an English translation for the test graphs. I believe the rest of the test report is in English text. I have also included a statement from the manufacturer in regards to the visual examination of the double welded shutter on the test shields. If a more defined test for the double welded shutter mechanisms is deemed necessary by The State of Tennessee, further testing can be performed.

I would also like to update the State in regards to our single welded shutter replacement program, where any single welded CR shutter mechanisms distributed by us are being upgraded to the double welded design. We identified 17 customer sites across the U.S. involving 27 shields. Work has been ongoing getting the shields upgraded and we expect to have all upgrades completed by the end of March except for three customer sites. Because of possible customer shutdown schedules, the remaining three sites are scheduled to completed by the end of April 2004. I will send a formal notification as soon as this project is completed.

Please let me know of any additional clarification or information I can provide.

Sincerely,

Mark Morgan

Radiation Safety Officer
Berthold Technologies – U.S. Operations

TÜV Product Service GmbH · Dudenstraße 28 · D-68167 Mannheim
Group TÜV Süddeutschland

Telephone (06 21) 3 95-277
Telefax (06 21) 3 95-604

TÜV
PRODUCT SERVICE

# Test Report

Accredited Test Laboratory (DATech)
Reg.No.DAT-P-087/99-11

The test results relate only to the items tested as mentioned below.
This report shall not be reproduced except in full without the written approval of TÜV PRODUCT SERVICE.

| Report No | Number of copies | Number of pages | issued date |
|---|---|---|---|
| MHM-EST-7.7057620e | 1 | 5 | 26.11.2003 |

**Test**

Vibration Test

**Test Basis / Specification**

Customer specification, following DIN EN 60068-2-6

| Unit under Test (UUT) | Type Designation | Identification no. |
|---|---|---|
| 2 shielded containers for radioactive radiators | LB 7440-D-CR<br>LB 7442-D-CR | 1166<br>1045 |

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HEALTH

**Client**

Berthold Technologies
GmbH & Co. KG
Calmbacher Str. 22
75323 Bad Wildbad

**Manufacturer**

see client

| Test Engineer | Receipt of UUT date | Test Date / Period of Time |
|---|---|---|
| B. Abel | 03.11.2003 | 03.11.2003 |

**edited**
signature

B. Abel
Test Engineer

**verified**
signature

R. Knapp
Dept. Vice-Manager

# Table of Contents

1 Test Equipment

2 Test Procedure

2.1 Unit under Test

2.2 Test Specification

2.3 Test Sequence

3 Test Result

4 Legend of the Measuring Diagrams

5 Photo Documentation

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## Integrated Documents

| | | |
|---|---|---|
| /A-1/ | measuring diagrams of the vibration test, sine | sheet 1 to 3 |

## 1 Test equipment

| Equipment | Type | Ser.-No. | Manufacturer |
|---|---|---|---|
| shaker: | V875-440 | | Ling Dynamic Systems |
| vibration control system: | Vibco-NT | | Mahrenholz & Partner |
| signal conditioner: | 133 | AG 90 | Endevco |
| accelerometers: | 752-10 | 11610<br>11611 | Endevco |

All measuring equipment is calibrated regularly according the calibration instruction of TÜV PRODUCT SERVICE GmbH. All calibrations are traced back to national standards.

## 2 Test Procedure

### 2.1 Unit under Test

The units under test were 2 shielded containers for radioactive radiators for caesium 137 and cobalt 60.

### 2.2 Test Specification

2.2.1 Vibration test, sine

| | |
|---|---|
| frequency range: | 5 Hz - 200 Hz |
| amplitude: | 5 – 5,45 Hz; 12,5 mm<br>5,45 - 200 Hz; 1,5 g |
| sweep rate : | 4 Hz/min |
| test duration: | 2 sweeps / axis (1 h 38 min),<br>in 3 axes |

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## 2.3 Test Sequence

| No. | Test | Run | Axis | Measuring points and notes |
|---|---|---|---|---|
| 1 | vibration, sine | 1 | Y | screen open |
| 2 | vibration, sine | 2 | Z | screen open |
| 3 | vibration, sine | 3 | X | screen open |

## 3 Test Results

After each vibration axis the radiator support used for the vibration test was removed from the shielded container and checked for damages. Visually no damages could be determined on the outside of the radiator support or the shielded container.
A detailed test will be carried out by the customer in his works.

## 4 Legend of the Measuring Diagrams

### 4.1 Vibration Test ( see / A-1 / sheet 1 )

1 frequency range in Hz
2 acceleration level in g
3 acceleration spectral density in $g^2$/Hz
4 test duration
5 acceleration "a", reference value in g ( pk or rms )
6 acceleration "a", measured value in g ( pk or rms )
7 velocity "v", reference value in m/s
8 velocity "v", measured value in m/s
9 displacement "d", reference value in mm
10 displacement "d", measured value in mm
11 indication of the control channel
12 indication of the measuring channels
13 vibration axis
14 number of run

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TÜV Product Service GmbH · Dudenstraße 28 · D-68167 Mannheim
Group TÜV Süddeutschland

TÜV
PRODUCT SERVICE



## 5 Photo Documentation

Photo 1: Y-axis

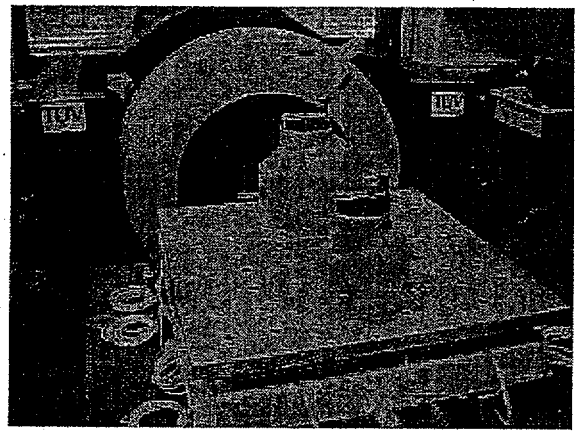


Photo 2: Z-axis

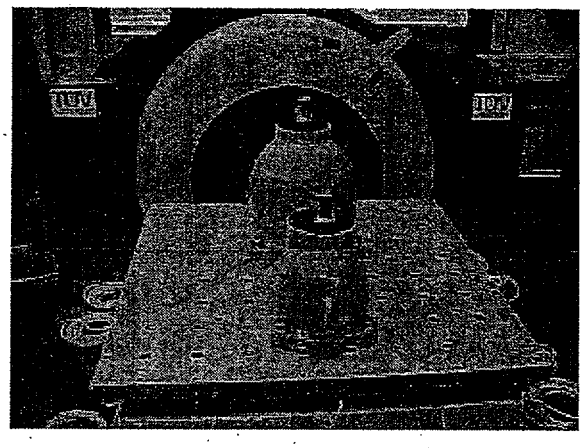


Photo 3: X-axis

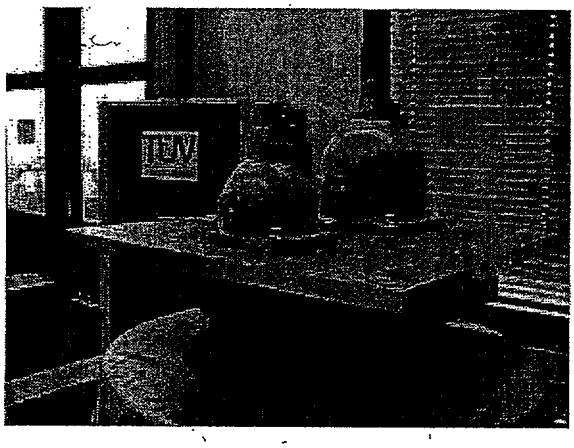
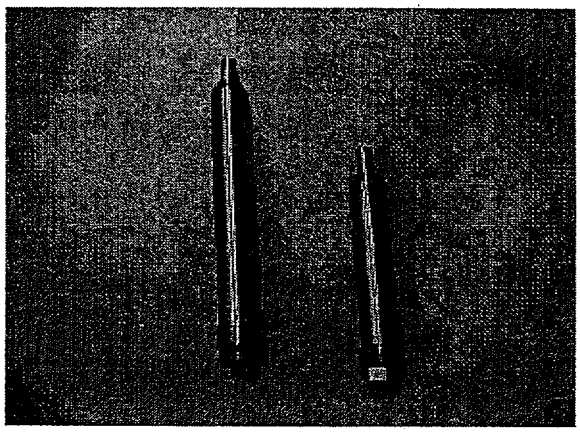


Photo 4: radiator support



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# TRANSLATION SHEET

Sinus SINE

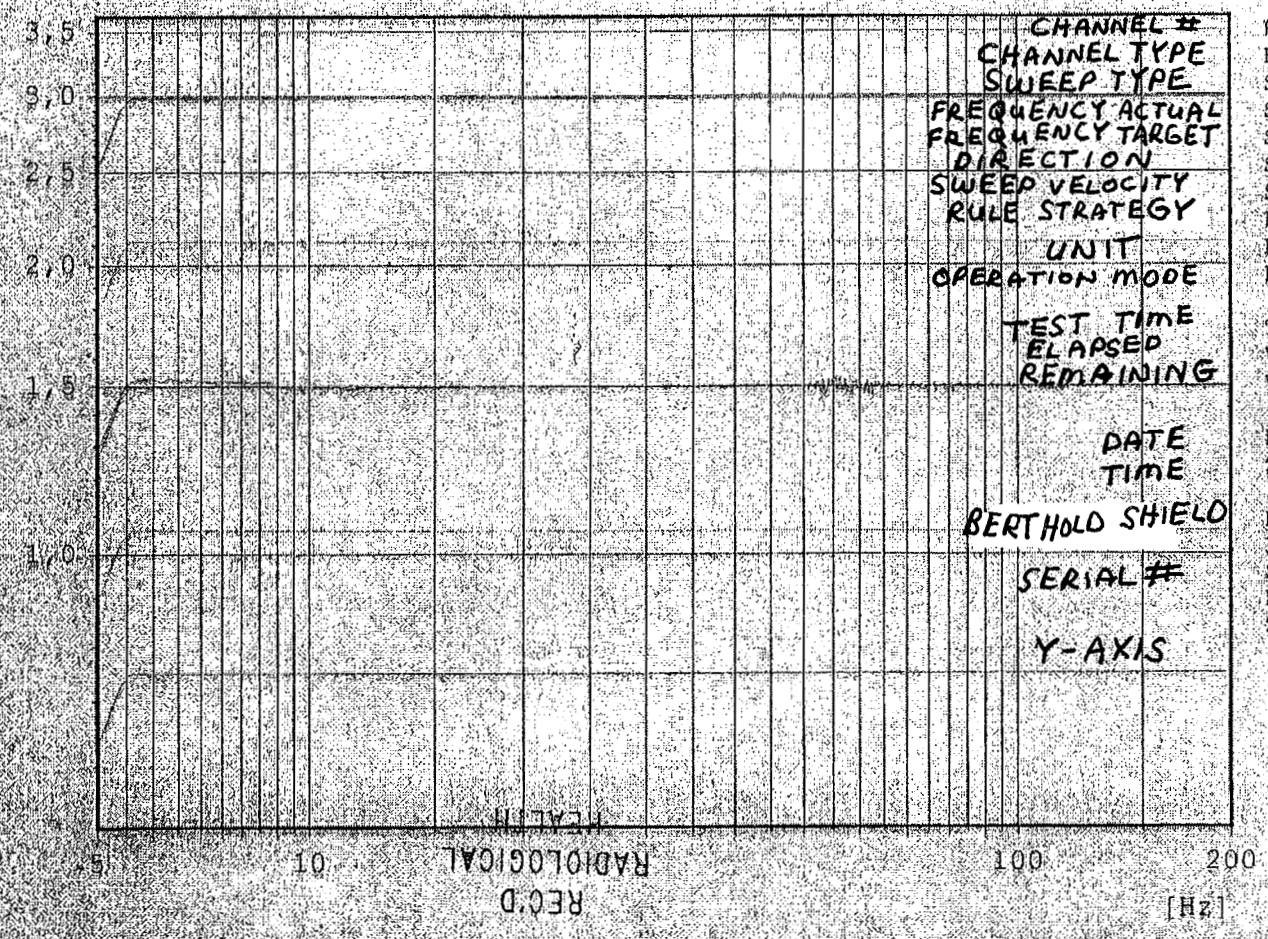
Control: Ch.4

Abschirmung geöffnet

SHIELDING

Regel

STANDARD




| | |
|---|---|
| Kan.Nr: | 4 |
| Kan.Typ: | CW |
| Sweeptyp: | linear |
| Sweeps Ist: | 2 |
| Sweeps Soll: | 2 |
| Sweepricht.: | neg. |
| Sweepg.: | 4,00 Hz/min |
| Regelstrat.: | Maximum |
| Einh.: | g |
| Betriebsart: | Closed loop |

Testzeit

| | |
|---|---|
| Verstrichen: | 001:39:00 |
| Verbleibend: | 000:00:00 |

| | |
|---|---|
| Datum: | 03.11.03 |
| Zeit: | 13:24:35 |

Berthold Abschirmbehälter
LB 7440-D-CR und LB 7442-D-CR
S.-Nr. 1166 und 1045
Run 2
Z-Achse


TÜV Product Service GmbH
Annex (A-4) sheet 2 of 3
MHM-EST-7-7005-620e dated 26.11.2003
TÜV PRODUCT SERVICE



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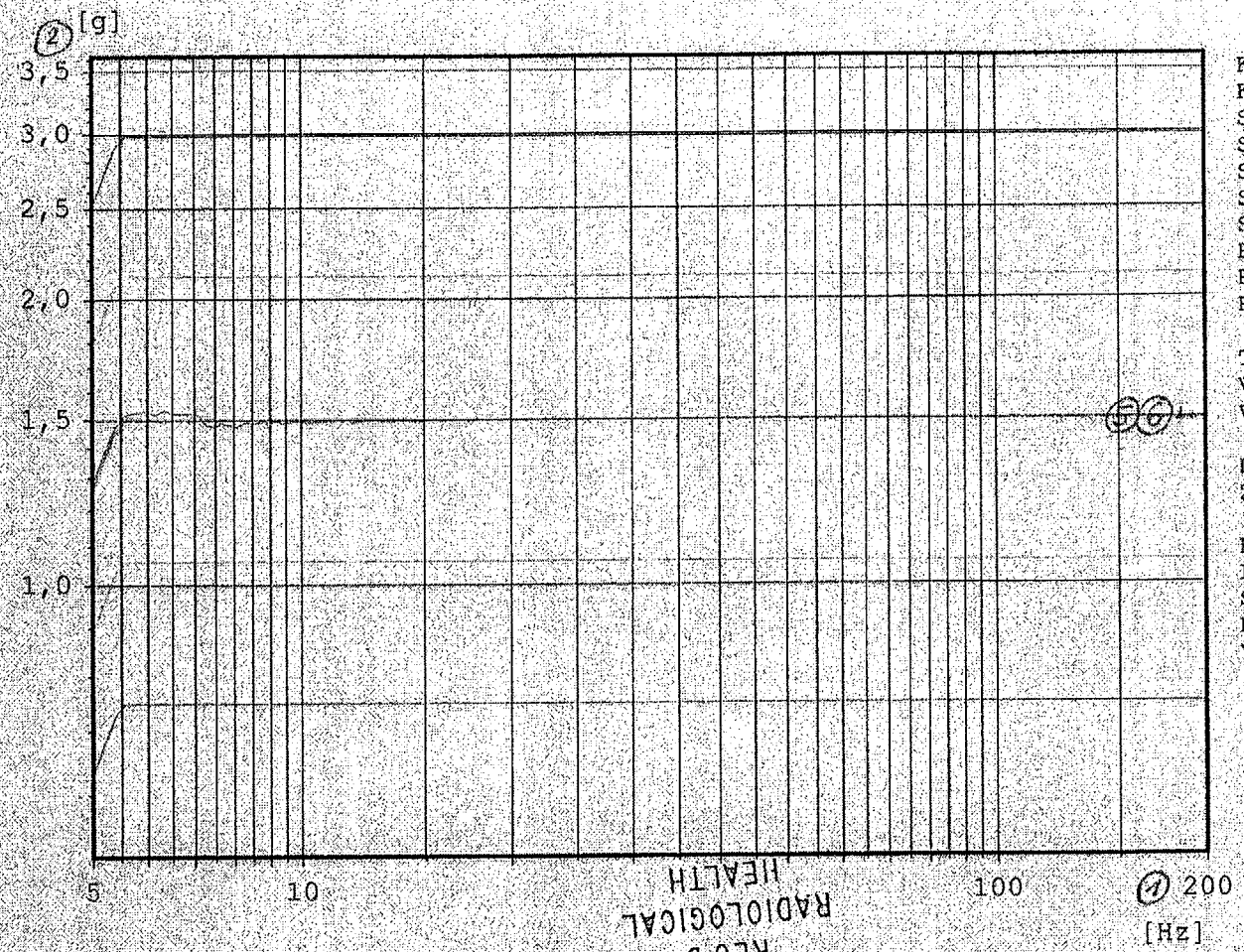
HEALTH


C:\VcpNT\Daten\est\Sine\Berthold1_003.rsn

TÜV PRODUCT SERVICE

# Regel

Sinus
Control: Ch.4 (11)
Abschirmung geöffnet




| | |
|---|---|
| Kan.Nr: | 4 |
| Kan.Typ: | CW |
| Sweeptyp: | linear |
| Sweeps Ist: | 1 |
| Sweeps Soll: | 2 |
| Sweepricht.: | pos. |
| Sweepg.: | 4,00 Hz/min |
| Regelstrat.: | Maximum |
| Einh.: | g |
| Betriebsart: | Closed loop |
| Testzeit | |
| Verstrichen: | 001:37:30 (4) |
| Verbleibend: | 000:00:00 |
| Datum: | 03.11.03 |
| Zeit: | 11:33:09 |

Berthold Abschirmbehälter
LB 7440-D-CR und LB 7442-D-CR
S.-Nr. 1166 und 1045
Run 1 (14)
Y-Achse (13)

2004 MAR 26 AM 10 46
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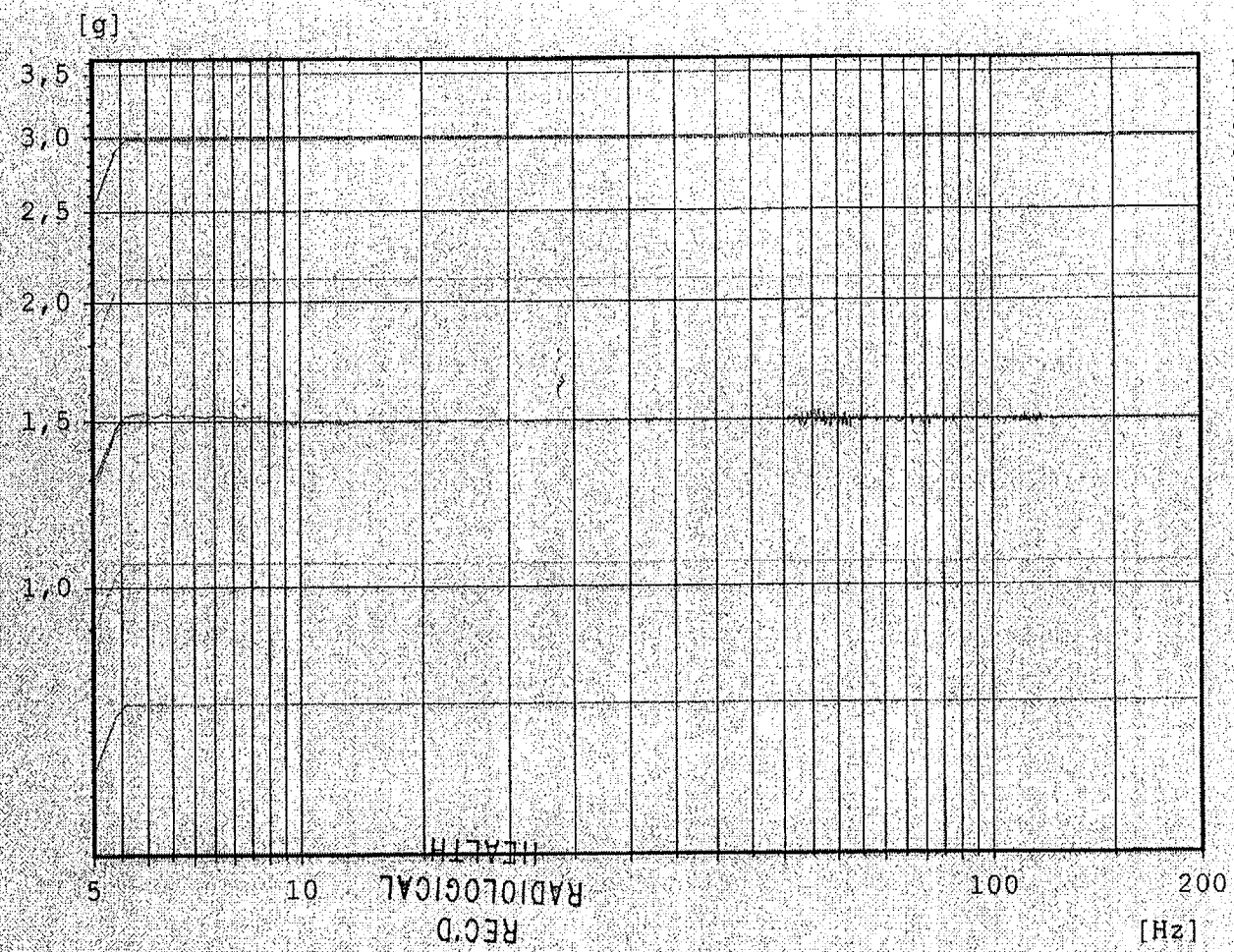
C:\VopNT\Daten\est\Sine\Berthold1_002.rsn

# Regel

Sinus
Control: Ch.4
Abschirmung geöffnet




| | |
|---|---|
| Kan.Nr: | 4 |
| Kan.Typ: | CW |
| Sweeptyp: | linear |
| Sweeps Ist: | 2 |
| Sweeps Soll: | 2 |
| Sweepricht.: | neg. |
| Sweepg.: | 4,00 Hz/min |
| Regelstrat.: | Maximum |
| Einh.: | g |
| Betriebsart: | Closed loop |
| Testzeit | |
| Verstrichen: | 001:39:00 |
| Verbleibend: | 000:00:00 |
| Datum: | 03.11.03 |
| Zeit: | 13:24:35 |

Berthold Abschirmbehälter
LB 7440-D-CR und LB 7442-D-CR
S.-Nr. 1166 und 1045
Run 2
Z-Achse

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2004 MAR 26 AM 10 46



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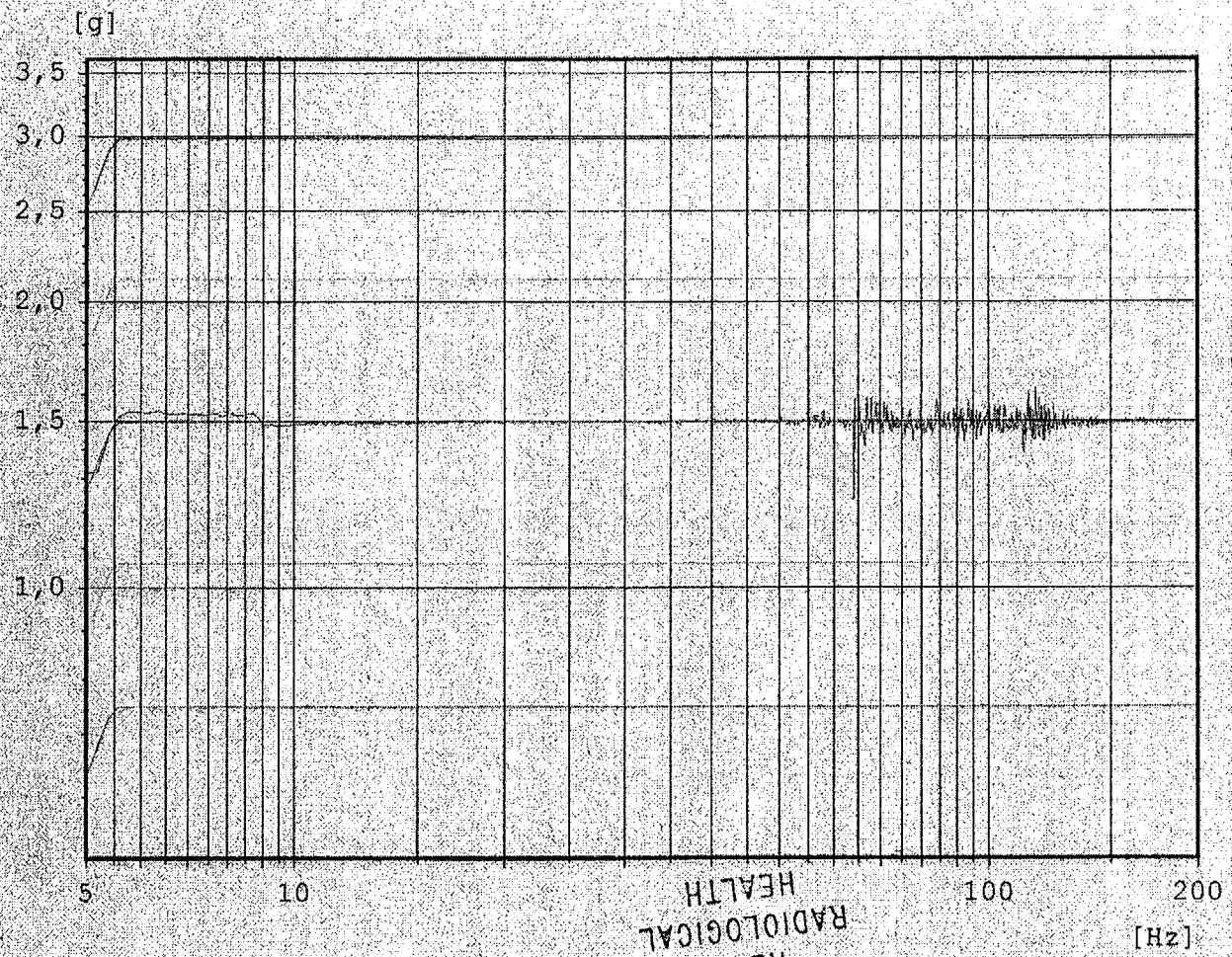
PRODUCT SERVICE

Sinus

# Regel

Control: Ch.4

Abschirmung geöffnet




| | |
|---|---|
| Kan.Nr: | 4 |
| Kan.Typ: | CW |
| Sweeptyp: | linear |
| Sweeps Ist: | 2 |
| Sweeps Soll: | 2 |
| Sweepricht.: | neg. |
| Sweepg.: | 4,00 Hz/min |
| Regelstrat.: | Maximum |
| Einh.: | g |
| Betriebsart: | Closed loop |
| Testzeit | |
| Verstrichen: | 001:39:00 |
| Verbleibend: | 000:00:00 |
| Datum: | 03.11.03 |
| Zeit: | 15:51:07 |

Berthold Abschirmbehälter
LB 7440-D-CR und LB 7442-D-CR
S.-Nr. 1166 und 1045
Run 3
X-Achse

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2004 MAR 26 AM 10 46

C:\VcpNT\Daten\est\Sine\Berthold1_004.rsn

BERTHOLD TECHNOLOGIES

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75323 Bad Wildbad, Germany

Phone +49 7081 177-0
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Vibration test for USA (ANSI)

A suggested vibration test for shieldings:

The unit shall be fully operational after being subjected to swept sinusoidal vibration input in each of the three principal orthogonal axes from 5 to 200 to 5 HZ at a sweep rate of 10 minutes per 40 Hz (a total test duration of one hour in each axis), at an input acceleration of 1.5 g, with a maximum displacement of 1 inch (2.5cm) peak-to-peak.

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Beiratsvorsitzender / Chairman of the Board Dr. Fritz Berthold
USt.-IdNr. / VAT Reg.No DE813050511
Deutsche Steuernummer / German Tax No 49038/08038

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Sparkasse PF-CW 75323 Bad Wildbad Konto/account no.80 450 05 (BLZ 606 510 70)/ SWIFT-BIC PZHSDE66 IBAN: DE76 6065 1070 0008 0450 05

BERTHOLD TECHNOLOGIES
Kk065204

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info@BertholdTech.com
www.BertholdTech.com

Bad Wildbad, 17.02.04

# Examination Report of Source Containers Id 37624, SN 1166 and 36275 SN 1045 after TÜV Vibration Test

An outside visual examination of the shields didn't show any damages. Afterwards both containers were dismantled. The visual inside inspection didn't show any damages. The lead of the shutter and of the shielding was fixed in correct position. The dimensions of the relevant parts were measured such as shutter, cover plate and shielding container.

## Dimensional Verification

### LB7440 D-CR Id.37624 S/N1166

Shutter Id.37605 ; Dimensions in mm

| | | |
|---|---|---|
| 1. | 71.5-0.1 | o.k. |
| 2. | 60.5 | o.k. |
| 3. | 128 | o.k. |
| 4. | 12 | o.k. |

Cover plate Id.35644

| | | |
|---|---|---|
| 5. | 160-0,5 | o.k. |
| 6. | 2 | o.k. |

Shielding LB7440 Id.37846

| | | |
|---|---|---|
| 7. | 15 | o.k. |
| 8. | 10,5 | o.k. |

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### LB7442 D-CR Id.37626 S/N1045

Shutter Id.37607 Dimensions in mm

| | | |
|---|---|---|
| 1. | 86,5-0,1 | o.k. |
| 2. | 96,5 | o.k. |
| 3. | 160 | o.k. |
| 4. | 13 | o.k. |

Cover plate Id.36275

| | | |
|---|---|---|
| 5. | 220-0,5 | o.k. |
| 6. | 2 | o.k. |

Shielding LB7442 Id.37847

| | | |
|---|---|---|
| 7. | 15 | o.k. |
| 8. | 10,5 | o.k. |

## Dose rate Measurements

### LB7440 D-CR Id.37624 S/N1166

| | before | after |
|---|---|---|
| 1. | 1,7µSv/h | 2,5µSv/h |
| 2. | 3,8µSv/h | 5,1µSv/h |
| 3. | 9,1µSv/h | 7,4µSv/h |
| 4. | 3,5µSv/h | 3,3µSv/h |
| 5. | 3,6µSv/h | 3,2µSv/h |
| 6. | 5,4µSv/h | 7,2µSv/h |
| 7. | 14µSv/h | 13,5µSv/h |

### LB7442 D-CR Id.37626 S/N1045

| | before | after |
|---|---|---|
| 1. | 1,6µSv/h | 1,1µSv/h |
| 2. | 1,5µSv/h | 1,3µSv/h |
| 3. | 1,0µSv/h | 0,9µSv/h |
| 4. | 1,2µSv/h | 1.1µSv/h |
| 5. | 1,3µSv/h | 1,0µSv/h |
| 6. | 1,3µSv/h | 1,01µSv/h |
| 7. | 1,5µSv/h | 1,8µSv/h |

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## Conclusion

The differences in dose rate measurement results before and after vibration test are within the measuring tolerances.

Based on the test results, the examiner sees no apparent damage or changes in the structural integrity of the shields as a result of the vibration tests.

Best Regards
**BERTHOLD TECHNOLOGIES GmbH & Co. KG**

Benno Hoffmann
**Manager Source Production**
**Process Control**

2004 MAR 26 AM 10 46
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BERTHOLD TECHNOLOGIES

BERTHOLD TECHNOLOGIES GmbH & Co.KG

Calmbacher Str. 22
75323 Bad Wildbad, Germany

Phone +49 7081 177-0
Fax +49 7081 177-100
info@BertholdTech.com
www.BertholdTech.com

Bad Wildbad, 22.03.04

# Amendment 1 to Examination Report dated 17.02.04

Examination Report of Source Containers Id 37624, SN1166 and 36275 SN 1045 after TÜV Vibration Test

A special part of the inside visual inspection was the welding of the shutter mechanism. The welding was free of cracks and the double welded shutter did not show any damages.

Best Regards,
**BERTHOLD Technologies GmbH & Co. KG**

Benno Hoffmann
**Manager Source Production**
**Process Control**

2004 MAR 26 AM 10 46
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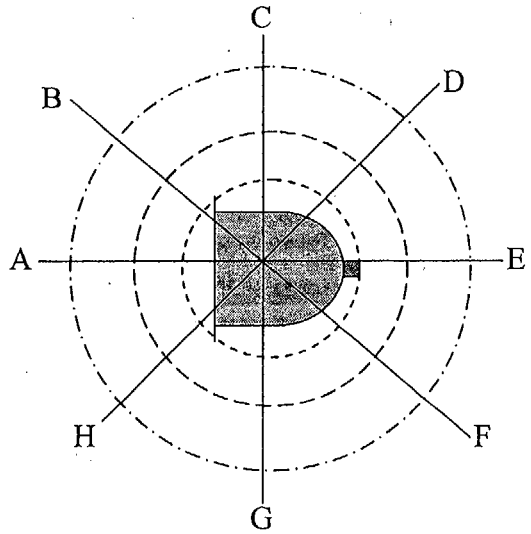
HEALTH

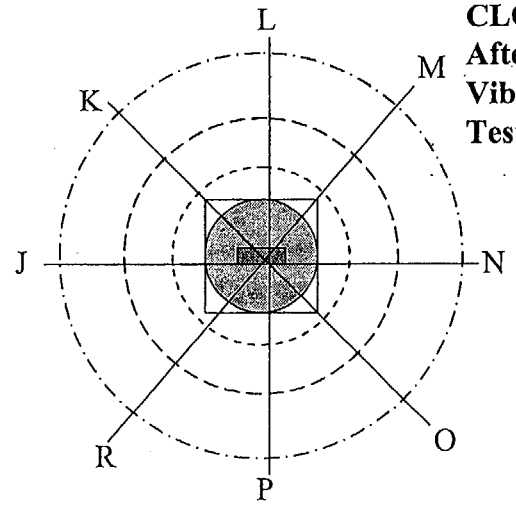
**SHUTTER CLOSED After Vibration Tests**

# DOSE RATES, MODEL SERIES LB 74XX AND LB 75XX




**PLANE 1 MicroSv**

| | |
|---|---|
| Shielding Model Nr. | LB7440D -CR |
| Shielding Serial Nr. | 1166 |
| Source Isotope | Cs-137 |
| Source Model Nr. | CDC.P4 |
| Source Serial Nr. | LK536 |
| Source Activity | mCi 10 Bq 0.37 |
| Date: Signed | 2/13/04 |




**PLANE 2 MicroSv**

| PLANE 1 | A | B | C | D | E | F | G | H | PLANE 2 | J | K | L | M | N | O | P | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Surface** | 7.4 | | 5.1 | | 2.5 | | 7.2 | | | | | 3.3 | | | | 3.2 | |
| **30 cm** | | | | | | | | | | | | | | | | | |
| **100 cm** | | | | | | | | | | | | | | | | | |

Dose Rate Meter Model…LB 123 S/N 1827

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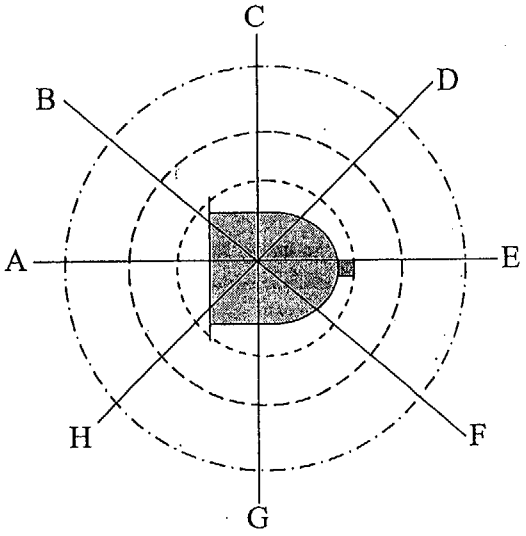
HEALTH
2004 MAR 26 AM 10 46

Your Name: Bernd Hagelskamp

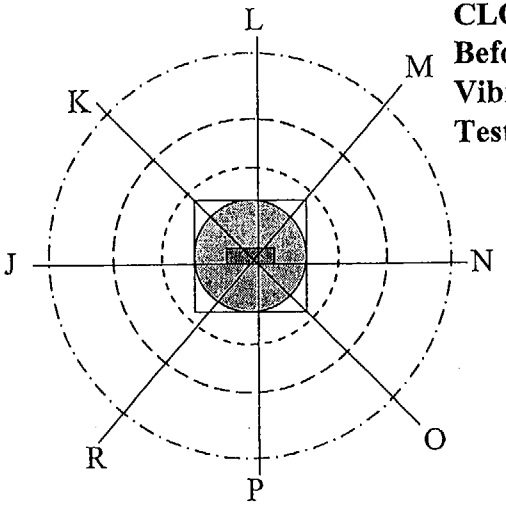
**SHUTTER CLOSED Before Vibration Testing**

## DOSE RATES, MODEL SERIES LB 74XX AND LB 75XX




**PLANE 1 MicroSv**

| | |
|---|---|
| Shielding Model Nr. | LB 7440D-CR |
| Shielding Serial Nr. | 1166 |
| Source Isotope | Cs-137 |
| Source Model Nr. | CDC.P4 |
| Source Serial Nr. | LK 536 |
| Source Activity | mCi 10<br>Bq 0.37 |
| Date: Signed | 2/13/04 |




**PLANE 2 MicroSv**

| PLANE 1 | A | B | C | D | E | F | G | H | PLANE 2 | J | K | L | M | N | O | P | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Surface** | 9.1 | | 3.8 | | 1.7 | | 5.4 | 14 | | | | 3.5 | | | | 3.6 | |
| **30 cm** | | | | | | | | | | | | | | | | | |
| **100 cm** | | | | | | | | | | | | | | | | | |

Dose Rate Meter Model LB 123, Ser Nr 1827

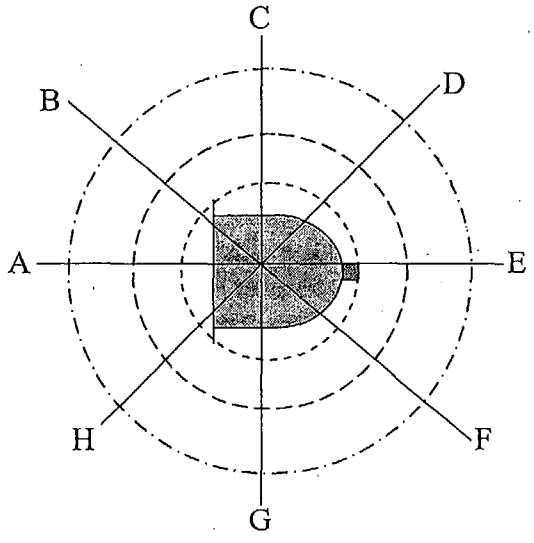
REC'D
RADIOLOGICAL
HEALTH
2004 MAR 26 AM 10 46

Your Name: Bernd Hagelskamp

**SHUTTER CLOSED After Vibration Tests**

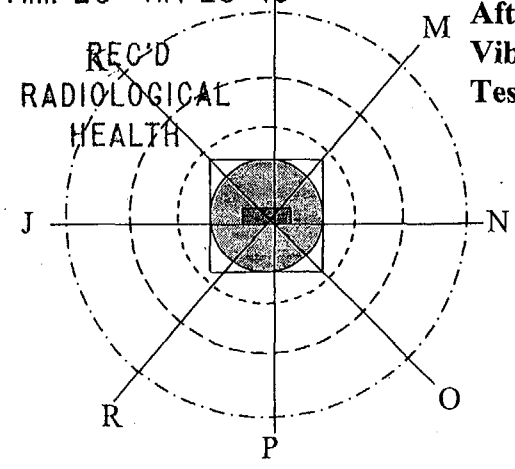
# DOSE RATES, MODEL SERIES LB 74XX AND LB 75XX

2004 MAR 26 AM 10 46
REC'D
RADIOLOGICAL
HEALTH




**PLANE 1 MicroSv**

| | |
|---|---|
| Shielding Model Nr. | LB7442D-CR |
| Shielding Serial Nr. | 1045 |
| Source Isotope | Cs-137 |
| Source Model Nr. | CDC.P4 |
| Source Serial Nr. | LN 944 |
| Source Activity | mCi 50<br>Bq 1.85 |
| Date: Signed | 2/13/04 |




**PLANE 2 MicroSv**

| PLANE 1 | A | B | C | D | E | F | G | H | PLANE 2 | J | K | L | M | N | O | P | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Surface** | 0.9 | | 1.3 | | 1.1 | | 1.01 | 1.8 | | | | 1.1 | | | | 1.0 | |
| **30 cm** | | | | | | | | | | | | | | | | | |
| **100 cm** | | | | | | | | | | | | | | | | | |

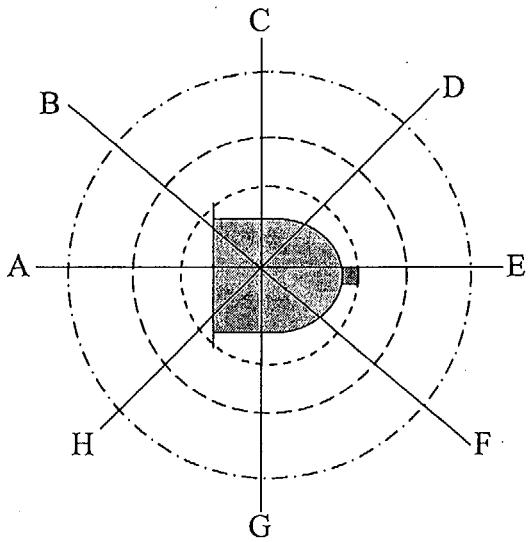
Dose Rate Meter Model…LB 123 S/N 1831……

Your Name: Bernd Hagelskamp

**SHUTTER CLOSED Before Vibration Testing**

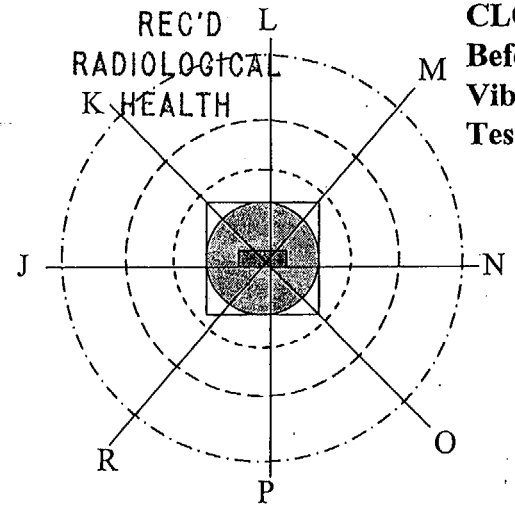
# DOSE RATES, MODEL SERIES LB 74XX AND LB 75XX

2004 MAR 26 AM 10 46
REC'D
RADIOLOGICAL
HEALTH




**PLANE 1 MicroSv**

| | |
|---|---|
| Shielding Model Nr. | LB 7442D-CR |
| Shielding Serial Nr. | 1045 |
| Source Isotope | Cs-137 |
| Source Model Nr. | CDC.P4 |
| Source Serial Nr. | LN 944 |
| Source Activity | mCi 50<br>Bq 1.85 |
| Date: Signed | 2/13/04 |




**PLANE 2 MicroSv**

| PLANE 1 | A | B | C | D | E | F | G | H | PLANE 2 | J | K | L | M | N | O | P | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Surface** | 1.0 | | 1.5 | | 1.6 | | 1.3 | 1.5 | | | | 1.2 | | | | 1.3 | |
| **30 cm** | | | | | | | | | | | | | | | | | |
| **100 cm** | | | | | | | | | | | | | | | | | |

Dose Rate Meter Model LB 123, Ser Nr 1831

Your Name: Bernd Hagelskamp

CWA

BERTHOLD TECHNOLOGIES
99 Midway Lane, Oak Ridge, TN 37831 USA
Tel: 865 483 1488, Fax 865 425 4309, www.berthold.com
Industrial, Bioanalytical and Radiation Protection Instruments

Mr. Charles Arnott
Division of Radiological Health
Department of Environment and Conservation
L and C Annex, 3rd Floor
401 Church Street
Nashville, TN 37243-1532

February 16, 2004

Dear Mr. Arnott,
With reference to our recent meeting and subsequent correspondence relating to an incident at Monsanto, Louisiana Plant last year, we would like to further clarify and define the performance of the series of Models LB 7440-CR and LB7442-CR when used in vibrating environments.
One of each type of device was measured for dose rates and tested on a shake table in three axes according to the following test criteria:

"Each unit shall be fully operational after being subjected to swept sinusoidal vibration input in each of three principal orthogonal axes from 5Hz to 200 to 5 Hz at a sweep rate of 10 minutes per 40 Hz and an input acceleration of 1.5g with a maximum displacement of 1 inch (2.5 cm) peak to peak."

After testing, the dose rates were again measured and the units disassembled and inspected. Parts were dimensionally compared to drawings.
No adverse conditions were noted and the supporting information is attached.
In terms of a practical and numerical interpretation of the results, we suggest the following be provided to users, sales and service persons and included in the device registration documents:

"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."

Please let me know if you find this acceptable and thank you for your assistance.

Sincerely,

Martin (Gus) Norton
Alternate RSO

Attachments:
Vibration Test Report
Inspection Report
Dose Rate Measurements

TÜV Product Service GmbH · Dudenstraße 28 · D-68167 Mannheim
Group TÜV Süddeutschland

Telephone (06 21) 3 95-277
Telefax (06 21) 3 95-604

TÜV
PRODUCT SERVICE

# Test Report

Accredited Test
Laboratory (DATech)
Reg.No.DAT-P-067/99-11

The test results relate only to the items tested as mentioned below.
This report shall not be reproduced except in full without the written approval of TÜV PRODUCT SERVICE.

| Report No | Number of copies | Number of pages | Issued date |
|---|---|---|---|
| MHM-EST-7.7057620e | 1 | 5 | 26.11.2003 |

**Test**

Vibration Test

**Test Basis / Specification**

Customer specification, following DIN EN 60068-2-6

| Unit under Test (UUT) | Type Designation | Identification no. |
|---|---|---|
| 2 shielded containers for radioactive radiators | LB 7440-D-CR<br>LB 7442-D-CR | 1166<br>1045 |

| Client | Manufacturer |
|---|---|
| Berthold Technologies GmbH & Co. KG<br>Calmbacher Str. 22<br>75323 Bad Wildbad | see client |

| Test Engineer | Receipt of UUT date | Test Date / Period of Time |
|---|---|---|
| B. Abel | 03.11.2003 | 03.11.2003 |

| edited signature | verified signature |
|---|---|
| B. Abel<br>Test Engineer | R. Knapp<br>Dept. Vice-Manager |

# Table of Contents

1 Test Equipment

2 Test Procedure

2.1 Unit under Test

2.2 Test Specification

2.3 Test Sequence

3 Test Result

4 Legend of the Measuring Diagrams

5 Photo Documentation

## Integrated Documents

/A-1/ measuring diagrams of the vibration test, sine sheet 1 to 3

# 1 Test equipment

| Equipment | Type | Ser.-No. | Manufacturer |
|---|---|---|---|
| shaker: | V875-440 | | Ling Dynamic Systems |
| vibration control system: | Vibco-NT | | Mahrenholz & Partner |
| signal conditioner: | 133 | AG 90 | Endevco |
| accelerometers: | 752-10 | 11610<br>11611 | Endevco |

All measuring equipment is calibrated regularly according the calibration instruction of TÜV PRODUCT SERVICE GmbH. All calibrations are traced back to national standards.

# 2 Test Procedure

## 2.1 Unit under Test

The units under test were 2 shielded containers for radioactive radiators for caesium 137 and cobalt 60.

## 2.2 Test Specification

### 2.2.1 Vibration test, sine

| | |
|---|---|
| frequency range: | 5 Hz - 200 Hz |
| amplitude: | 5 – 5,45 Hz; 12,5 mm<br>5,45 - 200 Hz; 1,5 g |
| sweep rate : | 4 Hz/min |
| test duration: | 2 sweeps / axis (1 h 38 min),<br>in 3 axes |

## 2.3 Test Sequence

| No. | Test | Run | Axis | Measuring points and notes |
|---|---|---|---|---|
| 1 | vibration, sine | 1 | Y | screen open |
| 2 | vibration, sine | 2 | Z | screen open |
| 3 | vibration, sine | 3 | X | screen open |

## 3 Test Results

After each vibration axis the radiator support used for the vibration test was removed from the shielded container and checked for damages. Visually no damages could be determined on the outside of the radiator support or the shielded container.
A detailed test will be carried out by the customer in his works.

## 4 Legend of the Measuring Diagrams

### 4.1 Vibration Test ( see / A-1 / sheet 1 )

1 frequency range in Hz
2 acceleration level in g
3 acceleration spectral density in $g^2$/Hz
4 test duration
5 acceleration "a", reference value in g ( pk or rms )
6 acceleration "a", measured value in g ( pk or rms )
7 velocity "v", reference value in m/s
8 velocity "v", measured value in m/s
9 displacement "d", reference value in mm
10 displacement "d", measured value in mm
11 indication of the control channel
12 indication of the measuring channels
13 vibration axis
14 number of run

## 5 Photo Documentation

Photo 1: Y-axis

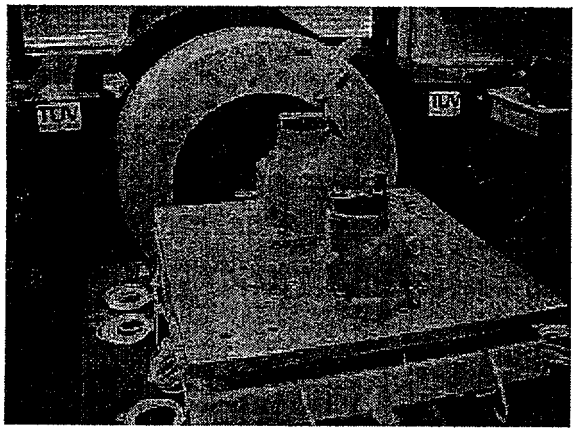


Photo 2: Z-axis

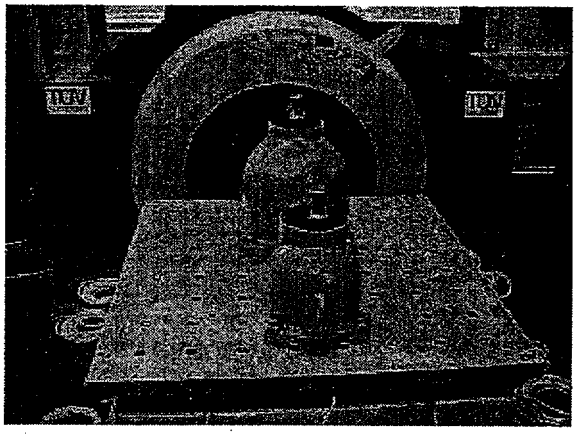


Photo 3: X-axis

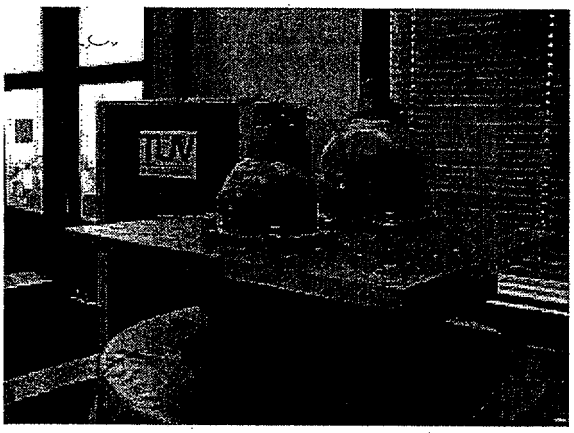
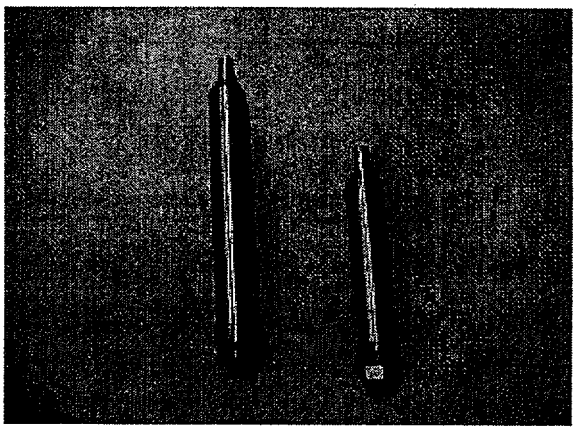


Photo 4: radiator support

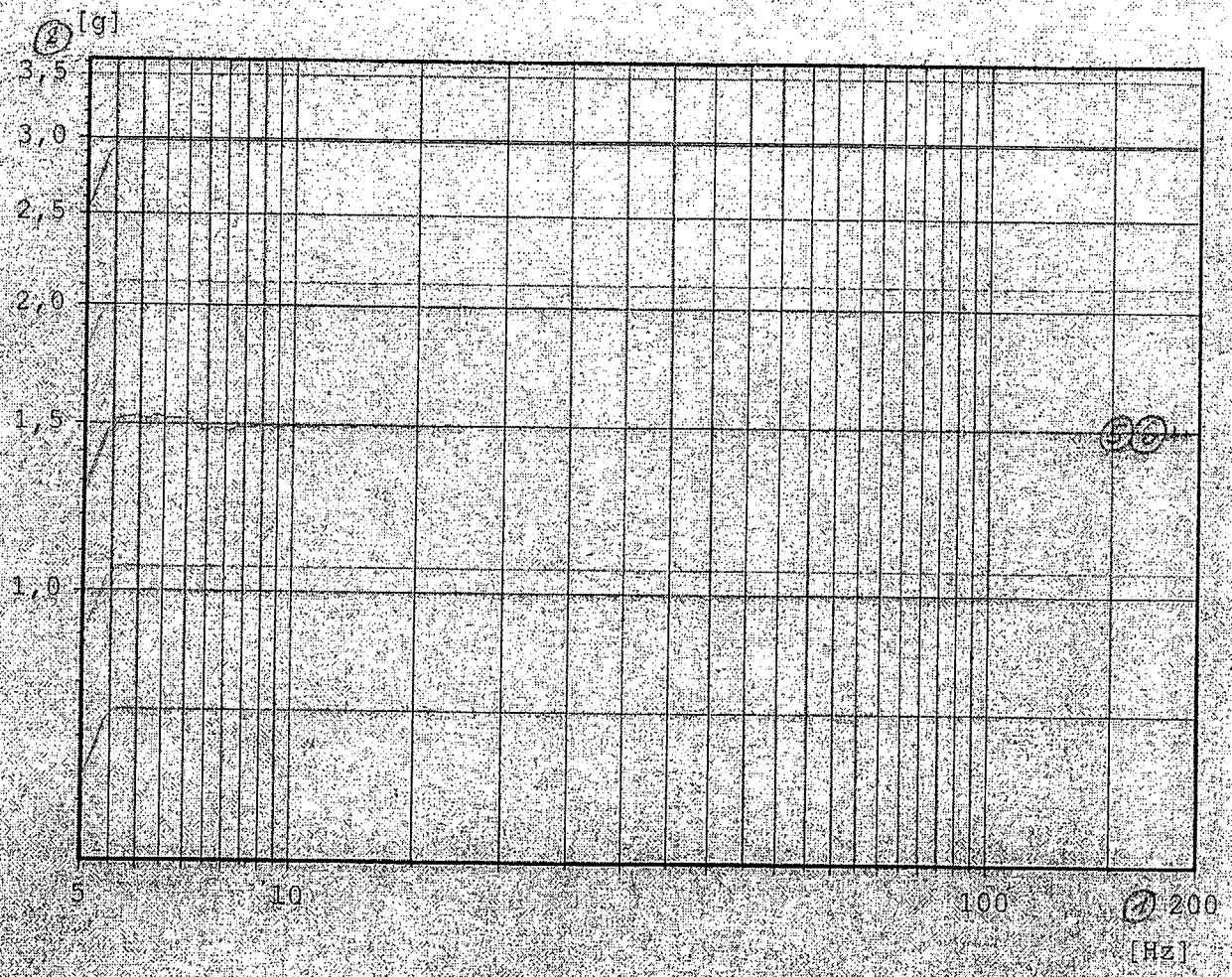


Sinus

Control: Ch.4 (11)

Abschirmung geöffnet

# Regel




| | |
|---|---|
| Kan.Nr: | 4 |
| Kan.Typ: | CW |
| Sweeptyp: | linear |
| Sweeps Ist: | 1 |
| Sweeps Soll: | 2 |
| Sweepricht.: | pos. |
| Sweepg.: | 4,00 Hz/min |
| Regelstrat.: | Maximum |
| Einh.: | g |
| Betriebsart: | Closed loop |

Testzeit

| | |
|---|---|
| Verstrichen: | 001:37:30 (4) |
| Verbleibend: | 000:00:00 |

| | |
|---|---|
| Datum: | 03.11.03 |
| Zeit: | 11:33:09 |

Berthold Abschirmbehälter
LB 7440-D-CR und LB 7442-D-CR
S.-Nr. 1166 und 1045
Run 1 (14)
Y-Achse (13)

TÜV Product Service GmbH
Annex / A-1 / sheet 1 of 3
part of test report
MHM-EST-7 70057620e dated 26.11.2003

TÜV PRODUCT SERVICE

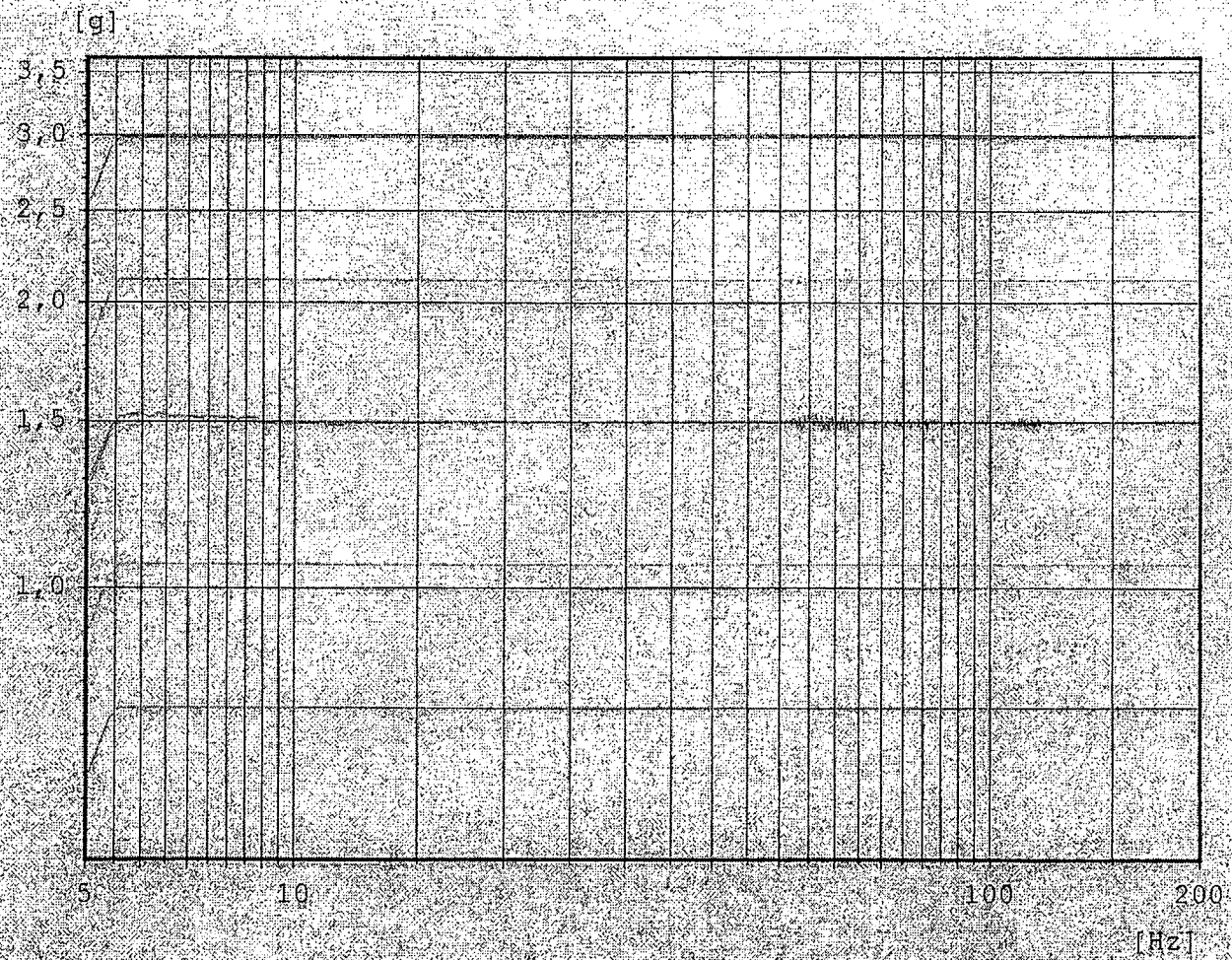
C:\VcpNT\Daten\est\Sine\Berthold1_002.rsn

Sinus

# Regel

Control: Ch.4

Abschirmung geöffnet




| | |
|---|---|
| Kan.Nr: | 4 |
| Kan.Typ: | CW |
| Sweeptyp: | linear |
| Sweeps Ist: | 2 |
| Sweeps Soll: | 2 |
| Sweepricht.: | neg. |
| Sweepg.: | 4,00 Hz/min |
| Regelstrat.: | Maximum |
| Einh.: | g |
| Betriebsart: | Closed loop |

Testzeit

| | |
|---|---|
| Verstrichen: | 001:39:00 |
| Verbleibend: | 000:00:00 |

| | |
|---|---|
| Datum: | 03.11.03 |
| Zeit: | 13:24:35 |

Berthold Abschirmbehälter
LB 7440-D-CR und LB 7442-D-CR
S.-Nr. 1166 und 1045
Run 2
Z-Achse

C:\VcpNT\Daten\est\Sine\Berthold1_003.rsn

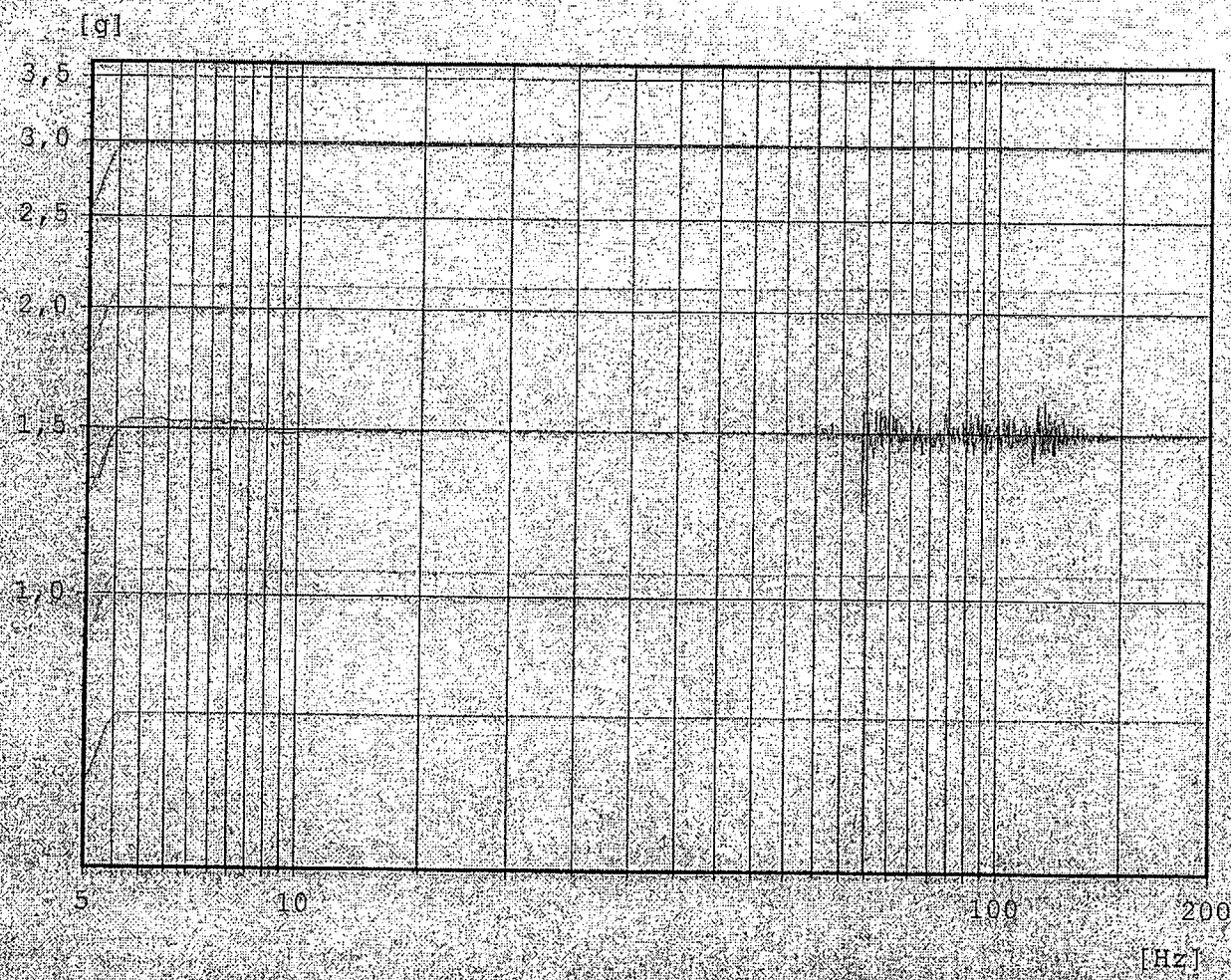

TÜV Product Service GmbH
Annex / A-1 / sheet 2 of 3
part of test report
MHM-EST-7.7005/620e dated 26.11.2003
TÜV PRODUCT SERVICE

Sinus

# Regel

Control: Ch.4

Abschirmung geöffnet




| | |
|---|---|
| Kan.Nr: | 4 |
| Kan.Typ: | CW |
| Sweeptyp: | linear |
| Sweeps Ist: | 2 |
| Sweeps Soll: | 2 |
| Sweepricht.: | neg. |
| Sweepg.: | 4,00 Hz/min |
| Regelstrat.: | Maximum |
| Einh.: | g |
| Betriebsart: | Closed loop |

Testzeit

| | |
|---|---|
| Verstrichen: | 001:39:00 |
| Verbleibend: | 000:00:00 |

| | |
|---|---|
| Datum: | 03.11.03 |
| Zeit: | 15:51:07 |

Berthold Abschirmbehälter
LB 7440-D-CR und LB 7442-D-CR
S.-Nr. 1166 und 1045
Run 3
X-Achse

C:\VcpNT\Daten\est\Sine\Berthold1_004.rsn



TÜV PRODUCT SERVICE

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Fax +49 7081 177-100
info@BertholdTech.com
www.BertholdTech.com

Vibration test for USA (ANSI)

A suggested vibration test for shieldings:

The unit shall be fully operational after being subjected to swept sinusoidal vibration input in each of the three principal orthogonal axes from 5 to 200 to 5 HZ at a sweep rate of 10 minutes per 40 Hz (a total test duration of one hour in each axis), at an input acceleration of 1.5 g, with a maximum displacement of 1 inch (2.5cm) peak-to-peak.

Registergericht / Court of Registration Calw HRA 991
Persönlich haftende Gesellschafterin / Fully liable Associates BERTHOLD TECHNOLOGIES Verwaltungs-GmbH
Registergericht / Court of Registration Calw HRB 1520
Geschäftsführer / Chief Executive Officer Hans J. Oberhofer
Beiratsvorsitzender / Chairman of the Board Dr. Fritz Berthold
USt.-IdNr. / VAT Reg.No DE813050511
Deutsche Steuernummer / German Tax No 49038/08038
Dresdner Bank 75105 Pforzheim Konto/account no.6 511 120 (BLZ 666 800 13)/ SWIFT-BIC DRES DE FF 666 IBAN: DE05 6668 0013 0651 1120 00
Sparkasse PF-CW 75323 Bad Wildbad Konto/account no.80 450 05 (BLZ 606 510 70)/ SWIFT-BIC PZHSDE66 IBAN: DE76 6065 1070 0008 0450 05

BERTHOLD TECHNOLOGIES
Kk065204

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Bad Wildbad, 17.02.04

# Examination Report of Source Containers Id 37624, SN 1166 and 36275 SN 1045 after TÜV Vibration Test

An outside visual examination of the shields didn't show any damages. Afterwards both containers were dismantled. The visual inside inspection didn't show any damages. The lead of the shutter and of the shielding was fixed in correct position. The dimensions of the relevant parts were measured such as shutter, cover plate and shielding container.

## Dimensional Verification

### LB7440 D-CR Id.37624 S/N1166

Shutter Id.37605 , Dimensions in mm

| | | |
|---|---|---|
| 1. | 71.5-0.1 | o.k. |
| 2. | 60.5 | o.k. |
| 3. | 128 | o.k. |
| 4. | 12 | o.k. |

Cover plate Id.35644

| | | |
|---|---|---|
| 5. | 160-0,5 | o.k. |
| 6. | 2 | o.k. |

Shielding LB7440 Id.37846

| | | |
|---|---|---|
| 7. | 15 | o.k. |
| 8. | 10,5 | o.k. |

### LB7442 D-CR Id.37626 S/N1045

Shutter Id.37607 Dimensions in mm

| | | |
|---|---|---|
| 1. | 86,5-0,1 | o.k. |
| 2. | 96,5 | o.k. |
| 3. | 160 | o.k. |
| 4. | 13 | o.k. |

Cover plate Id.36275

| | | |
|---|---|---|
| 5. | 220-0,5 | o.k. |
| 6. | 2 | o.k. |

Shielding LB7442 Id.37847

| | | |
|---|---|---|
| 7. | 15 | o.k. |
| 8. | 10,5 | o.k. |

## Dose rate Measurements

### LB7440 D-CR Id.37624 S/N1166

| | before | after |
|---|---|---|
| 1. | 1,7µSv/h | 2,5µSv/h |
| 2. | 3,8µSv/h | 5,1µSv/h |
| 3. | 9,1µSv/h | 7,4µSv/h |
| 4. | 3,5µSv/h | 3,3µSv/h |
| 5. | 3,6µSv/h | 3,2µSv/h |
| 6. | 5,4µSv/h | 7,2µSv/h |
| 7. | 14µSv/h | 13,5µSv/h |

### LB7442 D-CR Id.37626 S/N1045

| | before | after |
|---|---|---|
| 1. | 1,6µSv/h | 1,1µSv/h |
| 2. | 1,5µSv/h | 1,3µSv/h |
| 3. | 1,0µSv/h | 0,9µSv/h |
| 4. | 1,2µSv/h | 1.1µSv/h |
| 5. | 1,3µSv/h | 1,0µSv/h |
| 6. | 1,3µSv/h | 1,01µSv/h |
| 7. | 1,5µSv/h | 1,8µSv/h |

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www.BertholdTech.com

## Conclusion

The differences in dose rate measurement results before and after vibration test are within the measuring tolerances.

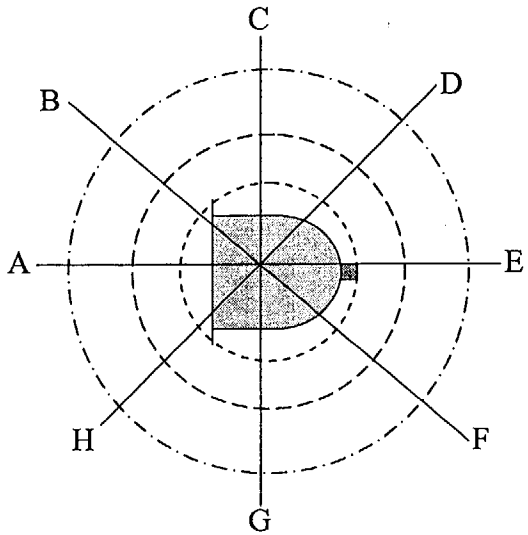
Based on the test results, the examiner sees no apparent damage or changes in the structural integrity of the shields as a result of the vibration tests.

Best Regards
**BERTHOLD TECHNOLOGIES GmbH & Co. KG**

Benno Hoffmann
**Manager Source Production**
**Process Control**

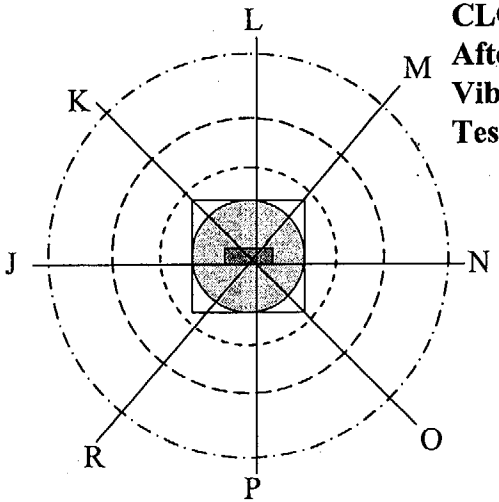
**SHUTTER CLOSED After Vibration Tests**

# DOSE RATES, MODEL SERIES LB 74XX AND LB 75XX




**PLANE 1 MicroSv**

| | |
|---|---|
| Shielding Model Nr. | LB7440D -CR |
| Shielding Serial Nr. | 1166 |
| Source Isotope | Cs-137 |
| Source Model Nr. | CDC.P4 |
| Source Serial Nr. | LK536 |
| Source Activity | mCi 10 Bq 0.37 |
| Date: Signed | 2/13/04 |




**PLANE 2 MicroSv**

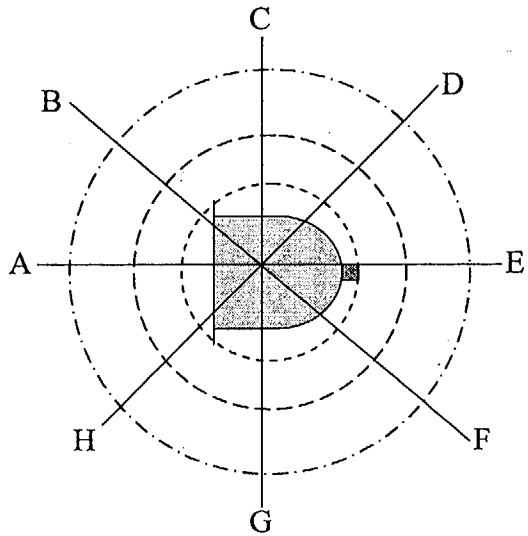
| PLANE 1 | A | B | C | D | E | F | G | H | PLANE 2 | J | K | L | M | N | O | P | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Surface** | 7.4 | | 5.1 | | 2.5 | | 7.2 | | | | | 3.3 | | | | 3.2 | |
| **30 cm** | | | | | | | | | | | | | | | | | |
| **100 cm** | | | | | | | | | | | | | | | | | |

Dose Rate Meter Model…LB 123 S/N 1827……

Your Name: Bernd Hagelskamp

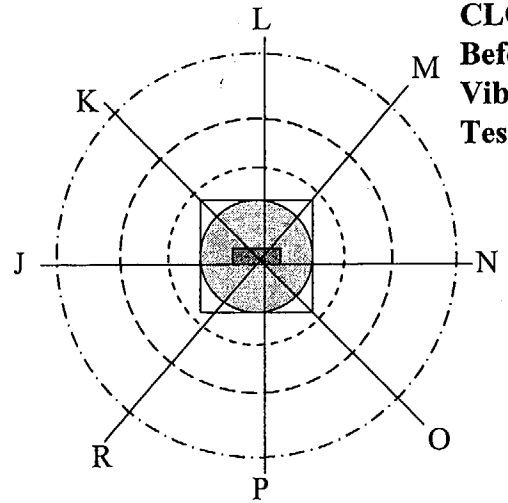
**SHUTTER CLOSED Before Vibration Testing**

## DOSE RATES, MODEL SERIES LB 74XX AND LB 75XX




**PLANE 1 MicroSv**

| | |
|---|---|
| Shielding Model Nr. | LB 7440D-CR |
| Shielding Serial Nr. | 1166 |
| Source Isotope | Cs-137 |
| Source Model Nr. | CDC.P4 |
| Source Serial Nr. | LK 536 |
| Source Activity | mCi 10<br>Bq 0.37 |
| Date:<br>Signed | 2/13/04 |




**PLANE 2 MicroSv**

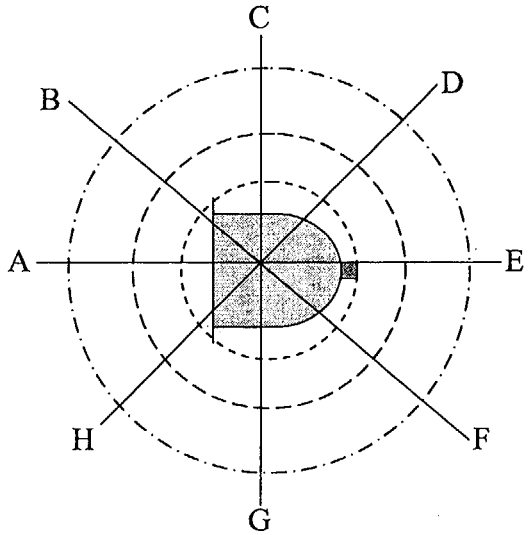
| PLANE 1 | A | B | C | D | E | F | G | H | PLANE 2 | J | K | L | M | N | O | P | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Surface** | 9.1 | | 3.8 | | 1.7 | | 5.4 | 14 | | | | 3.5 | | | | 3.6 | |
| **30 cm** | | | | | | | | | | | | | | | | | |
| **100 cm** | | | | | | | | | | | | | | | | | |

Dose Rate Meter Model LB 123, Ser Nr 1827

Your Name: Bernd Hagelskamp

**SHUTTER CLOSED After Vibration Tests**

## DOSE RATES, MODEL SERIES LB 74XX AND LB 75XX




**PLANE 1 MicroSv**

| | |
|---|---|
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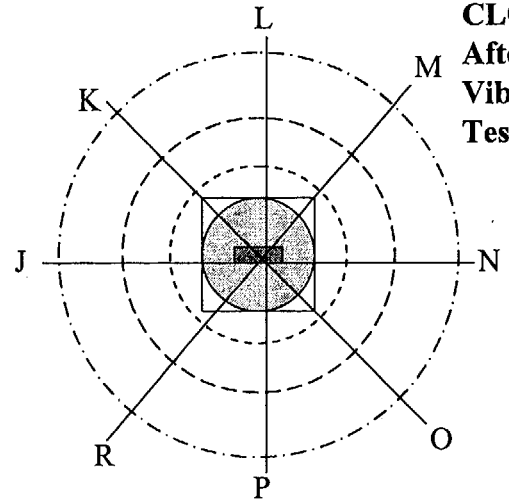
| Shielding Serial Nr. | 1045 |
| Source Isotope | Cs-137 |
| Source Model Nr. | CDC.P4 |
| Source Serial Nr. | LN 944 |
| Source Activity | mCi 50<br>Bq 1.85 |
| Date:<br>Signed | 2/13/04 |




**PLANE 2 MicroSv**

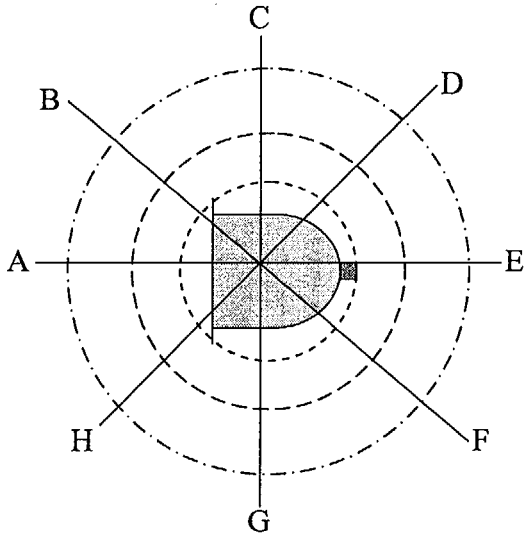
| PLANE 1 | A | B | C | D | E | F | G | H | PLANE 2 | J | K | L | M | N | O | P | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Surface** | 0.9 | | 1.3 | | 1.1 | | 1.01 | 1.8 | | | | 1.1 | | | | 1.0 | |
| **30 cm** | | | | | | | | | | | | | | | | | |
| **100 cm** | | | | | | | | | | | | | | | | | |

Dose Rate Meter Model…LB 123 S/N 1831……

Your Name: Bernd Hagelskamp

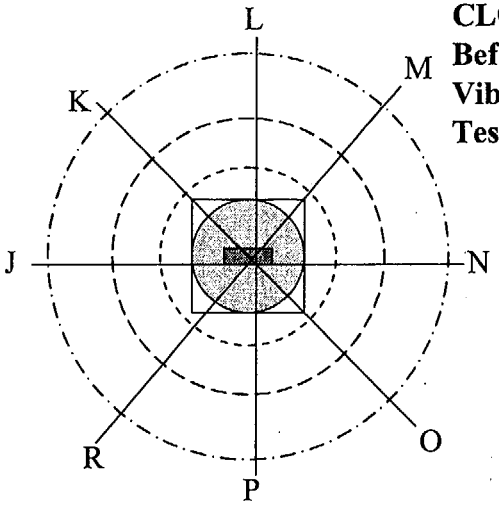
**SHUTTER CLOSED Before Vibration Testing**

## DOSE RATES, MODEL SERIES LB 74XX AND LB 75XX




**PLANE 1 MicroSv**

| | |
|---|---|
| Shielding Model Nr. | LB 7442D-CR |
| Shielding Serial Nr. | 1045 |
| Source Isotope | Cs-137 |
| Source Model Nr. | CDC.P4 |
| Source Serial Nr. | LN 944 |
| Source Activity | mCi 50<br>Bq 1.85 |
| Date:<br>Signed | 2/13/04 |




**PLANE 2 MicroSv**

| PLANE 1 | A | B | C | D | E | F | G | H | PLANE 2 | J | K | L | M | N | O | P | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Surface** | 1.0 | | 1.5 | | 1.6 | | 1.3 | 1.5 | | | | 1.2 | | | | 1.3 | |
| **30 cm** | | | | | | | | | | | | | | | | | |
| **100 cm** | | | | | | | | | | | | | | | | | |

Dose Rate Meter Model LB 123, Ser Nr 1831

Your Name: Bernd Hagelskamp