

Eckert & Ziegler Nuclitec GmbH
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akkreditiert durch die / accredited by the

Deutsche Akkreditierungsstelle GmbH



Deutsche
 Akkreditierungsstelle
 D-K-15203-01-00

als Kalibrierlaboratorium im / as calibration laboratory in the

Deutschen Kalibrierdienst



026045
D-K- 15203-01-00
2013-05

Kalibrierschein
 Calibration certificate

Kalibrierzeichen
 Calibration mark

Strahler Nr. / Source number AC-2449

Gegenstand
 Object **Beta Wide Area Reference Source**

Dieser Kalibrierschein dokumentiert die Rückführung auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem internationalen Einheitensystem (SI).

Hersteller
 Manufacturer **Eckert & Ziegler Nuclitec GmbH**

Die DAkkS ist Unterzeichner der multilateralen Übereinkommen der European co-operation for Accreditation (EA) und der International Laboratory Accreditation Cooperation (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine.

Typ
 Type **CIR07032**

Strahler-Nr.
 Source number **AC-2449**

Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

Auftraggeber
 Customer **Eckert & Ziegler Analytics
 Atlanta, GA 30318, USA**

This calibration certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI).

Auftragsnummer
 Order No. **CO00155161**

The DAkkS is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates.

Anzahl der Seiten des Kalibrierscheines
 Number of pages of the certificate **2**

Datum der Kalibrierung
 Date of calibration **25 April 2013**

The user is obliged to have the object recalibrated at appropriate intervals.

Dieser Kalibrierschein darf nur vollständig und unverändert weiterverbreitet werden. Auszüge oder Änderungen bedürfen der Genehmigung sowohl der Deutschen Akkreditierungsstelle GmbH als auch des ausstellenden Kalibrierlaboratoriums. Kalibrierscheine ohne Unterschrift haben keine Gültigkeit.

This calibration certificate may not be reproduced other than in full except with the permission of both the Deutsche Akkreditierungsstelle GmbH and the issuing laboratory. Calibration certificates without signature are not valid.

Datum
 Date **22 May 2013**

Leiter des Kalibrierlaboratoriums
 Head of the calibration laboratory
Dr. Thieme

Bearbeiter
 Person in charge
Schueler

026045
D-K- 15203-01-00
2013-05

Beta Wide Area Reference Source

Source no.	AC-2449
Drawing	VZ-628-001
Nuclide	Chlorine-36
Activity	3.90 kBq
Beta surface emission rate	$2.48E03 \text{ s}^{-1}$ in 2π steradian
Reference date	25 April 2013 at 12:00 UTC
Dimensions of active surface	150 mm x 100 mm
Overall dimensions	170 mm x 120 mm x 3 mm
Leakage and contamination test	The amount of the removable activity does not exceed 10 Bq. (Wipe test according to ISO 9978, no. 5.3.1)
Wipe test passed on	22 May 2013
Construction	Cl-36 is incorporated into the surface of an anodized aluminium foil of 0.3 mm thickness. The thickness of the activated layer is approximately 6 μm . The activated foil is mounted into a holder.
Measuring method	The activity was determined by comparison with a reference source of the same construction. The beta surface emission rate was measured using a windowless proportional counter.
Traceability	Additional to the direct traceability to the PTB through the DAkKS this product complies with the requirements for traceability to NIST specified in the American National Standard "Traceability of Radioactive Sources to the NIST and Associated Instrument Quality Control (ANSI N42.22-1995)". As a requirement of the ANSI N42.22-1995 Eckert & Ziegler Nuclitec GmbH participates in the NRMAP/NIST Measurements Assurance Program of the Nuclear Power Industry.
Uncertainty	The relative uncertainty of the activity is 5 %, the relative uncertainty of the beta surface emission rate is 3 %. The reported uncertainty, determined according to the DAkKS-DKD-3 report is based on the standard uncertainty multiplied by a coverage factor of $k = 2$, providing a level of confidence of 95 %. (Ref. NIST Technical Note 1297/"Guide to the Expression of Uncertainty in Measurement" ISO Guide, 1995)
Radioactive impurities	Related to Cl-36 (equal 100 %) the following radioactive impurities were detected: none
Quality assurance system	The quality assurance system of Eckert & Ziegler Nuclitec GmbH was certified by Lloyd's Register Quality Assurance (LRQA) according to ISO 9001, issue 2008. Isotrak products meet the requirements of 10CFR50 Appendix B in the USA.
Uniformity	The uniformity of the surface emission rate is better than 10 %.
Remark	This is an EZN Class 2 reference source. Ref: PO#3950/SO#32561, End User Ref: PO#13-0185

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026055
D-K- 15203-01-00
2013-05

Strahler Nr. / Source number AC-2450

Gegenstand
 Object **Beta Wide Area Reference Source**

Hersteller
 Manufacturer **Eckert & Ziegler Nuclitec GmbH**

Typ
 Type **SIR07032**

Strahler-Nr.
 Source number **AC-2450**

Auftraggeber
 Customer **Eckert & Ziegler Analytics
 Atlanta, GA 30318
 United States of America**

Auftragsnummer
 Order No. **CO00155161**

Anzahl der Seiten des Kalibrierscheines
 Number of pages of the certificate **2**

Datum der Kalibrierung
 Date of calibration **22 May 2013**

Dieser Kalibrierschein dokumentiert die Rückführung auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI).

Die DAkkS ist Unterzeichner der multilateralen Übereinkommen der European co-operation for Accreditation (EA) und der International Laboratory Accreditation Cooperation (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine.

Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

This calibration certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI).

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The user is obliged to have the object recalibrated at appropriate intervals.

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Datum Date	Leiter des Kalibrierlaboratoriums Head of the calibration laboratory	Bearbeiter Person in charge
28 May 2013	Dr. Thieme <i>i.A. E. Heind</i>	Schueler <i>E. Schueler</i>

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D-K- 15203-01-00
2013-05

Beta Wide Area Reference Source

Source no.	AC-2450
Drawing	VZ-628-001
Nuclide	Strontium-90
Activity	3.49 kBq
Beta surface emission rate	4.50E03 s ⁻¹ in 2 π steradian
Reference date	22 May 2013 at 12:00 UTC
Dimensions of active surface	150 mm x 100 mm
Overall dimensions	170 mm x 120 mm x 3 mm
Leakage and contamination test	The amount of the removable activity does not exceed 10 Bq. (Wipe test according to ISO 9978, no. 5.3.1)
Wipe test passed on	27 May 2013
Construction	Sr-90 is incorporated into the surface of an anodized aluminium foil of 0.3 mm thickness. The thickness of the activated layer is approximately 6 µm. The activated foil is mounted into a holder.
Measuring method	The activity was determined by comparison with a reference source of the same construction. The beta surface emission rate was measured using a windowless proportional counter.
Traceability	Additional to the direct traceability to the PTB through the DAkKS this product complies with the requirements for traceability to NIST specified in the American National Standard "Traceability of Radioactive Sources to the NIST and Associated Instrument Quality Control (ANSI N42.22-1995)". As a requirement of the ANSI N42.22-1995 Eckert & Ziegler Nuclitec GmbH participates in the NRMAP/NIST Measurements Assurance Program of the Nuclear Power Industry.
Uncertainty	The relative uncertainty of the activity is 5 %, the relative uncertainty of the beta surface emission rate is 3 %. The reported uncertainty, determined according to the DAkKS-DKD-3 report is based on the standard uncertainty multiplied by a coverage factor of k = 2, providing a level of confidence of 95 %. (Ref. NIST Technical Note 1297/"Guide to the Expression of Uncertainty in Measurement" ISO Guide, 1995)
Radioactive impurities	Related to Sr-90 (equal 100 %) the following radioactive impurities were detected: none
Quality assurance system	The quality assurance system of Eckert & Ziegler Nuclitec GmbH was certified by Lloyd's Register Quality Assurance (LRQA) according to ISO 9001, issue 2008. Isotrak products meet the requirements of 10CFR50 Appendix B in the USA.
Uniformity	The uniformity of the surface emission rate is better than 10 %.
Remark	This is an EZN Class 2 reference source. Ref: PO#3950/SO#32561 End user Reference PO#13-0185

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026031
D-K- 15203-01-00
2013-05

Strahler Nr. / Source number AC-2448

Gegenstand
 Object **Beta Wide Area Reference Source**

Hersteller
 Manufacturer **Eckert & Ziegler Nuclitec GmbH**

Typ
 Type **TCR07032**

Strahler-Nr.
 Source number **AC-2448**

Auftraggeber
 Customer **Eckert & Ziegler Analytics
 USA-Atlanta, GA 30318**

Auftragsnummer
 Order No. **CO00155161**

Anzahl der Seiten des Kalibrierscheines
 Number of pages of the certificate **2**

Datum der Kalibrierung
 Date of calibration **25 April 2013**

Dieser Kalibrierschein dokumentiert die Rückführung auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI).

Die DAkkS ist Unterzeichner der multilateralen Übereinkommen der European co-operation for Accreditation (EA) und der International Laboratory Accreditation Cooperation (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine.

Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

This calibration certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI).

The DAkkS is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates.

The user is obliged to have the object recalibrated at appropriate intervals.

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Datum Date	Leiter des Kalibrierlaboratoriums Head of the calibration laboratory	Bearbeiter Person in charge
13 May 2013	Dr. Thieme <i>i.A. E. Thieme</i>	<i>i. A. T. Schueler</i> Schueler

026031
D-K- 15203-01-00
2013-05

Beta Wide Area Reference Source

Source no.	AC-2448
Drawing	VZ-628-001
Nuclide	Technetium-99
Activity	3.79 kBq
Beta surface emission rate	$1.83E03 \text{ s}^{-1}$ in 2π steradian
Reference date	25 April 2013 at 12:00 UTC
Dimensions of active surface	150 mm x 100 mm
Overall dimensions	170 mm x 120 mm x 3 mm
Leakage and contamination test	The amount of the removable activity does not exceed 10 Bq. (Wipe test according to ISO 9978, no. 5.3.1)
Wipe test passed on	13 May 2013
Construction	Tc-99 is incorporated into the surface of an anodized aluminium foil of 0.3 mm thickness. The thickness of the activated layer is approximately 6 μm . The activated foil is mounted into a holder.
Measuring method	The activity was determined by comparison with a reference source of the same construction. The beta surface emission rate was measured using a windowless proportional counter.
Traceability	Additional to the direct traceability to the PTB through the DAkKS this product complies with the requirements for traceability to NIST specified in the American National Standard "Traceability of Radioactive Sources to the NIST and Associated Instrument Quality Control (ANSI N42.22-1995)". As a requirement of the ANSI N42.22-1995 Eckert & Ziegler Nuclitec GmbH participates in the NRMAP/NIST Measurements Assurance Program of the Nuclear Power Industry.
Uncertainty	The relative uncertainty of the activity is 5 %, the relative uncertainty of the beta surface emission rate is 3 %. The reported uncertainty, determined according to the DAkKS-DKD-3 report is based on the standard uncertainty multiplied by a coverage factor of $k = 2$, providing a level of confidence of 95 %. (Ref. NIST Technical Note 1297/"Guide to the Expression of Uncertainty in Measurement" ISO Guide, 1995)
Radioactive impurities	Related to Tc-99 (equal 100 %) the following radioactive impurities were detected: none
Quality assurance system	The quality assurance system of Eckert & Ziegler Nuclitec GmbH was certified by Lloyd's Register Quality Assurance (LRQA) according to ISO 9001, issue 2008. Isotrak products meet the requirements of 10CFR50 Appendix B in the USA.
Uniformity	The uniformity of the surface emission rate is better than 10 %.
Remark	This is an EZN Class 2 reference source. Ref: PO#3950/SO#32561, End User Ref: PO#13-0185

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Kalibrierzeichen
Calibration mark

026288
D-K- 15203-01-00
2013-07

Strahler Nr. / Source number AC-2446

Gegenstand
Object **Alpha Wide Area Reference Source**

Hersteller
Manufacturer **Eckert & Ziegler Nuclitec GmbH**

Typ
Type **TZR86470**

Strahler-Nr.
Source number **AC-2446**

Auftraggeber
Customer **Eckert & Ziegler Analytics
Atlanta, GA 30318
United States of America**

Auftragsnummer
Order No. **CO00155161**

Anzahl der Seiten des Kalibrierscheines
Number of pages of the certificate **2**

Datum der Kalibrierung
Date of calibration **25 July 2013**

Dieser Kalibrierschein dokumentiert die Rückführung auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI).

Die DAkkS ist Unterzeichner der multilateralen Übereinkommen der European co-operation for Accreditation (EA) und der International Laboratory Accreditation Cooperation (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine.

Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

This calibration certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI).

The DAkkS is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates.

The user is obliged to have the object recalibrated at appropriate intervals.

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Datum
Date

Leiter des Kalibrierlaboratoriums
Head of the calibration laboratory

Bearbeiter
Person in charge

30 July 2013

Dr. Thieme

Schueler

026288
D-K- 15203-01-00
2013-07

Alpha Wide Area Reference Source

Source no.	AC-2446
Drawing	VZ-628-001
Nuclide	Thorium-230
Activity	2.21 kBq
Alpha surface emission rate	$1.08E03 \text{ s}^{-1}$ in 2π steradian
Reference date	25 July 2013 at 12:00 UTC
Dimensions of active surface	150 mm x 100 mm
Overall dimensions	150 mm x 120 mm x 3 mm
Leakage and contamination test	The amount of the removable activity does not exceed 10 Bq. (Wipe test according to ISO 9978, no. 5.3.1)
Wipe test passed on	30 July 2013
Construction	Th-230 is incorporated into the surface of an anodized aluminium foil of 0.3 mm thickness. The thickness of the activated layer is approximately 6 μm . The activated foil is mounted into a holder.
Measuring method	The activity was determined by comparison with a reference source of the same construction. The alpha surface emission rate was measured using a windowless proportional counter.
Traceability	Additional to the direct traceability to the PTB through the DAkKS this product complies with the requirements for traceability to NIST specified in the American National Standard "Traceability of Radioactive Sources to the NIST and Associated Instrument Quality Control (ANSI N42.22-1995)". As a requirement of the ANSI N42.22-1995 Eckert & Ziegler Nuclitec GmbH participates in the NRMAP/NIST Measurements Assurance Program of the Nuclear Power Industry.
Uncertainty	The relative uncertainty of the activity is 3 %, the relative uncertainty of the alpha surface emission rate is 3 %. The reported uncertainty, determined according to the DAkKS-DKD-3 report is based on the standard uncertainty multiplied by a coverage factor of $k = 2$, providing a level of confidence of 95 %. (Ref. NIST Technical Note 1297/"Guide to the Expression of Uncertainty in Measurement" ISO Guide, 1995)
Radioactive impurities	Related to Th-230 (equal 100 %) the following radioactive impurities were detected: none
Quality assurance system	The quality assurance system of Eckert & Ziegler Nuclitec GmbH was certified by Lloyd's Register Quality Assurance (LRQA) according to ISO 9001, issue 2008. Isotrak products meet the requirements of 10CFR50 Appendix B in the USA.
Uniformity	The uniformity of the surface emission rate is better than 10 %.
Remark	This is an EZN Class 2 reference source. Ref: PO#3950/SO#32561, End User Ref: PO#13-0185