



SLOVENSKI STANDARD

SIST EN 60405:2008

01-februar-2008

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Nuclear instrumentation - Constructional requirements and classification of radiometric gauges

Strahlungsmessgeräte - Konstruktionsanforderungen und Klassifikation radiometrischer Einrichtungen

iTeh STANDARD PREVIEW
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Instrumentation nucléaire - Prescriptions de construction et classification pour les jauges de mesure des rayonnements ionisants

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Ta slovenski standard je istoveten z: EN 60405:2007

ICS:

27.120.01 Jedrska energija na splošno Nuclear energy in general

SIST EN 60405:2008

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**Nuclear instrumentation -
Constructional requirements and classification of radiometric gauges
(IEC 60405:2003, modified)**

Instrumentation nucléaire -
Prescriptions de construction
et classification pour les jauges
de mesure des rayonnements ionisants
(CEI 60405:2003, modifiée)

Strahlungsmessgeräte -
Konstruktionsanforderungen
und Klassifikation radiometrischer
Einrichtungen
(IEC 60405:2003, modifiziert)

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This European Standard was approved by CENELEC on 2007-07-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of the International Standard IEC 60405:2003, prepared by IEC TC 45, Nuclear instrumentation, together with common modifications prepared by CENELEC BTTF 111-3, Nuclear instrumentation and radiation protection instrumentation, was submitted to the formal vote and was approved by CENELEC as EN 60405 on 2007-07-01.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2008-07-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2010-07-01

Clauses, subclauses, notes, tables and figures which are additional to those in IEC 60405:2003 are prefixed “Z”.

Annexes ZA and ZB have been added by CENELEC.

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Endorsement notice

The text of the International Standard IEC 60405:2003 was approved by CENELEC as a European Standard with agreed common modifications as given below.

COMMON MODIFICATIONS

Delete the clause INTRODUCTION in total.

Replace “radiation protection class” with “shielding class” all over the document.

1 Scope and object

In the last sentence of the last paragraph, **replace** “special attention is attached” with “special attention may be attached”.

2 Normative references

Add:

EN 60846:2004, *Radiation protection instrumentation – Ambient and/or directional dose equivalent (rate) meters and/or monitors for beta, X and gamma radiation* (IEC 60846:2002, modified)

EN 61005:2004, *Radiation protection instrumentation – Neutron ambient dose equivalent (rate) meters* (IEC 61005:2003, modified)

Delete the indications of IEC 61326:2002 and ISO 7205:1986.

3 Definitions

3.4 source holder [https://standards.iteh.ai/catalog/standards/sist/02608173-b2d3-4671-](https://standards.iteh.ai/catalog/standards/sist/02608173-b2d3-4671-ba45-efc3f195fca8/sist-en-60405-2008)

Replace “support and contain” with “support and fix”.

Add a note below the definition, reading:

NOTE Z1 In the context of this standard the term source holder means the part of the device which fixes or holds the source. This can be e.g. the shutter or a part of the housing.

3.6 source housing

Add a note below the definition, reading:

NOTE Z1 If the source housing is not part of a measuring head the term source container shall be used (see definition 3.Z1).

3.9 collimation device

Delete “useful”.

Add a note below the definition, reading:

NOTE Z1 This term is usually applied to collimators used in combination with detectors.

Add an additional definition 3.Z1, reading:

3.Z1

source container

device which includes the radioactive source, its holder and primary shielding measure and shutter mechanism, if any

NOTE Z1 The term usually means stand alone source container.

4 Classification of radiometric gauge types

Add an additional Subclause 4.Z1 below 4.2, reading:

4.Z1 Category C: Source containers for fixed radiometric gauges

Category C comprises stand alone source containers for radiometric gauges equipped with a shielding and properties for collimation of the useful beam.

The source container shall be designed in such a way that the radiation, except for the useful beam, is attenuated in conformity with the requirements of this standard.

NOTE Z1 Such source containers are used in fixed level or density gauging systems in which the source holder and the detector are independent units and the useful beam is not restricted by the detector but by additional radiation protection measures.

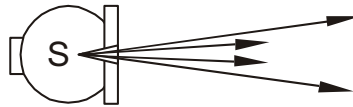


Figure Z1 – Category C stand alone source container for fixed level or density gauges

4.3 Radiation protection classes

In Table 1, **replace** all entries for shielding classes 1 and 7 with “Not to be applied”.

In Table 1, **add** for shielding class 6 in the first line of 5 cm distance “> 3,0 $\mu\text{Sv/h}$ ” and in the first line of 100 cm distance “> 1,0 $\mu\text{Sv/h}$ ”.

In Table 1, **add** a new column for class “E” with “ $\leq 3,0 \mu\text{Sv/h}$ ” in the line of 5 cm distance and “ $\leq 1,0 \mu\text{Sv/h}$ ” in the line of 100 cm distance.

Add the following notes below Table 1:

NOTE Z1 The values given in Table 1 are NOT related to limits required in European or national regulations for radiation protection. Those limits may require additional measures on site and have to be verified in the specific application.

NOTE Z2 Referring to 10.1 to each gauge four shielding classes are assigned. Two for “shutter closed” at 5 cm and 100 cm respectively, and two for “shutter open” at 5 cm and 100 cm respectively.

NOTE Z3 The dose equivalent rate can be measured in terms of \dot{H} (10) and/or \dot{H}' (0,07), see 8.4.

4.4 Temperature class

Replace “Temperature class” with “Temperature classes” in the headline of 4.4.

In Table 2, **replace** all entries for temperature class 1 with “Not to be applied”.

In Table 2, **replace** all entries for temperature class 7 with “Other values”.

Add the following paragraph below Table 2:

If the temperature class corresponding to the testing range of an incorporated source (e.g. according to ISO 2919) is lower than that of the source housing the temperature class of the source only shall be used.

5 General requirements

5.2 Source holder

In a), **replace** “installation” with “installation and de-installation”.

5.4 Alignment of the useful beam

In the first paragraph, **replace** “collimation device” with “collimating properties” and “restricts” with “restrict”.

In the second paragraph, **replace** “Category B” with “Category B and C” and “source holder” with “source container or the source housing”.

5.5 Other requirements

Delete the preultimate sentence of the last paragraph.

6 Protection against ionizing radiation

6.1 General requirements

Add the following paragraphs below the current text:

Following the ALARA principle in position "shutter closed" of the gauge the shielding class should be E or 6.

Radiation profiles of gauges may be influenced by the individual application on site and may require additional measurement after installation (see Annex ZA).

6.2 Requirements for Category A gauges

Begin the last paragraph with “If the shutter of the device is remote-controlled or servo-controlled, any failure of the control circuits ...”

6.3 Requirements for Category B gauges

Replace the second paragraph with:

The shielding housing shall ensure that the dose equivalent rate for the respective shielding class is adhered to in accordance with 4.3 and this class shall be used for "shutter closed" indication in the classification according to 10.1.

Add an additional Subclause 6.Z1 below 6.3, reading:

6.Z1 Requirements for Category C source containers

The source container shall ensure that the dose equivalent rate for the respective shielding class is adhered to in accordance with 4.3.

The source container shall be equipped with shutters for interrupting the useful beam.

If the shutter of the device is remote-controlled or servo-controlled any failure of the control circuits (e.g. failure of power supply) shall automatically close the shutter. After elimination of the fault, the shutter shall not automatically open until the system is intentionally returned to its normal operating mode.

The shielding housing shall include a safety lock in order to prevent unauthorized access to the source.

6.4 Resistance of the source housing in case of fire

Replace the whole text of 6.4 with:

A source housing and its shielding device, if any, intended to withstand a case of fire shall be constructed in such a way that the dose equivalent rate does not exceed the values of national regulatory limits for a fire reaching an ambient temperature of 800 °C for 30 min. The radioactive source shall remain shielded.

If the requirements of 9.3 are met, "F" shall be indicated for the fire test condition within the classification code of 10.1.

If the conditions above are not met or no test is performed, "N" shall be stated for the fire test condition.

7 Other safety devices

7.2 Protection against non-authorized use

Replace "prevent being used" with "prevent use".

7.3 Indication of the shutter position

In the last sentence, **replace** "upon a failure" with "upon a technical failure".

7.4 Additional warning devices

Delete "the user or" in the last sentence of the first paragraph.

8 Determination of the dose equivalent rate

8.1 General [https://standards.iteh.ai/catalog/standards/sist/02608173-b2d3-4671-](https://standards.iteh.ai/catalog/standards/sist/02608173-b2d3-4671-b45-af3f195fa8/sist-en-60405-2008)

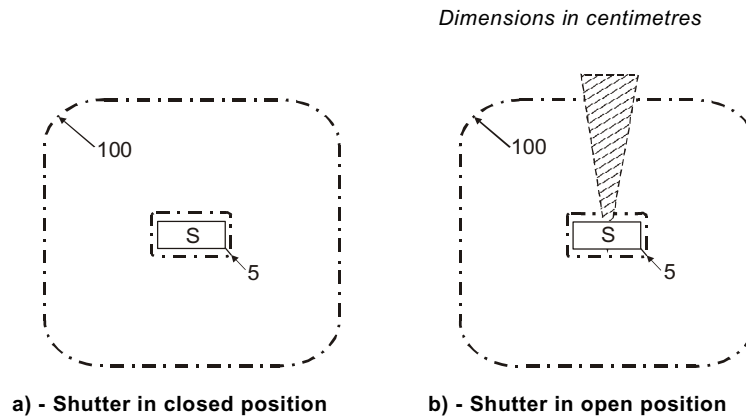
In the first paragraph, **delete** "or can be calculated".

In the second paragraph, **add** at the end of the first sentence "or of the stand alone source container (see Figure Z2)" and **replace** the last sentence with "For non-uniform fields, the dose rate should be averaged over an area of 10 cm²."

Add a note to Figure 4, reading:

NOTE Z1 The container depicted in Figure 4 a) may also be an other appliance for storing or carrying medium, for example a conveyor belt in case of a bulk flow measurement.

Add an additional Figure Z2 below Figure 4, reading:



Key

S source container

NOTE Z2 No measurements are made within the shaded area.

Figure Z2 – Schematic representation of isodistance gauging faces in the case of stand alone source containers

8.2 Dose equivalent rate measurements in the case of closed shutters

Add the following paragraph below the current text:

In this case the values in the center between source housing and detector housing shall be taken as practicable and documented for information.

8.4 Procedure for dose equivalent rate measurements

Replace the whole text of 8.4 with:

Appropriate measuring instruments according to EN 60846 (photon and beta radiation) or EN 61005 (neutron radiation) shall be used for measuring the dose equivalent rate:

- a) in every case the measuring quantity shall be the ambient dose equivalent rate \dot{H} (10) ;
- b) in the case of low energy (gamma sources) and beta sources an additional measurement with the measuring quantity directional dose equivalent rate $\dot{H}'(0,07)$ shall be undertaken.

For neutron radiation for the distance of 5 cm calculation back from the measurement at 1 m is permitted.

8.5 Determining the relevant values of the dose equivalent rate

Replace the whole text of 8.5 with:

For calculation of the relevant values of the dose equivalent rates for shielding classification according to Table 1, values in terms of \dot{H} (10) for penetrating radiation are to be used. Values in terms of $\dot{H}'(0,07)$ shall be divided by ten before applying Table 1 for classification.

Where both \dot{H} (10) and $\dot{H}'(0,07)$ are relevant the lowest class of the different measuring quantities shall be used for classification of the entire gauge.

9 Test methods

9.1 General

Replace the first paragraph with:

Where proof of the properties required cannot be verified by the prototype tests specified in 9.2 through 9.4 this proof shall be determined by other means (e.g. calculations and evaluation of the material characteristics).

9.2 Temperature cycle test on the shutters and the source holder

9.2.2 Procedure

In the first paragraph, **replace** “can be determined” with “shall be determined”.

In the last paragraph, **replace** the last sentence with “The values shall not be different from the original values by more than that which could be expected from statistical variation.”

9.3 Test for checking the resistance of the shutter and the source holder in case of fire

Replace the headline of 9.3 with “**Test for checking the resistance of the shutter, the source holder and the source container in case of fire**”.

9.3.2 Procedure

Replace the second paragraph with:

The source housing is introduced into a furnace preheated to at least 800 °C and heated until equilibrium is achieved and then maintained at at least 800 °C for at least 30 min.

Replace the last paragraph with:

If the source has moved (e.g. due to the melting of the shielding material) the dose equivalent rates that would occur in the case of a real source shall be determined. The dose equivalent rates derived shall not exceed the limit values in accordance with 6.4 where that source would be in the most critical place for maximum dose rate.

10 System classification coding and labelling

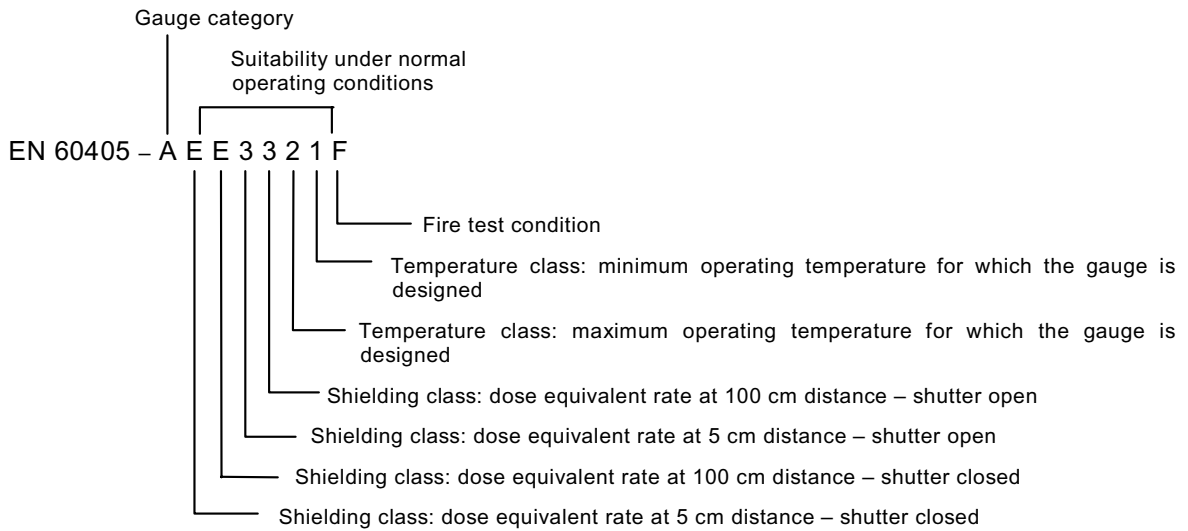
10.1 Classification code

In the first paragraph, **replace** “radiometric gauge” with “radiometric gauge or source container” and “international standard designator IEC 60405” with “standard designator EN 60405”.

Add a note below the first paragraph, reading:

NOTE Z1 The classification code may depend on the source characteristics (e.g. activity, temperature range, radionuclide, encapsulation, accident conditions).

Replace the shown example for the classification code with:



11 Accompanying documents

Replace item b) with

- b) the information on labelling given in Clause 10 and an application that the classification is in accordance with the provisions given EN 60405;

Add a note below item c), reading:

NOTE Z1 In some cases it may be necessary to describe the basis of the dose rate calculation.

Replace item g) with

- g) certificate related to the leakage of radioactive material from the source;

In item h), replace “is to be performed” with “are to be performed”.

Add the following new items k), l), m) and n):

- k) in case of shielding class 2 (see Table 1) indication of the respective dose rate value(s);
- l) in case of temperature class 7 (see Table 2) indication of the respective temperature(s);
- m) instructions for appropriate radiation protection measures;
- n) value according to 8.2 if the measuring gap is below 10 cm for information.

Additional Annex ZA

Add additional Annex ZA, reading:

Annex ZA
(informative)**Guideline for installation of radiometric gauges**

This guideline is intended to give examples of aspects which may be required to be considered in design, operation or servicing of gauging systems.

It is recommended to undertake a radiation protection risk analysis before installation and to verify the protective measures by measurements before operational use.

- 1) Due to the purpose of shielding penetrating radiation (e.g. gamma radiation) the source container or auxiliary screening measures may have a considerable weight that can easily exceed several 100 kg. This shall be taken into consideration when planning
 - mounting brackets or consoles;
 - installation, e.g. with cranes;
 - access to the source container for service purposes.
- 2) For reduction of the possible dose exposure, the useful beam shall not be directed towards places of high foot traffic. Besides that, the dose equivalent rate at the detector side has to be considered as well as the dose equivalent rate at the source container.

While reduction of the dose equivalent rate at the source container is simply possible by slightly increasing the distance (inverse square law), this is unlikely to apply to the detector side because the distance to the source is already considerable. Also the dose equivalent rate at the detector has to be considered under worst conditions (e.g. empty vessel).
- 3) Access to the useful beam between source container and e.g. vessel at least in case of Category A or C gauges shall be restricted.
- 4) Figure ZA.1 gives examples of protection principles which may be required to be considered in design or operation of gauging systems.