



BSI Standards Publication

Radiation protection instrumentation — Installed personnel surface contamination monitors

National foreword

This British Standard is the UK implementation of EN IEC 61098:2024. It is identical to IEC 61098:2023. It supersedes BS EN 61098:2007, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee NCE/2, Radiation protection and measurement.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Date	Text affected
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English Version

Radiation protection instrumentation - Installed personnel
surface contamination monitors
(IEC 61098:2023)

Instrumentation pour la radioprotection - Moniteurs fixes
pour la surveillance de la contamination de surface du
personnel
(IEC 61098:2023)

Strahlenschutz-Messgeräte - Fest installierte
Personenkontaminationsmonitore
(IEC 61098:2023)

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Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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European foreword

This document (EN IEC 61098:2024) consists of the text of IEC 61098:2023 prepared by IEC/SC 45B "Radiation protection instrumentation" of IEC/TC 45 "Nuclear instrumentation".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2025-01-22
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2027-01-22

This document supersedes EN 61098:2007 and all of its amendments and corrigenda (if any).

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In the official version, for Bibliography, the following note has to be added for the standard indicated:

ISO 11929 (series) NOTE Approved as EN ISO 11929 (series)

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-395	-	International Electrotechnical Vocabulary - Part 395: Nuclear instrumentation: Physical phenomena, basic concepts, instruments, systems, equipment and detectors	-	-
IEC 61000-4-2	-	Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test	EN 61000-4-2	-
IEC 61000-4-3	-	Electromagnetic compatibility (EMC) - Part 4-3 : Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test	EN IEC 61000-4-3	-
IEC 61000-4-5	-	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test	EN 61000-4-5	-
IEC 61000-4-6	-	Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields	-	-
IEC 61000-4-8	-	Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test	EN 61000-4-8	-
IEC 61000-4-12	-	Electromagnetic Compatibility (EMC) - Part 4-12: Testing and measurement techniques - Ring wave immunity test	EN 61000-4-12	-
IEC 62706	-	Radiation protection instrumentation - Environmental, electromagnetic and mechanical performance requirements	-	-
ISO 8769	2020	Measurement of radioactivity - Alpha-, beta- and photon emitting radionuclides - Reference measurement standard specifications for the calibration of surface contamination monitor	EN ISO 8769	2022

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

RADIATION PROTECTION INSTRUMENTATION – INSTALLED PERSONNEL SURFACE CONTAMINATION MONITORS

FOREWORD

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IEC 61098 has been prepared by subcommittee 45B: Radiation protection instrumentation, of IEC technical committee 45: Nuclear instrumentation. It is an International Standard.

This third edition cancels and replaces the second edition published in 2003. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Title is modified.
- b) As an alternative of small area sources, area sources are added to be used for methods of test with respect to the variation of response with source position, effective instrument efficiency, detection limit (DL), and variation of response with energy.
- c) Detection limit (DL) complies with the ISO 11929 series.
- d) Descriptions of influence quantities of type F and type S are added.
- e) Consistency with IEC 62706 is promoted for environmental requirements, mechanical requirements, electromagnetic compatibility and methods of test.
- f) Descriptions of overhead detectors are added.

- g) Descriptions of friskers are added with respect to the hand and foot monitoring.
- h) Figures are made easier to understand the relation between the detector position and the response, and the positional relation between the detector surface and the source.

The text of this International Standard is based on the following documents:

Draft	Report on voting
45B/1020/FDIS	45B/1026/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1, ISO/IEC Directives and IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended

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RADIATION PROTECTION INSTRUMENTATION – INSTALLED PERSONNEL SURFACE CONTAMINATION MONITORS

1 Scope

This document applies to contamination monitors that include warning assemblies and meters used for the monitoring of radioactive contamination on the surface of personnel whether they be clothed or not. The document is applicable only to that type of equipment where the user stays at the monitor. It is not applicable to the user passes quickly through the monitor. It is also not applicable to any peripheral equipment which can be associated with a particular type of equipment such as small article monitors. Probes (friskers) for measuring clothes or body by the person under monitoring or someone else are included in this document. The probes (friskers) are always connected to the monitor.

This document is applicable to the monitoring of the whole body (including the head), hands and feet, but parts of this document can be used for monitors designed for the monitoring of radioactive contamination on the hands and/or feet only. This document does not include tritium measurement.

This document is applicable to:

- installed personnel monitor (all clauses applicable);
- transportable personnel monitor (all clauses applicable);
- monitor for monitoring the hands (see the following clauses and subclauses: 2, 3, 4, 5, 6, 7.1.3, 7.2, 7.3.4, 7.4.2.2 b), 7.4.3, 7.4.4.1, 7.4.4.2, 7.4.4.3 b), 7.5, 7.6, 7.7, 8, 9, 10, 11, 12, 13 and 14);
- monitor for monitoring the feet (see the following clauses and subclauses: 2, 3, 4, 5, 6, 7.1.4, 7.2, 7.3.5, 7.4.2.2 c), 7.4.3, 7.4.4.1, 7.4.4.2, 7.4.4.3 c), 7.5, 7.6, 7.7, 8, 9, 10, 11, 12, 13 and 14); and
- monitor for monitoring the hands and feet (including probe (frisker) for whole body measurement) (see the following clauses and subclauses: 2, 3, 4, 5, 6, 7.1.3, 7.1.4, 7.1.5, 7.2, 7.3.4, 7.3.5, 7.3.6, 7.4.2.2 b), 7.4.2.2 c), 7.4.2.2 d), 7.4.3, 7.4.4.1, 7.4.4.2, 7.4.4.3 b), 7.4.4.3 c), 7.4.4.3 d), 7.5, 7.6, 7.7, 8, 9, 10, 11, 12, 13 and 14).

The object of this document is to define mechanical and operational characteristics, minimum performance characteristics and general test procedures for personnel monitors.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-395, *International Electrotechnical Vocabulary (IEV) – Part 395: Nuclear instrumentation – Physical phenomena, basic concepts, instruments, systems, equipment and detectors*, available at www.electropedia.org

IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electronic discharge immunity test*.

IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*.

IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measuring techniques – Power frequency magnetic field immunity test*

IEC 61000-4-12, *Electromagnetic compatibility (EMC) – Part 4-12: Testing and measuring techniques – Ring wave immunity test*

IEC 62706, *Radiation protection instrumentation – Recommended climatic, electromagnetic and mechanical performance requirements and methods of tests*

ISO 8769:2020, *Measurement of radioactivity – Alpha-, beta- and photon emitting radionuclides – Reference measurement standard specifications for the calibration of surface contamination monitors*

3 Terms, definitions, units and symbols

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions, as well as those given in IEC 60050-395 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1.1

surface emission rate

<of a source> number of particles or photons of a given type above a given energy emerging from the face of the source or its window per time in a mass-free environment

[SOURCE: ISO 8769:2020, 3.1, modified – Word "second" replaced with "time" in the definition.]

3.1.2

source efficiency

ε_s

ratio between the number of particles of a given type above a given energy emerging from the face of the source or its window per unit time (surface emission rate) and the number of particles of the same type created or released within the source (for a thin source) or its saturation layer thickness (for a thick source) per unit time

3.1.3

small area source

source whose active surface area has a maximum linear dimension not exceeding 2,5 cm

3.1.4

surface emission rate response

<instrument efficiency> under stated conditions specified by the manufacturer (sensitive area of the detector, active area of the source and the distance between source and detector), ratio of the number of detected particles (for instance counts per unit time, corrected for background) to the number of particles of the same type emitted by the radiation source in the same interval of time (conventionally true surface emission rate)

3.1.5

sensitive area of the detector

area of the detector, defined by the manufacturer, where the efficiency for a small area source is greater than 50 % of the maximum efficiency

3.1.6

total equivalent thickness

thickness, generally expressed in mass per unit area, that a particle (alpha or beta) emitted normally from the contaminated surface crosses in order to reach the sensitive volume of the detector

Note 1 to entry: This thickness includes the distance in the air plus the detector window thickness and, sometimes, the thickness of any screen fitted over the detector window which protects it from contamination.

3.1.7

effective range of measurement

absolute value of the difference between the two limits of a nominal range

3.1.8

response

R

ratio of the indicated value of a monitor M_i to the conventional true value M_t

$$R = \frac{M_i}{M_t}$$

3.1.9

relative error of indication

I

quotient of the error of indication of a measured quantity $M_i - M_t$ by the conventional true value M_t of the quantity

Note 1 to entry: It may be expressed as a percentage.

$$I = \frac{M_i - M_t}{M_t} \times 100$$

3.1.10

relative intrinsic error

relative error of indication of an assembly with respect to a quantity when subjected to a specified reference radiation under specified reference conditions

3.1.11 coefficient of variation

V

ratio V of the standard deviation s to the value of the arithmetic mean $\bar{x}$ of a set of n measurements x_i given by the following formula:

$$V = \frac{s}{\bar{x}} = \frac{1}{\bar{x}} \sqrt{\frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2}$$

3.1.12 deviation

D

difference between the indicated values for the same value of the measured quantity, when made under reference conditions and when subject to an influence quantity

$$D = M_i - M_t$$

where

M_i is the indicated value of a monitor;

M_t is the conventional true value

Note 1 to entry: The deviation can be positive or negative resulting in an increase or a decrease of the indicated value, respectively.

Note 2 to entry: The deviation is of special importance for influence quantities of type S.

3.1.13 lower limit of effective range of measurement

A_0

minimum activity or activity concentration to be measured over which the performance of a monitor meets the requirement of its specifications

3.1.14 decision threshold

y^*

value of the estimator of the measurand, which, when exceeded by the result of an actual measurement using a given measurement procedure of a measurand quantifying a physical effect, is used to decide that the physical effect is present

Note 1 to entry: The decision threshold is defined such that in cases where the measurement result y exceeds the decision threshold y^* , the probability that the true value of the measurand is zero is less or equal to a chosen probability α .

Note 2 to entry: If the result y is below the decision threshold y^* , the result cannot be attributed to the physical effect; nevertheless, it cannot be concluded that it is absent.

[SOURCE: ISO 11929-1:2019, 3.12, modified – Notes to entry rephrased.]

3.1.15 detection limit

DL

$y^{\#}$

smallest true value of the measurand which ensures a specified probability of being detectable by the measurement procedure

Note 1 to entry: With the decision threshold according to 3.1.15, the detection limit is the smallest true value of the measurand for which the probability of wrongly deciding that the true value of the measurand is zero is equal to a specified value β when, in fact, the true value of the measurand is not zero.

[SOURCE: ISO 11929-1:2019, 3.13, modified – Last sentence of Note 1 to entry removed, and Note 2 to entry deleted.]

3.1.16 conventional true value

best estimate of the value of that quantity

Note 1 to entry: This is usually the value determined by, or traceable to, a secondary or primary standard or by a reference instrument which has been calibrated against a secondary or primary standard.

3.1.17 frisker

probes for whole body monitoring attached to hand and/or foot contamination monitors

3.1.18 influence quantity of type F

influence quantity whose effect on the indicated value is a change in response

Note 1 to entry: An example is radiation energy and angle of radiation incidence.

Note 2 to entry: "F" stands for factor: The indication due to radiation is multiplied by a factor due to the influence quantity.

3.1.19 influence quantity of type S

influence quantity whose effect on the indicated value is a deviation independent of the indicated value

Note 1 to entry: An example is the electromagnetic disturbance.

Note 2 to entry: All requirements for influence quantities of type S are given with respect to the value of the deviation D .

Note 3 to entry: "S" stands for sum. The indication is the sum of the indication due to radiation and due to the influence quantity.

3.1.20 ambient background

gamma radiation field in which the monitor is intended to operate which includes natural background and radiation due to radioactive sources and/or plants adjacent to the monitor

3.1.21 reference background

artificial background created to simulate the maximum ambient background for which the monitor is designed

Note 1 to entry: This background includes the naturally occurring background and additional radiation provided by a source of ^{137}Cs (or other radionuclide by agreement between the purchaser and manufacturer) placed at least 3 m from the detector of interest of the monitor under test.

3.1.22**uniformity of surface emission rate of sources**

uniformity of a surface in respect to the surface emission rate in relation to the average surface emission rate

Note 1 to entry: For further information on area radioactive sources, refer to ISO 8769.

3.1.23**monitoring channel**

system of assemblies or parts of assemblies enabling the signals from one or more detectors to show whether contamination is present or not on specific parts of the body, feet or hands

3.1.24**emission probability**

probability of the emission of the particle or photon of interest per disintegration

3.1.25**effective instrument efficiency**

E_{ff}

mean value of the instrument efficiency over the whole of the detector, used when the detection limit (DL) is determined

Note 1 to entry: In a case of using the detector for the body surface monitoring, the effective instrument efficiency is the mean value of the instrument efficiency distribution measured using a phantom.

3.1.26**qualification test**

sets of tests performed in order to verify that the requirements of a specification are fulfilled

3.1.27**type test**

conformity test made on one or more items representative of the production

Note 1 to entry: Type tests are qualification tests which are performed on one assembly or on a small number of assemblies considered to be representative of a standard production assembly, and which, in principle, are not repeated on each assembly.

[SOURCE: IEC 60050-151:2001, 151-16-16, modified – Note to entry added.]

3.1.28**routine test**

conformity test made on each individual item during or after manufacture

[SOURCE: IEC 60050-151:2001, 151-16-17]

3.1.29**acceptance test**

contractual test to prove to the customer that the item meets certain conditions of its specification

Note 1 to entry: Acceptance tests are, in general, selected from the qualification tests specified, but this selection is a contractual matter and does not form any part of this document.

[SOURCE: IEC 60050-151:2001, 151-16-23, modified – Note to entry added.]

3.2 Units

In this document, units of the International System (SI) are used¹. The definitions of radiation quantities are given in IEC 60050-395. The corresponding old units (non SI) are indicated in brackets.

Nevertheless, the following units may also be used:

- for energy: electron-volt (symbol: eV), $1 \text{ eV} = 1,602 \times 10^{-19} \text{ J}$; and
- for time: years (symbol: y), days (symbol: d), hours (symbol: h), minutes (symbol: min).

Multiples and submultiples of SI units are used, when practicable, according to the SI system.

¹ International Bureau of Weights and Measures: The International System of Units, 8th edition, 2006.

3.3 Symbols (see Table 1)

Table 1 – Symbols and abbreviate terms

Symbol	Meaning	Unit
α	probability of the error of the first kind	N/A
β	probability of the error of the second kind	N/A
A_0	lower limit of effective range of measurement	s^{-1}
D	deviation	s^{-1}
E_{ff}	effective instrument efficiency	N/A
I	relative error of indication	%
$k_{1-\alpha}$	quantile of the standardized normal distribution for the probability $1-\alpha$	N/A
$k_{1-\beta}$	quantile of the standardized normal distribution for the probability $1-\beta$	N/A
M_i	indicated value of a monitor	s^{-1}
M_t	conventional true value	s^{-1}
R	response	N/A
r_0	estimate of the background count rate	s^{-1}
r	counts per second average response	s^{-1}
r_x	difference of count rate between the detector for measurement and the detector for background	s^{-1}
s	standard deviation	s^{-1}
S_{DL}	detection limit (DL) of the surface emission rate	s^{-1}
t_g	measurement duration of the measurement of the gross effect	s
t_0	measurement duration of the measurement of the background effect	s
$\tilde{u}(0)$	uncertainty of the measurand when its true value equals zero	N/A
$\tilde{u}(y^{\#})$	uncertainty of the measurand when its true value equals $y^{\#}$	N/A
V	coefficient of variation	N/A
$\bar{x}$	value of the arithmetic mean of a set of n measurements	s^{-1}
x_i	value of i th measurement	s^{-1}
y^*	decision threshold of the measurand	s^{-1}
$y^{\#}$	detection limit of the measurand	s^{-1}
y	measurement result of the measurand	s^{-1}
ϕ	surface emission rate of the source in determining the response	N/A
ε_s	source efficiency	N/A

4 Classification of monitors

4.1 According to type of radiation to be measured

- Alpha contamination monitors
- Beta contamination monitors
- Gamma contamination monitors
- Alpha-Beta contamination monitors (where the alpha and beta contaminations are indicated separately)
- Beta-Gamma contamination monitors (where the beta and gamma contaminations are indicated together)
- Alpha-Beta-Gamma contamination monitors (where the alpha contamination is indicated separately, the beta and gamma contaminations are indicated together)

4.2 According to body surface being monitored

- For the monitoring of the whole body (including the head and the overhead)
- For the monitoring of hands only
- For the monitoring of feet only
- For the monitoring of both hands and feet

4.3 According to background compensation method

a) Subtraction of predetermined background

Monitors whose background compensation is achieved by measuring background with each detector constantly while measured persons are not using monitors.

b) Simultaneous subtraction of determined background

Monitors whose background compensation is achieved by having a number of detectors measuring the ambient background radiation simultaneously with the measurement of the contamination.

c) No background subtraction

Monitors without background subtraction.

5 Design characteristics

5.1 Positioning of the person being monitored

Sensors shall be included for alpha and beta monitoring to ensure that the feet, hands and body of the person being monitored are correctly positioned. The hands shall be open so that the palms and both sides of the fingers are properly monitored. Such sensors shall indicate to the person being monitored that he/she has positioned himself/herself correctly and remains in the correct position for the full monitoring period. Both audible and visual indication shall be given if the person being monitored moves from the correct position and the monitoring procedure shall cease until the correct position is regained. The monitoring time may either be the total time the person being monitored in the correct monitoring positions and monitoring is taking place or a single continuous monitoring time; in the latter case, the information collected prior to the person being monitored moving shall be ignored.

5.2 Size of the person being monitored

It is impossible to define dimensions of the detecting system and location of detectors in a standard because of the great variation between nations of the average size of persons.

However, the manufacturer shall state the relevant body size limits for which the monitor has been designed.

5.3 Hand monitoring facilities

The design shall be such that both hands shall be monitored with both sides of a hand being monitored simultaneously, or the design shall be such that both sides of both hands shall be monitored. The design shall be such that both hands shall be open to be monitored.

The hand detectors should touch both sides of the hands during measurement. The distance between the detector and hands shall be small to allow a reasonable measurement of the potential level of contamination required by regulations. As for sensitive area of the detector, it should be considered not to get contaminated, or to remove contamination easily.

The size of the sensitive area of the detector for each side of each hand shall be at least 12 cm × 20 cm if not otherwise agreed between manufacturer and user for existing monitor.

Protective materials and other grilles over the sensitive area of the detector shall not obscure more than 40 % of that sensitive area. This level of obscurity shall include any collimation effect at distances of up to 10 mm from the outer surface of the grille. In the un-observed area, the total density thickness of material between the sensitive volume of the detector and the outer edge of the protective grille shall not exceed 6 mg/cm² (2 mg/cm² for detectors intended to measure alpha or low energy beta contamination). Thicker material may be used by agreement between the manufacturer and user subject to conformity with the performance requirements of 7.4.

5.4 Foot monitoring facilities

The facilities should monitor each foot independently. Where a single detector is used, it shall have twice the area specified below.

The sensitive area of the detector for each foot shall be at least 15 cm × 30 cm.

Protective materials and other grilles over the sensitive area of each detector shall not obscure more than 60 % of that sensitive area. This level of obscurity shall include any collimation effect at distances of up to 10 mm from the outer surface of the grille. In the un-observed area, the total density thickness of material between the sensitive volume of the detector and the outer edge of the protective grille shall not exceed 6 mg/cm² (2 mg/cm² for detectors intended to measure alpha or low energy beta contamination). Where material is included between the feet and the detector to collect dirt from the feet, it shall be easily removable. Alternatively, it shall be possible to expose the detectors so that their sensitive area can be cleaned.

5.5 Body monitoring facilities

The detectors shall be arranged so that the whole of the body surface, including the head and the external surface of the outermost clothing is monitored.

The detectors should be arranged in one or more sets such that the response capability is the same for each detector of that set unless otherwise agreed between the manufacturer and user. The maximum height of the person for which monitor is designed shall be specified by the manufacturer.

5.6 Frisker

For monitor for monitoring the hands and feet only, frisker for monitoring whole body other than hands and feet may be attached to hand and/or foot contamination monitors.

The detection assembly shall normally have one frisker. The user shall be able to move the frisker over the area to be monitored. The length of a cable connecting the measurement assembly and the frisker shall be appropriate and the frisker shall be sufficiently light so that it can be handled with one hand.

5.7 Visual display

5.7.1 For the user

The monitor shall display prominently at least the following information:

- a) Instructions for the user, where audible instructions are not available;
- b) Indication of all positions where contamination is sufficient to operate the alarm trip on any measuring channel detected. For assemblies capable of monitoring two or more types of contamination, the display shall display distinguishing between them;
- c) Indication at the end of a cycle that no alarm trip has operated during the monitoring cycle;
- d) Monitor operational;
- e) Monitor faulty;
- f) Measurement proceeding; and
- g) Body, hands or feet correctly positioned.

5.7.2 For maintenance purposes

Followings are not necessarily visible to the user:

- a) Capability of displaying the counts or count-rate from any measuring channel and if available any related quantity, i.e. total contamination (Bq) or surface contamination (Bq/cm²);
- b) Flow-rate of the gas supply, if applicable;
- c) Alarm set points for each channel;
- d) Low level alarm settings;
- e) Measuring time;
- f) Background too high for correct operation;
- g) High tension (bias voltage); and
- h) Fault diagnosis.

5.8 Audible indicators

Audible indicators shall be clearly distinguishable from one another.

There shall be an audible signal at the end of the monitoring cycle if contamination above the alarm level is indicated.

An audible indication is desirable if, at the satisfactory completion of the monitoring cycle, no contamination is indicated.

There shall be an audible indication of an interrupted cycle.

5.9 Monitoring period

Contamination alarms shall only be given at the end of the monitoring period. There shall be an indication when the monitoring cycle is completed. An audible indication, visual indication or door opening can be used as an indication for this purpose. Other way of indication may be acceptable.

5.10 Ease of decontamination

The monitor shall be designed and constructed in such a manner as to minimise the risk of becoming contaminated in use and to facilitate decontamination.

5.11 Detectors used

The type of detector used will be determined by the manufacturer to meet the classification (Clause 4) and radiation characteristics (Clause 7) for which the monitor is designed.

Depending on the type of monitoring system, the monitor should use (but not limited to): gas flow detectors, GM counters, semiconductor detectors or plastic scintillation detectors.

Where gas flow detectors are used, all tests shall be undertaken with the gas flow rate equal to or just above the flow rate specified by the manufacturer for units using continuous flow. Where the flow is not continuous, the manufacturer shall be able to demonstrate that monitor will operate satisfactorily with a mean flow rate as specified by the manufacturer.

5.12 Seismic consideration

The monitor design, manufacture, and installation should ensure that the person being monitored will not be harmed when exposed to the maximum earthquake strength expected at the user location. Loss of measurement function is acceptable, but following consideration should be taken into account:

- prevent fall of overhead detectors not to harm the person being measured; and
- the doors can be easily open after the event to prevent confinement.

6 Performance requirements and test procedures

6.1 General test procedure

6.1.1 Nature of tests

Tests in this document are to be considered as type tests unless otherwise specified. In acceptance test, the tests of the effective instrument efficiency at the specific operating point (7.3.3) and alarm threshold (7.7) shall be performed, although test items may be extended by agreement between the manufacturer and purchaser. The stated requirements are minimum requirements and may be extended for any particular monitor or function.

Standard test conditions with allowable tolerances are defined in Table 3.

Testing does not necessarily need to be carried out on the whole monitor. Depending on the test item, it is acceptable to select and perform the necessary components.

Test procedures applicable to the assemblies listed in 4.2 are shown in Clause 7.

6.1.2 Tests performed under standard test conditions

Tests which are performed under standard test conditions are listed in Table 3 which indicates, for each characteristic, the limits of variation and the relevant subclause where the corresponding method of test is described.

6.1.3 Tests performed with variation of influence quantities

These tests are intended to determine the effects of variation in influence quantities, and are given in Table 5, with the range of variation of each influence quantity and limits of consequent variation in the effective alarm point.

The limits of variation of indication in Table 5 defines a nominal operating range within which the variation in indication shall remain within the limits stated by the manufacturer. These limits shall in no case exceed those laid down in Table 5.