
Components for containment enclosures —

Part 3:

Transfer systems such as plain doors, airlock chambers, double door transfer systems, leaktight connections for waste drums

Composants pour enceintes de confinement —

Partie 3: Systèmes de transfert tels que portes, sas, doubles portes de transfert étanche, connexions étanches pour fûts de déchets



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 11933-3 was prepared by Technical Committee ISO/TC 85, *Nuclear energy*, Subcommittee SC 2, *Radiation protection*.

ISO 11933 consists of the following parts, under the general title *Components for containment enclosures* :

- *Part 1: Glove/bag ports, bungs for glove/bag ports, enclosure rings and interchangeable units*
- *Part 2: Gloves, welded bags, gaiters for remote-handling tongs and for manipulators*
- *Part 3: Transfer systems such as plain doors, airlock chambers, double doors for leaktight transfer, leaktight connections for waste drums*
- *Part 4: Ventilation and air cleaning systems, such as filters, traps, pressure regulators, safety and control devices*
- *Part 5: Penetration for electrical and fluid circuits*

Annexes A and B of this part of ISO 11933 are for information only.

Introduction

A great number of components or systems used for achieving leaktight transfer functions in containment enclosures are presently offered on the market. These equipment or systems

- may have different geometrical dimensions;
- may differ by their design criteria;
- may require holes of different diameters to be installed on the containment enclosure wall;
- may be attached to the wall by different methods;
- may use different mounting techniques for their corresponding leaktightness.

These components or systems are generally not mutually compatible, but nevertheless often have the same performance level; therefore it was not possible to select only one system or component as the International Standard.

As a consequence, the aim of this part of ISO 11933 is to present general principles of design and operation, and to fully describe the most common systems or components in use in order to:

- avoid new parallel systems or components based on identical principles and differing only in details or geometric dimensions;
- make possible interchangeability between existing devices;
- demonstrate consistency among the various parts of the same system such as the basic elements (described in ISO 11933-1), the associated leaktight components (described in ISO 11993-2) or the transfer systems (described in this part of ISO 11933).

Components for containment enclosures —

Part 3:

Transfer systems such as plain doors, airlock chambers, double door transfer systems, leaktight connections for waste drums

1 Scope

This part of ISO 11933 specifies the designations and characteristics of the various transfer systems which can be mounted on containment enclosures either used alone or placed behind a shielding wall.

These transfer systems may also be used directly on shielding walls made of metal (carbon steel or stainless steel) or of concrete.

The systems covered by this part of ISO 11933 are

- plain doors,
- airlock chambers,
- double door transfer systems,
- leaktight connections for waste drums.

Some of these systems, such as plain doors, airlock chambers or double door transfer systems can be used in addition to components defined in ISO 11933-1 or ISO 11933-2 (glove/bag ports, bungs for glove/bag ports, support rings, welded bags, etc.).

Large size doors and airlock chambers, used for personnel or large equipment, are not within the scope of this part of ISO 11933.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 11933. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 11933 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 7212:1986, *Enclosures for protection against ionizing radiation — Lead shielding units for 50 mm and 100 mm thick walls.*

ISO 9404-1:1991, *Enclosures for protection against ionizing radiation — Lead shielding units for 150 mm, 200 mm and 250 mm thick walls — Part 1: Chevron units of 150 mm and 200 mm thickness.*

ISO 10648-1:1997, *Containment enclosures — Part 1: Design principles.*

ISO 10648-2:1994, *Containment enclosures — Part 2: Classification according to tightness and associated checking methods.*

ISO 11933-1:1997, *Components for containment enclosures — Part 1: Glove/bag ports, bungs for glove/bag ports, enclosure rings and interchangeable units.*

ISO 11933-2:1997, *Components for containment enclosures — Part 2: Gloves, welded bags, gaiters for remote-handling tongs and for manipulators.*

3 Definitions

For the purposes of this part of ISO 11933, the following definitions apply.

3.1

plain door

a device used to close an opening in a containment enclosure or in an airlock chamber. The plain doors may be leaktight and/or shielded

3.2

airlock chamber

an isolated volume used to introduce equipment or materials into a containment enclosure or to transfer such equipment or materials from a containment enclosure to another without breaking the leaktightness or the shielding of the enclosure. It constitutes a barrier against spread of contamination and/or introduction of external air pollution. Two types of airlock chambers are considered below

3.2.1

leaktight airlock chamber

this kind of airlock chamber is used to maintain or protect the purity of the atmosphere of the containment enclosure and/or to avoid the spread of contamination during transfer of materials or equipments

3.2.2

shielded airlock chamber

this kind of airlock chamber comprises shielded walls and doors, for use with shielded containment enclosures

3.3

double door transfer system

a system which allows the connection of a container to an enclosure in such a way that during the transfer and after the transfer, minimum contamination may occur on the external parts of the door of the enclosure and on the door of the container (for further details see clause 7)

3.4

leaktight connection for waste drums

a transfer system, based on the principle of the double door transfer system, used to transfer contaminated materials between a containment enclosure and a waste drum

NOTE In this system, the containment enclosure and the waste drum may or may not be shielded.

4 Designation

The designation of the transfer systems for containment enclosures consists of its name written in full, reference to this part of ISO 11933 and the reference number as explained in 4.1.

4.1 Explanation of the reference number

The reference number consists of a four digit number fixed by the Series Allocation shown in table 1. These series allocations are in accordance with other series allocations given in ISO 11933-1 and ISO 11933-2. This may be followed by one or several alphanumerical marks characterizing the mounting procedure and/or the material of construction. (See also tables 2 through 13.)

4.1.1 Series allocation

Series allocations corresponding to the component described in this part of ISO 11933 are given in table 1. The differentiation between the various types of components in the same family is explained in clauses 5, 6, 7 and 8.

Table 1 — Series allocation

Transfer system	Series	Clause
Plain doors		
— circular doors	1400 - 1419	5
— rectangular doors	1420 - 1439	5
Airlock chambers		
— introduction airlock chamber, with circular cross-section ¹⁾	1500 - 1519	6
— introduction airlock chambers, with rectangular cross-section ¹⁾	1520 - 1539	6
— enclosure linking or introduction airlock chambers, with circular cross-section ²⁾	1540 - 1559	6
— enclosure linking or introduction airlock chambers, with rectangular cross-section ²⁾	1560 - 1579	6
Double door transfer systems		
— type 1 ³⁾	1600 - 1619	7 / 7.2
— type 2 ³⁾	1620 - 1639	7 / 7.3
Leaktight connections for waste drums		
— type 1 ³⁾	1650 - 1659	8 / 8.3
— type 2 ³⁾	1660 - 1669	8 / 8.4
1) Simple introduction airlock chambers (with opening at one end). 2) Airlock chambers for linking an enclosure to another or for introduction (stiff simple or T shape). 3) For definition, see clauses 7 and 8.		

4.1.2 Alphabetical codes corresponding to the mounting procedures

The equipment can be mounted on the containment enclosure wall by different techniques.

The letter codes for the mounting procedure are the following:

- B for bonded types,
- W for welded types,
- T for threaded types.

4.1.3 Alphabetical codes corresponding to the construction materials

The equipment can be manufactured using different materials.

The letter codes for the material used are the following:

- M for polymethyl methacrylate (PMMA),
- V for polyvinyl chloride (PVC),
- X for stainless steel,
- O for carbon steel,
- A for light alloy,
- C for polycarbonate (PC),
- E for polyethylene (PE),

- P for polypropylene (PP),
- S for glass,
- Z for other materials.

In this part of ISO 11933, widely used materials will be designated by their standard abbreviations as listed above.

4.2 Designation — Examples and explanation

4.2.1 Plain doors

Designation example: ISO Plain door 1401 V m.

In the case of circular components, the last digit(s) of the reference numbers of the plain door is (are) the same as the last digit(s) of the reference numbers of the airlock chambers on which this door is intended to be mounted. These digits correspond to the useful diameter of the two systems: plain door and airlock chambers, according to the explanations given in clauses 5 and 6.

This (these) last digit(s) of the reference number may also correspond to the useful diameter of the equivalent glove/bag port receiving the corresponding circular plain door, as defined in ISO 11933-1. Such circular doors may also be called bungs, in accordance with ISO 11933-1.

The correlation between the reference numbers of circular plain doors and the useful diameters of glove/bag port receiving the plain doors is defined in the table 2.

Table 2 — Correlation between the reference numbers of plain doors and the useful diameters of ports receiving plain doors

Dimensions in millimetres									
Useful diameter of ports receiving the plain doors, <i>U</i>	156	180	186	200	249	254 ¹⁾	330	340	400
Reference number of plain door	1400	1401	1402	1403	1404	1405	1406	1407	1408
1) 254 mm = 10 in.									

In the case of rectangular components, the last digit of the reference number is correlated to the cross-section of the plain door (see clause 4). There is not necessarily a correlation between the last digits of reference numbers of rectangular plain doors and rectangular airlock-chambers of the same cross-section.

The alphabetical code indicates the following information.

The first code letter indicates the material of manufacture; in accordance with the explanations given in 4.1.3.

The second code letter indicates the way of locking the door:

- g for a door locked with an inflatable seal,
- m for a door locked with mechanical compression of the seal.

4.2.2 Airlock chambers

Designation example: ISO Airlock chambers 1522 W X s.

In the case of circular components, as explained in 4.2.1, the last digits of the reference numbers of the airlock chambers are the same as the reference numbers of the plain doors which are intended to be mounted on them (see also 4.2.1 and clause 5).

The last digit(s) correspond(s) to the useful diameter of the two related transfer components: airlock chamber and plain door, according to table 3.

Table 3 — Correlation between the reference numbers of plain doors/airlock chambers and the useful diameters of related transfer systems

Dimensions in millimetres

Useful diameter of transfer system, <i>U</i>	156	180	186	200	249	254	330	340	400	350
Reference number of plain door	1400	1401	1402	1403	1404	1405	1406	1407	1408	1413
Reference number of airlock chamber	1500 or 1540	1501 or 1541	1502 or 1542	1503 or 1543	1504 or 1544	1505 or 1545	1506 or 1546	1507 or 1547	1508 or 1548	1513 or 1553

In the case of rectangular components, the last digit(s) of the reference number is (are) correlated to the cross-section of the airlock chamber (see clause 5). There is not necessarily a correlation between the last digits of the reference numbers of rectangular airlock chambers and rectangular plain doors of the same cross-section.

The alphabetical code indicates the following information.

The first code letter indicates the mounting procedure on the containment wall, in accordance with 4.1.2.

The next code letter indicates the material of manufacture, in accordance with explanations given in 4.1.3.

The last code letter indicates the type of use:

- s for a simple airlock chamber,
- a for a ventilated airlock chamber,
- v for a vacuum airlock chamber.

4.2.3 Double door transfer systems

Designation example: ISO Double door transfer system 1602 X t.

The last digit of the reference number indicates:

- either the reference number of the associated shielding aperture brick (see ISO 7212),
- or the reference number of the associated enclosure ring (see ISO 11933-1),
- or an arbitrary chosen number, in other cases.

The alphabetical code indicates the following information.

The first code letter indicates the material of manufacture in accordance with the definitions given in 4.1.3.

The last code letter indicates the mode of locking or unlocking the double door transfer system:

- m for manual locking,
- t for remote locking.

4.2.4 Leaktight connections for waste drums

Designation example: ISO Leaktight connection for waste drums 1651 X O.

The last digit of the reference number corresponds to a useful diameter of the drum.

The alphabetical code indicates the following information.

The first code letter indicates the material of manufacturing of the double door transfer system used in accordance with the definitions given in 4.1.3.

The second code letter indicates the material of manufacturing the drum in accordance with the definitions given in 4.1.3.

5 Plain doors

5.1 General

5.1.1 Application

Equipment and/or material are transferred into or out of containment enclosures during normal or special operations through special apertures closed by plain doors (see figure 1).

Plain doors can also be mounted on airlock chambers (see clause 6).

The type of door and the way of mounting shall be chosen in accordance with

- the leaktightness requirements of the containment enclosure or the airlock chamber on which the door is intended to be mounted (see requirements in ISO 10648-2),
- the dimensions of the object to be transferred.

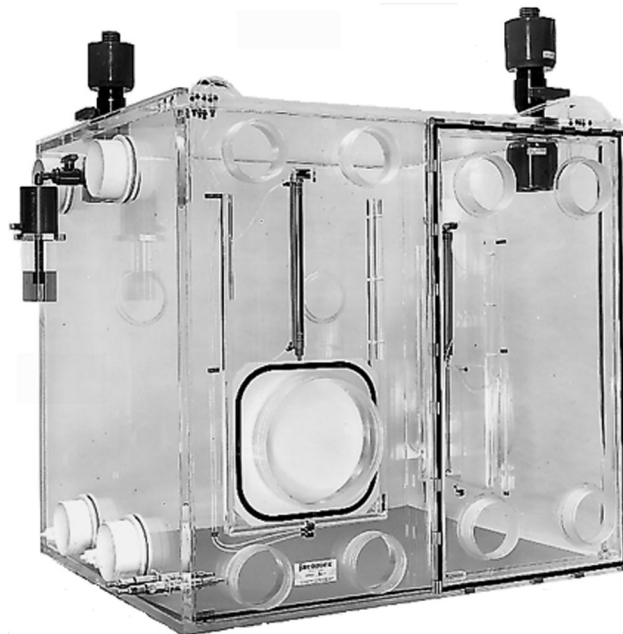


Figure 1 — Door for containment enclosures

5.1.2 Precautions for opening the doors

Plain doors are only allowed to be used for the transfer of non-contaminated equipment. Other type of systems (welded bags, double door transfer systems, etc.) should be used for contaminated objects.

The ventilation system of the containment enclosure shall be designed with respect to the size of the door. When the door is open, the direction and velocity of the air flow shall be inward to ensure no spread of possible contamination present in the enclosure or in the airlock chamber.

In designing plain doors, the following criteria shall be taken into account:

- simple and quick operation,
- size in accordance with the equipment to be introduced or removed,
- position providing ease of access to the equipment,
- profile and surface minimizing deposit of contamination and allowing ease of decontamination.

In the case of two motorized plain doors mounted on the inlet and outlet parts (that connected with the enclosure) of an airlock chamber, the two doors should be interlocked to prevent them from opening simultaneously [see figure 3 b)].

5.1.3 Choice of the leaktight system (way of locking)

5.1.3.1 Doors with an inflatable seal [see figure 2 a)]

These doors are generally made of PVC or metal (light alloy or stainless steel).

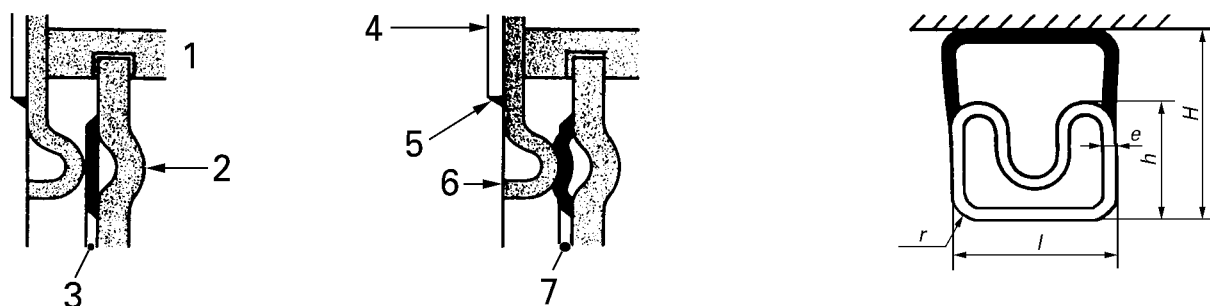
The seal may be inflated by pneumatic or hydraulic means, according to the safety requirements.

They need an external permanent source of pressure supply.

5.1.3.2 Doors with a mechanical compression of the seal [see figure 2 b)]

These doors are generally made of metal (stainless steel or light alloy). They are usually associated with metal or partially metal leaktight enclosures.

This kind of door presents the advantage of being simple and cheap.

**Key**

- 1 Groove
- 2 Door with inflatable seal
- 3 Deflated seal

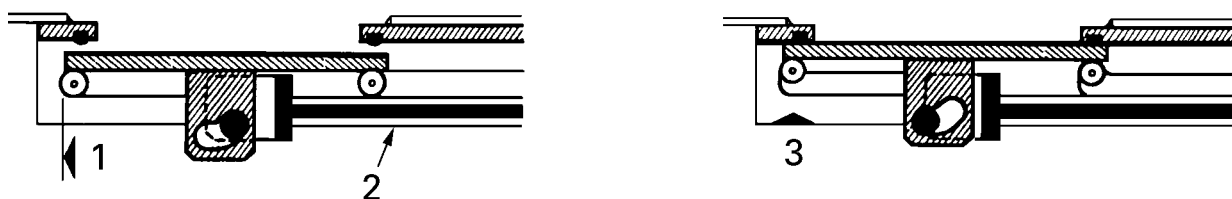
- 4 Leaktight wall
- 5 Weld
- 6 Padded door-frame
- 7 Inflated seal

Case 1: Seals allowing mounting by bounding in a rectangular casing

a) Inflatible seal

Unlocked door

Locked door

**Key**

- 1 Stop
- 2 Jack
- 3 Locking

b) Mechanical compression of the seal

Figure 2 — Examples of ways of locking the doors

5.2 Description

5.2.1 Shape

Plain doors may be square, circular or rectangular.

The choice is made according to the objects to be transferred and to the design of the enclosure wall.

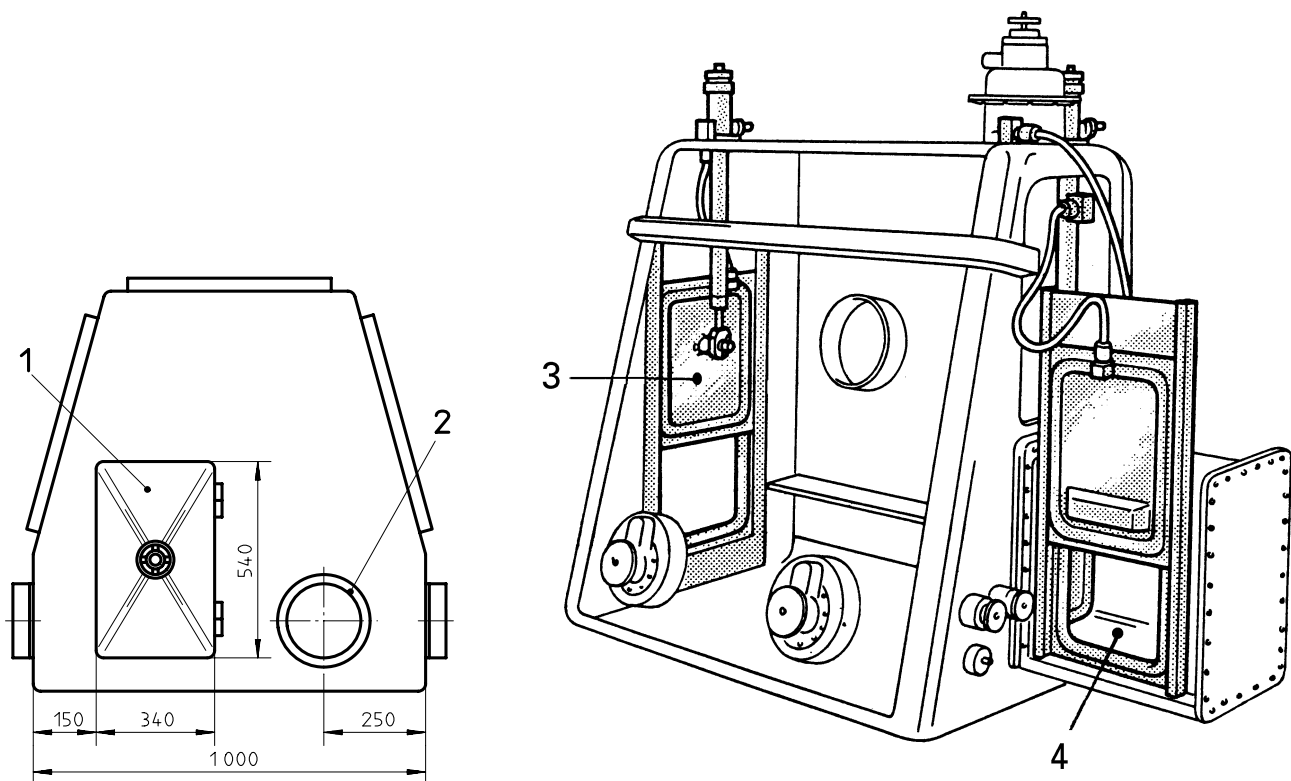
5.2.2 Assembly

Plain doors are generally mounted either on the lateral faces or on the back face of the enclosure wall [see figure 3 a)]. They are also used as closing elements for airlock chambers [see figure 3 b)].

Opening of doors can be provided in different ways:

- hinged doors [see figure 3 a)],
- sliding doors [see figure 3 b)],

Dimensions in millimetres

**Key**

- 1 Rectangular door
- 2 Glove / bag port

- 3 Door directly mounted on the face of the enclosure
- 4 Door used as the closing element of an interlock-chamber

a) Directly on the enclosure wall**b) Directly or as closing element of an airlock chamber****Figure 3 — Different ways of mounting the doors**

In the case of non-shielded containment enclosures, the doors may be mounted either on the transparent or on the non-transparent faces.

In the case of shielded containment enclosures, it is recommended to mount the doors on metal parts fully integrated to the enclosure structure.

The additional shielding material for gamma or neutron radiations may be either included as part of the door or added to it (see ISO 10648-1).

5.2.3 Materials

Plain doors may be made of metal (carbon steel, stainless steel, light alloy) or of plastic material (PVC, PMMA, PC). Generally, they are made of the same material as the enclosure wall on which they are intended to be mounted. The choice of plain door material also depends on

- the products handled in the enclosure,
- the toxicity of the atmosphere,
- the required leaktightness,
- the need to provide shielding or not,
- the ease of decontamination.