INTERNATIONAL STANDARD

ISO 11933-2

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Components for containment enclosures —

Part 2:
Gloves, welded bags, gaiters for remote-handling tongs and for manipulators

Composants pour enceintes de confinement —
Partie 2: Gants, sacs à souder, manches de protection pour pinces à distance et télémanipulateurs

Reference number
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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 11933-2 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 manipulators*

— *Part 3: Transfer systems such as plain doors, double doors for leaktight transfer, airlock chambers, leaktight connections for waste drums*

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

Introduction

A great number of leaktight mechanical components for containment enclosures are presently offered on the market. These components:

— may have different geometric dimensions;

— may require holes of different diameters for attachment on the containment enclosure wall;

— may be attached to this wall by different methods;

— may use different mounting systems for their associated leaktight elements, such as gloves, welded bags, bungs, transfer systems, etc.

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

As a consequence, the aim of this part of ISO 11933 is to present general principles of design and use, and to fully describe the different existing systems in order to:

— avoid new parallel systems based on identical principles and differing only in details or geometric dimensions;

— make possible interchangeability between existing equipment;

— demonstrate consistency among the various parts of the same system such as the basic elements (described in ISO 11933-1), the elements associated with leaktightness (described in ISO 11933-2), or the transfer systems (described in ISO 11933-3).

Components for containment enclosures —

Part 2:
Gloves, welded bags, gaiters for remote-handling tongs and for manipulators

1 Scope

This part of ISO 11933 specifies requirements for the selection, construction and use of the following leaktight components fitted on glove/bag ports and/or ejectable support rings used in containment enclosures and dealt with in ISO 11933-1:

— gloves,

— welded bags,

— gaiters for remote-handling tongs,

— manipulator gaiters.

Tong and manipulator gaiters are respectively the protection sleeves for remote-handling tongs and mechanical master-slave manipulators.

Equipment which differs from those listed in this part of ISO 11933 can be used, but their design criteria should respect those given in this document.

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 10648-1:1996, *Containment enclosures — Part 1: Design principles.*

ISO 10648-2:1994, *Containment enclosures — Part 2: Classification according to leak 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 11933-3:—[1], *Components for containment enclosures — Part 3: Transfer systems such as plain doors, double doors for leaktight transfer, airlock chambers, leaktight connections for waste drums.*

ISO 1043-1:—[1], *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics.*

EN 421, *Protective gloves against ionizing radiation and radioactive contamination.*

3 Definitions

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

3.1 glove (for glove boxes or containment enclosures): Glove of impermeable flexible material with a long cuff designed to obtain a leaktight fitting around or on the sides of a glove port or on any other component and providing at the same time satisfactory mechanical behaviour.

3.2 welded bag: Flexible component used to introduce pieces or materials into a glove box or into the containment enclosure or to remove them from the containment enclosure.

They are generally made of impermeable, flexible and weldable material, ending in a lip seal, a bead or thermally welded hem containing an O-ring.

3.3 tong or manipulator gaiter: Specially profiled flexible sleeve designed to protect the mechanical parts of remote-handling tongs or the arms of mechanical master-slave manipulators against contamination.

3.4 interchangeable elements: Parts of equipment for containment enclosures which may be exchanged one for another or replaced:

— either manually, by mounting, dismounting or substitution operations (for example screwed enclosure rings which may be replaced by screwed glove ports of the same diameter);

— or by remote-controlled operation and/or using an automatic or manual ejecting device (for example, support rings equipped with gloves, welded bags, tong or manipulator gaiters, bungs or rigid pugs, etc.).

These elements are designed so that their replacement one by another:

— does not reduce the containment enclosure tightness;

— and does not need any modification, by replacement or piercing, of the containment enclosure wall.

3.5 ejectable elements: Elements of containment enclosures which may be exchanged by remote-controlled operation, generally using an appropriate mechanical device, in which the new element takes the place of the old one by pushing it into the containment enclosure by a simple translatory motion.

This equipment is intended for enclosure rings such as: support rings equipped with gloves, welded bags, tong or manipulator gaiters, circular windows, rigid plugs, etc.

They are designed in such a way as to ensure that the leaktightness between the attached element on the enclosure wall (enclosure ring) and the mobile part (ejectable element) is never broken during the exchange operation.

These operations are fully described in this part of ISO 11933.

1) To be published.

4 Designation

The designation of a given component of a containment enclosure shall include the complete name of the component, reference to this part of ISO 11933 and a 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 11933-3. This may be followed by one or several alphanumeric marks characterizing the mounting procedure and/or the material of construction (see also tables 2 through 8).

Table 1 — Series allocation

Components for containment enclosures		Series	Subclause
Gloves	{for glove ports {for support rings	1300-1309 1310-1319	5/5.2 5/5.3
Welded bags	{for bag ports {for support rings	1320-1329 1330-1339	6/6.3 6/6.4
Tong gaiters	{for type 1 support rings {for type 2 support rings {for type 3 support rings	1340-1349 1350-1359 1360-1369	7/7.1 7/7.2 7/7.3
Manipulators gaiters		1)	8

1) Because of the numerous variations in length, type, etc., it is not possible to standardize the designation of manipulator gaiters.

The last digit of the reference number corresponds to the last digit of the glove/bag port or support ring onto which the leaktight component is intended to be mounted. Therefore the reference numbers of the two elements (component and glove/bag port or support ring) have the same correspondence to the internal nominal diameter of the glove/bag port or support ring, in accordance with the designation of these associated components (see definition in ISO 11933-1).

The alphanumeric codes are in accordance with the International Designation System (see ISO 1046).

4.1.1 Gloves

The first group of letters of the alphanumeric code indicates the material(s) of manufacture of the gloves, in accordance with standardized designations of plastics materials.

The designations for the most common glove materials are:

NR for natural rubber

CR for polychloroprene

CSM for chlorosulfonated polyethylene solution

IIR for (chloro- or bromo)-butyl (butyl)

FPM for copolymer of vinylidene fluoride and hexafluoropropylene

PU for polyurethane

PVC for polyvinyl chloride

EPDM for ethylene propylene EPM

NBR for nitrile rubber

EVA for polyethylene-vinyl acetate

PE for polyethylene

PP for polypropylene

XX for other materials

In this part of ISO 11933, the most commonly used materials will be designated by their standardized abbreviations as indicated above: PVC, PU, EVA, PE, etc.

Some materials may be combined with lead; in this case the designation includes the coding letter of the base material, followed by the letter **b** in bold typeface.

EXAMPLE

CR**b** (lead-loaded polychloroprene)

When gloves are manufactured with several layers (double-layer or triple-layer gloves) the designation includes coding letters corresponding of the association, separated by a "/".

EXAMPLES

CR/CSM: polychloroprene coated with chlorosulfonated polyethylene

CR/IIR/CR: polychloroprene/butyl/polychloroprene

CR/FPM: polychloroprene coated with fluorinated elastomer

CSM/CR**b**/FPM: lead-loaded polychloroprene coated on one side with chlorosulfonated polyethylene and on the other side with fluorinated elastomer

The following indicators refer to:

— the size of the glove (7, 8, 9 or 10),

— the length of the glove, expressed in millimetres (750, 800, etc.),

— the diameter of the bead, expressed in millimetres, preceded by the mark ∅.

NOTE — The association of the different materials (layers) depends on the techniques of manufacturing and/or on the working conditions.

4.1.2 Welded bags

The first group of letters of the alphanumeric code indicates the material of bag manufacture according to 4.1.1 and to standardized designations of plastics materials.

The designations below are for commonly used materials of manufacture:

PVC for polyvinyl chloride

PU for polyurethane

EVA for ethyl vinyl acetate

The following indicators refer to:

— the length of the bag, expressed in millimetres (900, 1 200 or 1 500),

— the type of seal ending the bag:

  d for a bead,

  l for a lip seal,

  r for an O-ring seal,

— the diameter (or width) of the seal, expressed in millimetres, preceded by the mark ∅.

4.1.3 Gaiters for remote-handling tongs

The first group of letter(s) of the alphanumeric code indicates the material of gaiter manufacture, according to 4.1.1 and to standardized designations of plastics materials.

For tong gaiters, designations for the usual materials of manufacture are:

PVC for polyvinyl chloride

NR for natural rubber

CR for polychloroprene

CR/CSM for polychloroprene coated with chlorosulfonated polyethylene

PU for polyurethane

The following indicators refer to

— the length of the gaiter, expressed in millimetres (500, 750, 900, 1 000, 1 100, 1 200, etc.),

— the type of seal ending the gaiter:

  d for a bead,

  l for a lip seal,

  r for an O-ring seal,

— the diameter (or width) of the seal, expressed in millimetres and preceded by the mark ∅.

4.1.4 Gaiters for manipulators

Because of numerous variations in length, etc. it is not possible to standardize the designation of manipulator gaiters.

4.2 Designation examples

A butyl glove for a support ring of type 1 with a nominal diameter of 150 mm [2], a length of 750 mm, size 8 and bead diameter of 8 mm is designated as follows (see table 3):

ISO glove 1311 IIR 8 750 ∅ 8

A PVC welded bag for a support ring of type 1 with a nominal diameter of 150 mm [2], a length of 900 mm, with a lip seal of a width of 6 mm is designated as follows (see table 5):

ISO welded bag 1331 PVC 900 l ∅ 6

A polyurethane tong gaiter, with a length of 1 000 mm, for a support ring of type 1 with a nominal diameter of 150 mm [2] and a O-ring seal of a width of 6 mm is designated as follows (see table 7):

ISO tong gaiter 1341 PU 1 000 r ∅ 6

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2) The nominal diameter indicated here corresponds to the diameter of the leaktight component, and not to the diameter of the support ring or of the glove/bag port on which this leaktight component is mounted. For this latter information, see the corresponding tables.

5 Gloves

5.1 General

5.1.1 Categories of gloves classified according to mounting on enclosure wall

Two types of gloves are considered in this document:

a) gloves for glove ports,

b) gloves for ejectable support rings.

5.1.2 Categories of gloves classified according to their material of manufacture and design

The criteria for the choice of the manufacture material are given in annex B.

There are four categories of gloves as follows.

a) Single-layer gloves

- gloves made of natural rubber,
- gloves made of polychloroprene rubber,
- gloves made of chlorosulfonated polyethylene,
- gloves made of butyl rubber,
- gloves made of PVC,
- gloves made of EPDM,
- gloves made of fluorinated elastomer,
- gloves made of polyurethane,
- gloves made of nitrile rubber,
- gloves of other material.

b) Double-layer gloves

- gloves made of polychloroprene coated with chlorosulfonated polyethylene,
- gloves made of polychloroprene coated with fluorinated elastomer,
- gloves made of polyurethane coated with polychloroprene,
- gloves of other combinations of material.

c) Triple (or more) layer gloves

- gloves made of polychloroprene/bromobutyl/polychloroprene,
- gloves made of polychloroprene/polyurethane/polychloroprene,
- gloves of other combinations of material.

d) Lead-loaded gloves

Lead-loaded gloves are used when protection against ionizing radiation is required. They are manufactured with three layers; only the middle layer is loaded with lead, depending on the needed resistance to ionizing radiation.

The outer layers are made of the material selected to meet the other requirements (mechanical resistance, chemical resistance, thickness, etc.).

EXAMPLE: gloves made of polychloroprene/lead-loaded polychloroprene/chlorosulfonated polyethylene.

5.2 Gloves for glove ports

5.2.1 Assembly of gloves on glove ports and glove-changing methods

Depending on the design of the different types of glove port, several methods exist to assemble gloves to glove ports and to change gloves.

NOTE — In most of the cases described hereafter, the mechanical assembly of gloves on glove ports is achieved by auxiliary devices such as adhesive tape or internal/external clamping rings. These auxiliary devices improve the mechanical assembly of gloves on glove ports during use, and prevent the spread of contamination during exchange of gloves.

In no case do these auxiliary devices participate directly in the leak tightness of the containment enclosure; this function is provided only by the bead of the glove.

5.2.1.1 Method a: Glove port with two external grooves and glove assembly without clamping and/or O-ring

The glove is set in the first groove of the glove port (as seen from the operator's standpoint) and mechanically fastened with adhesive tape (see figure 1).

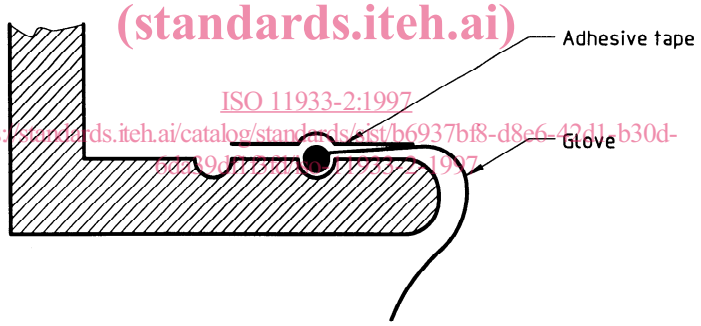


Figure 1 — Normal method of glove attachment to glove ports with two external grooves

The advantages of this method are as follows:

a) The space between the two grooves can never be contaminated in normal use.

b) The glove is not held with a clamping ring or a snap ring and therefore the mechanical stress on the glove sleeve is minimized.

The glove-changing procedure for this method is described in clause A.1 of annex A.

5.2.1.2 Method b: Glove port with two external grooves and glove assembly with an auxiliary inner clamping ring

This method of fastening the gloves to the glove port is nearly identical to method a, except that the glove is held inside the glove port by a clamping ring (see figure 2).

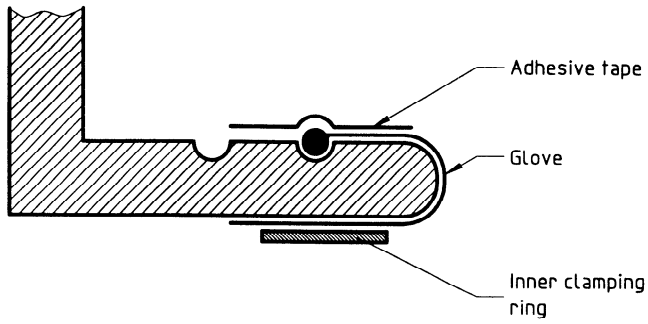


Figure 2 — First alternative method of glove attachment to glove ports having two external grooves

The advantages of this method are as follows.

a) The space between the two grooves can never be contaminated in normal use.

b) The glove is always held, in normal use, by the use of two independent mechanical securing devices (adhesive type, clamping ring).

The glove-changing procedure for this method is described in clause A.2 of annex A.

5.2.1.3 Method c: Glove port with two external grooves and glove assembly with an auxiliary outer clamping ring and an O-ring

This method is nearly identical to methods a and b, except that (see figure 3):

— the bead of the glove is mounted on the second groove of the glove port (seen from the operator's standpoint),

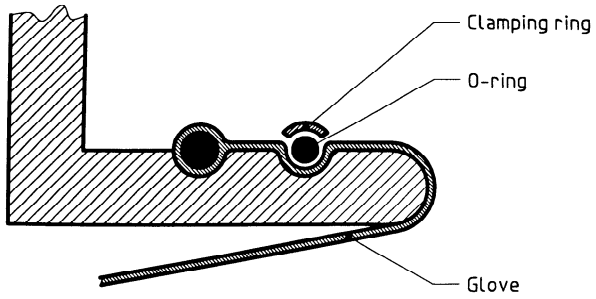
— the glove is held by an external O-ring and a clamping ring fastened over the first groove.

The advantages of this method are as follows.

a) The space between the two grooves can never be contaminated in normal use.

b) The glove is always held, in normal use, by the use of two independent securing devices (O-ring, clamping ring).

The glove-changing procedure for this method is described in clause A.3 of annex A.



Clamping ring

Figure 3 — Second alternative method of glove attachment on glove ports having two external grooves

5.2.1.4 Method d: Glove port having three external grooves and glove attachment on glove ports with two auxiliary external O-rings

The glove is clamped on the port using all three grooves (see figure 4) with the bead placed in the third groove and with two additional O-rings, placed over the other grooves.

When placing the glove sleeve into the glove port, care must be taken to avoid removing the two O-rings simultaneously.

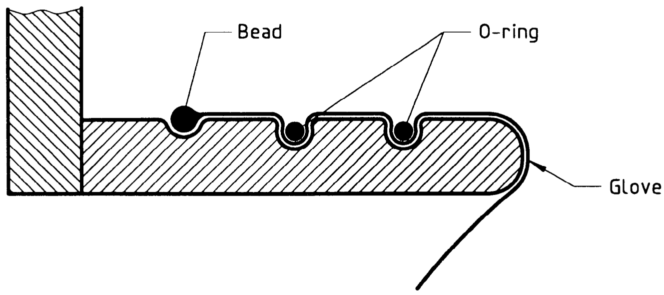


Figure 4 — Method of glove attachment on glove ports having three external grooves

The advantages of this method are as follows.

a) In normal use, the glove is held by the use of two independent securing devices.

b) The spread of contamination is limited by the use of two separate O-rings.

The glove-changing procedure for this method is described in clause A.4 of annex A.

5.2.1.5 Method e: Glove port having one external and two internal grooves and glove attachment on glove ports with two auxiliary internal O-rings

This case is very similar to the previous, except that two additional grooves are situated on the inside of the glove port instead of the outside (see figure 5).

The glove and the changing procedure used for this method are similar to those in the method with the use of two additional O-rings.

The thickness and the flexibility of the glove must be in accordance with the size of the O-ring and the dimensions of the grooves.

When placing the glove sleeve into the glove port, care must be taken to avoid removing the two O-rings simultaneously.

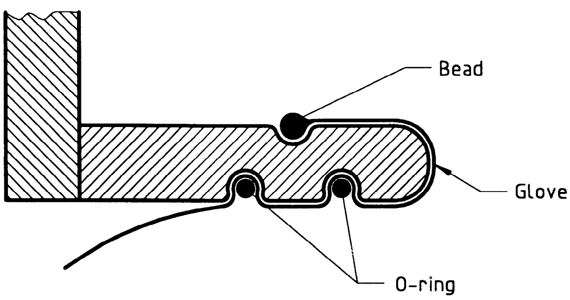


Figure 5 — Method of glove attachment on ports having one external groove and two internal grooves

The advantages of this method are as follows.

a) In normal use, the glove is always held by two independent securing devices (O-rings).

b) The spread of contamination is limited by the use two internal O-rings.

The glove-changing procedure for this method is described in clause A.5 of annex A.

5.2.2 Dimensions (see figure 6)

The usual thickness for a single-layer glove is (0,5 ± 0,1) mm. The standardized bead diameter is 6 mm. Other diameters are also available.

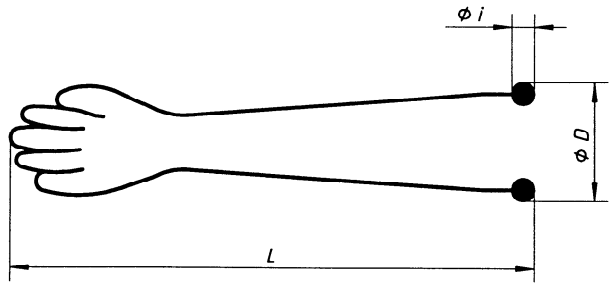


Figure 6 — Glove for glove ports

Standard dimensions of ISO gloves for glove ports are given in table 2.

Table 2 — Standard dimensions of gloves for glove ports

Dimensions in millimetres

References	Glove dimensions			Associated glove ports	
	Nominal diameter [1]	Length [2]	Diameter of bead	Type	Useful diameter of glove port
	D	*L*	*i*		*U*
1300 m t *L* Ø *i* [3]	160	750	6	1000	156
1301 m t *L* Ø *i* [3] [4]	194	750	6	1001/1002/1003	180/186/200
1304 m t *L* Ø *i* [5] [4]	250 [6]	750	6	1004/1005	249/254

1) Nominal dimension, varying according to the material of the glove.

2) Depending on type, other lengths ranging from 500 mm to 800 mm may be supplied on request.

3) This glove could also have reference 1302 or 1303, according to the rule given in clause 4.

4) According to the rule given in clause 4, m, t, *L* and *i* are alphanumeric indexes corresponding respectively to:
   - the material(s) of manufacture (m = NR, CR, CSM, IIR, FPM, PU, EPDM, NBR, CR/CSM, CR/IIR/CR, CR/FPM, ..., SCM/CRb/FPM, CR/CRb/CSM, etc.),
   - the size of the glove (t = 7, 8, 9 or 10),
   - the length of the glove (*L* = 750 mm for a standard glove),
   - the diameter of the bead (*i* = 6 mm for a standard glove).

5) This glove could also have reference 1305, according to the rule given in clause 4.

6) Special glove for glove ports of large diameter.

NOTE — Gloves manufactured in accordance with national codes and standards may have thicknesses, lengths, diameters and other aspects different from those presented in this part of ISO 11933. The use of such items is acceptable, providing that they are used in accordance with this part of ISO 11933.

5.3 Gloves for support rings

5.3.1 General

These types of gloves are used on containment enclosures generally located behind a shielding wall and equipped with enclosure rings of type 1 or 2. They are fitted on ejectable support rings of the same type (type 1 or 2) (see figure 7). These gloves are interchangeable with other leaktight components (welded bags, bungs, tong gaiters and manipulator gaiters).

They are replaced using an ejection device. Ejectable support rings are dealt with in ISO 11933-1.

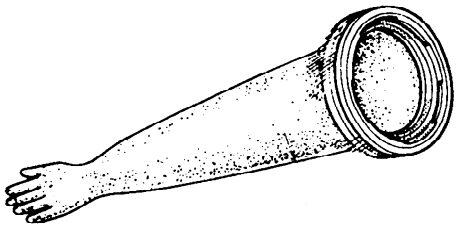


Figure 7 — Glove fitted on an ejectable ring (general view)

5.3.2 Material and design

The gloves are made of elastomer and terminate with a bead of diameter 6 mm to 8 mm (see figures 8 and 9 and table 3).

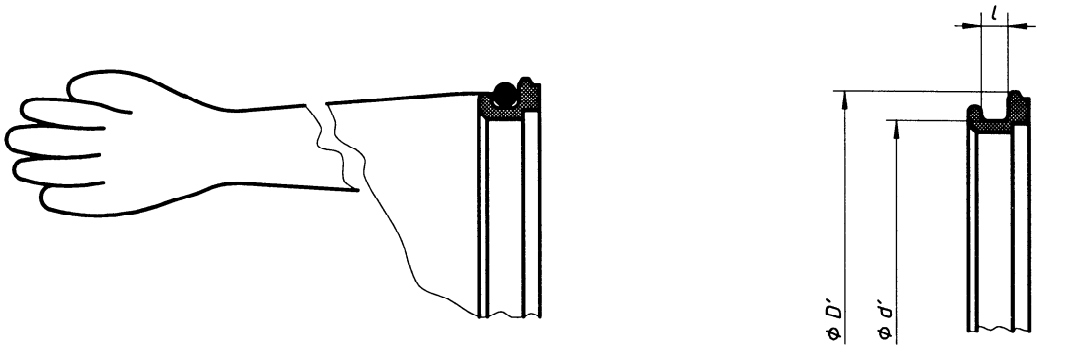
The diameter of the bead is designed in accordance with the width of the groove of the support ring on which it intended to be mounted (8 mm for a support ring of type 1 and 6 mm for a support ring of type 2, see ISO 11933-1).

5.3.3 Fitting of gloves on the support ring

The diameter of the bead and the shape of the groove on the ejectable support ring shall be designed to provide the required leaktightness when mounted under any operating condition.

This leaktightness is obtained by the bead of the glove when mounted on support ring of type 1 (see figure 8) and with the bead of the glove associated with a flat seal when mounted on a support ring of type 2 (see figure 9).

Gloves equipped with these two kinds of seal are supplied already fitted on the respective support rings. The proper fit of the glove to its support ring shall be checked by an approved method before acceptance.



a) Support ring of type 1 equipped with an elastomer glove

b) Support ring design alone

Figure 8 — Elastomeric glove fitted on an ejectable support ring of type 1