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## Technical Requirements Specification

### Safe Access for Maintainability

This document sets out the safety requirements, primarily in terms of accessibility, which shall be implemented within the ITER design in order to comply with article R4323-7 from the French labour code: "Work equipment is installed, arranged and used in order to limit the exposure to hazards for the users and for other workers. They are installed, together with their components, in such a way workers can operate and maintain them in the safest possible way."

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<i>Change Log</i>			
<b>Safe Access for Maintainability (RUGWUK)</b>			
<i>Version</i>	<i>Latest Status</i>	<i>Issue Date</i>	<i>Description of Change</i>
v0.0	In Work	14 Sep 2015	
v1.0	Approved	15 Sep 2015	First version
v1.1	Approved	10 Dec 2015	<p>Page 3 - Modification of the list of superseded document: QS7TX5 v1.0 has been considered during the creation of this document. The new versions of QS7TX5 now consider RUGWUK as an input document, so it is no longer required to supersede QS7TX5.</p> <p>Page 14 - The maintenance classification refers to tasks, not to equipment. Modification of the sentence "Equipment [concerned by tasks] classified MC1 and MC2..."</p>
v1.2	Approved	11 Jan 2017	<p>Use of the new MQP template.</p> <p>Minor updates:</p> <ul style="list-style-type: none"> <li>- modification of the reference R15</li> <li>- enhancement of the consideration of surfaces exposed to bad weather conditions.</li> </ul>
v1.3	Approved	27 Feb 2017	Specification of "occasionally" and "short distance", based on benchmark (RENAULT - Production Ergonomics - Main specifications intended for engineering and Manufacture - 2007)
v1.4	Approved	03 Apr 2017	Introduction in the MQP system following MQP doc Request TK5PZ6

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# 1 Purpose

This document sets out the safety requirements, primarily in terms of accessibility, which shall be implemented within the ITER design in order to comply with article R4323-7 from the French labour code:

“Work equipment is installed, arranged and used in order to limit the exposure to hazards for the users and for other workers. They are installed, together with their components, in such a way workers can operate and maintain them in the safest possible way.”

# 2 Scope

The requirements detailed in this document apply to all the systems (building and machine) at ITER that may require personnel access for operations and maintenance.

Considering Remote Handling Equipment (as defined in [R3]) will operate where man access is not allowed, RHE are excluded from the scope of this document.

Scaffolding and temporary platform are excluded from the scope of this document.

This working instruction, in the Occupational Health and Safety process, is belonging to Identification of Occupational Health & Safety Requirements related to Design ([TME48W](#)).

# 3 Definitions and acronyms

**RHE:** Remote handling equipment

**MC1:** Maintenance Category 1 as defined in [R3]

**MC2:** Maintenance Category 2 as defined in [R3]

**MC3:** Maintenance Category 3 as defined in [R3]

**DOE:** U.S. Department of Energy

## Access terminology

- **Circulation:** The term circulation shall be understood as pathway crossing premises and connecting two doors. This is shown in yellow in Figure 1.
- **Access:** A passage which allows a worker to reach workplaces or plant equipment. This is shown in blue in Figure 1.
- **Workplace:** A place where a worker interacts with the equipment, for operation or maintenance purpose. This is shown in purple in Figure 1.

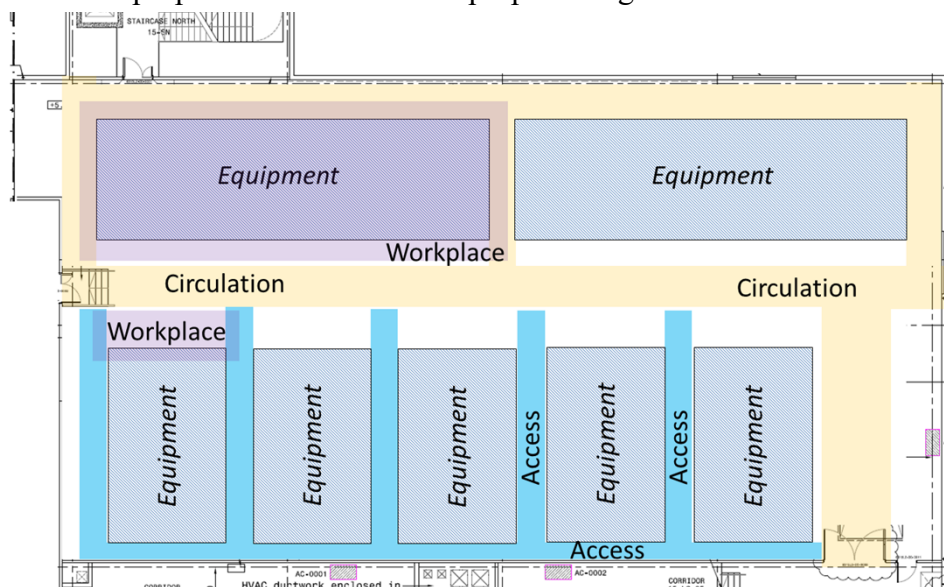


Figure 1 – Circulation / Access / Workplace

## 4 References

[27ZRW8](#) – Project requirements

[6LCG7B](#) - Occupational Health and Safety Management Plan

[TME48W](#) - Identification of Occupational Health & Safety Requirements related to Design.

[AJLQRF](#) - Procedure for Occupational Health and Safety Hazard Identification and Assessment.

### 4.1 Origin of requirements:

French Labour Code > Fourth part: Health and Safety at work:

- Book II: Requirements applicable to work places > Title I: Project owner obligations concerning the work place design > Chapter IV: Work place safety ([articles R4214-1 and followings](#))
- Book III: Work equipment and protective measures
  - Title I: Design ([articles R4311-1 and followings](#))
  - Title II: Use ([articles R4321-1 and followings](#))

### 4.2 Cross references concerning requirement details:

- [R1] *Fire Safety Guidance Note* ([NQFUNJ](#))
- [R2] *Protective suits: safety design requirements* ([RBYZ42](#))
- [R3] *Change Notice based on PCR-M354 for Project Requirements (PR)* ([27ZRW8](#) v5.3): review and approval ([RKNLMD](#))
- [R4] *Storage and manual handling safety guidance note* ([PNT5XX](#))
- [R5] *Standard ISO 15534-1 to 3: Ergonomic design for the safety of machinery*
- [R6] *ITER Site Signage & Graphics Standards* ([4ALJEU](#))
- [R7] *Standard ISO 14122-1 : Moyens d'accès permanents aux machines - Sécurité des machines - Partie 1 : choix d'un moyen d'accès fixe entre deux niveaux*
- [R8] *Standard NF E85-013: Elements of industrial facilities - Permanent means of access - Choice of a means of access*
- [R9] *Standard ISO 14122-2: Safety of machinery - Permanent means of access to machinery - Part2: working platforms and walkways*
- [R10] *Standard NF E85-014: Elements of industrial facilities - Permanent means of access - Gangways and work platforms*
- [R11] *Standard ISO 14122-3: Safety of machinery - Permanent means of access to machinery - Part 3: stairs, stepladders and guard-rails*
- [R12] *Standard NF E85-015: Elements of industrial facilities - Permanent means of access - Stairways, stepladders and guardrails*
- [R13] *Standard ISO 14122-4: Safety of machinery - Permanent means of access to machinery - Part 4: fixed ladders*
- [R14] *Standard NF E85-016: Elements of industrial facilities - Permanent means of access - Fixed ladders*
- [R15] *Protective equipment and hostile environment layout* ([RBYZ42](#))
- [R16] *NF EN 12464 - Light and lighting - Lighting of work places*
- [R17] *Policy for the ITER Plant Maintenance* ([FFTH8A](#))

This document is based on the DOE Handbook: Human factors/ergonomics handbook for the design for ease of maintenance ([DOE-HDBK-1140-2001](#), February 2001)

**Note:** the DOE handbook specifies a comprehensive set of safety design recommendations. It could be used as a reference when it is not in contradiction with French regulations.

This document is also based on the information compiled in the version 1.0 of the document TCWS IBED Pump maintenance space consideration ([QS7TX5](#)).

This document is based on and supersedes the following documents:

- D7.1 Design requirements for System design for operation and maintenance access ([RD45KB](#))
- Safety of machinery - Passage and access opening minimal dimensions ([QNF3PS](#))

## 5 Responsibilities

The employer provides workers with needed work equipment, suitable for the work to be done, in order to preserve their health and safety. [French Labour Code - R4321-1]

Preventive measures shall be considered in the design phase to reduce the frequency or the probability of an event and that should establish the rules to follow for the construction, installation and utilization of equipment in order to protect people and equipment from OHS risks. [PR1444-R]

Each Organisational Breakdown Structure (Department, Division and Section) Leader is responsible for enforcing applicable procedure in his area of responsibility. [Occupational Health Safety Management Plan (6LCG7B) – Section 6.1]

## 6 Treatment of exceptions / deviations

When there is an impossibility to implement the OHS requirement, or when the OHS requirement can induce a worst effect on the safety results, because of others contradictory interactions, it is required to contact the ITER Occupational Safety Team to agree upon a suitable way forward. Exceptions can be made in particular cases based on a risk assessment.

## 7 Circulation in the ITER premises

### 7.1 Fire Safety Requirements

The circulations shall be designed in compliance with fire safety requirements. These requirements are summarized in the *Fire Safety Guidance Note* [R1].

### 7.2 Circulation Routes

Minimal dimensions		Note
Width	900 mm	This value shall be increased regarding the foreseeable head count in the room (refer to [R1]).
Height	2100 mm regarding [R8]	When <b>justified by the risk assessment</b> and restrictions due to the machinery or environment, the clear height may be reduced to no less than 1900 mm if: <ul style="list-style-type: none"> <li>▪ the working platform or walkway is used only occasionally (<b>± less than once a week</b>), or</li> <li>▪ the reduction is made only for a short distance (<b>less than 1m</b>).</li> </ul>

The implementation of equipment shall not impair the minimal dimension of the circulation, driven by the fire safety regulations.

Passageways shall be free of snagging and impact hazards (e.g. pipework, lighting features).

### 7.3 Doors

Minimal dimensions		Note
Width	900 mm	- This value shall be increased regarding the foreseeable head count in the room, based on fire safety requirements (refer to [R1]). - 600mm is acceptable for toilets and showers.
Height	2100mm	When <b>justified by the risk assessment</b> and restrictions due to the machinery or environment, the clear height may be reduced to no less than 1900 mm if the door is used only occasionally ( <i>less than once a week</i> ).

The dimensions specified in the table above shall be adapted regarding the following requirements:

- Doors shall be sized to permit the **largest item** of equipment through that door, plus allowance<sup>1</sup> for personnel and handling of that item.
- Double doors, sliding or swinging doors shall provide **sufficient space** for opening full swing, taking into account the location of permanent systems / equipment.
- Door height shall be sufficient to avoid **overhead clearance**<sup>1</sup> problems caused by any curb at the doorway.

Swinging doors shall embed a **transparent window** at eyes level.

Where doorway **threshold** may impede vehicular or equipment movement ramps should be available and may be built in if they will not interfere with traffic passing by the doorway.

### 7.4 Access to equipment

Some dimensions of passages which only allow workers to reach workplace or plant equipment are less restrictive. They are specified in Chapter 8.

### 7.5 Access to components

The dimensions associated to workplaces and the accessibility conditions to reach components are specified in Chapter 9.

### 7.6 Vehicles

Aisle ways used by vehicles should be sized to accommodate the **dimensions of the vehicle, its load, and any personnel** who may have to accompany the load. Aisle way size should allow for vehicle turning radius and variations in load width, length, and placement. The following values shall be observed:

- ☐ (mobile equipment width or load width) + 1 meter
- ☐ or, in case of two-way traffic : 2x (mobile equipment width or load width) + 1.4 meters

The requirements concerning the **traffic flow** organization specified in [R4] shall be implemented:

- ☐ Traffic flows have to be separated
- ☐ Vehicle and pedestrian traffic flows have to be separated (either by using floor markings or preferably physical barriers)
- ☐ In areas where mobile equipment is moving, the presence of pedestrians shall be limited.

<sup>1</sup> The allowance and the clearance shall be defined regarding the equipment used and the position of the worker(s). The values specified in section 8.1 shall be observed. In case of difficulty, please contact ITER Occupational Safety Team.



Doors for pedestrians and for vehicles (flow in normal operations, such as in warehouse) have to be separated.

**Storage area:** safety requirement concerning the traffic flows in the storage area are summarized in the *Storage and manual handling safety guidance note [R4]*.

## 7.7 Flooring

Passageways shall have an even, flat, horizontal surface and be free from **trip hazards**. In line with [R1], it is forbidden to implement one or two isolated steps in passageways.

Floor **marking and signage** shall be in accordance with the ITER Site Signage & Graphics Standards [R6].

**Slip resistant flooring** (coefficient of friction (CoF) of 0.4 or more) shall be used in all areas where a risk assessment indicates foreseeable water contamination. Enhanced slip resistance (CoF of 0.6 or more) shall be provided where strenuous activity (e.g. pushing/pulling equipment) is undertaken routinely on flooring where a risk assessment indicates foreseeable water contamination. . **Enhanced slip resistance shall be provided where surfaces are exposed to bad weather (rain and snow).**

**Inclined floors:** the increase on coefficient of friction shall be determined by taking the tangent of the angle of the incline and adding that to the minimum coefficient of friction for the slip resistant classification of the floor (unsuitable for wet conditions, slip resistant surface, or enhanced slip resistant surface).

**Metal treads or landings:** the gratings shall not allow passage of a 20mm diameter ball (in compliance with [R8]).

**Open holes in pathways:** Open holes in pathways that can cause tripping or ankle-turning should be covered. Where temporary openings occur due to floor plug removal, temporary railings should be available to guard against falling.

## 7.8 Fixed means of access between two levels

The type of structure chosen to be used should be based on the angle of the structure's inclination in relation to the available space and structural constraints.

The following figure shows the recommended angles of inclines suitable for these structures.

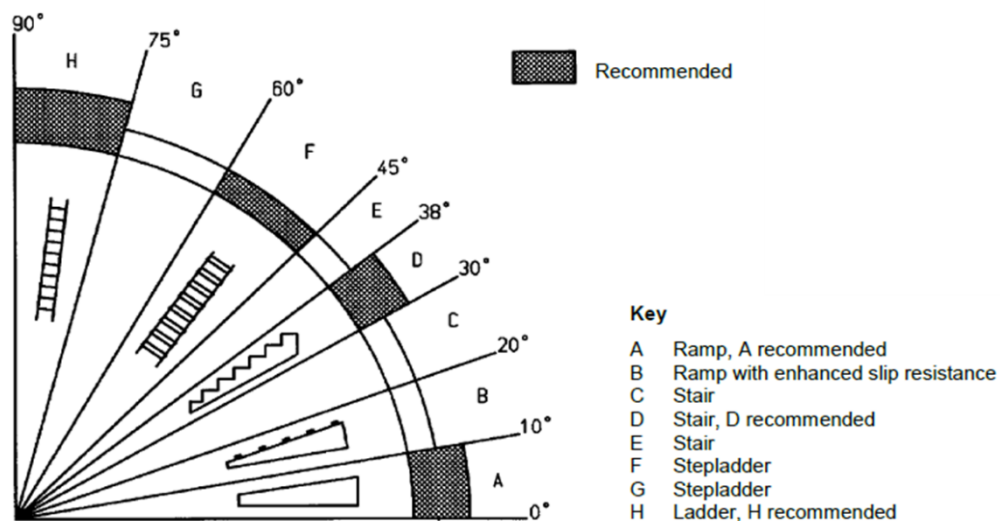


Figure 2 - Range of the various means of access

Types of structures that allow personnel to change elevation and characteristics that shall be considered in selecting them for use are detailed in the following table. They are sorted by preference.



## 1. Stair

Fixed means of access with an angle of pitch from more than 20 ° up to 45 °, whose horizontal elements are steps.

**Stairs allow the fastest, safest, and easiest passage of personnel, especially when they are carrying loads.**

Flights are limited to 25 rungs.

Minimal clearance: 1900mm

Tread c, and riser b shall meet the formula:  $600\text{mm} \leq c + 2b \leq 660\text{ mm}$

### Straight staircase

Stair width: 800 mm. It can be decreased for a stair considered as a secondary access but not less than 600 mm.

The overlap shall be 50 mm if there is no riser, and 10mm if there is.

Stairs are equipped with a handrail. Stairs wider than 1200mm are equipped with handrails on both sides.

A guard-rail shall be fitted whenever the height to climb exceeds 500 mm, and when there is a lateral space adjacent to the string which is greater than 200 mm, in order to provide protection on the side of the stair where this gap exists.

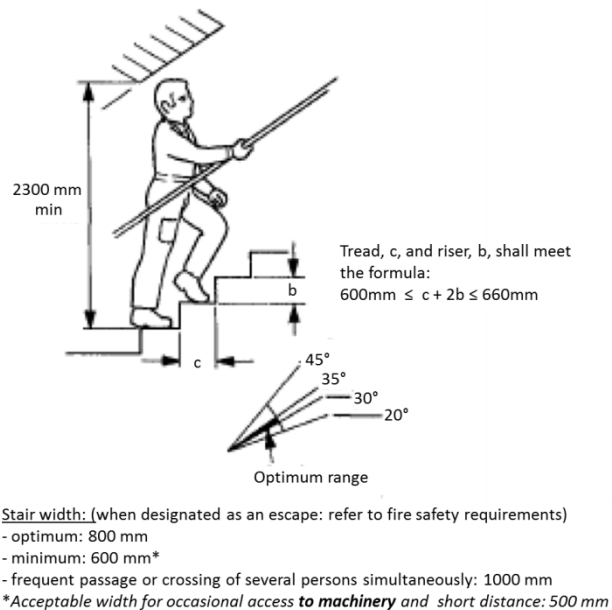


Figure 3 - Dimensions of straight staircase

### Spiral staircase (for infrequent use only)

Width: between 700mm and 900mm.

Minimal headroom: 2000mm

A guardrail shall be implemented on the outer side. If the stair is installed in a staircase which can replace the guardrail, a handrail shall be implemented on the outer side.

Tread and riser are measured at the tread line, at 7/10 of the passage width:

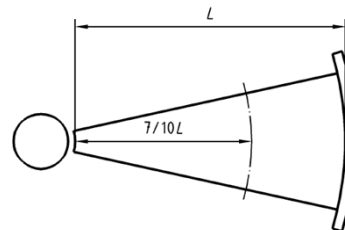


Figure 4 - Tread and riser measurement position

The overlap r shall be (dimensions in mm):

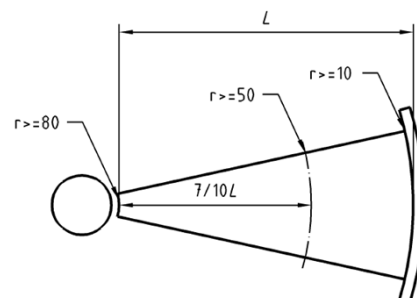


Figure 5 - Minimum overlap

## 2. Stair ladder or stepladder:

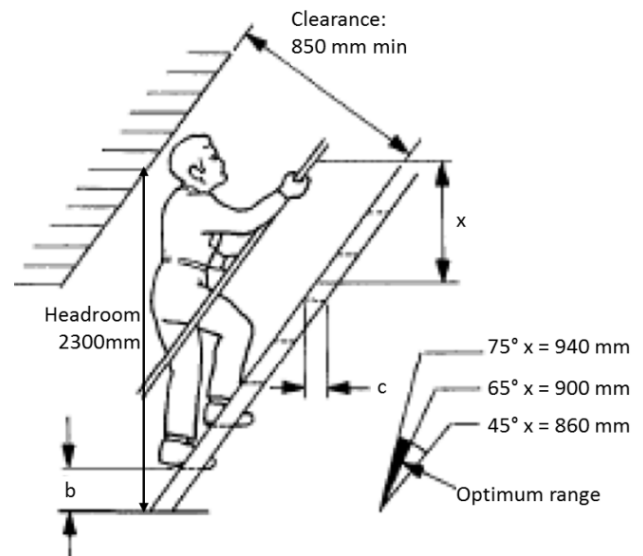
Fixed means of access with an angle of pitch from more than  $45^\circ$  up to  $75^\circ$ , whose horizontal elements are steps.

Stair ladders are preferred to ladders because they provide better footing and faster, safer passage. However, sure balance and fast movement require the use of both hands on the handrails. Carrying loads up stair ladders is also hazardous.

The minimum overlap is 10mm.

Clear width can be decreased to 450mm in case of access integrated to a machine.

Two hand rails shall be implemented.



Clear width between guard rails: 600 to 800 mm

Riser  $b$ : 250 mm max

Tread width  $c$ : 80 to 150 mm

Figure 6 - Stepladder: minimal dimensions

The flight height is limited, regarding the incline, as indicated in the figure below:

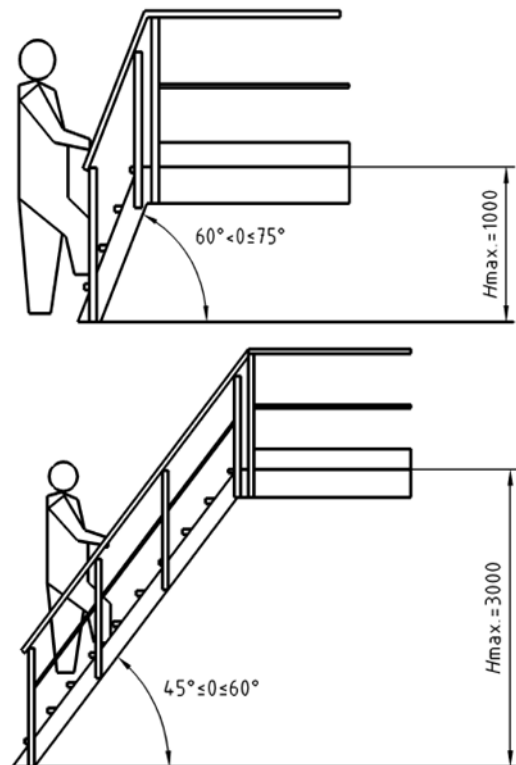


Figure 7 - Height limitations

### 3. Ramp:

Fixed means of access, comprising a continuous inclined plane having an angle of pitch from more than 0 ° up to 20°.

**Ramps shall be used only when rolling stock must be moved between different levels.**

The incline depends on the use:

- Hand pallet truck or other wheeled equipment manually moved: 3° max
- Motorised vehicle (such as forklift): 7° max.
- Pedestrian: 20° max (preferably less than 10°)

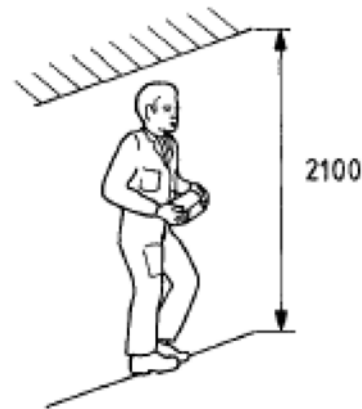


Figure 8- Ramp: minimal dimensions

### 4. Ladder

Fixed means of access with an angle of pitch from more than 75° to 90°, whose horizontal elements are rungs.

Ladders are comparatively unsafe, difficult to climb, and it is prohibited to work from.

**Only loads which are strapped to personnel can be carried up ladders.**

Portable ladders should be required and provided only for emergency functions or for use during **infrequent maintenance tasks**.

**Ladders shall be avoided in circulations.** Due to the incompatibility with frequent passage, the dimensions are specified in paragraph 8, dedicated to access to equipment.

## 8 Access to equipment

**!/ \ As defined in section Error! Reference source not found., access and circulation routes are not similar. The following requirements only apply to access.**

Workers must have safe means of access to all the areas necessary for production, adjustment and maintenance operations.

**The preferred means of access** to the equipment shall be in the following order:

- a. access directly from the ground level or from a floor;
- b. lifts, ramps or stairs;
- c. stair ladders or ladders.

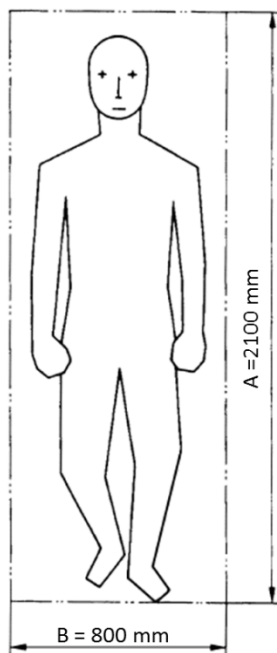
**Movement of equipment and materials through aisle ways:** Passageway dimensions should reflect sizes of equipment and materials that personnel will move through the aisles.

Requirements to be implemented in areas where **protective suits** may be used are summarized in [R15].

## 8.1 Minimal dimension

### Standard access

Horizontal forward movement in upright posture



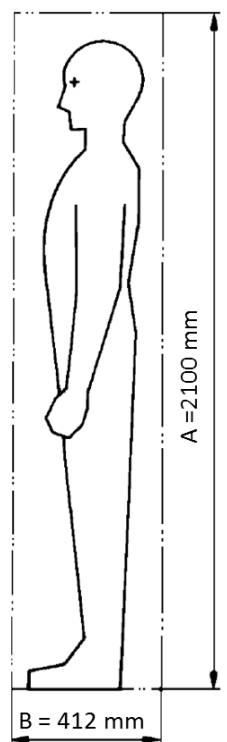
When **justified by the risk assessment** and restrictions due to the machinery or environment, the clear height A may be reduced to no less than 1900 mm if:

- the working platform or walkway is used only occasionally (*less than once a week*), or
- the reduction is made only for a short distance (*less than 1m*).

Note: The value of B is requested by the French labour code, article R4323-12.

### Sideway access

Horizontal sideways movement over **short distance** in upright posture



#### **NOT APPLICABLE FOR EGRESS ROUTES**

When **justified by the risk assessment** and restrictions due to the machinery or environment, the clear height A may be reduced to no less than 1900 mm if:

- the working platform or walkway is used only occasionally (*less than once a week*), or
- the reduction is made only for a short distance (*less than 1m*).

Frequent or long duration use:

A + 100 mm

B + 100 mm

Clothes that will be damaged by contact with the passage walls:

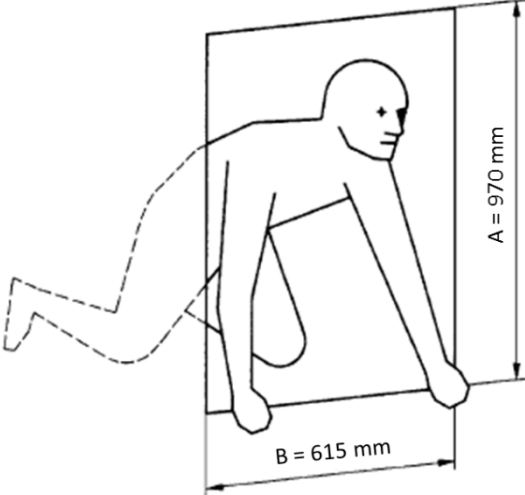
B + 100 mm

Heavy winter clothing or personal protective clothing:

B + 100 mm

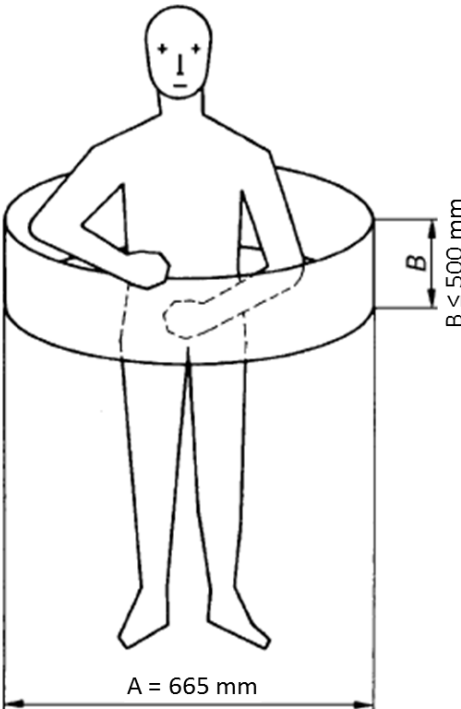
### Rectangular horizontal access hatches

Opening for entry in kneeling posture

	<p>Frequent or long duration use:  <math>A + 100 \text{ mm}</math>  <math>B + 100 \text{ mm}</math></p> <p>Clothes that will be damaged by contact with the passage walls:  <math>B + 100 \text{ mm}</math></p> <p>Heavy winter clothing or personal protective clothing:  <math>B + 100 \text{ mm}</math></p> <p>Transportation of injured person:  <math>B + 200 \text{ mm}</math></p>
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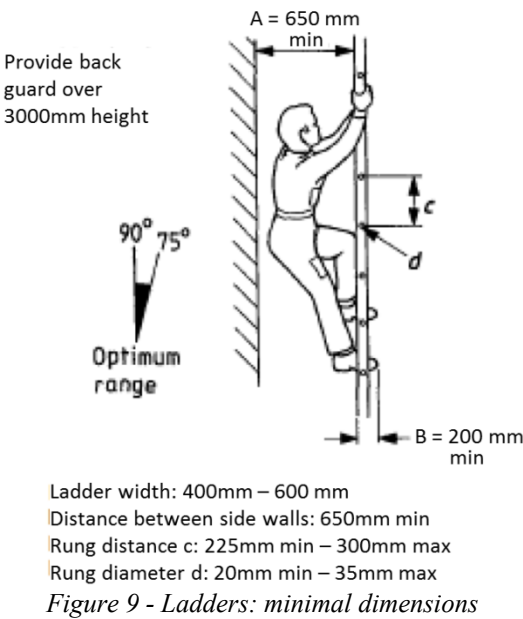
### Circular Hatches

Manhole through which rapid active movement needs to be possible

	<p>Heavy winter clothing or personal protective clothing:  <math>A + 100 \text{ mm}</math></p> <p>Personal protective equipment (excluding breathing apparatus):  <math>A + 100 \text{ mm}</math></p>
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Ladders

Vertical movement using a ladder



In case of non-continuous obstacle (no longer than 1000mm):  
A = 600 mm  
B = 150 mm

The distance between the walking surface of the departure area and the first rung shall not exceed the spacing between two consecutive rungs (225-300mm). The top rung shall be positioned at the same level as the walking surface of the arrival area.

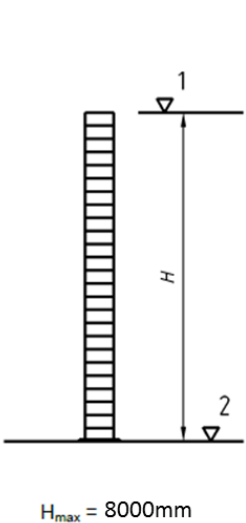


Figure 1.a : Ladder without rest platform (single flight)

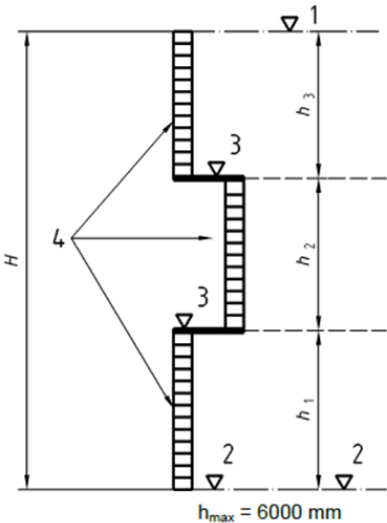


Figure 1.b : Ladder with staggered flights

- Key
- 1 Arrival area
  - 2 Departure area
  - 3 Intermediate platform or rest platform
  - 4 Ladder flight

Figure 10 - Height of flights and location of platforms

The lowest part of safety cage, e. g. the lowest hoop shall start at a height of between 2200 mm and 3000 mm above the departure area.

Front or side exit:

- Ladder without safety cage: The width of the access opening (measured at 1100mm height) shall be between 650 mm and 800 mm.
- Ladder with safety cage: The width of the access opening shall be between 500 mm and 700 mm.

The ladder shall be fitted with a **fall protection** device when:

- a) height of the ladder flight is more than 3000 mm;
- b) height of the ladder is 3000 mm or less, but at the departure area there is the risk of falling an additional distance. In this case, the total distance of fall from the upper level of the ladder could be more than 3000 mm.

NOTE **Risk of falling** is considered to exist when the distance from the centre of the ladder to the unprotected side of a platform (or similar structure) is less than 3000 mm.

A **cage** is not necessary if surrounding structures (walls, parts of machines, etc.) in front of and on the sides of the ladder provide a similar safety function (e. g. by providing similar dimensions). With regard to the ladder axis, the distance from the surrounding structure in the absence of a safety cage shall be between 325 mm and 400 mm.

If the horizontal distance from a fixed ladder to the guard-rail of the raised departure area is not more than 1500 mm, the guard-rail shall be fitted with an **extension** or the structure of the cage (if equipped with a safety cage) shall be extended down to the guard-rail.

To prevent falling through the access opening at arrival areas the opening shall be provided with a **gate**.

The ladder elements shall comply with the standard NF EN131-2.

### Crawling through a pipe



Preferred width: 810 mm

## 9 Workspace – Access to components

### 9.1 General requirements

Areas and points for working on, or maintenance of work equipment must be suitably lit in line with the operation to be carried out.

Workers must be able to remain safely in all the areas necessary for inspection, adjustment and maintenance operations.

Work equipment must be installed, located and used in such a way as to reduce risks to users of the work equipment and for other workers, for example by ensuring that there is sufficient space between the moving parts of work equipment and fixed or moving parts in its environment and that all forms of energy and substances used or produced can be supplied or removed in a safe manner.



**General maintenance clearance:** A nominal 900 mm maintenance clearance shall be provided around all major system components and piping of 610 mm diameter and larger for general clearance.

**Accessibility:** Accesses should be designed to make the repair or servicing operation as simple as possible. It should provide:

- a. Sufficient clearance to use the tools needed to complete the task.
- b. Adequate space to permit convenient removal and replacement of components.
- c. Adequate visual exposure to the task area.

**Use of accesses:** Accesses should be designed and located, covered, and fastened to avoid the need for removing components, wires, etc. to reach the item requiring maintenance. Items that require visual inspection (e.g., hydraulic reservoirs, gauges) should be located so they can be observed without the removal of panels or other components

**Facilitating access:** Where feasible, accessibility shall be facilitated by:

- a. Using hinged or removable chassis.
- b. Designing major units and assemblies (especially engines, turbines, etc.) with removable housings to allow for complete inspections.
- c. Correlating the design of unit accessibility features with the accessibility requirements of the overall system.

**Compatibility with protective equipment:** Maintenance space around equipment must consider removing parts, removing surrounding equipment, bringing aids in and personnel being burdened by individual protective equipment.

- Since feet are less sensitive in boots and tripping is more likely, ladders should have broader rungs.
- Lift and movement aids should be provided to facilitate operations in protective suits.
- Access openings shall consider the increased size of operators wearing protective suits.

Equipment concerned by tasks classified Maintenance Classification MC1 and MC2 (radiological or toxic areas) shall be designed to accommodate maintenance technicians wearing protective clothing including allowing for decreased manual dexterity because of protective clothing. The designs for facilities and equipment which are located in these hazardous areas should optimize speed of maintenance operations to minimize stay times and associated exposure levels. [Refer to [R2]]

**Fixed, safe access provisions,** such as fixed ladders, catwalks, and platforms should be provided for equipment that requires recurrent maintenance.

**Temporary, safe access provisions:** Where equipment maintenance is infrequent, clearances should be provided for erecting temporary access provisions such as portable ladders and scaffolding rather than relying on ad-hoc access provisions.

**Obstruction:** Structural members and permanently installed equipment should not visually or physically obstruct adjustment, servicing and removal of replaceable equipment or other required maintenance tasks. Panels, cases, and covers removed to access equipment should have the same accessibility as replaceable equipment.

**Comfortable working positions:** Systems should be designed and routed so that maintenance personnel can ease themselves around the systems and assume comfortable working positions. Forcing maintainers to assume a working position close to the floor should be avoided.

Platforms, catwalks, and scaffolds should be provided to prevent the technician from having to work overhead with outstretched arms. Workspace should allow the technician to change posture if the maintenance task being performed requires prolonged kneeling, crawling, or crouching.

**Easy equipment access:** Locations of grease fittings, adjustment points, test points, isolation points, and fill and drain points on equipment should be positioned for easy access. Sufficient

clearance should be provided around connectors and other equipment components requiring manual manipulations to allow firm grasping for mating and de-mating.

Heavy units that are to be pulled out of their installed position should be mounted on rollers or slides when feasible.

## 9.2 Accessibility Priority Groups

Components critical for system performance and safety which require rapid maintenance as well as those requiring the most frequent access should have the greatest ease of accessibility.

ITER components fall into one of three accessibility groups. These groups relate to the design requirements that support maintenance access, including the following features: time available to repair the component following fault detection, the safety function of the component, and the importance to the availability of the ITER machine.

Group 1 items are the most critical regarding the accessibility.

### 9.2.1 Group definitions:

**Group 1** items are any component, or system that meets any of the following criteria:

- All Protection Important Class (PIC) components
- All equipment covered by the maintenance categories MC1 (except RHE) and MC2 regarding [R3]
- Equipment essential for routine or emergency operations where rapid and unencumbered maintenance access is essential when required
- Equipment where failure to obtain quick access results in serious consequence (e.g. major damage to equipment, significant disruption to ITER programme)
- Equipment that requires access during the **Short Term Maintenance Phases**
- Equipment with maintenance interval of less than one month

**Group 2** items are any component, or system that meets the following criteria:

- Equipment that does not require quick intervention for maintenance (i.e. access time can be > 24h)
- Equipment not critical for normal or emergency operations but are used during routine maintenance activities
- Equipment requiring access during the **Long Term Maintenance Phases** only
- Equipment with a planned intervention frequency of less than 2 years
- Equipment with a low operating frequency (i.e. with an interval of more than 6 months between operations))

**Group 3** maintenance items are any component, or system that meets the following criteria:

- Equipment that is not planned to be used during normal operations / maintenance activities
- Equipment used only during start-up / testing / commissioning / shut down
- Non-operating equipment used in particular circumstances on an infrequent or rare basis (e.g. equipment used for system testing)
- Equipment covered neither by group 1 nor group 2.

## 9.2.2 Access requirements per groups

	Group 3	Group 2	Group 1
An access solution shall be planned and designed, with sufficient space and access for personnel, tools, parts and auxiliary equipment.	mandatory	mandatory	mandatory
Circulation			
▪ Use of temporary access (scaffolding, mobile platform, man lift)	acceptable	tolerable	prohibited
▪ Use of ladders	acceptable	acceptable	prohibited
▪ Use of stair ladders	preferable	preferable	prohibited
▪ Use of stairs	advisory	advisory	mandatory
Getting access:			
▪ Removal of masonry	tolerable	prohibited	prohibited
▪ Removal of demountable partitions, doors, etc.	acceptable	prohibited	prohibited
▪ Removal of clearly marked hatches, floor traps, panels/tiles in false ceilings, walls and partitions.	preferable	acceptable	prohibited
▪ Use of hinged door which opens outward through 180° (if enclosed)	preferable	preferable	mandatory
▪ No obstruction	advisory	advisory	mandatory
Workspace:			
▪ Operation performed from platform	acceptable	acceptable	acceptable
▪ Operation performed from ground level or floor level	preferable	preferable	mandatory
▪ Implementation range for equipment referring to following <b>Error! Reference source not found..</b>	acceptable	acceptable	preferred

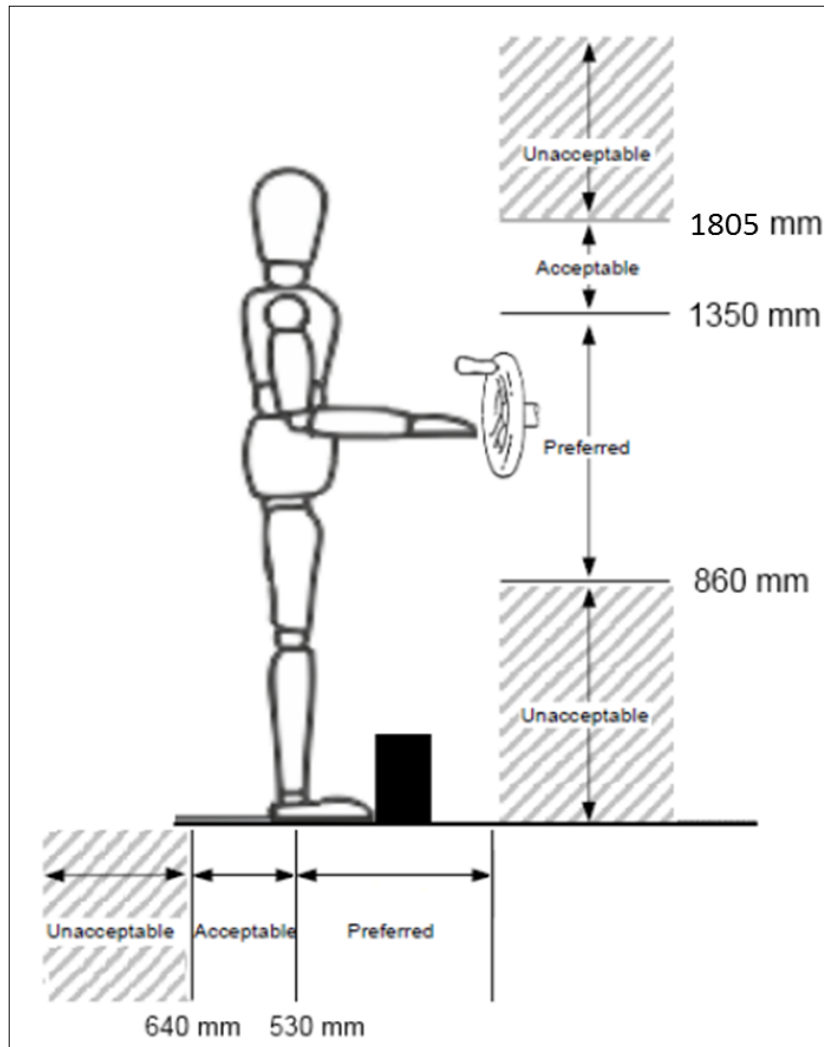
Tolerable: it could be accepted as last resort. It should be avoided.

Acceptable: it could be accepted, with justifications.

Preferable: the implementation is encouraged.

Advisory: the implementation is strongly encouraged

Mandatory: it shall be implemented.



### 9.3 Minimal dimensions

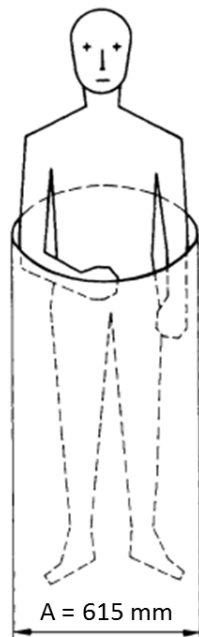
The following requirements specify **minimum, not optimum**, dimension for openings. Consequently, wherever possible:

- For access hatches and space for non-standing activities, the dimensions should be increased.
- For Access openings for body parts, the basic dimensions for the openings should be increased, and the maximum dimensions for reach should be decreased.

### 9.3.1 Access hatches

#### Circular hatches for upper body access

Access opening for the upper body and arms



Clothes that will be damaged by contact with the passage walls:

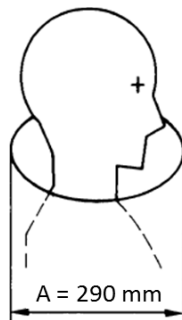
A + 100 mm

Personal protective equipment (excluding breathing apparatus):

A + 100 mm

#### Circular hatches for the head as far as the shoulders

Access opening for the head as far as the shoulders for inspection tasks



**THIS TYPE OF ACCESS SHOULD BE AVOIDED WHEREVER POSSIBLE**

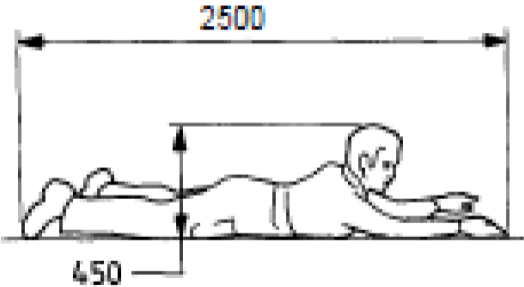
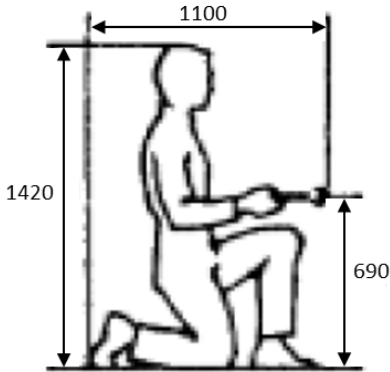

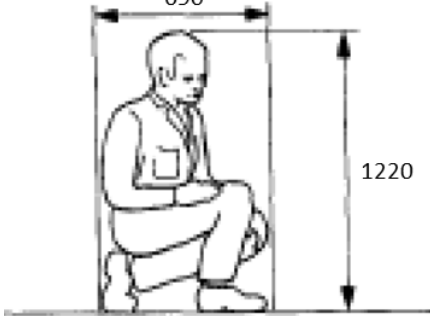
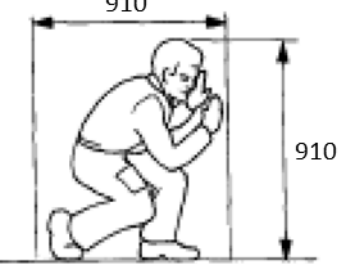
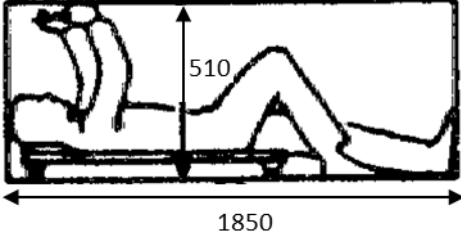
Personal protective equipment (helmet, hearing protectors, safety goggles, respirators):

A + 100 mm

To avoid touching the access opening (e.g. because chemicals, dirt, grease):

A + 100 mm

### 9.3.2 Space requirements for non-standing activities

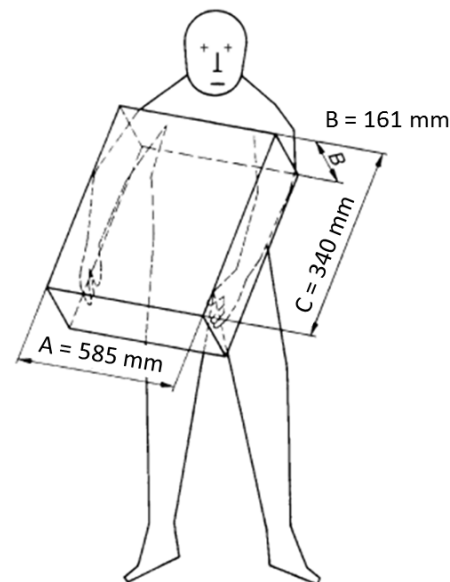
Prone position	Kneeling position
 <p>The suited height is 610 mm</p>	 <p>The suited height is 1500 mm The suited width is 1270 mm</p>
Crawling position	Squatting position
 <p>The suited length is 1570mm When justified by the risk assessment and restrictions due to the machinery or environment, the clear height may be reduced to no less than 790 mm if:</p> <ul style="list-style-type: none"> <li>•the area is used only occasionally (<i>less than 15 minutes a month</i>), or</li> <li>•the reduction is made only for a short distance (<i>less than 1m</i>).</li> </ul>	 <p>The suited height is 1300 mm The suited width is 1020 mm</p>
Stooping position	Supine position
 <p>The suited width is 1120 mm</p>	 <p>The suited height is 660 mm The suited width is 1980 mm</p>

### 9.3.3 Access openings for body parts

Access openings for body parts are to be avoided as far as possible. Should they be required, their minimum dimensions are given in the following tables and figures.

#### Access opening for both arms

either forward or downward



Heavy winter clothing or personal protective clothing:

$A + 100 \text{ mm}$

$B + 100 \text{ mm}$

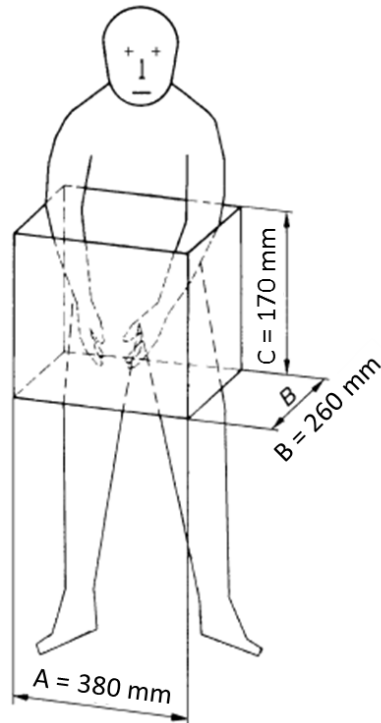
Clothes that will be damaged by contact with the access-opening walls:

$A + 100 \text{ mm}$

$B + 100 \text{ mm}$

#### Access opening for both lower arms up to elbow

either forward or downward



Heavy winter clothing or personal protective clothing:

$A + 100 \text{ mm}$

$B + 100 \text{ mm}$

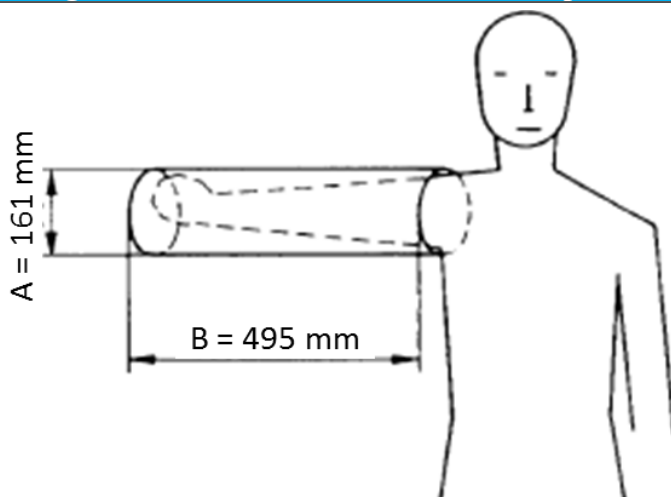
Clothes that will be damaged by contact with the access-opening walls:

$A + 100 \text{ mm}$

$B + 100 \text{ mm}$



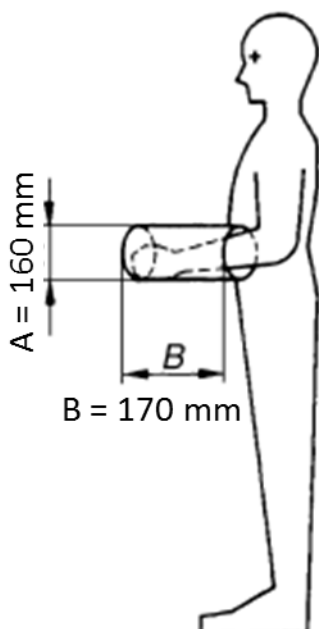
### Opening for access to the side for one arm up to shoulder joint



Heavy winter clothing or personal protective clothing:  
A + 100 mm

Clothes that will be damaged by contact with the access-opening walls:  
A + 100 mm

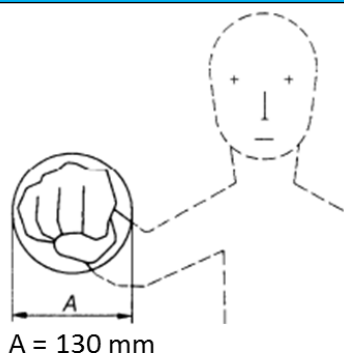
### Access opening for one lower arm up to the elbow



Heavy winter clothing or personal protective clothing:  
A + 100 mm

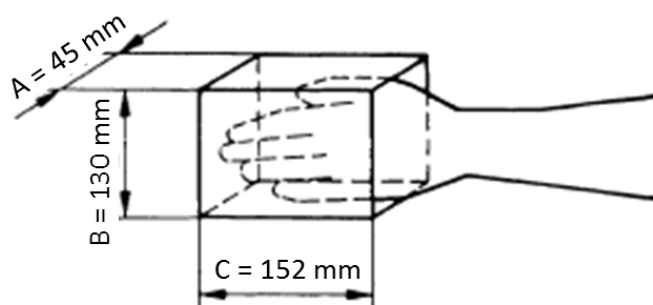
Clothes that will be damaged by contact with the access-opening walls:  
A + 100 mm

### Access opening for fist



Use of hand-protective equipment:  
A + 20 mm

### Access opening for flat hand to wrist including thumb

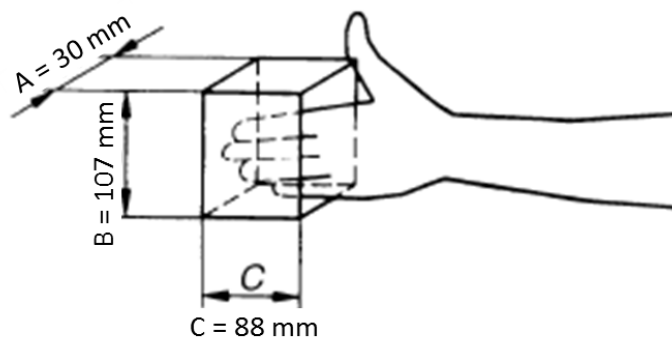


Use of hand-protective equipment:

$A + 20 \text{ mm}$

$B + 20 \text{ mm}$

### Access opening for flat hand (four fingers) to base of thumb

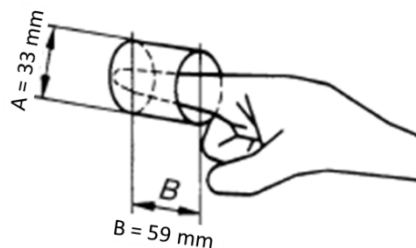


Use of hand-protective equipment:

$A + 20 \text{ mm}$

$B + 20 \text{ mm}$

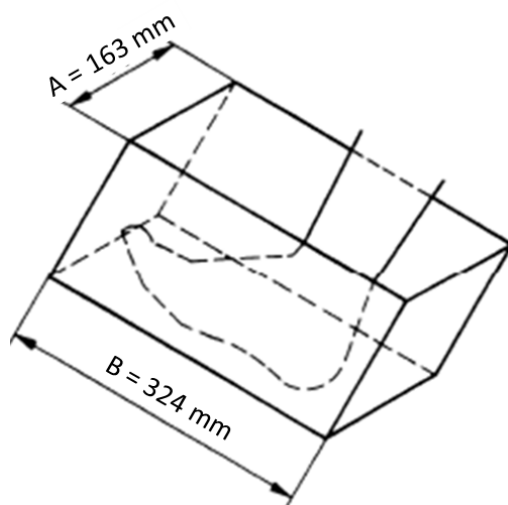
### Access opening for index finger, restricted by the other fingers



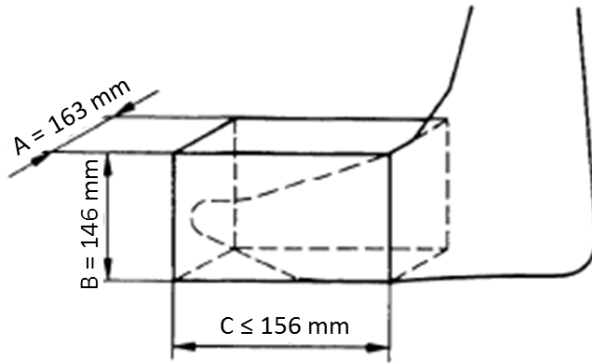
Use of hand-protective equipment:

$A + 20 \text{ mm}$

### Access opening for one foot to ankle bone



### Access opening for fore-foot operated control actuators



## 9.4 Use of lifting equipment

**Heavy equipment movement and lifting aids:** Appropriate cranes, monorails, forklifts, carts, and other movement aids shall be available within the area to allow moving equipment and hardware that requires a weight of more than 25kg to be carried per worker.

**Manual Vehicles:** Vehicles in the form of hand trucks and dollies shall be provided for handling smaller loads. The premises layout shall be compatible with these manual vehicles access.

**Clearance for hand trucks:** Turning clearances shall accommodate at least the length of the truck plus the handler. Floor surfaces shall also have no obstructions that would interfere with the use of the hand truck. A minimum turning clearance of 1220 mm is recommended.

**Routing systems to allow use of lifting and movement aids:** Systems shall be routed around access paths and envelopes such as overhead cranes, other movement paths and equipment-hatch removal envelopes. Where applicable, sufficient clearance shall be provided to permit the use of vehicular or other transportation aids near the system. Systems should be routed around overhead clearance should be a minimum of 2130 mm above the floor for passage of personnel and removal of equipment.

**Requirements for major equipment:** The removal path for all major pieces of equipment shall be defined and documented in prints and drawings. These paths include aisles, hatches, doors, knockout walls, removable components, elevators, ramps, as well as handling devices such as permanent and temporary cranes, chain falls, skids, and vehicles. Handling and mounting requirements shall be described and dimensions and weights of equipment should be combined with the handling devices to evaluate the removal envelope and the handling capacity of elevators.

## 9.5 Working in protective suits

The design of the equipment classified MC1 or MC2 shall integrate the use of protective equipment.

Requirements to be implemented in areas where protective suits may be used are summarized in [R15][R12].

## 10 Lighting Requirements

The minimum lighting requirements defined in the French regulations are specified in the table below. The recommended values are defined in the [R16].

Indoor	
Work area	Lux
Circulation areas and corridors	Minimum: 40 Recommended: 100
Stairs, ladders	Minimum: 60 Recommended: 100
Work premises	Minimum: 120 Recommended: based on the activity (refer to [R16])
Work premises without natural light, with permanent workplace	Minimum: 200 Recommended: based on the activity (refer to [R16])
Outdoor	
Work area	Lux
Circulation areas	Minimum: 10 Recommended: 50
Permanent work places	Minimum: 40 Recommended: based on the activity (refer to [R16])

## 11 Protection

A guard-rail shall be installed near to the dangerous areas where there is a risk of falling from height or close to dangerous equipment (for example, walkway accesses to equipment mounted on a roof).

When the height of the possible fall exceeds 500 mm, a guard-rail shall be installed. When the height of the possible fall is between 200mm and 500mm a guard rail shall be implemented (recommended) or the drop shall be marked through appropriate signage.

A guard-rail shall be provided when the gap between a platform and the structure of a machine or wall is greater than 200 mm or if the protection of the structure is not equivalent to a guard-rail.

A toe plate shall be provided when the gap between the platform and adjoining structure is greater than 30 mm.

Guard-rail shall be designed in compliance with ISO 14122-3 [R11] (machinery) or NF E85-015 [R12] (building). The minimal dimensions are presented in the following figure:

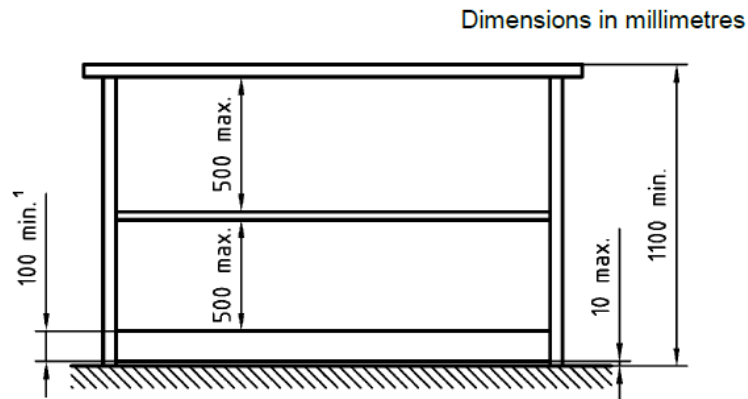


Figure 11 - Horizontal guard-rail

Every part likely to be in contact with worker shall be designed in order to avoid any injuries (sharp edges ...).

Guard rail shall be designed and implemented in order to limit their interruption. Foreseen operations shall be possible without removal of permanent collective protective equipment.

In the case of an interrupted handrail, to prevent hand traps the clear space between the two segments should not be less than 75 mm and not greater than 120 mm (see figure below). If there is a larger opening, a self-closing gate shall be used. The use of the gate shall not create additional risk against user or surrounding worker.

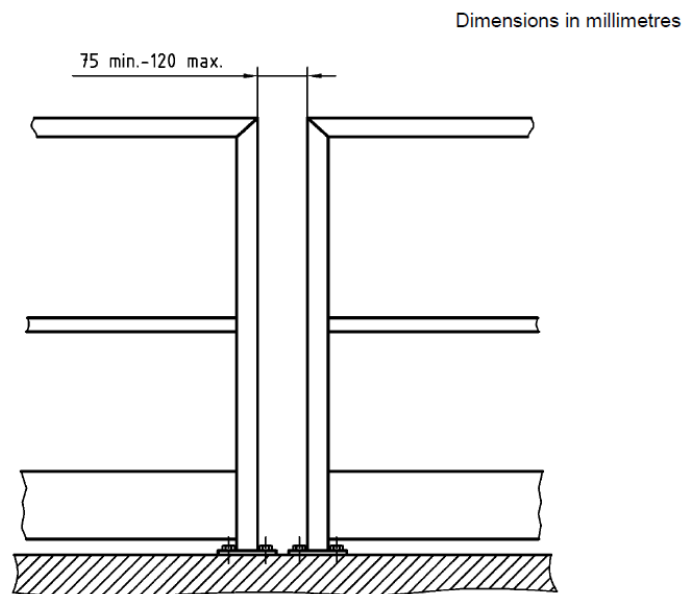


Figure 12 - Clear space between two guard rail segments

Where access through the guard rail is required, a self-closing gate shall be used. A gate shall have the handrail and knee rail positioned at the same level as that of the guard-rail that it extends to. Any gates shall be self-closing and shall be designed to open onto the platform or floor and to close against a firm stop to prevent users pushing against them and falling through the opening. Gates shall be subject to the same loading criteria as guard-rails.

The length of the handrail shall be clear of obstacles within a distance of 100 mm, except on the underside of the handrail, for the mounting of stanchion supports. In order to avoid the deviation of a handrail in case of punctual non-hazardous obstacle (pipe, cable tray...), the gap between the handrail and the obstacle can be decreased to 50 mm on a maximum length of 500mm.

The shape of the handrail should have a diameter between 25 mm to 50 mm or an equivalent section, to provide a good grip for the hand.

## 12 Forms and templates and checklists

[RY8HAF](#) - Template for PBS occupational safety demonstration

## 13 Records

Records shall be managed in accordance with the procedure AJLQRF - section 8.

- IDM document type (if required)	
- Location of folder (in IDM)	
- Instructions for identification of the records (naming convention of the documents)	
- The responsible team (for managing the records)	
- The retention period (the retention period may be governed by external standards and regulations. The responsible team in charge of records shall consult Legal, Safety and Quality division to ensure proper definition of retention periods)	