



## PPE: PROTECTION AGAINST FALLS

CODE

**SHR 109**

Date:

**July 2003**

Revision:

**00**

Page:

**1 of 13**

A fall arrest system must be designed and manufactured to ensure that:

- Under the normal conditions of use for which it was designed, users can carry out the activity that exposes them to a risk, with suitable protection at the highest level possible.
- It does not cause risks or other factors of discomfort under normal conditions of use.
- It can be donned by the user as easily as possible in the right position, and remain in this position during the expected period of use, taking into account environmental factors, the user's movements and stance.
- It must be as light as possible, without detriment to the solidity of the construction or its effectiveness.
- Once it has been tightened, it cannot come loose on its own without the user's intervention, under normal conditions of use.
- When it is used under normal conditions, the distance that a person could fall should be as short as possible to avoid any impact with an obstacle.
- Once a fall has been arrested, the system must leave the user in a suitable position so that he/she can wait for help if necessary.



In addition to a harness and an anchorage, a fall arrest system must include a shock absorber.

The person in charge of assembling a fall arrest system or a connecting subsystem designed to arrest falls must ensure that all the components and elements meet test requirements. In addition, they must ensure that the components of a fall arrest system are compatible with any other components to which they may be connected.

### TYPES OF FALL ARREST SYSTEMS

There are several types of system to protect against falls from height. The following are among the ones most commonly used:

- Body belts
- Body harnesses
- Retractable-type fall arresters
- Guided-type fall arresters on a fixed anchor line
- Guided-type fall arresters on a flexible anchor line
- Connectors
- Lanyards
- Shock absorbers
- Anchorage devices

Some of the main characteristics of the aforementioned systems are described below.



## PPE: PROTECTION AGAINST FALLS

CODE

SHR 109

Date:

July 2003

Revision:

00

Page:

2 of 13

### BODY BELTS

Body belts are used to attach users to an anchorage point and thus prevent the possibility of free falls while at work. They are comprised of a wide belt and one or more lanyards. There are two types:

**Type 1:** body belt with a single D-ring.

**Type 2:** body belt with two D-rings.

Body belts are used when the aim is to restrain a worker at height; they are never used as devices to arrest falls from height.

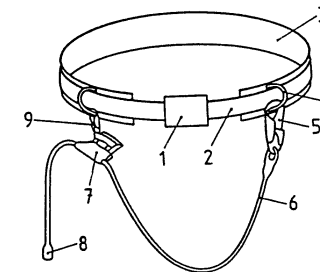
Body belts are used as positioning systems designed to restrain workers at height and prevent free fall. A positioning system should not be used for fall arrest; it should only be used for work in which there are no appreciable movements, to prevent free fall, or in work involving only horizontal, vertical or oblique movements, in which additional mobile anchorage systems can be used.

**Positioning system:** comprised of components connected together to form a complete system to restrain the user at work. Positioning systems are used to work at height up poles or on other structures in an anchored position, so that workers have their hands free to work. They are not designed for use to arrest falls.

**Lanyard:** component that joins the body belt to a structure. The lanyard must be equipped with a length adjustment system and under normal circumstances it should be no more than 2 m long. When this is not possible, the length should be kept as short as possible so that the equipment continues to protect the worker.

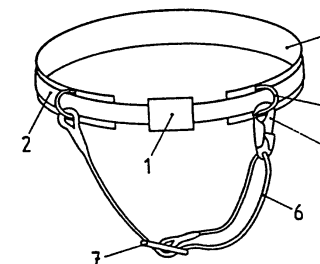
To reduce the possibility of the belt being unbuckled accidentally, the snap hooks and karabiners at the end of the lanyard must close and block automatically. They should only open if at least two consecutive, deliberate actions are performed.

Body belt with a lanyard connected to two D-rings



- 1 Buckle
- 2 Band of the belt
- 3 Back support
- 4 D-ring
- 5 Connector (snap hook)
- 6 Lanyard
- 7 Length adjustment system
- 8 End of the lanyard
- 9 Connector

Body belt with an incorporated lanyard



- 1 Buckle
- 2 Band of the belt
- 3 Back support
- 4 D-ring
- 5 Connector (snap hook)
- 6 Lanyard
- 7 Length adjustment system



## PPE: PROTECTION AGAINST FALLS

CODE

**SHR 109**

Date:

**July 2003**

Revision:

**00**

Page:

**3 of 13**

### BODY HARNESS

This kind of personal protection equipment should be selected when there is a risk of falling from height that cannot be prevented by collective protection systems.

When there is a risk of falling from height, a harness must always be used instead of a body belt.

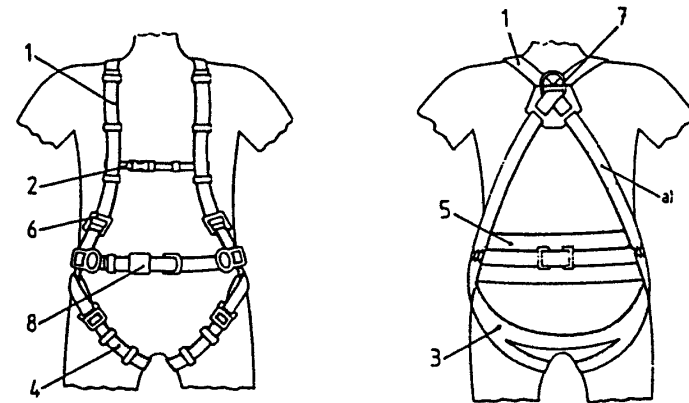
Body harnesses are donned and tightened to fit the user's body, so that the person is held during a fall and after fall arrest.

**Body harness:** This is a device that holds the body and is designed to arrest falls, i.e. it is a component of a fall arrest system. A body harness may be comprised of straps, adjusters, buckles and other elements arranged and tightened properly on a person's body so that it would be held during a fall and after fall arrest.

**Main straps / secondary straps:** The main straps are the straps of a body harness that hold the body or exercise pressure on the body during a fall and after fall arrest. The rest of the straps are secondary straps.

The straps and the threads used to sew a body harness must be made from synthetic fibres that have characteristics equivalent to those of nylon and polyester fibres. The straps must not move from their planned position and must not loosen on their own.

It must be possible to visually inspect all of a harness, even if it is incorporated into work clothes. All safety buckles (that is, those that are not used for tightening) must be designed so that they can only be connected correctly. If they can be connected in several ways, each potential method of connection must meet the strength and performance requirements.



- |   |                                      |   |                 |
|---|--------------------------------------|---|-----------------|
| 1 | <b>Strap</b>                         | 6 | <b>Adjuster</b> |
| 2 | <b>Secondary strap</b>               | 7 | <b>D-ring</b>   |
| 3 | <b>Sub-pelvic strap (main strap)</b> | 8 | <b>Buckle</b>   |
| 4 | <b>Thigh strap</b>                   | 9 | <b>Marking</b>  |
| 5 | <b>Back support for restraint</b>    |   |                 |

## PPE: PROTECTION AGAINST FALLS

|      |         |           |           |
|------|---------|-----------|-----------|
| CODE | SHR 109 | Date:     | July 2003 |
|      |         | Revision: | 00        |
|      |         | Page:     | 4 of 13   |

### RETRACTABLE-TYPE FALL ARRESTERS

These are fall arrest devices with automatic locking and an automatic system of tensioning and backwards movement of the lanyard; in other words, the lanyard is retractable. A shock absorber can be incorporated into the device itself or into the self-retracting lanyard.

Given that a retractable-type fall arrester is designed and tested as a complete connecting subsystem to arrest a fall, a shock absorber that is a separate component should not be attached to the connector of the self-retracting lanyard.

A retractable-type fall arrester may consist of a drum around which the lanyard is coiled or a weight and pulley system to change the direction of the lanyard. The self-retracting lifeline should be made of a metal cable, or synthetic webbing or rope.

### GUIDED-TYPE FALL ARRESTERS ON A RIGID ANCHOR LINE

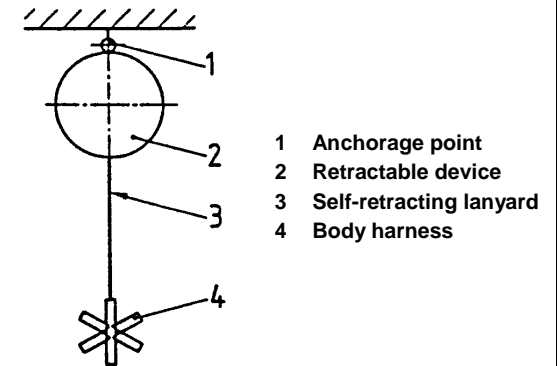
These are used fixed or incorporated into ladders or other climbing systems and must be attached properly to appropriate structures.

**Guided-type fall arrester on a rigid anchor line:** a subsystem comprised of a rigid anchor line, a guided-type fall arrester device with automatic locking attached to the rigid anchor line, and a lanyard attached to the guided-type fall arrester. A shock absorber can be incorporated into the guided-type fall arrester, the lanyard or the anchor line.

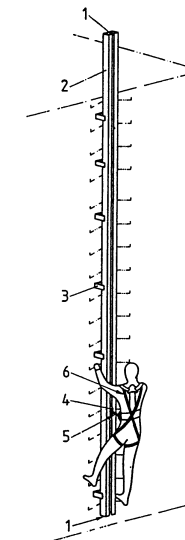
**Rigid anchor line:** a connecting element designed for a subsystem with a guided-type fall arrester. For example, a rigid anchor line could be a rail or metal cable fixed to a structure so that lateral movements of the line are limited.

To limit lateral movements, the rigid anchor line must be fixed to a structure at the recommended intervals, or the two ends of the anchor line must be attached to a structure and the cable must be tensioned.

The anchor line must be designed so that it only allows the movement of the guided-type fall arrester in the specified directions and prevents accidental disconnection of the fall arrest device from the anchor line.



- 1 Anchorage point
- 2 Retractable device
- 3 Self-retracting lanyard
- 4 Body harness



- 1 Attachment / detachment point / end stop
- 2 Rigid anchor line
- 3 Support
- 4 Guided-type fall arrester
- 5 Lanyard
- 6 Body harness



## PPE: PROTECTION AGAINST FALLS

CODE

**SHR 109**

Date:

**July 2003**

Revision:

**00**

Page:

**5 of 13**

### GUIDED-TYPE FALL ARRESTER ON A FLEXIBLE ANCHOR LINE

**Guided-type fall arrester on a flexible anchor line:** a subsystem comprised of a flexible anchor line, a guided-type fall arrester device with automatic lock attached to the flexible anchor line, and a lanyard attached to the guided-type fall arrester. A shock absorber can be incorporated into the guided-type fall arrester, the lanyard or the anchor line.

**Flexible anchor line:** connecting element designed for a subsystem with a guided-type fall arrester. A flexible anchor line could be a synthetic rope or a metal cable and is fixed to an upper anchorage point.

A flexible anchor line must be fixed to an upper anchorage point and have an end stop, or be designed in such a way that an end stop can be fitted, so that the guided-type fall arrester cannot come off the anchor line accidentally.

Guided-type fall arresters should not only work by inertia. If a guided-type fall arrester has a manual lock, the lower end of the flexible anchor line must be secured, for example, by a fixed manufactured lower end or by ballast.

Metal flexible anchor lines must have a fixed manufactured lower end or ballast in all cases.

A lanyard may be synthetic rope, webbing, a metal cable or a chain. The length of the lanyard, including the shock absorber, should be no more than 1 m. The two ends of the lanyard should have suitable fittings.

### CONNECTORS

These are used together with a body harness or body belt and a lanyard (rope). Connectors must not have sharp or rough edges that could cut, wear out by friction, or damage the ropes or straps in any other way, or injure the user.

**Snap hook:** a connector with an automatic closing mechanism and an automatic or manual lock.

**Karabiner:** a specific kind of snap hook.

To reduce the probability of snap hooks and karabiners opening accidentally, they must close automatically, and lock automatically or manually. They should be designed so that they can only be detached if at least two voluntary, consecutive actions are carried out.

If a connector is a component, it must be supplied with instructions of use. These instructions of use must be followed by all manufacturers who incorporate a connector into a component such as a lanyard, a shock absorber or a fall arrester.

In addition, the instructions of use should indicate that snap hooks and karabiners with manual locks are only acceptable when the user does not have to attach and detach the snap hook or karabiner many times during the working day.



## PPE: PROTECTION AGAINST FALLS

CODE

**SHR 109**

Date:

**July 2003**

Revision:

**00**

Page:

**6 of 13**

### LANYARDS

These are used with a body harness or a body belt and a connector (snap hook or karabiner).

**Lanyards:** connecting elements or components of a system. A lanyard may be a synthetic rope, a metal cable, a strap or a chain. The two ends of a lanyard must have the right kind of fittings.

The total length of a fixed or adjustable lanyard, including a shock absorber when applicable and the manufactured end fittings, which may be connectors or string loops, should be no more than 2 m.

Adjusters should be incorporated in such a way that an adjustable lanyard can extend no further than 2 m. All of the intermediate ends of an adjustable lanyard must have the right fittings.

Lanyards should be selected according to the use of the fall arrester device. In no cases should the length of a lanyard be over 2 m.

### SHOCK ABSORBERS

These are normally used as part of a fall arrest system.

**Shock absorber:** a component of a fall arrest system that ensures a safe stop after a fall from height under normal conditions of use.

If a shock absorber is incorporated into a lanyard (in other words, the shock absorber cannot be removed without damaging the lanyard or without using a specific tool), the lanyard must comply with Section 4.2 of Standard UNE – EN 354.

In particular, the manufacturer's instructions of use must specify all relevant information about the following:

- The characteristics required for a safe anchorage point, and the minimum clearance that is needed under the user, which is the sum of the stopping distance plus an additional distance of 2.5 m. The additional distance covers the extension of the harness and the free space under the feet of the user once the fall has been arrested.
- The correct way to connect the shock absorber to a secure anchorage point, a body harness and other components in the fall arrest system.

Most fall arrest systems include a shock absorber device. You should select the device that the manufacturer recommends as the most suitable for the specific fall arrest system. If the fall arrest system and the shock absorber are made by different manufacturers, consult both of them to check that the items are compatible.



## PPE: PROTECTION AGAINST FALLS

CODE

**SHR 109**

Date:

**July 2003**

Revision:

**00**

Page:

**7 of 13**

### ANCHORAGE DEVICES

These are elements or series of elements or components that include one or more anchorage point.

- **Element:** part of a component or subsystem. Ropes, straps and webbing, attachment elements, adjusters and lanyards are all examples.
- **Component:** part of a system marketed by a manufacturer that is supplied in its packaging with markings and instructions of use. Body harnesses, body belts and lanyards are examples.
- **Anchorage point:** the element to which personal protection equipment can be attached after the installation of the anchorage device.
- **Structural anchor:** an element or elements that are fixed permanently to a structure, to which an anchorage device or personal protection equipment can be attached.
- **Terminal structural anchor:** a structural anchor situated at both ends of a flexible anchor line.
- **Intermediate structural anchor:** an additional structural anchor that could be necessary between terminal structural anchors.
- **Anchor line:** a flexible line between structural anchors to which personal protection equipment can be attached.
- **Anchor rail:** a rigid line situated between two structural anchors to which personal protection equipment can be attached.
- **Mobile anchor point:** an additional mobile element fitted to an anchor line to which personal protection equipment can be attached.
- **End stop:** a specific piece that prevents the mobile anchor point or the personal protection equipment from coming off the anchorage device.
- **Connectors:** lanyards, shock absorbers or other devices that meet the manufacturer's specifications, attached to the mobile anchor point on a flexible anchor line.

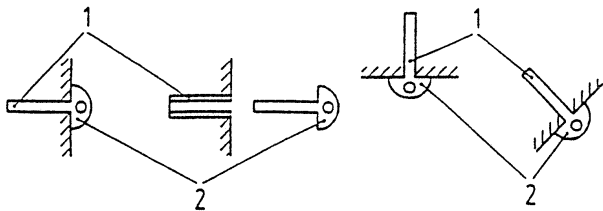
## PPE: PROTECTION AGAINST FALLS

|      |                |           |                  |
|------|----------------|-----------|------------------|
| CODE | <b>SHR 109</b> | Date:     | <b>July 2003</b> |
|      |                | Revision: | <b>00</b>        |
|      |                | Page:     | <b>8 of 13</b>   |

### CLASS A

**Class A1:** includes structural anchors designed to be secured to vertical, horizontal and inclined surfaces, such as walls and columns.

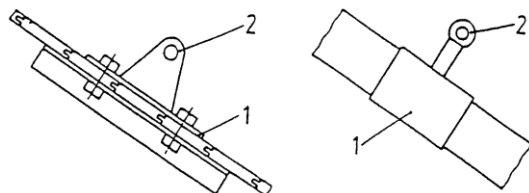
**Examples of structural anchors designed to be attached to vertical, horizontal and inclined surfaces**



1. Structural anchor      2. Anchor point

**Class A2:** includes structural anchors designed to be secured to inclined roofs.

**Examples of structural anchors designed to be secured to inclined roofs**

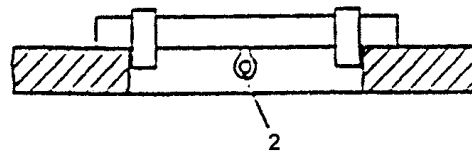


1 Structural anchor  
2 Anchor point

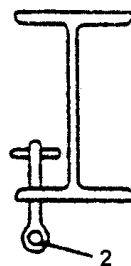
### CLASS B

Includes transportable, temporary anchor devices.

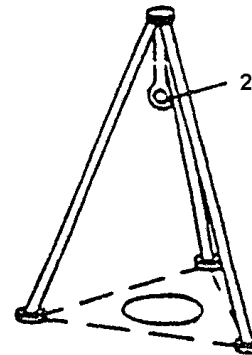
**Examples of transportable, temporary anchor devices**



a) Cross beam



b) Anchor pin



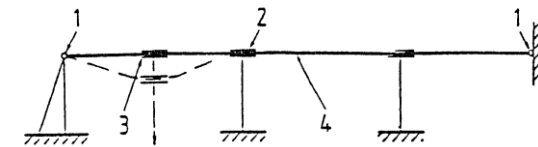
c) Tripod

2 Anchor point

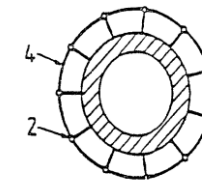
### CLASS C

Includes anchor devices designed for use with horizontal, flexible lifelines. A horizontal lifeline is defined as a line that does not deviate by more than 15° from the horizontal. The instructions must include the maximal force allowed on the end and intermediate structural anchors.

**Examples of anchor devices used with horizontal, flexible lifelines**



a) Anchoring device that can be used on a roof



b) Anchoring device that can be used in a chimney

- 1 End structural anchor
- 2 Intermediate structural anchor
- 3 Mobile anchor point
- 4 Anchor line





## PPE: PROTECTION AGAINST FALLS

CODE

**SHR 109**

Date:

**July 2003**

Revision:

**00**

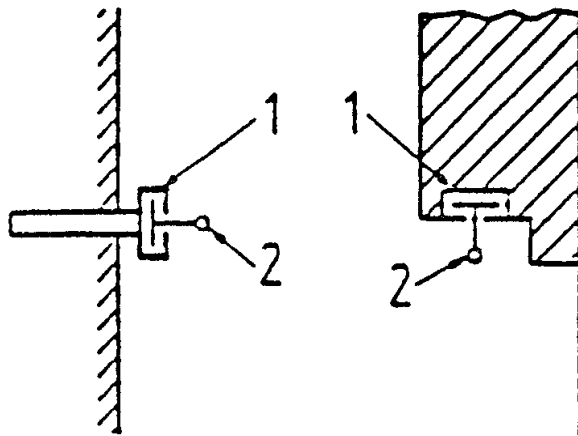
Page:

**9 of 13**

### CLASS D

Includes anchorage devices designed for use with horizontal, rigid rails.

#### Examples of anchor devices designed for use with horizontal, rigid rails

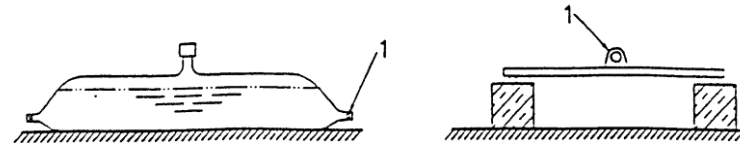


**1 Anchoring rail**  
**2 Mobile anchoring point**

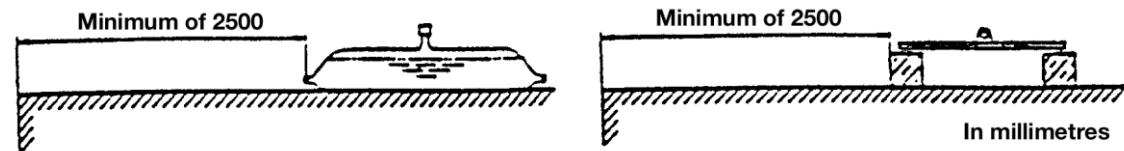
### CLASS E

Includes dead-weight anchors for use on horizontal surfaces. For the use of a dead-weight anchor, a horizontal surface is considered one that does not deviate from the horizontal by more than 5°.

#### Examples of dead-weight anchors



**1 Anchor point**



#### Minimum distance to the edge of a roof for dead-weight anchors

For classes C and E, the manufacturer or installer must clearly indicate the following parameters on the anchorage device, or close to it:

- The maximum number of workers who can connect to it.
- Whether shock absorbers need to be used.
- The minimum height required.

Class E anchoring devices must be permanently marked on the dead-weight anchor with the type of construction material and the conditions of use that are declared suitable by the manufacturer.



## PPE: PROTECTION AGAINST FALLS

CODE

**SHR 109**

Date:

**July 2003**

Revision:

**00**

Page:

**10 of 13**

### MARKING

Each separate component of fall arrest equipment must be marked clearly, indelibly and permanently by any suitable method that does not damage the materials in any way. The marking must provide the following information:

- The CE marking
- The number of the harmonised regulation used to assess the product's conformity with essential health and safety requirements.
- The identification mark, which should include the following:
  - The two last figures from the year of manufacture, for example 92 for 1992.
  - The name, trade name or any other means of identifying the manufacturer or authorised supplier.
  - Manufacturer's batch number or serial number of the component.

The characters used in the identification mark must be visible and legible.

- The size, year and month of manufacture and the expiry date, if the protective features can be significantly affected by ageing

### SELECTION: RECOMMENDATIONS

1. The **manufacturer's information booklet** should be considered, and must include all useful data referring to instructions on each system or each component, written in the language of the country where the product is sold.

The instructions must cover at least the following aspects:

- Detailed descriptions of how to use the system or component correctly. This may be supplemented with drawings, warnings, etc.
- Recommendations to establish whether or not it is appropriate to allocate the system or component (e.g. the harness) to a specific person who needs to use it.
- Recommendations on providing and keeping documents with each system or component. The descriptive file should contain the following data:
  - The identification mark.
  - The name and address of the manufacturer or supplier and manufacturer's serial number.
  - The year of manufacture and suitability for use with other components to form part of individual fall arrest systems.
  - The date of purchase and date of first use.
  - The name of the user and a space for comments.



## PPE: PROTECTION AGAINST FALLS

CODE

**SHR 109**

Date:

**July 2003**

Revision:

**00**

Page:

**11 of 13**

- Instructions on anchoring the fall arrest system preferably above the position of the user, and details of the recommended anchor point. The minimum strength of the anchorage should also be specified.
- A statement on the use and limitations of the product.
- A warning to users that they should do the following before use:
  - Visually inspect the system or the component to check that it is in good condition and working properly.
  - Ensure that the recommendations for use are met, along those of other components that form part of the system, as stated in the file on the system or component.
- A warning that any system or component must be replaced immediately if there are any concerns about its safety.
- An instruction specifying that, if the system or component has been used to arrest a fall, it is essential for safety purposes to stop using it until it has been sent to the manufacturer or the relevant repair centre for repairs and new safety tests.
- For textile components, the recommended cleaning method and a warning that these should be followed strictly.
- For textile components, an instruction stating that any items that have got wet during use or cleaning should be dried naturally, away from a direct flame or any other heat source.
- Instructions for protection during use.
- Instructions for protection from any risk.
- Storage instructions. If there are any environmental or industrial factors that could affect the materials, instructions should be given for their correct storage.
- Instructions for cleaning and maintenance.
- Instructions stating that a skilled person should examine (or, if the manufacturer considers necessary, repair) the system or component every twelve months at least.

# SAFETY AND HYGIENE REGULATIONS



Servei de Prevenció de Riscos Laborals  
UNIVERSITAT POLITÈCNICA DE CATALUNYA

## PPE: PROTECTION AGAINST FALLS

CODE

**SHR 109**

Date:

**July 2003**

Revision:

**00**

Page:

**12 of 13**

### SELECTION OF PERSONAL PROTECTION EQUIPMENT (PPE): PROTECTION AGAINST FALLS

| TYPES  | CHARACTERISTICS  |
|--|--|
| <b>BODY BELT</b>   | Body belts are used to attach users to an anchorage point and thus prevent the possibility of free falls while at work. They are comprised of a wide belt and one or more lanyards. There are two types:<br>Type 1: body belt with a single D-ring.<br>Type 2: body belt with two D-rings.   |
| <b>BODY HARNESS</b>  | This kind of personal protection equipment should be selected when there is a risk of falling from height that cannot be prevented by collective protection systems. When there is a risk of falling from height, a harness must always be used instead of a body belt.<br>Body harnesses are donned and tightened to fit the user's body, so that the person is held during a fall and after fall arrest. |
| <b>RETRACTABLE-TYPE FALL ARRESTER</b>                      | These are fall arrest devices with automatic locking and an automatic system of tensioning and backward movement of the lanyard; in other words, the lanyard is retractable. A shock absorber can be incorporated into the device itself or into the self-retracting lanyard.  |
| <b>GUIDED-TYPE FALL ARRESTER ON A RIGID ANCHOR LINE</b>    | A subsystem comprised of a rigid anchor line, a guided-type fall arrester device with automatic locking attached to the rigid anchor line, and a lanyard attached to the guided-type fall arrester. A shock absorber can be incorporated into the guided-type fall arrester, the lanyard or the anchor line.   |
| <b>GUIDED-TYPE FALL ARRESTER ON A FLEXIBLE ANCHOR LINE</b> | A subsystem comprised of a flexible anchor line, a guided-type fall arrester device with automatic lock attached to the flexible anchor line, and a lanyard attached to the guided-type fall arrester. A shock absorber can be incorporated into the guided-type fall arrester, the lanyard or the anchor line.  |
| <b>CONNECTORS</b>  | These are used together with a body harness or body belt and a lanyard (rope). Connectors must not have sharp or rough edges that could cut, wear out by friction, or damage in any other way the ropes or straps, or injure the user.<br>Snap hook: a connector with an automatic closing mechanism and automatic or manual lock.<br>Karabiner: a specific type of snap hook.                             |
| <b>LANYARDS</b>  | Connecting elements or components of a system. A lanyard may be a synthetic rope, a metal cable, a strap or a chain. The two ends of a lanyard must have the right kind of fittings.   |
| <b>SHOCK ABSORBERS</b>                                     | Components of a fall arrest system that ensures a safe stop after a fall from height under normal conditions of use. These are normally used as part of a fall arrest system.  |

# SAFETY AND HYGIENE REGULATIONS



Servei de Prevenció de Riscos Laborals  
UNIVERSITAT POLITÈCNICA DE CATALUNYA

## PPE: PROTECTION AGAINST FALLS

CODE

**SHR 109**

Date:

**July 2003**

Revision:

**00**

Page:

**13 of 13**

### SELECTION OF PERSONAL PROTECTION EQUIPMENT (PPE): PROTECTION AGAINST FALLS

| TYPES                    | CLASS    | CHARACTERISTICS  |
|--------------------------|----------|--|
| <b>ANCHORING DEVICES</b> | <b>A</b> | <b>A1</b><br>Structural anchors designed to be secured to vertical, horizontal and inclined surfaces, such as walls and columns.   |
|                          |          | <b>A2</b><br>Structural anchors designed to be secured to inclined roofs.  |
|                          | <b>B</b> | Transportable, temporary anchor devices.   |
|                          | <b>C</b> | Includes anchor devices designed for use with horizontal, flexible lifelines. A horizontal lifeline is defined as a line that does not deviate by more than 15° from the horizontal. The instructions must include the maximum force allowed on the end and intermediate structural anchors. |
|                          | <b>D</b> | Anchoring devices designed for use with horizontal, rigid rails.   |
|                          | <b>E</b> | Dead-weight anchors for use on horizontal surfaces. For the use of a dead-weight anchor, a horizontal surface is considered one that does not deviate from the horizontal by more than 5°.   |