IRATA International code of practice for industrial rope access

Part 3: Informative annexes

Annex E: Other types of lanyard

December 2013

The first edition of Annex E was published in October 2011.
This edition was published in March 2013.

Amendments issued since publication since March 2013

Amd. No	Date	Text affected
1	2013-Sep-01	Front cover: *September 2013* replaces *2013 edition*. This page: change of IRATA address and telephone number. Date in footer updated. All the changes are classed as editorial.
2	2013-Dec-01	Front cover: *December 2013* replaces *September 2013*. Date in footer updated. E.3.2: Words (*safety back-up excluded)* are deleted due to change of drawing in Figure E.7. Drawings in Figures E.6 and E.7 changed.

Published by:

IRATA International
First Floor, Unit 3
Eurogate Business Park
Ashford
Kent
TN24 8XW
England

Tel: +44 (0)1233 754600

Email: info@irata.org

Website: www.irata.org

ISBN: 978-0-9544993-5-8

Annex E (informative)
Other types of lanyard

Introduction

Annex E gives advice and other information that could be relevant to users of rope access methods and is one of a number of informative annexes in Part 3 of this code of practice. This informative annex should be read in conjunction with other parts of this code of practice, should not be used in isolation and is not intended to be exhaustive. For further advice, readers should refer to relevant specialist publications.

E.1 General

E.1.1 It is recommended that Part 2, 2.7.1 and 2.7.8 are read and understood before reading this informative annex. The user should also read and understand the product information supplied by the manufacturer.

E.1.2 There are many types of lanyard and often these lanyards can be used for different applications within a personal fall protection system, e.g. in a rope access system, a device lanyard can sometimes be used as an anchor lanyard. Sometimes, lanyards may be suitable for use in more than one personal fall protection system. For example, some lanyards designed for use in a fall arrest system may be used in a rope access system, a work positioning system or a work restraint (travel restriction) system. However, as explained in **Part 2, 2.7.1.6** and **2.7.1.7**, the converse is not true: equipment specifically for use in a work restraint system should not be used in a work positioning or fall arrest system and lanyards specifically for use in a work positioning system should not be used in a fall arrest system. Lanyards specifically for rope access are covered in **Part 2, 2.7.8**.

E.2 Fall arrest lanyards

E.2.1 General

E.2.1.1 Fall arrest systems (see **Part 2, 2.7.1.5**) should incorporate an energy dissipating element, component or feature to keep the impact load (more accurately, the deceleration) experienced by the user in a fall to an acceptable level. This varies from 4 kN to 8 kN, depending on the region, e.g. in the European Union it is currently a maximum of 6 kN, in Canada it varies between 4 kN and 6 kN, while in the USA, it is generally 6 kN but in some cases is allowed to reach 8 kN for a few milliseconds (ms). (This brief excursion to 8 kN is considered to be inconsequential.) The impact loads are kept below these maximums typically by the use of an energy absorber either integrated with or attached to the fall arrest lanyard that connects the user directly or indirectly to the structure or natural feature.

E.2.1.2 Fall arrest lanyards should be known to have minimum static strengths in accordance with local legislation or good practice. Examples of minimum static strengths for fall arrest lanyards made from man-made fibres are 22 kN in Europe and 5,000 lbs/22.7 kN in the USA, and for fall arrest lanyards made from steel wire: 15 kN in Europe, 15 kN in Canada but 5,000 lbs/22.7 kN in the USA.

E.2.2 Energy-absorbing fall arrest lanyards

E.2.2.1 As explained in **E.2.1.1**, energy-absorbing fall arrest lanyards are intended to ensure that any impact load experienced by a rope access technician who falls does not exceed an acceptable maximum. See **Figure E.1** and **Figure E.2** for two examples of energy-absorbing fall arrest lanyards. Appropriate energy-absorbing fall arrest lanyards can be used as device lanyards fitted between the user and a fall arrest or back-up device, and as anchor lanyards, but see **E.2.2.2**. They could also be fitted between an anchor and an anchor line, (working line, safety line or both). However, this is unusual, has certain problems, and is not covered in this annex.

E.2.2.2 As well as having to keep the impact load in a fall to an acceptable level, energy-absorbing fall arrest lanyards conforming to known standards have a requirement not to deploy more

than a few millimetres under a certain minimum load: this is typically 2 kN. To ensure correct functioning of the energy absorber, should it be called upon to arrest a fall, it is important that this load is not exceeded. A user of say 100 kg mass including equipment carried could easily achieve a 2 kN load on the energy-absorbing fall arrest lanyard if it were used for support. Unless an energy-absorbing fall arrest lanyard is specifically designed to support a user, such use should be avoided.

E.2.2.3 Energy absorbers, particularly those used to support the user, should always be checked before each use and continually while being used to ensure they have not been partially or fully deployed. If there are any signs of deployment, the energy-absorbing fall arrest lanyard should be taken out of service.

E.2.2.4 In all cases where energy-absorbing fall arrest lanyards are used, careful attention should be given to the additional clearance distance required due to the extension of the energy absorber during deployment, should a fall occur.

E.2.2.5 It is important to ensure that energy-absorbing fall arrest lanyards are appropriate for the mass of the user including any equipment carried. This can be confirmed by checking the marking on the energy-absorbing fall arrest lanyard or by reading the information supplied by the manufacturer. This advice applies to rope access technicians with a low mass as well as those with a high mass. If there is any doubt about the energy-absorbing fall arrest lanyard being appropriate, the manufacturer or his authorized representative should be contacted and written confirmation obtained.

E.2.2.6 Energy-absorbing fall arrest lanyards should not be extended beyond the maximum length specified by the manufacturer, e.g. by linking two energy-absorbing fall arrest lanyards or other lanyards end to end. This is because the potential free fall distance is increased, with an increased risk of hitting the ground, structure or natural feature and, in addition, the loads on the user in a fall could rise to an unacceptable level.

E.2.2.7 Two (or more) energy-absorbing fall arrest lanyards should not be used in parallel, i.e. side by side. This is because in a fall the load might be shared by both (or all) the energy absorbers. This is likely to cause them not to function as intended and for there to be an increase in the loads experienced, which could result in a serious injury. Also see **E.2.3.2**.

E.2.2.8 For reasons similar to those given in **E.2.2.6**, it is not recommended to connect an energy-absorbing fall arrest lanyard to the end of the retractable lanyard of a retractable fall arrest device, unless this is permitted by the manufacturers.

E.2.3 Twin-tailed energy-absorbing fall arrest lanyards

E.2.3.1 When there is a need to climb up, down, diagonally or horizontally on a structure such as a tower or mast, a method commonly employed is the use of twin-tailed (sometimes known as twin-legged) fall arrest lanyards. Twin-tailed fall arrest lanyards should employ a single energy dissipating feature, i.e. an energy absorber, to which at one end two lanyards are incorporated. These are the tails (or legs). The other end of the energy absorber is intended for attachment to a fall arrest harness. See **Figure E.2** for an example of a twin-tailed energy-absorbing fall arrest lanyard. Each tail end is fitted with a suitable connector, which, in use, is connected to the structure alternately as progress is made, in such a way that the length of any potential fall is minimised. Should a fall occur, the load is taken by a single energy absorber, which should perform as intended and keep the impact load to an acceptable level.

E.2.3.2 A twin-tailed energy-absorbing fall arrest lanyard should not be confused with two single energy-absorbing fall arrest lanyards, where each is equipped with its own energy absorber. The use of two such single lanyards is not recommended as there is an inherent problem with this method. In the very predictable situation that both lanyards are connected to the structure at the same time and a fall occurs, the impact load on the user is likely to be much higher than the intended maximum impact load of the energy absorber. This is because the load has been shared by two energy absorbers, which have not been able to function as intended. This could result in a serious injury.

E.2.3.3 There are also potential safety issues that apply to some designs of twin-tailed energy-absorbing fall arrest lanyards. In November 2004, a worker received fatal injuries as a result of falling

from a transmission tower. The worker was using a twin-tailed energy-absorbing fall arrest lanyard and the lanyard failed during the fall arrest phase. The ensuing investigation highlighted important factors that are essential in the design of twin-tailed energy-absorbing fall arrest lanyards. These are described in **E.2.3.3.1** to **E.2.3.3.3**.

E.2.3.3.1 The attachment point between the energy absorber and lanyard tails sometimes consists of webbing that is stitched back onto itself to form a connecting loop. When a fall arrest load is applied to the lanyard assembly, such that the load is in line with the energy absorber body, this connecting loop should transfer the load without failing. This type of loading is illustrated in **Figure E.3**. However, in some fall arrest situations, a side load can be applied to the loop, see **Figure E.4**. In a poorly designed product, this load will tend to rip apart the stitching on the loop.

E.2.3.3.2 A side load can be applied to the connecting loop if the user falls from a structure when the twin-tailed energy-absorbing fall arrest lanyard is used in either of the following two ways:

a) both tails of the twin-tailed energy-absorbing fall arrest lanyard are attached to different locations on the structure, e.g. the twin-tailed energy-absorbing fall arrest lanyard is used to move along a structure horizontally and the user falls with both lanyard tails attached to the structure. The worst case is when the tails are at the maximum usable horizontal distance between the ends of the lanyard tails;

b) one tail is attached to a side connection point on the user's fall arrest harness or to the harness webbing and one tail is attached to an anchorage point on the structure with the tail positioned between the user's legs when the user falls. (This is bad practice: see **E.1.3.6**.) **E.2.3.3.3.** It is also conceivable that side loading may be applied to the connecting loop in the event of a fall when the user is moving vertically up and down, horizontally or diagonally on a structure.

E.2.3.4 It is essential that the design of a twin-tailed energy-absorbing fall arrest lanyard is such that no matter which direction the load in a fall is applied to the point where the lanyard tails are attached to the energy absorber, there is no catastrophic failure of any part of the twin-tailed fall arrest lanyard. Before using twin-tailed energy-absorbing fall arrest lanyards, rope access technicians are strongly advised to check the configurations permitted by the manufacturer. Conformance to an appropriate standard is recommended. An example of an appropriate standard for twin-tailed energy-absorbing fall arrest lanyards is British Standard BS 8513:2009, Personal fall protection equipment – Twin-legged energy-absorbing lanyards – Specification.

E.2.3.5 If there are any doubts about the design safety of a twin-tailed energy-absorbing fall arrest lanyard, verification that the product has been successfully tested should be sought from the manufacturer or his authorised representative. In this case, if written verification cannot be supplied, it is recommended that the twin-tailed energy-absorbing fall arrest lanyard is not used.

E.2.3.6 An unused lanyard tail should not be attached back to the harness or clothing (e.g. to keep it out of the way) except to specifically designed breakaway attachment points intended to fail at low loads. These are sometimes referred to as parking points.

E.2.3.7 Only the free end of the energy absorber, i.e. the end of energy absorber at which the tails are not attached, should be attached to the harness attachment point.

E.2.3.8 Twin-tailed energy-absorbing fall arrest lanyards should not be used in situations where they could be stressed over an edge in the event of a fall.

E.2.3.9 The shortest twin-tailed energy-absorbing fall arrest lanyard suitable for the task should be selected and, during use, the amount of slack in it should always be kept to a minimum.

E.2.3.10 Account should be taken of the minimum clearance distance required to prevent a collision with the ground or structure, should a fall from a height occur.

E.3 Work positioning lanyards

E.3.1 Work positioning lanyards are used in a work positioning system to support the user, either partially or fully. For more information on work positioning systems, see **Part 2, 2.7.1.5** and Annex L. (Lanyards used in rope access are covered in **Part 2, 2.7.8**).

E.3.2 Designs of work positioning lanyards differ depending on the work positioning method employed, see **Annex L**. **Figure E.5** shows examples of adjustable work positioning lanyards (sometimes called pole straps) for partial support in a work positioning method which uses a work positioning lanyard passed around a structure and connected to the harness. This connection is typically to two side waist attachment points on the harness or to a central attachment point at approximately waist level. **Figure E.6** shows one of these adjustable work positioning lanyards in use. **Figure E.7** shows an example of a method of work positioning used on relatively steep or slippery sloping surfaces, e.g. a roof or a steep concrete or grassy banking. (Rope access technicians are recommended to use rope access equipment, procedures and techniques.)

E.3.3 Work positioning lanyards may be made from textiles, e.g. webbing or rope, or metal, e.g. wire rope. They may be of a fixed length or may be equipped with an adjustment element. An adjustable work positioning lanyard may be a proprietary system or not, e.g. it could consist of an anchor line and an appropriate anchor line device.

E.3.4 Adjustable work positioning lanyards offer an alternative to fixed-length anchor lanyards in rope access (see **Part 2, 2.7.8**). Being able to set a precise length of lanyard can assist in several manoeuvres and also reduce potential fall distances. Adjustment elements on work positioning lanyards should not be capable of inadvertent adjustment because this could lead to an unintended lengthening of the work positioning lanyard and an unplanned potential fall situation. Adjustment elements should not be capable of being detached from the work positioning lanyard inadvertently. To protect against this, if the adjustment element can be detached from the work positioning lanyard, it should be such that it can only be detached and attached by at least two consecutive deliberate manual actions.

E.3.5 Where work positioning lanyards could be vulnerable to wear, e.g. where they are often in contact with the structure while under load, or damage, e.g. by powered tools, they should be of a heavier duty than normal lanyards and/or be protected from wear or damage, e.g. by a protective sleeve or by the use of lanyards made from steel wire.

E.3.6 To allow for foreseeable misuse, it is recommended that work positioning lanyards have at least the same static strength as lanyards used for fall arrest.

E.3.7 Work positioning lanyards should not be difficult to adjust and ideally this should be possible with one hand.

E.4 Restraint lanyards

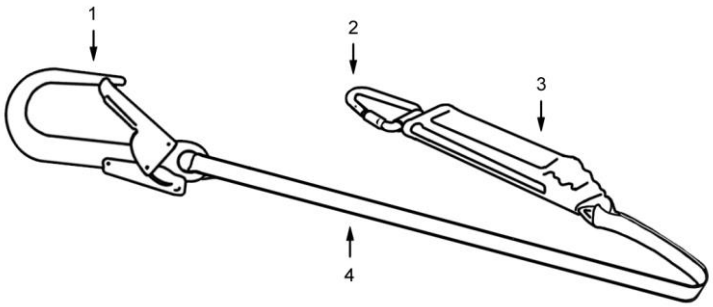
E.4.1 Restraint lanyards are used to restrict a user's broadly horizontal travel so that he/she is physically prevented from reaching zones where there is a risk of a fall from a height, e.g. a fall over an edge (see **Part 1, 1.3** for the definition of work restraint). For information on restraint systems, see **Part 2, 2.7.1.5** and **Annex L, L.2**.

E.4.2 The length of a restraint lanyard should be such that, when connected to the selected anchor point, it is long enough to allow the user to carry out the intended work but short enough to prevent a situation where a fall might have to be arrested. The restriction of travel should be determined, e.g. by measuring the distance from the anchor point to the closest point at which there could be a risk of a fall from a height. The length of the restraint lanyard should be limited to less than that distance when measured from the anchor point to the attachment point on the user's body-holding device, which may be a simple belt or a harness.

E.4.3 The range of broadly horizontal travel can sometimes be extended by the use of a horizontal anchor line to which the restraint lanyard is attached, e.g. by an appropriate connector. However, great care should be taken when using horizontal anchor lines to ensure any sag in the line,

e.g. when under the load of a person, would not allow the user to reach zones where there could be a risk of a fall from a height.

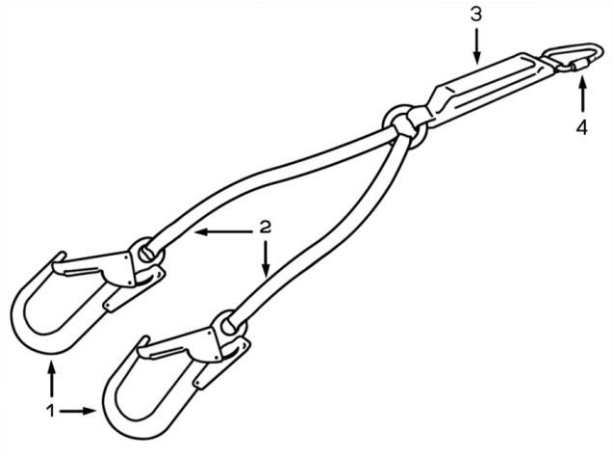
E.4.4 A lanyard or anchor line intended solely for restraint should not be used for fall arrest purposes, nor should it be used to support the weight of a person, either partially or fully, e.g. as in a work positioning system. However, sometimes users do choose to use restraint lanyards for support, e.g. on a sloping surface where normally support from an anchor line or lanyard is not needed but where at certain times it would aid carrying out the task in hand. When using a restraint lanyard in such a way, which, it is stressed, is not recommended, users should be fully aware of the consequences of a slip or equipment failure and should consider employing a safety back-up system such as that used in a work positioning or rope access system.



Key

1 Connector for attachment to structure
2 Connector for attachment to harness fall arrest attachment point
3 Energy absorber
4 Lanyard

Figure E.1 — Example of an energy-absorbing fall arrest lanyard



Key

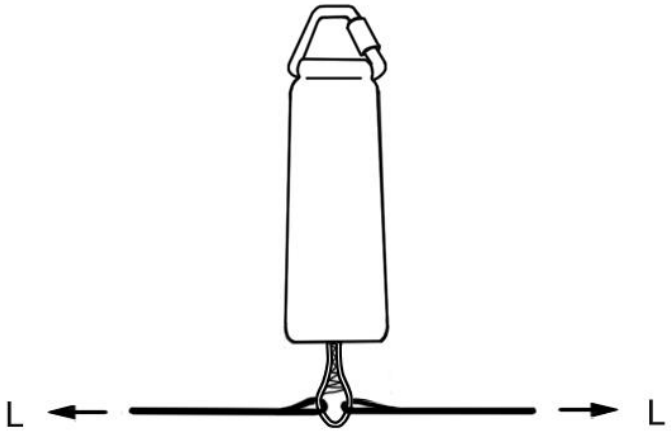
1 Connectors for attachment to structure
2 Lanyard tails (or legs)
3 Energy absorber
4 Connector for attachment to harness fall arrest attachment point

Figure E.2 — Example of a twin-tailed energy-absorbing fall arrest lanyard

Key

L Load

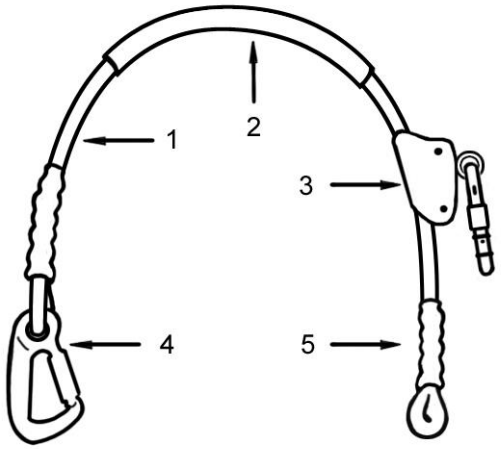
Figure E.3 — Twin-tailed energy-absorbing fall arrest lanyard loaded in line with the energy absorber



Key

L Load

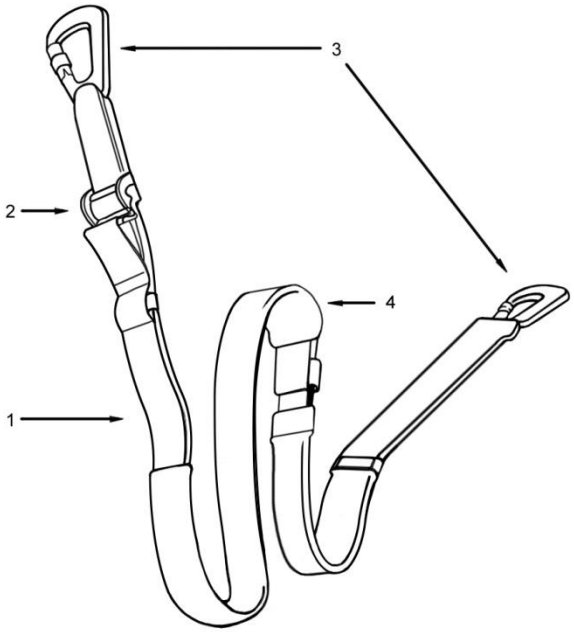
Figure E.4 — Twin-tailed energy-absorbing fall arrest lanyard loaded sideways, showing potential for stitching failure



a) Example of an adjustable work positioning lanyard made from rope

Key

1 Rope lanyard
2 Protective sleeve
3 Adjustment device
4 Connector
5 End stop



b) Example of an adjustable work positioning lanyard made from webbing

Key

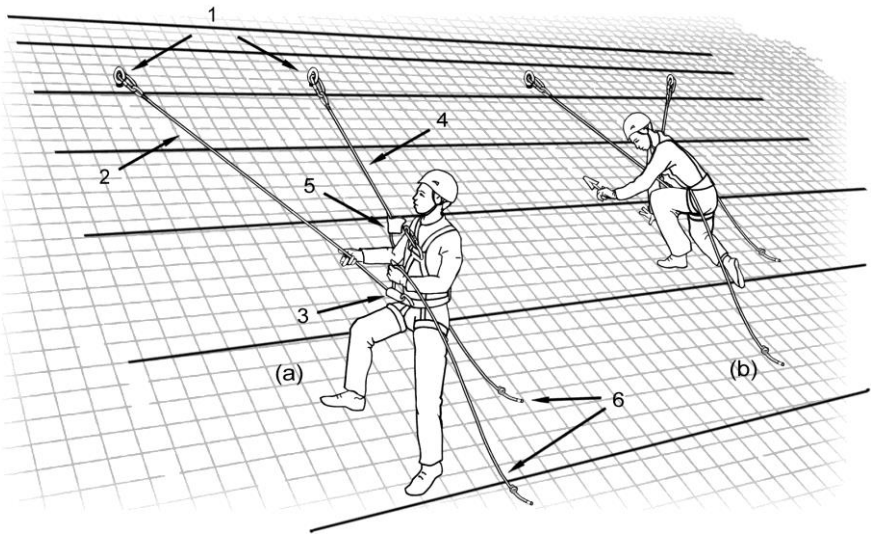
1 Webbing lanyard
2 Adjustment device
3 Connectors
4 Protective sleeve

Figure E.5 — Examples of adjustable work positioning lanyards used for fitting around a structure

Key

1 Safety back-up (in this example, an energy-absorbing fall arrest lanyard coupled to an anchor sling)
2 Work positioning lanyard passed around structure
3 Work positioning lanyard attached to work positioning attachment point on harness (could be two side attachment points)

Figure E.6 — Example of an adjustable work positioning lanyard being used for partial support (as a pole strap)



Key

(a) Adjusting the length of the anchor line used as an adjustable work positioning lanyard

(b) Worker supported by the anchor line being used as an adjustable work positioning lanyard

1 Anchor
2 Anchor line for work positioning and support (adjustable work positioning lanyard)
3 Adjustment device
4 Anchor line for safety back-up system
5 Fall arrest device
6 Spare length of anchor line with stopper knot or stopper device fitted

Figure E.7 — Example of an adjustable work positioning lanyard, in this case an anchor line, being used for partial support