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Target Audience:

FOD Inspectors (Bands 0-4)

SG Specialist Inspectors (Construction & Mechanical) (Bands 0-3)

HID Inspectors (Bands 0-4)

## ROPE EVACUATION FROM MECHANICAL HANDLING EQUIPMENT

This OC advises inspectors on the use of emergency rope evacuation systems to assist rescue from mechanical handling equipment at high level. It describes the components of a rope evacuation system and the limitations, selection and maintenance of such equipment. It advises on risk assessment criteria for considering their use and on training needs. The OC covers self rescue, not instances where a third party rescues the evacuee

### INTRODUCTION

- 1 This OC has been discussed with representatives of manufacturers, suppliers, major training organisations and users of the equipment it covers.
- 2 The guidance in this OC is not intended to cover evacuation from lifting equipment such as tower cranes, but many of the principles can be applied to evacuation from such equipment.
- 3 [Clause 5.3.7 of BS EN 1726-2:2000<sup>1</sup>](#) specifies that “Trucks that are designed to elevate the operator position more than 3000 mm above ground level shall be provided with means, e.g. descender devices complying with [BS EN 341:1993<sup>2</sup>](#) Class C, rope ladder etc by which the operator can reach the ground safely in the event of the operator position becoming fixed in the elevated position.”
- 4 Some mechanical handling equipment (e.g. order pickers, ‘operator up’ forklift trucks, overhead travelling cranes) is provided with a rope evacuation system to assist evacuation in the event of the equipment being rendered immobile at height, where there is a need for immediate evacuation.
- 5 HSE is aware of several serious incidents and at least one fatal incident involving the use of rope evacuation systems when the person using it has descended at high speed and been injured or killed, on hitting the ground. These incidents predominantly occurred during training for rope escape and reinforce the importance of: equipment selection and maintenance; a safe system of work; the initial training of personnel, under supervision; and, regular refresher training. The competence of the training organisation and instructor is particularly important.
- 6 The appointed person referred to throughout this document can be an employee of the user company providing they have received appropriate training to enable them to fulfil this

role. The competent person carrying out the LOLER thorough examination requirements and the initial and recommended 12 monthly refresher training in the use of the equipment, should normally be sourced from an external provider.

### ROPE EVACUATION EQUIPMENT - GENERAL

7 The principle of a rope evacuation system is the use of a single descent line with the user attached via a harness, to a descent device (descender). Descenders offer a controlled descent to floor level when correctly used.

8 Rope evacuation equipment should be differentiated from the techniques employing two ropes used for rope access/positioning (e.g. by industrial rope access technicians) where a safety line is used in addition to the main working line. This is anchored independently of the working line and provides a security back up.

9 In a real life emergency evacuation from mechanical handling equipment, there is little benefit in using a two rope system. Operators are unlikely to ever gain the skills required to use them properly and, as they may be under stress, there maybe a delay or confusion during evacuation.

### RISK ASSESSMENT

10 The dutyholder's risk assessment for the use of mechanical handling equipment where the operator works at a high level should recognise the possibility of the operator being stranded at high level. It should determine the need for means of escape and the most appropriate system of work for achieving a safe escape.

11 A suitable safe system of work may include a means of raising the alarm (a shout or whistle may be adequate), followed by a controlled lowering of the platform by rescuers at ground level.

12 A rope evacuation system is a "last resort" which should only be used in exceptional circumstances, e.g. where:

a) the mechanical handling equipment is immobilized and cannot be repaired, lowered or long travelled in a reasonable time; **and**

b) alternative safer means of escape cannot reasonably be provided; **and**

c) the operator is at risk from another more imminent hazard, which cannot reasonably be controlled to allow rescue without using a rope evacuation system. Examples include risk of fire (e.g. where fire fighting measures such as sprinkler systems do not adequately control the risk); smoke, halon, the effects of cold in a cold store (though thermal clothing and heated cabs may control the risk sufficiently to allow time for a safer method of evacuation).

13 The dutyholder's risk assessment should determine safer alternative means of evacuation. Appendix 1 gives more information on some issues to be considered for some possible alternative means of evacuation.

14 In determining the most appropriate system of work for achieving a safe escape, the physical characteristics and fitness of the operator should be considered.

15 Where the risk assessment determines that rope evacuation equipment is appropriate,

it should also consider any limitations with rope evacuation systems. The suitability of any particular equipment, for specific circumstances, will depend upon advice from the manufacturers of the mechanical handling equipment and evacuation systems. Rope evacuation systems should only be used with mechanical handling equipment that has been designed or is suitable to accommodate such use. If a machine is modified, it will need to be carefully assessed to make sure that additional risks have not been added.

### LIMITATIONS OF ROPE EVACUATION SYSTEMS

16 If a rope evacuation system is the only option for emergency evacuation from mechanical handling equipment, there are several factors for consideration:

- a) Operators should be sufficiently competent to use them safely. Operators who are not sufficiently competent should not be allowed to use mechanical handling equipment where the use of rope evacuation may be required. Regular refresher training is necessary so that users can acquire and maintain the competence and confidence necessary to use the evacuation equipment safely.
- b) Training should be undertaken with a safety rope controlled by the trainer (except as described in [Appendix 2 para 1 \(d\) \(iv\)](#)), even if staff have received regular training and are deemed competent. The independent safety rope should be used with an auto-locking belay device and attached to the trainee generally via a separate full body harness (but not necessarily where an [BS EN 813:1997<sup>4</sup>](#) sit harness is used). If the evacuation system itself utilises a full body harness then the safety rope should be attached to a separate fall arrest attachment point on the harness.
- c) The equipment should be maintained (see [paras 21 - 25](#)). Operators needing to use the equipment in an emergency may not have the skills to assess the condition of equipment. A rope evacuation system that has already been used for an evacuation should not be re-used unless it has been deemed suitable for re-use, by a competent person.
- d) Inexperienced operators may be nervous and tend to grip a handled descender which, with certain types, will create a rapid descent (see [Appendix 2 para 1 \(d\)](#)). To avoid confusion it is recommended that the same type of descender be used in all rope evacuation systems used at the same location.

17 During a **real life evacuation**, wherever possible, descent should be supervised (from ground level) by a person trained in emergency rope evacuation methods. During **training**, descent should **always** be supervised (generally from the upper level) by a competent person trained in emergency rope evacuation methods. With handled descenders another person appropriately instructed, could also assist by holding the bottom of the descent rope, although they should not be directly below the evacuee. This may be one of the group undergoing instruction. Checks should be made with the appropriate descender manufacturer and/or supplier to ensure that this will not impede its function.

### EQUIPMENT SELECTION

18 It is important that any equipment selected is compatible with other component parts of the rope evacuation system and the mechanical handling equipment. Clear information should be provided on the components of the system and instructions for use. Care will be needed when replacing component parts of a rope evacuation system to ensure they are

compatible with existing components (e.g. the diameter of a rope may affect the performance of the descender). Replacement of component parts may need to be done in consultation with the manufacturer/supplier of the rope evacuation system.

19 Where possible, the evacuation equipment selected should be common across the fleet of machines in use. This will reduce the complexity of the training arrangements and avoid user confusion in emergency situations.

20 [Appendix 2](#) provides more information on the components of an emergency rope evacuation system and current standards.

## INSPECTION, MAINTENANCE AND STORAGE OF EQUIPMENT

21 There should be a system for regular inspection of rope evacuation equipment by an appointed person. Duty holders should consult the supplier and/or manufacturer of the rope evacuation equipment for specific recommendations for checks and inspections. Regulation 9 of the Lifting Operations and Lifting Equipment Regulations 1998 (LOLER) applies to evacuation equipment because it is used for lowering people. The equipment should be thoroughly examined by a competent person at least six monthly, or in accordance with a written scheme of examination, drawn up by a competent person. Equipment used for training is more likely to be used more frequently and may need to be inspected and thoroughly examined more frequently.

22 INDG 367 *Inspecting fall arrest equipment made from webbing or rope* gives more information on an inspection regime for fall arrest equipment. It does not cover rope evacuation equipment, but many of the principles can be applied to rope evacuation equipment.

23 It may not be reasonably practicable to do a pre-use check of the rope evacuation system before a real life evacuation, however it should be done where it is reasonably practicable to do so (eg if there is damage to the sealed bag containing the equipment).

24 Rope evacuation systems should:

- a) be packed in a sealed 'ready to use' condition;
- b) have clear instructions attached to them and, where possible, a copy placed adjacent to the operator's normal working position;
- c) be uniquely identifiable;
- d) be stored where it is easily retrievable, will not become damaged or contaminated and close to where it will be deployed from.

25 Rope evacuation systems found in open or damaged bags should be referred to the appointed person to decide whether it is safe to use.

## TRAINING

26 Employees new to the work should be trained **before** they may have to evacuate in an emergency (initial training). It is recommended that refresher training should be done **at least** every 12 months to produce an effective "conditioning" and maintain confidence. Initial and refresher training should be carried out by a competent person.

27 In addition, it is recommended that an assessment of the competence and confidence of operators should be carried out every 6 months. The assessment should include ground level practice of donning the equipment and questioning about the sequence of actions in an evacuation. The assessment can be carried out by the appointed person (see [para 6](#)). The assessment should decide whether individuals require refresher training, ie those who have forgotten the important principles for the use of the equipment or express a lack of confidence if they would have to use it in an actual escape.

28 The employer's risk assessment can be used to determine an alternative frequency and arrangements for refresher training and assessment of competence and confidence. In practice, it may be more straightforward to carry out refresher training every 6 months using a competent person.

29 Candidates should be continually assessed throughout the training and complete a final assessment. It is recommended that the assessment is both oral and practical. Trainers may also wish to consider the use of written assessments. Unwilling or nervous candidates should not be forced to act beyond their own ability and inclination, and further instruction may be appropriate.

30 Training providers should be able to demonstrate they are competent and should only undertake instruction on evacuation equipment they are familiar with. [Appendix 3](#) gives more information on issues for consideration when assessing competence of trainers; and contents of a training programme.

31 It is recommended that the evacuation equipment fitted to mechanical handling equipment is not used for training, unless it is inspected by a competent person before being returned to the mechanical handling equipment for use. Most descenders are designed for single use followed by inspection and re-packing. The equipment used should replicate the equipment supplied with the machine but ideally should be designed specifically for training.

#### ACTION BY INSPECTORS

32 Inspectors should ensure that dutyholders have adequate risk assessments and appropriate precautions in place. Where rope evacuation is appropriate, Inspectors should draw dutyholders' attention to the need for training to be carried out by competent persons. FOD inspectors should contact specialist group (SG) construction or mechanical specialist inspectors for further technical advice; and FOD Safety Unit for further advice on enforcement policy.

#### EMM GUIDANCE

33 The following guidance is based on EMM Operational Version 3.0 (May 2002). The advice given is for guidance only and may be varied by the actual risks on site or other duty holder and strategic factors.

34 When training including a practice descent is taking place and:

- a) there is no safety rope; or where automatic descenders are being used, and a higher level of supervision is not provided at the top ([Appendix 2 para 1\(d\) \(iv\)](#)); or
- b) appropriate training is not being done by competent persons;

there is an imminent risk of serious personal injury and a Prohibition Notice (PN) should be considered. This is because operators are more vulnerable during training.

35 Where training is not taking place, but the employer has not made a risk assessment, which recognises the possibility of the operator being stranded at a high level and which identifies appropriate precautions, the standard of compliance is absent. The Management of Health and Safety at Work Regulations 1999, Regulation 3 is a defined standard (Ch 2, section 3, table 4 and 5.2 of EMM). The initial enforcement expectation (IEE) is Improvement Notice (IN).

36 Where training is not taking place, but rope evacuation equipment will be used in the event of an operator being stranded high up, and appropriate training has not been done by a competent person, the actual risk is possible risk of serious personal injury. With appropriate training by competent persons, the general benchmark is remote risk of significant injury. The Personal Protective Equipment at Work Regulations 1992, Regulation 9; Provision and Use of Work Equipment Regulations 1998, Regulation 9; and this OC are established standards (Ch 2, section 3, table 5.1 of EMM). The IEE is Improvement notice (IN).

37 Where employers have not implemented an adequate training programme the EMM guidance is as in [para 36](#).

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## APPENDIX 1

Alternative means of evacuation may include:

1 A fixed rigid side ladder, fitted with safety hoops or a vertical lifeline as part of a fall arrest system involving the use of a full body harness. Where the ladder is more than 2.5 m high, hoops should begin at a height of 2.5 m above the base of a ladder and be at maximum intervals of 900 mm.

2 Using a mobile elevating working platform (MEWP) for evacuation introduces other risks such as falling during transfer or overturning of the MEWP. It is often very difficult for MEWPs to get close enough to effect a safe transfer. As a result, the practice of transferring at height to a MEWP is not normally acceptable. However, it may be done for rescue purposes, provided the risks are adequately controlled and the equipment is compatible. In particular, a MEWP with a gate or sliding rail should be used to avoid the need to climb over the guard rails. The transfer may need to be done using fall arrest equipment with a twin leg energy absorbing lanyard with one of the lanyards always attached to a suitable anchor. If the MEWP is to be used as an anchor for fall arrest purposes, any dynamic effects on the MEWP from use of the fall arrest equipment will need to be considered. Careful consideration should be given to ensuring a safe distance to allow the energy absorber to deploy in the event of a fall, to reduce the risk of injury from hitting the ground or other object below. Consideration will also need to be given to: rescue in the event that the evacuee falls using the fall arrest equipment; and inspection / maintenance of the fall arrest equipment and user training. More information on inspection

is given in OC 282/30 and INDG 367 *Inspecting fall arrest equipment made from webbing and rope*.

3 [BS EN 1726-2:2000<sup>1</sup>](#) states that “plain ropes or knotted ropes and similar shall not be used”, and although it suggests the use of a rope ladder as a means of escape, Construction Division Technology Unit (CDTU) do not recommend this method as it is not a steady, stable means of escape.

4 Climbing down racking with a twin leg energy-absorbing lanyard, so that the evacuee can climb down disconnecting one lanyard while still being connected with the other. While it is not generally envisaged that this method will be used, careful consideration should be given to:

- the stability and suitability of the racking system to support the loads to be imposed;
- the availability and suitability of attachment points within any racking;
- the ability to achieve safe use of fall arrest equipment (see [Appendix 1 para 2](#)). Suitable protection below approximately 5 m may be difficult to achieve because of the distance needed for the energy absorber to deploy in the event of a fall. In this case, an alternative could be the use of a suitably anchored self-retracting lifeline. In any situation where fall arrest equipment is to be used, a full body harness is required.

## APPENDIX 2

1 This appendix provides more information on the components of a rope evacuation system and current standards. Although individual standards are specified, this does not preclude the use of equipment meeting other standards requiring equivalent or higher standards, provided the equipment is suitable for the purpose and compatible.

### (a) Anchors

The anchor point should be designated by the manufacturer and/or supplier of the mechanical handling equipment, and be marked accordingly. Preferably, it should be as high as possible in order to reduce the effects of any unintentional dynamic loading on the rope evacuation equipment. When purchasing mechanical handling equipment, consideration should be given to the position of the evacuation system anchor point. It should be positioned to: prevent the descent rope passing over sharp or angular edges to avoid abrasion; avoid impact and trapped fingers. A safe position is ‘outboard’ of the proposed drop. The independent anchor point for the safety rope used during training, should be appropriate for any dynamic loading that may occur as a result of a foreseeable fall.

### (b) Harnesses

A number of types of harness are available (e.g. rescue triangles also known as ‘nappies’, full body harnesses and sit harnesses). Rescue triangles should comply with Class C of [BS EN 1498:1996<sup>3</sup>](#). Consideration should be given to preventing rescue triangles from slipping around the knees/ankles when exiting the machine to descend. Sit harnesses should comply with [BS EN 813:1997<sup>4</sup>](#). Full body harnesses, usually used in the back up system, should comply with [BS EN 361:2002<sup>5</sup>](#). Any harness should be easily adjustable, quickly and easily donned.

## (c) Rope

The rope should meet the requirements of a recognised Standard, as specified by the manufacturer and/or supplier of the rope evacuation system. This may be [BS EN 1891:1998<sup>6</sup>](#), or similar, although there may be alternative specifications for automatic descenders.

It is particularly important that appropriate precautions are taken in the selection and use of the rope evacuation system to prevent damage to the rope from sharp or angular edges (e.g. rack and pinion, fork edges etc). The equipment should be rigged to avoid sharp edges. If this cannot be done edges may need to be suitably protected (e.g. using proprietary edge protection products, matting etc). As the same rope is generally used repeatedly during training, some form of edge protection, if required, is considered essential.

Ropes should always be long enough for the distance covered.

## (d) Descenders

Two generic types of descender are considered suitable: handled descenders ('double brake') and automatic descenders ('hands free'). A 'single brake' handled descender, or similar device that has no automatic locking device, is not considered suitable because if squeezed hard the device does not brake. People are more likely to grab and squeeze hard when under stress during an evacuation.

## (i) Handled Descenders

Some descenders are easier to operate than others and because handled descenders permit a variable speed of descent caution should be exercised in the selection (and use) of handled descenders. Handled descenders with a 'double brake' action offer the advantage that the operator can control the rate of descent by gently squeezing the handle (or 'brake'). The operator is able to stop to clear obstructions and assess the conditions below. However, in the event that the handle is squeezed too tightly the device will lock. It should be noted the operation of the brake may still result in some limited, but slower, movement. Handled descenders should meet the requirements of either [BS EN 341:1993<sup>2</sup>](#) or [BS EN 567:1997<sup>7</sup>](#). 'Double brake' descenders are a relatively recent development. Some equipment may still be fitted with a 'single' brake descender. Where this is the case, the employer should be asked to demonstrate why its continued use is reasonably practicable; and what other measures are taken to reduce the risk of operators in real life evacuations grabbing the descender and squeezing hard when under stress (eg more frequent refresher training).

## (ii) Automatic Descenders ('hands free')

There are two types of automatic descenders: those with a constant descent speed which is irrespective of the operator's weight, and those where the descent speed is related to the weight of the operator. Automatic descent devices have the advantage of requiring no operator intervention. They are generally robust, but most do not offer the opportunity to control or stop the descent. This could result in injury or snagging affecting the safe functioning of the descender, if fingers or clothing become trapped. It is also important that there is an unobstructed descent. Automatic descenders should meet the requirements of [BS EN 341:1993<sup>2</sup>](#) and an overhead attachment point will always be required to minimise impact forces. They should only be considered where the descent rope does not change

direction. Automatic descender devices are not generally suitable for passing obstructions. Therefore, their use may not be appropriate where there are adjacent obstructions e.g. racking.

(iii) The following should also be considered when deciding on the type of descender to use:

- handled descenders may require the rope to be thrown to the floor prior to deployment and consideration should be given to possible snagging/trapping of the rope preventing full deployment. If this can happen, it may be appropriate to use a device where the rope is deployed from a bag during descent;
- with automatic descenders, the speed of descent and whether this may be too fast for the evacuee. [BS EN 341:1993<sup>2</sup>](#) specifies depending on the class of descender, a maximum speed of descent of up to 2 m per second;
- with automatic descenders, it is more difficult, during training, to obtain user confidence because once the evacuee steps off, they begin to descend immediately as there is no initial resistance from the device. This can make the trainee nervous, with a tendency to 'hang on' which may impede the operation of the device.

(iv) It should be noted that currently products that allow the use of a safety rope (auto locking belay), in conjunction with an automatic descending device are limited. However, if automatic descending devices are used only in situations where there is no change of direction, or risk of obstruction, then omitting the safety rope would be acceptable. In this case, a higher level of supervision at the top, during training is needed to ensure that: the equipment is properly anchored overhead; all attachments are properly fastened; there are no obstructions below; and to guide the trainee over the edge.

(e) Deployment and Descent

The equipment should be checked before it is deployed. Care should be taken to ensure that no one is directly below the descent route and that, once deployed, the system is not entangled and has reached the ground. When using handled descenders any slack between the harness and the descender should be taken up before descent, to avoid shock loading of the system. When lowering off, an evacuee should gradually allow the descender to take their weight. Automatic descenders should not be shock loaded and the evacuee should not try to grab passing obstructions. If used in a real life evacuation, the rope evacuation system should be returned to the manufacturer and/or supplier (unless otherwise specified by them) for inspection, testing, and servicing as necessary by a competent person.

(f) Helmets

Helmets should be used during training. Consideration should be given to the provision and use of helmets for real life evacuations, where there remains a risk of head injury (eg the risk of turning over and banging the head on landing). They should comply with [BS EN 12492:2000<sup>8</sup>](#), because mountaineering helmets are designed with chinstraps to avoid strangulation and to protect against side impact.

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## APPENDIX 3

1 Issues for consideration when assessing the competence of trainers include:

- a) past experience and industry awareness;
  - b) knowledge and experience of the use of the evacuation equipment and the machine it is to be used on; the manufacturers' recommendations/instructions for its proper use, and techniques for its safe use;
  - c) the training of instructors and maintenance of their skill levels.
2. Some organisations provide a training standards scheme and register, e.g. Independent Training Standards Scheme and Register (ITSSAR).

The Road Transport Industry Training Board (RTITB) have introduced an accreditation scheme for trainers and a competent instructor registration scheme.

3 A training provider should:

- a) carry out (and record) a site-specific risk assessment before undertaking any instruction and training. The risk assessment should include consideration of the suitability of the equipment and trainee (e.g. a heavy person may descend more rapidly, and the harness may not fit properly);
- b) inspect all equipment before training and record the results, taking note of any discard criteria;
- c) use compatible equipment of the same type as that provided for escape from the mechanical handling equipment;
- d) use a safety rope at all times except where automatic descenders are used (but see [Appendix 2 para 1 \(d\) \(iv\)](#)). An appropriate independent anchor point will need to be identified. It is recommended that the safety rope, operated under the control of the trainer, be attached to the rear fall arrest attachment point. This should give better control at ground level as the descent ends and the transition is made from suspension to ground support. The trainer should explain the purpose, during training, of the safety rope (as it will not be used during actual evacuations).
- e) ensure that an appropriate safety helmet is used when necessary during training.

4 Shock absorbing mats may also be appropriate in addition.

Elements of a training programme

5 A training programme should include practice, under supervision, of the actual tasks to be performed, on the type of mechanical handling equipment that will be used. It should adequately cover at least the following issues:

- a) trainees should receive a graduated training programme, under direct supervision, commencing with familiarisation on the equipment that will be used, at ground level (e.g. 'hands on'). Continuing with practice descents from low level before descents from full height (typically, up to 15 metres or more) are undertaken;

- b) how to rig and position the evacuation system (e.g. anchor point), how to get into it (e.g. harness) and how to exit the mechanical handling equipment (e.g. pre-descent checks, protection of the rope from sharp edges);
  - c) use of the descender device, including its limitations and (where appropriate) how to vary the rate of descent, as well as an explanation of its mode of use and the functioning and use of other components;
  - d) the employer's systems for: regular inspection of the equipment by an appointed person;  
periodic refresher training / practice;
  - e) how to carry out a pre use check of their own evacuation equipment (see paras 21 – 25);
  - f) what to look for at the start of a shift (e.g. that the equipment is in place, the seal is intact, no damage to the pack is evident); and
  - g) the hazards and risks associated with rope evacuation, including: moving from the mechanical handling equipment to a suspended position on the rope; the effects of misuse of the descender (e.g. fingers incorrectly positioned under the brake lever, preventing panic braking); the risk of trapped fingers, striking of the head, obstructions, entrapment of long hair; loose clothing jamming the descender; contamination; excessive speed and landing on uneven surfaces.
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#### APPENDIX 4: REFERENCES

- 1 BS EN 1726-2:2000 *Safety of industrial trucks. Self-propelled trucks up to and including 10 000 kg capacity and industrial tractors with a drawbar pull up to and including 20 000 N. Additional requirements for trucks with elevating operator position and trucks specifically designed to travel with loads.*
- 2 BS EN 341:1993 *Personal protective equipment against falls from a height. Descender devices* (under revision).
- 3 BS EN 1498:1996 *Rescue equipment - Rescue loops* (under revision).
- 4 BS EN 813:1997 *Personal protective equipment for the prevention of falls from a height - Sit harnesses* (under revision).
- 5 BS EN 361:2002 *Personal protective equipment against falls from a height - Full body harnesses.*
- 6 BS EN 1891:1998 *Personal protective equipment for the prevention of falls from a height. Low stretch kernmantel ropes*
- 7 BS EN 567:1997 *Mountaineering equipment. Rope clamps. Safety requirements and test methods.*
- 8 BS EN 12492:2000 *Mountaineering equipment. Helmets for mountaineers. Safety requirements and test methods.*

