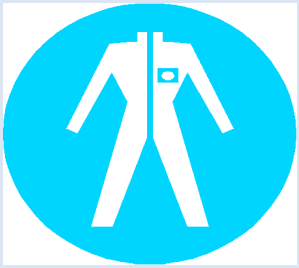


## APPENDIX 3— BODY

### CLOTHING

Protective clothing covering the entire body or the torso needs careful selection depending on the hazard or range of hazards. This is true of all PPE, but as clothing is the most commonly used PPE, it is particularly important that it fits correctly and does not in itself introduce a further unforeseen hazard (such as entrapment in machinery), or give a false sense of assurance (such as a nylon lab coat or plastic apron worn when working with solvents and / or heat sources).

For example, the general purpose overalls usually worn daily by Estates personnel and visiting engineers, would be unsuitable in areas where there was a potential for these to become contaminated by exposure to hazardous materials, so they would need to wear **additional** laboratory coats (and safety spectacles), in laboratories, and additional overalls etc in the CBS.

Clothing comes as overalls, tops and trousers, coats, tabards and aprons in a variety of styles, materials and sizes and each of these will need to be considered depending on the hazard. The local temperature must be considered when picking appropriate clothing.

**INFOBOX**

**The nature of the exposure and the period of exposure must be considered as part of the selection process**

For example a general purpose laboratory coat would not be suitable for spraying large volumes of pesticide—so a disposable overall would be worn instead and then disposed of as contaminated waste.

Whether or not the overall was of high or low specification, would depend on the risk assessment—on the nature of the chemical and its health effects, its concentration, the duration, location and scale of the task

### TYPICAL HAZARDS AT THE COLLEGE

At the College, typical hazards would include aggressive chemicals, radioactive substances and infectious biological agents, allergens, fire, hot or cold substances, extremes of temperature or weather, poor light conditions, soil and sewage. In certain circumstances such as in field work, additional hazards will be encountered—for example when using boats and dinghies or working near rivers and water sources, drowning is a risk, so buoyancy aids might be necessary or safety lines. In some areas protection from UV or biting insects may be desirable. Whatever the hazard, it is likely to have specifically designed PPE and a relevant manufacturing standard (BS EN, ISO etc) to meet. Some of these **standards are detailed in the table at the end of this appendix**.

| Example of environment/hazard | Example of clothing property |
|---|---|
| **Poor lighting conditions** fieldwork, construction sites, deliv- | Hi vis/reflective jacket or tabard |
| **Bright weather conditions** – UVA, UVB | UV-proof clothing |
| **Wet environments** fieldwork, construction sites, plant rooms, grounds | Water/penetration resistance |
| **Cold environments** cold rooms, field work, refrigerated food stores, plant areas | Thermal insulation |
| **Hot environments** fieldwork, plant areas, kitchens | Thermal insulation against convective and radiant heat |
| **Water:** Using boats and dinghies / working near rivers and water sources | Life jackets, buoyancy aids, safety lines |
| **Aggressive chemicals** laboratories, workshops, plant rooms | Chemical resistance, flame retardant |
| **Grounds and glasshouse** - spraying pesticides etc | Chemical resistance, spray-tight |
| **Flammable substances, fire, explosion** Laboratories, fire/ flammable rated zones | fire retardant materials, anti-static clothing, |
| **Infectious biological agents** Laboratories, plant rooms, sew- age pipes, soils | Protection from infectious agents |
| **Molten metal** welding – workshops, plant areas | Molten metal and fire-resistant, shock proof |
| **Chain saws, other activities with higher than normal risk of skin penetration** (eg jointing/deboning meat) | Chain-saw resistant clothing, cut-resistant cloth- ing, chain mail aprons. |

**Example—Selection of a high specification overall:**

An overall suitable for dismantling jobs in the nuclear, pharmaceutical, manufacturing industry or in re- search and biosecurity laboratories, as well as in chemical and medical applications and when exposed to biological hazards, would have a higher specification then a general purpose overall, and may have match-ing hood, gloves and socks:

- Chemical protective clothing, Category III, Type 4-B, 5-B and 6-B.
- EN 14126 (barrier to infective agents – Tyvek = down to 1 micron), EN 1073-2 (protection against partic-ulate radioactive contamination).
- Antistatic treatment (EN 1149-5) - on both sides.
- Stitched and over-taped seams for protection and strength.

## LABORATORY COATS AND GOWNS

The most commonly required protective clothing at the College is the laboratory coat, to be worn by ALL staff, students, visitors, and contractors entering laboratories. It is also the most commonly abused item of PPE, often worn when it is damaged or dirty, or worn unfastened, or worn in clean areas where it is likely to be a source of contamination. At worst, it could provide the wearer with no protection. In many instances it is not worn at all and the requirement to wear it is not enforced. The consequences of not wearing a lab coat or of wearing the wrong type of lab coat can be severe, both for the wearer and for the Responsible Person. See the news extract relating to a terrible incident in UCLA in December 2008.

**NEWS EXTRACT:** Richard Jansen, IChemE, TCE Today.com August 2013

**A LITTLE over four years ago, chemist Sheri Sangji was working in a University of California Los Angeles (UCLA) research laboratory when she spilled a small amount of *t*-butyl lithium solution on her sweatshirt. The highly pyrophoric solution spontaneously ignited, blanketing her in flames.**

Sangji suffered third-degree burns on more than 40% of her body, and died less than three weeks later.

At the time of the accident, Sangji wasn't wearing a flame-resistant lab coat, let alone the protective clothing recommended. The US Occupational Safety and Health Administration (OSHA) also found no evidence that she'd received any safety training, and decided to bring criminal charges against both UCLA and chemistry professor Patrick Harran who was supervising Sangji at the time.

UCLA settled with OSHA by agreeing to overhaul its safety measures and set up a US$500,000 scholarship in Sangji's name, but early this year Harran was told he would stand trial for violating health and safety regulations. If found guilty, he faces up to four-and-a-half years in prison.

## FIRE RESISTANT MATERIALS

Note neither cotton or poly-cotton are naturally fire resistant unless treated. Topical fire-retardent treatments may only last for a few washes, whilst inherent or durable fire retardency, lasts the life of the garment – check manufacturers' data if this is relevant to your selection.

| Lab Coat style | Fastening: | Front protection | Cuff type: |
|---|---|---|---|
| Howie style | Side, pop fasteners | Double layer | Elasticated |
| Conventional | Front; sometimes with buttons | Single layer | Elasticated or plain |
| Theatre gowns | Rear, generally tied | Single layer | Elasticated |
| Disposable plastic aprons | Provide a waterproof layer of protection when handling some but not all hazardous liquids—eg they are unsuitable for use with solvents, corrosives or heat sources. | | |

## LAB COATS IN BIOLOGICAL LABORATORIES

Lab coats for use in laboratories where biological materials and infectious agents are commonly used, must be of the Howie-style—and must be worn fully fastened. Any other lab coat such as a theatre gown or overall (such as those in Containment Level 3 laboratories or CBS), must be included within the risk assessment approval. In addition to any decontamination methods within the risk assessment, there may also be local decontamination and laundering arrangements; in the event of a spill onto your lab coat, make sure you know which protocol to use.

Ensure the outer potentially contaminated layer of your lab coat does not contaminate your regular clothing, or anyone else's (see also "Storage").

## UNSUITABLE ATTIRE IN THE LABORATORY

Open shoes such as sandals and slippers are not permitted in the laboratory (or workshop), because of the risk of spilling a hazardous substance onto the foot, or crushing it when moving equipment. In addition, scarves and jewellery can get caught in equipment or contaminated. In wet laboratories, bare legs, skirts and shorts may be unsuitable depending on the risks.

## LAB COAT DOS AND DON'TS

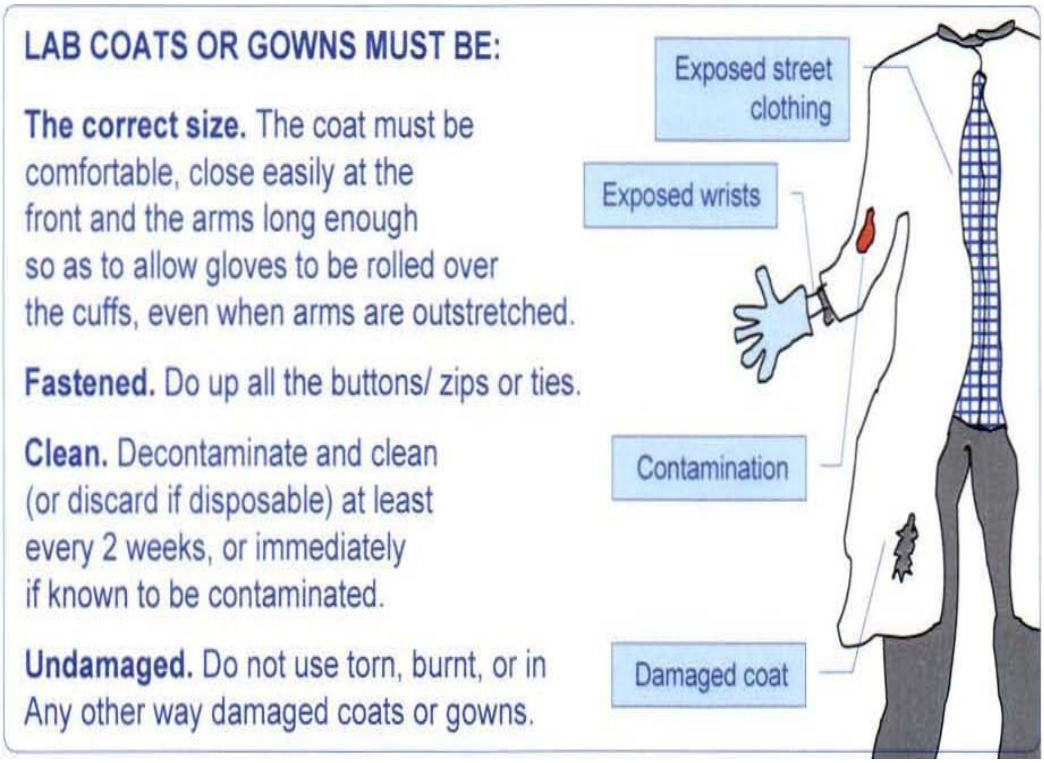
All persons working in or visiting the laboratory must:

- Wear long trousers or skirts that cover the leg to the ankle in areas where a risk assessment has shown bare legs to be unsuitable.
- Wear socks and shoes (rather than slippers or sandals) that completely cover the feet.
- Select personal clothing that allows easy fitting of lab coats/gowns and gloves.
- Ensure all clothing (other than head and leg coverings) is under the coat or gown. For example, the Hijab or other headscarves should be worn tightly around the head and tucked in under the lab coat/gown.
- Fasten lab coats when in use, and replace them if damaged or no longer fit correctly.
- Select lab coats with poppers (press stud) fastenings if there is likely to be a need to remove the coat quickly (ie because of a spill of hazardous substance).
- Remove the lab coat when outside of the laboratory unless travelling directly to an adjacent laboratory work area.
- Store them where they will not contaminate personal clothing or other lab coats, not stacked or in lockers.

## LAUNDERING AND DISPOSAL

Departments have local arrangements for laundering of laboratory coats and overalls, which may include containing it in a soluble autoclaveable bag prior to local autoclaving, use of an external laundering contractor (with specific drop-off and collection procedures), or even of a departmental laundering facility. In most instances, departments will issue two (or more) laboratory coats to enable cleaning and return to take place; follow the departmental requirements for labelling to ensure it is returned to the department after cleaning. Please note:

- Laboratory coats must NOT be taken home to be laundered.
- Contaminated clothing must be disposed of as contaminated waste through the hazardous waste routes if it cannot be safely laundered.



## DIFFERENT LAB COATS FOR DIFFERENT TASKS

In some areas and for certain tasks, it may be necessary to have separate laboratory coats to ensure there is no cross-contamination between areas. For example if working in a CL3 or perhaps if working with tritium there should be specific laboratory coat for the designated area or task which is clearly separated and identified, with appropriate storage and laundering facilities.

## LEAD VESTS: PROTECTION AGAINST IONISING RADIATIONS

Lead vests are used in some areas (e.g. iodination labs and for some animal work). Storage of these is a particular issue as if folded the lead gets thinner and cracks, reducing the efficiency of the vest.

Advice on specification, obtaining, inspecting and storing lead vests is available from the College Radiation protection Team.

## TABLE THREE - CLOTHING SELECTION (type 6 = Overalls; PB = Part body (lab coat, jacket, apron etc)

Must also meet EN340 General requirements of protective clothing – ie must not harm the wearer

| | |
|---|---|
| Rain protection | |
| EN 343: 2003+A1:2007<br>  <br> | X: Resistance to water penetration (Levels 1-3: 3 is best)<br>Resistance to water penetration is the most important quality for an adequate protection.<br>Y: Water vapour resistance – Breathability (Levels 1-3: 3 is best) |
| Cold environments | |
| EN 342:2004 temperatures lower than minus 5°C<br>  <br> | Cold protection garments - includes ensembles such as underwear specified by the garment manufacturer. |
| EN 14058:2004 temperatures at or above minus 5°C<br>  <br> | Four parameters depending on the environment to be used in - higher numbers are better protection in all cases:<br>• **Thermal resistance:** Levels 1 – 3<br>• **Air permeability:** Levels 1 – 2 (optional)<br>• **Water penetration resistance:** Levels 1 – 2 (optional)<br>• **Thermal insulation:** Levels 1 – 2 (optional) for garment or ensemble |
| Enhanced visibility requirements | |
| EN ISO 20471:2013—replaces EN 471<br>  <br> | High-visibility warning clothing – for enhanced visibility during day, twilight and dark with two different performance classes, relating to the proportion of fluorescent background material (x) and retro-reflective material (y).<br>Class 1 is lower performance than Class 2 and rarely used.<br>May also include other standards for cold weather, rain wear etc. |
| UV Protection | |
| EN13758-2<br>  <br> | UV protective clothing for prolonged exposure to the sun |
| Electrostatic environments | |
| EN 1149:2008<br>  <br> | Environments where there is a risk of explosion (ATEX environments). Unlikely to be found at the College.<br>Outer fabric of garment is anti-static. |
| Chemical environments | |
| EN 13034<br>  <br> | Protective clothing against liquid chemicals -<br>Lowest level of protection – only for small quantities of spray or accidental low volume splashes of less hazardous chemicals against which a complete liquid permeation barrier (at a molecular level) is not required.<br>Overalls (Type 6), **Lab coats,** jackets and aprons (partial body "PB") |
| EN 14605<br>  <br> | Protective clothing against liquid chemicals -<br>With permeation resistance test – liquid tight and spray tight seals in overalls.<br>For full specification, refer to manufacture for details. |
| Heat & Flame retardency | |
| EN ISO 11612<br>  <br> | Clothing to protect against heat and flame" (not suitable for welders); insulation against convective and radiant heat. |
| EN ISO 11611 – replaces EN 470<br>  <br> | Welders - protect the wearer against small splashes of molten material, short contact time with flame, radiant heat from ARC, the clothing minimizes the possibility of electrical shock by short accidental contact with live electrical conductors up to 100 V d.c. voltage.<br>Class 1 – lower level, less hazardous welding activities<br>Class 2 – high risk welding activities |

| | |
|---|---|
| Chainsaw protection | |
| EN 381<br>  <br>EN 381 | Clothing offering protection against injuries from chain saws, including gloves, leg protectors, gaiters and upper body protection (see also footwear table) |
| Maritime environments | |
| EN ISO 12401 Deck harnesses / Safety lines | Harnesses and safety lines in the following sizes of body weight:<br>Size 1: over 50kg<br>Size 2: between 20kg and 50kg<br>Size 3: lower than 20kg<br>Use: to be worn by all persons when in the exposed cockpit or on the working deck of a recreational vessel afloat.<br>A different standard applies to dinghy "trapeze" harnesses, windsurfing harnesses or seat harnesses for fast motor boats. |
| EN ISO 12402-5 50N Buoyancy aids<br>  <br>EN 393 | Equivalent: EN 393<br>Buoyancy: no less than 50 Newton for the average adult.<br>Use: sheltered waters where more bulky or buoyant devices would impair the user's activity or actually endanger the user, and when help is close at hand and the user is a conscious, competent swimmer. |
| EN ISO 12402-4: 100N Life jackets<br>  <br>EN 395 | Equivalent: EN 395<br>Buoyancy: no less than 100 Newton (EN 395) for the average adult.<br>Use offshore or when foul weather clothing is used. |
| EN ISO 12402-3: 150N Life jackets<br>  <br>EN 396 | Equivalent: EN 396<br>Buoyancy: no less than 150 Newton for the average adult.<br>Use offshore or when foul weather clothing is used. |
| EN ISO 12402-2: 275N Life jackets<br>  <br>EN 399 | Equivalent: EN 399<br>Buoyancy: no less than 275 Newton for the average adult.<br>Use offshore in extreme conditions, when heavy protective clothing is used, or loads such as tool belts are being carried. |
| Surgical environments | |
| EN 13795 | Surgical gowns, drapes & clean air suits – re-usable and disposable, complying with Medical Devices Directive 1993 |
| Laboratory Coats and overalls | Check if lab coats are tested for resistance to heat and flame, and biological hazards if in accordance with the risk assessment. |
| BS EN 13034<br>  <br>EN 13034 | Lowest level of chemical protection intended to protect from a potential exposure to small quantities of spray or accidental low volume splashes of less hazardous chemicals<br>May need to check performance against the specific chemicals in use – see clothing manufacturer's information.<br>Ensure single use items are disposed of and *not* reused. |
| BS EN 14126<br>  | Protects against infective agents. Appropriate for maintenance and dismantling jobs in the nuclear industry, pharmaceutical manufacturing or in research and biosecurity laboratories, as well as in medical applications and when exposed to biological hazards. |
| BSEN 14116:2008<br>  <br>EN ISO 14116 | The protective clothing is intended to protect workers against occasional brief contact with small flames, by reducing the possibility of the garment catching fire and causing burns.<br>The working circumstances offer no significant heat hazard and there is no presence of another type of heat. |
| EN 1073-2<br>  | Protective clothing against particulate radioactive contamination - non-ventilated suits |

## PERSONAL FALL ARREST SYSTEMS:

### FALL PROTECTION EQUIPMENT (SPECIALISED USE ONLY)

This is for specialised use when working at height and danger of a fall exists. It is not for general use—all users must be authorised, suitably trained and competent in the system they are using.

### RISK ASSESSMENT FOR SELECTION, PURCHASE AND USE

Selection and purchase of fall protection equipment can only be sanctioned once a specific risk assessment has been submitted to the Responsible Person, who may need to take specific advice from the manufacturer, College Insurance Officer or Safety Department. The risk assessment will help to identify the controls needed before purchase, including what information, instruction and training is needed. In most cases, the manufacture will provide this.

The use of the fall arrest is also subject to risk assessment—mainly because external conditions can vary considerably.

### SHELF LIFE AND USE LIFE

Note that this type of equipment has both a shelf life (usually a maximum of 10 years) and a use life (maximum 5 years), so **recording** purchase date and logging periods of use is extremely important—as is using the appropriate unique identification system so items are not mixed up accidentally.

### DEPARTMENTS USING FALL ARREST SYSTEMS

All fall arrest systems must be notified to the College's insurers, via the Facilities Management Customer Services Helpdesk, requesting addition to the College Insurance and Inspection register.

### SELECTION, MAINTENANCE AND USE

The standard described in BS 8437:2005, Code of practice for selection, use and maintenance of personal fall protection systems and equipment for use in the workplace, must be followed.

### REQUIREMENTS FOR WEBBING AND ROPE LANYARDS

These must be:

- Identified with a unique identification.
- Inspected (including their unique identification) by a designated competent person (at the College this is normally an Insurance Inspector).
- The associated frequency and type of inspection (pre-use checks, detailed inspection and, where appropriate, interim inspection) recorded.
- Means of recording the inspection findings.
- Means of monitoring the inspection regime to verify inspections are carried out accordingly and actions are closed out.
- Any action to be taken on finding defective lanyards must be recorded and closed out by the Responsible Person or their Competent delegate.
- There must be training of users on the specific system and this training must be recorded.
- Users must also make comprehensive pre-use and after use checks (logged).
- Stored securely where they are free from weathering, chemical attack and deliberate or accidental tampering.
- If they fail an inspection, must be withdrawn from use and either destroyed or repaired and re-inspected prior to re-use.
- Hired lanyards need special consideration and checks to ensure the relevant inspections have been carried out in the appropriate time scale.

## WITHDRAWAL OF LANYARDS FROM USE

Lanyards must be withdrawn from use and passed to a competent person for a detailed inspection to decide whether they should continue to be used, destroyed or returned to the manufacturer for testing (the manufacturer should be able to advise), to enable a product performance history to be determined, if:

- There is no evidence that a lanyard has been inspected by a competent person within the last six months.
- Identification is not evident (lanyards should be indelibly and permanently marked in accordance with BS EN 365:2004.
- They should be uniquely identifiable so that they can be easily associated with their respective inspection documentation).
- A lanyard is still in use and marked to the old British Standard "BS 1397:1979 Specification for industrial safety belts, harnesses and safety lanyards" (i.e. pre CE-marking).
- A lanyard is thought to be defective, or if there is any doubt about its safety after a pre-use check or interim inspection.
- A lanyard that has been used to arrest a fall must never be reused. It must be withdrawn from service immediately and destroyed or returned to the manufacturer.

## CHECKING OR INSPECTING LANYARDS ETC

Only persons who have been trained make pre-use checks of the specific fall arrest system should make such checks. Webbing, stitching and hardware must be systematically checked for:

- Soil or chemical contamination (e.g. Paint or other solvents which can weaken the material).
- Cuts and abrasion.
- Any other physical damage – damaged energy absorber, connectors, missing labels; wear at the end of the loop, damage to the karabiner or buckles.
- If there is any sign or suspicion of damage, the fall arrest must not be used, and must be taken out of service immediately, and reported to the Responsible Person, who must instigate repair and re-inspection, or disposal and removal from the College Insurance Register (contact the Facilities Management Customer Services Helpdesk).
- Local records of these actions (inspection and outcome) must be retained.
- Guidance on lanyards: www.hse.gov.uk/pubns/indg367.pdf

## BUOYANCY AIDS, DECK HARNESSES AND SAFETY LINES

The purchase and selection, training and use (including inspection) of buoyancy aids, deck harnesses and safety lines must be risk assessed as part of the College's Offsite Work policy, and purchased only through a competent supplier. The table gives an outline of the variation available, depending on body weight, the weather conditions, etc.

Buoyancy aids must be used for all maritime and riverine activities where there is a chance of drowning either through capsize or from falling into the water, regardless of the competency of the person as a swimmer.

Harness and safety lines are not designed as "fall arrest" equipment, and any that has been subject to shock load (eg in a fall situation), must be returned to the manufacturer for inspection.

## STANDARDS FOR FALL ARREST

As with all PPE, current standards must be checked before purchase or hire. The manufacturer is usually the best source of information on selection. HSE and the British Standards Institution (BSi) have expressed concerns over the EN standards for fall arrest (see table below). Again please consult the manufacturer.

| | | |
|---|---|---|
| BS 8437:2005 | | Code of practice for selection, use and maintenance of personal fall protection systems and equipment for use in the workplace |
| BS 7883:2005 | | Code of practice for design, selection, use and maintenance of anchor devices conforming to BS EN 795 |
| BS EN 813:2008 | Personal fall protection equipment | Sit harnesses |
| BS EN 341:2011 | PPE - Descender devices for rescue | Escape or rescue device, for controlled descent at a limited velocity (Class D—for single use) |
| BS EN 353-1:2002 | PPE - Guided type fall arresters (on a rigid anchorage line) | Vertical travelling device locking onto a rigid anchorage line as result of a fall (additional end stops may be needed to stop arrestor falling of the end of the rail). **BSI issued a safety alert in 2004** relating to weaknesses in the standard: www.hse.gov.uk/press/2004/e04074.htm |
| BS EN 353-2:2002 | PPE - Guided type fall arresters (on a flexible anchorage line) | Vertical travelling device working on a wire cable or a rope, locking in a fall |
| BS EN 354:2010 | PPE - Lanyards | Fall arrest lanyards—but **BSI has concerns that standard does not consider effects of UV on degrading harness materials**. This must be considered during selection and in inspections. |
| BS EN 355:2002 | PPE - energy absorbers | Lanyard shock absorbers and tear web sections |
| BS EN 358:2000 | PPE - Work positioning systems—belts and lanyards | A combination of components to make up a system e.g. pole strap, NOT to be used for fall arrest |
| BS EN 360:2002 | PPE - Retractable type fall arrestors | Inertia reel blocks (NOT retractable 2.4m car seat belt style lanyards), previously called “fall arrest blocks” |
| BS EN 361:2002 | PPE - Full body harnesses | Full body support harness (NOT a belt) |
| BS EN 362:2004 | PPE - Connectors | Karabiners, hooks and other connectors |
| BS EN 363: 2008 | PPE - Fall arrest systems | A system combination e.g. a harness together with a lanyard and an energy absorber. **BSI recommends BS 8437** is used instead. |
| BS EN 364:1993 | PPE - Test methods | Detail of test methods to be carried out in the laboratories of an accredited test house, to confirm the products compliance with the requirements of the standard |
| BS EN 365:2004 | PPE - General requirements | Instructions for marking products with user instructions inspection periods and retesting |