



Review of Work at Height Practices in the UK Broadcasting Industry

A Report from NEL for

Health & Safety Executive

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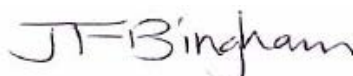
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Date: November 2006

EXECUTIVE SUMMARY

Over a ten month period from September 2005, NEL was contracted by HSE to undertake a review of work at height within the UK broadcasting industry. The work practices of the industry were assessed against the Work at Height Regulations, which have been introduced in the UK in order to reduce the number of accidents and deaths caused by falls from height. These remain the single largest cause of fatalities in the workplace.

Surveys conducted at three outdoor events and two indoor events revealed a large variation in fall protection levels. Although examples of good practice were observed, many instances of bad practice were evident, where workers were inadequately protected from potential injury or death when working at height.

Although there was evidence that efforts had been made to avoid work at height by implementing alternative methods and introducing equipment, the review highlighted weaknesses in the management and control of work at height. In particular there was a failure to ensure workers were adequately trained and competent and that PPE in use was adequate and compliant with current legislation.

Amongst the most common issues encountered during the review was the use of work positioning PPE for fall arrest applications and the widespread use of unapproved PPE, including lanyards and lifelines. A fall protection PPE should be CE marked for the intended purpose under PPE Directive 89/686/EC.

Other issues included the absence of fall protection for worker safety and the lack of rescue plans to ensure the safe and timely recovery of persons suspended after a fall.

In general, improvements are necessary in order to achieve compliance with the Work at Height Regulations.

This report provides guidance and makes a number of recommendations aimed at improving the management and safety of workers at height.

CONTENTS

		Page
	EXECUTIVE SUMMARY	
1	INTRODUCTION	5
2	PURPOSE	5
3	APPROACH	5
4	TERMS AND DEFINITIONS.....	6
5	SURVEY FINDINGS AND DISCUSSION.....	7
5.1	Introduction.....	7
5.2	Survey Visits.....	7
5.3	Inadequate Fall Protection.....	10
5.4	No Protection Against Falls	11
5.5	No Protection During Access and Egress	12
5.6	No Fall Arrest Backup During Work Positioning	12
5.7	Unapproved PPE.....	15
5.8	Incorrect Selection of PPE.....	18
5.9	Misuse of PPE	23
5.10	Poor Condition of PPE.....	34
5.11	Poor Selection of Structural Anchor Points and Poor Installation of PPE	35
5.12	Unprotected Fragile Roofs.....	39
5.13	Marquees and General Framework.....	39
5.14	Inadequate Rescue Plans	42
5.15	MEWPS	42
5.16	Ladders and Mobile Scaffold Towers	42
5.17	Mobile Stages.....	43
5.18	Environmental and General Conditions.....	44
6	CONCLUSIONS	45
7	RECOMMENDATIONS	46
7.1	Risk Assessment.....	46
7.2	Access, Egress and Places of Work.....	47
7.3	Danger Areas	49
7.4	Selection of Work Equipment	49
7.5	Assessment of Personnel.....	49
7.6	Training and Competence of Personnel.....	50
7.7	Inspection of Workplace and Conditions	50
7.8	Inspection of Work Equipment Before Use.....	50
7.9	Management System.....	50
7.10	Personal Protective Equipment (PPE).....	51
	ACKNOWLEDGEMENTS	
	REFERENCES	
	LIST OF FIGURES	
APPENDIX 1	Examples of good practice observed during the survey	
APPENDIX 2	Guidance on Procurement and Selection of PPE	
APPENDIX 3	Working at Heights – Risk Assessment Process	
APPENDIX 4	Work at Height Training Information	

1 INTRODUCTION

This report presents the findings of surveys conducted between September 2005 and April 2006 by NEL for HSE to assess working at height activities within the UK broadcasting industry.

The findings detailed in this report collate and summarise the conclusions from five separate broadcasting visit reports^{1,2,3,4,5} submitted to HSE.

For confidentiality reasons, all photographs contained within this report have been made anonymous.

2 PURPOSE

The purpose of the survey was to assess practice in the industry against the Work at Height Regulations⁶ (WAHR), which were introduced in the UK during 2005. For the first time the WAHR covers all industries with a single set of regulations.

Specific objectives of the project were to:

- Identify working at height activities
- Evaluate risks and control measures
- Document, report and present findings
- Provide recommendations and guidance

3 APPROACH

The project involved a survey of three outdoor and two indoor broadcasting events to provide representative samples of working at height activities during the assembly and dismantling of typical temporary structures for entertainment events. The review covers all work activities at height where there is a need to prevent or control the risk of a worker falling a distance liable to cause personal injury.

All observations made during the survey were captured on film using a digital video recorder and still camera for information and analysis purposes. All images obtained during the survey have been given to HSE.

Due to the nature of the survey, the presence of NEL and HSE staff may have influenced the behaviour of workers, with the result that the procedures observed during the visits may have differed from those normally used.

Workers and management representatives were consulted at times during the survey to provide necessary information. Therefore, many of the findings from this survey rely on the accuracy of information supplied.

In assessing the methods used to protect against falls from height, consideration has also been given to provisions for rescue and evacuation in emergency situations, where the timely and safe recovery of falls victims is essential to prevent further discomfort, injury or even death.

Although the survey includes only a sample of working at height activities within the UK broadcasting industry, the specific events selected for review are believed to be representative.

In order to provide guidance, much of this report focuses on bad practice observed during the survey. Examples of good practice are contained in Appendix I.

4 TERMS AND DEFINITIONS

In this report the following terms and definitions apply.

Working platform	Platform used to provide place of work or as a means of access and egress from another place of work e.g. mobile elevated working platform, integrated elevating working platforms, suspended cradles, scaffolding.
MEWP	Mobile elevated working platform i.e. cherry picker or scissor lift.
Collective fall protection	Equipment used to provide fall protection for more than one Person. Includes guardrails, safety nets and landing mats.
Guardrails	A rigid barrier used to restrict access to hazardous areas or to prevent falls from height.
Safety nets	A net used to restrain or catch a falling person.
Landing mats	Systems used to provide the worker with a soft landing in the event of a fall e.g. air bags and filled soft landing bags.
Fall protection PPE	Equipment used to protect an individual from falls, including work restraint, work positioning and fall arrest PPE.
Work restraint PPE	Equipment used to restrain the worker and prevent the accessing of hazardous areas, e.g. open edges.
Work positioning PPE	Equipment used to support the positioning of person during work activities, leaving both hands free to carry out the work tasks.
Fall Arrest PPE	Equipment used to protect an individual during a fall, by arresting the individual before reaching the ground within prescribed safe fall distances and arrest forces. A fall arrest system comprises a body support element (fall arrest full body harness only), shock absorbing element (energy absorber lanyard or another form of absorbance designed in the fall arrest system) and anchor point.
Notified body	A body which is appointed by the DTI to undertake specific duties under the European PPE Directive PPE/89/686/EEC ⁷ .

5 SURVEY FINDINGS AND DISCUSSION

5.1 Introduction

The broadcasting industry regularly erects and dismantles structures of a temporary nature, which require a significant amount of work at height. This can often involve working in outdoor environments, when building temporary concert arenas or working indoors, building stages inside existing concert halls.

Typically work at height involves structural riggers, responsible for the structural elements of the work and technicians, responsible for preparation of the production equipment. A small part of the work covered equipment operators, in particular lighting operators. Workers were generally self-employed but some employed by rigging and production companies.

Work was often carried out under pressure to meet tight schedules, and could involve restrictions to public access ways during the work.

Outdoor work was at times carried out in darkness, under hostile weather conditions including rain, wind, ice and cold.

5.2 Survey Visits

- **Visit 1 (Outdoors Entertainment) NEL Report No. 2006/196**

The survey focused on the dismantling of a temporary, large-scale, dome-shaped structure, which enclosed a concert stage. Working at height was largely avoided by dismantling the structure at stage level, while supported by an overhead crane. The main element of working at height was necessary during the rigging of the upper trusses, which involved workers climbing and working directly on the arched framework to attach lifting tackle and auxiliary equipment.

Where possible MEWPs were used to install and remove auxiliary equipment and roof coverings.

Protection measures included:

- Variety of fall protection harnesses (including fall arrest complying with EN361⁸ and work positioning complying with EN358⁹ and EN813¹⁰)
- Fall arrest lanyards complying with EN355¹¹
- MEWPs

All workers observed during the survey were inadequately protected against serious injury or fatality in the event of a fall. Typical reasons are given in Section 5.3.

- **Visit 2 (Outdoors Entertainment) NEL Report No. 2006/197**

The survey mainly focused on the construction of a temporary, large-scale, traditional box-shaped structure, which enclosed a concert stage. Working at height was largely avoided by elevating the roof structure on the main support

columns. Work at height was however necessary to secure the structure and to rig the roof trusses, where lifting tackle was installed to support production equipment. Workers worked directly on the trusses and gained access by climbing the support column framework.

The survey also included a review of some mobile transportable stages and marquees.

Both work positioning PPE and fall arrest PPE were observed in use during the visit.

Protection measures included:

- Variety of fall protection harnesses (including fall arrest complying with EN361 and work positioning complying with EN358 and EN813)
- Variety of fall arrest lanyards (complying with EN355)
- Unapproved work positioning lanyards
- Presence of a medical staff during work at height

Some workers were at times inadequately protected against serious injury or fatality in the event of a fall. Typical reasons are given in Section 5.3.

• **Visit 3 (Indoors Entertainment) NEL Report No. 2006/198**

The survey focused on the assembly and dismantling of a concert stage, situated inside a concert hall. The work involved the rigging of existing roof beams to allow the support of production equipment, including lighting and sound. Workers worked directly on the roof beams, which were accessed via MEWPs.

Protection measures included:

- Variety of fall protection harnesses (including fall arrest complying with EN361 and work positioning complying with EN358 and EN813)
- Variety of fall arrest lanyards (complying with EN355)
- Matrix of horizontal lifelines
- Retractable type fall arresters (complying with EN360¹²)
- Flexible ladders
- MEWPs

Some workers were inadequately protected against serious injury or fatality in the event of a fall. This is discussed in Section 5.3.

- **Visit 4 (Outdoors Entertainment) NEL Report No. 2006/199**

The survey mainly focused on the installation of temporary screens on the external fascia of a cinema hall. Work at height was necessary during the construction of a steelwork frame, which was cantilevered from the main roof to support the display screens. Installers worked directly on the framework and on the main roof of the building, which included fragile roof sections. Access to the external roof area was gained from an internal stairwell inside the cinema hall.

The survey also included a review of marquees and other general working at height activities.

Protection measures included:

- Variety of fall protection harnesses (including fall arrest complying with EN361 and work positioning complying with EN358 and EN813)
- Variety of fall protection lanyards (including fall arrest complying with EN355 and work positioning complying with EN358)
- Unapproved fall protection lanyards
- Unapproved horizontal lifelines
- Retractable type fall arresters
- MEWPs

Some workers were inadequately protected against serious injury or fatality in the event of a fall. Typical reasons are given in Section 5.3.

- **Visit 5 – Indoors Entertainment NEL Report No. 2006/200**

The survey focused on the assembly and dismantling of a concert stage situated inside a concert hall. The work involved the rigging of an overhead truss framework to allow the support of production equipment, including lighting and sound. Working at height was largely avoided by lowering the truss framework to ground level and then raising it back into position following the rigging work. Where working at height was necessary, installers worked directly on the trusses or from work platforms stationed above a fragile roof ceiling. The upper work platforms were accessed from existing stairwells and walkways and the trusses were accessed generally by flexible ladders.

Protection measures included:

- Enclosed walkways
- MEWPs
- Extensive use of safety nets (used in conjunction with fall arrest PPE)
- Variety of fall protection harnesses (including fall arrest complying with EN361 and work positioning complying with EN358 and EN813)

- Variety of fall protection lanyards (including fall arrest complying with EN355 and work positioning complying with EN358)
- Permanent horizontal lifelines (normally complying with EN795¹³ Class C)
- Temporary horizontal lifelines (normally complying with EN795 Class C or EN795 Class B)
- Vertical fall arrest lines (complying with EN353-1)
- Retractable type fall arresters (complying with EN360)
- Flexible ladders

Satisfactory fall protection measures were in place at all times to protect all workers when at height.

5.3 Inadequate Fall Protection

Although fall protection equipment was observed at most of the venues surveyed, the PPE was frequently inadequate being either the wrong type, neglected or misused. In order for PPE to be effective in providing fall protection, it must be suitable for the intended application, CE approved, properly maintained and used by competent trained personnel. From the five events surveyed, only one event fully satisfied these criteria, but for the remaining events workers were, for most of the time, inadequately protected due to at least one or more of the following reasons:

- No protection against falls
- No protection during access and egress
- No fall arrest backup during work positioning
- Unapproved PPE
- Incorrect selection of PPE
- Misuse of PPE
- Poor condition of PPE
- Poor selection of structural anchor points and poor installation of PPE systems
- Unprotected fragile roofs
- Inadequate rescue plans

5.4 No Protection Against Falls

On a number of occasions no effective means of protection was evident to protect workers at height, even for extremely risky work at heights above 40 m. This was either due to the worker not having been provided with PPE and suitable structural anchor points to attach the PPE to, or the worker neglecting to use the PPE provided.

The failure to provide workers with suitable fall protection was attributable to various reasons including:

- Lack of awareness of safety requirements
- Disregard of safety
- Difficulty or perceived difficulty in sourcing suitable fall protection systems, including collective and personal fall protection equipment.
- Cost

Figures 1-2 provide examples where no fall protection was in place during situations when there was a danger of workers falling from extreme heights, while exposed to open edges.



FIGURE 1 NO PROTECTION AT HEIGHT

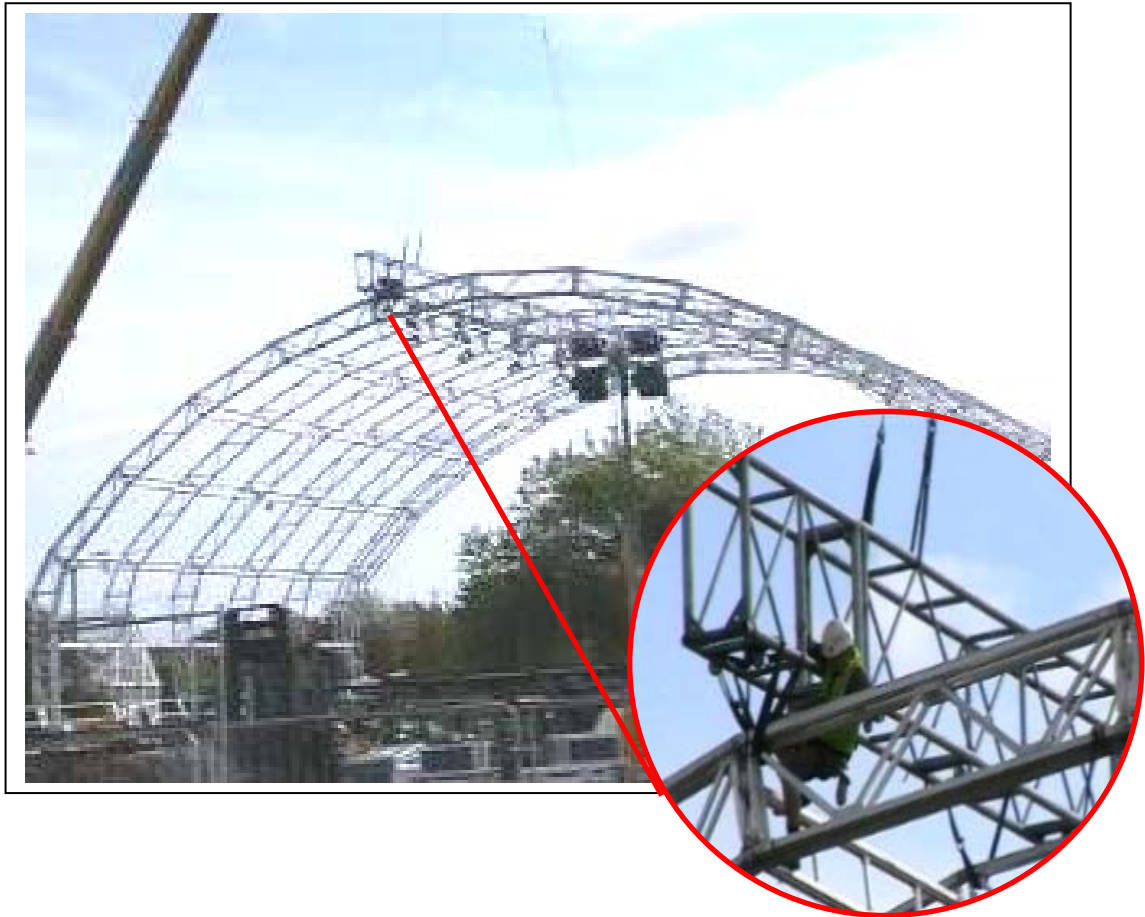


FIGURE 2 NO PROTECTION AT HEIGHT

5.5 No Protection during Access and Egress

In order to protect workers against falls, in addition to providing a safe place of work, it is equally important to ensure a safe method for access and egress. Where this could not be achieved via existing stairwells, installations or MEWPs, workers frequently climbed the steelwork using the lattice framework to provide footholds and handholds. This was regularly done without any form of fall protection, Figures 3 - 5, where no utilisation was made of retractable type fall arresters (conforming to EN360), fall arrest lines (conforming to EN353-1¹⁴ or EN353-2¹⁵), or twin tail fall arrest lanyards (conforming to EN355).

5.6 No Fall Arrest Backup during Work Positioning

Fall arrest backup systems were regularly absent during work positioning activities, Figures 6-7. As required by the Work at Height Regulations, it is essential that a fall arrest back-up is in use at all times to protect against inadvertent failure of work positioning equipment.

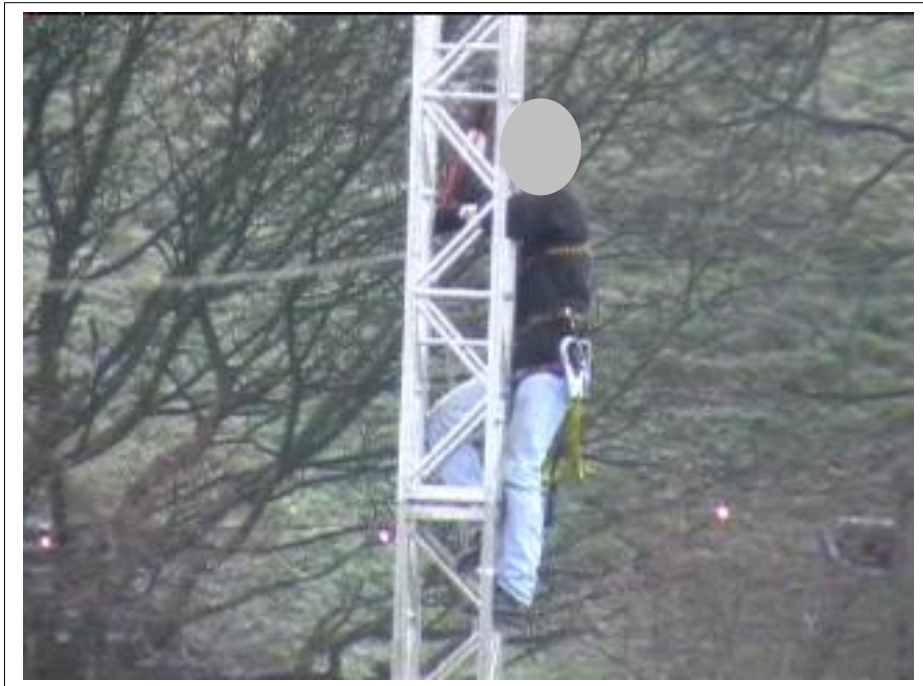


FIGURE 3 NO PROTECTION DURING ACCESS AND EGRESS



FIGURE 4 NO PROTECTION DURING ACCESS AND EGRESS



FIGURE 5 NO PROTECTION DURING ACCESS AND EGRESS

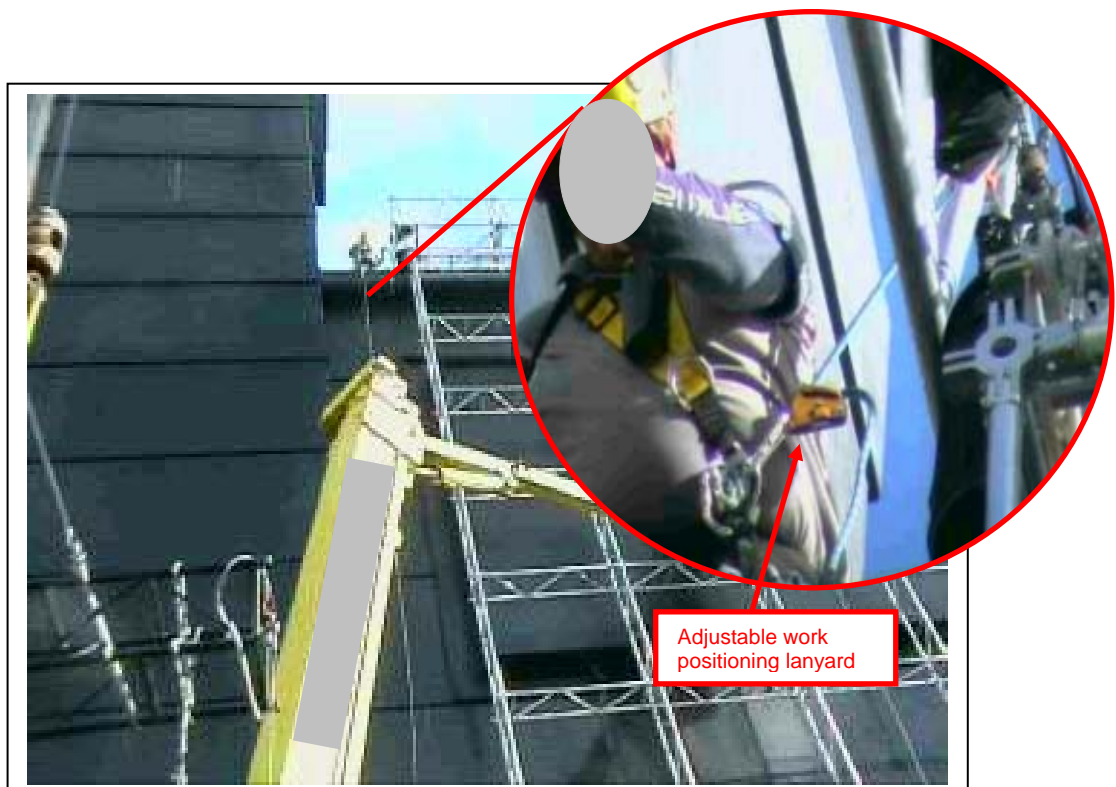


FIGURE 6 NO FALL ARREST BACKUP DURING WORK POSITIONING



FIGURE 7 NO FALL ARREST BACKUP DURING WORK POSITIONING

5.7 Unapproved PPE

A large amount of PPE was self-made, including fall protection lanyards, Figures 8-11 and flexible horizontal lifelines, Figure 12. Generally the PPE was formed out of lengths of mountaineering rope, knotted at each end. Horizontal lifelines in particular are prone to complex loading during falls, where large resultant loads, introduced from the flexible line angles, can be induced on the anchor points and adjoining structure.

These types of system are engineered and EC type-tested to a high standard to ensure they perform in a predictable and safe manner, arresting falls within prescribed fall distances and fall forces. PPE manufacturers are required to model these types of system for all configurations, where varying the system lengths, line tension, number of users and intermediate support distances, can have a significant variation on system performance. It is likely the self-made PPE observed during the survey would not have been strong enough for fall arrest, particularly the knotted end-terminations, which is not a standard termination mode utilised by PPE lanyard manufacturers. It is essential that all PPE used for fall protection complies with UK legislation and is CE approved for the intended purpose under the PPE Directive 89/686/EEC. Without using approved PPE, which has been EC type tested and quality controlled, there is no guarantee that the PPE is fit for purpose and capable of providing the necessary protection during falls.



FIGURE 8 SELF-MADE KNOTTED FALL ARREST LANYARDS



FIGURE 9 SELF-MADE KNOTTED FALL ARREST LANYARD

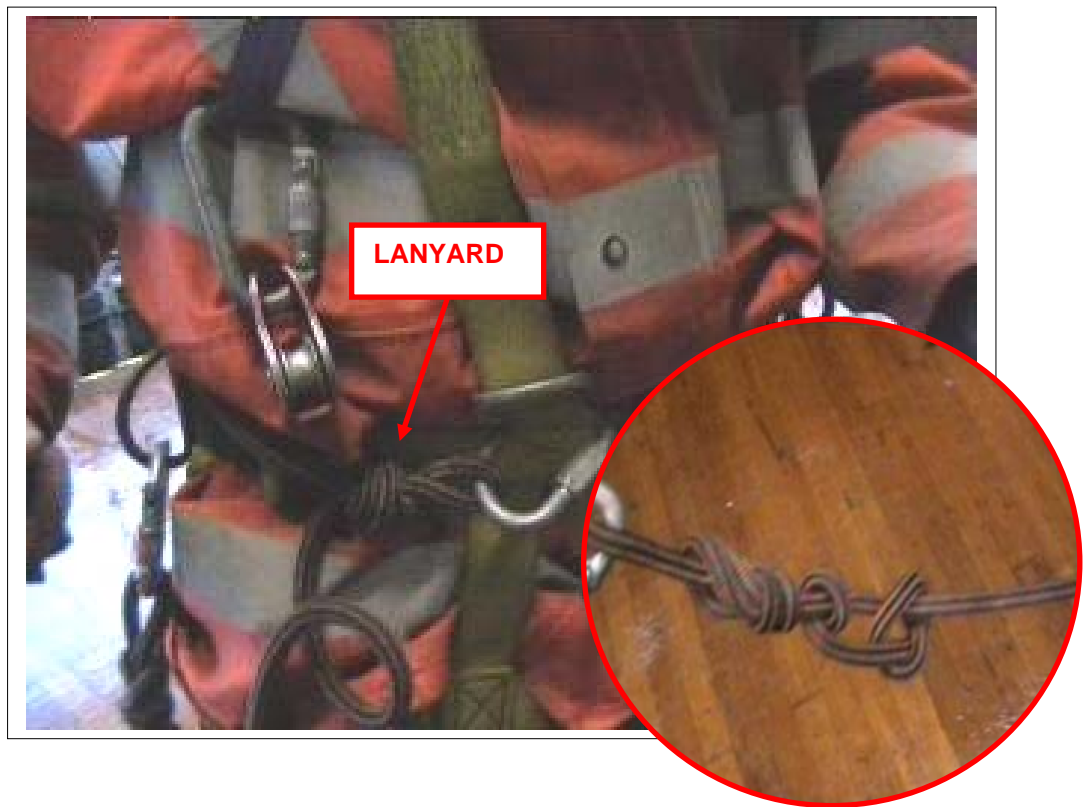


FIGURE 10 SELF-MADE KNOTTED FALL ARREST LANYARD

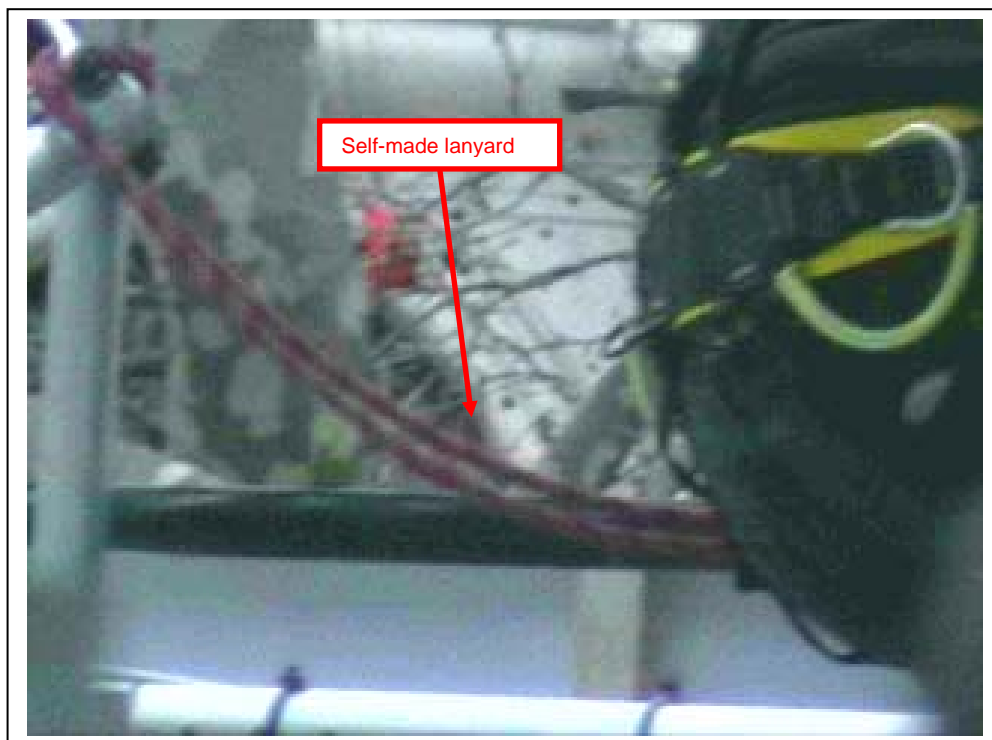


FIGURE 11 SELF-MADE FALL ARREST LANYARD



**FIGURE 12 SELF-MADE HORIZONTAL LIFELINE, INSET
KNOTTED END ANCHOR**

5.8 Incorrect Selection of PPE

On one occasion a worker was observed at height wearing a standalone waist belt/sit harness, Figure 13. Only full body harnesses complying with EN361 are acceptable for fall arrest applications. The use of standalone waist belts and sit harnesses for fall arrest were deemed unsafe and banned in the UK and other countries many years ago, as without shoulder straps there is a high risk of the body falling out of the harness during a fall. Standalone waist belts and sit harnesses also fail to provide sufficient body support and distribution of forces during falls.

At times work positioning lanyards conforming to EN358 were used for fall arrest applications. Work positioning lanyards are not designed nor EC type tested for use under fall conditions. Work positioning lanyards, Figure 14, do not feature an energy absorber element to dissipate the fall forces, which can result in a high risk of the lanyard failing under impact or transferring life threatening loads to the worker, i.e. loads in excess of the EU maximum allowable 6 kN force limit.

On occasion sports PPE was used instead of industrial works PPE, where the energy absorber part of a lanyard was intended for mountaineering sport 'Via Ferrata'. The lanyard, Figure 15, comprised a fixed length rope, which passed through a metallic figure of eight shaped friction link. The configuration of the lanyard and the method in which it was being used would not have provided adequate energy absorbance in the event of a fall, resulting in potential failure of the rope or excessive arrest forces. Sports PPE and industrial works PPE used for fall protection, are regularly confused, particularly lanyards and karabiners, which can often look similar. Sports PPE is type tested and CE marked to completely different EN standards from industrial PPE, and is generally unsuitable for industrial work fall arrest use.



FIGURE 13 WAIST BELT/SIT HARNESS USED FOR FALL ARREST



FIGURE 14 TYPICAL WORK POSITIONING LANYARD



FIGURE 15 MOUNTAINEERING SPORTS LANYARD USED FOR FALL ARREST

Workers were at times equipped with single leg fall arrest lanyards, conforming to EN355, Figure 16, which often provided inadequate protection when manoeuvring between positions. In these instances the use of twin leg fall arrest lanyard, Figure 17 may have been a safer option, where permanent protection could have been achieved by alternating between lanyard legs.

For some applications retractable type lanyards conforming to EN360 or elasticated energy absorber lanyards conforming to EN355 might have been more suitable, where standard fall arrest lanyards introduced potential trip hazards.

On occasion connectors may not have been the most suitable type for the work involved. For example the use of large scaffold hooks conforming to EN362¹⁶ would have prevented the need to choke lanyards around structures, where the gate of the small karabiners were too small to pass over the framework. Squeeze release, Figure 18, or twist lock type connectors, Figure 19, may have been more suitable for applications where frequent connection and disconnection was required, as opposed to screw-gate connectors, Figure 20, which can be extremely awkward and time consuming.

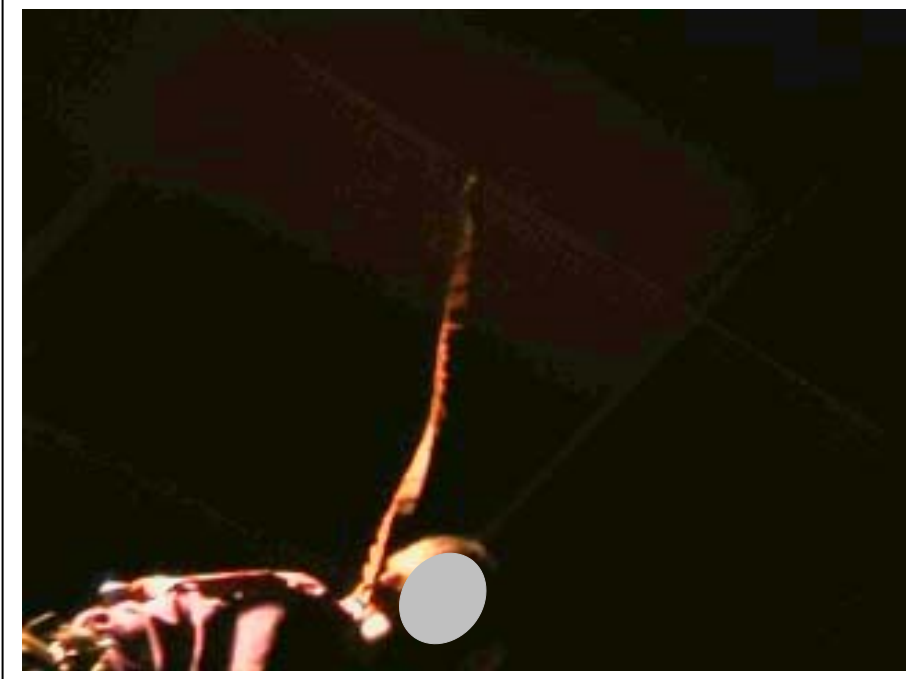


FIGURE 16 SINGLE-LEG FALL ARREST LANYARD



FIGURE 17 USING TWIN-LEG FALL ARREST LANYARD



FIGURE 18 SQUEEZE TYPE SCAFFOLD HOOK



FIGURE 19 TWISTLOCK SCAFFOLD HOOK



FIGURE 20 SCREWGATE KARABINER

5.9 Misuse of PPE

Common misuse of PPE occurred when workers attached their fall arrest lanyards to the wrong attachment point of the full body harness, where their lanyards were connected to the lower waist points, Figure 21. The waist and sit points of a harness should only be used for work positioning applications, in situations where the lanyard is always taut and there is never any slack which may introduce potential free fall.

Only the fall arrest points on a harness, which have been EC type-tested for fall arrest use, have the guaranteed strength and capability to provide sufficient body support and safe distribution of forces during falls. Failure to use the fall arrest points of a harness, which are located at either the upper dorsal or thorax points, may result in serious injury, including paralysis and internal organ failure, or fatality. When harnesses are of a multi-purpose nature, combining EN361 fall arrest, EN358 waist belts and EN813 sit harness, it is important that the attachment points are not mixed up and used for the wrong purpose. The manufacturer's user instructions clearly detail the purpose of each attachment point on a harness.



FIGURE 21 FALL ARREST LANYARDS ATTACHED TO WRONG HARNESS POINTS

Lanyards were at times choked around the harness D rings, Figure 22-23, which is not the method approved by the manufacturer for fall arrest. Lanyards are normally attached to the harness points directly via a karabiner, which passes through the lanyard eyelet termination.

At times the PPE was incomplete, for example where energy absorber packs had been removed from the fall arrest lanyards, Figure 24. In cases where the energy absorber part and lanyard are of a separable design, it is crucially important that the absorber pack is included during fall arrest use. Otherwise the lanyard may rupture during impact or transfer life-threatening loads to the worker.

A large number of workers failed to wear their fully body harnesses correctly, and the shoulder straps were often left hanging off by the waist, Figure 25. Without the shoulder straps secured in position there is a high risk of the worker falling out of the harness during a fall, when the body is not adequately enclosed. In addition, the trailing shoulder straps are susceptible to snagging and rubbing on other structures, which could result in loss of the worker's stability at height or damage to the PPE.

Harnesses were at times poorly adjusted, leaving the fall arrest Dee rings located too far down on the body, Figure 26. In order to ensure the correct fall motion and safe arrest it is essential that harnesses be of the correct fit and adjustment.



FIGURE 22 PPE LANYARDS CHOKED AROUND THE HARNESS ATTACHMENT POINT



FIGURE 23 PPE LANYARDS CHOKED AROUND THE HARNESS ATTACHMENT POINT

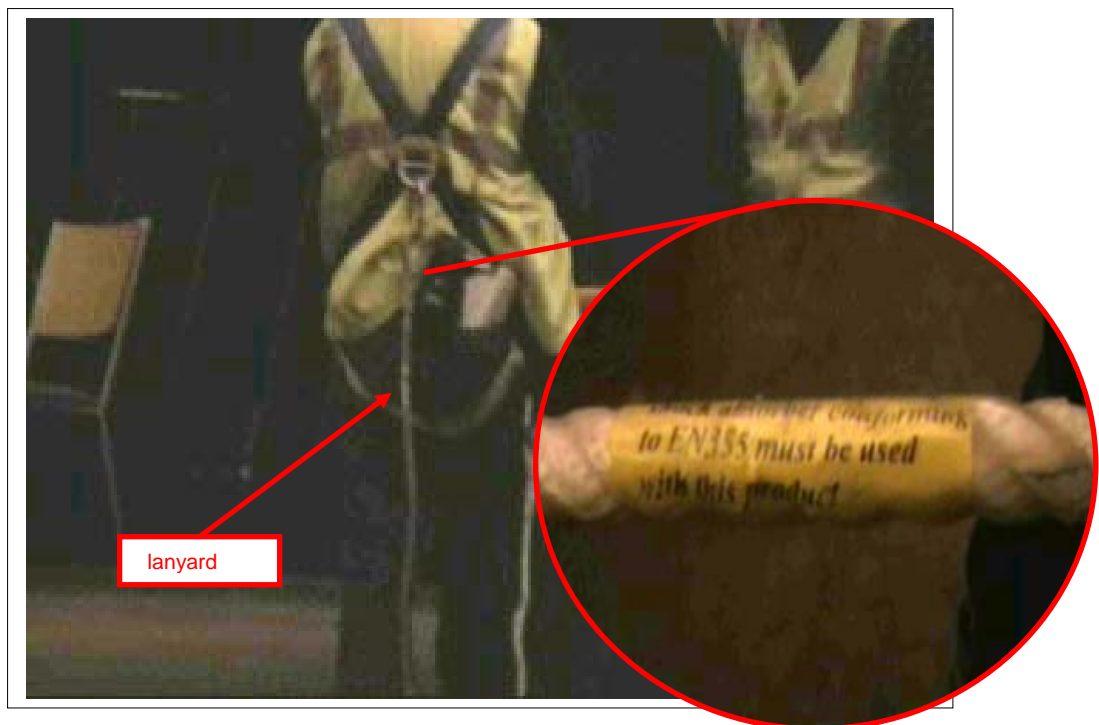


FIGURE 24 ENERGY ABSORBER PACK MISSING FROM LANYARD, INSET: WARNING ON LANYARD TO INCLUDE ABSORBER

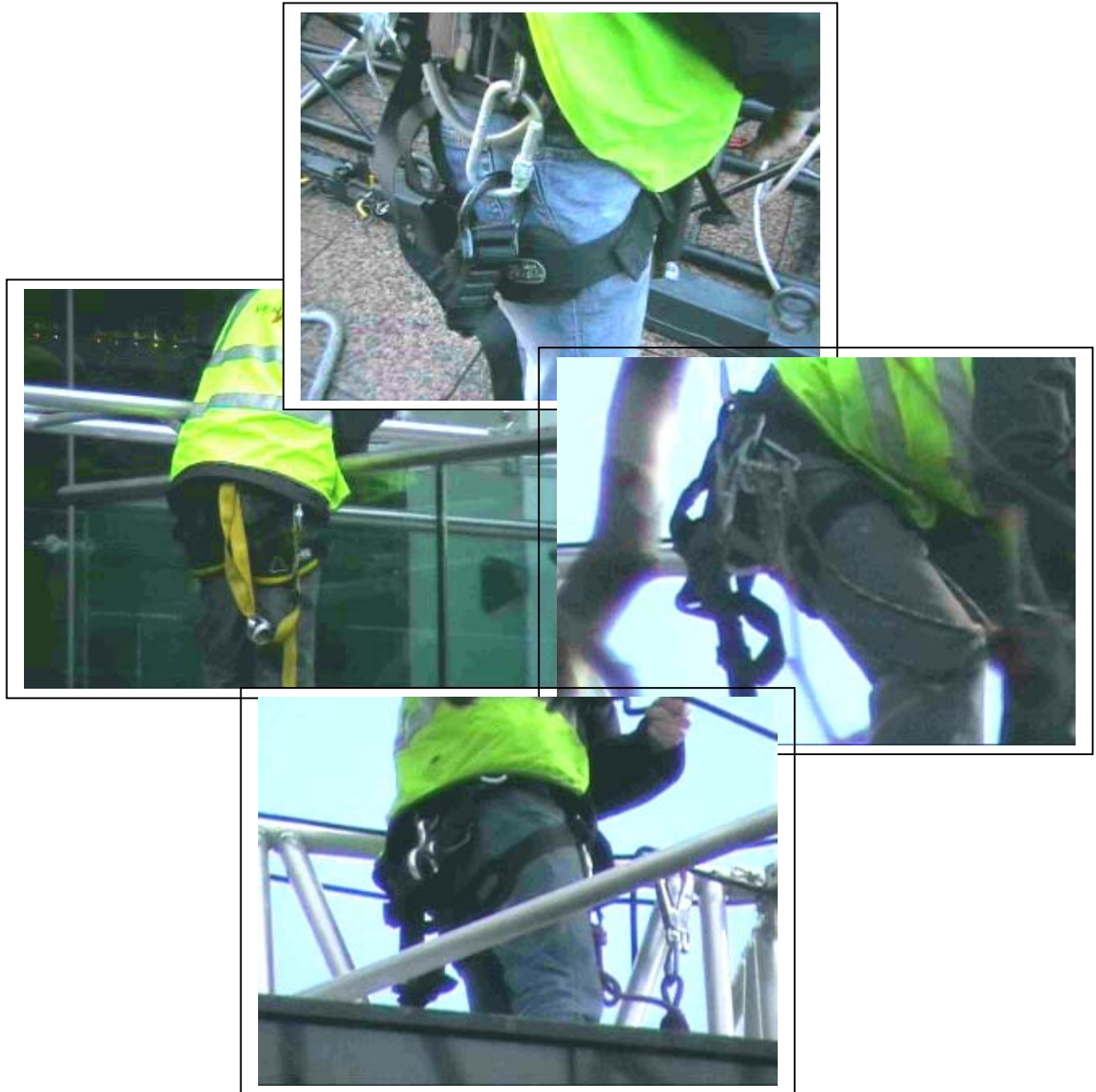


FIGURE 25 HARNESS STRAPS HANGING DOWN



FIGURE 26 LOW POSITIONED HARNESS DEE RING

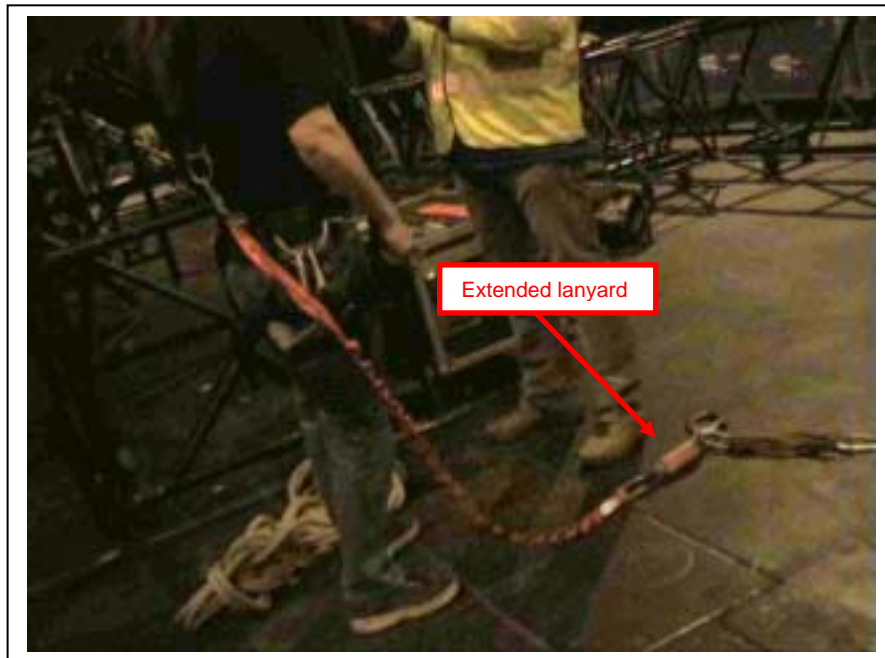
Fall arrest lanyards were regularly extended, at times up to double their original length, where additional connections, including lanyards and connectors were added, Figures 27-29. Fixed fall arrest lanyards complying with EN355 are required to be no more than 2 metres long, including end connectors. By adding additional elements, the working length of the lanyard is extended, which in turn increases the potential free fall distance and subsequent arrest forces, which would then exceed the loads for which the lanyards are designed and tested.

Fall arrest lanyards were often choked or looped around structures, Figures 30-31. The majority of fall arrest lanyards are not suitable, nor EC type tested, for choking or looping, and they should generally be connected directly to the structure via a connector or approved interface device. Choking lanyards can induce large strains on the PPE and loading in undesirable directions. It is important to ensure lanyards are fixed exactly as instructed by the manufacturer.

Twin leg fall arrest lanyards were on occasion misused where the energy absorber pack appeared to have been bypassed, Figure 32, where one 2-metre leg was attached to the structure and the second 2-metre leg attached to the harness, providing almost a 4 metre lanyard length. In this configuration the energy absorber, which should have been attached to the harness, would not have served any purpose. The lanyard would most probably have failed in the event of a fall. This particular misuse is believed to have been the cause of a recent fatality in Australia.



**FIGURE 27 ADDITIONAL LANYARD ADDED TO
FALL ARREST LANYARD**



**FIGURE 28 ADDITIONAL LANYARD ADDED TO
FALL ARREST LANYARD**

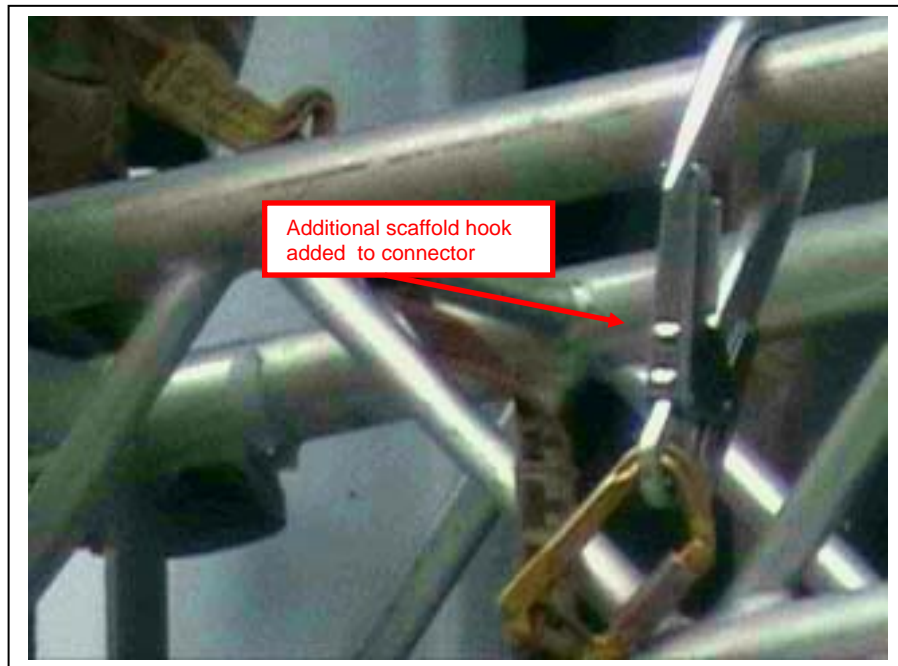


FIGURE 29 ADDITIONAL CONNECTOR ADDED TO FALL ARREST LANYARD



FIGURE 30 LANYARD CHOKED AROUND STRUCTURE



FIGURE 31 LANYARD CHOKED AROUND STRUCTURE

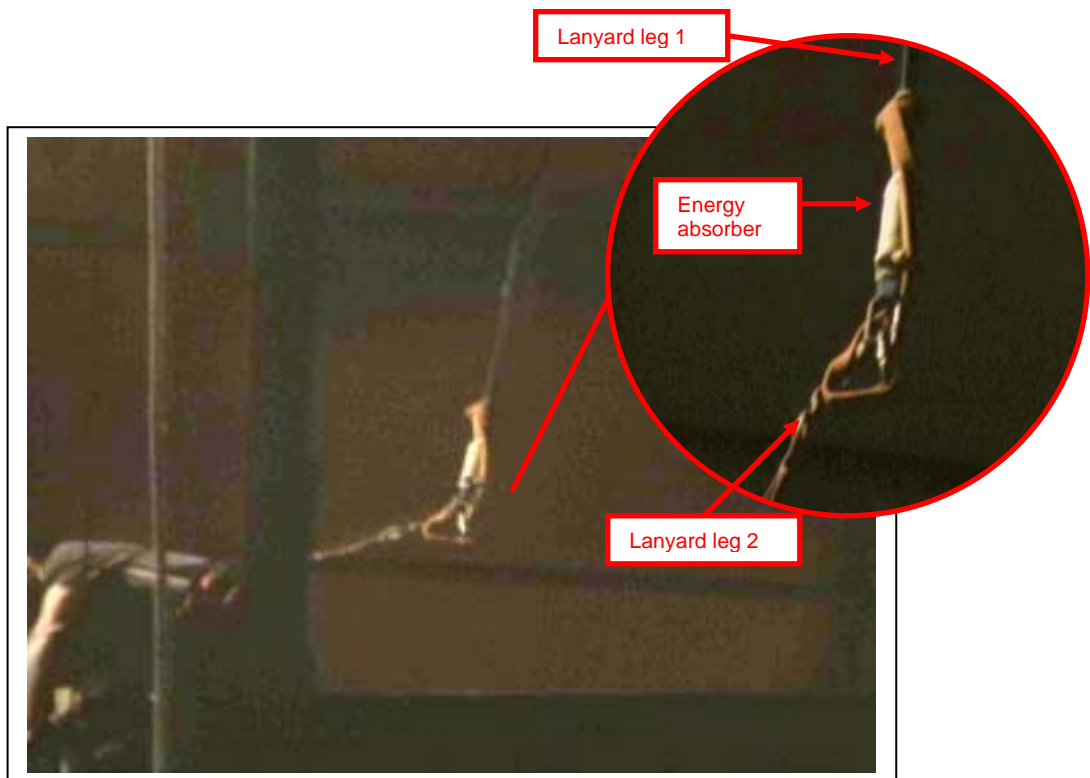


FIGURE 32 FALL ARREST LANYARD - BYPASSED ENERGY ABSORBER

Retractable type fall arresters were occasionally misused. Retractable fall arresters operate by inertia sensing, where at a given velocity/force they are designed to lock instantly and arrest the fall, with the built in absorber feature dissipating the fall forces to within 6 kN. The types of misuse observed during the survey included:

- Retractable arrester used in conjunction with 2-metre long energy absorber lanyards, where the lanyard was attached to the free end of the retractable fall arrester, Figure 33. Adding other energy absorber elements will cushion the input forces to the retractable arrester and delay or prevent the device from locking, or result in a ratcheting effect, where the device alternately locks on and off. The retractable arrester end connector should be attached directly to the harness attachment point.
- The retractable cables at times weaved in and out of framework, Figure 34. By wrapping or passing the retractable cable around structures, the introduced friction can limit the inertia and prevent the device from locking.
- The retractable cable passed over structures during use, possibly resulting in excessive loading of the cable during a fall or cutting and damage over edges.
- At times the angle of the cable appeared excessive, Figure 35. It is essential that the devices be used within the maximum angle specified by the manufacturer, which is usually 40 degrees from the vertical plane. The pendulum motion from angular falls can limit the vertical forces input to the device and prevent the braking mechanism from functioning.

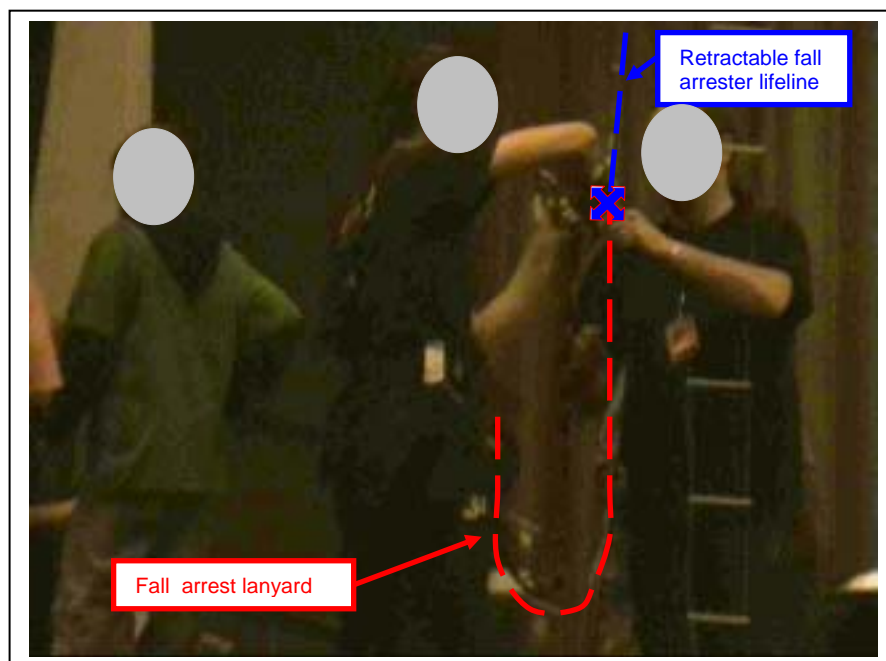


FIGURE 33 FALL ARREST LANYARD ATTACHED TO THE END OF A RETRACTABLE FALL ARRESTER – LANYARD PATHS HIGHLIGHTED FOR CLARITY

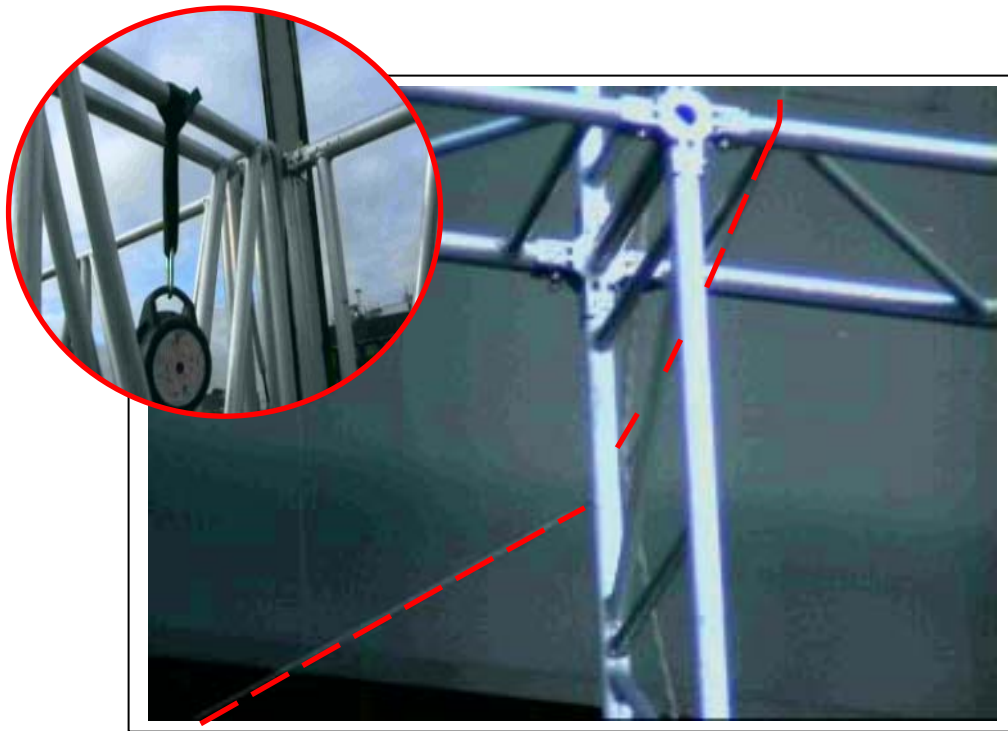


FIGURE 34 RETRACTABLE FALL ARRESTER CABLE WEAVING IN AND OUT OF FRAMEWOK - CABLE PATH HIGHLIGHTED FOR CLARITY



FIGURE 35 RETRACTABLE FALL ARRESTER CABLES – POTENTIAL PENDULUM SWINGS

5.10 Poor Condition of PPE

At times PPE appeared in poor condition. Examples included the following:

- Textiles, including lanyards and lifelines were at times heavily knotted, Figure 36. Knots in textiles not only increase wear and tear of the material, but also significantly weaken the PPE, where the PPE could rupture under impact.
- PPE textiles at times appeared aged and worn, which may have affected the strength of the materials.
- On occasion the PPE labelling had faded and was unreadable. The label holds important information relating to the PPE, including date of manufacture, warnings and serial numbers. It is important that there is a record of this information and that the PPE can be properly identified and controlled.
- A permanent steel lifeline, Figure 37, was extensively rusted, soiled and deformed, and may not have been in a safe condition for use (for these reasons the workers involved did not make use of the PPE system).

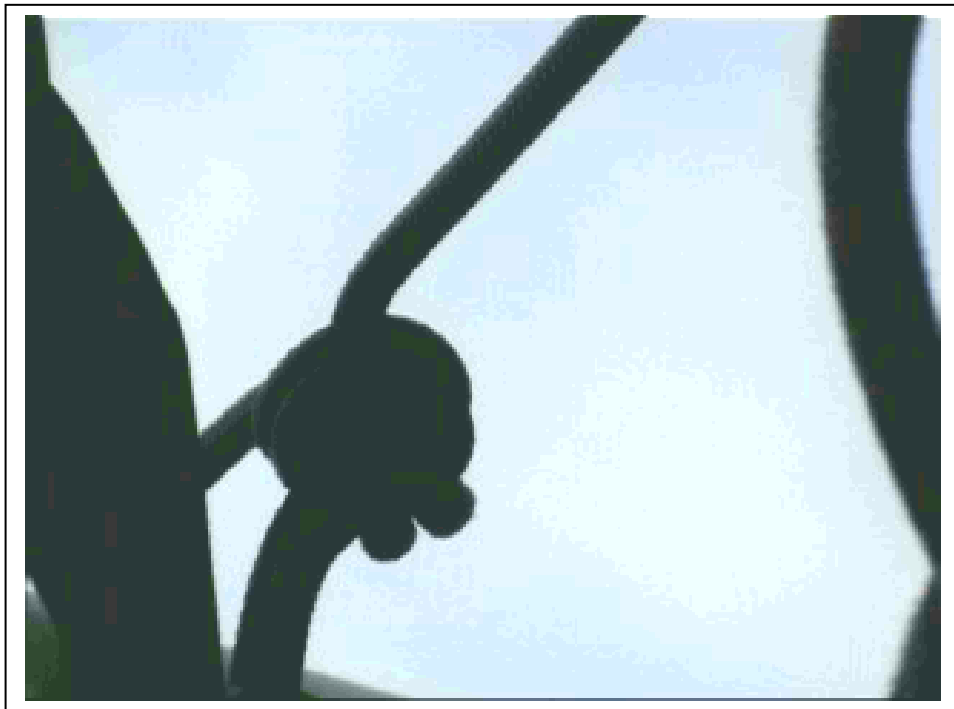


FIGURE 36 KNOTTED LIFELINE

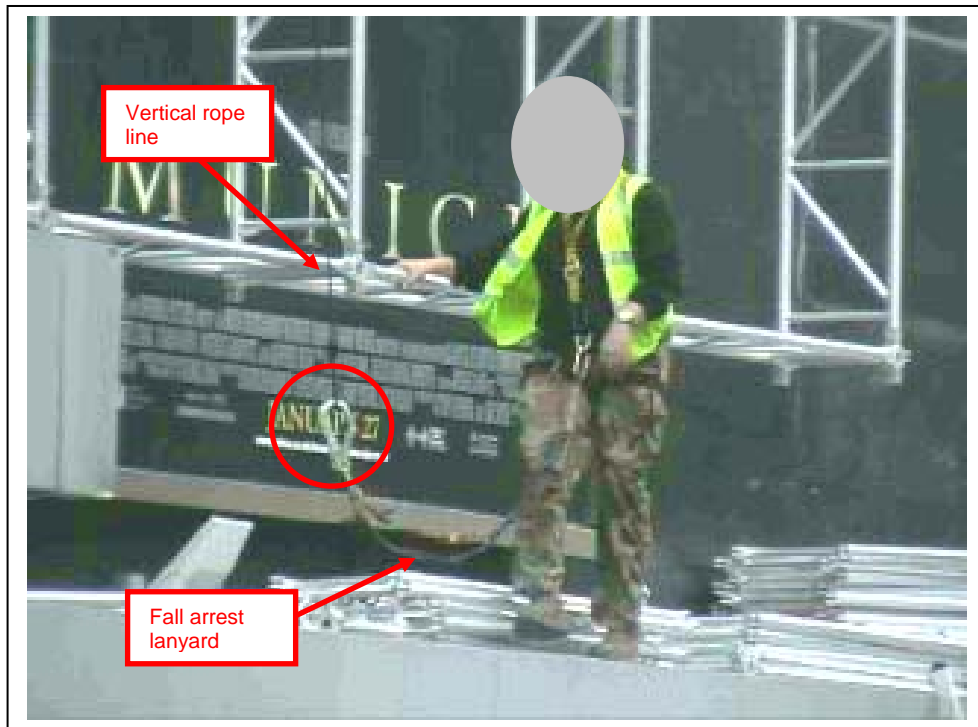


**FIGURE 37 HORIZONTAL LIFELINE IN POOR CONDITION
(LIFELINE HANGING DOWN AFTER REMOVAL)**

5.11 Poor Selection of Structural Anchor Points and Poor Installation of PPE

The safe use of PPE is largely dependent on the installation of the PPE and the suitability of the structural anchor point. The anchor points and installations observed during the survey often introduced potential risks and fall hazards, which may have affected the safe operation of the PPE and endangered the workers during a fall. This included the following.

- Anchor points were generally uncontrolled and chosen at random. It is essential that PPE anchor points have been validated as fit for purpose to ensure the safe use of the PPE.
- Anchor points and the structures upon which they were mounted, may not have had the strength and/or stability to sustain the dynamic forces encountered during falls. One of the worst examples of this was where PPE fall arrest lanyards were anchored to the ends of knotted ropes, Figures 38-39. The excessively long ropes, which were further weakened by the knotted end-terminations, were most likely unfit for purpose. In addition, the stretch of the rope may have also, during a fall, significantly increased the fall distance and severity. It is important that the PPE is attached to a stationary, non-yielding anchor point to ensure a safe and predictable performance of the PPE.



**FIGURE 38 PPE ANCHORED TO VERTICAL ROPE LINES
SUSPENDED FROM ROOF**



**FIGURE 39 PPE ANCHORED TO VERTICAL ROPE LINE VIA
KNOTTED EYELET**

- The position of anchor points relative to the worker at times introduced the potential for pendulum swings. In addition to the risk of the worker impacting against other objects, the swinging motion can also affect the safe operation of certain types of PPE.
- PPE was at times in danger of being damaged or cut during general use and during falls. Where the PPE was in contact with sharp profiles, abrasive and imperfect surfaces, Figures 40-41.
- Fall arrest PPE may have been used in situations where there was insufficient space below the worker to arrest the fall clear of the ground below, Figure 42. This can often be the case with low frame building, where the worker is standing full height on the roof with the 2 metre lanyard attached at foot level. A minimum distance is required for certain PPE fall arrest systems to allow for free fall, stretch of components and deployment of the energy absorber. Manufacturers advise the minimum clearance height above the ground for specific PPE. In these situations possibly a different type of access or fall protection may have been more suitable, such as ladders or mobile towers, or PPE which operates in smaller fall distances.

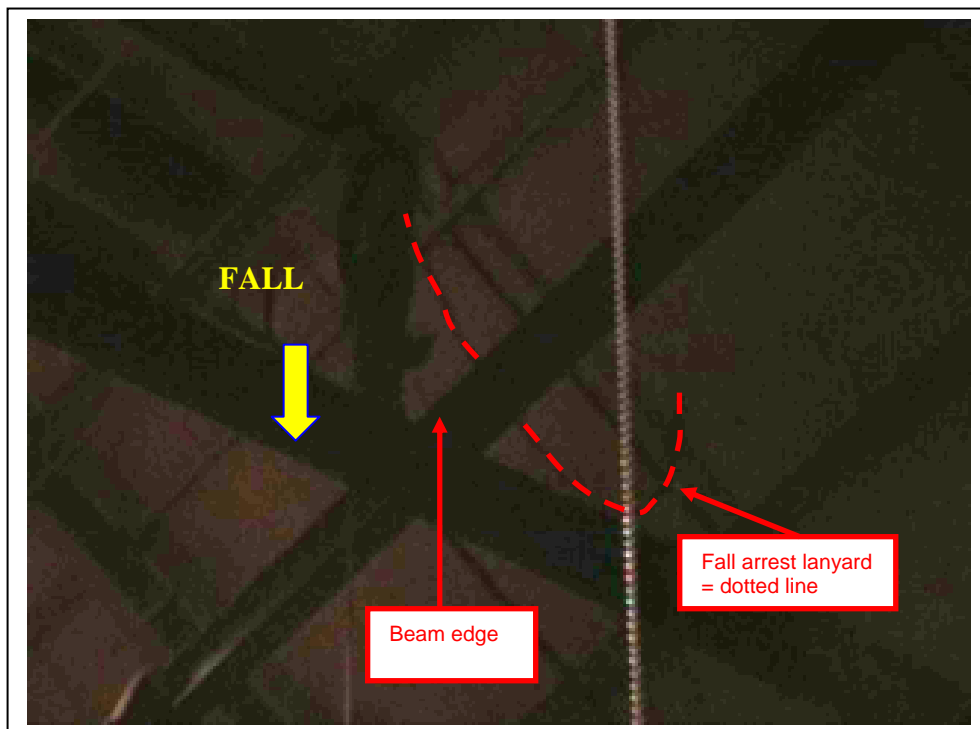


FIGURE 40 TRAILING LANYARDS OVER BEAM EDGES

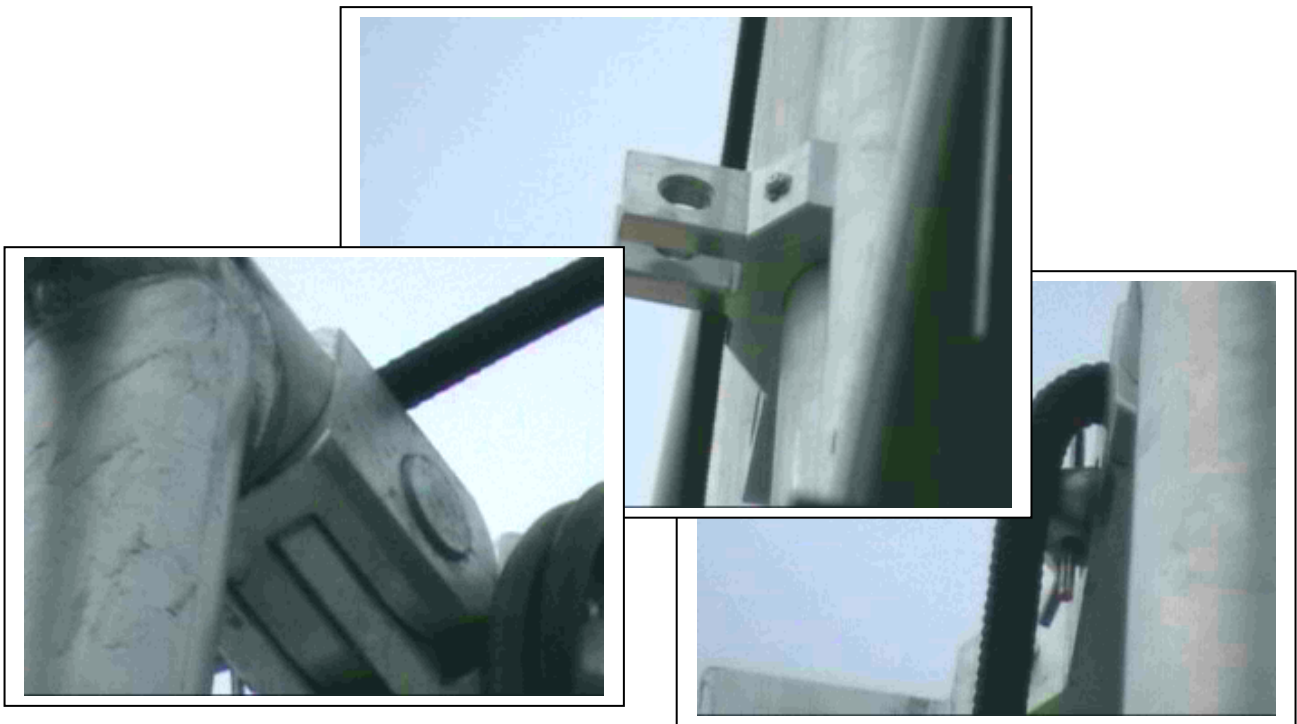


FIGURE 41 PPE IN CONTACT WITH OTHER EDGES

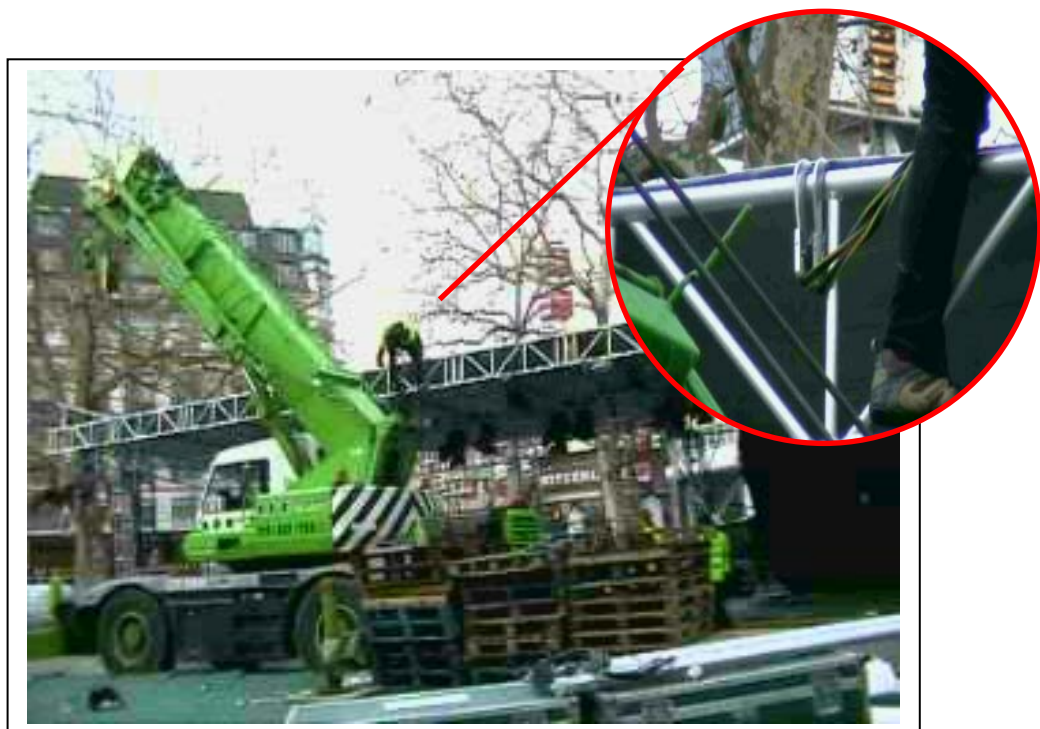


FIGURE 42 FALL ARREST PPE AT LOW LEVELS

- The selection of anchor points frequently resulted in fall arrest PPE anchored to points below the attachment point of the worker's harness, and at times below foot level, Figures 43-44. Manufacturers will normally instruct that anchor points are as far above the attachment point of the harness as possible, to reduce free fall and lessen the severity of the fall. Although on a large number of occasions, selection of anchor points below the harness points was inevitable due to an absence of suitable overhead structural anchors, there were occasions when workers could have attached to structures above the attachment point of the harness.
- PPE (self-made PPE) appeared on one occasion to be in use next to a MEWP, Figure 45, where there may have been a risk of the PPE getting snagged or damaged during contact. It is important that PPE is free from other moving structures to prevent unintended movement of the worker.

5.12 Unprotected Fragile Roofs

On one occasion workers worked alongside unprotected, accessible fragile roofs, comprising glass and plastic coverings, Figure 46. The access routes around the fragile roof sections were extremely narrow, and were laced with trip hazards and obstructions.

5.13 Marquees and General Framework

Marquees and small frames were generally built at ground level, including fitting of production equipment, which eliminated much of the need to work at height.

On one occasion a free standing scaffold tower located on sloped ground appeared to have inadequate base supports, illustrated in Figure 47. A number of the base plates observed were not fully supported by the foundation packers and the packers used were inappropriately shaped. It is essential that the foundations for a scaffold are adequate to prevent movement and improper loading of the structure and components.

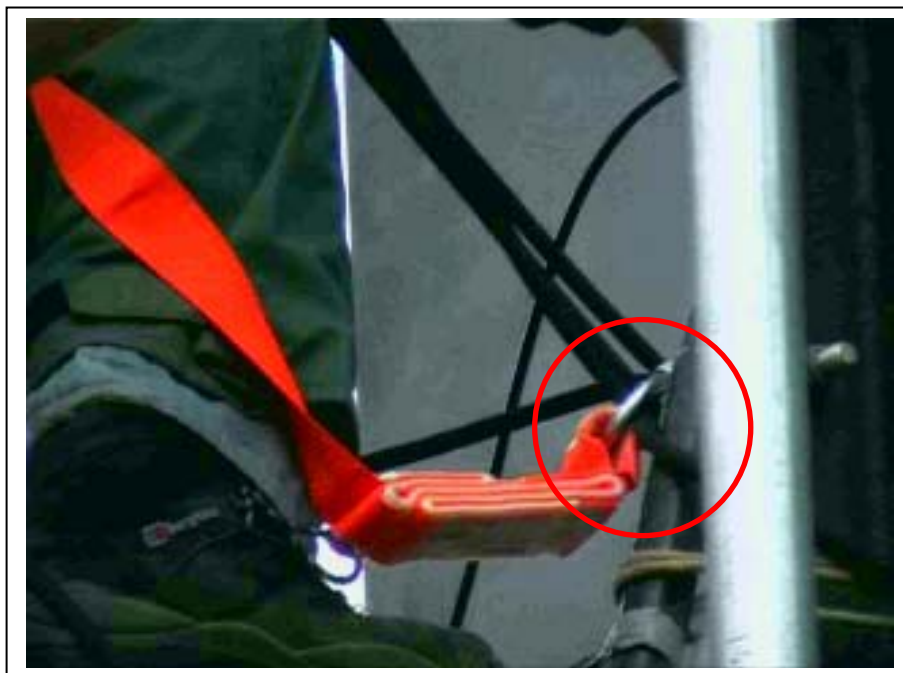


FIGURE 43 FALL ARREST LANYARD ANCHORED AT FOOT LEVEL



FIGURE 44 FALL ARREST LANYARD ANCHORED AT FOOT LEVEL



FIGURE 45 VERTICAL ROPE LINE IN CONTACT WITH MEWP

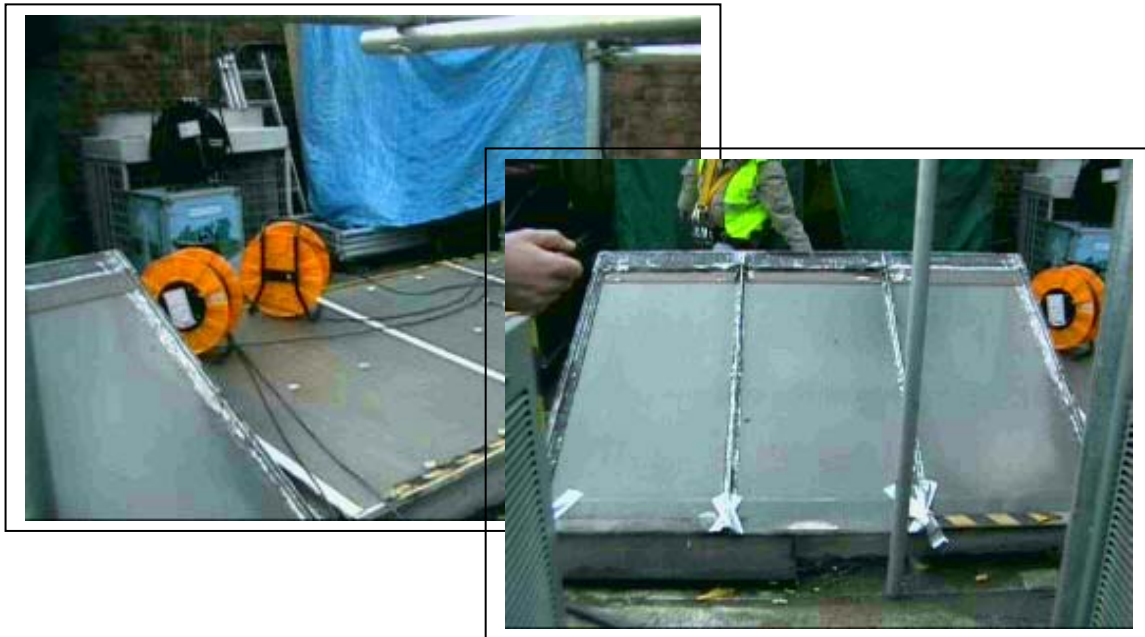
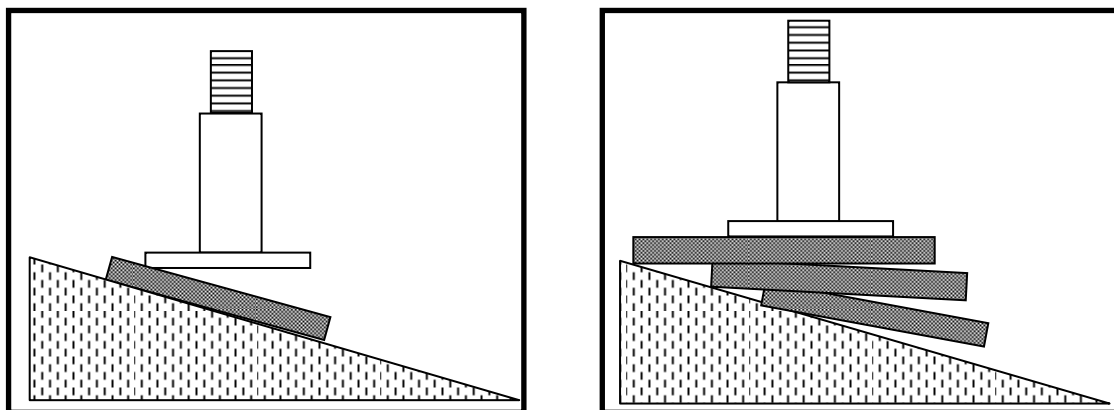


FIGURE 46 UNPROTECTED FRAGILE ROOFS



**FIGURE 47 FREE STANDING SCAFFOLD TOWER – IMPROPER BASE
PLATE LOADING AND ILL FITTING PACKERS**

5.14 Inadequate Rescue Plans

Provisions for rescue were regularly inadequate with no effective plans to facilitate the speedy and safe recovery of falls victims in order to prevent further discomfort, injury or even death.

At times there was a lack of awareness of rescue needs, hazards and risks, including suspension trauma, a condition which affects persons suspended in a harness for a given period of time. There was no awareness of the causes, effects and consequences of suspension trauma, which, with proper planning, can be minimised.

Suspension trauma results from accumulation of blood in the veins at the lower part of the body due to gravity and lack of movement caused by the body being in a suspended position. Due to the immobility of the legs, blood is not effectively circulated around the body, which can affect the functioning of the brain and other vital organs, such as the kidneys and heart. The victim can experience a number of symptoms including sweating, breathlessness, nausea, dizziness, paleness, hot flushes, low blood pressure, slow heart rate, fast heart rate, loss of vision, faintness, unconsciousness and possibly death. Such effects can occur in relatively short periods of time, as little as 15 minutes, dependent on a number of contributing factors such as immobility of the legs, pain, injuries, fatigue, shock, dehydration, hypothermia, cardiovascular disease, respiratory disease and loss of blood. In order to mitigate the consequences of suspension trauma a number of steps can be taken including minimising the duration of suspension, ensuring that a comfortable well-fitted harness is used to reduce strangulation around the leg arteries and the use of rescue aids such as rescue straps and leg loops to raise the legs to an upright position to improve blood circulation. Proper training in rescue and first aid is essential to promote awareness of this condition.

5.15 MEWPs

Workers generally wore PPE, either work positioning or fall arrest, when inside MEWPs. It is important that fall arrest PPE is worn if the worker is required to reach out of or above the basket.

All MEWPs observed during the survey were fitted with adequate enclosures.

At times MEWPs were used as a form of transfer, where workers would climb out of the MEWP when at height to access their place of work. MEWPs are not recommended or intended for this use. Climbing out of MEWPs should only be done where no alternative safer method exists. Transferring from a MEWP to a structure can be extremely risky. While the use of a single leg fall arrest lanyard may provide the worker with some protection, there is the potential for exposure to risk of a fall when transferring between anchor points. Although the risk can be overcome by using a twin leg fall arrest lanyard, if one leg is attached to the MEWP and the other leg is attached to the structure, then serious consequences could result if there is unintentional excessive movement of the MEWP.

5.16 Ladders and Mobile Scaffold Towers

Ladders and mobile scaffold towers were regularly used throughout to provide a means of access.

Ladders were generally secured during use, and were restrained or heeled by a second person.

Mobile scaffold towers, Figure 48, were fitted with adequate enclosures and stabilizers.

At times workers climbed ladders while carrying bulky equipment. This can often increase the risk of falls, by preventing the safe use of both hands and reducing visibility during climbing.

5.17 Mobile Stages

Mobile stages, Figure 49, were the types that unfolded from articulated trailers, with the main structure hydraulically actuated into position. This minimised the need to work at height, and any minor working at height was conducted using secured ladders and fully enclosed mobile access towers.



FIGURE 48 MOBILE SCAFFOLD TOWERS



FIGURE 49 GENERAL VIEW OF MOBILE STAGE

5.18 Environmental and General Conditions

The environmental and general conditions encountered when building temporary entertainments can often introduce additional hazards and pressures. This can at times increase the difficulties and risks experienced when working at height. Typical problems are listed below:

- In outdoor environments weather conditions can greatly affect the safety of workers and work equipment, including exposure to rain, temperature effects, wind, snow, ice, darkness and lightning strike. These conditions can affect worker visibility and balance, ground conditions, stability of structures, surface grip and the safe operation of equipment. In addition hostile conditions can accelerate the corrosion of metals and degradation of textile materials used in fall protection equipment.
- Often space and access is restricted in both indoor and outdoor environments, which can limit the choice of work equipment and installations, such as permanent stairwells, MEWPS, cranes, scaffolding and collective protection equipment.
- Tight schedules can frequently affect the safety of staff working under extreme pressure and can also influence the choice of work equipment particularly if it is known that some work equipment may slow down the working process, i.e. scaffolding and MEWPs.

- The absence of suitable structures in outdoor environments can regularly present difficulties in finding anchor points to accommodate fall protection equipment, such as safety nets and PPE.
- Where temporary structures are concerned, some permanent type PPE systems can only be installed after the structure has been erected. Therefore, for many applications, only temporary PPE systems are feasible.

6 CONCLUSIONS

- 1 Generally, good efforts were made to avoid and minimise work at height by implementing alternative methods and equipment. Where work at height was observed, it appeared unavoidable and necessary.
- 2 Where work at height was necessary, the industry relied heavily upon the use of PPE to protect workers against falls, where often preventative measures or collective protection was not feasible.
- 3 A large variation existed in fall protection levels and the type and condition of PPE differed greatly from worker to worker. This may have been partly attributable to the fact that many of the workers were self-employed.
- 4 Fall protection was regularly inadequate and where workers were exposed to the risk of serious injury or fatality in the event of a fall.
- 5 Management systems were often negligent in fully addressing and controlling the risks and hazards involved where working at height was necessary.
- 6 PPE did not always comply with the PPE Directive 89/686/EC, particularly self-made PPE.
- 7 The care of PPE was at times inadequate and there was an absence of pre-inspection, periodic examination, control and maintenance.
- 8 The type of PPE chosen was regularly unsuitable for the application in which it was used.
- 9 The type of PPE misuse encountered during the surveys was indicative of poor work at height training and awareness.
- 11 Training courses and certifications acquired by workers at times may not have been relevant to the particular work at height activities and work equipment observed during the survey. For example, many workers had acquired IRATA qualifications aimed at work positioning using rope lines, even though their work activities did not involve this particular application. In these occasions, a general work at height course covering the use of fall arrest PPE and rescue of suspended persons may have been more relevant.
- 12 At times a lack of management and supervision was evident, where workers failed to make use of the PPE or use the PPE correctly.
- 13 The selection of structural anchor points, anchoring techniques and the installation of PPE systems were at times inadequate.

- 14 Work positioning backup systems were inadequate and for the majority of times no fall arrest backup existed.
- 15 Rescue provisions were regularly lacking and often no effective rescue plans and equipment were in use to allow the safe and timely recovery of falls victims.
- 16 Working at height in the broadcasting industry can be further compromised due to the additional hazards and pressures experienced when working in outdoor environments where weather conditions in particular can greatly affect the safety of workers and work equipment.
- 17 At times the temporary nature, shape and size of a structure can present difficulties and limit the choice of fall protection equipment, including collective equipment and PPE.
- 18 One out of the five events surveyed demonstrated compliance with the Work at Height Regulations, where workers were adequately protected against falls at all times with the proper training, supervision and protection systems. On this occasion an effective management system was in place to control the risks and hazards associated with working at heights.
- 19 Although not applicable to all workers observed during the survey, in general, improvements are necessary within the industry to achieve compliance with the Work at Height Regulations.

7 RECOMMENDATIONS

The following recommendations incorporate the general principles and approach of the Work at Height Regulations.

7.1 Risk Assessment

A risk assessment should be carried out for all work at height activities in accordance with the WAHR, adopting the safe work at height hierarchical approach of Avoidance, Prevention and Mitigation.

The risk assessment should identify all working at height activities, including working beside fragile surfaces, and should assess all associated hazards and risks, including methods for access to and egress from the workplace, suitability of personnel and prevailing site conditions.

Steps must be taken to control the risks identified in the assessment as suggested in the following sections.

- **Avoidance**

Every effort should first be made to avoid work at heights by exploring other means to perform the tasks. This could include, where reasonably practicable, assembly of structures at ground level and, thereafter, craning into position.

- **Prevention of falls**

Where avoiding work at height is not reasonably practicable, suitable and sufficient measures should be taken to prevent workers and equipment from falling distances liable to cause personal injury. This may be achieved by employing suitable installations and work equipment, such as permanent staircases, ladders, work platforms, edge protection, enclosures and MEWPs.

- **Mitigation**

In the event that the risk of falling still exists, steps should be taken to minimise the distance and consequences of the fall.

This should first be approached by exploring **collective fall protection**, e.g. safety nets, air mats and filled landing bags before opting for PPE, which should always be a last resort and justified within the risk assessment, on the grounds that no other safer means are reasonably practicable.

Where PPE is deemed necessary, consideration should first be given to **work restraint PPE**, to prevent workers reaching hazardous areas such as open edges.

Where it is not reasonably practicable to use work restraint PPE to prevent workers from accessing hazardous areas, consideration should be given to **work positioning PPE** (used in conjunction with a fall arrest PPE back-up system) to provide adequate support of the worker, so ensuring that the worker adopts the correct posture and has both hands free for conducting the required tasks.

Where no other safer means are reasonably practicable, **fall arrest PPE** should be selected as a last resort. This may be a single system or a combination of different PPE systems to allow a safe access, place of work and transfer between locations. Various types of PPE systems and their uses are explained in Appendix 2.

7.2 Access, Egress and Places of Work

In order to prevent falls from occurring preferably if possible, adequate staircases, walkways, and platforms should ideally be provided to allow safe access and a safe place of work. Platforms and access routes should be:

- Strong, secure and stable enough to support the required loads.
- Supported by structures that are strong, secure and stable enough.
- Located on even and non-yielding surfaces.
- Of adequate size and dimensions to accommodate the worker and work equipment.
- Free of trip hazards and obstructions from equipment, cables and other objects.

- Fitted with adequate edge and floor protection (where a guardrail or safety net is used for edge protection, it must be strong enough for the intended purpose and adequately enclosed to prevent workers or objects falling through openings)
- Where there is a risk of falling from openings, collective protection and or PPE fall arrest should be utilised.
- Provided with effective anti-slip surfaces.
- Secure from the intrusion of moving parts.

Where the installation of adequate staircases, walkways and platforms is not feasible, particularly during the building of temporary outdoor structures, consideration should be given to the use of other equipment, including MEWPs and scaffolding, including lightweight mobile scaffold towers, fitted with adequate enclosures. Where applicable, provisions for work positioning and fall arrest should be addressed in conjunction with such equipment.

Ladders should only be used to provide access and a place of work where a risk assessment shows that no other reasonably practicable means is suitable for the particular task. Ladders should satisfy the following criteria:

- If fixed ladders are used, where serious injury or death could occur in the event of a fall, consideration should be given to fall arrest systems, including:
 - rigid systems conforming to EN353-1
 - flexible systems conforming to EN353-2
 - long range retractable type fall arresters conforming to EN360

These types of PPE allow users to climb with both hands and in the event of a fall provide a controlled arrest within short distances and prescribed arrest forces.

- Ladders spanning more than 9 metres should, where reasonably practicable, be fitted with landing/resting platforms at suitable intervals.
- Fixed ladders used for access must be long enough to protrude above the place of landing, to at least handrail height, and provide a safe means of transfer to the place of work.
- Ladders must be stable, secure and strong enough to support the required loads. This may at times include dynamic forces experienced during falls from those ladders which are fitted with fall arrest systems.
- Swivelling, interlocking and extending ladders must be prevented from moving while in use.
- Where ladders are interrupted and obstructed, secure foot-holds and hand-holds must be made available to ensure safe transfer.
- Temporary ladders should be secured to a sound structure at all times or heeled by a second person.

Where work at height entails climbing and working directly on frames and structures, the following provisions should be made:

- The structure should be fitted with some form of fall protection to provide protection when both climbing the structure and when carrying out the work tasks. Where the use of collective protection, such as safety nets and landing mats is impractical, PPE, including twin leg fall arrest lanyards (EN355), retractable fall arresters (EN360), vertical fall arrest lines (EN353 1&2), and horizontal fall arrest lines (EN795) should be considered.
- Where PPE is anchored to the structure, the anchor points should be validated as fit for purpose.
- The structure should be strong, secure and stable enough to support the required loads, especially frames that are part built. This may include dynamic forces experienced during falls from those frames which are fitted with fall protection equipment.
- The structure should be free from obstructions and hazards, including sharp edges, trip and slip hazards, which may endanger the worker or damage equipment during normal use or in fall conditions. This includes the risk of PPE cutting or loading over parts of a structure during a fall.
- The structure should have adequate hand and foot holds.

Carrying objects and tools while climbing should be minimised and consideration given to alternative means including gin wheels, hoists and tool belts.

7.3 Danger Areas

Where there is a risk of objects or personnel falling from a height, provisions should be taken to ensure that hazardous areas are sealed off to prevent entry of other persons who may be endangered.

7.4 Selection of Work Equipment

All work equipment selected for working at heights, including MEWPs, scaffolding, guardrails, ladders, collective protection and PPE, must satisfy the UK legislation in force to ensure the safe installation, operation, inspection, training and maintenance requirements.

Requirements for work equipment are specified within the new WAHR under the appropriate schedules.

7.5 Assessment of Personnel

An assessment should be made of staff working at height, including levels of fitness, competence and health conditions, which may endanger them or other persons while working at height.

When using fall protection equipment, the weight of any tools and equipment in addition to the body mass of the worker should be considered when selecting the appropriate work equipment. Special provisions may need to be made to provide

adequate safety. This could, for example, involve sourcing special PPE from manufacturers to suit total user weights exceeding 100 kg.

7.6 Training and Competence of Personnel

To work safely at height, it is essential that staff are adequately trained and deemed competent both in the use of all work equipment and in the work tasks. This may require continued supervision by management to assess staff competence levels.

It is essential that staff be trained by competent persons. These may be persons that are specially authorised by the work equipment manufacturer.

7.7 Inspection of Workplace and Conditions

Inspections should be made of the workplace environment and prevailing conditions to determine whether working at height is safe. This includes an assessment of general hazards such as weather conditions, ground conditions, strength and stability of the workplace, fall obstructions, slip and trip hazards and contaminants such as water, chemicals or oil.

7.8 Inspection of Work Equipment before Use

All work equipment, including but not limited to, ladders, scaffolding, MEWPs, guardrails, collective fall protection systems and PPE should be inspected by a competent person before use.

In general, this should be done in accordance with the manufacturer's instructions.

7.9 Management System

A management system should be established to organise, plan and control all work at heights. The management system should assess risks, establish work procedures and retain records and documentation.

7.9.1 Work procedures

Work procedures should be established to ensure effective management and control of safe working at heights. Typical procedures include:

- Procedures for identifying hazards and assessing risks
- Procedures for selection, procurement and installation of work equipment
- Procedures for identification and control of work equipment
- Procedures for selection of competent training providers
- Procedures for inspection, periodic examination, maintenance and care of work equipment (including PPE)
- Procedures for training, competence and supervision of staff

Work procedures should also be established for operational staff to ensure safe methods of work are adhered to. These procedures should cover, but not be limited to, the following:

- Procedures for inspection of workplace and conditions
- Procedures for inspection of work equipment (including PPE)
- Procedures for use and care of work equipment (including PPE)
- Procedures for performing specific working at height duties
- Procedures for emergency rescue/evacuation (including lone working)

7.9.2 Record keeping

Records and documentation should be maintained and retained covering, but not limited to, the following:

- Risk assessments
- Work procedures
- Work equipment purchase documents
- Work equipment manufacturer's user and installation instructions
- Work equipment inspection and periodic thorough examination records
- Workplace inspection records
- Work equipment maintenance records
- Staff training and competence records

7.10 Personal Protective Equipment (PPE)

7.10.1 Selection and procurement of PPE

All PPE used for fall protection must be CE marked under the PPE Directive 89/686/EC to the applicable EN standard(s) or, where none exists, to a specification authorised by the notified body.

All PPE should be supported by an EC declaration of conformity which is prepared by the manufacturer or his authorised representative established in the community, certifying that the PPE covered by it is in conformity with the PPE Directive 89/686/EEC requirements. The declaration will include the model, serial number, manufacturer details, standards used during the conformity process and details of the notified body who issued the CE approval certificate.

It is important that the buyer ensures that the CE mark(s) and any other product claims made in writing by the manufacturer satisfy the intended use of the PPE. It is essential for safety reasons that the product is not used outside the manufacturer's instructions.

All PPE (including second-hand PPE) should be accompanied by user/installation instructions in the official language of the country of destination. The user instructions should be used to aid the preparation of work procedures.

Appendix 2 contains the background and legal requirements for fall protection PPE, and a guide to the selection and procurement of PPE. In addition, a recently published British Standard code of practice BS 8437:2005 also exists to cover the selection, use and maintenance of personal protective equipment for use in the workplace.

7.10.2 Work restraint PPE

Under no circumstances should restraint equipment be used in a fall arrest situation where there is a danger of free fall occurring.

Workers should be trained in the use of restraint equipment and techniques.

Anchor points used for work restraint applications must be strong enough to withstand the required load and an acceptable margin of safety.

A work restraint PPE system should comprise:

- **A suitable body support element** – either a waist belt (EN358), full body harness (EN361) or sit harness (EN813). Some full body harnesses combine all functions in one multi-purpose unit.
- **A suitable lanyard** – either fixed or adjustable conforming to EN358, EN354¹⁷ or EN355.
- **A suitable connector conforming to EN362** – which is compatible with the structural anchor point.
- **A suitable structural anchor point** – should the structural anchor point be deemed unsuitable for direct fixing of the connector, it may be necessary to install a PPE anchor device conforming to EN795 as an interface between the structure and connector. Typical anchor devices include eyebolts, anchor slings and clamps.

7.10.3 Work positioning PPE

Under no circumstances should work positioning equipment be used for fall arrest in a situation where there is a danger of free fall occurring.

Work positioning systems must be used in conjunction with a suitable fall arrest back-up system.

It is essential that workers are adequately trained and competent to ensure safe use of the intended work positioning and fall arrest equipment.

Anchor points used for work positioning applications must be strong enough to withstand the required loads and an acceptable margin of safety.

A work positioning PPE system should comprise:

- **A suitable body support element** – either a waist belt (EN358), full body harness (EN361) or sit harness (EN813). In situations requiring suspension of the user a suitable sit harness to EN813 should be used to permit adequate positioning and posture.
- **A suitable lanyard** – either fixed or adjustable conforming to EN358, EN354 or EN355 should be used.
- **A suitable connector conforming to EN362** - which is compatible with the structural anchor point.
- **A suitable structural anchor point** – should the structural anchor point be deemed unsuitable for direct fixing of the connector, it may be necessary to install a PPE anchor device conforming to EN795 as an interface between the structure and connector.

It should be noted that for certain types of rope access and positioning techniques, other types of equipment may be necessary in addition to that specified above, including specific types of mountaineering rope, ascenders, descenders, and support aids e.g. bosun's seat.

7.10.4 Fall arrest PPE

It is essential that workers are adequately trained and competent to ensure safe use of the intended fall arrest equipment.

Anchor points used for fall arrest applications must be strong enough to withstand the required static and dynamic loads resulting from a fall. The PPE manufacturer should advise the strength requirements for the anchor point to accommodate the specific PPE.

A fall arrest PPE system must comprise:

- **A suitable body support element** – only a full body harness conforming to EN361 is acceptable for use in fall arrest applications. It is essential that workers are aware of the correct harness attachment points to be used with the specific PPE system, especially in instances where full body harnesses incorporate other attachment points for other purposes, such as work positioning points to EN358 and sit positioning points to EN813. It is crucial that these attachment points are not used for fall arrest. The full body harness must be of the correct adjustment and fit and used with the shoulder straps secured in position.
- **A suitable fall arrest lanyard incorporating an energy absorber** – this could be an energy absorber with integral lanyard conforming to EN355 or, where supplied separately, a fall arrest lanyard conforming to EN354 fitted with a compatible energy absorber conforming to EN355. In these configurations the fall arrest lanyard including energy absorber part, lanyard part and end connectors, must not exceed 2 metres. Other acceptable types of fall arrest lanyard include retractable type fall arrest lanyards conforming to EN360, or special energy absorbers supplied with EN353-1 or EN353-2 fall arrest systems.

- **Suitable connectors conforming to EN362** – to enable attachment of lanyards to harnesses and anchor points (PPE lanyards are often supplied fitted with an option of end connectors).
- **A suitable structural anchor point** – should the structural anchor point be deemed unsuitable to enable direct fixing of the connector, it may be necessary to install a PPE anchor device conforming to EN795 as an interface between the structure and lanyard.

7.10.5 Selection and control of PPE structural anchor points

It is essential that structural anchor points are validated as fit for purpose for the specific PPE and work requirements. This means validation that they are strong and stable enough to support the static and dynamic loads encountered under normal use and where applicable, during falls, and that they are compatible with the PPE attached to them. The PPE manufacturer's user instructions should detail the strength and requirements of the structural anchorage relating to specific PPE.

Anchor points should be stationary and non-yielding in order to allow predictable fall conditions for the PPE attached to it.

Every effort should be made to ensure, where possible, that the structural anchor point is located above the attachment point of the user harness, in order to minimise the severity of falls, i.e. fall distances and subsequent fall arrest forces.

When selecting anchor points for fall arrest applications it is vital to ensure the free space below the anchor point is sufficient to prevent the user hitting the ground or colliding with other obstacles in the fall path. The available space below the anchor point may determine the type of PPE selected. The space required below the worker is based on a combination of factors including user weight, height, free fall distance, extension, deformation and deployment of PPE, and harness stretch. The PPE manufacturer should be able to provide guidance on the free space required below the worker to accommodate the specific PPE.

When selecting suitable structural anchor points, consideration should be given to potential hazards that may endanger the worker or work equipment during normal use or under fall conditions. Comments on some typical hazards are given below:

- Anchor points and surrounding structure should be free of burrs, abrasive surfaces and sharp edges to prevent wear and lacerations of PPE textiles
- The fall path should be clear of any obstructions
- The area should be checked for electrical cables
- The danger of pendulum falls should be considered

It is essential that PPE be attached in a correct manner to the anchorage point, as instructed in the manufacturer's PPE user instructions. For example, if a PPE lanyard or anchor strap is choked around a structure, it is important that the manufacturer has approved the PPE for this method of attachment.

Anchor points should be identified and controlled; this includes inspection by workers before use, in addition to regular periodic inspections by a competent person. This is

paramount in ensuring that the integrity of anchor points and safety of PPE, especially in an outdoor environment where structures are more prone to corrosion and may be subject to environmental hazards.

7.10.6 Installation of PPE

It is important that where PPE systems require specialist installation, the installer is authorised by the PPE manufacturer and that the installation is carried out in compliance with the PPE manufacturer's instructions.

Where specialised installation is not deemed necessary for PPE, it is essential that persons responsible for installing it are competent and adhere to the manufacturer's instructions; this includes anchoring of lanyards, lifelines and connectors.

Horizontal fall arrest systems should only be installed within the geometric limits specified by the manufacturer, as instructed in the PPE installation and user instructions and as agreed by the notified body in the CE Approval Certificate. This is normally horizontal or near to horizontal.

Vertical fall arrest systems should only be installed within the geometric limits specified by the manufacturer, as instructed in the PPE installation and user instructions and as agreed by the notified body in the CE Approval Certificate. This is normally vertical or near to vertical.

Retractable type fall arresters should be installed in a manner that allows the devices to be used within the manufacturer's scope. In particular, the device should be used within the angles specified, with the cable free from contact with other surfaces, which may damage or cut the cable or slow down the operation of the device.

Harnesses should be donned and detached as instructed by the manufacturer within the user instructions, and should be a secure and comfortable fit, with proper adjustment to enable the correct positioning of the harness attachment points relative to the user. This will enable a safe mode of arrest with the correct fall posture, distributed loads and security.

7.10.7 Compatibility of PPE

It is essential that components of a PPE system are not interchanged and mixed with other PPE components, unless authorised by the PPE manufacturer. Mixing and altering PPE can have serious effects with potentially disastrous consequences, where the functioning of the one system can be hindered by the action of another.

The following should be avoided at all times:

- Connecting in series EN355 energy absorber lanyards to EN360 retractable type fall arresters or other system energy absorbers
- Using two EN355 single leg fall arrest lanyards in parallel, instead of a twin leg fall arrest lanyard
- Adding connectors and additional lanyards to fall arrest energy absorber lanyards, thus exceeding the maximum intended length
- Substituting the lanyards of EN353-1 and EN353-2 fall arrest systems

- Connecting EN360 retractable type fall arresters to flexible EN795 class C horizontal lines
- Connecting EN360 retractable type fall arresters to EN795 class E deadweight anchors
- Using the wrong types of connectors on lanyard terminations
- Changing the rope and wire specifications on sliding chuck type fall arrest systems i.e. EN358 rope grabs, EN353 fall arrest systems and EN795 class C horizontal systems
- Using a different type of harness and attachment point from that specified by the manufacturer
- Substituting the PPE system fixings, clamps and anchors

7.10.8 PPE Training, awareness and competence

Fall protection PPE must only be used by trained and competent personnel and in conjunction with an effective rescue plan in the event that a fall should occur.

Training should be provided by competent persons, who fully understand the equipment and work techniques involved. A large number of training providers now exist within the UK, including a number of PPE manufacturers. However, it is unfortunate that no mandatory certification scheme currently exists within the UK to control the competence of training providers within this highly specialised area.

A number of training courses and certification schemes exist to cater for a range of work at height applications. These range from general work at height and rescue to specialised fields, including rope access, where workers are suspended on rope lines. It is important that the courses selected are relevant to the actual work activities and equipment involved when working at height. For example, an industrial rope access course may not be relevant to general work at height using fall arrest equipment. Information relating to work at height training is provided in Appendix 4.

It is essential that the manufacturer's PPE user instructions are read, understood and retained, since these provide vital information relating to the intended use of the PPE and its limitations, relevant warnings, inspection procedures, storage requirements and cleaning. The PPE user instructions should be used as an aid in the preparation of work procedures regarding inspection, training and maintenance.

In order to assess the competence of staff working at height, workers should be under continued supervision with training and competence levels recorded.

7.10.9 Inspection, care and maintenance of PPE

It is important that PPE is properly cared for and maintained to ensure its continued safety and reliability. Relevant issues include record keeping, general use, inspection, periodic examination, servicing, repair, cleaning and storage.

An HSE guidance leaflet INDG367 exists to specifically address the inspection of fall arrest PPE made from webbing or rope.

7.10.9.1 Record keeping for PPE

Records should be kept and maintained for all PPE components including systems and subsystems. The records should include the following information:

- PPE type and model
- Means of identification i.e. batch or serial number
- Manufacturer/supplier details
- Date of purchase
- Date of manufacture
- Expiry date
- Date first put into use
- Maintenance requirements (i.e. inspection, examination, servicing, storage)
- Maintenance records covering inspections, examinations, servicing and repairs. The records should include dates, name and signature of the competent person who carried out the maintenance.

7.10.9.2 General use of PPE

It is essential that PPE be properly looked after during general use to prevent damage and wear which may hinder the safe operation or reduce the strength of the equipment.

Special care should be taken to avoid poor storage, dragging and scuffing of equipment, and using equipment in contact with sharp edges, abrasive surfaces, oil, water and other contaminants and chemicals. Special care should also be exercised to protect PPE from direct sunlight, temperature effects, knotting, abrasive surfaces, cutting, contaminants, chemical reagents and climatic conditions.

Special care should be taken when using fall arrest devices, particularly retractable types or those which operate with fall arresters sliding on a wire, rope or rail, to avoid soiling from oil, which can act as a lubricant and greatly affect the ability of the fall arrester to stop.

It is imperative that users are aware of the potential hazards and risks associated with the specific PPE to avoid actions of neglect and abuse.

7.10.9.3 Pre-use inspection of PPE

PPE should be inspected and checked by a competent person prior to each occasion of use. The manufacturer's user instructions should provide guidance on pre-inspection and equipment checks.

PPE should be withdrawn from use if damage is evident or if there is any doubt about the integrity and safety of the equipment.

Pre-use inspections, although often not as thorough as periodic examinations, can highlight a number of concerns which may affect the safety of the PPE. Typical checks and observations include but are not limited to the following:

- Checks for the expiry dates of PPE
- Checks for abrasion, wear and cuts
- Checks for cracks and deformation of parts
- Checks for damaged stitching
- Checks for loose fixings
- Checks for signs of falls (i.e. parted/deployed equipment, fall indicators)
- Checks for contaminants (i.e. oil, water, dirt, paint)
- Checks for discolouring
- Checks for heat damage
- Checks for corrosion
- Checks for knots
- Checks for ill fitting parts (ensure that connectors and buckles close and lock properly)

7.10.9.4 Periodic inspection/examination of PPE

It is important that all PPE used for fall protection is subjected to regular periodic inspection/examination by a competent person in accordance with the manufacturer's requirements as stated in the PPE user instructions. This is normally required at least once every 12 months. However, dependent on the equipment, frequency of use, and conditions, inspection/examination may be required on a more frequent basis.

For certain types of PPE, inspection/examination may only be permitted by the manufacturer or by a competent person authorised by the manufacturer.

A record should be kept of all periodic inspections/examinations.

7.10.9.5 Servicing and repair of PPE

Servicing and repair of fall protection PPE must only be carried out by the manufacturer or by a competent person authorised by the manufacturer.

A record should be kept of all servicing and repairs.

7.10.9.6 Cleaning of equipment

Care should be taken when cleaning PPE because certain chemicals and cleaning detergents can harm and degrade the equipment. It is essential that PPE is cleaned only as advised by the manufacturer within the PPE user instructions.

Drying of PPE should be done naturally away from direct heat.

7.10.9.7 Storage of PPE

PPE should be stored as advised by the manufacturer in the user instructions, which for textiles usually requires storage in a cool dry place, out of direct sunlight.

7.10.9.8 Disposal of PPE

It is essential that PPE is disposed of when deemed unsuitable for use and where repair is not possible or recommended by the manufacturer.

PPE should be disposed of before the expiry date or lifetime stated by the manufacturer. This is regardless of the condition of the PPE and the frequency of use, where textiles can naturally degrade and weaken without obvious signs. The maximum lifetime for textiles is usually stated as 5 years. However, this may decrease significantly depending on the conditions and frequency of use.

It is essential that PPE is withdrawn from service immediately after a fall and if deemed unserviceable disposed of in the correct manner.

7.10.9.9 Rescue plans

It is important that an effective rescue plan is in place to enable the speedy and safe recovery of falls victims in the event that a fall should occur. The rescue plan should also deal with the causes, effects and consequences of suspension trauma and take the necessary steps to prevent and minimise. The plan should address a range of issues:

- Fast response plan to emergency situation (i.e. no lone working and provisions for raising the alarm and seeking medical assistance)
- Comfortable harnesses to prevent strangulation of arteries
- Adequate rescue training of staff by a competent person to enable a safe and speedy rescue
- Leg loops and aids to enable the workers legs to be brought to an upright position to aid the flow of blood
- Encouragement of worker movement to aid circulation, where workers should be trained to pump the leg muscles frequently to reduce the risk of venous pooling.
- Continuous monitoring for symptoms of suspension trauma
- Awareness of first aid and medical requirements post trauma, which may include resuscitation and hospitalisation.

Guidance in suspension trauma is recommended in HSE Research Report No. 451/2002¹⁸ Harness Suspension.

ACKNOWLEDGEMENTS

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- 2 NEL report 2006/197
- 3 NEL report 2006/198
- 4 NEL report 2006/199
- 5 NEL report 2006/200
- 6 Work at Height Regulations 2005 (WAHR)
- 7 PPE Directive 89/686/EEC
- 8 European Test Standard EN361:2002- Personal protective equipment against falls from a height - Full body harnesses
- 9 European Test Standard EN358:2000 – Personal protective equipment for work positioning and prevention of falls from height – Belts for work positioning and restraint and work positioning lanyards
- 10 European Test Standard EN813:1997 – Personal protective equipment for prevention of falls from a height - Sit harnesses
- 11 European Test Standard EN355: 2002 - Personal protective equipment against falls from a height – Energy absorbers
- 12 European Test Standard EN360:2002 – Personal protective equipment against falls from a height – Retractable type fall arresters
- 13 European Test Standard EN795: 1997 - Personal protective equipment against falls from a height - Anchor devices
- 14 European Test Standard EN353-1:2002 – Personal protective equipment against falls from a height - Guided type fall arresters including a rigid anchor line
- 15 European Test Standard EN353-2:2002 - Personal protective equipment against falls from a height - Guided type fall arresters including a flexible anchor line
- 16 European Test Standard EN362:1993 - Personal protective equipment against falls from a height - Connectors
- 17 European Test Standard EN354:2002 – Personal protective equipment against falls from a height - lanyards
- 18 HSE Research Report 451/2002 – Suspension Trauma
- 19 British Standard BS 8437:2005 – Code of practice for selection, use and maintenance of personal fall protection systems and equipment for use in the workplace
- 20 INDG367 (reprinted 08/06) – Inspecting fall arrest equipment made from webbing or rope

LIST OF FIGURES

- 1 No protection at height
- 2 No protection at height
- 3 No protection during access and egress
- 4 No protection during access and egress
- 5 No protection during access and egress
- 6 No fall arrest backup during work positioning
- 7 No fall arrest backup during work positioning
- 8 Self-made knotted fall arrest lanyards
- 9 Self-made knotted fall arrest lanyards
- 10 Self-made knotted fall arrest lanyards
- 11 Self-made fall arrest lanyard
- 12 Self-made horizontal lifeline, inset knotted end anchor
- 13 Waist belt/sit harness used for fall arrest
- 14 Typical work positioning lanyard
- 15 Mountaineering sports lanyard used for fall arrest
- 16 Single-leg fall arrest lanyard
- 17 Using twin-leg fall arrest lanyard
- 18 Squeeze type scaffold hook
- 19 Twistlock scaffold hook
- 20 Screwgate karabiner
- 21 Fall arrest lanyard attached to wrong harness points
- 22 PPE lanyards choked around harness attachment point
- 23 PPE lanyards choked around harness attachment point
- 24 Energy absorber pack missing from lanyard, inset: warning on lanyard to include absorber
- 25 Harness straps hanging down
- 26 Low positioned harness dee ring

- 27 Additional lanyard added to fall arrest lanyard
- 28 Additional lanyard added to fall arrest lanyard
- 29 Additional connector added to fall arrest lanyard
- 30 Lanyard choked around structure
- 31 Lanyard choked around structure
- 32 Fall arrest lanyard – bypassed energy absorber
- 33 Fall arrest lanyard attached to the end of a retractable type fall arrester – lanyard paths highlighted for clarity
- 34 Retractable fall arrester cable weaving in and out of framework – cable path highlighted for clarity.
- 35 Retractable fall arrester cable – potential pendulum swings
- 36 Knotted lifeline
- 37 Horizontal lifeline in poor condition
- 38 PPE anchored to vertical rope lines suspended from roof
- 39 PPE anchored to vertical rope line via knotted eyelet
- 40 Trailing lanyards over beam edges
- 41 PPE in contact with other edges
- 42 Fall arrest PPE at low levels
- 43 Fall arrest lanyard anchored at foot level
- 44 Fall arrest lanyard anchored at foot level
- 45 Vertical rope line in contact with MEWP
- 46 Unprotected fragile roofs
- 47 Free standing scaffold tower – improper base plate loading and ill fitting packers
- 48 Mobile scaffold towers
- 49 General view of mobile stage

APPENDIX 1

EXAMPLES OF GOOD PRACTISE OBSERVED DURING THE SURVEY

AVOIDING WORK AT HEIGHT



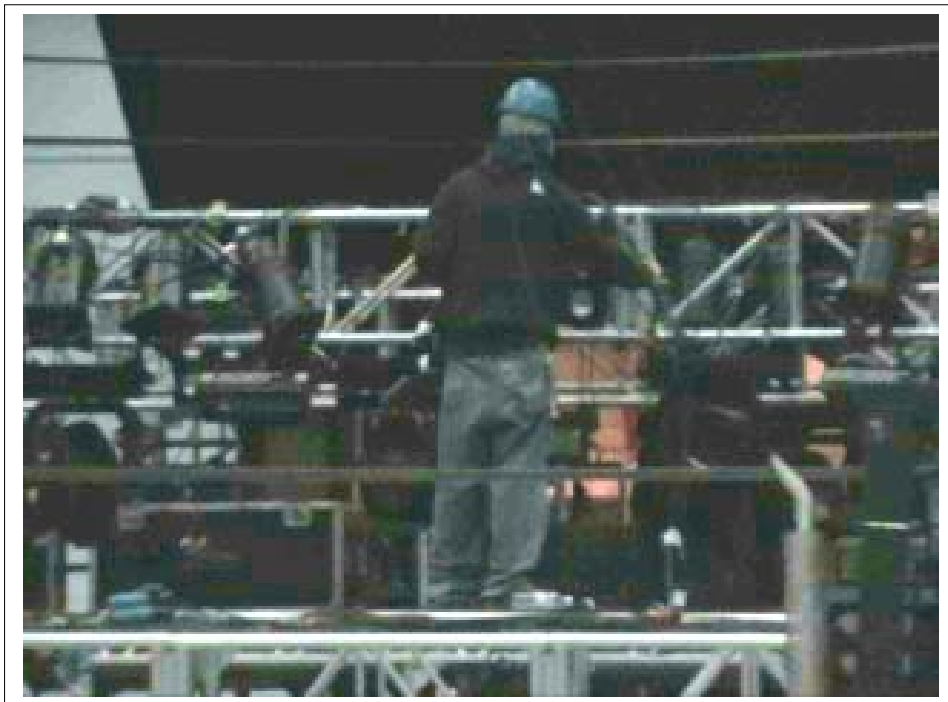
BUILDING ROOF STRUCTURE AT STAGE LEVEL



**ROOF STRUCTURE ELEVATED INTO POSITION VIA
ELECTRIC HOISTS FITTED TO LEGS**



MARQUEE FRAME ASSEMBLED AT GROUND LEVEL



**FITTING AUXILLIARY EQUIPMENT TO OVERHEAD TRUSSES
AT STAGE LEVEL**



**FITTING AUXILLIARY EQUIPMENT TO ROOF STRUCTURE
AT GROUND LEVEL**



**HAULING TARPAULIN COVERS INTO POSITION
FROM GROUND LEVEL**

PPE ATTACHED TO THE CORRECT HARNESS POINTS



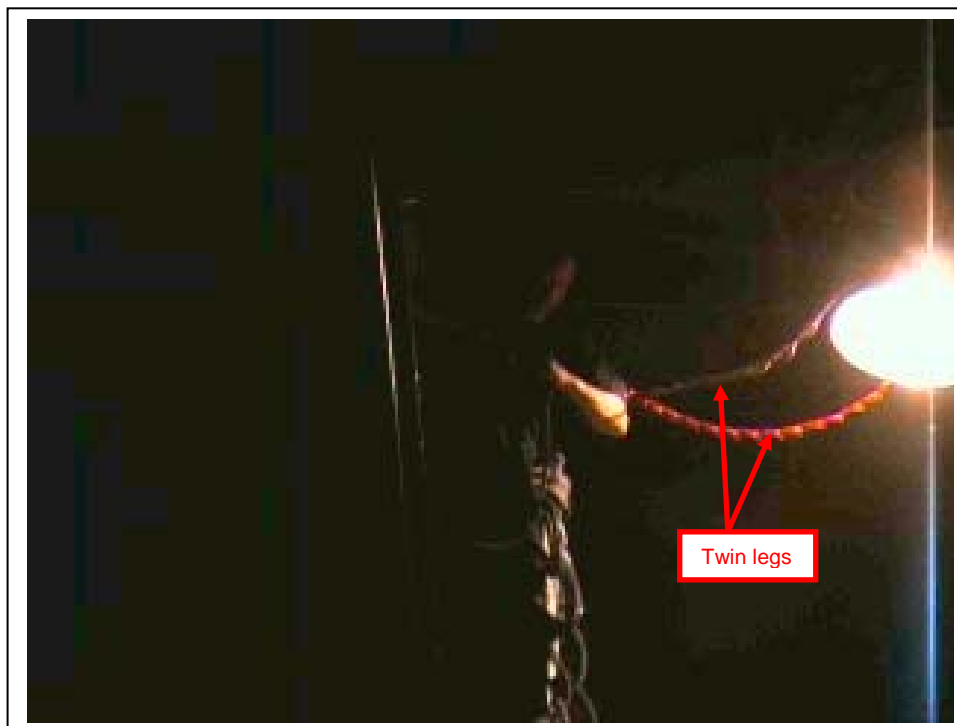
WORK POSITIONING AND FALL ARREST LANYARDS ATTACHED TO CORRECT HARNESS ATTACHMENT POINTS



RETRACTABLE TYPE FALL ARRESTER ATTACHED TO CORRECT HARNESS FALL ARREST ATTACHMENT POINT

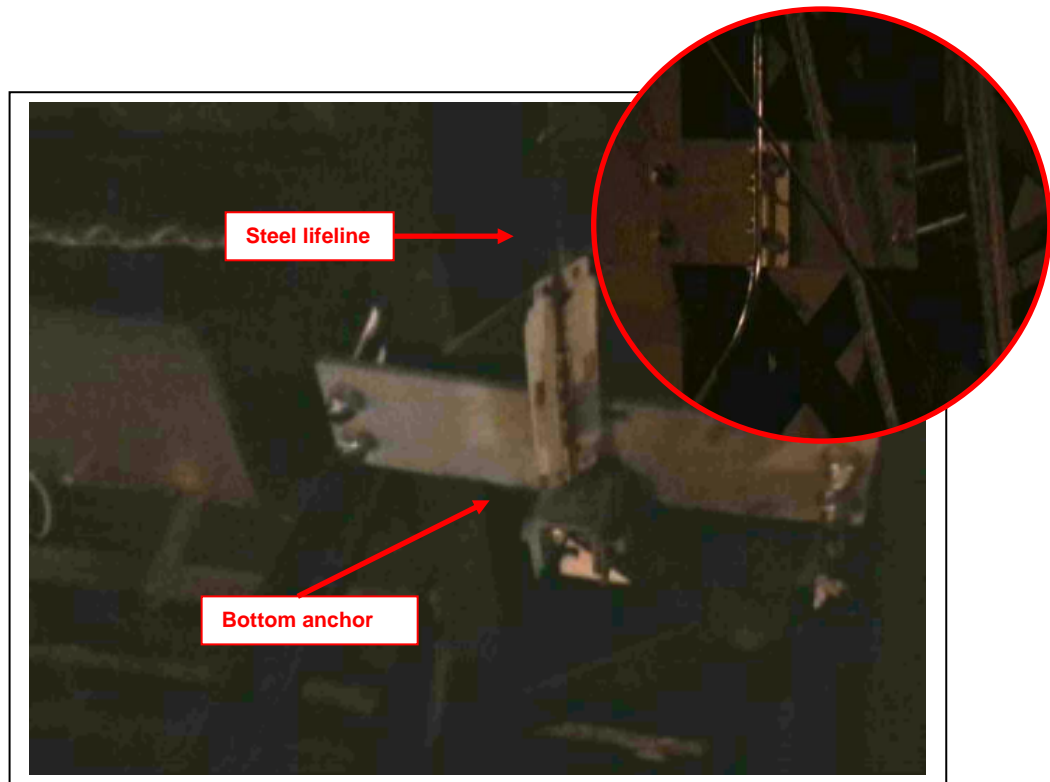


**TRANSFERRING BETWEEN POSITIONS USING
TWIN LEG FALL ARREST LANYARD**

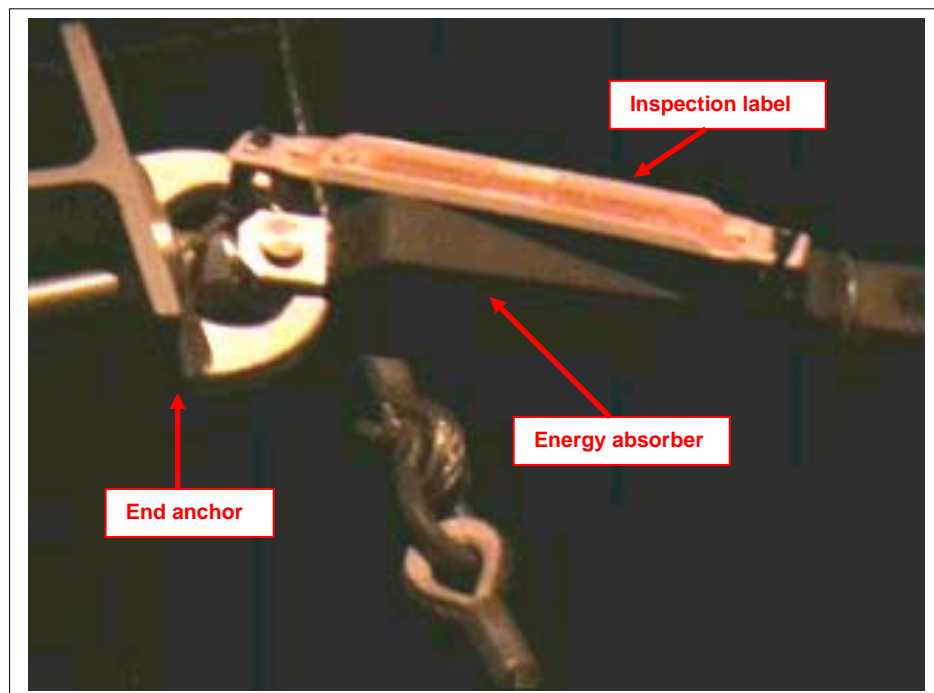


USING TWIN LEG FALL ARREST LANYARD

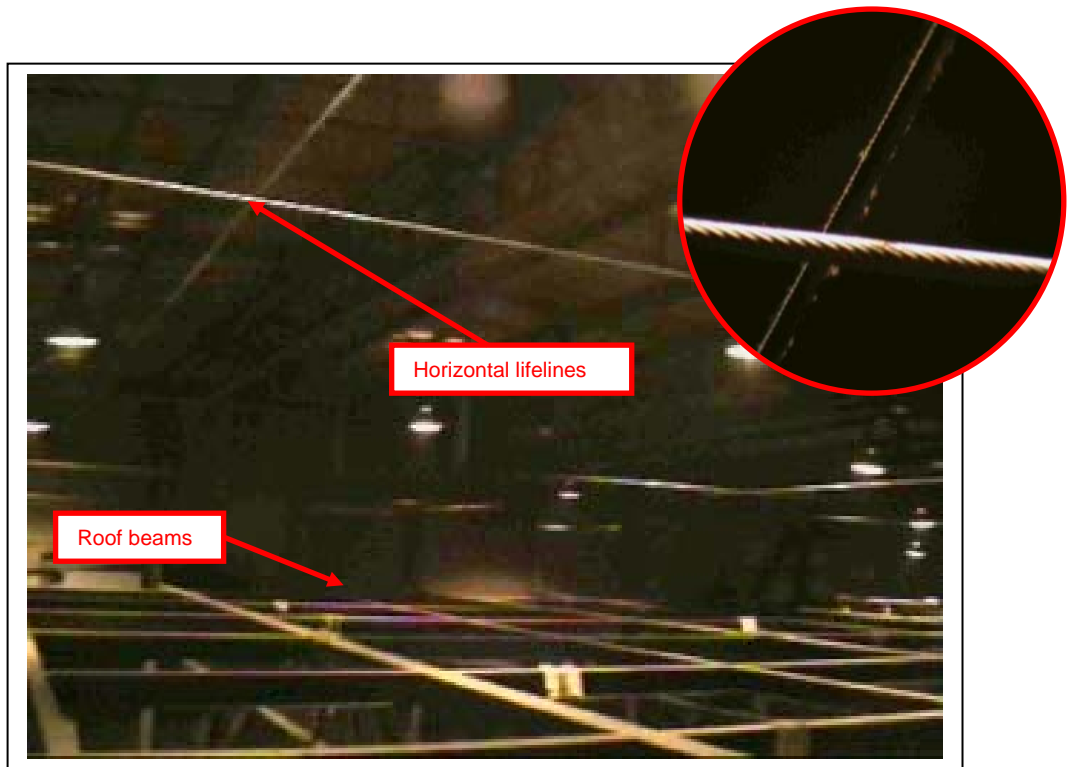
USE OF APPROVED VERTICAL AND HORIZONTAL LIFELINES



VERTICAL LIFELINE FITTED TO UPRIGHT FRAMEWORK

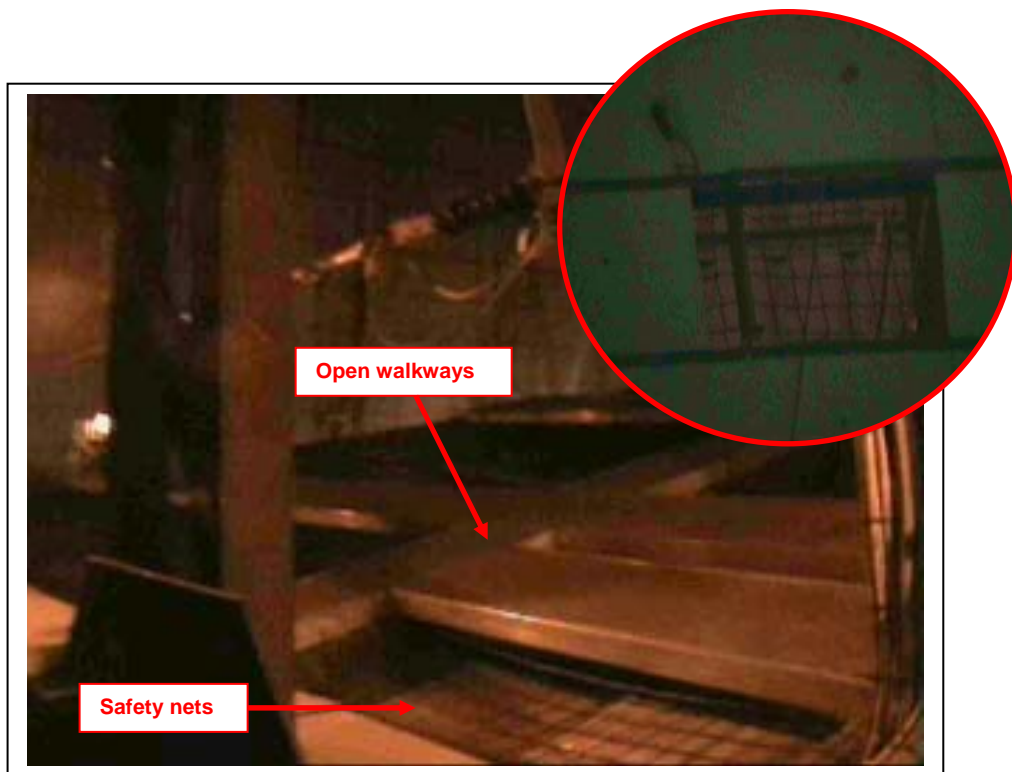


HORIZONTAL LIFELINE



MATRIX OF HORIZONTAL LIFELINES ABOVE ROOF BEAMS

USE OF COLLECTIVE FALL PROTECTION

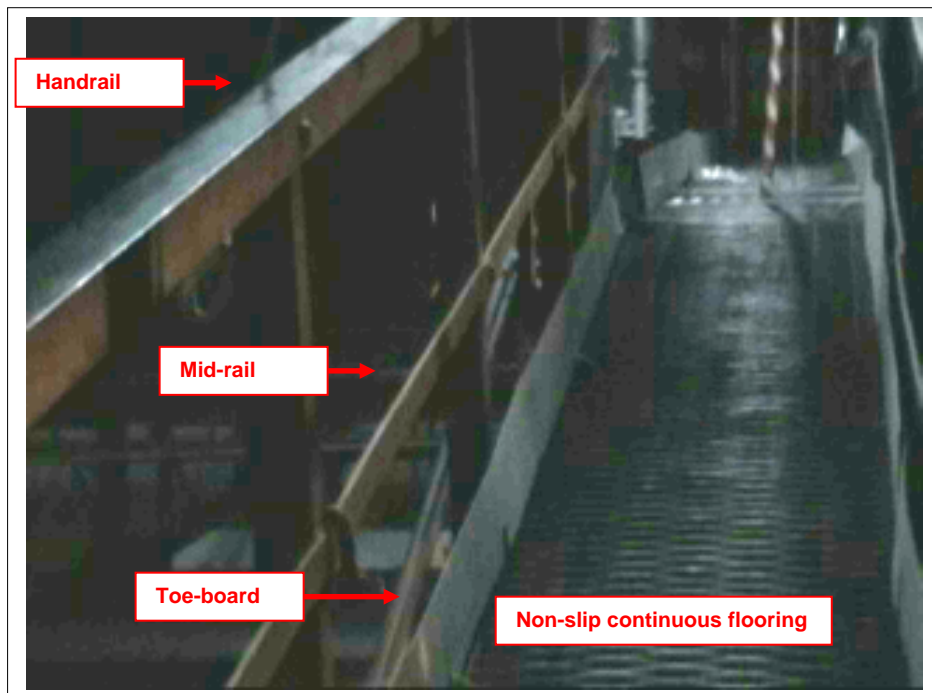


SAFETY NETS FITTED BELOW OPEN WALKWAYS

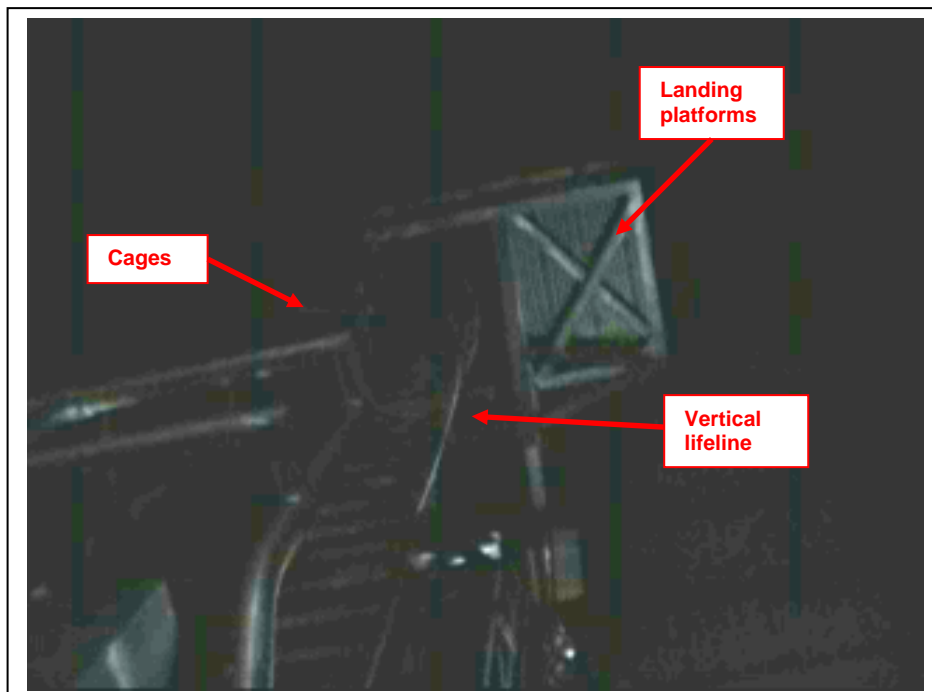


SAFETY NETS ENCLOSING SIDE OF WALKWAYS

ADEQUATE WALKWAYS AND LADDERS



**WALKWAY FITTED WITH ADEQUATE ENCLOSURES AND
NON-SLIP FLOORING**



**PERMANENT LADDER FITTED WITH VERTICAL FALL
ARREST SYSTEM**

FULLY ENCLOSED MOBILE WORK TOWERS



**MOBILE TOWER FITTED WITH ADEQUATE ENCLOSURES,
LADDERS AND STABILIZERS**

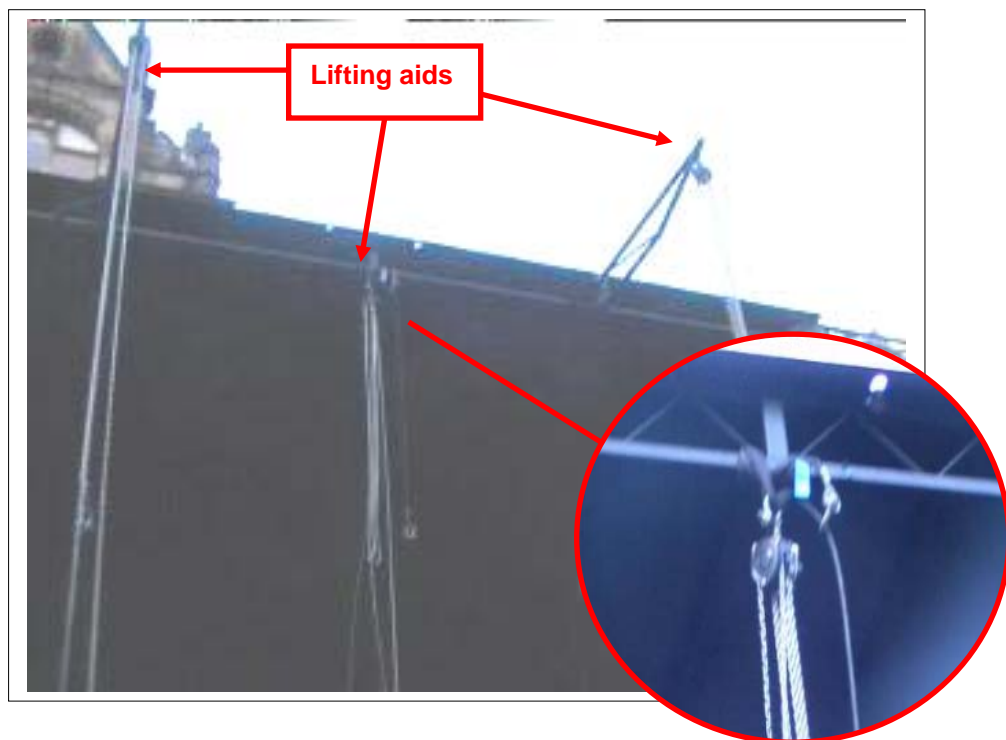


**MOBILE TOWER FITTED WITH ADEQUATE ENCLOSURES,
LADDERS AND STABILIZERS**

WORKING AT HEIGHT - WORK AIDS



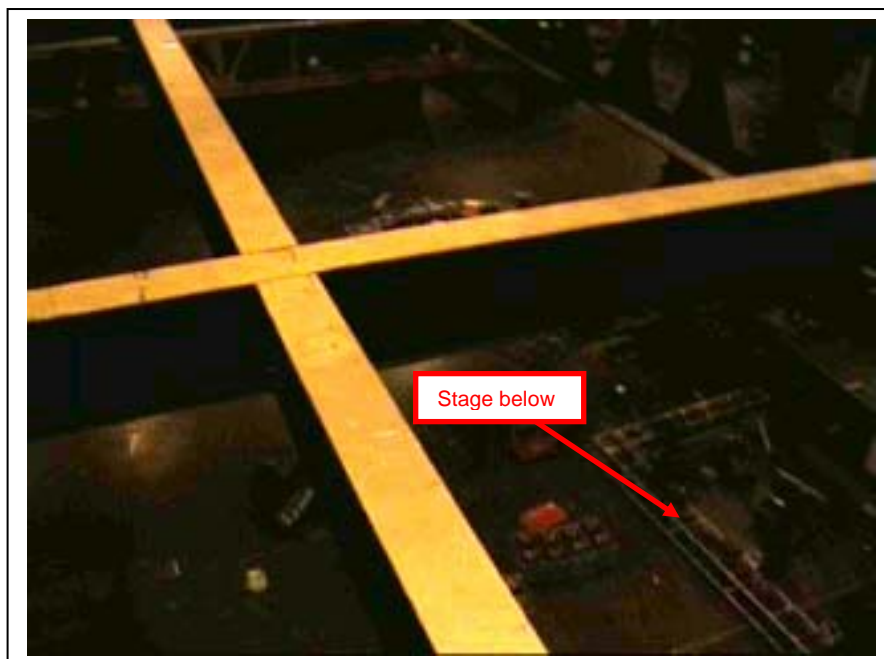
SUSPENDED FROM WORK POSITIONING PPE



**LIFTING AIDS REMOVE THE NEED TO CLIMB
WHILE CARRYING EQUIPMENT**

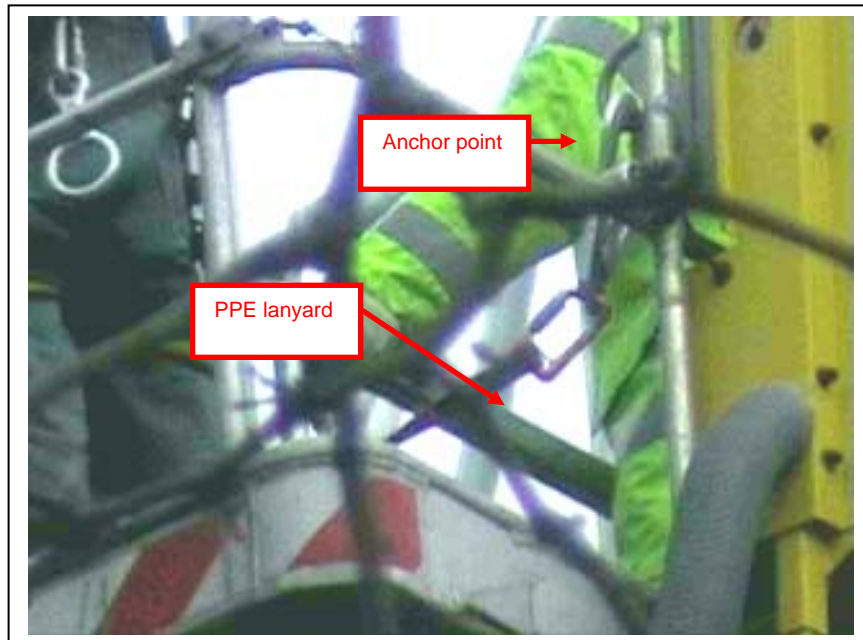


TOOL BAGS



YELLOW PAINTED ROOF BEAMS TO ENHANCE FOOTING

FALL PROTECTION IN MEWPS



**FALL PROTECTION LANYARD ANCHORED TO MEWP
PPE ATTACHMENT POINT**



**FALL PROTECTION LANYARD ANCHORED TO MEWP
PPE ATTACHMENT POINT**

SECURED LADDERS



HEELED LADDERS



HEELED LADDERS



**LADDER SECURED IN POSITION BY WEBBING
RATCHET STRAP**

APPENDIX 2

GUIDANCE ON THE PROCUREMENT AND SELECTION OF PPE

GUIDANCE ON THE PROCUREMENT AND SELECTION OF PPE

1 PPE BACKGROUND

Personal Protective Equipment (PPE) used for protection from falls comes under Category III Equipment of the European PPE Directive 89/686/EEC. This means that all fall protection PPE used within the European Community, must be CE marked and conform to the following requirements:

- 1) As a minimum, be tested to the appropriate harmonised EN (European) test standard or to another standard or test specification agreed by the notified body.
(Output: notified body issues EC type test certificate)
- 2) Undergo CE approval by a notified body to Article 10 of the European PPE Directive 89/686/EEC.
(Output: notified body issues CE approval certificate)
- 3) Be part of a notified body's Article 11 quality control system to ensure ongoing surveillance and conformity of the PPE.
(Output: notified body issues annual Article 11 certificate).

Following compliance with the above, the manufacturer is legally permitted to affix the CE mark to the PPE. For Category III PPE, the CE mark must include the 4-digit identification number of the notified body which is responsible for the product's Article 11 quality control phase, as detailed in (3) above (e.g. CE 0320).

Note: A notified body is a body appointed by DTI to undertake specific duties of the PPE Directive 89/686/EEC.

2 PROCUREMENT OF PPE

It is the responsibility of the buyer to ensure that the PPE conforms to UK legislation as described above, has the appropriate CE markings and satisfies the intended use. CE markings alone will not determine the suitability of the product for specific applications, where additional tests and conformity to other standards may be necessary, over and above the minimum CE approval requirements.

PPE supplied as new must be obtained with a Declaration/Certificate of Conformity in the official language of the country of destination. The certificate includes identification of the PPE, EN conformity standards/details, details of manufacturer, associated CE approval certificate number (as issued by the notified body) and details of the notified body which awarded the CE approval certificate.

It is essential that the PPE is supplied by a competent manufacturer, supplier or distributor, who has the required technical knowledge of the product, and who is able to provide advice and ongoing support. This includes product scope, performances, limitations, training and maintenance requirements.

PPE must be supplied with clear and unambiguous instructions to ensure the safe installation and use of the product. The following sections list information which should be available from the PPE supplier or included in the PPE user/installation instructions:

Instructions for use

- Written in the language of the country where the PPE is sold
- Name and contact details of manufacturer/authorised representative
- Statements describing the PPE, its intended purpose, applications and limitations
- Instructions for use, including, where necessary, pictograms.
- Warnings that the equipment should only be used by trained personnel
- Warnings about medical conditions which could affect the safety of the user in normal and emergency use
- A warning that a rescue plan should be in operation
- A warning against making any alterations or additions to the PPE without the manufacturer's prior written consent, and that any repair should only be carried out in accordance with manufacturer's instructions
- A warning that the equipment must not be used outside its limitations, or for any other purpose than that which it is intended
- Advice as to whether the equipment should be a personal issue item, where this is applicable
- Sufficient information to ensure the compatibility of items and equipment when assembled into a system
- Warnings of any dangers which may arise through the use of combinations of items of equipment in which the safe function of any one item is affected by or interferes with the safe function of another
- Instructions for the user to carry out a pre-use check of the PPE, to ensure that it is in a serviceable condition and operates correctly before it is used. This may not be applicable to pre-packed or sealed rescue equipment
- A warning stating that it is essential for safety that the PPE is withdrawn from service immediately should any doubt arise about its condition for safe use or if it has been involved in a fall
- Requirements of the anchor device or structural member chosen to serve as the anchor point(s), in particular suitability, position and the minimum strength required
- Where relevant, instructions on how to connect to the anchor device or structure
- Where relevant, information on the correct harness attachment point to be used and how to connect to it
- For fall arrest PPE, a warning to emphasise that it is essential for safety that the anchor device/point should always be positioned, and work carried out in such a way, as to minimise both the potential for falls and the fall distance. Where it is essential that the anchor point is placed above the position of the user, the manufacturer shall make a statement to that effect
- Where relevant, an instruction that the full body harness is the only acceptable body holding device that can be used in a fall arrest system
- For PPE intended for fall arrest systems, a warning to emphasise that it is essential for safety to verify the free space required beneath the user at the workplace before each occasion of use, so that in a case of a fall, there will be no collision with the ground or other obstacle in the fall path
- Information on the hazards that may affect the performance of the PPE and corresponding safety precautions that have to be observed e.g. extremes of temperature, trailing/looping of lanyards, sharp edges, chemical reagents, electrical conductivity, cutting, abrasion, climatic exposure and pendulum falls
- Information on the meanings of any markings and symbols

- A statement describing the equipment model, type, identification marks and if appropriate the document and year to which it conforms
- The name, address and identification number of the notified body involved in the design stage testing under Article 10 of the PPE Directive and in the production quality control phase to Article 11 of the PPE Directive
- Statement of any known limit of the safe useable life of the product or any part of the product and advice on how to determine that the product is no longer safe for use
- A warning that if the PPE is resold it is essential that instructions for use, maintenance and periodic examination are provided in the language of destination

Instructions for Maintenance

- Maintenance instructions should be clear, legible and unambiguous and should contain appropriate detail, supplemented by diagrams if necessary to enable the PPE to be maintained correctly and safely.
- Cleaning procedures and warnings.
- A warning that when the equipment becomes wet, either in use or during cleaning that it shall be allowed to dry naturally, away from direct heat.
- Advice on storage procedures relevant to the equipment.

Instructions for periodic examinations

- Warnings to emphasise the need for periodic thorough examinations and to state that the safety of the user depends on the continued efficiency and durability of the equipment
- A recommendation on frequency of examination, taking into account legislation, equipment type, frequency of use, and environmental conditions. The recommendation will include a statement to the effect that the periodic inspection/examination frequency will be at least every 12 months
- Warning that the periodic inspections/examinations are only to be conducted by a competent person and in accordance with the manufacturer's periodic examination procedures
- Where deemed necessary by the manufacturer, e.g. due to complexity or novelty of the PPE or where safety critical knowledge is needed in dismantling, reassembly or examination, a statement instructing that periodic inspection/ examination must only be carried out by the manufacturer or an authorised body, approved by the manufacturer

Instructions for repair

- Where the manufacturer permits repair, repair instructions should be supplied in the language of country in which the item is to be serviced. Instructions that the repair should only be carried out by a competent person, who is authorised by the manufacturer, and that the repair procedure shall be strictly in accordance with the manufacturer's instructions

Records

Advice should be given that a record is kept for each item of PPE, including component, subsystem and system. The record should contain headings for and spaces to allow entry of the following details:

- Type of PPE, model name and trade name
- Name and contact details of manufacturer/supplier

- Means of identification i.e. batch or serial number
- Year of manufacture and life expiry date
- Date of purchase
- Maintenance and frequency of use
- Date first put into use
- History of periodic examination and repairs, including (1) dates and details of each periodic examination and repair, and name and signature of the competent person who carried out the periodic examination or repair and (2) next due date for periodic examination

Product Marking

Each item of PPE shall be clearly and permanently marked by the manufacturer in the official language of the country of destination, and shall include the following:

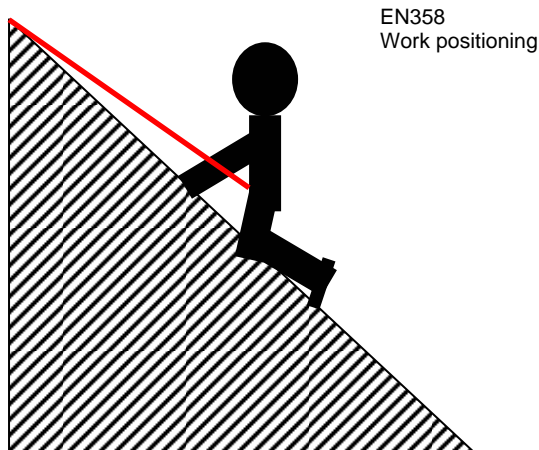
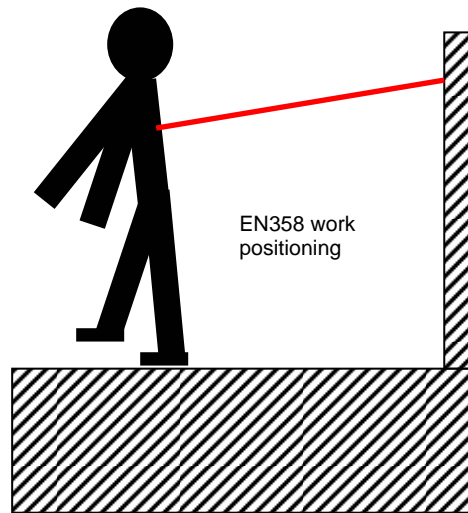
- Manufacturer's/supplier's name or trademark
Note. Where the PPE is marked with a supplier's name this shall be with the approval of the notified body
- Manufacturer's production batch or serial number or other means of traceability
- Model and type/identification
- Number and year of document (e.g. standard) to which the equipment conforms
- Pictogram or other method to indicate the necessity for users to read the instructions for use

3 SELECTION OF PPE

When selecting personal protective equipment, consideration should first be given to **Restraint PPE** to prevent falls from occurring, secondly to **Work Positioning PPE** (used in conjunction with a suitable fall arrest back-up PPE) to aid positioning and support of the worker while carrying out the work tasks. Lastly consideration should be given to **Fall Arrest PPE**, used to arrest the worker in the event that a fall should occur. These three types are illustrated in the following diagrams, followed by typical PPE examples.

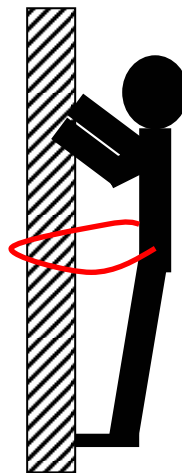
RESTRAINT PPE

PPE used to prevent workers from reaching hazardous areas e.g. open edges. A restraint system comprises body support element (**waist belt/harness**), a connecting element (**work positioning lanyard/rope**), a connector (**karabiner/hook**) and an anchorage.



WORK POSITIONING PPE

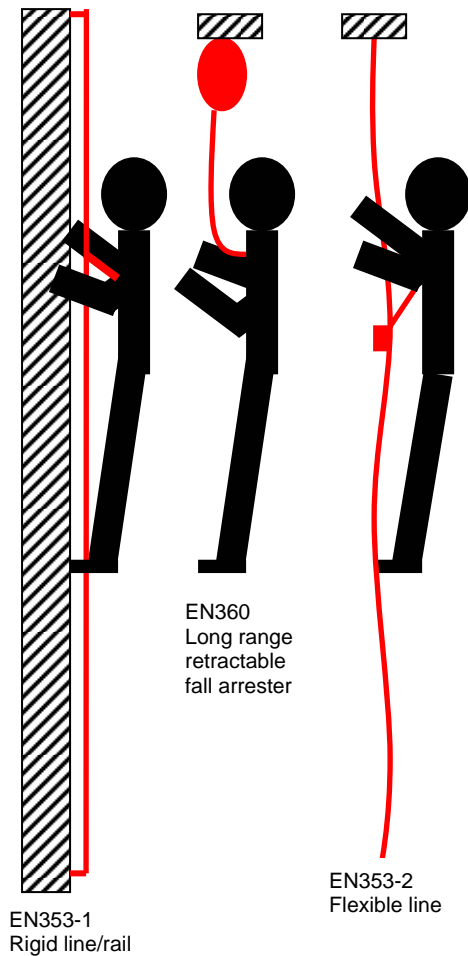
PPE used to support and suspend the worker to allow both hands to be free for work tasks. A work positioning system comprises body support element (**waist belt/harness**), a connecting element (**work positioning lanyard**), **connector** (**karabiner/hook**) and end anchorage.



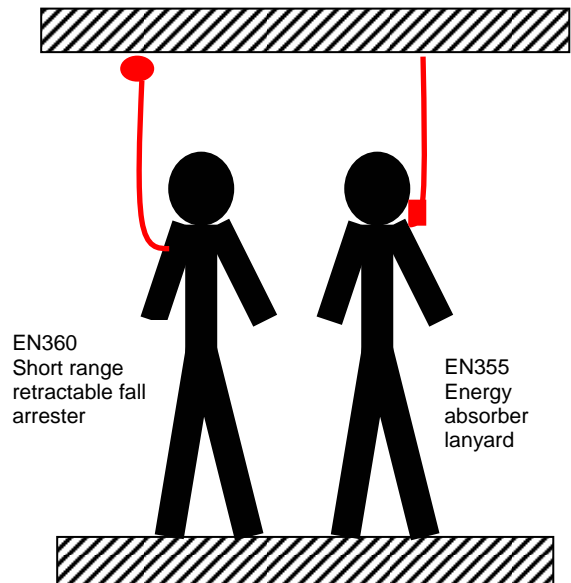
Note. Work positioning PPE must be used in conjunction with a PPE fall arrest back-up.

FALL ARREST PPE

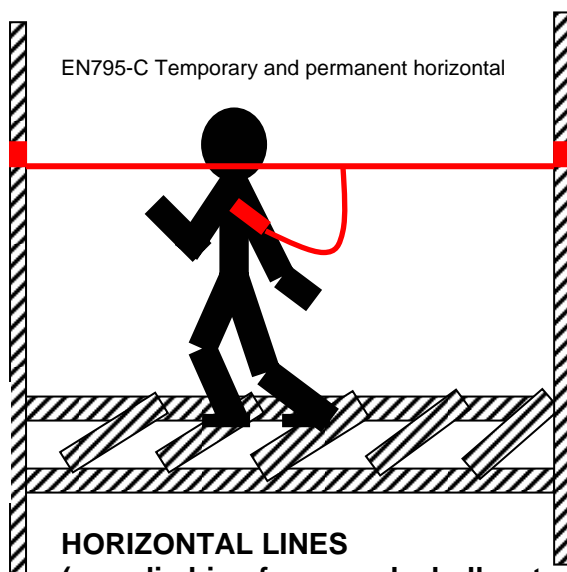
PPE used to arrest the worker in the event of a fall. A PPE fall arrest system comprises a body support element (**fall arrest full body harness**), a connecting element (**fall arrest lanyard with built in energy absorber**), a connector (**karabiner/hook**) and an anchorage (**lifeline/anchor**). A fall arrest system will normally maintain fall arrest forces within 6 kN



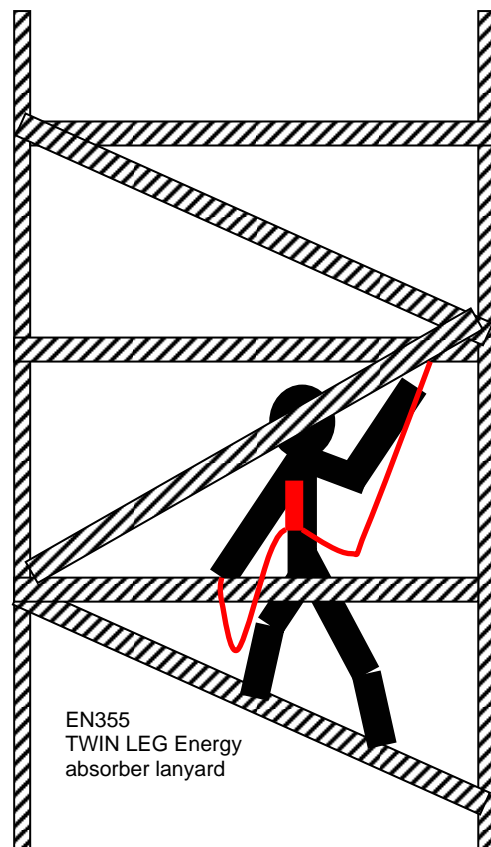
VERTICAL SYSTEMS
(e.g. ladders)



SINGLE POINT ATTACHMENT






HORIZONTAL LINES
(e.g. climbing framework , hollow tracks)









TRANSFERRING BETWEEN POSITIONS
(e.g. climbing framework)




Typical PPE examples	European Standard of Conformity
<div data-bbox="268 360 703 607" data-label="Image"> </div> <div data-bbox="328 629 628 719" data-label="Caption"> <p>Waist belt fitted with front 'D' attachment points EN358</p> </div> <div data-bbox="260 779 691 1070" data-label="Image"> </div> <div data-bbox="328 1072 628 1162" data-label="Caption"> <p>Waist belt fitted with side 'D' attachment points EN358</p> </div> <div data-bbox="276 1211 676 1361" data-label="Image"> </div> <div data-bbox="312 1406 644 1496" data-label="Caption"> <p>Adjustable work positioning/restraint lanyard EN358</p> </div> <div data-bbox="360 1498 587 1912" data-label="Image"> </div> <div data-bbox="363 1921 612 1989" data-label="Caption"> <p>Adjustable rope grab EN358</p> </div>	<div data-bbox="751 367 1262 400" data-label="Section-Header"> <h3>EN 358- Work Positioning/Restraint PPE</h3> </div> <div data-bbox="751 427 1345 490" data-label="Text"> <p>(Note. The majority of work positioning equipment can be used for restraint purposes).</p> </div> <div data-bbox="751 517 1350 763" data-label="Text"> <p>A waist belt provides body support for work positioning, supporting the worker to enable both hands to be free to carry out the work tasks. Waist belts are fitted with either two attachment points at each side for attachment around structures or one attachment point in at the front to connect direct to supporting structures. Waist belts are often integrated into full body harnesses.</p> </div> <div data-bbox="751 790 1353 916" data-label="Text"> <p>A fixed length work positioning lanyard providing a connection between the body support element and anchor point (it can be looped around structure or connected direct).</p> </div> <div data-bbox="751 943 1358 1068" data-label="Text"> <p>An adjustable work positioning lanyard provides an adjustable length connection between the body support and the anchor point (it can be looped around structures or connected direct).</p> </div> <div data-bbox="751 1095 1372 1341" data-label="Text"> <p>An adjustable rope grab lanyard provides an adjustable length connection between the body support and the anchor point. The metallic grab with attachment eye provides a constant grip on the rope and is manually adjusted to the desired operating length by the user. It is made available in any length of rope and can be looped around structures or connected direct.</p> </div> <div data-bbox="751 1368 861 1402" data-label="Section-Header"> <h3>Warning</h3> </div> <div data-bbox="751 1404 1377 1496" data-label="Text"> <p><i>Under no circumstances should work positioning PPE be used for fall arrest where the potential exists for free fall motion to occur..</i></p> </div> <div data-bbox="751 1523 1323 1588" data-label="Text"> <p><i>Work positioning PPE should always be used in conjunction with a back-up fall arrest system.</i></p> </div> <div data-bbox="751 1615 1307 1648" data-label="Text"> <p><i>Training is essential for this type of equipment.</i></p> </div> <div data-bbox="751 1675 1345 1740" data-label="Text"> <p><i>For adjustable rope grabs only the rope specified by the manufacturer should be used.</i></p> </div>




Typical PPE examples	European Standard of Conformity
 <p data-bbox="360 967 603 994">Wire System EN353-1</p>  <p data-bbox="400 1733 533 1787">Rail System EN353-1</p>	<p data-bbox="751 338 1249 371">EN 353:1 – Rigid Fall Arrest System</p> <p data-bbox="751 407 1372 741">This is a fall arrest system comprising either a rail or steel wire line, fixed rigidly to a suitable structure e.g. steel ladder. The user attaches to a fall arrester carriage, which moves freely upwards and downwards on the rail/line without requiring manual adjustment by the user, allowing both hands free for climbing. In the event of a fall, the fall arrester will lock on the rail/line and provide almost immediate arrest of the user. The systems are normally intended and CE tested for use in vertical or near to vertical applications.</p> <p data-bbox="751 757 1291 817">Ideal for providing a permanent fall protection system during climbing of vertical structures.</p> <p data-bbox="751 833 874 862">Warnings</p> <p data-bbox="751 864 1366 925"><i>Normally intended and CE tested only for vertical or near vertical use.</i></p> <p data-bbox="751 954 1370 1014"><i>Only the interface (lanyard/coupling) supplied by the manufacturer should be used.</i></p> <p data-bbox="751 1043 1310 1135"><i>No additional connectors or lanyards should be added to the system, this includes small size karabiners.</i></p> <p data-bbox="751 1164 1366 1379"><i>Only for use with a full body fall arrest harness conforming to BSEN 361 on specific attachment points as instructed by the manufacturer. Systems are not suitable for connection to waist or other attachment points which would prevent adequate body support and result in possible malfunction and failure of the system</i></p> <p data-bbox="751 1408 1334 1534"><i>EN353-1 systems, unless otherwise stated in the user instructions, must not be used for work positioning applications, where the user is suspended on the system.</i></p> <p data-bbox="751 1563 1372 1655"><i>Should be installed in proximity to the user to enable freedom of movement during climbing and to prevent pendulum falls.</i></p> <p data-bbox="751 1684 1380 1776"><i>Should only be mounted on inclined angles as permitted by the manufacturer in the installation/user instructions.</i></p> <p data-bbox="751 1805 1348 1897"><i>The structure used for the installation e.g. ladders, fixings, should be strong enough to support the dynamic forces expected during falls.</i></p> <p data-bbox="751 1926 1305 1960"><i>Training is essential for this type of equipment.</i></p>

Typical PPE examples	European Standard of Conformity
	<p>EN 353:2 – Flexible Fall Arrest System</p> <p>This is a fall arrest system comprising either a textile or wire rope which is suspended vertically from an upper anchorage point. The user attaches to a fall arrester carriage, which moves freely up and down on the rope without requiring manual adjustment by the user, allowing both hands to be free for climbing. In the event of a fall, the fall arrester will lock on the rope and provide almost immediate arrest of the user.</p> <p>Ideal for providing a speedy and temporary fall protection system during climbing of vertical structures. No complex installation is involved.</p> <p>Warnings</p> <p><i>Only the interface (lanyard/coupling) supplied by the manufacturer should be used.</i></p> <p><i>No additional connectors or lanyards should be added to the system. This includes small size karabiners.</i></p> <p><i>Only for use with full body fall arrest harness attachment points conforming to BSEN 361.</i></p> <p><i>Systems are not suitable for connection to waist or other attachment point which would prevent adequate body support and result in possible malfunction and failure of the system.</i></p> <p><i>EN353-2 systems, unless otherwise stated in the user instructions, must not be used for work positioning applications, where the user is suspended on the system.</i></p> <p><i>The structure used for the installation should be strong enough to support the dynamic forces expected during falls.</i></p> <p><i>Training is essential for this type of equipment.</i></p> <p><i>Only the rope/wire line specified by the manufacturer should be used.</i></p>

Typical PPE examples	European Standard of Conformity
 <p>Fixed length energy absorber lanyard – EN355</p>  <p>Adjustable energy absorber lanyard – EN355</p>  <p>Twin leg energy absorber lanyard– EN355</p>	<p>EN355–Fall Arrest Energy Absorber Lanyard</p> <p>An energy absorber lanyard has two main components, a lanyard part and an energy absorber part. During a fall the energy absorber element, (typically comprising a length of webbing folded and stitched repeatedly until a short pack is formed) tears out and dissipates the energy of the fall, providing the user with a cushioned arrest. Fall arrest lanyards are available in lengths of up to 2 metres. The lanyards can be terminated with a variety of end connectors to suit the anchorage requirements (see connectors EN362).</p> <p>Energy absorber lanyards conforming to EN355 or the lanyard part if separable, can be used for work positioning and restraint applications. It is however important to remember that this does not work in reverse, so work positioning and restraint lanyards conforming to EN358 cannot be used for fall arrest applications.</p> <p>The lanyard part is available in the following materials:</p> <ul style="list-style-type: none"> ➤ Standard webbing (single/double ply) Lightweight with double ply option improving wear and strength. ➤ Elasticated webbing Aimed at reducing tripping/snagging caused by hanging webbing. ➤ Rope Lightweight, strong. ➤ Chain Excellent wear properties and strength ➤ Wire rope Excellent wear properties and lightweight <p>Energy absorber lanyards are available in the following configurations:</p> <ul style="list-style-type: none"> ➤ Fixed length ➤ Adjustable length Ideal for restraint applications.

Typical PPE examples	European Standard of Conformity
 <p>Elasticated energy absorber lanyard – EN355</p>  <p>Fixed loop energy absorber lanyard – EN355</p>  <p>Energy absorber lanyard fitted with protective wear sleeve – EN355</p>	<ul style="list-style-type: none"> ➤ Twin leg Two lanyards in a 'Y' configuration provide a permanent method of attachment while transferring between positions. ➤ Choking loop Suitable for choking around structures ➤ Lanyard is separable from absorber ➤ Lanyard and absorber inseparable ➤ Protective wear sleeve Provides greater protection against abrasion and damage. <p>Warnings <i>No additional connectors or lanyards should be added to the fall arrest lanyard other than those specified by the manufacturer.</i></p> <p><i>When used for fall arrest applications the lanyard should only be attached to the harness thorax (upper front) or dorsal (upper back) attachment points.</i></p> <p><i>Should not be attached in line with other energy absorber devices, including EN360 retractable fall arresters.</i></p> <p><i>Two off single leg energy absorber lanyards should not be used in parallel as a substitute for a twin leg energy absorber lanyard, since two absorber elements would provide double the rated arrest forces.</i></p> <p><i>When parking the free leg of a twin tail energy absorber lanyard when only one leg is in use, ensure the free leg is not tied around the user's body or in front of the energy absorber pack to ensure the operation of the energy absorber is not hindered during a fall.</i></p> <p><i>The lanyard should be anchored to a point as far above the attachment point of the harness as possible to limit free fall distances in the event that a fall should occur.</i></p>

Typical PPE examples	European Standard of Conformity
 <p>Short range, lightweight auto reel EN360 Typically 2-metres long</p>  <p>Wire lifeline – EN360 stainless steel/galvanized (Readily available up to 30 metres)</p>  <p>Webbing lifeline – EN360 (Readily available up to 30 metres)</p>	<p>Retractable Fall Arresters – EN360</p> <p>Retractable fall arresters typically comprise a lanyard, housed in an upper protective casing. The lanyard will reel out and retract freely to provide the user with freedom of movement over large areas. The fall arrester operates on inertia sensing, where in the event of any sudden jerk or free fall the device will lock on and provide the user with a cushioned arrest. There are two main types of fall arrester: a lightweight short range auto reel type, normally approx. 2 metres long and the long range type, available in lengths up to and exceeding 30m.</p> <p>Retractable fall arresters are usually designed and CE tested for use in vertical or near vertical applications with specified angles up to 30 degrees from the vertical.</p> <p>The retractable lanyard is available in webbing, wire rope or fibre rope.</p> <p>The long range types are available with secondary functions, including an integrated winch to provide lifting or lowering of a fall victim or a descender facility, to allow controlled lowering of a fall victim or evacuation in an emergency situation.</p> <p>Warnings</p> <p><i>No additional connectors or lanyards should be added to the retractable fall arrester.</i></p> <p><i>The arrester, should not be attached in line with other energy absorber devices, including EN360 retractable fall arresters.</i></p> <p><i>The arrester should be attached above the user's head to minimise free fall.</i></p> <p><i>The arrester should not be attached to free moving or flexible anchorages/lines unless CE tested in this mode and specified by the manufacturer.</i></p> <p><i>The arrester should not be used in horizontal applications unless CE tested in this mode and specified by the manufacturer.</i></p> <p><i>Do not use over sharp edges.</i></p> <p><i>The arrester should not be used on solid chutes in non-vertical free fall conditions unless the manufacturer specifies suitability of device.</i></p>

Typical PPE examples	European Standard of Conformity
 <p data-bbox="280 969 619 1025">With integrated descender – EN360</p>  <p data-bbox="268 1424 663 1451">With integral rescue winch facility</p>	<p data-bbox="719 338 1326 394"><i>Periodic inspection and servicing is required by the manufacturer.</i></p> <p data-bbox="719 427 1270 454"><i>Training is essential for this type of equipment.</i></p>
 <p data-bbox="560 1496 679 1574">Dorsal EN361 Fall arrest</p> <p data-bbox="300 1921 667 1977">Full body harness with rear dorsal fall arrest point – EN361</p>	<p data-bbox="719 1514 1190 1541">EN361–Fall Arrest Full Body Harness</p> <p data-bbox="719 1559 1342 1704">Full body harness is essential in providing adequate body support in the event of a fall. Harness attachment points tested for fall arrest to EN 361 are also suitable for use in work restraint and work positioning applications.</p> <p data-bbox="719 1738 1326 1827">Harnesses are available in different types of webbing, including polyester, nylon and elasticated webbing.</p>



Full body harness with rear dorsal & front thoral fall arrest points -EN361



Full body harness with rear dorsal & front thoral fall arrest point & waist belt EN361/EN358



Full body harness rescue strap





Harness features include:

- **Fitted with dorsal, thoral or both dorsal and thoral attachment points.**
A combination of attachment points provides a multi purpose harness suitable for attachment in front of and behind the user.
- **Part elasticated webbing**
Aimed at enhancing comfort during normal use and during falls.
- **Fully adjustable (legs, chest, shoulders)**
Enhances fit
- **Available with integral rescue loop**
Facilitates speedier recovery of falls victim.
- **Available in selection of colours**
- **Available with integral work positioning waist belts to EN358 and sit harnesses to EN813** A combination of attachment points provides a multi purpose harness suitable for attachment in front of and behind the user
- **Available with different types of adjusters and buckles**
- **Available with tool hooks to enable storage of small tools while working at height.**

Warnings

EN358 work positioning and EN813 sit positioning specified attachment points must not be used for fall arrest purposes.

Harnesses must be of a proper fit to ensure a safe mode of arrest.

Typical PPE examples	European Standard of Conformity
 <p>Screwgate karabiner – EN362</p>  <p>Screwgate karabiner – EN362 with captive eye to retain lanyard</p>  <p>Twistlock Hook – EN362 (often referred to as 'scaffold hook')</p>  <p>Large scaffold snaphook – EN362</p>	<p>Connectors– EN362</p> <p>Many different types of connectors exist to enable connection between the various PPE components. Connectors conforming to EN362 have a self-locking or manual locking function to ensure a secure attachment is maintained.</p> <p>Connectors are available in different sizes and geometry to enable compatibility with varying types of PPE elements and structural anchorages.</p> <p>Connectors are available in many different materials and finishes, including:</p> <ul style="list-style-type: none"> ➤ Carbon steel Excellent strength properties ➤ Stainless steel Excellent corrosion properties ➤ Aluminium alloy Lightweight <p>The following types of connector are available:</p> <ul style="list-style-type: none"> ➤ Screwgate Available in a range of sizes and shapes. Requires a screwing action to lock and unlock the hook. ➤ Twistlock Available in a range of sizes and shapes. Hook has a twist-to-open and automatic self-closing and locking mechanism. Aimed to provide enhanced security with automatic locking feature and speedy attachment and disconnection. ➤ Double action snap Hook Available in a range of sizes and shapes. A double action is required to open the hook which snaps shut and locks on release. Provides very speedy attachment and disconnection with enhanced security in the automatic locking feature.



Oval Link – EN362
(often used to connect PPE
elements to harness attachment
points)






Deltal Link – EN362
(often used to connect PPE
elements to harness attachment
points)

Warnings

Loading must be applied via the major axis of the connector.

The connector must be compatible with the fixing point, avoiding point loading of the hook.

Typical PPE examples	European Standard of Conformity
 <p>Temporary horizontal line EN795 – Class B</p>  <p>Temporary anchor sling EN795 – Class B</p>  <p>Temporary eyebolts for steelwork EN795 – Class B</p>	<p>Anchor Devices to EN795</p> <p>In the event that PPE cannot be attached directly to a suitable structural anchor point, due to incompatibility between the connector and structure, a number of anchors are available, to provide both temporary and permanent solutions.</p> <p>Different classes of anchor exist to accommodate different requirements.</p> <ul style="list-style-type: none"> ➤ Class A1 Anchors designed to be fixed to vertical, horizontal and inclined structures e.g. eyebolts ➤ Class A2 Anchors designed to be secured to vertical, horizontal and inclined structures e.g. eyebolts ➤ Class B Any type of anchors which are transportable and temporary. This can include: <ul style="list-style-type: none"> ○ Tripods – for working in confined spaces ○ Girder clamps/trolleys for suitable steelwork ○ Anchor straps/slides – for passing around and choking on suitable structures. ○ Temporary horizontal lines ○ Temporary eyebolts ➤ Class C Horizontal flexible fall arrest lines ➤ Class D Horizontal rigid rails ➤ Class E Deadweight anchors which rely on weight and friction, where the structure is not penetrated.

Anchor device examples continued/

Temporary sling anchor
EN795 – Class B






Temporary adjustable beam clamps
EN795 – Class B



Temporary adjustable anchor strap
EN795 – Class B



Temporary adjustable beam trolley
fitted with rollers to enable
repositioning over suitable structures.
EN795 – Class B

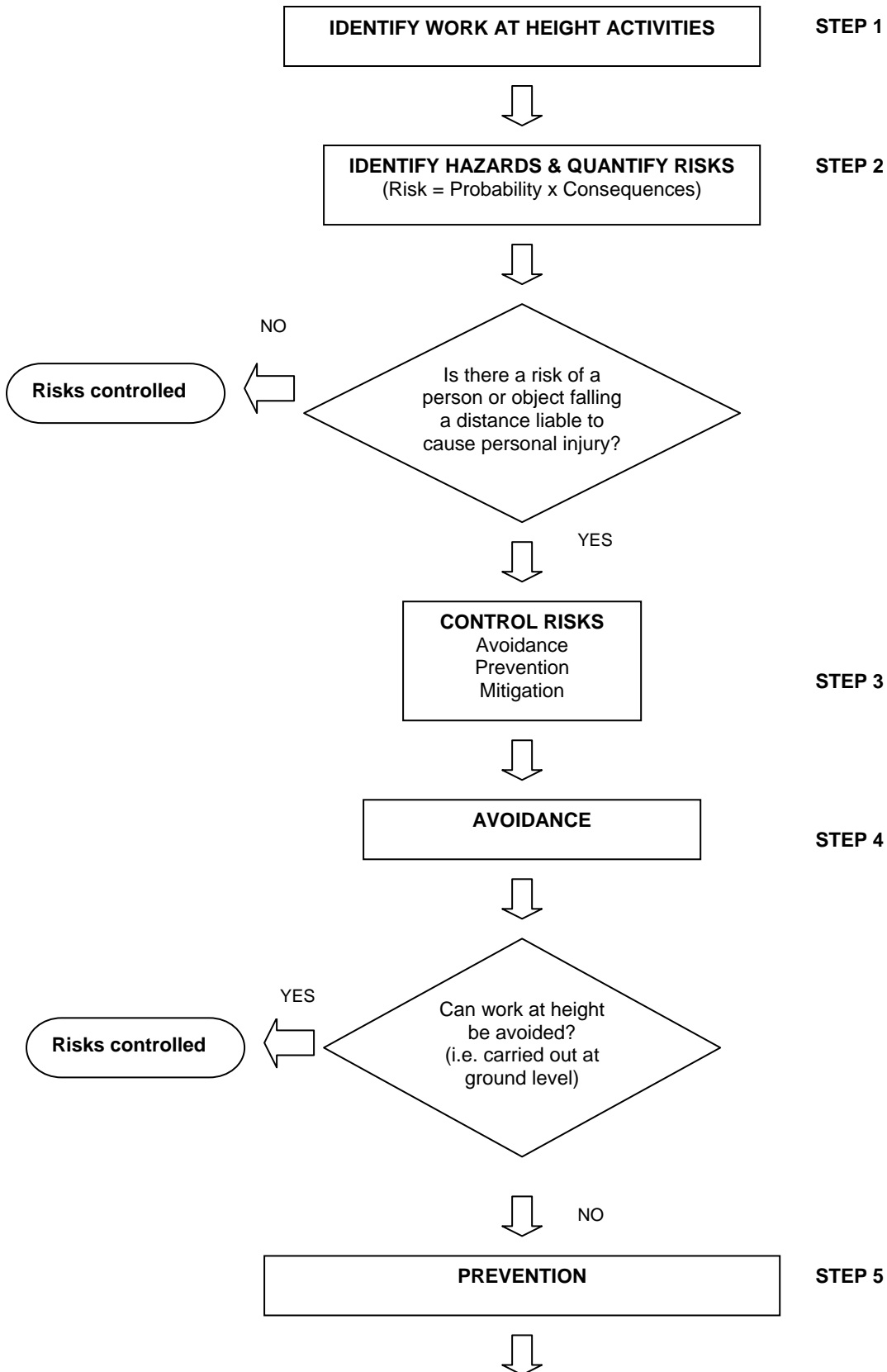
Typical PPE examples	European Standard of Conformity
 <p data-bbox="411 943 544 972">Rescue Kit</p>  <p data-bbox="352 1397 539 1426">Nappy Harness</p>  <p data-bbox="228 1852 695 1944">Lightweight rescue hoist to assist in the transfer of fall victim's body weight to rescue system</p>	<p data-bbox="746 398 987 427">Rescue Equipment</p> <p data-bbox="746 461 1343 582">Although the majority of rescue equipment is no longer covered under the PPE Directive, there are still a number of EN test standards which exist to demonstrate the integrity of rescue equipment.</p> <ul data-bbox="794 613 1294 887" style="list-style-type: none"><li data-bbox="794 613 1294 705">➤ EN1496 Covers rescue lifting devices, such as rescue winches<li data-bbox="794 734 1147 795">➤ EN1497 Covers rescue harnesses<li data-bbox="794 824 1086 887">➤ EN 1498 Covers rescue loops <p data-bbox="746 920 1343 1128">A number of lightweight kits are available on the marketplace which are conveniently packaged in a rucksack type bag and contain a number of aids to assist in the recovery of falls victims. Typically a rescue kit includes rescue straps, pulley devices, lifting lowering devices and descender devices.</p>

APPENDIX 3

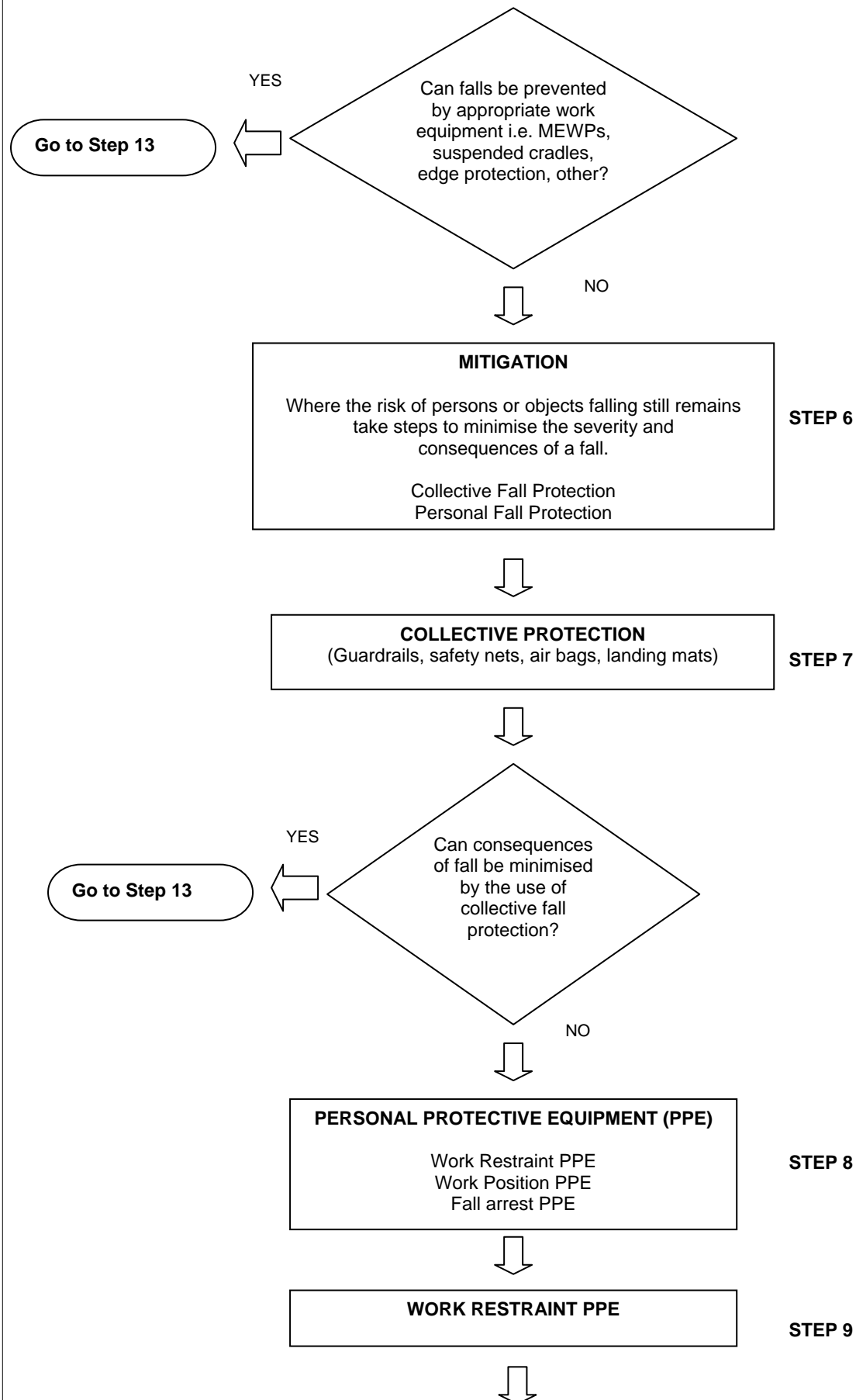
WORKING AT HEIGHTS – RISK ASSESSMENT PROCESS

Working at Heights – Risk Assessment Process

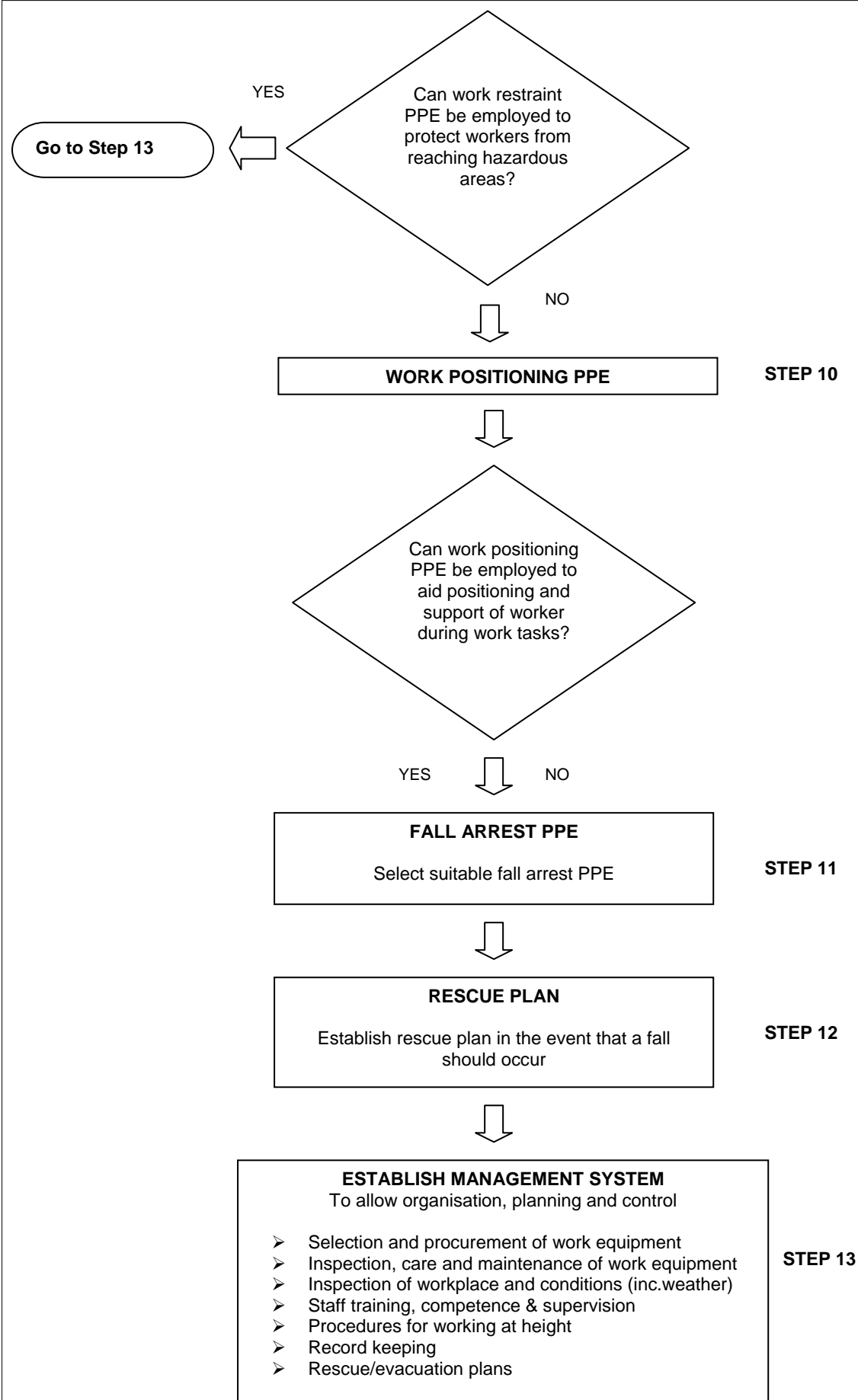
This flow chart illustrates the general risk assessment process adopting the safe working at heights hierarchy approach of Avoidance, Prevention and Mitigation.



Continued/



Continued/



APPENDIX 4

WORK AT HEIGHT TRAINING INFORMATION

WORK AT HEIGHT TRAINING INFORMATION

A number of training and certification schemes have been devised to cover a wide range of work at height applications. Two specific examples of training relevant to work at height activities are discussed below.

1 WORK AT HEIGHT TRAINING

Training courses for general work at height applications mainly address the use of fall protection PPE, including work restraint, work positioning and fall arrest. In addition courses cover rescue equipment and techniques used to recover falls victims suspended after falls. A large number of courses are provided by PPE manufacturers and training bodies and typically, focus on the following areas:

- Awareness of the range of fall protection equipment together with practical experience of the use of the equipment
- Work methods and techniques including general work positioning, restraint and fall arrest using both fixed and temporary methods
- Selection and control of suitable anchor points
- PPE installation, pre-use checks and inspection
- Awareness of hazards and risks associated with work at height
- Rescue after a fall (including the use of rescue equipment, techniques and suspension trauma)
- Managing work at height (including specifying safe systems of work)
- Work at Height Regulations

2 INDUSTRIAL ROPE ACCESS TRAINING

Rope access, where the worker is supported on ropes, is a form of work positioning initially developed from techniques used in climbing and caving. These techniques are applied to gain access to areas that cannot be easily accessed using other means.

A training and certification scheme is provided by the Industrial Rope Access Trade Association (IRATA). This scheme is specifically aimed at workers involved in rope access activities, covering mainly industrial abseiling. Three levels of certification can be attained and these are described in the following sections:

2.1 LEVEL 1 (Trainee technician)

Level 1 technician is capable of covering a limited range of access tasks under the supervision of a Level 3 rope access supervisor. The Level 1 syllabus content includes the following:

Theoretical Knowledge

- a) Relevant legislation, guidelines and standards
- b) Awareness of risk assessment and safety method statement
- c) Awareness of permit to work system
- d) Exclusion zones
- e) Working practices and worksite organisation
- f) Categories of PPE
- g) Selection, use and maintenance of equipment
- h) Equipment checks and inspection
- i) Hazardous substances
- j) IRATA syllabus and certification scheme
- k) Logbooks
- l) Anchorage types and systems
- m) Angle loading
- n) Awareness of fall factors
- o) Awareness of hauling systems
- p) Awareness of suspension trauma and casualty management

Equipment and Rigging

- a) Assembly and fitting of PPE
- b) Checking of PPE
- c) Use of the back-up device
- d) Tying, dressing and setting of appropriate knots
- e) Rigging of basic anchor system
- f) Rigging a small Y hang
- g) Awareness of rope and sling protection rigging

Manoeuvres

- a) Descent
- b) Ascent
- c) Changeovers
- d) Descent using descenders
- e) Ascent using ascenders
- f) Passing knots
- g) Passing deviations
- h) Passing a re-belay
- i) Rope-to-rope transfer
- j) Passing an edge or obstruction at the top
- k) The use of a work seat
- l) Passing mid-rope protection

Climbing

- a) Climbing with cow's-tails
- b) Climbing with fall arrest lanyards

Rescue/hauling

- a) A descent rescue
- b) An awareness of a basic haul and lower

2.2 LEVEL 2 (Operative Technician)

Level 2 technician is capable of rigging working ropes, undertaking rescues and performing rope access tasks under the supervision of an IRATA approved Level 3 rope access supervisor. The technician should have some knowledge of legislation, safety requirements and quality assurance procedures relating to rope access.

The Level 2 syllabus content includes the following:

Theoretical Knowledge

In addition to the 16 Level 1 theoretical requirements the following is included:

- a) Tensioned lines
- b) Work restraint
- c) Horizontal lifelines
- d) Anchorage selection
- e) Team work
- f) Communication

Equipment and Rigging

In addition to the requirements of Level 1 the following is included:

- a) Wide Y hang
- b) Re-belay
- c) Deviations
- d) Rope and sling protection
- e) Pull through
- f) Work restraint and horizontal lifelines
- g) Tensioned ropes

Manoeuvres

This section includes all the requirements listed for Level 1.

Climbing

This section includes all the requirements listed for Level 1.

Rescue/hauling

In addition to the requirements of Level 1 the following is included:

- a) Rescue from the ascent mode
- b) Rescue from an aid climbing situation
- c) Rescue past a small re-belay
- d) Rescue past a deviation
- e) Rescue from rope to rope
- f) Haul and lower from a platform
- g) Hanging a haul
- h) Cross haul

2.3 LEVEL 3 (Supervisor Technician)

Level 3 supervisor is capable of site supervision for rope access work and is conversant with relevant work techniques and legislation. In addition to satisfying the criteria for Levels 1 and 2, the technician undertakes a 5-day training course in advanced rescue, equipment examinations and legislation. The technician should hold a first aid certificate and be conversant with the IRATA scheme.

The Level 3 syllabus content includes the following:

Theoretical Knowledge

This section includes all Level 1 and 2 theory sections but to greater depths of understanding than at these levels, and in addition shall include the following:

- a) Risk assessment and method statements
- b) Equipment inspection, management and records
- c) Rescue management
- d) Assessment of alternatives to lead climbing and where lead climbing is a valid safe option, be capable of writing a method statement for lead climbing in a particular situation.

Rescue/hauling

- a) Advanced rescue
- b) Tensioned ropes
- c) Short link
- d) Descent passing knot
- e) Break into tight knot
- f) Large re-belay
- g) Tensioned ropes