

SECTION XXXXX

LATCHWAYS MANSAFE LIFELINE FALL PROTECTION SYSTEM

PART 1 GENERAL

1.1 SYSTEM DESCRIPTION

- A. Type of system required: Inclined Horizontal Lifeline (HLL)
- B. System location: Roof/ Wall/ Tower/ Etc... What is the angle of incline of the system?
- C. Maximum number of workers on system at one time: ##
- D. Systems environmental exposure: What are the service conditions (indoors, outdoors, corrosive environment)? What materials will be required (steel, hot dip galvanizing, stainless steel, marine grade stainless etc...)?
- E. Workers task while on the system: Workers will walk along edge. Occasionally, workers are required to look over the edge. While walking, workers need to carry heavy objects.
- F. Type of fall protection required: Fall Restraint and Fall Arrest
- G. Range of movement while on the system: Uninterrupted movement throughout the entire length of the system
- H. Additional components: All attaching hardware necessary for # workers.
- I. Insurances required: Commercial Liability and Workers' Comp.

1.2 RELATED SECTIONS

- A. Section 03300 - Cast-In-Place Concrete
- B. Section 03400 - Pre-Cast Concrete
- C. Section 05100 – Structural Metal Framing
- D. Section 05400 – Cold Formed Metal Framing
- E. Section 05310 - Metal Deck
- F. Section 06100 – Rough Carpentry

- G. Section 07510 - Built-Up Roofing
- H. Section 07700 - Roof Specialties and Accessories
- I. Section 11010 - Maintenance Equipment

1.3 REFERENCES

A. Occupational Safety & Health Administration (OSHA)

1. 29 CFR 1910.28 (b) (1) & 29 CFR 1926.501(b) (1) - Occupational Health and Safety Standards General Industry & Construction: Duty to have fall protection
2. 29 CFR 1910.140(c) (11) (i-ii) & 29 CFR 1926.502(d) (8) - Safety and Health Regulations for General Industry & Construction: Horizontal Lifeline Design Requirements.
3. 29 CFR 1910.140(c) (13) (i-ii) & 29 CFR 1926.502(d) (15) (i-ii) - Safety and Health Regulations for General Industry & Construction: Anchorage Design Requirements.
4. 29 CFR 1910.66 (e) (1) (i) - General Industry: Powered Platform Installations -Affected parts of buildings.

B. American National Standards Institute (ANSI)

1. Z359.1 [2016] – The Fall Protection Code
2. Z359.3 [2017] – Safety Requirements for Positioning and Travel Restraint Systems.
3. Z359.6 [2016] – Specifications and Design Requirements for Active Fall Protection Systems.
4. Z359.11 [2014] – Safety Requirements for Full Body Harnesses.
5. Z359.12 [2009] – Connecting Components for Personal Fall Arrest Systems.
6. Z359.13 [2013] – Personal Energy Absorbers and Energy Absorbing Lanyards.
7. Z359.14 [2014] – Safety Requirements for Self-Retracting Devices for Personal Fall Arrest and Rescue Systems.
8. Z359.15 [2014] – Safety Requirements for Single Anchor Lifelines and Fall Arrester for Personal Fall Arrest Systems.

9. Z359.18 [2017] – Safety Requirements for Anchorage Connectors for Active Fall Protection Systems.
- C. Materials, Bolting, Finishing: American Society of Testing Materials (ASTM)
1. A36 - Standard Specification for Carbon Structural Steel.
 2. A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
 3. A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 4. F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105 KSI Yield Strength.
 5. A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
 6. A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 7. A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 8. A992 - Standard Specification for Structural Steel Shapes.
 9. F3125 - Standard Specification for High Strength Structural Bolts, Steel and Alloy, Heat Treated, 120ksi and 150ksi Minimum Tensile Strength, Inch and Metric Dimensions.
- D. American Welding Society (AWS) D1.1/D1 - Structural Welding Code – Steel
- E. Design Standards
1. American Institute of Steel Construction (AISC) 325-05 [13th ed.] – Steel Construction Manual
 2. National Design Specification (ANSI/NDS) [2005] – Wood Construction Manual
 3. International Building Code (IBC) [2009] – Building Design Manual
 4. American Society of Civil Engineers (ASCE/SEI) 7-10 [2010] – Minimum Design Loads for Buildings and Other Structures
 5. American Concrete Institute (ACI) 318-08 Building Code Requirements for Structural Concrete.

F. Definitions

1. Anchorage – per ANSI Z359.0 – A secure connecting point or a terminating component of a fall protection system capable of supporting impact forces applied by a fall protection system.
2. Anchorage Connector – per ANSI Z359.0 – A component or subsystem that functions as an interface between the anchorage and a fall protection, work positioning, rope access or rescue system for the purpose of coupling the system to the anchorage.
3. Clearance – per ANSI Z359.0 – The distance below an authorized person that must remain clear of obstructions in order to ensure that the authorized person does not make contact with any objects that would cause injury in the event of a fall.
4. Continuous Fall Protection – per ANSI Z359.0 – One or more fall protection systems that provide fall protection without interruption.
5. Fall Arrest – per ANSI Z359.0 – The action or event of stopping a free fall or the instant where the downward free fall has been stopped.
6. Fall Hazard – per ANSI Z359.0 – Any location where a person is exposed to a potential free fall.
7. Fall Restraint/Travel Restraint – per ANSI Z359.0 – A combination of anchorage, anchorage connector, lanyard (or other means of connection) and body support (full body harness) that limits travel in such a manner that the user is not exposed to a fall hazard.
8. Qualified Person – per ANSI Z359.0 – A person with a recognized degree or professional certificate and with extensive knowledge, training and experience in the fall protection and rescue field who is capable of designing, analyzing, evaluating and specifying fall protection and rescue systems to the extent required by the Z359 standards.

1.4 PERFORMANCE

A. System shall comply with 1.1 System Description

B. Performance Requirements

1. System Performance

- a. The Fall Protection Horizontal Lifeline System shall be designed to allow users to walk the entire length of the system without having to disconnect from the system to pass through intermediate supports. The system shall be designed to support required number of users in case of a fall and to prevent the users from

free falling more than 6 feet. All components shall be designed by the fall protection system supplier and shall meet the applicable fall protection ANSI standards and applicable OSHA regulations.

- b. The Fall Protection Horizontal Lifeline System shall be designed to control swing fall at corners and other locations in accordance with Z359.6.

2. Structural Performance:

- a. Structure supporting the Horizontal Lifeline system must be capable of withstanding design loads based on the maximum specified number of users as required by governing regulations and codes. Where component design loads are specified herein, they represent design minimum requirements.
- b. All fall protection components and systems shall be designed with a minimum 2:1 safety factor per section reference 1.3.A.2. In addition, structure supporting fall protection components and systems shall be designed for combined loading conditions in accordance with section reference 1.3.B.3.

1.5 DESIGN

A. Design Requirements

- 1. Fall protection Inclined horizontal lifelines shall comply with current applicable OSHA, ANSI, and state regulations and standards.
- 2. The fall protection system and any supporting structure shall be designed by:

Latchways PLC
Hopton Pk Ind Est
Devizes SN102JP UK

Phone: 011-44-1380-732700
Website: www.latchways.com
E-mail: info@latchways.com.

Gravitec Systems Inc.
21291 Urdahl Road NW,
Poulsbo, WA 98370-7124

Phone: 1-800-755-8455
Website: www.gravitec.com
E-mail: solutions@gravitec.com.

3. General Requirements:

- a. The inclined HLL(s) shall be designed and installed, under the supervision of a Qualified Person, as part of a complete personal fall protection system.
- b. Engineers shall, at minimum determine the performance of the system when a fall occurs on the shortest span (largest forces) and the longest span (largest total fall distance) in the system.

- c. The inclined HLL(s) constant force energy absorbers shall not be used to limit the maximum arrest force of the worker. The inclined HLL(s) constant force energy absorbers shall be used only to control or reduce the maximum arrest load on the structure.
 - d. Anchorages for the inclined HLLs shall be verified and designed, prior to use, by a Qualified Person with experience and training in designing and using inclined horizontal lifelines systems.
 - e. The inclined HLL(s) shall satisfy the seismic conditions for nonstructural components as described by ASCE/SEI 7 and the most current edition of the IBC. No exceptions can be taken if the system is required to function for life-safety purposes after an earthquake.
 - f. The inclined HLL shall consist of a stainless steel safety cable attached to the structure. The cable shall be continuous or shall have swaged splices, which allow the user to pass without disconnecting from the system.
 - g. Brackets and supports shall be attached to the structure with appropriate anchors of proper size to adequately support the intended loaded.
 - h. Inclined HLL(s) shall comply with Latchways design requirements.
4. Restraint inclined HLL(s) shall be designed per ANSI Z359.2 & ANSI Z359.6:
- a. The inclined HLL(s) shall prevent workers from reaching and falling into any open hole or off the edge of a working surface.
 - b. The inclined HLL(s) shall comply with the requirements for fall arrest inclined HLLs as indicated in this document.
 - c. Where a worker is using a full body harness the force on the worker's body shall not exceed 400 lbs.
 - d. Inclined HLL(s) constant force energy absorbers may be used in travel restraint systems; provided that the engineer has determined that the restraint forces will not cause the inclined HLL(s) constant force energy absorbers to deploy and ensures that the deflection of the wire rope in combination with other deformations of the restraint system will not permit the worker(s) to reach the fall hazard.
 - e. The use of fall restraint systems shall be limited to surfaces at or less than a slope of 4:12 from the horizontal, This is so a fall will not result in dynamic loading on the fall restraint system or where

the authorized person could end up being suspended vertically from the system.

5. Fall Arrest inclined HLL(s) shall be designed per ANSI Z359.2 & ANSI Z359.6:
 - a. The selection, design, and installation of fall arrest inclined HLL(s) shall be performed under the supervision of a Qualified Person.
 - b. Fall arrest inclined HLL(s) shall have the strength capable of sustaining static loads applied to the wire rope of at least two times the maximum arresting force.
 - c. When more than one user is attached to an inclined HLL, the load on the lifeline can be determined using either lumped mass or sequential fall as described in ANSI Z359.6 [6.3.6]
 - d. The swing fall shall comply with ANSI Z359.6 [5.3]
 - e. The clearance safety margin shall comply with ANSI Z359.6 [7.2.6.2]

B. Sub-System Requirements

1. Harnesses and Vertical Lifelines (VLLs) used with the system shall comply with ANSI Z359.1
2. Connecting Components (carabiners and snaphooks) used with the system shall comply with ANSI Z359.12
3. Energy Absorbing Lanyards (EALs) used with the system shall comply with ANSI Z359.13
4. Self Retracting Lifelines (SRLs) used with the system shall comply with ANSI Z359.14

- C. The inclined HLL(s) shall be used exclusively for its designed use and shall be marked to prevent other uses.
- D. The design shall take into consideration the potential uses of and loads on the inclined HLL, in order to facilitate the prompt rescue of workers who may fall while attached to the system.
- E. The manufacturer shall test the inclined HLL design using a 660lb weight on various roof structures.
- F. Each batch of inclined HLLs shall be static, dynamic, salt spray, and x-ray tested.

- G. Each component of the inclined HLL shall be batch marked or individually serial numbered.

1.6 Submittals

- A. Submit under provisions of Section ##### – Submittal Procedures
- B. Product Data: Latchways' data sheet on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations
 - 3. Installation methods
- C. Drawings and Calculations:
 - 1. Drawings:
 - a. Show the layout of the system including where the system is located and the complete assembly of all components. And how the system is to be accessed.
 - b. Include a specification of the number, location, and qualifications of workers using the system.
 - c. Clearly specify the type of system, (restraint or arrest), maximum and average arrest force of PFAS equipment, type of equipment to be used (lanyard, self-retracting device, etc.), equipment dimensions, materials, fabrication details, hardware, and installation instructions. And additional information as indicated in Z359.6 Section 3.2.
 - d. Clearly specify the required clearance for each system and location.
 - 2. Calculations:
 - a. Calculations shall be prepared under the supervision of a registered Professional Engineer and Qualified Person.
 - b. Include a statement defining the type of system and indicating that the design is in accordance with the requirements of ANSI Z359.6.
 - 3. The Professional Engineer who oversaw the design of the system shall affix their professional seal to each drawing and calculation package issued.

- D. Operation and Maintenance Data shall be prepared per ANSI Z359.2 & ANSI Z359.6:
1. Include complete list of equipment replacement parts; identify each entry with the equipment description and part numbers.
 2. Include technical information for servicing equipment.
 3. Include legible “as-constructed” drawings of the installed system.
 4. Include installation date and system owner’s name and address.
 5. Include detailed operating procedures:
 - a. Written by a Qualified or Competent Person.
 - b. Identifying the inclined horizontal lifelines location
 - c. Stating any safety precautions that shall be followed during access and egress.
 - d. Describing the limitation on use of system: maximum load, designated equipment, required clearance and maximum number of persons permitted to be attached to the system at one time.
 - e. Instructions for inspection, maintenance, and retirement of the system and all of its components, including how often inspection and maintenance are to be performed and a description of the qualifications required for persons performing these tasks.
 - f. Procedure for inspection:
 - I. Required or recommended inspection intervals.
 - II. Detailed instruction for inspecting each component of the system.
 - III. Description of acceptance or rejection criteria, including retirement criteria, of each component of the system.
 - IV. Fall protection procedures shall include a requirement that any incidents, including accidents or near misses, be investigated to determine if procedures can be improved.
 6. Provide or direct the owner of the system or the employer of the workers using the system to develop and implement a rescue plan before the system is used.

1.7 QUALITY ASSURANCE

- A. Single Source: Obtain all materials and equipment required under this section from a single supplier.
- B. Designer/Installer Qualifications: Engage a single firm to assume undivided responsibility for the design and fabrication of all fall protection system components. Firm shall have a minimum of 5 years documented experience in the fabrication of such components similar to that required for this project. Additionally, the firm shall have a minimum of 5 years documented experience in the installation of such components and who offers a regular inspection and maintenance service on such systems.
- C. Design Engineer: Employ a firm with a minimum of 10 years experience designing fall protection systems with a minimum of 5 systems installed in the previous 12 months. Who employs a registered Professional Engineer (PE), with evidence of being the principal PE on at least 3 fall arrest systems which have been in use for no less than 1 year prior to bid closing date.
- D. Professional Engineer and Fall Protection Qualified Person: Shall oversee the fall protection systems' design, such that all component items meet the "Structural Performance" requirements, including sizing and spacing of all attachments to the building structure and verify the design is compliant with all applicable OSHA and ANSI standards. Additionally, they must prepare, stamp and sign all required calculations; while also approving the system designer's drawings.
- E. Welding to be executed by certified welders in accordance with AWS requirements.

1.8 DELIVERY, STORAGE & HANDLING

- A. Material delivery shall be coordinated with all effected entities.
- B. Storage and Protection:
 - 1. Store originally packaged materials in a cool, dry, and protected location.
 - 2. Materials shall be in new condition and show no signs of damage.

1.9 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.10 WARRANTY

- A. Manufacturer's standard warranty for materials and workmanship.
- B. Installer's standard one (1) year warranty for materials and workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers shall comply with the *Quality Assurance* section of this documentation.
- B. All supporting structure which connects the inclined horizontal lifeline to the super structure shall be designed by:

Gravitec Systems Inc.
21291 Urdahl Road NW,
Poulsbo, WA 98370-7124

Phone: 1-800-755-8455
Website: www.gravitec.com
E-mail: solutions@gravitec.com.

2.2 PRODUCTS

- A. Latchways PLC
Hopton Pk Ind Est
Devizes SN102JP UK

2.3 MATERIALS

- A. Product
 - 1. The system shall be a complete and turnkey complying with the performance and design criteria of this document.
 - 2. The Inclined HLL(s) shall be the product of Latchways PLC.
 - 3. Components: All system connectors, cables and bolts shall be stainless steel Type 316 or epoxy coated aluminum. Fabricated supports required for additional support may be carbon steel with a corrosion resistant coating. However a faying surface shall be used to prevent galvanic reactions.
 - 4. Post Base Plate Connectors: Provide complete with required components for weatherproof mounting to the following surfaces:
 - a. Standing Seam Roof Type.
 - b. Composite Ribbed Roofing Type.
 - c. Metal Roofing Type.
 - d. Insulated Roof Deck Type.
 - e. Concrete Deck Type.
 - f. Timber Deck Type.
 - g. Non-Penetrating.

5. The Latchways Fall Protection System shall be attached to the supporting structure with appropriate fasteners. The fasteners shall be designed to support a load on the fall protection system of 2 times the maximum design load without failure.
6. Provide all designed sub-system items per Section 1.5 (B) of this document.

B. Supporting Structure

1. Structural Components shall comply with the applicable standards:
 - a. Structural Steel: ASTM A36
 - b. Structural Tubing: ASTM A500 Grade B
 - c. Structural Bars, Plates, Shapes, and Sheet Piling: ASTM A6
 - d. Piping: ASTM A53
2. Fasteners shall comply with the applicable standards:
 - a. Structural Bolts: ASTM A325
 - b. Alloy-Steel and Stainless Steel Bolting: ASTM A193
3. Flashing and Sealing Material shall comply with the applicable standards:
4. Material substitutions shall be better than or equal to the requirements found in this section.
5. Fabrication
 - a. Fabricate work true to dimension, square, plumb, level, and free from distortion or defects detrimental to performance.
 - b. Coordinate the system with supporting structure.
 - c. Welding:
 - I. AWS D 1.1 as applicable.
 - II. If Butt welds are used, then surplus welding material is to be ground off to ensure exposed surfaces are smooth. Fillet welds shall not be ground.
 - III. Slag is to be removed from the materials surface.

6. Finishes

- a. Hot Dipped Galvanizing: Comply with ASTM A123.
- b. Powder Coat: Safety Yellow

2.4 INCLINED HLL DESIGN

- A. Inclined HLL design shall comply with the *Design Requirement* section of this document.
- B. Steel design shall comply with AISC 14th ed.
- C. Wood design shall comply with ANSI/NDS [2005]
- D. Concrete design shall comply with ACI [2008]
- E. Fall protection systems attached onto an existing or new structure shall comply with IBC [2009] and ASCE/SEI [2010]

PART 3 EXECUTION

3.1 INSTALLATION

- A. Installation shall be performed by:

Gravitec Systems Inc. 21291 Urdahl Road NW, Poulsbo, WA 98370-7124	Phone: 1-800-755-8455 Website: www.gravitec.com E-mail: solutions@gravitec.com
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- B. Install in accordance with approved shop drawings and manufacturer's instructions.
- C. The Latchways Fall Protection System shall be installed under the direction of manufacturer's authorized trained personnel and under the supervision of a Qualified Person
- D. Install anchorages and fasteners in accordance with their manufacturer's recommendations to obtain the allowable working loads published in the product literature and in accordance with this specification.
- E. Do not load or stress the Latchways Fall Protection System until all materials and fasteners are properly installed and ready for service.
- F. Where bolting is used for fastening, no fewer than three threads are to be exposed and the nut is to be positively locked using a thread-locking fluid or the double nutting technique.
- G. Dissimilar materials with greater than 0.15V shall be separated by a faying surface.

- H. Constant Force posts must be secured to roof surface with waterproof mechanical connectors as approved.

3.2 FIELD QUALITY CONTROL

After the Latchways Fall Protection System is installed and properly tensioned, Latchways approved authorized Qualified or Competent Person shall inspect and operate the system and shall make all final adjustments for proper operation.

3.3 ADJUSTMENTS AND FINAL INSPECTION

- A. Verify that all manufactured units have been installed in accordance with specifications and details, and will function as intended. Adjust any items where necessary to ensure proper operation.
- B. Provide a complete drawing set with any revisions to the design or layout of the horizontal lifelines during installation.

3.4 OPERATOR TRAINING

Provide a minimum of 4 hours of operator training after system has been installed. Training is to be for the users of the system conducted at the installation site.

3.5 MAINTENANCE, INSPECTION AND TESTING

- A. Provide manufacturer maintenance, inspection and testing instructions.
- B. Provide documentation that is consistent with applicable OSHA and ANSI standards.

END OF SECTION

ManSafe® for Roofing

Fall protection systems
for rooftop maintenance

Constant Force® Post
Freestanding Constant Force® Post
WalkSafe®
VersiRail®



Introduction

Falls from height are the single biggest cause of death and one of the biggest causes of serious injury in the workplace today. For businesses whose workers need to operate quickly and effectively at height, fall protection is already a major issue—and this will become increasingly important as regulatory authorities introduce ever-stricter rules governing:

- Where height safety should be implemented
- The systems that are acceptable for use
- Who is responsible for ensuring worker safety

Are you responsible?

The answer could well be 'Yes'. According to the health and safety legislation these people are 'duty-holders'—responsible for ensuring adequate fall protection and potentially liable in the event of an accident.

What you need to do

The official advice to duty-holders can be summarised as follows:

- Avoid work at height, where possible
- When working at height is essential, ensure that workers are not exposed to unnecessary risks
- Where it is not possible to eliminate the risk of falling, **use a suitable fall protection system to minimise the consequences of a fall**

Designer/Architect
Health and Safety
Manager
Facilities Manager

CDM Co-ordinator
Principal Contractors/
Sub-Contractor
Client/Building Owner

**Latchways plc—global leaders
in fall protection**

ManSafe for Roofing

Where is fall protection required?



Rooftop fall protection examples

1 Roof Access:

Access via ladders and roof hatches

2 Roof Edges:

Access required for gutter cleaning, leakage checks, inspection and maintenance to the rest of the roof

3 Roof Plant:

Air conditioning units, satellite dishes and solar panels all need regular checks

4 Walkways:

Walkways should be accompanied by a fall protection system

5 Rooflights:

Fall protection required for cleaning and maintenance

All roofs require some form of access for:

- General maintenance
- Structural/performance checks for warranty maintenance
- Plant access



What type of fall protection system should you install?

Latchways has developed an easy-to-use assessment method to help establish what type of system is required for permanent access. There are a number of key considerations that will help decide what type of system needs to be installed and therefore minimise risk:

- Experience of the worker(s) accessing the system
- Number of worker(s) accessing the system
- Duration of the worker(s) on the system
- Frequency of use

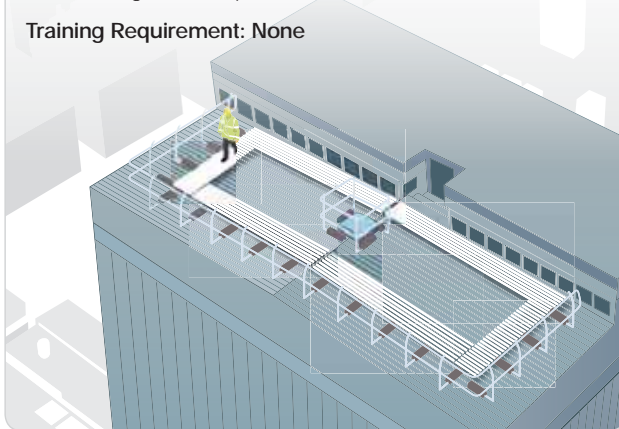
In most cases, unless specialist rope access is required, it is best practice to assume that the worker has only basic experience. The illustrations below are designed merely as a guide to the options that are available. In all cases a propriety walkway, such as WalkSafe® is recommended to accompany the fall protection system to provide a safe means of access to the place of work. WalkSafe also ensures the rooftop is protected from any possible damage caused during regular cleaning and maintenance of plant, gutters, down pipes etc.

Latchways' in-house design team can further advise on the most appropriate system for your particular requirement. For advice on system design and specification, email Latchways at spec@latchways.com.

Solution: Guardrail

Freestanding collective protection

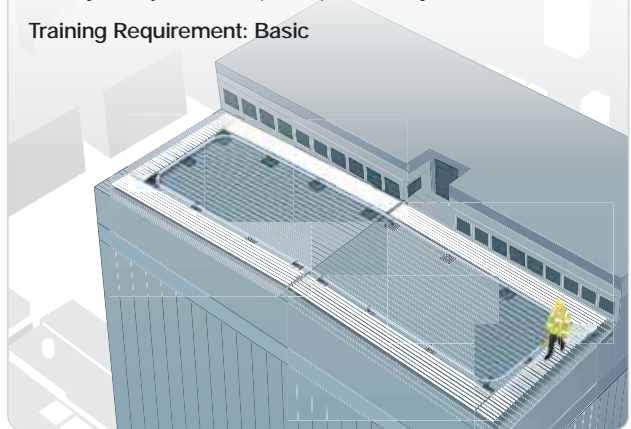
Training Requirement: None



Solution: Fall Restraint*

No lanyard adjustment required (perimeter system)

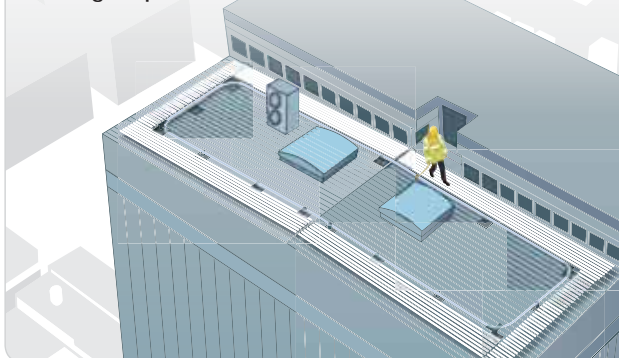
Training Requirement: Basic



Solution: Fall Arrest**

No lanyard adjustment required
(perimeter system with fall hazards present)

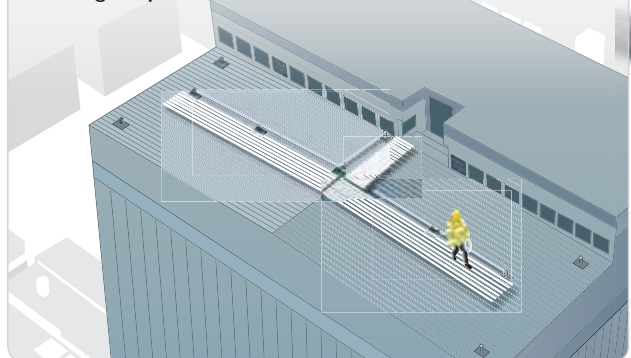
Training Requirement: Basic



Solution: Fall Arrest**

Lanyard adjustment required
(ridge system with anti-pendulum posts)

Training Requirement: Advanced



*Restraint system—system is located so a worker on a fixed-length lanyard cannot reach any fall hazard.
**Arrest system—system location is restricted and fall hazards can be reached by a worker on a fixed or variable length lanyard.

ManSafe for Roofing

What does the legislation say?

In April 2005 the HSE published the Work at Height Regulations (WAHR). These regulations brought together the relevant parts of the Construction (Health, Safety and Welfare) Regulations 1996 (CHSWR), the Workplace (Health, Safety and Welfare) Regulations 1992 and the Construction (Design and Management) Regulations (CDM).

These regulations all have references to working at height and are incorporated within the WAHR. The WAHR also implement the European Community Temporary Work at Height Directive (2001/45/EC), which is the second amendment to EC Directive (1989/655/EEC) on the provision and use of work equipment. These were further updated in 2007.

Construction (Design and Management) Regulations 2007 (CDM)

As with the original 1994 legislation, the Regulations continue to place duties on all those who can contribute to the health and safety of a construction project i.e. clients, designers, contractors and planning supervisors, requiring the production of certain documents, the health and safety plan and the health and safety file.

Specifically the designer's duties include the avoidance of risk to people

1. carrying out construction work
2. cleaning & maintaining
3. using a structure as a place of work
4. demolition & dismantling
5. others who may be affected by the above

The main changes in the 2007 Regulations were made to simplify the existing system by unifying CDM and the Construction (Health, Safety & Welfare) Regulations 1996 into a single package. Additionally there is a more explicit duty on architects to eliminate hazards and reduce risks during the design stage as far as is reasonably practicable, plus there is a new duty to ensure that workplaces comply with Construction (Health, Safety and Welfare) Regulations.

The legislation recognises that fall protection specifics are difficult to determine and hence legislate for. It allows some flexibility in interpretation and guidance but those responsible for providing adequate fall protection must be able to demonstrate that they have minimised risk, specified suitable equipment, considered the ability of the user and appreciated the conditions in which the system is likely to be used. The duty-holder must have evidence that these issues have been considered and addressed in the risk assessment.

In addition to these key pieces of legislation, the Booklet HSG 33 'Health and Safety in Roof Work' gives extensive guidance on how to work safely on roofs. It covers new buildings, repair, maintenance, cleaning work and demolition. It points to the principal problems, notably falls through fragile roofing materials and falls from unprotected roof edges and warns that many may undertake maintenance work with little or no experience of roof work or of working at height.

Latchways can advise and assist with compliance; for further information email: spec@latchways.com.



Quality products

Latchways' primary focus is to supply engineered fall protection products for all areas of industry, construction and maintenance. Installations include stadia, retail outlets, transmission towers, industrial complexes and notable sites such as Eden Project, Pier 6 at Gatwick Airport, Hong Kong Airport and Grand Central Station in New York. Latchways has worked closely with the major roofing manufacturers to produce a full range of fall protection systems for all designs and types of roofs.

Constant Force Fall Protection Innovation

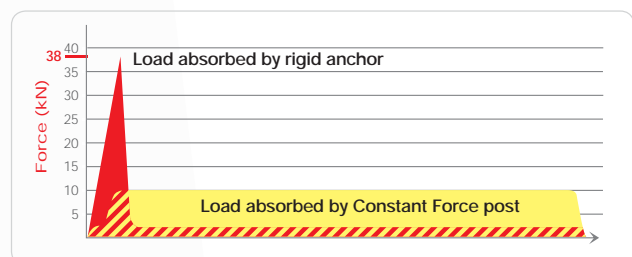
Latchways has taken the science of Constant Force and applied it to the fall protection industry providing an easy-to-install, reliable and cost-effective solution to rooftop safety.

The principles of fall arrest are based on effective load control. A system must be able to withstand the force of a person's fall and absorb the energy generated. Traditionally this was achieved by attaching the system to the structure of the building with the anchor point absorbing the load. This inherently caused difficulties for designers and installers as the system location was determined by the structural elements of the building.

System installation was time consuming as fixings had to be made from above and below. Such an installation method can create issues regarding warranties, leakage and cold bridging.

Latchways' Constant Force post does not need to be fixed to the building structure therefore simplifying installation (see pages 8 & 9). The Constant Force technology allows the load generated in the event of a fall to be absorbed through the entire system, as illustrated in the graph below.

Constant Force post performance compared against Rigid Anchor



ManSafe for Roofing

Legislation and equipment standards

In addition to 'in-house' evaluation, Latchways' products are tested externally by notified independent test bodies. All systems are CE marked and hold EC Declarations of Conformity.

The key European standards are:

- EN 353-1 Personal Protective Equipment (PPE) against falls from a height. Specification for guided type fall arresters on a rigid anchorage line
- EN 353-2 PPE against falls from a height. Guided type fall arresters including a flexible anchor line
- EN 341 PPE against falls from a height—Descender devices
- EN 354 PPE against falls from a height—Lanyards
- EN 355 PPE against falls from a height—Energy absorbers
- EN 358 PPE for work positioning and prevention of falls from a height—Belts for work positioning and restraint and work positioning lanyards
- EN 360 PPE against falls from a height—Retractable type fall arresters
- EN 361 PPE against falls from a height—Full body harness
- EN 362 PPE against falls from a height—Connectors
- EN 363 PPE against falls from a height—Fall arrest systems
- EN 364 PPE against falls from a height—Test methods
- EN 795 PPE against falls from a height—Anchor devices—Requirements and testing

The key standard is EN 795 which relates to the anchor devices. Developments in technology mean that the nature of the anchor device has changed. As such, Latchways conduct full roofing system tests (6 m x 6 m) to replicate the in-situ installation. This is a minimum requirement where top-fixed solutions are concerned.

Constant Force systems are recommended and approved for use by most roofing manufacturers.

Details of how the systems fit on all major roof types can be found in Latchways' ManSafe specifiers manual available on request or by visiting www.latchways.com.



Constant Force post: Fixing details

Latchways' Constant Force systems offer a complete fall protection solution for both fall restraint and fall arrest. The simplicity of the fixings allows a quick and easy installation providing safe solutions where workers are exposed to a fall hazard. System design can be verified with Latchways' software.

Latchways works with all major roof manufacturers. To see how posts fix to manufacturers' individual roofing systems visit www.latchways.com or ask for a ManSafe Specifiers Manual.

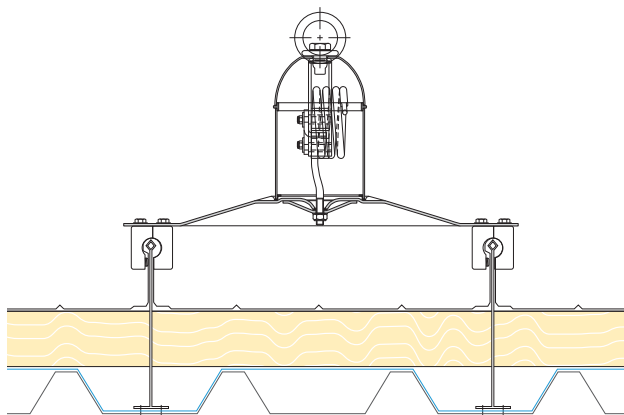
Email: spec@latchways.com for more information.

A variety of base plates are available to fit all roof configurations:

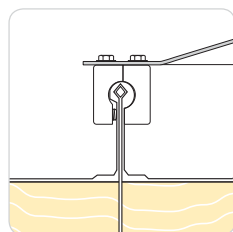
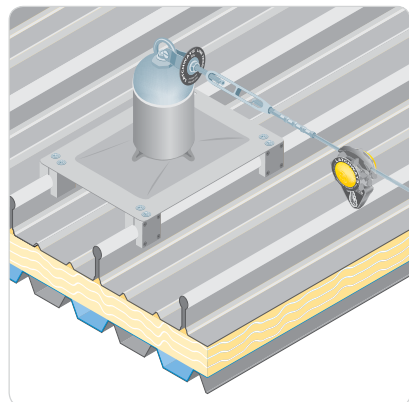
Roof type	Fixing dimensions (mm)
Standing-seam	300/305/333/400/500
Composite and built-up-on-site (BUOS)	250/300/333/400/500
Secret-fix	500/532
Steel deck	210/268/300/350/459
Concrete deck	210/268/300/350/459
Timber deck	210/268/300/350/459

Key advantages

- System technology limits load to 10 kN in the event of a fall
- Top-fixing ensures quick and easy installation
- Reduces cold bridging aiding compliance with Part L
- Does not invalidate roofing warranty
- System location not restricted to buildings' structural elements
- Option of powder coating posts to match roof
- Suitable for use on a roof pitch up to 15°

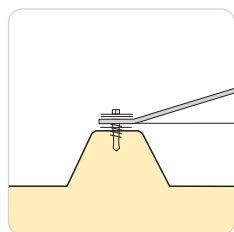
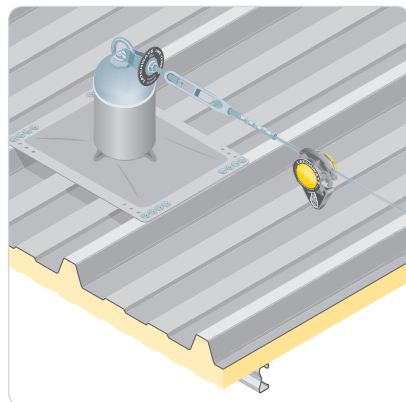


Constant Force post on standing-seam roofing



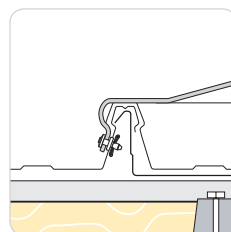
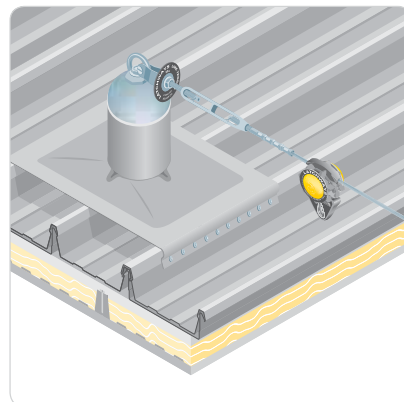
Fixing method:
4 split clamps

Constant Force post on composite/BUOS roofing



Fixing method:
16 stitching
screws/bulb
tite rivets

Constant Force post on secret-fix roofing

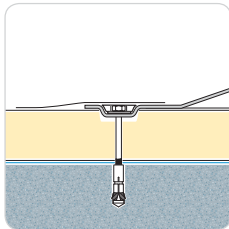
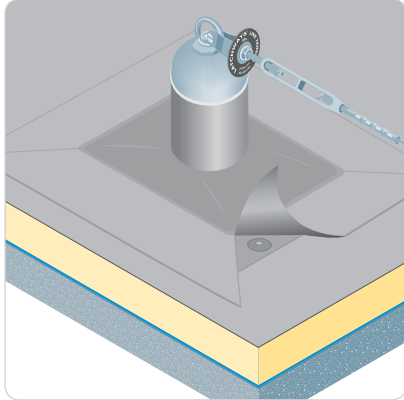


Fixing method:
20 bulb tite water
seal rivets

ManSafe for Roofing

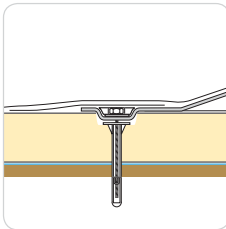
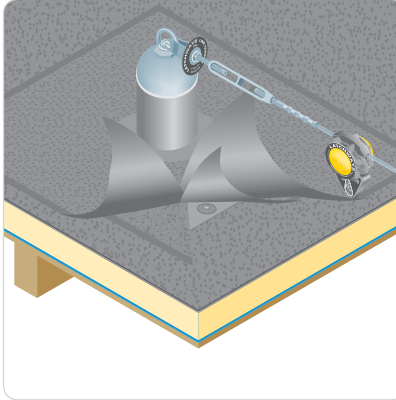
Constant Force post: Fixing details

Constant Force post on concrete deck flat roofing



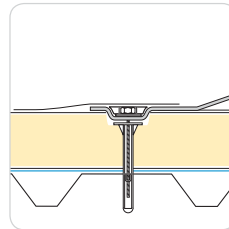
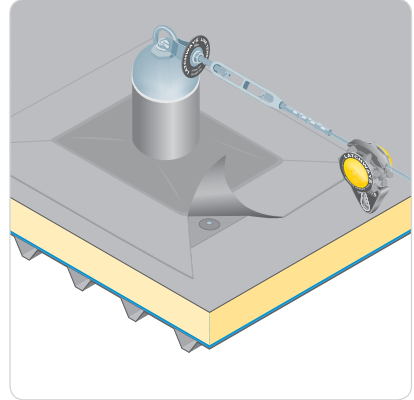
Fixing method:
4 M8 mechanical
fixing anchorages

Constant Force post on timber deck flat roofing



Fixing method:
4 toggle bolts

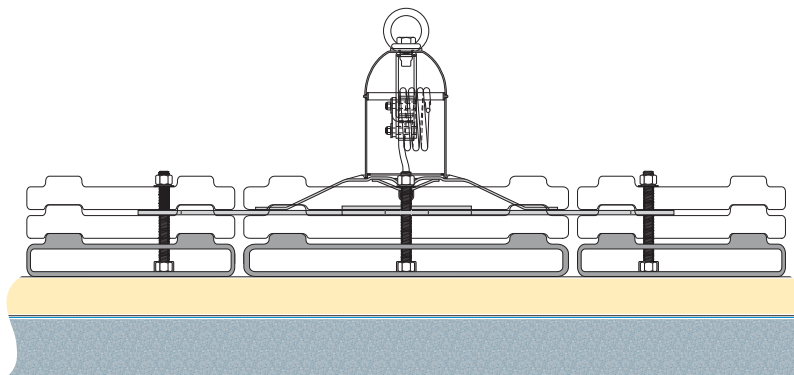
Constant Force post on steel deck flat roofing



Fixing method:
4 toggle bolts

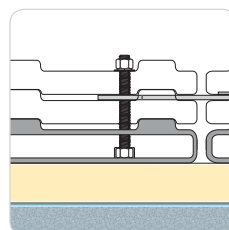
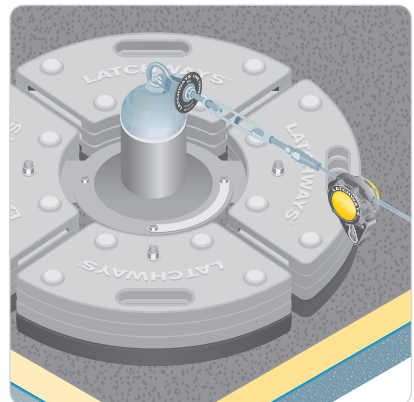
Freestanding Constant Force post

Freestanding Constant Force post is suitable for applications where roof penetration is not required or possible. It is available as a restraint or an arrest system and can be used singularly or in series, varying the number of sections to suit the application.



Dimensions of a 300 kg Freestanding Constant Force post

Freestanding Constant Force post on concrete deck flat roofing

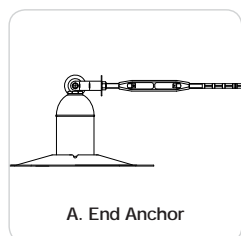
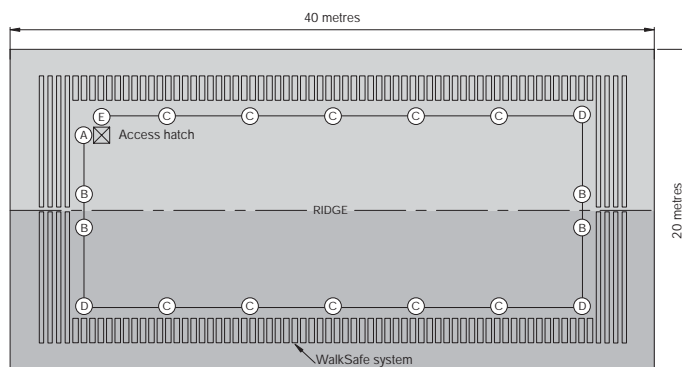


Consists of
weighted
segments

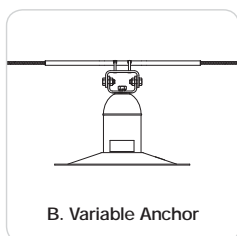
Constant Force post: System design

A typical roof layout for a perimeter system is illustrated identifying the different system components. Posts must not be spaced more than 10 m apart. Designers should try to ensure that access to all areas is achieved without the requirement for PPE (Personal Protective Equipment) adjustment. Latchways provides a bespoke system design service for your project requirements.

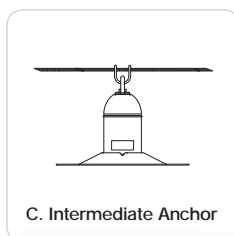
Email: spec@latchways.com for more information.



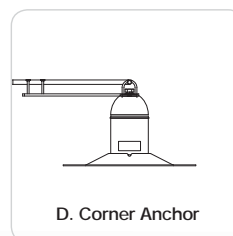
A. End Anchor



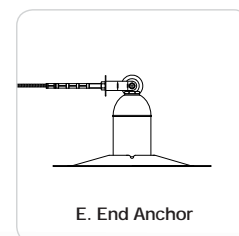
B. Variable Anchor



C. Intermediate Anchor



D. Corner Anchor



E. End Anchor

System components

The following components complete the system allowing hands-free operation. Latchways' components are manufactured in marine-grade stainless steel and are individually numbered to allow complete traceability. Inspection and maintenance are required annually.

Transfasteners

The user, wearing a full body harness and energy-absorbing lanyard, is continuously attached to the system with a Transfastener™, which rotates allowing it to pass through the intermediate cable supports. For systems on inclines over 15° a ClimbLatch device is required instead of the Transfastener.



Turnbuckle assembly

The turnbuckle assembly provides a cable termination and method of tensioning the system. The integral indicator disc will spin when the correct tension is reached.



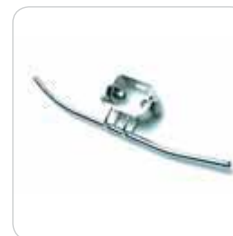
Swage & Clevis

The swage and clevis unit provides the method of terminating the cable at the opposite end of the system to the turnbuckle assembly.



90° Corner bracket

This one-piece corner bracket attached to an intermediate post provides an angle change of 90° within the system.



Variable bracket

This bracket attaches to an intermediate post and provides an angle change of between 0 and 80° both in the horizontal and the vertical plane.



D Ring & Hanger

The D ring and hanger form an intermediate cable support. The cable is threaded through the hanger allowing the Transfastener to travel the length of the system without disconnecting.

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WalkSafe system

In nearly all instances it is impractical to prevent roof access, therefore the ideal solution is to create a level, anti-slip surface with all fall hazards protected against. WalkSafe provides a demarcation route, guiding a workers' movement in areas where there are potential fall hazards. Manufactured from recycled PVCu, WalkSafe has an anti-slip surface and is attached to the rooftop.

In potentially highly trafficked areas of roofing, where regular access may be required for maintenance regimes, plant inspection, air quality monitoring, rooflight cleaning, etc, WalkSafe distributes the load evenly on the roof and thus reduces wear and tear on the roofing system itself.

WalkSafe is designed to work on all major roof systems: standing-seam, composite, built-up-on-site, secret-fix and single-ply membrane. Bespoke WalkSafe solutions for cementitious, slate and bituminous roofing are available upon request.

Key advantages

- Lifespan in excess of 25 years (BBA Certified)
- BBA Certified for slip resistance
- Manufactured from re-chipped window profiles and can be recycled
- Lightweight construction
- Designed for use on all major roofing systems
- Manufactured in the UK
- Fire resistance—Class 1Y against B476 fire resistance test
- Undergone full ACRM Fragility of Roofing Assemblies testing



WalkSafe: System layout

The orientation of the WalkSafe planks within a system is described as either shortways (running across the roofing profile) or longways (with the roofing profile).



The system can be configured in four ways to cover corners and change of directions:

As T-section, longways to shortways or vice versa, or as corner section either to shortways 'end' or longways 'side'.

ManSafe for Roofing

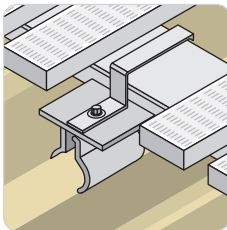
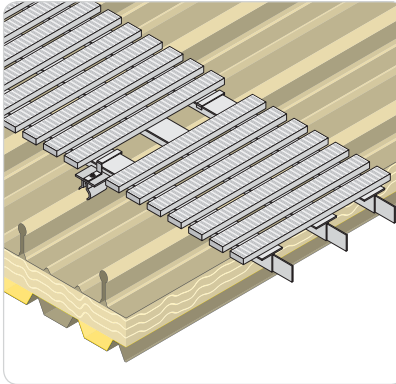
WalkSafe: Fixing details

Fixing information

The simplicity of the WalkSafe system allows a quick and easy installation.

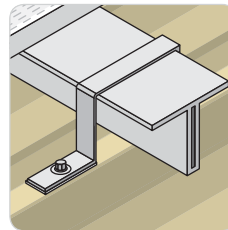
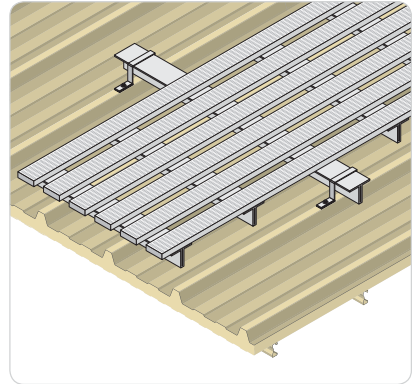
The 3-metre-long panels only require top fixing to the roofing system. In most cases the fixings are non-penetrative.

Shortways system on standing-seam roofing



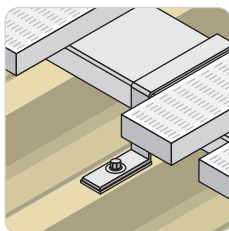
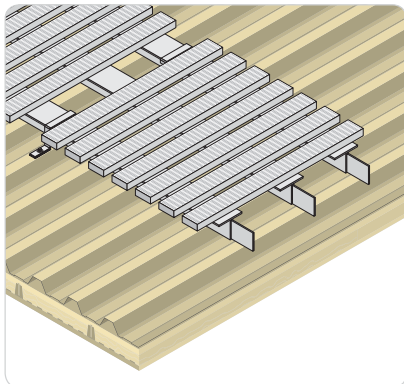
Fixing method:
Standing-seam
clamps

Longways system on composite roofing



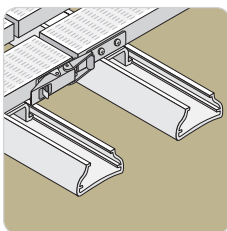
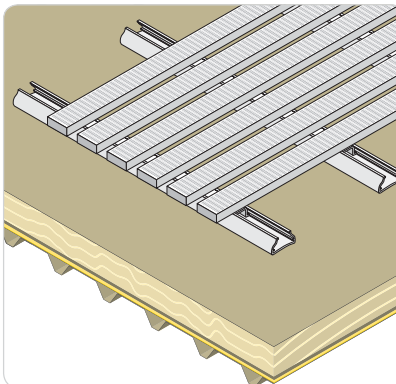
Fixing method:
Retaining brackets

Shortways system on built-up-on-site roofing



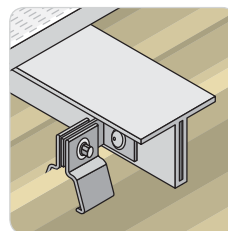
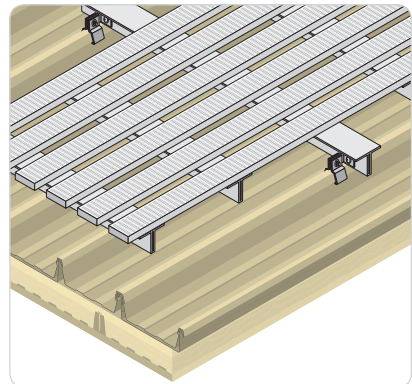
Fixing method:
Retaining brackets

Longways system on single-ply membrane roofing



Fixing method:
Self weighted—
panels are joined
with toggle clamp

Longways system on secret-fix roofing



Fixing method:
Secret-fix clamps

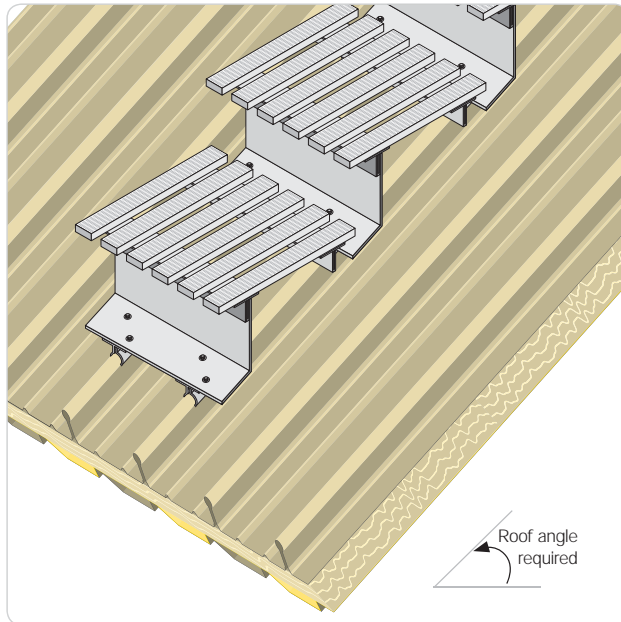
WalkSafe: Pitched roof system

WalkSafe's design flexibility allows it to be used as levelled walkways allowing safe access to all parts of the roof on slopes up to 15°, or as steps on steeper gradients.

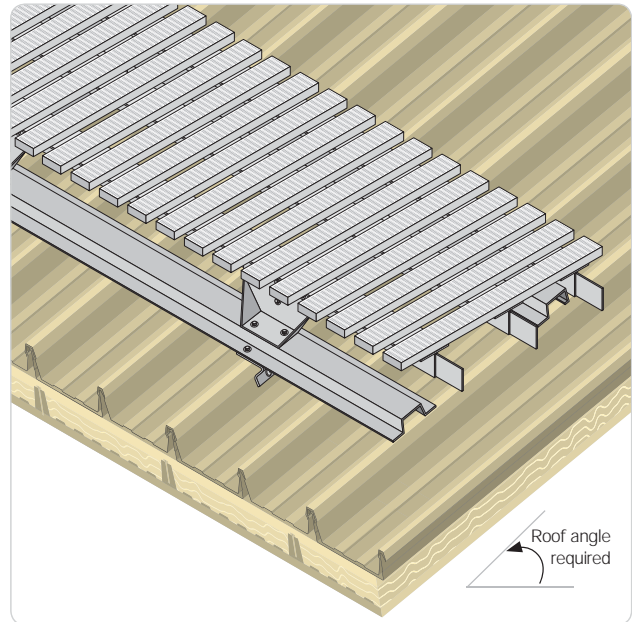
Where a level walkway is required it is key that the correct roof angle is identified as the levelling brackets are purpose-built for each job.

Traversing WalkSafe systems utilise different components to the stepped systems, therefore careful consideration must be given when detailing those areas which require access.

Steps on standing-seam

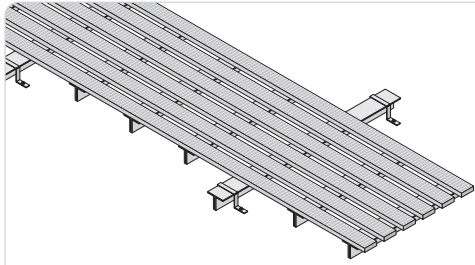


Traversing secret-fix

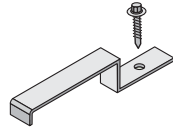


ManSafe for Roofing

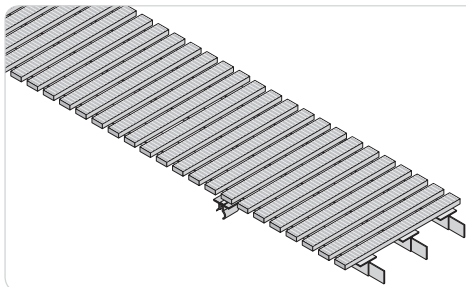
WalkSafe: System components



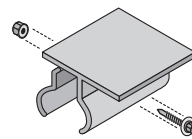
Longways system for composite roofing



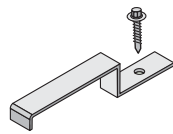
Retaining bracket



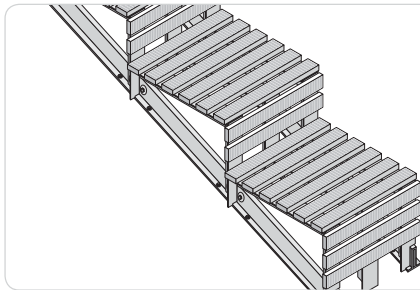
Shortways system for standing-seam roofing



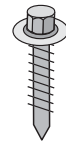
Standing-seam clamp



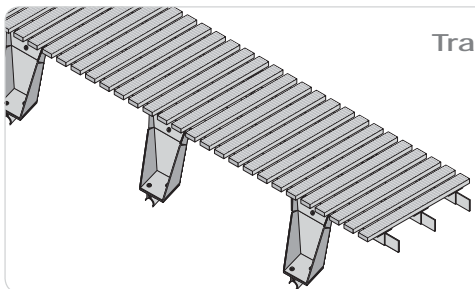
Retaining bracket



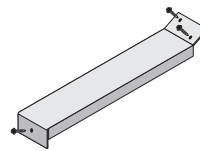
Stepped system for composite roofing



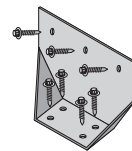
Self-tapping screw



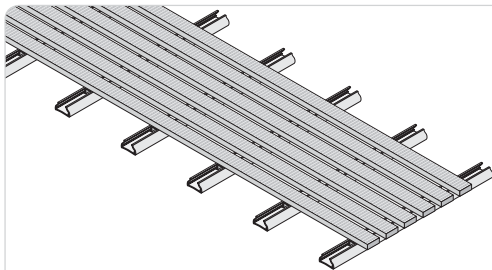
Transversing shortways system for standing-seam roofing



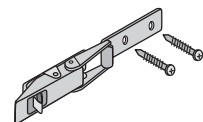
Support rail



Retaining bracket



Longways system for single-ply membrane roofing



Toggle clamp

VersiRail system

Where you need to restrict exposure to the hazard, the VersiRail® range offers an aesthetically-pleasing collective protection solution for flat surfaces up to a 10° slope. VersiRail comes as either a freestanding option where there is no need to drill or penetrate the roof, or as a fixed option which can be permanently attached to the roof.

Both freestanding and fixed solutions are available in three style choices; straight, curved or inclined and three finishes; natural, polished or powder coated to a RAL colour.

Freestanding VersiRail can also be supplied in a folding option to lie flat on the roof when the system is not in use.

A guardrail system should be designed to always provide a minimum edge protection height of 1100 mm. The fixed VersiRail system has upright supports that are available in various heights (from 300 – 1100 mm) to accommodate different parapet heights. For added safety VersiRail is supplied with kneerails as standard. Additional kneerails can be provided to meet individual requirement.

Key advantages

- Durable aluminium, corrosion-resistant construction
- Lightweight—quick and easy installation
- 30% lighter than steel alternative
- Fixed or freestanding (including folding) options
- Designer looks—three finishes available
- Adaptable, modular easy-fix system
- Fully weatherproof
- Tested and certified in accordance to EN 13374 and EN 14122-3
- No need for annual inspection
- Versatile—can be designed for any flat roof plan
- Available in three styles—straight, curved, inclined
- Freestanding option—no need to penetrate the roof
- Fixed option—a range of different heights to meet your needs (300, 500, 700, 900, 1000 and 1100 mm)



VersiRail: Freestanding upright



VersiRail: Fixed upright

Straight upright

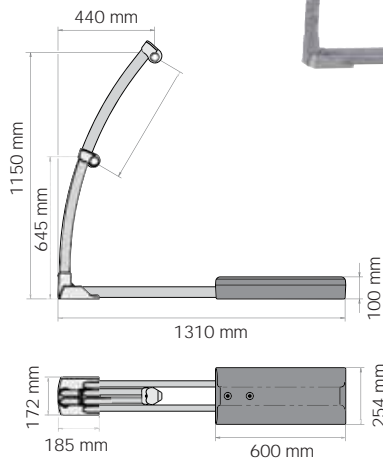
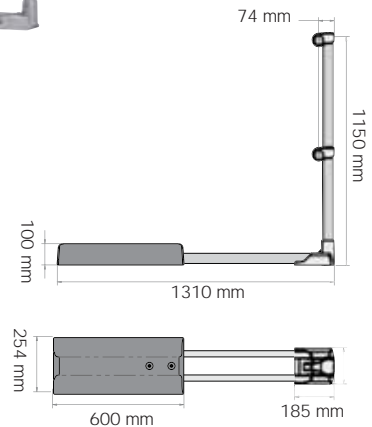
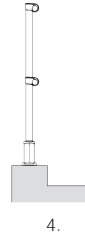
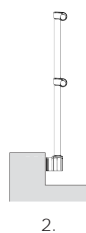
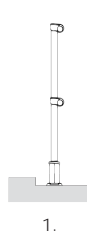
This simple design fits in perfectly with the clean lines and contours of a building.

The straight upright system is particularly suitable for protection at access points and demarking walkways.



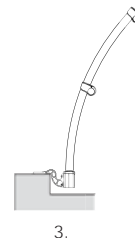
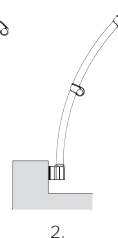
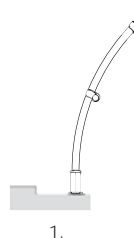
Straight upright system with:

- 1) Slab mounting plate
- 2) Wall mounting plate
- 3) Z-type mounting plate
- 4) Parapet mounting plate



Curved upright system with:

- 1) Slab mounting plate
- 2) Wall mounting plate
- 3) Z-type mounting plate
- 4) Parapet mounting plate



Curved upright

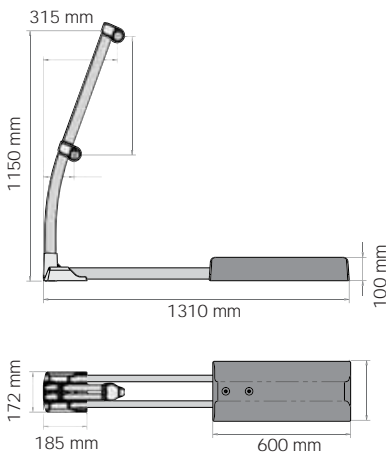
Whilst providing the primary function of collective protection, the curved upright system compliments the design of a building.

This solution also keeps people further from the roof edge, providing a greater level of safety.

VersiRail: System options

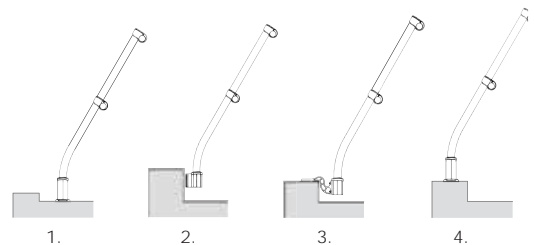
Inclined upright

This variation is inclined at 20°, which adds to the aesthetics of the system whilst making the system less visible from ground level. The result is better integration of VersiRail into the building design.



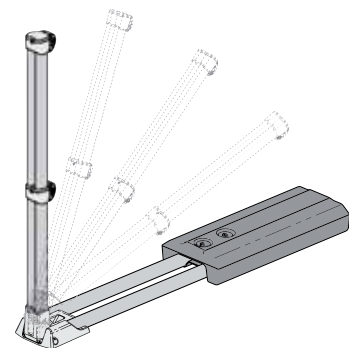
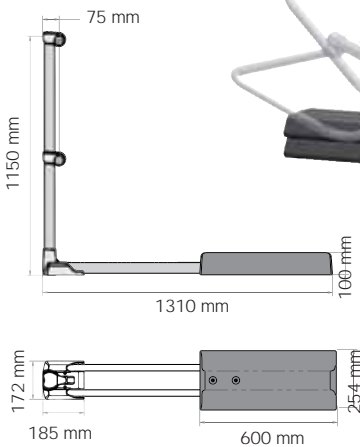
Inclined upright system with:

- 1) Slab mounting plate
- 2) Wall mounting plate
- 3) Z-type mounting plate
- 4) Parapet mounting plate



Freestanding folding

When collective protection is not being used, the folding uprights of this variation lie flat and are concealed when viewed from ground level, combining safe with architectural aesthetics. Available in straight, curved or inclined styles.

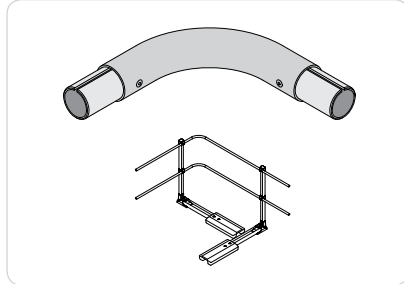


ManSafe for Roofing

VersiRail: System components

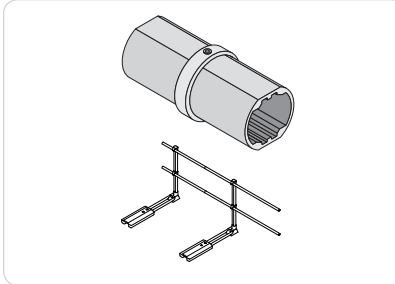
Ancillary items

VersiRail is exceptionally flexible in its application through modular easy-fix components allowing a wide range of configurations.



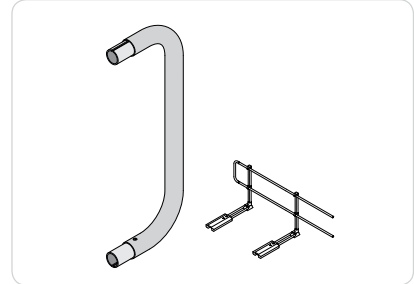
Corner sections

Where a change in system direction is required a standard 90° corner section can be supplied, or specific corner sections of between 45° to 175° can be made to order.



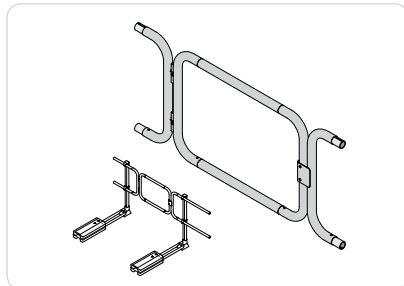
Connecting elements

T-Junctions, 45 – 45 corner sections and junction parts are all available to accommodate all system layouts.



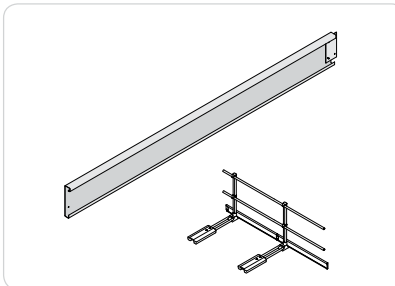
Closure bends

In situations where VersiRail needs to terminate and cannot be attached directly to a structural element, a closure bend can be specified. This same part can be incorporated into a length of system to designate a safe entry/exit point.



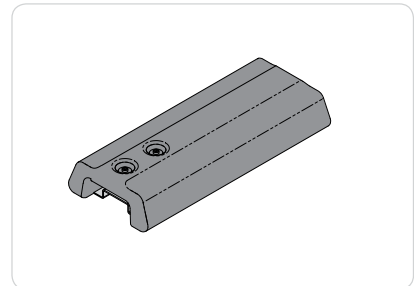
Access gate

Where VersiRail prevents access to a fall hazard such as a rooflight or trap door, but access may be needed for maintenance, the access gate can provide trained personnel controlled access to these areas.



Toeboard

On rooftops or surfaces where there is no parapet at the fall edge (or a parapet of less than 100 mm high) a toeboard can be affixed to the base of the VersiRail.

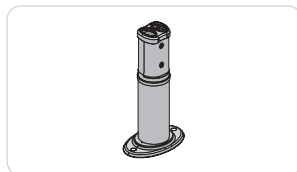


Additional counterweights

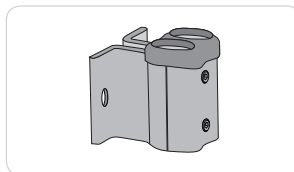
Slab mounting plate
(200, 250 or 300 mm high)

Fixing options

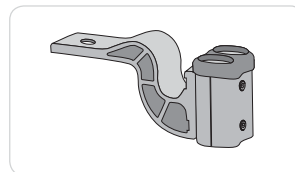
There are a number of brackets available for fixing on or to parapet walls using either M10 or M12 bolts. These fixings should also be chemically sealed where possible. It is essential to check the suitability of material that the fixed VersiRail is to be installed on.



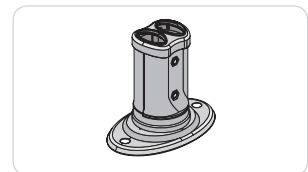
Slab mounting plate
(200, 250 or 300 mm high)



Wall mounting plate
(open option available)



Z-type mounting plate



Parapet mounting plate



ManSafe®