

ManSafe®

A Specification Guide for
Wind Turbines

TowerLatch®
ManSafe® Sealed SRL



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Latchways plc

Expertise from Experience

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Latchways plc Expertise from Experience

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Latchways plc Expertise from Experience

1



Latchways plc Expertise from Experience



Latchways plc—the global leader in fall protection solutions—is a UK based plc focussing on the design, manufacture and installation of a diverse range of products. Our products provide a complete fall protection solution for a variety of applications including industry, roofing, aircraft, windows, telecoms and utilities.

Latchways' systems can be seen installed globally on a diverse range of buildings and structures, from Hong Kong Airport and Manchester Stadium to the Sydney Harbour Bridge and Grand Central Station. The versatility, dependability and ease of use of Latchways ManSafe® systems makes them ideal for protecting people as they go about day-to-day activities such as maintenance, cleaning, access and inspection. Latchways is ISO 9001 certified for quality and ISO 14001 certified for environmental conformity.



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Sydney Harbour Bridge



Manchester Stadium



Hong Kong Airport



Grand Central Station

Latchways in the Wind Energy Industry

Latchways experience now encompasses onshore and offshore wind farms. With customers including wind farm owners, developers, global turbine manufacturers, construction/operations and maintenance contractors now adopting Latchways products and solutions.

The ManSafe® Sealed Self Retractable Lifeline (SRL)—when combined with a fixed, custom-made post—allows safe, unhindered access for an offshore turbine from boat to pile. Once inside the turbine (onshore or offshore), a vertical cable-based fall protection system allows a hands-free solution for ascending the ladder.

Latchways plc

Expertise from Experience

Global Capabilities

With over 30 years experience and a worldwide installer network, Latchways has established themselves as the global leader in fall protection. Latchways revolutionised the industry with its patented Constant Force® technology and the company continues to innovate, with new systems designed and manufactured specifically for the wind energy industry.

With offices and approved installers located globally, Latchways has the capacity to specify and install systems to all industries—no matter the location.

Company Capabilities

An essential aspect of Latchways is the continuous investment and commitment to extensive research and development, to ensure that the right materials are used in all its fall protection systems. Latchways is at the forefront of the industry sectors including electricity companies, turbine manufacturers and operational/management companies to ensure appropriate fall protection systems can be provided in response to any innovations in the marketplace. In addition, Latchways has the knowledge and flexibility to respond to bespoke needs and have produced purpose-designed systems for a diverse range of special applications.

Financial Status

Since its listing on the London Stock Exchange in 1997, Latchways plc has continued to take an increasing share of the fall protection market; whilst the development of new products—for both new and existing markets—continues to provide ample opportunity for future investors.



World leaders in fall protection

Membership and Associations

Latchways is an active member of the leading associations and works closely with the key authorities in the wind energy industry, bringing its unique expertise to all safety aspects that are involved with ladder access to both onshore and offshore wind energy facilities—ensuring Latchways remain at the forefront of industry developments, innovation and legislation. These include the American Wind Energy Association (AWEA), RenewableUK and the European Wind Energy Association (EWEA). To aid the procurement process, and guarantee piece-of-mind for the customer, Latchways is fully registered as a supplier on the Utilities Vendor Database.



Photography courtesy of Vestas



Latchways plc

Expertise from Experience

Quality Control (ISO 19001)

Latchways plc provides products and services that are accurate, reliable, repeatable and compliant with specifications and appropriate regulations. These, together with timely delivery of products, documentation and services are central to our operating policy.

To meet these commitments, we have implemented a Quality Management System (QMS) complying with the international standard ISO 9001:2008. In addition we are committed to continually improving the effectiveness of our QMS and have set relevant quality objectives against which we monitor our performance.

The QMS is implemented, reviewed, updated and audited through our management structure. The QMS and associated procedures are communicated regularly to all employees and are made available on the company's intranet.

Environmental Policies (ISO 14001)

Latchways has identified its environmental impacts and works to reduce them through continuous development of an Integrated Management System which meets the requirements of the ISO 14001:2004 standard. Latchways aim to protect and improve the environment through good management and by adopting 'best practice' wherever possible. On a practical level, Latchways strive to:

- Prevent pollution to land, air and water.
- Reduce water and energy use.
- Minimise waste and recycle within the framework of our waste management procedures.
- Provide suitable training to enable employees to become better prepared in managing their environmental impacts.
- Establish objectives and targets to measure the continuous improvement in our environmental performance.



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Corporate Social Responsibility

Latchways plc has embraced the concept of Corporate Social Responsibility by acknowledging the principles set out in the UN Global Compact and through the enactment of various company-wide policies and procedures. In this way, Latchways is able to influence and guide its operations in the manner with which they impact society and the environment.

Health and Safety Policy

Latchways is committed to promoting and preserving the health, well-being and safety of employees and contractors not only within their own premises but also on-site. This is achieved by compliance with the relative legislation and also by adopting the principles of the OSHAS 18001:2007 standard.

Employment Policy

Latchways operates as an equal opportunities organisation—treating all employees fairly, equitably and with respect. Latchways ensure that all employees are given the opportunity to learn, and are trained in such a way that they have the requisite of skills and knowledge to not only contribute to the company effectively but also develop in order to meet personal needs.

Insurance Liability

Latchways has developed—with the aid of their long-term insurance broker—an insurance programme to suit the many facets of the business. Based on this programme, Latchways maintains insurance policies with first-class UK insurance companies covering all liability issues such as employers liability, product liability, public liability, professional indemnity, contract works and motor vehicles.

Business Continuity Plan

Latchways recognises that fall protection forms a time-critical part of wind energy projects. To this end, we've investigated the potential risks that exist to our production facilities and wider business, from a power-cut to a catastrophic event, and the impact that they could have. Should an unfortunate event occur, our recovery strategy and policies are compiled within our business continuity plan.

Latchways plc Expertise from Experience

Performance

As an ISO 9001 company, quality is central to all development, design and manufacturing procedures and is embedded into every aspect of the Latchways business process.

Development: A dedicated design and specification team use the latest CAD/CAM and 'Pro-engineer' software to simplify the modelling and testing of alternative design and loading strategies—helping to ensure the most appropriate system is specified for any application. During product development, prototypes are subjected to comprehensive testing including: static strength, corrosion resistance, locking, conditioning and dynamic performance. Testing is conducted in Latchways' own laboratories and the products are then submitted to notified bodies for independent verification.

Design: Latchways systems are designed to maintain the integrity of the structure—not putting unnecessary strain on the structure to which it is fixed—yet provide a discreet and aesthetically pleasing solution. Whilst being of suitable quality, a Latchways cable-based fall protection system is comparatively lightweight and is designed not to encumber the user attached to the system. The individual components are easy to handle, further simplifying user and installation procedures.

Manufacturing Procedures:

In production, each individual system component is manufactured to the highest standard using the most appropriate materials—chosen to give maximum corrosion resistance. A high proportion of components are made from marine-grade 316 stainless steel, and all critical cast components are made from 17/4 PH grade stainless steel—these components are then subject to X-ray inspection and either dye-penetrant or magnetic-particle analysis. A Latchways vertical cable system uses stainless steel cable which is 8 mm in diameter and 1 x 19 in construction—which provides excellent resistance to corrosion and wear. A Latchways cable is expected to remain safely useable for up to 20 years and, as standard, every component will perform to a factor of safety 2.5—the steel bracketry is electro-polished to enhance corrosion resistance. Every part of every system is individually inspected and finally, every product is marked to provide complete traceability.



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Adherence to Standards

Latchways ensure that all products are tested beyond the requirements of relevant legislative standards. A minimum factor of safety 2.5 is applied to all tests resulting in products out-performing industry legislation.

Independent testing is carried out to further verify the inherent quality and durability of Latchways systems. This also ensures complete compatibility between Latchways products and tower internals.



Latchways' Bespoke Service

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Latchways' Bespoke Service

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Latchways' Bespoke Service

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Latchways' Bespoke Service

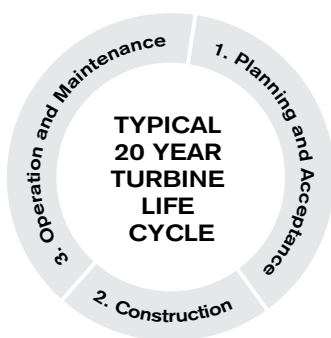
Understanding the Turbine Life Cycle

Latchways' has established close working relationships with all levels of companies involved in the life cycle of a turbine from design and construction, through to operation and maintenance. These include:

- Electricity Companies
- Turbine Manufacturers
- Tower Internal Manufacturers
- Build Contractors
- Operation and Maintenance Companies.

The establishment of such relationships means that Latchways is well placed to offer customers expert support and advice. These relationships also give Latchways a unique insight into individual customer requirements and an unrivalled ability to satisfy those requirements.

Latchways' experience of the Wind Energy industry and product flexibility, ensures they can be involved at any stage of a typical turbine life cycle.



1. Planning and Acceptance

Bespoke Service

Whilst the performance of the fall arrest system is only one element of the total turbine—and the only part that Latchways is responsible for—Latchways take into consideration all the tower internals to ensure that, should a fall occur, the fall is arrested and the integrity of the turbine is maintained.

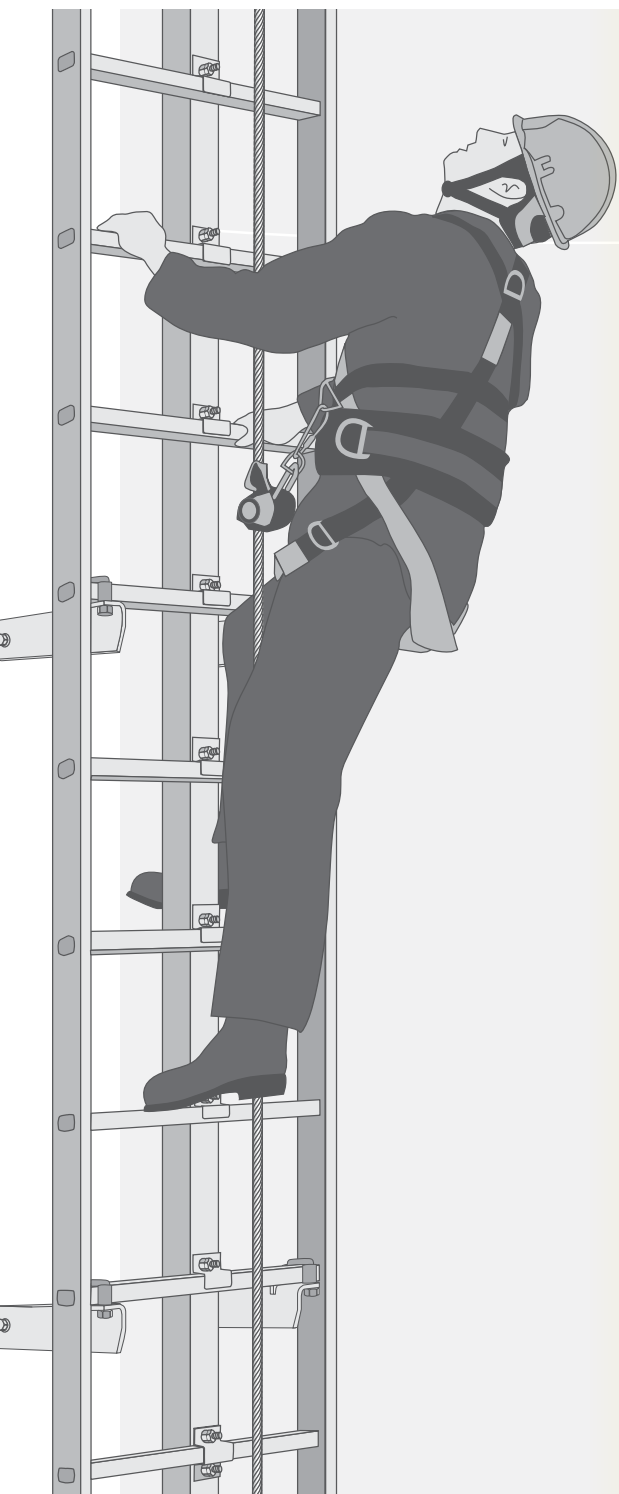
Considerations

For any turbine, Latchways consider the following elements:

- What is the ladder type?
- How and where is the ladder fixed back to the turbine wall?
- What is the internal layout?
- Is a lift incorporated?
- Does the lift run on the ladder?
- What is the clearance at the platform hatch doors?
- Does the ladder go down into the basement for access to the transformer?

Not only will Latchways ensure that the most appropriate fall protection solution is specified (to be compatible with other tower internals), but that the ladder to which it is fixed is suitable, and furthermore, that the way in which the ladder is fixed to the turbine is also structurally 'sound' to work with the fall protection system should a fall occur.

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When specifying a system, Latchways undertakes a series of steps to ensure that the total system is engineered to perform.

1. Survey the internal ladder layout and fittings.



Surveying

2. Acquire the specific ladder model from the manufacturer Construct a test rig to replicate the layout at Latchways' own testing facility.



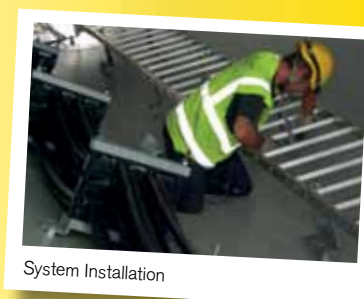
Ladder Procurement

3. Install the cable system onto the ladder in order to perform the relevant system performance tests e.g. static load tests.



Ladder Testing

4. Install a fall protection system for onshore/ offshore application.



System Installation

Latchways' Bespoke Service

1. Planning and Acceptance

When a Latchways system is specified as the fall protection system (whether onshore or offshore), time is spent with the manufacturer to develop optimum solutions suited to their specific tower internals.

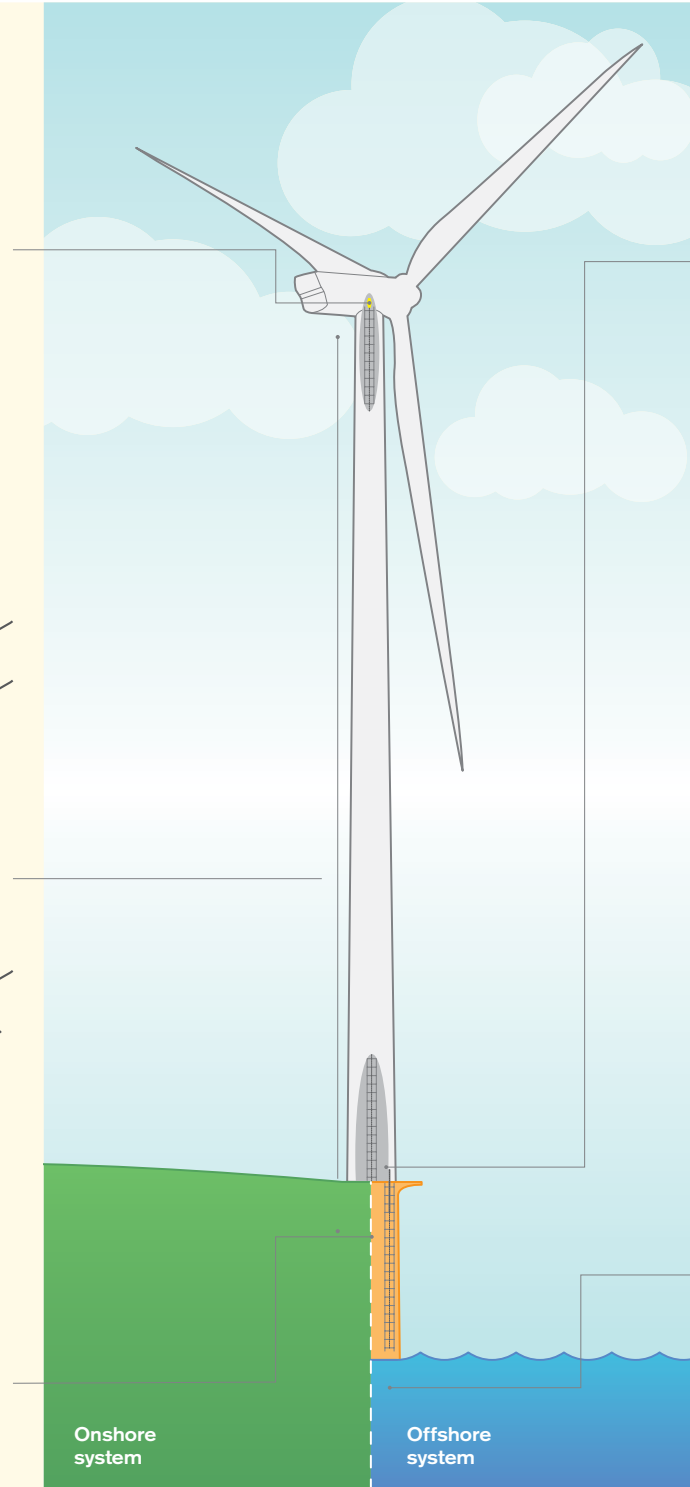
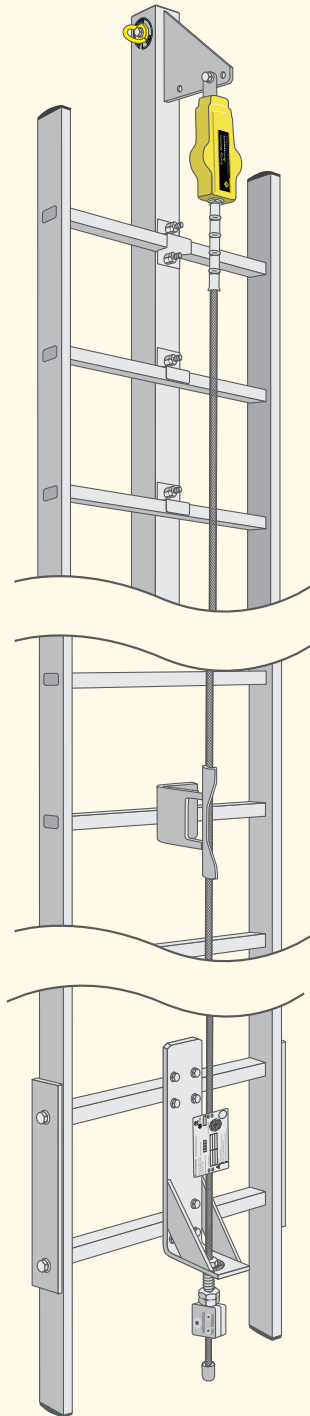
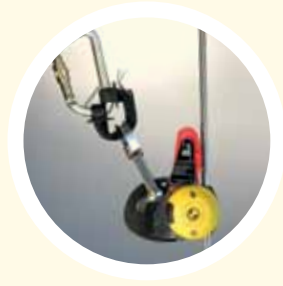
Latchways offers fall protection solutions for turbines both onshore and offshore.

Inside the turbine, the TowerLatch® cable system—for internal aluminium ladders—provides safe, permanent attachment without the need to remove the cable from the intermediate wire guides.

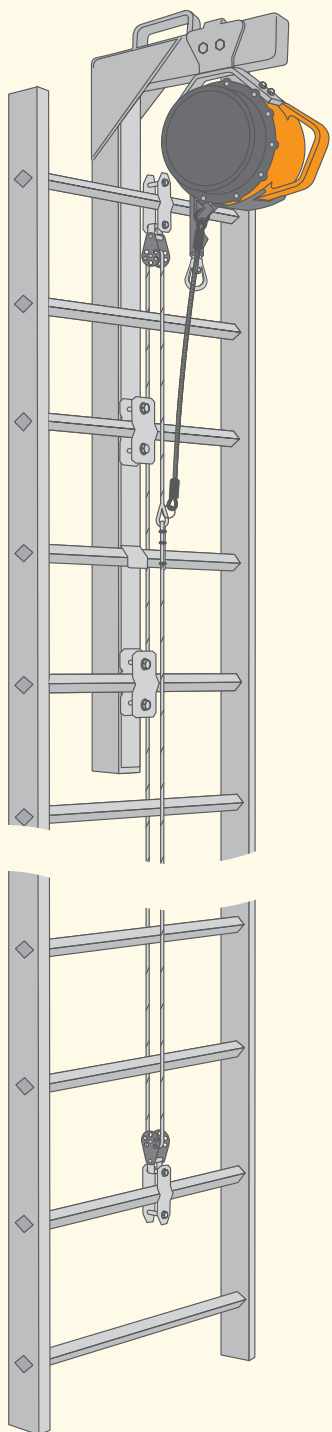
For ascending the internal ladder of a turbine

A vertical cable-based fall protection system allows a hands-free unhindered solution for ascending the ladder within a turbine, suitable for both new build and retrofit.

The system has been designed to be used with the TowerLatch® unit—a device that secures the climber to the cable via the chest D-ring on their full body harness. In the event of a fall the device immediately locks onto the cable, and arrests the fall. A built-in webbing stop then facilitates a rescue using the industry used 'cut-away' technique.



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The ManSafe® Sealed Self Retractable Lifeline (SRL)—when combined with a fixed, custom-made post—allows safe, unhindered access from boat to pile.

For access to offshore turbine

The ManSafe® Sealed SRL has been specifically designed for use in harsh marine environments such as offshore turbines. The modular design allows quick and easy servicing which can be undertaken on site with minimal specialist tools (following Latchways training). Once mounted on a specially-designed post, and combined with a pulley-based tether line, the SRL is easily accessible by the user from the boat.

2. Construction

The flexibility of a Latchways system means it can be installed at any stage in a turbine life cycle whether it be at the manufacturing stage, at the construction phase or as part of a retrofit programme.

Manufacture

Latchways can work closely with turbine manufacturers at production stage to fit systems and therefore ease the construction process.

Construction

During the construction phase, Latchways can install their systems both onshore or offshore.



Onshore



Offshore

Retrofit

Latchways can not only retrofit their own systems, but can simultaneously remove any existing systems they may be replacing.

Latchways' Bespoke Service

3. Operation and Maintenance

Installation and User Training

Latchways has a comprehensive training programme.

The training is split into two parts—Theory and Practical (if facilities allow).



Theory Training Session:

- Individual system layout.
- Overview of major standards.
- Installation methods.
- Temporary system installation method (if applicable to the installation).
- User instructions—for use of the attachment device.
- System inspection—for which a 'Safe to Climb' certificate is then issued.
- Written theory test.

Practical Training Installation:

- Installation (under supervision).
- Use of the system.
- Practical assessment.

All training can be conducted either within Latchways' facilities or at the customer's premises. Latchways record all details of any training undertaken. A certificate and photo ID card are issued to all personnel who successfully complete the programme—which can be renewed on an annual basis up to a maximum of 5 years.



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Supporting Documentation

All Latchways systems and componentry are supported by comprehensive documentation describing installation procedures, user instruction, inspection and testing requirements.

'Safe to Climb' certificate

A 'Safe to Climb' certificate is issued once the system has been installed and can be used as a reference document for inspection.

Inspection

No maintenance is required for a Latchways cable-base fall protection system. However it is necessary that the complete system is inspected by suitably qualified personnel.

Key system checks on an internal cable system:

A pre-climb check must be undertaken each time the system is used. The integrated tension indicator disc, located at the base of the system, allows for this check to be made easily before the user even attaches to the system—if the disc spins freely, the technician can then attach themselves to the cable and start climbing on the ladder.



Compliance to Standards

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Compliance to Standards

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Compliance to Standards

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Compliance to Standards

Compliance to International Standards

International Standards

Latchways systems comply with the major international standards in Europe, US, Canada, Australia and New Zealand.

Europe

See following pages.

Canada

- CSA Z259.2.1-1998, "Fall Arrestors, Vertical Lifelines and Rails"

USA

OSHA (Occupational Safety & Health Administration) regulations are:

- 29 CFR 1910—Occupational Health and Safety Standards for General Industry.
- 29 CFR 1926—Safety and Health Regulations for Construction, Subpart M—Fall Protection.

ANSI (American National Standards Institute) standard is:

- ANSI Z359.1-2007 (which detail the components of a personal fall arrest system, performance requirements, test methods, etc.).

Australia and New Zealand

- AS/NZS 1891:4 2000.

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Latchways' advice on the withdrawal of standard EN 353-1: 2002

2010

Commission Decision of 19 March 2010 withdrawing the reference of standard EN 353-1:2002 'Personal protective equipment against falls from a height — Part 1: Guided type fall arresters including a rigid anchor line' in accordance with Council Directive 89/686/EEC.

(notified under document C(2010) 1619) (2010/170/EU)

Article 1: The reference of standard EN 353-1:2002 'Personal protective equipment against falls from a height—Part 1: Guided type fall arresters including a rigid anchor line' is withdrawn from the list of harmonised standards published in the Official Journal of the European Union.

2011

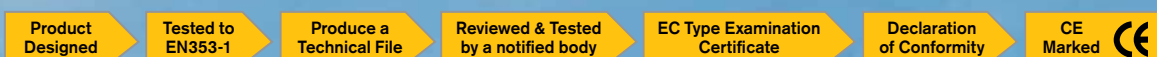
With the withdrawal of EN 353-1: 2002, a new test method has now been adopted by the industry group of notified bodies known as the VG11—these test methods were developed by CEN TC160 working group 2.

Latchways vertical systems have now been submitted, tested and have passed this new test method at Dekra Exam GmbH—copies of the full test report and certificate are available on request. It is anticipated that this test method will be accepted by the CEN TC160 and the PPE expert group of the European Commission and EU member states and once again become a harmonised standard under the PPE Directive.

The PPE Directive

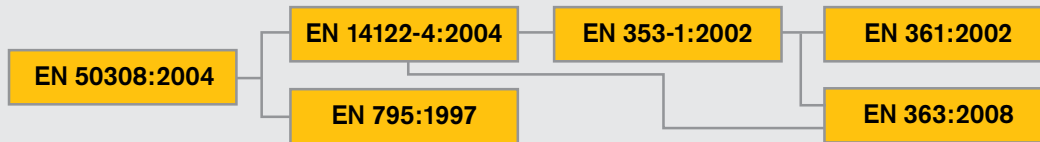
The PPE Directive (Personal Protective Equipment), is the major directive to which Latchways manufactures their products. Under the PPE Directive, fall arrest equipment must be CE marked if to be considered fit-for-purpose.

Latchways undertakes a rigorous process to achieve this marking on their products:



Compliance to Standards

European Standards



Latchways systems comply with European turbine standard EN 50308:2004

Latchways has conducted a review of standards relevant in the wind industry specifically related to Wind Turbines. We have listed these standards which contain requirements for compliance or performance pertaining to products used inside the turbine towers. A summary list of these standards is:

EN 50308:2004—Wind Turbines—Protective Measures—Requirements for design, operation and maintenance.

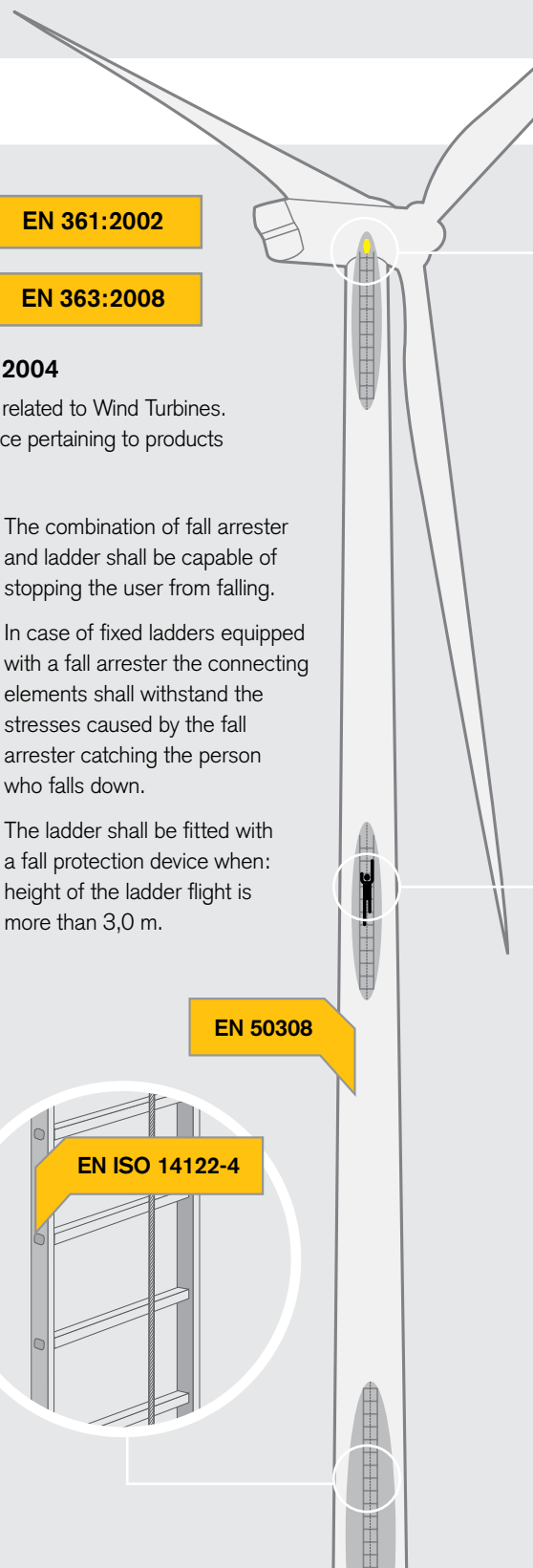
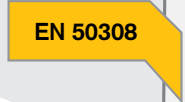
- Contains certain requirements for Fall Protection Systems and anchor points.
- Contains the requirement to comply with EN 14122-4:2004.
- Contains the requirement to comply with EN 795:1997
- Refers to EN 14122-4 and EN 795 as indispensable normative references for the application of this document.
- A ladder shall be safeguarded by an anti-fall device comprising of an anchor line and fall protection mechanism if the vertical height exceeds 3,0 m.
- Anchor points offer an opening having a minimum size of 30 mm diameter, a cross section diameter with a maximum of 20 mm and be calculated for a concentrated load of 20 kN.
- Anchor points should be coloured yellow.

- All flexible anchorage lines shall be of wire rope construction. Synthetic fibre or textile ropes shall not be used.
- Personal Protective Equipment includes full body harness, lanyard, energy absorber to reduce the braking force to 6 kN, protective helmet, ear protection, protective footwear, gloves, eye and ear protection, thermal clothes.
- A sufficient number of fall arrestors shall be available on a wind farm to equip persons required to undertake simultaneous activities in or on wind turbines requiring their use.

- The combination of fall arrester and ladder shall be capable of stopping the user from falling.
- In case of fixed ladders equipped with a fall arrester the connecting elements shall withstand the stresses caused by the fall arrester catching the person who falls down.
- The ladder shall be fitted with a fall protection device when: height of the ladder flight is more than 3,0 m.

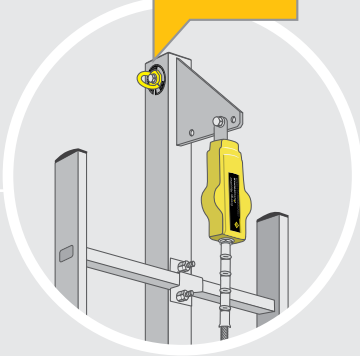
EN ISO 14122-4:2004—Safety of Machinery Permanent means of access to machinery—Part 4 : Fixed Ladders.

- Contains the requirement for Fall Protection systems to comply with EN353-1:2002.
- Refers to EN 353:1 and EN 363 as indispensable normative references for the application of this document.



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EN 795



EN 795



EN 353-1

EN 361



- An appropriate individual fall protection device is able to arrest a fall better than a cage.
- Fall arresters shall meet the relevant requirements of EN 353:1.
- Ladders with fall arresters shall be permanently marked with the following information— type of fall arrester and year of manufacture— notice: “Use of Personal Protective Equipment is mandatory”.

EN 795:1997—Protection against falls from a height—Anchor Devices— requirements and testing Class A1 (single point anchors).

- Is a product standard.
- Specifies the requirements, test methods, instructions for use and marking for anchor devices designed exclusively for use with personal protective equipment against falls from a height.
- Class A1 structural anchors designed to be secured to vertical, horizontal and inclined surfaces.
- Specifies a static strength test of 10 kN for 3 minutes in the direction in which the force can be applied in service.

EN 353-1:2002—Personal Protective Equipment against falls from Height— Part 1: Guided type fall arresters including a rigid anchorage line.

- Is the standard for vertical fall arrest systems.
- Specifies the requirements, test methods, marking, information supplied by the manufacturer.
- Specifies a full body harness complying with EN 361 must be used.
- Specifies the braking force should not exceed 6 kN and the arrest distance H shall not exceed 1,0 m.
- Specifies static strength test of 15 kN.

EN 361:2002—Personal protective equipment against falls from a height— full body harnesses.

- This is the standard for full body harnesses.
- Only a full body harness which complies with EN 361 should be used with a Latchways cable system. The Latchways TowerLatch® should be connected to the chest D-Ring on the full body harness.

Compliance to Standards

Testing on a Vertical ManSafe® System

'Fall Back' Testing

To ensure that Latchways' systems out-performed the standard that was previously required (EN 353-1), further rigorous testing has been undertaken to meet the requirements of the PPE Directive.

Testing was carried out to determine the ability of the Latchways system and device, to arrest a fall, then tested with an anthropometric dummy of two different weights (71 kg and 100 kg) in four different positions, resulting in 8 different tests:

Fall-back

With both legs straight the dummy's feet are placed on same ladder rung at either side of the fall arrest line. With the dummy's spine in a vertical attitude adjacent to the ladder, both arms/hands are left to hang freely at either side.

Sit-back

Both feet are placed on the same ladder rung at either side of the fall arrest line and both thighs are set almost perpendicular to the ladder. With the dummy's spine in a near vertical attitude, both arms/hands are left to hang freely at either side.

Climb-fall

With the dummy's spine in a vertical attitude, the legs are set in a climb position with the feet staggered between two vertically adjacent ladder rungs. The lower leg is straight, and upper leg bent with both arms/hands left to hang freely.

Fall-down

With the dummy in a vertical attitude, both hands are positioned on the same ladder rung at either side of the rail, with both legs hanging freely off the ladder.

The dummy was attached to the vertical system by the front attachment point of a full body harness to the system on an aluminium ladder released to fall freely, via an overhead quick release mechanism.

The tests were conducted and verified by independent test house TUV/NEL, for which an extract of test results are detailed below (full test reports are available on request).

DESCRIPTION (dummy position and weight)	RUNNER ARRESTED (vertical displacement of trolley on cable)	DUMMY DROPPED (vertical displacement of dummy)	RESULT
FALL BACK 71 kg	85 mm	1.09 m	PASS
SIT BACK 71 kg	220 mm	1.41 m	PASS
CLIMB FALL 71 kg	175 mm	1.24 m	PASS
FALL DOWN 100 kg	105 mm	0.74 m	PASS

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Dummies in pre-test positions



FALL BACK



SIT BACK



CLIMB FALL



FALL DOWN



A dummy at rest after fall

A 150 kg Steel Weight is tested



BEFORE



AFTER (A deployed energy absorber has a clearly visible red indicator)

To further the overall philosophy of testing above and beyond the requirements, Latchways also tested their systems with a maximum user weight of 150 kg.

Compliance to Standards

Compatability



Ladder Compatibility

Having surveyed the turbine, Latchways will purchase the specific ladder model used and build a replica of the way the ladder is mounted/fitted to the turbine wall. The fall arrest system is installed onto the ladder. The whole construction is then tested statically. This process is performed to provide peace of mind for customers in line with the requirements of the EN 14122-4 standard:

"...In case of fixed ladders equipped with a fall arrester the connecting elements shall withstand the stresses caused by the fall arrester catching the person who falls down."

Test setup:

- A Top Anchor is fitted to the ladder
- The ladder is fixed to a test rig in a similar manner as in the turbine, i.e. fixed in the same rung positions.

European testing:

- A force of 15 kN is then exerted on the ladder for a period of three minutes. Although the maximum load that can ever be exerted on the user is only 6 kN (as tested in 'Dynamic Performance' tests), 15 kN is tested to allow a factor of safety 2.5.

USA testing:

- The same test is carried out but with a force of 5,000 lbs (22.2 kN).

Latchways have tested aluminium ladders in conjunction with the following manufacturers:

- Hailo
- Poeschco
- Zarges
- Avanti.

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Harness Compatibility

Only a full body harness which complies with EN 361 should be used with a Latchways cable system. The Latchways TowerLatch® should be connected to the chest D-Ring on the full body harness.

Whilst there is no legal requirement to test the compatibility of harnesses in combination with fall arrest systems, Latchways have performed testing to cater for specific customer preferences.

Latchways has, to date, tested harnesses from several different manufacturers with the same series of “Fall Back” tests as detailed previously.

Lift Compatibility

If a lift is installed and it runs on the front face of the ladder, Latchways has a range of special brackets to ensure sufficient clearance between the lift and the fall arrest system.

Climb Assist Compatibility

Fall arrest systems are designed to arrest a free-falling 100 kg mass representing a worker. Climb Assist systems are designed to aid the worker on their ascent—connected to the Climb Assist using a full body harness.

These two types of system therefore have a potentially counteractive effect on each other. Currently there is no harmonised standard to test the use of both systems in conjunction with each other.

Latchways has tested both types of systems together. Latchways engaged TUV/NEL—the independent notified body—to develop a test method utilising anthropometric dummies to test our system with one specific brand of Climb Assist systems.

Climb Assist systems vary in design and features, therefore each variation should be tested—please contact Latchways for further information.

Specification

Inside Tower

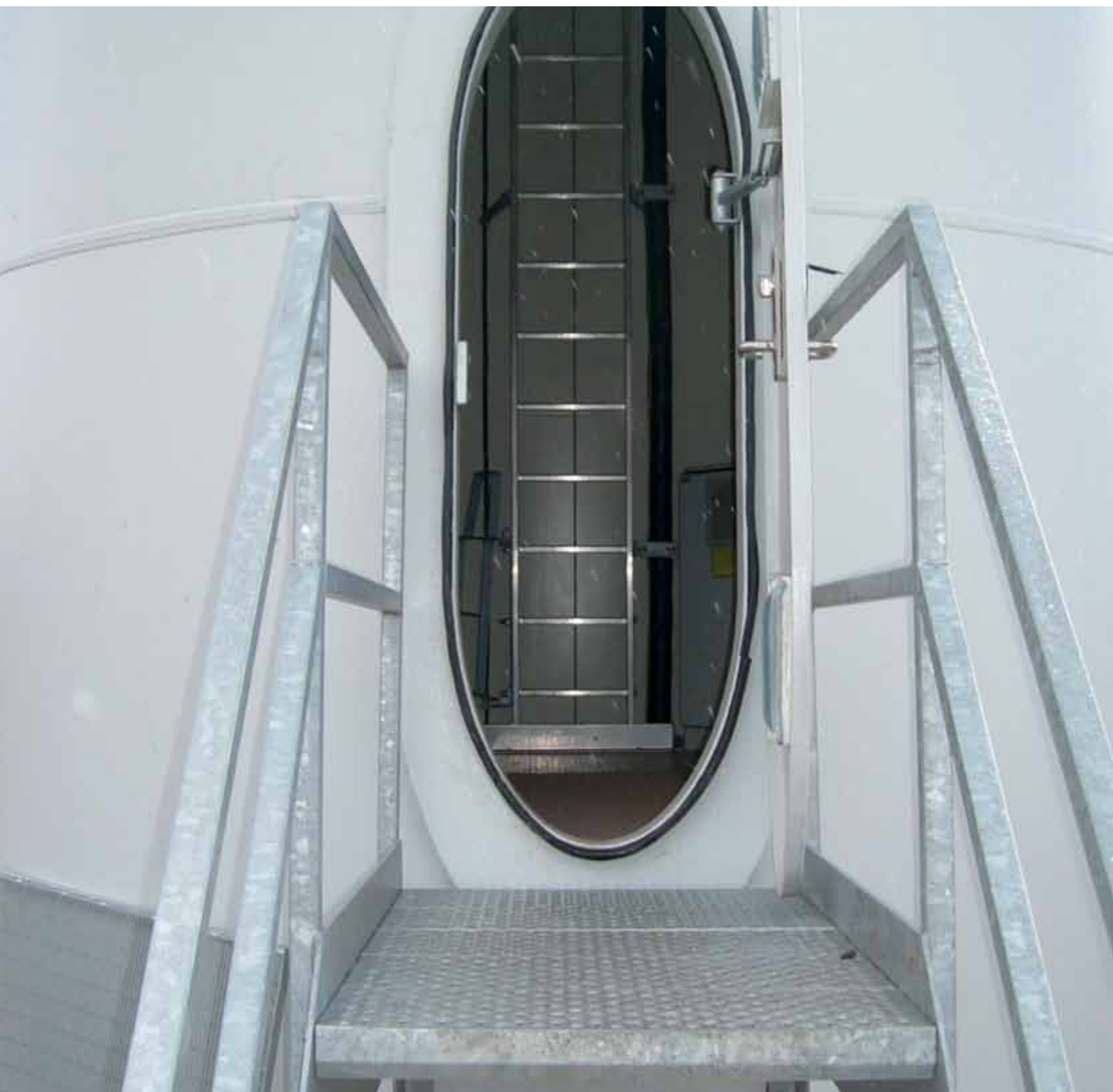
4

Specification Inside Tower

Introduction to Internal Solution	4: 2
Top Anchor	4: 2
Single Point Anchor	4: 2
Constant Force® Energy Absorber	4: 2
Intermediate Wire Guides	4: 3
Rung-Mounted Bottom Anchor	4: 3
Cable	4: 3
System Warning Label	4: 3
TowerLatch® Unit	4: 3
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Ladder Details Questionnaire	4: 4
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System Component Options	4: 6
Top Anchor Posts	4: 6
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In-line Tension Indicating Disc	4: 9
Floor-Fixed Bottom Anchor	4: 9
Temporary Systems	4: 10
Heavy Duty D-Ring	4: 11
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Specification
Inside Tower

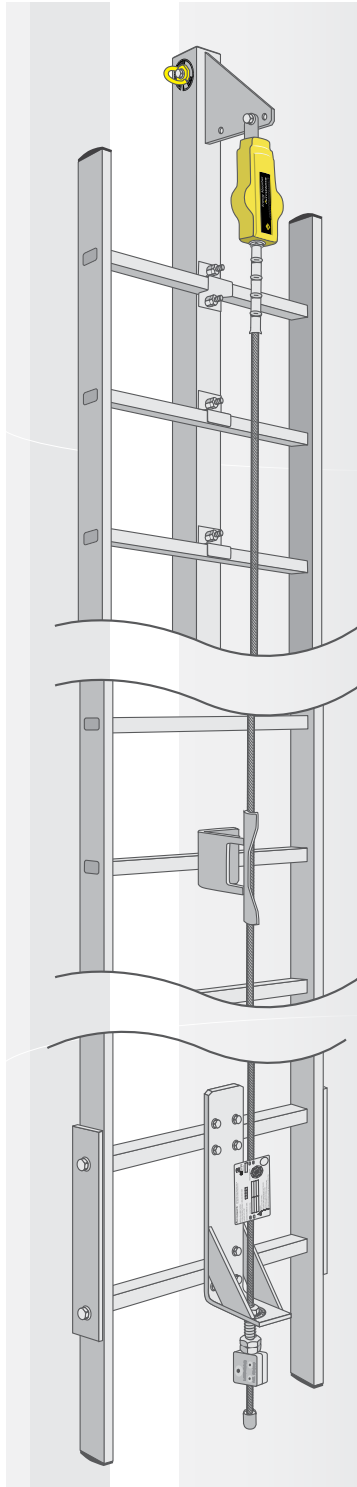
4



Specification

Inside Tower

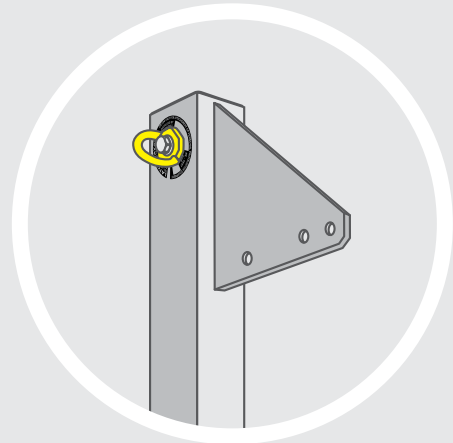
Introduction to internal solution



Once inside the turbine, the TowerLatch® cable system—for aluminium ladders—provides safe, permanent attachment without the need to remove the cable from the intermediate wire guides.

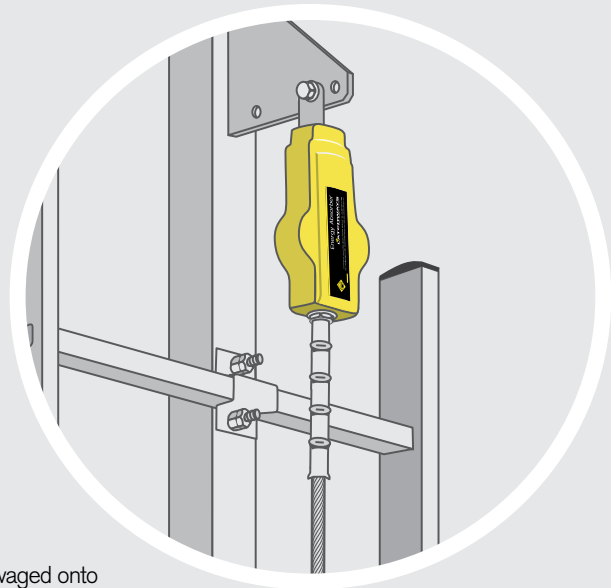
Top Anchor

This bracket has a built in factor of safety of 2.5 times the maximum input load of 6 kN. The top anchor is incorporated into a support post which is secured to the aluminium ladder rungs. There is a choice of three positions for the Constant Force® energy absorber, depending on the system positioning in relation to the platform hatch door or lift.



Single Point Anchor

Optional side D-Ring for disconnection at platform levels or in the nacelle.



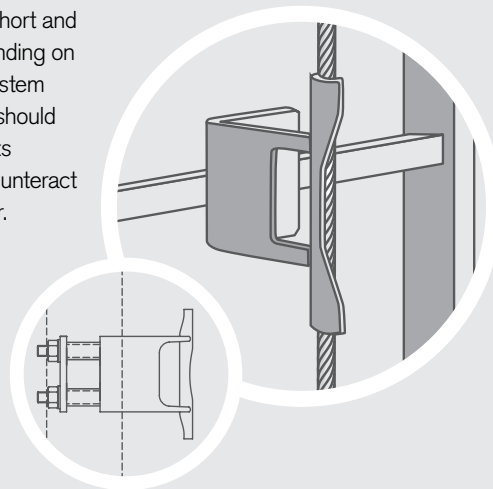
Constant Force® Energy Absorber

The energy absorber is swaged onto the cable and pull tested in our factory and certified as compliant. The absorber has a unique identification number laser etched onto it to provide complete traceability for the system. The standard system is supplied with a coil absorber rated for three people to be attached to the cable of the system at the same time.

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Intermediate Wire Guides

These coated brackets support the cable in the optimum climbing position in the centre line of the ladder. The unique helix profile enables the cable to be easily inserted during the installation and once the tension is introduced from the bottom anchor it retains the cable in place. A short and long version is available depending on the distance that the cable system is positioned from the ladder should a lift be present. The fixing kits incorporate locking nuts to counteract any vibration which may occur. Spacers are also provided to ensure the ladder rung is not damaged when tightening the wire guide fixings.



Cable

Latchways use $\varnothing 8$ mm 1 x 19 stainless steel cable which has a unique identification system. The cable is factory tested to check its physical properties and to ensure performance is consistent.



TowerLatch® Unit

The TowerLatch® unit secures the climber to the cable via the chest D-ring on their full body harness. The device passes through the intermediate supports without having to pull the cable out of the support allowing free movement up and down the system. In the event of a fall the device will immediately lock onto the cable. The unit incorporates a webbing stop to facilitate rescue using the cut away technique.

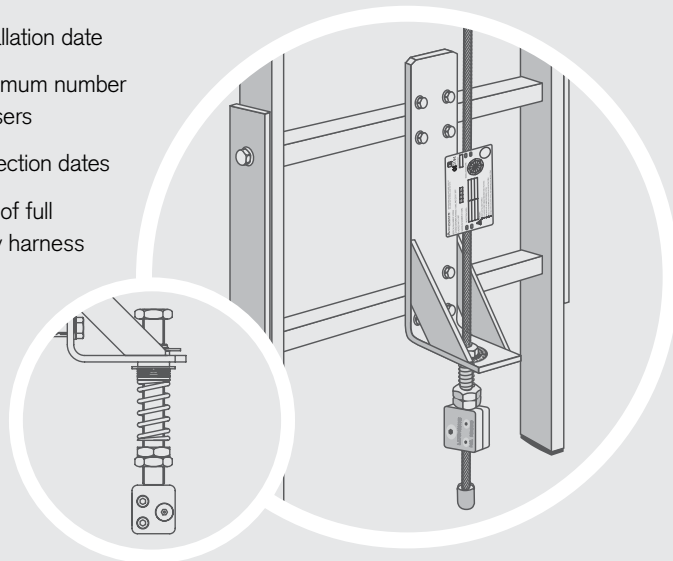
Rung-Mounted Bottom Anchor

This coated anchor provide a swage-free system termination and an integral tensioning device and can be mounted at the bottom of the system or above the lower platform to allow for sufficient hatch operation. When the correct level of tension is reached the tension indicator disc will spin freely. The rung mounted bottom anchor incorporates a rung strengthening kit, consisting of 2 x M16 threaded rods that are inserted into the rungs to accommodate the fixing of the bottom anchor. A spring mechanism is built-in to counteract lateral movement of the wind turbine, ensuring that a consistent cable tension is maintained.

System Warning Label

Each system is fitted with a label stating critical information such as:

- Installation date
- Maximum number of users
- Inspection dates
- Use of full body harness



Specification Inside Tower

Ladder Details Questionnaire

To survey the internal ladder layout and fitting Latchways' Design and Specification team require the following information.

External ladder width

Internal ladder width

Rung spacing

Stringer

Rung

Rung depth

Rung height

Ladder manufacturer _____

Ladder length _____ mm

Rung depth _____ mm

Rung shape:
 Square Round Other _____

Ladder width (Internal) _____ mm

Ladder width (External) _____ mm

Ladder model number/serial number

Rung spacing _____ mm

Rung height _____ mm

Ladder material:
 Aluminium Steel Other _____

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Installation

Incorporating Latchways systems into your turbine can be done in a number of ways:

- During manufacture
- During construction
- As a retrofit (on site).

Latchways has developed a solution which enables a cable system to be incorporated into each turbine section—ensuring there are no interruptions during the construction phase—for details please refer to page 4:10.

Installation can be undertaken by our network of registered installers or Latchways can train a customer's own contractors or technicians.



A turbine section arrives at site.



A Latchways cable system is installed.



Wireguide components are fitted.

Specification

Inside Tower

System Component Options

Through countless specifications and installations, Latchways has built up a range of component parts to enable a completely bespoke system to be specified depending on the customers requirements. The following pages are in no way an exhaustive list of parts, but shows several parts/solutions that Latchways have designed and manufactured thus far, and gives an idea of how a system can be built-up.

Top Anchor Posts

The top anchor and post can be specified depending on how many rungs it is affixed to: 2, 7 or 10.

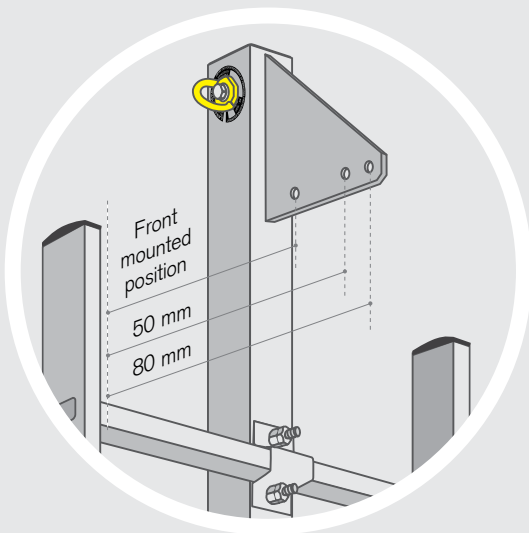
'Stand-off' Distances

The Latchways top anchor post has been designed with several features to allow flexibility to cater for different parameters in different turbine models.

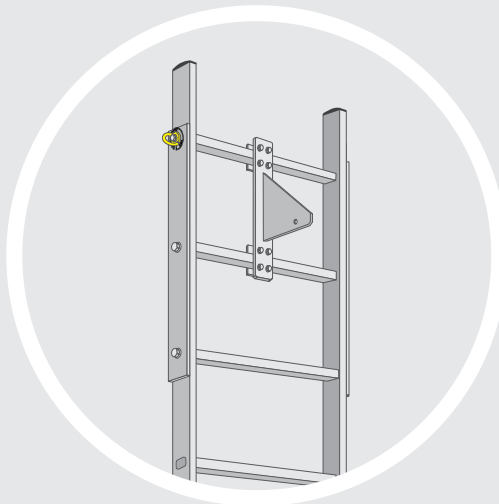
In the standard system the cable is positioned 80 mm from the front face of the ladder rung.

If a lift is installed on the ladder then the cable is positioned 50 mm from the front face of the ladder rung.

If there is limited clearance space between the back of the ladder and the power feeder cables, the 7- or 10-rung post can be installed on the front of the rungs.



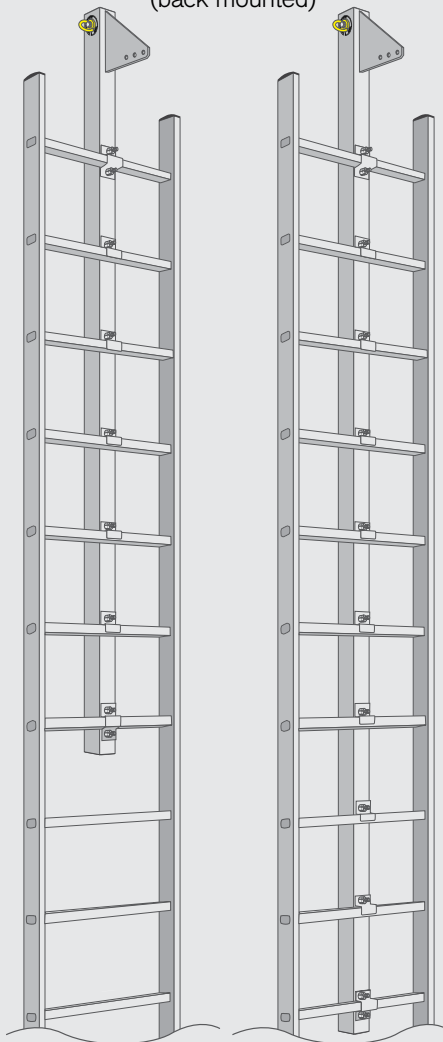
2-Rung Top Anchor (front mounted only)



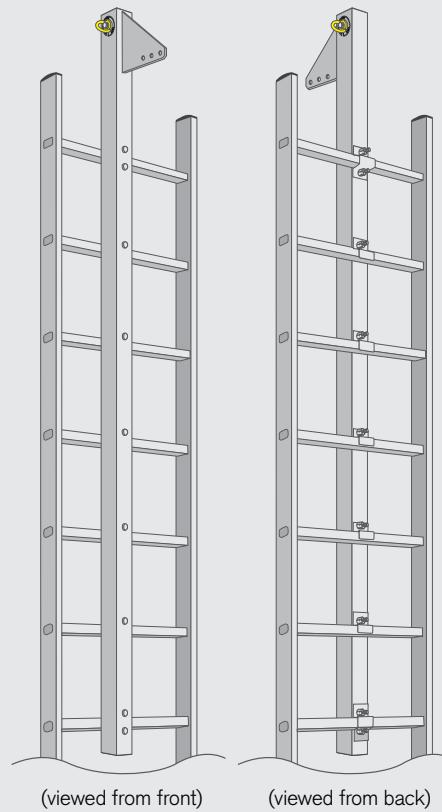
Depending on the make of ladder and how it is supported within a turbine it is possible to utilise a smaller top anchor. Typically this requires the additional strengthening of the top 3 rungs. This can be achieved using M16 threaded rods and side plates.

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7- and 10-Rung Top Anchor Post (back mounted)



Front Mounted Top Anchor Posts (shown with a 7-rung post)



Either the 7- or 10-rung post can also be mounted to the front of the ladder as shown—the fixings are replicated in a similar manner on the back of the ladder as with the back-mounted post.

Specification

Inside Tower

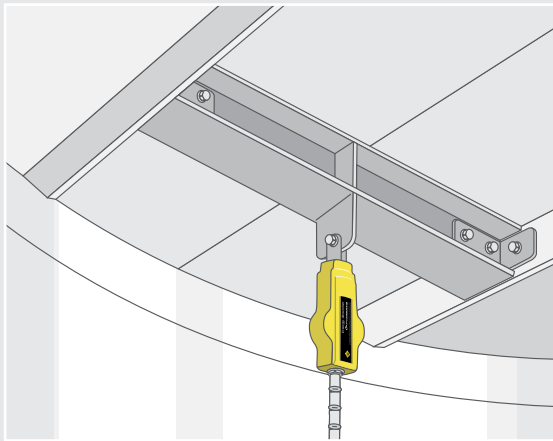
System Component Options

Top Anchor Fixings

The optimum solution is to install the top anchor fixing point off the aluminium ladder. Latchways has worked closely with turbine manufacturers to engineer top anchor arrangements which are now incorporated in new builds.

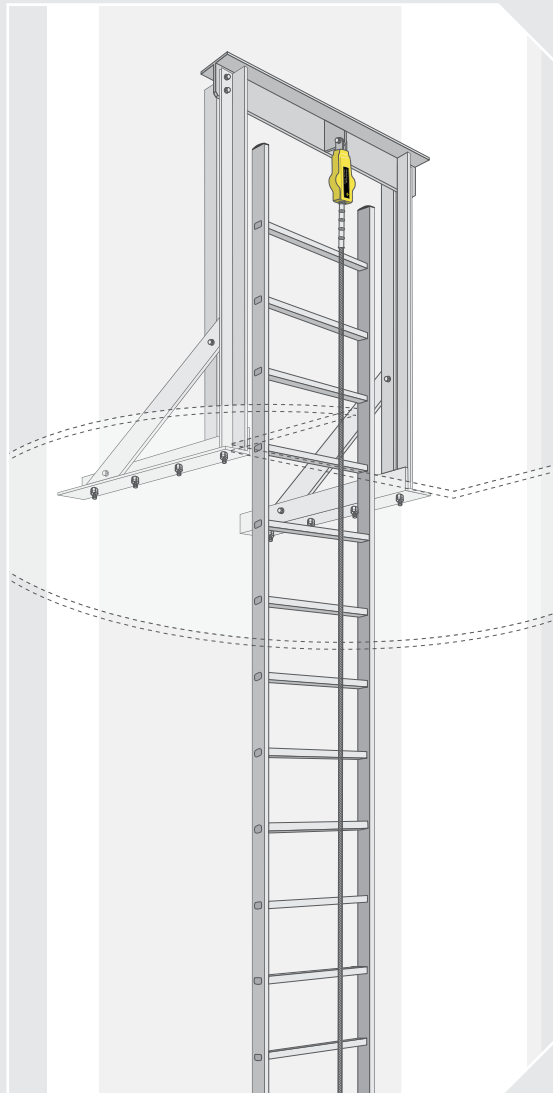
'I-beam' Top Anchor

Bespoke metal work manufactured to fix to the platform above, to which the system was fitted.



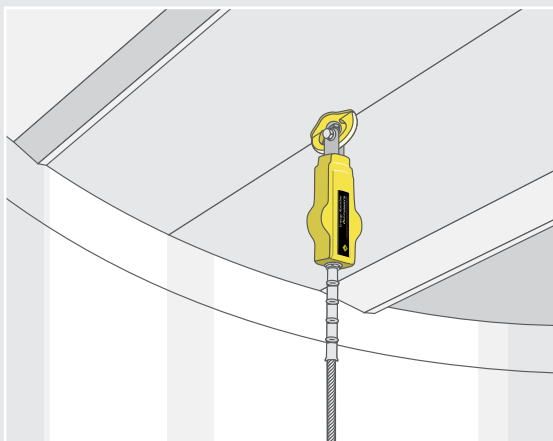
Platform-fixed Frame Top Anchor

Bespoke metal work manufactured to fix to the platform above, to which the system was fitted.

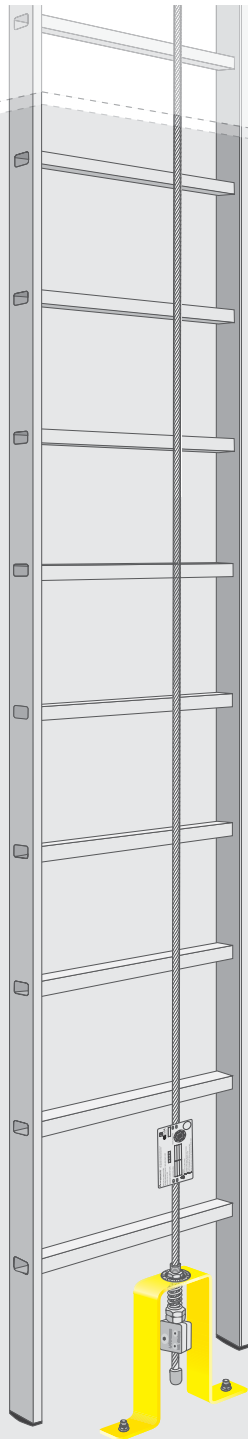


D-Ring Fixing Top Anchor

In this instance, the cable was simply fitted to the platform above by using a Heavy Duty D-Ring bolted through and attached to a U-channel steel member.



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In-line Tension Indicating Disc

The system shown consists of two x 1 x 19 swageless terminals which are mated together with a yolk containing the Latchways tension indicating disc. This can be positioned above the lower platform enabling the system pre-tension to be checked without the need to open the hatch door and climb down into the lower platform area.

Floor-Fixed Bottom Anchor

A yellow 'top hat' shaped anchor complete with tension indicator disc and additional spring to cater for lateral movement of the turbine and/or ladder. It can be installed directly to the turbine concrete floor below the lower platform hatch door.

Specification

Inside Tower

System Component Options

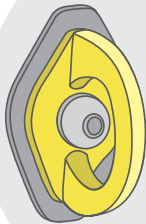
Temporary Systems

During a turbine construction, Latchways cable systems are often installed to ensure those carrying out the installation can do so in a safe manner. Typically this is done by installing a series of temporary systems for safe ascent whilst fixing turbine sections, once the turbine is completely constructed the permanent system is then installed. The system inside the top turbine section has a length of cable long enough for the total height of the turbine once the turbine is fully constructed. The cable is unravelled down through the middle turbine sections and into the bottom section—replacing short lengths of cable for one continuous piece as the user descends back down the system.



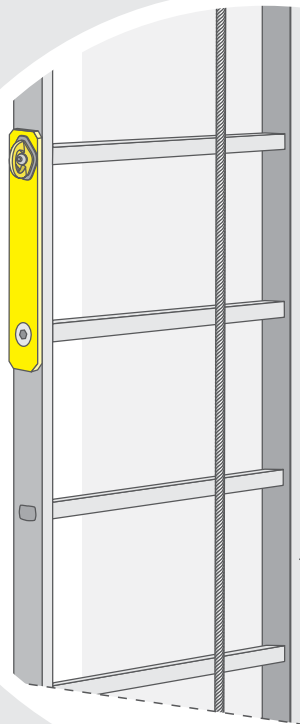
NB: Drawing
for illustrative
purposes only

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Heavy Duty D-Ring

A Heavy Duty D-Ring can be considered for use at various points within the turbine and also in the Nacelle.



A D-Ring can be installed on either side of the ladder at each intermediate platform to allow safe attachment/detachment, to/from the system using approved PPE.



6 Users



3 Users

Double Energy Absorber

A system with a single Constant Force® Energy Absorber specified allows for 3 users on the system at one time. Where it is necessary for more users, a system can be upgraded with a double absorber—which allows for up to 6 users.

Specification

Offshore: Boat to Pile Transfer

5

Specification Offshore: Boat to Pile Transfer

Ladder Attachment Post and Tether Line System	5: 2
Ladder Attachment Post	5: 2
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Specification
Offshore: Boat to Pile Transfer

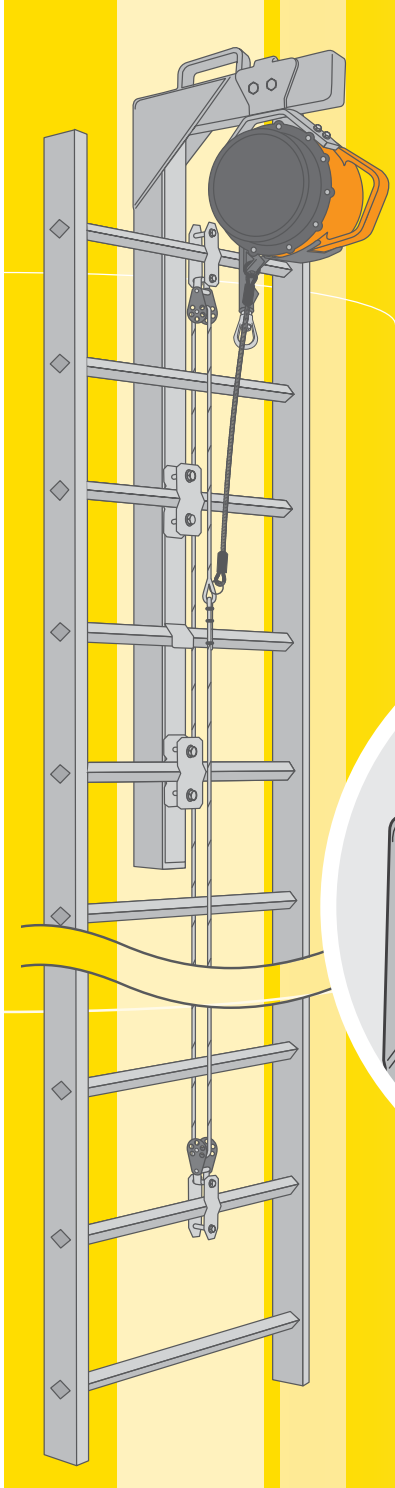
5



Specification

Offshore: Boat to Pile Transfer

Ladder Attachment Post and Tether Line System



The ManSafe® Sealed Self Retractable Lifeline (SRL), when combined with a purpose built easy to fit attachment post, offers a dependable means of fall protection whilst climbing any offshore wind turbine access ladder. Designed to work in the harshest conditions, the Sealed SRL has undergone extensive, independently verified testing to ensure consistent, reliable performance.

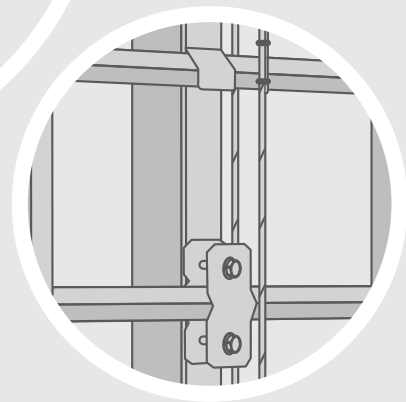
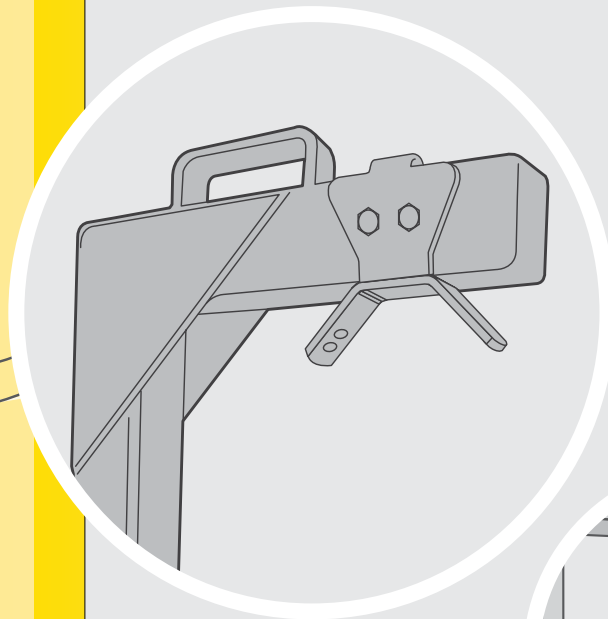
Ladder Attachment Post

Detachable attachment bracket ensures the SRL is easily mounted and removable for field servicing.

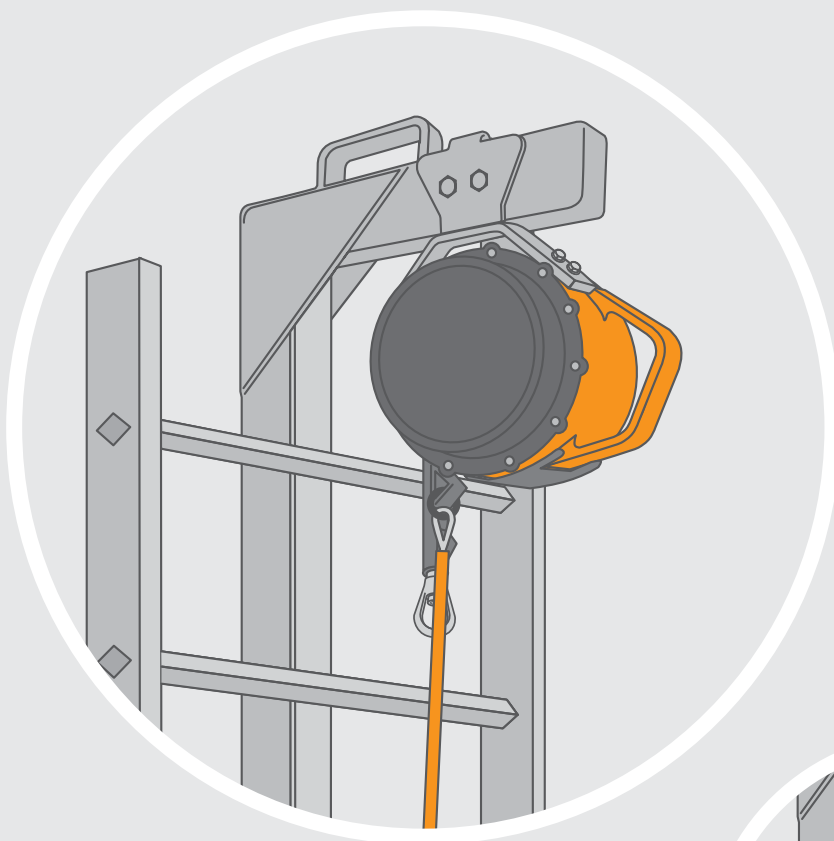
Post tested in accordance with EN795: 1997 for a Class-A Anchor Device.

Simple two bracket, four bolt attachment to ladder, with integrated rung hook to facilitate post fitting/positioning.

Designed to fit offshore diamond rung ladders (universal post fits 250 mm, 275 mm and 300 mm rung spacings). Custom design service available for alternative ladder sizes, as per customer requirements.

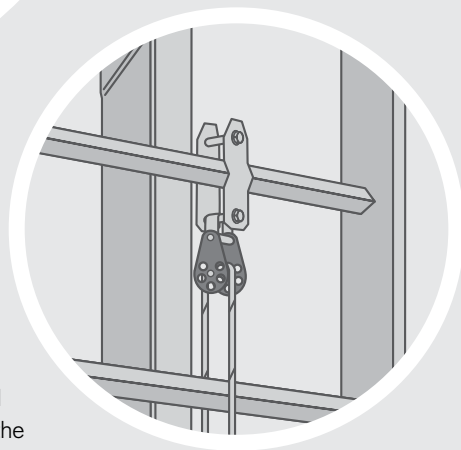


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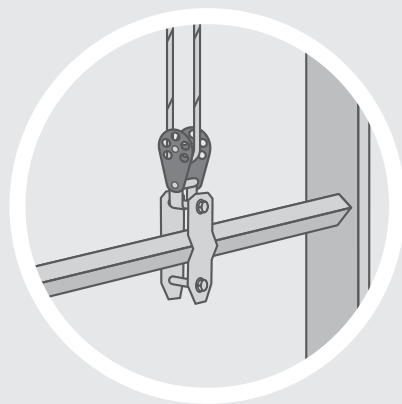
ManSafe® Sealed SRL

This SRL has been designed to ensure the user is protected from falling when accessing the external turbine ladder from the boat. Tested to, and exceeding the requirements of EN 360:2002 (for a retractable device), the SRL is available with cable lengths of 9 m, 15 m, 25 m and 40 m.



Tether Line System

A continuous loop or fixed tether line system allows the SRL attachment point to be easily accessible from the boat in any tidal conditions.



Specification

Offshore: Boat to Pile Transfer

Installation



World leaders in fall protection

5



Post is hoisted or raised using a davit crane onto platform.



Easy to fit, two bracket fixing kit, securely attaching post to ladder.



ManSafe® Sealed SRL is positioned and fixed to the attachment post.



Simple, continuous loop tether line system installed.

Specification

Offshore: Boat to Pile Transfer

ManSafe® Sealed SRL

The ManSafe® Sealed SRL has been developed with a number of unique features to provide a smarter, safer, stronger and better alternative to traditional 'Sealed' SRLs.

Smarter

- The ManSafe® Sealed SRL doesn't rely on the traditional "friction braking" technology that typically requires "re-tensioning" after a manufacturer specified period of time in order to ensure consistent performance. Instead Latchways' patented Constant Force® braking system is a frictionless braking system that won't go out of adjustment and ensures consistent braking performance in any conditions.

Safer

- The Full Contact™ pawl locking mechanism provides 100% reliable locking that won't freeze, hang up or corrode.
- This advanced pawl technology allows a user to both hear and feel the mechanism working and thus reassure them the system is in good working order.
- A built-in reserve line ensures that a fall is arrested safely even when the cable is fully extended.

Stronger

- Manufactured from quality components—following consultation with the Institute of Materials in the UK to ensure material compatibility and durability.



- Individual components undergo strict quality control procedures prior to assembly, including critical component batch "x-ray" to ensure material integrity—giving the end user added piece of mind regarding SRL reliability.

Better

- Internal critical components are protected by rubber seals ensuring the spring, locking mechanism and absorber are completely impenetrable to material/moisture ingress.

World leaders in fall protection

Recertification

The modular design allows quick and easy servicing of the SRL, which can be undertaken on-site, requiring minimal specialist tooling following Latchways training, therefore significantly reducing the lifetime cost of ownership of the product.

A minimum number of replacement component parts further emphasises the simplified serviceability, these include: cable assembly, energy absorber and labels.



Specification

Offshore: Boat to Pile Transfer

Testing

The ManSafe® Sealed SRL has undergone extensive independently-verified testing, ensuring consistent performance throughout its lifetime:

- 1,000 hours corrosion resistance testing.
- 2,000 hours corrosion resistance testing.
- IP testing.
- Cyclic testing—SRL cable fully extended and retracted 20,000 times (with component inspection of pawls, tooth disc for wear) ensuring consistent performance from first to last test.
- Artificial wave testing and extensive field trialling undertaken offshore to ensure SRL sensitivity is best suited for boat to ladder transitions.
- Tested operational temperature range -30 C to +54 C.

ManSafe® Sealed SRL Standards

Exceeds the requirements of:

- EN: 360 2002
- ANSI Z359.1-1999
- ANSI Z359.1-2007
- OSHA 1910.66
- OSHA 1926.502
- CSA Z259.2.2-98

1,000 Hours Corrosion Resistance Testing

The Latchways ManSafe® Sealed SRL was subjected to 1000 hours of salt spray exposure which far exceeds any test requirement by current EN standards. The test demonstrates the durability of the Latchways ManSafe® Sealed SRL.

A sample of Latchways ManSafe® Sealed SRL was independently tested for 1,000 hours corrosion resistance by SATRA test house.

Test Conditions

Corrosion test in accordance with ISO 9227:1990—Neutral Salt Spray

Temperature: 35 C

Fallout rate: approximately 1.2 ml/hr (average over total exposure time)

pH of test solution: approximately 6.7 (average over total exposure time)

Sample was removed and examined for damage periodically throughout exposure and after complete exposure time

Total exposure time: 1,006 hours

2,000 hours Corrosion Resistance Testing



The ManSafe® Sealed SRL has also undergone and passed similar corrosion testing but to 2000 hours.

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Test Results

EN 360:2002 Clause/Test	EN 360:2002 Requirement	Result/Comment	Pass/Fail
4.7 Corrosion resistance EN 364-1992 Clause 5.13)	No corrosion to be evident that could affect the function of the device (white scaling or tarnishing is acceptable).	Evidence of light white scaling present on external surfaces. Evidence of slight red discolouration around attachment bolts only. No visual evidence of rust present.	PASS (see note)

Note: EN 360:2002 Clause 4.7 requires that the device be subject to 24 hours neutral salt spray exposure. However, to demonstrate the robustness of the Latchways product, the exposure time was increased to 1,000 hours, after which **the device was found to fulfil the requirements of Clause 4.7.**

**Sealed Absorber Housing—
unaffected**



**Non-corroded Fixings—
no cross contamination**



**Sealed Pawls—
unaffected**



IP Testing



ManSafe® Sealed SRL before and after dust test.

Verified 'Sealed status'—achieved Ingress Protection (IP)69K, ensuring individual internal components are protected from the intrusion of any foreign matter—which could otherwise interfere with the operation of the device. Testing involves submersion to a 5 m depth, testing for ingress and additional testing in a dust 'suspension' for eight hours to ensure no material ingress into critical components.



ManSafe®

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 **LATCHWAYS**
FALL PROTECTION

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