

Safe Work Instruction	Issue date: 11/08/09
<b>Fall Arrest Systems (Harnesses, Lanyards and Attachment Hardware)</b>	Review date: 27/07/12

Document no.	Work description
SMS-06-SW-0256	<p>Selection and use of safety harnesses for access and safety at heights.</p> <p><b>Scope</b></p> <p>This SWI specifies the mandatory requirements and the additional features and options for safety harnesses, lanyards and attachment hardware.</p>
Review date	<p><b>References</b></p> <ul style="list-style-type: none"> <li>• AS/NZS 1891 (all parts) Industrial fall-arrest systems and devices</li> <li>• AS4488 Industrial rope access systems</li> <li>• <a href="#">SMS-06-GD-0240 Working at Heights</a></li> <li>• <a href="#">SMS-06-GD-0241 Fall Arrest Systems</a></li> <li>• <a href="#">SMS-06-SW-0255 Fall Arrest Systems (Fall Arrest Devices)</a></li> <li>• <a href="#">SMS-06-SW-0257 Fall Arrest Systems (Industrial Rope Access)</a></li> <li>• <a href="#">SMS-06-SW-0258 Fall Arrest Systems (Inspection and Maintenance)</a></li> <li>• <a href="#">SMS-06-SW-0259 Fall Arrest Systems (Safety Lines)</a></li> <li>• <a href="#">SMS-06-SW-0260 Fall Arrest Systems (Pole Straps)</a></li> <li>• <a href="#">SMS-06-SW-0264 Portable Ladders, Step Ladders and Step Platforms</a></li> </ul>

Responsible supervisor <i>Insert name in BLOCK letters</i>	PPE and precautions	Competencies or qualifications	Licences or permits required
	N/A	See below	N/A

Tools and equipment required
As below
<b>IF CONTROL MEASURES ARE NOT SUITABLE AND MAJOR CHANGES ARE NEEDED, CONDUCT A RISK ASSESSMENT AND DEVELOP NEW CONTROLS ACCORDING TO SMS-06-PR-0104 WORKPLACE RISK MANAGEMENT.</b>

<b>Identification</b>	All equipment is to have a manufacturer's label that is located in a position so that it remains legible during the serviceable life of the equipment. The label must include the following information: <ul style="list-style-type: none"> <li>• a serial number</li> <li>• date of manufacture</li> <li>• the maximum additional length resulting from the deployment of the energy absorber.</li> </ul>
<b>Component compatibility</b>	The supplier must identify any incompatibilities with any items that can be attached to their equipment.
<b>Manufacturer's instructions</b>	The manufacturer must supply instructions that indicate the method of lifting, adjustment and use, with each piece of equipment supplied.
<b>Acceptance inspection</b>	Inspections are to be carried out on receipt of the equipment. Fall arrest equipment is to be marked with the Standards Mark certified to comply with AS/NZS 1891.1 and incorporate the features and options as ordered.
<b>Inspection and maintenance</b>	The inspection, testing and maintenance of harnesses, lanyards and attachment hardware is to be conducted in accordance with the <a href="#">Fall Arrest Systems (Inspection and Maintenance)</a> SWI.

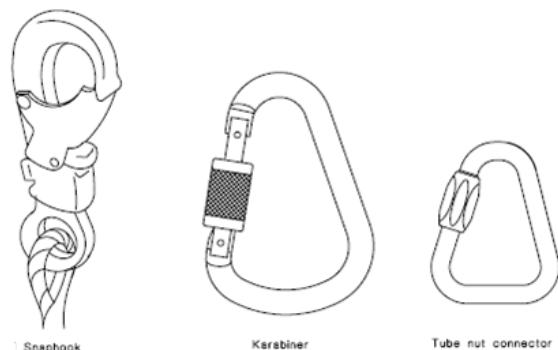
# Fall Arrest Systems (Harnesses, Lanyards and Attachment Hardware)

<b>Harnesses</b>	<p>RailCorp requires all personnel working at height to wear a full body fall arrest harness. Personnel who use industrial rope access techniques (work positioning) are the only exception. They may wear a work positioning (sit) harness, but must also wear a chest harness attachment, in compliance with AS1891 and AS4488.</p> <p>The following mandatory requirements exist for all fall arrest (full body) harnesses:</p> <ul style="list-style-type: none"> <li>• general webbing colour can be any colour other than orange. Orange webbing is to be used only for front rescue points and dorsal extension straps</li> <li>• the harness is to be worn over clothing and is to incorporate silver/white retroreflective bands, class RF as defined in AS 1906.4</li> <li>• it is to be the correct size for the wearer</li> <li>• bands are to be at least 30 mm wide</li> <li>• one band is to encircle the waist and two bands are to join the front and back of the waistband, extending over both shoulders and forming an "X" at the back</li> <li>• breaks are allowed in the bands for webbing adjustment</li> <li>• all buckles are to have adjusters for harness webbing</li> <li>• elastic webbing keepers are required to secure webbing tails at all adjustment points. Velcro or similar webbing keepers are to be used only for the dorsal extension attachment to the shoulder strap and the buttock support attachment to the waist belt of the harness</li> <li>• because they can be mistaken for restraint or rescue points, loops are not to be formed in the webbing by any of the keepers on the harness,</li> <li>• when used for rescue, the configuration of the front arrest or rescue points is to retain the wearer, whether conscious or unconscious, with the head held higher than the attachment point on the harness</li> </ul>
<b>Additional requirements</b>	<p>Personnel working in confined spaces are to wear a fall arrest harness with shoulder attachment points. These may be either webbing loops or D-rings.</p> <p>Front fall arrest attachment points are to be fitted and used where required, eg. when used for climbing ladders with a ladder fall arrest device.</p> <p>Where required, tool straps suitable for the fitting of tool holders and carry bags are to be provided on each side at the back of the waist belt of the harness.</p>
<b>Linesmen's harnesses - mandatory features</b>	<p>The following mandatory features are required for linesmen:</p> <ul style="list-style-type: none"> <li>• side D-rings for the pole strap attachment are to be as far forward as possible to provide ease of attachment of the pole strap. They can be Tang D-rings or Swinging D-rings with a 22.5mm minimum inside radius and a section diameter of 7 to 10mm</li> <li>• the rope rescue points are to be of orange webbing loops with D-rings s or another suitable attachment system to enable attachment to a single rescue hook. The rescue point is also to be suitable for use with snap hooks or karabiners and can be incorporated with the front arrest point</li> <li>• the two fall arrest points are to be an over-shoulder dorsal extension strap and a chest high front fall arrest point. The dorsal extension strap can be velcroed to the harness shoulder strap</li> <li>• the buttock support can be fixed or free to be attached to the waist belt when not in use</li> </ul>
<b>Lanyards</b>	<p>The purpose of a lanyard assembly is to connect a harness to an anchorage point, horizontal life line or rail, or other acceptable form of anchorage.</p> <p>A lanyard assembly is to be designed to limit the force on the harness attachment point during a fall arrest, to 6kN. A personal energy absorber can be used as part of the assembly, unless:</p> <ul style="list-style-type: none"> <li>• the lanyard material alone is capable of meeting the requirement</li> <li>• the device to which the lanyard is attached is capable of limiting the fall-arrest force to 6kN, eg. a Type 1 fall-arrest device</li> <li>• the fall distance is so restricted that a fall-arrest force of 6kN cannot be achieved, eg. where a lanyard, no longer than 300mm, is used to connect a ladder belt or harness to a ladder fall-arrest system, or Type 1 fall arrest device.</li> </ul> <p>If a fibre lanyard assembly can be damaged at the work site by flame, heat or the action of power cutting or abrading tools, a steel rope or chain lanyard is to be considered.</p> <p>Where the fall distance can exceed 600mm, steel rope or chain lanyards are to be fitted with energy absorbers.</p>

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<b>Lanyards</b> cont	<p>The safety lanyard assembly is to be of the separate type where one end of the safety lanyard is secured to the safety harness by a snap hook with a single, double acting latch or karabiner and the other end is attached to the anchor point by a snap hook with a single, double-acting latch.</p> <p>All lanyard assemblies are to incorporate a personal energy absorber.</p> <p>Inertia reels have a built in energy absorbing mechanism – they are not to be used with additional energy absorbers as this may stop the inertia reel from locking in the event of a fall.</p> <p>All lanyards are to be manufactured in accordance with AS/NZS 1891.1.</p>
<b>Material</b>	Lanyards are to be made of synthetic-fibre webbing or synthetic fibre rope.
<b>Length</b>	<p>Lanyards are not to be longer than 2 metres, measured between the anchorage point connector and the harness connector, including the length of the energy absorber in its unused condition, and the connectors.</p> <p>Retracting webbing inertia reel lanyards can be 3 metres long when fully extended.</p> <p>Twin tail (double) lanyards are not to be longer than 1.2 metres, measured between the anchorage point connector and the harness connector, including the length of the extended elastic webbing, energy absorber in its unused condition, and the connectors.</p>
<b>Colour</b>	<p>Red or orange are not to be used for lanyards.</p> <p>The purchaser is to specify a contrasting colour to the pole straps in use.</p>

**Attachment hardware****Figure 1 Examples of snap hooks, karabiner and tube nut connector**

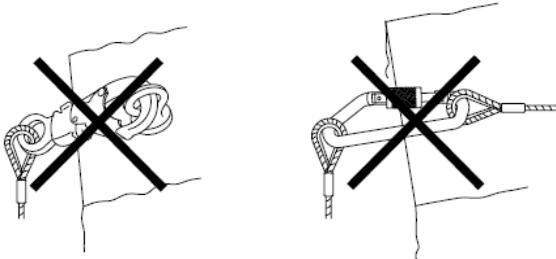
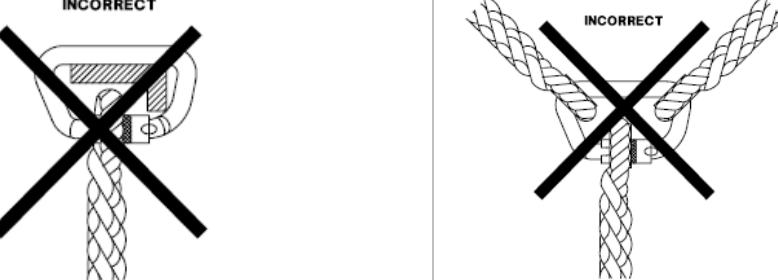
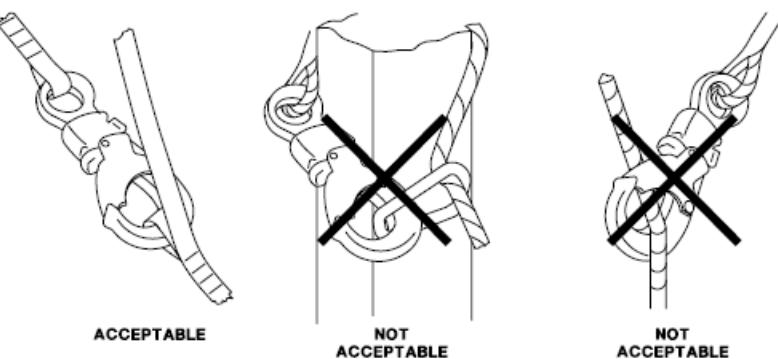
<b>Snap hooks</b>	<p>Snap hooks are to be of the self-closing and self-locking type which has a locking gate overriding the latch that remains closed until the hook is intentionally unlocked and opened by means of two separate manual operations.</p> <p>Snap hooks are to be selected for ease of operation of the self-closing, self-locking mechanism, and also with a view to eliminating the possibility of 'roll-out'.</p> <p>Snap hooks are highly susceptible to roll-out, and for this reason single acting (non-locking) snap hooks are not to be used. In double-acting (locking) snap hooks, the locking mechanism reduces but does not eliminate the possibility of roll-out – care is always to be taken.</p> <p>All snap hooks are to be capable of attaching to harness webbing loops and metal hardware up to 10 mm in diameter.</p> <p>The Line Manager is to check with the manufacturer before using a snap hook in a situation where there could be side loading of the gate and consequent roll-out.</p> <p>Some snap hooks are not suitable for direct connection to fibre rope or webbing due to the potential for damage to the material in this way.</p> <p>A check must also be made from time to time to make sure that no sharp edge is being built up in the snap hook.</p>
	<p><b>Warning</b></p> <p><i>By twisting a snap hook against a standard attachment D-ring it is almost always possible to demonstrate how inadvertent release of the snap hook from the D-ring can occur when the locking mechanism has first been disengaged by pressing it against the worker's body or an external object.</i></p>

# Fall Arrest Systems (Harnesses, Lanyards and Attachment Hardware)

<b>Attachment hardware cont</b>	<b>Karabiners</b>	<p>Karabiners are to be screw gate or triple locking – standard spring gate (twistlock) is not acceptable.</p> <p>Twistlock type karabiners require a twisting action to unlock the gate before it can be opened, and are highly susceptible to roll out</p> <p>The screw-gate type has a short barrel-type locking sleeve which is manually screwed into the locking position.</p> <p>Triple-locking types require a further action in addition to the above.</p> <p>If side or gate loading is possible, a karabiner with a captive eye or split pin which holds the device in the correct position is to be selected.</p> <p>Karabiners are to be made of steel, not aluminium.</p> <p>A screwgate karabiner is to be orientated in use so that the screwgate screws downwards to engage.</p>	
	<b>Tube nut connectors</b>	<p>Tube nut connectors are among the safest types of attachment hardware because they require a succession of screwing actions to open them, and they are not as prone to roll-out as are spring mechanisms.</p> <p>They can be further secured by the use of a spanner or a thread adhesive.</p> <p>Because the locking mechanism is slow to operate they are not suitable at the anchorage end of a lanyard assembly.</p> <p>They are suitable at the harness end of a lanyard assembly, providing operators do not frequently need to disconnect them from the harness.</p> <p>The triangular type is suitable for 3-way loading such as connecting anchorage sling ends together.</p> <p>A tube nut connector is to be orientated in use so that the nut screws downwards to engage.</p>	
		<p><b>Note</b></p> <p><i>A tube nut connector is not classified as either a karabiner or a snap hook. Therefore it is neither subject to the requirement for two separate opening/closing actions, nor is it required to be self-closing or self-locking.</i></p>	

<b>Attachment requirements</b>	<p>The safety lanyard assemblies are to be fitted with the attachment hardware listed below.</p> <table border="1"> <tr> <td data-bbox="339 1260 541 1507"> <b>Elastic and webbing lanyard</b> </td><td data-bbox="541 1260 1465 1507"> <p>Elastic and webbing type lanyard is to have:</p> <ul style="list-style-type: none"> <li>• snap hooks or karabiners at each end</li> <li>• an energy absorber at the harness end of the lanyard.</li> </ul> <p>A lanyard can incorporate a loop formed in the webbing for backhooking (choking) around a beam or similar anchorage and attaching the hook to the loop in the lanyard.</p> </td></tr> <tr> <td data-bbox="339 1507 541 1608"> <b>Adjustable rope lanyard</b> </td><td data-bbox="541 1507 1465 1608"> <p>Adjustable rope lanyard must have a snap hook at one end of the rope lanyard connected to an energy absorber and a rope length adjuster and karabiner at the opposite end of the lanyard assembly.</p> </td></tr> <tr> <td data-bbox="339 1608 541 1765"> <b>Retracting webbing inertia reel lanyard</b> </td><td data-bbox="541 1608 1465 1765"> <p>Retracting webbing inertia reel lanyard is to have:</p> <ul style="list-style-type: none"> <li>• a snap hook with a single, double acting latch attached to the webbing of the lanyard</li> <li>• a karabiner or tube-nut connector for attaching the inertia reel to the anchorage.</li> </ul> </td></tr> <tr> <td data-bbox="339 1765 541 1927"> <b>Twin-tailed elastic webbing lanyard</b> </td><td data-bbox="541 1765 1465 1927"> <p>Double (twin-tailed) elastic webbing lanyard with large gate alloy hook is to have:</p> <ul style="list-style-type: none"> <li>• a snap hook, with a single, double acting latch suitable for harness webbing loops and hardware up to 10 mm in diameter at the harness end of the lanyard</li> <li>• large gate alloy hooks with a single, double acting latch on the anchor ends of the twin lanyards.</li> </ul> </td></tr> </table>	<b>Elastic and webbing lanyard</b>	<p>Elastic and webbing type lanyard is to have:</p> <ul style="list-style-type: none"> <li>• snap hooks or karabiners at each end</li> <li>• an energy absorber at the harness end of the lanyard.</li> </ul> <p>A lanyard can incorporate a loop formed in the webbing for backhooking (choking) around a beam or similar anchorage and attaching the hook to the loop in the lanyard.</p>	<b>Adjustable rope lanyard</b>	<p>Adjustable rope lanyard must have a snap hook at one end of the rope lanyard connected to an energy absorber and a rope length adjuster and karabiner at the opposite end of the lanyard assembly.</p>	<b>Retracting webbing inertia reel lanyard</b>	<p>Retracting webbing inertia reel lanyard is to have:</p> <ul style="list-style-type: none"> <li>• a snap hook with a single, double acting latch attached to the webbing of the lanyard</li> <li>• a karabiner or tube-nut connector for attaching the inertia reel to the anchorage.</li> </ul>	<b>Twin-tailed elastic webbing lanyard</b>	<p>Double (twin-tailed) elastic webbing lanyard with large gate alloy hook is to have:</p> <ul style="list-style-type: none"> <li>• a snap hook, with a single, double acting latch suitable for harness webbing loops and hardware up to 10 mm in diameter at the harness end of the lanyard</li> <li>• large gate alloy hooks with a single, double acting latch on the anchor ends of the twin lanyards.</li> </ul>
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<b>Adjustable rope lanyard</b>	<p>Adjustable rope lanyard must have a snap hook at one end of the rope lanyard connected to an energy absorber and a rope length adjuster and karabiner at the opposite end of the lanyard assembly.</p>								
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# Fall Arrest Systems (Harnesses, Lanyards and Attachment Hardware)

<b>Attachment hardware - general</b>	<p>All mating components:</p> <ul style="list-style-type: none"> <li>• are to be checked to make sure that they are compatible</li> <li>• are <b>not</b> to affect the operation of either of the items being connected.</li> </ul> <p>Components are not to be able to jam in each other in a way that can overstress either of them eg. in some snaphook to snaphook connections.</p> <p>Each time a device is attached to another device a check is to be made by the user to make sure that both the primary latch and secondary locking device are secure.</p> <table border="1"> <tr> <td data-bbox="339 480 552 570"> <b>Incorrect bending of attachments</b> </td><td data-bbox="552 480 1465 570"> As most attachment hardware items are not designed to resist bending stresses, they are not to be used in a manner which subjects them to bending loads (Figure 2) </td></tr> </table> <div style="text-align: center;">  </div> <p><b>Figure 2 Incorrect bending of attachments</b></p> <table border="1"> <tr> <td data-bbox="339 916 552 1282"> <b>Incorrect side loading of a karabiner</b> </td><td data-bbox="552 916 1465 1282"> A karabiner must not be side-loaded incorrectly (Figure 3) </td></tr> </table> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  </div> </div> <p><b>Figure 3 Incorrect side loading of a karabiner</b></p>	<b>Incorrect bending of attachments</b>	As most attachment hardware items are not designed to resist bending stresses, they are not to be used in a manner which subjects them to bending loads (Figure 2)	<b>Incorrect side loading of a karabiner</b>	A karabiner must not be side-loaded incorrectly (Figure 3)
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<b>Incorrect side loading of a karabiner</b>	A karabiner must not be side-loaded incorrectly (Figure 3)				
<b>Backhooking</b>	<p>Backhooking (also known as 'choking') refers to a lanyard or safety line passed around a structure or structural member and hooked back onto itself.</p> <p>Backhooking is only permitted if the lanyard or safety line is fitted with a connecting facility designed for backhooking eg. a sewn loop in a suitable position (Figure 4).</p> <div style="text-align: center;">  </div> <p><b>Figure 4 Backhooking example of an acceptable method and two unacceptable methods</b></p>				

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<b>Backhooking</b> cont	<p>Most snaphooks are not designed for this purpose. Their use in this way can lead to cross gate loading, roll out, or bending of the snaphook across the corner of the structure.</p> <p>If the hook has a sharp edge the lanyard can be cut. Even an apparently well rounded hook can have a sharp edge due to wear.</p> <p>A running ring or other connector specifically designed for the purpose can be used, provided that it is not subjected to side loading due to choking or bending against a sharp edge.</p> <p>The choke angle is not to exceed 120°, as shown for a sling connection in the <a href="#">Fall Arrest Systems</a> guide.</p> <p>Padding must be used on any sharp edges on the structure over which the lanyard passes, together with provision to prevent movement of the lanyard on the structure. Reduction of the effective length of the lanyard may also need to be considered.</p> <p>The preferred alternative to backhooking, where a connection is to be made around a structural member, is to use an anchorage sling, see the <a href="#">Fall Arrest Systems</a> guide.</p>
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<b>Training</b>	<p>Before working at heights, RailCorp Employees and Contractors are to be properly trained in:</p> <ul style="list-style-type: none"><li>• the method of working at heights to be used</li><li>• an understanding of the particular task requirements and any hazards and risks involved</li><li>• correct selection, fitting, use, care and storage of:<ul style="list-style-type: none"><li>- fall prevention systems and arrest equipment</li><li>- personal protective equipment</li><li>- tools and equipment to be used</li></ul></li><li>• procedures in the event of an emergency such as rescue, accident or injury.</li></ul> <p>Users of fall arrest systems and equipment are to be trained and assessed as competent before being allowed to work without direct supervision in accordance with training requirements defined in the <a href="#">Working at Heights</a> guide.</p> <p>Line Managers are to make sure that employees are properly trained and possess the above competency.</p>
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<b>Additional controls</b>