

Fall Arrest Systems (Anchorages)

Document no.	Work description		
SMS-06-SW-0254	<p>Selecting fall arrest systems anchorages to be used by employees and contractors when working at height on:</p> <ul style="list-style-type: none"> • power poles • structures • fixed or collapsible ladders • rolling stock • large equipment such as large transformers and circuit breakers. 		
	<p>Scope</p> <p>This instruction provides details relating to the type and location of anchorages and should be read in addition to Working at Heights and Fall Arrest Systems guides.</p>		
Review date	<p>References</p> <ul style="list-style-type: none"> • OHS Reg 2001 Clauses 39, 56-61 • WorkCover CoP Safe Working on Roofs, part 1 • WorkCover CoP Safety Line Systems • AS/NZS 1891 Industrial Fall Arrest Systems and Devices (parts 1-4) • SMS-06-GD-0240 Working at Heights • SMS-06-GD-0241 Fall Arrest Systems 		
Responsible supervisor	PPE and precautions	Competencies or qualifications	Licences or permits required
	<ul style="list-style-type: none"> • Full body fall arrest harness • High vis vest where required • Helmet with chin strap, where helmet is required • Non-slip footwear 	Safety lines are to be installed by a person holding a WorkCover Certificate of Competency in either Basic Rigging or Basic Scaffolding.	N/A
Tools and equipment required			
Anchorage, lanyards, anchorage lines or restraint lines, Edge stops			
<p>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.</p>			

Selecting anchorages	<p>Selecting the type and location of anchorages depends on the type and location of the task, and the construction of the building or supporting structure.</p> <p>Unless the operator is already protected by another fall arrest system, and before the operator moves into a position where there would be risk of a fall, lanyards, anchorage lines or restraint lines are to be attached to the anchorages.</p> <p>Where used, drilled-in anchorages such as friction and glued-in anchorages are to be placed so that the shear load is at least twice the tension load.</p> <p>For collared eye-bolts this translates to a pull at an angle not exceeding 20° to the surface in which the bolt is installed.</p> <p>Every friction and glued-in anchorage is to be proof-loaded to 50% of the design ultimate strength specified in the table below in accordance with manufacturer's instructions after installation and before its initial use.</p> <p>The proof load must be applied as an axial pull-out force. Proof-loading to 50% of design load is also to be carried out as part of subsequent periodic inspections.</p>
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Anchorage strength requirements	Table 1 Strength requirement for anchorages		
	Type	Purpose of anchorage	Ultimate strength in direction of loading (kN)
Single point anchorages (see Note 1)	Free fall arrest—one person	Free fall arrest—one person	15
		Free fall arrest—two persons attached to same anchor	21
		Limited free fall arrest (including industrial rope access anchorages)	12
		Restrained fall arrest—restraint line anchorage	6
	Horizontal lifelines (see Note 2)	Total restraint only—no risk of a fall	6
		End anchorages	15
	Intermediate anchorages—diversion less than 15 degrees	Intermediate anchorages—diversion 15 degrees or more	12+(see Note 3)

NOTES:

- As far as practicable all single point one-person anchorages should meet the 15kN requirement regardless of primary purpose.
- Refers to fall arrest only. Does not refer to restraint only lines
- Horizontal component of forces induced during a fall arrest (multiplied by a safety factor of 2.0) is to be added.

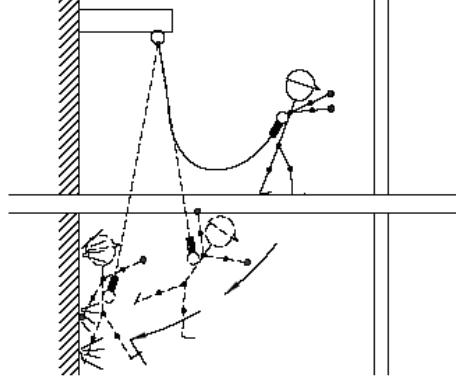
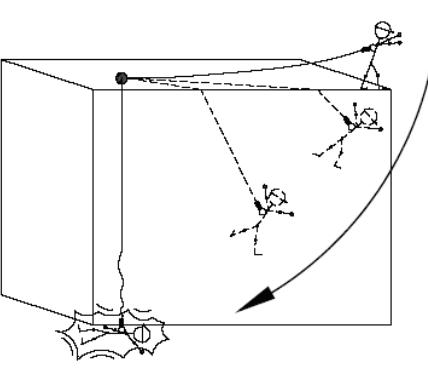
Avoiding lateral swing - the pendulum effect	<p>The pendulum effect is a lateral swing that can happen if there is a lateral offset between the line from the anchorage point to the operator and the line of fall.</p> <p>Two common consequences of the pendulum effect are illustrated in Figures 1. and 2.</p> <p>The hazard in the first case is a horizontal collision with a fixed object. In the second case it is a much longer fall distance. If the length of unsupported line is equal to or more than the height of the edge above the ground, the operator will strike the ground or other obstacle.</p>
	 

Figure 1 Example of simple pendulum effect

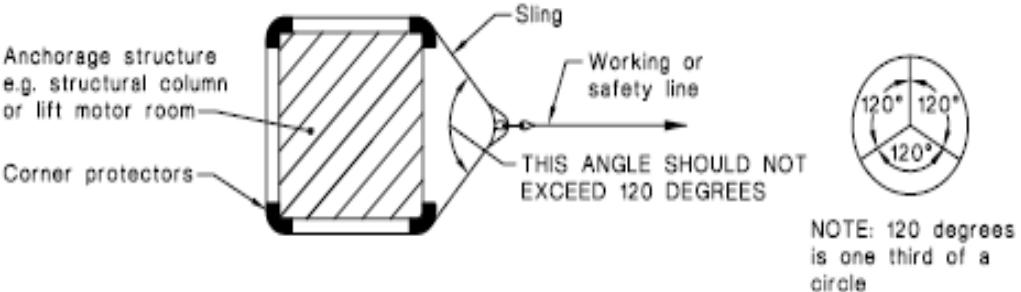
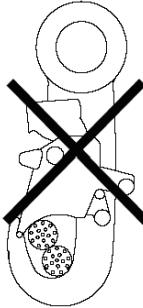
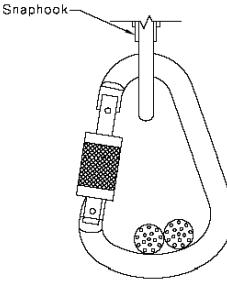
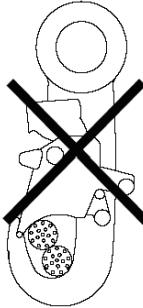
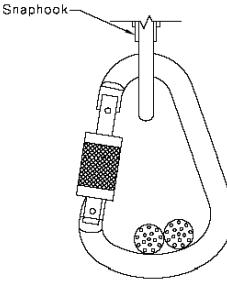
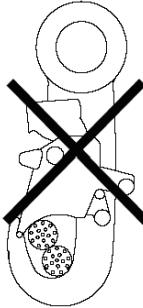
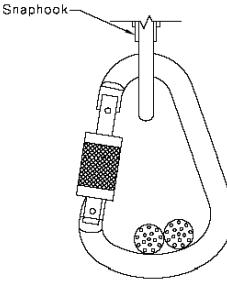
Figure 2 Example of pendulum effect – anchorage line sliding along edge

Where the pendulum effect cannot be avoided altogether by using alternative or changeable anchorage points, it is to be controlled to minimize injury in the event of a fall. This can be done use Dual or Diversion anchorage

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Avoiding lateral swing - the pendulum effect cont	Dual anchorages	<p>A second lanyard assembly is attached to a second anchorage point in a way that will limit lateral swing in the event of a fall, as illustrated in Figure 3.</p>	
	Diversion anchorage	<p>The lanyard assembly or anchorage line is diverted through a second anchorage point or a connector tethered to a second anchorage point as illustrated in Figure 4, and the lanyard or line runs freely through the anchorage point or connector.</p>	
		<p>As demonstrated in Figure 5, care is needed to determine the likely maximum fall arrest force on the diversion anchor. It may be significantly greater than that on the primary, anchorage. The calculated force, based on 6kN maximum lanyard/anchorage line force must be multiplied by a safety factor of 2.0 to determine the required ultimate strength of the diversion anchorage.</p>	
	Edge stops	<p>Stops such as vertical projections are placed along the edge of the roof, platform or stage on which the operator is working, as shown in Figure 6. In the event of a fall, the distance the line can slide along the edge is limited by the stops. Edge stops should not be located in such a manner as to provide a trip hazard, particularly if close to an edge such as a roof.</p>	

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Using anchorage slings	<p>Where slings are to be used to provide anchorages for fall arrest equipment other than horizontal life lines, eg. on a building by rigging each sling around one or more posts, beams or other structures, the safety requirements and recommendations are as follows:</p> <ul style="list-style-type: none"> the anchorage strength of the structure around which each sling is to be rigged must be verified to meet the requirements for anchorages set out in Table 1 the angle between the sling legs does not exceed 120°, as illustrated in Figure 7. a sling is not to be rigged with a choked pull unless it has been designed for this manner of rigging. A choked sling has a reduced load capacity and is not to be used unless this has been taken into account 				
	<p>Note:</p>  <p><i>Rigging a sling with a greater angle between the legs than shown in Figure 7 may result in the safe working load of the sling being exceeded.</i></p> <ul style="list-style-type: none"> protection is to be provided at all locations where slings could be subject to abrasion or cutting, leading to failure of the rope, eg. at sharp corners and edges where required, the sling is to be prevented from slipping along the member to which it is attached, eg. by using a double wrap or attachment at a cross member when connecting a line to the eyes of a sling, a connector is to be provided that is capable of accommodating both eyes without causing unsafe loading of the latch. Normally, an intermediate connector between the sling eyes and the line connector is required. Connectors of an appropriate shape, either a pear-shaped karabiner or a triangular tube nut connector are not to be used. <div style="text-align: center;">  <p>NOTE: 120 degrees is one third of a circle</p> </div>				
	<p>Figure 7 Example of correct angles between legs and provision of protection</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; vertical-align: top;"> Connector loading </td> <td style="width: 70%; vertical-align: top;"> <p>A connector is to be capable of holding both eyes of a sling without overloading the latch, as shown in Figure 8.</p> <p>Connectors of an appropriate shape are to be used, such as either a pear-shaped karabiner or a triangular tube nut connector.</p> </td> </tr> <tr> <td style="vertical-align: top;">  </td> <td style="vertical-align: top;">  <p>WRONG Cables are placing undue load on the latch of the snap hook</p> <p>CORRECT An adequate capacity connector is interposed between cables and snap hook</p> </td> </tr> </table> <p>Figure 8 Incorrect and correct examples of snap hook loading</p>	Connector loading	<p>A connector is to be capable of holding both eyes of a sling without overloading the latch, as shown in Figure 8.</p> <p>Connectors of an appropriate shape are to be used, such as either a pear-shaped karabiner or a triangular tube nut connector.</p>		 <p>WRONG Cables are placing undue load on the latch of the snap hook</p> <p>CORRECT An adequate capacity connector is interposed between cables and snap hook</p>
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Providing signage of anchorages	<p>Signs are to be provided for each anchorage point that will be in place for more than a month. The sign is to show the following information:</p> <ul style="list-style-type: none"> the name of installer and the installation date, or if an existing structure has been certified, the name of the certifier and the certification date the highest purpose category for which the anchorage is suitable, as shown in the Table 1 above the ultimate strength rating if less than 15kN. For example, if the strength rating is less than 15kN, the sign must say that the anchorage is not to be used for fall arrest the maximum number of people (not more than two) who are permitted to be connected to the anchorage at any one time if an anchorage point is to be in place for less than one month and does not need a label, it is to be removed as soon as it is no longer required at permanent installations the information is to be shown either on a sign located at each anchorage point or on a plan prominently displayed at the entry to the area
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Training	<p>Before working at heights, RailCorp Employees and Contractors are to be properly trained in:</p> <ul style="list-style-type: none">• the method of working at heights to be used• an understanding of the particular task requirements and any hazards and risks involved• correct selection, fitting, use, care and storage of:<ul style="list-style-type: none">- fall prevention systems and arrest equipment- personal protective equipment- tools and equipment to be used• procedures in the event of an emergency such as rescue, accident or injury. <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 Working at Heights guide.</p> <p>Line Managers are to make sure that employees are properly trained and possess the above competency.</p>
Additional controls	