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Technical Bulletin

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Understanding the Differences between Lifting Slings and Anchor Slings (Straps) used in Fall Protection

It has been common practice by a number of workers to use lifting slings (designed for lifting material loads) in fall protection scenarios and using these interchangeably with personal anchorage devices such as anchor straps, tie-off adaptors or personal round (endless slings). The purpose of this bulletin is to enlighten users of the potential dangers in this practice, and to clarify for users the design parameters of the different products.

Definitions and applicable sections within the Standard

Within AS/NZS1891.4, Part 1.4, Definitions, an anchorage sling (strap) is defined as a "Sling designed to be placed around a structural element to form an anchorage." Part 1.5 *Performance Requirements*, advises that "Performance requirements of with which items of equipment dealt with within this standard shall comply are specified in AS/NZS1891, parts 1, 2 and 3."

Further within Section 3, Part 3.1.2 *Anchorages*, the strength and use of attachment slings is only referred to in this area. The definitions provide that:

A) The anchorage and the structure to which it is attached shall be capable of sustaining an ultimate load equal to that shown in table 3.1 for the corresponding anchorage purpose for single person use (15kN) when loaded in the direction of the lanyard, anchorage line or restraint line during a fall arrest. This load requirement shall be increased by 6kN (i.e. to 21kN) if two people are to use the one anchorage point. The maximum number of people to any one point shall be two.
   As far as practicable, all single point anchorages for a single person attachment should have an ultimate strength of 15 kN, even though table 3.1 specifies a lesser strength for some categories.

B) The sling shall be of sufficient length so that it can be rigged with the angle between the legs no greater than 120 degrees (see clause 3.2(b)) unless an allowance has been made for higher loads in the legs of the sling which would be imposed by a greater angle.

Strength requirements for Anchorages under AS/NZS 1891.4

Personal anchorages are required to have minimum strength requirements as follows:

A) Single point anchorages

a. Free fall arrest one person - 15kN
b. Free fall arrest two persons - 21kN
c. Limited free fall (Including rope access) - 12kN

Personal slings (straps) in various configurations have been tested to perform as an anchorage strap, not as a lifting sling. The word 'sling' in the standard AS/NZS1891.4 is not intended to mean a 'lifting sling', which has different design requirements for performance rather than a temporary personal anchorage device.

Configurations

Both personal anchorage slings (straps) and lifting slights can be arranged in a multiple of configurations that are considered acceptable practice. Common use configurations include:

In ***Tension*** – Where the round (continuous sling) is looped over a product and anchorage, such as an oval 'loop' is maintained;

In ***Basket*** – Where the round (continuous sling) is folded 'in half' around a structure or product, that effectively reduces the length of the sling by half or less;

In **Choke** - Where the round (continuous sling) is looped over a product and then back through itself to choke against the product, leaving a single loop for connection.

Tension Basket Choke

The illustrations above show the types of configurations referred to above. During the application process of use of these products however, there are variations in performance and design, depending whether the product is to be used for lifting materials, or as a personal anchorage device.

Lifting slings – Reference to Australian Standard AS1353.1

Section 3.5, *Flat Lifting Slings* defines a lifting sling as "A sling made of flat woven synthetic fibre webbing which may incorporate end fittings complying with AS3585 or AS3776 for the lifting and handling of loads."

When manufactured and tested to Australian Standards AS1353.1 *Flat Synthetic Webbing Lifting Slings*, a product will have a Working Load Limit (WLL), with mechanical properties based on the webbing component of each sling that shall be capable of withstanding a test force equivalent to 'T'

times the Working Load Limit of the sling , where T = 8 for Polyester. This provides a safety factor of 8:1.

The lifting sling standard ***does not recognize 15kN or 21kN loads***.

The standard AS/NZS1891.4 does reference the lifting Standard AS1353, as may be seen in Part 3.1.3 *Anchorages*, requiring the use of a sling in basket configuration, providing for an angle of no greater than 120° as listed above, however this is more relevant to discussion about load angles based on configuration rather than the sling design/performance criteria.

Anchor Slings (Straps) – for Personal Fall Protection

The Standard AS/NZS1891.2 provides a test method for assessing personal anchorage loads and AS/NZS1891.4 defines the load ratings required.

AS/NZS1891.4 section 3.2.4 - *Safe Use of Anchorage Slings*

This section within the Standard details that where 'slings' are used to provide anchorages for fall arrest (other than for horizontal safety lines), then the safety requirements and recommendations are as follows;

(b) The angle between the sling legs (as illustrated in figure 3.2) should not exceed 120°. A 'sling' should not be rigged with a choke pull, unless it has been designed for this manner of rigging, as a 'choked' sling has a reduced load capacity;

(d) Where required, a means shall be provided for preventing the sling from slipping along a member to which it is attached, e.g. by using a double wrap or attachment at a cross member.

Contrasting Performance Ratings for Slings in Materials Handling vs Personal Anchorage Devices

It should be noted that when a personal anchor sling (strap) has been placed around a structure with an angle not exceeding 120°, the load rating is 1:1. In other words, if the strap is rated at 15 KN, then its rating is still 15 kN. By contrast, in materials handling, where lifting slings are used in 'choke', are reduced to 80 % of the WLL, or a ratio of 1: 0.8.

Similarly, in materials handling, when a sling is used in a 'basket' configuration, the sling is then able to hold twice the load of the WLL of the sling, however when a personal anchorage device is used in 'basket' configuration, the performance rating of the strap at either 15kN or 21kN does not change. When double-wrapping the personal anchorage sling or multiple wrapping is conducted, there is no loss of strength due to the wrapping process, as the strength is related to the choked eye/configuration of the strap.

In other words, the Lifting Sling Standard AS 1353.1 requires a materials lifting sling to be 'downgraded' in certain lift configurations. The chart below

outlines the variations between lifting slings and personal anchorage devices.

	Straight	Choke	Basket	Basket 120°
				
Lifting Sling (WLL)	2 tonne	1.6 tonne	4 tonne	2 tonne
Personal Anchorage Device	22kN	22kN	22kN	22kN

Testing completed under AS/NZS1891.1 to verify product performance

The chart below provides results of static tests completed on DBI-SALA brand personal anchorage straps completed in various configurations.

Test certificate	Date	Product	Straight	Basket	Choke
712	7/06/2007	E88-012	15kN	15kN	15kN
711	7/06/2007	E87-010	22kN	22kN	22kN
710	7/06/2007	E830-020	15kN	15kN	15kN
709	7/06/2007	E849-020	22kN	22kN	22kN

Note: Static Tests Loads were held for 3 minutes

The static loads shown in the above are the minimum force applied in each of the testing configurations.

Additionally, to verify the performance of personal anchorage devices was not compromised by double or multiple wrapping, additional testing was performed. The additional basket configuration where the leg angle was set at 120° was also tested. The chart below shows the results of these tests:

Test Certificate	Date	Product	Basket	Choke	Straight	Double wrap	120□ Basket
1372	25/08/2009	E88-012	15kN	15kN	15kN	15kN	15kN
1373	25/08/2009	AM450/120AU	22kN	22kN	22kN	22kN	22kN
1374	25/08/2009	E849-015	22kN	22kN	22kN	22kN	22kN
1375	25/08/2009	AM500-150AU	22kN	22kN	22kN	22kN	22kN

Note: All static loads were held for 2 minutes, as required by the standard.

The Australian / New Zealand Standard for fall arrest (AS/NZS1891.1 to 4) therefore provides for the various use considerations and providing the anchorage strap holds the minimum load required, no reduction of capacity is required to be undertaken, unlike a lifting sling.

Other considerations

One of the other significant elements that is not considered whilst using lifting slings in personal fall protection is that Lifting Slings are often abused and can be damaged through the process of lifting loads. Remember also that during the process of lifting a load using a crane, that the sling is subjected often to bouncing whilst the load is in transit, placing additional stress on the sling that might not be evident during an inspection. Typically a rigger has to 'estimate' the load being applied during a lift of goods and may through misjudgement apply loads greater than the rating lift rating or potential of the sling.

It is therefore good practice and highly recommended that lifting slings not be used as Personal Fall Arrest Anchor slings (straps), as they can inadvertently be subject to damage during materials lifts, are not designed to support a person and in the event may not adequately perform the job during a fall arrest situation. Lifting Slings should only ever be used for lifting materials to avoid the potential for confusion and misuse.