



April 11, 2018

Mr. John Yates  
Yates Gear  
2608 Hartnell, Suite 6  
Redding, CA 96002

Subject: Project 4788381698  
Commercial Test Services – Comparison of North American Full Body Harness and Energy Absorbing Lanyard Standards to Australian/New Zealand standard

Dear John:

This project was established to compare the requirements of AS/NZS 1891.1:2007, *Australian/New Zealand Standard for Industrial fall-arrest systems and devices Part 1: Harnesses ancillary equipment*, with the requirements of the following standards for full body harnesses:

NFPA 1983-2017	<i>Standard on Life Safety Rope and Equipment for Emergency Services</i>
ANSI/ASSE Z359.11-2014	<i>Safety Requirements for Full Body Harnesses</i>
CSA Z259.10-2012	<i>Full Body Harnesses</i>

and with the requirements of the following standard for energy absorbing lanyards:

ANSI/ASSE Z359.11-2014	<i>Personal Energy Absorbers and Personal Energy Absorbing Lanyards</i>
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We have completed the study, and this Letter Report is provided to give you our summary.

UL Commercial Test Services did not select or review any samples or conduct any testing. This report only gives a report of our comparison study of the standards.

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This letter serves to report that the work associated with this project has been completed. Thank you for the opportunity to provide Yates Gear with these services. Please do not hesitate to contact me if you have any questions or concerns.

Sincerely,

Beverly Wooten Stutts  
Staff Engineer  
Personal Protective Equipment  
Building and Life Safety Technologies

Reviewed:

Michael Seward  
Laboratory Manager  
Personal Protective Equipment  
Building and Life Safety Technologies

## REPORT

### Full Body Harnesses

The design requirements of each standard were compared. AS/NZS 1891.1 requires that webbing have a minimum width of 40mm. NFPA 1983 does not have a specific width requirement, but both ANSI/ASSE Z359.11 and CSA Z259.10 require a minimum width of 41mm, which exceeds the requirement of AS/NZS 1891.1.

Stitching and finishing requirements are similar for all standards. AS/NZS 1891.1 does not allow for holes, rivets, or eyelets to be used in load-bearing webbing, but that is not a concern because none of your current UL certified full body harnesses have holes, rivets, or eyelets in the load-bearing webbing.

AS/NZS 1891.1 does require that webbing be subjected to a degradation resistance testing, with the exposed webbing retaining at least 70% of the breaking strength when compared to the breaking strength without the conditioning. NFPA 1983, ANSI/ASSE Z259.11, and CSA Z259.10 do not have a similar requirement. However, in reviewing test data that you provided of your webbing tested by Bally Ribbon Mills (Lab Report Number 209443-6531), we conclude that harnesses made with the 4893 webbing as given in your file comply with these requirements.

For the attachment points, NFPA 1983 requires at least one load-bearing attachment point in the front waist or sternal location. ANSI/ASSE Z359.11 and CSA Z259.10 both require at least a dorsal attachment. AS/NZS 1891.1 requires at least one center frontal (e.g. chest) attachment point. Most of your harness models comply with this AS/NZS 1891.1 requirement.

AS/NZS 1891.1 does not allow for an attachment point in the center rear waist position. Therefore, those models that you currently have certified that include a rear waist attachment point would not meet the design requirements of AS/NZS 1891.1. However, if the rear waist attachment was removed, the models would meet the requirements.

For testing, the test torso called for by AS/NZS 1891.1 weighs 100 kg and is similar in design to the test torso required for EN testing. This differs from the test torsos used for NFPA 1983, ANSI/ASSE Z359.11, and CSA Z259.10. The NFPA 1983 test torso weighs 136 kg, the ANSI/ASSE Z359.11 test torso weighs 100 kg but is shaped differently than the AS/NZS 1891.1 test torso, and the CSA Z259.10 test torso weighs 160 kg. All of the test torsos have a different shape, as shown in the illustration below. After review of all of the test torsos with regard to shape, materials and weight, we conclude that the test torsos that have been used for testing of your certified harnesses demonstrate that your products should perform similarly when tested on the AS/NZS 1891.1 torso.

Full Body Harnesses cont'd



**ANSI/ASSE Z359**  
100 kg



**CSA Z259**  
160 kg



**NFPA 1983**  
136 kg



**EN**  
100 kg

For performance testing, all standards except for CSA Z259.10 require both static and dynamic (drop) testing. CSA Z259.10 does not require static testing.

For the static testing, the required loads are given in the table below:

Attachment Point	Standard Requirement for Force Applied during Static Testing			
	AS/NZS 1891.1	NFPA 1983	ANSI/ASSE Z359.11	CSA Z259.10
Chest	Upright – 15 kN Head Down – 10 kN	Upright-16 kN Head Down – 10kN	Upright – 16 kN	N/A
Front Waist	Upright – 15 kN Head Down – 10 kN	Upright-16 kN Head Down – 10kN	Upright – 16 kN	N/A
Dorsal	Upright – 15 kN Head Down – 10 kN	Upright-16 kN Head Down – 10kN	Upright – 16 kN	N/A
Shoulders	Upright – 12 kN	Upright – 13 kN	Upright – 16 kN	N/A
Side Positioning	Upright – 12 kN	Upright – 13 kN	Upright – 16 kN	N/A

The forces required by NFPA 1983 and ANSI/ASSE Z359.11 exceed the required loads given in AS/NZS 1891.1 for testing in the upright orientation of the test torso. The forces required by NFPA 1983 exceed or are equal to the required loads given in AS/NZS 1891.1 in the head down orientation of the test torso. NFPA 1983 and ANSI/ASSE Z359.11 also require that slippage of the buckles be measured after testing, and slippage cannot exceed 25mm at any location. AS/NZS 1891.1 does not have a slippage requirement for the static testing.

Full Body Harnesses cont'd

For the dynamic (drop) testing, the drop height requirements are given in the table below.

Attachment Point	Standard Height/Force Requirements for Drop Testing			
	AS/NZS 1891.1	NFPA 1983	ANSI/ASSE Z359.11	CSA Z259.10
Chest	Upright – 1.8 meter drop Head Down – 1.8 meter drop	Upright - 1 meter drop Head Down – 1 meter drop	Upright - no minimum drop height but must achieve peak force of at least 16 kN	Upright - 1 m drop
Front Waist	Upright – 1.8meter drop Head Down – 1.8 meter drop	Upright - 1 meter drop Head Down – 1 meter drop	Upright - no minimum drop height but must achieve peak force of at least 16 kN	Upright - 1 m drop
Dorsal	Upright – 1.8 meter drop Head Down – 1.8 meter drop	Upright - 1 meter drop Head Down – 1 meter drop	Upright - no minimum drop height but must achieve peak force of at least 16 kN  Head down no minimum drop height but must achieve peak force of at least 16 kN	Upright – 1 m drop Head Down – 1 m drop
Shoulders	N/A	N/A	N/A	Upright - 1 m drop
Side Positioning/Hips	Upright – 12 kN	N/A	N/A	Upright - 1 m drop

Even though ANSI/ASSE Z359.11 does not specify a drop height requirement, the peak force requirement is significant and often requires drop heights from well over 1.8 m and for your harnesses sometimes up to three or even four meters to achieve the required peak force. AS/NZS 1891.1 does require that slippage be measured after the drops, but the other standards only require slippage to be measured after the static testing. The ANSI/ASSE Z359.11 requires the more severe testing, but slippage is not addressed. Also, CSA is the only one of the North American standards that requires drop testing of the shoulder or side positioning attachment points

Additionally, ANSI/ASSE Z359.11 and CSA Z259.10 require testing of the fall arrest indicator. ANSI/ASSE Z359.11 also requires testing of the lanyard parking attachment.

ANSI/ASSE Z359.11 and CSA Z259.10 both require that the load-bearing webbing, after ambient conditioning, have a breaking strength of at least 22.2 kN, and ANSI/ASSE Z359.11 also requires that the load-bearing webbing, after abrasion conditioning, have a breaking strength of at least 16 kN. NFPA 1983 does not have any webbing strength requirements, but does require that the webbing be subjected to the Melting and Crystallization Temperatures Test (ASTM E794) and shall not have a melting point below 204° C. NFPA 1983 has the same melting requirement for the thread. ANSI/ASSE Z359.11 does not have any thread test requirements, but the thread is required to be of the same material as the load bearing straps.

Lanyards (Energy Absorbers and Energy Absorbing Lanyards)

AS/NZS 1891.1 requires that webbing used in shall have a minimum width of 20mm. ANSI/ASSE Z359.13 has no minimum width requirement. However, all of the webbings used in your certified ANSI/ASSE Z359.13 energy absorbers and energy absorbing lanyards exceeds the minimum AS/NZS 1891.1 width requirement. AS/NZS 1891.1 also requires that the webbing meet the resistance to light test requirements. We do not have any test data to review to verify if the webbing meets the resistance to light requirements.

Both standards require energy absorbers and energy absorbing lanyards to be subjected to both dynamic and static tests. For the static testing, AS/NZS 1891.1 requires that the product hold a test load of 15 kN for three minutes, while ANSI/ASSE Z359.13 requires that the product hold a test load of 22.2 kN for at least one minute.

For activation of the absorber, AS/NZS 1891.1 requires that the product be subjected to an increasing load until it is activated and that the load be recorded; the load shall be greater than 2 kN. ANSI/ASSE Z359.13 requires that the product be subjected to a load of at 2K without showing signs of activation or elongation greater than 51 mm.

The test weight used for the dynamic testing is 100 kg for the AS/NZS 1891.1 testing and 128 kg for the ANSI/ASSE Z359.13 testing. AS/NZS 1891.1 requires a 3.8 meter drop; ANSI/ASSE Z359.13 requires a 1.8 meter drop for a 6ft free fall model and requires a 3.6 meter drop for a 12ft free fall model. Both standards require that the force be measured and do not exceed the maximum allowed. Also the deployment distance is measured. See table below.

Requirements for Drop Testing			
Maximum Allowed	AS/NZS 1891.1	ANSI/ASSE Z359.11 6ft Free Fall	ANSI/ASSE Z359.11 12ft Free Fall
After Ambient Conditioning			
Maximum Average Arrest Force	6 kN	4 kN	6 kN
Maximum Arrest Force	N/A	8 kN	8 kN
Maximum Deployment Distance	195 cm	122 cm	152.4 cm
After Wet Ambient Conditioning			
Maximum Average Arrest Force	N/A	5 kN	7 kN
Maximum Arrest Force	N/A	8 kN	8 kN
Maximum Deployment Distance	N/A	122 cm	152.4 cm
After Cold Dry Conditioning			
Maximum Average Arrest Force	N/A	5 kN	7 kN
Maximum Arrest Force	N/A	8 kN	8 kN
Maximum Deployment Distance	N/A	122 cm	152.4 cm
After Hot Dry Conditioning			
Maximum Average Arrest Force	N/A	4 kN	6 kN
Maximum Arrest Force	N/A	8 kN	8 kN
Maximum Deployment Distance	N/A	122 cm	152.4 cm

The test methods are similar for the testing and the ANSI/ASSE Z359.13 standards more testing with different conditionings and with heavier weight. Your certified 6ft free fall and 12ft free fall energy absorbers and energy absorbing lanyards do comply with the performance requirement parameters of AS/NSZ 1891.1.