



TEST REPORT

(This Report is issued subject to the terms & conditions set out below)

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Business Reg. No. 196900269D

Date: 30 October 2017

Your Ref: -

Our Ref: MM-60718/AGK/1

Page 1 of 17

SUBJECT:

Testing of full body harness incorporated with energy-absorbing lanyard submitted by PDS International Pte Ltd on 05 October 2017.

Tested For:

PDS INTERNATIONAL PTE LTD

10 Pandan Crescent,
#05-03/04 (LL2),
Singapore 128466.

Date of Test

09 October 2017 to 26 October 2017

METHOD OF TEST:

SS 528: Part 1: 2006 - Specification for personal fall-arrest systems - Part 1: Full-body harnesses

SS 528: Part 2: 2006 - Specification for personal fall-arrest systems – Part 2: Lanyards and energy absorbers

SS 528: Part 5: 2006 - Specification for personal fall-arrest systems – Part 5: Connectors with self-closing and self-locking gates

SS 528: Part 6: 2006 - Specification for personal fall-arrest systems – Part 6: System performance test

SAMPLE DESCRIPTION:

Full body harness

Full body harness with dorsal anchorage point with 3 points buckle, quick connect and front loop. Incorporated with energy absorbing single and double lanyard were submitted as follow:

Brand / model: WORKSafe / WSF122
Classification: Class A (for fall arrest purposes)
Primary strap: 45 mm width

Brand / model: WORKSafe / WSF160
Classification: Class A (for fall arrest purposes)
Primary strap: 45 mm width

Brand / model: WORKGard / WGF512
Classification: Class A (for fall arrest purposes)
Primary strap: 45 mm width

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Energy absorbing lanyard (single)

Energy absorbing lanyard (12mm diameter rope-based lanyard)

Brand / model: WORKSafe / WSF221

Type: 2 (used in PFAS where the potential freefall distance limited to a maximum of 4 m)

Number of lanyards: One

Energy absorber: WORKSafe / WSF221

Rope lanyard: WORKSafe / WSF221-1

Steel snap hook: WORKSafe / WSF777 (55 mm gate opening)

Steel karabiner: WORKSafe / WSF333 (20 mm gate opening)

Energy absorbing lanyard (12mm diameter rope-based lanyard)

Brand / model: WORKGard / WGF611

Type: 2 (used in PFAS where the potential freefall distance limited to a maximum of 4 m)

Number of lanyards: One

Energy absorber: WORKGard / WGF611

Rope lanyard: WORKGard / WGF611-1

Steel snap hook: WORKGard / WGF777 (55 mm gate opening)

Steel karabiner: WORKGard / WGF333 (20 mm gate opening)

Energy absorbing lanyard (double)

Energy absorbing lanyard (12mm diameter rope-based lanyard)

Brand / model: WORKSafe / WSF222

Type: 2 (used in PFAS where the potential freefall distance limited to a maximum of 4 m)

Number of lanyards: Two

Energy absorber: WORKSafe / WSF222

Rope lanyard: WORKSafe / WSF222-2

Steel snap hook: WORKSafe / WSF777 (55 mm gate opening)

Steel karabiner: WORKSafe / WSF333 (20 mm gate opening)

Energy absorbing lanyard (12mm diameter rope-based lanyard)

Brand / model: WORKGard / WGF622

Type: 2 (used in PFAS where the potential freefall distance limited to a maximum of 4 m)

Number of lanyards: Two

Energy absorber: WORKGard / WGF622

Rope lanyard: WORKGard / WGF622-2

Steel snap hook: WORKGard / WGF777 (55 mm gate opening)

Steel karabiner: WORKGard / WGF333 (20 mm gate opening)

Configuration of Personal Fall Arrest System (PFAS)

- A + EAL + FBH



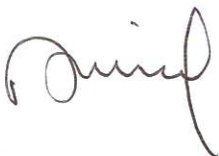

Results:**SS 528: Part 1: 2006 - Full body Harness**

Clause	Results	SS 528: Part 1: 2006 Requirements
4.3.1 General requirements Full body harness	Complied	The full body harness shall not create any supplementary risk and shall offer an acceptable degree of comfort.
	Complied	A means of adjustment shall be provided to enable the full body harness to fit the wearer in accordance with manufacturer's instructions.
	Complied	The full body harness shall be so designed so that when worn, the straps shall be incapable of inadvertently migrating or loosening from their original position or setting.
	Complied	It shall be possible to carry out a visual inspection of the whole full body harness, even if incorporated within a garment.
4.3.2 Textile requirements Primary straps, secondary straps and sewing thread	Complied	Primary straps shall have a width of at least 40 mm and secondary straps shall have a width of at least 20 mm.
	Complied	Sewing threads shall be physically compatible with and of a comparable quality to that of the webbing, but shall be of different colour from that of the webbing in order to facilitate visual inspection.




Results:

Clause	Results	SS 528: Part 1: 2006 Requirements
4.3.3 Requirements for fittings All buckles, attachment elements, collector plates, cleats, comfort pads, back support pads and tool loops.	Complied	All buckles, attachment elements, collector plates, cleats, comfort pads, back support pads and tool loops shall be smoothly finished and free from defects due to faulty material and manufacturer; they shall not have sharp or rough edges that may cut, abrade or otherwise damage webbing or cause injury to the user.
	Complied	All adjustment buckles shall self-lock securely onto the full body harness webbing material but shall not present roughened surfaces or sharp edges that may abrade or otherwise damage the webbing material.
	Complied	Fastening buckles shall not be capable of inadvertent uncoupling.
4.3.4 Additional requirements for attachment elements Class A – Fall arrest Class D – Controlled descent / ascent Class E – Confined-space access Class P – Work positioning	Not Applicable	All attachment elements made from loops of textile material shall be adequately protected against abrasion, both inside and outside of the loop.
	Complied	Depending upon full body harness classification, attachment elements shall be incorporated into the full body harness. Front and side attachment points for connecting into work-positioning systems are not accepted for fall-arrest use.
	Complied	The fall-arrest attachment element of a Class A full body harness, when incorporated as to lie at the back of the wearer and centrally between the upper shoulder blades, shall be so designed as to not slide down the back of the torso test mass during inverted dynamic test.




Results:

Clause	Results	SS 528: Part 1: 2006 Requirements
<p>4.4 Corrosion resistance Clause 5.2 Corrosion test - The metallic fittings shall be salt sprayed tested in accordance with ISO 9227, with an initial exposure of 24 h, followed by 1 h of drying, followed by a second exposure of 24 h.</p>	Complied	All metallic fittings shall be free of red rust, as visible to the unaided eye, or other evidence of corrosion of the base metal.
<p>4.5 Buckle uncoupling and slippage Clause 5.3 Buckle shake test - Grasp the webbing on either side of the buckle and shake it quickly by alternatively moving the webbing towards the buckle then away from it for a total of 25 cycles.</p>	Complied	Fastening buckles shall not uncouple, and adjustment buckles shall not allow a strap slippage of more than 25 mm.
<p>4.7 Dynamic performance Clause 5.7 Dynamic performance tests</p> <p>Feet first test – The full body harness fitted to the 100 kg torso test mass is allowed to fall freely over a distance of 1.0 m.</p> <p>Head first test – The full body harness fitted to the 100 kg torso test mass is allowed to fall freely over a distance of 1.0 m.</p>	Complied	<p>The full body harness shall retain the torso test mass clear of the ground and in an upright position when tested at each fall-arrest attachment element.</p> <p>In addition, there shall be:</p> <ol style="list-style-type: none"> no tearing of webbing material no tearing of any primary strap sewn joint no partial or complete fracture of any buckle no inadvertent opening of any fastening buckle <p>At the conclusion of the test the angle formed between the back of the torso test mass and the test lanyard shall not exceed 45°.</p> <p>The full body harness shall be capable of retaining the torso test mass in post-dynamic test suspension for a period of at least 10 min.</p>




Results:

Clause	Results	SS 528: Part 1: 2006 Requirements
<p><u>4.9 Static suspension angle test for Class AE full body harness</u> Clause 5.9 Static suspension angle test for Class AE full body harness. Raise the torso test mass so that it is just clear of the floor. Allow the torso test mass to remain suspended for 3 min.</p>	Not Applicable	Class AE full body harness shall retain the torso test mass in an upright position when tested at each confined-space access attachment element. The angle formed between the back of the torso test mass and the test lanyard shall not exceed 10°.
<p><u>6.1 Instructions for general use and maintenance</u></p>	Complied	Clear instructions in the appropriate national language, for fitting, adjustment and use shall be supplied with each full body harness.
<p><u>6.2 Marking</u></p>	Complied	Full body harness shall be clearly and indelibly marked or permanently labelled by any suitable method not having a harmful effect on materials.




Results:**SS 528: Part 2: 2006 - Lanyards and energy absorbers**

Clause	Results	SS 528: Part 2: 2006 Requirements
<u>4.2.1 Lanyard - Fibre rope and webbing</u> Fibre ropes, webbing and sewing threads for lanyards	Complied	Fibre ropes, webbing and sewing threads for lanyards shall be made from virgin high-tenacity filament or multifilament synthetic fibre or fibres suitable for the intended use.
	Complied	The number of strands of a laid rope shall be at least three.
<u>4.2.3 Lanyard - Terminations</u> Eye splices in laid fibre rope, stitched eye terminations on webbing lanyards and eye terminations of wire rope lanyards	Complied	One end of a lanyard may be permanently spliced or fixed to a full body harness or to an energy absorber, or to a connector. The free end (s) of the lanyard shall be terminated in such a manner that they can be connected into personal fall arrest system by an appropriate connector.
	Complied	Eye splices in laid fibre rope shall consist of 4 tucks using all the yarns in the strands and two taped tucks. The length of the splicing tails emerging after the last tuck shall be at least one rope diameter. Tails shall be whipped to the rope and protected with a rubber or plastic sleeve, or otherwise integrally finished to prevent termination or splice from unraveling. Eyes shall be formed around a plastic or metal thimble.
<u>4.2.4 Lanyard - Fittings</u> All buckles, adjustment mechanisms, thimbles, and integral connections Clause 5.2.4 – A sample of each metallic fitting from the lanyard under test shall be salt sprayed tested in accordance with ISO 9227, with an initial exposure of 24 h, followed by 1 h of drying, followed by a second exposure of 24 h.	Complied	All buckles, adjustment mechanisms, thimbles, and integral connections shall be smoothly finished and free from defects due to faulty material and manufacture. They shall not have sharp edges that may cut, abrade or otherwise damage the lanyard material or cause injury to the user. All metallic fittings shall be free from red rust, as visible to the unaided eye, or other evidence of corrosion of the base metal.




Results:

Clause	Results	SS 528: Part 2: 2006 Requirements
4.3.1 Energy absorber – General Energy absorber material and mechanisms	Complied	Energy absorber material and mechanisms designed to be utilized in the dissipation of kinetic energy shall have protective coverings incorporated to shield against external contaminants, sharp objects and adverse climate.
4.3.2 Energy absorber – Terminations All buckles, fittings, thimbles, and integral connections. Clause 5.3.9 – A sample of each metallic fitting from the energy absorber under test shall be salt sprayed tested in accordance with ISO 9227, with an initial exposure of 24 h, followed by 1 h of drying, followed by a second exposure of 24 h.	Complied	One end of an energy absorber may be permanently spliced or fixed to a full body harness or to a lanyard, or to a connector. The free end (s) of the lanyard shall be terminated in such a manner that they can be connected into personal fall arrest system by an appropriate connector.
	Complied	Where the free end(s) of the energy absorber are connected to metal components or will be connected into a personal fall arrest system using connectors, suitable reinforcement or another method shall be used to protect terminations from concentrated wear at all textile-to-metal fitting interfaces.
	Complied	All buckles, fittings, thimbles, and integral connections shall be smoothly finished and free from defects due to faulty material and manufacture. They shall not have sharp edges that may cut, abrade or otherwise damage the lanyard material or cause injury to the user.
	Complied	All metallic fittings shall be free from red rust, as visible to the unaided , or other evidence of corrosion of the base metal.




Results:

Clause	Results	SS 528: Part 2: 2006 Requirements
<p><u>4.3.3 Energy-absorbing lanyards and full body harness with energy absorber</u> An energy absorber is integral with a lanyard or harness (i.e. the energy absorber cannot be removed without mutilating the lanyard or harness, or without the use of a special dedicated tool.)</p>	Complied	All the requirements specified in 4.3 apply.
<p><u>4.3.5 Energy absorber (Type 2)– Dynamic performance</u> The 100 test mass of steel is allowed to fall freely over a distance of 4 m.</p> <p>Clause 5.3.3 – Dynamic test of energy absorber when supplied as a component.</p> <p>Clause 5.3.4 – Dynamic test of energy absorbing lanyard</p> <p>Clause 5.3.5 – Dynamic test of full body harness with integral energy absorber</p>	Complied	An energy absorber shall limit the arrest force to a maximum of 4 kN for Type 1 or 6 kN for Type 2.
<p>Clause 5.3.3 – Dynamic test of energy absorber when supplied as a component.</p> <p>Clause 5.3.4 – Dynamic test of energy absorbing lanyard</p> <p>Clause 5.3.5 – Dynamic test of full body harness with integral energy absorber</p>	Complied	Permanent extension of the energy absorber shall not exceed 1.2 m for Type 1 or 1.75 m for Type 2.
<p><u>6.1 Instructions for general use and maintenance</u></p>	Complied	Clear instructions in the appropriate national language, for fitting, adjustment and use shall be supplied with each lanyard and energy absorber.
<p><u>6.2 Marking</u> 6.2.1 – Marking on lanyards 6.2.2 – Marking on energy absorber</p>	Complied	Lanyards and energy absorber shall be clearly and indelibly marked or permanently labelled by any suitable method not having a harmful effect on materials.




Results:**SS 528: Part 5: 2006 – Connectors with self-closing and self-locking gates**

Clause	Results	SS 528: Part 5: 2006 Requirements
<u>4.1 General requirements</u> Connectors	Complied	All connectors shall be made from smoothly finished metal and shall be free from defects due to faulty material and manufacture; they shall have sharp edges or burrs that may cause injury to the user, or that may cut, abrade or otherwise damage webbing or rope.
	Complied	All connectors shall be self-closing and self locking and shall be capable of being opened only by at least two consecutive, deliberate actions.
	Complied	The self-closing gate shall be so designed that when it is released from the open position, it shall automatically close, and the locking feature shall automatically engage.
<u>4.2 Gate resistance</u> Clause 4.2.1 - Gate-face resistance Clause 4.2.2 - Gate-side load resistance	Complied	<u>Gate-face resistance</u> The connector shall withstand a minimum force of 1.0 kN for 1 min without the gate separating from the latch by more than 3 mm. Following this test, the gate shall function in accordance with Clause 4.1.3.
	Complied	<u>Gate-side load resistance</u> The connector shall withstand a minimum force of 1.5 kN for 1 min without the gate separating from the latch by more than 3 mm. In addition, there shall be no partial fractures, and permanent deformation of the gate shall not exceed 3mm. Following this test, the gate shall function in accordance with Clause 4.1.3.
<u>Clause 4.3 Static strength test</u> Applied a minimum force of 20 kN and maintain it for 60 sec.	Complied	The connector shall withstand a minimum force of 20 kN for 1 min. There shall be no partial fractures or inadvertent opening of the gate.

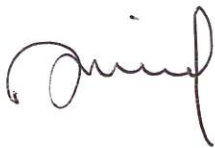



Results:

Clause	Results	SS 528: Part 5: 2006 Requirements
4.4 Corrosion resistance Clause 5.3 Corrosion test - Salt sprayed test the connector in accordance with ISO 9227, with an initial exposure of 24 h, followed by 1 h of drying, followed by a second exposure of 24 h.	Complied	When tested, the connector gate shall continue to function. There shall be no evidence of corrosion of the base metal.
6.1 Instructions for general use	Complied	A connector shall be supplied with clear instructions in the appropriate national language.
6.2 Marking	Complied	Connectors shall be clearly and indelibly marked or permanently labelled in accordance with relevant national regulations..

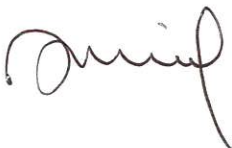
SS 528: Part 6: 2006 – Part 6: System performance test

Clause	Results	SS 528: Part 6: 2006 Requirements
5.1 Components and subsystem 1. Specific combination of components and subsystems 2. Compatibility of specific components and subsystems	Complied	The specific combination of components and subsystems intended for assembly into a personal fall arrest system has been proved capable of meeting the individual requirements of ISO 10333-1 to ISO 10333-5 according to type.
	Complied	The manufacturer shall give sufficient information on the compatibility of specific components and subsystems to the purchaser.




Results:

Clause	Results	SS 528: Part 6: 2006 Requirements
5.2 System performance Clause 6.2 – Performance test for A + EAL + FBH type PFAS a. 100 kg torso test mass b. 1.8 m free fall distance	Complied	The arrest force shall not exceed 6kN.
	Complied	The angle formed between the back of the torso test mass and the vertical plane shall not exceed 45°.
	Complied	For A + EAL + FBH configured PFAS, the fall distance, H _D , shall be recorded for required free space calculation.
	Complied	With the 100 kg torso test mass remaining in post drop suspension, there shall be none of the following results on a full body harness: <ul style="list-style-type: none"> a. Tearing of webbing material b. Tearing of any primary strap sewn joint c. Partial or complete fracture of any fastening or adjusting buckle d. Inadvertent opening of any fastening buckle e. Straps applying pressure to the neck of the torso test mass.
	Complied	With the torso test mass remaining in post drop suspension, there shall be neither of the following results on other parts of the PFAS: <ul style="list-style-type: none"> a. Tearing or rupture of any component (except where such tearing was deliberately designed to contribute to energy dissipation) b. Partial fractures or inadvertent opening of connector gates.




Remarks:

1. The tests conducted on the full body harness incorporated with energy absorber lanyard, as indicated above, complied with the following requirements:
 - a. SS 528: Part 1: 2006
 - b. SS 528: Part 2: 2006
 - c. SS 528: Part 5: 2006
 - d. SS 528: Part 6: 2006



SAM AU
Testing Officer



CHEN YU
Assistant Manager (Mechanical Testing)
Mechanical Technology Division



Photograph 1: Full body harness, model WSF122



Photograph 2: Full body harness, model WSF160

Dimp

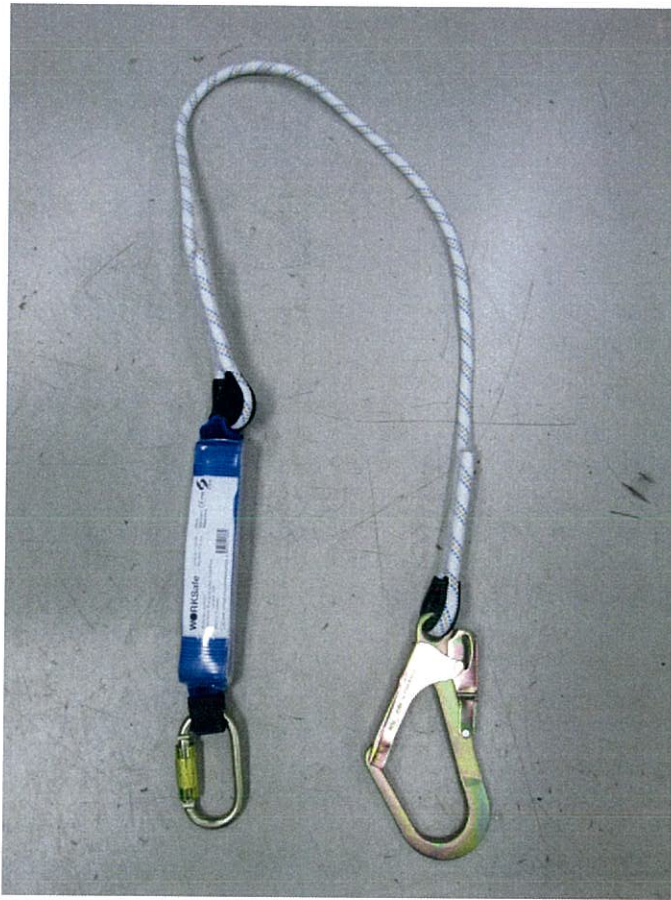




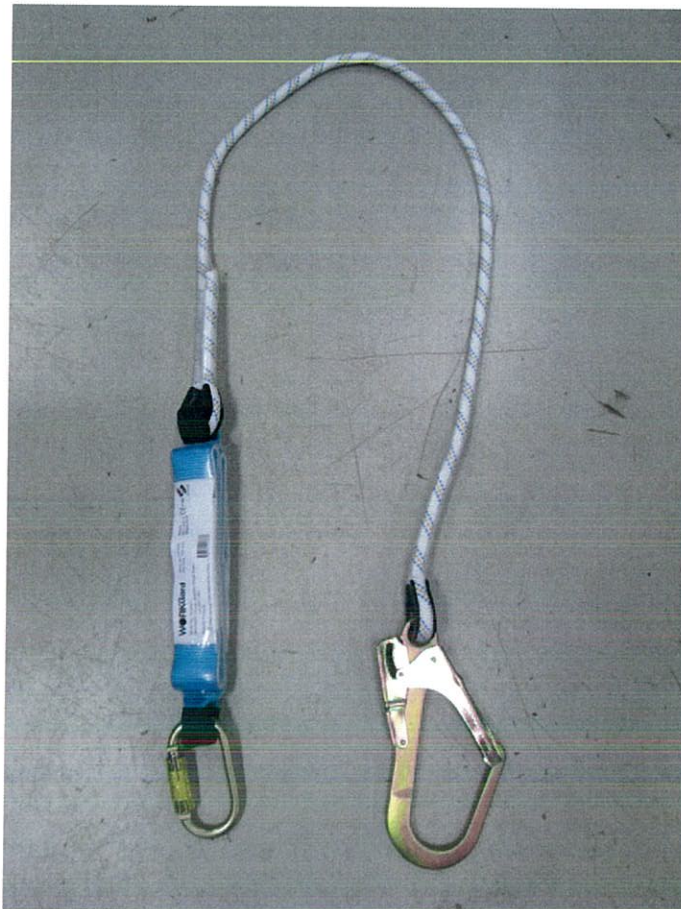
Photograph 3: Full body harness, model WGF512

Chief





Photograph 4: Energy absorber lanyard, model WSF221



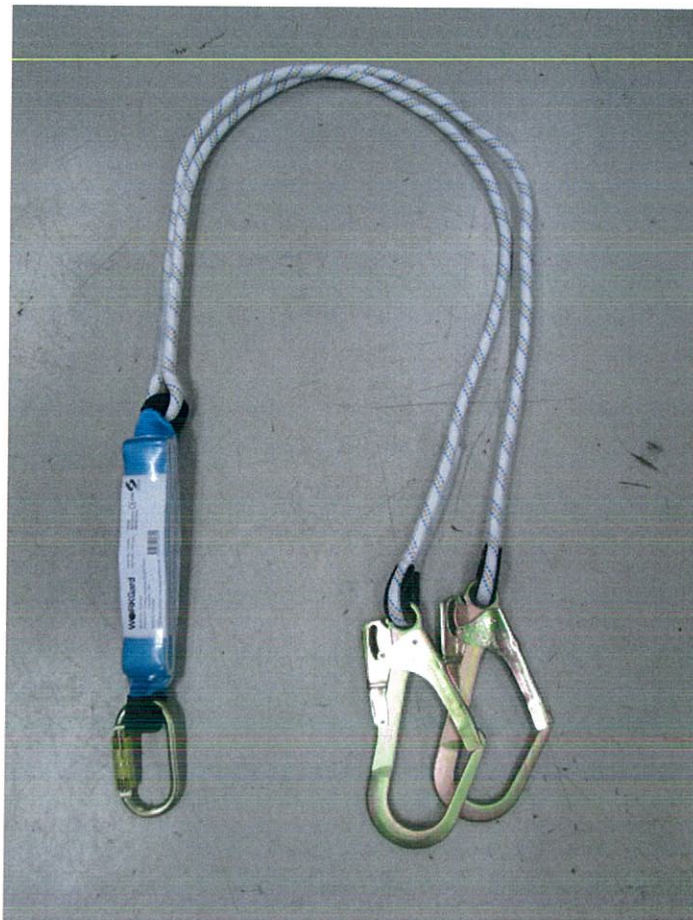
Photograph 5: Energy absorber lanyard, model WGF611

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Photograph 6: Energy absorber lanyard, model WSF222



Photograph 7: Energy absorber lanyard, model WGF622

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TEST REPORT

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Business Reg. No. 196900269D

Date: 26/10/2017

Your Ref: MQ-129874

Our Ref: MM-60718/NKG/2

Page 1 of 2

Subject : Salt Spray Test of Karabiner, Snaohook, Buckle and D-Ring submitted by PDS International Pte. Ltd. on 16th October 2017.

Tested for : **PDS INTERNATIONAL PTE LTD**
10 Pandan Crescent
#05-03/04 (LL2)
Singapore 128466
Attn: Mr. Tai Cze Wooi

Date & Place of Test : 24th to 26th October 2017 at Setsco Laboratory

Method of Test : BS EN ISO 9227: 2012
Corrosion tests in artificial atmospheres - Salt spray tests (Neutral Salt Spray)

Evaluation exposure period: 49hrs (Initial 24hrs of exposure follow by a drying period of 01hr followed by another 24hrs of exposure.)

Description of Sample : One (01) piece of karabiner, two (02) pieces of Snaohook, one (01) piece of D-Ring and six (06) pieces of buckle were received (refer to figure).

Salt Solution Preparation : Salt solution was prepared by dissolving 5% ± 1% by weight of analytical grade NaCl in 95% by weight of Type IV water

Chamber Model: Q-FOG CCT-600

Calibration Due Date: 17 Apr 2018

Method of support in chamber: Suspending on hanging rod at 15~25 deg from vertical

Cleaning method after testing: Warm water < 38°C



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*The results reported herein have been performed in accordance with the laboratory's terms of accreditation under the Singapore Accreditation Council.
LA-1994-0068-A, LA-1987-0001-B, LA-1993-0067-G, LA-1998-0144-D, LA-2000-0181-F, LA-2012-0519-E, LA-1993-0051-C



Daily Recorded Testing Parameters

Date	Exposure Temperature (°C)	Fog collected per 80cm ² (A) (ml/hr)	Fog collected per 80cm ² (B) (ml/hr)	Specific Gravity	pH of collected solution
251017	35	1.33	1.42	1.033	6.78
261017	35	1.40	1.48	1.033	6.75

Results: All the tested samples comply with SS 541: 2008, section 4.5 with no evidence of corrosion of the base metal.

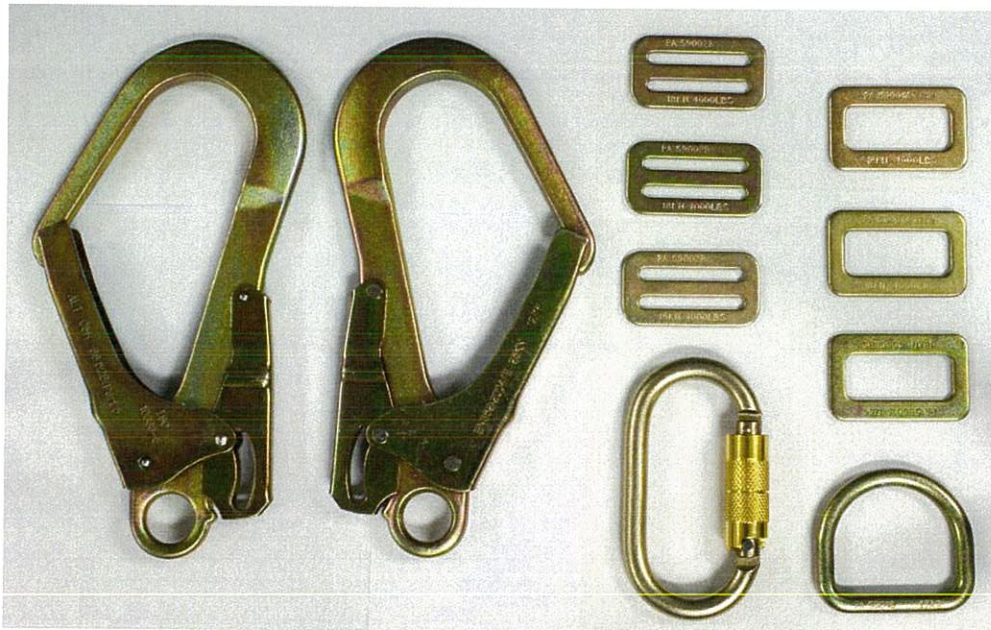


Figure shows samples in as-received condition

Kian Guan
 NG KIAN GUAN
 Testing Officer

Wong
 WONG KOK WAH
 Senior Engineer
 Mechanical & Metallurgical Testing
 Mechanical Technology Division