SPECIAL REPORT : SR2000/002

Dynamic testing of a Yachting Line

Roads and Traffic Authority
www.rta.nsw.gov.au

Crashlab
50 Rothschild Avenue
Rosebery NSW 2018
PO Box K 98
Haymarket 1238
Telephone (02) 9662 5272
Facsimile (02) 9662 5990

Client : NSW Police Service
NSW Water Police Branch,
Wharf 25
Harris Street
PYRMONT NSW 2009.

Client's Reference : Fax dated 23rd November 1999.

Test Specifications : Australian Standard AS 2227:1992,
Yachting harnesses and lines- Conventional lines.
Appendix B, Method of test for dynamic load.

Test Items : Four (4) Replica yachting lines
One (1) Burke Pty Ltd, 'YHB7' Yachting harness.

Date of Tests : 1st December 1999.

Report prepared by : _____ Date: 16 FEB 2000
Carlos Brito
Technical Officer.

Issued by : _____ Date: 18 Feb 2000
Derek Wainohu
Test Laboratory Manager.

CONTENTS

Page

Checked by: _____ *Date:* 15-2-2000

1. INTRODUCTION

The NSW Water Police Branch had requested testing of a yachting line, as part of a Coronial Inquest into the 1998 Sydney to Hobart Yacht Race. A webbing safety line allegedly failed on the 'Sword of Orion' resulting in the helmsman being washed overboard. This report examines the dynamic load performance of a newly manufactured 'replica' safety line to determine whether the stitch pattern is adequate for its application.

In March 1999 RTA Crashlab conducted dynamic drop tests on yachting harness samples supplied by NSW Water Police Branch and in July 1999 conducted tensile tests on yachting line also supplied by NSW Water Police Branch. The results of that testing are contained in Crashlab - Special Report SR99/004 and SR99/006 respectively. The failure of the safety lines reported in both Special Report SR99/004 and SR99/006 were total failure of the stitching with no significant damage to the webbing.

NSW Water Police Branch consulted Workcover NSW and RTA Crashlab to determine what would be required for the next phase of testing. It was recommended that dynamic testing to the requirements of Appendix B of AS 2227:1992 of newly manufactured 'replica' yachting lines would be conducted. Workcover NSW supplied a Burke yachting harness and organised an Industrial Harness manufacturer to produce six (6) safety lines to conduct dynamic testing. The safety lines were similar in construction and specification to the safety lines from the 'Sword of Orion', as used in the testing reported in Crashlab Special Report SR99/004 and SR99/006.

The results of the dynamic testing of the 'replica' safety line would then be compared with the results recorded in Crashlab Special Report SR99/004. This comparison would give an indication as to the ability of an 'as new' safety line from the 'Sword of Orion' to meet the dynamic test requirements of Appendix B of AS 2227:1992.

The harnesses and safety lines originally obtained from the 'Sword of Orion' were supplied to Crashlab as assemblies. However, only the harnesses bore the identification labels of Tuff Marine Australia. The only identification on the safety lines were the hand written words 'Sword of Orion'. For the purpose of this report the safety lines supplied from the 'Sword of Orion' are identified as such rather than assuming the identification of Tuff Marine Australia.

This report should be read in conjunction with Crashlab test reports SR99/004, SR99/006 and SR99/007.

2. AIM

- To determine whether or not a 'replica' safety line would demonstrate compliance with the dynamic load test requirements of Appendix B of AS 2227:1992.
- To assess whether or not an 'as new' safety line, as used on the 'Sword of Orion' yacht, would meet with the dynamic test requirements of Appendix B of AS 2227:1992.

3. DESCRIPTION

The 'replica' yachting line consisted of a length of blue webbing approximately 47 mm wide by 1550 mm long with single action snaphooks attached at both ends. The snaphooks were retained by the webbing being folded through an eye in the hook and then stitched in place. The stitch pattern consisted of three stitched 'bar tacks', approximately 25 mm long by 2 mm wide, equally spaced out across the main stitch pattern. The large rectangular stitch pattern was approximately 190 mm long by 40 mm wide with diagonals. The three stitched 'bar tacks' were slightly longer in length than the 'bar tacks' used on the safety lines from the 'Sword of Orion'.

The yachting lines were assigned with Crashlab test specimen numbers TS19029, TS19030, TS19031 and TS19032. Refer to Appendix A and Photographs in Appendix B.

4. DYNAMIC TEST

4.1 Test Equipment

Crashlab is NATA registered for dynamic testing of Yachting harness and line assemblies to Appendix B, Method of test for dynamic load, of Australian Standard AS 2227:1992.

Testing was conducted using the following equipment, as specified Appendix B;

- Crashlab Harness drop tower (rigid mounting), identified by Crashlab equipment number of TCL 473.
- A rigid dummy having a mass of 136 kg, identified by Crashlab equipment number of TCL 3266.

4.2 Test Description

The Burke harness was used for all tests conducted with a new replica yachting line for each test drop. As the requirements for testing yachting harnesses and lines requires the specimen to be wet, it was decided to conduct a series of 'wet' and 'dry' conditioning tests.

The harness was fitted onto the 136 kg test dummy as per the donning instructions and the adjuster was marked to determine the amount of webbing slippage.

The yachting line was attached to the front attachment point of the harness and then to the rigid anchorage point of the harness drop tower. The dummy was raised in an upright position and held via a quick release device until released to fall through the appropriate dropping distance of 1.47 m.

5. RESULTS

5.1. Test Run Number IH90338.

The test samples were tested in the dry condition.
Post test examination of the yachting line revealed that the extent of failure of the stitch pattern at the anchorage attachment end was severe. The anchorage end stitch pattern failed completely at 9.7 kN and the snaphook separated from the line.
The harness attachment end stitch pattern had approximately ten percent of the main stitch pattern torn and approximately fifty percent of one of the small reinforcing stitch patterns torn. The test dummy was not retained and only the hook was left at the anchorage point. Refer to Photographs 3,4, and 5 in Appendix B.
Assessment: Fail, Clause 7(a) and (b).

5.2. Test Run Number IH90339.

The test samples were tested in the wet condition.
Post test examination of the yachting line revealed that the extent of failure of the stitch pattern at the harness attachment end was severe. The harness end stitch pattern failed completely at 10.5 kN and the snaphook separated from the line.
The anchorage attachment end stitch pattern had approximately fifteen percent of the main stitch pattern torn and approximately seventy-five percent of one of the small reinforcing stitch patterns torn.
The test dummy was not retained and only the hook was left at the harness anchorage point. Refer to Photograph 6 in Appendix B.
Assessment: Fail, Clause 7(a) and (b).

5.3. Test Run Number IH90340.

The test samples were tested in the wet condition.
Post test examination of the yachting line revealed only minor stitch pattern failure at the anchorage attachment and harness attachment ends. The anchorage end snaphook failed completely at 9.0 kN.
The test dummy was not retained. Refer to Photograph 7 in Appendix B.
Assessment: Fail, Clause 7(a) and (b).

5.4. Test Run Number IH90341.

The test samples were tested in the wet condition.
Post test examination of the yachting line revealed that the extent of failure of the stitch pattern at the harness attachment end was severe. The harness end stitch pattern and the snaphook failed completely at 10.8 kN.
The anchorage attachment end stitch pattern had approximately fifteen percent of the main stitch pattern torn and approximately sixty percent of one of the small reinforcing stitch patterns torn.
The test dummy was not retained. Refer to Photograph 8 in Appendix B.
Assessment: Fail, Clause 7(a) and (b).

6. COMMENTS

The results from the dynamic test indicate that the yachting harness and line assemblies had similar extent of stitch pattern failures as the safety line from the 'Sword of Orion' tested in Crashlab test report SR99/004. The results differed in that they sustained a higher failure load and occurred at different attachment ends, and the snaphooks completely failed on two occasions of the replica testing.

The failure loads of the 'replica' safety lines was a load of 9.7 kN for the 'Dry' stitch pattern and an average load of 10.1 kN for the 'Wet' stitch patterns.

The failure load of the safety line, from the 'Sword of Orion' yacht as reported in Crashlab Special Report SR99/004 was 6.7 kN.

The stitch pattern used on the 'replica' safety line consisted of three stitched 'bar tacks' which were slightly longer than the 'bar tacks' used on the original safety lines from the 'Sword of Orion'. It was expected that the replica safety lines would give slightly higher loads as a result of more thread being used in the three longer stitched 'bar tacks' and the test results confirmed this expectation.

The 'replica' safety lines were produced and tested in an attempt to determine whether or not an 'as new' safety line, as used on the 'Sword of Orion' yacht, would demonstrate compliance with the dynamic test requirements of Appendix B of AS 2227:1992. The yachting lines represented by Crashlab test specimen numbers TS19029, TS19030, TS19031 and TS19032, when tested in conjunction with the Burke harness TS19028 were not able to meet the dynamic test requirements of Appendix B of AS 2227:1992.

Assessment: Fail, Clause 7(a) and (b), which state the following;

- *Clause 7(a) states, "the dummy shall be retained in the harness;".*
- *Clause 7(b) states, "no part of the harness or line shall fail or deform to such an extent as will render it incapable of performing its intended function;...".*

Refer to table of results in Appendix A.

7. CONCLUSION

- The 'replica' safety lines were unable to meet the dynamic test requirements of Appendix B of AS 2227:1992, in both the wet and dry conditions.
- It is unlikely that a 'new' safety line, of the design used on the 'Sword of Orion', would meet the dynamic test requirements of Appendix B of AS 2227:1992.

Checked by: _____ *Date:* 19-2-2001

APPENDIX A

TEST SPECIMEN DETAILS

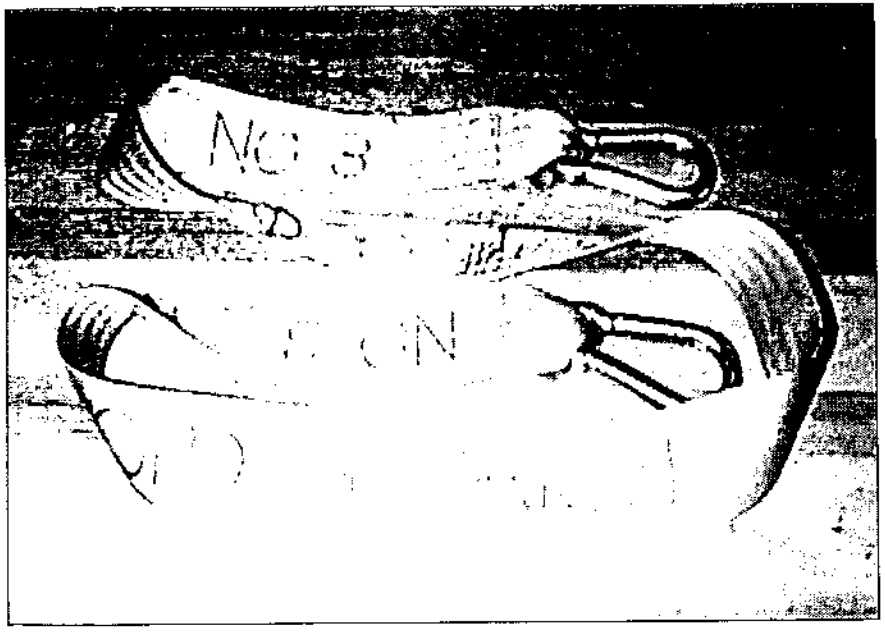
Specimen Number	Description	Model	Serial Number	Date of Manufacture
TS19028	Burke, Yachting harness	YHB7	284849	24 Mar 99
TS19029	Replica Safety line	Unknown	Unknown	Unknown
TS19030	Replica Safety line	Unknown	Unknown	Unknown
TS19031	Replica Safety line	Unknown	Unknown	Unknown
TS19032	Replica Safety line	Unknown	Unknown	Unknown

TEST RESULT DETAILS

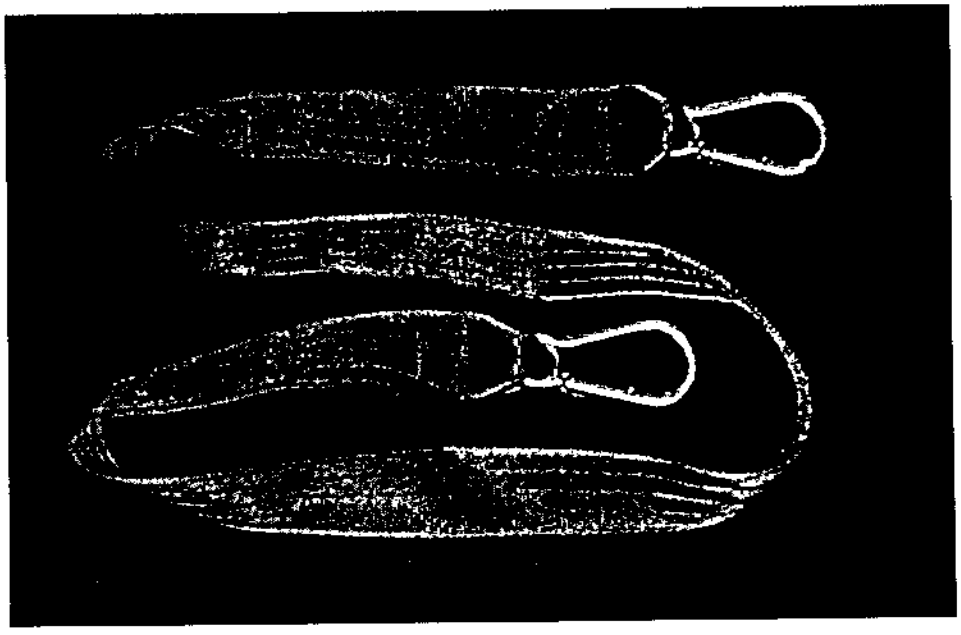
Test Number	Specimen Numbers *(Harness / line)*	Attachment Point	Mass of Dummy *(kg)*	Drop Height	Movement at Adjustable Point *(mm)*	Peak Load *(kN)*	Dummy shall be retained in the harness	Any Failure and / or Deformation
IH9338	TS19028 / TS19029	Frontal buckle	136	1.47	Inconclusive	9.7	**Fail**	**Fail**
IH9339	TS19028 / TS19030	Frontal buckle	136	1.47	Inconclusive	10.5	**Fail**	**Fail**
IH9340	TS19028 / TS19031	Frontal buckle	136	1.47	Inconclusive	9.0	**Fail**	**Fail**
IH9341	TS19028 / TS19032	Frontal buckle	136	1.47	Inconclusive	10.8	**Fail**	**Fail**

Checked By : _____ *Date :* 18-2-2000

APPENDIX B - PHOTOGRAPHS



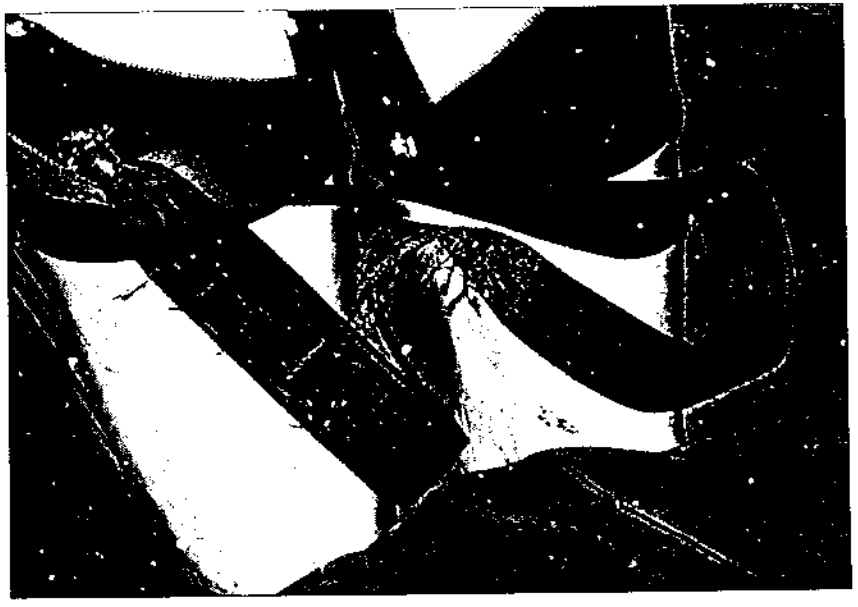
Photograph 1 – Comparison of safety lines, TUFF marine yachting line.



Photograph 2 – Comparison of safety lines, replica yachting line.

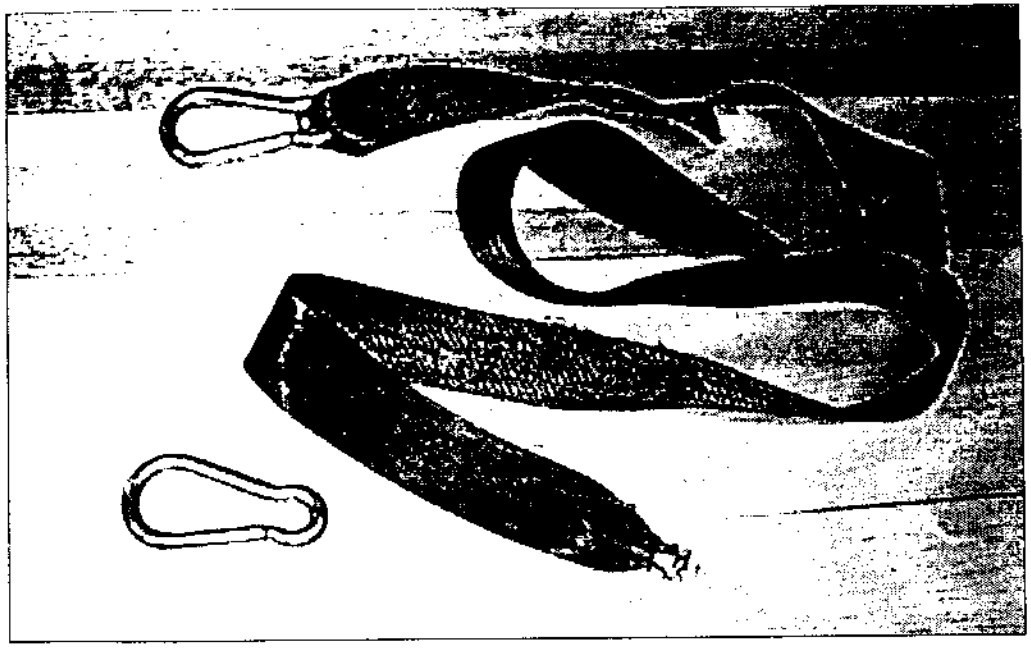
Checked By : _____ *Date :* 18-2-2000

Photograph 3 – Post test photo of Test Run IH90338.

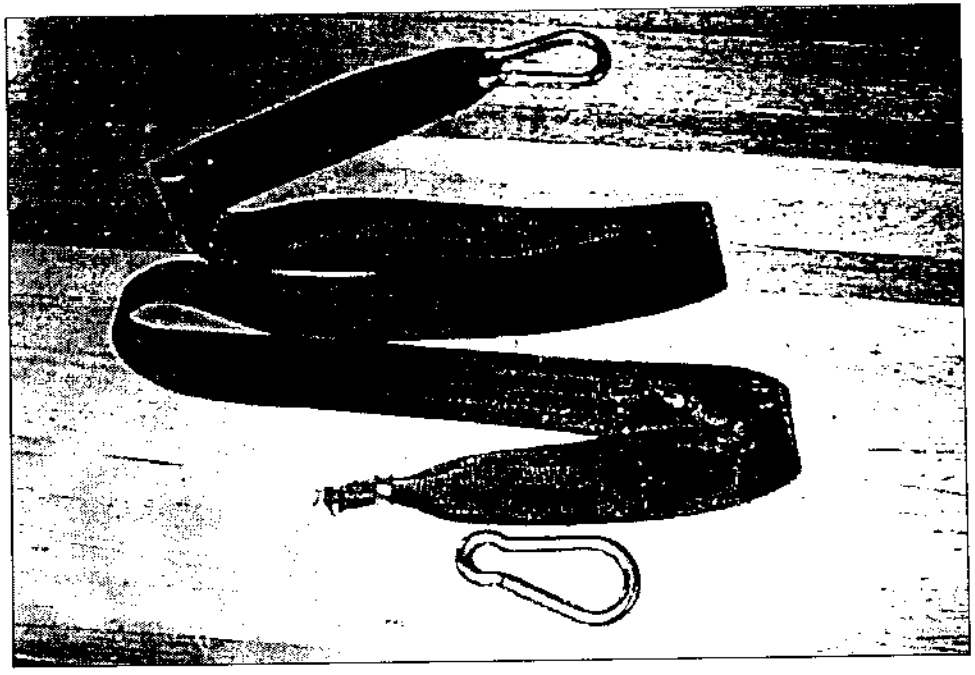


Photograph 4 –Close up photo of failure of safety line, in Test Run IH90338.

Checked By : _____ *Date :* 18-2-2000

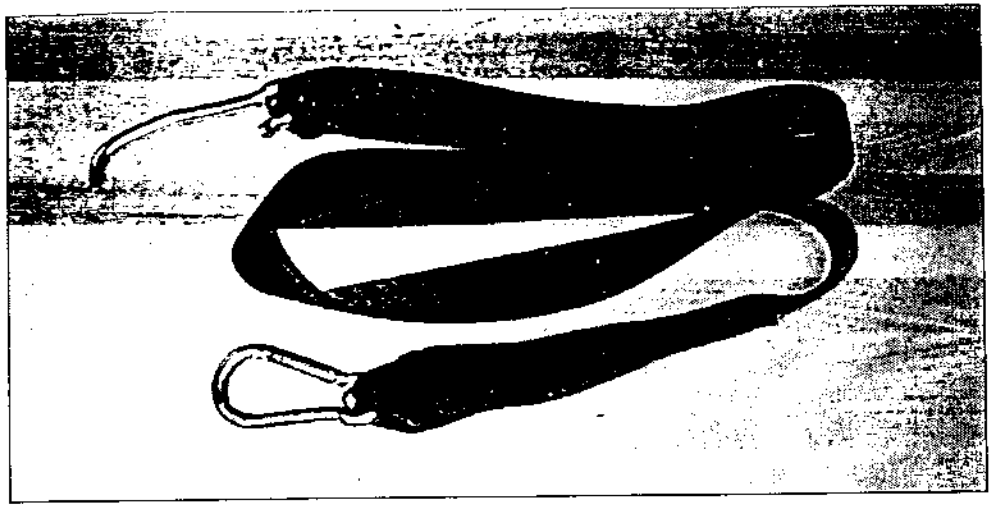


Photograph 5 – Post test photo replica safety line, test run number IH90338.

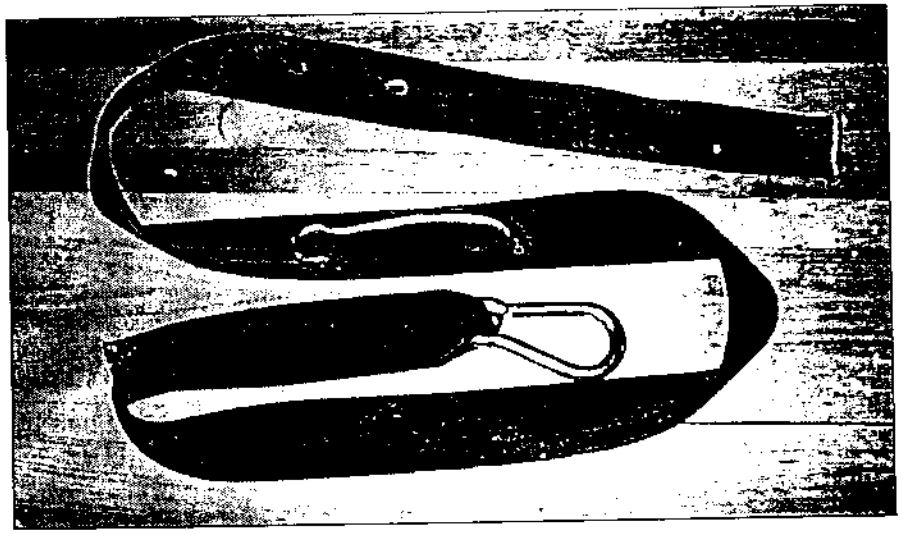


Photograph 6 – Post test photo replica safety line, test run number IH90339.

Checked By : _____ Date : 18-2-2000



Photograph 7 – Post test photo replica safety line, test run number IH90340.



Photograph 8 – Post test photo replica safety line, test run number IH90341.

Checked By : _____ *Date :* 18-2-2000