



DOCUMENTATION FRONT SHEET

Cortland FIBRON BX (CFBX)	Document Category:	CFBX Order no:	Total Pages:	Document Number:	
	Report	8695	6	TR8695-001	
00	02/05/08	For Review	AC	DRS	
Rev	Date	Reason for issue	Prepared	Checked	Approved

Works Order 8695

Bend Fatigue Test Report.

MBARI Umbilical.

Customer: SMD Hydrovision

This document is the property of CFBX and is not to be reproduced or disclosed to any party without the written consent of CFBX.

Contents

1.0	INTRODUCTION.....	3
2.0	GLOBAL MARINE TEST.....	3
3.0	BRIDON TEST.....	4
4.0	CONCLUSION.....	6

1.0 INTRODUCTION

Two bend fatigue tests have been carried out on the RM0011 ROV Umbilical for SMD Hydrovision. The first test was carried out at the Global Marine test facility in Chelmsford and the second at the Bridon test facility in Willington Quays. The first test at Global Marine failed and on subsequent investigation it was found that the set up and equipment used by Global Marine was inappropriate and failure had occurred for this reason. The second test, performed at the Bridon facility, passed.

2.0 GLOBAL MARINE TEST

This test was reported by Global Marine in their report number 0755. An explanation of the test set up and results obtained is provided within their report. Optical failure occurred after 2834 passes and electrical continuity after 9180 passes.

The test rig and set up were subsequently reviewed and a number of observations have been made, which are as follows:

1. Load was applied to the cable via two large steel ropes (connected to either end of the umbilical) and from two winch drums. The size and accuracy was applicable to very large umbilicals. The system was inappropriate for this small umbilical. Transient loads at reversal points would have been very high.
2. The sheave wheel was flat, non-circular and in poor condition. There was, therefore, no lateral support for the umbilical. The transients which occurred could have resulted in the umbilical lifting off the sheave wheel at the reversal points.
3. Global Marine had not determined the correct travel length for the diameter of sheave wheel used. The sheave wheel diameter was 450mm which is a circumference of 1414mm. The travel was 750mm and less than 50% of the cable was in contact with the sheave wheel (estimate approx 40%). The definition of a cycle is straight – bent – straight. Hence, with this set up a cycle is completed in one pass. Global Marine had intended, and had state in their report, that two passes were required for one cycle, but in fact, one pass resulted in the umbilical doing one cycle.
4. Connection of the steel rope to the umbilical was via a trolley on inflated wheels, once again introducing other transients particularly at reversal points.

Numerous cyclic reeling tests have been performed on similar products with no problems, thus it was concluded that this test rig was inappropriate and had induced faults, causing premature failure.

3.0 BRIDON TEST

This test was performed at the Bridon Willington Quays facility on Tuesday 15 April 2008. It was performed on a test machine designed for steel rope of a similar diameter to this umbilical and by Bridon personnel who are very experienced in doing this type of work. Catherine Toleman of SMD and Alan Clark of Cortland Fibron witnessed part of the testing.

Some photographs of the test rig with the umbilical install into it are shown below:



The sheave wheel had a pitch circle diameter of 347.3mm and a root diameter of 330mm which was less than the diameter of the Global Marine sheave wheel which had a 450mm root diameter. Thus, in theory, the Bridon test should have been more onerous.

The groove in the sheave was $17.3 + 7.5\%$ (18.6mm).

A load of 60kN (6.1T) was applied and it was cycled at approximately 9 cycles per min.

Ovality was monitored every 250 cycles, but optical and electrical continuity could not be performed until the test was completed.

The optical testing, electrical continuity and visual examination were performed at the Cortland Fibron factory after completion of the cycle test.

Ovality on load varied between 17.26mm and 17.02mm in one plane and between 16.83mm and 16.6mm in the opposite plane.

The optics and electrical units showed no discernable change from the virgin state.

Photographs of each dissection stage are provided below.

	Sample of the umbilical at the transition section that had been on and off sheave wheel (i.e. cycled) and that which had not.
	Section of the umbilical with the armour removed.
	Section of the umbilical with outer jacket removed. Discoloured portion is the area that had seen bending.

	Copper polyester tape removed from the umbilical. Signs of the tape cracking. This is typical on a cable that has undergone 5000 cycles.
	View of the assembly. Shows the assembly in good order with no evidence of mechanical damage to the component parts.
	View of the central quad. Again in good order with no signs of damage to the component parts

Although there was clear evidence that the cable had undergone a 5000 cycle test there were no visual signs of any degradation to the component parts.

As expected the cable had convincingly passed the cycle test.

4.0 CONCLUSION

The umbilical passed the 5000 cycle test on the Bridon test rig. There were deficiencies with the Global Marine test rig and set up that had resulted in premature failure.