Sachverständigenbüro Dipl.-Ing. Jan Hatecke

MARINE CONSULTANT

Investigation Report

Release Mechanism

of Port Life- and Rescue Boat

MT „OLIVER JACOB"

Very Serious Casualty

Dated 21.01.2006

Report-No.: 2006-05/e

Prepared For: Federal Bureau of Maritime Casualty Investigation (BSU)
Bernhard-Nocht-Straße 78
D-20359 Hamburg

Prepared By: Jan Hatecke, Dipl.-Ing. Schiffbau

Date: 22.06.2006

Signature: .....

Sachverständigenbüro Dipl.-Ing. Jan Hatecke • Alter Schulweg 49 • D-21737 Wischhafen

Mobil: 0171-5335934 • Tel.: 04770-808411 • Fax: 04770-808410 • E-Mail: jan@hatecke.de

Marine Expert of German Federal Bureau of Maritime Casualty Investigation

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1. Introduction

Dated 21st. of January 2006 at 11:20 o'clock (UTC+1h) a very serious casualty happened with Port Life- and Rescue Boat of MT "OLIVER JACOB" during abandon ship drill acc. to SOLAS, Chapter III, Reg. 19.3.3.3. Two Officers died and one crew member is injured.
At this time the vessel is staying at anchorage, 4 nm WNW of Kome-Kribi, FSO-Terminal, Cameroon.

2. Description of accident

The encl. description of this very serious casualty is based on official statements in the report no. Pol-10RK 5SE of German Embassy in Yaounde / Camaroon and from report of owner Ernst Jacob GmbH & Co KG.
Acc. to this reports the casualty happens as follows:
First the boat laden with inventory but without persons inside has swung out and lowered down to abt. two meters above water level. Next the boat has been hoisted again to deck level, embarked by three persons under command of 3. Officer and lowered in Water. Here the hoisting hooks has been released under OFF-load condition. The boat has been manoeuvred around the vessel. Next the boat has been manoeuvred again under davit system, davit falls have been connected to the boat's hoisting hooks and the boat has been hoisted up into stowing position and finally secured by lashing.
Next the boat has been cleaned up by 3.Officer and AB (able-bodied-seaman). They noticed that safety pin of central release gear in the boat is not in correct position and informed 1.Officer about this. 1.Officer has decided to swing out and lower down the boat again, seated by three persons, to solve the problem with the safety pin.
After boat has been swung out davit fall removes from the forward hook following by removing from the aft hook. Boat is falling down over abt. 18 m and hits the water surface with forward canopy area. Boat is swimming in a capsized position.
The AB is able to deliver himself through forward inspection hatch. 1.Offizier und 3.Offizier die in the boat.

3. Actions for securing of evidence

Employees of Federal Bureau of Maritime Casualty Investigation (BSU) supervise the delivery of the Boat, which has to be investigated, in Port Jefferson at Long Island, USA. The investigation of boat and dismantling of parts which have to be tested later on in Germany have been carried out in a workshop nearby.
They have been assisted by a specialist of US Coast Guard. The investigation on board of the tanker „Oliver Jacob" has been carried out at anchorage near Long Island/USA. The affected crew members on board have been asked about the casualty. The starboard lifeboat has been inspected.
Hoisting hooks, central release gear, hydrostatic securing with channel have been send to Germany.

4. Order

Investigation and testing of central release mechanism to determine reasons of casualty with following priorities:

A. **Investigation of correct technical condition of central release mechanism**
B. **Description of how the accident happened and the causes**
C. **Improvement proposals**
D. **Safety recommendations**

5. Particulars of boat:

Type:	HDL 71 CF, combined Life- and Resue Boat Base of design: former Netherlands Manufacturer MULDER & RIJKE (Successors Manufacturer: UMOE SCHAT HARDING)
Original Manufacturer:	HYUNDAI PRECISION & IND. CO. LTD., Korea
Successors Manufacturer:	HYUNDAI LIFEBOATS Co., LTD., Korea
Certificate:	D.N.V. Nr. ULN-98-1001 (see Appendix No. 1)
Serial No.:	E-98-32-546
Length:	7,10 m
Breadth:	2,40 m
Number of Persons:	32
Year of Building:	1998
Type of Release Mechanism:	TITAN TG 354

Figure 1:
Starboard Lifeboat
Type HDL 71 CF on vessel
MT „OLIVER JACOB“

6. Specification of release mechanism:

Central release disengaging gear consisting of one forward hoisting hook and one aft hoisting hook.
Both hoisting hooks are connected by each one release cable to central release gear
With this Central release gear both hooks can be released simultaneously.

The design allows two load possibilities for releasing:

1. OFF-LOAD: Boat is afloat in the water
2. ON-LOAD: Boat is hanging in davit-falls

A hydrostatic securing device (INTERLOCK) shall prevent unintentional release, if the boat is hanging in the davit falls above the water.

Principal scheme see Figure 4.

Typ: TITAN TG 354

Manufacturer: WILLIAM MILLS (MARINE) LTD
Manor Road
Levenshulme
Manchester M19 3EJ
United Kingdom (UK)

Figure 2:
Manufacturer - Sign Plate
of aft hoisting hook

Figure 3:
Manufacturers - Sign Plate of forward hoisting hook

Successors Manufacturer: Umoe Schat Harding Ltd.
Mumby Road
Gasport
Hampshire, PO12 1AE
United Kingdom (UK)

Max. Load: 3 Ton / Hoisting hook

Year of Building: 1998

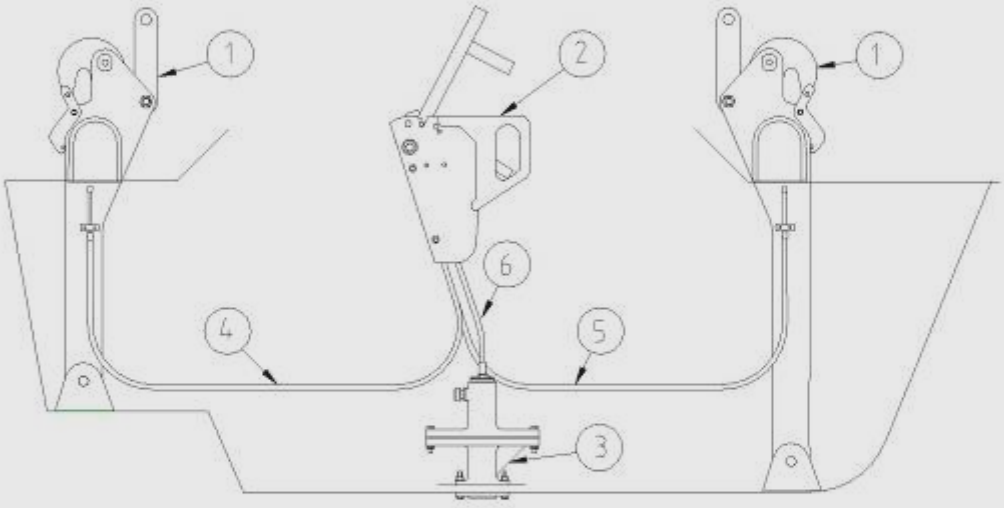
Certificate: A stamp of classification society or national authority could not be found on the aft and forward hook.
Therefore the certification of the hooks is covered by boats certification procedure.
In boat certificate (Appendix No. 1.) hook is confirmed as part of boat. Classification Society D.N.V. confirms that a hoisting hook type approval certificate of Lloyds Register of Shipping (Appendix No. 17) was the base of issuing boat certificate. This release mechanism type approval certificate has been issued by Lloyds Register dated 18.11.1997.
A valid release mechanism type approval certificate from D.N.V. didn't exist at date of issuing boat certificate.

Successors Type-Approval:
No. MED 0350311. Issued by Lloyd's Register
(MED Notified Body No. 0038) dated 26.11.2003

mills
MARINE

3. ILLUSTRATIONS

3.1 Typical Arrangement of Titan Release Gear

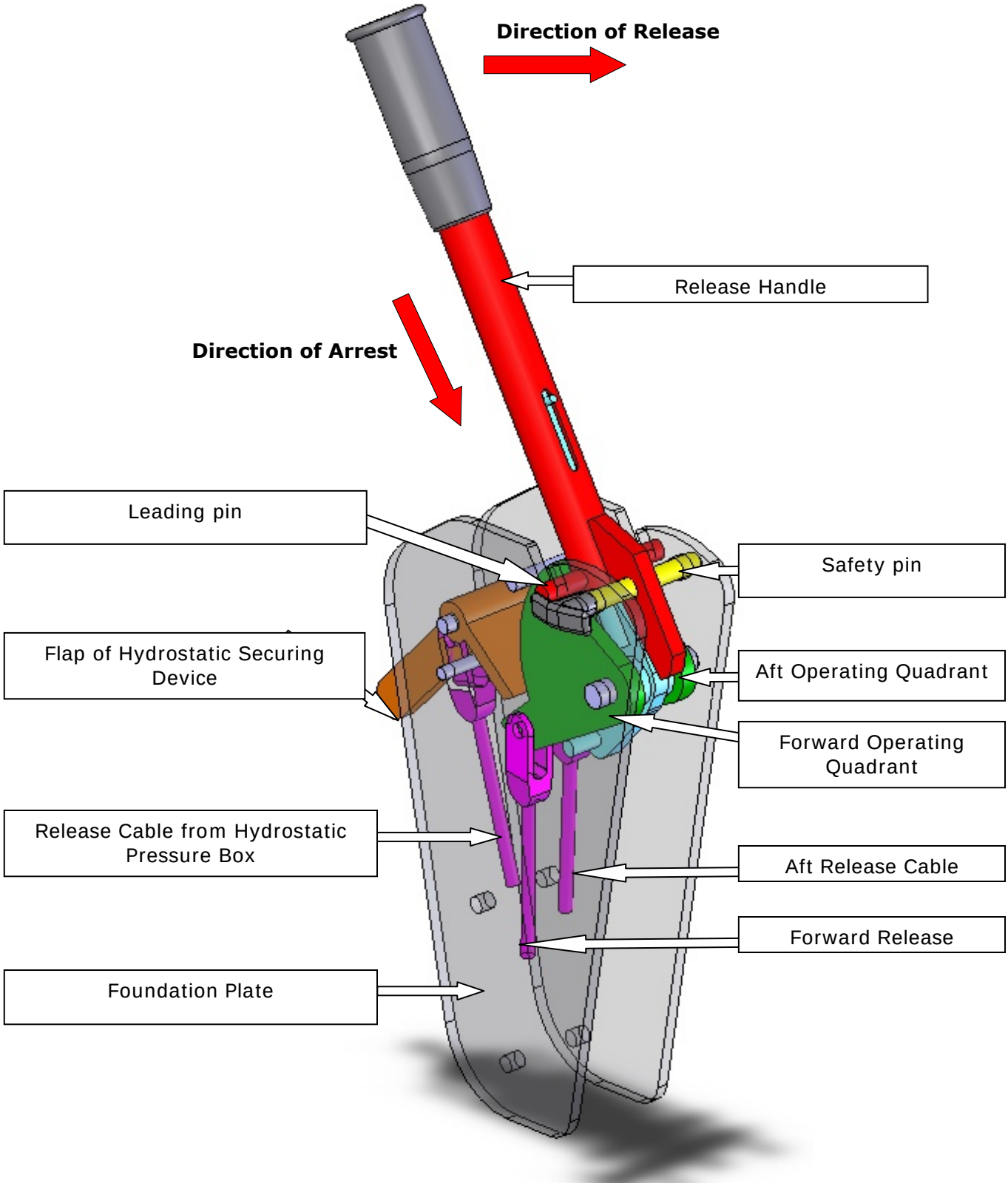


1 Hook Assembly
2 Release Handle Unit
3 Hydrostatic Unit
4 Aft Operating Cable
5 Forward Operating Cable
6 Hydrostatic Operating Cable

Figure 4: Principal description of the system:
„TITAN“ OPERATION MANUAL (WITH INDICATORS) issue 1- SEPTEMBER 1997

6.1. Description of central release unit:

Schematic 3-D diagram in the theoretical completely safe position:



6.2. Description of hoisting hooks:

Schematic 3-D diagram in the theoretical completely safe position using the forward hoisting hook as an example:

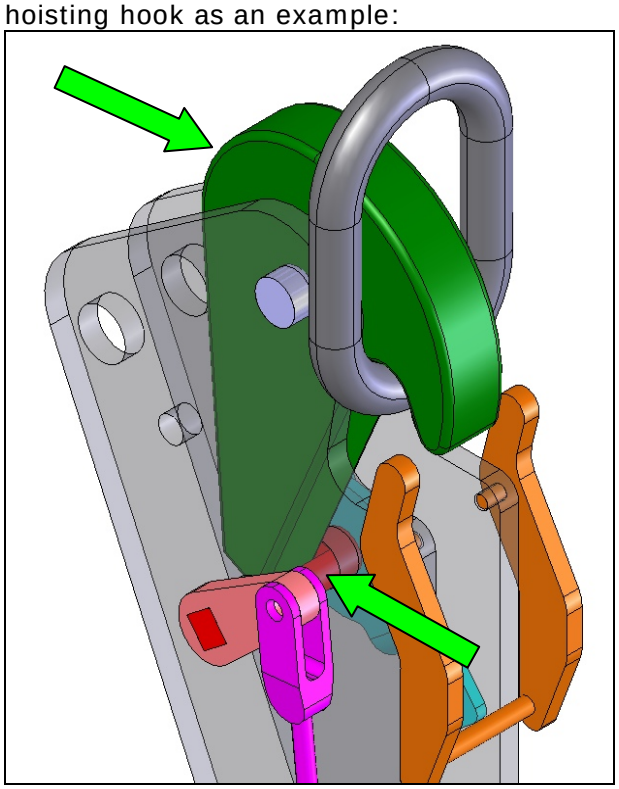


Figure 5:
View of forward release hook from portside with hook und release bolt.

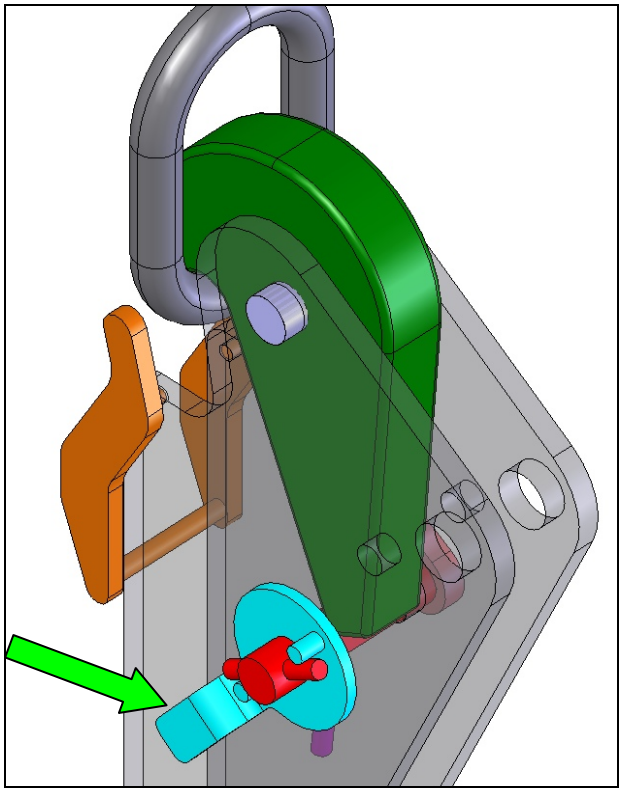


Figure 6:
View of forward hook from starboard with lever for manual reset.

7. Summary of the results

The undersigned carried out the tests and investigations on the central release mechanism of the port life- and rescue boat in the Institute for Material Science and Welding Technology in Hamburg. The firms and authorities involved were able to witness the tests.
The accident investigations carried out in this expert opinion can be summarised as follows:
The central release mechanism was not in a serviceable condition at the time of the accident. Primarily the aft release cable which was not correctly adjusted made it impossible for the safety pin to protect the central release mechanism.
Further secondary causes facilitated the accident and led to an automatic release of the hoisting hook about 18 m above the water line.

- Automatic release of both hoisting hooks due to the wear on the hooks, which was due to a lack of maintenance.
- The hydrostatic protection against unintended release could not be effective because the aft release cable was out of alignment.
- Misleading and inadequate lettering on the operating components of the central release mechanism.
- Missing manufacturer's handbooks for operating, maintenance and training for the central release mechanism.
- Non-use of the HANGING-OFF PENDANTS.

The crew of the boat may have been under the impression that in spite of the fact that the safety pin was not completely inserted the central release mechanism was in such a state that it was possible to safely lower and raise the boat.
At the same time that the 5 year test was carried out in 2004 under the supervision of the classification authority DET NORSKE VERITAS the central release mechanism was maintained by the firm TECHNOFIBRE (S) Pte. Ltd, Singapore. Since the staff of this firm were not at that time authorised to carry out maintenance on this mechanism it is possible that the maintenance work was counter productive and consequently a cause for the aft pulley block being out of alignment.
Due to the completely unsuitable operating and maintenance handbook for the lifeboats and rescue boats the ships management could not recognise the defective maintenance and safety condition of the central release mechanism.

As the result of this investigation, improvement proposals have been put forward for the successor of the manufacturer UMOE SCHAT HARDING LTD., the classification authority DET NORSKE VERITAS, the INTERNATIONAL MARITIME ORGANIZATION (IMO) and the firm TECHNOFIBRE (S) Pte. Ltd. These are given in Chapter C.

In Chapter D safety recommendations are given for ships at sea.

The question of why the boat remained capsized in the water after the crash was not the object of the investigation contract. According to the regulations the flooded and capsized boat must right itself again automatically.

This investigation has been carried out to the best of the undersigned's knowledge and belief.

A. Tests and Investigations

A.1. Laboratory

The tests and investigations have been carried out in laboratory:
Institute for Material Science and Welding Technology
Berliner Tor 13
D-20099 Hamburg
Certificate no. DAP-PL-2948.00 of laboratory (Appendix No. 2).
Parts which have to be investigated have been handed over to laboratory acc. to confirmation dated 07.03.2006 (Appendix No. 3)

A.2. Arrangement of Tests

The parts have been assembled dated 22.03.2006 as follows:

1. forward release cable / central release unit connected to forward hoisting hook
2. aft release cable / central release unit connected to aft hoisting hook

Remark: length of release cables didn't have been changed. Screws for cable length adjustment have been marked in original position.

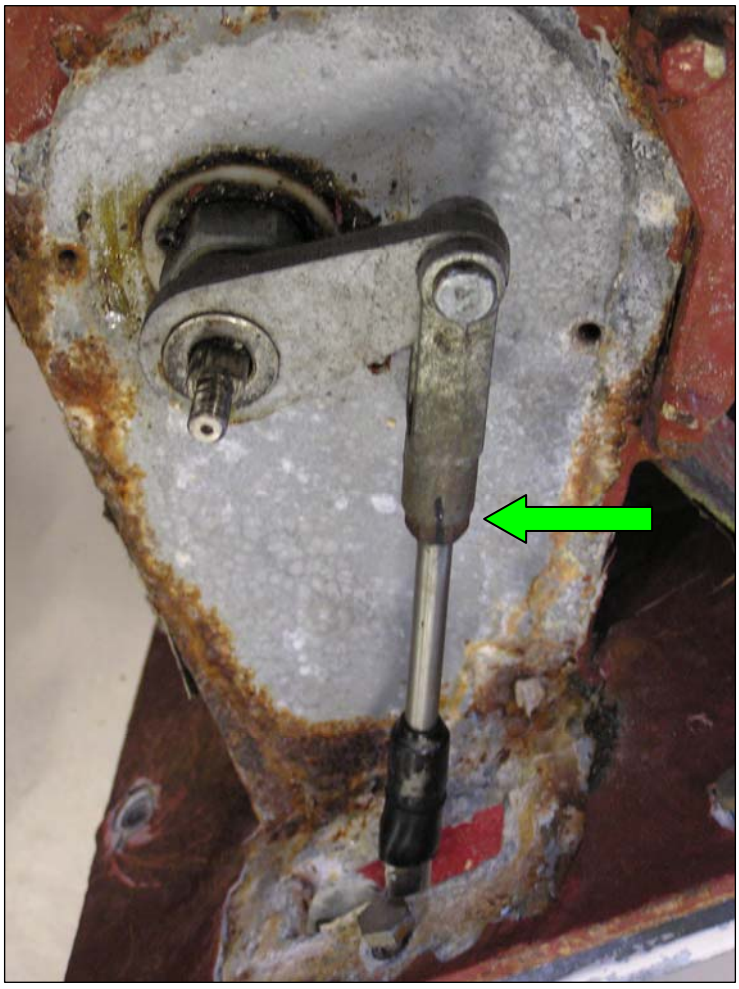


Figure 7:
Forward hoisting hook:
Assembly of release cable to release lever arm of forward hoisting hook.
Marking of release cable length:
This has been marked prior dismantling.

Next in laboratory operation cable has been mounted from hydrostatic pressure box to central release unit. Original length adjustment didn't has been changed during assembly. The hydrostatic pressure cell has been assembled vertically with a transparent filling pipe for measurement of water level.

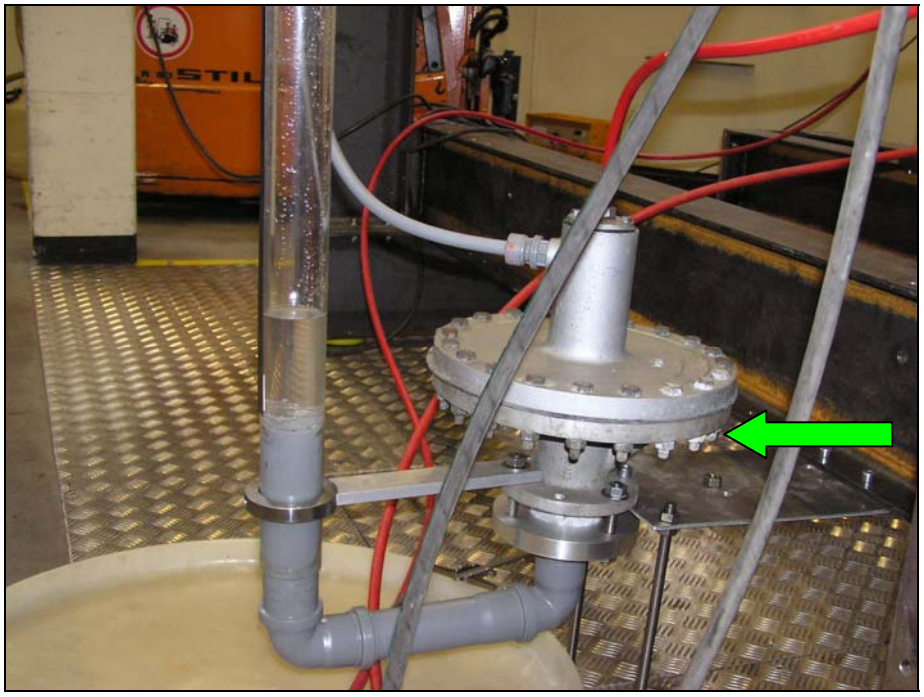


Figure 8:
Hydrostatic pressure cell with transparent filling pipe:
Distance between lowest point of flange of hydrostatic pressure box and lowest point of boat keel is abt. 317 mm. Draught of boat: abt 423 mm at this measurement point 0.

Forward and aft hoisting hook has been connected by there original foundations to test foundation structure. Tensile forces are directed into aft and forward hoisting hook under vertical direction by one hydraulic piston with a transverse beam and long links.

Figure 9:
Test Arrangement:
Test foundation structure with hoisting hooks, release cables, hydrostatic pressure cell und central release unit. Release cables are directed on top of foundation structure with generous radius between the elements.

Central release unit is mounted to test foundation structure. Release load at release handle will be measured by tensile force transducer. The rotary angle measurements in release handle as well as in the forward and aft hoisting hooks have been carried out optically with the help of a angle disc.

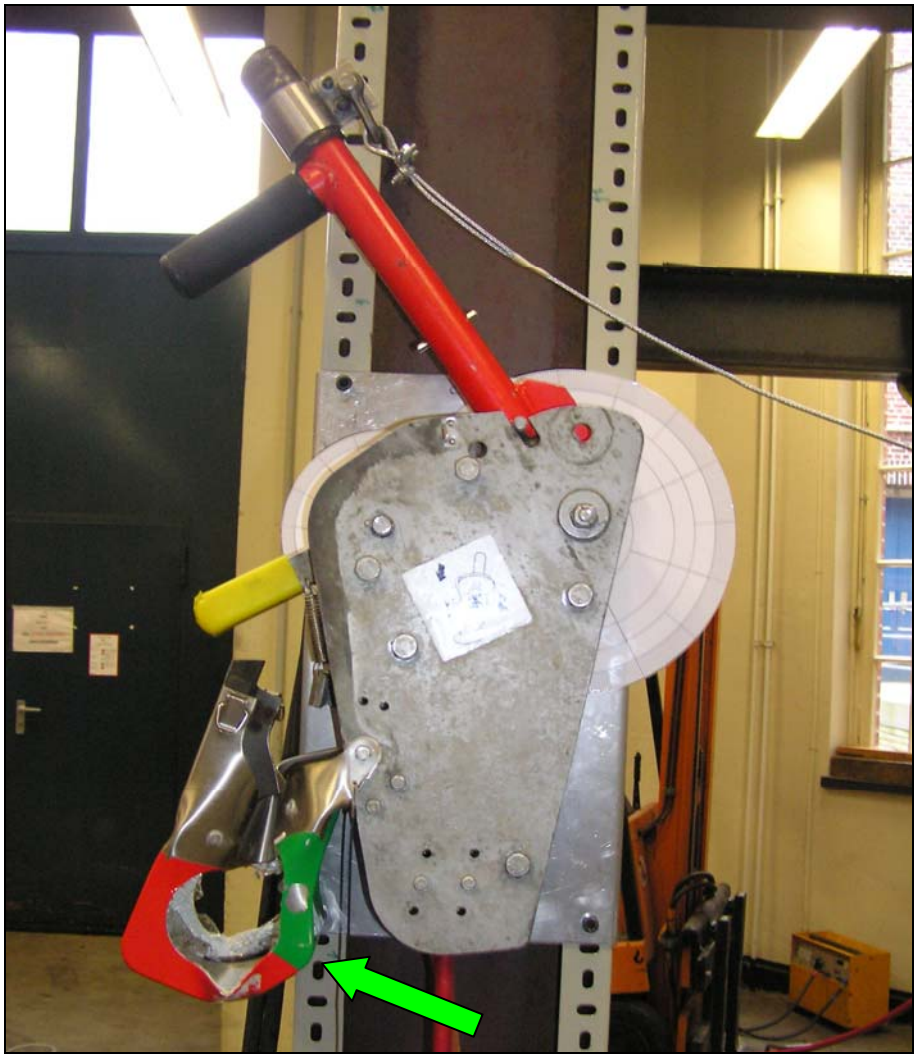


Figure 10:
Central release unit:
Mounted to test foundation structure.
Damaged safety cover of hydrostatic securing flap has been turned down during these tests.
The safety cover has been damaged by interior parts of the boat during accident.

Further information's to laboratory technique and test arrangement see Test Report No. K 269-2006 (Appendix No. 5)

A.4. Tests

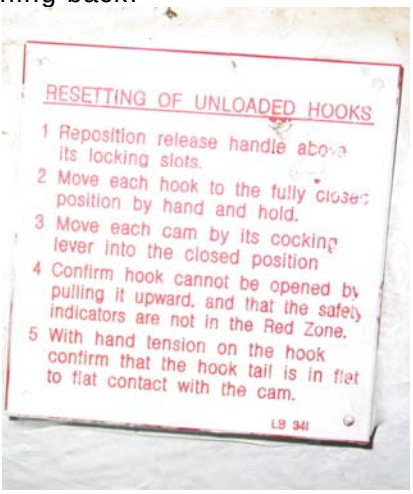
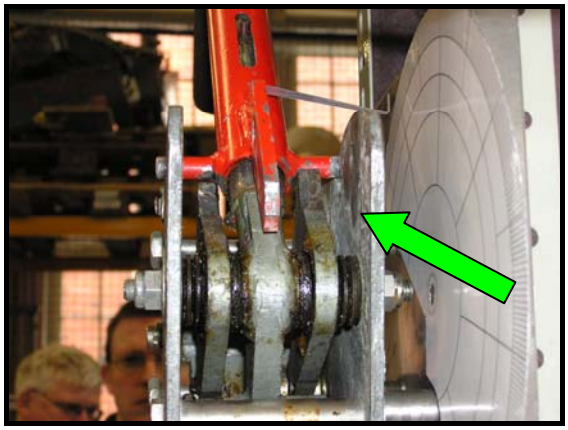
Date: 20.04.2006

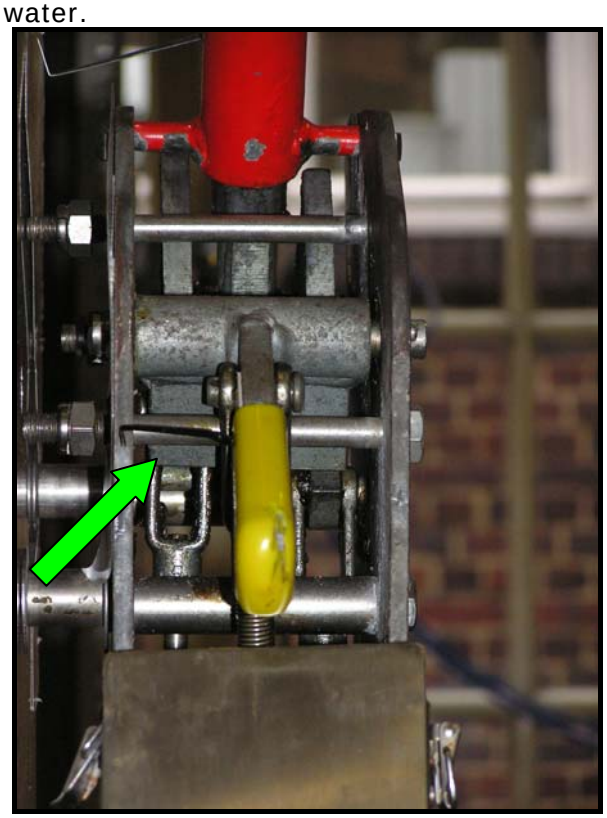
Time: 09:00 – 15:15

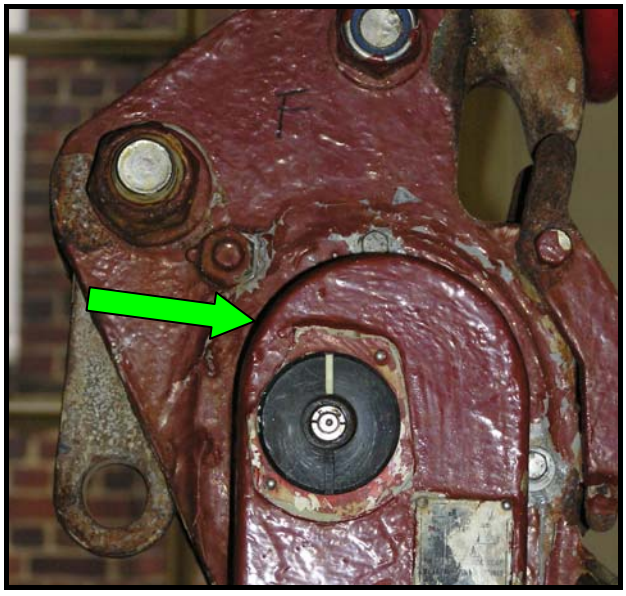
Persons present: Attendance list to Appendix No. 4

Test Report of Institute for Material Science and Welding Technology see Appendix No. 5

Test No.	Tests	Result / Remark
1.1.	**Release at very small tensile load of abt. 0,52 KN per hoisting hook. (condition: boat afloat)**	
1.1.1.	Simultaneous release?	Forward hook releases first. After detailed investigation: also aft hoisting hook has been released
1.1.2.	Release angle of forward hoisting hook release bolt:	68,5°
1.1.3.	Release angle of hoisting hook release bolt aft:	68,5°
1.1.4.	Release angle of release handle:	53°
1.1.5.	Tensile release force of release handle:	114,8 N
1.1.b	**Repeat of tests no. 1.1**	Confirmation of results of test no. 1.1.1. -1.1.5
1.2.	**Manually reset of forward hoisting hook into fully secured position**	Acc. to instruction plate LB 34i: forward hoisting hook release bolt is turned back to fully reset position. Manual reset lever is turning back.
1.2.1.	Is it possible to secure release handle at central release unit fully?	A fully securing at central release unit is possible.

1.3.	**Manually reset of aft hoisting hook into fully secured position**	Acc. to instruction plate LB 34i: aft hoisting hook release bolt is turned back to fully reset position. Manual reset lever is turning back.
		
		Figure 11
1.3.1.	Is it possible to fully secure release handle at central release unit?	A fully securing at central release unit is not possible. It is not possible to turn the aft operating quadrant (right washer in Figure 12) in the fully aft position for fully securing by safety pin. Right leading pin of release handle Has contact to aft operating quadrant causing friction to it. Release handle is in more or less secured and arrested position but a fully securing with safety pin can not be done. Safety pin can only be stick in partly.
		
		fig. 12

1.4.	**Investigation of hydrostatic lock system**	
1.4.1.	Water level 100 mm above hydrostatic pressure cell Draught of boat abt. 523 mm	Movement causing from hydrostatic pressure cell at the release lever can not be recognised.
1.4.1.1	Angel of opening of hydrostatic securing flap?	1,5° The hydrostatic securing flap partially has contact with the not fully returned aft operating quadrant (acc. to test no. 1.3.1) and to the fork-head of aft release cable. (Figure 13)
1.4.1.2	Is it possible to release the hoisting hooks by central release unit?	Yes, because hydrostatic securing flap could not be fully secured prior launching into water.  Figure 13
1.4.2.	Water level 200 mm above hydrostatic pressure cell Draught of boat: abt. 623 mm	Movement of hydrostatic securing flap can not be identified
1.4.2.1	Angel of opening of hydrostatic release lever?	7°
1.4.2.2	Is it possible to release the hoisting hooks by central release unit?	see 1.4.1.2

1.4.3.	Water level 300 mm above hydrostatic pressure cell Draught of boat: abt. 723 mm	The hydrostatic securing flap has opened fully
1.4.3.1	Angel of opening of hydrostatic release lever?	12,5°
1.4.3.2	Is it possible to release the hoisting hooks by central release unit?	Yes
1.5. 1.5.1.	**General Investigation:** Function of safety pin	
1.5.1.1	Unintentional push out of safety pin from fully inserted position possible?	The safety pin is fully functioning. Pushing out could not be recognised.
1.5.2.	Marking of cam release pin: Forward hoisting hook port	
1.5.2.1	Clear to be identified?	No, painted
1.5.2.2	Position?	Can not be identified
1.5.2.3	In correspondence with operation instruction plate no. 34i (Figure 11)?	Red zone can not be identified  Figure 14

1.5.3.	Marking of cam release pin: Forward hoisting hook starboard side	
1.5.3.1	Clear to be identified?	No, yellow zone
1.5.3.2	Position?	Secured, but in yellow zone
1.5.3.3	In correspondence with operation instruction plate no. 34i (Figure 11)?	No

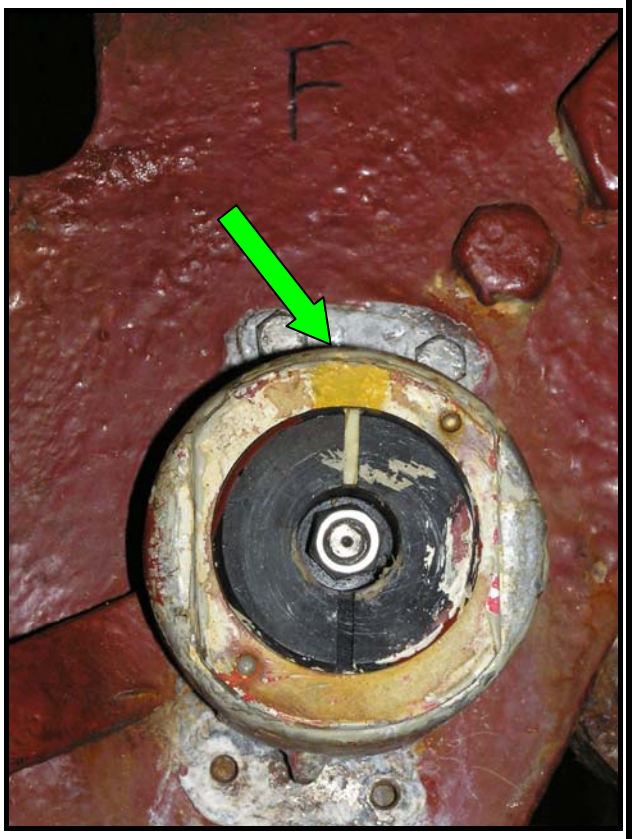
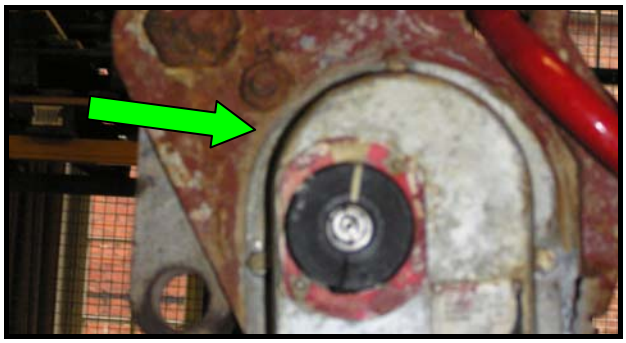
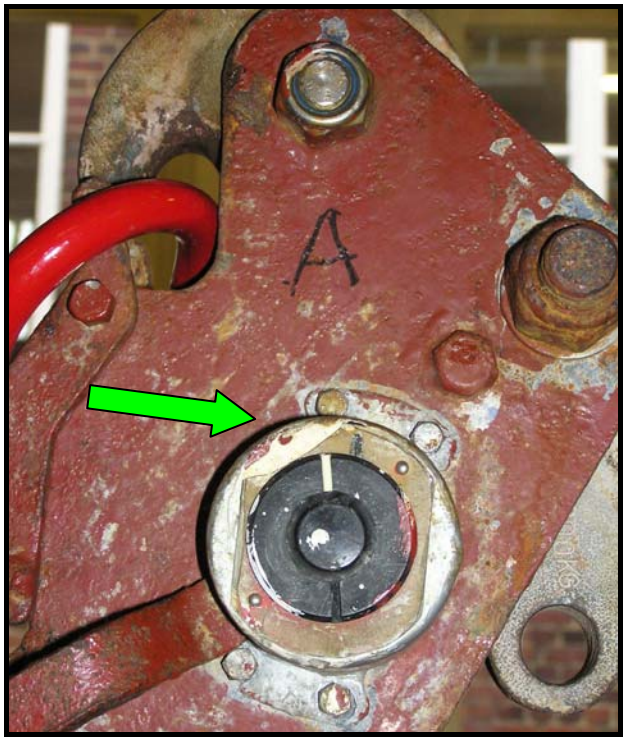
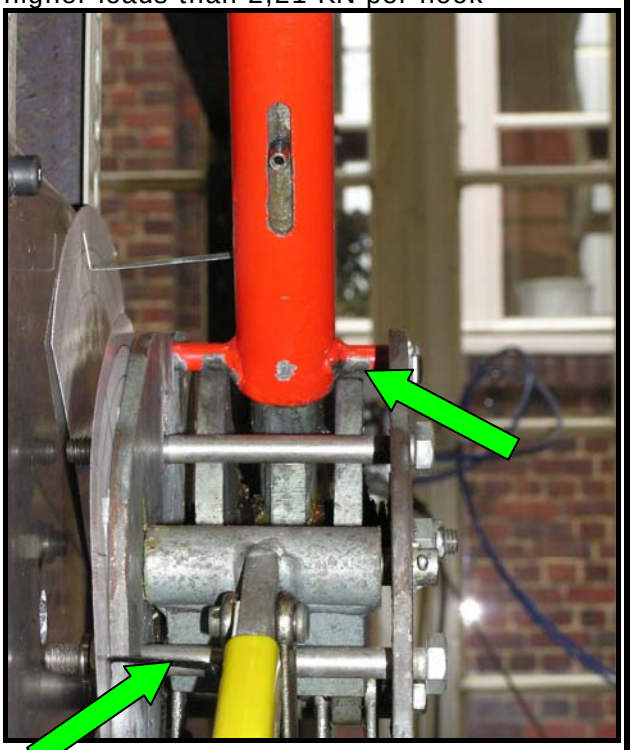
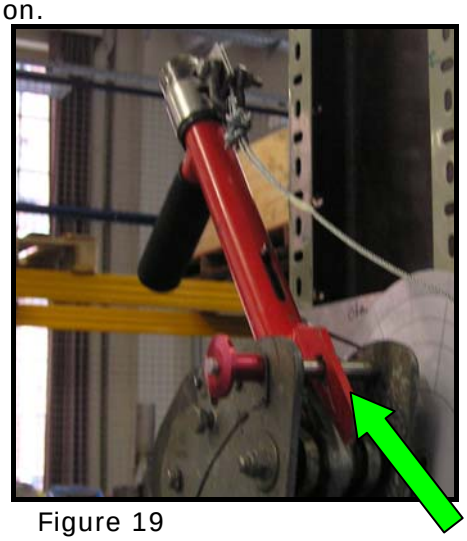


Figure 15

1.5.4. 1.5.4.1 1.5.4.2 1.5.4.3	Marking of cam release pin: Aft hoisting hook starboard side Clear to be identified? Position? In correspondence with operation instruction plate no. 34i (Figure 11)?	 Yes Secured Yes  Figure 16
1.5.5. 1.5.5.1 1.5.5.2 1.5.5.3	Marking of cam release pin: Aft hoisting hook port Clear to be identified? Position? In correspondence with operation instruction plate no. 34i (Figure 11)?	 No, partly damaged Not clear No  Figure 17

1.6.1.	**Functioning test with vertical tensile force of 16,51 KN per hook (boat loaded with 3 pers. of 75 kg). Simulation of release point**	Hydrostatic securing flap is open up to a tensile load of 2,21 to per hook (because boat is still afloat!) Release handle is in more or less secured and arrested position (as described in 1.3.1)
1.6.1.1	Simultaneous release of both hoisting hooks?	No. Forward operating quadrant is turning against welding seam of release handle at higher loads than 2,21 KN per hook  Figure 18 In this new position of forward operating quadrant the hydrostatic securing flap is not able to secure this forward operating quadrant, because the hydrostatic securing flap has contact with fork-head of aft release cable and can not turn further on. (see 1.4.1.1) Forward hoisting hook is releasing during lift up procedure of release handle in this secured angle position. Only forward hoisting hook is releasing self automatic.
1.6.1.2	Release angle of forward hoisting hook cam release pin?	79°
1.6.1.3	Release angle of release handle?	0°, release handle is in this secured angle position.
1.6.1.4	Tensile release force of release handle?	0 N, self automatic releasing

1.6.1 b	**Repeat of test 1.6.1.**	Confirmation of results
1.6.1.2b	Release angle of forward hoisting hook release bolt?	75,5°
1.6.1.3b	Release angle of release handle?	0°
1.6.2.	**Determination of the vertical tensile force of aft hoisting hook which causes a self automatically release**	Release handle is in more or less secured and arrested position (as described in 1.3.1). Right side guiding pin of release handle lies on aft operating quadrant causing friction to it.
1.6.2.1	Tensile force for self automatically releasing of aft lifting hook?	At a vertical tensile force of 36,55 KN aft hoisting hook releases self automatically. Release handle don't has been lifted up.
1.6.2.2	Release angle of aft hoisting hook release bolt?	62,5°
1.6.2.3	Release angle of release handle?	0°
1.6.3.	**Determination of the vertical tensile force of aft hoisting hook which causes a self automatically release (without friction at aft operating quadrant)**	Release handle is in more or less secured and arrested position (as described in 1.3.1). Release handle has been lifted up lightly.
1.6.3.1	Tensile force for self automatically releasing of aft lifting hook?	At a vertical tensile force of 26,85 KN aft hoisting hook releases self automatically. Release handle has been lifted up lightly.
1.6.3.2	Release angle of aft hoisting hook release bolt?	57,0°
1.6.3.3	Release angle of release handle?	0°
1.6.4.	**Repeat of test 1.6.2.**	
1.6.4.1	Tensile force for self automatically releasing of aft lifting hook?	At a vertical tensile force of 55,6 KN aft hoisting hook releases self automatically. Release handle don't has been lifted up.
1.6.4.2	Release angle of aft hoisting hook release bolt?	64,0°
1.6.4.3	Release angle of release handle?	0°
1.7.	**Determination of the vertical tensile force of both hoisting hooks which causes a self automatically release**	Hydrostatic securing flap is open up to a tensile load of 2,21 to per hook (because boat is still swimming!) Release handle is in more or less secured and arrested position (as described in 1.3.1) Right leading pin of release handle has contact to aft operating quadrant causing friction to it.
1.7.1.	Tensile force for self automatically releasing of both hoisting hooks?	At a vertical tensile force of 82 KN (41KN per hook) test has been stopped: No releasing.

1.8.	**Determination of the vertical tensile force of forward hoisting hook which causes a self automatically release**	Release handle is in more or less secured and arrested position (as described in 1.3.1). Right leading pin of release handle has contact to aft operating quadrant causing friction to it.
1.8.1.	Tensile force for self automatically releasing of forward lifting hook?	At a vertical tensile force of 39,00 KN forward hoisting hook releases self automatically. Release handle don't has been lifted up.
1.8.2.	Release angle of forward hoisting hook release bolt?	79,0°
1.8.3.	Release angle of release handle?	0°
1.9.	**Change of adjustment of aft release cable.**	
1.9.1.	Length of aft release cable will be changed to make securing possible:	At aft hoisting hook: Release cable lengthened: 4,73mm Central Release unit: Foundation of aft release cable has been mounted in a lower foundation position.
1.10.1.	**Manually reset of forward hoisting hook in the fully secured position** Is it possible to secure the release handle at the central release unit?	Acc. to instruction plate LB 34i: forward hoisting hook cam release pin is turned back to fully reset position. Release handle at central release unit has been turned back by forward operating quadrant into secured angle position.
1.10.2	**Manually reset of aft hoisting hook in the fully secured position** Is it possible to secure the release handle at the central release unit?	Acc. to instruction plate LB 34i: aft hoisting hook cam release pin is turned back to fully reset position. Release handle at central release unit has been turned back by aft operating quadrant into secured angle position. It is possible to secure the system by pushing in the safety pin in to fully insert position.  Figure 19

1.11.	**Tensile strength and functioning test with vertical tensile force of 27,17 KN per hook (boat loaded with 32 pers. of 75 kg)**	Release handle is secured and arrested with safety pin inserted fully. Hydrostatic securing flap is in fully securing position.
1.11.1.	Self automatically release of both hoisting hooks?	No, hoisting hooks are able to withstand the load without releasing. No self automatically release of the system.
1.12.	**Functioning test with vertical tension force of 16,51 KN per hook (boat loaded with 3 pers. a. 75 kg)**	Hydrostatic securing flap is in open position (ON-LOAD RELEASE). Safety pin is fully in inserted secured position.
1.12.1.	Self automatically release of both hoisting hooks, if safety pin is outside and release handle arresting is lifted up a little?	Forward hoisting hook is releasing, aft hoisting hook is still bolted. Aft hoisting hook has not released.
1.12.2.	Release angle of forward hoisting hook cam release pin?	80°
1.12.3.	Release angle of release handle?	0°, release handle is still in secured angle position.
1.12.4.	Tensile release force of release handle?	0 N, self automatically release

A.4. Examination of Hoisting Hooks

As result of test conducted dated 20.04.2006 further investigations will be necessary as follows:

1. Measurement of tolerances acc. to Maintenance Manual of manufacturer WILLIAM MILLS (MARINE) LTD, page 21 (Appendix No. 8)
2. Determination of material of forward and aft hooks in hoisting hooks
3. Determination of material of forward and aft cam release pins in hoisting hooks
4. Description of investigated parts in 2. and 3.
5. Measurement of distances of hooks in correspondence with drawing *3 TONNES HOOK (TITAN GEAR)* Nr. TG 94 of manufacturer WILLIAM MILLS (MARINE) LTD (Appendix No.7)

Acc. to information of successors manufacturer Umoe Schat Harding Ltd. parts should be manufactured with following materials:

6. Hooks: “Galvanised Mild Steel, grade 50 DD BS 4360 1986”. European material identification: S355J2 (DIN EN 10025).
7. Cam release pins: “stainless steel grade 316S31/33 to BS 970 Pt 1 1983”: Steel type X5CrNiMo 17 12 2 (material no.: 1.4401)

A.5. Results to A.4.

Investigations to A.4.1.-4. have been carried out acc. to test report no. K 270-2006 of Institute for Material Science and Welding Technology (Appendix No. 6)

1. Following distances have been measured:

Distance forward hook – cam release pin:	1,9 -2,0 mm
Distance aft hook – cam release pin:	1,8 -1,9 mm
Curve forward hook	1,75 -3,0 mm (Figure 20)
Curve aft hook:	1,75 -2,25 mm (Figure 28)

Figure 20:
Forward hook:
Curvature of 1,75-2,25 mm. Characteristic of curvature:

- Asymmetric
- Sign of wear.

Bottom part of hook is strong corroded.

2. Hooks: Material S355J2 (DIN EN 10025)
3. Cam release pins: Austenitic Stainless Steel X5CrNiMo 17 12 2
   Material-No.: 1.4401
4. Marks could be identified as follows:
   Forward hook: Stamp on one side area of hook:
   BTC 8279-4
   WLL 3T
   TL 7.5 oder TL 172.5 T
   FEB 04
   Aft hook: no stamp visible
   Forward and aft cam release pin: engraved no. 688309

5. Forward as well as aft hook has been checked by underwriter for right measurements. This investigation could be done after samples cut off acc. to A.5.3., because underwriter received drawing no. TG 94 (Appendix No. 7) dated 18.05.2006. This has been happen after repeated demand from company UMOE SCHAT HARDING LTD.
Acc. to photo (Figure 21) measurements could be determined only inaccurate.
Underwriter has no doubt about correspondence between measurements and drawing of these hooks.
Further on it has been determined that brass bushings are seated perpendicular to middle area of hooks.

Figure 21:
Forward hook:
Measurement of distances after samples cut off.

Remark: There was no need for investigation to determine rolled direction of steel plate. This would not be relevant to reason of accident.

A.6. Examinations of release cables

Release cables have been investigated by underwriter in not assembled condition.

Marks are different on the release cables as follows:
Aft release cable: 83C-4700 8H19 (8 or C!)
Forward release cable: 42B-1700 8H19
Release cable to hydrostatic pressure cell: No mark
Manufacturer identification marks couldn't be recognized.

Lengths of cables have been measured from points of pressure of fork-head of release cables as follows:
Aft release cable: 4860 mm
Forward release cable: 7160 mm
Release cable to hydrostatic pressure box: 1580 mm

During tests and investigations anomalous behaviours of release cables could not be recognized.

B. Description of how the accident happened and the causes

The description of how the accident happened is based on the assumption that during the swinging out and the lowering procedure the boat crew had not actively operated the release handle.

The port lifeboat and rescue boat was hauled up and swung into the stowage position after the running trials. Since the boat could be swung in without damage up to the stowage position, both the forward and the aft hoisting hooks were able, at times, to carry a total load of at least 33.02 kN (16.51 kN per hook). Because of the secured release mechanism the safety pin cannot have been fully pushed in before the hoisting since this was not technically possible. The release handle was indeed in the secured angular position but could not be completely locked, since the aft release cable could not turn the aft operating quadrant into a position which would have made it possible to secure the release handle with the safety pin. The aft release cable was both wrongly adjusted for length and incorrectly fitted onto the operating unit. As part of the test carried out (A.3-1.9) the release cable length on the aft hoisting hook was increased by 4.73 mm and the aft release cable on the release unit fixed to a new base position (Figures 22, 23). Only then was it possible to turn the aft operating quadrant into a position which enabled it to secure the release handle with the safety pin.

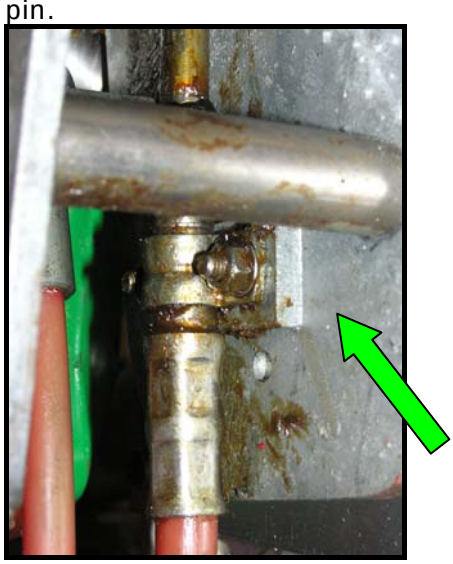


Figure 22: Original assembly point of the release cable on the release unit.

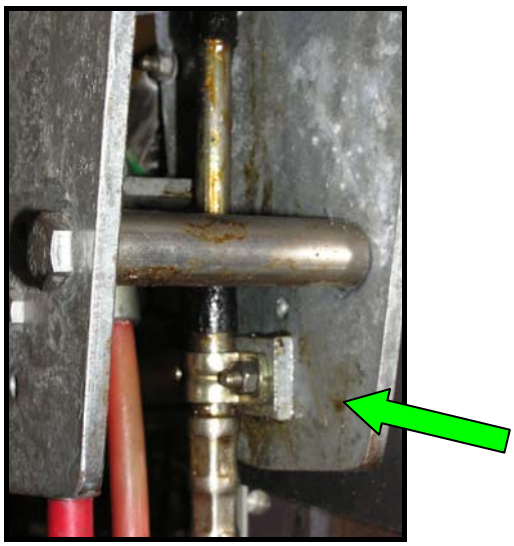


Figure 23: Modified assembly point of the release cable on the release unit.

The forward release cable was technically correctly adjusted and could turn the forward operating quadrant into a position that would have allowed locking the release handle in the safe position.

Before the accident the safety pin was not pushed in up to the rotary plane of the forward operating quadrant, since otherwise the forward hook would not have been able to release by itself (Figure 24).

Consequently it can be concluded that the safety pin was only pushed into the side base plate but not up to the area of the forward operating quadrant.

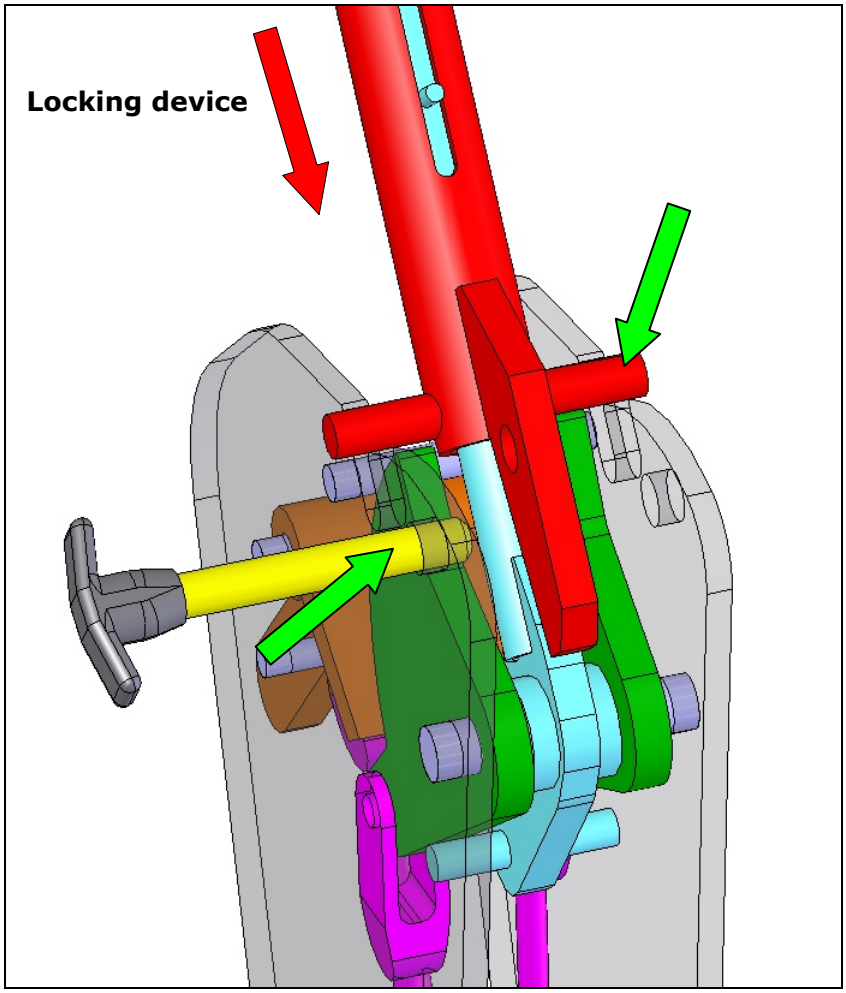


Figure 24:
Release unit:
The right side leading pin (see arrow marking) lies on the aft operating quadrant. Therefore the release handle cannot be lowered. The side leading pins thus do not reach the position to protect the operating quadrants.

As specified in the operating steps 1–4 of the operating plate (Figure 11) both forward and aft hoisting hooks could be secured with the handles by the crew member responsible for the manual securing of the hoisting hooks. The safety marking on the forward hoisting hook (Figure 15) was not in accordance with the details of the operating plate (Figure 11), since there was a yellow mark there and not a red one. There was also no red mark on the aft hoisting hook (Figure 17). In spite of this the crew member might have formed the impression that the hoisting hooks were correctly secured with the cam release pins, since the line on the position indicator pointed upwards (Figure 14).
In accordance with Figures 24 and 25 the release handle was in the safe angular position, however the release handle could not be completely protected by clicking into place, since the side leading pins lay on the aft operating quadrant. In accordance with Test No. A.3-1.8 an independent release of the forward hoisting hook occurred at a load of 39 kN. This load corresponds to a factor of 2.36 with a hook loading of 16.51 kN (boat with three people in it). Load peaks of up to a factor of 2.5 can occur when swinging out lifeboats, especially at the end of the swinging out process through the davit arms.

According to witnesses it was exactly at this point in time that the forward hoisting hook released.
According to Test No. A.3-1.6.2. and A.3-1.6.4. the aft hook then released independently at a load of 36.55 kN or 55 kN. This corresponds to a factor of 1.1. or 1.65 based on the complete weight of the boat with three people in it.

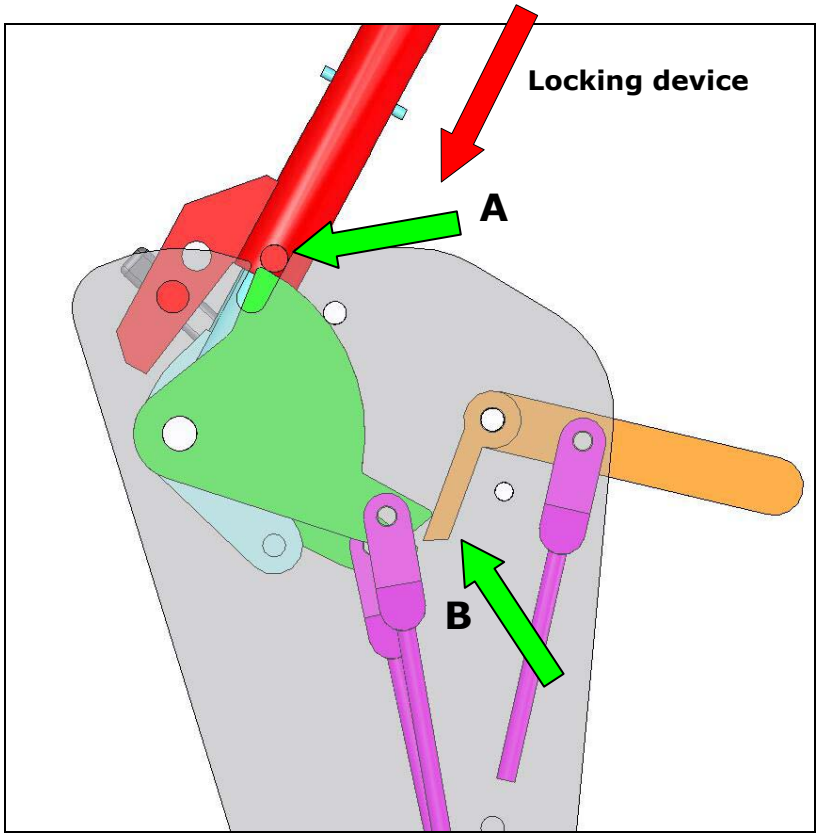


Figure 25:
Release unit:
A: The side leading pins of the release handle lies on the aft operating quadrant.
B: The hydrostatic securing flap cannot secure both operating quadrants, since they lie against the aft operating quadrant or against the aft release cable.

According to Test No. A.3-1.6.1 even a slight raising of the release handle leads to the independent release of the forward hook at a load of 16.51 kN. The vibrations and impacts when the lifeboat was swung out through the davit equipment might have led to the reduction of the friction on the release handle on the forward operating quadrant and consequently resulted in an independent release of the forward hoisting hook at an even lower load.
The hydrostatic protection flap could not exercise its function of protecting the two operating quadrants since even when lifted out of the water it was not able to turn into its safety position.
Conclusion: The misalignment of the aft release cable made protection of the release handle by the safety pin impossible.

B.1. Aft release cable: Reason why it was not possible to secure the aft operating quadrant

As already discussed under B the reason why the aft operating quadrant was not able to turn back completely lies in the aft release cable. The following conclusions on this:

1. No damage could be found in the aft operating cable.
2. The position of the rear operating quadrant can be affected by the following measures:

   A. Shortening of the release cable by further tightening of the fork head. This was not possible as shown in Figure 26.

   B. By shifting the mounting point for the cable hose fixing on the aft foundation plate of the operating unit as specified in Figure 22 and 23.

The measure under B was carried out in Test No. A.3-1.9. At the same time the aft release cable on the fork head of the aft hook fixing was extended by 4.73 mm, in order that the release distance was sufficiently long.

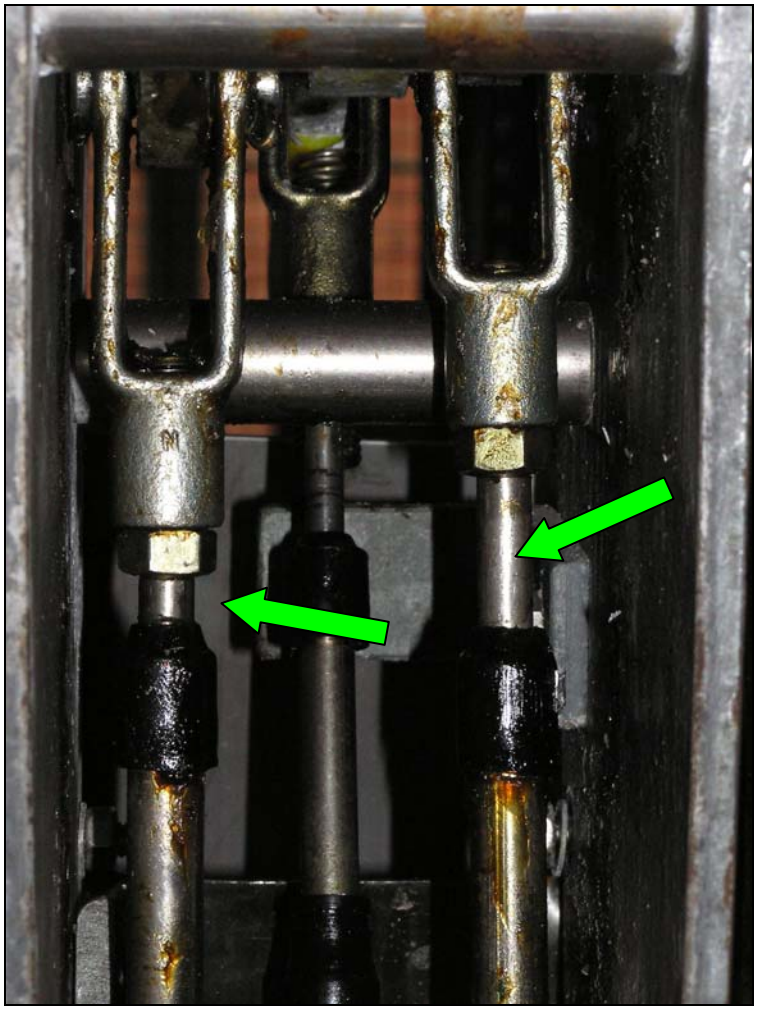


Figure 26:
Release unit:
Both release cables were in the maximum protected position. The right aft release cable clearly projected further from the cable hose and could not move the aft operating quadrant into the completely protected position.
Both fork heads were completely screwed in.

With the modifications carried out the aft operating quadrant could be moved into the fully protected position. Consequently a satisfactory protection by means of the safety pin was possible.
It should be noted that the new assembly position of the cable fixing on the release unit as shown in Figure 22 was already available predrilled. Consequently there was an adjustment possibility available to equalise a cable tolerance.

B.2. Cause for the independent release of the hoisting hooks

In this connection the following questions must now be asked: Why did a cam release pin on the hoisting hook release independently? In the description of the accident sequence of events an independent release took place, because as shown in Figure 27 the geometry of the hoisting hook due to a reduction of material by wear on the hoisting hook produced a releasing torque on the cam release pin.

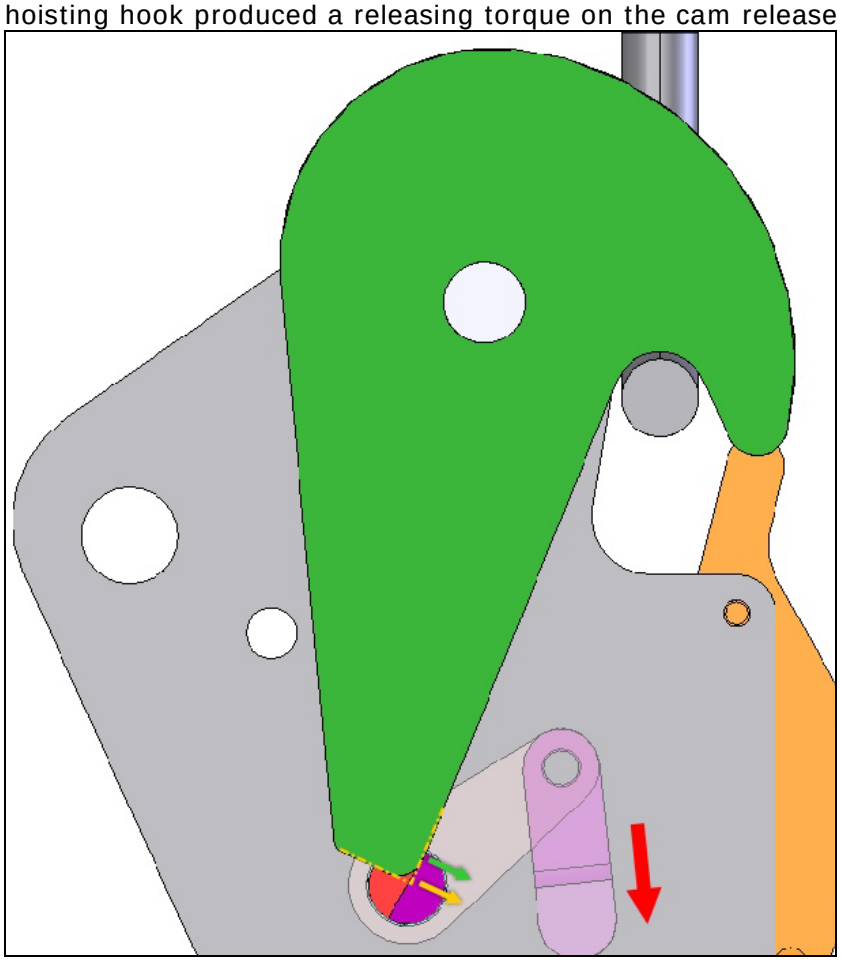
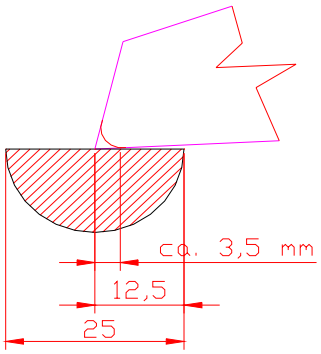


Figure 27:
Display of the releasing torque on the cam release pin: The theoretical pressure point of the hook on the cam release pin is shown by the yellow arrow. The actual pressure point of the hook on the cam release pin is shown by the green arrow. This produces the torque that led to the independent release of the aft and forward hoisting hooks.



No material reduction or abrasion could be seen on the cam release pins. The releasing torque due to the hook on the cam release pin was so great that it retrospectively affected the release cable which had turned the unprotected operating quadrant.
The method of operation of the release cable should be so that the cam release pin can be turned to the release point with the release handle. This was not the case with the hoisting hook system investigated: When loaded as in Test No. A.3-1.6.1. and A.3-1.6.2. both release cables were moved by the cam release pins of the hoisting hooks and not by the release handle of the release unit.

The maximum tolerance between release cam and hook as well as the maximum curvature of the hook are given in the maintenance handbook of the manufacturer WILLIAM MILLS (MARINE) LTD on page 21 (Appendix No. 8). According to Test No. A.4-1 these distances between cam release pins and hooks at 1.9 – 2.0 mm on the forward hook and 1.8 – 1.9 mm on the aft hook slightly exceed the maximum value given in the Handbook of 1.8 mm. The radii of the hooks were measured on the forward hook as 1.75 – 3.0 mm and on the rear hook as 1.75 – 2.25 mm. These values were clearly higher than the maximum value of 1.0 mm given in the Maintenance Handbook of the manufacturer. The fact that the values on the forward hook were higher than those in the aft hook was confirmed by the test results. The forward hook released independently in Test No. A.3-1.8.1. at 39 kN, the aft hook in Test No. A.3-1.6.4.1 at a load of 55.6 kN. The forward hook released first. The material S355J2 of the hooks and the material number 1.4401 of the cam release pins were confirmed in investigations A.5.-2 and A.5-3. There was some wear due to abrasion and corrosion of the hook material which had resulted in the radii on the hook being increased.
According to drawing TG 94 (Appendix No. 7) the hook should have a galvanising coat. This galvanising was no longer present in the area of the equipment surfaces for the release on both hooks as shown in Figures 20 and 28. It should be noted that galvanising is not a sensible way of preventing corrosion in the area of the hook. According to drawing TG 94 (Appendix No. 7) the manufacturing accuracy is given as 151.33 (+ 0.08/–0.00) mm for the part of the hook relevant for release. Galvanising and the wear in the operation of this material contradict the functional accuracy of this dimension. To reduce the material wear the hook material should be changed to a material with a greater wear resistant. Moreover it should be sea water resistant. As a result the maintenance requirements on this important part would be reduced. Furthermore the complete geometry of the force transmission from hook to cam release pin should be so changed that in future automatic release due to wear or corrosion can be excluded.

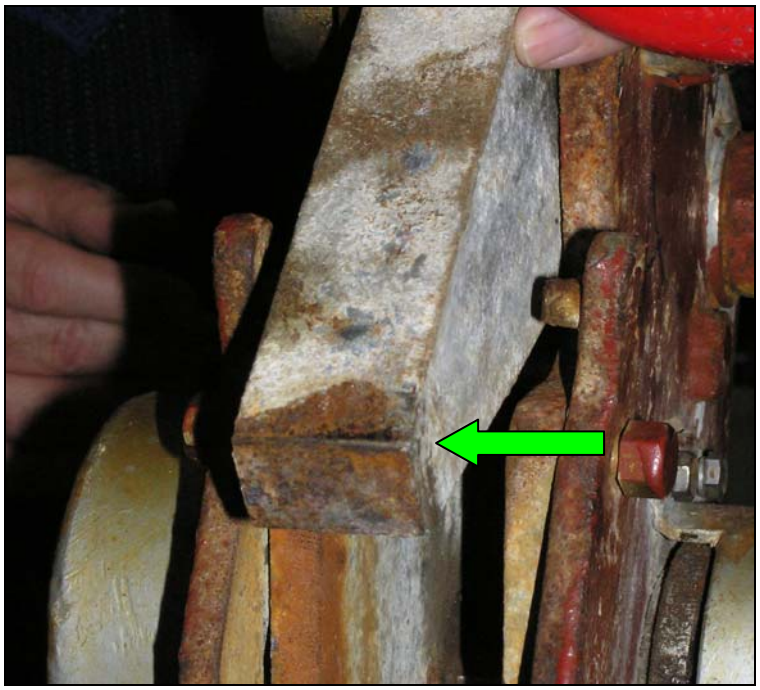


Figure 28:
Surface of the hook of the aft hoisting hook:
The galvanising was worn away.
The galvanising had already corroded in other areas of the hoisting hook.

B.3. The reason why it was not possible for the hydrostatic lock to lock

In Test No. A.3-1.4.1. – A.3-1.4.3. the water pressure cell worked when hoisting out of the water. As a result of the description given in B.1. the water pressure cell could not turn the hydrostatic securing flap into the securing position, since it fitted closely on the aft operating quadrant (Figure 25, Arrow B).
The hydrostatic lock was consequently not active and did not protect the system against unintended or independent release. The yellow handle of the hydraulic locking flap was in the red area of the cover (Appendix No. 10). The marking of the red area with the red sign OPEN might have given the operator the impression that the hydrostatic lock had protected the system.
Conclusion: The hydrostatic lock was not active and did not protect the system.
Due to the misalignment of the release system the locking element of the hydrostatic lock could not fulfil its function and did not protect the system against unintended release. It should be emphasised that this locking element was affected by other functional elements and could not work independently of them.

B.4. Handbook for Operating, Maintenance and Training

There was no special handbook available on the ship for the central release mechanism made by WILLIAM MILLS (MARINE) LTD which covered operating, maintenance and training. In the boat handbook of the boat manufacturers HYUNDAI PRECISION & IND. CO. LTD. which was on board, there was a brief description on just two pages (Appendix No. 14) of the operation of the release mechanism and the four maintenance steps. The instructions contained in this are very general and do not do justice to the complexity of the system. There was no information on the manufacturer of this system. This suggests that the description was left general in order to cover various hoisting hook products with this handbook. Moreover in the maintenance part only four points were mentioned, none of which were illustrated with pictures. This maintenance should be carried out as part of a training course.
In the MSC/Circ. guideline. 1136 of the International Maritime Organization Appendix 1.3.3. states that before a training course is run the relevant safety systems in the boat must be checked. Moreover it needs to be established whether the boat was maintained in accordance with the manufacturer's instructions.

> 1.3.3 Before conducting drills, it should be checked that the lifeboat and its safety equipment have been maintained in accordance with the manufacturer's instructions, as well as noting all the precautionary measures necessary. Abnormal conditions of wear and tear or corrosion should be reported to the responsible officer immediately.

The necessary information on the maintenance and operation of this central release mechanism was described to the user in the "TITAN" (WITH INDICATORS) MAINTENANCE MANUAL, issue 1 September 1997 and the "TITAN" (WITH INDICATORS) OPERATION MANUAL, issue 1 September 1997.
It is difficult to understand why these handbooks were not present on board the ship and why the boat manufacturer had not put the content in the handbook for operation and maintenance of the life boat and the rescue boat.
As part of their certification procedure for this boat the classification authority D.N.V. had approved the central release mechanism on the basis of a type approval by Lloyds Register. On enquiry D.N.V. was not able to produce this certificate that was valid in 1998. It needs to be checked whether the Operating and Maintenance Handbook was a part of the type approval certificate.

According to Appendix No. 15 in the RECORD OF APPROVED CARGO SHIP SAFETY EQUIPMENT No. 20266 the classification authority asked about the safety equipment of the ship when it was commissioned. This enquiry should have been extended to detailed information on the central release mechanism. Moreover the presence of the Operating and Maintenance Instructions for the safety relevant equipment should be checked. In addition there is the question of whether this involved the central release mechanism in the lifeboats and rescue boats.
Conclusion: Had they had the Operating and Maintenance Handbooks of the manufacturers WILLIAM MILLS (MARINE) LTD the ships management would have been able to understand the hoisting hook system and the method of operation by studying the illustrations. The handbook of the boat manufacturer is nowhere near sufficient. With this amount of information the ship's management could not recognise the defective maintenance and safety condition of the central release mechanism.

B.5. Marking on the central release mechanism

The marking and lettering of the operating units of the central release mechanism can be divided into two areas:
A. External: On the hoisting hook
B. Internal: In the vicinity of the operating unit
According to Tests A.3-1.5.2. – A.3-1.5.5. the markings of the position indicators of the cam release pins on the forward hoisting hook did not correspond to the description on the operating plate L 34i (Figure 11) and on the aft hoisting hook they only correspond on the starboard side. The position indicators were to some extent over-painted or in one case marked with the wrong colour. There were no further operating plates for the operator of the hoisting hook in the forward or in the aft outer boat area.
The following plates were missing on the hoisting hooks:

1. Illustrated description of the locking of the hoisting hooks before the boat was lifted out of the water (Appendix No. 9).
2. Designation of the release handle for the manual release in agreement with the concepts of the plate LB 341.
3. Description of the operation of the HANGING-OFF-PENDANT
4. Designation of the foundation for the HANGING-OFF-PENDANT

The following plates were fitted in red or white for the crew of the boat on the operating unit. Operating plate LB 34i (Figure 11). Operating plate LB 25 (Figure 29), operating plate LB 17i (Figure 29).
Reference should be made to the following points of the operating plate LB 17i:
Item 2: the designation "…fully dropped into its safety slots…" should have been shown in a diagram. A danger notice to explain the danger of the partial locking as was present during the accident is necessary.
Item 6: It is mentioned here that the position indicators should run in line. According to the indicators found there was only one line on the black washer but no second line. Here also an illustrated description would have been very helpful in order to define the condition of the indicators on the hoisting hooks without any dubiety.
Item 7: What exactly is meant by flat contact? A picture would be very useful.

Item 8: What is the locked position? The hydrostatic locking flap was according to Appendix No. 10 marked before the destruction with a green plate “Closed” in the green area and a red plate “Open” in the red area. This description is misleading. In order to properly describe the safe position of the hydrostatic locking system the same terminology should have been used: closed position and not locked position. An illustrated description would be very helpful to show the two positions of the handle:

A. OFF-Load (floating in the water)
B. ON LOAD (hanging in the davit)

According to the available knowledge during the hoisting out of the water the un-locked yellow handle of the hydrostatic locking flap was in the red area.
This indicated the OFF-LOAD situation. A warning note is necessary which instructs the crew on the consequences of this position during the lifting procedure. There was no further operating plate with the recommended IMO symbols (IMO-RES. A.760(18)) and an illustrated description of the release situation and the locking situation as shown in Appendix No. 9. The secured position of the hydraulic locking handle which is important for the hoisting process was described by this plate. The plate shown in Appendix No. 9 was made by the manufacturer WILLIM MILLS (MARINE) LTD. The question of why this plate was not in the boat remains to be answered.
A description of the use of the HANGING OFF-PENDANTS was not available.
Conclusion: The plate and description for the central release mechanism found in the boat was to some extent misleading and incomplete.

Figure 29:
Operating plate LB 25 and operating plate LB 17i.

B.6. Release device for hoisting hooks

The international regulations for life boats require in SOLAS, Chapter III, Reg. 16.2 that each lifeboat must be fitted with a device on which it can be hung from the davit equipment which unloads the release mechanism for maintenance.
Normally so called HANGING-OFF PENDANTS are used for this. With these the boat hangs without contact with the releasing part of the hoisting hook in the davit equipment. Consequently in order to carry out maintenance on the central release mechanism the boat does not have to be lowered into the water but the maintenance can be done hanging in the davit equipment.
In the Operating Instructions for the davit equipment of this ship (Appendix No. 13) the HANGING-OFF PENDENTS were mentioned in a completely different connection: **RECOVERY OF RESCUE BOAT USING RECOVERY STROPS.** This drawing describes the recovery of the rescue boat in a rough sea. A description of the HANGING-OFF-PENDANTS in connection with the maintenance of the hoisting hooks was not given in this Handbook. Likewise this possibility for maintenance was not mentioned in the handbook for the lifeboat and the rescue boat (Appendix No. 14).
There was neither a mark nor a description on the hoisting hooks or in the boat interior or on the davit equipment which marked clear the recognition of the fundamental points for the connection with shackles of the HANGING-OFF PENDANTS
Since the description of the use of the HANGING-OFF PENDANTS in this connection on the ship was not available, it is possible that the 1st Officer did not know about it.
Conclusion: If the HANGING-OFF PENDANTS had been pressed against the hoisting hooks this boat would not have had to be lowered into the water in order to undertake the test of locking and investigate the hoisting hook.

B.7. Maintenance situation of the central release mechanism

As is shown in the comments regarding B.1., B.2., B.4., B.5. and B.6. the technical condition of the central release mechanism did not correspond to the requirements defined by the manufacturer in the following points:

1. Adjustment of the aft release cable
2. Wear tolerances on the hook
3. Current signs and description of the operating functions and controls

INTERNATIONAL MARITIME ORGANIZATION
4 ALBERT EMBANKMENT
LONDON SE1 7SR

Telephone: 020 7735 7611
Fax: 020 7587 3210
Telex: 23588 IMOLDN G

IMO

E

Ref. T4/3.01

MSC/Circ.1093
17 June 2003

GUIDELINES FOR PERIODIC SERVICING AND MAINTENANCE OF LIFEBOATS, LAUNCHING APPLIANCES AND ON-LOAD RELEASE GEAR

In the not mandatory MSC/Circ. guideline 1093 of the International Maritime Organization a 5 year maintenance check with associated test and an annual check by the manufacturer or a specialist firm authorised by the manufacturer is specified for the central release mechanism of life boats and rescue boats.

The central release mechanism was tested in 2004 as described in the D.N.V-Survey Report No. 20266 (Appendix No. 11) under the supervision of the classification authority D.N.V with a load of 1.1 x SWL. The certificate confirmed that in connection with the tests a maintenance check was carried out on the central release mechanism by the firm TECHNO FIBRE in Singapore.
The address was: **TECHNOFIBRE (S) Pte Ltd.**
Kian Teck Crescent No. 7,
628874 Singapore
D.N.V Survey Report No. 20266 confirmed that the firm TECHNO FIBRE was authorised by the manufacturer to carry out this maintenance check. The successors of the manufacturer Umoe Schat Harding Ltd. explained in their letter of 10.05.2006 (Appendix No. 12) that the authorisation of the staff of TECHNOFIBRE (S) Pte. Ltd. when the maintenance was carried out had expired. No maintenance contract between TECHNOFIBRE (S) Pte. Ltd. and UMOE SCHAT HARDING was submitted to the undersigned. Consequently it was not possible to establish what the scope of the original authorisation was. It remains to be clarified why, in spite of a quality assurance system as specified in ISO 9002: 1994 (Lloyds Register No. 403097), this service was carried out although there was no authorisation.
The classification authority D.V.N. has not commented on what basis they confirmed the authorisation of TECHNOFIBRE (S) Pte Ltd. in the Survey Report which they issued.
It was recorded that during the services in 2004 both hooks were replaced with new ones. See the CERTIFICATE OF SERVICE (Appendix No. 18) of TECHNOFIBRE (S) Pte Ltd. in this connection. In addition a sealing washer in the water pressure seal was renewed. This was indicated by the mark seen on the forward hook in the investigation A.5.-4. The aft hook had no mark.
In accordance with the TEST REPORT OF HYUNDAI MOTOR LIFEBOAT dated 23.10.1998 (Appendix No. 16) of the boat manufacturer the central release mechanism was marked with the serial number 5630/28. This mark could not be found on the hoisting hooks or on the control unit inside the boat.
The following questions remain unanswered regarding the service carried out in 2004:

1. Why did TECHNOFIBRE (S) Pte. Ltd. carry out the service in 2004, although the staff of this firm were no longer authorised at this time? The quality management system should be asked about this.
2. Was the misalignment of the aft release cable due to an incorrect adjustment during the service?
3. Why was the latest operating instruction plate not fitted?
4. Why were the latest Operating and Maintenance Handbooks not delivered?
5. Why did the Classification Authority DVN recognised TECHNOFIBRE (S) Pte. Ltd as authorised by the manufacturer?

Conclusion: On the basis of the established facts the probability is that the service carried out in 2004 by TECHNOFIBRE (S) Pte. Ltd. was counterproductive, and after the renewal of the hooks the complete system was not correctly adjusted and consequently was unsafe. A service in accordance with the guideline MSC/Circ. 1093 would have been able to restore the safe functioning of the release mechanism or establish that it worked satisfactorily. In addition a service in accordance with this guideline should include the ship being supplied with the latest handbooks for operating, maintenance and training as well as the current instruction plates.

B.8. Summary of the sequence of events that led to the accident

1. The crew secured the two hoisting hooks with the handles on the hoisting hooks. The marks and descriptions that were not present gave the crew the impression that both hooks were secure.
2. The release handle at the operating position inside the boat was in the locked angular position but was not completely locked.
3. The crew could not push in the safety pin completely, they were only able to push it into the forward foundation plate. They decided however to hoist up since the release handle was in the secured position.
4. The boat was hoisted up
5. While it was being hoisted up the water pressure cell operated. It could not bring the hydrostatic locking flap into the locked position. The hydrostatic lock was consequently not active and did not protect the system against unintended or independent release. The yellow handle stood in the red area of the cover. The marking of the red area with the red sign OPEN might have given the operator the impression that the hydrostatic lock had protected the system.
6. The boat was hoisted up and swung into the stowage position by the davit equipment and shackled.
7. The 1st Officer was advised of the dubious securing of the hoisting hook system by the boat crew.
8. The 1st Officer was not aware of the possibility of using the HANGING-OFF-PENDANTS for the maintenance of the hoisting hooks on a boat hanging in the davit equipment.
9. The 1st Officer decided to check the hoisting hook system in the water.
10. After the boat had been swung out by the davit equipment the forward hoisting hook opened first and then also the aft hoisting hook independently.
11. The boat fell inclined forward from a height of about 18 m, the forward superstructure area hit the water surface and remained capsized in the water.
12. The AB was able to save himself through the forward hatch. The 1st Officer and 3rd Officer died in the boat.

C. Improvement proposals

C.1. Improvement proposals for central release mechanism Type TITAN MILLS Type 354

1. Modification of the geometry of the force transmission of the hook to the cam release pin so that in future wear and corrosion of the hook cannot cause the mechanism to release by itself.

2. Modification of the material of the hook: It should have a greater wear resistance and be resistant to sea water.

3. Modification of the design principle of the central release mechanism: Arrangements must be made to exclude the possibility that when the position indicators on the hoisting hooks are in a locked position they can release independently.

4. Modification of the locking principle of the central release mechanism:
   When the release handle is in the locked position but not completely engaged, it should either be impossible to apply a load to the hooks or when a load can be applied, the hydraulic locking should prevent an accidental premature or independent release.

5. Modification of the operating plate LB 171 according to the proposals in Chapter B.5

6. Modification of the lettering of the cover of the hydrostatic locking flap

C.2. Improvement proposals for the Classification Authority D.N.V.

1. The RECORD OF APPROVED CARGO SHIP SAFETY EQUIPMENT should be completed by the following questions:
   A. Type of central release mechanism, approval number
   B. Handbook for Operating and Maintenance of the central release mechanism.
2. The following questions should be added to the SURVEY REPORT TESTING OF LAUNCHING APPLIANCE AND ON-LOAD RELEASE GEAR:
   A. Authorisation number of the service workshop
3. TYPE APPROVAL CERTIFICATE for lifeboats and rescue boats:
   A. The procedure of a type approval of a lifeboat and rescue boat should contain the criteria for checking the design features of the central release mechanism that are relevant for the installation. All the types of central release mechanisms that are approved for this type of boat should be listed in the type approval certificate.
   B. The handbook for operation, maintenance and training should form part of this approval procedure.

C.3. Improvement proposals for the international standards

1. Modification of the international standards of the Life-Saving Appliance (LSA)–Codes, Chapter IV, 4.4.7.6.2:
   The standard should be so modified that for training or maintenance purposes the UNDER LOAD RELEASE can be made ineffective. Each hoisting hook should be fitted with a safety pin that can be manually put in as shown in Figure 30 which protects the hooks against accidental use during training or maintenance before a release by the central release mechanism. This safety pin can be put in both in the water or, if necessary, in the stowage position. The safety pin should be pulled out at every time also under ON-LOAD-conditions if the system is technically perfect.
   The design of this pin, as well as the design of the complete construction, should have a factor of safety of six compared with the breaking point of the materials.

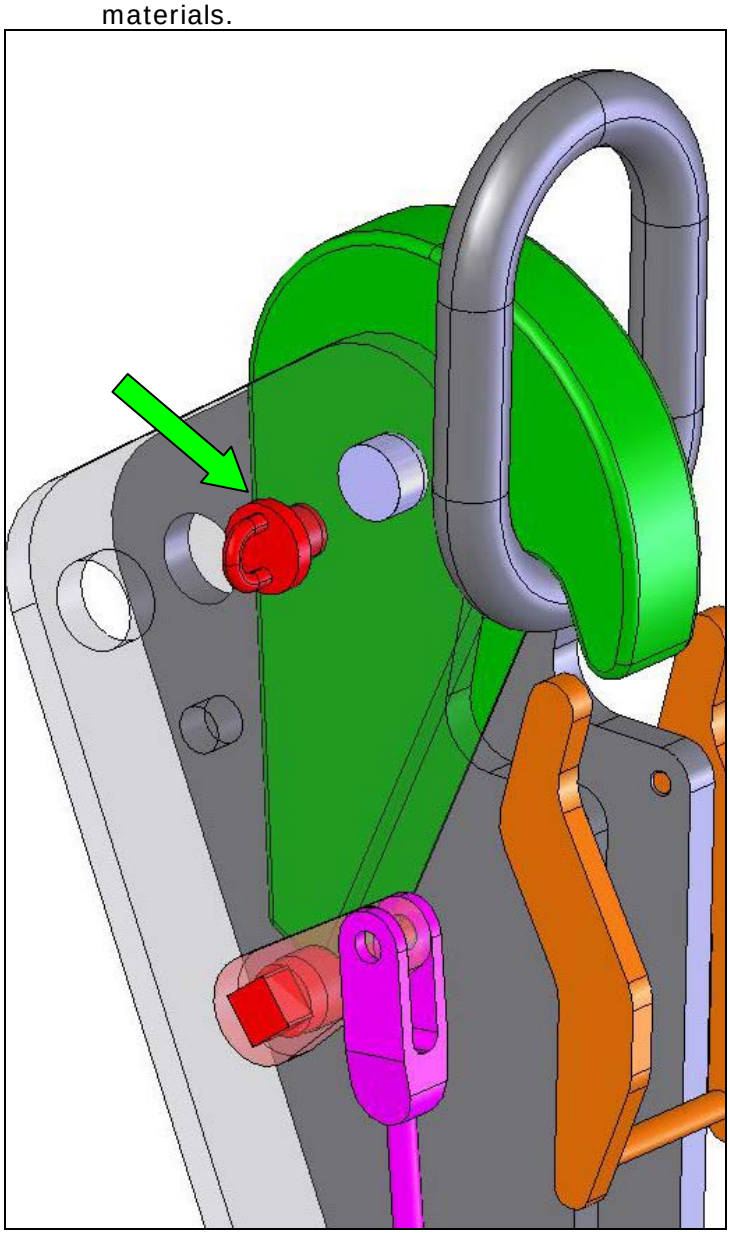


Figure 30:
Training and Maintenance protection:
An accidental ON-LOAD release of the hoisting hook is prevented by a safety pin manually pushed in to the hoisting hook cheek plates and the hooks.
(sketch shown as an example)

2. Modification of the international standards of the Life-Saving Appliance (LSA)–Codes, Chapter IV, 4.4.7.6.3. The new text for Item 3 at present in the approval process must be modified and supplemented.

> .2.2 on-load release capability shall release the lifeboat with a load on the hooks. This release shall be so arranged as to release the lifeboat under any conditions of loading from no load with the lifeboat waterborne to a load of 1.1 times the total mass of the lifeboat when loaded with its full complement of persons and equipment. This release capability shall be adequately protected against accidental or premature use. Adequate protection shall include special mechanical protection not normally required for offload release, in addition to a danger sign. To prevent a premature on-load release, on-load operation of the release mechanism should require a deliberate and sustained action by the operator;
>
> .3 to prevent an accidental release during recovery of the boat, unless the hook is completely reset, either the hook shall not be able to support any load, or the handle or safety pins shall not be able to be returned to the reset (closed) position without excessive force. Additional danger signs shall be posted at each hook station to alert crew members to the proper method of resetting;

3. The text of the international standard should be changed so that when the release handle is not in the completely locked position but load can be applied to the hooks, the hook system must nevertheless be secured by the locking elements such as the hydrostatic locking system or the safety pin.
4. to prevent an accidental release during recovery of the boat, unless the hook is completely reset, either the hook shall not be able to support any load, or he handle or safety pins shall not be able to be returned to the ***fully*** reset (closed) position without excessive force.

   If it is possible that the hook supports load under this not completely reset position, the release capability shall be adequately protected against accidental of premature use.

   Additional danger …"

C.4. Improvement proposals for TECHNOFIBRE (S) Pte. Ltd.

1. Modification of the quality assurance system as specified in ISO 9002.2000 in the following points:

A. Servicing and maintenance work may only be carried out on the types of hoisting hook for which the manufacturer has given authorisation.

B. The work instructions and check lists necessary for a service must be approved by the respective manufacturer.

D. Safety recommendations

The following safety recommendations should be issued on the basis of the experience of this accident:

1. Central release mechanism Type TITAN MILLS TG 354:
   With this central release system there is the possibility of the independent release under load conditions even though the release handle is in the secured position and the markings on the hoisting hook indicate a secure position.
   It is essential to ensure that the safety pin is always completely pushed in on the release unit under load conditions.

2. Central release mechanism in life boats and rescue boats: ***The annual and 5 yearly maintenance work on the central release mechanism may only be done by the manufacturer or by a specialist firm or person authorised by the manufacturer. A list of maintenance firms authorised by the manufacturer or their successors should be put into the ISM-SAFETY MANAGEMENT MANUAL.***
   The maintenance should be done as specified in IMO guideline MSC/Circ. 1093.
   Routine maintenance and inspections in weekly or monthly cycles shall be done in accordance with the manufacturer's specifications and suitably recorded.

3. Central release mechanism in life boats and rescue boats:
   The maintenance work carried out in accordance with the IMO guideline MSC/Circ. 1093 must contain the following checks:
   1. ***Does the ship have the latest handbooks for operating, servicing and training for the central release mechanism which is installed on the lifeboat and rescue boat?***
   2. ***Is the central release mechanism fitted with the latest version of the plate and illustrated description for the hoisting hook installed on the lifeboat and rescue boat?***

4. Central release mechanism in life- and rescue boats:
   It is pointed out to the ships management that a device for hanging the lifeboat and rescue boat from the davits must be available on the ship, which unloads the release mechanism for servicing. (HANGING-OFF PENDANTS). This device should only be attached to the release mechanism and the davits when servicing is undertaken.

Appendix No. 1.

CERT.NO.
ULN-981001

ORIGINAL

DNV

DET NORSKE VERITAS

CERTIFICATE OF INSPECTION

At the request of Messrs. Hyundai Precision & Ind. Co., Ltd. Ulsan, Korea, the undersigned attended the premises for the purpose of survey and test of the following item:-

7.1M TOTALLY ENCLOSED & FIRE PROTECTED LIFE/RESCUE BOAT

1.0 APPLICABLE CODES/STANDARDS

- 1996 Amendments to SOLAS 1974, LSA Code Chapter IV, 4.4, 4.6, 4.8, 4.9 & Chapter V 5.1.
- IMO Resolution A689(17), Recommendation on Testing of Life Saving Appliances.

2.0 PARTICULARS OF LIFEBOAT

Type	:	HDL71CF
Serial no.	:	E98-32-546
Intended for	:	DW5139
Capacity	:	32 persons
Dimensions LxBxDxH(M)	:	7.1M x 2.4M x 1.125M x 2.7M
Construction Material	:	G.R.P.
Cubic Capacity (M3)	:	Gross; 12.756, Net; 10.563
Speed	:	6.43 knots
Engine	:	SAAB MOTOR A/S Type: L3.139LB, 21.9 KW
Net Weight	:	2730 kgs
Full Weight (including full complement, equipment, fuel and water, etc.)	:	5540 kgs.
Lifting Hooks	:	WILLIM MILLS MARINE LTD. TG354 TITAN HOOK/SWL3000KGS
Air bottle I.D. Marks	:	NV NY00028, 00015, 00051.

CERT. NO. ULN-981001

ORIGINAL

3.0 SURVEY CARRIED OUT

The above lifeboat was satisfactorily visually examined and tested in accordance with the standards given in part 1.0 of this certificate.

4.0 OUTSTANDING ITEMS

The lifeboat's loose equipment was not installed at the time of survey and this is to be inspected when the lifeboat is taken onboard.

Ulsan, Korea
1998.10.23.

DET NORSKE VERITAS 1864 ULSAN

S. M. Jo
Surveyor to DET NORSKE VERITAS

Appendix No. 2.

DAP Deutsches Akkreditierungssystem Prüfwesen GmbH

Unterzeichner der Multilateralen Abkommen von
EA und ILAC zur gegenseitigen Anerkennung

vertreten im

Deutschen AkkreditierungsRat

Akkreditierung

Die DAP Deutsches Akkreditierungssystem Prüfwesen GmbH bestätigt hiermit, dass das

**Institut für Werkstoffkunde und Schweißtechnik
der Hochschule für Angewandte Wissenschaften
Hamburg (HAW)**

Berliner Tor 13
20099 Hamburg

die Kompetenz nach DIN EN ISO/IEC 17025:2005 besitzt, Prüfungen in den Bereichen

mechanisch-technologische Prüfungen an Metallen, metallographische Untersuchungen, chemisch-physikalische Analyse von Metallen und deren Produkten

gemäß den in der Anlage aufgeführten Prüfverfahren auszuführen.
Die Akkreditierung ist gültig vom 2006-02-02 bis 2011-02-01.
DAR-Registriernummer: **DAP-PL-2948.00**
Berlin, 2006-02-02

i. V. Valbruna
Univ.-Prof. Dr.-Ing. habil. K. Ziegler
Geschäftsführer
DAP Deutsches Akkreditierungssystem
Prüfwesen GmbH

DEUTSCHES AKKREDITIERUNGSSYSTEM PRÜFWESEN 004 DAP EA DAR ILAC MITGLIED

Dipl.-Ing. L. Burgfeld
Verantwortlicher Begutachter der DAP GmbH
Ingenieurbüro Lothar Burgfeld
Essen

Siehe Hinweise auf der Rückseite. 2. Ausfertigung

Appendix No. 3.

Sachverständigenbüro Dipl.-Ing. Jan Hatecke

MARINE CONSULTANT

Dipl. Ing. Jan Hatecke • 21737 Wischhafen • Alter Schulweg 49

Alter Schulweg 49
21737 Wischhafen
Germany

Mobil: +49(0)171-5335934
Tel. +49(0)4770-808411
Fax : +49(0)4770-808410
E-Mail: jan@hatecke.de

Übergabebestätigung

dem

IWS Institut für Werkstoffkunde und
Schweißtechnik Service GmbH
Berliner Tor 13
D-20099 Hamburg

sind am 07.03.2006 für eine Unfalluntersuchung folgende Teile übergeben worden:

1. hinterer Heißhaken
2. vorderer Heißhaken
3. Hydrostatiksicherungsdose
4. Auslöseinheit mit zwei Auslösekabeln

Wir bestätigen den Erhalt der obigen Teile und werden eine Aufbewahrung sicherstellen, die eine Manipulation Dritter an den Teilen ausschließt.

.....
IWS Service GmbH

Appendix No. 4.

Sachverständigenbüro Dipl.-Ing. Jan Hatecke

MARINE CONSULTANT

Teilnehmerliste

Erprobung: Untersuchungen am zentralauslösbaren Heißgeschirr des B.Bd.-Rettungs- und Bereitschaftsbootes des MT „OLIVER JACOB"

Ort: IWS Institut für Werkstoffkunde und Schweißtechnik Service GmbH Berliner Tor 13, D-20099 Hamburg

Datum: 20.04.2006

Name	Firma	Telefon-Nr.	E-Mail	Unterschrift
Jan Hatecke	Sachverständigenbüro	04770 808411	ja@hatecke.de	
IAN MACHIN	UNDE SCHAT HARDING LTD	00442392 603889	ian.machin@schat-harding.co.uk	
MARKUS KAHLE	UNDE Schat-Harding GmbH	04821 40837-12	m.kahle@schat-harding.de	
Katrin Ewert	BSU	040 3190 8530	katrin.ewert@bsh.de	
Ferenc John	BSH	040 31908320	ferenc.john@bsh.de	
Jens Mentzel	BSH	040 31908325	jens.mentzel@bsh.de	
Nils Kraglund	Ernst Jacob	0461 86042	Kraglund@ernstjacob.de	
Heinz Stührmann	See-BG	040-36137-218	Heinz.Stuermann@See-BG.de	
Jochen Buck	DNV	040-89057039	Jochen.Buck@DNV.com	
Jürgen Albers	BSH	040-31908110	juergen.albers@bsh.de	
Thomas Pfeiffer	IWS	040-42875-8837	Pfeiffer@iws-Hamburg.de	
Stefan Rosch	IWS	040-42875-8933	Rosch@IWS-Hamburg.de	

Appendix No. 5.

Hochschule für Angewandte Wissenschaften Hamburg
Hamburg University of Applied Sciences

INSTITUT FÜR WERKSTOFFKUNDE UND SCHWEISSTECHNIK

Akkreditiertes Prüflabor nach
DIN EN ISO/IEC 17025:2000
mit Erfüllung der Anforderungen nach
DIN EN ISO 9002:1994
DAP-PL-2948.00

Prof. Dr. B. Arnold (Inst. Direktorin)
Prof. Dr. H. Horn (stv. Inst. Direktor)
Prof. Dr. J. Happ
Prof. Dr. L. Müller

PRÜFBERICHT

Nr. K 269-2006

Auftraggeber:	Sachverständigenbüro Dipl.-Ing. Jan Hatecke Alter Schulweg 49 D-21737 Wischhafen
Auftrag vom:	16.03.2006; Auftrag Nr. A-2006-05
Aufgabe:	Belastungsversuche an zentralauslösbarem Heißgeschirr
Prüfgegenstand:	Heißgeschirr des Rettungs- u. Bereitschaftsbootes des MT „OLIVER JAKOB“ nach einem Unfall am 21.02.2006
Eingangsdatum des Prüfgegenstandes:	16.03.2006
Datum/Zeitraum der Prüfung:	16.03.2006 – 09.05.2006
Ausfertigungen:	1
Gesamtseitenzahl:	9

Die Bearbeitung des Auftrages erfolgte in Kooperation mit der IWS Service GmbH.

8983 (DURCHWAHL)

BERLINER TOR 13 • D-20099 HAMBURG
TELEFON +49(40) 428 75-8953/8743 • FAX 428 75 89 99
HTTP://WWW.HAW-HAMBURG.DE/IWS/

1 Aufgabenstellung

Das Institut für Werkstoffkunde und Schweißtechnik (IWS) hat gemäß Auftrag vom 16.03.2006 Belastungsversuche an einem zentralauslösbaren Heißgeschirr des Rettungs- u. Bereitschaftsbootes des MT „OLIVER JAKOB“ durchzuführen.

2 Sachstand

2.1 Charakterisierung des Prüfgegenstandes gemäß Auftraggeber

Das Heißgeschirr des Rettungs- u. Bereitschaftsbootes des MT „OLIVER JAKOB“ war Gegenstand eines Unfalles mit Todesfolge am 21.02.2006. Ziel der Prüfungen ist es, Hinweise auf die möglichen Unfallursachen zu geben.

3 Durchgeführte Prüfungen

3.1 Belastungsversuche

Für die Durchführung der Belastungsversuche wurde das angelieferte Heißgeschirr in einen Prüfrahmen montiert (s. Abb. 1). Die Heißhaken (Vorderer Heißhaken s. Abb. 1 linke Bildhälfte) wurden an der Unterseite des Rahmen fixiert. Die Krafteinleitung erfolgte über eine Traverse, die mittels eines Hydraulikzylinders vertikal belastet wurde. Der angebrachten Hydraulikzylinder ist Bestandteil (s. Abb. 3) einer Zugprüfmaschine Typ: Oehlgass MP12.

Die hydrostatische Sicherung wurde an der Vorderseite des Rahmen montiert und über ein Fallrohr mit Wasser beaufschlagt. Die Höhe der Wassersäule der hydrostatischen Sicherung erfolgte über einen Metallmaßstab.

Der Handhebel und die Kraftmessdose zur Messung der Auslösekraft am Handhebel wurden an der Seite des Prüfrahmen montiert (s. Abb. 2).

Prüfungsvorbereitend wurden die Messeinrichtungen des Prüfaufbaus kalibriert.

Die Messmittel (s. Abb. 4) und die Kalibrationsdaten sind in der folgenden Tabelle aufgeführt.

Tabelle 3.1: Messmittel

Messung	Messdose	Verstärker	Rel. Fehler
Kalibration	Z4 , Messbereich 100kN, Typ: HBM	DK 38, Typ: HBM	0,05 %
Zugkraft / Hydraulikzylinder	Druckaufnehmer P3MA Typ: HBM	AE 3407 B, Typ : HBM	0,5 %
Zugkraft / Handhebel	Z3H2, Messbereich 500 N, Typ: HBM	Al 3406 B, Typ: HBM	0,1 %

Die während der Versuche gemessenen Kräfte wurden mit einem Zwei-Kanal-Schreiber (Typ: SI Recorder 330, 2 Kanal) mit 50ig-facher Verstärkung aufgezeichnet.
Die Messung der Auslösewinkel erfolgte über angebrachte Winkelscheiben (s. Abb. 5), deren Verstellung jeweils vor und nach dem Versuch abgelesen wurden.
Es ist ein Winkelfehler von ca. 1,5 ° bei der Ermittlung des Winkels zu erwarten.

3.1.1 Durchgeführte Versuche

Die Versuche wurden gemäß eines Versuchsplanes des Sachverständigen Jan Hatecke vorbereitet. Im Laufe des Versuchtages wurde der Versuchsplan den Ergebnissen angepasst. Bei den Versuchen am 20.04.2006 in den Gebäuden des IWS waren neben dem Sachverständigen Jan Hatecke und den Mitarbeitern des IWS eine Reihe von geladenen Gästen anwesend. Die Gäste haben sich namentlich in die Konferenzliste des Sachverständigen Jan Hatecke eingetragen.

3.1.2 Versuchsplan und Ergebnisse

Der Versuchsplan und die Ergebnisse der Versuche sind in der folgenden Tabelle dargestellt.

Tabelle 3.2: Versuchsplan und Ergebnisse

Nr.	Bemerkung	Gemessene Kräfte	Gemessene Winkel
1.1	Es wurde eine vertikale Vorlast von **0,52 kN/Haken** aufgebracht.	Auslösekraft am Handhebel **114,8** N	Auslösewinkel Haken „ Vorn“: **68,5** ° Auslösewinkel Haken „Hinten“: **68,5** ° Auslösewinkel Handhebel: **53** °
1.1b	Versuch 1.1 wurde wiederholt.	Die Ergebnisse von 1.1. wurden bestätigt.	
1.4.1	**100 mm** Wassersäule	---	Öffnungswinkel der Sicherungsklappe: **1,5**
1.4.2	**200 mm** Wassersäule	---	Öffnungswinkel der Sicherungsklappe: **7,0**
1.4.3	**300 mm** Wassersäule	---	Öffnungswinkel der Sicherungsklappe: **12.5**
1.6.1	Es wurde eine vertikale Vorlast von **16,51 kN/Haken** aufgebracht.	Ab einer Last von **2,21 kN/Haken** dreht sich die Auslösescheibe des vorderen Hakens gegen die Schweißnaht des Auslösehebels. Eigenständiges Auslösen bei einer Last von **16,51 kN/Haken.** Auslösekraft des Handhebels: **0** N	Auslösewinkel des Handhebels: **0,0** ° Auslösewinkel Haken „ Vorn“: **79,0** °
1.6.1b	Versuch 1.6.1 wurde wiederholt.	Die Ergebnisse von Versuch 1.6.1 wurden bestätigt.	Auslösewinkel des Handhebels: **0,0** ° Auslösewinkel Haken „ Vorn“: **75,5** °
1.6.2	Belastung des hinteren Hakens bis Selbstauslösung.	Der hintere Haken löst bei einer Last von **36,55 kN** aus. Auslösekraft des Handhebels: **0** N	Auslösewinkel Haken „Hinten“: **62,5** ° Auslösewinkel des Handhebels: **0,0** °
1.6.3	Belastung des hinteren Hakens bis Selbstauslösung ohne Reibung an hinterer Auslösescheibe	Der hintere Haken löst bei einer Last von **26,85 kN** aus. Auslösekraft des Handhebels: **0** N	Auslösewinkel Haken „Hinten“: **57,0** ° Auslösewinkel des Handhebels: **0,0** °
1.6.4	Versuch 1.6.2 wurde wiederholt.	Der hintere Haken löst bei einer Last von **55,60 kN** aus. Auslösekraft des Handhebels: **0** N	Auslösewinkel Haken „Hinten“: **64,0** ° Auslösewinkel des Handhebels: **0,0** °
1.7	Aufbringen von Last bis zur Selbstauslösung beider Haken	Der Versuch wurde bei einer Last von **82,0 kN** abgebrochen. Es hat keine Selbstauslösung stattgefunden.	---
1.8	Belastung des vorderen Hakens bis zur Selbstauslösung. Sonst Randbedingungen wie bei 1.7.	Der vordere Haken löst bei einer Last von **39,00 kN** aus. Auslösekraft des Handhebels: **0** N	Auslösewinkel Haken „Vorn“: **79,0** ° Auslösewinkel des Handhebels: **0,0** °

Institut für Werkstoffkunde
und Schweißtechnik
haw hamburg

K 269-2006

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Tabelle 3.2 (Fortsetzung): Versuchsplan und Ergebnisse

Nr.	Bemerkung	Gemessene Kräfte	Gemessene Winkel
1.11	Festigkeitsprobe mit max. Last, Auslösehebel gesichert, Hydrostatiksicherung gesichert.	Die Haken werden mit einer Last von **27,17 kN/ Haken** belastet. Es findet keine Selbstauslösung statt.	---
1.12	Es wurde eine vertikale Vorlast von **16,51 kN/Haken** aufgebracht. Der Sicherungsstift wird gezogen, Handhebel aus der Nut gezogen.	Vorderer Haken löst aus, hinterer Haken bleibt verriegelt. Auslösekraft des Handhebels: **0 N**	Auslösewinkel Haken „Vorn“: **80,0 °** Auslösewinkel des Handhebels: **0,0 °**

Hamburg, 11.05.2006

Stellv. Geschäftsf. Direktor

Prof. Dr. Horn

Hochschule für Angewandte Wissenschaften 18 Hamburg

Sachbearbeiter

Dipl.-Ing. EWE Plohmann

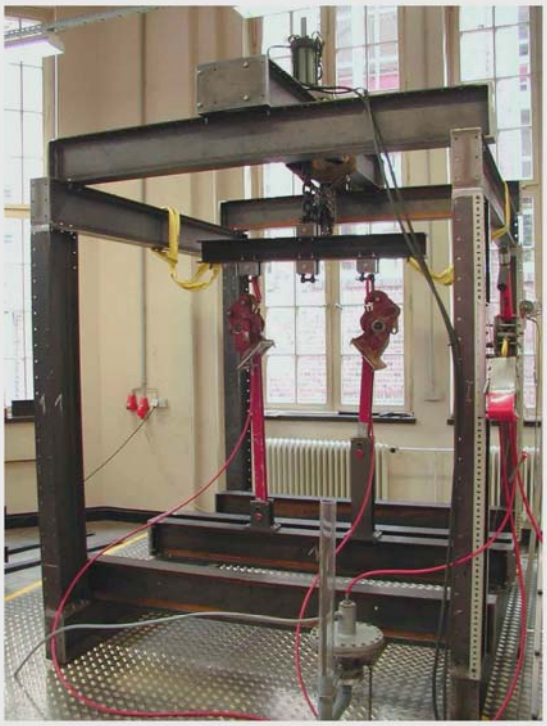


Abb. 1: Prüfaufbau Vorderansicht

Abb. 2: Prüfrahmen in der Seitenansicht

Abb. 3: Prüfmaschine

Abb. 4: Messmittel

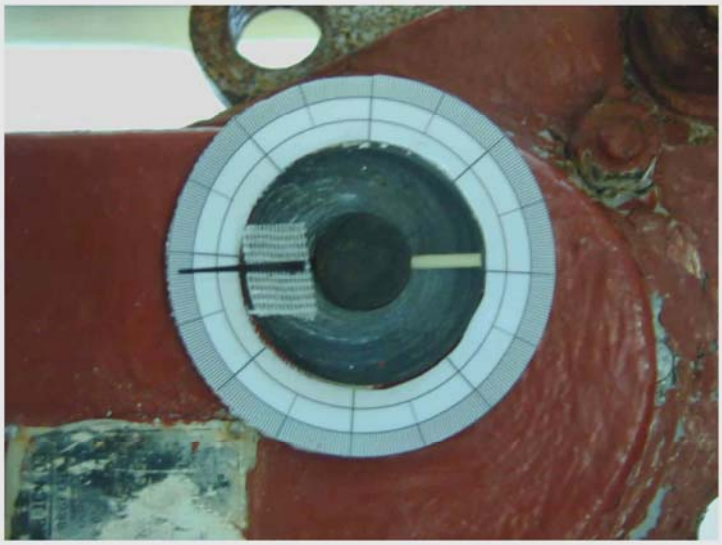


Abb. 5: Winkelscheibe an einem Heißhaken

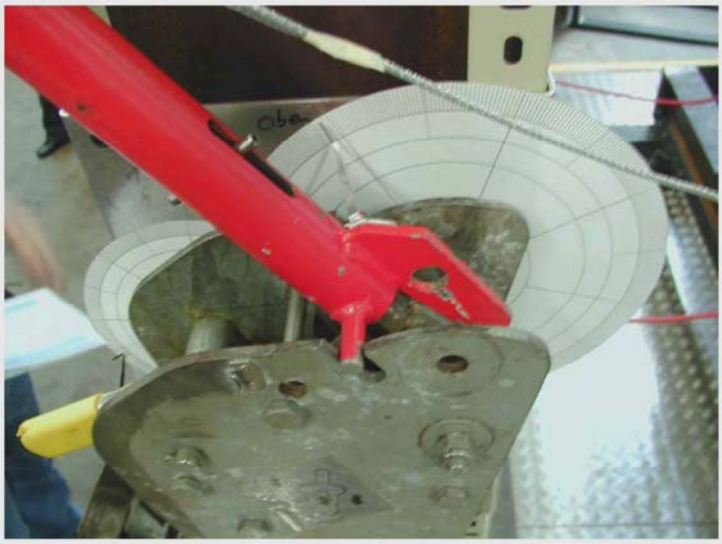


Abb. 6: Winkelscheiben am Handhebel

Appendix No. 6.

Hochschule für Angewandte Wissenschaften Hamburg
Hamburg University of Applied Sciences

INSTITUT FÜR WERKSTOFFKUNDE UND SCHWEISSTECHNIK

Akkreditiertes Prüflabor nach
DIN EN ISO/IEC 17025:2000
mit Erfüllung der Anforderungen nach
DIN EN ISO 9002:1994
DAP-PL-2948.00

Prof. Dr. B. Arnold (Inst. Direktorin)
Prof. Dr. H. Horn (stv. Inst. Direktor)
Prof. Dr. J. Happ
Prof. Dr. L. Müller

PRÜFBERICHT

Nr. K 270-2006

Auftraggeber:	Sachverständigenbüro Dipl.-Ing. Jan Hatecke Alter Schulweg 49 D-21737 Wischhafen
Auftrag vom:	08.05.2006; Auftrag Nr. A-2006-05
Aufgabe:	Werkstoffuntersuchungen an Haken und Bolzen eines zentralauslösbarem Heißgeschirres
Prüfgegenstand:	Heißgeschirr des Rettungs- u. Bereitschaftsbootes des MT „OLIVER JAKOB“ nach einem Unfall am 21.02.2006
Eingangsdatum des Prüfgegenstandes:	16.03.2006
Datum/Zeitraum der Prüfung:	16.03.2006 – 16.05.2006
Ausfertigungen:	1
Gesamtseitenzahl:	8

Die Bearbeitung des Auftrages erfolgte in Kooperation mit der IWS Service GmbH.

8983 (DURCHWAHL)

BERLINER TOR 13 • D-20099 HAMBURG
TELEFON +49(40) 428 75-8953/8743 • FAX 428 75 89 99
HTTP://WWW.HAW-HAMBURG.DE/IWS/

1 Aufgabenstellung

Das Institut für Werkstoffkunde und Schweißtechnik (IWS) hat gemäß Auftrag vom 08.05.2006 Werkstoffuntersuchungen an Haken und Bolzen eines zentralauslösbarem Heißgeschirres des Rettungs- u. Bereitschaftsbootes des MT „OLIVER JAKOB“ durchzuführen.

2 Sachstand

2.1 Charakterisierung des Prüfgegenstandes gemäß Auftraggeber

Die Untersuchungen werden durchgeführt um die Belastungsprüfungen aus K 269-2006 zu ergänzen.

Die zu prüfenden Bolzen waren stirnseitig beide mit der gravierten Nr.: 688309 gekennzeichnet (s. Abb. 1-2).

Der vordere Haken war auf einer Seitenfläche mit der Stempelung

BTC 8279-4
WLL 3 T
TL 7.5 T oder TL 172.5 T
FEB 04

markiert. Die Stempelung TL 7.5 T ist nicht eindeutig lesbar. Es kann auch als TL 172.5 T gedeutet werden (s. Abb. 3).

Der hintere Haken zeigt keine Kennzeichnung.

3 Durchgeführte Prüfungen

3.1 Spektralanalyse

3.1.1 Kurzbeschreibung der Prüfung

Grundlage der Spektralanalyse ist, dass die Elektronen eines einzelnen Atoms nur auf bestimmten Energieniveaus stabil sind. Durch Zufuhr von Energie (Anregung) können Elektronen auf ein höheres Energieniveau, d.h. auf eine andere Elektronenschale, angehoben werden. Dieser Zustand ist instabil. Die Elektronen springen in den stabilen Zustand zurück, wobei sie die überschüssige Energie in Form von Licht- oder Röntgenquanten wieder abgeben. Die Wellenlängen der entstehenden Strahlen können zur Bestimmung der Elemente herangezogen werden. Die Prüfung wurde mit dem Spektralanalysegerät SPEKTROLAB (LAV05) unter Schutzgas im IWS durchgeführt.

3.1.2 Proben

Die Prüfung erfolgte an geschliffenen Abschnitten der Haken und Bolzen.

3.1.3 Prüfergebnisse

Tabelle 3.1: Wesentliche Bestandteile der untersuchten Proben

Probe :	Elemente [Mittelwerte aus je 3 Messungen in Gew.%]											
	C	Si	Mn	P	S	Cr	Ni	Al	Mo	Ti	Nb	Fe
Haken „Vorn“	0,166	0,399	1,36	0,012	0,004	0,067	0,051	0,033	0,018	0,003	0,003	97,70
Haken „Hinten“	0,165	0,399	1,37	0,012	0,004	0,052	0,050	0,032	0,018	0,003	0,002	97,72
Bolzen „ Vorn“	0,039	0,648	1,27	0,018	0,016	17,17	11,13	0,001	2,17	0,008	0,001	66,84
Bolzen „Hinten“	0,022	0,672	1,32	0,016	0,019	17,25	11,25	0,001	2,13	0,007	0,001	66,65

Andere Elemente sind in nur unwesentlichen Spuren vorhanden.

3.2 Kerbschlagbiegeversuch nach Charpy DIN EN 10045-Teil 1

3.2.1 Kurzbeschreibung der Prüfung

Die Kerbschlagbiegeversuche wurden mit einem Kerbschlaghammer nach DIN 51222 mit der Genauigkeitsklasse 1 durchgeführt. Die Prüfung erfolgte bei -20 °C und wurde im IWS durchgeführt.

3.2.2 Proben

Die Prüfung erfolgte an zwei Probensätzen, bestehend aus je drei Kerbschlagbiegeproben (ISO - V - Probe), welche aus Abschnitten der Haken herausgearbeitet wurden.

3.2.3 Prüfergebnisse

Die Ergebnisse der durchgeführten Kerbschlagbiegeversuche sind in der folgenden Tabelle dargestellt.

Tabelle 3.2: Ergebnisse der Kerbschlagbiegeversuche

Probe	Breite	Höhe	Wert [Joule]
Haken „Vorn“ -1	10,0	10,0	215
Haken „Vorn“ -2	10,0	10,0	176
Haken „Vorn“ -3	10,0	10,0	209
Haken „Vorn“	Mittelwert:		200
Haken „ Hinten“ -1	10,0	10,0	260
Haken „ Hinten“ -2	10,0	10,0	240
Haken „ Hinten“ -3	10,0	10,0	222
Haken „ Hinten“	Mittelwert:		241

3.3 Härteprüfung nach Vickers DIN EN ISO 6507-1

Die Härteprüfung erfolgte gemäß DIN EN ISO 6507-1 mit einer Prüfkraft von 98,1 N.

3.3.1 Proben

Die Härteprüfung erfolgte an einem geschliffenen Abschnitt der angelieferten Haken.

Institut für Werkstoffkunde
und Schweißtechnik
haw hamburg

K 270-2006

Seite 5 von 7

4 Sachverständige Beurteilung

Gemäß der vorliegenden Befunde (Zusammensetzung, Kerbschlagzähigkeit und Härte) kann der Stahl der Haken dem Werkstoff S355J2 nach DIN EN 10025 zugeordnet werden.

Gemäß der chemischen Zusammensetzung kann der Werkstoff der Bolzen dem austenitischen Stahl X5CrNiMo 17 12 2 (Werkstoffnr.: 1.4401) zugeordnet werden.

Hamburg, 16.05.2006

Stellv. Geschäftsf. Direktor

Prof. Dr. Horn

Hochschule für Angewandte Wissenschaften 18 Hamburg

Sachbearbeiter

Dipl.-Ing. EWE Plohmann

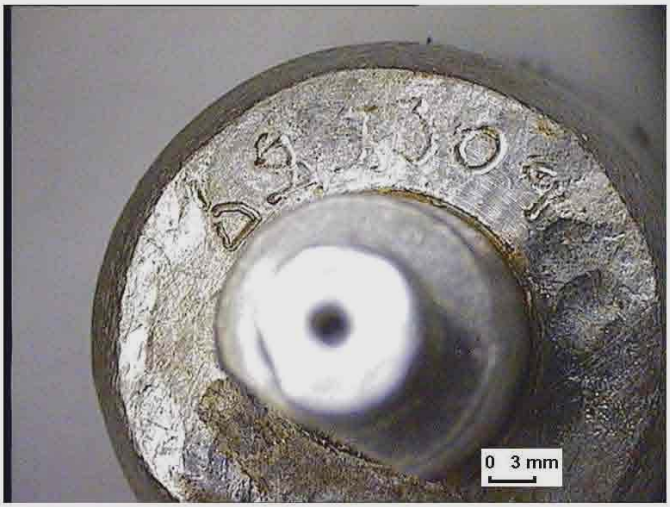


Abb. 1: Gravur an Bolzen „Hinten“

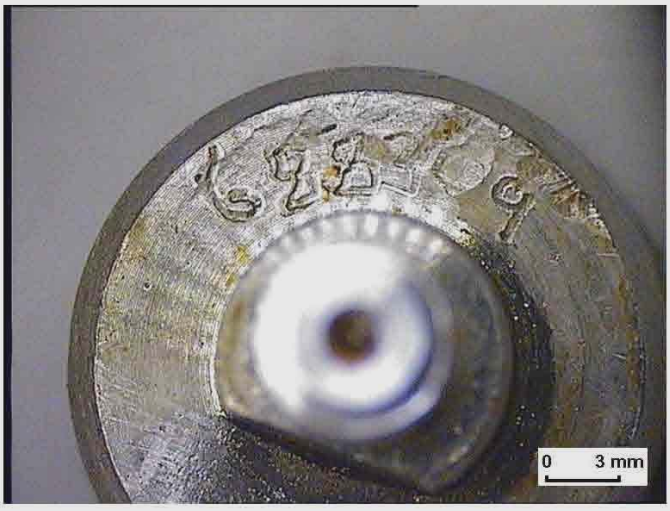


Abb. 2: Gravur an Bolzen „Vorn“

Abb. 3: Stempelung an Haken „Vorn“

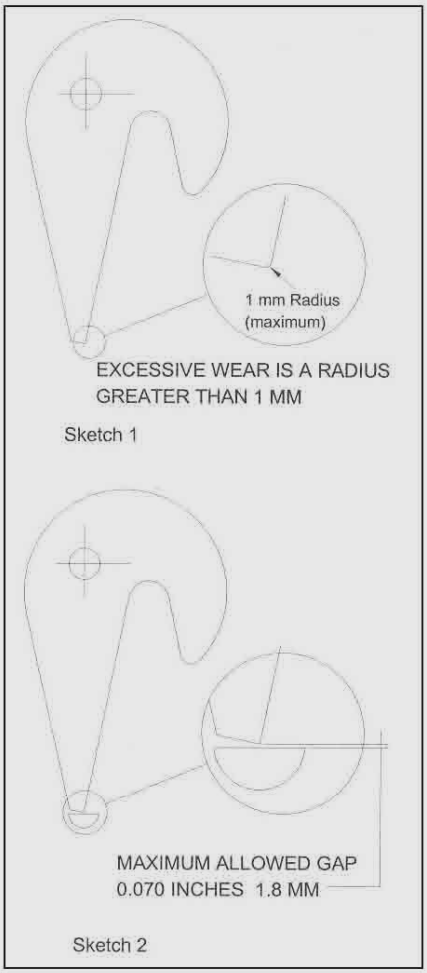
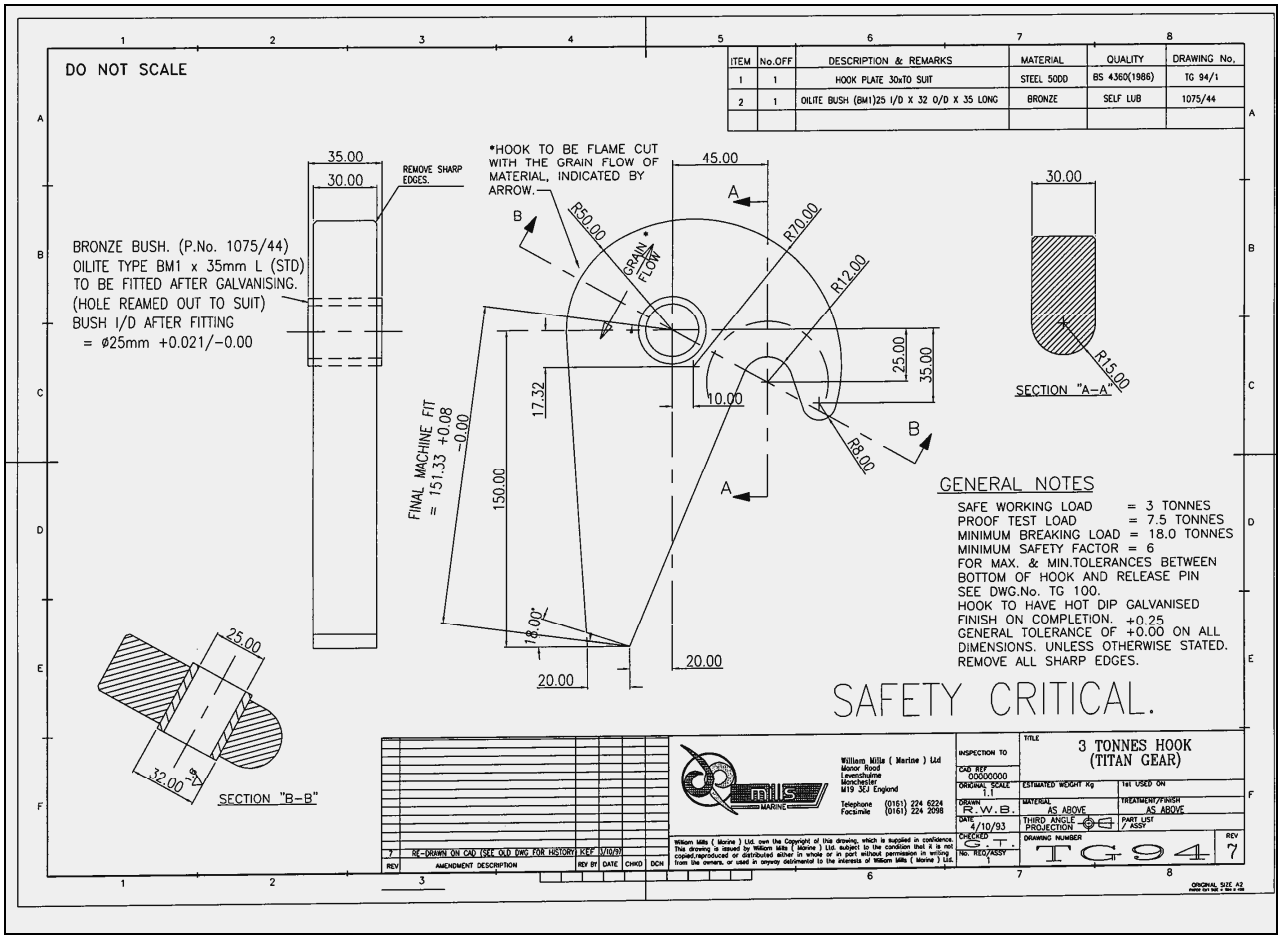


Abb. 4: Zu vermessende Abmessungen

Appendix No. 7.



Appendix No. 8.

mills
MARINE

7 HOOK TOLERANCES

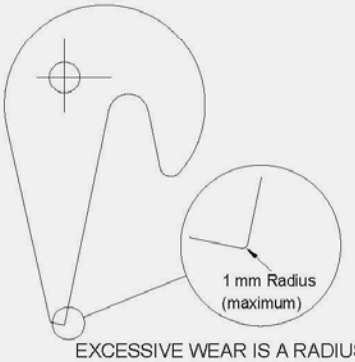
These are the only checks required to confirm the working tolerances of the Hooks.

a. Check the tail of the hook and the face of the cam release pin for signs of wear and damage. If wear of the hook tail is in excess of that shown in Sketch 1 the hook should be replaced.

If present this wear will normally appear in the form of a rounding of the hook tail and an indented line across the cam release pin. This condition generally having been caused by:-

i) The hooks having been unloaded from the falls when the craft is stowed. This has allowed vibration to chatter the hook and cam face together causing the indentation and rounding.

ii) Frequent on load test releases.

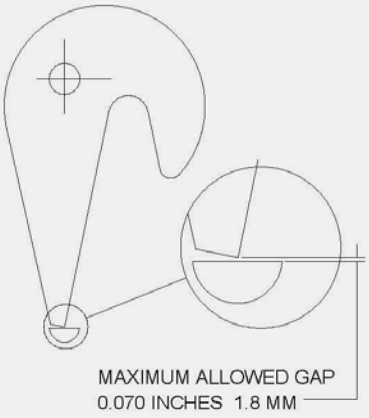


EXCESSIVE WEAR IS A RADIUS GREATER THAN 1 MM

Sketch 1

b. Check the gap formed between the tail of the hook and the flat of the release pin by using feelers as shown in sketch 2, lifting the hook as this is done will take account of any wear in the bush or pin . If the gap is in excess of that allowed, the gear must be withdrawn form service and the hook replaced.

Changes in this gap can only be due to wear and should be progressive rather than sudden.

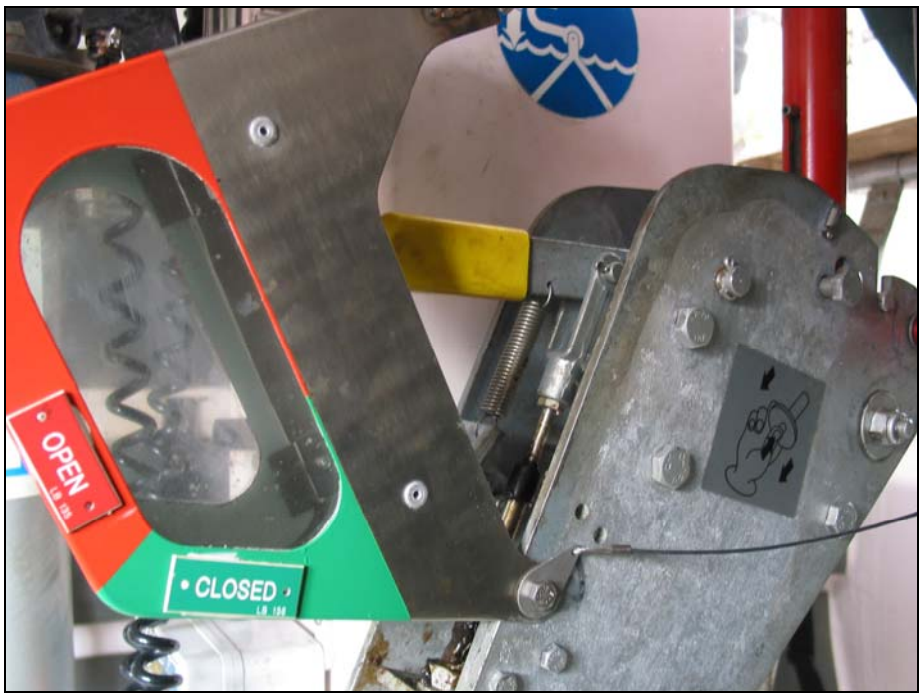


MAXIMUM ALLOWED GAP
0.070 INCHES 1.8 MM

Sketch 2

Appendix No. 9.

Appendix No. 10.



Appendix No. 11.

DET NORSKE VERITAS

DNV Id. No. 20266

SURVEY REPORT
TESTING OF LAUNCHING APPLIANCES AND ON-LOAD RELEASE GEAR

Thorough examination and 10% overload testing of launching appliances/winch brakes and on-load release gear for lifeboats/rescueboats and liferafts davits / cranes at least once every 5 years. The first overload test to be carried out within 2003.07.01

Name of ship: **OLIVER JACOB** | Port of registry: **MONROVIA**

THIS IS TO CERTIFY
that testing of launching appliances has been carried out with 10% overload on board the above mentioned vessel's
PORT (port/stbd or number) LIFE boat (life-/rescue-) as indicated below:
..... (port/stbd or number) ..... Liferaft davit / crane.

Calculation of weights to be placed in lifeboat/rescueboat:

		Weights to be placed in lifeboat:
Weight of lifeboat and equipment:	**3140** kg	
Weight of crew/pass. (75 Kg x **32**)	+ **2400** kg	→ **2400** kg
Total weight (Lifeboat, equip. and crew/pass.)	= **5540** kg	X 0,10 = → + **554** kg
		Sum = **2954** kg

Calculation of weights for liferaft davit/crane:

Weight of liferaft	kg	
Weight of crew/pass. (75 Kg x)	kg	
Total weight	kg	X 1,10 = →

	Yes/No/NA
Certification of wire falls, davits, winches, release gear hooks., links and shackles checked and found in order?	**Yes**
Operational and maintenance routines of the above checked and found in order?	**Yes**
Deck log book checked for confirmation of regular lifeboat drills?	**Yes**
Winch and brake tested by applying the hand brake sharply at maximum lowering speed?	**Yes**
Lifeboat lowered to just clear of water and on-load release gear tested?	**Yes**
Foundations, blocks, falls, release gear hooks, tie-bands,links and shackles inspected after test?	**Yes**
Lifeboat winch opened and inspected?	**Yes**
On-load release gears: Before the above tests, have the release gears been overhauled in connection with testing?	**Yes**
By whom which competent person/company? **TECHNO FIBRE**	
Said personnel are authorized by the manufacturer of the release gear system?	**Yes**
If not, what kind of documentation has been presented? -	
Remarks: -	

Issued at: **Singapore**

Date of issue: **2004-04-22**

DET NORSKE VERITAS * 1864 * SINGAPORE

BECH, GUNNAR HANS JACOB
Surveyor

Copy to the ship master

DET NORSKE VERITAS, VERITASVEIEN 1, N-1322 HØVIK, NORWAY, TEL INT: +47 67 57 99 00, TELEFAX: +47 67 57 99 11
Form No.: CEC304a Issue: October 2002

Page 1 of 1

Appendix No. 12.

Von: Ian Machin [Ian.Machin@schat-harding.co.uk]
Gesendet: Mittwoch, 10. Mai 2006 18:36
An: Jan Hatecke
Cc: thoward@comdt.uscg.mil; heinz.stuermer@see-bg.de;
jochen.buck@dnv.com; krejlgaard@ernstjacob.de
Betreff: RE: LIFEBOAT SERVICE - OLIVER JACOB

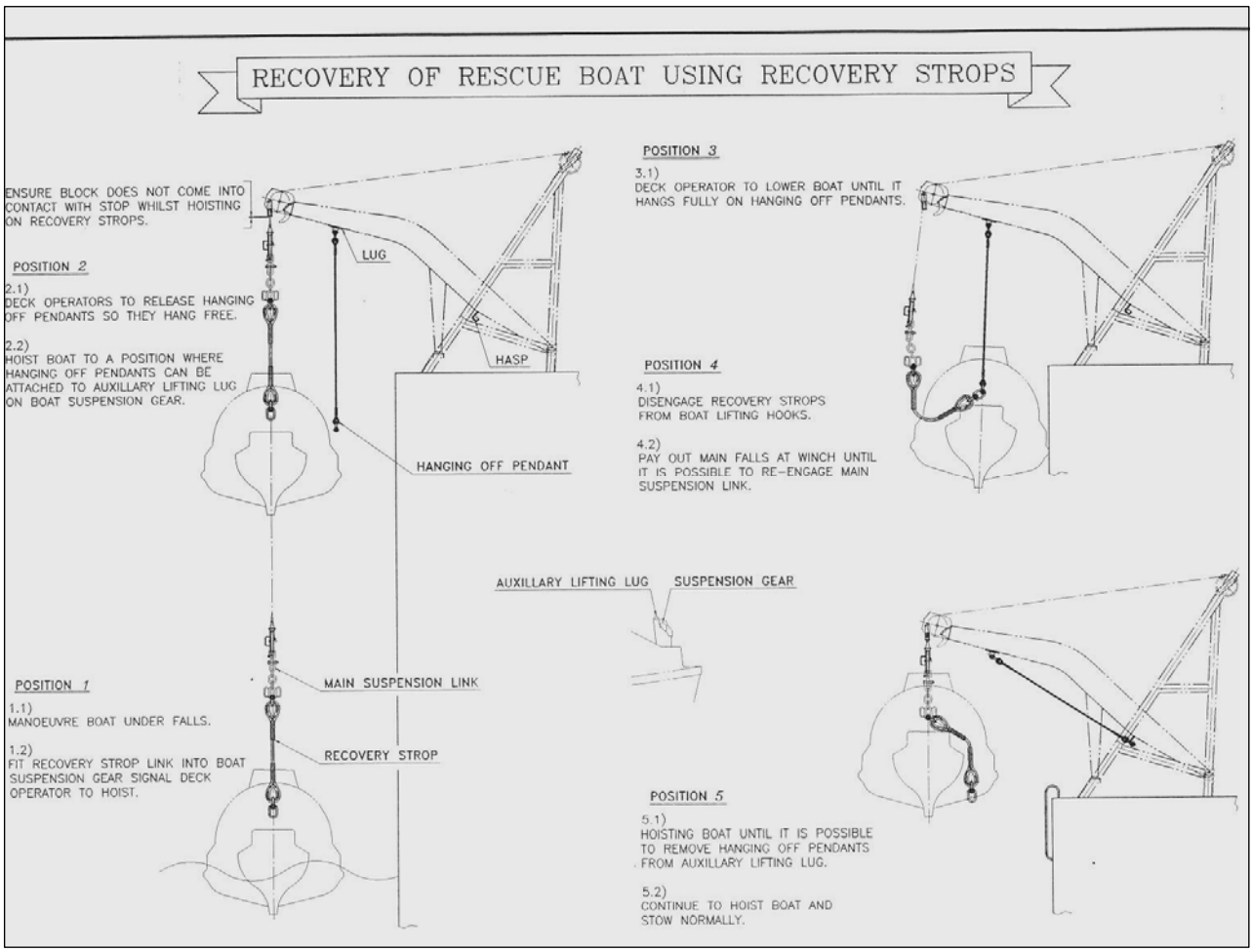
Hello Jan
We can confirm from the following list of previously certified mills maintainers that Technofibre were not authorised to conduct the release hook Service on this lifeboat.

EXPIRY DATE OF CERTIFICATE.
Mr Vincent D. Francis - 11/05/01
Mr Mohammed Othmen - 11/05/01
Mr Zulkeflee Bin A Rahim - 11/5/01
Mr Jamaludin Bin Sulaiman - 11/05/02
Mr Lee Wardle - 11/05/02
Mr Shamsuddin Bin ABD Wahad - 11/5/02
Mr Mohammed Ariff Bin Junied - 11/5/01
Mr James De Rozario - 11/5/02
Mr Karl S Gimson - 11/5/02
Mr Andrew Lemmis - 11/05/01
Mr Sukhbir Sing C/O Santa Singh - 11/5/01.

Best regards
Ian Machin
Engineering Manager
for Umoe Schat-Harding Limited

Ph: +44 (0)23 9258 1331 ext 215
Fax: +44 (0)23 9258 2565
Umoe Schat-Harding Limited
Mumby Road, Gosport,
Hampshire PO12 1AE
UNITED KINGDOM

Appendix No. 13.



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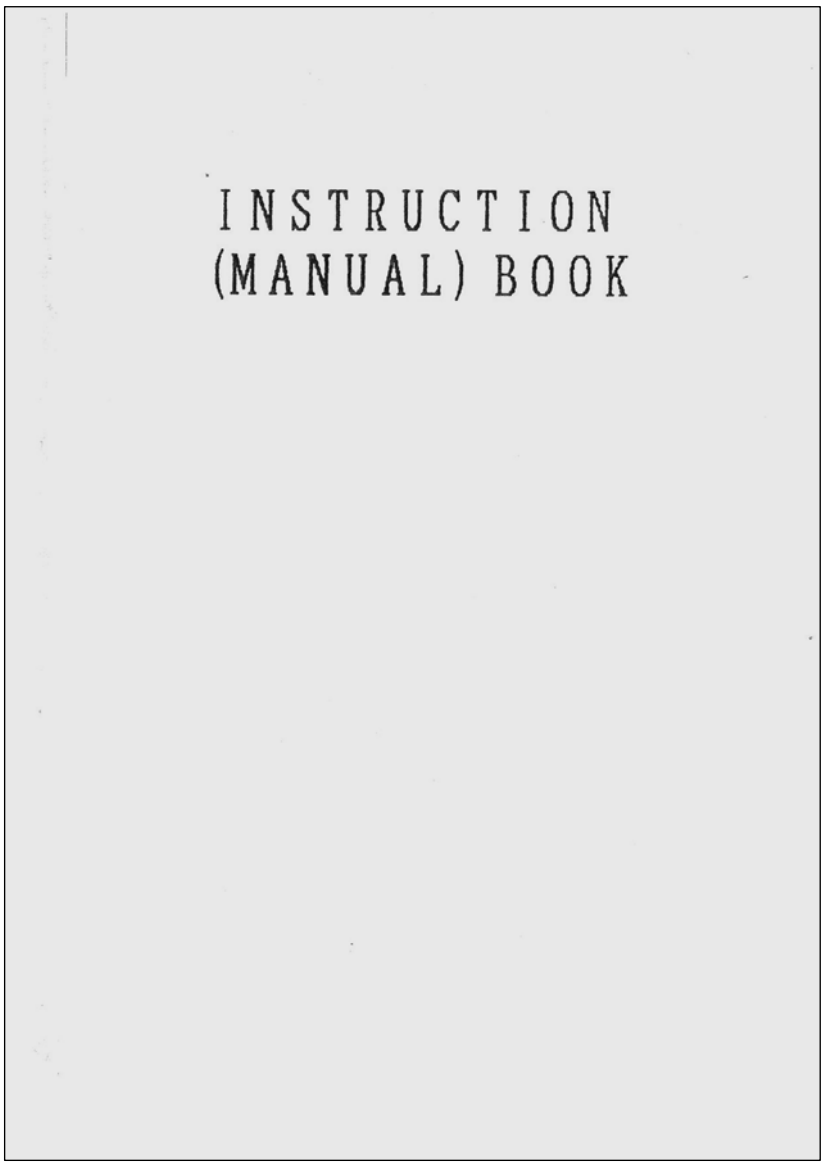


OPERATION and MAINTENANCE MANUAL

HYUNDAI
TOTALLY ENCLOSED
FIRE PROTECTED
LIFEBOAT AND AS A
RESCUE COMBINED BOAT

12 NOV. 1997

HYUNDAI PRECISION & IND. CO., LTD
Head Office ; 140 - 2 Kye - dong, Chongro - ku, Seoul, KOREA
Tel ; (02) 746 - 3865, Fax. ; (02) 746 - 3557
Factory ; 265 - 1 Yumpo - dong, jung - ku, Ulsan, KOREA
Tel ; (0522) 80 - 9365, 7 Fax. ; (0522) 80 - 9093

TABLE OF CONTENTS

A-4 LIFTING HOOK RELEASE

2) RELEASE & RECOVERY PROCEDURE

Release Suspension Gear Operating Instructions
이탈 매달림 장치 작동 설명서

Normal Release. (정상 이탈)

1. Do not operate until waterborne. (보우트가 수면 부상할때 까지 작동하지 맡것)
2. When the craft is waterborne, remove the T headed safety pin.
   (보우트 부상후 T머리형 안전핀 뽑을 것)
3. Lift release handle and pull aft. (이탈손잡이를 위로 올린후 뒤로 당길 것)

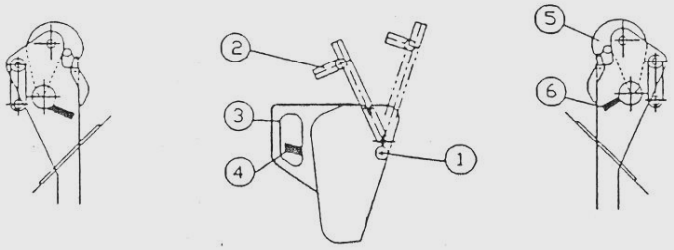
Emergency Release. (비상 이탈)

If the boat is fully waterborne, but the hydrostatic locking lever fails to move to the open position and hence the release handle unit cannot be operated, the proceed as follows
(보우트가 완전히 부상하고도 수압고정레버 고장으로 노란색 레버가 열림 위치에 가지 않아 이탈손잡이가 작동되지 않을 때는 아래 순서에 따를 것)

1. Double check that the craft is in the water.(보우트 부상되었는지 재 확인할 것)
2. Break the glass access panel.(유리카바 파손할 것)
3. Lift yellow lever and operate release machanism as normal release procedure.
   (노란 레버를 위로 올린후 정상적인 이탈작동순서에 따라 작동할 것)

Hook resetting.(훅 재 정열)

1. Return the release handle to the locked position.
   (이탈손잡이를 잠금위치에 되돌려 놓을 것)
2. At each hook assembly, swing the hook back to the closed position and lift the recocking lever upwards to the stop. (각각의 훅을 회전시켜 잠금위치에 놓고 재 정열레버를 위로 올려 훅을 정지 시킬 것)
3. Replace the T headed safety pin. (T 머리형 안전핀을 제자리에 끼울 것)



① T headed safety pin (T머리형 안전핀)
② Release handle (이탈손잡이)
③ Glass access panel (유리카바)
④ Yellow lever (노란색 레버)
⑤ Hook (훅)
⑥ Recocking lever (재 정열레버)

B-1 MAINTENANCE SCHEDULE

PART	CHECK POINT	WEEKLY	MONTHLY	TRAINING	REMARK
HULL & CANOPY	Checking of scracthes and damage at boat inside & outside		●	●	
STRUCTURE	Checking of cracks Checking Rusting		● ●	●	
LIFTING HOOK RELEASE SYSTEM	Condition of davit fall rings or links	●		●	
	Confirmation of recocking levers	●		●	
	Confirmation of T-headed safety pin	●		●	
	Confirmation of locking lever of release unit	●		●	
	Confirmation of release lever Operate release mechanism		●	●	
PAINTER RELEASE DEVICE	Check releasing capablities		●	●	
HATCH	Confirmation of seal condition & opening/ closing		●	●	
WINDOW	Confirmation of seal condition & opening/ closing		●	●	
STEERING SYSTEM	Operation by steering wheel / cable / tiller/ rudder/ emergency tiller		●	●	
ENGINE	See Attached sheet				

Appendix No. 15.

DET NORSKE VERITAS

DNV Id No.: 20266

RECORD OF APPROVED CARGO SHIP SAFETY EQUIPMENT

To meet the provisions of the International Convention for the Safety of Life at sea, 1974 and Amendments thereto . This form must be kept on board and be available for inspection by a nominated surveyor or recognized organization at all times

Name of ship	Distinctive number or letters	Gross Tonnage 1969	Gross Tonnage National	Keel Laid
M/T"COLUMBIA"	V7BI4	81,565	See note 1 below	98.08.17 See note 2 below

Nationality and Port of Registry	Previous Name and Nationality
REPUBLIC OF MARSHALL ISLANDS	N/A

Builders	Yard No.	IMO Identification No.
DAEWOO HEAVY INDUSTRIES LTD.	5139	9175078

Class	Type of ship
+1A1, E0, CSA-1, CCO, W1-OC, VCS-2B, LCS(SID)	TANKER FOR OIL ESP

Name and Address of Owners, Managers or Managing Agents	Length of Ship
MR. RENE. DESCLOUX / VICE ASSISTANCE PRESIDENT 90 PARK AVENUE, NEW YORK, NY10016, USA. COLUMBIA SHIPPING LLC. R.R.E COMMERCIAL CENTER, DELAP WING SUITE 208, P.O. BOX 1405, MAJURO.	B.P. 264.00 m Freeboard 265.366 m O.A. 274.00 m

Number	Type of Life-Saving appliances	Persons	Characteristics
1	Lifeboats on port side capable of accommodating:	32	~~Self righting / Partially~~ / Totally enclosed / With self-contained air support system / Fire protected / ~~Open (+)~~
1	Lifeboats on starboard side capable of accommodating:	32	~~Self righting / Partially~~ / Totally enclosed / With self-contained air support system / Fire protected / ~~Open (+)~~
2	Motor Lifeboats (included in the total lifeboats shown above)	2	
-	Mechanically propelled lifeboats (included in the total lifeboats shown above)	-	
-	Free fall lifeboats capable of accommodating:	-	Self righting / with self-contained air supp. / Fire protected (+)
1	Rescue boats (included / not included (+) in the total lifeboats shown above) capable of accommodating:	32	
-	Liferafts for which approved launching devices are required, capable of accommodating:	-	
4	Liferafts for which approved launching devices are not required, capable of accommodating:	64	
1	Liferafts stowed forward ~~X~~aft (+) capable of accommodating	6	
14	Lifebuoys	14	
42	Lifejackets with light & whistle	42	
32	Immersion suits	32	
-	Thermal protective aids	-	(Excluding those required by III/38.5.12.4, 41.8.31 & 47.22.13)

DET NORSKE VERITAS AS , VERITASVEIEN 1, N-1322 HØVIK, NORWAY. TEL INT: +47 67 57 99 00. TELEFAX: +47 67 57 99 11
Form No.: CEC.303a Issue: April 96

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Appendix No. 16.

TEST REPORT OF HYUNDAI MOTOR LIFEBOAT

HYUNDAI PRECISION & IND.CO.,Ltd.

265-1 Yempo-dong,Book-gu,Ulsan,KOREA TEL;0522-80-9366. FAX;0522-80-9093

1.PARTICULARS

INTENDED FOR	DAEWOO HN.5139	WEIGHT	BOAT,NET	2730 Kg	
LIFEBOAT HULL NO.	E98-32-546 (NO.2 PORT SIDE BOAT)		EQUIPMENT	265 Kg	
LIFEBOAT MODEL	HDL71CF		FUEL OIL	145 Kg	
KIND OF BOAT	FIRE PROTECTED LIFE /RESCUE BOAT		PERSONS	2400 Kg	
CONSTRUCTION MATERIA	FIBERGLASS REINFORCED PLASTIC		FULL LOAD	5540 Kg	
DIMENSION(LxBxDxH)	7.1M x 2.4M x 1.125M x 2.7M	CUBIC	GROSS	12.756	M^3
SEATING CAPACITY	32 PERSONS	CAPACITY	NET	10.563	M^3
FLAG	~~LIBERIA~~ MARSHALL Islands.	CAPACITY	TOP	1.260	M^3
CLASSFICATION	DnV	OF BUOYANCY	SIDE	2.976	M^3
APPLICABLE STANDARDS	1996 AMENDMENTS TO SOLAS 1974 IMO RESOLUTION A689(17)				

ENGINE	MAKER	SABB MOTOR A/S	PROPELLER	NO. OF BLADES	3
	MODEL	L3.139LB		DIAM.x PITCH	4575mm x 330mm
	HP x RPM	29 x 3000	LIFTING HOOK	MAKER	WILLIM MILLS LTD.
	COOLING SYS.	F.W COOLING W/KEEL COOLING		TYPE	3.0 TONNE ON-LOAD RELEASE
				SERIAL NO.	5630/28
	SERIAL NO.	320 NA	COMPASS	MAKER	KOREA SHIP'S CHANDLER CO.
	MANUFAC.DATE	1998-05		SERIAL NO.	547
REVERSE GEAR	MAKER	HURTH/HBW125LB	AIR BOTTLE	SERIAL NO.	00028
	REDUCTION	2.63 : 1			00015
F/O TANK	CAPACITY	170 LITERS			00051

2.HULL LAMINATION

INSPECTION ITEM	DATE(YY-MM-DD)	RESULT	INSP'ED BY	REMARKS
GELCOAT & 1st LAMI.	1998 - 7 - 13	Accepted	OAK	
CONT.LAMINATION	1998 - 7 - 14	Accepted	OAK	
P/S MOLD JOINT	1998 - 7 - 18	Accepted	OAK	
HULL REMOVE	1998 - 7 - 21	Accepted	OAK	

3.SEA TRIAL

DATE(YY-MM-DD)	1998 - 10 - 23	SPEED (KNOTS)	RESULT	LOAD CONDITION ; FULLY LOADED CONDITION
MILE POST DISTANCE	230 M	6.43 KNOTS (69.5")	ACCEPTED	
TIME(SECOND)	72" 67"			
MANEUVERING TEST(TURNING,ASTERN) WITH 2 HOURS RUNNING TEST			ACCEPTED	
EMERGENCY STEERING			ACCEPTED	

4.FUNCTION TEST

INSPECTION ITEM	DATE(YY-MM-DD)	RESULT	REMARKS
HOOK RELEASE	1998 - 10 - 23	ACCEPTED	10% overload / off load
WATERTIGHTNESS TEST	1998 - 10 - 23	ACCEPTED	
WATER SPRAY TEST	1998 - 10 - 23	ACCEPTED	
AIR SUPPLY SYSTEM	1998 - 10 - 23	ACCEPTED	200 BAR
ENGINE STARTING.	1998 - 10 - 23	ACCEPTED	POWER STARTING
ELECTRIC SYSTEM	1998 - 10 - 23	ACCEPTED	
BILGE PUMP / DRAIN PLUG	1998 - 10 - 23	ACCEPTED	

5.TEST REPORT SIGNED

DATE(YY-MM-DD)	CLASS	OWNER :	LIFEBOAT BUILDER :
98 - 10 - 23	BV PA. 10.23	ULN-981001	P.J.Kim MGR OF LIFEBOAT Q.C HYUNDAI PRECISION & IND.CO.,LTD

Appendix No. 17.

06-08 15:41 THU FROM:D.N.V ULSAN 052*252*3407 TO:+82522324166 PAGE:01

CERTIFIED COPY

Lloyd's Register

CERTIFICATE OF TYPE APPROVAL

This is to certify that

LLOYD'S REGISTER OF SHIPPING specified as a "person" under the terms of The Merchant Shipping (Delegation of Equipment Approval) Regulations 1996, did undertake the relevant type approval procedures of the equipment identified below which was found to be in compliance with the essential safety requirements subject to any conditions in the Design Appraisal Document attached hereto.

Manufacturer	William Mills (Marine) Ltd
Address	Manor Road Levenshulme Manchester M19 3EJ United Kingdom
Equipment Description	Centrally operated simultaneous release system for davit launched lifeboats with a safe working load of 3 tonnes.
Type	TITAN 3.0t
Specified Standard	SOLAS 74 Chapter III as amended and revised, Regulations 4, 16 and 31. SOLAS 74 Chapter III, Regulation 41.7.7. International Life-Saving Appliance (LSA) Code, Chapter IV, Regulation 4.4.7.6

The attached Design Appraisal Document forms part of this certificate.
This certificate remains valid unless cancelled or revoked, provided the conditions in the attached Design Appraisal Document are complied with and the equipment remains satisfactory in service.

Date of Issue	18 November 1997	Issued by	Lloyd's Register of Shipping, London
Expiry Date	17 November 2002		
Certificate No	MSA 9700090	Signed	
Sheet No	1 of 1	Name	R.D. Smart

Note:

This certificate is not valid for equipment, the design or manufacture of which has been varied or modified from the specimen tested. The manufacturer should notify the nominated body named on this certificate of any modification or changes to the equipment in order to obtain a valid Certificate.

MSA
MARINE SAFETY AGENCY
An Executive Agency of the Department of the Environment, Transport and the Regions

This certificate is issued under the authority given in Merchant Shipping Notice No M 1645.

NOTICE - This certificate is subject to the terms and conditions overleaf, which form part of this certificate.

Appendix No. 18.

Lifeboat Release System
Certificate of Service

Technofibre (S) Pte Ltd,

hereby state that the release System as fitted to the lifeboat/rescue boat for :

Vessel Name: Oliver Jacob
Port of Registration: Monrovia
Class: DNV

Release System type	**: Mills Titan On-Load**	Lifeboat maker	: Hyundai Precision
Manufacture date	**: Oct. 1998**	Manufacture date	: Oct. 1998
Serial number	**: FWD N/A**	Serial number	: E98-32-546
	AFT N/A	Dimensions	: 7.10 x 2.40 x 1.125mtrs.
		Capacity	: 32 persons

Has been duly serviced, tested and re-certified in accordance with 1998 Amendments to the SOLAS convention Chapter III. (Reg.20 clause 11.)

Comments: Loaded On-Load release system functional test conducted in presence of Class Surveyor.
Spares supplied and installed: Hydrostatic diaphragm x 1 piece, Solid 3 ton hook x 2 unit.

Annual inspection and test due on April 2005
Five yearly overhaul and recertification due on April 2009

TF Ref 2423 number Date of issue: April 2004

for TechnoFIBRE ..... **Ship's Officer/Class Surveyor**.....

MT "OLIVER JACOB" MASTER Off.No. 90674 MONROVIA

TechnoFIBRE

Techno Fibre (S) Pte Ltd 51, Shipyard Road Singapore 628139 Tel: (65) 6266 1412 Fax: (65) 6266 1435
e-mail: lifeboat@technofibre.com Website: http://www.technofibre.com

Lloyds Register Quality Assurance Approval Certificate No: 403097
Approved by Lloyds Register Quality Assurance to the following Quality Management System Standards
ISO 9002:1994 BS EN ISO 9002:1994 JIS Z 9002:1998 ANSI/ISO/ASQC/Q9002-1994 SS ISO 9002:1994