Annex B – Results from pilot tests

Annex to Report from Pulling Tests with Used Lashing Equipment

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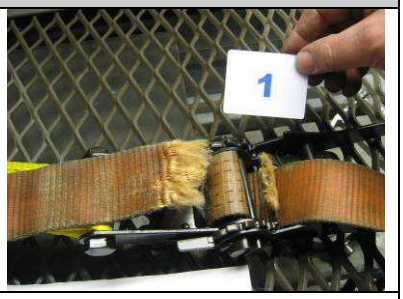
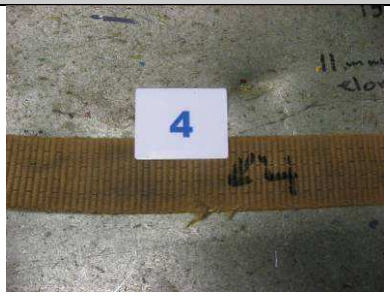
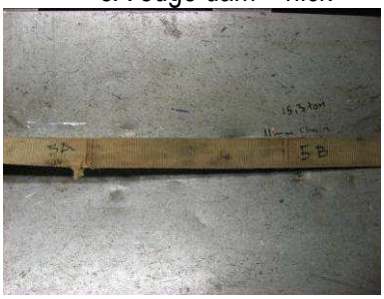
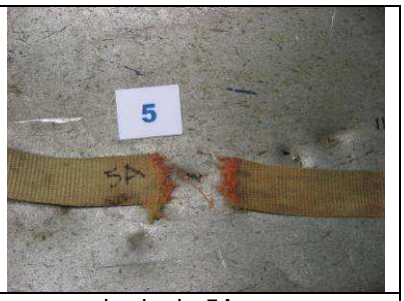
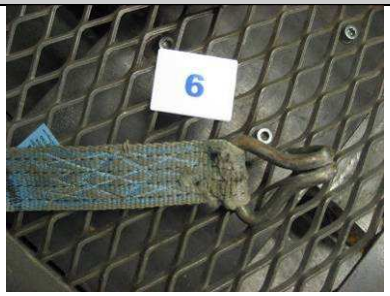
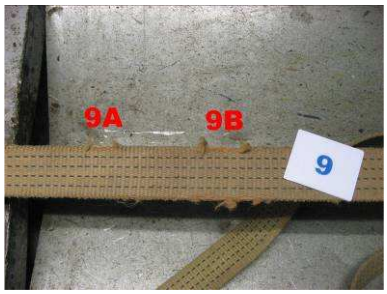
B1. Tests with 50 mm web lashings

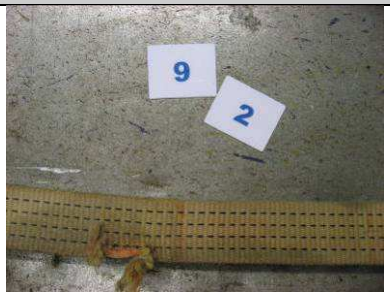
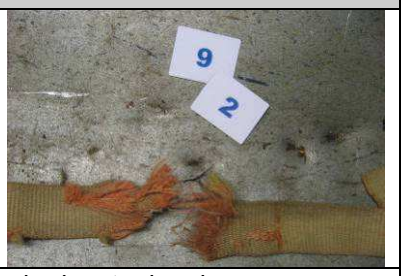
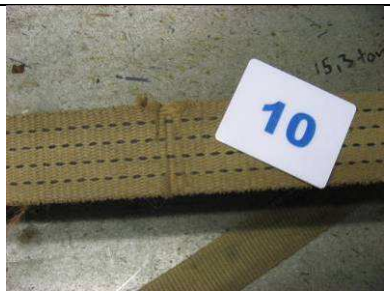
No.	Parameters and remarks	Before test	After test
K1	CORONA – PES web lashing – webbing + hook  Producer: Corona MBL = 5000 daN LC = 2500 daN Man. Date: Oct 2007	 - tested place – temperature or chemical damage 	 - broke at winch instead of at tested place  **Measured BL – 3710 daN**
K2	VOLVO PART – PES web lashing – webbing + hook  Producer: Ancra ABT AB MBL = 4500 daN MSL = 2250 daN Man. Date: 96.12 (Dec 1996)	 - knotted	 - broke in knot  **Measured BL – 1230 daN**
K2.1	VOLVO PART – PES web lashing – webbing + hook 		

No.	Parameters and remarks	Before test	After test
	Producer: Ancra ABT AB MBL = 4500 daN MSL = 2250 daN Man. Date 96.12 (Dec 1996)		- broke in tested place  **Measured BL – 2040 daN**
K3	PES web lashing – webbing + hook Producer: N/A MBL = N/A – (probably 4000 daN - 4 strips) Man. Date: N/A	 - large tear 	 - broke in another place close to identification tag and seam  **Measured BL – 3590 daN**

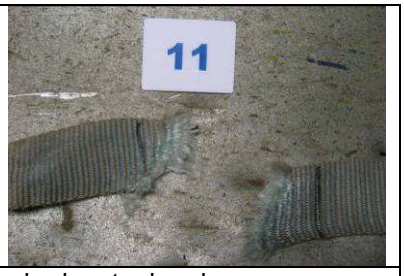
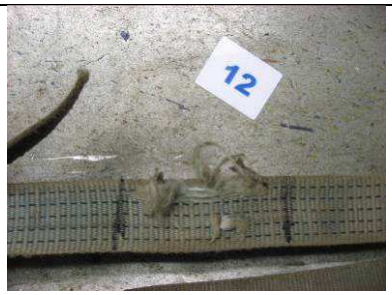
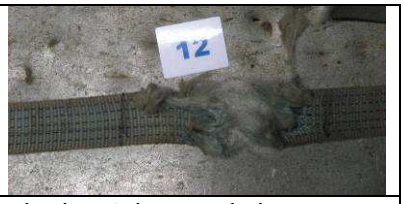
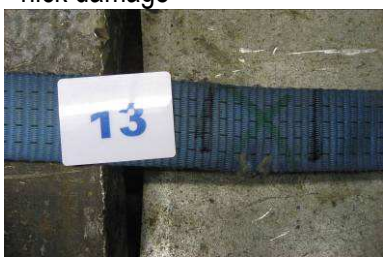
No.	Parameters and remarks	Before test	After test
K4	PES web lashing – webbing + hook Producer: N/A MBL = N/A – (probably 4000 daN - 4 strips) Man. Date: N/A	 - small edge damage	 - broke at winch  **Measured BL – 3350 daN**
K5	Web lashing – webbing + hook Producer: N/A MBL = N/A – (probably 4000 daN - 4 strips) Man. Date: N/A	 - 5A edge dam + nick  - 5A, 5B - nicks	 - broke in 5A  **Measured BL – 800 daN**

No.	Parameters and remarks	Before test	After test
K6	Gunnebo - PES web lashing – webbing + hook  Producer: Gunnebo MBL = 4000 kg Man. Date 05.01 (Jan 2005)	 - webbing damaged at hook	 - broke at hook  **Measured BL – 1820 daN**
K7	PES web lashing – ratchet part Producer: N/A MBL = 5000 kg Man. Date: N/A	 - used old ratchet part – rusty and dirty 	 - broke at hook  **Measured BL – 3050 daN**

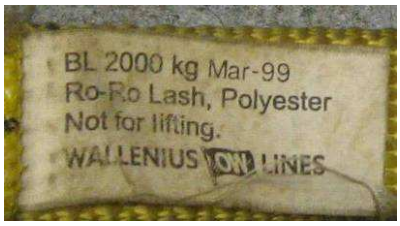
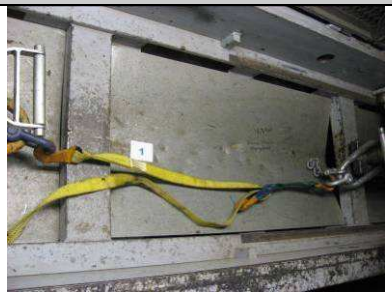
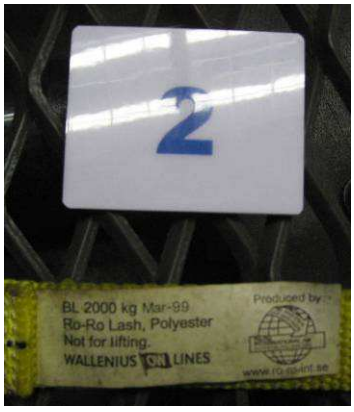
No.	Parameters and remarks	Before test	After test
K8	PES web lashing – ratchet part Producer: N/A MBL = N/A – (probably 5000 daN - 5 strips) Man. Date: N/A	 - used part without visible damage 	 - broke in sewing  **Measured BL – 5040 daN**
K9.1	Webbing only Producer: N/A MBL = N/A – (probably 4000 daN - 4 strips) Man. Date: N/A **PROBABLY POLYPROPYLENE MATERIAL EXPOSED TO WEATHER AND WIND.**	 - 9A edge damage on one side – 9B edge damage on both sides 	 - broke in 9B  **Measured BL – 1690 daN**

No.	Parameters and remarks	Before test	After test
K9.2	Webbing No. 9 Producer: N/A MBL = N/A – (probably 4000 daN - 4 strips) Man. Date: N/A **PROBABLY POLYPROPYLENE MATERIAL EXPOSED TO WEATHER AND WIND.**	 - edge damage	 - broke at edge damage  **Measured BL – 1400 daN**
K9.3	Webbing No. 9 Producer: N/A MBL = N/A – (probably 4000 daN - 4 strips) Man. Date: N/A **PROBABLY POLYPROPYLENE MATERIAL EXPOSED TO WEATHER AND WIND.**	 - no visible damage	  **Measured BL – 2060 daN**
K10	Webbing Producer: N/A MBL = N/A – (probably 4000 daN - 4 strips) Man. Date: N/A **PROBABLY POLYPROPYLENE MATERIAL EXPOSED TO WEATHER AND WIND.**	 - nick damage	 - broke at damaged place  **Measured BL – 1170 daN**

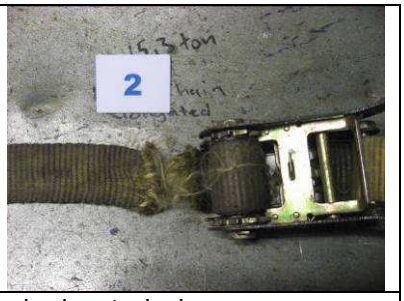
No.	Parameters and remarks	Before test	After test

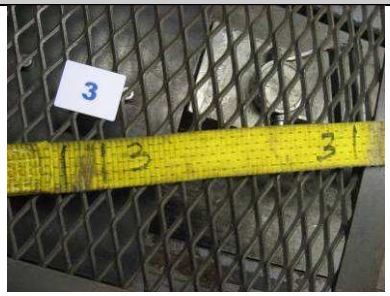
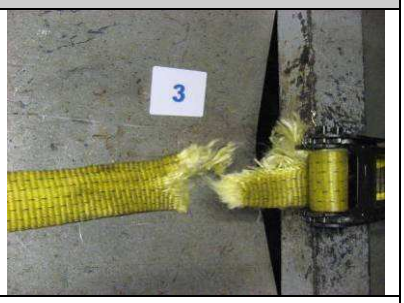
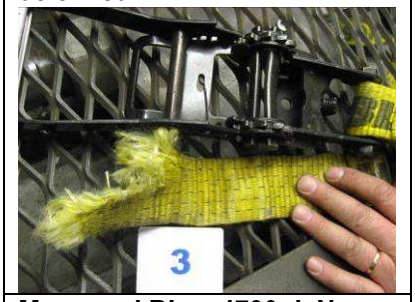
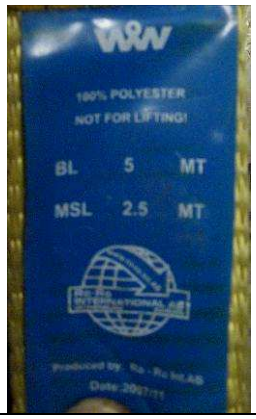
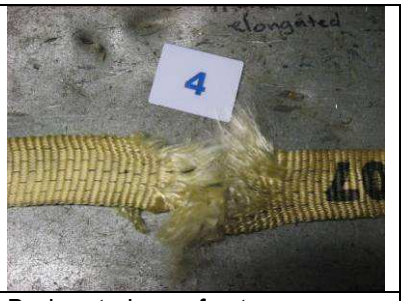
K11	Join Klippan PES – webbing  Producer: Join Klipan MBL = 5000 kg Man. Date: 2004:04	 - edge damage	 - broke at edge damage  **Measured BL – 3050 daN**
K12	Webbing Producer: N/A MBL = N/A – (probably 5000 daN - 5 strips) Man. Date: N/A	 - 2 tears	 - broke at damaged place  **Measured BL – 1500 daN**
K13	Webbing – Norfolkline  Producer: N/A MBL = N/A – (probably 4000 daN - 4 strips) Man. Date: N/A	 - nick damage  - edge damage	 - broke at nick damage  **Measured BL – 1480 daN**

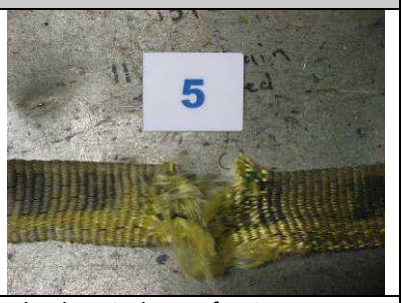
B.2 Tests with car lashings

No.	Parameters and remarks	Before test	After test
C1	PES web lashing Material: PES MBL = 2 tons MSL = 1 ton Manufacturer: Ro-Ro Int. 3/99  Man. Date: Mar-99	 - undamaged	 - broke close to buckle  **Measured BL – 1740 daN**
C2	PES web lashing Material: PES MBL = 2 tons MSL = 1 ton Manufacturer: Ro-Ro Int. 3/99  Man. Date: Mar-99	 - serious edge damages on both sides and chemical or temperature damage. The lashing was scrapped on board.	 - broke in place of damage  **Measured BL – 1370 daN**

B.3 Tests with rollashings

No.	Parameters and remarks	Before test	After test
R1	PES web lashing - yellow Material: PES MBL = 5 tons MSL = 2,5 tons Manufacturer: Ro-Ro Int. About 10 years old	 - worn but not damaged – scraped on board the vessel	 - broke at winch  **Measured BL – 4130 daN**
R2	PES web lashing - yellow Material: PES MBL = 5 tons MSL = 2,5 tons Manufacturer: Ro-Ro Int. About 10 years old	 - in good condition - dirty	 - broke at winch  **Measured BL – 4400 daN**

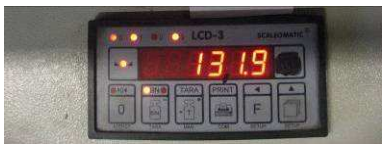
No.	Parameters and remarks	Before test	After test
R3	PES web lashing - yellow Material: PES MBL = 5 tons MSL = 2,5 tons Manufacturer: Ro-Ro Int. – Man. Date: Jun 2005 	 - nick and break damages 	 - but broke at winch – winch deformed  **Measured BL – 4790 daN**
R4	PES web lashing - yellow Material: PES MBL = 5 tons MSL = 2,5 tons Manufacturer: Ro-Ro Int. Man. Date: 2007/11 	 - very good condition – cut by knife to the depth of 2 strips	 Broke at place of cut  **Measured BL – 2550 daN**

No.	Parameters and remarks	Before test	After test
R5	PES web lashing - yellow Material: PES MBL = 5 tons MSL = 2,5 tons Manufacturer: Ro-Ro Int. Man. Date: Oct 2004 	 - very good condition – cut by knife to the depth of 1 strip	 - broke at place of cut  **Measured BL – 2640 daN**
R6	PES web lashing - yellow Material: PES MBL = 5 tons MSL = 2,5 tons Manufacturer: Ro-Ro Int.  About 10 years old	 - very good condition – cut by knife to the depth of ½ strip	 - broke at place of cut  **Measured BL – 3500 daN**

B.4 Tests with 10-tons trailer web lashings

No.	Parameters and remarks	Before test	After test
F1	Scan Unit PES web lashing Material: PES MBL = 10 tons MSL = 5 tons Manufacturer: Scan Unit Man. Date: 2007-10 	 - hanging on vessels' weather deck, no visible damage	 - broke at hook  **Measured BL – 10650 daN**
F2	Scan Unit PES web lashing Material: PES MBL = 10 tons MSL = 5 tons Manufacturer: Scan Unit Man. Date: 2007-5	 - hanging on vessels' weather deck, no visible damage	 - broke at elephant foot  **Measured BL – 9710 daN**
F3	Scan Unit PES web lashing Material: PES MBL = 10 tons MSL = 5 tons Manufacturer: Scan Unit Man. Date: 2007-10	 - hanging on vessel's weather deck – worn – 3 places – break damage	 - broke at winch  **Measured BL – 10220 daN**

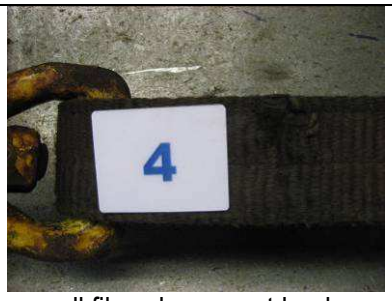
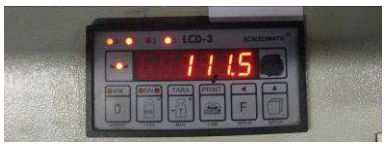
B.5 Tests with chain lashings

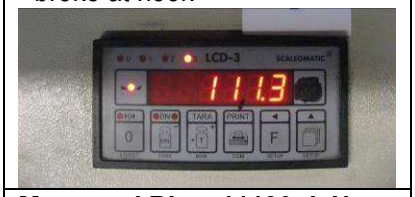
No.	Parameters and remarks	Before test	After test
W1	Lashing chain 11 mm long links. Used with a new tensioner. Material: Steel – Class 8 MBL = 15 tons MSL = 7,5 tons Manufacturer: Ro-Ro Int. 	 - good condition with new tensioner * MBL = 15 tons MSL = 7,5 tons Manufacturer: ORSA	 - new tensioner broke below MBL  **Measured BL – 13190 daN**
W1.1	Chain No. 1 without tensioner Material: Steel – Class 8 MBL = 15 tons MSL = 7,5 tons Manufacturer: Ro-Ro Int. About 10 years old		  **Measured BL – 16880 daN**
W2	Chain 11 mm – long links Material: Steel – Class 8 MBL = 15 tons MSL = 7,5 tons Manufacturer: Ro-Ro Int.	 - very good condition with a new tensioner *	 - broke at tensioner below MBL  **Measured BL – 14020 daN**
W2.1	Chain No. 2 without tensioner Material: Steel – Class 8 MBL = 15 tons MSL = 7,5 tons Manufacturer: Ro-Ro Int. About 10 years old		 **Measured BL – 17040 daN**

* In the tests the tensioner was fixed in one direction in the pulling machine and it could not swing freely. This is probably the reason why the marked MBL was not obtained. New tests will be carried out in the main study.

B.6 Tests with 20-ton trailer web lashings

No.	Parameters and remarks	Before test	After test
T1	**Trailer web lashing** Material: PES MBL = 20 tons MSL = 10 tons Manufacturer: Ro-Ro Int. Man. Date: N/A	 - hanging on vessels' weather deck – rusty and dirty but without visible damage	 - broke at hook  **Measured BL – 11150 daN**
T2	**Trailer web lashing** Material: PES MBL = 20 tons MSL = 10 tons Manufacturer: Ro-Ro Int.	 - hanging on vessel's main deck – (0,5 – 1 year old) – damaged at winch	 - broke at damaged place  **Measured BL – 12770 daN**
T3	**Trailer web lashing** Material: PES MBL = 20 tons MSL = 10 tons Manufacturer: Ro-Ro Int.	 - big tear damage – about 1 year old	 - broke at hole  **Measured BL – 9900 daN**
No.	**Parameters and remarks**	**Before test**	**After test**

T4	**Trailer web lashing** Material: PES MBL = 20 tons MSL = 10 tons Manufacturer: Ro-Ro Int.  Man. Date: N/A	 - small fibre damage at hook - dirty	 - broke at hook  **Measured BL – 11150 daN**
T5	**Trailer web lashing** Material: PES MBL = 20 tons MSL = 10 tons Manufacturer: Ro-Ro Int. Man. Date: N/A	 - good condition – used – no visible damage	 - broke at hook  **Measured BL – 19550 daN**
T6	**Trailer web lashing** Material: PES MBL = 20 tons MSL = 10 tons Manufacturer: Ro-Ro Int.  Man. Date: N/A	 - longer lashing worn – dirty – 1 small edge damage	 - broke at hook  **Measured BL – 14750 daN**

No.	Parameters and remarks	Before test	After test
T7	**Trailer web lashing** Material: PES MBL = 20 tons MSL = 10 tons Manufacturer: Ro-Ro Int.  Man. Date: N/A	 - dirty, small edge damages 	 - broke at hook  **Measured BL – 11130 daN**
T8	**Single webbing from lashing No. 6** Material: PES MBL = 17 tons MSL = 8,5 tons Manufacturer: Ro-Ro Int. Man. Date: N/A	 - good condition – used – no visible damage	  **Measured BL – 9400 daN in single part**

Summery of results of the pilot tests

In the table below the result of the pulling tests are found.

Test No.	Tested piece	Type of damage	Degree of damage	Broken place	Measured BL [daN]	MBL [daN]	M/C	MSL [daN]	M/C	LC [daN]	M/C	Relation to MSL	Relation to LC
K1	W+H	temp/chem	whole width	At winch	3710	5000	M	2500	C	2083	C	148%	178%
K2	W+H	knot	knot	D	1230	4500	M	2250	M	1875	C	55%	66%
K2.1	W+H	edge dam	small	D	2040	4500	M	2250	M	1875	C	91%	109%
K3	W+H	tear	large	A	3590	4000	M	2000	C	1667	C	180%	215%
K4	W+H	edge dam	small	At winch	3350	4000	M	2000	C	1667	C	168%	201%
K5	W+H	edge dam	medium	D	800	4000	M	2000	C	1667	C	40%	48%
K6	W+H	hook wear	medium	D	1820	4000	M	2000	C	1667	C	91%	109%
K7	RP	rusty, dirty	medium	hook	3050	5000	M	2500	C	2083	C	122%	146%
K8	RP	dirty	medium	sewing	5040	5000	M	2500	C	2083	C	202%	242%
K9.1	W	edge dam both sides	medium	D	1690	4000	M	2000	C	1667	C	85%	101%
K9.2	W	edge dam	medium	D	1400	4000	M	2000	C	1667	C	70%	84%
K9.3	W	no visible	-	-	2060	4000	M	2000	C	1667	C	103%	124%
K10	W	nick	medium	D	1170	4000	M	2000	C	1667	C	59%	70%
K11	W	nick	small	D	3050	5000	M	2500	C	2083	C	122%	146%
K12	W	2 tears	large	D	1500	5000	M	2500	C	2083	C	60%	72%
K13	W	nick	medium	D	1480	4000	M	2000	C	1667	C	74%	89%
C1	H - H	undamaged	-	at buckle	1740	2000	M	1000	M			174%	
C2	H - H	edge dam both sides	large	D	1370	2000	M	1000	M			137%	
R1	H - H	not visible	-	at winch	4130	5000	M	2500	M			165%	
R2	H - H	dirty	large	at winch	4400	5000	M	2500	M			176%	
R3	H - H	2 nicks	medium	at winch	4790	5000	M	2500	M			192%	
R4	H – H	2 strips edge cut	medium	D	2550	5000	M	2500	M			102%	
R5	H – H	1 strip edge cut	small	D	2640	5000	M	2500	M			106%	
R6	H – H	1/2 strip edge cut	small	D	3500	5000	M	2500	M			140%	
F1	H – H	good condition	-	at hook	10650	10000	M	5000	M			213%	hanging on weather deck
F2	H – H	good condition	-	at el. foot	9710	10000	M	5000	M			194%	
F3	H - H	2 breaks	small	at winch	10220	10000	M	5000	M			204%	
W1	Ch+T	new tensioner	-	tensioner	13190	15000	M	7500	M			176%	
W1.1	Ch	rusty	small	-	16880	15000	M	7500	M			225%	
W2	Ch+T	new tensioner	-	tensioner	14020	15000	M	7500	M			187%	
W2.1	Ch	good condition	-	-	17040	15000	M	7500	M			227%	

TestNo.	Tested piece	Type of damage	Degree of damage	Broken place	Measured BL [daN]	MBL [daN]	M/C	MSL [daN]	M/C	LC [daN]	M/C	Relation to MSL	Relation to LC
T1	H – H	dirty, rusty	large	at hook	11150	20000	M	10000	M			112%	hanging on weather deck
T2	H – H	damaged at ratchet	medium	D	12770	20000	M	10000	M			128%	
T3	H – H	hole in webbing,dirty	large	D	9900	20000	M	10000	M			99%	
T4	H – H	small nick - dirty	large	at hook	11150	20000	M	10000	M			112%	
T5	H – H	good condition	-	at hook	19550	20000	M	10000	M			196%	
T6	H – H	dirty	medium	at hook	14750	20000	M	10000	M			148%	
T7	H - H	dirty	large	at hook	11130	20000	M	10000	M			111%	
T8	W(T6)	dirty	medium	-	9400	17000	M	8500	M			111%	

Explanations:

Green marking in the table means that obtained breaking strength was at least 125% of LC or MSL.

Yellow marking in the table means that obtained breaking strength was between 100 - 125% of LC or MSL.

Red marking in the table means that obtained breaking strength was below 100% of LC or MSL.

W = webbing tested

W+H = Webbing + Hook tested

RP = Ratchet Part tested

H-H = Lashing tested from Hook to Hook

Ch = Chain alone tested

Ch+T = Chain + Tensioner tested

M = Marked value on tag or by stripes

C = Calculated value

MBL = Minimum break Break Load of new equipment

LC = Laching Capacity (Allowed load according to the standard EN 12195)

MSL = Maximum Securing Load according to the IMO regulations

Conclusions from the pilot tests

From the limited tests carried out in this pilot study no clear conclusions can be draw regarding which level of different damages that can be accepted on lashings in use. To be able to get a good picture of acceptable damages a large number of tests will have to carry out in the main tests. As far as practicable several examples of different damages types should be tested.