Air Turquoise SA
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Test Report

This test report describes the test results of the below mentioned paragliding harness.

All the tests were carried out by:

Air Turquoise SA, official test laboratory of Switzerland.

Standards

Tests were carried out in conformity with the following standards:

- 2. DV LuftGerPV §1, Nr. 7 c (*note: in what follows this will be abbreviated by "LTF")
- European Standard EN1651 September 1999 (*note in what follows this will be abbreviated by "EN")
- European Standard EN12491 September 2001 (*note in what follows this will be abbreviated by "EN12491")

Harness details

Manufacturer:	Niviuk Gliders
Harness model:	Hamak 2
Size:	XL
Harness Weight:	6.4 kg
Maximum certified pilot	110 kg
Impact protection type:	Mousse bag
Harness type:	ABS

Test responsible:	Alain Zoller
Test place:	Villeneuve
Test date:	November 11, 2011
Test room temp & humidity:	24.9° C; 59%rel
Certification number EN:	PH 024.2011
Certification number LTF:	GZ 024.2011

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Test summary

A. STRUCTURAL STRENGHT TESTS

A test plan was set up in order to execute the different tests in an efficient order. The table below summarizes this test plan together with the applicable standards and results.

Test ID	TESTED ?	Standard Ref. EN	Standard Ref. LTF	TEST setup	Anchoring Attach - ment points	Anchoring Dummy	Forces Req. Load in g	Forces Min. force [N]	Min. Test duration [sec]	Result
1	✓	5.3.2.1	4.2.1.a	**Default flying position**	2 main attachment points	Hip fixated	6g 9g	6000 9000	10	OK
2	✓	5.3.2.2					15g	15000	5	OK
3	✓		4.2.1.b	Default, **landing position**	2 main att. points	Hip fixated, landing conf.	6g	6000	10	OK
4	✓	5.3.2.7					15g	15000	5	OK
5	✓		4.2.1.a rescue	**Rescue**	2 rescue att. Pnts.	Hip fixated	9g	9000	10	OK
6	✓	5.3.2.4					15g	15000	5	OK
7	✓		4.2.1.b rescue	**Rescue,** landing		Hip fixated, landing conf.	6g	6000	10	OK
8	✓	5.3.2.3		**One riser**	ONE main att.	1 central hip fixation	6g	6000	10	OK
9		5.3.2.5	4.2.1.d	**Towing**	2 main att. + 2 tow att.	None	3g 5g	3000 5000	10	n / a
10	✓	5.3.2.6		Default, **Negatif**	One main att.	Head fix.	4.5g	4500	10	OK
11	✓		4.2.1.c	**Upside down**	2 main att. downw.	Head fix.	6g	6000	10	OK
12	✓		4.2.1.c rescue	**Upside down rescue**	2 rescue att. downw.		6g	6000	10	OK

B. HARNESS PROTECTION SHOCK TEST

Most paraglider harnesses are equipped with a protection device that damps the shock on the pilot's spine during a hard landing.

Shock impact tests have to be executed on these harnesses in order to prove the damping characteristics of it.

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Test ID	TESTED ?	Standard Ref.: LTF	TEST setup	Anchoring		Impact				Result
				Attach-ment points	Dummy	Max. tolerated peak impact in g	Max Peak impact measured	Impact duration of +38 g (if any) recorded:	Impact duration of +20 g (if any) recorded:	
PRO TECT 1	✓	5.1.1	Default flying position	Test dummy is attached to the harness like a pilot in flight.		+50g	36.32 g	0	17 ms	OK

C. RESCUE DEPLOYMENT RESISTANCE TEST

The deployment of the rescue system has to be ensured in all circumstances of flight. This test is to verify whether the force needed to deploy is in between reasonable limits.

Test ID	TESTED ?	Standard Ref. LTF	TEST setup	Anchoring		Force for single hand deployment			Result
				Attach-ment points	Dummy	Min. force [N]	Max. force [N]	Resistance measured [daN]	
Resc depl	✓	6.1.5	Default flying position	Test responisble is attached to the harness like a pilot in flight. (no dummy required)		20 N	70 N	n/t	OK

D. RESCUE DEPLOYMENT STRAP STRENGHT TEST

The connection between handgrip and inner container has to have sufficient load capacity/structural strength in any situation that may arise during normal use. During this test is verified, whether this connection fulfill the requirements.

Test ID	TESTED ?	Standard Ref. LTF	Standard Ref. EN 12491	TEST setup	Minimum force [N]	Min. Test duration [s]	Breaking resistance measured	Result
Resc strap	✓	6.1.8	5.3.2	Connection strap in tensile testing machine	700N	10	n/t	OK

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After careful examination as explained in above mentioned test reports (from page 2 to page 18), the undersigned persons declare that the harness:

Niviuk Gliders
Hamak 2
XL

DID complied with:

- **European Standard EN 1651 September 1999**

  And / or (if tested)

- **European Standard EN 12491 March 2001**

  And / or (if tested)

- **2. DV LuftGerPV §1, Nr. 7 c**

Villeneuve, November 11, 2011

Alain Zoller

Place, Date

Test responsible

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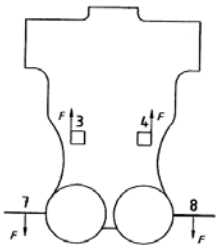
Annex: detailed test reports

Harness Test — Test ID 1

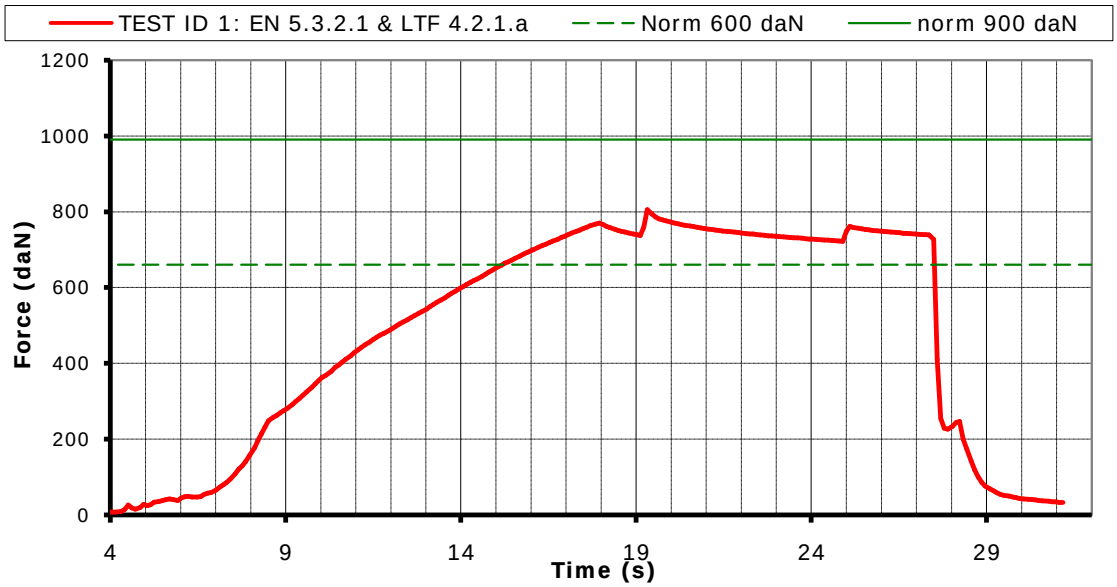
Item:	Hamak 2	
Manufacturer	Niviuk Gliders	
Test place & date:	Villeneuve	November 11, 2011
Test responsible:	Alain Zoller	
Temp. [°C] & Humidity:	24.9° C; 59%rel	
Maximum certified pilot weight [kg]:	110	kg
Standard	EN 1651 & 2. DV LuftGerPV §1, Nr. 7 c	
Test standard §:	5.3.2.1 (EN) & 4.2.1 a (LTF DV)	
Test setup:	Default flying position	
Anchoring: **Attachment points:**	Both main riser attachments (3, 4)	
Dummy:	Default, hip fixed (7, 8)	
Required load in g :	9g (EN: 6g)	
Minimum load [N]:	9000 N (EN: 6000 N)	
Required test load in kg:	**990**	**kg**
Min. duration [s]:	10 s	



Results

Duration of maintained min. load [s]:	**10.6 s**
Any signs of structural failure after this test:	**No visible failure**
Test result:	**Passed**

Graph:



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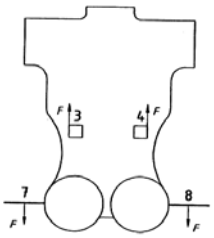
Harness Test — Test ID 2

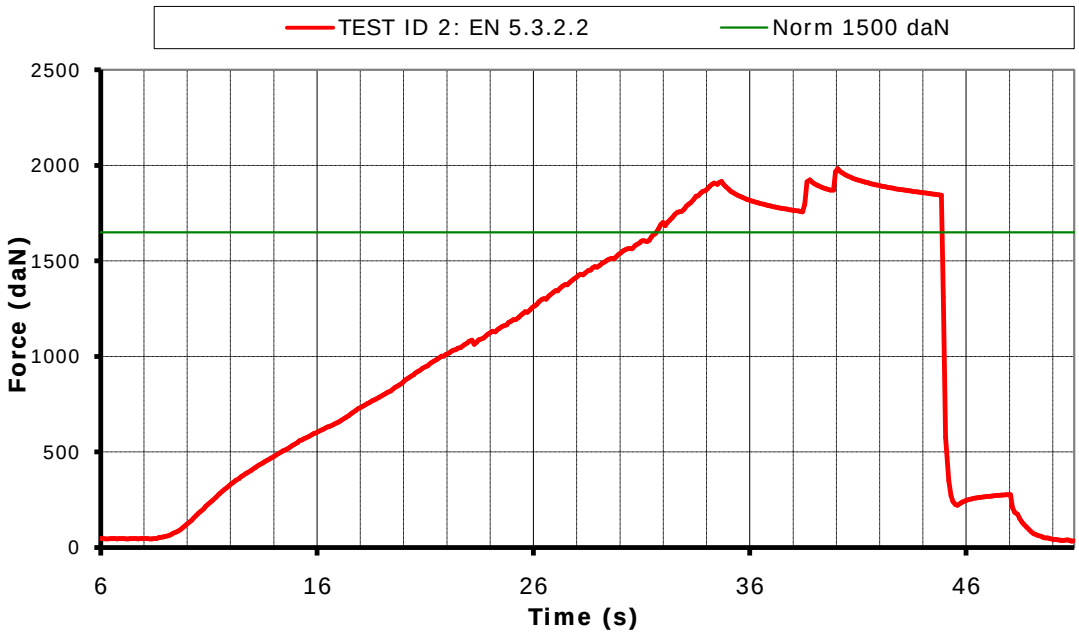
Item:	Hamak 2	
Manufacturer	Niviuk Gliders	
Test place & date:	Villeneuve	November 11, 2011
Test responsible:	Alain Zoller	
Temp. [°C] & Humidity:	24.9° C; 59%rel	
Maximum certified pilot weight [kg]:	110	kg
Standard	EN 1651	
Test standard §:	5.3.2.2	
Test setup:	Default flying position	
Anchoring: Attachment points:	Both main riser attachments (3, 4)	
Dummy:	Default, hip fixed (7, 8)	
Required load in g:	15	g
Min load [N]:	15 000 N	
Required test load in kg:	**1650**	**kg**
Min. duration [s]:	5s	



Results

Duration of maintained min. load [s]:	**6.1 s**
Any signs of structural failure after this test:	**No visible failure**
Test result:	**Passed**

Graph:



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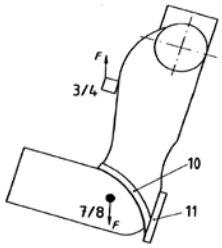
Harness Test — Test ID 3

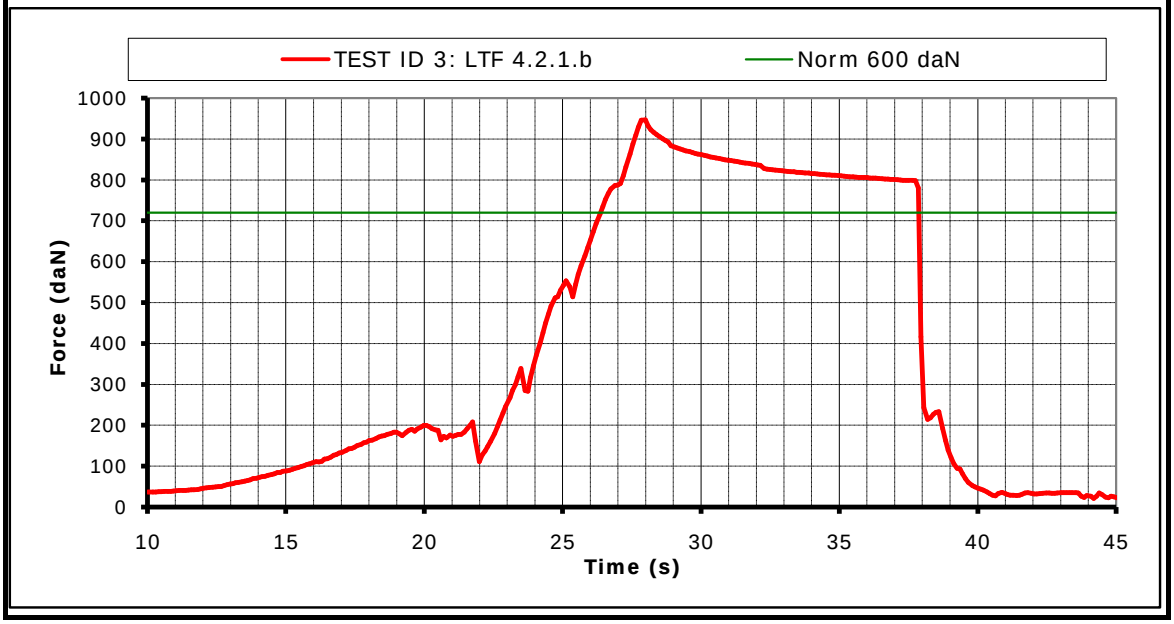
Item:	Hamak 2	
Manufacturer	Niviuk Gliders	
Test place & date:	Villeneuve	November 11, 2011
Test responsible:	Alain Zoller	
Temp. [°C] & Humidity:	24.9° C; 59%rel	
Maximum certified pilot weight [kg]:	110	kg
Standard	2. DV LuftGerPV §1, Nr. 7 c	
Test standard §:	4.2.1.b	
Test setup:	Flying position before landing: seat board (11) in landing position, leg straps (10) closed.	
Anchoring: **Attachment points:**	Both of the main riser attachments attached (3 and 4);	
Dummy:	Default, hip fixed (7, 8)	
Required load in g:	6	g
Min load [N]:	6000 N	
Required test load in kg:	**660**	**kg**
Min. duration [s]:	10 s	



Results

Duration of maintained min. load [s]:	**11.7 s**
Any signs of structural failure after this test:	**No visible failure**
Test result:	**Passed**

Graph:



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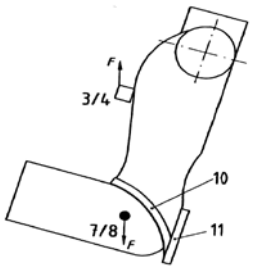
Harness Test — Test ID 4

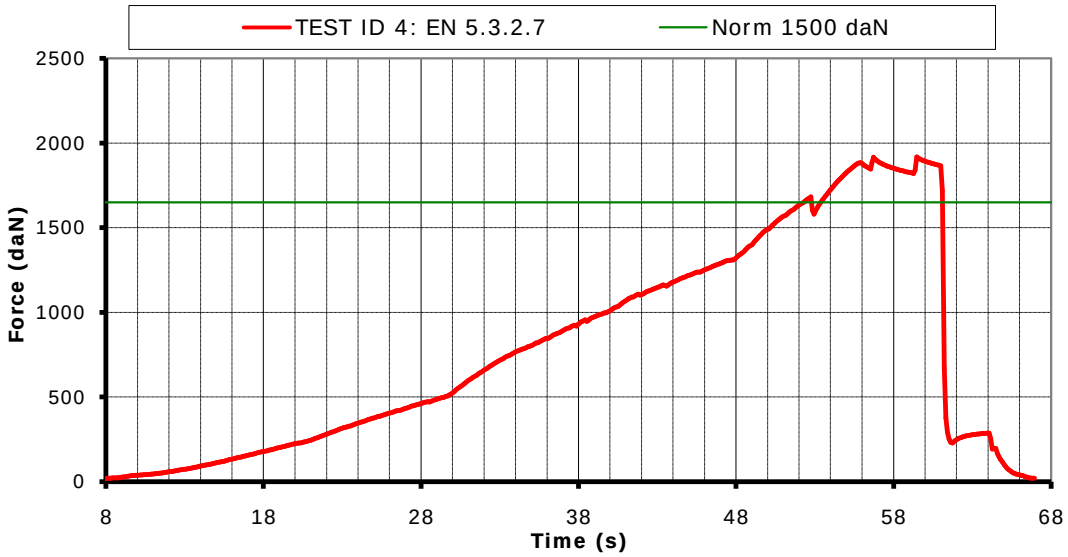
Item:	Hamak 2	
Manufacturer	Niviuk Gliders	
Test place & date:	Villeneuve	November 11, 2011
Test responsible:	Alain Zoller	
Temp. [°C] & Humidity:	24.9° C; 59%rel	
Maximum certified pilot weight [kg]:	110	kg
Standard	EN 1651	
Test standard §:	EN 5.3.2.7	
Test setup:	Flying position before landing: seat board (11) in landing position, leg straps (10) closed.	
Anchoring: **Attachment points:**	Both of the main riser attachments attached (3 and 4);	
Dummy:	Default, hip fixed (7, 8)	
Required load in g:	15	g
Min load [N]:	15 000 N	
Required test load in kg:	**1650**	**kg**
Min. duration [s]:	5 s	



Results

Duration of maintained min. load [s]:	**5.1 s**
Any signs of structural failure after this test:	**No visible failure**
Test result:	**Passed**

Graph:



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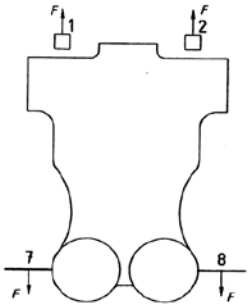
Harness Test — Test ID 5

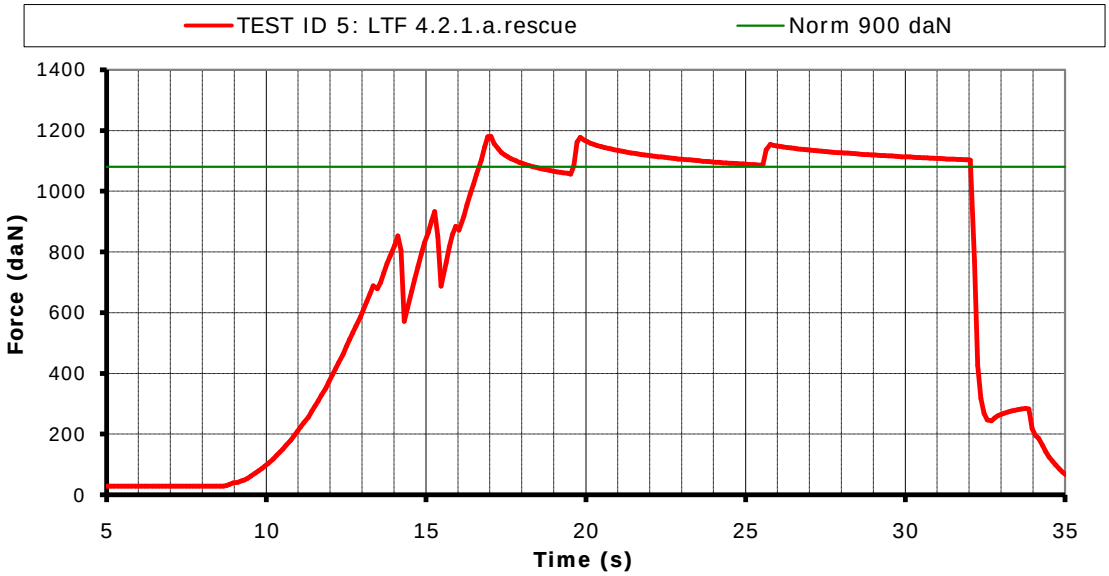
Item:	Hamak 2	
Manufacturer	Niviuk Gliders	
Test place & date:	Villeneuve	November 11, 2011
Test responsible:	Alain Zoller	
Temp. [°C] & Humidity:	24.9° C; 59%rel	
Maximum certified pilot weight [kg]:	110	kg
Standard	2. DV LuftGerPV §1, Nr. 7 c	
Test standard §:	4.2.1.a rescue	
Test setup:	Rescue attachments	
Anchoring: Attachment points:	Rescue riser attachments (1,2)	
Dummy:	Hip fixed (7, 8)	
Required load in g:	9	g
Min load [N]:	9 000 N	
Required test load in kg:	**990**	**kg**
Min. duration [s]:	10 s	



Results

Duration of maintained min. load [s]:	**12.2 s**
Any signs of structural failure after this test:	**No visible failure**
Test result:	**Passed**

Graph:



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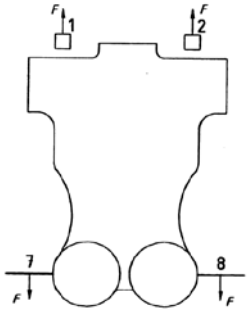
Harness Test — Test ID 6

Item:	Hamak 2	
Manufacturer	Niviuk Gliders	
Test place & date:	Villeneuve	November 11, 2011
Test responsible:	Alain Zoller	
Temp. [°C] & Humidity:	24.9° C; 59%rel	
Maximum certified pilot weight [kg]:	110	kg

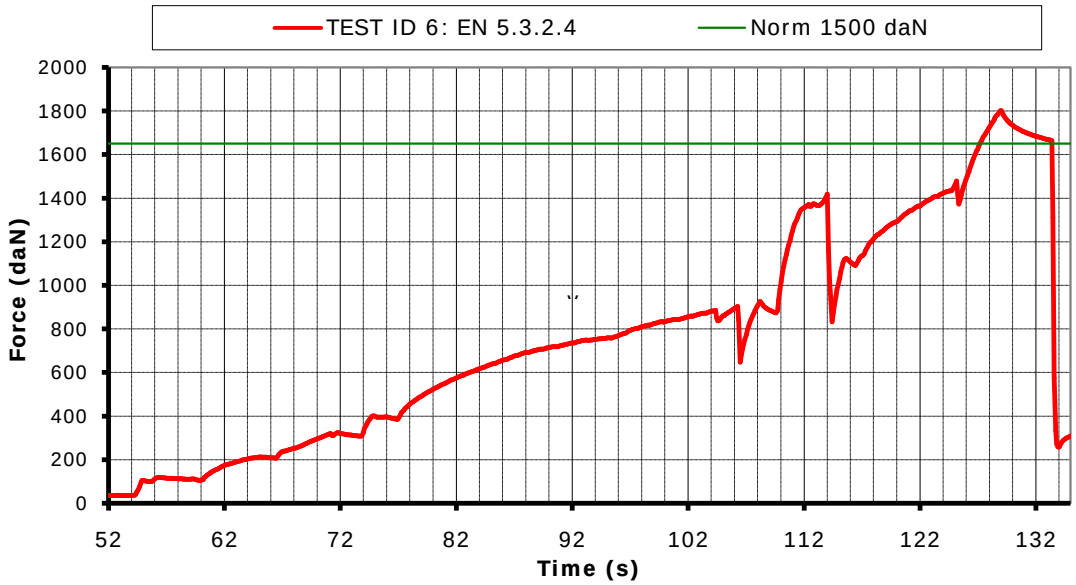
Standard	EN 1651	
Test standard §:	5.3.2.4	
Test setup:	Rescue attachments	
Anchoring: Attachment points:	Rescue riser attachments (1,2)	
Dummy:	Hip fixed (7, 8)	
Required load in g:	15	g
Min load [N]:	15 000 N	
Required test load in kg:	**1650**	**kg**
Min. duration [s]:	5 s	



Results

Duration of maintained min. load [s]:	**8.1 s**
Any signs of structural failure after this test:	**No visible failure**
Test result:	**Passed**

Graph:



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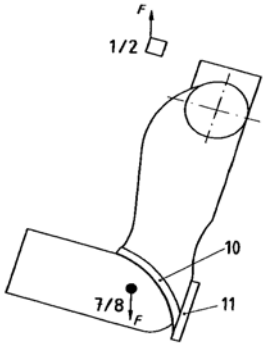
Harness Test — Test ID 7

Item:	Hamak 2	
Manufacturer	Niviuk Gliders	
Test place & date:	Villeneuve	November 11, 2011
Test responsible:	Alain Zoller	
Temp. [°C] & Humidity:	24.9° C; 59%rel	
Maximum certified pilot weight [kg]:	110	kg

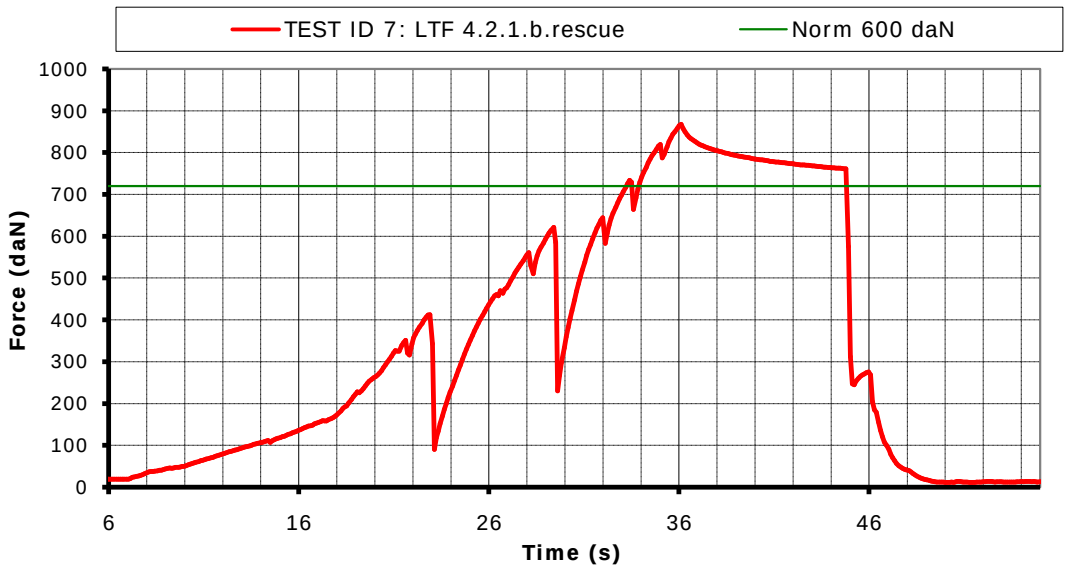
Standard	2. DV LuftGerPV §1, Nr. 7 c	
Test standard §:	4.2.1.b rescue	
Test setup:	Flying position before landing: seat board (11) in landing position, leg straps (10) closed.	
Anchoring: **Attachment points:**	Both of the rescue riser attachments attached (1 and 2);	
Dummy:	Default, hip fixed (7, 8)	
Required load in g:	6	g
Min load [N]:	6 000 N	
Required test load in kg:	**660**	**kg**
Min. duration [s]:	10 s	



Results

Duration of maintained min. load [s]:	**10.3 s**
Any signs of structural failure after this test:	**No visible failure**
Test result:	**Passed**

Graph:



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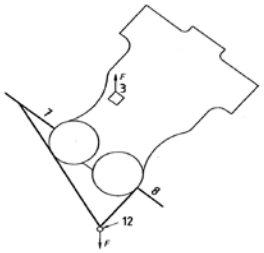
Harness Test — Test ID 8

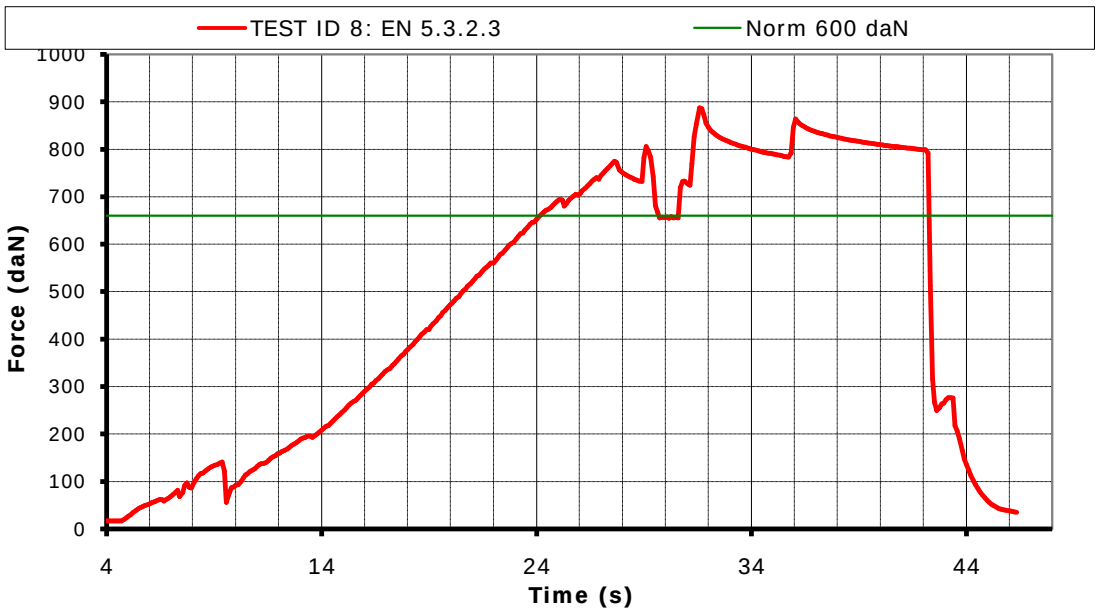
Item:	Hamak 2	
Manufacturer	Niviuk Gliders	
Test place & date:	Villeneuve	November 11, 2011
Test responsible:	Alain Zoller	
Temp. [°C] & Humidity:	24.9° C; 59%rel	
Maximum certified pilot weight [kg]:	110	kg
Standard	EN 1651	
Test standard §:	5.3.2.3	
Test setup:	Only one riser attached	
Anchoring: Attachment points:	One main riser attachments (3)	
Dummy:	Hip fixed (7, 8 -> 12)	
Required load in g:	6	g
Min load [N]:	6 000 N	
Required test load in kg:	**660**	**kg**
Min. duration [s]:	10 s	



Results

Duration of maintained min. load [s]:	**14.1 s**
Any signs of structural failure after this test:	**No visible failure**
Test result:	**Passed**

Graph:



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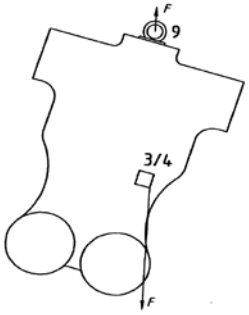
Harness Test — Test ID 10

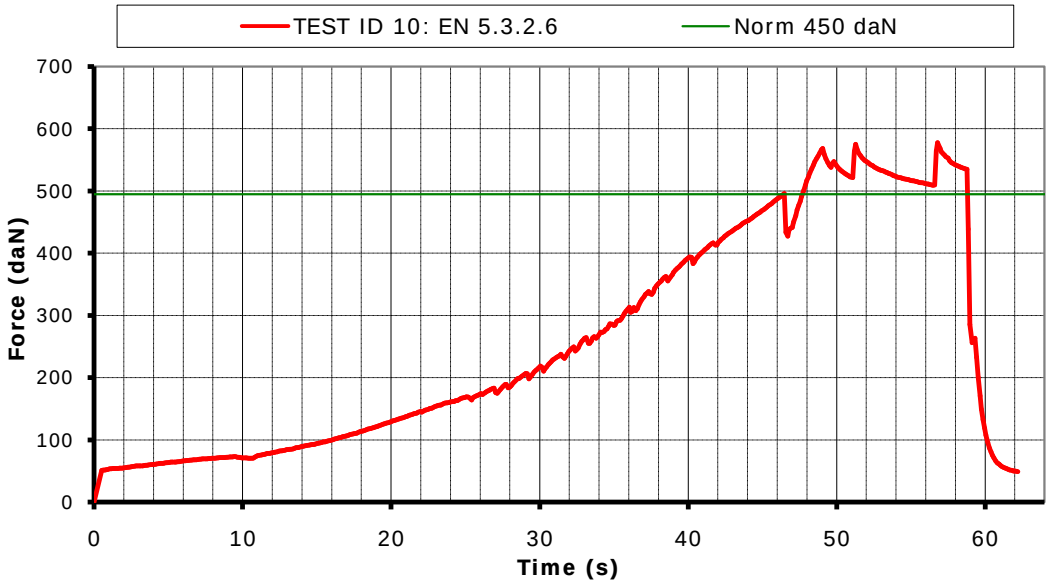
Item:	Hamak 2	
Manufacturer	Niviuk Gliders	
Test place & date:	Villeneuve	November 11, 2011
Test responsible:	Alain Zoller	
Temp. [°C] & Humidity:	24.9° C; 59%rel	
Maximum certified pilot weight [kg]:	110	kg
Standard	EN 1651	
Test standard §:	5.3.2.6	
Test setup:	Normal flying position in NEGATIF	
Anchoring: **Attachment points:**	ONE of the main riser attachments attached downwards(3 or 4);	
Dummy:	Dummy anchored at the head position (9)	
Required load in g:	4.5	g
Min load [N]:	4500 N	
Required test load in kg:	**495**	**kg**
Min. duration [s]:	10 s	



Results

Duration of maintained min. load [s]:	**11.3 s**
Any signs of structural failure after this test:	**No visible failure**
Test result:	**Passed**

Graph:



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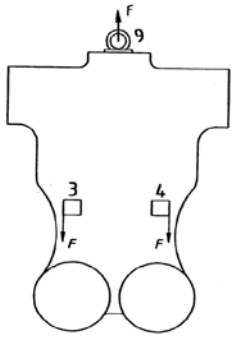
Harness Test — Test ID 11

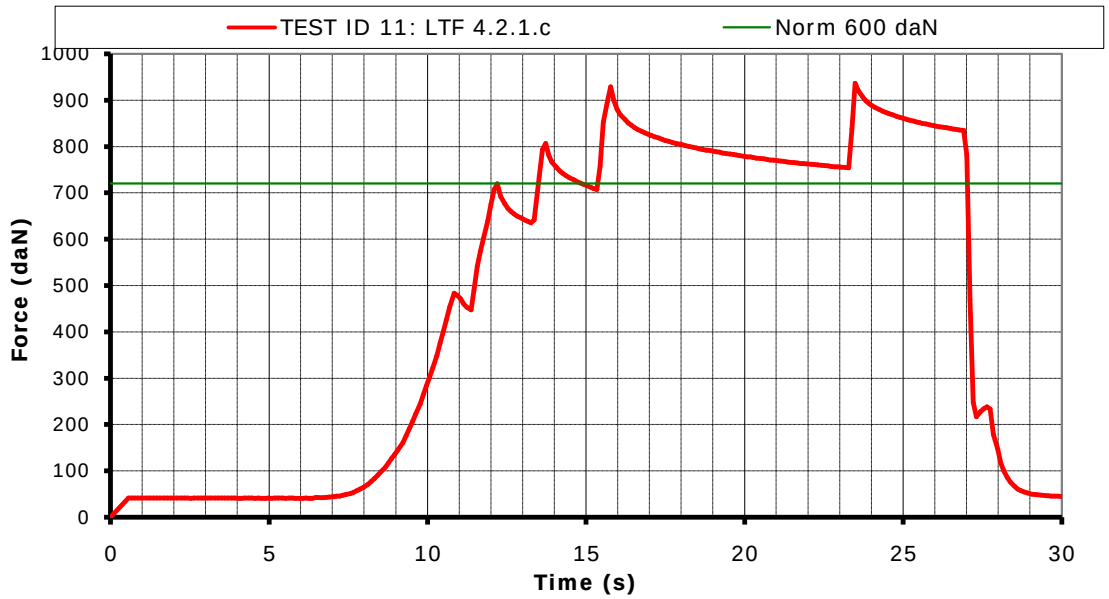
Item:	Hamak 2	
Manufacturer	Niviuk Gliders	
Test place & date:	Villeneuve	November 11, 2011
Test responsible:	Alain Zoller	
Temp. [°C] & Humidity:	24.9° C; 59%rel	
Maximum certified pilot weight [kg]:	110	kg
Standard	2. DV LuftGerPV §1, Nr. 7 c	
Test standard §:	4.2.1.c	
Test setup:	Pilot upside down flying position	
Anchoring: **Attachment points:**	Both of the main riser attachments attached downwards (3 and 4);	
Dummy:	Dummy anchored at the head position (9)	
Required load in g:	6	g
Min load [N]:	6 000 N	
Required test load in kg:	**660**	**kg**
Min. duration [s]:	10 s	



Results

Duration of maintained min. load [s]:	**11.7 s**
Any signs of structural failure after this test:	**No visible failure**
Test result:	**Passed**

Graph:



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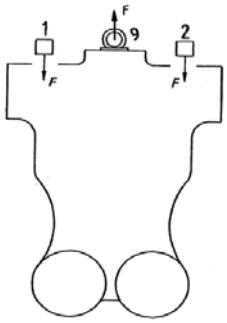
Harness Test — Test ID 12

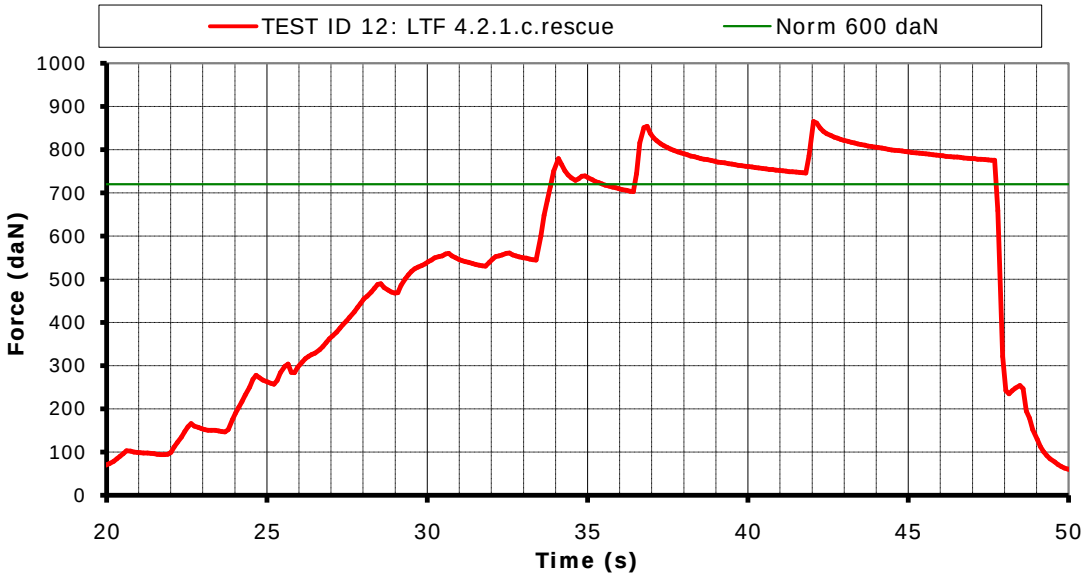
Item:	Hamak 2	
Manufacturer	Niviuk Gliders	
Test place & date:	Villeneuve	November 11, 2011
Test responsible:	Alain Zoller	
Temp. [°C] & Humidity:	24.9° C; 59%rel	
Maximum certified pilot weight [kg]:	110	kg
Standard	2. DV LuftGerPV §1, Nr. 7 c	
Test standard §:	4.2.1.c rescue	
Test setup:	Pilot upside down flying position	
Anchoring: **Attachment points:**	Both of the rescue riser attachments attached downwards (1 and 2);	
Dummy:	Dummy anchored at the head position (9)	
Required load in g:	6	g
Min load [N]:	6 000 N	
Required test load in kg:	**660**	**kg**
Min. duration [s]:	10 s	



Results

Duration of maintained min. load [s]:	**11.4 s**
Any signs of structural failure after this test:	**No visible failure**
Test result:	**Passed**

Graph:



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Protector shock test — Test ID Protect

Item:	Hamak 2	
Manufacturer	Niviuk Gliders	
Test place & date:	Villeneuve	November 11, 2011
Test responsible:	Alain Zoller	
Temp. [°C] & Humidity:	24.9° C; 59%rel	
Maximum certified pilot weight [kg]:	110	kg

Standard	2. DV LuftGerPV §1, Nr. 7 c	
Test standard §:	5.1.1	
Test setup:	Harness attached to protector test dummy, in a similar way like a real pilot in flight. Impact will be simulated by dropping the dummy from a certain height (with and without reserve). To simulate the "in-flight" conditions, the airbag is inflated with pressurized air equalling an airspeed of 7m/s. Inflation has to be stopped at least 5 sec before impact. Impact will be measured by an accelerometer mounted on the dummy. (Impact measured in g's)	
Requirements:	**Minimun height:**	1.65 m (between lowest point test dummy and impact surface)
	Impact requirements:	+50g as absolute maximum; +38g during less than 7 msec; +20g during less than 25 msec.
	Repetitions:	The test will be performed 2 times, minimum 1 hour and maximum 2 hours after the first impact (with airbag protectors this pause is not necessary). The 2 Max-values should not differ more than 20%

Results

Shock test 1:

Impact at a height of 1.65m:	36.32 g
Impact duration of+ 38 g (if any):	0
Impact duration of +20 g (if any):	17 ms

Shock test 2:

Impact at a height of 1.65m:	34.52g
Impact duration of+ 38 g (if any):	0
Impact duration of +20 g (if any):	14 ms

$\Delta < 20\,\%\,?$

Test Result: **Passed**

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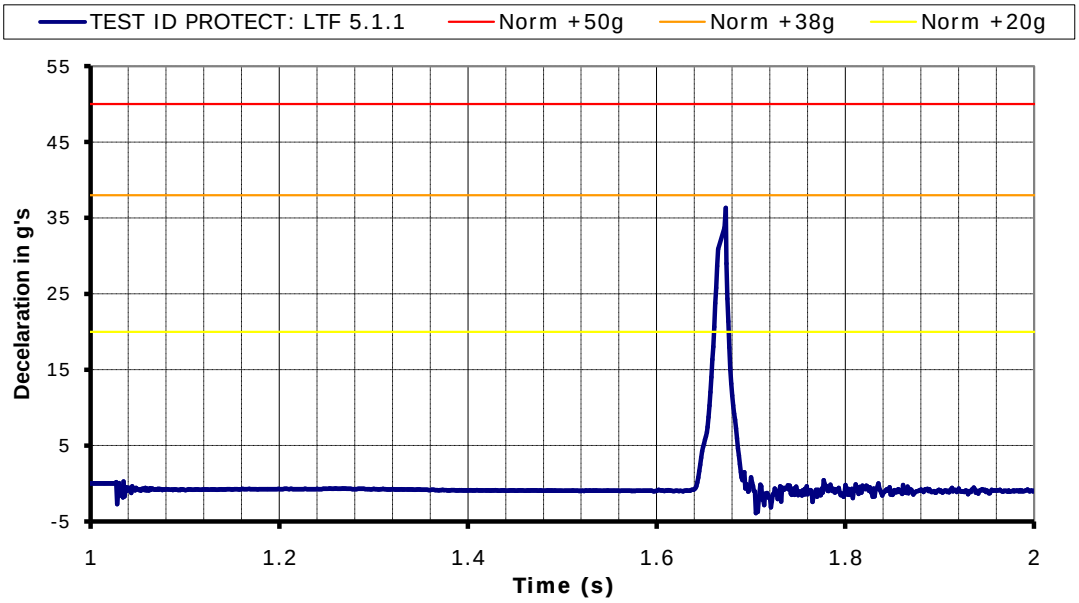
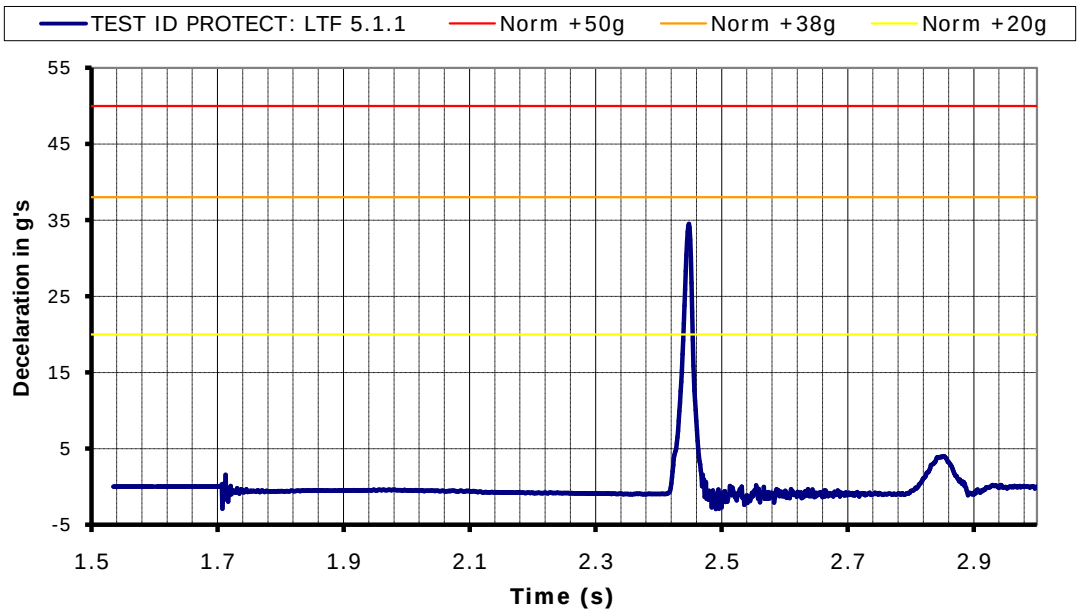
Graph 1:



Graph 2:



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Rescue deployment resistance test — Test ID resc

Item:	Hamak 2	
Manufacturer	Niviuk Gliders	
Test place & date:	Villeneuve	November 11, 2011
Test responsible:	Alain Zoller	
Temp. [°C] & Humidity:	24.9° C; 59%rel	
Maximum certified pilot weight [kg]:	110	kg

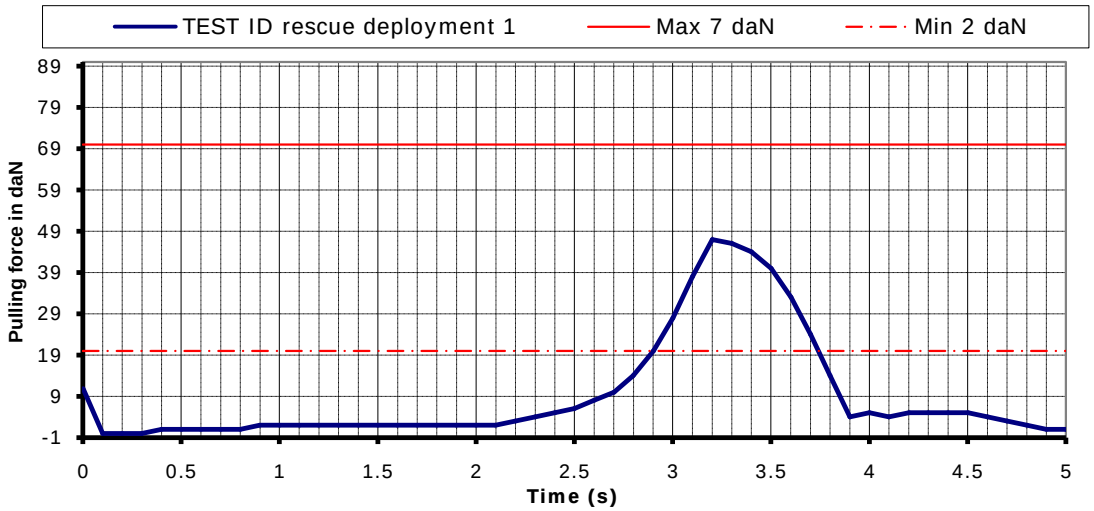
Standard	2. DV LuftGerPV §1, Nr. 7 c
Test standard §:	6.1.5
Test setup:	The deployment of the rescue system has to be ensured in all circumstances, especially with a damaged glider. The pilot has to be able to deploy the rescue chute with a single pull out of the outer container, single handed and in an anatomical favorable direction. In order to simulate this, the test responsible deploys the rescue seated in the harness. In a similar way as in real flight. The deployment resistance is approximately measured by the load cell, which is placed between the hand of the test responsible and the rescue hand grip. On the other hand inadvertent deployment has to be fairly remote. Therefore a shear link has to withstand a minimum load.

Requirements:	**Max force for single hand deployment:**	approx. 70 N
	Min force to prevent unwanted opening:	approx. 20 N

Results

Measured peak to peak required force for deployment [daN]:	6.7 daN
Comment:	**Passed**

Graph:



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Rescue deployment strap strength test

Test ID resc strap

Item:	Hamak 2
Manufacturer	Niviuk Gliders
Test place & date:	Villeneuve November 11, 2011
Test responsible:	Alain Zoller
Temp. [°C] & Humidity:	24.9° C; 59%rel
Maximum certified pilot weight [kg]:	110 kg
Standard	EN 12491 & 2. DV LuftGerPV §1, Nr. 7 c
Test standard §:	5.3.2 (EN 12491) & 6.1.8 (LTF)
Test setup:	The handgrip of the outer container has to be connected to the inner container with a removable loop in a way that it is possible to use the inner container with different types of outer containers. The connection between handgrip and inner container has to have sufficient load capacity/structural strength in any situation that may arise during normal operation. In order to verify this, the connection is tested on its tensile strength by a default tensile testing setup. In addition to this the breaking resistance will also be measured.
Requirements: **Min. tensile strenght for 10 s:**	700 N (= 70daN)

Results

Duration of maintained load [s]:	**13.5**
Breaking resistance [daN]:	**100.6**
Comment:	**Passed**

Graph: