TEST REPORT

Client: **INOVIKA S.R.L.**

Address: **Via Cal Trevisana, 26/A - 31044 Montebelluna TV – IT**

Article: **Dog leash**

Model: **WAW**

Job n.: **D150261**

Report n.: **150356**

Receiving date: **15/04/2011**

Date of test begin: **19/04/2011**

Date of test end: **22/04/2011**

Issuing date: **04/06/2015**

Standard applied: **Internal method based on Client specific**

The Technical Coordinator:

Luca Tamburlin

Note1: This Test Report is valid exclusively for the samples utilized for tests and any modification shall be solely performed with the issuing of a new test report.
Note 2: The partial divulgation of this test report is permitted against written authorization by Dolomiticert.
Note 3: Samples for tests are supplied by the Client.

Sample identification

Samples are identified as follow:

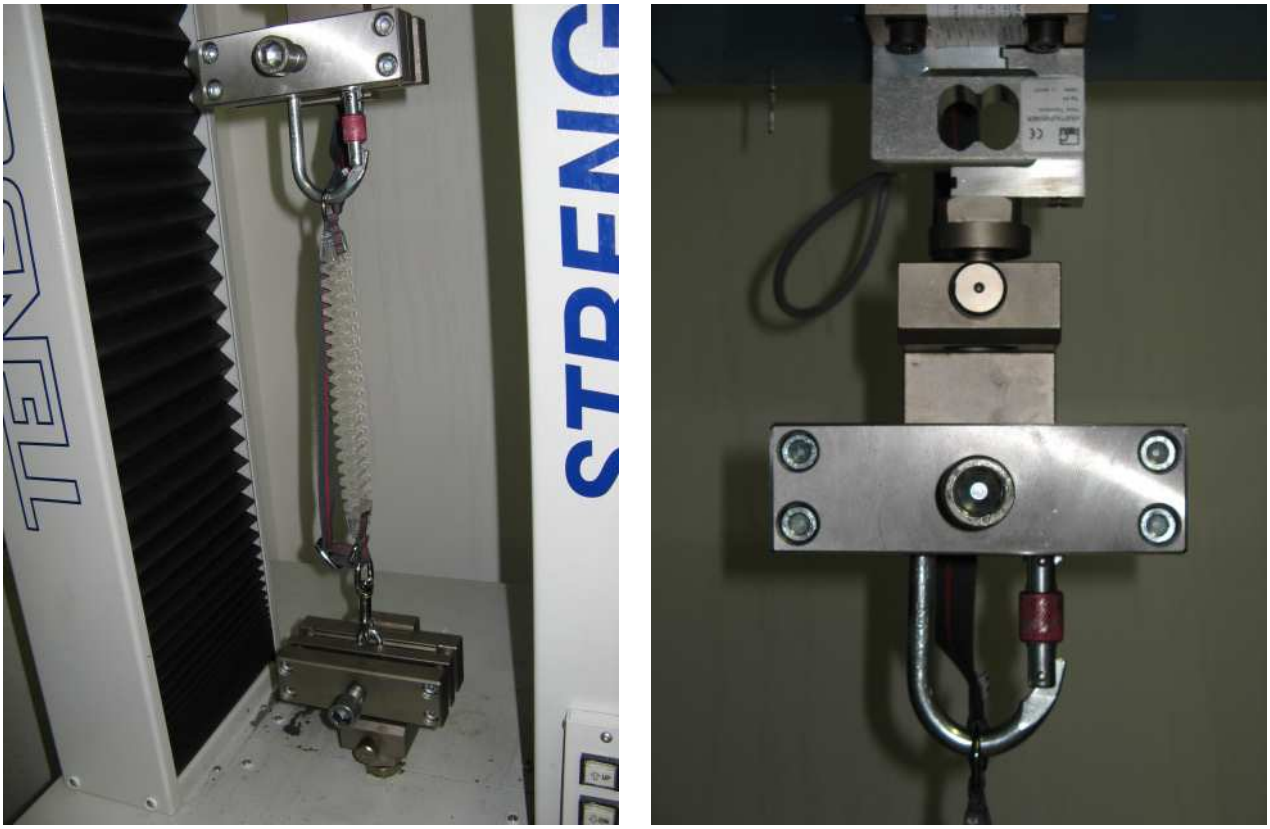
Sample	Size	Internal code
WAW	1	110175_1
WAW	2	110175_2
WAW	3	110175_3
WAW	4	110175_4
WAW	5	110175_5
WAW	6	110175_6
WAW	7	110175_7
Elastic leash	1	110175_8
Elastic leash	2	110175_9
Elastic leash	3	110175_10
Rigid	Unisize	110175_11

Introduction

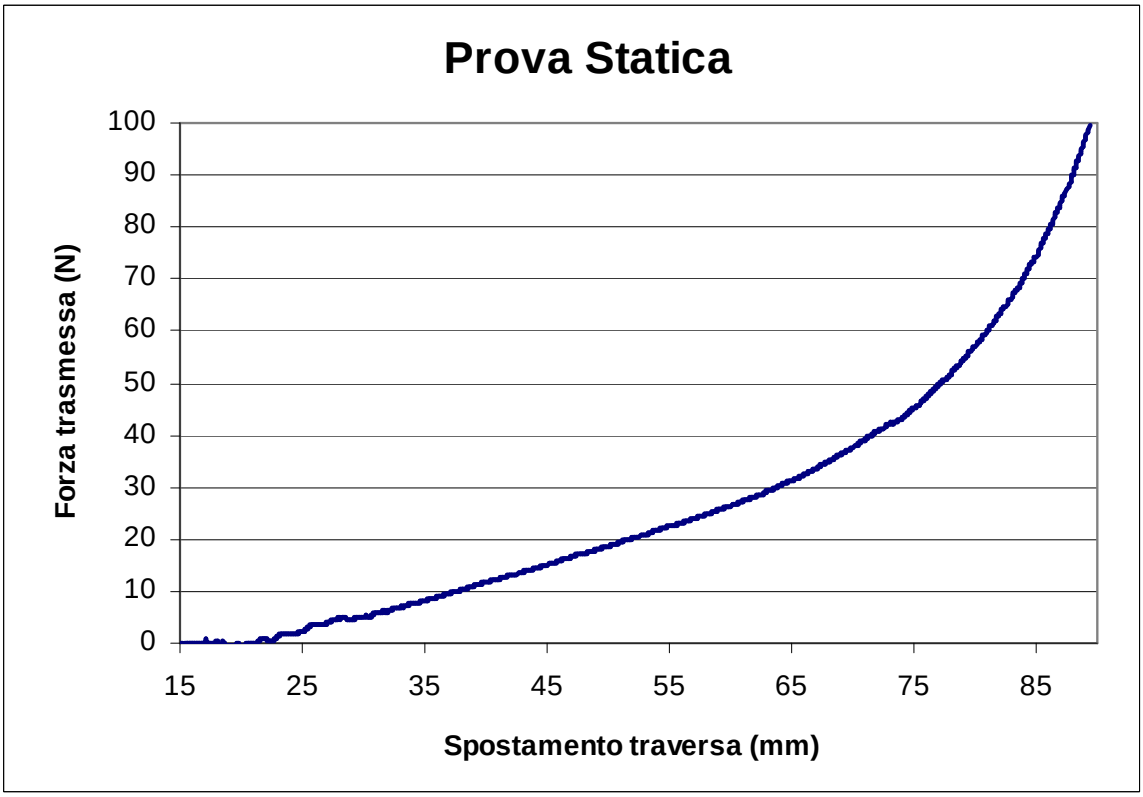
It has been performed tests on Client specific on an innovative dog leash called innovative WAW; the leash is manufactured in more sizes (seven) based on the size of the dog you are going to accompany with your device. The feature that distinguishes the leash model WAW is that to be equipped with a deformable accordion at one end with the aim to make less traumatic a possible tug from the animal during walking, without that, however, this goes to violently strike the same one in case that the master suddenly releases the grip end of the leash; in order to preserve the integrity of the accordion from overloads possible when used in normal practice, parallel to the deformable element is mounted in a tab tape with the possibility of adjusting the length of this appendage and consequently the maximum strain allowed for the accordion.
Characteristics of the new leash are been compared with those of two types of leash which are deliberately opposite each of them: a classic leash and therefore more rigid and an elastic leash and therefore deformable; purpose of these laboratory tests is to assess both qualitatively and quantitatively the goodness of the leash WAW than the other two traditional models: to assess what were conducted static and dynamic tests on the various devices.

Static test

It has been conducted a static test on the various devices in order to assess essentially two basic parameters: the stiffness and the elastic energy absorbed.
For the test, it was used an universal electromechanical tensile machine and were evaluated the parameters of the transmitted force and elongation of the device in question, respectively using an uniaxial load cell 1 kN and a displacement sensor integrated in the tensile machine.
Each devices have been locked between the deformable ends using clamps and connectors: the leash WAW was loaded only in the deformable accordion and not for the entirety of the device.
Each test was conducted at a deformation speed of 50 mm/min; for the leash WAW the static test was performed by applying the load in the way to don't stress the parallel rigid tape, adjusted to the maximum extent in so as to allow the maximum deformation of the accordion; for the other devices it has continued to apply the load up to around 100 N load.
At the end of the test, it is possible to save the data of strength and elongation in the way to obtain a chart that write on the horizontal axis the elongation value of the device and on the ordinate axis the value of the force transmitted by the same; for the calculation of the stiffness value for the various devices,it is has made reference to the linear elastic part presented by the load paths: the slope of the curve in the linear portion represents, in fact, the rigidity of the device. Using the Excel spreadsheet it is possible to estimate the slope of the curve in the linear part through the use of a regression line.



Picture 1: Static test on leashes; on the right, picture of clamping method and of the load cell 1 kN used to record data of the transmitted force



Picture 2: Path example from a tensile strength test on leash WAW: change of the slope in the final part of the curve is caused by the simultaneous loading of the parallel tape when the accordion is totally elongated

In the following table are reported indicative stiffness values of the various devices:

Sample	Stiffness (N/mm)
110175_1	0.72
110175_2	0.72
110175_3	1.49
110175_4	1.73
110175_5	1.79
110175_6	2.08
110175_7	3.08
110175_8	0.36
110175_9	0.29
110175_10	0.27
110175_11	5.15

Always using graphs obtained by static resistance tests, it is possible to evaluate strain absorbed energy by the device: this parameter is used to assess the ability of the device to not release the elastic energy when stressed by a static force which for some reason is cleared suddenly: the lower the strain energy absorbed by the device and the lower the risk that the dog is violently struck by the leash if the latter is released suddenly when under load.
The elastic energy absorbed by the leash is calculated as the integral of the area under the curve in the linear part of the path, according to the following equation:

$$E = \int_{F_0}^{F_1} F ds$$

In this case, elastic energy is evaluated between 5 N and 40 N for all devices in the way to compare values obtained with the same integral parameters.
In the following table are reported indicative elastic absorbed energy values by the leashes between 5 N and 40 N:

Sample	Elastic energy (N*mm)
110175_1	825
110175_2	840
110175_3	521
110175_4	417
110175_5	401
110175_6	332
110175_7	252
110175_8	1397
110175_9	1880
110175_10	2075
110175_11	95

Consideration about static tests

After performing static tests it is possible to do the following statements:

- stiffness of the leash WAW tends to increase with increasing sizes demonstrating that the accordion increases in stiffness with increasing sizes of the leash;
- leashes stiffness for model WAW (all sizes) is placed between the elastic leash and the rigid leash, as a compromise between the two;
- elastic energy absorbed by the leash model WAW tends to decrease with increasing size;
- elastic energy absorbed by leashes model WAW (all sizes) arises between the amount absorbed by the elastic leash and the rigid leash: this fact demonstrates that the eventual release under load of the rigid leash and leash WAW involves a situation less dangerous for the dog than the elastic leash that, for the reason that it is the more elastic device, once released under load, will free up suddenly this elastic energy, tending to quickly return to the

beginning position and tending to go to beat against the animal (elastic effect).
Another observation concerns the length of the devices: in fact, the leash WAW determines the elongation concentrated only in part of the accordion and then the release load of elastic energy absorbed will focus only on the part of the accordion, whereas the elastic leash size 3 distributes the energy absorption over its entire length and at the time of releasing the load occurs the release of the energy to the entire length of the device.

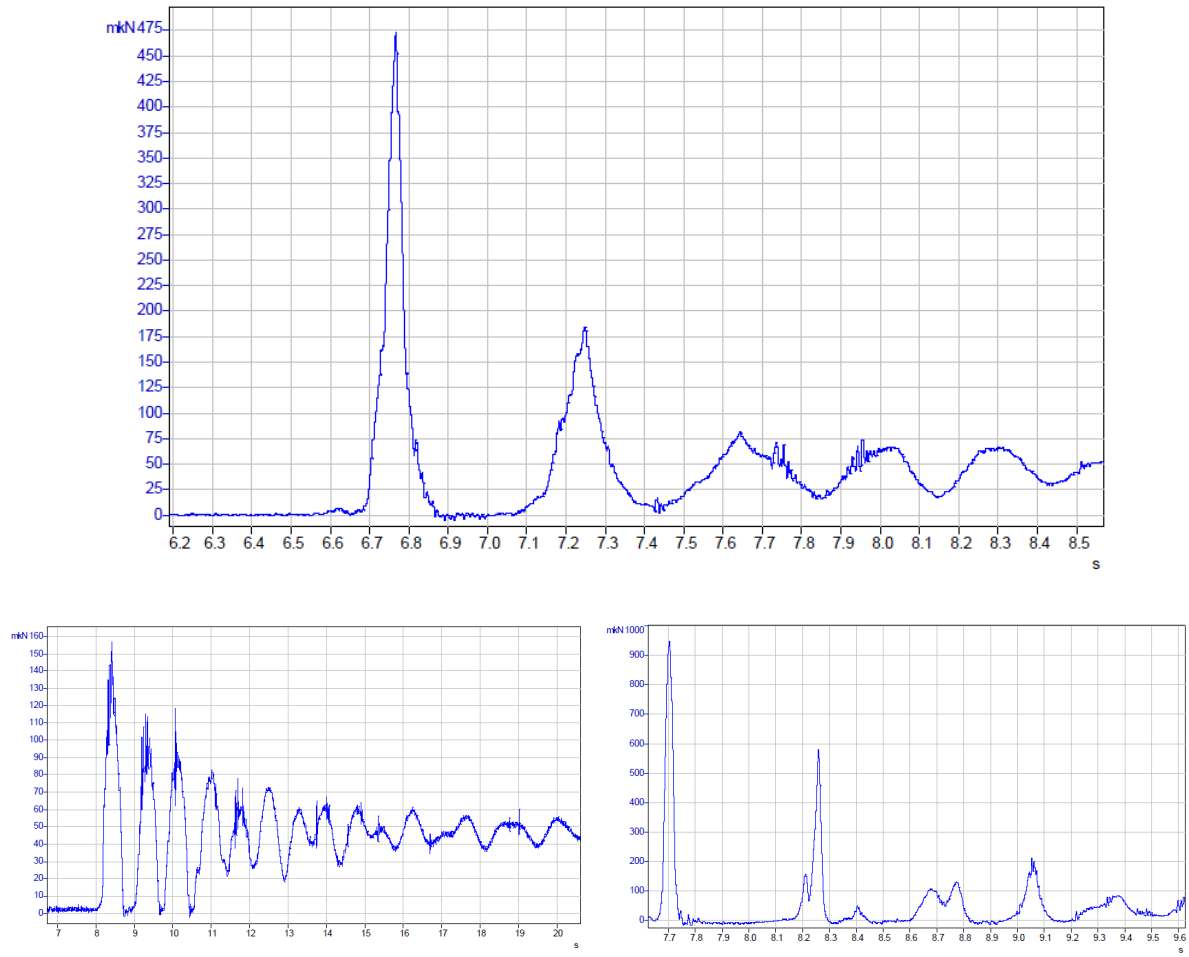
Dynamic test

It has been performed a dynamic test on the various devices in order to assess the maximum force transmitted to the leash during the impact and possibly the number of bounces and the height of the rebound after the first impact.
The sample was fixed with one end (master side, in normal practice) to a rigid anchor point while the other end (dog side) was fixed a mass of about 4.7 kg. For each device were conducted more tests at various fall energies, by varying the height release of the mass; the mass is released by a pneumatic system for automatic release. For the evaluation of the transmitted force has been used an uniaxial strain gauge load cell and the signal provided by this sensor it has been acquired through a dedicated software, in order to obtain a force-time curve of the impact.

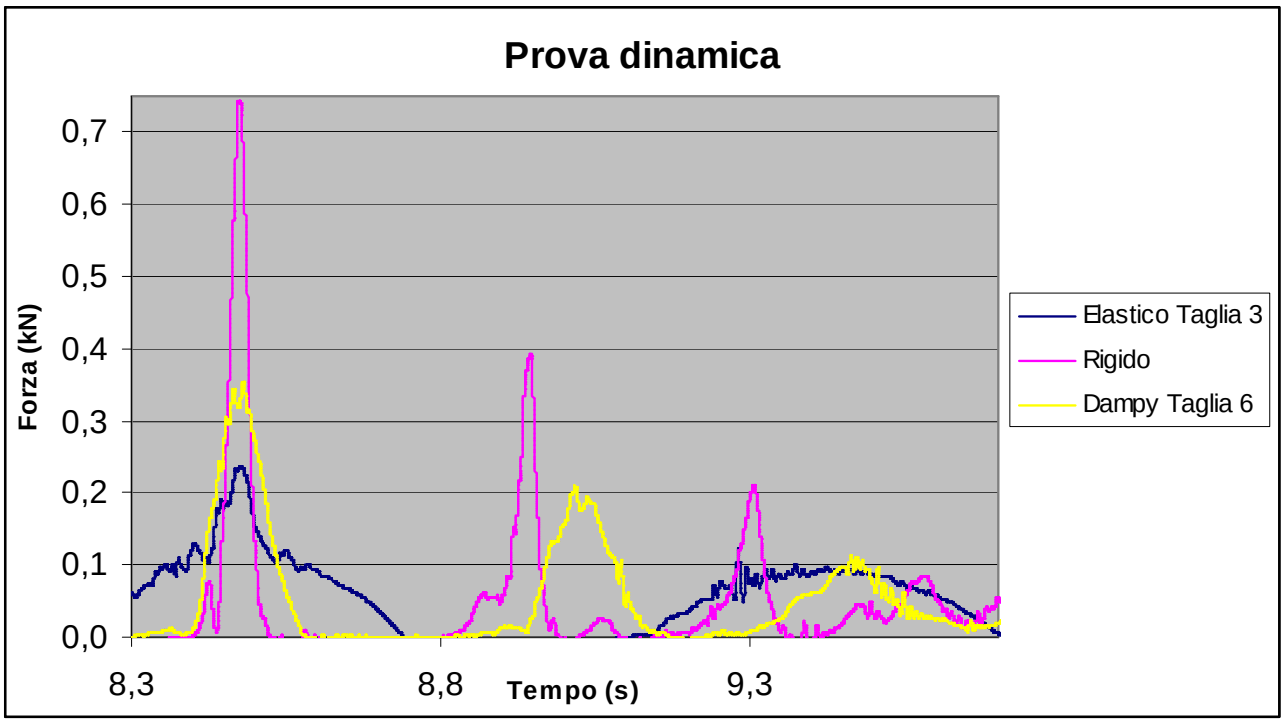
Picture 3: Dynamic test – on the left rigid leash and on the right leash WAW

In the following table are reported indicative valuies of the transmitted force for the various devices for different fall energy:

Sample	**Maximum force (N)**					
	10 J	**15 J**	**20 J**	**30 J**	**40 J**	**50 J**
110175_4	/	/	472	651	786	/
110175_5	/	/	280	413	671	826
110175_6	/	/	278	355	442	653
110175_7	/	/	286	357	485	621
110175_10	/	/	157	238	410	/
110175_11	285	294	621	745	948	1059



Picture 4: Above example of a path obtained for the leash WAW, below on the left example of a path obtained for the elastic leash and below on the right example of a path obtained for the rigid leash



Picture 5: Path overlapping for leash WAW, elastic and rigid leashes at the same fall energy (30J)

Consideration about dynamic tests

After performing dynamic tests, it is possible to do the following statements:

- elastic leash is those that transmits less force because it is the more deformable also if with a fall energy of 40J the difference with model WAW of size 6 and 7 is not so pronounced;
- rigid leash is those transmits more force of each fall energy because it is the more stiff: this fact bring a great advantage for the use of leash WAW against the classic rigid leash because dynamic force transmitted to the dog is less, with a consequent reduction of the pain for the animal;
- it has noted a sudden increase of the transmitted force for leash WAW size 5 against those of sizes 6 and 7 to pass from 30J and 40J of energy: this is caused by the fact that WAW accordion for size 5 with an energy of 40J reach its maximum deformation and there is a tug caused by the parallel tape.

Conclusions

To conclude it is possible to say that leash WAW leads to a reduction of trauma for the dog than traditional rigid leashes; this property is comparable to that of the elastic leases but, despite its greater deformation capacity, shall not bear important advantages compared to the leash WAW.
Furthermore, leash WAW appears to be significantly safer for the dog with respect to the elastic one every time the device is released for some reason under load: in fact, elastic energy absorbed by the WAW is much lower and focused only at the short stretch of the accordion with respect to that absorbed by elastic leash and distributed throughout the length of this device. Other thing, leash

WAW compared to a normal elastic leash has the advantage that the elongation is limited and in case of tearing, once reached the maximum extension of the accordion, it is tensioned the part of the tape parallel to the accordion which ensures a defined and limited elongation. In this way, it has a maximum length of the device that is known, important for a perfect control of the dog.

Picture 6: Leash model WAW (size 7)

Picture 7: On the left rigid leash and on the right elastic leash (size 3)