**Separating Fact from Fiction: The truth about climbing equipment standards, Part 1**

Working as a course provider of climbing awards I’ve always wanted to provide the best possible experience for my candidates. A recurring theme on courses has been candidates asking about specific breaking strains or tests on particular equipment. I’ve often found myself giving standard ‘stock’ answers (such as “this sling is rated at 22kN”, but often left asking myself ‘is that actually the whole story’? Now, I might be a little bit of a kit geek, but this has become an area of interest for me and through my research I discovered some facts about the testing of equipment that I found very surprising. This has given me a new perspective of the strength of equipment that we all use and allows me to answer those questions with more accuracy.

The aim of this short series is to develop knowledge of climbers and instructors to be better informed about the current European Norm (EN) standards rather than speculated myths. For example, a harness is tested to 22Kn, like belay karabiners – or is it? Treat this series like a telephoto zoomed in on specific elements of these comprehensive standards. The series is written in two parts with textiles covered in part one, and metal ware and helmets in part two. Depending on your own geek rating you may choose not to digest each article in a single sitting; take your time and hopefully inform others on new-found knowledge about those mystical EN standards. I am a mountaineer and climber and not a qualified engineer, so to check my interpretations the articles have been peer reviewed by DMM.

I hope you will find the series informative and helpful in separating fact from fiction and possibly inspire you to question similar myths elsewhere in the mountaineering world.

Accessory Cord (BS EN 564:2014)

**Myth**: *Accessory cord is safe to set up bottom ropes*. A close friend moved to America and conformed to the local practice of rigging bottom ropes with 5 and 6mm cord. As you can imagine I was rather alarmed and questioned whether he would have used the practice on his SPA Assessment?

**Reality:** A single strand with a tensile strength of 3-5kN leaves very little redundancy, comparable to the open gate strength of a karabiner – and that’s before it is further weakened by tying a knot!

Accessory cord is tested to withstand a force and not absorb energy and therefore a tensile strength test is used where a force is gradually loaded. The EN looks at cord between 4-8mm diameter with a kernmantle construction, and minimum tensile strength indicated in table 1.

Table 1: Tensile strength of cord.

|  |  |
| --- | --- |
| **Cord Diameter in mm** | **Minimum Tensile Strength in kN** |
| 45678 | 3.25.07.29.812.8 |

Slings (BS EN 566:2017)

***Myth:*** *Dyneema is the best/worst material for a sling*.

**Reality:** As with all kit, there are pros and strengths. Nylon, is the original material for slings and still has many advantages, particularly price and its ability to stretch to up to 30% when loaded, reducing impact forces. This “stretchability” is lost in polyester, which has largely replaced nylon in Europe. It is also lost in Dyneema/Spectra, brand names for *Ultra High Molecular weight Polyethelene* (UHMwPE) - however this material is much lighter and less bulky, so can be added in various proportions to nylon to create thinner, lighter slings that are also significantly more resistant to abrasion and water absorption. Dyneema tapes are great where weight or bulk is an issue - for example extendable quickdraws for trad climbing. However, for belays and improvised lanyards the material has an important flaw – the low stretch and relatively low melt point means that knots weaken these slings quite dramatically, leading to situations where certain falls (e.g.direct on to the sling) could conceivably break the sling or an anchor.

Regardless of materials used, the EN and UIAA tests examine the same parameters. Slings can be either tape or cord stitched together to make a complete loop. If the sling is made of tape/webbing the stability of the weave is tested by loading a yarn (strand of the weave) under a load of 150g. During this test the weave must not unravel.

Similar to accessory cord, the whole slings is then exposed to a force and must meet a minimal tensile strength of 22kN.

Belay Lanyards (UIAA 109)

***Myth:*** *Now that a standard has been issued for lanyards, you can no longer make an improvised belay lanyard or cowstail out of slings!*

**Reality:** To gain the UIAA safety label for a belay lanyard the manufacturers have to conform to the standard before they can sell the product, but although it may affect our practices it cannot dictate what we can and cannot do with other gear. However, the fact that the dynamic test is designed to minimise the peak force should give pause for thought: a sling cowstail should only be used for static loading.

There is no current EN standard for Belay Lanyards, however there is a new UIAA standard which has been used for this article. UIAA standards are globally recognised, but not a legal requirement.

The lanyard must have two termination ends and is attached to the harness using the recommended knot (e.g. larks foot). There is a tensile strength test where the lanyard must meet a minimum of 15kN and a dynamic test. The dynamic test uses an 80kg mass and involves 3 successive fall factor 2’s with 5min between each fall. The peak force in the dynamic test cannot exceed 10kN. If the lanyard is adjustable it must not slip more than 50mm.

Harnesses (BS EN 12277:2015)

**Myth:** *Harness is tested to 22kN*.

**Reality:** The maximum required load on a harness is 15kN.

Within the standard 4 types of harnesses are covered: full Body harness, small full body harness intended for climbers up to 40kg (children), sit harness and a chest harness. The harnesses are mounted on a dummy and tested in a variety of orientations dependant on their design. The harness is loaded, unloaded and loaded again to simulate real-world use. During this cycle the harness must hold the force seen in table 2, no load-bearing part can break and the buckles must not allow slippage greater than 20mm.

Table 2: The force applied in specific orientations.

|  |  |  |  |
| --- | --- | --- | --- |
| **Type of Harness** | **Head Up** **in kN** | **Head Down****In kN**  | **Perpendicular form the waist**  |
| Full Body HarnessSmall Full Body HarnessSit HarnessChest Harness | 15101510 | 107n/an/a | n/an/a10kNn/a |

Dynamic Mountaineering Ropes (BS EN 892:2012)

**Myth:** *a rope must be retired after the number of falls indicated on the manufacturers packaging*.

**Reality:** The number of falls demonstrates how burly the rope is and many climbing falls don’t come close to the fall factors used in testing.

Dynamic ropes undergo a variety of tests, of which this article will look at Sheath Slippage, Static Elongation, Dynamic Elongation, Peak force and Number of Drops. The information obtained by the manufacturer is then supplied to the consumer.

***Sheath slippage*** is tested by being pulled through an apparatus with moving and fixed plates that apply a force of 0.005kN on the sheath of the rope. The amount of sheath to core slippage is recorded and must not exceed 1%.

***Static elongation*** replicates gentle body weight loading of the rope with an 80kg mass being used for single, half and twin ropes.

The mass is gradually loaded without shock for 180sec before a 10min rest time. The sample is then loaded for another 60sec and the elongation is measured. The maximum static elongation can be seen in table 3.

Table 3: Maximum static elongation

|  |  |
| --- | --- |
| **Rope Type** | **Maximum Elongation in %** |
| SingleHalfTwin (double strand) | 101210 |

The testing rig for ***dynamic elongation, peak force*** and the ***number of drops*** follow the same testing protocol. The rope is exposed to a 4.8m fall and with a fall factor of 1.75. Single and twin (double strand) ropes are tested with an 80kg falling mass and a half rope with a 55kg falling mass. During the number of drop test, if the rope breaks at the knot attached to the mass the test is consider invalid and started again. The load must be removed from the rope within 60sec and every consecutive drop must be completed 300sec after. The maximum and minimum standards for dynamic elongation, peak force and number of drops can be seen in table 4.

Table 4: Dynamic elongation, peak force and number of drops.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Maximum Dynamic Elongation in %****(after the first drop)** | **Maximum Peak Force in kN****(during the first drop)** | **Minimum Number of Drops** |
| SingleHalfTwin (double strand) | 404040 | 12812 | 5512 |

For instructional work we’re probably more concerned with resistance to wear and dealing with small fall factors, as leader falls should be less likely. By contrast, for personal climbing weight and the rope’s ability to deal with leader falls are often prime factors to consider. Therefore some of these test are of more interest than others, depending on the intended main purpose for your rope.

**References**

BS EN 564:2014. Mountaineering equipment – Accessory cord –Safety requirements and test methods.

BS EN 566:2017. Mountaineering equipment – Slings – Safety requirements and test methods.

UIAA 109, 2018. Belay Lanyard – Climbing and Mountaineering Equipment

BS EN 12277:2015. Mountaineering equipment – Harnesses – Safety requirements and test methods.

BS EN 892:2012+A1:2016. Mountaineering equipment – Dynamic mountaineering ropes – Safety requirements and test methods.