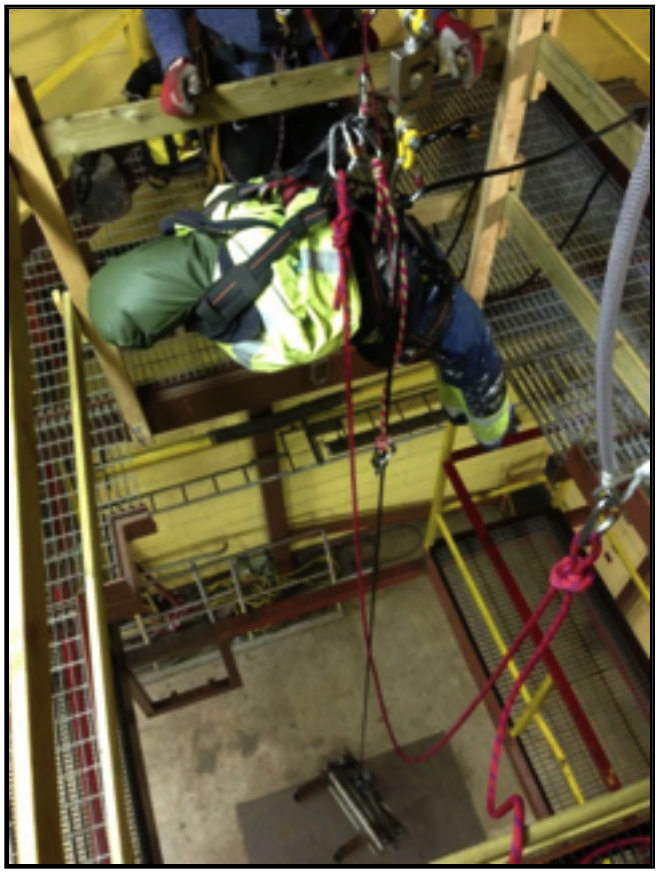
Test of
Back-up tools for rope access
- on a loaded rope.



Test of back-up tools for rope access on loaded ropes.

- Kong -Back-up
- Troll, Yates, ISC -Rocker
- ISC RED
- Petzl Shunt
- Petzl ASAP

At: Scan-Rope, Sweden
On: Thursday, the 13th. of december, 2012.
Done by: BARA;
Tradeassociation of Authorized Rope Access
www.bara.dk
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January, 2013.

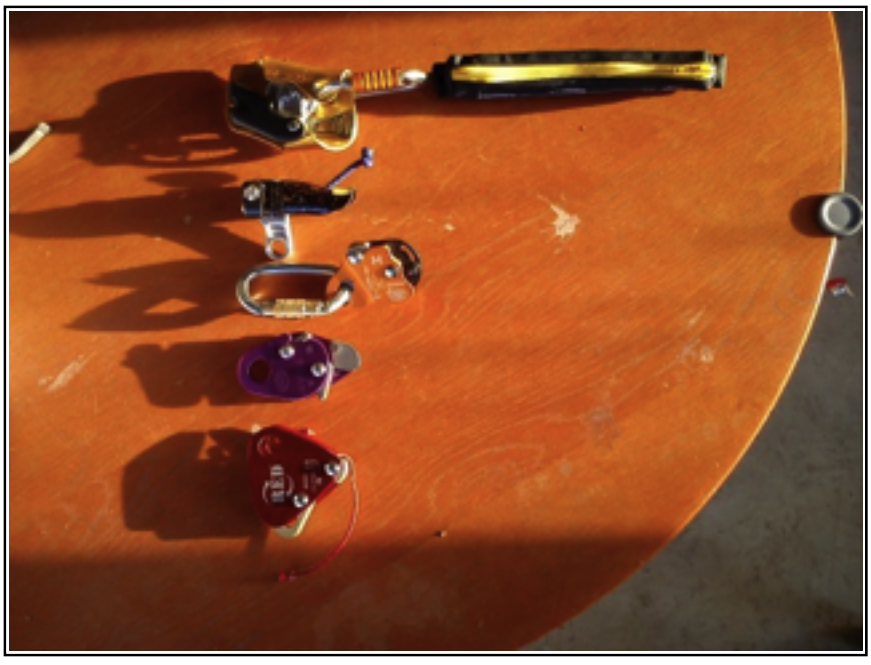
Test of
Back-up tools for rope access on loaded ropes, thursday, the 13th. of december, 2012.

Information:
When: 13th of december, 2013, 10.30 am - 17.30 pm.
Where: Scan-Rope rope access training facility, Hasslarp, Sweden.
Who: BARA-members from
ScanClimb; (www.scanclimb.dk),
Pro Access; (www.proaccess.nu) and
Scan-Rope; (www.scanrope.eu)..

General background:
During the last year, a number of our members in BARA have reported observations and incidents which has led to doubts and even worries, regarding the efficiency of the involved back-up tools for rope access, when the rope, on which the back-up tools were placed, was being loaded with a persons weight (as it would be during a pick-off rescue).

These concerns led to improvised testings on the PRAT®- annual rope access meting and workshops on the 15th and 23rd of november, 2012.
Many of the rope access companies in our tradeassociation had already shifted to or were considering shifting to the Red, as the Shunt no longer seemed an option, hence the letter from Petzl from January 2012 and the letters from the SPRAT Board of Directors from April and June, 2012, so it seemed natural, that the preliminary tests were done on the ISC RED.
The tests showed, that the ISC Red might not hold on a loaded rope.

This led to a decision to do further tests on a variety of back-up tools for rope access under similar condtions (on a rope, loaded with the weight of a person) and these tests were then done on the 13th of december, 2012.
The results are in this report.



Technical background.
Back-up tools for rope access are rarely loaded in daily use.
They are there on the secondary rope to catch the worker, if the primary system fails.
Over the years a number of tests have been made to test the efficiency of back-up tools for rope access in the standard operating mode, where the back-up rope is not loaded. These tests have ben made both with and without a two person load on the rope.
However, during a pick-off rescue, where the rescuer descends down or ascends up to the casualty, the back-up rope of either the rescuer or the casualty is loaded, and the situation is thus quite different, if the main rope fails.

- Some back-up tools rely on being able to twist the rope to lock on the rope.
However, when there is weight on the rope, this kind of back-up devices may not be able to twist the loaded rope and thus may not be able to hold a falling climber.
- Some back-up tools depend on the rope being of a certain diameter.
However, when there is weight on the rope, the effective diameter of the rope usually diminishes, and the back-up device may thus not be able to hold.
- Some tools depend on both.
Pick-off rescues play a major role in all internationally recognised rope access certification systems and thus in most rope access training.

As the safety of back-up devices in the above situations (pick-off rescues) is uncertain, and as we did not know of any other comparative tests of back-up tools on a loaded rope, it seemed to be a good idea to get some data on this.

We thus decided to test a number of the most commonly used and available back-up tools with a 100 kg. weight on the rope.

We tested:
- Kong Back-up,
- Troll/Yates/ISC Rocker,
- ISC Red,
- Petzl Asap
- Petzl Shunt

We were of course well aware of Petzls letter, regarding their withdrawal of the Petzl Shunt as a tool for rope access use from january, 2012.
However, because the Shunt has been and still is so commonly used as a back-up device for rope access, and because, it is being quite difficult for many rope access technicians and -companys t find a proper and safe alternative, we decided to test the Shunt too.

Testdescription:
A Sterling Superstatic 11,2 mm. rope was used as the back-up rope for the back-up device.
A 100 kg. weight (the “rescuer”), was left hanging from the rope, 30cm above the floor, simulating either the weight of the rescuer on the way up to the casualty or the wieght of the casualty with the rescuer being above the casualty.
- An 80 kg. dummy, equipped with a standard rope access harness (the "casualty") and attached to the back-up device from the sternal point, was used to drop onto the back up devices.
- Also a 50 kg. weight was dropped to see, if the back-up tools would hold, if the rope access worker wasn’t as heavy.
A dynamic rope was set up to prevent the falling weight from hitting the floor or the 100 kg weight, if the back-up device failed.
No lanyard was used on neither the Petzl Rocker nor the Kong Back-up.
A 60 cm. dynamic lanyard (11 mm. dynamic rope) was used with the Shunt and the Red.
A new Petzl Absorbica L57 was used for each test with the ASAP.
The back-up-devices were attached to the Sternal point on the harness, either with or without the above connectors.
The drop load was lifted up as high above the attached back-up tools as possible, simulating af fall with Fall Factor 2.
The drop load was tied off in that position with a 5 mm. cord, which was then cut with a knife to create the fall of the dropweight, simulating a failed primary system.
The length of movement/slide of the back-up device was measured from a piece of tape on the rope at the starting point.
The resulting force/load on the the working rope was measured, using a load-cell.

The tools, used were all new (except for one of the Shunts on the extra tests, that we did with that).
Some signs of slight damage was seen on some of the tools, particularly where they were connected to the carabiners. This was evident on the ISC Red, the Kong Back-up and the Petzl ASAP.
More serious damage was seen on the Shunts. After each fall with a Shunt, that Shunt was slightly deformed on the side, where the rope was placed.
It was not easily detected, but compared to a new Shunt, it was clear, that it was deformed/opened more on one side, and it was thus discarded.
And of course all the Petzl Absorbicas, used with the Petzl ASAP, were destroyed and had to be replaced for each new test.

Testresults.

Rope access back-up tools. Droptest on loaded rope.

100 kg on the back up rope	Dropweight: 50 kg.		Dropweight: 80 kg.	
	Drop length cm	Loadcell, load (kg)	Drop length (cm)	Loadcell, load (kg)
Petzl ASAP w. Absorbica L57, FF2	10	351	10	427
Rocker*, no lanyard. Stationary mode, FF2	Fail	449	Fail	416
Rocker*, no lanyard. Selftrailing mode, FF2			Fail	465
Kong Back-up (self-trailing mode). FF2	Fail	335	10	330
Petzl Shunt, 60 cm. lanyard, FF2	50	377	25	351
	30	300	80	314
	Fail	321	85	287
			Fail	368
ISC Red, 60 cm. lanyard, FF2	Fail	304	60	624
			110	719
- Original test (80 kg on back-up rope):				
ISC Red, 60 cm. lanyard, FF2	Fail	-		
	Fail	-		
**Same tool, different trademarks, eg: ISC, Yates or Troll*				

Our conclusions:
We were quite surprised to find, that many of the tools, which are being used widely in the rope access industry, may be unsafe when on a loaded rope (eg. during a pick-off rescue).
This calls for further investigation.

- The Rocker comes with the choice to use it as a sitting device (staying on the rope) or as a self-trailing back-up device, depending on whether or not you slide a plate on the top of it or not.
We tested both versions with 80 kg. weight and even put a carabiner through the hole there to ensure that the locking plate stayed in place. With the 50 kg weight we only tested in the sitting position with a carabiner in the hole, as it failed even in this configuration.
The Rocker failed in all configurations and with all weights and we have to conclude that...
- the Rocker seems to be unsafe for rope access work and for rope access -training and -evaluations/certifications.

- The Kong Back-up also comes with a choice to use it as a sitting device (staying on the rope) or as a self-trailing back-up device. As the sitting version requires a lanyard, and the length of this wasn't specified, we only tested in the self-trailing version.
The Kong Back-up failed, when the weight of the falling person was 50 kg., but it didn't fail, when the weight of the falling person was 80 kg.
Somewhere there seems to be a balance between the load on the rope and the weight of the falling person, and this test wasn't refined enough to pinpoint the details of this balance.
Will it hold, when the falling person weighs 60 kg., 70 kg?
Will it hold, when the rescuer weighs 80 kg and the falling person weighs 50 kg, 60 kg, 70kg?
We do not know.
As you would usually not plan who is going to make a rescue, who you are going to rescue and what the weight of these individuals might be, we concluded that...
- the Kong Back-up in self-trailing mode might be unsafe for rope access work (if a pick-off rescue is in the rescue plan) and for all rope access -training and -evaluations/certifications.
Also it should be noted, that the Kong Back-up, according to the manufacturer, is not allowed with a two-person load (eg. in a rescue).

- The ISC RED failed consistently (both on the tests, done on the previous two tests, done in November (with 80 kg. weight on the rope) and during these tests /with 100 kg. load on the rope), when the weight of the falling person was 50 kg., but it didn't fail, when the weight of the falling person was 80 kg.
However, it created quite high loads (624kg and 719 kg) during falls (the highest in the entire test).
As you would usually not plan who is going to make a rescue, who you are going to rescue and what the weight of these individuals might be, we concluded that...
- the ISC RED might be unsafe for rope access work (if a pick-off rescue is in the rescue plan) and for all rope access -training and -evaluations/certifications.

- The Petzl Shunt showed to be holding rather consistently.
However we did some more testing with the Shunt at the end of the day and to our surprise we found two instances (one with the 50kg dropload and one with the 80 kg. dropload), where it didn't hold.
We are not sure about the reasons for this seemingly inconsistent behaviour. Maybe it was because we did some of the repeated tests with an old, used Shunt. We don't really know at present and we hope to do some more testing with the Shunt.
Our conclusion is that the Petzl Shunt seemed to hold, both with the 50kg and with 80 kg weights, but disturbingly we had one that did not, so until further notice we have to conclude, that...
- the Petzl Shunt may be unsafe for rope access work (if a pick-off rescue is in the rescue plan) and for all rope access -training and -evaluations/certifications.

- The Petzl ASAP showed to be holding consistently on a loaded rope.
In each instance the Petzl Absorbica was zipped somewhat and would have to be changed.
Normally L57 would not be necessary or required for a one person load, but since we do a lot pick-off rescues with two person load during training, we have put the Petzl Absorbica L57 on the ASAP permanently, so we do not have to change it all the time depending on whether or not we have to do a pick-off rescue. So at the test we also used the Petzl Absorbica L57.
Our conclusion is that
- the Petzl ASAP held on a loaded rope.

However, as the ASAP has some other serious issues/problems, the ASAP may unfortunetaly not be the ideal back-up tool for rope access work.
Amongst these issues is its tendency to “fall down the rope” and thus invite to FF2 falls.
Another documented problem is, that wind easily pulls out rope above the ASAP, so that you risk having a back-up tool on a rope, that has a HUGE loop above you, if you are not paying attention to the ASAP.
Yet another issue is the manufacturers requirement for clearance when using the ASAP (which is 4 meters + 10% rope stretch for a one person load and 5 meters + 10% rope stretch for two person loads (rescues)).
This could easily lead to a manufacturer-based requirement of some 16 meters clearance to the ground and thus to having an alternative back-up solution for the last meters.
Anyway, this requirement from the manufacturer by itself basically renders the ASAP useless in most rope access training situations.
Yet another issue is that the ASAP is only approved to ropes between 10,5-13 mm.
This in itself doesn’t allow for much variation. (See later under Discussion).
Finally it might be noted that recent droptestings on the ASAP, done by IRATA in may, 2012, showed that the ASAP ripped the sheath of the rope completely and even ripped two of the inner cords.
Also, the ASAP itself was damaged.

So in conclussion, the only back-up tool that had no problems on loaded rope during our tests was the ASAP.
However, as mentioned, the ASAP has other issues.
So it is quite difficult to point at the perfect back-up tool for rope access work presently.

It is worth noticing, that the possible combinations of rope and tool may play a role in this.
We only had the opportunity to test the tools on one kind of rope, but other brands, materials, constructions etc. may change the outcome of similar tests.
However, as ropes change all the time, we do think that back-up tools should be working on in principle all ropes within the given parameters of ie. diameter.

Discussion.
Many of the above tools may be working perfectly in a standard rope access work situation.
However. If a pick-off rescue might become necessary, this test indicates, that the back-up tool of either the casualty or the rescuer (depending on whether or not the rescuer starts from the top or from below) might not be working as soon as the rescuer gets on the rope.
It is true, that accidents in rope access rarely happens and that a rescue thus is equially rare.
However. If the rescueplan requires a pick-off rescue, it is worth knowing, that this might mean that the back-up tool may not be working during the part of the rescue, where the rescuer is on the same rope as the casualty's back-up device.
The problem of back-up tools potentially not working properly on loaded ropes is particularly relevant for rope access training, where pick-off rescues are performed regularly in every internationally known rope access system.
In a standard rope access training session, pick-off rescues are trained repeatedly, and will certainly have to be demonstrated at the evaluation / certification session.
The above tests show that we should pay attention to how we do pick-off rescues in the future, including which tools we use, when we do them.

The present rope access certification systems all seem to focus on the pick-off rescue as the primary way to do a rescue.
However it might be worth considering if so much focus need to be put on the pick-off rescues in the first place.
It just might make better sense to rethink certification requirements a bit and possibly take away some of the focus which is presently on pick-off rescues and put it on setting up and using lowerable systems instead.
A pick-off rescue requires that the uninjured rescuer puts himself at risk by going down to the casulty and thus exposing him to the same dangers that may have incapacitated the casualty in the first place (eg. wind, sharp edges, hot pipes, CO, insects etc, etc.).
Overall it would of course be much better and not least much faster to lower the injured person to the ground (if possible) instead and thus to teach and train the use of lowerable systems more thoroughly, possibly even at level 1 and 2.
Of course pick-off rescues must still be trained, but proportionally it migh be worth discussing whether pick-off rescues should take up so much time and focus during rope access training as it actually does now, when lowerable systems are hardly taught nor present in the certification requirements, even though they might offer a much safer rescue in possibly 70-90% of all real life rope access situations.
And of course, the problem with rope access back-up tools not working and thus possibly failing during a pick-off rescue during rope access training situations, would then be a lot less serious.

Another relevant discussion, that also might call for further investigation, is the importance of the diameter (and even the construction, for that matter) of the rope for the tools that we use on the ropes.
It seems, that there is no standardized way of measuring the diameter of rope.
At the same time a number of tests have shown, that the diameter plays a major role in the efficiency of all or most of the tools, that we use.
In general, especially the back-up tools seem to work better, when the ropes are thicker.
We have seen ropes from different operators, that are marketed as 11 mm. and 9.2 mm. but where the unloaded 11 mm. rope actually measured thinner than the unloaded 9,2 mm. rope.
This basically means, that you might have chosen a rope, that is marketed with a diameter which lives up to the requirements of the manufacturer of the back-up tool, but in actual life, you might end up with a mismatch, where the requirements of the producer are not met, and the back-up tool may not be working as intented (or at all) for this reason.
That is why we chose a relatively thick rope for the tests.
What would have happened, if the rope was thinner (or of a different material or construction) is uncertain and may suggest, that more testing is required.

Also the rope diameter change, when the rope is loaded.
How much is uncertain and this also depends on how much weight there is on the rope.
Some ropes really get quite thin, when they are loaded. Others do not.
So the effectiveness of the back-up tools might vary a lot, depending on which ropes, they are being used on and how much load is on these ropes.
A suggestion could be, that we set up tests, that we would like the producers to perform and then ask the producers to add the result of these tests to the other information, which a rope us otherwise supplied with.
An idea could be, that the manufacturer tested for and supplied their ropes with information of measured diameter of an unloaded rope, a rope loaded with 50 kg. and a rope, loaded with 100 kg. and possibly even with 200 kg (rescue load).

Also (if anyone has the energy), further tests might be set up to test tools on a variety of ropes.
The problem is, that ropes change all the time, and thus even comprehensive tests would never be able to cover all variations of tools and ropes.
Really we should only use back-up tools which is guaranteed to work on ropes with a wide variety of diameter, eg. ropes with a diameter from 9,5-11,5 mm.
This is particularly true as long as there is no standard on specifying the diamter of a rope.

A final discussion topic.
It might be worth asking the manufacturers of back-up devices to be testing their tools on a rope, tensioned by a certain weight, eg. 100 kg. and then passing on the information about how the back-up tool performed along with the other product information.

Contact and credits:
All participants agreed to help out and put in unpaid time (one full, long day) to set up and perform this test.
We thank everyone involved for their time and effort.

Our purpose with this test was purely to help everyone in the rope access community to better understand their tools and workmethods.

We apologize in advance for any misunderstandings and misspellings etc.
They were not intended.

Please contact us, if you have any corrections, suggestions or comments.

Sincerely

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