Assisted Braking Belay Devices – Advantages, Disadvantages, Differences

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Wherever people are involved, mistakes are made! This is the reason why the German Alpine Club recommends assisted braking belay devices. When handled correctly any belay devices – manual devices and assisted braking belay devices - may prevent the climber from falling to the ground (provided that the climber does not clip too high above or skip quickdraws near the ground). But: When using tube, Munter hitch or figure eight, a belaying mistake will more easily lead to a fall to the ground than when using an assisted braking belay device which reduces the hand strength required to a minimum as it pinches the rope in case of a fall. When lowering, the device may thus be controlled and assisted braking may be annulled in a well-dosed manner.

How effective is this much discussed safety cushion? What are the individual strengths and weaknesses of the different assisted braking belay devices? What are their differences in detail? Are the new devices better than the old ones? Questions which currently haunt the climbing scene.

We thus took a closer look at the most common assisted braking devices, namely Click Up, Grigri2, Mega Jul and Smart, as well as the devices Ergo (Salewa), Jul^2 (Edelrid), and Matik (Camp) which were only recently put on the market. We focused on their handling when giving out rope and lowering, on how big the safety buffer if one makes the mistake of not controlling the rope with the braking hand, what role the position of the braking hand plays, and on typical handling mistakes. The resulting assessment relates to their application in single pitch climbing using a single rope and belaying off the harness (body belay).

No advantage without a disadvantage

Assisted braking obviously also involves disadvantages: handling the assisted braking belay devices is more complicated than with manual belay devices. In order to give out rope from the belay device quickly, safely, and easily without the device blocking the rope, more or less complex movements are required (e.g. th so-called “Gaswerk-Method” for the Grigri). This is at the expense of safety: If handling is complex, handling mistakes causing accidents are more probable. Belaying precisely and without much slack – very important near the ground – is also made more difficult by complex handling. Furthermore, assisted braking has to be put out of force at the belay device for lowering – manufacturers have developed different solutions here. All assisted braking belay devices are thus a tradeoff between easy handling on the one hand and wide safety margins on the other hand. This tradeoff is implemented differently depending on the assisted braking belay device. It is up to the user – considering the intended application, his or her personal belaying competence and level of training – to choose his or her optimum belay device!

Test criteria

The used rope (**rope diameter**, rigidity and surface characteristics) plays an important role with all evaluated assisted braking belay devices. Using thick, frayed ropes impairs handling characteristics for any devices when giving out rope. In particular for the Matik, for which Camp recommends a rope diameter from 8.6 mm to 9.6 mm, our results confirmed that the device is exclusively determined for thin ropes.

When considering **movement patterns** for paying out and taking in rope and the **dependency on the position of the brake hand** it makes sense to classify the assisted braking belay devices according to two functional principles:

a) Assisted braking belay devices which are independent of the position of the brake hand like the Grigri2 or the Matik, as well as the Eddy (Edelrid) and Cinch (Trango) which are not listed here (according to EN 15151-1 approved as „Braking devices with manually assisted locking“). The blocking mechanism of said assisted braking belay devices is based on a pinching mechanism within the device. For giving out and taking in rope, tube handling is safest (Fig. 1). For triggering the blocking mechanism these devices require – if no controlling hand is on the rope – a triggering impulse or tug. Such an impulse is not only given in case of a fall but possibly also when paying out rope quickly. Thus, the belayer in this case has to master a special complex handling method (Figs 2 and 3). In particular belaying near the ground is demanding here, where a quick change between giving out and taking in rope is important in order to avoid large amounts of slack rope.

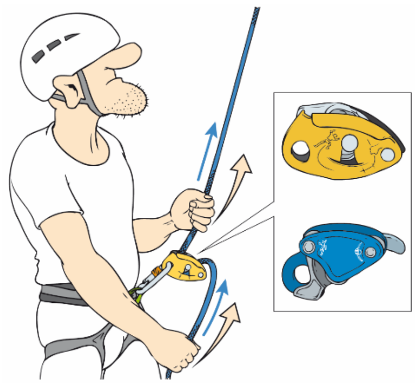

Fig. 1: Tube handling with the Grigri2 and the Matik – the safest operating method for this kind of belay device

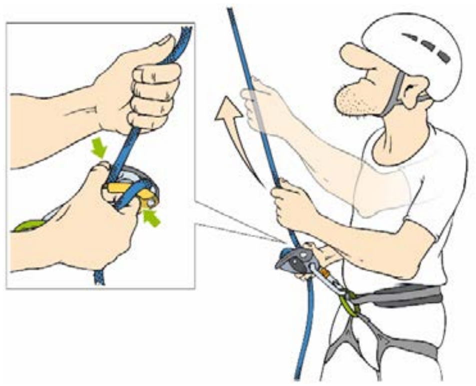

Fig. 2: The "Gaswerk-Technique" for quickly giving out rope using the Grigri

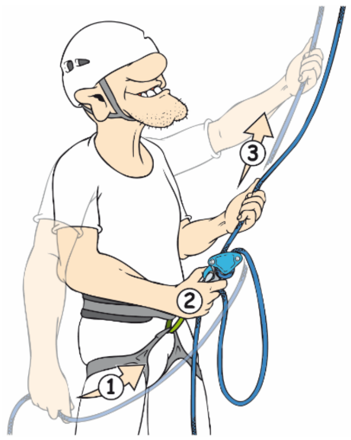

Fig. 3: „Pistol Grip Technique" for quickly giving out rope in case of the Matik

b) Assisted braking belay devices wherein functioning does depend on the position of the brake hand and wherein assisted braking is caused by pinching the rope between the carabiner and the device (according to En 15151-2 approved as „*Manual braking devices “*): Ergo, Mega Jul, Jul^2 and Smart are to be classified into this category of assisted braking belay devices („auto-tubes“ or „hybrid devices“ or „assisted tubes“). Assisted braking is already triggered by a slight pull of the rope. It thus has to be neutralized for quickly paying out rope, but the movement pattern here is motorically less demanding than for the assisted braking belay devices of the above category (Grigri, Matik) (see Fig. 4). Also the Click Up counts among this category of assisted braking belay devices, but here the basic pattern of handling exactly corresponds to tube handling. For giving out rope with the Click Up, the assisted braking function only has to be undone when the device is blocked by a fall, by the climber taking a break or false response – without the controlling hand leaving the rope, of course!
As it is the carabiner which causes the pinching effect with all assisted braking belay devices of this category, always a **dependency on the carabiner** is given. With some devices, a combination with unsuitable carabiners may even disable the function of assisted braking („strong“ dependency on the carabiner). Some manufacturers take account of this fact by selling their device as a set including the carabiner – according to our opinion the best solution, as this way fatal combinations of belay device and carabiner may be excluded.

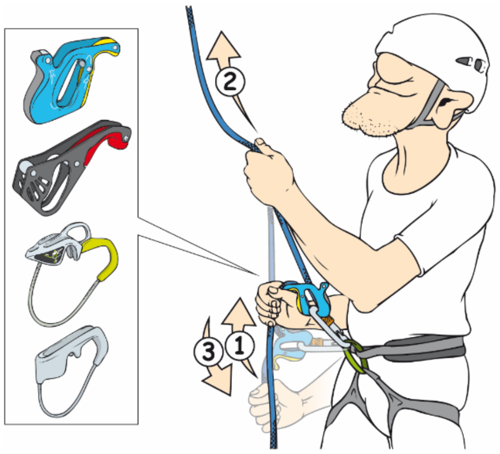

Fig. 4: Paying out and taking in rope using Ergo, MegaJul, Jul^2 and Smart

We had the South German Association for Technical Inspection TÜV determine the quasi-static **brake forces** of all tested devices. For this purpose, the assisted braking belay device was first brought into the blocking mode and the brake force of the device was then measured without a hand holding the rope. As the brake force obviously depends on the rope diameter and surface characteristics, for reasons of comparability of the results all devices were tested using the same type of rope (rope diameter 8.9mm). Furthermore, the brake forces for the largest and smallest approved rope diameter were determined to demonstrate a dependency of the brake force on the rope diameter. The results among others explain the limited safety cushion of some auto-tubes in case no controlling hand is kept on the rope (violation of the „brake hand principle“), in particular in combination with thin ropes.

In particular when paying out rope quickly, the belayer has to actively undo the assisted braking function of the belay device. For this reason it was important for us to test the safety margin of the devices regarding the special scenario of a **fall when giving out rope**. A fall at that moment consequently places high demands both on the reaction of the belayer and on the probability of a reflexive mishandling of the device. We thus tried out in fall tests how easy it is to erroneously undo the assisted braking function given a correct handling of the device.

As a further criterion we examined how large the safety buffer is **in case no controlling hand is kept on the rope** (e.g. when the belayer is hit by a stone or lets go of the rope due to a defensive reflex trying to prevent crashing into the wall, etc.) Attention: This criterion is merely an assessment of the safety reserve! The „brake hand principle“ has to be adhered to by the belayer at any time! There are scenarios possible also with assisted braking belay devices where the fall of a climber ends up on the ground if the belayer does not hold on to the rope! For this reason, the devices were tested in two borderline cases: a fall below the top anchor with a falling mass of 55kg involving high rope friction for testing the response in case of a soft fall without a major „jerk“, and a hard fall above an intermediate protection/bolt with a falling mass of 80kg and involving little rope friction. It was tested here, whether the brake force of the device is sufficiently large to reliably stop the hard fall. In case of a failure of a device in one of these extreme cases we additionally tested interim scenarios to be able to make a differentiated assessment.

With respect to handling, apart from paying out rope, **lowering** is an important aspect. In climbing gyms operated by the German Alpine Club, in the period from 2012 to 2014, 20% of all falls to the ground which required an emergency ambulance occurred during lowering! Representing 50% of the accident cases assisted braking belay devices are involved disproportionately (approx. 40%) in their increase. Assessment criteria are a) how easily may deblocking be controlled, b) may the lowering speed be controlled continuously and c) are human reflexes considered accordingly (e.g. panic function). In this respect, two scenarios were tested. First, we rapelled using each device on a single strand rope to simulate lowering a heavy climber in top rope. Then a weight of 55 kg was lowered involving high rope friction.

We have extensive information on device-dependent **typical operating mistakes** available from reported accidents and different studies regarding belaying performance in climbing gyms. Interesting results in this respect are listed at the end of the table.