

# Lifesaver

## 10 TOURNIQUETS IN A PRACTICAL TEST FROM THE EXPERTS

*Tourniquets are back in the spotlight: they save lives during road accidents, in mountains or in military conflicts, if you know how to use them. To help you navigate the market, we involved three experts from Critical Knowledge, who tested the popular tourniquets "TQs" for Ranger Magazin in terms of their usability.*



**T**ourniquets have been accompanying humanity for thousands of years. One of the oldest evidences of their use is registered in Indian records, which are more than 2,500 years old. Since then, we have found mentions of devices that prevent massive blood loss in case of serious limb injuries in almost every civilian and, in particular, military scenario until 1970-1980.

In the post-Vietnam War period, amid fears of complications due to improper use, a debate has emerged on whether the use of tourniquets for a wide range of soldiers and civilians was a blessing or a curse. It was only after analyzing the operations of American special forces for about 10 years that the conclusion was reached: tourniquets should be used, as they are today in Ukraine. In recent years, civilian medicine has also begun to actively implement them.

### Functions and application

How exactly does a tourniquet work? A limb tourniquet, also known as a hemostatic tourniquet, is a device for compressing blood vessels by applying pressure to soft tissues, in order to temporarily stop venous and especially arterial blood flow in the affected limb and thus stop bleeding. The tourniquet is applied as high as possible or approximately 5-7 centimeters above the wound and tightened firmly.

Further, in most models (in our testing, all except the models 2 and 9) pressure on the soft tissues is applied by rotating the windlass rod, which directly tightens the tourniquet ring. This creates the necessary pressure on the tissues

and, consequently, on the blood vessels until the blood flow stops. After that, the windlass rod is "parked" in the appropriate holder. The excess band is fixed and the time of the tourniquet application is recorded.

The other two models in the test series are applied to the limb either using a predefined wrapping technique (the model 9) or a mechanical tensioning device that resembles the buckle mechanism of a ski boot or binding (the model 2) to achieve the desired level of tension.

### Is it only for professionals?

Since human life is the highest legally protected value, in emergency situations in Austria even non-professionals are legally obliged to provide first aid. Failure to provide such assistance is considered a criminal offense.

Whether the specific actions performed as part of first aid comply with the legal regulations or exceed them depends on the knowledge and skills that the person providing the aid has acquired in advance. Incorrect or excessive first aid may cause additional injuries and, accordingly, be a reason for prosecution. Therefore, the choice of means must be evaluated and used on the basis of a sufficient level of training. Without appropriate action, such as applying a tourniquet, life-threatening bleeding from a limb can become fatal within five minutes.

### Materials

The ancient Romans used leather and bronze for their primitive occlusion systems, while polymers or aircraft-grade metal are used in modern tourniquets. Depending on the area of use, there are variations in materials, operating principles, and product dimensions. We always recommend purchasing an additional tourniquet for regular trainings to keep the "combat" tourniquet for real-life situations.



**TEST TEAM - JOHANNES KOUBA (ON THE BIG PICTURE) - NATO SPECIAL OPERATIONS COMBAT MEDIC (NSOCM), AMBULANCE AND FIRE-FIGHTING SERVICE PARAMEDIC. AS A FOUNDER OF CRITICAL KNOWLEDGE AUSTRIA, HE OFFERS INDIVIDUALLY DEVELOPED TRAININGS FOR CIVILIANS, HUNTERS, SPORT SHOOTERS, REPRESENTATIVES OF GOVERNMENT AGENCIES, COMPANIES AND LARGE-SCALE INDUSTRIES. HE LED OUR EXTENSIVE COMPARATIVE TESTING OF THE TOURNIQUETS. HE WAS ASSISTED BY TWO MEMBERS OF HIS TEAM WHO DID NOT WANT TO BE SHOWN ON THE PHOTOS BECAUSE OF THEIR SERVICE IN THE AUSTRIAN SECURITY FORCES.**

# THIS IS HOW *the test* WE CONDUCTED

The task of the Critical Knowledge team, consisting of civilian paramedics and combat medics, was to offer assistance in choosing a tourniquet for both non-professionals and professional users if necessary to provide aid to teenagers or adults.

We tested ten tourniquets available in Europe. Among them there are models recommended by the Committee on Tactical Combat Casualty Care (CoTCCC) - the leading institution for developing recommendations for treating battlefield injuries (the models 3, 5, 6, and 7), relatively new developments (the

models 2 and 10), and a tourniquet that was purchased at a low price from a large retailer (the model 1). It should be noted that all the test participants have been using CAT and SOF tourniquets in their official activities for over 10 years. With the exception of one tourniquet (TQ Dnipro, the model 10), all others were purchased privately. Since this product appeared on the market not so long ago, and currently its distribution is mainly concentrated in Ukraine, we contacted the manufacturer for test samples, which they kindly provided.

Hereafter we will try to conduct additional tests and provide results online for models that are mainly presented on the American market and are currently difficult to access in Europe.

The testing was aimed more at practical application, rather than testing in laboratory conditions. In order to obtain objective results, the presence or absence of blood circulation in each limb was determined using a Doppler ultrasound device. Also the study participants independently documented any features of each tourniquet in a special evaluation form.

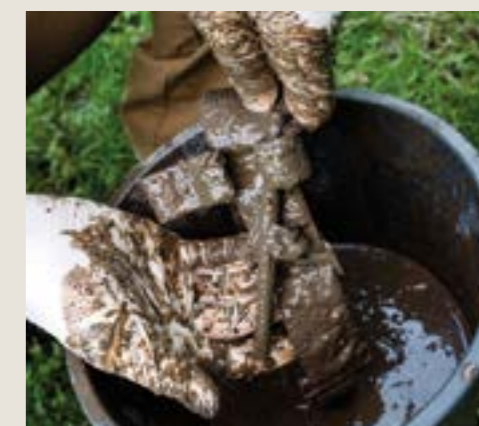
To determine the effects of low temperatures, the tourniquets were kept for 14 hours at a temperature of -24 ° C, after which they were tested.

To determine the effects of high temperatures, the tourniquets were kept at a temperature of 50 ° C for one hour before use.

The efficiency in conditions of heavy contamination was checked by immersing the tourniquets without original packaging in a bucket of mud, after which they were immediately used.

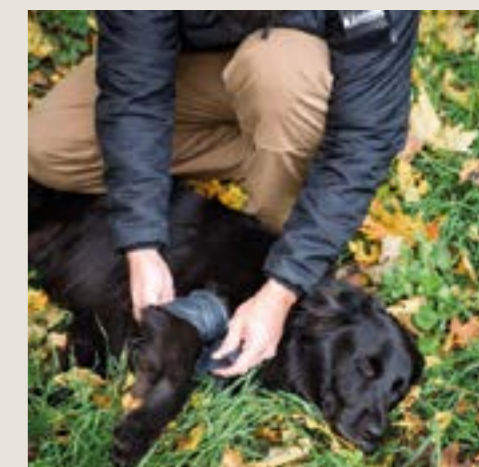
Also the study could not be complete and realistic without examining the possibility of effectively applying the tourniquets with hands in winter gloves and on a thick layer of outerwear (long underwear, trousers and sweater, Carinthia HIG 4.0 and MIG 4.0 jacket).

The other two models in the test series are applied to the limb either by wrapping it (the model 9) or by using a mechanical tensioning device that resembles the buckle mechanism of a ski boot (the model 2) to achieve the desired level of tension.



**IN PRACTICE** applying tourniquets on clothing and in tactical gloves is the most common scenario in real conditions, and dirt cannot be excluded either (the photo above, on the right). Reliable fixation of the remaining band in the CAT type tourniquets (the model 3) is always performed in the same way (the photo below: Rhino Gen2).

The Doppler device clearly confirms the effectiveness of stopping blood flow (the photo below, on the left). On thin limbs, the SWAT-T tourniquet performs its task well (the photo on the right), while applying it on a thick layer of winter clothing requires considerable efforts (the photo below, on the right).



**HARD TEST** - the Critical Knowledge team didn't spare the tourniquets (the photo above). During the day, about 40 "combat" applications were made, which were quite painful (the photo on the left). The high flexibility of the windlass rod and the very soft material of the internal sling demonstrated the poor quality of the Replika Tourniquets purchased from a large retailer (the photo below).



# TEST RESULTS

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RANGER MAGAZIN #2,  
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AUTHOR:  
JOHANNES KOUBA/  
CRITICAL KNOWLEDGE

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**REPLIKA TOURNIQUET**  
It is offered by large retailers as a cheap alternative to the CAT Gen7. However, compared to the original, a softer and thinner material was used. The internal sling, which provides pressure on the limb by rotating the windlass rod, is less rigid and longer than in the original. Therefore, it takes significantly more turns to create the necessary tension and pressure compared to the original. For example, during the test with thick clothing, the original CAT Gen7 (the model 3) required 4 turns to stop the blood flow, while the Replika required 11 turns. This clearly demonstrates the low quality of the materials used in the Replika tourniquet. The windlass rod bends so much that it looks like it is about to break. The flap tape for indicating the application time is only stuck, not rigidly fixed, which can lead to its loss both as a platform for indicating the time and as an element for fixing the rest of the tourniquet band. As in the original, when tightening the tourniquet ring, the skin may be pinched, which can cause discomfort.

**RAPIDSTOP-TOURNIQUET**  
is made of high-quality components. The tourniquet ring tightening device resembles a snowboard binding and consists of plastic and metal parts. After firmly tightening the first round, the pressure is then increased by a mechanism similar to a rack ratchet. To loosen or remove the tightened tourniquet, there is a small hook under the main buckle that unlocks the mechanism. However, this can be difficult in terms of coordination, especially during self-application to the upper limb if the ring tightening device itself is out of sight. Among the advantages of this innovative product are the absence of skin pinching and the low effort required to tighten the mechanism.

**COMBAT APPLICATION TOURNIQUET GENERATION 7 (CAT GEN7)**, is probably the best known in German-speaking countries and America. Due to its lightweight but robust construction, it has been successfully used for many years by the test team members both in domestic and foreign missions. In addition to this test, the tourniquet has also been successfully tested in Arctic training conditions in Canada and in hot climates in Africa. No team member has yet experienced this tourniquet failure due to component damage. During the test, it also ensured stopping the blood flow in all conditions. Among the great advantages is the thick polymer windlass rod, which adds strength to the product. However, the disadvantage is that the skin is often pinched in the buckle during tightening, which can cause severe pain and lead to the formation of hematomas.

**RHINO RESCUE GEN.2 TOURNIQUET ALUMINIUM** is almost identical in design to the CAT Gen7 (the model 3). Notable differences, besides color, include:

- a metal windlass rod;
- a flap tape for indicating the time of application with a marked area for documentation using a ballpoint pen built into the windlass rod;
- a coarser Velcro pile on the C-shaped clip of the windlass rod.

Otherwise, due to its almost identical design to the CAT Gen7, it has the same advantages and disadvantages.

**TACTICAL MECHANICAL TOURNIQUET (TMT)** looks like a hybrid of the CAT Gen7 (the model 3) and the SOF-Tourniquet (the model 7). All rigid parts are made of very soft plastic, and the windlass rod is quite smooth and relatively thin, which makes it difficult to control when twisting, especially in wet conditions. One of the testers found that during self-application to the upper limb it was impossible to secure the windlass rod due to its excessive deformation. The tourniquet requires double threading of the band into the buckle, and there is a risk of accidental release from the plastic fasteners, which can cause the same problems as those recorded with the SOF-Tourniquet. Among the advantages, it should be noted one of the widest bands (along with the SWAT-T, the model 9), which reduces point pressure on soft tissues.

**EXTREMITY TOURNIQUET SAM XT** has a design similar to the CAT Gen7 (the model 3), but is made of stronger component materials:

- a metal windlass rod connected to the tension band using rivets;
- a clasp similar to the SAM Pelvic Sling that works when a certain tension force is reached on the tourniquet band, so that the clips hold the band even if the Velcro tears, for example, when lifting or crawling.

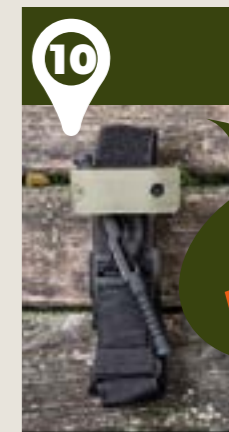
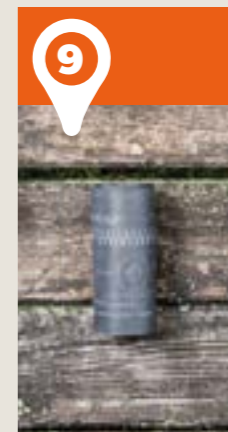
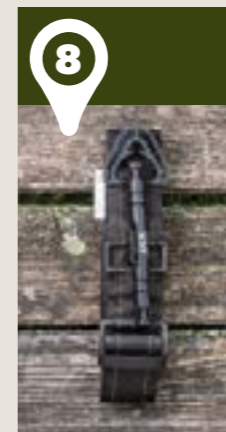
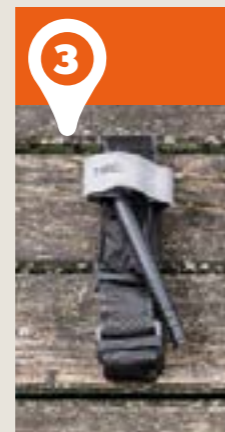
The opening of a fixed mechanism requires some practice, especially when applied as part of self-aid. The clasp worked properly and never jammed. However, it is worth noting that this product has the highest potential for skin pinching of any of the tourniquets tested, which can lead to unnecessary pain and hematomas.

**SOF-TOURNIQUET GEN4** has a metal windlass rod and a metal buckle for securing the band, as well as a polymer intermediate C-shaped clip and a polymer triangle for securing the windlass rod. The materials of the other components also look high-quality. There is a small gap on the tourniquet band label to record the time of application. The clip has been improved compared to the previous version, but it can still cause problems for less trained users in stressful situations. Another note: this product should only be used with double threading of the tourniquet band into the buckle, which makes it difficult to self-apply the tourniquet to the upper limb. To make it easier, you can press the upper part of the arm with the tourniquet applied against a hard surface or your body to tighten the first round. The excess band is wrapped around the tourniquet and fixed.

**SICH-TOURNIQUET** resembles the CAT Gen7 (the model 3), but has a stronger band and a different Velcro design. We especially liked that the buckle for connecting the tourniquet into a ring, the triangle for fixing the windlass rod and the windlass rod itself were made of metal. The band has a small field for recording the time, which can be filled in with a pen or scratched with a sharp metal object. The band tip is stitched, which makes it easy to work with it even with gloves and in stressful conditions. This tourniquet can be used both with the tourniquet band threaded into one slot of the buckle and into both slots. However, for self-application to the upper limb, double threading can be very difficult or even impossible, so this should be taken into account when preparing to use the tourniquet.

**SWAT-T TOURNIQUET (Stretch-Wrap-And-Tuck)** is a further development of the Esmarch bandage from the 19th century and resembles a manipulation tape. It is applied to the limb using the developed wrapping technique and is fixed on itself. The tourniquet has printed markers indicating the optimal tension force. This tourniquet has no restrictions on limb diameter, which allows it to be used on dogs (K9) or children. It also has a wide contact surface that is gentle for soft tissues. However, there is no special field for recording the time of application. This tourniquet performed its function on the upper limb, but when applied to the lower limb over trousers it didn't work in several cases, and also failed to perform its function when applied over winter clothing. The main problem is that under stress, if the tourniquet slips out of your hands, you need to completely re-roll it to apply it again, or try to use the rest of the band. Under these conditions, we recommend this tourniquet not as a universal one, but rather for cases where you need to work with thin limbs.

**TQ DNIPRO** looks and feels more solid than some of the previously described products. In particular, the coarse ribbed windlass rod and the ergonomically shaped metal connecting buckle. This product is also well-designed in the details: the flap tape for indicating the application time is securely fastened and has a hole, probably so that it can be found in poor lighting conditions. The tip of the tourniquet band is securely stitched, which makes it easier to separate it from the Velcro. Moreover, most testers didn't feel any painful pinching of the skin, or it was insignificant. Overall, this tourniquet received the highest marks in the tests due to its robust construction and stable performance indicators.



**TEST WINNER**

Product	Replika Tourniquet	RapidStop-Tourniquet	Combat Application Gen7	Gen. 2 Metal Tourniquet	Tactical Tourniquet (TMT)	SAM XT Tourniquet	SOF-Tourniquet Gen4	SICH-Tourniquet	SWAT-T Tourniquet	TQ Dnipro	Product
Manufacturer	No-Name-Produkt	RapidStop	CAT Resources	Rhino Rescue	Combat Medical	SAM Medical	TacMed	SICH	Combat Medical	TQ Dnipro	Manufacturer
Price	around 10 Euro	around 50 Euro	around 35 Euro	around 15 Euro	around 30 Euro	around 45 Euro	around 45 Euro	around 40 Euro	around 20 Euro	around 35 Euro	Price
Source / Manufacturer	amazon.at	rapid-stop.com/at/	combattourniquet.com	rhinorescuestore.com/en-at	combatmedical.com	sammedical.com	tacmedsolutions.com	sicheurope.com	combatmedical.com	tqdnprio.com	Source / Manufacturer

Testing and evaluation*											Testing and evaluation*
Tactile sensations and appearance	5	11	12	9	6	12	13	11	5	15	Tactile sensations and appearance
Self-aid (the upper limb)	6	9	13	12	7	10	7	10	4	13	Self-aid (the upper limb)
Self-aid (the lower limb)	7	10	13	13	7	12	12	10	5	14	Self-aid (the lower limb)
Mutual aid (the upper limb)	7	11	13	13	8	12	13	10	6	13	Mutual aid (the upper limb)
Mutual aid (the lower limb)	7	11	13	13	8	12	13	10	6	13	Mutual aid (the lower limb)
Gloves	7	7	12	11	5	10	10	8	4	12	Gloves
Training intensity	10	7	12	12	10	10	8	10	6	12	Training intensity
Total number of points	49	66	88	83	51	78	76	69	36	92	Total number of points
Rating in the test	9. Place	7. Place	2. Place	3. Place	8. Place	4. Place	5. Place	6. Place	10. Place	1. Place	Rating in the test

\*Self-aid (the upper limbs), Self-aid (the lower limbs), Mutual aid (the upper limbs), Mutual aid (the lower limbs), Gloves

= Application with gloves, Training intensity = Can a tourniquet be used without much practice? In each category of the testing, 15 points could be scored = 105 points in total.