PASSIVE PROTECTION

a guide for climbers and mountaineers

PHOTO: BMC

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PASSIVE PROTECTION

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INTRODUCTION

'He went for it, snatching the creaking flake above, the crucial stopper 1 in his mouth. In the failing light he couldn't locate the placement. In extremis, he screamed, "You've let me down Dave you bastard, you've let me down." Like some TV game, macabre in concept, I played with Johnny's life, and talked his hand to the small hole for the runner.'

Dave Towse recalling John Readhead's first ascent of Margins of the Mind, taken from Paul William's legendary 1988 Climbers' Club guide to Clogwyn Du'r Arddu.

The novice nervously psyching up for their first trad lead. The elite climber relaxing in preparation for the next challenging headpoint or on-sight. The weekend warrior racking up eagerly as they squeeze in one last route before heading back home to the city, work and that other life. For each and every one, passive protection forms the essential backbone of their equipment for traditional climbing. Understanding how to use this equipment is therefore a prerequisite for a long and rewarding trad climbing career.

There are many different names used for the various types and forms of passive protection - wires, nuts, chocks and hexentrics to name but a few. What all of these have in common is that they are placed by the climber into cracks and crevices in the rock. They can be used as runners to protect a climber leading up a route, or as anchors to create a solid attachment point or belay, usually at the top or part-way up a longer climb.

Coming in an array of different shapes and sizes, passive protection is differentiated from camming devices by having no moving parts. Their simplicity makes them relatively intuitive to use, and although individual pieces fit fewer placements than an equivalent camming device, this is offset by the fact that a larger number can be carried for the equivalent weight and bulk. In addition, some cracks and rock types are better suited to passive protection than to camming devices.

TYPES OF PASSIVE PROTECTION

PHOTO: BMC

Rack of passive pro.

TYPES OF PASSIVE PROTECTION

NUTS

Nuts are wedge shaped pieces of metal, and rely on a narrowing or taper in a crack to be held in place. Other names sometimes used are wires, stoppers or chocks. Usually the nut is connected to a loop of wire so that a karabiner or quickdraw can be clipped into it, although it is possible for larger nuts to use a cord or tape loop instead. Some form of colour coding or numbering is usual to help differentiate between sizes.

The geometry used in modern nuts generally allows several different orientations to be possible when attempting to place them in a crack. One of the key skills for the trad climber is to be able to look at the rock, identify possible placements for nuts, and then choose and deploy the best fitting nut to give the safest and most secure piece of protection; more on this later. In terms of the shapes used, these fall into two basic categories - curved and offset. Some rock types and placements lend themselves better to one type than the other, but in general curved nuts form a good base onto which to add offsets when building up a "rack" of equipment.


Curved nut, standard placement.

PHOTO: BMC

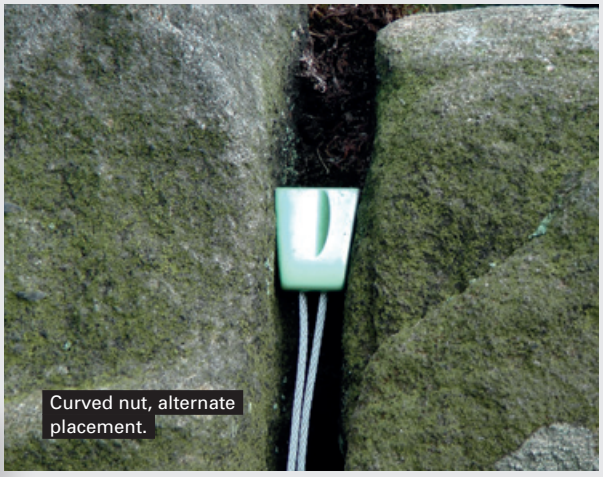
Curved nut, alternate placement.

PHOTO: BMC


Offset nut placement.

PHOTO: BMC

MICRO NUTS

Micro nuts are small versions of nuts, sometimes called micro wires or RPs. They come into their own as routes get harder and the available cracks smaller and thinner. Materials and construction vary - some are scaled down models of their larger cousins, others use distinctive features to provide maximum strength in the smallest sizes. An important thing to note for all protection, especially with the smaller sizes, is that this strength may not be enough in all circumstances. We'll cover this in more detail later, but suffice to say, don't expect a micro nut to necessarily hold a hard fall even if perfectly placed. For this reason they are often described as marginal protection.

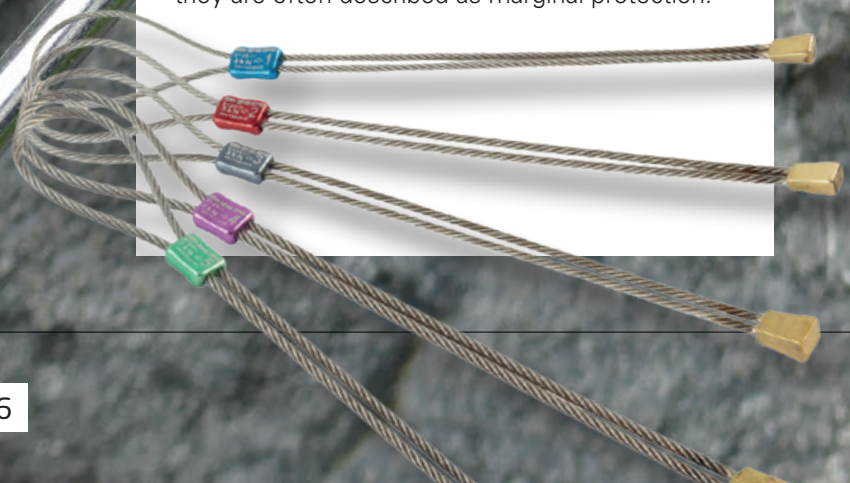

PHOTO: DMM

Micro nut placement.

PHOTO: BMC

CAMMING NUTS

Distinct from the normal wedging action of nuts, some nuts are designed to pivot and provide a camming action. Since the development of smaller and narrower camming devices, these have largely fallen from favour. In some situations, they still excel - the very narrow profile means they are often the only secure protection which will fit into limestone pockets or the shot holes found in quarried rock. They also hold better in icy and dirty rock than camming devices as they tend to stay in position once tugged in place and "set", which makes them a good choice for winter mixed climbing and alpinism.

PHOTO: BMC

PHOTO: BMC

HEXAGONAL NUTS

Hexagonal nuts can be either wedged or used like a camming nut due to the clever offset shaping of the six sides. The most useful sizes cover larger crack sizes than do standard nuts. Slower and trickier to place than camming devices, similarly to camming nuts they have become less popular for general usage. In winter they can be placed in icy or snow-filled cracks, providing reassuring protection in an otherwise hostile environment.

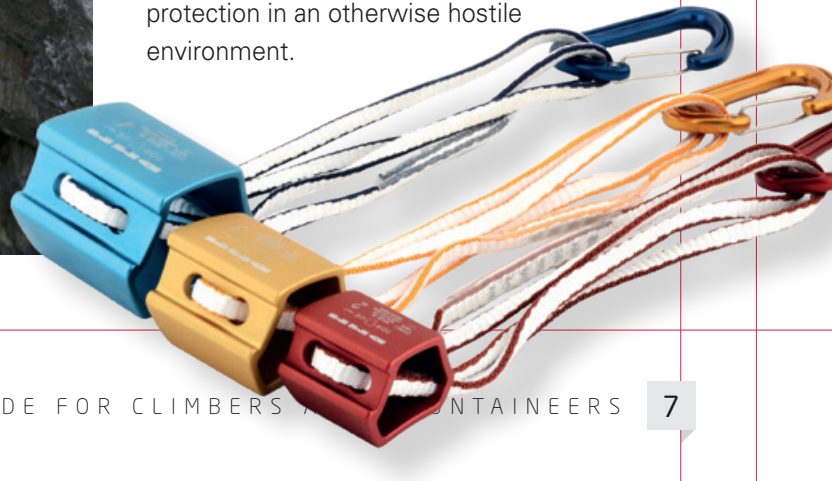

PHOTO: DMM

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USING PASSIVE PROTECTION

PHOTO: LUCY HAM

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USING PASSIVE PROTECTION

Rock quality is even more important for tiny pro.

PHOTO: BMC

BASIC PRINCIPLES

As mentioned earlier, the different types of nut allow a variety of different placement opportunities, using either a wedging or camming principle. As well as becoming familiar with the various possibilities offered, placing good passive protection involves learning to apply the following basic principles:

- **Poor rock equals a poor placement** - avoid friable or shattered rock when looking for placements. Check the soundness of any placements made behind flakes or blocks.
- **Account for rock strength** - a placement too close to the outside of a crack may break the rock away under load. The softer the rock, the more cautious you must be in this regard.
- **Seat well and check stability** - a good firm tug in the direction of the anticipated load helps seat a placement. Check for stability, is the piece firmly held in position or does it move around?
- **Smaller gear means higher loads on the rock** - a smaller contact area means higher stress on the rock, so take extra care with rock quality and try to ensure there is maximum contact between the nut and the rock.
- **Consider the direction of load** - any placement should be pulled more securely into position by the load applied by a fall, rather than lifted out.

Curve nut contact points.

PHOTO: BMC

Hex camming action.

PHOTO: BMC

WHEN TO USE DIFFERENT NUT TYPES

The shape of curved nuts is cleverly designed so that when placed in a smoothly tapering crack, there are three points of contact. This helps securely lock the nut in position, providing stability and preventing the nut from moving. This security is one reason why curved nuts are the go-to choice for most passive protection placements.

Offset nuts are often useful when normal curved nuts won't fit securely - the classic example being in the flared placements commonly found in peg-scarred cracks. They also have their devotees for use on angular rock such as slate and some volcanic rock types.

Camming placements are possible with camming nuts and hexagonal nuts. This allows them to function in parallel-sided placements where there is no chance of a wedge action holding. The action relies on the nut rotating as the load is applied. These passive camming placements are often more secure on low friction rock such as polished limestone than their camming device counterparts.

EXTENDING AND POSITIONING

It is vitally important to adequately extend any passive protection which is placed as a runner. Failure to do so may result in annoying rope drag when the leader is further up the route. In addition, this drag causes higher forces on the top runner in the event of the fall, because friction prevents the full elasticity of the rope from being engaged. Rope drag makes it more likely for critical runners to fail.

Furthermore, sharp angles in the rope path can lead to upwards or sideways forces on the runner which can cause it to lift out of position. Prevent this by using quickdraws or slings of a suitable length to allow as straight a rope path as possible. A belayer stood back from the rock face can also cause problems, known as the "unzipping" effect where runners lift out from the bottom upwards as the rope tightens during a fall.

Linking multiple placements together is an advanced technique which can be used where one placement on its own might be pulled out because of the direction of loading. This method allows some shallow horizontal cracks to be used for placements, or can help prevent unzipping when the belayer can't move in closer for any reason.

Tight bend in the rope causes rope drag and lifting of pro.

PHOTO: BMC

Extending pro reduces drag and lifting.

PHOTO: BMC

Good practice - belaying close in.

PHOTO: BMC

REMOVING GEAR

Placing protection is only half of the task - the second also has to remove it. This in itself is a skill which can only really be learnt through practice. A few tips can help. First, always carry a nut tool to aid removal. A gentle upwards tap will usually free a nut and enable its removal. Some placements may need a bit of guidance from the leader to assist removal - such as 'it went in from the left' - but for the really stubborn ones you may need to hang on the rope and get to work with both hands! Keep gear clipped to the rope during removal to avoid dropping it when you free it.

The second's life is easier with a nut tool.

PHOTO: BMC

WINTER CLIMBING

For winter climbing, good rock protection is usually more reliable than snow and ice protection. This can often require digging away snow and cleaning out cracks to find placements. Camming devices don't tend to hold securely in icy or dirty cracks, so using passive protection becomes the prevailing method for protecting the climber, particularly during winter mixed climbing. Gentle use of the ice tools to help seat larger nuts is often useful to help secure critical placements, as is scraping off as much ice as possible from inside cracks before placing gear.

STRENGTH OF PROTECTION

When a climber falls off or rests on a piece of protection, one of three things can happen. Most commonly, the protection will hold. Sometimes the protection will fail, by breaking free from its placement. Very rarely the piece of protection will fail as a result of it breaking structurally. We can see why if we look at the strengths of passive protection.

The figures come from testing of new equipment, pulled to breaking point in the laboratory. They range from as low as 2 kN for the smallest micro nut up to 14 kN for a large hexagonal nut.

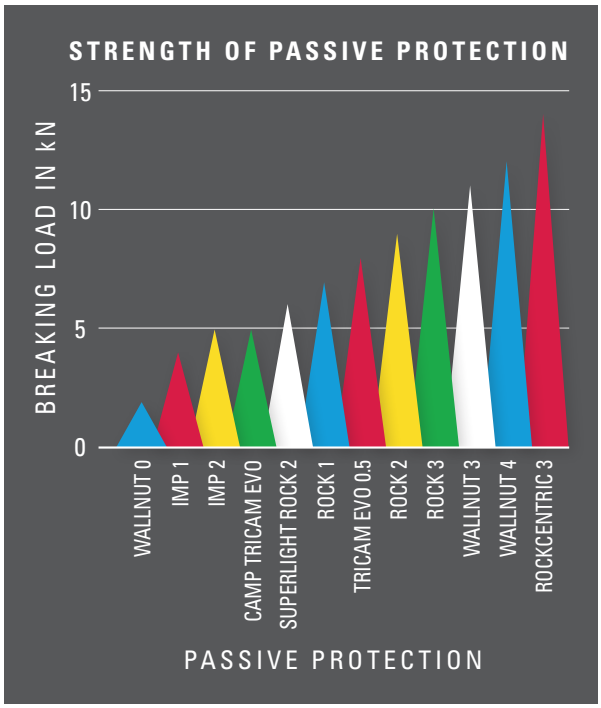
How do these numbers stack up against the forces found when climbing? A typical climber's mass is around 0.8 kN. Resting on a piece of protection and lowering off would result in a force of around 1.3 kN on that piece because of the physics of the pulley effect. This means that a climber should be able to retreat by lowering off even the smallest micro nut without it breaking.

In a fall many factors determine the magnitude of the forces on the top piece of protection. Most falls would result in a force of between 3-5 kN. The most serious falls might reach an upper limit of around 7 kN. From the figures we can see that for most falls, only the smaller micro nuts would be in danger of breaking due to overload. Even for the most serious falls, most protection apart from micro nuts is unlikely to break.

What about abnormal falls or situations? Higher forces than 7 kN can be achieved in a number of ways. The two most well-known are when a climber clips into protection directly with a static sling and falls, the other is when a climber takes a long fall with bad rope drag lower down the pitch. Both can cause higher forces than 7 kN and lead to protection breaking.

In summary, for normal falls any protection stronger than 7 kN is unlikely to break, unless it is weakened by damage in some way. We cover what to look out for in this respect later.

Unfortunately, real life isn't quite this simple. Protection breaking is very rare, but failure is much more common. It is most often a result of poor placement, but also sometimes because of rock fracture. This is more likely with smaller protection, because the forces are spread over a smaller area. The knowledge to take away from this is that if you have to rely on smaller protection, try to place plenty of it as even good placements may fail.



MATERIALS AND CONSTRUCTION

PHOTO: DMM

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Nuts are generally made from extruded sections of aluminium alloy, followed by machining to make holes for the wire or textile attachment sling. Tumbling is used to give a smooth rounded finish to help with handling and make extraction easier, and anodising aids colour coding for easy size identification. At the machining stage, additional work is sometimes done to remove material to reduce weight or modify the shape, especially on the larger sizes.

A number of different aluminium alloys are used, depending on the size, as smaller nuts require higher resistance to shear forces. Softer alloy grades bite better into the rock so tend to be used where possible in the larger sizes. Once the extruded and machined piece is ready, heat treatment gives the final temper, which is significantly stronger and harder than it was before treatment.

Wire cables are made from galvanised steel which gives a good balance between strength, corrosion resistance and affordability. Loops are made by swaging the wire ends together, which involves encasing the wire ends in a metal collar and then compressing this to clamp them together. These swages are incredibly strong considering they mainly hold the wire ends by friction. Correctly manufactured nuts never fail by the wires pulling out of the swages, rather the wires break where they are curved the most, which is usually as they go through the nut head.

Some micro nuts are manufactured in the same way as their larger brethren, but more commonly and particularly for the smallest sizes, different construction methods and materials are used. Brass alloys become the most common choice of material for the nut head, but the main difference can be seen in the method used to attach the wire loop. Holes are drilled into the nut, and the wire ends are silver soldered in place. This avoids a tight bend in the thin wires and allows tiny micro nuts to be stronger than they otherwise would be.

PHOTO: WILD COUNTRY

PASSIVE PROTECTION

CARE AND MAINTENANCE

PHOTO: D. MIDDLETON

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EQUIPMENT CHECKING

The usual principles of equipment checking to ensure safety apply to all forms of passive protection. This comprises of two parts – a brief check before using the equipment, backed up by a regime of regular more thorough checking at least once a year. Information on how to do this can be found on our website and online videos.

Broken/bent wires.

PHOTO: BMC

Corroded wire.

PHOTO: BMC

DAMAGE

The most common forms of damage affect the wire loop. Yanking the nut upwards during removal can cause mechanical damage to the wire strands. Any broken wire strands should be a cause for immediate retirement; a permanently kinked wire is also weakened and should be treated likewise.

Corrosion damage is another common problem. Always wash your gear in clean water and then dry it thoroughly before storing it after climbing on sea-cliffs or near the coast.

Damage to the nut head is rarer, but can occur as a result of a heavy fall or even from overzealous use of a nut removal tool. Retire if there is major damage or distortion; small gouges and shallow scratches are usually not a problem.

For equipment which includes a textile sling, this should also be carefully inspected for damage.

LIFESPAN

Lifespan refers to how long after manufacture before an unused or undamaged piece of equipment should be retired according to the manufacturer. It may range from an infinite lifespan for wholly metal products, to as little as five years for those incorporating a textile sling or cord loop. Some manufacturers provide a sling replacement service which can be used to extend the lifespan for these types of products. Information on the lifespan of equipment can be found on the tags attached to new equipment and on manufacturers' websites.

Damaged sling on hex.

PHOTO: BMC

FURTHER INFORMATION

PHOTO: BMC

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OTHER PROTECTION

As well as passive protection equipment described here, climbers and mountaineers also protect themselves with slings, camming devices, and to a lesser extent, pegs or pitons.

You can find out more about these on the BMC website:

SLINGS:

www.thebmc.co.uk/slings-for-climbers

CAMMING DEVICES:

www.thebmc.co.uk/camming-devices

PEGS OR PITONS:

www.thebmc.tv/videos/what-are-pegs

STANDARDS AND SAFETY

BMC TV

Videos showing how to perform safety checks on equipment

www.thebmc.tv/videos/?channel=gear

UIAA

International safety standards for climbing and mountaineering equipment

www.theuiaa.org/safety-standards

MANUFACTURERS

BLACK DIAMOND

eu.blackdiamondequipment.com/

CAMP

www.camp.it

DMM

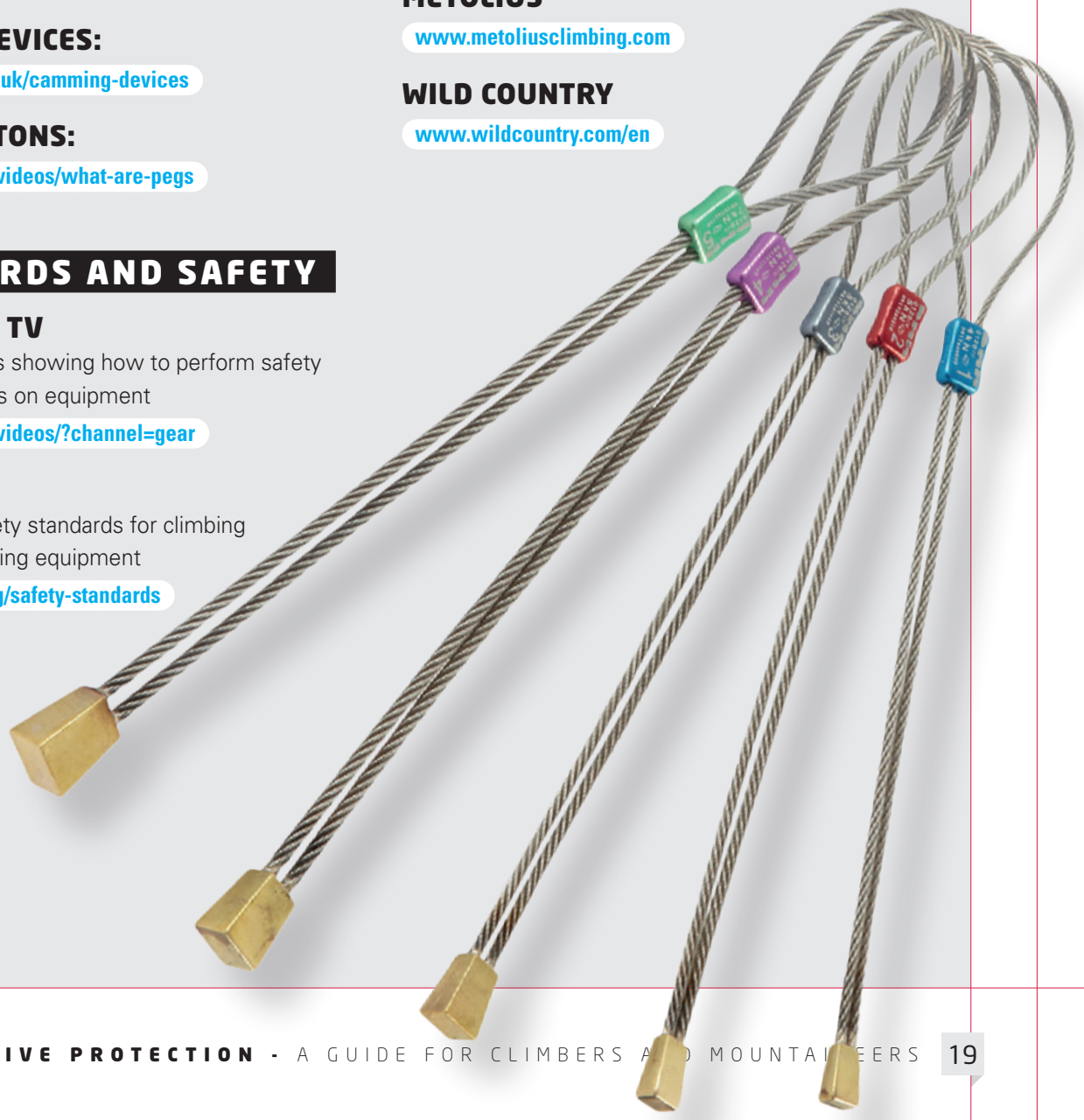
www.dmmclimbing.com

METOLIUS

www.metoliusclimbing.com

WILD COUNTRY

www.wildcountry.com/en



BMC

WE WORK TO PROTECT YOU

Over 70 years old and 85,000+ members strong, the British Mountaineering Council (BMC) exists to promote and protect the interests of climbers, hill walkers and mountaineers in England and Wales. And that's not all; there are huge benefits from being a BMC member:

GUARDIANS OF THE COUNTRYSIDE

Our members consistently tell us our most important role is maintaining access to hills, mountains and cliffs – and their conservation – which we do through our Access Management Group. We've noticed that our members value the natural world tremendously. And so we promote a wider concern for the environmental and economic interests of the rural communities our members visit. Meanwhile our charity – the Access & Conservation Trust (ACT) – funds footpath restoration and conservation events and information.

ACT NOW: www.thebmc.co.uk/bmc-access-conservation-trust

PROTECTORS OF OUR MEMBERS

We want to make sure our members are as safe as houses. That's why all our Club and Individual Members automatically receive £10 million Combined Liability insurance cover, all Individual Members get £10,000 Personal Accident Disability Insurance, and all members get access to our specialist travel insurance.

And to make sure you stay as safe as possible, the BMC tries to develop the skills of our members by providing subsidised and discounted courses, helps oversee the work of the UK's various training boards, offers knowledge and advice on safety equipment, and contributes to international standards work.

FIND OUT MORE: www.thebmc.co.uk/membership

INCLUSIVITY AND EQUITY

We believe the outdoors is for everyone and that the activities our members enjoy should be accessible. It's incredibly important that people of all ages, abilities and backgrounds can enjoy these activities, and disability needn't be seen as a barrier to participation.

Initiatives like This Girl Can Climbing, competitions and events for people to participate in paraclimbing, and many other projects aim to help overcome these barriers, and the BMC works with partners to provide support to clubs, climbing walls, activity providers and coaches to ensure the activities they run are accessible.

READ: www.thebmc.co.uk/supporting-you-to-provide-inclusive-activities

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OTHER VITAL WORK

CLIMBING WALLS:
supporting the management and sustainable development of climbing walls

CLUBS:
facilitating the sharing of information and advice between BMC affiliated clubs

COMPETITIONS:
developing competition climbing in Britain and managing the GB Climbing Team

EQUIPMENT:
providing an informed source of technical advice on safety equipment

GUIDEBOOKS:
publishing climbing guidebooks to the Peak District and surrounding Pennine areas

HERITAGE:
preserving mountaineering's rich heritage of artefacts, history and traditions

HUTS:
offering advice and guidance on the management and use of club huts

INTERNATIONAL:
supporting British mountaineers travelling overseas with information and grants

MOUNTAIN MEDICINE:
providing expert medical advice on keeping fit and healthy in the mountains

YOUTH:
providing advice and support for young people and their parents