METOLIUS Cams

Using Metolius Cams

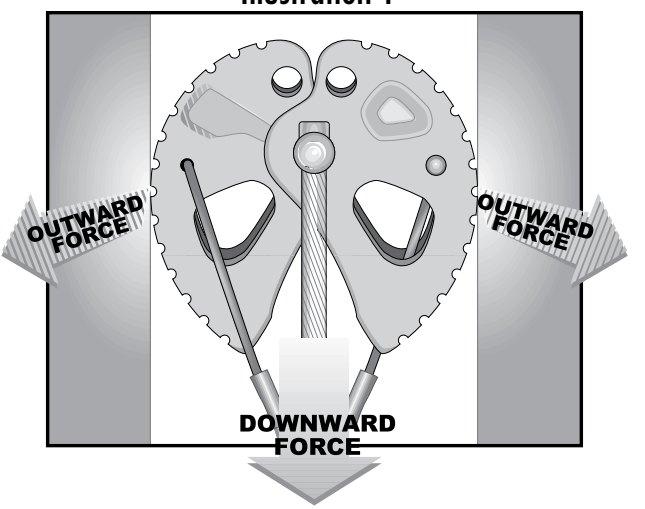
Spring loaded camming devices are complex pieces of equipment. A basic understanding of how cams work is critical to finding safe, reliable placements. After you've studied this guide, practice placing cams in a safe venue, at ground level, before you trust your life to a cam placement. This process can teach you a lot, but written guidelines and practice are no substitute for qualified instruction. We strongly recommend that you learn to place cams under the supervision of a certified guide.

How cams work

When you fall on a camming unit, three basic factors decide whether it will hold or pull out: how well the cams grip the walls of the placement (friction), how hard the cams push out against the walls of the placement (outward force), and how well the rock on the walls of the placement hold up to the pressure exerted by the cams (rock strength).

Spring loaded camming devices work by translating downward force into outward force. When a load is applied to a camming unit, the cam lobes respond by pushing out against the walls of the placement (Illustration 1).

Illustration 1



When the downward force is first applied, there is a brief instant during which the frictional forces between the cam lobes and the rock are the only thing keeping the cam from pulling out. If the unit holds during this instant, the outward force of the cam lobes pushing against the walls of the placement take over most of the work. If the outward force is sufficient, the cam continues to hold. A tremendous amount of outward force is required to hold a cam in place against the downward force generated by a fall. If the rock isn't strong enough to withstand the pressure, it fails and the cam pulls out. You must be able to assess these variables effectively in every cam placement you make.

About friction

All cam lobe materials currently on the market have about the same coefficient of friction. Therefore, the friction component is determined by the texture and composition of the rock in which the cam is to be placed. Soft, porous, or crystalline rock types such as sandstone or granite offer more friction than very compact or smooth rock like quartzite. However, soft rock is more susceptible to breakage or pulverization of the surface layer. Dirty, wet, or icy rock offers almost no friction and cam placements in these conditions should never be trusted; passive protection is much more reliable in these conditions.

About outward force

Outward force is determined by the cam angle used by the manufacturer. A smaller cam angle generates more outward force. It should be obvious by now that more outward force is better. However, as long as you have placed the cam correctly in an appropriately shaped placement, you don't have to worry about outward force. You already made that judgment when you bought your cams. There's nothing you can do about it now.

About rock strength

Rock fails in 2 basic ways: either a relatively large piece breaks off or the surface layer is crushed under the pressure of the cam lobe allowing the cam to "track out." You must assess the integrity of the rock and choose the soundest possible location for your placements. Look for fractures in and around the walls of a potential placement that could denote weakness, as well as pebbles, crystals or micro-flakes that could snap off.

Be extremely suspicious of placements behind flakes or blocks. As we said before, cams exert a tremendous amount of outward force in a fall, so they can expand or even lever off even seemingly solid flakes or blocks. Passive protection is often a better choice behind flakes or blocks.

Mitigate the danger of rock failure by spreading the force between the cam lobes and the rock over as large an area as possible -- always use the largest cam lobe surface area that will fit in any given placement. In other words, choose the largest unit that will fit the placement and always opt for a 4-cam unit over a 3-cam unit, if it will fit -- if the placement is deep enough to accommodate a Fat Cam, even better.

Placing cams

First you have to find a suitable placement. Cams work best in nearly parallel-sided cracks (Illustration 2). If a crack flares in any direction, it makes any potential placement much less reliable. If the crack flares inward or outward too much, it will prevent the individual cam lobes from making sufficient contact to hold (Illustration 3). If the crack flares downward too much, the cams will no longer generate enough outward force and friction to hold (Illustration 4). If the crack flares upward too much, the cams will walk until the unit is tipped out and useless (Illustration 5). Look for long sections of crack that have minimal variation in crack width, so the cam won't tip out if it walks, or better yet, look for placements with constrictions both above and below the unit that will limit the movement of the cam. Remember to assess rock quality. Any piece of protection is only as strong as the rock in which it is placed.

Illustration 2

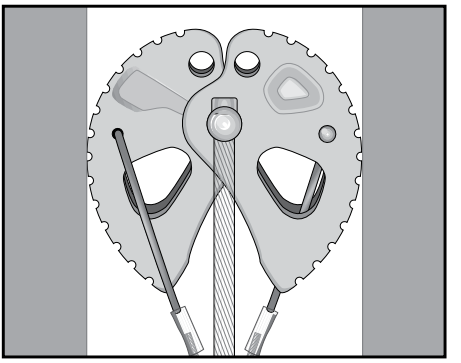


Illustration 3

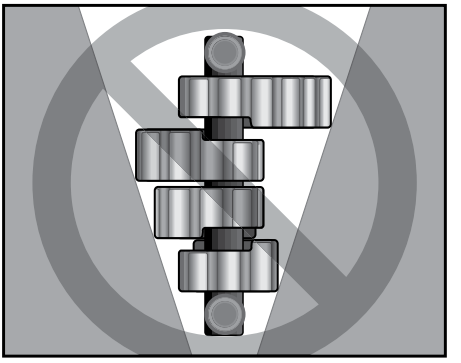


Illustration 4

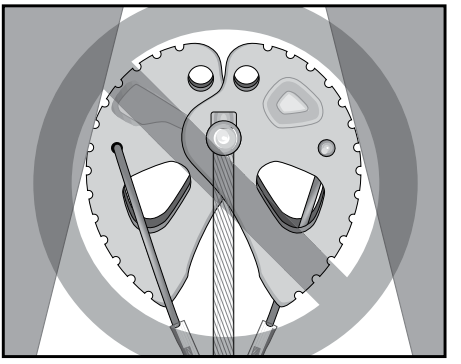
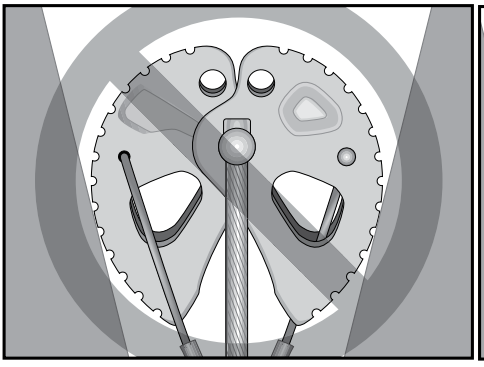
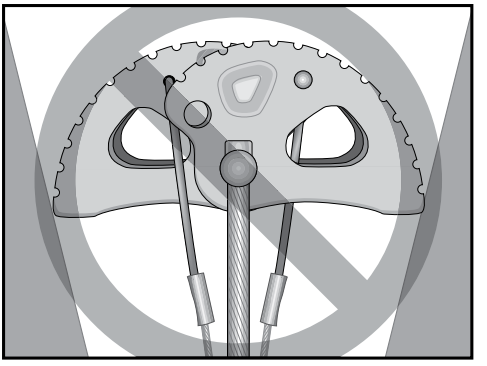


Illustration 5





Once you've found a placement, you need to select the correct size cam from your rack. Ideally, you will select the largest size cam that will fit without getting stuck. Cams should not be placed near the wide end of their expansion range. When a unit is loaded, it expands as the slack is removed from the system and the cams and rock compress. A nearly tipped-out cam won't have enough expansion left to accommodate this process. A loose cam is also more prone to walking and has little range left to adjust.

Now, retract the cam lobes, place the head of the cam into the placement, align the stem of the unit in the expected direction of the potential load, and release the trigger. Verify that you have chosen the best size by making sure that the green Range Finder dots are lined up where the cam lobes touch the walls of the placement (Illustration 6). Yellow dot alignment is okay too (Illustration 7), but you must exercise more caution with the placement, because the cam will be less stable, hence more prone to walking, and it will have less expansion range left to accommodate walking to a wider position. If the cam you choose aligns in the yellow zone, the next larger size will align perfectly in the green zone. Use that cam instead, if it's still on your rack. Never use a placement in the red zone (Illustration 8) unless it's the only placement available.

Illustration 6

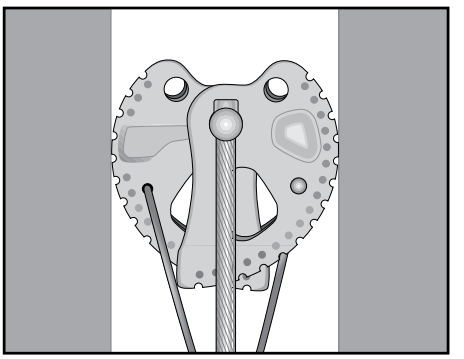


Illustration 7

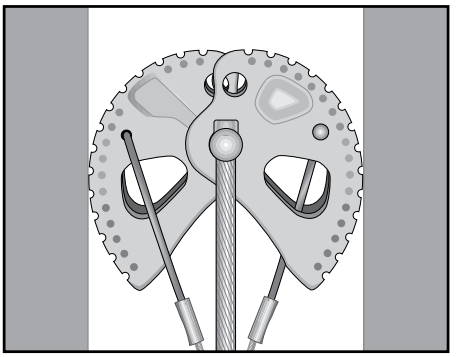
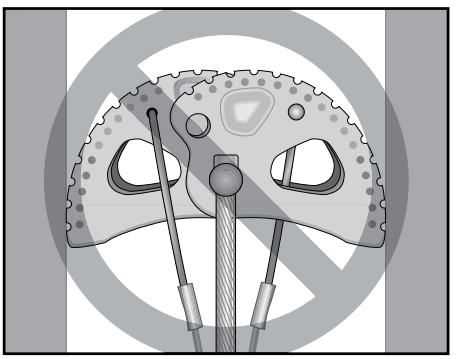


Illustration 8



Place the cam as deep as possible in the crack without making it difficult to retrieve. The rock near the front edge of the crack is much more likely to break than the rock deeper inside.

The insides of most cracks are full of undulations, flares, and a thousand other surface irregularities. Find the best spot for the cam lobes to nest, don't just plug the cam in and go.

Make sure that the all cam lobes are retracted evenly (Illustration 9). Off-center cam placements (Illustration 10) are less stable and more prone to walking.

Illustration 9

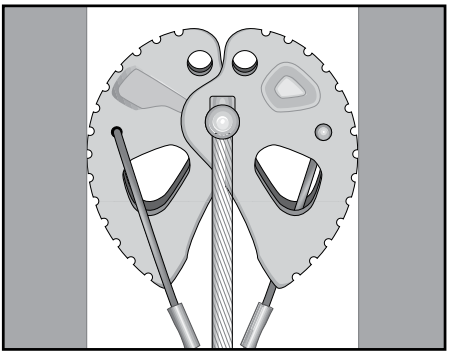
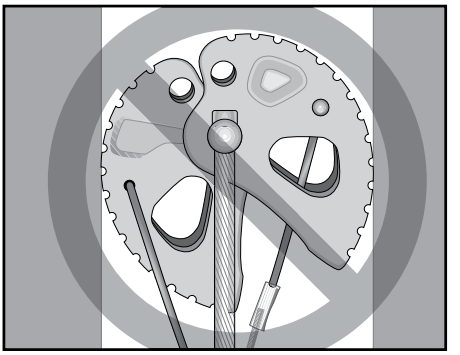
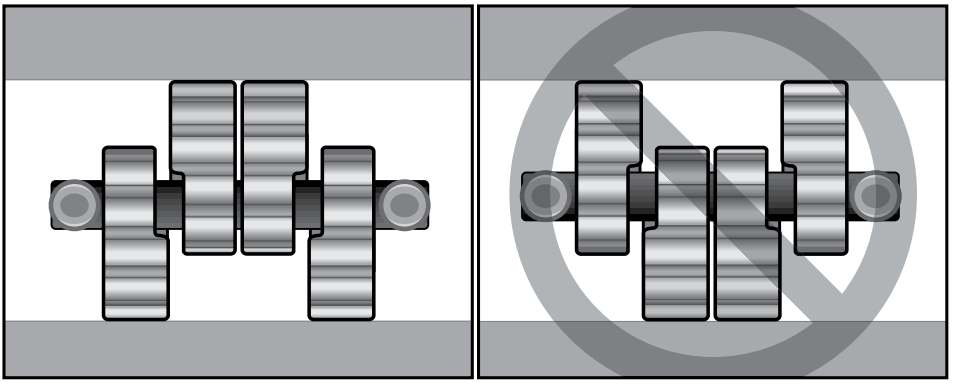


Illustration 10



Because they have flexible bodies, Metolius cams can be placed in horizontal cracks. However, whenever a cam body or sling is loaded over an edge it will sacrifice some strength, just like any other piece of gear. Inspect your cams carefully after using them in a horizontal placement. When placing cams in horizontals, always place the outboard cam lobes on the bottom (Illustration 11). This will result in a much stronger and more stable placement.

Illustration 11



Now imagine falling on the placement. Give the sling a tug in the direction it would be loaded in a fall. The unit should not shift or rotate. If it does, re-align it and try again. If you fail to align the camming unit with the direction of the potential fall, when the unit is loaded, the stem will rotate in the direction of the load. The cams will either walk (often to an undesirable position), to allow the entire unit to re-align, or the cams will be loaded unevenly, making the unit much more prone to breaking the rock or tracking out. When placing a cam always align it in the direction it will be pulled in a fall. This goes for belay anchors as well as running anchors.

Once a good placement has been established, it is critical to control movement of the cam as you continue to climb. Tight placements are less prone to walking and have more expansion range left to accommodate movement. Cams can move even in ideal looking placements, so anticipate how the cam might move and extend it with runners, place a piece in opposition, or counterweight the piece with extra gear if necessary.

Always clip into cams with a carabiner. Never thread the rope or a sling directly through the cam sling. Clip into the open loop at the bottom of the sling. Never clip into the sling above the locator bar tack, or into the cam body above the spreader bar or trigger. It is okay to clip directly into the tubing-covered loop of cable in aid climbing situations, but move the carabiner back into the sling once you have passed the placement and are relying on it for protecting a fall. Clipping into any place other than the bottom of the sling and loading the cam will result in failures well below the rated strength.

Life Span of Cams

It is nearly impossible to predict the lifespan of camming units because it is dictated by wear and damage rather than by time. Under moderate usage, with no exposure to salt-water environments, corrosive agents, severe falls or damage, cam bodies can easily last 10 years and the slings can last up to 5 years. However, any of the aforementioned factors can reduce their life span dramatically. You must inspect your cams frequently, and take personal responsibility for evaluating their condition and retiring unsafe units. You should destroy retired gear to prevent any chance of its future use. If you are ever in any doubt about the safety of your cams, return them to Metolius for inspection.

Care and Maintenance of Camming Units

The first and most important step in cam maintenance is inspection. Inspect your cams frequently. If you have any reason to doubt the integrity of a camming unit, (or any of your gear) heed your instincts and retire it. If it is a Metolius product, you can send it to us for inspection. You should destroy retired gear to prevent any chance of future use. Never alter or modify your cams in any way.

Look at the teeth on your cams. If they are worn unevenly or have been flattened in a hard fall, it probably means that the cam has lost its shape and is unsafe to use.

Check for slop between the cams and the axle. There should be some free-play, but too much play indicates that the axle holes in the cams have become oval. Compare the free-play to a new cam of the same size to get an idea of how much is acceptable.

Inspect the cable body carefully. It is okay to tweak the cable to straighten it after a fall, but if any of the wire strands that make up the cable have been broken or severely kinked, the unit needs to be retired.

Look at the springs and cam stops, which can break if the unit is improperly placed and then loaded.

Also take a look at the axle. It's possible to bend the axle of a small unit in a hard fall, in which case it needs to be retired.

The most likely places to find damage to your units are the trigger wires or the sling. Straighten the trigger wires if they become bent. Try to get the wires completely straight so all the cams lobes retract at the same rate. The cam lobes should line up evenly when fully retracted or fully open. Keep an eye on the swaged joint on the trigger wire. It is the most likely place for the wire to fray. If the sling or the stitching show major signs of abrasion, or if any of the stitching is broken, the sling must be replaced. Metolius will replace slings or trigger wires on our cams for a nominal fee. We don't offer repair kits for the triggers because we like to get damaged or worn cams back in-house for a thorough inspection.

Care of your cams is a simple process. Keep them clean and dry. If they get wet, don't just throw them in the closet until the next trip. Dry them off and re-lube them as soon as possible. If your cams are exposed to a salt-water environment, wash them with fresh water and dry them thoroughly as soon as possible. If they get corroded, you can use steel wool or a Scotch Brite pad to remove the corrosion. Keep your cams away from any corrosive substances or solvents. Acids are exceptionally bad for cam slings and other nylon climbing equipment. Even fumes from a car battery can reduce the strength of your slings to the point that they will fail under body weight. If your cams come into contact with any corrosive substances or solvents, have the slings replaced immediately. If you have any doubt, contact us to see if the corrosive substance could have compromised the metal parts of the unit. Replace the slings if you see any signs of damage or discoloration, after a severe fall, or after five years. Even though your cam slings may show no significant signs of wear, the nylon will deteriorate with the passage of time. If in doubt, send them to us for inspection. Store your cams in a cool, dry place away from U.V. light sources. When transporting cams, observe the same precautions as you would for storage.

To clean your cams, heat water in a pan until it is near the boiling point. Swish the heads in the hot water while working the trigger bar, being very careful not to burn yourself. Use a stiff-bristled brush to clean thoroughly all around the head, especially in the springs and inside the cam lobes. The Metolius M-16 brush is perfect for this task. Depending upon how dirty your cams are and what lubricants you have used in the past, they may require several cleanings to work all the dirt and old lube out from the axle. Using compressed air to blow the cams out while still wet can help. Dry the cams thoroughly and then lubricate. No amount of lube will restore good action to a dirty cam, so make sure your cams are cleaned thoroughly.

Now you're ready to lube your cams and restore like-new action. Shake Metolius Cam Lube vigorously, at room temperature, to mix all solids. (Use body heat to warm MCL if used in colder outdoor climates.) Apply MCL to the cam pivots and springs and work it in until the smooth action is fully restored. Wipe off excess lube with a rag then let MCL fully dry (several minutes to an hour). For optimum penetration, apply MCL to cams at or above 40ºF (5ºC). MCL can be applied to wet parts, but it will take longer to dry before becoming a waterproof, dirt-repelling shield.

Metolius Cam Lube is a patented, self-cleaning lubricant. When dirt attaches itself to the fully dried film, small particles of the lube will break away, carrying dirt with it. MCL keeps parts working smoothly and helps them last longer. MCL is waterproof after it has dried completely.

If you do not completely understand any of the above or if you have questions, contact Metolius at (541) 382-7585 or info@metoliusclimbing.com.

Markings
The following markings may be found on Metolius cams:

CE 0082: Indicates that the unit meets the requirements of Council Directive 89/686/EEC relating to personal protective equipment.

UIAA: Indicates that the cam is UIAA certified

Metolius Climbing: Name of the manufacturer

METOLIUS **:** Metolius logo

Master Cam, Supercam, Ultralight Power Cam, Ultralight TCU: Trademark name of the product

Size Designation: Indicates the size of the unit (specified as 00-8 or S, M, L)

Date Code: Indicates the date of manufacture

Strength Rating: Indicates the minimum breaking strength of the unit (specified in kN)

Metolius cams conform to EN 12276:1998, the CE standard for Mountaineering equipment – Frictional anchors.

Certification and monitoring performed by:
APAVE SUDEUROPE
BP 193
13322 Marseille Cedex 16
France
Notified body number 0082

* Fat Cams, Offset Cams and L Supercams are not currently CE certified.

* All cams are individually tested to half their rated strength

size	range		strength	weight
Master Cam				
00	0.34 - 0.47″	8.5 - 12.0 mm	5 kN 1100 lbf	2.2 oz. 62 g
0	0.39 - 0.59″	10.0 - 15.0 mm	5 kN 1100 lbf	2.3 oz. 65 g
1	0.49 - 0.71″	12.5 - 18.0 mm	8 kN 1800 lbf	2.4 oz. 68 g
2	0.62 - 0.89″	15.5 - 22.5 mm	10 kN 2250 lbf	2.5 oz. 70 g
3	0.74 - 1.04″	18.5 - 26.5 mm	10 kN 2250 lbf	2.9 oz. 82 g
4	0.93 - 1.32″	23.5 - 33.5 mm	10 kN 2250 lbf	3.2 oz. 90 g
5	1.01 - 1.56″	28.0 - 39.5 mm	10 kN 2250 lbf	3.5 oz. 98 g
6	1.28 - 1.89″	32.5 - 48.0 mm	10 kN 2250 lbf	3.9 oz. 110 g
Offset Master Cam				
00/0	0.34 - 0.52″	8.6 - 13.2 mm	5 kN 1100 lbf	2.2 oz. 63 g
0/1	0.44 - 0.65″	11.1 - 16.5 mm	5 kN 1100 lbf	2.3 oz. 66 g
1/2	0.57 - 0.80″	14.4 - 20.3 mm	8 kN 1800 lbf	2.4 oz. 70 g
2/3	0.67 - 0.97″	17.0 - 24.6 mm	10 kN 2250 lbf	2.7 oz. 79 g
3/4	0.85 - 1.19″	21.5 - 30.2 mm	10 kN 2250 lbf	3.0 oz. 87 g
4/5	1.09 - 1.56″	28.0 - 39.5 mm	10 kN 2250 lbf	3.3 oz. 94 g
Ultralight Power Cam				
00	0.34 - 0.47″	8.5 - 12.0 mm	5 kN 1100 lbf	1.6 oz. 45 g
0	0.39 - 0.59″	10.0 - 15.0 mm	5 kN 1100 lbf	1.7 oz. 48 g
1	0.49 - 0.71″	12.5 - 18.0 mm	8 kN 1800 lbf	1.9 oz. 54 g
2	0.62 - 0.89″	15.5 - 22.5 mm	10 kN 2250 lbf	2.3 oz. 64 g
3	0.74 - 1.04″	18.5 - 26.5 mm	10 kN 2250 lbf	2.4 oz. 68 g
4	0.93 - 1.32″	23.5 - 33.5 mm	10 kN 2250 lbf	2.7 oz. 77 g
5	1.01 - 1.56″	28.0 - 39.5 mm	10 kN 2250 lbf	3.0 oz. 86 g
6	1.28 - 1.89″	32.5 - 48.0 mm	10 kN 2250 lbf	3.5 oz. 98 g
7	1.57 - 2.26″	40.0 - 57.5 mm	10 kN 2250 lbf	4.5 oz. 127 g
8	1.91 - 2.81″	48.5 - 71.5 mm	10 kN 2250 lbf	5.3 oz. 150 g
Ultralight TCU				
00	0.34 - 0.47″	8.5 - 12.0 mm	5 kN 1100 lbf	1.4 oz. 41 g
0	0.39 - 0.59″	10.0 - 15.0 mm	5 kN 1100 lbf	1.5 oz. 43 g
1	0.49 - 0.71″	12.5 - 18.0 mm	8 kN 1800 lbf	1.8 oz. 50 g
2	0.62 - 0.89″	15.5 - 22.5 mm	10 kN 2250 lbf	2.0 oz. 57 g
3	0.74 - 1.04″	18.5 - 26.5 mm	10 kN 2250 lbf	2.1 oz. 59 g
4	0.93 - 1.32″	23.5 - 33.5 mm	10 kN 2250 lbf	2.4 oz. 68 g
Ultralight Offset TCU				
00	0.34 - 0.52″	8.6 - 13.2 mm	5 kN 1100 lbf	1.6 oz. 45 g
0	0.44 - 0.65″	11.1 - 16.5 mm	5 kN 1100 lbf	1.7 oz. 47 g
1	0.57 - 0.80″	14.4 - 20.3 mm	8 kN 1800 lbf	1.8 oz. 52 g
2	0.67 - 0.97″	17.0 - 24.6 mm	10 kN 2250 lbf	2.0 oz. 59 g
3	0.85 - 1.19″	21.5 - 30.2 mm	10 kN 2250 lbf	2.2 oz. 63 g
Supercam				
small	1.65 - 2.50″	42.0 - 63.4 mm	12 kN 2700 lbf	6.5 oz. 184 g
medium	2.07 - 3.60″	52.5 - 91.5 mm	12 kN 2700 lbf	9.0 oz. 255 g
large	2.62 - 4.67″	66.5 - 118.5 mm	12 kN 2700 lbf	11 oz. 312 g
Ultralight Fat Cam				
2	0.62 - 0.89″	15.5 - 22.5 mm	10 kN 2250 lbf	2.5 oz. 72 g
3	0.74 - 1.04″	18.5 - 26.5 mm	10 kN 2250 lbf	2.6 oz. 75 g
4	0.93 - 1.32″	23.5 - 33.5 mm	10 kN 2250 lbf	3.0 oz. 84 g
5	1.01 - 1.56″	28.0 - 39.5 mm	10 kN 2250 lbf	3.5 oz. 98 g
6	1.28 - 1.89″	32.5 - 48.0 mm	10 kN 2250 lbf	3.9 oz. 111 g
7	1.57 - 2.26″	40.0 - 57.5 mm	10 kN 2250 lbf	4.8 oz. 136 g
8	1.91 - 2.81″	48.5 - 71.5 mm	10 kN 2250 lbf	5.4 oz. 154 g