BRITISH MOUNTAINEERING COUNCIL

177-179 Burton Road
Manchester M20 2BB
www.thebmc.co.uk

Tel: 0161 445 6111
Fax: 0161 450 4500
office@thebmc.co.uk

TECHNICAL COMMITTEE MEMORANDUM TCM 07/02

HB Screwgate Karabiners, worn

Incident Ref. 07/02/C.WIL

SUMMARY

These HB aluminium karabiners were sent to the Technical Committee together with an Incident Report form and a written description, with the complaint that they have suffered excessive wear from very little use. These karabiners were used to add additional friction in a top rope scenario to lower a climber twice from a mixed water ice route in Gaustatoppfossene, Norway. The report included with the form indicates that during this climbing trip, climbing was done at several locations but that this wear was only seen after climbing at this location.

The result of this investigation indicates that, although severely worn the degree of wear on these karabiners is most probably due to the water and grit carried on the surface of the rope creating an abrasive action on the karabiners resulting in the wear seen.

Author:	**BMC Technical Committee**
Approved for issue:	**10/03/2014**

1. INTRODUCTION

These HB karabiners were received complete with a BMC Incident Report form stating that they were damaged when using them in a system to increase the friction whilst lowering a climber. The karabiners were used in conjunction with a new 9mm Edelrid rope. The complainant makes the observation that these karabiners were excessively worn.

Figure 1. The Worn HB Screwgate Karabiners

Karabiner No.1 is on the left and Karabiner No.2 is on the right

2. EXAMINATION

Initial inspection does indicate severe wear in both the karabiners on an internal radius close to the back of the krab. Other than this wear these karabiners look comparatively unworn. The gate and the screw mechanisms on both connectors operate smoothly as would be expected from light use. The spring mechanism on both of these karabiners is intact and undamaged. There are no excessive surface defects or imperfections on the karabiners. The images in Figure 2 and Figure 3 show this wear in greater detail

Figure 2. Detail of the Wear on Karabiner No.1

Figure 3. Detail of the Wear on Karabiner No.2

On the worn surfaces clear striations can be seen. The transverse direction of these striations confirms that the reported wear was produced by something (the rope) running over these radii. The wear seen on these karabiners is such that at its periphery it has produced sharp edges.

To get an estimate of the material strength of these karabiners, hardness testing was done on both karabiners. The hardness of each karabiner was measured in two places using the Brinell method. All measurements were taken on the flat sides of the karabiners. One hardness measurement was taken at a location near the "Radius" at the back of the karabiner. This was done on the radius opposite the worn radius because a flat surface was needed to do the measurement (Figure 4). The other hardness measurement was taken along the "Back" of the karabiner. Table 1 details the results of these hardness measurements.

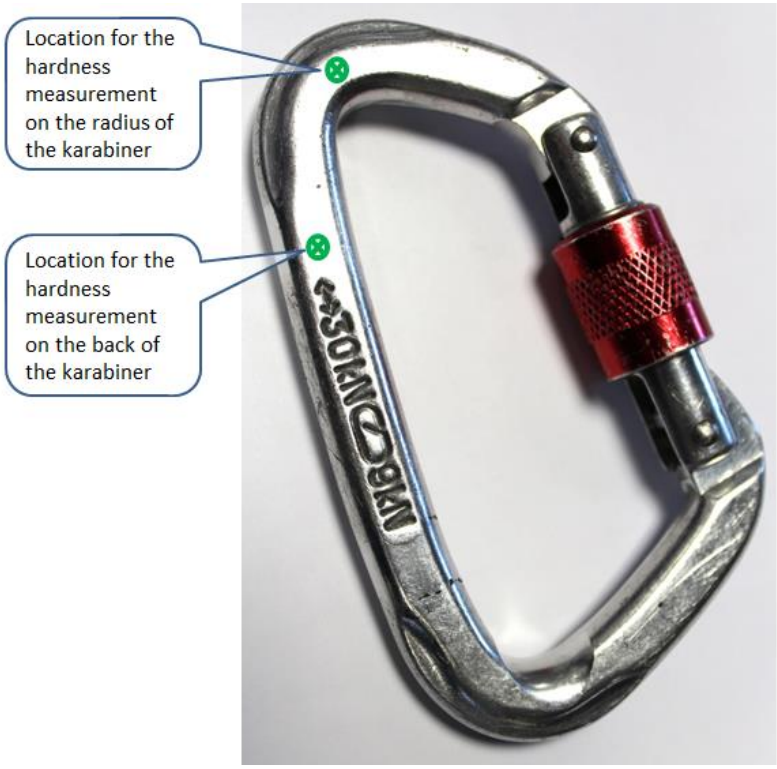

Figure 1. Locations where Hardness Testing was done

Karabiner ID	Hardness (HB)	
	Radius	Back
1	206	192
2	206	201

Table 1. Table of Karabiner Hardness Measurements

Aluminium karabiners are usually made from 7075 T6 aluminium alloy, which normally has a hardness of 174 Brinell (88 RB) and the material is likely to be slightly work hardened during the manufacturing process, The hardness values recorded in Table 1 do not seem unreasonable and indicate that the material used to make these karabiners is not unduly soft/weak.

3. ANALYSIS

Theses karabiners were sent to the BMC because of concerns over the unusually high degree of wear exhibited. The images (Figure 2 and Figure 3) show that these karabiners have been subjected to a high degree of wear for reportedly only being used twice.

However, the report included with the form states that these karabiners were used to increase the friction in a lower off situation. Using a karabiner in this manner does subject the karabiner to a high friction loading. The situation described, that these karabiners were subjected to, has the additional factors of wet ropes, due to the climbing on ice and, probably, grit picked up from the rock sections of the particular climb. These factors are likely to have exacerbated the wear by providing an abrasive (the grit) and a cutting fluid (the water) to increase the rate of wear.

The reporter suggests that wear of this kind was not seen when climbing in other regions of Norway during this trip. No information has been provided on what type of climbing was done in the other locations but it seems reasonable to suggest that the climbing elsewhere was of a different nature, e.g. dry rock or all ice and no rock. It may well be that climbing at this particular location at that time subjected the climbing equipment to just the right mixture of abrasive and lubricant to cause this damage.

Another reason for the karabiners to have been so badly worn at this one location is that as the report mentions that they were used in a lower-off system because of the poor weather at the time. The climbing at other locations may well have been done in better weather when there was no need to lower-off the climber and hence not use karabiners to increase system friction.

4. CONCLUSIONS

In summary, investigation of these worn karabiners shows that there is not any issue with the strength of the material that these karabiners have been made from. The high degree of wear exhibited by these karabiners is more likely due to the high rubbing load and the possible abrasive environment in which they were used. It also seems reasonable that this wear could be attributed to one location or route because the degree of wear will be dependent on the local environment. The amount of wear will be dependent on the ropes exposure to a combination of grit and water - some routes may be more detrimental to climbing equipment than others.

It may surprise most climbers that this degree of wear could occur with so little use but mixed climbing can produce a harsh abrasive environment for climbing equipment. In this case the use of the two karabiners will have not only added extra friction into the rope system but also spread the wear across each of the karabiners. The use of two karabiners was a sensible approach from the aspect of karabiner wear. The addition of the extra karabiner will have increased the volume of load bearing metal in the belay system which would reduce the likelihood of failure due to wear.

5. RECOMMENDATIONS

There are many ways to try and avoid such high wear on climbing equipment such as this. The most important point to emphasise is, like was done, is to check the equipment regularly and retire any suspect equipment. Another thing that could be done would be to use steel karabiners rather than aluminium ones in this scenario where there is likely to be a high degree of rubbing and a chance of abrasion. The improvement in hardness of the steel karabiners over that of aluminium ones will reduce the degree of wear and so increase the life.