

# 3 $\sigma$ MBS Explained



You might think that determining the strength of a carabiner would be relatively easy. But even with modern, high-tech alloys, two identical carabiners will break at slightly different forces. So, breaking the five samples called for by the NFPA test method will provide five different.

At CMC Rescue, we use modern statistical methods to ensure with extremely high confidence that even the weakest carabiner from the population will meet or exceed the reported MBS. NFPA 1983 specifies a minimum performance standard for rescue equipment which is referred to as 3 Sigma ( $3\sigma$ ), which ensures that at least 99.87% of the carabiners in the population exceed the specified strength.

NFPA 1983 specifies a minimum performance standard for rescue equipment. For example, a General Use carabiner must have a  $3\sigma$  minimum breaking strength (MBS) of at least 40 kN (8,992 lbf). The standard allows the manufacturer to label the product with the MBS required by the standard or any higher number that is not more than the actual  $3\sigma$  MBS calculated from the test results of the five samples.

Since 2011, all CMC products compliant with NFPA 1983 have been marked with the actual  $3\sigma$  MBS rounded down to the nearest kN. As always, CMC regularly submits products to a third-party test lab (currently Underwriters Laboratories, UL) to ensure that current production samples of compliant products continue to meet the performance requirements of the standard.

## NFPA 1983 CARABINER PERFORMANCE REQUIREMENTS

### Technical Use "T" (Formerly Light Use "L")

- Major Axis  $3\sigma$  MBS of not less than 22 kN (4,946 lbf)
- Major Axis with gate open  $3\sigma$  MBS of not less than 7 kN (1,574 lbf)
- Minor Axis  $3\sigma$  MBS of not less than 7 kN (1,574 lbf)

### General Use "G"

- Major Axis  $3\sigma$  MBS of not less than 40 kN (8,992 lbf)
- Major Axis with gate open  $3\sigma$  MBS of not less than 11 kN (2,473 lbf)
- Minor Axis  $3\sigma$  MBS of not less than 11 kN (2,473 lbf)

## NFPA 1983 PULLEY PERFORMANCE REQUIREMENTS

### Technical Use "T" (Formerly Light Use "L")

- $3\sigma$  MBS of not less than 18 kN (4,046 lbf)
- $3\sigma$  MBS of a becket of not less than 11 kN (2,473 lbf)

### General Use "G"

- $3\sigma$  MBS of not less than 36 kN (8,093 lbf)
- $3\sigma$  MBS of a becket of not less than 22 kN (4,946 lbf)

## NFPA 1983 DESCENT CONTROL AND ROPE GRAB PERFORMANCE REQUIREMENTS

### Technical Use "T" (Formerly Light Use "L")

- Rope grab devices must not show any permanent damage to the device or to the rope at 5 kN (1,124 lbf)
- Descent control devices must not show any permanent damage to the device or to the rope at 5 kN (1,124 lbf)
- If the descent control device has a passive breaking feature, the device shall not slip more than 300 mm at a force of 1.35 kN (300 lbf)

### General Use "G"

- Rope grab devices must not show any permanent damage to the device or to the rope at 11 kN (2,500 lbf)
- Descent control devices must not show any permanent damage to the device or to the rope at 11 kN (2,500 lbf)
- If the descent control device has a passive breaking feature, the device shall not slip more than 300 mm at a force of 2.7 kN (600 lbf)