



# Hardware Performance Requirements



## What's a "3 $\sigma$ MBS"?

You would think that answering the question "how strong is that carabiner?" or other item of rescue equipment would be relatively easy. Even with metals like aluminum and steel, two identical carabiners will break at slightly different forces. Maybe only a hundred pounds different, but still different. Breaking the five samples called for by the NFPA test method will provide five different results. If the average breaking strength is reported, the odds that your carabiner is weaker than the average are pretty good. Even if the strength of the weakest carabiner is used as the rating, there is still the possibility that your carabiner could be weaker and there is no way to know how much weaker. The industry solution is to use a statistical formula, referred to as three sigma ( $3\sigma$ ), that says that the minimum breaking strength calculation is 99.87% reliable.

NFPA 1983 specifies a performance standard for rescue equipment. For example, a general-use carabiner must have a 3 sigma minimum breaking strength of at least 40 kN (8,992 lbf). The test method requires five samples and a  $3\sigma$  MBS is calculated. The 2006 edition of 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. CMC feels that the user is best served if we label hardware with the minimum MBS required by the standard, while providing the actual  $3\sigma$  MBS figures in our literature.

During the transition between NFPA 1983, 2001 edition and the 2006 edition, there is not enough time for Underwriters Laboratories to test all of CMC's products before the publication of the catalog. Where we do not have the test results that provide the calculated MBS, we have left the MBS blank. If the product is marked as meeting the standard, then you know that it meets the MBS required by the standard and is marked accordingly. For the actual  $3\sigma$  MBS or any questions regarding product performance, just give us call or check our website at [www.cmcrescue.com](http://www.cmcrescue.com).

## Belay Device Performance Requirements

NFPA 1983 does not have a specific category for "belay devices." Depending on how the device functions, it is tested to either the Rope Grab Standard or to the Descent Control Device standard.

### Light-Use

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.) and have a  $3\sigma$  MBS of not less than 13.5 kN (3,034 lbf.)

If the belay device has a passive breaking feature, the device shall not slip more than 25 mm at a force of 1.35 kN (300 lbf.)

### General-Use

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 5 kN (1,124 lbf.) and have a  $3\sigma$  MBS of not less than 22 kN (4,946 lbf.)

If the belay device has a passive breaking feature, the device shall not slip more than 25 mm at a force of 2.7 kN (600 lbf.)



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## NFPA 1983 (2006) Pulley Performance Requirements

### Light-Use

Minimum 3 sigma breaking strength ( $3\sigma$  MBS) of not less than 22 kN (4,946 lbf.)

$3\sigma$  MBS of a becket of not less than 12 kN (2,698 lbf.)

### General-Use

Minimum 3 sigma breaking strength ( $3\sigma$  MBS) of not less than 36 kN (8,093 lbf.)

$3\sigma$  MBS of a becket of not less than 19.5 kN (4,383 lbf.)

## NFPA 1983 (2006) Descent Control Device Performance Requirements

### Escape and Light-Use

Descent control devices must not show any permanent damage to the device or to the rope at 5 kN (1,124 lbf) and have a  $3\sigma$  MBS of not less than 13.5 kN (3,034 lbf.) when tested with the rope locked off.

If the descent control device has a passive breaking feature, the device shall not slip more than 25 mm at a force of 1.35 kN (300 lbf.) when tested on the smallest and largest diameter specified by the manufacturer.

### General-Use

Descent control devices must not show any permanent damage to the device or to the rope at 5 kN (1,124 lbf) and have a  $3\sigma$  MBS of not less than 22 kN (4,946 lbf.) when tested with the rope locked off.

If the belay device has a passive breaking feature, the device shall not slip more than 25 mm at a force of 2.7 kN (600 lbf.) when tested on the smallest and largest diameter specified by the manufacturer.

### NOTICE:

Catalog figures are the latest calculated  $3\sigma$  MBS from the certification procedure at the time the catalog was produced. Product will be labeled with the minimum MBS required by the standard.