Descender Efficiency

Descent Control devices certified to the NFPA standard may soon be labeled with an efficiency rating. What is an efficiency rating? Will it be helpful in making an informed choice or will it lead you astray? We have tested SMC and Brand X descent control devices to this proposed standard and will present our findings and concerns about the new efficiency rating. We will be demonstrating the test at ITRS, so bring your favorite device and we'll find out how "good" it really is!

Matt Gilbert is currently SMC's Engineering Manager. He is involved in the design, manufacture and day to day quality control testing of SMC's product line. He has been an employee at SMC for over 6 years and has been active in the climbing and rescue industry for the past ten years.

Kevin Slotterbeck has been an employee with SMC for almost 10 years and currently serves as SMC's Technical Representative and Design Engineer. Over the past 10 years he has witnessed or conducted hundreds of destructive tests on climbing and rescue equipment. He is also currently involved in producing test methods and standards for ASTM and NFPA. Kevin has been an active climber since his introduction into climbing through The Ohio State University Mountaineering Club in 1985.

Garin Wallace is SMC's Production Manager. During his 15 years with SMC he has been involved with all aspects of manufacturing including product design, improvements and testing. In addition to his on the job education, he has studied computer science and mathematics at Central Washington University.

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ITRS '99

The purpose of our presentation is to share the results of our recent descender efficiency testing. Using the new proposed NFPA standard, we wanted to know what rating could be assigned to descenders currently on the market.

Review

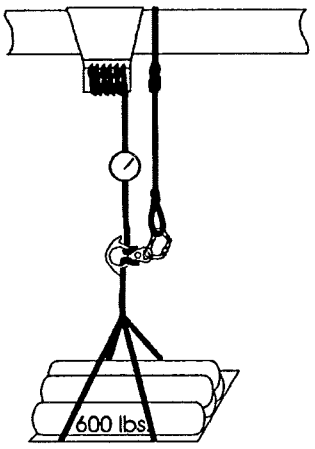
Our testing began with a review of the test procedure and a few practice tests. Quickly we found numerous variables not clearly addressed in the NFPA test procedure. To obtain comparative results we had to make assumptions about these variables.

- Does "locked-off" mean "tied-off" or "stopped"?
  For safety and ease of testing we chose "stopped."
- How fast do we let the load slip?
  We chose about 4 seconds/foot. The rate of our shop hoist.
- Is the force needed to "control" the same as "hold", and the same as "stop"? When and how often do we take our measurements?
  We chose to take several measurements while the load is moving through a one-foot length of rope. We avoided the peaky readings during the starting and stopping of the lower.
- Should we rig our tests in rappel or lowering configuration?
  We chose lowering. We felt it was a more common configuration for the general-purpose load.
- Does the rope need to be new?
  We chose to test using new totally unused sections of ropes. Some ropes yielded different results after they had been used.
- Do we need to control the angle of the breaking rope?
  Our choice was to hold the angle at 6 degrees for Figure 8's and 17-21 degrees for Racks. These angles were easy for us to repeat and we felt they were not untypical.

With these assumptions we pressed on with our testing.

Testing

For our testing we chose 4 NFPA rated rappel racks and 4 NFPA rated Figure 8's. For the ropes we used both 1/2" CMC Life Line and 12.5 mm PMI Classic. Our testing was done at SMC utilizing our load-cell, chain hoist, fish scale, assorted rigging materials and 600lb. of sand from a local hardware. Our setups were per the following two diagrams.



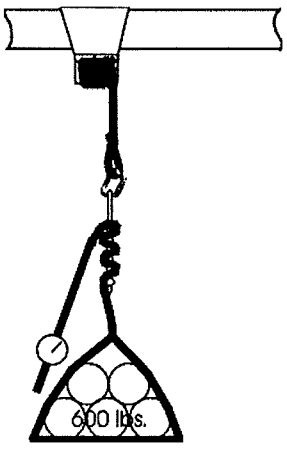
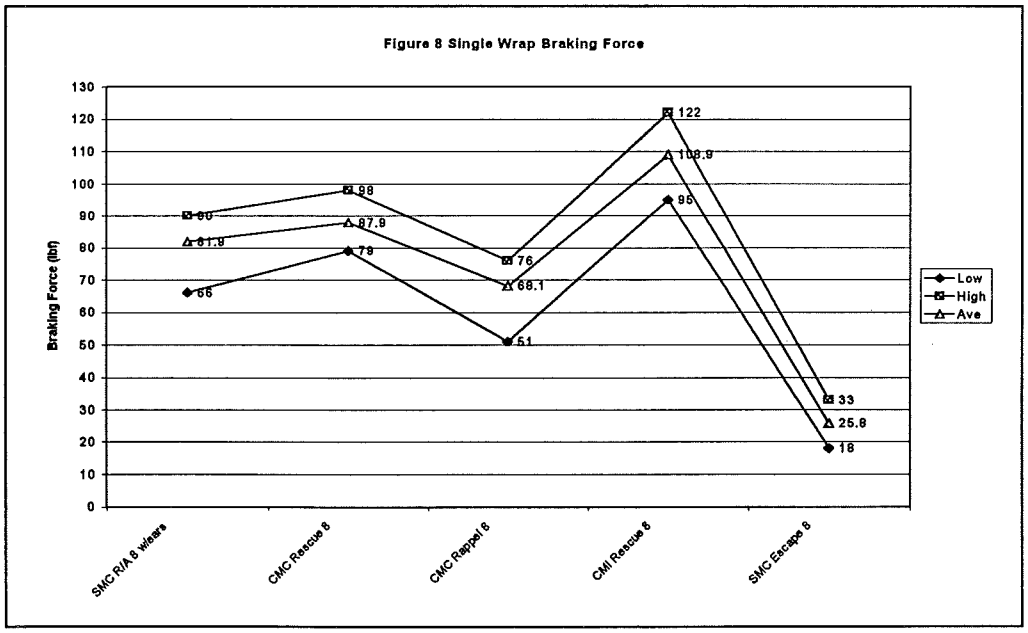
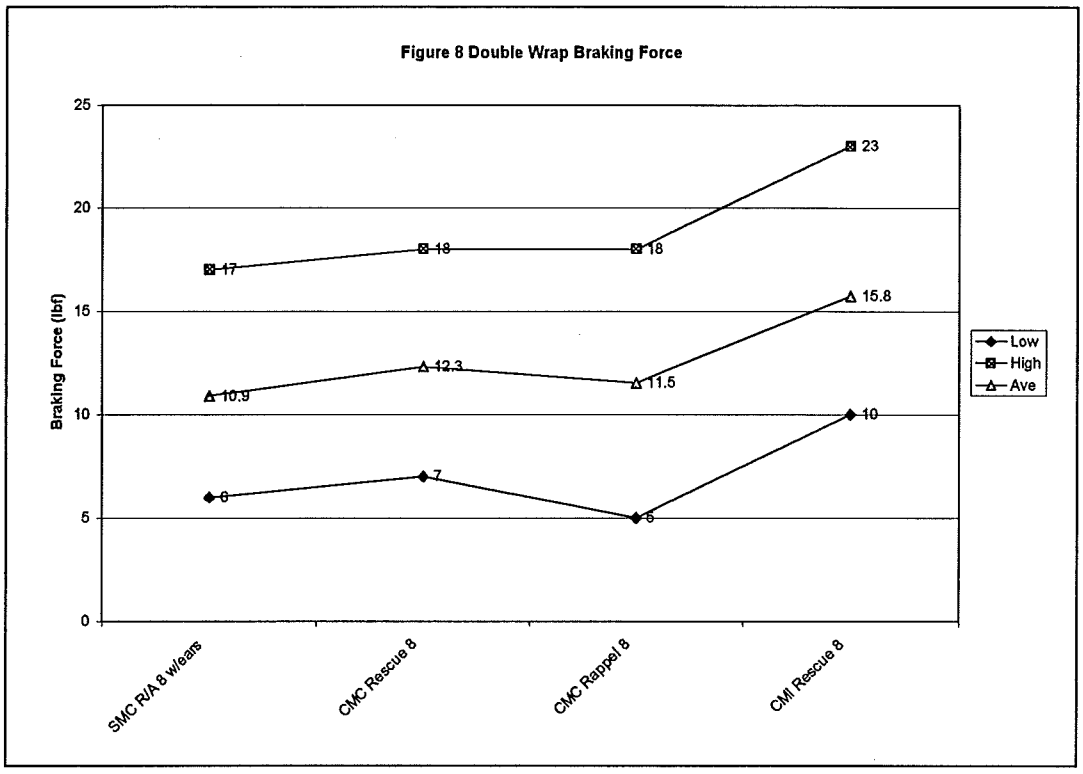


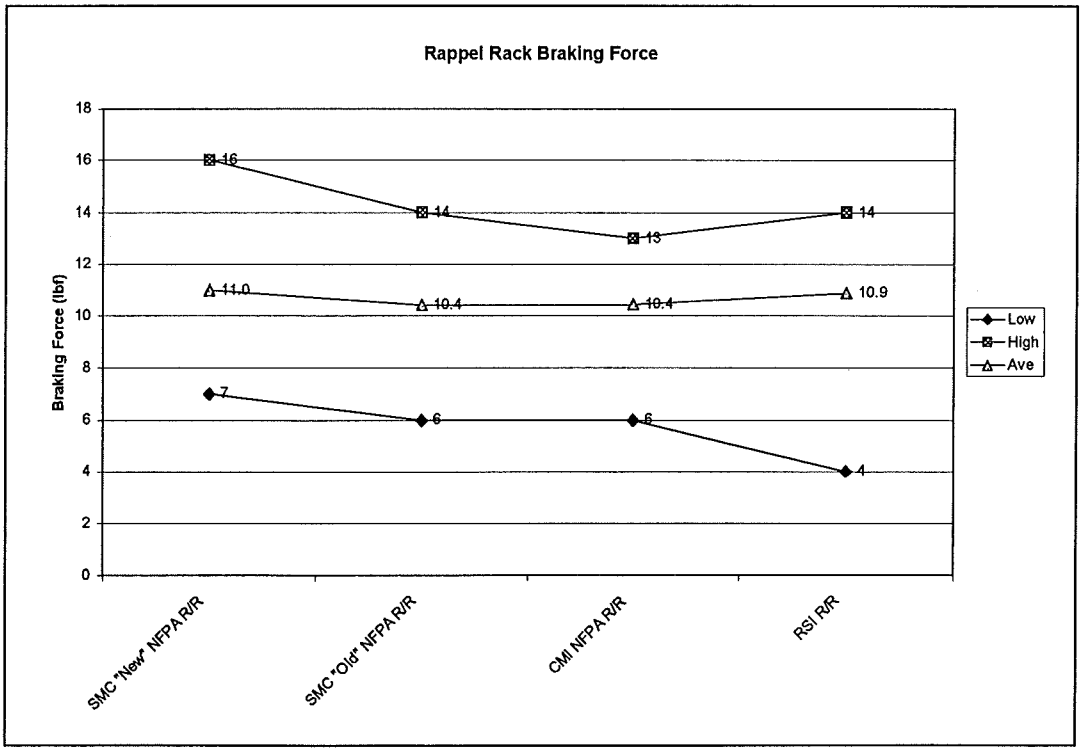
Figure 8 Rappel Rack

During the course of our testing we ran across many more variables. Each time, we had to make more assumptions and each new assumption meant backing up and re-testing some of our setups.

- Rope choice and rope condition affects descender efficiency
  Different brands and models of ropes yield different results.
- How much the bars are "preset" changes the efficiency of the rack.
  Preset is how hard the bars are pushed together before loading. We chose a firm hand preset, rather than going heavy or light.
- Double wrap Figure 8's can develop additional friction by the rope running over itself near the neck of the eight.
  We maintained a very shallow angle of 6 degrees to keep the rope running in this condition. Larger angles could allow the rope to run in and out of this condition which wildly varied its efficiency.







Data presented to ITRS '99 for discussion only

Analysis

The charts are a compilation of all comparable data taken on both ropes. It was difficult for us to draw any conclusions from the test data. Any attempt we made to place a single number value on a piece of hardware was simply misleading. In many cases we found that the variability of a single piece of gear could rank it near the top and the bottom of its type. We found that some gear tended to perform better on PMI rope and others on CMC. But neither rope clearly stood out as more efficient than the other.

Conclusions

Rope, descender, and user technique are all factors that interact and affect the efficiency of the "descender system." Even with all of our assumptions, we were not able to separate the descender from the "descender system". And ultimately we felt unable to assign a meaningful, and therefore useful, rating per this standard.

We did however come away from this project with a couple of not so new observations. First, we would not use a Figure 8 for belaying or lowering a vertical 600lbf rescue load. And second, evaluate your "descender system" during a training situation before you rely on it in a rescue situation.