

# Fire Service Ergonomics

## Hydraulically deployed hosebed helps carry the load for firefighters

Story by Bob Vaccaro



Ergonomic hosebed being deployed

When we hear the word “ergonomics,” we don’t usually associate it with fire service. According to Webster’s Dictionary, the term ergonomics “is an applied science that coordinates the design devices, systems, and physical working conditions with the capacities and requirements of the worker.” In plain English, ergonomics is the study of the work environment and how it affects the average worker.

Let’s look at some of the facts that prompted Pierce to engineer this new product. According to Andy Klein, Pierce’s NPD Pumper, Senior Product Coordinator, the findings from the NFPA firefighter injury statistics for the year 2002, and the NFPA 901, Uniform Coding for Fire Protection, showed that the five major injuries that occurred during fireground operations were strains, sprains (41.6 percent); wounds, cuts, bruises (21.7 percent); burns (8.5 percent); thermal stress (6.4 percent); and smoke or gas inhalation (5.9 percent). Non-fireground activities consisting of strains, sprains and muscular pain accounted for 55.1 percent of the injuries, while wounds, cuts, bleeding and bruises accounted for 18.6 percent.

Results for non-fireground activities had strains, sprains and muscular pain accounting for 55.1 percent of all non-fireground injuries and wounds, cuts, bleeding and bruises accounting for 18.6 percent.

Pierce decided to come up with a product that would aid and increase firefighter safety while working on the apparatus at the fireground. Pierce engineers had a third-party engineering firm conduct a comparative ergonomic study on the work performed by firefighters loading a hose the conventional way and then with the Pack Mule.™

### Facts

A normal hosebed on an Engine is 10-12 feet in height. It usually takes three firefighters to load a hose. One or two to climb up into the hosebed, and one at the back step to guide the hose, with possibly a fourth to back up the truck and signal the driver. Storing a 5-inch hose is the least favorite activity according to firefighters. Couplings alone weigh in at 24 pounds.

Some of the safety issues identified are: slips and falls, standing and walking on top of a moving truck, risk of ankle injury while a firefighter is walking back and forth on top of a hosebed, and risk of back injury from high force. The forces needed to lift, pull and position the hose were measured in excess of 80 pounds. Finally, physiological risk from high-energy demands of the task. Maximal heart rates increase from 80 to 90 percent, potentially creating cardiovascular stress, adding to the exhaustion of an already fatigued firefighter.

The analysis was performed using the University Of Ann Arbor 3 Dimension Static Strength Software. It showed the posture assumed while standing on the top of an engine, exerting a peak force, to be estimated at 80 pounds to both lift and pull the hose. A second trial showed that just standing on the ground and stowing the hose exerts a 20-pound sideway force. After performing the same tasks using the Pack Mule, significant improvements were shown.

- 1. Compression on the spine while completing the same task was one tenth that of the old style, which could eliminate low back injury.**
- 2. The decreased force requirement minimizes the risk of shoulder injury.**
- 3. Heart rate measures indicate that the new approach has fewer demands, which allow firefighters to conserve energy.**
- 4. The fall potential is eliminated, as firefighters are no longer walking on top of the engine.**
- 5. The decreased time to pack hose allows the unit to get back into service in a shorter period of time.**

### How does it work?

The Pack Mule was designed for ease of operation and has been extensively tested in all weather conditions. Utilizing the significant resources available to its parent company, Oshkosh Truck Corporation, and its thorough understanding of hydraulic engineering, the Pack Mule operates from a transmission mounted PTO. If you look at the rear of the hosebed, you will see a large screw. This screw operates hydraulically to move the hosebed up and down.

With the new Pack Mule, a full-size hosebed located at the rear of the engine, hydraulically deploys to waist level in 26 seconds. When activated, the hosebed moves backwards from the top of the vehicle to a position behind the apparatus, somewhere between 38 to 44 inches above the ground. Simple controls are located at the rear bulkhead on the driver’s side. After the hosebed is down, side panels flip down for repacking hose.

The hosebed can carry 1500 feet of 5-inch hose or 1000 feet of 5 inch hose combined with 400 feet of 2½-inch hose.

Under the hosebed is a large compartment that can be fitted with hydraulic rescue tools and reels. They can be lowered for use in 15 seconds.

### Not just hype

It seems that Pierce is on its way to changing the way fire service does business. Firefighter safety is of great concern to the people at Pierce Manufacturing. The design of the Pack Mule certainly proves this.

Bob Vaccaro has 30 years of fire service experience. He is a Past Chief with the Deer Park Fire Department located on Long Island. Vaccaro is also a photo journalist specializing in the fire apparatus industry.