



Vacs You Wear: Scientific Studies Shed Surprising Light on Backpacks

By Jim Harris, Sr.

Backpack and hip-style vacuums have soared in popularity in the commercial sector within the last decade. Since the first commercially viable backpack vacuum was brought to market by Pro-Team, Inc., Boise ID in 1987, numerous companies have introduced their version of the backpack. Advocates say backpacks raise vacuuming quality and efficiency by providing better suction and faster, more maneuverable operation than conventional units.

Few people question the legendary speed of backpacks. In 1999, the ISSA (International Sanitary Supply Association) published time/labor data showing backpacks to be more than twice as fast as typical upright vacuums (see Fig. 1).

Figure 1 – Vacuum Production Rates

Vacuum Type	Coverage per Hour
14" Two Motor Upright	3,240 ft ²
14" Tool & Backpack	7,407 ft ²

DATA SOURCE: ISSA ("358 Cleaning Times" by International Sanitary Supply Association)

Recent studies conducted by Battelle Memorial Institute, Columbus, OH—a non-profit research organization--provide more conservative but still impressive productivity numbers for backpack vacuums (i.e., backpacks covered twice the area of an upright vacuum in the same one hour test period).

Other questions arise, however. While backpacks have a clear productivity advantage, does the data show these vacuums clean as well or better than floor-based counterparts? Are backpack or hip-style vacuums ergonomically as safe as uprights for extended periods of use? Are backpacks more tiring to use than uprights?



Credible scientific sources, such as QUEST (Quality Environmental Services & Technologies, Inc.) in Denver CO and Battelle Memorial Institute (in conjunction with Ohio State University) have systematically analyzed the performance of backpack vacuums in relation to upright vacuums to provide reliable answers. Three recent studies shed surprising light on backpacks.

Backpacks versus Uprights: Cleaning Ability

QUEST, Denver CO, an independent test firm, compared the cleaning ability of backpack and upright vacuums in 1997. The lab tested soil removal effectiveness by evenly distributing 100 grams of test soil (80% silica sand and 20% talcum powder) onto a 6' by 6' commercial grade test carpet, working the test soil into the carpet with a carpet rake, vacuuming the test carpet for 60 seconds, and removing and weighing the pre-weighed filter bag. Researchers then calculated the percent of test soil picked up and retained in the filter bag. Upright vacuums, including a two motor unit, removed between 87.9 to 94.9 percent of soil, while backpack vacuums removed between 91.3 to 96.1 percent.

Contrary to the prevailing view that upright vacuums are necessary for thorough cleaning of commercial carpet, backpacks showed a slight but definite advantage in cleaning ability on this surface. The test report, published in August 1997, is available on request (See [Reference #1](#)).

Ergonomics & Energy Use: Backpacks versus Uprights

Battelle Memorial Institute conducted in-depth examinations of backpack versus upright ergonomics (biomechanical assessment) and energy use (metabolic assessment) at Ohio State University in 1997-1998.

Neither backpack nor upright vacuums were determined to be ergonomically detrimental in sustained use. Backpacks offer an advantage, researchers noted, by allowing the operator alternating methods of operation including the push-pull type motion typical of uprights or the side-to-side sweeping motion exclusive to backpacks. The floor cleaning wand of a backpack vacuum is also lighter to maneuver than an upright vacuum. The varying range of movements possible with backpacks may prevent or alleviate repetitive stress, the study concluded. (See [Reference #2](#))

From a metabolic perspective, backpacks were determined to consume half as much operator energy as uprights for equal amounts of cleaning. Put another way, backpacks



cleaned twice as much area using about the same amount of operator energy (see report excerpt below).

Battelle's Metabolic Assessment of Backpack Vacuums & Upright Vacuums

"In summary, these results indicate that in terms of metabolic demands and area cleaned the BPVC [Backpack Vacuum Cleaner] was ergonomically more efficient compared to the UVC [Upright Vacuum Cleaner]. These data suggest that with similar levels of energy expenditure and perceived effort, industrial cleaners can clean approximately 2.07x greater area with the BPVC than the UVC." (See Reference #3)

Conclusion

The data cited shows the tested backpack vacuums outperformed the tested upright models in deep cleaning ability on commercial carpet. Ergonomically speaking, in prolonged use, neither uprights nor backpacks were found to be detrimental to operators. Backpacks allowed a greater variety of motion to prevent or alleviate repetitive stress and fatigue. From a productivity perspective, backpacks cleaned over twice as much area as uprights with similar worker energy consumption. As scientific studies advance our knowledge of vacuum cleaners and related efficiencies, many long-held but erroneous viewpoints will have to be discarded with the dust removed.



Sidebar – Ergonomic Training: Fit and Technique

It's crucial that any specialized tool be used properly, especially one fitted to your body. Backpack vacuums must be worn and used properly for maximum comfort. The padded waist belt should fasten snugly around the hips, allowing shoulder straps to fit comfortably but loosely. The primary weight of the unit should rest on the hips, not the shoulders, since shoulder straps serve mainly to balance the pack and prevent load shifting. The backplate—a ventilated panel that rests against the operator's back and supports the vacuum unit—if adjustable, should be positioned according to the height of the operator. Backplate adjustment raises or lowers the vacuum relative to the operator to facilitate a range of torso sizes for convenient movement and use.

The upper body should stay upright during backpack vacuuming. For maximum productivity without fatigue, a side-to-side fanning technique with a lightweight aluminum vacuuming wand (a motion similar to mopping) allows rapid vacuuming without back bending or other biomechanical stress. Persons who can mop a floor without undue fatigue or discomfort are able to use a backpack vacuum using a similar motion for long periods.

When vacuuming underneath large desks or other furnishings, vacuumers should bend their knees rather than their backs. By bending at the knees, and using the vacuuming wand to get into hard to reach areas, no undue demands are placed on the back.

An often-neglected technique that makes vacuuming both easier and more effective is keeping the vac bag emptied. Emptying the bag frequently lightens the unit, keeps filter pores clean to trap maximum dust, and maintains airflow for good suction and motor cooling.

Knowing these simple techniques isn't enough, however. Vacuumers need time to adapt to new equipment and develop the right habits. Workers require hands on training and a practice session or two to get the feel of the backpack, and learn to use the tool without improper bending, twisting, or lifting. Observe workers, monitor complaints if any, and coach them in correct technique.

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References

Reference #1

“Improvements in Vacuum Cleaner Soil Removal Effectiveness”

By Robert A Woellner, Senior Scientist, Quality Environmental Services & Technologies, Inc., Denver CO. (Published August 11, 1997)

Reference #2

“Biomechanical Assessment of an Upright Vacuum Cleaner and Backpack Vacuum Cleaner” by Nancy L. Denniston, M.S., Sheldon R. Simon, M.D., Kirby Clark, B.S. Department of Surgery, Division of Orthopaedics, Ohio State University, and Battelle Memorial Institute, Columbus OH. (Completed 1998)

Reference #3

“Comparison of Metabolic Responses During a One-Hour Vacuuming Task With a Backpack Vacuum Cleaner and An Upright Vacuum Cleaner” by Larry J. Mengelkoch, Ph.D. and Kirby Clark, B.S. Physical Therapy Division, Ohio State University, and Battelle Memorial Institute, Columbus OH (Completed 1998)