



Technical Article on Specifications

By Dave Jansik

There are many things to consider when purchasing a vacuum cleaner. How well does it clean? How durable is it? Does it fit into a green cleaning program? Will the staff find it easy to operate? Part of the buying process is evaluating specifications for cleaning power. ProTeam lists product attributes such as amps, watts, static lift and CFM and provide numeric values to them. But what do those numbers mean?

When investing in new cleaning equipment, it's important to understand what these specs are telling you and how they fit into the overall operation of the machine. Many manufacturers think that big numbers are the way to make a sale, but specs alone don't tell the full story.

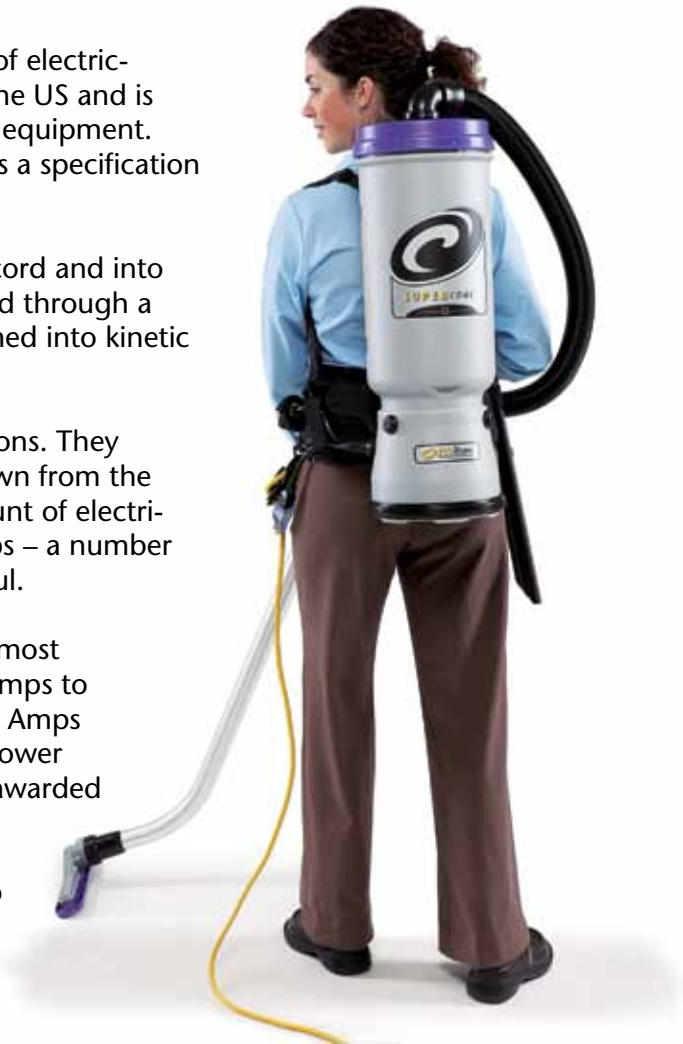
Plugging In

When the vacuum is plugged in, you gain access to 120 **volts** of electricity. This is the standard amount available from most outlets in the US and is enough to power such items as small appliances and electronic equipment. Since 120V is a standard number, volts are generally not used as a specification for a vacuum cleaner.

After flipping the switch, electric current is forced through the cord and into the vacuum. This is commonly compared to water being pushed through a pipe by a pump. In the case of the vacuum, current is transformed into kinetic energy by spinning the motor's rotor.

Amps are commonly used by manufacturers in their specifications. They are a measurement of how much electrical current is being drawn from the outlet by the motor to create suction and lift. The highest amount of electrical current a product may pull from a standard outlet is 15 amps – a number many manufacturers like to hype to show theirs is most powerful.

It is a common misconception that the vacuum that draws the most electricity is the best at dirt removal. Many manufacturers use amps to represent power like automobile manufacturers do horsepower. Amps are simply a measure of power drawn out of the wall, not the power behind the lift and airflow. For instance, ProTeam was recently awarded a Gold Seal of Approval by the Carpet and Rug Institute's (CRI) independent testing labs for the Super CoachVac® HEPA backpack and the Super QuarterVac® that each have a 9.9 amp motor. ProTeam commercial-grade vacuum cleaners are engineered with motors rated from 5.5 to 11 amps, depending on the model.



By taking the amount of voltage available at the outlet and multiplying that by the vacuum’s amps rating, you can determine its input power, or watts. **Watts** are a measurement of how much electricity is being used by the vacuum at the wall. Consider that light bulbs are rated by watts – the 100W bulb uses more power and is brighter than the 40W bulb. ProTeam vacuums operate within a range of 680 to 1320 watts, with backpacks coming in between 744 and 1188 watts.

Manufacturers vary in the power specifications they provide. Here are two simple formulas for determining power ratings:

$$\text{Watts} = \text{Volts} \times \text{Amps}$$

$$\text{Amps} = \text{Watts}/\text{Volts}$$

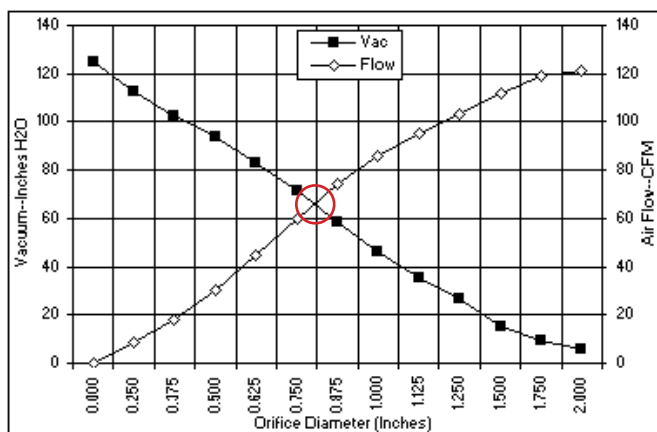
Moving Air

With electricity providing the kinetic energy, the goal is to build a pressure differential. For suction to happen there must be higher pressure in the room and the lowest possible pressure inside the machine.

There are several ways suction is reflected in power specifications. One is **airflow** – the maximum volume of air the vacuum can drive - measured in cubic feet per minute (CFM). Vacuums generally rate between 95 and 150 CFM. Another is **static lift**, or the force behind the flow. Measured in inches, this specification describes the vacuum’s maximum ability to lift and move dirt from a surface. In the lab, this number is determined by how many inches of water the vacuum cleaner can lift through a tube. Lift is what keeps the air flow at its peak when on the floor. Look for numbers ranging from 60 to 100 inches.

Numbers provided for these specifications reflect the vacuum’s highest power performance capabilities. Over the course of a cleaning shift, lift and flow changes based on a wide range of factors. Are you cleaning carpet or hard floors? How many levels of filtration are there? Is the filter becoming full? What is the diameter of the hose attachment being used? As an industry generally has advertised motor specs as a standardized way to compare product. A much more realistic approach would be how well vacuum cleaners perform as a whole system.

The graph below demonstrates the inverse relationship between airflow and lift. When one is at its maximum, the other is at its minimum. The highlighted area where the two lines cross is the focus of much of the engineering and design in a ProTeam vacuum cleaner. This indicates where the vacuum is performing, on average, throughout a day of cleaning.



[Graph info – black line is lift, white line is flow, the red circle highlights where vacuum designers need to optimize performance – in the area that reflects most realistic conditions the vacuum is in]

An exceptional vacuum cleaner is designed to have as little loss of lift as possible. True cleaning effectiveness and performance is measured when the vacuum design enables the intersection of lift and flow to be as high as possible when typical cleaning conditions affect maximum lift and flow.

Another measure of power used by some manufacturers is an ASTM International standard called **air watts**. It measures suction, airflow, air power and input power. Air watts are calculated by multiplying airflow CFM by static lift in inches then dividing that number by 8.5. Ratings come in between 250 and 450 air watts. Air watts represent overall vacuum performance at the motor, not taking into account the other vacuum components such as filter, hose and attachment diameter. ProTeam does not use this specification because it doesn't reflect on the job performance.

Cleaning effectiveness is also proven by gaining a Carpet and Rug Institute (CRI) seal of approval. CRI tests vacuums on various piles of carpet to measure soil removal, carpet fiber protection and dust containment after the dirt enters the machine. In 2010, seven of ProTeam's leading vacuums earned the gold Seal of Approval/Green Label from the CRI. This designation signifies these vacuums meet the highest standards for carpet cleaning effectiveness and indoor air quality. The gold winners are the Super CoachVac, Super CoachVac HEPA, Super QuarterVac, Super QuarterVac HEPA, MegaVac, RunningVac and ProVac CN.

In the end, power specifications matter – as long as the overall design of the vacuum makes the most of them. However, it is important to note that as an industry manufacturers generally have advertised motor specs as a standardized way to compare products. A much more realistic approach would be how well vacuum cleaners perform as a whole system.

Greener Cleaning

An important benefit of lower amp motors is that they deliver on green cleaning initiatives by being much more energy efficient. And using less power means quieter operation.

LEED-EB guidelines include a category for using sustainable cleaning equipment. A point is earned for using vacuum cleaners that both meet the requirements of the CRI Green Label testing program and operate at sound level below 70 dB.

Similarly, OSHA requires that employees be provided hearing protection when exposed to 90 decibels - comparable to a power drill, blender or a busy city street - for more than eight hours (acceptable timeframes decrease as sound levels rise). Independent testing has found many machines on the market operate in the disruptive 85 to 90+ dB range.

A quiet room doesn't actually register at 0 dB – typically it comes in between 35 and 40 dB. Normal conversation averages from 60-70 dB. In call centers, cubicle farms, and other office areas, the noise level typically hovers between 64 and 68 decibels. ProTeam has developed vacuums that are well below the required sound levels in LEED and OSHA standards. Commercial backpack and canister models are designed to operate between an unobtrusive 47 and 68 dB. This is a result of advanced engineering that includes solid body construction, sound baffles, quiet power modes and quieter motors. These machines help protect the hearing health of staff while letting them clean without causing undue disruptions.

