By Dan Pascoe

REGENERATIVE BLOWERS

Regenerative blowers, side channel blowers, and gas ring blowers are all the same technology, but different manufacturers use different terms to describe them.

A regenerative blower (Figure 1) is a fan with blades inside a housing (3). The fan or impeller, to give its correct term, is normally directly mounted to the electrical motor (4) shaft. As the impeller turns, gas (air in most cases) is pulled in through the inlet port (1). As the gas is drawn into the compression chamber, centrifugal force accelerates the gas outwards, increasing the pressure inside the pump. After a full rotation, the compressed air exits through the compression port (2). Consequently, the same model of pump can be used for both vacuum and pressure. However, accessories such as filtration and relief valves should be used based on the intended application of either vacuum or pressure duty.

Regenerative blowers in a vacuum application are often used for high-flow applications where a high vacuum level is not required. This could be something as simple as an application where the vacuum cups are very large and therefore do not need a high vacuum or where the blower is being used on a vacuum cup similar to the model shown in Figure 2 where the combined lifting force of many cups at a lower vacuum is very high. For example, each cup shown in Figure 2 is able to lift a weight of 5.5 pounds at 6 "Hg. However, the total lifting force of the head shown is 528 pounds, as there are 96 cups. This particular vacuum-lifting head was designed to lift 60-pound boxes. Therefore, there is plenty of extra lifting capacity or safety factor included.

However, there might be air leaks (vacuum leakage) due to the cups on the head (Figure 2) not being covered by the cardboard boxes. But because regenerative blowers offer a much higher flow than traditional rotary vane pumps per comparable motor HP, the blower is able to compensate or "keep up" with this leakage while still maintaining vacuum on the cups covered by the load being handled. Table A demonstrates a comparison of motor power versus vacuum level and airflow between a typical dry (oil-free) rotary vane pump and a regenerative blower.

actuation can dramatically decrease the size and indeed the type of vacuum pump choice.

Regenerative blowers have a particular advantage over most other types of vacuum pumps, as they are virtually maintenance-free in respect to consumable parts. They are a rotary piece of machinery without oscillating parts or lubrication needs. The only parts that might require periodic replacement are bearings, but with bearing technology today, you can expect tens of thousands of hours of life between bearing replacement.

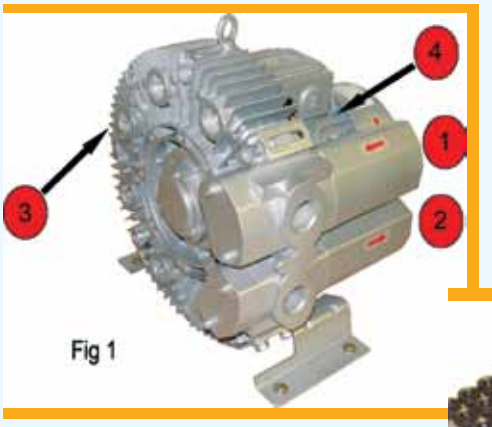

Fig 1

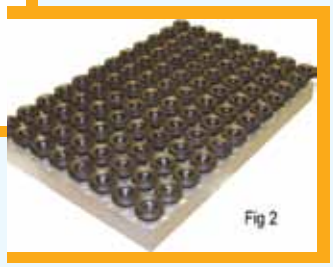
Fig 2

As with any vacuum pump installation, correct accessory selection is very important. Regenerative blowers should always be installed with inlet filtration and vacuum relief valves. The rated maximum vacuum level of the blower shown in Table A is its design vacuum level. If the pump is "dead-headed," the vacuum level will certainly increase, but the pump will overheat, the impeller will start to expand, and mechanical wear and consequent failure are inevitable. Relief valves for regenerative blowers should always be used. Some manufacturers' models do not need relief valves, but that is because the maximum achievable vacuum level is very low because of the large tolerances used in its construction.

The relief valve should be set just below the maximum design vacuum level recommended by the manufacturer. As the pump operates, normally in a continuous operation, the relief valve will "crack," allowing air to bypass the application and flow through the pump and out the exhaust. However, the user should not rely on the relief valve. If this valve becomes blocked or out of adjustment or simply fails, the pump could incur damage as previously described. Therefore, if the user knows that the pump will often be "dead-headed," a 3-way valve should be used to turn the vacuum on and off to the application. When the vacuum is OFF (to the application), the pump is able to draw air through the valve to ensure continuous airflow. If the application is vacuum cup, handling a further valve should be used to relieve the application of vacuum to allow release of the product. Therefore, during a lift cycle, the pump will rely on the relief valve but only during the lift cycle.

Inlet filters should always be used to prevent ambient particulates (in a compressor application) or application particulates (in a vacuum application) from entering the regenerative blower at the inlet port. The surface speed of the impeller is very fast due to its large diameter. For example, an impeller of 12-inches diameter that is coupled to a motor with an RPM of 1450 has a surface speed at the compression edge of about 50 mph. Quite fast if you consider a 0.25-inch diameter wood chip getting "sucked" into the inlet port. Because of the small tolerances between the impeller and housing, this debris would most certainly cause damage to the blower, yet it is very common to see applications where regenerative blowers are used without filtration.

A filtration porosity of around 5-10 µ (0.005 - 0.010 mm) is common, and the filter should be sized correctly for the maximum flow of the blower to minimize flow restriction. Always confirm the recommended filter specifications with the blower manufacturer.

The units of vacuum degree used in regenerative blower specifications catalogues vary depending on the origin of the manufacturer. In North America, the units are normally "Hg (inches of mercury) or more commonly "H_20 (inches of water). The "H_20 is very common due to its large divisible number. For example, 10 "Hg equates to about 117 "H_20. This is useful for accurate or precise specification of pumps or application need. Regenerative blower manufacturers in Europe use mbar (millibar). One millibar is one atmosphere (1 bar) divided by 1,000. It is also important to understand that most manufacturers of regenerative blowers use differential pressure for vacuum-level specification. That means that the figure given in either unit of measurement is the difference from normal atmospheric pressure. This should be indicated by the symbol Δp (delta P). Therefore, a maximum vacuum level of 200 mbar Δp is 200 mbar lower than the local atmospheric pressure.

When selecting a regenerative blower for vacuum use, like any vacuum pump, the time to evacuate a volume and the desired maximum vacuum level will determine the pump model. The accessories for that model are normally standard, and manufacturers are able to assist in the model selection and accessory choice.

NOTE: This article is intended as a general guide, and as with any industrial application involving machinery choice, independent professional advice should be sought to ensure correct selection and installation.

Vacuum Pump Type	Maximum Vacuum Level	Maximum Flow Rate	Weight	Motor Power
Rotary Vane	27 "Hg	71 CFM	202 lb	5 HP
Regenerative Blower	10.2 "Hg	85 CFM	57 lb	2.3 HP

TABLE A

Table A demonstrates the regenerative blower uses a much smaller electrical motor and is considerably lighter and more compact. The rotary vane pump is able to offer a much higher vacuum level, but in most cases, a high vacuum level for vacuum lifting is not necessary. The correct choice of vacuum cups, ancillary equipment, and methods of vacuum

Daniel Pascoe is General Manager of Vacuforce Inc., which specializes in the application of vacuum systems and components for industry in North America. Daniel can be reached via the Vacuforce website at www.vacuforce.com.