HANDLING LARGE LOADS

PART TWO

By Daniel Pascoe

In larger-load handling, the consequence of dropping the part is that much more expensive and of course more dangerous than handling small parts inside a guarded machine area. This article focuses on the solutions that should be employed to prevent the dropping of a load due to power failure, be it compressed air or electrical.

When vacuum lifting, it's easy to select a simple vacuum generator and cup. However, if compressed air or electrical power is suddenly lost, the load will fall unless safety logic is employed in the system. There are some products available that offer an all-encompassing logic circuit, but these are expensive and very limited in respect to the potential vacuum flow they can offer. This article will explain the individual components that should be employed in preventing sudden vacuum grip loss.

Fig. 1 shows a typical **all-pneumatic** vacuum circuit that includes multiple vacuum circuits and safety shut-off valves. The order of operation is as follows:

The compressed air **MAIN SUPPLY** connects to the **vacuum generator**, which in turn evacuates the **vacuum tank** after pulling the check valve open**.** The piping between the tank and the P ports of the **control valves** (C1 and C2) is also evacuated to the maximum vacuum level of the vacuum generator. If this vacuum generator has an "energy saving circuit" (which is recommended in most cases), the generator will turn OFF when the vacuum level is reached. The vacuum remains in the circuit, as the check valve closes when the generator is turned off.

When the vacuum cups are placed against the product to be lifted, the pneumatic pilot **control valves** (*Fig. 2*) are powered by the control supply circuit. The **safety valves** (S1 and S2), which are normally closed (NC), are powered OPEN by the Mains Supply, allowing vacuum to reach the cup face. The part is lifted by the machine. When the pilot signal is removed from C1 and C2, the part is released.

The safety valves will always be open if a mains compressed air supply is present. During a lift cycle, if the mains supply air is lost, the safety valves S1 and S2 will close, maintaining vacuum to the cups. The length of time the cups retain a holding force on the part is determined by the porosity of the product being handled and the leak tight condition of the system (interconnecting fittings and hose).

Fig. 3 shows a typical **electrical pump** circuit. Identical in operation to the pneumatic circuit shown in *Fig. 1*, this system uses solenoid valves (*Fig. 4*) instead of pneumatically piloted valves. Therefore, if mains power is lost to the vacuum pump, the safety valves S1 and S2 will close maintaining vacuum to the cups.

Vacuum tanks or reservoirs are very useful and a low-cost option for added safety in a vacuum circuit. These are employed in both the pneumatic and electrical circuits shown in *Fig. 1* and *Fig. 3*. The tank offers a buffer in the vacuum circuit to compensate for leakage in the circuit, therefore reducing potential vacuum decay rate but also offering the benefit of instant vacuum power being available when the vacuum controls valves are employed.

Assume, for ease of calculation, your vacuum circuit has a piping volume of 1 liter between the control valves and the cup face(s), and the volume, including tank and piping, between the tank and the valve is 10 liters. If the system vacuum level at rest is 24"Hg when the control valves are opened, the whole circuit, which is now 11 liters, will equalize. Therefore, the system vacuum level only drops to 21.8"Hg and then immediately starts increasing as the pump or generator returns the system to final vacuum level. (Calculation explained: 10/11= 0.91. 24"Hg x 0.91 = 21.8). Cycle times will be greatly increased

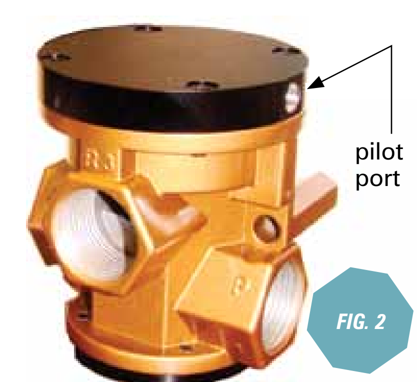

FIG. 2

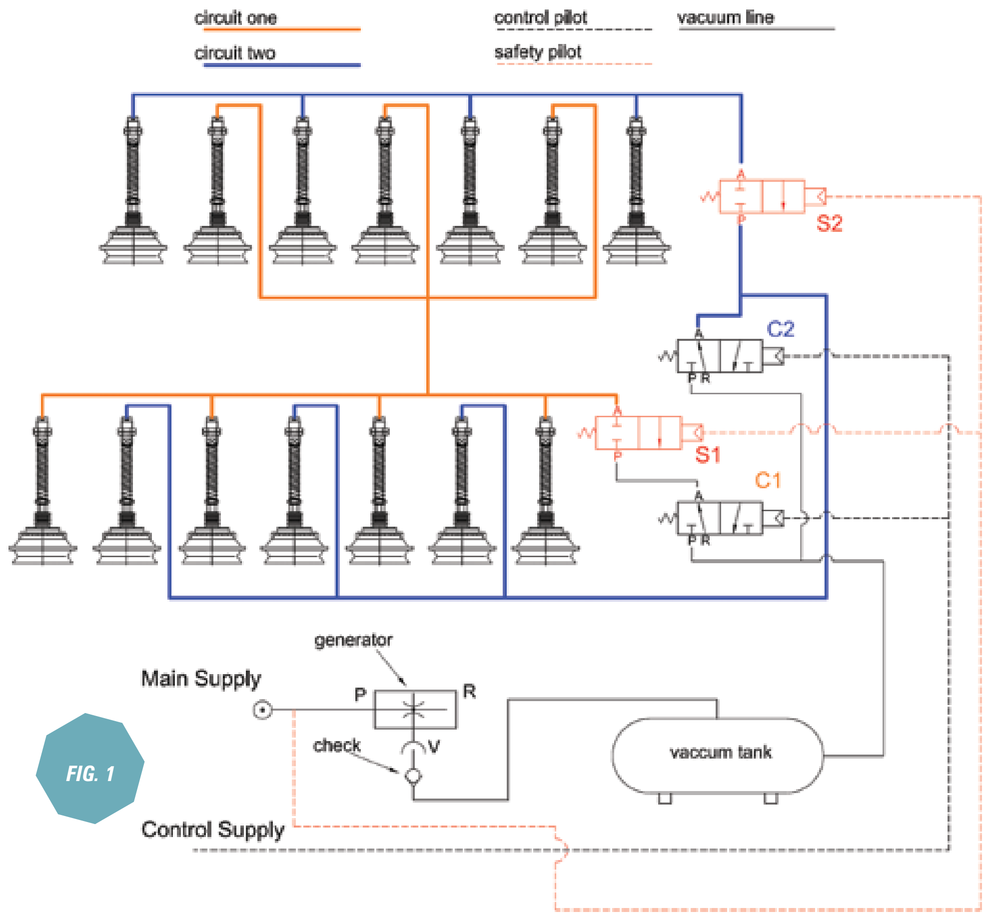

FIG. 1

as the system does not have to "ramp up" (start again) each time the control valves are powered

Vacuum filtration is not shown in *Fig. 1* or *Fig. 2*, however, vacuum filters should always be used to protect the pump or generator from debris on the parts being handled. That being said, the selection of filtration models and most importantly where they are placed in a vacuum circuit will determine the safety of the complete lifting application. Some manufacturers offer filter pads or disks that are installed *inside* the vacuum cup. These are very rarely a good idea. The simple reason is that unless they are checked very regularly, the user is unaware of how much these filters are restricting vacuum flow and indeed the lifting force of the associated cup. It is also very hard to know if the filters are clogged. The vacuum reading taken from the circuit via either a gauge or transducer could be much higher than what the actual cups are experiencing.

A single point filter should be used that is easily cleaned and inspected, and more importantly, offers a longer element life compared with filter disks installed inside cups.

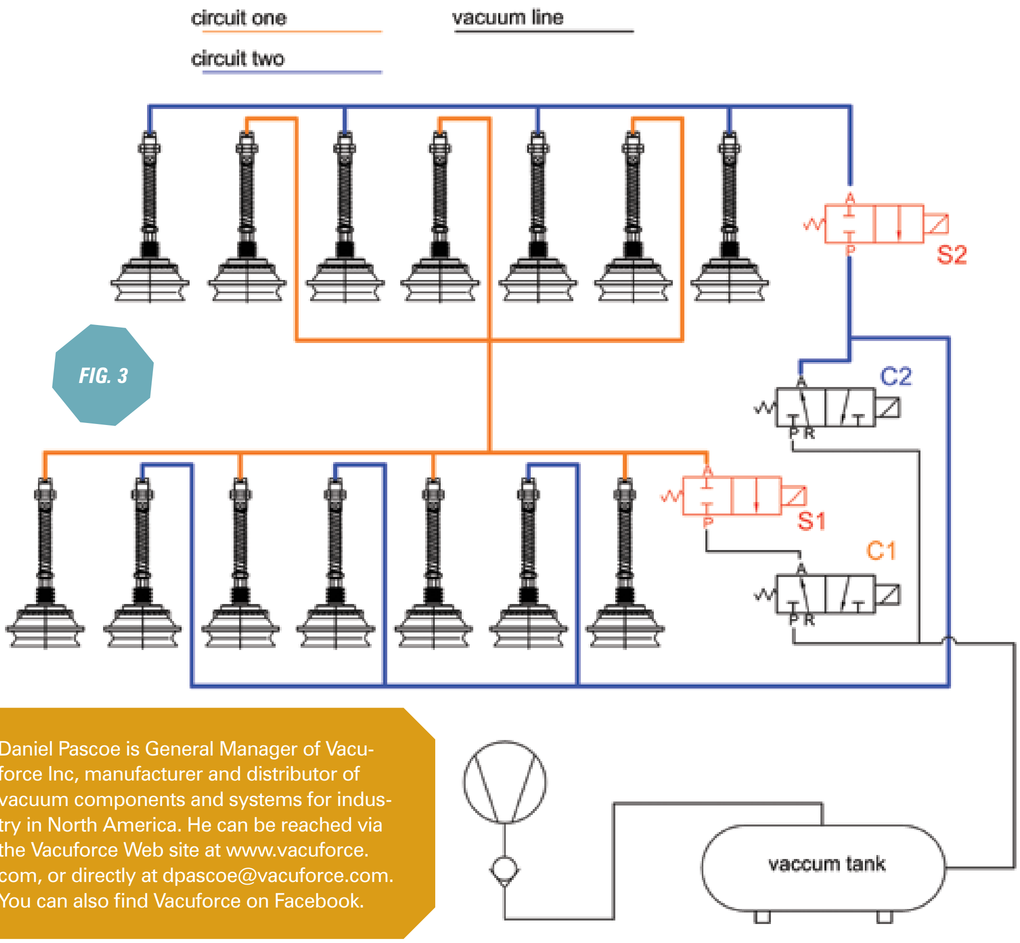

FIG. 3

As discussed in Part One of this article, when self-closing valves are employed on each vacuum cup, if one of the cups breaks away from the load or does not seal properly, the cup is isolated from the rest of the circuit, and the holding capacity of the remaining cups is not affected. Each vacuum cup in the circuits shown should have one of these valves installed.

By using two interlaced vacuum circuits, self-closing valves (velocity fuses), safety shut-off valves, vacuum tanks, and single point filtration, the user is assured of a safe, yet simple, large-load vacuum-lifting system.

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.

FIG. 4

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