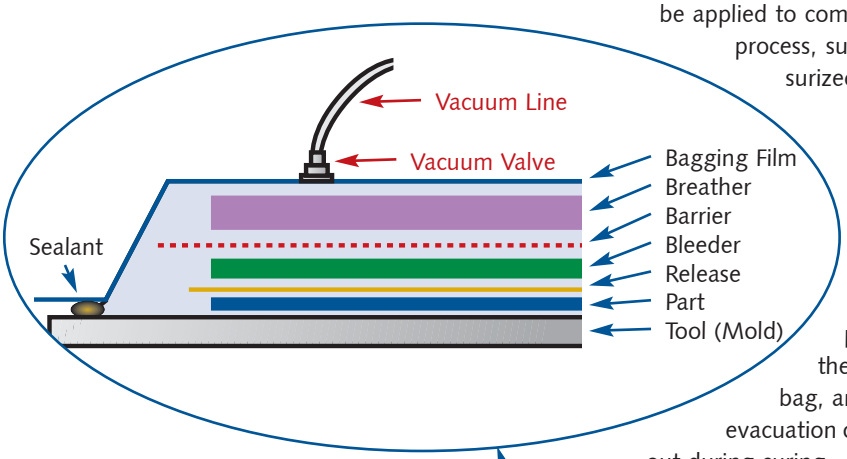
Nash Pumps for Processing Composites in Autoclaves

NASH
A Gardner Denver Product

An autoclave applies pressure uniformly, irrespective of the workload's shape

About Vacuum in Autoclaves

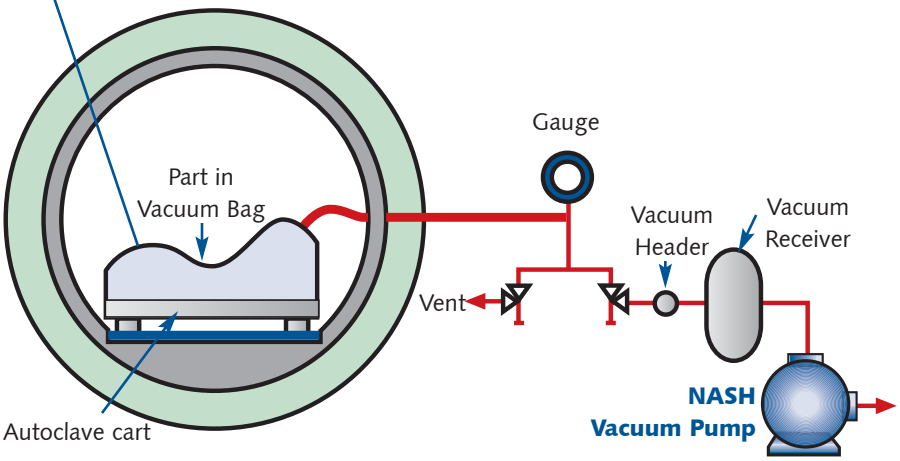
Autoclaves are pressure vessels used for sterilization or to process parts and materials which require exposure to elevated temperatures while under pressure. Both heat and pressure are required to make an autoclave work. Processing by autoclave costs more than oven heating, so it is usually only used when isostatic pressure must be applied to complex shapes. If steam is an integral part of the process, such as in rubber vulcanizing, an autoclave pressurized with steam is used.



Parts processed in an autoclave are often vacuum bagged, which allows pressure to operate isostatically on the pieces. A loosely fit bag, made of resilient plastic capable of withstanding the temperatures involved, encloses the part. When vacuum is drawn, the bag is compressed by atmospheric pressure and compacts the components inside. Between the parts and the bag, an absorbent material provides a channel for the evacuation of the air and wicks up the excess resin squeezed out during curing.

Typical autoclave cycle when curing composite parts:

- autoclave is loaded and the vacuum bag and thermocouple connections are made to the autoclave
- door is closed and locked
- pressure is applied until the required level is reached
- depending upon requirements, the vacuum bag can be kept under vacuum or not
- circulation fan starts
- heating begins and is maintained at specified rate
- once optimum temperature is reached, a timed soak begins and runs for the necessary duration
- at the end of the soak period, the temperature is cooled to a set value
- vessel is depressurized and the circulation is stopped



The simplest version of this vacuum system consists of a pump and gauge on the outside and a single quick-disconnect port on the inside. In more complicated systems, there may be a dozen or more vacuum supply lines going into the machine with as many gauge lines coming back out to vacuum sensors.

The flow capacity of the vacuum pump is less important than its peak vacuum level. Any significant flow means that there is a leak in the vacuum bagging, and a powerful pump will try to overcome this, resulting in a smaller measured vacuum loss than would be the case with a smaller pump. this would serve to hide the bag failure, because the vacuum drop would be harder to detect. Since at operating equilibrium there should be no air flow at all, it is better to draw a higher vacuum than to try and maintain a high flow rate.

A properly sized vacuum receiver tank can maintain system vacuum, though that is a rare event with Nash liquid ring vacuum pumps. When multiple parts are processed, it may be beneficial to have a separate vacuum line for each, reducing the potential loss if one vacuum bag leaks during the cure period.

If the process generates considerable resin flow out of the workplace, the process specification may demand resin traps. Some materials lose enormous amounts of highly mobile resin during heat-up, and this can sometimes work its way back through the vacuum. In addition, some resins, such as polyesters, give off significant amounts of volatiles during cure. These will also carry out through the vacuum ports. A Nash pump can easily handle these types of carryover, so they will not cause any process upset.

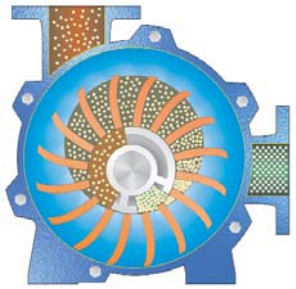
Typical Uses

The aerospace industry manufactures small numbers of very expensive products, made from composite materials. The curing of the composites requires compacting the plies of material, pressing this material against the mold, forcing out volatiles and excess resins and holding everything motionless during the entire cure cycle. An autoclave applies pressure uniformly, irrespective of the workload's shape, which makes it perfect for jobs like this.

Rubber vulcanizing can not be done in the air, so steam is used, which requires a pressure vessel of suitable capability - an autoclave. The manufacture of pressure treated wood may require autoclaves, as can the sterilization of waste products. These processes are carried out in an autoclave without a bag.

The Liquid Ring Advantage

Liquid ring vacuum pumps and compressors that use a fluid compressant in lieu of pistons, vanes or rotating lobes are the best choice in most applications. They provide benefits that are not possible with other alternatives.



Nash Reliability

Nash liquid ring vacuum pumps and compressors have been used in many industrial applications for more than 100 years. They are known as tireless workhorses, designed to stand up to the rigorous, nonstop demands of the harshest industrial environments. Built better than industry standards, Nash pumps are known for their reliability.

NASH Features	User Benefits
Ability to handle process carryover or recycled gases	Increased operating efficiency and reduced operating costs
Long design life	Highest reliability
No internal lubrication required	Less maintenance required; less downtime
No metal-to-metal contact	Simple operation; wear-free performance
Cool Running	Incoming vapor is condensed. Smaller, less costly equipment can be selected
Only one moving part	Simple and trouble-free operation
Proven energy efficient design	Lower operating costs, year after year
Over a century of engineering and application experience	Peace of mind

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