

## **Vacuum and Compressor Systems for the Chemical Process Industry**



# NASH Vacuum Pumps & Compressors

## Proven technology built from experience

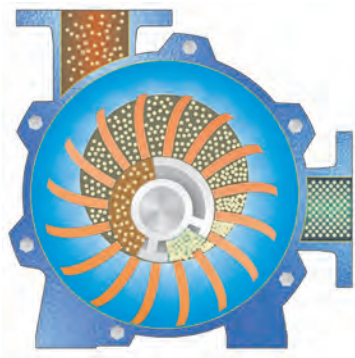
Gardner Denver Nash has been serving process industries such as petroleum, chemical and pharmaceutical for more than a century. You can count on Gardner Denver Nash to design and deliver the right solutions for your vacuum pump and compressor system application. As a worldwide leader in vacuum technology, Gardner Denver Nash has the expertise and knowledge to ensure that you receive the best product for your application.

We don't just sell something off the shelf. We take the time to determine what your needs are through a comprehensive analysis of your process. We then design the system to meet your specific requirements beginning with the fundamentals - capacities, vacuum or pressure levels and the unique demands your process will require. We take into consideration your objectives relative to operating costs and initial capital investment. Then, we engineer a NASH® system to satisfy all of your needs.



## 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.



Gardner Denver Nash easily complies with ATEX requirements because of the isothermal compression that is characteristic of liquid ring pumps. Simply put, NASH pumps run much cooler than other technologies.

Features	Benefits
Ability to handle carryover	Minimal process problems; Intended for severe mill and chemical duty use
Long design life	Highest reliability
No internal lubrication required	No routine maintenance required; less downtime
No metal-to-metal contact	Constant wear-free performance
Cool Running, Minimal temperature rise between inlet and discharge	Ideal for explosive gases and vapor recovery applications
Only one moving part	Simple and reliable operation

## Chemicals Handled

Unlike other vacuum pumps and compressors, NASH systems can handle moisture-laden inlet streams; explosive gases; dirty, abrasive or corrosive gas mixtures; and unpredictable streams that change with process variables. Some of these gases and vapors are:

Acetone  
Acids  
Air  
Alcohol  
Ammonia

Aniline  
Benzene  
Butadiene  
Carbon Dioxide  
Chlorine

Freon  
Hydrocarbons  
Hydrogen  
Hydrogen Cyanide  
Hydrogen Sulfide

Isopropyl Ether  
Ketones  
Nitrous Oxides  
Propylene Oxides  
PVC

Styrene  
Sulfur Dioxide  
Vinyl Chloride Monomer

# NASH Vacuum Pumps & Compressors

## Versatile product technology expertly applied

Our broad range of products, consisting of liquid ring vacuum pumps, liquid ring compressors and ejectors can be individually applied or combined into packaged systems with additional components to serve a variety of process demands.

## Liquid ring vacuum pumps

The NASH liquid ring vacuum pump family provides a wide range of product options. From the top-of-the-line heavy-duty P2620 with a dry air capacity of 23,000 CFM/ 39,082 m<sup>3</sup>/h to the mid-range Vectra (2,800 CFM/ 4,750 m<sup>3</sup>/h) and the smaller close-coupled 2BV series, we have the right answer for your individual vacuum requirement.

Gardner Denver Nash knows the technology behind liquid ring vacuum pumps, because it invented the liquid ring principle of operation. Liquid ring vacuum pumps operate at low temperatures and are suitable for handling liquids, steam and condensate. Developed for the toughest applications, these pumps can safely and reliably extract explosive gas and corrosive vapors.



NASH VECTRA



NASH TC/TCM

Requiring minimal care and known for extremely low maintenance, NASH liquid ring vacuum pumps provide years of dependable service due to their robust design, rigorous quality, and their fewer and generously proportioned parts. Thanks to their low operating costs and extensive performance range up to 23,000 CFM/ 39,082 m<sup>3</sup>/h, they excel in any application.

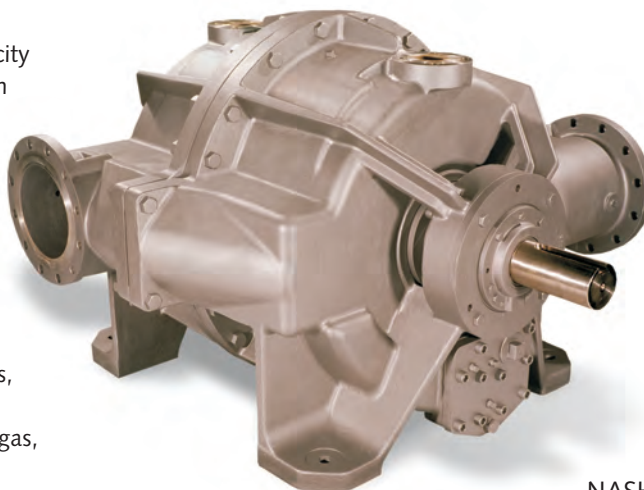


NASH 2BV

## Liquid ring compressors

Gardner Denver Nash offers the widest pressure and capacity ranges of liquid ring compressors worldwide. Together with the impressive NASH HP-9 and the introduction of the 14 over-hung models, NASH's high-pressure compressor product line provides compression greater than 200 PSIG/15 Bar abs and up to 2,500 CFM/ 4,250 m<sup>3</sup>/h per machine. Low-pressure compressors are available to 30 PSIG/ 3 Bar abs, and as much as 20,000 CFM/ 34,000 m<sup>3</sup>/h.

Found primarily in petroleum refineries and chemical plants, these rugged and reliable compressors handle highly toxic, explosive and corrosive gases in applications such as flare-gas, chlorine and Vinyl Chlorine Monomer (VCM) recovery.



NASH HP-9

# NASH Vacuum Pumps & Compressors

## NASH engineered systems are built to last

Gardner Denver Nash provides the broadest range of vacuum packages to ensure a complete solution for your process needs. For general applications, the readily available 2BV and VectraPaks offer economical vacuum when you need it. For



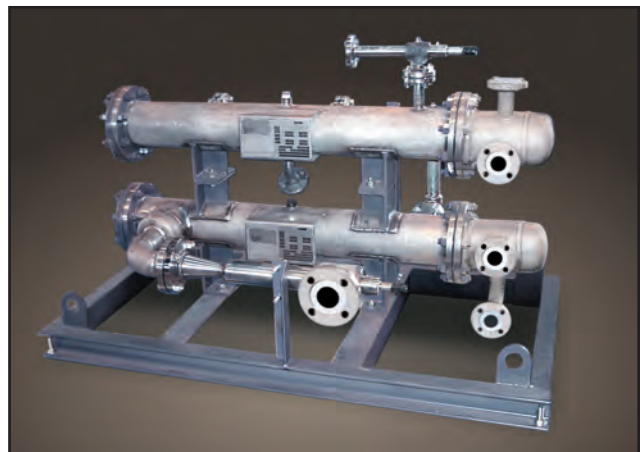
unique and demanding applications, our unparalleled engineering staff will custom design a system specifically for your needs. A high quality NASH package provides value in terms of reliability, long life, energy savings and ease of installation.

## Hybrid systems

NASH hybrid systems, combine different vacuum producing technologies to provide maximum efficiency and effectiveness for a wide array of applications. Benefits of a hybrid system include lower operating costs and reduced capital equipment investment; higher capacity, and higher vacuum levels at an economical advantage.

## Ejectors

NASH ejectors are ideally suited to handle applications with large volumes, high vacuum levels and low molecular weight gases. Designs are available in sizes ranging from one-inch to 78-inch inlets and may be combined in various stages to meet your specific application needs. Inlet capacities range from 20 CFM/ 34 m<sup>3</sup>/h to 20,000 CFM/ 34,000 m<sup>3</sup>/h or more, and pressures as low as 0.001 mm Hg absolute can easily be accommodated. Ejectors can be manufactured in a variety of materials and require no moving parts, translating into trouble-free continuous operation.



## Complete performance testing



## & worldwide service and support

Our quality standards are rigorously enforced, and as a final safeguard prior to leaving the factory, all NASH equipment is subjected to 100% performance testing. All Gardner Denver Nash manufacturing facilities worldwide are ISO 9001 certified. In addition, the development and design of all NASH products are in accordance with ISO 9001 standard.

Gardner Denver Nash provides full support from the initial system design through the installation and start-up. If equipment ever needs to be serviced, repaired or rebuilt, our service centers are located strategically around the world to respond quickly to your needs.

## Complete application solutions

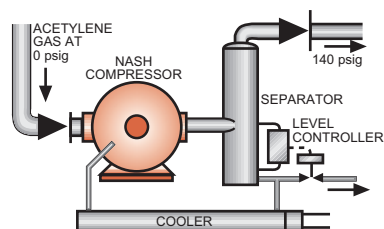
Our goal at Gardner Denver Nash is to provide long life, reliable, low maintenance and energy efficient solutions to processes like: evaporation, distillation, vacuum filtration, gas compression, VOC recovery, solvent recovery and drying.

**We produce a complete range of products and systems for industries including:**

Chemical	Petrochemical	Water Treatment
Mining	Oil & Gas	Steel
Biofuel	Pharmaceutical	Plastics

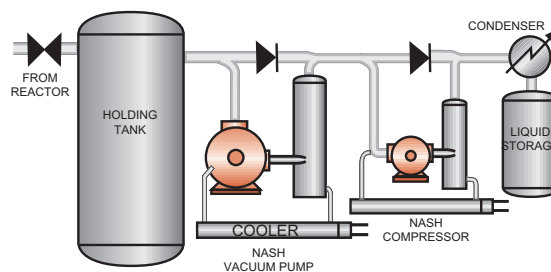
## Explosive Gas Compression

A typical arrangement for handling explosive gases, this compressor system keeps acetylene cool and saturated with water, which is used as the seal liquid. By doing this, the risk of explosion is minimized.



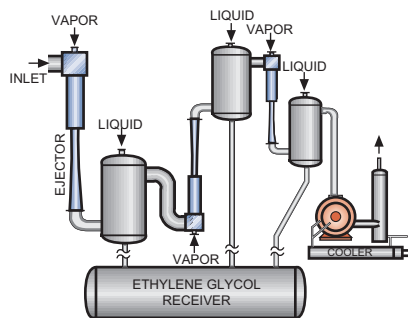
## VCM Recovery

In one of several batch monomer recovery systems, unreacted vinyl chloride is first transferred into the evacuated holding tank. A NASH vacuum pump scavenges gas out of the PVC and delivers it to the compressor inlet at or near atmospheric pressure. The single-stage compressor then compresses the gas for condensation and storage as a pressurized liquid.



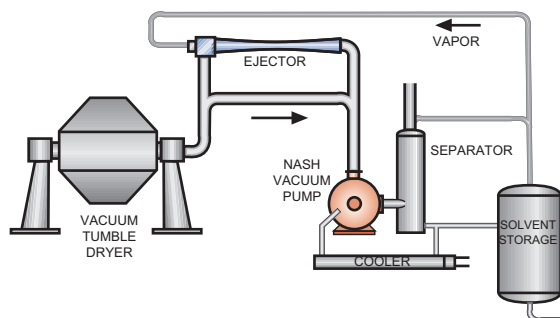
## Polymerization Reactor

To eliminate plugging from polymer carryover, NASH ejectors are driven with ethylene glycol vapor. Liquid ethylene glycol is then used as the vacuum pump seal liquid and also to cool the direct contact condensers. This eliminates process contamination from water, steam and air.



## VOC Recovery

Vacuum tumble-drying performed in batch processing requires a gradually increasing vacuum to draw out solvents at the maximum sustainable rate. Often times this same solvent can be used as the pump seal liquid and motive vapor in the ejector to operate the process. Contamination is eliminated and pure solvent is recovered.



## Seal Liquid Options

Water is an excellent seal liquid and is most often used due to its availability and convenience. There are many situations, however, where alternative seal liquids may yield important process advantages or where even trace amounts of water cannot be tolerated in the product.

In these instances, NASH vacuum pumps have demonstrated their versatility by successfully operating with a variety of other liquids. These liquids include:

Acetic Acid  
Acetic Anhydride  
Acetates  
Acetone

Alcohols  
Caustic Soda  
Chlorinated Hydrocarbons

Gasoline  
Glycols  
Hexane  
Hytor Fluid

Kerosene  
MEK  
Oils  
Sulfuric Acid

Toluene  
Xylene  
and many others

## Other NASH Products

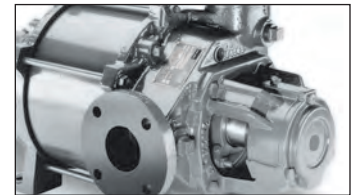
### TC/TCM

Integral 2 stage liquid ring pumps with improved performance at vacuum levels down to 0.8" HgA (27 mbar)  
Designed to handle large amounts of liquid carryover without difficulty  
Capacity of 100 to 2,240 CFM with vacuum to 0.8" HgA  
Capacity of 170 to 3,740 m<sup>3</sup>/h with vacuum to 27 mbar



### Vectra

Liquid ring vacuum pumps and compressors  
Available in feature rich budget designs (XL or GL)  
Designed to handle high back pressure requirements  
Capacity of 115 to 2,860 CFM with vacuum to 29+ HgV  
Capacity of 195 to 4,860 m<sup>3</sup>/h with vacuum to 31 mbar abs



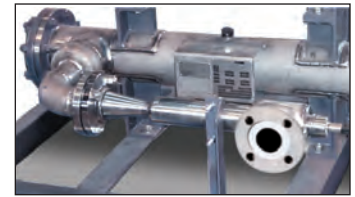
### 2BE3/P2620

Large liquid ring vacuum pumps with superior corrosion resistance  
Top discharge capability which eliminates need for trench  
Self-recirculating seal water, reducing need for external seal water source  
Capacity of 4,000 to 23,000 CFM with vacuum to 24" HgV  
Capacity of 6,800 to 39,000 m<sup>3</sup>/h with vacuum to 200 mbar abs



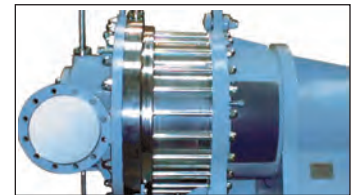
### Steam Jet Ejectors

Sizes range from one-inch (25mm) to 78-inch (2 meters) inlets  
Capacities range from 20 CFM to 20,000 CFM  
Capacities range from 34 m<sup>3</sup>/h to 34,000 m<sup>3</sup>/h  
Multi-stage system pressures as low as 0.001 mm HgA



### Compressors

Wide range of liquid ring compressors designed for many applications. Rugged and reliable, they can handle highly toxic, explosive and corrosive gases  
Specifically developed for applications such as flare-gas, chlorine and Vinyl Chlorine Monomer (VCM) recovery  
Capacity of 60 to 2,200 SCFM with pressure to 200 PSIG  
Capacity of 100 to 3,740 m<sup>3</sup>/h with pressure to 15 bar abs  
Single and two stage models available



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