NASH

A Gardner Denver Product

Vacuum Pumps and Compressors for the Oil and Gas Industry

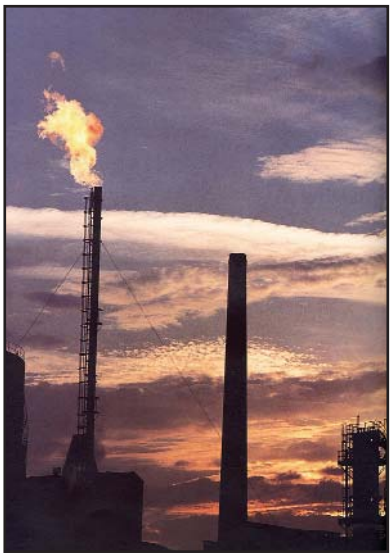
NASH Vacuum Pumps & Compressors

Proven Technology - Built From Experience

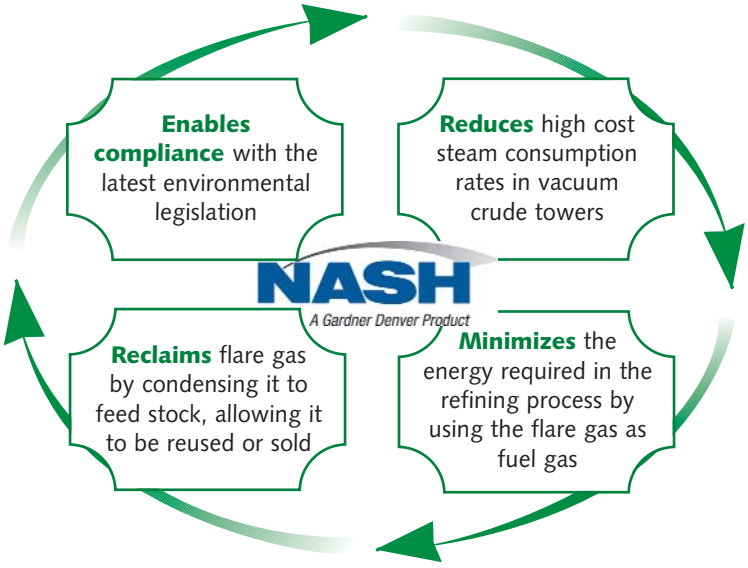
For over 50 years, Gardner Denver Nash has been providing the most reliable compressors and vacuum pumps designed for refinery requirements. NASH is the industry standard for flare gas recovery, vent gas boosting, vapor recovery (vacuum) and crude tower ejector hybrid systems. *Why are we successful?* Because we make you successful by eliminating unscheduled down time.

Our liquid ring vacuum pumps and compressors are renowned for:
- rugged design construction - making them tolerant to carryover from process upsets
- low maintenance requirements - best up-time in the industry
- cool-running - making them ideal for handling the explosive gases found in refinery applications, with pressures up to 215 PSIA (14.8 bar)
- the largest and most experienced technical staff in the industry
- comprehensive value-added centers throughout the world.

If you need gas handling equipment for your refinery, Gardner Denver Nash's products and capabilities are simply unmatched.



Eliminate your flares by using NASH flare gas recovery systems



Environmental Solutions - Helping You Comply With EPA and Kyoto Treaty Regulations

Gardner Denver Nash is committed to providing environmentally friendly solutions for your process needs.

Gardner Denver Nash wants to be your partner in responsible stewardship of the environment and building more profitable refineries.

Engineered Systems

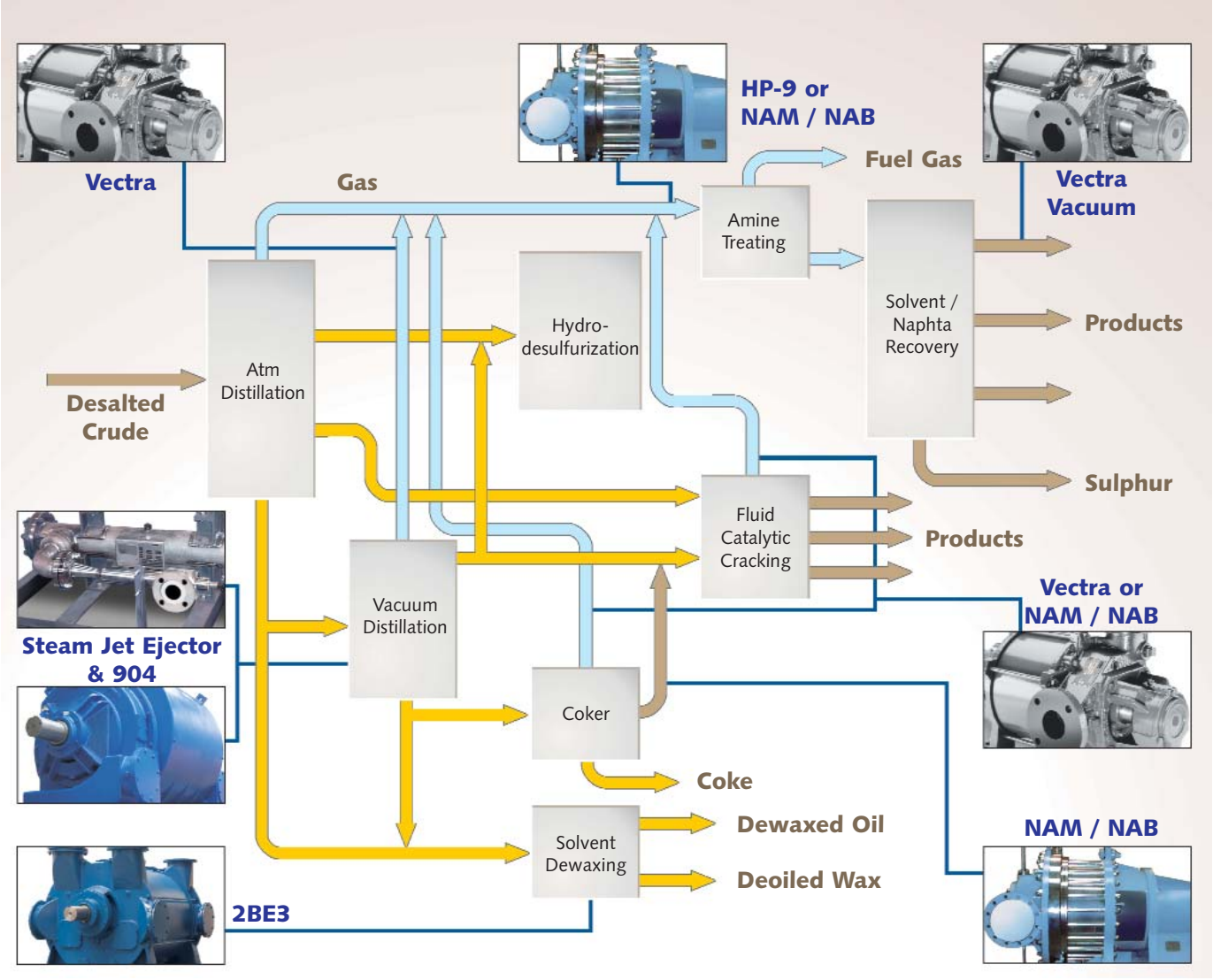
Our ISO 9001 certified value added centers, located in the Americas, Europe and Asia, provide:
- experienced engineering staff
- optimum solutions for your process
- compliance with industry standards such as API681, NEMA, IEEE, ATEX

The result is a custom NASH system that provides:
- unparalleled RELIABILITY
- lower operating costs
- lower maintenance costs
- environmental compliance

The long life and trouble free operation of a NASH liquid ring pump, steam ejector, and/or hybrid system are simply unmatched, with the highest reliability in the refinery industry.

XL350 Vent Gas compressor system

NASH Vacuum Pumps & Compressors



Features	Benefits
Ability to handle carryover	Minimal process problems resulting in more uptime; Intended for severe applications
Long design life of 40+ years	Highest reliability
No internal lubrication required	Less 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

Contact your Gardner Denver Nash representative for a cost calculator, which will help you determine just how much money a liquid ring pump will help you save in your existing process.

Gardner Denver Nash easily complies with ATEX Ⓔx requirements because of the isothermal compression characteristic of our pumps. Simply put, NASH pumps run much cooler than any other technology.

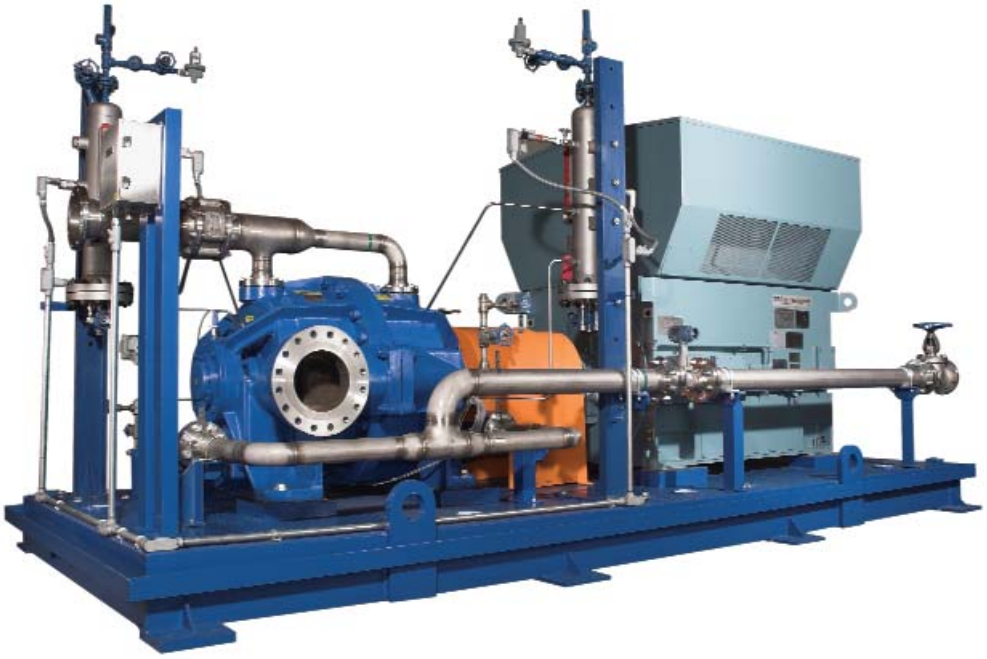
NASH Vacuum Pumps & Compressors

Flare Gas Recovery Compressors

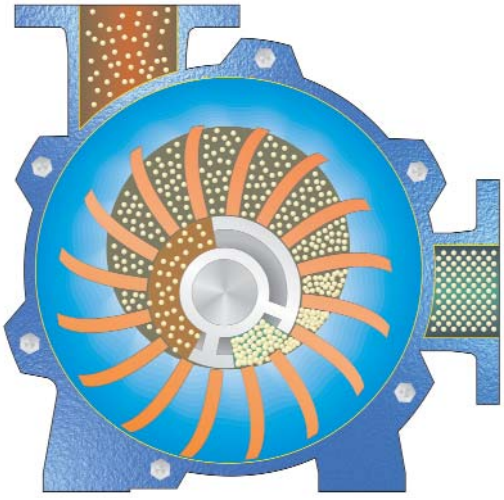
Gardner Denver Nash is committed to helping you meet the stringent environmental legislation which prohibits the flaring of waste gas. Our HP and NAB compressors are the ideal choice for recovering fuel gas and condensing valuable hydrocarbons, making more money for the refinery.

When reviewing the total life cycle cost of a flare gas compressor system, the NASH liquid ring system provides more value and better reliability than any other technology, hands down.

Liquid ring compressors run cool and they clean the gas as they compress it–eliminating the need for downstream aftercondensers and scrubbers. The result is a simpler, more reliable system.



Contact your Gardner Denver Nash representative for more information on the technical and economic benefits of a NASH system.



A NASH liquid ring system:

- is more economical over its life cycle
- will last longer
- requires significantly less maintenance than other compressors
- provides more uptime for your plant
- is safer. The isothermal compression allows it to:
  - run cooler
  - condense hydrocarbons for sale or reuse
  - eliminate auto-ignition concerns
  - keep the discharge gas cool
  - increase bearing life
  - reduce mechanical wear
- does not require many of the complicated instrumentation safety and ancillary accessories that add complexity to hot-running compressors

NASH Vacuum Pumps & Compressors

Crude Tower Vacuum Systems

Whether you are building a new vacuum crude distillation tower or upgrading an existing one, Gardner Denver Nash can provide the most efficient system available. NASH ejectors and pumps (hybrid systems) are much more efficient than steam ejector vacuum systems. This is supported by our engineering design expertise, high quality manufacturing practices, and the broad range of pump models available for this service.

The annual cost of operating a tower vacuum system will be several times the original equipment cost. We recognize that most companies keep a tight rein on capital investments – whether new systems or cost saving upgrades – and Gardner Denver Nash can offer you various hybrid system options to help you strike the optimum balance between capital costs and operational savings. No matter how you make your purchasing decisions, we can design and provide a tower vacuum system to meet your objectives, optimizing the number of stages and the interstage condensers to strike the balance that you need.

Duplex vacuum system used on a crude oil distillation tower

The operational cost savings provided by a Nash hybrid system can provide a typical payback of less than two years. Payback can be even less if exotic materials have been specified, due to the elimination of expensive aftercondensers.

Typical engineered package built for the Indian Oil Company

By utilizing our liquid ring vacuum pump with steam ejectors in a hybrid crude vacuum system, we can achieve a *more efficient system*. In a hybrid system, the liquid ring pump will replace one or more of the steam ejectors that consume most of the steam. The cost of operating and maintaining a liquid ring pump will be far less than the steam generation costs required to operate additional ejectors.

All NASH vacuum systems are designed and built to the latest API & HEI standards.

NASH Vacuum Pumps & Compressors

NASH compressors stay on-line handling wet, dirty gas streams

In refineries, even relatively clean gas streams may subject a compressor to carryover and wear during process upsets. At times, entrained liquids, gums, pastes, or particulate must be handled on a continuous basis. These situations are best served by NASH compressors, which scrub the gas stream and remove contaminants without wear.

The NASH compressor is very soundly built, with a heavy rigid shaft and bearings designed for long life of 20 years. It uses a liquid piston to create the pumping action with its rugged cast rotor, eliminating the need for close-fitting metal surfaces and the associated lubrication problems.

XL350 Vent Gas compressor system

A long record of continuous operation, without downtime for repairs or rebuilds, has established NASH as the preferred compressors in most refinery applications. They excel in applications which rapidly destroy other compressors.

NASH Vectra compressors, available from 100-3000 scfm (170-5070 m^3hr) and pressure up to 30 PSIG (2.1 bar), are the ideal choice for gas boosting applications. Shown at left, the Vectra XL.

NASH vacuum pumps aid in naphtha/solvent recovery

Cool running NASH vacuum pumps have the unique ability of acting as a condenser when extracting a saturated vapor from a dis-tillation process. In addition, many solvents can be used as the seal liquid – including naphtha – allowing you to seal the vacuum pump with the same liquid that is being condensed. The result is a vacuum pump system that reclaims valuable solvents without contamination. The recovered solvent can then be reused in the process or sold.

NASH two stage vacuum pumps are capable of operating at vacuum levels of 5 mm HgA (.2"HgA) using low vapor pressure seal liquids. Above, the NASH TC-8 pump.

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Additional refinery applications

Vacuum filtration:

NASH pumps are used extensively as the vacuum source on the rotary drum and disc filters used for solvent dewaxing, waste water treatment, and additive/lubricant production. Their ability to remove water and handle carryover more efficiently and reliably makes them the ideal choice for these installations.

Vapor Recovery:

Non-sparking and cool-running NASH pumps are used to recover hydrocarbon vapors vented from storage tanks. The condensate of the vapor can be used as the seal liquid in order to:

- avoid contamination of the recovered product
- eliminate waste
- reduce the pump size by condensing the gas vapors

NASH 2BE3 Vacuum Pump

NASH 2BG Compressor used for vent gas compression on an offshore rig

NASH products are not limited to refineries. They provide measurable benefits for upstream and offshore applications too!

Coal bed methane extraction:

The liquid ring pump's ability to be used simultaneously as both a vacuum pump and a compressor make it a great choice for extracting natural gas from coal seams and conveying it to a pipeline compressor house.

Oil field gas boosting:

NASH compressors are used to convey gases, which have been pulled off of oil wells, to storage or processing facilities.

Crude stabilization:

Liquid ring pumps are used to remove dissolved gases from crude oil tanks, thus stabilizing the true vapor pressure of the crude. The removed gas can be boosted downstream and used as fuel.

Offshore oil rigs:

NASH systems also provide great performance on offshore rigs, where they are used for gas compression, vapor recovery, and glycol recovery systems.

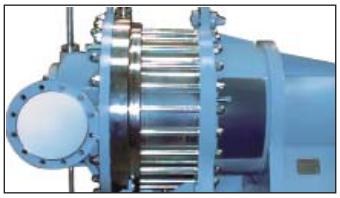
Gardner Denver

Gardner Denver Nash is a division of Gardner Denver, Inc. The histories of NASH and elmo provide more than 100 years of experience as the world's leading supplier of liquid ring pumps, compressors and vacuum systems.

Other NASH Products

Compressors

Highly rugged and reliable compressors that 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 2,200 SCFM with pressure to 200 PSIG
Capacity of 100 to 3,400 m³/h with pressure to 15 bar abs
Single and two stage models available



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 m³/h with vacuum to 31 mbar abs

2BE3/P2620

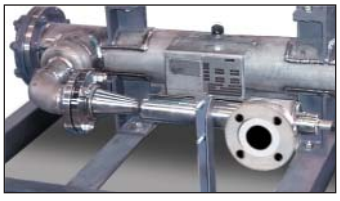
Large liquid ring vacuum pumps with superior corrosion resistance
Top discharge capability which eliminates need for trench
Self-recirculating seal water, reducing need for external seal water source
Capacity of 4,000 to 23,000 CFM with vacuum to 29+'' HgV
Capacity of 6,800 to 39,000 m³/h with vacuum to 31 mbar abs

TC/TCM

Integral 2 stage liquid ring pumps with improved performance at vacuum levels down to 0.8'' HgA / 27 mbar abs
Designed to handle large amounts of liquid carryover without difficulty
Capacity of 100 to 2,200 CFM with vacuum to 0.8'' HgA
Capacity of 170 to 3,740 m³/h with vacuum to 27 mbar abs

Steam Jet Ejector

Sizes range from one-inch (25 mm) to 78-inch (2 meters) inlets
Capacities range from 20 CFM to 20,000 CFM
Capacities range from 34 m³/h to 34,000 m³/h
Multi-stage system pressures as low as 0.001 HgA



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Order-No.: LRP:B-BR108-A1-EN
3.0/05-2007 Printed in Germany