



HYBRID VACUUM SYSTEMS

BULLETIN # PVS-80021021-HVS

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"The Best of Both Worlds"



12P-3003AJH Air Jet/LRVP Hybrid Vacuum System (Front & Rear Views) Being Prepped for Shipment

Steam ejectors and liquid ring vacuum pumps have advantages and disadvantages in any given process application. In some cases, the *disadvantages* of using one over the other make it difficult to make the best overall vacuum equipment selection to meet even the most basic process requirements. For example, in some power plants, seasonal variations in load demand require that the steam turbine operate at partial load conditions. To cover these low absolute conditions an ejector system would have to be significantly oversized, resulting in wasted steam usage for most of the operating requirements. A vacuum pump exhauster system would also be significantly oversized at low absolute pressures, resulting in high capital cost and wasted power consumption for normal operation, even if the pump could be made to work at these conditions.

Enter the hybrid concept...

By using steam- or air-motivated ejectors as the first-stage and a vacuum pump as the second-stage, the advantages of one component are used to overcome the disadvantages of the other. The vacuum pump can be used for hogging, which is very advantageous in some applications where motive steam is not available during system start-up, and can also be sized to handle normal process operating requirements. This takes advantage of the economic efficiency of vacuum pumps for most of the system operating cycle. When low absolute pressure operation is required, or when cooling water temperatures are too high for "pump only" operation, the ejector is used as a first-stage booster to extend the range of the vacuum system to the required pressure and capacity in a very economical package, from both capital and utility perspectives.

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The advantages hybrids offer to applications such as chemical, petrochemical, pharmaceutical and power, are worth consideration and include the following:

- ✚ Multiple ejector stages can be used to obtain just about any vacuum level, allowing the atmospheric stage – the vacuum pump – to be installed at floor level, eliminating the need for barometric sumps. The process outputs – gas & liquid – are collected at atmospheric pressure, simplifying and reducing installation costs.
- ✚ Motive steam consumption is reduced to a minimum – important in chemical applications where waste disposal is of major concern, or cases where steam supply is limited for process start-up.
- ✚ Hybrids allow process operational flexibility, important when the operating conditions can vary due to specific process requirements, which is common in batch-type operations and some continuous operations such as water deaeration. Seasonal changes and plant operating load conditions can vary significantly from normal design points.
- ✚ Hybrids are custom-designed to specific requirements and can incorporate whatever degree of automation, instrumentation and materials of construction as may be required.
- ✚ Hybrids can be designed to utilize waste utilities, such as low pressure steam or high temperature cooling water, which offers attractive economic alternatives in cases where such utilities are available or when they are severely limiting for equipment design purposes (ie. where only air-cooled, closed-cycle cooling water is available).

By the very nature of the concept, hybrid systems are always custom-designed to meet specific customer requirements. Process criteria generally needed to design a hybrid system for your consideration include the following:

- Process Requirements – Time, Load Characteristics, Pressures (Vacuum), Temperatures, etc.
- Available Utilities – Steam, Cooling Water, Electrical Supply
- Materials of Construction
- Space or Installation Restrictions
- Instrumentation & Automation Requirements
- Utility & Capital Cost Recovery Factors, If Applicable



MODEL # 4H-140E-2FR HYBRID AIR REMOVAL SYSTEM

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Unique Systems has the experience and engineering capability to design a hybrid vacuum system to meet your specific needs – from the smallest solvent recovery system for a pharmaceutical batch reactor to a 700+ HP system used in Geothermal Gas Extraction & Seawater Desalination plants.

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