UNIQUE SYSTEMS®
INCORPORATED
ONE SADDLE ROAD - CEDAR KNOLLS, NEW JERSEY 07927-1998
Phone 973-455-0440 Fax 973-455-7214

HEAT EXCHANGE INSTITUTE INCORPORATED MEMBER

LIQUID RING VACUUM PUMP SYSTEMS – ENGINEERING DATA

POWER PLANT APPLICATIONS
MAIN CONDENSER EXHAUSTING

Liquid ring vacuum pumps have been employed for removing air from steam surface condensers and industrial processes for over 40 years. They are among the simplest, most reliable method known of pumping gases.

A typical liquid ring vacuum pump Air Removal System for steam condenser service consists of two, identical 100% capacity pump skids. It is common practice to use both pumps simultaneously to evacuate or "hog" the condenser to the point where steam can be introduced into the turbine, then one pump shuts down while the other goes into "holding mode" to continuously remove air from the condenser during turbine operation.

In the air removal application, liquid ring vacuum pumps are employed to evacuate air and any other non-condensable gases from the steam space of the main condenser that services a steam turbine. This gas removal is done for the purpose of eliminating the insulating effect that non-condensable gases have on the transfer of heat from steam through the tubes to the cooling medium. Without a vacuum system, air would severely reduce the efficiency of the heat transfer, resulting in the condenser surface area increasing many times for a given steam load.

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Unique Systems vacuum pump exhausters are typically two-stage vacuum pumps. For hogging operation, the first-stage is employed to evacuate air at high absolute pressures, and the second-stage is by-passed to optimize efficiency and reduce peak horsepower demand. Both stages operate automatically to evacuate the condenser to a pressure determined by the requirements of the steam turbine. At this point, the system pressure switch sends a signal to shut-down the "lag" pump, while the "lead" pump continues operating in holding mode. At around 20" HgV, the second stage of the vacuum pump begins to operate efficiently and the inter-stage bypass check valve closes to allow two-stage pump operation at lower absolute pressures.

Unique Systems has developed a line of liquid ring condenser exhausters to satisfy typical Heat Exchange Institute (HEI) recommended venting capacities.

LRVP CONDENSER EXHAUSTER STANDARD ENGINEERED SYSTEMS

MODEL #	CAPACITY RANGE	MOTOR
3P-280E	3-4 SCFM	20 HP
4P-540E	3-5 SCFM	25 HP
4P-600E	4-5 SCFM	30 HP
4P-750E	5-7.5 SCFM	40 HP
6P-870E	7.5-10 SCFM	50-60 HP
6P-1260E	10-12.5 SCFM	50-75 HP
8P-1600E	12.5-15 SCFM	60-100 HP
8P-1800E	12.5-17.5 SCFM	60-100 HP
8P-2000E	15-20 SCFM	100 HP
8P-2600E	20-25 SCFM	125-150 HP
10P-3100E	25-35 SCFM	150 HP

Selection of a specific model for a condenser depends on a number of factors, with cooling water temperature being the most critical. For the majority of cases, the vacuum pump system heat exchanger uses the same water as the main condenser. This ensures proper pump sizing, and pump performance will "track" the condenser curve(s), ensuring that the condenser will operate on its thermal curve(s). In some cases, alternate cooling water sources are used and care must be taken to ensure that the pump will provide the required capacity at all required condenser operating points without the danger of cavitation.

The proper sizing & design of a condenser exhauster is a great deal more than just a simple "saturated air sizing" for a liquid ring pump. There are many factors that must be considered and allowed for in the system design, including careful attention to cavitation concerns at all "holding" operating points. Unique Systems employs a number of methods to ensure that the exhauster will not cavitate under any specified operating condition, some of which are proprietary, developed over several years of research and extensive testing. We provide our customers with an Exhauster Capability Curve that allows direct comparison of pump performance to main condenser thermal performance, showing backpressure as a function of cooling water temperature at constant capacity. This is our guaranteed system performance for your specific application, which ensures that your condensing system will provide the required turbine back-pressure for maximum output and lowest practical heat rates.

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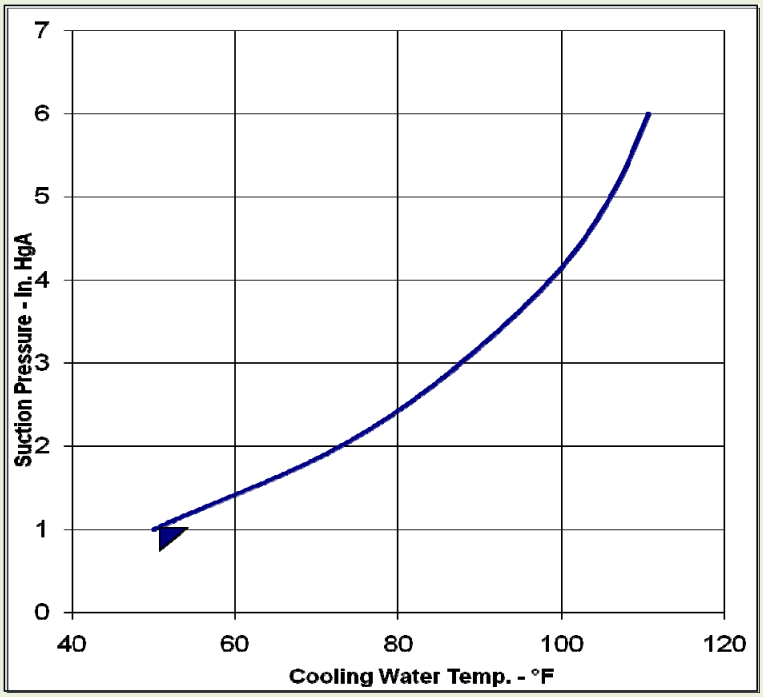
All Unique Systems condenser exhausters are complete, packaged systems, including pump, motor, heat exchanger, separator/silencer, manifolds, valves (manual & automatic), instrumentation, piping & wiring. Operation is fully automatic with remote DCS control standard. Packages can be customized with special materials of construction, transmitters for remote monitoring and custom system layouts for replacement of existing systems with space constraints. They are very "robust" systems, designed & built especially for the demanding environment of a power plant. All systems are designed & constructed in full compliance with typical Power Industry codes & standards, including PED/CE compliance as required.

Please contact Unique Systems with your specific requirements.



MODEL # 8P-1800E LRVP EXHAUSTER
PERFORMANCE CAPABILITY CURVE (TYPICAL)
15 SCFM CAPACITY (HEI)