a clear edge

Liquid ring pumps for the power industry

EDWARDS

Vacuum science... product solution.

a clear edge

in product innovation

The global need to improve the use and conservation of fossil fuels, harness nuclear power and discover new power sources and technologies is imperative in the world today.

As leader in vacuum technology for over 100 years, Edwards has grown with the power industry – from pioneering work in developing equipment for the early power stations, to the supply of sophisticated vacuum systems for thermal, nuclear and even solar-powered power plants today.

By working with power sector engineers and operators, Edwards is able to push the limits of vacuum system design, creating solutions to meet the demands of increasingly challenging applications.

Efficiency of steam turbines is an important part of electricity generation: Edwards liquid ring vacuum pumps play a vital role in maximising efficiency, removing excess air from the system. On exiting the turbine, steam is condensed either by a water or an air-cooled condenser, creating a vacuum inside the turbine and therefore increasing efficiency. To maintain this vacuum, air and other non-condensable gases (that leak into and build up within the condenser) must be extracted: liquid ring vacuum pumps are used worldwide in this critical application.

Edwards liquid ring pumps are also utilised to prime condensers, to ensure that they operate at optimum cooling performance; the pumps also perform a deaeration duty, continuing to remove accumulated air and non condensable gases from the condenser cooling water.

Liquid ring pumps also help to make a significant contribution to control emissions when they are utilised on vacuum filters in flue gas desulphurisation systems.

Why liquid ring pumps?

Highly effective pumping capability on saturated air loads

Liquid ring pumps can handle condensable vapours or even slugs of liquid entrained in the incoming gas stream, without damage to the pump. The condensing effect, which occurs as the incoming gas stream contacts the liquid ring, can greatly enhance the upstream capacity of the pump.

Liquid ring pumps are ideal for condenser air extraction, where the incoming non-condensable air load is fully saturated with steam.

Well suited to operation across the vacuum range

Liquid ring pumps are suitable for continuous operation across the complete vacuum range from atmospheric pressure down to 30 mbara. The principle of operation produces a relatively constant pumping speed at all inlet pressures. This enables the pump to track the turbine condenser outlet pressure over a much wider range of operating conditions than steam ejector systems. It also provides excellent hogging capability when using duty and standby pumps in parallel.

Capable of handling wet corrosive process streams

A wide selection of materials of construction is available, providing the optimum choice for handling most gases and seal liquids without corrosion. This option is very useful when considering systems using direct seal liquid supply from river or sea water, or on geothermal plants.

Common material options include cast iron, SG Iron, 316 stainless steel, aluminium bronze, duplex stainless steel.

Tolerant of small particulates in the gas stream

As the clearances inside the pump are quite generous, entrained particles can be handled without detrimental effect. The particulate matter is collected by the seal liquid and carried out to the pump discharge.

Robust, reliable, low maintenance construction

Liquid ring pumps have a simple design, with no contact between major pump components. The absence of contacting parts, allied with the low operating temperatures, ensures that these pumps are extremely reliable.

Capable of handling process upsets, they require only minimum maintenance and are often considered the workhorse of the vacuum world.

Low noise level

The typical noise level for liquid ring pumps is below 80 dbA, if correctly installed. The regular non pulsating gas flow contributes to low vibration levels in the pump and associated pipework.

Condenser air extraction

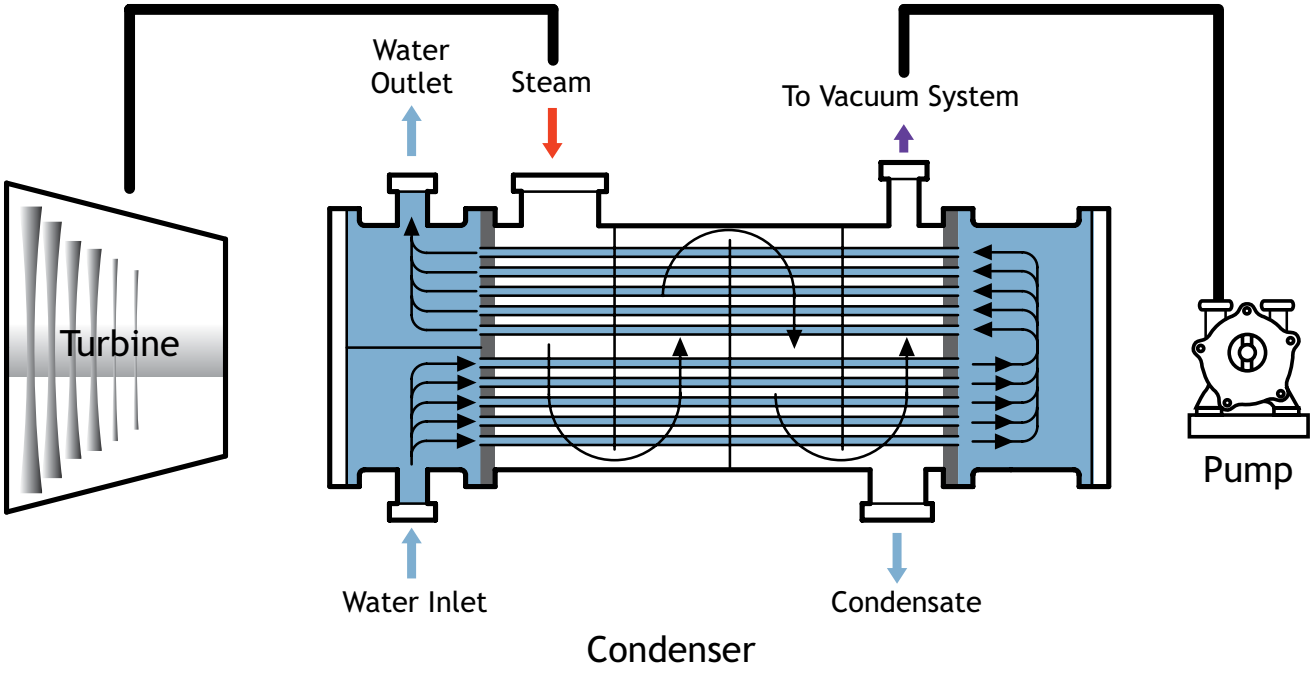
In order to increase the availability, operational performance and reliability of turbine condenser vacuum plants, the dynamic relationship between the vacuum pumping system, condenser performance and turbine back pressure is an important factor in the design requirements and needs careful appraisal when considering overall plant performance.

Selection of the vacuum equipment is usually based upon a theoretical condition, with performance requirements taken from HEI (or VGB) recommendations. Client specifications require further analysis of pump performance at actual operating temperatures and pressures, including part load and operation with alternate fuels.

Edwards condenser air extraction packages, based on two-stage liquid ring vacuum pumps, are designed to remove system air leakage across common sizes of turbine generator steam condensers. This is achieved by reducing the pressure in the turbine, enabling more heat from the steam to be converted to mechanical energy, increasing efficiency of the power plant.

The air load from the turbine condenser system is saturated with vapour: liquid ring pumps are ideal for handling high vapour loads as much of the vapour will be condensed at the pump suction (by the direct condensing action of the inlet water spray or contact with the pump seal water). This condensing reduces the total volume to be handled by the pump, which is a significant advantage when compared to other pumping technologies.

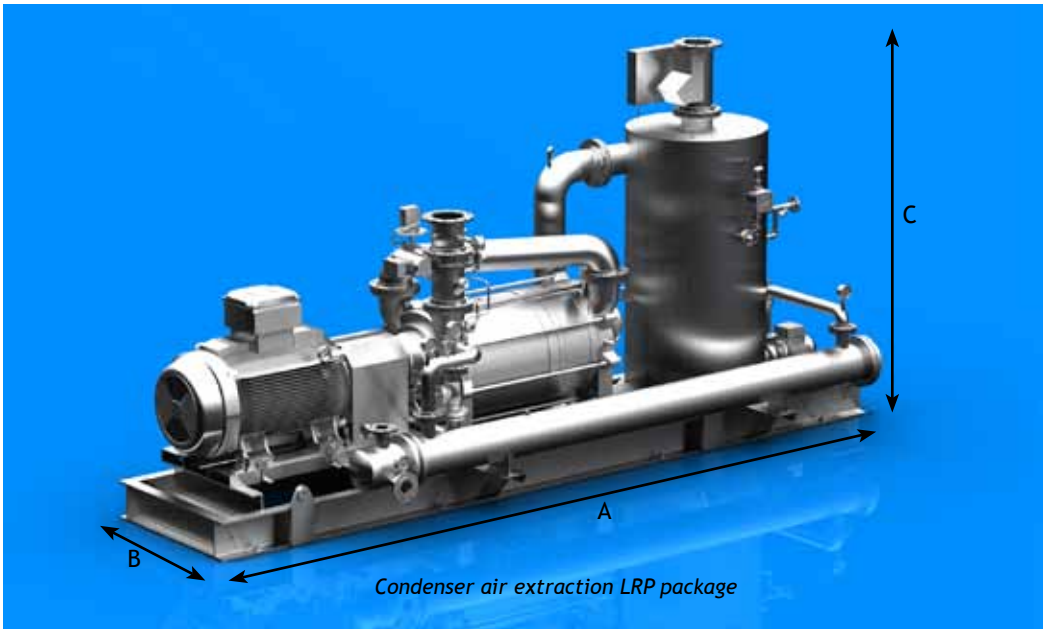
Condenser air extraction LRP package



Standard size listing per HEI standards

Edwards standard packages are designed to meet the requirements of HEI standards, Initial Temperature Difference is an important consideration in optimum pump selection, the table below gives pump selection based upon varying ITD's at 1"Hg abs (33.86mbara) at the condenser outlet.

ITD / SCFM	10°C	11°C	13°C	15°C	17°C
5	SHR2750	SHR2400	SHR2400	SHR2400	SHR2400
7.5	SHR2950	SHR2750	SHR2750	SHR2400	SHR2400
10	SHR2950	SHR2950	SHR2750	SHR2750	SHR7250
12.5	SHR2950	SHR2950	SHR2950	SHR2750	SHR2750
15	SHR21200	SHR21200	SHR2950	SHR2950	SHR2950
17.5	SHR21850	SHR21200	SHR21200	SHR2950	SHR2950
20	SHR21850	SHR21850	SHR21200	SHR21200	SHR2950
25	SHR22500	SHR21850	SHR21850	SHR21200	SHR21200
30	SHR22500	SHR22500	SHR21850	SHR21850	SHR21850
40	SHR22500	SHR22500	SHR22500	SHR22500	SHR21850



Condenser air extraction LRP package

MODEL	PUMP	SCFM	HP	kW	A*	B*	C*
CEP750-2	SHR2400	5 - 7.5	40	22	2350	1000	1500
CEP1000-2	SHR2750	7.5 - 12.5	75	45	3750	1350	2000
CEP1500-2	SHR2950	10 - 20	100	55	3750	1350	2000
CEP2000-2	SHR21200	15 - 25	125	75	4500	1500	2500
CEP3000 - 2	SHR21850	20 - 30	175	110	4500	1500	2500
CEP6000 - 2	SHR22500	25 - 40	225	132	5500	1700	3000

** Dimensions in mm*

Waterbox priming

The ability to handle wet gases without detrimental effect makes liquid ring vacuum pumps ideal for this priming application. The pumps are used initially to carry out priming of the main condenser water boxes and CW pump; once this is complete they are used to maintain vacuum in the water box at the required level.

Waterbox priming LRP set

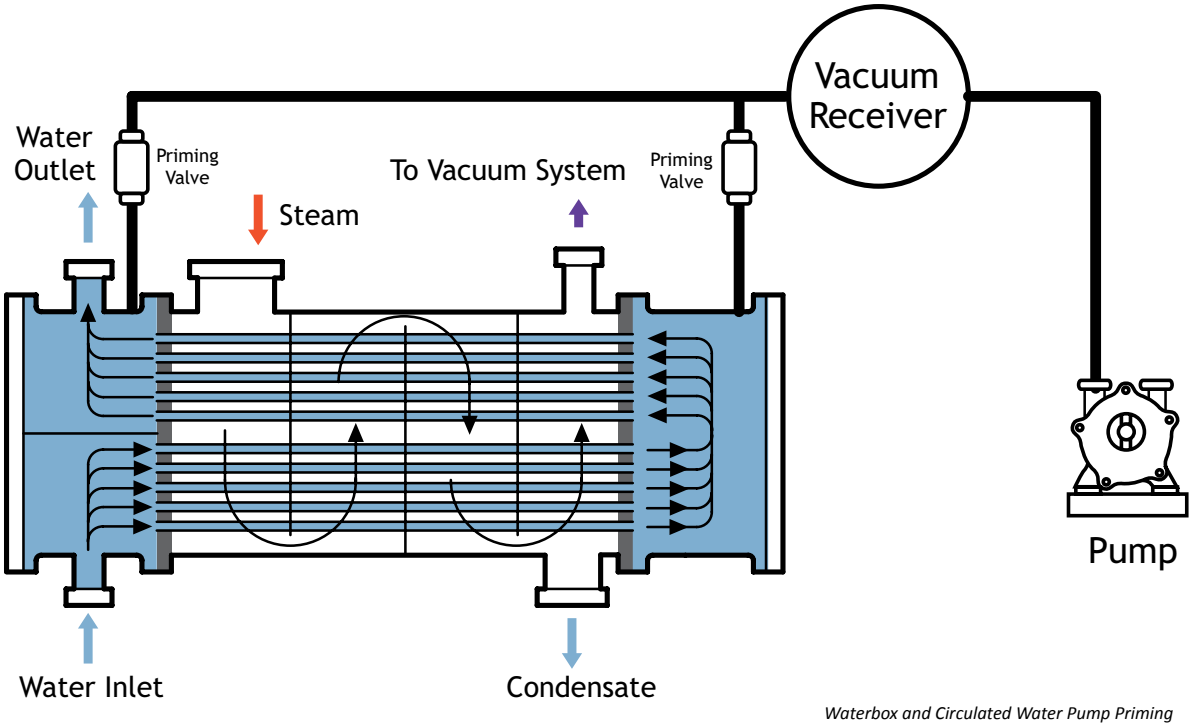
The removal of air from the condenser waterbox prevents accumulation of air in the upper parts of the cooling tube bundle, thereby preventing air locks and maintaining the effective cooling surface of the condenser, ensuring maximum cooling efficiency.

The Edwards priming system is a modular design comprising three component parts: vacuum pumps, vacuum receiver and priming valve and accessories, which are supplied as required to meet customer specifications.

The vacuum pump system comprises a single stage liquid ring pump complete with a total seal water recirculation system, sized to meet the process duty requirements. If duty and standby pumpsets are called for, then two systems are provided, giving true standby capability including the seal water recirculation system.

The vacuum receiver vessel is complete with a pressure transmitter to control the pump operation and includes an automatic drain tank arrangement to remove any water carry over from the system, therefore avoiding corrosion. If required, a priming valve and associated accessories can be supplied for each condenser vacuum connection: the priming valve helps to prevent cycling of the vacuum system and minimises carryover of cooling water.

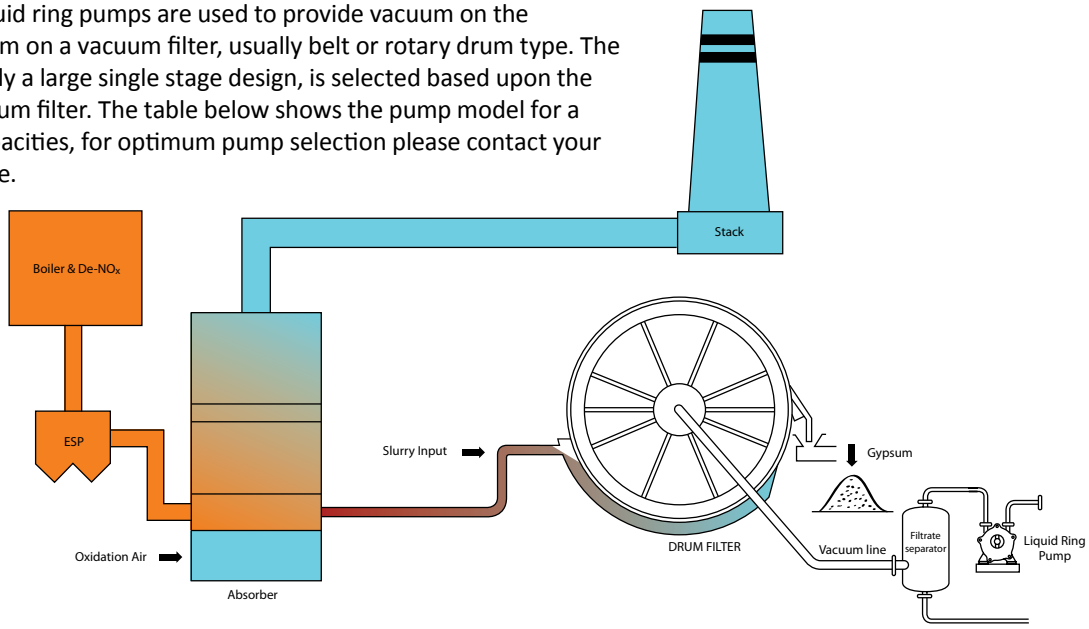
Additional connections can be made to the vacuum receiver to enable main cooling water pumps to be primed before operation.

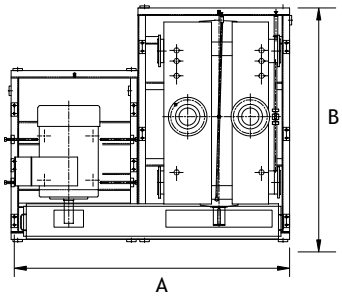


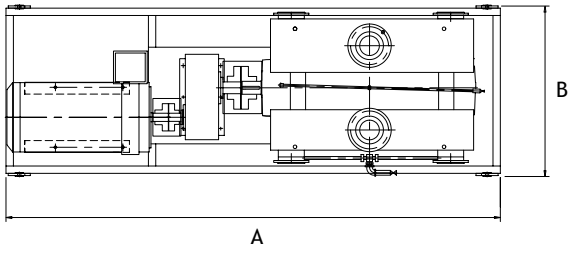
Waterbox and Circulated Water Pump Priming

Flue gas desulphurisation

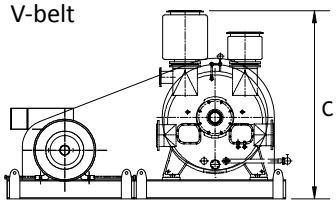
Flue Gas Desulphurisation systems are a common feature on modern coal fired power plants, a by-product of the process is gypsum which is produced at the outlet of a scrubber. Liquid ring pumps are used to provide vacuum on the dewatering of the gypsum on a vacuum filter, usually belt or rotary drum type. The liquid ring pump, typically a large single stage design, is selected based upon the surface area of the vacuum filter. The table below shows the pump model for a selection of nominal capacities, for optimum pump selection please contact your local Edwards sales office.



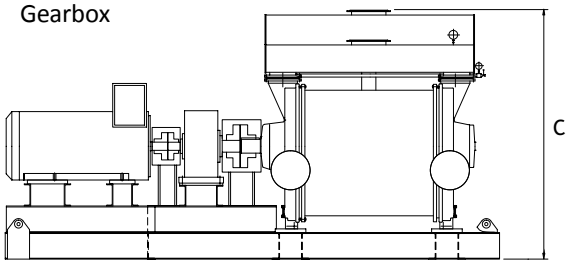




V-belt



Gearbox



Nominal Capacity m^3/h	Pump Size	Motor Size kW	Motor Size HP	Drive Type	A	B	C
2500	LR1A2500	55	75	V-belt	1920	1550	1425
5000	LR1A5000	110	150	V-belt	2300	2050	1540
6500	LR1A6500	160	220	V-belt	2700	2200	1774
10000	LR1A10000	200	270	V-belt	3100	2600	2069
13000	LR1A13000	330	450	V-belt	3400	3000	2440
19000	LR1B18000	355	475	Gearbox	5850	2100	2910
30000	LR1B30000	710	950	Gearbox	6500	2240	3375
37000	LR1B38000	800	1000	Gearbox	7000	2500	3500

Single stage Liquid Ring Pump

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