

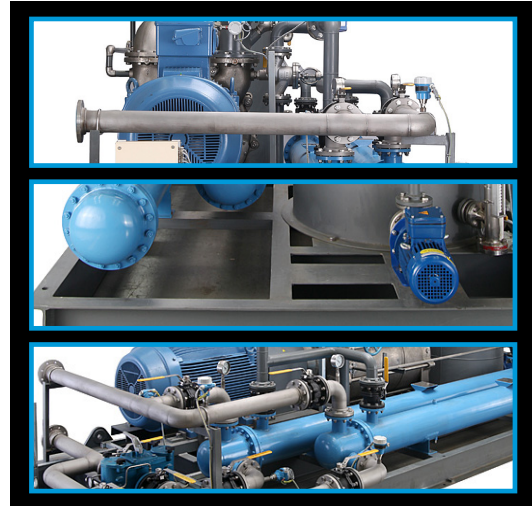
LIQUID RING PUMPS FOR THE POWER INDUSTRY VACUUM SOLUTIONS FOR THE POWER PLANT

Liquid Ring Pumps for The Power Industry

334

LIQUID RING PUMPS FOR THE POWER INDUSTRY

VACUUM SOLUTIONS FOR THE POWER PLANT



Liquid ring pumps are ideally suited for use in a number of vacuum applications in power generation, all of which benefit from the performance characteristics of liquid ring vacuum pumps. Condenser air extraction and waterbox priming both contribute to increased efficiency of the power plant, whilst flue gas desulphurisation and fly ash handling are associated with treatment of the boiler exhaust gas.

Edwards have developed a range of standard pump packages to meet the vacuum pumping requirements for each of these applications.



Features and Benefits

- Two stage liquid ring pump – for optimum performance supporting the steam surface condenser outlet pressure.
- Automatic inlet isolating valve controlled by dual pressure transmitters – for effective transition from hogging to holding.
- Inlet water spray nozzle – to reduce the condensable load to the vacuum pump.
- Interstage air bleed – to reduce cavitation when operating at pressure close to the seal water vapour pressure.
- Shell and tube heat exchanger with large diameter stainless steel tubes – maintaining efficiency by minimising fouling and corrosion.
- Plate type heat exchanger option with titanium plates – for use with seawater cooled applications.
- Seal water recirculation pump – to optimise seal water flow rate.
- Skid mounted junction box – single point electrical connection.

Pump Range

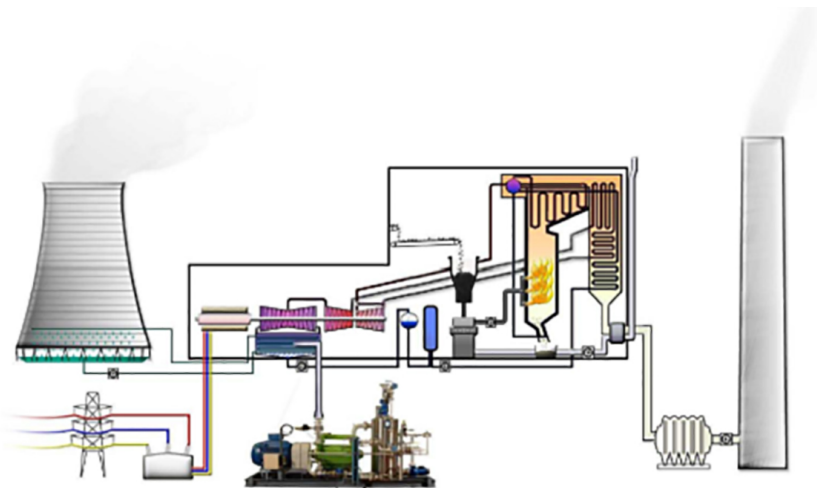
- EHR/SHR single and two stage.
- LR1A/B single stage.

Liquid Ring Pump Applications in Power Market

Liquid ring pumps are ideally suited for use in a number of vacuum applications in power generation, all of which benefit from the performance characteristics of liquid ring vacuum pumps.

- Condenser Air Extraction
- Waterbox Priming
- Flue Gas Desulphurisation
- Fly Ash Handling

Condenser air extraction and waterbox priming both contribute to increased efficiency of the power plant, whilst flue gas desulphurisation and fly ash handling are associated with treatment of the boiler exhaust gas. Edwards have developed a range of standard pump packages to meet the vacuum pumping requirements for each of these applications.



Condenser Air Extraction

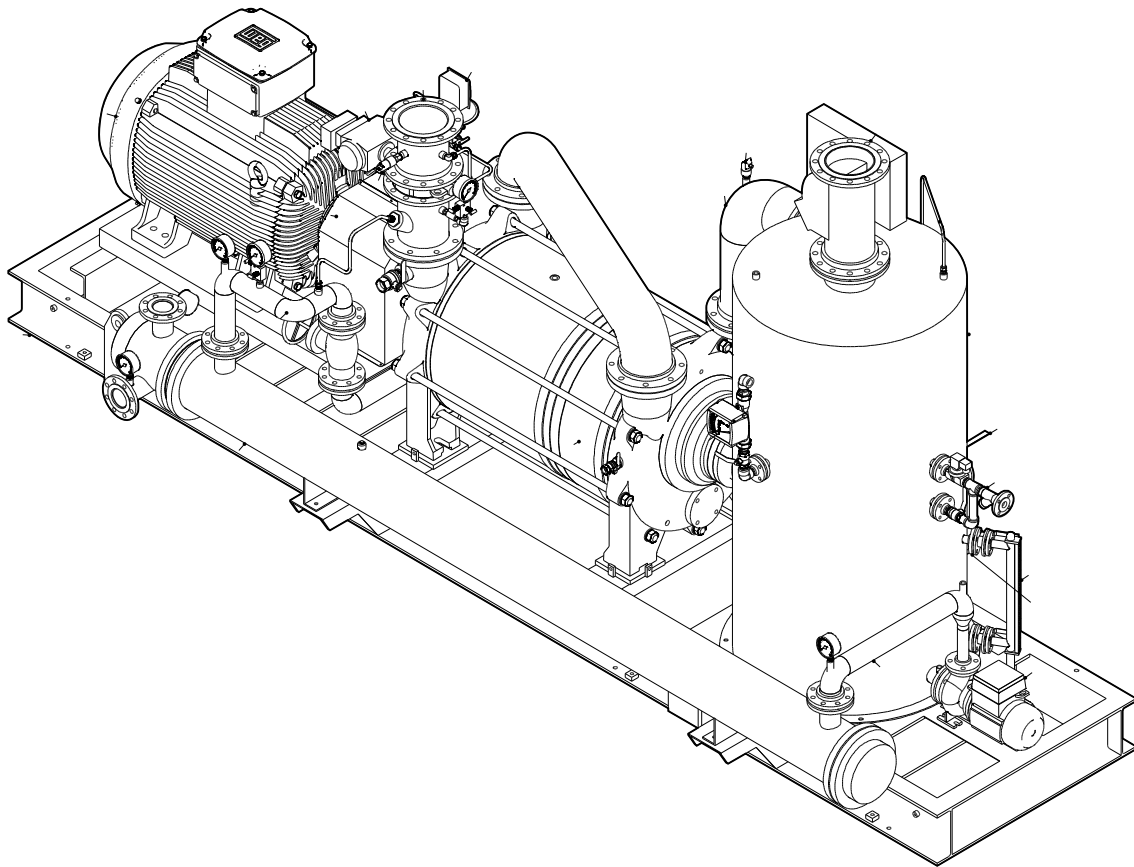
The efficient operation of a steam power plant is partially dependent upon the turbine back pressure which is determined by the performance of the steam surface condenser and the condenser air extraction system. Typically the lower the back pressure the higher the power output from the plant, selection of the correct vacuum system is critical to achieving optimum efficiency.

Selection of the vacuum equipment is complex, it is usually based upon a benchmark theoretical condition, with performance requirements taken from HEI (or VGB) recommendations, supplemented by plant specific criteria requiring further analysis of pump performance at actual operating temperatures and pressures, operation at part load or variation in fuel quality or type must also be considered.

Edwards have developed a range of standard packages based upon the SHR series of two stage liquid ring pumps. These are designed to extract air leakage rates as defined by the HEI Standards for Steam Surface Condensers in both hogging and holding phases and are able to operate over a wide range of operating conditions.

The air load from the turbine condenser system is saturated with steam, making liquid ring pumps the ideal pumping solution due to their superior performance when handling high vapour loads. 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), significantly reducing the total volume of gas to be handled by the pump.



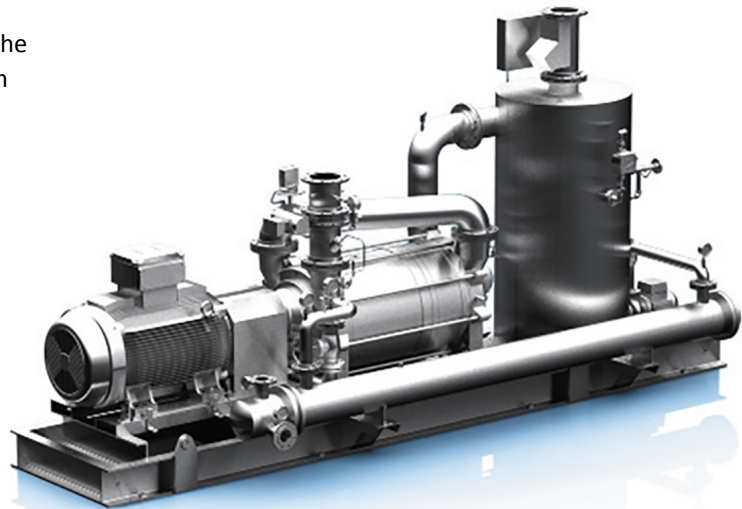


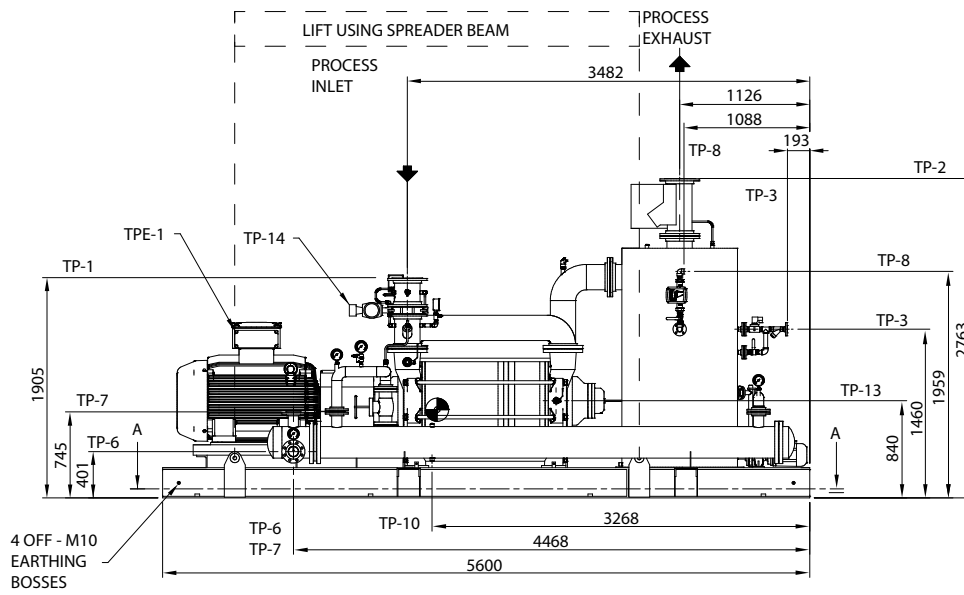
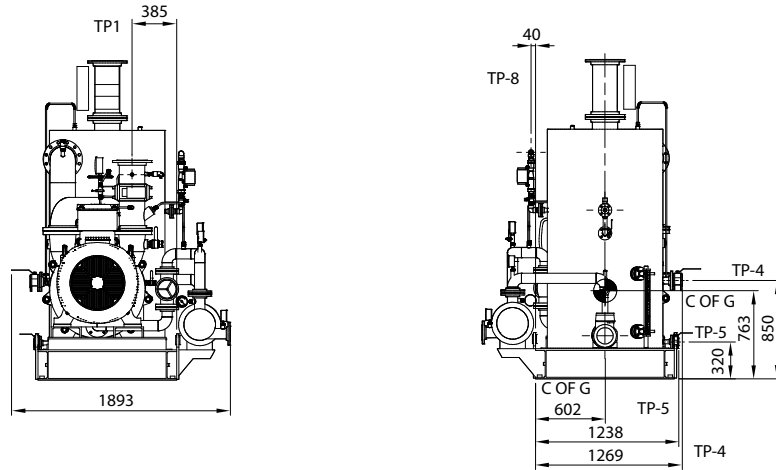
Liquid ring pumps are very effective when pumping wet gases and condensable vapours and are able to operate across the entire pressure range from atmospheric pressure to less than 30 mbar; this gives maximum flexibility in meeting the required condenser backing pressure under various operating conditions. A guide to pump selection can be seen in the table below,

this shows the pump size required to achieve the nominal HEI condition of 1" 0Hgabs (33.86 mbar) with varying ITD's (Initial Temperature Difference) between the condenser cooling water and the condenser outlet temperature. For more information on pump performance against specific operating conditions, please contact your local customer care office.

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

The standard package includes all of the associated equipment required to operate the pump package, including the transition from hogging to holding duty.



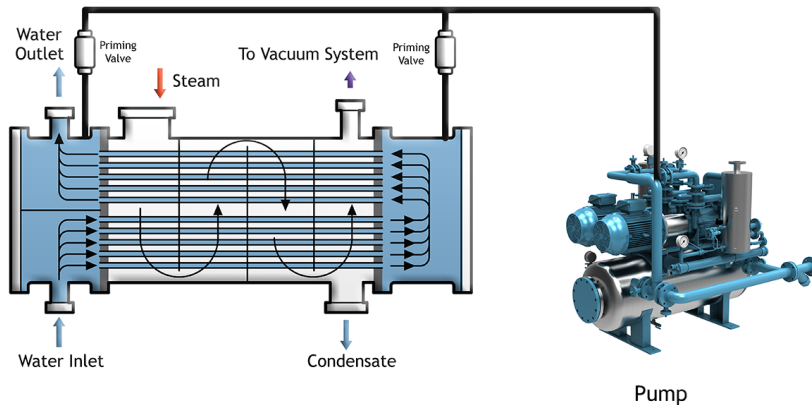


Condenser air extraction LRP

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 makes liquid ring vacuum pumps ideal for the waterbox priming application. The vacuum pumps are used initially in priming mode to evacuate the main condenser waterboxes, water intake pipe and CW pump. Once complete, the pumps are used in maintaining mode, ensuring the waterbox pressure remains within the required range.

Air removal from the condenser waterbox prevents accumulation of air in the upper parts of the cooling tube bundle, preventing air locks and maintaining the effective cooling surface area of the condenser, maximising the cooling effect.

Edwards waterbox priming system has a modular design comprising of three component parts, vacuum pumps, vacuum receiver and priming valves, which are supplied as required to meet the customer specification.

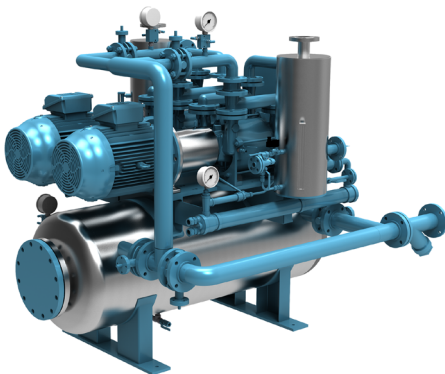
The vacuum pump module features a single stage liquid ring pump complete with flange mounted electric motor and total seal water recirculation system with

discharge separator and heat exchanger. When the specification requires duty standby pumps either two complete pumpsets are mounted side by side or a duplex package utilising a common recirculation system can be supplied.

The vacuum receiver module is complete with pressure transmitter to control vacuum pump operation and includes an automatic drain arrangement enabling any water carryover to be drained without stopping the system.

Priming valves are available as required for the waterbox priming air exhaust lines, the valves prevent vacuum pump cycling and also minimises the carryover of condenser cooling water to the vacuum pump.

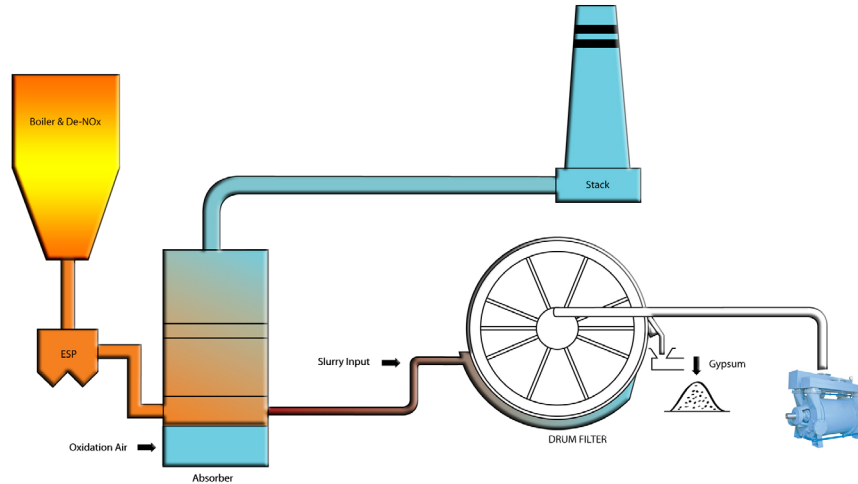
Depending upon specification requirements the vacuum pumps can be supplied mounted directly onto the vacuum receiver minimising floor space or can be supplied on separate baseplate for mounting on the floor.



A skid mounted control panel can be supplied as an option.

Exhaust Gas Treatment Applications

The boiler exhaust gas is conditioned by an electrostatic precipitator (ESP) which extracts the fly ash, before entering an absorber/scrubber where Sulphur Dioxide is absorbed by a limestone slurry forming gypsum as a by-product. Both of these processes require a vacuum system.



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 must be dewatered to enable it to be sold commercially. This is usually carried out using a rotary drum filter, which utilises a large single stage liquid ring pump to remove the water by sucking air through the slurry, leaving behind the dewatered gypsum. The vacuum pump is selected depending upon the surface area of the filter.

Fly Ash Handling

Once the fly ash has been separated in the ESP it is collected in a hopper. From the hopper, the ash is transported by a vacuum conveying system to a collection area for disposal or conversion into building products. The vacuum conveying duty is ideally suited to single stage liquid ring pumps which can handle any carryover of the abrasive ash.

The table below shows the appropriate pump model for a selection of nominal capacities.

Nominal Capacity m ³ h ⁻¹	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