

# LIQUID RING PUMPS FOR THE POWER INDUSTRY

 **EDWARDS**





## EDWARDS THE PARTNER OF CHOICE

**Edwards is a world leader in the design, technology and manufacture of vacuum systems for the power industry with over 95 years' history.**

We believe in delivering results that bring value to our customers by using our breadth of industry experience to identify and apply solutions to your problems. Using the most innovative and up-to-date modeling techniques, we can optimise the pumping configuration for customers to provide a system design giving the maximum performance in the most reliable and cost-effective way.

# VACUUM PUMPING SOLUTIONS FOR YOUR POWER PLANT

**As a leader in vacuum technology, today Edwards has grown within 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.**

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

The efficiency of steam turbines is an important part of electricity generation. Edwards' liquid ring vacuum pumps play a vital role in maximising efficiency by 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 used on condenser waterbox priming, 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 are also utilised on exhaust gas treatment processes for fly ash handling and flue gas desulphurisation.

Optimum solution for your requirements

**Standard packages customised to meet your specification**

Peace of mind

**Full factory acceptance test including saturated air test capability**

Reliability

**Compliance to global and industry standards**

Your local partner of choice

**Local applications expertise and service support**



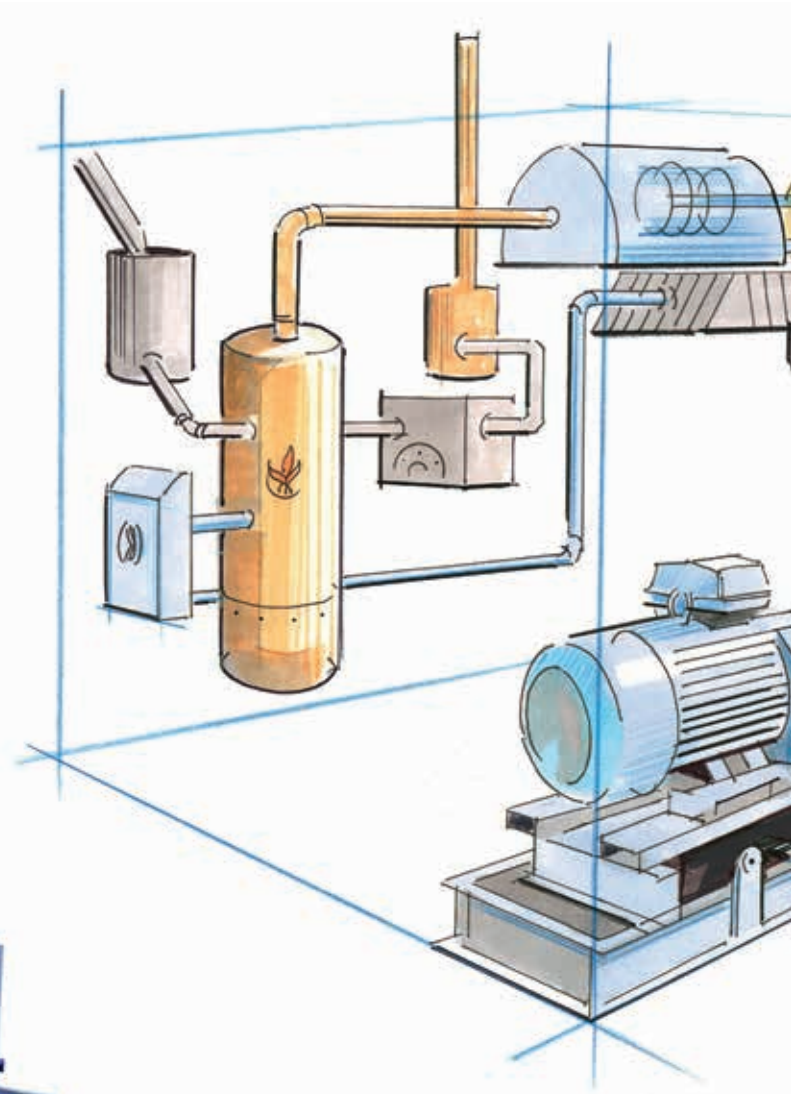
## Condenser Air Extraction

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.

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 a 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.

- Standard packages for holding and hogging
- Designed to meet HEI specifications
- Local service and site commissioning support



## Waterbox Priming

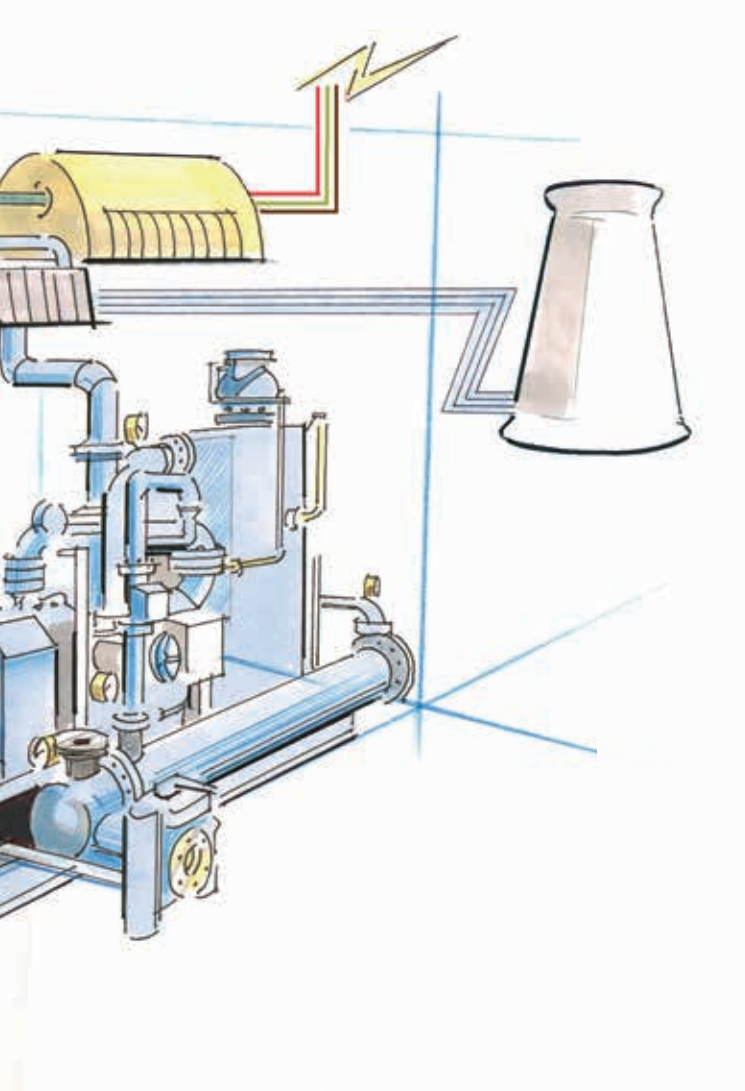
Waterbox priming serves two functions: to create a siphon effect reducing the amount of power required to start the main cooling water pumps; and to ensure maximum condenser cooling efficiency by preventing accumulation of air in the upper parts of the cooling tube bundle.

The ability to handle wet gases without any detrimental effect makes liquid ring vacuum pumps ideal for condenser waterbox priming applications. 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.

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 is comprised of 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.



## Fly Ash Handling

Ash from the combustion process is captured in the Electrostatic Precipitator; the collected ash is transported by a vacuum conveying system to the storage facility or loading silo. Liquid ring pumps offer a robust solution for this application often utilising stainless steel impellers.

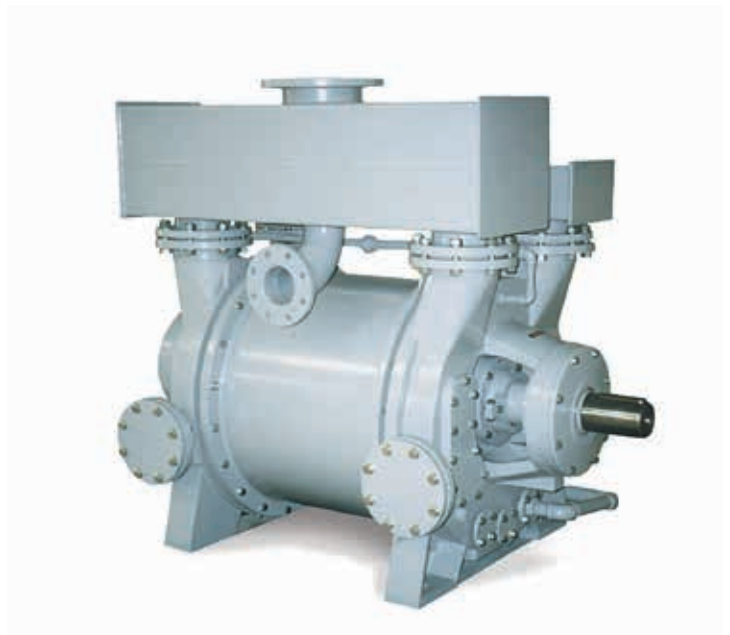
- Pump capacities up to 5000 m<sup>3</sup>/h
- Corrosion/erosion resistant materials available
- Systemised to meet project requirements
- Once through or partial recirculation seal water



## Flue Gas Desulphurisation

Flue Gas Desulphurisation systems are a common feature on modern coal fired power plants. Gypsum is a by product of the process 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.

Please contact an Edwards sales office for selection of the correct pump size for your application



## Condenser Air Extraction Pump Selection to HEI standards

Edwards's standard condenser air extraction packages are designed to meet the requirements of HEI standards for Steam Surface Condensers. Venting Equipment Capacities table, which recommends that venting equipment should be selected to operate at 1"Hgabs (33.86mbara). The ITD (Initial Temperature Difference) is an important consideration in optimum pump sizing which is based on the assumption that the ITD remains fixed. The table below gives pump selection guideline for operation at 1"Hgabs with specific HEI air leakage rates at various ITD's, as the ITD increases the capacity of the venting equipment also increases.

HEI SCFM	ITD				
	10°C	11°C	13°C	15°C	17°C
3	EHR2390	EHR2390	EHR2190	EHR2190	EHR2190
4	SHR2400	SHR2400	EHR2390	EHR2390	EHR2190
5	SHR2400	SHR2400	EHR2390	EHR2390	EHR2390
7.5	SHR2750	SHR2750	SHR2750	SHR2400	SHR2400
10	SHR2950	SHR2750	SHR2750	SHR2750	SHR2400
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	SHR23500	SHR23500	SHR23500	SHR22500	SHR21850

Power plants typically operate at higher pressures than the 1"Hgabs. As the operating pressure increases, assuming a fixed ITD the capacity of the venting equipment also increases. Other factors such as part load operation should also be taken into consideration.

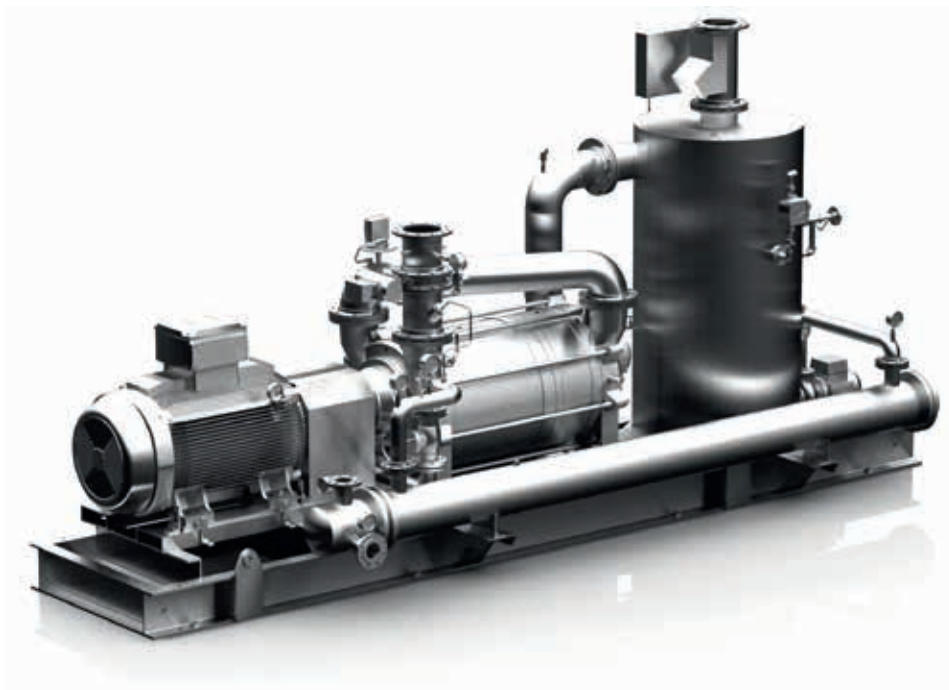




# Condenser Air Extraction Standard Packages

Edwards have developed two standard package concepts to meet the differing market requirements for condenser air extraction systems. The fully automated CEP packages are designed to meet the typical specification requirements for larger steam turbine plants which are developed by the major utility companies and IPP's whilst the smaller SCP packages are aligned with the requirements of the lower capacity plants for industrial and marine applications. Each of these concepts provide a base template which can be customised to meet the specific requirements of each project.

## CEP Packages



- Pump sizes SHR2400 – SHR23500
- Simplex design with dedicated seal water circuit
- Fully automatic operation
- Inlet water spray for inlet volume reduction
- Inter-stage anti cavitation device
- Recirculation pump to facilitate optimum seal water flow rate
- Level control with multiple set points
- Pump discharge temperature switch to detect operational problems
- Discharge air flow measuring flow meter
- Shell & tube heat exchanger with stainless steel tubes
- Option for plate type heat exchanger as alternative to shell & tube type

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
CEP7500-2	SHR23500	30 - 50	275	200	6000	1900	3200

\* Dimensions in mm



# SCP Packages

The SCP Packages are designed to meet the requirements of industrial installations where manual operation is the preferred solution. There are three design options to select from all including integrated seal water recirculation using a stainless steel plate type heat exchanger.

## Features

- Pump sizes EHR2190 – SHR2750
- Simplex, Duplex and Common Separator design options
- Manual operation
- Inlet water spray for inlet volume reduction
- Interstage anti cavitation device
- Plate type heat exchanger

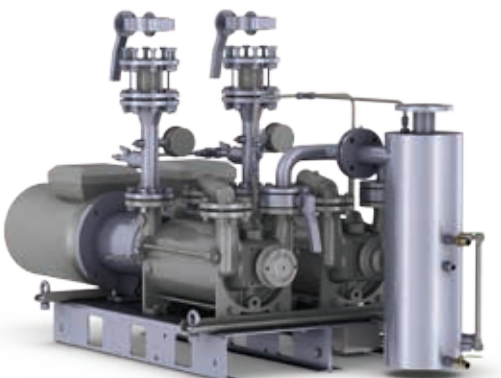


- Simplex—a single pump model complete with a dedicated total seal water recirculation system, multiple units can be arranged alongside

- Duplex — Duty/standby pumps each with a dedicated total recirculation system, used when initial evacuation requires multiple pumps or when extra capacity is required to specific operating conditions



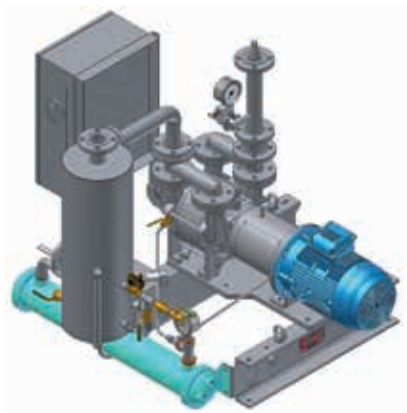
- Common — Duty/standby pumps with a common recirculation system , also used to meet additional specific operating conditions, with the added security of independent seal water recirculation systems



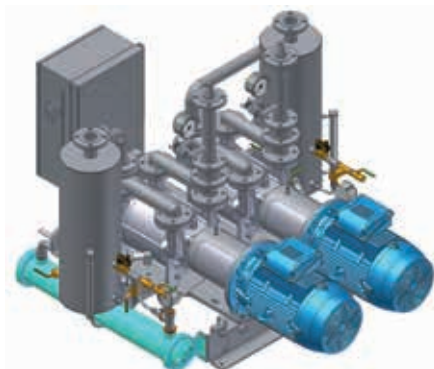
*Please contact your local sales office for detailed package information.*

## Waterbox Priming

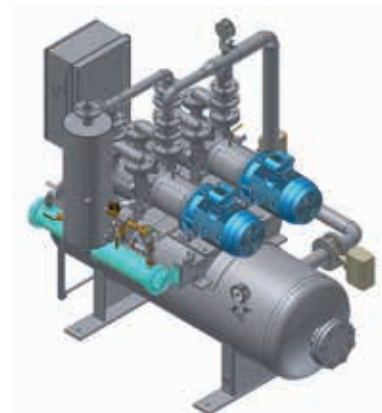
The Edwards waterbox priming system is a modular design comprised of three component parts: vacuum pumps, vacuum receiver and priming valves, supplied as required to meet the customer specifications. The complete duplex package includes two liquid ring pumps, each with an independent seal water recirculation system, a vacuum receiver, interconnecting pipework and local control panel. Alternatively pumps can be supplied as a simplex package, or as a common package with a combined recirculation system. All three package options are available with or without the vacuum receiver and can be mounted on a separate baseplate or on top of the vacuum receiver.



*Simplex - a single liquid ring pump complete with a dedicated seal water recirculation system*



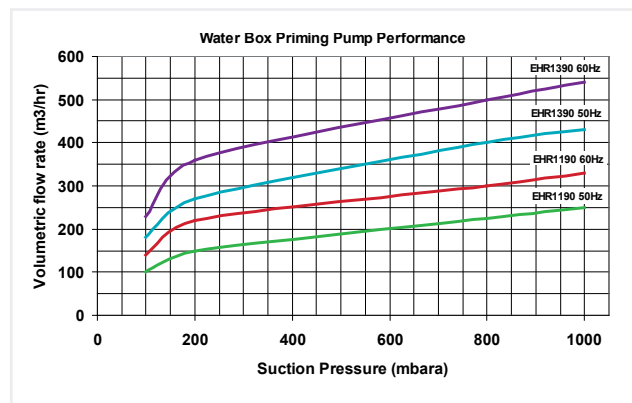
*Duplex - two liquid ring pumps each complete with a dedicated seal water recirculation system*



*Common - two liquid ring pumps with a common seal water recirculation system mounted on a vacuum receiver*

## Technical data

Model	Hz	rpm	Motor rating kW	Nominal capacity m <sup>3</sup> /h
EHR1190	50	1450	5.5	180
	60	1740	7.5	260
EHR1390	50	1450	11	340
	60	1740	15	440



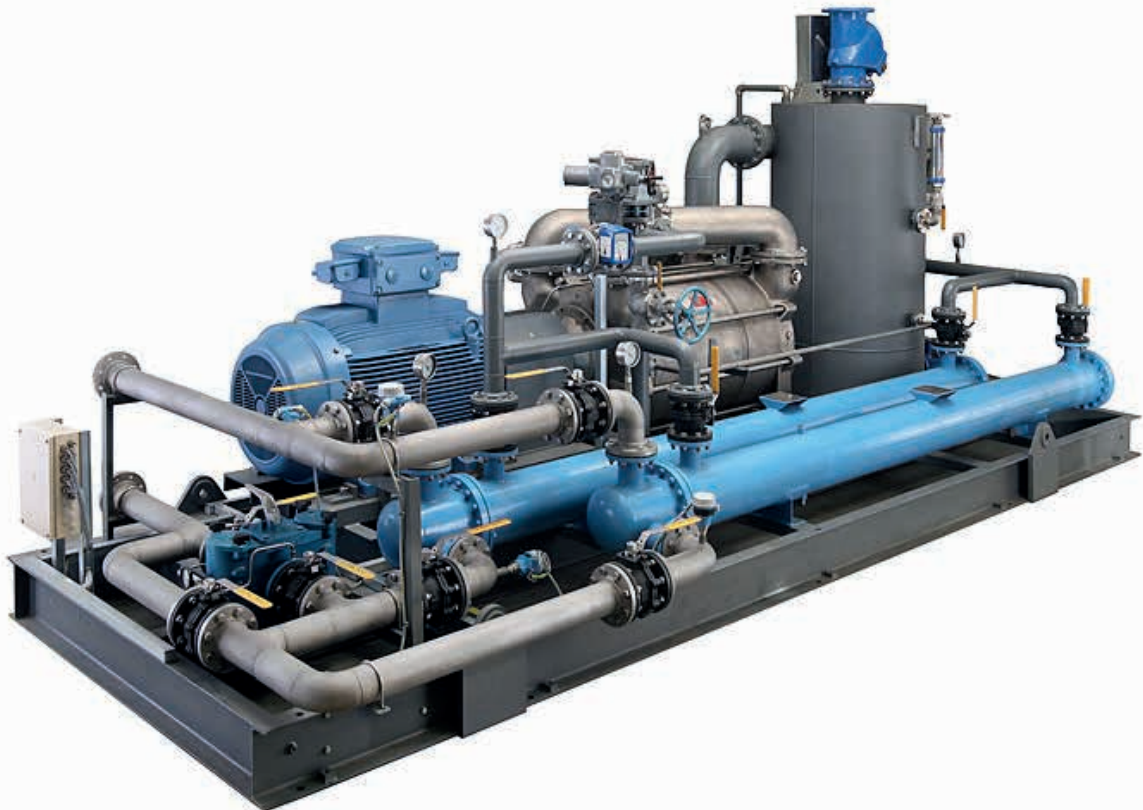
## Non Standard Packages

More complex systems include special recirculation systems or combinations of liquid ring pumps, air or steam ejectors. These hybrid systems can significantly extend the liquid ring pump performance.

In addition to the standard range of condenser air extraction packages Edwards also offer bespoke systems designed to meet customer specific requirements, including:

- Hybrid air ejector/liquid ring and steam ejector liquid pump systems
- Large capacity single stage hogging systems suitable for Air cooled condenser
- Stainless steel pump construction for geothermal applications
- Custom designed seal water cooling systems
  - multiple heat exchanger for low quality cooling water
  - air blast coolers for applications with limited cooling water supply

Contact your local Edwards sales office to discuss your specific requirements



Condenser air extraction LRP package



## GLOBAL CONTACTS

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