



CONCRETE VOLUTE PUMP (CR) SYSTEM

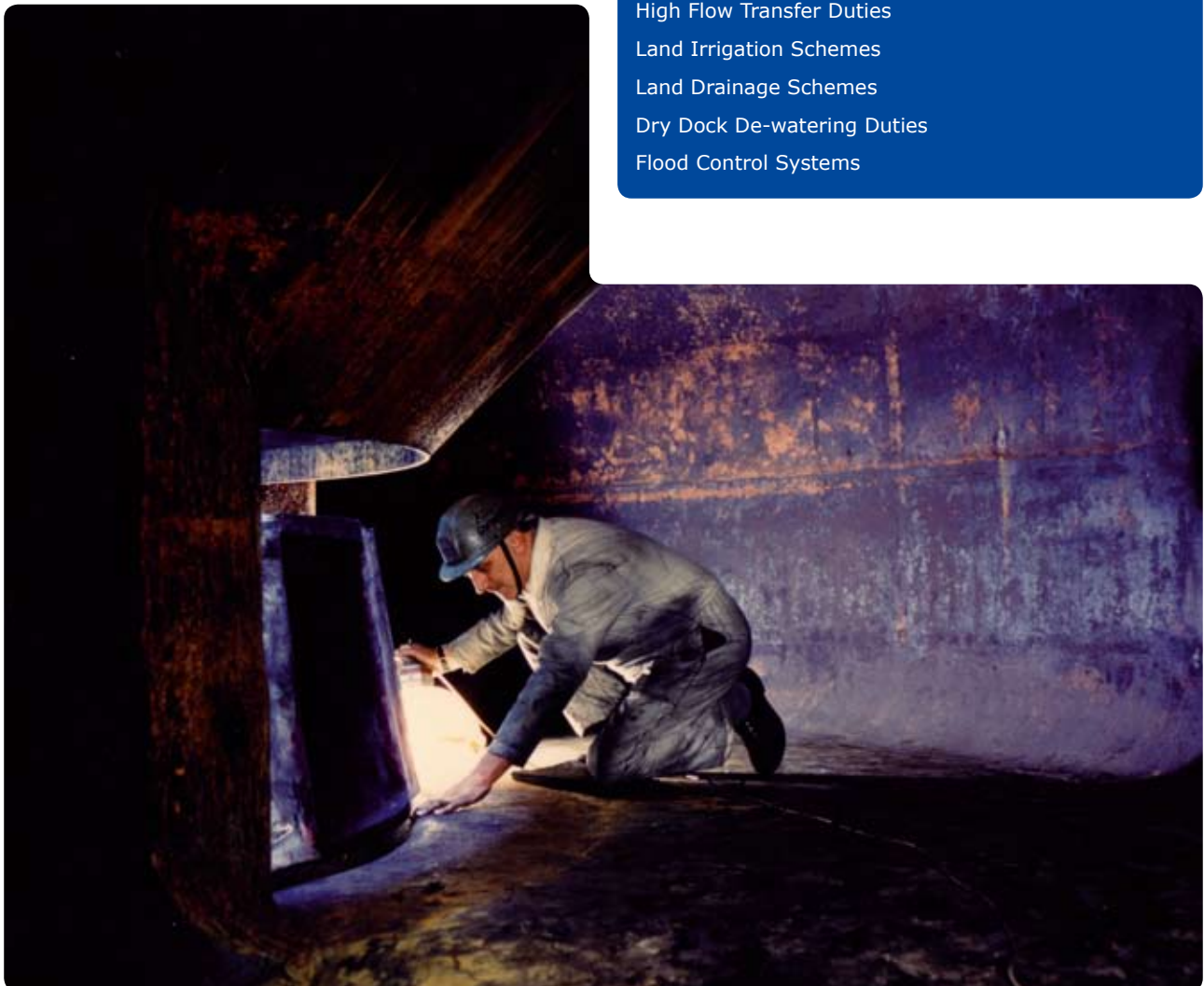


An Introduction to Concrete Volute Pumps

Concrete volute pumps are designed for high flow applications, resulting in fewer pumps. This need for fewer pumps reduces overall civil dimensions considerably.

The pump is predominantly produced in concrete, eliminating potential corrosion problems often experienced in corrosive environments. The pump is constructed as an integral part of the pump-house – ensuring consistent civil and mechanical interfaces. After installation **almost 100% availability is achieved** due to the effective combination of the slower running speed, minimal wear and exceptional reliability, eliminating the need for stand-by units.

Concrete volute designs boast a **minimum of 10 years** between internal inspections. These inspections can be performed within the volute without removal of the pump cartridge.



Duty Range

Capacity

- Up to 120,000 m³/hr / 530,000 gpm

Delivery head*

- Up to 70m / 230 ft

*Available head is related to application flow/speed

Temperature

- Up to 50°C (120°F) in standard configuration

Speeds

- 100 to 350 rpm

Flange drilling

- BS or ANSI

Applications

Large Scale Cooling Water Duties

High Flow Water Intake Systems

High Flow Transfer Duties

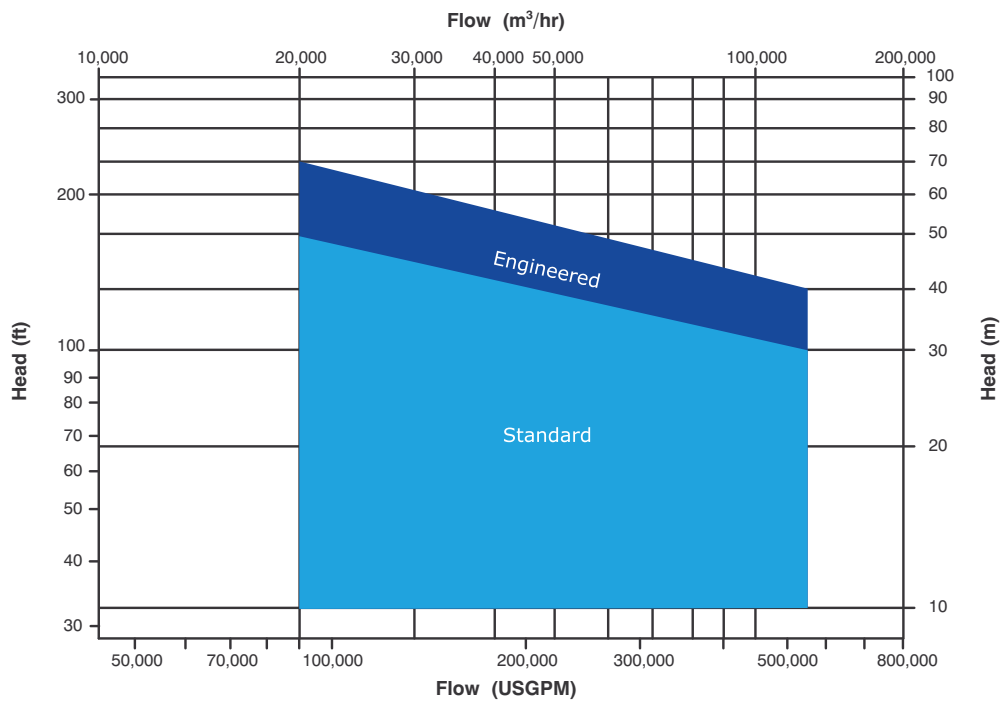
Land Irrigation Schemes

Land Drainage Schemes

Dry Dock De-watering Duties

Flood Control Systems

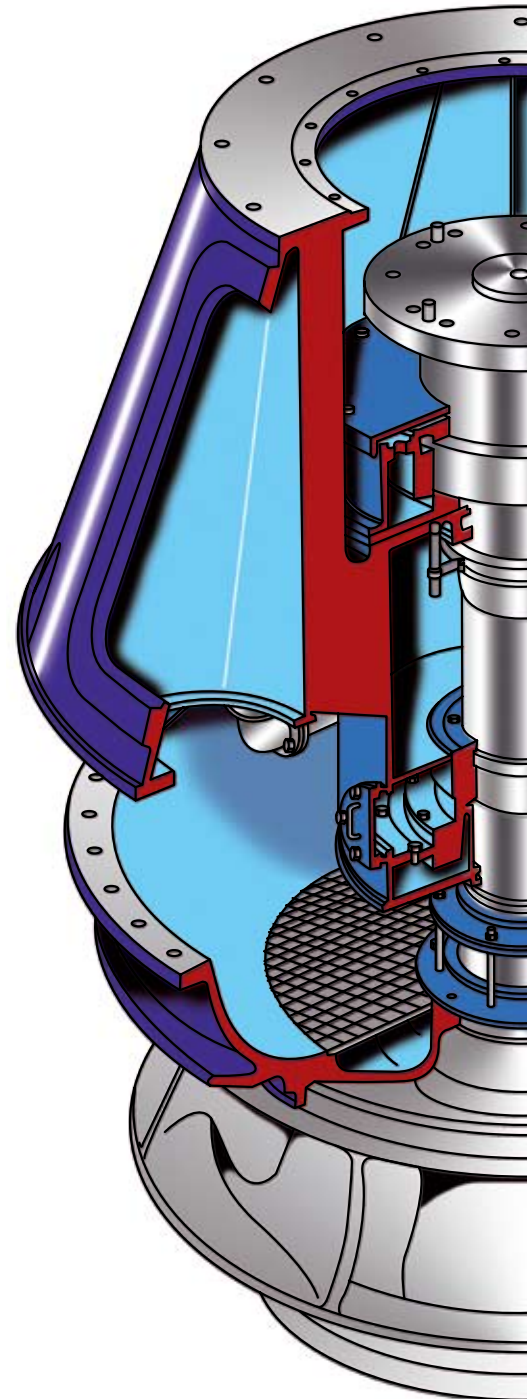
CONCRETE VOLUTE PUMP (CR) SYSTEM

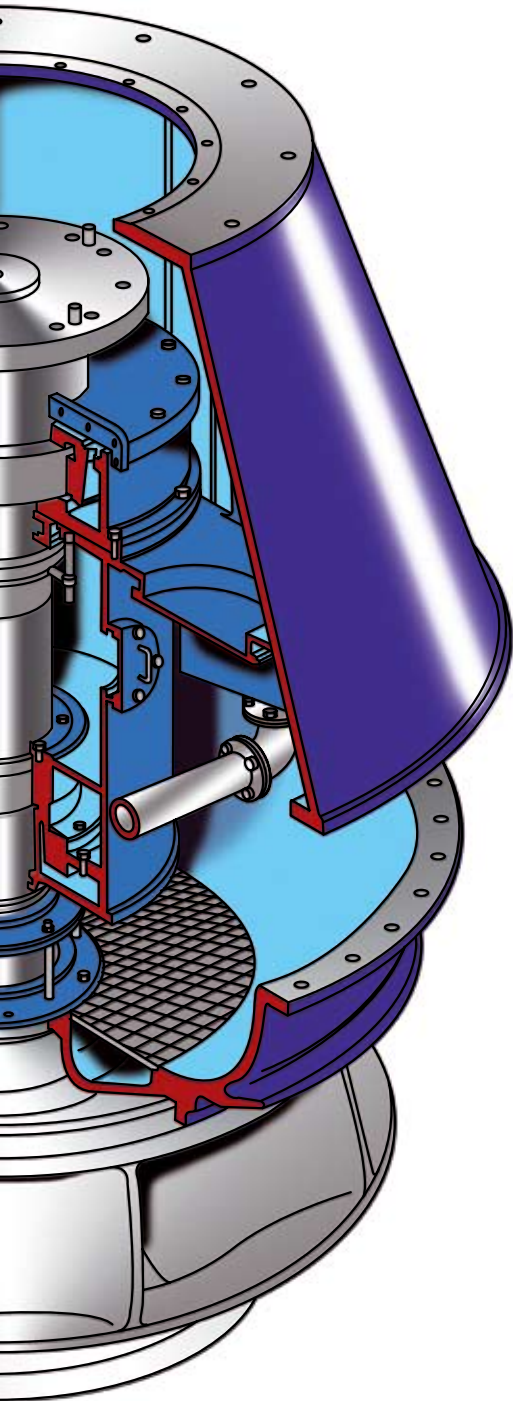


Features

Concrete volute pumps have several advantages over the conventional tubular casing pump. The main advantages are to be found in construction, total cost, handling, installation and maintenance:

- Vast experience with **over 200** concrete volute pumps supplied to date
- Concrete volute option will be suitable for a higher flow per pump, resulting in **fewer pumps being required**
- Pump casing is predominantly produced in concrete, which **eliminates potential corrosion problems** often experienced with suspended bowl pumps (especially in hot sea water)
- Lower specific speed results in a slower running speed and shorter submerged setting depth
- Both the above factors will significantly **reduce the depth of civil dig** and overall land area excavation required for the intake and pump house structures
- The lower specific speed (volute design) pump offers a lower rise to closed valve head, resulting in **reduced system pressure rating**
- The intake layout proposed by CLYDEUNION Pumps can **cater for any future extension** to the intake plant
- Pump construction is **concurrent with intake and pumphouse structures**, ensuring correctness of mechanical and civil interfaces
- The combination of the concrete volute pumps' slower running speed, minimal wear and exceptional reliability **eliminates the need for stand-by units**
- Low wear leads to **negligible spares** usage
- Approaching **100% availability** is achieved on all installations
- **Installed efficiency is higher** than conventional bowl pumps - concrete volute pumps are larger, more efficient and do not encounter column or bend losses
- Efficiency levels are maintained over long operating periods, **reducing overall power consumption** over life of plant life
- **Real long term power savings** leading to high value cost savings over plant life
- CLYDEUNION Pumps has actual experience of pumps operating in the UK power industry for **more than 100,000 hours** with no noticeable change in efficiency
- The concrete volute design boasts a **minimum of 10–12 years between internal inspections**. Bowl pumps require maintenance after 3 years
- **Common discharge manifold** allows exceptional versatility between pumps and system
- Defined limits of supply on structures/systems supplied by CLYDEUNION Pumps





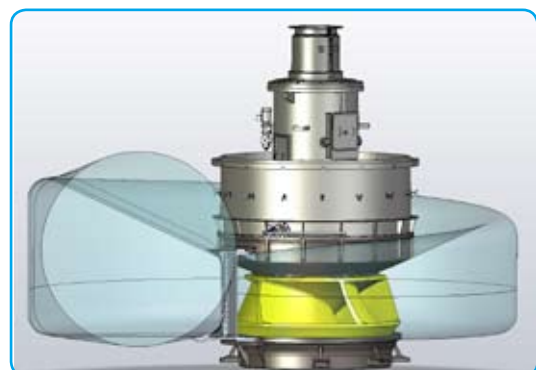
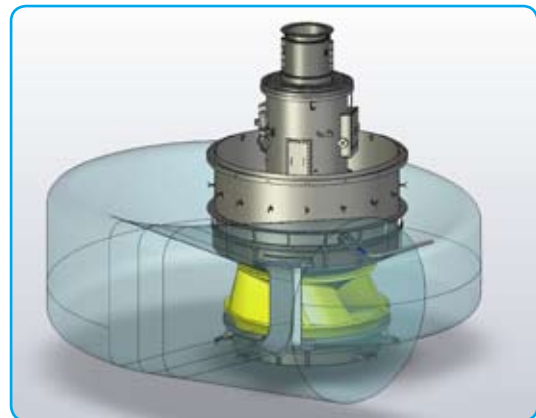
Concrete volute pumps offer advantages over conventional vertical bowl pumps in the following areas:-

Construction

- Civil Dig & Land Area
- Design Layout
- Space Restrictions
- System Design Pressure
- Supporting Steelwork Quantity

Long Term

- Maintenance Manpower
- Routine Maintenance Spares
- Major Maintenance Spares
- Reliability
- Component Replacement Costs
- Power Consumption
- Power Costs
- Overall Running Costs



Pump & Drive Arrangements

The concrete volute pump and drive arrangements comprise of –

- A motor directly coupled to the pump shaft
- A motor driving the pump through a speed reducing gearbox
- A diesel engine driving the pump through a speed reducing bevel gear

Direct Drive

- Driving the pump by a directly coupled slow speed motor requires only two major components
- This drive arrangement simplifies installation, maintenance and auxiliary equipment
- Overall noise levels are reduced

Epicyclic Drive

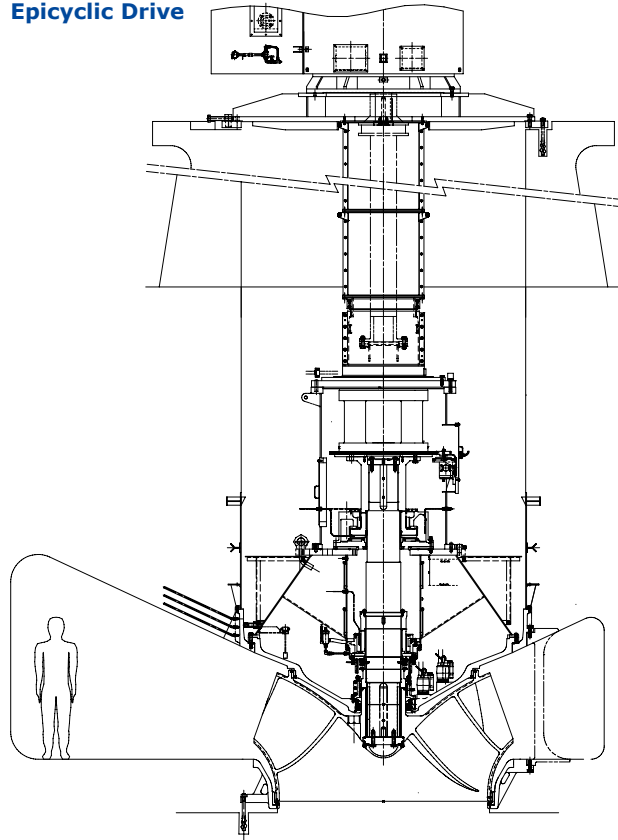
- Gear units are designed to suit motor and pump interfaces
- Gearcases can be designed to support weight of drive motor
- Reduced overall package size
- Coaxial drive train (Motor/Gearbox/Pump)
- High mechanical efficiency of 99%
- Self contained full duty lubrication system
- Reduced noise and vibration
- Transfers thrust, or accepts external thrust via integral thrust bearing
- Eliminates the need for a low speed coupling

Offset Geared Drive

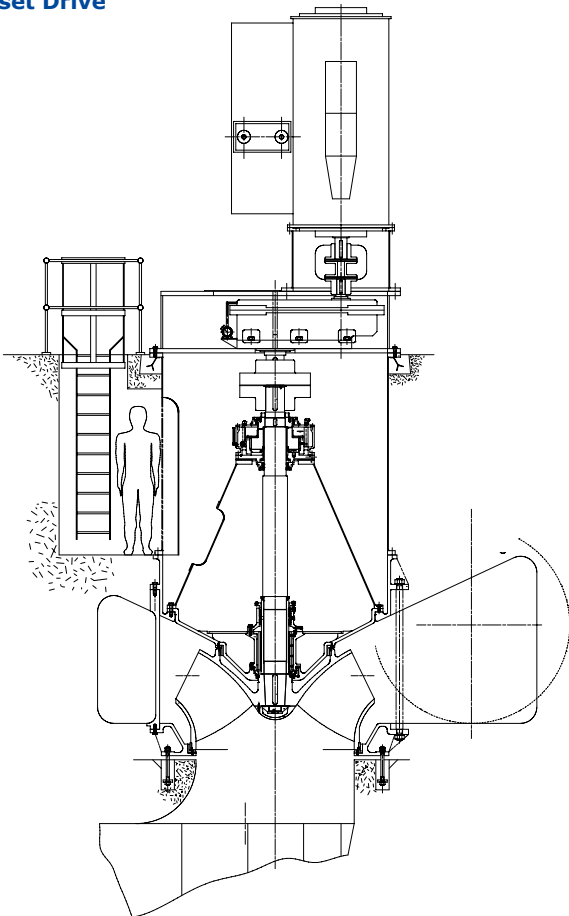
- A gearbox drive arrangement using a higher speed motor is lighter, smaller and generally operates at higher overall efficiency
- Cost of complete pump set is lower
- Cost of the overhead crane for the station may also be lower because of a reduced lifting capacity



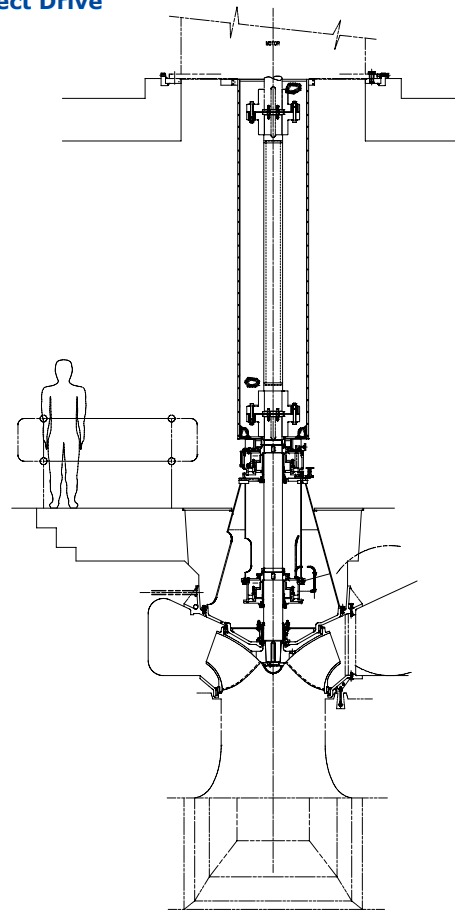
Epicyclic Drive



Offset Drive



Direct Drive



Construction

The complete rotating assembly consisting of shaft, impeller, bearings, seal, coupling and optional gearbox, together with the top cover and bearing bracket, are manufactured and delivered to site ready for installation into the built-in seating ring.

The finished machined seating ring is supplied at an early stage for building into the concrete. It forms a permanent structure around which the shuttering is located to reproduce the volute and discharge passage shape.

Stage 1

The draught tube is formed using accurately made shuttering, and concrete is poured up to a level approximately 50mm below the mounting position of the underside of the seating ring.

Stage 2

The seating ring is then positioned above the draught tube. Care is taken to ensure correct orientation and that it is perfectly level before the holding-down bolts are tightened and concrete is poured to the top of the seating ring mounting flange.

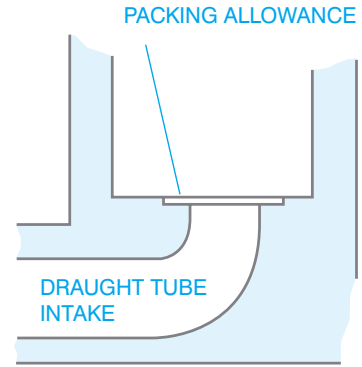
Stage 3

When the seating ring is rigidly secured in its final position the volute shuttering can be assembled around it. The discharge piping is then positioned to ensure correct alignment. Where mild-steel tubing is included it should be mounted on top of the seating ring at this stage. Concrete can then be poured, in accordance with good civil engineering practice, up to motor-room floor level.

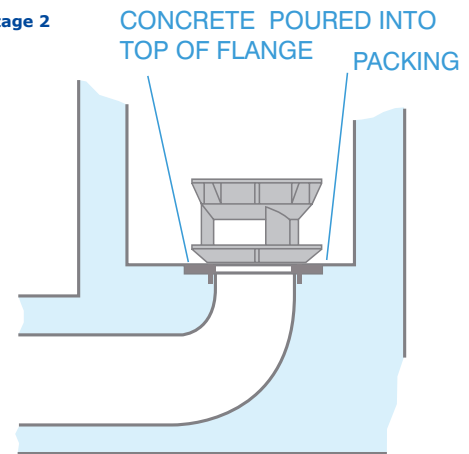
The volute shuttering is normally made by the civil engineering contractor to specified dimensions and can be re-used for further pumps on the same contract. The shuttering will be inspected in position by a CLYDEUNION Pumps engineer, prior to the reinforcing bars being positioned and concrete pouring commences.

The passages formed in the concrete should be within a tolerance of ± 0.3 per cent, and have a surface finish equal to good quality commercial cast-iron. This standard presents no difficulties and is necessary to ensure guaranteed hydraulic performance. Wear and life expectancy are excellent; pumps over 35 years old show little sign of wear.

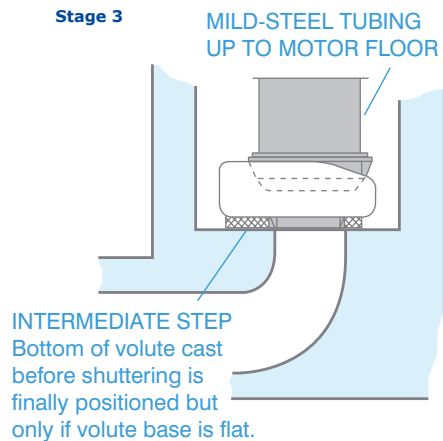
Stage 1



Stage 2



Stage 3



CONCRETE VOLUTE PUMP (CR) SYSTEM



Model Pump Testing

Experience has been gained over many years of testing conventional pumps for large-capacity low-head applications in the CLYDEUNION Pumps test house at Glasgow. This experience plays an important part in producing the best concrete volute pump design for specific performance and economic construction to the fullest benefit of our customers.

But, as **concrete volute pumps cannot be tested in the works of the manufacturer** – because the volute casings are produced on site – scale models of the pumps are constructed and tested in the CLYDEUNION Pumps laboratory in accordance with internationally accepted codes of practice. These tests enable the hydraulic characteristics of the full-size unit to be **accurately predicted**.

Another advantage of model testing is to prove pump performance when modifications to shape, which may simplify civil engineering construction of the pump house, are introduced at the design stage.

A simple sectional arrangement of the model pump is shown in [Figure 1](#). The model impeller is precision cast to obtain a high degree of accuracy with a smooth surface finish. Records of 'as tested' dimensions are produced as follows –

- Impeller eye diameter
- Impeller blade angle
- Blade thickness
- Blade pitching
- Impeller & volute surface roughness
- Critical dimensions are recorded (*i.e.* impeller outlet width, impeller outside diameter, volute throat area)

The volute is cast in epoxy resin inside a fabricated steel housing and made in two halves to facilitate the manufacturing process. The model pump is mounted vertically in a gantry, which also supports a torque meter and drive motor.

The draft tube is manufactured in resin or fibreglass and incorporates windows for qualitative assessments of impeller inlet contours. Wall pressure measurement tappings for assessing the static pressure distribution along its length are provided.

A provisional layout of the test rig is shown in [Figure 2](#) depicting the model pump, draft tube, test pipework and test tank. The suction pipework has the same sectional area as the draft tube entry. A transition section with a diffusion angle of less than 8% is used if necessary to convert from circular to rectangular section.

The model is – as far as is practical – **hydraulically identical**

to the main pump.

All testing on the model is carried out at 4 pole speed using fresh water at ambient temperature (approximately 15°C) such that the model head is similar to the site head.

Flow is measured using an electromagnetic flowmeter installed in the test pipework with adequate straight lengths upstream and downstream of the device.

Suction pressures (H_s) are measured using a mercury manometer and pressure transducer connected to a 4-tapping ring manifold. Discharge pressure is measured using a calibrated standard Bourdon test gauge and a pressure transducer connected to a 4-tapping ring manifold two diameters downstream of the pump discharge (H_d).

A perspex window on the draught tube – or if required a perspex draft tube – allows observation of flow in the region of the draught tube bend using thread tracers or dye injection. The velocity profile at the impeller inlet is established by a Pitot tube traverse.

The draught tube wall static pressure distribution, velocity profile at impeller inlet location and flow pattern in the draught tube is established at the normal duty condition.

Model pump performance is established in terms of measured head, flow and power. Whilst the figure to be used for comparison with site data is that achieved at design flow, a further series of flow/head/power readings are taken across the full range from 0–130% of rated flow to establish the full characteristic.

Power input to the pump is determined using a torque meter in conjunction with the speed read-out from a digital counter linked to a photo-electric sensor picking up the signal from a reflective marker on the pump shaft.

On completion of the pump performance testing, the suction draught tube is removed and replaced with a metal bend, allowing the required low levels of suction pressure to be gained for NPSH testing. Three sets of test points are measured evenly spaced from 30–120% flow.

As a GRP draft tube lacks the strength required to withstand the vacuum induced during NPSH testing an axi-symmetrical section (simple bend) is used which does not collapse under vacuum.

The NPSH levels measured on test are corrected to take account of the difference in suction losses between the draft tube and inlet bend as measured from a single point head measurement at BEP with an adequate NPSH.

On completion of testing in our laboratory, CLYDEUNION Pumps produces model pump performance curves to prove through scaled extrapolation that we meet the required duty.

In this instance the N_s of model used has been tested many times and CLYDEUNION Pumps can prove performance of model pump scaled extrapolation on existing concrete volute installations.

Figure 1
Sectional Arrangement of Model Pump

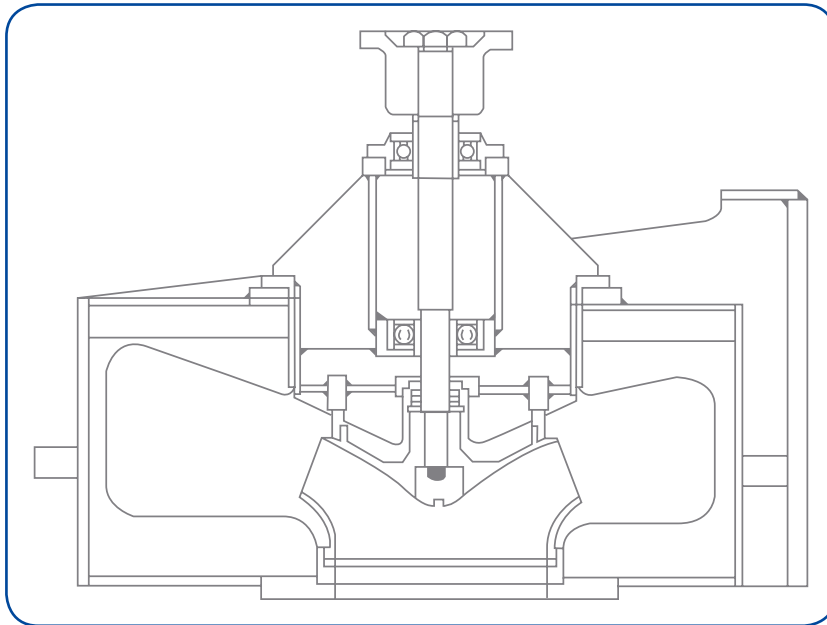
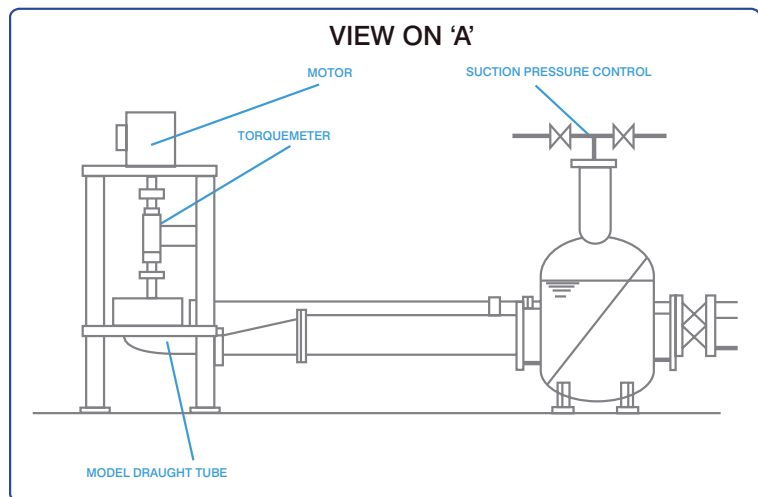
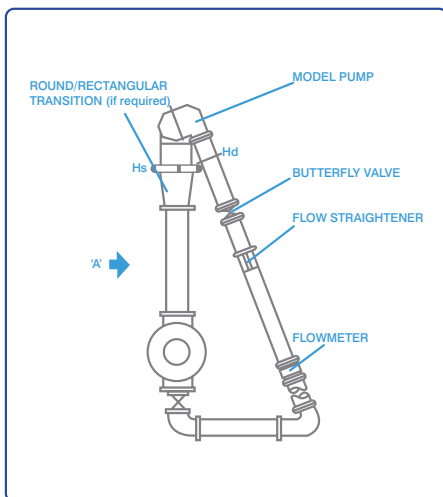


Figure 2
Test Rig Layout





Sales: ✓
Aftermarket: ✓
Manufacturing: ✓

Europe

✓	✓	Annecy:	Tel: + (33) 45 005 5600	Fax: + (33) 45 005 5880	Email: annecy@clydeunion.com
✓	✓	Penistone, UK:	Tel: + (44) 122 676 3311	Fax: + (44) 122 676 6535	Email: penistone@clydeunion.com
✓	✓	Glasgow, UK:	Tel: + (44) 141 637 7141	Fax: + (44) 141 637 7358	Email: glasgow@clydeunion.com
✓		Nordic countries:	Tel: + (47) 815 310 02	Fax: + (47) 815 310 03	Email: nordic@clydeunion.com
✓		Moscow:	Tel: + (7) 495 967 3453	Fax: + (7) 495 785 0636	Email: moscow@clydeunion.com

Americas

✓	✓	Baton Rouge, LA:	Tel: + (1) 225 775 2660	Fax: + (1) 225 778 0212	Email: batonrouge@clydeunion.com
✓	✓	Battle Creek, MI:	Tel: + (1) 269 966 4600	Fax: + (1) 269 962 3534	Email: battlecreek@clydeunion.com
✓	✓	Bethlehem, PA:	Tel: + (1) 866 224 4787	Fax: + (1) 610 746 5907	Email: bethlehem@clydeunion.com
✓	✓	Burlington, ON:	Tel: + (1) 905 315 3800	Fax: + (1) 905 335 8262	Email: burlington@clydeunion.com
✓	✓	Calgary, AB:	Tel: + (1) 403 236 8725	Fax: + (1) 403 236 7224	Email: calgary@clydeunion.com
✓	✓	Downey, CA:	Tel: + (1) 562 622 2380	Fax: + (1) 562 622 2375	Email: downey@clydeunion.com
✓	✓	Houston, TX:	Tel: + (1) 281 372 5040	Fax: + (1) 281 372 5042	Email: houston@clydeunion.com
✓	✓	Salt Lake City, UT:	Tel: + (1) 801 292 7882	Fax: + (1) 801 292 7885	Email: saltlake@clydeunion.com

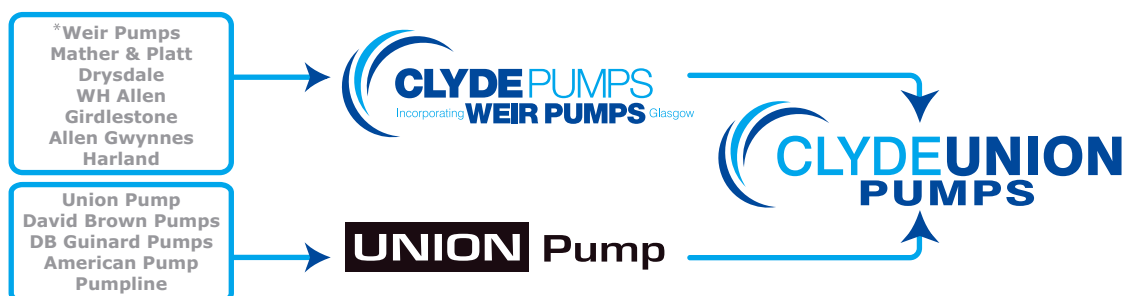
Asia

✓		Beijing:	Tel: + (86) 106 598 9500	Fax: + (86) 106 598 9505	Email: beijing@clydeunion.com
✓	✓	New Delhi:	Tel: + (91) 120 4640 400	Fax: + (91) 120 4640 401	Email: newdelhi@clydeunion.com
✓	✓	Shanghai:	Tel: + (86) 216 160 6969	Fax: + (86) 216 160 6968	Email: shanghai@clydeunion.com
✓		Singapore:	Tel: + (65) 62 76 7117	Fax: + (65) 62 78 7117	Email: singapore@clydeunion.com

Middle East / Africa

✓	✓	UAE:	Tel: + (97) 12 631 1959	Fax: + (97) 12 635 1242	Email: uae@clydeunion.com
✓		Algeria:	Tel: + (213) 21 69 2319	Fax: + (213) 21 69 3046	Email: algeria@clydeunion.com

CLYDEUNION Pumps - offers the following heritage products:



* This is a heritage product acquired when the Weir Pumps business transferred to Clyde Pumps in May 2007