

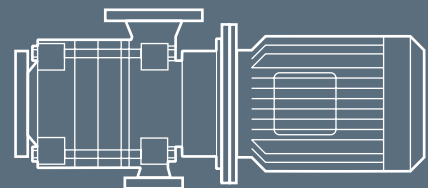


Application Guide

Made in Germany



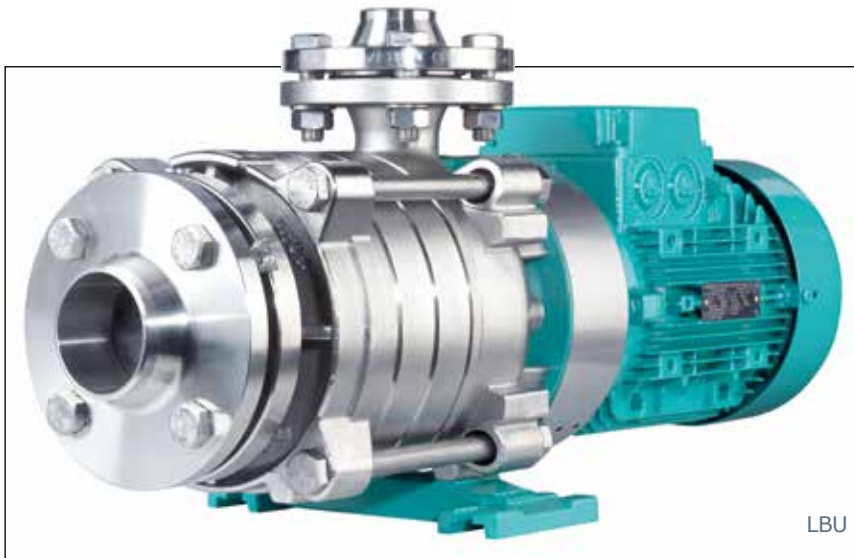
Multiphase Pumps



EDUR Multiphase Pumps

The integrated liquid-gas mixture transport and the generation of dispersions currently are the most important innovations in the centrifugal pump technology.

By EDUR developed to marketability and in the meantime already proven in thousands of systems, these efficient and smart solutions are currently revolutionizing new applications that seemed inconceivable just a few years ago.



Multistage multiphase pump in segmental type design

EDUR multiphase pumps differ considerably in design and operating mode compared to conventional centrifugal pumps. The EDUR multiphase pumps hydraulic is especially designed for suction side throttle operation without the cavitation effect that would result at standard type centrifugal pumps. Gas contents up to 30 percent are being automatically primed and handled in a reliable way. At the same time a good mixing effect as well as an excellent gas saturation does occur.

Rising gas contents tend to decrease of flow rate, pump pressure and power input. This has been considered by EDUR during construction accordingly. Further positive characteristics of the EDUR multiphase pumps include low wear even in case of slight impurities and stable operating conditions across the entire characteristic curves. The outstanding efficiency of the EDUR multiphase pumps and the reduced installation complexity does amortize the replacement of conventional low-efficiency multiphase equipment within a short time. In some cases municipal wastewater treatment plants utilizing the EDUR multiphase pumps have reported annual energy savings up to € 200.000.



EDUR multiphase pumps successfully in operation at the municipal WWTP Kiel.

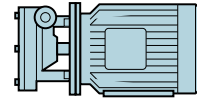


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Pump Features

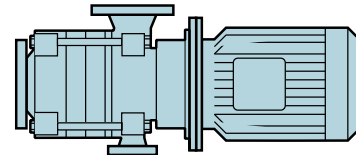
PBU

Single-stage regenerative turbine pump
unit-construction type, horizontal
0,5 to 12 m³/h, working pressure up to 16 bar
Gas contents: up to 15%
Materials: Stainless Steel



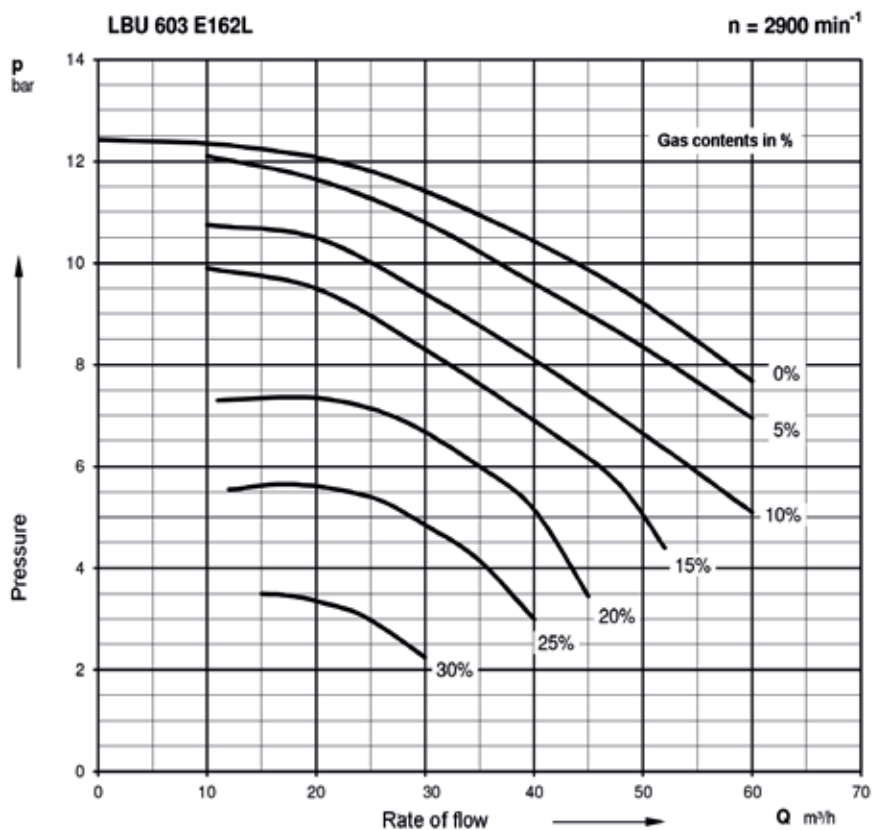
LBU

Multistage centrifugal pump
unit-construction type, horizontal
5 to 60 m³/h, working pressure up to 40 bar
Gas contents: up to 30%
Materials: Grey Cast Iron, Nodular Cast Iron,
All-Bronze, Stainless Steel, Super-Duplex

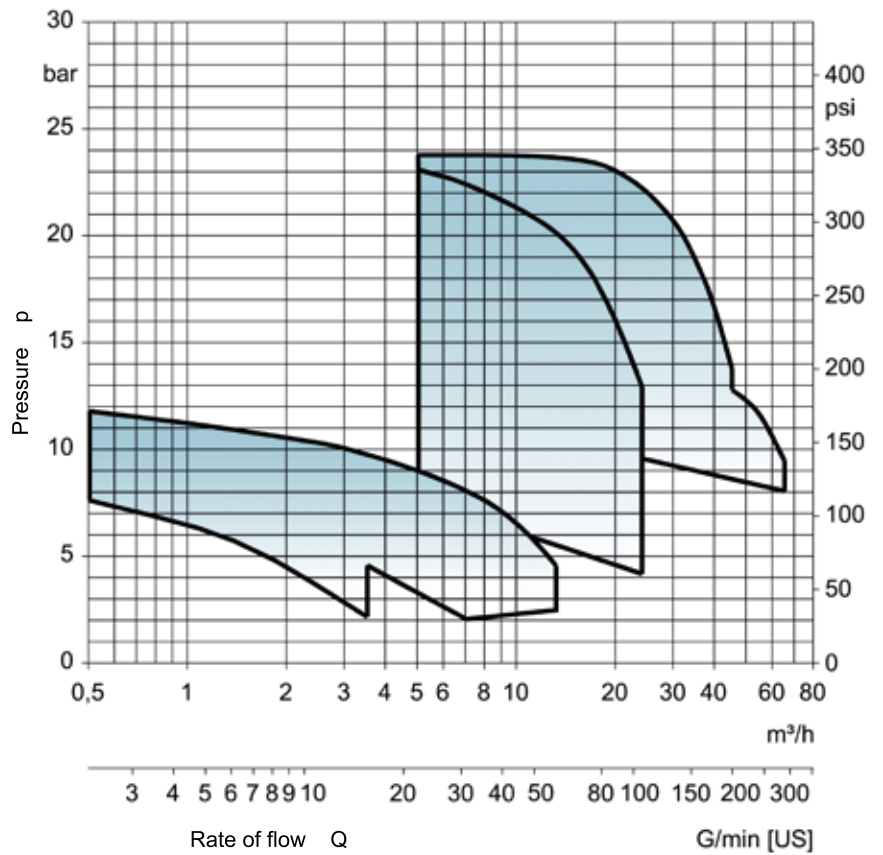


Characteristic Curves in Principle

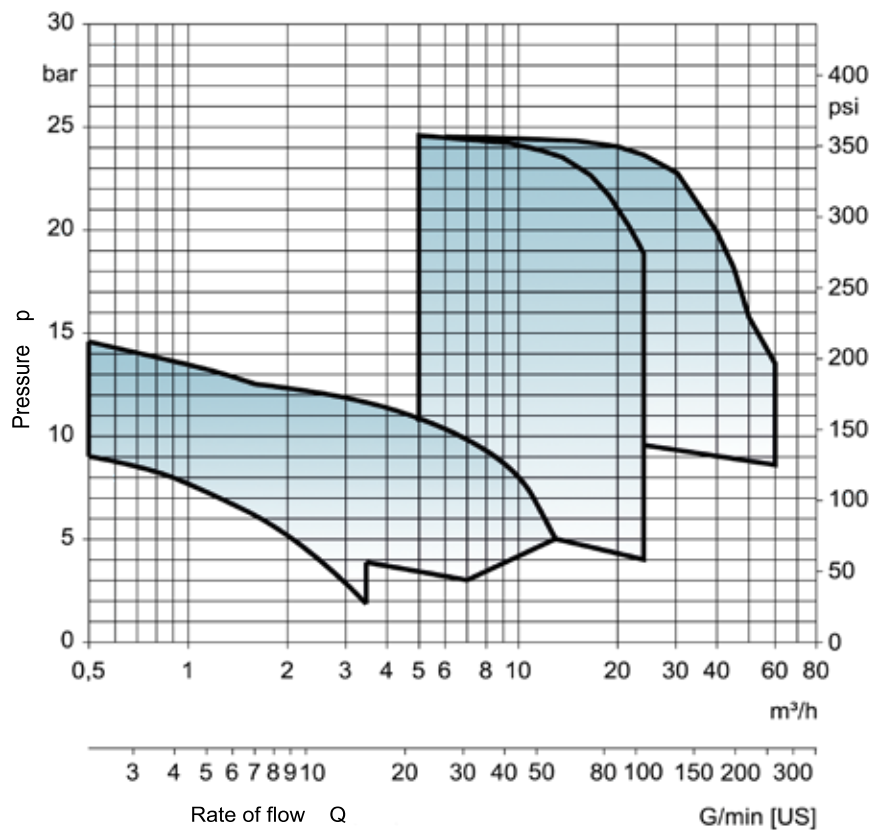
For pump layout it has to be considered that gas contents do influence the curves: lower pump heads and lower energy consumption compared to liquids only.



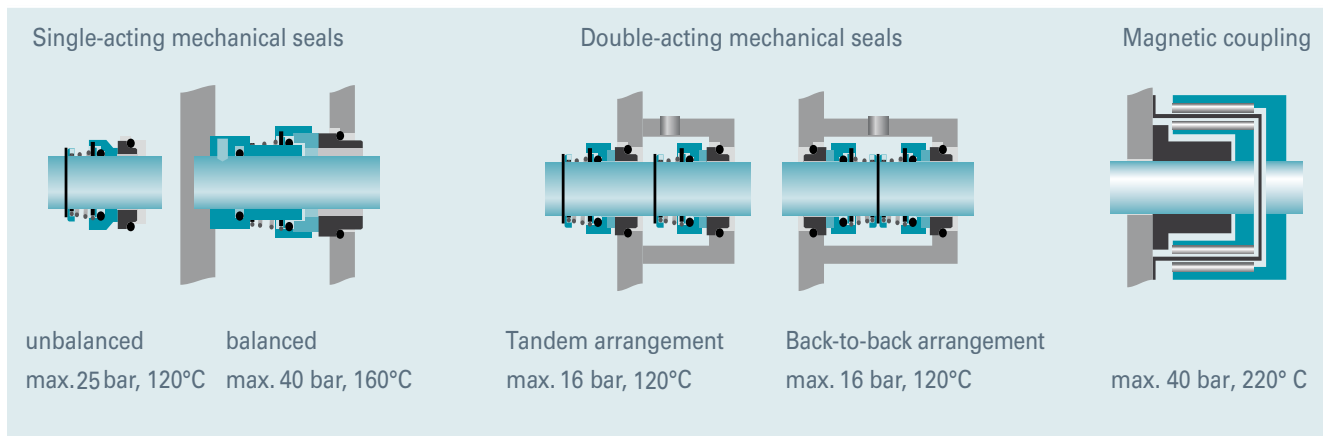
Characteristic Curves 50 Hz



Characteristic Curves 60 Hz

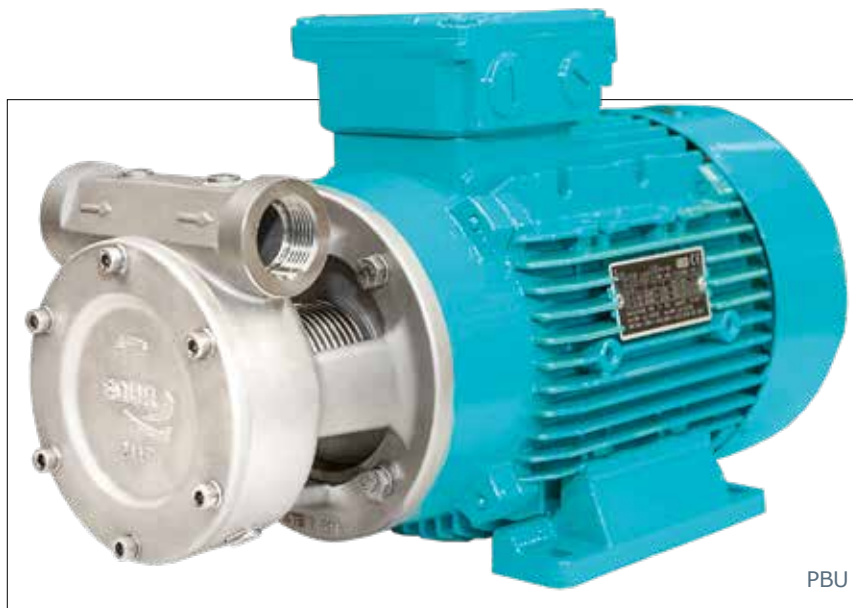


Shaft Sealing Systems - Materials



Prevent Failures

About 95 percent of all pump failures are caused by an incorrect or faulty shaft seal. In order to avoid premature failures and to increase the service life, a careful and state-of-the-art seal system selection is required. Nowadays the use of mechanical seals is technical standard.



Materials	Standard	Nodular Iron	All-Bronze	Stainless Steel	Super-Duplex
Casings	0.6025	0.7043	2.1050.01	1.4581	1.4517.01
Impellers	1.4517	0.7040	2.1052.01	1.4517	1.4517
Shaft	1.4057	1.4057	1.4057	1.4462	1.4501

Dissolved air flotation is a typical process for the treatment of wastewater.



Dissolved Air Flotation

Dissolved air flotation (DAF) is a proven process for the water and wastewater treatment as well as for the recovering of reusable materials. DAF provides an outstanding separation, by the floating of undissolved substances, of particles finely dispersed in suspensions. For doing so, water is saturated with air under high pressure and before entering the flotation tank released to atmospheric pressure again.

The microbubbles resulting from this instantaneous pressure release, get attached to the suspended solids and float these upwards to the surface where they are skimmed off. Typical fields of application include the treatment of oil-water emulsions, fat separation, phosphate and heavy metal precipitation as well as the final sedimentation in biological clarification plants. Multistage flotation systems are known as solution for special treatment processes.

**Green Ship Technology:
EDUR multiphase pumps are
successfully used in wastewater
treatment systems aboard of
cruise ships.**





Municipal WWTP

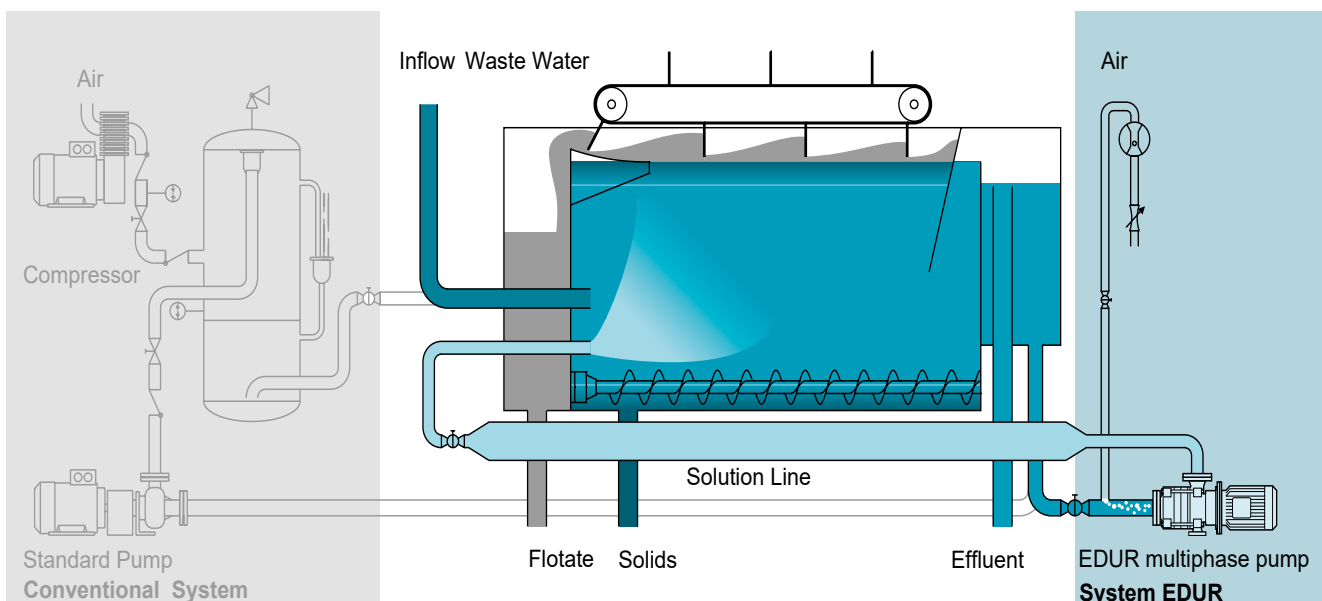
- 20 M m³/year wastewater
- ~ 400.000 inhabitants (PT)

Flotation System with EDUR Multiphase Pumps

When operating the EDUR multiphase pumps in a flotation system following the VDMA Specification 24430 (see below illustration, right block), the gas is fed directly into the suction line. This does allow a reduction of system components compared to conventional DAF system designs (left block): compressor, pressure tanks, complex control systems and various valves can be removed.

During pressure generation, the EDUR multiphase pumps at the same time achieve a thorough homogeneous mixing of liquid and gas contents. By installation of downstream retention lines the saturation effect will be additionally improved.

In systems with EDUR multiphase pumps solubility grades up to 100% can be realized. In order to capture a maximum amount of suspended materials, micro bubbles with an equal distribution have to be generated. Depending on the water quality and the saturation pressure, perfect dispersions with bubble sizes between 30 and 50 microns can be obtained by using the EDUR multiphase pumps.





Further Applications Fuel Production

During the processing of regenerative energy carriers, such as biofuel, wood, waste fractions with high heat value or animal meal, inert CO₂ has to be washed out from the synthetic gas.

For this purpose, the gas is pressed by a compressor into an absorption tank, where it flows upward through a packed bed. This packed bed is sprayed from above with water being supplied by an EDUR multiphase pump. The water accumulates with the CO₂ from the synthesis gas and then extensively is degassed in a desorption container. Since this water still is saturated for 100%, gas bubbles are generated when being sucked in again, but they are getting re-dissolved by the EDUR multiphase pump - the circular flow starts again.

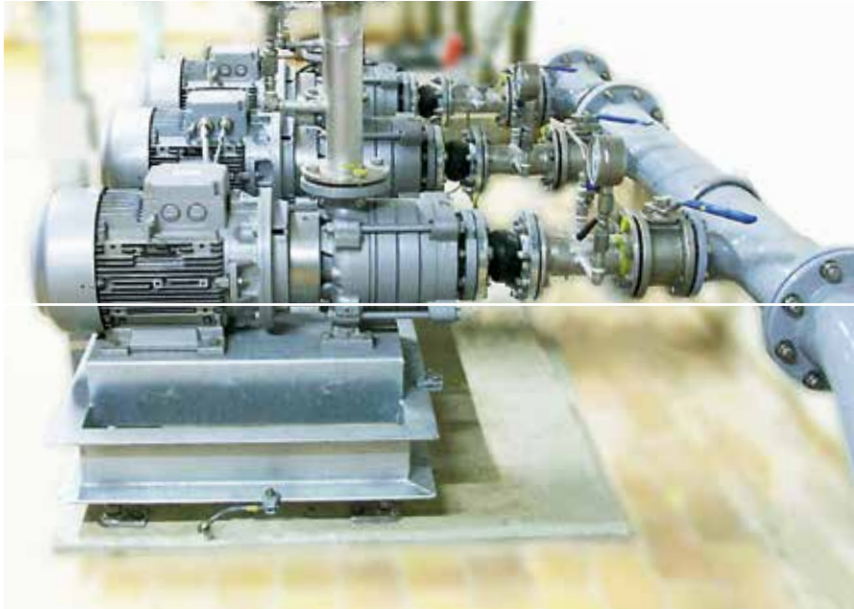
Induced Gas Flotation Petroleum Industry

The induced gas flotation is a proven method also for the separation of oil-water mixtures in the petroleum industry. In crude oil production, e.g. natural gas is fed into special flotation systems. EDUR multiphase pumps also here substitute extensive conventional plants worldwide: on the one hand they operate as gas saturation device instead of traditional systems with jet nozzles, pressure tanks and compressors. On the other hand the EDUR multiphase pumps function as dynamic mixers. Due to their open impellers in combination with the guide blades design, high shearing forces do result that are generating a much better dispersion of the gases, compared to the static mixers that have been in operation with standard types pumps.

Induced Gas Flotation

- impellers as dynamic mixers
- excellent gas dispersion
- replace complex systems





Wastewater Treatment

- **robust system construction**
- **easy handling**
- **very good drainage values**
- **low energy consumption**
- **numerous references**

Treatment of Cooling Lubricants

For the treatment of nonpolluting cleaned cooling lubricants for example out of the milling process for steel profiles the water-oil-mixture does flow through a collecting basin with a sludge trap towards an abstraction tank and from there it is transported into a sedimentation tank. EDUR multiphase pumps recycle the medium being primed with corresponding chemicals in the flotation system.

Mineral Processing

Most copper mining depends on crude ore that is cracked, grinded in rock crushers and subsequently supplied towards the flotation. Fine air bubbles transport the small mineral particles to the water surface and keep them in the flotite.

By means of the water-air mixture and adding of flotation additives at the same time the copper ore is separated from other ores. The ore concentrate subsequently is smelt in the following process.

Detergents Treatment

After the machining of mechanical parts as motor casings and gear boxes the parts are cleaned and oil residues accumulate. The cleansing agents transported in a closed circuit carry the oil residues and are cleaned subsequently in a flotation process.

Ammonia Stripping Plant

Downstream the fertilizer production process a stripping system is installed and serves for reducing the ammonia nitrogen content and also the chemical oxygen demand (COD) in the process waste water to the standard values.

Initially the waste water is fed into the tank near ground level. From there it is conducted into the EDUR multiphase pump where air is aspired along with the water and brought into solution under pressure. After pressure release the generated water-air mixture is delivered back into the tank through nozzles from above. Due to this sprinkling the ammonia releases gaseous from the wastewater. It can be conveyed by a gas pipe to the fertilizer production process again.

LPG Handling

- control of outgasing media
- low NPSH values
- higher efficiencies
- more compact configuration
- lower operating costs



Control of Gas Emissions during LPG Handling

LPG pumps are required for unloading, fueling, intertank transfer and for filling operations. There are high demands on pressure differences, conveying mixtures, low NPSH values, low-pulsation transport, low noise emission and ATEX-conformity.

Additionally a compact sturdy construction and optimized weight for the service at LPG trucks. The client does also expect a reliable transport of the liquid-gas-mixtures, the control of outgasing media as well as vapor pressure fluctuations and more often high pump efficiencies.

Lime Traps

In the paper industry limy deposits out of the circulation water in pipes, cooling systems, heat exchangers etc. are being eliminated by the utilization of lime traps. This considerably reduces the fresh water consumption and secures a sustainable improvement of the process reliability. Also the costs for maintenance and service of the systems are reduced significantly. By means of the EDUR multiphase conception it has been managed to reduce the energy costs of traditional systems by more than 65%. Moreover cost- and maintenance intensive components like pressure tanks and pressure reactors do not occur.

Cooling Water Treatment by Ozone

The innovative conception of the EDUR multiphase pumps did lead to participation at seventh frame programme of the EC for research and technological development. Marine bio-fouling is a major problem for materials in constant contact with seawater. Accumulation of marine organisms has impact on the proper functioning of engines and further appliances on board that need constant and proper cooling, and on the safety of the vessels.

The project comprises the development of a system for avoiding bio-fouling, by means of ozone improving the quality of the seawater for cooling the ship's engines and by this avoiding considerable maintenance costs and at the same time assuring a reliable operation of the seagoing vessels.

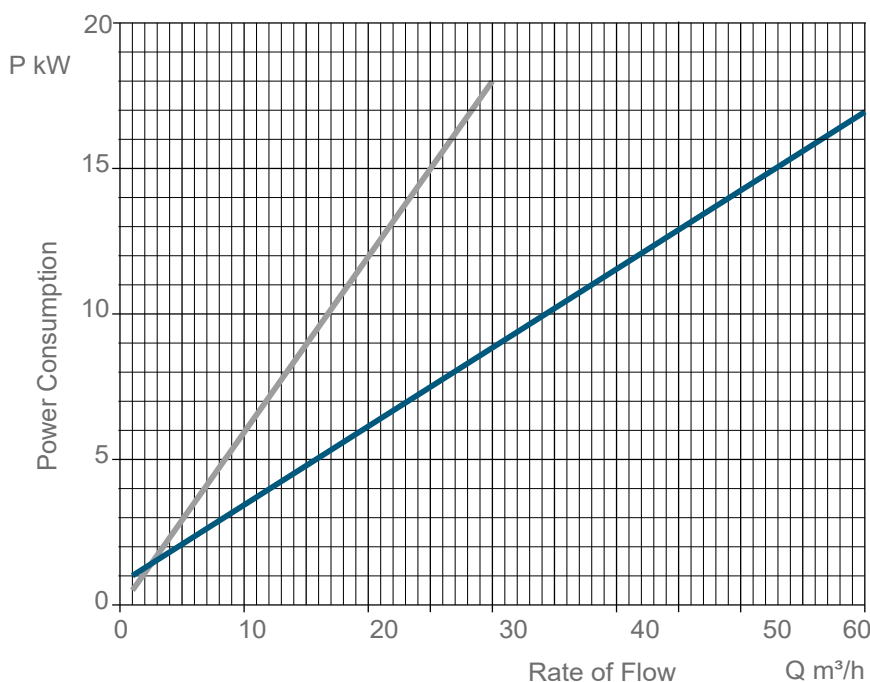


- Abattoir Wastewater**
- low investment costs
 - energy savings up to 50%
 - ideal for retrofitting
 - small footprint
 - excellent effluent values

Significant Savings by Retrofitting

Besides improved effluent values and a reduced use of chemicals many users do report about significant energy savings after a successful retrofitting of existing conventional systems. Thus in an abattoir the energy costs for a flotation system with two side channel pumps installed have been significantly reduced by one EDUR multiphase pump with less than 50 percent installed motor power.

Compared to side channel pumps the EDUR multiphase pumps do convince by stable conveying characteristics, low-wear operation and high energy efficiency. Original equipment manufacturers do report about savings both in investment costs and in operational costs, which depending on system design are up to 50 percent compared to conventional systems.

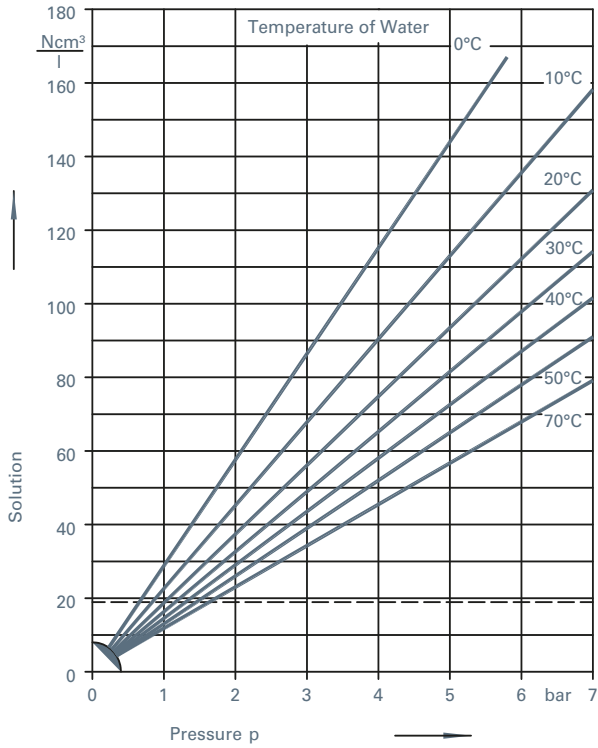


Power Consumption Comparison at 7 bar

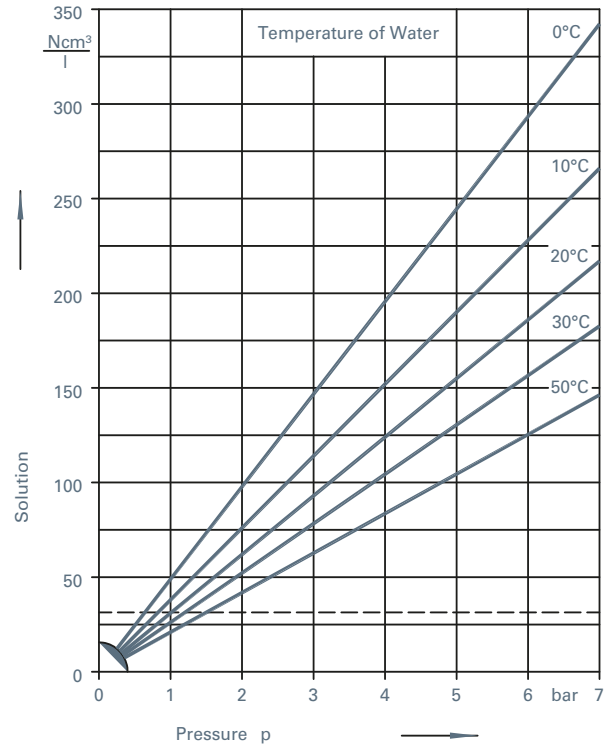
- EDUR multiphase pumps
- Side channel pumps

Solution of Different Gases in Water

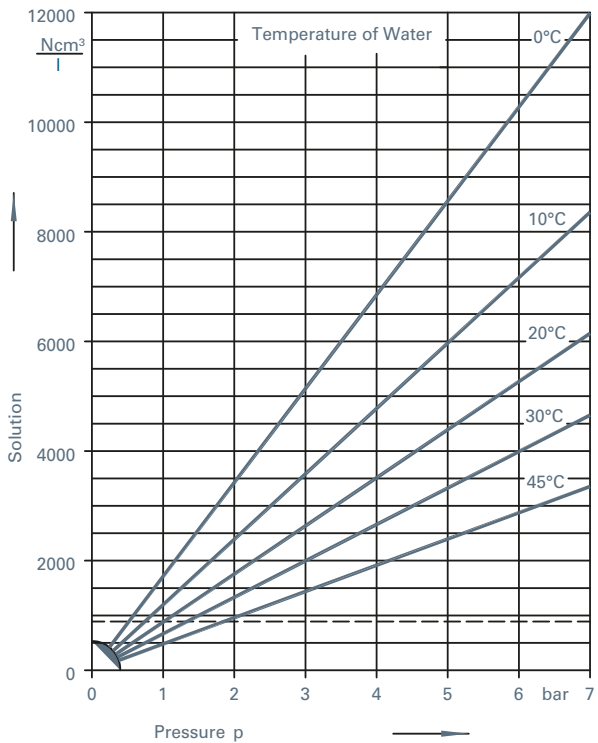
Solution of Air in Water



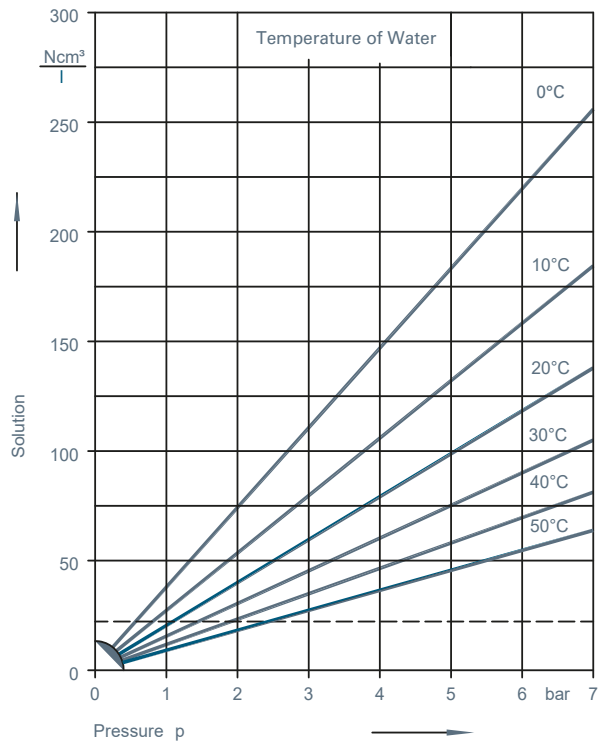
Solution of Oxygene in Water



Solution of Carbon Dioxide in Water



Solution of Ozone in Water



Solubility ozone per 200g ozone/ Nm³ O₃ conc. inlet gas
 - - remaining gas volume after dissolving to 1013 mbar at 20°C

Located at Sailing City Kiel
EDUR does manufacture a
wide pump range for the
global plant engineering
and construction industry.



EDUR Manufacturing Program	Performance Data	Models
Industry-Bloc	max. 600 m ³ /h, 90 m, 16 bar	NUB NUBS
Inline-Bloc	max. 220 m ³ /h, 55 m, 16 bar	LUB LUBS
Stainless-Bloc	max. 240 m ³ /h, 95 m, 10 bar	CB BC
Stainless-Vertical	max. 84 m ³ /h, 300 m, 30 bar	CV
Torque-Flow-Bloc	max. 400 m ³ /h, 55 m, 10 bar	FUB CBF
Multistage	max. 350 m ³ /h, 400 m, 40 bar	LBU VBU NH Z
Selfpriming	max. 300 m ³ /h, 160 m, 16 bar	SU SUB
Multiphase	max. 60 m ³ /h, 250 m, 40 bar	PBU LBU
Liquefied Gas	max. 340 m ³ /h, 400 m, 40 bar	NHE LBE
Immersed	max. 350 m ³ /h, 50 m, 10 bar	CTOL

Each Pump is carefully selected for its Application

Since 1927 the most modern pumps are produced in the highly specialized EDUR-Pumpenfabrik. With high demand on quality and latest technology, EDUR centrifugal pumps are setting standards.

Apart from process-attendant quality assurance proceedings every EDUR pump is subjected to a computer controlled final inspection. During this pressure, tightness, true characteristic curves and power input are tested and documented. Made by EDUR - 100% tested according to EN 9906.



The success in the world market is the result of excellent engineering, innovative production technology and a forward-looking company philosophy, where owner, management and employees feel obliged to. As a partner we are available to our customers, to realize the promise to work for them at the highest quality level, with the best production tools and latest information.

This is EDUR.



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