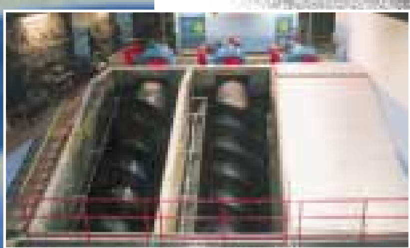
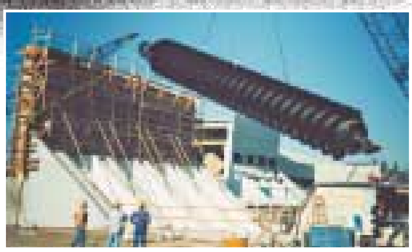
SCREW PUMPS





Spaans Babcock

General information

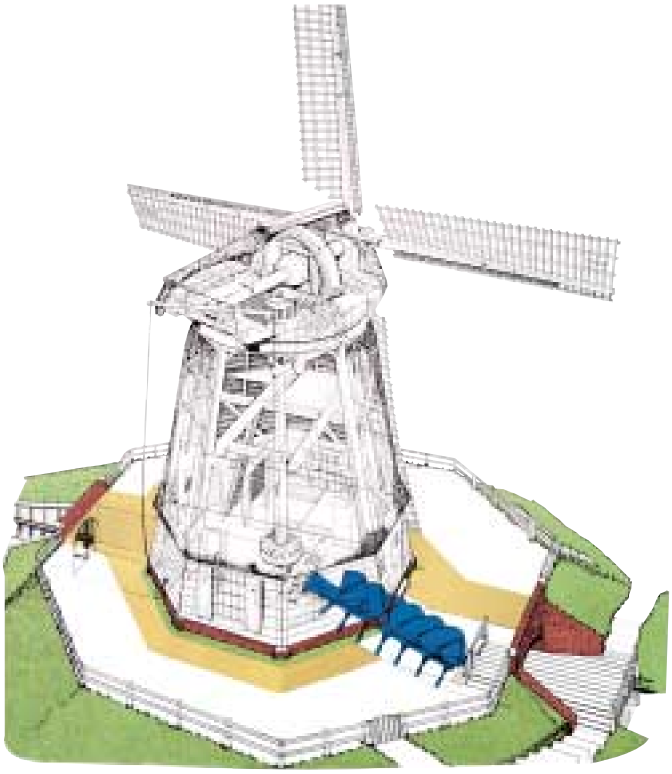
Several centuries BC, Archimedes the Greek philosopher, developed a turning spirally wound tube to raise water to a higher level for irrigation purposes.
In more recent times, this method of raising water was adapted by the Dutch to drain the polders using windmills as the drive unit.

Founded in 1895, Spaans Babcock bv adapted Archimedes original wound tube concept and produced their first screw pump in its present form. Although today electric motor drives have taken over from windmills the basic external screw design developed by Spaans over a century ago has stood the test of time and is today the industry accepted standard worldwide.

Applications

Over the last 100 years the demand for screw pumps has increased. Originally designed as a straight forward pump to maintain water levels in the Dutch polders today the screw pump is recognised as an ideal device in the water management industry having a wide variety of applications providing solutions for:

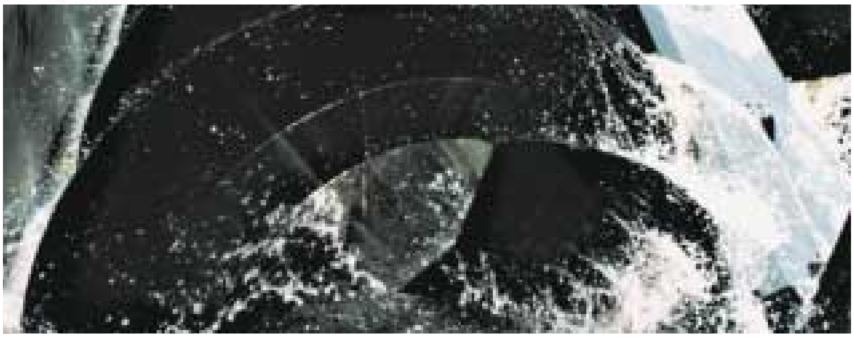
- irrigation
- drainage
- rainwater
- inlet and final effluent pumping in sewage treatment plants
- inter-stage pumping in sewage treatment plants
- return and surplus sludge pumping in sewage treatment plants..
- industrial process water
- horizontal flushing pump



Features

The screw pump is in most cases selected due to its outstanding features. The most important are:

Suitability for foul and contaminated water
Contamination comes in many forms and frequently includes glass, small metal objects ie food cans, builders stone, sand, textiles, slaughter waste etc all of which will be pumped without a problem and have no negative effect on the efficiency of the installation. This feature facilitates the use of a screen and/or sand trap after the screw pump at/or above ground level rather than before the screw pump below ground level, resulting in lower investment in civil works.

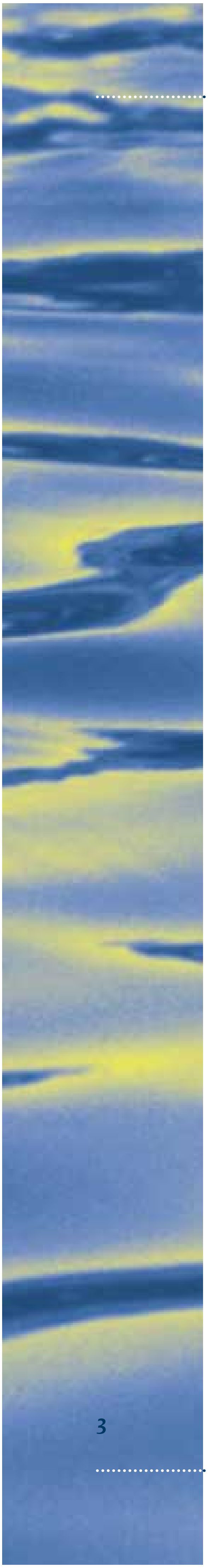


Simplicity and reliability
A screw pump is unable to cause cavitation and does not develop wear of that.

Little wear and tear and a extended lifetime
Screw pumps are operated on a low speed and cause therefore little wear and tear and almost no efficiency loss. Depending of the type of water a life time of 40 years is possible.

Minimal maintenance requirement
As of the robust design screw pump installations require a minimum of maintenance.

Wide capacity range
Screw pumps are employed to a unlimited range until approx. 11 m^3/s (40.000 m^3/h).



Type

Concrete Trough

The concrete trough is the classic design. The civil engineering contractor first builds a trough roughly 70 mm larger than the outer diameter of the screw pump body. After completion of installation of the screw and grouting of the bearings and drive baseplates the required trough diameter is obtained by rotating the screw with a temporary screed bar fitted slowly and applying a concrete screed until the correct trough profile has been achieved.

Concrete Trough

Steel Trough Liner

Steel Trough Liner

In certain circumstances the construction of a screeded concrete trough is not always practical and prefabricated steel trough liner can be provided. Anchors are attached to the back side of the trough and after positioning and fixing of the trough mass concrete is applied to form the final construction. Both the concrete trough and steel trough liner options require the provision of a separate drive mounting the following overcomes this requirement.

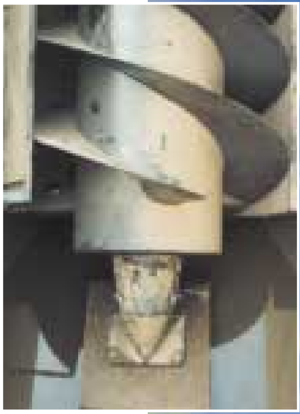
Compact Screw Pump

This design contains not only a screw and trough but fabricated water inlet and a discharge section which together form a prefabricated pumping station requiring the minimum of civil construction and providing scope for significant overall cost savings.

Compact Screw Pump

Bearings

Spaans Babcock took a conscious decision to oversize bearing design in order to achieve a long life. The Spaans Babcock lower bearing is designed to accommodate radial loads only, all axial loads are accommodated in the upper bearing design. The lower bearing housing flange is connected to the screw body using high tensile steel bolts and incorporates a bronze bush rotating around a fixed steel shaft which is in turn flange mounted using high tensile steel bolts to the bearing support bracket. Seals are fitted to prevent the ingress of contaminant to the bearing. The lower bearing is normally lubricated by a motorised or belt driven grease lubricator located adjacent to the main screw pump drive. The upper bearing is designed as a self aligning roller bearing, to accommodate axial and radial forces.



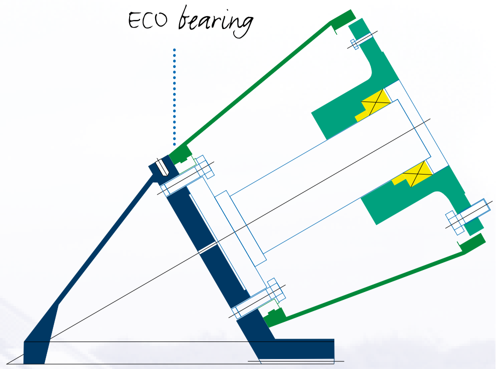
Test-equipment for upper bearing

Drive units

Screw pump drives are assembled on steel baseplates which on the compact screw pump are incorporated into the main screw pump fabrication enabling many units to be delivered completely factory assembled and minimising installation times. The standard drive arrangement consists of an electric motor connected by vee-belts to the input shaft of a right or left angle bevel helical reduction gearbox which is connected in turn to the screw pump upper bearing shaft through a flexible coupling. A reverse rotation brake is fitted to the motor shaft to prevent the weight of water in the flights rotating the screw backwards when the drive stops. An external brake is recommended for ease of access. All rotating parts are protected by close fitting guards.

With smaller drive units the electric motor is frequently mounted above the gearbox (piggy back) which also minimises the drive width. Spaans Babcock recommend vee-belt drives as they offer a simple solution when minor variations in speed are required to adjust the output of the screw pump. Frequency converting technology facilitates speed variation at the push of a button. A recently introduced option currently available on drives up to 22 kW rating incorporates the use of a frequency converter built in the electric motor housing. This facilitate a very compact construction and improves efficiency.

Special Features



ECO bearing

In a world becoming ever more conscious of the need to protect the environment in which we live we consider this bearing has an important part to play. The sealed for life roller bearing is environmentally friendly being completely enclosed preventing the leakage of lubricant into the pumped liquid. The ECO bearing is fully interchangeable with conventional bearings. The design of the **ECO bearing** is protected by patent.

Horizontal Flushing Installation

Horizontal Flushing Installation

This application is used when water systems i.e. canals in urban areas are polluted, contaminated with algae, suffer from oxygen deficiency, etc. To combat the objectionable smells associated with large bodies of standing water which would otherwise become stagnant if not circulated. The horizontal screw pump is an ideal solution for low head circulation pump applications.

Multiple Stages

When high heads are required screw pumps arranged in series could be the solution. The maximum lift can be approximately 22m.

Two stage pumping stat

Surface Treatment

Spaans Babcock offer the following coating systems:

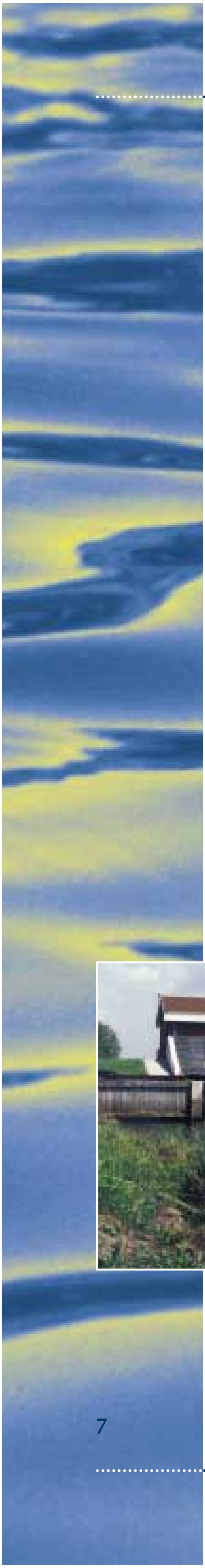
Item	Application	System	Dry Film Thickness in μ
Standard	Activated Sludge	Blast Clean SA 2,5 Epoxy coating	 2 x 150 μ
Auto cure	Waste Water	Blast Clean SA 2,5 Zinc primer Epoxy coating	 1 x 40 μ 2 x 150 μ
Heavy Duty I	Sand & Particles	Blast Clean SA 2,5 Zinc primer Sealer Epoxy coating	 1 x 40 μ 1 x 40 μ 2 x 150 μ
Cover coating	Contained H_2S occurrence	Blast Clean SA 2,5 Epoxy special coating	 2 x 175 μ

Materials

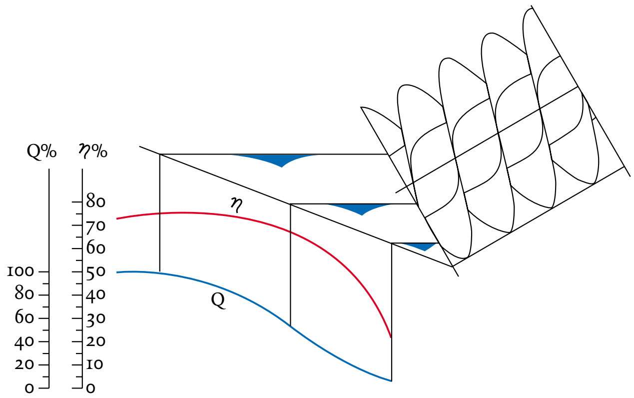
Screw pump bodies are usually fabricated from longitudinally or spirally wound steel tubes with flights formed from rolled steel plate. If Stainless Steel is required the steel tube is cladded with SS plating.

Special designs have been developed in the past to cater for handling the following:

- high sand content water
- heavily contaminated water
- sea water
- high and low pH values



High efficiency rate



The average efficiency rate (η) of a screw pump installation working at filling point and up is 75 %. The graph illustrates a flat efficiency curve when the screw operates within the capacity range of between 40% and 100 % of the design capacity. This flat efficiency curve results in significant energy cost savings especially in combination with frequency converting facilitating a smooth operation.

Screw pumps vs centrifugal pumps

The most important difference between both the pump types is the way they operate.

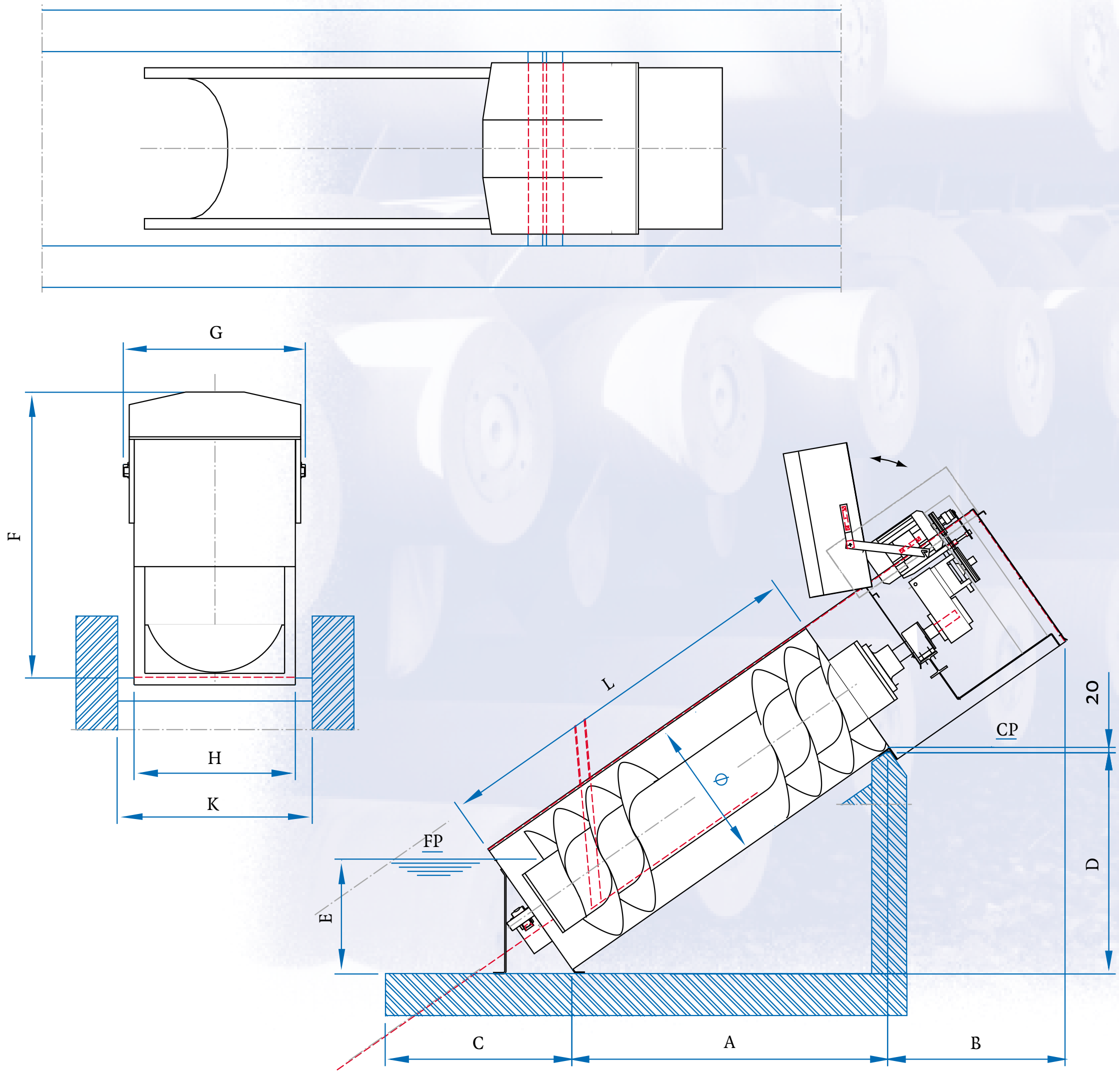
A screw pump is ideally suited to handling water carried contamination and maintains a relatively constant efficiency rate of 75% over most of the operating range without using a screen.

In order to effectively pump waste water a centrifugal pump impellor must be able to pass solids of not less than 100 mm in order to prevent clogging. Provision of open passage impellors dramatically increases system losses and reduces operating efficiency frequently to as low as 45%, resulting in higher running costs. To avoid clogging a screen has to be build before the pump against high building and maintenance costs.

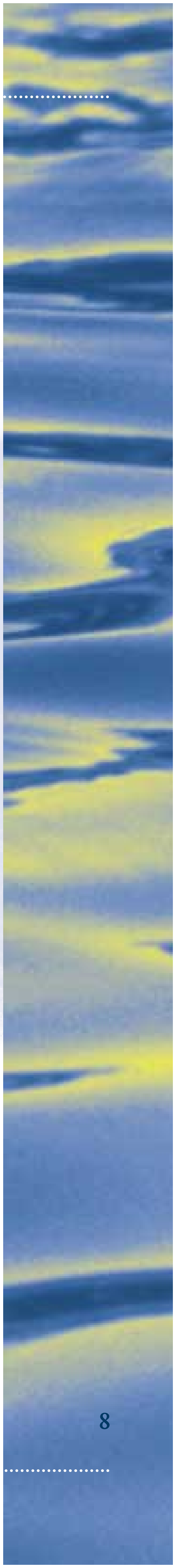
The difference in efficiency will result to a lower absorbed power of a screw pump. When more pumps need to be applied this difference leads to a lower number in case of a screw pump.

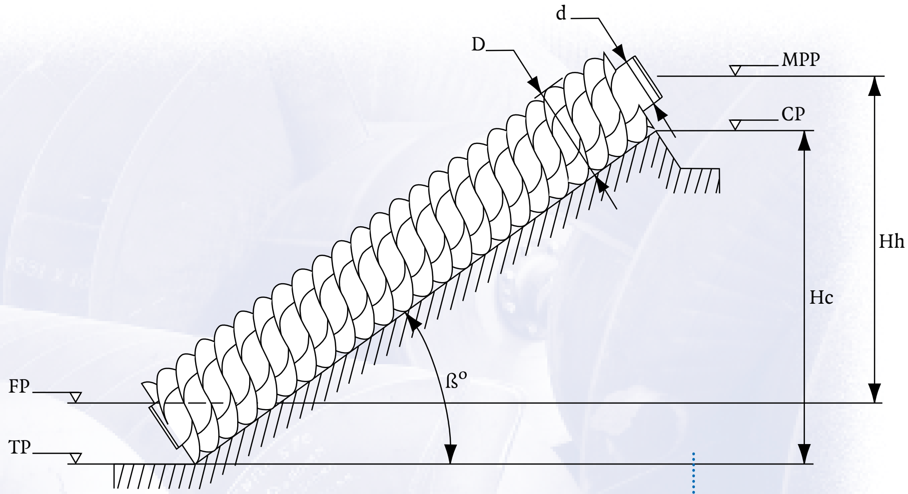
General arrangement drawing of a compact screw pump

This is an example of a design
with low cost civil construction.



ϕ	A	B	C	D	E	F	G	H	K	L
400	*	700	300	*	400	1000	660	510	680	*
500	*	700	360	*	450	1100	760	610	780	*
600	*	800	425	*	550	1250	860	710	880	*
700	*	800	490	*	650	1350	960	810	980	*
800	*	900	560	*	700	1500	1060	910	1080	*
900	*	1000	625	*	750	1650	1160	1010	1180	*
1000	*	1150	690	*	800	1850	1310	1162	1330	*
1100	*	1200	760	*	850	1950	1410	1262	1430	*
1200	*	1250	825	*	950	2100	1510	1362	1530	*





Basic design of a screw pump

List of abbreviations

FP	Filling point Screw pump capacity 100 %	Hh	Maximum head Difference between FP and MPP
TP	Touch Point Screw pump capacity 0 %	Hc	Building height Difference between TP and CP
CP	Chute point Invert of trough at outlet	D	Diameter of screw
		d	Diameter of centre tube
MPP	Maximum pumping point Highest pumping level possible and ηmax	ß	Angle Variable between 22° and 38° Depends on required capacity and head

Some dimensional aspects

1. Height difference between FP and TP is approx.0.75 x D cos ß
2. Height difference between MPP and CP is approx. 0.1 D - 0.3 D, this depends on the values of ß and D
3. To optimize the installation the trough width between the concrete walls must be D + 400 mm
4. The maximum angle is 38° due to economical reasons

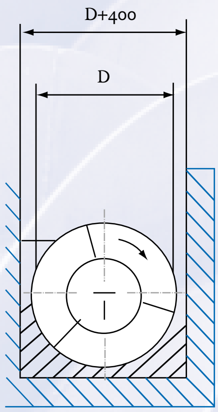


Table containing capacity and maximum (FP-CP) values at different heads

Diameter (mm)	30° Q (l/s)	30° FP-CP (m)	35° Q (l/s)	35° FP-CP (m)	38° Q (l/s)	38° FP-CP (m)
400	24	3.1	18	3.7	16	4.0
500	39	3.6	31	4.2	28	4.6
600	62	3.9	48	4.5	42	4.9
700	90	4.5	68	4.5	61	5.6
800	148	4.1	116	4.8	100	5.2
900	192	4.6	152	5.3	128	6.0
1000	250	4.6	195	5.3	166	5.7
1100	310	5.0	245	6.0	207	6.5
1200	380	5.5	300	6.5	250	7.0
1400	540	6.4	430	7.4	360	7.9
1600	745	6.3	586	7.25	500	7.7
1800	980	6.65	770	7.7	650	8.2
2000	1250	7.05	980	8.1	870	8.65
2200	1550	7.9	1200	9.15	1000	9.7
2400	1900	8.25	1500	9.45	1280	10
2600	2300	8	1800	9.2	1500	9.8
2800	2700	8.25	2100	9.6	1800	10.2
3000	3200	8.55	2500	9.9	2160	10.5
3200	3750	8.85	2950	10.3	2500	>10
3400	4300	9.1	3350	>10	2900	>10
3600	4900	9.4	3900	>10	3300	>10
3800	5600	9.7	4400	>10	3750	>10
4000	6350	9.7	5000	>10	4250	>10
4500	8300	>10	6500	>10	5600	>10
5000	10600	>10	8300	>10	7100	>10

The information in the table is intended to assist in initial layout design. More information is available in our sales manual. If budget prices are required please contact our sales department.

Spaans Babcock bv

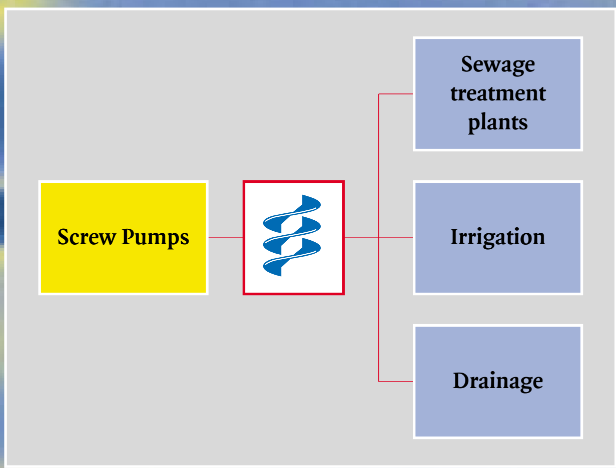
P.O. Box 79
8560 AB Balk
The Netherlands

Meerweg 26
8561 AV Balk
The Netherlands

Tel. +31 (0)514 60 82 82
Fax +31 (0)514 60 44 85

E-Mail
sales.balk@spaansbabcock.nl
Internet
www.spaansbabcock.com

KvK
Amsterdam 34004868



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