

Design recommendations

FOR PUMP STATIONS WITH VERTICALLY INSTALLED FLYGT AXIAL
AND MIXED FLOW PUMPS



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This document is intended to assist application engineers, designers, planners, and users of sewage and storm water systems incorporating Flygt axial and mixed flow pumps installed in a column.

A proper design of the pump sump is crucial in order to achieve an optimal inflow to the pumps. Important design requirements to be met are: uniform flow approach to the pumps, preventing pre-rotation under the pumps, preventing significant quantities of air from reaching the impeller, and transport of settled and floating solids. The Flygt standard pump station design can be used as is, or with appropriate variations upon review by Flygt engineers.

Pump and sump are integral to an overall system that includes a variety of structures and other elements such as ventilation systems and solids handling equipment. Operating costs can be reduced with the help of effective planning and suitable operation schedules. Our personnel and publications are available to offer guidance in these areas. Transient analysis of pump system behavior, such as air chamber dimensioning, valve selection, etc., should also be considered in wastewater pump station design. These matters are not addressed in this brochure, but we can offer guidance.

Please consult our engineers to achieve optimum pump performance, maximum pump life, and a guarantee that product warranties are met. The design recommendations are only valid for Flygt equipment. We assume no liability for non-Flygt equipment.

Systems Engineering

Our Systems Engineering team offers in-depth expertise in the design and execution of comprehensive solutions for water and wastewater transport and treatment.

Our know-how and experience are combined with a broad range of suitable products for delivering customized solutions that ensure trouble-free operations for customers. Our engineers utilize our own custom developed computer programs to provide evaluations for your specific project design.

Flygt not only can provide assistance with the selection of products and accessories but can provide analysis for complex systems and/or piping networks.

We also provide hydraulic guidance and assistance for flow-related or rheological issues. Assistance can include but is not limited to hydraulic transient calculations, pump starting calculations, and evaluation of flow variations.

Additional services

- Optimization of pump sump design for our products and specific sites
- Assistance with mixing and aeration specifications and design of appropriate systems
- System simulation utilizing computational fluid dynamics (CFD)
- Guidance for model testing - and organizing it
- Guidance for achieving the lowest costs in operations, service, and installation
- Specially developed engineering software to facilitate designing

The range of services is comprehensive, but our philosophy is very simple: There is no substitute for excellence.

Flygt PL and LL pump introduction

Flygt submersible vertically installed axial flow pumps (PL) and mixed flow pumps (LL) have been used in a wide variety of storm water stations and sewage treatment plants, land drainage and irrigation systems, fish farms and power plants, shipyards, amusement parks, and many other applications where large volumes of water have to be pumped.

Flygt submersible PL and LL pumps offer important advantages such as:

- Compact motor and pump unit
- No separate lubrication system
- No external cooling system
- Low operating sound level
- Quick connection and disconnection for installation and inspection
- Minimal station superstructure
- Simple pipe work

Flygt PL and LL pumps are usually installed in a vertical discharge tube on a support flange incorporated in the lower end of the tube. No anchoring is required because the weight of the pump is sufficient to keep it in place. The pumps are equipped with an anti-rotation gusset. This arrangement provides the simplest possible installation - the pump is just lowered into the discharge tube by hoist or crane. Retrieval of the pump is equally simple.



Flygt axial flow pumps (PL)

Flygt mixed flow pumps (LL)

General considerations for pumping station design

The proper design of the pump sump is crucial in order to achieve an optimal inflow to the pumps. Ideally, the flow at the pump inlet should be uniform and steady, without swirl, vortices, or entrained air.

- Non-uniform flow at the pump intake can reduce efficiency and cause pulsating loads on the propeller blades, resulting in noise, and vibrations.
- Unsteady flow can also cause fluctuating loads, noise, and vibrations.
- Swirl in the intake can change the head, flow, efficiency, and power in undesirable ways. It can also augment vortices.
- Vortices with a coherent core cause discontinuities in the flow and can lead to noise, vibration, and local cavitation. Vortices emanating from the free surface can become sufficiently powerful to draw air and floating debris into the pump.
- Entrained air can reduce the flow and efficiency, causing noise, vibration, fluctuations of load, and physical damage.

Experience with designs already in use provides valuable guidelines for the design of multiple pump stations. Adaptations of existing and well-proven designs can often provide solutions to complex problems even without model tests. We have extensive experience based on many successful projects, and the services of our qualified engineers are always available.

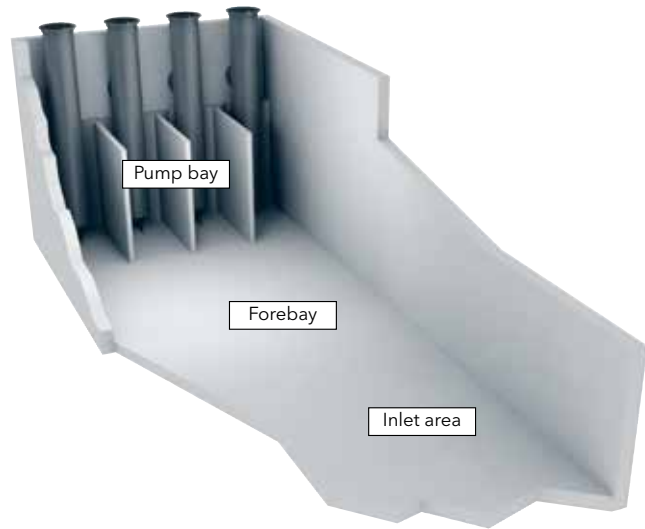
For special applications beyond the scope of this brochure, please contact our local system engineer for assistance.

Pumping station with multiple pumps

Multiple pump systems provide greater capacity, operational flexibility, and increased reliability, which is why pumping stations are usually equipped with two or more pumps.

Transition to the sump, whether diverging, converging or turning, should result in nearly uniform flow at the sump entrance. Obstacles that generate wakes should not be allowed to interfere with the approaching flow. High velocity gradients, flow separation from the walls, and entrainment of air should be avoided.

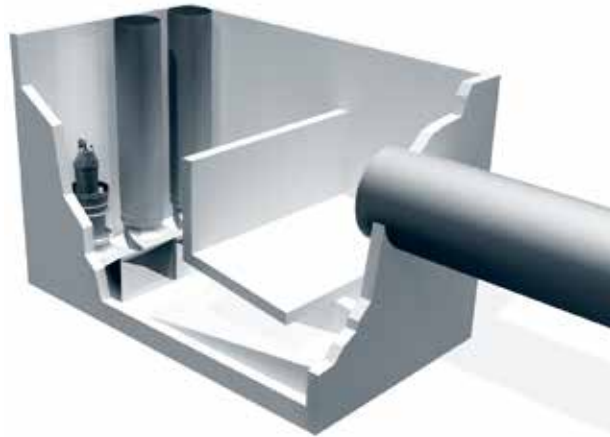
Hydraulically, three zones of the pumping station are significant: inlet, forebay, and pump bay.



- **Inlet:** An inlet conveys water to the pumping station from a supply source such as a culvert, canal, or river. Usually, the inlet has a control structure such as a weir or a gate.
- **Forebay:** The role of the forebay is to guide the flow to the pump bays in such a way that it is uniform and steady. Because the inflow to each module should be steady and uniform, the design of the forebay feeding the individual modules is critical and should follow guidelines in this brochure. Design of the forebay depends on water approach to the pumping station – commonly encountered as parallel with the sump centerline (the preferred layout) or perpendicular to the sump centerline.
- **Pump bay:** In practice, only the design of the pump bay can be standardized for a given pump type. A properly designed bay is a prerequisite for correct presentation of flow to the pumps, but it does not guarantee correct flow conditions. A bad approach to the pump bay can disturb the flow in the pump intake. As a rule of thumb, the approach velocity to the individual pump bays should not exceed 0.5 m/s (1.64 ft/s). The dimensions of the bay's individual modules are a function of pump size and the flow rate (see Appendix 4).

Front wide inlet to the station

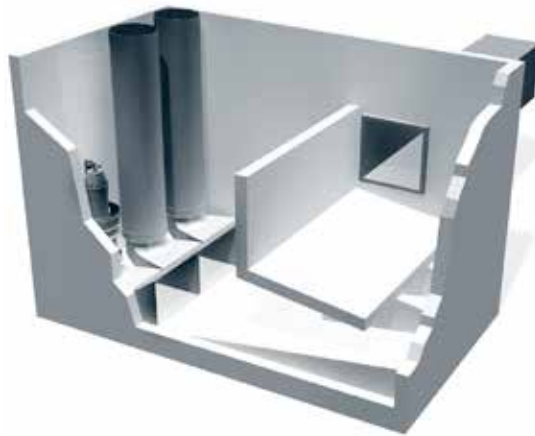
When water approaches the station from a wide supply source such as a culvert or canal, the pumps should be placed symmetrically to the inlet centerline without changing direction of the approaching flow. If the width of the inlet is less than the total width of the pump bays, the forebay should diverge symmetrically. The total angle of divergence should not exceed 20° for the open sump intake design or 40° for the formed intake design. The bottom slope in the forebay should not be larger than 10° (See Appendix 3). If these parameters cannot be met, flow direction devices should be used to improve the flow distribution. Such arrangements and more complex layouts should be investigated using model tests in order to arrive at suitable designs.



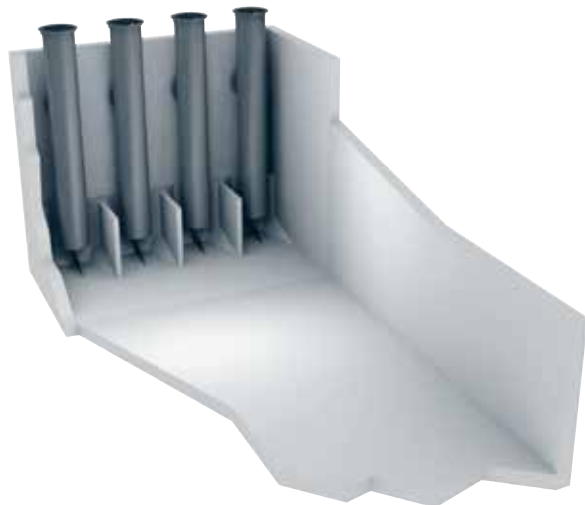
High level front inlet

High front inlet or side inlet to the station

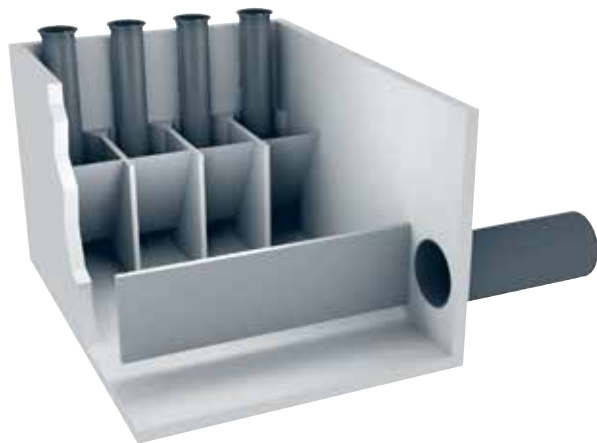
When the inlet to the station is located at higher level or perpendicular to the axis of the pump bays, an inlet chamber or overflow-underflow weir can help to redistribute the flow. A substantial head loss at the inlet area is required to dissipate much of the kinetic energy from the incoming flow. Alternatively, baffle systems can be used to redirect the flow, but model tests are then required to determine their correct shape, position, and orientation. The distance between the weir or baffles and the pump bays must be sufficient to allow eddies to dissipate and entrained air to escape before the water reaches the pump inlet (See Appendix 3).



High level side inlet



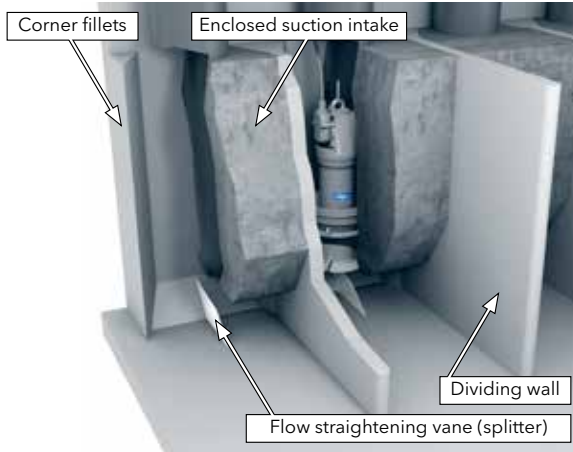
Culvert or canal inlet



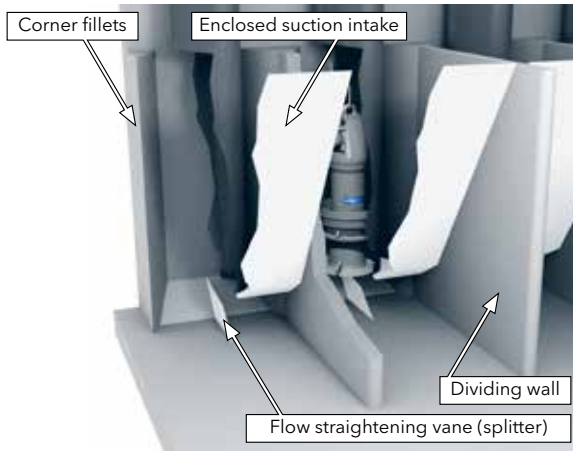
Low level side inlet

**Pump bay design alternative:
Enclosed intake design**

The enclosed intake design is the least sensitive to disturbances of the approaching flow that can result from diverging or turning flow in the forebay, or from single pump operation at partial load. Therefore, the enclosed intake design is nearly always the preferred choice and recommended for stations with multiple pumps with various operating conditions.



Enclosed intake design in concrete

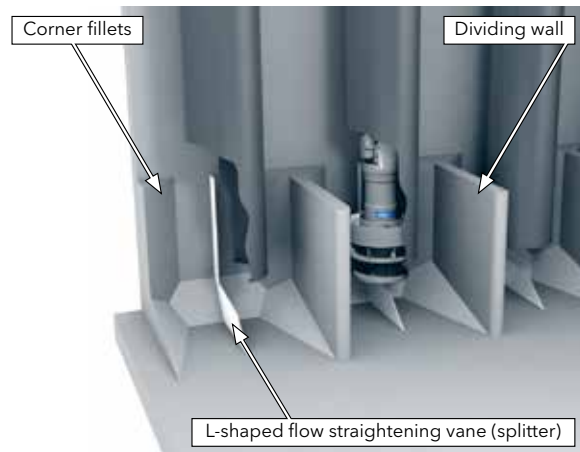


Enclosed intake design in steel

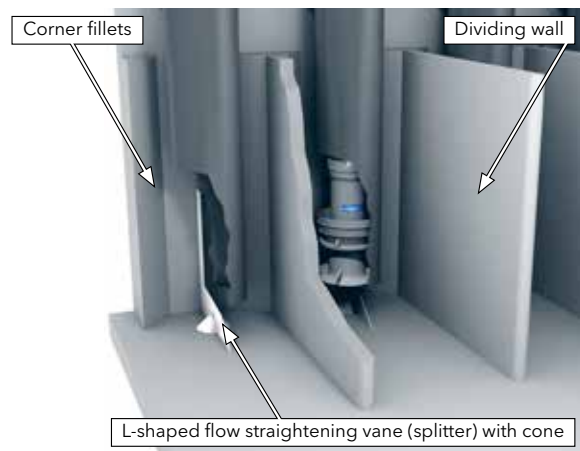
The enclosed intake design can be constructed in either concrete or steel. The intake reduces disturbances and swirl in the approaching flow. The inclined front wall prevents stagnation of the surface flow. Geometrical features of the intake provide smooth acceleration and turning as the flow enters the pump. The minimum inlet submergence should not be less than nominal diameter (D).

**Pump bay design alternative:
Open sump intake design**

The open sump intake design is the most sensitive to non-uniform approaches. If used for more than three pumps, the length of the dividing walls should be at least 2/3 of the total width of the sump. If flow contraction occurs near the sump entrance because of screens or gates, the sump length should be increased to 6D or more, depending on the degree of contraction.



Open sump intake design for Flygt LL pumps



Open sump intake design for Flygt PL pumps

The open sump intake design includes devices such as flow straightening vanes (splitters) that alleviate the effects of minor asymmetries in the approaching flow. The minimum required submergence of the pump inlet with open sump intake design is a function of the flow rate, the pump inlet diameter and the distribution of the flow at the approach to the pump. Minimum submergence diagrams are shown in the Appendix 2.

Each diagram has three curves for various conditions of the approaching flow. Because vortices develop more readily in a swirling flow, more submergence is required to avoid vortices if the inlet arrangement leads to disturbed flow in the sump. Hence, the upper curve in the submergence diagrams is for a perpendicular approach, the middle one is for a symmetrical approach, and the lowest curve is for duty-limited operation time (about 500 hours/year). The curve appropriate to the inlet situation should be used to determine the minimum water level in the sump to preserve reliable operation of the pumps.

Pump station model testing

Hydraulic models are often essential in the design of structures that are used to convey or control the flow distribution. They can provide effective solutions to complex hydraulic problems with unmatched reliability. Their costs are often recovered through improvements in design that are technically better and yet less costly. Model testing is recommended for pumping stations in which the geometry differs from recommended standards, particularly if no prior experience with the application exists. Good engineering practice calls for model tests for all major pumping stations if the flow rate per pump exceeds 2.5 m³/s (40,000 GPM) or if multiple pump combinations are used.

Tests are particularly important if:

- Sumps have water levels below the recommended minimum submergence
- Sumps have obstructions close to the pumps
- Sumps are significantly smaller or larger than recommended (+/- 10%)
- Multiple pump sumps require baffles to control the flow distribution
- Existing sumps are to be upgraded with significantly greater discharges.

A model of a pumping station usually encompasses a representative portion of the headrace, the inlet structure, the forebay, and the pump bays. The discharge portion of the flow is seldom included. Testing may encompass the following flow features and design characteristics:

- **Inlet structure:** flow distribution, vortex formation, air entrainment, intrusion of sediment and debris.
- **Forebay and pump bays:** flow distribution, mass swirl, surface and bottom vortices, sediment transport.
- **Operating conditions:** pump duty modes, start and stop levels, pump down procedures.

Model testing can also be employed to seek solutions to problems in existing installations. If the cause of a problem is unknown, it can be less expensive to diagnose and remedy with model studies rather than by trial and error at full scale. The pump manufacturer's involvement is often required in the evaluation of the results of model tests. Experience is required to determine whether the achieved results are satisfactory and will lead to proper overall operation.

We can offer guidance regarding the need for model tests and assist in their planning, arrangement and evaluation.

Computational modeling

Computational fluid dynamics (CFD) analysis has the potential of providing far more detailed information of the flow field at a fraction of cost per time needed for the model tests. It has been more and more accepted as a tool in station design in combination with computer-aided design (CAD) tools. It is possible to obtain a more efficient method for numerical simulation of station design utilizing CFD. It offers increased qualitative and quantitative understanding of pumping station hydraulics and can provide good comparisons between various design alternatives. However, the possibilities of CFD should not be overestimated. Difficult cases are encountered where free surface effects are important. Also, a phenomenon like air entrainment is difficult to capture with CFD analysis.

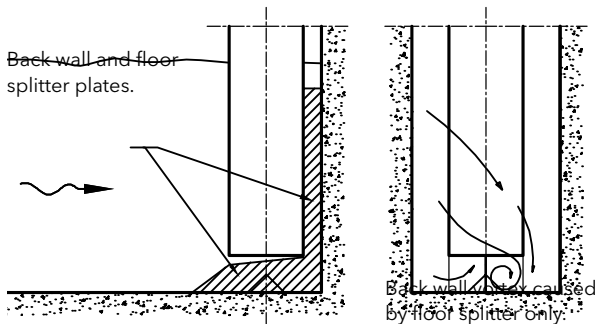
Both model tests and CFD have advantages and disadvantages that need to be evaluated in each individual case. We can advise on a good combination between model tests and CFD.



Corrective measures

The designs described in this brochure have been proven to work well in practice. However, in some applications – perhaps due to limitations of space, installation of new pumps in old stations, or difficult approach conditions – not all the requirements for a good, simple design can be met. Sometimes, for example, it may be impossible to provide adequate submergence so that some vortexing or swirl may occur. Corrective measures must then be undertaken to eliminate the undesirable features of the flow, particularly those associated with excessive swirl around the pump tube, with air-entraining surface vortices and with submerged vortices.

Swirl around the pump tube is usually caused by an asymmetrical velocity distribution in the approach flow. Ways should be sought to improve its symmetry. Subdivision of the inlet flow with dividing walls, and the introduction of training walls, baffles, or varied flow resistance are some options that may achieve this result. Alternatively, a reduction of the flow velocity, for example, by increasing the water depth in the sump, can help to minimize the negative effects of an asymmetrical approach.

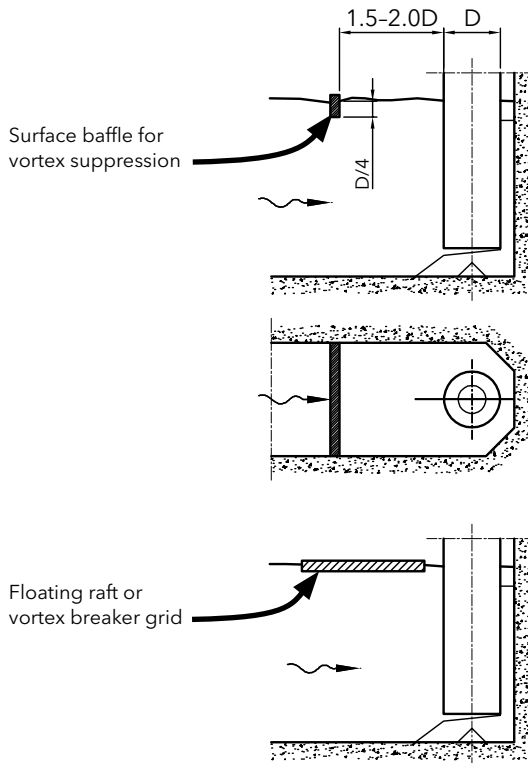


Relatively small asymmetries of flow can be corrected by the insertion of splitter plates between the pump tube and the back wall of the sump and underneath the pump on the floor. These plates block the swirl around the tube and prevent formation of wall vortices. These measures are integral features in most of our standard configurations.

Submerged vortices can form almost anywhere on the solid boundary of the sump and they are often difficult to detect on the site. However, they can be detected much more readily in model tests. Submerged vortices' existence may be revealed by the rough running of the

pump or from erosion of the propeller blades. They can be eliminated by disturbing the formation of stagnation points in the flow. The flow pattern can be altered, for example, by the addition of a center cone or a prismatic splitter under the pump, or by insertion of fillets and benching between adjoining walls, as in some of our standard configurations.

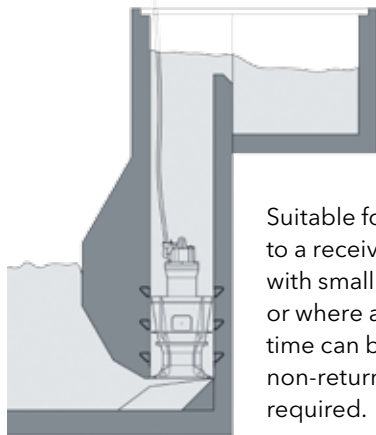
Air-entraining vortices may form either in the wake of the pump tube or upstream from it. They form in the wake if the inlet velocity is too high or the depth of flow is too small. Also, they form upstream if the velocity is too low. In either case, these vortices can be eliminated by introducing extra turbulence into the surface flow, i.e. by placing a transverse beam or baffle at the water surface. Such a beam should enter the water at a depth equal to about one quarter of the tube diameter and be placed at a point about 1.5-2.0 diameters upstream of the tube. If the water level varies considerably, a floating beam can be more effective. In some cases, a floating raft upstream of the tube will eliminate air-entraining vortices. This raft may be a plate or a grid. Both forms impede the formation of surface vortices. An alternative is the use of an inclined plate similar to that shown in the draft tube installation.



Installation alternatives

The following examples show possible alternatives using Flygt designed installation components.

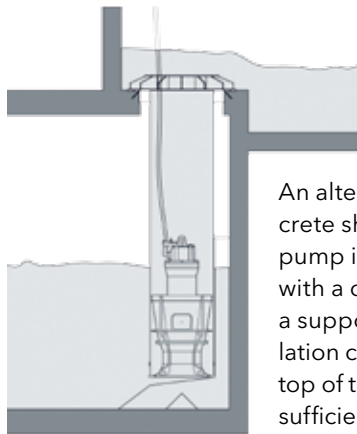
Installation type 1



Suitable for pumping liquid to a receiving body of water with small level variations or where a short running time can be expected, so non-return valves are not required.

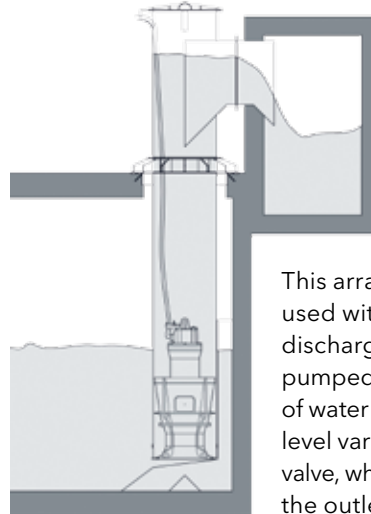
This arrangement is simple. It involves the least possible number of steel components. The pump is set in a circular concrete shaft with a relatively short tube grouted in place, installation component D3, which is used as the support structure for the pump. Alternatively, the shaft can have a rectangular cross-section above the discharge column. The shaft extends above the maximum water level in the outlet channel to prevent water from running back to the sump when the pump is shut off.

Installation type 2



An alternative to the concrete shaft is to place the pump in a steel column with a collar that rests on a supporting frame (installation component D1). The top of the pipe must extend sufficiently above the maximum water level to prevent back-flow from the outlet channel.

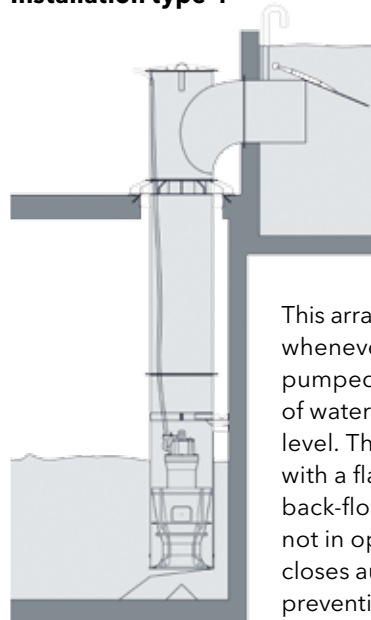
Installation type 3



This arrangement may be used with either a free discharge, when liquid is pumped to a receiving body of water with small water level variations, or with a flap valve, when the water level on the outlet side varies considerably so that the outlet is occasionally submerged. The flow is discharging into a closed culvert through the component E1.

The flow is discharging into a closed culvert through the component E1.

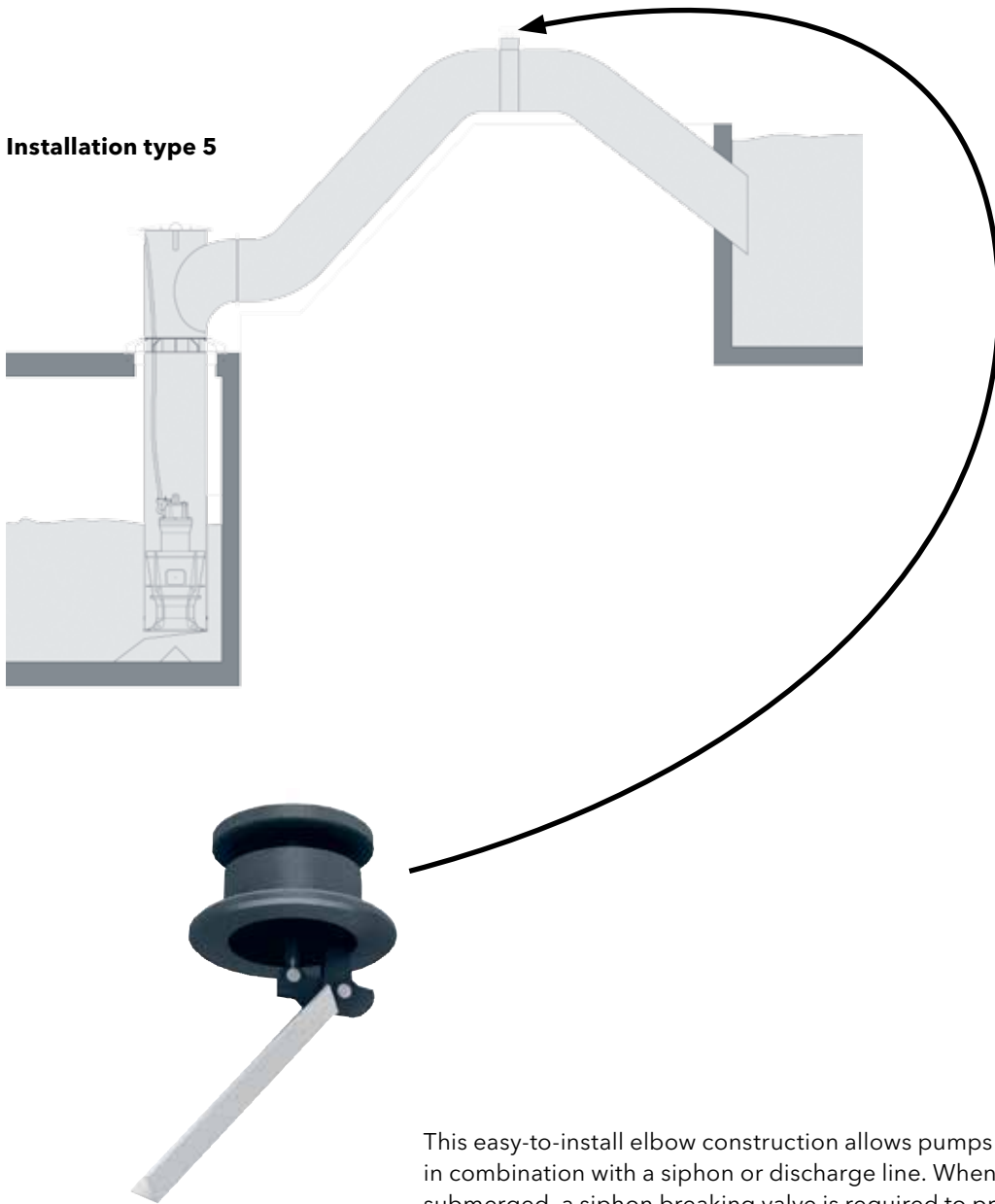
Installation type 4



This arrangement is suitable whenever the liquid is pumped to a receiving body of water with a varying water level. The outlet is equipped with a flap valve to prevent back-flow. When the pump is not in operation, the valve closes automatically, preventing water from running back into the sump.

The static head is the difference between water level in the sump and water level at the outlet, and it will be kept to a minimum in this type of installation. Elbow type E2-E4 can be used for discharging.

Installation type 5



This easy-to-install elbow construction allows pumps to work in combination with a siphon or discharge line. When outlet is submerged, a siphon breaking valve is required to prevent back-flow and allow venting at start. This installation keeps the static head to a minimum, since the static head will be the difference between the water level in the sump and the water level at the outlet. Two types of elbows can be used with this station E2-E4. As in previous cases, the steel tube rests on a support frame (installation component D1).

Note:

Support bracket (B1) should be used if the free unsupported length of the column pipe exceeds 5 times pipe diameter.

Installation components

The objective in the design and development of installation components is to devise simple systems that offer a wide variety of options to deal with most situations. These components have been developed to facilitate design work and estimation of costs. Normally, the installation components will be manufactured locally based on Flygt drawings. The drawings can also serve as a basis for the development of new or modified components that better match the local requirements and/or manufacturing facilities.

Drawings are available for the following installation components:

Flygt Formed Suction Intake (Flygt FSI) is preferable for very adverse inflow conditions or when the pump bay dimensions are less than recommended. The main function of the intake device is to preserve an optimal inflow to the pump by gradual acceleration and redirection of the flow toward the pump inlet.



Cover (C)
for discharge elbow (E1 and E2).



Vertical discharge column (D)

in which the pump is set depending upon the depth of the station, the installation may consist of one part (D1) or several parts joined together by flanges (D2), or it may consist of a short tube prepared for grouting in concrete (D3).



Discharge elbows (E)

with rectangular exit flange (E1) and discharge elbows with circular exit flanges (E2, E3).



Column bracket (B)
for anchoring the tube.



Supporting frame (F)
for suspending the tube from ceiling.



Cable protection and suspension for tube installed pumps

For tube-installed submersible pumps, proper cable protection and suspension is essential for trouble-free operation. Cable suspension and protection requirements become more stringent with longer cable lengths and higher discharge velocities.



Flygt cable suspension system

A few basic principles govern good cable protection and suspension practices:

- Cables must be suspended in such a way that if they should move, they will not come in contact with any surfaces that could abrade the jacket - these include pump and tube components, as well as other cables.
- Cables should be bundled together, using components that will not cut or abrade the cables.
- Proper strain relief and support at prescribed intervals (depending on length) should be provided. Spring-controlled tensioning and an integrated "guide wire" are recommended for long cable lengths.

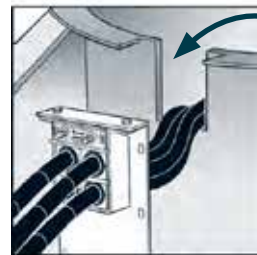
We offer a variety of cable protection and suspension accessories with recommendations to suit all types of installations and running conditions. Contact your local application engineer for information on the best system to meet your needs.

Installation of pumps

Pump installation can be facilitated with the aid of the Dock-Lock™ device for easy and safe retrieval of pumps in a wet well. The Dock-Lock consists of a spring-loaded hooking device, a guide line, and a tension drum. Because the line guides the hook, there's no time wasted trying to find the pump shackle. The device ensures that the hook actually locks into the shackle. Pumps are retrieved safely, easily, and quickly, with minimal maintenance costs.



Flygt cable seal units for pressurized tube (column)



The Flygt cable seal units with Roxtec sealing technology are used to make a water tight cable entry into a discharge column with water tight cover.

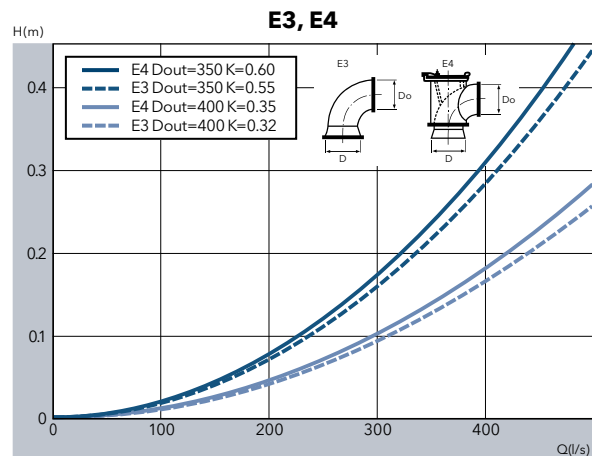
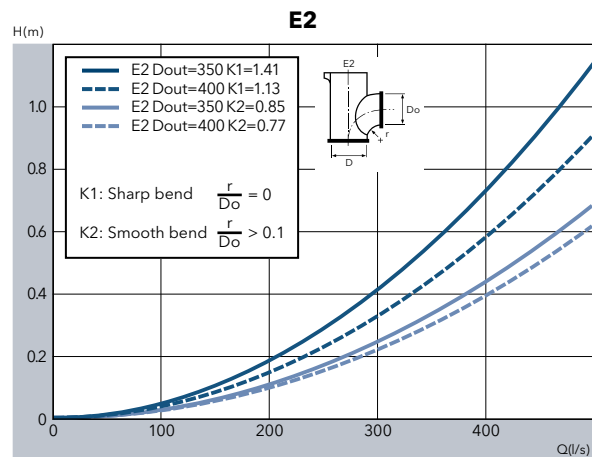
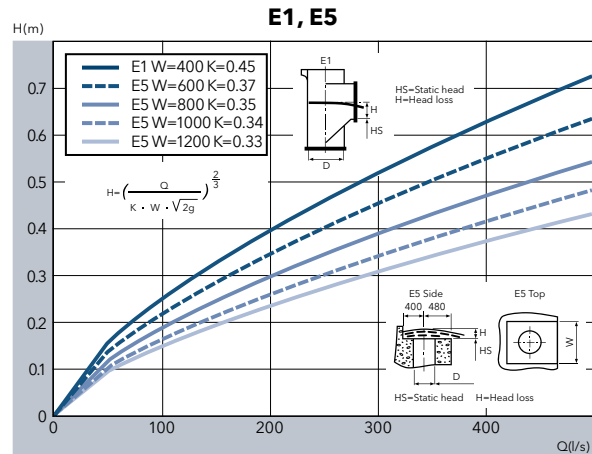
The cable seal units are complete with frame, Roxtec cable seal modules, tightening wedge, lubricant, and installation manual.



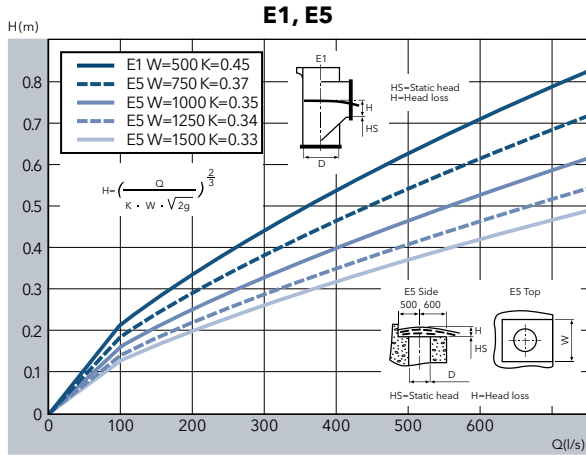
Appendix 1: Head losses diagrams for Flygt designed discharge arrangements

Head losses are comparatively small for systems using propeller pumps. Even so, an accurate prediction of losses, and hence the total required head, is crucial when selecting the best pump. Propeller pumps have relatively steep head and power characteristics, and an error in predicting the total head can result in a significant change in the power required. A potentially vulnerable situation can arise if head loss is significantly underestimated, which can mean that a pump operates against a higher head, delivers less flow, and uses more power. Conservative assumptions should thus be made in determining head loss calculations. For all installations described herein, the head losses that must be accounted for occur in the components of the discharge arrangement (friction losses in short pipes are usually negligible). The loss coefficients and the head loss as a function of the flow rate for the system components designed by Flygt are shown in the diagrams. For system components not covered by this document, loss coefficients can be obtained from their manufacturers or from appropriate literature.

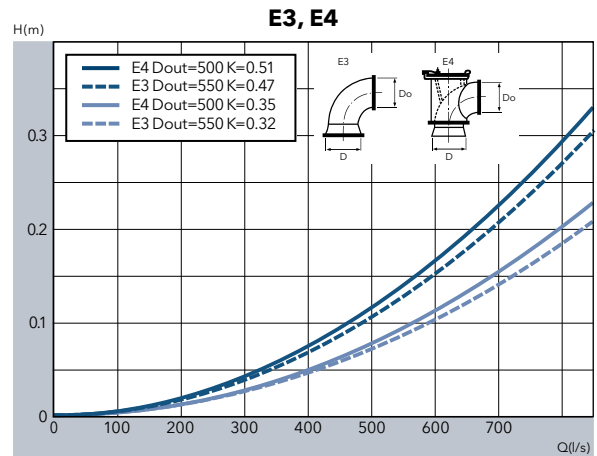
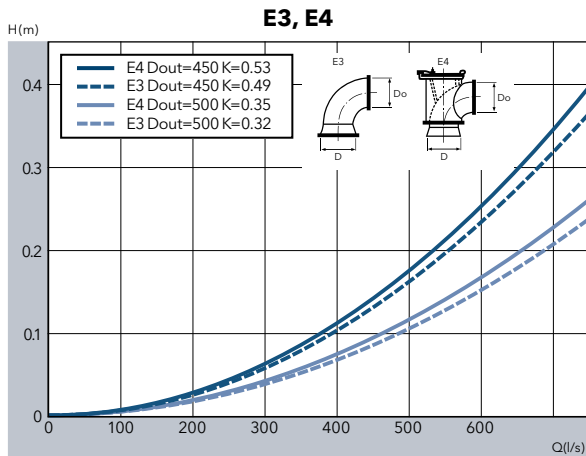
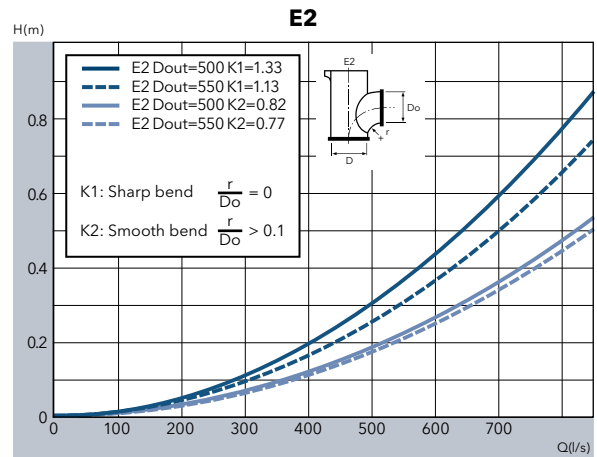
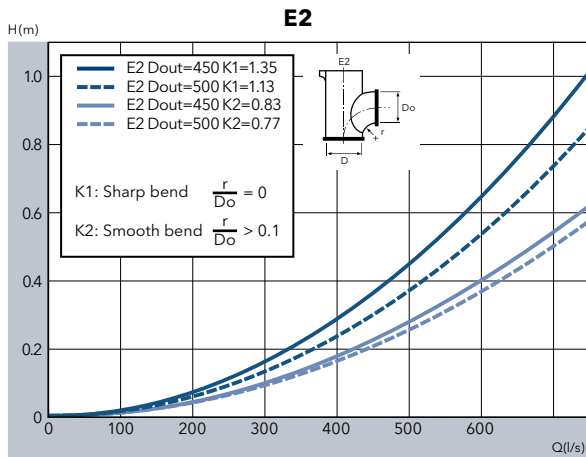
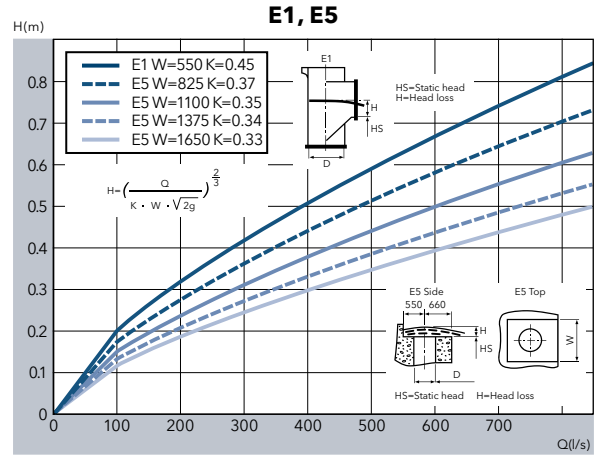
400 mm Installation pipe inner diameter (D) Flygt PL7020



**500 mm Installation pipe inner diameter (D)
Flygt PL7030**

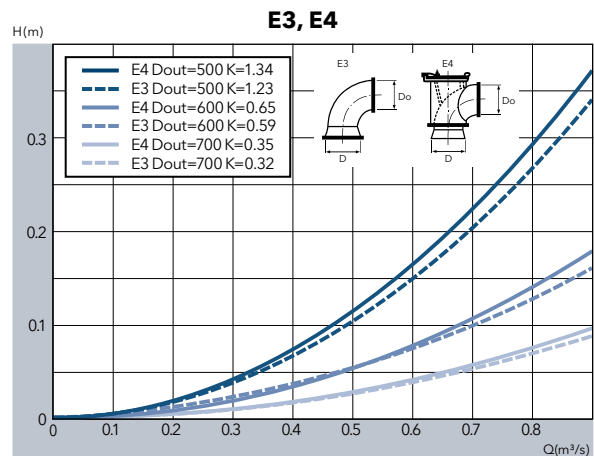
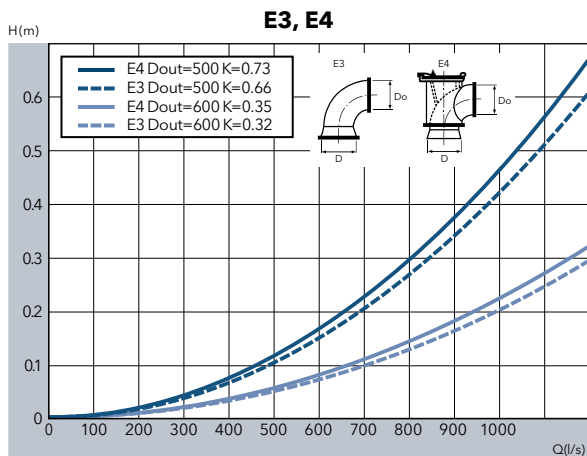
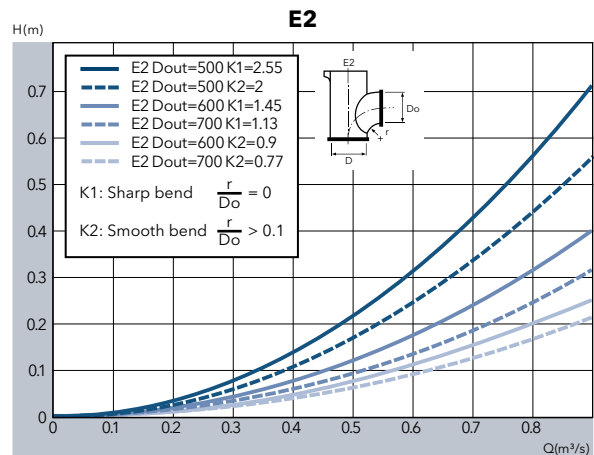
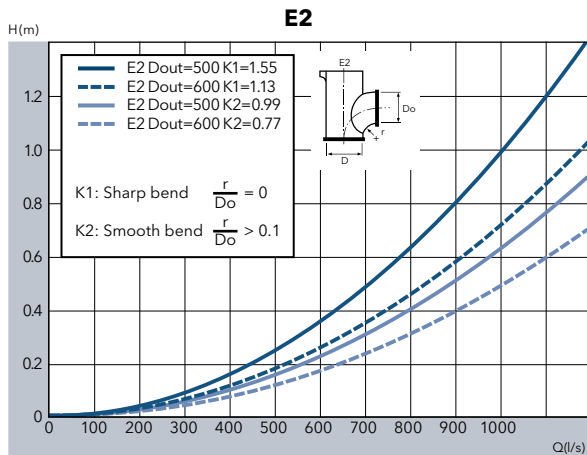
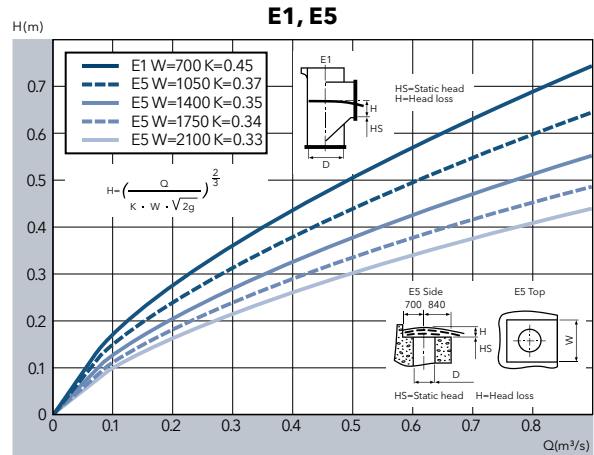
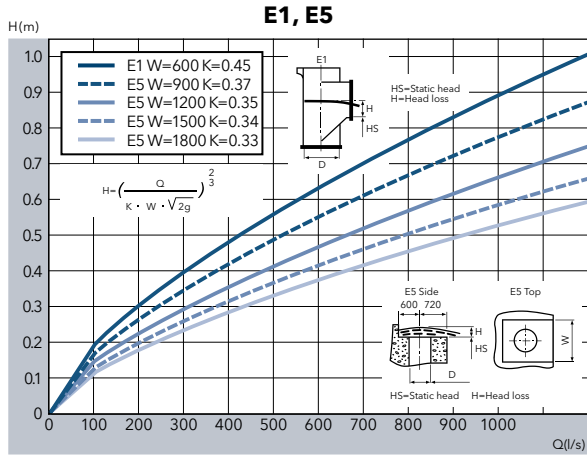


**550 mm Installation pipe inner diameter (D)
Flygt PL7035**



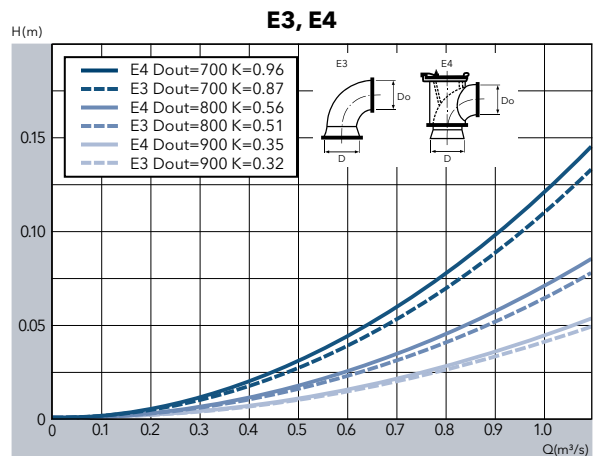
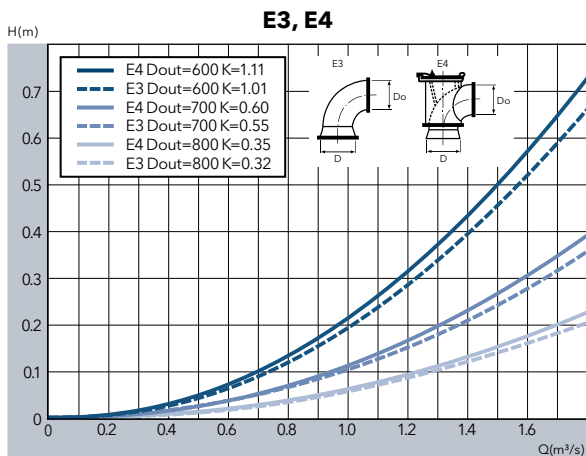
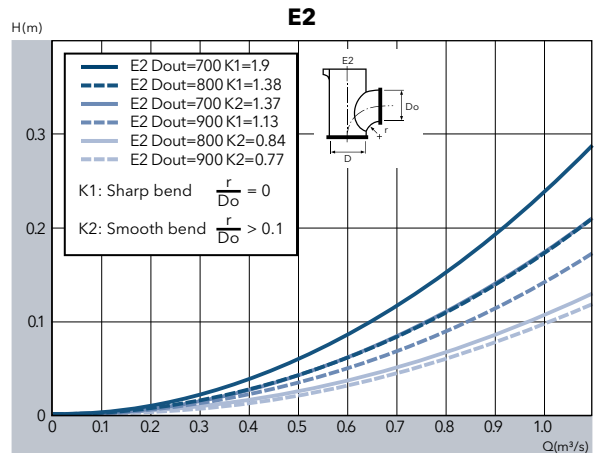
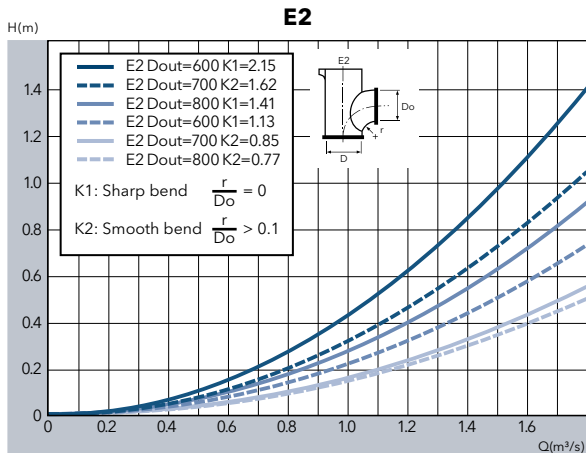
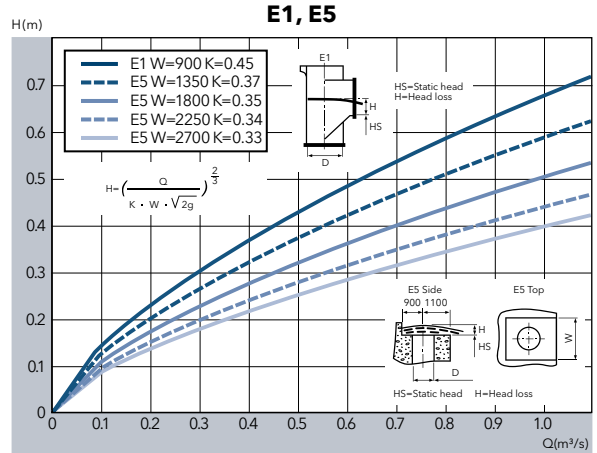
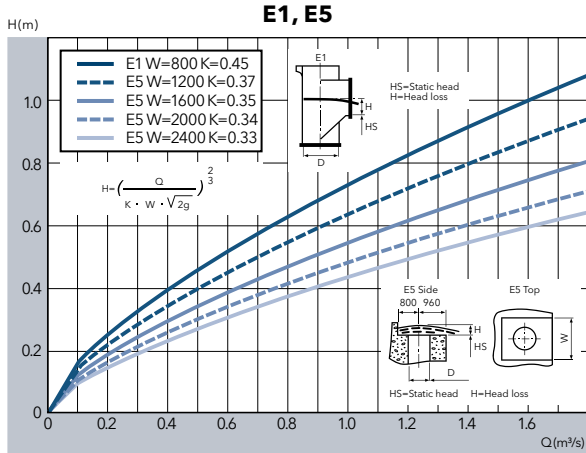
**600 mm Installation pipe inner diameter (D)
Flygt PL7040**

**700 mm Installation pipe inner diameter (D)
Flygt PL7045, PL7050**

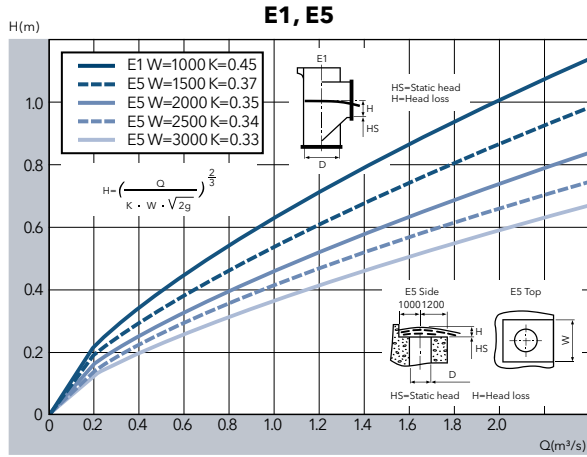


**800 mm Installation pipe inner diameter (D)
Flygt PL7055, PL7061, PL7065, LL3356**

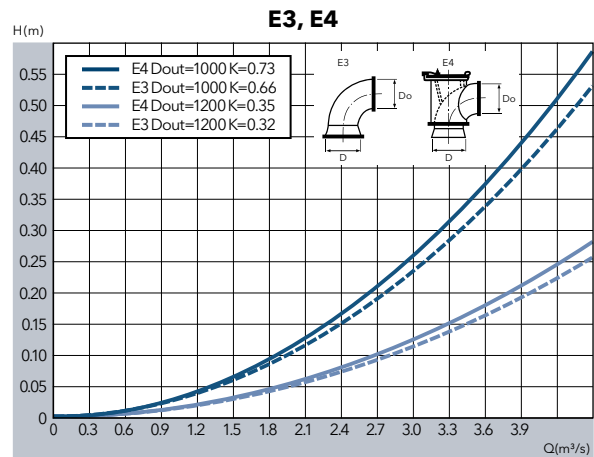
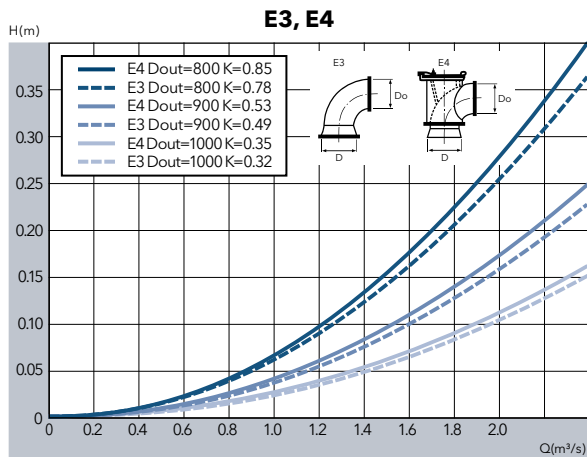
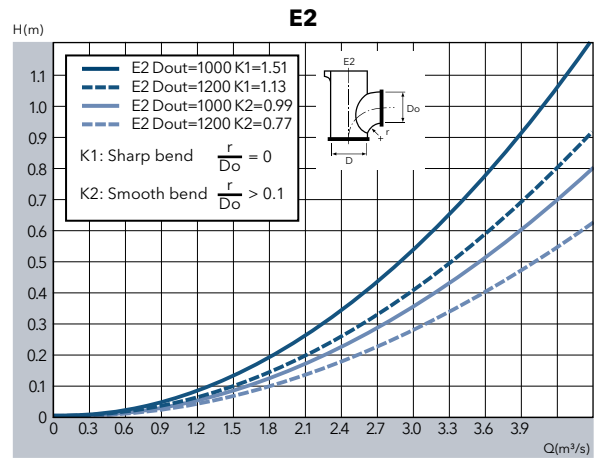
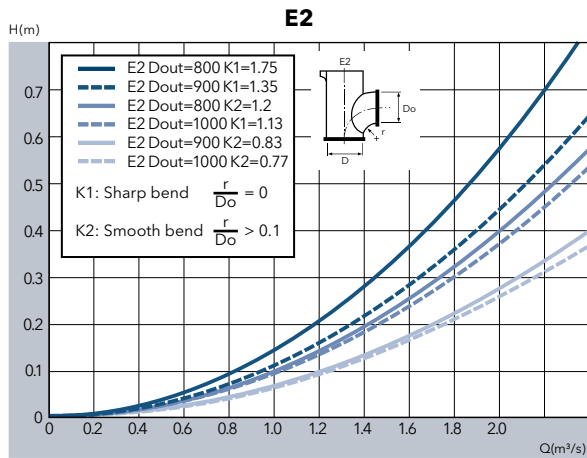
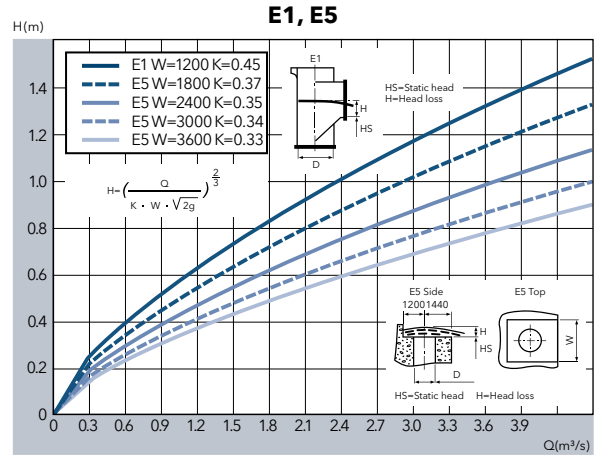
**900 mm Installation pipe inner diameter (D)
Flygt LL3400**



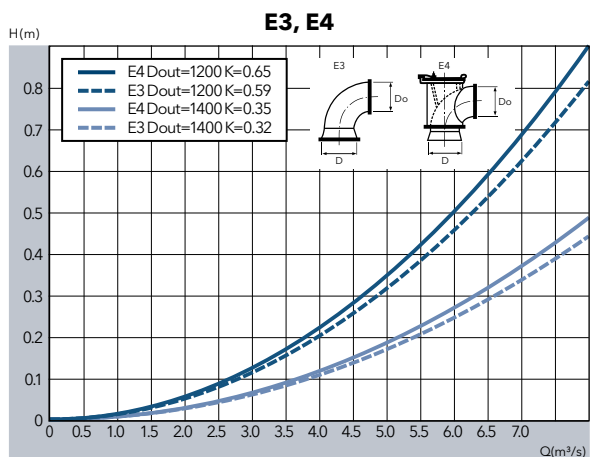
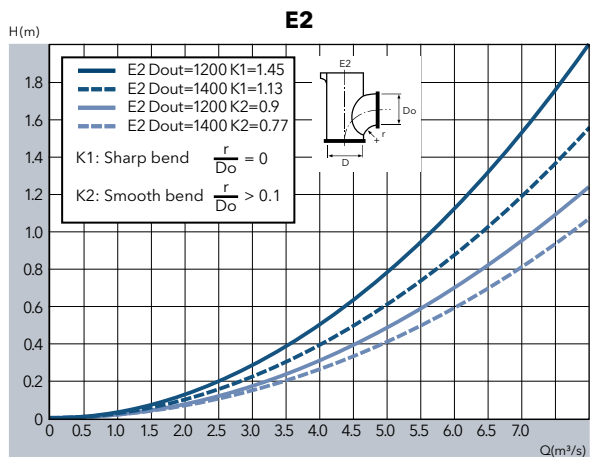
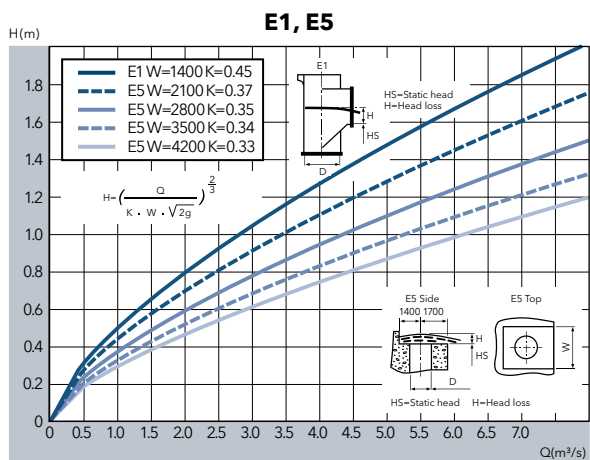
**1000 mm Installation pipe inner diameter (D)
Flygt PL7076, PL7081**



**1200 mm Installation pipe inner diameter (D)
Flygt PL7101, PL7105, LL3531, LL3602**



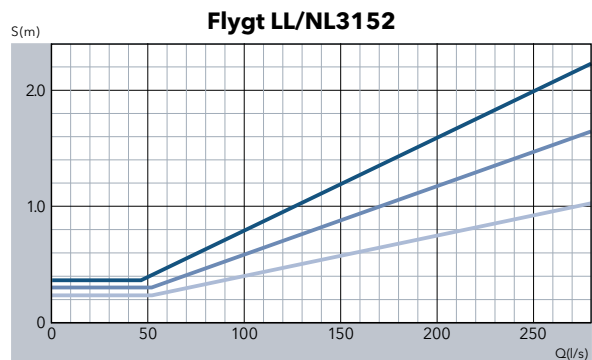
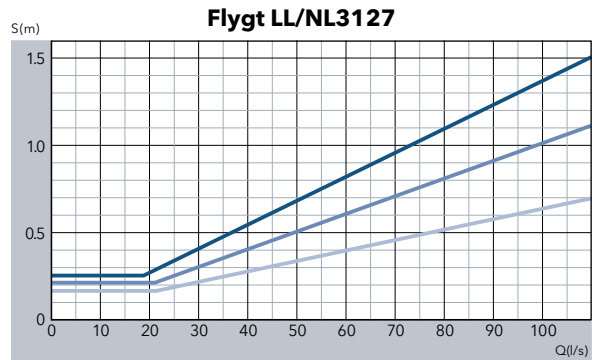
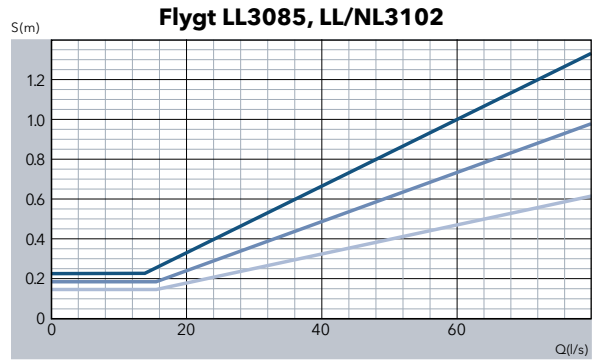
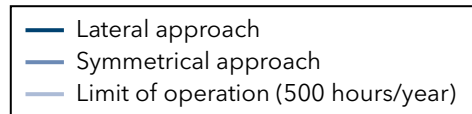
**1400 mm Installation pipe inner diameter (D)
Flygt PL7115, PL7121, PL7125**



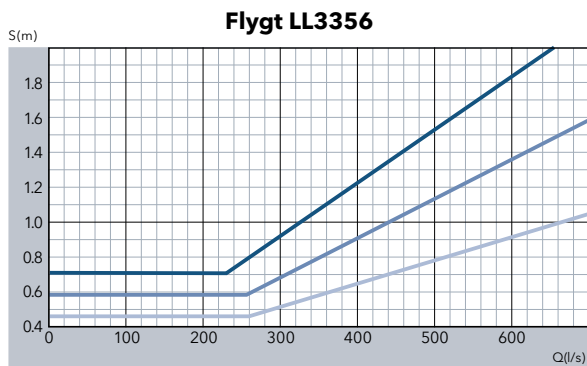
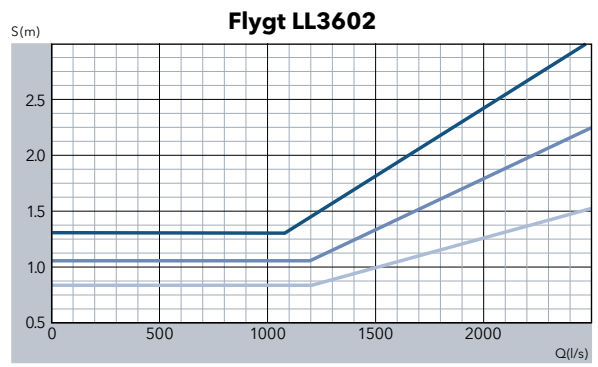
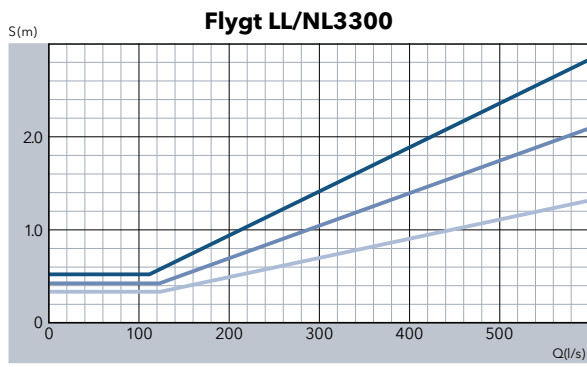
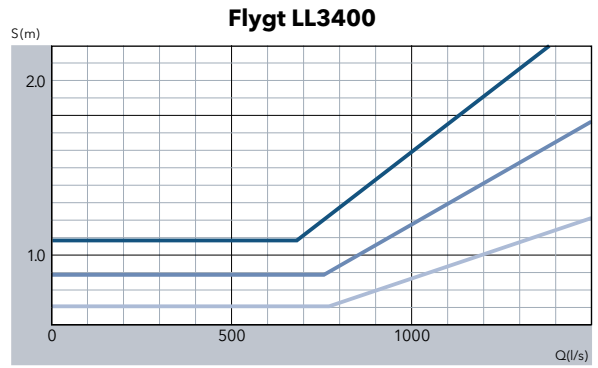
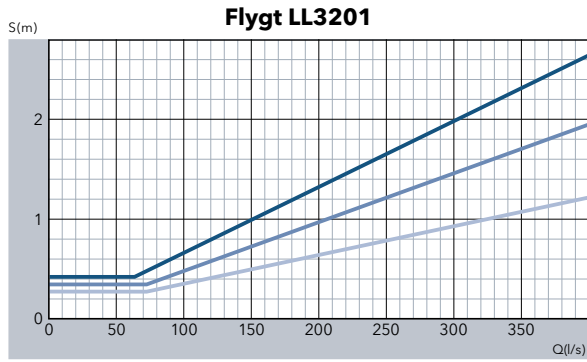
Appendix 2: Submergence diagram for open sump intake design

The minimum required submergence of the pump inlet with open sump intake design is a function of the flow rate, the pump inlet diameter, and the distribution of the flow at the approach to the pump. Each diagram has three curves for various conditions of the approaching flow. Because vortices develop more readily in a swirling flow, more submergence is required to avoid vortices if the inlet arrangement leads to disturbed flow in the sump. Hence, the upper curve in the submergence diagrams is for a perpendicular approach, the middle one is for the symmetrical approach, and the lowest curve is for duty-limited operation time (about 500 hours/year). The curve appropriate to the inlet situation should be used to determine the minimum water level in the sump to preserve reliable operation of the pumps.

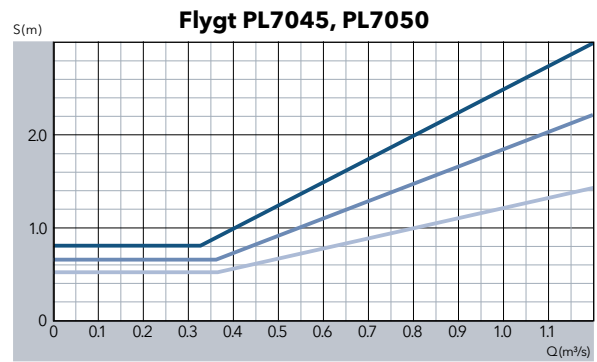
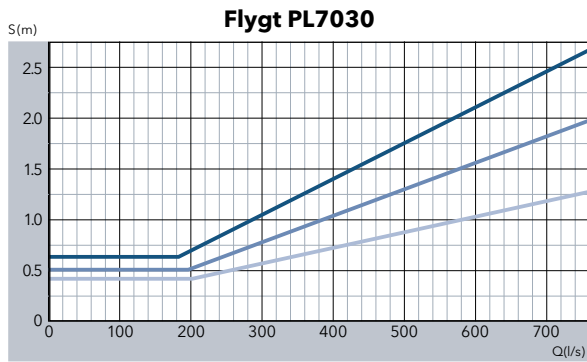
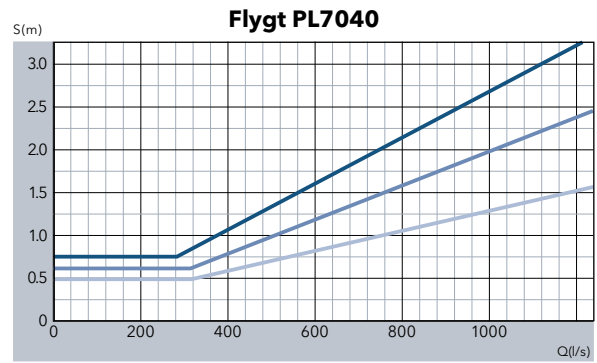
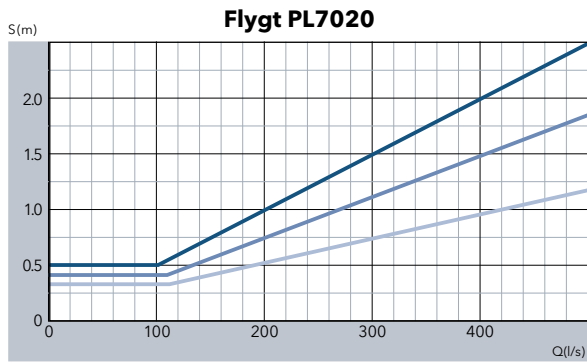
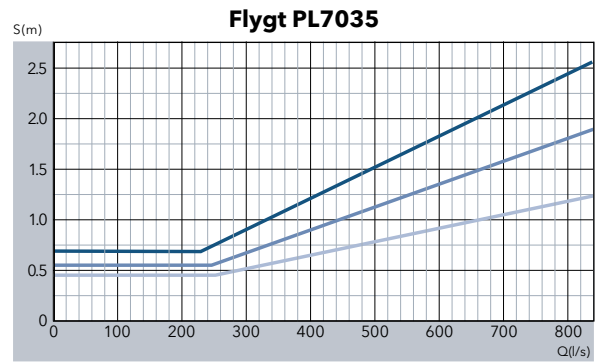
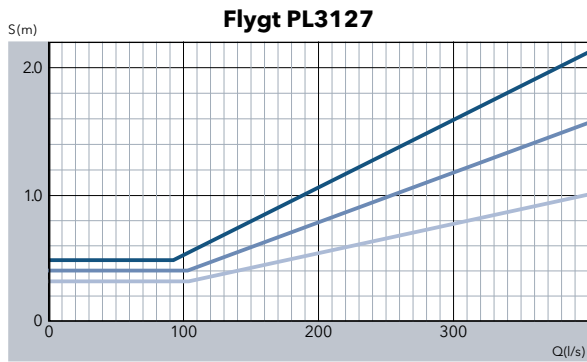
Note: NPSH required for specific duty point may supersede submergence requirements.



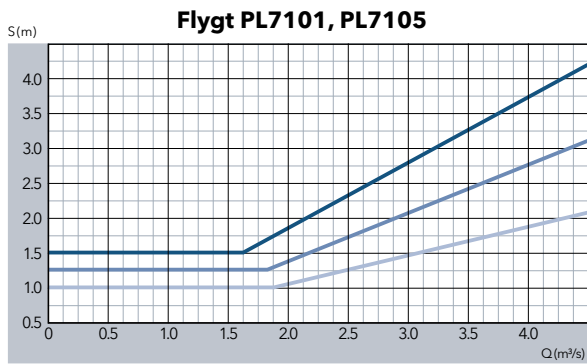
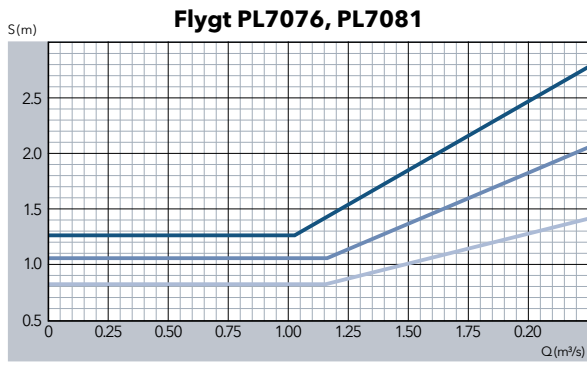
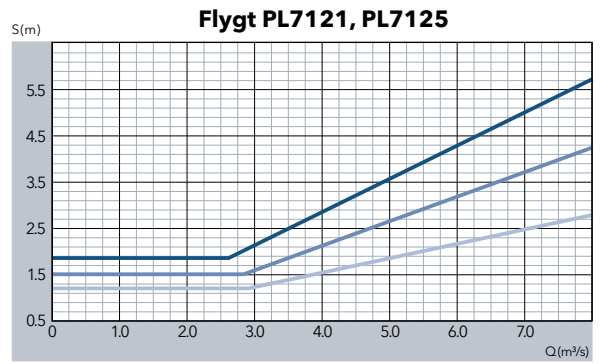
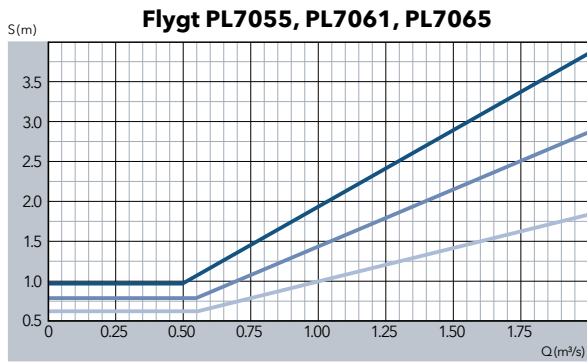
Appendix 2: Submergence diagram for open sump intake design



Appendix 2: Submergence diagram for open sump intake design

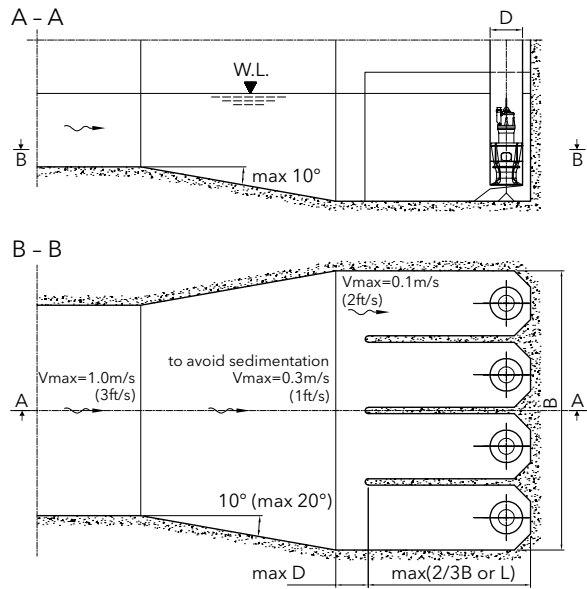


Appendix 2: Submergence diagram for open sump intake design

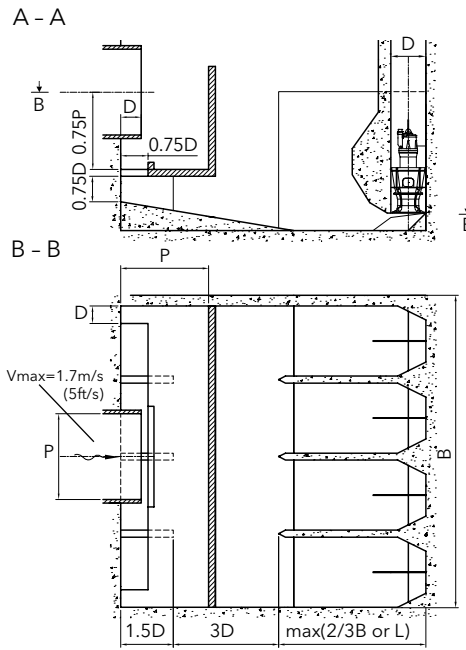


Appendix 3: Sump layout alternatives

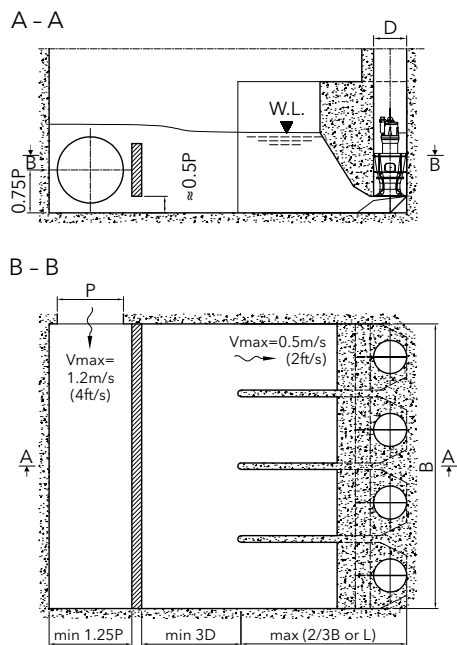
Stations with low level front inlet



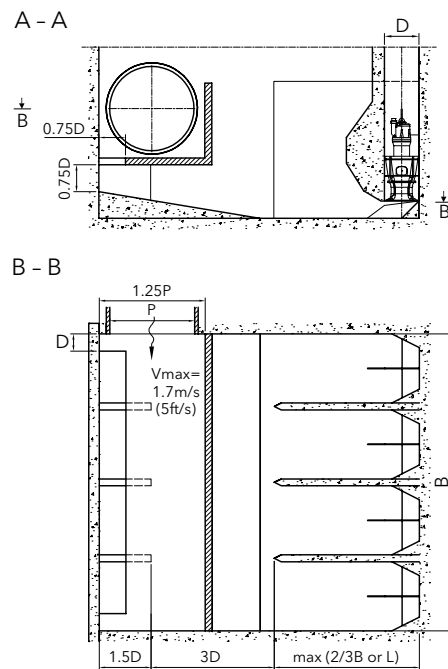
Stations with high level front inlet (max 4 pumps)



Stations with low level side inlet (max 4 pumps)

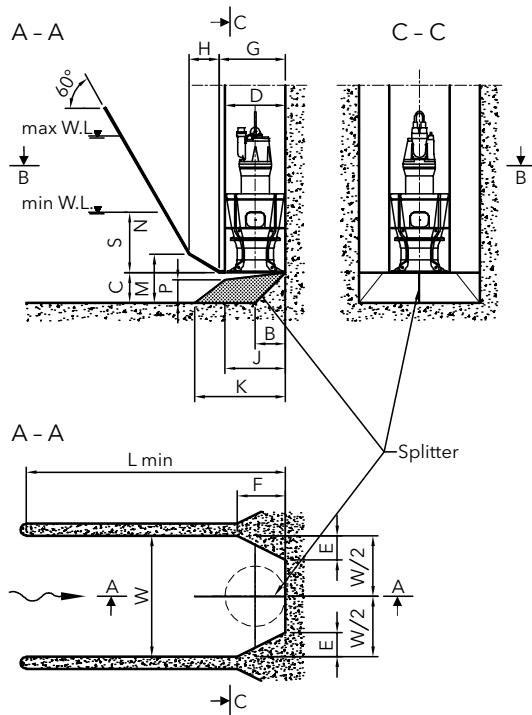


Stations with high level side inlet (max 4 pumps)

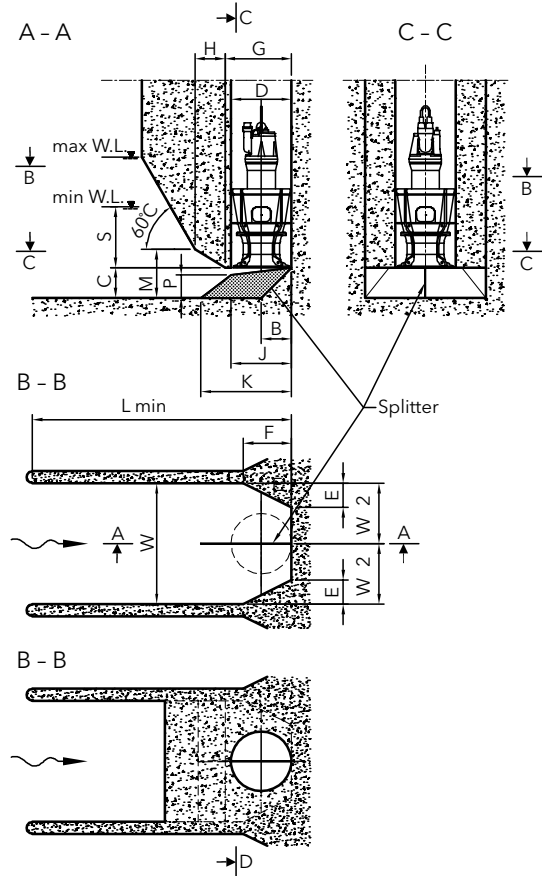


Appendix 4: Pump bay alternatives

Enclosed intake in steel for Flygt PL pumps



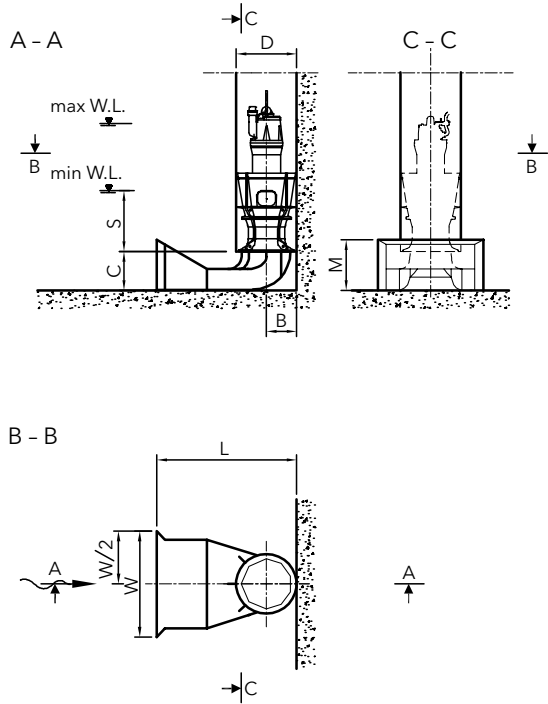
Enclosed intake in concrete for Flygt PL pumps



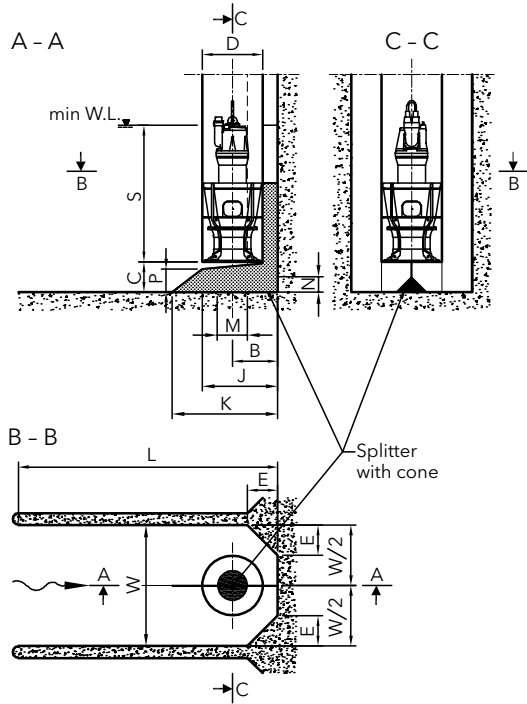
Recommended dimensions

	Pump type	Nom. dia (mm)	B	C	D	E	F	G	H	J	K	L	M	P	S	W
Formed Intake Design	PL7020	400	0.20	0.20	0.40	0.16	0.32	0.44	0.20	0.40	0.60	1.60	0.32	0.15	0.40	0.80
	PL7030	500	0.25	0.25	0.50	0.20	0.40	0.55	0.25	0.50	0.75	2.00	0.40	0.19	0.50	1.00
	PL7035	550	0.28	0.28	0.55	0.22	0.44	0.61	0.28	0.55	0.83	2.20	0.44	0.21	0.55	1.10
	PL7040	600	0.30	0.30	0.60	0.24	0.48	0.66	0.30	0.60	0.90	2.40	0.48	0.23	0.60	1.20
	PL7045 PL7050	700	0.35	0.35	0.70	0.28	0.56	0.77	0.35	0.70	1.05	2.80	0.56	0.27	0.70	1.40
	PL7055 PL7061	800	0.40	0.40	0.80	0.32	0.64	0.88	0.40	0.80	1.20	3.20	0.64	0.30	0.80	1.60
	PL7065	800	0.40	0.40	0.80	0.32	0.64	0.88	0.40	0.80	1.20	3.20	0.64	0.30	1.10	1.60
	PL7076 PL7081	1000	0.50	0.50	1.00	0.40	0.80	1.10	0.50	1.00	1.50	4.00	0.80	0.38	1.00	2.00
	PL7101	1200	0.60	0.60	1.20	0.48	0.96	1.32	0.60	1.20	1.80	4.80	0.96	0.46	1.20	2.40
	PL7105	1200	0.60	0.60	1.20	0.48	0.96	1.32	0.60	1.20	1.80	4.80	0.96	0.46	1.50	2.40
	PL7121	1400	0.70	0.70	1.40	0.56	1.12	1.54	0.70	1.40	2.10	5.60	1.12	0.53	1.40	2.80
	PL7125	1400	0.70	0.70	1.40	0.56	1.12	1.54	0.70	1.40	2.10	5.60	1.12	0.53	1.75	2.80

Flygt FSI



Open sump design for Flygt PL pumps

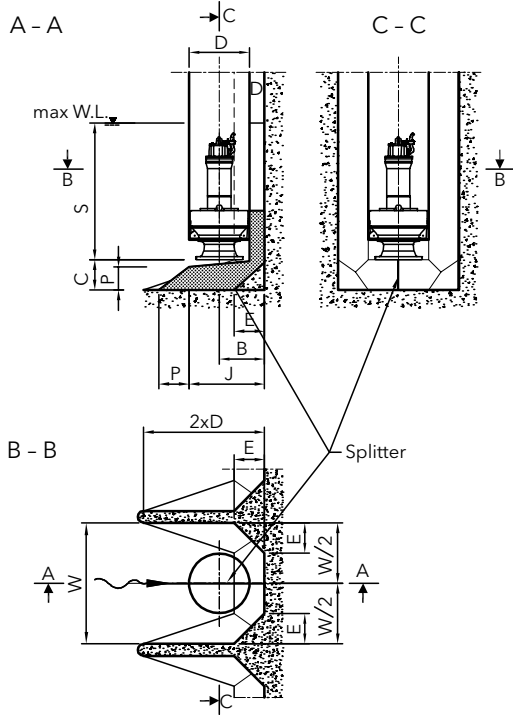


Recommended dimensions

	Pump type	Nom. dia. (mm)	B	C	D	E	F	G	H	J	K	L	M	N	P	S	W
Flygt FSI	PL7045 PL7050	700	0.35	0.40	0.70	-	-	-	-	-	-	1.49	0.53	-	-	0.70	1.11
	PL7055 PL7061	800	0.40	0.48	0.80	-	-	-	-	-	-	1.75	0.63	-	-	0.80	1.32
	PL7065	800	0.40	0.63	0.80	-	-	-	-	-	-	1.75	0.63	-	-	1.10	1.32
	PL7076 PL7081	1000	0.50	0.63	1.00	-	-	-	-	-	-	2.28	0.83	-	-	1.00	1.73
	PL7101	1200	0.60	0.75	1.20	-	-	-	-	-	-	2.74	1.00	-	-	1.20	2.09
	PL7105	1200	0.60	0.75	1.20	-	-	-	-	-	-	2.74	1.00	-	-	1.50	2.09
	PL7121	1400	0.70	0.90	1.40	-	-	-	-	-	-	3.27	1.20	-	-	1.40	2.50
	PL7125	1400	0.70	0.90	1.40	-	-	-	-	-	-	3.27	1.20	-	-	1.75	2.50
Open sump intake design	PL7020	400	0.30	0.20	0.40	0.20	-	-	-	0.50	0.70	1.60	0.20	0.10	0.15	-	0.80
	PL7030	500	0.38	0.25	0.50	0.25	-	-	-	0.63	0.88	2.00	0.25	0.13	0.19	-	1.00
	PL7035	550	0.41	0.28	0.55	0.28	-	-	-	0.69	0.96	2.20	0.28	0.14	0.21	-	1.10
	PL3127 PL7040	600	0.45	0.30	0.60	0.30	-	-	-	0.75	1.05	2.40	0.30	0.15	0.23	-	1.20
	PL7045 PL7050	700	0.53	0.35	0.70	0.35	-	-	-	0.88	1.23	2.80	0.35	0.18	0.27	-	1.40
	PL7055 PL7061 PL7065	800	0.60	0.40	0.80	0.40	-	-	-	1.00	1.40	3.20	0.40	0.20	0.30	-	1.60
	PL7076 PL7081	1000	0.75	0.50	1.00	0.50	-	-	-	1.25	1.75	4.00	0.50	0.25	0.38	-	2.00
	PL7101 PL7105	1200	0.90	0.60	1.20	0.60	-	-	-	1.50	2.10	4.80	0.60	0.30	0.46	-	2.40
	PL7121 PL7125	1400	1.05	0.70	1.40	0.70	-	-	-	1.75	2.45	5.60	0.70	0.35	0.53	-	2.80

See minimum submergence diagram

Open sump design for Flygt LL pumps



Recommended dimensions

Pump type	Nom. dia. (mm)	B	C	D	E	F	G	H	J	K	L	M	N	P	S	W	
Open sump intake design	LL3085 LL/NL3102	500	0.38	0.25	0.50	0.25	-	-	-	0.63	0.88	1.00	0.25	0.13	0.19	See minimum submergence diagram	1.00
	LL/NL3127 LL3152	600	0.45	0.30	0.60	0.30	-	-	-	0.75	1.05	1.20	0.30	0.15	0.23		1.20
	LL3201 LL/NL3300 LL3356	800	0.60	0.40	0.80	0.40	-	-	-	1.00	1.40	1.60	0.40	0.20	0.30		1.60
	LL3400	900	0.68	0.45	0.90	0.45	-	-	-	1.13	1.58	1.80	0.45	0.23	0.34		1.80
	LL3602	1200	0.90	0.60	1.20	0.60	-	-	-	1.50	2.10	2.40	0.60	0.30	0.46		2.40

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