

# Technical Memorandum



PO Box 1678 • Tacoma, WA 98401-1678  
711 Pacific Avenue • Tacoma, WA 98402  
Phone (253) 272-7220 • Fax (253) 272-7250  
JDaboy@cosmopolitaneng.com

**TM TITLE:** Raymond Pump Station #11 Preliminary Design Report

**DATE:** March 12, 2009

**TO:** Jay Swift, Gray & Osborne

**FROM:** Jim D'Aboy, Cosmopolitan Engineering Group JKD

**PROJECT #:** G&0.026

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## INTRODUCTION

As part of the planned regionalization of the wastewater facilities for the Cities of South Bend and Raymond, all the sewage from the City of South Bend will be pumped via South Bend's Pump Station #3 to a new Regional Wastewater Treatment Facility, to be constructed on the site of the existing City of Raymond WWTP. Current planning calls for upgrading the capacity of South Bend Pump Station #3 and construct a new pressure line to Raymond to an intersection with the existing pressure line that carries flow from the City of Raymond Pump Stations #3 and #11 to the existing Raymond WWTP. From the point of intersection, the existing pressure line will be upsized to carry the increased flow to the headworks structure at the new Regional Facility. This proposed pressure line system is discussed in the *Cities of South Bend and Raymond Regional General Sewer Plan/Wastewater Facility Plan* dated May 2007 and the Interlocal Agreement between the two cities. Preliminary sizing of the upgraded Raymond Pump Station #11 is also discussed in the document *Conveyance Systems for Regional WWTP*, by Gray & Osborne, dated 9/9/08.

As part of the proposed regionalization project, Raymond Pump Station #11 will be upgraded to pump the additional flows that will result from the new conveyance system.

The existing pumps are Flygt submersibles, with the following operating data:

Type .....CP-3201  
Head, ft.....57  
HP .....35  
GPM..... 1600  
RPM.....1170

## **PUMP STATION DESIGN FLOWS**


Per the 9/9/08 G&O document, upgraded Pump Station #11 capacity is 1800 gpm at just under 100 ft. TDH, with two pumps running. This would pump the sewage at 5.5 ft/s through the new 12" diameter force main.

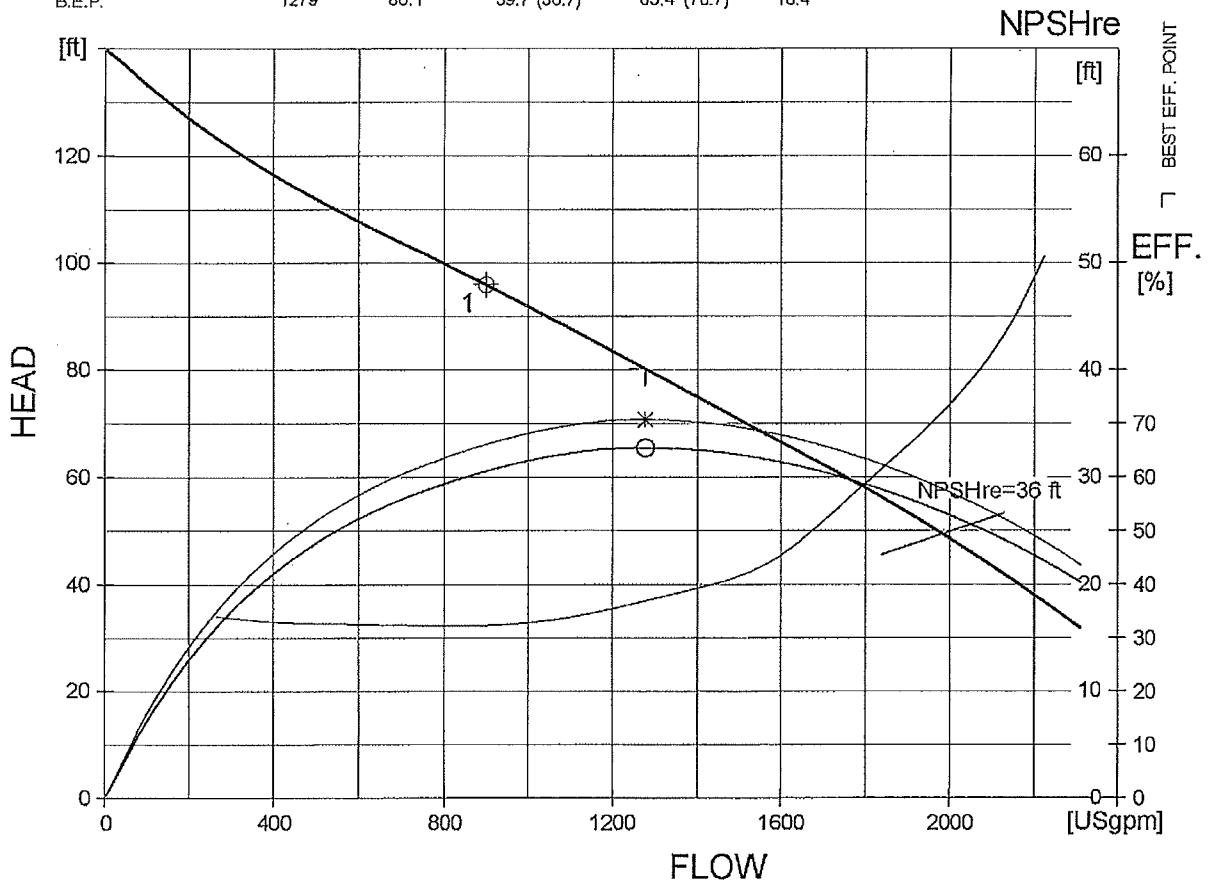
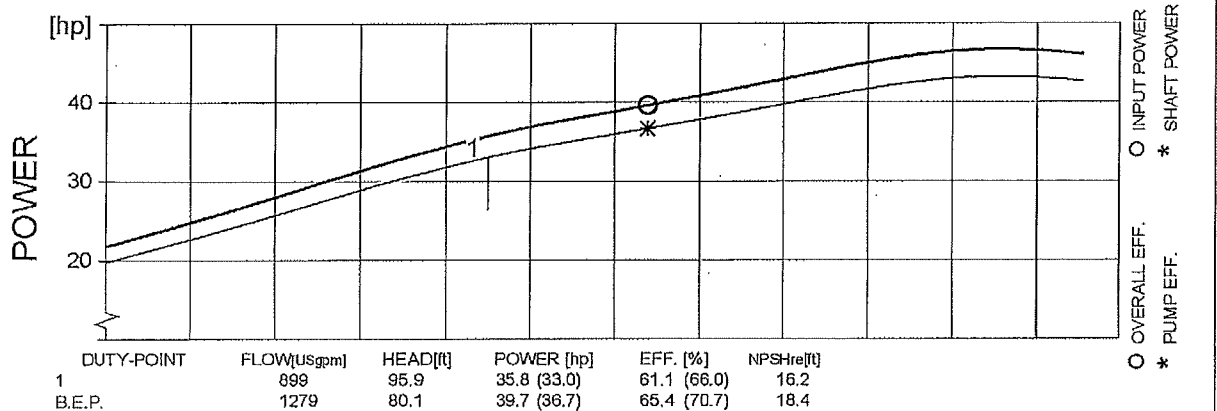
## **PUMP STATION PRELIMINARY DESIGN**

Per the attached pump curve (see Appendix) the appropriate Flygt pump is the NP3202.180, producing 1800 gpm at 96 ft. TDH with both pumps running. This selection corresponds very well to the preliminary selection in the 9/9/08 G&O document, with the only difference being the N-impeller to reduce clogging and maximize efficiency in the new selection.

According to the pump rep, the existing pump frames and rails should be fine for the new pumps, as they are the same series as the existing pumps. Pump control will be by VFD's, with all electrical gear reviewed as upgraded as required.

## APPENDIX

				PERFORMANCE CURVE				PRODUCT NP3202.180		TYPE HT				
DATE 2009-03-13				PROJECT				CURVE NO 63-462-00-3050		ISSUE 7				
POWER FACTOR		1/1-LOAD	3/4-LOAD	1/2-LOAD	RATED POWER .....	60	hp	IMPELLER DIAMETER 278 mm						
		0.89	0.86	0.79	STARTING CURRENT ...	465	A	MOTOR #		STATOR	REV			
EFFICIENCY		91.5 %	92.5 %	92.0 %	RATED CURRENT ...	68	A	30-24-4AA		01D	10			
MOTOR DATA		---	---	---	RATED CURRENT ...	68	A	FREQ.				PHASES	VOLTAGE	POLES
COMMENTS				INLET/OUTLET		RATED SPEED .....	1775	rpm	60 Hz	3	460 V	4		
				- / 6 inch		TOT. MOM. OF INERTIA ...	0.36	kgm2	GEARTYPE				RATIO	
				IMP. THROUGHLET		NO. OF BLADES	2	---		---				



FLYPS3.1.6.2 (20060531)

NPSH<sub>re</sub> = NPSH<sub>3%</sub> + min. operational margin  
Performance with clear water and ambient temp 40 °C



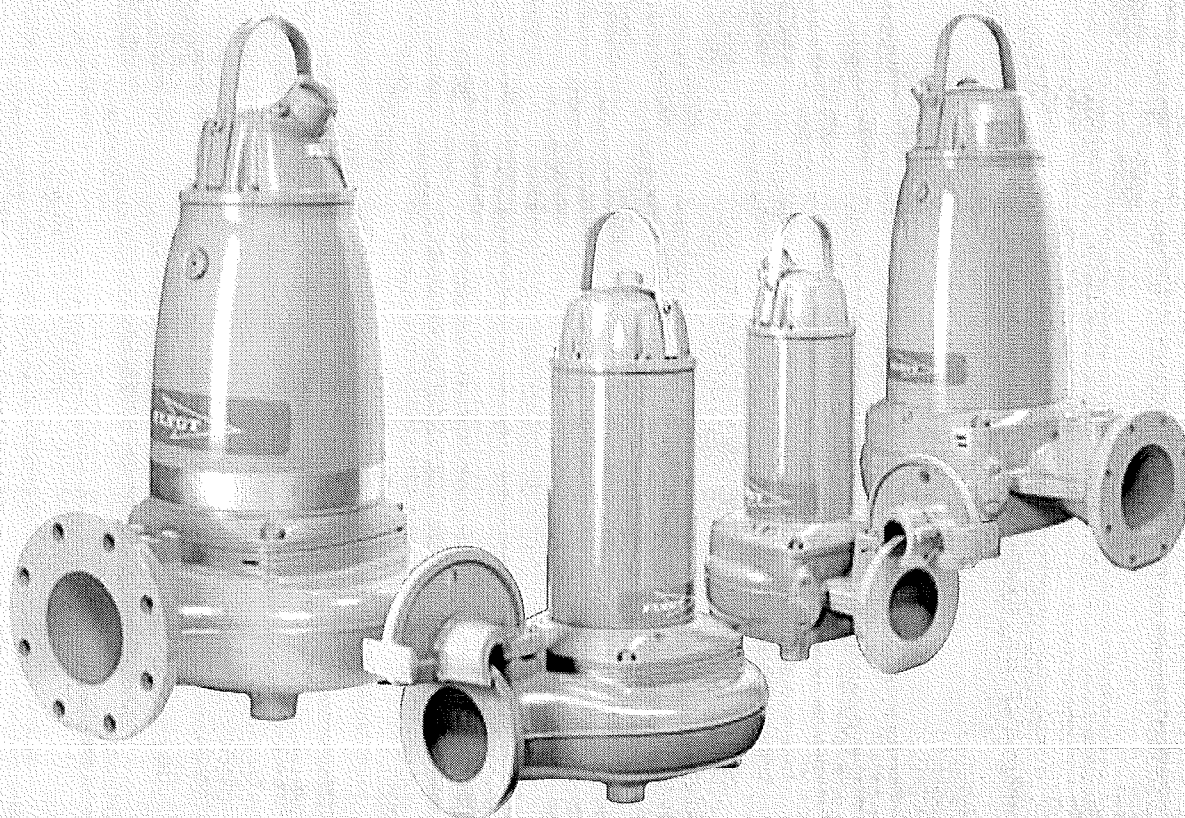
HI B Curve



Water & Wastewater

## Flygt N-Pumps 3153, 3171, 3202 & 3301

**A new generation of submersible wastewater pumps**



*Engineered for life*

# New generation Flygt N-Pumps

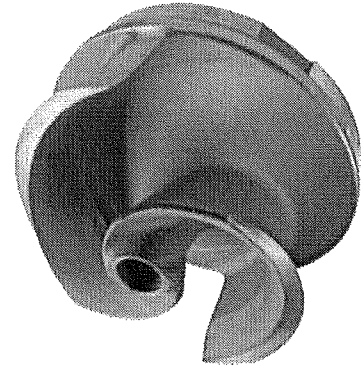
New levels of efficiency in wastewater handling

The new generation Flygt N-Pumps have been engineered to give you efficient, reliable and trouble-free pumping over long duty periods. And by improving your operational economy, this new series of pumps can have a dramatic effect on the total life costs of your installation.

Externally, you'll notice the difference straight away: these smooth new shapes are easy to keep clean and easier to service. But it's inside where the difference really counts.

At the heart of the new generation Flygt N-Pumps, you'll find the patented N-technique in the hydraulic end design. The unique, semi-open impeller, combined with the relief groove in the volute, has been proven to reduce the risk of clogging and maintain pumping efficiency, even under the worst of conditions.

We've taken operational serviceability even further by using class H insulated motors with improved cooling: less heat, less wear and tear. And there's a separate inspection chamber for rapid checking and maintenance.



*At the heart of the Flygt N-Pump is the proven N-impeller.*

*The unique semi open design of the impeller reduces the risk of clogging and maintains pumping efficiency over longer periods of time.*

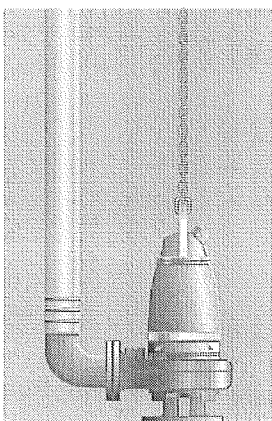


# Methods of installation



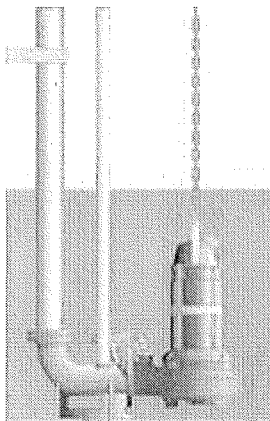
To reduce the cost of installation, ITT Water & Wastewater has standardized many of the main elements of pumping stations so that they can be combined in different combinations to match specific site conditions. The examples illustrated here show the flexibility of the system, and provide some guidelines for optimizing the design of your own station.

NS



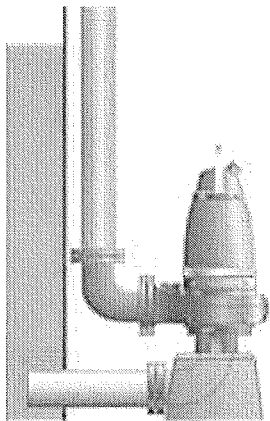
A semi-permanent, free-standing installation. Transportable version with pipe or hose connection.

NP



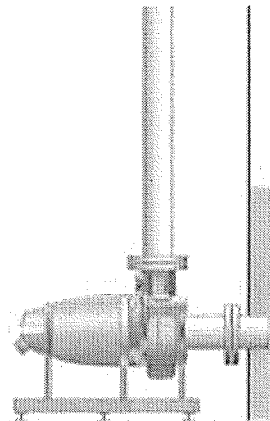
For semi-permanent wet well installations. The pump is installed with twin guide bars on a discharge connection.

NT



A vertically-mounted, permanent dry well or in-line installation with flange connections for suction and discharge pipe work.

NZ



A horizontally-mounted, permanent dry well or in-line installation with flange connections for suction and discharge pipe work.

# Pumping capacities up to 550l/s, 8,700gpm

The broad range of pumping capacities offered by the Flygt N-pump range, coupled with the self-cleaning advantages of the impeller and volute design, opens up new possibilities for cost-effective operation in a wide variety of applications. These include:

- Wastewater pumping
- Raw water pumping
- Cooling water
- Sludge handling
- Storm water handling
- Industrial effluent handling

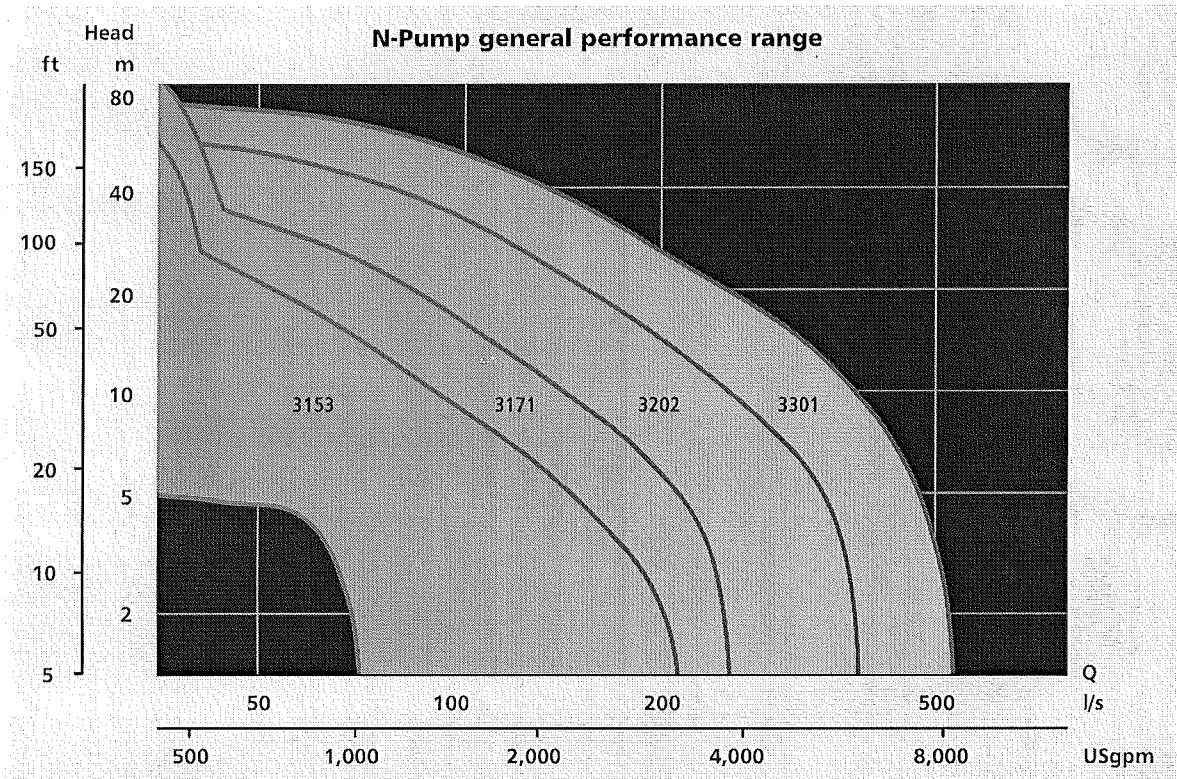
This new pump design has undergone extensive testing in the field. The results from these tests show considerably lower energy consumption and fewer running problems. The highest efficiency value for a typical single-vane pump in a best-specific speed range is around 70% efficiency. By comparison, Flygt N-Pumps deliver 80% or better - equating to 15% less power consumption.

In several installations where clogging of the conventional pump was an issue, the power saving was as great as 50%.

Choosing the optimum pump is further simplified through the use of WebFLYPS, ITT Water & Wastewater's dedicated pump selection software.



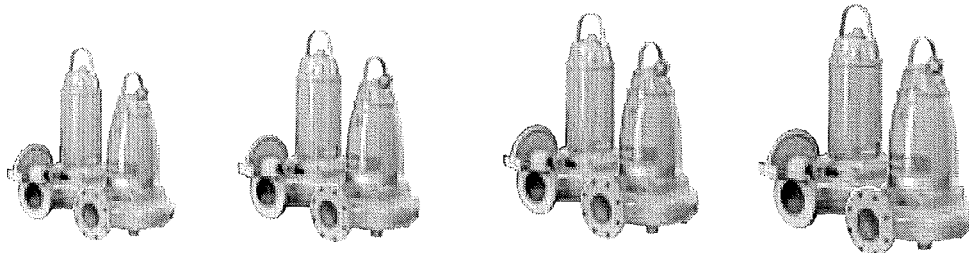




*Demonstrating the pumping performance of the New Generation Flygt N-Pumps*

## Flygt N-pumps

Model	3153	3171	3202	3301
<b>Rating</b>	50Hz, 7.5-15kW 60Hz, 12-23.5hp	50Hz, 13-22kW 60Hz, 20-35hp	50Hz, 22-45kW 60Hz, 35-75hp	50Hz, 45-70kW 60Hz, 75-110hp
<b>Discharge</b>	75 mm/3" 100 mm/4" 150 mm/6" 200 mm/8" 250 mm/10"	100 mm/3" 100 mm/4" 150 mm/6" 250 mm/10"	150 mm/6" 200 mm/8" 300 mm/12"	150 mm/6" 200 mm/8" 250 mm/10" 300 mm/12" 350 mm/14"



# Product quality means attention to details

## **Cable entry**

The cable entrance is designed to incorporate both a seal and a strain relief function.

## **Cooling system**

In normal applications the surrounding liquid cools the pump. In more demanding applications, or when dry installed, all pumps can be provided with an internal closed cooling system. The coolant is circulated around the stator housing by an integrated pump.

## **Seal wear protection**

Spin-out™ is a patented design that protects the outer seal by expelling abrasive particles from the seal chamber.

## **International standards approvals**

All pumps are tested and approved in accordance with national and international standards (IEC 34-1, CSA). They are also available in explosion-proof versions - Factory Mutual and European Norm (FM and EN) approvals.

## **Monitoring**

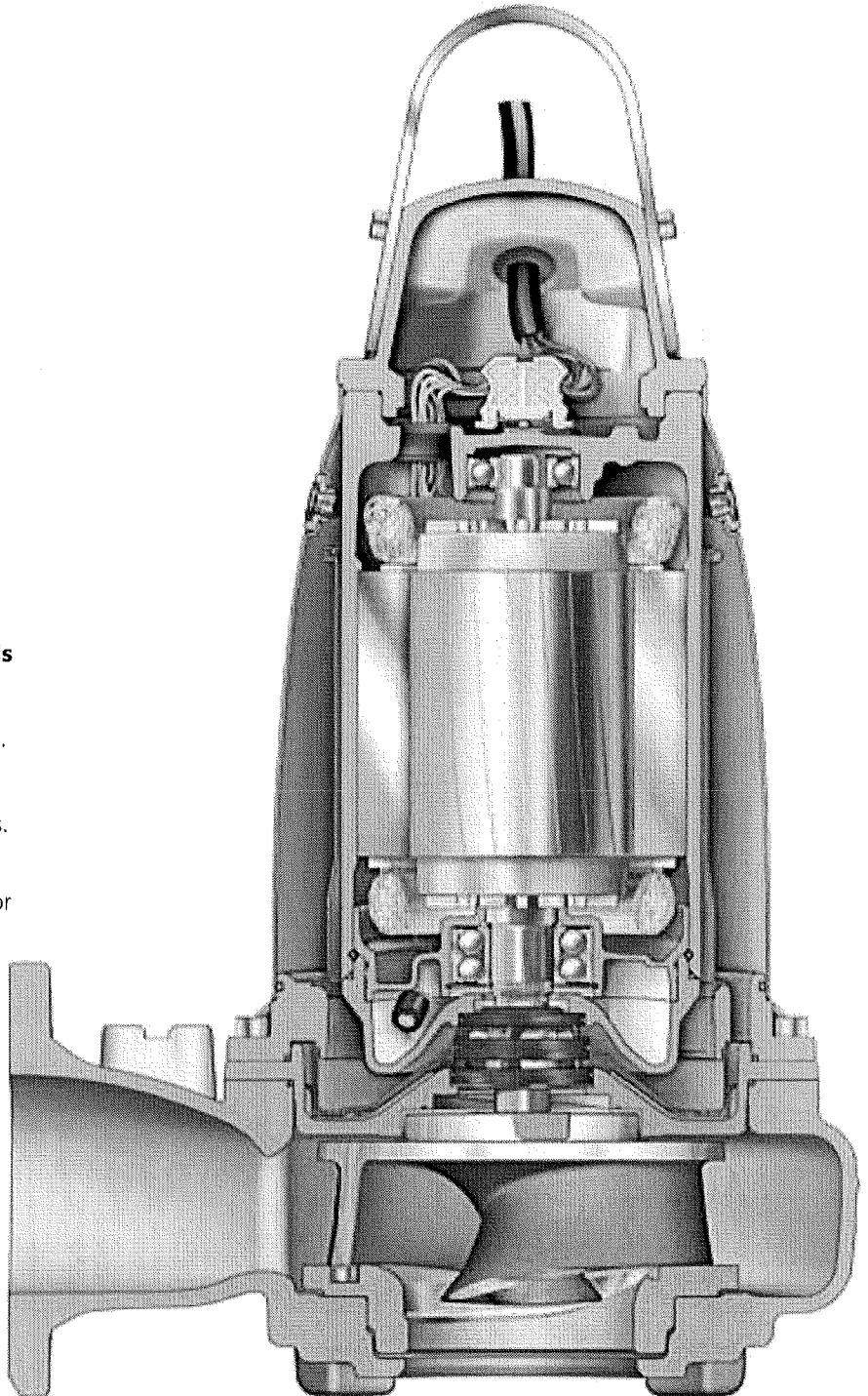
Thermal sensors embedded in the stator windings help prevent overheating. The inspection chamber is equipped with a leakage sensor.

## **Long life bearings**

Bearings in all Flygt pumps have been designed to provide a minimum 50,000 hour service life.

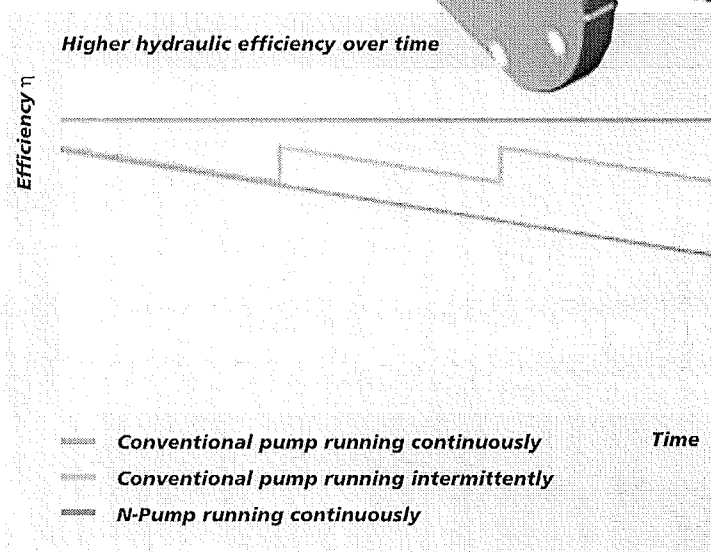
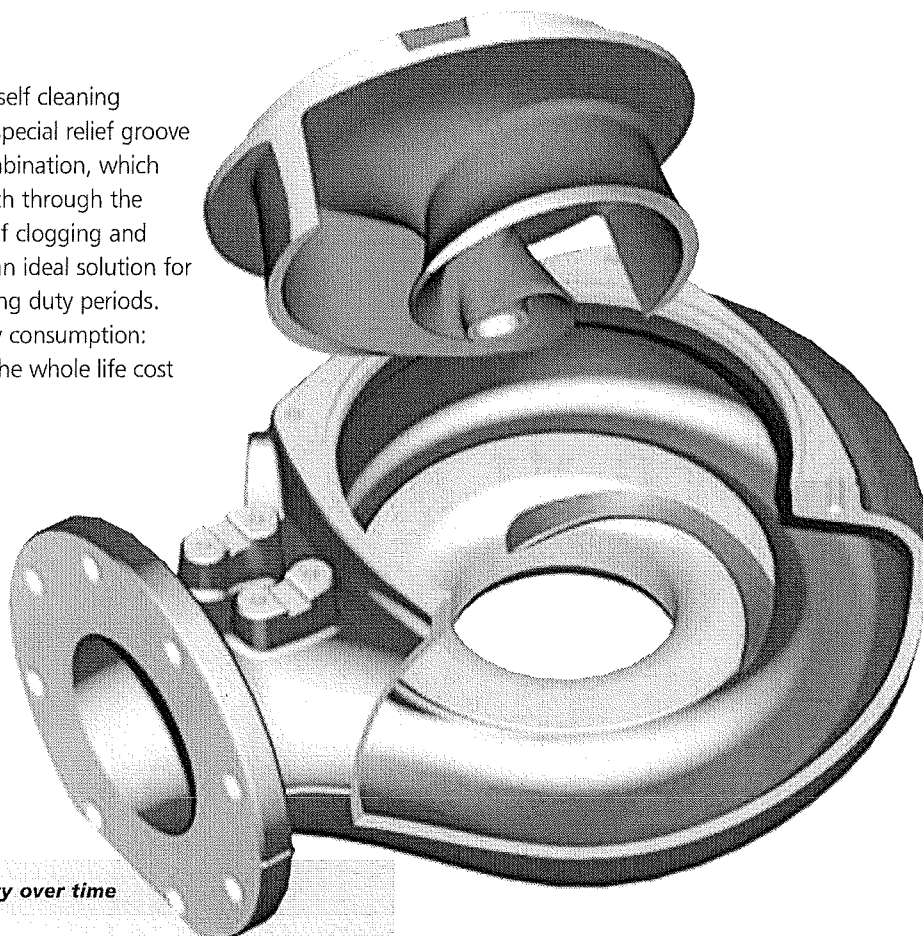
## **Inspection Chamber**

A separate inspection chamber, below the bearings, further increases operational reliability. The built-in sensor gives an early alert of any fluid build-up and allows for simple checking and maintenance.



# Sustained higher hydraulic efficiency

The revolutionary design of the self cleaning impeller is complemented by a special relief groove in the volute. This patented combination, which provides a self-cleaning flow path through the pump, greatly reduces the risk of clogging and makes the Flygt N-Pump series an ideal solution for high-efficiency pumping over long duty periods. That means lower overall energy consumption: a significant factor in reducing the whole life cost of your pumping operation.



The red line in the graph shows how the efficiency decreases when a conventional wastewater pump in continuous operation gets clogged.

The green line shows how a conventional wastewater pump that runs intermittently also has a generally low efficiency due to clogging. Temporary efficiency gains may be achieved through back flushing of the pump.

The blue line shows the Flygt N-Pump.

# Quality engineered for longer life

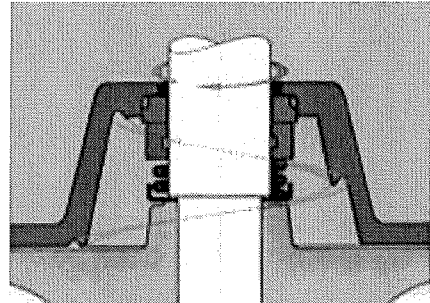
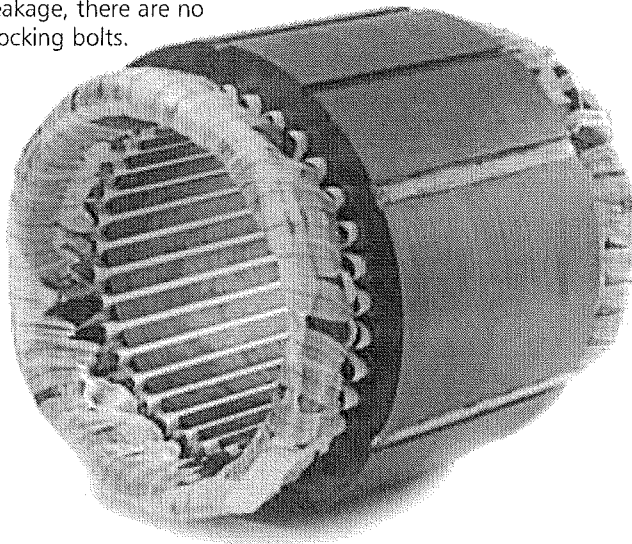
## New motor design

Rather than using standard, off-the-shelf motors, ITT Water & Wastewater has always manufactured its own units. Each one is specifically designed and produced for safe, reliable operation in submersible applications. Designing our own motors also allows us to build-in wide margins of safety for a long and trouble-free service life.

All motors in the new generation Flygt N-Pumps are squirrel cage induction units. Stator windings are trickle impregnated in resin (Class H insulation) and rated at 180°C (355°F), allowing for up to 30 starts per hour. However, since the maximum temperature rise does not exceed 80°C (176°F), this prolongs the operational life of the motor winding. In addition, thermal contacts are rated to 140°C (284°F) to prevent unnecessary tripping.

The new trickle impregnation with resin gives excellent insulation with less risk of air pockets. Rotor losses have been considerably reduced and heat generation is concentrated around the stator, which is easier to cool than the rotor. This also means less heat on the bearings.

The stator is heat-shrink fitted in the housing for superior heat transfer, and locked against rotation for perfect alignment with the rotor assembly. As a further measure of protection against leakage, there are no external locking bolts.

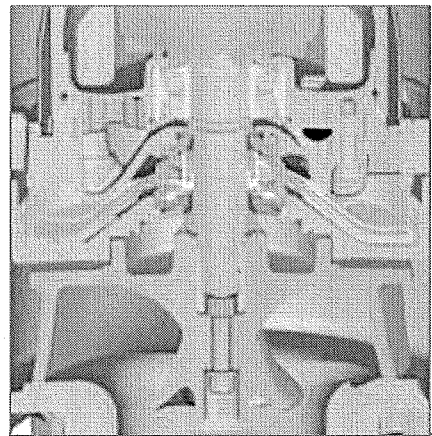


## Seal wear protection

Spin-out™ is a patented design that protects the outer seal by expelling abrasive particles from the seal chamber. As an integral part of the cast-iron housing, Spin-out is as simple as it is effective.

## Deflection-proof shaft

A short overhang of the shaft virtually eliminates shaft deflection. This results in significantly increased seal and bearing life, low vibration and quiet operation.

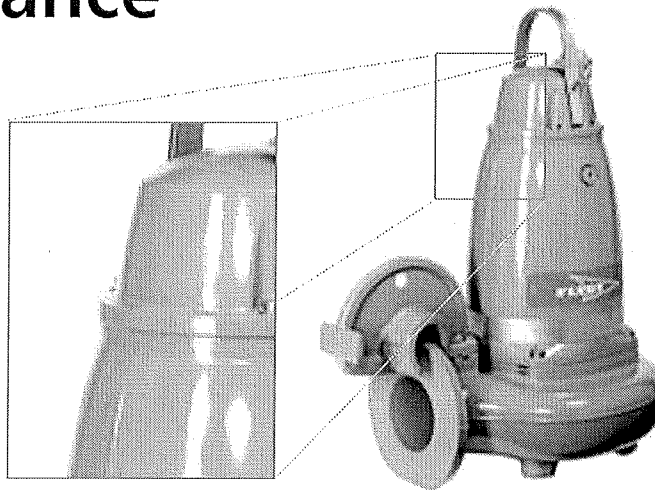


# Easier service and maintenance

The new generation Flygt N-Pumps feature numerous advanced technical solutions which together help to minimize the risk of downtime, and reduce the overall costs of your pumping operation.

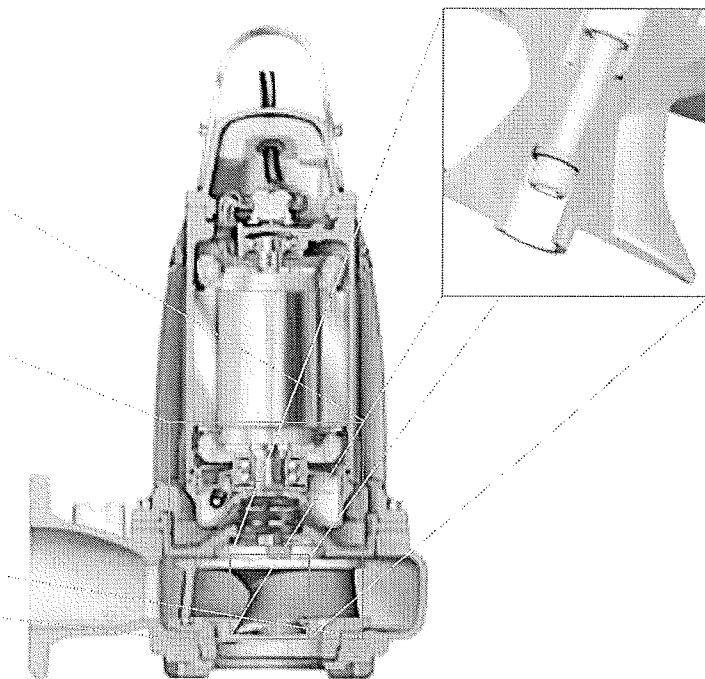
**An inspection chamber** between the seal unit and the bearings helps increase operational reliability, and allows for rapid spot checks and maintenance. A built-in sensor provides an early warning of any fluid build-up in the case of a seal failure, thus reducing the risk of expensive repair work.

**The impeller fastener** is a patent pending design, making the tasks of removing, trimming and mounting the impeller much simpler and faster.



**Smoother, rounder design** of the exterior casing keeps the pump cleaner; an increasingly important health and safety factor when servicing. Fewer external screws also make it easier to disassemble and re-assemble the pump.

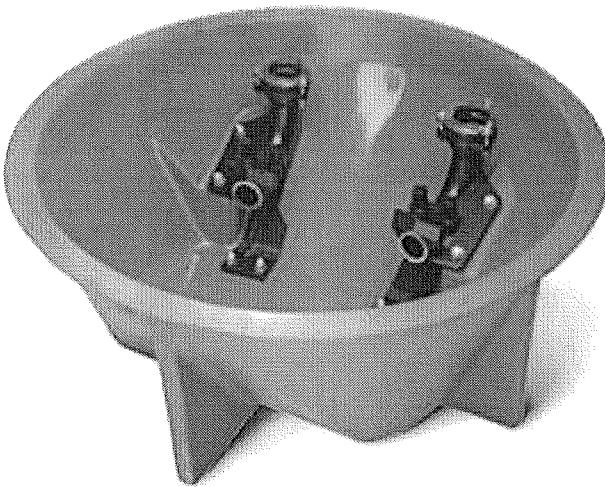
**The Plug-in™ seal unit** provides a perfect fit and faster, simpler replacement. The design also protects the seal surfaces during disassembly and mounting.





# Keeping your station in top form

Supplying our customers with problem-free solutions is our goal at ITT Water & Wastewater - and that means more than simply supplying the correct pump for your particular application. The following are examples of some of the ancillary equipment and systems which we can supply as aids to improving the all-round efficiency of your operation.



## The sump designed to clean itself

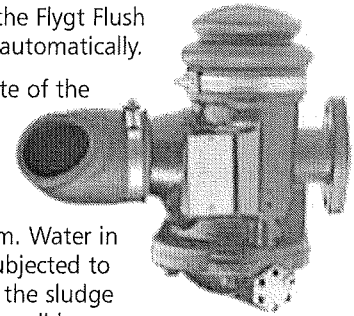
The unique design of The Optimal Pump station sump, with its integrated discharge connections, is an ideal cost-efficient solution for new stations and retro-fitting older stations. The sump has been hydraulically optimized to improve the flow over the sump floor during pumping. The result: increased turbulence, causing resuspension of settled solids and the entrainment of floating debris, which can then be pumped away during the operating cycle.

Special discharge connections are available in 100mm/4" and 150mm/6" sizes for NP3153 and NP3171.

## Flygt Flush valve: the automatic desludger

Developed specifically to be fitted to all standard Flygt submersible pumps, the Flygt Flush Valve operates completely automatically.

Attached easily to the volute of the pump, the valve is open at the start of each pumping cycle and water is forced through the valve in a powerful jet flushing stream. Water in the sump is immediately subjected to intense turbulence, and all the sludge deposits, as well as floating solids, are re-suspended before being pumped out. The valve closes automatically after approximately 20 seconds, and reopens again after pump stop, ready for the next pumping cycle.



## Flygt APF: automatic cleaning up to 40 times a day

Flygt APF is the maintenance-free control system that ensures clean stations even when you're dealing with the most heavily-contaminated wastewater.

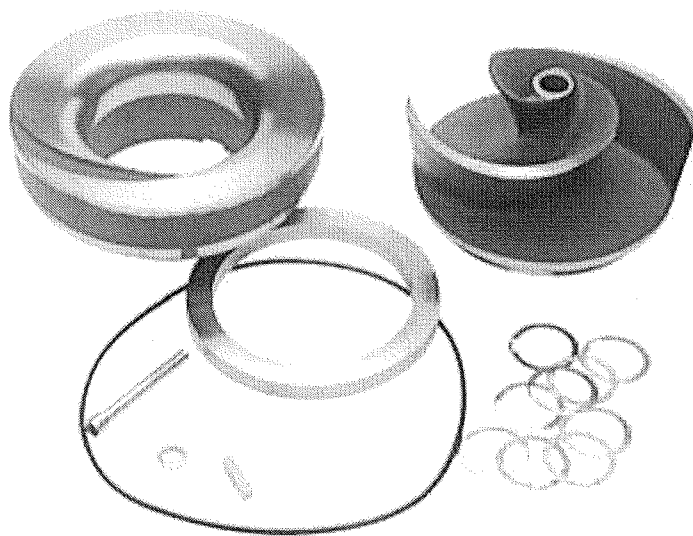
The Flygt APF is simply connected to the main control system, which it overrides during cleaning cycles by operating the pumps down to the level at which air starts to be drawn into the pump.

At this level, controlled turbulence and maximum velocities cause any solids, which have settled on

the sump floor, to be drawn into the pump together with any debris floating on the surface. The unit can be programmed to operate up to 40 times a day.



# Upgrading and servicing



ITT Water & Wastewater's design philosophy has always been to build equipment that gives you maximum return for your investment: and that means designing pumps for a long service life with minimum downtime.

If you already operate an installation with Flygt C-Pumps, the Flygt N-Pump upgrade kit gives you an opportunity to further extend the operational life of your equipment and gain the superior pumping efficiencies of the N-Pump range.

Each kit contains everything you need to upgrade your existing Flygt pumps to N-Pump standard, and there's a kit available for most Flygt C-Pump models (please check with your representative which models apply). Kits are easy to install and fully supported by the ITT Water & Wastewater Service Network.

The upgrade kit allows you to:

- Cut the cost of regular and emergency maintenance by reducing the risk of clogging
- Boost the operational efficiency of your existing equipment
- Improve the return on your original investment

## World-wide service network

No two pumping stations and systems will be alike, so the level of maintenance and support that you require from your service partner will differ according to your particular situation. With ITT Water & Wastewater, you can choose the type of support package that precisely fits your needs.

From simply supplying pumps to your specifications, to full service assistance on system planning, design, construction, implementation, operation or maintenance: Our total service concept means that you get the service you need, on your terms.

## 15-year spare parts guarantee

We guarantee availability of spare parts for 15 years after we stop production of a pump model. This is just one of the ways in which ITT Water & Wastewater guarantees its long-term commitment to customers.





### What can ITT Water & Wastewater do for you?

Integrated solutions for fluid handling are offered by ITT Water & Wastewater as a world leader in transport and treatment of wastewater. We provide a complete range of water, wastewater and drainage pumps, equipment for monitoring and control, units for primary and secondary biological treatment, products for filtration and disinfection, and related services. ITT Water & Wastewater, headquartered in Sweden, operates in some 140 countries across the world, with own plants in Europe, China and North and South America. The company is wholly owned by the ITT Corporation of White Plains, New York, supplier of advanced technology products and services.

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