

Goodwin

SUBMERSIBLE PUMPS



NUMBER ONE
FOR RELIABILITY, STRENGTH & ENDURANCE





Submersible Pumps

Goodwin submersible pumps have been manufactured since 1982 and are recognised as market leaders in terms of performance and reliability. The pumps have been continually developed over four decades to enhance strength and endurance. Goodwin pumps deliver proven performance in the most demanding environments.

Applications

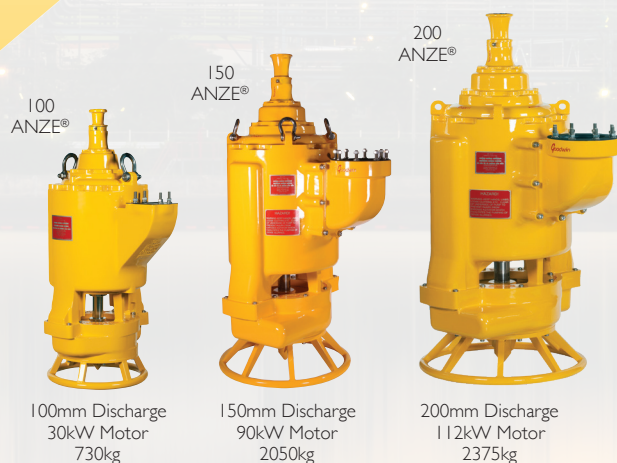
- Open pit mine dewatering
- Mine tailings recovery and reprocessing
- Minerals processing - separation, purification, concentration
- Power plant ash removal and cleaning
- Lagoon dredging and silt removal
- River water and dam desilting
- Harbour and dry-dock cleaning
- Steel slag transport
- Rolling mill scale and metal cutting swarf transport
- Sewage and waste transfer

Four Decades of Development

1982	First 100 ANZE Pump sold to UK coal mining industry
1992	Major redesign to improve reliability
1996	First sales in Africa to Copper, Gold and Platinum Mining
2005	Opening of Goodwin India
2009	Opening of Goodwin Bombas in Brazil
2013	Launch of 200 series pumps
2014	Opening of Goodwin Australia
2016	Opening of Goodwin Africa
2016	Launch of the 100 DWHH pump
2017	Launch of the 150 series pumps
2018	Launch of the Acid Resistant SDSS pump
2019	Launch of the 150 DWHH pump

Comprehensive range of Submersible Pumps for Demanding Applications

Slurry Pumps

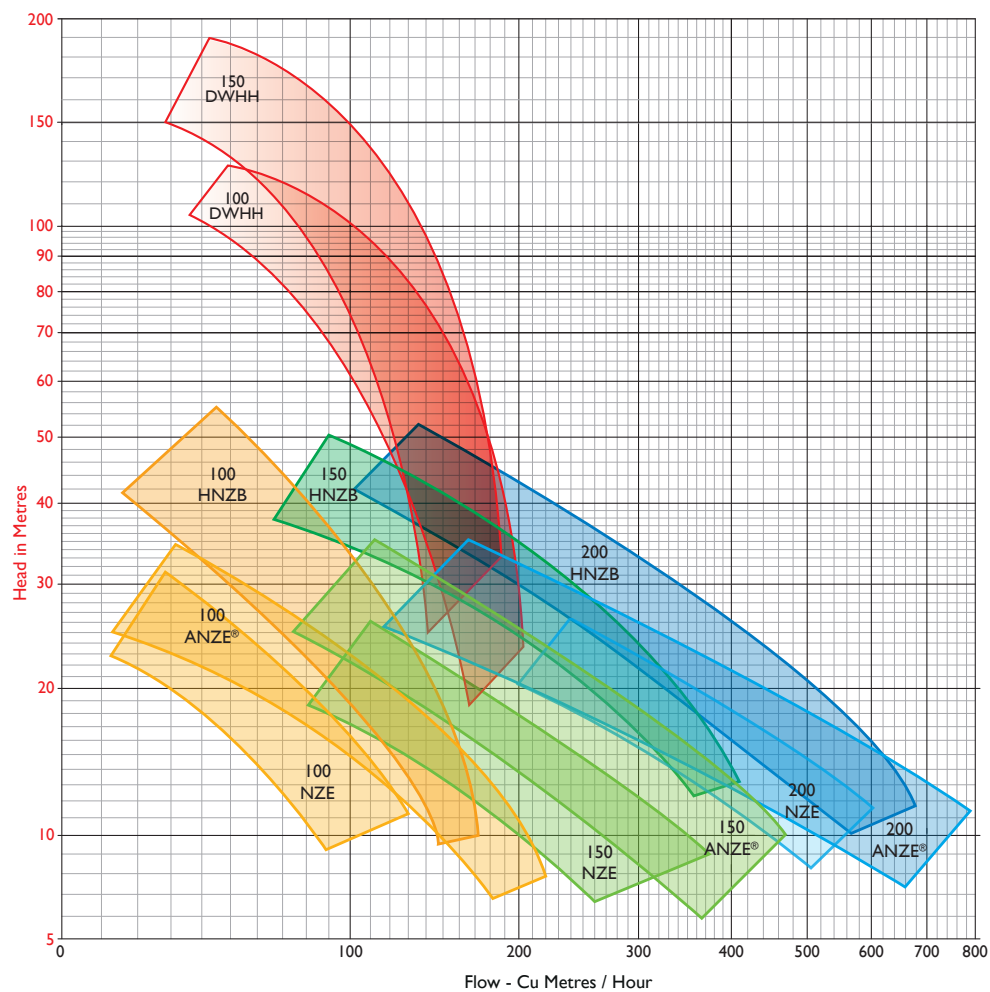


Dirty Water High Head Pumps



Acid Resistant Pumps





	100 NZE	100 ANZE®	100 HNZB	150 NZE	150 ANZE®	150 HNZB	200 NZE	200 ANZE®	200 HNZB	100 DWHH	150 DWHH	100 SDSS ANZE®
Max solid content (by weight)	65%	65%	25%	65%	65%	40%	65%	65%	40%	10%	10%	65%
Max slurry specific gravity kg/l	2.8	2.8	1.5	2.5	2.1	1.5	2.5	2.1	1.5	1.1	1.1	2.8
Max particle size	25mm	32mm	12mm	54mm	45mm	30mm	76mm	76mm	40mm	10mm	10mm	32mm
Max slurry temperature	90°C	90°C	90°C	90°C	90°C	90°C	90°C	90°C	90°C	90°C	90°C	90°C
Max flow m³/h	137	220	160	380	500	460	600	800	800	195	195	220
Max head (pressure bar)	33m (3.2 bar)	38m (3.7 bar)	60m (5.9 bar)	25m (2.4 bar)	38m (3.7 bar)	53m (5.2 bar)	27m (2.6 bar)	40m (3.9 bar)	53m (5.2 bar)	130m (12.8 bar)	190m (18.6 bar)	38m (3.7 bar)
Max submergence depth*	28m	28m	28m	28m	28m	28m	28m	28m	28m	28m	28m	28m
Minimum sump size based on pump dimensions** (length x width x depth)	(l) 2m (w) 1.5m (d) 2m	(l) 2m (w) 1.5m (d) 2m	(l) 2m (w) 1.5m (d) 2m	(l) 2.5m (w) 2m (d) 2.5m	(l) 2.5m (w) 2m (d) 2.5m	(l) 2.5m (w) 2m (d) 2.5m	(l) 3m (w) 2.5m (d) 3m	(l) 3m (w) 2.5m (d) 3m	(l) 3m (w) 2.5m (d) 3m	(l) 2.5m (w) 2m (d) 2.5m	(l) 2.5m (w) 2m (d) 2.5m	(l) 2m (w) 1.5m (d) 2m
Sump dead zone** (bottom)	0.35m	0.35m	0.35m	0.4m	0.4m	0.4m	0.45m	0.45m	0.45m	0.42m	0.42m	0.35m

* 28m as standard, can be deeper if required

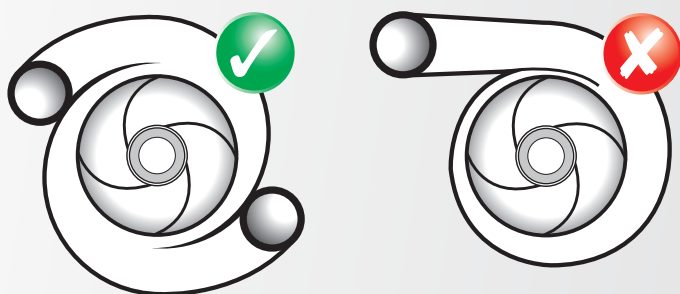
** See page 21+22 for more information

All pump designs and information is subject to change, upgrade and revisions

Features that make Goodwin Number One

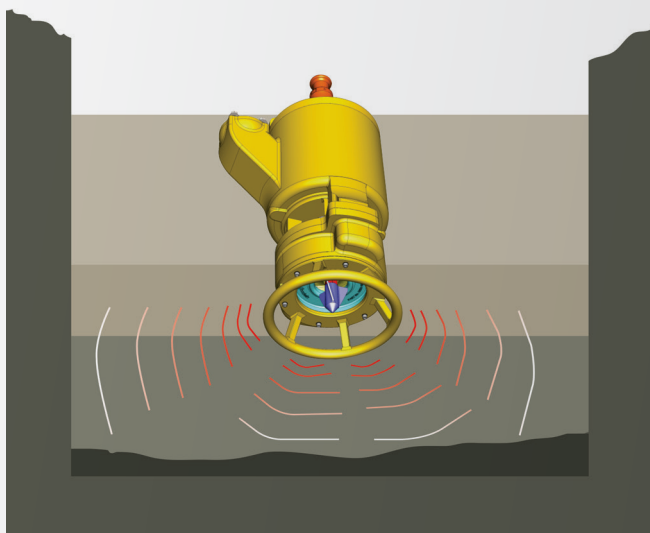
Goodwin heavy duty slurry pumps are designed with outstanding features that guarantee exceptional performance. Precision engineering and robust construction gives reliable operation in the most demanding conditions.

Twin Volute Casing



Goodwin use a Twin Volute casing to balance the load on the shaft when pumping variable density slurry. A traditional single volute design can put uneven loads on the rotating elements of the pump leading to premature failure in service.

Inducer Effect



The Goodwin Inducer sends hydrodynamic shock waves below the pump which makes settled solids start to flow.



Removable Discharge Elbow

The 150 and 200mm Goodwin Pumps are supplied with a removable and replaceable discharge elbow made from precipitation hardened Stainless Steel.

Non-Pressurised Mechanical Seal

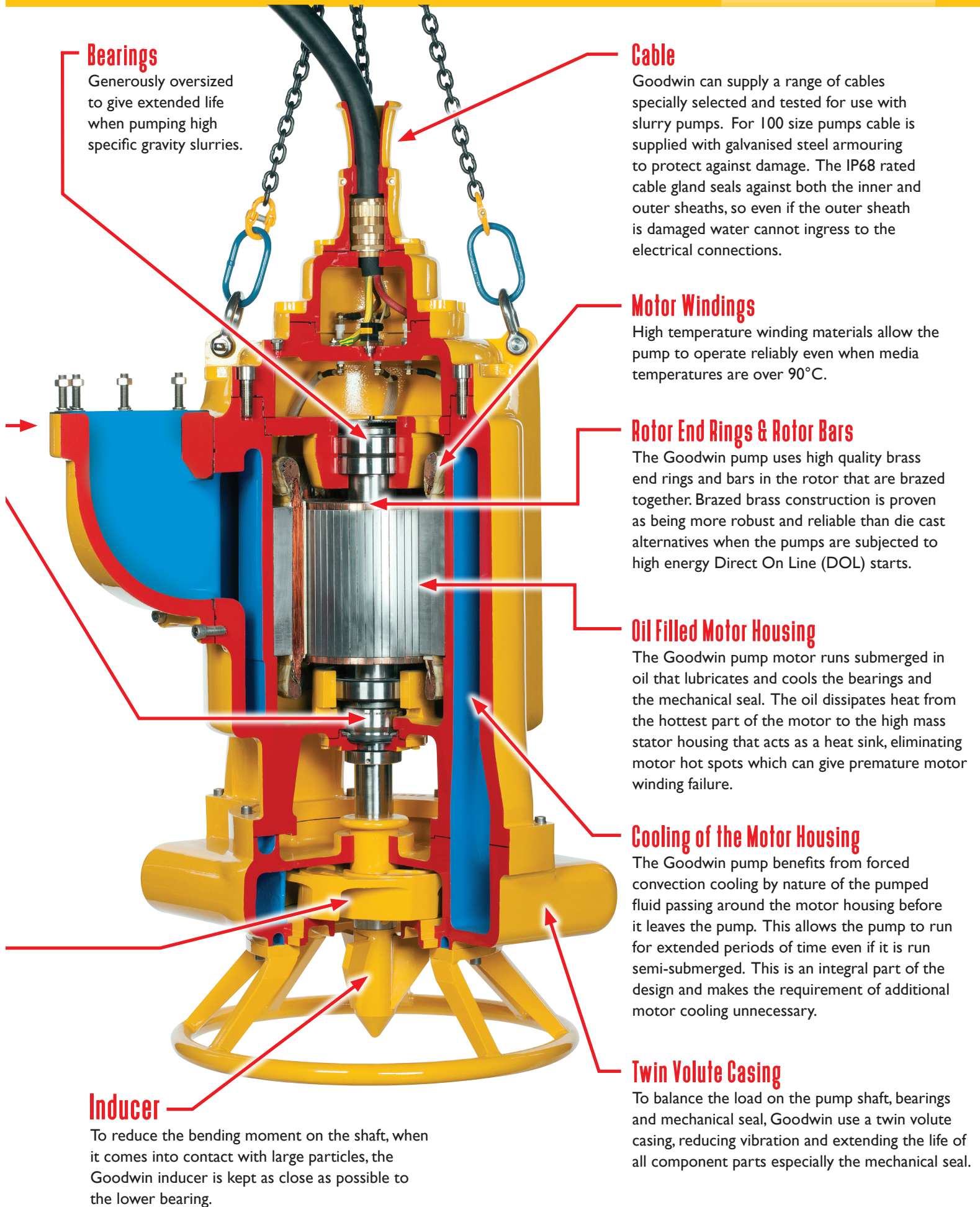
Suitable for submergence depth up to 28 metres as standard. The Goodwin mechanical seal is only subjected to the pressure from the submergence depth of the pump which generally is only a few metres of head and not the discharge pressure of the product. This greatly reduces the chance of fluid ingress into the motor itself and the destructive consequences which can result. The seal is positioned directly below the lower bearing to give it maximum support and protection from vibration.

Heavy Duty Wet-End Parts

The wet end of all Goodwin slurry pumps are made of NiHard alloy. For very abrasive applications Goodwin can offer tungsten carbide coated impellers, inducers and wear plates as it is possible to coat 100% of the rotating surface exposed to the slurry and thus provide the customer with excellent component life. Closed vane impeller designs have surfaces which can't be tungsten carbide coated. 150 and 200 size slurry pumps have tungsten carbide coated wet end parts as standard. For 100 size pumps, coating is optional.

Open Vane Impeller

This feature assists the breakdown of large particles in the impeller that might ultimately lead to a blocked pump. There is little if any chance of the impeller becoming blocked as opposed to closed vane impellers which are often blocked and tend to stay blocked.



Bearings

Generously oversized to give extended life when pumping high specific gravity slurries.

Cable

Goodwin can supply a range of cables specially selected and tested for use with slurry pumps. For 100 size pumps cable is supplied with galvanised steel armouring to protect against damage. The IP68 rated cable gland seals against both the inner and outer sheaths, so even if the outer sheath is damaged water cannot ingress to the electrical connections.

Motor Windings

High temperature winding materials allow the pump to operate reliably even when media temperatures are over 90°C.

Rotor End Rings & Rotor Bars

The Goodwin pump uses high quality brass end rings and bars in the rotor that are brazed together. Brazed brass construction is proven as being more robust and reliable than die cast alternatives when the pumps are subjected to high energy Direct On Line (DOL) starts.

Oil Filled Motor Housing

The Goodwin pump motor runs submerged in oil that lubricates and cools the bearings and the mechanical seal. The oil dissipates heat from the hottest part of the motor to the high mass stator housing that acts as a heat sink, eliminating motor hot spots which can give premature motor winding failure.

Cooling of the Motor Housing

The Goodwin pump benefits from forced convection cooling by nature of the pumped fluid passing around the motor housing before it leaves the pump. This allows the pump to run for extended periods of time even if it is run semi-submerged. This is an integral part of the design and makes the requirement of additional motor cooling unnecessary.

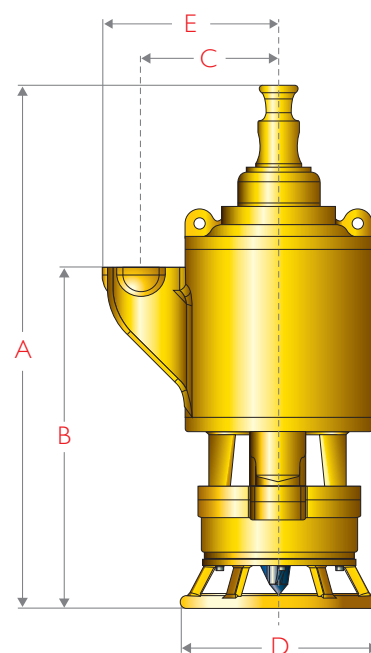
Twin Volute Casing

To balance the load on the pump shaft, bearings and mechanical seal, Goodwin use a twin volute casing, reducing vibration and extending the life of all component parts especially the mechanical seal.

Inducer

To reduce the bending moment on the shaft, when it comes into contact with large particles, the Goodwin inducer is kept as close as possible to the lower bearing.

SUBMERSIBLE SLURRY PUMPS



Weights & Dimensions

Pump Size	Power kW	Speed RPM	Weight kg	Dimensions					Outlet Dia. mm
				A	B	C	D	E	
100NZE	22/30	1450	710	1370	915	368	500	475	100
100ANZE®	30	1450	730	1375	920	368	527	475	100
100HNZB	30	1450	770	1370	915	368	657	475	100
150NZE	90	960	2020	1948	1270	545	857	664	150
150ANZE®	90	960	2050	1938	1260	545	937	664	150
150HNZB	90	960	2050	1987	1309	545	1057	664	150
200NZE	112	960	2300	1970	1323	596	857	771	200
200ANZE®	112	960	2375	1970	1323	596	937	771	200
200HNZB	112	960	2510	2020	1373	596	1057	771	200

All pump designs and information is subject to upgrade and revision.

Electrical Data 100mm



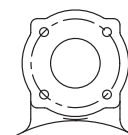
Volts	Full Load Current	Inrush Current Direct on line	No Load Current	Recommended Over Current Protection (A)
30kW, 1450RPM - 100mm NZE, ANZE® & HNZB				
380 V	58 A	300 A	14 A	100 A
415 V	54 A	280 A	13 A	100 A
525 V	42 A	220 A	10 A	100 A
660 V	33 A	170 A	8 A	80 A
1000 V	22 A	120 A	6 A	50 A

30kW, 1450RPM - 100mm NZE, ANZE® & HNZB

380 V	41 A	215 A	11 A	80 A
415 V	38 A	200 A	10 A	80 A
525 V	30 A	155 A	8 A	60 A
600 V	23 A	120 A	6 A	60 A
1000 V	19 A	100 A	5 A	50 A

22kW, 1450RPM - 100mm NZE Only

Outlet Flange Data



100mm Pump
4" Table 'D'
(Fits 100mm PN10)
M16*2.0P- 4 Places
ø179mm PCD

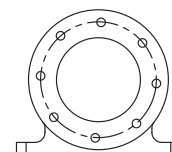
Electrical Data 150mm



Volts	Full Load Current	Inrush Current Soft Start*	No Load Current	Recommended Over Current Protection (A)
90kW, 960PM - 150mm NZE, ANZE® & HNZB				
380 V	171 A	600 A	40 A	350 A
415 V	160 A	560 A	38 A	350 A
525 V	128 A	450 A	30 A	300 A
660 V	97 A	335 A	23 A	300 A
1000 V	64 A	225 A	17 A	250 A

90kW, 960PM - 150mm NZE, ANZE® & HNZB

Outlet Flange Data



150mm Pump
150mm PN10
M20*2.5P
8 Places
ø240mm PCD

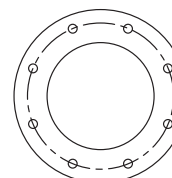
Electrical Data 200mm



Volts	Full Load Current	Inrush Current Soft Start*	No Load Current	Recommended Over Current Protection (A)
112kW, 960PM - 200mm NZE, ANZE® & HNZB				
380 V	210 A	735 A	52 A	400 A
415 V	190 A	665 A	48 A	400 A
525 V	150 A	530 A	39 A	350 A
660 V	120 A	420 A	30 A	300 A
1000 V	80 A	280 A	23 A	300 A

112kW, 960PM - 200mm NZE, ANZE® & HNZB

Outlet Flange Data

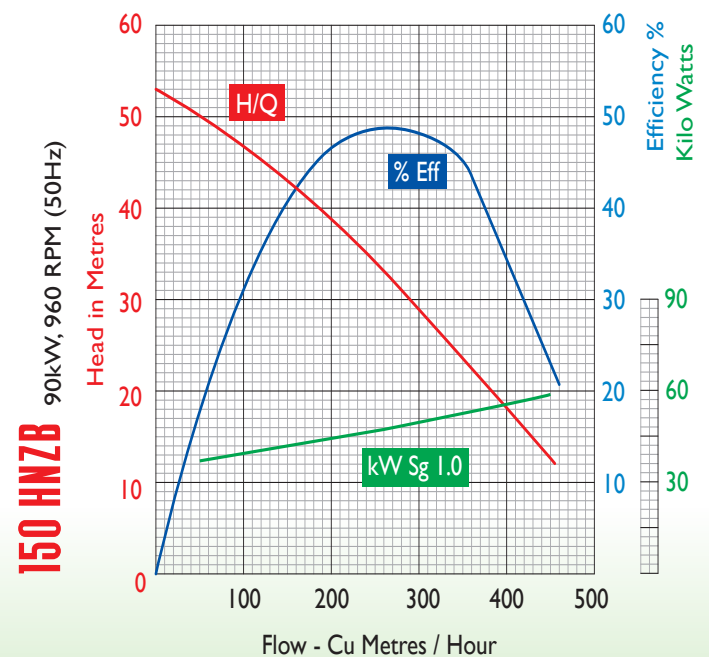
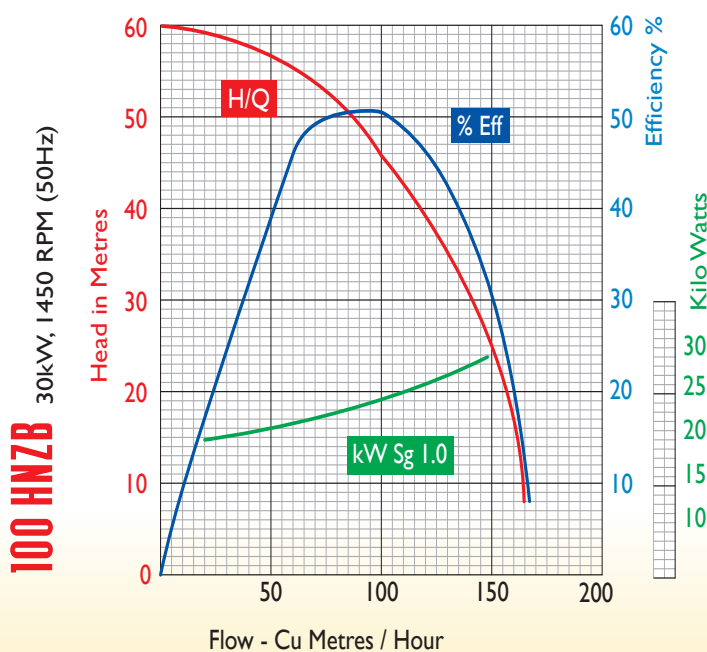
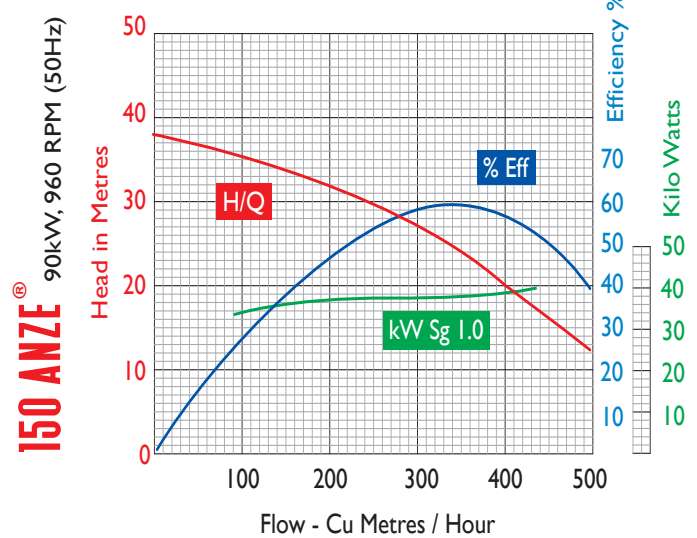
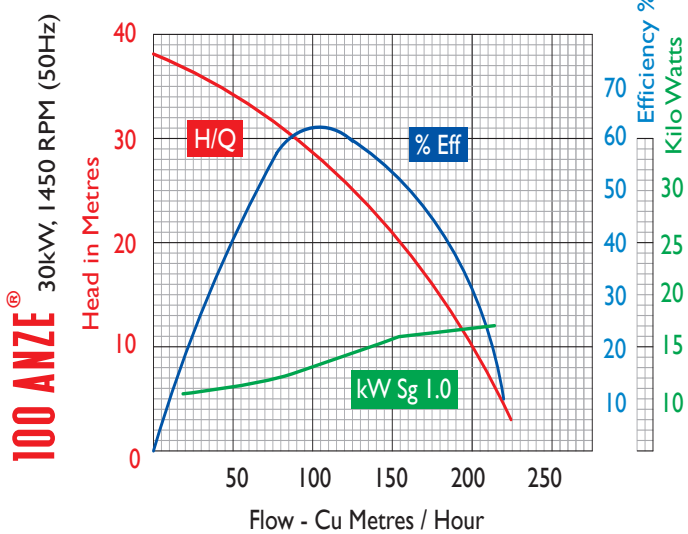
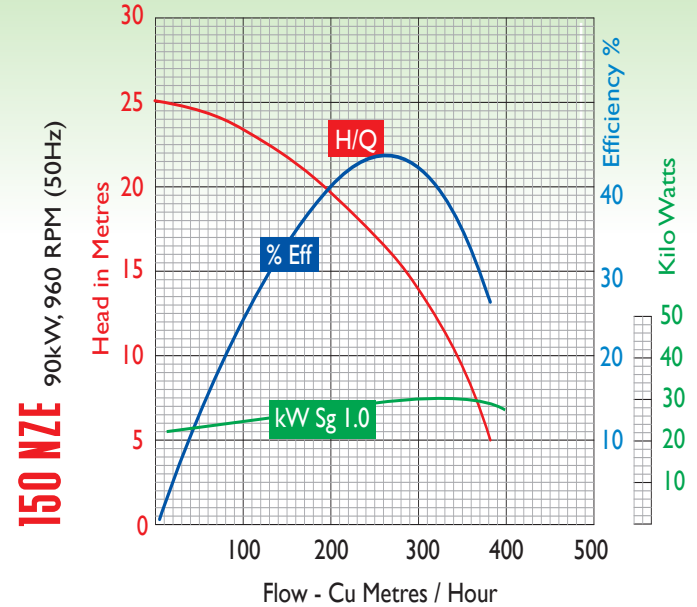
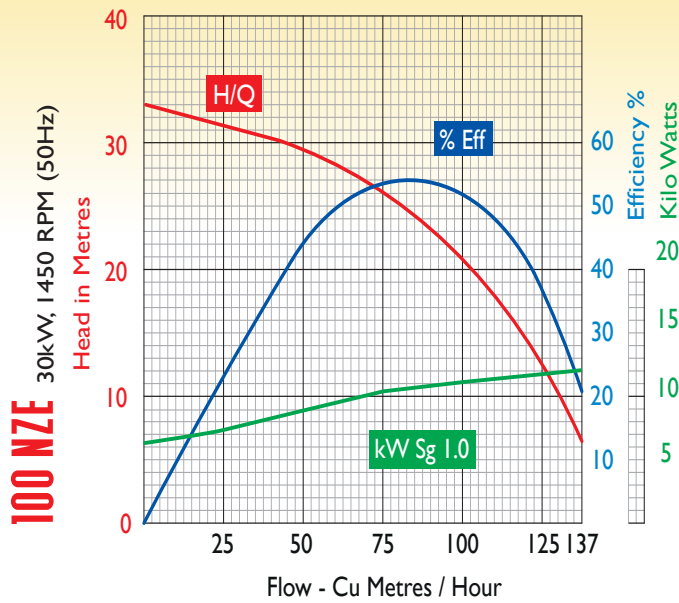


200mm Pump
200mm PN10
M20*2.5P
8 Places
ø295mm PCD

*150 and 200mm pumps are capable of DOL starts should it be necessary.

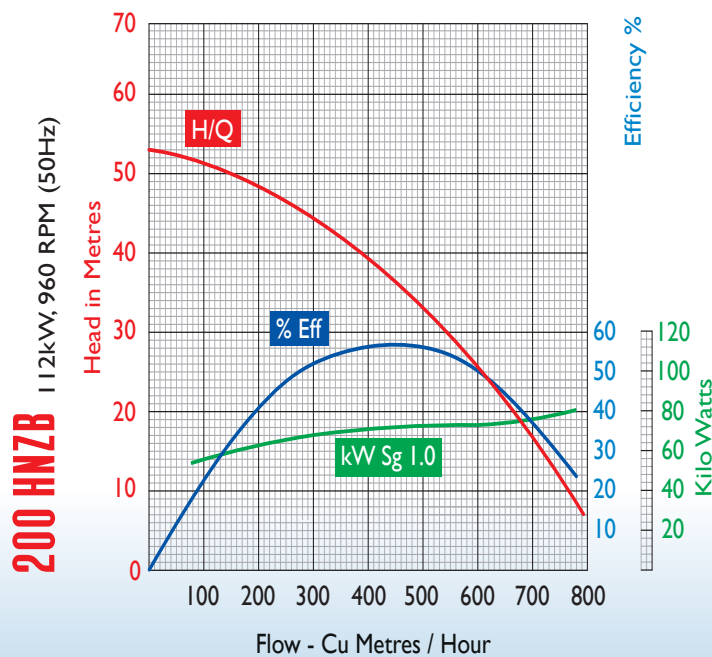
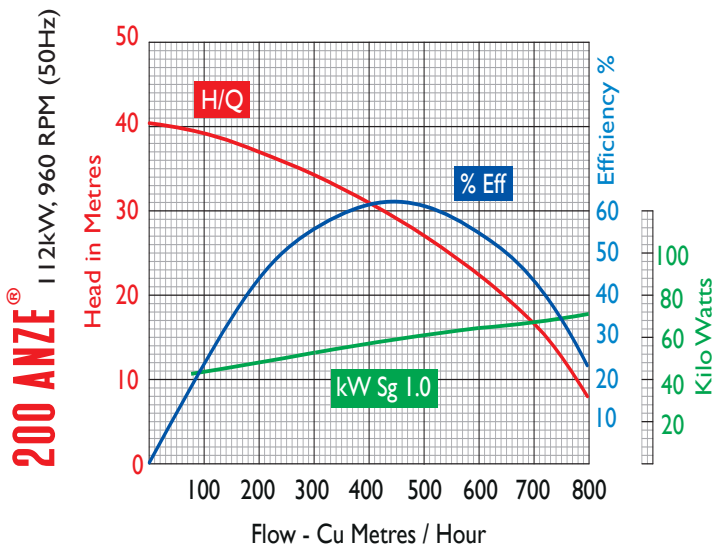
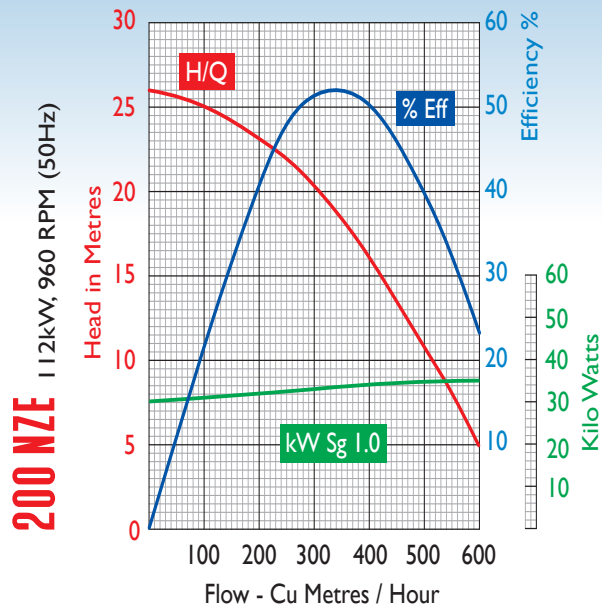
100mm Pump Curves

150mm Pump Curves



200mm Pump Curves

Goodwin



Max Solid Content
65%

Max Media Temperature
90°C

Max Submergence Depth
28m

High Head Dewatering Pumps

Goodwin DWHH (Dirty Water High Head) Submersible Pumps

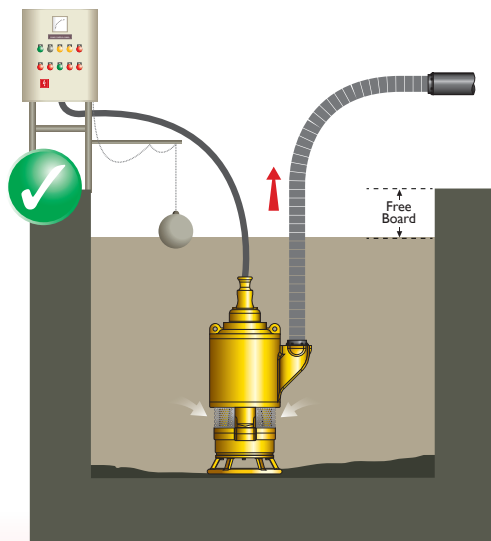
The Goodwin DWHH pump benefits from many of the Goodwin Submersible Slurry Pump unique advantages, making it one of the most versatile pumps in the world.

These features include forced convection cooling, oil filled motor, non-pressurised mechanical seal, twin volute casing, over-sized bearings and robust motor construction. This gives dry running capability for extended periods of time and reliable operation in media temperatures up to 90°C.

Many uses for the Goodwin DWHH pump include;

- High wall pumping (open pit) applications
- Construction of buildings, dams & harbour walls
- Long distance pumping applications (up to 4 km)
- Agriculture - irrigation water
- Mine dewatering
- Flood level control - industrial, municipal, mining & marine
- Emergency and environmental control

The Goodwin DWHH pump is a multiple stage, closed vane pump and runs at low rpm to make it very reliable. The Goodwin DWHH pump features a “Top Suction” inlet, which is protected by Stainless Steel strainers. These strainers prevent oversize particles from entering the pump, and thus preventing blockages.



Being a Top Suction pump, the DWHH is able to sit unsupported at the bottom of any sump



Max Solid Content
10%

Max Media Temperature
90°C

Max Discharge Pressure
13 bar 100 DWHH
19 bar 150 DWHH

Max Submergence Depth
28m

Goodwin DWHH - Technical Information

Electrical Data

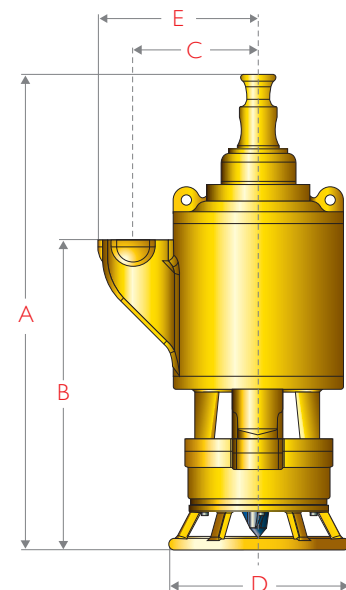
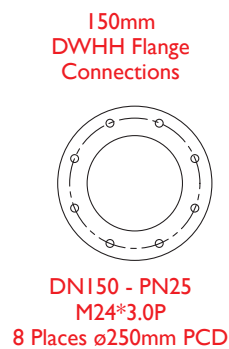
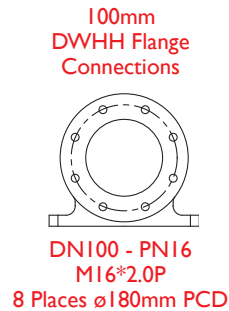
Volts	Full Load Current	Inrush Current Soft Start	No Load Current	Recommended Over Current Protection (A)
-------	-------------------	---------------------------	-----------------	---

90kW, 1450RPM - 100mm DWHH

380 V	165 A	578 A	39 A	350 A
415 V	156 A	546 A	37 A	350 A
525 V	124 A	434 A	29 A	300 A
660 V	94 A	329 A	22 A	300 A
1000 V	63 A	221 A	17 A	250 A

150kW, 1450RPM - 150mm DWHH

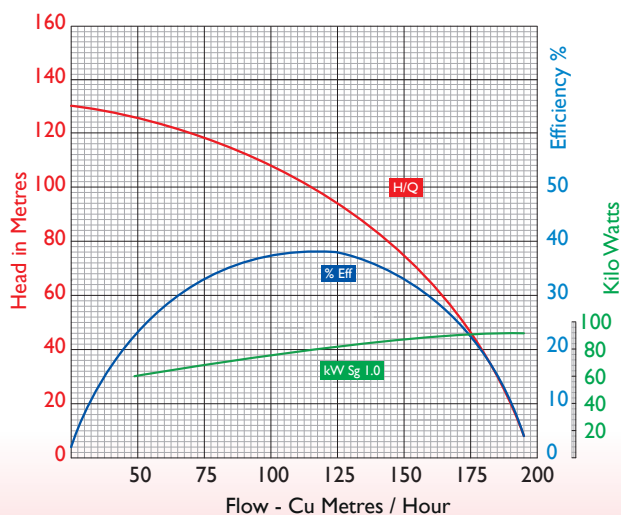
380 V	284 A	994 A	58 A	500 A
415 V	261 A	914 A	56 A	400 A
525 V	204 A	714 A	45 A	350 A
660 V	162 A	567 A	36 A	350 A
1000 V	106 A	371 A	28 A	300 A



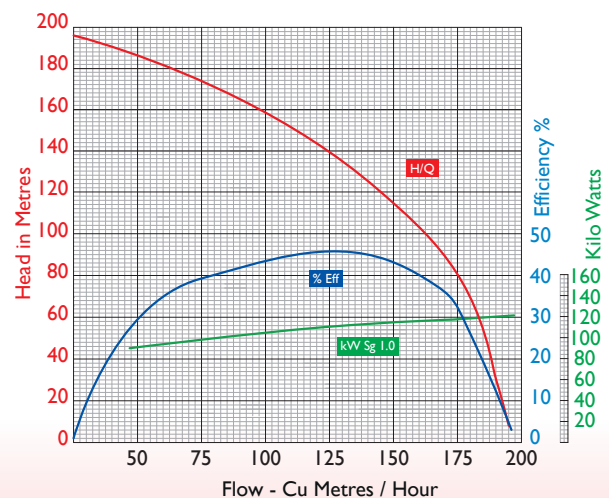
Weights & Dimensions

Pump Size	Power kW	Speed RPM	Weight kg	Dimensions					Outlet Dia. mm	Max Particle mm	Max Q m³/h	Max H m	Max Slurry Sg kg/l
				A	B	C	D	E					
100 DWHH	90	1450	1940	1898	1220	520	937	630	100	10	195	130	1.1
150 DWHH	150	1450	2750	2015	1368	597	937	747	150	10	195	190	1.1

100 DWHH 90kW, 1450 RPM (50Hz)



150 DWHH 150kW, 1450 RPM (50Hz)



SDSS (Super Duplex Stainless Steel)

Heavy Duty Super Duplex Stainless Steel Submersible Acid Resistant Slurry Pumps

Max Solid Content
65%

Max Media Temperature
90°C

Max Submergence Depth
28m



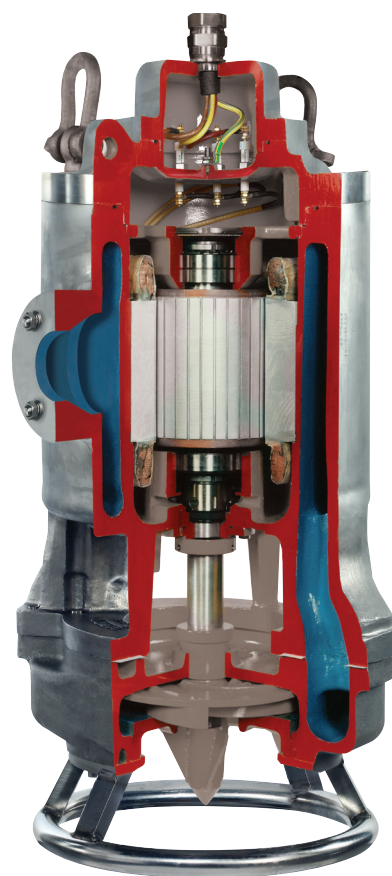
With our market leading design for dealing with heavy and abrasive slurries, by customer request we have developed a Super Duplex Stainless Steel (SDSS) variant of our internationally successful 100mm Submersible Slurry Pump specifically for acidic applications where there are no reliable alternatives.

The SDSS pump benefits from the same standard features of the Goodwin range of pumps

- A motor enclosure which eliminates electrical motor over heating and burnout.
- A motor designed to allow direct online starting even when the pump is embedded in settled solids.
- An integral inducer to re-suspend settled solids.
- A mechanical seal system which is not subjected to the pumped media pressure.
- A cable gland entry and motor configuration which keeps the terminal enclosure separate from the motor enclosure.

Max solid content (by weight)	65%
Max slurry specific gravity kg/l	2.8
Max particle size	32mm
Max slurry temperature	90°C
Max flow m³/h	220
Max head (pressure bar)	38m (3.7 bar)
Max submergence depth*	28m

* 28m as standard, can be deeper if required

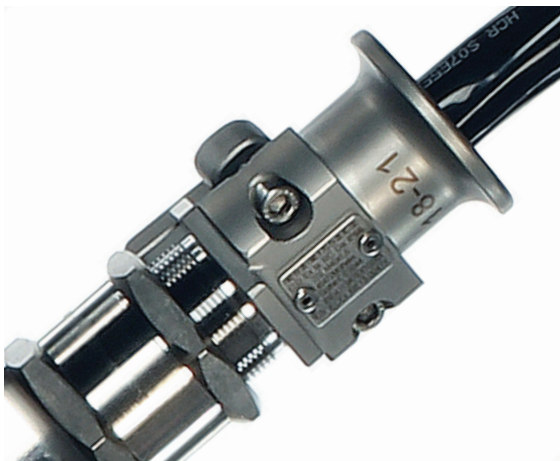
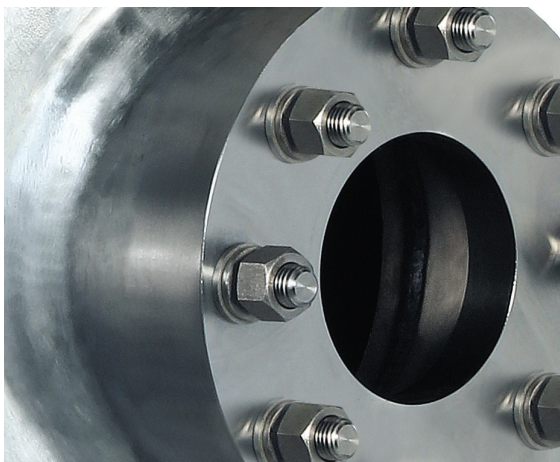
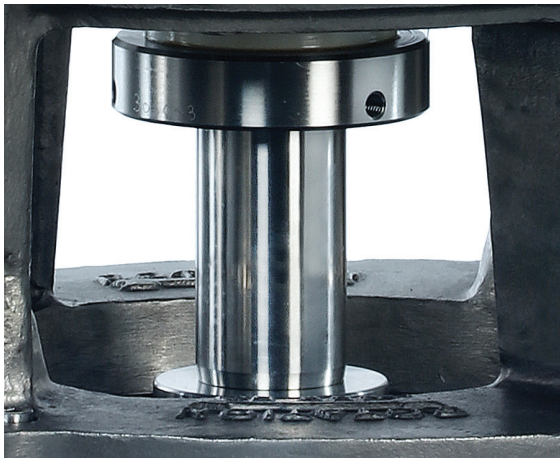


Goodwin Standard SDSS Construction

	Material	Pitting Resistance (PREn)
Pump Body	Super Duplex Stainless Steel	>40
Fasteners		
Pump Shaft		
Impeller	Cr, Mo, Co alloy with acid resistance and high hardness	Not applicable for this alloy
Inducer		
Wear Plate		
Cable	Fluorethylene propylene FEP	Both chemically and heat resistant
Elastomeric Seals	FEP Encapsulated Viton	Both chemically and heat resistant
Mechanical Seal	Fully Sintered Silicon Carbide	Both chemically and heat resistant
Other	Inconel 625	>45
Other	PTFE	Chemically Inert

As Goodwin manufacture these pumps - should there be any specific material requirements that your process requires; if our standard specification is not already exceeding your requirements, we can manufacture out of any alloy that is readably castable and machinable, should your requirement require different materials of construction.

SDSS (Super Duplex Stainless Steel)

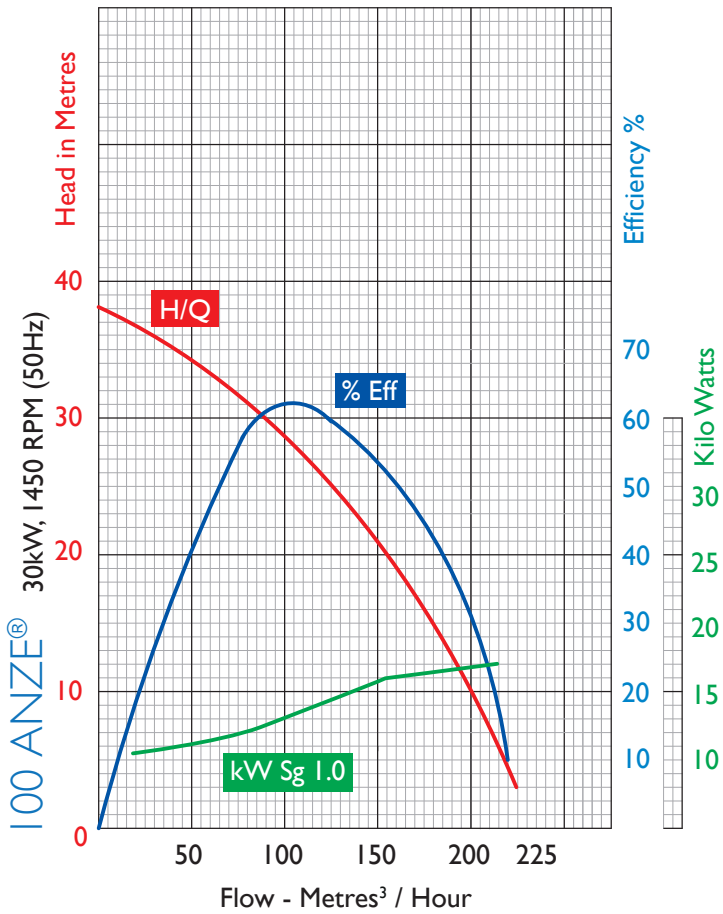


Electrical Data

Volts	Full Load Current	Inrush Current Direct on line	No Load Current	Recommended Over Current Protection (A)
-------	-------------------	-------------------------------	-----------------	---

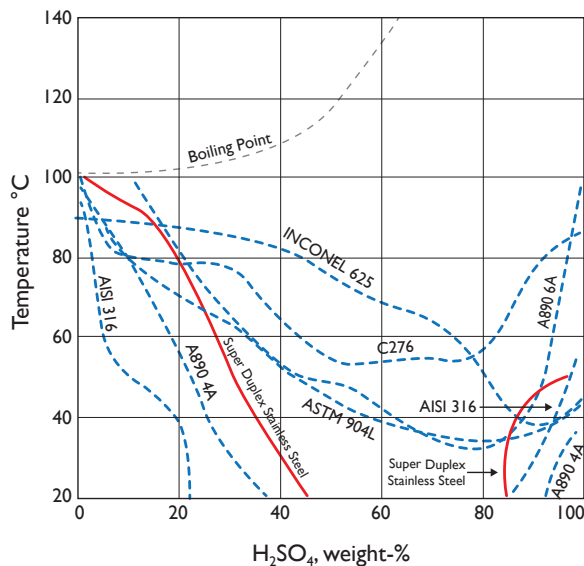
30kW, 1450RPM - 100mm ANZE®

380V	58 A	300 A	14 A	100 A
415V	54 A	280 A	13 A	100 A
525V	42 A	220 A	10 A	100 A
660V	33 A	170 A	8 A	80 A
1000V	22 A	120 A	6 A	50 A

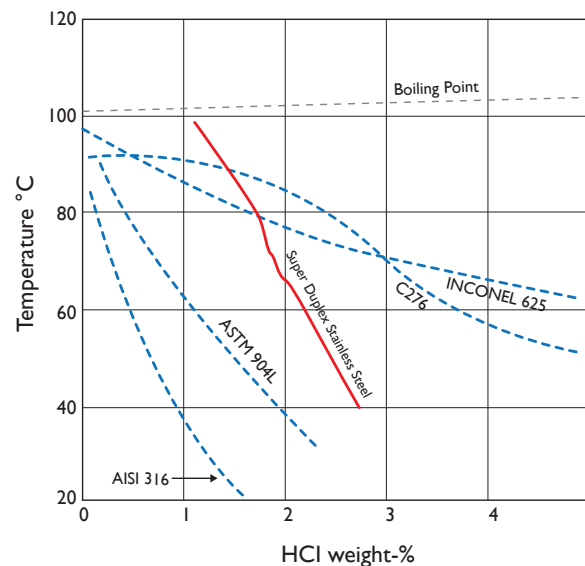


The material of construction is shown with a solid line. It offers good corrosion resistance against both Sulphuric and Hydrochloric Acids, as can be seen in the isocorrosion graphs below.

As this pump can handle slurry – material hardness needs to be taken into consideration as well as the chemical corrosion resistance to provide the best all round solution. Otherwise whilst being corrosion resistant the pump would wear out prematurely by erosion.



Isocorrosion diagram in naturally aerated sulphuric acid. The curves represent a corrosion rate of 0.1 mm/year (4 mpy) in a stagnant test solution.



Isocorrosion diagram in naturally aerated hydrochloric acid. The curves represent a corrosion rate of 0.1 mm/year (4 mpy) in a stagnant test solution.

	Chrome	Molybdenum	Nitrogen	PREn (Typical)	Hardness (HB)
Hastelloy C-276**	15	16	-	67.8	180
Inconel 625**	21.5	9	-	51	163
254 SMO	20	6.2	0.2	43.7	147
Super Duplex Stainless Steel*	25	4.1	0.3	43.3	241
904L	20	4.6	-	35	174
A890 Gr 4A	22	3	0.15	34.3	235
AISI 316	16.5	2	-	23.1	179
AISI 304	17.5	-	-	17.5	153

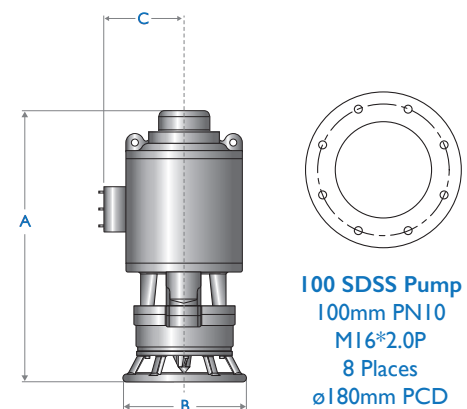
$$(PRE)n = Cr + 3.3 \times Mo + 16 \times N$$

* standard pump construction

**Would be subject to obtaining an export licence

Weights & Dimensions

Pump Size	Power kW	Speed RPM	Weight kg	Dimensions mm			Outlet Dia. mm
				A	B	C	
SDSS 100ANZE®	30	1450	770	1175	527	318	100mm PN10



PONTOONS

Submersible Pumps
often require a suitable
floating platform

Goodwin Standard Pontoon

For smaller applications Goodwin can supply a pontoon with a winch support frame suitable for 100, 150 and 200 series pumps.



All Goodwin pontoons are modular and are easily dismantled for road transport if needed. Assembly on site is quick and straightforward.

Goodwin has a wealth of experience on pontoons and can advise on best practice. Please contact your local sales office to discuss your exact requirements.

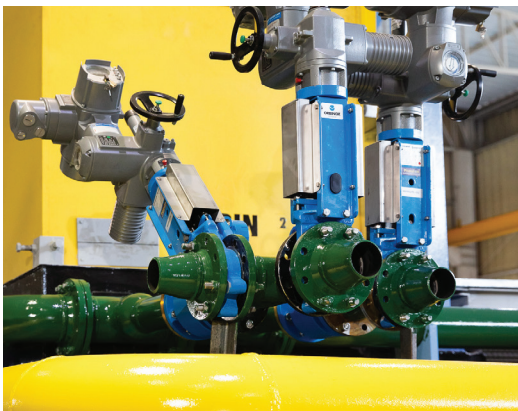
Goodwin can
supply a range
of different sized
pontoons
designed for
compatibility
with our range of
submersible
pumps



Goodwin Remote Control Dredging Pontoon

For larger applications, Goodwin have developed a dredging pontoon that works with the 200mm range of pumps. Each dredging pontoon is designed for a specific application, features can include:

- remote operation from shore to prevent personnel working in unsafe environments
- propulsion systems
- on board booster pumps
- umbilical or on board power supply
- fully automatic slurry volume/mass control



Pump Control Systems

The Goodwin fully automatic control panel has four main modes of operation:

- 1 **Manual mode**
The operator can Start and Stop the pump as required.
- 2 **Automatic with Float switch start**
When the high level float switch is activated, the pump will start. When the low current relay senses a drop in current, the pump will stop.
- 3 **Automatic with Timer start**
When the "Start Timer" is energised (user defined time), the pump will start. When the low current relay senses a drop in current (because the sump is empty), the pump will stop.
- 4 **Automatic with Float switch & Timer start**
In this mode, both the high level float switch and the start timer are used. This means that at a predetermined time the pump will start, but if the slurry level becomes high before this time, the pump will start earlier. Whenever the low current relay senses a drop in current (because the sump is empty), the pump will stop.

All Goodwin control panels protect against;

- Earth leakage faults - damage to the cable or pump
- Current overload - of the pump
- Phase imbalance - voltage variation of the incoming supply phases
- Phase rotation - to ensure the pump runs in the correct direction once installed correctly
- Phase loss - the loss of one or more of the incoming phases
- Under voltage - if the incoming voltage is too low
- Over Voltage - if the incoming voltage is too high



90kW, 112kW and 150kW Pump Control Panels

The benefits of using a Goodwin fully automatic control panel:

- Panels can operate in "Manual" mode, where the operator can Start and Stop the pump as required.
- When used in "Automatic" mode, panels extend the life of the pump wear parts, because the pump will not be left running on "snore" (running but not pumping) for extended periods of time. The Goodwin panel does this by using an electronic low current relay, which detects when the pump is running on a light load.
- Before starting, a Xenon beacon flashes and an audible (100dB) alarm sounds to warn operatives.
- Panels are fitted with a "lockable isolator" for safe maintenance.
- Panels have the facility to be connected to a "Remote" Start / Stop station, including an Emergency Stop.
- All 30kW panels are designed for direct on line (DOL) starting. Soft start or VSD can be supplied as an option. Higher powered pumps are always supplied with soft start or VSD control. Note that higher powered pumps are capable of DOL if required.
- All panels are IP65 rated as standard, and are suitable for both indoor and outdoor use.
- Panels can be optionally constructed from stainless steel
- Panels are constructed to local electrical regulations, please contact your nearest sales office for more details



30kW Pump Control Panel

Lifting Chain

Pumps are supplied as standard with lifting chains. Contact us if you require specific lifting equipment.



Cable

Goodwin can supply suitable heavy duty cable and cable glands for each of our range of pumps.



Hose and Couplings

Goodwin can supply suitable hose and couplings for each of our pumps.



Pump Maintenance Tools

Goodwin can supply a range of custom maintenance tools to facilitate pump maintenance and servicing.



Pump Spare Parts

Goodwin can supply spare parts for our full range of pumps through our service centres. Goodwin is also offers a full pump rebuild service if needed.



Wet End Spares Kit

To assist our customers, Goodwin have developed a 'Wet-End' spares kit for 100mm pumps which includes all of the necessary items your technicians will need to perform essential periodic maintenance on your Goodwin pump, to ensure reliable operation and the long life of your investment.

The spares kit includes an Impeller, Wear Plate, Inducer, Shaft Sleeve, Lock Nut, Spacers, Fasteners - plus all of the tools and lubricants needed to perform the task and a step-by-step guide.



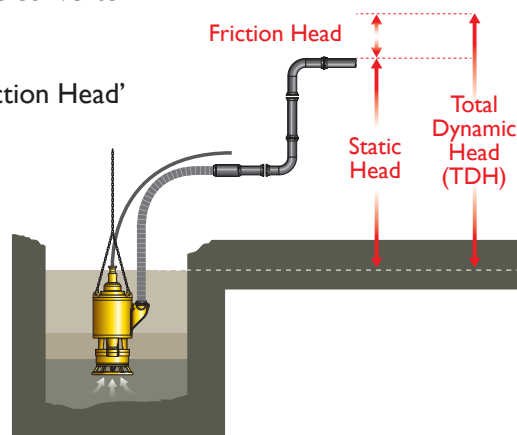
Pump Selection

Static Head - This is the vertical height from the surface of the slurry to the point of discharge.

Friction Head - Friction losses occur when pumping slurry through the discharge line, valves and fittings. This is known as 'Friction Head', and needs to be converted from equivalent length of pipe to pumped head (in metres).

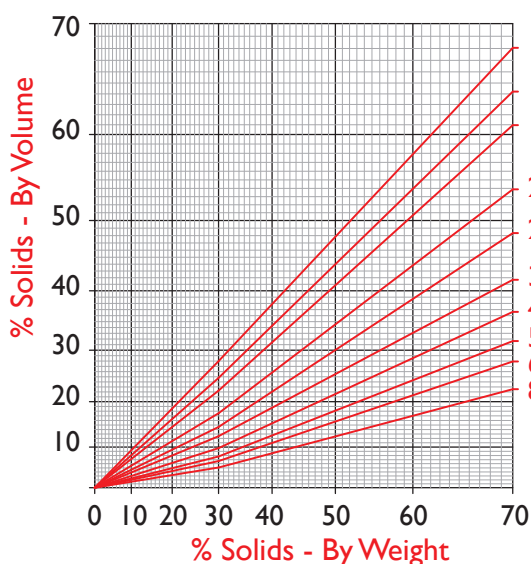
Total Dynamic Head (TDH) - This is the 'Static Head' added to the 'Friction Head' then converted into metres.

Pipeline Critical Velocity - The velocity of flow in the pipeline must be kept above a certain minimum value to prevent solids from settling out and blocking the pipe. This velocity can vary between different types of slurry, depending on the Specific Gravity (Sg) of the slurry being pumped. It is also important to remember that whilst it is essential to maintain a minimum velocity, having a velocity that is too high will also create problems such as high friction losses and increased wear on the piping system.



Typical Weights of Dry Materials and Advisable Pipeline Velocities

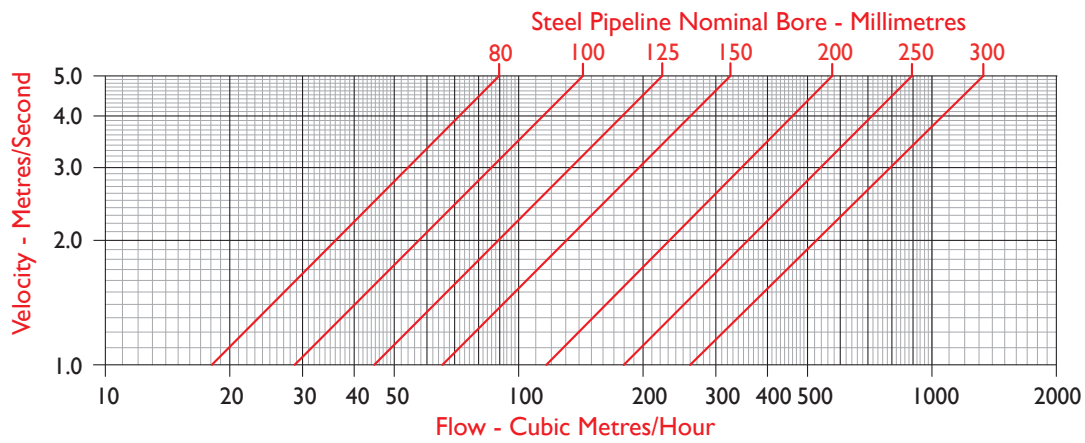
Material	Density (Sg) Mined	Density (Sg) Processed	Advisable Minimum Pipe Velocity	Advisable Maximum Pipe Velocity
Ash	N/A	0.7 - 1.2	1.5 m/Sec	5 m/Sec
Bauxite	1.8 - 2.5	2.6 - 2.8	2 m/Sec	5 m/Sec
Coal	1.1 - 1.5	1.4 - 1.8	2 m/Sec	5 m/Sec
Copper	1.9 - 4.3	8.8 - 9.0	2 m/Sec	5 m/Sec
Fluorspar	1.7 - 2.9	3.1 - 3.3	2 m/Sec	5 m/Sec
Gold	2.4 - 2.8	19.2 - 19.3	2 m/Sec	5 m/Sec
Iron	2.1 - 5.5	7.0 - 7.9	2 m/Sec	5 m/Sec
Lead	7.3 - 7.6	11.3 - 11.4	2.5 m/Sec	5 m/Sec
Magnetite	2.1 - 5.0	4.9 - 5.2	2 m/Sec	5 m/Sec
Mill Scale	N/A	2.2 - 8.2	2.5 m/Sec	5 m/Sec
Platinum	2.6 - 3.4	21.4 - 21.5	2 m/Sec	5 m/Sec
Sand	1.2 - 1.4	2.6 - 2.7	2 m/Sec	5 m/Sec
Shale	1.5 - 2.0	2.6 - 2.9	2 m/Sec	5 m/Sec
Slag (furnace)	N/A	2.5 - 3.0	2 m/Sec	5 m/Sec
Zinc	3.9 - 4.2	6.9 - 7.2	2 m/Sec	5 m/Sec



Pipe Diameter	90° Elbow	90° Swept Bend	Gate Valve	Butterfly Valve
80mm/3"	2.3 m	1.3 m	0.6 m	3.5 m
100mm/4"	3.1 m	1.6 m	0.8 m	4.6 m
150mm/6"	4.6 m	2.5 m	1.2 m	6.9 m
200mm/8"	6.1 m	3.2 m	1.6 m	9.1 m
250mm/10"	7.7 m	4.1 m	2.0 m	8.9 m
300mm/12"	9.1 m	4.9 m	2.4 m	10.6 m

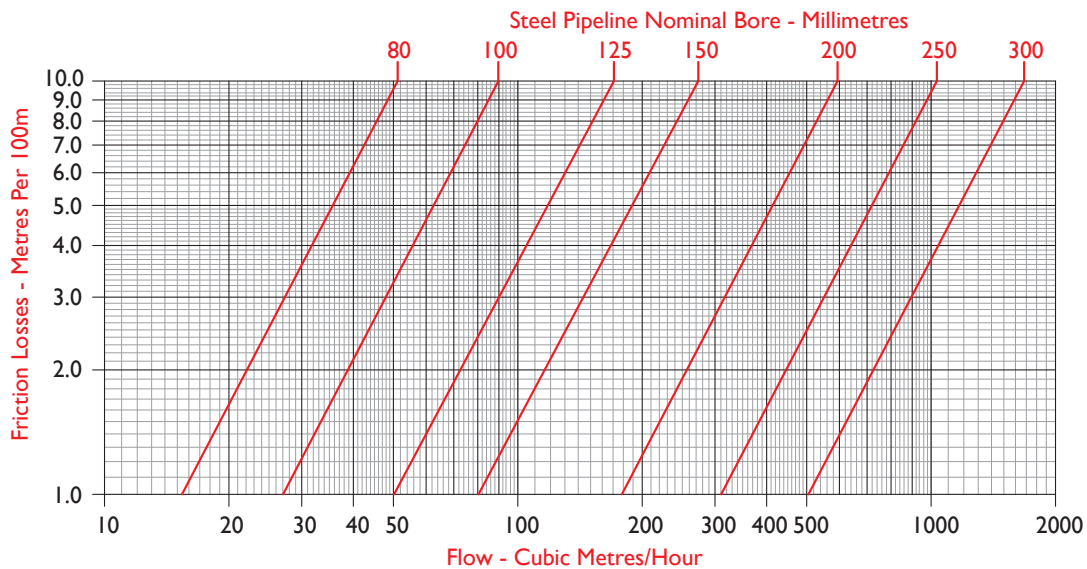
Equivalent Length of Straight Pipe created by Pipe Fittings

Pipeline Flow and Velocity for New Steel Pipeline Diameters



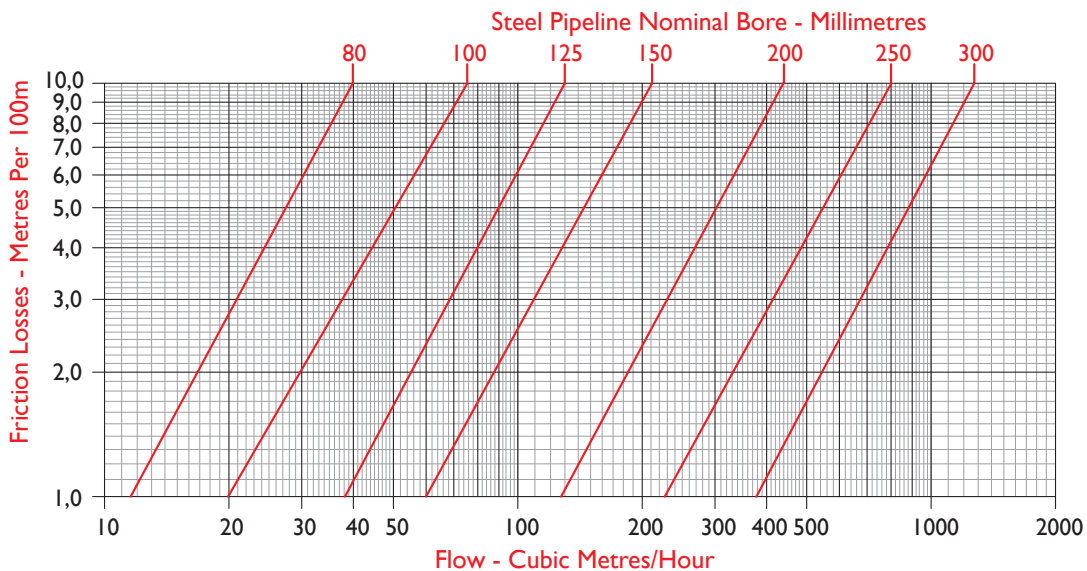
Friction Loss Pumping Water in New Steel Pipeline

Calculated using Hazen Williams method with a coefficient of 140



Friction Loss Pumping Slurry in New Steel Pipeline

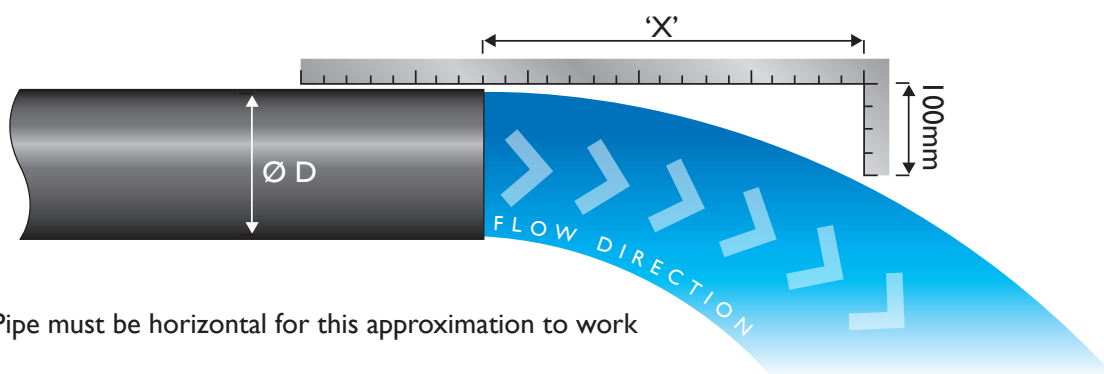
Calculated using Darcy Weisbach method with a slurry density of 1.35Kg/L and a Darcy Friction Factor of 0.0183



Field Estimation of Discharge Rate from Open Ended Pipes

Horizontal Distance 'X' mm	Ø D (Pipe Diameter)									
	2"	2.5"	3"	4"	5"	6"	8"	10"	12"	
	50 mm	65 mm	80 mm	100 mm	125 mm	150 mm	200 mm	250 mm	300 mm	
200	11	19	26	46	71	103	183	285	410	m ³ /h
250	14	24	32	57	89	128	228	356	513	m ³ /h
300	17	29	39	68	107	154	274	428	616	m ³ /h
400	23	39	51	91	143	205	365	570	821	m ³ /h
500	28	48	73	114	178	257	456	712	1026	m ³ /h
600		58	88	137	214	307	547	855	1231	m ³ /h
700			102	160	250	359	638	998	1437	m ³ /h
800			117	183	285	410	729	1140	1642	m ³ /h
900			131	206	320	462	821	1283	1847	m ³ /h
1000				228	356	513	912	1425	2053	m ³ /h
1100				250	392	565	1003	1568	2258	m ³ /h

The dark grey shaded area is the advised minimum flow to maintain a pipeline velocity 2m/s



Pipe must be horizontal for this approximation to work

Example: If distance 'X' is 400mm and the discharge pipe used is Ø100mm, then the flow from the pump will be approximately 91m³/h.

Nomograph

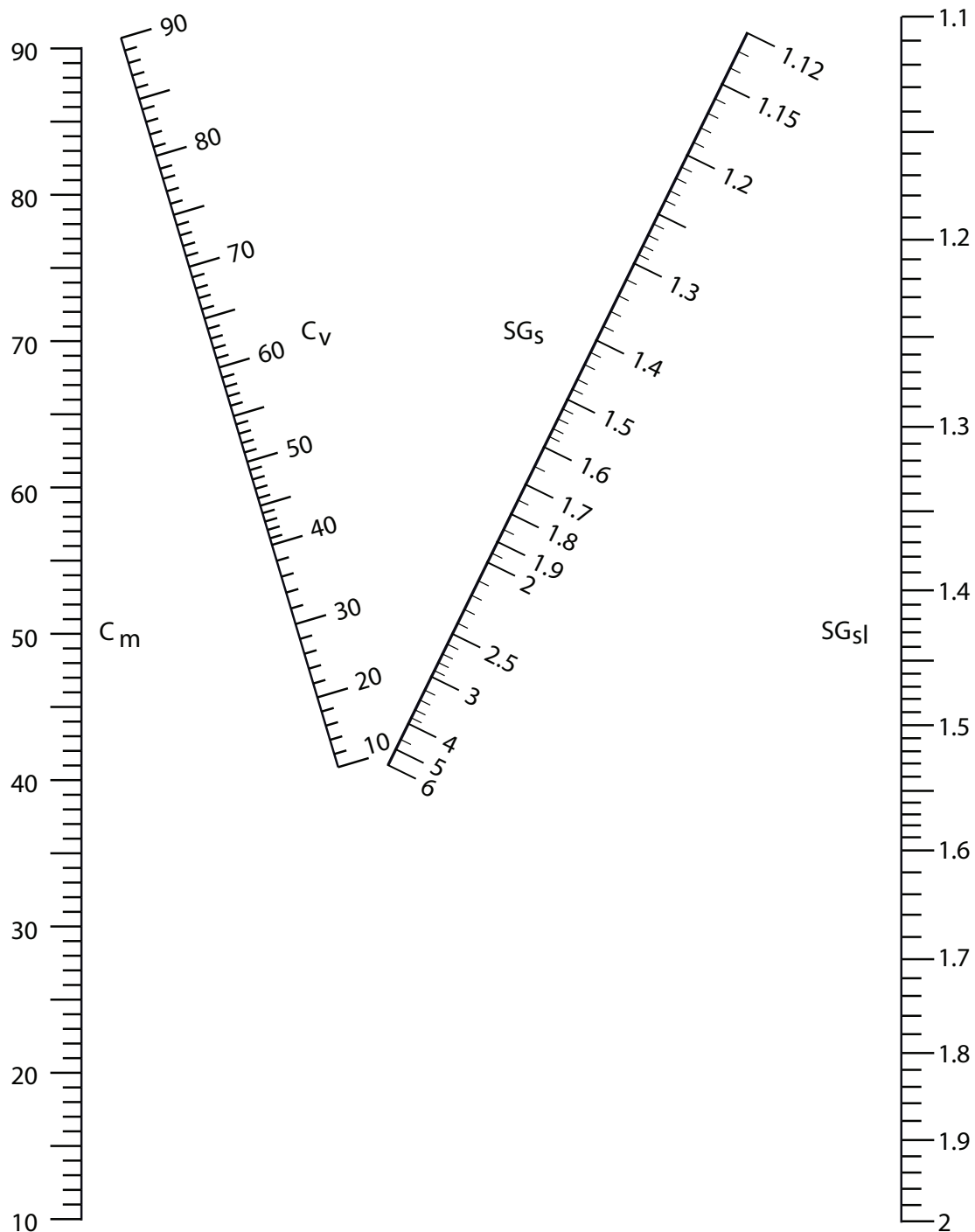
SGsl = Specific gravity of the slurry

SGs = Specific gravity of the solids

Cv = Concentration of solids by volume

Cm = Concentration of solids by weight

If two out of four values are known, draw a line between them and the other two values are given.



Best Operating Practice

Ideal Installation Example

Goodwin pumps are highly abuse resistant, however, to ensure that you get the best performance from your Goodwin Submersible Slurry Pump, we recommend that you follow the best practice procedures laid out on these pages.

- Correct sump size - The minimum sump size needs to be adhered to in order to obtain maximum life from the pump parts and to prevent pipeline blockages. Sump sizes are calculated based on, and are relative to:- pump size, inflow, outflow, sump working capacity and a maximum of 10 DOL pump stop/starts permitted in one hour.

The minimum sump sizes below are based on pump size and minimum outflow to ensure 2m/sec velocity in the discharge pipe and pumping cycles repeated every 10 mins (6 times per hour).

Example of how to size a sump

Pump Size Selection		100mm			150mm			200mm		
Min Sump Size l x w x d (m) - see page 2		2 x 1.5 x 2			2.5 x 2 x 2.5			3 x 2.5 x 3		
Pipe Size mm		100			150			200		
Min outflow vol to achieve a minimum pipe velocity of 2m/sec		55 m³/h			130 m³/h			230 m³/h		
Actual Sump Size in (m)		l	w	d	l	w	d	l	w	d
		2	1.5	2	2.5	2	2.5	3	2.5	3
Total Sump Capacity = $l \times w \times d$ (m³)		A			6.0			12.5		
Actual outflow of Pump (m³/h)		B			100			220		
Sump Free Board depth (m) - Variable according to conditions		C			0.7			0.7		
Sump Dead Zone see page 2 (m)		D			0.35			0.4		
Sump working Capacity = $A - (C \times l \times w) - (D \times l \times w)$ (m³)		E			2.9			7.0		
Sump Inflow (m³/h)		F			20			50		
Time to fill sump from empty (Minutes) = $E / (F/60)$		G			8.6			8.4		
Complete cycle time - pumping and resting (Minutes) = $(E / ((B-F)/60)) + G$ Ideally >10 minutes					10.7			10.9		

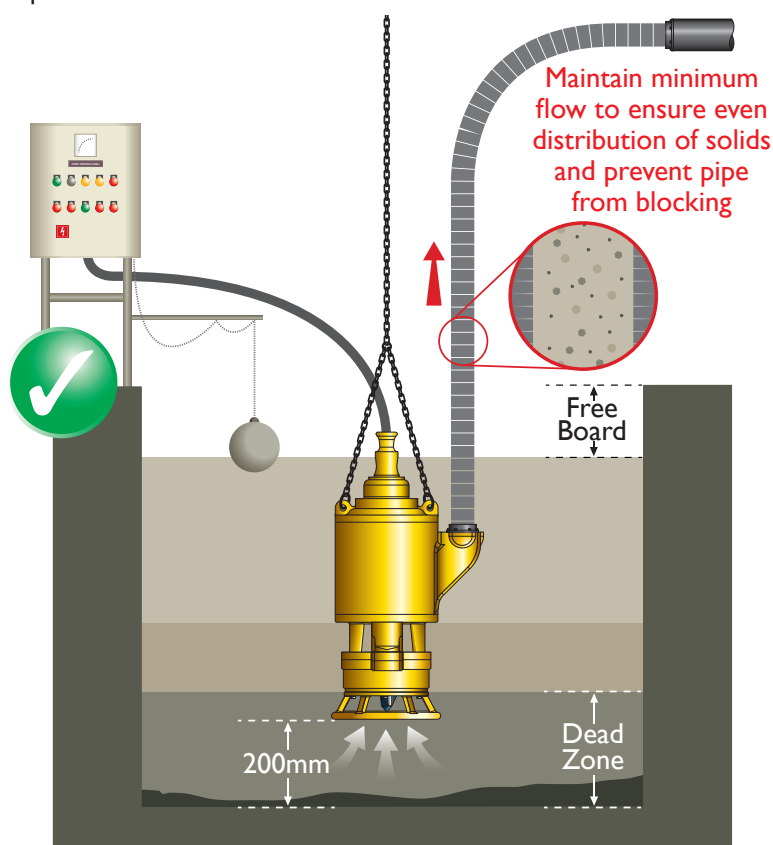
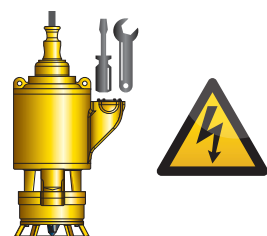
If assistance is needed for sump sizing, please contact your local representative as each situation can have more than one solution

- A good water to slurry ratio
- Sump level control - If the sump empties, the pump panel should switch the pump off by detection of low volume of material. The pump will switch on via a float switch or timer when the level rises.
- Pump should not exceed 10 DOL starts per hour.
- The pump should be suspended by chains at least 200mm from base of the sump to ensure maximum concentration of solids pumped.

Power Supply & Servicing

Always ensure that the pump is correctly connected and protected by using a Goodwin panel or equivalent that contains Earth Fault Leakage Protection.

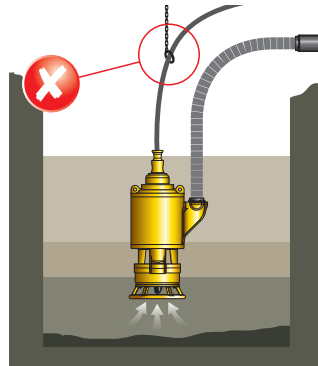
The pump should be inspected and maintained as per the recommendations in the operating and maintenance manual.



Poor Installation Examples

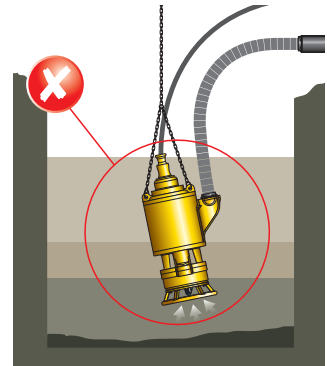
Correct Lifting

When moving or suspending the pump, always use certified lifting equipment. Never lift or suspend the pump using the power cable.



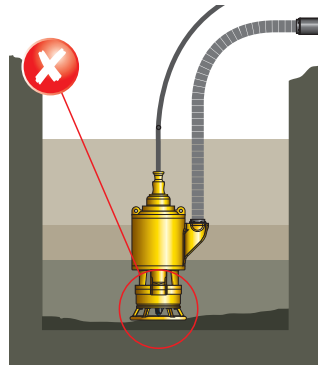
Vertical Positioning

For the best operation of the pump and inducer, ensure that the pump is suspended in a vertical position.



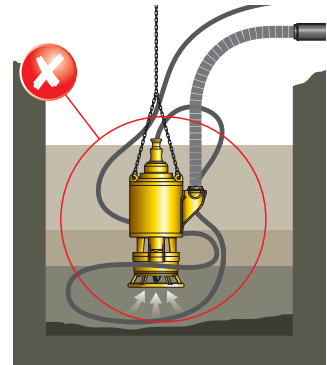
Pump Positioning

When pumping heavy slurries, always suspend the pump with the certified lifting equipment 200mm minimum above the bottom of the sump. Do not let the pump sit on the bottom of the sump.



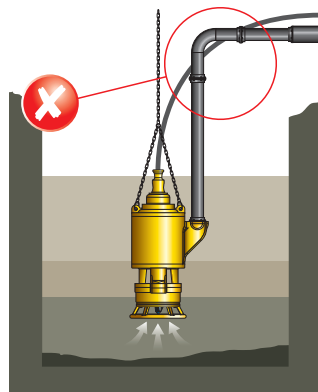
Cable Protection

Make sure that the cable cannot be damaged by the rotating shaft by not allowing too much cable to be released into the slurry.



Heavy Duty Flexible Hose Usage

Always use heavy duty flexible hose on the pump discharge. The flexibility of the hose will allow the pump to move on start-up. Do not connect the pump directly to a rigid pipe.

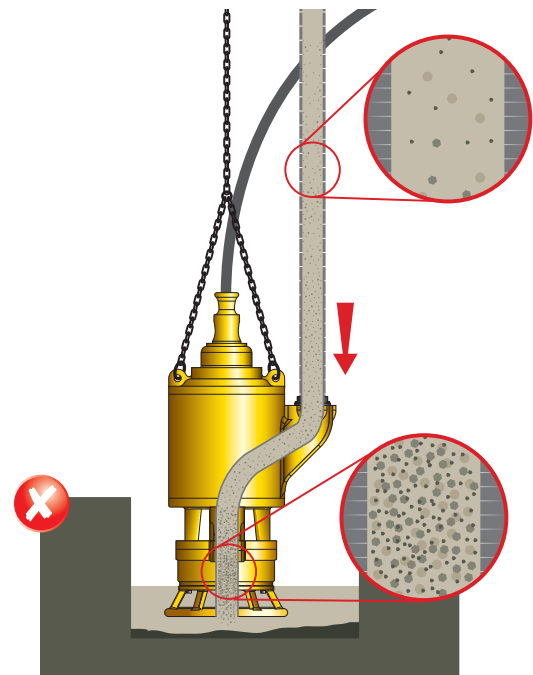


Small Sumps

A small sump will lead to excessive wear and blocked pipes. This is because the pump will quickly evacuate the slurry from the sump until it is snoring (sucking in air with the slurry). As soon as it starts to snore, the flow in the pipe stops as the velocity reduces to zero.

With no velocity in the pipe, all the heavy slurry particles settle out and fall back down the pipe, to the pump's impeller. If the pump is not switched off this leads to rapidly exaggerated wear, grinding the particles rather than pumping them.

If a small sump is continually filling with slurry, there would be a need to exceed the maximum number of starts per hour or to leave the pump running on snore - neither of which are recommended, as by starting too frequently the motor may burn out, and by leaving the pump running, the 'Wet-End' will wear out very quickly as it is grinding and not pumping.



Global Customers

- TATA STEEL
- COAL INDIA LTD
- PT AGINCOURT RESOURCES
- TRONOX
- VALE MINING
- TISCO
- GLENCORE
- CITIC PACIFIC MINING
- NC GEMCO
- BAOGANG GROUP
- MMX
- ALCOA
- DATONG COAL MINE GROUP
- JINDAL GROUP
- CHINA ALUMINIUM Co (CHALCO)
- CSN STEEL
- USIMINAS
- CHN ENERGY
- STEEL AUTHORITY OF INDIA LTD
- CHINACOAL
- LARSEN & TOURBO
- SHANXI COKING COAL GROUP
- KINROSS
- TONGLING NONFERROUS METALS GROUP
- YAMANA GOLD
- JIANGXI COPPER CORPORATION
- SHANDONG GOLD GROUP
- DE BEERS
- ANGLO PLATINUM
- MOPANI COPPER
- EXXARO COAL
- ANGLO GOLD ASHANTI
- IMPALA PLATINUM
- FIRST QUANTUM MINING LTD
- BEAVER GLOBAL
- BHP
- RIO TINTO
- NEW CENTURY ZINC
- NATIONAL THERMAL POWER CORP LTD
- RELIANCE GROUP
- ADANI GROUP
- VENDATA GROUP
- BIRLA GROUP

Servicing Global Industry:

Copper Mining
 Nickel Mining
 Gold Mining
 Coal Mining
 Steel Making
 Power Generation
 Mineral Processing
 Iron Ore Mining
 Alumina Processing
 Platinum Mining
 High Wall Pumping (open pit) Applications
 Construction of Buildings, Dams and Harbour Walls
 Long Distance Pumping Applications
 Agriculture Irrigation



Goodwin



GOODWIN UK



GOODWIN INDIA



GOODWIN BRASIL



GOODWIN AFRICA



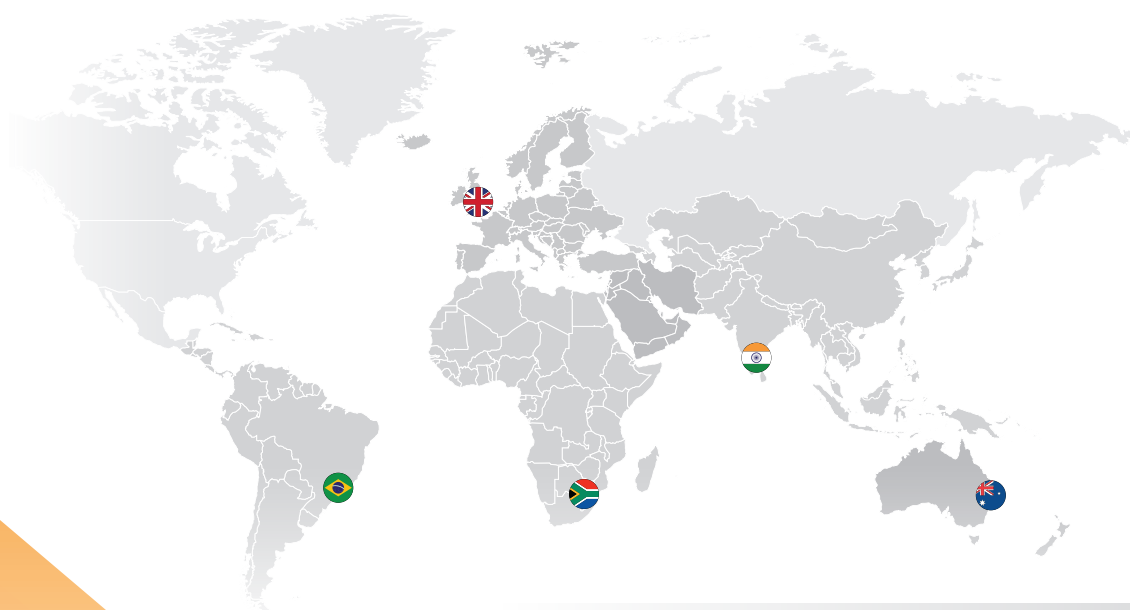
GOODWIN AUSTRALIA



**1,000's of Goodwin Submersible
Pumps are currently solving
customer problems worldwide.**



UNITED KINGDOM - INDIA - BRASIL - AFRICA - AUSTRALIA



 GOODWIN UK goodwininternational.co.uk/pumps

 GOODWIN INDIA goodwinindia.in

 GOODWIN BRASIL goodwinbombas.com.br

 GOODWIN AFRICA goodwinafrika.com

 GOODWIN AUSTRALIA goodwinaustralia.com.au

Goodwin

Goodwin Bombas

Rua das Margaridas

70 Terra Preta 07600-972

Mairiporã SP Brasil

Subsidiária do Grupo Goodwin

Tel +55 (11) 4486 1429

pumps@goodwinlatina.com

www.goodwinbombas.com.br