



PUMP HANDBOOK









50 Hz

Welcome to Grindex Pump handbook!

With this handbook we want to share some of our wide experience in pumping with submersible pumps. You will find an overview of all Grindex pumps with technical details and a pump school, intended to help pump users with common matters in pumping with submersible pumps. The handbook also contains more sophisticated technical information, like pH tables and graphs that show friction losses in pipes and hoses.

We are sure you will find this handbook handy. This handbook is also available for download from our website, www.grindex.com. If you need more copies, please contact Grindex.

INDEX

	Drainage pumps	4-16
	Minex, Minette, Minor, Major, Master, Master SH, Matador, Maxi, Magnum, Mega	
	Sludge pumps	17-21
	Salvador, Senior, Sandy	
	Small drainage and sludge pumps	22-27
	Micro, Macro, Solid	
	Drainage pumps made of stainless steel, INOX	28-33
	Minette Inox, Major Inox, Master Inox	
	Sludge pumps made of stainless steel, INOX	34-39
	Salvador Inox, Senior Inox, Sandy Inox	
	Slurry pumps	40-48
	Bravo 20, Bravo 30, Bravo 40, Bravo 50, Bravo 60, Bravo 70	
	Accessories	49-50
	Grindex Pump school	51-56
	Limitations	57
	More technical information	58-61
	Calculating friction losses in hoses	58
	Formulas for calculating friction losses in hoses and tubes	59
	Friction factor	59
	Sludge/slurry solids concentration	59
	pH tables	60
	Salt tables	60
	Translation charts	61
	Recommended generator sizes	62-63

Drainage pumps

Grindex drainage pumps are designed for professional use in tough applications like mines, construction sites, tunnel sites and other demanding industries.

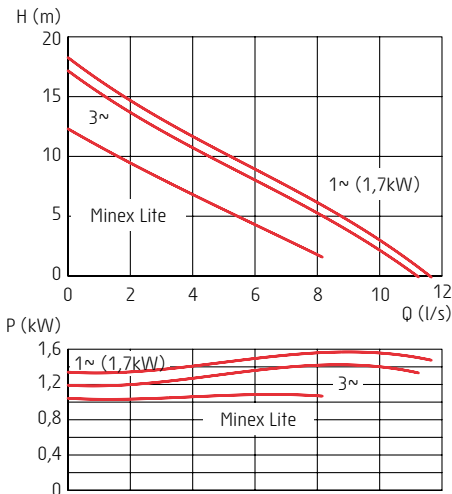
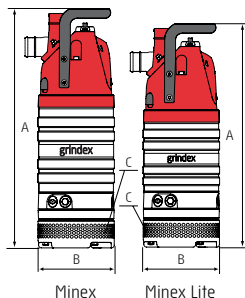
They are designed for:

- Pumping water that may contain solids – up to the size of the strainer holes
- Pumping water with abrasive solids
- Pumping ground water
- Pumping raw water
- Pumping spillage water

Grindex drainage pumps are designed for continuous, unattended operation. They have proven their reliability and dependable performance in demanding areas like building and construction, mining, tunnelling, quarries, industries and rental applications.



MINEX



Technical data

Discharge connection

Lite (1~ 1,2 kW)

1~ (1,7 kW)

3~

2"

2"

2"

Rated output

0,85 kW

1,3 kW

1,2 kW

Max power consumption

1,2 kW

1,7 kW

1,6 kW

Shaft speed

2755 RPM

2860 RPM

2760 RPM

Rated current at 230 V

5,1 A

7,2 A

-

Rated current at 400 V

-

-

2,7 A

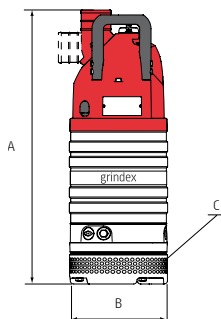
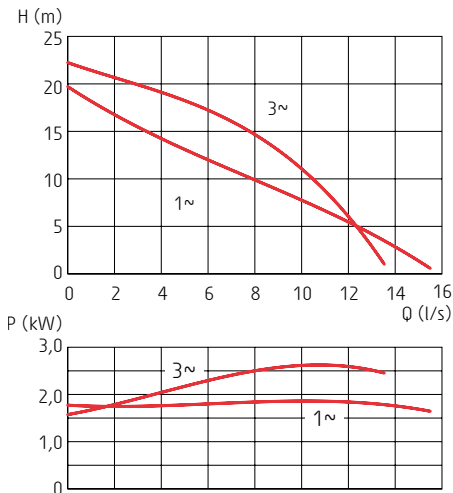
1~ (1,7 kW): A: 610 mm **B:** Ø 195 mm **C:** Ø 7,5 mm

Weight: 25 kg

Minex Lite (1~ 1,2 kW) and 3~: A: 570 mm **B:** Ø 195 mm

C: Ø 7,5 mm **Weight:** 21 kg

MINETTE



Technical data

1~

3~

Discharge connection

3"

3"

Rated output

1,5 kW

2,2 kW

Max power consumption

1,9 kW

2,7 kW

Shaft speed

2800 RPM

2800 RPM

Rated current at 230 V

8,4 A

-

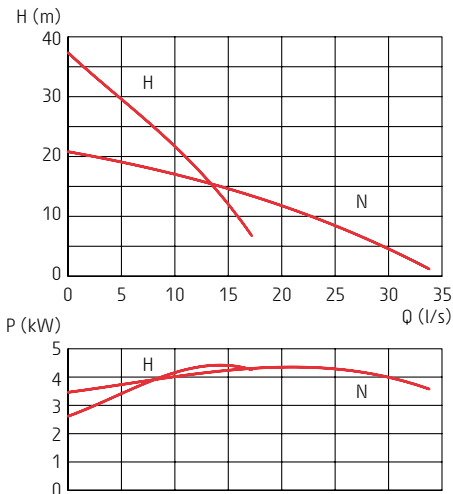
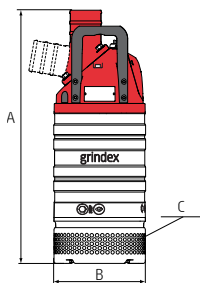
Rated current at 400 V

-

4,7 A

A: 667 mm **B:** Ø 240 mm **C:** Ø 9 mm **Weight:** 30 kg (1~) 32 kg (3~)

MINOR



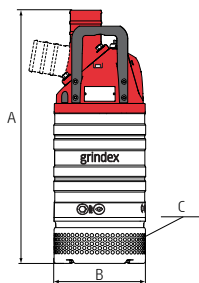
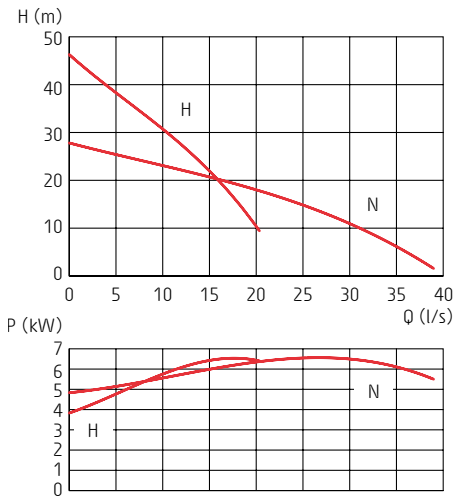
Technical data

	N	H
Discharge connection	4"	3"
Rated output	3,7 kW	3,7 kW
Max power consumption	4,5 kW	4,5 kW
Shaft speed	2870 RPM	2870 RPM
Rated current at 400 V	7,3 A	7,3 A
Rated current at 500 V	6,0 A	6,0 A

A: 793 mm **B:** Ø 286 mm **C:** Ø 10 mm **Weight:** 52 kg

Specifications can be changed without notice.

MAJOR



Technical data

N

H

Discharge connection

4"

3"

Rated output

5,6 kW

5,6 kW

Max power consumption

6,7 kW

6,7 kW

Shaft speed

2890 RPM

2890 RPM

Rated current at 400 V

11 A

11 A

Rated current at 500 V

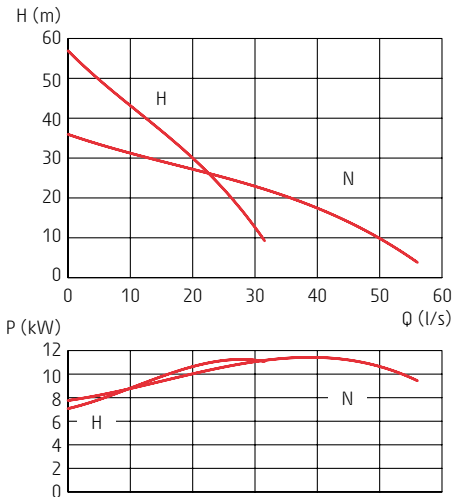
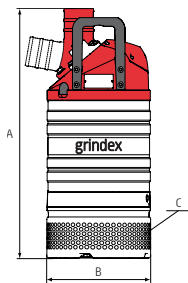
8,7 A

8,7 A

A: 793 mm **B:** \varnothing 286 mm **C:** \varnothing 10 mm **Weight:** 54 kg

Specifications can be changed without notice.

MASTER



Technical data

Discharge connection

N 6"

H 4"

Rated output

N 10 kW

H 10 kW

Max power consumption

N 11,7 kW

H 11,7 kW

Shaft speed

N 2860 RPM

H 2860 RPM

Rated current at 400 V

N 19 A

H 19 A

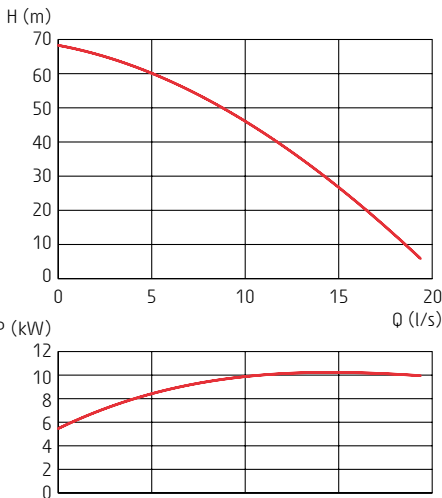
Rated current at 500 V

N 15 A

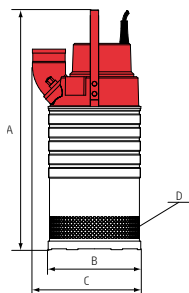
H 15 A

A: 832 mm **B:** Ø 346 mm **C:** Ø 12 mm **Weight:** 80 kg

Specifications can be changed without notice.



MASTER SH



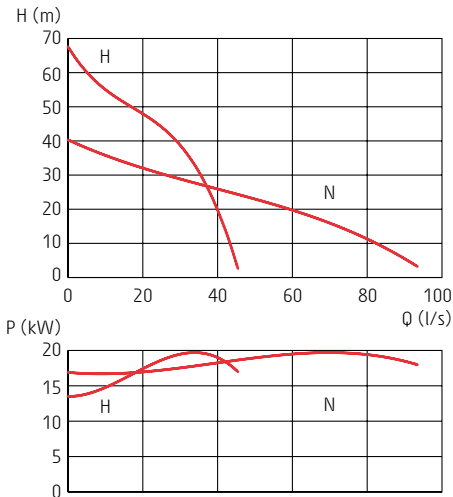
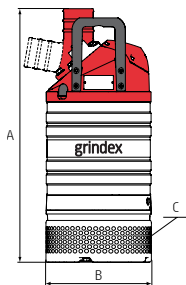
Technical data

Discharge connection	3"
Rated output	8.8 kW
Max power consumption	10,2 kW
Shaft speed	2835 RPM
Rated current at 400 V	16 A
Rated current at 500 V	13 A

A: 720 mm **B:** \varnothing 286 mm **C:** 330 mm **D:** \varnothing 8,5 mm **Weight:** 60 kg

Specifications can be changed without notice.

MATADOR

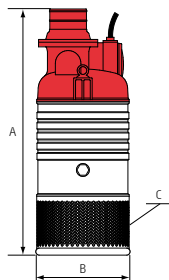
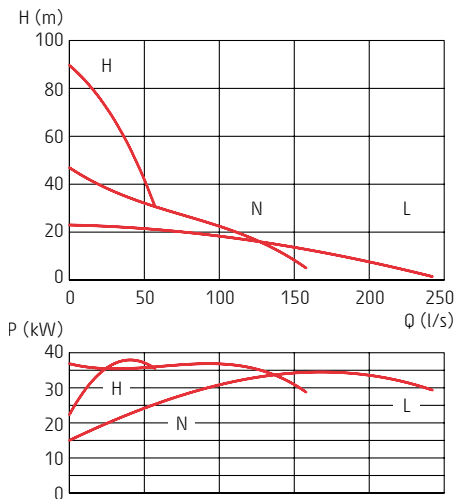


Technical data

	N	H
Discharge connection	6"	4"
Rated output	18 kW	18 kW
Max power consumption	20 kW	20 kW
Shaft speed	2900 RPM	2900 RPM
Rated current at 400 V	32 A	32 A
Rated current at 500 V	26 A	26 A

A: 954 mm **B:** Ø 395 mm **C:** Ø 12 mm **Weight:** 143 kg

Specifications can be changed without notice.

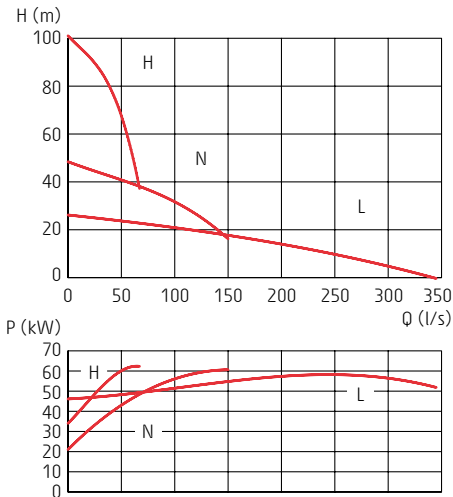
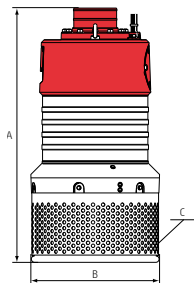
MAXI

Technical data	L	N	H
Discharge connection	8"	8"	4"
Rated output	30 kW	37 kW	37 kW
Max power consumption	33 kW	41 kW	41 kW
Shaft speed	1465 RPM	2950 RPM	2950 RPM
Rated current at 400 V	56 A	65 A	65 A
Rated current at 500 V	45 A	52 A	52 A

A: 1345 mm **B:** \varnothing 510 mm **C:** \varnothing 12 mm **Weight:** 285 kg

Specifications can be changed without notice.

MAGNUM



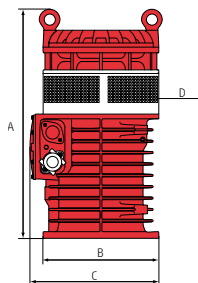
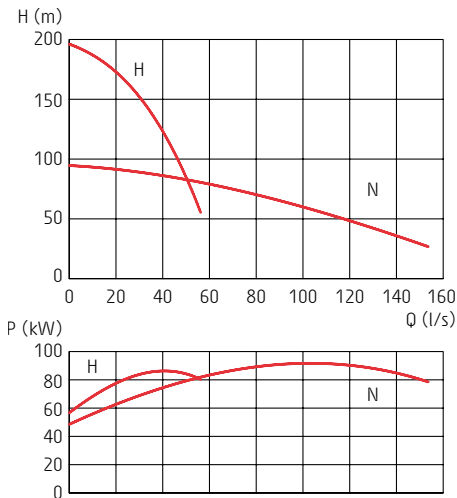
Technical data

	L	N	H
Discharge connection	10"	8"	6"
Rated output	57 kW	57 kW	57 kW
Max power consumption	62 kW	62 kW	64 kW
Shaft speed	1475 RPM	1475 RPM	2950 RPM
Rated current at 400 V	107 A	107 A	98 A
Rated current at 500 V	85 A	85 A	79 A

A: 1475 mm **B:** \varnothing 750 mm **C:** \varnothing 12 mm **Weight:** 540 kg

Specifications can be changed without notice.

MEGA



Technical data	N	H
Discharge connection	6"	4"
Rated output	90 kW	90 kW
Max power consumption	95 kW	95 kW
Shaft speed	2965 RPM	2965 RPM
Rated current at 400 V	148 A	148 A
Rated current at 500 V	118 A	118 A

A: 1245 mm **B:** 610 mm **C:** 680 mm **D:** 10x10 mm

Weight: 900 kg (N), 985 kg (H)

Specifications can be changed without notice.

Materials in drainage pumps

	Minex	Minette	Minor	Major	Master	Master SH	Matador	Maxi	Magnum	Mega
Material										
Upper seal										
Tungsten carbide - tungsten carbide	•	•	•	•	•		•	•	•	•
Carbon - silicon carbide						•				
Lower seal										
Tungsten carbide - tungsten carbide	•	•	•	•	•		•	•	•	•
Silicon carbide - silicon carbide						•				
Stator housing										
Aluminium	•	•	•	•	•	•		•	•	
Cast iron							•			•
Outer casing										
Stainless steel	•	•	•	•	•	•	•	•	•	•
Motor shaft										
Stainless steel	•	•	•	•	•	•	•	•	•	•
Impeller										
High chrome alloyed white cast iron	•	•	•	•	•	•	•	•	•	•
Suction cover										
High chrome cast iron		3~	•	•	•		•			
Lower diffusor										
Nitrile rubber	•	1~				•		•		•
Polyurethane								•	•	
Upper diffusor										
Nitrile rubber	•		•	•	•	•	•	•	•	
Polyurethane								•		
Screws and nuts										
Stainless steel	•	•	•	•	•	•	•	•	•	•
O-rings										
Nitrile rubber	•	•	•	•	•	•	•	•	•	•
Casted parts										
Aluminium	•	•	•	•	•	•	•	•	•	
Cast iron										•

Specifications can be changed without notice.

Sludge pumps

Grindex sludge pumps are designed for professional use in tough applications like mines, construction sites, tunnel sites and other demanding industries.

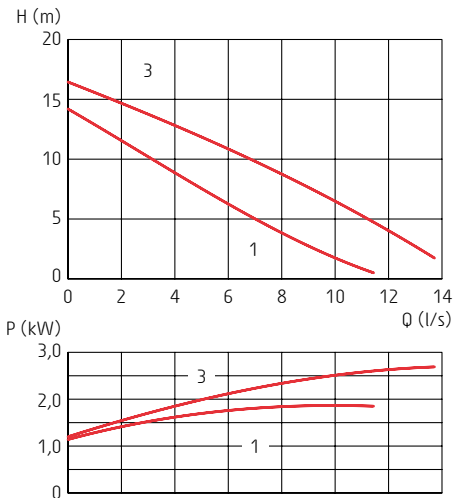
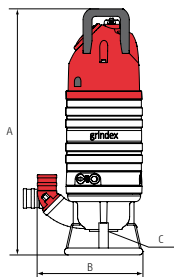
They are designed for:

- Pumping water with high content of solids, up to the size of 80 mm.
- Pumping water which contains abrasive particles
- Pumping different types of mud and sludge
- Pumping light slurry

The pumps are designed for continuous, unattended operation. They have proven their reliability and dependable performance in demanding areas like building and construction, mining, tunnelling, quarries, industries, car washes and rental applications.



SALVADOR



Technical data

Discharge connection

1~

3"

3~

3"

Rated output

1,5 kW

2,2 kW

Max power consumption

1,9 kW

2,7 kW

Shaft speed

2800 RPM

2800 RPM

Rated current at 230 V

8,4 A

-

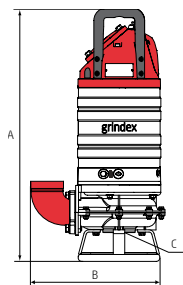
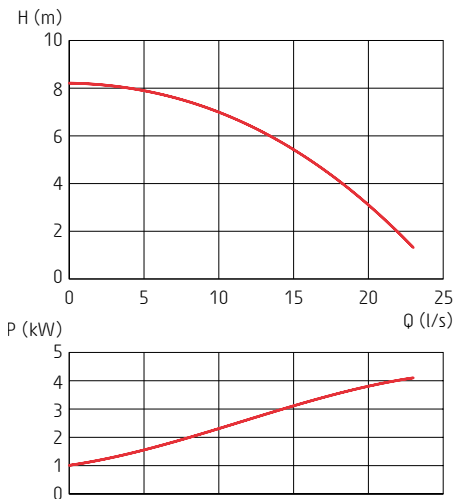
Rated current at 400 V

-

4,7 A

A: 766 mm **B:** Ø 375 mm **C:** Ø 50 mm **Weight:** 34 kg

Specifications can be changed without notice.

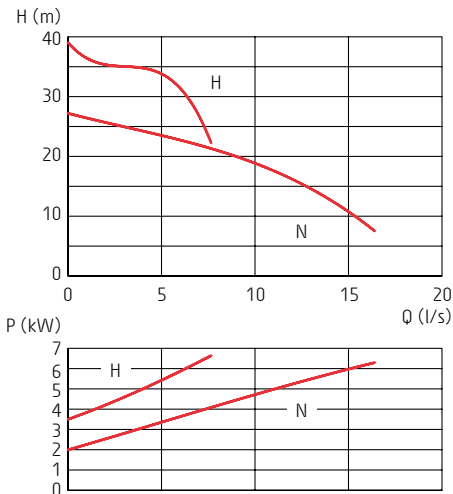
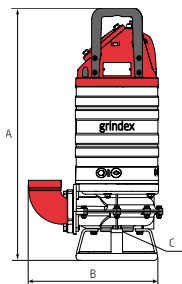
SENIOR**Technical data**

Discharge connection	4"
Rated output	3,2 kW
Max power consumption	4,2 kW
Shaft speed	1480 RPM
Rated current at 400 V	7,6 A
Rated current at 500 V	6,0 A

A: 786 mm **B:** Ø 480 mm **C:** Ø 80 mm **Weight:** 57 kg

Specifications can be changed without notice.

SANDY



Technical data

Discharge connection

3"

3"

Rated output

5,6 kW

5,6 kW

Max power consumption

6,7 kW

6,7 kW

Shaft speed

2890 RPM

2890 RPM

Rated current at 400 V

11 A

11 A

Rated current at 500 V

8,7 A

8,7 A

A: 879 mm **B:** Ø 480 mm **C:** Ø 46 mm (N) Ø 32 mm (H) **Weight:** 57 kg

Specifications can be changed without notice.

Materials in sludge pumps

	Salvador	Senior	Sandy
Material			
Upper seal:			
Tungsten carbide - tungsten carbide	•	•	•
Lower seal			
Tungsten carbide - tungsten carbide	•	•	•
Stator housing			
Aluminium	•	•	•
Outer casing			
Stainless steel	•	•	•
Motor shaft			
Stainless steel	•	•	•
Impeller			
High chrome alloyed white cast iron	•	•	•
Pump housing			
Polyurethane	•	•	•
Screws and nuts			
Stainless steel	•	•	•
O-rings			
Nitrile rubber	•	•	•
Casted parts			
Aluminium	•	•	•

Small drainage and sludge pumps

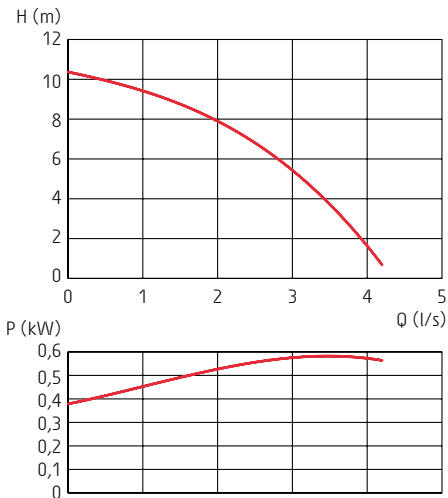
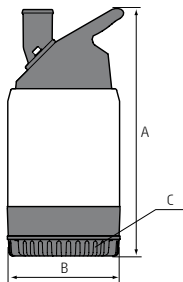
These small drainage and sludge pumps are small, easy to carry, yet still intended for professional use. They are frequently used in construction and rental applications, flood relief in basements and other applications that require lightweight pumps. Their capability of pumping liquids with pH values 3-9 makes them a good choice for use in general industries too.

The sludge pump Solid has set a new standard for light-weight sludge pumps and is appreciated all over the world. It can pump solids in suspension up to the size of 38 mm.





MICRO



Technical data

1~

Discharge connection

2"

Rated output

0,42 kW

Max power consumption

0,59 kW

Shaft speed

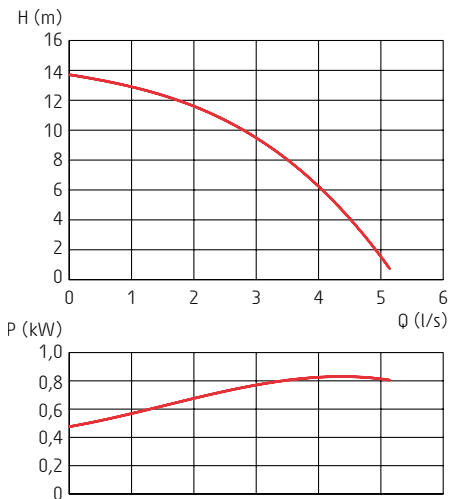
2760 RPM

Rated current at 230 V

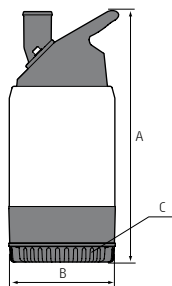
2,7 A

A: 400 mm **B:** Ø 185 mm **C:** 5 x 11 mm **Weight:** 10 kg

Specifications can be changed without notice.



MACRO



Technical data

1~

Discharge connection

2"

Rated output

0,75 kW

Max power consumption

0,97 kW

Shaft speed

2800 RPM

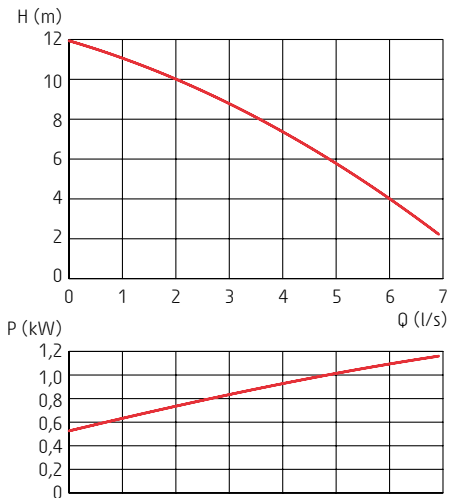
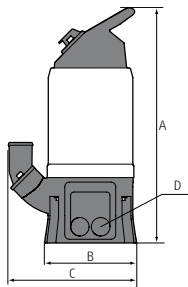
Rated current at 230 V

4,2 A

A: 430 mm **B:** Ø 185 mm **C:** 5 x 11 mm **Weight:** 12,5 kg

Specifications can be changed without notice.

SOLID



Technical data

1~

Discharge connection

2"

Rated output

0,9 kW

Max power consumption

1,2 kW

Shaft speed

2800 RPM

Rated current at 230 V

5,2 A

A: 510 mm **B:** Ø 185 mm **C:** 280 mm **D:** Ø 38 mm **Weight:** 15 kg

Specifications can be changed without notice.

Materials in small drainage and sludge pumps

	Micro	Macro	Solid
Material			
Pump top			
Stainless steel/ reinforced polymer	•	•	•
Diffuser (drainage)			
Polyurethane wear parts	•	•	
Pump housing (sludge)			
Polyurethane wear parts			•
Outer casing			
Stainless steel	•	•	•
Stator housing			
Stainless steel	•	•	•
Motor shaft			
Stainless steel	•	•	•
Upper seal			
Carbon/ceramic	•	•	•
Lower seal			
Silicon carbide/Silicon carbide	•	•	•
Impeller			
Polyurethane	•	•	•
Screws and nuts			
Stainless steel	•	•	•

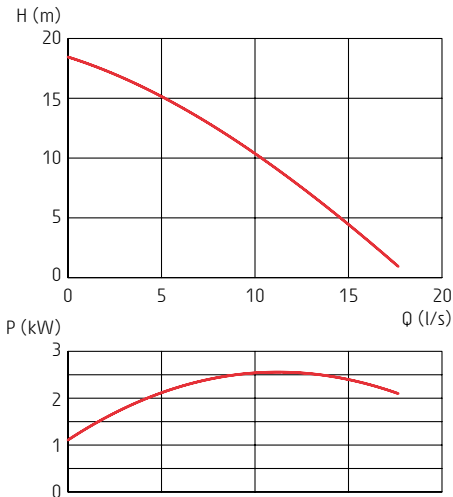
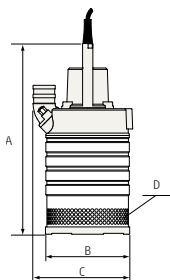
Specifications can be changed without notice.

Drainage pumps made of stainless steel, INOX

These pumps are designed to meet the tough requirements from mines, construction sites, landfill sites and other applications that deal with corrosive water. One application is in mines where the water becomes caustic and destroys conventional pumps in matter of days. The pumps may also be used in applications where saltwater is pumped, like ship-yards, fish farms, construction works in harbours and offshore projects. All INOX pumps can handle pH values from 2 - 10. They can also be equipped with zinc anodes for extra protection.



MINETTE INOX

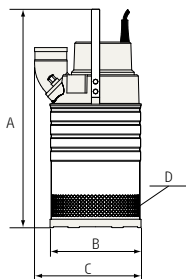
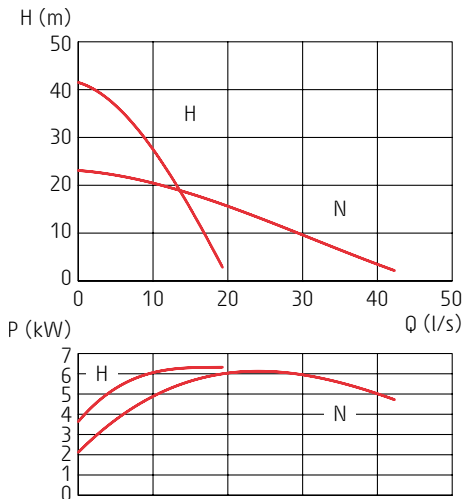


Technical data

Discharge connection	3"
Rated output	2,0 kW
Max power consumption	2,7 kW
Shaft speed	2800 RPM
Rated current at 400 V	4,7 A

A: 535 mm **B:** Ø 240 mm **C:** 295 mm **D:** Ø 7,5 mm **Weight:** 44 kg

MAJOR INOX



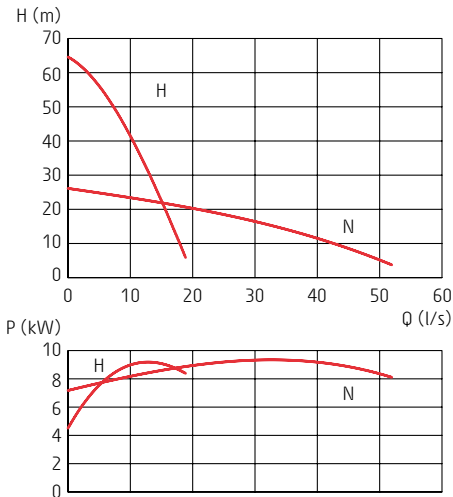
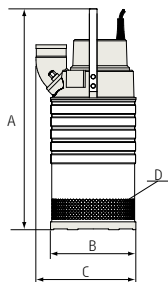
Technical data

	N	H
Discharge connection	4"	3"
Rated output	6,3 kW	6,3 kW
Max power consumption	7,3 kW	7,3 kW
Shaft speed	2840 RPM	2840 RPM
Rated current at 400 V	12 A	12 A

A: 665 mm **B:** Ø 280 mm **C:** 330 mm **D:** Ø 8,5 mm **Weight:** 65 kg

Specifications can be changed without notice.

MASTER INOX



Technical data

	N	H
Discharge connection	4"	3"
Rated output	8,0 kW	8,0 kW
Max power consumption	9,4 kW	9,4 kW
Shaft speed	2800 RPM	2800 RPM
Rated current at 400 V	15 A	15 A

A: 720 mm **B:** \varnothing 280 mm **C:** 330 mm **D:** \varnothing 8,5 mm

Weight: 77 kg (N), 81 kg (H)

Materials in drainage pumps made of stainless steel

	Minette INOX	Major INOX	Master INOX
Material			
Upper seal			
Carbon - silicon carbide	•	•	•
Lower seal			
Silicon carbide - silicon carbide	•	•	•
Casted parts			
Stainless steel (EN 10283-1.14412)	•	•	•
Outer casing			
Stainless steel (EN 10088-3-1.14436)	•	•	•
Motor shaft			
Stainless steel (EN 10088-3-1.14460)	•	•	•
Impeller			
Stainless steel (EN 10283-1.14412)	•	•	•
Screws and nuts			
Stainless steel (A4)	•	•	•
O-rings			
Viton rubber	•	•	•
Diffusers			
Nitrile rubber	•	•	•

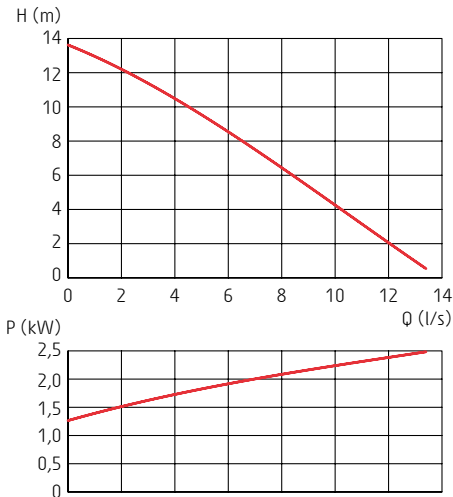
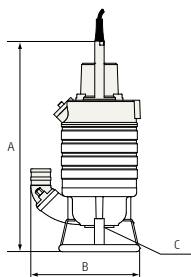
Specifications can be changed without notice.

Sludge pumps made of stainless steel, INOX

Our sludge pumps in stainless steel are used for pumping corrosive fluids with solids in harsh environment. The solids can be up to the size of 50 mm. These pumps are designed to meet the tough requirements from mines, construction sites, landfill sites and other applications that deal with corrosive water. One application is in mines where the water becomes caustic and destroys conventional pumps in matter of days. The pumps may also be used in applications where saltwater is pumped, like shipyards, fish farms, construction works in harbours and offshore projects. All INOX pumps can handle pH values from 2 - 10. They can also be equipped with zinc anodes for extra protection.



SALVADOR INOX

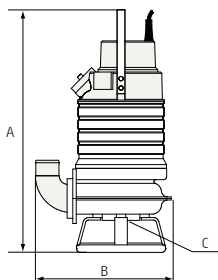
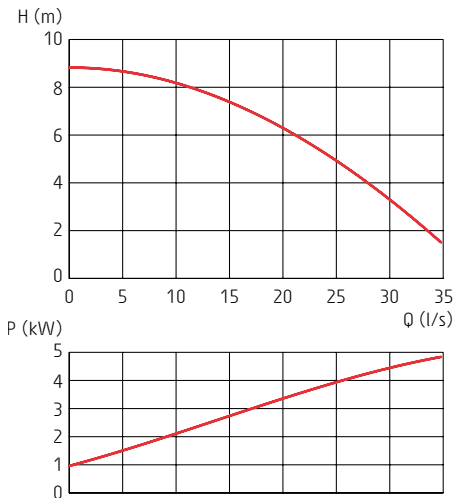


Technical data

Discharge connection	3"
Rated output	2,0 kW
Max power consumption	2,7 kW
Shaft speed	2800 RPM
Rated current at 400 V	4,7 A

A: 645 mm **B:** 375 mm **C:** Ø 50 mm **Weight:** 48 kg

SENIOR INOX



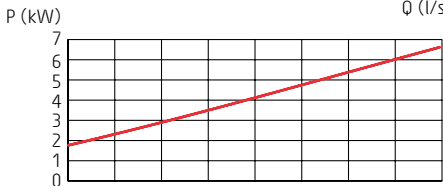
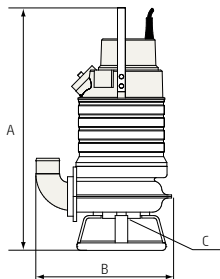
Technical data

Discharge connection	4"
Rated output	4,1 kW
Max power consumption	5,2 kW
Shaft speed	1350 RPM
Rated current at 400 V	8,8 A

A: 755 mm **B:** 480 mm **C:** Ø 80 mm **Weight:** 86 kg

Specifications can be changed without notice.

SANDY INOX



Technical data

Discharge connection 3"

Rated output 6,3 kW

Max power consumption 7,3 kW

Shaft speed 2840 RPM

Rated current at 400 V 12 A

A: 755 mm **B:** 480 mm **C:** Ø 46 mm **Weight:** 86 kg

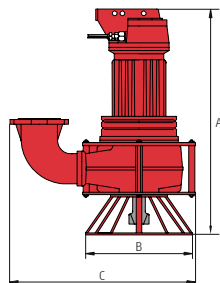
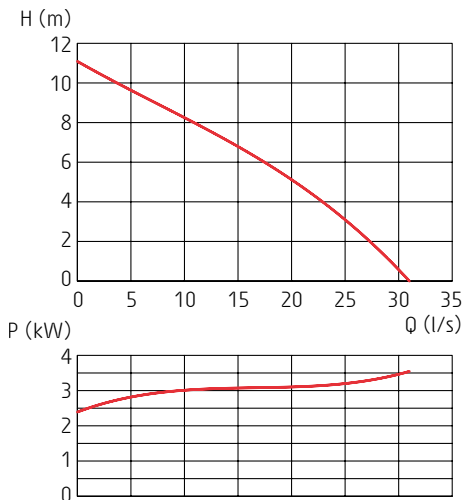
Materials in sludge pumps made of stainless steel

	Salvador INOX	Senior INOX	Sandy INOX
Material			
Upper seal			
Carbon - silicon carbide	•	•	•
Lower seal			
Silicon carbide - silicon carbide	•	•	•
Casted parts			
Stainless steel (EN 10283-1.14412)	•	•	•
Outer casing			
Stainless steel (EN 10088-3-1.14436)	•	•	•
Motor shaft			
Stainless steel (EN 10088-3-1.14460)	•	•	•
Impeller			
Stainless steel (EN 10283-1.14412)	•	•	•
Screws and nuts			
Stainless steel (A4)	•	•	•
O-rings			
Viton rubber	•	•	•
Pump housing			
Nitrile rubber	•	•	•

Specifications can be changed without notice.

Slurry pumps, BRAVO

Grindex slurry pumps are designed for use in quarries, mines, dredging, cleaning of settling ponds and other abrasive other industries that require pumps with very high durability. Each part of the BRAVO pump is designed for maximum endurance and reliability – an absolute must when pumping slurry. Wear is reduced by using NiHard 4 for all hydraulic components. NiHard 4 is a nickel alloy and one of the hardest materials available today. All BRAVO pumps can handle liquids with pH values from 4 up to 10.

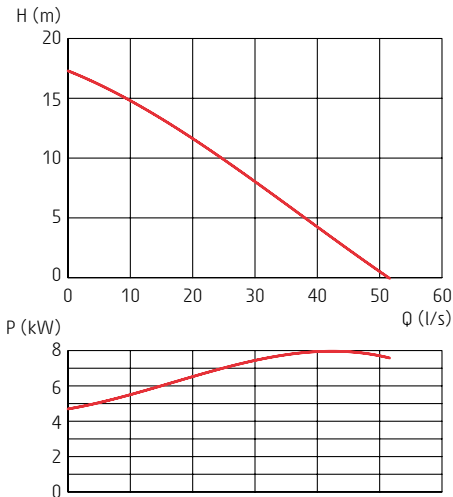
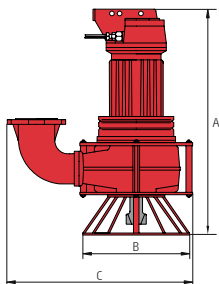
BRAVO 20**Technical data**

Discharge connection	4"
Rated output	3,5 kW
Max power consumption	4,4 kW
Shaft speed	1450 RPM
Rated current at 400 V	8,8 A
Rated current at 500 V	7,0 A
Throughlet with/without agitator	30/80 mm

A: 850 mm **B:** \varnothing 410 mm **C:** 713 mm **Weight:** 162 kg

Specifications can be changed without notice.

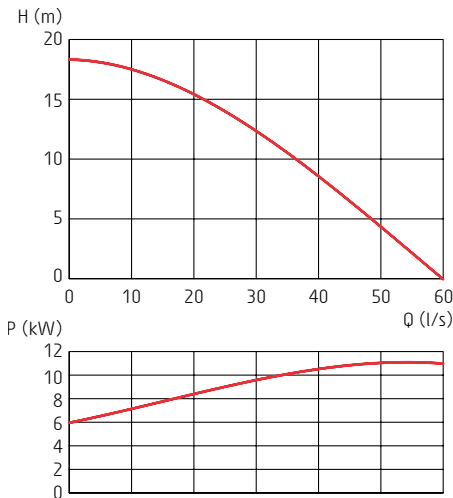
BRAVO 30



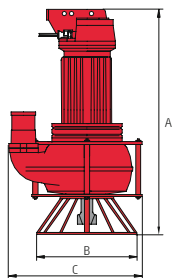
Technical data

Discharge connection	4"
Rated output	7,5 kW
Max power consumption	9,2 kW
Shaft speed	1390 RPM
Rated current at 400 V	15,1 A
Rated current at 500 V	12,1 A
Throughlet with/without agitator	30/80 mm

A: 850 mm **B:** \varnothing 410 mm **C:** 713 mm **Weight:** 167 kg



BRAVO 40

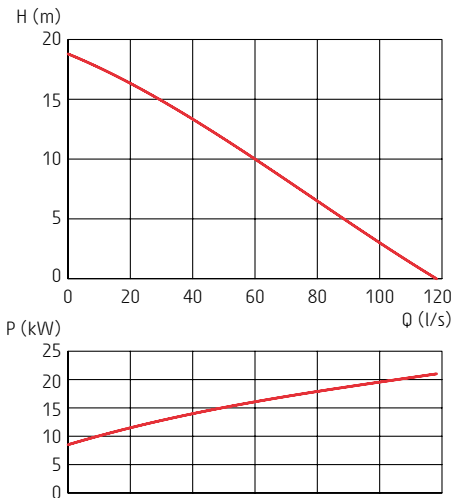
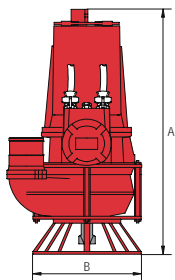


Technical data

Discharge connection	4"
Rated output	13,0 kW
Max power consumption	15,1 kW
Shaft speed	1450 RPM
Rated current at 400 V	26,0 A
Rated current at 500 V	20,8 A
Throughlet with/without agitator	35/100 mm

A: 960 mm **B:** \varnothing 410 mm **C:** 580 mm **Weight:** 199 kg

BRAVO 50

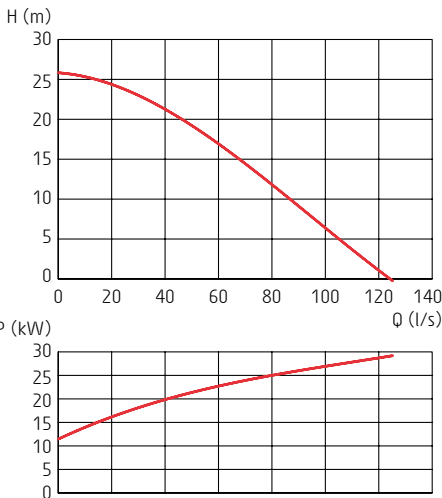


Technical data

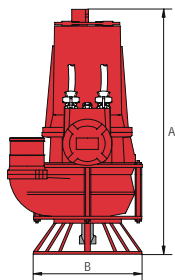
Discharge connection	6"
Rated output	22,0 kW
Max power consumption	26,2 kW
Shaft speed	1450 RPM
Rated current at 400 V	46,1 A
Rated current at 500 V	36,9 A
Throughlet with/without agitator	50/100 mm

A: 1040 mm **B:** Ø 470 mm **Weight:** 344 kg

Specifications can be changed without notice.



BRAVO 60



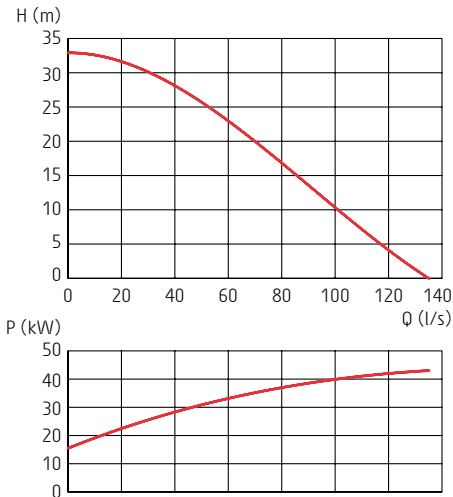
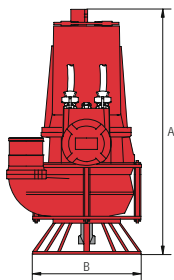
Technical data

Discharge connection	6"
Rated output	34,0 kW
Max power consumption	39,5 kW
Shaft speed	1450 RPM
Rated current at 400 V	66,4 A
Rated current at 500 V	53,1 A
Throughlet with/without agitator	50/100 mm

A: 1100 mm **B:** \varnothing 470 mm **Weight:** 407 kg

Specifications can be changed without notice.

BRAVO 70



Technical data

Discharge connection	6"
Rated output	48,0 kW
Max power consumption	54,4 kW
Shaft speed	1450 RPM
Rated current at 400 V	91,5 A
Rated current at 500 V	73,2 A
Throughlet with/without agitator	50/100 mm

A: 1175 mm **B:** \varnothing 470 mm **Weight:** 475 kg

Specifications can be changed without notice.

Pumping slurry

Pumping fluids with high solids concentrations is more complicated than pumping water. To avoid sedimentation in the system you need to choose the right pump size and dimensions of hoses and pipes. The concentration of solids together with their size and shape may also affect pump performance and power requirements and therefore pump choice. Remember that settled solids might need external agitators, water jets or mixers to get them back in suspension and allow them to be pumped.

As each application requires its own calculation, we recommend you to contact your Grindex dealer.



Materials in slurry pumps

	Bravo 20	Bravo 30	Bravo 40	Bravo 50	Bravo 60	Bravo 70
Material						
Motor housing						
Cast iron	•	•	•	•	•	•
Seal housing						
NiHard 4	•	•	•	•	•	•
Volute						
NiHard 4	•	•	•	•	•	•
Hose adapter						
NiHard 4	•	•	•	•	•	•
Impeller						
NiHard 4	•	•	•	•	•	•
Agitator						
NiHard 4	•	•	•	•	•	•
Motor shaft						
Stainless steel	•	•	•	•	•	•
Screws and nuts						
Stainless steel	•	•	•	•	•	•

Specifications can be changed without notice.

Accessories

Some applications require the use of additional devices. Here is a list of Grindex accessories and what pump they can be used with.

- Available
- Not an optimal choice
- x Not available

	Zinc anodes	Low suction collar	Float switch	Tandem connection	Pump raft
Drainage pumps					
Minex	○	○	○	x	○
Minette	○	○	○	x	○
Minor	○	○	○	○	○
Major	○	○	○	○	○
Master	○	x	○	○	○
Master SH	○	x	○	○	○
Matador	○	x	○	○	○
Maxi	○	x	○	○	○
Magnum	○	x	○	○ (H)	○
Mega	○	x	○	x	x

Sludge pumps					
Salvador	○	x	○	x	●
Senior	○	x	○	x	●
Sandy	○	x	○	x	●

	Zinc anodes	Low suction collar	Float switch	Tandem connection	Pump raft
Small drainage and sludge pumps					
Micro	X	○	○	X	○
Macro	X	○	○	X	○
Solid	X	X	○	X	○
Drainage pumps made of stainless steel					
Minette Inox	○	○	●	X	●
Major Inox	○	○	●	X	●
Master Inox	○	○	●	X	●
Sludge pumps made of stainless steel					
Salvador Inox	○	X	●	X	●
Senior Inox	○	X	●	X	●
Sandy Inox	○	X	●	X	●
Slurry pumps					
Bravo 20	X	X	○	X	○
Bravo 30	X	X	○	X	○
Bravo 40	X	X	○	X	○
Bravo 50	X	X	○	X	○
Bravo 60	X	X	○	X	○
Bravo 70	X	X	○	X	○

Grindex Pump school

The school consists of technical articles, intended to help pump users with common matters in pumping with submersible pumps.

Part 1: Choosing the right pump type for the job

A drainage pump is the most commonly used pump type at construction sites. It is used for pumping water with less abrasive solids, like clay. Sand and solids in suspension can also be pumped, up to the size of the strainer holes (normally 7-12 mm). As sand is quite abrasive to the pump, it must not be too concentrated.



Sludge pumps are suitable for pumping water with solids, as well as for pumping sludge. The solids can be up to the size of the pump inlet diameter (normally 32-80 mm).



Pumps made of stainless steel are often used in copper mines, gold mines and other applications with corrosive fluids. An aluminium pump can handle water with pH values from 5-8, while a stainless steel pump can cope with pH values from 2-10.



Slurry pumps are designed to handle abrasive solids in suspension, like sand, gravel and concrete, in high concentration. They are also frequently used to move sand in suspension, i.e. at a dredging operation. To cope with the abrasives, the hydraulic parts of a slurry pump are often made of NiHard 4, a very hard metal alloy. For improved performance, slurry pumps are generally equipped with an agitator.



Plug and pump

An electrical submersible pump is easy to use, just plug it in and pump. Several small pumps, placed where the need is for the moment, can pump the water to a dedicated collecting pit through long hoses. As the smaller pumps only weights 15-25 kg, you can carry the pump with you as the works moves to different spots at the site.

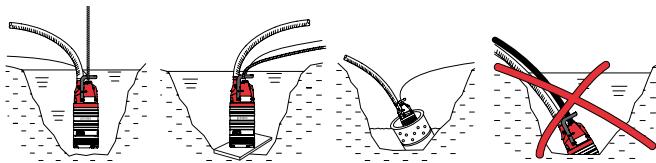


In the collection pit, a bigger pump is installed and pumps the water away from the site. By connecting hoses from several pumps to the pit, you can easily dewater a large area with just a few pumps.



Part 2: Pump arrangement

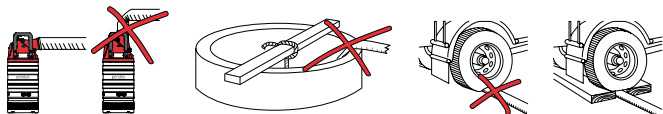
To install an electric submersible pump is easy; place it in the water, connect the hose and turn on the power. Despite the simplicity, there are a few details to consider for optimizing the pumping:



Arrange the pump so it doesn't burrow itself into sand or clay. This is a common problem at construction sites. It can be avoided quite simple by placing the pump on a bed of coarse gravel or a plank. The pump can also be hung freely by a rope or chain, or put into a cut-down and perforated oil drum.

Avoid sharp bend on the hose.

As sharp bends, kinks and pinching of the hose are reducing the capacity of the pump, a lot is won by avoiding those circumstances. Turning the pumps discharge connection so the hose doesn't begin with at kink is easily arranged; it can be fitted vertical or horizontal on almost all Grindex pumps.

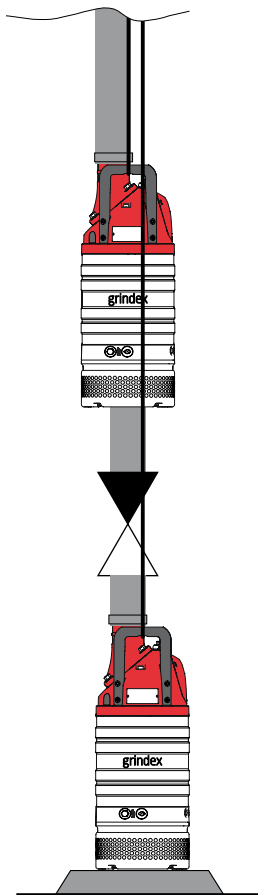


Tandem connection

In order to achieve higher pumping heads, two or more drainage pumps can be connected in series. For this purpose, a series connecting flange is available as an accessory. It is important that the hoses are equipped with check valves, preventing the pumps from suffering from wear when the water runs back from high heads uncontrolled if a power failure should occur.

Long distance pumping

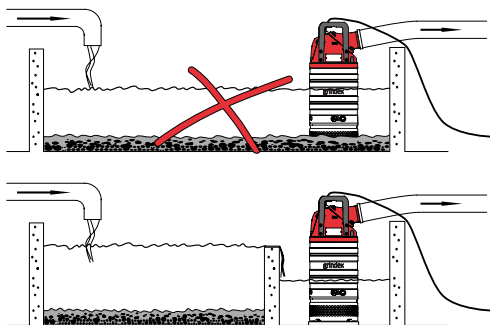
Tandem connection of pumps can also be used when the water needs to be pumped a longer distance. A simple arrangement can be pumping the water to a dedicated collection pit. The pit should be equipped with another pump, passing the water on. This technique can also be used for dewatering a greater area with several pumps spread out, pumping the water to a collection pit. The pit is then equipped with a greater pump, that pumps the water away from the site.



Part 3: Sedimentation

The pumped water is often containing solids that cause wear on pumps, valves and other dewatering equipment. This problem is very common in mines and tunnel construction sites. When pumping water that contains solids (like drill cuttings and sand), there is a risk of sedimentation in the system. A typical symptom is pipes and/or hoses that get filled with sediment, resulting in capacity losses. When the amount of solids increases, there is also an increase of wear on the pump.

One way to prevent this is by using sedimentation tanks where the drill cuttings may settle while the rest of the water is pumped away. The tank needs to be as close to the source as possible, ensuring that the solids are pumped as short distance as possible where the solids can settle in peace. To ensure the efficiency of the sedimentation tank, it needs to have as big surface area as possible. The more solids present in the water, the more careful the design of the sedimentation system is necessary.



For applications where solids can not be avoided, there are recommendations for the velocity of the medium in the discharge line:

Mixture	Min. velocity in discharge line
1. Water + coarse gravel	4 m/s (13.1ft/s)
2. Water + gravel	3 m/s (11.5 ft/s)
3. Water + sand	
Sand particles < 0.1 mm (0.004 in)	1.5 m/s (8.2 ft/s)
Sand particles < 0.6 mm (0.024 in)	2.5 m/s (4.9 ft/s)



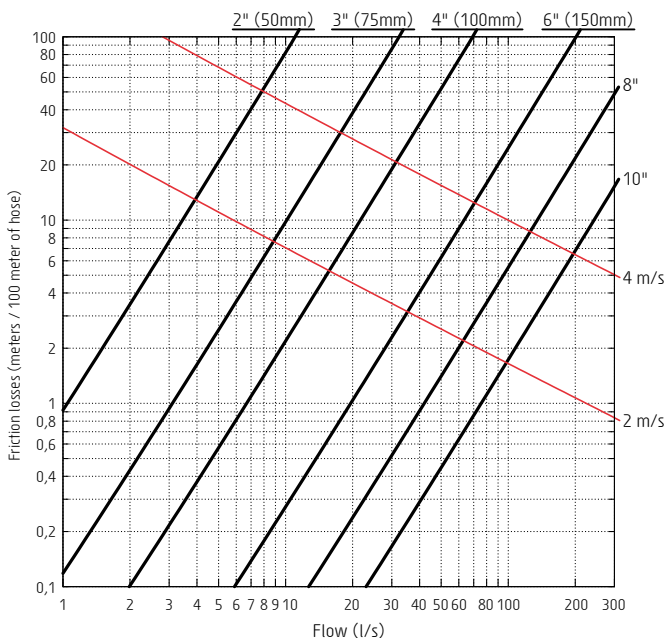
Limitations for Grindex pumps

Limitations	Drainage pumps	Sludge pumps	Small drainage and sludge pumps
Max. submersion depth (IP68)	20 m (Mega: 75 m)	20 m	20 m
Max. liquid temperature	40°C	40°C	40°C
Max. liquid density	1100 kg/m ³	1100 kg/m ³	1100 kg/m ³
pH of the liquid	5-8 (Mega: 6-13)	5-8	3-9

Limitations	Stainless steel pumps	Slurry pumps
Max. submersion depth (IP68)	20 m	20 m
Max. liquid temperature	40°C	40°C
Max. liquid density	1100 kg/m ³	1100 kg/m ³
pH of the liquid	2-10	4-10

Chart for calculating friction losses in hoses

All pump capacities are measured for clean water, directly at the discharge outlet. When collection a hose you need to consider the friction losses that comes from the size and length of the hose. The chart below shows this.



Formulas calculating friction losses in hoses and tubes

The chart at page 58 was created using the following formulas:

Friction loss (meters)	Velocity (m/s)	Reynolds number	Friction factor (Swamee & Jain formula)
$H_{friction} = \frac{1000 \times f \times L \times v^2}{2 \times g \times D}$	$V = \frac{1274 \times Q}{D^2}$	$Re = \frac{v \times D}{1000 \times \mu}$	$f = \frac{0,25}{\left[10 \log \left(\frac{\epsilon}{3,7 \times D} + \frac{5,74}{Re^{0,9}} \right)\right]^2}$
f = friction factor L = length (m) v = avg. velocity g = 9.81 m/s ² D = pipe Ø (mm)	Q = flow (l/s) D = pipe Ø (mm)	v = velocity D = pipe Ø (mm) μ = viscosity = 1,161 x 10 ⁻⁶ m ² /s = 1 cSt	ε = roughness factor (mm) D = pipe Ø (mm) Re = Reynolds number

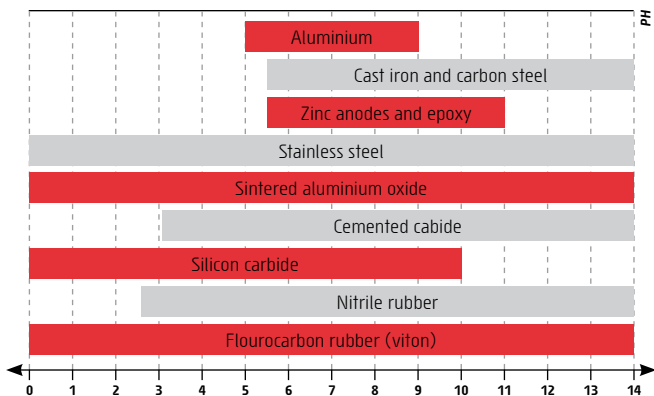
Friction factor

Material	Cast iron	Stainless	PVC	HDPE	Concrete	Hose
ε new (mm)	0,25	0,10	0,05	0,05	0,50	0,25
ε used (mm)	1,00	0,25	0,25	0,25	3,00	1,00

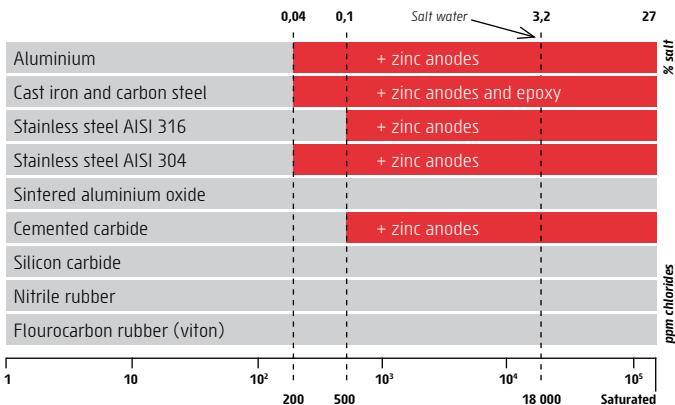
Sludge/slurry solids concentration

By volume (C _v)	By mass/weight (C _m)	Mixture
$C_v = \frac{V_{solids}}{V_{solids + water}}$	$C_m = \frac{m_{solids}}{m_{solids + water}}$	$\frac{SV_{mixture}}{SV_{solids}} = \frac{C_v}{C_m}$
V_{solids} = volume of solids V_{solids+water} = total sludge volume	m_{solids} = mass of solids m_{solids+water} = total sludge mass	SV = Specific weight

pH tables

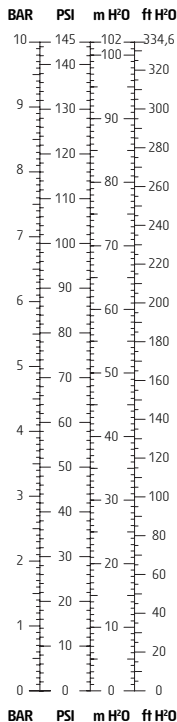


Salt tables

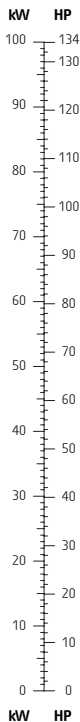


Translation charts

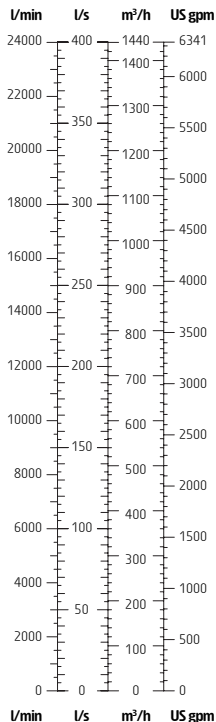
Pressure



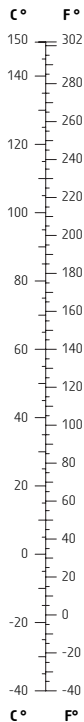
Effect



Flow



Temperature



Recommended generator sizes

Voltages 3~400 V, 50 Hz

Pump model	Max. power consumption	Rated current	Permissible cable length	Delayed fuse	Generator set
Minex	1,6 kW	2,7 A	270 m	10 A	5 KVA
Minette	2,7 kW	4,7 A	200 m	10 A	8 KVA
Minor N H	4,5 kW	7,3 A	215 m	16 A	13 KVA
Major N H	6,7 kW	11,0 A	145 m	25 A	18 KVA
Master SH	10,2 kW	16,0 A	95 m	32 A	25* / 30 KVA
Master N H	11,7 kW	19,0 A	130 m	32 A	25* / 30 KVA
Matador N H	20,0 kW	32,0 A	115 m	63 A	40* / 50 KVA
Maxi N H	41,0 kW	65,0 A	100 m	100 A	85* / 105 KVA
Maxi L	33,0 kW	56,0 A	120 m	100 A	70* / 85 KVA
Magnum	62,0 kW	107,0 A	100 m	190 A	125* / 155 KVA
Mega	95 kW	154 A	35 m	230 A	225* / 270 KVA
Minette Inox	2,7 kW	4,7 A	200 m	10 A	8 KVA
Major Inox	7,3 kW	12,0 A	130 m	25 A	20 KVA
Master Inox	9,4 kW	15 A	165 m	32 A	25 KVA
Salvador	2,7 kW	4,7 A	200 m	10 A	8 KVA
Senior	5,1 kW	9,0 A	128 m	25 A	13 KVA
Sandy	6,7 kW	11,0 A	145 m	25 A	18 KVA
Salvador Inox	2,7 kW	4,7 A	200 m	10 A	8 KVA
Senior Inox	4,1 kW	8,8 A	190 m	16 A	10 KVA
Sandy Inox	7,3 kW	12,0 A	130 m	25 A	18 KVA

*Y/D start

Voltages 1~230 V, 50 Hz

Pump model	Max. power consumption	Rated current	Permissible cable length	Delayed fuse	Generator set
Micro	0,59 kW	2,7 A	60 m	10 A	3 KVA
Macro	0,97 kW	4,2 A	60 m	10 A	3 KVA
Minex Lite	1,2 kW	5,1 A	70 m	10 A	4 KVA
Minex	1,7 kW	7,2 A	50 m	16 A	5 KVA
Minette	1,9 kW	8,5 A	50 m	16 A	5 KVA
Solid	1,2 kW	5,2 A	50 m	16 A	4 KVA
Salvador	1,9 kW	8,4 A	50 m	16 A	5 KVA

Note

- In general, delayed fuse shall be dimensioned by rated current x 1,75
- The above given kVA values are meant as guidelines to simplify the choice of generator size.

Regarding size of generator set, each different type has different characteristic; therefore it is always recommended to consult the manufacturer of generator to find out if the actual generator is capable of operating the pump.

Make sure that the cable is sized to allow a voltage drop of max. 5% of the nominal voltage.

www.grindex.com



Price: €3