








## **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](http://www.grindex.com). If you need more copies, please contact Grindex.

# INDEX

	<b>Drainage pumps</b>	<b>4-16</b>
	Minex, Minette, Minor, Major, Master, Master SH, Matador, Maxi, Magnum, Mega	
	<b>Sludge pumps</b>	<b>18-23</b>
	Salvador, Senior, Sandy	
	<b>Drainage pumps made of stainless steel, INOX</b>	<b>24-29</b>
	Minette Inox, Major Inox, Master Inox	
	<b>Sludge pumps made of stainless steel, INOX</b>	<b>30-35</b>
	Salvador Inox, Senior Inox, Sandy Inox	
	<b>Slurry pumps</b>	<b>36-47</b>
	Bravo 200, 300, 400, 500, 600, 700, 800, 900	
	<b>Accessories</b>	<b>48-49</b>
	<b>Grindex Pump school</b>	<b>50-55</b>
	<b>Limitations</b>	<b>56</b>
	<b>More technical information</b>	<b>57-62</b>
	Calculating friction losses in hoses	57
	Formulas for calculating friction losses in hoses and tubes	58
	Friction factor	58
	Sludge/slurry solids concentration	58
	pH tables	59
	Salt tables	59
	Translation charts	60
	<b>Recommended generator sizes</b>	<b>61-62</b>
	<b>Notes</b>	<b>63-66</b>

# Drainage pumps

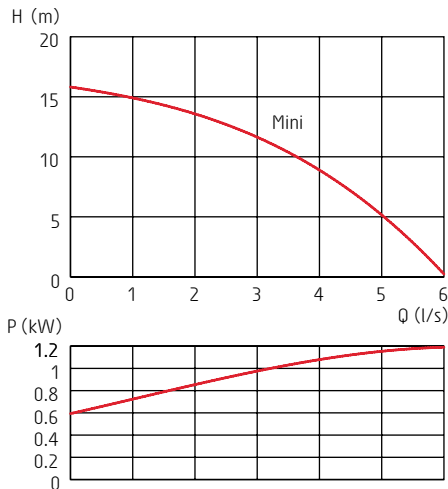
**Grindex drainage pumps are designed for professional use in tough applications like mines, construction sites, tunnel sites and other demanding industries.**

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.

# MINI



## Technical data

1~

Discharge connection 2"

Rated output 0,9 kW

Max power consumption 1,2 kW

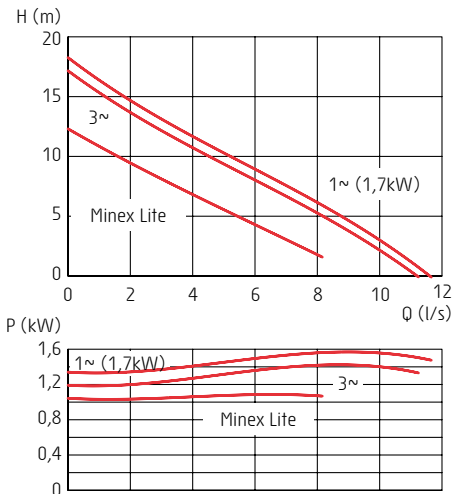
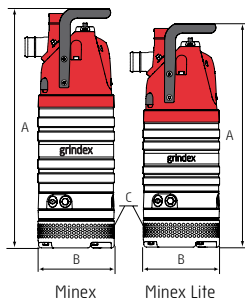
Shaft speed 2800 RPM

Rated current at 230 V 5,2 A

**A:** 440 mm **B:** Ø 185 mm **C:** 5x11 mm **Weight:** 14,5 kg

Specifications can be changed without notice.

# MINEX



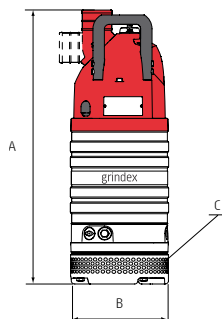
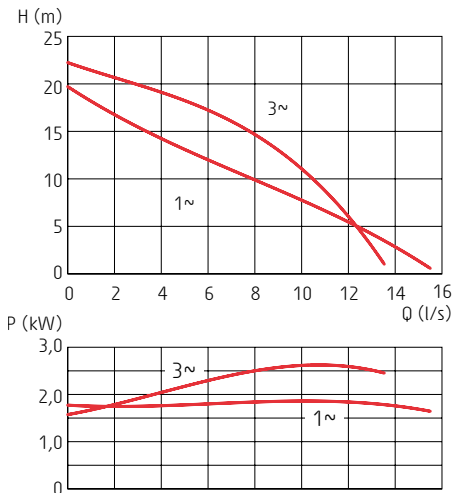
## Technical data

	Minex Lite	1~	3~
Discharge connection	2"	2"	2"
Rated output	0,85 kW	1,3 kW	1,2 kW
Max power consumption	1,1 kW	1,7 kW	1,6 kW
Shaft speed	2785 RPM	2860 RPM	2760 RPM
Rated current at 230 V	5,1 A	7,2 A	4,7 A
Rated current at 400 V	-	-	2,7 A

**1~ (1,7 kW):** A: 610 mm B:  $\varnothing$  195 mm C:  $\varnothing$  7,5 mm **Weight:** 24 kg

**Minex Lite (1~ 1,1 kW) and 3~:** A: 570 mm B:  $\varnothing$  195 mm C:  $\varnothing$  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

8,1 A

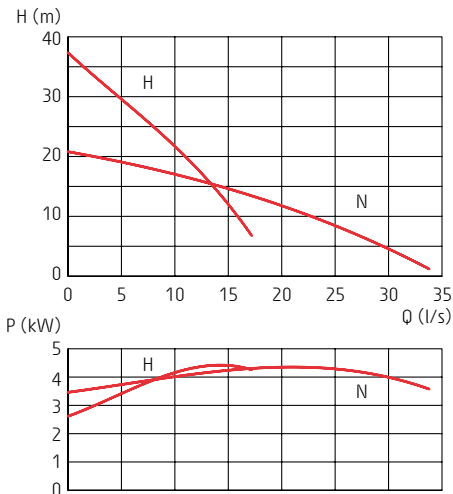
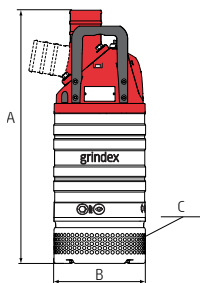
Rated current at 400 V

-

4,7 A

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

# MINOR



## Technical data

Discharge connection

N 4"

H 3"

Rated output

N 3,7 kW

H 3,7 kW

Max power consumption

N 4,5 kW

H 4,5 kW

Shaft speed

N 2870 RPM

H 2870 RPM

Rated current at 400 V

N 7,3 A

H 7,3 A

Rated current at 500 V

N 6,0 A

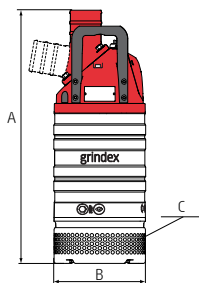
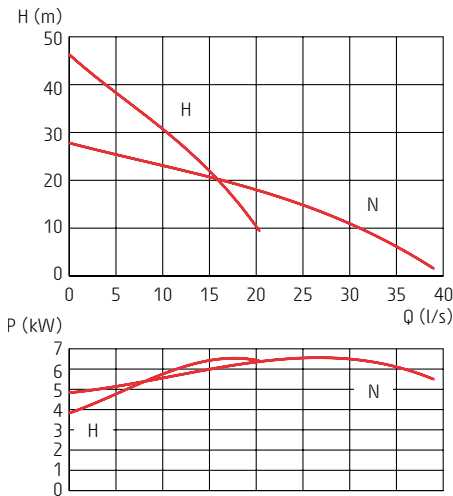
H 6,0 A

**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

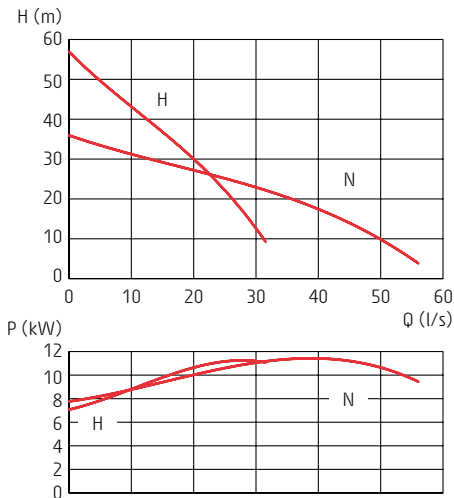
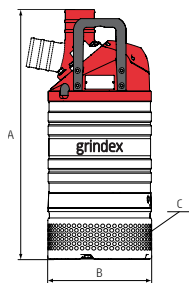
8,7 A

8,7 A

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

Specifications can be changed without notice.

# MASTER

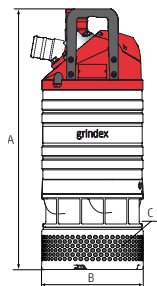
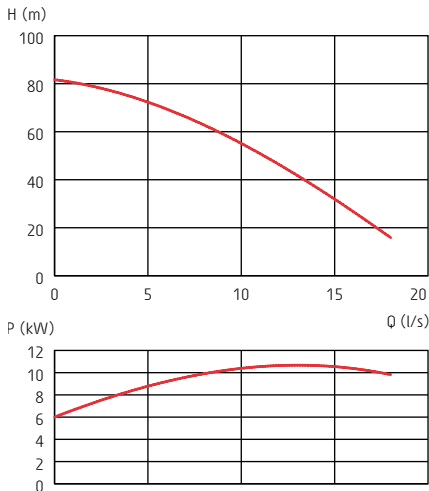


Technical data	N	H
Discharge connection	6"	4"
Rated output	10 kW	10 kW
Max power consumption	11,7 kW	11,7 kW
Shaft speed	2860 RPM	2860 RPM
Rated current at 400 V	19 A	19 A
Rated current at 500 V	15 A	15 A

**A:** 832 mm **B:** Ø 346 mm **C:** Ø 10 mm **Weight:** 80 kg

Specifications can be changed without notice.

## MASTER SH



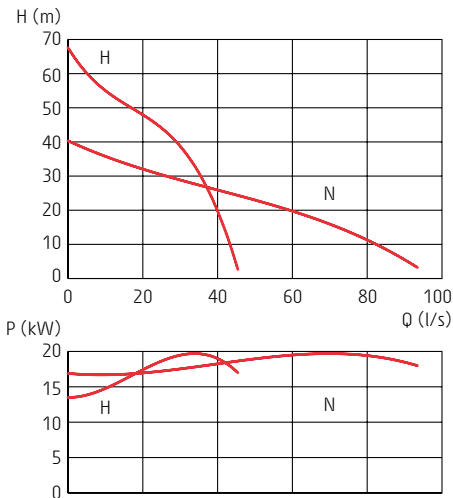
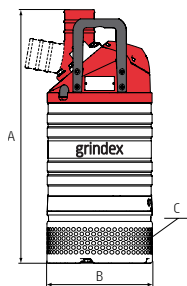
### Technical data

Discharge connection	3"
Rated output	10 kW
Max power consumption	11,7 kW
Shaft speed	2860 RPM
Rated current at 400 V	19 A
Rated current at 500 V	15 A

**A:** 887 mm **B:** Ø 346 mm **C:** Ø 10 mm **Weight:** 98 kg

*Specifications can be changed without notice.*

# MATADOR



## Technical data

Discharge connection

N  
6"

H  
4"

Rated output

N  
18 kW

H  
18 kW

Max power consumption

N  
20 kW

H  
20 kW

Shaft speed

N  
2900 RPM

H  
2900 RPM

Rated current at 400 V

N  
32 A

H  
32 A

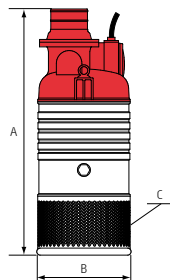
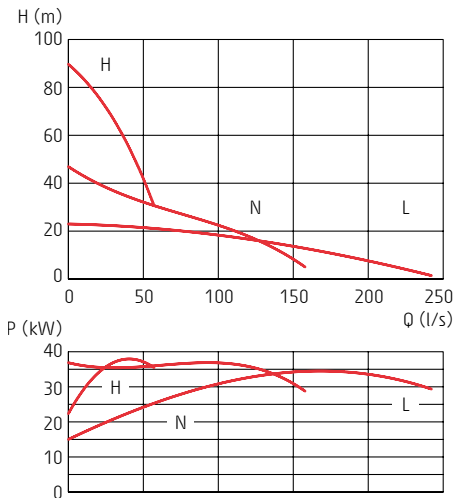
Rated current at 500 V

N  
26 A

H  
26 A

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

*Specifications can be changed without notice.*

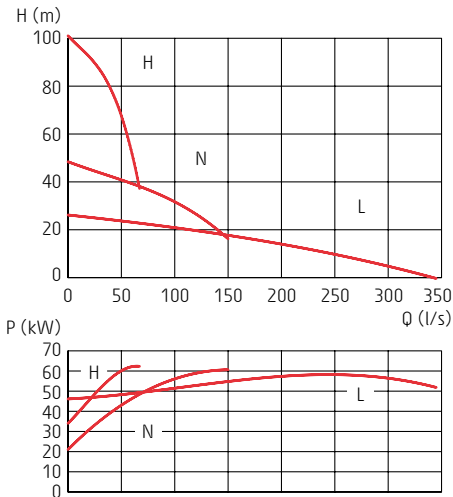
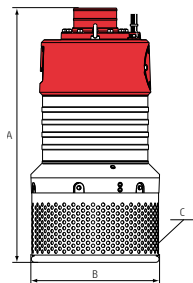
**MAXI**

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	57 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

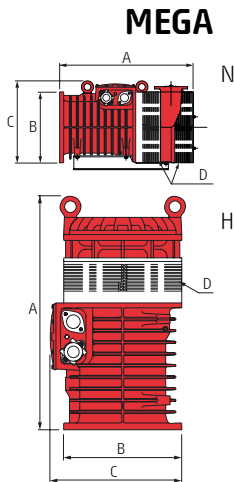
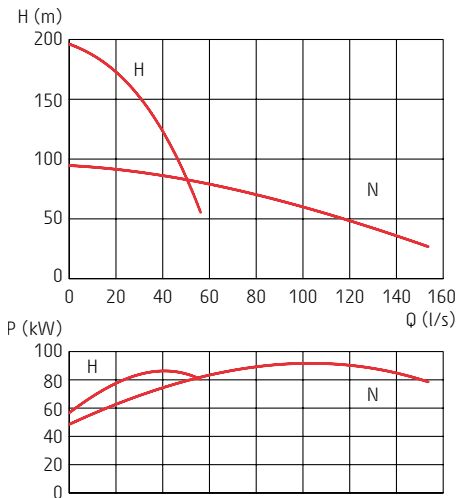


## Technical data

	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.

**Technical data****N****H**

Discharge connection	6" (DN150)	4" (DN100)
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	117 A	117 A

**A:** 1180 mm (N), 1245 mm (H) **B:** 610 mm **C:** 770 mm (N), 680 mm (H)  
**D:** 10x10 mm **Weight:** 900 kg (N), 985 kg (H)

*Specifications can be changed without notice.*

## Materials in drainage pumps

	Mini	Minex	Minette	Minor	Major	Master	Master SH	Matador	Maxi	Magnum	Mega
<b>Material</b>											
<b>Upper seal</b>											
Tungsten carbide - Tungsten carbide								•	•	•	•
Tungsten carbide - Aluminium oxide		•	•	•	•	•	•				
Carbon - Aluminium oxide	•										
<b>Lower seal</b>											
Tungsten carbide - Tungsten carbide									•	•	•
Silicon carbide - Silicon carbide	•	•	•	•	•	•	•	•			
<b>Casted parts</b>											
Aluminium	•	•	•	•	•	•	•	•	•	•	
Cast iron											•
<b>Stator housing</b>											
Aluminium	•	•	•	•	•	•	•		•	•	
Cast iron								•			•
<b>Outer casing</b>											
Stainless steel		•	•	•	•	•	•	•	•	•	
Aluminium	•										
Cast iron											•

Specifications can be changed without notice.



	Mini	Minex	Minette	Minor	Major	Master	Master SH	Matador	Maxi	Magnum	Mega
<b>Material</b>											
<b>Motor shaft</b>											
Stainless steel	●	●	●	●	●	●	●	●	●	●	●
<b>Impeller</b>											
Hard-Iron™		●	●	●	●	●	●	●	●	●	●
Polyurethane	●										
<b>Suction cover</b>											
Hard-Iron™	-		3~	●	●	●	●	●			
<b>Lower diffuser</b>											
Nitrile rubber		●	1~					●	○		●
Polyurethane	●								●	●	
<b>Diffuser ring</b>											
Nitrile rubber		●	●	●	●	●		●	○		●
Polyurethane									●	●	
<b>Screws and nuts</b>											
Stainless steel	●	●	●	●	●	●	●	●	●	●	●
<b>O-rings</b>											
Nitrile rubber	●	●	●	●	●	●	●	●	●	●	●

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.**

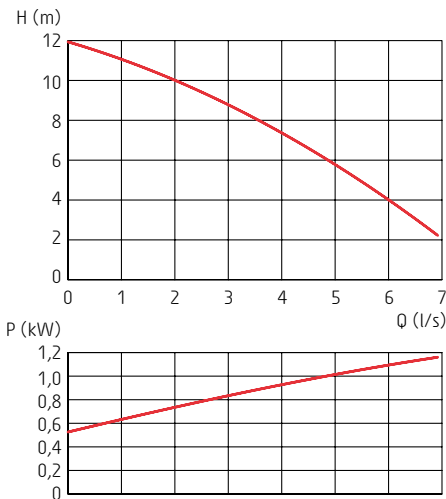
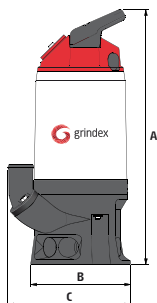
They are designed for:

- 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.



# SOLID



## Technical data

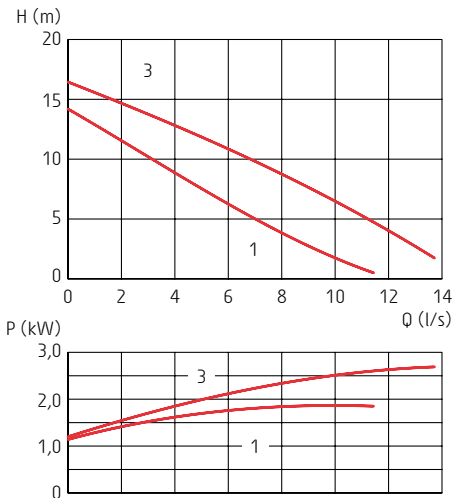
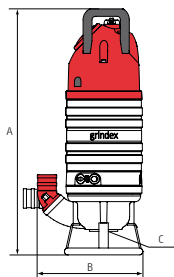
1~

Discharge connection	2"
Rated output	0,9 kW
Max power consumption	1,2 kW
Shaft speed 2	2800 varv/min
Rated current at 230 V	5,2 A

**A:** 510 mm **B:** Ø 200 mm **C:** 280 mm **D:** Ø 38 mm **Weight:** 17 kg

Specifications can be changed without notice.

# 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

8,1 A

Rated current at 400 V

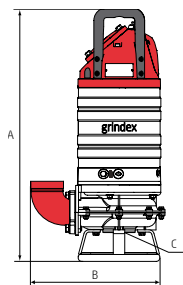
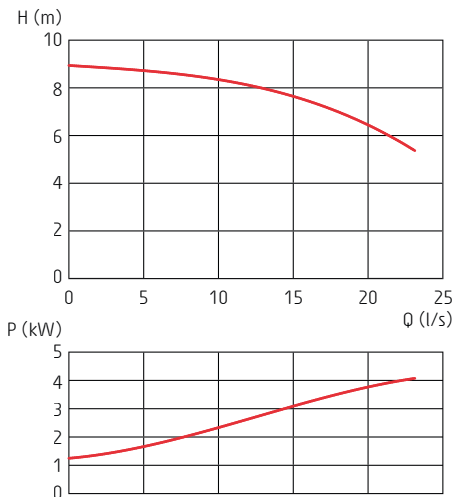
-

4,7 A

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

Specifications can be changed without notice.

## SENIOR



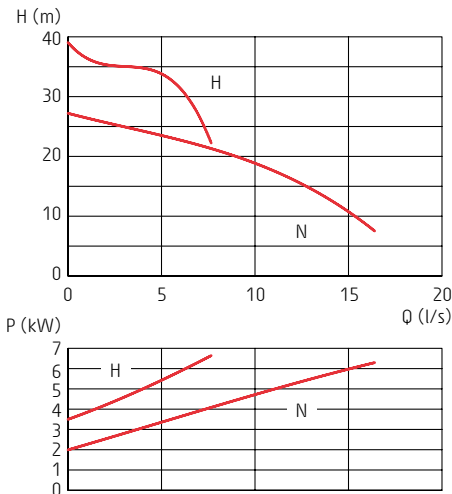
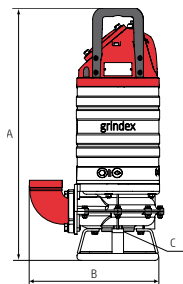
### Technical data

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:** 879 mm **B:**  $\varnothing$  480 mm **C:**  $\varnothing$  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

	Solid	Salvador	Senior	Sandy
<b>Material</b>				
<b>Upper seal:</b>				
Tungsten carbide - Aluminium oxide		•	•	•
Carbon - Aluminium oxide	•			
<b>Lower seal</b>				
Silicon carbide - Silicon carbide	•	•	•	•
<b>Stator housing</b>				
Aluminium	•	•	•	•
<b>Outer casing</b>				
Stainless steel		•	•	•
Aluminium	•			
<b>Motor shaft</b>				
Stainless steel	•	•	•	•
<b>Impeller</b>				
Hard-Iron™		•	•	•
Polyurethane	•			
<b>Pump housing</b>				
Polyurethane	•			
Aluminium with polyurethane lining		•	•	•
<b>Screws and nuts</b>				
Stainless steel	•	•	•	•
<b>O-rings</b>				
Nitrile rubber	•	•	•	•
<b>Casted parts</b>				
Aluminium	•	•	•	•

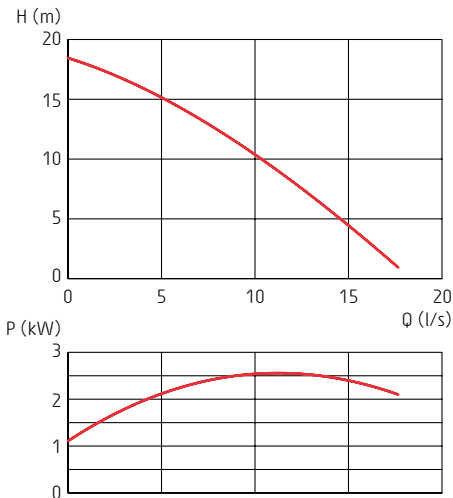
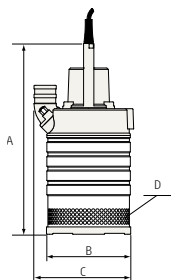
### Drainage pumps made of stainless steel, INOX

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

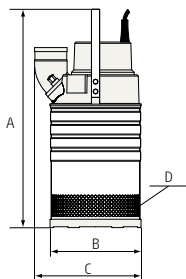
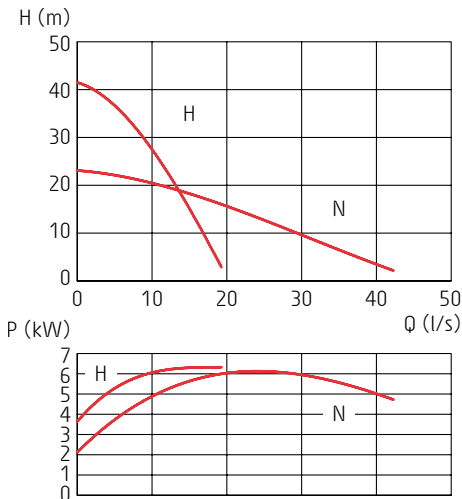


### Technical data

Discharge connection	3"
Rated output	2,0 kW
Max power consumption	2,6 kW
Shaft speed	2715 RPM
Rated current at 400 V	4,4 A

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

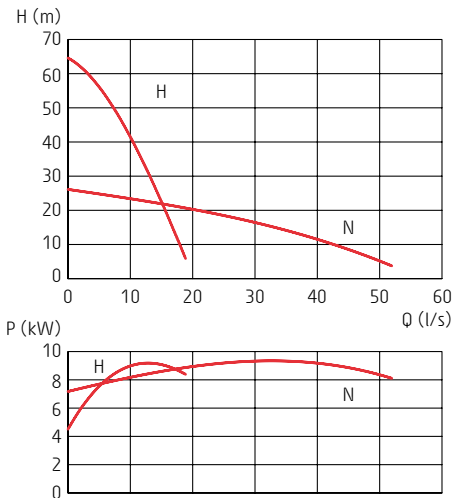
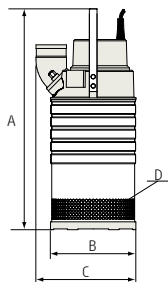
## MAJOR INOX



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
<b>A:</b> 665 mm <b>B:</b> Ø 280 mm <b>C:</b> 330 mm <b>D:</b> Ø 8,5 mm <b>Weight:</b> 65 kg		

Specifications can be changed without notice.

## MASTER INOX



### Technical data

Discharge connection

N  
4"

H  
3"

Rated output

8,0 kW

8,0 kW

Max power consumption

9,2 kW

9,2 kW

Shaft speed

2855 RPM

2855 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
<b>Material</b>			
<b>Upper seal</b>			
Carbon - silicon carbide	•	•	•
<b>Lower seal</b>			
Silicon carbide - silicon carbide	•	•	•
<b>Casted parts</b>			
Stainless steel (EN 10283-1.14412)	•	•	•
<b>Outer casing</b>			
Stainless steel (EN 10088-3-1.14436)	•	•	•
<b>Motor shaft</b>			
Stainless steel (EN 10088-3-1.14460)	•	•	•
<b>Impeller</b>			
Stainless steel (EN 10283-1.14412)	•	•	•
<b>Screws and nuts</b>			
Stainless steel (A4)	•	•	•
<b>O-rings</b>			
Viton rubber	•	•	•
<b>Diffusers</b>			
Nitrile rubber	•	•	•

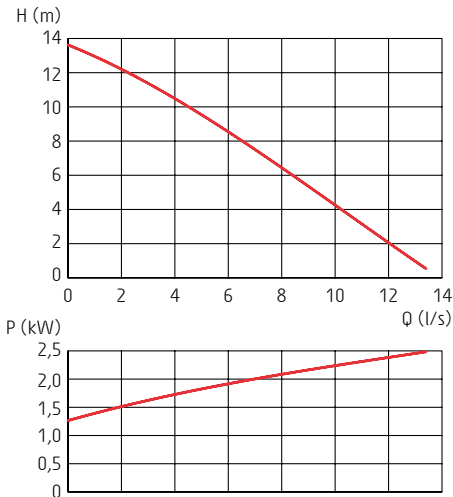
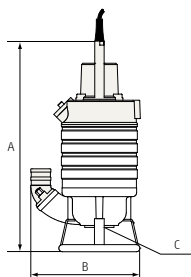
*Specifications can be changed without notice.*

### 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



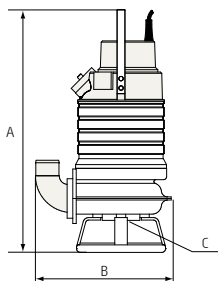
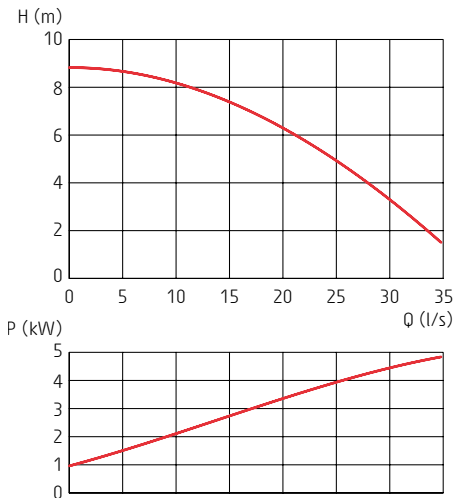
### Technical data

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

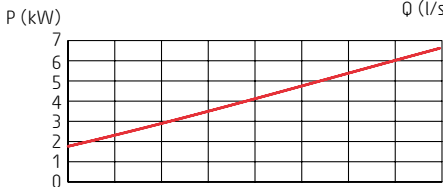
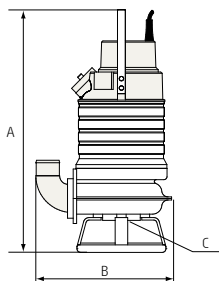
Shaft speed 1350 RPM

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

*Specifications can be changed without notice.*

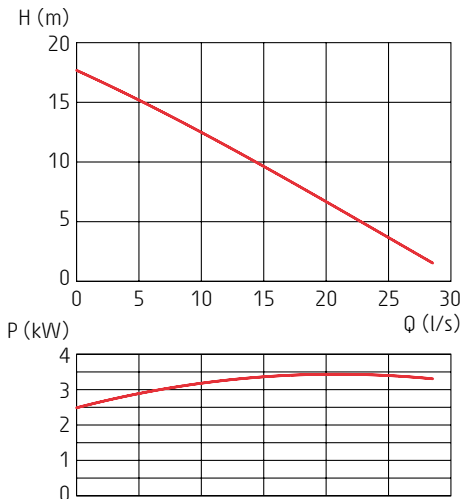
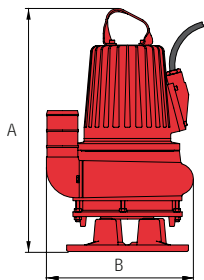
### Slurry pumps, BRAVO

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.

All BRAVO pumps can handle liquids with pH values from 5.5 up to 14. The Bravo 400 to 900 are equipped with agitator beneath the pump intake to stir up settled material toward the pump intake. The Bravo 400 to 900 can also be fitted with an optional cooling jacket for use in dry pit applications.



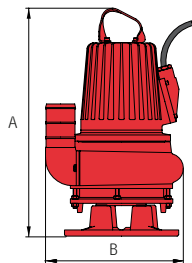
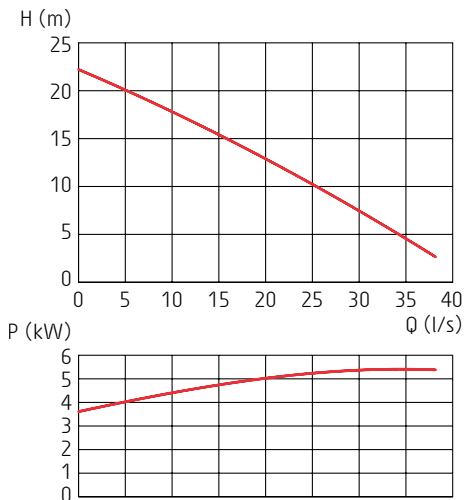
## BRAVO 200



### Technical data

Discharge connection	4"
Rated output	4,7 kW
Max power consumption	5,7 kW
Shaft speed	1445 RPM
Rated current at 400 V	9,6 A
Rated current at 500 V	7,7 A
Throughlet	50 mm

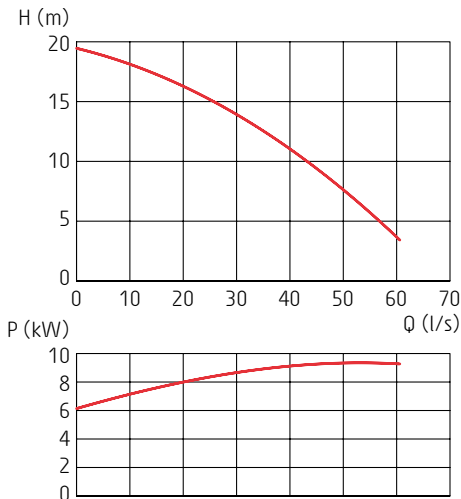
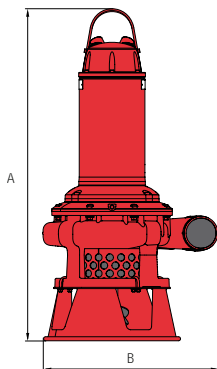
**A:** 760 mm **B:** 460 mm **Weight:** 157 kg

**BRAVO 300****Technical data**

Discharge connection	4"
Rated output	5,9 kW
Max power consumption	7,1 kW
Shaft speed	1450 RPM
Rated current at 400 V	12 A
Rated current at 500 V	9,5 A
Throughlet	50 mm

**A:** 760 mm **B:** 460 mm **Weight:** 157 kg

## BRAVO 400

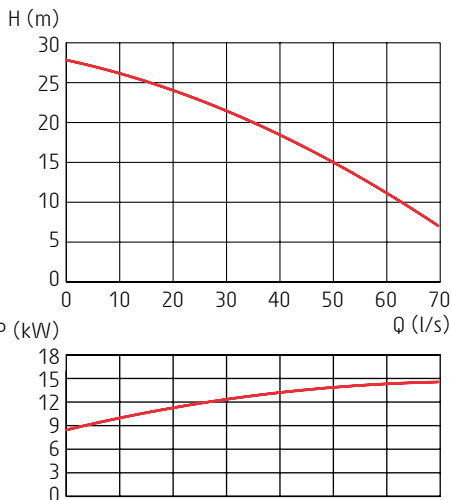


### Technical data

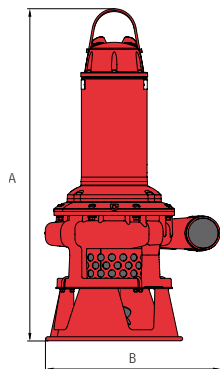
Discharge connection	4"
Rated output	13,5 kW
Max power consumption	16 kW
Shaft speed	1455 RPM
Rated current at 400 V	28 A
Rated current at 500 V	21 A
Throughlet	30 mm

**A:** 1148 mm **B:** 595 mm **Vikt:** 231 kg





## BRAVO 500



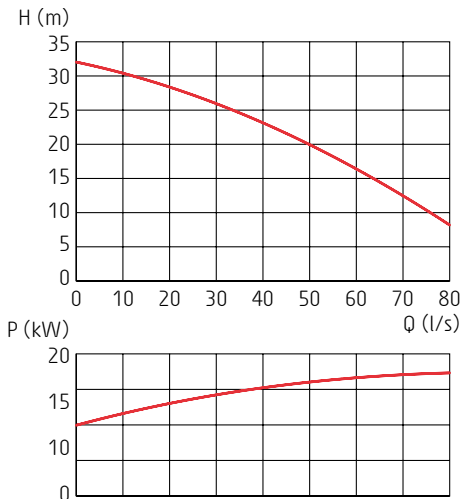
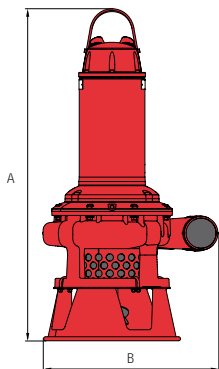
### Technical data

Discharge connection	4"
Rated output	18,5 kW
Max power consumption	21 kW
Shaft speed	1460 RPM
Rated current at 400 V	36 A
Rated current at 500 V	29 A
Throughlet	40 mm

**A:** 1273 mm **B:** 595 mm **Vikt:** 293 kg

*Specifications can be changed without notice.*

## BRAVO 600

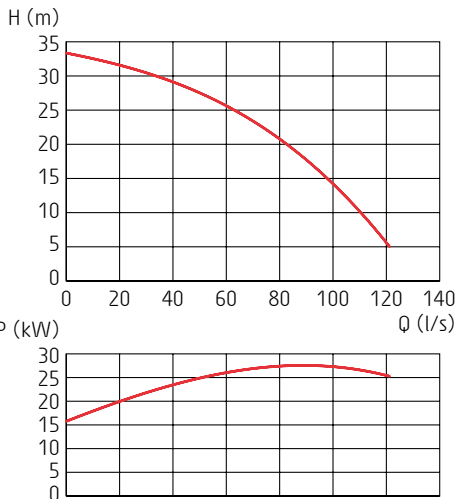


### Technical data

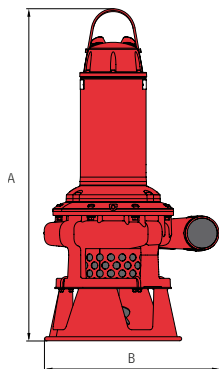
Discharge connection	4"
Rated output	22 kW
Max power consumption	25 kW
Shaft speed	1460 RPM
Rated current at 400 V	41 A
Rated current at 500 V	33 A
Throughlet	40 mm

**A:** 1273 mm **B:** 595 mm **Weight:** 293 kg

*Specifications can be changed without notice.*



## BRAVO 700



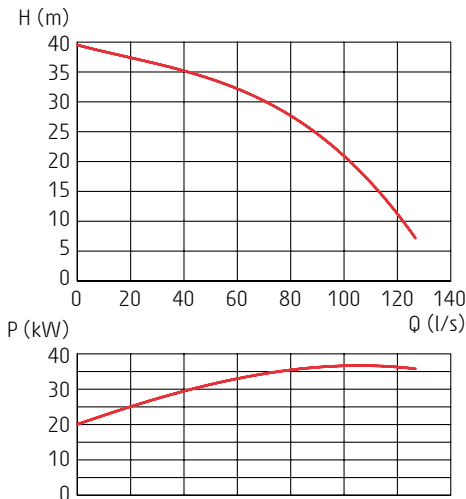
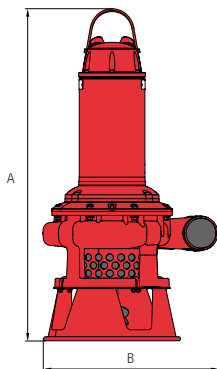
### Technical data

Discharge connection	6"
Rated output	37 kW
Max power consumption	40 kW
Shaft speed	1475 RPM
Rated current at 400 V	66 A
Rated current at 500 V	54 A
Throughlet	36 mm

**A:** 1652 mm    **B:** 875 mm    **Weight:** 613 kg

*Specifications can be changed without notice.*

## BRAVO 800

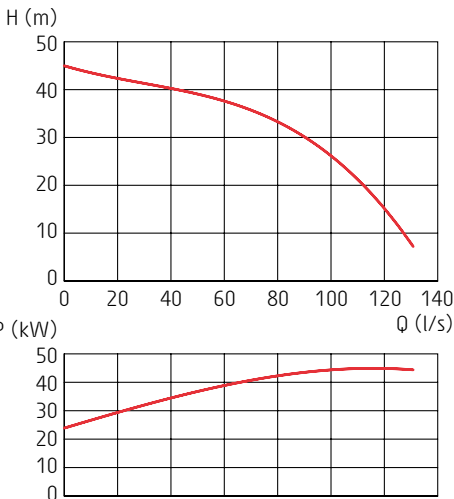


### Technical data

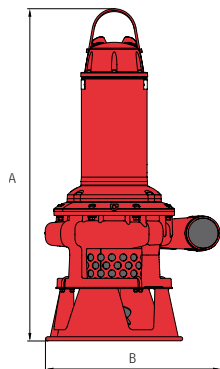
Discharge connection	6"
Rated output	45 kW
Max power consumption	49 kW
Shaft speed	1475 RPM
Rated current at 400 V	82 A
Rated current at 500 V	63 A
Throughlet	36 mm

**A:** 1652 mm **B:** 875 mm **Weight:** 613 kg

*Specifications can be changed without notice.*



## BRAVO 900



### Technical data

Discharge connection	6"
Rated output	70 kW
Max power consumption	75 kW
Shaft speed	1475 RPM
Rated current at 400 V	132 A
Rated current at 500 V	102 A
Throughlet	36 mm

**A:** 1779 mm **B:** 875 mm **Weight:** 845 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 for more information about slurry pumping.



## Materials in slurry pumps

	Bravo 200	Bravo 300	Bravo 400	Bravo 500	Bravo 600	Bravo 700	Bravo 800	Bravo 900
<b>Material</b>								
<b>Drive unit</b>								
Cast iron	•	•	•	•	•	•	•	•
<b>Suction cover</b>								
Nitrile rubber	•	•	—	—	—	—	—	—
<b>Pump housing</b>								
Cast iron	•	•						
Hard-Iron™			•	•	•	•	•	•
<b>Hose connector</b>								
Cast iron	•	•	—	—	—	—	—	—
<b>Impeller</b>								
Hard-Iron™	•	•	•	•	•	•	•	•
<b>Lifting handle</b>								
Galvanised steel	•	•						
Stainless steel			•	•	•	•	•	•
<b>Motor shaft</b>								
Galvanised steel	•	•	•	•	•	•	•	•
<b>Studs, screws and nuts</b>								
Stainless steel	•	•	•	•	•	•	•	•

— Not available

## 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
- Together with external starter
- ( ) Letter in parentheses refer to pump model

	Zinc anodes	Low suction collar	Float switch	Tandem connection	Pump raft
<b>Drainage pumps</b>					
Mini	X	○	○	X	○
Minex	○	○	○	X	○
Minette	○	○	○	X	○
Minor	○	○	○	○	○
Major	○	○	○	○	○
Master	○	X	□	○	○
Master SH	○	X	□	○	○
Matador	○	X	□	○	○
Maxi	○	X	□	○	○
Magnum	○	X	□	○ (H)	○
Mega	○	X	□	X	○



	Zinc anodes	Low suction collar	Float switch	Tandem connection	Pump raft
<b>Sludge pumps</b>					
Solid	X	X	○	X	●
Salvador	○	X	○	X	●
Senior	○	X	○	X	●
Sandy	○	X	○	X	●
<b>Drainage pumps made of stainless steel</b>					
Minette Inox	○	○	□	X	●
Major Inox	○	○	□	X	●
Master Inox	○	○	□	X	●
<b>Sludge pumps made of stainless steel</b>					
Salvador Inox	○	X	□	X	●
Senior Inox	○	X	□	X	●
Sandy Inox	○	X	□	X	●
<b>Slurry pumps</b>					
Bravo 200	X	X	□	X	○
Bravo 300	X	X	□	X	○
Bravo 400	X	X	□	X	○
Bravo 500	X	X	□	X	○
Bravo 600	X	X	□	X	X
Bravo 700	X	X	□	X	X
Bravo 800	X	X	□	X	X
Bravo 900	X	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 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.

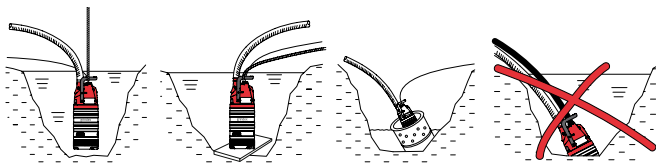


In the collection pit, a bigger pump is installed and pumps the water away from the site. By connecting hoses from several pumps to the pit, you can easily dewater a large area with just a few pumps.



### Part 2: Pump arrangement

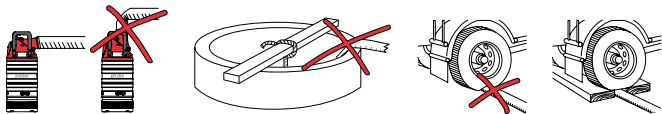
Despite the simplicity, there are a few details to consider for optimizing the pumping:



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.

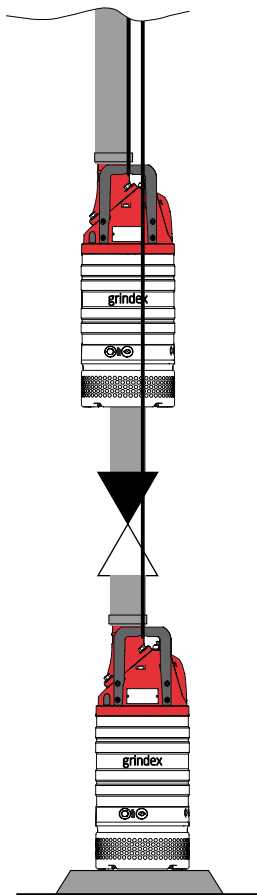


### Tandem connection

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

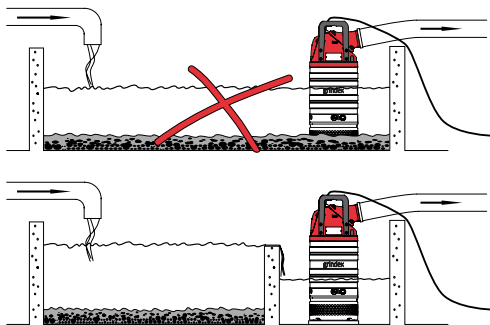
Tandem connection of pumps can also be used when the water needs to be pumped a longer distance. A simple arrangement can be pumping the water to a dedicated collection pit. The pit should be equipped with another pump, passing the water on. This technique can also be used for dewatering a greater area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

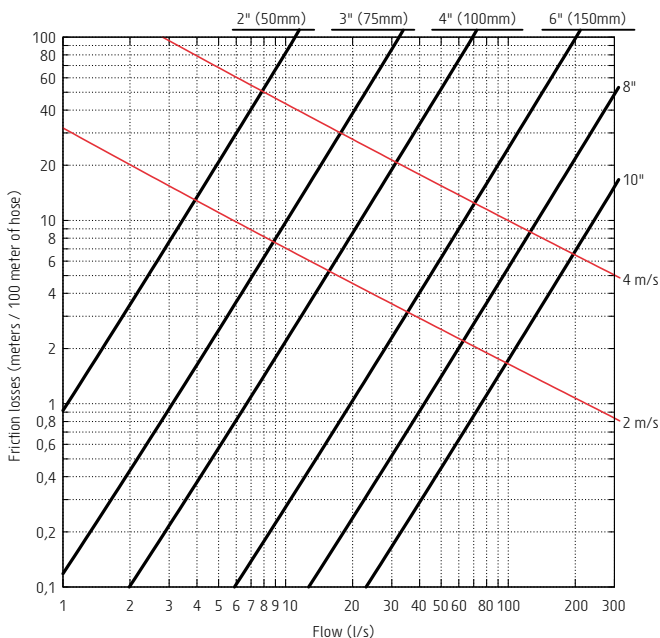
Limitations	Drainage pumps	Sludge pumps
<b>Max. submersion depth (IP68)</b>	20 m (Mini: 10 m, Mega: 75 m)	20 m (Solid 10 m)
<b>Max. liquid temperature</b>	40°C	40°C
<b>Max. liquid density</b>	1100 kg/m <sup>3</sup>	1100 kg/m <sup>3</sup>
<b>pH of the liquid</b>	5-8 (Mega: 6-13)	5-8

Limitations	Stainless steel pumps	Slurry pumps
<b>Max. submersion depth (IP68)</b>	20 m	20 m
<b>Max. liquid temperature</b>	40°C	40°C
<b>Max. liquid density</b>	1100 kg/m <sup>3</sup>	1100 kg/m <sup>3</sup>
<b>pH of the liquid</b>	2-10	5.5 - 14



## 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 57 was created using the following formulas:

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

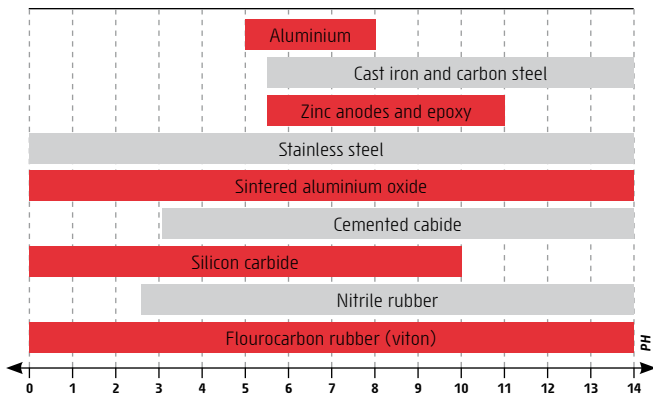
### Friction factor

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

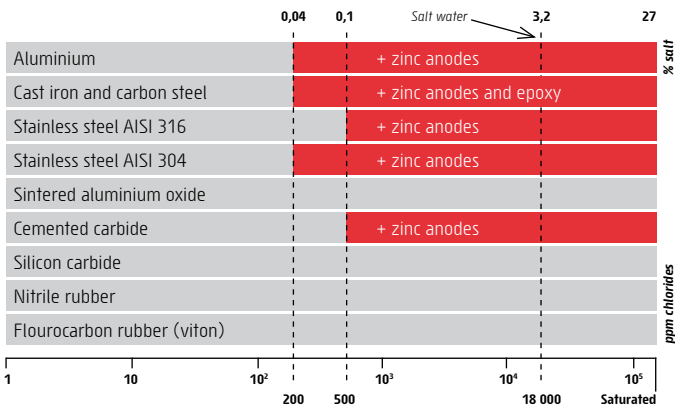
### Sludge/slurry solids concentration

By volume (C <sub>v</sub> )	By mass/weight (C <sub>m</sub> )	Mixture
$C_v = \frac{V_{solids}}{V_{solids + water}}$	$C_m = \frac{m_{solids}}{m_{solids + water}}$	$\frac{SV_{mixture}}{SV_{solids}} = \frac{C_v}{C_m}$
<b>V<sub>solids</sub></b> = volume of solids <b>V<sub>solids+water</sub></b> = total sludge volume	<b>m<sub>solids</sub></b> = mass of solids <b>m<sub>solids+water</sub></b> = total sludge mass	<b>SV</b> = Specific weight

## pH tables

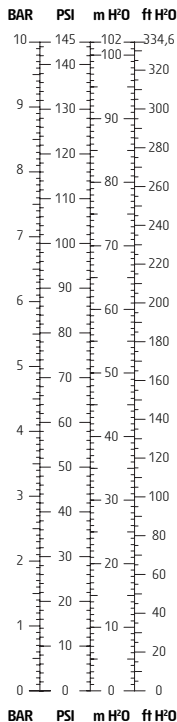


## Salt tables

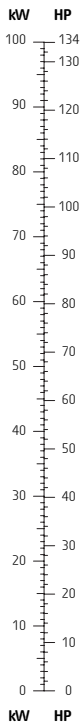


# Translation charts

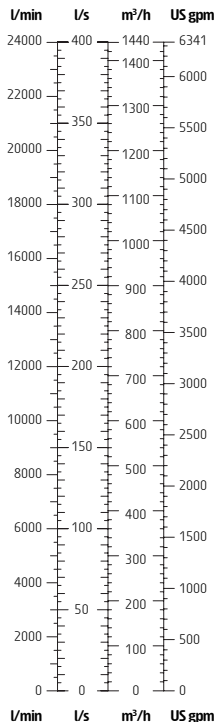
## Pressure



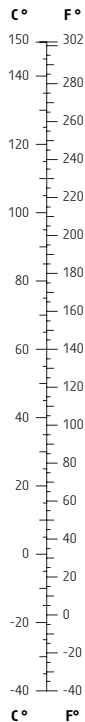
## Effect



## 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

## Recommended generator sizes

### Voltages 1~230 V, 50 Hz

Pump model	Max. power consumption	Rated current	Permissible cable length	Delayed fuse	Generator set
Mini	1,2 kW	5,2 A	50 m	10 A	4 KVA
Minex Lite	1,1 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
<hr/>					
Solid	1,2 kW	5,2 A	50 m	10 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.











**Grindex AB**

Gesallvagen 33  
S-174 07 Sundbyberg  
Sweden

Phone: +46 8 606 6600  
Fax: +46 8 745 5328

[www.grindex.com](http://www.grindex.com)

9005392 ENG 50Hz - Printed 2012.02.

Price: €3