NSI.WATER

SMART WATER & ENERGY SOLUTIONS

SCAN ME

# BOREHOLE PRODUCT MANUAL

2023

SOLAR / DC POWERED

AC POWERED ONLY

AC/DC (HYBRID)
Both Solar & hydro Electricity Powered

www.nsiwaterug.com


WELCOME
NSI WATER
SMART WATER & ENERGY SOLUTIONS
SOLAR WATER PUMPING APPLICATONS
NSI WATER
HONDA POWER PRODUCTS
SOLAR SECURITY LIGHTING SOLUTIONS
Ideal for
Farm Lighting
Street Lighting
Compound Lighting
Garden Lighting
So Much More
You're WELCOME to
THE
HOME OF ALL PUMPS
We are AUTHORISED DISTRIBUTORS of
GRUNDFOS
AB-TECH PUMPS
LEO
PEDROLLO
KSB
NASTEC
TEFEN FLOW & DOSING TECHNOLOGIES
LORENTZ
Other Brands Include the following

# TABLE OF CONTENTS

# 1. ABOUT NSI. WATER LTD

## 1.1 WHO WE ARE

NSI. Water is a limited company that specializes in providing water and energy solutions in East Africa. The company was incorporated in 2014 to provide water and energy solutions using the Latest and energy efficient systems and technologies in the below specialised areas;

- **Boreholes**
- **Water pumps**
- **Water Treatment**
- **Solar Systems**
- **Irrigation Systems**
- **Swimming Pools**

This is achieved through a Professional team with vast experience in design, Sourcing Reliable Equipment, Installation and Management of water and energy systems for Institutional, Industrial and domestic establishments.

## 1.2 OUR PURPOSE, MISSION AND GOAL

Our Purpose is ***to Provide sustainable Solutions and quality products that improve our customer's lives.***

Our Mission is ***to Build Strong partnerships with customers and together improve quality of water and energy solutions.***

Our Goal is ***to be a leader in water and energy solutions in the region through provision of innovative solutions, quality products and services in Water and Energy.***

## 1.3 OUR CORE VALUES

We believe in treating our;

- Customers with respect and Honesty
- Employees with Value and Dignity
- Partners with Integrity and Ethical Business Practices.

# 2. THE NSI WATER BOREHOLE PUMPS RANGE

This Borehole manual has been prepared with a specific focus on the wide range of Borehole pump solutions offered by NSI. Through this manual, it is envisaged that to help you quickly and easily find the perfect pump for your borehole.

***NSI. WATER LTD is committed to providing cost effective, smart and affordable solutions to meet the current pumping needs at all scales; domestic, institutional or industrial. To this end, we offer innovative and efficient pumping solutions based on the latest technologies and premium and well supported equipment brands. Some of these are presented hereafter.***

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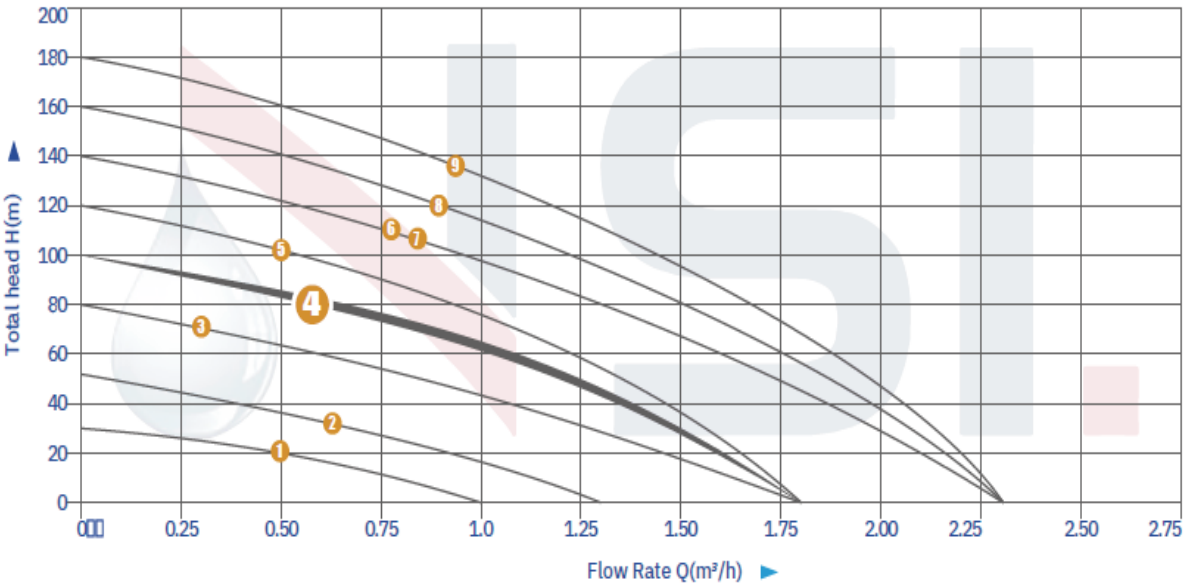
# AB-TECH PUMPS

# AB-TECH

## DC submersible pumps
## SHD Series


***PUMP:*** The AB-TECH SHD pumps are DC-powered helical rotor submersible borehole pumps designed for drinking water supply, livestock, watering and smaller irrigation applications. They deliver water economically, cleanly and reliably, anywhere.

***MOTOR:*** The Pumps are coupled with a Permanent magnet brushless DC motor offering good reliability and high efficiency.

***CONTROLLER:*** The pump set is controlled by an excellent Solar Pump Controller with built-in MPPT and all-round protection functions with Multi LED display, enabling delivery of an efficient and reliable solar system solution and a satisfactory user experience.

***Pumped liquid**: Clean water, with volume ratio of solid particles not exceeding 0.1%,* ***Max Liquid Temp**: 40$^0$C*

***Protection**: IP 68* ***Speed:** 500-4000 rpm* *IP54 Controller*

## *Specifications*

| SN | Model | Voltage (V) | Power (W) | $V_{MP}$ (V) | $V_{OC}$ (V) | Qmax ($m^3/h$) | Hmax (m) | Outlet (“) | Min. Well Size (“) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | SHD1-30 | DC24 | 80 | 24-48 | <50 | 1.0 | 30 | 0.75 | 3 |
| 2 | SHD1.3-50 | DC24 | 140 | 24-48 | <50 | 1.3 | 50 | 0.75 | 3 |
| 3 | SHD1.8-80 | DC24 | 210 | 24-48 | <50 | 1.8 | 80 | 0.75 | 3 |
| 4 | SHD1.8-100 | DC48 | 300 | 48-96 | <100 | 1.8 | 100 | 0.75 | 3 |
| 5 | SHD1.8-120 | DC48 | 500 | 48-96 | <100 | 1.8 | 120 | 0.75 | 3 |
| 6 | SHD2.3-140 | DC48 | 750 | 48-96 | <100 | 2.3 | 140 | 0.75 | 3 |
| 7 | SHD2.3-140B | DC72 | 750 | 72-144 | <150 | 2.3 | 140 | 0.75 | 3 |
| 8 | SHD2.3-160 | DC72 | 1000 | 72-144 | <150 | 2.3 | 160 | 0.75 | 3 |
| 9 | SHD2.3-180 | DC72 | 1200 | 72-144 | <150 | 2.3 | 180 | 0.75 | 3 |

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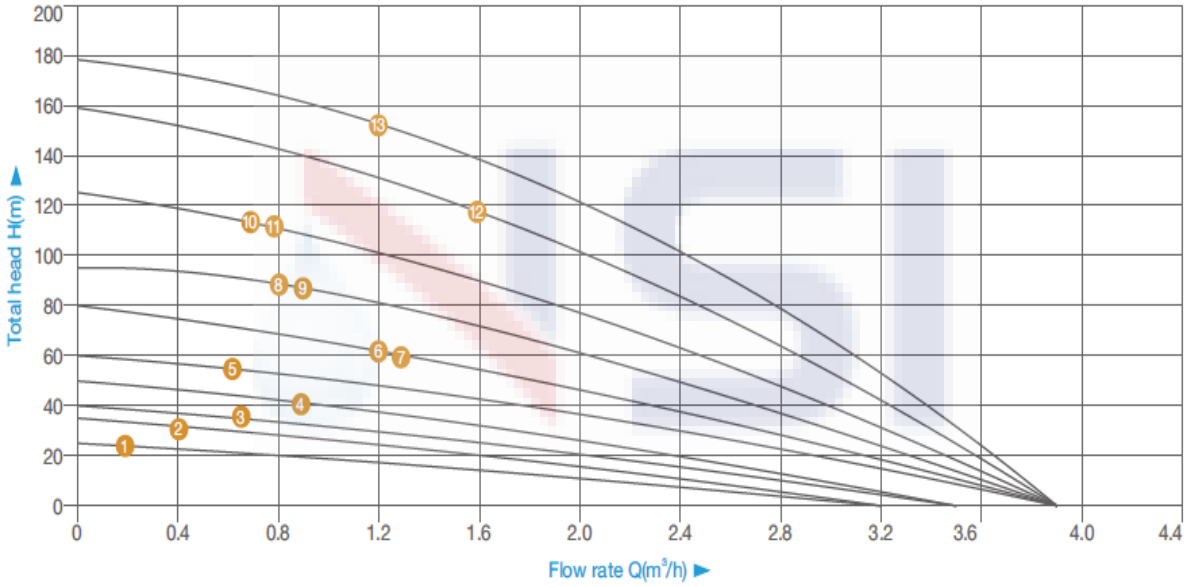
# AB-TECH

## DC submersible pumps
## SPD Series


***PUMP:*** The AB-TECH SPD pumps are DC-powered plastic impeller submersible borehole pumps designed for drinking water supply, livestock, watering and smaller irrigation applications. They deliver water economically, cleanly and reliably, anywhere.

***MOTOR:*** The Pumps are coupled with a Permanent magnet brushless DC motor offering good reliability and high efficiency.

***CONTROLLER:*** The pump set is controlled by an excellent Solar Pump Controller with built-in MPPT and all-round protection functions with Multi LED display, enabling delivery of an efficient and reliable solar system solution and a satisfactory user experience.

***Pumped liquid**: Clean water, with volume ratio of solid particles not exceeding 0.1%,* ***Max Liquid Temp**: 40⁰C*

***Protection**: IP 68* ***Speed:** 500-4000 rpm* *IP54 Controller*

### *Specifications*

| SN | Model | Voltage (V) | Power (W) | $V_{MP}$ (V) | $V_{OC}$ (V) | Qmax ($m^3/h$) | Hmax (m) | Outlet (“) | Min. Well Size (“) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | SPD3.2-25 | DC24 | 200 | 24-48 | <50 | 3.2 | 25 | 1.25 | 3 |
| 2 | SPD3.2-35 | DC24 | 300 | 24-48 | <50 | 3.2 | 35 | 1.25 | 3 |
| 3 | SPD3.5-40 | DC48 | 400 | 48-96 | <100 | 3.5 | 40 | 1.25 | 3 |
| 4 | SPD3.5-50 | DC48 | 450 | 48-96 | <100 | 3.5 | 50 | 1.25 | 3 |
| 5 | SPD3.9-60 | DC48 | 500 | 48-96 | <100 | 3.9 | 60 | 1.25 | 3 |
| 6 | SPD3.9-80 | DC48 | 600 | 48-96 | <100 | 3.9 | 80 | 1.25 | 3 |
| 7 | SPD3.9-80B | DC72 | 600 | 72-144 | <150 | 3.9 | 80 | 1.25 | 3 |
| 8 | SPD3.9-95 | DC48 | 750 | 48-96 | <100 | 3.9 | 95 | 1.25 | 3 |
| 9 | SPD3.9-95B | DC72 | 750 | 72-144 | <150 | 3.9 | 95 | 1.25 | 3 |
| 10 | SPD3.9-125 | DC72 | 1100 | 72-144 | <150 | 3.9 | 125 | 1.25 | 3 |
| 11 | SPD3.9-125B | DC96 | 1100 | 96-192 | <200 | 3.9 | 125 | 1.25 | 3 |
| 12 | SPD3.9-157 | DC110 | 1300 | 110-192 | <200 | 3.9 | 157 | 1.25 | 3 |
| 13 | SPD3.9-177 | DC110 | 1500 | 110-192 | <200 | 3.9 | 177 | 1.25 | 3 |

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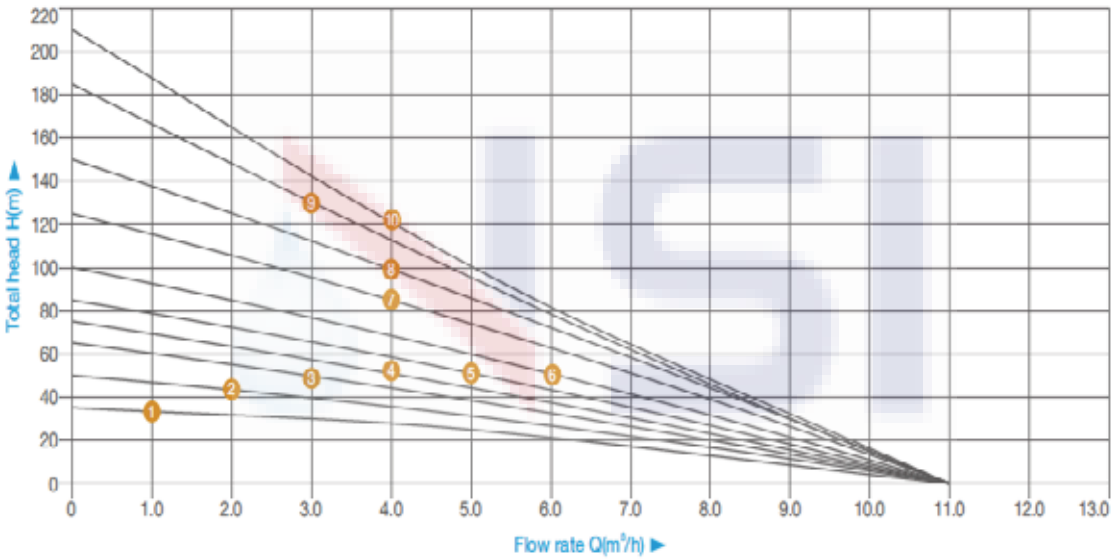
# AB-TECH

## AC/DC submersible pumps
## SSH Series


***PUMP:*** The AB-TECH SSH pumps are hybrid (AC/DC-powered) stainless steel impeller submersible borehole pumps designed for drinking water supply, livestock, watering and smaller irrigation applications. They deliver water economically, cleanly and reliably, anywhere. The pumps are made of High-quality materials guarantee longer working life.

***MOTOR:*** The Pumps are coupled with a Permanent magnet brushless AC/DC motor offering good reliability and high efficiency.

***CONTROLLER:*** The pump set is controlled by an excellent hybrid Solar Pump Controller with built-in MPPT and all-round protection functions with Multi LED display, enabling delivery of an efficient and reliable solar system solution and a satisfactory user experience.

***Pumped liquid**: Clean water, with volume ratio of solid particles not exceeding 0.1%,* ***Max Liquid Temp**: 40$^0$C*

***Protection**: IP 68* ***Speed:** 500-4000 rpm* *IP54 Controller*

## *Specifications*

| SN | Model | Power (W) | AC Voltage (V) | DC Voltage (V) | Qmax ($m^3/h$) | Hmax (m) | Outlet (“) | Min. Well Size (“) |
|---|---|---|---|---|---|---|---|---|
| 1 | SSH11-35 | 900 | 90-300 | 90-430 | 11 | 35 | 2 | 4 |
| 2 | SSH11-50 | 1100 | 90-300 | 90-430 | 11 | 50 | 2 | 4 |
| 3 | SSH11-65 | 1300 | 90-300 | 90-430 | 11 | 65 | 2 | 4 |
| 4 | SSH11-75 | 1500 | 90-300 | 90-430 | 11 | 75 | 2 | 4 |
| 5 | SSH11-85 | 1500 | 90-300 | 90-430 | 11 | 85 | 2 | 4 |
| 6 | SSH11-100 | 1500 | 90-300 | 90-430 | 11 | 100 | 2 | 4 |
| 7 | SSH11-125 | 2200 | 90-300 | 90-430 | 11 | 125 | 2 | 4 |
| 8 | SSH11-150 | 2200 | 90-300 | 90-430 | 11 | 150 | 2 | 4 |
| 9 | SSH11-185 | 2200 | 90-300 | 90-430 | 11 | 185 | 2 | 4 |
| 10 | SSH11-210 | 2200 | 90-300 | 90-430 | 11 | 210 | 2 | 4 |

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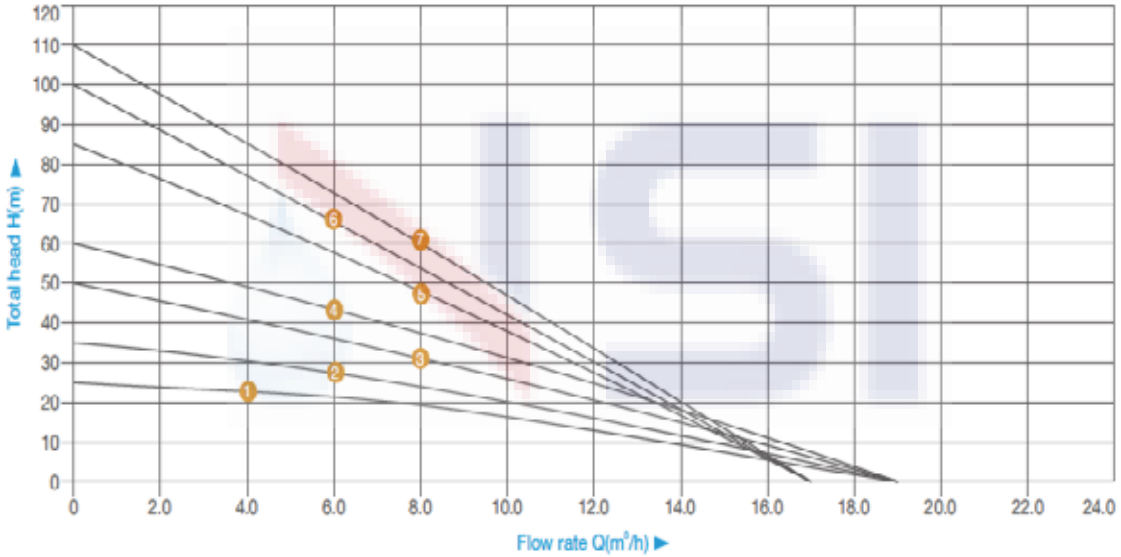


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|---|---|---|---|---|---|---|---|---|
| 1 | SSH19-25 | 900 | 90-300 | 90-430 | 19 | 25 | 2 | 4 |
| 2 | SSH19-35 | 1300 | 90-300 | 90-430 | 19 | 35 | 2 | 4 |
| 3 | SSH19-50 | 1500 | 90-300 | 90-430 | 19 | 50 | 2 | 4 |
| 4 | SSH19-60 | 2200 | 90-300 | 90-430 | 19 | 60 | 2 | 4 |
| 5 | SSH17-80 | 2200 | 90-300 | 90-430 | 19 | 80 | 2 | 4 |
| 6 | SSH17-90 | 2200 | 90-300 | 90-430 | 19 | 90 | 2 | 4 |
| 7 | SSH17-100 | 2200 | 90-300 | 90-430 | 19 | 100 | 2 | 4 |

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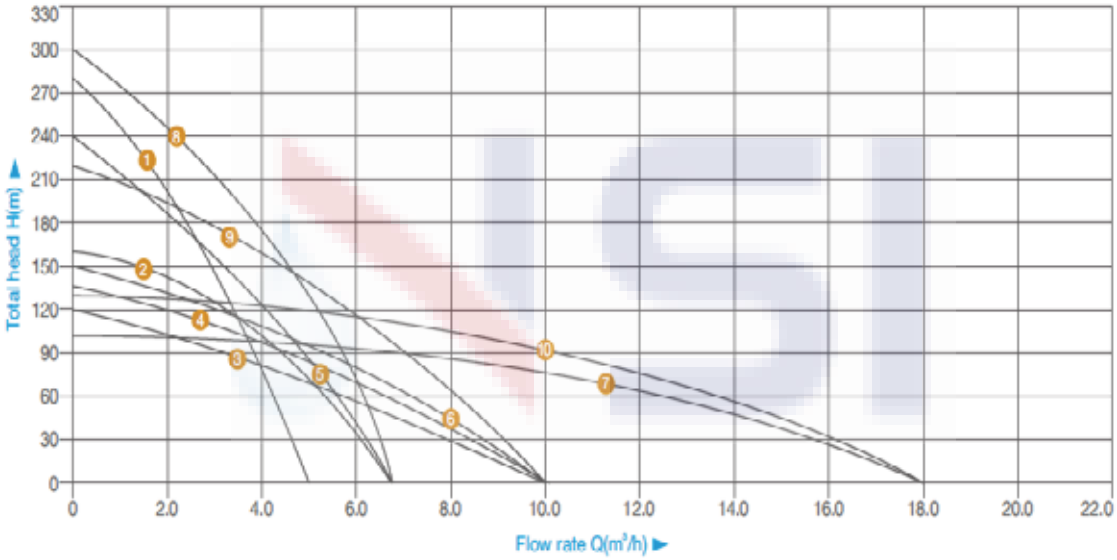


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## Specifications

| SN | Model | Power (W) | AC Voltage (V) | DC Voltage (V) | Qmax (m³/h) | Hmax (m) | Outlet (“) | Min. Well Size (“) |
|---|---|---|---|---|---|---|---|---|
| 1 | SSH5-280 | 3000 | 380 | 540 | 5 | 280 | 1.25 | 4 |
| 2 | SSH6.8-160 | 3000 | 380 | 540 | 6.8 | 160 | 1.25 | 4 |
| 3 | SSH10-120 | 3000 | 380 | 540 | 10 | 120 | 1.5 | 4 |
| 4 | SSH10.2-136 | 3000 | 380 | 540 | 10.2 | 136 | 1.5 | 4 |
| 5 | SSH6.8-240 | 4000 | 380 | 540 | 6.8 | 240 | 1.25 | 4 |
| 6 | SSH10-150 | 4000 | 380 | 540 | 10 | 150 | 1.5 | 4 |
| 7 | SSH18-105 | 4000 | 380 | 540 | 18 | 105 | 2 | 4 |
| 8 | SSH6.8-300 | 5500 | 380 | 540 | 6.8 | 300 | 1.25 | 4 |
| 9 | SSH10-220 | 5500 | 380 | 540 | 10 | 220 | 1.5 | 4 |
| 10 | SSH18-130 | 5500 | 380 | 540 | 18 | 130 | 2 | 4 |


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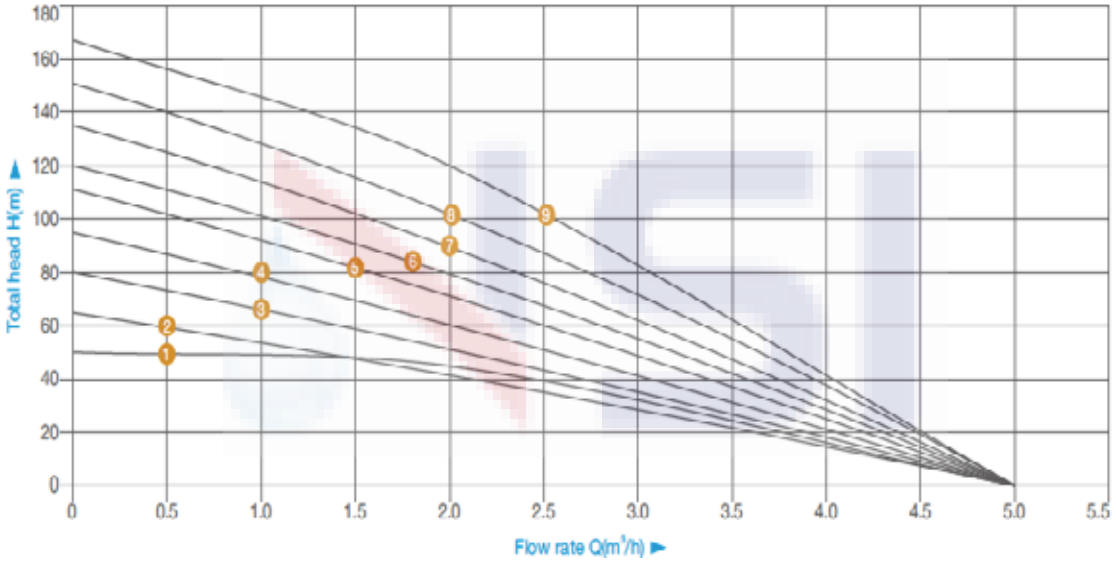


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|---|---|---|---|---|---|---|---|---|
| 1 | SSH5-50 | 750 | 90-300 | 90-430 | 5 | 60 | 1.25 | 3 |
| 2 | SSH5-65 | 750 | 90-300 | 90-430 | 5 | 65 | 1.25 | 3 |
| 3 | SSH5-80 | 900 | 90-300 | 90-430 | 5 | 80 | 1.25 | 3 |
| 4 | SSH5-95 | 900 | 90-300 | 90-430 | 5 | 95 | 1.25 | 3 |
| 5 | SSH5-112 | 1100 | 90-300 | 90-430 | 5 | 112 | 1.25 | 3 |
| 6 | SSH5-120 | 1300 | 90-300 | 90-430 | 5 | 120 | 1.25 | 3 |
| 7 | SSH5-135 | 1500 | 90-300 | 90-430 | 5 | 135 | 1.25 | 3 |
| 8 | SSH5-151 | 1500 | 90-300 | 90-430 | 5 | 151 | 1.25 | 3 |
| 9 | SSH5-167 | 1500 | 90-300 | 90-430 | 5 | 167 | 1.25 | 3 |

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# AB-TECH

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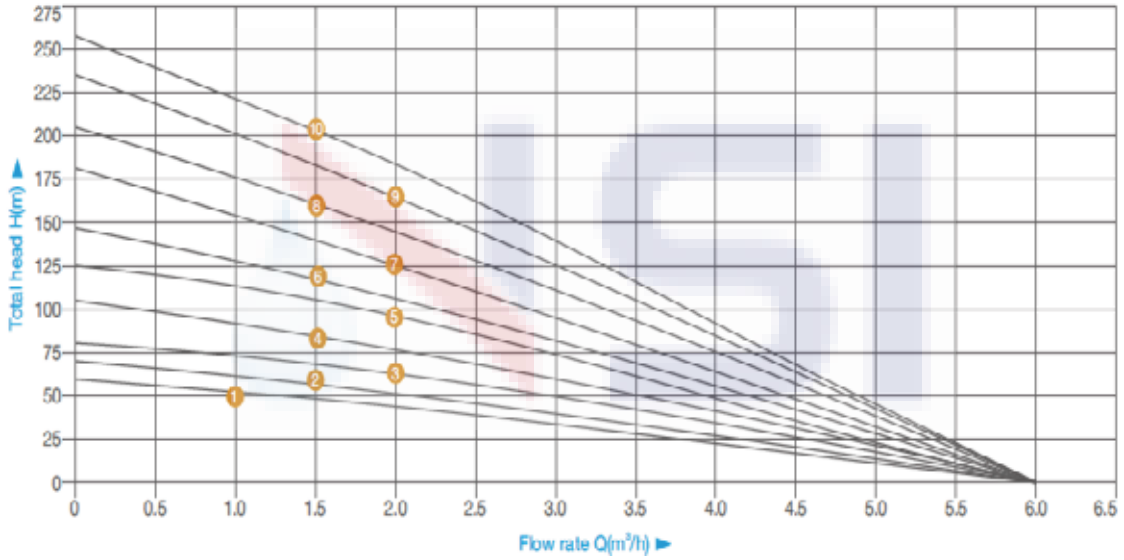


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## *Specifications*

| SN | Model | Power (W) | AC Voltage (V) | DC Voltage (V) | Qmax ($m^3/h$) | Hmax (m) | Outlet (“) | Min. Well Size (“) |
|---|---|---|---|---|---|---|---|---|
| 1 | SSH6-60 | 650 | 90-300 | 90-430 | 6 | 60 | 1.25 | 4 |
| 2 | SSH6-70 | 750 | 90-300 | 90-430 | 6 | 70 | 1.25 | 4 |
| 3 | SSH6-80 | 900 | 90-300 | 90-430 | 6 | 80 | 1.25 | 4 |
| 4 | SSH6-105 | 1100 | 90-300 | 90-430 | 6 | 105 | 1.25 | 4 |
| 5 | SSH6-125 | 1300 | 90-300 | 90-430 | 6 | 125 | 1.25 | 4 |
| 6 | SSH6-147 | 1300 | 90-300 | 90-430 | 6 | 147 | 1.25 | 4 |
| 7 | SSH6-182 | 1500 | 90-300 | 90-430 | 6 | 182 | 1.25 | 4 |
| 8 | SSH6-205 | 2200 | 90-300 | 90-430 | 6 | 205 | 1.25 | 4 |
| 9 | SSH6-235 | 2200 | 90-300 | 90-430 | 6 | 235 | 1.25 | 4 |
| 10 | SSH6-257 | 2200 | 90-300 | 90-430 | 6 | 257 | 1.25 | 4 |

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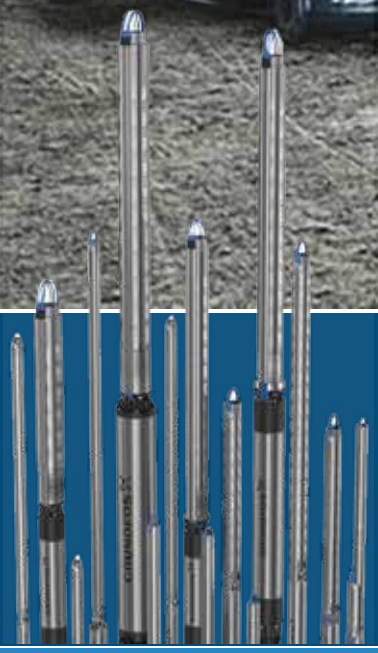
GRUNDFOS

UTILITY RANGE



Surface Pumps
Submersibles | Dosing Pumps | Booster Pumps
Circulation Pumps | Among others

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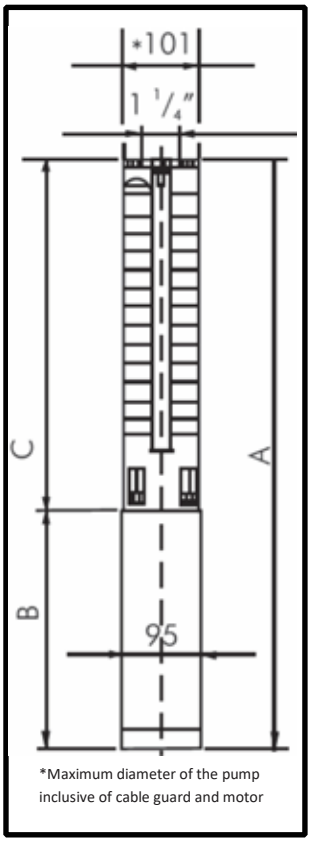
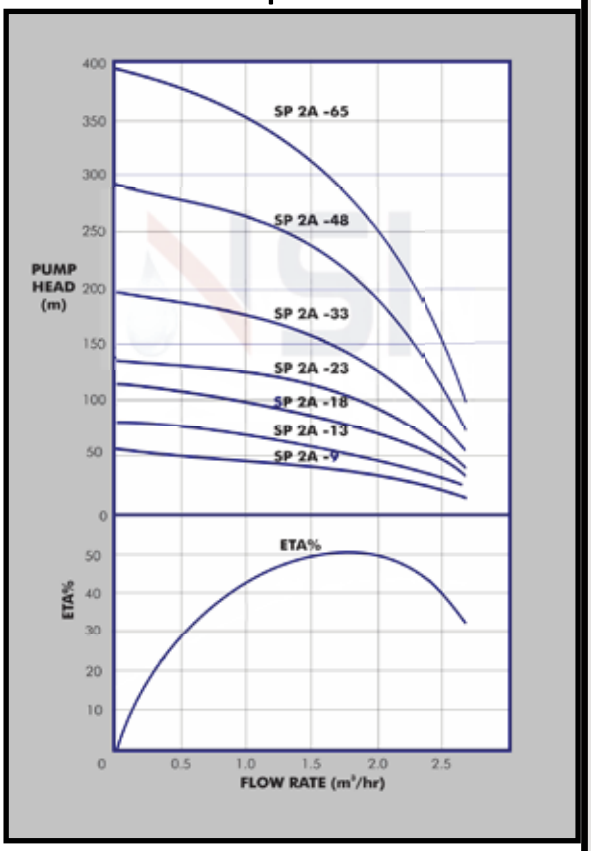
# GRUNDFOS AC

# SP 2A– Submersible Borehole Pump




*Maximum diameter of the pump inclusive of cable guard and motor




**PUMP :**Grundfos SP 2A submersible pumps are designed specifically for borehole applications. They are of multistage centrifugal impeller design. All parts are made from stainless steel (AISI 304) that ensures high corrosive resistance. This pump carries drinking water approvals. Standard pumps are designed for the pumping of non-aggressive water. An 'SP 2N' version is available for applications requiring a higher degree of corrosion resistance. Pump has sand shield and water lubricated rubber bearings. Suction is through a strainer between the pump and motor.

**MOTOR:** The pump is coupled to a sealed, liquid cooled 2-pole asynchronous squirrel-cage Grundfos motor constructed of stainless steel. The motor is fitted beneath the pump. Both single phase and three phase motors require a DOL control panel starter. If unstable power supply is likely, additional quick tripping control relays are recommended.

Enclosure Class: IP68 Insulation Class: B Speed: 2900 rpm

**OPERATING CONDITIONS**

Pumped Liquid: Thin, clean, chemically non-aggressive liquids without solid particles or fibres.

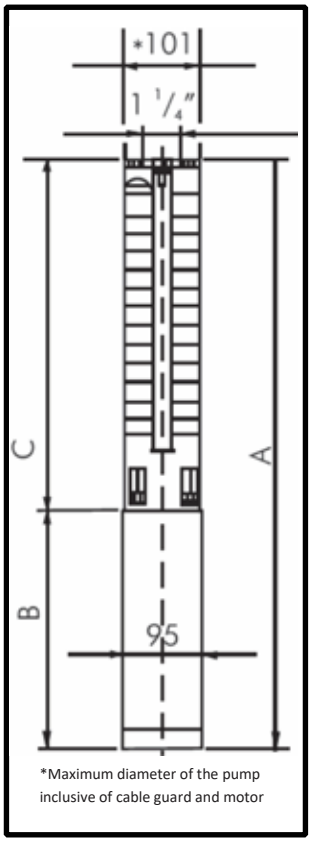
Max Liquid Temperature: +40 degrees C.

Max Water Depth: Up to 1.5 kW 1ph and 2.2 kW 3 ph -150 m, 2.2 kW 1ph and 3 kW 3 ph- 600 m

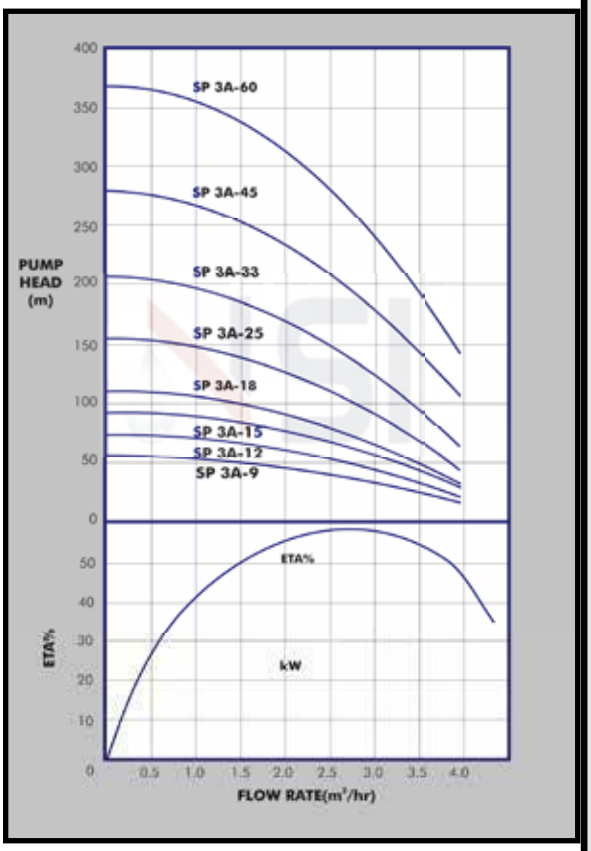
Minimum Borehole Diameter: 110mm

| Pump Type | Motor | | Full Load Current (A) | | Start Current (A) | | Dimensions (mm) | | | | | Weight (kg) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | A | | B | | C | | |
| | kW | HP | 1x240 | 3x415 | 1x240 | 3x415 | 1x240 V | 3x415 V | 1x240 V | 3x415 | | 1x240 V | 3x415 |
| SP 2A-9 | 0.37 | 0.5 | 3.8 | | 13 | | 600 | | 256 | | 344 | 11 | |
| SP 2A-13 | 0.55 | 0.75 | 5.5 | | 19 | | 719 | | 291 | | 428 | 13 | |
| SP 2A-18 | 0.75 | 1 | 7 | | 26 | | 839 | | 306 | | 533 | 15 | |
| SP 2A-23 | 1.1 | 1.5 | 7.1 | 3.7 | 31 | 16 | 984 | 944 | 346 | 306 | 638 | 17 | 16 |
| SP 2A-33 | 1.5 | 2 | 9.8 | 4.4 | 38 | 21 | 1190 | 1190 | 346 | 346 | 844 | 20 | 19 |
| SP 2A-48 | 2.2 | 3 | 14 | 5.7 | 62 | 26 | 1781 | 1554 | 573 | 346 | 1208 | 39 | 30 |
| SP 2A-65 | 3 | 4 | | 8.1 | | 35 | | 2058 | | 493 | 1565 | | 41 |

# SP 3A– Submersible Borehole Pump




*Maximum diameter of the pump inclusive of cable guard and motor




**PUMP :**Grundfos SP 3A submersible pumps are designed specifically for borehole applications. They are of multistage centrifugal impeller design. All parts are made from stainless steel (AISI 304) that ensures high corrosive resistance. This pump carries drinking water approvals. Standard pumps are designed for the pumping of non-aggressive water. An 'SP 3N' version is available for applications requiring a higher degree of corrosion resistance. Pump has sand shield and water lubricated rubber bearings. Suction is through a strainer between the pump and motor.

**MOTOR:** The pump is coupled to a sealed, liquid cooled 2-pole asynchronous squirrel-cage Grundfos motor constructed of stainless steel. The motor is fitted beneath the pump. Both single phase and three phase motors require a DOL control panel starter. If unstable power supply is likely, additional quick tripping control relays are recommended.

Enclosure Class: IP68 Insulation Class: B Speed: 2900 rpm

**OPERATING CONDITIONS**

Pumped Liquid: Thin, clean, chemically non-aggressive liquids without solid particles or fibres.

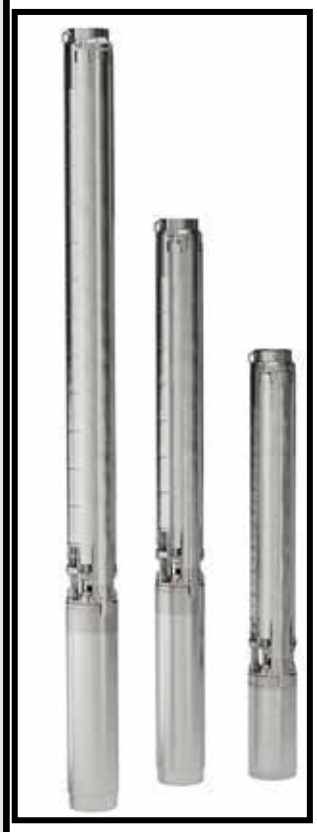
Max Liquid Temperature: +40 degrees C.

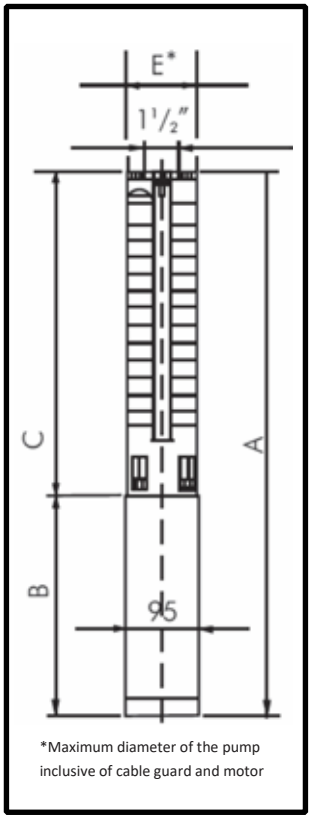
Max Water Depth: Up to 1.5 kW 1ph and 2.2 kW 3 ph -150 m, 2.2 kW 1ph and 3 kW 3 ph- 600 m

Minimum Borehole Diameter: 110mm

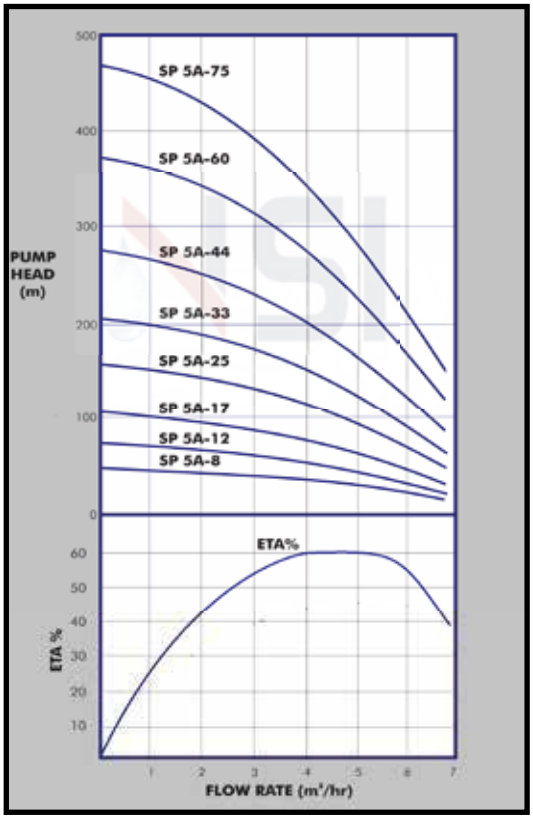
| Pump Type | Motor | | Full Load Current (A) | | Start Current (A) | | Dimensions (mm) | | | | | Weight (kg) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | A | | B | | C | | |
| | kW | HP | 1x240 | 3x415 | 1x240 | 3x415 | 1x240 V | 3x415 V | 1x240 V | 3x415 | | 1x240 V | 3x415 |
| SP 3A-9 | 0.55 | 0.75 | 5.5 | | 19 | | 291 | | 635 | | 344 | 12 | |
| SP 3A-12 | 0.75 | 1.0 | 7.0 | | 26 | | 306 | 276 | 713 | | 407 | 13 | |
| SP 3A-15 | 1.1 | 1.5 | 7.1 | 3.7 | 31 | 16 | 346 | 306 | 816 | 776 | 470 | 16 | 14 |
| SP 3A-18 | 1.1 | 1.5 | 7.1 | 3.7 | 31 | 16 | 346 | 306 | 879 | 839 | 533 | 16 | 15 |
| SP 3A-25 | 1.5 | 2.0 | 9.8 | 4.4 | 38 | 21 | 346 | 346 | 1026 | 1026 | 680 | 18 | 18 |
| SP 3A-33 | 2.2 | 3.0 | 14.0 | 5.7 | 62 | 26 | 573 | 346 | 1421 | 1194 | 848 | 30 | 21 |
| SP 3A-45 | 3.0 | 4.0 | | 7.9 | | 35 | | 493 | | 1638 | 1145 | | 34 |
| SP 3A-60 | 4.0 | 5.5 | | 9.6 | | 46 | | 573 | | 2033 | 1460 | | 43 |

# SP 5A– Submersible Borehole Pump






*Maximum diameter of the pump inclusive of cable guard and motor




**PUMP :**Grundfos SP 5A submersible pumps are designed specifically for borehole applications. They are of multistage centrifugal impeller design. All parts are made from stainless steel (AISI 304) that ensures high corrosive resistance. Standard pumps are designed for the pumping of non-aggressive water. This pump carries drinking water approvals. An 'SP 5N' version is available for applications requiring a higher degree of corrosion resistance. Pump has sand shield and water lubricated rubber bearings. Suction is through a strainer between the pump and motor.

**MOTOR:** The pump is coupled to a sealed, liquid cooled 2-pole asynchronous squirrel-cage Grundfos motor constructed of stainless steel. The motor is fitted beneath the pump. Both single phase and and three phase motors require a DOL control panel starter. If unstable power supply is likely, additional quick tripping control relays are recommended.

Enclosure Class: IP68 Insulation Class: B Speed: 2900 rpm

**OPERATING CONDITIONS**

Pumped Liquid: Thin, clean, chemically non-aggressive liquids without solid particles or fibres.

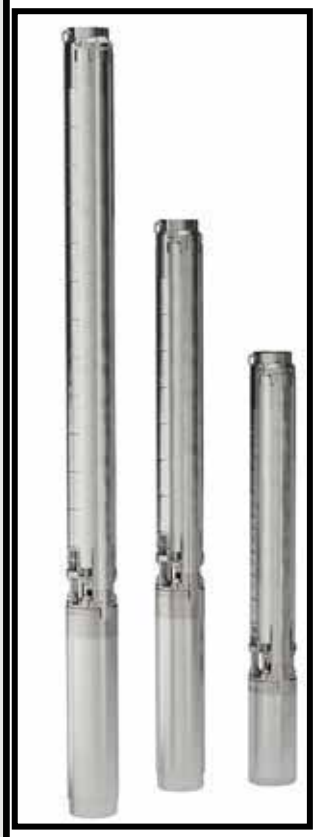
Max Liquid Temperature: +40 degrees C.

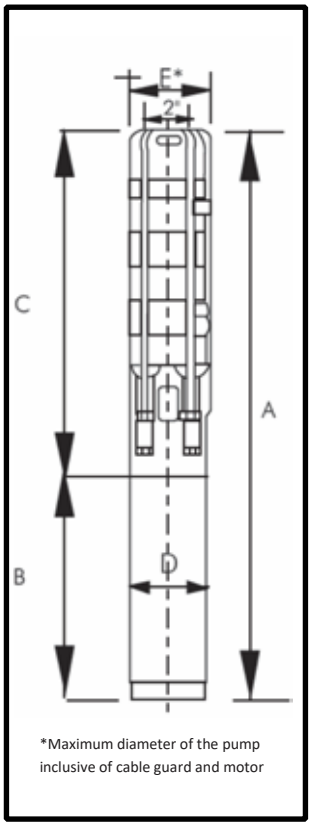
Max Water Depth: Up to 1.5 kW 1ph and 2.2 kW 3 ph -150 m, 2.2 kW 1ph and 3 kW 3 ph- 600 m

Minimum Borehole Diameter: 110mm (4"motor), 152mm (6" motor)

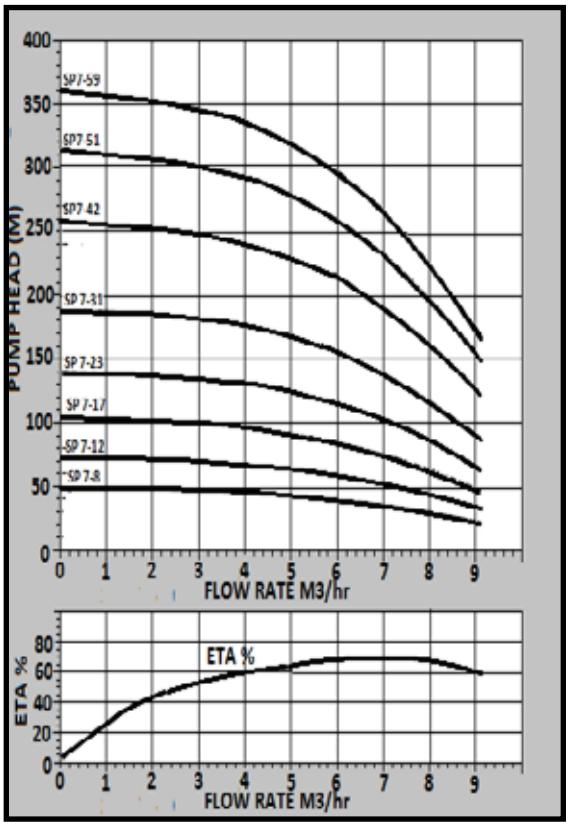
| Pump Type | Dia | Motor | | Full Load Current (A) | | Start Current (A) | | Dimensions (mm) | | | | | | | Weight (kg) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | A | | B | | C | D | E | | |
| | | kW | HP | 1x240 V | 3x415 V | 1x240 V | 3x415 V | 1x240 V | 3x415 V | 1x240 V | 3x415 V | | | | 1x240 V | 3x415 V |
| SP 5A-8 | 4" | 0.75 | 1.0 | 7.0 | | 26 | | 630 | | 306 | | 324 | 95 | 101 | 13 | |
| SP 5A-12 | 4" | 1.1 | 1.5 | 7.1 | 3.4 | 31 | 16 | 754 | 714 | 346 | 306 | 408 | 95 | 101 | 15 | 13 |
| SP 5A-17 | 4" | 1.5 | 2.0 | 9.8 | 4.2 | 38 | 21 | 859 | 859 | 346 | 346 | 513 | 95 | 101 | 17 | 16 |
| SP 5A-25 | 4" | 2.2 | 3.0 | 14.0 | 5.5 | 62 | 16 | 1254 | 1027 | 573 | 346 | 681 | 95 | 101 | 28 | 19 |
| SP 5A-33 | 4" | 3.0 | 4.0 | | 7.9 | | 35 | | 1342 | | 493 | 849 | 95 | 101 | | 26 |
| SP 5A-44 | 4" | 4.0 | 5.5 | | 9.6 | | 46 | | 1697 | | 573 | 1124 | 95 | 101 | | 38 |
| SP 5A-60 | 4" | 5.5 | 7.5 | | 13.0 | | 64 | | 2133 | | 673 | 1460 | 95 | 101 | | 60 |
| SP 5A-60 | 6" | 5.5 | 7.5 | | 13.6 | | 69 | | 2057 | | 535 | 1522 | 143 | 138 | | 60 |
| SP 5A-75 | 6" | 7.5 | 1.0 | | 16.6 | | 83 | | 2711 | | 565 | 2146 | 143 | 143 | | 86 |

# SP7– Submersible Borehole Pump






*Maximum diameter of the pump inclusive of cable guard and motor




**PUMP :**Grundfos SP 7 submersible pumps are designed specifically for borehole applications. They are of multistage centrifugal impeller design. All parts are made from stainless steel (AISI 304) that ensures high corrosive resistance. This pump carries drinking water approval. They exhibit high sand resistance at 150g/m3. Standard pumps are designed for the pumping of non-aggressive water. An 'SP 7N' version is available for applications requiring a higher degree of corrosion resistance. Pump has sand shield and water lubricated rubber bearings. Suction is through a strainer between the pump and motor.

**MOTOR:** The pump is coupled to a sealed, liquid cooled 2-pole asynchronous squirrel-cage Grundfos motor constructed of stainless steel. The motor is fitted beneath the pump. Both single phase and and three phase motors require a DOL control panel starter. Pump can be controlled with an NSI Control panel . Additional protection from mechanical failure is recommended for motors 7.5kw and above using the Grundfos MP 204 which also offers advanced monitoring features.

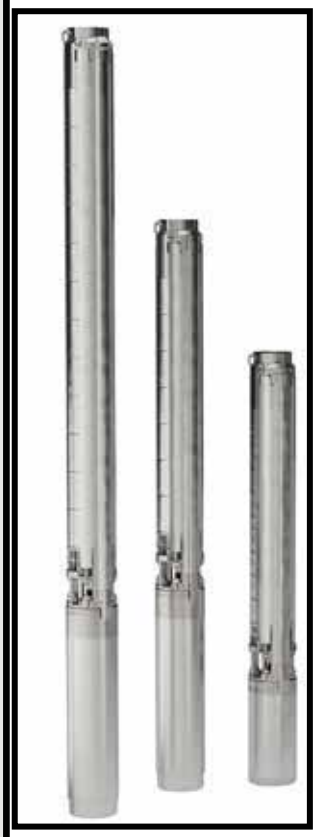
Enclosure Class: IP58 Insulation Class: F Speed: 2900 rpm

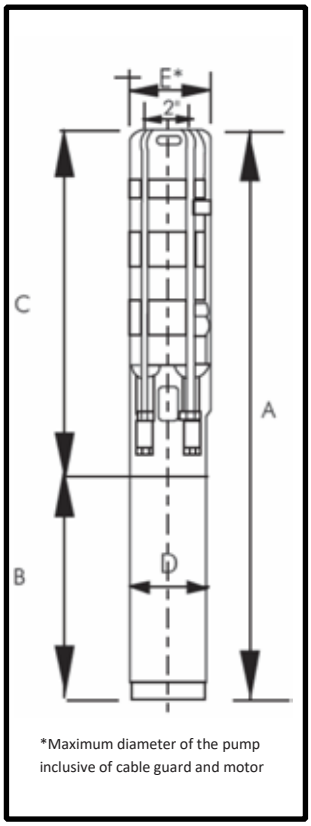
**OPERATING CONDITIONS**

Pumped Liquid: Thin, clean, chemically non-aggressive liquids without solid particles or fibres.
Max Liquid Temperature: +40 degrees C.
Max Water Depth: Up to 1.5 kW 1ph and 2.2 kW 3 ph -150 m, 2.2 kW 1ph and 3 kW 3 ph- 600 m
Minimum Borehole Diameter: 110mm (4"motor), 152mm (6" motor)

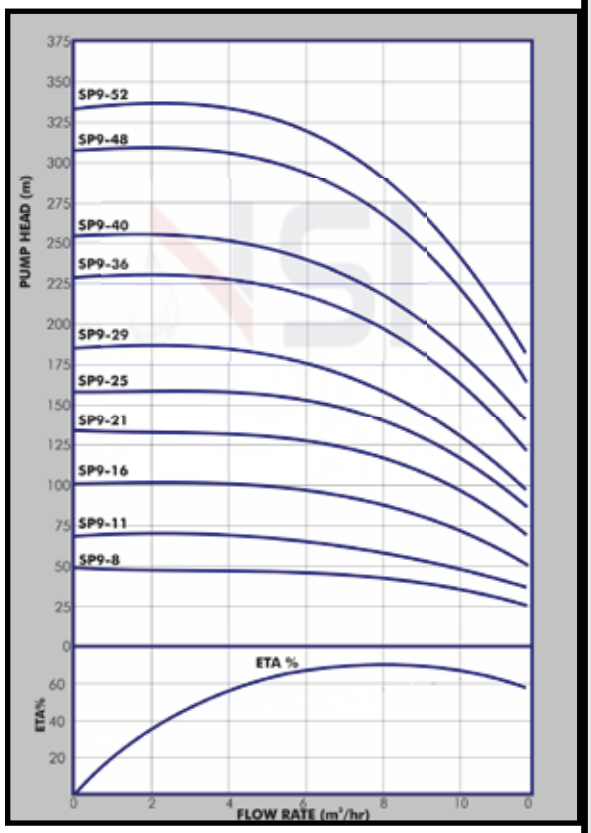
| Pump Type | Dia | Motor | | Full Load Current (A) | | Start Current (A) | | Dimensions (mm) | | | | | | | Weight (kg) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | A | | B | | C | D | E | | |
| | | kW | HP | 1x240 V | 3x415 V | 1x240 V | 3x415 V | 1x240 V | 3x415 V | 1x240 V | 3x415 V | | | | 1x240 V | 3x415 V |
| SP7 - 8 | 4" | 1.10 | 2.0 | 7.1 | 3.4 | 56.1 | 21 | 1025 | 985 | 387 | 347 | 638 | 95 | 101 | 20 | 19 |
| SP7 - 12 | 4" | 1.50 | 3.0 | 10.2 | 4.2 | 98 | 26 | 1225 | 1225 | 387 | 347 | 838 | 95 | 101 | 22 | 22 |
| SP7 - 17 | 4" | 2.20 | 4.0 | | 5.5 | | 35 | | 1545 | | 457 | 1088 | 95 | 101 | | 30 |
| SP7 - 23 | 4" | 3.00 | 5.5 | | 7.9 | | 58 | | 1885 | | 497 | 1388 | 95 | 101 | | 35 |
| SP7 - 31 | 4" | 4.00 | 7.5 | | 9.6 | | 82 | | 2165 | | 577 | 1588 | 95 | 101 | | 41 |
| SP7 - 42 | 4" | 5.50 | 7.5 | | 13.6 | | 82 | | 2765 | | 677 | 2088 | 95 | 101 | | 52 |
| SP7 - 51 | 4" | 7.50 | 10.5 | | 16.6 | | 118 | | 3565 | | 777 | 2788 | 95 | 101 | | 65 |
| SP7 - 59 | 4" | 7.50 | 10.5 | | 18.8 | | 105 | | 3965 | | 777 | 3188 | 140 | 140 | | 69 |

# SP9– Submersible Borehole Pump






*Maximum diameter of the pump inclusive of cable guard and motor




**PUMP :**Grundfos SP 9 submersible pumps are designed specifically for borehole applications. They are of multistage centrifugal impeller design. All parts are made from stainless steel (AISI 304) that ensures high corrosive resistance. This pump carries drinking water approval. They exhibit high sand resistance at 150g/m3. Standard pumps are designed for the pumping of non-aggressive water. An 'SP 9N' version is available for applications requiring a higher degree of corrosion resistance. Pump has sand shield and water lubricated rubber bearings. Suction is through a strainer between the pump and motor.

**MOTOR:** The pump is coupled to a sealed, liquid cooled 2-pole asynchronous squirrel-cage Grundfos motor constructed of stainless steel. The motor is fitted beneath the pump. Both single phase and and three phase motors require a DOL control panel starter. Pump can be controlled with an NSI Control panel . Additional protection from mechanical failure is recommended for motors 7.5kw and above using the Grundfos MP 204 which also offers advanced monitoring features.

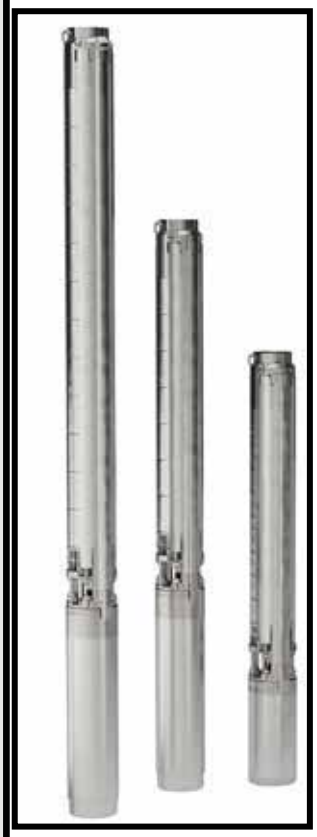
Enclosure Class: IP58 Insulation Class: F Speed: 2900 rpm

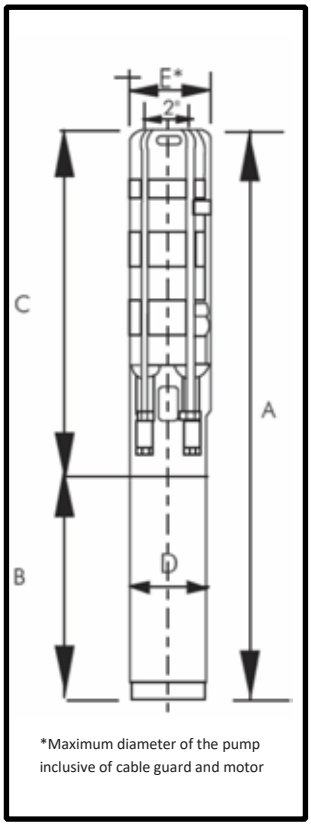
**OPERATING CONDITIONS**

Pumped Liquid: Thin, clean, chemically non-aggressive liquids without solid particles or fibres.
Max Liquid Temperature: +40 degrees C.
Max Water Depth: Up to 1.5 kW 1ph and 2.2 kW 3 ph -150 m, 2.2 kW 1ph and 3 kW 3 ph- 600 m
Minimum Borehole Diameter: 110mm (4"motor), 152mm (6" motor)

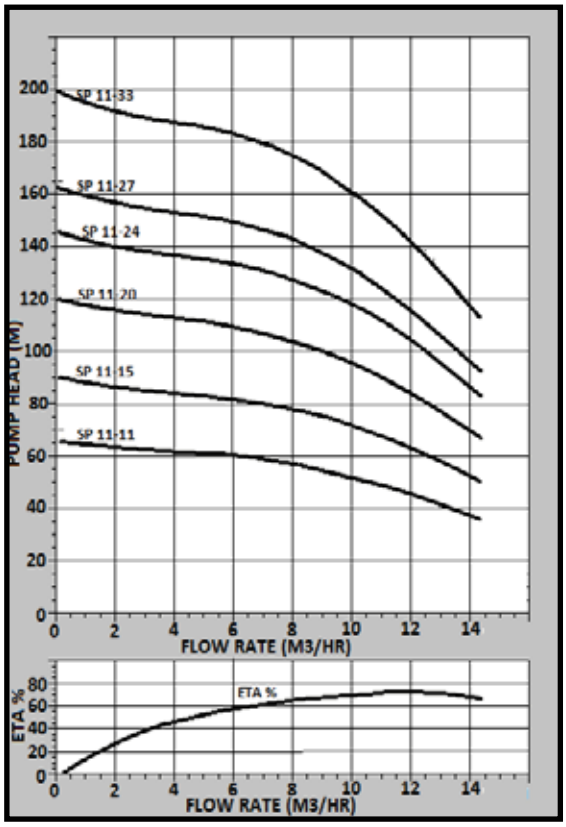
| Pump Type | Dia | Motor | | Full Load Current (A) | | Start Current (A) | | Dimensions (mm) | | | | | | | Weight (kg) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | A | | B | | C | D | E | | |
| | | kW | HP | 1x240 V | 3x415 V | 1x240 V | 3x415 V | 1x240 V | 3x415 V | 1x240 V | 3x415 V | | | | 1x240 V | 3x415 V |
| SP 9-8 | 4" | 1.5 | 2.0 | 10.2 | 4.2 | 56.1 | 21 | 1025 | 1025 | 387 | 387 | 638 | 95 | 101 | 22 | 22 |
| SP 9-11 | 4" | 2.2 | 3.0 | 14.0 | 5.5 | 98 | 26 | 1365 | 1175 | 577 | 387 | 788 | 95 | 101 | 34 | 25 |
| SP 9-16 | 4" | 3.0 | 4.0 | | 7.9 | | 35 | | 1535 | | 497 | 1038 | 95 | 101 | | 56 |
| SP9-21 | 4" | 4.0 | 5.5 | | 9.6 | | 58 | | 1865 | | 577 | 1288 | 95 | 101 | | 44 |
| SP9-25 | 4" | 5.5 | 7.5 | | 13.0 | | 82 | | 2165 | | 677 | 1488 | 95 | 101 | | 80 |
| SP9-29 | 4" | 5.5 | 7.5 | | 13.0 | | 82 | | 2365 | | 677 | 1688 | 95 | 101 | | 83 |
| SP9-36 | 4" | 7.5 | 10.5 | | 18.8 | | 118 | | 2815 | | 777 | 2038 | 95 | 101 | | 94 |
| SP9-40 | 6" | 7.5 | 10.5 | | 17.2 | | 105 | | 2878 | | 577 | 2301 | 140 | 140 | | 106 |
| SP9-48 | 6" | 9.2 | 12.0 | | 21.2 | | 110 | | 3308 | | 607 | 2701 | 140 | 140 | | 126 |
| SP9-52 | 6" | 11.0 | 15 | | 25.0 | | 107 | | 3538 | | 637 | 2901 | 140 | 140 | | 132 |

# SP11– Submersible Borehole Pump






*Maximum diameter of the pump inclusive of cable guard and motor




**PUMP :**Grundfos SP 11 submersible pumps are designed specifically for borehole applications. They are of multistage centrifugal impeller design. All parts are made from stainless steel (AISI 304) that ensures high corrosive resistance. This pump carries drinking water approval. They exhibit high sand resistance at 150g/m3. Standard pumps are designed for the pumping of non-aggressive water. An 'SP 11N' version is available for applications requiring a higher degree of corrosion resistance. Pump has sand shield and water lubricated rubber bearings. Suction is through a strainer between the pump and motor.

**MOTOR:** The pump is coupled to a sealed, liquid cooled 2-pole asynchronous squirrel-cage Grundfos motor constructed of stainless steel. The motor is fitted beneath the pump. Both single phase and and three phase motors require a DOL control panel starter. Pump can be controlled with an NSI Control panel . Additional protection from mechanical failure is recommended for motors 7.5kw and above using the Grundfos MP 204 which also offers advanced monitoring features.

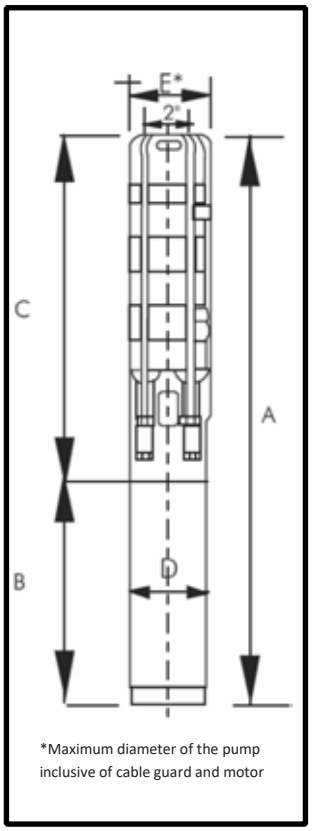
Enclosure Class: IP58 Insulation Class: F Speed: 2900 rpm

**OPERATING CONDITIONS**

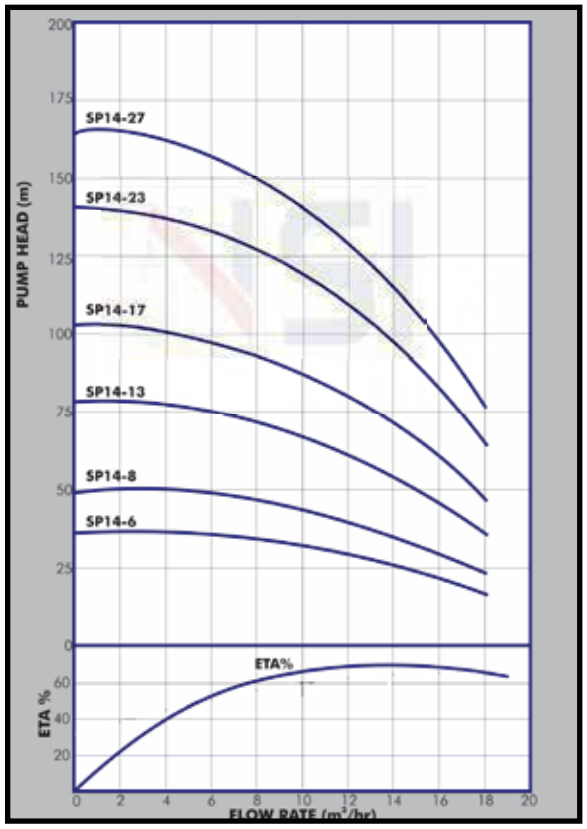
Pumped Liquid: Thin, clean, chemically non-aggressive liquids without solid particles or fibres.
Max Liquid Temperature: +40 degrees C.
Max Water Depth: Up to 1.5 kW 1ph and 2.2 kW 3 ph -150 m, 2.2 kW 1ph and 3 kW 3 ph- 600 m
Minimum Borehole Diameter: 110mm (4"motor), 152mm (6" motor)

| Pump Type | Dia | Motor | | Full Load Current (A) | | Start Current (A) | | Dimensions (mm) | | | | | | | Weight (kg) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | A | | B | | C | D | E | | |
| | | kW | HP | 1x240 V | 3x415 V | 1x240 V | 3x415 V | 1x240 V | 3x415 V | 1x240 V | 3x415 V | | | | 1x240 V | 3x415 V |
| SP11 - 11 | 4" | 2.20 | 2.0 | 14.0 | 5.5 | 98 | 26 | 1640 | 1450 | 577 | 387 | 1063 | 95 | 101 | 35 | 26 |
| SP11 - 15 | 4" | 3.00 | 3.0 | | 7.9 | | 35 | | 1860 | | 497 | 1363 | 95 | 101 | | 34 |
| SP11 - 20 | 4" | 4.00 | 4.0 | | 9.6 | | 58 | | 2315 | | 577 | 1738 | 95 | 101 | | 42 |
| SP11 - 24 | 4" | 5.50 | 5.5 | | 13.0 | | 82 | | 2715 | | 677 | 2038 | 95 | 101 | | 50 |
| SP11 - 27 | 4" | 5.50 | 7.5 | | 13.0 | | 82 | | 2940 | | 677 | 2263 | 95 | 101 | | 52 |
| SP11 - 33 | 4" | 7.50 | 7.5 | | 18.8 | | 105 | | 3490 | | 777 | 2713 | 95 | 101 | | 61 |

# SP14– Submersible Borehole Pump




*Maximum diameter of the pump inclusive of cable guard and motor




**PUMP :**Grundfos SP 14 submersible pumps are designed specifically for borehole applications. They are of multistage centrifugal impeller design. All parts are made from stainless steel (AISI 304) that ensures high corrosive resistance. This pump carries drinking water approval. They exhibit high sand resistance at 150g/m3. Standard pumps are designed for the pumping of non-aggressive water. An 'SP 14N' version is available for applications requiring a higher degree of corrosion resistance. Pump has sand shield and water lubricated rubber bearings. Suction is through a strainer between the pump and motor.

**MOTOR:** The pump is coupled to a sealed, liquid cooled 2-pole asynchronous squirrel-cage Grundfos motor constructed of stainless steel. The motor is fitted beneath the pump. Both single phase and and three phase motors require a DOL control panel starter. Pump can be controlled with an NSI Control panel . Additional protection from mechanical failure is recommended for motors 7.5kw and above using the Grundfos MP 204 which also offers advanced monitoring features.

Enclosure Class: IP58 Insulation Class: F Speed: 2900 rpm

**OPERATING CONDITIONS**

Pumped Liquid: Thin, clean, chemically non-aggressive liquids without solid particles or fibres.

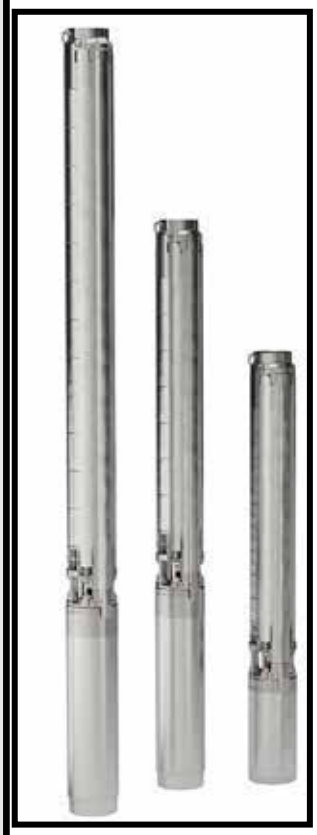
Max Liquid Temperature: +40 degrees C.

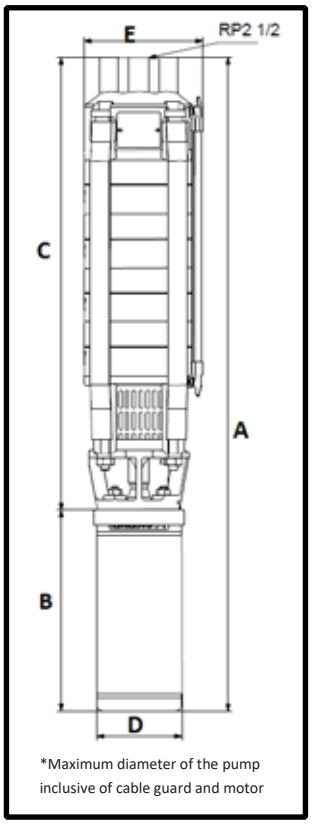
Max Water Depth: Up to 1.5 kW 1ph and 2.2 kW 3 ph -150 m, 2.2 kW 1ph and 3 kW 3 ph- 600 m

Minimum Borehole Diameter: 110mm (4"motors), 152mm (6" motors)

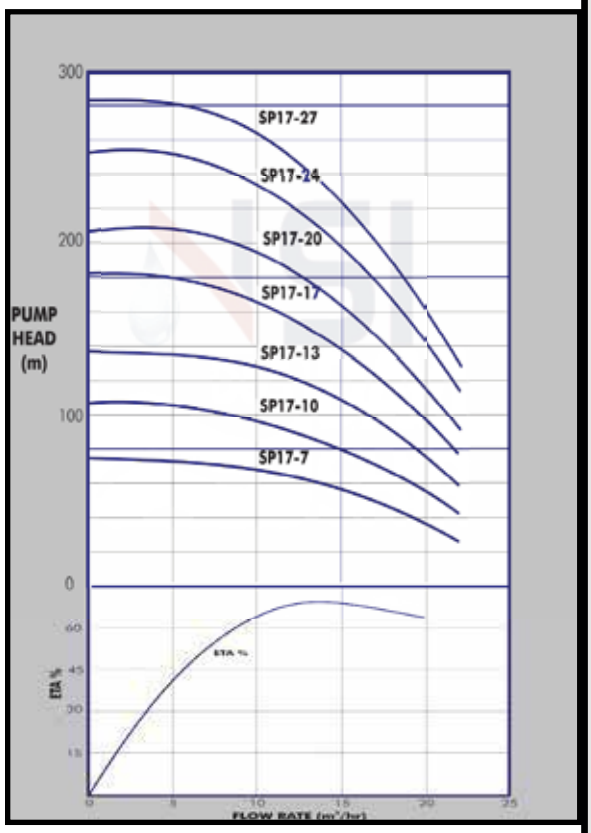
| Pump Type | Dia | Motor | | Full Load Current (A) | | Start Current (A) | | Dimensions (mm) | | | | | | | Weight (kg) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | A | | B | | C | D | E | | |
| | | kW | HP | 1x240 V | 3x415 V | 1x240 V | 3x415 V | 1x240 V | 3x415 V | 1x240 V | 3x415 V | | | | 1x240 V | 3x415 V |
| SP 14-6 | 4" | 1.5 | 2.0 | 10 | 4.2 | 40 | 21 | 1034 | 1075 | 346 | 387 | 688 | 95 | 101 | 23 | 22 |
| SP 14-8 | 4" | 2.2 | 3.0 | 14.0 | 5.5 | 62 | 23 | 1414 | 1225 | 576 | 387 | 838 | 95 | 101 | 34 | 25 |
| SP 14-13 | 4" | 3.0 | 4.0 | | 7.9 | | 35 | | 1710 | | 497 | 1213 | 95 | 101 | | 38 |
| SP14-17 | 4" | 4.0 | 5.5 | | 9.6 | | 58 | | 2090 | | 577 | 1513 | 95 | 101 | | 74 |
| SP14-23 | 4" | 5.5 | 7 | | 13.7 | | 75 | | 2640 | | 677 | 1963 | 95 | 101 | | 87 |
| SP14-27 | 6" | 7.5 | 10 | | 17.2 | | 105 | | 2903 | | 677 | 2326 | 140 | 140 | | 107 |

# SP17– Submersible Borehole Pump






*Maximum diameter of the pump inclusive of cable guard and motor




**PUMP :**Grundfos SP17 submersible pumps are designed specifically for borehole applications. They are of multistage centrifugal impeller design. All parts are made from stainless steel (AISI 304) that ensures high corrosive resistance. This pump carries drinking water approval.. Standard pumps are designed for the pumping of non-aggressive water. An 'SP 17N' version is available for applications requiring a higher degree of corrosion resistance. Pump has sand shield and water lubricated rubber bearings. Suction is through a strainer between the pump and motor.

**MOTOR:** The pump is coupled to a sealed, liquid cooled 2-pole asynchronous squirrel-cage Grundfos motor constructed of stainless steel. The motor is fitted beneath the pump. Both single phase and and three phase motors require a DOL control panel starter. Pump can be controlled with an NSI Control panel . Additional protection from mechanical failure is recommended for motors 7.5kw and above using the Grundfos MP 204 which also offers advanced monitoring features.

Enclosure Class: IP58 Insulation Class: F Speed: 2900 rpm

**OPERATING CONDITIONS**

Pumped Liquid: Thin, clean, chemically non-aggressive liquids without solid particles or fibres.

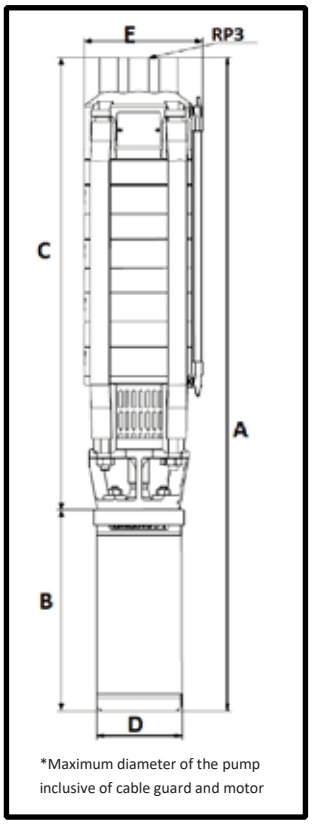
Max Liquid Temperature: +40 degrees C.

Max Water Depth: 600 m

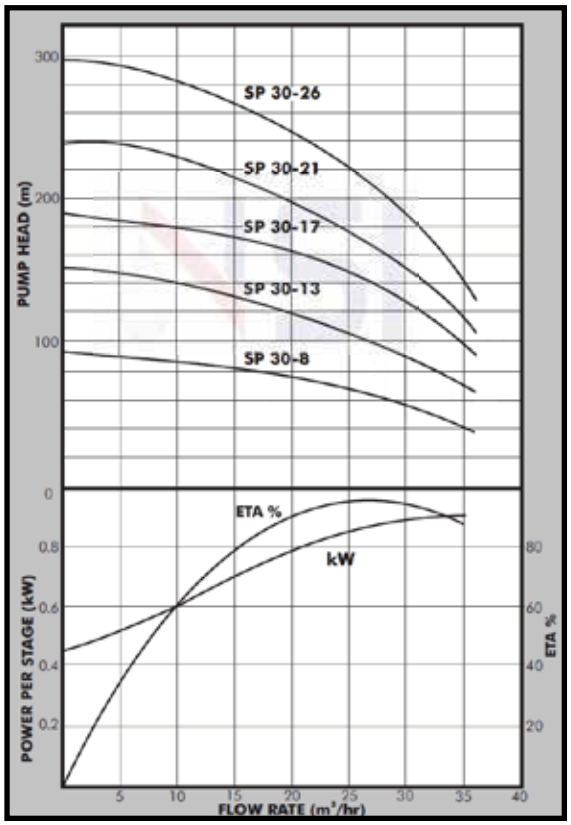
Minimum Borehole Diameter: 110mm (4"motors), 152mm (6" motors)

| Pump Type | Motor | | Full Load Current (A) | Start Current ratio | Dimensions (mm) | | | | | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| | kW | HP | | | A | B | C | D | E | |
| SP 17-7 | 4 | 5.5 | 9.7 | 5.0 | 1251 | 574 | 677 | 95 | 131 | 33 |
| SP 17-10 | 5.5 | 7.5 | 13.7 | 5.5 | 1631 | 773 | 858 | 95 | 131 | 41 |
| SP 17-13 | 7.5 | 10 | 17.6 | 4.9 | 1630 | 574 | 1056 | 138 | 142 | 57 |
| SP 17-17 | 9.2 | 12.5 | 20.2 | 4.8 | 1888 | 590 | 1298 | 138 | 142 | 67 |
| SP 17-20 | 11 | 15 | 24.8 | 4.7 | 2113 | 634 | 1479 | 138 | 142 | 74 |
| SP 17-24 | 13 | 17.5 | 29 | 4.6 | 2429 | 708 | 1721 | 138 | 142 | 82 |
| SP 17-27 | 15 | 20 | 34.0 | 5.0 | 2602 | 699 | 1903 | 138 | 142 | 89 |

# SP30– Submersible Borehole Pump




*Maximum diameter of the pump inclusive of cable guard and motor




**PUMP :**Grundfos SP30 submersible pumps are designed specifically for borehole applications. They are of multistage centrifugal impeller design. All parts are made from stainless steel (AISI 304) that ensures high corrosive resistance. This pump carries drinking water approval.. Standard pumps are designed for the pumping of non-aggressive water. An 'SP 17N' version is available for applications requiring a higher degree of corrosion resistance. Pump has sand shield and water lubricated rubber bearings. Suction is through a strainer between the pump and motor.

**MOTOR:** The pump is coupled to a sealed, liquid cooled 2-pole asynchronous squirrel-cage Grundfos motor constructed of stainless steel. The motor is fitted beneath the pump. Both single phase and and three phase motors require a DOL control panel starter. Pump can be controlled with an NSI Control panel . Additional protection from mechanical failure is recommended for motors 7.5kw and above using the Grundfos MP 204 which also offers advanced monitoring features.

Enclosure Class: IP58 Insulation Class: F Speed: 2900 rpm

**OPERATING CONDITIONS**

Pumped Liquid: Thin, clean, chemically non-aggressive liquids without solid particles or fibres.

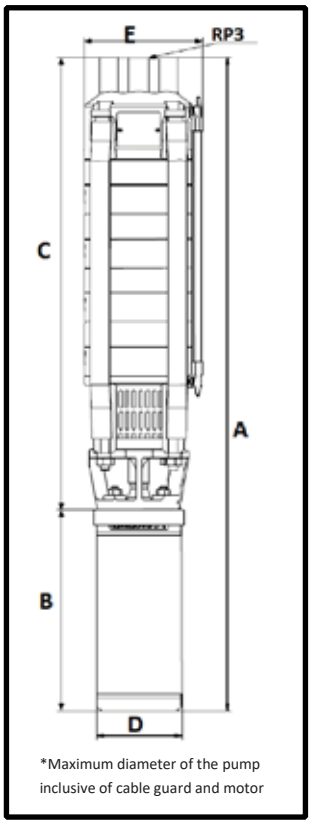
Max Liquid Temperature: +40 degrees C.

Max Water Depth: 600 m

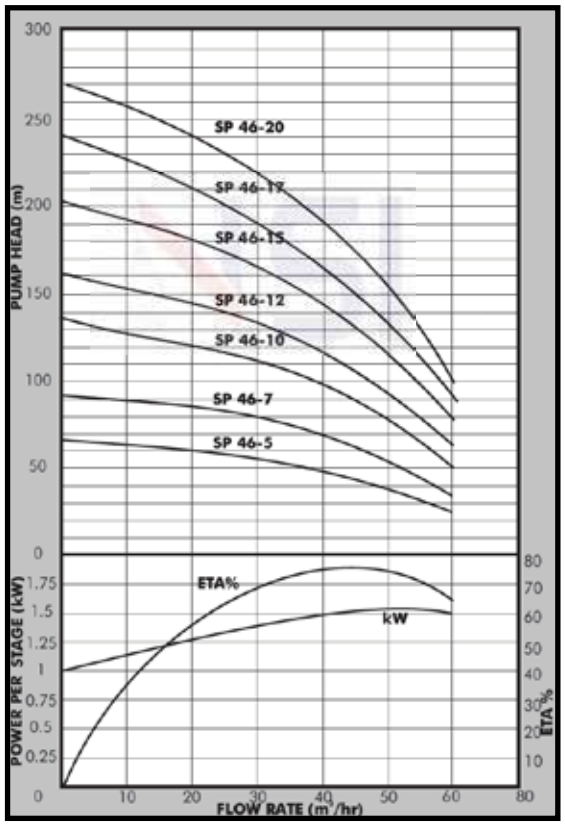
Minimum Borehole Diameter: 200mm

| Pump Type | Motor | | Full Load Current (A) | Start Current ratio | Dimensions (mm) | | | | | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| | kW | HP | | | A | B | C | D | E | |
| SP 30-8 | 7.5 | 10 | 18.8 | 4.5 | 1602 | 565 | 1037 | 95 | 142 | 53 |
| SP 30-13 | 11 | 15 | 24.8 | 4.7 | 2151 | 634 | 1517 | 138 | 142 | 72 |
| SP 30-17 | 15 | 20 | 34 | 5 | 2600 | 699 | 1901 | 138 | 142 | 85 |
| SP 30-21 | 18.5 | 25 | 42.2 | 5.1 | 3039 | 754 | 2285 | 138 | 142 | 98 |
| SP 30-26 | 22 | 30 | 48 | 5 | 3579 | 814 | 2765 | 138 | 142 | 112 |

# SP46– Submersible Borehole Pump




*Maximum diameter of the pump inclusive of cable guard and motor




**PUMP :**Grundfos SP46 submersible pumps are designed specifically for borehole applications. They are of multistage centrifugal impeller design. All parts are made from stainless steel (AISI 304) that ensures high corrosive resistance. This pump carries drinking water approval.. Standard pumps are designed for the pumping of non-aggressive water. An 'SP 17N' version is available for applications requiring a higher degree of corrosion resistance. Pump has sand shield and water lubricated rubber bearings. Suction is through a strainer between the pump and motor.

**MOTOR:** The pump is coupled to a sealed, liquid cooled 2-pole asynchronous squirrel-cage Grundfos motor constructed of stainless steel. The motor is fitted beneath the pump. Both single phase and three phase motors require a DOL control panel starter. Pump can be controlled with an NSI Control panel . Additional protection from mechanical failure is recommended for motors 7.5kw and above using the Grundfos MP 204 which also offers advanced monitoring features.

Enclosure Class: IP58 Insulation Class: F Speed: 2900 rpm

**OPERATING CONDITIONS**

Pumped Liquid: Thin, clean, chemically non-aggressive liquids without solid particles or fibres.

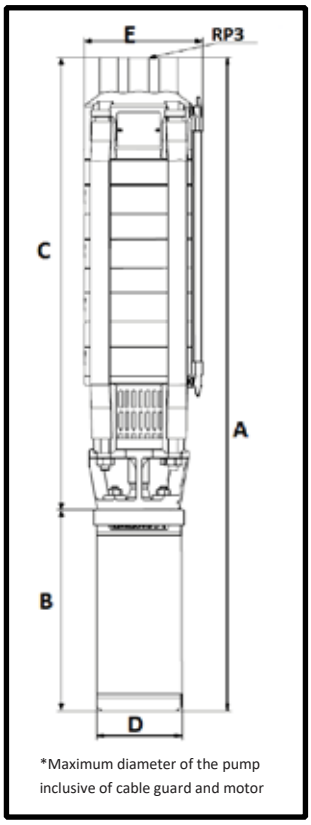
Max Liquid Temperature: +40 degrees C.

Max Water Depth: 600 m

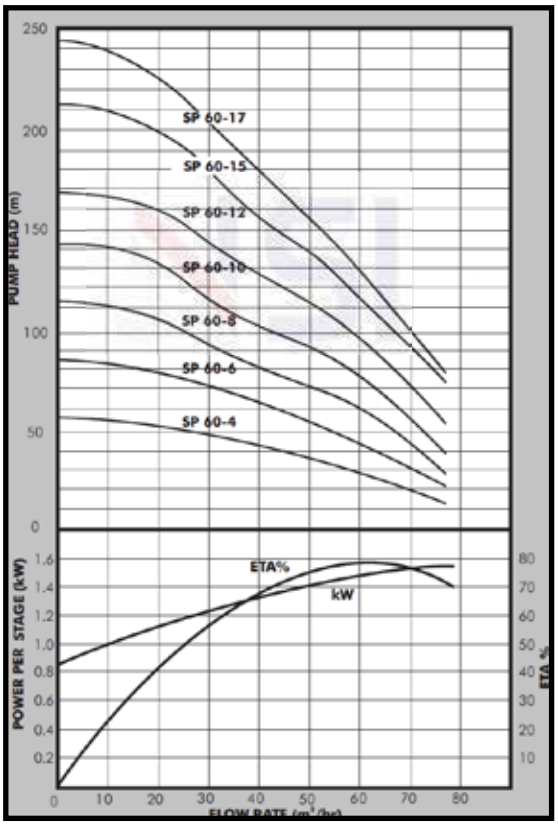
Minimum Borehole Diameter: 200mm

| Pump Type | Motor | | Full Load Current (A) | Start Current ratio | Dimensions (mm) | | | | | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| | kW | HP | | | A | B | C | D | E | |
| SP 46-5 | 7.5 | 10 | 17.6 | 4.5 | 1406 | 574 | 832 | 138 | 147 | 54 |
| SP 46-7 | 11 | 15 | 24.8 | 4.7 | 1698 | 634 | 1064 | 138 | 147 | 68 |
| SP 46-10 | 15 | 20 | 34 | 5 | 2102 | 699 | 1403 | 138 | 147 | 82 |
| SP 46-12 | 18.5 | 25 | 42 | 5.1 | 2383 | 754 | 1629 | 138 | 147 | 93 |
| SP 46-15 | 22 | 30 | 48 | 5 | 2782 | 814 | 1968 | 138 | 147 | 106 |
| SP 46-17 | 26 | 35 | 57 | 4.9 | 3068 | 874 | 2194 | 138 | 147 | 117 |
| SP 46-20 | 30 | 40 | 66.5 | 4.9 | 3477 | 944 | 2533 | 138 | 147 | 132 |

# SP60– Submersible Borehole Pump




*Maximum diameter of the pump inclusive of cable guard and motor




**PUMP :**Grundfos SP60 submersible pumps are designed specifically for borehole applications. They are of multistage centrifugal impeller design. All parts are made from stainless steel (AISI 304) that ensures high corrosive resistance. This pump carries drinking water approval.. Standard pumps are designed for the pumping of non-aggressive water. An 'SP 17N' version is available for applications requiring a higher degree of corrosion resistance. Pump has sand shield and water lubricated rubber bearings. Suction is through a strainer between the pump and motor.

**MOTOR:** The pump is coupled to a sealed, liquid cooled 2-pole asynchronous squirrel-cage Grundfos motor constructed of stainless steel. The motor is fitted beneath the pump. Both single phase and and three phase motors require a DOL control panel starter. Pump can be controlled with an NSI Control panel . Additional protection from mechanical failure is recommended for motors 7.5kw and above using the Grundfos MP 204 which also offers advanced monitoring features.

Enclosure Class: IP58 Insulation Class: F Speed: 2900 rpm

**OPERATING CONDITIONS**

Pumped Liquid: Thin, clean, chemically non-aggressive liquids without solid particles or fibres.

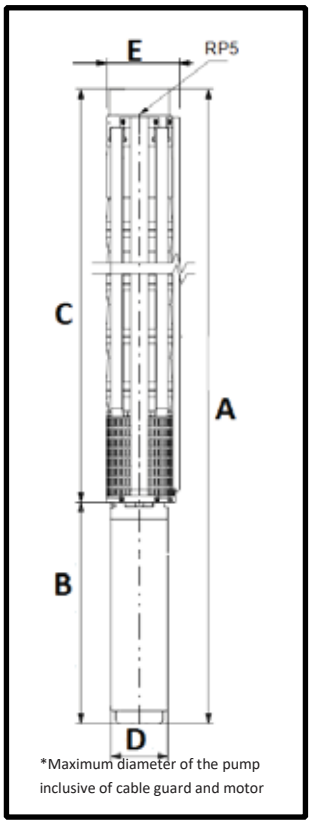
Max Liquid Temperature: +40 degrees C.

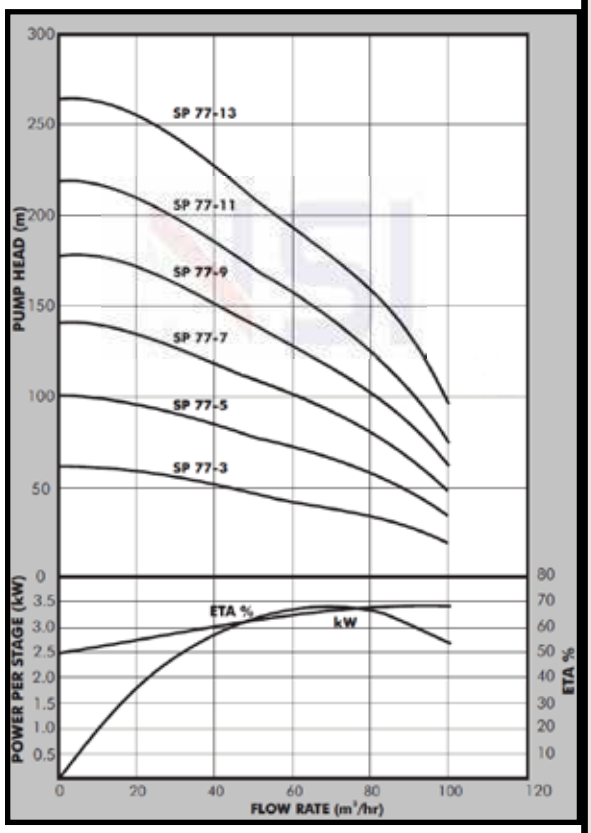
Max Water Depth: 600 m

Minimum Borehole Diameter: 200mm

| Pump Type | Motor | | Full Load Current (A) | Start Current ratio | Dimensions (mm) | | | | | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| | kW | HP | | | A | B | C | D | E | |
| SP 60-4 | 7.5 | 10 | 18.8 | 4.5 | 1482 | 773 | 709 | 95 | 152 | 44 |
| SP 60-6 | 11 | 15 | 24.8 | 4.7 | 1585 | 634 | 951 | 138 | 157 | 65 |
| SP 60-8 | 15 | 20 | 34 | 5 | 1876 | 699 | 1177 | 138 | 147 | 77 |
| SP 60-10 | 18.5 | 25 | 42 | 5.1 | 2157 | 754 | 1403 | 138 | 147 | 88 |
| SP 60-12 | 22 | 30 | 48 | 5 | 2443 | 814 | 1629 | 138 | 147 | 99 |
| SP 60-15 | 26 | 35 | 57 | 4.9 | 2842 | 874 | 1968 | 138 | 147 | 112 |
| SP 60-17 | 30 | 40 | 66.5 | 4.9 | 3138 | 944 | 2194 | 138 | 147 | 125 |

# SP77– Submersible Borehole Pump




**PUMP :**Grundfos SP77 submersible pumps are designed specifically for borehole applications. They are of multistage centrifugal impeller design. All parts are made from stainless steel (AISI 304) that ensures high corrosive resistance. This pump carries drinking water approval.. Standard pumps are designed for the pumping of non-aggressive water. An 'SP 17N' version is available for applications requiring a higher degree of corrosion resistance. Pump has sand shield and water lubricated rubber bearings. Suction is through a strainer between the pump and motor.

**MOTOR:** The pump is coupled to a sealed, liquid cooled 2-pole asynchronous squirrel-cage Grundfos motor constructed of stainless steel. The motor is fitted beneath the pump. Both single phase and and three phase motors require a DOL control panel starter. Pump can be controlled with an NSI Control panel . Additional protection from mechanical failure is recommended for motors 7.5kw and above using the Grundfos MP 204 which also offers advanced monitoring features.

Enclosure Class: IP58 Insulation Class: F Speed: 2900 rpm

**OPERATING CONDITIONS**

Pumped Liquid: Thin, clean, chemically non-aggressive liquids without solid particles or fibres.

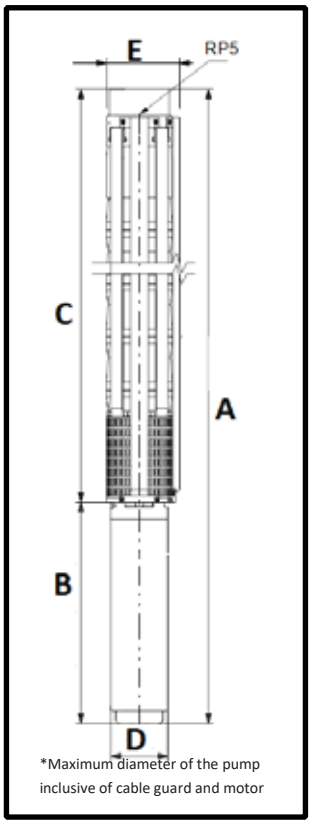
Max Liquid Temperature: +40 degrees C.

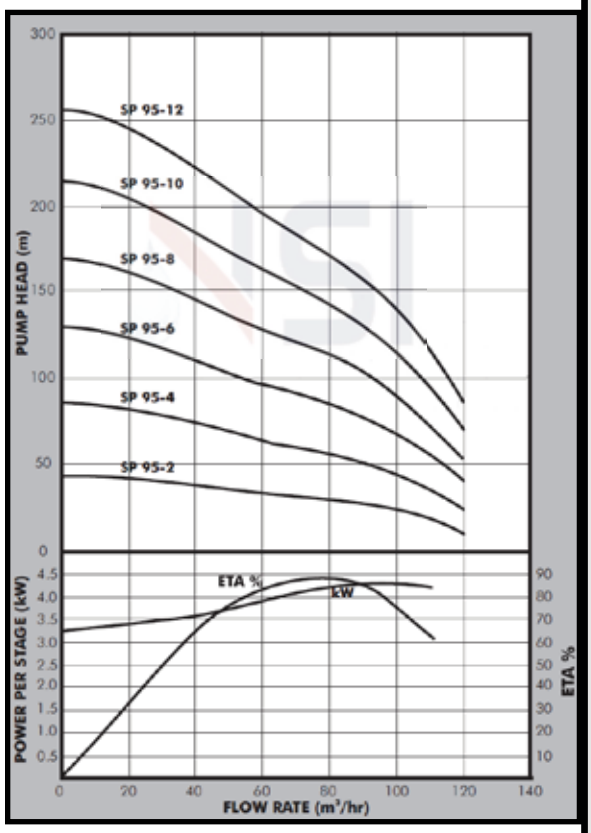
Max Water Depth: 600 m

Minimum Borehole Diameter: 200mm (With MS6 & MS 6000 Motors)- SP 77-13– 220mm

| Pump Type | Motor | | Full Load Current (A) | Start Current ratio | Dimensions (mm) | | | | | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| | kW | HP | | | A | B | C | D | E | |
| SP 77-3 | 11 | 15 | 24.6 | 4.8 | 1557 | 683 | 874 | 143 | 200 | 75 |
| SP 77-5 | 18.5 | 25 | 41.5 | 4.8 | 1914 | 784 | 1131 | 146 | 200 | 95 |
| SP 77-7 | 26 | 35 | 57.5 | 5.2 | 2290 | 903 | 1387 | 143 | 200 | 114 |
| SP 77-9 | 30 | 40 | 65 | 5.3 | 2611 | 968 | 1643 | 143 | 200 | 129 |
| SP 77-11 | 37 | 50 | 80 | 4.3 | 3339 | 1425 | 1898 | 144 | 200 | 184 |
| SP 77-13 | 55 | 74 | 114 | 5.9 | 3522 | 1350 | 2172 | 192 | 209 | 259 |

# SP95– Submersible Borehole Pump




**PUMP :**Grundfos SP95 submersible pumps are designed specifically for borehole applications. They are of multistage centrifugal impeller design. All parts are made from stainless steel (AISI 304) that ensures high corrosive resistance. This pump carries drinking water approval.. Standard pumps are designed for the pumping of non-aggressive water. An 'SP 17N' version is available for applications requiring a higher degree of corrosion resistance. Pump has sand shield and water lubricated rubber bearings. Suction is through a strainer between the pump and motor.

**MOTOR:** The pump is coupled to a sealed, liquid cooled 2-pole asynchronous squirrel-cage Grundfos motor constructed of stainless steel. The motor is fitted beneath the pump. Both single phase and and three phase motors require a DOL control panel starter. Pump can be controlled with an NSI Control panel . Additional protection from mechanical failure is recommended for motors 7.5kw and above using the Grundfos MP 204 which also offers advanced monitoring features.

Enclosure Class: IP58 Insulation Class: F Speed: 2900 rpm

**OPERATING CONDITIONS**

Pumped Liquid: Thin, clean, chemically non-aggressive liquids without solid particles or fibres.

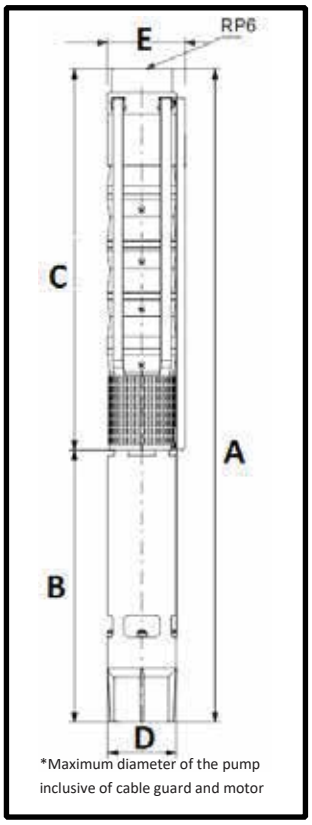
Max Liquid Temperature: +40 degrees C.

Max Water Depth: 600 m

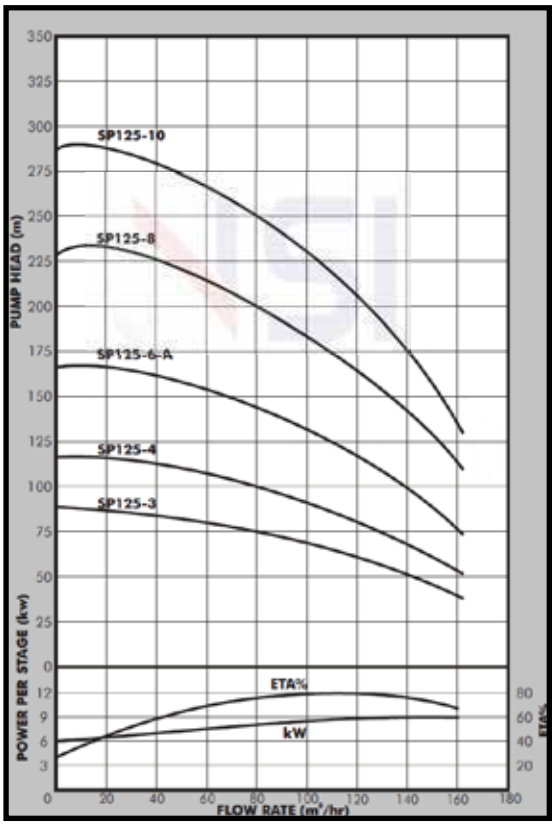
Minimum Borehole Diameter: 254mm

| Pump Type | Motor | | Full Load Current (A) | Start Current ratio | Dimensions (mm) | | | | | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| | kW | HP | | | A | B | C | D | E | |
| SP 95-2 | 9.2 | 12 | 20.2 | 4.9 | 1336 | 590 | 746 | 143 | 200 | 68 |
| SP 95-4 | 18.5 | 25 | 41.5 | 4.8 | 1786 | 783 | 1003 | 143 | 200 | 91 |
| SP 95-6 | 26 | 35 | 57.5 | 5.2 | 2162 | 903 | 1259 | 143 | 200 | 110 |
| SP 95-8 | 37 | 50 | 80 | 4.3 | 2940 | 1425 | 1515 | 144 | 200 | 173 |
| SP 95-10 | 45 | 60 | 96.5 | 6 | 3055 | 1270 | 1785 | 192 | 209 | 233 |
| SP 95-12 | 55 | 74 | 114 | 5.9 | 3393 | 1350 | 2043 | 192 | 209 | 255 |

# SP125– Submersible Borehole Pump



*Maximum diameter of the pump inclusive of cable guard and motor




**PUMP :**Grundfos SP125 submersible pumps are designed specifically for borehole applications. They are of multistage centrifugal impeller design. All parts are made from stainless steel (AISI 304) that ensures high corrosive resistance. This pump carries drinking water approval.. Standard pumps are designed for the pumping of non-aggressive water. An 'SP 17N' version is available for applications requiring a higher degree of corrosion resistance. Pump has sand shield and water lubricated rubber bearings. Suction is through a strainer between the pump and motor.

**MOTOR:** The pump is coupled to a sealed, liquid cooled 2-pole asynchronous squirrel-cage Grundfos motor constructed of stainless steel. The motor is fitted beneath the pump. Both single phase and and three phase motors require a DOL control panel starter. Pump can be controlled with an NSI Control panel . Additional protection from mechanical failure is recommended for motors 7.5kw and above using the Grundfos MP 204 which also offers advanced monitoring features.

Enclosure Class: IP58 Insulation Class: F Speed: 2900 rpm

**OPERATING CONDITIONS**

Pumped Liquid: Thin, clean, chemically non-aggressive liquids without solid particles or fibres.

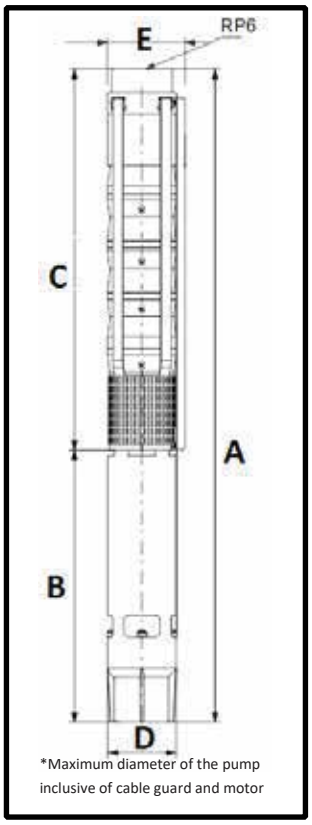
Max Liquid Temperature: +40 degrees C.

Max Water Depth: 600 m

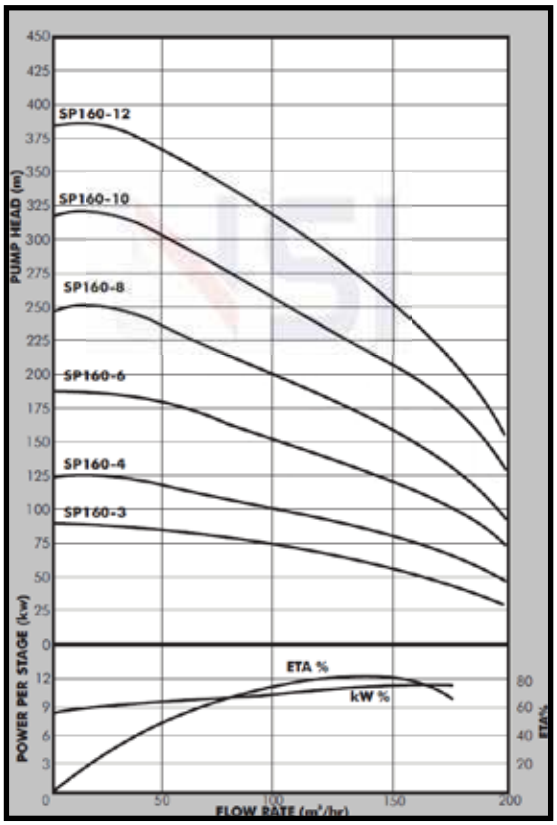
Minimum Borehole Diameter: 200 mm - MS6/MMS6000 , 254mm - MMS8000

| Pump Type | Motor | | Full Load Current (A) | Start Current ratio | Dimensions (mm) | | | | | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| | kW | HP | | | A | B | C | D | E | |
| **SP125-3** | 30 | 40 | 63 | 4.9 | 1907 | 944 | 963 | 139.5 | 211 | 123 |
| **SP125-4** | 37 | 50 | 85 | 5.1 | 2431 | 1312 | 1119 | 143 | 211 | 171 |
| **SP125-6-A** | 55 | 73 | 112 | 5.9 | 2781 | 1350 | 1431 | 192 | 213 | 257 |
| **SP125-8** | 75 | 100 | 152 | 5.4 | 3333 | 1590 | 1743 | 192 | 218 | 314 |
| **SP125-10** | 92 | 123 | 186 | 5.6 | 3885 | 1830 | 2055 | 192 | 218 | 372 |

# SP160– Submersible Borehole Pump



*Maximum diameter of the pump inclusive of cable guard and motor




**PUMP :**Grundfos SP160 submersible pumps are designed specifically for borehole applications. They are of multistage centrifugal impeller design. All parts are made from stainless steel (AISI 304) that ensures high corrosive resistance. This pump carries drinking water approval.. Standard pumps are designed for the pumping of non-aggressive water. An 'SP 17N' version is available for applications requiring a higher degree of corrosion resistance. Pump has sand shield and water lubricated rubber bearings. Suction is through a strainer between the pump and motor.

**MOTOR:** The pump is coupled to a sealed, liquid cooled 2-pole asynchronous squirrel-cage Grundfos motor constructed of stainless steel. The motor is fitted beneath the pump. Both single phase and and three phase motors require a DOL control panel starter. Pump can be controlled with an NSI Control panel . Additional protection from mechanical failure is recommended for motors 7.5kw and above using the Grundfos MP 204 which also offers advanced monitoring features.

Enclosure Class: IP58 Insulation Class: F Speed: 2900 rpm

**OPERATING CONDITIONS**

Pumped Liquid: Thin, clean, chemically non-aggressive liquids without solid particles or fibres.

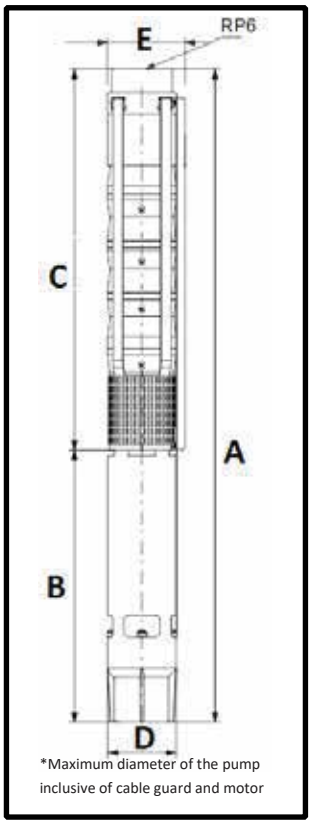
Max Liquid Temperature: +40 degrees C.

Max Water Depth: 600 m

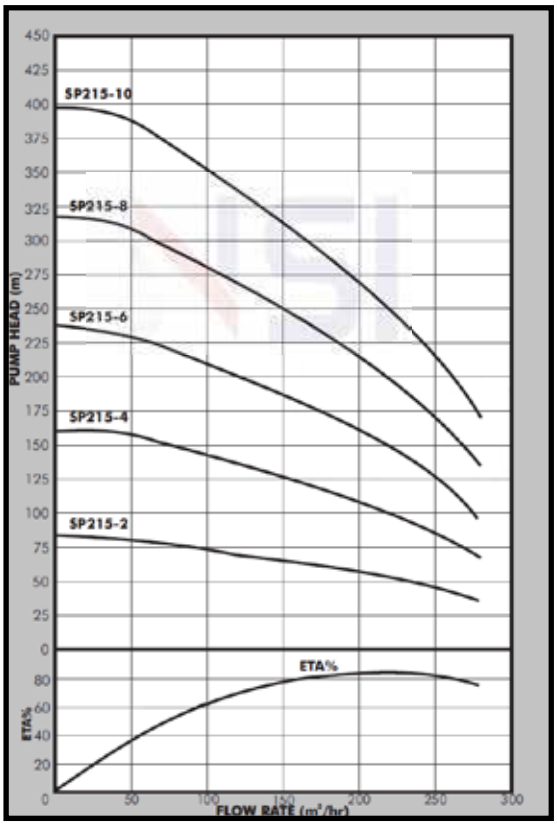
Minimum Borehole Diameter: 200 mm - MS6/MMS6000 , 254mm - MMS8000

| Pump Type | Motor | | Full Load Current (A) | Start Current ratio | Dimensions (mm) | | | | | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| | kW | HP | | | A | B | C | D | E | |
| **SP160-3** | 37 | 50 | 85 | 5.1 | 2275 | 1312 | 963 | 143 | 211 | 165 |
| **SP160-4** | 55 | 73 | 112 | 5.9 | 2469 | 1350 | 1119 | 192 | 218 | 245 |
| **SP160-6** | 75 | 100 | 152 | 5.8 | 3021 | 1590 | 1431 | 192 | 218 | 302 |
| **SP160-8** | 92 | 123 | 186 | 5.9 | 3573 | 1830 | 1743 | 192 | 218 | 360 |
| **SP160-10** | 132 | 176 | 270 | 5.7 | 4273 | 1870 | 2403 | 237 | 237 | 544 |
| **SP160-12** | 147 | 196 | **320** | 6.2 | 4784 | 2070 | 2714 | 237 | 237 | 621 |

# SP215– Submersible Borehole Pump



*Maximum diameter of the pump inclusive of cable guard and motor




**PUMP :**Grundfos SP215 submersible pumps are designed specifically for borehole applications. They are of multistage centrifugal impeller design. All parts are made from stainless steel (AISI 304) that ensures high corrosive resistance. This pump carries drinking water approval.. Standard pumps are designed for the pumping of non-aggressive water. An 'SP 17N' version is available for applications requiring a higher degree of corrosion resistance. Pump has sand shield and water lubricated rubber bearings. Suction is through a strainer between the pump and motor.

**MOTOR:** The pump is coupled to a sealed, liquid cooled 2-pole asynchronous squirrel-cage Grundfos motor constructed of stainless steel. The motor is fitted beneath the pump. Both single phase and and three phase motors require a DOL control panel starter. Pump can be controlled with an NSI Control panel . Additional protection from mechanical failure is recommended for motors 7.5kw and above using the Grundfos MP 204 which also offers advanced monitoring features.

Enclosure Class: IP58 Insulation Class: F Speed: 2900 rpm

**OPERATING CONDITIONS**

Pumped Liquid: Thin, clean, chemically non-aggressive liquids without solid particles or fibres.

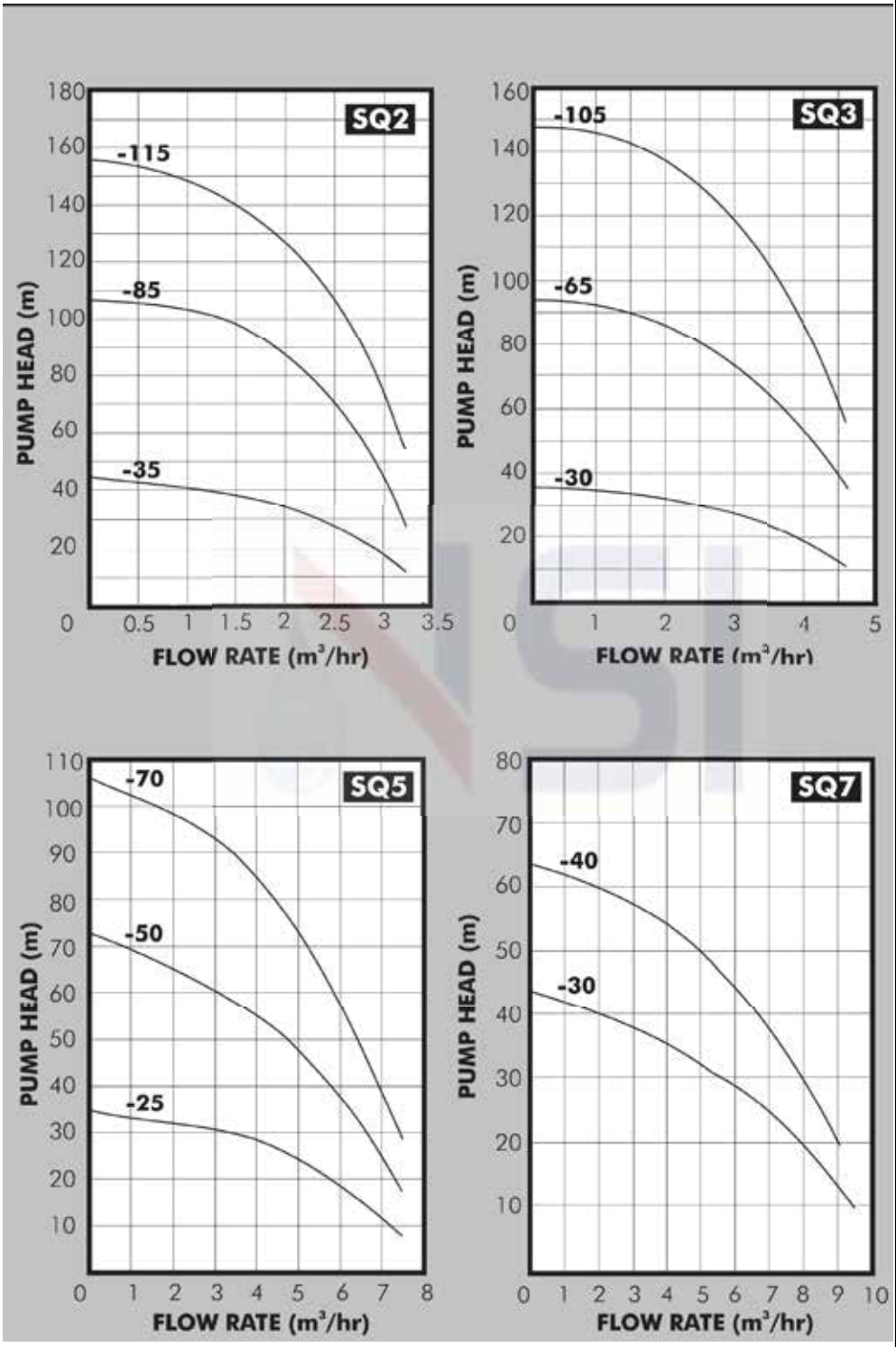
Max Liquid Temperature: +40 degrees C.

Max Water Depth: 600 m
Minimum Borehole Diameter: 254mm - MMS8000

| Pump Type | Motor | | Full Load Current (A) | Start Current ratio | Motor | Dimensions (mm) | | | | | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | kW | HP | | | | A | B | C | D | E | |
| **SP215-2** | 45 | 60 | 96 | 6.0 | MMS 8000 | 2236 | 1270 | 966 | 192 | 241 | 228 |
| **SP215-4** | 75 | 100 | 152 | 5.8 | MMS 8000 | 2908 | 1590 | 1318 | 192 | 241 | 308 |
| **SP215-6** | 110 | 147 | 222 | 5.8 | MMS 8000 | 3730 | 2060 | 1670 | 192 | 241 | 424 |
| **SP215-8** | 147 | 196 | 320 | 6.7 | MMS 10000 | 4392 | 2070 | 2322 | 237 | 247 | 622 |
| **SP215-10** | 190 | 253 | 395 | 6.7 | MMS 12000 | 4654 | 1980 | 2674 | 286 | 276 | 793 |

# GRUNDFOS SQ

# SQ– 3” Submersible Borehole




**PUMP :**The GRUNDFOS SQ range of 3 inch domestic submersible borehole pumps are built for trouble free operation in domestic water supply, water transfer and irrigation. Their small diameter allows them to fit in 3” diameter narrow boreholes. They have good starting characteristics making them suitable for pressure control operation. The **inbuilt** GRUNDFOS electronic motor controller offers the following features:-

- Dry run protection without electrodes
- Ideal for generator operation due to built in soft start
- Over and under voltage protection
- Overload and high temperature protection

Hydraulic components are made from polyamide plastic and the special design floating impellers each have a tungsten carbide/ceramic bearing. The pump sleeve, shaft and other components are made from stainless steel.

**MOTOR**

The unique integrated GRUNDFOS MS3 high efficiency permanent magnet motor is controlled by a built in frequency converter which increases the standard mains frequency enabling the pump to run at high speed. All control functions are built into the frequency converter and no additional motor protection is required other than a 13amp fuse or MCB.

***Voltage:*** 1 x 240V ***Speed:*** 10,700rpm ***Power Factor:*** 1

**OPERATING CONDITIONS**

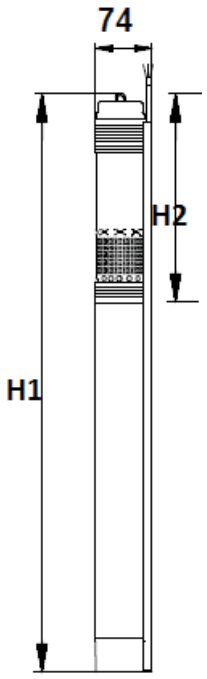
***Pump liquid:*** Thin, clean, non aggressive liquids containing no solids or fibres.

***Max. Water Temperature:*** +30 $_0$C (no liquid flow past motor)

+40 $_0$C (min 0.15 l/sec liquid flow past motor)

***Max Water depth:*** 150m

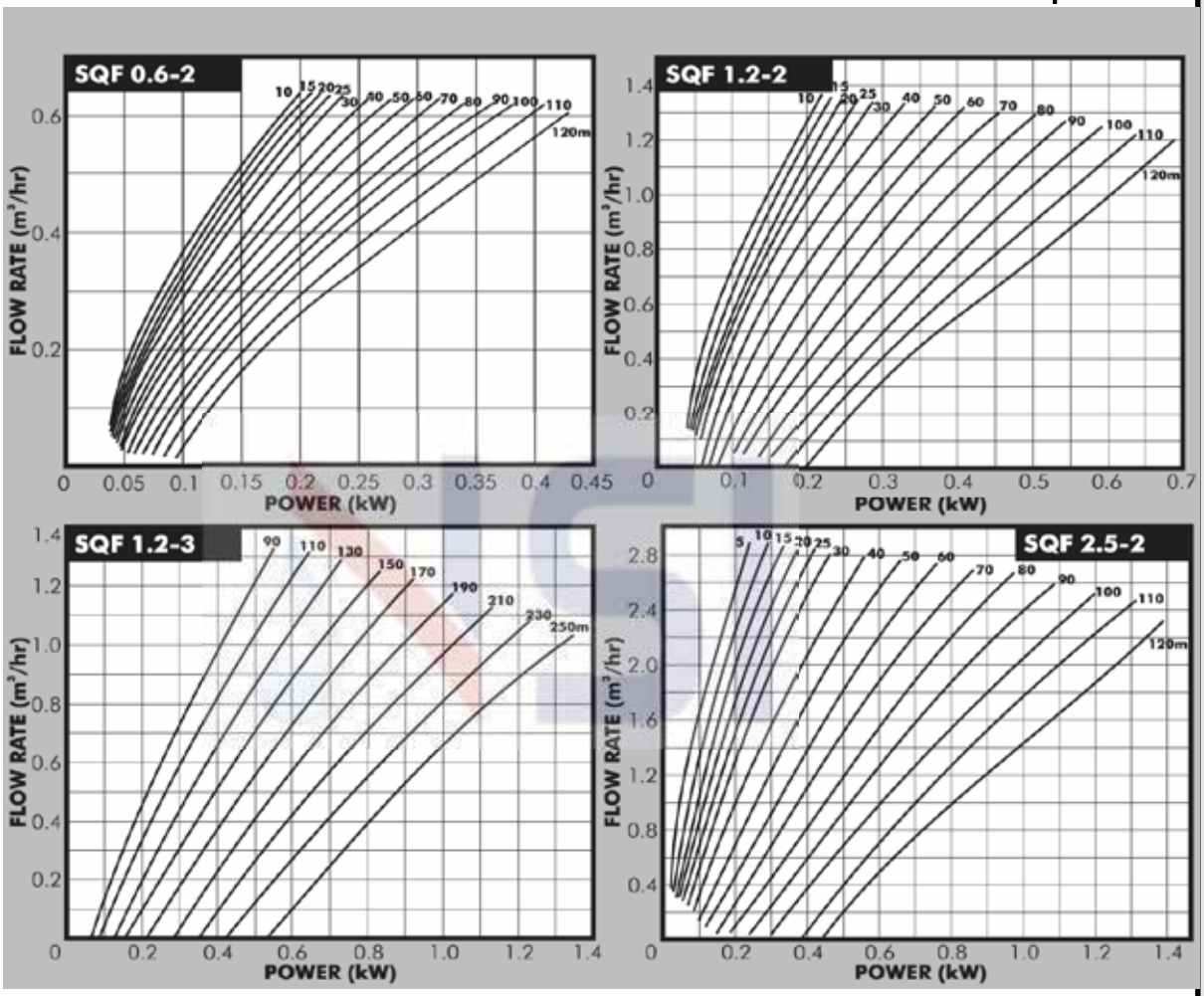
| Pump Type | Power | Running | Dimensions | | Outlet Rp | Weight |
|---|---|---|---|---|---|---|
| | KW | (A) | H1 | H2 | 1¼" | Kg |
| SQ 2-35 | 0.7 | 5.2 | 741 | 265 | 1¼" | 5 |
| SQ 2-85 | 1.2 | 8.4 | 825 | 346 | 1¼" | 6 |
| SQ2-115 | 1.9 | 12.3 | 889 | 265 | 1¼" | 7 |
| SQ3-30 | 0.7 | 5.2 | 745 | 373 | 1¼" | 5 |
| SQ 3-65 | 1.2 | 8.4 | 825 | 346 | 1¼" | 5 |
| SQ 3-105 | 1.9 | 12.3 | 942 | 427 | 1¼" | 7 |
| SQ 5-25 | 0.7 | 5.2 | 743 | 265 | 1½" | 6 |
| SQ 5-50 | 1.7 | 11.2 | 824 | 346 | 1½" | 7 |
| SQ 5-70 | 1.9 | 12.3 | 941 | 427 | 1½" | 7 |
| SQ 7-30 | 1.2 | 8.4 | 743 | 265 | 1½" | 6 |
| SQ 7-40 | 1.7 | 11.2 | 862 | 346 | 1½" | 7 |




All dimensions are in mm

GRUNDFOS SQ FLEX

# SQflex– Solar Powered Submersible Borehole Pump




**PUMP**

The SQflex range of helical rotor pumps consists of four models for high heads and low flows (suitable for 3”boreholes) . They are offered with high grade stainless steel AISI 316 used extensively in construction. AISI 316 stainless steel is better suited to handle aggressive borehole water in arid areas. Pump model selection is determined by the duty requirement.

**MOTOR**

One size of the unique 1400W Grundfos MSF 3 high efficiency permanent magnet motor is specified with all pump types. The motor can be powered by either DC or AC voltage within the range of 30-300V DC and 1X90-240V, 50/60Hz AC. An integral control module uses Maximum Power Point Tracking (MPPT) technology that continuously optimises output frequency to maximize system efficiency and protects against over and under voltage (except lightning), electrical overload and over temperature. Effective dry running protection is provided by a sensor in the motor cable.

Maximum current is 8.4A and speed 3600rpm.

**CONTROL UNITS**

A variety of switch boxes are available for the various installation options including:-

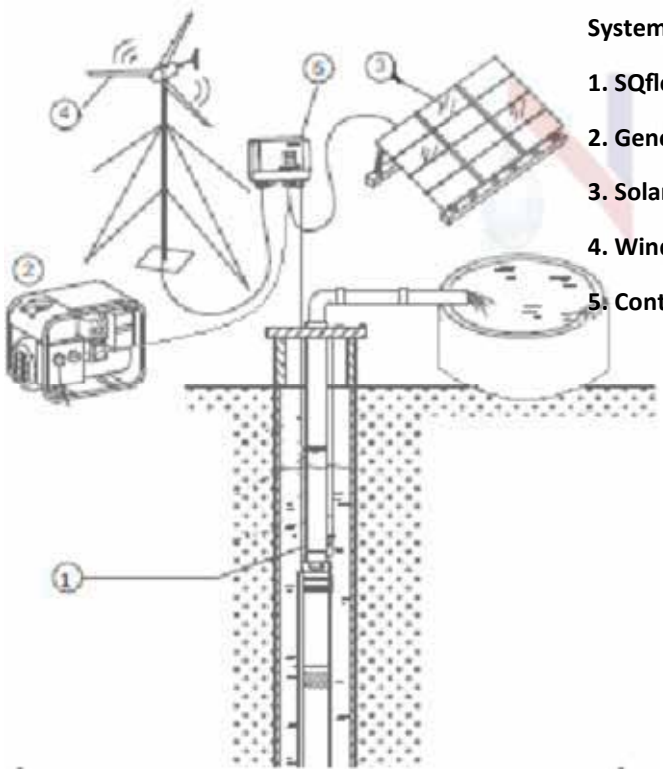
- IO50 for a manual solar system,
- IO101 for solar/generator systems
- IO102 for a wind system.
- CU200 control unit for high-level floatswitch control together with system monitoring and alarm indication.
- CIU 273 GRM interface unit for SQFlex for Grundfos Remote Management (GRM) using GPRS or SMS.

## SOLAR MODULES

SQ Flex systems are recommended to be powered by crystalline photo voltaic modules connected in arrays to provide the power selected. Arrays should be connected to produce at least 40V input voltage with higher voltage of around 100V recommended for maximum efficiency operation.

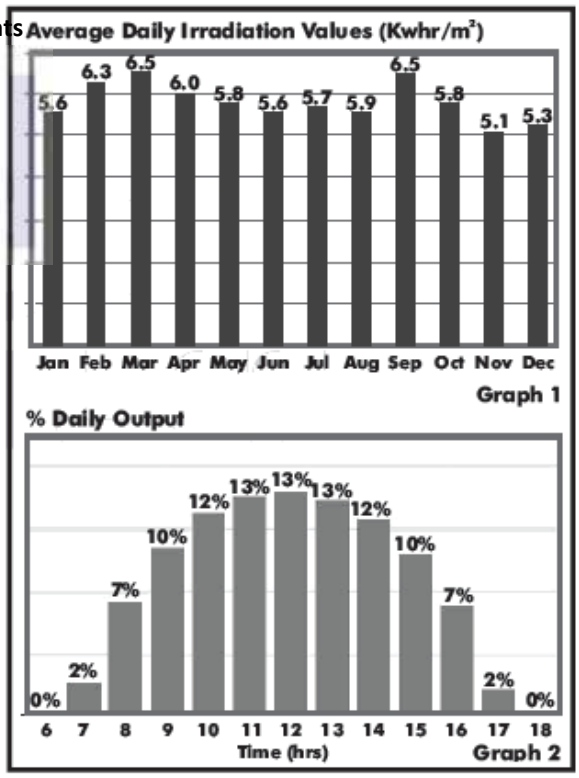
## ACCESSORIES

A complete range of accessories including drop cable, module support structures , pipes and fittings are available for a complete installation.



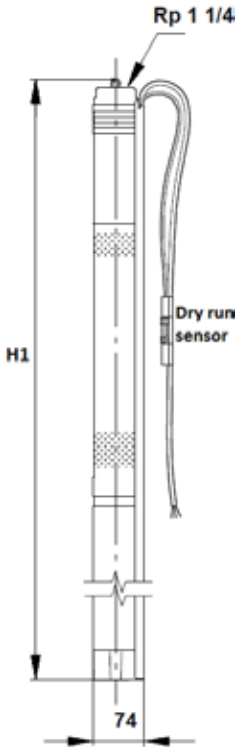
**System components**

1. SQflex pump
2. Generator
3. Solar Array
4. Wind Turbine
5. Controller




### Pump

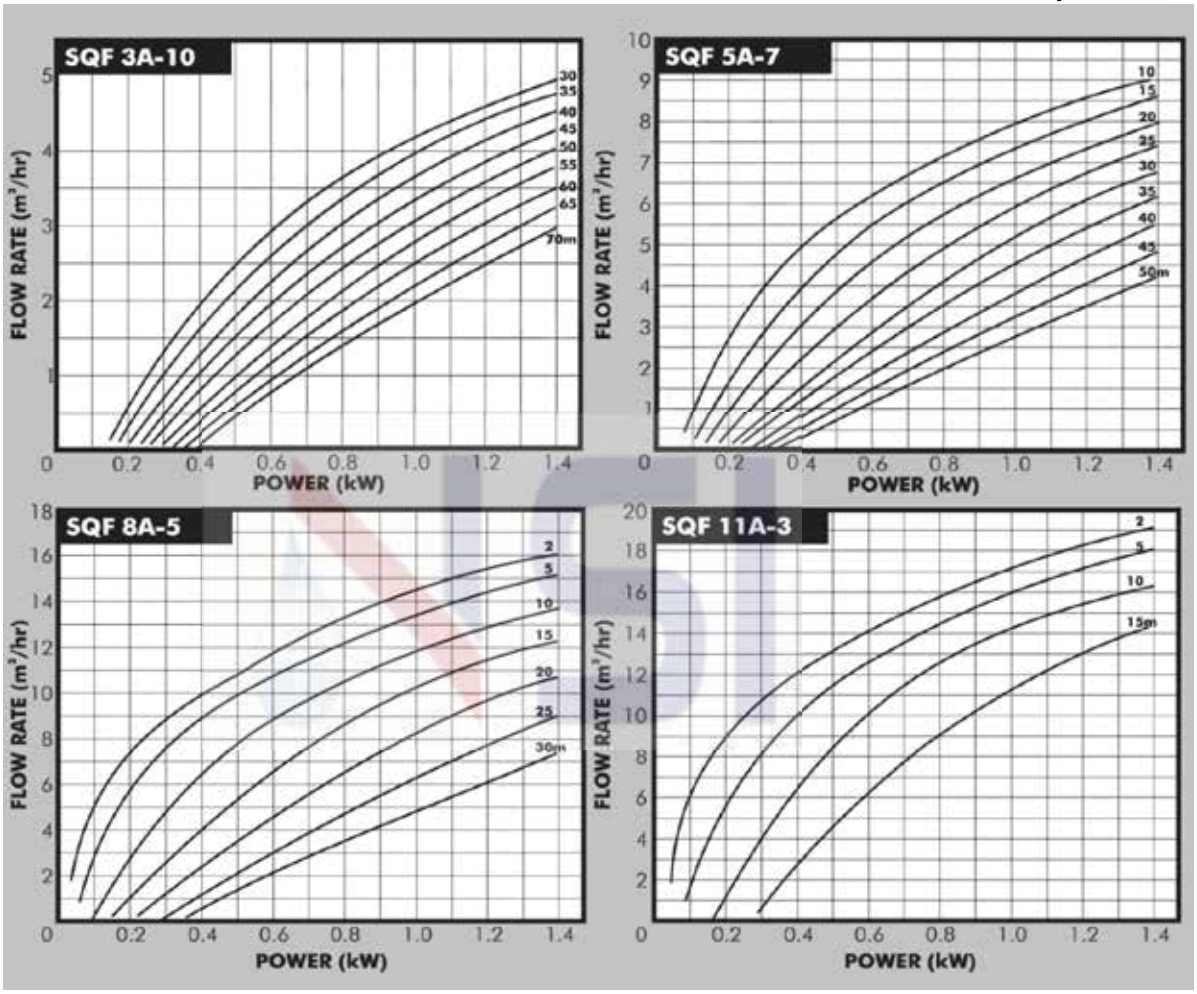
**Output Curves** are given at standard test conditions of 1000W/m solar irradiance and 25º C .Output will vary throughout the year depending upon prevailing irradiation levels. For estimated daily outputs at continuous pumping multiply by the daily irradiation given in Graph 1(see drawing). For indicative purposes factors of 1.1 can be applied for hot arid areas and 0.9 for temperate high altitude areas in East Africa. Output will vary through out the day as a proportion of the estimated hourly irradiation as shown in Graph 2.NOTE: Output estimations are strictly indicative. More accurate projections are available using manufacturers data when the exact site location and installation arrangement is defined. This information is available at www.grundfos.com/Grundfos product centre and will be provided with all offers.




| Pump Type | Dimensions | Outlet Rp | Weight |
|---|---|---|---|
| | H1 | Rp (Inch) | Kg |
| SQF 0.6-2N | 1185 | 1¼" | 9 |
| SQF 1.2-2N | 1225 | 1¼" | 10 |
| SQF 1.2-3N | 1295 | 1¼" | 10 |
| SQF 2.5-2N | 1247 | 1¼" | 10 |

All dimensions are in mm

# SQflex– Solar Powered Submersible Borehole Pump




**PUMP**

The SQflex range of centrifugal pumps consists of six models for low heads and high flows (suitable for 4"boreholes). Four models are shown in this catalogue SQF 3A-10N,SQF 5A-7N,SQF 8A-5N,SQF 11A-3N. Low head models SQF 5A-3N,SQF 8A-3N,are also available. They are offered with high grade stainless steel AISI 316 used extensively in construction. AISI 316 stainless steel is better suited to handle aggressive borehole water in arid areas. Pump model selection is determined by the duty requirement.

**MOTOR**

One size of the unique 1400W Grundfos MSF 3 high efficiency permanent magnet motor is specified with all pump types. The motor can be powered by either DC or AC voltage within the range of 30-300V DC and 1X90-240V, 50/60Hz AC. An integral control module uses Maximum Power Point Tracking (MPPT) technology that continuously optimises output frequency to maximize system efficiency and protects against over and under voltage (except lightning), electrical overload and over temperature. Effective dry running protection is provided by a sensor in the motor cable.

Maximum current is 8.4A and speed 3600rpm.

**CONTROL UNITS**

A variety of switch boxes are available for the various installation options including:-

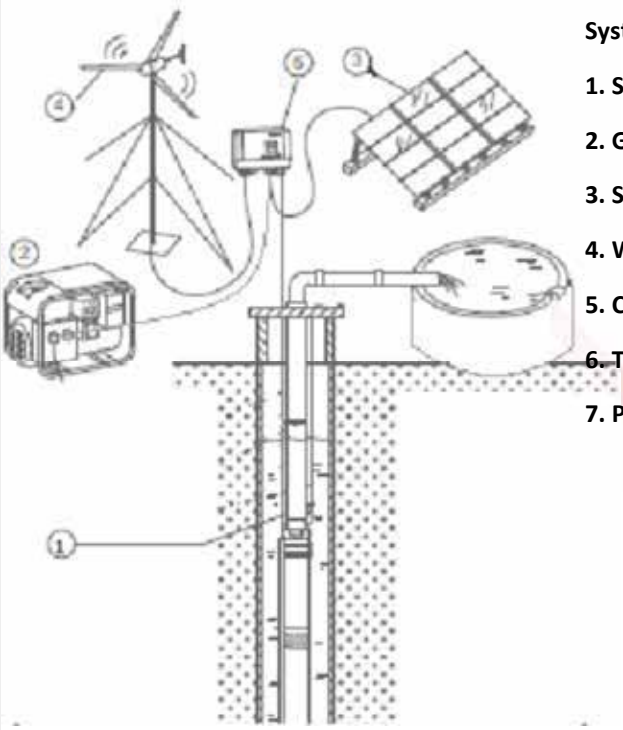
- IO50 for a manual solar system,
- IO101 for solar/generator systems
- IO102 for a wind system.
- CU200 control unit for high-level floatswitch control together with system monitoring and alarm indication.
- CIU 273 GRM interface unit for SQFlex for Grundfos Remote Management (GRM) using GPRS or SMS.

## SOLAR MODULES

SQ Flex systems are recommended to be powered by crystalline photo voltaic modules connected in arrays to provide the power selected. Arrays should be connected to produce at least 40V input voltage with higher voltage of around 100V recommended for maximum efficiency operation.

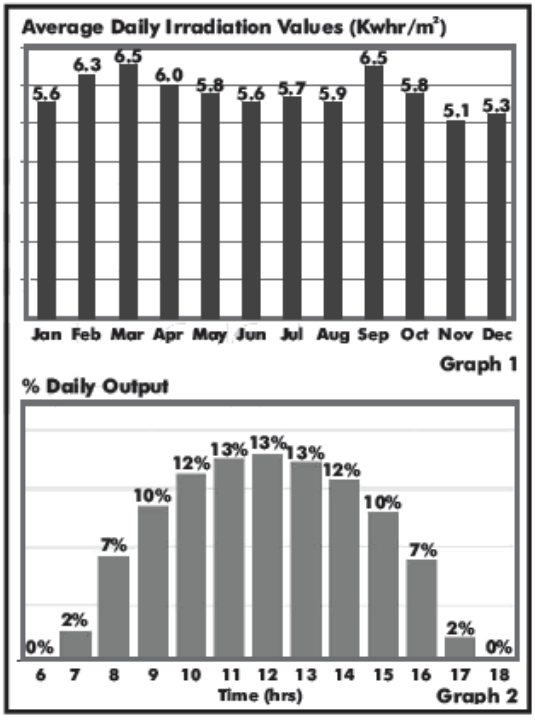
## ACCESSORIES

A complete range of accessories including drop cable, module support structures , pipes and fittings are available to provide all necessary components for a complete installation.




**System components**

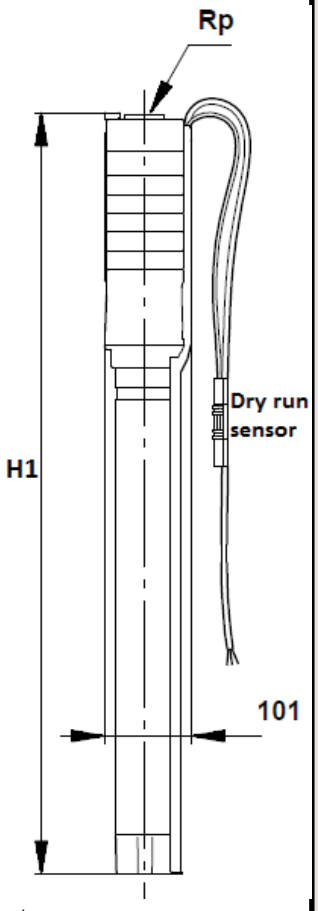
1. **SQflex pump**
2. **Generator**
3. **Solar Array**
4. **Wind Turbine**
5. **Controller**
6. **Tank**
7. **Pipes & Accessories**




**Pump Output Curves** are given at standard test conditions of 1000W/m solar irradiance and 25º C .Output will vary throughout the year depending upon prevailing irradiation levels. For estimated daily outputs at continuous pumping, multiply by the daily irradiation given in Graph 1(see above). For indicative purposes factors of 1.1 can be applied for hot arid areas and 0.9 for temperate high altitude areas in East Africa. Output will vary through out the day as a proportion of the estimated hourly irradiation as shown in Graph 2.

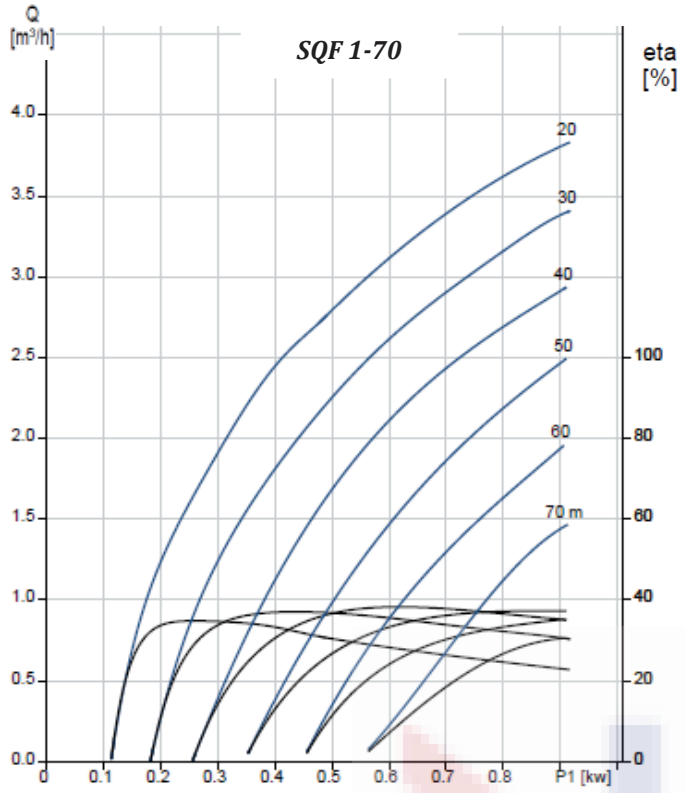
NOTE: Output estimations are strictly indicative. More accurate projections are available using manufacturers data when the exact site location and installation arrangement is defined. This information is available at Grundfos Product Center product-selection.grundfos.com. and will be provided with all offers.

| Pump Type | Dimensions | Outlet Rp | Weight |
|---|---|---|---|
| | H1 | Rp (Inch) | Kg |
| SQF 3A-10N | 968 | 1¼" | 11 |
| SQF 5A-3N | 815 | 1½" | 10 |
| SQF 5A-7N | 920 | 1½" | 10 |
| SQF 8A-3N | 920 | 2" | 11 |
| SQF 8A-5N | 1011 | 2" | 12 |
| SQF 11A-3N | 982 | 2" | 12 |

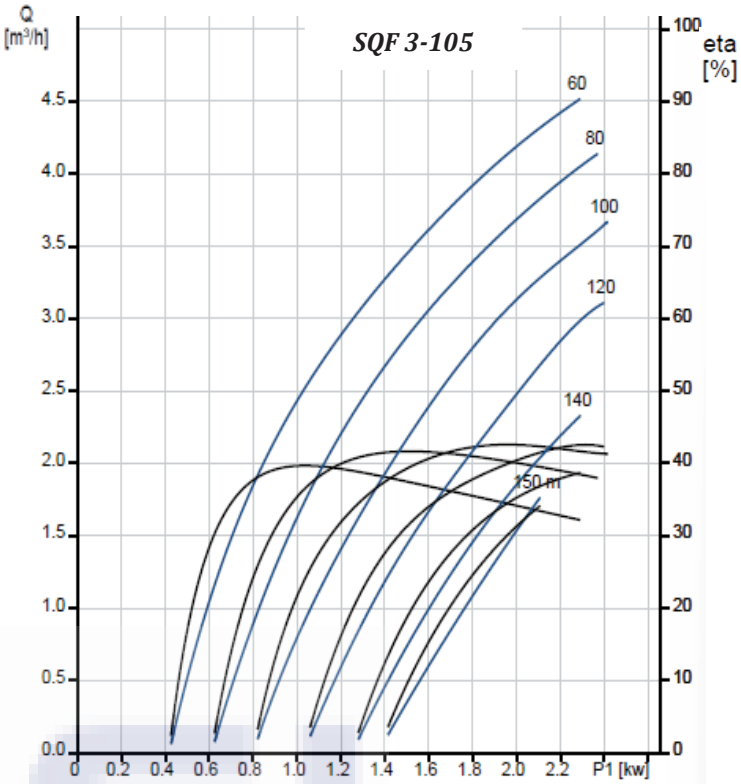



All dimensions are in mm

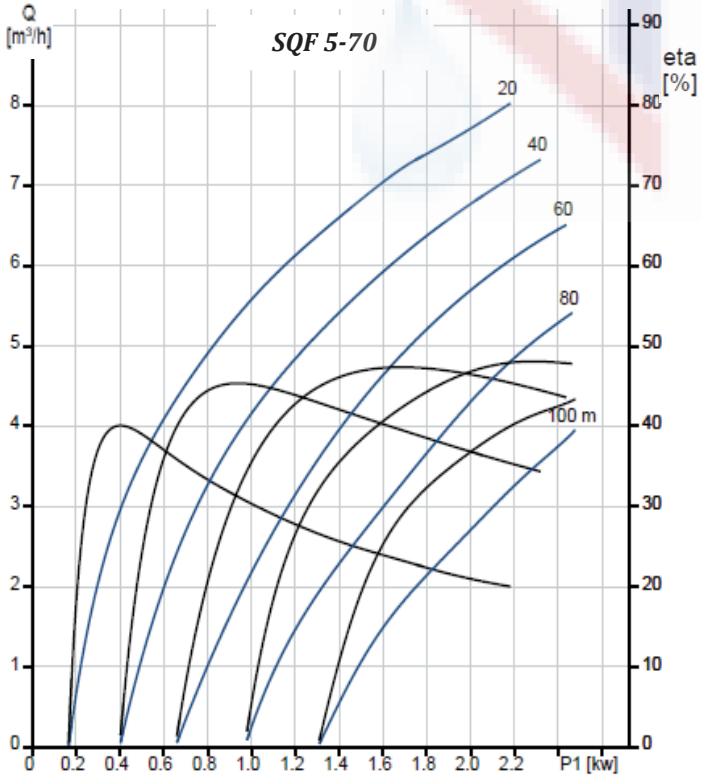
### SQF 1-70



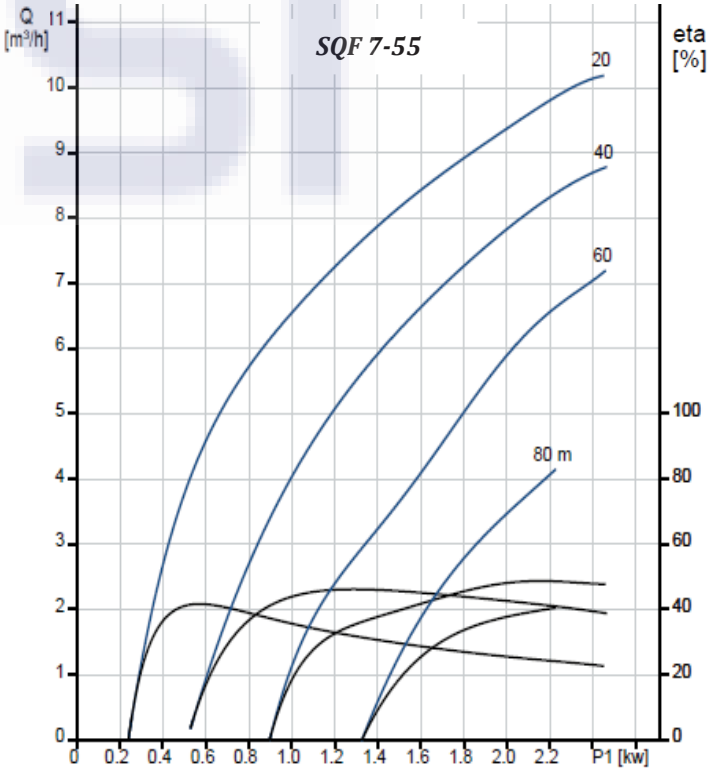

### SQF 3-105




### SQF 5-70




### SQF 7-55

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***PUMP:*** The Grundfos SQ Flex pumps are reliable water supply pumps based on renewable energy sources, such as solar and wind energy. The 3" SQFlex centrifugal pump is for medium heads and flow rates and is suitable for 3" boreholes. Thanks to its flexible energy supply and performance, the SQFlex system can be combined and adapted to meet any need on the installation site. The SQFlex system has a wide voltage range, built-in maximum power point tracking (MPPT) as well as dry-running, voltage and overload protection. All steel components are made in stainless steel, EN 1.4301 (AISI 304), that ensures high corrosive resistance.

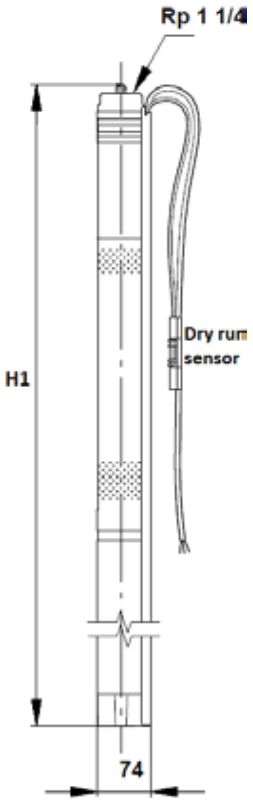
***CONTROLLER:*** The SQF pump set is powered by various Solar Pump controllers, including IO50 for manual solar systems, IO101 for solar/generator systems, IO102 for a wind system, CIU903 for advanced controls like system monitoring and alarm indication.

***MOTOR:*** The Pumps are coupled with an MSF3 motor with a sand shield, water-lubricated journal bearings and a volume compensating diaphragm. The motor is a permanent magnet synchronous, rewindable type submersible motor offering good reliability and high efficiency. The motors can be powered by either DC or AC input within the range of 30-300V DC and 1 x 90-240 V, 50/60Hz AC.

***Pumped liquid**: Clean water* ***Protection**: IP 68* ***Max Liquid temperature**: +40$^0$C* ***Speed:** 10700 rpm*

## *Specifications*

| MODEL | POWER | CURRENT | VOLTAGE | OUTLET | DIMENSIONS | Weight (kg) |
|---|---|---|---|---|---|---|
| | W | A | V | Inch | H1(mm) | |
| SQF 1-70 | 900 | 8.4 | 30-300 | $1\frac{1}{4}$ | 861 | 6 |
| SQF 3-105 | 2500 | 12.5 | 100-300 | | 942 | 7 |
| SQF 5-70 | 2500 | 12.5 | 100-300 | | 941 | 6 |
| SQF 7-55 | 2500 | 12.5 | 100-300 | | 860 | 6 |




***SQFlex – Accessory Range***

| | 300W | 1000W | 1400W | 2500W |
|---|---|---|---|---|
| Pump | • | • | • | • |
| IO 50 | • | • | • | • |
| IO 101 | • | • | • | |
| Generator | • | • | • | • |
| CU 200 | • | • | • | |
| Float Switch | • | • | • | • |
| Pressure Tank | • | • | • | • |
| Pressure Switch | • | • | • | • |
| Charge Controller | • | • | • | |
| Battery Backup | • | • | • | |
| CIU 903 | • | • | • | • |

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# GRUNDFOS SP SOLAR

SOLAR

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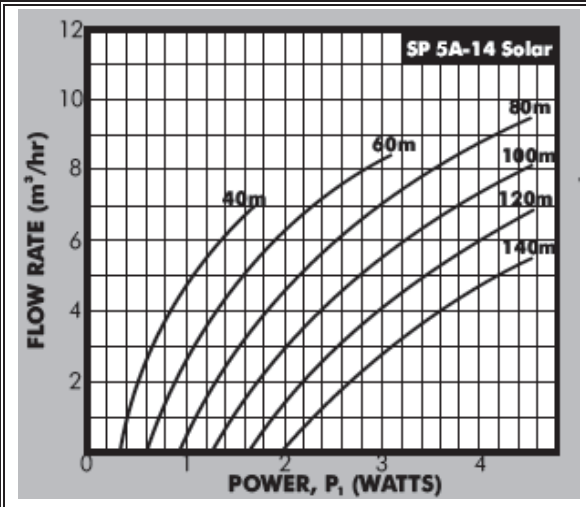
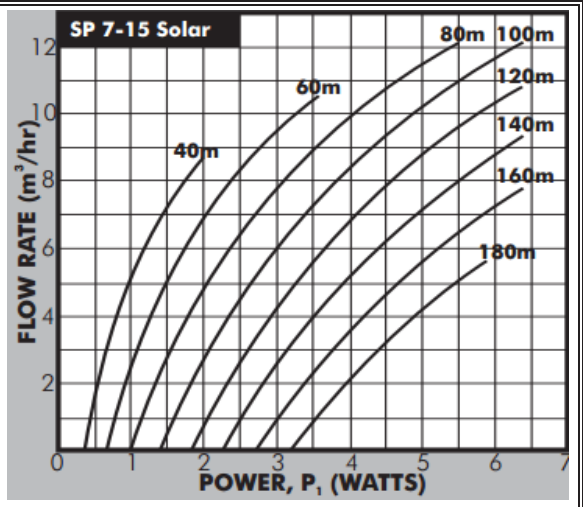
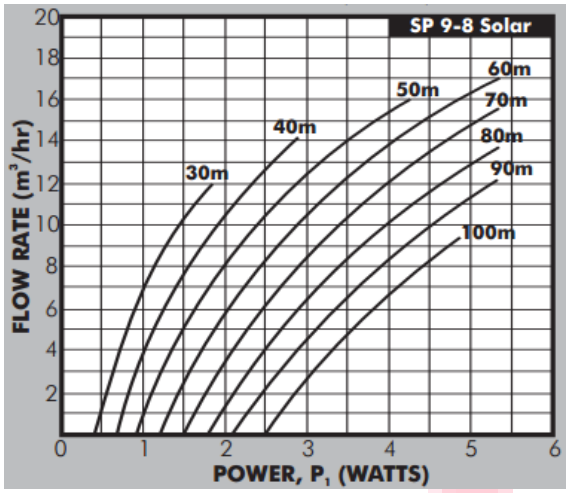
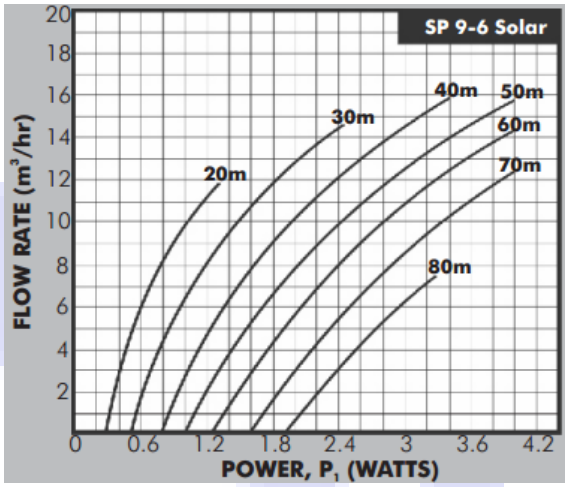
GRUNDFOS

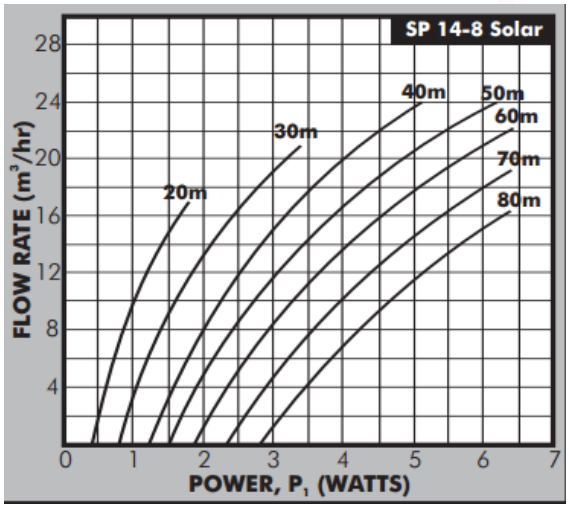
## *Solar submersible pumps*
## *SP Solar*

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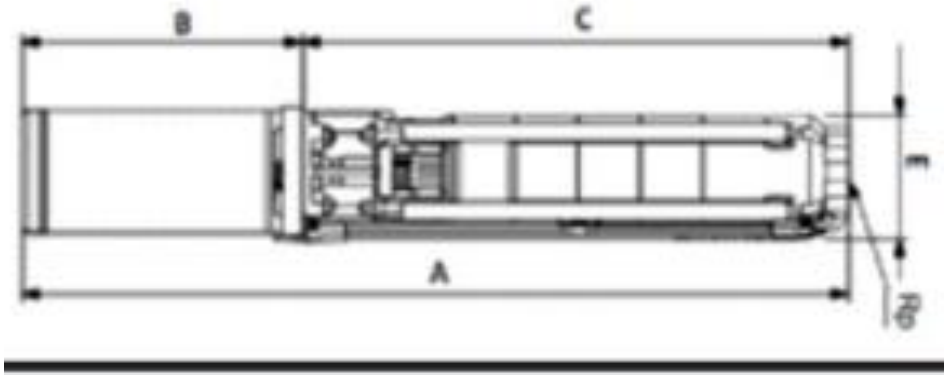
***PUMP:*** The Grundfos SP Solar pumps are submersible borehole pumps suitable for pumping clean water. They Can be installed vertically or horizontally. All steel components are made in stainless steel, EN 1.4301 (AISI 304), that ensures high corrosive resistance. The pump set is powered by Solar Pump Controller (SPC), an off-grid solar inverter customized to run SP with permanent magnet synchronous motors. With the built-in MPPT and protection algorithm, it delivers an efficient and reliable solar system solution.

***MOTOR:*** The Pumps are coupled with a MMS4P motor with a sand shield, water-lubricated journal bearings and a volume compensating diaphragm. The motor is a permanent magnet synchronous, rewindable type submersible motor offering good reliability and high efficiency. The motors can be powered by either DC or AC input within the range of 220-800V DC and 400V, 3 phase 50Hz AC.

***Pumped liquid**: Clean water* ***Protection**: IP 68* ***Max Liquid temperature**: +60$^0$C* ***Speed**: 4200 rpm*

## *Specifications*

| Model | Motor | | Current | Dimensions (mm) | | | | | Weight |
|---|---|---|---|---|---|---|---|---|---|
| | kW | HP | (A) | A | B | C | E | Rp | (kg) |
| **SP 5A-14** | 3.7 | 5 | 10.9 | 986 | 539 | 447 | 101 | 1½ | 26 |
| **SP 7-15** | 5.5 | 7.5 | 15.8 | 1593 | 605 | 988 | | | 39 |
| **SP 9-6** | 3.7 | 5 | 10.9 | 1077 | 539 | 538 | | 2 | 28 |
| **SP 9-8** | 5.5 | 7.5 | 15.8 | 1243 | 605 | 638 | | | 35 |
| **SP 14-8** | | | 16 | 1443 | 605 | 838 | | | 37 |



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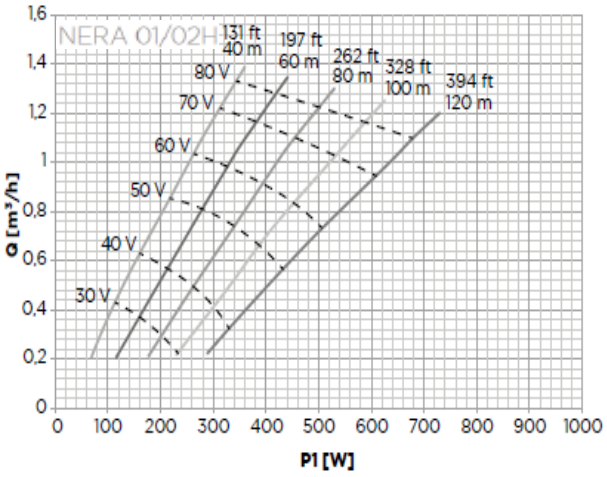
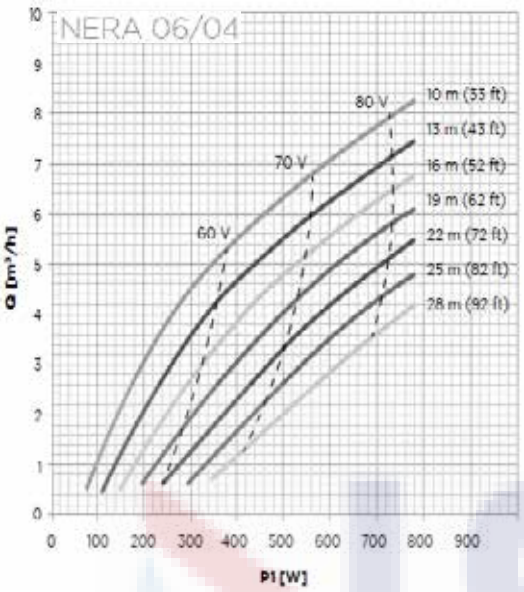
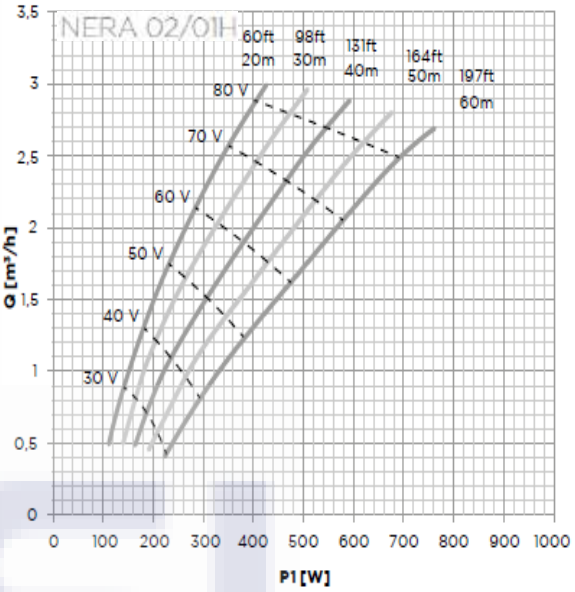
**These Include:- Solar Pumps, Inverters, etc**

## DC Pumps
## NERA






***PUMP:*** The NERA range of low flow submersible pumps is particularly suited for low yielding wells where water can be. pumped out continuously at low flows. The range consists of a helical rotor pump suited for low flow high head boreholes and a centrifugal pump suited for low head higher yielding boreholes.

***MOTOR:*** One size of the unique 800W Nastec high efficiency permanent magnet motor is specified with both pump types. The motor is powered by DC voltage within the range of 26-190V. The integrated inverter unit uses Maximum Power Point Tracking (MPPT) technology that continuously optimizes output frequency to maximize system efficiency and protects against over and under voltage, electrical overload and over temperature. Dry running protection is provided by an integrated water level sensor.

### *Specifications*

| Model | DC Voltage(V) | | Max DC current (A) | Max absorbed Power | Height (mm) | Delivery (") | Diameter (mm) | Weight (Kg) |
|---|---|---|---|---|---|---|---|---|
| NERA 01/02H | 26-190V | | 10 | 800 | 930 | 11/4 | 99 | 13 |
| NERA 02/01H | 26-190V | | 10 | 800 | 890 | 11/4 | 99 | 12 |
| NERA 06/04 | 26-190V | | 10 | 800 | 520 | 11/2 | 99 | 11 |

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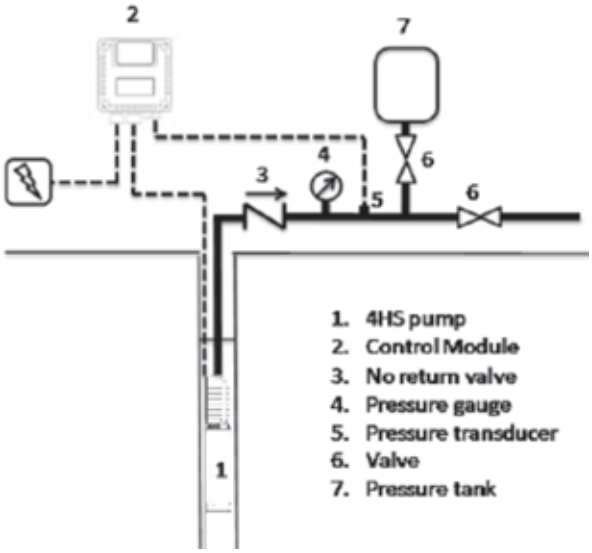
# 4HS– Variable Speed Borehole Pumps

Pump

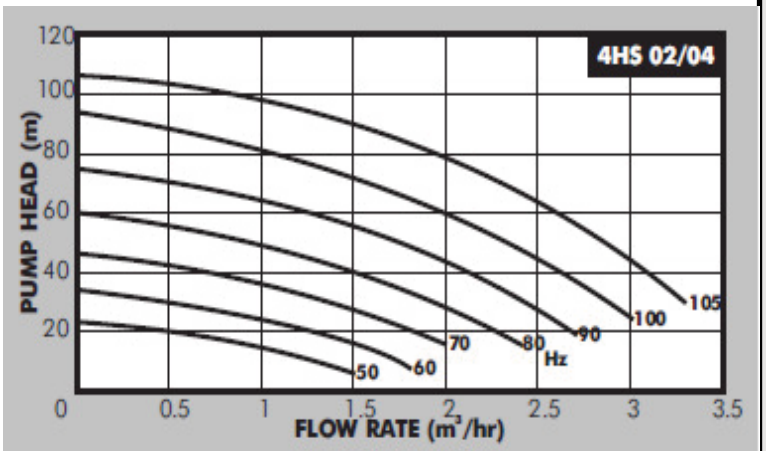
Motor

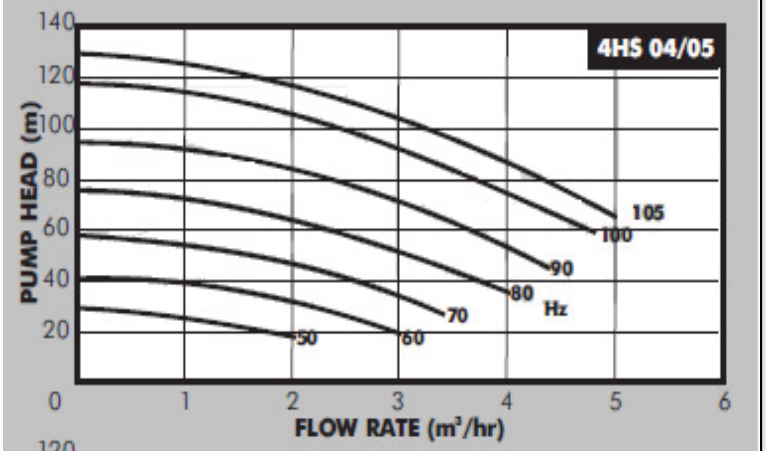
Inverter

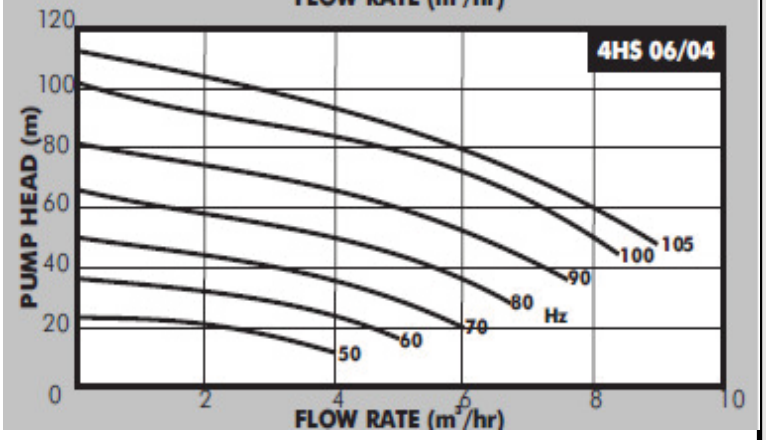
Controller




1. 4HS pump
2. Control Module
3. No return valve
4. Pressure gauge
5. Pressure transducer
6. Valve
7. Pressure tank



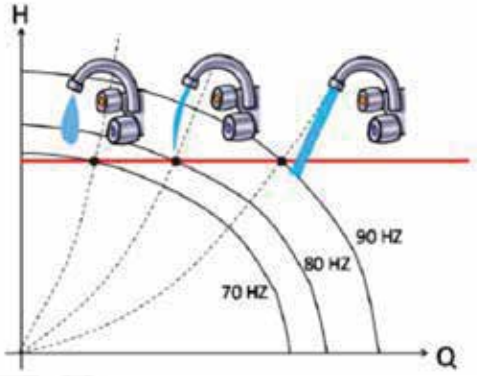




**PUMP :**The Nastec 4HS pumps is powered through an integrated variable speed drive unit to deliver constant pressure at the point of demand. 4HS pumps are entirely made of stainless steel AISI 304 to grant a long life of the components. Pump, motor and hydraulic components can be easily disassembled to have simple maintenance and replacement operations.

**MOTOR :** The 4HS range features an AC permanent magnet motor with a resin and encapsulated stator made of stainless steel AISI 304 and Water cooled rotor. The built-in electronics inside the motor avoids the use of shielded cables and output filters.

**CM Controller :** The surface mounted CM control module manages the pump operation by changing the pump speed to maintain the desired pressure in the system regardless of the water demand thus ensuring maximum comfort at the point of use. The controller also monitors the electrical, thermal and hydraulic parameters providing complete protection against under/ over-voltage, overload and dry-running.




**FEATURES & BENEFITS**

-Variable speed control ensures huge savings in energy consumption compared to conventional systems

-Constant pressure ensures comfortable operation of domestic outlets such as showers taps regardless of use.

-Integrated protection reduces cost of control panel (no additional components required)

**ACCESSORIES**

A complete range of accessories including drop cable, pipes and fittings are available for a complete installation. The pump is supplied as a complete package including:

- 4HS Pump with 2.5M tail cable
- CM control Panel
- Cable junction kit
- Pressure transducer 0-16 bar.

OPERATING CONDITIONS

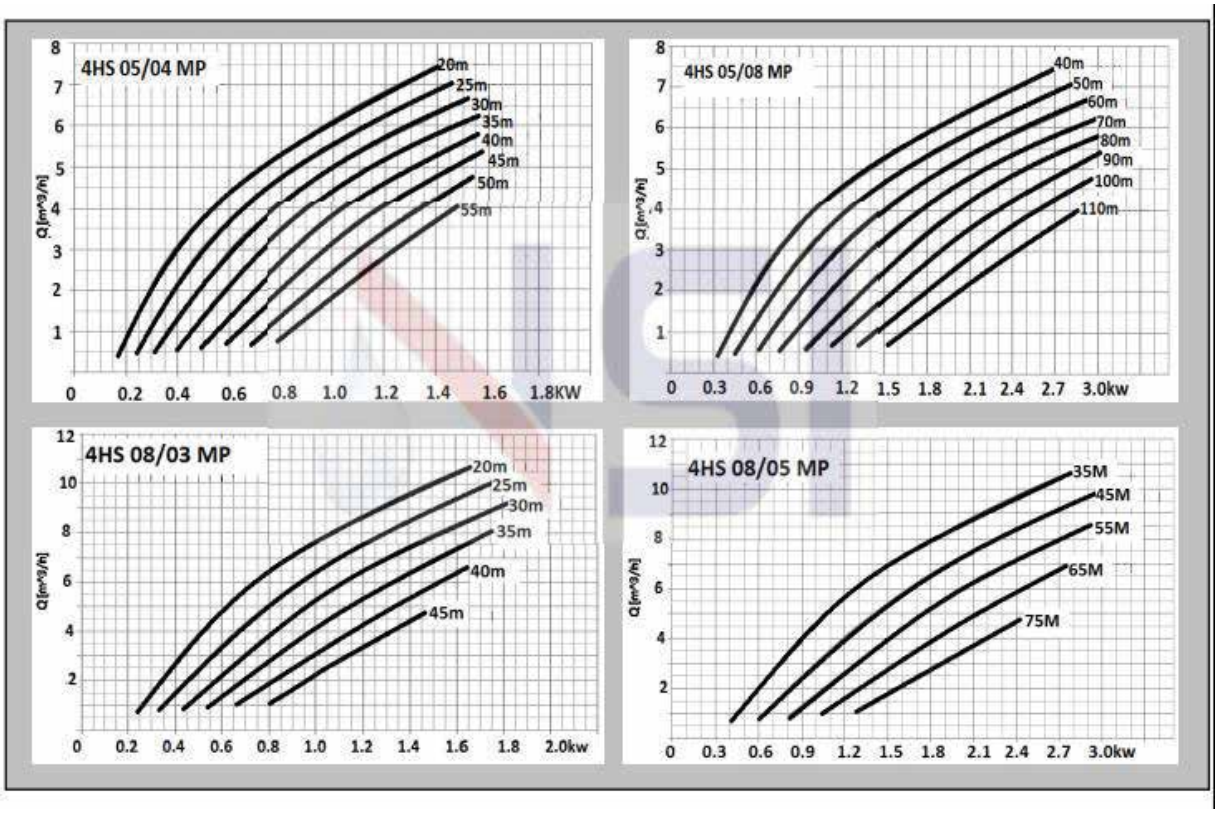
**Max operating pressure –**15 Bar **Max. Temperature** 35 C **Enclosure Class** :IP55

**Insulation class:** B **Max Speed** 6350 rpm

**PUMP DATA**

| ModeL | Voltage (V) | Power KW | Power HP | Current (A) | Length | Pump Outlet | Diameter mm | Weight Kg |
|---|---|---|---|---|---|---|---|---|
| 4HS 02/04 | 1X240 V | 1.1 | 1.5 | 7.1 | 936 | 1¼" | 101 | 19.5 |
| 4HS 04/05 | 1X240 V | 2.0 | 2.7 | 12 | 894 | 1¼" | 101 | 21.5 |
| 4HS 06/04 | 1X240 V | 2.2 | 3.0 | 14 | 981 | 1½" | 101 | 21.4 |

All dimensions are in mm




***PUMP:*** The Nastec 4HS Multipower pumps (4HS MP) are pumps powered by renewable energy sources, with built-in inverter. 4HS multipower pumps may be powered by AC or DC with a wide range of operating voltage (90 - 265 VAC / 90 - 340 VDC). This means that 4HS MP pumps can be connected to solar panels, batteries, wind turbine and diesel generator. 4HS pumps are entirely made of stainless steel AISI 304 to grant a long life of the components. Pump, motor and hydraulic components can be easily disassembled for maintenance and replacement operations. Protection against overvoltage, overload and dry running are integrated into the pump electronic circuit. Electronic protection against dry running avoids the use of probes.

***MOTOR:*** The 4HS range features an AC permanent magnet motor with a resin encapsulated stator made of stainless steel AISI 304 and a water-cooled rotor. The built-in electronics inside the motor avoids the use of shielded cables and output filters and it is the ideal solution for any application in remote locations.
4HS multipower pumps do not need of any external electronic component; it is just enough to connect the pump cable to the power source and start to ex-tract water. The built-in electronic are directly cooled by the water flow; the operating temperature of the electronic components is so low as to ensure considerably longer life when compared to a surface mounted inverter affected by high temperature, humidity, dust and solar radiation.In applications powered by solar panels, the MPPT (Maximum Power Point Tracking) function maximizes the input power for various conditions of radiation and temperature. When radiation increases, pump increases the rotation speed as well as the water flow.

## *Specifications*

| Model | AC Voltage (V) | DC Voltage(V) | Max AC current (A) | Max DC current (A) | Max absorbed Power | Height (mm) | Delivery DN | Diameter (mm) | Weight (Kg) |
|---|---|---|---|---|---|---|---|---|---|
| 4HS 05/04 MP | 90-265 | 90-400 | 16 (100 VAC) | 16 (100 VDC) | 1600 | 879 | 11/2 | 101 | 19.5 |
| 4HS 05/08 MP | 90-265 | 90-400 | 16(187 VAC) | 16(187 VDC) | 3000 | 1013 | 11/2 | 101 | 22 |
| 4HS 08/03 MP | 90-265 | 90-400 | 16(113 VAC) | 16(113 VDC) | 1800 | 858 | 11/2 | 101 | 19.4 |
| 4HS 08/05 MP | 90-265 | 90-400 | 16(187 VAC) | 16(187 VDC) | 3000 | 950 | 11/2 | 101 | 21 |

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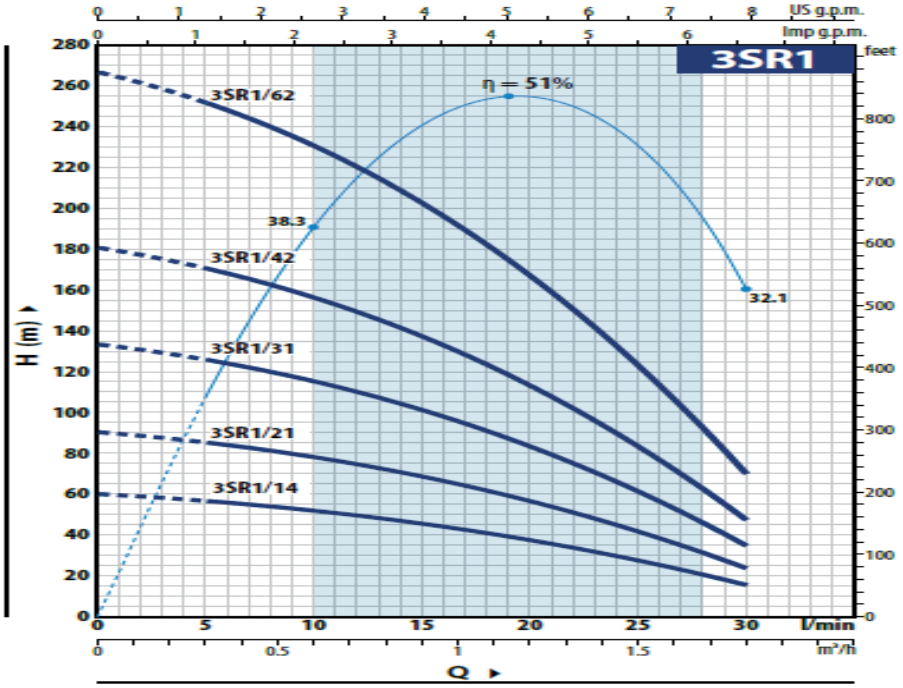



***PUMP:*** The Pedrollo 3" submersible pumps are suitable for pumping clean water for many applications such as domestic supply, irrigation and water systems for small communities. The hydraulic components, coupled to a high-performance electric motor, make the 3SR pump extremely efficient in 3" category. The construction with floating impellers allows the pumping of water with sand content of up to 150 g/m$^3$. The impellers are made from Delrin. The Pump shaft, Diffuser, Diffuser plate, non-return valve, motor bracket, drive coupling, filter and cable cover are all made from Stainless steel AISI 304. The delivery body is made from precision cast stainless steel AISI 304 complete with threaded delivery port in compliance with ISO 228/1. The pump comes with a 1.5m long power cable.

***MOTOR:*** The Pumps are coupled with high efficiency 2-pole oil filled rewindable motors (non-toxic oil for use with food) leading to reduced electricity consumption Motor and Economic savings on the use of water. With a diameter of only 3 inches, the costs of drilling a new well and the installation are greatly reduced. The shaft and jacket are made from Stainless steel AISI 304.

***Insulation Class****: F*

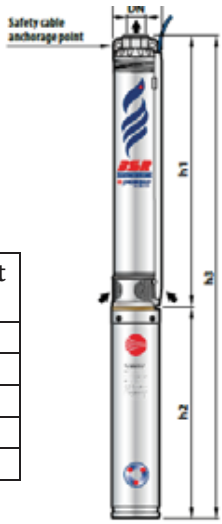
***Protection****: IP 68*

***Speed:*** *2900 rpm*

***Pumped liquid****: Clean water, max* sand content of up to 150 g/m$^3$

***Max Liquid temperature:*** *+35$^0$C*

***Max Immersion depth****: 60 m*




## *Specifications*

| MODEL | POWER | CURRENT (A) | | CAPACITOR | OUTLET | DIMENSIONS (mm) | | | | Weight |
|---|---|---|---|---|---|---|---|---|---|---|
| | KW | 1x240V | 3x415V | (µF) | (") | ø | h1 | h2 | h3 | (kg) |
| 3SR1/14 | 0.25 | 3.2 | 1.4 | 12.5 | 1 | 76 | 415 | 378 | 793 | 9.1 |
| 3SR1/21 | 0.37 | 3.4 | 1.5 | 12.5 | | | 547 | 378 | 925 | 9.6 |
| 3SR1/31 | 0.55 | 4.5 | 1.9 | 16 | | | 736 | 398 | 1134 | 11.0 |
| 3SR1/42 | 0.75 | 6.0 | 2.6 | 20 | | | 973 | 438 | 1411 | 13.1 |
| 3SR1/62 | 1.10 | 8.0 | 3.5 | 30 | | | 1380 | 478 | 1858 | 16.0 |

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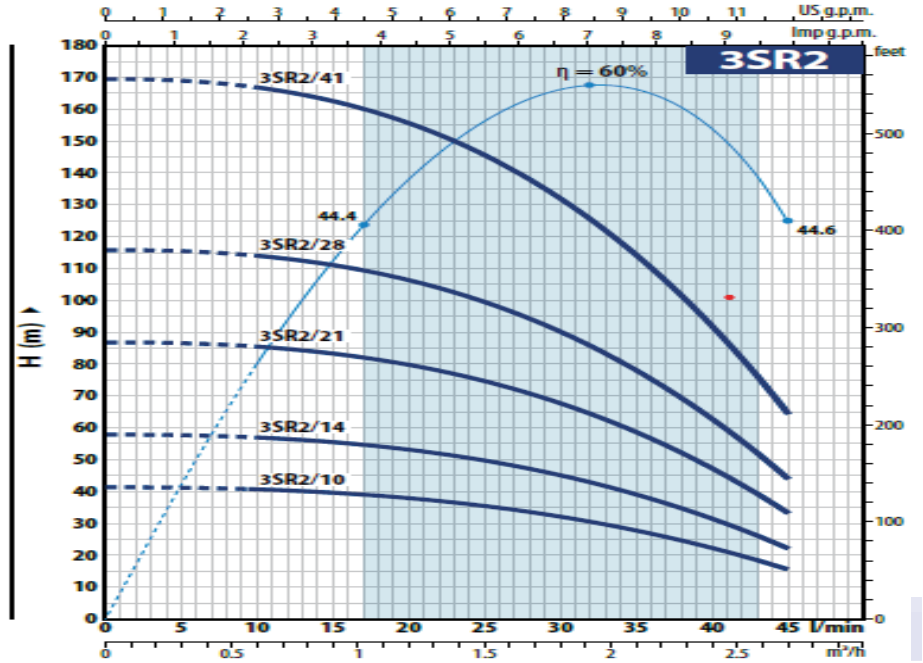



***PUMP:*** The Pedrollo 3" submersible pumps are suitable for pumping clean water for many applications such as domestic supply, irrigation and water systems for small communities. The hydraulic components, coupled to a high-performance electric motor, make the 3SR pump extremely efficient in 3" category. The construction with floating impellers allows the pumping of water with sand content of up to 150 g/m$^3$. The impellers are made from Delrin. The Pump shaft, Diffuser, Diffuser plate, non-return valve, motor bracket, drive coupling, filter and cable cover are all made from Stainless steel AISI 304. The delivery body is made from precision cast stainless steel AISI 304 complete with threaded delivery port in compliance with ISO 228/1. The pump comes with a 1.5m long power cable.

***MOTOR:*** The Pumps are coupled with high efficiency 2-pole oil filled rewindable motors (non-toxic oil for use with food) leading to reduced electricity consumption Motor and Economic savings on the use of water. With a diameter of only 3 inches, the costs of drilling a new well and the installation are greatly reduced. The shaft and jacket are made from Stainless steel.

***Insulation Class****: F*

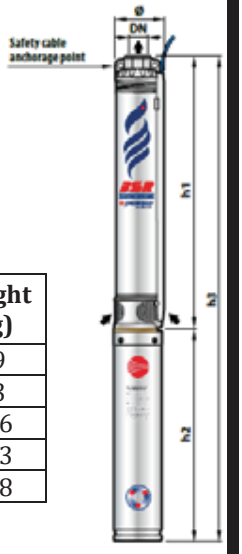
***Protection****: IP 68*

***Speed:*** *2900 rpm*

***Pumped liquid****: Clean water, max* sand content of up to 150 g/m$^3$

***Max Liquid temperature:*** *+35$^0$C*

***Max Immersion depth****: 60 m*




## *Specifications*

| MODEL | POWER | CURRENT (A) | | CAPACITOR | OUTLET | DIMENSIONS (mm) | | | | Weight |
|---|---|---|---|---|---|---|---|---|---|---|
| | KW | 1x240V | 3x415V | (µF) | (") | ø | h1 | h2 | h3 | (kg) |
| 3SR 2/10 | 0.25 | 3.2 | 1.4 | 12.5 | 1 | 76 | 376 | 378 | 754 | 8.9 |
| 3SR 2/14 | 0.37 | 3.4 | 1.5 | 12.5 | | | 466 | 378 | 844 | 9.3 |
| 3SR 2/21 | 0.55 | 4.5 | 1.9 | 16 | | | 624 | 398 | 1022 | 10.6 |
| 3SR 2/28 | 0.75 | 6.0 | 2.6 | 20 | | | 781 | 438 | 1219 | 12.3 |
| 3SR 2/41 | 1.10 | 8.0 | 3.5 | 30 | | | 1104 | 478 | 1582 | 14.8 |

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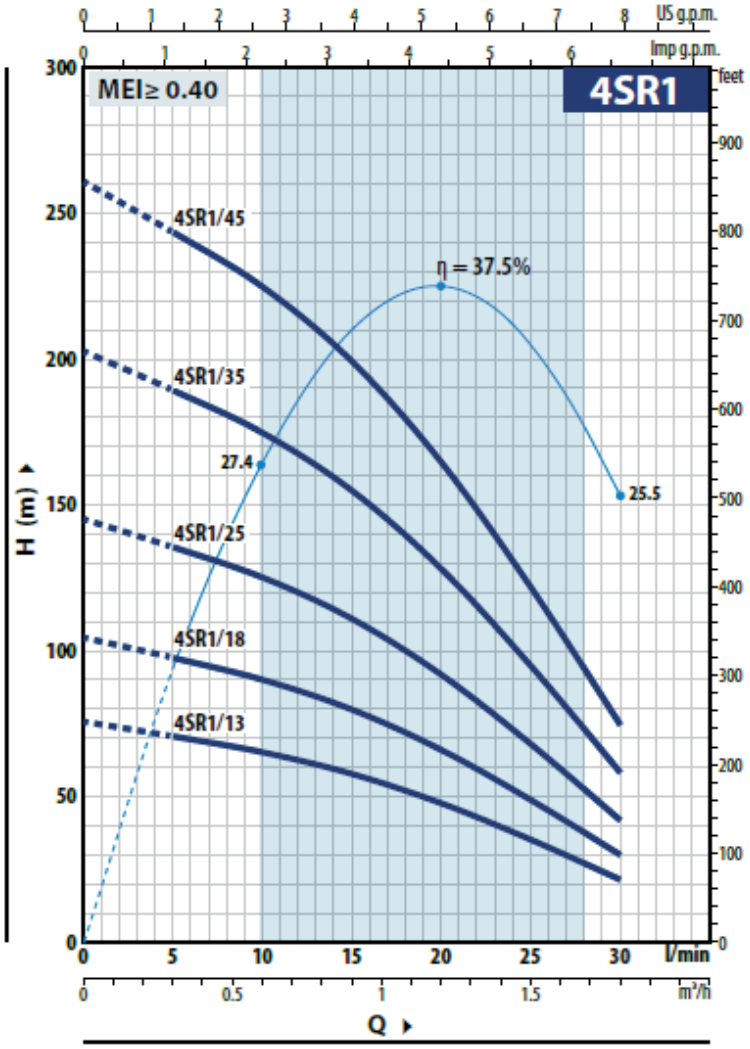



***PUMP:*** The Pedrollo 4" submersible pumps are suitable for use with clean water with a sand content of no more than 150 g/m$^3$. As a result of their high efficiency and reliability, they are suitable for use in domestic, civil and industrial applications such as for the distribution of water in combination with pressure sets, for irrigation, for washing plants and for pressure boosting in fire-fighting sets, etc. The impellers are made from Lexan. The Pump shaft, Diffuser, Diffuser plate, non-return valve, motor bracket, drive coupling, filter and cable cover are all made from Stainless steel AISI 304. The delivery body is made from precision cast stainless steel AISI 304 complete with threaded delivery port in compliance with ISO 228/1. The pump comes with a 1.5m long power cable.

***MOTOR:*** The Pumps are coupled with high efficiency 2-pole oil filled rewindable motors (non-toxic oil for use with food) leading to reduced electricity consumption Motor and Economic savings on the use of water. The shaft and jacket are made from Stainless steel AISI 304.

***Insulation Class****: F*

***Pumped liquid****: Clean water, max* sand content of up to 150 g/m$^3$ ***Protection****: IP 68* ***Speed:*** *2900 rpm*

***Max Liquid temperature:*** *+35$^0$C*

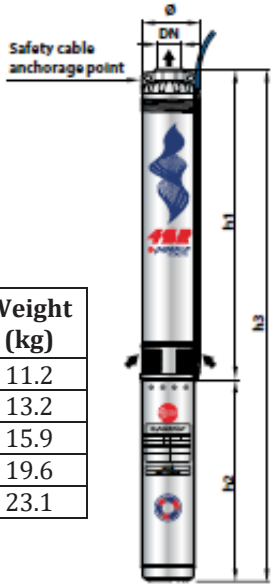
***Max Immersion depth****: 200 m with 4PD Motor, 100m with 4PS Motor*

Domestic use

Civil use

Agricultural use

Clean water
(Maximum sand content 150 g/m$^3$)




## *Specifications*

| MODEL | POWER | CURRENT (A) | | OUTLET | DIMENSIONS (mm) | | | | Weight |
|---|---|---|---|---|---|---|---|---|---|
| | KW | 1x240V | 3x415V | (") | ø | h1 | h2 | h3 | (kg) |
| 4SR1/13 | 0.37 | 3.6 | 1.8 | $1\frac{1}{4}$ | 98 | 400 | 311 | 711 | 11.2 |
| 4SR1/18 | 0.55 | 4.7 | 2.0 | | | 517 | 331 | 848 | 13.2 |
| 4SR1/25 | 0.75 | 5.9 | 2.5 | | | 646 | 356 | 1002 | 15.9 |
| 4SR1/35 | 1.10 | 8.3 | 3.4 | | | 856 | 396 | 1252 | 19.6 |
| 4SR1/45 | 1.50 | 10.7 | 4.8 | | | 1065 | 437 | 1502 | 23.1 |

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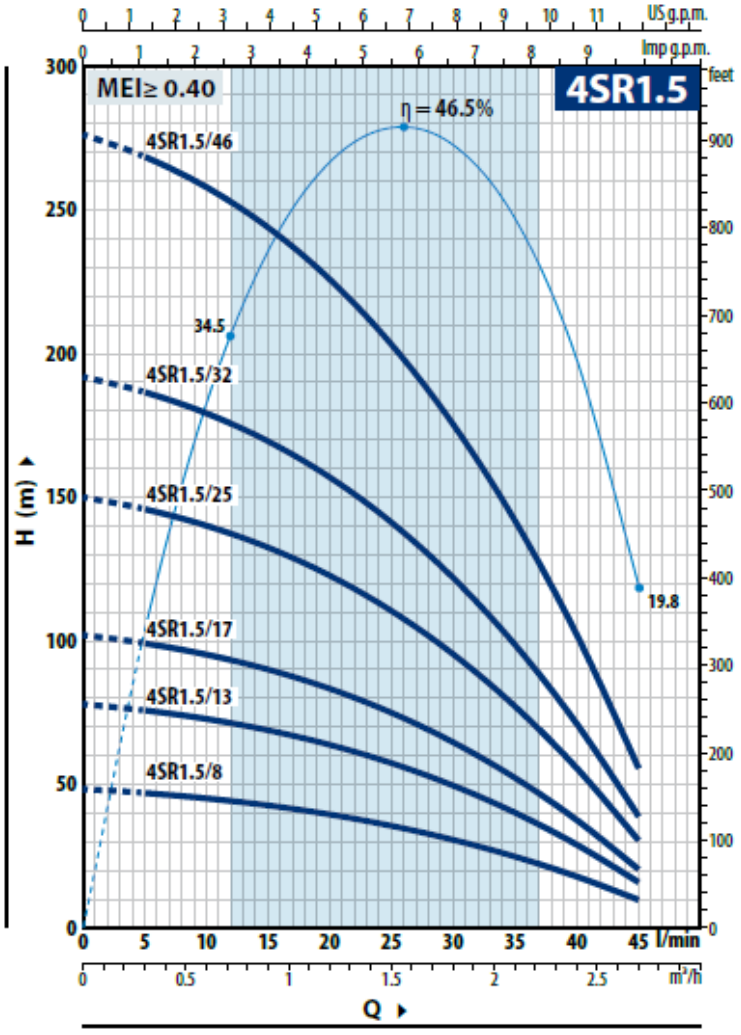



***PUMP:*** The Pedrollo 4" submersible pumps are suitable for use with clean water with a sand content of no more than 150 g/m$^3$. As a result of their high efficiency and reliability, they are suitable for use in domestic, civil and industrial applications such as for the distribution of water in combination with pressure sets, for irrigation, for washing plants and for pressure boosting in fire-fighting sets, etc. The impellers are made from Lexan. The Pump shaft, Diffuser, Diffuser plate, non-return valve, motor bracket, drive coupling, filter and cable cover are all made from Stainless steel AISI 304. The delivery body is made from precision cast stainless steel AISI 304 complete with threaded delivery port in compliance with ISO 228/1. The pump comes with a 1.5m long power cable.

***MOTOR:*** The Pumps are coupled with high efficiency 2-pole oil filled rewindable motors (non-toxic oil for use with food) leading to reduced electricity consumption Motor and Economic savings on the use of water. The shaft and jacket are made from Stainless steel AISI 304.

***Insulation Class****: F*

***Pumped liquid****: Clean water, max* sand content of up to 150 g/m$^3$ ***Protection****: IP 68* ***Speed:*** *2900 rpm*

***Max Liquid temperature:*** *+35$^0$C*

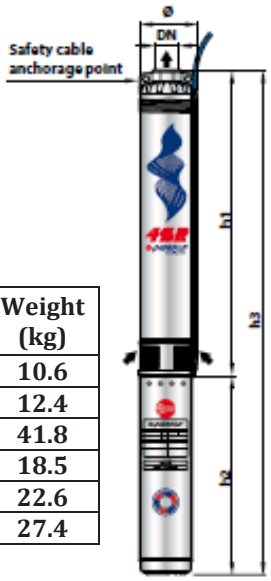
***Max Immersion depth****: 200 m with 4PD Motor, 100m with 4PS Motor*

Domestic use

Civil use

Agricultural use

Clean water
(Maximum
sand content 150 g/m$^3$)




## *Specifications*

| MODEL | POWER | CURRENT (A) | | OUTLET | DIMENSIONS (mm) | | | | Weight |
|---|---|---|---|---|---|---|---|---|---|
| | KW | 1x240V | 3x415V | (") | ø | h1 | h2 | h3 | (kg) |
| 4SR1.5/8 | 0.37 | 3.6 | 1.8 | $1\frac{1}{4}$ | 98 | 308 | 237 | 545 | 10.6 |
| 4SR1.5/13 | 0.55 | 4.7 | 2.0 | | | 400 | 257 | 657 | 12.4 |
| 4SR1.5/17 | 0.75 | 5.9 | 2.5 | | | 499 | 272 | 771 | 41.8 |
| 4SR1.5/25 | 1.10 | 8.3 | 3.4 | | | 646 | 312 | 958 | 18.5 |
| 4SR1.5/32 | 1.50 | 10.7 | 4.8 | | | 800 | 352 | 1152 | 22.6 |
| 4SR1.5/46 | 2.20 | 15.2 | 6.1 | | | 1134 | 402 | 1536 | 27.4 |

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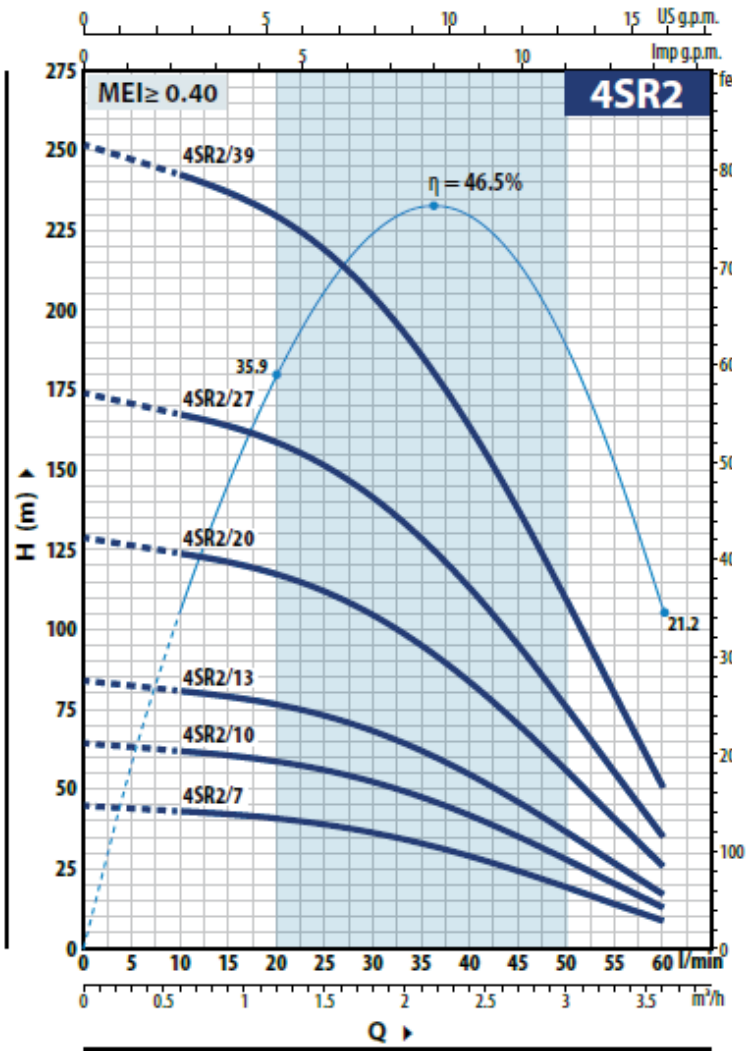



***PUMP:*** The Pedrollo 4" submersible pumps are suitable for use with clean water with a sand content of no more than 150 g/m$^3$. As a result of their high efficiency and reliability, they are suitable for use in domestic, civil and industrial applications such as for the distribution of water in combination with pressure sets, for irrigation, for washing plants and for pressure boosting in fire-fighting sets, etc. The impellers are made from Lexan. The Pump shaft, Diffuser, Diffuser plate, non-return valve, motor bracket, drive coupling, filter and cable cover are all made from Stainless steel AISI 304. The delivery body is made from precision cast stainless steel AISI 304 complete with threaded delivery port in compliance with ISO 228/1. The pump comes with a 1.5m long power cable.

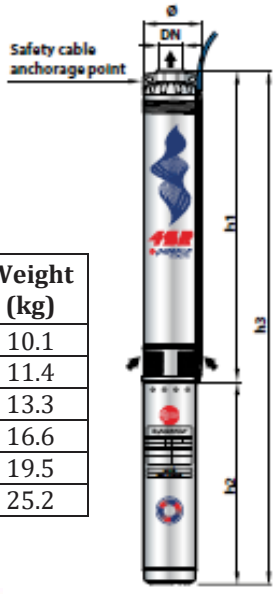
***MOTOR:*** The Pumps are coupled with high efficiency 2-pole oil filled rewindable motors (non-toxic oil for use with food) leading to reduced electricity consumption Motor and Economic savings on the use of water. The shaft and jacket are made from Stainless steel AISI 304.

***Insulation Class****: F*

***Pumped liquid****: Clean water, max* sand content of up to 150 g/m$^3$ ***Protection****: IP 68* ***Speed:*** *2900 rpm*

***Max Liquid temperature:*** *+35$^0$C*

***Max Immersion depth****: 200 m with 4PD Motor, 100m with 4PS Motor*


## *Specifications*

| MODEL | POWER | CURRENT (A) | | OUTLET | DIMENSIONS (mm) | | | | Weight |
|---|---|---|---|---|---|---|---|---|---|
| | KW | 1x240V | 3x415V | (") | ø | h1 | h2 | h3 | (kg) |
| 4SR2/7 | 0.37 | 3.6 | 1.8 | $1\frac{1}{4}$ | 98 | 290 | 311 | 601 | 10.1 |
| 4SR2/10 | 0.55 | 4.7 | 2.0 | | | 345 | 331 | 676 | 11.4 |
| 4SR2/13 | 0.75 | 5.9 | 2.5 | | | 400 | 356 | 756 | 13.3 |
| 4SR2/20 | 1.10 | 8.3 | 3.4 | | | 554 | 396 | 950 | 16.6 |
| 4SR2/27 | 1.50 | 10.7 | 4.8 | | | 683 | 437 | 1120 | 19.5 |
| 4SR2/39 | 2.20 | 15.2 | 6.1 | | | 929 | 492 | 1421 | 25.2 |

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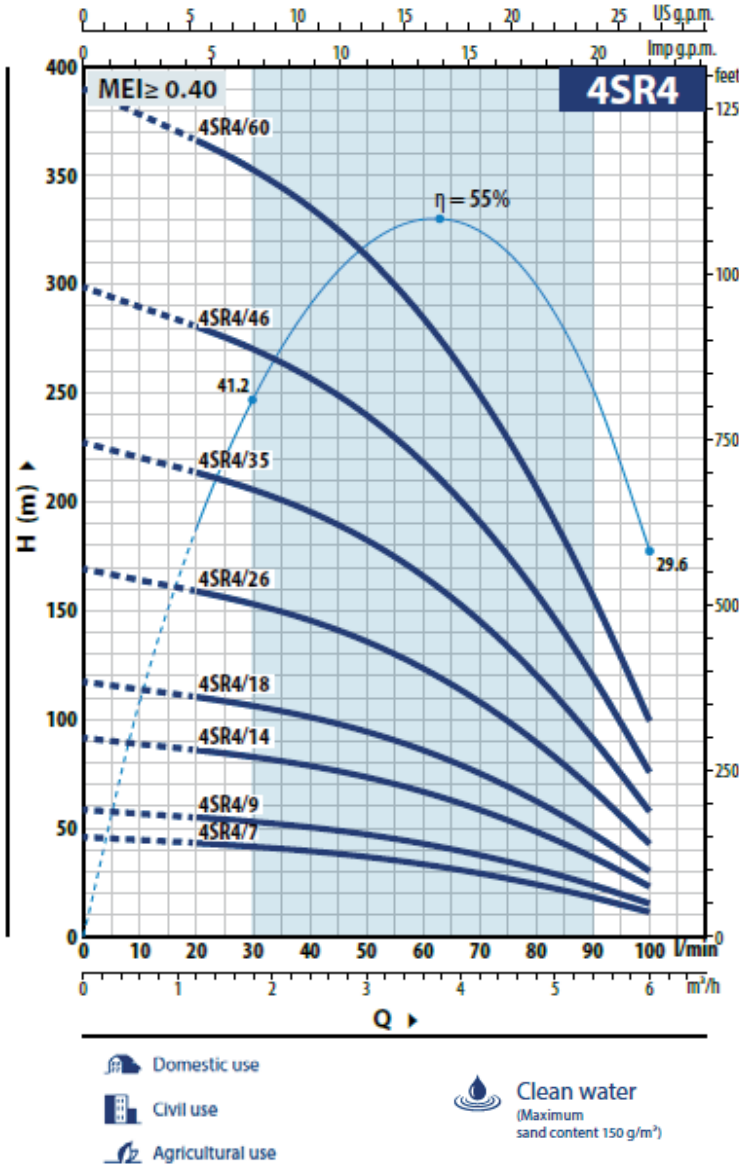



***PUMP:*** The Pedrollo 4" submersible pumps are suitable for use with clean water with a sand content of no more than 150 g/m$^3$. As a result of their high efficiency and reliability, they are suitable for use in domestic, civil and industrial applications such as for the distribution of water in combination with pressure sets, for irrigation, for washing plants and for pressure boosting in fire-fighting sets, etc. The impellers are made from Lexan. The Pump shaft, Diffuser, Diffuser plate, non-return valve, motor bracket, drive coupling, filter and cable cover are all made from Stainless steel AISI 304. The delivery body is made from precision cast stainless steel AISI 304 complete with threaded delivery port in compliance with ISO 228/1. The pump comes with a 1.5m long power cable.

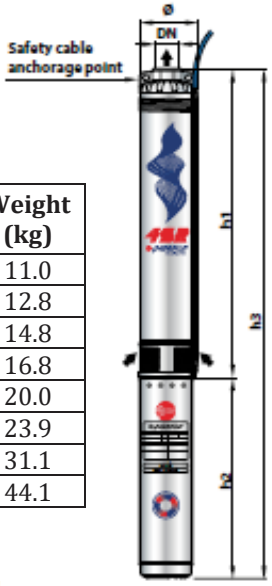
***MOTOR:*** The Pumps are coupled with high efficiency 2-pole oil filled rewindable motors (non-toxic oil for use with food) leading to reduced electricity consumption Motor and Economic savings on the use of water. The shaft and jacket are made from Stainless steel AISI 304.

***Insulation Class****: F*

***Pumped liquid****: Clean water, max* sand content of up to 150 g/m$^3$ ***Protection****: IP 68* ***Speed:*** *2900 rpm*

***Max Liquid temperature:*** *+35$^0$C*

***Max Immersion depth****: 200 m with 4PD Motor, 100m with 4PS Motor*




## *Specifications*

| MODEL | POWER | CURRENT (A) | | OUTLET | DIMENSIONS (mm) | | | | Weight |
|---|---|---|---|---|---|---|---|---|---|
| | KW | 1x240V | 3x415V | (") | ø | h1 | h2 | h3 | (kg) |
| 4SR4/7 | 0.55 | 4.7 | 2.0 | $1\frac{1}{4}$ | 98 | 314 | 331 | 645 | 11.0 |
| 4SR4/9 | 0.75 | 5.9 | 2.5 | | | 358 | 356 | 714 | 12.8 |
| 4SR4/14 | 1.10 | 8.3 | 3.4 | | | 468 | 356 | 839 | 14.8 |
| 4SR4/18 | 1.50 | 10.7 | 4.8 | | | 580 | 371 | 976 | 16.8 |
| 4SR4/26 | 2.20 | 15.2 | 6.1 | | | 756 | 396 | 1193 | 20.0 |
| 4SR4/35 | 3.00 | | 7.1 | | | 978 | 437 | 1428 | 23.9 |
| 4SR4/46 | 4.00 | | 9.2 | | | 1295 | 450 | 1800 | 31.1 |
| 4SR4/60 | 5.50 | | 12.3 | | | 1652 | 505 | 2242 | 44.1 |

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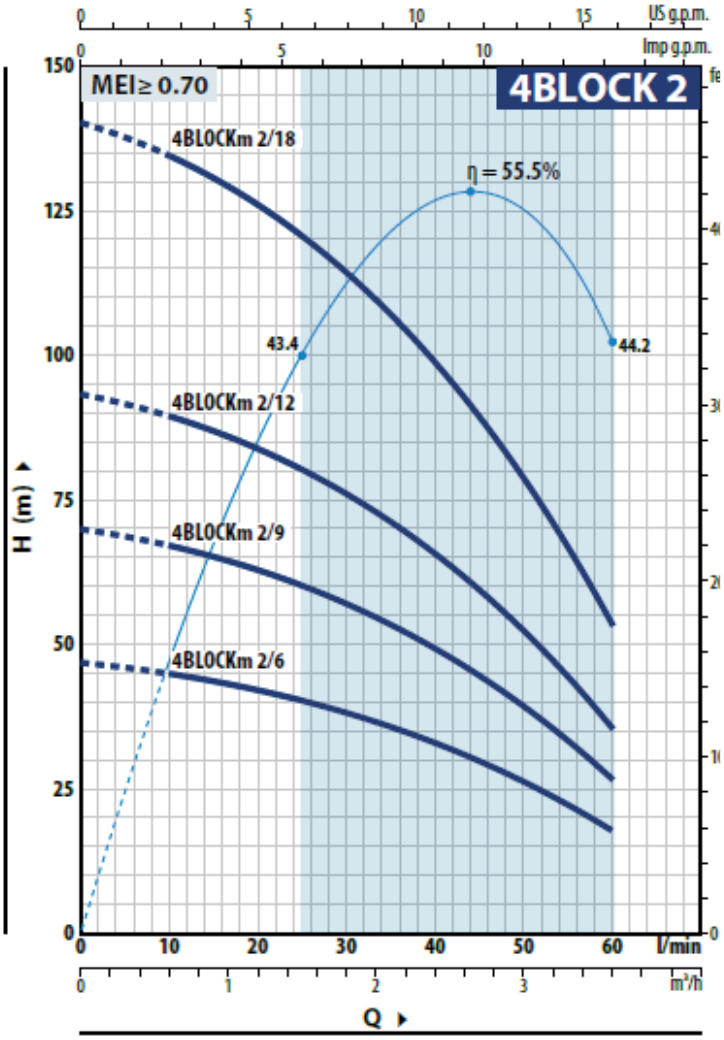


***PUMP:*** The Pedrollo monoblock submersible pumps are designed as a more economic and compact alternative to traditional borehole pumps without loss of performance and reliability. Supplied with integral capacitor and 20 m power cable for ease of installation and suitable for use with clean water with a sand content of no more than 200 g/m$^3$. As a result of their high efficiency and reliability, they are suitable for use in small-scale domestic, civil and industrial applications such as for the distribution of water in combination with pressure sets, for irrigation, for washing plants and for pressure boosting in fire-fighting sets, etc. The impellers are made from Delrin. The Pump shaft, Diffuser, Diffuser plate, non-return valve, motor bracket, drive coupling, filter and cable cover are all made from Stainless steel AISI 304. The delivery body is made from precision cast stainless steel AISI 304 complete with threaded delivery port in compliance with ISO 228/1.

***MOTOR:*** The Pumps are coupled with high efficiency 2-pole oil filled rewindable motors (non-toxic oil for use with food) leading to reduced electricity consumption Motor and Economic savings on the use of water. The shaft and jacket are made from Stainless steel AISI 304.

Domestic use
Civil use
Agricultural use

Clean water
(Maximum sand content 200 g/m³)


***Insulation Class**: F* ***Pumped liquid**: Clean water, max* sand content of up to 200 g/m$^3$

***Protection**: IP 68* ***Speed:** 2900 rpm* ***Max Liquid temperature:** +35$^0$C*

***Max Immersion depth**: 60 m with 4PD*

## *Specifications*

| MODEL | POWER | CURRENT (A) | OUTLET (") | DIMENSIONS (mm) | | Weight (kg) |
|---|---|---|---|---|---|---|
| | KW | 1x240V | | Ø | H | |
| 4BLOCK2/6 | 0.37 | 3.2 | $1\frac{1}{4}$ | 100 | 597 | 11.2 |
| 4BLOCK2/9 | 0.55 | 4.0 | | | 657 | 12.4 |
| 4BLOCK2/12 | 0.75 | 6.0 | | | 737 | 14.3 |
| 4BLOCK2/18 | 1.10 | 8.0 | | | 907 | 16.2 |

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# CONTROL UNITS AND INVERTERS

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NSI. SOLAR


# TGP SOLAR INVERTER

## THE IDEAL COMPLEMENT FOR YOUR PUMP

DATA SHEET

## DESCRIPTION

The DC/AC Hybird solar inverter (TGP) is an off-grid solar inverter which is AC and DC compatible.

TGP can be connected to the grid or a generator as complementary or back-up power during solar panel power weakness.

It is designed for continuous as well as intermittent operation. The system is suitable for various water supply systems including irrigation.

TGP can be used in both new and existing systems as long as the motor specs are compatible and is suitable for use with a variable frequency drive.

## ADVANTAGES

MPPT software ☒ the inverter will continuous optimize the output frequency based on the available input power to constantly deliver maximum system efciency

Automatic recovery from operation signal stop
Multi LED display for simple operation
Adjustable operation parameters
Display historical operation data

Dry-running protection
Over/under-voltage protection
Over current and overload protection
Over-temperature protection
Phase-lack protection
Fault detection with error code display
Compatible with DC or AC 3 phase motor
Self cleaning function
Anti stealing function
IOT remote monitoring function

## TECHNICAL DATA

| MODEL | TGP-1-1.5 | TGP-2-2.2 | TGP-3-4 | TGP-3-5.5 | TGP-3-7.5 |
|---|---|---|---|---|---|
| Power | 1500 | 2200 | 4000 | 5500 | 7500 |
| DC working voltage | 90 - 430V | 90 - 430V | 300 - 750V | 300 - 750V | 300 - 750V |
| VOC | <450V | <450V | <750V | <750V | <750V |
| AC working voltage | 90 - 300V Single phase input | | | 300 - 530V Three phase input | |
| Max input current | 15A | 15A | 15A | 15A | 20A |
| Frequency/Hz | 50/60HZ | 50/60HZ | 50/60HZ | 50/60HZ | 50/60HZ |
| Working speed | 500-400RPM | 500-400RPM | 500-400RPM | 500-400RPM | 500-400RPM |
| Enclosure class | IP54 | IP54 | IP54 | IP54 | IP54 |
| Ambient Temperature | | | 10 to 50 °C- | | |
| Efficiency | Max 98% | Max 98% | Max 98% | Max 98% | Max 98% |

# CUE– VARIABLE SPEED CONTROLLER

Grundfos CUE Variable speed pump controllers offer many benefits including reduced energy consumption as pump output is always matched to suit demand. The controllers can be applied to all pump types with motor size from 0.55 to 250kW. As they also offer motor protection for connected pump, no additional control panel is required– only a pressure sensor is needed to control the pump. Selection of CUE model is based on maximum motor current.

**Benefits**

- Soft start and stop that prevents water hammer and system pressure surges
- Reduced pump loads and extended pump and motor life
- Motor protection and reduced noise
- Varying motor speed to match demand—resulting in up to 40% energy savings.

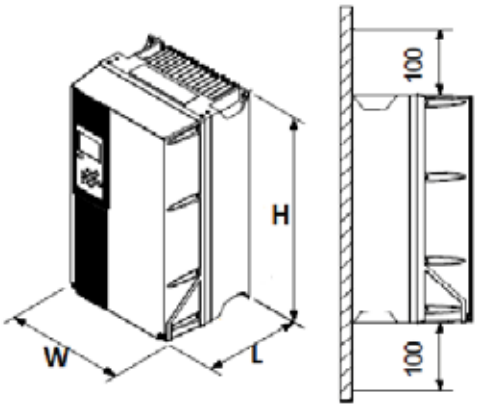
**Control Options**

The units can be set up to regulate various operating modes including constant pressure (add pressure sensor), constant differential pressure, proportional differential pressure, constant temperature (add temperature sensor) constant flow and constant level. These control options make the CUE particularly suited for boosting in industry, buildings and irrigation applications.

Other features include a start up guide for plug and pump installation, option of IP20 and IP 55 enclosure class. Selection of Enclosure Class: IP20 or IP 55 Voltage: 3 x 380/415V

| NSI Model | Max. Motor Current | Power | Dimensions | | | Weight |
|---|---|---|---|---|---|---|
| CUE | (A) | KW | L | W | H | Kg |
| CUE1.5 | 4.1 | 1.5 | 205 | 90 | 268 | 4.9 |
| CUE2.2 | 5.6 | 2.2 | 205 | 90 | 268 | 4.9 |
| CUE3.0 | 7.3 | 3 | 205 | 90 | 268 | 4.9 |
| CUE4.0 | 8.8 | 4 | 205 | 90 | 268 | 4.9 |
| CUE5.5 | 11.9 | 5.5 | 205 | 130 | 268 | 6.6 |
| CUE7.5 | 15.4 | 7.5 | 205 | 130 | 268 | 6.6 |
| CUE11 | 23 | 11 | 232 | 165 | 399 | 12 |
| CUE15 | 31 | 15 | 232 | 165 | 399 | 12 |
| CUE18.5 | 38 | 18.5 | 232 | 165 | 399 | 12 |

All dimensions are in mm




Note: Larger models of CUE upto 250 KW are available on demand. The Large models also have to be fitted with an output filter for additional motor protection

# Control MP 204 Motor Protection

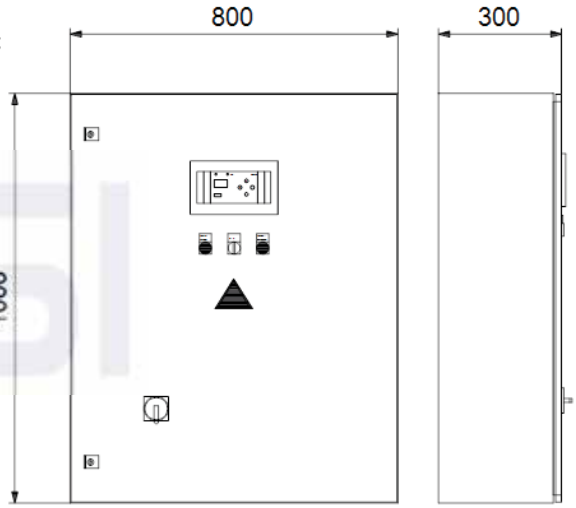
The Control MP204 control cabinet is used for starting / stopping the pump according to an input signal. The input signal comes either from a superior system, such as a PLC or from a simple input signal, such as a switch. The built-in MP204 motor protector unit will ensure long operating lifetime of the pump. The control MP204 cabinet is also available with an IO112 I/O module that can be set up to start / stop the pump in a filling or emptying application using an analog sensor signal.

Additionally, the Control MP204 control cabinet can be fitted with a CIU (Communication Interface Unit) to transmit the data collected.
Control MP204 control cabinets are available with the following starting methods;
DOL (Direct on-line)
SD (Star delta)
SS (Soft starter)

The Control MP204 cabinet without IO112 can be controlled by;
a float switch
a pressure switch
a superior system, such as a PLC.

Technical:
Approvals and markings: CE, GOST-R
Range of ambient temperature: -20 .. 50 °C

Electrical data:
Mains frequency: 50 Hz
Rated voltage: 3 x 220-440 V




| Model Name | Voltage Range | Phase | Current range | Starting Method | Weight |
|---|---|---|---|---|---|
| | | | | | Kg |
| CONTROL MP204-7.5KW | 220-440 | 3 | 13-21 | Direct online | 68 |
| CONTROL MP204-11KW | 220-440 | 3 | 21-28 | Direct online | 68 |
| CONTROL MP204-18.5KW | 220-440 | 3 | 34-43 | Direct online | 71 |
| CONTROL MP204-22KW | 220-440 | 3 | 43-53 | Direct online | 73 |
| CONTROL MP204-26KW | 220-440 | 3 | 53-68 | Direct online | 74 |
| CONTROL MP204-37KW | 220-440 | 3 | 68-85 | Direct online | 75 |

# PUMP CONTROLS & ACCESSORIES

**NSI Basic Control Panels**

A wide range of NSI Panels is available for both single and multi pump control in single phase or 3 phase confirguration all with standard or premium brand components (e.g. Siemens, Schneider, Lovatto etc).

**Advanced Control Panels & Remote Management**

Application specific panels for sensitive installations with remote management capability via SMS, or Web largely for multi pump control in 3 phase confirguration.

All with premium brand components (e.g. Siemens, Schneider, Lovatto etc). Data logging, energy and flow measurement are possible configuration.

Also offered with NSI.Water service contract.

**Active Drive Plus**

Variable Speed drive controller for constant outlet pressure and reduced energy consumption in pumps for 1.1-5.5kw motors


**Smart Press**

Automatic pressure control for single phase pumps with adjustable settings 1-2.2 bar

**Paddle Float switch**

Paddle float switch with weight and 3M cable for level control

**Pressure switches**

Pressure switches for automatic cut in and cut out of pumps in various systems.

**Pressure Vessels**

Pressure vessels in various sizes from 24 litres to 300 litres.

**Water Meters**

Wide range of domestic as well as bulk flow water meters range 1.5M3/hr to 300M3/hr

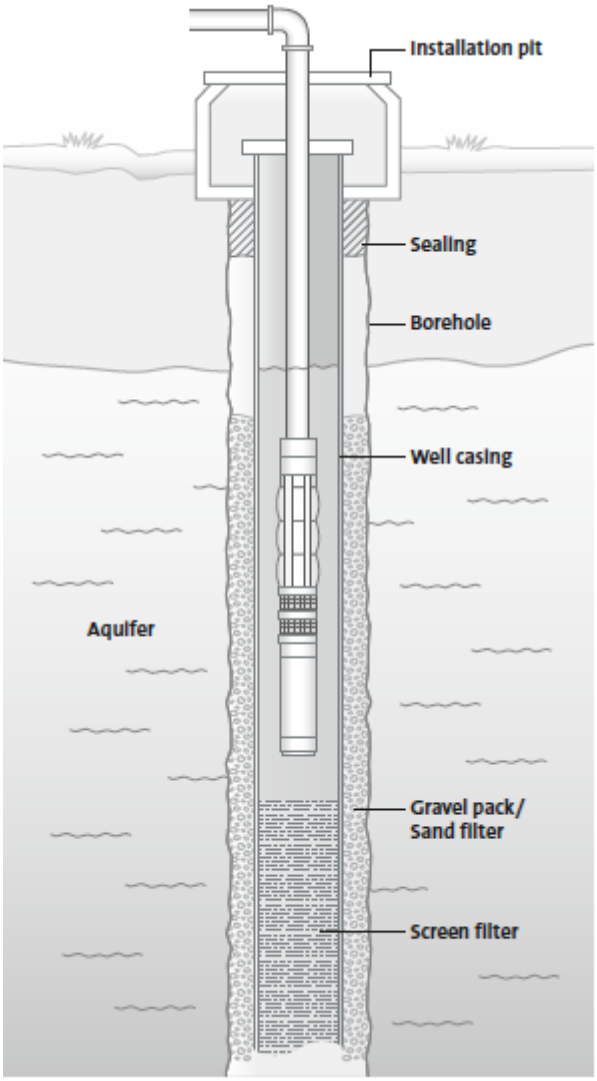
# TECHNICAL INFORMATION

# 3. TECHNICAL INFORMATION

## 3.1 THE WORLD'S WATER RESOURCES

The world's water resources exist mainly as Seawater and Freshwater. Seawater accounts for approximately 97.5 % of all water while Fresh water accounts for the remaining 2.5 %. Two thirds of the fresh water is bound as glaciers, polar ice, and snow cover. The remaining, less than 1 % of all water in the world, is available in form of Surface water (lakes, rivers) and groundwater.
Groundwater exists in shallow or deep underground aquifers. Before groundwater reaches the aquifers, it has been usually filtered and exposed to biological treatment on its way through the various layers of the ground. Groundwater is therefore usually of high quality and requires little or no treatment before it is consumed.

## 3.2 GROUNDWATER AND WELLS




A well is a hole, stretching from the surface of the earth to the underground aquifer, where the groundwater is found. The depth of the well may vary from a few meters to several hundred meters.

Wells are typically drilled with special drilling equipment, which is able to penetrate the various layers of the ground, such as sand, clay, bedrock, etc. Inside the drilled hole a casing (pipe) is typically installed, which prevents the well from collapsing around the pump. Below the casing, and in line with the aquifer, is another 'casing' with fine slots. This is the well screen, where the slots allow the water to enter the well. It holds back sand and larger particles trying to enter the well.

Groundwater wells enable extraction of groundwater from the surrounding formations which can then be pumped out for use. They can be shallow or deep wells. For sustainable groundwater supply, It is crucial to ensure that the pumping rate is not above the ***safe yield*** of the well, which is determined through ***pumping tests***. Pumping beyond the safe yield of a well results into ***over pumping*** and ***deep drawdown***. This gives room for oxidation, resulting in the formation of ochre which may clog well screen and pump. This means increased service costs for ***well regeneration*** and possibly reduced ***well life.***

## 3.3 WATER PUMPS

A Pump is a mechanical device used to transfer different fluids (liquids or gases), or sometimes slurries, from one position to another, by mechanical action, typically converted from electrical energy into hydraulic energy.

Water pumps can be classified based on various criteria as below;

### 3.3.1 INSTALLATION: SUBMERSIBLE VS DRY-INSTALLED PUMPS

A submersible pump is one where the whole assembly is submerged in the fluid to be pumped. Dry-Installed Pumps, usually called surface pumps are designed NOT to be submerged and are made to be installed away from the fluid to be pumped.
A submersible pump has many advantages compared to a dry-installed pump such as:

- **Low noise level**: The submersible pump is very silent and does not disturb any neighbours.
- **Low Theft risk**: The pump is usually installed inside the source.
- **No shaft seal**: This eliminates the risk of leakage above ground.

### 3.3.2 MECHANISM OF FLUID MOVEMENT: DYNAMIC VS POSITIVE DISPLACEMENT PUMPS

***Dynamic pumps***
Dynamic pumps are a type of velocity pump in which kinetic energy is added to the fluid by increasing the flow velocity. This increase in energy is converted to a gain in potential energy (pressure) when the velocity is reduced prior to or as the flow exits the pump into the discharge pipe.
The commonest forms of dynamic pumps are Radial-flow (***centrifugal***) pumps and Axial-flow pumps.

- ***Radial-flow*** pumps produce flow in a direction perpendicular to the shaft (90° angle) while ***Axial-flow pumps*** produce water flow along the impeller shaft direction.
- A mixed flow pump combines both radial and axial flow, producing a conical flow pattern around the shaft.

***Positive displacement pumps***
A positive-displacement pump makes a fluid move by trapping a fixed amount and forcing (displacing) that trapped volume into the discharge pipe.

The common forms include;

- ***Rotary-type positive displacement;*** includes Rotary vane pumps, gear pump, screw pump, Hollow disk pumps, Vibratory pumps)
- ***Reciprocating-type positive displacement:*** includes piston pumps, plunger pumps or diaphragm pumps
- ***Linear-type positive displacement:*** includes rope pumps and chain pumps.

***In Uganda the common pump types are summarized below;***

| Main Type | Sub-type | Specific types |
|---|---|---|
| Rotodynamic | Centrifugal | Single-stage |
| | | Multi-stage shaft driven |
| | | Multi-stage submersible |
| | Axial – and mixed | Axial flow |
| | | Mixed flow |
| Positive displacement | Reciprocating | Suction (shallow well) |
| | | Lift (deep well) |
| | Rotary | Helical Rotor |

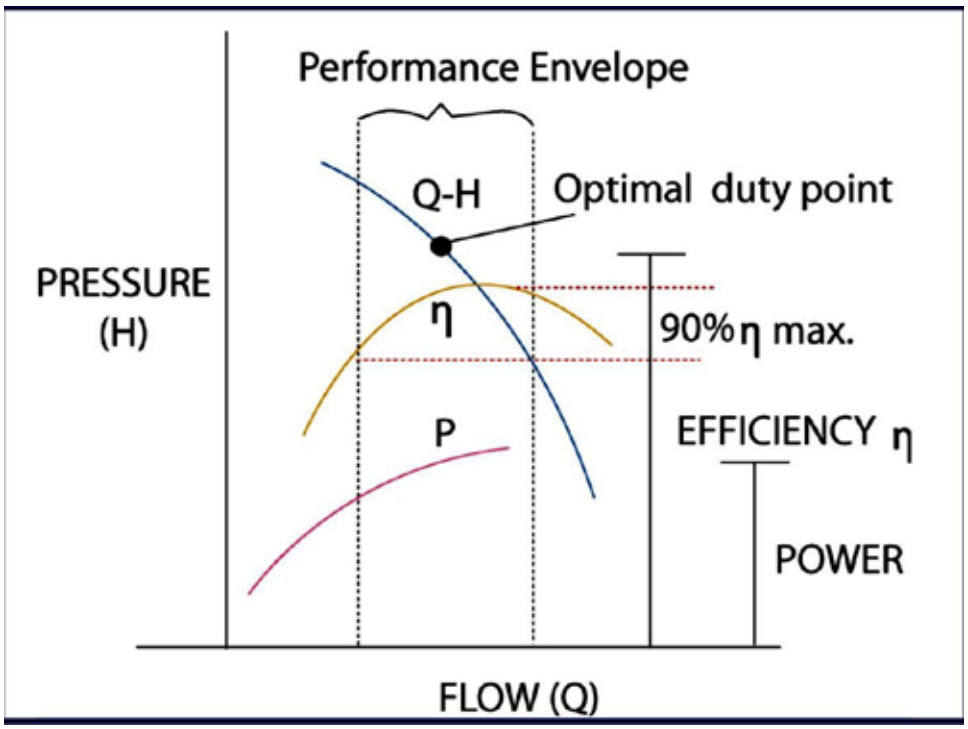
## 3.4 PUMP SELECTION

### 3.4.1 CONSIDERATIONS FOR PUMP SELECTION

The procedures adopted for selection of the right pump are based on such factors as;

- Required amount of water/flow (including water losses, storage considerations)
- Operating Head (including head losses)
- Type of fluid to be pumped (with quality considerations e.g sand content, temperature)
- Water availability at source (e.g., borehole yield)
- Pump availability, reliability and lifecycle cost (lead time, spares, service)
- Local operating conditions (power, safety etc.)

The principal performance parameters of submersible pumps include ***flow*** (or capacity) and ***total delivery head***. Others are power and efficiency. The relationship between them is depicted in the graph below;




### 3.4.2 PUMPING FLOW

Pumping flow/Capacity is measured in various units including litres per second, litres per minute and cubic meters per hour. Pumping flow is determined by reconciling the demand and available supply.

When sufficient water is available to meet all the demand, pumping flow is determined by availability of storage for the demand as below;

- **Storage available**: hourly requirement calculated by dividing the total daily demand by the number of hours the pump is required to work
- **Storage not available**: If there is direct supply, pump capacity should be related to peak hourly demand. This would be appropriate in irrigation or pressure systems.

### 3.4.3 PUMPING HEAD

The principal components of total pumping head when specifying a pump include

- Static head,
- Dynamic head (friction loss)
- Pressure head.

It is important to note that the pump does not know how much of its total head is allocated to static and dynamic head in the system.

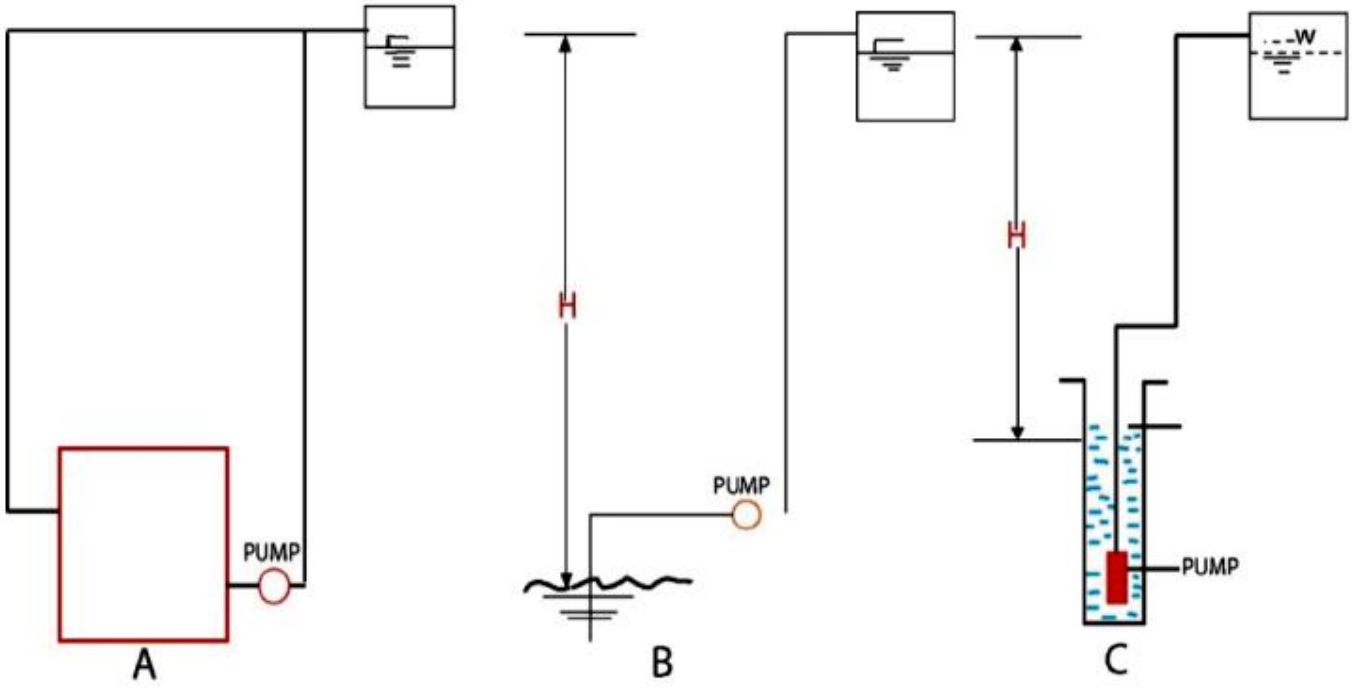
***Static head-*** is the vertical linear distance between the level of the water being pumped and either the delivery outlet or the reservoir water level, whichever is higher (see A & B of Figure below).

***Dynamic Head*** - The dynamic head is the sum of the head losses in the pipelines, valves, fittings, and other components in the system. For pipelines, head loss can be calculated using various head loss equations such as the Darcy equation below;

$$H_L = f \frac{L}{D} \frac{v^2}{2g}$$

Head loss can be estimated from friction tables.

***Pressure head:*** This is usually required in such applications where a certain residual pressure must be achieved such as fire installations or irrigation nozzles, where the required pressure at the nozzle must be included when calculating total head.




### 3.4.4 PUMP RISER MAIN

The riser main serves two key purposes;

- To convey water from the pump to the surface or transmission main
- To hold the submersible pump and motor safely in a suspended position.

Therefore, careful selection of riser main is essential.

The choice of riser main depends on several different factors:

- Discharge pressure and installation depth
- Type and size of pump
- The aggressivity of the groundwater

- Friction loss / operating cost
- Accessibility and cost of alternative
- Priority of initial costs in relation to service and repair costs at a later stage.

## 3.5 OPERATIONAL CONSIDERATIONS OF WATER PUMPING

### 3.5.1 PUMP EFFICIENCY

Pump efficiency is defined as the ratio of the power imparted on the fluid by the pump in relation to the power supplied to drive the pump. Its value is not fixed for a given pump, efficiency is a function of the discharge and therefore also operating head.
Pump efficiency should always be maximized by choosing a pump which will operate close to the peak of its efficiency curve.

### 3.5.2 PUMPING PERIOD

Pumping period has a significant bearing on the size of pump to deliver the required water amount. The number of operating hours of a pump will normally be affected by several factors as below:

- **Power Supply**: If power supply is intermittent e.g. solar power, the pump operating period may be scheduled based on the time interval of power availability. Usually, a relatively bigger pump is required to achieve required water in this period.
- **Borehole recovery**: It is normally required to allow some period for borehole recovery hence continuous pumping is discouraged. About 16 hours of pumping in a day can allow for recovery period
- **Duty/ Standby pumps**: In an arrangement where more than one set of pumps is available, it is possible to schedule the pumping period accordingly in alternation.
- **Storage capacity**: Where pumping is required to fill a reservoir, this can become a limiting factor of the pumping period.

### 3.5.3 WELL DIAMETER

The pump must be able to fit into the well, hence a certain minimum clearance between motor surface and internal well diameter is therefore always required.
If at the same time the motor is eccentrically positioned in the well with one side against the casing, the single sided inlet of water into the pump will create turbulences and affect the performance of the pump.

### 3.5.4 INSTALLATION DEPTH

The right installation depth of a submersible pump should always be ensured. Unnecessary deep installations will increase capital costs while unreasonable shallow installations limit the available water column.
The following are some of the considerations for pump installation depth;

- Pumps should never be set directly at the bottom of a well. It is usually best to place the pump 10 to 20 feet up from the bottom of the well.
- In order to protect the motor against boiling at pump stop and consequently a cooling water stop, it should be installed at least 5m below the dynamic water level. This will raise the boiling point.
- The pump must always be installed above the screen area of the casing. In this way, you ensure that the water is forced past the motor, providing adequate motor cooling. If the pump cannot be installed above the screen filter, a cooling sleeve is always recommended to create the necessary flow along the motor for proper cooling.
- During operation, the water must never fall below the inlet of the pump.

### 3.5.5 PUMP CAVITATION

Cavitation occurs when the atmospheric pressure acting on the water surface in the suction pump is not sufficient to push the water into the pump adequately, to replace the volumes being displaced by the impellers. In such circumstances, the water around the impellers tends to vaporize and form bubbles which explode, forming cavities in the impellers.
Cavitation does not normally take place in submersible pumps. If, however, the following factors occur, cavitational damage on both pump and motor may arise at low installation depths:

- Invasive air bubbles
- Reduction of counter pressure caused for instance by pipe fracture, severe corrosion of riser main and extremely high consumption.
- A clogged filter or strainer
- Part-closed valve mounted on the inlet to the pump
- Hot water, close to the boiling point,

Cavitation results into;

- Reductions and discontinuities in pump discharges
- Excessive noise in the pump
- reduction in overall performance efficiency.

The best way to prevent pumps from experiencing cavitation is to increase the pressure upstream from the pump's impeller. This pressure is known as the ***net positive suction head (NPSH).*** To calculate the required installation depth to prevent cavitation, the following formula is applied:

$$H = H_b - NPSH - H_{loss} - H_v - H_s$$

$H_b$ = barometric pressure
NPSH = Net Positive Suction Head
$H_{loss}$ = pressure loss in suction pipe
$H_v$ = vapour pressure
$H_s$ = safety factor

When the formula gives a positive H value, this means that the pump will be able to operate at suction lift. In that case, the standard indication of minimum installation depth is valid.

Further, Cavitation can be avoided through the below guidelines;

- If possible, reduce the temperature of your pump, liquid, and/or other components.
- Incorporate a booster pump into your pump system. This will take some of the stress off of your primary pump.
- Incorporate a booster pump into your pump system. This will take some of the stress off of your primary pump.

### 3.5.6 WATER HAMMER

Water hammer occurs frequently in pressure pipelines, and can be defined as the periodic pressure oscillations which move back and forth along a pipeline.
It is commonly caused by the following;

- Pump start-up can induce the rapid collapse of a void space that exists downstream from a starting pump
- Pump power failure can create a rapid change in flow, which causes a pressure upsurge on the suction side and a pressure down-surge on the discharge side
- Sudden valve opening and closing

- Improper operation or incorporation of surge protection devices can do more harm than good

Water hammers are avoided by including carefully designed surge protection devices in the water system and regularly checking that operating conditions are optimum.

### 3.5.7 PUMP MAINTENANCE AND SERVICING

Depending on the pumped media and the number of years a pump has been in operation, a service inspection of the pump is recommended. This includes replacing all wear parts in the pump. The recommended service parts are:

- bearings, radial
- valve seat
- neck rings
- seal ring
- upthrust ring.

## 3.6 POWER SUPPLY

Apart from the right power source, it is important to ensure that the right ***Voltage*** and ***Current*** are supplied to the pump.

### 3.6.1 POWER SOURCES

The different types of power sources commonly used for water supply pumps in Uganda;

- Diesel engines;
- Electric motors powered by the national electric grid;
- Electric motors powered by local diesel electric generators;
- Electric motors powered by solar power equipment; and
- Human – powered pumps – hands.

Before connecting a power source to a pump, the following should be ensured;

- The characteristics of the power should be known (e,g Current, Voltage, frequency) and matched against the pump motor power specifications
- The appropriate protection devices should be installed, including surge and lightening protection
- The right size of accessories should be used e.g cables,

### 3.6.2 CABLE SELECTION AND SIZING

The drop cable is the cable running from the well head to the motor cable that is attached to the submersible motor.

Drop cables are sized based on;

- **Current carrying capacity**: The submersible pump drop cable is never dimensioned for the locked-rotor current, as the motor starts up in less than 1/10 of a second. Always use the full load current from the nameplate as the dimensioning current.
- **Voltage drop**: The cable must be sized so the voltage drop does not exceed 3 %. Under no circumstances must the voltage at the motor terminals be lower than the minimum voltage for the motor, which is the rated voltage minus 10 %.
- **Water quality and temperature**: When the water temperature increases, the cable must be derated. The current carrying capacity of the drop cables is usually valid at 30 °C.
- **Drinking water approval requirements**: If the pump is used for pumping potable water, it is recommended that the selected drop cable has drinking water approval.
- **Regulations**: Local regulations must always be checked and followed.

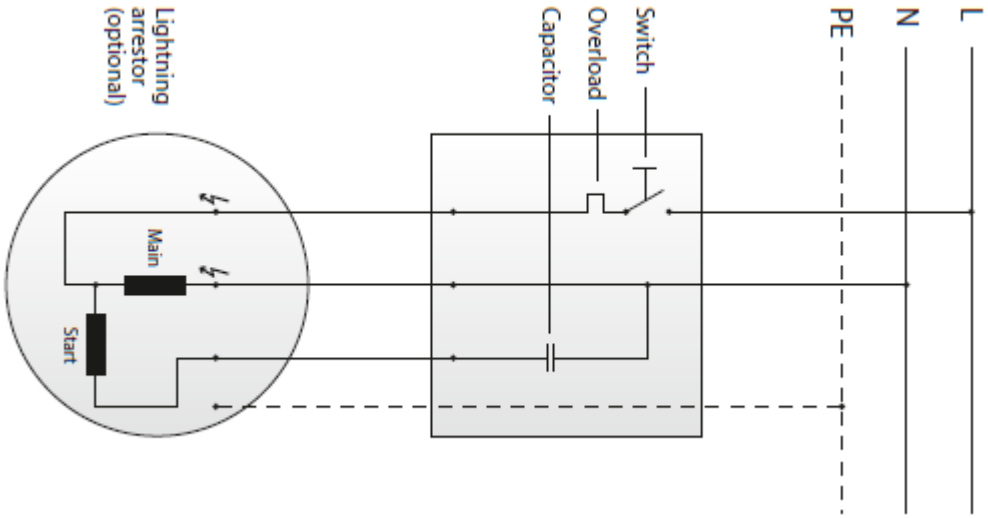
## 3.7 MOTORS AND CONTROLS

Submersible motors are special because they are designed to run underwater. Sound Control systems of such motors are essential for efficient operation of the system.

### 3.7.1 TYPES OF MOTORS

Motors can be classified as below;

- **Canned Motors**: In a canned motor the windings are enamel wire hermetically sealed from the surroundings and filled with embedding material in order to withhold the windings and at the same time increase heat transfer. These motors have a journal bearing system, consisting of upper and lower radial bearings as well as upthrust and downthrust bearings. Examples are the Grundfos MS motors.
- **Wetwound (rewindable) Motors**: Wetwound motors have a special water resist wire, and a watertight joint between the winding and the motor cable. The joint is always inside the motor, and no plug system is available. Examples are the Grundfos MMS motors.
- **Oil-filled motors**: An oil-filled motor is equipped with an impregnated standard surface motor winding. Transformer oil is filled into the motor and used as lubricant and cooling. The oil can be mineral or vegetable oil with high insulation resistance. The motor cable splice is typically made inside the motor as in a wetwound motors, few have plug systems. Oil-filled motors incorporate a ball-bearing system. Others include AF – Autotransformer, RR – Resistor starter, SS - Soft starter, FC - Frequency converter.
- **Permanent-split capacitor (PSC) motors**: Simple and reliable, PSC motors have a run-type capacitor included in the circuit. The capacitor size is a compromise between adding starting torque and ensuring a high efficiency during operation. This is illustrated below.




### 3.7.2 MOTOR STARTING

Motor starting can take several forms as summarized below;

- **DOL - Direct-on-line**: the motor is coupled directly to the grid by means of a contactor or similar. Assuming all other aspects to be the same, DOL starting will always give the lowest generation of heat in the motor, consequently providing the longest life span of motors up to 45 kW.
- **SD- Star-delta**: During start-up, the motor is connected for star operation. When the motor is running, it is switched over to delta connection. Helps in reducing the locked rotor current for motors
- **Others include** AF – Autotransformer, RR – Resistor starter, SS - Soft starter, FC - Frequency converter

A comparison of the different methods is shown below;

| Type | Reduced locked-rotor current | Price | Features in relation to price | Space requirement | Customer friendly | Reliable | Reduced pressure surge | | Energy savings during operation |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Mechanical | Hydraulic | |
| DOL | No | Low | OK | Low | Yes | Yes | No | No | No |
| SD<br>Below 45 kW<br>above 45 kW | <br>No<br>Yes | <br>Low<br>Low | <br>Low<br>OK | <br>Low<br>Low | <br>Yes<br>Yes | <br>Yes<br>Yes | No | <br>No<br>No | <br>No<br>No |
| AF | Yes | Medium | OK | Medium | Yes/No | Yes | Yes/No | No | No |
| RR | | | | | | | | | |
| SS | Yes | Medium | OK | Medium | Yes/No | Yes/No | Yes | No | Yes/No |
| FC | Yes | High | OK | Medium/ high | Yes/No | Yes/No | Yes | Yes/No | Yes/No |

The type of motor starter depends upon the type of motor being installed.

***Small Single Phase Motors***

Most small single-phase pumps are designed to operate without a remote starter and can be directly connected to the mains via an appropriate fuse or MCB. These pumps have built in thermal overload protection, which stops the motor in the event of an electrical or mechanical overload. Most types need a capacitor and some other accessories, which is built into a starter box. The starter box is dedicated for starting a given motor at specific voltage and frequency.

**Large Single Phase Motors**

Large single – phase motors, usually greater than 1.5 HP usually do not have built in motor protection and a direct-on-line starter should be used. If in doubt, contact the pump supplier.

**Small Three-Phase Motors**

Three phase motors for centrifugal surface pumps up to 7.5 HP need a direct-on-line starter with appropriate overload relay.

**Large Three-Phase Motors**

Three phase motors from 7.5 kW to 30 kW are usually specified with a Star/Delta starter with appropriate overload relay.

### 3.7.3 MOTOR DERATING

Motor derating is where there are special requirements to the motor, such as high-water temperature, voltage tolerances outside of acceptable interval, or voltage unbalance. All of these situations stress the motor winding more than what it has been designed for.

There are 2 basic approaches to motor derating;

- **Use of an oversized motor,** typically not more than two output sizes above the required output. The result is an extended lifetime, but the efficiency is not optimal, since the motor never operates at its optimal duty point. The power factor is normally low due to the partial load on the construction.
- **Having a motor specially wound in a larger stack length**, This is a better solution, due to the increased surface, the electrical data and cooling capability are improved. These motors are designed for higher temperatures, wider voltage tolerances, etc. Also, the efficiency of a standard motor is maintained or even increased.

### 3.7.4 MOTOR PROTECTION DEVICES AND CLASSES

Motors should be fitted with protective devices to avoid unexpected breakdowns, costly repairs and subsequent losses that may occur because of motor downtime. It is important to secure and limit short-circuiting currents and protect against phase-failures as well as overload. A motor protection relay is therefore designed to help protect motors from overloads, jams, phase loss or unbalance, heat, heavy start-ups or excessive operational cycles.

Most single-phase motors have a built-in thermal protector. If the protector is not built into the winding, it must be incorporated in the starter box. The protectors feature automatic or manual reset. Thermal protectors are designed to match the motor winding characteristics.
The common causes of motor damage include;

- **Problems with the power supply:** This manifests in form of Over voltage, Under voltage, imbalanced voltage/current, Frequency variation, and Power surges.
- **Slow increase in the temperature of motor windings:** Slow increase in the temperature of motor windings can be because of Bad power supply, Insufficient cooling, Increasing ambient temperature, Increasing liquid temperature, Frequent starts with high load inertia. Slow increase in the temperature of motor windings may cause a burned motor.
- **Fast increase in the temperature of motor windings**: Temperature of the motor windings may increase quickly due to Locked rotor and Phase loss. Rapid increase in the temperature of motor windings may cause burned motor windings.

**Motor protection devices**
Some forms of motor protection include;

- **Installation protection:** Fuses or short circuit relays provide protection of the electrical installation against short circuits in the motor.
- **External protection:** There are several types of overload relays that can be installed before the motor. The relays monitor one or several parameters. Motor current is the most typical one. When the value exceeds a pre-set limit, it shuts the motor off.
- **Internal protection:** Built-in protection with thermal overload protection helps prevent damage and breakdown of the motor. The built-in protection device always requires an external circuit breaker.

**Motor protection classes**
A motor IP (Ingress protection) class is a protection classification that defines the electrical equipment enclosure to particles and liquids. The table below gives a summary defining IP protection levels.

| Degree of protection against contact and ingress of foreign bodies | | Degree of protection against ingress of liquid | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | No Protection | Protection against drops of condensed water | Protection against drops of liquid | Protection against rain | Protection against splashing | Protection against water jets | Deck water-tight equipment | Protection against immersion in water | Protection against indefinite immersion under specified pressure. |
| No Protection | 1P00 | | | | | | | | |
| Protection against inadvertant contact | 1P10 | 1P11 | 1P12 | | | | | | |
| Protection against finger contact and ingress of medium sized bodies | 1P20 | 1P21 | 1P22 | 1P23 | | | | | |
| Protection against objects thicker than 2.5 mm | 1P30 | 1P31 | 1P32 | 1P33 | 1P34 | | | | |
| Protection against objects thicker than 1 mm | 1P40 | 1P41 | 1P42 | 1P43 | 1P44 | | | | |
| Complete protection against contact with live or moving parts. Dust resistant | 1P50 | | | | 1P54 | 1P55 | | | |
| Complete protection against contact with live or moving parts. Protection against ingress of dust. | 1P60 | | | | | 1P65 | 1P66 | 1P67 | 1P68 |

### 3.7.5 LEVEL CONTROLS

Level controls monitor the level of water at a preferred threshold and perform the set action e.g. to start or stop the pump. they usually employ the breaking or completion of an electric circuit on a relay.

They are used practically in the following scenarios;

- Avoiding dry running of the pump. Some pumps have in-built dry running protection while some require external level sensors specially installed. It is important to always check the mechanism of dry running protection for your pump.
- Tracking the level of water in the reservoir hence can start the pump if the level is below a set minimum and stop the pump if the reservoir is full.

They can take different forms such as ***electrode controls, float switch and paddle switch***.

### 3.7.6 PRESSURE CONTROLS

Pressure controls employ the variation of pressure to;

- Start/stop the pump based on a threshold pressure
- Control pump operation based on demand

### 3.7.7 ELECTRONIC CONTROLLERS

Electronic controllers are more modern control systems that offer integrated and compact control solutions. They are used in variable speed drives, press controls, easy press etc.

## 4. TROUBLESHOOTING

Troubleshooting of common pump problems are summarized below;

| Fault | Cause | Solution |
|---|---|---|
| Loud noises in pipework in home or building.<br><br>Pressure gauges stop working after short time.<br><br>Blow-out in piping and fittings | Water hammer at pump start and stop. | Fit a 50-litre diaphragm tank where the riser main and the horizontal discharge pipe meet.<br><br>Water from this diaphragm tank will be discharged when the pump is switched off and thus prevent the formation of the vacuum |
| Air penetrating suction piping as well as pressurised piping. | Water hammer creating vacuum | Introduce soft -start/stop,- VFD or pressure tank shock absorption. |
| A rapid decline in pump perfor-mance. | Wear and tear due to sand/silt penetrating into well | Detect the problematic wells, seal off the problematic section of the well or reduce pump performance to less than half of the problematic capacity. |
| Contactors fail too often, and motors consume excessive kWh per $m^3$ pumped. | High starting frequency | Reduce pump capacity, install a VFD or larger tank capacity. |
| Power consumption by the motor is excessive, and shaft /coupling splines wear down. | Upthrust | Throttle pump performance to around the best efficiency point or reduce the number of impellers on the pump. |

| | | |
|---|---|---|
| Worn upthrust bearings | Upthrust by ON/OFF operation | Establish the necessary flow control at start-up. |
| Thrust bearings on canned type motors fail<br><br>Insulation resistance on rewindable motors fails. | Cavitation | Remove flow restrictions to pump and check for performance around the best efficiency point. |
| Motor temperature increases over time; pump performance falls. | Deposits (Calcium, Iron, etc) on motor surface and in hydraulic parts of pump. | Pull the pump and motor for cleaning; clean the piping, well filter and install a cooling sleeve on motor. |
| Pump performance falls off | Aggressive water (Corrosion of pump and pipes) | Pressure test piping from ground level. If leakages occur, pull and replace the pump and pipes with a higher corrosion class. |
| Water disappears down the piping when the pump is stopped | Riser mains pipe corrosion | Pull the pump and replace the piping material with a higher corrosion class. |
| Pump performance is too low. The motor consumes insufficient kWh. | Gas evacuation | Lower the pump when equipped with gas evacuation sleeve. |
| The water level in the well is constantly becoming lower. | Well overpumping | Reduce pump capacity until the water level remains constant over the course of a year.<br><br>Drill more wells at other aquifers. |

# APPENDIX

TABLE 1: MOTOR CURRENT RATINGS, OVERLOAD & CIRCUIT BREAKER SIZES

| Motor Size | | SINGLE PHASE 240V | | | THREE PHASE 415V | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Direct On Line | | Star Delta | |
| KW | HP | Full Load current Max (A) | Overload Current rating (A) | Circuit Breaker Rating | Maximum Full Load current (A) | Overload Amps | Circuit Breaker Amps | Overload Amps | Circuit Breaker Amps |
| 0,37 | 0,5 | 3,5 | 2.5-4 | 6 | | | | | |
| 0,55 | 0,75 | | | | | | | | |
| 0,75 | 1 | 6 | 5.5-8 | 10 | | | | | |
| 1,1 | 1,5 | 8,8 | 7-10 | 15 | 2,7 | 2.4-4 | 6 | | |
| 1,5 | 2 | 11 | 9-13 | 16 | 3,6 | 2.5-4 | 6 | | |
| 2,2 | 3 | 17 | 12-18 | 25 | 5,3 | 4-6 | 10 | | |
| 3 | 4 | | | | 8,4 | 7-10 | 16 | 4-6 | 16 |
| 4 | 5,5 | | | | | | | | |
| 5,5 | 7,5 | | | | 12 | 9-13 | 16 | 55-8 | 16 |
| 7,5 | 10 | | | | 16 | 12-18 | 20 | 7-10 | 20 |
| 11 | 15 | | | | 23 | 17-25 | 32 | 9-13 | 32 |
| 15 | 20 | | | | 29 | 23-32 | 40 | 12-18 | 40 |
| 18,5 | 25 | | | | 36 | 28-36 | 50 | 17-25 | 50 |
| 22 | 30 | | | | 42 | 37-50 | 63 | 17-25 | 63 |
| 30 | 40 | | | | 56 | 48-65 | 80 | 23-32 | 80 |
| 37 | 50 | | | | 69 | 55-70 | 100 | 30-40 | 100 |
| 45 | 60 | | | | 82 | 80-125 | 125 | 37-50 | 125 |
| 55 | 75 | | | | 100 | 80-125 | 175 | 48-65 | 175 |
| 75 | 100 | | | | 134 | 100-160 | 225 | 63-80 | 225 |

TABLE 2: CABLE CURRENT CAPACITY & VOLTAGE DROP VALUES

| Cable Size (mm2) | MULTICORE ARMOURED PVC INSULATED CABLE | | | | TWIN & MULTICORE ARMOURED PVC INSULATED | | | |
|---|---|---|---|---|---|---|---|---|
| | Two Core cable, Single Phase Supply | | Three or Four core cable three phase supply | | Two Core cable, Single Phase Supply | | Three or Four core cable three phase supply | |
| | Max Current Capacity (A) | Voltage Drop/Amp/M (mv) | Max Current Capacity (A) | Voltage Drop/Amp/M (mv) | Max Current Capacity (A) | Voltage Drop/Amp/M (mv) | Max Current Capacity (A) | Voltage Drop/Amp/M (mv) |
| 1,5 | 22,0 | 29,00 | 19 | 25,0 | 19,5 | 29,00 | 17,5 | 25,0 |
| 2,5 | 31,0 | 18,00 | 26 | 15,0 | 27,0 | 18,00 | 24,0 | 15,0 |
| 4,0 | 41,0 | 11,00 | 35 | 9,5 | 36,0 | 11,00 | 32,0 | 9,5 |
| 6,0 | 53,0 | 7,30 | 45 | 6,4 | 46,0 | 7,30 | 41,0 | 6,4 |
| 10,0 | 72,0 | 4,40 | 62 | 3,8 | 63,0 | 4,40 | 57,0 | 3,8 |
| 16,0 | 97,0 | 2,80 | 83 | 2,4 | 85,0 | 2,80 | 76,0 | 2,4 |
| 25,0 | 128,0 | 1,75 | 110 | 1,5 | 112,0 | 1,75 | 96,0 | 1,5 |
| 35,0 | 157,0 | 1,25 | 135 | 1,1 | 138,0 | 1,25 | 119,0 | 1,1 |
| 50,0 | 190,0 | 0,94 | 163 | 0,81 | 168,0 | 0,94 | 144,0 | 0,81 |

TABLE 3: ARMOURED CABLE SPECIFICATIONS

| Cable Size (mm2) | THREE CORE ARMORED 600/1000 VOLT CABLE (Cable with stranded copper conductors) | | | | FOUR CORE ARMORED 600/1000 VOLT CABLE (Cable with stranded copper conductors) | | | |
|---|---|---|---|---|---|---|---|---|
| | MAXIMUM RESISTANCE PER 1000M OF | | Overall Di-ameter (mm) | Weight per Metre (Kg) | MAXIMUM RESISTANCE PER 1000M OF | | Overall Di-ameter (mm) | Weight per Metre (Kg) |
| | Conductor (ohm) | Armor (ohm) | | | Conductor (ohm) | Armor (ohm) | | |
| 1,5 | 12,10 | 10,2 | 12,3 | 0,3 | 12,10 | 9,50 | 13,0 | 0,7 |
| 2,5 | 7,28 | 8,8 | 13,6 | 0,4 | 7,25 | 7,90 | 14,5 | 0,0 |
| 4,0 | 4,61 | 7,0 | 15,8 | 0,6 | 4,61 | 4,60 | 17,8 | 0,8 |
| 6,0 | 3,08 | 4,6 | 18,0 | 0,7 | 3,08 | 4,10 | 19,2 | 0,9 |
| 10,0 | 1,83 | 3,7 | 21,2 | 1,0 | 1,83 | 3,40 | 22,8 | 1,3 |
| 16,0 | 1,15 | 3,8 | 20,6 | 1,1 | 1,15 | 2,60 | 23,9 | 1,5 |
| 25,0 | 0,73 | 2,4 | 25,0 | 1,7 | 0,73 | 2,10 | 27,8 | 2,1 |
| 35,0 | 0,52 | 2,1 | 27,3 | 2,1 | 0,52 | 1,90 | 30,5 | 2,6 |
| 50,0 | 0,39 | 1,9 | 30,5 | 2,6 | 0,39 | 1,30 | 35,4 | 3,40 |

TABLE 4: BOREHOLE DROP CABLE CABLE SIZING

| | MOTOR SIZE | | Full Load current Max (A) | Mini-mum Cable | CABLE DIMENSIONS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | KW | HP | | | 1.5mm² | 2.5mm² | 4mm² | 6mm² | 10mm² | 16mm² | 25mm² |
| | | | | | MAXIMUM LENGTHS FOR SUBMERSIBLE CABLES | | | | | | |
| SINGLE PHASE | 0,37 | 0,5 | 3.5 | 1.5 | 180 | | | | | | |
| | 0,55 | 0,75 | 5.0 | 1.5 | 121 | 202 | | | | | |
| | 0,75 | 1 | 6.7 | 1.5 | 91 | 152 | 243 | | | | |
| | 1,1 | 1,5 | 7.2 | 1.5 | 63 | 105 | 168 | | | | |
| | 1,5 | 2 | 10.6 | 1.5 | 49 | 81 | 130 | | | | |
| | 2,2 | 3 | 15.8 | 2.5 | | 56 | 89 | | | | |
| THREE PHASE | 1,1 | 1,5 | 3.1 | 1.5 | 382 | 636 | | | | | |
| | 1,5 | 2 | 3.9 | 1.5 | 303 | 505 | | | | | |
| | 2,2 | 3 | 5.5 | 1.5 | 210 | 350 | | | | | |
| | 4 | 5,5 | 8.7 | 1.5 | 131 | 218 | 349 | | | | |
| | 5,5 | 7,5 | 13.0 | 2.5 | | 155 | 248 | 372 | | | |
| | 7,5 | 10 | 17.2 | 2.5 | | | 184 | 276 | 460 | | |
| | 11 | 15 | 24 | 4.0 | | | 126 | 190 | 316 | 505 | |
| | 15 | 20 | 32.0 | 4.0 | | | 95 | 142 | 237 | 308 | |
| | 18,5 | 25 | 40.0 | 6.0 | | | | 114 | 190 | 304 | |
| | 22 | 30 | 46.0 | 10.0 | | | | | 164 | 262 | 380 |
| | 30 | 40 | 57.5 | 10.0 | | | | | 133 | 210 | 317 |
| | 37 | 50 | 66.5 | 16.0 | | | | | | 180 | 275 |
| | 45 | 60 | 80.0 | 16.0 | | | | | | 150 | 228 |

## HEAD LOSS IN PVC & GI PIPES IN METRES/100M

| Flow | ¾" | | | 1" | | | 1 ¼" | | | 1 ½" | | | | 2" | | | | 2 ½" | | | | 3" | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M³/hr | PVC | | GI | PVC | | GI | PVC | | GI | PVC | | | GI | PVC | | | GI | PVC | | | GI | PVC | | | | GI |
| | D | E | GI | D | E | GI | D | E | GI | C | D | E | GI | C | D | E | GI | C | D | E | GI | B | C | D | E | GI |
| 1 | 2,4 | 3,2 | 8 | | | 1,9 | | | 1,5 | | | | | | | | | | | | | | | | | |
| 1,5 | 5 | 6,8 | 18 | 1,6 | 2,2 | 4,2 | | | 2,6 | | | | | | | | | | | | | | | | | |
| 2 | 8,6 | 11 | 32 | 2,8 | 3,8 | 7,5 | 1,3 | 1,8 | 3,9 | | | | 1,5 | | | | | | | | | | | | | |
| 2,5 | 13 | 17 | 50 | 4,2 | 5,7 | 12 | 2 | 2,7 | 5,7 | | | | 2,3 | | | | | | | | | | | | | |
| 3 | 19 | 26 | 72 | 6,2 | 8,4 | 18 | 2,7 | 3,7 | 8 | 1,2 | 1,4 | 1,9 | 3,3 | | | | | | | | | | | | | |
| 3,5 | | | | 8,5 | 12 | 25 | 3,5 | 4,7 | 10 | 1,5 | 1,8 | 2,4 | 4,3 | | | | 1 | | | | | | | | | |
| 4 | | | | 11 | 15 | 33 | 4,9 | 6,7 | 16 | 2,2 | 2,6 | 3,5 | 6,3 | | | | 1,5 | | | | | | | | | |
| 5 | | | | 16 | 21 | 51 | 6,9 | 9,3 | 22 | 3,1 | 3,6 | 4,9 | 9 | 1,0 | 1,2 | 1,6 | 2,1 | | | | | | | | | |
| 6 | | | | 22 | 30 | 73 | 9,2 | 13 | 29 | 4,1 | 4,7 | 6,5 | 12 | 1,4 | 1,6 | 2,2 | 2,9 | | | | | | | | | |
| 7 | | | | 29 | 42 | 99 | 12 | 16 | 39 | 5,1 | 5,9 | 8,1 | 16 | 1,7 | 2 | 2,7 | 3,7 | | | | 1,2 | | | | | |
| 8 | | | | | | | 14 | 20 | 49 | 6,4 | 7,5 | 10 | 20 | 2,1 | 2,5 | 3,4 | 4,7 | | | | 1,6 | | | | | |
| 9 | | | | | | | 18 | 24 | 61 | 7.81 0.8 | 9 | 12 | 25 | 2,6 | 3 | 4,1 | 5,8 | | | | 1,9 | | | | | |
| 10 | | | | | | | | 33 | 87 | 14 | 13 | 17 | 35 | 3,6 | 4,2 | 5,8 | 8,4 | 1,2 | 1,4 | 1,9 | 2,7 | | | | | 1,1 |
| 12 | | | | | | | | | | 18 | 14 | 23 | 48 | 4,8 | 5,6 | 7,6 | 12 | 1,6 | 1,8 | 2,5 | 3,7 | | | | | 1,5 |
| 14 | | | | | | | | | | | 26 | 29 | 63 | 6,1 | 7,2 | 9,8 | 16 | 2 | 2,3 | 3,2 | 5 | | | | | 2 |
| 16 | | | | | | | | | | | | | | 7,6 | 8,9 | 14 | 21 | 2,5 | 2,9 | 4 | 6,3 | 1 | 1 | 1,3 | 1,8 | 2,5 |
| 18 | | | | | | | | | | | | | | 9,2 | 11 | 19 | 26 | 3 | 3,5 | 4,9 | 7,6 | 1,2 | 1,4 | 1,6 | 2,2 | 3,1 |

**HEAD LOSS IN PVC & GI PIPES IN METRES/100M**

| Flow M³/hr | | 2" | | | | 2 ½" | | | | 3" | | | | | 4" | | | | | 6" | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PVC | | | GI | PVC | | | GI | PVC | | | | GI | PVC | | | | GI | PVC | | | GI |
| | | C | D | E | GI | C | D | E | GI | B | C | D | E | GI | B | C | D | E | GI | B | C | D | GI |
| 20 | | 9,2 | 11 | 19 | 26 | 3 | 3,5 | 4,9 | 7,6 | 1,2 | 1,4 | 1,6 | 2,2 | 3,1 | | | | | | | | | |
| 25 | | 14 | 16 | 29 | 37 | 4,5 | 5,3 | 7,4 | 12 | 1,8 | 2,1 | 2,4 | 3,3 | 4,8 | | | | | 1,1 | | | | |
| 30 | | | | | | 6,4 | 7,5 | 10 | 17 | 2,5 | 2,9 | 3,4 | 4,7 | 6,9 | | | | | 1,7 | | | | |
| 35 | | | | | | 8,5 | 9,9 | 14 | 23 | 3,4 | 3,8 | 4,5 | 6,2 | 9,3 | 1 | 1,1 | 1,3 | 1,8 | 2,3 | | | | |
| 40 | | | | | | 11 | 13 | 18 | 30 | 4,3 | 4,9 | 5,8 | 8 | 2,2 | 1,2 | 1,4 | 1,7 | 2,3 | 2,9 | | | | |
| 45 | | | | | | 14 | 16 | 22 | 38 | 5,4 | 6,1 | 7,2 | 9,9 | 15 | 1,5 | 1,8 | 2,1 | 2,9 | 3,7 | | | | |
| 50 | | | | | | | | | | | 7,5 | 9,2 | 12 | 19 | 1,9 | 2,2 | 2,5 | 3,5 | 4,6 | | | | |
| 60 | | | | | | | | | | | 11 | 13 | 17 | 28 | 2,7 | 3,1 | 3,6 | 5 | 6,5 | | | | |
| 70 | | | | | | | | | | | 14 | 18 | 23 | 37 | 3,6 | 4,1 | 4,8 | 6,7 | 8,8 | | | | 1,2 |
| 80 | | | | | | | | | | | 18 | 23 | 29 | 49 | 4,5 | 5,2 | 6,1 | 8,4 | 12 | | | | 1,5 |
| 90 | | | | | | | | | | | | | | | 5,6 | 6,5 | 7,6 | 11 | 1,6 | | | | 1,9 |
| 100 | | | | | | | | | | | | | | | 6,8 | 7,9 | 9,2 | 14 | 18 | 1 | 1,2 | 1,4 | 2,4 |
| 120 | | | | | | | | | | | | | | | 9,5 | 11 | 14 | 20 | 26 | 1,4 | 1,7 | 1,9 | 3,4 |
| 140 | | | | | | | | | | | | | | | | | | | | 1,9 | 2,2 | 2,6 | 4,7 |
| 160 | | | | | | | | | | | | | | | | | | | | 2,4 | 2,8 | 3,3 | 6,3 |
| 180 | | | | | | | | | | | | | | | | | | | | 3 | 3,5 | 4,1 | 7,9 |
| 200 | | | | | | | | | | | | | | | | | | | | 3,6 | 4,2 | 5 | 9,5 |
| 225 | | | | | | | | | | | | | | | | | | | | 4,5 | 5,3 | 6,2 | 11 |
| 250 | | | | | | | | | | | | | | | | | | | | 5,5 | 6,4 | 7,8 | 15 |

TABLE 6: PIPE SPECIFICATIONS

GI PIPE SPECIFICATIONS

| Internal Diameter (Inches) | External Diameter (mm) | Wall Thickness | | | Weight (Kgs per Metre) | | | Max. Working Pressure (M) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | CLASS A | CLASS B | CLASS C | CLASS A | CLASS B | CLASS C | CLASS A | CLASS B | CLASS C |
| ½ | 21,4 | 2 | 2.62.9 | 3,3 | 1 | 1,2 | 1,5 | 100 | 200 | 250 |
| ¾ | 27 | 2,3 | 3,3 | 3,7 | 1,4 | 1,8 | 2,1 | 100 | 200 | 250 |
| 1 | 34,1 | 2,6 | 3,7 | 4,1 | 2 | 2,5 | 3 | 100 | 200 | 250 |
| 1¼ | 42,9 | 2,6 | 4,1 | 4,5 | 2,6 | 3,5 | 4,2 | 85 | 175 | 200 |
| 1½ | 48,4 | 2,9 | 4,1 | 4,9 | 3,3 | 4,5 | 5,5 | 85 | 175 | 200 |
| 2 | 60,3 | 2,9 | 4,5 | 4,9 | 4,2 | 5,7 | 6,7 | 70 | 140 | 175 |
| 2½ | 76,2 | 3,3 | 4,5 | 5,4 | 5,9 | 8 | 9,5 | 70 | 140 | 175 |
| 3 | 88,9 | 3,3 | 4,5 | 5,4 | 7 | 9,5 | 11,2 | 70 | 140 | 175 |
| 4 | 114,3 | 3,7 | 4,5 | 5,4 | 10,2 | 12,3 | 14,7 | 55 | 100 | 140 |
| 5 | 139,7 | | 4,5 | 5,4 | | 15,3 | 18,2 | | 100 | 140 |
| 6 | 165,1 | | 4,5 | 5,4 | | 18,3 | 21,8 | | 85 | 100 |

PVC PIPE SPECIFICATIONS

| Nominal Diametre | External Diametre | Wall Thickness | | | | Weight Per 6M Length | | | | Size in Inches |
|---|---|---|---|---|---|---|---|---|---|---|
| | | CLASS B | CLASS C | CLASS D | CLASS E | CLASS B | CLASS C | CLASS D | CLASS E | |
| DN25 | 25,2 | | | 1,6 | 1,8 | | | | 1,2 | ¾ |
| DN32 | 32,3 | | 1,6 | 1,9 | 2,35 | | | 1,6 | 1,9 | 1 |
| DN40 | 40,2 | | 1,8 | 2,4 | 2,85 | | 1,9 | 2,5 | 3 | 1¼ |
| DN50 | 50,2 | 1,6 | 2,2 | 2,9 | 3,5 | 2,1 | 3 | 3,8 | 4,6 | 1½ |
| DN63 | 63,2 | 1,9 | 2,8 | 3,6 | 4,45 | 3,3 | 4,7 | 6,1 | 7,4 | 2 |
| DN75 | 75,2 | 2,2 | 3,3 | 4,2 | 5,15 | 4,6 | 6,7 | 8,5 | 10,2 | 2½ |
| DN90 | 90,2 | 2,7 | 3,9 | 5,1 | 6,2 | 6,7 | 9,6 | 12,2 | 14,8 | 3 |
| DN110 | 110,2 | 3,3 | 4,8 | 6,1 | 7,55 | 10 | 14,3 | 18,4 | 22,2 | 4 |
| DN160 | 160,3 | 4,7 | 6,8 | 8,9 | 10,95 | 29,5 | 42,2 | 54,9 | 66,4 | 6 |
| DN200 | 200,3 | 5,2 | 7,6 | 10 | 12,3 | 37,6 | 53,7 | 69,1 | 83,9 | 7 |

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