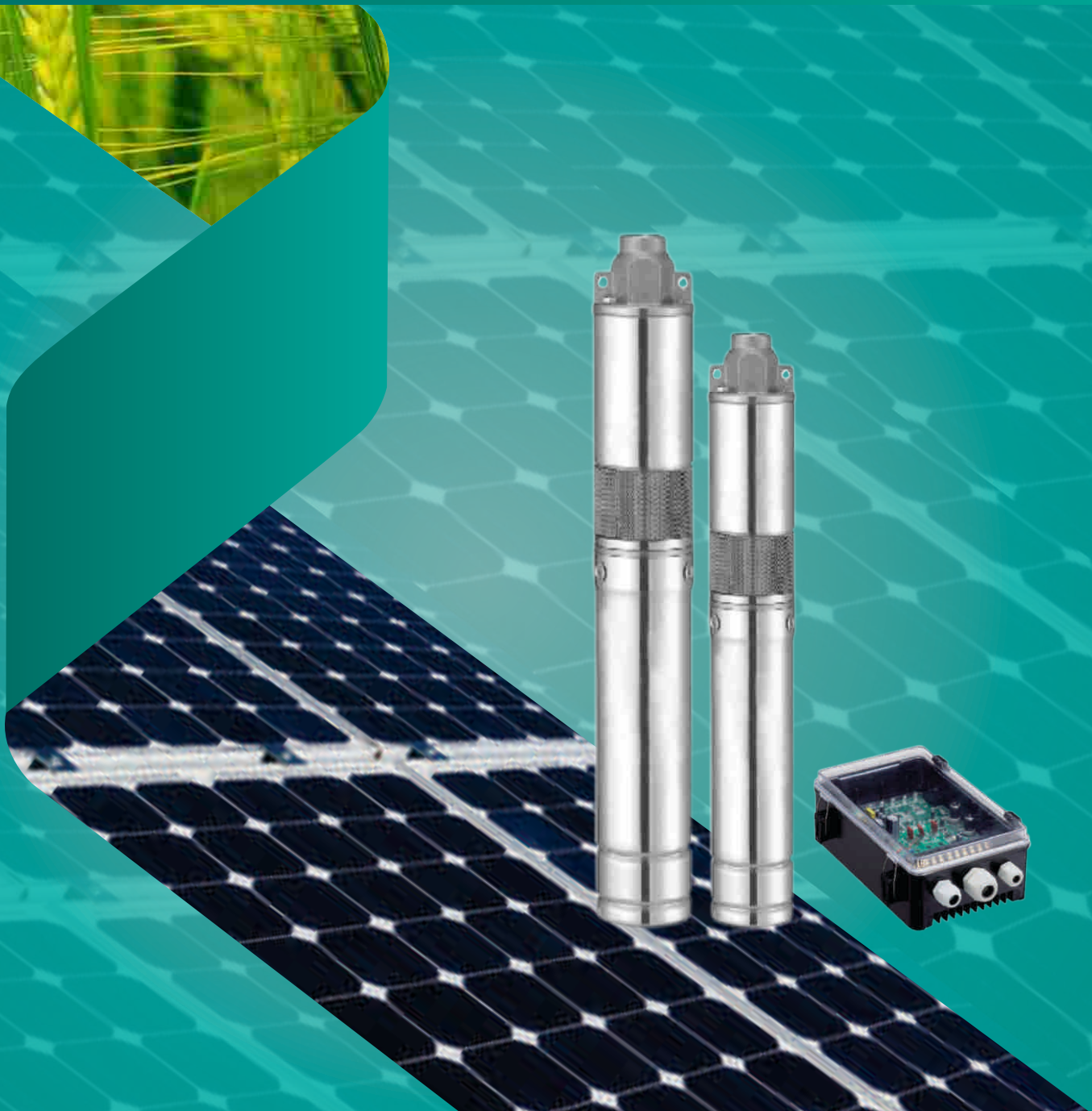




OUR WORLD IS FULL OF ENERGY



SOLAR SUBMERSIBLE PUMPS **TS** - SERIES

I N D E X

SOLAR SUBMERSIBLE PUMPS - TS SERIES

Introduction, Applications & Features	3
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SOLAR MODULES

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SOLAR INVERTER CONTROL PANELS

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--------------------------------------------	-----------

GENERAL DATA

SOLAR SUBMERSIBLE PUMPS > TS SERIES

Our world is full of energy. Tormac is passionate about meeting the most challenging technical demands and environmental conditions of the world's energy users with efficient solutions. With pioneering technology, Tormac offer's innovative systems that improve performance and return on investment while reducing operational and maintenance cost.

Tormac Solar Submersible pumps are ingeniously designed and developed employing latest engineering software's, high-tech machineries, tools and cutting edge of pump technology to deliver the best possible hydraulic efficiency. The integrated and most modern quality assurance systems used at every stage of the production and flawless workmanship ensure sustained and consistent operation.

Applications

Livestock

Agricultural

Recreational

Residential applications

Features

Tried & Trusted

Highly efficient

Corrosion free parts for hygiene

Perfectly and aesthetically designed

Water lubricated bearings

Brushless DC motor

Stainless Steel (AISI 304), POM, Rubber,
Cable Drinking water approved.

Note: The company reserves the right to modify the technical specifications and illustrations without prior notice.

Model Classification :

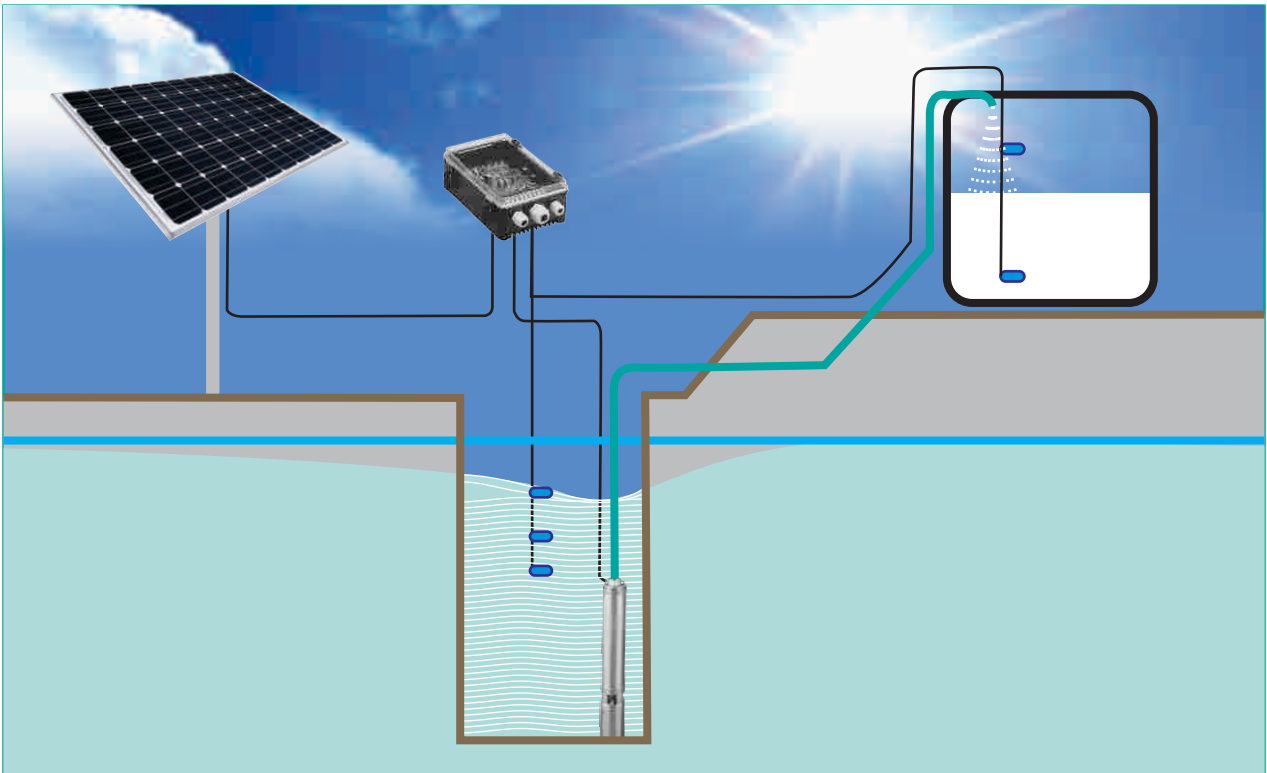
Sizing of Solar Pumps :

$$\begin{aligned} \text{The hydraulic energy required(kWH/Day)} &= \text{Volume required (m}^3\text{/day)} \times \text{Head (m)} \times \text{Water Density} \times \text{Gravity} \\ &= (3.6 \times 10^6) \\ &= 0.002725 \times \text{Volume (m}^3\text{/day)} \times \text{Head (m)} \end{aligned}$$

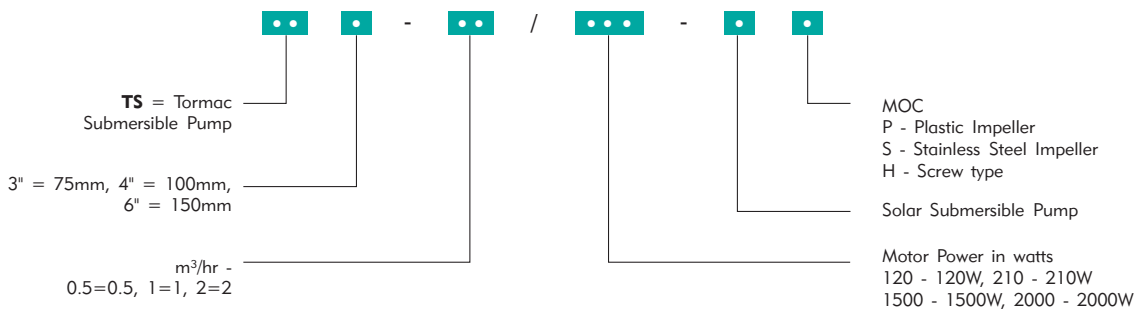
$$\text{The Solar array powered required (kWp)} = \frac{\text{Hydraulic Energy Required (kWH/day)}}{\text{Av. Daily solar irradiation (kW/m}^2\text{/day} \times F \times E)}$$

F = Array mismatch factor = 0.80 on average (a safety factor for real panel performance in hot sun and after 10-20 years)

E = Daily subsystem efficiency = 0.25 - 0.40 typically.



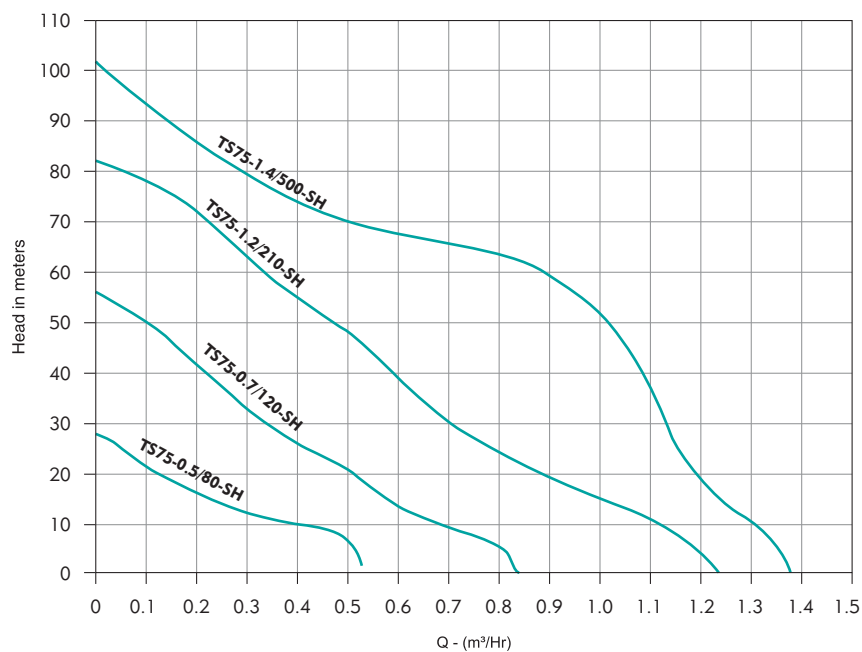
Model Designation > SOLAR PUMPS



TS 75-SH - SERIES > Performance Data

Pump set Model	Voltage	Power (W)	Max.Flow (m ³ /hr)	Max. Head (m)	Delivery Size in mm
TS75-0.5/80-SH	12	80	0.50	29	19
TS75-0.7/120-SH	24	120	0.76	58	19
TS75-1.2/210-SH	36	210	1.38	85	19
TS75-1.4/500-SH	48	500	1.40	100	19

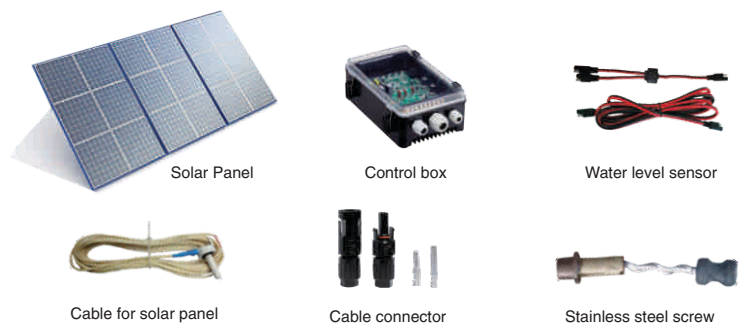
Performance Curve



Compliance :

Nominal Dia	: 75mm (3")
Outer diameter	: 76mm
Power Range	: 80, 120, 210 & 500W
Voltage	: 12, 24, 36 & 48 V. D.C.
Max. Head	: 100m
Max. Discharge	: 1.4m ³ /hr
Max. Immersion Depth	: 30m
Motor	: Oil filled DC motor
Impeller	: Screw Type
Outlet Size in mm	: 19

Accessories :



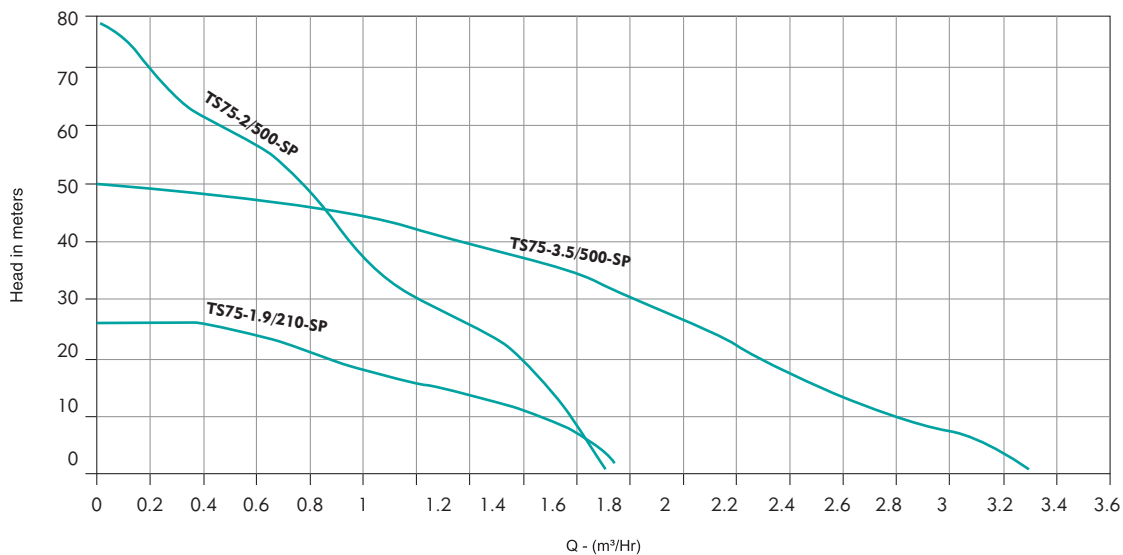
Constructional Data :

Outlet	: AISI / Brass
Pump Outer shell	: AISI
Motor Outer Shell	: AISI
Impeller	: AISI (Screw Type)
Bearing	: Ball Bearing

TS 75-SP - SERIES > Performance Data

Pump set Model	Voltage	Power (W)	Max.Flow (m ³ /hr)	Max. Head (m)	Delivery Size in mm
TS75-1.9/210-SP	36	210	1.9	25	25
TS75-2.0/500-SP	48	500	2.0	85	25
TS75-3.5/500-SP	48	500	3.5	50	25

Performance Curve



Compliance :

Nominal Dia	: 75mm (3")
Outer diameter	: 76mm
Power Range	: 210 & 500W
Voltage	: 36 & 48 V. D.C.
Max. Head	: 85m
Max. Discharge	: 3.5m ³ /hr
Max. Immersion Depth	: 30m
Motor	: Oil filled DC motor
Impeller	: Centrifugal type.
Outlet Size in mm	: 25

Accessories :



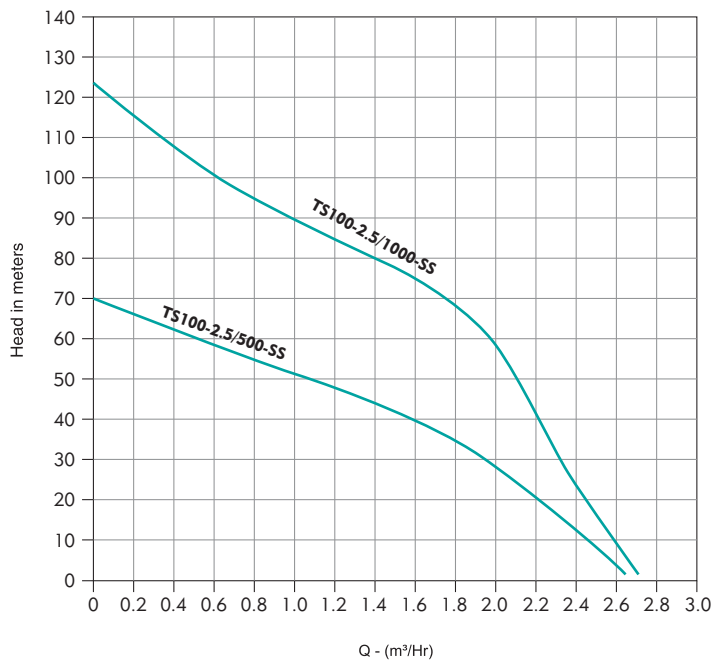
Constructional Data :

Outlet	: AISI / Brass
Pump Outer shell	: AISI
Motor Outer Shell	: AISI
Impeller	: Noryl
Bearing	: Ball Bearing

TS 100-SH - SERIES > Performance Data

Pump set Model	Voltage	Power (W)	Max.Flow (m ³ /hr)	Max. Head (m)	Delivery Size in mm
TS100-2.5/500-SS	48	500	2.5	70	25
TS100-2.5/1000-SS	110	1000	2.5	140	25

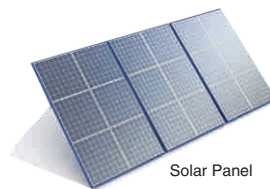
Performance Curve



Compliance :

Nominal Dia	: 100mm (4")
Outer diameter	: 100mm
Power Range	: 500 - 1000W
Voltage	: 48 & 110 V. D.C.
Max. Head	: 140m
Max. Discharge	: 2.5m ³ /hr
Max. Immersion Depth	: 30m
Motor	: Oil filled DC motor
Impeller	: Screw Type
Outlet Size in mm	: 25

Accessories :



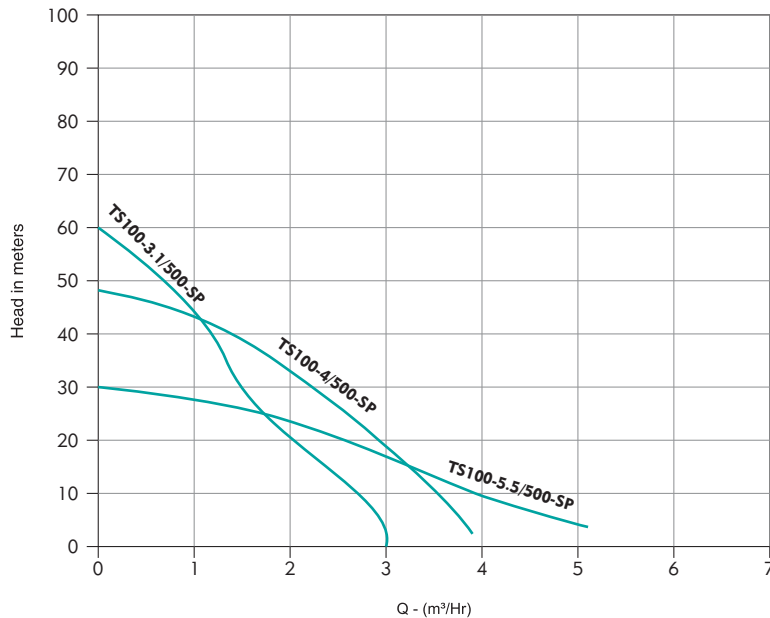
Constructional Data :

Outlet	: AISI / Brass
Pump Outer shell	: AISI
Motor Outer Shell	: AISI
Impeller	: AISI (Screw Type)
Bearing	: Ball Bearing

TS 100-SP - SERIES > Performance Data

Pump set Model	Voltage	Power (W)	Max.Flow (m ³ /hr)	Max. Head (m)	Delivery Size in mm
TS100-5.5/500-SP	48	500	5.5	40	32
TS100-3.1/500-SP	48	500	3.1	66	32
TS100-4.0/500-SP	48	500	4.0	57	32

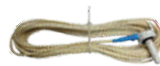
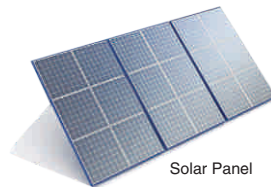
Performance Curve



Compliance :

Nominal Dia	: 100mm (4")
Outer diameter	: 100mm
Power Range	: 500 W
Voltage	: 48 V. D.C.
Max. Head	: 66m
Max. Discharge	: 5.5m ³ /hr
Max. Immersion Depth	: 30m
Motor	: Oil filled DC motor
Impeller	: Centrifugal
Outlet Size in mm	: 32

Accessories :



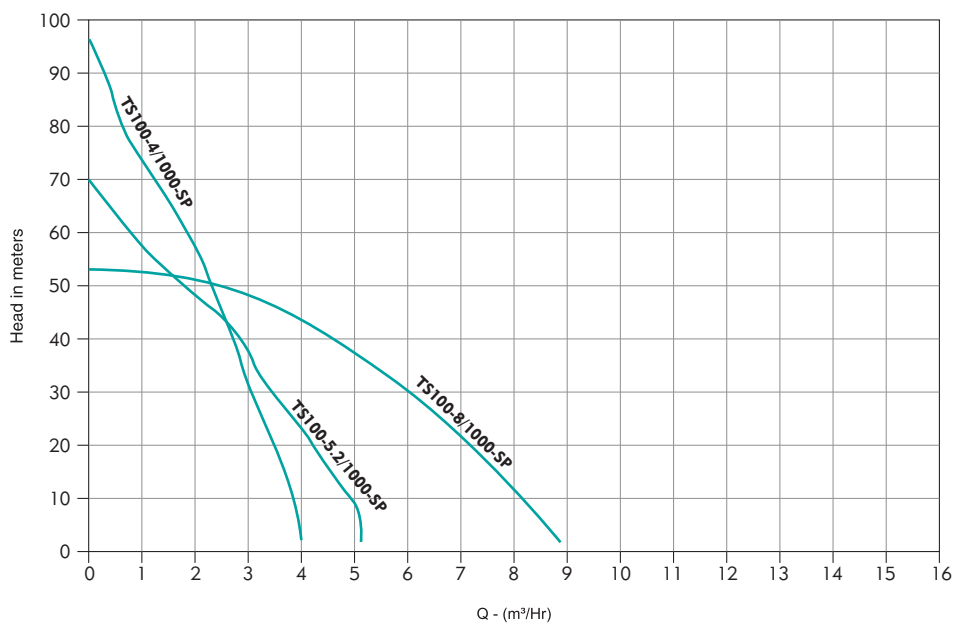
Constructional Data :

Outlet	: AISI / Brass
Pump Outer shell	: AISI
Motor Outer Shell	: AISI
Impeller	: Noryl
Bearing	: Ball Bearing

TS 100-SP - SERIES > Performance Data

Pump set Model	Voltage	Power (W)	Max.Flow (m ³ /hr)	Max. Head (m)	Delivery Size in mm
TS100-4.0/1000-SP	110	1000	4.0	96	32
TS100-5.2/1000-SP	110	1000	5.2	72	32
TS100-8.0/1000-SP	110	1000	8.0	48	50

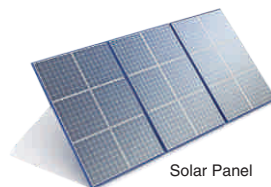
Performance Curve



Compliance :

Nominal Dia	: 100mm (4")
Outer diameter	: 100mm
Power Range	: 1000W
Voltage	: 110 V. D.C.
Max. Head	: 96m
Max. Discharge	: 8m ³ /hr
Max. Immersion Depth	: 30m
Motor	: Oil filled DC motor
Impeller	: Centrifugal
Outlet Size in mm	: 32 & 50

Accessories :



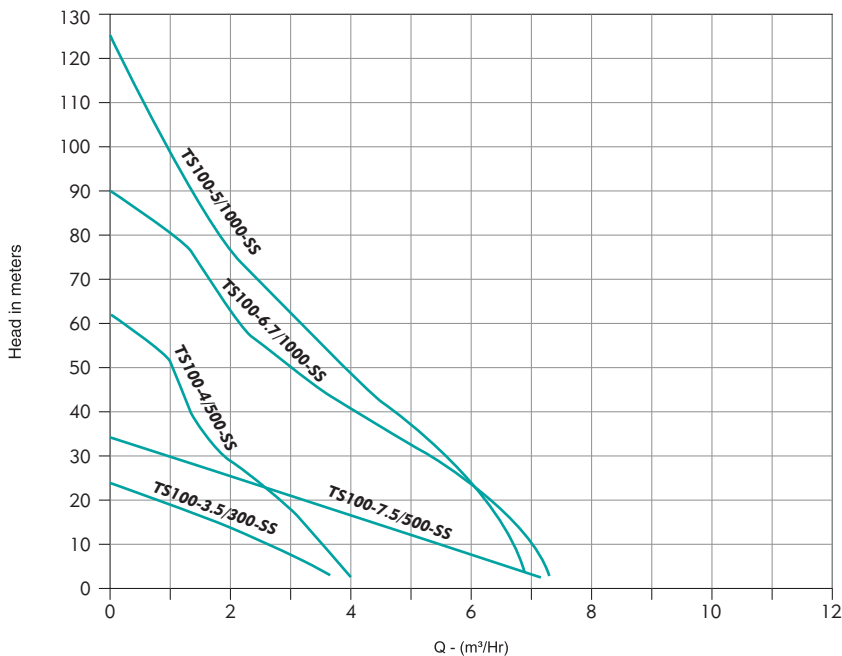
Constructional Data :

Outlet	: AISI / Brass
Pump Outer shell	: AISI
Motor Outer Shell	: AISI
Impeller	: Noryl
Bearing	: Ball Bearing

TS 100-SS - SERIES > Performance Data

Pump set Model	Voltage	Power (W)	Max.Flow (m ³ /hr)	Max. Head (m)	Delivery Size in mm
TS100-3.5/300-SS	36	300	3.5	24	32
TS100-4/500-SS	48	500	4.0	62	32
TS100-7.5/500-SS	48	500	7.5	34	32
TS100-5/1000-SS	110	1000	5.0	128	32
TS100-6.7/1000-SS	110	1000	6.7	88	38

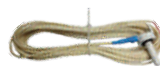
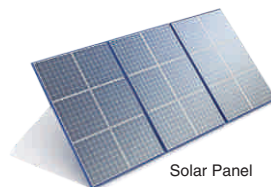
Performance Curve



Compliance :

Nominal Dia	: 100mm (4")
Outer diameter	: 100mm
Power Range	: 300, 500 & 1000W
Voltage	: 36, 48 & 110 V. D.C.
Max. Head	: 128m
Max. Discharge	: 7.5m ³ /hr
Max. Immersion Depth	: 30m
Motor	: Oil filled DC motor
Impeller	: Centrifugal
Outlet Size in mm	: 38

Accessories :



Constructional Data :

Outlet	: AISI / Brass
Pump Outer shell	: AISI
Motor Outer Shell	: AISI
Impeller	: AISI
Bearing	: Ball Bearing

CONTROL BOX TYPES AND CONNECTION DETAILS

- UNSEALED
- ALUMINIUM COVER AND BOX



Model :

TCP - 12

Suitable for :

12V Pumps

- SEALED
- PLASTIC COVER
- ALUMINIUM BOX



Model :

TCP - 24/48

TCP - 36/72

Suitable for :

24V and 48V Pumps

36V and 72V Pumps

- UNSEALED
- STEEL COVER AND BOX



Model :

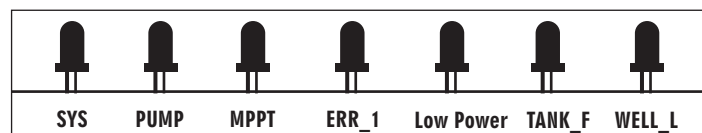
TCP - 72/110

Suitable for :

72~110V Pumps

CONTROL BOX INDICATIONS

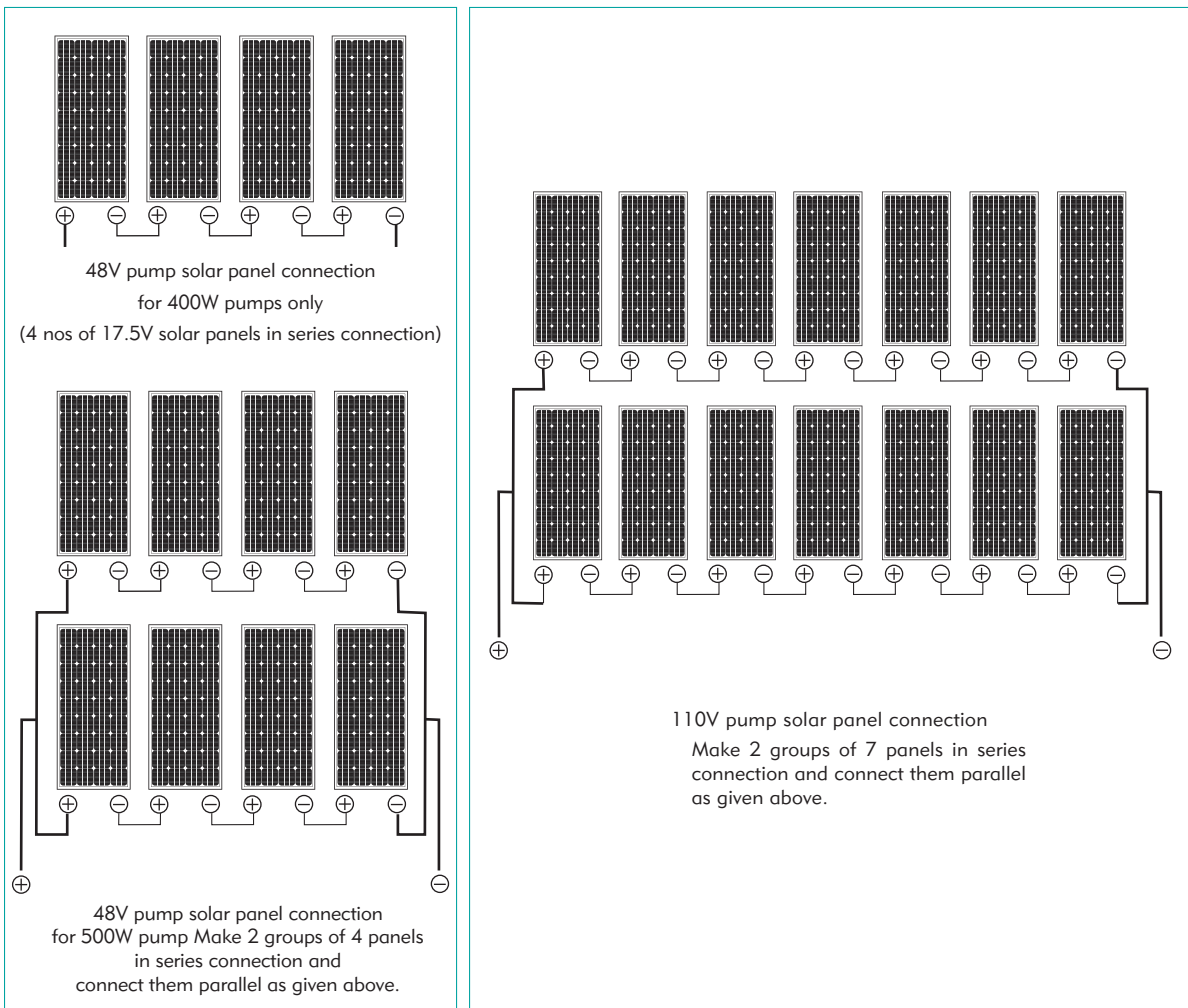
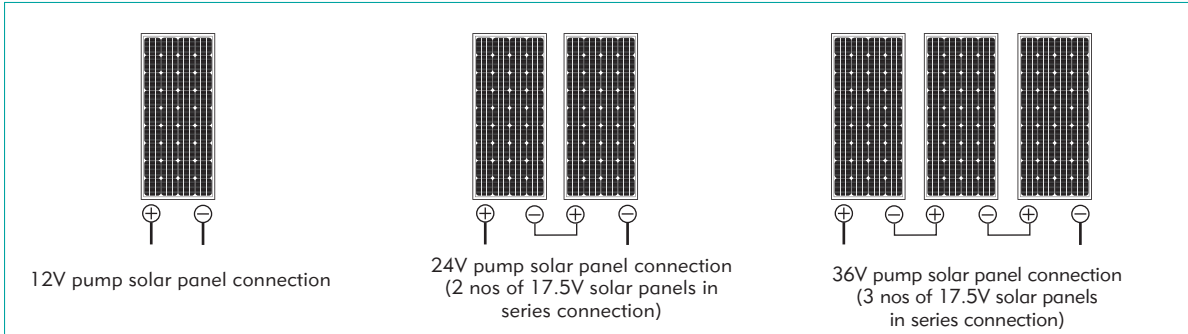
The control box is provided with set of LED's to indicate the different functions of the solar pumping system and the nature of problem in case of breakdown. Find below the control indicators and its functions for reference.



Indication	Function / Problem
SYS	Power ON
PUMP	Pump operating
MPPT	Pump operating at its best input power
ERR_1	Pump consuming high Amps / Insufficient sunlight
Low Power	Insufficient input voltage
TANK_F	Storage / collection tank is full
WELL_L	Water level in well / sump is low

SOLAR PANEL CONNECTION DETAILS

Note : The maximum power voltage of each solar panel is 17.5V



SOLAR PANEL SELECTION

The power of solar panel = Power of pump x 1.3

Output voltage of solar panel = Pump input voltage

The control box should be suitably selected based on the pump voltage

Note : The storage battery and frames required for solar panel mounting have to be sourced at customer end or contact our authorized dealer.

RECOMMENDED SOLAR PANEL SELECTION CHART

PUMP MODEL	PANEL POWER (W _p)	SOLAR PANEL		MAX. POWER VOLTAGE - V _{MP} (V)	OPEN CIRCUIT VOLTAGE V _{OC} (V)
		CAPACITY	QUANTITY		
TS75-0.5/80-SH	100	100W	1	17-18	21-22
TS75-0.7/120-SH	160	80W	2	17-18	21-22
TS75-1.2/210-SH	270	90W	3	17-18	21-22
TS75-1.4/500-SH	660	85W	8	17-18	21-22
TS75-1.9/210-SP	260	85W	3	17-18	21-22
TS75-2.0/500-SP	660	85W	8	17-18	21-22
TS100-2.5/500-SS	660	85W	8	17-18	21-22
TS100-2.5/1000-SS	1400	100W	14	17-18	21-22
TS100-3.1/500-SP	660	85W	8	17-18	21-22
TS100-4.0/500-SP	660	85W	8	17-18	21-22
TS100-4.0/500-SP	660	85W	8	17-18	21-22
TS100-5.5/500-SP	660	85W	8	17-18	21-22
TS100-4.0/1000-SP	1400	100W	14	17-18	21-22
TS100-5.2/1000-SP	1400	100W	14	17-18	21-22
TS100-8.0/1000-SP	1400	100W	14	17-18	21-22
TS100-3.5/300-SS	360	120W	3	17-18	21-22
TS100-4/500-SS	660	85W	8	17-18	21-22
TS100-7.5/500-SS	660	85W	8	17-18	21-22
TS100-5/1000-SS	1400	100W	14	17-18	21-22

BATTERY SELECTION PROCEDURE

To calculate battery capacity : $AH = \frac{T \times P}{V \times 0.6}$

To find the operating time of the pump : $T = \frac{AH \times V \times 0.6}{P}$

T - Pump running time in hours
P - Pump power in Watts
V - Pump voltage
AH - Ampere hour (Battery capacity)

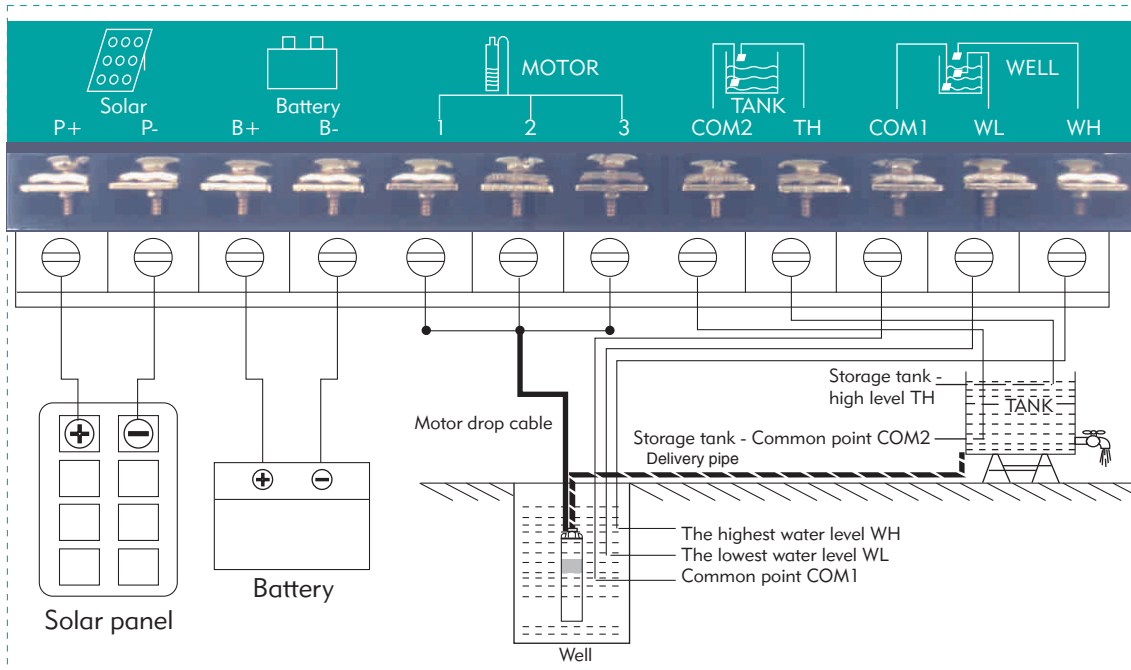
Example 1 (Pump running time calculation)

If the pump power is 200W, the battery capacity is 100AH, the pump voltage is 12V and when the battery is fully charged, then the pumpset running hour is calculated as : $100 \times 12 \times 0.6 / 200 = 3.6$ hours.

Example 2 (Battery capacity calculation)

If the pump power is 200W, the pump voltage is 12V, and the battery need to be used for 3.6 hours, then the battery capacity is calculated as : $3.6 \times 200 / 12 \times 0.6 = 100AH$.

INSTALLATION PROCEDURE



DWG - 1

Note ;

1. Solar mode :

Switch position to "SOLAR"

2. Battery mode :

Switch position to "BAT"

SOLAR MODULES

GENERAL DATA

SOLAR MODULES

Tormac Solar Pumping Systems are supplied with Highly Durable, high quality photovoltaic modules made up of Polycrystalline & Monocrystalline cells. These modules are available in the range of 3 Wp to 340 Wp and are certified in accordance with IEC 61215, IEC61730-II, IEC61701 (SALT MIST).

- 10Wp to 340Wp Poly Crystalline PV Modules
- 270Wp to 370Wp Mono Crystalline PV Modules
- Modules certified for IEC61215, IEC61730-II, IEC61701 (SALT MIST)
- IEC 62804 (PID) from German Laboratory
- Modules also certified for UL 1703 at Underwriters Laboratory for Canada & USA



Applications

Domestic Usage

Irrigation

Industries

Mining

Features

Up to 18% module efficiency

PID free modules

Multiple EL testing for defect free modules

Tested at 5400 Pascal's to withstand high wind loads

High Conversion Efficiency due to ARC coated glass

Note: The company reserves the right to modify the technical specifications and illustrations without prior notice.

TECHNICAL DATA - POLYCRYSTALLINE MODULE

Capacity rating - Pmax(Wp)	10	12	18	20	37	40	74	75	100	110	120	125	140	150
Cell Qty (pcs)	36	36	36	36	36	36	36	36	36	36	36	36	36	36
Rated voltage - Vmp(V)	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.8	18
Rated current - Imp(A)	0.57	0.68	1.02	1.13	2.15	2.3	4.19	4.25	5.7	6.25	6.78	7.08	7.89	8.35
Open circuit voltage - Voc(V)	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	22.2	22.5
Short circuit current - Isc(A)	0.65	0.78	1.16	1.3	2.3	2.5	4.6	4.7	6.2	6.8	7.4	7.7	8.3	8.7
Module efficiency (%)	9.52	11.43	9.89	10.99	12.03	12.94	13.25	13.43	13.31	14.64	14.32	14.92	14.08	15.09
Maximum System Voltage (V)	600V DC						1000V DC							
Temp. Coefficient of Pmax (%/°C)	-0.41						-0.41							
Temp. Coefficient of Voc (%/°C)	-0.32						-0.32							
Temp. Coefficient of Isc (%/°C)	0.05						0.05							
Nominal Operating Cell Temp (NOCT)	46°C±2°C						46°C±2°C							
Standard Test Condition (STC)	Irradiance 1000W/m ² , Tem. 25°C AM1.5						Irradiance 1000W/m ² , Tem. 25°C AM1.5							
Module Size L x W x H mm	300x350x22	520x350x22	465x665x34	840x665x34	1130x665x34	1260x665x34	1495x665x34							

TECHNICAL DATA - POLYCRYSTALLINE MODULE

Capacity rating - Pmax(Wp)	250	255	260	265	270	300	305	310	315	320	325	330	335	340
Cell Qty (pcs)	60	60	60	60	60	72	72	72	72	72	72	72	72	72
Rated voltage - Vmp(V)	30	30.15	30.3	30.5	30.7	36.6	36.75	36.9	36.7	36.9	37.2	37.4	37.7	37.9
Rated current - Imp(A)	8.35	8.46	8.59	8.69	8.8	8.2	8.3	8.42	8.59	8.68	8.75	8.83	8.9	8.98
Open circuit voltage - Voc(V)	37.6	37.9	38.2	38.4	38.6	45.2	45.4	45.7	45.5	45.7	45.9	46.2	46.5	46.8
Short circuit current - Isc(A)	8.6	8.7	8.8	8.95	9.05	8.6	8.7	8.8	8.98	9.05	9.12	9.19	9.26	9.32
Module efficiency (%)	15.4	15.71	16.01	16.32	16.63	15.5	15.76	16.02	16.28	16.53	16.79	17.05	17.31	17.57
Maximum System Voltage (V)	1000V DC													
Temp. Coefficient of Pmax (%/°C)	-0.41													
Temp. Coefficient of Voc (%/°C)	-0.32													
Temp. Coefficient of Isc (%/°C)	0.05													
Nominal Operating Cell Temp (NOCT)	46°C±2°C													
Standard Test Condition (STC)	Irradiance 1000W/m ² , Tem. 25°C AM1.5													
Module Size L x W x H mm	1640x990x36						1955x990x42							

TECHNICAL DATA - MONO CRYSTALLINE MODULE

Capacity rating - Pmax(Wp)	270	275	280	285	325	330	335	340	345	350
Cell Qty (pcs)	60	60	60	60	72	72	72	0-3	0-3	0-3
Rated voltage - Vmp(V)	31	31.1	31.3	31.5	37.2	37.3	37.4	17.57	17.83	18.08
Rated current - Imp(A)	8.71	8.85	8.96	9.05	8.74	8.85	8.96	37.90	38.1	38.4
Open circuit voltage – Voc(V)	38.7	39.1	39.5	47.8	46.5	46.9	47.4	8.98	9.06	9.12
Short circuit current - Isc(A)	9.05	9.12	9.2	9.26	9.05	9.12	9.17	46.80	47.1	47.3
Module efficiency (%)	16.62	16.93	17.24	17.55	16.79	17.05	17.3	9.32	9.4	9.48
Maximum System Voltage (V)	1000V DC									
Temp. Coefficient of Pmax (%/°C)	-0.42									
Temp. Coefficient of Voc (%/°C)	-0.33									
Temp. Coefficient of Isc (%/°C)	0.03									
Nominal Operating Cell Temp (NOCT)	46°C±2°C									
Standard Test Condition (STC)	Irradiance 1000W/m ² , Tem. 25°C AM1.5									
Module Size L x W x H mm	1640x990x36					1955x990x42				

SOLAR INVERTER CONTROL PANELS (SIP)

SOLAR INVERTER CONTROL PANELS (SIP)



SIP Solar Inverter Control Panels are designed to operate AC pumpsets with energy drawn from photovoltaic cells (PV) or grid supply / DG sets.. The inverter is customized to operate in dual supply mode, so the grid connected supply is used in the absence of energy from PV cells. A manual changeover switch enables switching between the two supply modes.

It's a fully electronic type of control panel fitted with ABB / Equivalent make inverter which starts automatically if DC bus voltage is more than the start DC voltage set in parameter. The inverter functions with the latest in technology maximum power point tracking (MPPT) algorithm to derive maximum power from the PV cells at any instant. The working principle is closely related with the VSD panels.

Features of Solar Inverter Control Panels:

It's an automatic design functions based on the DC input voltage from the solar modules.

Customised to operate in dual power mode, Solar / Grid supply.

DC Power Input	AC Power input
180 - 400 V DC	1 Phase 220V
400 - 800 V DC	3 Phase 220 V
(Output - 3 Phase 220 V)	3 phase 400V (Output 3 Phase - 400 V)

Complete motor protections in both the modes against supply faults.

Modular design of the power circuits for simpler maintenance routines.

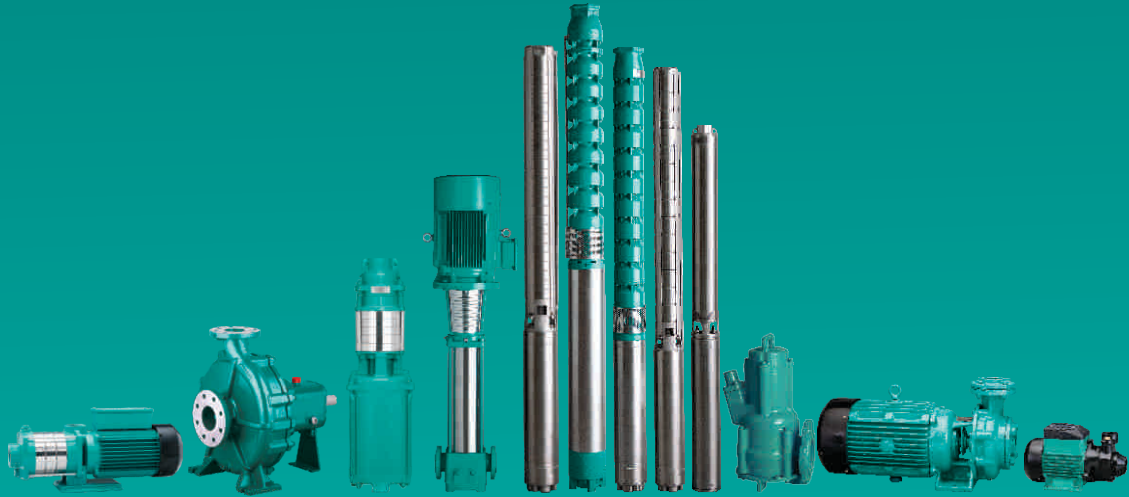
Support for standard communication protocols (Modbus, Profibus, Device Net, TCP/IP etc.)

All components are equipped in a powder coated sheet steel enclosures with proper cooling arrangements.

Range

- DC / AC input → 3 Phase 220 V AC output
0.37 kW - 11 kW
- DC / AC input → 3 Phase 400 V AC out put
0.37 kW - 45 kW

* The company reserves the right to modify the technical specifications and illustrations without prior notice.



T H E P O W E R B E H I N D T H E F O R C E

Naargo Industries Private Limited, one of the leading manufacturers of latest state of art, large range of pumps and motors, is managed by veterans who are in the pump industry for almost half a century. The products are employed in various applications like irrigation, domestic, civil construction, de-watering etc; The Company has a strong distribution network in India for sales & service and a strong global presence.

Quality is the key factor in Naargo's products. The expansive infrastructure and environment accredited with ISO 9001 quality certification, latest engineering softwares, high-tech machinery, futuristic pumping technology and high caliber workforce facilitate the production of flawless and efficient products on par with international standards under the brand name of "Tormac". The well equipped R & D wing stays alive to the changing global trends and comes out with viable solutions for innovative product development and upgradation.

The Products currently available include Stainless Steel Submersible Pumps, 4" Thermoplastic Submersible Pumps, 6" & 8" Cast Iron Submersible Pumps, Submersible Motors and Controls, Centrifugal Pumps, Inline Booster Pumps, Jet Self-priming Pumps and Peripheral Pumps.

The power, performance and endurance of the products backed by the uncompromising teamwork and value systems will certainly propel the company's growth towards new horizons in the pump industry.

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