AQUA®©

WORKMAN SHIP 30 MONTHS WARRANTY

Submerged
Turbine pumpsets

Combines the Robustness of Centrifugal Pumps, Efficiency of VT & Reliability of Induction Motors in a Ultra Low Maintenance, Portable Monoblock; Submersible enclosure.

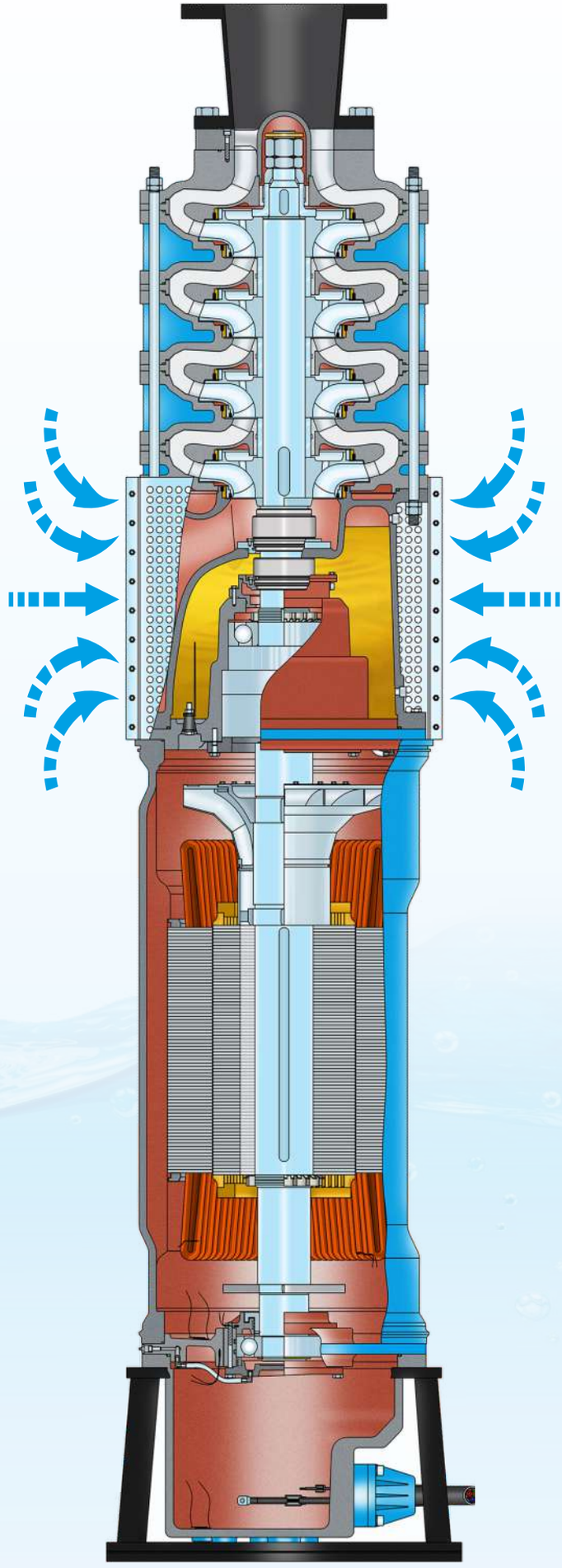
SubVT

Two-Stage
High Flow version

Five-Stage
High Flow version

Applications:

- Water **Supply** / Water **Distribution**
- **Service** Water
- **Platforms, Dry-Docks**
- **Make-Up** Water
- **Fire Fighting** *(Fire Service)*
- **River** Water **Intake**
- **Life Irrigation** *(Vertical & Inclined Mountings)*
- **Salvaging Dead Water**



Design :

Motor is **IEC / IS 60034** type Dry Air filled, Totally Enclosed ***(IP68)***; Self Surface Water Cooled ***(TESWC complying to ICA1WO)*** Submerged Squirrel Cage Induction type.

Due to elimination of Air Blower / Cooling Fan, the Windage losses are almost nil so; motor efficiency is slightly higher than air cooled bare shaft motors *(especialy in HT motors)*.

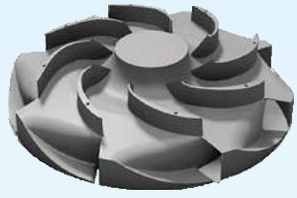
The insulations is of Class **"F"** for HT motors & Class **"H"** for LT motors; yet the Design Temperature Rise is restricted to just Class "A" for HT motors & Class "B" for LT motors; allowing excellent resistance to insulation failures.

All motors have **Dual Vacuum Pressure, Resin Impregnated Stator windings** for Excellent Dielectric Strength & larger HT motors are offered with robust Copper Bar# for LT motors; allowing excellent resistance to insulation failures.

As the motor itself is submerged in water, it is excellently Self Surface Water cooled irrespective of the Air Blower / Cooling Fan condition - huge benefit over Fan cooled TEFC / CACA motors.

Pump Casing is of Bowl / Diffuser type like in VT pumps.

Bowl



Diffuser

Heavy duty, **PN 25 / PN 40** rated Discharge Nozzles, withstand tensions & stresses associated with deep column depths & portable installations.

Enclosed **Impeller** is mounted directly on to the Extended Shaft of the motor hence eliminating alingment & vibration problems.

CADesigned, CFD optimized; Multi-bladed Water Hydraulics in Investment Castings *(smaller & medium sizes)* &/or Refractory Coated Sand Casting *(large sizes)* ensures good Surface Finish thereby Bowl Efficiency at par with Centrifugal & Vertical Turbine pumps.

Robust Oversized; Single piece **Shaft** is always made from rust free **Stainless Steel** & has its First Critical Speed well above the Maximum Operational speed thereby allowing **Fail Safe operation even when used with VFD.**

Heavy Duty, **Stainless Steel "Tie Rod"** type Stud-Nut clamping design *(like used in high pressure Boiler Feed pumps)* helps avoid Bowl's soft *(often CI for VT pumps)* female thread's erosion *(after frequent tightening / dismanting)* like in VT pump bowls.

Stainless Steel **Suction Stainer.**

Buffer, **Oil Chamber;** Oil bath effectively lubricates & cools both the Mechanical Seals in case of accidental dry running.

Comprehensive Cable Gland: Multi stage sealing ensures pressure resistant moisture proof sealing even in case of protective sheath puncture, ensuring moisture free motor environment.

Fully Submersible, dual sheathed PVC *(LT)* & EPR *(HT)* **Copper** cored Power and Control Cables.

Robust **Bottom Stand.**

Robust, API 610 inspired features:

- **Studs & Nuts** for diffuser type pump's pressurized components
- **O-ring** construction for Higher Pressure resistance
- Stubby, **One-piece Stainless Steel Pump-Motor Shaft** having it's **Critical Speed** above maximum operating speed allowing Vibration & Resonance.
- Dynamically balanced, **Keyed;** Enclosed **Impellers** of **Stainless Steel** for improved Erosion / Corrosion resistance in raw water.
- Pinned Wear Rings for easy maintenance.
- **Tough** ductile Iron / Cast Steel Bowls.
- **Bi-Directional** Seals, Bearings & Keyed Impeller/s allowing safe accidental / transient reverse rotation.
- Rubbed **Cast Iron** Motor Stator Frame
- All HT motors with **Copper** Bar Rotors
- **Sit Erosion resistant,** Textile Laminated Woven Inter-Stage Seal rings
- Bearing (L10H) Life is atleast **1,00,000 hours** (exceeds API 610 10th Edition requirements of 25,000 hours).
- **All Fasteners** exposed to water are exclusively of Stainless Steel.

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Design : **MOTOR END**

The Totally Enclosed, Self Water Cooled *[**TESWC IC-4A1W1** to **IEC/IS-60034_6**]* motor is similar to Dry Type Induction Motor, the major difference being the Degree of Protection - it is of **IP-68** Enclosure – to ensure **Hermetic Sealing** *(even under water immersion).*

HT Motor

LT Motor

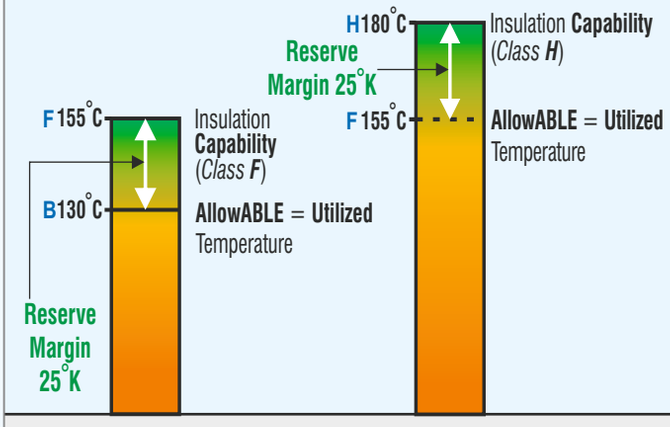
Huge Reserve Margin

As a rule of thumb in Motor Industry *(based on **Arrhenius** Equation)*; for every 10°C *(or more precisely 10°K)* Drop in Temperature, the useful Life of Insulation is Doubled.

Hence with a 50°K Reserve Margin *(v/s just 25°K of Competitors)*; Aqua's *(Motor {Stator Insulation})* will have a **6 times Higher Life** *(than competitors)*...!

Thanks to generous Reserve Margins & Optimized Design: Aqua's Motors keep coolly working even in scorching Indian summers.

Competing Designs / Motors

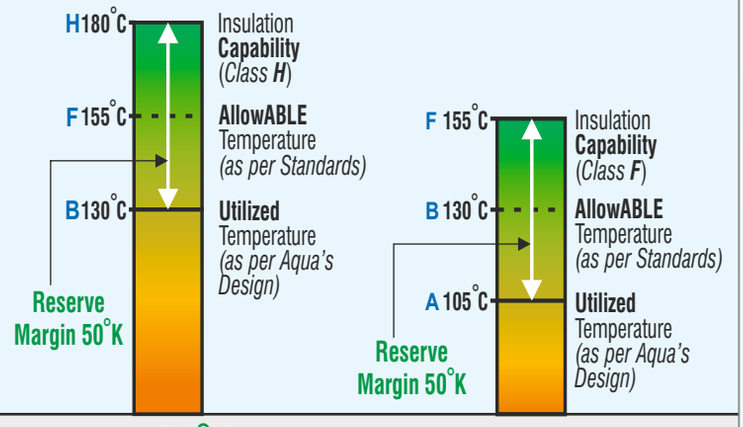


Just 25°K Thermal Reserve **Margin**

Class "**F**" Insulation x Class "**B**" Utilization

Class "**H**" Insulation x Class "**F**" Utilization

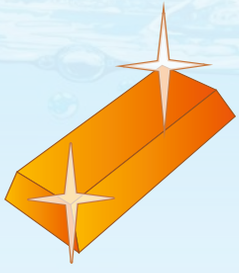
Aqua's TESWC Induction Motors



50°K Thermal Reserve **Margin** leads to **6x** Higher Life.

Option1 : *(Medium & Large LT Motors)* Class **"H"** Insulation x Class **"B"** Utilization

Option2 : *(HT & Smaller LT Motors)* Class **"F"** Insulation x Class **"A"** Utilization



Larger motors can be offered with **Ultra High Efficiency, Copper Bar Rotors** resulting in a **IE3** Equivalent* **Efficiency even for H. T. Motor** *(at a price premium)*.

IE2 Equivalent*	**High** Efficiency	✓	**STANDARD**
IE3 Equivalent*	**Premium** Efficiency	✓	**OPTIONAL**

Option of IEC IE3 Equivalent * Motor Efficiencies are available (at a price premium) even for HT Motors.

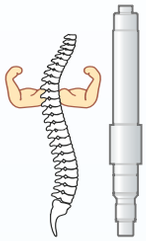
How to reduce Cable Size?

Consider a High Voltage Motor to reduce Cable Size.

**Refer our White Paper on 'IE Efficiency Submersible Motors...'*

At **Non Drive End** Bearing *(NDE)*, we offer *(at no extra cost)* **Increased Internal Clearance Class Bearings** *({for most models (larger than 15kW 2P, 30kW 4P & 40kW 6P})* for **Increased Safety** against **Accidental Dry Running.**

Design : **Pumpset**



A **Strong, Mono Shaft** for Fail Safe Operation

Single, Robust & oversized Shaft is Common between the motor & pump. It is (upto 1550kW 4P, 1200kW 6P, 900kW 8P) made from Stainless Steel & designed without any Sleeves (below the Mechanical Seals) thereby reducing maintenance problems & eliminating need of Costly Spare Parts.

Shaft Sealing is by means of **Two**, Independent, high quality Bi-Directional; **Mechanical Seals** permitting reverse running due to accidental back-flow. The Primary seal is always of **Silicon Carbide** faces to withstand Erosion incase of increased silt content in water.

Seals are rated for at least 16 bar pressure capability for L_{10H} life in excess of 50,000 hours &/or 10 years.

Superb Bearing Life
thanks to Heavy Duty Designs (upto Quadruplex arrangements are offered)

All **Thrusts** are absorbed by **Grease Lubricated, Anti Friction Bearings** located deep inside the motor & inherently **isolated from the pumped media -** this makes the **bearings Fail Proof** even in case of increased Silt / Abrasive levels in Pumped Liquid.

Anti Drip, Fully Synthetic: Super Premium Synthetic Grease ensures a minimum Regreasing Interval (F_{10H}) of 75,000h (for Pumpsets rated upto 650kW) & 45,000h (for larger kW)

Intelligent InBuilt Monitoring

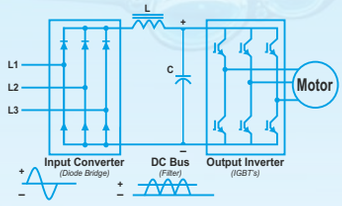
Easy Monitoring (& Remote Control#) of your Pumpset's Health.

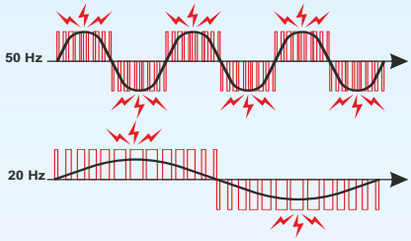
- **PSLD** detects Pressurized Water Leakage from Mechanical Seals.
- **CCWLD** detects Accidental Water Leakage from Cable Sheath's Cuts &/or Nicks into the Motor.
- **SBWLD** detect Accidental Water Leakage in to Motor's Stator Chamber.

- **BTDs** in the form of Bi-metallic Switches *(for All Pumpsets)* & **RTD's** *(PT100 - 3 Wire Simplex type - from Size > 150kW)* to Monitor Bearing Temperature *(without any Additional Cost)#*.
- **WTDs** in the form of Bi-metallic Switches *(for All Pumpsets)* & **RTD's** *(PT100 - 3 Wire Simplex type - 1 per each Phase - from Size > 150kW)* to Monitor Winding Temperature *(without any Additional Cost)#*.

#requires additional communication hardware

VFD



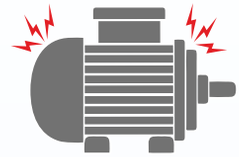


Side Effects of **Speed Control** of Pumpsets via **VFD's :**

1) Generate PWM Output with **High Harmonic Distortion** which causes **severe Di-Electric stress** *(on Motor's Stator's Winding Insulation)*,
2) Excite Motor Stator - Rotor **Bearing Circulating Currents** (*which flow through **NDE bearings***),
3) May cause **Shaft Vibrations** & **even Structural Resonance** *(if the Critical Speed of the Shaft lies below the maximum speed)* &
4) Reduce the Motor Speed which inturn **reduces the Volume Flow** of Motor **Fan's Cooling Air** *(in TEFC, CACA, TETV type Air Cooled Motors)* leading to Motor Stator **Winding OverHeating** *(despite over all speed & kW reduction)*...!

VFD Compatible

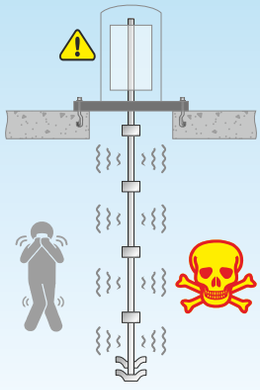
Thanks to Additional **Mica** *(Over & Above Glass Fibre Aramid)*, **+ Dual Vacum Pressure Resin Impregnation** *(VPI)*; Aqua's Motor's **Insulation** has **Extremely High** Stator **Winding Di-Electric Strength** enabling it to work satisfactorily even when fed by **VFD.**



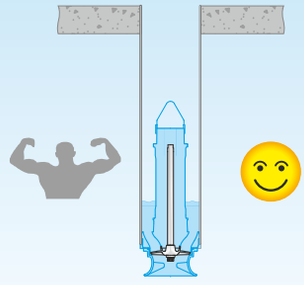
Larger & HT motors are always offered with Current Insulated NDE Bearing Housings, reducing the risk of bearing failures arising from internal Rotor-Stator-Bearing Circulating Currents excited by VFD's.

As the motor itself is submerged in water, it is Excellently Cooled irrespective of the Motor Speed.

Rotor Critical Speed & Variable Speed Operation



Multiple, Jointed; Long Slender Shafts
*(Vertical Turbine Pumpset **(VT)**)*

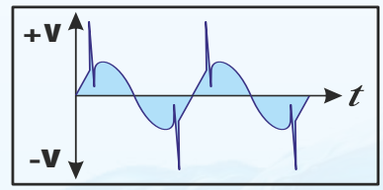


Rigid, Single; Robust Shaft
*(Submerged Tubular Column Pumpset **(ATBx)**)*

As the Critical Speed of Submerged Tubular Column Pumpsets lies Safely ABOVE it's Maximum Speed, there is No Risk of Resonance or Vibration (when speed is varied with VFD)

Tolerates...

...Wide Voltage Variation



...Power Spikes & Surges

Standard **Technical Specifications**		
Pump	Discharge Sizes	DN 550 to 2,100mm
	Flow Rate	Upto 27,000 m³/hr
	Head	Up to 40m
Motor	Ratings	15kW to 2500kW
	Speeds	1500, 1000, 750, 600, 500 & 375 rpm *(synchronous)*
	Duty & Enclosure	S1 & Exceeding IP 68
	Supply Options	3Ø; 415V, 550V, 690V, 3300V, 6600V, 11000 V
InBuilt Monitoring	Primary Seal Leakage Monitoring *(PSLD)*	By built in Detection System
	Cable Connection Chamber Water Leakage Detector *(CCWLD)*	Available from size 200kW & above
	Winding Temp Detector *(WTD)*	Available by default by Bimetallic Switches in each phase *(PT100 optionally available for sizes 150kW & above)*
	Drive End Bearing Temperature Detector *(BTD) (DE)*	Available by default by Bimetallic Switches from size 22 kW & above *(PT100 optionally available for sizes 150kW & above)*
	Non Drive End Bearing Temperature Detector *(BTD) (NDE)*	Available by default by Bimetallic Switches from size 22 kW & above *(PT100 optionally available for sizes 150kW & above)*
	Stator Chamber Water Leakage Detector *(SBWLD)*	Available from size 22 kW & above

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Material of Construction *(MoC)*		Option 1	Option 2
Pump Casing *(Bowl)* & Suction Bell Mouth		Grey Cast Iron, Ductile CI, NiResist, NiAL Bronze *(NAB)*	CF8, CF8M, CD4MCu
Impeller / Propeller		NiResist, NiAL Bronze *(NAB)*	CF8, CF8M, CD4MCu
Motor Casing, Cable, Terminal Chamber		Grey Cast Iron	NiAL Bronze *(NAB)*
Oil Chamber		Grey Cast Iron, Ductile CI, NiResist, NiAL Bronze *(NAB)*	CF8, CF8M, CD4MCu
Shaft		Stainless Steel	
Fasteners *(Exposed to Liquid)*		Stainless Steel *(A2 - SS304)*	Stainless Steel *(A4 - SS316)*
Elastomers		Nitrile	Viton
Mechanical Shaft Seals	**Primary** *(Pump Side)*	Silicon Carbide v/s Silicon Carbide	Tungsten Carbide v/s Tungsten Carbide
	Secondary *(Motor Side)*	Cast Chrome Moly Steel v/s Resin Impregnated Carbon	Silicon Carbide v/s Silicon Carbide
Wearing Ring / Plate *(Casing)*		Stainless Steel	
Motor Squirrel Cage Rotor Bars		Aluminum bar	Copper bar
Cables		PVC insulated, Copper Cored	ERPS insulated, Copper Cored
Oil		Eco friendly Paraffin White Oil ISO VG 20 or 40	
Auto Coupling	**Canister Ring**	Stainless Steel	
Riser		Mild Steel, Stainless Steel	RCC

Concept Benefits

Saves *(upto 66%)* **Land** Requirement*

Saves *(upto 50%)* **Capital Cost** of Entire Pumping Station*

Saves *(upto 75%)* **Spare Parts** & **Consumables***

Saves *(upto 66%)* **O&M Staff***

Low Energy Cost : Due to Elimination of Ancillary & Auxiliaries; **Wire to Water Power Consumption** of Submerged Tubular Column Pump based Pumping Station **is slightly Lower** *(compared to Conventional Bare Shaft Pump - Motor Set based Pumping Stations).**

Requires No Special Pre – Post / Ancillary-Auxillary Operations; like Operating & Maintaining the Forced Water Lubrication systems operation, No damage due to Flood or Rains.

No need for Frequent Periodic....

Shafts/Sleeves &/or **Coupling** | **Gland Packing** | **Oil** &/or **Grease**

Minimal Noise, Vibration & Heat Emission; due to **elimination** of Auxiliary & Ancillary systems *(like Forced Water Lubrication, Thrust Bearing Cooling system, Motor Hear Exchanger)*.

Low Life Cycle Costs *(LCC)**

**(refer marketing@aquapumps.com for additional white papers)*

- **Minimal Station Superstructure**
- **Simple Pipe Work**
- **Simple Foundation -** *conducive for Water Logged Terrain*
- **Quick Connection & Disconnection of Pumpset.**
- **Inherently Flood Proof**
- **Unsurpassed Reliability**
- **Zero Consumables**
- **Simple to Operate**
- **Minimal Routine Maintenance**
- **Competitive Wire to Water Pumping Machinery Efficiency.**

Major **Technical Challenges** for **VT Pumps** Solution:

- Longer suspension length to draw water from deeper resulting into higher weight of the equipment.
- Requires sufficient room height with higher capacity overhead crane in the pump house super structure. Heavy duty Civil structure suitable to carry load of the crane with equipment.
- Due to cantilever suspension design CG of the equipment is located away from base making it overall unstable design.
- Highly sensitive to vibration : Closer degree of dynamic balancing requires for both pump and motor rotors and coupling.
- Higher wear and tear of line shaft bearings and shaft sleeves as line shafts are always in contact with pumped water.
- Higher degree of skills requires for achieving close tolerance for levelling, centring and alignment of foundation while erection.
- Loss of power due to indirect transmission of power, friction in line shaft bearings and Thrust Bearings of pump & motors.
- Additional requirement for external filtered water for lubrication of line shaft bearings in case of raw water application.
- Additional power requirement for external water cooling or air cooling of surface motor to maintain temperature rise of windings within limit.
- Additional requirement of Air Ventilation System for the pump house in case of Air Cooled Motors.
- Higher noise in case of higher speed machines requiring additional Noise protection enclosure.
- Higher maintenance cost due to higher wear and tear and sensitivity to vibration.
- Additional instruments required such as Vibration Monitors for Pump and Motors, Temperature sensors for Thrust bearing of Pump, DE/NDE Bearings of Motor and Cooling water for Pump and motor bearings.

Market **Drivers:**

- Due to depleting water levels in almost all the water sources and large variation in intake water levels makes it necessary to reach to deeper levels. This calls for longer suspension lengths for the VT pumps making installation further challenging.
- Due to space constraint in city and industrial plants there is increasing demand for compact foot print and underground installation having versatility and flexibility in installation.
- Demand for highly reliable, robust and self-reliant solution. Less dependency on external systems like cooling / lubrication system and monitoring instruments
- Long term trouble free operation of system. Equipment with less of negligible maintenance are highly in demand.
- Lowest life cycle cost: Lowest CAPEX and OPEX cost of ownership. Focus on higher sustainable system efficiency.

Summary:

1. Submersible Pumpsets will be mitigating all of the above technical challenges faced by VT Pumps and will also satisfy the major market drivers.
2. It is estimated that use of submersible pump solution will have 7 to 10% of better system efficiency which will be sustainable over loner period
3. Submersible pump solution will provide approx.. 40 to 45 % saving in Life cycle cost for given system compared to VT Pump solution

Market **Approach:**

Very focused marketing approach with following approach is required *(Similar to what is done for Concrete Volute Pumps).*

1. High level of conceptual selling with focus on user benefits ma
2. Identify Target market specific application
3. Create high level of market visibility: Utilise various platforms like Exhibition, Conferences and Seminars
4. Deploy Effective GO TO MARKET strategy
5. Create success stories with pilot projects in each market segment
6. Deploy highly knowledge based sales force backed up with strong service network

Conclusion:

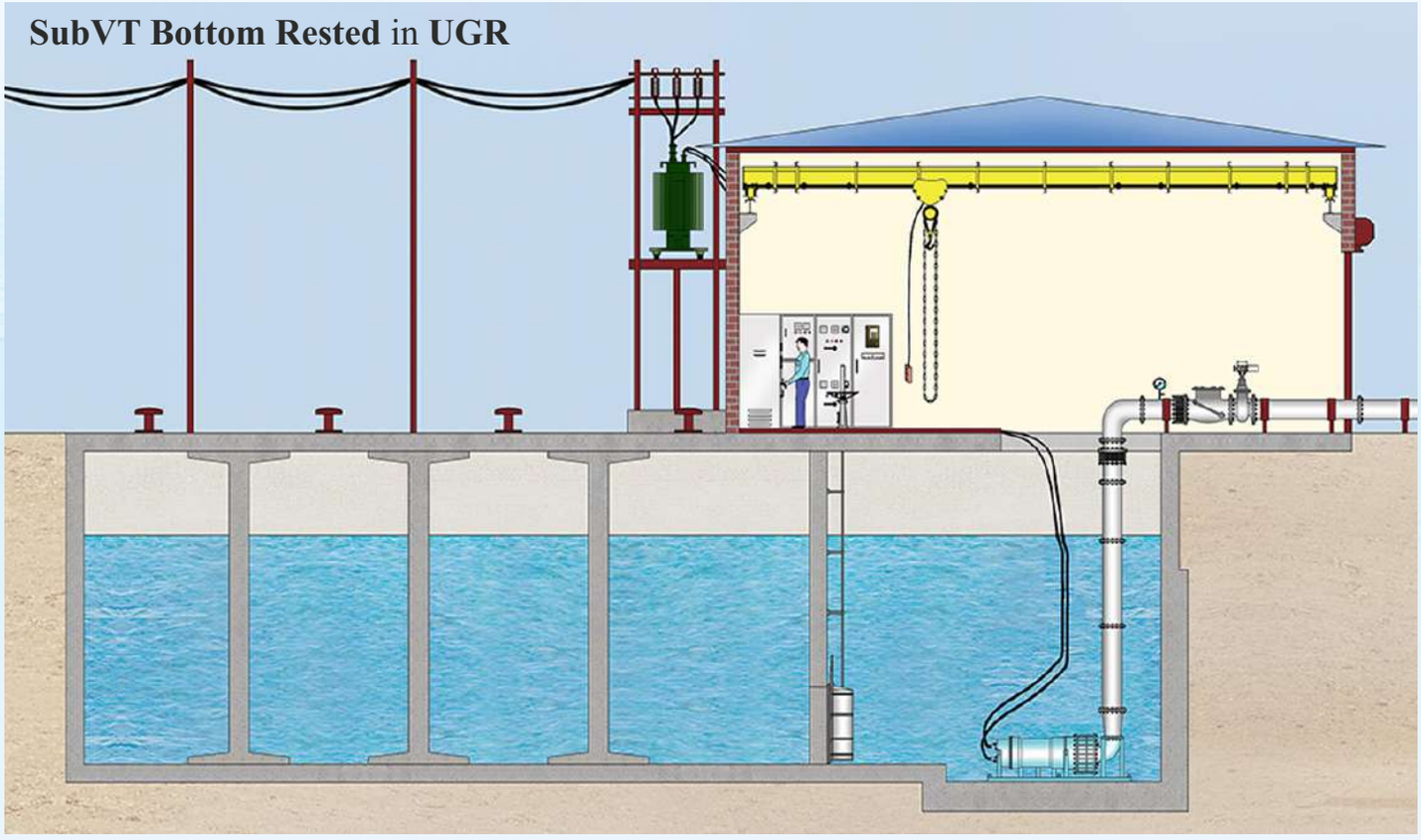
Submersible pump has great potential to replace the VT Pump market in India. It has potential to replace atleast 50% market in next 3/5 years period and it will increase progressively over the time.

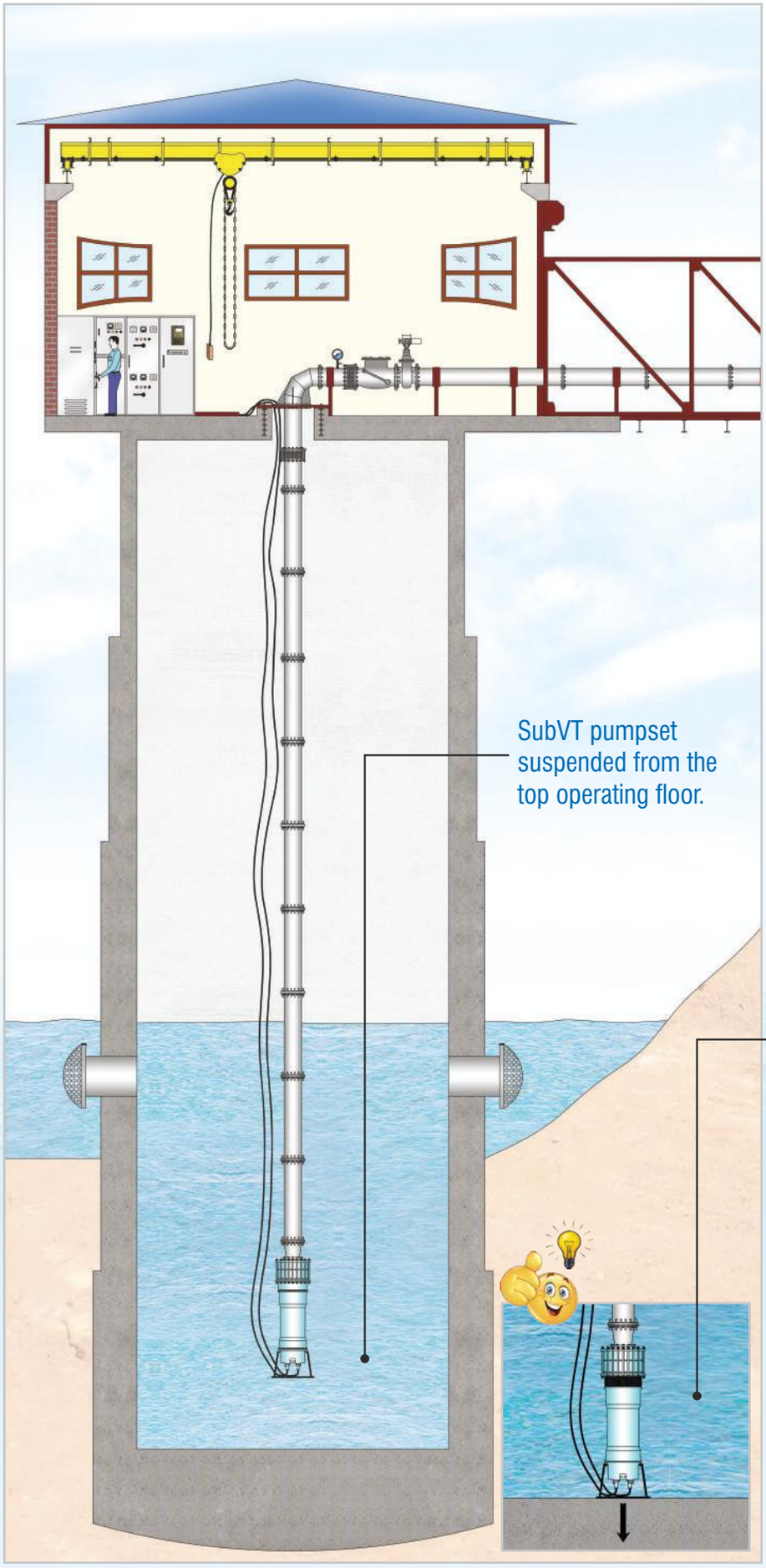
This is right time to launch in Indian market with strong technology and proven credentials to take early bird advantage.

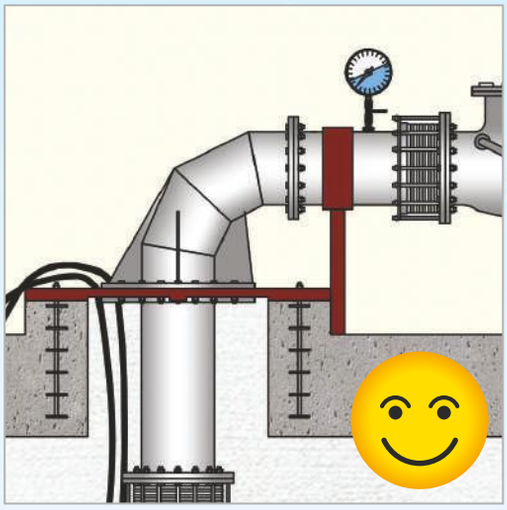
Five Compelling Advantes:

- Unsurpassed **Reliability**
- **Zero** Consumables
- **Simple** to Operate
- **Minimal** Routine Maintenance
- **Competitive** Wire to Water Pumping Machinery Efficiency.

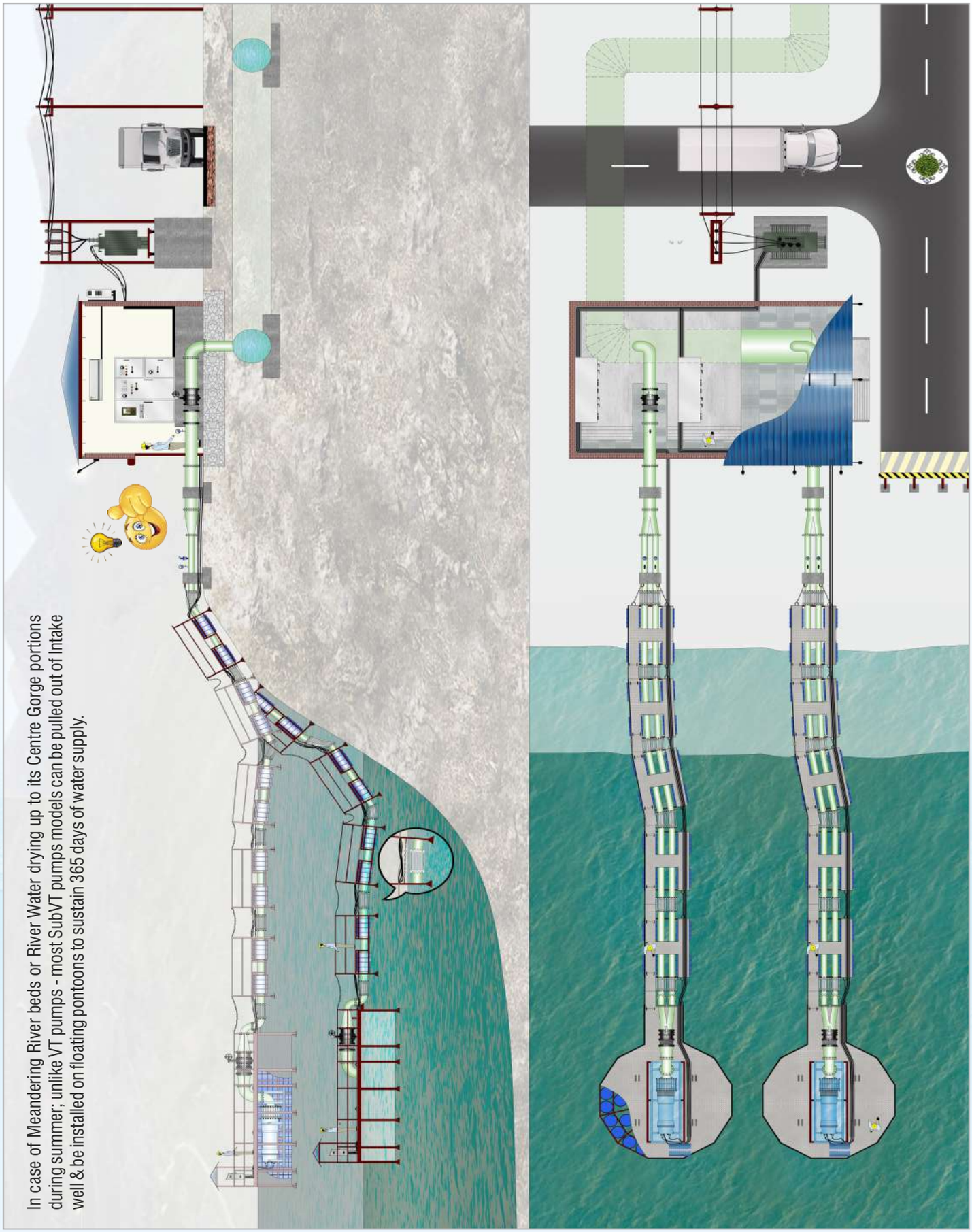
Installations




SubVT pumpset
suspended from the
top operating floor.
SubVT pumpset can also be bottom
rested, thereby eliminating any live or
dead loads on top operating floor.



SubVT on Floating Pontoon *(Self adjusting in accordance with water level)*



In case of Meandering River beds or River Water drying up to its Centre Gorge portions during summer; unlike VT pumps - most SubVT pumps models can be pulled out of Intake well & be installed on floating pontoons to sustain 365 days of water supply.

AQUA®©

MAKE IN INDIA

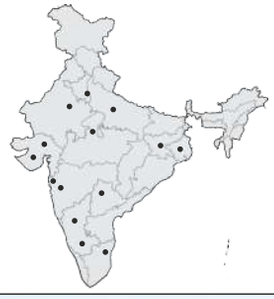
Aqua has been awarded the Prestigious

Best Quality Pump Vendor

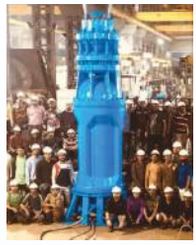
by

BHEL

A Pan India Support set up



Some of Our **Other Products**



Submerged Turbine Pumpsets *(AVT)*

Submerged Centrifugal Pumpsets *(SCF)*

Dry Pit Installed Submerged Centrifugal Flood Proof Pumpsets *(ARFP)*

Non Clog Submersible Sewage Pumpsets *(ANS)*

Pontoons & Walkways

Submerged Elbow Pumpsets *(AES)*

Submerged Mine Dewatering Pumpsets *(AMS)*

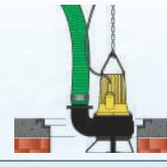
Submersible Slurry Hydro Electric Pumpsets *(ASSHE)*

Submersible Slurry Pumpsets *(ASS)*

Submersible Dredging Pumpsets *(ADS)*

Dry Pit Installed Non Clog Flood Proof Submersible Pumpsets *(ANFP)*

Ultra Compact Submersible Sewage Pumpsets *(Scavenger)*



Submersible Sewer Manhole Pumpsets *(AM)*

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एक कदम स्वच्छता की ओर

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www.aquapumps.com

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