Land & Cost Saving;

Future Proof & Augmentable;

Flood Proof & Climate Change Resistant;

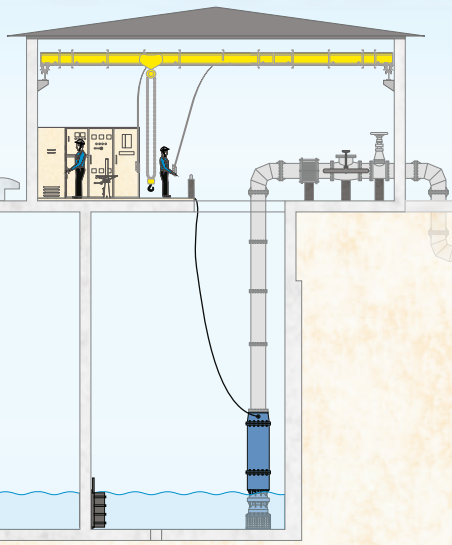
Ultra Low Maintenance & Least Energy Consuming;

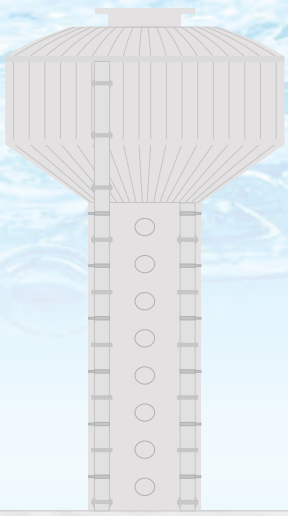
& Least Life Cycle Cost (LCC);

Water Supply Distribution Pumping Stations

...Enabled by Aqua's Submerged Pumpsets

Flood Proof | **Land Saving** | **Cost Saving** | **Compatible** | **Energy Saving** | **VFD Compatible**





Comparision : Land & Cost of PS

(All PS with 10W + 3S x 1364m³/hr pumps each)

Submerged Pump based Flooded Suction Pump Room

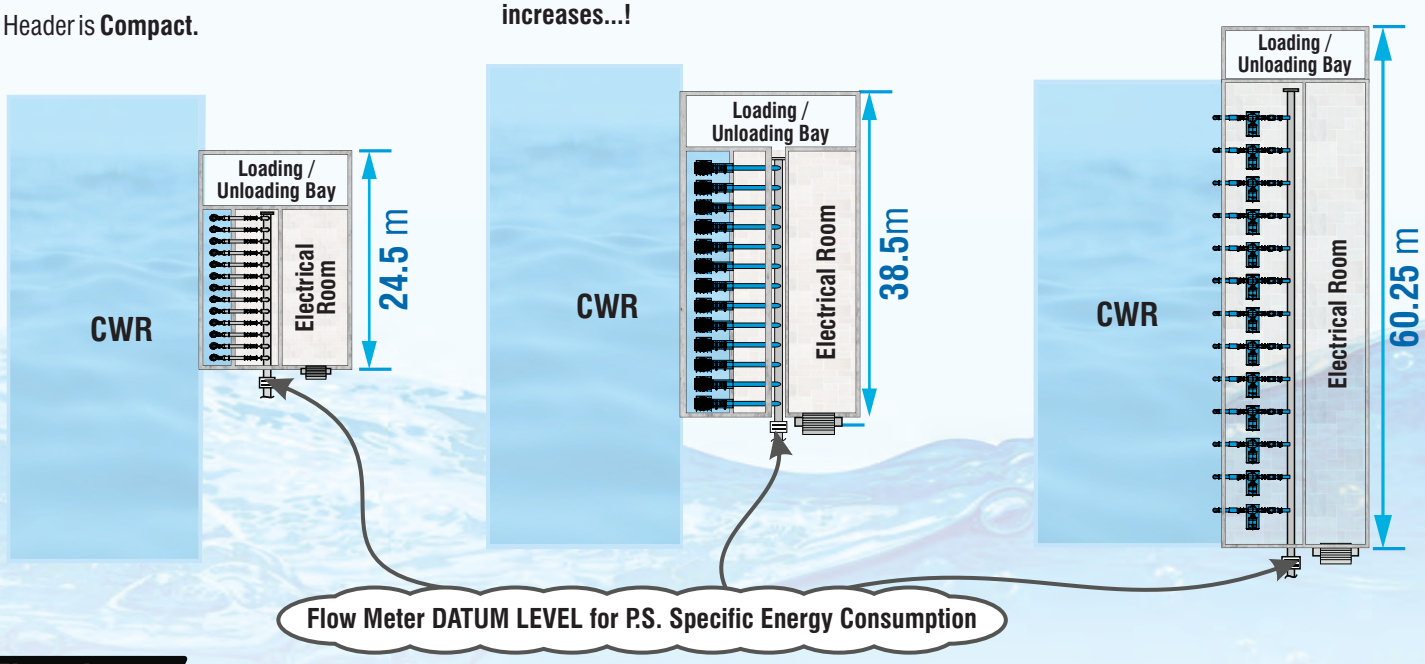
Due to Self **Water Cooled** Motors & ability to quickly pull up any single pump within minutes *(for maintenance at Loading/Unloading Bay)*, in Submerged pumpsets; the Pumpset Center to Centre SPACING can be kept LOW *(as per minimum permissible by HIS Suction standards)* & hence the WIDTH & Cost of Pump Room & Common Header is **Compact.**

VT based Flooded Suction Pump Room

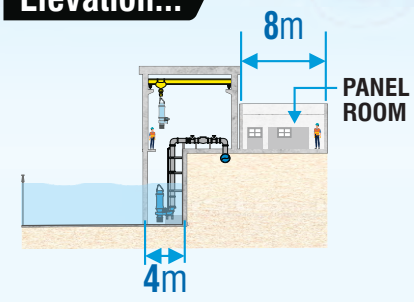
Due to **Air Cooled Motors** *(requiring ample free space between motors to avoid each other's heat pickup)* & Operator Access Space *(required between every pumpset for their O&M)*, in VT pumpsets; the Pumpset **Center to Centre SPACING is HIGHER** *(than the minimum permissible by HIS Suction standards)* & hence the WIDTH & Cost of Pump Room & Common Header **increases...!**

HSCF based Positive Suction Pump Room

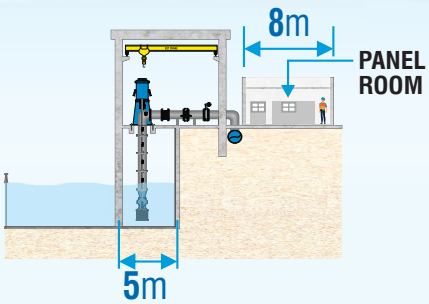
Due to **Perpendicular Orientation** *(of Motor with respect to Piping)*; in HSCF pumpsets the pump Center to Centre SPACING & hence the WIDTH *(& Cost)* of Pump Room & Common Header **increases drastically...!**



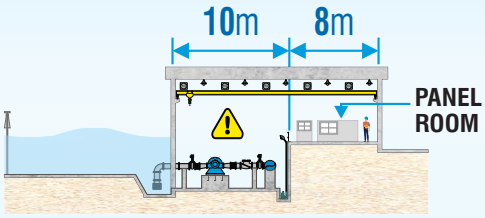
Elevation...



No Need of Below Ground PumpRoom



No Need of Below Ground PumpRoom



Below Ground PumpRoom is Required

Conclusion: Submerged Pumpset based Pumping Station Saves & upto 55% Land...

Land Saving

Comparision : Land & Cost of PS

(All PS with 10W + 3S x 1364m³/hr pumps each)

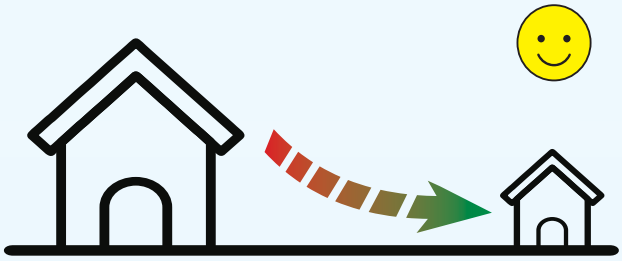
Component / Type of Installation			Unit	Submerged Pumping Station	VT Pumping Station	HSCF Pumping Station
Time Frame of Project Completion			month	**6**	**9**	**18**
Capital Cost : Civil Structure *(Pump Room)*	**Pumpset Portion**	Carpet Area : Under Ground Portion	m²	82.0	172.5	562.5
		Rate / m²	₹/m²	17,000	17,000	22,000
		Cost of Under Ground Portion	₹	**13,94,000**	**29,32,500**	**1,23,75,000**
		Carpet Area: Above Ground Portion	m²	163.0	212.5	40.0
		Rate / m²	₹/m²	14,000	14,000	14,000
		Cost of Above Ground Portion	₹	**22,82,000**	**29,75,000**	**5,60,000**
	Electrical *(Switch Gear)* **Room**	Carpet Area	m²	196	340	480
		Rate / m²	₹/m²	12,500	12,500	12,500
		Cost of Electrical Portion of Pump Room	₹	**24,50,000**	**42,50,000**	**60,00,000**
	Pump Room	**Total Component Capital Cost**	₹	**61,26,000**	**1,01,57,500**	**1,89,35,000**
	Land Cost of Pump Room	Area	m²	759	1,261	1,546
		Rate /m²	₹/m²	**20,000**	**20,000**	**20,000**
		Total Component Capital Cost *(IV - not time interest adjusted)*	₹	1,51,80,000	2,52,20,000	3,09,10,000
CAPEX - Capital Cost : Pumping Station *(Civil)*			₹	**2,13,06,000**	**3,53,77,500**	**4,98,45,000**
			comparative %	**100%**	**166%**	**234%**
Capital Cost	**Pumping Machinery**	Pump Set Qty. *(W)*	nos.	**10**	**10**	**10**
		Pump Set Qty. *(S)*	nos.	**3**	**3**	**3**
		Nearest Standard Motor Rating	kW	**82**	**82**	**82**
		Approx. Total Rating of Installed Pumping m/c	kW	1066	1066	1066
		Rate of Pumpset *(Pump+Motor+Suction & Delivery manifolds)*	₹/kW	**18,000**	**24,500**	**22,000**
		Rate of Common Header	₹/kW	1,725	2,100	2,760
				Due to Perpendicular Orientation of Motor with respect to Piping; in HSCF pumpsets the pump Center to Centre SPACING & hence the WIDTH *(& Cost)* of Pump Room & Common Header increases drastically		
		Lump Sum Capital Cost P/M	₹	**2,10,26,850**	**2,83,55,600**	**2,63,94,160**
CAPEX - Capital Cost : Pumping Station *(Civil)* + Pumping M/c			₹	**4,23,32,850**	**6,37,33,100**	**7,62,39,160**
			comparative %	**100%**	**153%**	**175%**

Conclusion: Submerged Pumpset based Pumping Stations are upto 45% More Economical . . . .

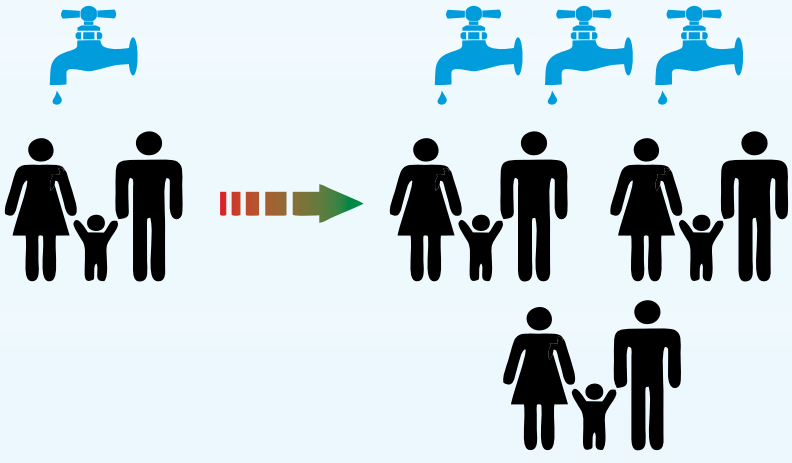
Air Cooled Motor - Conventional Pumpsets require Costly & Spacious Pump Rooms

Submerged pumps can be installed in Existing Old Clear Water Sumps by simply cutting open the top slab

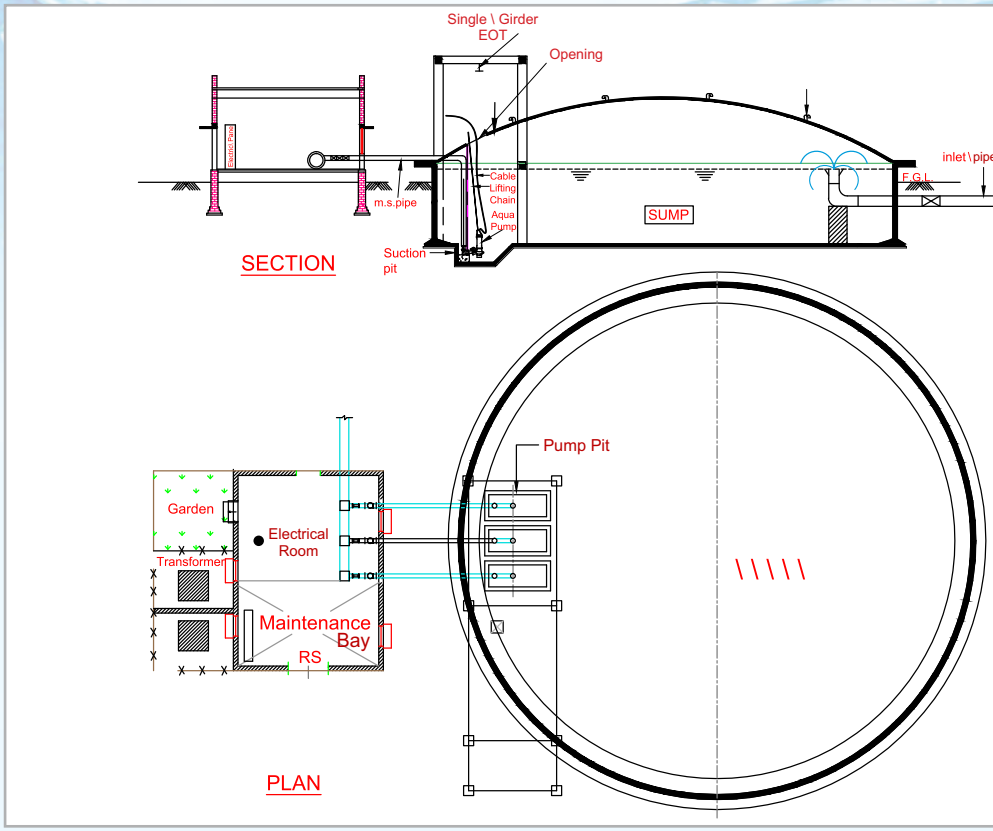
Submerged pumpsets can be immersed directly in to Wet Pit *(CWR)*; hence **eliminating** the need of Dry Pump Room resulting in **upto 55% saving** in **Land** required ....



...the Saved Land can be **Better Utilized** to make a **Larger Clear Water Reservoir** *(CWR)* thereby **serving a Larger Population** *(in same available land)* for **Additional Decades** to come.



Bottom Rested Submerged Pumps Permit Flow Augmentation by Larger Pumps w/o modifying / cutting Pump Motor Floor Civil Slab.



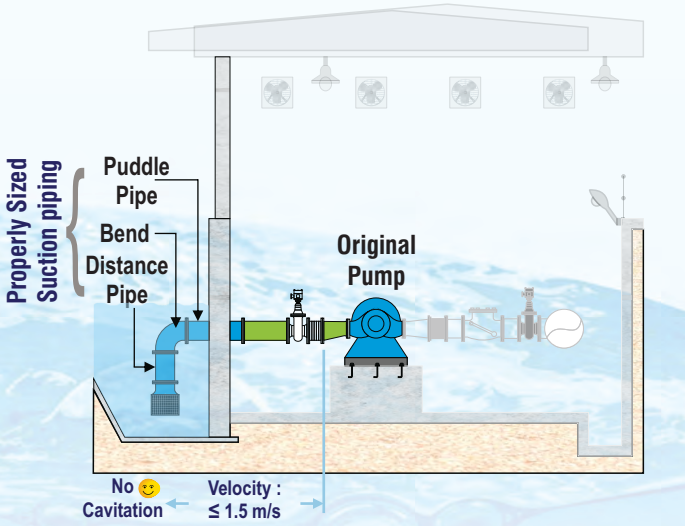
Flow Augmentation

Flow Augmentation upto 2.5X within Existing Pump Rooms & Existing Piping is Easily Possible with Submerged Pumpsets

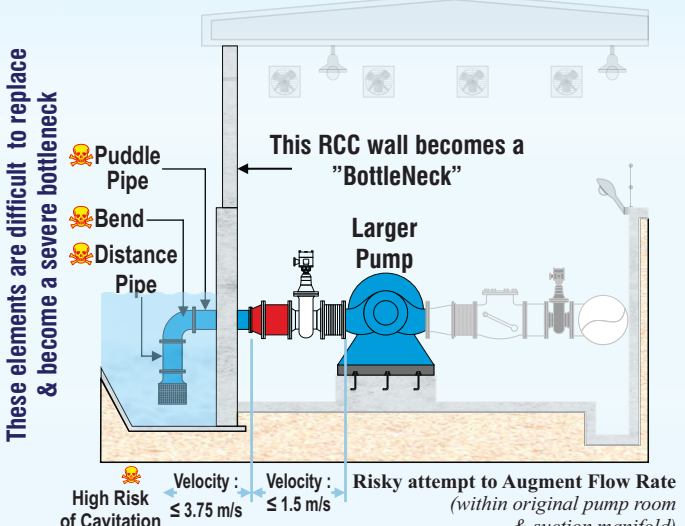
- Old city WDS were developed around **1950's-80's** – but now Old Bunglows have given way to High Rise Flats which impose approximately **4** to **6** times more Population Density...!
- Naturally, such **increased population** requires more water & hence will **severely stress the existing WDS's rated output.**
- Old design Dry Installed HS Centrifugal pumpsets are installed in Dry Pit *(Underground Pump Rooms)* & **"suck"** water from a **Cast Iron suction manifold** which:
  - Is **Grouted** into a **thick RCC partition wall** which separates Water of Clear Water Reservoir *(CWR)* from Under Ground Pump Room *(UGPR – Dry Pit)* – hence chipping out the old small suction pipe to replace it with a new large suction pipe is :
    - **Tedious** *(to chip off concrete in suffocating underground CWR)*,
    - **Time Consuming** *(leads to total shutdown of WDS for weeks)* disturbing public water supply &
    - **Risky** *(the new cement mortar plugging may never be as leak free as the old mono lithic casting).*

Unless, a larger flow; Dry Installed HS Centrifugal pumpset is **also** fitted with a **Larger Suction Pipipng; i**ncreasing pump's flow rating will *(also inevitably increase Suction Velocity)* **lead to dangerous Cavitation, Vortexing, & even premature pump failure..!**

Original Pump Room + Original *(HSCF)* Pumps



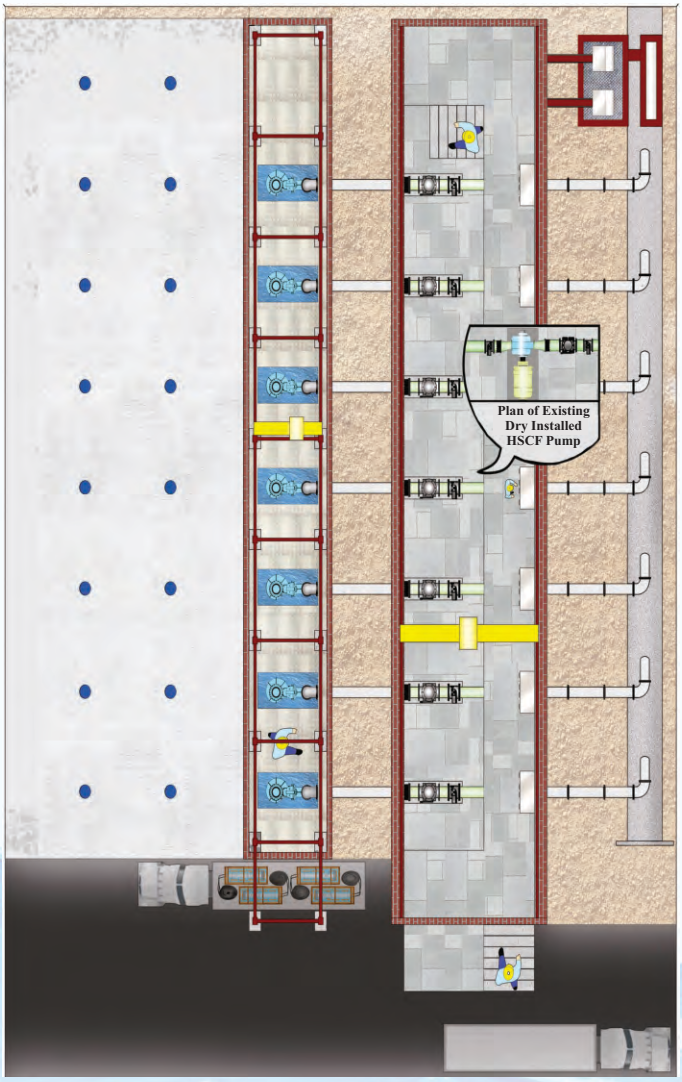
Original Pump Room + New *(HSCF)* Pumps



This is where, SubCF pumpsets **are a Blessing** – they can be immersed directly in to Wet Pit *(Clear Water Sump)*; hence :

- They don't need a Suction Piping so there is **no risk of Cavitation, Vortexing or premature damage**
- They can simply be lowered into CWR Sumps so as to sustain Water Supply 24x7x365 **without** pump change over **interruption** or **shut down.**

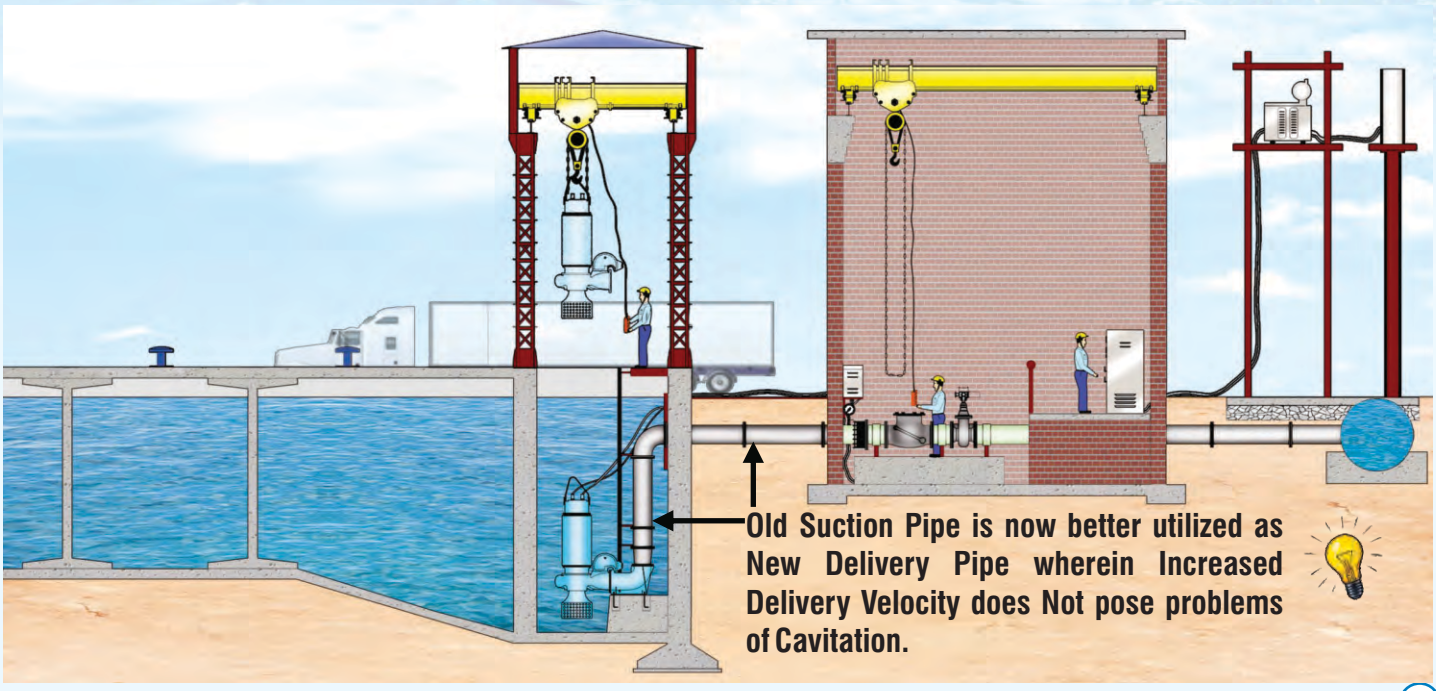
Augmentation of existing Dry Installed HSCF Pump based Water Pumping Station without disturbing Civil Structure & Grouted Suction Manifold.



OLD

Replacing Dry installed HS CF pumpsets by Wet installed Submerged pumpsets; utilizing Old Suction pipes as Delivery pipes

NEW



Old Suction Pipe is now better utilized as New Delivery Pipe wherein Increased Delivery Velocity does Not pose problems of Cavitation.

Due Climate Change, Incidences of **Intense Rainfall in Shorter Time** are Increasing, while **Rapid Urbanization** & **Encroachment of Drains** is leading to Frequent Flooding of Below Ground Pumping Stations.

Infact, the latest version of **GoI's MoHDA's CPHEEO's "Water Manual"** highlights this Risk & **discourages Conventional Air Cooled Motor** ***(prone to Failure If Flooded)*** **Horizontal Centrifugal pumps** for Below Ground PumpRooms.

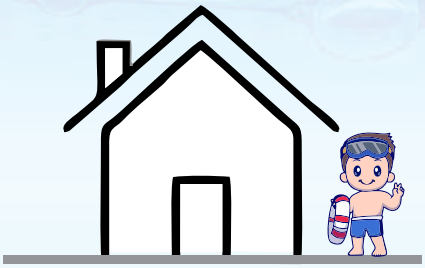
Water PS with Old Technology Air Cooled Motor Horizontal Dry installed Pumps - Floods have rendered it useless

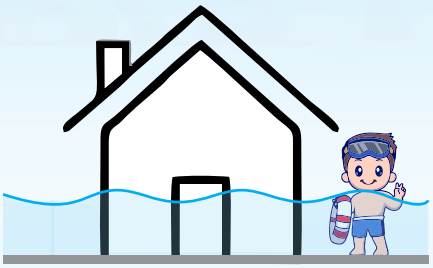
Chapter 5
Pumping Station and Machinery

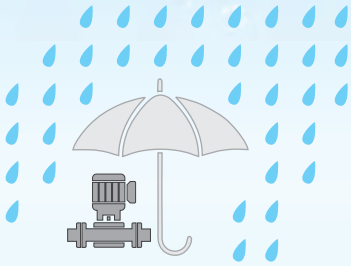
Part A- Engineering

Installation of horizontal centrifugal pump on floor below surrounding ground level to the extent possible should be avoided as in the event of burst of any valve or pipe of individual delivery of pump in the pump house, the motor can be damaged due to water logging on the floor.

Source : Water Manual by CPHEEO







Flood Proof Insurance

for Your Water Pumping Stations

All of Aqua's Pumpsets, installed Either Dry or Wet; are always equipped with IP68 Hermetically Sealed, Water Proof Motors & hence are Not Adversely Impacted by Flooding....

Flood Proof **WET Pit PS**

Aqua's Submerged pumpsets, Wet Installed in Below Ground Pump Room.

Equipped with IP68 Hermetically Sealed, Water Proof Motors they are Not Adversely Impacted by Flooding....

All of Aqua's Pumpsets can be Bottom Rested thereby Simplifying/Reducing Cost & Complexity of Pump/Motor Floor

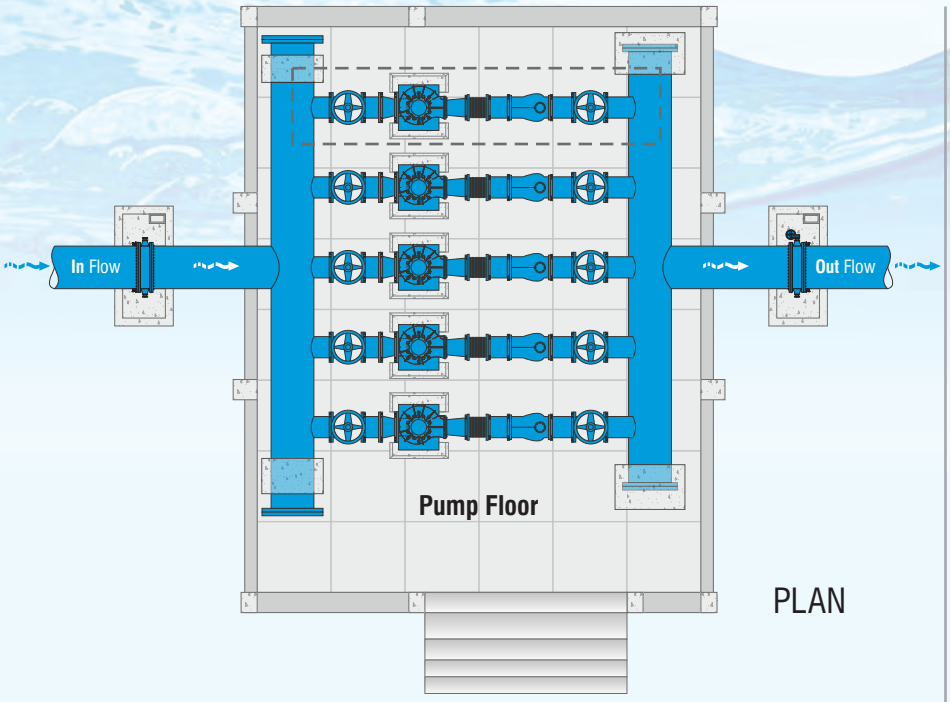
Flood Proof **DRY Pit PS**

Aqua's ARFP pumpsets, Dry Installed in Below Ground Pump Room

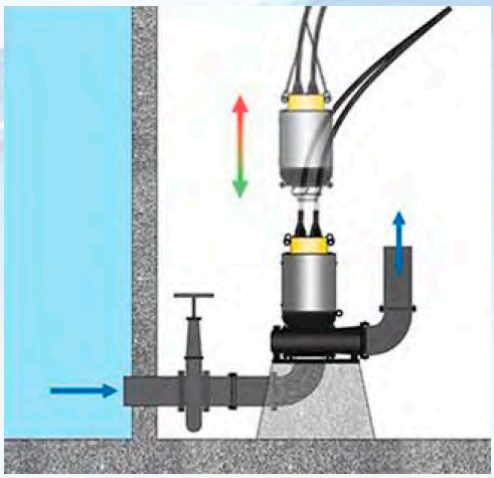
Dry Installed Flood Proof Motor Pumpsets are the latest technological development - their Pump-end is similar to **Conventional** *(End Suction)* **Volute pumps** while their Motor-end is much more superior then Conventional Air / Water Cooled Bare Shaft Induction motors - these motors *(already popular in Submersible pumpsets)* are **Fully Immersible** thanks to their **IP68** enclosure.

The motor is **Amphibious** & hence can safely operate either in totally Dry or Submerged *(Flooded)* conditions.

A built in Jacket Cooling system ensures that the motor is efficiently cooled irrespective of whether or not it is submerged; while the **IP68 Enclosure** ensures that **even if the surroundings are flooded, the Motor is Safe to Run.**



PLAN

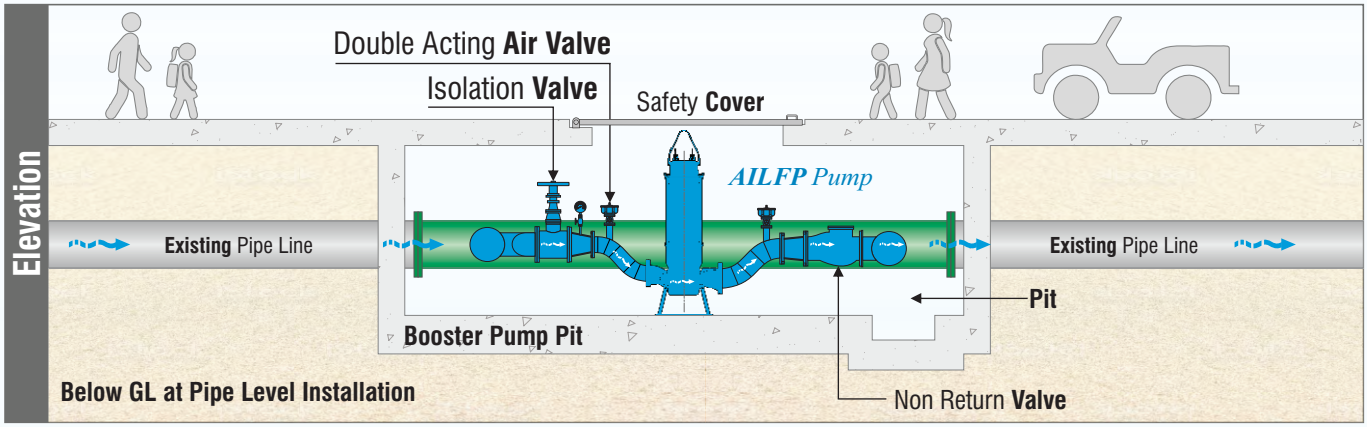


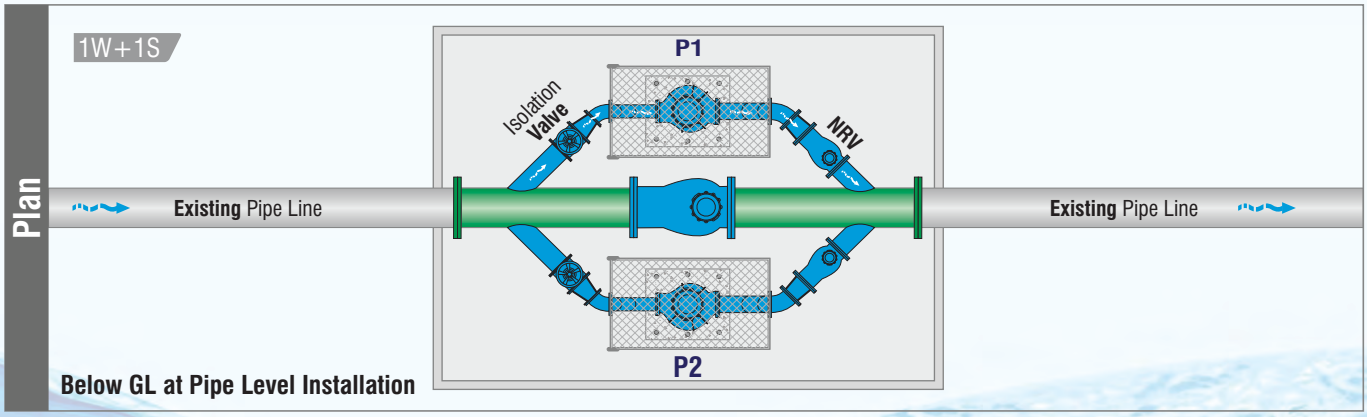
Thanks to the **Back Pull Out design**; the Entire Motor+Shaft+Impeller can be pulled out as a **Single unit** *(without disturbing the pipeline)*; Maintained Ground Level & Refitted within minutes *(without the risk of misalignment).*

Upgrade your Existing Below Ground Pump Rooms to Flood Proof Pumping Stations

Localized, InLine Pressure Boosting

Localized, InLine Pressure Boosting to Improve Water Supply to High GL/ Tail End Zones without the need of an dedicated pumping station





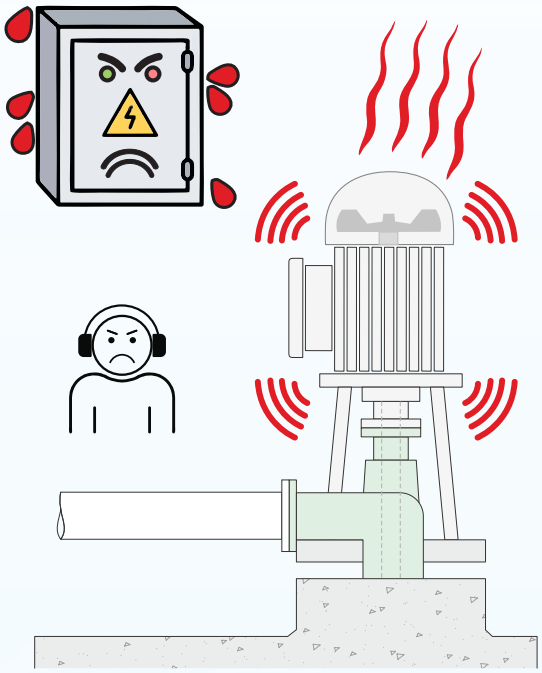
Ground Level Pressure Boosting

Below Ground at Main Pipe Level ....& the Surrounding Pit can be constructed later on....

Thanks to Amphibious, Flood Proof IP68 motors; Open to Sky Installation is Safely possible

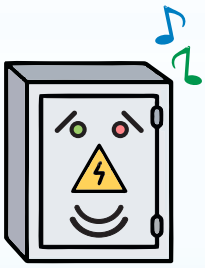
Electrical/ Electronic SwitchGears are very Sensitive to Temperatures & can Fail/ Malfunction Prematurely if exposed to High Temperatures.

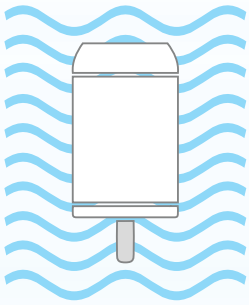
Conventional Pumps



Conventional Pumps use **Air** Cooled ***(TEFC / CACA)*** **motor** which **dissipate** their **Heat** & **Noise** into the Operating Room.

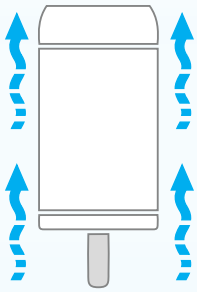
Submerged & Flood Proof Pumps





ARS, ARSES, ARSDS

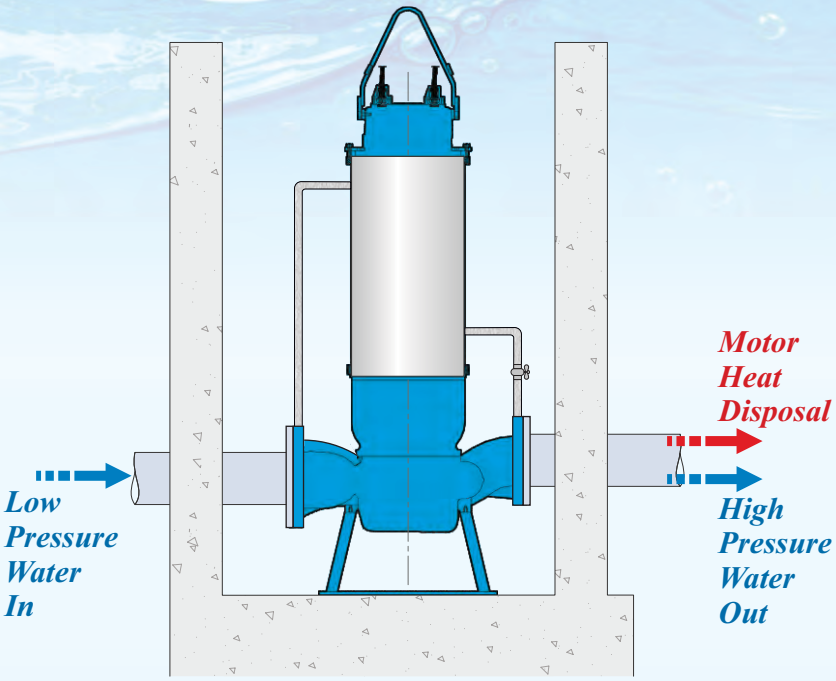
Lower NVH *(Noise, Vibration & Harshness)* **Levels**



AVTB, ATBM

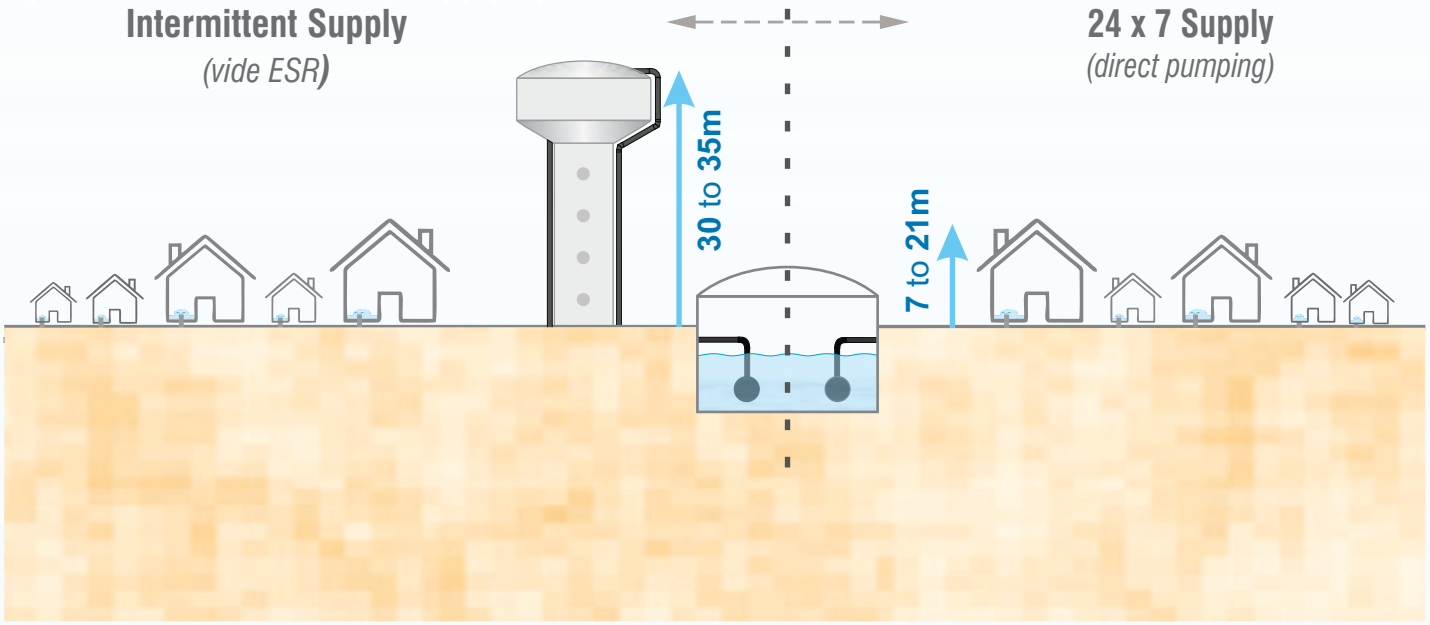
Motor Heat is Safely dissipated in Pumped Water resulting in a Cooler Room thereby Increasing Electrical/Electronic SwitchGear's Life

No need of Costly, Maintenance Prone & Energy Consuming **A**ir **H**andling **U**nits ***(AHU)*** for Pump Motor heat



Dry Installed Aqua Pump

ARFPD, AIFPE, ARFP



In **Intermittent** Water *(Distribution)* Supply, water is Lifted *(pumped)* from Underground Tanks ***(CWR)*** to Elevated Service Reservoirs ***(ESR)*** & Supplied *(released)* at odd hours *(typically for just 2-4 hours in Morning (& sometimes 1-2hours in the Evening)).*

I) Hence the Pumps have to pump against a **Fixed** *(mostly Static)* **High Head** *(of the ESR)* thereby consuming *(wasting)* a lot of Energy.

ii) Due to Receipt of water in a short span at odd hours; public has a Physcological tendency to **Store water** increasing it's wastage

iii) The Distribution Pipe Network is Non Pressurized during Non Supply hours which may lead to the unfortunate **accidental Ingress of Waste Water** *(like sewage, effluent, etc.)* adversely impacting Public Health.

In **24 x 7** systems; water is supplied Round the Clock which :

a) eliminates the need of ESRs *(as pressurized (vide pumps) water is fed Directly into Pipelines)* hence instead of pumping all the way 30-35m *(to an ESR)*, now water is to be pumped just upto 1 or 2 Floor *(8m to 11m)* thereby **reducing Static Head.**

b) reduces Instantaneous Flow Rate *(as people use water as & when required instead of concentrated time zones).*

Since System's Frictional Head is Squarely Proportional to the Flow Rate; there is a **great reduction in the Required Total Head** to be pumped - also there is a **reduction in Rate** of water to be pumped *(albeit variable during the 24hour clock cycle)*.

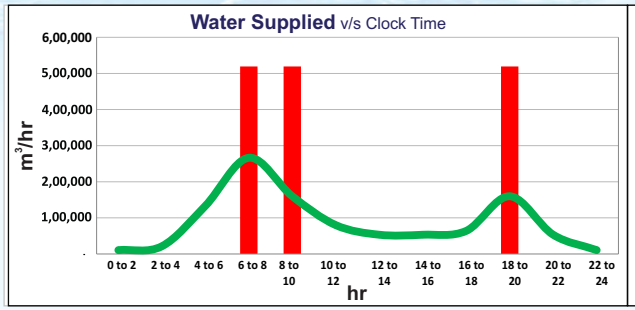
This subsequently opens up an lucrative potential of using VFD driven pumps which apart from **varying Pump's Discharge Flow & Head** *(in accordance with system's requirement)* **can result in huge Energy savings.**

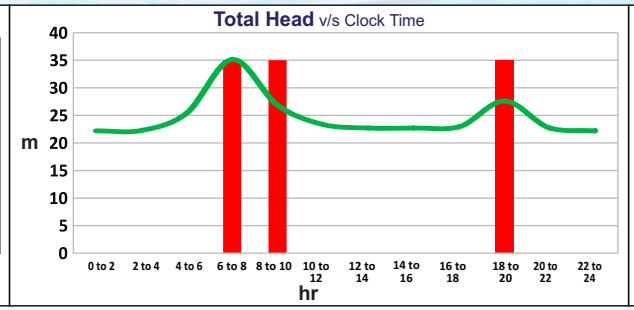
⚠ *Of course, the above presumes that End Users don't waste water (mostly ensured by Water Metering)*

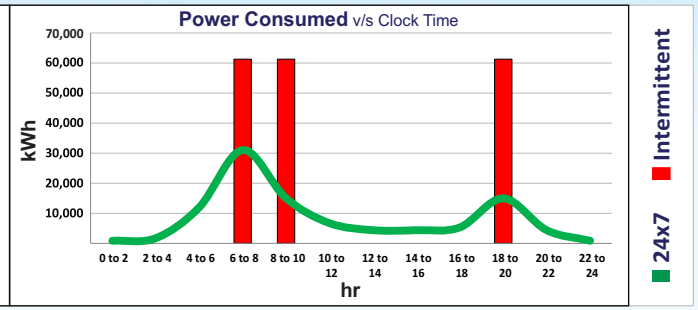
Optional Water *(Distribution)* Supply Systems

Comparision of Pumping : Intermittent v/s 24 x 7

Salient Features	Population	Souls	7,500,000												7,500,000										
	Per Capita Consumption	lpcd	135												135										
	System of Supply		**Intermittent** *(vide ESRs)*												**24x7** *(Direct Pumping to Piped Network)*										
	Utility (1/Wastage) Factor	%	65%												95%										
	Total Water (Supplied) Pumped/day	m3/day	1,557,692												1,065,789										
		MLD	**1,558**												**1,066**										
Clock Time		Clock	**0** to **2**	**2** to **4**	**4** to **6**	**6** to **8**	**8** to **10**	**10** to **12**	**12** to **14**	**14** to **16**	**16** to **18**	**18** to **20**	**20** to **22**	**22** to **24**	**0** to **2**	**2** to **4**	**4** to **6**	**6** to **8**	**8** to **10**	**10** to **12**	**12** to **14**	**14** to **16**	**16** to **18**	**18** to **20**	**20** to **22**	**22** to **24**
		duration (hr)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Supply (Pumping) On/ Off		1=On, 0=Off	0	0	0	1	1	0	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1
		Cumulative hr	6												24										
Supply (Pumping) Rate		m3/hr	-	-	-	519,231	519,231	-	-	-	-	519,231	-	-	10,658	21,316	133,224	266,447	159,868	79,934	53,289	53,289	63,947	159,868	53,289	10,658
Head	Static / Pressure	m	32	32	32	32	32	32	32	32	32	32	32	32	**21**	21	21	21	21	21	21	21	21	21	21	21
	Demand Variation Factor	%	1.0%	2.0%	12.5%	25.0%	15.0%	7.5%	5.0%	5.0%	6.0%	15.0%	5.0%	1.0%	1.0%	2.0%	12.5%	25.0%	15.0%	7.5%	5.0%	5.0%	6.0%	15.0%	5.0%	1.0%
	Piping Frictional & Station Losses	m	0.0	0.0	0.0	3.0	3.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	3.02	3.07	5.64	13.56	6.80	3.95	3.42	3.42	3.61	6.80	3.42	3.02
	Total Head to be Developed by Pump	m	**0.0**	**0.0**	**0.0**	**35.0**	**35.0**	**0.0**	**0.0**	**0.0**	**0.0**	**35.0**	**0.0**	**0.0**	**24.0**	**24.1**	**26.6**	**34.6**	**27.8**	**25.0**	**24.4**	**24.4**	**24.6**	**27.8**	**24.4**	**24.0**
Pump	**Power Consumed by Pump Motor Sets** *(assuming Constant Efficiency (85% Ep, 95% Em) & Constant Station Losses & Ancillary Auxiliary Power Consumption)*	kWhr	-	-	-	**61,289**	**61,289**	-	-	-	-	**61,289**	-	-	**863**	**1,730**	**11,970**	**31,058**	**14,990**	**6,726**	**4,389**	**4,389**	**5,307**	**14,990**	**4,389**	**863**
			183,867												**101,665**										
			100%												*55%*										







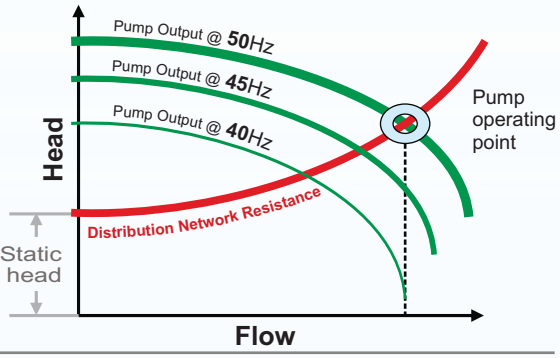
The use of VFD driven Submerged pumpsets for Direct (to Network) pumping water supply systems is a promising Opportunity to Save Energy between 33% to 45% (& Regulate Flow too)

VFD Fully Compatible

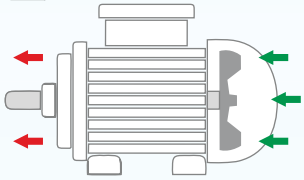
Typical effects of VFD on Pump-Motor sets

(rated parameters 125kW, 1500rpm (sync) 4P; 35m x 1000m³/hr @ 50Hz)

Frequency		Hz	50	45	40	35	30
Pump	Speed *(sync)*	rpm	1500	1350	1200	1050	900
	Head	m	35.0	28.4	22.4	17.2	12.6
	Flow	m³/hr	1000	900	800	700	600
	bkW	kW	112.1	86.9	61.0	50.3	34.3



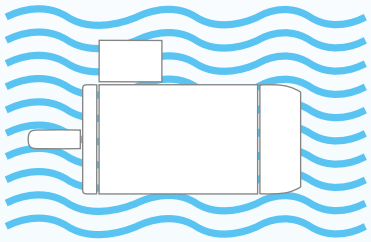
VFDs & their Side Effects on Motors : Overheating due to Speed Reduction



Totally Enclosed **AIR Fan** Cooled ***(TEFC)*** *(Squirrel Cage Induction)* **motor** *(Shaft Mounted Fan - IC4A1A1)*

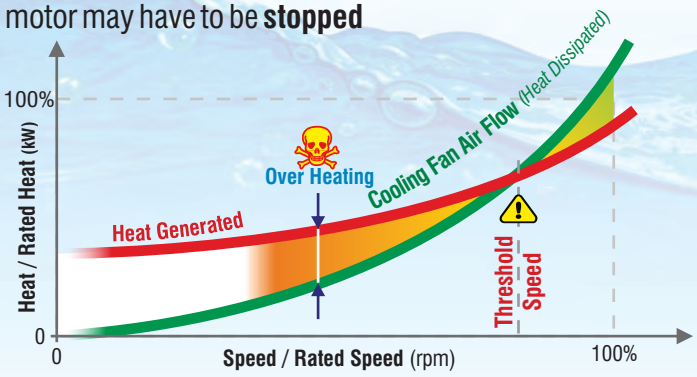
In case of typical Air Cooled *(TEFC)* motors, Heat Dissipation *(Cooling)* is by mode of Forced Air blown by a *(centrifugal axial)* **Fan mounted on the motor shaft itself.** Due to the basic law of centrifugal m/c, the **Fan's Output** *(heat dissipation)* is proportional to the **cube** of it's **speed**.

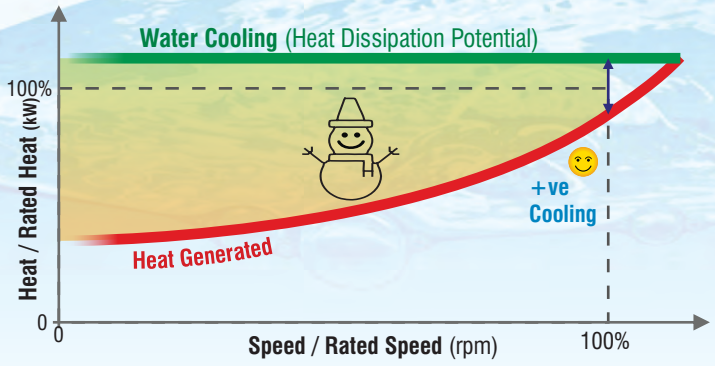
When TEFC motor's speed is slowed down, the Cooling **Fan also slows down** & subsequently the **Cooling Air Flow** *(heat dissipation)* **reduces drastically** leading to motor tendency to **overheat** - infact, below a certain speed the motor may have to be **stopped**



Totally Enclosed *(IP68)* **WATER** Cooled ***(TESWC)*** *(Squirrel Cage Induction)* **Submerged motor** *(Self surface water cooled - IC4A1W0)*

Totally Enclosed *(IP68)* **Water** Cooled ***(TESWC)*** *(Squirrel Cage Induction)* **Submerged** motors are cooled *(quenched)* by **Surrounding Water - hence it's cooling effectiveness is not dependent on the speed** *(or VFD).*





Frequency		Hz	50	45	40	35	30
Pump	bkW	kW	112.1	86.9	61.0	50.3	34.3
Motor	Total Heat Generated	kWh	11.39	8.60	6.70	4.98	3.48
TEFC Air Cooled motor	Cooling Fan Flow *(Heat Dissipated)*	cfm (kWh)	11.75	8.57	6.70	4.97	3.48
	Heat Dissipated / Heat Generated	%	103%	100%	90%	81%	73%
		Condition	Cool	Cool	⚠ Heats up	☠ Heats up	☠ Heats up
Submerged Water Cooled motor	Water Cooling *(Heat Dissipation Potential)*	kWh	11.75	11.75	11.75	11.75	11.75
	Heat Dissipated / Heat Generated	%	103%	137%	175%	236%	337%
		Condition	Cool	Cool	Cool	Cool	Cool

Due to Constant Cooling by surrounding Water: Submerged motors always operate coolly at any Speed...

Energy Saving

Pumping Station's Wire to Water *(Specific)* Power *(kW/ML)* Consumption

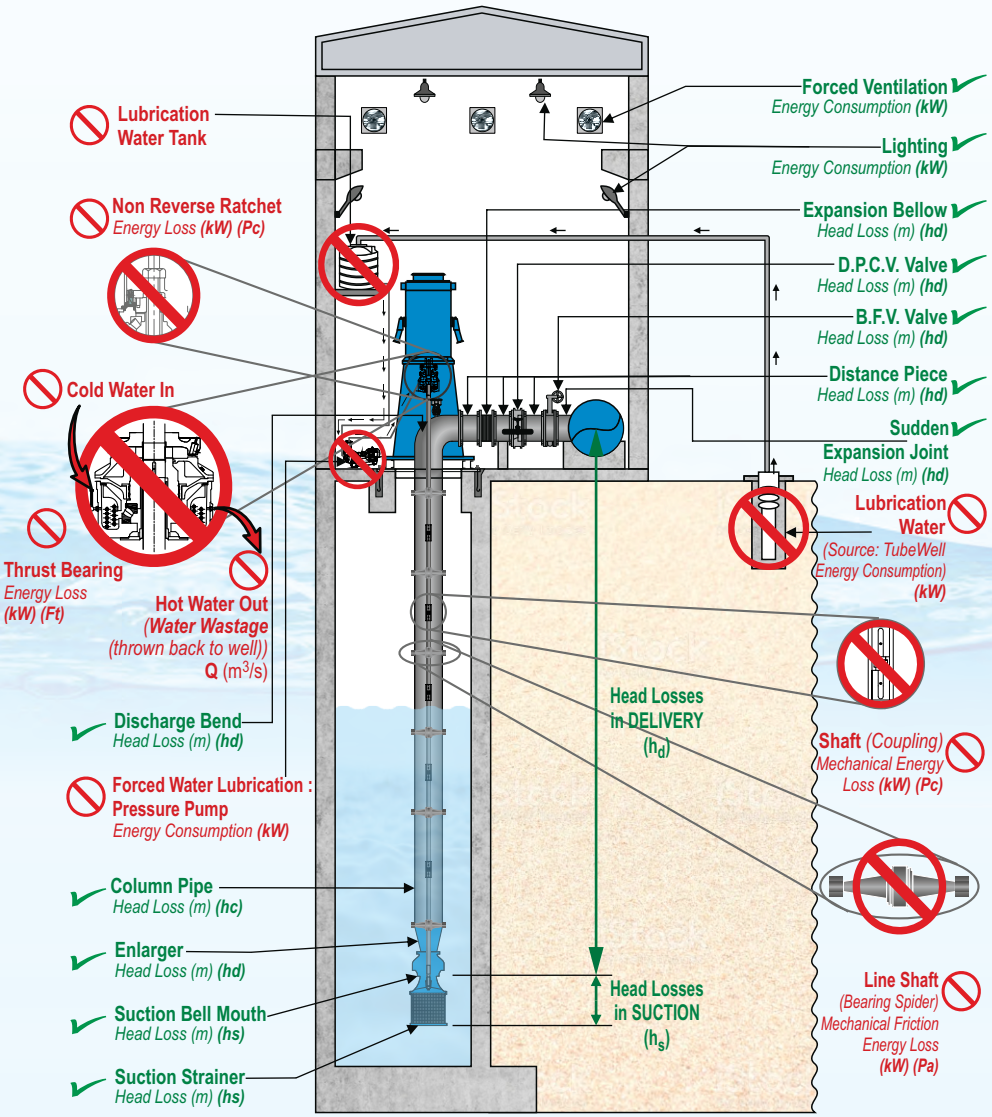
Legend :

Ancillaries / Auxiliaries / Components marked **RED** (⃠) indicate that they are **Not required** / **required** in **Lesser Quantity** in SubCF pumps *(& hence their **Losses** / **Parasitic Energy Wastage** is also automatically **Eliminated**).*

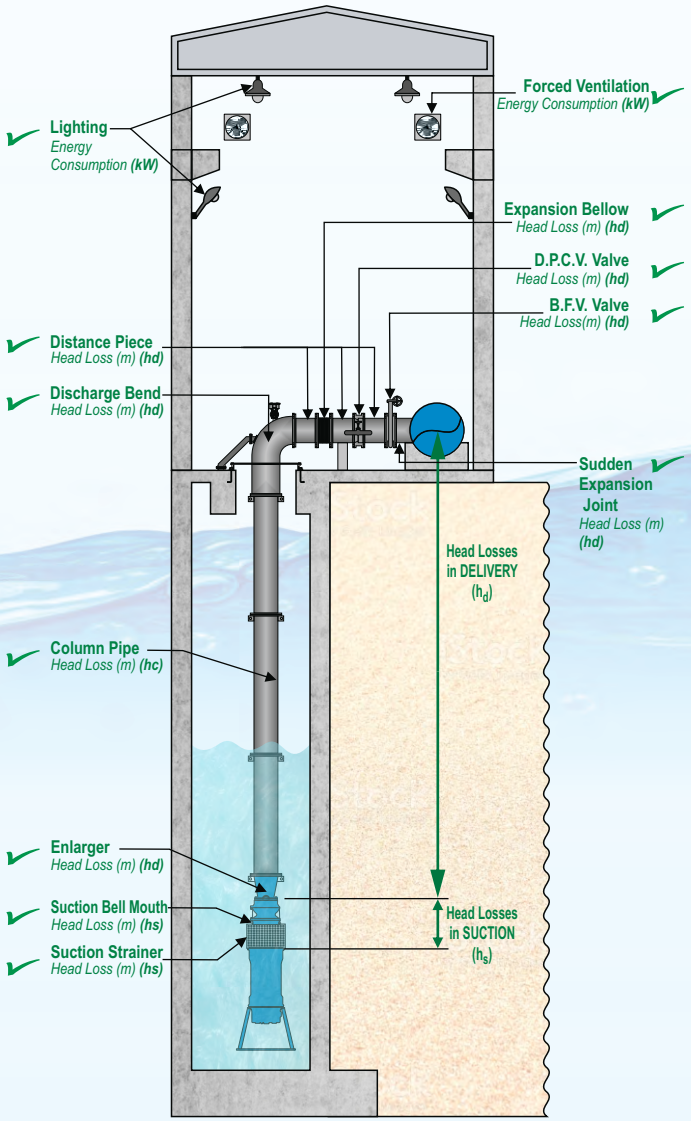
Legend :

Ancillaries / Auxiliaries / Components marked **GREEN** (✔) indicate that they are **common** in all Pump / Pumping Stations types *(& hence their **Losses** / **Parasitic Energy Wastage** is also **unavoidable**).*

VT based Pumping Station



SubVT based Pumping Station



Energy & Efficiency Comparison

VT v/s **SubVT** *(Detailed Calculation)*

PROJECT : ****

S.No.	Description		Unit	Type of Pumpsets VT	Type of Pumpsets SubVT	Remarks
1	***Total Capacity***		*MLD*	***150***		–
2	***Working Hours Per Day***		*hr*	*22*		–
3	***Pumpsets Quantity***	*Working*	*Nos*	***4***		–
		Stand-by	*Nos*	*1*		–
4	***Pumpset's Rated*** *(Duty Point)* ***@ Discharge Bend***	*(Effective) Head (h)*	*m*	***27***		–
5		*(Effective) Discharge (Q)*	*l/s*	473.5		–
6			***m³/hr***	**1704.5**		–
7	***Thrust Bearing Cooling Water*** *(Leakage)*	*Q Thrust Bearing Leakage / Q Pump Rated Discharge*	*%*	*0.09*	*0.00*	–
8		*Q / Pump*	*m³/hr*	1.53	0.00	–
9	***Q Bowl*** *@ Nozzle*		***m³/hr***	**1706.1**	**1704.5**	–
10	***Pump's Water Power*** *(p)*		*kW*	*125.3*	*125.3*	–
11	***Pump Delivery***	*Nozzle Size*	*mm*	300		–
12	***Delivery Pipe***	*Size*	*mm*	400		–
13		*Length*	*m*	10		–
14		*Hazen Williams Constant*	*C*	*140*		C value from CPHEEO Water Manual Table : 6.1 (Page No : 106)
15	***Suction*** *(Head)* ***Losses*** (h_S)	15.1 **Suction Strainer**	Loss Factor "K"	K Value *(Resistance Co-Efficient)*	0.5	0.5	Strainer Losses = $KxV^2/2g$
			Loss	*m*	0.025	0.025	K Value Assumed = 0.5
		15.2 **Suction Bell Mouth**	Loss Factor "K"	K Value *(Resistance Co-Efficient)*	0.5	0.5	Bell Mouth Losses = $KxV^2/2g$
			Loss	*m*	0.363	0.362	K value from CPHEEO Water Manual Table : 6.5
		Sub TOTAL		*m*	**0.39**	**0.39**	–
16	***Delivery*** *(Head)* ***Losses*** (h_d)	16.1 **Enlarger**	Loss Factor "K"	K Value *(Resistance Co-Efficient)*	0.5	0.5	Enlarger Losses = $KxV^2/2g$
			Loss	*m*	1.145	1.145	K Value Assumed = 0.5
		16.2 **Column Pipe**	Loss	*m*	0.55 (Fig.5 in IS 1710)	0.16	For Sub. Pump = $3.35x10^6Q$ (l/s) / $d2.6^3C$
		16.3 **Discharge Bend**	Loss	*m*	0.50 (Fig.6 in IS 1710)	0.36	For Sub. Pump = $K \times V^2/2g$ K value from CPHEEO Water Manual_Table : 6.5

S.No.	Description			Unit	Type of Pumpsets VT	Type of Pumpsets SubVT	Remarks
16	***Delivery*** *(Head)* ***Losses*** (h_d)	16.4 **Distance Piece**	Length	*m*	0.5	0.5	Distance Piece Losses = $3.35 \times 10^6 Q (l/s) / d^{2.63} C$
			Loss	*m*	0.012	0.012	C value from CPHEEO Water Manual_Table : 6.1 (Page No : 106)
		16.5 **Expansion Bellow**	Loss Factor "K"	K Value *(Resistance Co-Efficient)*	0.5	0.5	Bellow Losses = $KxV^2/2g$
			Loss	*m*	0.362	0.362	K value from CPHEEO Water Manual_Table : 6.5
		16.6 **Distance Piece**	Length	*m*	0.5	0.5	Distance Piece Losses = $3.35 \times 10^6 Q (l/s) / d^{2.63} C$
			Loss	*m*	0.012	0.012	C value from CPHEEO Water Manual_Table : 6.1 (Page No : 106)
		16.7 **DPCV Valve**	Loss Factor "K"	K Value *(Resistance Co-Efficient)*	0.3	0.3	Valve Losses = $KxV^2/2g$
			Loss	*m*	0.217	0.217	K value from CPHEEO Water Manual_Table : 6.5
		16.8 **Distance Piece**	Length	*m*	0.5	0.5	Distance Piece Losses = $3.35 \times 10^6 Q (l/s) / d^{2.63} C$
			Loss	*m*	0.012	0.012	C value from CPHEEO Water Manual_Table : 6.1 (Page No : 106)
		16.9 **BFV Valve**	Loss Factor "K"	K Value *(Resistance Co-Efficient)*	0.3	0.3	Valve Losses = $KxV^2/2g$
			Loss	*m*	0.217	0.217	K value from CPHEEO Water Manual_Table : 6.5
		16.10 **Sudden Expansion Joint**	Loss Factor "K"	K Value *(Resistance Co-Efficient)*	0.3	0.3	Sudden Expansion Joint Losses = $KxV^2/2g$
			Loss	*m*	0.217	0.217	K value from CPHEEO Water Manual_Table : 6.5
		Sub TOTAL		*m*	**3.25**	**2.72**	–
17	***Bowl Assembly Head (H)*** = 4+15+16 *to be developed by bowl to overcome ALL Head Losses upto Discharge Nozzle*			*m*	**30.63**	**30.11**	–

S.No.	Description		Unit	Type of Pumpsets VT	Type of Pumpsets SubVT	Remarks
18	***Bowl Efficiency*** (η_b)		%	***85.00***	***84.50***	From HIS 2010
19	***Bowl Assembly Input Power*** (P_b)		*kW*	167.4	165.4	–
20	*(Mechanical -Friction)* ***Line Shaft*** *(IF applicable)* ***Losses*** (P_a)		*kW*	*2.00*	*0.00*	For VT Pump = (Fig.7 in IS 1710)
21	*(Mechanical)* ***Thrust Bearing*** *(IF External TB is provided)* ***Losses*** (P_t)		*kW*	*0.60*	*0.00*	From SKF
22	***Pump Input Power (P)*** = 19+20+21		*kW*	170.0	165.4	–
23	***Pump Efficiency*** (η_p)		%	**73.71**	**75.78**	–
24	***Coupling*** *Efficiency (IF provided)* (η_c)		%	**99.00**	–	From HIS & Euro Pumps Standard
25	***Non-Reverse Ratchet*** *Efficiency (IF provided)* (η_c)		%	**99.75**	–	–
26	***Coupling + Non-Reverse Ratchet*** *(Mechanical)* ***Losses*** *(If Provided)* (P_c)		*kW*	**2.13**	**0.0**	–
27	*(Mechanical)* ***Power Drawn From*** *(Driver)* ***Motor*** = 22+26		*kW*	**172.2**	**165.4**	–
28	***Forced Water Lubrication system*** *(IF applicable for Line Shaft lubrication)* *(Electrical)* ***Power Consumption*** *(of forced water pumping system)*	*Power Consumed to Source Forced Water*	*kW*	1.10	0.00	–
		Power Consumed to Pressurize Forced Water	*kW*	1.85	0.00	–
29	***Motor Rating Offered***		*kW*	**200**	**200**	–
30	***Motor Efficiency*** (η_m)		%	***95.10***	***95.40***	–
31	***Motor Terminal Input*** *(Electrical)* ***Power Consumed*** *(PumpSET)* (P_{mi}) = 27/30		*kW*	181.0	173.4	–
32	***Overall*** *(PumpSET)* ***Efficiency*** (η_O) = 10/31		%	**69.23**	**72.29**	–
33	***TOTAL Electrical Power Consumed*** *(PumpSET + Forced Water Lubrication system)*		*kW/hr*	**184.0**	**173.4**	–
			kW-hr / Day	16,192	15,257	–
34	***Energy Consumption in Lighting***	*Unit Rating*	*kW*	0.10	0.10	–
		Quantity/W+S	*nos*	5	3	–
		Working hr/day	*hr*	12	12	–
		Total Power	*kW/Day*	**6.0**	**3.6**	–
35	***Energy Consumption in Forced Ventilation***	*Current*	*A*	3.8	3.8	–
		Volt	*V*	240	240	–
		Power Factor	*Cos Ø*	1	1	–
		Power	*kW*	0.9	0.9	–
		Quantity of Fans	*nos*	4	2	–
		Total Power	*kW/Day*	**80.3**	**40.1**	–
36	***Total Auxiliary & Ancillary Power Consumption*** = 34+35	*Unit Rating*	*kW/Day*	86.3	43.7	–
37	***Transformer, Electrical Substation & Miscellaneous Losses***		*kW/Day*	**406.9**	**382.5**	–
38	***Pumping Station*** *(P.S.)*	*P.S.Total Power Consumed*	*kW/Day (33+36+37)*	**16,685**	**15,683**	–
			Ratio	**1.06**	**1.00**	–
		P.S. Efficiency (Wire to Water)	%	66.1	70.3	–
		Specific Power Consumption	*kW/ML*	**111.2**	**104.6**	–

Despite having Nearly Similar Bowl Efficiency (as that of Conventional VT pump),
Submerged pumpset based Pumping Station Consumes Lower Energy.

Energy Saving

Pumping Station's Wire to Water *(Specific)* Power *(kW/ML)* Consumption

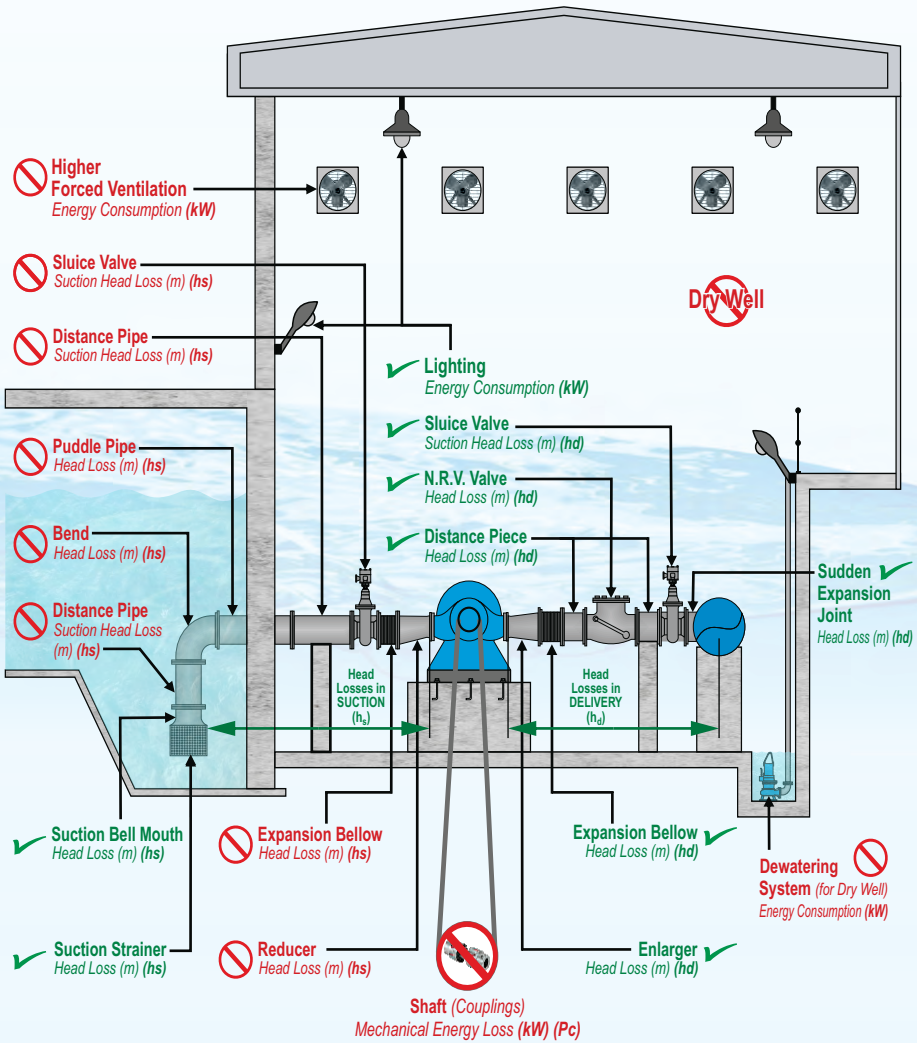
Legend :

Ancillaries / Auxiliaries / Components marked **RED** (⃠) indicate that they are **Not required** / **required** in **Lesser Quantity** in SubCF pumps *(& hence their **Losses** / **Parasitic Energy Wastage** is also automatically **Eliminated**).*

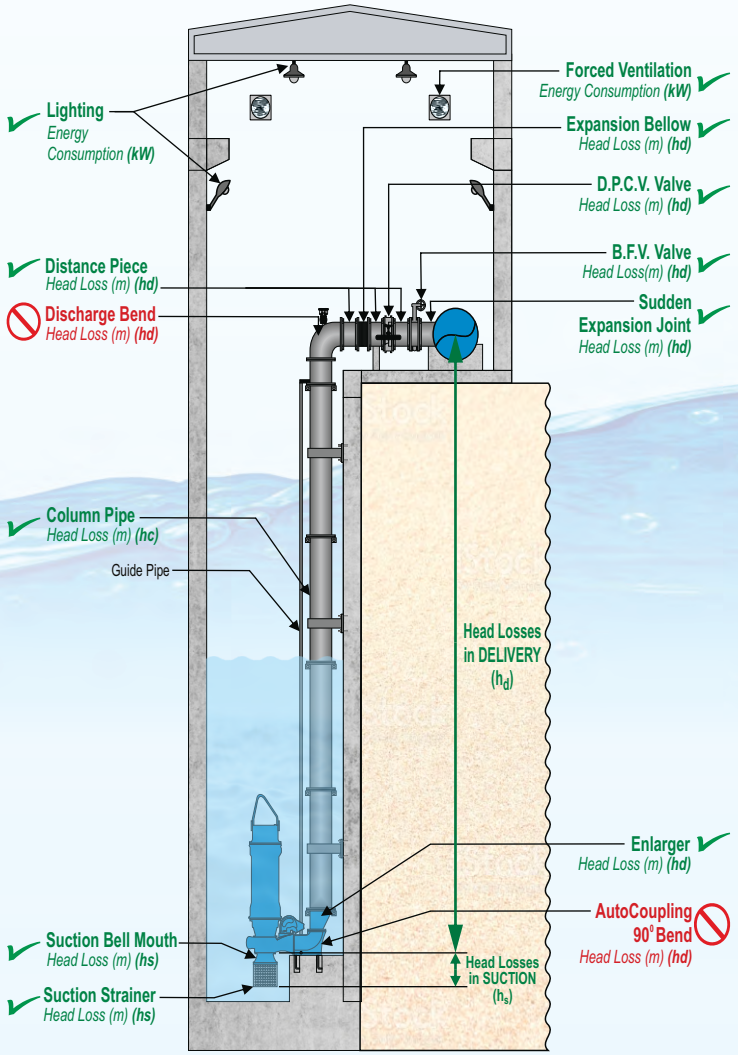
Legend :

Ancillaries / Auxiliaries / Components marked **GREEN** (✔) indicate that they are **common** in all Pump / Pumping Stations types *(& hence their **Losses** / **Parasitic Energy Wastage** is also **unavoidable**).*

HSCF based Pumping Station



SubCF based Pumping Station



Energy & Efficiency Comparison

HSCF v/s SubCFT *(Detailed Calculation)*

PROJECT : ****

S.No.	Description		Unit	Type of Pumpsets HSCF	Type of Pumpsets SubCF	Remarks
1	***Total Capacity***		*MLD*	***150***		–
2	***Working Hours Per Day***		*hr*	*22*		–
3	***Pumpsets Quantity***	*Working*	*Nos*	***4***		–
4		*Stand-by*	*Nos*	*1*		–
5	***Pumpset's Rated*** *(Duty Point)* ***@ Discharge Bend***	*(Effective) Head (h)*	*m*	***27***		–
6		*(Effective) Discharge (Q)*	*l/s*	473.5		–
7			***m^3/hr***	**1704.5**		–
8	***Pump's Water Power*** *(p)*		*kW*	*125.3*		–
9	***Pump Delivery***	*Nozzle Size*	*mm*	300		–
10	***Delivery Pipe***	*Size*	*mm*	400		–
11		*Hazen Williams Constant*	*C*	*140*		C value from CPHEEO Water Manual Table : 6.1 (Page No : 108)
12	***Suction*** *(Head)* ***Losses*** (h_S)	12.1 Suction Strainer – Loss Factor "K"	K Value (Resistance Co-Efficient)	0.5	0.5	Strainer Losses = $KxV^2/2g$
		12.1 Suction Strainer – Loss	*m*	0.025	0.025	K Value Assumed = 0.5
		12.2 Suction Bell Mouth – Loss Factor "K"	K Value (Resistance Co-Efficient)	0.5	0.5	Bell Mouth Losses = $KxV^2/2g$
		12.2 Suction Bell Mouth – Loss	*m*	0.362	0.362	K value from CPHEEO Water Manual Table : 6.5
		12.3 Distance Piece – Length	*m*	0.5	–	Distance Piece Losses = $3.35 \times 10^6 Q / (l/s)/d^{2.63} C$
		12.3 Distance Piece – Loss	*m*	0.012	–	C value from CPHEEO Water Manual, Table : 6.1 (Page No : 108)
		12.4 90° Bend – Loss Factor "K"	K Value (Resistance Co-Efficient)	0.75	–	Bend Losses = $KxV^2/2g$
		12.4 90° Bend – Loss	*m*	0.543	–	K value from CPHEEO Water Manual Table : 6.5
		12.5 Puddle Pipe – Length	*m*	2.0	–	Distance Piece Losses = $3.35 \times 10^6 Q / (l/s)/d^{2.63} C$
		12.5 Puddle Pipe – Loss	*m*	0.049	–	C value from CPHEEO Water Manual, Table : 6.1 (Page No : 108)
		12.6 Distance Piece – Length	*m*	0.5	–	Distance Piece Losses = $3.35 \times 10^6 Q / (l/s)/d^{2.63} C$
		12.6 Distance Piece – Loss	*m*	0.012	–	C value from CPHEEO Water Manual, Table : 6.1 (Page No : 108)
		12.7 Sluice Valve – Loss Factor "K"	K Value (Resistance Co-Efficient)	0.3	–	Valve Losses = $KxV^2/2g$
		12.7 Sluice Valve – Loss	*m*	0.217	–	K value from CPHEEO Water Manual Table : 6.5
		12.8 Expansion Bellow – Loss Factor "K"	K Value (Resistance Co-Efficient)	0.5	–	Bellow Losses = $KxV^2/2g$
		12.8 Expansion Bellow – Loss	*m*	0.362	–	K value from CPHEEO Water Manual Table : 6.5
		12.9 Reducer – Loss Factor "K"	K Value (Resistance Co-Efficient)	0.5	–	Reducer Losses = $KxV^2/2g$
		12.9 Reducer – Loss	*m*	0.362	–	K value from CPHEEO Water Manual Table : 6.5
		Sub TOTAL	*m*	**1.95**	**0.39**	–
13	***Delivery*** *(Head)* ***Losses*** (h_d)	13.1 Auto Coupling 90° Bend – Loss Factor "K"	K Value (Resistance Co-Efficient)	–	0.5	Bend Losses = $KxV^2/2g$
		13.1 Auto Coupling 90° Bend – Loss	*m*	0.000	1.145	K value from CPHEEO Water Manual Table : 6.5
		13.2 Enlarger – Loss Factor "K"	K Value (Resistance Co-Efficient)	0.5	0.5	Enlarger Losses = $KxV^2/2g$
		13.2 Enlarger – Loss	*m*	1.145	1.145	K Value Assumed = 0.5
		13.3 Discharge Bend – Loss	*m*	0.00	0.36	For Sub. Pump = $KxV^2/2g$
		13.4 Expansion Bellow – Loss Factor "K"	K Value (Resistance Co-Efficient)	0.5	0.5	Bellow Losses = $KxV^2/2g$
		13.4 Expansion Bellow – Loss	*m*	0.362	0.362	K value from CPHEEO Water Manual Table : 6.5
		12.3 Distance Piece – Length	*m*	0.5	0.5	Distance Piece Losses = $3.35 \times 10^6 Q / (l/s)/d^{2.63} C$
		12.3 Distance Piece – Loss	*m*	0.012	0.012	C value from CPHEEO Water Manual, Table : 6.1 (Page No : 108)
		13.6 NRV Valve – Loss Factor "K"	K Value (Resistance Co-Efficient)	0.3	0.3	Valve Losses = $KxV^2/2g$
		13.6 NRV Valve – Loss	*m*	0.217	0.217	K value from CPHEEO Water Manual Table : 6.5
		13.7 Distance Piece – Length	*m*	0.5	0.5	Distance Piece Losses = $3.35 \times 10^6 Q / (l/s)/d^{2.63} C$
		13.7 Distance Piece – Loss	*m*	0.012	0.012	C value from CPHEEO Water Manual, Table : 6.1 (Page No : 108)
		13.8 Sluice Valve – Loss Factor "K"	K Value (Resistance Co-Efficient)	0.3	0.3	Valve Losses = $KxV^2/2g$
		13.8 Sluice Valve – Loss	*m*	0.217	0.217	K value from CPHEEO Water Manual Table : 6.5
		13.9 Sudden Expansion Joint – Loss Factor "K"	K Value (Resistance Co-Efficient)	0.3	0.3	Sudden Expansion Joint Losses = $KxV^2/2g$
		13.9 Sudden Expansion Joint – Loss	*m*	0.217	0.217	K value from CPHEEO Water Manual Table : 6.5
		Sub TOTAL	*m*	**2.18**	**3.69**	–
14	***Bowl Assembly Head (H)*** = 5+12+13 *to be developed by bowl to overcome ALL Head Losses upto Discharge Nozzle*		*m*	**31.13**	**31.08**	–

S.No.	Description		Unit	Type of Pumpsets HSCF	Type of Pumpsets SubCF	Remarks
15	***Pump*** *(Bowl)* ***Efficiency*** (η_b)		%	***85.00***	***84.50***	From HIS 2010
16	***Pump*** *(Bowl)* ***Assembly Input Power*** (P_b)		*kW*	170.00	170.73	–
17	***Coupling*** *Efficiency (IF provided)* (η_c)		%	**99.00**	–	From HIS & Euro Pumps Standard
18	***Coupling*** *(Mechanical)* ***Losses*** *(IF Provided)* (P_c)		*kW*	**1.70**	**0.0**	–
19	*(Mechanical)* ***Power drawn from*** *(Driver)* ***Motor*** = 16+18		*kW*	**171.7**	**170.7**	–
20	***Motor Rating Offered***		*kW*	**200**	**200**	–
21	***Resultant Motor Margin*** *@ Duty Point*		%	17.6	17.1	–
22	***Motor Efficiency*** (η_m)		%	***95.1***	***95.4***	–
23	***Motor Terminal Input*** *(Electrical)* ***Power Consumed*** *(PumpSET)* (P_{mi}) = 19/22		*kW*	180.6	179.0	–
24	***Overall*** *(PumpSET)* ***Efficiency*** (η_O) = 8/23		%	**69.42**	**70.04**	–
25	***TOTAL Electrical Power Consumed by PumpSET***		*kW/hr*	**180.6**	**179.0**	–
			kW-hr / Day	15,888	15,748	–
26	***Energy Consumption*** *in* ***Lighting*** *of* ***Electrical Room***	*Unit Rating*	*kW*	0.10	0.10	–
		Quantity/W+S	*nos*	6	6	–
		Working hr/day	*hr*	12	12	–
		Total Power	*kW/Day*	**36.0**	**36.0**	–
27	***Energy Consumption*** *in* ***Lighting*** *of* ***UnderGround Pump Room (Dry Well)***	*Unit Rating*	*kW*	0.10	0.00	–
		Quantity/W+S	*nos*	8	0	–
		Working hr/day	*hr*	12	0	–
		Total Power	*kW/Day*	**48.0**	**0.0**	–
28	***Energy Consumption*** *in Auxillary Power Consumption of* ***DeWatering System*** *(used for DeWatering seepage, gland & gasket leakage dewatering of Dry well under ground pump room)*	*Unit Rating*	*kW*	2.2	0.00	–
		Quantity/W+S	*nos*	1	0	–
		Working hr/day	*hr*	5	0	–
		Total Power	*kW/Day*	**44.8**	**0.0**	–
29	***Energy Consumption*** *in* ***Forced Ventilation*** *of* ***UnderGround Pump Room (Dry Well)***	*Current*	*A*	3.8	3.8	–
		Volt	*V*	240	240	–
		Power Factor	*Cos Ø*	1	1	–
		Power	*kW*	0.9	0.9	–
		Quantity of Fans	*nos*	4	2	–
		Total Power	*kW/Day*	**80.3**	**40.1**	–
30	***Total Auxiliary & Ancillary Power Consumption*** = 26+27+28+29	*Unit Rating*	*kW/Day*	209.1	76.1	–
31	***Transformer, Electrical Substation & Miscellaneous Losses***		*kW/Day*	**402.4**	**395.6**	–
32	***Pumping Station*** *(P.S.)*	*P.S.Total Power Consumed* (25+30+31)	*kW/Day*	**16,500**	**16,220**	–
			Ratio	**1.02**	**1.00**	–
		P.S. Efficiency (Wire to Water)	%	66.8	68.0	–
		Specific Power Consumption	*kW/ML*	**110.0**	**108.1**	–

Despite having Nearly Similar Pump Nozzle Efficiency (like that of Conventional Horizontal pump): Submerged pumpset based Pumping Station Consumes Lower Energy....

Lower Spares & Consumables requirements

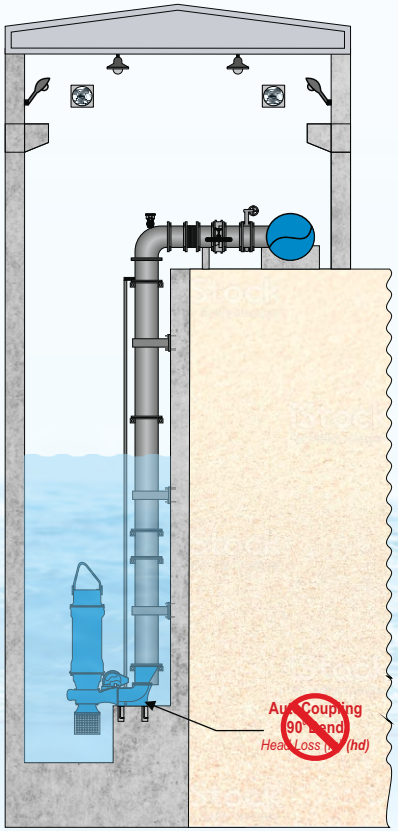
Zero Ancillary &/or Auxiliary Systems & Fewer Spare Parts

Lead to a Huge Reduction in Requirement of O&M ManPower & Spare Parts

MAKE IN INDIA

Legend : Ancillaries/ Auxiliaries / Parts marked ⃠ indicate that they are not required in All types of Pumping Stations *(& hence their associated Operation Hassles, Maintenance Problems & Spare Parts Consumption are also automatically eliminated).*

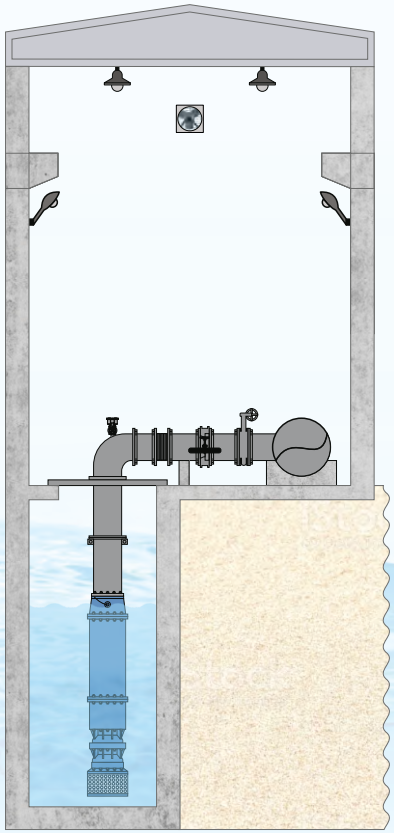
SubCF



Recommended Types of Spare Parts
to be kept in PumpHouse for 2year operation *(as per **DIN 24296**)*

1	Impeller	6	Casing wear ring
2	Rolling Element / Angular contact ball bearing	7	Impeller wear ring
3	Rolling Element / Deep Groove ball bearing	8	Cable Gland
4	O-ring	**9**	Motor *(Rotor, Stator)*
5	Mechanical seal *(set)*		

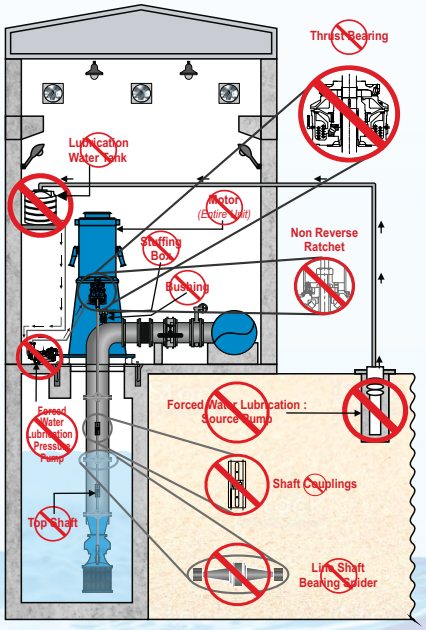
SubVT



Recommended Types of Spare Parts
to be kept in PumpHouse for 2year operation *(as per **DIN 24296**)*

1	Impeller	7	Impeller wear ring
2	Rolling Element / Angular contact ball bearing	8	Cable Gland
3	Rolling Element / Deep Groove ball bearing	9	Motor *(Rotor, Stator)*
4	O-ring	10	Stage sleeve
5	Mechanical seal *(set)*	**11**	Interstage bush
6	Casing wear ring		

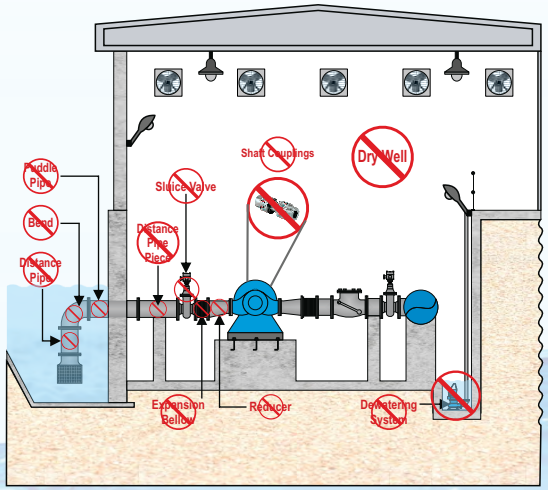
VT



Recommended Types of Spare Parts
to be kept in PumpHouse for 2year operation *(as per **DIN 24296**)*

1	Pump shaft	17	Casing wear ring
2	Intermediate shaft	18	Impeller wear ring
3	Top shaft	19	Stage sleeve
4	Impeller	20	Shaft protecting sleeve
5	Suction stage impeller *(if)*	21	Centring sleeve/locknut
6	Rotor	22	Bearing sleeve
7	Rolling Element / Angular contact ball bearing	23	Bush *(thrust and radial bearing)*
8	Rolling Element / Deep Groove ball bearing	24	Interstage bush
9	Bearing carrier	25	Locking sleeve, complete
10	Thrust collar	26	Threaded bush
11	Gasket	27	Bearing bush
12	Joint ring	28	Torque transmitting coupling elements
13	O-ring	29	Conical/threaded coupling
14	Felt ring	30	Nut with two flats
15	Mechanical seal *(set)*	31	Lock washer
16	Gland packing *(set)*	**32**	Motor (Entire Unit)

HSCF



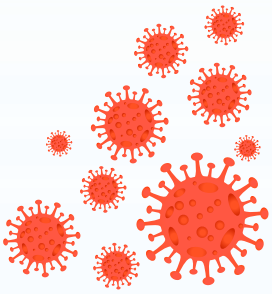
Recommended Types of Spare Parts
to be kept in PumpHouse for 2year operation (as per DIN 24296)

1	Impeller	15	Threaded bush
2	Rolling Element / Angular contact ball bearing	16	Bearing bush
3	Rolling Element / Deep Groove ball bearing	17	Torque transmitting coupling elements
4	Gasket	18	Lock washer
5	Joint ring	19	Grooved pin
6	O-ring	20	Fastening elements for the shaft
7	Mechanical seal *(set)*	21	Stuffing Box insert
8	Gland packing *(set)*	22	Gland follower
9	Casing wear ring	23	Neck ring
10	Impeller wear ring	24	Lantern ring
11	Shaft protecting sleeve	25	Spacer sleeve
12	Bearing sleeve	26	Seal cover
13	Bush *(thrust and radial bearing)*	**27**	Motor *(Entire Unit)*
14	Locking sleeve, complete		

Submerged pumpsets require Just 9 & 11 Spare Parts & as compared to 32 & 27 for VT & HSCF.....!

Lower Operation & Maintenance Hassles

don't require Periodic Maintenance & Minimal Operational ManPower so that you can...



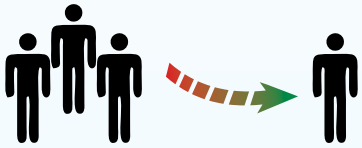
Ultra Low ManPower Requirement

Requires No Special Pre – Post / Ancillary-Auxillary Operations; like :

- Suction Priming during Pump StartUp,
- Valve Opening- Closing during pump Starting- Stopping
- Operating & Maintaining the Forced Water Lubrication systems operation,
- Operating the Dewatering Pump to water leakage from Seepage / Gland Piping Leakage, etc.

Requires No Periodic Consumables; like :

- Oil,
- Grease,
- Gland Rope Packing,
- Coupling Rubber/ Pins,
- Sleeves, etc



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

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

Intelligent InBuilt Monitoring

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

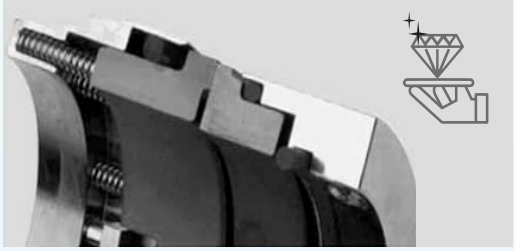
- **PSLD** detects Pressurized Water Leakage from Mechanical Seals.
- **CCWLD** detects Accidental Water Leakage from Cable Sheath's Cuts &/or Nicks into the Motor.
- **SBWLD** detect Accidental Water Leakage in to Motor's Stator Chamber.

- **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

Shaft Sealing is by means of **Two**, Independent, high quality Bi-Directional; **Mechanical Seals** *(& the Primary seal is always of **Silicon Carbide** faces to withstand Erosion incase of increased silt & grit content in sewage/ water)* hence there is Zero Leakage of water/ septic sewage into the Dry Well from the Shaft Gland.

Seals have **L_{10H}** life in excess of **50,000** hours &/or **5** years.

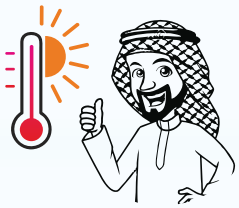


Bearings

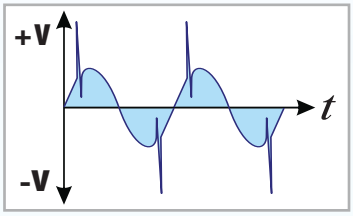
Heavy duty, Anti Friction, bearings are designed for L_{10H} life in excess of **1,00,000** hours &/or **10** years.

Tribologically Optimized **Bearing** Components for Bullet Proof Reliability

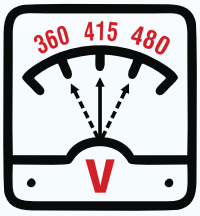
Vacuum **P**ressure **I**mpregnation Treatment (**VPI**) for Superb VFD Compatibility



Thanks to generous Reserve Margins & Optimized Design; Aqua's Motors keep coolly working even in Scorching Summers upto 55˚c



Tolerates **Power Spikes & Surges**



Tolerates **Wide Voltage** Variation

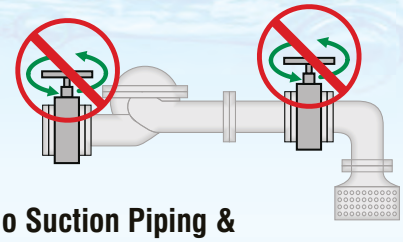
No need to Periodically...

...Check / Align Shaft Coupling

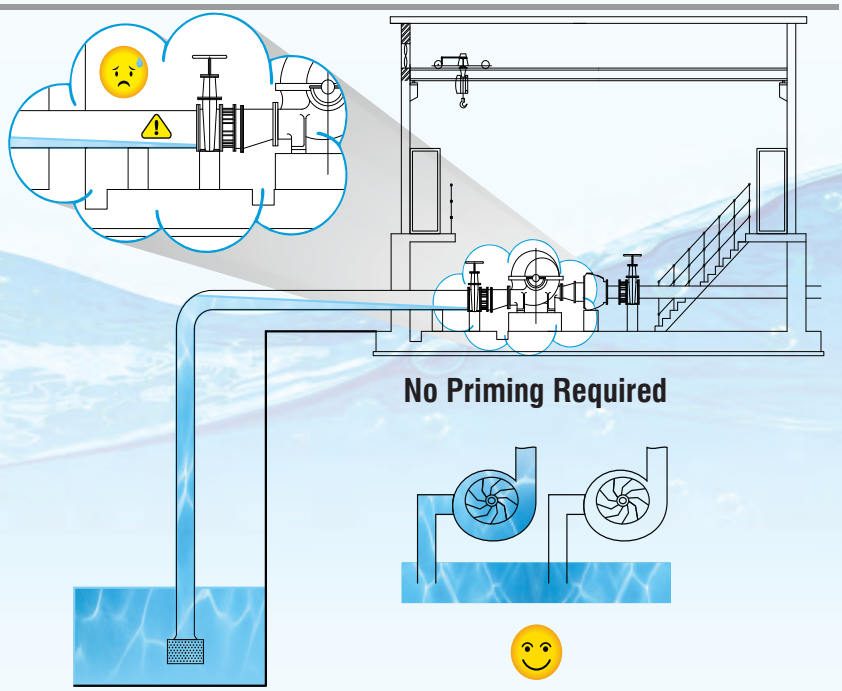
...Check / Change Gland Packing

...ReGrease / Refill Oil

No need of Valve Opening / Closing *(during Pumpset Start / Stop)*



No Suction Piping & it's associated Friction Head losses



No Priming Required

No need of ManPower for Suction Priming

Minimal Noise, Vibration & Heat Emission

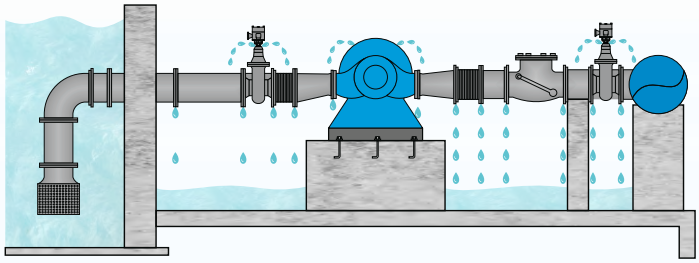
Low Energy Cost

Due to Elimination of Suction Losses, Coupling Losses & Auxillaries; Wire to Water Pumping Station Efficiency Of Submerged Pumps Based PS is slightly better than HSCF / VT based PS.

Low Life Cycle Costs *(LCC)* : Zero Consumables, Minimal Maintenance Spares & Good Efficiency.

User Friendly

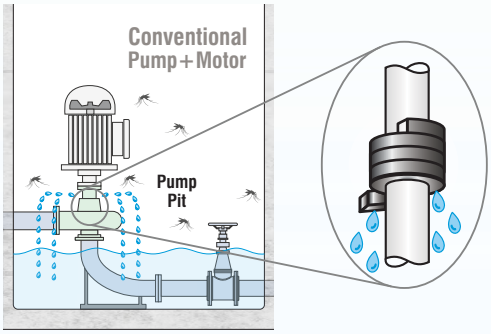
- No risk of cavitations.
- No damage due to Flood or Rains.



No Nuisance Leakage

(from Piping Flanges &/or Pump &/or Valve Glands)

to be Regularly DeWatered



Thanks to the use of Two Ultra High Quality **Mechanical Shaft Seals**, there is **no Nuisance Leakage** *(from Pump Gland Rope)* into the Pump Pit.

...**No Breeding** ground for **Mosquitoes**

Why Aqua....?

One Of The World's Largest Plant

Dedicated to Dry Motor Submerged Submersible Pumpsets

The Widest Types

of Submerged & Submersible Pumpsets in the World

Globally Un-Beatable Range *(of Dry Motor Sub pumps)*

upto 40,000m³/hr, 750m, 3000kW, 13.2kV & DN 2100mm

Globally Unmatched Types of

Dry Motor Submerged & Submersible Pumpsets

Field Proven Track Record...

Upto 12,240m³/hr, 300m, 1550kW, 6.6kV & DN 1300mm

Future Ready

Pumpset Designs....

A strong impetus on

Research & Development....

Competent Pre Order

Engineering Support....

....Highly

Experienced *Manpower*

End to End, Surface Water Transport ***Solutions....***

GoI's MoHUA's CPHEEO's Water Manual.....

GOVERNMENT OF INDIA
MINISTRY OF HOUSING AND URBAN AFFAIRS

MANUAL ON WATER SUPPLY AND TREATMENT SYSTEMS (DRINK FROM TAP)

PART A: ENGINEERING - PLANNING, DESIGN AND IMPLEMENTATION
FOURTH EDITION - REVISED AND UPDATED

CENTRAL PUBLIC HEALTH AND ENVIRONMENTAL ENGINEERING ORGANISATION
https://mohua.gov.in || https://cpheeo.gov.in

Installation of horizontal centrifugal pump on floor below surrounding ground level to the extent possible should be avoided as in the event of burst of any valve or pipe of individual delivery of pump in the pump house, the motor can be damaged due to water logging on the floor. A good example of centrifugal pump installations is of Bengaluru water supply systems where the pump mounting floor levels are at or above surrounding ground levels, thus, avoiding such risk. Clear water sumps are at higher ground levels, thus rendering positive suction to the pumps.

5.6.2.8 Submersible pump (conventional)

Submersible pumps have bowl assemblies that are similar to those of vertical turbine pumps. The motor, however, is submerged under water and directly connected to and located just below the bowl assembly. Water enters through an inlet strainer between motor and bowl assembly, passes through the stages, and is discharged to the surface via the vertical delivery pipes. Submersible pumps have become a major type of pump used in domestic wells, and increasing numbers of submersible pumps have been installed in large diameter, high-capacity wells. Submersible pumps have several advantages including the following.

- Motor is easily cooled because of complete submergence.
- Noise level transmitted to ground surface is very low or practically eliminated due to submergence and water column.
- The submersible pump has a hermetically sealed motor close-coupled to the pump. The entire assembly is immersed in the fluid being pumped. The pump is just above the motor, and both of these components are suspended in water. Submersible pumps use enclosed impellers and are easy to install and maintain. These pumps run only on electric power and can be used for pumping water from very deep and crooked wells. Moreover, they are unlikely to be struck by lightning and require a constant flow of water across the motor.
- The submersible pumps are suitable for following installations:
  a. tube well/borewell/dug well;
  b. small intake (if raw water turbidity is low);
  c. sump for small schemes.

Single phase (230 V) and three-phase (415 V) submersible pump-motor sets manufactured in India are as follows:

1 phase: Fractional kW to 2.25 kW	Generally used for a very small rural scheme
3 phase: 0.5 kW onwards	Other schemes

5.6.2.9 Submerged turbine and submerged centrifugal pump sets

Submerged turbine pump and centrifugal pump sets wherein both pump and motor submerged and common shaft provided for pump and motor are manufactured in India and abroad.

The design engineers should arrive at decision after due consideration of merits and demerits. These pumps are, however, very meriting for application where space and time are limited and/or installations where no adequate time is available for construction of civil works. Features of these submerged pump sets, their merits, and demerits including comparison with conventional VT and centrifugal pumps are as follows.

(i) Submerged turbine pump set

This type of pump on detailed consideration of merits and demerits and comparison with conventional VT pump including requirements of civil works may be evaluated as alternative to conventional VT pump. The features of submerged turbine pumps are:

(ii) Submerged vertical centrifugal pump rested with auto-coupling

Figure 5.9 (a) illustrates salient features of the pump.

- Merits of the submerged vertical centrifugal pump

a. Regular pump house can be dispensed with, or smaller pump house is required. However, panel room and lifting equipment are required.
b. Width of pump well can be reduced as working clearance between motors for heat dissipation is not required being under water.
c. No need for elaborate ventilation as motor is under submerged condition.
d. Noise level is negligible

- Demerit

a. A common shaft for pump and motor making entire set out of service even if either pump or motor fail.

I. Intake
II. Sump (raw water/clear water)
III. Low lying/waterlogged areas at the pumping station prone to floods.

(iii) Submerged Horizontal centrifugal pump set with portable base frame and submerged vertical centrifugal pump set with portable base frame.

Figure 5.9 (b) illustrates salient features of horizontal centrifugal pump set. The features of vertical centrifugal pump set are similar with motor on top and pump at bottom with end suction and side delivery.

...also acknowledges the benefits of Latest Technology Submerged pumpsets !

Aqua is the Pioneer of Submerged & Flood Proof pumpsets.....

have similar layout. In case of submersible/submerged pumps; except for suction strainer; no other suction piping or suction valves etc will be present. The losses need to be computed depending upon equipment involved in pumping station on case-to-case basis.

Note: Above layout of VT pumping station is illustrative. In case of submerged VT pumps; the line shafts, line shaft bearings, couplings, etc., will not be present. Also, no separate pre-lubrication or external lubrication arrangement will be present. The losses need to be computed depending upon equipment involved in pumping station on case-to-case basis.

Submerged Centrifugal End Suction, Water Pumpset

ARSES

Submerged Centrifugal Double Suction, Water Pumpset

ARSDS

Dry Installed Flood Proof *(Fully Immersible)* **Inline Booster Double** Suction Pumpset

ARFPD

Dry Installed Flood Proof *(Fully Immersible)* **Inline Booster End** Suction Pumpset

AIFPE

Bottom Suction, **Submerged Vertical Turbine Multistage** Pumpset

AVTB

Submerged Tubular Column **Mix** Flow Pumpset

ATBM

Dry Installed, Raw Water **Flood** Proof *(Fully Immersible)* **Back** Pull Out **End** Suction Pumpset

ARFP

AQUA®©

MAKE IN INDIA

UKcert
Certification & Inspection

Certificate of Compliance

CE

We hereby declare that the technical file of product complied with the requirement of directives 2014/35/EU Low Voltage Directive, 2014/30/EU Electromagnetic Compatibility Directive & 2006/42/EC Machinery Directive.

Certificate No.: CE-3096

Manufacturer
Name : AQUA MACHINERIES PRIVATE LIMITED
Address : S. NO.504/1 & 2,442/2, NR HARIDARSHAN ESTATE, NE. EXPRESSWAY HIGHWAY, RAMOL, AHMEDABAD-382445, GUJARAT, INDIA

Products :
- Submerged Centrifugal, Turbine, Single, Multistage: Single, Double Suction, Monoshaft Pump set for Water & Waste Water
- Submersible Bore well Motor and Pump Set
- Polder Type Pump Set
- Submersible Mono Type Pump Set
- Pump Set With Glycol Cooled Motor

The quality system file has been assessed, approved and is subject to continuous surveillance according to the Council Directives 2006/42/EC Machinery Directive & 2014/35/EU Low Voltage Directive.

This certificate is issued under the following conditions:

1. It applies only to the quality system maintained in the manufacture of above referenced models and it does not substitute the design or type-examination procedures, if requested.
2. The certificate remains valid until the manufacturing conditions or the quality systems are changed.
3. The certificate validity is conditioned by positive results or surveillance audits.
4. After fulfilling the relevant EU legislation, the manufacturer shall affix to each device, of the referenced models.

The CE mark as shown above can be used, under the responsibility of the manufacturer, after completion of an EC Declaration of conformity and compliance with all relevant EC Directives. The statement is based on a single evaluation of one sample of above mentioned product. It does not imply an assessment of the whole production.

Validity of this certificate can be verified at www.ukcertifications.org.uk/verify

Date of this Certificate	16th August 2023
1st Surveillance Audit Due	15th August 2024
2nd Surveillance Audit Due	15th August 2025
Certificate Expiry (subject to the company maintaining its system to the required standard)	15th August 2026

Authorised Signatory

This certificate is the property of UK Certification & Inspection Limited and shall be returned immediately on request.
71-75 Shelton Street, Covent Garden, London, WC2H 9JQ, United Kingdom
Website:- www.ukcertifications.org.uk, email:- info@ukcertifications.org.uk
Company No. 11847851

ISO International Organization for Standardization
ISO **45001**:2018
(OHSAS - Occupational Health & Safety Management System)

ISO International Organization for Standardization
ISO **9001**:2015

ISO International Organization for Standardization
ISO **14001**:2015
(Environment Management System)

Conformité Européenne (CE)

Aqua has been awarded the Prestigious
Best Quality Pump Vendor
by
बी एच ई एल BHEL

Spacious & State of the Art Plant...

Aqua Machineries Pvt. Ltd.

www.aquapumps.com

Registered Office & Manufacturing Plant
Survey No. 504/1-2, 442/2, Nr Haridarshan Estate, Nr Express Highway, Ramol, Ahmedabad-382 445. Gujarat, India.

marketing@aquapumps.com

Scan QR Code to visit our website