



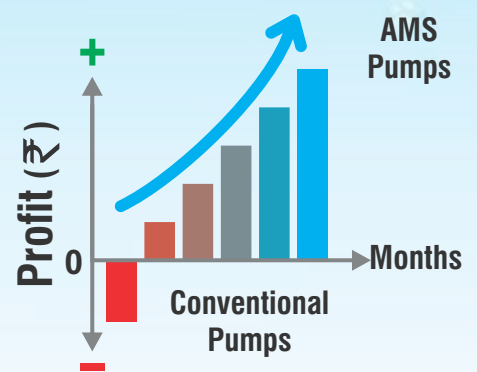
*Latest Technology, Heavy Duty,
Ultra Low Maintenance & Cost Effective
Horizontal, Monoshaft;
Submerged Mine Dewatering pumpsets*

AMS

Highly Dependable, All Weather pumpsets

Increase Dewatering (upto 33%) &

Reduce Costs (upto 66%)



Situation :

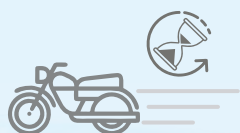


Pumping Machinery in Mines is exposed to **hot & humid** ambience. Even Minor Rains (*in OCM*) &/or Power Cuts (*in UGM*) deposit humongous volumes of water on the pumps causing **Catastrophic Damage** putting them **out of action** for a **long time**.

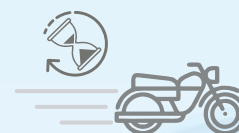


Conventional pumpsets are fitted with Rope Packed Glands which unavoidably suffer from Water Leakage (*often the mine waters are*

corrosive & erosive) which unavoidably suffer from **Water Leakage** (*often the mine waters are corrosive & erosive*) which aggravates Bearing Corrosion (& it's Pre-Mature Failure), causes Frequent Shaft & Sleeve damage which not drastically Increases Pump Downtime & Costs



The typical **distance** (*between the Pumps & Operator's Locations*) being **very long**, Operators **have to go upto the Pump frequently** (*during each Start/Stop & Frequently for Routine Maintenance*) – this is **time-wasting & tedious**.



Conventional pumps have a **Paradoxical Locational Constraints** – they need to be placed **As Near as Possible** (*to the water level (to have assured (water) Suction Lift)*) & **yet placed As Far Away as Permissible** (*from water level (to be protected from the abrupt rise in water level (say due to Rains in OCM or Power Failure in UGM))*).



This requires **Constant Monitoring**, is Labourious & calls for **Frequent Shifting** which is not only Costly but also causes **Huge Down Time** & occasional **Damage** (*either by submergence &/or by manhandling during shifting*).



During **BLASTING**, sharp high-speed debris impact & damage surface mounted Conventional pumps.





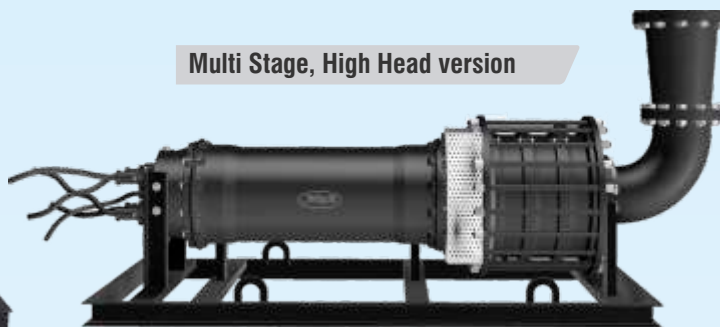
Solution

Aqua has taken a hard look at mining applications & used our vast design experience to develop a New Generation, Submerged Mine Dewatering pumpsets. With its robust design, flexible to use & smart capabilities; the **AMS** Horizontal, Monoshaft; Submerged Mine Dewatering pumpsets ensure Reliable, Ultra Low Maintenance & Highly Productive mine dewatering.

Single Stage, High Flow version



Multi Stage, High Head version



Design

The Submerged Induction **Motor** is an **IS 60034 compliant**, Dry **Air filled, Totally Enclosed (Ip68)**; **Self Water Cooled (TESWC)** Squirrel Cage type Induction Motor

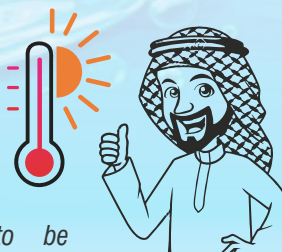
It is Immersed in Water (with IP68 Hermetically Sealed Enclosure) & hence it :

1. Is **Naturally Earthed** (yet we are prudently offering $1/2$ & **1 Earthing Core** in Power Cables (for OCM & UGM motors respectively))
2. Is **Inherently Flame Proof, Gas Proof & Moisture Proof**
3. Offers **Increased Safety** against Potential Damage by flying debris during **Blasting** (as water absorbs most of the momentum (of such flying debris) & hence hugely lessens the risk of damage).

Due to **Self Water Cooling**, there is No Air Blower & hence **Windage & Blower Losses** of these motors are **Extremely Low** & ultimately the **Motor Efficiencies are High** - in fact these motors can offer Energy Efficiency **Slightly Better than Conventional Air Cooled motors** (even in the **HT** range)...!

As the motor itself is immersed under water, it is always Excellently Cooled, thereby able to **Run 24 x 7** even in **Hottest Summer** - a huge benefit over Surface Mounted

Conventional Motors (which need to be periodically rested due to Heat, Mine Dust Deposition on the Blower/ Fan / Cowl).

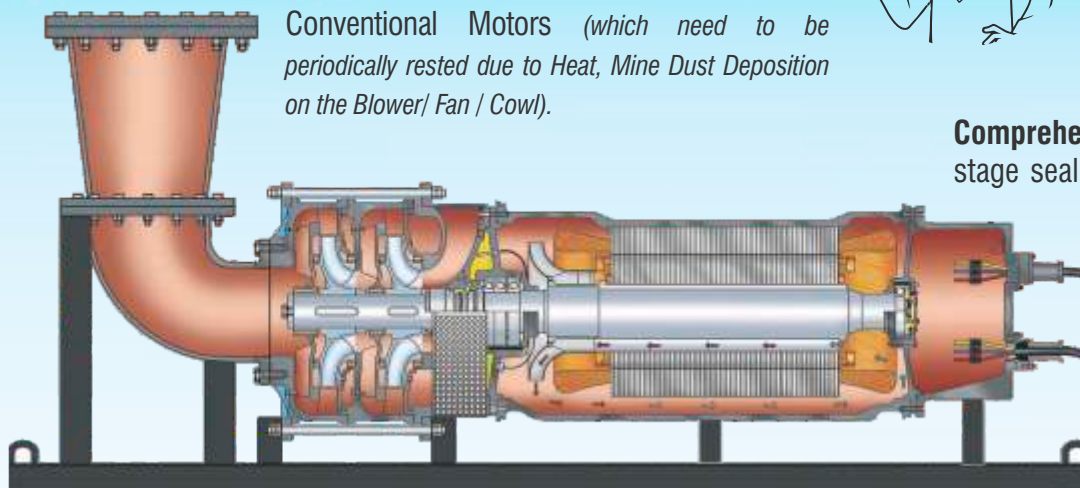


Motor's **Insulation** is based on World Leading "**Power House**" type **treatment** (Mica based; Dual Vacuum Pressure Resin Impregnation (VPI)) technology for Un-parallel **Di-Electric Strength**.



Comprehensive Cable Gland Multi stage sealing ensures Flame, Gas & Moisture Proof Sealing.

Dual Sheathed PVC (LT) & EPR (HT), Copper cored; Mine Approved Submersible Cables



Design

The Shaft-Motor **Gland** is sealed by **Two**, High Quality **Maintenance Free Mechanical Seals** - the Primary (*pump end*) seal is made of **Super Hard Silicon Carbide** faces for **excellent Erosion Resistance**.



Secondary Mechanical Seal is designed to be normally replaced @ **7.5 years** (*for 90% surety*) or 50,000 (*working*) Hours (*for 99% surety*)

Primary Mechanical Seal is designed to be normally replaced @ **5 years** (*for 90% surety*) or 25,000 hr (*Working Hours*) (*for 99% surety*)



Premium Materials

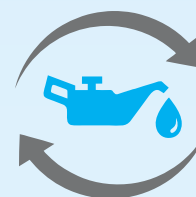


Premium Materials

Premium, **Ultra Long Life; Synthetic Grease** ensures a Typical Regreasing Interval of **5 years**



Super Heavy **Bearings** are designed for typical Life of **10 years** (*L_{10h} with 90% surety*)



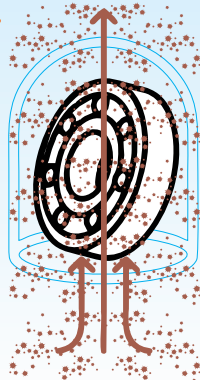
Typical Oil Replacement interval of **2.5 years**

Intelligent Design



Conventional pumpsets are fitted with **Rope Packed Glands** which unavoidably suffer from **Water Leakage** which causes **Bearing's Corrosion & Pre-Mature Failure** of pumpsets...!

Conventional Pumpset

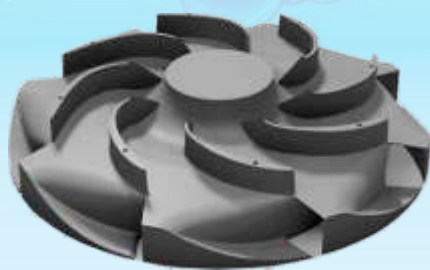


Bearings & Cast Iron Gland are **exposed to Ash & Water** leading to their **Rusting** Frequent **Premature Failures**

Submerged Pumpset



Bearings are Located Deep inside the motor & are **Totally Sealed by Two Mechanical Seals** thereby **Isolated** from Water & **Silt** for 100% **Bullet Proof performance**



Premium Materials

Diffuser Casing (Multi Stage pump)

Pump **Casing/Body** is always made of high-performance **Tough, Crack Resistant; Ductile materials** like Spheroidal Iron (SG Iron) or Cast Steel (WCB) (*instead of Brittle & Cheap materials like Cast Iron typically used in Conventional pumps*).



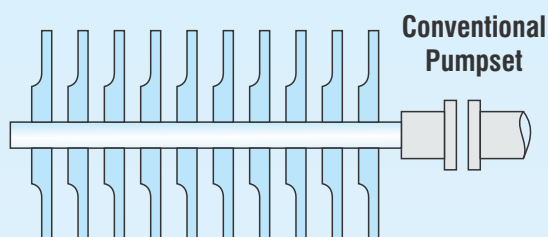
Impeller/s is/are mounted directly on to the Extended Shaft of the motor hence **Eliminating Coupling & Alignment, vibration problems**.

Design

Robust, API 610 inspired features

- Heavy Duty Stainless Steel “**Tie Rod**” clamping design.
- Dynamically balanced, **Keyed**; Enclosed **Impellers** of **Stainless Steel** for improved Erosion / Corrosion resistance in raw water.
- **Rugged** Cast Iron Motor Stator Frame.
- **Bi-Directional** Seals, Bearings & Keyed Impeller/s allowing safe accidental / transient reverse rotation.
- **Silt Erosion resistant**, Textile Laminated Woven Composite Inter-Stage Seal rings.
- **Studs & Nuts** for diffuser type pump's pressurized components.
- **Pinned Wear Rings** for easy maintenance.
- **O-ring** construction for Higher Pressure resistance.

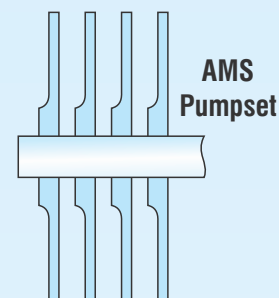
Due to **Lower** Number of Pump **Stages**, **Thicker Shafts** & the Outright **Elimination of Coupling & Rubbing Gland Ropes**; the Shafts of AMS pumpsets are **Vibration Proof** leading to a **huge** Reduction in **Wear & Tear**.



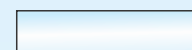
Thin, Long & Slender....!



Prone to Vibration



Thick, Short & Robust....



Vibration Proof



Mono Shaft (*Single Piece*), Robust Oversized; Pump & Motor **Shaft** is always made from **Rust Free Stainless Steel** (*instead of Cheap Rust & Maintenance Prone Carbon Steel typically used in Conventional pumps*) leading to **Zero Spare requirements**, Shaft is designed for a typical Life of **15 years** (L_{1h} 99% surety)



Heavy duty **Stainless Steel** Suction Strainer



All wetted **Fasteners** are exclusively of **Stainless Steel**

Intelligent InBuilt Monitoring

Easy Monitoring (& Remote Control[#]) of your pumpset's health



- **LSLD** detects Pressurized Water leakage from Mechanical Seals
- **CCWLD** detects Accidental Water leakage from Cable Sheath's Cuts &/or Nicks into the Motor

- **WTDs** in the form of Bi-metallic Switches &/or PT100 monitor Stator Winding temperature.
- **BTDs** in the form of Bi-metallic Switches &/or PT100 monitor Bearing Temperature.
- **SBWLD** detect Accidental Water leakage in to Motor's Stator Chamber.



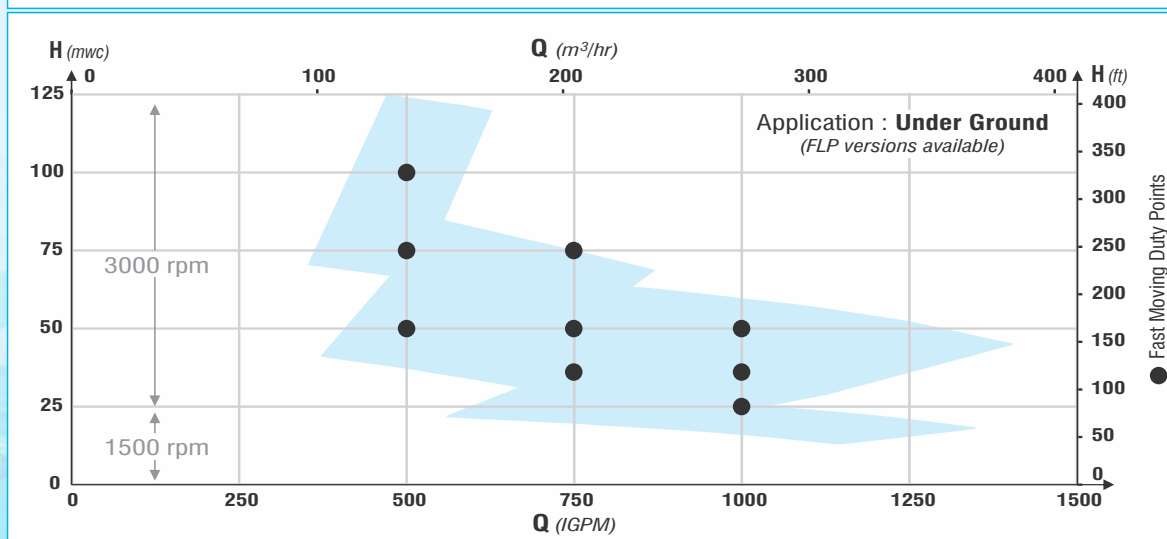
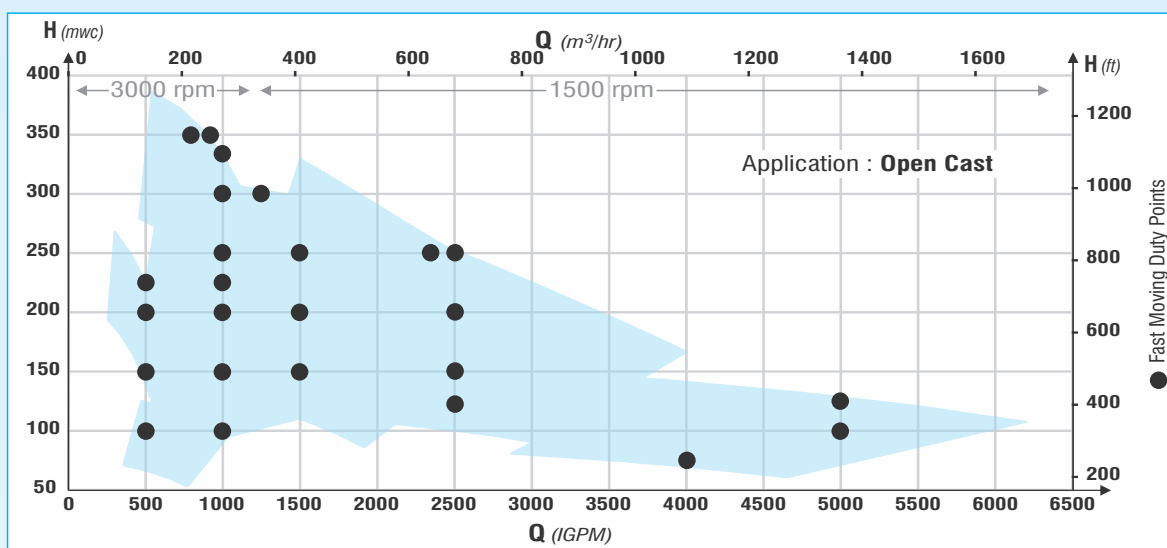
[#]requires additional communication hardware

Standard Production Range:

- Pumpset Discharge Size : **DN 100mm (4") to DN 250mm (10")**
- Flow : **Upto 6000 igpm (1635 m³/hr)**
- Head : **Upto 350 mwc**
- Voltage Rating : **415V, 550V, 690V, 3300V, 6600V**
- Motor Rating : **Upto 700kW**
- Motor Speed : **3000 rpm, 1500 rpm (syn)**

Typical Performance Range

Totally Enclosed (IP68), Air filled; Surface Water Cooled; Submerged TESWC motor MonoShaft **AMS** pumpsets



Materials of Construction:

- Pump Casing : **Cast Steel** (ASTM A216, Grade WCB) [CF8 (SS304) &/or CF8M (SS316) - Optional] or **Ductile Iron**
- Impeller : **CF8M** (SS316) [Duplex Stainless Steel (ASTM A351, Grade CD4MCu) - Optional]
- Pump Gland (Mechanical Seals) : **Silicon Carbide**, Stainless Steel & Fluro Carbon Elastomer (Viton)
- Shaft : **Stainless Steel** (SS410 or SS431)
- Fasteners (Exposed to Liquid) : **Stainless Steel** (SS304 (A2))
- Elastomers : **Nitrile Rubber**
- Motor Casing, Cable Chamber & Oil Chamber : **Grey Iron** (IS 210, Grade FG 260)



Premium Materials

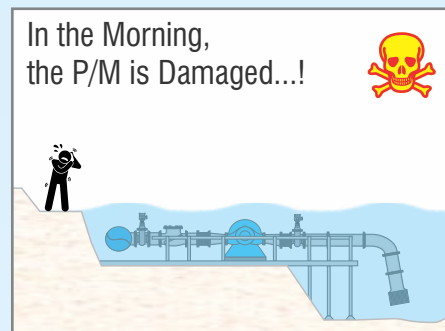
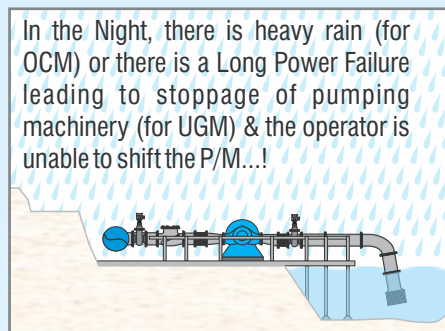
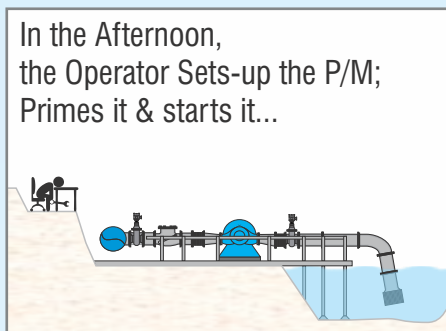
Benefits of Submerged Pumpsets

Use of AMS Submerged pumps have the following advantages:

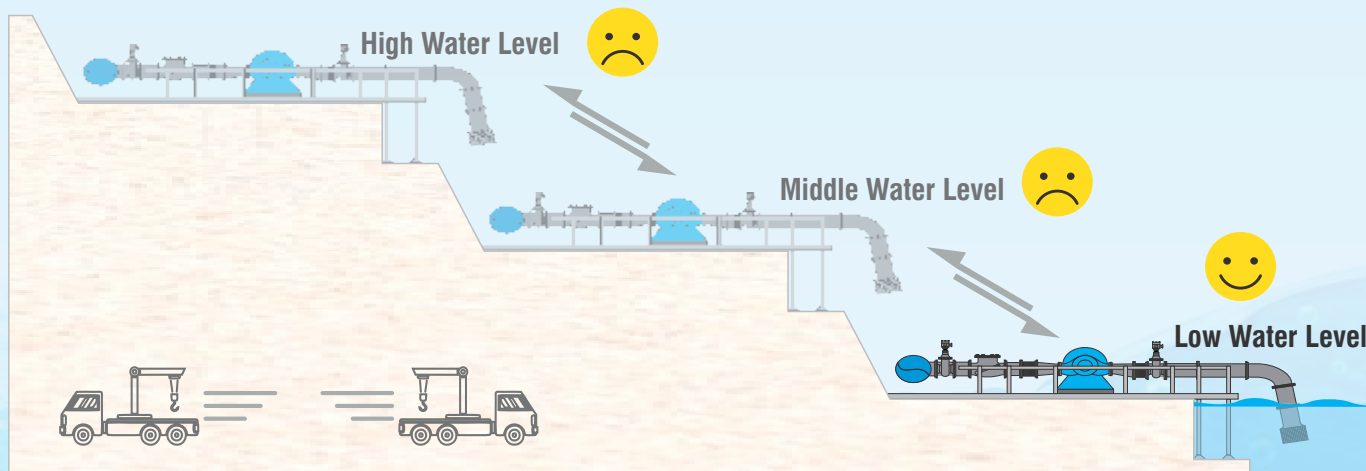
- 1) Abrupt Water Rise due to Failure of Electrical Power Supply does not endanger the pumps
- 2) No Underground pump house is required
- 3) The pump is easy to Install, very easy to Commission & supremely easy for O&M



**Conventional Pumpsets need to be Protected from...
...Rains & High Water Level (Submergence)**



Conventional pumps have a **Paradoxical Locational Constraints** – they need to be placed **As Near as Possible** (to the water level (to have assured (water) Suction Lift)) & **yet placed As Far Away as Permissible** (from water level (to be protected from the abrupt rise in water level (say due to Rains in OCM or Power Failure in UGM))).

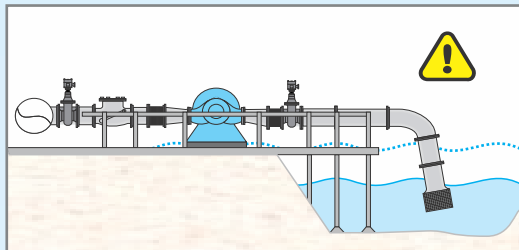
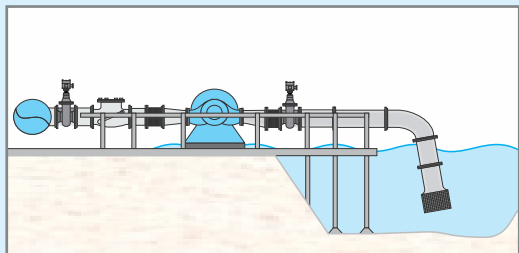


Conventional pumpsets need to be Shifted Frequently leading to Loss of Working Hours, Increased Operational Manpower, Transportation Costs & increased Risk of Damage...!

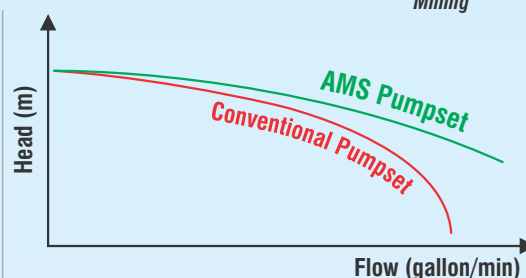
**Submerged Pumpset don't need Shifting for years together
& hence are available for many More Working Hours**



Benefits of Submerged Pumpsets



Conventional pumps "Pull" water (against Earth's Gravity) & even a Small Depletion (of Suction) Water Level (say by just 2-3m) may cause **Cavitation** (i.e. Collapse of Water Suction) causing a **disproportionately Huge Drop** in Pump's Flow



Due to **Submerged installation**, AMS pumps are **Cavitation Proof** & hence they **Sustain their Design Flow** (irrespective of Depletion of suction water level).

If there's water in the pit, AMS pumps will always "Push" it away 😊

⌚ No need to Periodically ⌚



...Check / Align Shaft Coupling

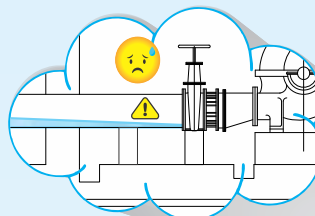


...Check / Change Gland Packing

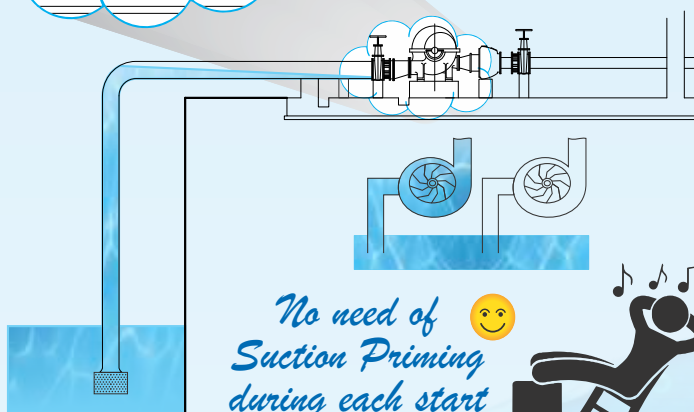


Conventional Pumpset

No need of Valve Opening / Closing during pump Start/Stop

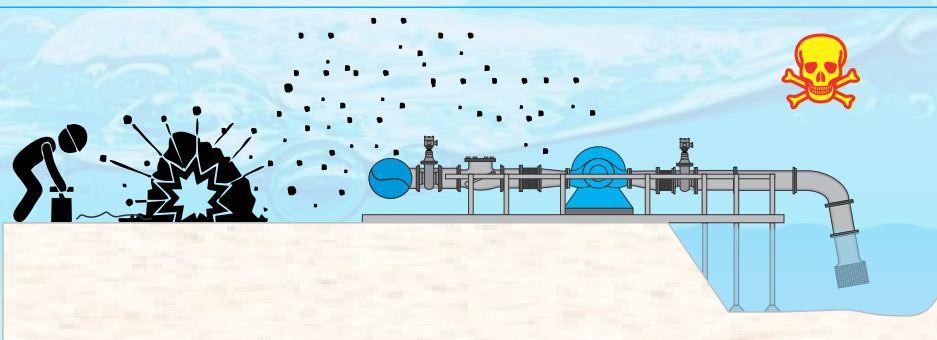


Conventional Pumpset

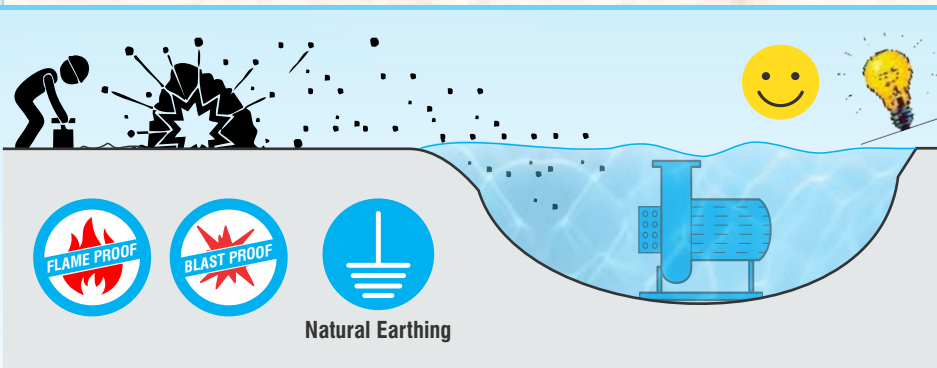


No need of Suction Priming during each start 😊

No Foot Valve Suction Losses & Energy



During **Blasting**, sharp **high speed debris** often impact & damage Conventional Pumpsets



Natural Earthing

However, in case of Submerged pumpsets; **Water absorbs** most of the **momentum** (of such flying debris) & hence hugely lessens the risk of damage....

Energy Consumption

The **Pump Efficiency** of Conventional pumps & Submerged pumps is **nearly Similar** (for the same duty conditions, & assuming the same speed & number of stages).



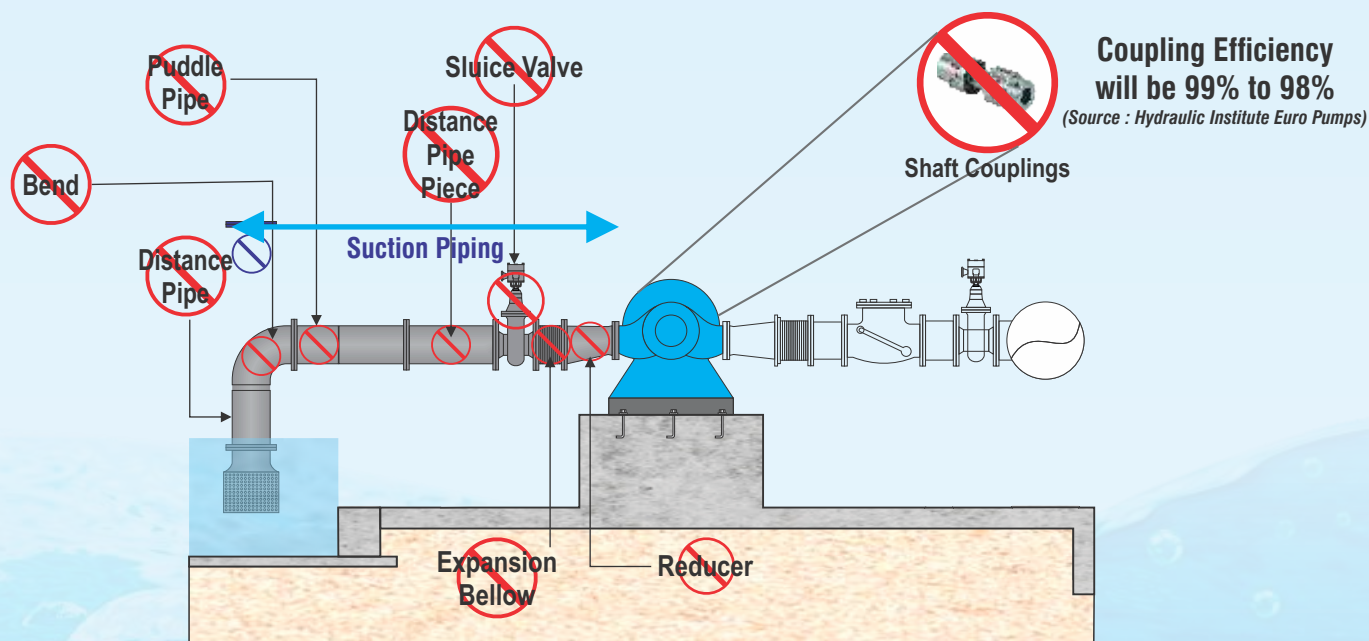
Saves Energy*

But, Conventional Bare Shaft pumps utilize :

- 1) **Suction Piping Auxiliaries** (*Foot Valve/ Sluice Valve, Bell Mouth, Reducer, Suction Pipe, etc*) all of which will have their **Inherent Friction Head (m) Losses** & hence will make the pump-motor do more **Unnecessary Work** & subsequently **Waste Energy** too.
- 2) **Coupling** (between Motor & Pump) which will incur **wasteful Mechanical Power (kW) Losses** (*upto 1 % to 2%*)
- 3) **Air Blower Cooled Motors** with Slightly Higher Internal Windage Losses (*i.e. Slightly Lower Efficiency especially in HT*)

However, the above Ancillaries & Auxiliaries are not required in AMS pumpsets & hence AMS pumpsets will have Lesser Internal Energy Wastage.

Legend : Ancillaries/ Auxiliaries / Parts marked indicate that they are not required in Horizontal Submerged Mine Dewatering Pumpsets (& hence their associated Operation Hassles, Maintenance Problems & Spare Parts Consumption are also automatically eliminated).



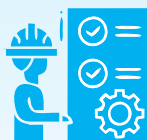
Due to Elimination of drawbacks 1, 2 & 3; AMS pumpsets consume approx 1.5% to 3.5% Less Energy (kW/gallon) 😊

Pumping Plant Load Factor (PPLF)

Pumping Plant Load Factor (PPLF) is the Ratio of Total Dewatering Actually done per Annum (*by the pumping plant*) to the Maximum Theoretical Dewatering (*i.e. assuming 365d x 24hr/d working*) that could have been done.

Higher PPLF results in :

Constant & Planned Production



Better Revenues



Lower Capitalized Costs of the Pumping Plant

$$\text{PPLF \%} = \frac{\text{De Watering Actual}}{\text{De Watering Theoretical}}$$

(Pumping Plant Load Factor)

$$\text{De Watering Theoretical (m}^3\text{/y)} = \text{Pump Capacity (m}^3\text{/hr)} \times 365 \text{ d} \times 24 \text{ hr (hr/y)}$$

$$\text{De Watering Actual (m}^3\text{/y)} = \text{Pump Capacity (m}^3\text{/hr)} \times \text{AVAILABLE Pump WORKING Hours (hr/y)}$$

AVAILABLE Pump WORKING Hours = ((365d x 24hr) - (Time Lost in Start-Stop, Maintenance & Repairs))

Conventional Pump

$$\text{DeWatering Actual (m}^3\text{/y)} = \text{Pump Capacity (m}^3\text{/hr)} \times \left((365 \times 24) - (\text{Time Lost in Start-Stop, Shifting, Maintenance \& Repairs}) \right)$$

(hr/d)
(Starter Push/Off, Priming, Valve Open-Close Pump Shifting due to Loss of Suction Priming etc.)

(hr/d)
(Gland Tightening, Gland Rope Replacement, Bearing Re-Greasing, Coupling Clearance & its Alignment, Replacement of Shaft Protection Sleeve, Bearing Bush, Spacer Sleeve, Suction Pipes & Suction Valve Cleaning, Discharge Valve Cleaning Replacement of Vibration Pad, etc)

= Low PPLF
(0.7 to 0.75)



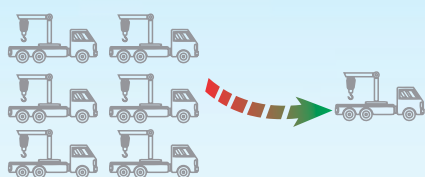
AMS Pump

$$\text{DeWatering Actual (m}^3\text{/y)} = \text{Pump Capacity (m}^3\text{/hr)} \times \left((365 \times 24) - (\text{Time Lost in Start-Stop, Shifting, Maintenance \& Repairs}) \right)$$

(hr/d)
(Starter Push/Off; Priming, Valve Open Close Pump Shifting due to Loss of Suction Priming etc.)

(hr/d)
(Gland Tightening, Gland Rope Replacement, Bearing Re-Greasing, Coupling Clearance & its Alignment, Replacement of Shaft Protection Sleeve, Bearing Bush, Spacer Sleeve, Suction Pipes & Suction Valve Cleaning, Discharge Valve Cleaning Replacement of Vibration Pad, etc.)

= High PPLF
(0.95 to 0.98)



Saves (upto 85%) Pump Shifting Costs*



Saves (upto 65%) of Total Costs*
(Capital + Operational (Spares + Consumables + Manning + Handling Shifting))



Increases Cummulative Dewatered Volume (upto 33%) *

* refer marketing@aquapumps.com for detailed Case Studies

Aspect		Conventional Pumpset	Submerged Pumpset
Startup	Suction Priming	Mandatory ⚠️ <i>tedious & requires the operator to go upto the pump during each startup; adds to overall Maintenance</i>	Not required 😊
	Suction Vacuum Pump <i>Operation during Pump Start Stop</i>		
	Need of Vacuum Pump/ Foot Valves		
	Installation & Operating Manpower: Skill level required & Quantity	Highly Skilled 👤👤👤 😞	Medium Skilled 👤 😊
	Time Consumed	15-30mins *	approx 5mins
	Ease of Operation	Very Cumbersome	Easy
	Conducive to Remote Operation	👤👤👤 No 😞	👤 Yes 😊
Risk of Bearings Damage <i>(due to Ash &/or Ingress)</i>		High Risk	No Risk <i>(as bearings are sealed off by 2 mechanical seals)</i>
Routine / Daily Check Up	Shifting of Pumpsets <i>to Save from Submergence/ Sustain Suction Prime</i>	👤👤👤 Very Frequently	Very Rare
	Recommended Mean Time between Maintenance of Gland : Rope / Mechanical Seal	approx Fortnightly	5 to 7.5 Years 😊
	Recommended Mean Time between Alignment Check (if) & Maintenance of Couplings (if) & Shaft	approx monthly	Not Required 😊
	Vibration & Noise Check Up	Every Week	Not Required 😊
	Suction Manifold Cleaning	Monthly	Not Required 😊
Periodic Maintenance	Spare Parts : nos/ types of Spare Parts to be kept in Stock as per DIN 24296 for 2y of operation	36nos	12nos
	Lubrication Durations	Weekly/ Monthly	30 to 60 months 😊
	Shaft Sleeve Replacement	Every 6 months	60 months 😊
	Discharge Valves Maintenance	Every 4-6 months	Every 4-6 months
	Mean Time Between Maintenance/ Replacement of Bearings	2 ½ Years	10 Years
Operational Energy Cost (kW/hr)		100%*	98.5% to 96.5%
Pumping Plant Load Factor (PPLF)		~0.74*	~0.98*
Total Water Actually Dewatered in LifeTime		100%*	~133%*

* refer marketing@aquapumps.com for detailed Case Studies

Saves (upto 45%-75%) Spare Parts*

Saves (upto 66%) Man Power*

Saves (upto 70%) Consumables*

Why Aqua's pontoons...?

Supreme Operator Safety

Robust, Safe & Stable Design meets **AS3962 - 2001** standards – **Australian Standards Guidelines.**



Australian STANDARD

The centre of the structural steel frame of the pump pontoons have a **Low-Slung chassis** hence the **Pump sits below the deck** of the pontoon which lowers the **Centre of Gravity (CG) & Low Roll Centre (LRC)** for Increased Stability. The float systems are designed & sized with minimum **1.25X FoS (Factor of Safety)**.

Plastic/Steel Drum Pontoon

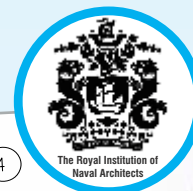
Can get Punctured / Leakage due to Sharp Stones / Debris.

Robust Tank like Build

Aqua's Metallic Pontoon



Certified by IIT



FRONT VIEW

TOP VIEW SECTION X-X

SIDE VIEW

ISOMETRIC VIEW

SRNO	DESCRIPTION	SIZE	MATERIAL	QTY
1	FLOAT	1.5X1X1	MS IS2062 B E250	8
2	PUMP-CAGE	2.5X2X1	MS IS2062 B E250	1
3	ISMC-COLUMN	3.3	MS IS2062 B E250	8
4	ISMB HORIZONTAL-BEAM	3	MS IS2062 B E250	4
5	CHAIN PULLEY & BLOCK	5	INDEF	1
6	ISMB-150CHAIN BLOCK&P	5	MS IS2062 B E250	1
7	ISMC-100-SUPPORTING	5.05	MS IS2062 B E250	2
8	SHORT RAILING	1.624	MS IS2062 B E250	4
9	LONG-RAILING	3.220	MS IS2062 B E250	2
10	ISA-65X65X5	3	MS IS2062 B E250	5
11	CORRUGATED-SHEETS	14 + 2E-Sft	GI SHEET150.5 MM	4
12	PROVISION FOR CHANGING BUDYANCY	500 MM	MS IS2062 G-B E250	8
13	HOOK FOR MURING/ SHIPPING LIFE -JACKET	STD	MS IS2062 G-B E250	2
	HARDWARE/NUT SET	---	SS 304	4
				LOT

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Achalayathay
B Tech & PG (Naval Architecture)
Chartered Engineer, IEG
License No - 31552328

UNLESS OTHERWISE SPECIFIED

- ALL DIMENSIONS ARE IN mm.
- SURFACE FINISHES AS PER CO. STD.
- UNMENTIONED TOLERANCES AS PER CO. STD.
- REMOVE ALL SHARP BURRS AND SHARP EDGES.
- DRAWING NOT TO BE SCALED.

UNMENTIONED

RADIUS ---

CHAMFER ---

UNDERCUT ---

NOTES

1. This drawing is a property of Aqua Machineries Pvt Ltd

2. Variation by permission shall be at the responsibility of the customer.

3. DATE :- 15/04/2019

4. DATE :- 15/04/2019

5. DATE :- 15/04/2019

ASSEMBLY OF PONTOONS
GENERAL ARRANGEMENT DRAWING
PONTOON-TYPE-1

Aqua Machineries Pvt. Ltd.
Survey No. 4427, 5247 & 5242, Near Haripurah Circle,
Near Science Highway, Anekal, Shivajinagar, Bengaluru, India.
Email : marketing@aquamachines.com Web : www.aquamachines.com
CIN : U25100KA2010PT000095 GST : 34AACD3014A128

Some Installations

300m, 1000IGPM, 3.3kV; 550hp.....
 Aqua Submerged Mine pump used at
RG1 OC3 Ramagundam by m/s.
SCCL.



m/s **TATA Steel Ltd.** is using **3.3 kV AMS** pumpsets (2200IGPM, **140m** head,
475hp) on **Floating Pontoon** for its **Sukhinda Chromite** Mines, Odisha.



APMDC for **Mangampet Barytes** Mines near Tirupathi, have replaced the maintenance prone Conventional Pumpsets with Aqua's Submerged Mining pumpsets (**100 m** head, upto **600 HP** having flow of upto **1250 m³/hr**) & benefit from **lower down time & increased production** compared to earlier pumpsets.



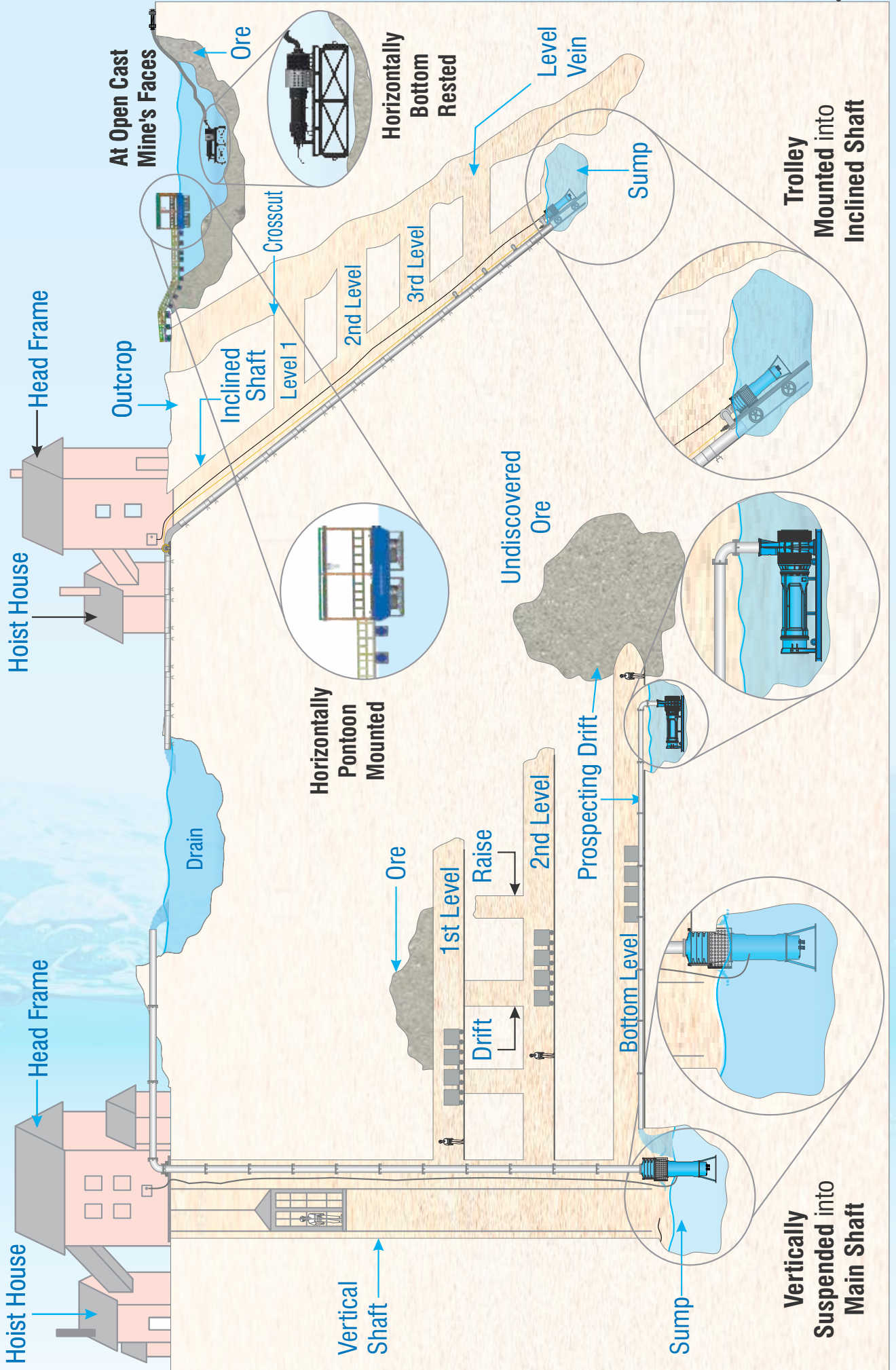
Balasure Alloys Ltd is using 2 Nos. of 250m³/hr, 100 m head of 250 HP AQUA Submerged Mine Pumpsets for **Kaliyapani Chromite Mines** Dewatering.



150m x 1835 IGPM, **3.3kV** 475hp AMS pumps being used by m/s **WCL** at **Pench (New Sethia OCM)**



Typical Applications





Aqua has been awarded the Prestigious Best Quality Pump Vendor

by



Some of Our Happy Clients....



Spacious & State of the Art Plant...

Aqua Machineries Private Limited

www.aquapumps.com

Registered Office & Manufacturing Plant

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