CHAPTER : 1 INTRODUCTION ABOUT COMPANY

1.1 OUR COMPANY LOCATION:

115/1-2, GIDC ESTATE, KANSA ROAD VISNAGAR

1.2 COMPANY Overview:

The company had initial of about 1 crore in plant. It was a pioneer small-scale industry in production of submersible pump set in north Gujarat.

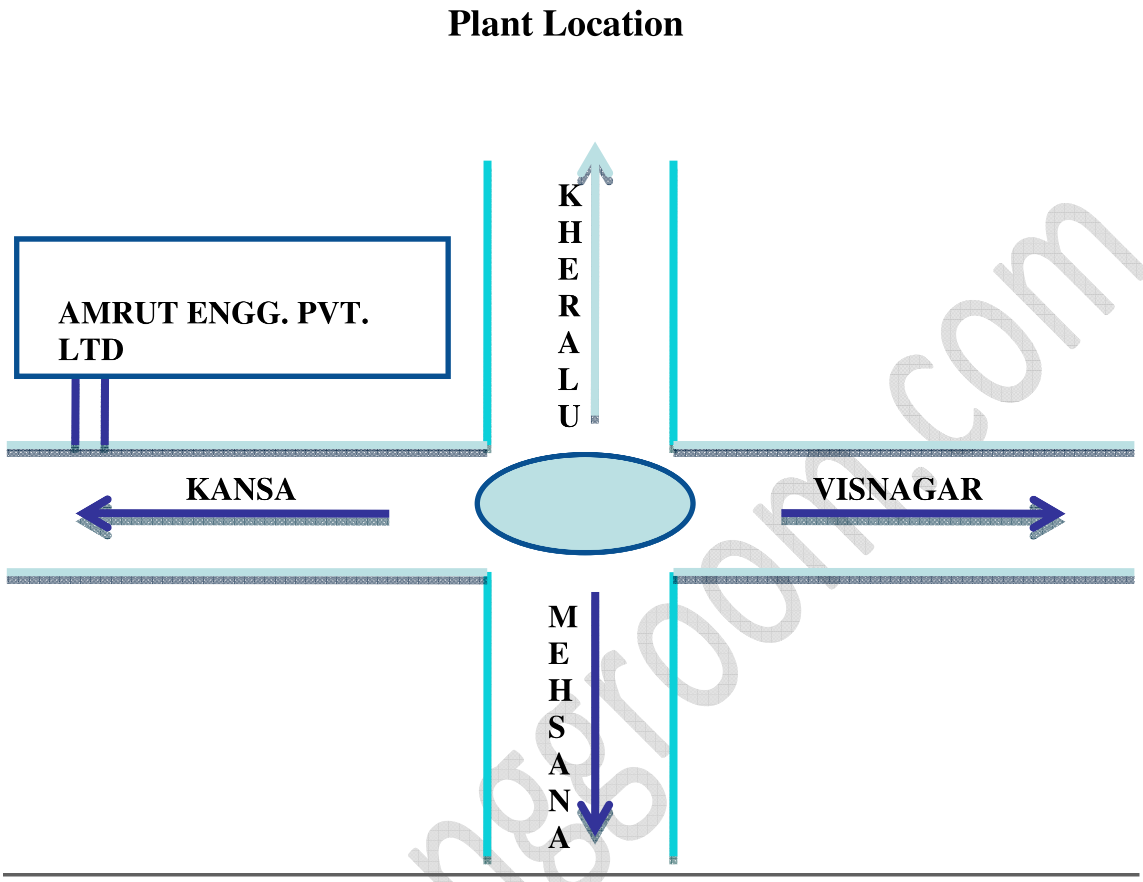
The company currently is well setup and is able to manufacture the submersible pump sets its own.

1.3 HISTORY :

In the year 1978 Mr. A.I.Patel Started his manufacturing activities & Introduce the AMRUT brand submersible pump set successfully and manufactured 227 sets in the first year and 329 in second years.

In 1981 M/S BAJAJ ELECTICALS PVT. LTD started marketing the pumps with their brand name. At this time they need of establishing a new unit with M/S BAJAJ ELECTRICALS PVT LTD. Named EMPIRE PUMPS PVT LTD.

1.4 PLANT LOCATION :



1.4 COMPANY PRODUCT:

Motor
Submersible pump.

1.4 COMPANY PRODUCTS

1.4.1 MOTOR:

Fig.1.1: MOTOR

- <u>MOTOR :-</u> when a current-carrying conductor is located in an external magnetic field perpendicular to the conductor, the conductor experiences a force perpendicular to itself and to the external magnetic field.

Fig.1.2: MOTOR

1.4.2 SUBMERSIBLE PUMP:

Fig.1.3 SUBMERSIBLE PUMP:

Raw material required for production of the pump like shaft, stage, casing, necking etc are assembled as per laid down in departmental procedures stated below work instruction, drawing & specification.

If the loading test is finished without problems then at that time the covering up of the pump takes place and now it is sand to dispatch section for the required sellings

Product Range

75mm Submersible Pump Sets (3”) – Single Phase
100mm Submersible Pump Sets (4″) – Single Phase
125mm Submersible Pump Sets (5″)
150mm Submersible Pump Sets (6″)
175 Submersible Pump Sets (7”)
200mm Submersible Pump Sets (8″)
250mm Submersible Pump Sets (10″)
300mm Submersible Pump Sets (12”)
350mm Submersible Pump Sets (14”)

CHAPTER : 2 PRODUCTION PROCESS OF PUMP

2.1 PUMP

Raw material required for production of the pump like shaft, stage, casing, necking etc are assembled as per laid down in departmental procedures stated below work instruction, drawing & specification.

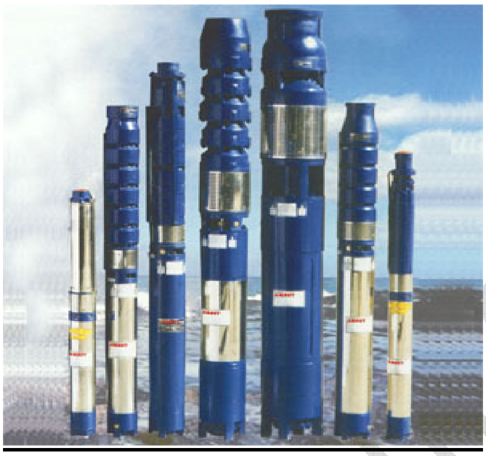


Fig 2.1 pump

If the loading test is finished without problems then at that time the covering up of the pump takes place and now it is sand to dispatch section for the required selling.

2.2 MACHINE SHOP:

- Lathe machine,
- Shaper machine,
- Radial Driling machine,
- Bench grinding machine,
- Material handling ,
- Welding & cutting device,
- Hexo cuter,
- Milling machine,
- Coloring machine.

2.2 MACHINE SHOP:

2.2.1 Lathe Machine:

Fig 2.2: LATHE MACHINE

SPECIFICATION	L-4	L-5	L-6
Bed Type	2 V & 2 Flat	2 V & 2 Flat	2V & 2 Flat
Bed Length	1372 (4'6")	1600 (5'3")	1825(6')
Bed Width	275(11")	275(11")	275 (11")
Gap Length	125 mm	125 mm	125 mm
Gap Length in front of face plate	110 mm	110 mm	110 mm
CAPACITY			
Height of Center	200 (8.0")	200 (8.0")	200 (8.0")
Swing Over Bed	350 mm	350 mm	350 mm
Swing Over Cross slide	200 mm	200 mm	200 mm
Swinging Gap m	500 m	500 m	500 m
Admit Between Center	487 mm	780 mm	940 mm
Movement of Compound Slide	110 mm	110 mm	110 mm
MAIN SPINDLE			

Spindle Nose	0 75 MM	0 75 MM	0 75 MM
	Threaded Type	Threaded Type	Threaded Type
Taper Bore in Spindle Sleeve	MT-4	MT-4	MT-4
Spindle Bore	0 50 (2")	0 50 (2")	0 50 (2")

TAIL STOCK			
Quill Diameter	0 50 MM	0 50 MM	0 50 MM
Taper in Quill	MT-4	MT-4	MT-4
Quill Travel	170 MM	170 MM	170 MM
SPEED			
No. of Spindle Speed	8	8	8
RPM (Low / High)	45 - 750	45 - 750	45 – 750
THREADS			
Metric Thread	13(1 to 6 mm)	13(1 to 6 mm)	13(1 to 6 mm)
English Thread	19(2to24TPI)	19(2to24TPI)	19(2to24TPI)
Lead Screw	0 32MM x 4 TPI	0 32MM x 4 TPI	0 32MM x 4 TPI
ELECTRICALS			
Motor Power	1.5KW/2HP	1.5KW/2HP	1.5KW/2HP
DRIVE			
Teethed V Belt	B-48	B-48	B-48
GENERAL			
weight (Approx.)	600 kg	675 kg	710 kg

Table 2.1

2.2.2 Shaper machine:

Fig 2.3: SHAPER MACHINE

SPECIFICATION:

- Length of stroke :Max.500 mm
- No. of speeds to Ram :To be indicated by the party
- No. of Ram cycles / min. : Maximum140 strokes/min.
  Steps to be indicated by the party
- Motor Power : A.C. 7.5H.P.
  Specs & make to be given by the party
- Vertical Travel of tool post slide : 150 mm (**Manual feed only**)
- Machine table is **NOT** Required. Shaper length will be reduced accordingly The Machine should be mounted on a slide (bed on which machine will travel) which will be clamped to the shop floor bedplates during operation.

- Overall dimensions of the machine should be as per the enclosed sketch. Machine structure should be rigid so that vibrations do not occur during.
- Machine slide (bed on which machine will travel) should be of single piece cast iron Block with hardened and ground guide ways.
- There should not be any leakage / spillage of oil during operation or otherwise. All moving guide ways, as well as their matching moving parts, shall be of Hardened and ground steel.
- Proper lifting arrangement shall be provided for shifting of machine from one Place to another place.
- Operator's platform shall be provided on both sides of machine. Provide machine light shall.
- For proper evaluation of the offer, Machine catalogue / Sketches shall be provided along with the quotation. Standard tool kit for operation and maintenance of the machine shall be provided.

SPECIFICATION TABLE:

Model ESS KAY	40mm	50mm	65mm
Drilling Capacity(in steel)	40	50	65
Drillin g Depth	180	225	305
Taper Spindle Nose Socket	M.T. 4	M.T. 5	M.T. 5
No. of Spindle Speeds	6	9	12
RPM of the Spindle	45-660	40-790	18-810
No. of Spindle Feeds	3	3	6
Range of Spindle Fees	.05-.15 mm/rev	.05-1.25mm/rev	.12-1

Table 2.2

POWER SUPPLY:

- AC 3-Phase, 415V +10 % / -15%, 50 HZ +/- 3%.

COLOUR:

- Color of the machine shall be apple green.

2.2.3 Radial Driling machine:

Fig 2.4: RADIAL DRILING MACHINE

SPECIFICATIONS	UNIT	RDM 50/1200	RDM 50/1500
CAPACITY			
Drilling capacity in steel / C.I.	Mm	50 / 60	50 / 60
Tapping Capacity			
Metric threads fine pitch	Mm	48 / 3	48 / 3

Any other threads fine pitch	inch	1.750	1.750
Light boring capacity in Steel	Mm	120	120
DRILL HEAD			
Taper in Spindle		MT -5	MT -5
Number of spindle speeds/range	rpm	12 / 40-1700	12 / 40-1700
No. of feed / range	mm/rev	6/ 0.12 - 1.25	6/ 0.12 - 1.25
WORKING RANGE			
Drilling radius: Min / Max	Mm	505/1200	530/1500
Drill head traverse	Mm	695	970
Dist. between spindle axis & column face: Min / Max.	Mm	355/1050	355/1325
Dist. between base plate & spindle: Max.	Mm	1420	1425
--------do------------Min. (spindle retracted)	Mm	695	675
Spindle Travel	Mm	325	325
Diameter of Column	Mm	300	350
Arm traverse	Mm	725	750
BASE PLAT			
Working surface of base plate	Mm	1300 x 800	1490 x 910
Height of base plate	Mm	210	210
Overall size of base plate	Mm	2000 x 830	2220 x 935
Nominal size of the T slots	Mm	22	22
No. of t slots / Spacing	no./mm	3 / 250	3 / 250
ELECTRICAL			
Power supply A.C.	V,ph, Hz	415,3,50	415,3,50

Power of drill head motor	Kilo watt	3.6 / 4.5	3.6 / 4.5
Arm elevating Motor	Kilo watt	1.5	1.5
DIMENSIONS& WEIGHT			
All over length	Mm	2090	2400
All over Width	Mm	995	1010
All over Height	Mm	3100	3150
dimensions of packing case-- Length	Mm	2265	2520
Width	Mm	1170	1200
Height	Mm	2795	2800
Net Weight (approx)	Kg	3200	3500
Gross Weight (approx)	Kg	4000	4550

Table 2.3

2.2.4 Bench grinding machine:

Fig 2.5: Bench grinding machine

SPECIFICATION:

Grinder Motor	0.55 KW , 0.75 HP, 3 Phase , 2800 RPM
Wheel Size	200 x 25 x 31.75 mm (8")
Dust Collector Motor	0.37 KW , 0.5 HP, 3 Phase
CFM	190
Shaker	Manual

Over all Dim:	L x W x H 650 x 650 x 1050
Approx Weight	180 KG.

Table 2.4

2.2.5 MILLING MACHINE :

Fig 2.6: Milling machine

SPECIFICATION:

MODEL TABLE	**M-1B**	**M-2B**
Working Surface	1100 x 270	1300 x 290
Swivel	+450	+450
T-Slot No./Size	3/17	3/17
T-Slot Centre	60	65
Dist. From Spindle max/min	350-0	400-0
X-Longitudinal Travel	500	650
Y-Cross Travel	180	205
Z-Vertical Travel	350	400
FEEDS		
No. of Feeds	9	18
Range of Longitudinal Feed/ min	13-200	13 to 305
Range of Cross Feed / min	13-200	13 to 305
Range of Vertical Feed / min	5-100	2.5 to 62
No. of Rapid Feeds	1	2

Longitudinal Rapid Feeds / min	700	735,1065
Cross Rapid Feeds / min	700	735,1065
Vertical Rapid Feeds / min	240	147, 210

EXTRA FIXTURE:

SPINDLE		
No. of Spindle Speeds	9	9
Range of Spindle Speeds (RPM)	45-1100	45 to 1100
Spindle Taper	ISO 40	ISO 40
Arbor Diameter	25.4	25.4
ELECTRICAL		
Main Motor	3 H.P.	3 H.P.
Feed Motor	2 H.P.	2 H.P.
Coolant Motor	0.1 H.P.	0.1 H.P.
DIMENTIONS		
Overall Length	1600	1850
Overall Width	1400	1600
Overall Height	1550	1680
Net Weight Kg	2000	2600
Gross Weight Kg	2200	2900

Table 2.5

2.2.6 Hexo cuter:

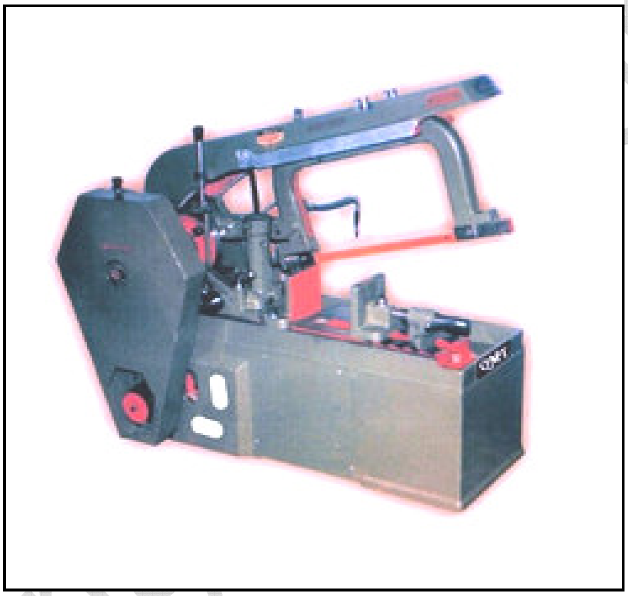


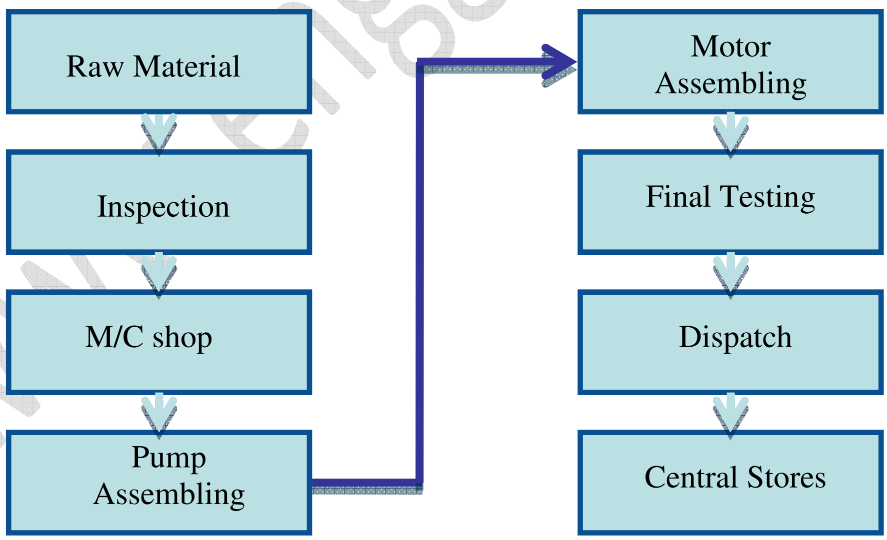
Fig 2.7: HACKSAW CUTER

SPECIFICATIONS	SAMI HYDRAULIC HACKSAW MACHINE
CUTTING CAPACITY(ROUND)	175
CUTTING CAPACITY(square)	150
CUTTING CAPACITY AT 45°	-
SAW BLADE	350
V- BELT	B-52 X A-32
MOTOR H.P.	1
FLOOR SPACE LXWXH	1250X525X850
STROKES AS PER MINITES(APPROX)	60/75
WEIGHT(APPROX)	205

Table 2.6

2.3 DIAGRAM OF MANUFACTURING PROCESS

**DIAGRAM OF
MANUFACTURING PROCESS**



CHAPTER : 3 DETAILED DISCRIPTION OF SUBMERSIBLE PUMP

3.1 SUBMERSIBLE PUMP:

- A submersible pump is a turbine pump close-coupled to a submersible electric motor. Both pump and motor are suspended in the water, thereby eliminating the long drive shaft and bearing retainers required for a deep well turbine pump. Because the pump is located above the motor, water enters the pump through a screen located between the pump and motor.

Fig.3. 1(SUBMERSIBLE PUMP)

- Submersible pumps can be selected to provide a wide range of flow rate and TDH combinations. Submersible pumps more than 10 inches in diameter generally cost more than comparably sized deep well turbines because the motors are more expensive.

- Many manufacturers make submersible booster pumps. These pumps are usually mounted horizontally in a pipeline. An advantage to using a submersible as a booster pump instead of a centrifugal is noise reduction.

3.2 BASIC PRINCIPLES:

- ESP systems are effective for pumping produced fluids to surface.

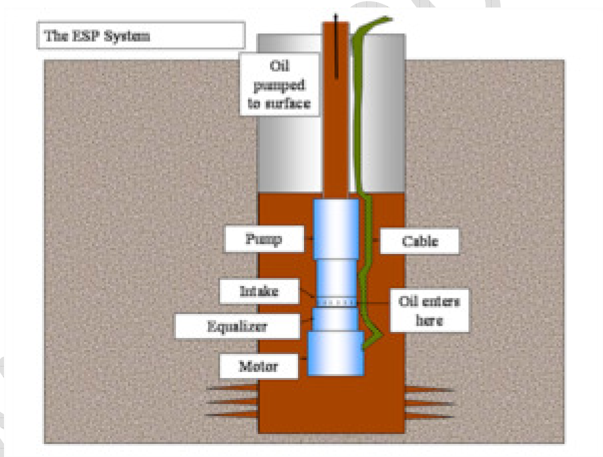


Fig 3.2 basic principle

- The submersible pumps used in ESP installations are multistage centrifugal pumps operating in a vertical position. Although their constructional and operational features underwent a continuous evolution over the years, their basic operational principle remained the same. Produced liquids, after being subjected to great centrifugal forces caused by the high rotational speed of the impeller, lose their kinetic energy in the diffuser where a conversion of kinetic to pressure energy takes place. This is the main operational mechanism of radial and mixed flow pumps.

- The pump shaft is connected to the gas separator or the protector by a mechanical coupling at the bottom of the pump. Well fluids enter the pump through an intake screen and are lifted by the pump stages. Other parts include the radial bearings (bushings) distributed along the length of the shaft providing radial support to the pump shaft turning at high rotational speeds. An optional thrust bearing takes up part of the axial forces arising in the pump but most of those forces are absorbed by the protector's thrust bearing.

- Submersible pumps are found in many applications. Single stage pumps are used for drainage, sewage pumping, general industrial pumping and slurry pumping. They are also popular with aquarium filters. Multiple stage submersible pumps are typically lowered down a borehole and used for water abstraction, water wells and in oil wells.

- Special attention to the type of ESP is required when using certain types of liquids. ESP's commonly used on board naval vessels cannot be used to dewater contaminated flooded spaces. These use a 440 volt A/C motor that operates a small centrifugal pump. It can also be used out of the water, taking suction with a 2-1/2 inch non-collapsible hose. The pumped liquid is circulated around the motor for cooling purposes. There is a possibility that the gasoline will leak into the pump causing a fire or destroying the pump, so hot water and flammable liquids should be avoided.
  ESP usage in oil wells

- Submersible pumps are used in oil production to provide a relatively efficient form of "artificial lift", able to operate across a broad range of flow rates and depths. By decreasing the pressure at the bottom of the well (by lowering bottom hole flowing pressure, or increasing drawdown), significantly more oil can be produced from the well when compared with natural production.[citation needed] The pumps are typically electrically powered and referred to as Electrical Submersible Pumps (ESP).[citation needed]

- ESP systems consist of both surface components (housed in the production facility, for example an oil platform) and sub-surface components (found in the well hole). Surface components include the motor controller (often a variable speed controller), surface cables and transformers. Subsurface components typically include the pump, motor, seal and cables. A gas separator is sometimes installed.

- The pump itself is a multi-stage unit with the number of stages being determined by the operating requirements. Each stage consists of a driven impeller and a diffuser which directs flow to the next stage of the pump. Pumps come in diameters from 90mm (3.5 inches) to 254mm (10 inches) and vary between 1 meter (3 ft) and 8.7 meters (29 ft) in length. The motor used to drive the pump is typically a three phase, squirrel cage induction motor, with a nameplate power rating in the range 7.5 kW to 560 kW (at 60 Hz).

- New varieties of ESP can include a water/oil separator which permits the water to be reinjected into the reservoir without the need to lift it to the surface. There are at least 15 brands of oilfield esps used throughout the world. Until recently, ESPs had been highly costly to install due to the requirement of an electric cable down hole. This cable had to be wrapped around jointed tubing and connected at each joint. New coiled tubing umbilical allow for both the piping and electric cable to deployed with a single conventional coiled tubing unit.

- The ESP system consists of a number of components that turn a staged series of centrifugal pumps to increase the pressure of the well fluid and push it to the surface. The energy to turn the pump comes from a high-voltage (3 to 5 kV) alternating-current source to drive a special motor that can work at high temperatures of up to 300 °F (149 °C) and high pressures of up to 5,000 psi (34 MPa), from deep wells of up to 12,000 feet (3.7 km) deep with high energy requirements of up to about 1000 horsepower (750 kW). ESPs have dramatically lower efficiencies with significant fractions of gas, greater than about 10% volume at the pump intake. Given their high rotational speed of up to 4000 rpm (67 Hz) and tight clearances, they are not very tolerant of solids such as sand.

3.3 TYPES OF SUBMERSIBLE PUMP

- Submersible Water Pump
- Submersible Well Pump
- Submersible Fountain Pump
- Submersible Garden Pump

- Submersible Pond Pump
- Submersible Electric Pump
- Submersible Solar Pump
- Submersible Pool Pump
- Submersible Sump Pump

3.4 APLICATION OF SUBMERSIBLE PUMP:

- Mining
- Pollution Control
- Tunneling
- Municipal Wastewater Plants
- Golf Course/Turf Irrigation
- Irrigation
- De-Watering
- Cooling Towers
- Water Parks and Other Fluid Intensive Environments.
- Dredging Application
- Quarrying
- Offshore Oil Duties

- Fluid Storage Caverns
- Thermal Power Station Pumps including Nuclear
- Offshore Marine and Aerospace Refinery, Chemical and Process Plant
- Electric Motors
- Oil and Gas

3.5 SUBMERSIBLE PUMP PARTS:

- Impeller
- Motor body
- Stamping
- Copper
- Road
- Copper winding
- Ratter shaft
- Balance ring
- Upper bearing housing
- Connecting piece
- Lower bearing housing

- Motor base
- Gun metal bush
- Rotter sleeve
- Thrust bearing set
- Suction tase
- N.R.V body
- Stage casing and so on
- Couple

3.6: MAINTENANCE TABLE FOR SUBMERSIBLE PUMP

Check the following points on a monthly basis

	Priming speed
	Capacity
	Noise in pump casing
	Gaskets and O-rings
	Shaft seal leakage of air and water

	Hose, hose washers and suction strainer
	Crankcase oil level (engine)
	Spark plug condition (engine)
	Air cleaner (engine)
	Unusual engine noise
	Proper RPM (engine)
	Carburetor adjustment (engine)
Check the following points every 6 months	
	Impeller wear
	clearance between impeller face and the volute (refer to manufacturer's recommendations)
	Shaft seal wear
	Shaft sleeve wear
	Clean the casing and volute passages

Table 3.1

3.7 SAFETY IN SUBMERSIBLE PUMP:

- A Submersible Pump is a pump that can operate when totally submersed in the liquid being pumped. Since submersible pumps are submersed in a liquid and/or in direct vicinity to liquids, the electrical components/connections are UL Listed for water applications as well as being waterproof to prevent electrical shock. In addition to electrical components being waterproof, the manufacturers still suggest use of a GFCI (Ground Fault Circuit Interrupter) to be installed in the branch circuit that supplies electricity to a submersible pump.

- Submersible pump motor housings are completely sealed and require little or no service when installed and used per manufacturers instructions.
- Motors of submersible pumps are designed for continuous-duty use, meaning that they are engineered and constructed in a manner to operate for long duration. Pump motor housings of submersible pumps are normally filled with dielectric oil for motor heat transfer as well as for lubricating of the internal moving parts of the motor. Cooling of the motor is also assisted from the liquid that the submersible pump is in contact when in use.
- Submersible pumps are offered in a variety of models that are constructed specifically for pumping of water and wastewater in commercial and/or industrial settings. Some examples of typical uses include crawl space and basement sump drainage, seepage cleanup, wash area discharge, flooded rooms, water discharge from construction sites, dewatering waters that collect on flat roofs, and recirculating water systems (eg. fountains).
- The most common categories of submersible pumps for use in special applications are frequently marketed/referred to as Portable Utility Sump Pumps, Sump/Sewage Pumps, Continuous Duty Sump Pumps, High Temperature Effluent Pumps, Dewatering/Sludge Pumps, and Waterfall/Stream Pumps. Performance specifications like horsepower, liquid discharge rates/volumes, material construction and portability are the key elements that differentiate these categories of submersible pumps from one another. Choosing a submersible pump that fits a specific application should be done with the help of the distributor and/or manufacturer who will indicate what and how their specific sump pump is primarily been designed for.

3.8 PUMPING FACTOR:

- The altitude at which a pump is operated will enhance or diminish its performance. At higher altitudes atmospheric pressure is decreased reducing suction lift. For this reason the pump should be located as close to the water source as possible. The table below shows suction lift altering at several locations for 4 different example pumps.

Altitude	**Pump A**	**Pump B**	**Pump C**	**Pump D**
Sea level	10.0	15.0	20.0	25.0
2,000 feet	8.8	13.2	17.6	22.0
4,000 feet	7.8	11.7	15.6	19.5
6,000 feet	6.9	10.4	13.8	17.3
8,000 feet	6.2	9.3	12.4	15.5
10,000 feet	5.7	8.6	11.4	14.3

Table 3.2

- Altitude affects engine performance as well. A rule of thumb is that gasoline and diesel engines will lose 3% of their power for every 1,000 feet of elevation. This is due to the "thinner air" or lack of oxygen at higher altitudes. The reduced engine speed results in reduced flow and head.

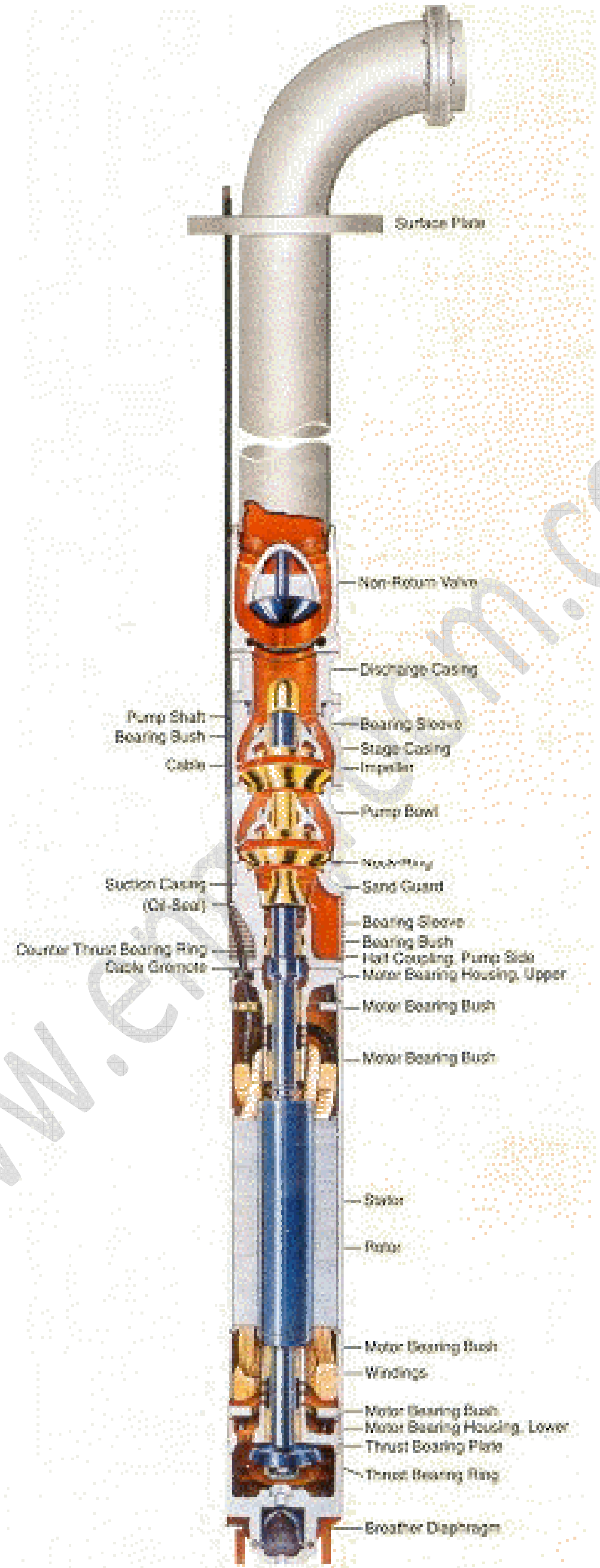


Fig 3.3 pumping factor

Altitude	Discharge Flow	Discharge Head
Sea level	100%	100%
2,000 feet	97%	95%
4,000 feet	95%	91%
6,000 feet	93%	87%
8,000 feet	91%	83%
10,000 feet	88%	78%

Table 3.3

- Many engine manufacturers offer methods of overcoming this loss by offering high altitude cylinder heads, as well as carburetor jets and air cleaners designed for use at higher elevations.
- Water temperature and suction lift have an inverse relationship. As water temperature increases the practical suction lift decreases, because warm water contains more entrained air, causing the pump to lose its ability to prime. If the water is too warm, it may be necessary to locate the pump below the water level. This creates a net positive suction head (NPSH). Always be cautious when pumping hot water as it can damage your pump. It is advisable to contact the pump.

3.9 PROBLEM IN SUBMERSIBLE PUMP:

Engine may not be running at the rated speed.	
	Strainer, inlet valve or suction line may be clogged.
	Suction line or fittings may be leaking air.
	Mechanical seal may be worn and leaking air or water. Check weep hole.
	There may be too much clearance between the impeller and the volute due to wear. For best performance refer to manufacturer's recommendations for proper adjustment.
	Lining in suction hose may be collapsing. This rubber lining inside the fabric layers may have pulled together under the vacuum created by the pump.

Table 3.4

CHAPTER : 4 INTRODUCTION ABOUT I.D.P

4.1 Choke up in submersible pump

- In working condition dust particles and other impurities suck in the pump with water. Because of these impurities, there are might be a chance of choke up in inlet valve, impeller, and also an in discharge valve. These impurities resist the flow water.

Fig 4.1 submersible pump

- When this type of problem occurred, we are going to repair the pipe or if the repairing is not possible then we are going to replace the pipe. But every time it is not possible to get out the pump from the tube well or bore well and repair or replace the pipe.

Fig 4.2 strainer

- To recover this type of problem we have to just make a few changes in the design of strainer. We can use the quality strainer. We can make the mesh of strainer smaller to stop the dust particles from entering in.

4.2 CAUSES FOR CHOKE UP IN SUBMERSIBLE PUMP:

- Because of the dust particles and other impurities.

- In working condition of pump, these are the impurities suck in the pump & try to resist the flow of water. Because of this water flow can be reduce.

- Any substances get stucked in strainer.

- If any substances get stucked in straier that might choke up the pump and reduce the water flow.

- If any type of metal substance or any plastic bag or anything stuck inside strainer that might resist the water flow.

- If the quality of strainer is not good than it can not able to stop these type of impurities from entering inside the pump.

4.3 EXPECTED OUTCOME

- To prevent this type of problem we have to make a quality strainer. And try to make the size of mesh of strainer smaller to stop dust particles and other impurities from entering in the pump.

- By providing I.P. oil seal we can able to stop dust and other impurities from entering inside the pump. And we can able to get require water flow.

- By providing rubber nickering inside the bowl, we can able to stop dust and impurities from entering inside the pump and prevent choke up.

- By using filter over a strainer we can prevent this type of problem.