

**Draft**

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# **OPERATION MANUAL**

**Volume - 2**

**Operational Procedures**  
**for**  
**Water Pumping Station**

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**Sodev**consult



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## **Operational Procedures in Water Pumping Station**

Pump Operators as well as Apprentice Pump Operators in the pumping stations have to carry out the following operations:

- a) Starting the Turbine/submersible pump
- b) Supervision during running of the Turbine/submersible pump
- c) Stopping the Turbine/submersible pump
- d) Preparation of Bleaching Powder Solution
- e) Starting and Supervising the Dosing Pump
- f) Stopping the Dosing Pump
- g) Starting and Supervising the Gas Chlorinator
- h) Stopping the Gas Chlorinator
- i) Changing the Chlorine Gas Cylinder
- j) Starting Standby Generator and Supervision
- k) Stopping Standby Generator

Procedures No. 1 through 11 provided in the following pages should be carried out for performing the above operations.

**Procedure No. 1: Starting the Turbine or Submersible Pump**

Step	Item	Description of Activity
1	Connections	Check the integrity of all electrical connections
2	Shaft Rotation (for Turbine pump)	Check the rotation of motor shaft by hand to see if the pump is free. If rotation is not free, correct it by adjusting the top nut. ( <i>Rotation should be counter-clockwise when viewed from the top</i> )
3	Lubrication (for Turbine pump)	Lubricate the rubber bearings and gland packing with fresh clean water from the pre-lubrication tank. ( <i>Caution – Never use any polluted water as this would contaminate the tubewell</i> )
4	Washout valve	Open the washout valve fully
5	Discharge Sluice Valve	Close the discharge sluice valve fully. ( <i>This reduces power required by the motor at the time of starting</i> )
6	Voltage	Check the voltage in each phase in the panel board by using the phase selector switch. ( <i>Caution – Do not switch on the pump if the difference of voltage between the phases is more than 10 volts or, the voltage in any phase is less than 380 volts.</i> )  If there is no power supply, start standby generator, switch on alternator supply to the pump control panel. Shift power interlocking switch to generator supply position.
7	Starter Relay Setting	Check if the starter relay setting is within the range. ( <i>If not, set it correctly</i> )
8	Circuit Breaker & Main Switch	Switch on the circuit breaker and main switch
9	Disinfection	For chlorination by bleaching power solution (i) switch on dosing pump and (ii) check visually that chlorine solution is being pumped, Or,  For gas chlorination (i) switch on carrier water booster pump and (ii) adjust rate valve on chlorinator for correct dosing.
10	Starter	<b>Manual Star-Delta Starter</b> – Turn the star-delta starter handle downwards, hold for at least 10-15 seconds then lift up to the second position. ( <i>Caution- Do not hold the starter handle downwards more than 15 seconds</i> ) Or, for <b>Automatic Starter</b> – Press the start button (usually green button) ( <i>Water starts to flow out of the wash out line</i> )
11	Discharge Sluice Valve	Within one minute of starting the pump, gradually open the discharge sluice valve. Water starts to flow into the delivery pipe. ( <i>Caution – To prevent overheating of the motor and pump do not keep the discharge sluice valve closed more than one minute while the pump is running</i> )
12	Washout valve	Close the washout valve.
13	Current Flow	Check the normal current consumption. Adjust the discharge valve so that the maximum permissible load current is not exceeded. If normal current consumption cannot be adjusted to or below the permissible load current, stop the pump and inform the office ( <i>Caution- Excess opening of the discharge valve may lead to overloading of the motor.</i> )
14	Record	Record pump start time, voltage, ampere, water meter reading (m <sup>3</sup> ), pressure gage reading (kg/cm <sup>2</sup> ), KWh reading and chlorine dosing rate in the log book

### Procedure No. 2: Supervision during Running of the Turbine or Submersible Pump

Step	Item	Description of Activity
1	Operation	Check the operation of the pump is smooth and free from vibration. <i>(Stop the pump if there is any abnormal sound or vibration and inform the office)</i>
2	Pressure	Check the pressure on the delivery pipe. Record in the log book. <i>(Compare with the reading when pump was started. Find reasons if there is large difference in the values. If excessive pressure develops, open the air relief valve or air vent cock to release pressure. If excessive pressure continues, stop the pump and inform the office)</i>
3	Gland packing (for Turbine pump)	Check the gland packing seal is dripping at the required minimum rate. <i>(If leakage is excessive tighten the gland nuts. If excessive leakage continues, stop pump and install new gland packing)</i>
4	Ampere meter	Check ampere meter reading and compare the current with that after pump start.
5	Mains Voltage	Check mains voltage. <i>(Stop pump if voltage in any phase is less than 380 volts or difference of voltage between any two phase is more than 10 volts)</i>
6	Power failure	If there is an interruption of mains power supply, switch off the main switch and the circuit breaker. Note the time of interruption.
7	Record	Record pressure, water meter reading, mains voltage, current and the time of power interruption in the log book.

### Procedure No. 3: Stopping the Turbine/Submersible Pump

Step	Item	Description of Activity
1	Discharge Sluice Valve	Close the discharge sluice valve gradually until fully shut. <i>(In case of emergency the pump should be stopped first by switching off)</i>
2	Starter, main switch and Circuit Breaker	Switch off starter, main switch and circuit breaker. (Motor will come smoothly and evenly to a stop).
3	Stop disinfection	For Bleaching powder disinfection, switch off dosing pump, or, for gas chlorination system switch off booster pump and close auxiliary valve on the cylinder.
4	Record	Record pump stop time, water meter reading (m <sup>3</sup> ) and energy meter reading (KWHr) in the log book.

**Procedure No. 4: Preparation of Bleaching Powder Solution**

Step	Item	Description of Activity
1	Cleaning Container	Remove insoluble residue from previously used solution container and dispose of carefully into pit or other suitable site. Clean out container and connecting pipe work. <i>(Two solution containers are normally required – one in use and one settling for the next day. A third container is required for clean water for flushing dosing pump and dosing lines)</i>
2	Leakage	Check for leakage in the container. Change container as necessary.
3	Quantity of Bleaching Powder	Weigh or measure out the prescribed quantity of bleaching powder. <i>(If possible, enough solution for one day's operation should be prepared)</i>
4	Solution Preparation	Add powder to the prescribed volume of clean water, stir well for several minutes to dissolve and leave to settle. <i>(Settling time should be 2-4 hours minimum but preferably longer)</i>
5	Connecting Container	Connect container to dosing pump pipe work ready for next pumping period.
6	Record	Record details of solution in the log book.

**Procedure No. 5: Starting and Supervising the Dosing Pump**

Step	Item	Description of Activity
1	Dosing Pump	Switch on the bleaching powder solution dosing pump. <i>(Caution - Dosing pump should be started before starting the turbine or submersible pump. The period will depend upon the length of the dosing line and whether it has been flushed out by clean water. The tubewell pump should not be started until the chlorine solution comes out at the injector end)</i>
2	Check	Check visually that chlorine solution is being pumped by the dosing pump
3	Tubewell pump	Start pump
4	Solution Level	Periodically check the level in the solution container. Change solution container when needed.

**Procedure No. 6: Stopping the Dosing Pump**

Step	Item	Description of Activity
1	Tubewell pump	Stop pump
2	Dosing pump	Switch off dosing pump.
3	Flushing	Flush out dosing lines and dosing pump with clean water for ten minutes. <i>(If insoluble residue remains in the dosing lines, it may block the dosing pump)</i>

**Procedure No. 7: Starting and Supervising the Gas Chlorinator**

Step	Item	Description of Activity
1	Leakage	Check that there is no leakage, damage or missing component.
2	Booster Pump	Switch on carrier water booster pump(s) before starting the tubewell pump.
3	Auxiliary Valve	Gradually open the auxiliary valve of the chlorine gas cylinder.
4	Rate Valve	Turn chlorinator rate valve knob until correct dose is obtained.
5	Tubewell pump	Start pump
6	Monitoring	Routinely monitor chlorinator to ensure correct rate of chlorine is being applied.

**Procedure No. 8: Stopping the Gas Chlorinator**

Step	Item	Description of Activity
1	Tubewell pump	Stop pump
2	Auxiliary Valve	Close the auxiliary valve of the chlorine gas cylinder to stop gas flow.
3	Booster Pump	Switch off the booster water pump.

**Procedure No. 9: Changing the Chlorine Gas Cylinder**

Step	Item	Description of Activity
1	Assistance	Make sure that another trained person is in attendance. ( <i>Very Important : All should be trained in handling chlorine and the use of breathing apparatus</i> )
2	Tools	Make sure that the correct tools are available
3	Cylinder Isolating Valve	Close the empty cylinder isolating valve carefully. ( <i>Caution : An empty cylinder still contains some chlorine gas</i> )
4	Breathing Apparatus	Put on the respirator or breathing apparatus ( <i>Two sets will be required. Apparatus must be checked monthly and replaced immediately if found defective</i> )
5	Union Connector	Carefully loosen the union connector on the chlorinator
6	Ammonia solution	Check for any leakage by ammonia solution. ( <i>White fumes will be produce if chlorine gas is present</i> )
7	Disconnect Chlorinator	If no leakages carefully disconnect the chlorinator. Remove respirator or breathing apparatus
8	Safety Valve Cover	Refit the safety valve cover to protect the cylinder isolating valve
9	Support Clamps	Undo support clamps or chains and remove empty cylinder.
10	Position new Cylinder	Carefully position a new cylinder and clamp it.
11	Safety Valve cover	Remove safety valve over from the cylinder.
12	Check	Visibly check valve assembly for any possible damage.
13	Connect Chlorinator	Using a new lead washer, connect the chlorinator with the new cylinder through a union nut.
14	Respirator or Breathing Apparatus	Put on respirator or breathing apparatus.
15	Auxiliary valve	Using correct tools, open the auxiliary valve slightly and detect if there is any leakage by smelling or using ammonia solution. If no leakage open cylinder auxiliary valve fully. If there is leakage, close auxiliary valve, dismantle chlorinator from cylinder and reconnect. If there is still leakage, mark cylinder "faulty", return to stores and bring a new cylinder to connect.
16	Respirator or Breathing Apparatus	Open respirator or breathing apparatus, clean and store correctly.
17	Record	Document activities.



**Procedure No. 10: Starting Standby Generator and Supervision**

Step	Item	Description of Activity
1	Daily Cleaning	Wipe out dust, oil, etc. from the generator surface.
2	Daily Check	While the engine is cold check 1) Engine oil level by dip stick and top up if necessary, 2) Check water level in radiator and top up if necessary, 3) Check fuel level in fuel tank. Add fuel if necessary. Ensure that enough fuel is in storage.
3	Battery	Daily - Clean battery top and terminals Weekly – Check battery electrolyte level, top up with distilled water if necessary
4	Generator supply circuit breaker	Check that the generator supply circuit breaker is in “off” position.
5	Ignition	Turn ignition key to crank the engine. Release key as soon as the engine starts. Allow engine to worm up.
6	Loading	Shift the generator supply circuit breaker to “on” position.
7	Interlock switch	Shift the interlock switch in the panel board to “Generator Supply” position. Deep tube well can be started now.
8	Frequency	After loading adjust frequency if necessary.
9	Operational check	During running check time to time : 1) Oil pressure does not fail (will be indicated by red light) 2) Water temperature is normal and does not rise 3) Battery charging rate is appropriate.

**Procedure No. 11: Stopping Standby Generator**

Step	Item	Description of Activity
1	Pump	Stop pump
2	Interlock switch	Shift interlock switch to “Public supply” position
3	Generator supply switch	Shift generator supply switch to “off” position and allow generator to run few minutes without load.
4	Cut off fuel supply	Cut off fuel supply to stop the engine.

## Trouble Shooting

This section is intended to assist operators to recognize potential problems and take actions before a major failure occurs. It is the responsibility of the operators to monitor all running equipment continuously. The following table gives typical plant abnormalities, likely causes and recommended actions.

### Trouble Shooting – Turbine/Submersible Water Pump

Plant Abnormality	Likely cause	Recommended Action
High current/excess heat (for turbine pump)	Low voltage	Stop pump, advise supervisor. Restart pump when voltage rises above 380 Volts
	Bearing beginning to seize	Stop pump, advise supervisor and maintenance personnel
Excessive vibration in pipe work	Failure of inline bearing between pump and motor (for turbine pump)	Stop pump immediately, advise supervisor and maintenance personnel
	Failure of pump bearing	
	Trapped air (following start up)	Check if pressure gauge is fluctuating- if it is vent the air.
	Pumping air water mixture due to low water level	Stop pump, advise supervisor. Inform maintenance group.
Low flow meter reading	Damaged pump unit	Check motor current – if normal continue to run pump but advise supervisor.
	Damaged flow meter	May be caused due to trapped air in flow meter. Advise supervisor to arrange venting or replacement of meter.
Low supply voltage	Incoming grid power supply	Stop pump when voltage is too low. Restart at 380 V.
Low indicated pressure	Damaged pump unit	Check motor current, if normal, continue to operate but advise maintenance personnel.
	Burst main	Check for excess flow rate, if confirmed stop pump and advise supervisor.

### Trouble Shooting – Disinfection Equipment

Plant Abnormality	Likely cause	Recommended Action
Dose level erratic	Gas cylinder or bleaching powder solution low	Stop pump, advise supervisor. Investigate cause.
	Trapped air in carrier water supply	Vent air from carrier water supply

### Trouble Shooting – Control Panel

Plant Abnormality	Likely cause	Recommended Action
Burning smell from starter panel	Overheating	Stop pump and isolate starter panel at main power switch. Check for fire. <b>Do not use water to extinguish fire.</b> Call supervisor and maintenance personnel immediately. If serious call Fire Services.
Instrumentation not functional	Instrument failure	Advise supervisor and inform maintenance personnel.

## Emergencies during Chlorine Leakage

In the event of an actual or indicated leakage of chlorine operators/employees should:

- a) Immediately evacuate the affected area shouting warning,
- b) Not attempt rescue operation without a working breathing apparatus,
- c) Never enter a contained area without a working breathing apparatus.

### Minor Leakage

Gas leaking from a faulty or incorrectly closed valve on a cylinder, or fracture of the pipe work/connections between the cylinder and the chlorinator can be considered as minor leakage.

*Protection requirement* – Self contained breathing apparatus

*Actions to be taken:*

- a) If available assistance should be summoned and a preliminary assessment of the extent of the leakage should be made.
- b) Gas supply should be shut off avoiding trapping chlorine in the pipe and system
- c) If leak cannot be shut off, ventilation should be started to remove the gas. If the leak cannot be stopped, doors and windows may be shut to contain the gas.
- d) Going below ground should be avoided in the affected area
- e) No repair should be attempted until the area is free from chlorine
- f) For a small leak, if it is not possible to shut of the gas flowing out the cylinder, put on breathing apparatus and with the auxiliary valve attached to the cylinder valve take the cylinder outside, disconnect the union and fit the cover nut to the valve.

### Major Leakage

In the event of a major leakage of chlorine a pre-established “Emergency Procedure” should be instituted immediately. If the leakage can be contained within the site, without risks to persons out with, it may not be necessary to involve all or any of the emergency services.

One person should be appointed in advance to take charge of a significant gas leak. This would normally be the superintendent or in his absence the plant operator.

*Protection required*

- One piece coverall PVC suit
- PVC gloves
- Rubber boots
- Self contained breathing apparatus

**Action to be taken****(a) Assessment**

Though preliminary assessment of the extent of the leakage may be carried out by one man, assistance should be summoned where possible.

Assessment should determine the source of the leak, the size of the escaping aperture, the amount of chlorine involved, the extent of possible contamination.

**(b) Action**

Stop it	-	if this can be done without risk
Reduce it	-	by turning the cylinder, if possible, to change its posture from a liquid leak to a gas leak, or by closing the valves.
Contain it	-	if it is not possible to stop the leak and the leakage is significant, switch off extractor fans and close all windows and doors. If the leakage is significant and in or to the outside atmosphere steps should be taken to prevent entry into the drains or water courses.
Disperse it	-	if possible water spray can be used to disperse the chlorine vapour. The water should not be directed towards the leaking container otherwise rapid corrosion may occur.

**First Aid**

Casualties should be immediately removed to fresh air and kept at rest. Rapid transfer of the casualty to hospital is essential. Provide first aid treatment as follows:

- a) Make the casualty is comfortable; this will usually be achieved by propping him up in a reclining position.
- b) Loosen the clothing around the neck and chest
- c) Try to keep the casualty calm, as apart from breathing difficulties, the casualty will be very apprehensive.
- d) If the casualty's skin or eyes are affected, drench the affected parts with water.
- e) If the casualty's clothing is contaminated it should be removed.
- f) If the casualty is breathing, the administration of oxygen will not be of any benefit and could do harm to the casualty.
- g) If the casualty has stopped breathing, apply artificial respiration combined with the use of resuscitation equipment (including oxygen) where available.

## Bleaching Powder

### Hazards

Bleaching powder is not potentially as dangerous as chlorine gas. However, operating personnel come into daily contact with the chemical during solution preparation and the simple safety precautions required may be neglected because of the familiarity of the exercise.

The main hazards include breathing in chlorine fumes, especially from a newly opened drum, and splashing of the dosing solution on the skin and eyes. There is also the possibility of physical injury resulting from the frequent lifting and moving of the containers.

### Precautions

The bleaching powder drums should be stored in a separate, cool, well ventilated room to avoid risk of chlorine fumes and corrosion. Only one drum should be opened at a time and should be sealed each time after use.

Personnel should wear safety goggles, PVC gloves and a breathing mask when preparing the bleaching powder solution. Protective overalls should also be provided to prevent damage to clothing.

The flexible dosing line should not be allowed to run across the pump house floor or across the open ground of the compound where it could be damaged by persons or vehicles. It should be supported off the ground on trays or underground in ducts. The former is preferable as it permits easier access in case of blockages. The line should be regularly inspected for damage or deterioration.

### Maintenance

Despite allowing the bleaching powder solution to settle before dosing there is always the possibility of insoluble particles being carried over into the metering pump and dosing line. It is, therefore, important that these are regularly cleaned and flushed out with water.

The insoluble residue from mixing the solution should be disposed of carefully. If the site is big enough on-site disposal in a dug pit is acceptable, otherwise off-site disposal in an approved tip will be required.

## Sewage Lift Station

### Sewage Lift Station Identity

Name of the Lift Pump Station : .....

Reference Number (if any) : .....

Type of Pump  
(Submersible/Centrifugal) : .....

Operators must carry out the following activities daily

Daily Activities		
1	Security	Check security of the station, report any defect
2	Shifting	Change over duty/standby pumps to match hours run for each pump
3	Record	Record hours run
4	Equipment	Check that all equipment is working as necessary following the manufacturer's instructions
5	Dry well	Check the condition of dry well, pump glands, report as necessary
6	Total plant	Check for any defect, and report if necessary
7	Cleanliness	Clean the station
8	Lubrication	Lubricate as necessary
9	Sewage level	Visually check sewage levels in wet well every 15 minutes throughout daylight and 30 minutes at night. Switch on extra pump as required. As level falls reduce pumping.
10	Screen	If differential of more than 9" exists across screen either switch on mechanical screen or manually remove screening. Caution – wet wells are dangerous. Men should be safe before entering and forced draft ventilation may be used.
11	Wet well	Remove grit from the wet well once it has reached 400 mm depth.
12	Lighting	Check all external and internal lighting, replace as necessary.
13	Building	Check outside of the building, report if any defect is seen
14	Ground maintenance	Keep the compound clean and tidy.

Daily log noting activities and pump runs should be recorded on Proforma – S2

## Sewage Lift Station Log

Lift Station Name :

Reference No:

Date	Purpose of Visit	Pump Run Hours (P1)	Pump Run Hours (P2)	Pump Run Hours (P3)	Pump Run Hours (P4)	Work carried out/Problem Found

(Note: Where there are more than 4 pumps, pump no. 5 shall be recorded in another column)

Purpose :

- E – Emergency Call Out
- M – M & E Maintenance
- O – Other Maintenance
- R – Routine Maintenance
- W – Well Cleaning



Note :