

Draft

Dhaka Water Supply and Sewerage Authority
Financial and Capacity Building Consultancy
of
Dhaka Water Supply Sector Development Project

Maintenance Manual

Volume - 1

Water Pumping Station

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*Schedule of maintenance activities are to assist the maintenance personnel
of Dhaka WASA to conduct maintenance programs at definite intervals*



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Instructions

Test results and maintenance activities carried out under monthly, quarterly, half yearly, yearly, and every two year must be recorded on the Job card, signed and dated by the maintenance supervisor. Date for the next activity must also be recorded on the Job card, which should be kept at the plant/equipment site and a copy with the maintenance personnel for follow up.

Ensure that all standard instructions of the manufacturer have been followed during every schedule of activity.

The personnel carrying out the maintenance work shall:

- Be competent and suitably qualified to carry out the work
- Be properly trained to complete the work to the required standard and in a safe manner
- Be equipped to carry out the work
- Be properly supervised

Before undertaking any maintenance work, the maintenance personnel shall:

- Inform their supervisors that the work is going ahead
- Before starting the work, lock off plant or equipment and ensure that the plant or equipment is safe to work on
- Post notices warning of works in progress

On completion of work, the maintenance personnel shall:

- Remove all tools and maintenance equipment
- Clean up and remove all rubbish from site to a point of safe disposal
- Test for correct operation of plant or equipment
- Remove warning notices

Job Card

Card No. : _____ Date :

Site :..... Name of Installation :

Equipment to be worked on:

Routine Maintenance : Urgent Maintenance :

Routine Maintenance
Frequency :

Weekly	Monthly	Quarterly	Half yearly	Annual	Biannual
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Requisitioned by:

Authorized by:

Signature:.....

Signature:.....

Date:.....

Date:.....

Seal :

Activity Report

Work done :

- (i)
- (ii)
- (iii)

Spare Parts used :

- (i)
- (ii)
- (iii)

Control Settings/Meter Readings :

Tests conducted :

Work outstanding :

- (i)
- (ii)

Defects noted:

Comments if any :

Data computerized:

Yes	No
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Date of next maintenance :

Maintenance Technician

Controlling Officer

Signature:.....

Signature:.....

Date:.....

Date:.....

Seal :

Water Pumping Station

Turbine/Submersible Pump

Half Yearly Maintenance : In-situ Performance Test								
1	Pump/Motor Condition	<p>This test should be carried out to determine if the pump needs to be removed from the tubewell for maintenance. Follow procedure given below.</p> <p>Procedure :</p> <ol style="list-style-type: none"> 1) Stop the pump and close the delivery valve. 2) Restart the pump against closed valve. (<i>Caution – Do not operate pump at closed valve condition for more than 3 minutes</i>). 3) Take readings of pressure from gauge, motor current on all three phases 4) Measure the depth of water table from the head plate. 5) Open pump delivery valve to revert to normal operation. 6) Check and record closed total valve head (gauge reading less tubewell level). Compare with the newly refurbished pump data at closed valve condition. Loss of head below the original data by 10% indicates wear of pump components. 7) For Submersible pump, if the motor current increases by 15-20% more than that in the new condition, it is an indication of bearing problems or potential motor winding failure. Corrective measures should be taken. 8) Remove pump from tubewell for maintenance. <p>Note: It is essential that when new or overhauled pump(s) is installed, the above test is carried out to obtain the base line data for cross-referencing at a later date.</p>						
2	Record	Record on the job card all test data for the above check including significant data such as hours run (from hours run meter) and voltage during test. Enter all information into the pump history file.						
3	Standard Instructions	Ensure that all standard Instructions of the manufacturer have been followed						
Date of Work								
Next Date								

Turbine/Submersible Pump (Contd.)

Yearly Maintenance	
1	Isolate the Pump Isolate the pump set both mechanically and electrically. For turbine pump separate the motor from the pump and remove the pump from the tubewell. For submersible pump remove pump and motor from the tubewell.
2	Pump maintenance Dismantle the Pump unit. Check : 1) Bowls, impellers, wear rings, bearings, etc., for excessive wear 2) Clearance of wear rings and bearings are within tolerances, 3) Condition and alignment of pump shaft.
3	Line shaft, bearings and discharge head works (for turbine pump) Check the line shaft, bearings and discharge head works for : 1) Condition and alignment of shafts, 2) Condition of shaft couplings 3) Shaft bearings and bearing housings 4) Clearances of shaft /bearings are within tolerances 5) Condition of bearings and motor coupling in discharge headwork. Replace/repair as necessary.
	Motor For turbine pump: 1) Check that the motor is secure and free from excessive vibration /overheating and there is no external damage or missing component. 2) Check cables, terminal connections, gaskets, fixings, glands, etc. 3) Measure insulation resistance and continuity of motor winding to earth (Do not megger thermistor winding) 4) Check the cooling fan is free and motor rotates freely 5) Lubricate bearings. For submersible pump : 1) Check cables, terminal connections, gaskets, fixings, glands, etc. 2) Measure insulation resistance and continuity of motor winding to earth.
	Operation 1) Run unit in automatic/manual mode and verify correct operation. 2) Check operation of emergency stop, if fitted. 3) Check motor load current is within correct range.
	Record Record all information and work done on the Job card.
	Manufacturer's Standard Instructions Ensure that all standard instructions of the manufacturer have been followed.
Date of Work	
Next Date	

Standby Generator

Monthly Maintenance		
1	Generator	Isolate generator
2	Check	Check condition of guards, foundation bolts, anti-vibration mounting, etc. Report any defect on Job card.
3	Fuel System	Check – 1) Fuel tank for leaks 2) Operation of emergency fuel cut off valve and other protection devices.
4	Lubrication system	Check for oil leaks
5	Battery	Check for battery cable and connection
6	Cooling System	Check for water leaks and hose damage, if any
7	Turbo charger	1) Clean inlet filter, compressor diffuser/restrictor plugs. 2) Check belt drives for wear and damage. Adjust as necessary
8	Exhaust System	Check exhaust system for damage to insulation (lagging), pipe work, joints, water jackets, bellows, etc. Report defects, if any on Job card
9	Generator	De-isolate/unlock generator.
Date of Work		
Next Date		
Quarterly Test Run		
1	Test Run without load	1) Run generator off load for about 30 minutes. 2) Check oil pressure and engine temperature 3) Check for oil, water or fuel leaks and excessive vibration
2	Test Run on load	1) Run generator on load for 90 minutes 2) Check oil pressure when engine is hot
Date of Work		
Next Date		
Quarterly Maintenance		
1	Isolate	Isolate/lock off generator
2	Fuel System	1) Clean sediment bowl (if fitted) 2) Clean/replace fuel filter element 3) Check fuel injection pump for fuel leakage 4) Check and lubricate external governor linkages 5) Drain of water, if any, from fuel tank 6) Check fuel pump solenoid for correct operation
3	Lubrication System	1) Grease all nipples and joints except alternator 2) Rotate percolator filter (if fitted) 3) Check whether instructions (hours run) for changing oil and oil filter has been reached or crossed. If so, change engine oil and oil filter. Otherwise record hours run and give date for oil and oil filter change.

4	Cooling system	1) Check radiator matrix for obstruction 2) Check header tank and pressure cap 3) Check cooling fan for any damage 4) Check cooling water pump
5	Crank case breather	Clean crank case breather
6	De-isolate	De-isolate/unlock generator
Date of Work		
Next Date		
Half yearly Maintenance		
1	Isolate	Isolate generator
2	Battery	1) Check Dynamo/alternator (12/24v) charging rate is correct. Record on Job card 2) Carry out voltage drop test on battery. Record result on Job card 3) Check Battery water specific gravity and record on Job card
3	Alternator	Remove terminal cover and check : 1) Connections, glands and gaskets 2) Visually inspect voltage regulator cards and diode rings. Clear off dusts 3) Check slip rings, brushes and brush gear (if fitted) 4) Visually inspect bearings, seals and lubricate if necessary 5) Record all information on Job card
4	Control System	Check : 1) Damage and /or malfunction of all control, protection and indicating devices. Report on Job card. 2) Security of wiring to components and terminals 3) Contactors/circuit breakers for damage or malfunctions. Report on Job card.
5	Dynamo	Check whether it is functioning normally without abnormal sound from the bearings. If necessary lubricate the bearings
6	De-isolate	De-isolate the generator. Run on load for 90 minutes. Check : 1) Out put voltage and record on job card 2) Setting of mains voltage sensing device. 3) Correct operation of protection devices and instruments
Date of Work		
Next Date		

Bleaching Powder Dosing Unit

Monthly Maintenance								
1	Complete Unit	Check : 1) The unit is secure and free from excessive vibration and there is no external damage or missing component 2) Any sign of overheating						
2	Solution delivery tube	Check for damage and replace if necessary						
Date of Work								
Next Date								
Half Yearly Maintenance								
1	Dosing Pump	1) Remove v-belt/coupling 2) Check that pump shaft turns freely (in case of reciprocator/diaphragm pump, check that the crank rotates freely) 3) Check pump for leakage, tighten /adjust bolts as necessary 4) Lubricate pump bearings 5) Check operation of valves, replace if necessary						
2	Motor	1) Check that the electrical connections are correct 2) Check for any sign of overheating 3) Lubricate/replace worn bearing 4) Check insulation resistance of motor						
Date of Work								
Next Date								
Yearly Maintenance								
1	Container base frame	1) Check for damage and repair as necessary 2) Paint base frame and pump						
Date of Work								
Next Date								

Chlorinator

Half Yearly Maintenance		
1	Isolate	Isolate gas supply and vent the manifold safely
2	Chlorinator	1) Dismantle the vacuum regulator, clean and replace parts. 2) Clean the master tube assembly 3) Clean the rate adjustment valve 4) Reassemble parts and test
3	Ejector Unit	1) Dismantle the ejector unit, leaving body in the pipe work 2) Clean ejector nozzle 3) Repair ejector valve seat if necessary 4) Clean and replace ejector diaphragm if necessary 5) Reassemble and test
4	Manifold	Replace gas manifold and valves if necessary
5	Check	Check and service remaining pipe work, replace parts as necessary
6	Re-commission	Test, operate and re-commission
Date of Work		
Next Date		

Valves : Sluice/Butterfly/Penstock

Every Two Year Maintenance			Sluice Valve	Butterfly Valve	Pen Stock
1	Hand wheel	Check security of hand wheel	√	√	
2	Inspect	Inspect valve shaft seal/packing for leakage. Adjust. Replace seal/packing if necessary	√	√	
3	Valves free travel	Exercise the valve through its full travel to ensure free movement	√	√	√
4	Lubricate	Lubricate spindle, gear box, bushes. Check shear pins.	√	√	
5	Depressurize	Depressurize system	√	√	√
6	Head stock	Lubricate head stock/steady assembly			√
7	Check	Check valve shaft seal, shaft condition and backlash	√		
8	Valve frame	Examine valve frame and spindle bushes. Check the end float between valve frame, spindle guides and wedges			√
9	Pressurize	Pressurize system and check operation for leaks	√	√	√
Date of Work					
Next Date					

Non-Return Valve

Every Two Year Routine Maintenance								
1	Check seal	Operate system normally and stop plant. Check Non-return valve seats properly to stop back flow.						
2	Depressurize	Depressurize system						
3	Seat/flap	Remove inspection cover. Inspect seat/flap and pivot pins. Clean interior						
4	Balance weight	Check balance weight (if fitted)						
5	Replace	Replace parts/components. Verify valve shut off capacity						
6	Operation	Check operation of no flow interlock (if fitted)						
Date of Work								
Next Date								

Turbine Type Mechanical Flow Meters

Every Two Year Maintenance								
1	Turbine Flow Meter	1) Stop pump and close delivery valve. 2) Remove turbine flow meter from pipe work. 3) Replace with a serviced meter. 4) Note serial number and meter reading of the replaced meter 5) Start pump and open delivery valve.						
2	Meter workshop	Send the meter to the meter workshop for testing the meter.						
3	Disassemble meter	Disassemble the meter for inspection according to the manufacturer's manual. 1) Clean all components and examine for wear 2) Replace all worn components with genuine replacement parts from the manufacturer. 3) Reassemble and paint outside of the meter						
4	Meter workshop	Send the refurbished meter back to Meter Workshop to test that calibration is within specifications						
5	Store	Store the refurbished meter.						
Date of Work								
Next Date								

Electrical Installation

Switch Gear

Half Yearly Maintenance								
1	Starter	<ol style="list-style-type: none"> 1) Inspect starter enclosure. Clean off any dust/ dirt, etc. 2) Check conditions of push buttons/ control devices/ labels, etc. for signs of any external damage. Repair or replace as necessary. 3) Open starter and visually inspect internal equipment. 4) Check condition and operation of all coils, contactors and contacts, as applicable. Clean or replace as necessary. 5) Check condition of timer and control sequence setting. Check condition of security of contactor interlocks. 6) Check condition of all contactors / arc shields. 7) Clean/replace, if necessary. 8) Check fuse ratings and condition. 9) Check over current settings. Adjust if necessary. 10) Check and tighten all connections as necessary. 11) Check condition and security of transformers and connections. 12) With supply restored start and check operation. 13) Check control timer sequence. 						
	Isolator/fused switch	<ol style="list-style-type: none"> 1) Visually inspect external surfaces for defects or corrosion. Remove rust. 2) Check fittings are secure and tight. 3) Open cover door and inspect internal surfaces. 4) Isolate elsewhere 5) Remove arc shields, phase separators and terminal covers. Clean off dust and arc flash deposits. Replace if damaged or burnt. 6) Inspect terminations for signs of overheating 7) Check tightness of terminals 8) Inspect contact blocks and switch blades for signs of arcing. Clean off and lubricate. 9) Refit interior shields and covers, etc. 10) Check fuse ratings are correct. 11) Check earth conductor for security and tightness. 12) Inspect cable glands, lock nuts and fittings are secure and tight. 13) Close and secure cover/door. Check switch operation. 						
Date of Work								
Next Date								
Every Two Year Maintenance								
1	Starter	Measure insulation resistance and continuity of cables between isolator and starter and motor and record.						
Date of Work								
Next Date								

Low Voltage Distribution Board

Yearly Maintenance								
1	Labels	Check condition of descriptive labels, door fasteners, hinges. Repair and lubricate as necessary						
2	Wiring diagram	Check if circuit diagram is present.						
3	Fuses	Check fuses/ circuit breakers are fitted and correctly rated according to circuit diagram						
4	Supply Point	Check location of supply point is indicated on the circuit diagram						
5	Cleaning	After isolation of supply, clean distribution interior						
6	Connection	Check security of all connections						
7	Phase barriers	Check phase barriers are fitted						
8	Earth	Ensure main earth connector is secure						
9	Insulation resistance	Measure insulation resistance of bus bars, phases to neutral and neutral to earth.						
Date of Work								
Next Date								

Power Factor Correction Equipment

Yearly Maintenance								
1	Safety	Ensure that capacitors are fully discharged before starting any work and earth discharge switch is closed.						
2	Visual inspection	Carry out external visual inspection. Clean dust and debris						
3	Earth Switch	Check operation of earth / earth switch. Clean/lightly grease as necessary.						
4	Insulation of phases	Test insulation of phases to earth.						
5	Support brackets	Check all cable support brackets and earth bonding. Tighten/ re-grease as necessary						
Date of Work								
Next Date								

Distribution Transformer

Yearly Maintenance								
1	Air breather	Inspect condition of air breather (if fitted). Replace crystals if more than 60% have turned pink.						
2	Alarm	Check external condition of temperature alarm and indicator.						
Date of Work								
Next Date								
Every Two Year Maintenance								
1	Isolation	Before starting any work ensure that the transformer has been isolated on both high voltage and low voltage side elsewhere. Do not enter transformer compound until safe to do so.						
2	Inspection	Visually inspect : 1) Cooling fins and pipe work, clean as needed 2) Casings of main tank, note any oil leak on Job card 3) Primary and secondary terminal boxes 4) Earth connections						
3	Oil	Check oil level. Top up or change oil following manufacturer's instructions						
4	Brackets	Check all cable support brackets and earth bonding. Tighten/clean/re-grease as necessary.						
Date of Work								
Next Date								

Battery Charging System

Half Yearly Maintenance								
1	Inspect	Inspect battery and battery charger for damage and overheating						
2	Battery	1) Disconnect battery and carry out load test 2) Remove battery from cradle, clean battery, cradle and reinstall battery. 3) Check security and cleanliness of terminals. Lubricate with appropriate lubricant. 4) Check specific gravity of each cell, record lowest reading. 5) Check ventilation around battery area.						
3	Battery charger	1) Check tightness of all connections 2) Check output voltage, charging rate and fuse rating. 3) Check charger alarm outputs.						
Date of Work								
Next Date								

Fixed Electrical Appliances

Yearly Maintenance								
1	Visual Inspection	Carry out external visual inspection of appliances and socket outlets for damage, security, signs of overheating and ingress of water. Repair and record on Job card						
2	Socket Outlets	1) Test with plug socket tester 2) Check earth leakage circuit breaker by test button 3) Temporarily isolate supply to circuit at local distribution board.						
3	Lighting	1) Check all light switches and fittings for security, damage, overheating, etc. Repair or replace as necessary. 2) Replace defective tube lights, bulbs.						
4	Ventilation (non-heated)	1) Check ventilation controls for security, damage, overheating. Repair or replace as necessary. 2) Check condition of fan louver, cowling. Clean and adjust.						
5	Street/Area Lighting	1) Check all street/area lights are working. Repair or replace defective lamps. 2) Replace broken glass lens 3) Check security and condition of lamp stands, brackets, fittings, etc.						
Date of Work								
Next Date								
Every Two Year Maintenance								
1	Insulation Resistance	1) Test appliances and cable insulation resistance. Disconnect electronic devices before test. Reconnect after test. 2) Check integrity and continuity of protective conductors. 3) Test Line earth loop fault impedance.						
Date of Work								
Next Date								

Chain Hoist (Manually Operated)

Quarterly Maintenance								
	Hook	1) Check for cracks, deformation and opening of the hook and rotation of thrust ball bearing. 2) Grease as necessary.						
	Load Chain	1) Check for rust, crack and deformation. Check/measure pitch of the chain with a chain gauge. 2) Lubricate Chain as necessary						
Date of Work								
Next Date								
Yearly Maintenance								
	Total Unit	1) Check security of the unit and that there is no external damage or missing component. 2) Tighten foundation bolts and nuts.						
	Body	1) Check for crack, deformation, wearing of the gears, load sheave and side plates. 2) Lubricate parts, as necessary.						
	Gear Box	1) Check for abnormal sound. 2) Lubricate as necessary.						
	Trolley	1) Check for bending, crack and deformation. 2) Check tightness of all bolts, nuts, cotter pins, etc. as well as welded joints. 3) Check for wear of toothed wheels and that the wheels rotate smoothly. 4) Lubricate the gears and bearings.						
	Painting	Check for rust and peeled up paint. Clean and apply paint as necessary						
Date of Work								
Next Date								
Every Two Year Maintenance								
	Trolley rail	Check security of rail and that bolts and nuts are tight.						
Date of Work								
Next Date								

Wire Rope Hoist

Quarterly Maintenance								
1	Motor	Check for humming noise and overheat of motor						
2	Motor Gear Box	1) Check for bending, crack and deformation. 2) Check for leakage of lubricating oil. 3) Grease or top-up with lubricating oil if necessary						
3	Wire Rope	1) Check for deformation, damage, wear, crack, etc. 2) Grease /lubricate as necessary						
4	Rope Drum	1) Check for deformation, damage, wear, crack and smooth rotation. 2) Grease /lubricate hub as necessary						
5	Hook	Check for crack, deformation and opening of the hook and its rotation. Grease as necessary.						
Date of Work								
Next Date								
Yearly Maintenance								
1	Total Unit	1) Check security of the unit and that there is no external damage or missing component. 2) Tighten foundation bolts and nuts.						
2	Motor	Check insulation resistance. Rewind motor, if necessary.						
3	Pendant/Push Button Switch	1) Check that the contact points are functioning effectively 2) Check for breakage and damage of rubber covered cables.						
4	Motor Gear Box	Change lubricating oil according to standard instructions.						
5	Trolley	1) Check for bending, crack and deformation. 2) Check tightness of all bolts, nuts, cotter pins, etc. as well as welded joints. 3) Check for wear and that the wheels rotate smoothly. 4) Lubricate bearings.						
6	Limit switch	Check limit switch for proper functionality. Check that the bolts and nuts are held securely.						
Date of Work								
Next Date								
Every Two Year Maintenance								
1	Trolley rail	Check security of rail and that bolts and nuts are tight.						
2	Painting	Check for rust, peeled up paint. Clean and apply paint as necessary.						
3	Record	Record all information in Job card						
4	Instruction	Ensure that all Manufacturer's Standard Instructions have been followed						
Date of Work								
Next Date								