

## DVV Clarifications

### Metrics Level Deviations

7.1.4	<p><b>Water conservation facilities available in the Institution:</b></p> <ol style="list-style-type: none"><li>1. Rain water harvesting</li><li>2. Borewell /Open well recharge</li><li>3. Construction of tanks and bunds</li><li>4. Waste water recycling</li><li>5. Maintenance of water bodies and distribution system in the campus</li></ol> <p><b>HEI Input :</b></p> <p><b>A. Any 4 or all of the above</b></p>	<p>Provide Bills for the purchase of equipment for the Rain water harvesting Borewell /Open well recharge Construction of tanks and bunds Waste water recycling Maintenance of water bodies and distribution system in the campus for year 2020-21.</p>
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#### Supporting Documents:

Bills and AMCs for the purchase and maintenance of equipments for the Rain water harvesting, Waste water recycling, Maintenance of water bodies and distribution system in the campus.

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# Ashok Kumar Ghosh

R.C.C. Bore Pile & General Order Suppliers

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Rain water diverting Line

Bill.

HIT-176-8/11/21 (Rst Rain water diverting - embuliy)  
Ref. No. ....

Date 8/11/21

S.No - Description of work -	Area / Qty (approx)	Unit price (Rs)	Amount (Rs)
1) Earth cutting - $115.9 \times 0.7 \times 0.6 = 48.67 \text{ cu.m.}$	(48.67 cu.m.)	180/-	8,760.60
2) Removal of paver Block - $30 \times 30$ $43 + 15 \times 15$	103.3 sq	48/-	5,000
3) Laying of 6" Pre pipe Line -	285.00 ft	24/-	6,840
4) Large size manhole pit making -	(2 nos)	4,000/-	8,000
5) Medium size manhole pit making -	(12 nos)	3,200/-	38,400
6) Small size pit making -	(1 nos)	2,200/-	2,200
7) Slope making for pits -	(15 nos)	450/-	6,750
8) Relaying of paver Block - $(15 \times 30 + 15 \times 15 + 12 \times 15 + 15 \times 15 + 16 \times 15 + 15 \times 15)$	103.3 sq	60/-	6,198
9) Carrying of materials -	103.3 sq	45/-	3,000
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8/11/21

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Bill Amt :- Rs. 85149

15/03/2022

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**Heritage Institute Of Technology**

Page 1 of 2

994 Madurdaha, Chowbaga Road, Anandapur, P.O.: East Kolkata Township, Kolkata - 700107

Phone: 033 2443 0454/56/57, Fax: +91 33 2443 0455, eMail: purchase@heritageit.edu

**SERVICE ORDER****SERVICE ORDER NO.:** SVC/HIT/00044/21-22**DATE :** 02/09/2021**Quotation No.:****Quotation Date :** 28/08/2021**Vendor Detail :****ASHOK KUMAR GHOSH**

102/1/1 Tollygunge Road

Phone:

98305 22631

Fax:

Email:

Website:

Service Tax No:

Pan No.:

Kolkata 700 026

**Kind Attention :**

Item Name & Description	QTY	UOM	Rate	Amount	Disc %	Disc Amt	Tax %	Tax Amt	Net Amount
<b>SERVICE</b> (1) Earth cutting.	48.67	cu.m	180.00	8760.60					8760.60
<b>SERVICE</b> (2) Removal of Paver Block (103.3 m).	1.00	L/S	5000.00	5000.00					5000.00
<b>SERVICE</b> (3) Laying of 6" PVC pipe line.	285.00	ft	24.00	6840.00					6840.00
<b>SERVICE</b> (4) Large size manhole pit making.	2.00	nos.	4000.00	8000.00					8000.00
<b>SERVICE</b> (5) Medium size manhole pit making.	12.00	nos.	3200.00	38400.00					38400.00
<b>SERVICE</b> (6) Small size pit making.	1.00	no.	2200.00	2200.00					2200.00
<b>SERVICE</b> (7) Slope making for pits.	15.00	nos.	450.00	6750.00					6750.00
<b>SERVICE</b> (8) Relaying of Paver Blocks.	103.30	m	60.00	6198.00					6198.00
<b>SERVICE</b> (9) Carrying of materials.	1.00	L/S	3000.00	3000.00					3000.00
								<b>Total</b>	<b>85148.60</b>
Add - RO(+)									0.40

Prepared By

Approved By Purchase

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# Ashok Kumar Ghosh

R.C.C. Bore Pile & General Order Suppliers

102/1/1, Tollygunge Road, Kolkata - 700 026

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Bahar

Ref. No. ....

Date 16-3-2022

Heritage Institute of Technology  
944, Radurdaha Chowbasa Rd Km-107  
Anandapur.

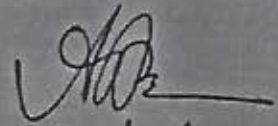
Re - Rain water Harvesting equipment

HIT - order no - SVE/HIT-00044/21-22

Date 02/09/2021, Quotation Date - 28/8/2021

Received for HIT - Rs - 84,298

(Eighty four thousand two hundred ninety eight only)



# OPERATION AND MAINTENANCE MANNUAL

## SEWAGE WATER TREATMENT PLANT

### INSTALLED AT

KALYAN BHARTI TRUST  
HARITAGE COMPLEX  
KOLKATA  
WEST BENGAL



### DESIGNED, MANUFACTURED & COMMISSIONED BY

M/S AKAR IMPEX PVT. LTD.  
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NOIDA ,  
DT. GAUTAM-BUDH NAGAR  
U.P. INDIA - 201 301.

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## PREFACE

The single most important item for a sewage treatment plant performance success or failure is OPERATION and more pointedly and ultimately, the OPERATOR. An operator aware of the Treatment Scheme & Process can derive the best solutions for day-to-day problems and emergency situations. This operation and maintenance manual (O & M manual) is intended to guide potential operator/user on how best to obtain optimum performance from AKAR DYNAMIC BIO-REACTOR (ADBR) based Sewage Treatment Plant supplied.

The basic requirements of successful operation and maintenance of any S.T.P are as under:-

- A thorough knowledge of plant & machinery and equipment provided for the plant and their functions.
- A thorough knowledge of adopted treatment process.
- Adequate tools.
- Systematic and periodic inspection and maintenance of plant and machinery.
- Strict adherence to maintenance schedules
- Good house keeping.
- Proper logging of all operation and maintenance activities.

In this manual an attempt has been made to briefly describe the system. The initial two chapters are entirely devoted to basic engineering and detailed engineering of the ADBR system, particularly referring to the features of the specific system supplied to the client in question. We believe that understanding the fundamentals of the treatment process would enable the operator to acknowledge and follow the operation procedures smoothly.

The operation and maintenance procedures are best illustrated in two separate chapters. The operation procedures are described unit wise for clarity.

Comments and suggestions to improve upon this O&M manual will be greatly appreciated.





## CHAPTER-1

### BASIC ENGINEERING OF AKAR DYNAMIC BIO- REACTOR (ADBR) SYSTEM

## **BASIC ENGINEERING OF AKAR DYNAMIC BIO-REACTOR (ADBR) SYSTEM**

### **1.1 Introduction**

AKAR Dynamic Bio-Reactor System (ADBR) is designed and manufactured by M/s Akar Impex Pvt Ltd as result of continuous research and development in the field of waste water treatment. One of the most important aspects of Akar technology is its specialization in the field of recycling of waste water. The ADBR system can be designed and manufactured M/s Akar Impex Pvt. Ltd to any quantity of sewage water or waste water. The plant shall treat Sewage generated from the domestic applications and source it from sewerage line. Details of Various components and parameters based on which the STP has been designed are provided in the next article.

### **1.2 Expected Sewage & Treated Water Characteristics**

Sewage emanating from various sources such as residential complexes, mess, canteen, staff quarters, college complex and school complex etc. has been assumed to have the following characteristics:

Parameter	Unit	Untreated	Treated
B.O.D.	mg/l.	250	< 20
C.O.D.	mg/l.	400	< 100
TSS	mg/l.	250	< 10
Oil & Grease	mg/l.	20	< 10
pH Factor		7.5 to 8.5	6.5 to 7.5

Table 1-1 Characteristics of Untreated and Treated Sewage water

### **1.3 Treatment Objectives**

The following factors were taken into consideration:

- To adopt a system that does not create bad odour and other nuisance associated with the Sewage Treatment Plant.
- To treat the sewage at a feasible capital and operating cost.
- To comply with statutory standards for treated water for horticulture application.





#### 1.4 ADBR (Akar Dynamic Bio-Reactor system)

ADBR (Akar Dynamic Bio-Reactor) system generally consist of the following:

- Screening in screen chamber
- Oil and grease removal in oil and grit trap
- Collection cum equalization tank
- Aeration tank (with air mixing by diffusion)
- Secondary clarifier or settler system (equipped with lamella plates and launders)
- Treated Water cum disinfection Tank
- Activated carbon filter (to reduce suspended matter and COD) ACF
- Dual Media Filter (DMF) for higher capacity more than 300 KLD
- Filter press for sludge treatment
- Related mechanical equipments and power supply control panel

**1.4.1 Screen:** Screen is a simple manual device to prevent coarse materials entering into the treatment plant. It is made of steel bars placed parallel to each other such that when needed, the stuck up material can easily be removed from screen.

**1.4.2 Oil and Grease Trap:** Oil and grease trap is a simple civil structural device, which traps oils and grease in tank. Oil and grease floats on top by virtue of its lower specific gravity. After sewage passes through the screen, it is stored for a period of about one-hour in an Oil and grease trap and from this Oil and grease trap, the water is removed from the bottom through a gap in the baffle wall. Oil and grease being lighter than sewage, floats on the top whereas the water free from Oil and grease is removed from the bottom and transferred by gravity to a chamber from where it is poured into the collection cum equalization tank by gravity. This system is not provided in the plant since sewage shall be directly collected from sewerage line and there is no provision to provide the same in a main line.



**1.4.3 Collection cum Equalization Tank:** In order to absorb fluctuations in hourly flow quantity and quality of sewage, an equalization tank (also called collection tank) is provided. This tank has a capacity of several hours. In normal cases, the collection cum equalization tank has a capacity of 6 hours retention. Thus fluctuations within any 6 hours are absorbed in this tank and the sewage gets equalized during this period. In order to prevent septic (anaerobic) conditions from occurring, a floating aerator of required capacity may be provided in the collection cum equalization tank. This aerator ensures that favourable conditions are created for development of aerobic bacteria.

- **Aeration or Reaction Chamber:** The sewage characteristic is that it is highly organic in nature. The treatment shall be carried out by biological process. The treatment condition shall be aerobic. In order to provide a compact system, the Sewage Treatment Plant designed employing ADBR system for secondary treatment.

#### **Function of Aeration or Reaction chamber**

The main function of an Aeration or Reaction chamber in a typical ADBR process are listed as under:-

- To maintain sufficient surface area for adequate surface loading by media.
- To retain media provided within reactor for biological growth.
- To maintain the dissolved oxygen concentration in the waste water.
- To maintain sufficient MLSS within reactor for bacterial degradation.
- To maintain sufficient biological growth on media for treatment.
- To provide adequate detention time for the above.





**1.4.4 Clarifier/Settler:** The mixed liquor from aeration tank coagulates as colloidal solids, which are otherwise non-settle able, bacterial cell tissues with a specific gravity slightly greater than that of water. These settle able matters are removed in the secondary clarifier. Secondary settling is significant since it affects the final treated sewage quality and activated sludge collected at clarifier bottom. The clarifier clarifies the water by removing suspended solids and the biomass. Clarification takes place as the result of settling of both biomass and suspended impurities. Hopper bottom is provided because when Sewage after bacterial activity rests for a given time biomass and suspended impurities being heavier tend to settle at the bottom of clarifier. Conical bottom helps this mass (called sludge) to slide down the slope and accumulate near the pit that is connected to the sludge pump. The sludge from the clarifier is pumped via sludge header. The bioreactor employs a Lamella plate settler, which consists of Lamella plates equidistant from each other to provide a much higher hydraulic surface loading area within limited volume and surface area of reactor space. The settler efficiencies match that of conventional clarification.

**1.4.5 Activated Carbon Filter (ACF):** An Activated Carbon Filter (ACF) is required to filter out suspended solids and any organic matter from water. Activated carbon filtration is most effective in removing organic contaminants from water. Unless specified otherwise, an activated Carbon Filter (ACF) has activated carbon media. It also helps in removing color and odor from water. ACF is generally packaged down flow type and of cylindrical vessel with inlet and outlet pipes with multi-port valve.

**1.4.6 Filter Press:** The filter press is a moisture reducing equipment working on the principle of pressure and air-drying. This mechanical device is used for concentration of sludge. Filter Press is a batch operation in which sludge is pumped into the space between the plates. The solids in the slurry are retained by the filter cloth and gradually fill the space inside the plate while the liquid is forced through the filter cloth.



**1.4.7 Mechanical Equipments:** Mechanical equipment consists of various pumps such as sewage water/filter feed/treated water/sump/chlorine dosing pumps etc. and blowers.

**1.4.8 Power Supply Contol Panel :** The power supply control panel is required to supply powers to various pumps/prime movers. This houses various switches and electrical safety switch-gears.

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## **CHAPTER - 2**

### **TREATMENT PROCESS AND CHEMICAL & BACTERIOLOGICAL SYNTHESIS**

## **TREATMENT PROCESS AND CHEMICAL & BACTERIOLOGICAL SYNTHESIS**

### **2.1 Treatment Process Concept**

To treat the incoming sewage collected from the sewerage line, "Mixed bed bio-reactor", a process modification of "Suspended Growth" process and "Attached growth" process is provided to achieve BOD removal. Also, in the process, excess sludge does not require separate digestion & the quantity of sludge generated is less. This avoids cumbersome sludge disposal exercise which needs more manual labour and land area.

The process is a combination of suspended growth and attached growth. A medium to fluidize the reactor is used which increases the available surface area in reactor thereby giving it a higher hydraulic loading for sewage treatment. The media floats on water and therefore remains always in suspension. Air shall be provided for both diffusion as well as rotating the media within reactor. Suitable screening is provided in reactor chambers to ensure that media is retained within reactor.

Bacterial growth is aided on the media to ensure that sewage when passes through reactor comes in contact with the media and the organics present in sewage react with media and are bio-degraded. The outer layer of the biological growth on media is oxygenated. The biological growth tends to increase in size and volume owing to attachment of organics on the bio-growth. Bacteria present in the bio-growth degrade the organic matter and being heavier, tend to break after a passage of time. They shall be collected at base through sloughing outlets and passed to sludge filter press.

The reactor is made up of various cells. Staging promotes a variety of conditions where different organisms can flourish in varying degrees. The degree of development in any stage depends primarily on the soluble organic concentration in the bulk liquid. As sewage flows through the system, each passing stage receives an influent with a lower organic concentration than previous stage.

The attached growth process is further aided by suspended growth process, which is explained below.

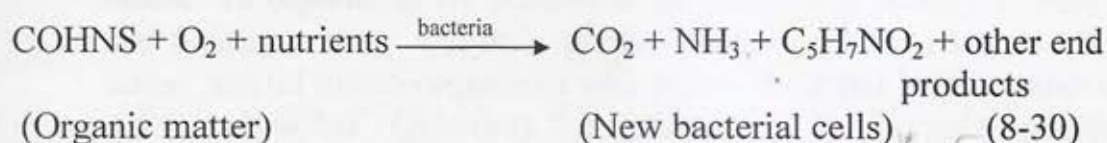




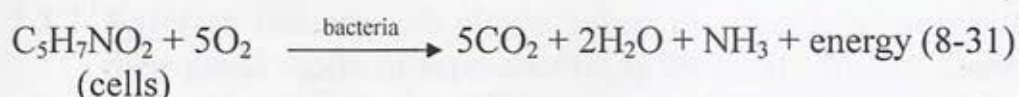
## 2.2 Growth Process

Operationally, Organic waste is introduced into a reactor where an aerobic bacterial culture is maintained in suspension. The reactor contents are referred to as the "mixed liquor." In the reactor, the bacterial culture carries out the conversion in general accordance with the equation.

### Oxidation and Synthesis



### Endogenous Respiration



In these equations, COHNS represents the organic matter in sewage. Although the endogenous respiration reaction results in relatively simple end products and energy, stable organic end products are also formed. It can be seen that, if all of the cells can be oxidized completely, the ultimate BOD of the cells is equal to 1.42 times the concentration of cells. The aerobic environment in the reactor is achieved by the use of diffused or mechanical aeration, which also serves to maintain the mixed liquor in a completely mixed regime. After a specified period of time, the mixture of new cells and old cells is passed into a settling tank, where the cells are separated from the treated sewage. A portion of the settled cells is recycled to maintain the desired concentration of organisms in the reactor, and a portion is wasted. The portion wasted corresponds to the new growth of cell tissue.





## 2.3 Various Terminology Associated with Water Treatment

- 2.3.1 pH Factor:** pH is one of the most common water quality tests performed. pH indicates the sample's acidity, but is actually a measurement of the potential activity of hydrogen ions ( $H^+$ ) in the sample. pH measurements run on a scale from 0 to 14, with 7.0 considered neutral. Solutions with a pH below 7.0 are considered acids. Solutions with a pH above 7.0, up to 14.0 are considered bases. All organisms are subject to the amount of acidity of water and function best within a given range. Most bacteria and other useful micro-organisms will perish if the pH is either above 9.5 or below 4.0. Generally the optimum pH for bacterial growth is between 6.5 & 8.5 factor is also determined in test laboratory and it must be performed on treated water.
- 2.3.2 Bateria:** Bacteria are single celled procanotic micro organisms; their usual mode of reproduction is by binary fusion. Generally a bacterial cell contains 80% water and 20% dry material, out of which 90% is organic & 10% is inorganic.
- 2.3.3 Bio-Chemical Oxygen Demand (BOD):** It is the demand of dissolved oxygen required by bacteria and other microbes for bio-chemical oxidation of Organic matter. The test laboratory conducts this test on both untreated & treated water.
- 2.3.4 Chemical oxygen demand (COD):** Chemical oxygen demand (COD) is a measure of the capacity of water to consume oxygen during the decomposition of organic matter and the oxidation of inorganic chemicals such as ammonia and nitrite. COD measurements are commonly made on samples of waste waters or of natural waters contaminated by domestic or industrial wastes. Chemical oxygen demand is measured as a standardized laboratory assay in which a closed water sample is incubated with a strong chemical oxidant under specific conditions of temperature and for a particular period of time. The test laboratory conducts this test on both untreated & treated water.





**2.3.5 Mixed Liquor Suspended Solids (MLSS):** The suspended solids concentration in the Aeration or Reaction chamber is referred to as Mixed Liquor Suspended Solids. It is an index of the mass of active microorganisms in the Aeration tank. The level of MLSS that has to be maintained depends upon the desirability of treated water quality. MLSS level of 3000 - 5000 mg /lit would be optimum in a conventional aeration tank.

**2.3.6 Total Suspended Solids :** Total suspended solids is a water quality measurement usually abbreviated TSS. This parameter was at one time called non-filterable residue (NFR), a term that refers to the identical measurement: the dry-weight of particles trapped by a filter, typically of a specified pore size. "filterable" meant the material retained on a filter, so non-filterable would be the water and particulates that passed through the filter. The material passed by a filter, usually called "Total dissolved solids" or TDS. Thus in chemistry the non-filterable solids are the retained material called the residue. TSS is also measured by the Test laboratory for both untreated and treated water.

**2.3.7 Nutrients:** To continue reproduction & stabilization of organic matter, an organism must have

- source of energy
- Carbon for the synthesis of new cellular material
- Inorganic elements such as nitrogen, phosphorus, sulphur, potassium, calcium and magnesium.

For deriving energy bacteria use light and other chemical reaction as a source. Carbon is derived from organic matter and atmospheric CO<sub>2</sub>. Inorganic elements are sufficiently available in Sewage. A generally recommended Nutrient ratio of BOD: N: P in 100: 5:1.



**2.3.8 Food to Microbes Ratio (F/M):** It is the ratio between amounts of Organic material available to material population. In other words it is the ratio between BODS is Kg/MLSS in kilograms. Increasing or decreasing the rate of Return Activated Sludge (RAS) from Secondary clarifier can achieve a proper F/M. Optimum F/M ratio for a conventional ASP is 0.1 - 0.2 and varies for a ADBR owing to attached growth.

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## **CHAPTER-3**

### **DETAILED DESCRIPTION OF SEWAGE TREATMENT PLANT**

#### **HERITAGE COMPLEX**

#### **KALYAN BHARTI TRUST**

#### **KOLKATA**



### **3.4 Vipul Belmonte STP Lay-out**

The layout of STP consists of the various tanks locations and the required mechanical equipment fitted in the plant. The layout has been given at appendix "A". However, various civil structure & different tanks and plant mechanical equipment which are designed and included/installed in the plant are as under:

#### **3.4.1 Civil Structure and Different Tanks**

- (a) Screening Chamber
- (b) Oil & Grease Trap chamber
- (c) Equalization Tank
- (d) Reactor Tank I
- (e) Settler Tank
- (f) Collection Tank
- (g) Treated Water Tank
- (h) Recycled Water Sump

#### **3.4.2 Major Mechanical/Electrical Equipment**

- (a) Activated Carbon Filter – Qty 1
- (b) Blower - Qty 2
- (c) Submersible Sewage (Effluent) Pump – Qty 2
- (d) Sludge Pump – Qty 2
- (e) Filter Feed Pump – Qty 2
- (f) Screw Sump Pump – Qty 2
- (g) Chlorine Dosing Pump – Qty 1
- (h) Chlorine Tank – Qty 1
- (i) Mechanical Filter Press with Hopper tray for sludge removal – Qty 1
- (j) Electrical Control Panel – 1
- (k) Various measuring Instruments





3.4.3 The specifications of the important mechanical/electrical equipments are given in para 3.3.2 are as under:

(a) **Activated Carbon Filter**

ACF Make	Akar Impex Pvt Ltd
ACF Vessel Diameter	400 mm
Height	1400 mm
Type	Down flow type
Material of construction	MOC FRP VESSEL

**Table 3-3 Specifications of ACF**

(b) **Air Blower** The Blower is mechanical equipment used to aerate the Effluent. The aeration of the wastewater is done in order to facilitate the bacteria in degrading the organic waste present the wastewater. Blower with a motor is mounted on base frame.

Blower Model No.	20.01
Blower Make	BETA
Blower Capacity	60 CFM
Drive Motor Make	KIRLOSKAR
Drive Motor Power rating	5.0HP
Material of Construction	Mild Steel/CI
RPM of Motor	1500
Protection	IP55

**Table 3-5 Specifications of Air Blower**

- (d) **Sewage (Effluent) Pump/ Sludge Pump/Filter Feed Pump/ Sump Pump/ Chlorine Dosing Pump**: All the Pumps installed in the Plant are Self-priming pumps. All Pumps are of reputed make. Pumps and motors are fitted on base frame. Various Salient features of the Pump provided are in table given below :

Equipment Identification	Effluent /Sewage Pump	Sludge Pump.	Filter Feed Pump	Chlorine dosing pump
Type	Submersible type pump	Screw type	Horizontal Cetrifugal, self priming pump	Metering pump
Make	KSB	Rotomac	Kirloskar	Toshniwal
No. of Pumps	2 Nos	2 Nos	2Nos	1 Nos
Discharge (Max.)	6.0 Cum/Hr	2.0 Cum/hr	9.7 Cum/Hr	0-6 Litres /Hour
Head (max.)	8 Meters	22 Meters	24 Meters	5 Bar
Power rating	0.75 KW	1.5 KW	2.2 KW/3HP	0.25 KW
Power supply	Three Phase	Three Phase	Three Phase	Single Phase
Suc./Del size	65 x 65 mm	40 x 40 mm	50 x 50 mm	6 x6 mm
Impeller RP	2760	345	2830	----
Solid handling Size	40 mm	20 mm	10.5 mm	----
M.O.C.	SS	Carbon steel	Carbon steel	----
Motor Type	Submersible	Horizontal Centi.	Kirloskar	----

Table 3-6 Specification of various Pumps in STP



- (e) **Mechanical Filter Press (Manually Operated):** The filter press is a moisture reducing equipment working on the principle of pressure and air-drying. This mechanical device is used for concentration of sludge. Filter Press is a batch operation in which sludge is pumped into the space between the plates. The solids in the slurry are retained by the filter cloth and gradually fill the space inside the plate while the liquid is forced through the filter cloth.

Size of Press	14" x 14"
No. of Plates	14
Filter Cloth Size (appx) 16"x16"	Model No. AIPL-FP-24
No. of Filter Cloth	14
Operation	Hydraulic
Material of construction	Cast Iron/P.P.
M.O.C of plates	P.P.

Table 3-7 Specifications of Filter Press

- (f) **Electrical Control Panel :** The control panel houses all switches/switch gears/electrical security equipments. It facilitates distribution of electricity supply to various mechanical prime movers in the STP.

Control Panels	One Akar Make, 3 Phase 4 Wire.
Size	Width - 800 mm
	Height - 900 mm
	Depth - 350 mm
Thickness of sheet	16 SWG
Material of construction	M.S
Amps / Volts	100 Amps. 415 V
Instruments	Ampere meter. 0-100 A Volt meter 0-500V TPN SFU with HRC fuses. With TP MCB for each motor.

Table 3-8 Specifications of Elec. Control Panel



## **CHAPTER-4**

### **STP OPERATION GUIDELINES**



## **STP OPERATION GUIDELINES**

### **4.1 Introduction**

The primary aim of operation of Sewage treatment plant is to ensure that the sewage treated by the plant meets the prescribed standards in terms of BOD/ COD/ SS/ pH etc., laid down by the local body or any other statutory body while discharging the sewage safely in public sewer, on land or in the water body. The standards required to be met with are listed in Table 2-2. A good Sewage treatment plant must achieve this most efficiently and economically.

### **4.2 Start up of the Plant**

Before one start up the ADBR system, please check the following:

- 4.2.1 Please check that all the valves at the out let of the pumps and blowers. They should be functional and open. If any of the valves is closed, it can create problem.
- 4.2.2 Check that valves of the stand by units are in shut off position.
- 4.2.3 Ensure that all pumps have water in them, priming is generally not required.
- 4.2.4 Check all phase indicating lamps on control panel. Make sure that all the phases of power supply are available. Do not switch on motors, if any one phase is not available.
- 4.2.5 Start the all pumps one by one. Carefully check for no abnormal sounds. Any unusual sound may indicate faulty running.
- 4.2.6 After all pumps are operated and checked for satisfactory running, & that there is required quantity and grade of oil in the blowers. If in doubt, refer to this manual or contact Akar Impex Pvt. Ltd. at the address, phone numbers given in the cover page of this manual.
- 4.2.7 Start blowers (one or more as required). Again carefully listen for the sound for any abnormal sound. Any abnormal sound may indicate poor driving pulley alignment, motor not connected properly, lack of oil, defective belt fitment etc.

- 4.2.8 Check that air supply is uniformly received at the tanks, diffusers.
- 4.2.9 Ensure that screens are placed in screen chamber before accepting sewage or effluent in STP.
- 4.2.10 Ensure required quantity of media in the reactor tanks.

### **4.3 Operation of STP**

- 4.3.1 After ensuring pre-operational check, accept the sewage or effluent in the plant.
- 4.3.2 Start and continue operating sewage pumps and blowers non stop for several days to enable NBio mass to develop in the aeration tank to the level as desired.
- 4.3.3 In ADBR systems normally sludge is not recycled in the normal operation. However, sludge may have to be recycled in the initial stages. Therefore check and recycle sludge in the starting up stage till adequate MLSS develop in the aeration tank.
- 4.3.4 Do not operate the filter feed pump till sufficient quantity of MLSS develops in the aeration tank.
- 4.3.5 After some days of operation, which may last from 10 up to 21 days or may be even more (depending upon the type of sewage), sludge will begin to develop and MLSS might reach the optimum level. To check this in a simple way without any use of instruments follow the procedure as follows:
- Take water from the aeration tank in a transparent glass or jar or bottle. Let the water settle for by placing this container on table so that there is no movement to disturb the water inside.
  - Let water rest for 20 minutes. You will observe that impurities in water begin to settle gradually. These impurities or the mass, which tends to settle at the bottom, is called sludge.
  - After 20 minutes, check the water in the jar, bottle or glass. If you find that sludge occupies 1/3 rd or 33% of the height of the container and 2/3 rd or 67% is occupied by clearer water, it will be safe to presume that the aeration tank has reached optimum level of MLSS or Bio-Mass.



- If the clearer portion is higher than 67%, the aeration tank has yet to develop required level of Bio-Mass. And if the level of clearer water is less than 67% (which means sludge is more than 33%), this means that excess sludge has already developed or is beginning to develop and must be taken off to filter press from ADBR settler as per quantum of excess sludge.
  - Another indication of sufficient MLSS not being formed is to watch the surface of the water in the settler tank. Water will look muddy and the lighter sludge patches are seen on the surface of water which indicates that sufficient sludge is not formed.
- 4.3.6 After ensuring that the sufficient quantity of MLSS being formed the start filter feed pump to run the water from collection tank to DMF and ACF.
- 4.3.7 Ensure that the chlorine dosing tank is filled with sufficient quantity of clean water and chlorine working properly and feed chlorine at the outlet of ACF
- 4.3.8 The filter press should now be operated to remove the sludge from the settler tank by operating sludge pump regularly. Also it must be ensured that the filter press operated regularly to remove the sludge from settler. Care to be taken not to operate the sludge pump continuously. It should be run at a regular interval to remove the sludge so formed and also allow the sludge to settle in settler tank.
- 4.3.9 The water should be allowed to run through ACF for at least 3 to 5 days and only then the treated water sample should be collected for analysis.
- 4.3.10 Backwash the ACF every day at least twice. For this the treated water should be used.



#### 4.4 Unit Wise Operation Procedure

- 4.4.1 Sewage Lifting Pumps : The Sewage in passing sewer is pumped continuously to the Reactor chamber. The pump suction side valve should be regulated such that the Sewage generated per day is pumped out at a constant rate. While regulating the discharge, it should be ensured that the sewer line does not dry out in a full day's operation. Similarly, pumps shall not be run dry. This constant feeding of Sewage is essential to ensure good Biological Activity in Reaction tank. For example 100 Cum/day sewage generated, the Pump should constantly discharge at a rate of 4.0 cum per hour or 4000 litres per hour approximately.
- 4.4.2 Reaction Tank (ADBR) : This is the most important unit in the Treatment Process. Any faulty operation of this unit would adversely affect the treated water quality for a long time span even after the operation is rectified. The Operator would do well to understand the basic definitions, Operational Parameters explained under article 2-1. Normal operation of plant shall mean operating air blower, sewage pump and sludge pump for sludge pressing. The operator is advised to alternate operation of the above mentioned equipment every 4 hours to avoid heating and making sure both working and standby pumps are able to run for uniform number of operating hours.
- 4.4.3 Settlers : Lamella settler is designed for sludge separation from passing sewage. The biodegraded sewage contains particles heavier in weight and provides sufficient surface area for them to settle. The sludge settles at base and is carried out for pressing. The sludge separation is carried out by gravity and no mechanical rotating device is adopted. However, care is to be taken to check sludge settling regularly. The sludge pump should be operated regular interval so sludge so formed is removed and also allow sufficient time for sludge to formed and settled in the settler.



**4.4.4 Sludge Removal Operation :** For removing Sludge from Clarifier bottom to Sludge pump, a sludge header has been provided. Pump suction shall ensure that sludge is removed from all area of base. In case of any problem like choking of sludge header, sludge pump failure or even cleaning the settler, the following procedures should be followed in the same order. Empty the Sump to minimum possible level by operating the sludge recycle pump. Open the discharge Valve full. Due to difference in water level, the large hydrostatic pressure would ensure complete flushing of Clarifier bottom. Again close the Valve full. Pump out the Sludge from sump. Repeat the cycle if more sludge is to be removed. Sludge removal should be frequent to avoid development of anaerobic conditions. Excess Sludge removal would result in watery sludge. This watery sludge removal should be avoided. Excess Sludge should be pumped to the filter press. A good operation calls for prompt removal of excess sludge from the settling tank to ensure that the sludge is fully aerobic. Sludge cakes should be removed daily for disposal.

- **Sludge Recycle rate:** As illustrated in Article 2-1, the MLSS concentration in aeration tank is maintained by returning Activated Sludge from the clarifier. Generally for activated sludge process with Extended Aeration type, the ratio between RAS ( return Activated Sludge) and sewage inflow is 0.5 - 1.0.

**4.4.5 Operation of Filter Press :** The filter press is operated by starting the sludge pump, as per the condition of sludge depth in the sludge tank or clarifier (in case there is no sludge sump). In case of MBBR system, the sludge generated will be limited and sludge pump to filter-press must be operated twice for about half an hour, in 24 hours in case the plant is receiving sewage at full capacity. In case, the plant is operated at less than full capacity, the operation of filter press may be delayed based on the operator's experience. Over a period of time, the cakes will start to form in the filter press and due to resistance against free flow through filter cloth, the sludge pump will be subjected to higher



back pressure. Although no pressure recommendations have been specified, it is recommended that when the water dripping from the filter press reduces to trickle, it is good time to open the filter press for cake removal after stoppage of sludge pump and after stoppage of water coming from the filter press.

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## MAINTENANCE GUIDELINES

### 5.1 Introduction

Maintenance operations can be classified into two categories viz preventive maintenance and corrective maintenance. Preventive maintenance is more economical and provides uninterrupted service, which is essential to achieve the basic objectives of treatment. Maintenance of the sewage treatment plant includes structures, electrical and mechanical equipment, piping etc. Electrical maintenance includes checking of the ampere taken by each motor used in treatment plant intermittently. The Control Panel installed in the plant should be periodically checked by a qualified electrician. If there is any short circuit or if the Star- Delta starter doesn't get tripped, the fault should be immediately rectified. **Care should be taken to ensure that earthing (grounding of neutral) of the panel is done properly as per standard good engineering practices.**

### 5.2 Structures, Piping, Mechanical Equipment etc.:

- Panel room building and other treatment units should be well ventilated, air-conditioned and illuminated.
- They should be maintained in good repair, white or colour washed, metallic parts painted annually. The effect of corrosive gases like Hydrogen Sulphide can be minimized by proper ventilation.
- The side walls of the settling tanks should be cleaned so as to minimize the collection of solids, grease, oil and aquatic growths. Collections, if any should be removed periodically by brushing and hosing them down without disturbing the tank contents.
- Dark floating matter and rising bubbles on the surface indicate improper cleaning and inadequate sludge removal.
- Inlet and outlet channels should be kept clean and hosed at least once a week.
- All baffles should be cleaned of any sticky materials and stringy growths on the surface and edges.



- The bearings, transmission gears, traction rollers, etc., should all be properly lubricated as per the lubricating schedule suggested by the manufacturer.
- In addition, it is good practice to dewater each clarifier at least once a year to inspect the submerged portions of the mechanism such as flight scrapers, squeezes or lamella plates etc., repair or replace the worn-out parts, check all nuts and bolts for tightness and repaint all metallic parts.
- Motors of all pumps should be checked periodically for overload conditions and electric wiring for proper insulation.

### 5.3 Maint of Pump Installations

All Pumps are installed in the Plant are of standard makes. We reproduce some important maintenance details of these pumps from manufacturers O&M manual.

- Do not run pumps dry. If a pump is used to handle water containing solids and silt, it is necessary to wash out the same with clean water before restarting.
- Restarting of the pump should be done after filling the casing with clean water.
- The Bearing should be lubricated once in a month. Stork recommend Servo Gem - 2, Indian Oil make grease for that purpose.
- If the Pump is idle for some time, it may get stuck or locked in one place. The free end of the shaft should be given a little jerk to ensure free rotation. Turn the Lantern ring 2 to 3 turns.
- This should be repeated weekly or as per need.

The following maintenance schedule shall be followed for optimum performance from the Pumps:

- Monthly - Check the Priming time (Priming time for the Pumps installed are listed in Table 4-1), Pump noise if any, Pipe connections and Valves installed in the line for blockages.



- Six Monthly - Open the Pump to check and clean interior parts.
- Yearly - Replace shaft sleeve, Gland Packing, Impeller vanes and other worn out parts.

For further details the original manual can be referred.

#### 5.4 Blowers

Check the blower for any abnormal sound may indicate poor driving pulley alignment, motor not connected properly, lack of oil, defective belt fitment etc. The oil must be replaced every three months. The quantity of oil to be refilled/replaced should be as per the instruction of the blower manual.

#### 5.5 Control panel

Check the control panel for the following:

- Proper contact of all wires
- No loose wiring anywhere
- Any burnt out contact
- Proper condition of all switch gear and safety devices
- Illumination of all switch bulb/LED
- Proper earthing

#### 5.6 Aeration Tank

- The operational variables in an activated sludge plant include rate of flow of sewage, air supply, MLSS, aeration period. D.O in aeration and setting tanks, rate of sludge return and sludge condition. The operator should possess a thorough knowledge of the type of system adopted viz. conventional, high rate, extended aeration, ADBR or contact stabilization so that effective control of the variables can be exercised to achieve the desired efficiency of the plant.
- Inspection of mechanical aerators should be done for bearings, bushes, and transmission gears, and they should be lubricated as per the schedule suggested by the manufacturers.



- The whole unit should be thoroughly inspected once in a year including replacement of worn out parts and painting with anti-corrosive paint to achieve desired efficiency of the plant.
- The record of maintenance should be maintained.

### 5.7 Air Supply

Frequent checks of DO at various points in the tank and at the outlet end, which should not be less than 1 mg/l will help in determining the adequacy of the air, supply. Mechanical or surface aerators should be kept free from fungus or algae growths by cleaning them periodically.

### 5.8 Miscellaneous

- Maintenance and lubricating instructions for all pumps and other mechanical equipment should be strictly followed.
- Special attention should be given to maintaining pumps in an efficient operating condition, free from clogging, excessive friction or entrance losses and abnormal power consumption due to wear and tear.
- Water level in the wet wells should not be lower than the minimum designed level and all accumulations of grease and other deposits removed promptly.
- Floats and sequence switches controlling the pumping cycles should be examined at the beginning of each shift.
- All pumps including standby pumps should be operated in rotation so that the wear and tear is distributed evenly.
- When pumps may have to be operated manually time interval between start & stop, should not be less than 5 minutes. The manufacture directions for operation and lubrication should be strictly followed. Packing glands should be checked for over-tightening.
- All bearings, motors and electrical control equipment should be inspected daily for any overheating.
- Valves and piping should be regularly checked for leaks. Leaks should be attended to as per the instruction in the manufacturers' catalogues.





### **5.9 Recording And Reporting**

The daily operation and maintenance records should be logged in respective log-books. All operating and maintenance records of the various treatment units in a plant should be properly compiled on an day-to-day basis and daily, monthly and yearly reports prepared, maintained and periodically reviewed. These reports will form a valuable guide to better operation and serve as an important document in the event of a legal suit resulting from nuisance or danger attributed to the plant or for meeting the statutory requirements about the satisfactory performance of the plant.

### **5.9 Training of Personnel**

All operating staff engaged in technical and skilled work should be trained. The person who would be looking after the maintenance and operation of the plant should be preferably involved in the activities at the time of design, procurement and installation including inspection of equipment at manufacturers' place and their test and trials on completion of system.

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## **CHAPTER-6**

### **LIKELY PROBLEMS AND RECTIFICATION**



## **LIKELY PROBLEMS AND RECTIFICATION**

### **6.1 Bulking and Rising of Sludge**

The quick settle ability of sludge is an important factor in the efficient performance of the activated sludge plant. The SVI serves also as an index of sludge settleability. SVI values of 80 - 1600 are considered satisfactory in plants operating with MLSS of 800-3500 mg/l. Sludge with poor settling characteristics is termed bulking sludge. Sludge bulking results in poor sewage treatment due to the presence of excessive suspended solids and also in rapid loss of MLSS from aeration tank. Sludge bulking is generally due to inadequate air supply, low pH or septicity and also due to growth of filamentous organisms consequent to the presence of industrial wastes\* containing high concentration of carbohydrates in sewage. Sludge bulking is controlled by eliminating the causes and by application of chlorine to the incoming sewage to control filamentous growths. Chlorine requirements are 0.2 to 1.0 percent of dry solids weight in return sludge. When sludge bulking occurs, the suggested remedies are:

- Reduction in rate of sewage flow into aeration tanks;
- Reduction in ratio of return sludge;
- Increase in air supply or Dilution of the incoming sewage.

Chemicals that may be used to reduce bulking include chlorine, lime (raising pH to 8.6 to 8.8) or chlorinated copperas etc. These are added to the return sludge in small doses to ensure that they do not become toxic to micro-organisms.

### **6.2 Foaming**

Foaming or frothing is sometimes encountered in activated sludge plants when the sewage contain materials which reduce the surface tension, the synthetic detergents being the major offender. Froth, besides being unsightly, is easily blown away by wind and contaminates all the surface it comes into contact with. It is a hazard to workmen because it creates a slippery surface even after it collapses. Foam problems can be overcome



by the application of a spray of screened sewage or clear water, increasing MLSS concentration, decreasing air supply or addition of other special anti-foam agents. The presence of synthetic anionic detergents in sewage also interferes with the oxygen transfer and hence reduces aeration efficiency.

The operator should maintain a book of catalogues supplied by manufactures containing instruction sheets of all equipment. In addition, printed or written operating and maintenance schedules should be displayed near each equipment in the language understood by all operating staff. Lubricating schedules cleaning and painting schedules, checks for efficiency, leaks and wear and tear and testing of safety devices, should be followed strictly according to manufacture instructions.

All metering devices should be maintained in proper working condition including calibration. Charts should be changed at the same hour every day. Records maintained should show total maximum and minimum rates of flow.



### 6.3 Trouble Shooting:

#### 6.3.1 Operation Troubles In Sewage Treatment Plant

S.N.	Signs & Symptoms	Possible Causes	Suggested Action
1.	Floating sludge in all tanks.	Accumulated sludge decomposing in the tank and buoyed to the surface.	Remove sludge more completely and more often
2.	Floating sludge not in all tanks	Affected tanks receiving too much sewage.	Reduce flow to affected tanks.
3.	Bubbles rising in tanks	Septic conditions	Report and empty tank completely as soon as possible.
4.	Contents black and odorous.	Septic sewage or strong digester supernatant.	Take action to eliminate septicity by improving hydraulics of sewer system Pre aeration of organic industrial wastes admitted to the system etc. or improve digester operations as to have improved quality supernatant or reduce flow into setting tank or bypass completely supernatant to lagoons etc. till situation improves.
5.	Excessive settling in inlet channels	Velocity too low	Reduce cross sectional area by installing inner wall of suitable material along one wall of channel: or agitate with air, water or otherwise to prevent deposition.



6.	Excessive suspended matter in sewage-all tanks	Accumulated sludge Flow through tanks too fast (over loading) Humus sludge or under drainage returned too fast.	Clean tanks more often. Report and get the loading reduced pumping rate.
7.	Excessive suspended matter in sewage – not all tanks.	Some tanks receiving too much sewage.	Reduce flow to affected tanks.
8.	Excessive floating matter in the sewage.	Defective scum boards or none.	Repair scum boards or install new ones.
9.	Sludge pipes choke	Sludge too thick	Clean more often.
10.	Intermittent surging of flow	High intermittent pumping rates.	Adjust pumping rates to keep close to rates of flow of install or adjust baffling to reduce inlet velocity and to have effective flow distribution across the width of tank.
11.	Sludge hard to remove from hopper.	High content of grit and /or clay	Reduce grit Content: or reduce clay content: or rod the clogged lines.
		Low velocity in withdrawal line.	Pump sludge more often: or change sludge piping.
12.	Change in sludge Volume index.	High soluble organic loads in sewage.	Decrease aeration liquor suspended solids: or bulking of activated sludge may be controlled by proper application of chlorine to return sludge: or control sludge index by converting deposited sludge to activated sludge.



13.	Rising sludge in setting tanks.	Due to excessive nitrification	Increase the rate of return activated sludge from the final set-ting tank: or decrease the rate of flow of aeration liquor into the tank or increase the speed of sludge collecting mechanism in the final setting tank to increase rate of removal of sludge: or decrease nitrification by reducing aeration or lowering the detention period.
14.	Frothing	Synthetic detergents cause, frothing. The froth increases with decrease in aeration liquor suspended solids or increase in aeration. or increase in degree of purification of sewage or increase in atmospheric temperature.	Use water sewage or clarified sewage sprays in the frothing areas. or apply deferments in small quantities to tank surface (repeated dosing is necessary) or increase aeration liquor SS concentration.
15.	Slough Removal	Once in a month	Suck slough from 2 inch sized extension of sludge line by sludge pumps and pass through filter press along with settler sludge drying operation.

**6.3.2 Operation Troubles In Mechanical Components**

Sl. No.	Name of section or part to be attended.	Maintenance to be carried out	Frequency	Remarks
1.	Bearings	Checking of temperature with thermometer	Two months	Hot ball or roller bearings point to too much oil or grease. Hot sleeve bearings need more oil or heavier lubricant. If does not correct, disassemble and inspect the bearing alignment of pump and driver.
2.	Glands	Changing of Gland packing	Two months	
3.	Bearings	Lubrication (greasing)	Two months	Check for specification resulting in whitish colour. Washout with kerosene.
4.	Gauges	Checking of pressure and vacuum gauges.	Three months	
5.	Valves	Changing of gland packing in delivery sluice valve, suction valves, bye pass valve. Reflux valve.	Six months	





6.	Exhaust pump and its auxiliaries.	Checking of gland packing & its auxiliaries etc.	Six months	
7.	Impeller.	Checking of impeller blades. Sleeves efficiency rings, bearings necking impeller nut etc.	One Year	

**6.3.3 Operation Troubles in Electric Motors** (For details please see the O&M Manual of this equipment separately enclosed)

S. N.	Name of section or part to be attended.	Maintenance to be carried out	Frequency /time interval at which inspection and maintenance to be done	Remarks
1.	Induction Motor stator And Rotor	Opening of end covers dust blowing and checking of air gap.,	One month	Depending on the working conditions & maintenance staff avail-able.
2.	Slip ring device.	Cleaning of slip rings and adjustment of carbon brushes short circuiting jaws, oiling of cloth etc.	One month	
3.	Bearings	Proper lubrication	Two months	
4.	Windings	Checking of motor after taking out its	Two years	



		Rotor dust blowing. checking of end connections of stator. Rotor and taking insulation test no load rest before putting the motor on load.		
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#### 6.4 Conclusion

The completed Sewage Treatment Plant has a designed capacity to treat 100 KLD of sewage coming to the sewage treatment plant (STP) through a network of sewer lines and manholes. The Mixed Bed Bio-reactor Process (ADBR) incorporating suspended growth combined with Attached growth has been used as per the process scheme. ASP with extended aeration has the advantages for the nature of sewage coming to the STP having low organic loading, low F/M ratio, and high MLSS concentration. This process almost completely digests the organic matter and partially stabilises the sludge, which is wasted in lesser quantity in comparison to other processes.

There is 90-95% reduction of BOD and 90-95% reduction of TSS. Consequently, the treated sewage achieves the stringent pollution control board norms.

To run the Sewage Treatment Plant, it becomes imperative to follow the guidelines as detailed in this complete work report cum running, maintenance and operation manual. The emphasis should be on preventive maintenance to incur lesser expenditure in comparison to consequent maintenance.

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## OFFER

### AIPL HIGH SPEED BIO SYSTEM

#### SEWERAGE CHARACTERISTICS:

Type: Domestic Sewerage

#### Basic parameters for designing the plant

Average Daily flow (cum/day)	100 cum	150 cum
Average flow (cum/hr.)	4.5	6.5
pH	6.5	6.5
BOD (5 days at 20 degree C) (mg/l)	250	250
COD (mg/l)	400	400
Suspended solids ( mg/l)	150	150
Oil & Grease (mg/l)	20	20
Total Sewage / day	100000 liters	150000 liters
Invert level of sewer	3.5m deep	3.5m deep

Treated water Characteristics	
BOD	Less than 20 mg/l
COD	Less than 250 mg/l
Suspended solids	Less than 30 mg/l
Oil & Grease	Less than 10 mg/l
pH	6.5 – 7.5

Invert Level: As per available data and site, it is assumed that the incoming sewage or wastewater shall be available at 3.5m below the available Nominal ground level.



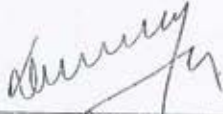
## 7. TECHNICAL DATA

Equipment	Specification	Unit	ADBR 100	ADBR 150
Tank Container	Overall Length	M	6	9
	Overall Width	M	2	2
	Overall Height	M	2.6	2.6
Bio Medium	Proprietary	M <sup>3</sup>	2	3
Settling Medium	80 x 40 inch plates	Nos.	4	6
Blower	Nominal Capacity	CFM	70	90
	Back Pressure	PSI	05	05
	Motor rating	KW	3.7	3.7
Centrifugal Pump	Nominal Capacity	M <sup>3</sup> /hr	4.5	6.5
	Head	M	8	8
	Revolutions	RPM	1440	1440
	Motor rating	KW	0.75	1.5
Sludge Pump	Nominal Capacity	M <sup>3</sup> /hr	2	2
	Head	M	14	14
	Revolutions	RPM	2880	2880
	Motor rating	KW	0.75	0.75
Filter Feed Pump	Nominal Capacity	M <sup>3</sup> /hr	4	6.5
	Head	M	20	20
	Revolutions	RPM	2880	2880
	Motor rating	KW	1.5	2.2
Sludge Filter Press	Size	M	0.4 x 0.4	0.45 x 0.45
	No. of plates	No.	12	14
	Type	**	C.I	C.I
Activated carbon filter	Size	M	0.5	0.7
	Height on straight	M	1.4	1.4
	Material of construction	***	M.S.R.L	M.S.R.L

## HANDING/TAKING OVER OF SEWAGE TREATMENT PLANT

1. We have jointly handed/taken over the Sewage Treatment Plant at Heritage Complex, Kalyan Bharti Trust, Kolkata supplied/Installed/ Commissioned by M/s AKAR IMPEX PVT LTD, E-9, Sector – 6, Noida (U.P.)
2. Details of the Plant as under:
  - (a) Type of plant : Sewage Treatment Plant
  - (b) Installed Capacity : 100 KLD
3. Following documents are attached:
  - (a) List of Major Equipment Installed (Appx A)
  - (b) Lost of documents attached (Appx B)
  - (c) Operation and maintenance Manual (Enclosed)
4. We have handed/taken over the STP in full working and satisfactory condition. There is no deficiency/discrepancy.

Representative of  
M/s Akar Impex Pvt Ltd  
(Handing Over Authority)

  
\_\_\_\_\_  
(D. K. ASHARA)

Lt Col (Rtd)

Designation : GM, Projects

Date: 29 Sep 2009

Company Seal



Representative of  
Kalyan Bharti Trust  
(Taking Over Authority)

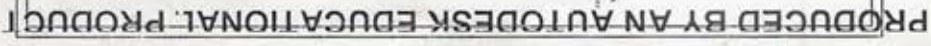
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Designation :

Date: sep 2009

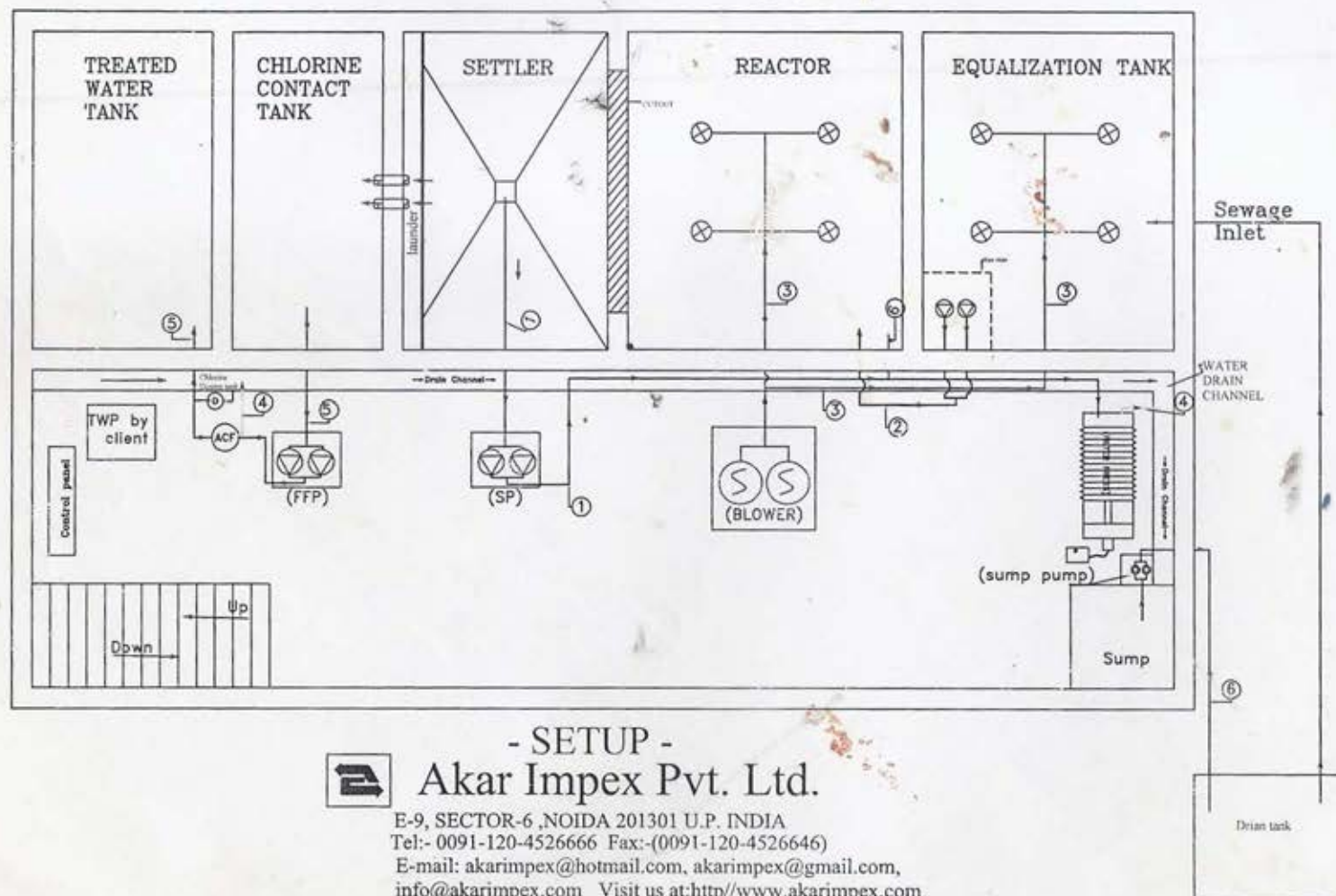
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## Kalyan Bharti Trust

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BLO	Blower
FIP	Filter Press
ACF	Activated Carbon Filter
FFP	Filter Feed Pump
TWP	Treated Water Pump
SLP	Sludge Pump
SWP	Sewage Pump
①	Sludge line
②	Sewage line
③	Air line
④	Back wash line
⑤	Filter Line
⑥	Resarculet Line
⊗	Air diffuser
⊙	Pump
→	Flow direction
⊗	Blower
⊗	Filter Press With Backwash

- SETUP -



**Akar Impex Pvt. Ltd.**

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## **WATER CONSERVATION: FACILITIES AVAILABLE IN THE INSTITUTE**

### **1. Rainwater Harvesting.**

The Institute use appropriate Rain Water Harvesting mechanism to utilize roof top rain waters of 12000 sqft roof area. An underground RCC reservoir of 1 lakh capacity is in place to store rain water for further distribution of various purposes. Available roof top rainwater for storage is 350 kl/annum.

### **2. Borewell/Open recharge.**

A total No of five bore well pumps installed in the campus in following Locations:-

- (a) HIT C Building – 20 CMH
- (b) 17 Bigha Campus – 27 CMH
- (c) 30 Bigha Campus – 20 CMH
- (d) Ankur Building – 20 CMH
- (e) Vivekananda Hostel – 12 CMH

Total quantity of 528 Cubic Meter water per day is being supplied from these bore wells to fulfil the water requirement of the campus. Presently central water treatment plant is running at its optimum capacity (16 Hrs/Day).

### **3. Construction of tanks and bunds**

2 x RCC rooftop tanks in every building for a capacity of 50,000ltr each is in place. Both the tanks are interconnected and are used as fire security & domestic purpose separately. Fire tanks are filled initially and the overflow water is passes to the domestic tank. The overflow lines of all tanks are connected and the water is finally stored to the rainwater harvesting tank.

### **4. Waste water recycling**

2 x heavy duty RO plants of capacity @500ltr/hr at CME building & 600ltr/hr at ICT building are installed with reject water tanks of 5000ltr in each building. Outlet of the reject water is connected with toilet flush water system and the flashed water from the toilets is recycled through 100KLD STP planted inside the campus.

Place: Kolkata

Date: 28 Aug 21

  
**Lt Colonel**  
**Amitava Ghosh Dastidar**  
Campus Administrator  
Heritage Group of Institutions

**Heritage Institute of Technology**

(An Autonomous Institute under MAKAUT, WB)

(An Initiative of Kalyan Bharti Trust)

16/03/2022

13:09:23

**The Heritage School**

Page 1 of 5

994 Madurdaha, Chowbaga Road, Anandapur, P.O.: East Kolkata Township, Kolkata - 700107  
Phone: 033 2443 0454/56/57, Fax: +91 33 2443 0455, eMail: purchase@theheritageschool.org

**SERVICE ORDER****SERVICE ORDER NO.:** SVC/THS/00050/21-22**DATE :** 19/07/2021**Quotation No.:** Nil**Quotation Date :** 09/07/2021Vendor Detail :**Phone:** 9434074153**Fax:** 40011685**Email:** adk\_enterprises@yahoo.com**Website:** www.adwik.co.in**Service Tax No:****Pan No.:****ADWIK SECURITY & HR SOLUTIONS PVT. LTD.**

99/5/8E, Ballygunge Place,  
3rd Floor,

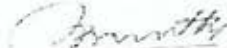
Kolkata 700019

**Kind Attention : Mr. Arabinda Dutta**

Item Name & Description	QTY	UOM	Rate	Amount	Disc %	Disc Amt	Tax %	Tax Amt	Net Amount
<b><u>SERVICE</u></b> AMC for Water supply, Sewage system, Storm Water and Fire Fighting, plumbing, STP - Operations and Maintenance	1.00	Year	1287000.00	1287000.00					1287000.00
								<b>Total</b>	<b>1287000.00</b>
								<b>Grand Total</b>	<b>1287000.00</b>

**In Words-Rupees:** Twelve Lakh Eighty Seven Thousand Only

Prepared By



Approved By Purchase



Approved By CFO/DGM



Approved By Principal/CEO

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### SERVICE ORDER

#### Terms & Conditions

##### 01 PRICE

Price includes all taxes and delivery charges

##### 03 PAYMENT

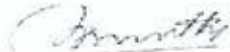
An all inclusive amount of Rs.1,07,250/- (Rupees one lakh seven thousand two hundred fifty only) will be paid by A/c. Payee Cheque/NEFT within 7 days of your submission of bill for the previous month within 3rd of each month. Statutory deductions, if any, will be made at source.

##### VALIDITY

This contract will remain valid for the period from 01.04.2021 to 31.03.2022 and may be terminated with one month's notice if the performance is not found satisfactory. The contract may be extended beyond 12 months subject to mutual consent of both the parties.



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**SERVICE ORDER****YOUR SCOPE****Scope of work:**

A. Operation and maintenance of Sewage system, Storm water drainage, Fire fighting pumps, Plumbing and water supply system of present **Heritage complex** including operation of the entire R. O. Plants & Filtration unit and also cleaning of Septic Tank & STP.

**Regular Operation & Check-up**

1. Routine checkup & preventive maintenance of Sewage system including Sewage System Plant (STP).
2. Controlling and draining of the water by operating the 5 nos. existing Sewage Pumps including Fire Fighting, Sprinkler Pumps & all the Portable Diesel Pumps.
3. Maintenance of daily logbook of pump performance and submission of daily inspection report to the client.
4. Attending any breakdown job – both internal and external within 24 hours.
5. For any repairing/overhauling job labour charge is included in the contract value. Only spare parts and consumables need to be supplied from our end.

**Periodical Maintenance:**

1. Based on performance report from daily logbook, programme for overhauling of water discharging units and complete repairing of the same.
2. De-silting of the Sumps chamber and Sewer line in every fortnight.
3. During overhauling/maintenance of pump 'Adwik Security & H R Solutions Pvt. Ltd.' will provide manpower to dismantle and identification of defective parts. Heritage will provide spare parts and the pump will then be assembled and put to operation inside our campus only.
4. Regular cleaning of all overhead tanks.
5. Maintenance of CWTP, WTP & STP.
6. Water Hardness Test Report to be submitted with our manager maintenance on daily basis.

**B. Regular maintenance of water supply system****Regular Operation and check up:**

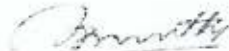
1. Daily check-up of the water supply system with preventive maintenance including maintenance of toilet, water coolers and laboratories.
2. Operation of water pumps to fill up the overhead tanks.
3. Attending any defect to stop cocks/valves of the system and any other fault in connection with water supply and sewerage system.
4. Maintain daily logbook of system performance.

**Periodic Maintenance:**

1. In case of replacement of any valve/pipe, it will be done by programming the time schedule.
2. In case of any jam towards the suction or delivery line, it will be cleared by programming schedule and will not include the replacement of boring pipe and submersible pump.
3. Overhauling of the distribution pumps by programming the schedule.
4. Overhauling job will be carried out inside our campus only as far as possible.



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## The Heritage School

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Phone: 033 2443 0454/56/57, Fax: +91 33 2443 0455, eMail: purchase@theheritageschool.org

### SERVICE ORDER

**C. Fire Fighting:**

Regular running and maintenance of Fire pumps with motors.

**D. Plumbing & Sanitation of all buildings in the premises as mentioned in Annexure 'A' (Sl. no. 6).**

Regular Maintenance of the systems and all the equipments.

**TERMS & CONDITIONS**

**TERMS-1**

**TERMS-2**

**TERMS-3**

**TERMS-4**

**TERMS-5**

**TERMS-6**

**TERMS-7**

**TERMS-8**

**09 LABOUR**

**OTHER TERMS**

At least one person should be present round the clock seven days a week.

You will position one no. 7.5 H. P. Submersible pump and its accessories and maintain it to keep in readiness for operation in the Heritage complex as stand by to both installed pumps for the entire period of this contract.

Your competent technical representative will visit the site at least once a week besides other days as per requirement.

You will submit monthly performance report to us with suggestions, if any.

The offer excludes supply of materials and consumables required for repair and maintenance job.

One weekly off day will be given to every personnel. The day off should be on a fixed day and no violation / exchange of that day will be allowed unless prior written permission is taken from the management.

On any notified holiday at least 3 persons should be present in the campus to control preventive and emergency services. They will be compensated with a leave on a day convenient later.

i) You will provide replacement for any personnel absent for three days or more.

ii) You shall take all effective steps to ensure that proper handling of all tools, gadgets, equipments etc. that may be put at your disposal, such that there is no damage or loss arising out of any negligence or omissions on your part to the properties of 'The Heritage School' that are entrusted to you as a consequence of the present contract, failing which you shall be held liable for the consequences thereof.

iii) Name & contact no. of Plumber staying at night should be made available previous day to our Manager Maintenance.

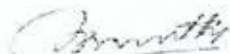
You shall abide by the prevailing labour laws of the land and shall have to obtain appropriate licenses etc. from appropriate authorities at your own cost as well as ensure absolute compliance of all statutory obligations as applicable from time to time, at your own cost & expenses.

Statutory Obligations:

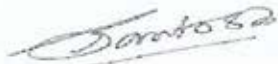
PF, ESI etc. of your deputed workers would be solely taken care of by you and 'The Heritage School' in no way would be responsible for the same.



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## The Heritage School

Page 5 of 5

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Phone: 033 2443 0454/56/57, Fax: +91 33 2443 0455, eMail: purchase@theheritageschool.org

### SERVICE ORDER

#### 06 REMARKS

#### ANNEXURE – 'A'

Frequency of Maintenance, Jobs for Water Supply, Sewage System, Storm Water and Fire fighting Pumps,

Plumbing – Operation & Maintenance Contract.

- 1 Cleaning of overhead tanks/ reservoir:- Monthly
- 2 Submersible Main pump – Routine check-up and preventive maintenance and operational functions check-up:- Monthly
- 3 Deep Tube well – Removal of iron deposits & maintaining water level. Surging is also needed once a year for which Adwik Security & HR Solutions Pvt. Ltd. should make compressor available:- Yearly
- 4 Overhauling of Submersible Pumps & Sewage Pumps:- Yearly
- 5 Overhauling, repairing, cleaning & servicing all other pump machinery – both Diesel & Electrical:- Half Yearly
- 6 Routine check-up of water supply & sewage system at Senior & Junior School buildings, Ankur, Ankuran, Multi- Purpose Hall, Swimming Pool, Security/ Reception, All HIT Hostels, HIT (A, B, C, ICT, CME, SAC Buildings, Central Block, Service Block & Degree College), Staff quarters and also 30 bigha:- Regularly
- 7 Septic Tank – Technical assistance for removing the deposition (Men & materials will be provided by us):- Yearly
- 8 Filtration Plants:- Yearly
- 9 Any other related work of water supply, sewage system etc.:- As & When required
- 10 Fire fighting system:- Weekly
- 11 STP:- Regular Maintenance

Note: Overhauling/Maintenance of Pumps and Motors at all above sites are to be taken care of by you, however, necessary materials for the same will be provided by us.

Bill in duplicate along with a photocopy of order to be submitted to our stores Department Heritage Campus.

#### 04 NOTE

#### 05 LOCATION

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Approved By Purchase

Approved By CFO/DGM

Approved By Principal/CEO

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## SALE INVOICE

**Pre-Authenticate  
For Akar Impex Pvt. Ltd.**

**Akar Impex Pvt. Ltd.**

**Authorized Signatory**

E-9, Sector-6, Noida - 201301

Distt. Gautam Budh Nagar (U.P.)

Ph : (0120) - 2422240, Fax : 0120 - 2422541

Book No. 01

Tax Invoice No. 016 Date 18.03.09

Your Order No. KBT 107-CP 1324

Date 17.02.2008

No. Pkgs. Despatched .....

Through By Road

LR/RR/No. UP 47/9079 Date 12/12/11

TIN No. ....

Delivery.at.....

	Qty.	Rate	Amount Rs.
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Cellular Control Equipment  
(Sewage Treatment Plant)

TOTAL	1619 712.00
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CST/VAT	4788.00
---------	---------

CARTAGE

G. TOTAL	16,845.00.00
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Documents Through ..... S. T Form .....

ad Off. : 205, Shanti Doot Apt. 18, Vasundhara Enclave, Delhi-96

Inds Off (1) R. C. Aggrwal & Co., 3-A, Achrol House Jacob Road, Civil Lines Jaipur

Tin No. : 08481612089

(2) Vipul Green Sector-48, Gurgaon (Haryana)

Tin No. : 06821827081

Cheque/Drafts bedrawn in favour of AKAR IMPEX PVT. LTD. New Delhi or Noida

Our responsibility ceases after material are delivered to despatching authorities

and we are not responsible for any loss damage or non delivery in transit.

Bill not paid within 4 weeks from the date of issue will carry interest @20% p.a.

Subject to Delhi Jurisdiction

E. &amp; O. E.

For AKAR IMPEX PVT. LTD.

**Authorized Signatory**

pared by

Checked by

# Kalyan Bharti Trust

Regd. Off. : 994 Madurdaha, Chowbaga Road, Anandapur  
P.O. East Kolkata Township, Kolkata - 700 107  
Tel. : +91 33 2443-0450-52/54/56/57, 1256-58  
Fax : +91 33 2443-0455/1259, E-mail : kalyanbhartitrust@vsnl.net

KBT/07-08/334

19 March 2008

## AKAR IMPEX PVT. LTD

E-9, Sector-6  
Noida 201 301  
Uttar Pradesh

Attn: Mr Taral Kumar

Dear Sirs,

Subject: Construction of Sewage Treatment Plant (STP)

With reference to your offer Ref. No. x:\gm\trv\offers\080226s RKG.Heritage.ADBR.doc, dated 18 March 2008 and subsequent discussion you had with us, we are pleased to place our firm order on you for the subject work at the Heritage complex, Kolkata on the terms and conditions enumerated below:

### CONTRACT VALUE:

The estimated value of this order has been finalized at **Rs 12,00,000/- (Rupees Twelve lakh) only**. The item wise break up of unit rates are as per "**Annexure -A**" enclosed with this work order.

### TERMS AND CONDITIONS

#### TAXES, DUTIES & TRANSPORTATION:

The rates quoted by you and agreed upon as hereunder are deemed to be inclusive of all transportation, taxes, duties, levies, royalties, labour and tools. The variation in the price shall not be allowed on revision of taxes / duties / levies or any statutory revision.

#### INDEMNITY:

You shall indemnify us fully from all risks and damages due to strikes, riots etc if any, in your organization and by your suppliers and manufacturers and any other cause till you handover the completed work to us.

#### PAYMENT TERMS:

- 20% of the total order value will be paid along with order.
- 50% will be paid on delivery of materials at site.
- 25% will be paid after commissioning & satisfactory operation.
- Balance 5% will be retained for 6 months from the date of completion of work.
- All payments by A/c Payee Cheque only.
- Statutory deductions, as applicable, would be made.



# Kalyan Bharti Trust

Bill, in triplicate, along with photocopy of order should be submitted to the Department, 994 Madurdaha, Chowbaga Rd, Anandapur, PO: 700 107, Kolkata 700 107.

## **OTHER DETAILS:**

- 1). The price includes the total cost of the work.
- 2). The three phase electric connection and power supply will be provided within 15 meters of the construction site.
- 3). All normal facility such as water supply, accessible lockable.
- 4). Force majeure clause- The contract will be governed by the clause.
- 5). All permissions regarding the site/ existing structure and construction will be taken care of by us.
- 6). We will do any alteration, if any, and ground arrangement.
- 7). Fooding & Lodging of your staff will be taken care of. help/coordination will be extended to the extent possible.

## **DATE OF COMPLETION:**

As advised by Project Engineer(s).

## **DELIVERY:**

Delivery for the system shall be effected within 60 days from order or receipt of advance whichever is later.

## **WARRANTY:**

Bill, in triplicate, along with photocopy of order should be submitted to our Purchase Department, 994 Madurdaha, Chowbaga Rd, Anandapur, PO: East Kolkata Township, Kolkata 700 107.

**OTHER DETAILS:**

- 1). The price includes the total cost of the work.
- 2). The three phase electric connection and power supply will be provided free and within 15 meters of the construction site.
- 3). All normal facility such as water supply, accessible lockable storage space.
- 4). Force majeure clause- The contract will be governed by the normal force majeure clause.
- 5). All permissions regarding the site/ existing structure and construction will be taken by us.
- 6). We will do any alteration, if any, and ground arrangement departmentally.
- 7). Fooding & Lodging of your staff will be taken care of by you. Any help/coordination will be extended to the extent possible.

**DATE OF COMPLETION:**

As advised by Project Engineer(s).

**DELIVERY:**

Delivery for the system shall be effected within 60 days from the date of receipt of order or receipt of advance whichever is later.

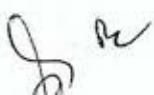
**WARRANTY:**

2 years from date of supply of equipment as per manufacturer's discretion.

**LIQUIDATED DAMAGES:**

You have clearly understood the scope covered in this contract. In the event of your failing to complete the entire work within the stipulated period of completion, the same shall be considered as inadequate performance and the damages shall be recovered from the bill @ 0.5% per week of delay subject to a maximum of 5%.

The day with extraordinary restrictions (wasting whole days work) shall be jointly recorded and given to you as grace day while arriving at liquidated damages.





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**VARIATIONS IN QUANTITIES:**

Effect on the contract price due to variation in quantities shall be calculated on the basis of difference in quantity reckoned at the rates agreed upon, and correspondingly adjusting the contract price.

**DEFECTS LIABILITY PERIOD:**

All the work carried out by you shall be free from defects on the date of handing over to us. In the event of any defects in the workmanship etc. noticed during the above period, it shall be notified to you. You shall attend to such defects within 7 days from the date of notification and rectify all the defects at your cost. If the defects are not attended to in the stipulated time, the same shall be rectified by us from any other agency appointed by us, at your risk and responsibility. The cost thereof, shall be recovered from you.

**SECURITY OF MATERIALS:**

You shall be solely responsible for the physical security of materials at site. Any loss or damage to materials lying at site caused by theft, and riots, weather, accident, fire, rain, flood etc. will be entirely to your account and you shall make it good, the value of such loss to the owner. You, at your own cost will take all necessary steps to ensure protections of material lying at site.

**SITE FACILITIES:**

The electrical supply shall be provided to you at one point. Onward distribution shall be done by you at your own cost. The construction/drinking water shall be made available to you at one point, free of charge. And you shall, at your cost do the further distribution.

**SAFETY MEASURE:**

You shall take all suitable safe precautionary measures, bracing, strutting etc. to ensure that no damage occurs in the existing structure. The rates are deemed to be inclusive of the same.

Any damage to the property during work by your worker will have to be compensated by you.

**QUALITY ASSURANCE & DEFECTIVE WORK:**

You are expected to perform work of high standard and quality. You shall perform quality check as per standard engineering practice and as per document issued to you time to time. Periodic reports shall be generated and or as advised by site engineer.

*Ja*

Complete work is subject to our approval. In case the work carried out by you are found to be of unacceptable quality to the site engineer, you shall dismantle such defective work and carry out quality work to the entire satisfaction of the project manager without affecting the contract price or contract time.

Any deviation from the specifications will attract penalty through deduction from the bills.

It is agreed that the makes for equipment/material suggested shall be accepted after the client's approval on the same.

**DEVIATION:**

Any unauthorized deviation from the assigned job by you will attract penalty through deduction from your bills. Any addition/or changes by the consultant in the assigned job should have our prior approval failing which no extra payment will be allowed at any cost.

**LABOUR:**

All labourers/workers (skilled/unskilled) employed by you or on behalf of you will be treated as your workers and you should pay their wages as per minimum wage act. You will also insure your workers against any accident or mishap. You will be responsible for maintaining relevant records as per statutory requirements.

All workers should be above 18 years of age and any direct/indirect employment of child labourers is strictly prohibited.

Your labourers will work as per the rules and regulations of our organization and will not enter any area other than the authorized area without prior approval.

You shall obtain all policies necessary as per govt. regulations and shall cover third party risk of required amount per accident per person. These policies will be taken in the beginning and kept alive till the virtual completion of the work. You shall solely be responsible for any accident, mishap etc. on site and shall indemnify the client from the same.

You are legally liable for arranging coverage and for depositing P.F. and other statutory liabilities of your employees and workers to the concerned departments and Kalyan Bharti Trust is in no way responsible for the same.

**TOOLS & TACKLES:**

You will register all your tools and any other material etc. at the security. While taking them out of the premises it should always be supported by proper authorized gate pass along with the details of receipt of material. Please note that if any of the labourers is found taking our material/tools without proper documents at any time then he will be prosecuted with a suitable action as per our rules and regulations.



**ARBITRATION:**

In the event of any dispute or differences between the parties arising out of the interpretation, construction or import of this Agreement shall be resolved by reference to the Arbitration of two independent arbitrators, one to be appointed by the each party. The Arbitrators may appoint an Umpire to resolve any difference of opinion that may arise from the award of the Arbitrators so appointed. The award granted by the Arbitrators or Umpire shall be final and conclusive on the issue as between the parties. Arbitration proceedings referred hereto will be deemed to be conducted within the ambit of the Arbitration and Conciliation Act, 1996 with its latest modification or re-enactment thereof as may be in force at the time of reference of disputes to the Arbitrators.

This agreement and transactions contemplated herein shall be subject to the exclusive jurisdiction of the competent courts in Calcutta only.

Please sign on the duplicate copy as a token of acceptance of our order as per the above mentioned terms and conditions. In case of any objection, the same should be intimated to the management within 7 (seven) days of the receipt of the Work Order in writing failing which it will be deemed to have been accepted by you.

Terms and conditions mentioned above are applicable in totality, thereby terms and conditions mentioned in your quotation stand NULL & VOID.

Thanking you,

Yours faithfully,



**Authorized Signatory**



**AIPL HIGH SPEED BIO SYSTEM****SEWERAGE CHARACTERISTICS:**

Type: Domestic Sewerage

**Basic parameters for designing the plant**

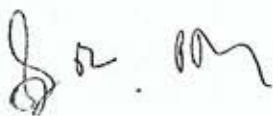
Average Daily flow (cum/day)	50 cum
Average flow (cum/hr.)	4
pH	6.5
BOD (5 days at 20 degree C) (mg/l)	250
COD (mg/l)	400
Suspended solids (mg/l)	150
Oil & Grease (mg/l)	20
Total Sewage / day	50000 liters
Invert level of sewer	2m deep

<b>Treated water Characteristics</b>	
BOD	Less than 20 mg/l
COD	Less than 250 mg/l
Suspended solids	Less than 30 mg/l
Oil & Grease	Less than 10 mg/l
pH	6.5 – 7.5

Invert Level: As per available data and site, it is assumed that the incoming sewage or wastewater shall be available at 2m below the available Nominal ground level.

**BATTERY LIMITS:**

The battery limits for the plant start from inlet flange of sewage suction pump and terminates at the outlet of outlet flange of activated carbon filter and for sludge at filter press.





## GENERAL DESCRIPTION OF THE AKAR DYNAMIC BIOREACTOR

The AIPL ADBR system is based on the biodegradation and sedimentation technology, which is unique due to its compactness and performance in respect of volumetric efficiency. These technologies are combined in a standardized tank system suitable for various capacities. Since the systems are excessively aerated, the smell caused by anaerobic rotting is negligible.

### 1. DIMENSIONAL CRITERIA

All treatment plants shall be based on actual measurements of the waste stream to be treated in respect of hydraulic load suspended and dissolved organic material, and the applicable local effluent requirements.

### 2. CAPACITIES

The ADBR system is manufactured in containerized format in order to suit any particular need. The basic system with 2 chambers, have capacities at a guaranteed effluent of 30 ppm BOD as daily average.

Final treatment by activated carbon filter shall produce required BOD.

### 3. PRE-SEDIMENTATION SYSTEM

It is assumed that the sewage piping system ends in a customer provided pump well tank system, which shall be preceded by a screen chamber, and oil and grease trap. The system shall ensure that grit, floating matter, oils and coarse particles, which shall hinder the operation of the plant equipment, are separated before the process.

The buffer capacity must be sufficient to level out the daily peak flows.

### 4. BIOLOGICAL TREATMENT SYSTEM

The treatment plant will take suction from the pump well by its own feed pump. The pump is level controlled and has a capacity, which is slightly higher than the average daily flow. The plant has therefore an intermittent working mode in terms of hydraulic flow, while the air blower supplying air to the bioreactors is continuous.

The bioreactors degrade the dissolved organic matter by oxidation into carbon dioxide, which escapes to the air, and to biomass that acts as activated sludge. A suspended, free-floating bio-film carrier medium provides a large, protected bio-film surface for the bacteria and simultaneously accumulates the active bio-sludge inside the reactors.

**5. SLUDGE SEPARATION SYSTEM**

The biodegraded water flows to a clarification stage where the suspended solid settles by gravity. The water is directed through a skim well to plate settler system which provides the final clarification of the effluent.

The sludge pump is manually activated with suction from the clarification stage. The pump discharges through a CI sludge filter press with the overflow back to the bioreactor, while the sludge drying underflow is discharged to the pumping sump. When necessary, the sludge is emptied by a truck and hauled away for external disposal.

**EQUIPMENT SPECIFICATION**

The basic system comes with the following standard equipment:

- A reactor tank in RCC consisting of various sections and sides and partitions. The tank shall be suitably designed and constructed in RCC with water proof plaster on inside and outside.
- A free floating plastic bio-film carrier medium in bioreactor.
- A plate separator system of 60 degree inclined PVC plates in the settling tank made in RCC.
- Two twin lobe roots blower (1w+1s) with air header and air distribution system in G.I.
- Two horizontal centrifugal sewage feed pumps and sludge pumps each.
- One chlorine-dosing tank for disinfection with dosing metering pump.
- One Activated carbon filter for filtration of treated sewage with two filter feed pumps for wastewater purification.
- One main electrical panel with start/stop push buttons and running lights.
- One C.I. molded manually operated plate type filter press with filter cloth for sludge solids separation with water.



## 7. TECHNICAL DATA

Equipment	Specification	Unit	ADBR 100
Bio Medium	Proprietary	M <sup>3</sup>	2
Settling Medium	80 x 40 inch plates	Nos.	4
Blower	Nominal Capacity	CFM	30
	Back Pressure	PSI	05
	Motor rating	KW	2.2
	Make	***	Beta
Centrifugal Pump	Nominal Capacity	M <sup>3</sup> /hr	4
	Head	M	8
	Revolutions	RPM	1440
	Motor rating	KW	0.75
	Make	***	Kirloskar
Sludge Pump	Nominal Capacity	M <sup>3</sup> /hr	2
	Head	M	14
	Revolutions	RPM	2880
	Motor rating	KW	0.75
	Make	***	Kirloskar
Filter Feed Pump	Nominal Capacity	M <sup>3</sup> /hr	4
	Head	M	20
	Revolutions	RPM	2880
	Motor rating	KW	1.5
	Make	***	Kirloskar
Sludge Filter Press	Size	M	0.4 x 0.4
	No. of plates	No.	12
	Type	**	C.I
	Make	***	Akar
Activated Carbon Filter	Size	M	0.4
	Height on straight	M	1.4
	Material	of ***	M.S.R.L
	construction		
	Shell thickness	MM	5
	Dished end thickness	MM	6
	Make	***	Akar

**LIST OF ITEMS IN CLIENT'S SCOPE**

**1. CIVIL CONSTRUCTION** (Sizes may change as per actual design).

- One underground oil & grease trap. Approx. size 2m x 1.5m x 1.4m + 2m FBD.
- One underground pumping sump. Approx. size 3m x 3m x 3m + 2.2m FBD.
- One reaction and settler tank (partitioned) of size 4m x 3m x 2.5m + 0.5m fbd. Thus, present capacity plant shall be 1.5m x 4m x 2.5m + 0.5m fbd.
- One treated water sump of capacity 4m x 3m x 4.4m + 0.3m fbd.
- Chlorine contact tank of size 2m x 1m x 2.2m + 2.5m fbd.
- Plant room of size 7m x 3m x 4.7m height with staircase, exhaust fan and access door etc..
- Site grading, leveling, tiling, site access road, peripheral drains etc.
- Plant room for operator, fencing, beautification, dilution water line etc.

**2. OTHER SERVICES**

- Electrification for plant room and plant area lighting with cables.
- Filter press operation and sludge collection etc.
- Dilution water piping provision and connections. This may be 25mm I.D pipe with valve.

**3. ENERGIZATION**

- The client shall provide required LT power connection of 440VAC, 50Hz, 3 phase.

**OTHER INFORMATION:**

- Bringing the sewage to the inlet of the screen chamber, disposal of treated sewage, screenings, grit particles & sludge is out of our scope.
- All statutory clearances shall be out of our scope. Should any clearance be required, we shall help in getting technical matters cleared.



- Supply of chemicals and consumables during erection are out of our scope.
- Any other item not covered in our offer specifically is excluded from our scope of work.
- Cost of analysis of effluent, bringing effluent to system and disposal of sludge, screenings and treated effluent shall be in client's scope.
- The final water quality shall be BOD<20 mg/l.
- The sewage pumps and filter feed pumps shall be designed to provide a discharge of 4.5 cum/hr. minimum and generally a discharge of 5 cum/hr. @ 10m head.
- All pumps and blower shall be provided on 1w+1s basis.
- DMF or MGF shall not be required.
- Screen chamber and Oil and Grease trap shall be made in civil works by us. However, the screen shall be provided by you in M.S.E.P.
- You shall provide a filter press of 14-inch x 14-inch size of 12 plates with manually operated hydraulic system for operation.

## PRICE SCHEDULE

## ADBR 50

Supply of all equipment  
& accessories as per offer

: Rs. 12,00,000/-

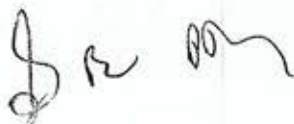
Rs. 12,00,000/-

**(Rupees Twelve lakh for 50 KLD ADBR)**

**Upgradation:** In order to upgrade the system, client shall be required to only add one more blower and 2 cum media of same specification and capacity as specified. No other increase in civil or mechanical equipment is deemed necessary.

## SUPERVISION:

We shall depute our person to check on civil works on regular basis and for operation of plant after erection to help client's operators understand the working of the plant.



# Kalyan Bharti Trust

Regd. Off. : 994 Madurdaha, Chowbaga Road, Anandapur  
P.O. East Kolkata Township, Kolkata - 700 107  
Tel. : +91 33 2443-0450-52/54/56/57, 1256-58  
Fax : +91 33 2443-0455/1259, E-mail : kalyanbhartitrust@vsnl.net

*o/c*

KBT/08-09/267

18 November 2008

## AKAR IMPEX PVT. LTD

E-9, Sector-6  
Noida 201 301  
Uttar Pradesh  
Fax: (120) 2422541

Attn: Mr R. G. Vaidya

Dear Sirs,

Subject: Upgradation & additional work for Sewage Treatment Plant

With reference to your offer Ref. No. rgv\aipl\oc\kbt\080914s, dated 14 September 2008 and subsequent discussion you had with us, we are pleased to place our firm order on you for the subject work at the Heritage complex, Kolkata on the terms and conditions enumerated below:

### CONTRACT VALUE:

The estimated value of this order has been finalized at **Rs 4,84,500/- (Rupees Four lakh eighty-four thousand five hundred) only.**

### TERMS AND CONDITIONS

#### TAXES, DUTIES & TRANSPORTATION:

The rates quoted by you and agreed upon as hereunder are deemed to be inclusive of all transportation, taxes, duties, levies, labour and tools. The variation in the price shall not be allowed on revision of taxes / duties / levies or any statutory revision.

#### INDEMNITY:

You shall indemnify us fully from all risks and damages due to strikes, riots etc if any, in your organization and by your suppliers and manufacturers and any other cause till you handover the completed work to us.

#### PAYMENT TERMS:

- 20% of the total order value will be paid along with order.
- 50% will be paid on delivery of materials at site.
- 25% will be paid after commissioning & satisfactory operation.
- Balance 5% will be retained for 6 months from the date of completion of work.
- All payments by A/c Payee Cheque only.
- Statutory deductions, as applicable, would be made.

*S*



Bill, in triplicate, along with photocopy of order should be submitted to our Purchase Department, 994 Madurdaha, Chowbaga Rd, Anandapur, PO: East Kolkata Township, Kolkata 700 107.

**OTHER DETAILS:**

- 1). The price includes the total cost of the work.
- 2). A three phase electric connection and power supply will be provided free and within 15 meters of the construction site.
- 3). All normal facility such as water supply, accessible lockable storage space.
- 4). Force majeure clause- The contract will be governed by the normal force majeure clause.
- 5). All permissions regarding the site/ existing structure and construction will be taken by us.
- 6). We will do any alteration, if any, and ground arrangement departmentally.
- 7). Fooding & Lodging of your staff will be taken care of by you. Any help/coordination will be extended to the extent possible.

**DATE OF COMPLETION:**

You will provide a detailed work programme for the work.

**DELIVERY:**

Delivery for the system shall be effected within 60 days from the date of receipt of order or receipt of advance whichever is later.

**WARRANTY:**

2 years from date of supply of equipment as per manufacturer's discretion.

**LIQUIDATED DAMAGES:**

You have clearly understood the scope covered in this contract. In the event of your failing to complete the entire work within the stipulated period of completion, the same shall be considered as inadequate performance and the damages shall be recovered from the bill @ 0.5% per week of delay subject to a maximum of 5%.

The day with extraordinary restrictions (wasting whole days work) shall be jointly recorded and given to you as grace day while arriving at liquidated damages.

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**VARIATIONS IN QUANTITIES:**

Effect on the contract price due to variation in quantities shall be calculated on the basis of difference in quantity reckoned at the rates agreed upon, and correspondingly adjusting the contract price.

**DEFECTS LIABILITY PERIOD:**

All the work carried out by you shall be free from defects on the date of handing over to us. In the event of any defects in the workmanship etc. noticed during the above period, it shall be notified to you. You shall attend to such defects within 7 days from the date of notification and rectify all the defects at your cost. If the defects are not attended to in the stipulated time, the same shall be rectified by us from any other agency appointed by us, at your risk and responsibility. The cost thereof, shall be recovered from you.

**SECURITY OF MATERIALS:**

You shall be solely responsible for the physical security of materials at site. Any loss or damage to materials lying at site caused by theft, and riots, weather, accident, fire, rain, flood etc. will be entirely to your account and you shall make it good, the value of such loss to the owner. You, at your own cost will take all necessary steps to ensure protections of material lying at site.

**SITE FACILITIES:**

The electrical supply shall be provided to you at one point. Onward distribution shall be done by you at your own cost. The construction/drinking water shall be made available to you at one point, free of charge. And you shall, at your cost do the further distribution.

**SAFETY MEASURE:**

You shall take all suitable safe precautionary measures, bracing, strutting etc. to ensure that no damage occurs in the existing structure. The rates are deemed to be inclusive of the same.

Any damage to the property during work by your worker will have to be compensated by you.

**QUALITY ASSURANCE & DEFECTIVE WORK:**

You are expected to perform work of high standard and quality. You shall perform quality check as per standard engineering practice and as per document issued to you time to time. Periodic reports shall be generated and or as advised by site engineer.

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Complete work is subject to our approval. In case the work carried out by you are found to be of unacceptable quality to the site engineer, you shall dismantle such defective work and carry out quality work to the entire satisfaction of the project manager without affecting the contract price or contract time.

Any deviation from the specifications will attract penalty through deduction from the bills.

It is agreed that the makes for equipment/material suggested shall be accepted after the client's approval on the same.

**DEVIATION:**

Any unauthorized deviation from the assigned job by you will attract penalty through deduction from your bills. Any addition/or changes by the consultant in the assigned job should have our prior approval failing which no extra payment will be allowed at any cost.

**LABOUR:**

All labourers/workers (skilled/unskilled) employed by you or on behalf of you will be treated as your workers and you should pay their wages as per minimum wage act. You will also insure your workers against any accident or mishap. You will be responsible for maintaining relevant records as per statutory requirements.

All workers should be above 18 years of age and any direct/indirect employment of child labourers is strictly prohibited.

Your labourers will work as per the rules and regulations of our organization and will not enter any area other than the authorized area without prior approval.

You shall obtain all policies necessary as per govt. regulations and shall cover third party risk of required amount per accident per person. These policies will be taken in the beginning and kept alive till the virtual completion of the work. You shall solely be responsible for any accident, mishap etc. on site and shall indemnify the client from the same.

You are legally liable for arranging coverage and for depositing P.F. and other statutory liabilities of your employees and workers to the concerned departments and Kalyan Bharti Trust is in no way responsible for the same.

**TOOLS & TACKLES:**

You will register all your tools and any other material etc. at the security. While taking them out of the premises it should always be supported by proper authorized gate pass along with the details of receipt of material. Please note that if any of the labourers is found taking our material/tools without proper documents at any time then he will be prosecuted with a suitable action as per our rules and regulations.

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**ARBITRATION:**

In the event of any dispute or differences between the parties arising out of the interpretation, construction or import of this Agreement shall be resolved by reference to the Arbitration of two independent arbitrators one to be appointed by the each party. The Arbitrators may appoint an Umpire to resolve any difference of opinion that may arise from the award of the Arbitrators so appointed. The award granted by the Arbitrators or Umpire shall be final and conclusive on the issue as between the parties. Arbitration proceedings referred hereto will be deemed to be conducted within the ambit of the Arbitration and Conciliation Act, 1996 with its latest modification or re-enactment thereof as may be in force at the time of reference of disputes to the Arbitrators.

This agreement and transactions contemplated herein shall be subject to the exclusive jurisdiction of the competent courts in Calcutta only.

Please sign on the duplicate copy as a token of acceptance of our order as per the above-mentioned terms and conditions. In case of any objection, the same should be intimated to the management within 7 (seven) days of the receipt of the Work Order in writing failing which it will be deemed to have been accepted by you.

Terms and conditions mentioned above are applicable in totality, the by terms and conditions mentioned in your quotation stand NULL & VOID.

Thanking you,


Yours faithfully,

*[Handwritten Signature]*

*[Handwritten Signature]*

**Authorized Signatory**



Sl. No.	Items to be supplied and installed	Amount Rs
1	<i>Submersible Sewage pump</i> Nominal Capacity M3/hr 6  Head M 8 Revolutions RPM 1440 Motor rating KW 0.75 Make *** KSB Qty. 2 Nos.	65,000
2	<i>Blower</i> Nominal Capacity CFM 30 Back Pressure PSI 05 Motor rating KW 5.0 Make *** Beta Qty. 2 Nos.	42,000
3	<i>Settling Medium</i> 1 metre x 4 metres Plate Nos. 6	22,000
4	<i>Bio Media Proprietary</i> M3 5	83,000
5	<i>Sludge Pump</i> Screw Pump Nominal Capacity M3/hr 2 Head M 22 Revolutions RPM 345 Motor rating KW 1.5 Make *** Rotomac / Roto Qty. 2 Nos.	53,000
6	<i>Filter Feed Pump</i> Centrifugal Nominal Capacity M3/hr 5 Head M 24 Revolutions RPM 2880 Motor rating KW 2.2 Make *** Kirloskar Qty. 2 Nos.	20,000
7	<i>Sludge Filter Press with hopper tray</i> Size 14" x 14" No. of plates No. 14 Type ** C.I Make *** Akar Qty. 1 No.	30,000
8	<i>Activated Carbon Filter</i> Size Dia. M 0.4 Height on straight M 1.4 MOC. FRP VESSEL Make *** Akar Qty. 1 No.	18,000

Sl. No.	Items to be supplied	Amount (Rs)
9	Chlorination metering pump 3 LPH at 3 bar pressure 1 No.	-
10	Electric Control Panel Non-compartmentalized of suitable size and capacity.	15,000
11	Piping and valves Inter connecting piping and valves within the STP.	25,000
12	Acoustic Enclosure To reduce the noise pollution and to provide silence working of blowers.	1,05,000
13	Chlorine and relay tanks Of suitable size.	10,000
14	Air Grid and Diffusers Dia. 50 mm / 25 mm Dia. Qty: 8 Nos.	22,000
		5,10,000
	Discount @ 5%	25,500
	<b>Rupees Four lakh eighty-four thousand five hundred only</b>	<b>4,84,500</b>

CC - CEO

Wf/s ✓

Storer