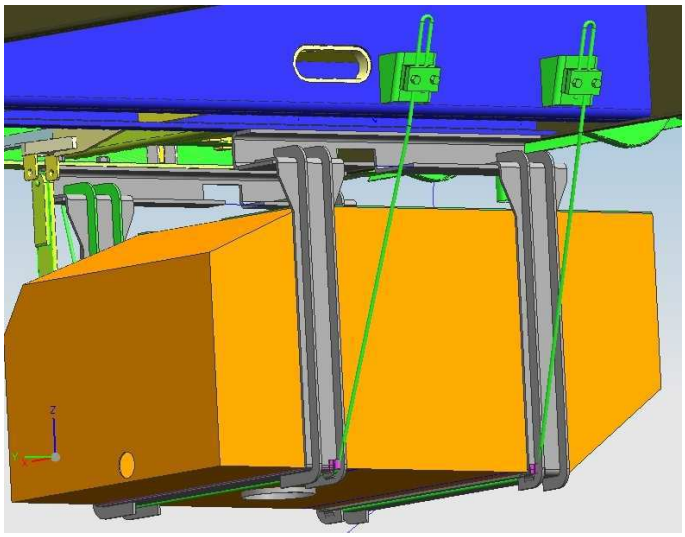
सत्यमेव जयते

**(Govt. of India)**
**(Ministry of Railways)**

# Handbook
# on
# IR-DRDO BIO-TOILETS
# For
# OPEN LINE STAFF



**(For official use only)**

**IRCAMTECH/2014/M/GWL/Bio-Toilets**
**August 2014**

अआमागंRDS
रेल अग्रदूत Transforming Railways

An ISO 9001-2008 Certified Organisation
उच्च अनुरक्षण प्रौद्योगिकी केन्द्र
EXCELLENCE IN MAINTENANCE

**Indian Railways**
**Centre for Advanced Maintenance Technology**

**MAHARAJPUR, GWALIOR--474005**

# INDEX

# Environment Friendly Toilet Systems

## Green toilet aims at - Zero-Defecation on the ground

Discharge on track, besides creating environmental issues creates problem in working to workmen. A multi directional strategy has been implemented for adoption of Environment friendly toilets on IR passenger coaches. A MOU has been signed with DRDO for joint technology development. The first prototype rake with bio-toilets based on the designs developed jointly with DRDO is running successfully in Bundelkhand express since 18th January 2011. Indian Railways have decided 05 more rakes to be fitted with DRDE technology Bio-toilets from the production of 2011-12 and 2500 more coaches from the production of 2012-13.

## Benefits of green toilet

- Environment friendly
- Preventing damages to tracks due to corrosion
- Improved aesthetics at Railway Stations

## Types of Environment friendly toilets are:

- **Bio toilets**- The Bio toilet system, discharge processed waste on track

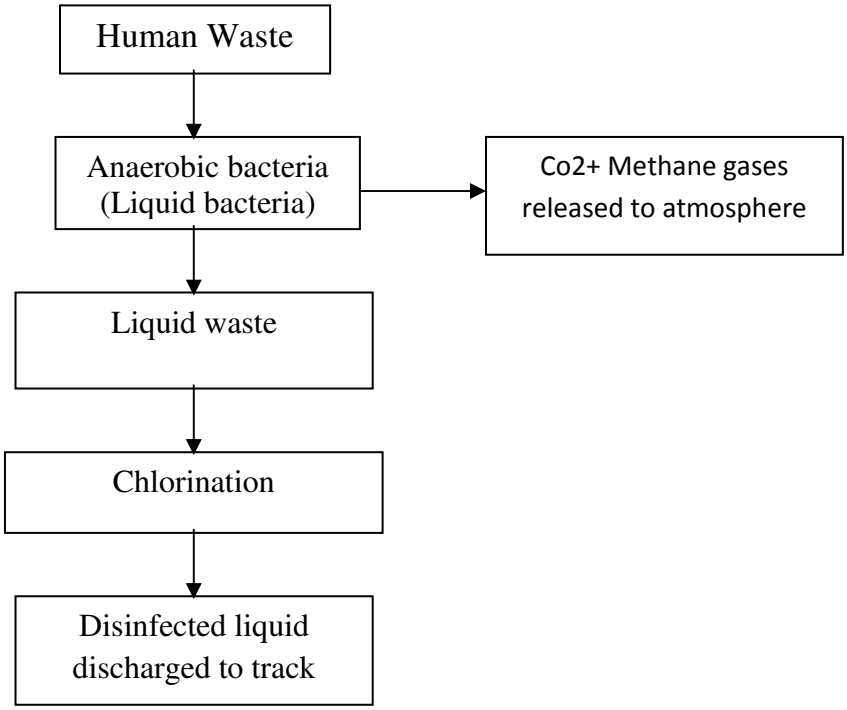
- **Vacuum toilets** :
  Based on the principle of direct transport from the toilet bowl to the tank aided by vacuum creation in the tank and pipeline.

- **Zero discharge toilet systems**:
  In Zero Discharge toilet system, waste is collected at terminus and then processed. Solid and liquid separation is done in the tank itself and liquid is recycled as flush water.

## Advantage of Anaerobic bio-toilet with MOU with DRDE and IR:

- Require less maintenance
- Simple in design
- Easier Retro fitment on existing coaches in service
- Can be in operation upto years together

## Working of Biological toilet System (Anaerobic)




***Note: System does not require oxygen and also does not require regular cleaning***

## Brief about bacteria –aerobic/anaerobic

### Aerobic Bacteria

- Growth rate of aerobic bacteria is higher
- Requires forced aeration and large surface area
- Large amount of bio-mass is generated
- Disposal of bio-mass is again an environmental problem

### Anaerobic bacteria

- Can process doubling its population within 6 to 8 hrs
- Dominates and de-compose matter into liquid and gases.
- Can be kept for 3-4 months at ambient temperature in bio-digester tank
- Can withstand sub zero temperature as well as upto 60 degree centigrade
- Cold temperature would not affect the inside processing because Anaerobic process is exothermic in nature & thus in cold regions, heat will be available inside the chamber because of chemical process.

## Advantage of IR-DRDO Bio-Digester

1. No bad smell in toilets from the tanks
2. No infestation of Cockroaches & flies
3. Fecal matter in the tank not visible
4. No clogging of digester
5. Effluent is free from off odour and solid waste
6. No maintenance required
7. Reduction in organic matter by 90%
8. No requirement of adding bacteria/ enzyme
9. No need of removal of solid waste

# IR-DRDO Bio-digester Tank for Coaches

**These tanks are made of stainless steel and having following constructional features**

The size of the tank is 540 X 1150 X 720 MM with the provision of 04 nos mounting brackets at both the sides along the length of the tank. Each bracket is with the provision of 02 nos. M16 Size bolts which are tighten in the under slung on mounting brackets.

**Main parts of the Bio digester tank:**

1. Stainless steel tank with 06 partition walls in side the tank
2. Poly grass mats for protection of bacteria in side the walls.
3. Ball valve with handle for operation during emergency for making toilet direct discharge in case of choking.
4. SS fasteners in place of MS on tank covers.
5. Stronger bonding of Colonized rubber mat with vertical walls.

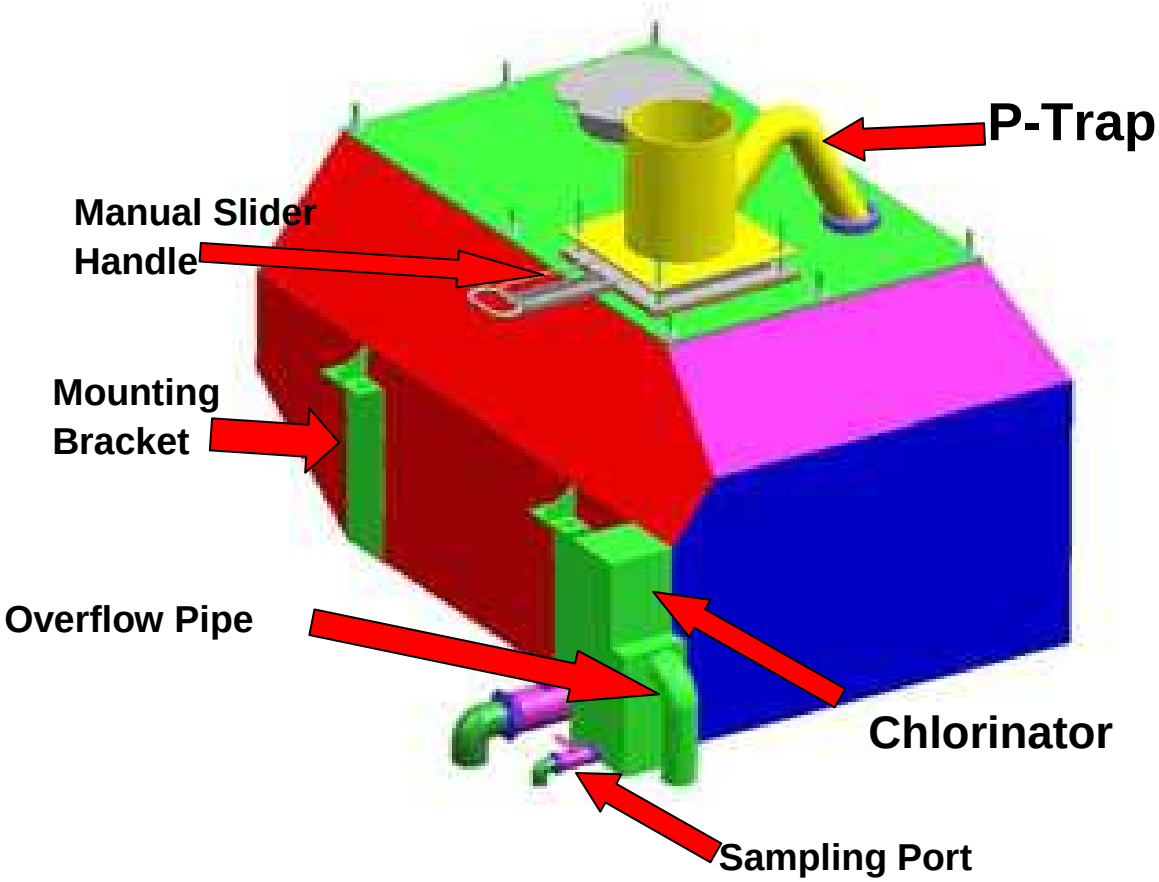

**Important Dimensions & Volume of Bio-digester Tank:**

1. Length - 1150 mm 2-Width - 720 mm, 3. Height – 540 mm
4. Total Volume of Tank – 400 lt. 5. Effective Volume of Tank – 300 it.
6. Empty Tank weight – 110 Kg. 7. Full Tank Weight – 410 Kg.
8. Height from Rail level -225 mm

## Other components of Bio-Digester Tank

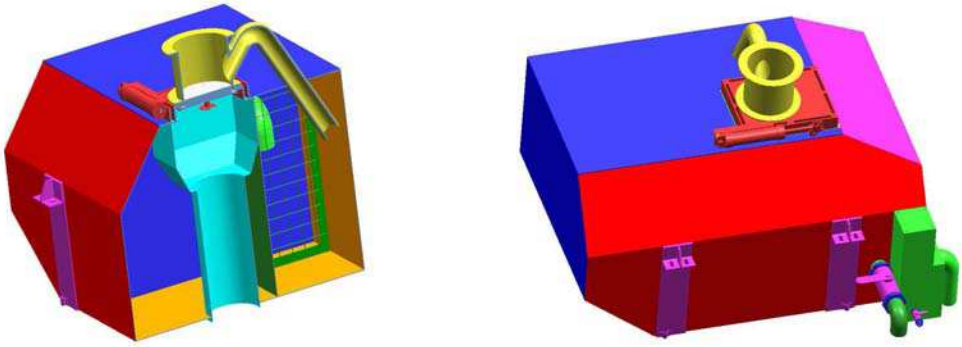
| | | | |
|---|---|---|---|
| 1. | Mounting Bracket | - | 04 Nos |
| 2. | Safety Rope | - | 04 Nos |
| 3. | Locking Plate | - | 08 Nos |
| 4. | Hex. Head Bolt (M16 X70) | - | 16 Nos |
| 5. | Hex. Nut (M16) | - | 16 Nos |
| 6. | Spring Washer (B16) | - | 16 Nos |
| 7. | Hex. Head Bolt (M8 X35) | - | 16 Nos |
| 8. | 'U' Bracket(8 X20 X38) | - | 08 Nos |

## Sketch of Bio-Digester Tank



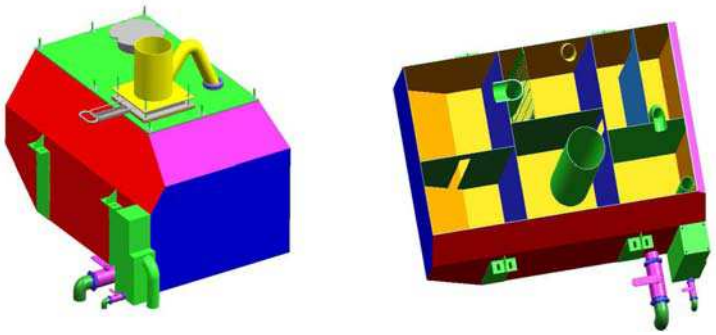
# Different variants of Bio toilets:

| Brief description | Features | | | |
|---|---|---|---|---|
| | **Pneumatics** | **Electrics** | **PLC** | **Flush** |
| System with flapper valve | Yes | Yes | Yes | Pressurized |
| System with manual slider valve | no | no | no | gravity |
| System with reduced opening at inlet<br>For western style Hindware commode is proposed | no | no | no | gravity |
| System with solid liquid separator | no | no | no | gravity |



**Variant-I**

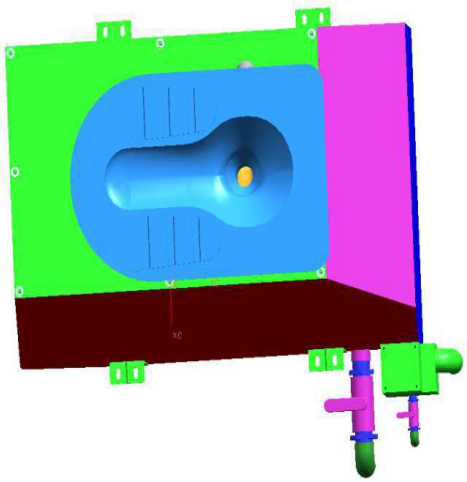
Fail safe mode exist- chute system can be operated without dismantling of tank

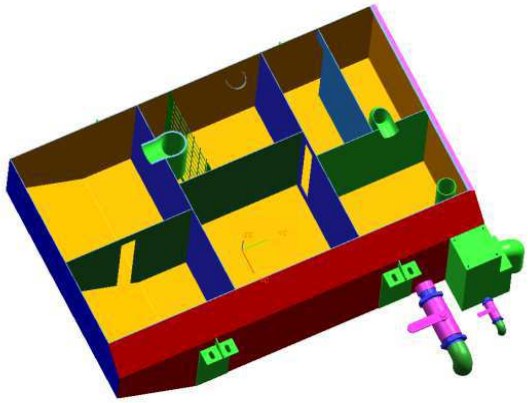


**Variant-2**

Fail safe mode exist- chute system can be operated without dismantling of tank

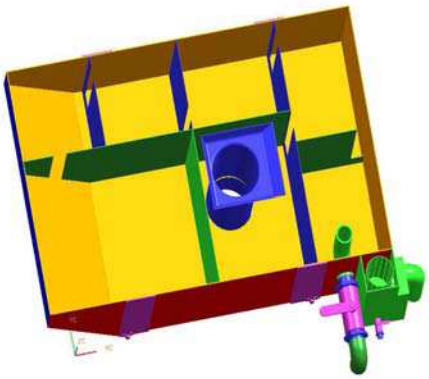
**PLC = Programmable Logic Controller**

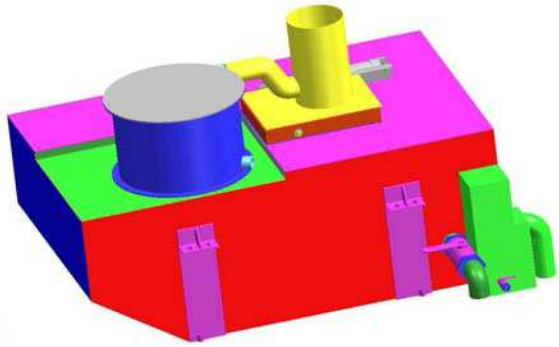




**Variant-3**

Fail safe mode does not exist

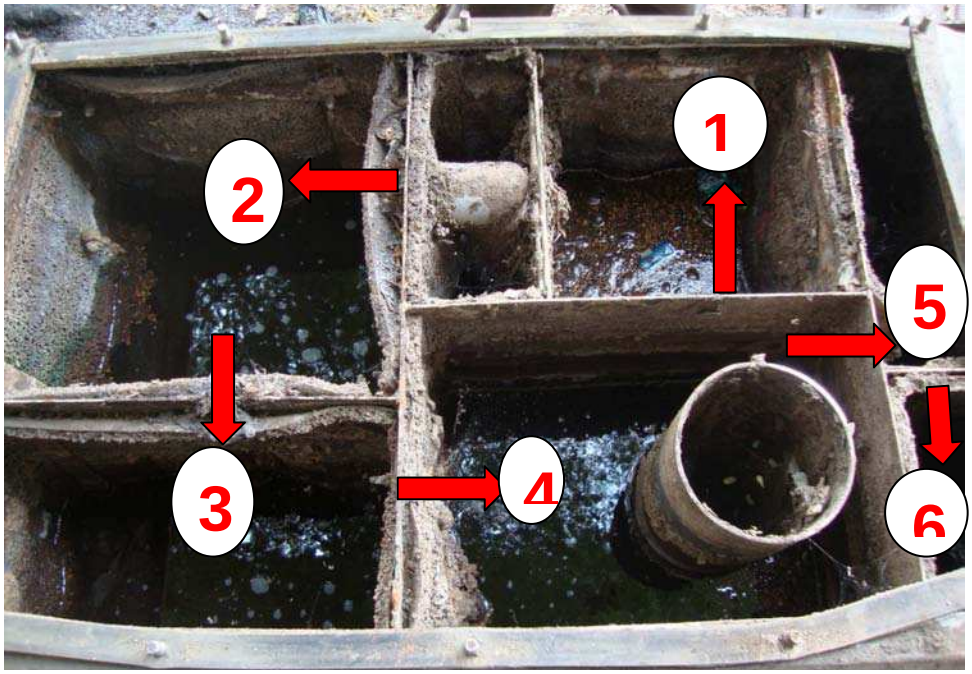




**Variant-4**

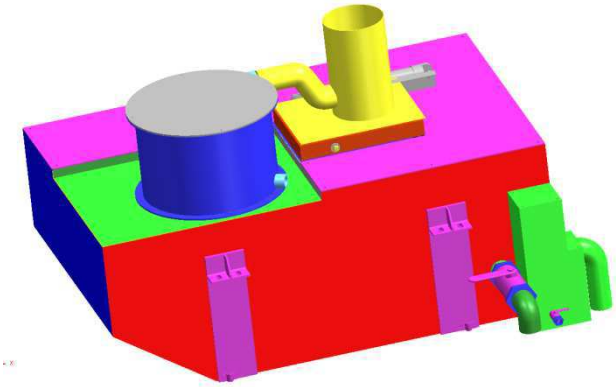
Fail safe mode exist- chute system can be operated without dismantling of tank

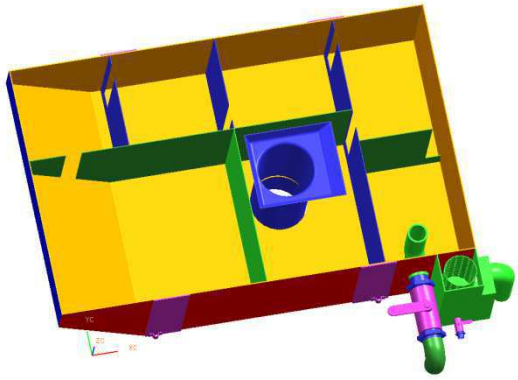
## Waste Flow Path

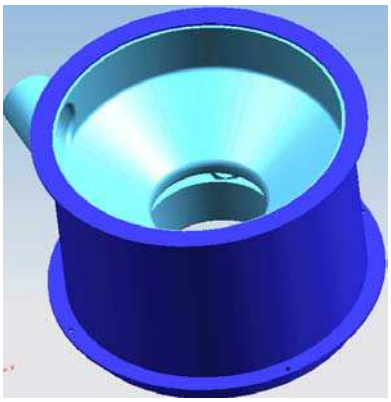


## Brief about variant 4 with PLC fitted at ICF

| Brief description | Features | | | |
|---|---|---|---|---|
| | **Pneumatics** | **Electrics** | **PLC** | **Flush** |
| System with Solid liquid separator **with the provision of Ball valve.** | Yes | Yes | Yes | Pressurized |





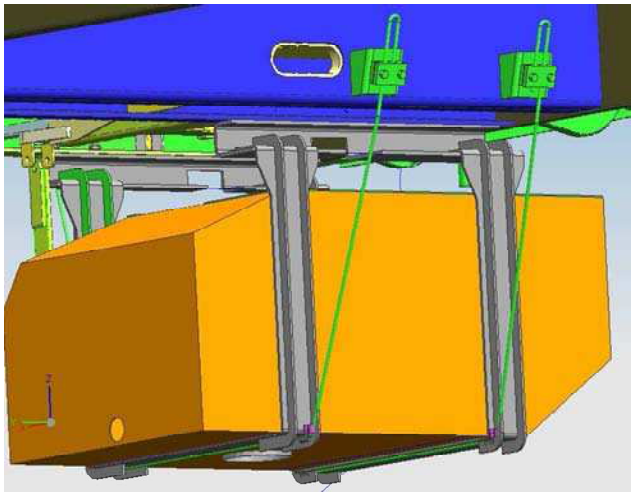


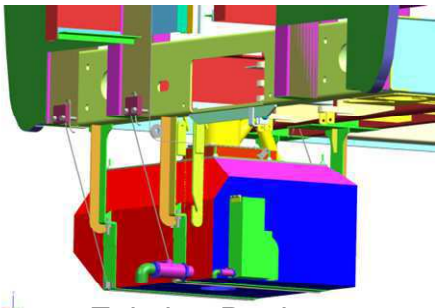
# Alternate Design of bio-digester tank

**For strengthening of the Bio digester tank, an alternate design has been developed by RCF and approved by RDSO in the month of May -2013.**

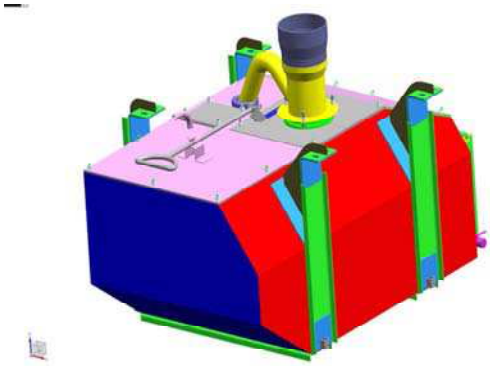
- **Alternate design finalised by RCF & RDSO for fitment-Positive mounting with bolted fastening**

**The constructional features of the new design are shown as under:-**





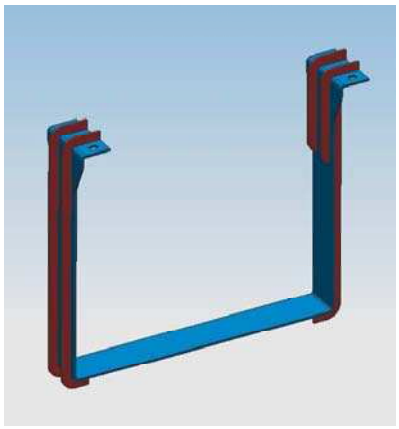
Existing Design

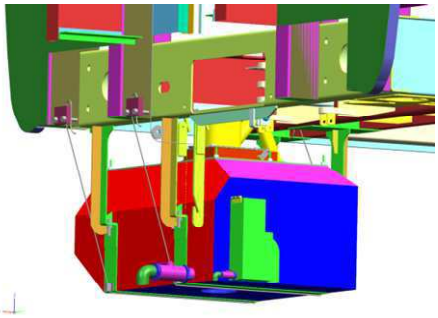


Alternate Design

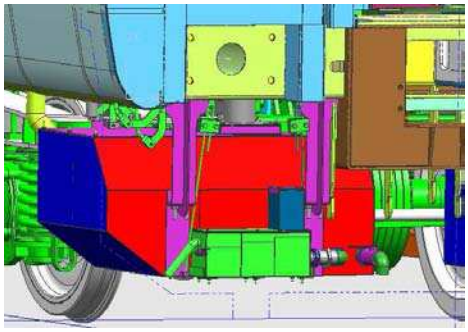
# Alternate Design of bio-digester tank

- **Problem/Issues of old design Bio digesters have been eliminated**
- **In old design tank, too much welding in mounting brackets with tank.**
- **Possible infringement of hangers with bigger chlorinator, re-location of chlorinator.**



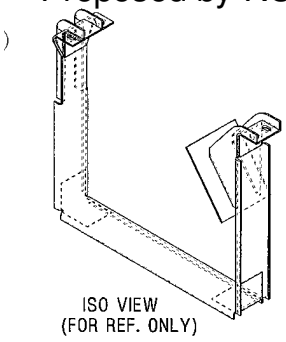


Smaller chlorinator-discharge at the center of track



Bigger chlorinator-discharge on side of track

Proposed by RCF

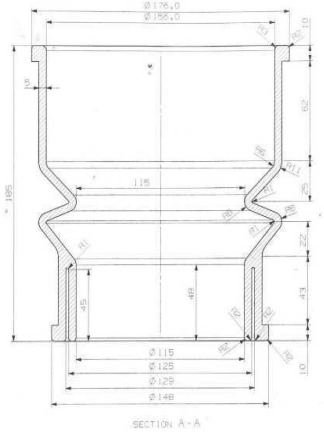


# Alternate Design of bio-digester tank

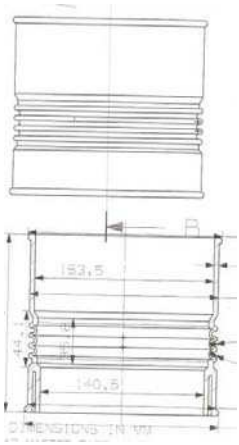
## ❑ Issues of old design digester:

**Following issues were raised by field staff in old design tanks:**

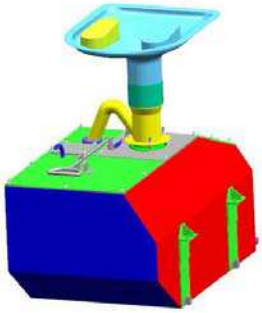
- **Shape of connector – difficult to manufacture and prone to damage while cleaning.**
- **Material proposed as TPE instead of EPDM.**
- **Differential dia connector 150/125 mm:** In old design connector, the dia was same at both the ends, now the dia on top is 150 mm and 125 mm in bottom.



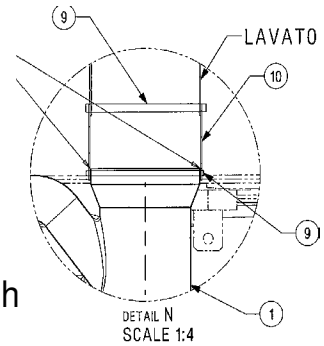
Differential dia connector 150/125



Same on both side with bellow formation



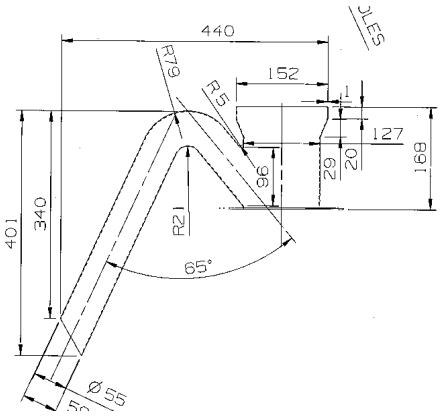
Diameter of pan and P-trap pipe same

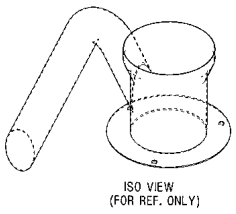


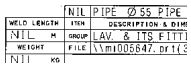
# Bio toilets with Ball Valve

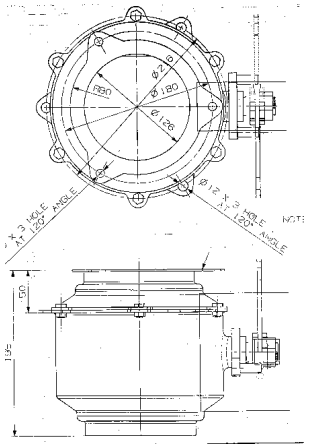
# Design of ball valve & operating mechanism

- Material of ball valve
  - Stainless steel body and ball (AISI 304)
  - Procured as per RDSO drawing
  - Flange width of 30 mm



# Design of ball valve & operating mechanism

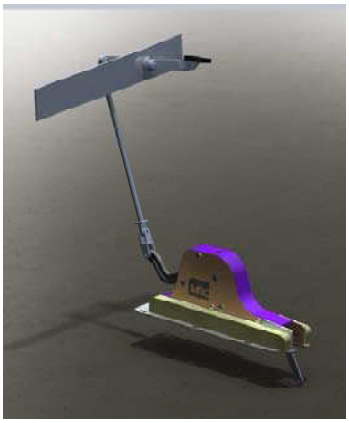
- **Initial tanks with outside opening mechanism**
- **Mechanism re-designed to operate from inside with the help of foot paddle.**
- **Existing manufactures -**

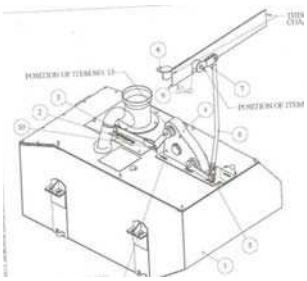
❑ **M/s MRC**

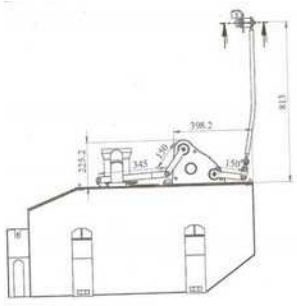
❑ **M/s JSL**

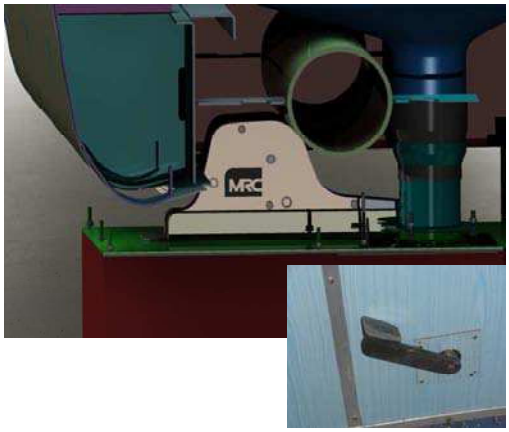
❑ **M/s Rail Fab**

- **M/s Rail Fab design has been approved by RDSO and RCF**









# Proliferation issue/Suggestions

**RDSO deared 4 bio toilets in AACN & SCN and 2 Bio-toilets for GS, diagonally apposite**

- **GS coaches suitable with 04 Bio-toilets**
  - **Coach with suitable suspension (VPH) turned out**
  - **Oscillation trial has been conducted - RDSO / NR**
  - **Different design of lower spring plank, bogie bolsters and nested secondary springs (for VPH suspension) would be required. As such, implementation would take about 06 months to start.**
- **Standardisation of dust bin has been done in toilet**

# Bio-Digestar Tank Mounting





# Performance Parameters of Bio Toilets:

| SN | Parameter (as per APHA Test Method). | Recommended Values for next six months | Targeted value (Max.) |
|---|---|---|---|
| 1 | pH | 6 to 9 | 6 to 9 |
| 2 | Total Solids | Max 750 mg/100 ml | 750 mg/100 ml |
| 3 | Total Volatile solids | Max 500 mg/100 ml | 500 mg/100 ml |
| 4 | Total Dissolved solids | Max 350 mg/100 ml | 350 mg/100 ml |
| 5 | COD levels | Max 2000 MgO2/Lts | Max 2000 MgO2/Lts |
| 6 | Fecal Coli Forms count | 99% Reduction (Less than $10^8$/100 ml) | |

# Performance Parameters Inoculum:

| SN. | Parameter (as per APHA Test Method). | Recommended Values |
|---|---|---|
| 1. | pH | **6-9** |
| 2. | Percentage methane | **40%** |
| 3. | MPN for methanogens | **>$10^3$** |

## INSTRUCTIONS FOR PRESSURISED CLEANING OF BIOTOILETS IN THE OPEN LINE:

The preventive maintenance schedule for maintenance of coaches being followed in IR and time schedule to be followed for maintenance of the IR-DRDO Bio-toilet system are issued by RDSO under guidelines for AMOC for Bio-toilets (DRDE type).

***Maintenance of the Bio-toilet systems and Guidelines for handling of Bacteria***

- Visual inspection of complete toilets system including under slung equipments.
- Toilet chute to be cleared in bio-toilets if there is choking.
- Checking the toilets system for any deficiency.
- Collection and transportation of sample from retention tanks to DRDE, Gwalior or any other nominated Govt. accredited lab as per the test scheme.
- Charging of chlorine tables and examination of chlorinator.
- Checking of following equipments/repair/replacement for proper functioning:
  - **i.** Flapper/slider/ball valve
  - **ii.** Leakage in piping, flush system, pneumatics, tank etc. valves, pressurise, PLC, pneumatic valves, ball valves etc.
  - **iii.** Charging of Bio-culture if required (based on test reports).Culture will be supplied by DRDE/IR

**(Issued by the RDSO document no. RDSO/2010/CG/CMI-03(Rev.1)**

## Guidelines for coaching depots for handling of Bacteria

1. Wear gloves while handling bacterial culture
2. Store bacterial culture in containers with lid which can be closed
3. During transportation lids should be tightly closed.
4. During storage, lids should be kept loose so that the gas generated inside the container can escape easily otherwise container will get damaged physically.
5. Do not mix detergents/acids with bacteria at any stage during use.
6. Toilets fitted with bio digesters/ bio toilets should preferably be cleaned by pressurized water cleaning system so as to minimize the water usage.
7. Clean / sanitize hands with detergents/ soaps after handling of the bacteria.

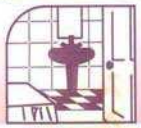
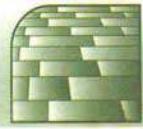
## List of cleaning agents being used in mechanized coach cleaning in Bio toilet system

Following cleaning agents are being used for cleaning of bio-toilets in NCR. These agents are considered to be suitable for IR-DRDO bio toilets.

| Sr.No | Locations | Name of chemicals used |
|---|---|---|
| **1** | PVC Floor Cleaning | Spiral (Johnson Diversey) or Sigla Neutral of Eco Lab |
| **2** | Ceramic Toilet fittings cleaning | Taski R1/Taski R 6 (Johnson Diversey) or Sigla Neutral of Eco Lab |
| **3** | Cleaning agent for commode pan & wall protector | Harpic/Retoil/Domex |
| **4** | Glass Cleaning | Taski R3 (Johnson Diversey) or OC Glass cleaner of Eco Lab or Collin |
| **5** | Laminated Plastic Sheet & Berth Rexene cleaner: | Taski R7 (Johnson Diversey) or OC Neutral cleaner of Eco Lab or Collin |
| **6** | Painted Surface | Spiral (Johnson Diversey) or Absorbit of Eco Lab or Collin |
| **7** | Stainless Steel Polisher | Suma Inox (Johnson Diversey) or Chromol of Eco Lab or Collin |
| **8** | Disinfectant | Brands Stride (Johnson Diversey) or Antiback of EcoLab or Collin or Lizol |

**Note :** Revised specification/alteration brands can be issued by Railways for achieving better performance.

**(Ref: DRM (M)'S/JHS Letter No. JHS/ M/ CW/ 130/OBHS dated 26.08.2010 to ED/ CAMTECH)**

| PRODUCT | PRODUCT DESCRIPTION | ICON | RECOMMENDED USAGE | KEY AREAS |
|---|---|---|---|---|
| TASKI R1 Super | Bathroom Cleaner-Cum-Sanitiser Concentrate |  | Normal soiling: 10 ml. in 1 litre of water.<br>Heavy soiling / Disinfection : 30 ml. in 1 litre of water. | All surfaces in the bathroom, viz. sink, tub, tiles, floor and fittings.<br>Safe for use on marble and granite. |
| TASKI R2 | Hygienic Hard Surface Cleaner Concentrate |  | Hard surface : 20 - 50 ml. in 1 litre of water.<br>Glass : 10 - 20 ml. in 1 litre of water. | All hard surfaces (e.g. TV cabinets, photo frames, telephones, etc.) including glass, mirrors and also on shiny floor surfaces like polished marble, granite, etc. |
| TASKI R3 | Glass Cleaner Concentrate |  | 20 - 50 ml. in 1 litre of water. | All types of glass, windows, mirrors and glass display cases. |
| TASKI R4 Shine-Up | Furniture Maintainer |  | Ready-to-use product. | All wooden surfaces such as tables, chairs and bedside tables.<br>Can also be used to maintain polished metal surfaces like nameplates, brass handles, etc. |
| TASKI R5 | Air Freshener |  | Ready-to-use product. | Deodorises guestrooms, banquet halls and office rooms and rooms where tobacco or other odours are very strong. |
| TASKI R6 | Toilet Bowl Cleaner |  | Ready-to-use product. | Removes lime-scale deposits and stubborn stains and leaves toilet bowls and urinals sparkling clean. |
| TASKI R7 | Floor Cleaner Concentrate |  | Normal soiling: 20ml. in 1 litre of water.<br>Heavy soiling : 50ml. in 1 litre of water. | Used for both wet mopping as well as scrubbing with a machine on all kind of floors. |
| TASKI R9 | Bathroom Cleaner Concentrate (Specific to hard water locations) |  | Normal soiling: 50-100 ml. in 1 litre of water. | All fittings and walls in the bathroom viz. sink, tub, tiles and fittings. Regular usage prevents scale deposition on walls and fittings. Exercise caution while cleaning acid-sensitive surfaces. |
| TASKI Spiral | Floor Cleaner Concentrate |  | Normal soiling: 20ml. in 1 litre of water.<br>Heavy soiling : 50ml. in 1 litre of water. | Used for both wet mopping as well as scrubbing with a machine on all kind of floors. |

## Evaluation of Cleaning Agents provided by Railway

| S No | Treatments | Cumulative Biogas (ml) | pH | % COD Reduction |
|---|---|---|---|---|
| | | | 42 days | 42 days |
| **1** | **control** | **16790** | **7.61** | **94.72** |
| 2 | Harpic 100 ppm | 15820 (94%) | 7.54 | 84.08 |
| 3 | Harpic 250 ppm | 14750 | 6.50 | 76.28 |
| 4 | Domex 100ppm | 14660 | 7.23 | 93.55 |
| 5 | Domex 250 ppm | 13620 | 6.33 | 74.78 |
| 6 | Lizol 100 ppm | 14340 | 7.28 | 85.58 |
| 7 | Lizol 250ppm | 14250 | 6.27 | 58.38 |
| 8 | R7 cleaner 100ppm | 16030 | 7.20 | 77.77 |
| 9 | R7 cleaner 250ppm | 14210 | 6.26 | 45.29 |
| 10 | PVC floor cleaner 100ppm | 14320 | 7.31 | 82.32 |
| 11 | PVC floor cleaner 250ppm | 14070 (83%) | 6.46 | 62.32 |
| 12 | Toilet cleaner 100ppm | 15450 | 7.50 | 77.92 |
| 13 | Toilet cleaner 250ppm | 14550 | 6.51 | 69.71 |

**Conclusion**: All the six chemicals do not show any deleterious effect on biodegradation up to 100 ppm during 42 day study period (30 ml/Toilet)

# TESTING SCHEME FOR

# BIO TOILET EFFLUENT FOR OPEN LINE (COACHING DEPOT)

# Testing Scheme for Bio-Toilet Effluent in Coaching Depots.

Following tests and parameters have been recommended for effluent discharged after bio degradation from the bio toilets of coaches in Indian Railways.

## 1. pH Value Test:

To measure pH value of the effluent of bio toilets to ensure environmental safety.

| S. No. | Description | Details |
|---|---|---|
| 1. | Purpose of test | To measure pH value of the effluent **of bio toilets to ensure environmental safety.** |
| 2. | Target value | 6 – 9 pH |
| 3. | Equipments required | Table top pH meter / Portable pH meter / pH indicator strips & magnetic stirrer |
| 4. | Consumables | pH calibration buffers (4.0, 7.0, 10.0), and magnetic stirrer bars |
| 5. | Quantity of sample | 50-100 ml |
| 6. | Electricity requirement | Yes |
| 7. | Frequency of sampling | **90 days** |
| 8. | Testing spot | Railway laboratory |
| 9. | Staff required | 1 |

## Procedure:

- First of all, take 02 ltrs. Effluent sample in the bottle from bio-toilet tank.
- Take 50 – 100 ml of mixed effluent sample in a beaker.
- Put a magnetic bar and keep the beaker on a magnetic stirrer and switch “on” the magnetic stirrer to mix it continuously.
- Wash the electrode and temperature compensation rod with distilled water and wipe it with tissue paper.
- Put the electrode and automatic temperature compensation rod into the sample and keep it until stable reading appears in the displays; note the reading.
- Discard the sample and wash the electrode and automatic temperature compensation rod with distilled water and wipe it with tissue paper.
- Keep the electrode back in the container.

**Precaution: Do calibration with appropriate buffers before taking readings.**

## pH Value Test (Simplified Procedure):

To measure pH value of the effluent of bio toilets to ensure environmental safety.

| S. No. | Description | Details |
|---|---|---|
| 01 | Purpose of test | To measure pH value of the effluent **of bio toilets to ensure environmental safety.** |
| 02 | Target value | 6 – 9 pH |
| 03 | Equipments required | Portable pH meter |
| 04 | Other equipments | pH indicator paper of all ranges |
| 05 | Consumables | pH calibration buffers (4.0, 7.0, 10.0) |
| 06 | Quantity of sample | 50-100 ml |
| 07 | Electricity requirement | Yes |
| 08 | Frequency of sampling | **90 days** |
| 09 | Testing spot | Railway laboratory |
| 10 | Staff required | 01 |

### Procedure:

- First of all, take 02 ltrs. Effluent sample in the bottle from bio-toilet tank.
- Take 50 – 100 ml of mixed effluent sample in a beaker.
- Put pH meter on the stand.
- Mix the liquid properly.
- Put the electrode of portable pH meter in the beaker until stable reading appears in the displays;
- Note the reading from display of Ph meter.
- Discard the sample and wash the electrode of pH meter with distilled water and wipe it with tissue paper.
- Keep the electrode back in the container.

**Precaution: Do calibration with appropriate buffers before taking readings.**

## 2. Total Solids (TS) Test:

This test should be carried out to estimate amount of total solids available in the effluent.

| S. N | Description | Details |
|---|---|---|
| 1. | Purpose of test | To estimate amount of total solids in the effluent. |
| 2. | Set Target | <750 mg /100 ml |
| 3. | Equipments required | Electronic weighing balance, pipettes, Silica crucible, Hot air oven, desiccators. |
| 4. | Consumables | Self indicating silica gel. |
| 5. | Quantity of sample | 25 ml |
| 6. | Electricity requirement | Yes |
| 7. | Frequency of sampling | **90 days** |
| 8. | Testing spot | Railway laboratory |
| 9. | Staff required | 1 |

**Procedure:**

- Heat an empty crucible and clean silica at 103 – 105°C for 1 hour in a hot air oven.
- Cool in desiccators to room temperature and take the initial weight.
- Pipette a measured volume of well mixed sample (25 ml).
- Keep the silica crucible in a hot air oven at 103 – 105°C for 1 hour; keep till the water gets dried or constant weight is achieved.
- Remove the silica crucible and keep it in desiccators until it reaches room temperature.

Note the final weight

**Calculations:**

mg total solids/ 100 ml = (A –B) X 100 X1000 / Volume of sample (ml)

Where,

A – Weight of the dried residue + dish (g)

B - Weight of dish (g)

**Note: Self indicating silica gel turns pale/ white if it absorbs moisture; activate it in oven @ 200°C till the colour turns blue.**

## 3. Total Dissolved Solids (TDS):

This test should be carried out to estimate amount of total dissolved solids available in the effluent.

| S. N | Description | Details |
|---|---|---|
| 1. | Purpose of test | To estimate amount of total dissolved solids in the effluent. |
| 2. | Target value | < 350 mg /100 ml |
| 3. | Equipments required | Electronic weighing balance, pipettes, Silica crucibles, Hot air oven, desiccators, filter assembly, vacuum pump |
| 4. | Consumable | Self indicating silica gel. Whatman Glass wool filters |
| 5. | Quantity of sample | 25 ml |
| 6. | Electricity requirement | Yes |
| 7. | Frequency of sampling | **90 days** |
| 8. | Testing spot | Railway laboratory |
| 9. | Staff required | 1 |

### Procedure:

1. Heat an empty and clean silica crucible at 180 ± 2°C for 1 to 2 hour in a hot air oven, cool it in desiccators to room temperature and weight.
2. Insert disc and filter assembly, apply vacuum and wash disc with three successive 20-mL volumes of reagent grade water.
3. Dry it in a hot air oven at 180 ± 2°C for 1 hour in an oven. Store in desiccators until needed. Weigh immediately before use.
4. Stir sample with a magnetic stirrer and pipette a measured volume (25 ml) into a glass fiber filter with applied vacuum.
5. Wash with three successive 10-ml volume of distilled water, allowing complete drainage between washings.
6. Transfer total filtrate (with washings) to a pre-weighed clean silica crucible.
7. Dry it in a hot air oven at 180 ± 2°C for 1 hour in an oven. Cool it in desiccators to room temperature. Note the final weight

**Calculations:**

mg total dissolved solids/ 100 ml = (A –B) X 100 X1000 / Volume of sample (ml)

Where,

A – Weight of the dried residue + dish (g)

B - Weight of dish (g)

## Total Dissolved Solids (TDS) (Simplified Procedure):

This test should be carried out to estimate amount of total dissolved solids available in the effluent.

| S. No. | Description | Details |
|---|---|---|
| 01 | Purpose of test | To estimate amount of total dissolved solids in the effluent. |
| 02 | Target value | < 350 mg /100 ml |
| 03 | Equipments required | **Portable TDS meter** |
| 04 | Other equipments | Beaker 100-150 ml |
| 05 | Quantity of sample | 100 ml |
| 06 | Frequency of sampling | **90 days** |
| 07 | Testing spot | Railway laboratory |
| 08 | Staff required | 01 |

**Procedure:**

1. Ensure availability of all the equipments and effluent in the lab.
2. Fill the sample effluent in the beaker and mix it properly.
3. Keep the TDS meter ON and put electrode in the beaker up to marking line.
4. TDS value will appear on the display of TDS meter. It should be noted.
5. Repeat the test again and record the TDS value in the register.

## 4. Total Volatile Solids (TVS):

This test should be carried out to estimate amount of total volatile solids available in the effluent.

| S. No. | Description | Details |
|---|---|---|
| 1. | Purpose of test | To estimate amount of total volatile solids available in the effluent. |
| 2. | Target value | < 500 mg /100 ml |
| 3. | Equipments required | Electronic weighing balance, pipettes, Silica crucibles, Hot air oven, muffle furnace, desiccators, filter assembly. |
| 4. | Consumable | Self indicating silica gel. Whatman Glass wool filters |
| 5. | Quantity of sample | 25 ml |
| 6. | Electricity requirement | Yes |
| 7. | Frequency of sampling | **90 days** |
| 8. | Testing spot | Railway laboratory |
| 9. | Staff required | 1 |

**Procedure:**

1. Heat an empty and clean silica crucible at 550°C for 1/2 hour in muffle furnace.
2. Cool it in dissector to room temperature and take the initial weight.
3. Pipette a measured volume of well mixed sample (25 ml) to a pre-weighed silica crucible.
4. Keep the silica crucible in a hot air oven at 103 – 105°C; keep till the water gets dried.
5. Remove the silica crucible and keep it in muffle furnace at 550°C for 1 hour.
6. Keep the silica crucibles in desiccators.
7. Note the final weight

**Calculations:** mg total volatile solids/ 100 ml = (A –B) X 100 / Volume of sample (ml)

Where, A – Total solids (mg)

B - Weight of the dried residue + dish (g) - Weight of dish (g) then convert the value to milli gram

**Note: The total solids amount is calculated as described above.**

Over all details of testing scheme for bio-toilet effluent & bacterial culture (inoculum), Please rffer our document No. IRCAMTECH/GWL/MECH/Bio-Toilets Test Scheme.

# Effluent parameter Analysis, instruments Specifications and approximate cost

| S.No | Instrument | Specifications | Approximate Cost (Rs) |
|---|---|---|---|
| 1. | **Table top pH meter** | **Ph accuracy** – 0.01 units,<br>**Calibration** – up to 3 points with auto buffer recognition,<br>**Display** – large dual line,<br>**Temperature compensation** – Automatic/manual 0 - 100°C,<br>**Memory** – 50 data sets,<br>**Power requirements** – 220 V<br>**Warranty** – 1 Year for instrument and 6 months for electrode. | 25,000 |

**Table top pH meter**

**Portable pH meter**


| | | | |
|---|---|---|---|
| 2. | **Portable pH meter** | **Ph accuracy** – 0.01 units,<br>**Calibration** – up to 2 points with auto buffer recognition,<br>**Temperature compensation** – Automatic/manual 0 - 100°C,<br>**Power requirements** –Battery operated, Auto power off for 10 minutes.<br>**Warranty** – 1 Year for instrument and 6 months for electrode. | 5000 |

| | | | |
|---|---|---|---|
| 3. | **Hot air oven** | **Temperature –** Up to 250°C,<br>**Temp control** – Thermostatic ± 2°C,<br>**Oven** – Double walled Aluminum/SS, outside MS with epoxy coating.<br>**Shelves** –Wire mesh shelves.<br>**Door** – With synthetic rubber gasket.<br>**Air circulation Fan** – present.<br>**Size** – 455 mm x 455 mm x 455 mm (W x D x H) | 40,000 |

**HOT AIR OVEN**

**Filter flask assembly**

**Silica crucible**

**Weighing balance**

| | | | |
|---|---|---|---|
| 4. | **Filtering flask assembly** | **Assembly** – SS/ Glass.<br>**Filter Dia**- 47 mm.<br>**Filtration area :** 5 -10 $cm^2$.<br>**Size** – 15-20 cm X 5-10 cm<br>**Out let** – No. 8 perforated silicone<br>**Volume -** 500 ml<br>**Stopper** – mounted on 1 L Glass vessel | 10,000 |

| | | | |
|---|---|---|---|
| 5. | **Muffle Furnace** | **Size –** 125 mm x 125 mm x 300 mm (W x D x H)<br>**Power –** 3.0 KW<br>**Temperature –** Up to 900°C,<br>**Outer Casting** – MS with epoxy coating.<br>**Temp Control** – Digital Temperature controller cum indicator.<br>**Heating element**- Kanthal wire/ special high temperature alloy | 25,000 |

**MUFFLE FURNACE**

| | | | |
|---|---|---|---|
| 6 | **COD Digester** | **Controller –** Microprocessor Based Digital Temperature Indicator cum Controller<br>**Display –** LED with set value (SV) and process value (PV)<br>**Block Dimensions (WxDxH) in mm-**<br>270 mm(L) x 150 mm(W) x 70 mm(D)<br>**Heater Load –** 1.0 KW<br>**Tube cavity –** 40 mm(Φ)x 65 mm (D)<br>**No. of cavities –** 15 holes to accommodate 15 samples<br>**Glass Tube Size –** Supplied with 15 Nos of glass tubes of size 38 mm (Φ)x 200 mm (Length)<br>**Glass Air Condenser Size** – 15 nos. of air condensers of 600 mm length each.<br>**Temperature Range**–Ambient+5°C to150 °C<br>**Temperature Accuracy –** ±1 °C<br>**Sensor –** RTD (Pt- 100)<br>**Material –** External Power Coated CRC Steel<br>**Block –** Polished Aluminum<br>**Tube Rack -**1 No.<br>**Power Supply –** 230 V AC, 50/60 Hz.<br>**Optional –** spare digestion tubes (15 No.)<br>Tube rack (1 No.) | 42,000 |
| 6a. | | **Lab Coat and Hand Gloves** | |

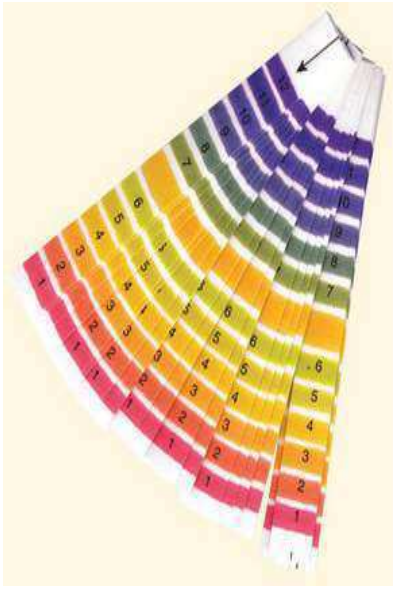

**COD DIGESTION APPARATUS**

| | | | |
|---|---|---|---|
| 7. | **Magnetic Mixing platform** | **Maximum Stirring Capacity –** 1 liter (0.26 gallons)<br>**Speed Range –** Min. 100 rpm, Max. 1000 rpm<br>**Cover Material –** ABS plastic<br>**Dimensions –** 137 mm (dia) x 51 mm (h)<br>**Weight –** 640 g (1.4lb)<br>**Accessories:** Micro Stir Bars for Magnetic Stirrers. | 25,000 |

# pH Equipments

**Magnetic stirrer**

**Magnetic bars**



**pH indicator strips**

| | | | |
|---|---|---|---|
| 8. | **Autoclave** | **Material of vessel** – inside – Stainless steel, outside – epoxy coated MS<br>**Effective volume –** 22 L (250 mm x 450 mm; Dia x depth)<br>**Weight -**15 - 25 Kg.<br>**Power consumption –** 2 - 3 KW.<br>**Operating temperature Range –** 120 ± 10°C<br>**Keep warm temperature –** 45 °C – 60 °C.<br>**Safety device –** Safety valve, over temperature & over pressure limiter, Error indicators.<br>**Accessories –** 2/3 stainless steel baskets, indfoss piezostat to adjust pressure between 15 to 22 PSI | 20,000 |

| | | | |
|---|---|---|---|
| 9. | **Laminar air flow chamber** | **Size –** 1200 mm x 600 mm x 600 mm (L x W x D)<br>**Door –** Acrylic<br>**Light –** Both UV and Flourescent<br>**Outer casting –** Duro board / SS 304.<br>**Filter –** HEPA with 0.3 µm pore size.<br>**Accessories:** Cock for Gas/vacuum line, Bunsen burner | 1,50,000 |


Laminar air flow chamber

| | | | |
|---|---|---|---|
| 10. | **Incubator** | **Temperature –** Ambient to 60 °C.<br>**Temp Control** – Thermostatic ± 1°C<br>**Size –** 450 mm x 450 mm x 600 mm (LxWxD)<br>**Heating elements:** Bottom.<br>**Casing –** inside – Double walled<br>Aluminium/SS, outside – MS with epoxy coating<br>**Door –** Glass window and with synthetic rubber gasket.<br>**Shelves –** Wire mesh shelves,<br>**Power –** 240 V AC<br>**Air circulation Fan –** Present. | 40,000 |

Incubator

| | | | |
|---|---|---|---|
| 11 | **Burette** | **Class –** A class.<br>**Make –** PTFE pathway.<br>**Capacity –** 50 ml.<br>**Graduation interval** – 0.1 ml.<br>**Height –** 720 mm.<br>**Tolerance –** 0.1 ml. | 2500 |

| | | | |
|---|---|---|---|
| | | **Accessories:** leak proof stopcocks. | |
| 12 | **Fume Hood System** | **Internal size:** L 1200 x D 600 x H 600 mm<br>**Make:** wood<br>**Working Space**: Stainless steel 316, Acid resistant.<br>**Wash basin size:** 250 x 200 x 150 mm depth of Stainless Steel 316.<br>**Sliding slash:** Glass make moves vertically up and down with concealed counter balanced weight.<br>**Exhaust system:** Exhaust fan with stainless steel deck & Duct to take out fumes.<br>**Electrical:** 1 fluorescent lamp, power socket (5/15 A).<br>**Accessories:** Cock for Gas supply | 50,000 |
| 13 | **Micropipettes** | **Digital micropipette**<br>**Chemical resistant**<br>**Autoclavable**<br>**Volume Range**<br>**20µl - 200 µl**<br>**100µl - 1000 µl**<br>**1 ml - 5 ml** | 50,000 |
| | |  <br>**Micropipette** | |
| 14 | **General Facilities Required** | **Graduated glassware** | 10,000 |
| | | **Sampling containers of plastic / Glass make** | 5,000 |
| | | **Refrigerator** | 15,000 |
| | | **Thermometer** | 1,000 |
| | | **Volumetric glassware** | 10,000 |
| | | **Magnetic bars all range** | 5,000 |
| | | **Tissue paper** | - |
| | | **Blotting paper** | - |
| | | **Para film** | - |
| | | **Cotton** | - |
| | | **Test tube bucket** | - |

# Sources of supply for all Testing Equipments being used for bio-digester effluent analysis.

| S No. | Parameter | Equipment | Source of supply |
|---|---|---|---|
| 1 | **pH** | pH meter | M/s Eutech Instruments<br>M/sThermo Scientific Instruments.<br>M/s Mettler toledo India (P) Ltd.<br>M/s Hanna Instruments.<br>M/s Labindia Analytical instruments (P) Ltd<br>M/s Bioscreen Instruments (P) Ltd. |
| | | Magnetic stirrer & Magnetic stirrer bars | M/s Remi Elektrotechnik Limited, Mumbai<br>M/s IKA Group, Bengaluru<br>M/s Labnet Inc<br>M/s Thermo Scientific Instruments<br>M/s Labindia Analytical instruments (P) Ltd<br>M/s Bioscreen Instruments (P) Ltd. |
| 2 | **Solids (TS, TDS, VS)** | Electronic weighing balance | M/s Thermo Scientific Instruments.<br>M/s Mettler toledo India (P) Ltd.<br>M/s Hanna Instruments.<br>M/s Labindia Analytical instruments (P) Ltd<br>M/s Bioscreen Instruments (P) Ltd.<br>M/s Advanced Technology, Ambala<br>M/s Sansui Electronics (P) Ltd |
| | | Pipettes | M/s Genaxy scientific (P) Ltd,<br>M/s Thermo Scientific Instruments (P) Ltd<br>M/s Agile Lifescience Technologies India Pvt. ltd.<br>M/s Himedia Laboratories (P) Ltd.<br>M/s Eppendorf India (P) Ltd<br>M/s Labindia Analytical instruments (P) Ltd<br>M/s Bioscreen Instruments (P) Ltd. |
| | | Silica crucibles | M/s Borosil Glass works Ltd<br>M/s Vensil Glass works Ltd<br>M/s Rivera Glass private Ltd<br>M/s SCHOTT Glass India Pvt. Ltd<br>M/s Edutek instrumentation, Ambala<br>M/s Multilink marketing international, Chennai.<br>M/s Thermo scientific Instruments. |
| | | Hot air oven | M/s Narang Scientific Works Ltd.<br>M/s Rodwell scientific instruments.<br>M/s Hindustan Apparatus Manufacturing company, Mumbai<br>M/s Labindia Analytical instruments (P) Ltd<br>M/s Bioscreen Instruments (P) Ltd.<br>M/s Thermo scientific Instruments. |

| | | | |
|---|---|---|---|
| | | Desiccators | M/s Narang Scientific Works Ltd.<br>M/s Rodwell scientific instruments.<br>M/s Hindustan Apparatus Manufacturing company, Mumbai<br>M/s Labindia Analytical instruments (P) Ltd<br>M/s Bioscreen Instruments (P) Ltd.<br>M/s Thermo scientific Instruments. |
| | | Filter assembly | M/s Millipore India (P) Ltd<br>M/s Labindia Analytical instruments (P) Ltd<br>M/s Bioscreen Instruments (P) Ltd.<br>M/s Thermo scientific Instruments<br>M/s Labnet Inc |
| | | Vacuum pump | M/s Millipore India (P) Ltd<br>M/s Labindia Analytical instruments (P) Ltd<br>M/s Bioscreen Instruments (P) Ltd.<br>M/s Thermo scientific Instruments<br>M/s Labnet Inc |
| | | Glass wool filters | M/s Whatman<br>M/s Thermo scientific Instruments (P) Ltd<br>M/s Millipore India (P) Ltd |
| 5 | **Chemical Oxygen Demand** | COD digester along with digestion tubes and condensers | M/s Narang Scientific Works Ltd.<br>M/s Rodwell scientific instruments.<br>M/s Hindustan Apparatus Manufacturing company, Mumbai<br>M/s Labindia Analytical instruments (P) Ltd<br>M/s GenNext Lab Technologies (P) Ltd, Delhi<br>M/s Hatch<br>M/s Krishgen biosystems (P) Ltd, Mumbai |
| 6 | **Total Fecal Coli forms count** | Laminar Air Flow Chamber | M/s Thermo scientific Instruments (P) Ltd<br>M/s Narang Scientific Works Ltd.<br>M/s Rodwell scientific instruments.<br>M/s Hindustan Apparatus Manufacturing company, Mumbai. |

| | | | |
|---|---|---|---|
| | **Total Fecal Coli forms count** | Incubator | M/s Narang Scientific Works Ltd.<br>M/s Rodwell scientific instruments.<br>M/s Hindustan Apparatus Manufacturing company, Mumbai<br>M/s Labindia Analytical instruments (P) Ltd<br>M/s GenNext Lab Technologies (P) Ltd, Delhi<br>M/s Hatch<br>M/s Krishgen biosystems (P) Ltd, Mumbai<br>M/s Thermo scientific Instruments (P) Ltd |

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## Genpure Technologies Pvt.Ltd

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Phone : 011-25814297

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Phone: 033-25333171

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Phase – II, Panchkula, Haryana, India - 134113

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# INDIAN RAILWAYS


## GUIDELINES FOR ANNUAL MAINTENANCE AND OPERATION CONTRACT (AMOC)

## FOR

## BIOLOGICAL TOILETS (DRDE TYPE)

## FITTED IN

## INDIAN RAILWAY BG COACHES

| S. No. | Month/Year of issue | Revision / Amend. | Page No. | Reason for Amendment |
|---|---|---|---|---|
| 1. | August, 2010 | Nil | N A | First Issue |
| 2. | December, 2011 | 01 | All | Entire guidelines for AMOC Reviewed in the light of experience gained from field trial. Variant –III (Smaller dia. version) eliminated. Variant–IV has been renumbered as Variant – III. |
| 3. | August, 2014 | 02 | All | Guidelines for AMOC Reviewed in the light of experience gained from field trial. |

**ISSUED BY**

**CARRIAGE DIRECTORATE**

**RESEARCH DESIGNS AND STANDARDS ORGANISATION**
**MANAK NAGAR LUCKNOW – 226011**

## CONTENTS

# ANNUAL MAINTENANCE AND OPERATION CONTRACT (AMOC) FOR AN-AEROBIC BIOLOGICAL TOILETS

## 1.0 GENERAL

1.1 The Annual Maintenance & Operation Contract (AMOC) entered between Contractor and Base Railway will be inclusive of spares and consumables required for maintenance and operation of Bio-Toilet system (Anaerobic Technology herein after termed as Bio-toilet only). However contractor have to quote the charges for the AMOC for the warranty period without including the cost of spares (as these will be supplied under warranty, if required) and after warranty period charges shall be inclusive of the both i.e. cost of operational charges, spares and consumables. This contract shall merely act as a model on broad guidelines. Railways may suitably modify the contract as local conditions.

1.2 The AMOC will cover the maintenance (both preventive and break down) of Bio-Toilet System along with the on board rectification of the minor problems encountered and day-to-day operation of Bio-toilet systems. It shall also cover the preventive and break down maintenance of the Bio-Toilet System within warranty period. During warranty the AMOC shall include cost of only preventive maintenance checks, rectification against damage and deficiency owing to other manufacturing defects whereas defective parts replacement will be free of cost as per terms and conditions of the warranty clause of the relevant purchase order. This would also include attention of the Bio-Toilets during periodical overhaul (POH) of the coaches in the designated workshops at an interval of 12/18/24 months.

## 2.0 INTRODUCTION

2.1 This Annual Maintenance & Operation Contract (AMOC) is for trouble free operation, maintenance and cleaning of Bio-Toilets System fitted in IR coaches. The contract is comprehensive in nature wherein all the Maintenance (Preventive and Breakdown) and day-to-day operation of the Bio-Toilets fitted on IR coaches is to be done by the Contractor including supply of spares/materials required for this AMOC.

2.2 Details of coaches fitted with IR-DRDO type Toilet system shall be provided by the concerned Division /Zonal Railway of IR on the format given in ANNEXURE-I.

2.3 The contract shall be inforce for an initial period of 3 years and extendable upto 5 years.

**2.4** Nodal Officer - will be responsible for operating the contract. In case of breakdown of Bio-Toilets System, Nodal Officer will liaise with the firm and inform the firm immediately by telephone/telex/e-mail/SMS or any other suitable means, duly mentioning the coach numbers and location of the coaches along with the time of call, when the breakdown maintenance is to be attended to.

## 3.0 Definitions

a) **Base Railway** – The Zonal Railway to whom coach is allotted.

b) **Nodal Officer** – Sr. DME of the concerned division or his nominated Coaching Depot Officer/Supervisor.

c) **Contractor** – Firm / Company on whom the order for the Annual Maintenance and Operation of the Biological Toilets in passenger coaching stock on IR has been placed.

## 4.0 Technical

## 4.1 DESCRIPTION OF COMPLETE SYSTEM (INSTALLED IN THE COACH) UNDER THE CONTRACT:

**General Outline of the existing System:**

Three variants of Bio Digester are being tried out on IR Coaches.

**Option_1**

1. **Bio-toilet system with PLC:**

   The retention tank of this system has been designed keeping in view the DRDE bacteria. The fecal matter will pass through a U-trap to the tank. U-trap bend towards inlet side of the tank shall be slanted to achieve double seal and will also eliminate gas emission to the toilet room. Vent hole is provided on the top of the retention tank for venting out gases (preferable in first and last chamber) One flapper valve is provided for water seal to arrest foul smell and will also act as a passage to clear foreign materials such as Bottles, polythenes etc. This will also act as a fail safe mode in case of emergency. Since this system has PLC, hence the flapper valve can be opened at pre-determined cycles; say 40 cycles or so, to clear the foreign materials automatically through a chute which is open to ground. There will be no speed sensor which is the major cause of non-operation of flapper valves fitted in toilet systems. In this system the flushing will be pressurized. A chamber having 1 litre capacity has been provided after the chlorination chamber. This chamber has two outlets; one with tap for sample collection for testing the performance of the bio-degradation (effluent discharge parameters) and other for normal discharge i.e. chlorinated discharge.

2. This PLC can also be simplified by providing a counter and a solenoid valve and the flushing system with gravity only. Thus eliminating all the complexity of the system.

**Option-2**

**Bio-toilet system without any pneumatics, electronics and electrical:**
The retention tank of this system is same as in option-1 above. In this system also the faecal matter will pass through a U-trap to the tank. But in place of flapper valve, one slider valve/Ball valve has been provided which will be operated manually from outside of the coach/by foot pedal. Alternatively, it should be operated from inside the coach by a lever also. This will also act as a water seal to arrest foul smell and will also act as a passage to clear foreign material such as Bottles, polythenes etc manually. This will also act a fail safe mode in case of emergency. If anything goes wrong this valve can be kept in open condition and the complete system will act as the conventional chute system which is open to ground. There will be no speed sensor, no pneumatics, and no electronics thus eliminating electrical and mechanical failures. In this system the flushing will be through the gravity head only.

**In nutshell, these may be summarized as below:**

| Variant of Bio-Digester | Brief Description | Features | | | |
|---|---|---|---|---|---|
| | | Pneumatics | Electrics | PLC | Flush |
| Option–I | System with flapper valve | Yes | Yes | Yes | Pressurized |
| **Option-II** | System with manual slider valve/Ball Valve. | No | No | No | Gravity |
| | | | | | |

**4.2 System Installed shall comprise of the following:**

i) Bio Digester Tank
ii) PLC Controls – as applicable
iii) Control Panel– as applicable
iv) Chlorinator
v) Flapper/Slider/Ball Valve – as applicable
vi) Flushing Unit/Pressuriser
vii) Piping system
viii) Pneumatic Valve – as applicable

## 5.0 SCOPE OF WORK

### 5.1 Scope of work at Base Depot:

For the works are to be carried out under supervision of nominated Railway staff for the Annual Maintenance and Operation Contract (AMOC) of complete Toilet System including following equipments:

i) All bio-toilets (2/4) of the coach and its supporting systems like flushing arrangement, piping etc.
ii) Pan outlet piping connection upto the retention tank including TPE connector etc.
iii) Existing plumbing fittings and its control systems etc.
iv) The maintenance work of PLCs and Flapper valves/Ball valve (wherever applicable).
v) Any other job related to toilet system new or old assigned to the contractor are to be done by the contractor under the contract.

### 5.2 Details of Staff:

**Site Supervisor:**

The supervisor will organize the said operations, monitoring and maintenance in the shift during which the trains with bio-toilet are maintained in the depot. He will be

reporting to nominated Railway Representative and will be entirely responsible for all the activities as mentioned. The supervisor should be acquainted with such types of jobs with satisfactory working knowledge of the system and various accessories provided.

5.3 **Skilled staff:**

5.3.1 Well trained staff with satisfactory working knowledge of the system and working of railway coaching depot who can handle and maintain the Toilet system as mentioned in the scope assisting Railway staff in day to day maintenance**.**

5.3.2 The staff pattern is illustrative only and not exhaustive. Over and above it, the contractor is to ensure proper supervisory staff.

5.3.3 The contactor will furnish bio-data along with testimonials of staff proposed to be engaged to the nominated Railway representative at least two weeks before the proposed date of employment and he will engage such staff after screening and obtaining clearance from Nodal Officer. The clearance issued by the office will not absolve/responsibility of the contractor for misconduct of his staff members.

5.3.4 During the period of contract, nominated Railway person will have authority to ask the contractor to remove/replace any staff members in the event of any misconduct of the later. For this purpose his decision will be final.

5.4 **Man Power (minimum man power to be deployed)**

**5.4.1 Man Power Required per shift**

1. Supervisor : 1 (All 7 days as per schedule given by Nodal Officer)

2. Skilled technician : 1 (All 7 days as per schedule given by nodal officer)

3. Semi skilled technician: 1 (All as per schedule maintenance given by nodal officer)

The availability of manpower has to be ensured in consultation with Nodal officer and can be increased or decreased as per the workload on a particular day.

**5.4.2 Man Power Deployment:-**

Trains equipped with Bio-toilets are maintained at Coaching Depot as per specified schedule. The staff should be deployed as per this maintenance time of the train on washing line/Nominated line. The contractor's Supervisor shall remain in touch with the Railway representative to keep track of any changes in the maintenance time and adjust his time accordingly.

5.5 **Place of work, Working hours and holiday for manpower deployed:–**

5.5.1 Place of work will be washing line/Sick line/Coaching depot/Terminal station/any other maintenance point selected by the nodal office. Bio-toilet maintenance timing will depend on No. of trains and their maintenance schedule. Contractor has to maintain the bio-toilet in the given maintenance schedule of the respective trains.

The manpower requirement can be assessed by Nodal Officer and accordingly manpower deployment may be increased or decreased.

5.5.2 It will be the responsibility of the contractor to clean the area after completion of the work. Any refuse/garbage generated during the course of work shall be disposed off by the contractor.

5.5.3 The manpower requirement above is indicative only. Bidders may suggest additional man power if required. Bidder may assess the man power required by visiting the site and familiarising themselves with the system of working and Train timings.

5.5.4 The Bidder should provide additional man power if required in future at the same rate quoted. The Contractor shall comply all provision of minimum wages act, 1948, Contract labour (Regulation and Abolition) Act 1970 and rules framed there under and other labour laws affecting contract labour that may be brought in to time to time. Details of payment calculation should be submitted with break up along with price bid. Necessary supporting documents should be submitted with the tender.

**5.6 Preventative Maintenance schedule:**

The preventive maintenance schedule for maintenance of coaches being followed in IR is given in ANNEXURE-II. However following work schedule is to be followed for proper maintenance of the Bio-toilet System under the contract:

**5.6.1 WORK TO BE CARRIED OUT DAILY/TRIP:**

a. Attending the daily routine complaints received from the users.

b. Removing choking of all toilets, if any.

c. Checking of all the comp components of Bio-toilet system for any deficiency

d. Attention to PLC if fault is noticed ( if applicable).

e. Ensuring easy operation of ball valve and attention to TPE connector.

f. Charging of Chlorine/Kmno4 tablets if required and examination of chlorinator unit for any leakage or tilting.

**5.6.2 WORK TO BE CARRIED OUT MONTHLY:**

a. All works to be carried out as mentioned in daily schedule above;

b. Collection and transportation of samples from retention tanks to DRDE, Gwalior or any other nominated Govt. accredited lab as per the test scheme (RDSO/2010/CG/TS-10 or any applicable test scheme) issued by RDSO.

c. Visual inspection of complete toilet system including under slung equipments.

d. Charging of Chlorine/Kmno4 tablets and examination of Chlorinator unit.

e. Application of evacuation machine for removing garbage from first chamber of the bio-digester.

**5.6.3 WORK TO BE CARRIED OUT ON QUARTERLY BASIS:**

a. All works to be carried out in Daily and Monthly schedule above;

b. Checking of following equipments/repair/replacement for proper functioning:
   i) Flapper/slider/ball Valve.
   ii) Leakage in piping, flush system, pneumatics, tank etc. Valves, pressuriser, PLC, pneumatic valves, Ball valves etc.
   iii) Charging of Bio-culture if required (based on test reports). Culture will be supplied by DRDE/IR.

**5.6.4 WORK TO BE CARRIED OUT IN HALF YEARLY**

a. All jobs as mentioned in the quarterly work schedule above;

b. Servicing of all PLCs.

c. Testing of complete Toilet system

d. .

e. Drawing and delivering of samples as per requirement to Govt. Accredited labs as advised by Railways. The cost of test will be born by Railways.

f. Charging of Bio – culture if required (based on test reports)

**5.6.5 WORKS TO BE CARRIED OUT ON POH:(By Workshop contractor)**

a. All the works to be carried out in half yearly schedule above; and

b. Dismantling of retention tank for inspection and thorough cleaning. This will be required to be done in one tank of each variant to check general condition. In case condition requires, then all tanks will be removed and thoroughly cleaned. (Based on the remarks of base depot)

c. Charging of Bio – culture. Culture will be supplied by DRDE/IR or will be arranged by Workshop.

## 5.7 Detailed Terms and Conditions for providing Manpower

5.7.1 Contractors should provide 2 sets of uniforms of approved colour for the employees deputed in the Depot at his own cost and safety shoes one pair.

5.7.2 In order to ensure the fulfilment of statutory obligations, contractor shall ensure that the payment of wages of the workmen of the contractor is made in the presence of a representative nominated by Railways in campus only.

5.7.3 The contractor shall issue the identity cards to his workmen on his own cost and shall duly be intimating in writing the nominated Railway person as and when there is any change.

5.7.4 The contractor shall ensure to provide an alternate qualified manpower or replace with a stand by in case any of the regular staff deployed is absent or on leave.

5.7.5 The contractor shall be responsible for the safety of all the items and other fittings provided in the premises and shall be liable to make good of any loss to the same if damaged during the execution of their duties which shall be recoverable from his monthly bill or other dues payable to the contractor by the company.

5.7.6 The monthly bills for the service shall be submitted by the contractor before the end of every month and the same will be settled by Railways before 10th of every month.

5.7.7 The contractor shall ensure that the workmen deployed by him behave decently and do not indulge themselves in any such activities, which are unbecoming on the part of a person working in the Government Office.

5.7.8 The contractor shall be responsible for the good conduct and behaviour of his employees. If any employee of the contractor is found misbehaving with the supervisory staff or any other staff member, the contractor shall terminate the services of such employees at their own risk and responsibility on the recommendation of the Nodal Officer. The contractor shall issue necessary instruction to their employees to act upon the instructions given by the nominated Railway person at the Depot.

**6.0 AMOC Charges:** To be quoted in the tender for AMOC.

## 7.0 Authority for Signing and Operation of the Contract

The Nodal Officer of the concerned Division will be the authority for signing the Contract. The Nodal officer shall be responsible for overall supervision of the contractor's work and issue of requisite certificate for performance of the contractor for maintenance and operation of the Biological Toilets.

## 8.0 Responsibilities of Parties:

### 8.1 Base Railway:

8.1.1 Base Railway shall execute an agreement with the contractor at the beginning of the contract.

8.1.2 The Nodal Officer shall permit the contractor to undertake AMOC for the Biological Toilet system (IR-DRDO Type).

8.1.3 The Nodal Officer shall issue the necessary identity card or authority letter to the contractor's working staff/service engineer for their entry on the platform and other Railway premises. However, this Identity Card will not be taken as an authority to travel. Records of the persons who have been issued with valid identity cards shall be maintained by CDO.

8.1.4 All safety and security rules prevailing at the place of work shall be issued to the working staff/service engineers of the contractor by the Railway.

8.1.5 The Biological Toilets shall be attended to on the platform or washing line or Sick line or coaching depot or the terminal stations or any other maintenance point. The Nodal Officer shall provide to contractor the following facilities for AMOC:

a) Suitable room and workplace for accommodating the tanks etc. located in the proximity of maintenance activity.

b) Suitable open space at convenient location for the storage of residual waste which shall be removed and disposed of by the contractor ensuring clean and hygienic environment in the depot.

c) Air pressure at 5 bar on "as is where is" basis for maintaining the system.

d) Power Supply at 110 V DC and 220 V AC on "as is where is" basis.

e) Water supply on "as is where is" basis.

8.1.6 In case of receipt of breakdown of Bio-Toilet in any coach, the nominated nodal officer shall intimate the contractor by telephone/telex/e-mail/SMS or in person mentioning the coach numbers and location of the coaches along with the time of call. He shall maintain the register of such calls made for reference of both the parties.

8.1.7 CDO shall nominate supervisor(s) for joint inspection of the Toilets maintained. Joint inspection shall be done as per scheduled maintenance.

8.1.8 The necessary records for the AMOC will be maintained with the nominated officer for reference of both the parties.

8.1.9 The Nodal Officer should ensure that no maintenance schedule of Bio-toilet system is allowed to run over due and offer the coaches accordingly to the Contractor.

8.1.10 The Nodal Officer should ensure that the certificate of the satisfactory maintenance and operation of the Biological toilets as issued by him is sent to the contractor within a week after completion of each quarter.

**8.2 Contractor**

**8.2.1** The Contractor shall provide trained man power for the prompt and efficient maintenance (preventive as well as Break down) and day to day operation of the Bio toilets. The Contractor shall ensure that all necessary consumables and spares required for the proper functioning and day-to-day operation and maintenance / repairs for out of course defects of the Bio toilets are available at site. The contractor shall also keep sufficient unit exchange spares for replacement within reasonable time as considered necessary by the Nodal Officer for repairing the defect.

**8.2.2** The contractor shall submit a list of authorized persons deputed for carrying out the repairs along with their contact numbers i.e. mobile numbers, to Nodal Officer. The service engineer nominated by the contractor for the repair on the station/Depot shall observe all safety and security rules prevailing at the place of work. IR shall not be responsible for any mishap resulting out of non-observation of prevailing safety and security rules.

**8.2.3** The contractor shall ensure that no toilet system remains out of operation and the maintenance staff should report immediately after receipt of breakdown call during the working of trains.

**8.2.4** The Contractor shall ensure that all chemicals and bacteria essentially required for the proper functioning of the bio-toilet system are supplemented for the waste treatment. He will ensure that emptying and cleaning of the toilet tank including disposal of residual waste.

**8.2.5** The contractor shall set-up the facility for servicing and bench testing at contractor's cost at the place provided by the Railway. The facilities will include skilled staff, tooling required for dismantling, servicing, testing and assembling of various parts of the Bio Toilets. The Contractor shall ensure that his staff does not spread filth/litter around working area and it shall be the duty of the staff to maintain cleanliness of the area. Besides, firm will keep all the testing and maintenance facilities in working order at all times. Back-up of critical machinery, tools etc. should be maintained to ensure un-interrupted attention. Break down of such items should be reported to CDO immediately.

**8.2.6** Contractor shall be solely responsible for the safety of all the men and equipment of the firm. Railways will not be responsible on this account in any manner.

**8.2.7** Boarding & lodging facilities to staff of firm to be made available at any station shall be the responsibility of the contractor.

**8.2.8** The Contractor shall ensure that there is no damage to the Railway property/material.

**8.2.9** The contractor shall ensure that all employees/persons engaged/authorized by him for carrying the work, behave properly with Railway officers and staff. In the event of any misbehaviour, reported by the Nodal officer, the contractor shall immediately withdraw such employee/person from the work.

**8.2.10** The contractor will liaise with the Nodal officer for the AMOC and maintain necessary records for reference of both the parties.

**8.2.11** In case of any problem that the on-board staff is unable to attend, he will advise CDO for urgent action to be taken.

**8.2.12** In case of the coach requiring to go to a periodic repair workshop for any reason the supplier shall, during warranty as also during operation of AMOC, be responsible for evacuating and cleaning the tank before workshop repairs are undertaken and also for re-commissioning the toilet systems after the coach is attended in the workshop.

**8.2.13** In case of any loss /damage to the firm/his men/machinery, the Railway shall not be responsible and all claims placed on his account will be on the contractor's own risk and cost.

**9.0 Warranty**:

Warranty of Toilet system shall be as per the Purchase order.

**10.0 Validity of contract:**

The AMOC shall be valid for a period of 3 years extendable to 05 years.

**11.0 Ownership of the rejected or defective components/or parts:**

Ownership of the rejected or defective components/or part is that of the Contractor against the replacement made by them on the Biological Toilet System to make it operative.

**12.0 Payments:**

12.1 The payment for AMOC shall be made in instalments on quarterly basis on certificate of satisfactory performance for the Nodal Officer.

12.2 Any excess/shortfall in the work actually carried out will be adjusted at the time of 2nd installment and the last installment of the year.

12.3 The bills of the contractor for payment must accompany as under: -

a) The Coach numbers of which the toilets maintained by the firm for each three monthly schedule covered under this AMOC.

b) A certificate of the satisfactory maintenance of the bio-logical toilets as issued by Nodal Officer of Base Railway to be submitted to the Paying Authority.

12.4 There will be no deduction for the period during which the coach is under POH.

**13.0 Paying Authority**

The payment against this contract shall be made by the Sr. Divisional Finance Manager of the concerned Division associated with the Depot for maintenance of the coaches.

**14.0 Records to be maintained by Maintenance Depot:**

a) Depot shall maintain the coach numbers to be maintained under this AMOC along with the date of inclusion/deletion of the coaches under AMOC.

b) The Nodal officer or Nominated officer concerned shall keep the register /records for the previous bills paid for each coach to avoid duplicity of the payments at any time.

c) List of Plant & Machinery installed by the contractor and stock position of the spares for execution of the AMOC

15.0 **Security Deposit:**

Security Deposit shall be submitted by the contractor as specified in the contract.

**16.0 Performance Guarantee – As per purchase order**

a) The contractor shall furnish a Performance Guarantee Bond from a Bank acceptable to Paying Authority for an amount equivalent to 5% of the value of the AMOC valid for 66 months towards performance and completion of the contract in all respect. On the performance and completion of the contract in all respect the PGwill be returned to the Contractor without any interest. The PG is to be submitted to Paying Authority of the concerned Division.

b) As and when an amendment is issued to the contract, the contractor shall, within 15 days of receipt of such an amendment furnish to the Nodal Officer an amendment to the Performance Guarantee Bond rendering the same valid for the contract as amended.

**17.0 Force Majeure Clause**

This will be as per Clause 19 of latest General Conditions of Contract.

**18.0 Arbitration**:

This will be as per clause 2900 of Indian Railway Standard Conditions.

**19.0 Laws Governing the Contract**

This will be as per Clause 2700 of Indian Railway Standard Conditions.

**20.0 Jurisdiction of the Courts**

This will be as per Clause 2703 of Indian Railway Standard Conditions.

**21.0 Failure:**

This will be as per Clause 0702 of Indian Railway Standard Conditions.

**22.0 Subletting and Assignment**

This will be as per Clause 1505 of Indian Railway Standard Conditions.

**23.0 Other terms and conditions as per I.R.S conditions of contract will apply.**

**24.0 Penalty:**

If the defective toilets are not attended within 24 hours, the AMOC contractor shall be fined Rs. 200/- per day per toilet.

**CONTRACTOR**

**WITNESS : 1. _____** **WITNESS : 1. _____**

**2._____** **2. _____**

**ANNEXURE – I**

## DETAILS OF COACHES FITTED WITH DRDE TYPE BIO TOILETS

| S. No. | COACH NO. | TYPE | BASE DEPOT | No. of toilets with Variant | | |
|---|---|---|---|---|---|---|
| | | | | I | II | III |
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**Anexure – II**

**Preventative Maintenance schedule of IR Coaches**

**A. Maintenance Schedule in Depots**

| Type of Schedule | Periodicity |
|---|---|
| (i) Trip Schedule | At the end of each trip or as prescribed |
| (ii) Schedule 'A' or Monthly examination | 1 month +/-3 days |
| (iii) Schedule 'B' or tri-Monthly examination | 3 months +/-3 days |
| (iii) Schedule 'c' or Half- yearly examination | 6 months +/-7 days |
| (iv) Special Schedule | As prescribed by each Railway |

**B. Maintenance Schedule in Works Shops**

**Non-Air Conditioned coaches**

| | |
|---|---|
| (i) Coaches in Mail and Express rakes.<br>(a)Coaches earning less than 2 lakhs Kms annum.<br>(b) Coaches earning more than 2.5 lakhs Kms annum.<br>( c) Coaches earning between then 2.5 lakhs Kms annum | 12 months<br>12 /18 months with IOH after 6/9 months<br>**Adopt (a) or (b) as per local conditions** |
| (ii) Coaches in other rakes | 18/24 Months |

**Air Conditioned coaches**

| | |
|---|---|
| (i)Rajdhani & Shatabdi coaches<br>(a) POH<br>(b) IOH | After 4 lakhs kms or 18 months whichever is earlier.<br>After 2 lakhs kms or 9 months whichever is earlier |
| All other coaches | 12 months |

*Specified Scheduled Maintenance Periodicities are indicative in nature and subject to change as per Railway requirement/rules.

# INDIAN RAILWAYS


# TRIAL/TEST SCHEME
# FOR
# "FIELD TRIAL OF BIO TOILETS"
# (DRDE TECHNOLOGY)
# ON
# INDIAN RAILWAY PASSENGER COACHES

| S. No. | Amend./ Rev. No. | Date/Month of Issue | Page No. | Reason for Amend./ Rev. |
|---|---|---|---|---|
| 1 | Rev.Nil | Dec., 2010 | NA | **I$^{st}$ Issue** |
| 2 | Rev. 1 | Jan., 2011 | 3 | Frequency of testing of effluent discharge changed & agency specified. |
| 3. | Rev.2 | May, 2011 | All pages | i) Reasons of choking/ malfunctioning of toilet with coach &lav. variant added in visual observations.<br>ii) Annexure-I Generalised. |
| 4. | Rev.3 | June, 2012 | All Pages | i) Review of testing parameters & inclusion of parameters Volatile Solids & Faecal Coliforms.<br>ii) Inclusion of:<br>- Sampling Criteria<br>- Testing procedure |
| 5 | Rev-4 | October, 2012 | All pages | - Complete trial scheme revised.<br>- Sampling procedure and list of test labs added as annexure III and IV. |

**ISSUED BY:**

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## 1. TRIAL/TEST SCHEME FOR IR-DRDO BIO TOILETS IN INDIAN RAILWAY

Indian Railway has developed "IR-DRDO" bio-toilets jointly with the DRDO. To establish it in IR conditions trials on IR is going on. For proper monitoring of these bio-toilets, a test/trial scheme has been prepared. This Test /Trial scheme may be divided mainly in two parts.

A) Visual inspection.

B) Quality check of the effluent discharged from bio toilet.

Period for monitoring of above Test /Trial scheme shall be 2 POH Period i.e. 36 months. Consolidated test / trial report shall be submitted to RDSO on 6 monthly basis.

To cater the requirement of doing these tests efficiently, it has also been proposed to provide suitable training to Railway staff by CAMTECH in liaison with DRDE so that proper monitoring can be ensured at appropriate level in the Zonal Railways. Some of the minor tests of effluent of bio-toilets have been proposed to be carried out by coaching depot staff at In-House Labs being setup at diesel sheds/ coaching depots for this purpose.

The sampling procedure and testing procedure of effluent discharge of IR-DRDO bio toilets has been tentatively finalized by DRDE based on the past experience of 12 months trial is attached as **Annexure - III** and **Annexure - V.**

## 2. VISUAL INSPECTION DURING FIELD TRIAL

The following parameters will be monitored during field trial by concern Railway in each trip.

**Date of Inspection……** **Coach No. ……**

**Type of coach ……..** **Toilet Variant……..…….**

| S. No. | Parameters to be checked | Observations/Remarks |
|---|---|---|
| 1. | Thorough inspection of mounting/securing arrangement for the bio-digester tank. | |
| 2. | Any leakage in joints/connections in the complete system including retention tank, air & water pipelines | |
| 3. | Adequacy of the provisions made for segregation of non-bio-degradable items. | |
| 4. | Functionality of all controls & indications i.e.<br>Flush button/lever<br>Water taps<br>Pneumatics operation efficiency (if any) | |
| 5. | Adequacy of flushing of the pan<br>a) By using pressurized flushing<br>b) By Normal manual flushing | |
| 6. | Any mal odour/stench Yes/No<br>(Specify if yes, Light, Medium or Heavy) | |
| 7. | Overall Cleanliness level of the toilet room | |

| | | |
|---|---|---|
| 8. | Notices for users and maintenance personnel in Hindi, English & Regional Language of the originating & destination station. | |
| 9. | Emergency operation of flush arrangement without power/air supply. | |
| 10. | Performance of non-bio-degradable waste ejection system. Its effectiveness and reliability.<br>a) Check operation of flapper/ ball valve, whether working satisfactorily (Yes/No).<br>If No, Give reason & remarks for malfunctioning.<br>b) Choking of toilet pan/ P-Trap (Yes/No)<br>If yes, Give reason & remarks for Choking. | |
| 11. | Tank evacuation date (if any) with coach number and date. | |
| 12 | Details of attention/maintenance required with coach number, date and time taken. | |
| 13 | Adequacy of strength & capacity of Waste treatment tank. | |

Consolidated trial report shall be sent by monitoring Railway to RDSO at the interval of 6 months in the prescribed format at **Annexure II**.

## 3. QUALITY CHECK OF THE EFFLUENT DISCHARGED FROM BIO TOILET

### 3.1 Sampling:.

i) Sample shall be collected from the toilet retention tank's sampling port in the nominated coaching depot/washing line on quarterly basis.

ii) Samples will be collected randomly – from lot of 5% coaches of the total coach holding but minimum one coach of each type.

iii) Sampling will start after coach is put into passenger service for 10 days or more.

iv) The samples should be collected as per specified detailed sampling procedure given in **Annexure-III** and sealed in the presence of railway representative.

### 3.2 Test Parameters:

For the quality check of effluent discharged from Bio-toilets, following parameters shall be tested.

| SN | Parameter (as per APHA Test Method). | Recommended Values | In-house/ Govt. Lab |
|---|---|---|---|
| 1 | pH | 6 to 9 | In-house /Govt. Lab |
| 2 | Total Solids | Max 750mg/100ml | In-house /Govt. Lab |
| 3 | TDS | 350mg/100 ml max. | In-house /Govt. Lab |
| 4 | COD levels | Max 2000 ppm | Govt. Lab |
| 5. | Volatile Solids | Max 500mg/100ml | In-house /Govt. Lab |
| 6. | Faecal Coliform | $<10^8$ CFU/100ml | Govt. Lab |

### 3.3 Testing Procedure:

i) Samples collected may be divided in two category one for In-house testing and second for Govt. Accredited Lab.

**ii)** The samples marked for Govt. Lab testing shall be transported to the nearest Govt. Accredited testing Labs listed in **Annexure IV** at the earliest. However prior consent for testing of the samples shall be required by the respective railway from such Govt. Approved Lab.

**iii)** Samples marked for in-house testing shall be tested as per test procedure attached at **Annexure V**

**iv)** The test results shall be furnished in prescribed format attached as **Annexure-I.**

**v)** The necessary record of monitoring and testing should also be maintained & kept in the concerned depots in the format of **Annexure –I**.

vi) In case of samples not meeting the requirements, tests will be repeated after taking necessary corrective actions within a fortnight.

Consolidated all the test reports (In-House/Govt. Approved Labs) of effluent discharge shall be submitted to RDSO on Six monthly basis.

**Annexure-I**

**Date of Sampling: .....** **Date of Lab Testing: .....**

| **Coach No.** | **Variant of Bio-digester** | **Observations/Results** | | | | | |
|---|---|---|---|---|---|---|---|
| | | **pH Value** | **Total Solids** (mg/100ml) | **TDS** (mg/ 100ml) | **COD Level** (ppm) | **Volatile Solids** (mg/100ml) | **Faecal Coliform Count** (MPN/ 100ml) |
| | | | | | | | |
| | | | | | | | |

Signature of Evaluating Authority :

Name & Designation :

Seal :

**Annexure -II**

| **Field Trial of Bio-Toilet (IR-DRDO Technology) on Indian Railway Passenger Coaches** | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Train No…… Rake No……. Coach No. ……....Date……Name of SE/ JE R/ Maint……** | | | | | | | | | | | | | | | | | | |
| **Sl. No.** | **Parameters to be checked**<br>**Coach no.** | | | | | | | | | | | | | | | | | |
| 1. | Thorough inspection of mounting / securing arrangement for the bio-digester tank. | | | | | | | | | | | | | | | | | |
| 2. | Any leakage in joints/ connections in the complete system including retention tank, water pipe line. | | | | | | | | | | | | | | | | | |
| 3. | Adequacy of the provisions made for segregation of non bio-degradable items. | | | | | | | | | | | | | | | | | |
| 4. | Functionality of flush buttons/ lever & water tabs | | | | | | | | | | | | | | | | | |
| 5. | Adequacy of the flushing of the pan | | | | | | | | | | | | | | | | | |
| | (a) By using pressurized flushing<br>(b) By normal manual flushing | | | | | | | | | | | | | | | | | |
| 6. | Any mal odour/ stench: (yes/No),<br>if yes, please specify Light, medium or Heavy | | | | | | | | | | | | | | | | | |
| 7. | Overall cleanliness level of the toilet room. | | | | | | | | | | | | | | | | | |
| 8. | Notices for users and maintenance personal in Hindi/English & regional language of the originating & destination station. | | | | | | | | | | | | | | | | | |
| 9. | Emergency operation of flush arrangement without power / air supply. | | | | | | | | | | | | | | | | | |
| 10. | Performance of non-bio-degradable waste ejection system its effectiveness and reliability.<br>a. Check operation of flapper / Ball valve whether working satisfactorily (Yes/ No),<br>If no, give reasons and remarks for malfunctioning.<br>b. Choking of toilet pan/ P-Trap (Yes/ No),<br>If yes give reasons and remarks for choking. | | | | | | | | | | | | | | | | | |
| 11. | Tank evacuation date (if any) with coach No. and date. | | | | | | | | | | | | | | | | | |
| 12. | Details of attentions / maintenance required with coach no. , date and time taken for maintenance. | | | | | | | | | | | | | | | | | |
| 13. | Adequacy of strength & capacity of waste treatment tank | | | | | | | | | | | | | | | | | |

**Annexure-III**

## EFFLUENT SAMPLING PROCEDURE

**Objective:** Procedures to be followed for collection of valid and representative effluent samples from bio-digester.

**Scope:** This document contains the procedure that should be followed to collect effluent samples from bio-digester for analysis of physiochemical and biological parameters. The sample size is small enough in volume to be transported conveniently and yet large enough for analytical purposes.

**Requirements:**

| | |
|---|---|
| Sample container | -Autoclavable plastic (polyethylene or equivalent) /Glass container marked in red/black for effluent samples. |
| Refrigerator | -For storage of samples. |

**Description:**

**General Requirements:**

- Ensure all sample equipment and containers are clean and quality assured before use.
- Use sample containers that are clean and free of contaminants.
- Fill sample containers without pre-rinsing with sample; pre-rinsing results in loss of any pre-added preservative and sometimes can bias results high when certain components adhere to the sides of the container. ).
- Leave an air space approximately 10% of the container volume to allow for thermal expansion during shipment.
- Collect samples 2-3 times from the same source with 2 minutes interval between each of them and make composite sample, take necessary amount and use it for analysis.
- Make record of every sample collected and identify every bottle with a unique sample number, preferably by attaching an appropriately inscribed tag or label.
- In unique identification number write/mention name of the sampler, date of sample collection, train No/Name of sample, coach no, toilet no.
- Use water proof ink to record all information (preferably with black, non solvent based ink).
- Maintain the sampling information in bound sample log book at the sampling site at the time of sample collection.
- Always prohibit eating, drinking, or smoking near samples, sampling locations, and in the laboratory.

## Collection of samples:

1. **Sample collection guidelines:**
   - Collect sample from the bio-digester 30 minutes after the train becomes stationery/still.
   - Sample should be collected from sampling port only, in case sampling port is not there, can be collected from effluent discharge port.
   - If water is not draining from sample port remove the debris which may plugged the sample port by iron wire and let it drain for 2 minutes and collect composite sample.
   - Even after cleaning of sampling port, if water is not draining from sample port, flush mild steam of water with intermittent pause for 5 minutes into the bio-digester. Collect composite sample.
   - Too much of water also should not be flushed.

**2. Type of sample**
   - Composite sampling may be done by combining small portions of multiple grab samples taken from the same Bio-digester.
   - Collect individual portions in a wide mouth bottle every 2 min and mix it at the end of the sampling period or combine in a single bottle as collected.

**3. Sampling methods**
   - Manual sampling may be used for routine sampling programmes.
   - Trained field technician is often necessary for sample collection.

**4. Sample containers:**
   - Containers are typically made of plastic (PTFE Poly Tetra Fluoro Ethylene) or glass may be used.
   - The containers cap should made of foil or PTFE liners.
   - In rare situations it may be necessary to use containers not specifically prepared for use, or otherwise unsuitable for particular situation.
   - Please thoroughly document these situations.
   - For QA purposes the inclusion of a bottle blank may be necessary.

**5. Number of samples:**
   - Because of variability from analytical and sampling procedures (i.e. population variability) small number of samples is insufficient to reach any reasonable desired level of confidence.
   - Minimum three consecutive sampling has to be done from same Bio-toilet to draw conclusion.

**6. Sample volume:**
   - Collect 1 L of sample for most physical and chemical analyses.
   - Always collect enough sample volume in appropriate container in order to comply with sample handling, storage and preservation requirements.

**7. Check the sample for the following:**

**Quantity** -Does the sample have sufficient quantity (500 -1000ml)

**Label** -*Label on the container* should bear the following details:
Name of sample/train no, Date of collection, Sample no.
Integrity of the seal across the sample should be checked.

**8. Person handling the sample:**

- If leakage is observed, wipe the container with cotton soaked in spirit and transfer the specimen into a new container, held by an assistant, Label the new container.
- Wear proper hand gloves, apron, face mask and goggles for personal safety of the sample handler.

**9. Storage and preservation:**

- In general, shorter the time that elapses between collection of a sample and its analysis, the more reliable will be the analytical results.
- Analyse the samples as quickly as possible on arrival at the laboratory.
- Samples should be stored in refrigeration (~4°C) but above freezing to avoid Changes caused by the growth of micro-organisms.

**10. Disposal of remaining sample & waste:**

- Hold the samples for the prescribed amount of time for the project or un till the data have been reviewed and accepted.
- Discard the gloves, plastic bags, paper and cotton wool that were used for receiving the specimen into the disposal bin.
- Discard the Fecal coli form growth after autoclaving.
- Discard the remaining samples after treatment with Bleaching powder/sodium hypochlorite (5 -10 %).

## Annexure IV

## Central Pollution Control Board

**ENVIRONMENTAL LABORATORIES WITH VALID RECOGNITION UNDER SECTION 12(1} B OF THE ENVIRONMENT (PROTECTION) ACT, 1986**

The Environmental laboratories (Govt./Semi-Govt./Public Sector Undertakings/Educational Institutes) with valid recognition (updated upto 15th April, 2012) under the Environment (Protection) Act, 1986 are as below:

| S. No. | Name of laboratory | Group of parameters | Gazette notification no. and date | Validity upto |
|---|---|---|---|---|
| 1. | Goa State Pollution Control Board EDC Plaza Patto, Panaji, Goa-403001 | Physical, Chemical, Microbiological, and Air Pollution parameters for analysis of ambient air, source emission and micro-meteorological parameters. | Legal *42(3}/87* dated 111 October, 2007 | 30th September, 2012 |
| 2. | Centre Laboratory Madhya Pradesh Pollution Control Board ·"Paryavaran Parisar", E-5, Arera Colony BhopaI-462 018. M. P. | Physical. Chemical, Microbiological. Toxicological and Air Pollution parameters for analysis of ambient air, sources emission and micro-meteorological parameters. | Legal *42(3)/87* dated 1" October, 2007 | 30th September, 2012 |
| 3. | Eco-Auditing Laboratory National Botanical Research Institute Rana Pratap Marg, Lucknow-228 001 U.P. | Physical. Chemical, Microbiological, and Air Pollution parameters for analysis of ambient air, source emission and micro-meteorological parameters. | Legal *42(3)187* dated 1st October, 2007 | 30th September, 2012 |
| 4. | Zonal Office Laboratory, Central Pollution Control Board Synergy House-II Gorwa Subhanpura Road Subhanpura Vadodara-390 023 ,Gujarat . | Physical, Chemical, Microbiological. Toxicological and Air Pollution parameters for analysis of ambient air, source emission and micro-meteorological parameters. | LegaI42(3)/87 dated 1st October, 2007 | 30th September, 2012 |
| 5. | Central Laboratory Pollution Control Board. Assam BamunimaidanGuwahati-781 021. Assam | Physical. Chemical. Microbiological, Toxicological and Air PoIll.1ion parameters for analysis of ambient air, 80Ures emission and micro-meteorological parameter. | Legal 42(3)/87 dated 1-February, 2008 | 31" January, 2013 |
| 6. | Environmental Management Division Central Pulp & Paper Research Institute, Post Box No. 174, Paper Mills Road, Himmat Nagar Saharanpur 247001,U.P. | Physical, Chemical. Microbiological, Toxicological. biological and Air Pollution parameters for analysis of ambient air. source emission and micro-meteorological parameters. | Legal 42(3)/87 dated 101 February, 2008 | 31" January, 2013 |

| S. No. | Name of laboratory | Group of parameters | Gazette notification no. and date | Validity upto |
|---|---|---|---|---|
| 7. | Central Laboratory National Fertilizers Limited Vijaipur Unit,Vijaipur-743111 Tehsil-Raghogarh Dist.Guna, M. P. | Physical. Chemical, Microbiological. Toxicological and Air Pollution parameters for analysis of ambient air. source emission and micro-meteorological parameters. | LegaI42(3)187 dated 1st February, 2008 | 31st January, 2013 |
| 8. | Central Laboratory Andhra Pradesh Pollution Control Board A-3. Industrial Estate Sanathnagar Hyderabad-500 018 Andhra Pradesh | Physical. Chemical. Organics Microbiological. Toxicological. Biological. Hazardous Waste and 1Jr Pollution parameters for analysis of ambient air. Source emission and micro-meteorological parameters. | Legal 42(3)/87 dated 1st February, 2008 | 31st January, 2013 |
| 9. | Gujarat Pollution Control Board, Regional Office -Surat 338, Typical First Floor Belgium Square Sliver Plaza Complex, Opp. Linear Bus Stand, Ring Road Surat-395 003, Gujarat | Physical. Chemical. Organics Microbiological. Toxicological. and Air Pollution parameters for analysis of ambient air. source emission. noise. vehicular emission and micro-meteorological parameters | Legal42(3)187 dated 1st February. 2008 | 31st January. 2013 |
| *10.* | Gujarat Pollution Control Board Regional 0fI'ice Laboratory-Vadodara Geri Compound Race Course. Opp. S. T. Depot Vadodara-390 007 Gujarat | Physical. Chemical, Organics Micro biological. Toxicological. and Air Pollution parameters for analysis of ambient air, .source emission. noise. vehicular emission and micro-meteorological parameters | Legal42(3)187 dated 1st February, 2008 | 31st January, 2013 |
| 11. | Regional Office Laboratory-Rajkot Gujarat Pollution Control Board Race Course. Ring Road **Near Union** Bank, Rajkot-360 001 Gujarat | Physical. Chemical. Organics Microbiological. Toxicological. and Air Pollution parameters for analysis of ambient air. source emission. noise. vehicular emission and micro-meteorological parameters | Legal *42(3)/87* dated 1st February. 2008 | 31st January. *2013* |
| 12. | Environmental Laboratory Central Mine Planning & Design Institute limited Gondwana Place ,Kanke Road, Ranchi-834 008. Jharkhand | Physical. Chemical, Microbiological, and Air Pollution parameters for analysis of ambient air. source emission and micro-meteorological parameters. | Legal *42(3)/87* dated 1st February. 2008 | 31st January. 2013 |
| 13. | Pollution Control Research institute, Bharat Heavy Electricals Limited Ranipur. Haridwar-249 403 Uttarakhand | Physical. Chemical. Microbiological. Toxicological and Air Pollution parameters for analysis of ambient air. source emission. and, micro-meteorological parameters. | Legal *42(3)/87* dated 1st April. 2008 | 31st March. 2013 |

| S.No. | Name of laboratory | Group of parameters | Gazette notification no. and date | Validity upto |
|---|---|---|---|---|
| 14. | Central Laboratory Central Pollution Control Board Parivesh Bhawan East Arjun Nagar Delhi-110032 | Physical. General and non- Metallic. Metals. Organics. Microbiological. Toxicological Biological, Hazardous Wastes, Soil, Sludge, Sediments and Air Pollution parameters for analysis of ambient air, source emission. noise and micro-meteorological parameters, | Legal42(3)J87 dated 1st October, 2009 | 30th September. 2014 |
| 15. | Central Laboratory Punjab Pollution Control Board Vatavaran Bhawan. PatiaIa, Punjab-147001 | Physical, General Chemical and non-Metallic, Metals, Organics, Microbiological, Toxicological Biological, Hazardous wastes. Soil. Sludge, Sediments and Air Pollution Parameters for analysis of ambient air, source emission, noise and micro-meteorological &vehicular emission monitoring parameters, | Legal42(3)/87 dated 15th January. 2010 | 14th January. 2015 |
| 16. | Regional Laboratory Maharashtra Pollution Board Control Jog Centre, 3td Floor, Puna-Mumbai Road, Shivaji Nagar. Pune-411003 | Physical, General, Chemical and non-Metallic, Metals, Organics, Microbiological, Toxicological, Hazardous wastes, Soil, Sludge, Sediments and Air Pollution parameters for analysis of ambient air, source emission, noise and micro-meteorological parameters. | Legal 42(3)/87 dated 15 January, 2010 | 14thJanuary, 2015 |
| 17, | Zonal Laboratory Central Pollution Control Board, Zonal office , Kolkata 502, South end Conclave, 1582 Rajdanga Main Road KoIkata700107 | Physical, General, Chemical and non-Metallic. Metals, Organics, Microbiological, Toxicological Biological, Hazardous Wastes, Soli, Sludge, Sediments and Air Pollution parameters for analysis of ambient air, source emission, noise and micro-meteorological& vehicular emission monitoring parameters, | Legal42(3)J87 dated 15 January, 2010 | 14th January. 2015 |
| 18. | Environment Protection Training and Research Institute (EPTRI), *91/4,* Gachi BowIi. Hyderabad. 500032 Andhra Pradesh | Physical, General, Chemical and non-Metallic, Metals, Organics, Microbiological. Toxicological Biological, Hazardous Wastes, Soil, Sludge. Sediments and-Air Pollution parameters for analysis of ambient air, source emission, noise and micro-meteorological Parameters, | Ler-142(3)/87 dated 20 September. 2010 | 19th September, 2015 |
| 19. | P.G. Department of Environment Management Chhatrapati Shahu Institute of Business Education and Research (SIBER). University Road, KoIhapur. 416004 Maharashtra | Physical, General, Chemical and non-Metallic, Metal, Organics, Microbiological, Toxicological, Biological, and Air Pollution parameters for analysis of ambient air, source emission, and micro-meteorological parameters. | Legal *42(3)/87* dated 20 September. 2010 | 19th September. 2015 |

| S. No. | Name of laboratory | Group of parameter's | Gazette notification no. and date | Validity upto |
|---|---|---|---|---|
| 20. | Punjab Bio-Technology Incubator Agri. And Food. testing Laboratory SCO: 7 & 8 (Top Floor). Phase.V, SAS Nagar. Mohali-160059 Punjab. | Physical, General. Chemical and non-Metallic. Metals. Organics, Microbiological. Toxicological. Hazardous Wastes, Soil. Sludge. Sediments and Ai Pollution parameters for analysis of ambient air, source emission, and micrometeorological parameters. | Legal42(3)187 dated 20th September. 2010 | 19th Septemb er, 2015 |
| 21. | Regional Laboratory Maharashtra State Pollution Control Board 6thFloor, "Udyog Bhawan" Civil Lines Nagpur-440001 Maharashtra | Physical. General. Chemical and non-Metallic, Metals. Organics, Microbiological, Toxicological Biological. Hazardous Wastes, Soil, Sludge, Sediments and Air Pollution parameters for analysis of ambient air, source emission. noise and micro-meteorological parameters. | Legal *42(3)/87* dated 2ndJanuary. 2011 | 26th January, 2016 |
| 22. | Regional Laboratory Maharashtra State Pollution Control Board 1stFloor Udyog Bhawan. Rathi Chowk, Trimbak Road,Nashik-422007 Maharashtra | Physical, General, Chemical and non-Metallic, Metals, Organics, Microbiological, Toxicological Biological, Hazardous wastes, Soil, Sludge, Sediments and Air Pollution parameters for analysis of ambient air, source emission, noise and micro-meteorological parameters. | Legal *42(3)187* dated 27th January, 2011 | 26th January, 2016 |
| 23. | Regional Laboratory Maharashtra State Pollution Control Board "Paryavaran Bhavan" A-4/1,Chikalthana MIDC, Behind Dhoot Hospital, Aurangabad·431210 Maharashtra | Physical, General, Chemical and non-Metallic, Metals, Organics, Microbiological. Toxicological Biological, Hazardous Wastes, Soil. Sludge, Sediments and Air Pollution parameters for analysis of ambient air, source emission, noise and micro-meteorological Parameters. | Legal *42(3)187* dated 27th January. 2011 | 26th January. 2016 |
| 24. | Central Laboratery Uttar Pradesh Pollution Control Board PICUP Bhawan, 3rd Floor, B-Block Vibhuti Khand, Gomati Nagar Lucknow.226010 U.P. | Physical, General, Chemical and non-Metallic, Metals, Organics. Microbiological. Toxicological. Soil, Sludge. Sediments and Air Pollution parameters for analysis of ambient air, source emission, noise and micro-meteorological parameters. | Legal42(3)187 dated 31st January, 2012 | • |
| 25. | Regional Laboratory M.P. Pollution Control Board Plot No, 455/456, Vijay Nagar. Jabalpur-482002 Madhya Pradesh | Physical. General, Chemical and non-Metallic, Metals, Organics, Microbiological, Toxicological, Soli. Sludge, Sediments and Air Pollution parameters for analysis of ambient air, source emission, noise and micro-meteorological Parameters. | Legal *42(3)/87* dated 31st January. 2012 | • |

| S. No. | Name of laboratory | Group of parameters | Gazette notification no. and date | Validity upto |
|---|---|---|---|---|
| 26. | Regional Laboratory M.P. Pollution Control Board Sc-17,Bharatpuri Ujjain-456010 Madhya Pradesh | Physical, General, Chemical and non-Metallic, Metals, Organics, Microbiological, Toxicological, Soil, Sludge, Sediments and Air Pollution parameters for analysis of ambient air, source emission, noise and micro-meteorological parameters. | Legal 42(3)187 dated 31st January, 2012 | • |
| 27. | Regional Laboratory M.P. Pollution Control Board Scheme No.-78 Part-II. Aranya Nagar Indore 452010 Madhya Pradesh | Physical, General, Chemical and non-Metallic, Metals, Organics, Microbiological. Toxicological. Soil. Sludge, Sediment; -and Air Pollution parameters for analysis of ambient air, source emission, noise and micro-meteorological parameters. | Legal 42(3)/87 dated 31st January, 2012 | • |

- Environmental laboratories and the Government Analysis so mentioned shall remain valid only up to 31" Aug 2012 as per provision of office memorandum dated 12th AUG 2011 Issued by ministry of Environment & forest to acquire the required accreditation / certification to achieve eligibility under the essential pre-requisite or office memorandum.

***By Fax / Post***

Phone : 2233490, 2340245
Fax : 0751- 2341148
Gram : DEFRES
E-mail : drde@sancharnet.in


No. : TC-25/05160/ 2012
Defence Res. & Dev. Establishment,
Govt. of India, Ministry of Defence,
Jhansi Road, Gwalior - 474 002.

Date : 07 June, 2012

All Correspondence should be addressed to the Director only

Fax No. 0522-2458500

To,

Director
Research Design & Standards Organisation
Govt. of India Ministry of Defence
Lucknow - 226011

Sub: **List of the ToT holders for Biodigesters & Supply of Inoculum for Railways**

Ref: Your office letter No. MC/CB/LF/Anaerobic dated 14.05.2012

With reference to above subject, the list of the ToT holders for biodigesters and supply of bacterial Inoculums for railway is enclosed herewith for your necessary action please.

(A.C. Pandey)
Head TC & HRD
For Director

Encls :

(i) List of the ToT holders

# List of the TOT holders for Biodigesters

| Sr. No. | Name and Address of Firms |
|---|---|
| 1. | M/s S.B. Equipments<br>309 Durga Chambers,<br>1333 D.B. Gupta Road, Karol Bagh<br>**New Delhi – 110 005.** |
| 2. | M/s Aikon Technologies Pvt. Ltd.<br>58, Khan Market,<br>**New Delhi. – 110 003.** |
| 3. | M/s Dass Hitachi Ltd.<br>8/9, Milestone, GT Road Sahibabad, |
| 4. | M/s Alfa Therm Limited<br>6, Community Centre,<br>Mayapuri, Phase-I,<br>**New Delhi – 110 064.** |
| 5. | M/s Stone India Limited (SIL)<br>16, Taratalla Road,<br>**Kolkata – 700 088.** |
| 6. | M/s Mohan Rail Components (P) Ltd.,<br>Opp. Rail Coach Factory,<br>Hussainpur, **Kapurthala – 144 602** |
| 7. | M/s Thakar Equipment Company<br>66, Okhla Industrial Estate, (Phase-II)<br>**New Delhi – 110 020.** |
| 8. | M/s Kemrock Industries & Exports Ltd.<br>Survey No. 120/2, At Village Asoj,<br>Vadodara-Halbol Express Way, Ta.Waghodia,<br>**Vadodara – 391 510.** |
| 9. | M/s Flexo Foam Pvt. Ltd.<br>R-838, New Rajendra Nagar,<br>**New Delhi – 110 005.** |
| 10. | M/s Omax Autos Limited<br>Plot No.-26, (4 Bays),<br>Institutional Area, Sector-32,F<br>**Gurgaon – 122 001 (HR).** |
| 11. | M/s Escorts Limited , 11,<br>Scindia House, Connaught Circus,<br>**New Delhi -110 001.** |
| 12. | M/s CBS Technologies Pvt. Ltd.<br>48-C, Pocket-C (HIG) SFS Flats,<br>SFS Flats, Mayur Vihar, Phase-III,<br>**Delhi – 110 096.** |

| Sr. No. | Name and Address of Firms |
|---|---|
| 13. | M/s Daulat Ram Industries<br>10-E, Industrial Area, Govindpura,<br>**Bhopal – 462 023.** |
| 14. | M/s Darshan Enterprises<br>38-39, DSIDC Complex, Scheme-III,<br>Okhla Industrial Area, Phase-III<br>**New Delhi - 110 020.** |
| 15. | M/s Rail Tech<br>5625, Qutab Road,<br>**New Delhi -110 055.** |
| 16. | M/s Rail Coach Engrs.,<br>Outside Octroi Post,<br>Near Village Barindpur, PO Sheikhpur Distt.: **Kapurthala** |
| 17. | M/s CTS Management Services P. Ltd., E-52, Second Floor, Sector-03<br>**Noida (UP) – 201 301.** |
| 18. | M/s Faiveley Transport India Limited<br>P.B. No. 39, Harita,Horita<br>**Hosur – 635 109 (T.N.)** |
| 19. | M/s Saranya Electronics Ltd.<br>PlotNo.A-7/1 2nd Floor,<br>Electronics Complex, Kushalguda<br>**Hyderabad – 500 062.** |
| 20. | M/s Sidwal Refrigeration Ind. Ltd.<br>108-A, Madangir,<br>**New Delhi - 62.** |
| 21. | M/s Pushpa Enterprises,<br>A-5/24 Pashcim Vihar<br>**New Delhi – 110 063.** |
| 22. | M/s Samudra Shipyard (P) Ltd.,<br>PB No. 10 Chemical Industrial Estate,<br>**Aroor – 688 534.(Kerala)** |
| 23. | M/s Alfa System & Services,<br>E-19-C, Sector 8,Noida 201301 UP |
| 24. | M/s Shri Ram Raja Wood Packers,<br>905-906, Silver Estate, University Road, 474 009, Gwalior, |
| 25. | M/s Go Green Solution Pvt., Ltd.,<br>1, Samarth Nagar (w), Ajni Sq.,<br>Wardha Road, Nagpur – 15. |
| 26. | M/s Anjana Steel Industries Pvt., Ltd.,<br>Dhirganga More, NH-2 Delhi Road,<br>Baidyabati, Distt Hoogly (WB) |
| 27. | M/s E-Pack Polymers,<br>2584 Rohatgi Mansion,<br>2nd Floor, Hamilton Road,,Delhi,110 006 |

| Sr. No. | Name and Address of Firms |
|---|---|
| 28. | M/s Airflow Equipments (India) P. Ltd.,<br>9 Chellaiamman Koil Street Chennai-600117 |
| 29. | M/s Super Flow Engg. Corp., Parking No.1, Transport Nagar, Gwalior |
| 30. | M/s Maan Enviro Technologies,<br>Plot No.38-39 Mangalmurti Naulakha<br>Sq. Nemawar Road Indore |
| 31. | M/s Banka Enterprises<br>A-111, Express Apartment,<br>Lakdi-Ka-Pool,<br>**Hyderabad – 500 004.** |
| 32. | M/s Besco Limited (Foundry Division)<br>7th Floor, Poonam, 5/2 Russel Street<br>**Kolkata – 700 071** |
| **33** | **Moti bagh Workshop, Nagpur** |
| **34** | **DRDE, Gwalior** |

## Bio-Toilet Maintenance Proforma

| Lavatories arrived choked and cleared during Maintenance | | | | | | |
|---|---|---|---|---|---|---|
| **S.No.** | **Date** | **Coach No. Manufacturer/ CLASS/ VARIANT** | **Lavatory Number** | **Reason for choking** | **Signature of Railway Engineer** | **Signature of representative of AMOC Agency** |
| 1. | | | | | | |
| 2. | | | | | | |
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| 22. | | | | | | |

**Remarks: Description of choked lavatory & leakages.**

**GOVERNMENT OF INDIA**
**MINISTRY OF RAILWAYS**
**(RAILWAY BOARD)**

No. 2000/M(C)/141/8 Vol.V

New Delhi, dt. 19.10.2012

**Chief Mechanical Engineers,**
**CR, NCR, NR, NER, NFR, SECR, SR, WR, NWR & WCR.**

**Chief Mechanical Engineers,**
**ICF/Chennai,**
**RCR/Kapurthala.**

**Sub: Environment friendly IR-DRDO Bio-toilets to IR coaches.**
**Ref: Board's letter No.2009/Dev.Cell/ICCI/I Vol.II dated 18.11.2011.**

Issue of turning out the Bio-toilet fitted coaches from PUs as per Para (i) of above referred letter in the rake form was examined in the Board and following has been decided:

i) While it is preferable to turn out coaches fitted with Bio-toilets in rake form, PUs can also turn out such coaches in part rakes/piecemeal.

ii) Bio-toilets should be fitted in coaches which are allotted to CR, NCR, NR, NER, NFR, SECR, SR and WR as per para (v) of letter under reference.

iii) Railways receiving part rakes/coaches fitted with Bio-toilets in piecemeal shall amalgamate and run them preferably in one train/rake for ease in monitoring.

iv) All Bio-toilets under AMC by one particular agency be fitted preferably in one rake for ease in maintenance.

v) Such Bio-toilets should be fitted in preferably long distance trains to the extent possible to enable passengers to use them extensively particularly in the mornings. Such intensive and heavy usage of Bio-toilets would bring out any issues related to its design/fitment.

vi) Secondary/Terminating railway should preferably be nominated railways as per para (v) of letter under reference.

Notwithstanding above, coaches which are to be turned out strictly in the rake form owing to specific instructions of the Board, should be despatched in the complete rake form.

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Other instructions contained in the letter under reference should be followed without any diviation.

18/10/12

**(Prashant Kumar)**
**Dir. Mech. Engg. (Chg.)**
**Railway Board**

**Copy for information and necessary action to:**

- CDE/RCF/Kapurthala, CDE/ICF/Chennai, ED (Carriage)/RDSO, CWM/CRWS/BPL, ED/IR-CAMTECH/GWL, CRSE(Chg.)/NR, CRSE(Chg)/NCR, CRSE(Chg)/SECR

- EDME (Dev.), Railway Board

# Monitoring, Operation and maintenance of IR-DRDO Bio-Toilets.

**(Railway Board's L.No. 2009/Dev.Cell/ICCI/1 Vol.IV Dated 24.12.2012)**

1. Ensure that no Bio-toilet coach is put in service without charging of bacteria in bio-tanks.
2. Base all Bio-toilet coaches at single nominated depot as of now.
3. Put these coaches in service in rake form, to the extent possible.
4. Ensure use of proper cleaning agents as prescribed by RDSO to avoid any adverse effect on bacteria in the Bio-tanks.
5. Have spares/consumable as per the holding of Bio-toilet coaches.
6. Keep performance record and take passenger/staff feedback regularly.
7. Carry out monitoring as per trial/test scheme issued by RDSO.
8. Enter AMOC with supplier(s) as per RDSO instructions/guidelines.

In past, there were incidents of failure of welding of mounting brackets. Recently, NR has reported the breakage of safety wire ropes provided to hold the bio-tanks in case of bracket weld failure. For fail-safe operation of these bio-toilet coaches, all Railways must ensure –

1. The regular/periodic inspection of welding of mounting brackets.
2. The regular/periodic inspection of safety wire ropes and
3. That fasteners for bio-tanks/safety wire ropes are intact.

Corrective/preventive action must be taken immediately, if anything abnormal is found.

## Responsibility and job distribution for maintenance of Bio-Toilet

SUPERVISOR**:** will be fully responsible in all respect for any failure in maintenance and record keeping of Bio-toilets.

a) STAFF DEPUTED FOR INSIDE EXAMINATION: To check Condition of Chlorinator assembly for any leakage, tilting, sampling port blockage and drain cock for being defective or deficient

b) STAFF DEPUTED FOR SIDE EXAMINATION: To check mounting and securing arrangement for bio-tank fitted at their side for following items

- **J bracket for Welding failure**
- **Mounting bolt for threads missing/broken/deficient/loose a*nd breakage***
- **Safety wire rope for proper securing and any kind of shear**
- **P-trap assembly for any eccentricity or any other defect**
- **Any physical damage in Bio-toilet tank**

c) STAFF DEPUTED FOR PIPE FITTING EXAMINATION: Whole pipe fitting in Bio-toilet including proper attention to flushing system.

d) STAFF DEPUTED FOR CARPENTRY WORK: to check and ensure proper fitting of dust bin provided in Bio-toilet and all other fittings including panel and ceiling.

1. **Cleaning practices adopted :** Group "D" staff who has deputed for cleaning work will ensure that

a) She/he will wear hand gloves, face mask and gumboots.

b) No bio-toilet will bypassed by paddle operation before cleaning. Any blockage /choking will be removed by Choke Removing Gadgets and choking article will be kept in bucket before disposal to dust bins provided at washing line. Choke removing gadgets and buckets are available in sub store round the clock.

c) After cleaning of ball valve, it will be lubricated and checked for smooth operation.

d) No acid treatment will be done in bio toilet coaches

e) If any foul smell noticed from any bio-toilet after cleaning he will immediately inform to concerned supervisor and after his consent top up the tank by 15 Ltrs of bacteria.

## 2. Check list for good working of bio toilets :

| Check List of Items along with corrective action for ensuring a good working Bio-Toilet | | | |
|---|---|---|---|
| **S.No.** | **Items to be checked** | **Details of check** | **Corrective action** |
| **1.** | Mounting/ Securing Arrangement | a. Check mounting bolts and J-brackets for any welding defects. | Repair work to be done at washing/sick line as per condition. |
| | | b. Check condition of safety wire rope for proper securing and any damage of strands. | Replacement to be done if strands are damaged. |
| | | c. Check availability of chlorine tablets in chlorinator.<br>d. Condition of chlorinator assembly for any tilling & leakage from threads. | Ensure recharging by chlorine tablet when required.<br><br>Repair work to be done at washing line /sick line if required. |
| | | e. Check condition of flexible Rubber connector for any leakage, tearing and securing of clamp. | Repair /replacement to be done as per condition. |
| | | f. Check over flow for fecal material from Rubber gasket provided between tank body and top plate of Bio-tank instead of drain port of chlorinator. | Dismount the chlorinator at washing line, remove the choking at exit/outlet port and thus again mount the chlorinator. |
| **2.** | Flushing Systems | Functionality of flush valve, flush pipe including fish tail for proper flushing without leakage. | Repair /replacement to be done as per condition. |
| **3.** | By-pass Mechanism | Check By-pass mechanism by operation of paddle / Handle only after removal of choking if any. | Proper lubrication and replacement of spares if required. |
| **4.** | Choking on arrival | Choking of P-trap at inlet as well as inside of it. | All gadgets as advised by Nodal Centre –DEE are to be used. |
| **5.** | Foul Smell | Any foul smell noticed after removal of choking and cleaning of toilet. | 1. Topping up with bacteria with check after one week.<br>2. Send the sample for lab testing after one week |

### 3. Daily Maintenance Performa for Bio-toilets:

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Depot:-** | **……..** | | | | | **BIO TOILET POSITION ON ARRIVAL** | | | | | | |
| Date | Train No. | Coach No. | BT No. | Green Tape | Sticker: On Lav. Door | Sticker: In side of Lav. | Dustbin | Condition of Ball valve | Choking | Flush Status | Condition of 'J' bracket welding | Condition of wire ropes |
| | | | | | | | | | | | | |

| **AFTER MAINTENANCE BEFORE WITHDRAWL OF RAKE FROM WASHING LINE** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Ball vale Condition | | | Foul smell notice if any | Discharge from chlorinator or Tank over flow | Condition of 'J' bracket welding | Condition of wire ropes | Remakes |
| Closed | Partially open | By passed | | | | | |

### 4. Choke Removing gadgets in used:

| S.N. | Name of Gadget | Photo |
|---|---|---|
| 1. | Garbage Picking Tong |  |
| 2. | Conventional Choke Remover |   |

# Provision of Stickers in Bio-Toilets

भारतीय रेल को बायोटॉयलेट हरित क्रान्ति में सहयोग प्रदान करैं।

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# Kindly help the Railways for IR-DRDO Green Bio Toilet System

## Instructions for Coach Maintenance Staff

### This is Bio-Toilet- Hence during Maintenance-

- **Remove Bottles, newspapers, napkins, polybages, sanitary cloths etc. from toilet chute.**
- **Do flushing in each bio-toilet to check choking of P-trap.**
- **In case of choking of Bio-toilet at train examination station, operate foot paddle in toilet if available.**

- **In case of defect in foot paddle, remove choking of P-trap with the help of "Choke Remover".**
- **At train examination station, get the portable dustbin cleaned which is available in toilet.**

- **At CTS station, clean the Bio-toilet properly.**

## P-Trap choke (

पहले वॉल–वाल्व को ओपिन करैं जिससे कि P-Trap assembly का कचरा नीचे गिर जावे। इसके पश्चात वॉल वाल्व को बन्द करें। इसके पश्चात flusher को चलाएं, यदि P-Trap चोक है तो पानी उसमें ऊपर तक भर जाएगा। इस पानी भरी स्थिति में इस बने हुये यन्त्र/को प्रेशर के साथ दवायेगें (यह यन्त्र water tight होना चाहिये) इस दबाव के कारण P-Trap का कचरा वायो डायजेस्टर में चला जाएगा एवं वह खुल जाएगा। यदि नहीं खुलता है तो पुनः पानी भरेंगे फिर प्रेशर से यंत्र को दबाएंगे। जब तक P-Trap खुल नहीं जाता, इस process को दोहराते रहेगें।

**P-Trap chokes Remover**