Guidelines
For
POH of Bio-Toilet
Fitted Coaches

(For official use only)
IRCAMTECH/MECH/GWL/POH/Bio-Toilet
JULY - 2015

Indian Railways
Centre for Advanced Maintenance Technology

MAHARAJPUR, GWALIOR--474005
Preface

On the basis of MoU between Indian Railways and DRDO, the bio toilet trial on IR is going on. As per Railway Boards guidelines, the bio-toilet tanks i.e. Bio digesters are being fitted in the new coaches being turned out from RCF. At present, POH and retro-fitment work are being carried out in Railway Workshops. Guidelines for POH of Bio-Toilet fitted Coaches has been prepared by CAMTECH with the objective that those involved in maintenance of coaching stock in workshop must be aware of functioning and correct maintenance procedure of Bio-Toilet system.

The purpose of these Guidelines to improve knowledge of Workshop staff about maintenance procedure of Bio-Toilet fitted Coaches received for POH in Railway Workshops. Guidelines are also useful for retrofitment work of Bio-Toilet system.

It is clarified that this handbook does not supersede any existing procedures and practices laid down in the maintenance instructions issued by manufacturers or by Railway Board/RDSO.

July, 2015

Place: CAMTECH/GWL

(K.P. Yadav)
Director / Mechanical
CAMTECH/Gwalior
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CORRECTION SLIPS

The correction slips to be issued in future for these Guidelines will be numbered as follows:

CAMTECH/2015/ MECH/GWL/POH/Bio-Toilet/1.0/C.S. # XX date …. 

Where “XX” is the serial number of the concerned correction slip (Starting from 01 onwards)

CORRECTION SLIPS ISSUED

<table>
<thead>
<tr>
<th>Sr.No. of C.Slip</th>
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<th>Page No. and Item no. modified</th>
<th>Remarks</th>
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</tbody>
</table>
1.0 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 that all coaches to be fitted with Bio-toilets by 2020-2021.

**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:**

- Require less maintenance
- Simple in design
- Easier Retro fitment on existing coaches in service
- Can be in operation upto years together
- No oxygen and sunlight required for processing
2.0 Working of Biological toilet System (Anaerobic)

- Human Waste
  - Anaerobic bacteria (Liquid bacteria)
    - Liquid waste
      - Chlorination
        - Disinfected liquid discharged to track

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 biodigester 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 over Conventional Toilet system:-
- No bad smell in toilets from the tanks
- No infestation of Cockroaches & flies
- Fecal matter in the tank not visible
- No clogging of digester
- Effluent is free from off odour and solid waste
- No maintenance required
- Reduction in organic matter by 90%
- No requirement of adding bacteria/ enzyme
- No need of removal of solid waste
3.0 IR-DRDO Bio-digester Tank for ICF 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 tight in the under slung on mounting brackets.

Main parts of the Biodigester 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 Biodigester 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 lt.  
6. Empty Tank weight – 110 Kg.  
7. Full Tank Weight – 410 Kg.  
8. Height from Rail level -225 mm
### 4.0 Other components of Bio-Digester Tank

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting Bracket</td>
<td>04 Nos</td>
</tr>
<tr>
<td>Safety Rope</td>
<td>04 Nos</td>
</tr>
<tr>
<td>Locking Plate</td>
<td>08 Nos</td>
</tr>
<tr>
<td>Hex. Head Bolt (M16 X70)</td>
<td>16 Nos</td>
</tr>
<tr>
<td>Hex. Nut (M16)</td>
<td>16 Nos</td>
</tr>
<tr>
<td>Spring Washer (B16)</td>
<td>16 Nos</td>
</tr>
<tr>
<td>Hex. Head Bolt (M8 X35)</td>
<td>16 Nos</td>
</tr>
<tr>
<td>‘U’ Bracket(8 X20 X38)</td>
<td>08 Nos</td>
</tr>
</tbody>
</table>

### 5.0 Sketch of Bio-Digester Tank

![Diagram of Bio-Digester Tank](image.png)
6.0  IR-DRDO Bio-digester Tank for LHB Coaches

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

The size of the tank is 547 X 580 X 1680 MM (HXWXL) with the provision of 02 nos inbuilt C-Type mounting system along the length of the tank. Each mounting is with the provosion of 02 nos. M16 Size bolts which are tigten with the inner and outer head stocks.

**Main parts of the Biodigester 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 emrgency 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 Biodigester Tank:**
1. Length - 1680 mm  
2. Width - 580 mm,  
3. Height – 547 mm
4. Total Volume of Tank - 600 lt.  
5. Effective Volume of Tank – 450 lt.
6. Empty Tank weight – 120 Kg.  
7. Full Tank Weight – 425 Kg.
8. Height from Rail level -225 mm
7.0 Different variants of Bio toilets:

<table>
<thead>
<tr>
<th>Brief description</th>
<th>Pneumatics</th>
<th>Electrics</th>
<th>PLC</th>
<th>Flush</th>
</tr>
</thead>
<tbody>
<tr>
<td>System with flapper valve</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Pressurized</td>
</tr>
<tr>
<td>System with manual slider valve</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>gravity</td>
</tr>
<tr>
<td>System with reduced opening at inlet</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>gravity</td>
</tr>
<tr>
<td>For western style Hindware commode is proposed</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>gravity</td>
</tr>
<tr>
<td>System with solid liquid separator</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>gravity</td>
</tr>
</tbody>
</table>

**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 in the tank
Brief about variant 4 with PLC fitted at ICF

<table>
<thead>
<tr>
<th>Brief description</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>System with Solid liquid separator with the provision of Ball valve.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pneumatics</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
</tr>
</tbody>
</table>

![Diagram of system components]
8.0 Alternate Design of bio-digester tank

For strengthening of the Bio digester tank, alternate designs have been developed by RCF and approved by RDSO for fitment in the bio toilet coaches.

1. Alternate design finalised by RCF & RDSO for fitment in the coaches with Positive mounting with bolted fastening.

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

2. Direct mounted Bolted design mounting arrangement with smaller Bio-digester eliminating Hose Connector.

   Design finalised for bolted design smaller bio digester eliminating hose connector has been issued to ICF by RDSO for proto-typing and fitment trial in the month of March-15. Brief details are as under:-

   i) Lavatory pan standardized at 100 mm dia.
   ii) Pan & P-trap has been re-designed having flange connection for ease in fitment.
iii) Quick coupling for evacuation has been incorporated on the top cover of digester.

![Mounting arrangement as per RDSO Drg. CG-14004 Alt-1]

- Flexible hose connector for easy fitment and detachment of bio digester tank when ever desired
- Quick coupling interface provided in top cover and outlet towards side wall with dust cover
- Additional angle and support provided in under frame for mounting offflanged ball valve on U/frame.
Direct Mounting Bolted Design Bracket Bio-digester Tank

BOLTED DESIGN BRACKETS ON INNER HEAD STOCK

BOLTED DESIGN BRACKETS ON OUTER HEAD STOCK
8.1 Provision of S-Trap in Bio-Toilet

- Item no. 3.3 of 14th JWG directed to undertake trial with S-trap on 10 coaches.
- Provision already made in 02 AC coaches & same is running successfully in JP-MYS Exp. for almost 06 months.
- Further 10 GS coaches were nominated for fitment.
- 2 GS Coaches turned out by JUWS in the month of Feb-2015 with S-Trap.

8.1.1 Main features of S-Trap Design are followings-

- Complete elimination of foot paddle, Ball valve, P-trap and flexible rubber hose connector from tank unit.
- In place of existing 60 mm diameter P-trap, a ‘S’ band of 100 mm diameter(ID) is directly coupled to commode pan thus increasing flow area and streamline the waste flow into Bio-Toilet tank.
- First chamber is increased with available space of fourth chamber to increase volume and to accommodate ‘S’ band.
- The material of S-Trap is poly ethyle vinyle easter.
- S-Trap wall thickness is 3.5 ± 0.5 mm.
- The S-Trap is seamless pipe of above material.
"S" TRAP FOR BIO TOILET

1. वसी जग एवं एम.मे है।
2. इसका मेटलिस्ट मोटी इंसानियत विद्युतित इंस्टेंट होगा।
3. पहाड़ी जल विभाग 35.5.0.1.9.8.म. होगी।
4. ताए ट्रैप निर्माण होगा।
5. साइडस मेटलिज्ड (बी.एम. 25-45) किया होकर झुक जायगा।
6. पहाड़ी प्राण से नाला का सीना 15 प्रतिशत से कमका नहीं होकर झुक जाएगा।
9.0 Applicable Designs of Bio-Toilet tanks for Coaching Stock.

A. For conventional coaches -:

- **C-mounting bio-tank**
  - GS, SCN, AC-3T

- **SLRD-Integrated bio-tank** for passenger and disabled passengers
  (RCF Drg No.MI006290)

- **DSLR-Guard lavatory**

B. For LHB Coaches -:

Common for all types except power car.
10.0 Bio-Toilet Tanks with the provision of Ball Valve

Ball valves are provided for removing external choking in the toilet pan by operating foot paddle.
11.0 Design of Ball valve & Operating Mechanism

BALL VALVE TO RDSO DRAWING NO. CG-14097

- Ball valve redesigned to mount inside the tank as mounted earlier.
- All the required parameters have been defined in the above drawing.
- Mounting of Ball valve has been made 6 point in place of 3 points earlier.

Operating Mechanism:

- Initially developed Bio-tanks were with outside opening mechanism.
- Mechanism re-designed to operate from inside with the help of foot paddle.
- Existing manufacturers are - M/s MRC, M/s JSL and M/s Rail Fab etc.

Foot paddle arrangement
12.0 Standardisation of dust-bin for Bio-toilets

Standard dust bin as shown below has been finalised by RDSO for fitment in the Bio-Toilets. APD should also be provided for safety of dust bins by coaching depots & workshops.

13.0 Performance Parameters of Bio Toilet effluent & Inoculum:

For following lab tests of effluent, lab samples should be collected as per testing scheme circulated by RDSO & results should be recorded in prescribed proformas.

<table>
<thead>
<tr>
<th>SN</th>
<th>Parameter (as per APHA Test Method)</th>
<th>Recommended Values</th>
<th>Targeted value (Max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>pH</td>
<td>6 to 9</td>
<td>6 to 9</td>
</tr>
<tr>
<td>2</td>
<td>Total Solids</td>
<td>Max 750 mg/100 ml</td>
<td>750 mg/100 ml</td>
</tr>
<tr>
<td>3</td>
<td>Total Volatile solids</td>
<td>Max 500 mg/100 ml</td>
<td>500 mg/100 ml</td>
</tr>
<tr>
<td>4</td>
<td>Total Dissolved solids</td>
<td>Max 350 mg/100 ml</td>
<td>350 mg/100 ml</td>
</tr>
<tr>
<td>5</td>
<td>COD levels</td>
<td>Max 2000 MgO2/Lts</td>
<td>Max 2000 MgO2/Lts</td>
</tr>
<tr>
<td>6</td>
<td>Fecal Coli Forms count</td>
<td>99% Reduction (Less than $10^8$/100 ml)</td>
<td>99% Reduction (Less than $10^8$/100 ml)</td>
</tr>
</tbody>
</table>
Performance Parameters of Inoculum:

Record of these 04 tests should be maintained at Bacteria Generation Plant-SN.

<table>
<thead>
<tr>
<th>SN.</th>
<th>Parameter (as per APHA Test Method)</th>
<th>Recommended Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>pH</td>
<td>6-9</td>
</tr>
<tr>
<td>2.</td>
<td>Bio-Gas production test</td>
<td>As per test scheme</td>
</tr>
<tr>
<td>2.</td>
<td>Percentage methane</td>
<td>40%</td>
</tr>
<tr>
<td>3.</td>
<td>MPN for methanogens</td>
<td>( &gt;10^3 )</td>
</tr>
</tbody>
</table>

14.0 INSTRUCTIONS FOR PRESSURISED CLEANING OF BIO-TOILETS:

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 CAMTECH under Guidelines for AMOC for Bio-toilets.

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/KMNO4 tables and examination of chlorinator.
- Checking of following equipments/repair/replacement for proper functioning:
  - Ball valve
  - Leakage in piping, flush system, pneumatics, tank etc. valves, pressurise, PLC, pneumatic valves, ball valves etc.
  - Charging of Bio-culture if required (based on test reports). Culture will be supplied by DRDE/GWL or MIBW/SECR/NGP.

(Issued by RDSO under document no. RDSO/2010/CG/CMI-03(Rev.1)
15.0 Guidelines for Coaching Workshops for handling of Bacteria

*Following precautions should be taken by workshop staff during handling of inoculum.*

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.
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.

16.0 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.

<table>
<thead>
<tr>
<th>SN</th>
<th>Locations</th>
<th>Name of chemicals used</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PVC Floor Cleaning</td>
<td>Spiral (Johnson Diversey) or Sigla Neutral of Eco Lab</td>
</tr>
<tr>
<td>2</td>
<td>Ceramic Toilet fittings</td>
<td>Taski R1/Taski R 6 (Johnson Diversey) or Sigla Neutral of Eco Lab</td>
</tr>
<tr>
<td>3</td>
<td>Cleaning agent for commode pan &amp; wall protector</td>
<td>Harpic/Retoil/Domex</td>
</tr>
<tr>
<td>4</td>
<td>Glass Cleaning</td>
<td>Taski R3 (Johnson Diversey) or OC Glass cleaner of Eco Lab or Collin</td>
</tr>
<tr>
<td>5</td>
<td>Laminated Plastic Sheet &amp; Berth Rexene cleaner:</td>
<td>Taski R7 (Johnson Diversey) or OC Neutral cleaner of Eco Lab or Collin</td>
</tr>
<tr>
<td>6</td>
<td>Painted Surface</td>
<td>Spiral (Johnson Diversey) or Absorbit of Eco Lab or Collin</td>
</tr>
<tr>
<td>7</td>
<td>Stainless Steel Polisher</td>
<td>Suma Inox (Johnson Diversey) or Chromol of Eco Lab or Collin</td>
</tr>
<tr>
<td>8</td>
<td>Disinfectant</td>
<td>Brands Stride (Johnson Diversey) or Antiback of EcoLab or Collin or Lizol</td>
</tr>
</tbody>
</table>

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

*(Ref: DRM (M)*'S/JHS Letter No. JHS/ M/ CW/ 130/OBHS dated 26.08.2010 to ED/ CAMTECH)*
### 17.0 Evaluation of Cleaning Agents provided by Railways

The effect of cleaning agents was analysed by DRDE/GWL. The results of 6 Chemicals are tabulated as under for information-

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

**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).
18.0 List of TOT Holders for Bio-Digester & Supply of Inoculum for Railways

By Fax / Post

No. : TO-28/05160/12

Defence Res. & Dev. Establishment,
Govt. of India, Ministry of Defence,
Jhansi Road, Gwalior - 474 002.

Date : 07 June, 2012

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/Aerobic 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.

[Signature]

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

Encls:

(i) List of the ToT holders
# List of the TOT holders for Biodigesters

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name and Address of Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>M/s S.B. Equipments</td>
</tr>
<tr>
<td></td>
<td>309 Durga Chambers,</td>
</tr>
<tr>
<td></td>
<td>1333 D.B. Gupta Road,</td>
</tr>
<tr>
<td></td>
<td>Karol Bagh</td>
</tr>
<tr>
<td></td>
<td>New Delhi – 110 005.</td>
</tr>
<tr>
<td></td>
<td>58, Khan Market,</td>
</tr>
<tr>
<td></td>
<td>New Delhi. – 110 003.</td>
</tr>
<tr>
<td>3.</td>
<td>M/s Dass Hitachi Ltd.</td>
</tr>
<tr>
<td></td>
<td>8/9, Milestone, GT Road Sahibabad,</td>
</tr>
<tr>
<td>4.</td>
<td>M/s Alfa Therm Limited</td>
</tr>
<tr>
<td></td>
<td>6, Community Centre,</td>
</tr>
<tr>
<td></td>
<td>Mayapuri, Phase-I,</td>
</tr>
<tr>
<td></td>
<td>New Delhi – 110 064.</td>
</tr>
<tr>
<td>5.</td>
<td>M/s Stone India Limited (SIL)</td>
</tr>
<tr>
<td></td>
<td>16, Taratalla Road,</td>
</tr>
<tr>
<td></td>
<td>Kolkata – 700 089.</td>
</tr>
<tr>
<td>6.</td>
<td>M/s Mohan Rail Components (P) Ltd.,</td>
</tr>
<tr>
<td></td>
<td>Opp. Rail Coach Factory,</td>
</tr>
<tr>
<td></td>
<td>Hussainpur, Kapurthala – 144 602</td>
</tr>
<tr>
<td>7.</td>
<td>M/s Thakar Equipment Company</td>
</tr>
<tr>
<td></td>
<td>66, Okhla Industrial Estate, (Phase-II)</td>
</tr>
<tr>
<td></td>
<td>New Delhi – 110 020.</td>
</tr>
<tr>
<td>8.</td>
<td>M/s Kernrock Industries &amp; Exports Ltd.</td>
</tr>
<tr>
<td></td>
<td>Survey No. 120/2, At Village Asoj,</td>
</tr>
<tr>
<td></td>
<td>Vadodara-Halbol Express Way, Ta Waghodia,</td>
</tr>
<tr>
<td></td>
<td>Vadodara – 391 510.</td>
</tr>
<tr>
<td></td>
<td>R-838, New Rajendra Nagar,</td>
</tr>
<tr>
<td></td>
<td>New Delhi – 110 005.</td>
</tr>
<tr>
<td>10.</td>
<td>M/s Omax Autos Limited</td>
</tr>
<tr>
<td></td>
<td>Plot No.-26, (4 Bays),</td>
</tr>
<tr>
<td></td>
<td>Institutional Area, Sector-32,F</td>
</tr>
<tr>
<td></td>
<td>Gurgaon – 122 001 (HR).</td>
</tr>
<tr>
<td>11.</td>
<td>M/s Escorts Limited , 11,</td>
</tr>
<tr>
<td></td>
<td>Scindia House, Connaught Circus,</td>
</tr>
<tr>
<td></td>
<td>New Delhi -110 001.</td>
</tr>
<tr>
<td>12.</td>
<td>M/s CBS Technologies Pvt. Ltd.</td>
</tr>
<tr>
<td></td>
<td>48-C, Pocket-C (HIG) SFS Flats,</td>
</tr>
<tr>
<td></td>
<td>SFS Flots, Mayur Vihar, Phase-III,</td>
</tr>
<tr>
<td></td>
<td>Delhi – 110 096.</td>
</tr>
<tr>
<td>Sr. No.</td>
<td>Name and Address of Firms</td>
</tr>
<tr>
<td>---------</td>
<td>---------------------------</td>
</tr>
</tbody>
</table>
| 13.     | M/s Daulat Ram Industries  
          10-E, Industrial Area, Govindpura, Bhopal - 462 023. |
| 14.     | M/s Darshan Enterprises  
          38-39, DSIDC Complex, Scheme-III, Okhla Industrial Area, Phase-III  
          New Delhi - 110 020. |
| 15.     | M/s Rail Tech  
          5625, Qutab Road, New Delhi - 110 055. |
| 16.     | M/s Rail Coach Engrs.,  
          Outside Octroi Post,  
          Near Village Barindpur, PO Sheikhpur Distt.: Kapurthala |
| 17.     | M/s CTS Management Services P. Ltd., E-52, Second Floor, Sector-03  
          Noida (UP) – 201 301. |
| 18.     | M/s Faiveley Transport India Limited  
          P.B. No. 39, Harita,Horita  
          Hosur – 635 109 (T.N.) |
| 19.     | M/s Saranya Electronics Ltd.  
          PlotNo.A-7/1 2nd Floor,  
          Electronics Complex, Kushlaguda  
          Hyderabad – 500 062. |
| 20.     | M/s Sidwal Refrigeration Ind. Ltd.  
          108-A, Madangir,  
          New Delhi - 62. |
| 21.     | M/s Pushpa Enterprises,  
          A-5/24 Pashchim Vihar  
          New Delhi – 110 063. |
| 22.     | M/s Samudra Shipyard (P) Ltd.,  
          PB No. 10 Chemical Industrial Estate,  
          Aroor – 688 534.(Kerala) |
| 23.     | M/s Alfa System & Services,  
          E-19-C, Sector 8, Noida 201301 UP |
| 24.     | M/s Shri Ram Raja Wood Packers,  
          905-906, Silver Estate, University Road, 474 009, Gwalior, |
| 25.     | M/s Go Green Solution Pvt., Ltd.,  
          1, Samarth Nagar (w), Ajni Sq., Wardha Road, Nagpur – 15. |
| 26.     | M/s Anjana Steel Industries Pvt., Ltd.,  
          Dhirganga More, NH-2 Delhi Road, Baidyabati, Distt Hoogly (WB) |
| 27.     | M/s E-Pack Polymers,  
          2584 Rohatgi Mansion,  
          2nd Floor, Hamilton Road, Delhi, 110 006 |
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name and Address of Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>28.</td>
<td>M/s Airflow Equipments (India) P. Ltd., 9 Chellaianman Koil Street Chennai-600117</td>
</tr>
<tr>
<td>32.</td>
<td>M/s Besco Limited (Foundry Division) 7th Floor, Poonam, 5/2 Russel Street Kolkata – 700 071</td>
</tr>
</tbody>
</table>
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). The AMOC scope of work shall include supply/repair and fitment of defective components in both kinds of coaches (i.e. coaches under warranty period and coaches beyond warranty period) except supply of ball valve & its operating mechanism, bio-toilet tank for which no trend of repair/replacement is available and cost of which is very high. In case replacement is necessary, ball valve, its operating mechanism, bio-toilet tank and safety wire rope will be provided by Railways for which fitment would be done by AMOC contractor without any extra payment.

1.2 Railways may suitably modify the contract as per local conditions with the approval of concerned HOD/CME.

1.3 The AMOC will cover the maintenance (both preventive and break down) of Bio-Toilet System along with 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. Railways may include attention of the Bio-Toilets during periodical overhaul (POH) of the coaches in the designated workshops at an interval of 18/24 months or Workshop may invite a separate tender for POH attention as per requirement of the Railway.

1.4 Railways have to decide on the need of AMOC. The work of maintenance of IR-DRDO bio-toilets could be done departmentally or through AMOC based on the manpower available with the Railways.

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. Except items mentioned in Para 1.1 above.

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-II.

2.3 A long duration contract at this juncture are not advisable due to non availability of experienced contractors and as the technology is still evolving and a lot of improvements are expected in future. Hence one year contract is practically feasible however in case of lesser population of bio-toilets in certain depot, it can be for a longer duration. Railways may decide the duration as per their requirement.
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/ Dy.CME of the concerned division/ Workshop or his nominated Coaching Depot/ Workshop 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.
d) **Credentials:**

Credentials shall be submitted by the tenderer as stipulated in the revised GCC-2014 or latest.
e) **Similar nature of work:**

i) Since it would be very difficult for the tenderers to qualify minimum eligibility criteria since the work has been introduced only in past two years and also the technology is still evolving.

The following definition of similar work is proposed:

“Mechanized cleaning of coaches in Indian Railways or AMOC of Bio-Toilets or supply/fitment of bio toilets in coaches of Indian Railways.

ii) **Scope of work** – As per Para 5.0 of this document.

iii) **Penalty** – As per Para 23.0 of this document.

iv) **Eligibility criteria** - As per Clause-10 of Annexure-I (Part-I) of Standard General Condition of Contract 2014 or latest.

4.0 Technical:

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

*General Outlines of the existing System:*

Two 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 faecal matter will pass through P-trap to the tank. P-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.

**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 P-trap to the tank. But in place of flapper valve, one 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:

<table>
<thead>
<tr>
<th>Variant of Bio-Digester</th>
<th>Brief Description</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pneumatics</td>
</tr>
<tr>
<td>Option-I</td>
<td>System with flapper valve</td>
<td>Yes</td>
</tr>
<tr>
<td>Option-II</td>
<td>System with Ball valve.</td>
<td>No</td>
</tr>
</tbody>
</table>
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) Ball Valve/ Flapper/Slider– as applicable  
vi) Operating mechanism with paddle- GEAR(Rake & pinion) type, Link type, clutch-wire type or any other design as applicable  
vii) Flushing Unit/Pressuriser.  
vg) Piping system  
x) Pneumatic Valve – as applicable

5.0 **SCOPE OF WORK:**

5.1 **Scope of work at Base Depot:**

For the works 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 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 valves/operating mechanism (wherever applicable).  
v) Exterior cleaning of tank.  
vi) If required, Interior Cleaning with evacuation of tank. Replenishment of bacteria and poly grass after internal cleaning. Bacteria may be arranged from DRDE/GWL or MIBW/NGP/SECR or by any outside source approved by DRDE Gwalior/Railways or any other nominated Govt. accredited lab.  
vii) Collection and transportation of samples from retention tanks to nominated Govt. accredited lab as per the test scheme (RDSO/2010/CG/TS-10 or any applicable test scheme) issued by RDSO.  
viii) Any other job related to toilet system assigned to the contractor is 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 contractor will furnish bio-data along with testimonials including competency certificate issued by contractor for 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

1. Man Power (minimum man power to be deployed) in Coaching Depot:
   a) 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 as under.

   The team of contract staff should consist of
   1) Supervisor: 1 per shift.
   2) Skilled technician: 1 for every 30 Bio toilets or part thereof.
   3) Semi skilled technician: 1 for every 30 Bio toilets or part thereof.
b) A fortnightly planner for Daily and Non daily/Special trains in the following format shall be issued by CDO/SSE in-charge of the depot to the contractor to arrange the above mentioned team of contract staff for attention of Bio-Toilets. Every Bio toilet is to be checked as per the check sheet and jointly signed.

A. Regular trains

<table>
<thead>
<tr>
<th>Date</th>
<th>Shift</th>
<th>Train No.</th>
<th>No of coaches with bio Toilets</th>
<th>No of Bio toilets</th>
<th>Arrival</th>
<th>Departure</th>
<th>Maintenance time</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3rd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. Non daily/Special Trains

<table>
<thead>
<tr>
<th>Date</th>
<th>Shift</th>
<th>Train No</th>
<th>No of coaches with bio Toilets</th>
<th>No of Bio toilets</th>
<th>Arrival</th>
<th>Departure</th>
<th>Maintenance time</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3rd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Shift Timings as prevalent in the Coaching Depot.

2. **Manpower for POH in Workshop.**

Staff shall be deployed in General shift as per the following distribution during attention of POH.

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Supervisor</th>
<th>Skilled</th>
<th>Semi skilled</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>POH</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>

**Note:** Additional man power if required as per the workload as intimated by Coaching Depot officer and Workshop shall be arranged by the contractor for POH attention of Bio toilets so that cycle of POH activity is not delayed.

i) The manpower requirement given above is for current work load and is indicative only. In case of increase in work load, the contractor shall provide additional man power as deemed fit by CDO/SSE/Incharge if required in future at the same accepted rate.
Manpower is to be deployed at various depots as per the orders of Sr.DME/C&W in addition to depots mentioned in TS.

The staff should be deployed as per the 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 change in the maintenance time and adjust his time accordingly.

The bidder should provide additional man power if required in future at the same rate quoted.

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 concerned CDO/SSE/In-charge(IC). The Supervisor nominated by the contractor for the repair on the station /depot shall observe all safety and security rules prevailing at the place of work. Railway shall not be responsible for any mishap resulting out of non-observation of prevailing safety and security rules.

The contractor shall comply all provision of minimum wages act, 1948, Contractor labour (Regulation and Abolition) Act 1970 and rules frame there under and other labour laws affecting contract labour that may be brought in to time to time.

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 and Working hours for manpower deployed:-

5.5.1 Place of work will be washing line/Sick line/Coaching depot/Terminal station/Workshops or any other maintenance point selected by the nodal officer. 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-III. 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. Removal of choking from toilets of on arrival rakes by nominated choke removing gadgets only.

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

d. Attention to operating mechanism of Ball valve and attention to TPE connector.

e. Examination of chlorinator unit for any leakage, tilting and thread missing and charging by Chlorine/Kmno4 tablets, if required

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

g. Exterior washing of bio- digester tank at washing line during maintenance.

5.6.2 WORK TO BE CARRIED OUT MONTHLY or “A” Schedule:

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 latest applicable test scheme) issued by RDSO.

c. Visual inspection of complete Toilet system including under slung equipments and mounting arrangements of Bio-Toilet system and attend if found any deficiency.

d. Charging of Chlorine/Kmno4 tablets and examination of Chlorinator unit every 10 days or as required depending on life of the tablet.

5.6.3 WORK TO BE CARRIED OUT ON QUARTERLY BASIS or “B” Schedule:

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

b. Checking of following equipments/repair/replacement for proper functioning:

1. Ball Valve/ Flapper/slider with operating mechanism
2. Leakage in piping, flush system, pneumatics, tank etc. Valves, pressuriser, PLC, pneumatic valves (if applicable) and Ball valves etc.

3. Charging of Bio-culture if required (based on test reports). Inoculum will be supplied by DRDE/IR(MIBW/SECR, Nagpur).

5.6.4 WORK TO BE CARRIED OUT IN IOH SCHEDULE.

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

b. Servicing of all PLCs if applicable.

c. Testing of complete Toilet system

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

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 (Inoculum) if required (based on test reports)

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

All the works to be carried out as mentioned in POH instructions in ANNEXURE-I.

Charging of Bio – culture (Inoculum) should be done after POH. It will be supplied by DRDE/GWL and MIBW/NGP 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. Name of firm should be printed on uniform of firm’s employees.

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 only through ECS facility in employee’s Bank account and submit detail to nodal officer.

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 standby 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/quarterly bills for the work done shall be submitted by the contractor in the following 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.

5.7.9 The contractor should provided masks, gloves and boots for his staff. The contractor should also provide the following tools for removal of choke from P-Trap i.e. bottle picker, choke remover, handle for foot paddle operation and any other tools defined by Railways.

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 IR-DRDO Bio-Toilet system.

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 Nodal officer.

8.1.5 The Bio-Toilets shall be attended to on the platform or washing line or Sick line or coaching depot or the terminal stations/Workshop 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 Nodal officer 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.

8.2 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 Supervisor 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 from Nodal officer.

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 with effluent treatment plant 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 Nodal officer 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 misbehavior, 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 staff is unable to attend, he will advise Nodal officer 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 for one year contract is practically feasible however in case of lesser population of bio-toilets in certain depot, it can be for a longer duration as requirement by Nodal officer.

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 Bio-Toilet System to make it operative except in case of warranty claims of OEM agreed to by Railways.

12.0 Payments:

12.1 The payment for AMOC shall be made in installments on Monthly/Quarterly basis.

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 Bio-Toilet tank numbers and Coach numbers.
b) Numbers of the Bio-toilets maintained by the firm for each monthly/quarterly schedule covered under this AMOC.

c) 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.

13.0 Paying Authority

The payment against this contract shall be made by the concerned Account officer of the Division/workshops associated with the Depot/workshop for maintenance of the coaches.

14.0 Records to be maintained by Maintenance Depots:

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.

d) In addition to the above the Nodal officer may keep records as per required for effective monitoring of AMOC.

15.0 EMD and Security Deposit:

EMD and 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 submit Performance guarantee as per Clause No. 16(4) of Standard General Conditions of Contract, July 2014 or latest.

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 17 (Part-II) of Standard General Conditions of Contract-2014 or latest.
18.0 **Arbitration:**

   This will be as per clause 63 to 64 (Part-II) of Standard General Conditions of Contract- 2014 or latest.

19.0 **Laws Governing the Contract**

   This will be as per Clause 03.(1)(Part-II) of Standard General Conditions of Contract 2014 or latest.

20.0 **Determination:**

   This will be as per Clause 61 and 62 (Part-II) of Standard General Conditions of Contract 2014 or latest.

21.0 **Subletting and Assignment**

   This will be as per Clause 07 (Part-II) of Standard General Conditions of Contract 2014 or latest.

22.0 **Other terms and conditions as per Standard General Conditions of Contract-2014 or latest will apply.**

23.0 **Penalty:**

   The following penalties will be levied on contractor for bad workmanship and penalty amount will be deducted from the on account bills.

<table>
<thead>
<tr>
<th>SN</th>
<th>Item</th>
<th>Amount of Penalty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>If the defective toilets are not attended before schedule departure time of the train,</td>
<td>The contractor shall be fined Rs.2000/- per day (Excluding the day of attention) per toilet till it is rectified.</td>
</tr>
<tr>
<td>2</td>
<td>Complaint received from inspecting officers /Passenger compliant for unsatisfactory maintenance of Bio Toilet.</td>
<td>A penalty of up to Rs.5000/- per toilet shall be imposed on contractor. However choking of bio toilets due to misuse by passengers is exempted.</td>
</tr>
<tr>
<td>3</td>
<td>In case staff not turn up for AMOC on any day,</td>
<td>A penalty of Rs 2500/- per person per day shall be imposed.</td>
</tr>
<tr>
<td>4</td>
<td>If Charging of chlorine tablet in chlorinator not done,</td>
<td>The contractor shall be fined Rs500/- per trip per toilet till it is provided.</td>
</tr>
<tr>
<td>5</td>
<td>Not carrying out sampling testing quarterly as per schedule quantity.</td>
<td>A penalty of Rs 5000/- per toilet shall be imposed.</td>
</tr>
<tr>
<td>6</td>
<td>Any other deviation of Agreement conditions</td>
<td>As decided by the Nodal officer upto maximum of Rs 2000/- per instant.</td>
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</tbody>
</table>

**Note:** The Railway Administration will terminate the contract if the work executed by the contractor is consistently unsatisfactory.
<table>
<thead>
<tr>
<th>CONTRACTOR</th>
<th>NODAL OFFICER</th>
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<tr>
<td></td>
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</tr>
<tr>
<td>WITNESS : 1. ___________________</td>
<td>WITNESS : 1. ___________________</td>
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<tr>
<td>2._______________</td>
<td>2. ________________</td>
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Annexure-I

Instructions for POH of the Coaches fitted with Bio toilets.

1. Place the coach at maintenance workshop’s pit line, where fork lifter can be placed under the tank.
2. Mark all the tanks with their respective coach number and lavatory number.
3. Remove all the nut bolts used for fastening of safety ropes and safety ropes provided for IR-DRDE bio toilet retention tank.
4. Dismount hose clamp provided for securing of Rubber hose at Lavatory Pan.
5. Remove all the pneumatic pipes for flapper valve if any.
6. Open all the nuts and washer with the help of suitable spanner/ wrench. Atleast one bolts should remain in the holes of each mounting brackets and tank to avoid accidental dropage of tank during placement and lifting of the tank.
7. Place the arms of fork lifter below tank and lift the tank slowly about half inch. Remove remaining bolts carefully.
8. Remove all the tank with the help of fork lifter for thorough cleaning, tank and mounting brackets should be inspected for any damage, leakages etc.
9. Complete tank evacuation and cleaning of whole tank.
10. Attention to Ball valve linkages or operating mechanism.
11. Ball valve should be overhauled and PTFE seal of Ball valve should be renewed 100% during POH.
12. Rubber connector should be renewed during POH.
13. Replacement of poly grass mat with proper securing arrangement.
14. If there is any damage or leakage in the tanks or non-confirming results of effluent discharges are being reported etc., these tanks should be drained out at designated place having proper drainage, cleaned properly and tank should be rectified for the deficiency noticed.
15. If there is no deficiency found, It should be stored after cleaning in the racks (3tier stacks as suggested by CAMTECH / Gwalior) earmarked for bio toilets. Racks should be placed in cool, safe area and without sunlight.
16. Ingress of water, chemicals or any other foreign object to the tank should be prevented during storage of the bio toilet tanks.
17. Then the coach should be sent to all regular stages of POH attention.
18. After completion of POH of the coaches, tanks marked with respective coach number and lavatory number should be taken out from storage rakes and restored in position.
19. Check the rubber hose used for joining of P-trap and Lavatory pan for any defects, remove all dirt, scaling and old sealant before fixing it again.
20. Reconnect pneumatic pipes for flapper valve if fitted with PLC version.
21. Nut, bolts and spring washers used for mounting bracket and securing of safety rope should be checked for wear, tear or corrosion etc. and should be replaced with same size material and grades if defective.

22. Check the safety rope before re-mounting for any defects.

23. Ensure all the nuts and bolts used for mounting and securing of safety rope are be properly tightened before dispatch of the coach.

24. NDT of J Brackets/Positive mounting bracket.

25. Tanks should be Re-filled with the required level of bacterial Inoculum before dispatch of the coach.

**Work to be attended by AMOC contractor during POH**

Work to be done in the scope of AMOC by the contractor during POH is mentioned in **clause no. 5.6.5 of the guidelines for AMOC.**
### DETAILS OF COACHES FITTED WITH DRDE TYPE BIO TOILETS

<table>
<thead>
<tr>
<th>S. No.</th>
<th>COACH NO.</th>
<th>TYPE</th>
<th>BASE DEPOT</th>
<th>No. of toilets with Variant</th>
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<tr>
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<td>I</td>
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</tbody>
</table>
Preventative Maintenance schedules of IR Coaches

A. Maintenance Schedule in Depots

<table>
<thead>
<tr>
<th>Type of Schedule</th>
<th>Periodicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Trip Schedule</td>
<td>At the end of each trip or as prescribed</td>
</tr>
<tr>
<td>(ii) Schedule ‘A’ or Monthly examination</td>
<td>1 month +/- 3 days</td>
</tr>
<tr>
<td>(iii) Schedule ‘B’ or tri-Monthly examination</td>
<td>3 months +/- 7 days</td>
</tr>
<tr>
<td>(iv) Special Schedule</td>
<td>As prescribed by Zonal Railways</td>
</tr>
</tbody>
</table>

B. Periodicity of Maintenance Schedules [IOH & POH] for ICF/RCF design Coaches.

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Coach Categories</th>
<th>Periodicity (Months)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>IOH</td>
</tr>
<tr>
<td>1</td>
<td>New coach turned out by PU or a coach turned out by MLR</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>Rajdhani/ Shatabdi</td>
<td>09</td>
</tr>
<tr>
<td>3</td>
<td>Mail Express, Garib rath, Jan-Shatabdi &amp; OCVs forming part of standard rake composition of M/E trains.</td>
<td>09</td>
</tr>
<tr>
<td>4</td>
<td>Passenger</td>
<td>09</td>
</tr>
<tr>
<td>5</td>
<td>Other OCVs</td>
<td>12</td>
</tr>
</tbody>
</table>

Note:
1. Specified Scheduled Maintenance Periodicities are indicative in nature and subject to change as per Railway requirements/rules.
2. Periodicity of Maintenance schedule for LHB coaches should be followed according to CAMTECH Manual for LHB Coaches or latest instructions issued by RDSO/Railway Board.
20.0 Procedure for retrofitment of Bio-Toilet tank on ICf/RCf design BG Coaches

No. MC/CB/LF/Ane aerobic

In reference to para 1.1 of the MOM of the 15th JWG on IR-DRDO bio toilets, Design/ Drawings of direct mounting, bolted design, IR-DRDO bio digester has been prepared and being issued for fitment in all eligible coaches.

Qualifying criteria for retrofitment of IR-DRDO bio toilets in existing coaches has been already issued vide this office letter under ref.2.

Procedure for Retrofitment of IR-DRDO Bio-Toilet Tank on ICF/ RCF Design BG Coaches issued vide letter under reference 3 has been revised and attached as annexure 2 for ready reference.

Enclosure: 1. Drawing no. CG-15028 and its components
   2. Procedure for retrofitment
<table>
<thead>
<tr>
<th>S.N.</th>
<th>Drawing No.</th>
<th>Alt.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>CG-15028</td>
<td>Nil</td>
<td>DRDE tank mounting arrangement (For Ball valve type arrangement)</td>
</tr>
<tr>
<td>2.</td>
<td>CG-15029</td>
<td>Nil</td>
<td>IR-DRDO Bio Tank with Bottle catcher and separator</td>
</tr>
<tr>
<td>3.</td>
<td>CG-15030</td>
<td>Nil</td>
<td>Bio Toilet tank for ICF/RCF type Coaches</td>
</tr>
<tr>
<td>4.</td>
<td>CG-15031</td>
<td>Nil</td>
<td>Top Cover with Evacuation interface Assembly</td>
</tr>
<tr>
<td>5.</td>
<td>CG-15032</td>
<td>Nil</td>
<td>Mounting Bracket on inner head stock for IR-DRDO Biological Toilet Tank</td>
</tr>
<tr>
<td>6.</td>
<td>CG-15033</td>
<td>Nil</td>
<td>Mounting Bracket on Outer head stock for IR-DRDO Biological Toilet Tank</td>
</tr>
<tr>
<td>7.</td>
<td>CG-15034</td>
<td>Nil</td>
<td>Securing Bracket for S.S. wire rope welded on inner head stock</td>
</tr>
<tr>
<td>8.</td>
<td>CG-15036</td>
<td>Nil</td>
<td>Brackets on U/f for mounting of DRDE Bio tank</td>
</tr>
<tr>
<td>9.</td>
<td>CG-15037</td>
<td>Nil</td>
<td>Locking plate</td>
</tr>
<tr>
<td>10.</td>
<td>CG-K9086</td>
<td>2</td>
<td>Tank part 1</td>
</tr>
<tr>
<td>11.</td>
<td>CG-K9087</td>
<td>3</td>
<td>Tank part 2</td>
</tr>
<tr>
<td>12.</td>
<td>CG-K9088</td>
<td>1</td>
<td>Tank part 3</td>
</tr>
<tr>
<td>13.</td>
<td>CG-K9089</td>
<td>2</td>
<td>Tank part 4</td>
</tr>
<tr>
<td>14.</td>
<td>CG-K9090</td>
<td>3</td>
<td>Tank part 5</td>
</tr>
<tr>
<td>15.</td>
<td>CG-K9091</td>
<td>3</td>
<td>Tank part 6</td>
</tr>
<tr>
<td>16.</td>
<td>CG-K9092</td>
<td>4</td>
<td>Tank part 7</td>
</tr>
<tr>
<td>17.</td>
<td>CG-K9093</td>
<td>2</td>
<td>Tank part 8</td>
</tr>
<tr>
<td>18.</td>
<td>CG-K9094</td>
<td>2</td>
<td>Lower Bracket</td>
</tr>
<tr>
<td>19.</td>
<td>CG-11064</td>
<td>1</td>
<td>Tank part 10</td>
</tr>
<tr>
<td>20.</td>
<td>CG-12013</td>
<td>1</td>
<td>Frame for chlorinator</td>
</tr>
<tr>
<td>21.</td>
<td>CG-11065</td>
<td>Nil</td>
<td>Rubber Strip</td>
</tr>
<tr>
<td>22.</td>
<td>CG-11063</td>
<td>1</td>
<td>Tank part 9</td>
</tr>
<tr>
<td>23.</td>
<td>CG-K9031</td>
<td>1</td>
<td>Filter Mesh</td>
</tr>
<tr>
<td>24.</td>
<td>CG-K9030</td>
<td>2</td>
<td>Rubber Sealing</td>
</tr>
<tr>
<td>25.</td>
<td>CG-12012</td>
<td>2</td>
<td>Chlorinator Complete</td>
</tr>
<tr>
<td>26.</td>
<td>CG-11085</td>
<td>3</td>
<td>P-Trap</td>
</tr>
<tr>
<td>27.</td>
<td>CG-K9028</td>
<td>2</td>
<td>Adaptor for Ball Valve</td>
</tr>
<tr>
<td>28.</td>
<td>CG-11089</td>
<td>2</td>
<td>Ball Valve 5&quot;</td>
</tr>
<tr>
<td>29.</td>
<td>CG-13006</td>
<td>Nil</td>
<td>Covering Plate</td>
</tr>
<tr>
<td>30.</td>
<td>CG-13008</td>
<td>Nil</td>
<td>Rubber sealing for Ball Valve</td>
</tr>
<tr>
<td>31.</td>
<td>CG-14070</td>
<td>Nil</td>
<td>Hose Connector</td>
</tr>
<tr>
<td>32.</td>
<td>CG-11088</td>
<td>1</td>
<td>Bracket for Safety Rope</td>
</tr>
<tr>
<td>33.</td>
<td>CG-12009</td>
<td>2</td>
<td>Bend Sheet for Chlorination chamber</td>
</tr>
<tr>
<td>34.</td>
<td>CG-12010</td>
<td>2</td>
<td>Chlorination chamber</td>
</tr>
<tr>
<td>35.</td>
<td>CG-12011</td>
<td>1</td>
<td>Top cover with chlorine jacket</td>
</tr>
<tr>
<td>36.</td>
<td>CG-14101</td>
<td>Nil</td>
<td>Bend Pipe for Evacuation of first Chamber</td>
</tr>
</tbody>
</table>
Procedure for Retro-fitment of DRDE Bio-toilet Tank on ICF/ RCF Design
BG Coaches

1. Remove lavatory chute mounted on brackets.
2. Remove bracket welded on under frame provided for mounting of the lavatory chute arrangement.
3. If any corrosion is evident on the structural member it should be repair as per procedure laid down in RDSO maintenance manual RDSO/2011/CG/CMI-01 (latest version).
4. Removal of buffer ribs and plates on outer head stocks
5. Check that adequate clearance between underframe and tank is available, where tank has to be mounted. In some design of coaches water filling pipe for overhead tank and air brake piping for passenger emergency alarm signal device (PEASD) or any other item may infringe, should be relocated before welding of mounting brackets.
6. Weld all strengthening/supporting brackets on outer and inner head stock of under frame as per RDSO drawing No. CG-15036 with recommended electrodes for welding with carton steel.
7. Check the alignment of all mounting brackets for each bio digester tank as per RDSO drawing No. CG-15028 (latest alteration). Mark the location of each mounting bracket for making holes of specified size on inner and outer head stock C-Channels as per RDSO drawing No. CG-15036.
8. Drill the holes required for mounting brackets of IR-DRDO Bio digester on inner and outer head stock of under frame as per RDSO drawing No. CG-15036 with the help of suitable Jig/Fixtutre and recommended drilling tools for in position drilling.
9. Mark, cut, tack weld or weld to formulate the foundation provision of clutch wire opening/closing mechanism as per CAI issued for this purpose.
10. Mount all bolted design J-Brackets at the location marked in the drawing No. CG-15028. All the brackets should be properly fastened with specified size, material, grade fastener only and properly tightened.
11. Fix one end of safety ropes on inner head stock with specified size, material, grade fastener only and properly tightened.
12. Load empty bio-toilet tank assembly with the help of the fork filter or any other suitable arrangement.

13. Align P-trap, rubber hose to the outlet of lavatory Pan and fix it, after fixing of P-trap and rubber hose, it should be sealed with suitable sealant to make joint leak proof.

14. All the fasteners used should be to the specified size, material, grade mentioned in the drawings and properly tightened.

15. Fix second end of the safety ropes properly routed through bio-digester tank as per RDSO drawing no. CG-15028 (latest alteration).

16. Check all the modification done for fixing of bio-toilet tanks and rectify if any deficiency noticed before dispatch of the coach.

17. Fill bacterial inoculums about 150 liters obtained from DRDE Gwalior on their TOT holder just before putting coach into service.
21.0 Qualifying criteria for retrofitment of Bio-Toilets in Existing Coaches

NO. MC/CB/LF/Anaerobic

Dated 10.02.2015

Sub: Qualifying criteria (Defining the residual thickness of Head stock) for retro-fitment of IR-DRDO bio toilets in existing coaches.

Ref: 1. This office letter of even no. dated 12-08-2014 and 29.10.2014.
3. MOM of the 14th JWG meeting held at Southern Railway Chennai on 02.12.2014.

In reference to above referred letters at ref.1, instructions for retrofit-fitment of IR-DRDO bio digester in in-service coaches as per boitted design arrangement of JU/NWR design was issued for regular fitment.

Issue of qualifying criteria for retrofit-fitment of IR-DRDO bio digester was deliberated in 13th and 14th JWG meetings on IR-DRDO bio toilets held at C.Rly. Mumbai and S.Rly Chennai and it was decided that CR and WR will advise the condition of Head stock to RDSO during POH.

Accordingly WR has submitted the details of actual measurement of thickness taken in 100 coaches to analyse life of outer head stock to Railway Board.

To decide qualifying criteria (Defining the residual thickness of Head Stock beams) for retrofit-fitment of IR-DRDO bio toilets in existing coaches, RDSO has conducted FEM analysis of the coach model and complete head stock considering the provision of four bio digester at specified location of the head stock and uniform reduced cross section of Head stock beam and other important members of the complete head stock up to the limit 20% reduction of the original thickness as defined in corrosion repair manual of the coaches.

No adverse results have been observed in FEM report for above mentioned criteria. However FEM analysis have their own limitation for correctness of the results as per criteria adopted for analysis.
In observation of actual measurement of the outer head stock made by Western Railway and on the basis of FEM report, it may be concluded that reduction of cross section of outer and inner head stock beams may be allowed up-to 1 mm (almost 10 % reduction of the original thickness) only for the purpose of retro-fitment of bolted design IR-DRDO bio toilets in in-service coaches.

It may also be noted that beside observation of the above mentioned criteria, all other important members of head stock and all welded joints should be thoroughly inspected for any defects and corrective action should be taken accordingly.

Determination of the residual thickness of head stock beams should be done as per criteria laid down in RDSO corrosion repair manual RDSO/2011/CG/CMI-01 amendment 01 or latest version.

For assessment of cross section thickness at different locations of the head stock and other important members, proper surface cleaning / removal of corroded layers should be done before measurement.

Measurement of thickness at such locations should be done by calibrated vernier caliper scale / screw gauge at sufficient number of locations, to determine the residual strength of head stock for the purpose of the retro-fitment of IR-DRDO bio toilets.

(M.K. Pandey)
Director (SS)/Carriage

प्रतिलिपि:

1. कार्यकारी निर्देशक यांत्रिक (कंट्रोल), रेलवे बोर्ड, रेलवे मंत्रालय, नई दिल्ली— 110 001.
2. कार्यकारी निर्देशक यांत्रिक (कोम्प्लिकेशन), रेलवे बोर्ड, रेलवे मंत्रालय, नई दिल्ली— 110 001.
3. गृह अभिकल्प अभिनव इंटीग्रल कोष फंड, होजिंग सेक्रेट्री, नई दिल्ली— 600 038.
4. गृह अभिकल्प अभिनव इंटीग्रल रेल कोष, दुर्गा-पुर, अभिकल्प— 144 602.
5. अभिकल्प रेल, नई अभिज्ञ, तिरुवानामेल, नेर्सिल— 10.

IRCAMTECH/MECH/GWL/POH/Bio-Toilet/52
22.0 Procedure in detail for Retro-fitment of DRDE Bio-toilet Tank on ICF/RCF Design BG Coaches. (Being followed in JUWS).

(a) CUTTING PROCESS
- Cut all four lavatory commode chute plate by gas cutting.
- Cutting for vertical supporting support strip welding.
- Cutting of both hose pipe lever if required.
- Partial cutting of floor stiffner.

(b) DRILL POSITION IN HEAD STOCK & GUIDE PLATE WELDING
- After marking over outer head stock and inner headstock as per RDSO Drg No. CG-15036, tag weld drilled guide plate after drilling over head stock according to marking as shown in figure.
(c) DRILLING OPERATION

- Drilling should be done in outer and inner headstock by vertical drilling machine for making holes of specified size on inner and outer headstock C-Channels as per RDSO drawing No. CG-15036.
- Mark, cut, tack weld or weld to formulate the foundation provision of clutch wire opening/closing mechanism as per CAI issued for this purpose.

(d) BIO- TANK MOUNTING

- Mount all bolted design J-Brackets at the location marked in the drawing No. CG-15028. All the brackets should be properly fastened with specified size, material, grade fastener only and properly tightened.
- Mounting of Bio-Tank with the help of Hydraulic lifting trolley and adjusting the tank P-Trap of Bio-Tank with aligning commode chute. Fit the tank with J-bracket with nut and bolts.
(e) INNER PLATE WELDING FOR WIRE ROPE

- Fix one end of safety ropes on inner head stock with specified size, material, grade fastener only and properly tighten it.
(f) CLUTCH WIRE TYPE OPENING MECHANISM FOR BALL VALVE.
Operating mechanism of Ball valve should be as per RCF Specification No. MDTS-41493.

(g) CHLORINATOR UNIT FITMENT
Chlorinator unit should be fitted with Bio-Toilet tank as per RDSO drawing No. CG-12012. Other parameters are given in Drg. No. CG-12010 & CG-12011.
(e) WIRE ROPE FITMENT

- Wire rope should be kept slightly loose at the time of fitment to avoid strand cutting due to oscillation during train running.

(h) RUBBER CONNECTOR FITTING

- One end of Rubber connector should be fitted with Lavoratory chute and clamped.
- Other side of rubber connector should be clamped with Bio-Tank and secure leak proof joint to avoid leakage of effluent.
- Size and material of Hose Connector should be as per RDSO drawing No. 14070 or latest.
(i) PROBLEMS BEING FACED IN BIO TANK FITMENT

- Rib height must be adjusted according to the head stock.
- Turn under cutting to be done with gas cutting upto suitable space to pedal rod.
- Ensure alignment of Bio-Tank inlet and lavatory outlet at the time of final mounting.
- Wire rope should be kept slightly loose at the time of fitment to avoid strand cutting at the time of oscillation during running.
- Joint of rubber connector should be leak proof for water.
- Distance of Inside plate for wire rope fitting should not be less than 20 mm from head stock level.
- Ensure easy operation of operating mechanism of ball valve.
23.0 Welding Failure in J-Bracket mounting

During Maintenance of the Rake, on duty rake maintenance supervisor should personally inspect the mounting brackets for any weld failure or crack in the supporting members.

Following are the critical vulnerable locations for weld failures:

![Image of critical weld failure locations](image1.png)

![Image of critical weld failure locations](image2.png)
Weld location of Bracket
Bracket came out due to weld failure

Weld location of bracket
Bracket came out due to weld failure

Weld location of bracket
Bracket came out due to weld failure
24.0 Monitoring of IR-DRDO Bio-Toilets in Passenger Coaches

GOVERNMENT OF INDIA (BHARAT SARKAR)
MINISTRY OF RAILWAYS (RAIL MANTRALAYA)
(RAILWAY BOARD)

No.2009/Dev.Cell/ICCI/1 Vol.IV

Chief Mechanical Engineer
All Indian Railway

Sub.: IR-DRDO Bio-toilets in passenger coaches

Presently, 436 IR-DRDO bio-toilets have been provided in eight trains for in-service trials. Coaches of these trains were turned out in the rake-form and these rakes are based in nominated depots for proper and efficient monitoring, maintenance and operation of bio-toilets.

Based on the performance, feedback and out-come of the trials with these toilets, RDSO and Joint Working Group (JWG) of IR’s Mechanical Engineers and DRDO’s Bio-technologists have recommended for proliferation of IR-DRDO bio-toilets in passenger coaches.

Now, all bio-toilet coaches are being turned out/will be turned out in piece-meal manner. In last three month, RCF has dispatched 127 coaches equipped with IR-DRDO bio-toilets to different railways. For proper and efficient monitoring, operation and maintenance of IR-DRDO bio-toilets in these coaches, it is advised that the Railways must:

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/consumables 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

(i) the regular/periodic inspection of welding of mounting brackets,
(ii) the regular/periodic inspection of safety wire ropes and
(iii) that fasteners for bio-tanks/safety wire ropes are intact.

Corrective/preventive action must be taken immediately, if anything abnormal is found.
It is advised that if any issue regarding fitment, operation, maintenance, safety, design modification/improvement, new design etc. is seen/foreseen/encountered in regards to these IR-DRDO bio-toilets, it must be informed to CDE/RCF/Kpurthala, the Convener of JWG with intimation to RDSO and Railway Board.

A Compendium on IR-DRDO Bio-toilets has been compiled and prepared by IRCAMTech/GWL. IRCAMTech is also conducting training courses on IR-DRDO bio-toilets. All railways are advised to get the copy of the compendium and nominate concerned officer/staff for training at IRCAMTech/GWL.

Copy to:

- To kindly ensure that the tanks of same make are fitted in coaches nominated to one railway, as far as possible.
- Also, advance intimation to the allottees may kindly be sent to enable them to plan for maintenance and operation

ED/IRCAMTech

To kindly update IR-DRDO bio-toilet compendium and to circulate to all Railways along with schedule of training on IR-DRDO bio-toilets

ED/C/RDSO/LKO

To kindly update AMOC and Trial/Test scheme Documents, if necessary, and to circulate to all Railways

CDE/RCF and Convener/JWG

For kind information and necessary action on advices/feedbacks from Railways

CDE/ICF

For kind information

Nitin Chowdhary
Exe.Dir.ME (Dev.)
25.0 Performance monitoring of IR-DRDO Bio-Toilet on ICF/RCF Coaches

No. MC/CB/LF/Anerobic

Dated, 10.12.2013


2. This office letter of even no. dated 12-11-2012.

Railway Board have been instructed for submission of performance report of IR-DRDO bio toilets on monthly basis to Railway Board with copy to RDSO. But same is not being received.

RDSO has already issued Test/Trial scheme no. RDSO/2010/CQ-TS10 Rev-04 for performance monitoring of IR-DRDO bio toilet in IR BG coaches. Performance monitoring data of all the coaches should be compiled as per sample sheet attached in test trial scheme mentioned above.

Performance monitoring data along with effluent test reports should be submitted to Railway Board along with copy to RDSO on monthly basis. Test reports / Performance reports may kindly be submitted through email on dir@rdsso@gmail.com and adcarr.rdsso@gmail.com or faxed at 0522-2450679 to RDSO.

The matter may be treated as urgent.

(India) Shankar

निदेशक/एसएस/सवारी डिब्रा

प्रतिस्पर्धी :-

1. मुख्य अधिकारी अभियंता, इल्लाकाळ कॉश फॉक्स, चेन्नाई— 630 036.
2. मुख्य अधिकारी अभियंता, रेल कोष फॉक्स, हुसैनाबाद, कम्पूर्स— 144 602.
3. कार्यकारी निदेशक, कॉमेंटेक, गाजियाबाद
4. कार्यकारी निदेशक यात्रिक (कोशिंग), रेलवे बोर्ड, रेल भारत, नई दिल्ली— 110 001.
5. कार्यकारी निदेशक यात्रिक (अस्थ), रेलवे बोर्ड, रेल भारत, नई दिल्ली— 110 001.
26.0 A. Technical specification for Chlorine tablets for use in IR-DRDO Bio-Toilets

[ Specification No. MDTS-14274 Rev-00 dated 30.04.2015 ]

1.0 Scope:

1.1 The scope of this specification is to supply the chlorine tablets as per the specified dimensions and properties. These will be used in IR-DRDO Bio-Toilets (using anaerobic bacteria) for reduction of faecal coliforms of the discharged effluent from the bio toilets.

2.0 Eligibility conditions:

2.1 The tenderer should be a reputed manufacturer of chlorine tablets and should have all the requisite testing facilities or have authorization from reputed manufacturer of chlorine tablets having requisite testing facilities. In absence of above, offers shall be deemed as incomplete and may not be considered.

2.2 The tenderer must submit detailed clause wise comments on the specification indicating manufacturing and testing facilities. In absence of above, offers shall be deemed as incomplete and may not be considered.

3.0 Technical requirement:

3.1 The tablet size should be 78 mm diameter and weight should be of approx. 200 gms.

3.2 The tablet should have active molecule of 3, 5 di-chloro-iso-s-cyanuric-acid.

3.3 It should have effective chlorine of ≥ 50% chlorine.

3.4 The tablet should be formulated for sustained release (should last for at least 21 days in tap water).

3.5 Moisture content should be ≤ 4%.

3.6 The tablet should be stable during storage for at least 01 year.

4.0 Identification marking:

Each chlorine tablet shall have manufacturer’s name/Logo, month and year of manufacture.

5.0 Packing:

The packing should properly protect against moisture, rubbing, impact, scratches during handling, transportation and storage. Each package shall be of convenient mass for easy handling.

6.0 Warranty:

The manufacturer shall warrant for conformance to quality for a period of 12 months from date of supply.
26.0 B  Technical specification for KMNO4 tablets for use in IR-DRDO Bio-Toilet

MD22301

CRSE/NCR
CRSE/NR

Sub: Description, likely source and quotation of KMnO4 tablets.

Vide para 4.1 of 16th JWG held at NCR, Gwallor on 03.07.15 RCF was assigned to provide general description, likely source and quotation for KMnO4 tablets to NCR and NR.

M/s Shivathene Linopack, Parwanoo who had provided KMnO4 tablets with various compositions to DRDE/Gwallor for laboratory trials had been requested to provide the general description and quotation of KMnO4 tablets. A copy of data sheet and budgetary quote of KMnO4 tablets obtained from them is enclosed.

The general description of KMnO4 tablets may be taken as: **Hygroscopic solid KMnO4 tablets having slow dissolution rate in black colour of diameter 75mm, thickness 25mm, density 1.4 to 1.6 gnm/cc and weight 170 to 180 gns and should not have acidic and metallic corrosive ingredients.**

Likely source:

M/s Shivathene Linopack, Plot:1A, Sector 3, Industrial Area,
Parwanoo (HP)-173220
Ph: 1792 233 115/158, Fax: 1792 232910
sapiwna@shivathene.com

NCR and NR may please make arrangement for procurement of KMnO4 tablets and for carrying out trials under DRDO advise. As decided in 16th JWG, RD will co-ordinate the field trials.

(A.K. Katpail)
CDE

Encls: As above (03 pages)

Copy to:
ED/Carriages/RDSO
L&D, CAMTECH
Sh. D.V. Kamboj, Scientist 'F', DRDE, GWL
EDME, Development, Railway Board
27.0 Performance of Lister mounted evacuation system suction machine for Bio-Toilets

Executive Director
CAMTECH/GWL

Sub: Performance of Lister mounted evacuation system suction machine for Bio-Toilet.
Ref: CAMTECH Specification No. CAMTECH/M/SUCTION SYSTEM/03/11

On the subject matter, Motibagh workshop has procured a Lister/Trolley mounted sewage suction machine on the basis of above referred specification. The suction machine has been received in workshop on 24.01.2014 and successfully commissioned on 22.04.2014. The field trials have also been conducted on 50 coaches by M/S Vogelsang India Pvt. Ltd. from 22.04.2014 to 24.04.2014. The machine is working satisfactorily for evacuation of Non-Bio degradable waste material from 1st chamber of Bio-digester tank. The performance of the machine is good.

After field trials, following suggestions are offered for better performance of the machine –

a. As the three-phase connection is not available along the maintenance pit line in some of the depots, feasibility of single phase machine with same rating may be thought of.

b. 15 meters long suction hose should be planned out of which 10 meters should be of 50 mm and 5 meters length of interface attachment of 35/40 mm as per requirement.

c. Only electrically driven machine may be procured to minimize total weight of the unit.

This is for your information and further courses of actions.

Chief Workshop Manager
Motibagh Workshop, SEC Rly/NGP
28.0 Trolley Mounted Sewage Suction Machine

INFORMATION
OFFICE OF THE EXECUTIVE DIRECTOR
CENTRE FOR ADVANCED MAINTENANCE TECHNOLOGY
MAHARAJPUR, GWALIOR – 474 005
Phone: 0751-2470850, Fax: 0751-2470841

No. IRCA TECH.M.GWL.Bio-toilets
CRSE/(Coaching)
All Indian Railways

Sub: Development of Evacuation system for Bio-Toilets.

Ref: (i) 15th JWG Meeting minutes circulated vide letter No. MD22301/Rail Coach Factory, Kapurthala dated 07.03.2015 item No.13.

(ii) Railway Board’s letter No. 2009/Dev.cell/ICC1/1 Vol.V dated 05.11.2014.

(iii) CWM/MI BW letter No. 48/30/Sewage suction machine/X/927 dated 11.03.2015.

As per instructions of Railway Board in JWG Meeting minutes circulated vide letter No. 2009/Dev.cell/ICC1/1 dated 05.05.2010, a Sub-group for developing evacuation technologies was formed consisting of following members -

1. Shri S.C. Singhal
   ED/CAMTECH/GWL
2. Shri Prashant Kumar
   Dy CME(D)/RCF/Kapoorthala
3. Shri Vinay Shrivastava
   Director/Carriage/RDSO/LKO
4. Shri Vijay Arora
   Sr DME(Chg.)/NDLS

The Group had already submitted their report along with specifications, recommendations and likely sources for development of evacuation system for Bio-Toilets vide Committee report No. CAMTECH/M/Bio-Digester dated 25.08.2011 and same recommendations were communicated to ED/Dev./Railway Board vide CAMTECH letter No. IRCA TECH/M.GWL.Bio-Digester dated 30.09.2011 for further course of actions (copies enclosed).

It was also proposed by above committee members to procure this system by CWM/MI BW/SECR/NGP and Northern Railway. The machine has been procured by CWM/MI BW/NGP in the month of January-2014 and reported vide his letter No. 48/30/Sewage suction machine/X/927 dated 11.03.2015 that evacuation machine is working satisfactorily for evacuation of 1st chamber of Bio-Digester tank.

CWM/MI BW has also given following suggestions for this machine–

a. As the three-phase connection is not available along the maintenance pit line in some of the depots, feasibility of single phase machine with same rating may be thought of.

b. 15 meters long suction hose should be planned out of which 10 meters should be of 50 mm and 5 meters length of interface attachment of 35/40 mm as per requirement.

c. Only electrically driven machine may be procured to minimize total weight of the unit.

Zonal Railways are advised for considering item a, b & c above as per their requirement before initiating procurement as per instructions of Railway Board communicated to Zonal Railways vide referred letter No. at Sr No. (i). (copies enclosed).

In 15th JWG at JP, it is recommended at item 13.1 that circulation of this specification should be done by CAMTECH to all zonal railways, PUs and Rly Board for procurement of the Evacuation machine. The specification is attached for further course of actions.

DA/ Specification No. CAMTECH/M/Suction System/03/1

(K.P. Yadav)
Director/Mech.

Copy also for kind information to: All JWG members.

Components of Suction Machines

- Rack for holding Hose
- Option for Direct Discharge
- FRP Tank 200 L
- Quick Connect Coupling for Hose
- Trolley
- Pneumatic Tyres
- Control Panel
- Single Phase Geared Motor
- Power: 2.2 kW
- Rotary Lobe Pump VX100-45Q
- Option for Direct Discharge
- Quick Connect Coupling for Hose
- Trolley
- Pneumatic Tyres
Trolley Mounted Sewage Suction Machine:

- The Trolley Mounted Sewage Suction Machine supplied by M/s Vogelsang India, Noida UP.
- It consists of a Retention tank (200 L) and Vacuum pump.
- This machine is mounted on a trolley.
- The vacuum pump can suck the slurry/garbage from the toilet tank and can blow back bacterial culture through same pump.
- The system is provided with Reverse and Forward Switches, which sucks the slurry and discharges through same pipe.
- The use of this machine is 100% human touch free.
- Successful trials have been conducted at MIB workshop & Bilaspur on Bio-Toilet Tanks.
- This machine is now available in Coaching Depot/GWL under Sr. DME/JHS.
- The functioning of the machine is reported satisfactory.
Leading Parameters of Machine

**Collection Tank:** Corrosion resistant reinforcement FRP : LXBXH: 875X580X615 mm capacity 200 litters.

**Drive System:** Single Phase Electric Motor rating : 2.2 kW

**Tank Mounting:** Mild steel galvanized frame size 60 mm X 30 mm and 6 mm thick. Mounted on 15 mm thick MS plate of 40 mm width X 680 mm Length.

**Suction Hose:** Heavy Duty flexible suction hose dia 50 mm, length 15 meters: 10 meters of 50 mm and 5 m length of 35/40 mm.

**Suction Pump:** Positive displacement rotary pump, suitable to develop vacuum of atleast 0.92 bar or 684 mm of Hg.

**Control Panels:** the control panel shall be with an on/off and a Forward and Reverse switches.

**Vacuum Gauge:** 150 mm dia gauge for showing 0 to 760 Hg Vacuum level.

**Trolley:** 4- Wheeled Pedestrian controlled fixed plate frame, single axled, length 1450-1500 mm and width 950-1000 mm.

**Float Switch:** The float switch arrangement PSN-X should be at the top lid of the FRP tank for auto cut off in case of “tank full” condition to ensure that there is no spill over during operation.

**Tool Bag:** one tool box consisting spanners, keys and power tools for machine.
29.0 Facilities required in workshop for POH of coaches fitted with Bio-toilets.

Consequent upon introduction of DRDE bio-toilets in ICF coaches, it is felt necessary to develop facilities for dismounting, storing and handling of bio-toilet tanks during POH activities in POH workshops. The following basic facilities are required for the coaches fitted with IR-DRDO bio-toilets:

A. M&Ps required for transporting and loading/unloading of bio tanks of coaches-

<table>
<thead>
<tr>
<th>S.N</th>
<th>Name of item</th>
<th>Total nos.</th>
<th>Capacity</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Low lift hydraulic jack</td>
<td>04</td>
<td>2T</td>
<td>To facilitate loading/unloading</td>
</tr>
<tr>
<td>2</td>
<td>Fork lifter for 6 feet height lift</td>
<td>01</td>
<td>5T</td>
<td>For transportation</td>
</tr>
<tr>
<td>3</td>
<td>Evacuation Machine (Spec. No. CAMTECH/M/SUCTION SYSTEM/03/11)</td>
<td>01</td>
<td>As per spec.</td>
<td>To evacuate first chamber of bio tank</td>
</tr>
</tbody>
</table>

B. Loading/unloading facilities for bacteria inoculum in POH shop-

<table>
<thead>
<tr>
<th>S.N</th>
<th>Name of items</th>
<th>Total Nos.</th>
<th>Capacity</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plastic/fiber drums</td>
<td>As per requirement</td>
<td>100 liters</td>
<td>For collection/storing of inoculum</td>
</tr>
<tr>
<td>2</td>
<td>Truck</td>
<td>01</td>
<td>9 t</td>
<td>Transportation facility for inoculum from generation plant to POH workshop</td>
</tr>
</tbody>
</table>

C. Infrastructure required for storing of bio toilet tanks:

a. – Racks
b. - Covered shed
c. - Other handling and maintenance Tools & Equipments

a. Racks for storing of bio toilet tanks of size 1150 mm x 720 mm x 761 mm, the size of one 3-tire rack for housing of 9 tanks is as under -

- Length – 1250 X 3 = 3.7 Meters
- Width – 1000 mm = 1.0 Meter
- Height = 2.7 Meters

Total no of racks required for 90 bio tanks = 10 rakes
b. Covered shed for storing bio-toilet tanks

*Size of covered shed for 10 (3-tire) racks:*
* Height of shed – 4 Meters
* Width of shed – 7.4 Meters (2 racks shall be in one row)
* Length of shed – 13 Meters (5 rows will be in shed, 2 m space for moving of fork lifter)
* Area of shed – 13 X 7.4 = 96.2 m² say 100 m²

c. Other handling and maintenance Tools & Equipments

May be kept at work places as per requirement.

D. Infrastructure for unit exchange in Sick Lines for Bio-Toilets

As per JWG meeting held at GWL on 03.07.2015, it was decided by members vide item No.12 that Infrastructural facilities should be developed in coaching depots for dismounting of Bio-Toilet tanks for repairs and washing/cleaning of tanks. For above activities, following facilities are proposed –

1. Bio-Toilet CC Apron for unit exchange size 8M X 50M
2. Construction of Cleaning/Washing apron size 3m X 3m X 0.3m (H)
3. Water Jet Machine
4. Inoculum storage for charging in tanks
5. Scissor Platform Trolley for dismounting & Mounting of tank.
6. Covered Drainage Sump size 3m X 3m X 4m (Deep) with sewage connection from Cleaning apron.

**Break up of cost:** As per estimate prepared by NWR Ref: MLB item No.25 Project ID No. 09.03.53.15.4.52.025 dated 08.06.2015.

a. Engineering Deptt. – Rs. 554000.00
b. Electrical Deptt. – Nil
c. S&T Deptt. – Nil

**Total (Civil) – Rs. 554000.00 Approx.**

Note: M&P Cost should be ascertained from local market

APRON FOR BIO-TOILET FOR UNIT EXCHANGE AND WASHING/CLEANING IN COACHING DEPOTS

- **Under ground Drain**
- **SEWAGE LINE**
- **Drain Sump Covered**
- **Covered Drain**
- **Inoculum Barrel Platform with covered shed**
- **Steel Jali**
- **Water Hydrants**

**CLEANING APRON**
- **Size: 3m x 3m x 0.3m (H)**

**C.C. APRON**
- **Size: 50 m x 8 m**

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