

**AUTOMETIC WORKING BIO-TOILET TANK FOR RAILWAY COACHES**Pandya Chintan<sup>1</sup>, Yadav Jatin<sup>2</sup>, Kareliya Sanket<sup>3</sup>, Asst. Prof. Darshan Adeshara<sup>4</sup><sup>1,2,3,4</sup>*Department of Mechanical Engineering SPNVTC Surendranagar, Gujarat 363-030, India*

**Abstract** — Bio toilet tank is human waste disposal mechanism in area with no infrastructure facilities. That is easy to operate alternative to the tradition waste disposal system. In that project are two doors in tank, the one input door and second exit door. The input door is on top of the tank and exit door is assembling inside the tank. The doors open and close by using pneumatic cylinder. Pneumatic cylinder is control by using RPM controller, Proximity sensor, and Compressed air tank. So, whole system is controlled with train speed. If the train speeds exceed 30 km/h then exit door will open and total waste depositor drop in tracks and input door is close. Input door is open when train is under 30 km/h speed.

**Keywords**-Bio-toilet tank, input door, exit door Pneumatic cylinder, RPM controller, Proximity sensor.

**I. INTRODUCTION**

The limitation in current model is that the waste depositor is not felt down automatically and the model is working manually.

Biological toilets convert human waste and other biodegradable substances into inoffensive liquid & gas, leaving a small amount of residue. The process is accelerated by addition of suitable biological agents.

The toilet system should provide a sealed commode with an efficient flushing system and provide our free interior in the coach and toilets. It should be applicable to Western and Indian style toilets of mainline broad gauge (BG) coaches of Indian Railways.

**II. CURRENT SYSTEM****1. DESIGN & CONSTRUCTION**

The toilet system offered should be installed in the toilet module as an integrated system, which in case of an emergency, due to the loss of power and/or air, should always be functional.

➤ **The main system components which will all be in the scope of supply of the supplier are:**

- Lavatory bowl (Oriental/European design).
- Flushing arrangement including interfacing with water, compressed air supply, Retention with stainless steel trap.
- Control panel and associated ancillaries for the system operation.
- Associated water hoses, pneumatic piping and electrical wiring.
- Ground facilities required at the terminals

The technical implications/reasons for capacity rating of important components of the system shall be explained in detail by the tendered. Similarly, critical dimensions in the fixing & location drawings shall be clearly indicated by the tendered. The system should be so designed that during routine maintenance does not require contact with semi-processed waste by maintenance personnel. Before extensive repairs, a manual drain out and flush of the complete system should be possible. The tendered should indicate the consumption of power, air, water & chemicals if any per use and per hour by the toilet system offered.

**1.1. Toilet Bowl**

Both Indian squat-pan and Western style commodes are fitted on IR coaches. Seats of Western style commode are 400 - 425mm above the toilet floor; the Indian style squat pan is mounted on / below the floor, projecting less than 50mm above the floor. The total height of the toilets should be such as to avoid infringement with under-frame members (space available approx. 135mm).

The diameter of the toilet bowl outlet hole should be minimum 100mm and shall be so designed to prevent any obstruction in outflow of waste. The toilet bowl design must include an integrated water spray ring system which covers the entire toilet bowl. The toilet bowl should be manufactured from Stainless Steel to AISI 304.

The toilet bowl should be aesthetically pleasing. The outlet whole diameter size should be adequate to handle normal waste and some foreign objects thrown in such as bottles, caps, napkins, plastic bags & cups etc. The waste should never be visible or flow backwards into the bowl even in cases of mal-functioning.

The system shall, in no case, permit bad odors to escape into the toilets or around the coach. The Biological Toilet system must have the following design and functional parameters:

- i. The toilet bowl (Indian and European) must be totally sealed and must be equipped with an efficient water spray ring, which should cover the entire toilet pan in order to provide uniform flow of water in the toilet bowl thus ensuring 100% bowl wash.
- ii. The toilet system must be provided with an effective stench trap to ensure sealing of odors from the waste treatment tank to the toilet room. The system adopted for odors sealing must be of a proven design which totally seals the space between the toilet bowl and the waste treatment tank and must meet the following operating criteria: During normal operating conditions, when both air and power are available, a water stench trap should always be available between the tank and the bowl. On loss of air and power, the stench trap should always be in the closed position thus ensuring that there is no passage of odors from the waste treatment tank to the toilet room. During non-availability of power and air, the toilet should be fully operable and the stench trap should open to only allow the flow of waste into the tank and thereafter should remain in closed position.

## **1.2 Transport Pipe System**

All pipes and pipe connections should be made of stainless steel to AISI 304. It should be completely leak-proof and made of non-corroding materials. Line valves should be located for easy accessibility for maintenance, and should be completely leak-proof while in use. Different circuits should be isolated so that repairs in a particular line do not require complete dismantling.

## **1.3 Waste Processing**

Toilet system shall disintegrate/decompose the waste by the bacteria proliferating due to agents added in it. The system should be able to work satisfactorily even with foreign objects as above. The human waste may be treated in single or multiple stages to ensure complete decomposition. The tendered shall clearly indicate the system for rendering the toilet discharge environmentally inert. Chemicals used in the toilet if any, shall be dispensed in such a manner that there is no chance of their contact with the user.

The media used in the waste treatment tanks should be of proven design. The media must be made of synthetic material which does not absorb any chemicals or detergents. The material should be highly resistant to any chemical reaction and must not allow the absorption and existence of any foreign material in the media. The media must be able to sustain high pressure washing and cleaning of the tank. Documentary evidence of the satisfactory performance of the media must be provided.

Details of chemicals/agents, along with their consumption rates and approximate costs, shall be indicated. All the consumables should preferably be available in the Indian market. All the material, chemicals/agents being used should meet environmental standards as applicable.

## **1.4 Waste Collection & Processing Tank**

The tank shall be of stainless steel to AISI 316L with sufficient capacity for duty cycle mentioned earlier. If under-slung tanks are provided, they shall be of superior quality stainless steel, designed to withstand ballast stone hits and cattle run over by the trains. The tendered shall ensure high quality of material, fabrication and welding, for completely leak proof construction. Level sensors should be provided in the collection tank which can be seen from outside.

The waste treatment tank shall be designed so that the same tank can be installed in either side or end of the coach. The waste treatment tank design must include a separate screen to collect large Non-biodegradable foreign objects. This screen must be designed so that it can be easily cleaned during regular maintenance to remove such non degradable

objects without the maintainer coming into contact with human waste. A proven positive venting system must be provided in the waste treatment tank for proper functioning of the biological waste treatment tank.

The maintenance requirement of the toilet system should be clearly spelt out by the supplier. The maintenance should be done at the time of the maintenance schedules of IR as given in the annexure. The waste treatment tank shall be so designed that it should be possible to clean the tank and service it without removing the tank from the coach during POH.

### **III. FUTURE SYSTEM**

#### **2.1 Rpm Controller**

Train protection is a family of functions whose purpose is to assure the safety of train movement by preventing collisions and derailments. Train protection functions and requirements override all other control system functions either through equipment design or, in a completely manual mode, by rules and procedures.

The automatic equipment that accomplishes train control functions is often of complex design, but the basic technology is quite simple. The purpose of this section is to provide an acquaintance with the fundamental elements of an ATC system—track circuits, signaling apparatus, train operating devices, interlocking controls, and supervisory equipment. The details of this technology and the design features of ATC equipment now in use in rail rapid transit systems are omitted here but are provided in appendices B and C. For safety and efficient operation of a transit system, it is imperative to know the locations of trains at all times. The sensing device providing this information is the track circuit, which was invented over 100 years ago and has remained essentially unchanged in principle even though extensively refined and modified in its engineering details. Rpm controller will measure a wheel, if set rpm using by rpm controller than the sensor is highlight.

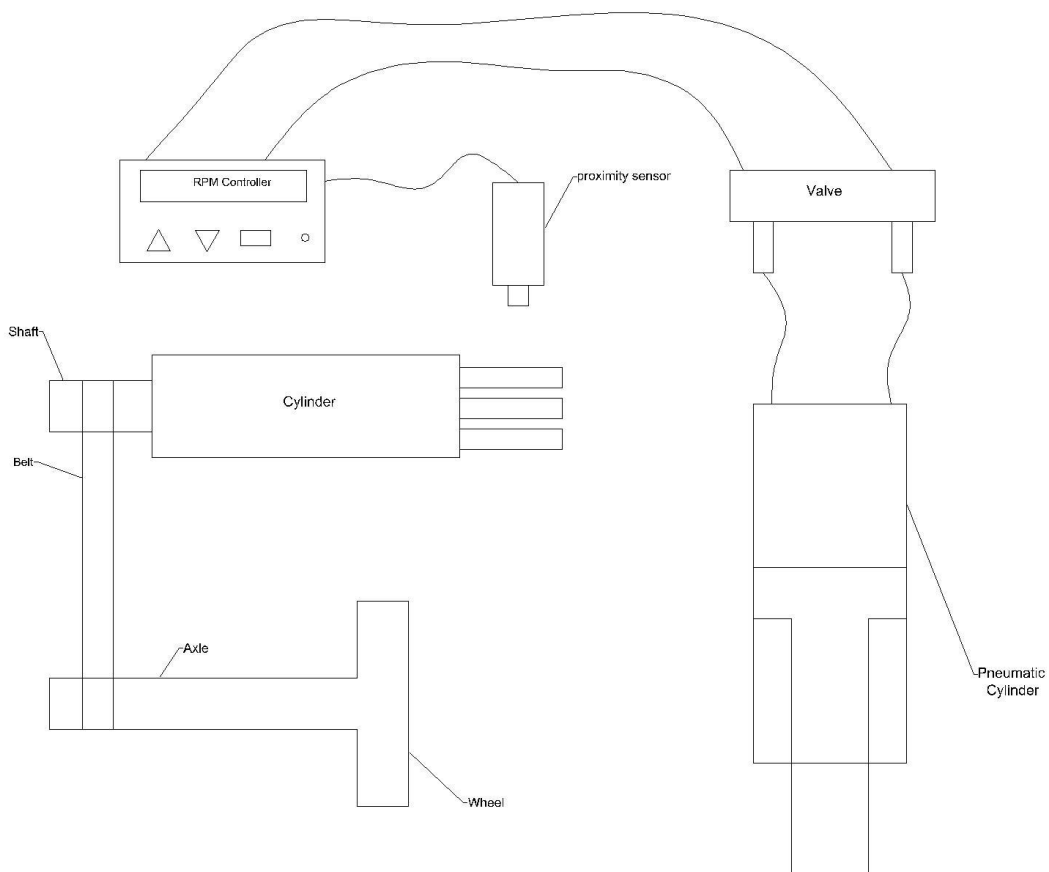
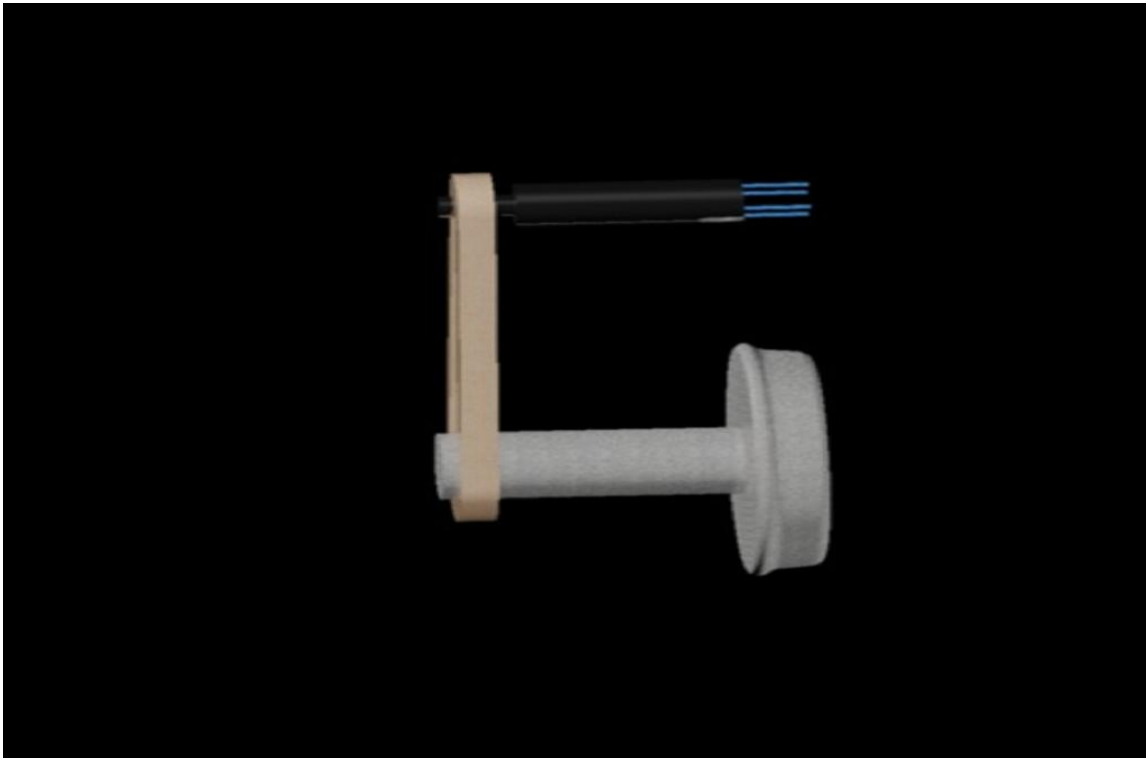


#### **2.2 Proximity sensor**

Due to rather long braking distances of rail vehicles, a reliable train location is a prerequisite for flexible train operation concepts. State-of-the-art systems depend on installations along the track, e. g. belies and axle counters. New systems of operation, e. g. moving block, need a reliable and accurate train location. Therefore, enhancing the track capacity based on a more detailed train location comes along with high investments in infrastructure and high maintenance costs. A train based location system helps to reduce these costs to a minimum.



The Proximity sensor is using in pneumatic cylinder, the pneumatic cylinder will work open/close using this sensor. Proximity sensor depends to rpm controller because rpm controller is measure to speed and transfer to sensor. Theses sensor input a toilet tank inside and second sensor is measure eddy current.



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