

A
STUDY ON CONTROL
DISCHARGE TOILET SYSTEM

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ABSTRACT

The main purpose of this technical paper is to study Control Discharge Toilet System, its purpose, working principle , parts , testing and some modifications in the system.

1) INTRODUCTION

The basic purpose of introduction of Control Discharge toilet system in Indian Railway is to eliminate the practice of spillage of toilet waste on to railway station area & in the populated area of city. These toilet systems are designed to operate on the principle of high - flush through which the evacuation of toilet bowl is carried out by means of water pressure. It operates with a pressurized water bowl wash that covers 100 % of the toilet bowl area. The toilet waste is transferred to the retention tank with a control amount of water.

2) Salient feature of control discharge toilet system:

- It's easily programmable and reprogrammable
- Less Air, Water and electricity
- Fully P.L.C Controlled.
- Easy to clean.
- Hygienic, improves environmental conditions at Railway stations.

3) Main suppliers of CDTS

- (a) M/s Aikon Technologies Pvt Ltd.
- (b) M/s Vibhu Composite works.

4) Working Principle Of CDTs

This system works on electrical & pneumatic pressure arrangement. The retention tank which stores effluent has two openings. These two openings activates by double acting pneumatic cylinders fed by Feed pipe of air brake system. Upper opening opens every time the user operates the flush button, whereas lower opening at predetermined speed & after predetermined no. of cycle of flushes. The solenoid/magnetic valves control the entry of pneumatic pressure in pneumatic cylinders attached to openings/slides.

The pressurizer provided in CDTs system, delivers pressurized water to flush the waste. The logical control records the no. of flush cycles as well as speed of the vehicle through WSP System to operate the lower opening to drain out the effluent.

Schematic Diagram of CDTs

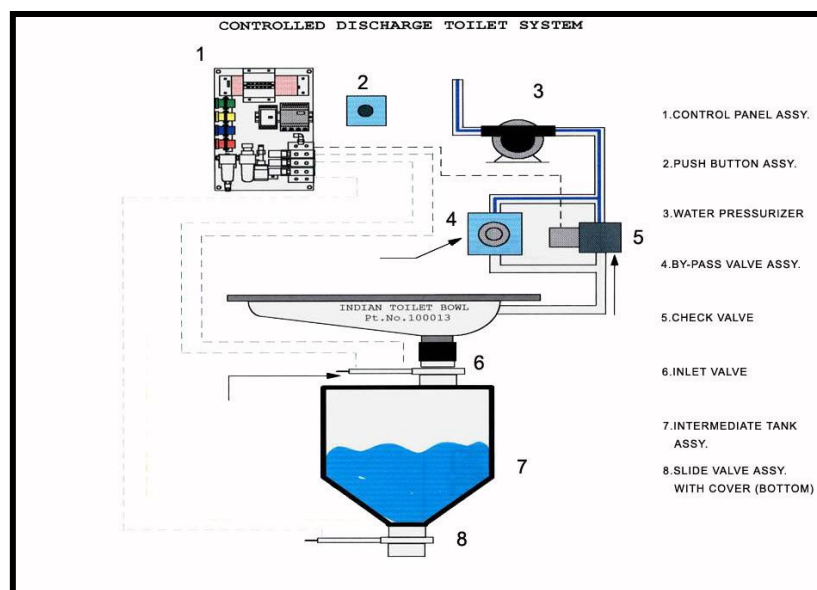


Figure 4.1

5) Major Components of CDTs

1. Indian & European toilet basin with flush nozzles:

There are two types of toilet basin used in these CDTs system. These toilet basin bowls made up of Stainless Steel AISI 304 with upper side pickled & grinded

2. Control panel:

Control panel consists of following equipments:

- Programmable logic controller (PLC):



- Solenoid valve:



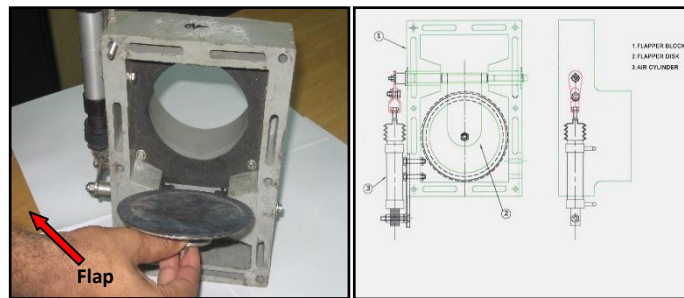
- Control relay:



3. Retention tank:

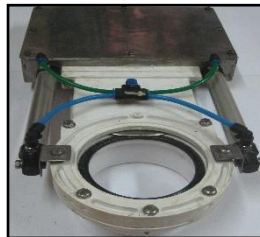


4. Flapper Valve:



Flapper assembly

5. Lower Slide valve:



6. Flush button:



7. Water Pressurizer:



6) General Operations of CDTS

1)Stand-by condition

2)Flush Cycle

3)Retention Tank Discharge Cycle

1)Stand-by condition

- Water Pressurizer – Off
- Water check Valve – Closed
- Upper Flapper Valve – Closed
- Lower Slide Valve – Closed

2)Flush Cycle

Step – 1

- Water Pressurizer – On (for a predetermined time)
- Water check Valve – On (for a predetermined time)
- Upper Slide Valve – Open (for a predetermined time)

Step - 2

- Water Pressurizer – Off
- Water check Valve – Off
- Upper Slide Valve – Closed

3)Retention Tank Discharge Cycle

Condition – I

- If train speed is - below 30 kmph then the retention tank lower slide valve – closed.

Condition – II

- If the train speed is above 30 kmph and Flush Count is below Predetermined value, then the Retention Tank Lower Slide Valve remain closed
- If the train is above 30km/h and Flush Count is equal or above Predetermined value, the Retention Tank Lower Slide Valve Opens (for a predetermined time).

End of Retention Tank Discharge Cycle

Flush Count restarts at ZERO (0)

7) Testing procedure of CDTs

CDTS DEMONSTRATION STAND

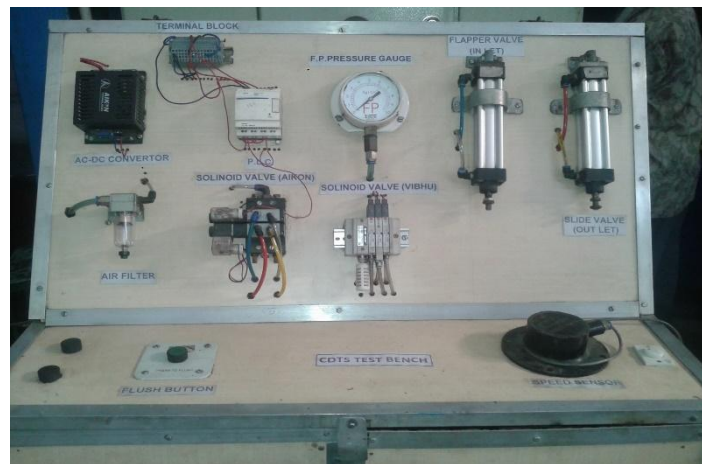


Figure 7.1

AUTO PULSE GENERATOR



Figure7.2

Figure 7.1 shows a Demonstration stand on which the testing of CDTs can be demonstrated. Connect the auto pulse generator as shown in figure 7.2 (this pulse generator is approved by EDME/chg/RBLr.No.96/M(C)/137/33 VoL.II Dt: 27.09.2010) to the PLC and provide necessary inputs like electric supplies to all electrical components like solenoid valve, PLC, AC-DC convertor and water pressuriser. Connect the air pressure to the inlet of the demonstration stand. After giving all necessary connections press the flush button for some pre-determined no of flushes. For every press of flush button the upper flapper valve gets open for some pre-determined seconds. After completion of pre-determined flushes increase the speed of vehicle (here the corresponding pulses) from 0 to above 30 kmph. After attaining the speed above 30 kmph the upper slide valve gets open for pre-determined seconds and closes. This is how the CDTs can be tested for it working.

8) Modification suggested

- Presently the connection between Toilet Bowl and CDTs Retention Tank is a straight pipe if that Straight pipe is replaced with a " P " Trap then the following advantages may be attain
 - 1) Bad smell can be avoided as the water accumulate in the " P " Trap will act as an insulator
 - 2) Avoiding of entering the materials in to the Retention Tank like Bottles, cloth etc.

The water flow diagram in " P " trap and some example are shown in figure 8.1, figure 8.2 subsequently.

Water Flow Diagram of " P " Trap

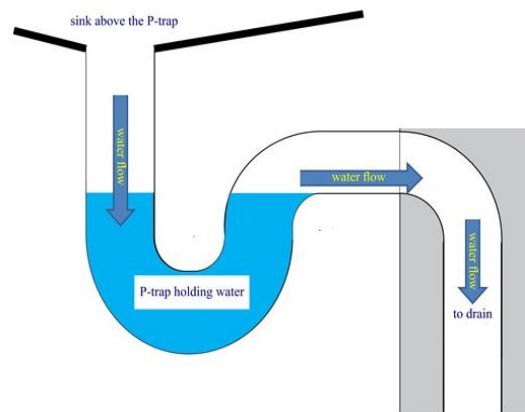


Figure 8.1

" P " Trap



Figure 8.2

- 9) **Conclusion** : studied working principle of the control discharge toilet system, its parts , analysed how to test the control discharge toilet system and with suggesting some modifications.