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Review on Automatic Train Washing System

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Abstract: *The rail industry is constantly evolving to keep pace with the demands on the network and the need to provide an efficient and reliable service. Our close working relationship with the rail industry means that we are always looking for ways to improve the day to day operations of many parts of the railway industry and to use our engineering expertise and considerable experience to provide solutions. We has drawn on this experience to design, develop, install and maintain a wide range of train wash systems which ensure that rolling stock is kept as clean and pristine as the day it was rolled out of the assembly yard. Automatic train washing system is very common in developed countries. Train washing system is usually associated with fuel filling stations. It consists of large machines with automated brushes. Automatic train washing system is fully automated with different stages of rinsing, shampooing, washing, drying and waxing. Different types of train washing systems are discussed in this report. This system uses large quantity of water, thus water recycling plant is also an integral part of the automatic train washing system. I studied some of the train washing systems in GUJRAT; I hope this report will be useful to understand the basics of automatic train washing system.*

Keyword: *Train, Washing system, Machines, Water recycling.*

I. INTRODUCTION

The first automatic train washes appeared in the late 1930s. Automatic train washes consist of tunnel-like buildings into which customers (or attendants) drive. Some train washes have their customers pay through a computerized POS (point of sale unit), also known as an "automatic cashier".. The mechanism inputs the wash PLU (Price look-up codes) into a master computer or a tunnel controller automatically. When sale is automated, after paying the train is put into a line-up often called the stack or queue. The stack moves sequentially, so the wash knows what each train purchased. After pulling up to the tunnel entrance, an attendant usually guides the customer onto the track or conveyor. At some washes, both tires will pass over a tire sensor, and the system will send several rollers. The tire sensor lets the wash know where the wheels are and how far apart they are. On other systems the employee may guide the customer on and hit a 'Send Train' button on the tunnel controller, to manually send the rollers which push the train through. When the customer is on the conveyor, the attendant will instruct the customer to put the train into neutral, release all brakes, and refrain from steering. Failure to do so can cause an accident on the conveyor. The rollers come up behind the tires, pushing the train through a detector, which measures train length, allowing the controller to tailor the wash to each individual train. The equipment frames, or arches, vary in number and type. A good train wash makes use of many different pieces of equipment and stages of chemical application to thoroughly clean the train or such kind of vehicle.

II. NEED FOR AUTOMATIC TRAIN WASHING PLANT

The Automatic Train Washing Plant is able to achieve complete exterior cleaning of a rake of 24 coaches in about 15-20 minutes time while being placed on the pit line, for primary/secondary maintenance. Besides providing safe and reliable service to our esteemed passenger, it is also necessary for the Railways to offer the convenience of neat and clean train coaches.

III. BASIC COMPONENTS

- 1) *Brushes:* Brushes are used to rub the surface of the train it gives them the cleaning effect and sometime it rub the surface more than necessity it causes damages and scratches on the surface. It is the disadvantage of the brushes also.
- 2) *Jet spray:* Jet spray are used to spray the water and the clean the surface of train through pressure application and then it removes most of the dirt from the surface.
- 3) *Dryers:* Dryers are used to dry the washed surface quickly through the application of the pressure of air. It is necessary to dry the surface before the train start going if once train start running there is much more possibility to the dry dust is stick to them so the drying the surface before train start is necessary.
- 4) *Sensors:* Sensors are necessary to sense the trains present or upcoming of the train because after sensing the train we start the our cleaning process otherwise our time and water and energy would be waste.

- 5) *Controllers*: Controller are used to control the entire process like starting of the spray jet, Running of the brushes and also taking instruction from the sensor and give feedback to controller of the entire system and also used to run the pump.
- 6) *Pump*: Pump are used to feel the water in water tank and also used to create pressure on the pressure jet. The flow of the water and the air in the dryer is caused by the pump.
- 7) *Nozzles*: Nozzles are used to increase pressure of the water and the air.

IV. LAYOUT AND CONSTRUCTION

The Automatic train Washing Plant can be installed at the entry point of the train examination pit at coaching depots. This consists of 4 fabricated structures. Overall Length of the plant is 30M and width 5.26m across Railway Track, with additional space requirement beside the track of 4x5.5m & 2x2m for Pump/Operating room and air reservoir. ETP if required will need additional space of 4x5.5m.

A. Stage-1 - prewash unit



Fig.1 Pre wash unit

- 1) Pre-wash is the first operation in the washing sequence.
- 2) Pre-wash operation wets the coach walls and roof through low velocity water jets.
- 3) Pre-wash operation helps to loosen dust & dirt from the coach exterior.

B. Stage-2 - Soap solution spray and the First brush



Fig. 2 Soap solution spray and first brush

- 1) Pressurised mixture of soap solution is sprayed on coach body and roof.
- 2) The soap solution is then brushed on coach walls and roof with help of four vertical i.e. two on each side and one horizontal brush placed on the roof of the coach.
- 3) All brushes are driven by gear motors.

C. Stage-3 – Under-gear cleaning



Fig.3 Under gear cleaning

- 1) Pressurised jets of water and disinfectant directed towards toilet discharge area clean the areas beneath the toilets which are not otherwise accessible.
- 2) The jets also clean the under gear portion of the trolleys.
- 3) Disinfectant spray prevents breeding of cockroaches.

D. Stage- 4 – Main wash



Fig.4 Main wash

- 1) Total eight vertical brushes – four on either side – are used to wash vertical walls of the coaches.
- 2) One horizontal overhead brush is used to wash roof of the coaches.
- 3) All brushes are driven by motors.
- 4) This work-station thoroughly cleans areas such as, window shutters, destination.

V. OPERATING CHAMBER



Fig.5 Operating Chamber

An operating chamber is provided with underground tank of 20,000 liters and over head syntax tank of 5,000 litres for soap solution.

- 1) Electrical / Electronic operating panel with electrical fittings, wiring etc. is provided in the control room with PLC control system for automatic working of the entire plant. Manual option is also provided.
- 2) Three sets of pumps with spare pumps are provided in series with an arrangement to switch over in case of break down.

VI. PROBLEM DEFINITION

A. Brush patches

In car wash when car is cleaned with the rotator brush it leaves it's pattern on car body, also known as brush patches.

B. Corrosion

Corrosion is the gradual destruction of material, usually metals, by chemical reaction with its environment. This means electrochemical oxidation of metals in reaction with an oxidant such as oxygen. Corrosion degrades the useful properties of materials and structures including strength, appearance and permeability to liquids and gases.

C. Wastage of water

In the system large amount of water is required which after use goes in sewage, can't be use again, also known as water waste.

D. Water patches

Water spots are caused by minerals deposits that etch the outline of a drop of water into your vehicle's paint. All water has minerals, whether it from the hose or the sky as the water evaporates, the minerals remain on the surface and they will eventually create water spots or water patches.

VII. WATER RECYCLING

In which the train wash system operates with the introduction of water recycling which works by re-using the waste water in the main wash section with fresh water being used for the final rinse. Water recycling can be incorporated into new plant and retrofit applications to give cost savings from a reduction in the use of fresh water.

VIII. ADVANTAGES

- A. Low capital and operational cost.
- B. Continuously self-cleaning.
- C. Minimal maintenance.
- D. Simple installation.
- E. Easily re-locatable.
- F. Easy to operate.
- G. Easy to understand and maintain.
- H. Standard parts and components used (easily available).

IX. LIMITATIONS

- A. Primary investment is high
- B. Uses of chemical shampoos
- C. Scratches

X. CONCLUSION

There is more and more pressure on maintenance depots, where an increasing schedule of maintenance is required on a daily basis using a site, equipment and technology which was fit for purpose when it was designed decades ago. Our extensive experience in the design and installation of train wash systems together with our team of PTS certified engineers means that we are also able to offer a full range of maintenance packages which are designed to extend the operating life of your equipment. These range from simple Planned Preventative Maintenance (PPM) contracts right through to an all-inclusive option for periods of up to 30 years



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