



NTSB

SAFETY ALERT

National Transportation Safety Board



Rail Transit Vehicle Emergency Brake Push-button Electrical Switch Failure



The problem:

Emergency brake systems on some trolley cars and rail transit vehicles may not activate correctly because of the improper installation or adjustment of the electrical switch in the push-button mechanism.

Related accident:

On January 4, 2017, at 12:47 p.m., eastern standard time, Southeastern Pennsylvania Transportation Authority (SEPTA) trolley car 9101, with 47 passengers, was traveling north on trolley route number 10 when it stopped at the southeast corner of Lancaster Avenue and 38th Street, Philadelphia, Pennsylvania, to offload passengers. SEPTA trolley car 9085, with six passengers, traveling in the same direction, collided with the rear of the stopped trolley car at an estimated speed of 11 miles per hour (mph). Emergency responders transported both operators and 46 passengers to local hospitals for nonlife-threatening injuries. SEPTA estimated equipment damages at \$60,000. The weather at the time of the accident was partly cloudy and 54°F.

Both trolley cars were electrically powered 600 Volt-Direct Current (DC) single-car light rail vehicles (LRV) with two trucks, four axles, and four DC traction motors. The braking system for such trolley cars is both friction and dynamic.¹ The friction brake system consists of an inboard friction ring with a pneumatic caliper on each axle and two track brakes on each truck.²

The trolley car's emergency brake push-button (Westinghouse Air Brake Company Fluid Power Division, part number 0584566) is a two-position, on/off, manually operated push-button pneumatic valve with an electrical switch. (See figure 1.) The push-button controls the flow of air and activates the electrical switch, depending on its position.

Pressing the emergency brake push-button located on the right side of the console of the LRV activates the emergency brakes. (See figure 2.) When activated, the emergency brake push-button releases brake pipe air through the pneumatic portion of the switch and a push rod in the mechanism actuates the electrical switch. Releasing brake pipe air causes the in-board friction brakes on each axle to apply and the actuation of the electrical switch activates the track brakes. The track brakes are primarily used for emergency braking or when quick stops are necessary.

¹ *Friction braking* is a system that uses friction to absorb energy to slow or stop a vehicle. *Dynamic braking* refers to the use of traction motors of a rail vehicle as an electric brake by reconfiguring the motor into a generator.

² A *track brake* is an electromagnetically activated mechanism that slows or stops a trolley car or rail transit vehicle by transmitting the braking force against the running rail.

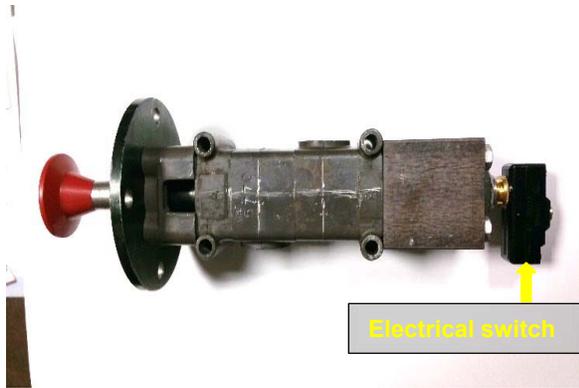


Figure 1. Emergency brake push-button with the electrical switch.



Figure 2. LRV operating console with the emergency brake push-button circled.

Following the accident, investigators tested the effectiveness of the emergency brake application using the emergency brake push-button. In these tests, investigators observed that the track brake portion of the LRV braking system was not functional. Further investigation attributed the failure to the electrical switch portion of the emergency brake push-button. (See figure 3.) The failure of the switch was caused by improper installation in the body of the push-button mechanism. The push rod portion of the emergency brake push-button can overstress the electrical switch if it is installed too far into the body of the mechanism, breaking the electrical switch and causing it to separate from the pneumatic valve.

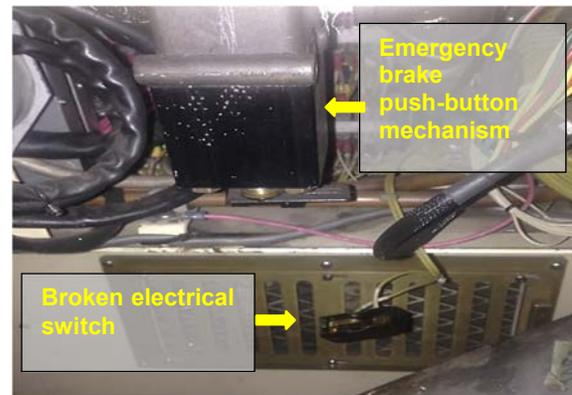


Figure 3. Emergency brake push-button showing a broken electrical switch.

After identifying this failure, NTSB contacted the owner of the switch design, WABTEC Corporation, who issued a service bulletin that addressed the proper installation of the switch.³

What can rail transit agencies do?

- Identify all rail transit vehicles with emergency brake push-buttons that are equipped with electrical switches
- Once identified, inspect and test each switch in accordance with WABTEC Service Bulletin No. 115, January 2017
- Revise your maintenance procedures in accordance with *WABTEC Service Bulletin No. 115*
- Test after any maintenance to ensure proper operation
- If there are any questions contact WABTEC Corporation at 864-433-5900

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³ See *WABTEC Service Bulletin No. 115*, January 2017, in NTSB docket DCA17FR003.