

Incident Summary #II-1288198-2021 (#25069) (FINAL)

SUPPORTING INFORMATION	Incident Date	November 17, 2021	
	Location	North Vancouver, BC	
	Regulated industry sector	Elevating devices - Elevator	
	Impact	Qty injuries	1
		Injury description	A person tripped and hit their head. Person suffered cuts and abrasion that required medical attention.
		Injury rating	Moderate
	Damage	Damage description	No damage
		Damage rating	None
Incident rating	Moderate		
Incident overview	A hydraulic elevator traveling in the down direction failed to level accurately as it approached a floor. As a result, a person tripped and hit their head while trying to egress the elevator.		
INVESTIGATION CONCLUSIONS	Site, system and components	<p>This passenger hydraulic elevator serves 5 floors at a residential building. To execute accurate stops at each floor level, it uses magnetic proximity switches installed on top of the car in conjunction with a 6-inch metallic actuating cam. The cams are installed in the hoistway at each floor level to target the leveling and stopping (Image).</p> <p>The magnetic proximity switches can detect the approach of the metallic actuating cam when it is within the switch's magnetic field range. When the cam is within proximity of the switch's magnetic field range, it closes a set of contacts within the proximity switches. The switch's contacts normally revert to their normal open state once the cam is out of the magnetic field range. The state of the contacts is also monitored by the elevator controller which initiates the starting and stopping of the elevators at all landings. It is also intended to monitor for faulty leveling switch conditions.</p> <p>The leveling system at top of the car has three magnetic proximity switches: the Up Level (UL), Door Zone (DZ) and Down Level (DL). The door zone switch when actuated, opens the car door at floor level.</p> <p>Under normal operation when the car is descending towards a targeted floor, the DL magnetic proximity switch is the first switch to be actuated by the cam. It is then immediately followed by the door zone magnetic proximity switch and both contacts are closed by the activating cam. As the elevator continues to inch down towards the target level, the DL switch drops out of the cam's range; its contact reverts back to the open state. The controller then sees that the DL switch has dropped out. The elevator immediately stops the car since this would signal that the car has reached its target. The car sill and floor sill would normally be leveled with each other and the DZ switch would normally be actuated. This would initiate a car door open cycle, that under normal conditions, would happen with the car leveled at the floor. The elevator code at the time of the installation required that controllers be equipped with a</p>	

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	<p>monitoring means to detect faulty leveling switches (aka a redundant system). It would require the elevators to remove themselves from service if such a condition were to occur.</p>
<p>Failure scenario(s)</p>	<p>While the car was descending to a floor level, the DL proximity switch contacts failed to reopen. Car stopped 1.5 inches below floor level. Monitoring means to detect faulty leveling switches did not activate unit to remove itself from service.</p>
<p>Facts and evidence</p>	<p>November 19, 2021 - Interview with mechanic and on-site observations.</p> <ul style="list-style-type: none"> • Elevator mechanic who attended to the incident confirmed that the programmable logic controller indicated stuck contacts on the DL switch. • Elevator mechanic stated that the car was still in service the day after the incident. • Elevator mechanic witnessed that the elevator would travel in the down direction at a very slow speed and overshoot the floor levels. Elevator would travel at rated speed in the up direction and would also level accurately. • Witnessed the car parked at 1.5 inches below target floor level, before repairs were made. • Confirmed through logbooks that elevator is maintained regularly. <p>November 26, 2021 - On site simulation/testing performed by elevator mechanic.</p> <ul style="list-style-type: none"> • Jumper was used to simulate a DL switch welded in. • Confirmed that the elevator stopped at 1.5 inches below floor level. • Confirmed that elevator would remain in operation even after it registered a stuck DL contactor. • Confirmed that elevator would travel in both directions with a stuck contactor. • Confirmed that the car did not re-level. <p>April 19, 2022 - Phone conversation with controller manufacturer programmer</p> <ul style="list-style-type: none"> • Controller manufacturer programmer stated that all their controllers including first gen controllers had a redundancy monitoring means to detect a failed/faulty leveling switch. • Controller manufacturer programmer stated that the program was designed to remove the elevator from service in the occurrence of a faulty leveling switch. It is also supposed to prevent the elevator from restarting under such a condition.

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- Controller manufacturer programmer stated that they have confirmed through simulation of their program that the elevator would shut down under the circumstances mentioned.

April 25, 2022 – Phone conversation with controller manufacturer programmer

- Controller manufacturer programmer stated that after going back to review the program installed for that unit, they found that the redundancies may not have been properly applied or working as per the requirements of the B44-M90.
- Programmer stated that the controller would need an update to fix the issue and make it compliant with the requirements of the B44-M90.

Note:

Confirmed through manufacturer's website that the switches are sealed and not serviceable.

Causes and contributing factors

There is a high probability that at some point prior to the incident, the DL's proximity switch contact became stuck in the close position. This condition very likely caused the car to overshoot the floor levels on all down calls. It is very unlikely that regular maintenance would have prevented such an incident since the switch is sealed by the manufacturer and does not require maintenance. There is a high possibility that redundant systems required by the B44-M90 Elevator Safety Code, failed to remove the car from service. This may likely be due to the controller not being equipped with the required features during the time of install. The controller's fail safe and redundant features are currently being investigated by the original elevator installer and programmer.

