Incident Summary #II-892940-2019 (#14785) (FINAL)

SUPPORTING INFORMATION	Incident Date		August 1, 2019
	Location		Vancouver BC
	Regulated industry sector		Elevating devices - Elevator
	Impact – Injury	Qty injuries	1
		Injury description	Elevator occupant reported that the elevator became shaky and made a fast decent which resulted in their back injury.
		Injury rating	Moderate
	Impact – Damage	Damage description	Deteriorated packing gland and clogged check valve
		Damage rating	Minor
	Incident rating		Moderate
	Incident overview		A mechanical failure caused misalignment with the hydraulic system resulting in the elevator shaking and rapid but controlled decent.
INVESTIGATION CONCLUSIONS	Site, system and components		This elevator unit is a twin post hydraulic jack configuration. This hydraulic jack has an internal and external packing gland which maintains a seal between the hydraulic piston and the cylinder and prevents oil from leaking out. The check valve is located at the bottom of the main section of the piston and controls the flow rate of hydraulic fluid in both the up and down direction. When the valve on one side of the twin post remains open while the other cylinder check valve is operating as designed, the side with the open valve will allow hydraulic fluid to flow out of the piston which will cause that piston to be lower than the other piston, and cause misalignment. In this configuration, when one of the cylinders is not at the same position as the other cylinder a sensor will detect this mis-alignment. When this occurs, the controller will lower both cylinders (the elevator) to the lowest position and then the controller will apply pressure to both cylinders and raise the elevator evenly. This process is called cylinder re-sync and this process usually occurs late in the evening when the elevator is normally idle.
	Failure scenario(s)		There was oil loss from one of the cylinders as a result of a deteriorated internal packing gland and uneven pressure due to a clogged check valve. The sensors, located within the system, detected that the pistons were not within the tolerances set by the manufacturer and proceeded to resync the jacks to ensure that both pistons were within equal positions. Resyncs usually occur at night but in this case it occurred during the day when there was an occupant in the elevator.
	Facts and evidence		During a visual inspection with the maintenance contractor, it was witnessed that there was a significant amount of oil on the outside of the cylinder casing. Interview with Maintenance Contractor confirmed:

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	• Upon dismantling the cylinder, they discovered a deteriorated internal packing gland on the cylinder with oil loss. • Check valve located in the cylinder that had oil loss, was clogged with debris from the deteriorated packing gland and was stuck open. • Packing gland lifespan on average is 8-9 years. • Packing glands are replaced when excessive leaks are found. No excessive leaks were found on this unit. • Internal packing glands cannot be seen without dismantling the entire cylinder. • During resyncs, elevators typically move at 25ft per minute. • The elevator was approximately 5 years old. Maintenance log confirms regular maintenance was being performed. Oil log confirms that there was no excessive loss leading up to the incident. Elevator was installed and received final acceptance inspection in October 2014.
Causes and contributing factors	It is likely that accelerated wear-and-tear lead to the deteriorated packing gland. It is highly probable that the deteriorated packing gland led to the oil loss and the oil loss triggered the cylinder to resync. It is highly probable that the clogged check valve that remained open also contributed to the uneven pressure and led to the cylinder resync.

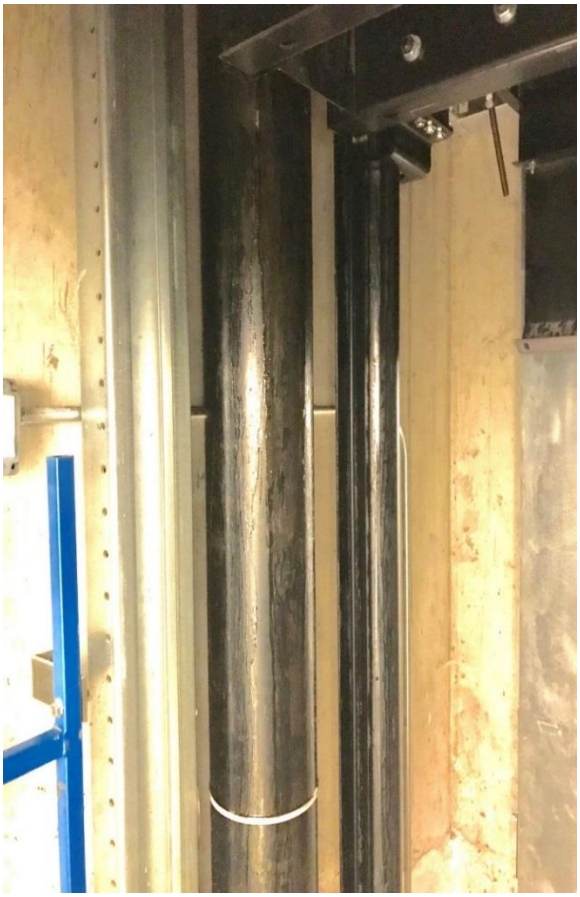

Photo 1: Picture of oil on exterior of cylinder

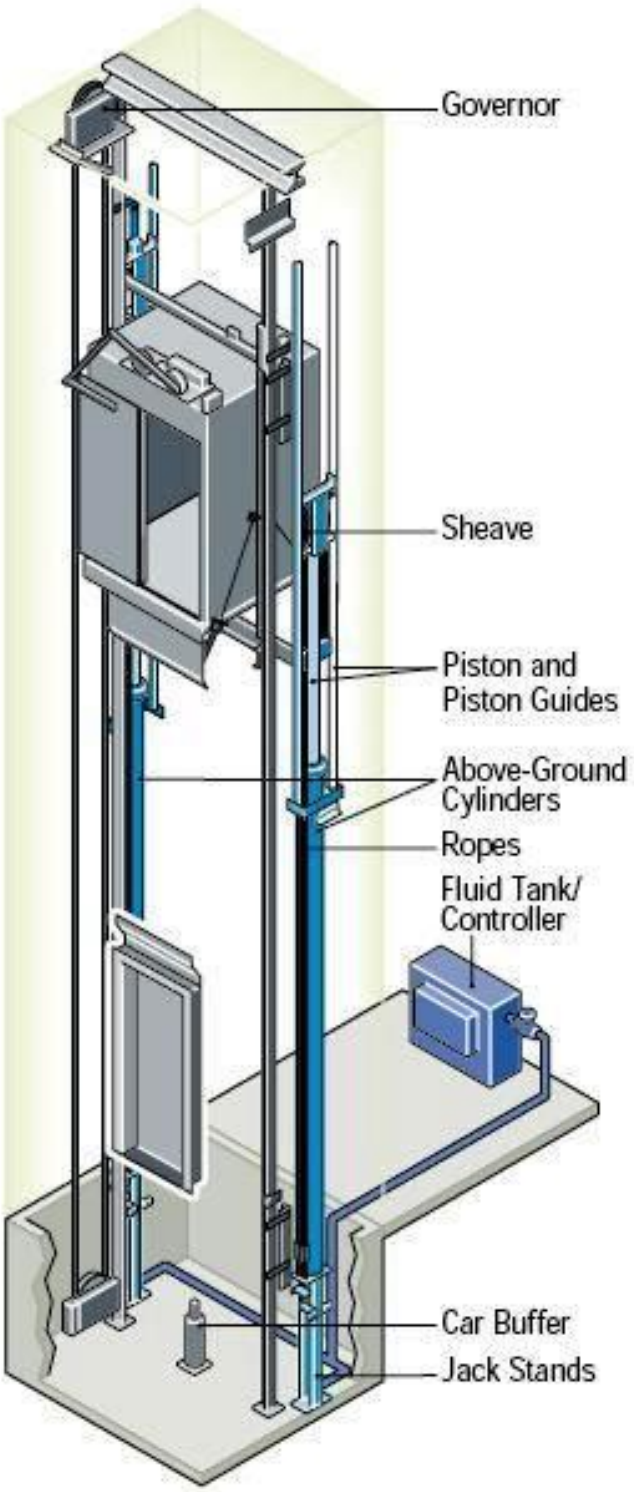

Diagram 1: Twin Post Hydraulic Elevator Layout

Photo 2: A new check valve – Rear

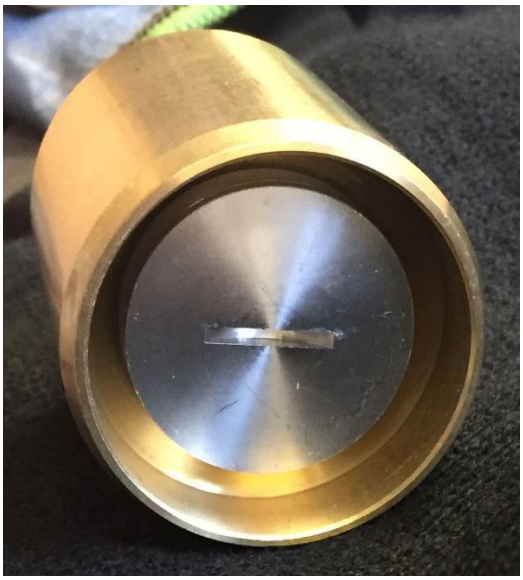

Photo 3: A new check valve – Front.