

## Incident Summary #II-1286980-2021 (#25031) (FINAL)

SUPPORTING INFORMATION	Incident Date		November 15, 2021
	Location		Vancouver, BC
	Regulated industry sector		Elevating devices - Construction / personal hoist/ man lift
		Qty injuries	0
	:t Injury	Injury description	No injuries reported
	Ipac	Injury rating	None
	In nage	Damage description	Damaged treadles and hardware. Top sheave shifted out of alignment.
	Dan	Damage rating	Minor
	Inciden	t rating	Minor
	Incident overview		A worker at a refinery, trying to go up from the first floor to the third floor, stepped onto an endless belt manlift. As the manlift ascended, the step assembly became dislodged from the guide rail. This resulted in the step assembly losing its stability, as the worker hung onto the hand grips to keep their balance until arriving at the next landing.
INVESTIGATION CONCLUSIONS	Site, system and components		The endless belt manlift is a device used at the refinery to move workers vertically between floors. It is similar to a vertical conveyor belt but with step and hand grips attached to it. A motor housed on top of the lift moves the belt in one direction, allowing workers to go up or down by simply using the opposite side of the loop. The belt is looped around a set of pulleys located at the head and foot of the lift. The pulleys are centered onto a shaft. They are then secured to prevent lateral movement along the shaft with a set of screw shaft collar rings. A set screw shaft collar ring is a steel ring with a threaded hole on its circumference, designed for a screw or bolt to be driven through. The set screw shaft collar rings slide into each end of the shaft. Tightening the screws through the ring forces the tips into the shaft, thus locking the collar in place and preventing the pulley from moving laterally along the shaft. (Photos 3 and 4) Each step assembly on the belt is equipped with four rollers that run inside a guide track. Two roller guides are attached on each side of the step assembly. They are fixed in the guide track with fasteners to keep them aligned. The roller guides help in maintaining the alignment and support of the steps while the belt is in motion. (Photos 1 and 2)
	Failure scenario(s)		A set screw shaft collar ring installed on one side of the pulley failed to keep the pulley from rotating out of alignment. The clearance between the roller guides and pulley was reduced as a result. The hex fasteners that keep the roller guides from falling off the track, wore off from the continuous contact with the edge of the pulley. (Photos $5$ , $6$ and $7$ )



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Site Visit- November 25,2021- Safety Officer Notes and Observations.
<ul> <li>Safety Officer assessed lower pulley installation. Noted that belt was out of alignment.</li> </ul>
<ul> <li>The mechanic on site stated that the set screw may not have been biting on the shaft deep enough to secure the collar in place.</li> </ul>
<ul> <li>Safety Officer requested to have the set pin assessed to ensure it was of the proper rating for the application.</li> </ul>
<ul> <li>Safety Officer noted that all the steps had damaged fasteners on one side. (<u>Photos 5</u> and <u>6</u>)</li> </ul>
<ul> <li>Noted that the fasteners had signs of wear. Signs of grinding of metal on metal.</li> </ul>
<ul> <li>The worker stated that they did not hear or see any signs of issues prior to getting on the lift.</li> </ul>
January 18,2022- Confirmation of broken steps and replacements.
<ul> <li>E-mail received from maintenance contractor reporting a piece of step bracket had fallen off while in use and suggested new replacements for damaged ones.</li> </ul>
January 28, 2022- E-mail confirmation from maintenance contractor on repairs and Non-Destructive Testing inspection.
• Non-destructive testing performed for damaged step brackets. Documents attached to file.
<ul> <li>Mechanic stated in e-mail that new steps were engineered to replace weak or broken ones. Stamped engineering documents for design submitted to Safety Officer</li> </ul>
<ul> <li>Maintenance contractor confirmed that clearances were provide between drums/pulleys and roller guide fasteners after repairs were completed.</li> </ul>
May 05, 2022- E-mail from contractor reporting misalignment with head drum/pulley and solutions for fix.
<ul> <li>E-mail from maintenance contractor stated that the top pulley had rotated out of alignment after performing annual testing drop tests.</li> </ul>
<ul> <li>Maintenance contractor stated that the set pin originally installed on the head pulley may not be adequate enough to withstand the excessive forces exerted on them during a drop test, and thus allowing the drum pulley to shift out of place.</li> </ul>
May 13, 2022 – Engineering documentation submitted for the replacement of the lock pins to the upper pulley.
<ul> <li>Engineering letter was submitted to Safety Officer confirming a replacement of the existing set pins. Set pins to be upsized to prevent upper traction pulley from vibrating and moving laterally along the shaft. Documents attached to file.</li> </ul>



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Causes and contributing factors

It is very likely that the bottom end pulley rolled out of alignment because of the failure of the shaft collar ring. It is highly likely that the fasteners on the roller guides were coming into contact with the edges of the pulley as the steps looped around. It is also likely that the fastener's structural integrity was compromised as a result. It is certain that the damaged hardware is what led to the roller guide falling off while under load. It is unknown what caused the set screw shaft collar ring to fail. It is possible that the set pins installed at the time of the failure were not torqued adequately to withstand the forces exerted on them or were not adequate for the installation. The set pins for the top and bottom drums were upgraded to prevent the drums from moving laterally in the future.





**Photo 1** - Roller guides are connected to the steps and tracks. The rollers run on the inside a track know as the guide rail.



**Photo 2** - Front view of the belt and a step assembly just as it's about to loop under the bottom pulley. The rollers are secured in place by fasteners of the bolt and nut type.





**Photo 3** - Set screw shaft collar ring installed on one end of the pulley shaft.







**Photo 5** - One of the many roller guide fasteners that were damaged by coming into contact with the side of the pulley.



**Photo 6** - Hex nut that normally threads on to the end of the roller guide bolt has worn off.



**Photo 7** - *Roller guide that fell off the step assembly* 



