

## Incident Summary (5613292) Final

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|---------------------------|-----------------------------|--------------------|--|---|
| SUPPORTING INFORMATION    | Incident Date               |                    | March 16, 2017   |   |
|                           | Location                    |                    | Golden   |   |
|                           | Regulated industry sector   |                    | Passenger ropeway, passenger conveyor  |   |
|                           | Impact                      | Injury             | Qty injuries   | 1   |
|                           |                             |                    | Injury description   | Victim was reported to be fatally injured |
|                           |                             |                    | Injury rating  | Fatal                                     |
|                           | Damage                      | Damage description | N/A  |   |
|                           |                             | Damage rating      | N/A  |   |
|                           | Incident rating             |                    | Severe   |   |
|                           | Incident overview           |                    | While accessing the tail drum of a passenger conveyor in order to perform routine maintenance, the worker fell into the moving equipment. The worker was pulled between the belt and the snub pulley. The worker was reported to have died as a result of the injury.  |   |
| INVESTIGATION CONCLUSIONS | Site, system and components |                    | <p>The passenger conveyor tail drum is located at the bottom end of the conveyor. The tail drum for this unit also acts to maintain tension and alignment of the conveyor belt. The means of tensioning and alignment is set with the use of a “firestone” rubber spring with a predetermined spring compression length and a tensioning rod connected to the tail drum.</p> <p>The snub pulley is used to re-direct the conveyor belt over the top running surface of the passenger conveyor.</p> <p>Adjustment of the belt tension or alignment may be required during the operating season and is considered to be a routine part of maintaining the equipment.</p> <p>There are two removable cover plates on the top of the tail unit and two hinged access cover plates beside the removable covers. There are rear access holes which allow for adjustment of the tension and alignment of the belt. Accessing the rear access holes is difficult during the operating season due to the buildup of snow.</p> |   |
|                           | Failure scenario(s)         |                    | The worker was responding to complaints of surging, which is a condition that is caused by the belt slipping or a buildup of snow or ice on the tail pulley. The worker removed the cover plates at the tail unit of the conveyor while the conveyor was still running, exposing the worker to moving equipment. The worker either fell entering the tail unit area, or tripped when making adjustments to the conveyor, and was pulled into the equipment.  |   |
|                           | Facts and evidence          |                    | <p>Physical condition of conveyor</p> <ul style="list-style-type: none"><li>- There was some build-up of snow in the tail unit and it was snowing lightly at the time of the incident</li><li>- The worker was reported to be found on his back between the conveyor belt and snub pulley (see Figure 1)</li><li>- Both cover plates at the tail drum were removed</li></ul>   |   |

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| <p>Facts and evidence,<br/>continued</p> | <ul style="list-style-type: none"> <li>- There was no additional guarding around operating equipment</li> <li>- The work space in the tail unit is limited with some tripping hazards             <ul style="list-style-type: none"> <li>- Uneven snow-covered ground</li> <li>- Cover plate support angle close to knee height</li> </ul> </li> </ul> <p>Owner's adjustment procedures</p> <ul style="list-style-type: none"> <li>- The conveyor is required to be stopped by the lift operator before removing the cover plates</li> <li>- Worker is required to enter the tail unit machine area</li> <li>- Conveyor is required to be started with maintenance personnel in the tail unit</li> <li>- Adjustments are to be completed while the conveyor is moving</li> <li>- Maintenance personnel are to observe the belt alignment while in the tail unit</li> <li>- Conveyor is to be stopped when exiting</li> </ul> <p>Manufacturer's requirements</p> <p>The manual requires the conveyor to be locked out when entering the machine areas for maintenance.</p> <p>A bulletin issued in 2013 provides requirements for safeguarding against hazards, and states:</p> <ul style="list-style-type: none"> <li>- That since, "there is no one size fits all", recommendation for guarding, that the operator is to "determine the required level of guarding for each identified hazard".</li> <li>- To ensure, that people having access to areas where electrical and motion hazards exist are to be protected by safeguarding methods (design, protection by guard, presence sensing, safe location, signage lock out tag out, procedures and training of personnel).</li> <li>- That when a safeguard must be bypassed for start-up, set up, adjustment or repair that the operator is to establish, a program, in writing, that include "proper procedures and adequate training of maintenance personnel".</li> </ul> <p>The bulletin also identifies "specific areas of concern" with specific procedures during operation and maintenance. They include:</p> <ul style="list-style-type: none"> <li>- Panels to be bolted down when in operation</li> <li>- Maintenance personnel are to be specifically trained and informed of the hazards associated with conveyor maintenance</li> <li>- Stored energy is required to be identified</li> <li>- Lock out/tag out procedure must be in place with written instructions</li> <li>- Safeguarding/perimeter guarding is to be provided</li> <li>- Stop buttons to be provided at loading/unloading areas, operator stations and in machine compartments and entrances to crawl spaces</li> <li>- Two maintenance personnel are required when maintenance is being performed.</li> <li>- No bypasses are permitted on a conveyor lift.</li> </ul> <p>Statements from the manufacturer indicate that the covers are not required to be removed for the purpose of adjusting the belt.</p> <ul style="list-style-type: none"> <li>- Access to the adjustment rods can be achieved via rear access holes or via hinged side covers.</li> <li>- Adjustments that were made to the conveyor can be observed through the hinged access.</li> </ul> |
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| Facts and evidence, continued   | <p>The manufacturer's maintenance instructions and bulletins do not define an adjustment procedure and access locations other than shown on Figure 2.</p> <p>NOTE: Some of the procedures suggested by the manufacture may not be practicable due to the small work space and limited visibility of the tail drum through the hinged access.</p> <p>The worker:</p> <ul style="list-style-type: none"> <li>- was a licensed millwright with approximately 20 years of experience.</li> <li>- removed the panels prior to stopping the conveyor belt.</li> <li>- did not request the lift operator to stop the conveyor for maintenance</li> </ul> |
| Causes and contributing factors | <p>It is highly probable that the incident was a result of the belt tracking procedure, which requires the worker to make adjustments while positioned in an area of moving, unguarded equipment.</p> <p>It is highly probable that exposure to operating equipment was a contributing factor to the incident.</p> <p>It is highly probable that the absence of guarding was a contributing factor to the incident.</p> <p>It is also likely that the slippery surface at the entrance of the tail unit and inside the tail unit was a contributing factor to the incident.</p>   |

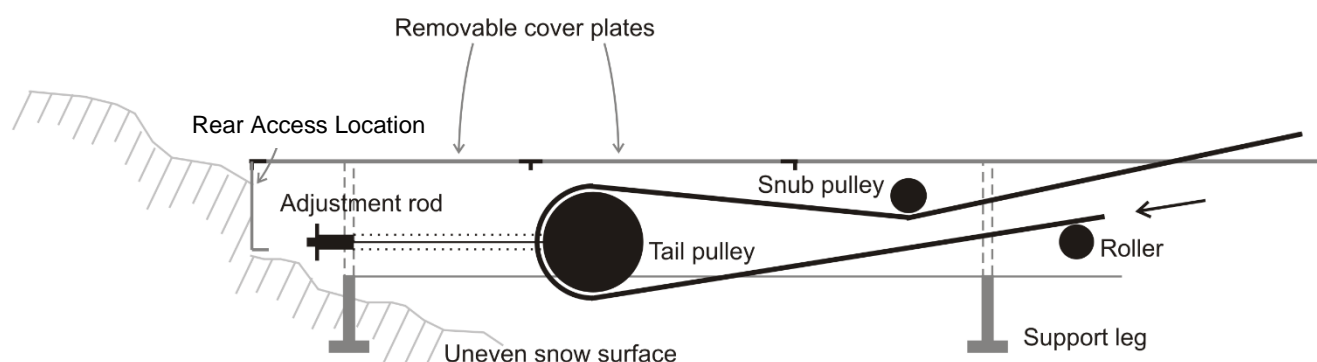


Figure 1: Depiction of complete tail unit.

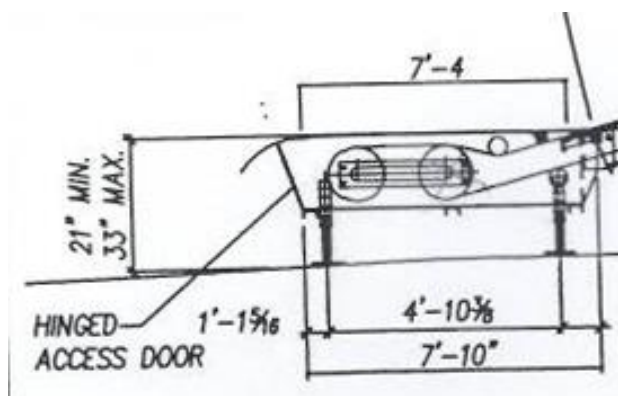


Figure 2: Portion of manufacturer's drawing indicating rear access to adjustment rods.



Figure 3: Adjustment rod with tension spring.





Figure 4: Opening of the tail unit

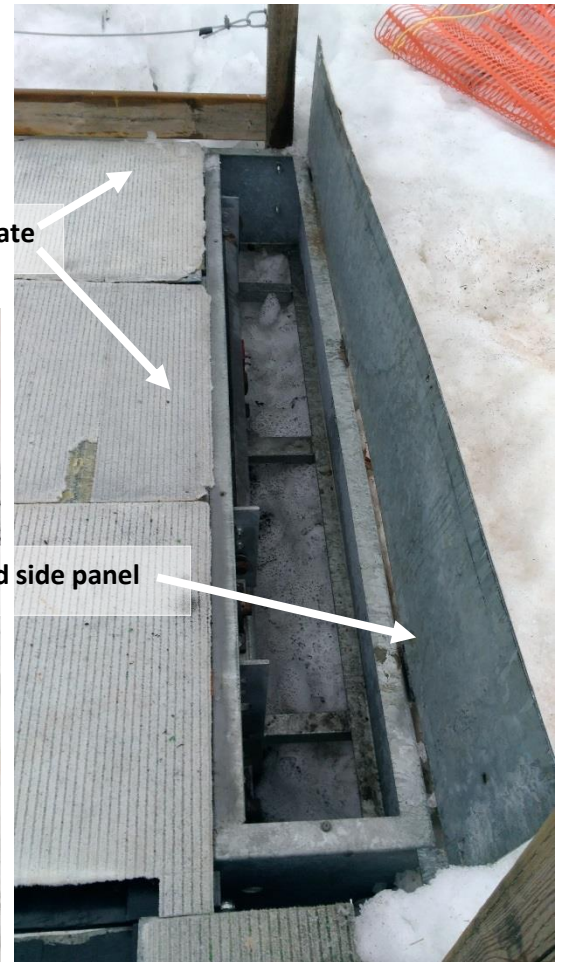


Figure 5: Hinged side panel open.

Figures 4 and 5 show the same hinged side panel. In Figure 4, the panel is closed and covered with snow.



Figure 6: Tail unit, shows limited work space and tripping hazards when adjusting the belt.



Figure 7: View of tail unit and drum. Snow covered and slippery surfaces. Tripping hazards.



Figure 8: Belt entry where worker was found in equipment. Tripping hazard in foreground.