

December 2016 Quick Draw Express Lift (SC-008) Incident

Report of Investigation

This report complies with sections 25-5-704(b) and 25-5-715(4) of the Colorado Revised Statutes (“C.R.S.”) and the Colorado Passenger Tramway Safety Board Rule 23.3, which require a “report of investigation” following an incident *“when a death or injury results from a possible malfunction of a passenger tramway.”*¹ This report provides an overview of the Colorado Passenger Tramway Safety Board and details the incident, the investigation, and the findings of the Board.

Overview of the Colorado Passenger Tramway Safety Board

Colorado law established the Colorado Passenger Tramway Safety Board (“Board”) to assist in safeguarding the life, health, property, and welfare of this state through its licensure, inspection and regulation of passenger tramways. Since the establishment of the Board in 1965, there have been seven lift related fatalities as a result of three incidents in Colorado.²

To meet its objective of safeguarding the public, the legislature placed the primary responsibility for design, construction, maintenance, operation, and inspection for passenger tramways with area operators, while empowering the Board to prevent unnecessary mechanical hazards in the operation of passenger tramways, and to assure reasonable design and construction, accepted safety devices and sufficient personnel, and that periodic inspections and adjustments are made which are deemed essential to the safe operation of passenger tramways. See §§ 25-5-701 and 705, C.R.S. Toward this end, the Board is authorized to issue licenses, collect fees, receive complaints, conduct investigations, prosecute or enjoin persons violating the Passenger Tramway Safety Act, hold hearings, impose discipline on area operators for such violations, establish technical and safety committees, and promulgate such rules as may be necessary and proper to carry out the provisions of the Passenger Tramway Safety Act, including the use of the standards found in the *American National Standard for Passenger Ropeways-Aerial Tramways and Aerial Lifts, Surface Lifts, Tows, and Conveyors-Safety Requirements*, as promulgated by the American National Standards Institute (“ANSI standards”). § 25-5-704 (a), C.R.S.

A public passenger tramway shall not be operated in the state of Colorado unless licensed by the Board. § 25-5-709(2), C.R.S. All lifts in Colorado must be licensed annually prior to the operating season. §§ 25-5-711, 712, and 713, C.R.S. Prior to annual licensure, each Colorado lift must be inspected by Board inspection engineers³ to confirm no unreasonable safety hazard exists, and to confirm that the lift is in reasonable compliance with the current ANSI B77.1 Standard, the Passenger Tramway Safety Act and Board Rules. § 25-5-712, C.R.S. The Board inspector conducts a visual and audible inspection of: all safety systems and functions of the lift; functionality of all drive systems; brake systems; speed controls; stops and tower safety systems, and any other lift specific systems, including records and other documents. Board Rule 22.4. Once the inspection is complete, the Board inspector provides a list of the deficiencies observed during the inspection that must be addressed prior to licensure of the lift. Board Rule 22.4.4. The area operator must certify that these deficiencies

¹ This report was prepared in furtherance of the Board’s duty to investigate and report as set forth in §§25-5-704(b) and 25-5-715(4), C.R.S. and Board Rule 23.3, and does not, in and of itself, resolve any pending disciplinary complaints before the Board.

² Colorado Tramway related fatalities occurred in 1976-four fatalities as a result of a cable incident; in 1985- two fatalities as a result of a bullwheel failure; and, the 2016 fatality that is the subject of this investigation.

³ Board Inspection Engineers are required to be licensed as professional engineers in the state of Colorado pursuant to §25-5-702(5), C.R.S., and Board Rule 22.5.

have been addressed before the lift is licensed for public operation. Board Rule 20.2. When the inspector finds deficiencies that may be a risk to public safety, “the inspector shall issue an immediate report to the Board for appropriate investigation and order” pursuant to section § 25-5-715(5), C.R.S., and Board Rule 22.4.5.

In addition to the annual pre-licensure inspection, the Board inspectors conduct unannounced operational inspections during each operating season of the year. § 25-5-715, C.R.S., and Board Rule 22.3.2. These inspections focus on operational issues and confirm that deficiencies noted in the annual inspection have been corrected and that the lift is being maintained and operated in a safe manner. Board Rule 1.1.

Further, the Board must approve and inspect any major modification to a lift. § 25-5-710, C.R.S. Prior to major modifications⁴ of any lift, licensees are required to submit documentation that includes a verification statement that the design is in compliance with the applicable rules. The submission must also include a proposed acceptance test procedure to demonstrate the modification meets applicable rules and standards. Board Rule 21.3.7. A Board Inspector must be present during the acceptance test. Board Rule 21.3.11. Upon successful completion of the test, the area must submit additional documents confirming that the modification was installed according to the original proposal. After all documentation has been reviewed, the Board may issue a license to allow public operation of the lift.

The Incident-Quick Draw Express Lift at Granby Ranch Ski Area

Description of the Incident

On the morning of December 29, 2016, three skiers boarded the Quick Draw Express Lift (SC-008) (“QDE”) at the Granby Ranch Ski Area in Granby, Colorado. As their carrier (Carrier 58) approached Tower 5, the carrier swung excessively and struck Tower 5. The three skiers were ejected from Carrier 58 and fell to the snow surface. Granby Police Department confirmed that one passenger was fatally injured and the two other passengers were seriously injured. No other injuries were reported. The lift was evacuated with the electric prime mover.

Description of Lift

The QDE is a detachable quad lift built in 1999 by Leitner Lifts (See attachment B). The lift has a slope length of 4,360 feet and a vertical rise of 837 feet with 14 towers and a line gauge of seventeen feet five inches (17’-5”). The lift’s ultimate design capacity is 2,400 passengers per hour at the design speed of 1,100 feet per minute (ft./min.) in a clockwise rotation, but the current tested capacity is 1,800 passengers per hour.

The top fixed drive chairlift uses an Electric Prime Mover consisting of 500 horsepower (“hp”) electric motor through a Sew Eurodrive gearbox. The Diesel Prime Mover is a Cummins N14-P475 engine utilizing 475 hp through the same gearbox. The Evacuation Engine is a Cummins B5 9P-152 engine utilizing 152 hp through a torque converter and a belted connection to the same gearbox.

The original electronic drive controls were a Control Techniques drive with a Leitner low voltage system utilizing a Pilz “Programmable Logic Controller” (“PLC”). Until the new drive was installed in December 2016, there had been no major electrical changes since the lift’s construction.

The tension system is a single hydraulic cylinder used in a compression application, or “push” style design on the return bullwheel at the bottom terminal. The hydraulic controls are also located on the carriage at the bottom terminal.

⁴ A Major tramway modification is defined as: an alteration of the current design of the tramway which results in: a change in the design speed of the system; a change in the rated capacity by changing the number of carriers, spacing of carriers, or load capacity of carriers; a change in the path of the rope; any change in the type of brakes and/or backstop devices or components thereof; a change in the structural arrangements; a change in power or type of prime mover or auxiliary engine; or, a change to control system logic. Board Rule 1.2.4.3.

The haul cable consists of a 6x25 Redaelli rope with a plastic core. The rope has not been shortened from the original installation and the rope has stretched such that the tension carriage is near its fullest extent, requiring a re-splice to shorten the cable in the near future.

The chairlift has 67 four-passenger carriers, Leitner model SA4-99 using a Leitner grip model LA48-95. The grip is a two-spring, non-over center, style coil spring grip.

INVESTIGATION

The Investigation of this matter commenced on December 29, 2016, the date of the incident, and preliminarily⁵ concluded March 30, 2017. The investigation included the assembly of an investigation team, a review of the QDE lift history, licensure and inspections, extensive on-site testing of the QDE, witness interviews/review of statements, and review of the information from the data logger.

Initial Board Assessment and Assembly of Investigation Team

Immediately following the incident, Area representatives evacuated the lift and closed the lift for public operation. The Granby Ski Patrol was the first to respond to the scene at 10:55 a.m., and contacted the Granby Police Department, who arrived at approximately 12:05 p.m. The Area then notified the Board Supervisory Tramway Engineer (“STE”). Both the Granby Ski Patrol and Granby Police Department assisted in taking witness statements as the lift was evacuated with the primary drive (See attachment K). The weather was partly cloudy and the temperature was 30 degrees with wind less than five miles per hour (“mph”). Area maintenance personnel preserved the lift’s recorded drive performance data from the time of the incident.

The STE arrived from Denver at 1:30 p.m. on the day of the incident to coordinate the investigation. The STE assembled an investigation team of four licensed professional engineers with extensive tramway engineering experience.

The investigative team included:

1. Lawrence Smith, P.E. - Board STE (40*)
Responsible for overseeing the investigation
2. Thomas LaVenture, P.E. - Board inspecting engineer (30*)
Responsible for technical support and documentation
3. Bruce Allen, P.E. - Board inspecting engineer (20*)
Contributing technical support via telephone
4. Charles Peterson, P.E. - Independent consultant (41*)
Responsible for directing investigation and report development

Others present during the investigation included:

1. Jamie Bunch, P.E. - Tramway Engineer (40*)
2. Jim Fletcher, P.E. - Tramway Engineer (40*)
3. Josef Gmuender, P.E. - Consultant (30*)
4. Rod Stocking - Senior lift technician for Leitner/Poma (40*)
5. Ski Granby Ranch managers and lift maintenance personnel
6. Granby Police Department

*Years of experience in the aerial ropeway industry

⁵ Due to the unprecedented nature of this dynamic occurrence, continued investigation/analysis of this event will likely continue for years.

Review of Quick Draw Express Licensure and Inspections

The QDE lift at Ski Granby Ranch (the “Area”) has been licensed to operate since December 9, 1999. During that time, the lift was inspected annually for both its licensing and unannounced operational inspections. During its 18 years of operation, there have been no reported incidents attributed to unstable lift dynamics.

The summer operational inspection of the QDE was conducted on August 7, 2016, by Board Inspector, Bruce Allen, P.E. The report (See attachment C) noted a deficiency related to the incorrect labeling of a tower test switch on the control panel. In their August 13, 2016, response to the deficiency (See attachment M), the Area reported that the deficiency was corrected.

In early December 2016, the electrical controls of the QDE were modified per the “Notice of Installation” received by the Board office in October of 2016 (See attachment D). The modification did not change the existing manufacturer supplied low voltage control system. The Engineer of Record for the modification was Joe Gmuender, P.E. The installation and drive setup was performed by Ed Thompson of Electramic Associates.

The modifications to the QDE lift included:

1. Replacement of the original 1999 Control Techniques digital DC drive with an ABB DCS-800 digital DC drive;
2. Addition of an interface controller between existing low voltage controls and the new DC drive. The interface controller adds safety functions for both electric and auxiliary operation;
3. Fine-tuning to set parameters in the new drive that controls how the drive interacts with the electric motor that drives the lift; and,
4. Routine major maintenance of the electrical motor by the Area (off site - See attachment F).

The acceptance testing for the drive modification was conducted on December 5, 2016, by Board Inspector, Bruce Allen, P.E. The test included the verification that the new drive was capable of accelerating a fully loaded lift to design speed. Per ANSI Standard B77.1-2011, the test procedure (See attachment G) requires the lift be loaded with 110% passenger weight on the up-going line. Containers of water were utilized to simulate the passenger weight. The lift was driven backwards a minimum of three times during testing to keep the loaded carriers on the heavy side and non-run loaded carriers through the terminals. During the multiple acceleration tests, neither Inspector Allen nor any of the personnel (See attachment E - “Personnel attending”) who witnessed the test reported any unusual rope dynamics.

The annual licensing inspection for the QDE lift was completed by Inspector Allen, on December 5 and 8, 2016, concurrent with the new drive acceptance test. The Inspection Report dated December 12, 2016, noted a deficiency regarding the need to submit to the Board a software security procedure and additional as-built documentation of the modification. The Area submitted a report to the Board on December 14, 2016, correcting the deficiency (See attachment H).

In addition to the aforementioned deficiency, Inspector Allen noted a comment on the Inspection Report. A comment is not a deficiency of the required standards, but rather a way of informing the Area of a specific item that may need attention in the future. Inspector Allen noted “The new motor drive’s proof of torque circuit is not able to maintain static torque or forward motion on a start with a loaded lift due to the proprietary nature of the existing control system and brake control module. A very slight rollback does occur on all loaded lift starts, and should be rectified when the new control system is installed in 2017.” Inspector Allen further noted the proof of torque complied with the ANSI B77.1 requirement 3.1.2.6(b) and the ANSI “proof of torque” requirement (See attachment I). The comment was reviewed by the investigative team and since it is unrelated to dynamic effects on the lift, it was not considered relevant to the incident or investigation.

The Area submitted all of the required documents (See attachment E) for the modification and testing of the new drive and the lift was licensed on December 15, 2016, following the December 5 and 8, 2016 inspection and review of the December 12, 2016 Acceptance Test Report.

The investigative team also reviewed the initial Acceptance Test Report dated December 12, 2016, from the December 5 and 8, 2016 inspection (See attachment G). In the case of a lift modification such as this, the design engineer Joe Gmuender, P.E., is responsible for the programming, adjustments and fine-tuning subject to the modification. The Board inspecting engineers are not responsible for review of particular programmed settings such as drive parameters, but observe the test procedure to verify performance complies with the Board Rule 21.3.11 and the ANSI B77.1-2011 Standard. The investigative team found no deficiencies, unusual dynamics, or anomalies in the December 12, 2016 Acceptance Test Report.

Witness Statements

The investigative team reviewed the witness statements gathered by the Granby Police Department and the Granby Ranch Ski Patrol for information. In addition, the investigative team was notified of a post to the Area's "Facebook" page regarding QDE operations on a day prior to the incident. These statements provided a wealth of knowledge to allow the investigation team to get a better picture of the dynamics as the incident unfolded and possible indications of input variables into the cause of the incident (See Attachment K).

The statements allowed the investigation team to deduce the loaded characteristics of the three loaded carriers ahead of the incident chair and four chairs back. Witness statements indicate Carrier 58 was the lightest loaded carrier in the grouping of affected carriers.

The witness statements also tell of Carrier 58 swing beginning at Tower 4 and continuing to increase until contact was made at Tower 5. The statements also indicate the amount of carrier swing of the other nearby carriers.

Witness statements also verified that there was no outside influence of energy, i.e. wind, tree contact or other force inducing additional energies into the cable system, and indicated there was no passenger misconduct.

One specific witness comment regarding the noticeable increase in dynamic cable movement during the first 10 days of this season was further investigated by the STE. According to the witness, the line was much more dynamic than in the previous 10 years they had been skiing at this area. During that visit, these observations were reported to area representatives. The witness further stated the dynamics occurred along the entire line.

Several witness statements allege multiple stops immediately prior to the incident. However, the computer data logger does not show those stops. It was later understood with testing that those perceived "stops" were actual changes in speed of the cable and gave the passengers the impression that the chairlift had momentarily stopped, indicating additional dynamic movement in the chairlift.

All the information gathered from the witness statements allowed the investigation team a better understanding of the overall situation surrounding Carrier 58's contact with Tower 5.

Site Investigation

The site investigation and testing were conducted by the investigation team from December 29, 2016 to January 5, 2017.

The major components of the lift were inspected and found to be within industry standards and complied with Board Rules and ANSI B77.1-2011 Standard. The investigative team verified that the Carrier 58 contacted the Tower 5 tube. The marking on the Tower 5 tube was consistent with marks on the outside surface of the Carrier 58 bail. In addition, there were matching marks on the grip rollers and the outside flange of the lead-in sheave. The tensioning system was tested and found to be functional with an expected amount of carriage movement under varying loading conditions.

While the investigation team was unable to recreate events exactly as they occurred on the date of the incident, the investigation was able to reasonably simulate the variables present at the time of the incident. To begin the testing, the empty lift was operated at various speeds with multiple changes of

speed. During one of the tests, there was some instability in certain carriers as they passed over and uphill of Tower 12. No other indications of instability were observed. The investigative team noted that Carrier 58 was removed from the line following the incident. The gap left by this missing carrier was slowly closing as the carriers were automatically repositioned in the terminal to be a uniform distance apart. The carriers are spaced in the upper terminal to be a pre-set distance apart based on 67 carriers on line. As with all detachable lifts, there is a gap that remains in the line between Carrier 67 and Carrier 1 during normal operation.

Carriers 55 through 63 (without Carrier 58) were loaded to simulate the estimated weight of passengers as described in the witness statements. The eight loaded carriers were positioned on the down-going line at the lower terminal. The lift was started and accelerated without noticeable carrier movement at Tower 5. After repositioning the loaded carriers to the same starting location of the previous test, the lift was again accelerated to design speed and given a random series of speed change commands. There was significant carrier movement between Towers 2 and 4, but little movement near Tower 5. However, carrier swing between Towers 3 and 4 became so violent that the test was stopped before the lift was damaged. After load repositioning, the test was repeated with rapid speed changes and yielded similar results. Tests were suspended for the day.

On January 2, 2017, there was a meeting of all parties to be involved in additional testing. After lengthy discussions, the investigation team agreed the tuning within the newly installed drive was a probable contributor to the observed carrier instability. The investigative team inspected the new electronic drive. While reviewing the new electric drive parameters, it was noted that one particular setting of the speed controller's Proportional-Integral-Derivative (PID) parameters, TiS, was set outside of the expected range.

When the lift is operating under electrical power, the lift motor converts electrical energy into mechanical energy to accelerate the lift, and converts mechanical energy into electrical energy to decelerate (slow down) the lift. The electrical energy is managed by the electronic "drive". The PID portion of the speed regulator controls the motor speed based on the measured real-time motor speed, and the motor speed command. When a new motor drive is installed, the motor drive PID parameters must be programmed based upon the overall mechanical and electrical properties of the individual ski lift. The desired end result of programming the speed controller PID parameters is to have smooth acceleration and deceleration, a constant steady state speed, and minimal speed overshoot. Also, the PID must not overreact to disturbances such as a change in speed command or a change in load. If the PID does overreact, the torque applied to the drive bullwheel can cause line dynamics or surging.

The investigation team noted another drive setting of interest. The deceleration time ("DecTime1") was set at 6.5 seconds. The DecTime1 makes the lift decelerate rapidly from "fast" to "slow." The investigation team developed a new test procedure to verify the hypothesis that these important variables (TiS and DecTime1) could have contributed to the carrier instability. A series of six tests were developed to determine the effect of increasing the TiS and DecTime1 parameter values to more traditional values⁶ used for detachable chairlifts.

The testing continued on January 3, 2017, with the same loaded carrier configuration as used previously. The weather had changed to include a light snow and temperatures ranging between three and five degrees Fahrenheit during the testing with winds less than five mph. The test procedure called for the lift to be operated in the same sequence of speed changes used on the previous tests that resulted in instability. The test procedure that produced the dramatic carrier swing the previous day was muted on the second day of testing due to decrease in temperature. However, the same type of carrier swing was evident at the lower terminal. The team monitored the speed and current at the

⁶ The ANSI Standard is a "performance" standard, meaning that the standards do not include specific parameter settings, but looks at the performance of the drive parameters so that the entire drive complies with the ANSI requirements of acceleration/deceleration, stops and starts. The parameter "traditional values" or "typical settings" are those which are utilized by a large proportion of other drive installers and ski lift manufacturers in the ski lift industry.

upper drive terminal. The team observed that increasing the TiS parameter to a typical setting did indeed remove a vast majority of the instability as observed at lower terminal and on the drive display screen at the top terminal. In addition, the investigative team observed that setting a larger deceleration time (DecTim1 changed to 10 seconds) also resulted in decreased torque and carrier dynamics. Following the extensive testing, the investigative team notified the Area that the new electronic drive was unsafe for public operation. The STE further opined that the lift would be safe for public operation using the Diesel Prime Mover since the Diesel Prime Mover operates independent of the electronic drive.

The Board met on January 9, 2017, to review the initial findings of the investigation team. The Board agreed to allow the Area to reopen the QDE lift under a Non-Disciplinary Interim Operation Agreement ("Agreement") requiring the Area operate the lift under the power of the Diesel Prime Mover as long as there was no interface between the modified drive and control of the lift. In addition, Area personnel had to monitor the lift to watch for any unusual lift dynamics and report any unusual dynamics to the Board. The lift was reopened to the public under this Agreement on January 10, 2017.

On January 18, 2017, the Area personnel contacted the STE when acceleration drive faults occurred with the Diesel Prime Mover. The acceleration rate of the empty lift at times was exceeding the 2.0 feet per second squared ("fps²") limit allowed by the ANSI B77.1 Standard (ANSI 3.1.2.4).

The STE arrived on site the following morning, January 19, 2017, prior to normal daily operations and observed the acceleration faults and some indications of lift instability. The initial slow speed setting of the diesel was reduced and resulted in the acceleration rate being reduced, and within the required ANSI B77.1 Standard (ANSI 3.1.2.4). Following this adjustment, however, the lift began having "parity faults" when the lift was started. This fault is an indication that the return bullwheel had rotated in the reverse direction as determined by the encoder that is mounted on the PTO sheaves at the lower terminal. The STE recommended that the Area close the lift pending further investigation. The Area voluntarily closed the QDE lift for public use through an agreement with the Board, on January 19, 2017.

The STE investigated the dynamic response of the lift. Upon further testing, the STE found that the high deceleration for the diesel and a quick restart was contributing to carrier instability of the lift. The dynamic effects experienced during all speed changes was greatly reduced when there was a time delay between any stops or changes in speed. This time delay allowed the lift dynamic energy to naturally decay and the lift to become steady before adjusting the speed or starting. When a slow command is initiated, the lift must go to that speed and remain there for a minimum of 15 seconds before a fast command can be actuated. Also, the STE found that when the lift comes to a stop as a result of pressing the stop button, if the STE imposed a 15 second delay before the lift could be restarted, the dynamic energy decayed allowing the lift to steady. After additional testing, the STE recommended that the lift was safe for public operation if the deceleration rate was below the ANSI B77.1 requirement of 5.0 fps² and there was a time delay after a speed change.

After the Board reviewed initial findings of the diesel shutdown, the Area signed an Amended Non-Disciplinary Interim Operation Agreement ("Amended Agreement") with the Board that required the Area to "take appropriate measures to mechanically modify the lift to stabilize and remove the dynamics from the lift." The Area contacted Leitner/Poma to complete the modifications to the lift. Leitner/Poma increased the tested time delay between speed changes from 15 seconds to 30 seconds. Following the modification, the STE and Board Inspector Chris Hale, P.E., inspected and tested the lift with multiple load case scenarios, including the eight chairs loaded to simulate the December 29, 2016 incident. The STE and Inspector Hale observed no lift dynamics. Based on the inspection, the Board permitted the Area to reopen the lift for public operation, in accordance with the terms of the Amended Agreement, on January 27, 2017. The terms of this Amended Agreement required reduced speed and Area monitoring of the line. The Area operated QDE under the terms of this Amended Agreement through April 2, 2017, the date the lift closed for the season (See attachment L).

Review of Data Logger

On March 30, 2017, a member of the investigation team re-visited the site to gather more information from the lift's data logger, and to confirm measurements of several components of the line equipment and tension cylinder. The lift is equipped with a data logger which records every fault and produces a line graph of the motor current and lift speed for every start and stop since the QDE lift was installed in 1999. The investigative team reviewed the data to determine the role of the motor drive and lift operator in the incident. On the day of the incident, Record 38 of the data logger shows that the QDE lift accelerating to a "Fast," the lift's maximum licensed design speed, and the motor current waveform shows strong oscillations of 400 to 500 amperes ("amps") with roughly a four second oscillation period. The on-site team only observed current oscillations of this magnitude during testing when commanding an increase in speed while the lift was in a deceleration or motor drive regeneration mode. The current oscillations indicate that the operator had not allowed the QDE lift to reach its steady state speed before commanding a Fast. Record 38 further documents a Tower 5 derail fault when Carrier 58 struck Tower 5 and the lift decelerated to a stop.

Findings

The investigation team assembled by the STE included seven Licensed Professional Engineers with combined ropeway experience of over 250 years. After reviewing the physical evidence, the investigation team found that Carrier 58 collided with Tower 5 at an approximate 40 degree angle from horizontal. Witness statements verified that the passengers were ejected from Carrier 58 when it swung and hit Tower 5. The investigation confirms there was no passenger misconduct on the lift, Carrier 58 did not collide with any external fixtures to cause it to swing into Tower 5 and the weather conditions were not a factor. No one on the investigative team has ever witnessed or heard of a similar event. Likewise, literature does not describe such an event.

At this stage of the analysis, the investigation team was able to isolate the two main contributing factors to the incident. In addition, the investigation team identified multiple factors that *may have* also contributed to the incident. The investigation team is in agreement that the lift should not be operated for public use using any of the primary electric motor drive system that was modified, repaired or replaced.

The investigation team found the following factors contributed to this event:

Contributing Factors:

1. Drive Modification. The testing confirmed two of the drive parameters may have created pulses of energy that could explain the rope instability. The first parameter was the TiS parameter with the PID part of the speed controller. During testing the TiS was increased from the setting of 97 to 3200. The amount of lift dynamics was significantly reduced with the higher value.

The second drive parameter ("Speed Filter Time" ABB 50.06) that was evaluated directly influences the actual lift speed measured by the drive. At the time of the incident, it was set at 50 milliseconds ("ms") compared to a more typical setting of 5 ms. It is probable that the combined effect of this setting along with the TiS setting may have resulted in the drive trying to respond too aggressively to lift demands when changing from "Fast" to "Slow" and back to "Fast" again. With the Speed Filter Time at 50 ms, the motor speed measurements may lag behind when conditions are changing rapidly. In this case, the drive may over-react because it does not detect that the motor is keeping up with corrections.

2. Influence of Speed Changes. Unstable lift dynamics could only be re-created by making rapid changes in the lift speed with the newly installed drive. Many of the witness statements mention multiple changes of lift speed that occurred just prior to the incident. According to

the operator, he did not remember making any speed change prior to the incident. Although the data logger does not record speed changes, there is supporting evidence indicating that rapid and significant accelerations/decelerations of the lift occurred immediately prior to the incident. Given the information provided by the data logger, the investigation team believes a speed change occurred immediately prior to the incident.

The investigation team found the following factors *may have* contributed to this event:

Potential Contributing Factors

1. Control System Complexity. The new drive was the first major modification made to the lift's electrical control system since installed in 1999. The new ABB DCS-800 drive replaced the original Control Techniques drive. The new drive required an interface with the original Pilz/Leitner control system, which also controls the regulated service brake application. At this stage of the analysis, it has not been possible to confirm that the interface was made correctly due to the proprietary nature of the original Pilz programming.
2. Control Board Replacement. Maintenance personnel reported that in February 2016, one of the control boards in the old DC drive was replaced. After the control board was installed, there appears to have been a period where the lift operated with speed/current graph showing signs of motor current instability similar to that seen during the testing. The graphs indicate that the drive was tuned within a week and the instability was reduced.
3. Electric Motor Encoder Possible Damage. During the reinstallation of the rebuilt electric motor, the motor had an internal lead that was not bolted down. Upon energizing the motor, the unbolted lead resulted in a catastrophic failure of the main electrical circuit breaker. The company that rebuilt the motor was consulted and came on site to make repairs to the electric motor. The rebuild and re-installation of the electric motor occurred while the old drive was still in place but prior to public operation in the fall of 2016. Without a complete analysis of the electric motor and encoder, the possible connection or contribution is unknown.
4. Unknown Second Electrical Cycle. The data logs show a consistent low energy pulse into the system at about a 3.7 second interval for the past 18 years. The timing is not speed dependent. The source or significance of this "noise" has not been determined.
5. Tension System Verification. Rope stability is directly related to tension. A single hydraulic cylinder is used in a "push" style application and is near full extension. It is possible the cylinder may be "binding" due to the full extension and not operating consistently to maintain constant rope tension. Any binding of the cylinder could affect the overall rope tension. Detailed forensic testing of the tension system and the hydraulic cylinder would be required to determine if the cylinder is binding and operating correctly when fully extended and the significance to the incident OR a statement that it is determined that it could/would be of little/considerable/no significance.
6. Natural Instability of the Profile. The incident was highly unusual in that the dramatic rope and carrier instability appears to be somewhat localized between Towers 3 and 5. There appears to have been a very unique combination of rope tension, carrier spacing, tower spans, tower height, carrier loading and natural carrier movement that led to the transverse carrier swing that resulted in Carrier 58 hitting Tower 5. Carriers 57 and 58 were relatively lightly loaded with one adult and two children each amongst several fully loaded Carriers 55, 56, 59

and 60. Both Carriers 57 and 58 experienced excessive carrier swing prior to the collision of Carrier 58. Further analysis is required to determine the influence of each of these variables.

7. Natural Harmonic Response of the Haul Rope. Fast/Slow speed commands by the operator in rapid succession along with oscillating bullwheel torque from the selected tuning of the drive combined to excite the natural harmonics in the lower spans of the lift. These factors resulted in excessive carrier swing leading to the collision at Tower 5.

The rope position is primarily controlled by the tower sheave wheels at the end of each span. The suspended carriers can swing on all three axes to create transverse displacement of the rope which must be converted back to the longitudinal rope energy at the tower sheave wheels or otherwise be absorbed by the towers and/or carriers. Tower 5 being relatively tall and more flexible may not have been able to absorb much of the translational energy. Standing transverse wave patterns occur in suspended cables with defined harmonics.

Conclusions

The purpose of the investigation was to comply with sections 25-5-704(b) and 25-5-715(4), C.R.S., and Board Rule 23.3 that require an investigation be conducted *“when a death or injury results from a possible malfunction of a passenger tramway.”*

Ropeway, or lift, malfunctions resulting in casualties are extremely rare. The incident that occurred on December 29, 2016 at Granby Ranch was unprecedented. Although many factors may have combined to amplify the effect of the rope instability leading to Carrier 58 colliding with Tower 5, as outlined above, the performance of the new drive is considered to be the primary cause of the incident.

Electronic drives are not manufactured specific to ropeways. In fact, the same drive may be used in hundreds of other industries from paper mills and food processing to gravel quarries. In addition, each lift is a one-of-a-kind, unique in its design, terrain, vertical profile, length, tower spacing, tower sheaves, carrier spacing, and type of carrier-detachable or fixed grip. As a result, there are no “standard” settings for the drive, but rather a recommended range of settings for the drive to power a lift. The purpose of “tuning,” or “fine-tuning,” a drive during installation is to find the right combination of drive parameter settings to optimize the lift performance under operational conditions. It appears the new drive was not comprehensively tuned to this particular lift during installation.

It is the conclusion of the investigation team that the selected tuning of the drive combined with the natural harmonics of the lift system, along with rapid speed changes, caused the rope instability resulting in Carrier 58 contacting Tower 5. The selected tuning of the drive resulted in oscillations of the drive bullwheel torque. The rapid periodic changing of the applied torque caused rope instability (surging) that was amplified by the natural lift dynamics. This rope surging is greatest near the bottom terminal where the tension is lowest. In this case, the maximum instability (rapid speed change) appears to have occurred as the lightly loaded Carrier 58 approached Tower 5. Witness statements confirmed that the carrier was swinging as it approached the tower. The combination of rapidly changing rope speed amplified the lateral swing to the point that the carrier struck Tower 5. The data logger provides supporting evidence for this conclusion (See attachment J).

The investigation team deemed the drive unsafe for public operation and the lift was powered by the Diesel Prime Mover from the time of the incident until the end of the ski season in accordance with the aforementioned Agreements designed by the Board to ensure public safety. However, the investigation team remains steadfast in its opinion that the existing configuration of the electronic drive and the original, pre-modified low-voltage control system were unsafe for public operation.

To completely understand how the relationship of all the variables converged to produce this large and unusual dynamic event, a detailed technical analysis would need to be completed to address those items that may have contributed to the amplification of the rope instability. By using the historic drive performance data from the data logger compared to the lift performance during and at the completion of the testing, and lengthy extensive testing and monitoring of all variables, a better understanding of the relationship of the multiple variables may explain in greater detail the effects of each variable in the creation of the dynamic events. Unfortunately, given the lengthy testing and analyses required and the depth of the analyses of the resulting data, that examination is beyond the scope of this investigation and is better suited to an academic environment.

Moving forward, the STE, with the assistance of the investigation team, notes the following suggested action items, above and beyond what current national and industry standards require, to ensure optimal public safety on Colorado passenger tramways. These action items will be addressed through Board subcommittees working in conjunction with ANSI, and include but are not limited to:

1. Tuning a drive. The current standards for acceptance testing only simulate an empty or a fully loaded lift. The primary purpose of the test is to confirm that the lift can accelerate a loaded lift with the primary and secondary drives from stop to full speed within a certain time. Moving forward, each of the controlling PID parameters in the drive must be adjusted to the optimum values for the correct response under multiple loading conditions.

Currently the drive parameters must be submitted to the Board as part of the testing documentation. Consideration should be given to whether the drive parameters are tested and optimized under operational conditions. It is recommended that all drive parameters be submitted to the Board after they have been tuned by a qualified person.

2. Acceptance testing. Current industry standard acceptance testing verifies all the drive systems are able to pull the full load. Because the quality of the drive components has evolved, so must the acceptance testing. Given the occurrence of dynamics noted in this incident, current acceptance test procedures need to be revisited with consideration given to the development of new procedures. It is also recommended that the acceptance test procedure include a grouping of loaded carriers. The dynamic actions of the carrier grouping should be observed under multiple speed changes issued as fast as the software will allow. The dynamic action of the cable should be observed in the longer spans in the area of the lowest tension. Lifts with downhill capacity should be tested to confirm stability with the maximum allowable downhill load. Example: New loading scenarios of carrier groupings at less than 110% load with empty carriers mixed in under multiple speed variations. Consideration should be given to whether personnel should be required along the line for visual confirmation of carrier swing.
3. Speed change time delay/Speed command delay. Delays need to be included in all speed change commands to allow the cable to come to the desired speed for a certain length of time to stabilize dynamics before another speed change can begin. It is recommended that each lift is tested during the licensing inspections to confirm the appropriate time delay between speed changes on all Prime Mover drive systems.
4. Stop time delay/Stop command delay. A delay needs to be included in all stop commands to allow the cable to remain stationary for a certain length of time to stabilize dynamics before the cable begins to move again. It is recommended that each lift is tested during the licensing inspections to confirm the appropriate time delay after each stop on all Prime Mover drive systems.
5. Monitor return bullwheel parameter. Under constant operation, the rotational speed of both terminal bullwheels should be the same within normal lift dynamics. If there is a variation in the two speeds, there are possible dynamic instabilities. Both bullwheel speeds are currently being monitored on many new lifts. It is recommended that if the lift has such capabilities,

that any rapid variations in either bullwheel speed be monitored. If either bullwheel speed changes in an unacceptable manner, the issue should be addressed prior to continued operation of the lift to the public.

6. Analog Drive Modifications. Analog drives may react differently to speed control changes than a digital drive. Review requirements for the design engineer to take into consideration when an analog drive is replaced with a digital drive, to include the dynamic response of the lift, and other considerations.
7. Potential drive modification conflicts. Many of the electrical controls of upgraded lifts are monitored and adjusted by multiple subsystems. Most of these subsystems are software protected by the manufacturer of the system. It can be difficult to determine if there is any conflict between subsystems when one part of the control system is upgraded. It is recommended that the design engineer take into consideration any existing systems that could conflict with the modification.
8. Acceleration/Deceleration and overspeed monitoring. In the 2006 ANSI Standard, ANSI changed the requirement of these monitoring systems to be located on the cable allowing the monitoring of the cable whether it was driven by the Electric Prime Mover or Diesel Prime Mover. The requirement was also added to all new and relocated fixed grip chairlifts built after 2006.

In older fixed grip chairlifts prior to 2006, if monitoring was included, it was usually found in the Electric Motor Drive. After 2006, almost all drive controller manufacturers no longer included these monitoring systems in the Electric Motor Drive.

Most existing fixed grip ropeways currently do not have these functions monitored as they were built prior to 2006. The Board currently requires this monitoring be added to fixed grips during major modifications of the Electric Motor Drive.

The result of adding these functions on the cable of earlier ropeways means that it is possible to monitor and evaluate the acceleration/deceleration and overspeed of Diesel Prime Movers.

Most analog diesel controllers are setup to accelerate the ropeway when the lift is fully loaded with a single acceleration curve. When the lift is empty, that same acceleration curve is followed and can result in a faster acceleration than allowed by the ANSI Standard.

Considerations:

- a. Add to ALL drive upgrades the testing of the Diesel Prime Mover to the Acceptance Testing to verify ANSI compliance and possibly the review of recently changed drives to be retested for diesel compliance.
- b. Review the ANSI Standard for this acceleration rate as it applies to analog Diesel Prime Movers and consider revisions to either the rate or method of testing.
- c. Consider “retesting” the existing chairlifts that have had drive modifications and did NOT test the diesel drive with the new acceleration/deceleration and overspeed monitoring.
- d. Electric motor drive instability detection. Given the results of the testing following the December 29, 2016 incident, there may be parameters and electronic drive feedback that have the possibility of being used for indications of drive instability. Investigate developing new test tools for electronic drives to allow better monitoring of the drive parameters and drive stability.

9. Tuning an Electronic Drive and Licensure. Address the licensing aspect of “fine tuning” a drive, including the consideration of issuing a “temporary” license until the tuning is complete and signed off by a P.E. Another issue for board consideration includes the appropriate load for “fine-tuning” a drive.
10. “Black Box” Recording Device. Consider requiring a “black box” recording device for all aerial lifts for data collection of stops, starts, speed changes and any parameters that have significant dynamic effects on the haul cable.

Appendices:

- A - Lift Photos
- B - Lift Data Sheet
- C - Summer Inspection Report
- D - Notice of Modification
- E - Modification Paperwork
- F - Electric Motor Rebuild Information
- G - Acceptance Test for Modification
- H - Licensing Response Letter from Granby
- I - ANSI B77.1 3.1.2.6 Brakes Requirement
- J - Computer Recorded Stop Printouts
- K - Witness Statements
- L - Amended Non-Disciplinary Interim Operation Agreement
- M - Summer Inspection Response

Appendix

A







Appendix B

COLORADO PASSENGER TRAMWAY SAFETY BOARD

LIFT EQUIPMENT DATA SHEET SC-008

LIFT ID:	SC-008	LICENSEE:	Ski Granby Ranch
MANUFACTURER:	LEITNER	AREA ID:	SC
YEAR INSTALLED:	1999	ENTRY DATE:	6/18/99
LIFT DESCRIPTION:	DETACH. QUAD CHAIR	LIFT NAME:	Quick Draw Express
LIFT CODE:	314	YEAR RELOCATED:	
LIFT MODEL:	SA4C	OLD AREA ID:	
ACTIVE LIFT:	YES	PUBLIC LAND:	USFS
		LAST UPDATE:	12/12/16

GENERAL SPECIFICATIONS

CAPACITY (PRES):	1800	PPH	SPEED:	1100	(FPM / MPS)
CAPACITY (INT):	1800	PPH	OVERHAULING:	ROH	
CAPACITY (ULT):	2400	PPH	LINE GAUGE:	17	FT. 5 IN.
VERTICAL RISE:	837	FT.	CARRIER SPACING	146.7	FT.
HORIZONTAL LENGTH:	4298	FT.	DRIVE LOCATION:	T	
SLOPE LENGTH:	4386	FT.	TENSION LOCATION:	B	
LOAD INTERVAL:	8	SEC.	ROTATION:	CW	
CARRIER No.:	67		DOWNHILL LOAD:	50%	CARRIERS (OR %)

ROPE SPECIFICATIONS

MAIN HAUL ROPE

HAUL ROPE DIA:	40	HROPE MFG:	REDAELLI
HAUL ROPE SPECS:	6x25 FW Black	HROPEWGHT:	4.03 LBS./FT.
NOMINAL BREAK:	93.3 TONS	MAX UPHILL	
CALC SF:	5.6	ROPE ANGLE:	22.5

DRIVE EQUIPMENT

DRIVE 'A' (PRIME MOVER)

MAIN DRIVE (ELEC/GAS/DIESEL): ELECTRIC

DRIVE BW DIA:	13.78	(FT/M)	GEARBOX MDL:	KSS5 AB/FL/Vleft
DRIVE BW MFG:	LEITNER		GEARBOX RATIO:	59.81
GEARBOX MFG:	LEITNER		MAIN DRV. LINE CONN:	U SHAFT
SECONDARY RED. MFG:	SEW EURODRIVE		DRV. LINE MFG:	
SECONDARY RED. MDL:	R137		DRV. LINE MDL:	
SECONDARY RED. RATIO:	5.15		DRV. LINE RATIO:	

DRIVE 'B' (PRIME MOVER)

DRIVE 'B' (GAS/D/ELEC):	DIESEL	DRIVE 'B' (TC/FC):	TORQUE CONV.
DRIVE 'B' MFG:	CUMMINS	DRIVE 'B' LINE CONN:	U SHAFT
DRIVE 'B' MDL:	N14-P475	DRIVE 'B' FUEL TANK:	EXT. TANK/DAY TANK
DRIVE 'B' HP:	475	DRV. LINE RATIO:	1:1
DRIVE 'B' (FT/EVAC):			

DRIVE 'C' (EVACUATION DRIVE)

DRIVE 'C' (GAS/D/ELEC):	DIESEL	DRIVE 'C' (TC/FC):	TORQUE CONV.
DRIVE 'C' MFG:	CUMMINS	DRIVE 'C' LINE CONN:	V-BELT
DRIVE 'C' MDL:	B5.9P-152	DRIVE 'C' FUEL TANK:	ENGINE MOUNTED
DRIVE 'C' HP:	152	DRV. LINE RATIO:	
DRIVE 'C' (FT/EVAC):			

COLORADO PASSENGER TRAMWAY SAFETY BOARD

LIFT EQUIPMENT DATA SHEET SC-008

BRAKING SYSTEMS

SERVICE BRAKE:	LEITNER Electro Mechanical	OVERSPEED 110%:	MOTOR ENCODER
DRIVE TRAIN BACKSTOP:	NO	OVERSPEED 115%:	ROPE ENCODER
DRIVE SHEAVE BRAKE:	LEITNER FE 100	BRAKE TEST TORQUE:	25% OF MOTOR CURR
ROLLBACK DEVICE:	LEITNER FE 100		

ELECTRICAL SYSTEM

DRIVE SYSTEM

DRIVE MFG:	ABB	ELECTRIC MTR MFG:	GE
MODEL:	DCS800	ELECTRIC MTR MDL:	CD 5010 AY
AC OR DC:	DC	ELECTRIC MTR RPM:	1750
YEAR MFG:	2016	ELECTRIC MTR HP:	500
CONTROLLER (SCR/DRUM/SOFT START, VFD, FULL VOLTAGE):	SCR	REGEN DRIVE:	YES

CONTROL SYSTEM

CONTROL MFG:	LEITNER	ANTICOLLISION MFG:	LEITNER
MODEL:		ANTICOLLISION YR MFG:	1999
YEAR MFG:	1999	DEROPEMENT CIRCUIT #1	RPD
PLC CONTROLLED (Y/N):	YES	(RPD,BRITTLE BAR,WIRE..):	
		DEROPEMENT CIRCUIT #2	BRITTLE BAR
		(RPD,BRITTLE BAR,WIRE..):	

TOWERS, GRIPS, LINE EQUIPMENT, CARRIER

TOWERS

NO. OF TOWERS: 14

LINE EQUIPMENT, CARRIERS

SHEAVE TRAIN MFG:	LEITNER
SHEAVE TRAIN MDL:	460
SHEAVE LINER:	RUBBER

CARRIERS

CARRIER MFG:	LEITNER
CARRIER MDL:	SA4-99
CARRIER YR MFG:	1999
TOTAL WEIGHT CARRIER,GRIP,HANGER):	474 LBS.
RESTBAR (Y/N):	YES
FOOTREST (Y/N):	YE

GRIPS

GRIP MFG:	LEITNER
GRIP MDL:	LA48-95
GRIP YR MFG:	1999
GRIP SPRING TYPE:	COIL SPRING
GRIP SPRING QTY:	2
GRIP SLIP TEST:	1325 LBS.

TENSIONING EQUIPMENT

TOTAL TENSION FORCE: 40465 LBS.

TOP TENSION: LBS.

BOTTOM TENSION: LBS.

CWT ROPE MFG:
CWT ROPE SPEC:
CWT ROPE SF:
REEVE:
RATIO:
CWT MATERIAL:

No. OF CYLINDERS:	
NOMINAL PRESSURE:	805 LBS.
MAXIMUM PRESSURE:	925 LBS.
MINIMUM PRESSURE:	680 LBS.
ROD DIA:	
CYLINDER BORE:	

Appendix C

August 18, 2016

Hello Nicki, this is my response letter for the summer unannounced inspection held on August 7, 2016 by Bruce Allen. On the Quick Draw(SC-008)

SC-008 (QUICK DRAW EXPRESS)

A. Bottom Terminal

1) 3.3.3.1 – General.

Relabel the bottom Tower Test switch located on the inside control door. *New label installed. Reference work order attached.*

2) Comment.

The gearbox lubrication pump sounds rough. (Maintenance staff acknowledged that the pump has sounded bad, but will verify the pump is ok for continued use. A backup pump is available as needed.) *Gearbox lubrication pump operation checked. Reference work order attached.*

B. Line

No deficiencies observed by Inspector.

C. Top Terminal

No deficiencies observed by Inspector.

D. Record Keeping

No deficiencies observed by Inspector.

E. General Deficiencies

No deficiencies observed by Inspector.

All deficiencies have been remedied.

Sincerely,



Blaine Faulkner

Lift Maintenance Supervisor

NON - SCHEDULED WORK ORDER

Work Order #: 0817-1

MECHANICAL

ISSUE DATE: 8/17/2016

Lift Maintenance Department

COMPONENT CODE: 111

LIFT: SC08 Quick Draw

REPORTED BY: inspector

PROBLEM: RELABEL BOTTOM TOWER TEST INSIDE CONTROLS.

ACTION TAKEN: CREATED A NEW LABEL AND
INSTALLED.

NOTE: WHEN PERFORMING MAINTENANCE, ALWAYS REFER TO THE MANUFACTURERS MANUALS AS REQUIRED. ALSO, THINK ABOUT THE REQUIREMENTS FOR THE SAFE PERFORMANCE OF THESE PROCEDURES. THINK SAFE, WORK SAFE!

NAMES / TOTAL HOURS INVOLVED:

TECHNICIANS: ANDY BIRCH

HRS.

HELPERS: BLAINE FAWKNER

HRS.

OPERATORS:

HRS.

PARTS / MATERIALS USED:

COMMENTS: WORK ORDER COMPLETE

TECHNICIAN'S SIGNATURE:



DATE: 8-17-16

SUPERVISOR'S SIGNATURE:



DATE: 8-17-16

RECORD ENTERED

INITIAL

DATE:

NON - SCHEDULED WORK ORDER

Work Order #: 0817-2

MECHANICAL

ISSUE DATE: 8/17/2016

Lift Maintenance Department

LIFT: SC08 Quick Draw

COMPONENT CODE: 111

REPORTED BY: inspector

PROBLEM: THE GEARBOX LUBRICATION PUMP SOUNDS ROUGH.

ACTION TAKEN: MONITORED OIL PUMP. PUMPING
FULL PRESSURE AND FUNCTIONING AND
SOUNDING NORMAL.

NOTE: WHEN PERFORMING MAINTENANCE, ALWAYS REFER TO THE MANUFACTURERS MANUALS AS REQUIRED. ALSO, THINK ABOUT THE REQUIREMENTS FOR THE SAFE PERFORMANCE OF THESE PROCEDURES. THINK SAFE, WORK SAFE!

NAMES / TOTAL HOURS INVOLVED:

TECHNICIANS: BLAINE FAULKNER HRS.

HELPERS: ANDY BIRCH HRS.

OPERATORS: HRS.

PARTS / MATERIALS USED:

COMMENTS: WORK ORDER COMPLETE.

TECHNICIAN'S SIGNATURE:

Blaine Faulkner

DATE: 8-17-16

SUPERVISOR'S SIGNATURE:

Blaine Faulkner

DATE: 8-17-16

RECORD ENTERED

INITIAL

DATE:

Appendix D



COLORADO

Department of
Regulatory Agencies

Division of Professions and Occupations

COLORADO PASSENGER TRAMWAY SAFETY BOARD

NOTICE OF MODIFICATION OR INSTALLATION

Pursuant to Colorado Passenger Tramway Safety Board's rules and regulations, this form shall be sent to the Board office prior to installation or modification of a tramway. Please provide all data and enclose the applicable fee. Mail this completed form with a check, payable to Colorado Passenger Tramway Safety Board, to same at 1560 Broadway, Suite 1350, Denver, Colorado 80202.

Licensee Granby Ranch

Address of Licensee 100 Village Rd. Granby, CO 80446

TYPE OF WORK: New Installation ☐ (see proper fee below) Relocation ☐ (see proper fee below)
Major Mod ☒ (see proper fee below) Minor Mod ☐ (no fee required)

Type of Lift Leitner Detatch

Name/Number of Lift Quick Draw Lift ID Number (if applicable) SC008

Name of Design Engineer Ed Thompson, EMAX Controls

Name of Construction Engineer Joe Gmuender, Gmuender Engineering

Area Contact Person & Title Blaine Faulkner, Lift Maintenance Supervisor

Description of Work Change Control Techniques drive to an ABB drive.

FEE SCHEDULE

The following fee schedule is in effect July 1, 2016 through June 30, 2017

PLEASE CIRCLE THE TYPE OF TRAMWAY CONSTRUCTION BEING COMPLETED

<u>Modifications</u>	<u>Fee</u>	<u>New or Relocated</u>	<u>Fee</u>
All Major Modifications.....	\$150.00	Detachable.....	\$3150.00
		Reversible Tram.....	\$2775.00
		Funicular	\$2775.00
		Fixed Grip.....	\$1775.00
		Surface Lift.....	\$1025.00
		Incline Elevator	\$1025.00
		Tow.....	\$ 655.00
		Conveyor.....	\$ 655.00

(Fee includes construction fee plus licensing fee)

Designated Agent's Signature Janie Wally

Title Director maintain operations Date 10.25.16

Appendix E



Mail: Box 452 Dobbins, Ca 95935
Ship: 14985 Fountain House Rd Dobbins, Ca 95935
Phone 480.540.7829 435.677.2412

9 December, 2016

Mr. Blaine Faulkner
Ski Granby Ranch
P.O. Box 1110
Granby, CO 80446

Certification of hardware and software function for DC drive replacement and 'RSM' ramp and speed monitor: Quick Draw Express (SC-008), Ski Granby Ranch CO

Blaine,

To the best of our knowledge, we have verified that the function of hardware and software associated with the DC drive replacement and the 'RSM' Ramp and Speed Monitor for Quick Draw Express Chair has been tested and is in compliance with the design documents. The tests were conducted on December 5, 2016. The results of the testing are documented in the acceptance test procedure (attached).

The software package consists of three parts

1. The PLC ladder logic: 'DRIVEPLC'
2. The Touch Screen (HMI) program: 'QDDRIVE SCREEN 12-5-2016 LOAD TEST'
3. The DCS800 DC drive changed parameter list

The software package was saved upon completion of testing and a zipped copy has been provided via email and on a CD:

File Name: *QuickDrawExpress_GranbyRanchCO-AsInstalled-PLC_HMI_DCDrive-5Dec2016.zip*

File Date: 12/09/2016 2:08 PM File Size: 1542 KB MD5 checksum: A9F406A8128637E0A61257E7435BEA9C

Any alterations to the software in any of the fore mentioned components shall be approved by the qualified software programmer and/or qualified engineer prior to implementation.

If it is necessary to change any of the existing software or parameters the following procedure shall be followed:

1) Drive Parameter changes.

The approved drive parameter changes can be made by the user following instructions provided by Electramics Associates, or by Electramics Associates directly. Testing procedures, if required, shall be provided to confirm the proper changes are made. The changes shall be documented on a change order document which must be included in the lift documentation package. The change order document shall include a description of the reason for the changes, the revised drive parameter list (with current revision number and date), name of the person who developed the changed parameters, name of the person who implemented the changed parameters on the drive, and name of the person who completed the testing procedures, if applicable.

2) PLC Programs

The PLC programs require development software to effect changes. *Use of this software by the end user to alter the program logic or parameters is not permitted.* Any alterations to the programs shall be made by Electramic Associates using a qualified software programmer. Changes to the PLC programs fall under 2 categories: *Parameter Changes* and *Logic Changes*.

Parameter Changes can be transferred to the customer via replacement CPU modules with the changes made by Electramics Associates. Altered CPU modules will be accompanied with a change order document which must be included in the lift documentation package. Testing procedures, if required, shall be provided to confirm the proper changes are made.

The change order document shall include the file name(s) for the changed PLC program (with current revision number and date), a description of the reason for the changes, a list of the changed parameters including the line numbers in the program where the changes are made, name of the person who developed the changed parameters,

name of the person who installed the replacement CPU module in the PLC, and name of the person who completed the testing procedures, if applicable.

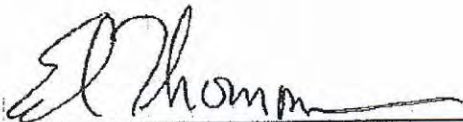
Logic Changes can be transferred to the customer via replacement CPU modules with the changes made by Electramics Associates. Altered CPU modules will be accompanied with a change order document which must be included in the lift documentation package. Testing procedures, if required, shall be provided to confirm the proper changes are made.

The change order document shall include the file name(s) for the changed PLC program (with current revision number and date), a description of the reason for the changes, a printout of the changed ladder logic including the line numbers in the program where the changes are made, name of the person who developed the ladder logic changes, name of the person who installed the replacement CPU module in the PLC, and name of the person who completed the testing procedures, if applicable.

3) Touch Screen

Touch Screen changes can transferred to the customer be via a replacement touch screen with the changes made by Electramics Associates, or via USB memory stick with the changes made by Electramics Associates. These will be accompanied with a change order document which must be included in the lift documentation package. Testing procedures, if required, shall be provided to confirm the proper changes are made.

The change order document shall include the file name(s) for the changed Touch Screen (HMI) program (with current revision number and date), a description of the reason for the changes, a screen shot of any changed screens, name of the person who developed the HMI changes, name of the person who installed the replacement Touch Screen module or uploaded the replacement software in the Touch Screen, and name of the person who completed the testing procedures, if applicable.



9 Dec 2016

Ed Thompson
Electramic Associates



Josef Gmuender, PE
Gmuender Engineering LLC

Changed Parameter List

Lift: **Quickdraw Express** Color Code: **Default**
 Area: **Granby Ranch CO** **Set by autotune**
 Drive: **ABB DCS800-S02-1200-05-b** Parameters not listed are set at factory default
 Ser No: **6748406C16243117**

Rev: **1** As Installed
 Date: **12/6/2016**

Index	Name	Value	Note	Index	Name	Value	Note
99	Start-up data			21	Start / stop		
9902	M1NomVolt	500		2102	Off1Mode	RampStop	
9903	M1NomCur	781		2103	StopMode	RampStop	
9904	M1BaseSpeed	1750		2104	E StopMode	CoastStop	
9910	NomMainsVolt	480		2110	FlyStart	FlyingStart	
9911	M1NomFieldCur	8.25		2116	MainContCtrlMode	On	
9912	M1UsedFexType	Fex-425-Int		2118	FldHeatSel	NotUsed	
10	Start/Stop Select			22	Speed Ramp		
1001	CommandSel	Local I/O		2201	AccTime1	30	
1002	Direction	DI4		2202	DecTime1	6.5	
1003	reset	D 6		24	Speed Control		
1006	MotFanAck	NotUsed		2403	KpS (p part speed contr	12	
1008	Off2	DI2		2409	TIS (I part speed control	97	
1009	E Stop	NotUsed		30	Fault Functions		
1015	OnOff1	DI7		3009	ArmOvrCurLev	150%	
1016	Start/Stop Command	DI7		3012	M1 FldMinTrip	90%	
1020	ConvFanAck	NotUsed		3013	M1FldOvrCurLev	110%	
1021	MainContAck	DI3		3016	M1 Overspeed	1751	
11	Speed Reference Inputs			31	Motor 1 Temperature		
1102	Ref1Mux	Close		3108	M1KlixonSel	NotUsed	
1103	Ref1Sel	AI1		34	Panel Display		
13	Analog Inputs			3401	Display Part1 Select	103	SpeedActEnc
1301	AI1HighVal	10000 (speed cmd)		42	Brake Control		
1302	AI1LowVal	0		4201	M1BrakeCtrl	on	
1303	ConvModeAI1	0-10 v uni		4203	M1BrakeRefDly	0	
1304	FiltAI1	0		4207	M1StrtTorqRefSel	start torque ref	
1305	AI2HighVal	10000 (not used)		4208	StrtTorqRef	20%	
1306	AI2LowVal	0		43	Current control		
1307	ConvModeAI2	+/-10V Bi		4306	M1KpArmCur	0.14	
1308	FiltAI2			4307	M1TIArmCur	33	
1309	AI3HighVal	10000 (not used)		4308	M1DiscontCurLim	51.38	
1310	AI3LowVal	0		4309	M1ArmL	0.47	
1311	ConvModeAI3	+/-10V Bi		4310	M1ArmR	14	
1312	FiltAI3			4314	RevDelay	15 ms	
1313	AI4HighVal	10000 (not used)		44	Field Excitation		
1314	AI4LowVal	0		4401	Field Ctrl Mode	Fix	
1315	ConvModeAI4	+/-10V Bi		4402	M1KpFEX	13.05	
1316	FiltAI4			4403	M1TIFEX	66	
14	Digital Outputs			4412	Field Cur Flux 40	40	
1401	DO1Index	603 (not used)		4413	Field Cur Flux 70	70	
1402	DO1BitNo	0		4414	Field Cur Flux 90	90	
1403	DO2Index	801 running		45	Field Converter Settings		
1404	DO2BitNo	2		4502	M1PosLimCtrl	57	
1405	DO3Index	-801 Drive Fault		4518	FieldMinTripDelay	500	
1406	DO3BitNo	3		50	Speed Measurement		
1407	DO4Index	802 Zero speed		5001	M1SpeedScale	1523	
1408	DO4BitNo	11		5002	M1EncMeasMode	A+/-B+/-	
1409	DO5Index	802 torque proof		5003	M1SpeedFbSel	encoder	
1410	DO5BitNo	8		5004	M1EncPulseNo	300	
1411	DO6Index	(not used)		5005	Max Encoder Time	3	
1412	DO6BitNo			5006	Speed Filter Time	50	
1413	DO7Index	(not used)		51	Fieldbus		
1414	DO7BitNo			5104		192	
1415	DO8Index	603 Main Ctct On		5105		168	
1416	DO8BitNo	7		5106		100	
15	Analog Outputs			5107		210	
1501	IndexAO1	104 MotSpeed		5108		255	
1503	ConvModeAO1	0-10v abs		5109		255	
1504	FilterAO1	10 ms		5110		255	
1505	ScaleAO1	8600mv		5111		0	
1506	IndexAO2	108 Mot Torq		5119		101	
1508	ConvModeAO2	+/-10V Bi		5128		0114hex	
1509	FilterAO2	10 ms		5129		0114hex	
1510	ScaleAO2	6300 mv		5130		0040hex	
16	System Control Inputs			5131			
1602	Par Lock	Locked		5132		0130hex	
1603	SysPassCode			5133		0308hex	
1604	Local Lock	TRUE		97	Measurement		
1609	USI select	extended		9719	ZeroCurTimeOut	50 ms	
20	Limits			98	Option modules		
2001	M1SpeedMin	-306 at 1.1 m/s		9802	Comm Module	Fieldbus	
2002	M1SpeedMax	1523 at 5.6 m/s					
2003	M1ZeroSpeedLim	25					
2005	TorqueMax	125%					
2006	TorqueMin	-100%					
2012	M1CurLimitBrdg1	150%					

Load Test Procedure for Detachable Grip Chairlift

(rev 2)

Quick Draw Express Detachable Chair

Ski Granby Ranch, CO

CO PTSB ID: SC-008

Date: 5 Dec 2016

1.0 Introduction

The Quick Draw Express detachable quad chairlift, manufactured by Leitner, was installed in 1999 (area known as Sol Vista at the time). The original Control Techniques DC drive has been replaced:

- New ABB DCS-800 DC drive
- Reuse existing DC motor
- No changes to existing Leitner low voltage controls.
- New 'Ramp and Speed Monitor' (Electramics)

The acceptance test is intended to confirm the proper function of the new DC drive and its interface with the existing low voltage controls. The test will also test the function of the independent 'Ramp and Speed Monitor' (RSM) that monitors overspeed, rollback, acceleration and deceleration.

2.0 Lift Specifications

Lift Type	4 Passenger Detachable Grip Chairlift
Slope Length	1310 m
Vertical Rise	256 m
Number of Carriers (design)	67
Number of Carriers (actual)	<u>67</u>
Carrier Spacing (design)	44.8 m (8.00 sec interval)
Carrier spacing (actual)	<u>44.8</u> m (<u>8.0</u> sec interval)
Lift speed	5.6 m/sec (1100 FT/min)
Capacity-Uphill (design)	1800 passengers/hour
Capacity-Downhill (design)	900 passengers/hour
Capacity (actual)	<u>1800</u> passengers/hour
Carrier type	Leitner SA4-99 with Leitner LA48-95 SA4 grip
Carrier weight	215 kg
Drive Location	Top
Drive bullwheel size	4.20 m
Main drive	500 HP DC 1750 rpm 781 A DC ABB DCS800
Standby drive	Cummins N14-P475 with Rockford torque converter
Evac drive	Cummins B5.9-P152 with Rockford torque converter
Tension location	Bottom
Tensioning force	kN
Tension type	Hydraulic Cylinders (55.5 bar, 805 psi)
Return bullwheel size	4.20 m
Line gauge	5.30 m
Haul rope	40 mm 6x25 RLL PC (nom strength 830 kN)
Gearbox	Leitner KSS5 i=59.81
Main Drive input	Direct to gearbox

3.0 Personnel Attending

Name	Company / Organization
BRUCE ALLEN	CO PTSB
JOE GAVENDER	GAVENDER ENGINEERING
ED THOMPSON	ELECTRATICS
FRANK DERTY	ELECTRATICS
BLAINE FAULKNER	GRANBY RANCH
ANDY BIRCH	GRANBY RANCH
JACOB (AT LARGE TERNUM)	GRANBY RANCH

4.0 Initial Checks

Perform visual review of entire line.
Confirm top and bottom communications is functional
Hourmeter at start of testing:

☒
☒
60563.8

4.1 Remote terminal operator switches/controls

Confirm function of remote terminal-signals to drive station

	INDICATION*
Medium (return)	<input checked="" type="checkbox"/>
Slow (return)	<input checked="" type="checkbox"/>
Stop (Ch 1) (return)	<input checked="" type="checkbox"/> 19A1 (PNOZ X2)
Stop (Ch 2) (return)	<input checked="" type="checkbox"/>
E Stop (Ch 1) (return)	<input checked="" type="checkbox"/> 33A0 (PNOZ X2)
E Stop (Ch 2) (return)	<input checked="" type="checkbox"/>
Signal (return)	<input checked="" type="checkbox"/>
Phone (return)	<input checked="" type="checkbox"/>
_____	<input checked="" type="checkbox"/>
_____	<input type="checkbox"/>

4.2 Local terminal operator switches/controls

Confirm function of local operator controls

	INDICATION*
Fast DLS	<input checked="" type="checkbox"/>
Fast CON	<input checked="" type="checkbox"/>
Medium DLS	<input checked="" type="checkbox"/>
Medium CON	<input checked="" type="checkbox"/>
Slow DLS	<input checked="" type="checkbox"/>
Slow CON	<input checked="" type="checkbox"/>
Slow OPS	<input checked="" type="checkbox"/>
Stop DLS	<input checked="" type="checkbox"/>
Stop CON	<input checked="" type="checkbox"/>
Stop OPS	<input type="checkbox"/>
Stop STN	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
Stop Cords STN	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> (normal stop)
E Stop DLS	<input checked="" type="checkbox"/>
E Stop OPS	<input checked="" type="checkbox"/>
E Stop CON	<input checked="" type="checkbox"/>
E Stop STN	<input checked="" type="checkbox"/>
Start DLS	<input checked="" type="checkbox"/>
Start CON	<input checked="" type="checkbox"/>
Fault Reset DLS	<input checked="" type="checkbox"/>
Fault Reset CON	<input checked="" type="checkbox"/>
Forward/Backward CON	<input checked="" type="checkbox"/>
Signal	<input checked="" type="checkbox"/>
Phone	<input checked="" type="checkbox"/>
_____	<input type="checkbox"/>
_____	<input type="checkbox"/>

DLS=Downhill Loader Station-top
CON=Operator Console-top operator house
STN=Drive Station (motor platform)

4.3 DC Drive <> Leitner Controls

	INDICATION*
Main Motor Contactor-Aux contact-1 <i>when closed</i>	<input checked="" type="checkbox"/> (X6-0, 0600)
Main Motor Contactor-Aux contact-0 <i>when open</i>	<input checked="" type="checkbox"/> (X6-0, 0600)
Drive Fault-1 <i>when no fault</i>	<input checked="" type="checkbox"/> (X6-1, 0601)
Drive Fault-0 <i>when fault</i>	<input checked="" type="checkbox"/> (X6-1, 0601)
Proof of Torque-1 <i>when above set level</i>	<input checked="" type="checkbox"/> (X7-0, 0700)
Proof of Torque-0 <i>when below set level</i>	<input checked="" type="checkbox"/> (X7-0, 0700)
Run (start/stop)-1 <i>when running</i>	<input checked="" type="checkbox"/> (X6-11, 0611)
Run (start/stop)-0 <i>when stopped (at instance of stop command)</i>	<input checked="" type="checkbox"/> (X6-11, 0611)
Reverse-1 <i>when forward</i>	<input checked="" type="checkbox"/> (X6-15, 0613)
Medium	<input checked="" type="checkbox"/> (X6-16, 0614)
Fast	<input checked="" type="checkbox"/> (X6-17, 0615)
Torque Test	<input checked="" type="checkbox"/> (via Modbus)

4.4 Ramp and Speed Monitor (RSM) <> Leitner Controls

	INDICATION*
Normal Stop-1 <i>when closed</i>	<input checked="" type="checkbox"/> (19A1, DLS Stop+Drive Fault)
Normal Stop-0 <i>when open</i>	<input checked="" type="checkbox"/> (19A1, DLS Stop+Drive Fault)
Emergency Stop-1 <i>when no fault</i>	<input checked="" type="checkbox"/> (33A0, STN E Stop+Drive Fault)
Emergency Stop-0 <i>when fault</i>	<input type="checkbox"/> (33A0, STN E Stop+Drive Fault)

5.0 0% UH, 0% DH (Main Drive-Electric)

Record tension carriage position:

235 cm

Record tension system pressure:

860 psi

Main Drive-Electric:

Measure acceleration time:

30.2 sec.

Max motor torque during acceleration:

55%

Measure lift speed:

10 rev in 23.56 sec >> 25.47 rpm

5.60 m/s → 1162 ft/min
5.4 m/s (LEINER) 1100 ft/min (RSM)

Speed Meter Reading:

1520 RPM

Motor RPM:

30-35%

Steady state motor torque:

440 VR

Steady state armature voltage:

P-1E. Perform Coasting stop-(Use service brake test mode, bypass DA 92.10 'Deceleration supervision main drive', DA 92.11 'Deceleration supervision service brake, hold service brake off during stop with button inside control panel)

Stop time:

18.77 s

Stop distance-measured:

(52.7 m) RSM

Stop distance:

173 ft (per controls) (52.3 m ON LEINER DISPLAY)

Measured distance matches displayed distance ☒

Max deceleration rate:

-

'Black Box' photo taken? ☒

#76

P-2E. Perform Normal Stop (drive ramp down, service brake at 'zero speed'):

Stop time:

6.11 sec.

Stop distance:

18.8 m 54A

Max deceleration rate:

3.55 m/s²

'Black Box' photo taken? ☒

#70

Max regenerative current during stop:

-71%

P-3E. Perform Emergency Stop (emergency brake, service brake at 'zero speed')

Stop time:

5.96 s

Stop distance:

18.0 m 54A

Max deceleration rate:

3.83 m/s²

'Black Box' photo taken? ☐

#72

P-4E. Perform Service Stop (Service brake only, modulated)

Stop time:

6.20 s

Stop distance:

18.5 m 54A

Max deceleration rate:

3.93 m/s²

'Black Box' photo taken? ☐

#74

6.0 Load Lift to 100% x 1.1 Design Load (for 110% UH / 0% DH load test)

Design load for testing:

$$0.5 \times (\text{Number of Chairs}) \times (\text{pass/chair}) \times 170 \text{ lb/pass} \times 1.1 = \text{Total test weight}$$

$$0.5 \times (67-4) \times 4 \times 170 \times 1.1 = 23,562 \text{ lb}$$

*2 chairs in terminal on each end, 63 chairs on line

Chairs to load (for 110% test load):

$$(0.5 \times \text{Number of Chairs}) - \text{Chairs left empty} = \text{Chairs with test load}$$

$$(0.5 \times 63) - 4.5 = 27 \gg \text{Load 27 chairs}$$

$$\text{Total test weight} / \text{Chairs with test load} = \text{load per chair}$$

$$23,562 / 27 = 873 \text{ lb per chair}$$

Test weight for 50% load: $873 \text{ lbs} / 4 = 218 \text{ lbs/seat position}$

Load test material: *18x18x24 CARDBOARD BOX W TRASH (17H LINER
CALIBRATED FILL STICK IN STOP WITH SCALE AND FILLED BOX
(TILTED TO SEAT ANGLE)*

Load carriers from Chair 1 to Chair 27

Record tension system pressure:

Record tension carriage position:

*215 CM (20 CM FORWARD)
911 PSI*

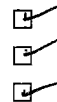
6.1 Check static holding of brakes

(Note any adjustments performed)

Service brake:

Emergency brake:

Rollback brake:



6.2 Check dynamic rollback of brakes

Open service brake. Slowly open emergency brake and let lift roll back.

...Leitner Rollback switch sets Rollback Brake, activates E-Stop:

...RSM PLC Rollback activates E-Stop:



Bypass Leitner rollback switch, RSM PLC Rollback. Set emergency brake. Open service brake. Slowly open emergency brake and let lift rollback to approximately 1/3 of design speed. Set emergency brake:

Emergency brake stopping performance: *WITH ALL BRAKES OPEN, LIFT ROLLED BACKWARDS
AT < 0.5 M/S (< 100 F/H.M) SPEED, E BRAKE STOPPED + HELD LOAD*

Set service brake. Open emergency brake. Slowly open service brake and let lift roll back to approximately 1/3 of design speed. Set service brake:

Service brake stopping performance: *WITH ALL BRAKES OPEN, LIFT ROLLED
BACKWARDS AT < 0.5 M/S (< 100 F/H.M) SPEED, S. BRAKE STOPPED
AND HELD LOAD.*

6.3 110% UH, 0% DH Lift Tests (Main Drive-Electric)

Measure acceleration time: 30 SEC
Max motor torque during acceleration: 103%
Measure lift speed:
Speed Meter Reading: 1100 FT/min
Motor RPM: 1520 RPM
Steady state motor torque: 80%
1F. Perform Coasting stop (see procedure under section 5.0, P-1E)
Stop time: 8.97 SEC
Stop distance-measured: -
Stop distance: 26.0m 84ft. (per controls)
Max deceleration rate: 2.62 ft/s^2
'Black Box' photo taken? ☒ #192

2F. Perform Normal Stop (drive ramp down, service brake at 'zero speed'):
Stop time: 6.15s
Stop distance: 57 ft.
Max deceleration rate: 3.24 ft/s^2
'Black Box' photo taken? ☒ #156
Max regenerative current during stop: -40%

3F. Perform Emergency Stop (emergency brake, service brake at 'zero speed')
Stop time: 5.44s
Stop distance: 55 ft.
Max deceleration rate: 4.67 ft/s^2
'Black Box' photo taken? ☒ #158

4F. Perform Service Stop (Service brake only, modulated)
Stop time: 5.95s
Stop distance: 61 ft 18.5m
Max deceleration rate: 4.89 ft/s^2
'Black Box' photo taken? ☐ #165

6.4 110% UH, 0% DH Lift Tests (Auxiliary Drive-Diesel)

Measure acceleration time: 30 SEC
Measure lift speed:
Speed Meter Reading: 790 ft/min
Engine RPM: 1600 RPM

1-AuxF. Perform Normal Stop (engine ramp down, service brake at 'zero speed'):
Stop time: 4.12 sec.
Stop distance: 31 ft.
Max deceleration rate: 4.11 ft/s^2
'Black Box' photo taken? ☒ #244

2-AuxF. Perform Emergency Stop (engine kill, emergency brake, service brake at 'zero speed')
Stop time: 3.68 sec
Stop distance: 24 ft 7.8m
Max deceleration rate: 4.65 ft/s^2
'Black Box' photo taken? ☒ #246

~~4F. Perform Service Stop (Service brake only, modulated)~~
~~Stop time:~~ _____
~~Stop distance:~~ _____
~~Max deceleration rate:~~ _____
~~'Black Box' photo taken?~~ ☐ _____

7.0 Load Lift to 50% x 1.1 Design Load (for 55% DH, 0% UH load test)

Empty even numbered carriers from Chair 1 to Chair 27 ☒

Notes: AUXILIARY VOLUME USED TO MOVE CARRIERS FROM 110% UH TO 55% DH - EVERY OTHER CHAIR EMPTIED AT TOP TERMINAL

7.1 55% DH, 0% UH Lift Tests (Main Drive-Electric)

Measure acceleration time: ~ 30 SEC
Max motor torque during acceleration: 49%
Measure lift speed:
Speed Meter Reading: 1100 FT/MIN
Motor RPM: 1520 RPM
Steady state motor torque: 27%

1D. Perform Coasting stop-(see procedure under section 5.0, P-1E) NOT PERFORMED

Stop time: —
Stop distance-measured: —
Stop distance: — (per controls)
Max deceleration rate: —
'Black Box' photo taken? ☐

2D. Perform Normal Stop (drive ramp down, service brake at 'zero speed'):

Stop time: 6.15 SEC
Stop distance: 54 FT
Max deceleration rate: 3.47 ft/s^2
'Black Box' photo taken? ☒ #254
Max regenerative current during stop: 86% MAX

3D. Perform Emergency Stop (emergency brake, service brake at 'zero speed')

Stop time: 6.66 SEC
Stop distance: 65 FT
Max deceleration rate: 3.79 ft/s^2
'Black Box' photo taken? ☒ #256

4D. Perform Service Stop (Service brake only, modulated)

Stop time: 7.04 SEC
Stop distance: 64 FT 19.6M
Max deceleration rate: 3.99 ft/s^2
'Black Box' photo taken? ☒ #274

8.0 Empty all carriers

Unload all carriers.

Record tension system pressure:

Record tension carriage position:



(NOT REQUIRED)

(NOT REQUIRED)

8.1 Repeat empty lift tests if changes made to brake settings

Any changes made? If no changes Sect 8.1 and 8.2 do not need to be performed:

NO CHANGES MADE TO BRAKE SETTINGS OR DRIVE SETTINGS - SKIP SECT 8.1, 8.2

0% UH, 0% DH (Main Drive-Electric)

Measure acceleration time:

Max motor torque during acceleration:

Measure lift speed:

Speed Meter Reading:

Motor RPM:

Steady state motor torque:

1E. Perform Normal Stop (drive ramp down, service brake at 'set speed'):

Stop time:

Stop distance:

2E. Perform Emergency Stop (drive disconnected, drive sheave brake, service brake at 'set speed')

Stop time:

Stop distance:

3E. Perform Service Stop (drive disconnected, service brake only set)

Stop time:

Stop distance:

4E. Perform Coasting stop-activated from 'service' menu (drive disconnected, no brakes set)

Stop time:

Stop distance:

5E. Perform E-Only Stop activated from 'service' menu (drive disconnected, drive sheave brake only set)

Stop time:

Stop distance:

8.2 0% UH, 0% DH (Auxiliary Drive-Diesel)

Measure acceleration time:

Measure lift speed:

Speed Meter Reading:

Engine RPM:

1-AuxE. Perform Normal Stop (engine ramp down, service brake at 'zero speed'):

Stop time:

Stop distance:

Max deceleration rate:

'Black Box' photo taken? ☐

2-AuxE. Perform Emergency Stop (engine kill, emergency brake, service brake at 'zero speed')

Stop time:

Stop distance:

Max deceleration rate:

'Black Box' photo taken? ☐

9.0 Lift Safeties

9.1 DC Drive Safeties / PLC Safeties

DC Drive Safeties

DC Drive Overcurrent Test: (change par 3009)

Motor Tach Feedback Loss: (pull isolation relay)

DC Drive Field Loss (change par. 4502 to 20%)

Motor Overspeed: 110% 1751 → 1060

Ramp fault (accel time changed from 30 s to 24 s)

☒ 150% → 70% FS22 (on DC drive display)
☒ FS22 (on DC drive display)
☒ 57% → 20% FS41 (on DC drive display)
☒ FS32 (on DC drive display)

Torque Limit Settings:

Parameter 2005 'TorqMax': +125 +150% (driving)
Parameter 2006 'TorqMin': -100 -100% (regen)

Motor Overcurrent Setting:

Phase Loss (open breaker to phase loss relay)

Blower Fault (motor overload)

'Drive Fault' indicated on Leitner controls

Contactor acknowledge in ABB

PERFORMER ACTUAL OVERSPEED

BY SETTING PPR

☒ 150% (PAR 3009)
☒ DRIVE FAULT

☒ _____

☒ _____

☒ NO STOP IF NO CNT. ACKNOWLEDGE

☒ BOTH LEITNER CONTROLS + RSM ALL TRIPPED FOR 110% OVERSPEED

RSM: PLC Module Safeties/Functions

(tested from service menu/PLC tests)

FROM 'DC DRIVE (motor encoder 1 > ABB Drive > Analog output-Speed > RSM PLC):

	Normal	Test	INDICATION*
PLC-Motor Encoder Loss		<u>MAX SPEED</u>	<input checked="" type="checkbox"/> NS-'TACH LOSS'
PLC-Motor Accel Fault	<u>80</u>	<u>25</u>	<input checked="" type="checkbox"/> ES-'ACCEL FAULT-DRIVE'
PLC-Motor Decel Fault	<u>190</u>	<u>40</u>	<input checked="" type="checkbox"/> NS-'DECEL FAULT-DRIVE'
PLC-Motor 115% Overspeed	<u>4025</u>	<u>1800</u>	<input checked="" type="checkbox"/> ES-'115% DRIVE'
PLC-Motor 110% Overspeed	<u>3850</u>	<u>1800</u>	<input checked="" type="checkbox"/> NS-'110% MOTOR SPEED
PLC-Speed-Motor vs Rope Enc	<u>SET SPEED CHARACTER</u>		<input checked="" type="checkbox"/> NS-'SPEED-MOTOR VS ROPE'
PLC-Ramp Fault	<u>0</u>	<u>+1.5 SEC</u>	<input checked="" type="checkbox"/> NS-'RAMP FAULT'

FROM 'ROPE-ENCODER':

	Normal	Test	INDICATION*
PLC-Rope Encoder Loss		<u>MAX SPEED</u>	<input checked="" type="checkbox"/> NS-'ROPE SPEED LOSS
PLC-Rope Encoder Accel Fault	<u>60</u>	<u>25</u>	<input checked="" type="checkbox"/> ES-'DECEL FAULT-ROPE'
PLC-Rope Encoder Decel Fault	<u>190</u>	<u>40</u>	<input checked="" type="checkbox"/> NS-'DECEL FAULT-ROPE'
PLC-Rope Encoder 115% Overspeed	<u>4025</u>	<u>1800</u>	<input checked="" type="checkbox"/> ES-'115% ROPE'
PLC-Rope Encoder 110% Overspeed	<u>3850</u>	<u>1800</u>	<input checked="" type="checkbox"/> NS-'110% MOTOR SPEED'
PLC-Rope Encoder Position Test	<u>FLIP VALUES</u>		<input checked="" type="checkbox"/> NS-'ROPE POSITION LOSS'
PLC-Speed- Rope Enc vs Motor Enc 2	<u>SET SPEED ERROR → 1</u>		<input checked="" type="checkbox"/> NS-'SPEED ROPE VS MOTOR'
PLC-rope Encoder-Rollback	<u>FLIP VALUES</u>		<input checked="" type="checkbox"/> ES-'ROLLBACK'

Tach test:

300 PPR TACHS ON DC MUX + 'ROPE' TACH

IN RSM PLC: 3500 SPEED UNITS = 100% SPEED = 1100 RPM

* NS = Normal Stop Command from RSM, ES = Emergency Stop Command from RSM

10.0 Perform Brake Torque Test

Follow existing brake torque test procedures

TESTED PER EXISTING PROCEDURE, SERVICE BRAKE,
ROLLBACK BRAKE AND EMERGENCY BRAKE ALL HELD
STATICALLY AT 25% TORQUE.

11.0 Load Test Completed



COLORADO

Department of
Regulatory Agencies

Division of Professions and Occupations

Business and Inspections Branch

Passenger Tramway Safety Board

October 26, 2016

Mr. James Wolter
Director of Mountain Operations
Ski Granby Ranch
P.O. Box 1110
Granby, CO 80446

MAJOR MODIFICATION OF:
LIFT NAME: Quick Draw Express
LIFT ID: SC-008
CHANGE CONTROL TECHNIQUES DRIVE TO AN ABB DRIVE.

Dear Mr. Wolter:

Pursuant to the rules and regulations of the Board, you have fulfilled the requirements of Rule 21.3.1 and the Board is authorizing you to proceed as required in Rule 21.3.2.

It is your responsibility to see that all submissions are complete and submitted in a timely manner. Please be advised that only current forms will be accepted. All outdated forms should be destroyed. The current Submissions Booklet, which includes the current forms, can be found on the Board's website at www.dora.colorado.gov/professions/tramways.

The lift identification number must be included on all submissions to this office. If the lift identification number is not included, the materials will be returned to you for resubmission.

If requests for variances are found to be necessary as a result of the acceptance test, a license to operate cannot be issued until the Board has ruled on the variance request. Variance requests must be routed through the Technical Committee prior to being placed on the Board's agenda. Please give yourself plenty of time to get your variance requests through the Technical Committee and Board. Every effort will be made in such an instance to obtain a decision as soon as possible, however, the Board does have thirty days to act on a request for variance as per Rule 21.3.4

Sincerely,

Nicki Cochrell
Program Manager





COLORADO

Department of
Regulatory Agencies

Division of Professions and Occupations

COLORADO PASSENGER TRAMWAY SAFETY BOARD

**ELECTRICAL SYSTEM ACCEPTANCE TEST
ANSI X.2.11**

Licensee Ski Granby Ranch Lift Identification # SC-008

Name/Number of Lift Quick Draw Express Date 9 Dec 2016

Name of Professional Engineer Josef C. Gmuender

VERIFICATION

I hereby certify that to the best of my knowledge and ability, the above-named passenger tramway software and/or relay logic functions have been verified and any modifications made to the electrical design shall be clearly marked on the on-site documentation according to ANSI X.2.11 Electrical system acceptance test requirement.

Professional Engineer's Signature and Seal

SEAL &
SIGNATURE





COLORADO

Department of
Regulatory Agencies

Division of Professions and Occupations

COLORADO PASSENGER TRAMWAY SAFETY BOARD

**SOFTWARE SECURITY
ANSI X.2.12**

Licensee Ski Granby Ranch Lift Identification # SC-008

Name/Number of Lift Quick Draw Express Date 9 Dec 2016

Name of Professional Engineer Josef C. Gmuender

VERIFICATION

I hereby verify that the "as built" documents include a procedure, that ensure the security of the software logic and operating parameters that will control the aerial tramway are in place and operational per ANSI X.2.12 Software security.

Professional Engineer's Signature and Seal

SEAL &
SIGNATURE





COLORADO

Department of
Regulatory Agencies

Division of Professions and Occupations

COLORADO PASSENGER TRAMWAY SAFETY BOARD

VERIFICATION OF ACCEPTANCE TEST

FOR

NEW, RELOCATED, OR MAJOR MODIFICATION OF TRAMWAYS

Licensee: Ski Granby Ranch
Lift Identification #: SC-008
Name/Number of Lift: Quick Draw Express
Type of Lift: Detachable Grip Quad Chair
Date: _____

Name of Professional Engineer: Josef C. Gmuender

Address of Professional Engineer: 638 Long Valley Road, Gardnerville NV 89460

Description of Work: Replacement of existing DC drive with ABB DCS800, addition of
overspeed/accel/decel monitor: 'Ramp and Speed Monitor' (RSM)

VERIFICATION

I hereby verify that to the best of my knowledge and ability, the above-named passenger tramway has completed the acceptance test as required in X.1.1.11.2 and all applicable items of X.1.1.11.1. All deficiencies discovered during the acceptance test have been documented in the acceptance test report by the Board Inspector (21.2.12, 21.3.12) and shall be remedied prior to operation (22.4.4).

Professional Engineer's Signature and Seal



SEAL &
SIGNATURE

Load Test Procedure for Detachable Grip Chairlift

(rev 2)

Quick Draw Express Detachable Chair

Ski Granby Ranch, CO

CO PTSB ID: SC-008

Date: 5 Dec 2016

1.0 Introduction

The Quick Draw Express detachable quad chairlift, manufactured by Leitner, was installed in 1999 (area known as Sol Vista at the time). The original Control Techniques DC drive has been replaced:

- New ABB DCS-800 DC drive
- Reuse existing DC motor
- No changes to existing Leitner low voltage controls.
- New 'Ramp and Speed Monitor' (Electramics)

The acceptance test is intended to confirm the proper function of the new DC drive and its interface with the existing low voltage controls. The test will also test the function of the independent 'Ramp and Speed Monitor' (RSM) that monitors overspeed, rollback, acceleration and deceleration.

2.0 Lift Specifications

Lift Type	4 Passenger Detachable Grip Chairlift
Slope Length	1310 m
Vertical Rise	256 m
Number of Carriers (design)	67
Number of Carriers (actual)	<u>67</u>
Carrier Spacing (design)	44.8 m (8.00 sec interval)
Carrier spacing (actual)	<u>44.8</u> m (<u>8.0</u> sec interval)
Lift speed	5.6 m/sec (1100 FT/min)
Capacity-Uphill (design)	1800 passengers/hour
Capacity-Downhill (design)	900 passengers/hour
Capacity (actual)	<u>1800</u> passengers/hour
Carrier type	Leitner SA4-99 with Leitner LA48-95 SA4 grip
Carrier weight	215 kg
Drive Location	Top
Drive bullwheel size	4.20 m
Main drive	500 HP DC 1750 rpm 781 A DC ABB DCS800
Standby drive	Cummins N14-P475 with Rockford torque converter
Evac drive	Cummins B5.9-P152 with Rockford torque converter
Tension location	Bottom
Tensioning force	kN
Tension type	Hydraulic Cylinders (55.5 bar, 805 psi)
Return bullwheel size	4.20 m
Line gauge	5.30 m
Haul rope	40 mm 6x25 RLL PC (nom strength 830 kN)
Gearbox	Leitner KSS5 i=59.81
Main Drive input	Direct to gearbox

3.0 Personnel Attending

Name	Company / Organization
BRUCE ALLEN	CO PTSB
JOE LAVENDER	GHUENDER ENGINEERING
ED THOMPSON	ELECTRATICS
FRANK DERTY	ELECTRATICS
BLAINE FAULKNER	GRANBY RANCH
ANDY BIRCH	GRANBY RANCH
JACOB (AT LARGE TERNUM)	GRANBY RANCH

4.0 Initial Checks

Perform visual review of entire line.
Confirm top and bottom communications is functional
Hourmeter at start of testing:

☒
☒
60563.8

4.1 Remote terminal operator switches/controls

Confirm function of remote terminal-signals to drive station

	INDICATION*
Medium (return)	<input checked="" type="checkbox"/>
Slow (return)	<input checked="" type="checkbox"/>
Stop (Ch 1) (return)	<input checked="" type="checkbox"/> 19A1 (PNOZ X2)
Stop (Ch 2) (return)	<input checked="" type="checkbox"/>
E Stop (Ch 1) (return)	<input checked="" type="checkbox"/> 33A0 (PNOZ X2)
E Stop (Ch 2) (return)	<input checked="" type="checkbox"/>
Signal (return)	<input checked="" type="checkbox"/>
Phone (return)	<input checked="" type="checkbox"/>
_____	<input checked="" type="checkbox"/>
_____	<input type="checkbox"/>

4.2 Local terminal operator switches/controls

Confirm function of local operator controls

	INDICATION*
Fast DLS	<input checked="" type="checkbox"/>
Fast CON	<input checked="" type="checkbox"/>
Medium DLS	<input checked="" type="checkbox"/>
Medium CON	<input checked="" type="checkbox"/>
Slow DLS	<input checked="" type="checkbox"/>
Slow CON	<input checked="" type="checkbox"/>
Slow OPS	<input checked="" type="checkbox"/>
Stop DLS	<input checked="" type="checkbox"/>
Stop CON	<input checked="" type="checkbox"/>
Stop OPS	<input type="checkbox"/>
Stop STN	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
Stop Cords STN	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> (normal stop)
E Stop DLS	<input checked="" type="checkbox"/>
E Stop OPS	<input checked="" type="checkbox"/>
E Stop CON	<input checked="" type="checkbox"/>
E Stop STN	<input checked="" type="checkbox"/>
Start DLS	<input checked="" type="checkbox"/>
Start CON	<input checked="" type="checkbox"/>
Fault Reset DLS	<input checked="" type="checkbox"/>
Fault Reset CON	<input checked="" type="checkbox"/>
Forward/Backward CON	<input checked="" type="checkbox"/>
Signal	<input checked="" type="checkbox"/>
Phone	<input checked="" type="checkbox"/>
_____	<input type="checkbox"/>
_____	<input type="checkbox"/>

DLS=Downhill Loader Station-top
CON=Operator Console-top operator house
STN=Drive Station (motor platform)

4.3 DC Drive <> Leitner Controls

	INDICATION*
Main Motor Contactor-Aux contact-1 <i>when closed</i>	<input checked="" type="checkbox"/> (X6-0, 0600)
Main Motor Contactor-Aux contact-0 <i>when open</i>	<input checked="" type="checkbox"/> (X6-0, 0600)
Drive Fault-1 <i>when no fault</i>	<input checked="" type="checkbox"/> (X6-1, 0601)
Drive Fault-0 <i>when fault</i>	<input checked="" type="checkbox"/> (X6-1, 0601)
Proof of Torque-1 <i>when above set level</i>	<input checked="" type="checkbox"/> (X7-0, 0700)
Proof of Torque-0 <i>when below set level</i>	<input checked="" type="checkbox"/> (X7-0, 0700)
Run (start/stop)-1 <i>when running</i>	<input checked="" type="checkbox"/> (X6-11, 0611)
Run (start/stop)-0 <i>when stopped (at instance of stop command)</i>	<input checked="" type="checkbox"/> (X6-11, 0611)
Reverse-1 <i>when forward</i>	<input checked="" type="checkbox"/> (X6-15, 0613)
Medium	<input checked="" type="checkbox"/> (X6-16, 0614)
Fast	<input checked="" type="checkbox"/> (X6-17, 0615)
Torque Test	<input checked="" type="checkbox"/> (via Modbus)

4.4 Ramp and Speed Monitor (RSM) <> Leitner Controls

	INDICATION*
Normal Stop-1 <i>when closed</i>	<input checked="" type="checkbox"/> (19A1, DLS Stop+Drive Fault)
Normal Stop-0 <i>when open</i>	<input checked="" type="checkbox"/> (19A1, DLS Stop+Drive Fault)
Emergency Stop-1 <i>when no fault</i>	<input checked="" type="checkbox"/> (33A0, STN E Stop+Drive Fault)
Emergency Stop-0 <i>when fault</i>	<input type="checkbox"/> (33A0, STN E Stop+Drive Fault)

5.0 0% UH, 0% DH (Main Drive-Electric)

Record tension carriage position:

235 cm

Record tension system pressure:

860 psi

Main Drive-Electric:

Measure acceleration time:

30.2 sec.

Max motor torque during acceleration:

55%

Measure lift speed:

10 rev in 23.56 sec >> 25.47 rpm

5.60 m/s → 1162 ft/min
5.4 m/s (LEINER) 1100 ft/min (RSM)

Speed Meter Reading:

1520 RPM

Motor RPM:

30-35%

Steady state motor torque:

440 VR

Steady state armature voltage:

P-1E. Perform Coasting stop-(Use service brake test mode, bypass DA 92.10 'Deceleration supervision main drive', DA 92.11 'Deceleration supervision service brake, hold service brake off during stop with button inside control panel)

Stop time:

18.77 s

Stop distance-measured:

(52.7 m) RSM

Stop distance:

173 ft (per controls) (52.3 m ON LEINER DISPLAY)

Measured distance matches displayed distance ☒

Max deceleration rate:

-

'Black Box' photo taken? ☒

#76

P-2E. Perform Normal Stop (drive ramp down, service brake at 'zero speed'):

Stop time:

6.11 sec.

Stop distance:

18.8 m 54A

Max deceleration rate:

3.55 m/s²

'Black Box' photo taken? ☒

#70

Max regenerative current during stop:

-71%

P-3E. Perform Emergency Stop (emergency brake, service brake at 'zero speed')

Stop time:

5.96 s

Stop distance:

18.0 m 54A

Max deceleration rate:

3.83 m/s²

'Black Box' photo taken? ☐

#72

P-4E. Perform Service Stop (Service brake only, modulated)

Stop time:

6.20 s

Stop distance:

18.5 m 54A

Max deceleration rate:

3.93 m/s²

'Black Box' photo taken? ☐

#74

6.0 Load Lift to 100% x 1.1 Design Load (for 110% UH / 0% DH load test)

Design load for testing:

$$0.5 \times (\text{Number of Chairs}) \times (\text{pass/chair}) \times 170 \text{ lb/pass} \times 1.1 = \text{Total test weight}$$

$$0.5 \times (67-4) \times 4 \times 170 \times 1.1 = 23,562 \text{ lb}$$

*2 chairs in terminal on each end, 63 chairs on line

Chairs to load (for 110% test load):

$$(0.5 \times \text{Number of Chairs}) - \text{Chairs left empty} = \text{Chairs with test load}$$

$$(0.5 \times 63) - 4.5 = 27 \gg \text{Load 27 chairs}$$

$$\text{Total test weight} / \text{Chairs with test load} = \text{load per chair}$$

$$23,562 / 27 = 873 \text{ lb per chair}$$

Test weight for 50% load: $873 \text{ lbs} / 4 = 218 \text{ lbs/seat position}$

Load test material: *18x18x24 CARDBOARD BOX W TRASH (17H LINER CALIBRATED FILL STICK IN STOP WITH SCALE AND FILLED BOX (TILTED TO SEAT ANGLE))*

Load carriers from Chair 1 to Chair 27

Record tension system pressure:

Record tension carriage position:

*215 CM (20 CM FORWARD)
911 PSI*

6.1 Check static holding of brakes

(Note any adjustments performed)

Service brake:

Emergency brake:

Rollback brake:



6.2 Check dynamic rollback of brakes

Open service brake. Slowly open emergency brake and let lift roll back.

...Leitner Rollback switch sets Rollback Brake, activates E-Stop:

...RSM PLC Rollback activates E-Stop:



Bypass Leitner rollback switch, RSM PLC Rollback. Set emergency brake. Open service brake. Slowly open emergency brake and let lift rollback to approximately 1/3 of design speed. Set emergency brake:

Emergency brake stopping performance: *WITH ALL BRAKES OPEN, LIFT ROLLED BACKWARDS AT < 0.5 M/S (< 100 F/H.M) SPEED, E BRAKE STOPPED + HELD LOAD*

Set service brake. Open emergency brake. Slowly open service brake and let lift roll back to approximately 1/3 of design speed. Set service brake:

Service brake stopping performance: *WITH ALL BRAKES OPEN, LIFT ROLLED BACKWARDS AT < 0.5 M/S (< 100 F/H.M) SPEED, S. BRAKE STOPPED AND HELD LOAD.*

6.3 110% UH, 0% DH Lift Tests (Main Drive-Electric)

Measure acceleration time: 30 SEC
Max motor torque during acceleration: 103%
Measure lift speed:
Speed Meter Reading: 1100 FT/min
Motor RPM: 1520 RPM
Steady state motor torque: 80%
1F. Perform Coasting stop (see procedure under section 5.0, P-1E)
Stop time: 8.97 SEC
Stop distance-measured: -
Stop distance: 26.0m 84ft. (per controls)
Max deceleration rate: 2.62 ft/s^2
'Black Box' photo taken? ☒ #192

2F. Perform Normal Stop (drive ramp down, service brake at 'zero speed'):
Stop time: 6.15s
Stop distance: 57 ft.
Max deceleration rate: 3.24 ft/s^2
'Black Box' photo taken? ☒ #156
Max regenerative current during stop: -40%

3F. Perform Emergency Stop (emergency brake, service brake at 'zero speed')
Stop time: 5.44s
Stop distance: 55 ft.
Max deceleration rate: 4.67 ft/s^2
'Black Box' photo taken? ☒ #158

4F. Perform Service Stop (Service brake only, modulated)
Stop time: 5.95s
Stop distance: 61 ft 18.5m
Max deceleration rate: 4.89 ft/s^2
'Black Box' photo taken? ☐ #165

6.4 110% UH, 0% DH Lift Tests (Auxiliary Drive-Diesel)

Measure acceleration time: 30 SEC
Measure lift speed:
Speed Meter Reading: 790 ft/min
Engine RPM: 1600 RPM

1-AuxF. Perform Normal Stop (engine ramp down, service brake at 'zero speed'):
Stop time: 4.12 sec.
Stop distance: 31 ft.
Max deceleration rate: 4.11 ft/s^2
'Black Box' photo taken? ☒ #244

2-AuxF. Perform Emergency Stop (engine kill, emergency brake, service brake at 'zero speed')
Stop time: 3.68 sec
Stop distance: 24 ft 7.8m
Max deceleration rate: 4.65 ft/s^2
'Black Box' photo taken? ☒ #246

~~4F. Perform Service Stop (Service brake only, modulated)~~
~~Stop time:~~ _____
~~Stop distance:~~ _____
~~Max deceleration rate:~~ _____
~~'Black Box' photo taken?~~ ☐ _____

7.0 Load Lift to 50% x 1.1 Design Load (for 55% DH, 0% UH load test)

Empty even numbered carriers from Chair 1 to Chair 27 ☒

Notes: AUXILIARY VOLUME USED TO MOVE CARRIERS FROM 110% UH TO 55% DH - EVERY OTHER CHAIR EMPTIED AT TOP TERMINAL

7.1 55% DH, 0% UH Lift Tests (Main Drive-Electric)

Measure acceleration time: ~ 30 SEC
Max motor torque during acceleration: 49%
Measure lift speed:
Speed Meter Reading: 1100 FT/MIN
Motor RPM: 1520 RPM
Steady state motor torque: 27%

1D. Perform Coasting stop-(see procedure under section 5.0, P-1E) NOT PERFORMED

Stop time: —
Stop distance-measured: —
Stop distance: — (per controls)
Max deceleration rate: —
'Black Box' photo taken? ☐

2D. Perform Normal Stop (drive ramp down, service brake at 'zero speed'):

Stop time: 6.15 SEC
Stop distance: 54 FT
Max deceleration rate: 3.47 ft/s^2
'Black Box' photo taken? ☒ #254
Max regenerative current during stop: 86% MAX

3D. Perform Emergency Stop (emergency brake, service brake at 'zero speed')

Stop time: 6.66 SEC
Stop distance: 65 FT
Max deceleration rate: 3.79 ft/s^2
'Black Box' photo taken? ☒ #256

4D. Perform Service Stop (Service brake only, modulated)

Stop time: 7.04 SEC
Stop distance: 64 FT 19.6M
Max deceleration rate: 3.99 ft/s^2
'Black Box' photo taken? ☒ #274

8.0 Empty all carriers

Unload all carriers.

Record tension system pressure:

Record tension carriage position:



(NOT REQUIRED)

(NOT REQUIRED)

8.1 Repeat empty lift tests if changes made to brake settings

Any changes made? If no changes Sect 8.1 and 8.2 do not need to be performed:

NO CHANGES MADE TO BRAKE SETTINGS OR DRIVE SETTINGS - SKIP SECT 8.1, 8.2

0% UH, 0% DH (Main Drive-Electric)

Measure acceleration time:

Max motor torque during acceleration:

Measure lift speed:

Speed Meter Reading:

Motor RPM:

Steady state motor torque:

1E. Perform Normal Stop (drive ramp down, service brake at 'set speed'):

Stop time:

Stop distance:

2E. Perform Emergency Stop (drive disconnected, drive sheave brake, service brake at 'set speed')

Stop time:

Stop distance:

3E. Perform Service Stop (drive disconnected, service brake only set)

Stop time:

Stop distance:

4E. Perform Coasting stop-activated from 'service' menu (drive disconnected, no brakes set)

Stop time:

Stop distance:

5E. Perform E-Only Stop activated from 'service' menu (drive disconnected, drive sheave brake only set)

Stop time:

Stop distance:

8.2 0% UH, 0% DH (Auxiliary Drive-Diesel)

Measure acceleration time:

Measure lift speed:

Speed Meter Reading:

Engine RPM:

1-AuxE. Perform Normal Stop (engine ramp down, service brake at 'zero speed'):

Stop time:

Stop distance:

Max deceleration rate:

'Black Box' photo taken? ☐

2-AuxE. Perform Emergency Stop (engine kill, emergency brake, service brake at 'zero speed')

Stop time:

Stop distance:

Max deceleration rate:

'Black Box' photo taken? ☐

9.0 Lift Safeties

9.1 DC Drive Safeties / PLC Safeties

DC Drive Safeties

DC Drive Overcurrent Test: (change par 3009)

Motor Tach Feedback Loss: (pull isolation relay)

DC Drive Field Loss (change par. 4502 to 20%)

Motor Overspeed: 110% 1751 → 1060

Ramp fault (accel time changed from 30 s to 24 s)

☒ 150% → 70% FS22 (on DC drive display)
☒ FS22 (on DC drive display)
☒ 57% → 20% FS41 (on DC drive display)
☒ FS32 (on DC drive display)

Torque Limit Settings:

Parameter 2005 'TorqMax': +125 +150% (driving)
Parameter 2006 'TorqMin': -100 % (regen)

Motor Overcurrent Setting:

Phase Loss (open breaker to phase loss relay)

Blower Fault (motor overload)

'Drive Fault' indicated on Leitner controls

Contactor acknowledge in ABB

PERFORMER ACTUAL OVERSPEED

BY SETTING PPR

☒ 150% (PAR 3009)
☒ DRIVE FAULT
☒
☒ NO STOP IF NO CNT. ACKNOWLEDGE
☒ BOTH LEITNER CONTROLS + RSM ALL TRIPPED FOR 110% OVERSPEED

RSM: PLC Module Safeties/Functions

(tested from service menu/PLC tests)

FROM 'DC DRIVE (motor encoder 1 > ABB Drive > Analog output-Speed > RSM PLC):

	Normal	Test	INDICATION*
PLC-Motor Encoder Loss		<u>MAX SPEED</u>	<input checked="" type="checkbox"/> NS-'TACH LOSS'
PLC-Motor Accel Fault	<u>80</u>	<u>25</u>	<input checked="" type="checkbox"/> ES-'ACCEL FAULT-DRIVE'
PLC-Motor Decel Fault	<u>190</u>	<u>40</u>	<input checked="" type="checkbox"/> NS-'DECEL FAULT-DRIVE'
PLC-Motor 115% Overspeed	<u>4025</u>	<u>1800</u>	<input checked="" type="checkbox"/> ES-'115% DRIVE'
PLC-Motor 110% Overspeed	<u>3850</u>	<u>1800</u>	<input checked="" type="checkbox"/> NS-'110% MOTOR SPEED
PLC-Speed-Motor vs Rope Enc	<u>SET SPEED CHARACTER</u>		<input checked="" type="checkbox"/> NS-'SPEED-MOTOR VS ROPE'
PLC-Ramp Fault	<u>0</u>	<u>+1.5 SEC</u>	<input checked="" type="checkbox"/> NS-'RAMP FAULT'

FROM 'ROPE-ENCODER:*

	Normal	Test	INDICATION*
PLC-Rope Encoder Loss		<u>MAX SPEED</u>	<input checked="" type="checkbox"/> NS-'ROPE SPEED LOSS
PLC-Rope Encoder Accel Fault	<u>60</u>	<u>25</u>	<input checked="" type="checkbox"/> ES-'DECEL FAULT-ROPE'
PLC-Rope Encoder Decel Fault	<u>190</u>	<u>40</u>	<input checked="" type="checkbox"/> NS-'DECEL FAULT-ROPE'
PLC-Rope Encoder 115% Overspeed	<u>4025</u>	<u>1800</u>	<input checked="" type="checkbox"/> ES-'115% ROPE'
PLC-Rope Encoder 110% Overspeed	<u>3850</u>	<u>1800</u>	<input checked="" type="checkbox"/> NS-'110% MOTOR SPEED'
PLC-Rope Encoder Position Test	<u>FLIP VALUES</u>		<input checked="" type="checkbox"/> NS-'ROPE POSITION LOSS'
PLC-Speed- Rope Enc vs Motor Enc 2	<u>SET SPEED ERROR → 1</u>		<input checked="" type="checkbox"/> NS-'SPEED ROPE VS MOTOR'
PLC-rope Encoder-Rollback	<u>FLIP VALUES</u>		<input checked="" type="checkbox"/> ES-'ROLLBACK'

Tach test:

300 PPR TACHS ON DC MUX + 'ROPE' TACH

IN RSM PLC: 3500 SPEED UNITS = 100% SPEED = 1100 RPM

* NS = Normal Stop Command from RSM, ES = Emergency Stop Command from RSM

10.0 Perform Brake Torque Test

Follow existing brake torque test procedures

TESTED PER EXISTING PROCEDURE, SERVICE BRAKE,
ROLLBACK BRAKE AND EMERGENCY BRAKE ALL HELD
STATICALLY AT 25% TORQUE.

11.0 Load Test Completed

Appendix F



Grand Junction
819 Pitkin Avenue (81501)
PO Box 429 • Grand Junction CO 81502
Office: 970.242.9980 • Fax: 970.242.9903
[REDACTED]

Craig
120 W 16th Street (81625)
PO Box 1527 • Craig, CO 81626
Office: 970.824.7023 • Fax: 970.824.3621
[REDACTED]

WITH DIVISION:

Rocky Mountain Standby Power
2295 Tall Grass Drive (81505) • PO Box 1805 • Grand Junction, CO 81502
Office: 970.244.0960 • Fax: 970.243.8272 • [REDACTED]

October 18, 2016

Granby Ranch
1000 Village Road
Granby CO 80446

Attn: Blaine Faulkner
[REDACTED]

Reference: GE 500Hp DC Motor – **Revised**

Blaine,

We are in receipt and have completed the tear down and inspection of the above referenced unit. Attached please find our revised workscope and pricing. Should you have any questions or require additional information, please feel free to contact this office at your earliest convenience.

Qty 1 ea

EMT-GJ #7511

General Electric DC Motor
500Hp, 1750/1900 Rpm
500 Volt Armature, 300/150 Field Volt
Type CD5010AY, M/N 5CD226AA824B801
S/N WP-7-5-WP

Workscope:

- Receive unit
- Tear down and inspect
- Perform a series of electrical and mechanical tests, as a minimum: meggar, bridge, surge and hipot windings; mic all bearings, journals, housings, seals, seal fit areas; as well as perform a TIR on rotor shaft; record all tests performed and results achieved
- Steam clean and bake all components
- Steam clean and bake armature and fields
- Recondition armature and fields
- Sand blast and clean brush holder assembly
- Turn and undercut commutator
- Balance armature
- **Provide and replace brushes**
- Provide and replace bearings
- Reassemble complete unit
- Paint
- Package for shipment

Delivery: 1 week from receipt of order
Freight and tax not included in pricing

Sincerely,

Michael P Anton





819 Pitkin Ave. (81501)
P.O. Box 429, Grand Junction, CO 81502
Office: 970.242.9980 • Fax: 970.242.9903

120 West 16th Street (81625)
P.O. Box 1527, Craig, CO 81626
Office: 970.824.7023 • Fax: 970.824.3621

JOB # **F 4000**

Field Service

Customer: Granby Ranch Date: _____

Customer PO# / Workorder #: _____

Contact: Blaine Faulkner

Phone #: 970-531-9379 / 970-887-5154 Fax #: _____

Email: _____

Nameplate Information: _____

Description of Work Performed: 1 Hatch #4 BRUSH LEAD

Time on Site: Beginning 9:00 am pm Ending 10:30 am pm

Travel Time: _____ (round trip)

Labor Rate: Standard _____ Overtime _____

Additional: _____

Mileage: 400 miles @ _____ per mile

Materials: _____

Service Technician: Rodney & Larry Taxable: Yes No (circle one)

Removal Signature: _____ Date: _____

Installation Signature: x Blaine Faulkner Date: 11/22/16

I hereby acknowledge the satisfactory completion of the above described work.

Blue Copy - Plant

Green Copy - Customer

White Copy - File

12-31-16

INFO RELATED TO ISSUES WITH ELECTRIC MOTOR
INSTALL.

WE HAD EM-TECH IN GRAND JUNCTION REBUILD
OUR ELECTRIC MOTOR. WHEN MOTOR WAS DONE
WE REINSTALLED ELECTRIC MOTOR, REATTACHING
MOTOR LEADS BOLTING DOWN MOTOR AND COUPLING
TO GEAR BOX. WE STARTED LIFT ^{LIFT MOVED}. WITHIN 3 SECONDS
HAD A BIG BANG, LIFT STOPPED MAIN DISCONNECT TRIPPED
AND WOULD NOT RESET. OUR ELECTRICIAN STARTED TRACING
AND RINGING OUT WIRES. NOTICED A WIRE THAT LOOKED
OUT OF PLACE AND NOT ATTACHED INSIDE ELECTRIC MOTOR
- SEE ATTACHED PHOTOS - . CALLED EMTECH, THEY HAD NO
IDEA HOW IT COULD HAPPEN, THEY THEN SENT OUT A
TECH, REATTACHED LOOSE WIRE AND SAID IT WAS GOOD
TO GO. WE INSTALLED A REBUILT BREAKER DUE TO
THE OLD ONE HAD ~~AF~~ FAILED AND NEEDED REPLACED. THE
C.T. DRIVE SEEMED FINE WHEN WE POWERED EVERYTHING
UP SO WE THEN RAN THE LIFT WITH, REBUILT BREAKER IN PLACE,
CT DRIVE IN PLACE, EMTECH REBUILT MOTOR IN PLACE AND
EVERYTHING SEEMED TO RUN FINE. COMPLETELY FINISHED
AND RAN 3 DAYS BEFORE ELECTRIC SHUTS UP FOR
NEW DRIVE INSTALL PROJECT.


BLAINE FAULKNER
LIFT MAINTAINANCE SUPERVISOR
12-31-16 2:08 PM

**ROCKY MOUNTAIN ELECTRIC MOTORS, INC.**

dba EMTECH INC - GRAND JUNCTION

PO BOX 429

GRAND JUNCTION, CO 81502

Phone: (970) 242-9980 Fax: (970) 242-9903
[REDACTED]**Invoice**

DATE	INVOICE / JOB NO.
10/26/2016	7450

BILL TO	SHIP TO
GRANBY RANCH PO BOX 798 GRANBY CO 80446	GRANBY RANCH 1000 VILLAGE ROAD GRANBY CO 80446

SALES TAX NO.	P.O. NO.	TERMS	DUE DATE	SHIP VIA
	BLAINE FAULKN...	C.O.D.	10/26/2016	RMEM
DESCRIPTION		QTY	RATE	AMOUNT
GENERAL ELECTRIC 200HP, 150/300 FIELD VOLTS 2.53 FIELD AMPS, 550 ARM VOLTS 293 ARM AMPS, 1750 RPM TYPE CD504AY, MN 5CD222NA83AB01 SN JT-1-418-KT WORK SCOPE AS PER QUOTE LABOR MATERIAL MATERIAL Sales Tax			[REDACTED]	[REDACTED]
A 2% INTEREST FEE WILL BE CHARGED ON ANY UNPAID BALANCE AFTER 60 DAYS.			Total	[REDACTED]

Or

Appendix G



COLORADO

Department of
Regulatory Agencies

Division of Professions and Occupations

COLORADO PASSENGER TRAMWAY SAFETY BOARD

**VERIFICATION OF ACCEPTANCE TEST
FOR
NEW, RELOCATED, OR MAJOR MODIFICATION OF TRAMWAYS**

Licensee: Ski Granby Ranch
Lift Identification #: SC-008
Name/Number of Lift: Quick Draw Express
Type of Lift: Detachable Grip Quad Chair
Date: _____

Name of Professional Engineer: Josef C. Gmuender

Address of Professional Engineer: 638 Long Valley Road, Gardnerville NV 89460

Description of Work: Replacement of existing DC drive with ABB DCS800, addition of
overspeed/accel/decel monitor: 'Ramp and Speed Monitor' (RSM)

VERIFICATION

I hereby verify that to the best of my knowledge and ability, the above-named passenger tramway has completed the acceptance test as required in X.1.1.11.2 and all applicable items of X.1.1.11.1. All deficiencies discovered during the acceptance test have been documented in the acceptance test report by the Board Inspector (21.2.12, 21.3.12) and shall be remedied prior to operation (22.4.4).

Professional Engineer's Signature and Seal



SEAL &
SIGNATURE

**Load Test Procedure
for
Detachable Grip Chairlift
(rev 2)**

**Quick Draw Express Detachable Chair
Ski Granby Ranch, CO
CO PTSB ID: SC-008
Date: 5 Dec 2016**

1.0 Introduction

The Quick Draw Express detachable quad chairlift, manufactured by Leitner, was installed in 1999 (area known as Sol Vista at the time). The original Control Techniques DC drive has been replaced:

- New ABB DCS-800 DC drive
- Reuse existing DC motor
- No changes to existing Leitner low voltage controls.
- New 'Ramp and Speed Monitor' (Electramics)

The acceptance test is intended to confirm the proper function of the new DC drive and its interface with the existing low voltage controls. The test will also test the function of the independent 'Ramp and Speed Monitor' (RSM) that monitors overspeed, rollback, acceleration and deceleration.

2.0 Lift Specifications

Lift Type	4 Passenger Detachable Grip Chairlift
Slope Length	1310 m
Vertical Rise	256 m
Number of Carriers (design)	67
Number of Carriers (actual)	<u>67</u>
Carrier Spacing (design)	44.8 m (8.00 sec interval)
Carrier spacing (actual)	<u>44.8</u> m (<u>8.0</u> sec interval)
Lift speed	5.6 m/sec (1100 FT/min)
Capacity-Uphill (design)	1800 passengers/hour
Capacity-Downhill (design)	900 passengers/hour
Capacity (actual)	<u>1800</u> passengers/hour
Carrier type	Leitner SA4-99 with Leitner LA48-95 SA4 grip
Carrier weight	215 kg
Drive Location	Top
Drive bullwheel size	4.20 m
Main drive	500 HP DC 1750 rpm 781 A DC ABB DCS800
Standby drive	Cummins N14-P475 with Rockford torque converter
Evac drive	Cummins B5.9-P152 with Rockford torque converter
Tension location	Bottom
Tensioning force	kN
Tension type	Hydraulic Cylinders (55.5 bar, 805 psi)
Return bullwheel size	4.20 m
Line gauge	5.30 m
Haul rope	40 mm 6x25 RLL PC (nom strength 830 kN)
Gearbox	Leitner KSS5 i=59.81
Main Drive input	Direct to gearbox

3.0 Personnel Attending

Name	Company / Organization
BIRCE ALLEN	CO PTSB
JOE GAVENDER	GAVENDER ENGINEERING
ED THOMPSON	ELECDYNAMICS
FRANK DELRY	ELECDYNAMICS
BLAINE FAULKNER	GRANBY RANCH
ANDY BIRCH	GRANBY RANCH
JACOB (as LANE TENDON)	GRANBY RANCH

4.0 Initial Checks

Perform visual review of entire line.
Confirm top and bottom communications is functional
Hourmeter at start of testing:

☒
☒
60,563.8

4.1 Remote terminal operator switches/controls

Confirm function of remote terminal-signals to drive station

	INDICATION*
Medium (return)	<input checked="" type="checkbox"/>
Slow (return)	<input checked="" type="checkbox"/>
Stop (Ch 1) (return)	<input checked="" type="checkbox"/> 19A1 (PNOZ X2)
Stop (Ch 2) (return)	<input checked="" type="checkbox"/>
E Stop (Ch 1) (return)	<input checked="" type="checkbox"/> 33A0 (PNOZ X2)
E Stop (Ch 2) (return)	<input checked="" type="checkbox"/>
Signal (return)	<input checked="" type="checkbox"/>
Phone (return)	<input checked="" type="checkbox"/>
_____	<input checked="" type="checkbox"/>
_____	<input type="checkbox"/>

4.2 Local terminal operator switches/controls

Confirm function of local operator controls

	INDICATION*
Fast DLS	<input checked="" type="checkbox"/>
Fast CON	<input checked="" type="checkbox"/>
Medium DLS	<input checked="" type="checkbox"/>
Medium CON	<input checked="" type="checkbox"/>
Slow DLS	<input checked="" type="checkbox"/>
Slow CON	<input checked="" type="checkbox"/>
Slow OPS	<input checked="" type="checkbox"/>
Stop DLS	<input checked="" type="checkbox"/>
Stop CON	<input checked="" type="checkbox"/>
Stop OPS	<input checked="" type="checkbox"/>
Stop STN	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
Stop Cords STN	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> (normal stop)
E Stop DLS	<input checked="" type="checkbox"/>
E Stop OPS	<input checked="" type="checkbox"/>
E Stop CON	<input checked="" type="checkbox"/>
E Stop STN	<input checked="" type="checkbox"/>
Start DLS	<input checked="" type="checkbox"/>
Start CON	<input checked="" type="checkbox"/>
Fault Reset DLS	<input checked="" type="checkbox"/>
Fault Reset CON	<input checked="" type="checkbox"/>
Forward/Backward CON	<input checked="" type="checkbox"/>
Signal	<input checked="" type="checkbox"/>
Phone	<input checked="" type="checkbox"/>
_____	<input type="checkbox"/>
_____	<input type="checkbox"/>

DLS=Downhill Loader Station-top
CON=Operator Console-top operator house
STN=Drive Station (motor platform)

4.3 DC Drive <> Leitner Controls

	INDICATION*
Main Motor Contactor-Aux contact-1 <i>when closed</i>	<input checked="" type="checkbox"/> (X6-0, 0600)
Main Motor Contactor-Aux contact-0 <i>when open</i>	<input checked="" type="checkbox"/> (X6-0, 0600)
Drive Fault-1 <i>when no fault</i>	<input checked="" type="checkbox"/> (X6-1, 0601)
Drive Fault-0 <i>when fault</i>	<input checked="" type="checkbox"/> (X6-1, 0601)
Proof of Torque-1 <i>when above set level</i>	<input checked="" type="checkbox"/> (X7-0, 0700)
Proof of Torque-0 <i>when below set level</i>	<input checked="" type="checkbox"/> (X7-0, 0700)
Run (start/stop)-1 <i>when running</i>	<input checked="" type="checkbox"/> (X6-11, 0611)
Run (start/stop)-0 <i>when stopped (at instance of stop command)</i>	<input checked="" type="checkbox"/> (X6-11, 0611)
Reverse-1 <i>when forward</i>	<input checked="" type="checkbox"/> (X6-15, 0613)
Medium	<input checked="" type="checkbox"/> (X6-16, 0614)
Fast	<input checked="" type="checkbox"/> (X6-17, 0615)
Torque Test	<input checked="" type="checkbox"/> (via Modbus)

4.4 Ramp and Speed Monitor (RSM) <> Leitner Controls

	INDICATION*
Normal Stop-1 <i>when closed</i>	<input checked="" type="checkbox"/> (19A1, DLS Stop+Drive Fault)
Normal Stop-0 <i>when open</i>	<input checked="" type="checkbox"/> (19A1, DLS Stop+Drive Fault)
Emergency Stop-1 <i>when no fault</i>	<input checked="" type="checkbox"/> (33A0, STN E Stop+Drive Fault)
Emergency Stop-0 <i>when fault</i>	<input type="checkbox"/> (33A0, STN E Stop+Drive Fault)

5.0 0% UH, 0% DH (Main Drive-Electric)

Record tension carriage position:

235 cm

Record tension system pressure:

860 psi

Main Drive-Electric:

Measure acceleration time:

30.2 sec.

Max motor torque during acceleration:

55%

Measure lift speed:

10 rev in 23.56 sec >> 25.47 rpm

5.66 m/s → 1102 ft/min

Speed Meter Reading:

5.4 m/s (Leimier) 1100 ft/min (250)

Motor RPM:

1520 RPM

Steady state motor torque:

30-35%

Steady state armature voltage:

440V DC

P-1E. Perform Coasting stop-(Use service brake test mode, bypass DA 92.10'Deceleration supervision main drive', DA 92.11'Deceleration supervision service brake, hold service brake off during stop with button inside control panel)

Stop time:

18.77 s

Stop distance-measured:

(52.11700) 25m

Stop distance:

173 ft (per controls) (52.3 m on Leimier display)

Measured distance matches displayed distance ☒

Max deceleration rate:

-

'Black Box' photo taken? ☒

#76

P-2E. Perform Normal Stop (drive ramp down, service brake at 'zero speed'):

Stop time:

6.11 sec.

Stop distance:

18.5m 54ft

Max deceleration rate:

3.55 ft/s²

'Black Box' photo taken? ☒

#70

Max regenerative current during stop:

-71%

P-3E. Perform Emergency Stop (emergency brake, service brake at 'zero speed')

Stop time:

5.96 s

Stop distance:

18.0m 54ft

Max deceleration rate:

3.83 ft/s²

'Black Box' photo taken? ☐

#72

P-4E. Perform Service Stop (Service brake only, modulated)

Stop time:

6.20 s

Stop distance:

18.5m 54ft

Max deceleration rate:

3.93 ft/s²

'Black Box' photo taken? ☐

#74

6.0 Load Lift to 100% x 1.1 Design Load (for 110% UH / 0% DH load test)

Design load for testing:

$$0.5 \times (\text{Number of Chairs}) \times (\text{pass/chair}) \times 170 \text{ lb/pass} \times 1.1 = \text{Total test weight}$$

$$0.5 \times (67-4) \times 4 \times 170 \times 1.1 = 23,562 \text{ lb}$$

*2 chairs in terminal on each end, 63 chairs on line

Chairs to load (for 110% test load):

$$(0.5 \times \text{Number of Chairs}) - \text{Chairs left empty} = \text{Chairs with test load}$$

$$(0.5 \times 63) - 4.5 = 27 \gg \text{Load 27 chairs}$$

$$\text{Total test weight} / \text{Chairs with test load} = \text{load per chair}$$

$$23,562 / 27 = 873 \text{ lb per chair}$$

Test weight for 50% load: $873 \text{ lbs} / 4 = 218 \text{ lbs/seat position}$

Load test material: *18x18x24 CARDBOARD BOX W TRASH CAN LINER
CALIBRATED FILL STICK IN SHIP WITH SCALE AND FILLED BOX
(TILTED TO SEAT ANGLE)*

Load carriers from Chair 1 to Chair 27 ☒

Record tension system pressure:

215 CM (26 CM FORWARD)
911 PSI

Record tension carriage position:

6.1 Check static holding of brakes

(Note any adjustments performed)

Service brake: ☒

Emergency brake: ☒

Rollback brake: ☒

6.2 Check dynamic rollback of brakes

Open service brake. Slowly open emergency brake and let lift roll back.

...Leitner Rollback switch sets Rollback Brake, activates E-Stop: ☒

...RSM PLC Rollback activates E-Stop: ☒

Bypass Leitner rollback switch, RSM PLC Rollback. Set emergency brake. Open service brake. Slowly open emergency brake and let lift rollback to approximately 1/3 of design speed. Set emergency brake:

Emergency brake stopping performance: *WITH ALL BRAKES OPEN, LIFT ROLLED BACKWARDS
AT < 0.5 M/S (100 FPM) SPEED, E BRAKE STOPPED + HELD LOAD*

Set service brake. Open emergency brake. Slowly open service brake and let lift roll back to approximately 1/3 of design speed. Set service brake:

Service brake stopping performance: *WITH ALL BRAKES OPEN, LIFT ROLLED
BACKWARDS AT < 0.5 M/S (< 100 FPM) SPEED, S. BRAKE STOPPED
AND HELD LOAD.*

6.3 110% UH, 0% DH Lift Tests (Main Drive-Electric)

Measure acceleration time: 30 sec
Max motor torque during acceleration: 103%
Measure lift speed:
Speed Meter Reading: 1100 ft/min
Motor RPM: 1520 RPM
Steady state motor torque: 80%
1F. Perform Coasting stop (see procedure under section 5.0, P-1E)
Stop time: 0.97 sec
Stop distance-measured: -
Stop distance: 26.0m 84ft. (per controls)
Max deceleration rate: 2.62 m/s^2
'Black Box' photo taken? ☒ #192

2F. Perform Normal Stop (drive ramp down, service brake at 'zero speed'):

Stop time: 6.15s
Stop distance: 57 ft.
Max deceleration rate: 3.24 m/s^2
'Black Box' photo taken? ☒ #156
Max regenerative current during stop: -40%

3F. Perform Emergency Stop (emergency brake, service brake at 'zero speed')

Stop time: 5.44s
Stop distance: 55 ft.
Max deceleration rate: 4.67 m/s^2
'Black Box' photo taken? ☒ #158

4F. Perform Service Stop (Service brake only, modulated)

Stop time: 5.95s
Stop distance: 61 ft. 18.5m
Max deceleration rate: 4.69 m/s^2
'Black Box' photo taken? ☐ #168

6.4 110% UH, 0% DH Lift Tests (Auxiliary Drive-Diesel)

Measure acceleration time: 30 sec
Measure lift speed:
Speed Meter Reading: 790 ft/min
Engine RPM: 1600 RPM

1-AuxF. Perform Normal Stop (engine ramp down, service brake at 'zero speed'):

Stop time: 4.12 sec.
Stop distance: 31 ft.
Max deceleration rate: 4.11 m/s^2
'Black Box' photo taken? ☒ #244

2-AuxF. Perform Emergency Stop (engine kill, emergency brake, service brake at 'zero speed')

Stop time: 3.66 sec.
Stop distance: 24 ft. 7.3m
Max deceleration rate: 4.65 m/s^2
'Black Box' photo taken? ☒ #246

~~4C. Perform Service Stop (Service brake only, modulated)~~

~~Stop time: _____~~
~~Stop distance: _____~~
~~Max deceleration rate: _____~~
~~'Black Box' photo taken? ☐ _____~~

7.0 Load Lift to 50% x 1.1 Design Load (for 55% DH, 0% UH load test)

Empty even numbered carriers from Chair 1 to Chair 27 ☒

Notes: AUXILIARY VLINE USED TO MOVE CARRIERS FROM 110% UH TO
55% DH - EVERY OTHER CHAIR EMPTIED AT TOP TERMINAL

7.1 55% DH, 0% UH Lift Tests (Main Drive-Electric)

Measure acceleration time: ~30 SEC.
Max motor torque during acceleration: 49%.
Measure lift speed:
Speed Meter Reading: 1100 ft/min
Motor RPM: 1520 RPM
Steady state motor torque: 27%.

1D. Perform Coasting stop- (see procedure under section 5.0, P-1E) NOT PERFORMED

Stop time: —
Stop distance-measured: —
Stop distance: — (per controls)
Max deceleration rate: —
'Black Box' photo taken? ☐

2D. Perform Normal Stop (drive ramp down, service brake at 'zero speed'):

Stop time: 6.15 sec
Stop distance: 54 ft.
Max deceleration rate: 3.47 ft/s²
'Black Box' photo taken? ☒ #254.
Max regenerative current during stop: 86% max

3D. Perform Emergency Stop (emergency brake, service brake at 'zero speed')

Stop time: 6.66 sec
Stop distance: 65 ft.
Max deceleration rate: 3.79 ft/s²
'Black Box' photo taken? ☒ #256.

4D. Perform Service Stop (Service brake only, modulated)

Stop time: 7.04 sec
Stop distance: 64 ft. 19.8 ft
Max deceleration rate: 3.99 ft/s²
'Black Box' photo taken? ☒ #274.

8.0 Empty all carriers

Unload all carriers.

Record tension system pressure:

Record tension carriage position:



(NOT RECORDED)

(NOT RECORDED)

8.1 Repeat empty lift tests if changes made to brake settings

Any changes made? If no changes Sect 8.1 and 8.2 do not need to be performed:

NO CHANGES MADE TO BRAKE SETTINGS OR DRIVE SETTINGS -- SKIP SECT 8.1, 8.2

0% UH, 0% DH (Main Drive-Electric)

Measure acceleration time:

Max motor torque during acceleration:

Measure lift speed:

Speed Meter Reading:

Motor RPM:

Steady state motor torque:

1E. Perform Normal Stop (drive ramp down, service brake at 'set speed'):

Stop time:

Stop distance:

2E. Perform Emergency Stop (drive disconnected, drive sheave brake, service brake at 'set speed')

Stop time:

Stop distance:

3E. Perform Service Stop (drive disconnected, service brake only set)

Stop time:

Stop distance:

4E. Perform Coasting stop-activated from 'service' menu (drive disconnected, no brakes set)

Stop time:

Stop distance:

5F. Perform E-Only Stop activated from 'service' menu (drive disconnected, drive sheave brake only set)

Stop time:

Stop distance:

8.2 0% UH, 3% DH (Auxiliary Drive-Diesel)

Measure acceleration time:

Measure lift speed:

Speed Meter Reading:

Engine RPM:

1-AUX1. Perform Normal Stop (engine ramp down, service brake at 'zero speed'):

Stop time:

Stop distance:

Max acceleration rate:

'Black Box' photo taken? ☐

2-AUX1. Perform Emergency Stop (engine kill, emergency brake, service brake at 'zero speed')

Stop time:

Stop distance:

Max acceleration rate:

'Black Box' photo taken? ☐

9.0 Lift Safeties

9.1 DC Drive Safeties / PLC Safeties

DC Drive Safeties

DC Drive Overcurrent Test: (change par 3009)
Motor Tach Feedback Loss: (pull isolation relay)
DC Drive Field Loss (change par. 4502 to 20%)
Motor Overspeed: 110% *1751 → 1000*
Ramp fault (accel time changed from 30 s to 24 s)

☒ *150% → 20% FS22* (on DC drive display)
☒ *FS22* (on DC drive display)
☒ *57% → 20% FS41* (on DC drive display)
☒ *FS32* (on DC drive display)

Torque Limit Settings:

Parameter *2005* 'TorqMax': *+125* ~~+150~~ % (driving)
Parameter *2006* 'TorqMin': *-100* % (regen)

Motor Overcurrent Setting:
Phase Loss (open breaker to phase loss relay)
Blower Fault (motor overload)
'Drive Fault' indicated on Leitner controls
Contractor acknowledge in ABB

☒ *150% (PAR 3009)*
☒ *DRIVE FAULT*
☒
☒ *NO STOP IF NO CONT. ACCUMULATION*
☒ *DRIVE LEITNER CONTROLS + RSM ALL TRIPPED FOR 110% OVERSPEED*

PERMANENT ACCEL OVERSPEED
BY SETTING PAR

RSM: PLC Module Safeties/Functions

(tested from service menu/PLC tests)

FROM 'DC DRIVE (motor encoder 1 > ABB Drive > Analog output-Speed > RSM PLC):

	Normal	Test	INDICATION*
PLC-Motor Encoder Loss		<i>MINI SPEED</i>	<input checked="" type="checkbox"/> NS-'TACH LOSS'
PLC-Motor Accel Fault	<i>80</i>	<i>25</i>	<input checked="" type="checkbox"/> ES-'ACCEL FAULT-DRIVE'
PLC-Motor Decel Fault	<i>190</i>	<i>40</i>	<input checked="" type="checkbox"/> NS-'DECEL FAULT-DRIVE'
PLC-Motor 115% Overspeed	<i>4025</i>	<i>1800</i>	<input checked="" type="checkbox"/> ES-'115% DRIVE'
PLC-Motor 110% Overspeed	<i>3850</i>	<i>1800</i>	<input checked="" type="checkbox"/> NS-'110% MOTOR SPEED
PLC-Speed-Motor vs Rope Enc	<i>SET SPEED EQUALITY</i>		<input checked="" type="checkbox"/> NS-'SPEED-MOTOR VS ROPE'
PLC-Ramp Fault	<i>0</i>	<i>+1.5 SEC</i>	<input checked="" type="checkbox"/> NS-'RAMP FAULT'

FROM 'ROPE-ENCODER':

	Normal	Test	INDICATION*
PLC-Rope Encoder Loss		<i>MINI SPEED</i>	<input checked="" type="checkbox"/> NS-'ROPE SPEED LOSS
PLC-Rope Encoder Accel Fault	<i>80</i>	<i>25</i>	<input checked="" type="checkbox"/> ES-'DECEL FAULT-ROPE'
PLC-Rope Encoder Decel Fault	<i>190</i>	<i>40</i>	<input checked="" type="checkbox"/> NS-'DECEL FAULT-ROPE'
PLC-Rope Encoder 115% Overspeed	<i>4025</i>	<i>1800</i>	<input checked="" type="checkbox"/> ES-'115% ROPE'
PLC-Rope Encoder 110% Overspeed	<i>3850</i>	<i>1800</i>	<input checked="" type="checkbox"/> NS-'110% MOTOR SPEED'
PLC-Rope Encoder Position Test	<i>FLIP VALUES</i>		<input checked="" type="checkbox"/> NS-'ROPE POSITION LOSS'
PLC-Speed- Rope Enc vs Motor Enc 2	<i>SET SPEED EQUALITY → 1</i>		<input checked="" type="checkbox"/> NS-'SPEED ROPE VS MOTOR'
PLC-Rope Encoder-Rollback	<i>FLIP VALUES</i>		<input checked="" type="checkbox"/> ES-'ROLLBACK'

Tach test:

3000 RPM TACHS ON DC MOTOR + 'ROPE' TACH
IN RSM PLC: 3850 SPEED UNITS = 100% SPEED = 1100 RPM

* NS = Normal Stop Command from RSM, ES = Emergency Stop Command from RSM

10.0 Perform Brake Torque Test

Follow existing brake torque test procedures

TESTED PER EXISTING PROCEDURE, SERVICE BRAKE,
PARKING BRAKE AND EMERGENCY BRAKE ALL HELD
STATICALLY AT 25% TORQUE

11.0 Load Test Completed

Appendix H



COLORADO

Department of
Regulatory Agencies

Division of Professions and Occupations

Business and Inspections Branch
Passenger Tramway Safety Board

December 14, 2016

Mr. James Wolter
Director of Mountain Operations
Ski Granby Ranch
P.O. Box 1110
Granby, CO 80446

RE: Annual Licensure Inspection

Dear Mr. Wolter:

Attached is the Annual Licensure Inspection report and invoice for your area.

In accordance with the Colorado Passenger Tramway Safety Board's rules and regulations, a signed letter is required prior to the issuance of a license stating all deficiencies in the Annual Licensure Inspection report have been remedied at the time the letter is submitted.

Please address each deficiency individually. Letters which do not address each deficiency individually will not be accepted by this office.

Recommendations to the area operator, comments and observations are not classified as deficiencies. "Recommendations to the Board" will be discussed by the Board at the next regular meeting.

Authorization to operate a passenger tramway in the State of Colorado will be by receipt of a license. The Colorado Passenger Tramway Safety Board will not issue verbal approval to operate.

Sincerely,

Nicki Cochrell
Program Manager

Attachments



**ACCEPTANCE TEST AND ANNUAL LICENSING INSPECTION
GRANBY RANCH
DECEMBER 5 & 8, 2016**

PREPARED FOR:

**COLORADO PASSENGER TRAMWAY SAFETY BOARD
1560 BROADWAY, SUITE 1300
DENVER, COLORADO 80202**

PREPARED BY:

**BRUCE L. ALLEN, P.E.
HIGHLINE AUTOMATION
PO BOX 1368
SILVERTHORNE, CO 80498**

**ANNUAL LICENSING INSPECTION
GRANBY RANCH**

**BRUCE L. ALLEN
December 5 & 8, 2016**

December 12, 2016

Colorado Passenger Tramway Safety Board
1560 Broadway STE 1350
Denver, CO 80202-5146

RE: ACCEPTANCE TEST AND ANNUAL LICENSING INSPECTION
GRANBY RANCH
DECEMBER 5 & 8, 2016

LIFTS: SC-008

Dear Board Members:

Enclosed is the Annual Licensing Inspection and Acceptance Test for a new DC motor drive on the Quick Draw Express lift (SC-008) at Granby Ranch. This report is made pursuant to Sections 25-5-712 and 25-5-715 of the Colorado Revised Statutes (July 1, 2008).

The Acceptance Test was conducted on December 5, 2016, and the remainder of the Annual Licensing Inspection was conducted on December 8, 2016. I was accompanied by Blaine Faulkner, and Andy Birch of Granby Ranch. I gave a copy of the Preliminary Inspection Report to Blaine Faulkner on December 8, 2016.

The tramways referenced in the attached report have been inspected according to established procedures. Except for the deficiencies noted in the report, I did not observe any unreasonable safety hazards, nor any violations of the statute of the May 15, 2016 edition of the Rules and Regulations of the Colorado Passenger Tramway Safety Board.

Sincerely,
Bruce Allen, P.E.
Tramway Inspector
HIGHLINE AUTOMATION



December 12, 2016

SC-008 (QUICK DRAW EXPRESS).....	4
GENERAL COMMENTS	4
CPTSB FORM 25-06	

SC-008 (QUICK DRAW EXPRESS)

A. Bottom Terminal

Comment – During the inspection, a flat tire caused a chair to stall which resulted in a chair collision while running on the evacuation power unit (anti-collision not active). This lift still has many of the original tires which are severely weathered, and should be replaced as soon as possible.

B. Line

No deficiencies observed by Inspector.

C. Top Terminal

Comment – The new motor drive's proof of torque circuit is not able to maintain static torque or forward motion on a start with a loaded lift due to the proprietary nature of the existing control system and brake control module. A very slight rol back does occur on all loaded lift starts, and should be rectified when the new control system is installed in 2017.

D. Record Keeping

1) 3.2.12 – Software Security.

Develop a Software Security procedure for protection of the motor drive parameters and the new PLC interface logic. The procedure should address all the items required by the CPTSB Rules and Regulations May 15, 2016 edition for 3.2.12, to protect against unauthorized changes as well as a systematic approach to revision control and testing.

2) 21.3.10 – Submittal of As-Built drawings and additional documents.

Complete the As-Built drawings for the new motor drive and associated PLC interface and relay logic, and submit a copy to the CPTSB.

E. General Deficiencies

3) Complete all items on CPTSB Form 25-06 prior to opening to the public.

GENERAL COMMENTS

The previous inspection report has been reviewed. This inspection verifies that all previous deficiencies have been corrected.



COLORADO

Department of
Regulatory Agencies

Division of Professions and Occupations

CPTSB ITEMS TO BE COMPLETED PRIOR TO OPENING

During the licensing annual inspection, all of the following items may or may not be in place for the Inspector to observe. For winter operation, it is understood that with early season snow conditions, snow may be nonexistent and that you remove many of these items because of vandalism, construction etc., when the lift is not being operated for public operation.

IT IS THE RESPONSIBILITY OF THE OPERATOR TO HAVE ALL OF THESE ITEMS IN PLACE PRIOR TO OPERATION OF THE LIFT FOR PUBLIC USE.

- X.1.1.5.1 Vertical clearances. Install appropriate barriers where there is inadequate clearance under the lift line.
- X.1.1.5.1 Vertical clearances. Remove temporary closure barriers that do not have adequate clearance under the lift.
- X.1.1.9 Loading and unloading areas. Properly prepare the surface at loading and unloading areas.
- X.1.2.6 Brakes and rollback devices. Torque test all brakes according to the approved torque test procedures.
- X.1.2.10.2 Counterweights. Install appropriate fencing around counterweights to prevent unauthorized persons from coming in contact with or passing under counterweight.
- X.1.5 Provisions for operating personnel. Supply operating instructions and emergency procedures in all operators and attendants stations.
- X.2.3.2 Stop Gates. Where appropriate, properly install all removable stop gate wands or ropes.
- Annex F.7 Provisions for operating personnel. Provide properly certified fire extinguishers that are correctly hung in all operator and attendants stations and in the machine room.
- X.2.13.4 Emergency lighting. For those lifts that operate at night, verify that the emergency lighting is properly installed and is functional.
- X.3.1.2 Signs. Post all required signs at loading and unloading areas.
- X.3.2.1.5 First aid. Provide all required first aid equipment, personnel, and supplies prior to public operation.
- X.3.2.4.1 Control of passengers. Install appropriate fencing and gates at the loading area for the marshaling of passengers.
- X.3.3 General (Maintenance). Complete all tramway maintenance that is defined on the maintenance schedule as required prior to public operations.

If these items are not completed upon opening to public operation, they may be considered a PREVIOUS DEFICIENCY during the Unannounced Inspection.

Load Test Procedure for Detachable Grip Chairlift (rev 2)

**Quick Draw Express Detachable Chair
Ski Granby Ranch, CO
CO PTSB ID: SC-008
Date: 5 Dec 2016**

1.0 Introduction

The Quick Draw Express detachable quad chairlift, manufactured by Leitner, was installed in 1999 (area known as Sol Vista at the time). The original Control Techniques DC drive has been replaced:

- New ABB DCS-800 DC drive
- Reuse existing DC motor
- No changes to existing Leitner low voltage controls.
- New 'Ramp and Speed Monitor' (Electramics)

The acceptance test is intended to confirm the proper function of the new DC drive and its interface with the existing low voltage controls. The test will also test the function of the independent 'Ramp and Speed Monitor' (RSM) that monitors overspeed, rollback, acceleration and deceleration.

2.0 Lift Specifications

Lift Type	4 Passenger Detachable Grip Chairlift
Slope Length	1310 m
Vertical Rise	256 m
Number of Carriers (design)	67
Number of Carriers (actual)	<u>61</u>
Carrier Spacing (design)	44.8 m (8.00 sec interval)
Carrier spacing (actual)	<u>44.8</u> m (<u>8.0</u> sec interval)
Lift speed	5.6 m/sec (1100 FT/min)
Capacity-Uphill (design)	1800 passengers/hour
Capacity-Downhill (design)	900 passengers/hour
Capacity (actual)	<u>1800</u> passengers/hour
Carrier type	Leitner SA4-99 with Leitner LA48-95 SA4 grip
Carrier weight	215 kg
Drive Location	Top
Drive bullwheel size	4.20 m
Main drive	500 HP DC 1750 rpm 781 A DC ABB DCS800
Standby drive	Cummins N14-P475 with Rockford torque converter
Evac drive	Cummins B5.9-P152 with Rockford torque converter
Tension location	Bottom
Tensioning force	kN
Tension type	Hydraulic Cylinders (55.5 bar, 805 psi)
Return bullwheel size	4.20 m
Line gauge	5.30 m
Haul rope	40 mm 6x25 RLL PC (nom strength 830 kN)
Gearbox	Leitner KSS5 i=59.81
Main Drive input	Direct to gearbox

3.0 Personnel Attending

Name	Company / Organization
BRUCE ALLEN	CO PTSB
JOE GAVENDER	GAVENDER ENGINEERING
ED THOMPSON	ELECTRATICS
FRANK DERTY	ELECTRATICS
BLAINE FAULKNER	GRANBY RANCH
ANDY BIRCH	GRANBY RANCH
JACOB (AT LARGE FARMER)	GRANBY RANCH

4.0 Initial Checks

Perform visual review of entire line.
Confirm top and bottom communications is functional
Hourmeter at start of testing:

☒
☒
60563.8

4.1 Remote terminal operator switches/controls

Confirm function of remote terminal-signals to drive station

		INDICATION*
Medium	(return)	<input checked="" type="checkbox"/>
Slow	(return)	<input checked="" type="checkbox"/>
Stop (Ch 1)	(return)	<input checked="" type="checkbox"/> 19A1 (PNOZ X2)
Stop (Ch 2)	(return)	<input checked="" type="checkbox"/>
E Stop (Ch 1)	(return)	<input checked="" type="checkbox"/> 33A0 (PNOZ X2)
E Stop (Ch 2)	(return)	<input checked="" type="checkbox"/>
Signal	(return)	<input checked="" type="checkbox"/>
Phone	(return)	<input checked="" type="checkbox"/>
_____		<input checked="" type="checkbox"/>
_____		<input type="checkbox"/>

4.2 Local terminal operator switches/controls

Confirm function of local operator controls

		INDICATION*
Fast	DLS	<input checked="" type="checkbox"/>
Fast	CON	<input checked="" type="checkbox"/>
Medium	DLS	<input checked="" type="checkbox"/>
Medium	CON	<input checked="" type="checkbox"/>
Slow	DLS	<input checked="" type="checkbox"/>
Slow	CON	<input checked="" type="checkbox"/>
Slow	OPS	<input checked="" type="checkbox"/>
Stop	DLS	<input checked="" type="checkbox"/>
Stop	CON	<input checked="" type="checkbox"/>
Stop	OPS	<input type="checkbox"/>
Stop	STN	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
Stop Cords	STN	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> (normal stop)
E Stop	DLS	<input checked="" type="checkbox"/>
E Stop	OPS	<input checked="" type="checkbox"/>
E Stop	CON	<input checked="" type="checkbox"/>
E Stop	STN	<input checked="" type="checkbox"/>
Start	DLS	<input checked="" type="checkbox"/>
Start	CON	<input checked="" type="checkbox"/>
Fault Reset	DLS	<input checked="" type="checkbox"/>
Fault Reset	CON	<input checked="" type="checkbox"/>
Forward/Backward	CON	<input checked="" type="checkbox"/>
Signal		<input checked="" type="checkbox"/>
Phone		<input checked="" type="checkbox"/>
_____		<input type="checkbox"/>
_____		<input type="checkbox"/>

DLS=Downhill Loader Station-top
CON=Operator Console-top operator house
STN=Drive Station (motor platform)

4.3 DC Drive <> Leitner Controls

	INDICATION*
Main Motor Contactor-Aux contact-1 <i>when closed</i>	<input checked="" type="checkbox"/> (X6-0, 0600)
Main Motor Contactor-Aux contact-0 <i>when open</i>	<input checked="" type="checkbox"/> (X6-0, 0600)
Drive Fault-1 <i>when no fault</i>	<input checked="" type="checkbox"/> (X6-1, 0601)
Drive Fault-0 <i>when fault</i>	<input checked="" type="checkbox"/> (X6-1, 0601)
Proof of Torque-1 <i>when above set level</i>	<input checked="" type="checkbox"/> (X7-0, 0700)
Proof of Torque-0 <i>when below set level</i>	<input checked="" type="checkbox"/> (X7-0, 0700)
Run (start/stop)-1 <i>when running</i>	<input checked="" type="checkbox"/> (X6-11, 0611)
Run (start/stop)-0 <i>when stopped (at instance of stop command)</i>	<input checked="" type="checkbox"/> (X6-11, 0611)
Reverse-1 <i>when forward</i>	<input checked="" type="checkbox"/> (X6-15, 0613)
Medium	<input checked="" type="checkbox"/> (X6-16, 0614)
Fast	<input checked="" type="checkbox"/> (X6-17, 0615)
Torque Test	<input checked="" type="checkbox"/> (via Modbus)

4.4 Ramp and Speed Monitor (RSM) <> Leitner Controls

	INDICATION*
Normal Stop-1 <i>when closed</i>	<input checked="" type="checkbox"/> (19A1, DLS Stop+Drive Fault)
Normal Stop-0 <i>when open</i>	<input checked="" type="checkbox"/> (19A1, DLS Stop+Drive Fault)
Emergency Stop-1 <i>when no fault</i>	<input checked="" type="checkbox"/> (33A0, STN E Stop+Drive Fault)
Emergency Stop-0 <i>when fault</i>	<input type="checkbox"/> (33A0, STN E Stop+Drive Fault)

5.0 0% UH, 0% DH (Main Drive-Electric)

Record tension carriage position:

235 cm

Record tension system pressure:

860 psi

Main Drive-Electric:

Measure acceleration time:

30.2 sec.

Max motor torque during acceleration:

55%

Measure lift speed:

10 rev in 23.56 sec >> 25.47 rpm

5.66 m/s → 1162 ft/min
5.4 m/s (LEINER) 1120 ft/min (RSM)

Speed Meter Reading:

1520 RPM

Motor RPM:

30-35%

Steady state motor torque:

440 VDC

Steady state armature voltage:

P-1E. Perform Coasting stop-(Use service brake test mode, bypass DA 92.10 'Deceleration supervision main drive', DA 92.11 'Deceleration supervision service brake, hold service brake off during stop with button inside control panel)

Stop time:

18.77 s

Stop distance-measured:

(52.0 m) RSM

Stop distance:

173 ft (per controls)

Measured distance matches displayed distance

☒

(52.3 m on LEINER display)

Max deceleration rate:

-

'Black Box' photo taken? ☒

#76

P-2E. Perform Normal Stop (drive ramp down, service brake at 'zero speed'):

Stop time:

6.11 sec.

Stop distance:

18.5 m 54 ft

Max deceleration rate:

3.55 ft/s²

'Black Box' photo taken? ☒

#70

Max regenerative current during stop:

-71%

P-3E. Perform Emergency Stop (emergency brake, service brake at 'zero speed')

Stop time:

5.96 s

Stop distance:

18.0 m 59 ft

Max deceleration rate:

3.83 ft/s²

'Black Box' photo taken? ☐

#72

P-4E. Perform Service Stop (Service brake only, modulated)

Stop time:

6.20 s

Stop distance:

18.5 m 59 ft

Max deceleration rate:

3.93 ft/s²

'Black Box' photo taken? ☐

#74

6.0 Load Lift to 100% x 1.1 Design Load (for 110% UH / 0% DH load test)

Design load for testing:

$$0.5 \times (\text{Number of Chairs}) \times (\text{pass/chair}) \times 170 \text{ lb/pass} \times 1.1 = \text{Total test weight}$$

$$0.5 \times (67-4) \times 4 \times 170 \times 1.1 = 23,562 \text{ lb}$$

*2 chairs in terminal on each end, 63 chairs on line

Chairs to load (for 110% test load):

$$(0.5 \times \text{Number of Chairs}) - \text{Chairs left empty} = \text{Chairs with test load}$$

$$(0.5 \times 63) - 4.5 = 27 \gg \text{Load 27 chairs}$$

$$\text{Total test weight} / \text{Chairs with test load} = \text{load per chair}$$

$$23,562 / 27 = 873 \text{ lb per chair}$$

Test weight for 50% load: $873 \text{ lbs} / 4 = 218 \text{ lbs/seat position}$

Load test material: *18x18x24 CARDBOARD BOX W TRASH CAN LINER
CALIBRATED FILL STICK IN SHOP WITH SCALE AND FILLED BOX
(TILTED TO SEAT ANGLE)*

Load carriers from Chair 1 to Chair 27

Record tension system pressure:

Record tension carriage position:

*215 CM (20 CM FORWARD)
911 PSI*

6.1 Check static holding of brakes

(Note any adjustments performed)

Service brake:

Emergency brake:

Rollback brake:

☒

☒

☒

6.2 Check dynamic rollback of brakes

Open service brake. Slowly open emergency brake and let lift roll back.

...Leitner Rollback switch sets Rollback Brake, activates E-Stop:

...RSM FLC Rollback activates E-Stop:

☒

☒

Bypass Leitner rollback switch, RSM FLC Rollback. Set emergency brake. Open service brake. Slowly open emergency brake and let lift rollback to approximately 1/3 of design speed. Set emergency brake:

Emergency brake stopping performance: *WITH ALL BRAKES OPEN, LIFT ROLLED BACKWARDS
AT < 0.5 M/S (100 FPM) SPEED, E BRAKE STOPPED & HELD LOAD*

Set service brake. Open emergency brake. Slowly open service brake and let lift roll back to approximately 1/3 of design speed. Set service brake:

Service brake stopping performance: *WITH ALL BRAKES OPEN, LIFT ROLLED
BACKWARDS AT < 0.5 M/S (< 100 FPM) SPEED, S. BRAKE STOPPED
AND HELD LOAD.*

6.3 110% UH, 0% DH Lift Tests (Main Drive-Electric)

Measure acceleration time: 30 SEC
Max motor torque during acceleration: 103%
Measure lift speed:
Speed Meter Reading: 1100 FT/min
Motor RPM: 1520 RPM
Steady state motor torque: 80%
1F. Perform Coasting stop (see procedure under section 5.0, P-1E)
Stop time: 8.97 SEC
Stop distance-measured: -
Stop distance: 24.0m 84ft. (per controls)
Max deceleration rate: 2.62 ft/s^2
'Black Box' photo taken? ☒ #192

2F. Perform Normal Stop (drive ramp down, service brake at 'zero speed'):

Stop time: 6.15s
Stop distance: 57 ft.
Max deceleration rate: 3.24 ft/s^2
'Black Box' photo taken? ☒ #156
Max regenerative current during stop: -40%

3F. Perform Emergency Stop (emergency brake, service brake at 'zero speed')

Stop time: 5.44s
Stop distance: 55 ft.
Max deceleration rate: 4.67 ft/s^2
'Black Box' photo taken? ☒ #158

4F. Perform Service Stop (Service brake only, modulated)

Stop time: 5.95s
Stop distance: 61 ft 18.5m
Max deceleration rate: 4.89 ft/s^2
'Black Box' photo taken? ☐ #165

6.4 110% UH, 0% DH Lift Tests (Auxiliary Drive-Diesel)

Measure acceleration time: 30 SEC
Measure lift speed:
Speed Meter Reading: 790 ft/min
Engine RPM: 1600 RPM

1-Aux F. Perform Normal Stop (engine ramp down, service brake at 'zero speed'):

Stop time: 4.12 sec.
Stop distance: 31 ft.
Max deceleration rate: 4.11 ft/s^2
'Black Box' photo taken? ☒ #244

2-Aux F. Perform Emergency Stop (engine kill, emergency brake, service brake at 'zero speed')

Stop time: 3.68 sec.
Stop distance: 24 ft 7.8m
Max deceleration rate: 4.65 ft/s^2
'Black Box' photo taken? ☒ #246

~~4F. Perform Service Stop (Service brake only, modulated)~~

~~Stop time: _____~~
~~Stop distance: _____~~
~~Max deceleration rate: _____~~
~~'Black Box' photo taken? ☐ _____~~

7.0 Load Lift to 50% x 1.1 Design Load (for 55% DH, 0% UH load test)

Empty even numbered carriers from Chair 1 to Chair 27 ☒

Notes: AUXILIARY DRIVE USED TO MOVE CARRIERS FROM 110% UP TO 55% DH - EVERY OTHER CHAIR EMPLOYED AT TOP TERMINAL

7.1 55% DH, 0% UH Lift Tests (Main Drive-Electric)

Measure acceleration time: ~30 SEC
Max motor torque during acceleration: 49%
Measure lift speed:
Speed Meter Reading: 1100 FT/MIN
Motor RPM: 1520 RPM
Steady state motor torque: 27%

1D. Perform Coasting stop- (see procedure under section 5.0, P-1E) NOT PERFORMED

Stop time: —
Stop distance-measured: —
Stop distance: — (per controls)
Max deceleration rate: —
‘Black Box’ photo taken? ☐

2D. Perform Normal Stop (drive ramp down, service brake at ‘zero speed’):

Stop time: 6.15 SEC
Stop distance: 54 FT
Max deceleration rate: 3.47 ft/s^2
‘Black Box’ photo taken? ☒ #254
Max regenerative current during stop: 86% MAX

3D. Perform Emergency Stop (emergency brake, service brake at ‘zero speed’)

Stop time: 6.66 SEC
Stop distance: 65 FT
Max deceleration rate: 3.79 ft/s^2
‘Black Box’ photo taken? ☒ #256

4D. Perform Service Stop (Service brake only, modulated)

Stop time: 7.04 SEC
Stop distance: 64 FT 19.8 M
Max deceleration rate: 3.99 ft/s^2
‘Black Box’ photo taken? ☒ #274

8.0 Empty all carriers

Unload all carriers.

Record tension system pressure:

Record tension carriage position:



(NOT RECORDED)

(NOT RECORDED)

8.1 Repeat empty lift tests if changes made to brake settings

Any changes made? If no changes Sect 8.1 and 8.2 do not need to be performed:

NO CHANGES MADE TO BRAKE SETTINGS OR DRIVE SETTINGS - SKIP SECT 8.1, 8.2

0% UH, 0% DH (Main Drive-Electric)

Measure acceleration time:

Max motor torque during acceleration:

Measure lift speed:

Speed Meter Reading:

Motor RPM:

Steady state motor torque:

1E. Perform Normal Stop (drive ramp down, service brake at 'set speed'):

Stop time:

Stop distance:

2E. Perform Emergency Stop (drive disconnected, drive sheave brake, service brake at 'set speed')

Stop time:

Stop distance:

3E. Perform Service Stop (drive disconnected, service brake only set)

Stop time:

Stop distance:

4E. Perform Coasting stop-activated from 'service' menu (drive disconnected, no brakes set)

Stop time:

Stop distance:

5E. Perform E-Only Stop activated from 'service' menu (drive disconnected, drive sheave brake only set)

Stop time:

Stop distance:

8.2 0% UH, 0% DH (Auxiliary Drive-Diesel)

Measure acceleration time:

Measure lift speed:

Speed Meter Reading:

Engine RPM:

1-AuxE. Perform Normal Stop (engine ramp down, service brake at 'zero speed'):

Stop time:

Stop distance:

Max acceleration rate:

'Black Box' photo taken? ☐

2-AuxE. Perform Emergency Stop (engine kill, emergency brake, service brake at 'zero speed')

Stop time:

Stop distance:

Max acceleration rate:

'Black Box' photo taken? ☐

9.0 Lift Safeties

9.1 DC Drive Safeties / PLC Safeties

DC Drive Safeties

DC Drive Overcurrent Test: (change par 3009)
Motor Tach Feedback Loss: (pull isolation relay)
DC Drive Field Loss (change par. 4502 to 20%)
Motor Overspeed: 110% *1751 → 1040*
Ramp fault (accel time changed from 30 s to 24 s)

☒ *150% → 20% F522* (on DC drive display)
☒ *F522* (on DC drive display)
☒ *57% → 20% F541* (on DC drive display)
☒ *F532* (on DC drive display)

Torque Limit Settings:

Parameter *2005* 'TorqMax': *+125* ~~+150~~ % (driving)
Parameter *2006* 'TorqMin': *-100* % (regen)

Motor Overcurrent Setting:
Phase Loss (open breaker to phase loss relay)
Blower Fault (motor overload)
'Drive Fault' indicated on Leitner controls
Contactor acknowledge in ABB

☒ *150% (PAR 3009)*
☒ *DRIVE FAULT*

PERFORMER ACTUAL OVERSPEED
BY SETTING PAR

☒ *NO STOP IF NO CONT. ACKNOWLEDGE*
☒ *BOTH LEITNER CONTROLS + RSM ALL TRIPPED FOR 110% OVERSPEED*

RSM: PLC Module Safeties/Functions

(tested from service menu/PLC tests)

FROM 'DC DRIVE (motor encoder 1 > ABB Drive > Analog output-Speed > RSM PLC):

	Normal	Test	INDICATION*
PLC-Motor Encoder Loss		<i>MAX SPEED</i>	<input checked="" type="checkbox"/> NS-'TACH LOSS'
PLC-Motor Accel Fault	<i>80</i>	<i>25</i>	<input checked="" type="checkbox"/> ES-'ACCEL FAULT-DRIVE'
PLC-Motor Decel Fault	<i>190</i>	<i>40</i>	<input checked="" type="checkbox"/> NS-'DECEL FAULT-DRIVE'
PLC-Motor 115% Overspeed	<i>4025</i>	<i>1800</i>	<input checked="" type="checkbox"/> ES-'115% DRIVE'
PLC-Motor 110% Overspeed	<i>3850</i>	<i>1800</i>	<input checked="" type="checkbox"/> NS-'110% MOTOR SPEED'
PLC-Speed-Motor vs Rope Enc	<i>SET SPEED CHARACTER</i>		<input checked="" type="checkbox"/> NS-'SPEED-MOTOR VS ROPE'
PLC-Ramp Fault	<i>0</i>	<i>+1.5 SEC</i>	<input checked="" type="checkbox"/> NS-'RAMP FAULT'

FROM 'ROPE-ENCODER':

	Normal	Test	INDICATION*
PLC-Rope Encoder Loss		<i>MAX SPEED</i>	<input checked="" type="checkbox"/> NS-'ROPE SPEED LOSS'
PLC-Rope Encoder Accel Fault	<i>60</i>	<i>25</i>	<input checked="" type="checkbox"/> ES-'DECEL FAULT-ROPE'
PLC-Rope Encoder Decel Fault	<i>190</i>	<i>40</i>	<input checked="" type="checkbox"/> NS-'DECEL FAULT-ROPE'
PLC-Rope Encoder 115% Overspeed	<i>4025</i>	<i>1800</i>	<input checked="" type="checkbox"/> ES-'115% ROPE'
PLC-Rope Encoder 110% Overspeed	<i>3850</i>	<i>1800</i>	<input checked="" type="checkbox"/> NS-'110% MOTOR SPEED'
PLC-Rope Encoder Position Test	<i>RIP VALUES</i>		<input checked="" type="checkbox"/> NS-'ROPE POSITION LOSS'
PLC-Speed- Rope Enc vs Motor Enc 2	<i>SET SPEED ERROR → 1</i>		<input checked="" type="checkbox"/> NS-'SPEED ROPE VS MOTOR'
PLC-Rope Encoder-Rollback	<i>RIP VALUES</i>		<input checked="" type="checkbox"/> ES-'ROLLBACK'

TACH LOSS

300 PPR TACHS ON DC MOTOR + 'ROPE' TACH

IN RSM PLC: 3500 SPEED UNITS = 100% SPEED = 1100 RPM

*NS = Normal Stop Command from RSM, ES = Emergency Stop Command from RSM

10.0 Perform Brake Torque Test

Follow existing brake torque test procedures

TESTED PER EXISTING PROCEDURE, SERVICE BRAKE,
PARKING BRAKE AND EMERGENCY BRAKE ALL HELD
STATICALLY AT 25% TORQUE.

11.0 Load Test Completed

STATE OF
COLORADO

Cochrell - DORA, Nicki [REDACTED]

(no subject)

1 message

Blaine Faulkner [REDACTED]

Wed, Dec 14, 2016 at 11:49 AM

To: "Cochrell - DORA, Nicki" [REDACTED]

Cc: Jamie Wolter [REDACTED]

This is my response letter for the ALI deficiency list on SC-008(Quick Draw Express). Thank you.

Blaine Faulkner

Lift Maintenance Supervisor

Granby Ranch, CO 80446

[970.887.5154](tel:970.887.5154)

[REDACTED]

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23K

**ACCEPTANCE TEST AND ANNUAL LICENSING INSPECTION
GRANBY RANCH
DECEMBER 5 & 8, 2016**

PREPARED FOR:

**COLORADO PASSENGER TRAMWAY SAFETY BOARD
1560 BROADWAY, SUITE 1300
DENVER, COLORADO 80202**

PREPARED BY:

**BRUCE L. ALLEN, P.E.
HIGHLINE AUTOMATION
PO BOX 1368
SILVERTHORNE, CO 80498**

**ANNUAL LICENSING INSPECTION
GRANBY RANCH**

**BRUCE L. ALLEN
December 5 & 8, 2016**

December 12, 2016

Colorado Passenger Tramway Safety Board
1560 Broadway STE 1350
Denver, CO 80202-5146

RE: ACCEPTANCE TEST AND ANNUAL LICENSING INSPECTION
GRANBY RANCH
DECEMBER 5 & 8, 2016

LIFTS: SC-008

Dear Board Members:

Enclosed is the Annual Licensing Inspection and Acceptance Test for a new DC motor drive on the Quick Draw Express lift (SC-008) at Granby Ranch. This report is made pursuant to Sections 25-5-712 and 25-5-715 of the Colorado Revised Statutes (July 1, 2008).

The Acceptance Test was conducted on December 5, 2016, and the remainder of the Annual Licensing Inspection was conducted on December 8, 2016. I was accompanied by Blaine Faulkner, and Andy Birch of Granby Ranch. I gave a copy of the Preliminary Inspection Report to Blaine Faulkner on December 8, 2016.

The tramways referenced in the attached report have been inspected according to established procedures. Except for the deficiencies noted in the report, I did not observe any unreasonable safety hazards, nor any violations of the statute of the May 15, 2016 edition of the Rules and Regulations of the Colorado Passenger Tramway Safety Board.

Sincerely,
Bruce Allen, P.E.
Tramway Inspector
HIGHLINE AUTOMATION

**ANNUAL LICENSING INSPECTION
GRANBY RANCH**

**BRUCE L. ALLEN
December 5 & 8, 2016**

SC-008 (QUICK DRAW EXPRESS)
GENERAL COMMENTS
CPTSB FORM 25-06

4
4

SC-008 (QUICK DRAW EXPRESS)

A. Bottom Terminal

Comment – During the inspection, a flat tire caused a chair to stall which resulted in a chair collision while running on the evacuation power unit (anti-collision not active). This lift still has many of the original tires which are severely weathered, and should be replaced as soon as possible. **Problem tire replaced with new and replacing other worn tires soon as possible.**

B. Line

No deficiencies observed by Inspector.

C. Top Terminal

Comment – The new motor drive's proof of torque circuit is not able to maintain static torque or forward motion on a start with a loaded lift due to the proprietary nature of the existing control system and brake control module. A very slight rollback does occur on all loaded lift starts, and should be rectified when the new control system is installed in 2017. **Engineer planning new controls is aware of this issue and will have it rectified with new system installation.**

D. Record Keeping

1) 3.2.12 – Software Security.

Develop a Software Security procedure for protection of the motor drive parameters and the new PLC interface logic. The procedure should address all the items required by the CPTSB Rules and Regulations May 15, 2016 edition for 3.2.12, to protect against unauthorized changes as well as a systematic approach to revision control and testing. **Deficiency corrected refer to WO#1214-5**

2) 21.3.10 – Submittal of As-Built drawings and additional documents.

Complete the As-Built drawings for the new motor drive and associated PLC interface and relay logic, and submit a copy to the CPTSB. **Deficiency corrected refer to WO# 1214-6**

E. General Deficiencies

3) Complete all items on CPTSB Form 25-06 prior to opening to the public. **Will complete all items prior to opening. Refer to WO#1206-6**

GENERAL COMMENTS

The previous inspection report has been reviewed. This inspection verifies that all previous deficiencies have been corrected.

Appendix I

ANSI-2011 B77.1

3.1.2.6 Brakes and rollback devices

The aerial lift shall have the following friction-type brakes and other devices as specified in table 3-3:

- service brake (see 3.1.2.6.1);
- bullwheel brake (see 3.1.2.6.2);
- rollback device (see 3.1.2.6.3).

All braking systems shall be designed and monitored to ensure that:

b) The service brake shall not open prior to the drive system developing sufficient torque to prevent overhauling;

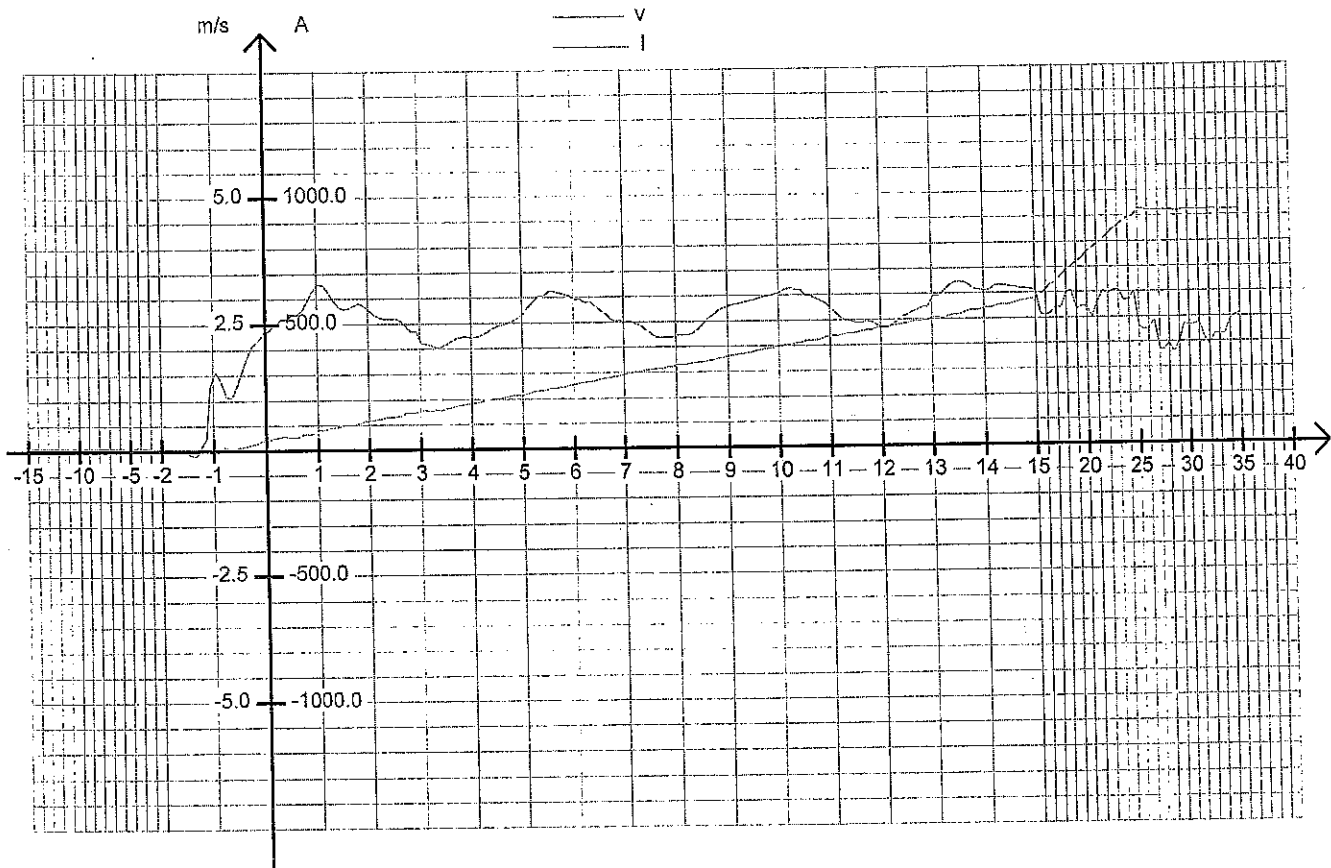
EXCEPTION – For an aerial lift that overhauls only in the reverse direction, a drive train backstop (3.1.2.6.4) may be used in lieu of the above.

Appendix J

BlackBox-Reports of 29/12/2016

Record Nr.: 37, Registered on RUN at 09:27:52

Dynamic Values for Motor and Brake



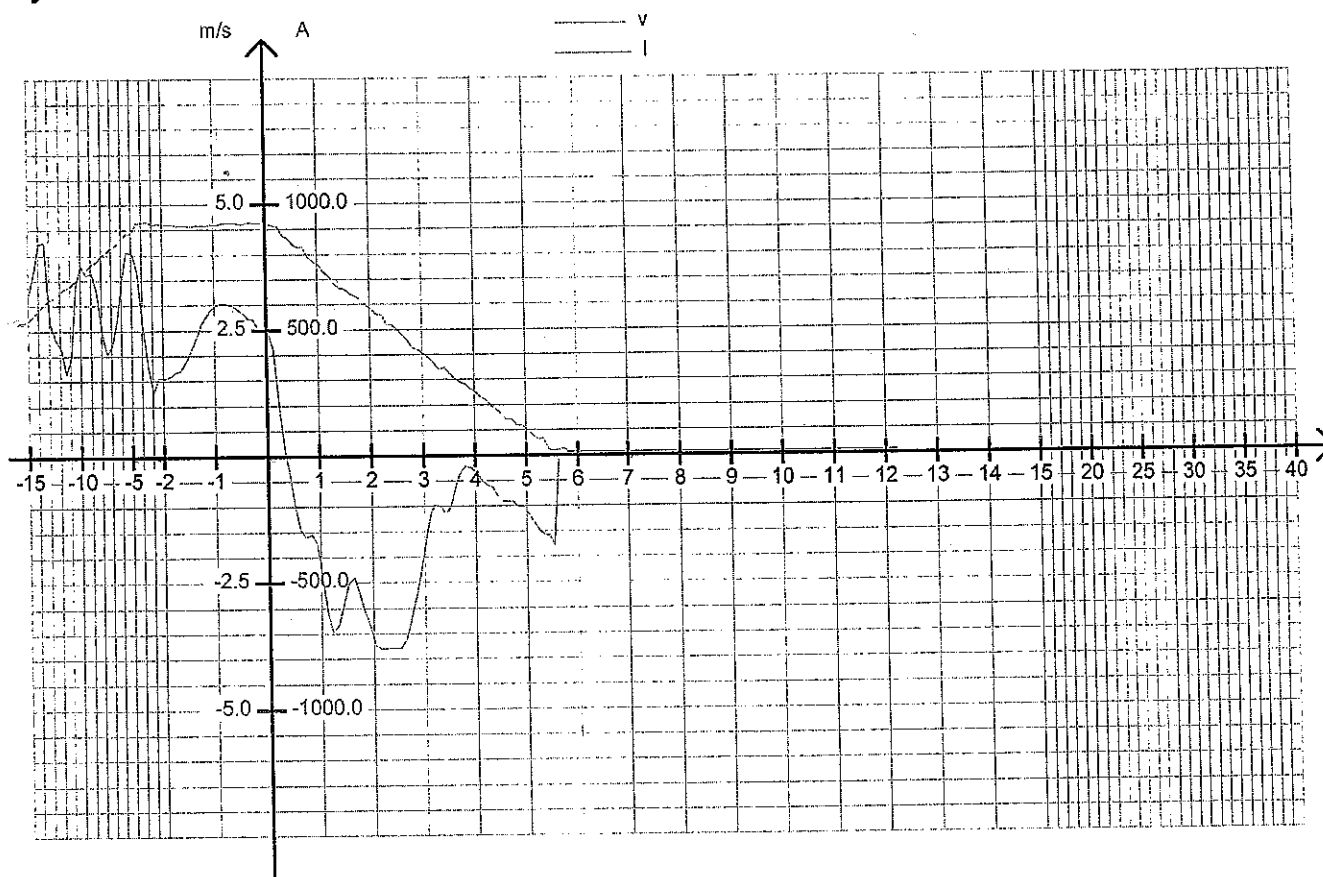
BlackBox-Reports of 29/12/2016

Record Nr.: 38, Registered on STOP at 09:30:28

Messages:

09:30:28,40 : DA 91.29 *Stop ch. 1 from return
09:30:28,40 : DA 91.30 *Stop ch. 2 from return
09:30:28,40 : DA 95.14 *Tower circuit 1
09:30:28,40 : RA 95.20 *TOWER 5 FAULT
09:30:35,90 : RA 91.06 *Checkback direction signal parity

Dynamic Values for Motor and Brake



BlackBox-Reports of 29/12/2016

Record Nr.: 39, Registered on RUN at 09:39:33

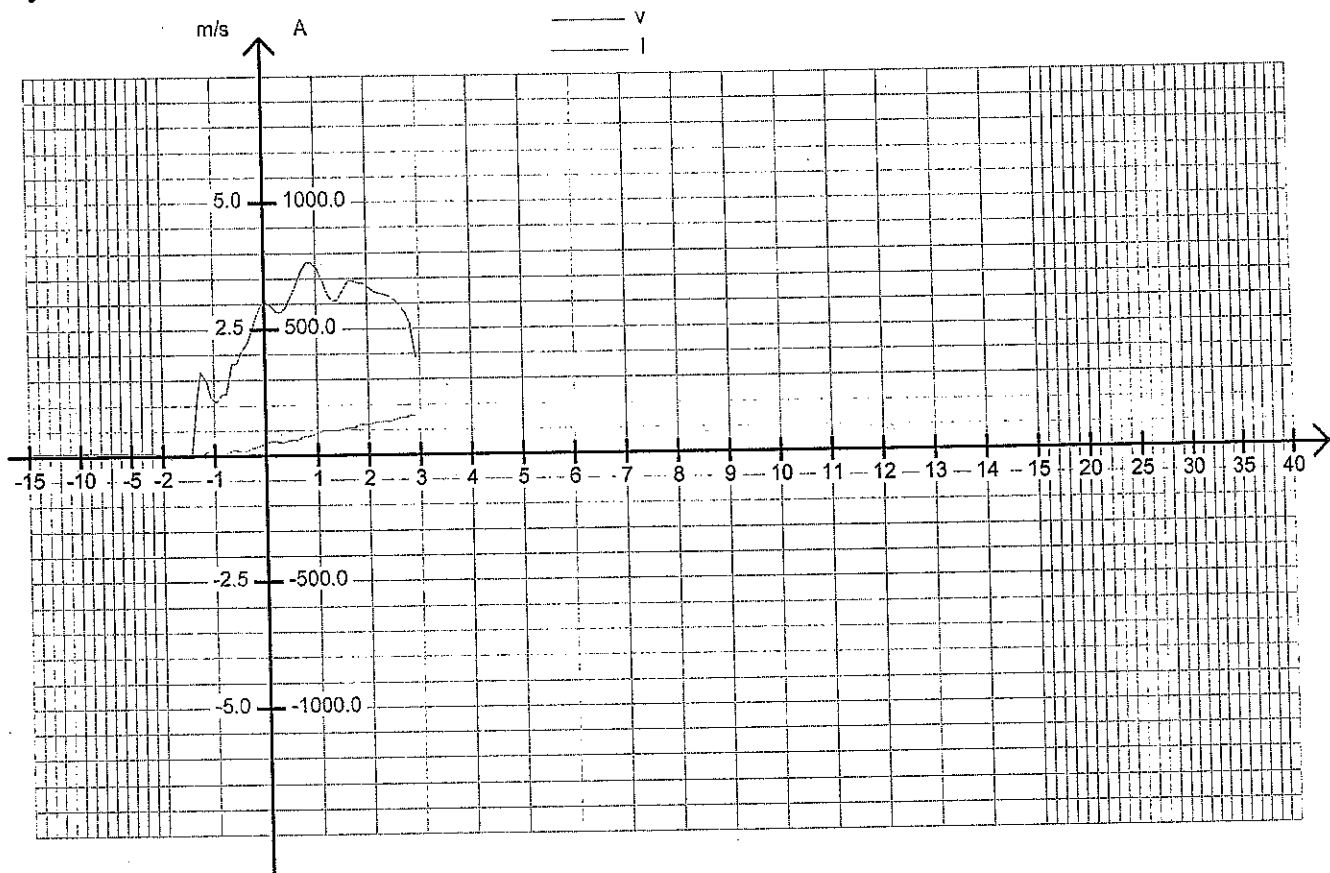
Messages:

09:39:36,29 : DA 91.29 *Stop ch. 1 from return

09:39:36,29 : DA 91.30 *Stop ch. 2 from return

09:39:36,29 : RA 93.07 *ANTICOL S9

Dynamic Values for Motor and Brake



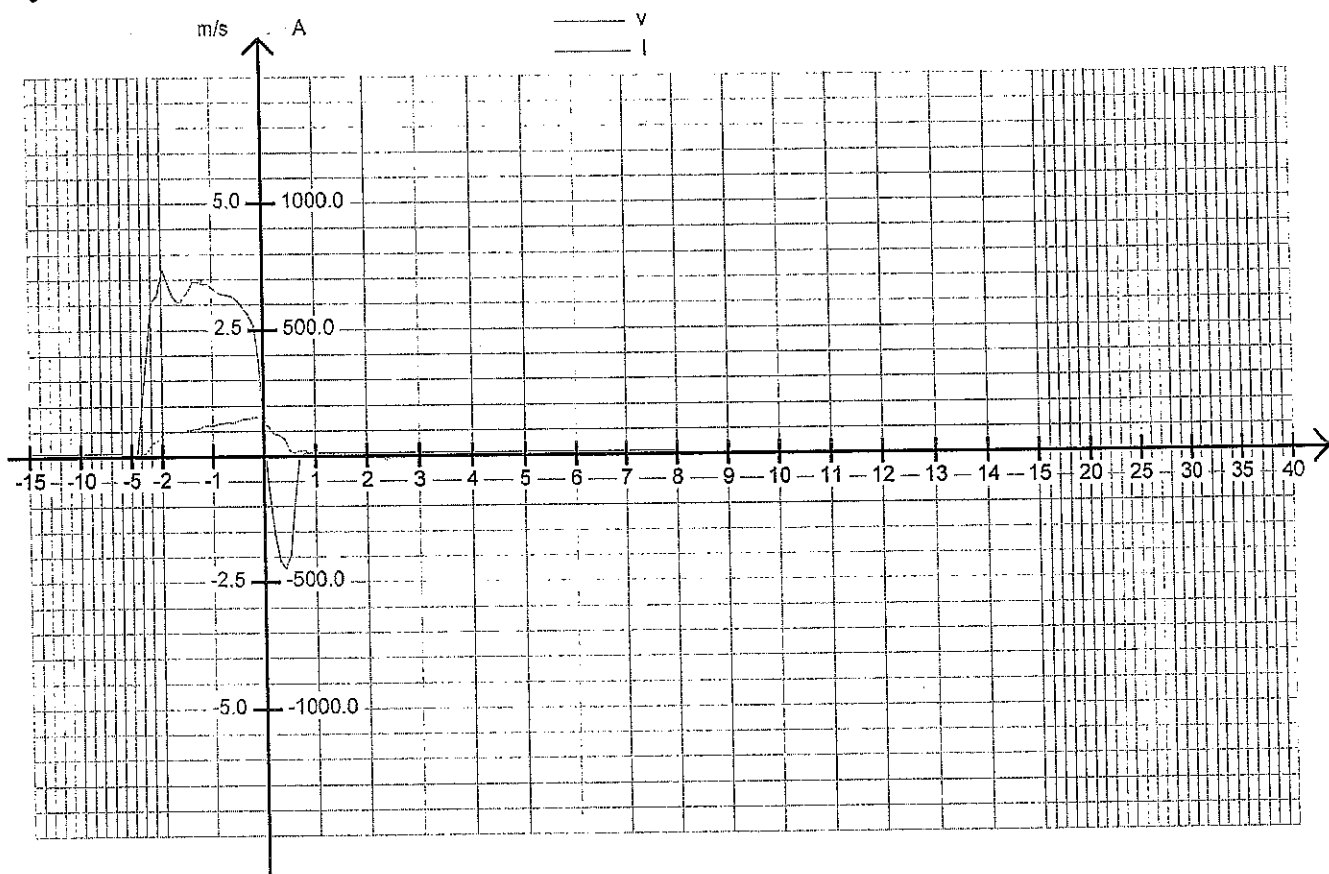
BlackBox-Reports of 29/12/2016

Record Nr.: 40, Registered on STOP at 09:39:36

Messages:

before 09:39:21,40 : DA 91.29 *Stop ch. 1 from return
before 09:39:21,40 : DA 91.30 *Stop ch. 2 from return
09:39:36,40 : DA 91.29 *Stop ch. 1 from return
09:39:36,40 : DA 91.30 *Stop ch. 2 from return
09:39:36,40 : RA 93.07 *ANTICOL S9

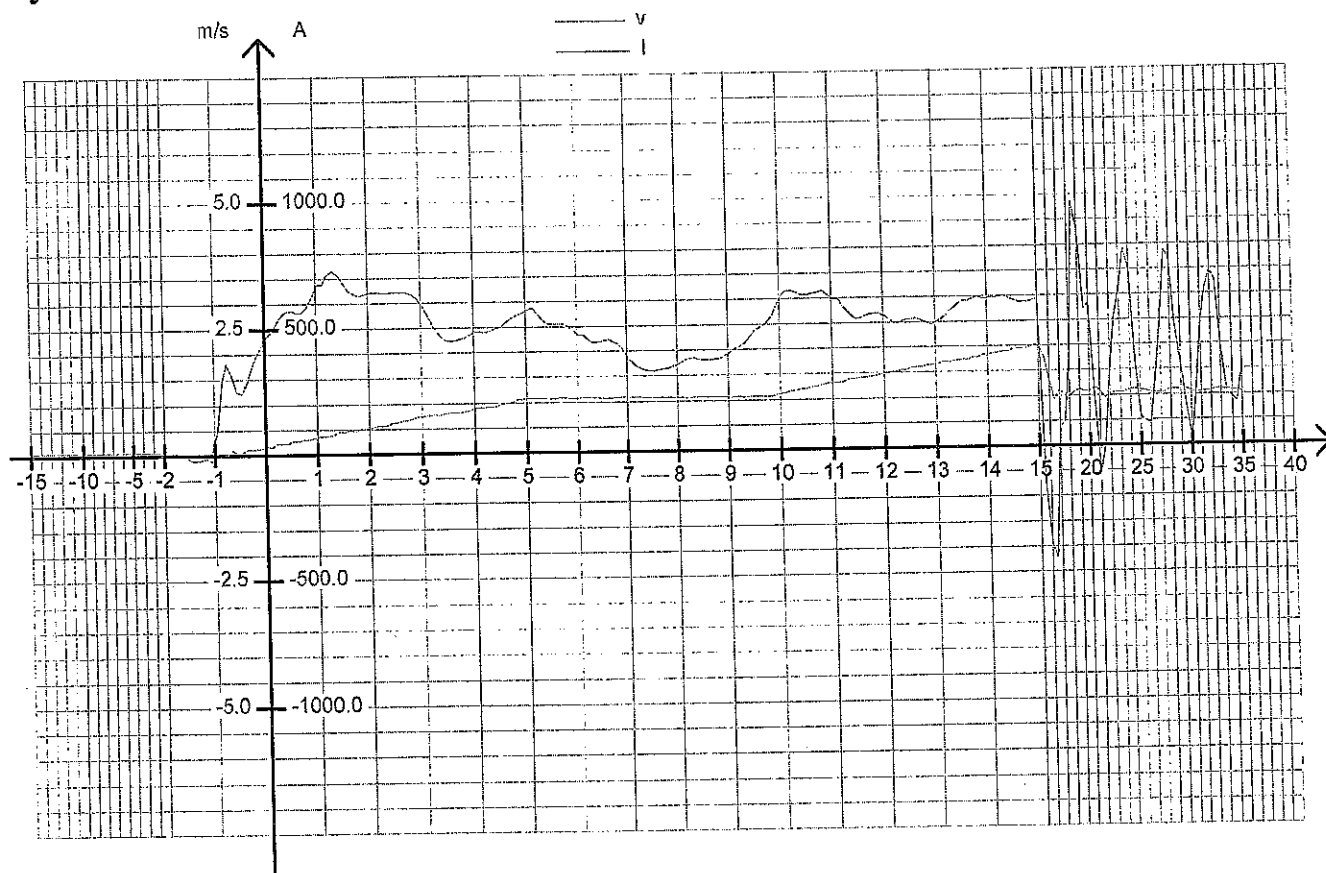
Dynamic Values for Motor and Brake



BlackBox-Reports of 29/12/2016

Record Nr.: 41, Registered on RUN at 09:40:56

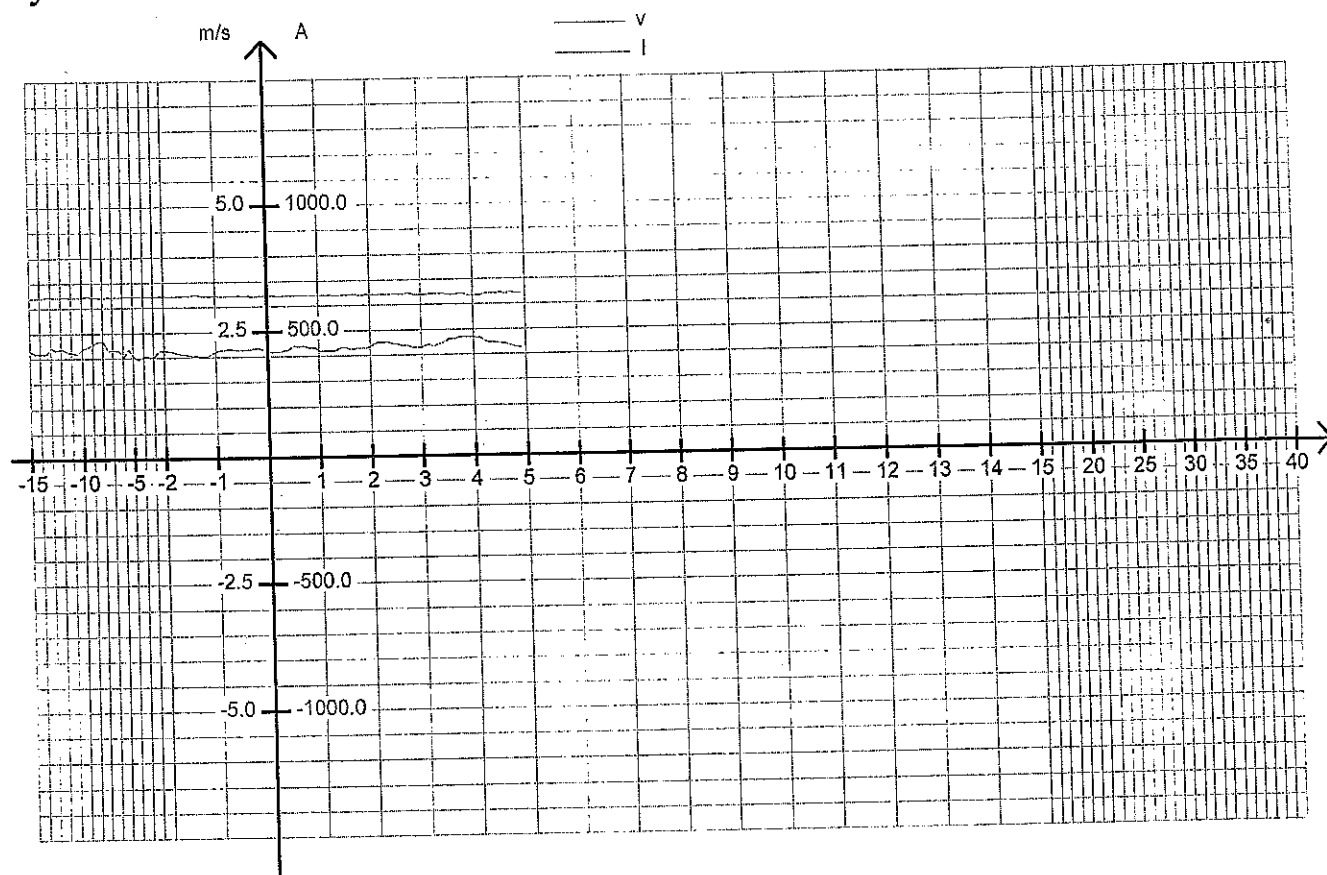
Dynamic Values for Motor and Brake



BlackBox-Reports of 29/12/2016

Record Nr.: 42, Registered on PERIODIC CALL at 10:11:31

Dynamic Values for Motor and Brake



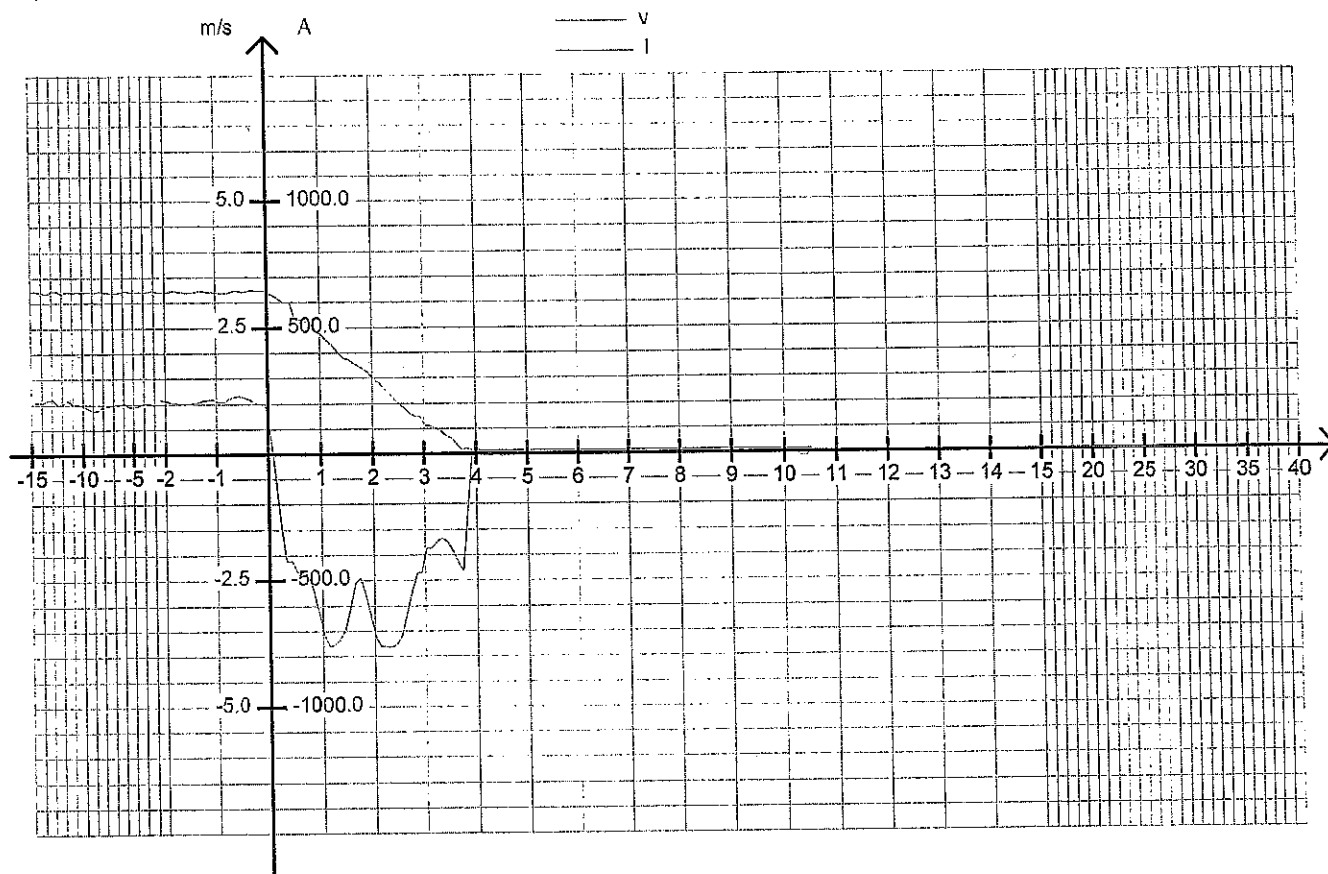
BlackBox-Reports of 29/12/2016

Record Nr.: 43, Registered on STOP at 10:23:20

Messages:

10:23:20,90 : DA 90.20 **N-Stop Return
10:23:20,90 : DA 91.29 *Stop ch. 1 from return
10:23:20,90 : DA 91.30 *Stop ch. 2 from return
10:23:20,90 : RA 90.22 **N-Stop loading area
10:23:21,90 : DA 90.19 *N-Stop relay

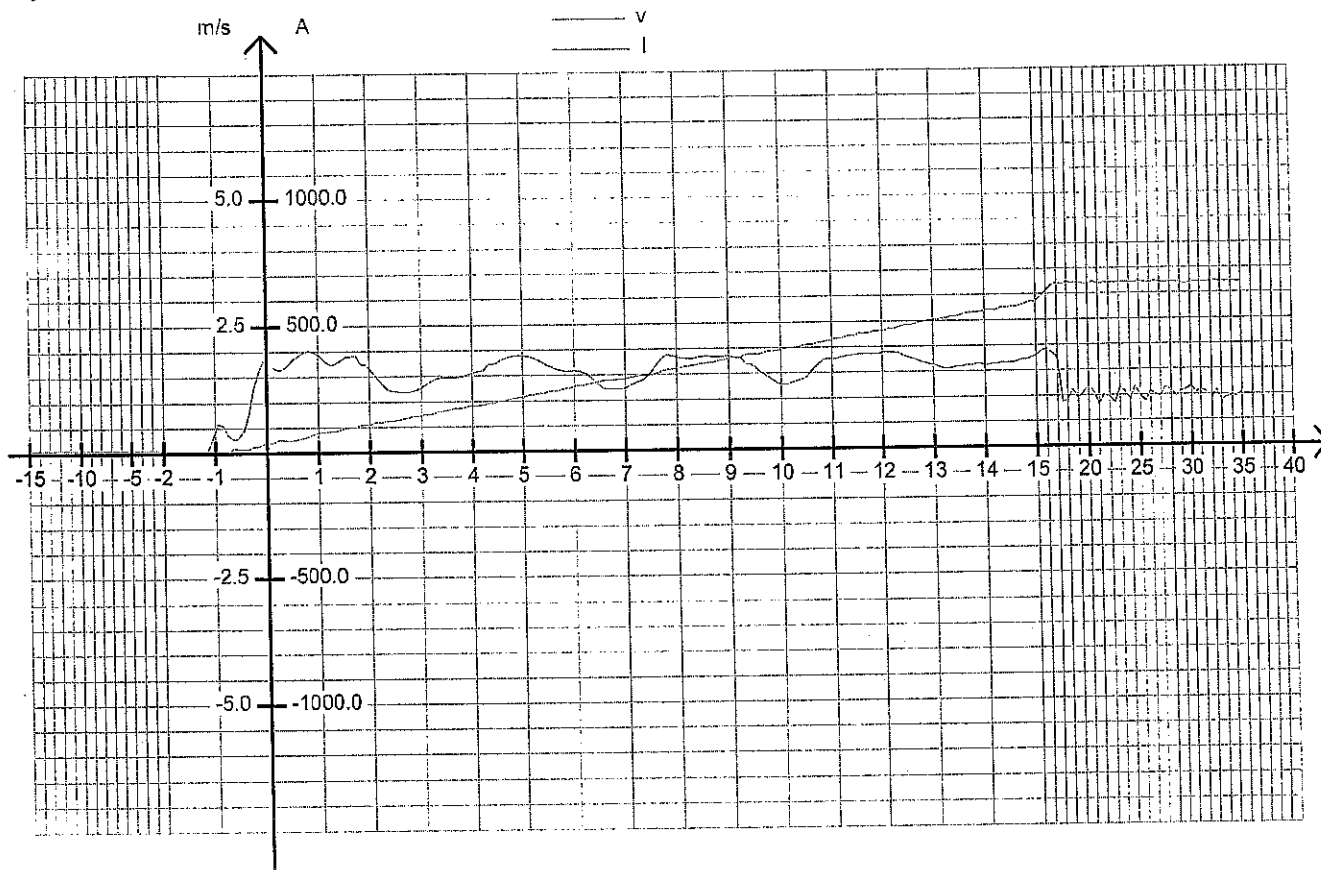
Dynamic Values for Motor and Brake



BlackBox-Reports of 29/12/2016

Record Nr.: 44, Registered on RUN at 10:28:23

Dynamic Values for Motor and Brake



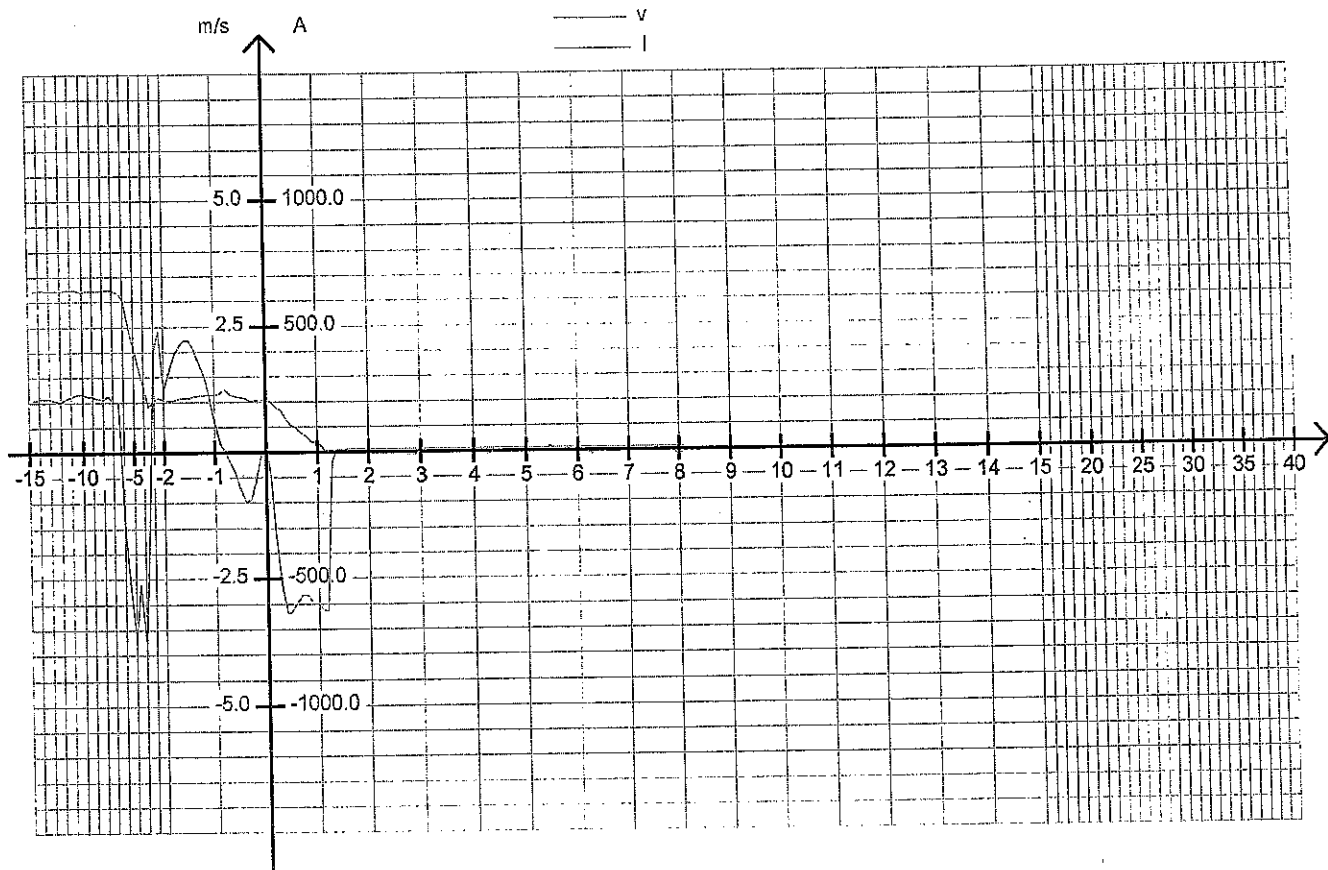
BlackBox-Reports of 29/12/2016

Record Nr.: 45, Registered on STOP at 10:35:22

Messages:

10:35:22,59 : DA 90.23 **N-Stop downloading area

Dynamic Values for Motor and Brake



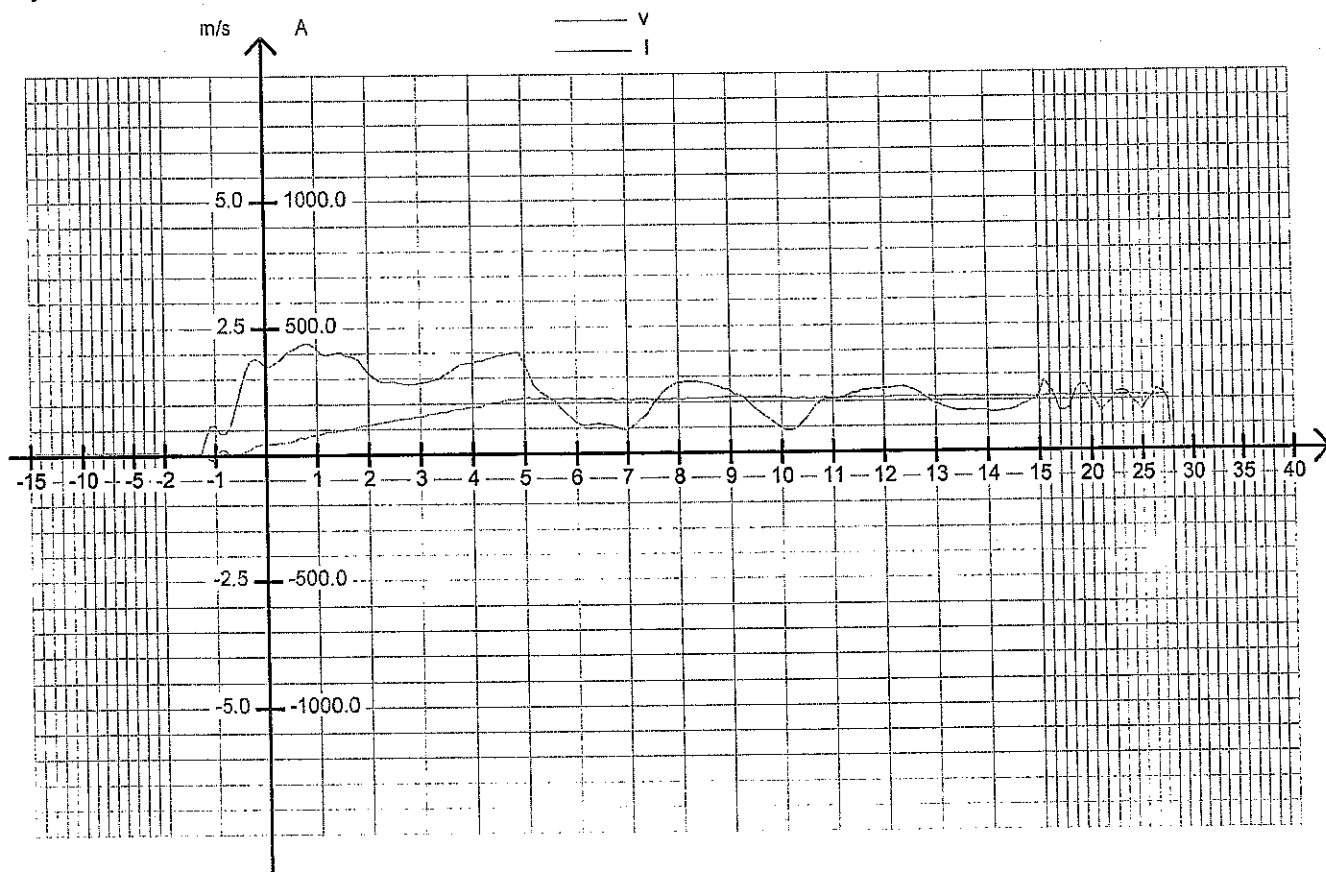
BlackBox-Reports of 29/12/2016

Record Nr.: 46, Registered on RUN at 11:05:05

Messages:

11:05:32,59 : DA 90.24 **N-Stop operator consol

Dynamic Values for Motor and Brake



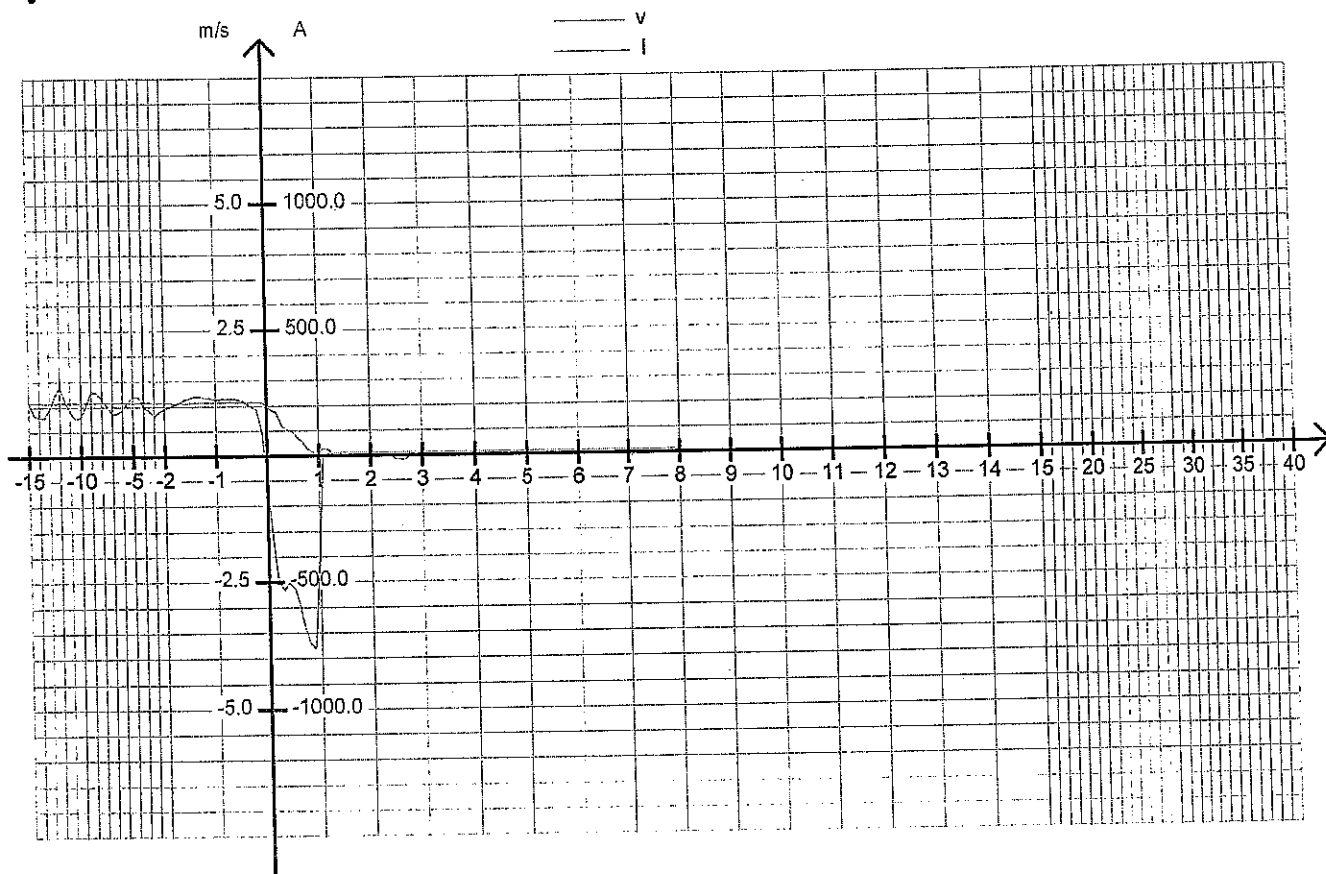
BlackBox-Reports of 29/12/2016

Record Nr.: 47, Registered on STOP at 11:05:32

Messages:

11:05:32,90 : DA 90.24 **N-Stop operator consol

Dynamic Values for Motor and Brake



Appendix K

12/30/16

8:10am

My name is Jordan Schwartz. I am a first year patroller at Granby Ranch with over 25 years of skiing and chair lift riding experience.

On 12/29/16, I was loaded onto the Quickdraw Express at Granby Ranch, chair 57. My chair consisted of myself, 220lbs, and 3 children, all about 12 years old and between 90-120 lbs each. The following events are my experiences with regard to the chair stopping and the passengers falling from chair 58.

#5
Following a brief stoppage when my chair was between towers 3&4, the lift began to accelerate again which was the beginning an up and down motion of the chair and cable through loaded side of the line. This continued through tower the span of towers 4&5, and the lift came to a stop as my chair was approximately 100ft prior to tower 6. Several seconds prior to the stop, there was a rumble through the line which was followed by the 'thunk' of chair 58 hitting tower 5.

Shortly prior to reaching tower 5, I had reached my arm over the back side of the chair to hold on as this was the largest vertical motion I had ever felt in a lift line. Following grabbing on, and telling the 3 children riding with me to hold on, I felt the rumble and proceeded to look backwards as the 3 passengers were falling from chair 58 and the now empty chair swaying side to side.

5
I would like it to be noted that the mother was visibly holding one of the children in what appeared to be an attempt to protect the child from the impact of landing.

Immediately I called dispatch to report the incident and call for help.


Jordan D. Schwartz

Ski Patroller

Granby Ranch, CO

970-887-5125 - Office

970-710-0242 - Cell

Load Percent: 98+

0907

Lift Supervisor stated on her way up that morning (approximately 0900), lift was stopped for 8 minutes for F-71 fault; @ 0943 lift stopped more abruptly than usual and noted a Tower 5 fault. Lift restarted 10 minutes later on slow, then sped up to medium. Called last chair at 1015.

✓ Chair 56 – experienced repeated stops and starts, bouncing, swinging back and forward, then steadied. After that heard a cable popping and screaming

Chair 57 – (ski patroller) quick stop then start; after Tower 3 experienced a big vertical sway and bouncing; after Tower 4 noticed increase in vertical movement then vibration and heard “thunk”; turned around and saw the victims had fallen and radioed to ski patrol

→ Chair 58 – (victim’s chair) experienced swinging side to side, struck the tower and ejected

Chair 59 – experienced a stop, swinging front to back, bouncing, then swinging side to side; just missed striking Tower 4, stopped swinging after going through rollers, but noticed that Chair 58 started swinging when they stopped

Chair 60 – stop and start then severe side to side on 1st incline; equipment hit Tower 4, noticed swinging had transferred 2 chairs ahead and observed Chair 58 strike Tower 5

Chair 61 – stopped then started a couple of times; observed Chair 58 start swinging side to side, which got worse and then hit the tower

↖ Chair 62, 63, or 64 – (exact number unknown) lots of starting and stopping, their chair and others in front were swinging violently side to side

↖ Chair 63 or 64 – (exact number unknown) did not experience stop/start

Lift operator at bottom had no notable events but looked up when he heard yelling and noticed chairs were swinging more than normal

56 57 58 59 60 61 62 63 64

12/30/16

8:10am

My name is Jordan Schwartz. I am a first year patroller at Granby Ranch with over 25 years of skiing and chair lift riding experience.

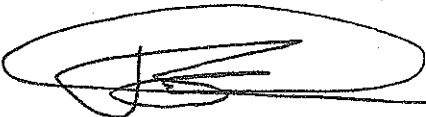
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Q
I would like it to be noted that the mother was visibly holding one of the children in what appeared to be an attempt to protect the child from the impact of landing.

Immediately I called dispatch to report the incident and call for help.


Jordan D. Schwartz

Ski Patroller

Granby Ranch, CO

970-887-5125 - Office

970-710-0242 - Cell

Load Percent: 98+⁺

0907

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↖ Chair 63 or 64 – (exact number unknown) did not experience stop/start

Lift operator at bottom had no notable events but looked up when he heard yelling and noticed chairs were swinging more than normal

56 58 58 59 60 61 62 63 64

Granby Ranch Witness Statement Card

Name Thomas Jones Date 12/29/16 Time 1000Street Address 1203 Daisy LaneCity Temple State TX Zip Code 76502Phone 254 718 7080Your relationship to injured party: NoneDid you see the incident occur? ☒ Yes ☐ NoPlease describe what you know about the incident: We startedswinging side to side, my sons side almost hitpole. I think that when we hit wheel theforce was moved into forward chair because ourmotion stopped. They hit pole and were knocked offfalling straight down. little girl landed on blue skiComments by injured party at scene: ^{pants} screaming. Don't let herdieAre you a Granby Ranch Employee? ☐ Yes ☒ No

I ACKNOWLEDGE THAT THE ABOVE INFORMATION IS CORRECT.

(x) Thomas Russell Jones 12/29/2016
Signature of Witness Date



Name Jason ZERRER Date 12/29 Time 1022
Street Address 500 Westwood Ave
City COLUMBIA State MO Zip Code 65203
Phone ~~573-445-3123~~ 573-823-6501
Your relationship to injured party: None

Did you see the incident occur? ☐ Yes ☐ No

Please describe what you know about the incident: metal/
sound from lift, looked over & saw
Adult & 2 children falling forward
out of chair last 10-15 ft.

Comments by injured party at scene: Adult in response fine
children with complaints of back & leg pain
Are you a Granby Ranch Employee? ☐ Yes ☒ No

I ACKNOWLEDGE THAT THE ABOVE INFORMATION IS CORRECT.

(x) [Signature]
Signature of Witness

12/29/14
Date

Granby Ranch Witness Statement Card



Name Jordan Schwartz Date 12-29-16 Time _____

Street Address 737 Polar bear Lane

City Fraser State CO Zip Code 80442

Phone 970-710-0242

Your relationship to injured party: Patrol 1 chair ahead.

Did you see the incident occur? ☒ Yes ☐ No

Please describe what you know about the incident: My chair started
an up and down swing around tower 3. About 1/2
way to tower 3 I heard a "thunk" and felt a rattle through
the line. I turned around to see 3 people falling
and chairs behind with a horizontal swing.
1 person (child) landed on the adult. This child was

Comments by injured party at scene: _____

Are you a Granby Ranch Employee? ☒ Yes ☐ No

I ACKNOWLEDGE THAT THE ABOVE INFORMATION IS CORRECT.

Signature of Witness

12-29-16

Date

57

PATRICK

Tower 3??

TOK STATEMENT when at Top

Additional space for comments: The only person to move following the fall. ~~For~~ I immediately radioed Dispatch about the fall and my chair lowered the bar on our chair #57. The chair which suffered the fall was #58. Shortly after patrol arrived on scene several passers by stopped and began rendering aid in the mean time.

Upon arriving at the top, I took statements from the witnesses (4 chairs behind #58) ~~and~~

(x) 
Signature of Mountain Patroller

12-29-16
Date

Granby Ranch Witness Statement Card



Name Katharine Aarnio Date 12/29/16 Time _____

Street Address 7608 Lebron Ct

City Lone Tree State CO Zip Code 80129

Phone 303.703.4473

Your relationship to injured party: _____

Did you see the incident occur? ☒ Yes ☐ No

Please describe what you know about the incident: _____

#60
As we were coming up we started to bounce
that turned into heavy swaying back + forth.
we had our hair down. It was an experience
I never felt; such swaying we almost hit
the post prior to the accident & location

Comments by injured party at scene: _____

Are you a Granby Ranch Employee? ☐ Yes ☒ No

I ACKNOWLEDGE THAT THE ABOVE INFORMATION IS CORRECT.

(x) K Aarnio
Signature of Witness

12/29/16
Date

Additional space for comments: We were chair 60
I looked up and commented on chair
59 was not sure if they started the
swaying but it was so drastic my husband
said no. I then commented on how
the swaying moved to chair 58 as
well and then ~~we~~ I saw them hit
the pole and then they fell to the
ground. We all started to scream for
help.

(x)
Signature of Mountain Patroller

Date

Granby Ranch Witness Statement Card



Name BRETT AARNIO Date 12/29/16 Time 10:00
Street Address 7668 LEBRON CT
City LOVE TREE State CO Zip Code 80124
Phone 303 703 4473 CELL = 303 669 7565
Your relationship to injured party: N/A (2 CHAIRS BEHIND)

Did you see the incident occur? ☒ Yes ☐ No

Please describe what you know about the incident: _____

3 CHAIRS (AT LEAST) SEVERELY SWAYING.
1ST CHAIR HIT THE POLE AND THE PEOPLE FELL
OUT. WE WERE CLOSE ENOUGH TO OUR
POLE THAT OUR GEAR MADE CONTACT
BUT NOT OUR CHAIR (#60)

Comments by injured party at scene: WE HEARD
SCREAMING

Are you a Granby Ranch Employee? ☐ Yes ☒ No

I ACKNOWLEDGE THAT THE ABOVE INFORMATION IS CORRECT.

(x) Brett Aarnio 12/29/16
Signature of Witness Date

Chair
#60
swinging



Granby Ranch Mountain Patrol - Contact/Refusal of Care Card

Date 12/11 Time of Incident 9:45 Age 25 ☒ Male ☐ Female

Name Rory Jones Height _____

Street Address 600 Franklin Ave Apt 212 Weight _____

City Albany State TX Zip Code 76701

Phone 254/931-6686 Occupation Student

Statement: On lift directly behind 3 that fell
the lift before there was the chair hit, our chair began
swinging around violently. Our chair went at least
30° to parallel and we missed the beam by about
a yard and a half/two yards. Our chair stopped after

Equipment: ☐ Alpine ☐ Snowboard ☐ Nordic/Telemark

☐ Rental # _____ ☐ Other Rental ☐ Borrowed ☐ Owned

Bindings Released? Left: ☐ Yes ☐ No Right: ☐ Yes ☐ No

I ACKNOWLEDGE THAT THE ABOVE INFORMATION IS CORRECT

cc Rory Jones
Signature of Rider or Guardian

12/14/14

Continued on back

Chair
59

Refusal of Care. I hereby acknowledge that I am refusing to allow the Granby Ranch Mountain Patrol to give me medical treatment and/or transportation to the first aid facility.

(x)

Signature of Rider (or guardian)

Date

Incident Location: _____

Lift Involved: _____ ☐ Top ☐ Bottom **Operator:** _____

Ski School Instructor: _____ **Type of Class:** _____

Patroller comments: the bar. About 5/10 seconds later, the chair in front of us started shaking, not more violently. With bar up, their chair hit the beam and all three girls fell directly down. The smallest girl on the right landed partially on the woman to her immediate left. The girl on the far left fell

Snow Conditions: ☐ powder ☐ packed ☐ hard ☐ soft and landed on her left side. The girl who had landed on the larger
☐ corn ☐ heavy ☐ variable
Visibility: ☐ fair ☐ overcast ☐ fog ☐ snowing ☐ raining

I ACKNOWLEDGE THAT THE ABOVE INFORMATION IS CORRECT. woman sat up after landing but the other two did not move. After that

(x)

Signature of Mountain Patroller

we yelled at her to stay down and yelled at everyone to find her & stop the lift.

ZACH PAPPAS

CELL: (678) 327-9239

~~DUR~~

CHAIR WAS SWAYING BACK AND FORTH. WE ALMOST CAME OFF THE TRACK BUT WE STAYED ON BUT CAME WITHIN INCHES OF THE POST. IT TRANSFERRED FROM US TO THE CHAIR IN FRONT OF US. CHAIR (58) THEIRS WAS SWAYING INCREDIBLY HARD AND HIT THE POST.

ALL 3 OF THE GIRLS FELL OFF THE LIFT. ALL 3 FELL APPROXIMATELY 50 FT. DOWN AND HIT DIRECTLY ON THEIR HEADS.

PLEASE LET ME KNOW IF THEY'RE OKAY.

57

Granby Ranch Witness Statement Card



Name Joshua Lewis-Martin Date 12-29-16 Time 10:22am

Street Address 3726 Wonderland Hill Ave

City Boulder State CO Zip Code 80304

Phone 303-878-6692 Amanda (mom)

Your relationship to injured party: none

Did you see the incident occur? ☐ Yes ☒ No

Please describe what you know about the incident: I saw the
chair swinging wildly (there were two,
the second one as bench I kept on going
and then I heard people saying "Somebody
Fell off the lift!" I took off my skis and
saw, then came down to tell ski patrol.

Comments by injured party at scene: _____

Are you a Granby Ranch Employee? ☐ Yes ☒ No

I ACKNOWLEDGE THAT THE ABOVE INFORMATION IS CORRECT.

(x) Dustin Smith
Signature of Witness

12-29-16
Date

Additional space for comments: _____

(x) *Ami Nolt*
Signature of Mountain Patroller

12-29-16
Date

Granby Ranch Witness Statement Card



Name Taha Zahra Date 12/29/16 Time 10:30am
Street Address 415 E pine st apt 704
City Orlando State FL Zip Code 32801
Phone 786-206-6994

Your relationship to injured party: witness

Did you see the incident occur? ☒ Yes ☐ No

Please describe what you know about the incident:

Did not see initial cause of fall - saw 3 females in midair before
making impact with ground

Comments by injured party at scene: mother - PEA arrest on arrival
started CPR until first responders
arrived
other 2 girls with wrist appeared to be broken - extremely
poss back
both AIO x3

Are you a Granby Ranch Employee? ☐ Yes ☒ No

I ACKNOWLEDGE THAT THE ABOVE INFORMATION IS CORRECT.

(x) [Signature]
Signature of Witness

12/29/16
Date

Additional space for comments:

EMT did not arrive until late → when they did
no epi to give

Woman had no chance to receive cardiac
arrest without epi at that point - SAD!

Not sure how to do things. I am an MD
internal medicine - second that we should have
been able to save the man if
EMT could be there sooner to
get Epinephrine for BP support

(x)

Signature of Mountain Patroller

Date

Granby Ranch Witness Statement Card



Name Sue Haugen Date 12-29-16 Time

Street Address 932 Gardonyx Dr.

City Jefferson City State MO Zip Code 65109

Phone 573-238-8651

Your relationship to injured party: none

Did you see the incident occur? ☒ Yes ☐ No

Please describe what you know about the incident: A
chair tipped + all 3 fell from
chair, then didn't move.

Comments by injured party at scene: only concern for
her mother + p broken leg

Are you a Granby Ranch Employee? ☐ Yes ☒ No

I ACKNOWLEDGE THAT THE ABOVE INFORMATION IS CORRECT.

(K) [Signature]
Signature of Witness

12-29-16
Date

Granby Ranch Witness Statement Card



Name Lana Zerrer Date 12-29 Time

Street Address 500 Westwood Ave.

City Columbia State MD Zip Code 21043

Phone 573-823-6500

Your relationship to injured party: None, bystander

Did you see the incident occur? ☐ Yes ☒ No

Please describe what you know about the incident:

Heard screaming, looked over and saw 3 people
on ground below lift. Ran over. Adult female
unresponsive. Female children both awake, complaining
of pain in back and legs. Taylor's helmet
cracked in multiple places.

Comments by injured party at scene:

Are you a Granby Ranch Employee? ☐ Yes ☒ No

I ACKNOWLEDGE THAT THE ABOVE INFORMATION IS CORRECT.

(x) [Signature] 12-29-16
Signature of Witness Date

Granby Ranch Witness Statement Card

PARAMEDIC



Name Andrew Bowes Date 12-29 Time _____

Street Address 3737 E. 65th St

City Indianapolis State IN Zip Code _____

Phone 317 491-5390

Your relationship to injured party: NONE

Did you see the incident occur? ☐ Yes ☐ No

Please describe what you know about the incident: _____

ASSISTED IN MEDICAL CARE
ON QUICK DRAW LEFT INCIDENT.

Comments by injured party at scene: _____

Are you a Granby Ranch Employee? ☐ Yes ☐ No

I ACKNOWLEDGE THAT THE ABOVE INFORMATION IS CORRECT.

(x) Andrew Bowes 12-29-16
Signature of Witness Date

Granby Ranch Witness Statement Card

Name John Huseby Date 12/29 Time 1030AStreet Address 6450 SW 82 STCity MIAMI State FL Zip Code 33143Phone 305 - 761-2347Your relationship to injured party: N/ADid you see the incident occur? ☐ Yes ☒ No

Please describe what you know about the incident: I WAS FIRST
ON SCENE. HEARD THE FALL SAW THEM ON GROUND
UNCLIPPED MY BOARD AND RAN TO THEM. NOTICED
TWO YOUNG GIRLS WERE MOVING/RESPONSIVE. MOTHER
WAS NOT. WEA W/ MY GIRLFRIEND TALIA WAS
WITH ME FROM BEGINNING. A MAN AND WOMAN

Comments by injured party at scene: MY BACK HURTS, MY LEG
HURTS, IS MY MOM OK? IS MY SISTER OK? AM

Are you a Granby Ranch Employee? ☐ Yes ☒ No I ALIVE??

I ACKNOWLEDGE THAT THE ABOVE INFORMATION IS CORRECT.

(x) [Signature]
Signature of Witness12/28/16
Date

Additional space for comments: ARRIVED A MINUTE OR SO
AFTER TALIA AND I. WE NOTICED THE WOMAN HAD
~~NO~~ PULSE SO WE TURNED HER OVER AND
BEGAN CPR. MEDICAL PERSONEL FROM MOUNTAIN
ARRIVED ABOUT 5 MINUTES AFTER AT
THAT POINT ~~WAS~~ ~~THE~~ ~~WOMAN~~ I TRIED
TO CALM ASHLEY DOWN....

(x) 1
Signature of Mountain Patroller

Date

720-320-6711



Granby Ranch Mountain Patrol - Contact/Refusal of Care Card

Date 12/27/16 Time of Incident _____ Age 45 ☒ Male ☐ Female
Name Glenn Samuels Height 5'8"
(Please Print)

Street Address 12148 Elton Way Weight _____
City Parker State CO Zip Code 80138
Phone _____ Occupation CEO

Statement: Lift started swinging drastically. At least
45° angles The people in front of us hit the pole and
Fell off. The lift operator kept start & stopping
the lift.

Equipment: ☐ Alpine ☐ Snowboard ☐ Nordic/Telemark
☐ Rental # _____ ☐ Other Rental ☐ Borrowed ☐ Owned
Bindings Release? Left: ☐ Yes ☐ No Right: ☐ Yes ☐ No

I ACKNOWLEDGE THAT THE ABOVE INFORMATION IS CORRECT.

(x) [Signature]
Signature of Rider (or guardian)

12-27-16
Date

#59

Refusal of Care: I hereby acknowledge that I am refusing to allow the
Granby Branch Mountain Patrol to give me medical treatment and/or
transportation to the nearest medical facility.

Name: _____
Address: _____
City: _____

Incident Location: Man 34 Mt @ Granby

Lift Involved: _____ ☐ Top ☐ Bottom Operator: _____

Ski School Instructor: _____ Type of Class: _____

Patroller comments: _____

Snow Conditions: ☐ Excellent ☐ Good ☐ Fair ☐ Poor

_____ ☐ Wind ☐ Heavy ☐ Variable

Visibility: ☐ Clear ☐ Overcast ☐ Fog ☐ Snowing ☐ Hailing

I HEREBY CERTIFY THAT THE ABOVE INFORMATION IS CORRECT

Signature: _____
Date: _____

Name Etham, S	Phone # 3037923769
Samantha S. Sister	720-525-8644
Gage D.	970-488-9556
Cisco M.	(925) 784 8505
Clint H.	719 246 7462
Evan B.	(719)-930-7205
Steve Blubayh	719-805-1643
Kaitlyn Hatt	(762) 333-3108
Allen M	303 907 3667
Tim Pless	281-788-8552

Chair lift stopped & started, then chair
 started a side to side swing that increased
 the angle of swing until it struck the tower
 and unloaded the skiers. Steve Blubayh



STATE OF
COLORADO

Smith - DORA, Lawrence [REDACTED]

Granby Ranch Accident

From: Marco Aieta [REDACTED]
Sent: Saturday, December 31, 2016 8:45 AM
To: 'dora_tramwayboard@state.co.us'
Cc: 'Jennifer Aieta'
Subject: Granby Ranch Accident

We own a place at Granby Ranch and were at the ski area the week before the accident. We raised concerns about the lift operation as it was much different than in years past. I mentioned it to a Granby Ranch official and my wife also talked with one of the mechanics that was there to work on the lift. The intense, hi amplitude swinging and bounce was way out of the ordinary and appeared to be a change in operational procedure to speed skier transport. If you would like to discuss further, please contact me. Both my wife and I are registered engineers in the State of Colorado. Thanks!

E. Marco Aieta PHD, PE, BCEE

Executive Vice President

ACE Engineering LLC

2420 Ginny Way

Lafayette, CO 80026

Mobile: [303-489-1564](tel:303-489-1564)



Appendix L

BEFORE THE COLORADO PASSENGER TRAMWAY SAFETY BOARD
STATE OF COLORADO

Case No. 2017-97

AMENDED NON-DISCIPLINARY INTERIM OPERATION AGREEMENT

IN THE MATTER OF THE LICENSE TO OPERATE THE QUICK DRAW
EXPRESS PASSENGER TRAMWAY LIFT (LICENSE NO. TRM.OSC-008)
BY SKI GRANBY RANCH,

Operator

IT IS HEREBY STIPULATED and agreed by and between Colorado Passenger Tramway Board ("Board") and Ski Granby Ranch ("Operator") (collectively, "parties"), as follows:

1. Operator was licensed to operate the Quick Draw Express passenger tramway lift ("lift") in the state of Colorado on June 18, 1999 and was issued license number TRM OSC-008, which Operator has held continuously since that date. The lift is a Leitner-Poma detachable quad chair lift.

2. The Board has jurisdiction over Operator and over the subject matter of this Amended Non-Disciplinary Interim Operation Agreement ("Amended Agreement").

3. On December 30, 2016, the Colorado Department of Regulatory Agencies ("DORA") received written information from the Operator indicating that, on December 29, 2016, three individuals fell from the lift, including a forty-year-old woman, a twelve-year-old girl, and a nine-year-old girl (the "incident"). The written statement further stated that the forty-year-old woman was pronounced dead at the Middle Park Medical Center on December 29, 2016. It was later learned that the two juvenile girls were injured as a result of the fall. The written notice further stated:

Granby Ranch voluntarily shut the lift down after running the lift to remove all the remaining passengers from the lift. We agree to keep the lift shut down until the inspector [sic] Larry Smith from CPTSB, deems the lift safe to operate for the public and gives us permission to reopen.

4. By its December 30, 2016 letter and based upon the information and the totality of the circumstances, Operator entered into an agreement for

Operator to cease operation of the lift until Operator received approval to operate the lift from the Board or Larry Smith.

5. DORA, on behalf of the Board, initiated an investigation of the incident and its cause on December 30, 2017, including on-scene testing, interviews, and meetings among engineers and the investigative team. The investigation revealed that Chair #58 on the lift struck support tower number five and the occupants were ejected or fell from that chair. The occupants fell approximately twenty-five feet onto hard-packed snow. Operator's Ski Patrol and Grand County Emergency Medical Services responded. Investigations into the incident were conducted by the Board, Operator, the Granby Police Department, the Grand County Sheriff's Department, and the Grand County Coroner's Office. The circumstances indicated that environmental factors, weather, and the occupants of Chair #58 did not contribute to the cause of the incident.

6. Engineers involved in the Board investigation of the cause of the incident identified issues within the chairlift's electrical drive/control system that contributed to a rare dynamic event that occurred on the lift at the time of the incident. The preliminary determination by the engineers involved in the investigation indicates that the lift's diesel prime mover is currently capable of operating the chairlift.

7. The facts of the incident show that, on December 29, 2016, an unreasonable hazard existed in the continued operation of the lift. The Board and the Supervisory Tramway Engineer, Larry Smith, had and continue to have authority to order an emergency shutdown of the lift under section 25-5-716, C.R.S. Operator voluntarily shut down the lift in lieu of an emergency shutdown order.

8. On January 4, 2017, the Board convened a special meeting to:
(a) review materials relating to the incident, including information from an ongoing investigation of the incident by the Granby Police Department and materials contained in records of the ongoing administrative investigation of the incident by DORA; and (b) consider a request by Operator to reopen the lift. After discussion, the Board moved to table further consideration of the incident pending additional information.

9. On January 6, 2017, the Granby Police Department issued a public fact sheet summarizing its investigation of the incident.

10. At a special meeting on January 9, 2017, the Board authorized the parties to enter into the Agreement for Operator to resume operating the lift under specific conditions and limitations.

11. Effective January 9, 2017, the Board and the Operator entered into a Non-Disciplinary Interim Operation Agreement ("Agreement").

12. The Operator reopened the lift for transportation of passengers on January 10, 2017 in accordance with the Agreement.

13. On January 18, 2017, the Operator observed dynamic action in the lift, voluntarily shut down the lift, and contacted Supervisory Tramway Engineer.

14. On the morning of January 19, 2017, the Supervisory Tramway Engineer appeared at the lift and the area submitted a Voluntary Shut Down form. The Supervisory Tramway Engineer conducted an investigation into the condition and operation of the lift.

15. On January 20, 2017, the Board convened a special meeting to consider the current lift condition and operation. The Board authorized the parties to enter into this Amended Agreement for Operator to resume operating the lift under specific conditions and limitations.

16. Operator agrees that the lift will remain closed to the public until this Amended Agreement is fully executed by both parties. Operator agrees that, upon reopening, Operator will only operate the lift according to the following specific conditions and limitations while this Amended Agreement is in effect:

a. Operator will continue to leave the lift disconnected from the electrical drive. Operator will continue to operate the lift with the diesel prime mover only.

b. Operator shall take appropriate measures to mechanically modify the lift to stabilize and remove dynamics from the lift. The Operator shall not reopen the lift for public passenger transportation unless and until the lift is subject to and passes dynamic acceptance testing and inspection to the satisfaction of an inspector employed by the Board. Such dynamic acceptance testing and inspection shall include partial loadings and full (*i.e.*, 110%) loadings.

c. Operator will increase surveillance and inspection of the lift.

i. Lift mechanics will visually inspect the entire lift, from base terminal to top terminal, on their way up to the drive station via snowmobile (top drive).

ii. Lift mechanics will visually inspect the top terminal, power the lift, supervise the operational pre-operation checks, and ride the entire line in both directions.

iii. Operator's Ski Patrol personnel and top operator will ride the up-side line together as a part of the pre-operational inspection.

iv. The results of both the lift mechanics' visual inspection and the Ski Patrol visual inspection, including any irregular operating conditions of the lift, will immediately be reported to Patrol Dispatch. Patrol Dispatch shall record and retain the results of all visual inspections.

d. Operator's Ski Patrol personnel will conduct a supplemental lift operating "Line Check" protocol.

e. The rated capacity of the diesel motor is 900 feet per minute. Operator will operate the lift at speeds within operational capacity and below state-approved maximums:

i. Up to 600 feet per minute for two days after reopening the lift;

ii. Up to but not more than 700 feet per minute beginning on the third day after reopening the lift and continuing thereafter as conditions allow.

f. Operator shall appoint trained and qualified individuals to establish and perform routine visual ground checkpoints that will provide a complete lift inspection from top to bottom. In addition, Operator shall appoint trained and qualified individuals to ride the lift from top to bottom. The inspections set forth in this paragraph shall observe the physical condition and operation of the lift, including but not limited to noting any irregularities in line dynamics. Lift maintenance personnel will perform these inspections and report observations to patrol dispatch. Patrol dispatch will record and retain the findings of those inspections. Ground inspections and ride checks required by this paragraph shall be conducted daily during regular lift operations at 11:00 a.m., 1:00 p.m., 3:00 p.m., 5:00 p.m., and 7:00 p.m.

g. Upon finding any irregular conditions or operation of the lift, Operator shall immediately and safely slow and shut down the lift,

evacuate all passengers from the lift, and immediately report such irregular conditions or operation directly to the Supervisory Tramway Engineer and the Board.

17. Operator denies any and all allegations of any violation of Part 7 of Article 5 of Title 25, C.R.S. (the "Act")

18. This Agreement shall remain in effect until such time as the parties reach a final disposition of this case or, in the event summary suspension proceedings are initiated, an order for summary suspension enters.

19. The Board agrees that it will not institute summary suspension proceedings while this Amended Agreement is in effect so long as Operator remains in compliance with this Amended Agreement and so long as the Board does not learn of new information that would indicate that summary suspension is warranted.

20. Nothing in this Amended Agreement shall constitute disciplinary action, a finding that Operator has engaged in any act or omission constituting grounds for disciplinary action under the Act, or any admission by Operator that it has engaged in any act or omission constituting grounds for disciplinary action under the Act. There have been no final determinations regarding Operator's acts or omissions relating to the incident or any cause thereof. Nothing in this Amended Agreement shall constitute final action, as defined in section 24-4-102(1), C.R.S.

21. Nothing in this Amended Agreement shall preclude the Board or the Supervisory Tramway Engineer from initiating disciplinary action or taking other action pursuant to the Act, specifically including without limitation, sections 25-5-706, -707, -708, -715, and -716, C.R.S., or issuing a final agency order while this Amended Agreement is in effect.

22. Operator understands that Operator has the right to be represented by counsel of Operator's choice in this matter. Operator is represented by counsel in this matter.

23. The terms of this Amended Agreement were mutually negotiated and determined by the parties.

24. The parties acknowledge that they understand the legal consequences of this Amended Agreement, that the parties enter into this Amended Agreement voluntarily, and that the parties agree that no term or condition of this Amended Agreement is unconscionable.

25. This Agreement and all its terms constitute a valid Board order for purposes of section 25-5-707, C.R.S.

26. Invalidation of any portion of this Amended Agreement by judgment or court order shall in no way affect any other provision, which provision shall remain in full force and effect.

27. This Agreement shall be effective upon signature by Operator or its duly authorized agent.

28. This Agreement constitutes the entire agreement between the parties, and there are no other agreements or promises, written or oral, which modify, interpret, construe or affect this Amended Agreement.

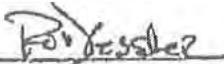
29. All costs and expenses incurred by Operator to comply with this Amended Agreement shall be the sole responsibility of Operator, and shall in no way be the obligation of the Board.

30. Upon becoming effective, this Amended Agreement shall be open to public inspection and shall be publicized pursuant to the Board's standard policies and procedures.

31. The Board delegates full authority to the undersigned to execute this Amended Agreement on behalf of the Board.

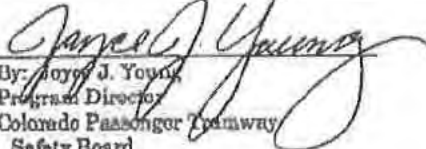
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OPERATOR

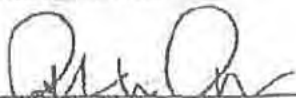

Rod Kessler
Vice President of Operations and
Chief Operating Officer
Granby Ranch Amenities, LLC d/b/a Ski
Granby Ranch
1000 Village Road
Granby, Colorado 80446

Signed and effective this 24th day of
January 2017.

**COLORADO PASSENGER
TRAMWAY SAFETY BOARD**

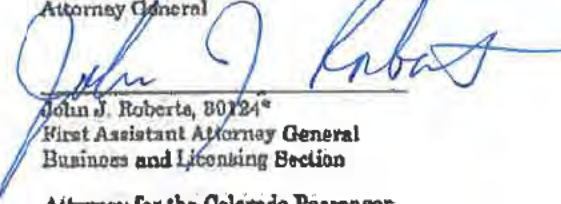

By: Joyce J. Young,
Program Director
Colorado Passenger Tramway
Safety Board
1500 Broadway, Suite 1370
Denver, Colorado 80202
Approved this 25th day of
January 2017.

**APPROVED AS TO FORM:
THE RIETZ LAW FIRM**


Peter W. Rietz, 15042
P.O. Box 5268
114 Village Place, Suite 301
Dillon, Colorado 80435
Telephone: 970-468-0210

Attorney for Operator Ski Granby Ranch

**CYNTHIA H. COFFMAN
Attorney General**


John J. Roberts, 80124*
First Assistant Attorney General
Business and Licensing Section

Attorney for the Colorado Passenger
Tramway Safety Board

Colorado Department of Law
Office of the Attorney General
Business and Licensing Section
1300 Broadway, 10th Floor
Denver, Colorado 80203
Telephone: 720-508-6434
*Counsel of Record

Appendix

M

August 18, 2016

Hello Nicki, this is my response letter for the summer unannounced inspection held on August 7, 2016 by Bruce Allen. On the Quick Draw(SC-008)

SC-008 (QUICK DRAW EXPRESS)

A. Bottom Terminal

1) 3.3.3.1 – General.

Relabel the bottom Tower Test switch located on the inside control door. *New label installed. Reference work order attached.*

2) Comment.

The gearbox lubrication pump sounds rough. (Maintenance staff acknowledged that the pump has sounded bad, but will verify the pump is ok for continued use. A backup pump is available as needed.) *Gearbox lubrication pump operation checked. Reference work order attached.*

B. Line

No deficiencies observed by Inspector.

C. Top Terminal

No deficiencies observed by Inspector.

D. Record Keeping

No deficiencies observed by Inspector.

E. General Deficiencies

No deficiencies observed by Inspector.

All deficiencies have been remedied.

Sincerely,



Blaine Faulkner

Lift Maintenance Supervisor

NON - SCHEDULED WORK ORDER

Work Order #: 0817-1

MECHANICAL

ISSUE DATE: 8/17/2016

Lift Maintenance Department

COMPONENT CODE: 111

LIFT: SC08 Quick Draw

REPORTED BY: inspector

PROBLEM: RELABEL BOTTOM TOWER TEST INSIDE CONTROLS.

ACTION TAKEN: CREATED A NEW LABEL AND
INSTALLED.

NOTE: WHEN PERFORMING MAINTENANCE, ALWAYS REFER TO THE MANUFACTURERS MANUALS AS REQUIRED. ALSO, THINK ABOUT THE REQUIREMENTS FOR THE SAFE PERFORMANCE OF THESE PROCEDURES. THINK SAFE, WORK SAFE!

NAMES / TOTAL HOURS INVOLVED:

TECHNICIANS: ANDY BIRCH

HRS.

HELPERS: BLAINE FAWKNER

HRS.

OPERATORS:

HRS.

PARTS / MATERIALS USED:


COMMENTS: WORK ORDER COMPLETE

TECHNICIAN'S SIGNATURE:



DATE: 8-17-16

SUPERVISOR'S SIGNATURE:



DATE: 8-17-16

RECORD ENTERED

INITIAL

DATE:

NON - SCHEDULED WORK ORDER

Work Order #: 0817-2

MECHANICAL

ISSUE DATE: 8/17/2016

Lift Maintenance Department

LIFT: SC08 Quick Draw

COMPONENT CODE: 111

REPORTED BY: inspector

PROBLEM: THE GEARBOX LUBRICATION PUMP SOUNDS ROUGH.

ACTION TAKEN: MONITORED OIL PUMP. PUMPING
FULL PRESSURE AND FUNCTIONING AND
SOUNDING NORMAL.

NOTE: WHEN PERFORMING MAINTENANCE, ALWAYS REFER TO THE MANUFACTURERS MANUALS AS REQUIRED. ALSO, THINK ABOUT THE REQUIREMENTS FOR THE SAFE PERFORMANCE OF THESE PROCEDURES. THINK SAFE, WORK SAFE!

NAMES / TOTAL HOURS INVOLVED:

TECHNICIANS: BLAINE FAULKNER HRS.

HELPERS: ANDY BIRCH HRS.

OPERATORS: HRS.

PARTS / MATERIALS USED:

COMMENTS: WORK ORDER COMPLETE.

TECHNICIAN'S SIGNATURE:

Blaine Faulkner

DATE: 8-17-16

SUPERVISOR'S SIGNATURE:

Blaine Faulkner

DATE: 8-17-16

RECORD ENTERED

INITIAL

DATE: