Elevator Rope Investigation

part 1: Inspection from the machine room

Service Bulletins are directed specifically to elevator field personnel and will deal with the hands-on issues normally faced by the group. Whereas our Technical Bulletin series addresses cause-and-effect issues related to elevator ropes, the Service Bulletins will discuss the mechanics, or how-to's of wire rope usage.

The first Service Bulletin provides a guideline for investigating elevator problems believed to be wire rope related. Utilizing a common investigative procedure ensures the investigator (certified inspector, service mechanic, field sales representative) has covered all bases before leaving the job site. Following this outline may resolve many questions in the field. However, it should be noted that not all issues can be resolved quickly. In some cases the information gathered will be used by the wire rope manufacturer to aid in additional analysis.

Getting Started

Prior to beginning the inspection, conduct some preliminary groundwork. Documentation is very important for current and future traceability. Record:

- Job site and address
- Elevator car number(s)
- Number of floors serviced by the subject car(s)
- Type of hoist rope reeving, such as 2:1 Double Wrap
- Rope description, length and manufacturer's reel number, if known
- Customer purchase order number
- Date of rope installation
- Groove configuration of primary and secondary sheave, if applicable
- Previous service problems or car history, if available
- Nature of problem, providing as much detail as possible, including seemingly insignificant items

Tools Needed for Inspection

WW recommends the following tools for rope inspection and investigation.

- **Dial or digital gauge caliper** for measuring rope diameter
- **Lay paper (adding machine paper) and keel** for lay length measurements
- **Circumference tape** to measure drum diameter
- **Metal straightedge and feeler gauges** for determining groove depth
- **Level** to check drum balance
- **Chalk** for performing a slippage test
- **Magnet** to determine metallic content of throw off
- **Flashlight**
- **Groove gauges** to check groove contours
- **Torque wrench/pressure gauge**
- **Camera** for documentation purposes

In the Machine Rooms

Record Machine Plate Information

Before inspecting the ropes, note and record the information on the machine plate—rope requirements, car weight, etc. This information is very important in the event the elevator OEM needs to be contacted for clarification.

Modernization

Has the car undergone a modernization? If so, when and to what extent? If the car weight has increased as a result of a mod job, compare its new weight with that recorded on the machine plate. An increase in car weight may cause rope slippage, particularly if the new weight requires a change in rope specification (construction or grade) that has not yet been addressed. In the event the car has become heavier, contact the elevator OEM to verify the correct rope specification for the new weight of the car.

Observe Ropes in Operation

From the machine room, observe the ropes in operation. When investigating a wear problem, ask that the car be taken to the lobby. Typically, the worst area of wear is visible at the drive sheave when the

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car is in the lobby. To help in locating this section of wear when on top of the car, mark the ropes with chalk in this area while still in the machine room. As a reminder, always make sure the the car is clear before touching the ropes or any part of the elevator system.

Inspect the Drive Sheave

Using the sheave groove gauges, place the respective gauge into the first groove. Obviously, this needs to be in an area where the rope is not seated. Begin with the groove closest to the machine, and record this groove as Rope Groove 1. Hold the flashlight behind the gauge. If light passes beneath the gauge, a tight sheave condition is indicated. Light shining on either side of the gauge signals an oversized groove. Standard sheave gauges work best for U-grooves, but with a little practice can also be used with undercut U and progressive grooves.

To measure for differential groove depths, place a metal straightedge across the ropes at the drive sheave. Make sure the straightedge is a length which will not hinder its ability to properly indicate groove depths. The straightedge should sit nearly on all of the ropes without teetering or wobbling. A seesaw movement may signify differential groove depths. To verify the findings, measure the amount of space or clearance between the ropes and straightedge using the feeler gauges. Record the findings and mark the sheave and rope where the readings were taken. Move the car to rotate the drive sheave to a new section and repeat the procedure. If the findings are consistent with the first measurement, differential groove depths are present. If the readings are different, run the car through a few cycles and return to the original area on the sheave where the first reading was taken. Make sure that a different section of rope is in groove area to be remeasured. Remember, this area was marked with chalk and should be easy to locate. Using the straightedge and feeler gauges, run through the procedure a third time. If the findings verify the first test, a differential groove depth condition exists. If, however, the results are different from the first two readings, this points to a wire rope diameter problem requiring the attention of the manufacturer's engineering department.

Finally, place the level on top of the drive sheave to determine its horizontal alignment. Misaligned or skewed sheaves may cause unusual wear patterns, vibration and premature wire breakage. For more information on sheave groove conditions, please refer to Bethlehem Elevator Rope Technical Bulletins 7, 9, 10, 11, and 12.

Conduct a Slippage Test

To determine slippage, place the car at the top or bottom of the shaft. Using the straightedge and chalk, draw a straight line across the ropes, and also mark both sides of the sheave. Run the car through two complete cycles and measure the distance between the lines on the rope and the lines on the drum. If after operation the lines do not match as originally marked, the ropes are slipping. Record and report the findings. Refer the Bethlehem Elevator Technical Bulletin no. Four: Elevator Rope Slippage for further discussion.

Check for Proper D/d Ratios

Using the circumference tape, measure the drum to determine the D/d ratio. Keep in mind that the minimum D/d ratio required, per code, is 40:1.

Look for Signs of Throw-Off

Check the floor around the drive sheave for throw-off. Also look in the less obvious places where a broom cannot reach. Placing a piece of lay paper over the magnet, run the magnet through the debris. A high metallic content, which will be picked up by the magnet, is indicative of a number of problems, including tight sheaves, improper tensioning, and differential groove depths.

After completing these steps, the inspection may be moved to the car top. These investigative techniques will be reviewed in Service Bulletin 2.

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