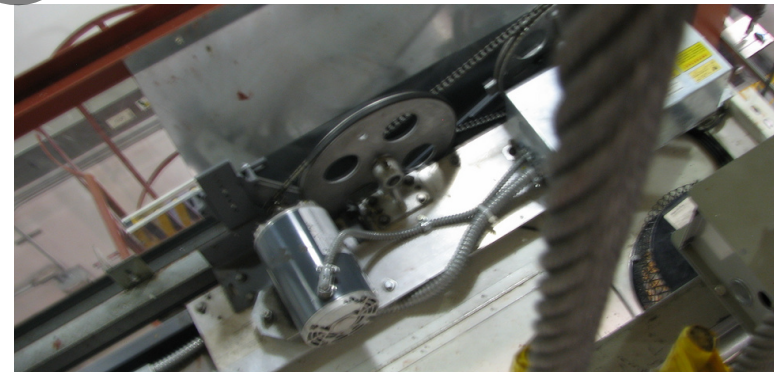
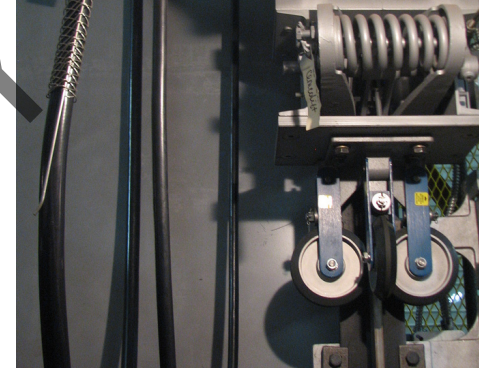


Instructor Guide



218: Elevator: Hydraulic Elevator Module 3: Control Systems

Elevator – Hydraulic Control Systems

Instructor's Guide



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PREVIEW ONLY

Elevator – Hydraulic Control Systems

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Icons Used In This Guide



REVIEW slides



ASK



CLASSROOM ACTIVITY



SMALL GROUP ACTIVITY



INDIVIDUAL ACTIVITY



WRITE



Multimedia



REFER participants to

Agenda

Topic #	Topic Title	Duration
1	Overview	30 minutes
2	Systems Operation	60 minutes
3	Selector Controllers	20 minutes
4	Door Controllers	20 minutes
5	Traveling Cables	20 minutes
6	Drive Control	30 Minutes
7	Hoistway Safety Devices	30 minutes
8	Summary	30 Minutes
9	Related Field Trips	180 Minutes
	Total Time:	420 Minutes

Elevator – Hydraulic Control Systems

Instructor's Guide



Overview

Purpose The purpose of this module is to:

- The purpose of this unit is to explain and discuss the foundation of control systems in transit hydraulic elevator systems. The key concepts discussed will aid the trainee in their future applications of elevator concepts and terminology.

Objectives

At the end of this lesson, the transit elevator/escalator trainee will be able to:

- Identify the different types of control systems encountered in elevator systems
- Discuss methods of interfacing between elevator car and controller
- Explain purpose of traveling cable, (fastening, securing, looping)
- Identify control systems and associated components
- Name the associated safety circuit and safety devices
- Identify and describe types of selectors

Materials

Mandatory

Make sure you have the following

- PowerPoint Presentation
- Course book
- Quizzes
- Pencils
- Paper

Optional

You may also want the following for optional activities:



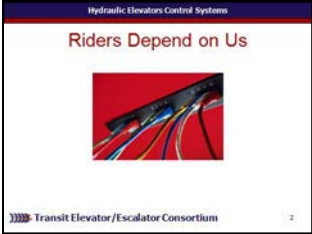
- Chalk board with chalk, large paper with marker, etc.
- Internet connection
- Lab, simulator or out of service elevator

Elevator – Hydraulic Control Systems

Instructor's Guide



Module Length: 420 min Time remaining: 420 min This section: 30 min (9 slides) Section start time: _____ Section End Time: _____

DO	SAY	Materials Needed
<div> REVIEW introduction slides</div> <div><h3>Instructor's Notes</h3><div></div><div></div><div></div><div></div><div></div><div></div></div>	<p>In your own words:</p> <p>Welcome to the control systems module for hydraulic elevators.</p> <p>Advance.</p> <p>Riders depend on us, and the vast and complex electrical control system is the power behind every elevator component action and car movement.</p> <p>Advance.</p>	<p>✓ PPT slides 1, 2</p> <div></div> <div></div>

Elevator – Hydraulic Control Systems

Instructor's Guide



Module Length: 420 min Time remaining: 420 min This section: 30 min (9 slides) Section start time: _____ Section End Time: _____

DO	SAY	Materials Needed
<div></div> <div> <p>REVIEW module objectives</p> </div> <div> <h3>Instructor's Notes</h3> </div> <div> <hr/><hr/><hr/><hr/><hr/> </div>	<div> <h3>In your own words:</h3> </div> <div> <p>Today we will look at the basic control systems for hydraulic elevators. In doing so, we will...</p> </div> <div> <ul style="list-style-type: none"> -Identify control systems and associated components - Name the associated safety circuits - Describe the interaction of the safety circuits -Identify and describe types of selectors <p>Later on in course 214, we will examine control systems in greater detail.</p> </div> <div> <p>Advance.</p> </div>	<div> <p>✓PPT slide 3</p> </div> <div> </div>

Elevator – Hydraulic Control Systems

Instructor's Guide



Module Length: 420 min Time remaining: 420 min This section: 30 min (9 slides) Section start time: _____ Section End Time: _____


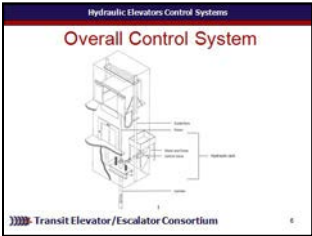
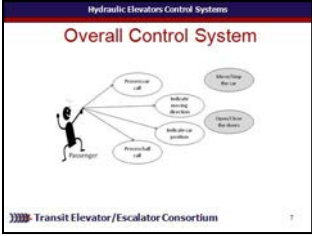
DO	SAY	Materials Needed
<div></div> <div> <p>REVIEW key terms</p> </div> <div> <h3>Instructor's Notes</h3> </div> <div> <hr/><hr/><hr/><hr/><hr/> </div>	<div> <h3>In your own words:</h3> </div> <div> <p>Lets take a look at some of the key words we will be defining as move through this module: Car operating panel, Control key switch, Control system, Controller, Door Close Limit Switch, Door controller, Door edge sensor, Door Open Limit Switch, Door zone switch, Down level switch,</p> </div> <div> <p>Advance.</p> </div> <div> <p>Floor switches, Hoistway Access Limit Switches, Input devices, Inspection key switch, Inspection service Position indicator (PI), Programmable Logic Control (PLC), Pump Unit</p> </div> <div> <p>Advance.</p> </div> <div> <p>Advance.</p> </div>	<div> <p>✓PPT slide 4</p> </div> <div> </div>

Elevator – Hydraulic Control Systems

Instructor's Guide



Module Length: 420 min Time remaining: 420 min This section: 30 min (9 slides) Section start time: _____ Section End Time: _____

DO	SAY	Materials Needed
<div> REVIEW slides</div> <div><h3>Instructor's Notes</h3><div></div><div></div><div></div><div></div><div></div><div></div></div>	<p>In your own words:</p> <p>You will recall from course 213 that hydraulic elevator lift systems include a hydraulic jack which is mounted in the hoistway pit and supports the elevator car. A pump unit supplies hydraulic fluid from a reservoir to the jack through a solenoid-operated valve that includes flow regulating pistons for selectively raising and lowering the car. Advance.</p> <p>You will recall as a passenger initiates elevator use, the control system also performs the function of receiving hall calls and car calls, dispatching the car to the appropriate floors, stopping the car level with the floor landings, and opening and closing the doors – all according to the passenger's input. Also part of the overall control system is the selector which senses the position of the elevator car in the hoistway and determines slowdown and stopping points. Advance.</p>	<p>✓ PPT slides 6, 7</p> <div></div> <div></div>

Elevator – Hydraulic Control Systems

Instructor's Guide



Module Length: 420 min Time remaining: 420 min This section: 30 min (9 slides) Section start time: _____ Section End Time: _____


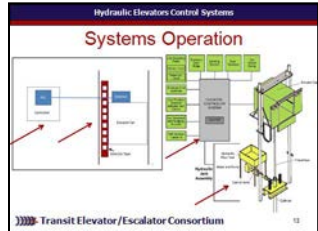
DO	SAY	Materials Needed
<div> </div> <div> <p>REVIEW slide</p> </div> <div> <h3>Instructor's Notes</h3> </div> <div> <hr/><hr/><hr/><hr/><hr/> </div>	<div> <p>In your own words:</p> </div> <div> <p>Traditionally, all of the control functions of a hydraulic elevator have been performed by relay circuitry centrally located in the machine room adjacent to the pump unit. Car position signals are provided by switches mounted at appropriate locations in the hatchway. The switches are actuated by cams mounted on the car and signals are brought to the controller by a hoistway riser also known as a <i>conduit</i>. But just like anything else, technology changes with time.</p> <p>Advance.</p> </div>	<div> <p>✓ PPT slide 8</p> </div> <div> </div>

Elevator – Hydraulic Control Systems

Instructor's Guide



Module Length: 420 min Time remaining: 390 min This section: 60 min (19 slides) Section start time: _____ Section End Time: _____



DO	SAY	Materials Needed
<div> REVIEW slides</div> <div><h3>Instructor's Notes</h3><div></div><div></div><div></div><div></div><div></div><div></div></div>	<p>In your own words:</p> <p>If a stop is requested at the target floor, the controller removes the run signal. If a stop is not issued the car continues to run, Advance, and the selector issues a late car refusal signal, at the last chance to stop, to the controller. The controller then advances the target floor and the process is repeated. If a stop has been requested at the target floor, the selector sends the interrupt signal at the slowdown point to the controller and the controller relinquishes control to the hydraulic control valve for leveling. Advance. Final leveling is then done by the control valve and the selector.</p> <p>Advance.</p>	<p>✓ PPT slide 13</p> <div></div>

Elevator – Hydraulic Control Systems

Instructor's Guide



Module Length: 420 min Time remaining: 390 min This section: 60 min (19 slides) Section start time: _____ Section End Time: _____

DO	SAY	Materials Needed
<div> REVIEW slide</div> <div><h3>Instructor's Notes</h3><div></div><div></div><div></div><div></div><div></div><div></div></div>	<p>In your own words:</p> <p>For inspection service, there are typically three means to control car movement: at the car top inspection station, by the hoistway access key switches, and inside the controller. Car movements initiated by the car top inspection station or by the hoistway key switches may be at either low or high speed and would disable the controller inspection switch. The controller may also be equipped with a low or full speed selection. Advance. Activating any of the run/stop switches to the stop position renders the car inoperative to hall calls. Advance. Turning the inspection switch to the “run” position will restore the car to automatic operation. Advance.</p>	<p>✓ PPT slide 19</p> <div></div>

Elevator – Hydraulic Control Systems

Instructor's Guide



Module Length: 420 min Time remaining: 390 min This section: 60 min (19 slides) Section start time: _____ Section End Time: _____


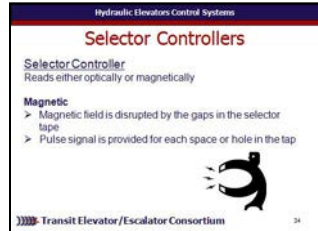

DO	SAY	Materials Needed
<div></div> <div> <p>REVIEW slide</p> </div> <div> <h3>Instructor's Notes</h3> </div> <div> <hr/><hr/><hr/><hr/><hr/> </div>	<div> <p>In your own words:</p> </div> <div> <p>At the same time it would be desirable from the standpoint of cost to minimize the number of dedicated terminals used by the PLC for input/output with peripheral devices, to perform control functions using minimum microprocessor capability, and to perform critical decision-making functions with a minimum of delay.</p> </div> <div> <p>Advance.</p> </div>	<div> <p>✓ PPT slide 21</p> </div> <div> </div>

Elevator – Hydraulic Control Systems

Instructor's Guide



Module Length: 420 min Time remaining: 270 min This section: 20 min (11 slides) Section start time: _____ Section End Time: _____

DO	SAY	Materials Needed
<div>  REVIEW slides </div> <div> <h3>Instructor's Notes</h3> <hr/><hr/><hr/><hr/><hr/><hr/> </div>	<div> <p>In your own words:</p> <p>For magnetic selectors, the magnetic field is disrupted by the gaps in the selector tape and a pulse signal is provided for each space or hole in the tape.</p> <p>Advance.</p> <p>And here is an magnetic selector controller by EECO.</p> <p>Advance.</p> </div>	<div> <p>✓ PPT slides 35, 36</p> </div> <div>  </div> <div>  </div>

Elevator – Hydraulic Control Systems

Instructor's Guide



Module Length: 420 min Time remaining: 250 min This section: 20 min (6 slides) Section start time: _____ Section End Time: _____


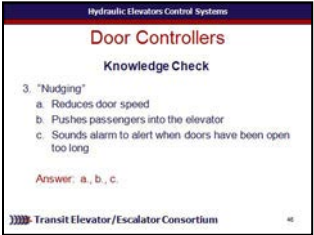
DO	SAY	Materials Needed
<div></div> <div> <p>REVIEW slide</p> </div> <div> <h3>Instructor's Notes</h3> </div> <div> <hr/><hr/><hr/><hr/><hr/> </div>	<div> <p>In your own words:</p> </div> <div> <p>Elevator doors are also equipped with an electronic door edge sensor installed Advance. along the edge of the elevator doors outside of the car door frame structure. Advance. The door edge sensor provides a full light curtain door protective system which does not rely on physical contact with, or the motion of, a person or object to inhibit door movement or initiate door reversal. The light curtain, shown in Figure 12, operates in the invisible light spectrum. Advance. Detection of an intrusion into the protected area causes the doors, if fully open, to be held in the open position and, if closing, to stop and reverse to the fully open position. Advance.</p> </div>	<div> <p>✓ PPT slide 42</p> </div> <div> </div>

Elevator – Hydraulic Control Systems

Instructor's Guide



Module Length: 420 min Time remaining: 250 min This section: 20 min (6 slides) Section start time: _____ Section End Time: _____

DO	SAY	Materials Needed
<div> ASK</div> <div>Instructor's Notes <hr/><hr/><hr/><hr/><hr/><hr/></div>	<p>In your own words:</p> <p>“Nudging”</p> <ul style="list-style-type: none">a. Reduces door speedb. Pushes passengers into the elevatorc. Sounds alarm to alert when doors have been open too long <p>Call on participants for answer.</p> <p>Advance for correct answer.</p> <p>Answer: a., c.</p> <p>Advance.</p>	<p>✓PPT slide 46</p> <div></div>

Elevator – Hydraulic Control Systems

Instructor's Guide



Module Length: 420 min Time remaining: 120 min This section: 30 min (13 slides) Section start time: _____ Section End Time: _____

DO	SAY	Materials Needed
<div></div> <div> <p>REVIEW slide</p> </div> <div> <h3>Instructor's Notes</h3> </div> <div> <hr/><hr/><hr/><hr/><hr/> </div>	<div> <h4>In your own words:</h4> </div> <div> <p>The safety circuit is Advance. a series circuit containing electrical contacts from safety devices so that, Advance. in the event of an unsafe condition, they send signals to the controller to stop the operation of the elevator. Advance. Within a hydraulic elevator system, safety devices consist of a series of switches to signal conditions affecting the floor, leveling, door, landing, and hoistway. Advance.</p> </div>	<div> <p>✓ PPT slide 60</p> </div> <div> </div>

Elevator – Hydraulic Control Systems

Instructor's Guide



Module Length: 420 min Time remaining: 120 min This section: 30 min (13 slides) Section start time: _____ Section End Time: _____

DO	SAY	Materials Needed
<div></div> <div> <p>REVIEW slide</p> </div> <div> <h3>Instructor's Notes</h3> </div> <div> <hr/><hr/><hr/><hr/><hr/> </div>	<div> <p>In your own words:</p> </div> <div> <p>Conditions (1) and (2) are required to change the floor relays and initiate slowdown. Condition (3) is required at the terminal landings, but is optional at the intermediate landings. Condition (4) is optional. There are many acceptable methods of providing the floor switch signals, such as by having a single Floor Switch at floor level, and an adjustable length cam on the car, or by having two Floor Switches per floor, and a fixed length cam on the car. The Floor Switches may be mounted on the car if they are in separate rows.</p> </div> <div> <p>Advance.</p> </div>	<div> <p>✓PPT slide 63</p> </div> <div> </div>

Elevator – Hydraulic Control Systems

Instructor's Guide



Module Length: 420 min Time remaining: 120 min This section: 30 min (13 slides) Section start time: _____ Section End Time: _____



DO	SAY	Materials Needed
<div></div> <div> <p>REVIEW slides</p> </div> <div> <h3>Instructor's Notes</h3> </div> <div> <hr/><hr/><hr/><hr/><hr/> </div>	<div> <p>In your own words:</p> </div> <div> <p>Leveling Switches include the up level switch and the down level switch.</p> </div> <div> <p>Advance. The Up Level Switch is a normally open contact that closes when the car is in the leveling zone below the floor, Advance. and the Down Level Switch is a normally open contact that closes when the car is in the leveling zone above the floor.</p> </div> <div> <p>Advance.</p> </div> <div> <p>The Door Zone Switch is a switch (or switches) Advance. activated by the leveling vane/target when the car is within 3" of floor level.</p> </div> <div> <p>Advance. If the leveling vane/target is 6" long, then only one switch is required, mounted between the Up and Down Leveling Switches, Advance. otherwise two switches wired in series should be provided.</p> </div> <div> <p>Advance.</p> </div>	<div> <p>✓ PPT slides 64, 65</p> </div> <div> </div> <div> </div>

Elevator – Hydraulic Control Systems

Instructor's Guide



Module Length: 420 min Time remaining: 120 min This section: 30 min (13 slides) Section start time: _____ Section End Time: _____

DO	SAY	Materials Needed
<div>  REVIEW slide </div> <div> <h3>Instructor's Notes</h3> <hr/><hr/><hr/><hr/><hr/> </div>	<p>In your own words:</p> <p>The Terminal Landing Normal Limit Switch Advance. is also known as a <i>Directional Limit Switch. Advance.</i> This is a normally closed contact that opens when the car has traveled 1" past floor level at a terminal landing. Advance. The car should not be on the Terminal Landing Normal Limit Switch when the car is floor level at the terminal landing. Advance. The Limit Switch will prevent the car from traveling further away from the normal area of car travel, but allows the car to run back towards the normal area of car travel. Advance.</p>	<p>✓PPT slide 66</p> <div>  </div>

Elevator – Hydraulic Control Systems

Instructor's Guide



Module Length: 420 min Time remaining: 120 min This section: 30 min (13 slides) Section start time: _____ Section End Time: _____



DO	SAY	Materials Needed
<div></div> <div> <p>REVIEW slide</p> </div> <div> <h3>Instructor's Notes</h3> </div> <div> <hr/><hr/><hr/><hr/><hr/> </div>	<div> <p>In your own words:</p> </div> <div> <p>The last two we will look at are the Door Open Limit Switches and the door close limit switches.</p> </div> <div> <p>Advance. The Door Open Limit Switch is open when the doors are fully open, and closed at all other times. It will de-energize the door open relays in the door operator when the doors have opened fully.</p> </div> <div> <p>Door Close Limit Switch</p> </div> <div> <p>Advance. The Door Close Limit Switch is open when the doors are fully closed, and closed at all other times. It will de-energize the door close relays in the door operator when the doors have closed fully.</p> </div> <div> <p>Advance.</p> </div>	<div> <p>✓PPT slide 69</p> </div> <div> </div>

Elevator – Hydraulic Control Systems

Instructor's Guide



Module Length: 420 minutes Time remaining: 90 minutes This section: 60 minutes Section start time: _____ Section End Time: _____


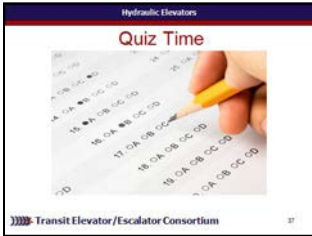
DO		SAY	Materials Needed
<div> CLASSROOM ACTIVITY</div> <div>Instructor's Notes <hr/><hr/><hr/><hr/><hr/><hr/></div>		<p>In your own words: Okay, now it's time to see how this works in the real world. Please get your stuff together for a trip to the lab. <i>[At instructor's discretion, take time to visit the field and look for various hydraulic elevator control systems and related information.]</i> Advance.</p>	<p>✓ PPT slide 73</p> <div></div>

Elevator – Hydraulic Control Systems

Instructor's Guide



Module Length: 420 min Time remaining: 30 min This section: 30 minutes (3 slides) Section start time: _____ Section End Time: _____

DO	SAY	Materials Needed
<div> CLASSROOM ACTIVITY</div> <div>Instructor's Notes</div> <div><hr/><hr/><hr/><hr/><hr/></div>	<p>In your own words:</p> <p><i>Administer quiz.</i></p>	<p>✓ PPT slide 76</p> <div></div>