Table of Contents

Icons Used In This Guide

REVIEW slides

INDIVIDUAL ACTIVITY

ASK

WRITE

CLASSROOM ACTIVITY

Multimedia

SMALL GROUP ACTIVITY

REFER participants to

Agenda

Topic #	Topic Title	Duration
1	Overview	10 minutes
2	Personal Protective Equipment	20 minutes
3	Electrical Hazards	15 minutes
4	Proper Lifting Techniques	20 Minutes
5	Working Around Hazardous Equip	20 Minutes
6	Securing Worksites	5 Minutes
7	Confined & Restricted Spaces	10 Minutes
8	MSDS	10 Minutes
9	Fire Service Safety & Shunts	15 Minutes
10	Field Trip	45 Minutes
11	Summary	10 Minutes
	Total Time:	10 Minutes

Overview

Purpose The purpose of this module is to:

- Provide the participant with a general knowledge and understanding of the safety regulations and procedures associated with elevator maintenance.

Objectives

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

- Describe general strategies to minimize workplace hazards and prevent workplace injuries.
- List Personal Protective Equipment that may be used to protect the eye, face, head, feet, hands/arms, bodies and hearing.
- Describe four types of injuries that may result from contact with electricity.
- Explain and demonstrate proper lifting techniques.
- Differentiate between confined and restricted space.
- Identify the types of information found on a Material Safety Data Sheet.
- Differentiate between the two phases of fire service emergency operations.

Materials

Mandatory Make sure you have the following

- PowerPoint Presentation
- Coursebook
- Quizzes
- Pencils
- Elevator Industry Field Employees' Safety Handbook

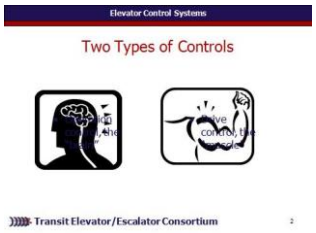
Optional You may also want the following for optional activities:

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

Elevator – Control Systems

Instructor's Guide

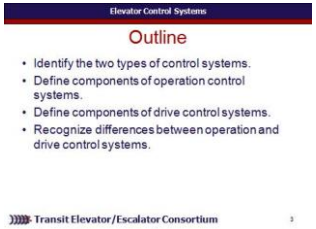
Module Length: 180 minutes Time remaining: 180 minutes This section: 15 minutes *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW introduction slides **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Welcome to the introductory module for electric traction and mrl elevators. ***Advance.*** Two types of controls in elevator systems: operation control (the "brain") and drive control (the "muscle") ***Advance.*** ***[Drawings appear after each text block.]*** ***Advance.***	✓PPT slides 1, 2  

Elevator – Control Systems

Instructor's Guide

Module Length: 180 minutes Time remaining: 180 minutes This section: 15 minutes *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW module objectives **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Today we will look at the principles of operation for hydraulic elevators. In doing so, we will… ***Advance for each objective.*** -Identify the two types of control systems. -Define components of operation control systems. -Define components of drive control systems. -Recognize differences between operation and drive control systems. ***Advance.***	✓PPT slide 3 

Module Length: 180 minutes Time remaining: 180 minutes This section: 15 minutes *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW key terms **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Lets take a look at some of the key words we will be defining as move through this module. Drive Control, Frequency drives, Line Voltage, Operation Control, Position Indicator, Programmable Logic Control (PLC), Relay Logic ***Advance.*** Safety, Safety Circuit, Safety Types: A, B, C, SCR, Selective Collective Operation, Selector, Variable Voltage ***Advance.***	✓PPT slide 4 

DO	SAY	Materials Needed
ASK participants what they remember about electric traction elevators	**In your own words:** Thinking back to course 200, what are some things you remember about elevator control systems? ***[Discuss student responses, if list them on a chalk board or similar.]*** ***Advance.***	✓PPT slide 5

Instructor's Notes

_____

_____

_____

_____

_____

Elevator – Control Systems

Instructor's Guide

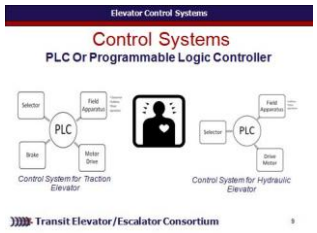
Module Length 180 minutes Time remaining: 165 minutes This section: 35 minutes *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW objective and slides	**In your own words:** Lets take another look at our first objective. Some of you may remember some of this already, but lets take another look at two types of control systems in elevators. ***Advance.***	✓PPT slides 6, 7
Instructor's Notes _____ _____ _____ _____ _____	Elevator control systems controls the movement of elevator. The functions of the control system include regulation of speed & direction, floor selection, braking, and the monitoring of safety circuits. ***Advance.***	 

Elevator – Control Systems

Instructor's Guide

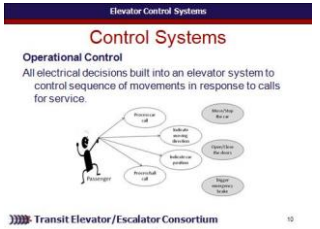
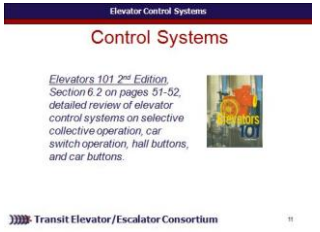
Module Length: 180 minutes Time remaining: 165 minutes This section: 35 minutes *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW slides **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Essentially there are two types of controls: operation and drive. **Operation control** may be characterized as the "brain" while **drive control** as the "muscle" controlling the motion of the elevator. Operational control includes components such as selector, brake, governor, safeties, and door operation. Drive control includes the drive motor. ***Advance.*** The **Program Logic Controller (PLC)** is the heart of the control system in a traction elevator and hydraulic elevator systems. The PLC controls all other objects in the system. ***[Review slide with participants.]*** ***Advance.***	✓PPT slides 8, 9  

Elevator – Control Systems

Instructor's Guide

Module Length: 180 minutes Time remaining: 165 minutes This section: 35 minutes *Section start time: _____* *Section End Time: _____*

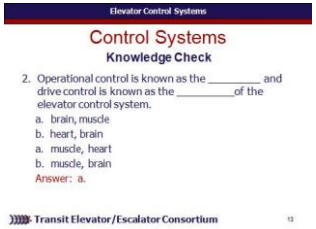
DO	SAY	Materials Needed
REVIEW slides **REFER** participants to Elevators 101 2nd Edition, Section 6.2 pages 51-52. **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** This diagram shows four electrical decisions that are relayed to the elevator control system when a passenger presses the call button for an elevator. At the back end of these four pieces of information, the elevator control system engages other electrical information such as to move or stop the car, open or close the doors, or even trigger the emergency brake. ***Advance.*** ***[Direct students to Elevators 101 2nd Edition, Section 6.2 on pages 51-52, gives a detailed review of elevator control systems on selective collective operation, car switch operation, hall buttons, and car buttons.]*** ***Advance.***	✓PPT slides 10, 11  

DO	SAY	Materials Needed
ASK **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Lets see what we have learned so far: Functions of the control system include: (check all that apply) a. Regulates speed. b. Monitors passenger conversation. a. Regulates direction. b. Monitors safety circuits. ***Call on students for answer.*** ***Advance for correct answer.*** Answer: a., c., d. ***Advance.***	✓PPT slide 12 

Elevator – Control Systems

Instructor's Guide

Module Length: 180 minutes Time remaining: 165 minutes This section: 35 minutes *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
ASK **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Operational control is known as the _____ and drive control is known as the _____of the elevator control system. a. brain, muscle b. heart, brain a. muscle, heart b. muscle, brain ***Call on students for answer.*** ***Advance for correct answer.*** Answer: a. ***Advance.***	✓PPT slide 13 

Elevator – Control Systems

Instructor's Guide

Module Length: 180 minutes Time remaining: 165 minutes This section: 35 minutes *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW objective and slides	**In your own words:** Next we will look at components of the operational part of the control system. ***Advance.*** Components of operational control include the controller, selector, governor, safeties, motor overloads, and brakes. ***Advance.***	✓PPT slides 14, 15

Instructor's Notes

_____

_____

_____

_____

_____

Elevator – Control Systems

Instructor's Guide

Module Length: 180 minutes Time remaining: 165 minutes This section: 35 minutes *Section start time: _____* *Section End Time: _____*

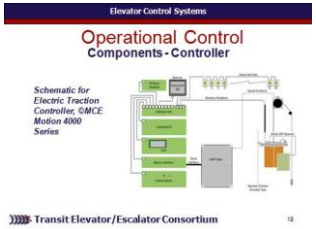
DO	SAY	Materials Needed
REVIEW slides	**In your own words:** Functions of the controller include **Advance** car movement, **Advance** car leveling, door movement, **Advance** safety circuit and controller computer monitoring, **Advance** car positioning indicator also known as PI, floor passing sound, car riding and hall direction lighting or lanterns, and car arrival gong. ***Advance.*** The controller also **Advance** checks for AC power loss or reversal, **Advance** monitors a safe elevator occupancy, and **Advance** in a hydraulic system monitors the hydraulic oil level according to car movement. ***Advance.***	✓PPT slides 16, 17

Instructor's Notes

Elevator – Control Systems

Instructor's Guide

Module Length: 180 minutes Time remaining: 165 minutes This section: 35 minutes *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
Review slides **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** The controller monitors and controls how the system is operating in each section of the elevator. It contains important information on elevator systems for use by trained elevator/escalator technicians and others. Typically controllers are represented schematically as here. ***Advance.*** This figure gives a schematic representation of all the functions of a controller system for a hydraulic elevator. For a better view, please look at course book page 56. ***Advance.***	✓PPT slides 18, 19  

DO	SAY	Materials Needed
Review slides **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Both electric traction and hydraulic elevators have controllers and they are typically located in the machine room. This photographs show controllers for an electric traction elevator. and for a hydraulic elevator (Figure 24) in a U.S. transit authority. ***Advance.*** This photographs show controllers for a hydraulic elevator in a U.S. transit authority. ***Advance.***	✓PPT slides 20, 21  

Elevator – Control Systems

Instructor's Guide

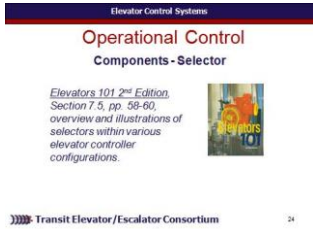
Module Length: 180 minutes Time remaining: 165 minutes This section: 35 minutes *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW slides **REFER** participants to Elevators 101 2nd Edition, Section 7.6 pages 60-65. **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** ***[Direct students to Elevators 101 2nd Edition, Section 7.6, pp. 60-65, gives overview and illustrations of elevator controllers.]*** ***Advance.*** The second major component of operation control systems is the **selector** which is an **Advance** electrical device, driven by the elevator, which simulates elevator movements. **Advance** It communicates information to the controller. **Advance** Zack McCain describes the selector "as a miniature elevator and perhaps (for older selectors) the most complicated part of the elevator system." **Advance** Selectors use both electrical and mechanical technology and **Advance** are connected to the elevator car by magnetic or steel tape. ***Advance.***	✓PPT slides 22, 23 

Elevator – Control Systems

Instructor's Guide

Module Length: 180 minutes Time remaining: 165 minutes This section: 35 minutes *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW slides **REFER** participants to Elevators 101 2nd Edition, Section 7.5 pages 58-60. **Instructor's Notes**	**In your own words:** ***[Direct students to Elevators 101 2nd Edition, Section 7.5, pp. 58-60, gives overview and illustrations of selectors within various elevator controller configurations.]*** ***Advance.*** The governor is a mechanical speed control mechanism that stops the elevator in an overspeed condition. ***Advance.***	✓PPT slides 24, 25  

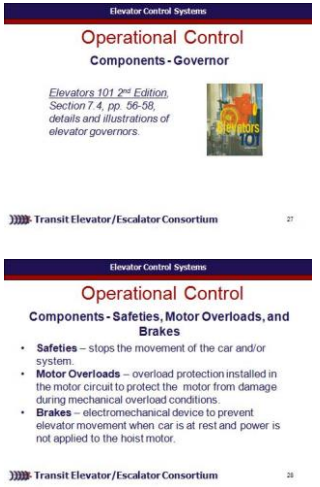
Elevator – Control Systems

Instructor's Guide

Module Length: 180 minutes Time remaining: 165 minutes This section: 35 minutes *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW slide **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** In the event of a traveling at a preset overspeed in the down direction ***Advance.*** A wire rope driven centrifugal device stops and hold movement of its' driving rope… ***Advance.*** And Initiates activation of car safety device by means of opening a switch and cutting off power to the drive motor and brake. In addition, some types of governors will also open the governor switch and cut off power to the drive motor and brake if the car overspeeds in the up direction. ***Advance.***	✓PPT slide 26 

Module Length: 180 minutes Time remaining: 165 minutes This section: 35 minutes *Section start time: _____* *Section End Time: _____*

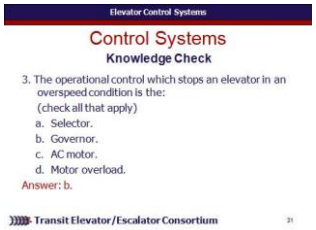
DO	SAY	Materials Needed
REVIEW slides **REFER** participants to Elevators 101 2nd Edition, Section 7.4 pages 56-58. **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** ***[Direct students to Elevators 101 2nd Edition, Section 7.4, pp. 56-58, gives details and illustrations of elevator governors.]*** ***Advance.*** Additional components of operational control include safeties, motor overloads, and brakes. Safeties will stop the movement of the car and/or system. Motor Overload is overload protection installed in the motor circuit to protect the motor from damage during mechanical overload conditions. Brakes are the electromechanical device to prevent elevator movement when car is at rest and power is not applied to the hoist motor. ***Advance.***	✓PPT slides 27, 28 

Module Length: 180 minutes Time remaining: 165 minutes This section: 35 minutes *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
ASK **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Lets see what we have learned so far. Controller components include: (check all that apply) a. Selector. b. Controller. c. AC motor. d. Brake. ***Call on students for answer.*** ***Advance for correct answer.*** Answer: a., b., d. ***Advance.***	✓PPT slide 29 

DO	SAY	Materials Needed
ASK **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Controller functions include: (check all that apply) a. Car leveling. b. Car movement. c. Monitors hydraulic oil level. d. Floor sweeping. ***Call on students for answer.*** ***Advance for correct answer.*** Answer: a., b., c. ***Advance.***	✓PPT slide 30 

Module Length: 180 minutes Time remaining: 165 minutes This section: 35 minutes *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
ASK **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** The operational control which stops an elevator in an overspeed condition is the: (check all that apply) a. Selector. b. Governor. c. AC motor. d. Motor overload. ***Call on students for answer.*** ***Call on students for answer.*** ***Advance for correct answer.*** Answer: b. ***Advance.***	✓PPT slide 31 

Elevator – Control Systems

Instructor's Guide

Module Length: 180 minutes Time remaining: 130 minutes This section: 40 minutes *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
CLASSROOM ACTIVITY **Instructor's Notes** _____ _____ _____ _____ _____	**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. ***[At instructor's discretion, take time to visit the field and look at elevator control systems and examples of operation control along with related information.]*** ***Advance.***	✓PPT slide 32 

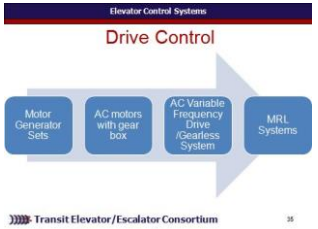
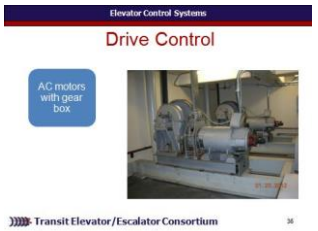
Module Length: 180 minutes Time remaining: 90 minutes This section: 35 minutes *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW objective and slides **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Next we will look at the other form of elevator control. ***Advance.*** Drive Control can be characterized as the muscle that runs the elevator and the power source for the hoist motors. ***Advance.***	✓PPT slides 33, 34  

Elevator – Control Systems

Instructor's Guide

Module Length: 180 minutes Time remaining: 90 minutes This section: 35 minutes *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW slides **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Motor generators often are made up of an AC induction motor and a DC generator. AC motors are known to have difficulty controlling the speed; therefore, it was common to use this system with a gearbox (known as a geared traction system). However, the use of AC variable frequency drives has made the use of AC systems without a gearbox more efficient (gearless systems). This has led to the use of machine and brake systems being connected directly to the top of the elevator car (machine room-less or MRL systems). ***Advance.*** Here is an AC motor with a gear box. ***Advance.***	✓PPT slides 35, 36  

Elevator – Control Systems

Instructor's Guide

Module Length: 180 minutes Time remaining: 90 minutes This section: 35 minutes *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW slides	**In your own words:** This is a photo of an AC variable frequency drive gearless system. ***Advance.*** The 2 Main Platforms for drive control are relay logic and solid state relay. **Relay Logic** Is a system of controlling power circuits through a series of switches. **Solid Sate Relay** is a power circuit with no moving parts. and uses a semiconductor device to perform switching. ***Advance.***	✓PPT slides 37, 38

Instructor's Notes

_____

_____

_____

_____

_____

Elevator – Control Systems

Instructor's Guide

Module Length: 180 minutes Time remaining: 90 minutes This section: 35 minutes *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW slides **ASK** **Instructor's Notes**	**In your own words:** Common Drives for drive control include **SCR** or Silicone Control Rectifier, **VFD or** Variable Frequency Drive, and **VVVF or** Variable-Voltage Variable Frequency. ***Advance.*** Lets see what we have learned so far. Drive Control is known as the (check all that apply) a. Brains of the elevator. b. Heart of the elevator. c. Muscle of the elevator. ***Call on students for answer.*** ***Advance for correct answer.*** Answer: c. ***Advance.***	✓PPT slides 39, 40  

DO	SAY	Materials Needed
ASK **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Drive control that has no moving parts and uses a semiconductor device for switching is known as(check all that apply) a. VVVF. b. Relay logic. c. SCR. d. Solid State Relay ***Call on students for answer.*** ***Advance for correct answer.*** Answer: d. ***Advance.***	✓PPT slide 41 

Module Length: 180 minutes Time remaining: 90 minutes This section: 35 minutes *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
ASK **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Common drives found in transit elevator systems include (check all that apply) a. VVVF. b. Relay logic. c. SCR. d. Solid State Relay e. VFD ***Call on students for answer.*** ***Advance for correct answer.*** Answer: a., c., d. ***Advance.***	✓PPT slide 42 

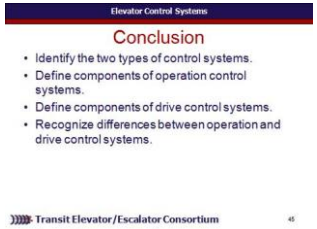
DO	SAY	Materials Needed
CLASSROOM ACTIVITY **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Okay, now it's time to see how this works in the real world. Please get your stuff together for a trip to the lab. ***[At instructor's discretion, take time to visit the field and look at elevator control systems, examples of operation, and related information.]*** ***Advance.***	✓PPT slide 42 

Elevator – Control Systems

Instructor's Guide

Module Length: 180 minutes Time remaining: 15 minutes This section: 15 minutes *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW slide **ASK** **Instructor's Notes**	**In your own words:** ***Read slide.*** ***[For each objective, briefly review what was learned in this module or ask students to share what they have learned for each learning objective and briefly discuss as a class.]*** ***Advance.***	✓PPT slide 43



DO	SAY	Materials Needed
REVIEW slide **ASK** **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Lets take a look at some of the key words we have defined as moved through this module. ***[Read slide. Discuss definitions as a group.]*** ***Advance.*** ***[Read slide. Discuss definitions as a group.]*** ***Advance.*** ***Read slide.*** Each employee will be trained on their authorities specific policies. ***Advance.*** ***Administer quiz.***	✓PPT slide 44, 45