

Instructor/Participant Guide



209: Escalator-Specific: Electrical Systems

Module 3: Escalator Safety Circuits

Escalator Safety Circuits



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None

PREVIEW ONLY



Icons Used in This Guide

Throughout the Instructor's Guide, the following icons indicate the type of content presented.



Refer To



PowerPoint



Multimedia



Web based Training



Write



Ask



Individual Activity



Small Group Activity



Classroom Activity



Duration

Agenda

Topic No.	Topic Title	Duration
1	Introduction	5 minutes
2	Electrical System Safety Circuits	20 minutes
3	Passenger Safety Circuits	20 minutes
4	Remote Monitoring and Annunciation	20 minutes
5	Summary	5 minutes
Total Time:		1.0 hours



Overview

Purpose

The purpose of this module is to:

- Provide the participants with a basic knowledge of the various types of electrical safety circuits that protect the passengers, as well as the mechanical and electrical systems of a transit escalator.

Objectives

At the end of this chapter, the learner will be able to:

- Identify the function of different types of safety circuits
- Locate various safety devices in a schematic diagram
- Explain the function of specific types of safety circuits
- Test and verify the operation of various types of safety circuits
- Discuss the circuit fault conditions as they relate to safety circuits
- Identify the upper and lower safety circuits of a transit escalator

Materials

Make sure you have the following:

- Laptop (one for leader)
- Participant Guides
- PowerPoint slide deck
- LCD projector

- A17.1 Safety Code for Elevators and Escalators
- A17.2 Guide for Inspection of Elevators, Escalators and Moving Sidewalks
- A17.3 Safety Code for Existing Elevators and Escalators
- Heavy Duty Transportation System Elevator Design Guidelines (APTA RT-RP-FS 008-03)
- Heavy Duty Transportation System Escalator Design Guidelines (APTA RT-RP-FS 007-02)
- Field Employees' Safety Handbook
- Transit Agency Handbook

Preparation

PREPARE flip charts with the following title:

- Class Expectations



Instructor's Notes

Escalator Safety Circuits

Safety Circuit Switches

Conventional "limit" switches

- Designed to use a spring force to open normally closed electrical contacts.
- Subject to two potential failure modes:
 - Spring failure
 - Inability of the spring force to overcome "stuck" or "welded" contacts

"Positive-break" safety interlocks

- Electromechanical switches designed with normally closed electrical contacts.
- Upon switch actuation, are forced to open by a non-resilient mechanical drive mechanism such as a step roller.

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Slide 3



REVIEW the different safety circuit switches.



ASK the participants to describe the listed switches.

Escalator Safety Circuits

Electrical System Safety Circuits

- Designed to protect the electrical system and the riders/maintenance personnel of a transit escalator.
- Most common type of input device used within the escalator safety system is a switch.
- Modern PLC controlled transit escalators have two independent contacts, one normally closed (NC) for the safety circuit and one normally open (NO) for signaling.
 - The escalator can be stopped either by the NC or the NO contact.

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Slide 5

Safety Circuit Switches

Describe the following circuits:

Conventional Switches:

Positive-break Interlocks:



Instructor's Notes

Escalator Safety Circuits

Ground Fault Detection

- Required for equipment such as the Wye electrical feed to an escalator drive system.

Direct Method

- A sensor around one conductor.
- When the current reaches the setting of the ground fault sensor, the shunt trip opens the circuit breaker, removing the load from the line.

Zero Sequencing

- A sensor installed around all the circuit conductors.
- When this current reaches the setting of the ground-fault sensor, a signal is fed to the PLC removing power from the escalator.

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Slide 8



REVIEW slide 8 and discuss ground fault detection.

CONTENT: Direct participants to describe in their own words the details of the electrical safety circuits.

APPLICATION FEEDBACK: Now that we have discussed a little about ground fault detection, have the participants answer the following questions.



ASK: What is zero sequencing?

Ground Fault Detection

What is zero sequencing?



Instructor's Notes

Escalator Safety Circuits

Phase Monitoring

- Relays protect electrical equipment against failures due to phase loss, phases out of sequence, and phase imbalance issues.
- A phase monitoring relay is designed to detect an incorrect phase sequence and keep the motor starter from starting.



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Slide 10



REVIEW slide 10 and review phase monitoring.



ASK participants to describe the purpose of the phase monitoring relay.

Phase Monitoring

What is the purpose of a phase monitoring relay?



Instructor's Notes

Escalator Safety Circuits

Contactor Dropout Check

- Each main and auxiliary contactor provides a signal via a normally closed contact to the PLC for a dropout check.
 - Carried out every time the escalator stops.
- When the safety circuit is closed and the dropout check is completed successfully, a command is issued for starting the escalator in either direction.

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Slide 11



REVIEW slide 11 and review the contactor dropout check.



ASK: When is the contactor dropout check conducted?

Contactor Dropout Check

When is the contactor dropout check conducted?



Instructor's Notes

Escalator Safety Circuits

Speed Monitors

- Used in escalator systems where it is necessary not to exceed rated speeds such as the motor, handrail, and step chain.
- The output is supplied to the PLC and the speed is converted to a speed proportional frequency.
- This frequency is compared to an internal adjustable frequency reference.
- If the measured frequency is higher or lower than the reference, the PLC will shut down the escalator drive.

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Slide 13



REVIEW slide 13 and discuss the purpose of speed monitors.



ASK the participants to describe what can occur if the measured frequency is higher or lower than the reference.

Speed Monitors

What can occur if the measured frequency is higher or lower than the reference?



Instructor's Notes

Escalator Safety Circuits

Mechanical System Safety Circuits

Step Upthrust Device

- Stops the escalator when a step is forced upward before entering the combplate.
- Prevents the step from crashing into the combplate or causing damage.

Broken Step Chain Device

- Cuts electrical power to the escalator motor and brake, stopping the escalator in the event of drive chain breakage.

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Slide 15

Escalator Safety Circuits

Mechanical System Safety Circuits

Step Lateral Displacement Device

- Detects when a step experiences a sideward displacement at either side of the step riser or at the step chain axle due to wear or failure.

Handrail Entry Device

- Stops the escalator when an object becomes lodged between the handrail and the handrail guard or if an object nears the space between the handrail and the handrail guard.

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Slide 16



REVIEW slides 15 and 16 to discuss the mechanical system safety circuits.

CONTENT: Direct participants to describe in their own words how speed monitors operate.

APPLICATION FEEDBACK: Now that we have discussed a little about electrical safety circuits, have the participants answer the following questions.



ASK the participants to describe the listed devices.

Mechanical System Safety Circuits

Describe the listed devices below.

Step Upthrust Device:

Broken Step Chain Device:

Step Lateral Displacement Device:

Handrail Entry Device:



Instructor's Notes

Summary

Escalator Safety Circuits

Summary

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Slide 22



REVIEW slide 22 and summarize the module.

EVALUATION AND CLOSURE: Recap the main points of the module before moving on to the next topic within this course.



ASK the participants if they have any outstanding questions on what was presented.