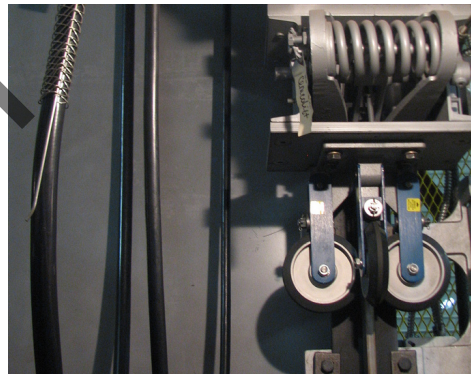
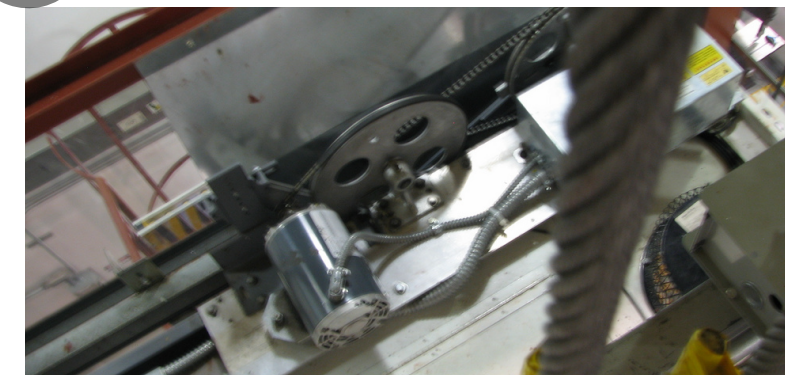
Instructor Guide





214: Elevator: Electrical Systems
Module 3: Electrical Systems Testing

TRANSIT ELEVATOR/ESCALATOR CONSORTIUM

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	30 minutes
2	Safe Testing Methods	60 minutes
3	Testing Power Systems	60 minutes
4	Field Trip	60 Minutes
5	Testing Control Systems	60 Minutes
6	Field Trip	60 Minutes
7	Summary	30 Minutes
	Total Time:	360 Minutes

Overview

Purpose The purpose of this module is to:

- Provide the participant with an introduction to safe elevator electrical testing methods on both elevator power and controls circuits using the Motion Control Engineering (MCE) controller HMC-1000-PHC Programmable Hydraulic Controller as an illustrative model.

Objectives

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

- Identify safe troubleshooting methods for elevator electrical systems.
- Perform electrical power measurements to confirm a fault condition using a schematic diagram.
- Perform electrical control measurements to confirm a fault condition using a schematic diagram.

Materials

Mandatory Make sure you have the following

- PowerPoint Presentation
- Coursebook
- Quizzes
- Pencils
- Elevator Industry Field Employees' Safety Handbook
- Related transit authority specific procedures and policies

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
- Digital Multi-Meter

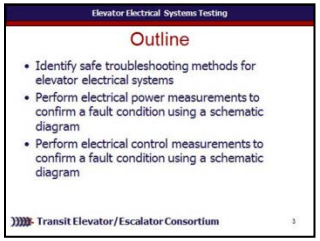
Elevator – Electrical Systems Testing

Instructor's Guide

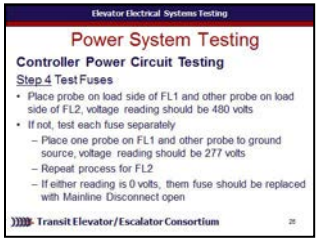
Module Length: 360 min | Time remaining: 360 min | This section: 30 min (7 slides) | *Section start time: _____* | *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW introduction slides **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Welcome to the course on electrical systems testing for elevators. ***Advance*** ***Advance***	✓PPT slides 1, 2  

Module Length: 360 min Time remaining: 360 min This section: 30 min (8 slides) *Section start time: _____* *Section End Time: _____*

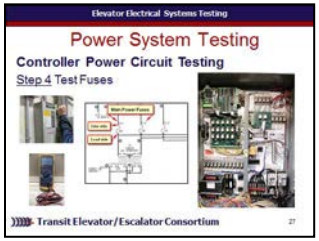
DO	SAY	Materials Needed
REVIEW module objectives **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Today we will - Identify safe troubleshooting methods for elevator electrical systems. ***Advance.*** - Perform electrical power measurements to confirm a fault condition using a schematic diagram. ***Advance.*** And -Perform electrical control measurements to confirm a fault condition using a schematic diagram. ***Advance.***	✓PPT slide 3 

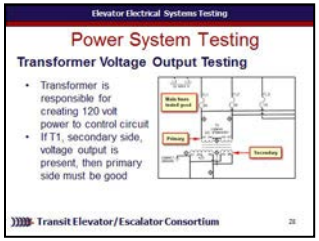
Module Length: 360 min Time remaining: 270 min This section: 60 min (18 slides) *Section start time:* _____ *Section End Time:* _____

DO	SAY	Materials Needed
REVIEW slide **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Step 4 is to test the fuses. ***Advance*** With the Mainline Disconnect on, place one probe on the load side of FL1 and the other probe on the load side of FL2. The result should be a reading of 480 volts between FL1 and FL2. ***Advance*** If the resulting voltage readings are less than this value, test each fuse separately. ***Advance*** To do this, place one probe on the load side of FL1 and the other probe to a ground source. The voltage reading if the fuse is good should be approximately 277 volts. ***Advance*** Repeat this process for FL2. ***Advance*** If a reading of 0 volts is obtained on either of the fuses, the fuse should be replaced with the Mainline Disconnect opened. ***Advance***	✓PPT slide 26 

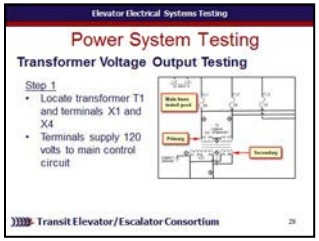
Module Length: 360 min Time remaining: 270 min This section: 60 min (18 slides) *Section start time:* _____ *Section End Time:* _____

DO	SAY	Materials Needed
REVIEW slide **ASK** **Instructor's Notes**	**In your own words:** Again, with the mainline disconnect on, place one probe on the load side of FL1 and the other probe on the load side of FL2. The result should be a reading of 480 volts between FL1 and FL2. If the resulting voltage readings are less than this value, test each fuse separately. ***How do we do this again?*** ***Answer: Place one probe on the load side of FL1 and the other probe to a ground source.*** The voltage reading if the fuse is good should be approximately 277 volts. Repeat this process for FL2. If a reading of 0 volts is obtained on either of the fuses, the fuse should be replaced with the Mainline Disconnect opened. ***Advance***	✓PPT slide 27

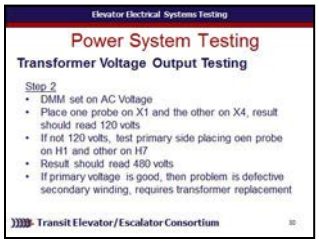


DO	SAY	Materials Needed
REVIEW slide **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Assuming the fuses tested good, the next step is to follow the circuit downward from the fuses and test the next layer of components. Following the circuit downward from fuses FL1 and FL2 leads us to the transformer labeled T1. ***Advance*** The transformer is responsible for creating the 120 volt power to our control circuit. ***Advance*** We are more concerned with the output of T1 which is its secondary side because it stands to reason that if the voltage output is present on the secondary, then the primary side must be good. Therefore we will test the secondary side first. Note that the secondary side terminals of T1 are labeled X1, X2, X4, X5, and X8. ***Advance***	✓PPT slide 28 

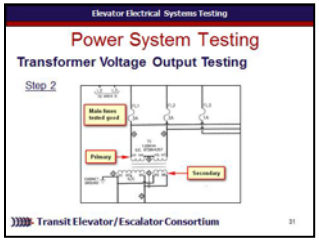
Module Length: 360 min Time remaining: 270 min This section: 60 min (18 slides) *Section start time: _____* *Section End Time: _____*

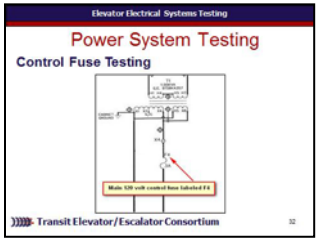
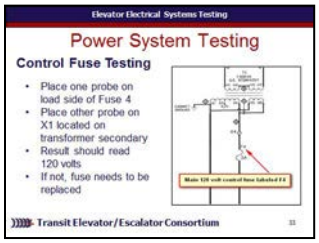
DO	SAY	Materials Needed
REVIEW slide **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** To test transformer voltage output, the first step is to locate transformer T1 in the controller and its terminals X1 and X4. These are the terminals supplying the 120 volts to the main control circuit. ***[Direct participants to X1 and X4.]*** ***Advance***	✓PPT slide 29 

Module Length: 360 min Time remaining: 270 min This section: 60 min (18 slides) *Section start time:* _____ *Section End Time:* _____

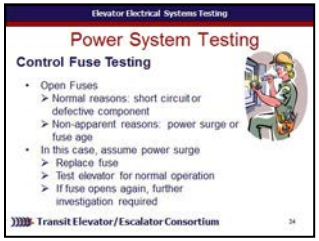
DO	SAY	Materials Needed
REVIEW slide **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Step 2: ***Advance*** Again, with the DMM set on AC Voltage, ***Advance*** place one probe on X1 and the other on X4. The result should read 120 volts. ***Advance*** If not, test the primary side placing one probe on H1 and the other probe on H7. ***Advance*** The result should read 480 volts. ***Advance*** If the voltage reading on the primary is good, then the problem is a defective secondary winding which necessitates the replacement of the transformer. ***Advance***	✓PPT slide 30 

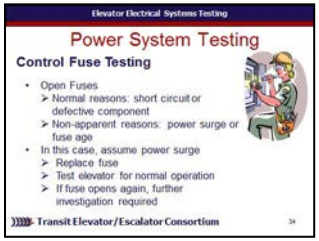
Module Length: 360 min Time remaining: 270 min This section: 60 min (18 slides) *Section start time: _____* *Section End Time: _____*

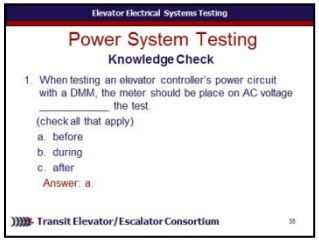
DO	SAY	Materials Needed
REVIEW slide **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Again with our diagram, Step 2: With the DMM set on AC Voltage, place one probe on X1 and the other on X4. The result should read 120 volts. If not, test the primary side placing one probe on H1 and the other probe on H7. The result should read 480 volts. If the voltage reading on the primary is good, then the problem is a defective secondary winding which necessitates the replacement of the transformer. ***[Direct participants to X1 and X4.]*** ***Advance***	✓PPT slide 31 

DO	SAY	Materials Needed
REVIEW slide **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Assuming that the voltage reading on the transformer secondary reads 120 volts, it is necessary to move down to the next level of the power circuit for further testing. Following down the secondary output of the transformer, Terminal X4, we see that it feeds a 3 amp control fuse labeled F4 that supplies the 120VAC power to the control system. ***Advance*** Place one probe on the load side of Fuse F4 and ***Advance*** the other probe onto X1 located on the transformer secondary. ***Advance*** The result should read 120 volts. ***Advance*** If not, the fuse is open and needs to be replaced. ***Advance***	✓PPT slides 32, 33  

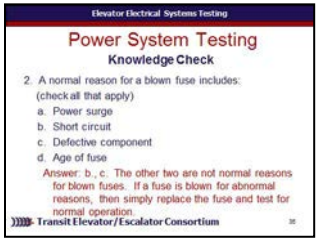
Module Length: 360 min Time remaining: 270 min This section: 60 min (18 slides) *Section start time:* _____ *Section End Time:* _____

DO	SAY	Materials Needed
REVIEW slide **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Fuses open for reasons that are normally obvious such as ***Advance*** a short circuit or defective component that it is designed to protect in the circuit. ***Advance*** However, fuses sometimes open for non-apparent reasons such as power surges or it has weakened due to its age. In this case there was no apparent reason why the fuse opened. ***Advance*** It can be assumed that perhaps an intermittent power surge occurred causing the fuse to blow. ***Advance*** Replacing the fuse and ***Advance***	✓PPT slide 34 

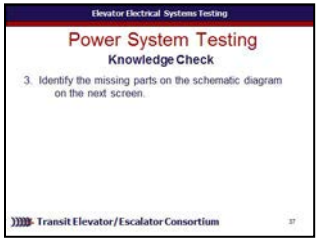
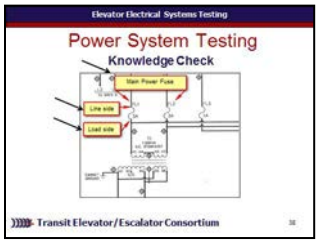
DO	SAY	Materials Needed
REVIEW slide **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Testing the elevator for normal operation will verify whether the reason that caused the fuse to open was a one time event or ***Advance*** the result of another underlying cause that necessitates further investigation. ***Advance***	✓PPT slide 34 

DO	SAY	Materials Needed
ASK **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Lets see what we have learned so far. When testing an elevator controller's power circuit with a DMM, the meter should be place on AC voltage _____ the test. (check all that apply) a. before b. during c. after ***Call on participants for answer*** ***Advance once given the correct answer*** Answer: a. ***Advance***	✓PPT slide 35 

Module Length: 360 min Time remaining: 270 min This section: 60 min (18 slides) *Section start time:* _____ *Section End Time:* _____

DO	SAY	Materials Needed
ASK **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** A normal reason for a blown fuse includes: (check all that apply) a. Power surge b. Short circuit c. Defective component d. Age of fuse ***Call on participants for answer*** ***Advance once given the correct answer*** Answer: b., c. The other two are not normal reasons for blown fuses. If a fuse is blown for abnormal reasons, then simply replace the fuse and test for normal operation. ***Advance***	✓PPT slide 36 

Module Length: 360 min Time remaining: 270 min This section: 60 min (18 slides) *Section start time:* _____ *Section End Time:* _____

DO	SAY	Materials Needed
ASK **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Identify the missing parts on the schematic diagram on the next screen. ***Advance*** ***Advance*** What was this called? ***Call on participants for answer.*** ***Advance for the correct answer*** Answer: Main Power Fuse ***Advance*** And this was called? ***Call on participants for answer.*** ***Advance for the correct answer*** Answer: Line side. ***Advance*** And this was called? ***Call on participants for answer.*** ***Advance for the correct answer*** Answer: Load side. ***Advance***	✓PPT slides 37, 38  

Module Length: 360 min Time remaining: 30 min This section: 30 min (3 slides) *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
CLASSROOM ACTIVITY **INDIVIDUAL ACTIVITY** **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** ***Administer quizzes.***	✓PPT slides 57 ✓Quizzes ✓ Pencils