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PREVIEW ONLY

Principles of Troubleshooting

Instructor's Guide



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	20 Minutes
2	Troubleshooting Steps	45 Minutes
3	Strategies and Pitfalls	45 Minutes
4	Troubleshooting & Escalators	60 Minutes
5	Troubleshooting & Elevators	60 Minutes
6	Field Trip	60 Minutes
7	Summary	10 Minutes
	Total Time:	300 Minutes

PREVIEW ONLY

Principles of Troubleshooting

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Overview

Purpose The purpose of this module is to:

Provide the participant with an overview of the troubleshooting process along with related general strategies, tips and pitfalls. Troubleshooting in the context of escalator and elevator systems will also be discussed.

Objectives

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

- Define and explain the importance of troubleshooting
- Describe a process for general troubleshooting
- Identify and describe troubleshooting strategies
- Identify and describe troubleshooting tips and pitfalls
- Discuss the general troubleshooting process given an example problem
- List common failures in an escalator system
- Discuss the troubleshooting process given a specific escalator failure
- List common failures in an elevator system
- Discuss the troubleshooting process given an authority specific elevator problem

Materials

Mandatory Make sure you have the following

- PowerPoint Presentation
- Coursebook
- Quizzes
- Pencils
- Blank Troubleshooting Note Sheets (8 for each participant)
- Problem Instructor Keys

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
- Deck (or decks) of cards with a missing card(s)
- Sample of manufacturer manual and specific trouble shooting guide
- Select problems for slide 46

Principles of Troubleshooting

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Module Length: 300 min

Time remaining: 300 min

This section: 20 min (7 slides)

Section start time: _____

Section End Time: _____

DO



REVIEW module objectives

Instructor's Notes

SAY

In your own words:

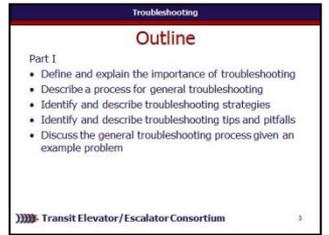
Today we will

- Define and explain the importance of troubleshooting
- Describe a process for general troubleshooting
- Identify and describe troubleshooting strategies
- Identify and describe troubleshooting tips and pitfalls
- Discuss the general troubleshooting process given an example problem

Advance Slide

Materials Needed

✓ PPT slide 3



Principles of Troubleshooting

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Module Length: 300 min Time remaining: 300 min This section: 20 min (7 slides) Section start time: _____ Section End Time: _____

DO



REVIEW key terms

Instructor's Notes

SAY

In your own words:

Lets take a look at some of the key words we will be defining as move through this module:

- Half-Split
- Hypothesis
- Root cause
- Sensory inspection
- Subsystem
- Systematic approach
- Troubleshooting attitude

Advance Slide

Materials Needed

✓ PPT slide 5



Principles of Troubleshooting

Instructor's Guide



Module Length: 300 min Time remaining: 280 min This section: 90 min (46 slides) Section start time: _____ Section End Time: _____

DO

SAY

Materials Needed

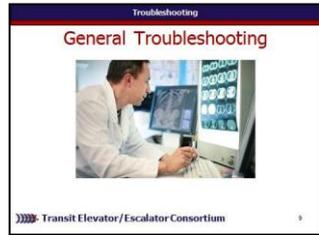


REVIEW slide

In your own words:

Sometimes troubleshooting requires a simple solution, and other times “symptoms” may be a sign of a larger problem that is more hidden from “surface” view. Either way, troubleshooters are like a doctor for their assigned system. In this case of escalator and elevators, a troubleshooter is a doctor for the escalator or elevator.

✓ PPT slide 9



Instructor's Notes

Advance Slide

Principles of Troubleshooting

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DO

SAY

Materials Needed



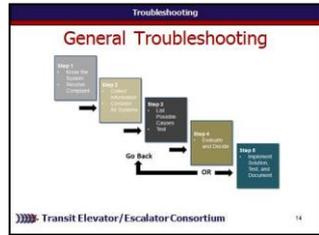
REVIEW slide

In your own words:

The following is a list of steps one can follow for troubleshooting. Depending on the problem and additional strategies utilized, this may vary from time to time. But this is a general approach one can use for troubleshooting.

- Step 1 – Know the system and receive the complaint
 - Step 2 – Collect information and consider all systems
 - Step 3 – List all possible causes and test
 - Step 4 – Evaluate and decide
 - Step 5 – Implement solution, test, and document or go back to the troubleshooting process if a solution was not found.
- Lets take a look at each of these parts.

✓ PPT slide 14



Instructor's Notes

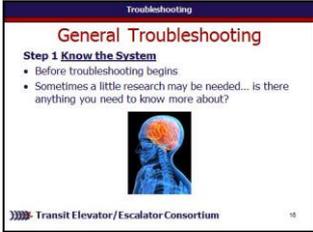
Advance Slide

Principles of Troubleshooting

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Module Length: 300 min Time remaining: 280 min This section: 45 min (28 slides) Section start time: _____ Section End Time: _____

DO	SAY	Materials Needed
 <p>REVIEW slide</p> <h3>Instructor's Notes</h3> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<p>In your own words:</p> <p>If we compare troubleshooting to the job of a doctor, we know a doctor would have a difficult time identifying the problem and solution for a patient if they did not have knowledge of anatomy and how the body works. The same is true for anything that needs troubleshooting: one must know and understand the parts and how they work together in the larger system in order to identify, analyze, and find an effective solution to any problem that should arise.</p> <p><i>Advance Slide</i></p>	<p>✓ PPT slide 16</p> 

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DO

SAY

Materials Needed



REVIEW slides

Instructor's Notes

In your own words:

Complex problems will especially benefit from the process of documentation as one can get lost in the process of troubleshooting and easily forget a step taken or symptom observed. If needed later, documenting and notes will provide an immediate resource for the problem at hand and for any later occurrences of problems either directly or indirectly related to the current problem at hand.

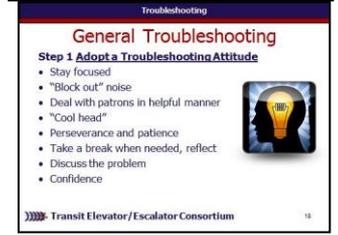
Advance Slide

Adopt a Troubleshooting Attitude.

Troubleshooting can sometimes be an easy process with a simple and obvious solution right away. Other times, troubleshooting can be complicated and more intense.

Do Not Advance Slide

✓ PPT slides 17, 18



Principles of Troubleshooting

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DO

SAY

Materials Needed



REVIEW slides

Instructor's Notes

In your own words:

Step back and take a break when needed and when possible. Sometimes those answers will come to you when you remove yourself from the situation and take a little time to reflect.

Converse with someone about the problem. Sometimes talking it out may help bring clarity, or talking with another may bring a new perspective or ideas not yet considered derived from different experiences.

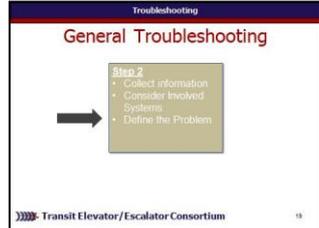
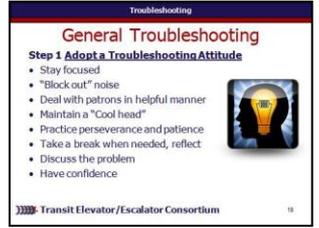
Remember: you know the system. Confidence is important.

Advance Slide

Moving on to Step 2, we begin to expand our knowledge of the problem by collecting information, establishing involved systems, and defining the problem.

Advance Slide

✓ PPT slides 18, 19



Principles of Troubleshooting

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DO	SAY	Materials Needed
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REVIEW slides

Instructor's Notes

In your own words:

These two areas are not directly related and come to mind immediately when a car will not start, but could certainly prevent a car from starting if levels are not as they should be or empty altogether.

Advance Slide

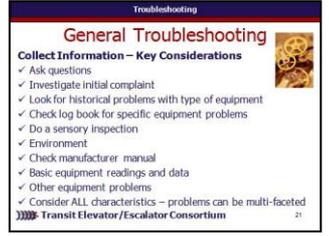
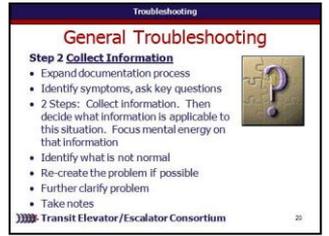
Again, continue taking notes as this is important throughout and may be useful if a solution is not immediately found.

Advance Slide

As you collect information, some key considerations you will want to think about include:

- Gather immediate information about the situation – Ask about the situation or anyone who may have relevant knowledge about the problem or condition. **Do Not Advance Slide**
- Investigate initial complaints or situation,

✓ PPT slides 20, 21



Principles of Troubleshooting

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REVIEW slides

Instructor's Notes

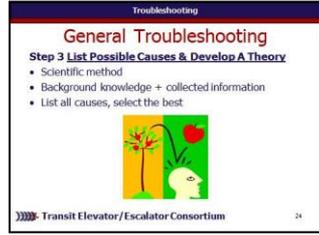
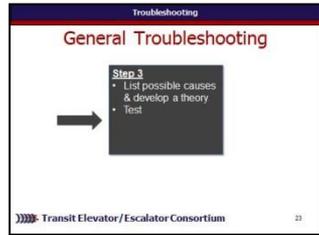
SAY

In your own words:
 Now that information about the systems and symptoms has been collected, it is time to begin to think about what are the possible and eventually probably causes and from there perform appropriate tests. This is step three.
Advance Slide

List possible causes & develop your theory. Remember the scientific method in school? This is the step to state what you think may be going on, or make a hypothesis. A **hypothesis** is an educated guess. You have educated yourself as to the nature of the problem, and now is the time to use your background knowledge of the equipment along with the new information you have gathered to make an educated guess about what is happening and the cause of the problem.
Do Not Advance Slide

Materials Needed

✓ PPT slides 23, 24



Principles of Troubleshooting

Instructor's Guide



Module Length: 300 min

Time remaining: 280 min

This section: 45 min (28 slides)

Section start time: _____

Section End Time: _____

DO

SAY

Materials Needed



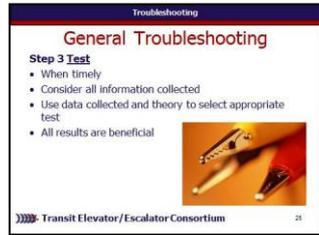
REVIEW slide

In your own words:

Test. Some may want to jump to this step right away and skip other steps. However, a good troubleshooter will go through the previous steps of documentation & taking notes, establishing the problem, collecting information sorting what is related and what is not, looking at the whole picture, and developing a theory prior to any testing. These previous steps will help determine what tests are appropriate for the situation and therefore save time, resources, and frustration in the long run. Also, be sure to consider all the symptoms and information you collected and test accordingly. Do not ignore a symptom and be sure to keep the documentation & note taking process going since recording those test results will help in the deciding if you've found the solution.

Do Not Advance Slide

✓ PPT slide 25



Instructor's Notes

Principles of Troubleshooting

Instructor's Guide



Module Length: 300 min Time remaining: 280 min This section: 45 min (28 slides) Section start time: _____ Section End Time: _____

DO

SAY

Materials Needed

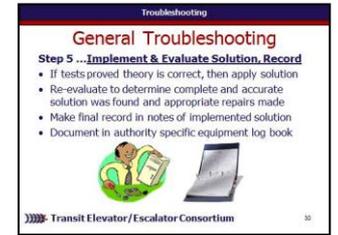


REVIEW slide

In your own words:

Tests were completed and a solution found. Now it is time to apply the solution and make the necessary repairs. Once the repairs have been made, it is important to re-evaluate and decide if the equipment has been adequately repaired and restored to proper working condition by testing once more.

✓ PPT slide 30



Instructor's Notes

The last step in the troubleshooting process is to record and document your conclusions. This recording and documentation should occur in two places. The first place is to conclude your final results in your own troubleshooting notes. The second place is to document in your transit authority's equipment maintenance log book. This is an important step and will be covered more later in the module.

Advance Slide

Principles of Troubleshooting

Instructor's Guide



Module Length: 300 min Time remaining: 280 min This section: 45 min (28 slides) Section start time: _____ Section End Time: _____

DO	SAY	Materials Needed
<div> </div> <div> <p>ASK</p> </div> <div> <h3>Instructor's Notes</h3> </div> <hr/> <hr/> <hr/> <hr/> <hr/>	<div> <p>In your own words: Yes or No. If test results indicate a solution was not found, after the solution is implemented the system should be re-tested and checked for verification of effective operation.</p> </div> <div> <p>Call on participants for answer Advance Slide once given the correct answer</p> </div> <div> <p>Answer: Yes</p> </div> <div> <p>Advance Slide</p> </div>	<div> <p>✓ PPT slide 34</p> </div> <div> </div>

Principles of Troubleshooting

Instructor's Guide



Module Length: 300 min Time remaining: 280 min This section: 45 min (11 slides) Section start time: _____ Section End Time: _____

DO

SAY

Materials Needed



REVIEW slide

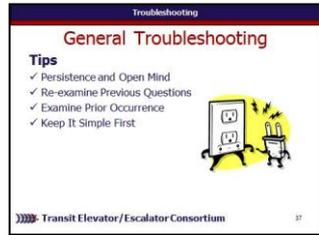
In your own words:

Examine prior occurrence: Look at the maintenance log and other records to see how this problem was resolved before. If the log shows a common solution to the problem, then the technician should check that solution first. If the previous solution did not adequately and effectively solve the problem, then one can avoid repeating what hasn't already worked and use this information to start in a new direction.

Look for easy solutions first. Is it plugged in?

Advance Slide

✓ PPT slide 37



Instructor's Notes

Principles of Troubleshooting

Instructor's Guide



Module Length: 300 min Time remaining: 280 min This section: 45 min (11 slides) Section start time: _____ Section End Time: _____

DO



REVIEW slides



REFER participants to the 250 Course Book p. 13.

Instructor's Notes

SAY

In your own words:

If one must stop for some reason before a solution is found, then there is also a record to review before beginning again therefore preventing the possibility of repeating steps. Additionally, if more than one person is involved in the process, notes can be helpful in the communication process.

Advance Slide

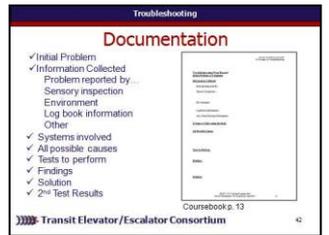
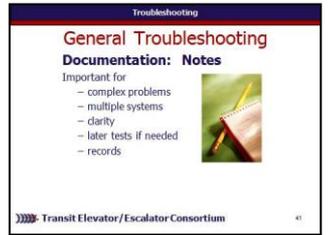
Notes can be kept in a small notebook, or you can use a sheet like in your course book on page 13. This sheet may be helpful for your first time or two troubleshooting as it will remind you of steps to take.

[Review the course book p. 13 with slide.]

Advance Slide

Materials Needed

✓ PPT slides 41, 42



✓ 250 Course Book

Principles of Troubleshooting

Instructor's Guide



Module Length: 300 min Time remaining: 280 min This section: 45 min (11 slides) Section start time: _____ Section End Time: _____

DO	SAY	Materials Needed
<div></div> <div>ASK</div> <div></div> <div>CLASSROOM ACTIVITY</div> <div></div> <div>Multimedia</div> <div> <h3>Instructor's Notes</h3> <hr/> <hr/> <hr/> <hr/> <hr/> </div>	<p>In your own words:</p> <p><i>At instructor's discretion, take time to practice discuss troubleshooting with selected problems from the linked website.</i></p> <p><i>Again, discuss with participants:</i></p> <ul style="list-style-type: none"> <i>Their preparation for solving the problem</i> <i>Questions they asked themselves and methods they used to determined the missing card</i> <p><i>Optional – Allow participants to use a blank(s) Troubleshooting Record Sheet(s) to help in guiding to solve the problem.</i></p> <p><i>Advance Slide</i></p>	<p>✓PPT slide 46</p> <div> </div> <p>✓Internet connection</p> <p>✓Troubleshooting Record Sheet – blank copy</p>

Principles of Troubleshooting

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Module Length: 300 min Time remaining: 190 min This section: 60 min (9 slides) Section start time: _____ Section End Time: _____

DO	SAY	Materials Needed
<div> </div> <p>REVIEW slide</p> <div> </div> <p>REFER participants to Course Book p. 13</p> <p>Instructor's Notes</p> <hr/> <hr/> <hr/> <hr/> <hr/>	<p>In your own words:</p> <p><i>Distribute blank copies of Troubleshooting Note Record Sheet</i></p> <p><i>Option 1 - Continue to discuss troubleshooting problem 2 as done with problem 1</i></p> <p><i>Option 2 – Assign individual or pairs or students problem 2 and allow approximately 10 minutes to work through the problem independently. Use Instructor Key to discuss ideas when they are finished.</i></p> <p><i>Advance Slide</i></p>	<p>✓ PPT slide 53</p> <div> </div> <p> ✓ Troubleshooting Note Record Sheet Blank Copy ✓ Escalator Problem 2 Instructor Key ✓ Chalk board, large paper, or similar </p>

Principles of Troubleshooting

Instructor's Guide



Module Length: 300 min Time remaining: 190 min This section: 60 min (9 slides) Section start time: _____ Section End Time: _____

DO

SAY

Materials Needed



REVIEW slide



REFER participants to Course Book p. 13

Instructor's Notes

In your own words:

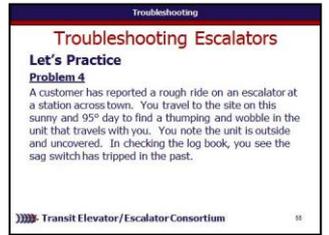
Distribute blank copies of Troubleshooting Note Record Sheet

Option 1 - Continue to discuss troubleshooting problem 4 as done with problem 1

Option 2 – Assign individual or pairs or students problem 4 and allow approximately 10 minutes to work through the problem independently. Use Instructor Key to discuss ideas when they are finished.

Advance Slide

✓ PPT slide 55



- ✓ Troubleshooting Note Record Sheet Blank Copy
- ✓ Escalator Problem 4 Instructor Key
- ✓ Chalk board, large paper, or similar

Principles of Troubleshooting

Instructor's Guide



Module Length: 300 min Time remaining: 130 min This section: 60 min (9 slides) Section start time: _____ Section End Time: _____

DO	SAY	Materials Needed
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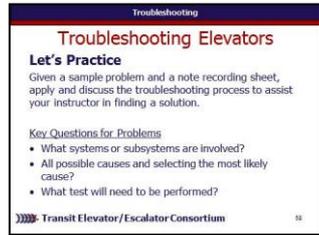


REVIEW slide

In your own words:

Lets practice the troubleshooting process in elevator systems with some sample discussion problems.
 Given a sample problem and a note recording sheet, apply and discuss the troubleshooting process to assist your instructor in finding a solution.

✓ PPT slide 58



Instructor's Notes

We will have some of the information, and with the information provided we will want to focus on later steps of the troubleshooting process.

Key Questions for Problems

- What systems or subsystems are involved?
- All possible causes and selecting the most likely cause?
- What test will need to be performed?

Advance Slide

Principles of Troubleshooting

Instructor's Guide

Module Length: 300 min

Time remaining: 190 min

This section: 60 min (9 slides)

Section start time: _____

Section End Time: _____



Troubleshooting Elevator Problem 3 Instructor Key

Initial Problem or Complaint: Customer Service has Reported an elevator runs and responds to all calls but the door won't open when the hall button is pressed. You arrive to find the hoistway as well as the control room to be dry, clean, and a comfortable 72°. A sensory inspection leads you to find the car runs normal, there is an MCE controller, and the PLC is receiving a door zone input from the tape reader. The log record book shows that monthly maintenance was performed one week ago.

Information Collected:

Problem Reported By – customer service

- Elevator responds to all calls but door doesn't open
- Door doesn't open when hall button is pressed

Sensory Inspection: Car runs normal, PLC is receiving a door zone input from taper reader, MCE controller

Environment: Hoistway dry and clean, Control room dry and clean, temp 72 degrees

Log Book Information: Monthly maintenance performed 1 week prior

Systems or Subsystems Involved: Door Open Relay

All Possible Causes: Defective door open relay coil

Tests to Perform: Resistance test on the door open coil

Findings: Door open coil resistance test indicates on open coil

Solution: Replace door open relay

2nd Test Results: Cycle elevator a few times to verify proper operation

Principles of Troubleshooting

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Module Length: 300 min Time remaining: 10 min This section: 10 min (4 slides) Section start time: _____ Section End Time: _____

DO

SAY

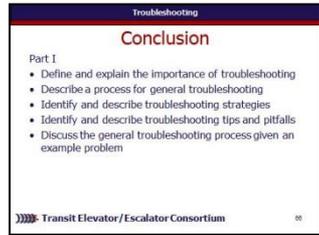
Materials Needed



**CLASSROOM
ACTIVITY**

In your own words:
*[Read slide.
 For each objective, briefly review what was learned in this module or ask participants to share what they have learned for each learning objective and briefly discuss as a class.]*
Advance Slide

✓ PPT slides 66, 67



Instructor's Notes

Read slide.
For each objective, briefly review what was learned in this module or ask participants to share what they have learned for each learning objective and briefly discuss as a class.]
Advance Slide

