Instructor Guide



214: Elevator: Electrical Systems Module 4: Wiring Systems (NEC Code Compliance)

TRANSIT ELEVATOR/ESCALATOR CONSORTIUM

Elevator – Wiring Systems Instructor's Guide

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Elevator – Wiring Systems Instructor's Guide **Icons Used In This Guide** Agenda **Topic Title** Topic # **Duration** 30 Minutes 1 Overview **REVIEW** slides INDIVIDUAL ACTIVITY 2 **Conductors & Overload Protection** 120 Minutes ASK WRITE Wiring Methods & Materials 3 120 Minutes Switches 4 60 Minutes CLASSROOM ACTIVITY Multimedia **NEC Code Compliance** 5 30 Minutes SMALL GROUP ACTIVITY **REFER** participants to Field Trip 6 90 Minutes Summary 7 30 Minutes **Total Time:** 480 Minutes

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<u>Overview</u>

Purpose The purpose of this module is to:

Provide the participant with knowledge of the different types of conductors and conduits, and installation techniques related to elevator maintenance.

Objectives

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

- Use the correct tables from the National Electrical Code to properly select and size conductors
- Determine conductor voltage rating by the conductor insulation code
- Select the proper size and type of conduit according to electrical code
- Discuss the methods used for the proper installation of conduit and raceways.
- Discuss electrical code requirements with regard to an elevators traveling cable

Materials Mandatory

Optional

Make sure you have the following

- **PowerPoint Presentation**
- Coursebook
- Quizzes
- Pencils
- Electrical Systems Based on the 2011 NEC
- National Electric Code 2011
- Conductor Selection Activity

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

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Module Length: 480 min Time remaining: 480	min This section: 30 min (6 slides)	Section start time:	Section End Time:
DO	SAY		Materials Needed
Instructor's Notes	In your own words: Welcome to the course on Ele Systems, Wiring Systems and Compliance. NEC you will rea National Electric Code. Advance According to the NEC 2008, " must be done in a "neat and w manner". Riders depend on u a big part of making it all happ thanks to Elevator Bob.com for and caption.) Advance	evator Electrical d NEC Code call stands for Your wiring workmanlike us, and wiring is ben. (And br the photo	<section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><text><text><text></text></text></text></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header>

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DO	SAY	Materials Needed
REVIEW module objectives	In your own words: In doing so, we will - Use the correct tables from the Nati Electrical Code to properly select and conductors - Determine conductor voltage rating	 ✓ PPT slide 3 ✓ PPT slide 3 Everter System With System Size Best the correct tables from the National Electrical code to properly select and size conductors Best the proper size and type of conduit according to select the proper issteallation of the proper issteallation of the proper installation of the proper installa
Instructor's Notes	 conductor insulation code Select the proper size and type of c according to electrical code Discuss the methods used for the p installation of conduit and raceways And Discuss electrical code requirement regard to an elevators traveling cable 	sonduit proper ts with
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Module Length: 480 min Time remaining: 450	min This section: 120 min (30 slides) Section start time:	Section End Time:
DO	SAY	Materials Needed
REVIEW slide	In your own words: Covered Conductors are utilized the most infrequently. These conductors use material covering that has not been rated in terms of insulation. While it is not used often, when used it tends to be found in overhead service conductors because of the lack of accessibility by unqualified persons. The free air environment allows for greater dissipation of heat. Advance	<section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header>

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DO	SAY	Materials Needed
REVIEW slides REFER participants to Sectrical Systems Based on the NEC 2011, Figure 5-2, p. 156	In your own words: Insulated conductors are the most common and constructed with insulating material recognized by the NEC. Unless specifically permitted, all conductors should be insulated. The type of insulation depends on conditions and use of conductor, but they must provide opposition or resistance to flow of electricity and must be marked to identify the rating. Advance [Have participants turn to p. 156 in Electrical Systems Based on the NEC 2011. Review figure 5-2 together.] Advance	<section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header>

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Instructor's Guide		
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DO	SAY	Materials Needed
REVIEW slide REFER participants to Lectrical Systems Based on the NEC 2011, Tigure 5-3, p. 157 Distructor's Notes	In your own words: Insulated Conductor Degradation Factors include: • Ambient temperature where conductor will operate • Internal heat as a result of current flow • Dissipation rate • Heat generated by adjacent conductors <i>[Have participants turn to p. 157 in Electrical Systems Based on the NEC 2011. Review figure 5-3 together.]</i> <i>Advance</i> Conductor Construction Material can be • Copper • Aluminum • Copper-clad Aluminum <i>Advance</i>	<section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header>

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Module Length: 480 min Time remaining: 450	min This section: 120 min (30 slides) Section start time:	Section End Time:
DO	SAY	Materials Needed
REVIEW slides	In your own words: Section 110.5 requires all conductors to be copper unless otherwise specified by NEC Disadvantages to this type of material is the expense and it requires additional vertical raceway support. Advance Types of copper conductors include - Hard-drawn: has the greatest strength, but difficult to work with and uses are limited - Medium-hard-drawn: easier to work with, but lacks tensile strength of hard-drawn - Soft-drawn: easy to work with and the most versatile Advance	<section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header>

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Module Length: 480 min Time remaining: 450	min This section: 120 min (30 slides) Section start time:	Section End Time:
DO	SAY	Materials Needed
REVIEW slides	 In your own words: Aluminum Conductors are not as conductive as copper, but considerably less expensive. They are installed same as copper except for termination, and made with joint compounds to prevent the oxide from reforming during installation. If oxide is not prevented, insulation failure could result at termination. Advance Copper-clad aluminum conductors are a compromise between copper and aluminum with increased conductivity and termination of copper + lighter weight and less cost of aluminum. Ampacity is selected from same column used for aluminum. 	<section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header>

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DO	SAY	Materials Needed
REVIEW slide REFER participants to Electrical Systems Based on the NEC 2011, Figure 5-6, p. 159 Instructor's Notes	In your own words: Conductors are either solid or stranded. By solid, we mean a single piece of wire or strand. By stranded we mean multiple wires. The NEC provides some specifications regarding the use of solid vs. stranded. [Have participants turn to p. 159 in Electrical Systems Based on the NEC 2011. Review figure 5-6 together.] Advance	<section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header>

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Module Length: 480 min Time remaining: 450	min This section: 120 min (30 slides) Section start time:	Section End Time:
DO	SAY	Materials Needed
REVIEW slide	In your own words: The last factor in deciding a conductor's allowable ampacity is location. Locations will be classified as dry, damp, or wet. A wet condition can mean a location that is always wet. Depending on insulation type, ampacity adjustments may be required.	✓ PPT slide 30 <u>Everter External Systems</u> <u>Everter Exte</u>
Instructor's Notes	Advance	3000 Transit Elevator/Escalator Consortium 20

Elevator – Wiring Systems Instructor's Guide Module Length: 480 min Time remaining: 330 min This section: 120 min (48 slides) Section start time: Section End Time:	
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Module Length: 480 min Time remaining: 330	min This section: 120 min (48 slides) 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: Article 300 covers the following wire methods: (check all that apply) a. Protecting installed underground conductors b. Securing fire-resistant-rated walls c. Wiring for factory-assembled control equipment d. Toxic fume spread prevention in event of fire Call on participants for answer Advance once given the correct answer Answer: a., b., d. Advance 	<section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header>
Instructor's Notes	 Article 300 covers the following wire methods: (check all that apply) a. Protecting installed underground conductors b. Securing fire-resistant-rated walls c. Wiring for factory-assembled control equipment d. Toxic fume spread prevention in event of fire Call on participants for answer Advance once given the correct answer Answer: a., b., d. Advance 	Identify United Systems Works Systems Wiring Methods Knowledge Check 1. Article 300 covers the following wire methods: (check all that app) a. Protecting installed underground conductors b. Securing fire-resident-reads walls c. Wring for Factory-assembled control equipment d. Transit Elevator/Escalator Consortium ymmetric Transit Elevator/Escalator Consortium

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DO	SAY		Materials Needed
CLASSROOM ACTIVITY INDIVIDUAL ACTIVITY INSTRUCTOR'S NOTES	In your own words: Administer quizzes.		<section-header></section-header>