Course 303

Troubleshooting Propulsion and Dynamic Braking Systems

Includes DC Traction Motors

INSTRUCTOR GUIDE

RAIL CAR TRAINING CONSORTIUM

Table of Contents

Overview to Module 1

- This is a one-module course
- Duration of this module: 272 minutes (4.5 hours) not including hands-on demonstration activities
- PowerPoint slides: 21
- This module has a quiz.

Order of Instruction for Module 1

1. Give each participant a copy of the Participant Guide.
2. Begin instruction using the PowerPoint as a tool. The notes are intended as instruction guides or prompts for the instructor.
3. After completing the module, give each participant their own copy of **Module 1 Quiz**. Allow 15 minutes for them to complete the quiz.

Demonstrations and Take-aways

Participant Guide Reference	PPT Slide Reference	Instructional Method / Learning Application Type	Materials (References, Equipment, Tools, Etc.)
Learning App 3A Page 4	Slide 9	Small group exercise	- LearnApp 3A PATCO PBECU System
Master Controller Troubleshooting Chart Page 7	Slide 14	Small group exercise	

Outline of PowerPoint Presentation

Topic Title	Slides	Duration (Minutes)
Overview	1-6	27
Propulsion Control Logic Diagnostics	7-9	60
Diagnostic Software Lesson	10-11	60
Master Controller	12-13	20
Propulsion Blower	14	30
Traction motors	15-16	35
Brake resistors	21-22	25
Summary, Quiz	23-25	15
	TOTAL	**272 minutes (4.5 hours)**

Learning Objectives for Module 1

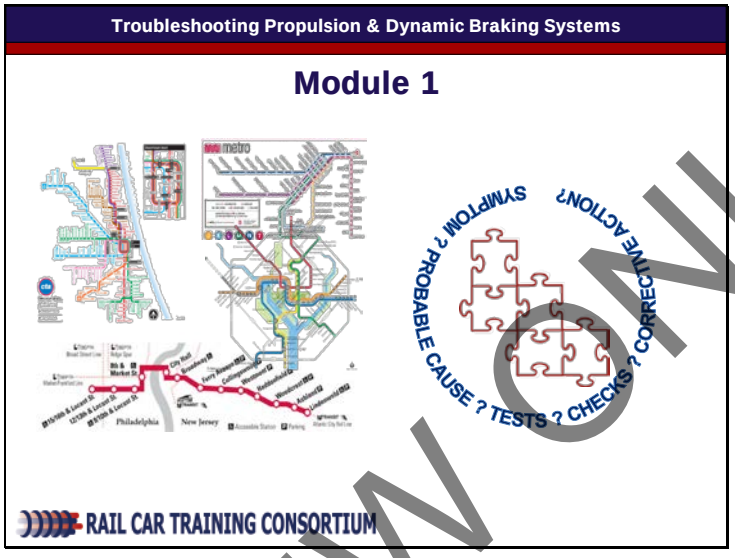
Following the completion of this module, the participant should be able to complete the objectives with an accuracy of 75% or greater:

- Troubleshoot master controller
- Troubleshoot Propulsion Control logic
- Troubleshoot propulsion ventilation
- Troubleshoot braking resistors
- Troubleshoot traction motor

Slide-by-slide Instruction

Overview

Slide 1



INSTRUCTIONAL EVENT: Gain attention

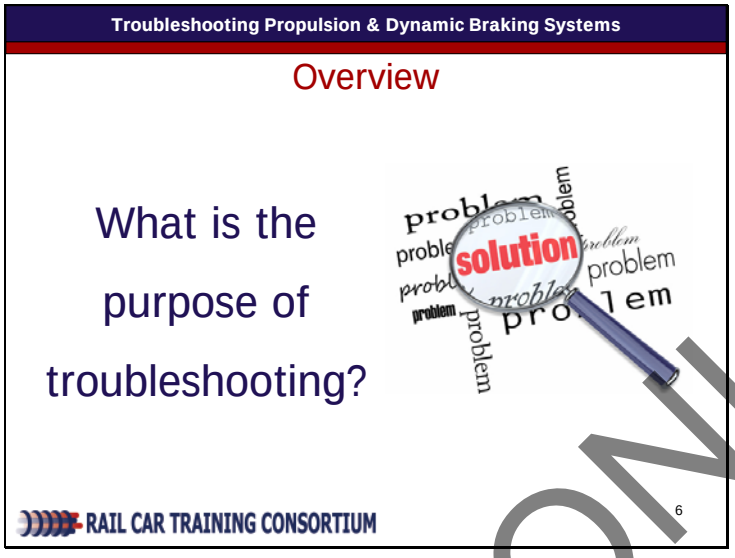
TIME: minutes

SAY: Welcome to Course 303: *Troubleshooting Propulsion and Dynamic Systems*. Course 303 has one module! Module 1 The purpose of this module is to provide participants with an overview to troubleshooting propulsion and dynamic braking systems on rail cars within the context of general troubleshooting and best practices. This module also prepares participants for national qualification testing. **We will have knowledge checks throughout this class as well as a quiz at the end.**

DO: Make sure that each participant has a Participant Guide. If this is your first time teaching these class participants, tell them a little about yourself – how long have you been with the agency, how long have you been teaching, etc. Ask participants to introduce themselves telling the class their name, department, previous work experience, and other information that you think is relevant.

OTHER: System maps for Muni (San Francisco, CA); CTA (Chicago, IL); WMATA (Washington, DC) PATCO (Port Authority, Lindenwold, NJ)

Slide 6



INSTRUCTIONAL EVENT: Recall of prior learning

TIME: 5 minutes

SAY: From previous courses and experience, what do you already know about troubleshooting? What is the purpose of troubleshooting?

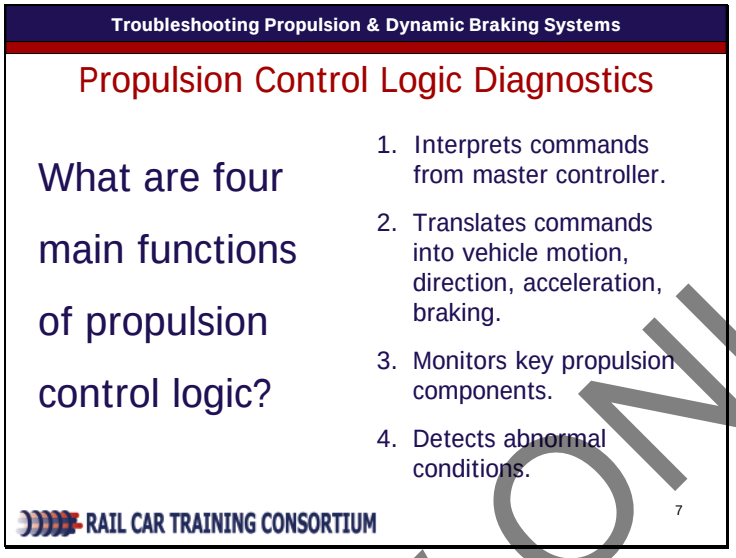
DO: Ask participants the question on the slide. Encourage discussion. If they completed in Course 300 *Troubleshooting Principles* encourage them to draw up on what they learned in that course. Allow participants to think about their answers for 30 seconds to 1 minute.

Answer: The purpose of troubleshooting is to systematically detect faults and to identify components that need to be repaired or replaced.

PARTICIPANT GUIDE PAGE REFERENCE: 2

Propulsion Control Logic Diagnostics

Slide 7



INSTRUCTIONAL EVENT: Recall

TIME: 10 minutes

SAY: What do you recall are the four main functions of **propulsion control logic**?

DO: Wait for participants to respond to the question. Encourage them to have a discussion on what they think are the four main functions. After they have responded, advance slides to reveal four functions. As you advance slide, read each section.

PARTICIPANT GUIDE (COURSEBOOK) PAGE REFERENCE: 3

Slide 9

INSTRUCTIONAL EVENT: Application Feedback

TIME: 45 minutes

SAY: It is time for a small group exercise.

DO: Give each participant a printout of **303 Learning Application 1A PATCO PBECU System**.

SAY: Let us examine a Propulsion Logic Control system software that is used by PATCO, the Port Authority Transit Corporation, which operates between Philadelphia, PA, and Camden, NJ. I am going to give each of you your own copy of sections from PATCO's manual which describes how to use PATCO's Propulsion and Brake Electronic Control Unit (PBECU). **Don't worry, the objective is NOT to learn specifics of this system**. Rather, I'd like us to read this and discuss some **main concepts** and **take aways** on how we approach diagnostic troubleshooting. You're going to work in teams of 2 or 3. So let's count off by 1, 2, 3.

DO: The first participant counts 1, the next 2, the third 3. The next person starts with 1, etc. Once everyone has counted off, suggest that all the 1's huddle together, all the 2's together, and all the 3's together.

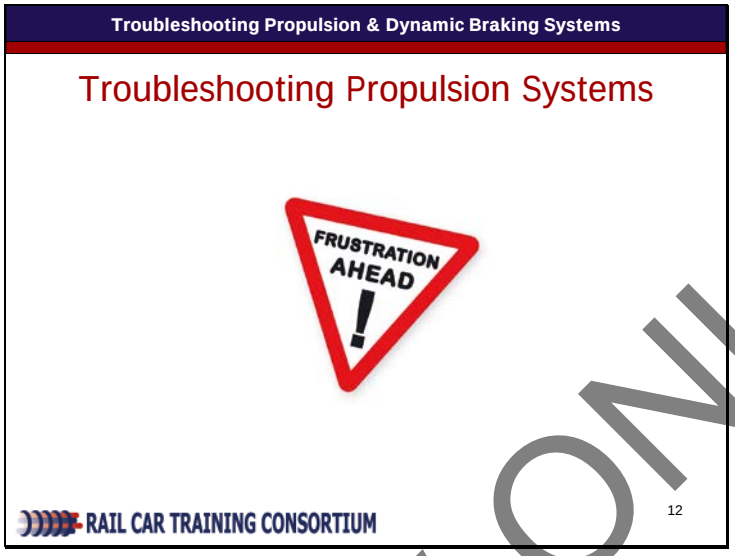
SAY: In your groups, each person should read the packet I just handed you. Once you've all read this, discuss the answers to **Learning Application 1A** found on page 4 of the participant guide. Be prepared to present your findings to the entire group.

DO: Allow 30 minutes for participants to read and discuss the answers in the exercise. After 30 minutes ask the entire group if they are ready to report on their findings. If they are not, ask them if they need another five minutes. Once all groups are ready, ask Group 2 to report their findings on Questions 1-3. Ask Group 3 to report on Questions 4-6. Ask Group 1 to report on Questions 7-9. Then ask the entire group to suggest the possible responses or answers to Question 10. Encourage discussion among participants.

PARTICIPANT GUIDE (COURSEBOOK) PAGE REFERENCE: 4-5

Master Controller

Slide 12



INSTRUCTIONAL EVENT: Present new content.

TIME: 5 minutes

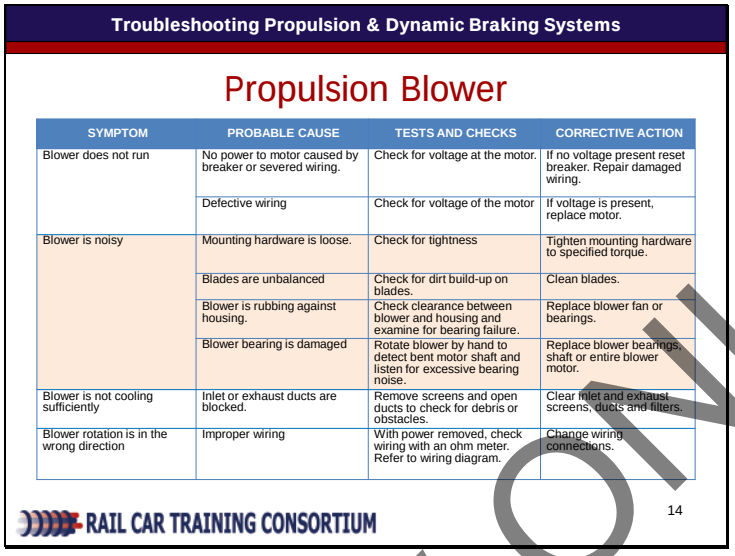
SAY: We'll now begin going through some recommended steps for troubleshooting common problems with the main areas of the propulsion system. We'll start with the Master Controller and work our way through the Propulsion Blower, Traction Motors, and Brake Resistors. Why do you think I put this "Frustration Ahead" warning? I didn't put this "Frustration Ahead" warning to alarm you. Not at all. Sometimes, though, there is some frustration in troubleshooting the propulsion system and that's because, despite our extensive knowledge of – as well as excellent diagnostic tools – there is going to be some mystery in figuring out a problem. Let me ask you – if there is a troubleshooting problem that any one person cannot resolve, what would be options available to them?

DO: Encourage discussion.

PARTICIPANT GUIDE (COURSEBOOK) PAGE REFERENCE: 7

Propulsion Blower

Slide 14



INSTRUCTIONAL EVENT: Present new content.

TIME: 30 minutes

SAY: This chart on possible symptoms with the propulsion blower is on page 8 in your Participant Guide. Lets go through each of these symptoms and their cause, tests, and corrective actions, together. If there are additional notes to what is here and in your Participant Guide, please jot them down in the appropriate column.

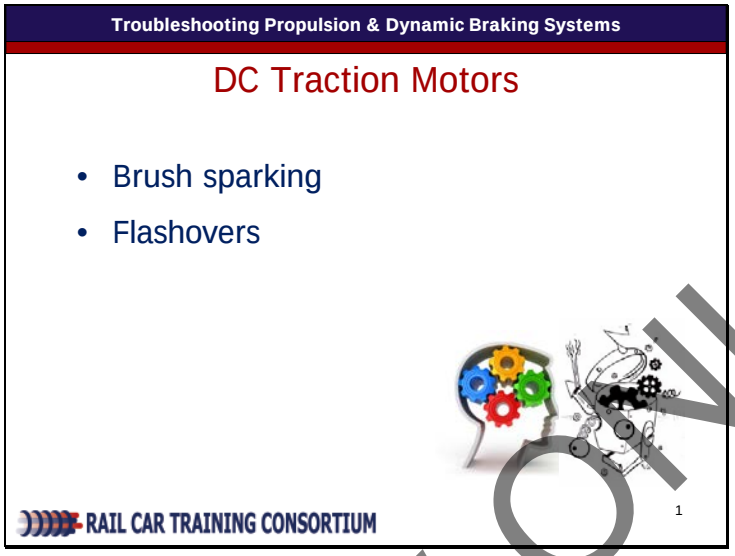
DO: Address each of these symptoms with as much participation as possible. If you have a personal story with a difficult troubleshooting situation involving the propulsion blower (ventilation) system that no one could figure out, please relate it.

PARTICIPANT GUIDE (COURSEBOOK) PAGE REFERENCE: 8

NOTE: This lesson is greatly enhanced with agency-specific references such as on-line manuals, job bulletins, and the like.

DC Traction Motor

Slide 15



INSTRUCTIONAL EVENT: Present content

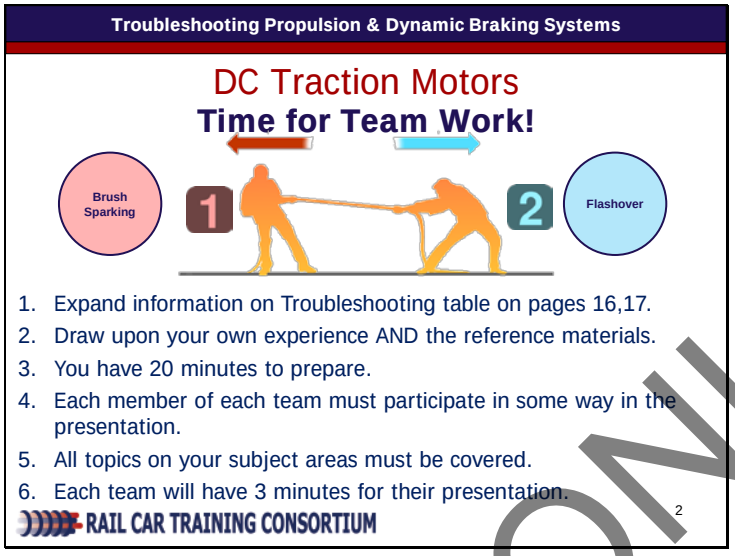
TIME: 5 minutes

SAY: When it comes to DC traction motors, brush sparking and flashovers are common symptoms. Do you agree? What other **common** symptoms are usually associated with DC motors.

DO: Read each bullet. Encourage discussion and add your own insight/experience with common symptoms of DC motors

PARTICIPANT GUIDE (COURSEBOOK) PAGE REFERENCE: 15-17

Slide 16



INSTRUCTIONAL EVENT: Provide learning activity on new content.

TIME: 30 minutes

SAY: We're going to divide into two teams. **[Have participants count off by twos. The 1s and 2s assembly in their teams at opposite ends of the classroom]**. Each team will read up about troubleshooting DC motors of a specific nature. You goal is to expand the information in the troubleshooting charts on pages 16-17. If you notice these symptoms Let me start by giving you the topic areas. **Team #1** you get to look at the **brush sparking**. **[ADVANCE SLIDE] Team #2** you will look at **flashover. [ADVANCE SLIDE]** Here are the rules…

DO: [**ADVANCE SLIDE]** as you read each of the four rules. Leave the slide up as teams get together in their groups. Circulate to assist and answer any questions regarding the activity. After 10 minutes, call time. Have each team report back their findings. Each team is to address the other team, i.e. not the instructor. After each team has presented to the other team, you may add new information if they've overlooked any aspect of troubleshooting of these symptoms of the AC motor.

PARTICIPANT GUIDE PAGE REFERENCE: 15-17

MATERIALS: You should have reference materials such as manuals, maintenance bulletins, operating procedures, etc. so the participants can easily access for this exercise.