Inspection and Maintenance of Couplers

Course 201

PARTICIPANT GUIDE

RAIL CAR TRAINING CONSORTIUM

Rail Vehicle Couplers

Inspection and Maintenance

Course 201

Participant Guide

December 2019

Rail Car Training Consortium

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REVISION INDEX

Any additions, deletions, or revisions are to be listed below.

Revision No.	Date	Section	Description of Change	Revision Author

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HOW TO USE THE PARTICIPANT GUIDE

Purpose of the Course

Course 201, *Inspection and Maintenance of Couplers,* provides participants with the essential steps for inspecting and maintaining coupler assemblies on rail vehicles.

Approach of the Book

Each course module begins with an outline, a statement of purpose and objectives, and a list of key terms. The outline will discuss the main topics to be addressed in the module. A list of *key terms* identifies important terminology that will be introduced in this module. *Learning objectives* define the basic skills, knowledge, and abilities course participants should be able to demonstrate to show that they have learned the material presented in the module. *Exercises* are built in throughout the course materials to assist the participants in learning and reviewing key information.

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MODULE 1

Preparing for Inspection and Maintenance

Outline

Purpose and Objectives

The purpose of this module is to provide participants with an overview to on the job safety hazards and personal protective equipment used for inspecting and maintaining couplers.

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

- Explain safety hazards that exist when inspecting couplers
- Identify PPE required for inspection and maintenance of couplers

Key Terms

- Hazards
- Scheduled Maintenance
- Personal Protective Equipment
- Pinch Points
- Unscheduled maintenance

1-1 OVERVIEW TO INSPECTION AND MAINTENANCE

Maintenance has been defined as the method that equipment is kept in its existing condition; preserved or protected; or kept from failure or decline. The goal of maintenance on a rail car is to provide optimal reliability that meets safety standards in providing onboard services for transit passengers and crew. A good definition of reliability is: The probability or duration of failure-free performance under stated conditions. There are two categories of maintenance; **Unscheduled** and **Scheduled.**

Unscheduled maintenance may also be known as reactive maintenance, corrective maintenance, breakdown maintenance, or run-to-fail maintenance, and is unavoidable.

Scheduled (preventive) maintenance is the proactive approach of scheduling maintenance in order to preserve, protect, and keep rail car systems from failure or decline. Scheduled maintenance includes predictive maintenance and preventive maintenance.

Scheduled maintenance serves two purposes: To keep equipment working properly and to extend the life of the equipment. Sometimes in the process of performing scheduled maintenance, the technician may encounter a situation where the corrective action (repair or replace components) may need to happen.

Scheduled maintenance is generally guided by authority requirements, regulatory and code requirements, technical safety requirements, in-service inspection and testing, engineering decisions, and OEM recommendations.

Working Safely

Hazards exist in every workplace. Section 1-2 of this course will cover PPE to be worn while inspecting couplers however, it is important to identify and understand hazards that exist during coupler inspection, which may include:

Electrical Hazards

- Shocks: Rail car technicians should ensure they followed proper Lockout Tagout (LOTO) procedures while cleaning electrical coupler pins. For more information regarding LOTO, refer to Course 100.

- Electrical heaters may become extremely hot. When inspecting around the area be sure to steer clear of the area as touching the heater may result in burns.

Mechanical Hazards

- Pinch Points: A pinch point is an area where there is a chance of a body part getting caught between a stationary and moving part of a machine. Examples on the coupler include any spring-loaded components

Other Hazards

- The coupler should never be stepped on or used as a "ladder" as this could result in a fall and cause serious injury.

1-2 PREPARING FOR INSPECTION AND MAINTENANCE

Personal Protective Equipment (PPE)

Hazards exist in every workplace in many different forms; sharp edges, falling objects, flying sparks, chemicals, noise, and a myriad of other potentially dangerous situations. The Occupational Safety and Health Administration (OSHA) requires that employers protect their employees from workplace hazards that can cause injury.

Personal Protective Equipment, often referred to as PPE, is equipment provided to the worker to limit exposure to workplace hazards. Hard hats, safety glasses, ear plugs and safety boots are common pieces of PPE. According to OSHA, PPE is worn to minimize the risk the exposure to chemical, radiological, physical, electrical, mechanical or other workplace hazards.

OSHA Standard 1920.132(a) states that PPE, including protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition whenever it is necessary by reason of hazards, processes, environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact.

PPE should be maintained and cleaned per equipment and agency guidelines. PPE should fit comfortably. The difference between properly and ill-fitting PPE, could result in injury or death.

Employer Responsibility

Employers are responsible to assess the workplace to determine if hazards are present, or likely to be present. Hazards that are present, or that are likely to be present, necessitate the use of PPE. If such hazards are present, or likely to be present, the employer is required to train and educate employees on the following.

- When PPE is necessary;
- What kind of PPE is necessary;
- How to properly wear, adjust and take off PPE;
- Limitations of the equipment; and
- Proper care, maintenance, life-span and disposal of equipment.

Employee Responsibility

Employees also have a responsible to ensure their safety. The employee shall:

- Attend PPE training sessions;

- When required, wear PPE properly;
- Care for and maintain PPE; and
- Advise a supervisor regarding the replacement of damaged PPE.

Employees should have a clear understanding on which piece of PPE to use for each job function and how to properly use PPE before beginning any work.

In some cases, employers may have reason to believe that an employee who has already been trained on PPE does not have an adequate understanding required to safely utilize the PPE. In this situation, the employer shall retrain the employee. Retraining is required in the following situations, but is not limited to:

- Changes in the workplace which renders previous training obsolete;
- Changes in the types of PPE to be used which renders previous training obsolete; and
- Unsatisfactory knowledge or skills in an employees' use of assigned PPE which indicate the employee has not retained the requisite understanding or skill.

Employer Responsibilities and Worker's Rights

Workers have a right to a safe workplace. There are laws that protect employees and require employers to provide a safe workplace. For more information, visit www.osha.gov or call 1-800-321-OSHA (6742).

A full list of PPE items was provided in Course 100. When performing rail vehicle coupler maintenance or inspection checks, it is necessary to wear the appropriate PPE. PPE for rail car technicians may include:

- Gloves;
- Respirator/dust mask; and
- Safety glasses.

Gloves

There are many different types of gloves workers can wear and that depend on the hazard and nature of technical work. Choosing the correct type of glove for the job being performed is vital for the protection and safety of workers. It is important for a worker to select the correct type of glove for the work duty that they are performing because one type of glove may protect worker against one type of hazard but not another. Common types of gloves include, leather, canvas, metal mesh, fabric, and coated fabric and chemical and liquid resistant gloves.

Figure 1.1 Safety Gloves

Most often rail car technicians will have to wear rubber gloves. Rubber gloves are a comfortable, general purpose glove. They are elastic and temperature resistant. Rubber gloves protect workers' hands from abrasions and some water solutions, like acids.

Follow your individual agency's directives when choosing the appropriate type of glove for the work being performed.

Respirator/Dust Mask

Respirators and **dust masks** cover the nose and mouth or the entire face to protect workers from inhaling hazardous materials. They can be disposable, reusable or powered and supplied by oxygen. Respirators protect workers from inhaling chemicals that can be irritating and hazardous to the health of the worker. It is important to choose the correct respirator depending on the hazard the worker is encountering.

For example, a rail car technician cleaning debris out of the tracks may be required to wear a respirator or dust mask. In this instance, the technician will use a citrus-based aerosol spray to clean the debris, thus requiring a respirator or dust mask to protect themselves from the harmful chemicals.

Figure 1.2 Dust Mask

Figure 1.4 Face Shield, Courtesy of CTA

Safety Glasses

Safety glasses are a standard PPE that rail car technicians should wear. They protect the eyes and can be constructed from metal or plastic. On some models, they may have side shields.

The above-mentioned PPEs are only a few examples that rail car technicians may wear when performing their job duties. It is important to follow your individual agency's guidelines on the appropriate PPE to wear for specific job tasks.

Figure 1.5 Safety Glasses

PPE Maintenance and Care

Understanding and following the proper care and maintenance of PPE is an important training issue and on that can easily fall through the cracks. Following agency required maintenance of PPE will ensure equipment function as it should. Below are some general maintenance guidelines for PPE required of rail car technicians.

- Regularly clean and/or disinfect PPE with soap and water or cleaning solution, according to manufacturer's instructions and guidelines.
- Check for holes, cracks, deterioration and other problems, regularly.
- Store in a clean and dry location where PPE will not get scratched (safety glasses) or damaged
- Replace PPE immediately, if damaged

Learning Application 1.1 Hazard Specific PPE

Work together in pairs. Think about safety hazards a rail car technician may encounter during Coupler inspection and maintenance. List 3 potential safety hazards and the PPE required for each. Be prepared to report out to the class on the Hazards and PPE you identified with your partner.

Hazard Specific PPE	
Potential Safety Hazard	PPE Required
1.	
2.	
3.	

1-3 SUMMARY

This Module provided the participant with an overview to safety hazards to be aware of when inspecting rail vehicle couplers. Required PPE for Coupler inspection and proper maintenance and care was also discussed. As always, refer to your agency for specifics regarding safety and PPE.

MODULE 2

Inspection and Maintenance of Coupler Components

Outline

Purpose and Objectives

The purpose of this module is to provide participants with the general procedures for inspection and maintenance of the coupler.

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

- Demonstrate the ability to perform a pre-trip inspection
- Demonstrate the ability to inspect and maintain mechanical coupler components
- Demonstrate the ability to inspect and maintain electrical coupler components
- Demonstrate the ability to inspect and maintain pneumatic coupler components

Key Terms

- Audible inspection
- Visual inspection

2-1 OVERVIEW

This Module will provide the participant with the general procedures for a coupler pre-trip inspection as well as procedures for inspecting all parts of the coupler. Please note that the procedures provided are *general* and may need to be tailored to the specific type of coupler used at your agency. As always, be sure to follow all safety guidelines and procedures as mandated by your agency.

General inspection and maintenance procedures are presented in tables. Space is provided, and encouraged for participants to take notes on agency specific information related to coupler inspection and maintenance.

2-2 PRE-TRIP INSPECTION

The pre-trip inspection consists of a visual and audible inspection. It can be performed on coupled and/or uncoupled couplers from outside the vehicle.

First, the technician will perform an **audible inspection**. This includes:

- Listen for air leaking coming from air lines, tappet valve, and solenoid valves attached to the coupler

Next, the technician will perform a **visual inspection**. This includes:

- Coupler centering device is centering coupler to center of body;
- Coupler buffer tube is extended out the correct distance from carbody;
- Verify electric coupler head doors are in the correct position in uncoupled;
- Verify electric cables and air hoses are not hanging on ground or damaged;
- If coupled, verify there is no air gap between coupler head mating surfaces;
- If coupled, verify locking pins are in place, if needed;
- If coupled, verify exterior lights are in correct orientation;
- Verify coupler is not hanging lower than normal.

During the pre-trip inspection, if the technician identifies any problems, he will address that component individually. Inspection and maintenance procedures for individual coupler components can be found in the next section.

Learning Application 2.1 Pre-Trip Inspection

Together as a class, identify the steps taken for a coupler pre-trip inspection at your agency.

Step	Task	Notes
1		
2		
3		
4		
5		

2-3 MECHANICAL PARTS TO THE COUPLER

Mechanical Coupler Head

Maintenance for the mechanical coupler head includes cleaning the coupler head and applying lubricant, as necessary. If damaged, it is replaced. The general inspection procedure is as follows:

Mechanical Coupler Head Inspection and Maintenance	
General Recommendations	Agency Requirements
1. Check for damage, rust, corrosion 2. Check **throat opening** *(where hooks insert into of each adjacent car)* 3. Check level	
Other notes:	

Latching Device

The latching device, which may be a link, hook plate or knuckle has relatively low maintenance. The latching device must be lubed, according to OEM or agency requirements. If it is damaged, the latching device is replaced. The general inspection procedure is as follows:

Latching Device Inspection and Maintenance	
General Recommendations	Agency Requirements
1. Check for damage, rust, corrosion 2. Check play/alignment with go/no-go gauge	
Other notes:	

Uncoupling Device

As you will recall from Course 101, the uncoupling device is used for the automatic and manual uncoupling of rail passenger vehicle's mechanical coupler.

The general inspection procedure, is as follows:

Uncoupling Device Inspection and Maintenance	
General Recommendations	Agency Requirements
1. Inspect for air leaks 2. Ensure air connections are tight 3. Ensure proper rotation of uncoupling device 4. Ensure all seals are holding air 5. Ensure smoothness of operation 6. Inspect linkage for damage	
Other notes:	

If the uncoupling device is damaged, it is rebuilt with new seals. The damaged uncoupling device is typically sent to the rebuild shop.

Suspension Attachment and Centering Device

In proper working condition, the suspension attachment and centering device springs are quiet and centered. If either are damaged, they are replaced.

Suspension Attachment and Centering Device Inspection and Maintenance	
General Recommendations	Agency Requirements
Suspension Attachment 1. Check height 2. Check level 3. Check hardware 4. Lube, as necessary 5. Ensure coupler returns to center when pulled out of center 6. Check for leaks (shocks) 7. Check for wear	
Centering Device 1. Check for damage 2. Ensure coupler returns to center	
Other notes:	

Cushioning Device

As you will recall from Course 101, the Cushioning Device is also referred to as the Draft Gear. If the cushioning device is damaged, the whole couple is removed and replaced with a re-manned coupler. There is no maintenance on the cushioning device.

Cushioning Device Inspection and Maintenance	
General Recommendations	Agency Requirements
Buffer Tube 1. Verify indicator, check inspection hole 2. Visually inspect chrome plated rod and look for signs of excessive movement	
Draft Gear 1. Visually inspect	
Other notes:	

Anchorage Device

The anchorage device provides a means of physically attaching the coupler to the carbody. It is typically attached with shear bolts.

Anchorage Device Inspection and Maintenance	
General Recommendations	Agency Requirements
1. Visually inspect the shear bolts/mounting bolts a. Safety wire/torque strip (paint) broken bolts 2. Move coupler to look for excessive movement	

Anchorage Device Inspection and Maintenance	
General Recommendations	Agency Requirements
Other notes:	

If damaged, shear bolts are replaced. The anchorage device is removed and replaced with a whole coupler, as needed. Maintenance includes applying grease, as necessary.

2-4 ELECTRICAL PARTS TO THE COUPLER

As you will recall from Course 101, the electrical coupler allows for trainline communication between vehicles. Prior to beginning inspection and/or maintenance of the electrical coupler, it is important to take the necessary safety precautions. If necessary, lockout/tagout electrical systems. Place the vehicle on flat or over pit and chock one wheel of the vehicle.

Inspecting and maintaining the electrical coupler will require specific tools and materials, such as:

- Cleaning solvents (manufacturer recommended)
- Cleaning materials (rag, brush, cleaning pad – manufacturer recommended)
- Flashlight
- Hand tools (wrenches, screwdrivers)
- Cooling element (manufacturer recommended)

The general inspection process for the electrical coupler is as follows:

Electrical Coupler Inspection and Maintenance	
General Recommendations	Agency Requirements
Electrical Coupler Head 1. Visually inspect insulating block. Must be clean and not cracked.	
Coupler Door(s) 3. Activate electrical coupler doors by placing a metal object in front the proximity switch 4. Verify proper operation of the electrical couplers and doors by depressing the coupling switch	

Electrical Coupler Inspection and Maintenance	
General Recommendations	Agency Requirements
Electrical Pins 5. Visually inspect pins for evidence of arcing, corrosion. 6. Depress pins to check spring tension 7. Spray pins with recommended cleaning solvent and clean pins with a rag, brush, or cleaning pad. Clean any remaining solvent from pins and electrical face. 8. Using multimeter, pins must be checked for stray voltage. *Anything more than .5 volts indicates failure of electrical coupler head.*	
Proximity Switch & Rotary Switch 9. Visually inspect switch(es) and wiring for evidence of damage. 10. Clean switch (sensor), if necessary	
Trainline Cables 11. Visually check cables for evidence of damage and exposed wires. Look for dragging or rubbing.	
Actuators (electrical/pneumatic) 12. Visually inspect actuators for damage. 13. Actuate electrical couplers by placing a metal object in front of the proximity or depressing the coupling switch and verify the electrical coupler and door operation. 14. Check the dust boots and wires for damage.	

Electrical Coupler Inspection and Maintenance	
General Recommendations	Agency Requirements
Heaters (not all properties will have) 15. Activate heaters by applying a cooling element (reference maintenance manual) to the heating sensor on the sensing unit. 16. Check for radiant heat around the coupler face and electrical couplers	
Coupler Control 17. Once the electrical couplers have been activated, depress the uncoupling button on the cab console and verify the electrical couplers retract and doors close. 18. Check for air leaks: a. Operate cutout handle** i. Locking pawl locks ii. Spring operation	
Other notes:	

It should be noted that if there is some damage to pins, they can be replaced. If the pins cannot be replaced, the electric coupler will be replaced. Under most conditions of defects, the entire coupler will be replaced. Maintenance of the electrical coupler is typically performed through inspections.

******If the coupler control cutout handle does not lock, clean and lube. If it still does not lock, replace control cutout. Worn parts are rebuilt at service interval.

Learning Application 2.1 – Electrical Coupler Inspection

Inspection of the electrical coupler may be a one or two-man job, depending on agency. As a class, discuss how the electrical coupler is inspected at your agency.

2-5 PNEUMATIC PARTS TO THE COUPLER

Air Filter

Maintenance for the air filter includes periodically draining excess moisture and debris, as directed by OEM or agency.

The general procedure for inspecting the air filter is below. If any of the inspected items are damaged, or do not operate OEM states, they are replaced.

Air Filter Inspection and Maintenance	
General Recommendations	Agency Requirements
1. Check for leaking air at or around air filter 2. Check for air filter damage 3. Ensure there is air flow when bladder valve is open 4. Check for excessive debris in filter	
Other notes:	

Pneumatic Valves

Pneumatic valves, such as the impulse valve, tappet valve and solenoid valves all follow similar inspection procedures. The general inspection procedure is as follows:

Pneumatic Valves Inspection and Maintenance	
General Recommendations	Agency Requirements
1. Listen for air leaks 2. Inspect for physical damage (kinks, cuts, dents) 3. Operate valve to verify component is functioning normally.*	
Other notes:	

*Operating a valve may require two technicians.

If broken, the component is replaced. Replace worn seals and lines. Damaged components are rebuilt on a service interval; based on mileage or time.

2-6 SUMMARY

This Module guided the participant through general inspection and maintenance procedures for the mechanical, electrical and pneumatic coupler. The procedures provided are general and participants should refer to their agencies for any specific information related to inspection and maintenance of the coupler.