

6. Recommended Practice for Coupler System Periodic Inspection and Maintenance

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Abstract: The recommended practices described in this document provide guidance for the periodic inspection and maintenance of coupler systems mounted on rail transit vehicles. This document includes mechanical, electrical and pneumatic coupling systems. It provides a set of useful practices that can be selected and applied during the inspection and maintenance process as the particular design warrants.

Keywords: couplers, draft gears, drawbars, link bars, periodic inspection and maintenance

Introduction

(This introduction is not a part of APTA RT-RP-VIM-006-02, *Recommended Practice for Coupler System Periodic Inspection and Maintenance*.)

This Recommended Practice for Coupler Systems Periodic Inspection and Maintenance for rail transit vehicles represents a common viewpoint of those parties concerned with its provisions, namely, transit operating/planning agencies, manufacturers, consultants, engineers and general interest groups. The application of any standards, practices or guidelines contained herein is purely voluntary. In some cases, federal and/or state regulations govern portions of a rail transit system's operations. In those cases, the government regulations take precedence over these recommended practices. APTA recognizes that for certain applications, the standards or practices, as implemented by individual rail transit systems, may be either more or less restrictive than those given in this document.

This document describes the basic inspection and maintenance functions for coupler systems mounted on rail transit vehicles. APTA recommends the use of these practices by:

- Individuals or organizations that maintain coupler systems on rail transit vehicles;
- Individuals or organizations that contract with others for the maintenance of coupler systems on rail transit vehicles; and
- Individuals or organizations that influence how coupler systems are maintained on rail transit vehicles.

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Recommended Practice for Coupler System Periodic Inspection and Maintenance

1. Overview

This recommended practice provides guidance for the periodic inspection and maintenance of coupler systems mounted on rail transit vehicles. It includes emergency release bolts, energy absorption devices, support devices, centering devices, safety locks, guides, yokes, anchorages, draft gears, and safety hangers. This document also includes electrical, pneumatic, and mechanical systems used for coupling rail transit vehicles, with manual, automatic, remote, and power-assisted mechanisms.

1.1 Scope

This recommended practice is intended for use by rail transit systems as a guide for developing systematic and comprehensive, equipment specific, coupler system inspection procedures.

1.2 Purpose

The recommendations presented provide guidance to aid in the establishment of a systematic and comprehensive inspection and maintenance set of procedures using manufacturer's recommendations, and proven best practice maintenance and procedures developed by rail transit systems.

2. References

Original Equipment Manufacturer's Inspection and Maintenance Manuals.

Rail Transit System Practices for the Inspection and Maintenance of Coupler Systems

29 CFR 1910.242b, Compressed Air Used For Cleaning.

3. Definitions, abbreviations, and acronyms

3.1 Definitions

With a diversity of manufacturers and rail transit systems it is necessary to establish a common vocabulary to describe components that are identical or similar in nature and function. For the purposes of clarity the following terms and definitions will be used in this document:

3.1.1 buffer: A spring assembly, gas-hydraulic self re-setting energy absorption device, crush cartridge assemblies, or series of elastomeric elements within some coupler assemblies, which can absorb a high impact coupling or severe buff loads.

3.1.2 centering device: A device that prevents or limits a free or uncoupled coupler assembly from moving in its normal lateral range.

3.1.3 coupler control box/panel: A device from which commands/signals are generated to initiate a coupling or uncoupling sequence of events and the isolation/connection of electric trainline circuits.

3.1.4 coupler – electrical: A mechanical device mounted to a mechanical coupler assembly that makes the electrical circuit connections between rail transit vehicles through a series of mating contacts.

3.1.5 coupler – mechanical: A device, which as part of a coupler assembly makes the physical connection between rail transit vehicles. Consists of a face plate with alignment pins and matching holes to mate to a like device on another rail transit vehicle. Also known as the mechanical coupler head.

3.1.6 coupler – pneumatic: A self-sealing valve assembly mounted to a coupler assembly that allows for air pressure equalization between coupled rail vehicles.

3.1.7 coupler switch box: A termination point for electrical circuits to the electric coupler heads. Also known as a Jumper/Drum Switch.

3.1.8 coupler system/assembly: A mechanical device optionally consisting of a mechanical coupler, electrical coupler, pneumatic coupler, draft gear, yoke, and energy absorber.

3.1.9 deformation tube: A two-section tube as part of a coupler assembly, which upon unusual severe impact collapses one into the other for dissipation of energy and momentum. Acts as an energy absorption device. It is not repairable and must be replaced when activated.

3.1.10 draft gear: A device enclosed within a coupler assembly that transmits draft and buff loads to the carbody.

3.1.11 drawbar: A metal bar/tube connected directly to the anchorage castings used to connect rail transit vehicles together without the option of an uncoupling device. This device normally has a draft gear.

3.1.12 emergency release ring/plate: A metal section encased within the coupler assembly into which shear/tension bolts are threaded.

3.1.13 emergency release/tension bolts: Threaded devices, which are designed to break under a specified load, when subjected to severe buff loads as a result of a collision or other causes. Also known as shear pin/bolts.

3.1.14 energy absorption cylinder: A device used within a coupler assembly to absorb a high impact coupling or severe buff loads. It is not self re-setting.

3.1.15 link bar: A metal bar/tube used to connect rail transit vehicles together. It generally connects to the coupler yokes of the cars it is connecting, replacing the respective mechanical couplers. It is not equipped with a quick release device for uncoupling.

3.1.16 radius/radial carrier bar: A flat steel bar mounted to the underside of a vehicle used to support the coupler assembly at the end opposite of the anchorage connection. It allows for full lateral movement within the couplers normal range.

3.1.17 yoke: A mechanical articulation connection as part of a coupler assembly that allows for normal limited movement in the vertical plane, horizontal plane, and rotation about the longitudinal axis to compensate for the natural varied orientation of coupled rail transit vehicles in motion.

3.2 Abbreviations and acronyms

ANSI	American National Standards Institute
CFR	Code of Federal Regulations
MSDS	material safety data sheet
OEM	original equipment manufacturer
OSHA	Occupational Safety and Health Administration

4. Frequency of conduct

Periodic inspection and maintenance tasks on the coupler system should be performed on a regular schedule as determined by the rail transit system. The frequency of any task contained within this Recommended Practice for Periodic Inspection and Maintenance of Coupler Systems document should comply with all applicable federal, state and local regulations. Further, in the conduct of a rail transit system's periodic inspection and maintenance programs, the frequencies for individual tasks may be established based on a number of additional factors, including but not limited to:

- OEM – recommended intervals
- Industry Experience
- Operating Environment/Conditions
- Historical Data
- Performance Requirements
- Failure Analysis
- Reliability Centered Maintenance Programs

5. Requirements and specific tasks

WARNING: Ensure that equipment is secured against uncontrolled movement, in accordance with the rail transit system's safety practices, before commencing any inspection or maintenance procedure.

WARNING: Compressed air with pressures up to 170 psi can be encountered and can be hazardous when released. Compressed air remains in components even when isolated. Be alert to airborne particles and noise. Appropriate eye, face, and hearing protection, meeting minimum ANSI standards, plus other personal protective equipment, as approved by the rail transit system, shall be worn.

WARNING: When performing work on a coupler system, follow the rail transit system's safety procedures. Some coupling equipment can be remotely activated. Ensure that all personnel are aware and clear of any danger as required. The electric coupler should be isolated, prior to inspecting or while performing certain maintenance activities.

WARNING: Use only those cleaning products and lubricants proven safe and authorized for use by the rail transit system. Consult OEM and MSDS references for suitability for each separate application to prevent personal injury and damage to the equipment.

5.1 Materials

Consumables such as air filters, "O" rings, and lubricants will be required. Refer to OEM for specifications with respect to consumables and recommended intervals.

5.2 Tools

In addition to the standard tools carried by maintenance personnel, specialized tools will be required:

- go/no-go gauges,
- profile and hook gauges,
- gap measuring devices,
- spirit levels, and
- dial indicators will be required.

These gauges and devices are required to determine proper clearance of components and condemning limits, and are essential in adjustment procedures. Refer to the OEM for specific gauging and measuring requirements and other specialized tooling.

5.3 Safety/personal protective equipment

Appropriate personal protective equipment, meeting minimum ANSI standards, and as required by the rail transit system, shall be worn at all times in the performance of these inspection and maintenance tasks.

5.4 Training requirements

Rail transit systems and/or their maintenance contractors should develop and execute training programs that provide employees with the knowledge and the skills necessary to safely and effectively perform the tasks outlined in this recommended practice.

5.5 Inspection and maintenance

In all of the following procedures and recommended practices, the OEM's Maintenance Manuals should be referred to for torque values, condemning limits, clearance measurements, and specific procedure methodology. Devices should be cleaned for proper inspection. These procedures cover only the visual inspection, gauging, adjustment, and functional testing of a coupler system mounted on a rail transit vehicle. Some procedures may require the use of heavy lifting and support devices due to the size and weight of the equipment. Some procedures require more than one individual. Some procedures will not be applicable due to design variations. Methodologies for the resolution of deficiencies noted while inspecting, gauging, adjusting, or functionally testing the coupler systems and associated devices should be tailored by the rail transit system in conjunction with the Original Equipment Manufacturer. Documentation of the inspection and maintenance process as to interval, deficiencies, and resolution of those deficiencies found should be done in a comprehensive manner so as to create a useful database, which will enhance the reliability and accountability of the process.

5.5.1 Coupler assembly (less mechanical, electrical, and pneumatic couplers)

- a) Inspect the coupler anchorage for damage, evidence of movement, and security of fastening devices.
- b) Inspect mounting plate emergency release screws, nuts, washers, and bushings for presence and condition.
- c) Inspect the coupler connection to the anchorage. Inspect connecting hinge pin/bolts, washers, nuts, cotter pins, safety retaining devices, shimming material, and retaining hardware for degradation and security of attachment. Never reuse hardware removed from the tail socket.
- d) Inspect for degradation of the spherical rubber bearing.
- e) Inspect all pneumatic hoses, piping, and connections for evidence of leakage or damage.
- f) Inspect for freedom of movement at coupler/drawbar anchorage connection.
- g) Gauge hinge pin/bolt, bushings, and ball/socket for proper clearance at the coupler/drawbar anchorage. Shim or condemn as required.
- h) Inspect anchorage mounted lateral limit stops/bumpers for wear, damage, and security of attachment.
- i) Inspect grounding straps and shunts for integrity and security of attachment.
- j) Inspect anchorage integrated centering mechanism for wear, seal leakage, damage, and security of attachment. Inspect centering springs, chains, pins, snap hooks, and eye connections. Check for function.
- k) Inspect coupler support assembly for freedom of movement, and security of attachment. Inspect support springs for damage, and proper resilience.

- l) Lubricate anchorage connection as required.
- m) Inspect cut out valves for evidence of leakage. Operate cut out valves to check for ease of use and proper function. Lubricate as required.
- n) Inspect emergency release bolts and washers for presence, security of attachment, and evidence of damage or loosening. Inspect safety wire and/or retaining devices for presence and proper application.

NOTE: Emergency release bolts should be replaced in sets whenever any bolt is suspected of being damaged due to a high buff load event or shows evidence of damage.

- o) Inspect emergency ring witness mark alignment for evidence of movement. Any indication of movement would warrant removal and physical inspection of the emergency release bolts.
- p) Inspect draft gear elements for signs of movement or deterioration. Inspect security of plug/yoke nut and associated retaining/locking hardware.
- q) Inspect gas-hydraulic buffer for signs of damage, leakage, or unusual movement or play.
- r) Inspect split ring spring compression nut and ring spring for movement, damage, and signs of wear.
- s) Inspect the yoke and corrosion ring for damage, proper rotational movement, and security of all associated attachment hardware. Gauge yoke clearance within coupler assembly housing. Gauge pivot bushings and pin/bolt as required. Shim and lubricate as required.
- t) Inspect mechanical coupler head support spring assembly for signs of damage, proper resiliency and wear, and check for normal movement.
- u) Inspect radius/radial carrier bar for signs of damage, wear, and security of mounting hardware and stops. Gauge as required. Lubricate as required.
- v) Inspect spring carrier for signs of damage, wear, proper resilience, and function.
- w) Inspect and operate center-locking device to check for function, leakage, and security of attachment.
- x) Inspect safety hanger for integrity, and security of attachment.
- y) Inspect deformation tube for signs of damage, dents, rust, or collapse.
- z) Inspect all attaching hardware on the coupler/drawbars for cabling, pneumatic hoses/piping and other equipment for presence, security, and function.
- aa) Inspect the coupler/drawbars and attached pneumatic hoses/piping, cabling, and chains/springs for evidence of fouling or chafing while moving it through its normal range of movement. Repair/adjust as required.

5.5.2 Link bars and drawbars

- a) Inspect the link bar/drawbar for evidence of damage, dents, or deformation.
- b) Inspect link bar/yoke connections for clearances and proper play. Gauge bushings and hinge pin/bolts as required. Shim as required.
- c) Inspect link bar/yoke connection shims for degradation or displacement.
- d) Inspect all attaching hardware on the link bar/drawbar cabling, pneumatic hoses/piping and other equipment for presence, security, and function.
- e) Inspect all link bar/drawbar attached pneumatic hoses/piping and cabling for evidence of fouling or chafing. Repair/adjust as required. It may be necessary to move the coupler through its normal operating range to confirm repairs/adjustment.
- f) Inspect pneumatic connections for evidence of leakage.
- g) Inspect ground straps and shunts for integrity and security of attachment.
- h) Lubricate the link bar/yoke hinge pin/bolt as required.
- i) Inspect drawbar for proper rotational movement.
- j) Inspect two-section drawbars for security of attachment of joining hardware.
- k) Inspect gangway support and associated hardware for security of attachment.
- l) Inspect safety hanger for integrity, and security of attachment.
- m) Inspect all pneumatic hoses/piping and cabling at attachment to the carbody for security of attachment and proper suspension support.

5.5.3 Couplers – mechanical and pneumatic

- a) Gauge coupler for proper height. This should be done after all other coupler checks verify the integrity of the inspected coupler. Prior to any gauging or adjustment, verify that carbody is at proper height, air springs are functioning, coupler face is perpendicular as per OEM, and coupler head is rotationally horizontal and level. Gauging should be done with coupler assembly aligned to the center of the vehicle. Adjust as required.
- b) Inspect mechanical coupler face, throat, hook, link, cam, springs, knuckle, linkages, levers, guide/alignment pins, hinge pins/bolts, and bushing components for damage, burrs, or unusual wear. Repair or replace as required.
- c) Inspect all component retaining hardware for wear and security of attachment.
- d) Gauge coupler face, throat, hook, knuckle, guide/alignment pins, hinge pins/bolts and bushing components using the appropriate go/no-go gauges. Adjust/condemn/replace as required.

- e) Inspect buffing face wear plates for presence and condition of condemning marks.
- f) Lubricate mechanical coupler, uncoupling devices (remote, automatic, manual), and other associated components as required.
- g) Inspect the front face limit switch for security of attachment. Gauge plunger tip protrusion, adjust as required. Operate front face limit switch and check for proper function.
- h) Inspect coupler isolation switch assembly for damage and security of attachment. Operate coupler isolation switch and check for proper function.
- i) Inspect the remote uncoupling device. Check for wear of cams, linkages, springs, evidence of leakage, and pivots.
- j) Operate the remote uncoupling device. Verify full opening of the coupler, full travel of the release mechanism, and ease of movement with no binding or fouling of the device.
- k) Inspect the safety lock and linkage for damage. Operate the coupler and check for engagement of the safety lock with no fouling or binding.
- l) Inspect the uncoupling cylinder vent choke plug for fouling, as evidenced by a slow hook/latch reset. Clean/replace as required.
- m) Inspect the uncoupling cylinder for evidence of damage or seal leakage.
- n) Inspect the cut out valve for evidence of leakage. Operate cut out valve to test for function.
- o) Open drain plug on filter assembly. Drain condensation. Re-secure drain plug.
- p) Replace air filter, gaskets, and “O” rings as required. Inspect housing and connections for evidence of leakage.
- q) Inspect uncoupling solenoids/motors for integrity of electrical connections and seals.
- r) Operate the coupler manual release mechanism and check for function. Verify full opening of the coupler, full travel of the release mechanism and ease of movement with no binding or fouling of the device.
- s) Inspect uncoupling cylinder tappet valve and gasket for signs of leakage. Gauge pin for proper protrusion and diameter as required. Renew seals/“O” ring and adjust as required.
- t) Inspect trainline air valve tappet and pneumatic connections for leakage or damage. Gauge pin for proper protrusion and diameter as required. Renew seals/“O” ring and adjust as required.
- u) Inspect mechanical coupler heater for loose wiring and damage. Test for function.

5.5.4 Couplers – electrical

- a) Inspect the electric coupler housings for damage and security of attachment.
- b) Inspect the integrity and security of attachment of the electrical cables and cable supports for the coupler housing. Check for connection security, chafing of cabling, and signs of degradation.
- c) Check and operate the manual electric coupler cover. Check the condition of the cover, rollers, pivots, cams, bearings, gaskets, and spring closures for damage, wear, and proper function.
- d) Check and operate automatic or remote power assisted electric coupler doors. Check gaskets, seals, pivots, rollers, springs, and bearings for damage, wear and proper movement, no binding or fouling of the device.
- e) Check and gauge fixed electric coupler head faces for proper position relative to the mechanical head. Adjust or repair as required.
- f) Check and gauge movable electric coupler head faces for proper position relative to the mechanical head when in a fully forward (coupled) position. Operate the devices to inspect for proper movement with no binding or fouling.
- g) Clean and inspect all electric coupler contacts and the insulation block. Inspect for wear, discoloration, damage, and spring tension.

NOTE: Care should be taken to use only approved cleaning materials and procedures so as not to damage the electric contact surface.

- h) Operate and check manual and automatic electric coupler contact retractors. Check the devices for ease and fullness of movement. Check locking detents in both retracted and full forward positions.
- i) Inspect electric coupler faceplate hold-open device and check for function.
- j) Inspect and test the electric coupler heater for function and condition of wiring.
- k) Lubricate the electric coupler and associated devices as required.

5.5.5 Miscellaneous equipment

NOTE: The coupler drum switch and coupler contact block should be blown out using an air pressure wand. Follow OSHA regulations as detailed in 29 CFR 1910.242b “Compressed Air Used For Cleaning Purposes”.

- a) Inspect coupler switch box for evidence of pneumatic leakage, and condition of gaskets, covers, cams, contact surfaces, and switches.
- b) Manually operate coupler switch box to check for wear, ease and fullness of movement, and condition of entire cam surfaces. Check for pitting, discoloration, and evidence of loose wiring or hardware.

- c) Remotely operate coupler switch box and check for function.
- d) Inspect coupler control box for damage, evidence of pneumatic leakage and condition of electrical contacts, switches, solenoids, and valves.
- e) Inspect coupler control wiring for damaged insulation, loose/overheated terminations, and proper distance from moving components. Verify security of plugs and receptacles. When disconnected, check plugs and receptacles for pushed back pins/elements.
- f) Inspect electronic components for evidence of overheating or other damage.
- g) When practical, manually operate switches, valves, solenoids, and relays to check for wear or binding.
- h) Inspect, test, and adjust limit switches and relays at OEM recommended intervals.
- i) Perform an operational test of the coupler control box and check for proper function of the mechanical coupler, electrical coupler, pneumatic coupler, tappet valve, center lock/centering devices, coupler switch box, and isolation valves/switches.

5.6 Correction of deficiencies

Any deficiencies uncovered during the inspections in Sections 5.5.1 through 5.5.5 should be corrected and documented in accordance with established rail transit system procedures and OEM recommendations.