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Commuter, Intercity and High-speed
Rail Mechanical Working Group

Safety Appliances for Passenger Equipment

Abstract: This standard establishes requirements for safety appliance design, installation and maintenance for passenger equipment including non-passenger-carrying locomotives.

Keywords: attachment, collision post handhold, crew handhold, end handhold, handbrake, handrail, ladder, roof handhold, safety appliance, side door handhold, side door step, sill step, sill step handhold, uncoupling device

Summary: This standard provides detailed requirements for the application, installation, maintenance, repair and replacement of safety appliances for passenger equipment including non-passenger-carrying locomotives.

Scope and purpose: This standard applies to new tier I, II and III passenger equipment, with initial procurement contract awarded on or after one year after publication of the newest revision, for use on the general railroad system of the United States and Canada. This standard is intended for only newly made passenger equipment but does not prevent application to rebuilt or overhauled passenger equipment. In the event of discrepancy between the text of this standard and the illustrations, the text shall govern. APTA developed this standard to enhance the operational safety of new passenger equipment by recognizing modern analytical techniques and manufacturing methods and to provide clarity and uniformity in the application of safety appliance regulations. APTA intends to petition the Federal Railroad Administration (FRA) and Transport Canada to incorporate this standard in total or by reference into the appropriate rules and regulations. If that happens, changes to existing contracts resulting in financial burdens caused by this standard should be handled through the established FRA and Transport Canada waiver/exemption processes.

This document represents a common viewpoint of those parties concerned with its provisions, namely transit operating/planning agencies, manufacturers, consultants, engineers, and general interest groups. APTA standards are mandatory to the extent incorporated by an applicable statute or regulation. In some cases, federal and/or state regulations govern portions of a transit system's operations. In cases where this is a conflict or contradiction between an applicable law or regulation and this document, consult with a legal advisor to determine which document takes precedence.

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Table of Contents

Participants.....	iv
Introduction.....	vi
1. Coordinate system and units of measurement.....	1
2. General requirements	2
2.1 General.....	2
2.2 Purpose.....	2
2.3 Materials and processes	2
2.4 Strength and rigidity requirements.....	2
2.5 Manner of application	3
3. Safety appliance requirements	4
3.1 Parking brake system	4
3.2 Crew provisions to ride.....	8
3.3 Crew access.....	17
3.4 End handholds.....	23
3.5 Collision post handholds.....	25
3.6 Handrail on open platform cars.....	26
3.7 Uncoupling devices.....	28
3.8 Conditional safety appliances	30
3.9 Optional (elective) steps and handholds	32
4. Safety appliance design verification inspection.....	33
5. Inspection, maintenance, repair and replacement	33
5.1 Inspection.....	33
5.2 Maintenance.....	33
5.3 Repair and replacement.....	33
Related APTA standards.....	34
References.....	34
Definitions.....	35
Abbreviations and acronyms.....	38
Summary of document changes	38
Document history	40
Appendix A (informative): Sample car inspection checklist	41
Appendix B (informative): Document development background	51
Appendix C: Ergonomic considerations	52
Appendix D: Explanatory material	53

List of Figures and Tables

Figure 1	Safety Appliance Coordinate System	1
Figure 2	Passenger Equipment Coordinate System	1
Table 1	Functional Service Level RMS Acceleration	3
Figure 3	Lever Type Handbrake	6
Figure 4	Wheel Type Handbrake	7
Figure 5	Enclosed Step Open Space Examples.....	9
Table 2	Sill Step Box Dimensions.....	9
Figure 6	View of Sill Step in Transverse Direction	11
Figure 7	Sill Step with Two Horizontal Handholds.....	12
Figure 8	Sill Step with One Horizontal Handhold	13
Figure 9	Sill Step with Two Vertical Handholds	14
Figure 10	Sill Step with One Vertical Handhold	15
Figure 11	Sill Step with One Horizontal and One Vertical Handhold	16
Figure 12	Sill Step Handholds for Riding at Passenger Steps	17
Table 3	Side Door Step Dimensions	18
Figure 13	Crew Access at Low-Level Floors.....	19
Figure 14	Crew Access at High-Level Floors with Inclined Steps	20
Figure 15	Crew Access at High-Level Floors with Vertical Steps	21
Figure 16	Carbody Structure Clearance with Step Tread.....	22
Figure 17	Allowable Transverse Alignment for Step and Threshold.....	22
Figure 18	Allowable Transverse Alignment for Step and Handhold.....	23
Figure 19	End Handhold and Uncoupling Lever	25
Figure 20	Collision Post Handholds	26
Figure 21	Handrail on Open Platform Car.....	28
Figure 22	End Handhold and Uncoupling Lever	29
Figure 23	Foot Guards on Ladder Treads	31
Figure 24	Stepping Around the Corner of a Vehicle.....	32
Figure 25	Sill Step Length and Clearances	35
Figure 26	Clear Length of Handholds.....	36
Figure 27	1st Percentile Female Ergonomics.....	52
Figure 28	Crew Access Step Clear Depth Evaluation.....	55



Participants

The American Public Transportation Association greatly appreciates the contributions of the **Safety Appliances Task Group** of the APTA Commuter, Intercity and High-speed Rail Mechanical Working Group, which provided the primary effort in the drafting of this document.

At the time this standard was completed, the task group included the following members:

Benjamin Spears, Hatch LTK, *Task Group Lead*

B.A. “Brad” Black, *Virginkar & Associates*

Robert Jones, *Stadler Rail Group*

Joseph Kenas, *ALSTOM Transport*

Francesco Maldari, *MTA Long Island Rail Road*

Eloy Martinez, *Hatch LTK*

Gerhard Schmidt, *Siemens Mobility*

David Warner, *retired (SEPTA)*

At the time this standard was completed, the Commuter, Intercity and High-speed Rail Mechanical Working Group included the following members:

Rudy Vazquez, Amtrak, *Chair*

Chris Madden, Amtrak, *Vice Chair*

Greg Buzby, SEPTA, *Secretary*

Mohamed Alimirah, *Metra*

Carl Atencio, *American Rocky Mountaineer*

Frank Banko, *WSP USA*

Juan Barahona, *Talgo*

Michael Barnes, *Jacobs*

Taft Bearden, *Atkins Global NA*

David Bennett, *Capital Metro. Trans. Authority*

Jonathan Bernat, *New York Air Brake*

Eric Bisaillon, *Wabtec*

Kristoffer Bittner, *MTA Long Island Rail Road*

B.A. “Brad” Black, *Virginkar & Associates*

Stephen Bonina, *WSP USA*

Glenn Brandimarte, *ORX*

Richard Bruss, *retired*

Dennis Cabigting, *STV*

Elvin Calderon, *Denver Transit Operators*

Paul Callaghan, *Transport Canada*

Julia Camacho, *Talgo*

Gordon Campbell, *Crosslinx Transit Solutions*

Kevin Carmody, *STV*

David Carter, *New Jersey Transit*

Steve Cavanaugh, *Metrolinx (GO Transit)*

Dion Church, *SNC-Lavalin*

Vlad Ciobanu, *Siemens Mobility*

John Condrasky, *retired*

Joshua Coran, *Talgo*

Michael Craft, *Paragon Robotics*

Brian Creely, *Siemens Mobility*

Brendan Crowley, *New York Air Brake*

Ryan Crowley, *Atkins Global NA*

Richard Curtis, *Curtis Engineering Consulting*

Joe Di Liello, *VIA Rail Canada*

David Diaz, *Hatch LTK*

Adam Eby, *Amtrak*

Phillippe Etchessahar, *ALSTOM Transport*

Gary Fairbanks, *Federal Railroad Administration*

Robert Festa, *MTA Long Island Rail Road*

Steve Finegan, *Atkins Global NA*

Gavin Fraser, *Jacobs*

Francesco Fumarola, *ALSTOM Transport*

Edward Gacsi, *New Jersey Transit*

Joe Gagliardino, *Arcosa*

Sebastien Geraud, *ALSTOM Transport*

Jeffrey Gordon, *Federal Railroad Administration*

Guillaume Ham-Livet, *ALSTOM Transport*

Eric Harden, *Knorr Brake*

Nick Harris, *Hatch LTK*

Jasen Haskins, *Atkins Global NA*

James Herzog, *Hatch LTK*

Kenneth Hesser, *Hatch LTK*

Lew Hoens, *MTA Metro-North Railroad*
 Christopher Holliday, *STV*
 Greg Holt, *Penn Machine*
 George Hud, *Hatch LTK*
 Paul Jamieson, *retired*
 John Janiszewski, *Hatch LTK*
 MaryClara Jones, *Transportation Technology Center*
 Robert Jones, *Stadler Rail Group*
 Larry Kelterborn, *LDK Advisory*
 Joseph Kenas, *ALSTOM Transport*
 Peter Klauser, *Vehicle Dynamics Group*
 Christian Knapp, *Denver Transit Operators*
 Karan Kothari, *Amtrak*
 Heinz-Peter Kotz, *Siemens Mobility*
 Scott Kramer, *Arcosa*
 Tammy Krause, *Atkins Global NA*
 Pallavi Lal, *Hatch LTK*
 Peter Lapre, *Federal Railroad Administration*
 Nicolas Lessard, *ALSTOM Transport*
 Cameron Lonsdale, *Standard Steel*
 Daniel Luskin, *Amtrak*
 John MacEwan, *SEPTA*
 Francesco Maldari, *MTA Long Island Rail Road*
 Brian Marquis, *Volpe*
 Eloy Martinez, *Hatch LTK*
 Francis Mascarenhas, *Metra*
 Raynald Masse, *EXO*
 Maria Mauri, *Wabtec*
 Robert May, *Hatch LTK*
 Ronald Mayville, *Simpson Gumpertz & Heger*
 Katie McCabe, *ORX*
 Patrick McCunney, *Atkins Global NA*
 Gerard McIntyre, *Knorr Brake*
 Bryan McLaughlin, *New York Air Brake*
 William Minnick, *Omni Strategy*
 Luke Morscheck, *Hatch LTK*
 Karl Mullinix, *Knorr Brake*
 Joshua Munoz, *Hatch LTK*
 Paul O'Brien, *Transit District of Utah*
 Chase Patterson, *Voith Turbo*
 Joe Patterson, *Amsted Rail*
 Martin Petzoldt, *Railroad Friction Product*

James Pilch, *Standard Steel*
 Ian Pirie, *STV*
 Brian Pitcavage, *Hatch LTK*
 Brandon Reilly-Evans, *Hatch LTK*
 Peter Reumueller, *Siemens Mobility*
 Danial Rice, *Wabtec*
 Carol Rose, *STV*
 Thomas Rusin, *Rusin Consulting*
 Mehrdad Samani, *Hatch LTK*
 Gerhard Schmidt, *Siemens Mobility*
 Martin Schroeder, *Jacobs*
 Richard Seaton, *TDG Transit Design Group*
 Frederic Setan, *ALSTOM Transport*
 Patrick Sheeran, *Hatch LTK*
 Melissa Shurland, *Federal Railroad Administration*
 David Skillman, *Amtrak*
 Benjamin Spears, *Hatch LTK*
 Rick Spencer, *Knorr Brake*
 Mark Stewart, *Hatch LTK*
 Jonathan Sunde, *Strato*
 Lukasz Szymasiak, *VIA Rail Canada*
 Mehdi Taheri, *Raul V. Bravo & Associates*
 Ali Tajaddini, *Federal Railroad Administration*
 Jeff Thompson, *SEPTA*
 Matthew Todt, *Amsted Rail*
 Michael Trosino, *Amtrak*
 Ron Truitt, *HTSI*
 Anthony Ursone, *UTC/Rail & Airsources*
 Frank Ursone, *UTC/Rail & Airsources*
 Gary Wagner, *Amsted Rail*
 David Warner, *retired*
 Michael Wetherell, *McKissack & McKissack*
 Brian Whitten, *SNC-Lavalin*
 Kristian Williams, *Amtrak*
 Todd Williams, *Penn Machine*
 Nicholas Wilson, *Transportation Technology Center*
 Tim Wineke, *Knorr Brake*
 Reggie Wingate, *Knorr Brake*
 Aleksey Yelesin, *ALSTOM Transport*
 Kevin Young, *Axis, LLC*
 Gregory Yovich, *NICTD*
 Steven Zuiderveen, *FRA*

Project team

Narayana Sundaram, *American Public Transportation Association*
 Nathan Leventon, *American Public Transportation Association*

Introduction

This introduction is not part of APTA PR-M-S-016-06, Rev. 1, “Safety Appliances for Passenger Equipment.”

This standard applies to all:

1. railroads that operate intercity or commuter passenger train service on the general railroad system of transportation; and
2. railroads that provide commuter or other short-haul rail passenger train service in a metropolitan or suburban area, including public authorities operating passenger train service.

This standard does not apply to:

1. rapid transit operations in an urban area that are not connected to the general railroad system of transportation;
2. tourist, scenic, historic or excursion operations, whether on or off the general railroad system of transportation;
3. operation of private cars, including business/office cars and circus trains; or
4. railroads that operate only on track inside an installation that is not part of the general railroad system of transportation.

APTA undertook the development of this standard for application to passenger equipment that do not neatly fall into the traditional federal regulations contained in 49 CFR Part 231 governing safety appliances. 49 CFR 231 contains three different passenger car types in parts 231.12 (Passenger-train cars with wide vestibules), 231.13 (Passenger-train cars with open-end platforms) and 231.14 (Passenger-train cars without end platforms). Modern equipment designs do not follow these specific car configurations. Today’s passenger railroads have introduced and operate multi-level cars, cars with center boarding, cab cars, married pairs, cars with no vestibules, semi-permanently connected trainsets, etc. These new car types do not easily fit into the three passenger car types defined in the regulation.

Additionally, APTA and its members worked collaboratively with FRA as part of the regulatory changes to 49 CFR 238 under the Engineering Task Force as part of FRA’s Rail Safety Advisory Committee. Revisions to this standard also consider the discussions and consensus language developed as part of this effort.

The intent of this standard is to provide clarity in the design, manufacturing, installation, inspection, maintenance, repair and replacement of safety appliances for various passenger equipment. The standard clearly defines the function of each type of safety appliance and gives detailed requirements on the dimensions, material, location and manner of attachment. Appendix A of this standard includes a compliance checklist that railroads, and car builders can use to ensure compliance with the standard. This checklist can also be part of the basis for a sample car inspection if conducted.

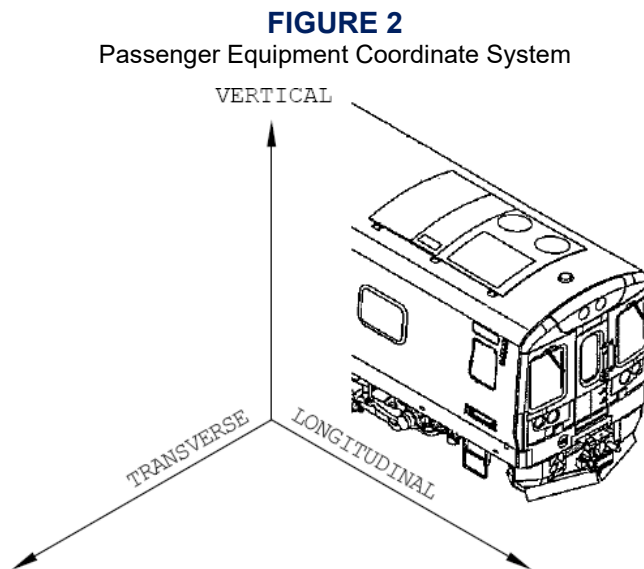
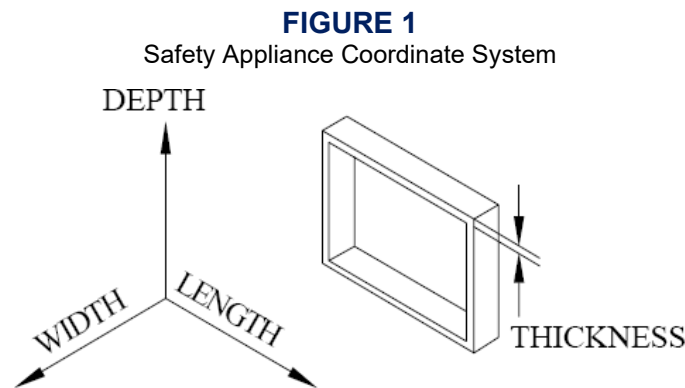
APTA patterned the standard after the Association of American Railroads’ Standard AAR S-2044, covering freight car safety appliances. The AAR has petitioned FRA to incorporate the freight car safety appliance standard into the federal regulations.

APTA intends similarly to petition the FRA and Transport Canada to incorporate this standard into the federal regulations.

Safety Appliances for Passenger Equipment

1. Coordinate system and units of measurement

The following figures show the coordinate system used in this standard. This coordinate system is used to be consistent with FRA and AAR terminology. **Figure 1** shows coordinates in relation to safety appliances. **Figure 2** shows coordinates in relation to passenger equipment.



Vertical dimensions defined relative to the top of rail are to be based on new wheels, ready to run, empty car conditions.

Units of measurement used in this standard are US customary units. These are followed by their rounded equivalents in International System (SI) units, enclosed in parentheses. The first value stated shall be regarded as the requirement.

2. General requirements

2.1 General

Safety appliances applied to cars shall be designed, manufactured, installed, inspected, maintained, repaired and replaced in accordance with the requirements of this standard. The design of safety appliances shall not violate the railroad's clearance diagram and shall account for vehicle manufacturing tolerances.

NOTE: APTA recommends that railroads and carbuilders consider designing to dimensions greater than the minimums and less than the maximums contained in this standard to allow for manufacturing tolerances and other minor deviations.

2.2 Purpose

Safety appliances aid railroad employees or contractors in performing their duties safely by providing a means to support and/or stabilize themselves while riding equipment, entering or leaving equipment, inspecting equipment, coupling/uncoupling equipment, or setting handbrakes.

2.3 Materials and processes

All sill steps, side door steps, ladders, handrails and handholds shall be made of wrought iron or steel with minimum yield strength of 25,000 psi (173 MPa). Stainless steel of equivalent strength may be used. Steel safety appliances may be cast, rolled, forged or made by any other process that provides the required strength.

Alternate materials may be used if the safety appliance is evaluated in accordance with Section 2.4.2. This equivalency would also be subject to approval by the purchasing authority.

To allow for standard mill tolerances, actual sizes of components (material thickness, diameter, etc.) may be 5% below the nominal sizes. Clearance dimensions are minimum dimensions (−0%).

2.4 Strength and rigidity requirements

All handrails, handholds, ladders, side door steps and sill steps shall meet the strength and rigidity requirements of this section by demonstrating compliance with either of the following two methods:

1. For strength purposes, safety appliances shall meet the dimensions as follows:
 - a. For handrails, handholds and ladders, they must be made of $\frac{5}{8}$ in. (16 mm) diameter steel.
 - b. For sill steps and crew access steps, a rectangular cross-section shall be used, with a minimum cross-sectional area of $\frac{1}{2}$ in. (12.7 mm) thick by 2 in. (50.8 mm) wide steel. Alternate sections may be used if they meet the strength and rigidity of a $\frac{1}{2}$ in. (12.7 mm) thick by 2 in. (50.8 mm) wide steel section.
 - c. Sill steps and crew access steps exceeding 18 in. (457 mm) in depth shall have an additional tread and be transversely (laterally) braced.
 - d. Handholds exceeding 60 in. (1524 mm) in length shall be securely fastened with at least two fasteners at each end.
2. Alternatively, safety appliances may be designed to comply with the following minimum design loads. For purposes of evaluation, the load may be distributed over a distance of not more than 3 in. (76 mm) along the usable length of the safety appliance. The design loads shall be supported in all directions as follows:
 - a. Handholds shall be designed to support a load of 350 lb (1557 N) at any point on the usable length of the handhold in any direction and shall be rigidly attached to the carbody structure such that the maximum elastic deflection at the midpoint of an unsupported span under 50%

APTA PR-M-S-016-06, Rev. 1
Safety Appliances for Passenger Equipment

of the applied 350 lb (1557 N) load shall be no greater than $L/120$, where L is the unsupported length of the span.

- b. Steps shall be designed to support individually applied loads at any point on the usable length of 450 lb (2002 N) in the vertical (\pm) direction and 350 lb (1557 N) in any horizontal direction (\pm transverse or \pm longitudinal) such that the maximum elastic deflection at the midpoint of an unsupported span under 50% of the applied loads shall be no greater than $L/120$, where L is the unsupported length of the span.
- c. Stresses in the safety appliance and the car structure to which it is attached shall be less than the specified minimum yield strength for each component for the load values given in paragraphs 2.a. and 2.b.
- d. Fillet welds, if used, and fasteners shall be designed to have an ultimate strength with a factor of safety of at least two with respect to the load values give in paragraphs 2.a. and 2.b..
- e. The safety appliance and the connection to the carbody to which it is attached shall be designed for infinite fatigue life (10 million cycles) based upon the service vibration environment and the mass of the safety appliance. If the intended service environment is undefined, the accelerations listed in Table 1 may be used for the evaluation. If the connection is part of the carbody as defined in Section 2.5.2, then the connection to the carbody is exempt from the fatigue evaluation.

TABLE 1
Fatigue Loads for Service Environment

Orientation	Acceleration
Vertical	± 0.25 g
Transverse	± 0.20 g
Longitudinal	± 0.15 g

2.5 Manner of application

1. All safety appliances shall be securely fastened to the carbody structure using one of the following methods:
 - a. **Mechanical fasteners.** Safety appliance mechanical fasteners shall have mechanical strength and fatigue resistance equal to or greater than a $\frac{1}{2}$ in. (12.7 mm) diameter fastener conforming to one of the following specifications:
 - i. Carbon/low alloy steel: SAE J429 Grade 5 bolt (English units) or ISO 898-1, Grade 8.8 (metric units).
 - ii. Stainless steel: ASTM F593, Groups 1–3, Condition CW1 (English units) or ISO 3506-1, Grades A2-70 or A4-70, Condition CW (metric units).

If providing safety appliances in accordance with Section 2.4.1, the size of fasteners used shall be $\frac{1}{2}$ in. (12.7 mm) diameter.

Threaded fasteners must be secured by one of the following methods:

- i. Self-locking feature, including locknut and locking bolt that meet the prevailing torque requirements for locking fasteners specified by the Industrial Fastener Institute for the applicable grade and size fastener used.
- ii. Locking device that provides the minimum prevailing first removal torque value for locking fasteners specified by the Industrial Fastener Institute for the applicable grade and size fastener used.

APTA PR-M-S-016-06, Rev. 1
Safety Appliances for Passenger Equipment

- iii. Wedge-locking washers consisting of two symmetrically designed washers that have inclined ramps on the sides in mutual contact and non-slip contact surfaces on the sides in contact with the nut and work piece. Washer and nut or bolt arrangements utilizing similar locking principles are also acceptable.
- iv. Lock washers that meet the requirements for lock washers specified by the Industrial Fastener Institute for the applicable grade and size fastener used.
- v. Locking tab, cotter pin, or safety wire that restricts rotation of the bolt, nut or both. One- or two-piece rivets or swaged lock fasteners similar to Huck^{®1} bolts may be used without additional locking features.

b. **Welded safety appliances.** Welded safety appliances and connections, when used, shall have the following qualities:

- i. Designed and fabricated in accordance with the welding process and the quality control procedures contained in the applicable current American Welding Society Standard, the Canadian Welding Bureau Standard, or an equivalent nationally or internationally recognized welding standard.
- ii. Welded by an individual possessing the qualifications to be certified under the applicable current American Welding Society Standard, the Canadian Welding Bureau Standard, or an equivalent nationally or internationally recognized welding qualification standard.
- iii. Inspected by an individual qualified to determine that the welding has been performed in accordance with the requirements in paragraph (b)(ii) of this section.
- iv. Repairs to welded safety appliances and connections shall meet the requirements contained in paragraphs (i)–(iii) of this section.
- v. Welded safety appliances and safety appliance subassemblies shall be welded in accordance with paragraphs (i)–(iii) of this section.
- vi. Structural members or brackets welded in accordance with paragraphs (i)–(iii) and meeting the strength requirements in Section 2.4.2, “Strength and rigidity requirements,” shall be considered part of the carbody structure.

2. Brackets and supports. For safety appliances provided in accordance with Section 2.4.1, brackets or supports to which safety appliances are fastened are considered part of the carbody if they can support the load requirements applied to the safety appliances as defined in Section 2.4.2 with a factor of safety of 2 against yield strength.

3. Inspection. All appliances and support members shall, as far as practicable, be installed to facilitate inspection of all attachments, fasteners or welds.

3. Safety appliance requirements

3.1 Parking brake system

3.1.1 General

Any individual car that is not semi-permanently connected to an adjacent car and any set of semi-permanently coupled cars must be equipped with a parking brake. Semi-permanently coupled cars shall have a minimum of one location to set and release the parking brake.

Tier III trainsets may be equipped with an alternative means of securing the equipment as in compliance with 49 CFR 238.731(o).

¹ Huck[®], a registered Trademark of Howmet Aerospace Inc.

3.1.2 Purpose/function

The parking brake is used to apply force mechanically to one or more brake shoes or pads on the car.

3.1.3 Location

3.1.3.1 General

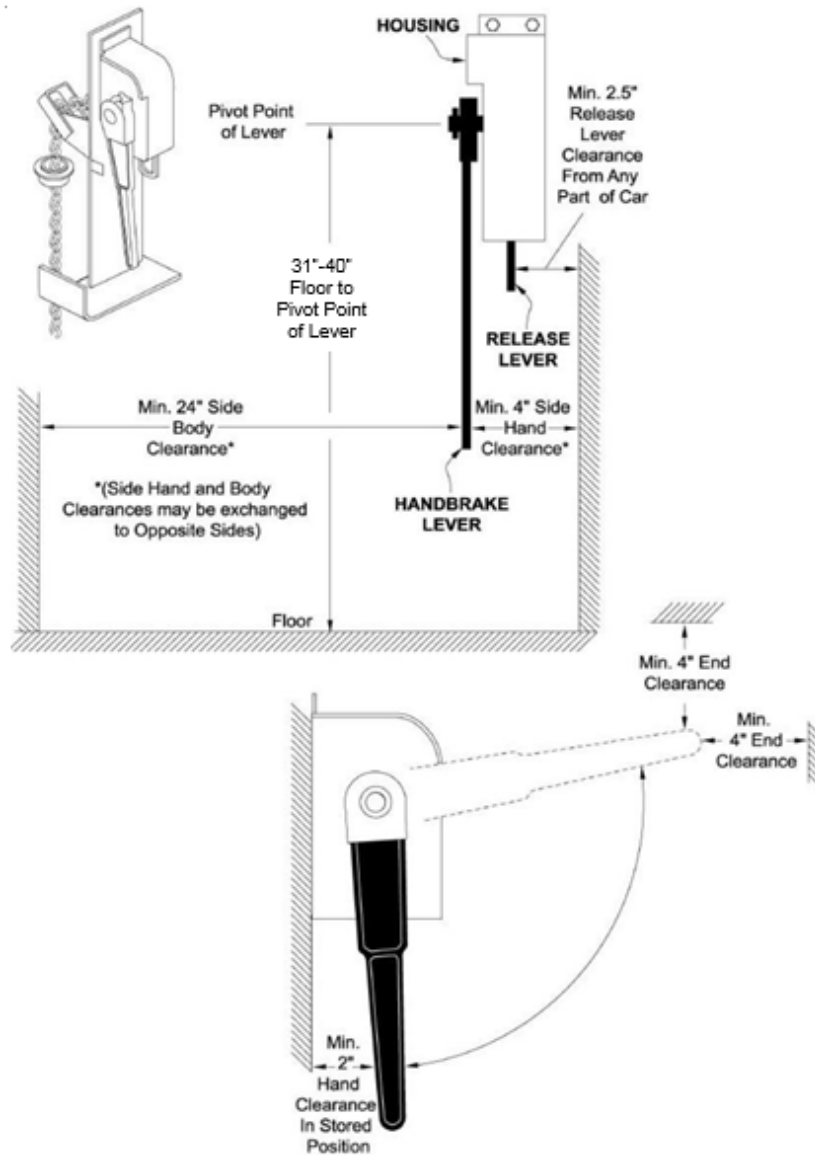
1. The handbrake as installed shall be located so as to not restrict passenger flow through any passageway. The handbrake handle, whether applied or released, and in its stored position, shall not restrict passenger flow through any passageway.
2. The handbrake shall be located so it can be safely operated while the car is in motion.
3. A handhold shall be provided to stabilize an employee when using the handbrake. The handhold shall have a minimum 2 in. (51 mm) hand clearance.

3.1.3.2 Handbrake, lever type

1. The center point of the pivot point of the lever used to apply the handbrake shall be located 31 to 40 in. (788 to 1016 mm) above the floor.
2. Any handbrake handle retention mechanism shall not interfere with the normal grip position of the lever.
3. The handbrake release lever shall have a minimum 2 in. (51 mm) hand clearance in the operating position.
4. The handbrake lever shall have a minimum 2 in. (51 mm) hand clearance in the stored position, a 24 in. (610 mm) body clearance on one side of the lever, and a minimum 4 in (102 mm) hand clearance on the opposite side and end in the operating position.
5. The clearance between the grip portion of the release lever, if used, and any part of the car shall be no less than 2½ in. (64 mm).

See **Figure 3**.

FIGURE 3
Lever Type Handbrake

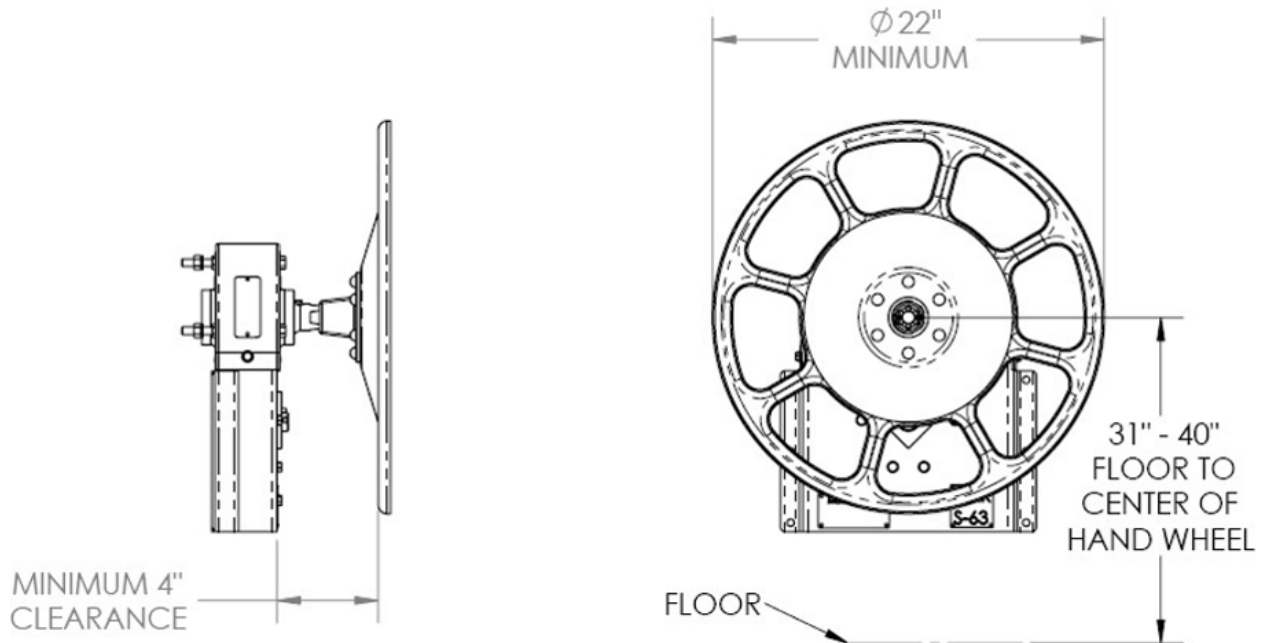


3.1.3.3 Handbrake, wheel type

1. The center point of the wheel shall be located 31 to 40 in. (788 to 1016 mm) above the floor.
2. The wheel type handbrake shall have a minimum 4 in. (102 mm) hand clearance.
3. The wheel diameter shall be at least 22 in. (559 mm).

See **Figure 4**.

FIGURE 4
Wheel Type Handbrake



4. If equipped, the hand brake manual release lever shall have a minimum 2 in. (51 mm) hand clearance.

3.1.3.4 Power-assisted applied/release parking brake

A readily accessible operational control mechanism and manual release lever shall be provided.

3.1.4 Manner of application for wheel or lever handbrake type

The handbrake housing must be securely fastened. Bolts used for mounting the handbrake shall be designed to resist the maximum chain force with a minimum factor of safety of 2. The maximum chain force is that developed by the handbrake mechanism when a 125 lb (556 N) force is applied 3 in. (77 mm) in from the end of the application lever, typically 20 to 24 in. (508 to 609 mm) long, or on the rim of a handbrake wheel unless the design of the mechanism restricts the applied force to a lower value.

Handbrake mounting brackets are to be securely fastened, preferably with mechanical fasteners. Bell crank mounting brackets, sheave wheel mounting brackets, brake rod supports and guides, and chain supports and guides are not considered safety appliances, and hence are not subject to the manner of application requirements in this standard. See [Figure 3](#) and [Figure 4](#) for typical handbrake applications.

3.2 Crew provisions to ride

3.2.1 General

Sill steps and associated handholds are required at each end of passenger equipment equipped with an automatic coupler, unless the following applies:

1. For the leading and the trailing cab ends of semi-permanently coupled passenger cars or passenger trainsets.
2. A crew member who performs switching operations is able to ride safely inside the cab or on a crew or passenger access doorway/step and has an unobstructed view of the track ahead for that crew member.
3. Cab/control ends of self-propelled passenger equipment with fully automatic couplers.

3.2.1.1 Purpose/function

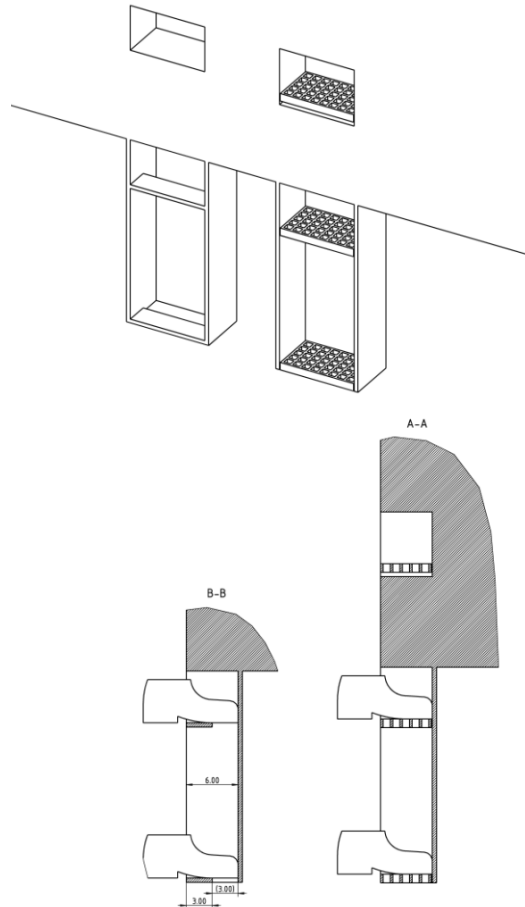
1. Sill steps allow an employee to ride on the side, near the end of the car during switching moves.
2. Sill step handholds are used to stabilize an employee while riding on the sill step.

3.2.2 Sill steps

3.2.2.1 Dimensions for sill steps

1. The minimum usable length of tread shall be not less than 10 in. (254 mm), preferably 12 in. (305 mm).
2. Sill steps shall be no less than 2 in. (51 mm) wide.
3. The clear depth above the entire usable length of the sill step tread shall be no less than 8 in. (204 mm). For Tier III trainsets, the value for clear depth may be reduced to 4.7 in. (120 mm). The clear width of all sill step treads shall be no less than 6 in. (153 mm) with the trucks rotated to simulate the maximum curvature specified for the uncoupled car. (See **Figure 25** in “Definitions” for clear depth and clear width definition.)
4. Sill steps shall not have a vertical rise between treads exceeding 18 in. (457 mm).
5. The portion of the tread surface area of each sill step that is normally contacted by the foot shall be treated with an anti-skid material or be slip-resistant by texturing of the metal surface in such a way that it lasts the life of the car. Some examples of acceptable methods are diamond plate and stamped, upset or expanded metal. For enclosed step designs, at least 50% of the tread area shall be open space. See **Figure 5** for open space examples.

FIGURE 5
Enclosed Step Open Space Examples



- To account for minor deviations, the application of sill steps shall be such that a box with the dimensions shown in **Table 2** can pass through the opening above the sill step to the point where the box is flush with the outer edge of the step.

TABLE 2
Sill Step Box Dimensions

	Box Length	Box Depth	Box Width
Sill step	10 in. (254 mm)*	8 in. (204 mm)	6 in. (153 mm)
Sill step (Tier III)	10 in. (254 mm)*	4.7 in. (120 mm)	6 in. (153 mm)

* Box Length Preferably 12 inches (305 mm)

3.2.2.2 Location

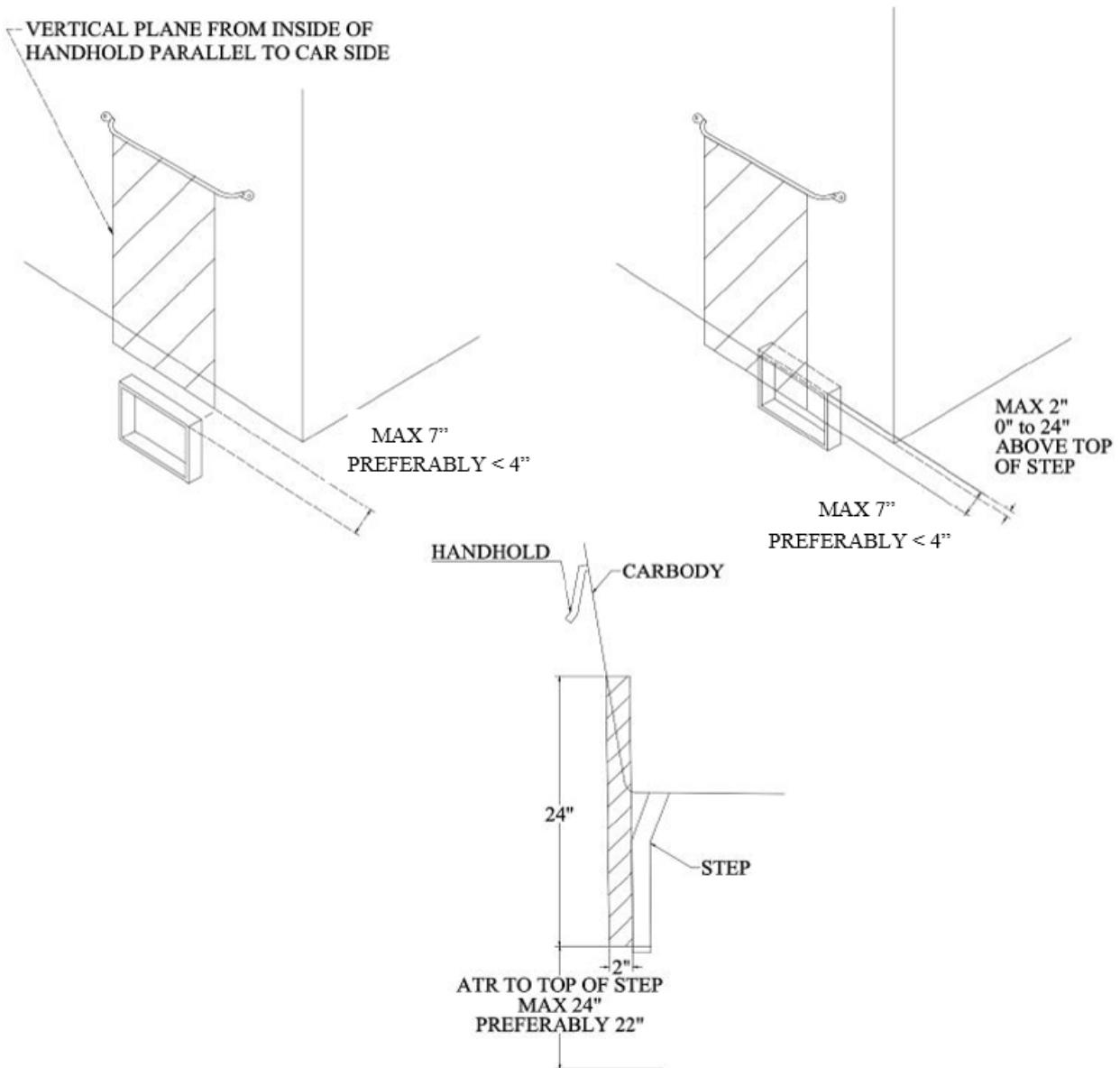
- One sill step shall be applied at each corner of the car. A passenger step may be used in lieu of a sill step if it meets the clear depth, clear width, usable length and location requirements for a sill step.
- The outboard end of the usable length of the sill step shall be not more than 18 in. (457 mm) in the longitudinal direction from the corner of the car. For cars without well-defined corners, the intent is

APTA PR-M-S-016-06, Rev. 1
Safety Appliances for Passenger Equipment

for the sill step to be positioned for the employee to have an unobstructed view of the track ahead. The sill step shall be placed so the employee has a clear view in both longitudinal directions and shall be placed outside the gauge of the track.

3. The sill step tread shall be not more than 24 in. (609 mm), preferably not more than 22 in. (558 mm), above the top of rail. The design goal is to have the tread of the sill step as close to the top of rail as the clearance diagram permits.
4. The outside edge of any sill step tread shall be no more than 2 in. (50 mm) inboard of any car structure or additional steps within 24 in. (610 mm) directly above the clear length of the step. A maximum of 4 in. (101 mm) is permitted for sill step treads at or below 21 in. (534 mm) above the top of rail, provided it is otherwise not possible to remain within the clearance diagram. The design goal is to have the outside edge of the sill step tread to be as flush with the side of the car as the clearance diagram permits. See **Figure 6**.
5. Coordination of step to handhold in transverse direction: The outside edge of any sill step tread shall be a maximum 7 in. (177 mm), preferably less than 4 in. (101 mm) inboard or outboard of the inside surface of the lowest adjacent side handhold clear length. The design goal is to have the outside edge of the sill step tread to be aligned with the sill step handhold as the clearance diagram permits.

FIGURE 6
Schematic View of Sill Step in Transverse Direction



3.2.3 Sill step handholds

3.2.3.1 Dimensions for sill step handholds

Handholds shall be no less than $\frac{5}{8}$ in. (16 mm) in diameter. Minimum clear length of handholds shall be 16 in. (406.4 mm). Minimum clearance shall be 2 in. (51 mm), preferably $2\frac{1}{2}$ in. (64 mm).

3.2.3.2 Location

1. There shall be a minimum of two handholds over each sill step. If it is not possible to place two handholds over a sill step, then there shall be one handhold over that sill step, and it is recommended that the railroad prohibit employees from riding on that sill step.

APTA PR-M-S-016-06, Rev. 1
Safety Appliances for Passenger Equipment

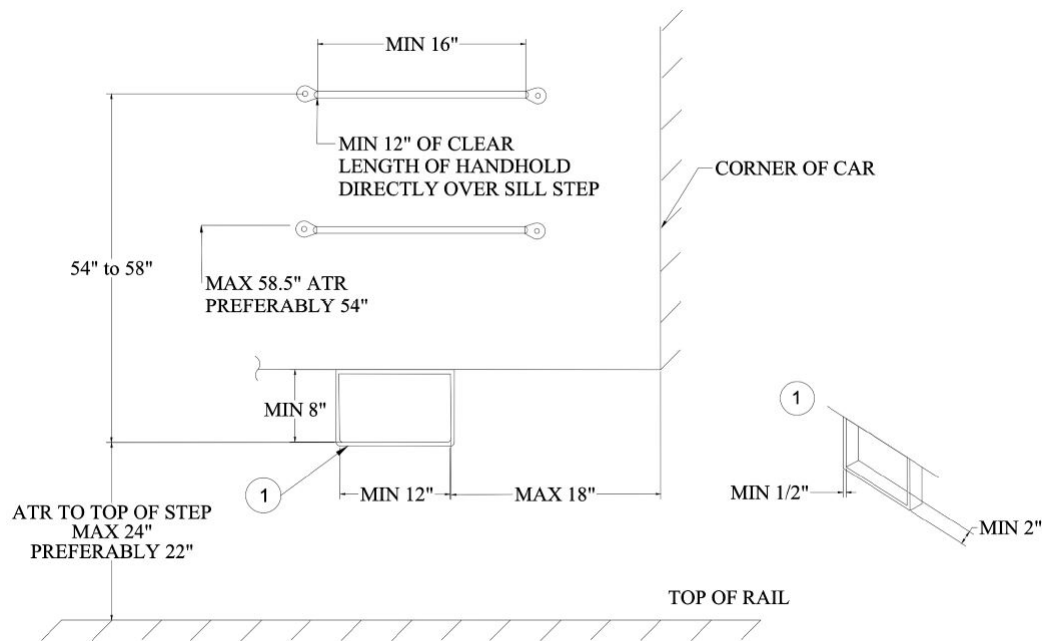
NOTE: When only one sill step handhold is used, APTA recommends that a “DO NOT RIDE” sign be affixed to the car above the sill step.

If a passenger step is used in lieu of a sill step as noted in Section 3.2.2.2 (1), handholds shall be provided in accordance with Section 3.2.4.

2. The lower handhold shall be at most 58½ in. (1485 mm), preferably 54 in. (1371 mm), above the top of rail (ATR). The second horizontal handhold shall be 54 to 58 in. (1372 to 1473 mm) above the lowest (riding) step. See **Figure 7**.

FIGURE 7

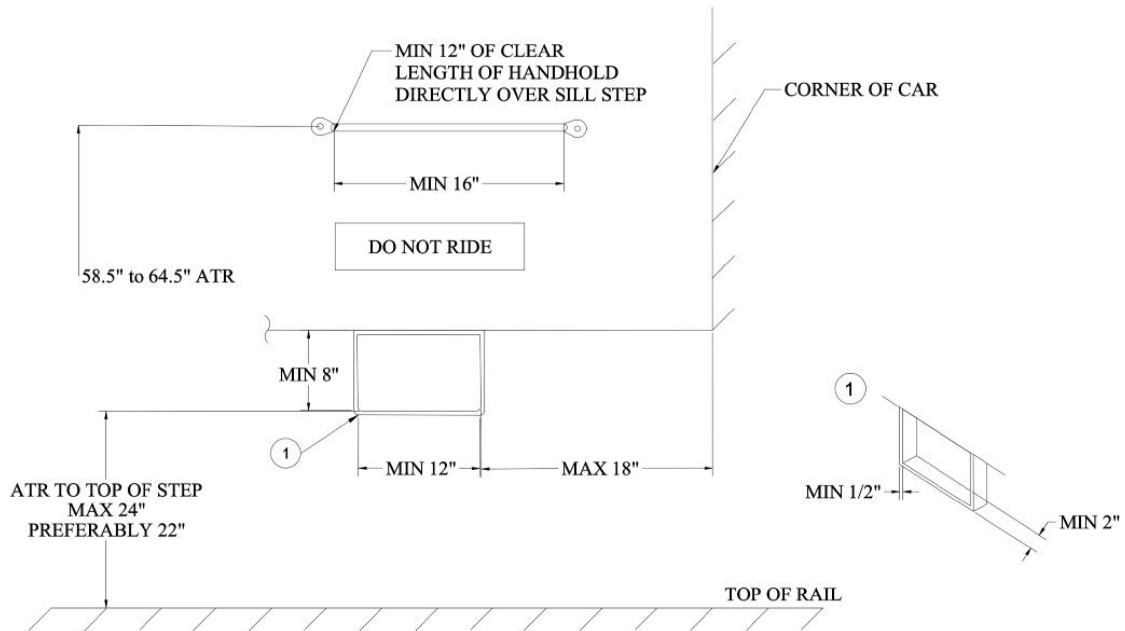
Sill Step with Two Horizontal Handholds



3. When one horizontal handhold is used, it shall be 58½ to 64½ in. (1486 to 1638 mm) ATR. See **Figure 8**.
4. 12 in. (305 mm) of the clear length of each horizontal handhold shall be directly over the sill step. See **Figure 7**.

FIGURE 8

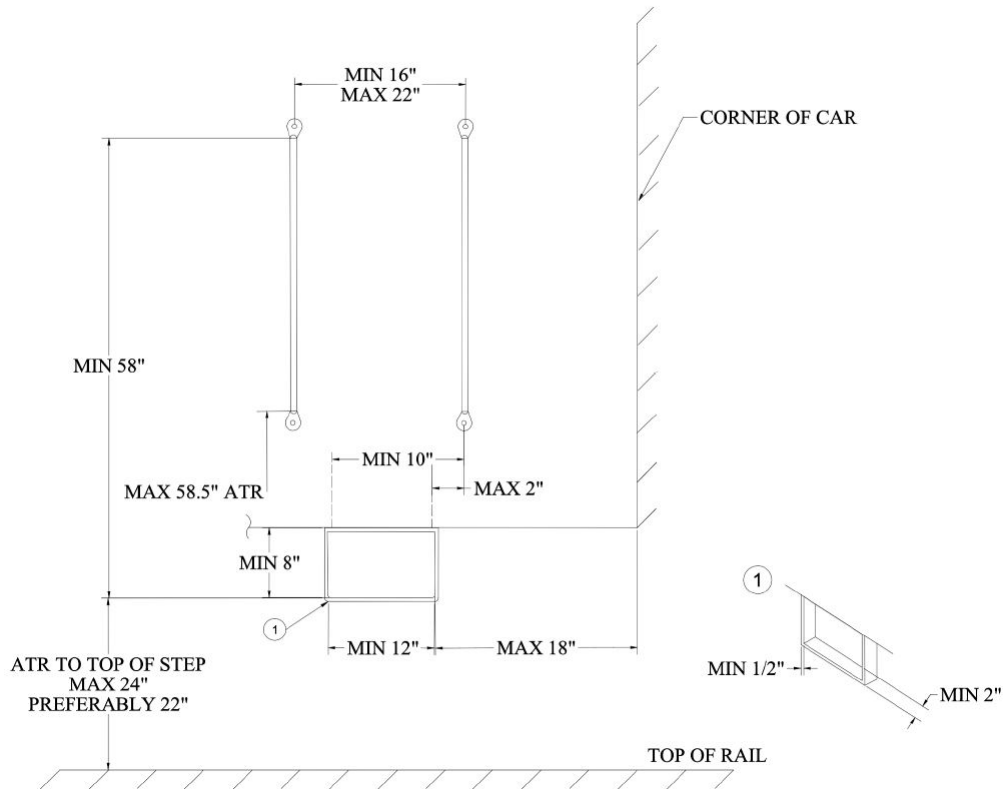
Sill Step with One Horizontal Handhold



5. When at least two vertical handholds are used, the lowest clearance point of each vertical handhold shall be at most 58½ in. (1485 mm) ATR. The highest clearance point of each vertical handhold shall be at least 58 in. (1474 mm) above the lowest (riding) step. Each set of vertical handholds shall be spaced not less than 16 in. (407 mm) nor more than 22 in. (558 mm) apart. See **Figure 9**.

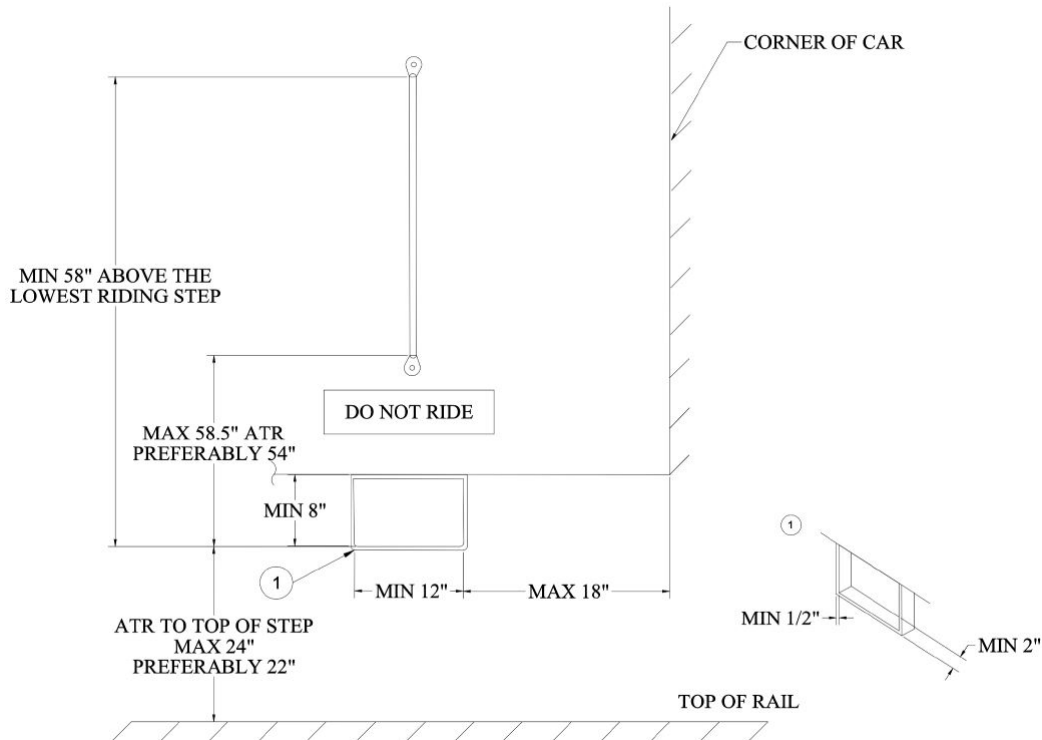
FIGURE 9

Sill Step with Two Vertical Handholds



6. When one vertical handhold is used, its lowest clearance point shall be at most 58½ in. (1485 mm) ATR, preferably 54 in. (1371 mm) ATR. Its highest clearance point shall be at least 58 in. (1474 mm) above the lowest (riding) step. See **Figure 10**. The handhold shall be located above the clear length of the step.

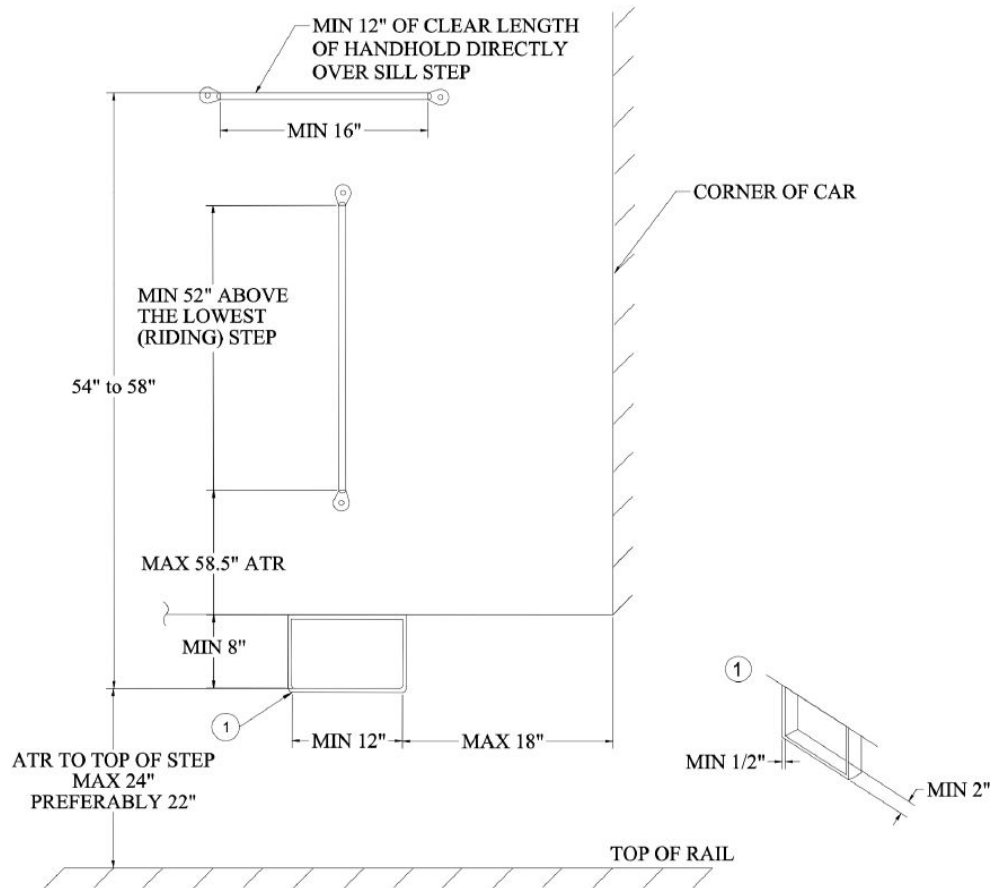
FIGURE 10
Sill Step with One Vertical Handhold



7. To align two vertical handholds with the sill steps, the handholds shall be located in the longitudinal direction such that the inside face of the outboard handhold is no more than 2 in. (50 mm) outboard of the inside face of the outboard vertical leg of the step and is no less than 10 in. (254 mm) outboard from the inside face of the inboard vertical leg. See **Figure 9**.
8. When a combination of horizontal and vertical handholds is used, the horizontal handhold shall be 54 to 58 in. (1372 to 1473 mm) above the lowest (riding) step. The lowest clearance point of the vertical handhold shall be at most 58½ in. (1485 mm) ATR. The highest clearance point of the vertical handhold shall be at least 52 in. (1321 mm) above the lowest (riding) step. See **Figure 11**. One continuous handhold may be used as long as it meets the dimensional requirements of this paragraph. If possible, the vertical handhold should be within the clear length of the step.

FIGURE 11

Sill Step with One Horizontal and One Vertical Handhold



3.2.4 Handholds for riding at passenger steps

3.2.4.1 General

Low-level passenger boarding steps with a height of not more than 24 in. (609 mm) can be used in lieu of sill steps (where the functionality of sill steps is required in accordance with Section 3.2.2.2). In order to do so, the handhold provisions of this section shall apply.

3.2.4.2 Purpose/function

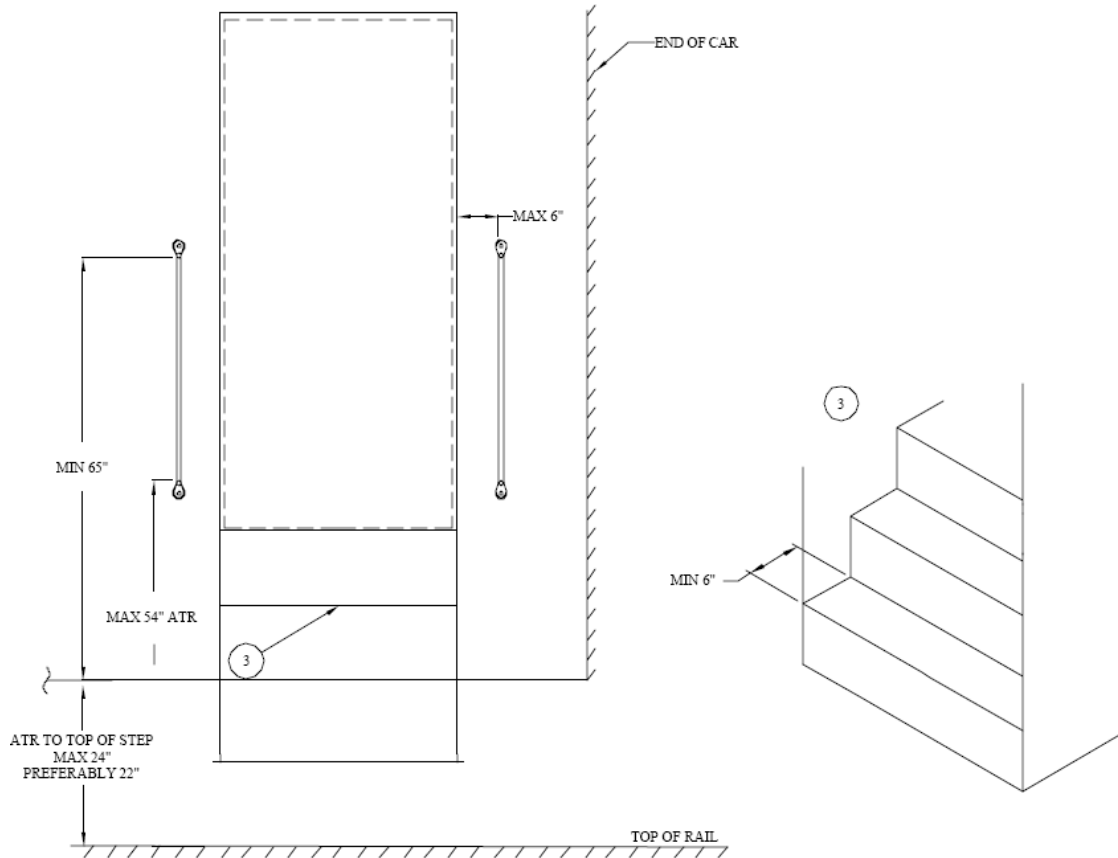
These handholds are used to assist an employee while riding the train for switching operations where passenger steps are used in lieu of sill steps.

3.2.4.3 Location

- There shall be two vertical handholds, one on each side of the door opening.
- The lowest clearance point of each crew handhold shall be at the most 54 in. (1371 mm) ATR.
- If the crew handhold is located outside the door opening, the crew handhold shall be located no more than 6 in. (152 mm) from the vertical inside face of the door opening.

See **Figure 12**.

FIGURE 12
Sill Step Handholds for Riding at Passenger Steps



3.3 Crew access

3.3.1 General requirements

1. The equipment shall provide locations where crew members can board or disembark the equipment safely from ground level (referenced at ATR) and be able to access all passenger and crew areas within every vehicle in the consist and be positioned to paragraphs (1)(a) or (b), depending on the type of equipment:
 - a. A minimum of one crew access location per side per car.
 - b. A minimum of two crew access locations per side per set of semi-permanently coupled passenger cars, provided that each location provides access to all the passenger and crew areas in the set.
2. The following access locations are considered acceptable crew access locations if all design requirements for crew access locations stipulated in this standard are met at those locations:
 - a. Ground access from the side of the vehicle into cabs or machinery compartments (if equipped) if the whole interior of the vehicle can be reached by crew members from these areas.
 - b. Passenger step access may be used for this purpose if all crew and passenger areas can be accessed by the crew members.
 - c. Crew access steps and handholds shall be provided on any carbody side door directly leading into a cab or machinery compartment.
 - d. Alternatively, retractable steps may be used as crew access steps as long as they meet the dimensional and location requirements for crew access steps.

APTA PR-M-S-016-06, Rev. 1
Safety Appliances for Passenger Equipment

- e. Tier III trainsets may use portable ladders equipped with handrails designed for safe access from ground level in lieu of the requirements in this standard for crew access steps and handholds.

NOTE: If using this approach for Tier III equipment, FRA/TC will likely request the opportunity to review and approve the portable ladder arrangement.

3.3.1.1 Dimensions for crew access steps

1. The minimum usable length of tread shall be no less than 10 in. (254 mm), preferably 12 in. (305 mm).
2. Treads shall be no less than 2 in. (51 mm) wide.
3. Steps shall not have a vertical rise between treads exceeding 18 in. (457 mm). If needed to comply, additional treads shall be provided.
4. The clear depth above the entire usable length of the lowest crew access step tread shall be no less than 8 in. (204 mm), and the clear depth above the entire usable length of all other crew access step treads shall be no less than 6 in. (153 mm). For Tier III vehicles, both values may be reduced to 4.7 in. (120 mm). The clear width of all crew access step treads shall be no less than 6 in. (153 mm) with the trucks rotated to simulate the maximum curvature specified for the uncoupled car.
5. The portion of the tread surface area of each crew access step that is normally contacted by the foot shall be treated with an anti-skid material or be slip-resistant by texturing of the metal surface in such a way that it lasts the life of the car. Some examples of acceptable methods are diamond plate and stamped, upset or expanded metal. For enclosed step designs, at least 50% of the tread area shall be open space. For steps above the lowest step, the open space shall extend at least 1 in. (26 mm) below the top surface of the tread.
6. To account for minor deviations, the application of crew access steps shall be such that a box with the dimensions shown in **Table 3** can pass through the opening above the crew access step to the point where the box is flush with the outer edge of the step.

TABLE 3
Side Door Step Dimensions

	Box Length	Box Depth	Box Width
Lowest side door step	10 in. (254 mm)*	8 in. (204 mm)	6 in. (153 mm)
All side door steps, except lowest	10 in. (254 mm)*	6 in. (153 mm)	6 in. (153 mm)
All side door steps (Tier III)	10 in. (254 mm)*	4.7 in. (120 mm)	6 in. (153 mm)

* Box Length Preferably 12 inches (305 mm)

3.3.1.2 Dimensions for crew access handrails

Handrails shall be no less than $\frac{5}{8}$ in. (16 mm) in diameter. Minimum clear length of vertical handrails shall be 24 in. (610 mm). Minimum clearance shall be 2 in. (51 mm), preferably 2½ in. (64 mm).

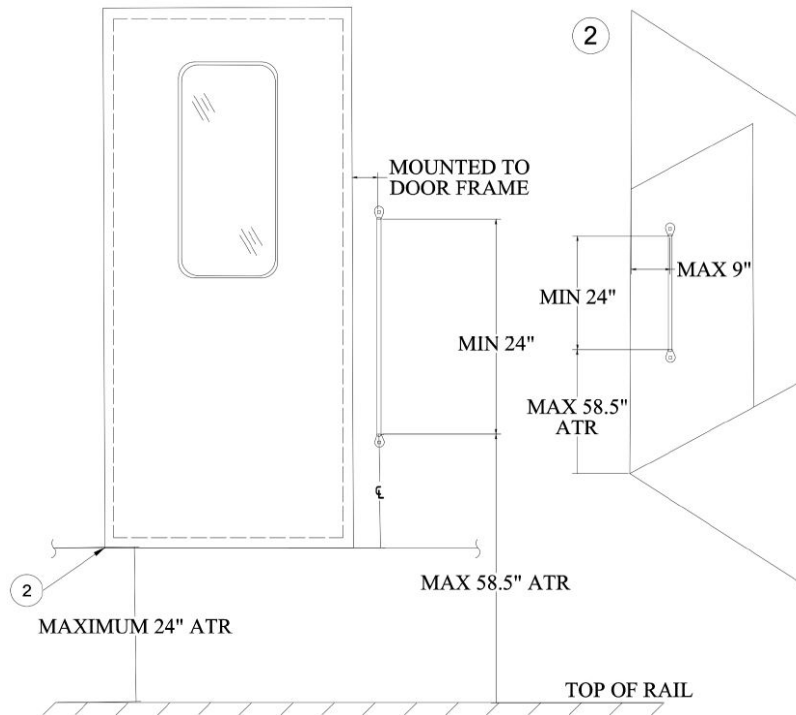
Where interior handrails are used for passenger access, the handrail diameter and the minimum clearance around the vertical handrail shall comply with §38.97(a) or §38.115(a).

3.3.2 Requirements for crew access at low-level floors

Low-level floor equipment includes those cars having the door thresholds at a height no more than 24 in. (609 mm) above the top of rail.

FIGURE 13

Crew Access at Low-Level Floors



3.3.2.1 Steps

Additional crew access steps are not needed where the door threshold is at a height not more than 24 in. (609 mm), preferably 22 in. (558 mm) ATR.

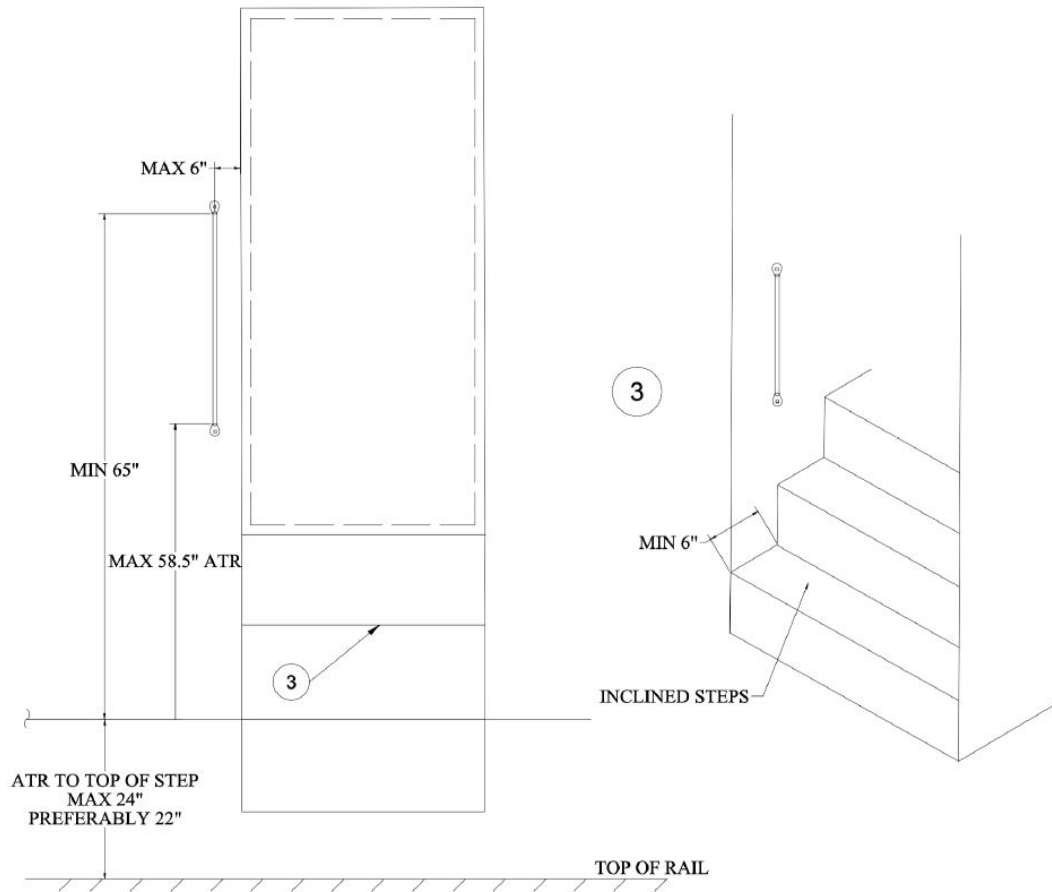
3.3.2.2 Handholds

1. There shall be at least one vertical handhold on one side of the door opening, inside of the car or on the doorframe, not more than 9 in. (228 mm) from the outside face of the door opening.
2. The lowest clearance point of the vertical handrail shall be at most 58½ in. (1485 mm) ATR.

3.3.3 Requirements for crew access at high-level floors with inclined steps

A high-level floor is defined in this section as an interior car floor with a height greater than 24 in. (610 mm) ATR.

FIGURE 14
Crew Access at High-Level Floors with Inclined Steps



3.3.3.1 Steps

1. The first (lowest) crew access step shall be not more than 24 in. (609 mm), preferably not more than 22 in. (558 mm) ATR.
2. For designs that have inclined steps with the lowest step more than 24 in. (609 mm), additional crew access steps and handholds shall be applied in accordance with Section 3.3.4.

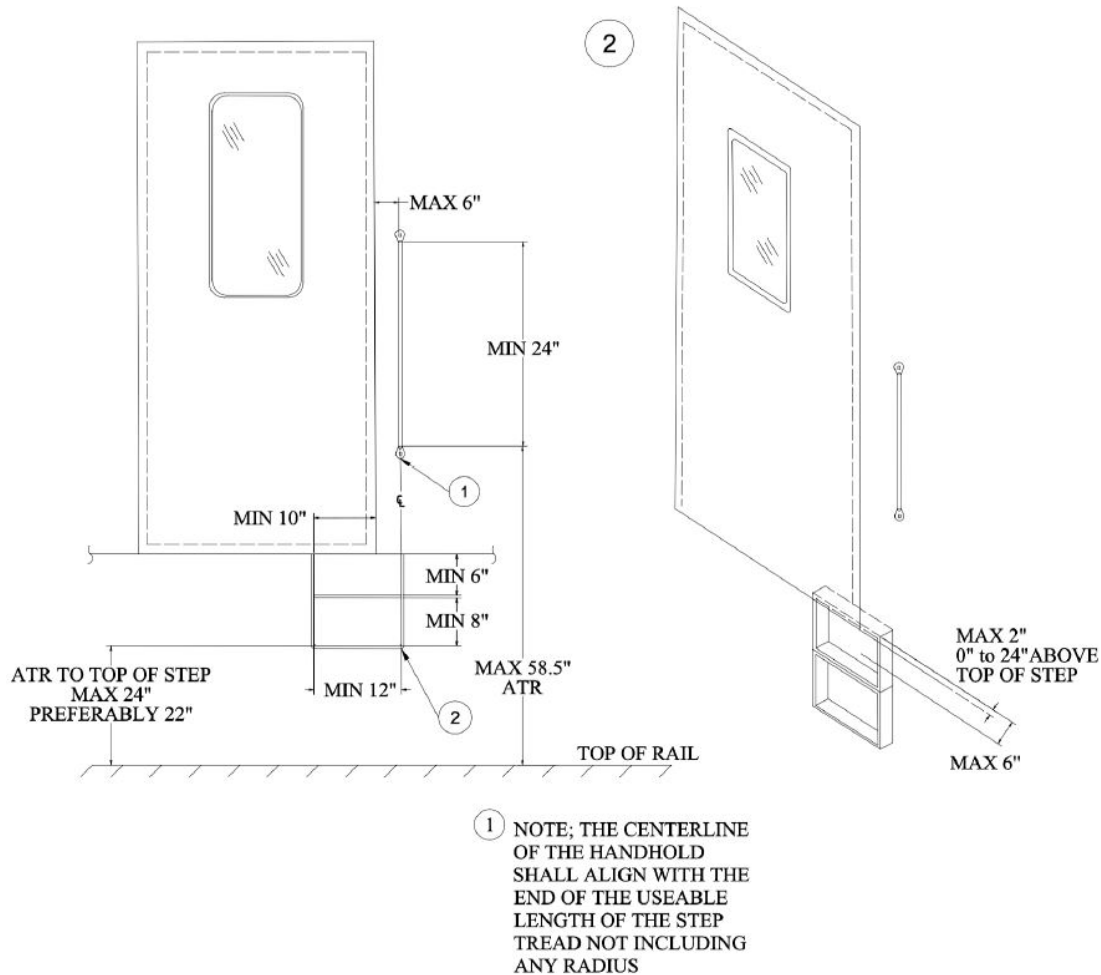
3.3.3.2 Handholds

1. There shall be at least one vertical crew handhold on the side of the door opening.
2. The lowest clearance point of the vertical handrail shall be at most 58½ in. (1485 mm) ATR.
3. There shall be a second handhold provided to facilitate stepping up into the car.
4. If the crew handhold is located outside the door opening, the crew handhold shall be located no more than 6 in. (152 mm) from the vertical inside face of the door opening.

3.3.4 Requirements for crew access at high-level floors with vertical steps or ladders

A high-level floor is defined in this section as an interior floor with a height greater than 24 in. (610 mm) ATR without inclined steps. See [Figure 15](#).

FIGURE 15
Crew Access at High-Level Floors with Vertical Steps

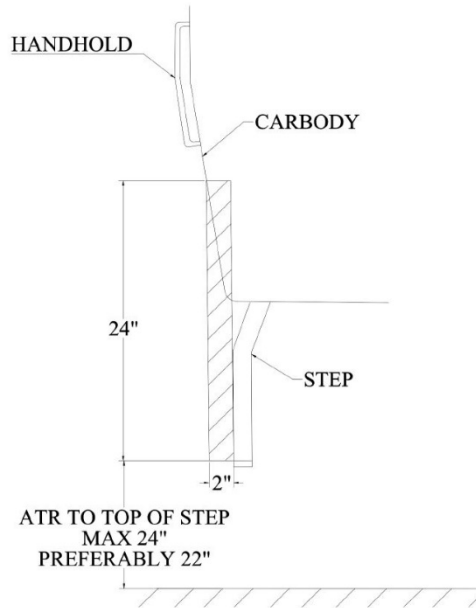


3.3.4.1 Steps

1. The treads shall be aligned with the door opening to provide at least 10 in. (254 mm) of tread within the clear door opening. The opposing ends of the treads shall align with or extend past the centerline of the crew access handhold.
2. The lowest tread shall be not more than 24 in. (609 mm), preferably not more than 22 in. (558 mm) ATR. The design goal is to have the lowest tread as close to the top of rail as permitted by the clearance diagram.
3. The outside edge of any tread shall be no more than 2 in. (50 mm) inboard of any car structure or treads within 24 in. (609 mm) directly above the clear length of any step. A maximum of 4 in. (101 mm) is permitted for treads at or below 21 in. (534 mm) ATR, provided it is otherwise not possible to remain within the clearance diagram. The design goal is to have the outside edge of the crew access step tread to be as flush with the side of the car as the clearance diagram permits. See **Figure 16**.

FIGURE 16

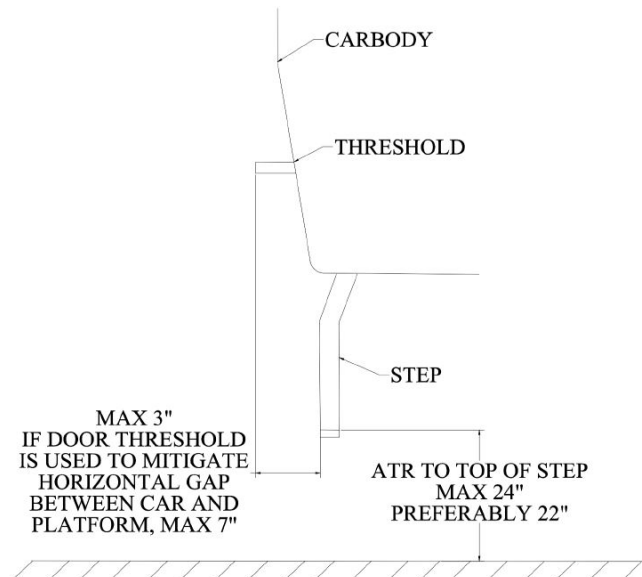
Carbody Structure Clearance with Step Tread



4. The outside edge of any tread shall be no more than 3 in. (76 mm) inboard of the door threshold. If the door threshold is used to mitigate the horizontal gap between the car and platform, up to 7 in. (177 mm) is permitted. See **Figure 17**.

FIGURE 17

Allowable Transverse Alignment for Step and Threshold

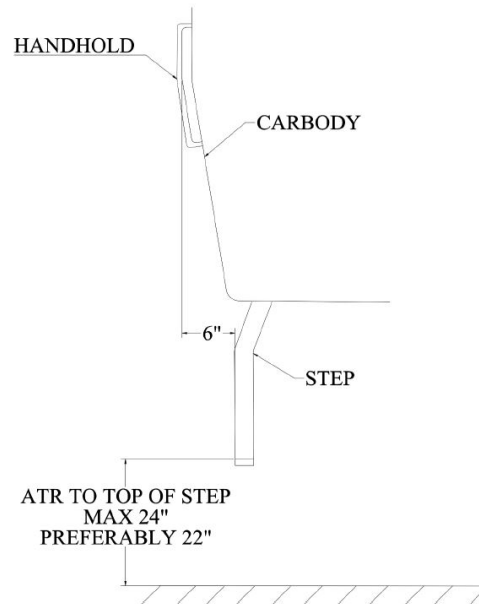


5. The outside edge of all treads shall be aligned in the transverse direction within 6 in. (152 mm) inboard to 8 in. (203 mm) outboard of the exterior sidewall plane at the handhold attachment points inside surface of the adjacent handhold at any point along the handhold clear length. The design goal

APTA PR-M-S-016-06, Rev. 1
Safety Appliances for Passenger Equipment

is to have the outside edge of the crew access step to be as aligned with the crew access handhold as the clearance diagram permits. See **Figure 18**.

FIGURE 18
Allowable Transverse Alignment for Step and Handhold



3.3.4.2 Handholds

1. There shall be one interior or exterior vertical crew access handhold over each crew access step located between the inside faces of the legs of the crew access step. If an exterior handhold is used, then an additional interior handhold shall be provided to facilitate stepping up into the car. This additional handhold does not need to meet the lowest clearance point in paragraph (2).
2. The lowest clearance point of the crew access handhold shall be at most 58½ in. (1485 mm), preferably 54 in. (1371 mm), ATR.
3. An exterior crew access handhold shall be located no more than 6 in. (152 mm) from the vertical inside face of the door opening.
4. When ground access is provided for cabs or machinery compartments, two vertical side door handrails shall be provided, one on each side of the door, to continue to a point at least 60 in. (1524 mm), or as high as practicable based on carbody design, above the floor of the cab at the door entrance. For Tier III equipment, the handholds shall continue to a point at least 48 in. (1220 mm), or as high as practicable based on carbody design, above the cab floor at the door entrance. If a 2 in. (51 mm) minimum clearance cannot be provided for the entire length due to handrails being secured at locations between the top and bottom connections, alternate configurations that are ergonomically designed for the intended function may be used as approved by the railroad.

NOTE: Any deviations may require FRA/TC approval.

3.4 End handholds

3.4.1 General

Two end handholds are required at each end of a vehicle or trainset unit equipped with an automatic coupler. However, end handholds are not required at ends of vehicles or trainset units equipped with an automatic coupling mechanism that can be safely operated from inside the appropriate cab of the vehicle and does not

require ground intervention from a person such as to go on, under or between to couple air, electric or other connections.

3.4.2 Purpose/function

End handholds are used to stabilize an employee when performing such tasks as making or breaking end connections, opening and closing angle cocks and performing inspections.

3.4.3 Dimensions

Handholds shall be no less than $\frac{5}{8}$ in. (16 mm) in diameter. Minimum clear length of end handholds shall be 16 in. (407 mm). Minimum clearance shall be 2 in. (51 mm), preferably 2½ in. (64 mm), with end connections applied and end receptacle covers in resting position.

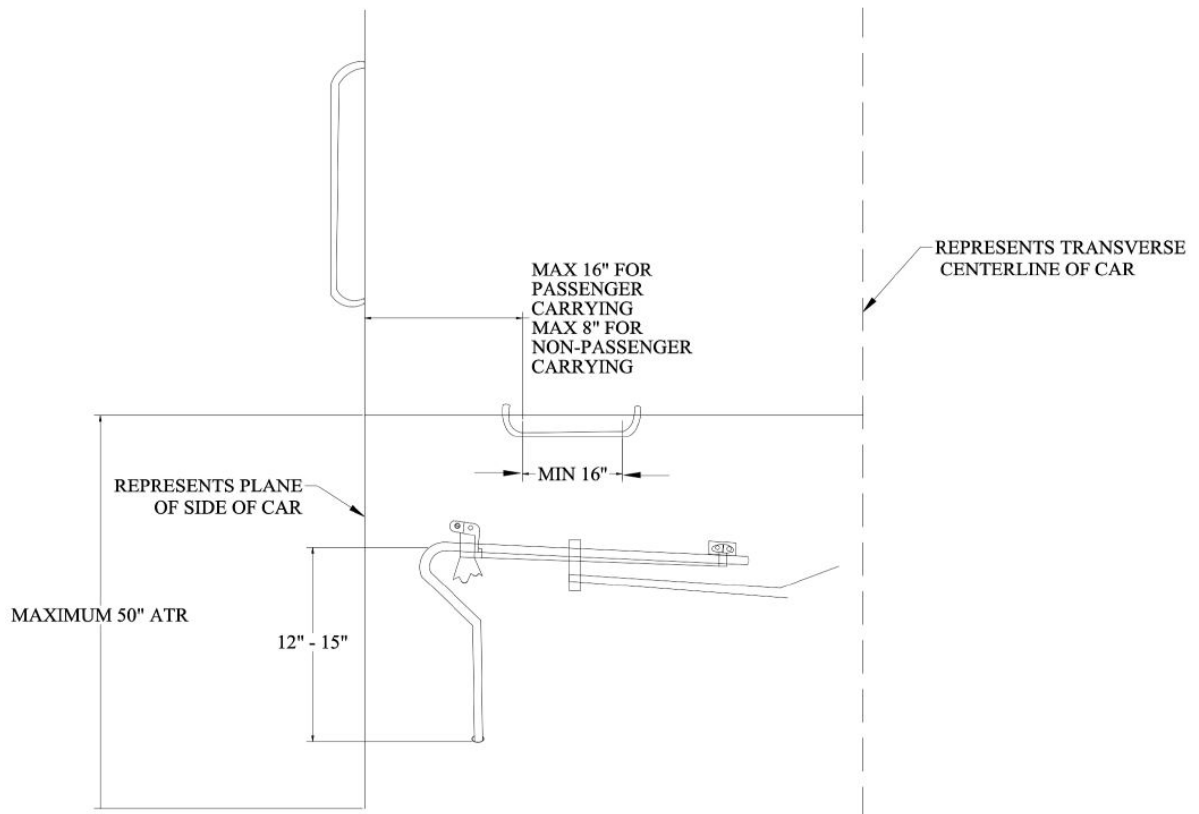
3.4.4 Location

1. End handholds shall be oriented horizontally, one near each side on each end projecting from the face of the end sill or sheathing.
 - a. For passenger-carrying vehicles, the clearance point of the outboard end of the end handhold shall be not more than 16 in. (406 mm) from side of car.
 - b. For non-passenger-carrying locomotives, the clearance point of the outboard end of the end handhold shall be not more than 8 in. (203 mm) from side of car.
2. If the equipment is designed with a tapered nose, the side of the car shall be determined based on the outer dimension of the tapered nose where the end handhold is attached.
3. The handholds shall be located not greater than 50 in. (1270 mm) from top of rail. Handholds may be attached to any primary structure (e.g., carbody frame or pilot, or plow on cab cars), so long as it meets the dimensions above.
4. An uncoupling lever may be used as an end handhold if it otherwise meets the requirements for end handholds.

See **Figure 19**.

FIGURE 19

End Handhold and Uncoupling Lever



3.5 Collision post handholds

3.5.1 General

Two collision post handholds shall be at each end passageway if that passageway is utilized for guiding reverse moves.

3.5.2 Purpose/function

Collision post handholds provide a means to stabilize an employee standing at the end of the car guiding reverse moves. Collision post handholds also provide a means to stabilize an employee when walking between cars.

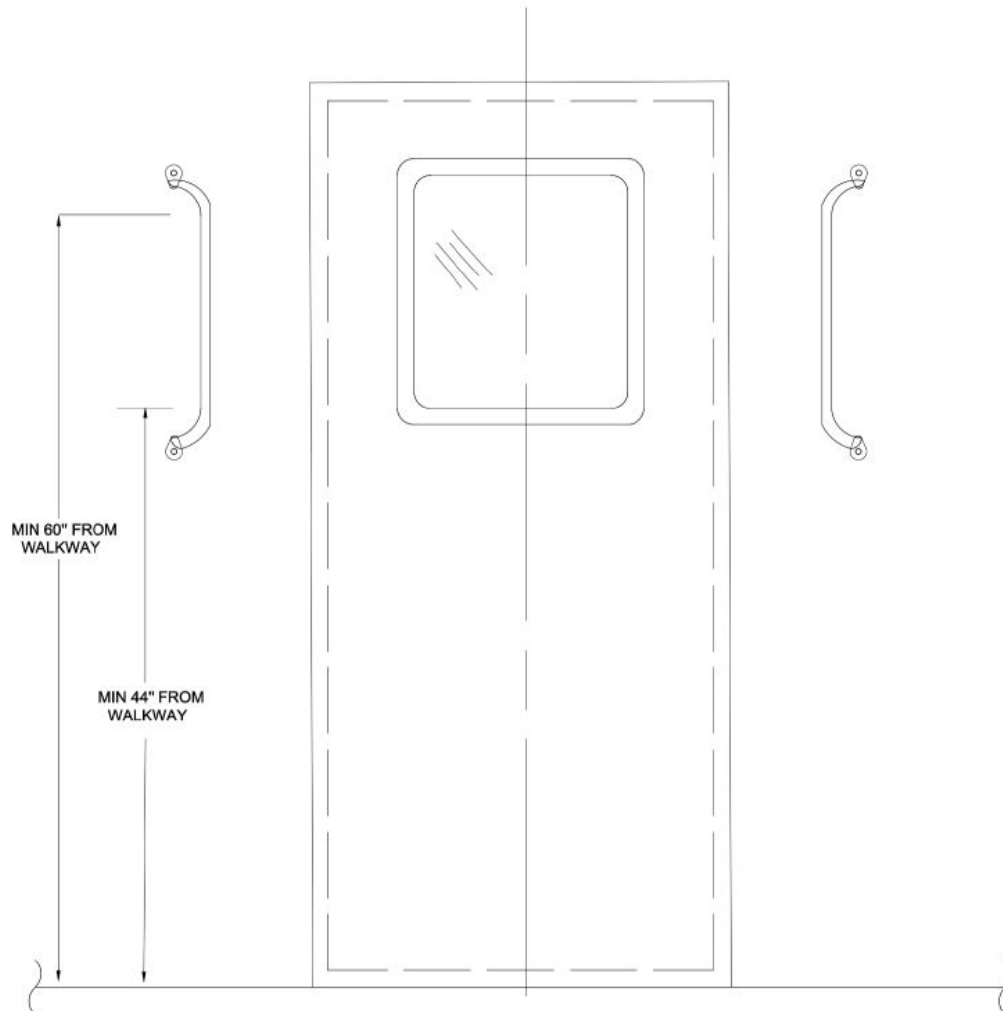
3.5.3 Dimensions

Handholds shall be no less than $\frac{5}{8}$ in. (16 mm) in diameter. Minimum clearance shall be 2 in. (51 mm), preferably 2½ in. (64 mm).

3.5.4 Location

Collision post handholds shall be oriented vertically. The lowest clearance point shall be at most 44 in. (1117 mm) above the floor of the walkway, and the highest clearance point shall be at least 60 in. (1524 mm) above the floor of the walkway. See [Figure 20](#).

FIGURE 20
Collision Post Handholds



3.6 Handrail on open platform cars

3.6.1 General

Open platform cars shall have the platform area enclosed. If handrails are used to enclose the platform area and are intended to stabilize an employee standing in this area, the requirements of this section shall apply.

3.6.2 Purpose/function

A handrail or a shortened wall is used on open platform cars to enclose the platform area and stabilize an employee standing on the open platform.

3.6.3 Dimensions

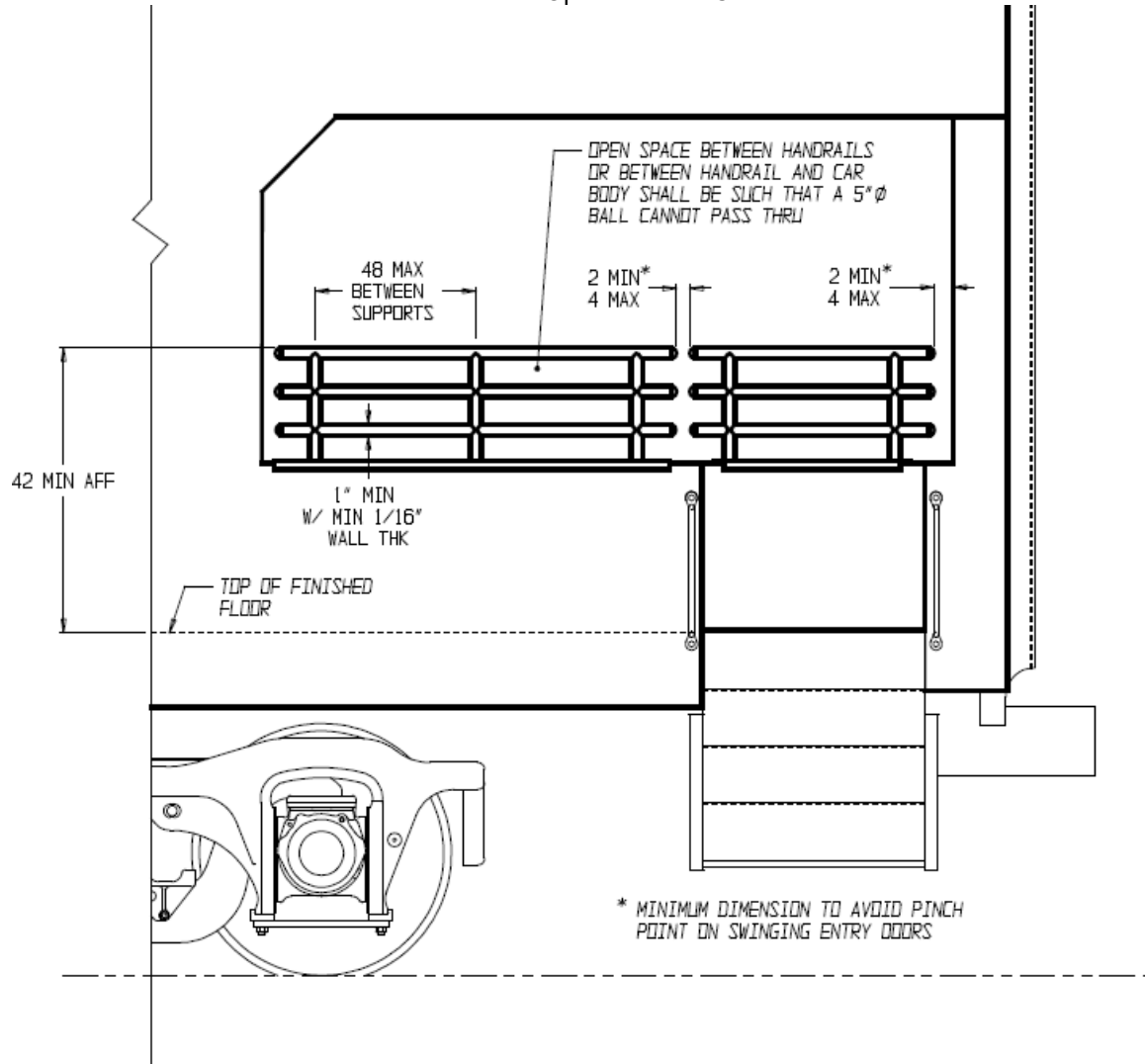
Handrails shall be no less than $\frac{5}{8}$ in. (16 mm) diameter steel. Alternatively, handrails shall be no less than 1 in. (26 mm) diameter tubing with a minimum wall thickness of $\frac{1}{16}$ in. (2 mm).

3.6.4 Location

1. Open platform cars shall have the platform area enclosed with either a handrail or shortened walls. The handrail may be continuous or may be intermittent to extend between other members of the car, such as collision posts and corner posts.
2. If an intermittent handrail is used, the end of the handrail shall be capped with a rounded end to reduce risk of injury.
3. The distance from the end of the handrail to a vertical car member shall not exceed 4 in. (101 mm).
4. The handrail shall be at least 42 in. (1067 mm) from the top of the platform floor to the top of the handrail, including entry doors.
5. The handrail arrangement shall be designed such that a 5 in. (127 mm) diameter ball cannot pass through any space between handrail members or between the handrail and the carbody.
6. Handrail members shall not be unsupported for spans over 48 in. (1219 mm).
7. The railing and stile assembly may be welded but the ends of the final assembly must be securely fastened to the car structure.
8. If a shortened wall is used, it shall meet the location requirement for handrails as detailed in paragraphs (1) through (7) above.

See **Figure 21**.

FIGURE 21
Handrail on Open Platform Car



3.7 Uncoupling devices

3.7.1 General

Each passenger-carrying vehicle end equipped with an automatic coupler shall have either:

- a manual uncoupling lever; or
- an uncoupling mechanism operated by remote controls.

Each non-passenger-carrying locomotive end equipped with an automatic coupler shall have either:

- a manual double-lever uncoupling lever, operative from either side of the locomotive; or
- an uncoupling mechanism operated by remote controls.

Additional manual uncoupling levers or handles provided on the coupler as a backup for the remotely operating mechanism shall not be subject to the requirements of this standard.

3.7.2 Purpose/function

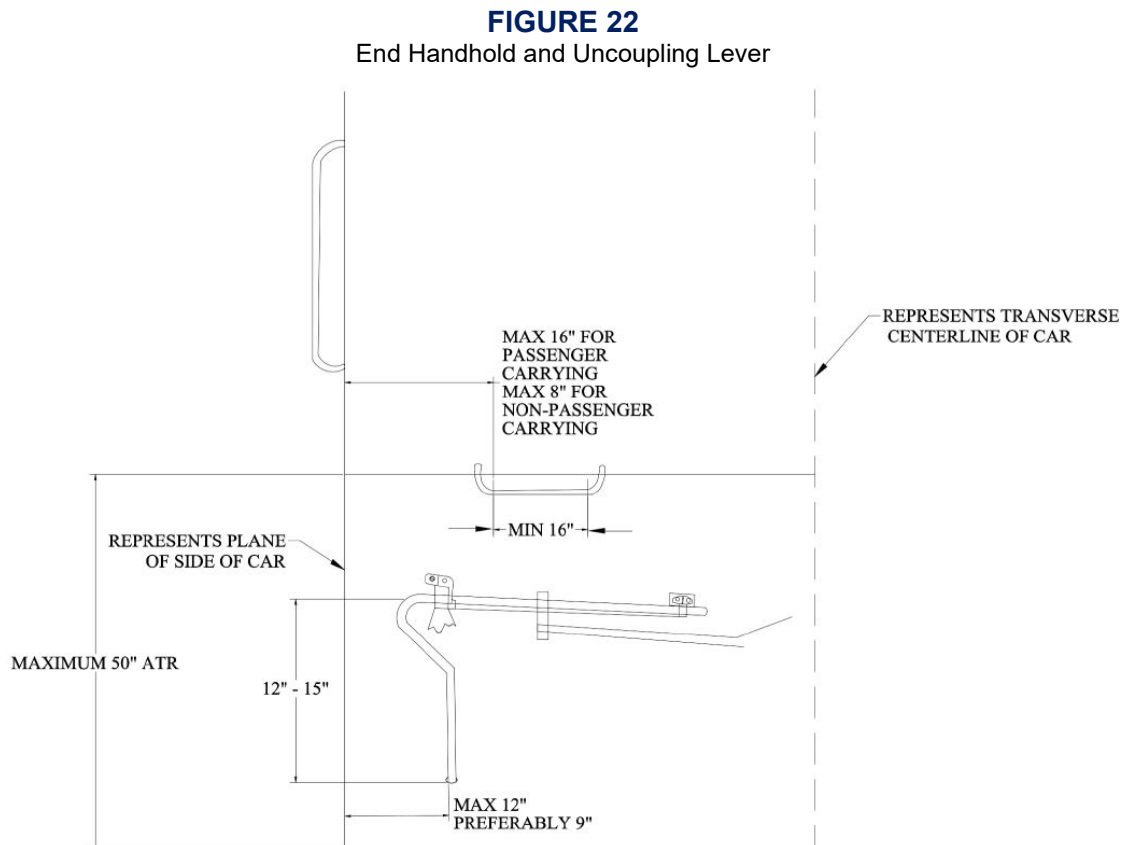
The uncoupling device is a mechanism used to uncouple cars without requiring an employee to go between cars.

3.7.3 Dimensions

If a manual uncoupling lever is provided, the following shall apply:

1. Lever handles shall not be more than 12 in. (304 mm), preferably 9 in. (228 mm):
 - a. from the side of the car; or
 - b. for cab ends with shrouding or aerodynamic treatment, from the outer dimension of the tapered nose at the location where the end handhold is attached.
2. Uncoupling attachments shall be applied so they can be operated by a person standing on the ground.
3. The bottom end of the handle shall be no less than 12 in. (305 mm) and no more than 15 in. (381 mm) below the centerline of the outermost pivot point of the uncoupling lever to which the handle is attached.
4. The end of the handle shall be constructed to provide a minimum 2 in. (51 mm), preferably 2½ in. (64 mm) clearance around the handle.

See **Figure 22**.



3.7.4 Location

When used, the manual uncoupling levers shall be located in the following manner.

1. For passenger cars, the uncoupling lever shall be applied so the coupler can be operated from the left side of the car as seen when facing the end of the car from the ground.
2. For non-passenger locomotives, uncoupling levers shall be applied so the coupler can be operated from both sides of the locomotive.
3. Road locomotives with corner stairway openings must be equipped with uncoupling mechanisms that can be operated safely from the bottom stairway opening step, as well as ground level. No part of the uncoupling mechanism may extend into the stairway opening or end platform area when the mechanism is in its normal position or when it is operated.

When used, the uncoupling mechanism operated by remote controls shall be located in the appropriate cab or control stand. See [Figure 22](#).

3.7.5 Manner of application

The uncoupling lever device shall be securely fastened to the carbody structure or supporting bracket.

3.8 Conditional safety appliances

Safety appliances in this section are considered mandatory if either the design of the car or railroad operating rules, and actual practice, entails the maintenance or replacement of equipment conducted by maintenance personnel in locations not protected by the requirements of Part 218, Subpart B. If not, these safety appliances can be omitted.

3.8.1 Handholds and steps for appurtenances and windshields

Vehicles having appurtenances such as headlights, windshield wipers, marker lights and other similar items required for the safe operation of the vehicle and designed to be replaced from the exterior of the vehicle shall have handholds and steps meeting the dimension and clearance requirements of side door steps and side door handholds to allow for the safe maintenance and replacement of these parts. Alternatively, the requirements for ladders or a combination of ladders, steps and handholds may be used.

3.8.2 Ladders

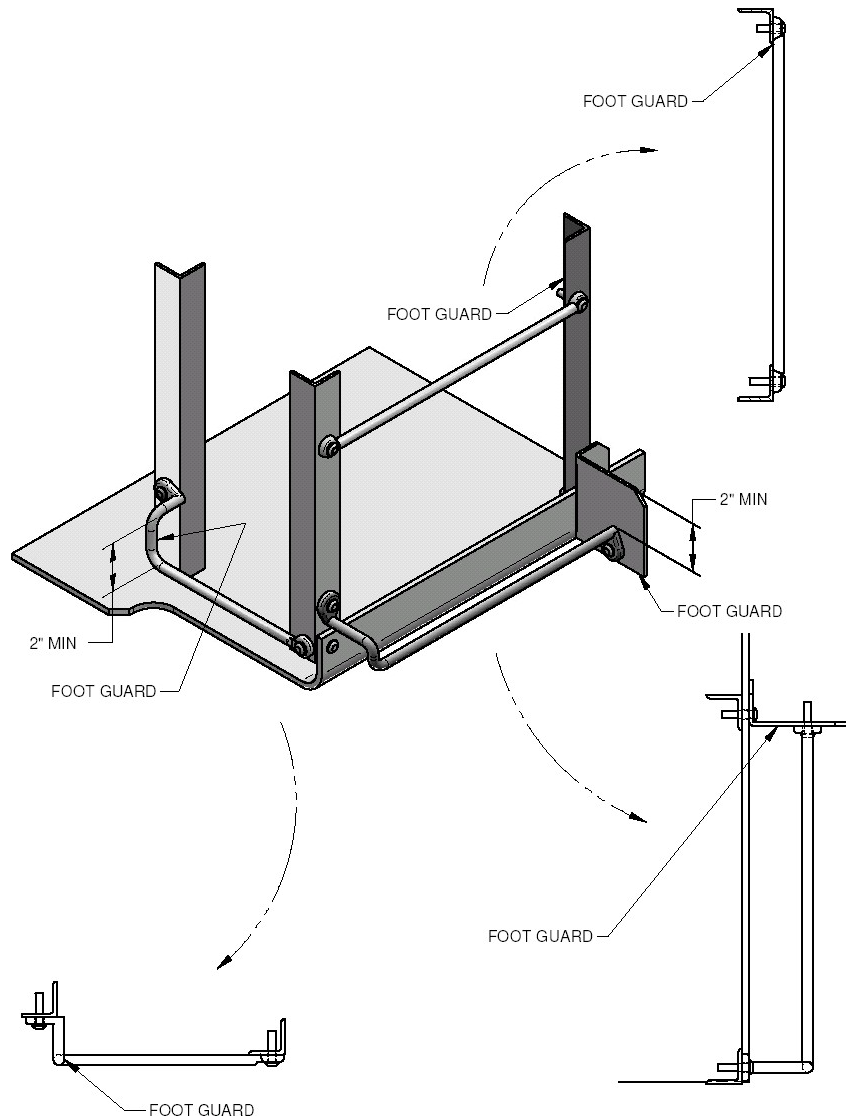
3.8.2.1 Purpose/function

Ladders enable an employee to access equipment or to perform a function that cannot be done from the ground.

3.8.2.2 Dimensions

1. The minimum usable length of tread shall be not less than 16 in. (407 mm) on side ladders and not less than 14 in. (356 mm) on end ladders.
2. Treads of rectangular cross-section shall be no less than 2 in. (51 mm) wide. The minimum diameter of treads of circular cross-section shall be $\frac{5}{8}$ in. (16 mm) in diameter.
3. Minimum clearance of treads shall be 2 in. (51 mm), preferably 2½ in. (64 mm).
4. All ladder treads shall have foot guards. Ladder side rails may serve as foot guards ([Figure 23](#)).

FIGURE 23
Foot Guards on Ladder Treads



3.8.2.3 Location

1. If the ladder is used for access to the roof, the top ladder tread shall be no less than 12 in. (305 mm), and no more than 18 in. (457 mm), below the mounting surface of the outboard end of the adjacent roof handhold.
2. The maximum spacing between ladder treads shall be 19 in. (482 mm). Spacing of ladder treads shall be uniform within a limit of 2 in. (50 mm) from top tread to bottom tread of ladder.

3.8.3 General appliances for moving on side and end walls

3.8.3.1 Purpose/function

These safety appliances are used for accessing the vehicle or moving on its walls where standard arrangements do not fit.

3.8.4 Dimensions

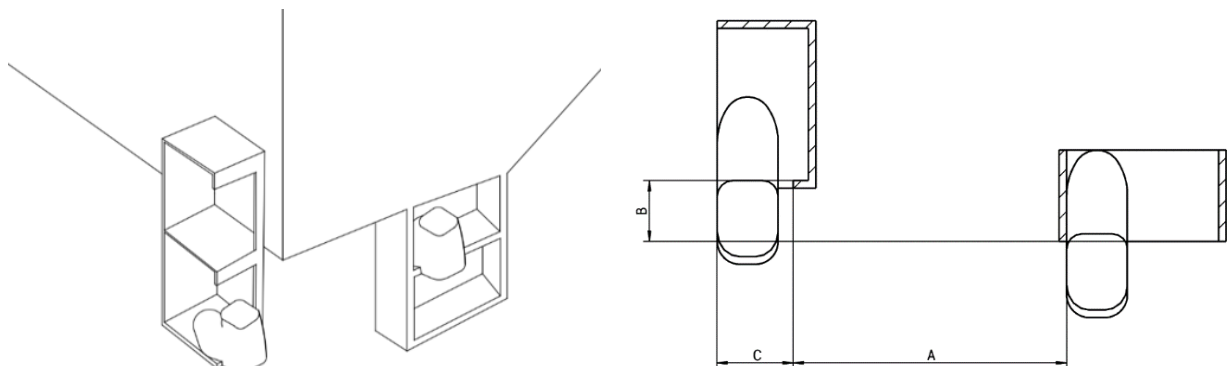
All handholds and steps shall meet the dimension and clearance requirements of side door steps and side door handholds. Alternatively, the requirements for ladders or a combination of ladders, steps and handholds may be used.

3.8.4.1 Stepping around the corner of a vehicle

1. Treads for stepping around the corner of a vehicle shall be aligned vertically; a maximum vertical variation of 2 in. (50 mm) is allowed.
2. The total horizontal distance between the steps around the corner shall not be more than 16 in. (406 mm) (a+b dimension; see **Figure 24**), measured from the inside edge of ladder foot guards or the clearance of treads.
3. If the design allows for both feet to be parallel during the transition, a maximum of 22 in. (558 mm) (a+b dimension in **Figure 24**) of total horizontal distance around the corner shall be allowed for transitioning from one ladder to the other. The clear length for placing the feet shall be a minimum 5 in. (127 mm) (c dimension in **Figure 24**) and fully supported on the tread surface.

FIGURE 24

Stepping Around the Corner of a Vehicle



3.8.5 Roof handholds

3.8.5.1 Purpose/function

Roof handholds are used on the roof of the car to stabilize an employee when performing such tasks as inspecting equipment located on the roof.

3.8.5.2 Dimensions

Handholds shall be no less than $\frac{5}{8}$ in. (16 mm) in diameter. Minimum clear length shall be 16 in. (407 mm). Minimum clearance shall be 2 in. (51 mm), preferably $2\frac{1}{2}$ in. (64 mm).

3.8.5.3 Location

If roof handholds are located above a ladder, then the centerline of the roof handhold shall be no more than 8 in. (203 mm) from the centerline of the ladder in the transverse direction.

3.9 Optional (elective) steps and handholds

Steps and handholds applied to the exterior of cars in addition to those required by this standard are defined as optional (elective) steps and handholds and shall comply with the requirements of this standard that are applicable to similar safety appliances, except for their quantity and location, to the extent practicable.

4. Safety appliance design verification inspection

The railroad and the carbuilder may use the checklist in Appendix A as a tool in verifying that all the requirements of this standard have been addressed.

The carbuilder or railroad shall request a safety appliance sample car inspection from the FRA in the United States or Transport Canada in Canada on each new design of car. If any design changes take place to safety appliances during production, the railroad shall request an additional safety appliance sample car inspection.

Previous sample car inspections can be applied to new orders of the same design if there are no changes to the safety appliances. However, FRA and TC will require submittal of the safety appliance arrangement drawings for that order with reference to the previous sample car inspection.

This inspection can be combined with the standard sample car inspection. Both FRA and TC require inspection of items in addition to safety appliances during the sample car inspection.

Contact FRA and/or TC for details on these requirements.

It is recommended that a safety appliance design review with the Federal Railroad Administration or Transport Canada be conducted as early as possible in the design process. The carbuilder or railroad shall submit a written request to FRA and/or TC at least 30 days prior to a sample car inspection. The letter shall include the drawings of all safety appliances and may include the completed checklist in Appendix A. The letter shall be sent to:

Federal Railroad Administration:

Director, Office of Safety Assurance and Compliance
Federal Railroad Administration
US Department of Transportation
1200 New Jersey Ave. S.E.
Washington, DC 20590

Transport Canada:

Transport Canada Rail
Safety Enterprise Building
427 Laurier Ave. W.
14th floor, Suite 1410
Ottawa, Ontario Canada, K1A 0N5

5. Inspection, maintenance, repair and replacement

5.1 Inspection

Safety appliances shall be inspected in accordance with the respective sections of 49 CFR 238; and/or Transport Canada's Railway Passenger Car Inspection and Safety Rules as applicable.

5.2 Maintenance

Safety appliances shall be maintained in accordance with the respective sections of 49 CFR 238; and/or Transport Canada's Railway Passenger Car Inspection and Safety Rules as applicable.

5.3 Repair and replacement

Safety appliances shall be repaired and replaced in accordance with the respective sections of 49 CFR 238; and/or Transport Canada's Railway Passenger Car Inspection and Safety Rules as applicable.

Fastener locking devices shall not be reused.

Related APTA standards

APTA PR-CS-S-020-03, Latest Revision “Passenger Rail Vehicle Structural Repair”

APTA PR-IM-S-007-98, Latest Revision, “Passenger Car Exterior Periodic Inspection and Maintenance”

APTA PR-M-S-006-98, Latest Revision, “Parking Brakes for New Passenger Locomotives and Cars”

References

This standard is to be used in conjunction with the following publications. When non-regulatory references are superseded by an approved revision, the revision shall apply for this standard and APTA will petition the Federal Railroad Administration and Transport Canada for a corresponding change in their rules and regulations.

Code of Federal Regulations:

49 CFR, Part 231, Railroad Safety Appliance Standards

49 CFR, Part 238, Rail Passenger Equipment Safety Standards AAR S-2044, Requirements for Freight Car Safety Appliances

American Welding Society standards:

AWS D1.1-06, Structural Welding Code – Steel

AWS D1.3-98, Structural Welding Code – Sheet Steel

AWS D1.6-99, Structural Welding Code – Stainless Steel

Canadian Standards Association standards:

CSA W47.1-03, Certification of Companies for Fusion Welding of Steel

CSA W59-03, Welded Steel Construction (Metal Arc Welding)

Transport Canada’s Passenger Car Inspection and Safety Rules

Bibliography

AAR Manual of Standards and Recommended Practices:

Section B, S-132, Type No. 6 Operating Mechanism

Section C, S-224, Handhold and Ladder Tread Material and Design Specifications

Section C, S-2042, Sill Step Performance Specification

Section E, S-475, Geared Hand Brakes

“FRA Motive Power and Equipment Compliance Manual,” Chapter 2, Inspection and Compliance Program

SAE J429, 1999, “Mechanical and Material Requirements for Externally Threaded Fasteners”

EN 16116, Railway applications. Design requirements for steps, handrails and associated access for staff. Passenger vehicles, luggage vans and locomotives

SAE J185, “Access Systems for Off-Road Machines”

Definitions

All CFR definitions cited here are current as of the date of publication of this standard and provided here for convenience only. However, the user should refer to the latest definitions in the CFR.

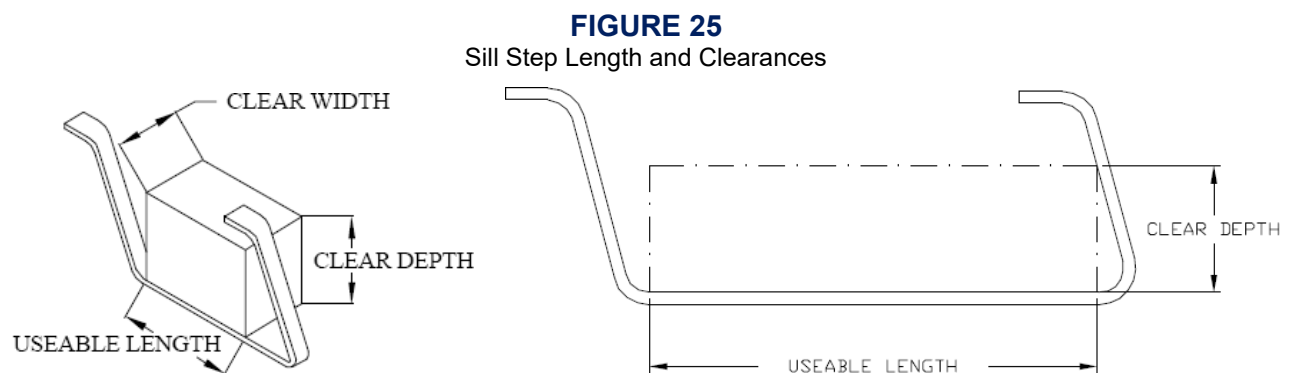
automatic coupler: A coupler that allows for mechanical coupling upon impact and uncoupling by either activation of a traditional uncoupling lever, or some other type of uncoupling mechanism that does not require a person to go on, under or between the equipment units.

automatic coupler, fully: A coupler that allows for all required mechanical, electrical, and pneumatic coupling upon impact and mechanical, electrical and pneumatic uncoupling by activation of a control within the vehicle.

cab: A locomotive cab defined per 49 CFR §238.5, and for the purposes of this APTA standard, the cab shall also include a space onboard a locomotive where an auxiliary control stand (or hostler stand) is located that is normally occupied by the engineer (or hostler engineer) when the locomotive is operated for switching moves in a yard or maintenance facility.

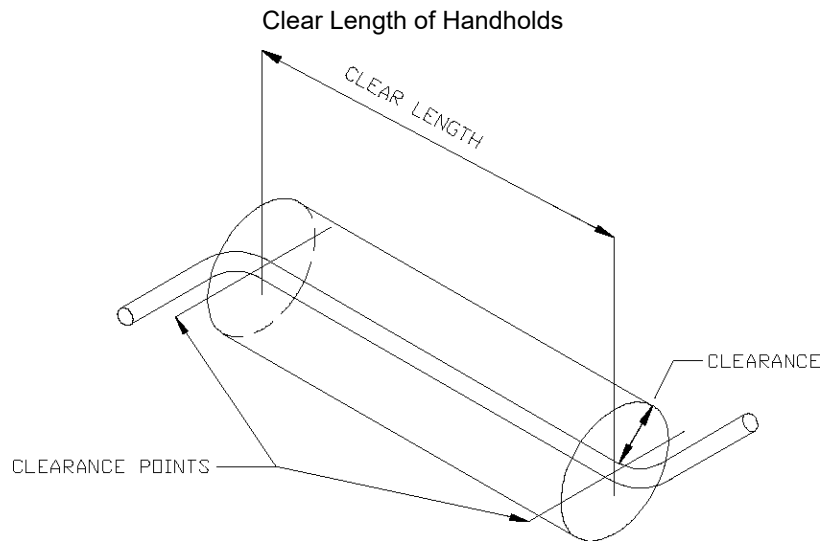
cab, locomotive (49 CFR §238.5 definition): The compartment or space onboard a locomotive where the control stand is located, and which is normally occupied by the engineer when the locomotive is operated.

clear depth: As applied to step treads, clear depth is the distance measured vertically from the top surface of the tread to the closest obstruction anywhere within the specified minimum clear width and usable length. See **Figure 25**.



clear length: As applied to handholds, clear length is that distance about which a minimum 2 in. (51 mm) hand clearance (from obstructions due to car design) exists in all directions around the handhold. The clear length of one portion of a handhold does not include handhold portions in other directions or bend radii connecting noncontinuous portions of a handhold. Intermediate supports may be considered part of the clear length. Unless otherwise stated, limitations on handhold length apply to the clear length. See **Figure 26**.

FIGURE 26



clear width: As applied to step treads, clear width is the distance measured from the outboard surface of the tread to the closest inboard obstruction anywhere within the specified minimum clear depth and usable length. See [Figure 25](#).

clearance points: As applied to handholds, clearance points are the ends of the clear length. See [Figure 26](#).

collision post handhold: The handhold located at the end passageway of the vehicle to stabilize an employee when standing at the end of the car guiding reverse moves and to stabilize an employee when walking between cars.

crew handhold: The handhold used to assist an employee while entering or leaving a passenger entrance.

end handhold: The handhold located at the end of the vehicle to stabilize an employee when using the uncoupling device or as needed when connecting and disconnecting hoses and cables or when inspecting the vehicle.

fastener locking device: A device applied to a fastener to prevent the fastener from loosening.

handbrake, manually applied: A type of parking brake system where the brake force is applied and released by hand to prevent movement of a rail car such as a lever or wheel type handbrakes.

handhold: A device used for gripping or support when on steps or for assisting passengers and crew members when boarding or departing the vehicle. Handholds may be handrails.

handrail: Safety appliances installed on either side of a rail vehicle's exterior doors to assist passengers and crew members to safely board and depart the vehicle.

inboard: Toward the centerline of the car in either the transverse or longitudinal direction.

ladder: An arrangement of treads and/or handholds used for climbing to allow an employee to access equipment or perform a function that cannot be done from the ground.

longitudinal: Parallel to the centerline of track.

APTA PR-M-S-016-06, Rev. 1
Safety Appliances for Passenger Equipment

open platform car: A railcar with a non-enclosed section at the end of the car.

outboard: Away from the centerline of the car in either the transverse or longitudinal direction.

parking brake or handbrake (49 CFR §238.5 definition): A brake that can be applied and released by hand to prevent movement of a stationary railcar or locomotive.

parking brake system: A system applied to prevent a car from rolling due to gravity. This equipment shall include systems referred to as handbrakes or power assisted applied/release parking brakes.

passenger cars (49 CFR §238.5 definition): Rail rolling equipment intended to provide transportation for members of the general public and includes a self-propelled car designed to carry passengers, baggage, mail or express. This term includes passenger coach, cab car and MU locomotive. In the context of articulated equipment, “passenger car” means that segment of the rail rolling equipment located between two trucks. This term does not include a private car.

passenger equipment (49 CFR §238.5 definition):

1. All powered and unpowered passenger cars, locomotives used to haul a passenger car, and any other rail rolling equipment used in a train with one or more passenger cars. Passenger equipment includes—
 - a. A passenger coach,
 - b. A cab car,
 - c. A MU locomotive,
 - d. A locomotive not intended to provide transportation for a member of the general public that is used to power a passenger train, and
 - e. Any non-self-propelled vehicle used in a passenger train, including an express car, baggage car, mail car, freight car, or a private car.
2. In the context of articulated equipment, “passenger equipment” means a segment of rail rolling equipment located between two trucks that is used in a train with one or more passenger cars. This term does not include a freight locomotive when used to haul a passenger train due to failure of a passenger locomotive.

passenger trainsets; passenger train (49 CFR §238.5 definition): A train that transports or is available to transport members of the general public. If a train is composed of a mixture of passenger and freight equipment, that train is a passenger train for purposes of this part.

prevailing-off torque: The torque measured when the fastener is being removed when there is zero axial load in the assembly.

railroad (49 CFR §270.5 definition):

1. Any....

roof handhold: Handhold located on the roof to be gripped for support when performing maintenance or inspections on the roof.

securely fastened: See Section 2.5, paragraph (2), for the definition of *securely fastened*.

semi-permanently coupled (49 CFR §238.5 definition): Coupled by means of a drawbar or other coupling mechanism that requires tools to perform the uncoupling operation. Coupling and uncoupling of each semi-

permanently coupled unit in a train can be performed safely only while at a maintenance or shop location where employees can safely get under or between units.

side door handhold: Handhold located on the side of the car above a side door step.

side door step: Step or stirrup located on the side of the car to assist an employee in entering or leaving a side door entrance.

sill step: Step or stirrup located on the side, near the end of the car to allow an employee to ride on the side of the car during switching moves.

sill step handhold: Handhold located on the side of the car above a sill step.

transverse: Perpendicular to the centerline of the track in the horizontal plane.

uncoupling device: Mechanism used to uncouple cars without requiring an employee to go between cars.

usable length: As applied to sill steps, side door steps and step treads, usable length is the straight length, not including bend radii, above which the specified minimum clear depth exists. Unless otherwise stated, limitations on the length of sill steps and step treads apply to the usable length. See **Figure 25**.

Abbreviations and acronyms

AAR	Association of American Railroads
ATR	above top of rail
AWS	American Welding Society
CFR	Code of Federal Regulations
FRA	Federal Railroad Administration
IEC	International Electrotechnical Commission
NATSA	North American Transportation Services Association
SAE	Society of Automotive Engineers
SI	<i>Système international</i> (International System of Units)

Summary of document changes

- Document formatted to the new APTA standard format.
- Sections have been moved and renumbered.
- Scope and summary moved to the front page.
- Definitions, abbreviations and acronyms moved to the rear of the document.
- Two new sections added: “Summary of document changes” and “Document history.”
- Some global changes to section headings and numberings resulted when sections dealing with references and acronyms were moved to the end of the document, along with other changes, such as capitalization, punctuation, spelling, grammar and general flow of text.
- Participants updated.
- Abstract – Added non-passenger carrying locomotives to abstract.
- Scope and Purpose – Added “This standard is intended for only newly made passenger equipment but does not prevent application to re-built or overhauled passenger equipment.”
- Section 2.1 – Add requirement to inspect, repair and replace safety appliance in accordance with the requirements of this standard. Added requirement to account for vehicle manufacturing tolerances during safety appliance design.
- Section 2.3 – Added allowance of safety appliances made of wrought iron and alternate materials.
- Section 2.4 – Added section Strength and rigidity requirements.

APTA PR-M-S-016-06, Rev. 1
Safety Appliances for Passenger Equipment

- Section 2.5 – Added to the list of allowable securement methods.
- Section 3.1.1 – Added requirement parking brake requirement for semi-permanently coupled trainsets.
- Section 3.1.3.1 – Added 2 in. (51 mm) minimum hand clearance requirement for hand brake. Added requirement that the handbrake shall be placed to be safely operated while the car is in motion.
- Section 3.1.3.3 – Added center point location for wheel type handbrake.
- Section 3.1.3.4 – Added section Power-assisted applied/release parking brake.
- Section 3.2.1 – Added crew provisions to ride general exceptions for semi-permanently coupled, automatic coupler equipped, and self-propelled equipment.
- Section 3.2.2.1 – Removed minimum thickness requirement for sill steps. Added clear depth requirements for Tier III equipment. Added maximum vertical rise between treads. Added anti-skid area requirement.
- Section 3.2.2.2 – Removed allowance for steps exceeding 18 in. (457 mm) in depth. Added coordination of step to handhold in transverse direction. Added anti-skid area requirement.
- Section 3.2.3.2 – Added allowance for a passenger step to be used in lieu of a sill step. Adjusted maximum allowable ATR distance for lower handhold when two horizontal handholds are used. Raised height of handhold when only one horizontal handhold is used. Lowered highest clearance point and adjusted lowest clearance point where one vertical hand hold is used. Raised maximum lowest clearance point and adjusted the reference point of the highest clearance point of vertical handhold from ATR to above lowest step when both horizontal and vertical handholds are used; added recommendation that the vertical handhold be within the clear length of the step.
- Section 3.2.4 – Removed redundant dimensional requirements. Requirements are in Section 3.2.3.1.
- Section 3.3 – Added Section Crew Access.
- Section 3.3.1 – Added general requirements section for crew access.
- Section 3.3.1.1 – Adjusted minimum usable length requirement for crew access steps. Removed allowance for steps exceeding 18 in. (457 mm). Added tread surface area requirements.
- Section 3.3.1.2 – Added section Dimensions for Crew Access Handrails.
- Section 3.3.2 – Added Section Requirements for Crew Access at Low Level Floors.
- Section 3.3.3 – Added Section Requirements for Crew Access at High Level Floors with Inclined Steps.
- Section 3.3.4 – Added Section Requirements for Crew Access at High Level Floors with Vertical Steps or Ladders.
- Section 3.4.1 – Added handhold requirement exemption for equipment with automatic couplers.
- Section 3.4.4 – Added clearance point of the outboard end of the end handhold for non-passenger carrying locomotives. Added tapered nose equipment side of car determination criteria. Added maximum end handhold distance ATR and primary structure attachment allowance and uncoupling lever as end handhold allowance.
- Section 3.5.1 – Clarified two collision post requirement for cars with end passageways utilized to guide reverse moves.
- Section 3.6.3 – Added alternative handrail diameter allowance.
- Section 3.7.1 – Added automatic coupler equipped vehicle uncoupling device requirements.
- Section 3.7.3 – Adjusted maximum allowable distance of manual uncoupling levers from side of car and for cab ends with shrouding or aerodynamic treatment. Added preferred minimum clearance for uncoupling lever handle.
- 3.7.4 – Added location requirements for uncoupling levers for non-passenger carrying locomotives and uncoupling mechanisms for road locomotives with corner stairways. Added in-use remote control uncoupling mechanism location requirement.
- Section 3.8 – Added section Conditional safety appliances. This section includes the use of ladders in lieu or in combinations with side door steps and side door handholds.


APTA PR-M-S-016-06, Rev. 1
Safety Appliances for Passenger Equipment

- Section 3.8.1 – Added section Handholds and steps for appurtenances and windshields. This includes the use of ladders in lieu or in combinations with side door steps and side door handholds.
- Section 3.8.2 – Removed thickness requirement for ladder treads.
- Section 3.8.3.1 – Added function of general appliances for moving on side and end walls.
- Section 3.8.4.1 – Added section Stepping around the corner of a vehicle. This section contains dimension requirements.
- Section 3.8.5 – Added new section Rood handholds.
- Section 3.9 – Added new section Optional steps and handholds.
- Section 4 – Updated addresses of FRA and TC.
- Section 5 – Removed references to APTA PR-IM-S-007-98, Rev. 1 and reference to specific subsections under 49 CFR 238.
- References – Added references to EN 16116 and SAE J185.
- Definitions – Added definitions for 1) automatic coupler, 2) automatic coupler, fully, 3) cab, 4) cab, locomotive, 5) handbrake, manually applied, 6) handhold, 7) parking brake or handbrake, 8) parking brake system, 9) passenger cars, 10) passenger equipment, 11) passenger trainsets; passenger train, and 12) railroad. Removed definitions for handbrake, handrail, and parking brake. Modified definition for securely fastened.
- Updated Appendix A, Sample Car Inspection Checklist to reflect changes to the standard.
- Added Appendix B, Document Development Background, and Appendix C, Ergonomic Considerations.

Document history

Document Version	Working Group Vote	Public Comment/ Technical Oversight	Rail CEO Approval	Policy & Planning Approval	Publish Date
First published	—	—	—	May 18, 2007	June 2, 2007
First revision	Feb. 24, 2022	Mar. 31, 2022	Apr. 25, 2022	Jul. 8, 2022	Feb. 28, 2023

Appendix A (informative): Sample car inspection checklist

	STANDARDS <small>Driving Innovation in Public Transportation</small>	Safety Appliance Design Review Checklist Edited: 1-17-18		
Reviewer:	Organization:	Date:	Region:	
Builder:	Car Initials & Series:	Car Type:	Cars to be Built:	Builder Job #

HANDBRAKE/PARKING BRAKE

#	Number/Dimensions/Location/Manner of Application	APTA PR-M-S-016-06 Reference	Notes
General Requirements		3.1.1	
1	<input type="checkbox"/> Each individual car/semi-permanently coupled car has a handbrake or parking brake.		
1.a	<input type="checkbox"/> (Tier III only) Each trainset is equipped with a means of securing the equipment per 49 CFR 238.731(o).		
2	<input type="checkbox"/> If parking brake is used, it can be set from each car and can be released manually.		
Handbrakes, Lever or Wheel Type		3.1.3.1	
3	<input type="checkbox"/> Handbrakes are located so as to not restrict passenger flow through any passageway, whether applied or released and in their stored position.		
4	<input type="checkbox"/> Handbrakes are located so they can be safely operated while the car is in motion.		
5	<input type="checkbox"/> A handhold is provided to stabilize an employee when using the handbrake.		
Handbrake, Lever Type (Figure 3)		3.1.3.2	
6	<input type="checkbox"/> Center point of the pivot point of the lever is located 31 to 40 in. (788 to 1016 mm) above floor.		
7	<input type="checkbox"/> Handle retention mechanism does not interfere with the normal grip position of the lever.		
8	<input type="checkbox"/> The handbrake release lever has a minimum 2 in. (51 mm) hand clearance in the operating position.		
9	<input type="checkbox"/> The handbrake lever has a minimum 2 in. (51 mm) hand clearance in the stored position and a 24 in. (610 mm) body clearance on one side of the lever and a minimum 4 in. (102 mm) hand clearance on the opposite side and end in the operating position.		

APTA PR-M-S-016-06, Rev. 1
Safety Appliances for Passenger Equipment

#	Number/Dimensions/Location/Manner of Application	APTA PR-M-S-016-06 Reference	Notes
Handbrake, Wheel Type (Figure 4)		3.1.3.3	
10	<input type="checkbox"/> Center point of the wheel is located 31 to 40 in. (788 to 1016 mm) above floor.		
11	<input type="checkbox"/> The wheel type handbrake has a minimum 4 in. (102 mm) hand clearance.		
12	<input type="checkbox"/> The wheel diameter is at least 22 in. (559 mm).		
13	<input type="checkbox"/> If equipped, the hand brake manual release lever shall have a minimum 2 in. (51 mm) hand clearance.		
Parking Brake Only		3.1.3.4	
14	<input type="checkbox"/> Manual release lever has a minimum 2 in. (51 mm) hand clearance.		
Power Assisted Applied/Release		3.1.3.5	
15	<input type="checkbox"/> A readily accessible operational control mechanism is provided.		
Manner of Application		3.1.3.6	
16	<input type="checkbox"/> Handbrake housing and handbrake mounting brackets securely fastened.		

CREW PROVISIONS TO RIDE: SILL STEPS AND SILL STEP HANDHOLDS

#	Number/Dimensions/Location/Manner of Application	APTA PR-M-S-016-06 Reference	Notes
General		2.4	
16	<input type="checkbox"/> Securely fastened to the carbody structure.		
17	<input type="checkbox"/> Welds done in accordance with the standard and with proper welding procedures.		
Dimensions for Sill Steps		3.2.2.1	
18	<input type="checkbox"/> Minimum usable length 10 in. (254 mm).		
19	<input type="checkbox"/> Tread width no less than 2 in. (51 mm) wide.		
20	<input type="checkbox"/> Minimum clear depth, 8 in. (204 mm).		
20.a	<input type="checkbox"/> (Tier III only) Minimum clear depth 4.7 in. (120 mm).		
21	<input type="checkbox"/> Minimum clear width 6 in. (153 mm) with trucks rotated to simulate the maximum curvature specified for the uncoupled car.		
22	<input type="checkbox"/> Vertical rise between treads does not exceed 18 in. (457 mm).		
23	<input type="checkbox"/> The portion of the tread surface normally contacted by the foot is treaded with an anti-skid material or is slip resistant by texturing of the metal surface. Enclosed step designs have at least 50% of the tread area as open space.		

APTA PR-M-S-016-06, Rev. 1
Safety Appliances for Passenger Equipment

#	Number/Dimensions/Location/Manner of Application	APTA PR-M-S-016-06 Reference	Notes
24	<input type="checkbox"/> 10 × 8 × 6 in. (254 × 208 × 153 mm) test box passes through opening above each sill step, so box is flush with outer edge of step.		
24.a	<input type="checkbox"/> (Tier III only) 10 × 4.7 × 6 in. (254 × 120 × 153 mm) test box passes through opening above each sill step, so box is flush with outer edge of step.		
Location for Sill Steps		3.2.2.2	
25	<input type="checkbox"/> One sill step is located at each corner of the car. A passenger step may be used in lieu of a sill step if it meets the clear depth, clear width, usable length and location requirements for a sill step.		
26	<input type="checkbox"/> Outboard end of the usable length is a minimum 18 in. (457 mm) in the longitudinal direction from the corner of the car. For cars without well-defined corners, the intent is for the sill step to be positioned for the employee to have an unobstructed view of the track ahead. The sill step shall be placed so the employee has a clear view in both longitudinal directions and shall be placed outside the gauge of the track.		
27	<input type="checkbox"/> Sill step tread is a maximum 24 in. (609 mm) ATR.		
28	<input type="checkbox"/> Outside edge of any sill step tread is a maximum 7 in. (177 mm) inboard or outboard of the inside surface of the lowest adjacent side handhold.		
29	<input type="checkbox"/> The outside edge of any sill step tread is no more than 2 in. (50 mm) (4 in. (101 mm) if clearance diagram does not allow 2 in. and if the step tread is a maximum 21 in [533 mm] ATR) inboard of any car structure in the area between 0 and 24 in. (0 and 609 mm) above the top of the step.		
Dimensions for Sill Step Handholds		3.2.3.1	
30	<input type="checkbox"/> Minimum diameter 5/8 in. (16 mm).		
31	<input type="checkbox"/> Minimum clear length 16 in. (407 mm).		
32	<input type="checkbox"/> Minimum clearance 2 in. (51 mm).		
Location for Sill Step Handholds		3.2.3.2	
33	<input type="checkbox"/> Minimum of two handholds over each sill step. If it is not possible to place two handholds over a sill step, there shall be at least one handhold over that sill step, and the railroad shall prohibit employees from riding on that sill step.		
34	<input type="checkbox"/> If a passenger step is used in lieu of a sill step, handholds are provided in accordance with Section 3.2.4.		
<i>Horizontal Sill Step Handholds Only</i>			
35	<input type="checkbox"/> If two horizontal handholds are used, one handhold is a maximum 54 in. (1371 mm) ATR. Second handhold is 54 to 58 in. (1372 to 1473 mm) above the lowest (riding) step. (Figure 7)		

APTA PR-M-S-016-06, Rev. 1
Safety Appliances for Passenger Equipment

#	Number/Dimensions/Location/Manner of Application	APTA PR-M-S-016-06 Reference	Notes
36	<input type="checkbox"/> If one horizontal handhold is used, it is 58½ to 64½ in. (1486 to 1638 mm) ATR. (Figure 8)		
37	<input type="checkbox"/> 12 in. (305 mm) of the clear length of the handhold(s) is directly over the sill step.		
<i>Vertical Sill Step Handholds Only</i>			
38	<input type="checkbox"/> If two vertical handholds are used, the lowest clearance point of each is a maximum 58½ in. (1485 mm) ATR. Highest clearance point of each is at least 58 in. (1474 mm) above the lowest (riding) step. (Figure 9)		
39	<input type="checkbox"/> Each set of vertical handholds is spaced 16 to 22 in. (407 to 558 mm) apart. (Figure 9)		
40	<input type="checkbox"/> If one vertical handhold is used, then the lowest clearance point is a maximum 58½ in. (1485 mm) ATR. Highest clearance point is at least 58 in. (1474 mm) above the lowest (riding) step. (Figure 10)		
41	<input type="checkbox"/> Inside face of the outboard handhold maximum 2 in. (50 mm) outboard of the inside face of the outboard vertical leg of the step Inside face of the outboard handhold minimum 10 in. (254 mm) outboard from the inside face of the inboard vertical leg. (Figure 10)		
<i>Combination Sill Step Handholds Only</i>			
42	<input type="checkbox"/> When a combination of horizontal and vertical handholds is used, the horizontal handhold is 54 to 58 in. (1372 to 1473 mm) above the step. Lowest clearance point of the vertical handhold is a maximum 54 in. (1371 mm) ATR. Highest clearance point of the vertical handhold is a minimum 70 in. (1778 mm) ATR. (Figure 11)		
Handholds for Riding at Passenger Steps (Figure 12)			
43	<input type="checkbox"/> Two vertical handholds, one on each side of the door opening.		
44	<input type="checkbox"/> The lowest clearance point of each crew handhold is 54 in. (1372 mm) ATR.		
45	<input type="checkbox"/> If the crew handhold is located outside the door opening, the crew handhold is located no more than 6 in. from the vertical inside face of the door opening.		

APTA PR-M-S-016-06, Rev. 1
Safety Appliances for Passenger Equipment

CREW ACCESS: STEPS AND HANDHOLDS

#	Number/Dimensions/Location/Manner of Application	APTA PR-M-S-016-06 Reference	Notes
General Requirements		3.3.1	
46	<input type="checkbox"/> A minimum of one crew access location per car side		
47	<input type="checkbox"/> A minimum of two crew access locations per side per set of semi-permanently coupled passenger cars, provided that each location provides access to all the passenger and crew areas of the set.		
48	<input type="checkbox"/> Crew access steps and handholds are provided on any carbody side door directly leading into a cab or machinery compartment		
48.a	<input type="checkbox"/> (Tier III only) Tier III trainsets may use portable ladders equipped with handrails.		
49	<input type="checkbox"/> Securely fastened to the carbody structure.	2.4	
50	<input type="checkbox"/> Welds done in accordance with the standard and with proper welding procedures.		
Dimensions for Crew Access Steps		3.3.1.1.	
51	<input type="checkbox"/> Minimum usable length 10 in. (254 mm)		
52	<input type="checkbox"/> Tread width no less than 2 in. (51 mm) wide.		
53	<input type="checkbox"/> Steps do not have a vertical rise between treads exceeding 18 in. (457 mm). Additional treads are provided if needed.		
54	<input type="checkbox"/> Minimum clear depth of lowest side door step 8 in. (204 mm)		
55	<input type="checkbox"/> Minimum clear depth of all side door steps except lowest 6 in. (153 mm)		
55.a	<input type="checkbox"/> (Tier III only) Minimum clear depth of all steps is 4.7 in. (120 mm).		
56	<input type="checkbox"/> Minimum clear width is 6 in. (153 mm), with trucks rotated to simulate the maximum curvature specified for the uncoupled car.		
57	<input type="checkbox"/> The portion of the tread surface normally contacted by the foot is treaded with an anti-skid material or is made slip-resistant by texturing of the metal surface. Enclosed steps designs have at least 50% of the tread area as open space.		
58	<input type="checkbox"/> 10 × 8 × 6 in. (254 × 204 × 153 mm) test box passes through opening above the lowest side door step, so box is flush with outer edge of step.		
59	<input type="checkbox"/> 10 × 6 × 6 in. (254 × 153 × 153 mm) test box passes through opening above all side door steps except the lowest, so box is flush with outer edge of step.		
59.a	<input type="checkbox"/> (Tier III only) 10 × 4.7 × 6 in. (254 × 120 × 153 mm) test box passes through opening above all side door steps, so box is flush with outer edge of step.		

APTA PR-M-S-016-06, Rev. 1
Safety Appliances for Passenger Equipment

#	Number/Dimensions/Location/Manner of Application	APTA PR-M-S-016-06 Reference	Notes
Dimensions for Crew Access Handrails		3.3.1.2	
60	<input type="checkbox"/> Minimum diameter 5/8 in. (16 mm)		
61	<input type="checkbox"/> Minimum clear length 24 in. (610 mm)		
62	<input type="checkbox"/> Minimum clearance 2 in. (51 mm)		
63	<input type="checkbox"/> In interior handrails also used for passenger access, the diameter and minimum clearance around the vertical handrail shall comply with §38.97(a) or 38.115(a).		
Requirements for Crew Access at Low-Level Floors (Figure 13)		3.3.2	
64	<input type="checkbox"/> Additional crew access steps are not needed where the door threshold is at a height not more than 24 in. (609 mm) ATR.		
65	<input type="checkbox"/> At least one vertical handhold on one side of the door opening, inside the car or on the door frame, not more than 9 in. (228 mm) from the outside face of the door opening.		
66	<input type="checkbox"/> The lowest clearance point of the vertical handrail shall be at most 58½ in. (1485 mm) ATR.		
Requirements for Crew Access at Inclined Steps (Figure 14)		3.3.3	
67	<input type="checkbox"/> The first (lowest) crew access step is not more than 24 in. (609 mm) ATR.		
68	<input type="checkbox"/> For designs that have inclined steps with the lowest step more than 24 in. (609 mm), additional crew access steps and handholds are applied in accordance with Section 3.3.4.		
69	<input type="checkbox"/> There is at least one vertical handhold on the side of the door opening.		
70	<input type="checkbox"/> The lowest clearance point of the vertical handhold is at least 58½ in. (1486 mm) ATR.		
71	<input type="checkbox"/> There is a second handhold provided to facilitate stepping up into the car.		
72	<input type="checkbox"/> If the crew handhold is located outside the door opening, the crew handhold is located no more than 6 in. (152 mm) from the vertical inside face of the door opening.		

APTA PR-M-S-016-06, Rev. 1
Safety Appliances for Passenger Equipment

#	Number/Dimensions/Location/Manner of Application	APTA PR-M-S-016-06 Reference	Notes
Requirements for Crew Access at Vertical Steps or Ladders (Figure 15)		3.3.4	
73	<input type="checkbox"/> For side door steps that extend beyond the side door opening in the longitudinal direction, the inside face of the leg of side door step located under the door opening is minimum 10 in. (254 mm) in the longitudinal direction from the vertical inside face of the door opening. Inside face of opposite leg of the side door step is located on the centerline of the side door handhold or extends beyond it.		
74	<input type="checkbox"/> Side door step tread maximum 24 in. (609 mm) ATR.		
75	<input type="checkbox"/> Outside edge of any side door step tread is a minimum 6 in. inboard or outboard of the inside surface of the lowest adjacent side handhold.		
76	<input type="checkbox"/> The outside edge of any sill step tread is no more than 2 in. (50 mm) (4 in. (101 mm) if the clearance diagram does not allow 2 in. (50 mm) and if the step tread is a maximum 21 in. (533 mm) ATR) inboard of any car structure in the area between 0 and 24 in. (609 mm) above the top of step within the clear length of the step.		
77	<input type="checkbox"/> The outside edge of any crew access steps is no more than 3 in. (76 mm) inboard of the door threshold. If the door threshold used to mitigate the horizontal gap between the car and platform does not allow this 3 in. (76 mm) requirement to be achieved, up to 7 in. (177 mm) is permitted.		
78	<input type="checkbox"/> One interior or exterior vertical crew access handhold over each crew access step located between the inside faces of the legs of the crew access step. If an exterior handhold is used, then an additional interior handhold is provided to facilitate stepping up into the car.		
79	<input type="checkbox"/> The lowest clearance point of the crew access handhold is at most 58½ in. (1485 mm) ATR.		
80	<input type="checkbox"/> An exterior crew access handhold is located no more than 6 in. (152 mm) from the vertical inside face of the door opening.		
81	<input type="checkbox"/> When ground access is provided for cabs or machinery compartments, two vertical side door handrails are provided, one on each side of the door, to continue to a point at least 60 in. (1524 mm), or as high as practicable based on carbody design, above the floor of the cab at the door entrance. For Tier III equipment, the handholds shall continue to a point at least 48 in. (1220 mm), or as high as practicable based on carbody design, above the cab floor at the door entrance.		

APTA PR-M-S-016-06, Rev. 1
Safety Appliances for Passenger Equipment

END HANDHOLDS (Figure 19)

#	Number/Dimensions/Location/Manner of Application	APTA PR-M-S-016-06 Reference	Notes
82	<input type="checkbox"/> Two horizontal end handholds are located on each end of a vehicle or trainset unit equipped with an automatic coupler, one near each side on each end projecting downward from the face of the end sill or sheathing.	3.4.1	
83	<input type="checkbox"/> Minimum diameter $\frac{5}{8}$ in. (16 mm)	3.4.3	
84	<input type="checkbox"/> Minimum clearance 2 in. (51 mm)		
85	<input type="checkbox"/> Minimum clear length 16 in. (407 mm)		
86	<input type="checkbox"/> Securely fastened to the carbody structure.		
87	<input type="checkbox"/> Welds done in accordance with the standard and with proper welding procedures.		
88	<input type="checkbox"/> Clearance point of the outboard end of the end handhold is maximum 16 in. (406 mm) from side of car for passenger-carrying vehicles.	3.4.4	
89	<input type="checkbox"/> Clearance point of the outboard end of the end handhold is maximum 8 in. (203 mm) from side of car for non-passenger carrying vehicles.		
90	<input type="checkbox"/> If the equipment is designed with a tapered nose, the side of the car is determined based on the outer dimensions of the tapered nose where the end handhold is attached.		
91	<input type="checkbox"/> The handholds are located not greater than 50 in. (1270 mm) from top of rail. Handholds may be attached to any primary structure (e.g., carbody frame; or pilot, or plow on cab cars).		
92	<input type="checkbox"/> An uncoupling lever may be used as an end handhold if it otherwise meets the requirements for end handholds		

COLLISION POST HANDHOLDS (Figure 20)

#	Number/Dimensions/Location/Manner of Application	APTA PR-M-S-016-06 Reference	Notes
93	<input type="checkbox"/> Two vertical collision post handholds at each end passageway.	3.5.1	
94	<input type="checkbox"/> Securely fastened to the carbody structure.	2.4	
95	<input type="checkbox"/> Welds done in accordance with the standard and with proper welding procedures.		
96	<input type="checkbox"/> Minimum diameter, 5/8 in. (16 mm)	3.5.3	
97	<input type="checkbox"/> Minimum clearance, 2 in. (51 mm)		
98	<input type="checkbox"/> Lowest clearance point, maximum 44 in. (1117 mm) above the walkway.	3.5.4	

APTA PR-M-S-016-06, Rev. 1
Safety Appliances for Passenger Equipment

99	<input type="checkbox"/> Highest clearance point, minimum 60 in. (1524) above the walkway.		
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HANDRAIL ON OPEN PLATFORM CARS (Figure 21)

#	Number/Dimensions/Location/Manner of Application	APTA PR-M-S-016-06 Reference	Notes
100	<input type="checkbox"/> Platform area enclosed with either a handrail or shortened walls.	3.6.1, 3.6.4	
101	<input type="checkbox"/> Railing and stile assembly may be welded, but the ends of the final assembly must be securely fastened to the carbody structure.	3.6.4	
102	<input type="checkbox"/> Welds done in accordance with the standard and with proper welding procedures.	2.4	
103	<input type="checkbox"/> Minimum handrail diameter 1 in. (26 mm)	3.6.3	
104	<input type="checkbox"/> Minimum wall thickness 1/16 in. (2 mm)		
105	<input type="checkbox"/> If intermittent handrail is used, end of the handrail is capped with a rounded end to reduce risk of injury.	3.6.4	
106	<input type="checkbox"/> Maximum distance from end of handrail to a vertical car member 4 in. (101 mm)		
107	<input type="checkbox"/> Minimum length from top of the platform floor to the top of the handrail, including entry doors, 42 in. (1067 mm)		
107	<input type="checkbox"/> Handrail designed such that a 5 in. (127 mm) diameter ball cannot pass through any space between handrail members or between the handrail and the carbody.		
108	<input type="checkbox"/> Handrail members shall not be unsupported for spans over 48 in. (1219 mm)		
109	<input type="checkbox"/> If shortened wall is used, it meets the location requirements for handrails as detailed above.		

UNCOUPLING DEVICES (Figure 22)

#	Number/Dimensions/Location/Manner of Application	APTA PR-M-S-016-06 Reference	Notes
110	<input type="checkbox"/> Each car equipped with an automatic coupler has either a manual uncoupling device at each end of the car, located so it can be operated from the left side of the car as seen when facing the end of the car from the ground, an uncoupling mechanism operated by remote controls.	3.7.1 3.7.4	
111	<input type="checkbox"/> Each non-passenger-carrying locomotive end equipped with an automatic coupler has either a manual double-lever uncoupling lever, operative from either side of the locomotive, or an uncoupling mechanism operated by remote controls.	3.7.1 3.7.4	
112	<input type="checkbox"/> Road locomotive with corner stairways are equipped with uncoupling mechanisms that can be operated safely from the bottom stairway opening or end platform area when		

APTA PR-M-S-016-06, Rev. 1
Safety Appliances for Passenger Equipment

	the mechanism is in its normal position or when it is operated.		
113	<input type="checkbox"/> Securely fastened to the carbody structure.	2.4	
Only if Mechanically Operated from Side of Car		3.7.3	
114	<input type="checkbox"/> Under all operating conditions, outside surface of uncoupling device handles is not more than 12 in. (304 mm) from the side of the car or, for cab ends with shrouding or aerodynamic treatment, from the outer dimension of the tapered nose where the end handhold is located.		
115	<input type="checkbox"/> Uncoupling attachments are applied so they can be operated by a person standing on the ground.		
116	<input type="checkbox"/> Bottom end of the handle is between 12 (305 mm) and 15 in. (318 mm) below the centerline of the outermost pivot point of the uncoupling lever to which the handle is attached.		
117	<input type="checkbox"/> Minimum 2 in. (51 mm) clearance around the handle at its end.		
118	<input type="checkbox"/> Securely fastened to the carbody structure or supporting bracket.	3.10.5	

OPTIONAL SAFETY APPLIANCE: LADDERS

#	Number/Dimensions/Location/Manner of Application	APTA PR-M-S-016-06 Reference	Notes
119	<input type="checkbox"/> Securely fastened to the carbody structure.	2.4	
120	<input type="checkbox"/> Welds done in accordance with the standard and with proper welding procedures.		
121	<input type="checkbox"/> Minimum usable length 16 in. (407 mm) on side ladders and 14 in. (356 mm) on end ladders.	3.8.2.3	
122	<input type="checkbox"/> If rectangular cross section, treads are minimum 2 in. (51 mm) wide.		
123	<input type="checkbox"/> If circular cross-section, minimum tread diameter is 5/8 in. (16 mm)		
124	<input type="checkbox"/> Minimum tread clearance 2 in. (51 mm)		
125	<input type="checkbox"/> All ladder treads have foot guards.		
126	<input type="checkbox"/> Top ladder tread is between 12 and 18 in. (305 to 457 mm) (below the mounting surface of the outboard end of the adjacent roof handhold).	3.8.2.4	
127	<input type="checkbox"/> Maximum spacing between ladder treads is 19 in. (482 mm)		
128	<input type="checkbox"/> Spacing of side ladder treads is uniform within a limit of 2 in. (51 mm), from top ladder tread to bottom tread of ladder.		

Appendix B (informative): Document development background

The original APTA working group that developed this safety standard included an ergonomics professional. The ergonomics professional advised APTA that riding a sill step when holding on to a single handhold is difficult in some operating circumstances. As a result, the standard requires two handholds placed at an ergonomically acceptable distance apart above each sill step on new cars.

This caused controversy because many car designs have doors near the corner of the car that would preclude the placement of the second handhold an ergonomically acceptable distance from the first handhold.

Some passenger railroads currently prohibit their employees from riding sill steps because they believe the employees are safer riding inside the car or walking beside the car during switching moves. APTA surveyed 18 passenger railroads; 16 of them either currently have operating rules that prohibit riding sill steps or strongly discourage riding sill steps and would be willing to implement such an operating practice.

As a result of this survey, APTA considered an option to eliminate sill steps if the railroad has in place an operating practice that prohibits their use. The best way to enforce this operating practice is to eliminate the sill step. Employees cannot use what is not there. This solves the door-near-the-corner-of-the-car design problem. If a railroad wishes to operate equipment of this design, that railroad must either ban riding the sill step or determine a way to install a second handhold above the sill step an ergonomically correct distance from the first handhold.

The standard requires a sill step and two corresponding handholds an ergonomically correct distance apart for all new equipment. If a railroad wishes to procure new equipment designs where placement of two handholds above the sill step is not possible, that railroad may do so if it adopts an operating practice that prohibits riding that sill step.

This new requirement accomplishes two important things:

- For new equipment, railroad employees are provided the extra safety of a second handhold, or they are not allowed to expose themselves to the danger of riding a sill step equipped with only one handhold.
- Railroads can continue to purchase equipment designs with corner doors.

As with all compromises, the new requirement has a downside: A sill step with a single handhold must be provided even when the railroad bans riding the sill step. From a railroad's perspective, this does not make sense. But it gained the FRA, Transport Canada and labor support necessary for APTA to go forward. This compromise answers labor's concern over the interchange of equipment without sill steps between passenger railroads and hauling such passenger cars in freight trains. Overall safety of railroad employees will increase with time as more cars with two handholds above sill steps enter the fleet.

Appendix C: Ergonomic considerations

There is a concern that a worker could step down to the ground from a moving car and be struck by part of the same car or the next car moving toward the worker. A 1st percentile female for the horizontal measurement and a 99th percentile male vertical measurement were used as conservative parameters for clearance. These will ensure that the shorter person will be clear of the car as the car side passes by and that the taller person will not hit his or her head on a low load. The figure below is representative of the posture assumed by individuals getting off equipment.

FIGURE 27
1st Percentile Female Ergonomics



Figure 27 depicts a body position at its maximum height from the top of rail (24 in.), which will place the person higher closer to the car side. The body position above shows a 1st percentile female with a horizontal distance from the ladder of approximately 18 in. This is approximated, because it could be less or more depending on the actual body position. FRA's Research and Development Division noted that many engineering designs employ a safety margin to lessen the likelihood of failure. In most cases, a factor of 2 is applied. In the present instance, that would reduce the acceptable inboard distance from 18 to 9 in. The safety margin could help to ensure that once the employee has fully contacted the ground, all parts of the body would have cleared 9 in. before a piece of equipment occupied the same space. When getting off moving equipment, the motion of the car transfers momentum to the employee, so clearing 9 in. is a safe margin.

According to the US Army Natick anthropometric tables, a 99th percentile male is 75 in. in height. Subtracting 9 in. for the height of the rail, FRA recommends that the protrusion of the car should be no lower than 66 in. ATR. This point in space then is 66 in. from top of rail and 9 in. in from the clearance diagram.

Appendix D: Explanatory material

NOTE: This appendix is not part of the requirements of this APTA standard and is included for informational purposes only. This appendix contains explanatory material, numbered to correspond with the applicable text paragraphs. The C stands for commentary.

C.2.4

1.b. The intent of allowing for alternate material sections in 1.b. is to allow different geometries to be used in the step instead of a solid uniform cross-section. For example, an expanded metal or serrated type step that does not have uniform cross section. It is also to allow for thinner cross section if a stronger base material is utilized.

1.b. only applies to wrought iron, steel or stainless steel of equivalent strength as defined in Section 2.3.

1.c. The purpose of the additional tread and lateral bracing is historically required by the CFR and is necessary to provide rigidity. See also 3.2.2.1.

2.e. To establish baseline acceleration requirements for the carbody, the following standards were reviewed. The most conservative acceleration was selected, Category L from EN 12663-1.

- EN 12663-1, Railway applications – Structural requirements of railway vehicle bodies – Part 1: Locomotives and passenger rolling stock (and alternative method for freight wagons). Tables 16 thru 18 were reviewed for category L for locomotives and Category P-I and P-II for passenger rolling stock.

Orientation	Acceleration Category L	Acceleration Category P-I/P-II
Vertical	±0.25 g	±0.15 g
Transverse	±0.20 g	±0.15 g
Longitudinal	±0.15 g	±0.15 g

- IEC 61373, Railway applications – Rolling stock equipment – Shock and vibration tests. A service vibration environment can be calculated by using the 3-sigma values from Category 1, Class A, functional service level RMS acceleration.

Orientation	Acceleration (m/s ²)	
	RMS from IEC 61373 ¹	Analysis
Vertical	0.750	±2.25 (±0.23 g)
Transverse	0.370	±1.11 (±0.11 g)
Longitudinal	0.500	±1.50 (±0.15 g)

1. Assume fully reversing amplitudes based on RMS value and that the RMS value = sigma.

C.3.2.2.1 Dimensions for sill steps

(1) Regarding the minimum usable length of the tread, the 12 in. (305 mm) length is in line with EN 16116, which specifies 300 mm as the clear length

C.3.2.2.2 Location

(5) The maximum dimension of 7 in. for aligning the step with the handhold the transverse direction was chosen to accommodate cars with very strict clearance diagrams, such as equipment running the US Northeast

or running in third-rail territory (Amtrak, Long Island Rail Road, Metro-North Railroad, etc.). Assuming a 10 ft, 6 in., carbody width, the maximum could be around 7 in., based on review of the LIRR clearance diagram.

C.3.2.3.2 Location

(6) It is important to set the minimum highest clearance point with respect to the lowest step, as the crew will only ride on the lowest step.

(8) The highest clearance point of the vertical handholds was changed from 70 in. ATR in the previous version of this standard to 52 in. from the lowest riding step to ensure a 16 in. minimum clear length of the handhold. The 52 in. allows for a minimum 17½ in. clear length and at least 2 in. of spacing between the vertical and horizontal handholds.

C.3.3.1

(5) The allowance for portable ladders is included in the latest Engineering Task Force (as part of FRA's Rail Safety Advisory Committee) language for safety appliances. It is anticipated that this language will be incorporated into the Code of Federal Regulations during a future rulemaking.

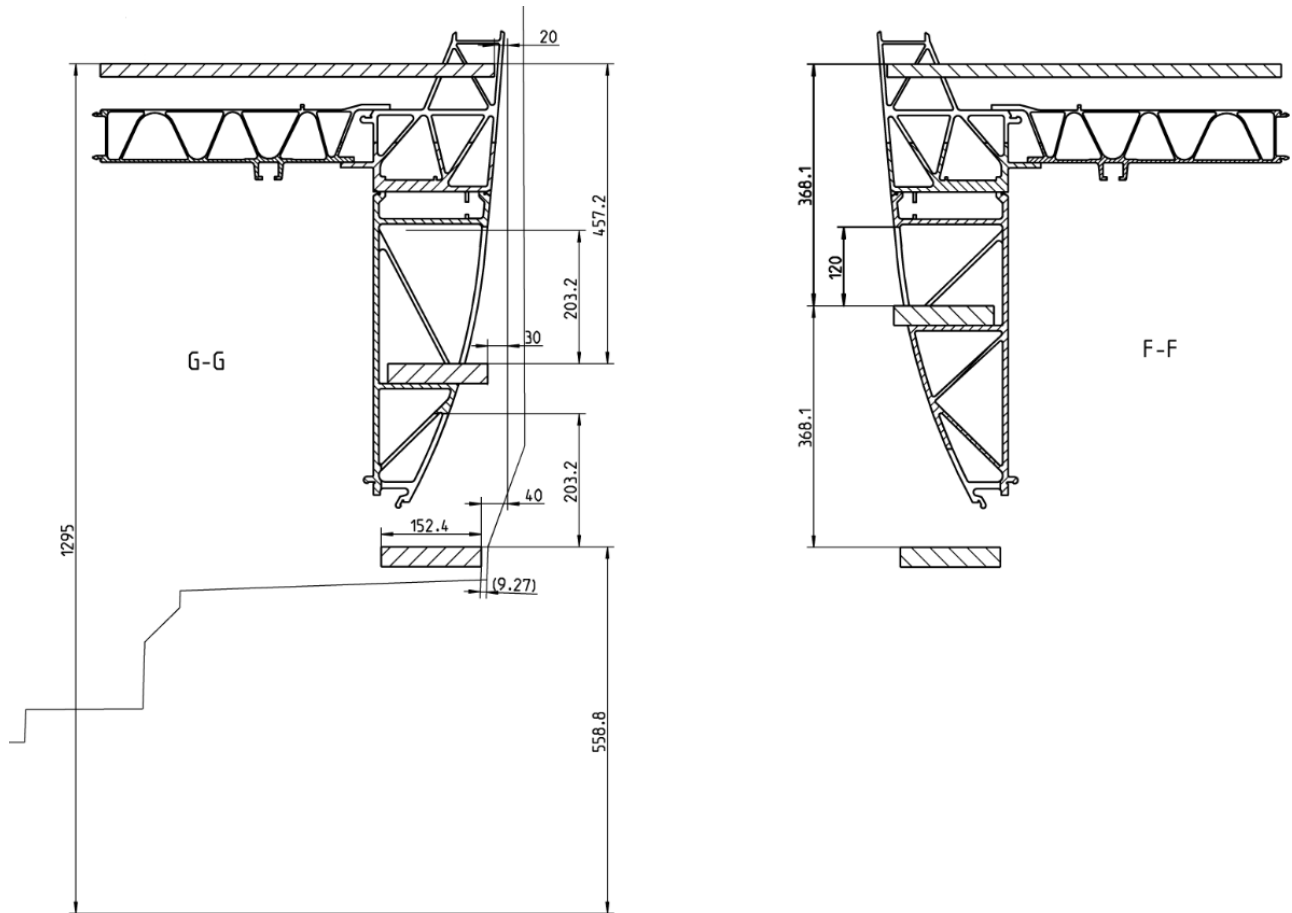
C.3.3.1.1

(4) There were questions raised as to why the clear depth for all other steps other than the lowest step was allowed to be only 6 in. (152 mm) instead of 8 in. (203 mm) required for the lowest step.

The working group researched minimum clear depth requirements for other industries and identified that 6 in. (152 mm) is acceptable. EN 16116 requires a minimum 150 mm (5.91 in.) for shunting type power units and 120 mm (4.7 in.) for other vehicle tapes. 29 CFR 1910.266 specifies SAE J185 for off-road machinery. SAE J185 Table 1 indicates (5.91 in.), a minimum of 15 mm for instep and toe clearance.

The group also determined that the 6 in. allowance for steps other than the lowest step is necessary due to certain car constructions with a 51 in. floor height and traditional closed box side sill construction. To maintain an 18 in. maximum vertical rise, a 6 in. clear depth in some cases may be necessary. See **Figure 28**.

FIGURE 28
Crew Access Step Clear Depth Evaluation



C.3.3.4.2

(4) The standard allows a lower handhold height above the cab floor for Tier III equipment. This reduction was considered due to Tier III aerodynamic end car designs that may limit the height above cab floor for the handholds. The working group considered 48 in. (1219 mm) in line with EN 16116, which requires 1200 mm (47 in.) for shunting locomotives and 1000 mm (39 in) for all other types. In addition, the elbow height for a 95th percentile male is approximately 45 to 47 in.

C.3.8 Conditional safety appliances

The working group changed the language from “optional” to “conditional” to use wording that was more reflective of the requirements of these safety appliances. This wording also matches the latest Engineering Task Force language (as part of FRA’s Rail Safety Advisory Committee) for safety appliances. It is anticipated that this language will be incorporated into the Code of Federal Regulations during a future rulemaking.