

Improvements in Safety Provided by AAR Standard S-2044 Compared to FRA Part 231 Safety Appliance Regulations

The objective of AAR Safety Appliance Standard S-2044 is to restate the requirements of the FRA safety appliance regulations in 49 CFR Part 231 in a manner that is less ambiguous when applied to cars of modern construction, but not to change the substance of those requirements. S-2044 and its appendices, which detail the safety appliance requirements of particular car types, also include additional requirements that the AAR believes provide an increased degree of safety beyond that provided by the requirements of FRA Part 231. Many of those improvements are described below.

1. Protecting Feet on Sill Step from Truck Rotation

Text of S-2044, Appendices A, B, and C, paragraph 3.2.4: *“.....clear width of the lowest sill step tread shall be no less than 6 in. with the truck rotated to simulate the maximum curvature specified for the uncoupled car.”*

CFR Part 231 does not address this issue.

On cars with short end overhang, the sill step is often close to the outer end of the truck. When the truck rotates on curved track, the end of the side frame could infringe on the space occupied by the foot of a person standing on the sill step. While Part 231 does not address this issue, S-2044 requires a minimum of 6 inches foot clearance with the truck rotated.

2. Cross Section of Sill Step Material

Text of S-2044, Appendices A, B, and C, paragraph 3.2.2: *“Sill steps shall be of steel no less than ½ in. (0.5 in.) thick and no less than 2 in. wide.”*

Text of CFR Part 231.27(c) Sill Steps (2) Dimensions: *“Minimum cross-sectional area one-half (1/2) by one and one-half (1 ½) inches, or equivalent.....”*

Part 231 would permit sill steps thinner than ½ inch if the width is increased to provide the same cross sectional area as a ½ inch thick by 1-1/2 inch wide step. Such a step would be less stiff and provide less support than the nominal ½ inch by 1-1/2 inch step. In addition to requiring that the step be ½ inch thick regardless of its width, S-2044 also requires that it be no less than 2 inches wide, rather than 1-1/2 inches wide. This represents a noticeable increase in sill step stiffness and the wider step is also more comfortable to the foot when supporting a person's weight.

3. Longitudinal Location of Sill Steps

Text of S-2044, Appendices A, B, and C, paragraph 3.3.1: *“One shall be applied near each end of each side of the car. The sill steps shall be located in the longitudinal direction such that the inside face of the outboard vertical leg of the sill step is no more 2 in. inboard of the outboard clearance point of any side handhold. The inside face of the inboard vertical leg of the sill step shall be no less than 10 in. from the outboard clearance point of any side handhold.”*

Text of CFR Part 231.27(c) Sill Steps (3) Location (i): *“One (1) near each end of each side of car, so that there shall be no more than eighteen (18) inches from end of car to center of tread of sill step.”*

Because of the difficulty in defining the end of the car in some cases, S-2044 locates the sill step differently than does Part 231. The AAR believes that the most important factor in the longitudinal location of a sill step is its position relative to the handholds above it so that someone climbing down from the side handholds to the sill step will be able to predict where he should place his foot. S-2044 therefore aligns the outboard end of the sill step with the outboard end of the side handholds. Part 231 would permit sill step and handhold configurations in which the outboard vertical leg of the sill step is as much as 11 inches inboard of the outboard clearance of the lowest handhold. S-2044 limits that distance to two inches. These requirements are illustrated in the side elevations and View 5 of Figures A1, B1, C1, and C2 of Appendices A, B, and C, respectively.

4. Location of Hand Brake Wheel Relative to End-Platform Handhold

Text of S-2044, Appendices A, B, and C, paragraph 2.2.3: *“.....The outside edge of the hand brake wheel shall be no less than 1 in. outboard of the inside surface of the horizontal end-platform handhold.”*

CFR Part 231 does not address this issue.

The above limit in Standard S-2044 prevents the hand brake from being located inboard of the end-platform handhold. This condition, which exists on some cars and which makes it very difficult to apply adequate force to the hand brake wheel, is not prohibited by Part 231.

5. Minimum Foot Clearance above End Platform

Text of S-2044, Appendix A, paragraph 6.3.4; Appendix B, paragraph 7.3.4; and Appendix C, paragraph 8.3.4: *“Minimum vertical clearance above end platform mounting brackets shall be no less than 7 in. Where possible, no part of the car end or fixture on the car end above the end platform, other than the hand brake, hand brake rod, hand brake chain, bell crank and end-platform handhold, shall extend closer to the outer edge of*

the end platforms than 8 in. When car construction does not permit 8 in. clearance to be provided, no less than 5 in. clearance shall be provided.”

CFR Part 231 does not address this issue.

While Part 231 has no similar provision, S-2044 establishes minimum foot clearance above the end platform, both in height and in length from the outer edge of the platform.

6. End Platform Support Brackets

Text of S-2044, Appendix A, paragraph 6.4; Appendix B, paragraph 7.4; and Appendix C, paragraph 8.4: *“Each end platform shall be supported by four mounting brackets. The mounting brackets shall be of steel no less than 3/8 in. (0.375 in.) thick, no less than 2 in. wide.....”*

Text of CFR Part 231.27(b) End platforms (4) Manner of application (i): *“Each end platform shall be securely supported by not less than three (3) metal braces having a minimum cross sectional area of three-eighths (3/8) by one and one-half (1 ½) inches or equivalent....”*

Part 231 requires only three end platform supports and permits the support material to be thinner than 3/8 inch if it is made wider than 1-1/2 inches. This has resulted in the end platforms of some cars providing inadequate support. In addition to requiring four supports, S-2044 also requires that they be no thinner than 3/8 inch and no less than 2 inches wide.

7. Transverse Relationship of Roof Handhold and Bulkhead Top Handhold to Top Ladder Tread

Text of S-2044, Appendix B, paragraph 11.3.2 and Appendix C, paragraph 7.3.2: *“In the transverse direction, the clearance points of the inboard end of roof handholds (bulkhead top handholds) shall be no more than 8 in. inboard from and no further outboard than the clearance point of the inboard end of the top ladder tread.”*

Text of CFR Part 231.28(c) Roof handholds (3) Location: *“.....parallel to treads of each ladder, not less than eight (8) nor more than fifteen (15) inches from edge of roof.....”*

While the wording of Part 231.28(c)(3) as quoted above is somewhat ambiguous and might possibly be interpreted as locating the roof handhold either from the end or from the side, Plate V clearly shows that the 8 inch minimum to 15 inch maximum is applied in the longitudinal direction. Part 231 therefore does not define the location of the roof handhold relative to the side of the car. It is of great importance that a person has confidence when stepping from the roof to the end ladder that his foot will find the top ladder tread.

Appendices B and C to S-2044 directly specify a minimum eight inch overlap between the roof handhold or bulkhead top handhold and the top ladder tread.

8 Height of End Handholds and Side Handholds above Top of Rail

Text of S-2044, Appendices A, B, and C, paragraphs 5.3.1 and 4.3.2: *“The end handholds shall be oriented horizontally.....with the lowest handhold located not more than 21 in. above the top tread of sill step nor more than 45 in. above the top of rail.....Individual side handholds shall coincide in height with corresponding end handholds within a maximum variation of 2 in.”*

Text of CFR Part 231.27(e) Side handholds (3) Location and 231.27(f) End handholds (3) Location: *“Horizontal:.....and with the bottom handhold located not more than twenty-one inches from top tread of sill step.....”*

Text of 45 U.S. Code, Section 4: *“.....it shall be unlawful for any railroad company to use any car in interchange that is not provided with secure grab irons or handholds in the ends and sides of each car for greater security to men in coupling and uncoupling cars.”*

While 45 U.S. Code, Section 4 requires side and end handholds to provide security to crews coupling and uncoupling cars, it provides no guidance as to the location of those handholds. Part 231 locates the side and end handholds from the top sill step tread, which would permit handholds as high as 66 inches above the top of rail. S-2044 addresses the issue directly by requiring that the lowest end handholds be no more than 45 inches above the top of rail. Since side handholds must be within two inches of the adjacent end handhold, the lowest side handholds can be no more than 47 inches above rail.

9 Limited Gap between End Platforms and Adjacent End Handholds

Text of S-2044, Appendix A, paragraph 6.3.1; Appendix B, paragraph 7.3.1; and Appendix C, paragraph 8.3.1: *“.....The center of the outer mounting holes shall be no more than 7 ¾ in. (7 ¾ in.) from the clearance points of the nearest end handholds.”*

CFR Part 231 does not address this issue.

While Part 231 establishes minimum lengths for end platforms and end handholds, it does not limit the size of the gap between them. On a full-width car with standard 60 inch end platforms and 16 inch minimum length end handholds, the distance from the outer edge of the end platform to the clearance point of the end handholds could be as much as 15 inches. Smaller gaps could be just large enough for a person's foot to be jammed in between. S-2044 limits the distance from the end platform mounting holes to the clearance point of the end handholds to no more than 7-3/4 inches. Since the distance from the edge of the platform to the center of the outboard mounting hole is always greater than 1-3/4 inches, the distance from the edge of the platform to the clearance of the handhold must be less than 6 inches. A two inch wide ladder stile would leave a gap less than four inches wide.

10 Height of End Platform relative to Adjacent End Handholds

Text of S-2044, Appendix A, paragraph 6.3.3; Appendix B, paragraph 7.3.3; and Appendix C, paragraph 8.3.3: *“The platform-support surface of the mounting brackets shall be no more than 2 in. above nor more than 4 3/8 in. (4.375 in.) below the top surface of the nearest end handhold.”*

CFR Part 231 does not address this issue.

Part 231 does not limit the vertical distance between the top of the end platform and the adjacent end handholds. Since end platforms are permitted to vary in thickness from 3/8 inch to 2 inches, S-2044 in effect states that the top of the end platform may be no more than 4 inches above or below the top of the nearest end handhold. This improves safety by limiting the distance that a person would have to step up or down when moving from the end platform to the end handholds or vice versa.

11. Height of Hand Brake above End Platform

Text of S-2044, Appendices A, B, and C, paragraph 2.2.1: *“...The center of the hand brake shaft.....shall be not less than 28 in. nor more than 40 3/8 in. (40.375 in.) above the platform-support surface of the end platform mounting brackets.”*

Text of CFR Part 231.27(a) Handbrakes (3) Location (ii): *“The brake shaft shall be located.....not less than twenty-six (26) nor more than forty (40) inches above top of end-platform tread.”*

Standard S-2044 sets limits on the thickness of the end platform and defines the height of the hand brake relative to the end platform mounting brackets rather than to the top of the platform itself. The limits are set such that, if the original end platform is replaced in the future with any platform that complies with the thickness limits, the height of the hand brake above the end platform will still be within FRA limits. If a hand brake is applied at the 40-inch maximum height above the end platform permitted by FRA Part 231.27(a)(3)(ii), and the original platform is later replaced by a platform of lesser thickness, the hand brake would then be higher than the 40-inch maximum height. A similar condition could occur with a hand brake applied at the minimum height. S-2044's revised dimensioning system prevents this from happening.

12. Hand Clearance around Hand Brake Quick-Release Lever

Text of S-2044, Appendices A, B, and C, paragraph 2.2.4: *“If the hand brake application is such that the requirements of paragraph 2.2.2 can be met only with hand brakes having short hand brake release levers or only with long release levers, but not both,*

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the car shall be marked adjacent to the hand brake in 1 ½ in. (1.5 in.) high letters: "SHORT (LONG) RELEASE LEVER BRAKE ONLY".

CFR Part 231 does not address this issue.

Due to limited available space, cars are sometimes built with a hand brake application such that proper clearance is provided around the hand brake wheel and quick-release lever when the hand brake has a short (or long) release lever, but proper clearance would not exist if a brake were applied during maintenance that has the other release lever. The notice required by Section 2.2.4 of S-2044 Appendices A, B, and C ensures that maintenance forces are aware of this condition and thereby makes it less likely that an unsafe application will inadvertently be created by applying an inappropriate hand brake.

13. Length of Sill Step Tread

Text of S-2044, Appendices A, B, and C, paragraph 3.2.1: *".....Minimum useable length of tread shall be not less than 12 in."*

Text of CFR Part 231.27(c) Sill Steps (2) Dimensions: *".....Minimum length of tread, ten (10), preferably twelve (12) inches."*

While Part 231 indicates a preference for sill step treads having 12 inches useable length, it permits steps with only 10 inches. S-2044 requires 12 inches minimum useable tread length on all cars.

14. Handhold Diameter

All references to handhold diameter in Part 231 require handholds to be no less than 5/8 inch diameter. S-2044 provides a greater degree of safety by requiring all handholds to be no less than ¾ inch or, if the unsupported length is greater than 36 inches, one inch diameter.

15 Longitudinal Location of Side Handholds and Transverse Location of End Handholds

Text of S-2044, Appendices A, B, and C, paragraphs 4.3.3 and 5.3.3: *"The clearance points of the outboard end of the side (end) handholds shall be not more than 10 in. inboard of, and no farther outboard than, the inside surface of the end (side) handholds."*

Text of CFR Part 231.27(e) Side Handholds (3) Location and 231.27(f) End Handholds (3) Location: *"....Clearance of outer ends of handholds shall be not more than eight (8) inches from end (side) of car."*

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Because of the difficulty in defining the ends and sides of some car configurations, S-2044 locates the side handholds from the end handholds rather than from the end of the car. The AAR believes that locating the side and end handholds relative to each other provides greater security when a worker is moving around the corner of a car from the end handholds to the side handholds. Locating the side handholds from the end handholds and vice versa also makes it easier to determine whether or not a car is in compliance.

16. Location of Hand Brake Wheel Relative to End of Car

Text of S-2044, Appendices A, B, and C, paragraph 2.2.3: *“The outside edge of the hand brake wheel shall not extend more than 8 in. beyond the striker or end of the center sill...”*

Text of CFR Part 231.27(a) Handbrakes (4) Manner of Application (ii): *“Outside edge of brake wheel shall be not less than four (4) inches from a vertical plane parallel with end of car and passing through the inside face of knuckle when closed with coupler horn against the buffer block or end sill.”*

Standard S-2044 and Part 231 define the location of the hand brake wheel relative to the end of the car differently, although if a car complies with the requirements of S-2044 it will also comply with Part 231. However, by locating the hand brake from the striker rather than from the pulling face of the coupler knuckle, S-2044’s requirement is significantly easier to measure, which therefore makes it easier to determine whether a particular car is in compliance or not.

17. Relationship of Running Boards to End of Car

Text of S-2044, Appendix B, paragraph 10.3.1: *“.....The ends shall be not more than 6 in. beyond the striker or end of the center sill.....”*

Text of CFR Part 231.1(c) Running boards (4) Manner of application (ii): *“The ends of longitudinal running board shall be not less than 6 nor more than 10 inches from a vertical plane parallel with end of car and passing through the inside face of knuckle when closed with coupler-horn against the buffer block or end sill.....”*

As in Items 16 and 18, defining the relationship of the end of the running boards relative to the striker rather than to inside of the coupler knuckle makes the relationship significantly easier to measure and therefore makes it easier to confirm compliance. Again, if a car complies with S-2044 in this regard, it will also comply with Part 231.

18. Definition of End Ladder (Appliance) Clearance to End of Car

Text of S-2044, Appendix A, paragraph 8.0; Appendix B, paragraph 9.0; and Appendix C, paragraph 10.0: *“No part of car.....shall extend beyond the striker or end of the center sill with the cushioning device (if used) at full buff.....”*

Text of CFR Part 231.27(d) End ladder (appliances) clearance: *“No part of car.....shall extend to within a vertical plane parallel with end of car and passing through the inside face of knuckle, when with the coupler horn against the buffer block or end sill and cushioning device (if used) at full buff.....”*

As in Items 16 and 17 above, defining the minimum clearance of the end ladders and other safety appliances from adjacent cars relative to the striker rather than to inside of the coupler knuckle makes the relationship significantly easier to measure and therefore makes it easier to confirm compliance. Again, if a car complies with S-2044 in this regard, it will also comply with Part 231.

19. Relationship of Uncoupling Lever to Side Handhold

Text of S-2044, Appendix A, paragraph 9.3.2; Appendix B, paragraph 13.3.2; and Appendix C, paragraph 11.3.2: *“Under all operating conditions, the outside surfaces of the uncoupling device handles shall be no more than 14 in. closer to the car center than the inside surface of the adjacent side handholds.”*

Text of CFR Part 231.27(h) Uncoupling levers (2) Dimensions (ii)(a): *“Handles shall be not more than twelve (12), preferably nine (9) inches from sides of car.....”*

The dimensioning system used in S-2044 better defines the relationship between the uncoupling device handle and the side handhold which a person would be using for support while operating the coupler. It is also easier to measure and determine compliance on some cars.

20. Color of Border around “Excess Height” Stencil on Sides of Cars

Text of S-2044, Appendix A, paragraph 10.3; Appendix B, appendix 14.3; and Appendix C, paragraph 12.3: *“On each side sill, or as close to the side sill as practicable, near each lower end corner there shall be painted or otherwise displayed a yellow rectangular area with a ¾ in. (0.75 in.) border of contrasting color containing the words ‘THIS CAR EXCESS HEIGHT’ in lettering no less than 1 ½ in. (1.5 in.) high.”*

Text of CFR Part 231.27(j) Painting and Marking (2): *“On each side sill near each end corner there shall be painted or otherwise displayed a yellow rectangular area with a three-fourths (3/4) inch black border containing the words “this car excess height” in lettering not less than one and one-half (1 1/2) inches high.”*

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Instead of the black border required in Part 231, S-2044 calls for a border of contrasting color. Many cars are painted black or other dark colors against which a black border would not be visible. Requiring a border of contrasting color better insures that the border and the marking will stand out as intended.

21. Vertical Relationship of Roof Handhold to Top Ladder Tread

Text of S-2044, Appendix B, paragraph 6.3.3: *“The top ladder tread shall be no less than 12 in., nor more than 18 in., below the mounting surface of the outboard end of the adjacent roof handhold.”*

Text of CFR Part 231.1(e) Ladders (2) Dimensions (ii): *“Top ladder tread shall be located not more than 12 nor more than 18 inches from roof at eaves.”*

The roof eaves are difficult to define on some cars, especially those with curved sides and roof. In addition to removing that degree of uncertainty and making it easier to determine compliance, the system used in S-2044 more directly controls the relationship between the ladder and the roof handhold. That is the relationship of greatest importance when a person is moving from the roof to the end ladder or vice versa.

Summary

AAR Standard S-2044 and its appendices provide improvements in safety for people using freight car safety appliances in two different ways. First, by restating the requirements of CFR Part 231 in terms that are more meaningful for contemporary freight car technology, it eliminates much of the uncertainty in interpreting the requirements of Part 231. If the safety appliance requirements are more clearly understood, there is less likelihood that non-compliant safety appliances will be inadvertently applied. Second, as described in the various items listed above, S-2044 adds additional requirements and redefines some existing requirements in ways that provide an increased level of safety beyond that provided by Part 231.

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