ASME RT-1–2015

(Revision of ASME RT-1–2009)

Safety Standard for Structural Requirements for Light Rail Vehicles

AN AMERICAN NATIONAL STANDARD

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FOREWORD

On March 18, 1998, The American Society of Mechanical Engineers (ASME) formed the Standards Committee on Rail Transit Vehicles.

The Standards Committee on Rail Transit Vehicles develops and maintains standards that cover safety, functionality, performance, and operability requirements, as well as mechanical systems, components, and structural requirements for rail transit vehicles. Rail transit includes heavy rail and light rail, and excludes freight, commuter, high-speed, or any other rail operations under the jurisdiction of the Federal Railroad Administration.

The Standards Committee is responsible for developing a series of safety standards within its Charter under the designation of RT. The purpose of the RT standards is to provide the rail transit industry with safety standards that address vehicle mechanical systems, components, and structural requirements, so as to enhance public safety. Principles, recommendations, and requirements included in these standards promote good engineering judgment as applied in designing rail transit vehicles for safety. The standards are subject to revisions that are the result of Committee consideration of factors such as technological advances, new data, and changing environmental and industry needs.

Both SI (metric) and U.S. Customary units are used in this Standard, with the latter placed in parentheses. These units are noninterchangeable and, depending on the country as well as industry preferences, the user of this Standard shall determine which units are to be applied. Parameters are derived from IEEE/ASTM SI 10-1997 or the latest revision, with the U.S. Customary units noted in parentheses.

This edition was approved by the American National Standards Institute on September 9, 2015, and designated as ASME RT-1–2015.

ASME RT COMMITTEE
Rail Transit Vehicles

(The following is the roster of the Committee at the time of approval of this Standard.)

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General. ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the Committee by requesting interpretations, proposing revisions, and attending Committee meetings. Correspondence should be addressed to

Secretary, RT Standards Committee
The American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990
http://go.asme.org/Inquiry

Proposing Revisions. Revisions are made periodically to the Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Interpretations. Upon request, the RT Standards Committee will render an interpretation of any requirement of the Standard. Interpretations can only be rendered in response to a written request sent to the Secretary of the RT Standards Committee.

The request for an interpretation should be clear and unambiguous. It is further recommended that the inquirer submit his/her request in the following format:

Subject:	Cite the applicable paragraph number(s) and the topic of the inquiry.
Edition:	Cite the applicable edition of the Standard for which the interpretation is being requested.
Question:	Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. The inquirer may also include any plans or drawings that are necessary to explain the question; however, they should not contain proprietary names or information.

Requests that are not in this format may be rewritten in the appropriate format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.

Attending Committee Meetings. The RT Standards Committee regularly holds meetings and/or telephone conferences that are open to the public. Persons wishing to attend any meeting and/or telephone conference should contact the Secretary of the RT Standards Committee. Future Committee meeting dates and locations can be found on the Committee Page at http://go.asme.org/.

INTRODUCTION (15)

Safety of light rail transit operations is a system characteristic. As do all transportation options in a given corridor, this operation has certain risks, including collision with another vehicle. The risks are mitigated by the design of the signal system and other system elements, by operating and maintenance procedures, and by the design of the vehicle. Risks are further mitigated by the elimination of grade crossings and the provision of safety barriers. Active safety systems on the vehicle include train control, communication, and propulsion and braking subsystems. The carbody, if properly designed, may be considered a passive safety device, and this Standard is intended to address the performance of the carbody in collisions.

This Standard draws from existing requirements and best practices for the design of the carbody of light rail vehicles. It also considers recent developments in the design of rail carbody structures intended to optimize the performance of the structure under the conditions of an overload, as might occur during a collision. This measure is commonly identified as crash energy management (CEM). The intent of CEM is to better manage the dissipation of the portion of the energy of a collision that can reasonably be expected to be absorbed by the deformation of the carbody. CEM design, when appropriately applied, may reduce risk of injuries to occupants of the light rail vehicle due to loss of survivable volume and due to secondary collisions of occupants with the car interior. Specific portions of the carbody are designed for controlled deformation and energy absorption, and are located in the structure so as to limit the damage to, and acceleration of, occupied volumes of the cars of light rail consists. For multiple-unit operation, distributing structural energy absorption through the train has been shown to be beneficial. This Standard requires the incorporation of CEM principles in the design of light rail vehicles.

ASME ASME RT-1–2015
SUMMARY OF CHANGES

Following approval by the ASME RT Committee and ASME, and after public review, ASME RT-1–2015 was approved by the American National Standards Institute on September 9, 2015.

ASME RT-1–2015 includes editorial changes, revisions, and corrections identified by a margin note, **(15)**.

Page	*Location*	*Change*
vii	Introduction	Revised
1	Section 1	Revised
	Section 2	(1) Definitions of *anticlimber*, *articulation*, *average collision acceleration* (formerly *average acceleration*), *belt rail*, *carbody*, *collision posts*, *consist*, *corner posts*, *crash energy management (CEM)*, *crashworthiness*, *end frame*, *end sill compression load (buff load)*, *light rail vehicle*, and *streetcar* revised (2) Definitions of *heavy rail transit vehicle* and *vehicle weights (vertical loads)* deleted (3) Definitions of *coupler system*, *vehicle*, and *vehicle vertical loads* added
3	Section 3	Revised
	Section 4	Revised
4	Section 5	Revised in its entirety
5	6.1	Revised
	Section 7	Revised
	Section 8	Revised
	9.1	Revised
6	9.2	Revised
	9.3	Revised in its entirety
7	10.2	Revised
	10.3.1	Revised
	10.3.2.1	Revised

Page	*Location*	*Change*
8	10.3.2.2	(1) Subparagraph (g) revised (2) Subparagraph (h) deleted and subsequent paragraphs redesignated
	10.3.3.1	Revised
	10.3.3.2	Subparagraph (b) revised
	10.3.4.1	Revised
9	10.3.4.2	Subparagraph (b) revised
	Section 11	Revised
10	Table 1	Revised in its entirety
13	Table 2	Revised in its entirety
16	Table 3	Added
	Table 4	Added

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SAFETY STANDARD FOR STRUCTURAL REQUIREMENTS FOR LIGHT RAIL VEHICLES

(15) 1 SCOPE

1.1 Subjects Covered by This Standard

This Standard applies to carbodies for newly constructed light rail vehicles and streetcars for transit passenger service. The Standard defines requirements for the incorporation of passive safety design concepts related to the performance of the carbody of light rail vehicles in conditions such as collisions, so as to enhance occupant safety and control damage.

1.2 Subjects Not Addressed by This Standard

There are several issues related to safety that are not addressed, such as, but not limited to

(a) structural repairs
(b) fatigue
(c) corrosion
(d) fire protection
(e) interior vehicle design
(f) emergency egress from vehicle
(g) inspection and maintenance
(h) operator seat belt

1.3 Effective Date

This Standard applies to carbodies of newly constructed light rail vehicles and streetcars for transit passenger service ordered 180 days following the date of issuance of this Standard by the RT Standards Committee and ASME.

(15) 2 DEFINITIONS

This Standard relies, where practical, on terms already in use by ASME, the American Public Transportation Association (APTA), and the Institute of Electrical and Electronics Engineers (IEEE). For the purposes of this Standard, the following definitions apply:

anticlimber: a structural member located at each end of the vehicle, used to engage an opposing car or other coupled vehicle to resist relative vertical travel between the two carbodies during a collision.

articulation: a connection sometimes used at the center of a vehicle or at the intermediate ends of carbody sections to allow negotiation of tracks with various vertical and horizontal profiles.

average collision acceleration: the average computed longitudinal acceleration at the vehicle center of gravity. The average computed acceleration is evaluated over the period of time from first contact between colliding vehicles to the time when the contact force between vehicles first returns to a magnitude of zero.

belt rail: a longitudinal structural member of the carbody located on each side of the carbody below the passenger side windows. The belt rail often establishes the overall width of the carbody, exclusive of the side door thresholds and the side cameras and mirrors.

carbody: the vehicle body comprising its main load-carrying structure above all truck suspension units. It includes all components and structural articulation parts, if any, that are connected to this structure and contribute directly to its strength, stiffness, and stability. Mechanical or electrical equipment and other mounted parts are not considered part of the carbody, though their attachment brackets are. The "coupler" ends of the carbody are the outside vehicle ends that contain the means for coupling to another vehicle. The "intermediate" ends, if any, contain the articulation system.

closing speed: the speed of a vehicle relative to another object or vehicle at the time of initial impact.

collision posts: a set of two structural posts located at each end of the carbody, extending from the bottom of the underframe structure up to the structural shelf. Collision posts can be made of several structural members assembled to each other, provided that the required performance is met. They are located at the approximate one-third points across the width of the vehicle, and are forward of the seating position of any passenger or crew person. An alternative to collision posts is the use of a collision wall.

collision wall: a structure at the leading end of the vehicle spanning the area between the structural shelf, corner posts, and top of the underframe.

consist: the makeup or composition of the individual units of a train, generally by number of cars and type of vehicle.

corner posts: a set of two full-height structural posts located at or near the two corners at one end of the carbody, extending from the bottom of the underframe