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(2) Battery chargers shall be designed to protect against overcharging.

(3) If batteries are of the type to potentially vent explosive gases, the battery compartment shall be adequately ventilated to prevent the accumulation of explosive concentrations of these gases.

(c) *Power dissipation resistors.*

(1) Power dissipating resistors shall be adequately ventilated to prevent overheating under worst-case operating conditions as determined by the railroad.

(2) Power dissipation grids shall be designed and installed with sufficient isolation to prevent combustion.

(3) Resistor elements shall be electrically insulated from resistor frames, and the frames shall be electrically insulated from the supports that hold them.

(d) *Electromagnetic interference and compatibility.* (1) The operating railroad shall ensure electromagnetic compatibility of the safety-critical equipment systems with their environment. Electromagnetic compatibility may be achieved through equipment design or changes to the operating environment.

(2) The electronic equipment shall not produce electrical noise that affects the safe performance of train line control and communications or wayside signaling systems.

(3) To contain electromagnetic interference emissions, suppression of transients shall be at the source wherever possible.

(4) All electronic equipment shall be self-protected from damage or improper operation, or both, due to high voltage transients and long-term overvoltage or under-voltage conditions. This includes protection from both power frequency and harmonic effects as well as protection from radio frequency signals into the microwave frequency range.

§ 238.227 Suspension system.

On or after November 8, 1999—

(a) All passenger equipment shall exhibit freedom from hunting oscillations at all operating speeds. If hunting oscillations do occur, a railroad shall immediately take appropriate action to prevent derailment. For purposes of this paragraph, hunting oscillations

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shall be considered lateral oscillations of trucks that could lead to a dangerous instability.

(b) All passenger equipment intended for service above 110 mph shall demonstrate stable operation during pre-revenue service qualification tests at all operating speeds up to 5 mph in excess of the maximum intended operating speed under worst-case conditions—including component wear—as determined by the operating railroad.

(c) Nothing in this section shall affect the requirements of part 213 of this chapter as they apply to passenger equipment as provided in that part.

§ 238.229 Safety appliances.

Except as provided in this part, all passenger equipment continues to be subject to the safety appliance requirements contained in Federal statute at 49 U.S.C. chapter 203 and in Federal regulations at part 231 and § 232.2 of this chapter.

§ 238.231 Brake system.

Except as otherwise provided in this section, on or after September 9, 1999 the following requirements apply to all passenger equipment and passenger trains.

(a) A passenger train's primary brake system shall be capable of stopping the train with a service application from its maximum authorized operating speed within the signal spacing existing on the track over which the train is operating.

(b) The brake system design of passenger equipment ordered on or after September 8, 2000 or placed in service for the first time on or after September 9, 2002, shall not require an inspector to place himself or herself on, under, or between components of the equipment to observe brake actuation or release.

(c) Passenger equipment shall be provided with an emergency brake application feature that produces an ir retrievable stop, using a brake rate consistent with prevailing adhesion, passenger safety, and brake system thermal capacity. An emergency brake application shall be available at any time, and shall be initiated by an unintentional parting of the train.

(d) A passenger train brake system shall respond as intended to signals

from a train brake control line or lines. Control lines shall be designed so that failure or breakage of a control line will cause the brakes to apply or will result in a default to control lines that meet this requirement.

(e) Introduction of alcohol or other chemicals into the air brake system of passenger equipment is prohibited.

(f) The operating railroad shall require that the design and operation of the brake system results in wheels that are free of condemnable cracks.

(g) Disc brakes shall be designed and operated to produce a surface temperature no greater than the safe operating temperature recommended by the disc manufacturer and verified by testing or previous service.

(h) *Hand brakes and parking brakes.* (1) Except for a locomotive that is ordered before September 8, 2000 or placed in service for the first time before September 9, 2002, and except for MU locomotives, all locomotives shall be equipped with a hand or parking brake that can:

- (i) Be applied or activated by hand;
- (ii) Be released by hand; and
- (iii) Hold the loaded unit on the maximum grade anticipated by the operating railroad.

(2) Except for a private car and locomotives addressed in paragraph (h)(1) of this section, all other passenger equipment, including MU locomotives, shall be equipped with a hand brake that meets the requirements for hand brakes contained in part 231 of this chapter and that can:

- (i) Be applied or activated by hand;
- (ii) Be released by hand; and
- (iii) Hold the loaded unit on the maximum grade anticipated by the operating railroad.

(3) The air brake shall not be depended upon to hold equipment standing unattended on a grade (including a locomotive, a car, or a train whether or not a locomotive is attached). When required, a sufficient number of hand brakes shall be applied to hold the train or equipment before the air brakes are released. Any hand brakes applied to hold equipment shall not be released until it is known that the air brake system is properly charged.

(i) Passenger cars shall be equipped with a means to apply the emergency

brake that is accessible to passengers and located in the vestibule or passenger compartment. The emergency brake shall be clearly identified and marked.

(j) Locomotives ordered after September 8, 2000, or placed in service for the first time after September 9, 2002, that are equipped with blended brakes shall be designed so that:

(1) The blending of friction and dynamic brake to obtain the correct retarding force is automatic;

(2) Loss of power or failure of the dynamic brake does not result in exceeding the allowable stopping distance;

(3) The friction brake alone is adequate to safely stop the train under all operating conditions; and

(4) Operation of the friction brake alone does not result in thermal damage to wheels or disc rotor surface temperatures exceeding the manufacturer's recommendation.

(k) For new designs of braking systems, the design process shall include computer modeling or dynamometer simulation of train braking that shows compliance with paragraphs (f) and (g) of this section over the range of equipment operating speeds. A new simulation is required prior to implementing a change in operating parameters.

(l) Locomotives ordered on or after September 8, 2000 or placed in service for the first time on or after September 9, 2002, shall be equipped with effective air coolers or dryers that provide air to the main reservoir with a dew point at least 10 degrees F. below ambient temperature.

(m) When a passenger train is operated in either direct or graduated release—

(1) all the cars in the train consist shall be set up in the same operating mode or

(2) up to two cars may be operated in direct release mode when the rest of the cars in the train are operated in graduated release mode, provided that the cars operated in direct release mode are hauled at the rear of the train consist.

(n) Before adjusting piston travel or working on brake rigging, the cutout cock in the brake pipe branch must be closed and the air reservoirs must be

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voided of all compressed air. When cutout cocks are provided in brake cylinder pipes, these cutout cocks may be closed, and air reservoirs need not be voided of all compressed air.

(o) All passenger trains to which this part applies shall comply with the requirements covering the use of two-way end-of-train devices contained in part 232 of this chapter.

[64 FR 25660, May 12, 1999, as amended at 65 FR 41307, July 3, 2000]

§ 238.233 Interior fittings and surfaces.

(a) Each seat in a passenger car shall—

(1) Be securely fastened to the car body so as to withstand an individually applied acceleration of 4g acting in the lateral direction and 4g acting in the upward vertical direction on the dead-weight of the seat or seats, if held in tandem; and

(2) Have an attachment to the car body of an ultimate strength capable of resisting simultaneously:

(i) The longitudinal inertial force of 8g acting on the mass of the seat; and

(ii) The load associated with the impact into the seatback of an unrestrained 95th-percentile adult male initially seated behind the seat, when the floor to which the seat is attached decelerates with a triangular crash pulse having a peak of 8g and a duration of 250 milliseconds.

(b) Overhead storage racks in a passenger car shall provide longitudinal and lateral restraint for stowed articles. Overhead storage racks shall be attached to the car body with sufficient strength to resist loads due to the following individually applied accelerations acting on the mass of the luggage stowed as determined by the railroad:

(1) Longitudinal: 8g;

(2) Vertical: 4g; and

(3) Lateral: 4g.

(c) Other interior fittings within a passenger car shall be attached to the car body with sufficient strength to withstand the following individually applied accelerations acting on the mass of the fitting:

(1) Longitudinal: 8g;

(2) Vertical: 4g; and

(3) Lateral: 4g.

(d) To the extent possible, all interior fittings in a passenger car, except seats, shall be recessed or flush-mounted.

(e) Sharp edges and corners in a locomotive cab and a passenger car shall be either avoided or padded to mitigate the consequences of an impact with such surfaces.

(f) Each seat provided for a crew-member regularly assigned to occupy the cab of a locomotive and each floor-mounted seat in the cab shall be secured to the car body with an attachment having an ultimate strength capable of withstanding the loads due to the following individually applied accelerations acting on the combined mass of the seat and a 95th-percentile adult male occupying it:

(1) Longitudinal: 8g;

(2) Lateral: 4g; and

(3) Vertical: 4g.

(g) If, for purposes of showing compliance with the requirements of this section, the strength of a seat attachment is to be demonstrated through sled testing, the seat structure and seat attachment to the sled that is used in such testing must be representative of the actual seat structure in, and seat attachment to, the rail vehicle subject to the requirements of this section. If the attachment strength of any other interior fitting is to be demonstrated through sled testing, for purposes of showing compliance with the requirements of this section, such testing shall be conducted in a similar manner.

§ 238.235 Doors.

(a) By December 31, 1999, each powered, exterior side door in a vestibule that is partitioned from the passenger compartment of a passenger car shall have a manual override device that is:

(1) Capable of releasing the door to permit it to be opened without power from inside the car;

(2) Located adjacent to the door which it controls; and

(3) Designed and maintained so that a person may readily access and operate the override device from inside the car without requiring the use of a tool or other implement.

(b) Each passenger car ordered on or after September 8, 2000, or placed in service for the first time on or after