PERFORMANCE REQUIREMENTS FOR DIESEL ELECTRIC LOCOMOTIVE FUEL TANKS

Standard S-5506

Adopted as Recommended Practice: 1995
Revised and Adopted as Standard: 1999; Revised 2001

1.0 SCOPE

The objective of this standard is to provide the basic performance requirements for four- and six-axle diesel electric locomotives. This standard is effective for all freight locomotives built after July 1, 1995.

2.0 BACKGROUND

By virtue of their location beneath the underframe and between the trucks, locomotive fuel tanks are vulnerable to damage from impact during a derailment or collision or by debris and loose equipment on the roadbed. Typically, damage during derailment is caused by impact with the track structure or from a puncture by a broken rail or debris from other equipment, such as the locomotive truck components. During a collision, the damage can be caused either by impact with the structure of another vehicle or by deformation of the structure of the locomotive itself. Severe damage to or puncture of the tank results in fuel spillage and all the associated problems that accompany it. Fuel loss also can occur in cases where the tank structure is not damaged but the locomotive comes to rest at an attitude where the fuel can leak from the filler/vent assembly.

3.0 LIMITATIONS

The performance requirements contained in this standard are intended to address the structural and puncture resistance properties of the locomotive fuel tank to reduce the risk of fuel spillage to acceptable levels under derailment and minor collision conditions. The complete elimination of fuel spills under the most severe accident conditions is considered to be impractical.

4.0 STRUCTURAL STRENGTH REQUIREMENTS

4.1 Design Considerations

4.1.1 Load Case 1—Minor Derailment

Support on the end plate of the fuel tank a sudden loading of one half the weight of the car body at a vertical acceleration of 2 G, without exceeding the ultimate strength of the material. The load is assumed to be supported on one rail, within a ±8-in. band at a point nominally above the head of the rail, on tangent track.

Consideration should be given in the design of the fuel tank to maximize the vertical clearance between the top of the rail and the bottom of the fuel tank.

4.1.2 Load Case 2—Jackknifed Locomotive

Support on the fuel tank transversely at the center for a sudden loading equivalent to one half the weight of the locomotive at a vertical acceleration of 2 G, without exceeding the ultimate strength of the material. The load is assumed to be supported on one rail, distributed between the longitudinal centerline and the edge of the tank bottom, with a railhead surface width of 2 in.

4.1.3 Load Case 3—Side Impact

Consider the case of a side impact collision at the longitudinal center of the fuel tank by an 80,000-lb GVW tractor/trailer. The fuel tank shall withstand, without exceeding the ultimate strength, a 200,000-lb load (2.5 G) distributed over an area 6 in. × 48 in. (half the bumper area) at a height of 30 in. above the rail (standard DOT bumper height).

4.1.4 Load Case 4—Penetration Resistance

The minimum thickness of the sides, bottom sheet, and end plates of the fuel tank shall be equivalent to 5/16-in. steel plate at 25,000 psi yield strength (where the thickness varies inversely with the square root of yield strength). The lower one third of the end plates shall have the equivalent penetration resistance by the above method of 3/4-in. steel plate at 25,000 psi yield strength. This may be accomplished by any combination of materials or other mechanical protection.

4.2 Sideswipe

To minimize fuel tank damage during sideswipes (railroad vehicle and grade crossings), all drain plugs, clean-out ports, inspection covers, sight glasses, gauge openings, etc., must be flush with the tank surface or be adequately protected to avoid catching foreign objects or from breakage. All seams must be protected or flush to avoid catching foreign objects.

4.3 Spill Controls

Vents and fills shall be designed to avert spillage of fuel even in the event of a rollover. Where possible, vents shall be internal to the fuel tank.

4.4 Fueling

Internal structures of the tank must not impede flow of fuel through the tank while fueling at a rate of 300 gpm.