

LNG is stored and transported at -162 °C (-260 °F). Due to this very low temperature, its contact with human skin or eyes will cause severe injury. It will also make ordinary metals subject to embrittlement and fracture when exposed to these temperatures. Transportation of cryogenic materials require specialized double walled tank cars (tank within a tank), with a stainless steel inner tank capable of holding the cryogenic liquid and wrapped with a highly insulating material, an outer carbon steel tank, and the space between the tanks evacuated to a high degree of vacuum to minimize heat leak from the outside to the inner tank.

#### DOT-113 Tank Car Characteristics

The DOT-113 specification rail tank car is specifically designed for the transport of cryogenic liquids. This tank car design has been in use for over 50 years, and it has a favorable safety record. There are only two documented derailments of DOT-113 specification tank cars where breaches of inner tank holding the cryogenic material occurred. These two derailments have resulted in lading releases due to significant damage sustained during the derailments.

The DOT-113 specification tank car is a double walled, or tank-within-tank, tank car that uses specific grades and thicknesses (3/16-inch minimum) of stainless steel for the inner tank (product tank) that provide high-strength characteristics under cryogenic conditions. The outer jacket shell (outer vessel) tank, or jacket, is made of specific grades and thicknesses (7/16-inch minimum for sidewalls and 1/2-inch for tank heads) of carbon steel that provides protection to the inner tank and service equipment located in the annular space between tanks, as well as provide the car with a tank-head puncture resistance system, which is required by 49 C.F.R. § 179.16.

Other key safety features of the DOT-113 specification tank car include, but are not limited to, the following:

- Several inches of aluminized Mylar super-insulation surrounding the inner tank.
- A high vacuum environment/annular space between the inner and outer tanks for enhanced product pressure and temperature control
- Specifically, designed loading and unloading equipment (piping, valves, gages, etc.) for use in cryogenic service.
- Safety equipment (pressure relief valves, safety vents, safety shut off valves, and remote monitoring systems) to prevent or limit overpressure issues or non-accident releases.
- Mandated in-transit tracking (time sensitive shipment) and car handling instructions.

#### DOT-113 Specification Tank Car Survivability

A DOT-113 specification tank car, because of its double walled construction and a thicker outer tank (compared to normal tank car jacket thicknesses), offers better crashworthiness and puncture resistance in derailment accidents when compared to single wall tank cars of wall thickness equal to the sum of the inner and outer tanks of DOT-113 tank car. However, derailments conditions could result in punctures of both the outer and inner tanks leading to a release of the product. As