The Code Truck Challenge: Real-World Protection

Summary

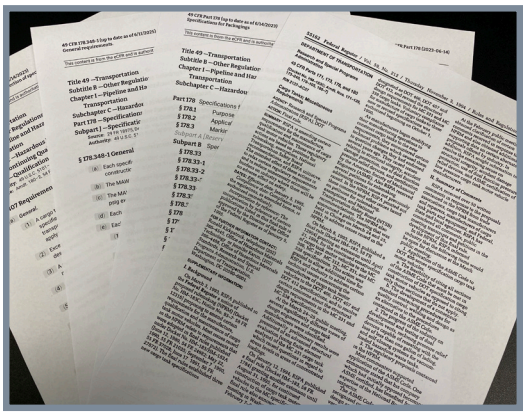
Code tanks are required by the US DOT to be 3rd-party certified for hazardous waste containment during transport. In isolation, this regulation creates a secure holding environment. When placed on a chassis, however, and driven down the road, the potential for collisions and rollovers creates damage risk, especially to valves, manways, and any other tank penetrations, that can result in loss of containment.

A full Code tank protection system, including appropriately sized and spaced rollover structures, a compliant bumper, and all other valve protections are needed to reduce risk and provide complete Code truck protection solution.

Unlike with Code tanks, however, independent certification isn't required for Code protection systems. As a result, many units on the road have protective systems that are under-specified or undersized. Only through documented voluntary design stress testing can manufacturers (and their customers) be sure that Code designs will handle real-world challenges and conform to US DOT regulations.

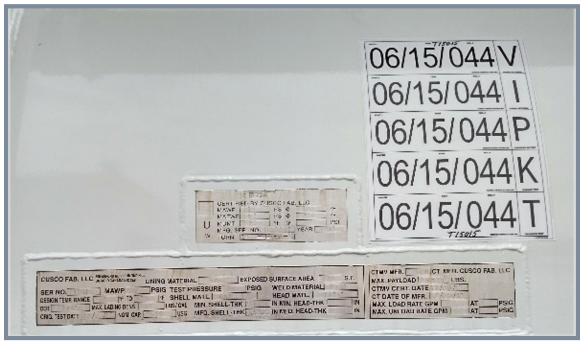
Code Tank Protection

"Code", in this context, is defined by US federal Hazardous Materials Transportation Act (HMTA) of 1975 (revised 1990 & 1994), and enforced by the US Department of Transportation (US DOT). US DOT regulations within the Code of Federal Regulations (CFR Part 178.345/347/348 lay out standards for hazardous materials tanks. These standards are typically referred to as DOT 407 & 412.



DOT 407 & 412 require that tank manufacturers be American Society of Mechanical Engineers (ASME) and DOT Federal Motor Carrier Safety Administration (FMCSA) certified, as well as National Board of Boiler & Pressure Vessel Inspectors (NBBI) registered. Manufacturers are required to have a 3rd party authorized inspector review, verify, audit, and certify the product at every stage of its design and manufacture.

- **Materials** – steel mill test reports verified
- **Design** – full Finite Elements Analysis (FEA) design review & certification, audit to ASME and DOT standards
- **Fabrication** – welder qualifications verified, welds & seams reviewed & verified, nozzles, flanges, & collars reviewed & verified
- **Build** – inspected for “out of roundness”, hydrostatic testing for leaks
- **Document** – stamp tank and maintain audit trail documentation for 20 years



Tanks must also be regularly inspected, every six months to two years, by the operator to confirm that they still meet Code specification.

Real-World Challenges

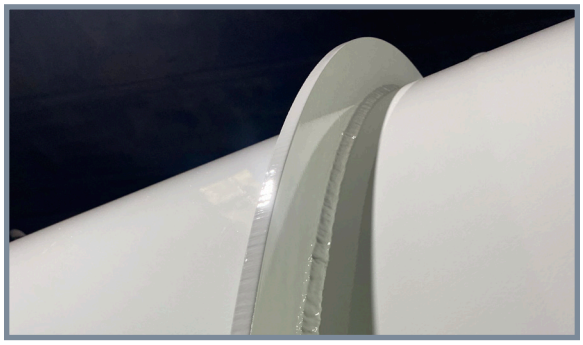
Trucks are driven on the road, where accidents can happen. Code trucks need special impact protection to keep these accidents from turning into spills:

- **Vehicle overturns** – manway fixtures and overhead valves are all vulnerable to crush and shear effects if not adequately protected. Undersized overturn structures can deform under full loads and forces.
- **Rear impacts** – dump valves are all vulnerable to impact-generated crush & shear forces if not fully protected. Bumper structures require both sufficient bumper clearance and structural rigidity to avoid excessive deformation resulting in valve impact during an accident.

Environmental and legal risks from a highway spill are enormous. Spills may lead to legal judgments against the hauling company and driver by multiple Federal, State, and Local government agencies for environmental cleanup and property damage, as well as from other drivers for related injuries and expenses. A system that keeps waste in its place, even during on-road incidents, is essential to avoiding these risks.

How to build a truly Code-compliant system:

Construct a Robustly Built Tank



While all hazmat trucks on the road are legally required to meet Code standards, there's building to meet Code, and then there's building to exceed Code. Cusco's standard tanks are built of 5/16" thick SA516-70 pressure vessel steel, versus the commonly used general purpose structural steel. Cusco also spaces ½" x 2 ½" reinforcing rings a maximum of every 51" apart for more support, delivering 4-5 rings per tank, versus the typical 2-3. Cusco's robust tanks allow the unit to pass thickness, leak, and pressure testing for a longer period of time than conventional tanks, extending usable Code life.

Add Full Rollover Protection

Code truck overhead protective structures, referred to as overturns, should be built to resist 2X gross vehicle weight (loaded to legal limit), the force associated with a full-unit rollover. Cusco has determined that the most effective and efficient overturn systems are those built of bent tubular steel, welded directly to the tank reinforcing rings. Easier to build flat plate structures typically have a lower strength to weight ratio, and higher stress concentrations, especially when located on non-reinforced tank sections. A larger number of overturns also spreads out loads over the length of the tank, again reducing deformation potential and resulting spill risk. Cusco provides an overturn at a maximum of every 51" of tank length, an industry best.

Weld-On a Reinforced Rear Bumper

Code truck bumpers need to be able to resist 2G deceleration of a 2X gross vehicle loaded weight without excessive deflection that can result in damage to rear valves. Two design factors are, therefore, key to success – distance from bumper edge to valve, and bumper rigidity. Cusco's bumpers provide 7" of clearance from the rear-most tank fixture and are built of 4" x 8" x ¼" thick high-strength steel box sections, welded to 8" I-beams which are then seam-welded directly to the chassis frame for maximum rigidity. Many competing bumper systems are both insufficiently deep, and feature light-duty structure, preventing them from meeting real-world Code requirements.

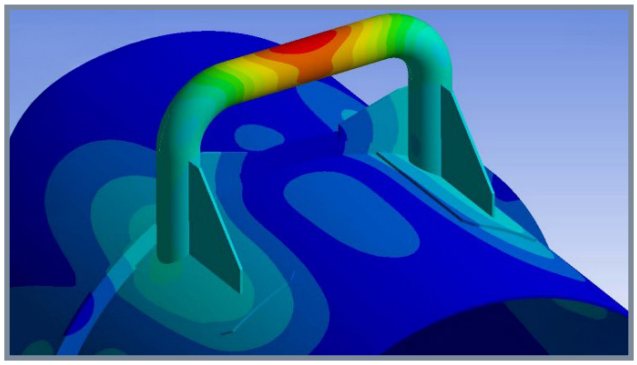
Assessing Code Protection:

No Compliance Assurance

While DOT Code tanks are subject to strict third-party inspection, testing, and audit, tank protective systems are not. Code truck rollover and rear impact protective systems are 100% self-certified by the manufacturer. Given the lack of any third-party certification, and how unevenly many manufacturers actually apply DOT standards to their protective systems, evidence of stringent manufacturer testing is the only way to determine which units will actually be able to remain leak-free after an on-road incident.

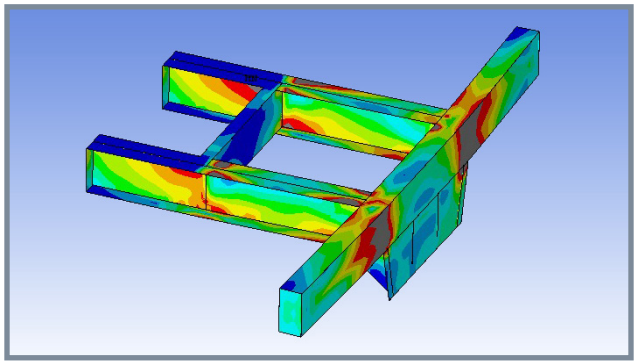
Assurance Requires Proof

Cusco subjects ALL its protective structural components (not just the tank) to full Finite Elements Analysis (FEA) software testing. By modeling forces and loads in worst-case scenarios, and following up by eliminating potential design failure points, Cusco has created the most secure hazardous waste hauling system on the market.



Next Steps

Find out more about Cusco's class-leading Code vacuum trucks at **www.cuscovactrucks.com**.



Citations

DOT 407 - https://www.ecfr.gov/current/title-49/subtitle-B/chapter-I/subchapter-C/part-178/subpart-J/section-178.347

DOT 412 - https://www.ecfr.gov/current/title-49/subtitle-B/chapter-I/subchapter-C/part-178/subpart-J/section-178.348

ASME - https://www.asme.org/certification-accreditation/boiler-and-pressure-vessel-certification

NBBI - https://www.nationalboard.org/

NHTSA FMVSS – https://www.ecfr.gov/current/title-49/subtitle-B/chapter-V/part-571