

Understanding Modern Storage Tank Design & Fabrication

By Erin Dillon, Charles Ross & Son Co.

Ever wonder how industries manage to store massive amounts of liquids, gases, and even powders? The answer lies in some pretty impressive storage tanks and pressure vessels.

In the expansive world of powder and bulk solids handling these storage systems are sophisticated, well-engineered solutions that are integral to maintaining product integrity, ensuring efficient material flow and worker safety. Custom-fabricated storage tanks, reactors, and pressure vessels are widely utilized across chemical, pharmaceutical, food processing, and energy production sectors.

As technology, industry standards, and certifications evolve, it is crucial for manufacturers to partner with experienced fabricators who can handle projects of any scale and complexity.

Design Principles of Modern Storage Tanks

Storage tanks come in many configurations, the two most common designs are flat-bottom tanks with conical tops and elevated tanks with support legs. The choice between flat-bottom and elevated tanks depends on various factors, including the properties of the stored material, discharge requirements, available space, and specific industry regulations.

Flat-Bottom Tanks

These cost-effective tanks are often built to API (American Petroleum Institute) standards and feature a flat bottom and a conical top. The flat bottom provides stability and even weight distribution, while the conical top allows for efficient rainwater runoff and helps minimize vapor space. Typically constructed from stainless steel, this design is particularly well-suited for storing large volumes of liquids at atmospheric or low pressures.

Elevated Tanks

Elevated tanks are supported by legs and offer unique advantages, particularly when gravity-fed discharge is required which reduces the need for pumps. These tanks can be designed with either a conical or dished bottom, depending on the specific application requirements and can be designed to optimize space in facilities with limited floor area. Additionally, the elevation allows for easier maintenance access underneath the vessel.



ROSS 9,400-gal condensate receiver tank is designed and built according to ASME standards for up to 5 psi at 200°F.



This ROSS 3,000-gal 304/304L stainless steel-type elevated tanks with dished bottom are ASME stamped and designed for 200 psi with full vacuum up to 200°F.



This ROSS 4,500-gal 304/304L stainless steel-type flat-bottomed tank is ASME stamped and designed for 25 psi with full vacuum up to 400 °F.

Materials & Fabrication Considerations

Material selection is crucial in tank design, with stainless steel being a popular choice due to its corrosion resistance and durability. However, other materials such as carbon steel, aluminum, and various alloys like Monel, Hastelloy, and Inconel are also used, depending on the specific requirements of the application.

Fabrication limitations are another important consideration, especially for shop-fabricated tanks. Typical maximum dimensions for shop-fabricated tanks are around 12 feet in outer diameter and 30 feet in length, yielding capacities of up to 30,000 gallons. Larger vessels can be fabricated but may require special transportation arrangements, including permits and escorts, which can impact project timelines and costs.

Industry Standards & Compliance

The design and fabrication of storage tanks are governed by various industry standards and codes, ensuring safety, reliability, and consistency across different applications. Some of the most prevalent standards include:

ASME Code

The American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, particularly Section VIII, Division 1, is widely used for the construction of pressure vessels. This code provides guidelines for materials, design, fabrication, inspection, and testing of pressure vessels.



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Quality Control & Testing

Ensuring the integrity and safety of storage tanks involves rigorous quality control measures and testing procedures:

Non-Destructive Testing (NDT)

Various NDT methods, such as radiography, ultrasonic testing, and magnetic particle inspection are employed to detect defects in welds and materials.

Hydrostatic Testing

Tanks are often filled with water and pressurized to test for leaks and structural integrity.

Surface Treatment

Interior surfaces may undergo thorough cleaning, drying, media blasting or mechanical polishing to ensure product purity and prevent contamination. Exterior surfaces often receive protective coatings to prevent corrosion.

Pre-Shipment Procedures

To maintain cleanliness during transportation, nozzles may be capped and tanks purged with inert gas like nitrogen.

Future Trends in Tank Design & Fabrication

As industries evolve, so do the requirements for storage tanks. Some emerging trends include:

- Increased use of composite materials for corrosion resistance and weight reduction
- Integration of smart sensors for real-time monitoring of tank conditions
- Advanced coating technologies for improved chemical resistance and longevity
- Design optimizations for seismic resistance and environmental protection

The design and fabrication of storage tanks and vessels continue to advance, driven by industry needs, technological improvements, and evolving standards. From material selection to customization options and rigorous quality control measures, modern tank manufacturing combines engineering expertise with stringent safety considerations. As industries demand more from bulk material storage and process equipment, the importance of good design, fabrication workmanship, and deep manufacturing experience remain paramount.

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