

**TANK
CONNECTION**
AFFILIATE GROUP

RTP DESIGN VS API 12B

RTP (ROLLED, TAPERED PANEL) SMOOTHWALL BOLTED DESIGN • API 12B (FLANGED PANEL) BOLTED DESIGN

BOLTED STORAGE TANK COMPARISON



TANK CONNECTION AFFILIATE GROUP... "OFF THE CHARTS WITH PERFORMANCE!"

Once you understand the facts on today's technology and precision storage products available, the tank selection process in dry bulk and liquid storage will narrow to one of six choices: RTP Bolted Construction, FP (flat panel), Field-Weld, Shop-Weld, Hybrid or Concrete Construction. API 12B (flanged panel) and seal welded bolted construction have become outdated designs, relics of the past.

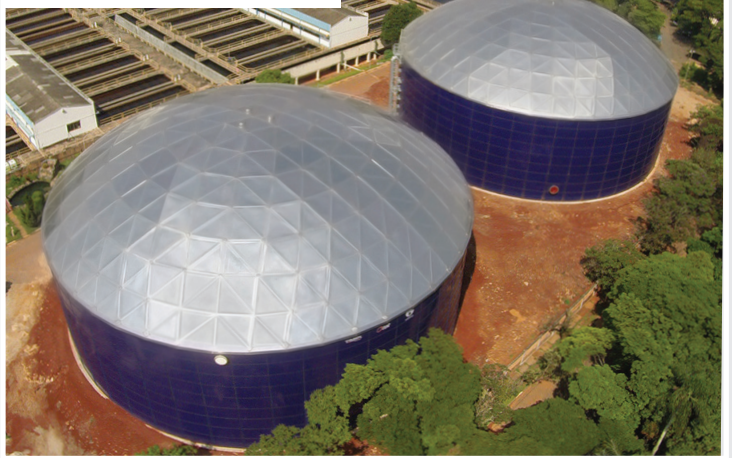
The Tank Connection Affiliate Group is recognized as the new global leader in bolted tank construction. All storage tank systems developed by the TC Affiliate Group fulfill today's storage requirements as prescribed by engineers around the world... **high quality, low maintenance, long life and cost efficient.**

The TC Affiliate Group is a family of companies that specialize in dry bulk and liquid storage applications. We remain the only company worldwide that designs, manufactures and installs all four types of steel storage systems. This includes Bolted RTP (rolled, tapered panel), Field-Weld, Shop-Weld and Hybrid Tank Construction.

RTP (rolled, tapered panel) bolted design



RTP municipal water storage



Because we listen to our customers and develop products to match today's requirements, our growth over the last decade has been unprecedented in the tank storage industry. **We have invested in the future of storage containment worldwide by investing in people. Our affiliate group has over 2500 years of combined storage tank/silo experience.** In review of our employee profiles, you will find that the TC Affiliate Group are the recognized experts in FP, RTP, API 12B, field-weld and hybrid tank construction. This experience level is tied to tank design, tank specification development, tank accessory development, tank fabrication, field installation, and always "golden rule" customer service. It is a pleasure to serve an industry with products that remain unmatched in the industry. Our products and our people show our commitment to serve our customers.

RTP dry bulk silo under construction



Field installation at grade level utilizing synchronized jacks



TANK CONNECTION SOLUTION:

- ◆ Eliminate the API exterior flange, which equated to removing the leak source
- ◆ Increase plate thickness (simulate field-weld tank construction for industrial process applications) without adding an “erector’s set” of stiffeners
- ◆ Utilize Fusion 5000 FBE™ powder coat system designed by Akzo Nobel for complete coating wrap-around on steel for “long life” storage
- ◆ Develop a safe field construction process utilizing “state-of-the-art” technology
- ◆ Utilize a field-weld hopper connection approach in dry bulk storage
- ◆ Align vertical seams (for symmetrical design)
- ◆ Utilize length x height panel equation - similar to field-weld construction

The result was an RTP (rolled, tapered panel) design that could address and eliminate all the problems associated with API 12B flanged panel tank construction.

How good is RTP construction?

In the power industry (i.e., limestone, lime, water, fly ash, coal storage, etc.), Tank Connection’s RTP construction is the **ONLY** bolted smoothwall tank design recognized as an acceptable alternate to field-weld construction.



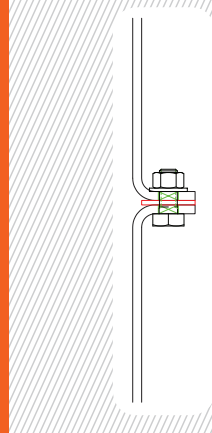
RTP Construction vs. API 12B (in review)

FEATURE	RTP DESIGN	API 12B
Panel construction	Bolted - rolled, tapered panel	Bolted - flanged panel
Seal between panels	EPDM gasket - dry bulk; mastic - liquid	EPDM gasket - dry bulk & liquid
Plate thickness	Heavy - up to 1/2” plate	Light - up to 1/4” plate
Fabrication quality	Precision fabrication	Inconsistent flange/break connection
Hopper attachment	Field-weld design attachment (upper & lower compression attachment)	Bent plate hopper attachment (same as corrugated grain tanks)
Stiffeners utilized	WF structural when required	Erector’s set of stiffeners
Interior lining	Fusion 5000 & 7000 FBE™	Powder coating primer
Exterior topcoat	Fusion 5000 SDP™	Acrylic Urethane
NO LEAK storage	YES	NO - continuous leaks
Field construction	Synchronized jacking process	Scaffold built with old process
Field safety	Construction workers at grade	Workers elevated in air
External ledge	None	YES - 2” horizontal ledge
Internal ledge	None	YES - source of product contamination
Single source resp.	YES - Fab & Field install by Manufacturer	NO - API construction utilizes subs
Installed quality	Excellent	Poor

THE HISTORY & FACTS - API 12B (AMERICAN PETROLEUM INSTITUTE) BOLTED TANKS

API 12B fabrication evolved from the oil patch market in the early 1900's. This standard was developed for a bolted flat bottom tank that would store crude oil. The tank sizes were small (~ 100 to 10,000 barrels in size) and were shipped to the field to be erected by oil field workers. The seal between panels utilized a buna nitrile gasket material. Flanging dies were utilized to create an exterior horizontal flange (chime) connection (see figure 1.1), which allowed the panels to be easily assembled in the field using a gin pole and scaffold system. The flanging dies were designed for forming light gauge material thicknesses ranging from 12 gauge up to 3/16" plate. Eventually these tanks evolved to include small hopper bottom designs for the storage of grain and other bulk materials.

Figure 1.1



API 12B flanged panel connection

API 12B flanged panel tank - scaffold built



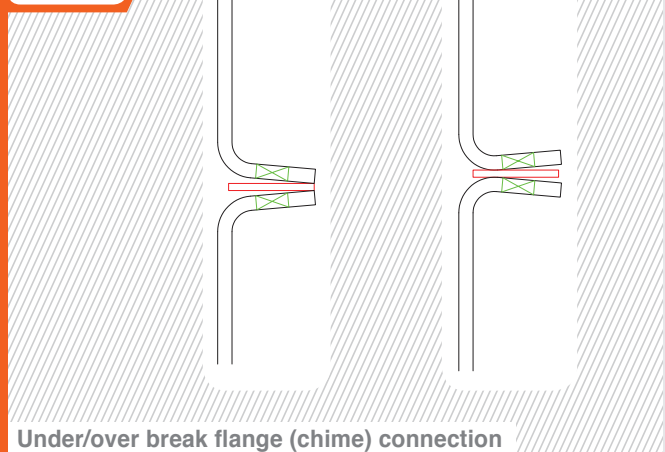
As time passed, the market required larger tank sizes, which historically had been served by field-weld and concrete construction. As a less expensive design, the API flanging dies were used and the material thicknesses were increased to 1/4" plate. An erector's set of stiffeners were added to meet basic design parameters (i.e., wind, seismic, etc.). The process continued to evolve with more and more stiffeners added to the tank skirt and sidewall areas, similar to today's corrugated grain tanks. Dry bulk and liquid storage tanks continued to grow in size and capacity. **This is when the design failure in API 12B fabrication started to appear.** When standard tank design parameters required heavier plate thicknesses, the flanging dies designed for 3/16" material were utilized on 1/4" and 5/16" plate material. The results were exterior flange connections (chimes) that did not break at 90 degrees and would not seal (see figure 2.1).

In 5/16" plate construction, the API 12B flange connection would not seal and the tanks would leak. The flange that originally simplified field construction in the oil field had now become a problematic issue with leakage in dry bulk and liquid storage applications. Additionally, in dry bulk storage, the flange created a collection point that held debris and rain. The exterior flange (chime) would quickly corrode, the paint would peel and the results were rusted exterior flange seams (see figure 2.2).

By pushing API 12B fabrication outside of its intended use and range of application, poor quality containment was being developed. When 12B fabrication evolved to include excessive stiffeners and 5/16" plate material, the API 12B tank failed miserably. Higher material grade steel (50, 60, 70 KSI) compounds the fabrication deficiency. The net result is a fabricated panel design that will not seal and will leak continuously in the future.

This is when API 12B fabrication becomes your problem.

Figure 2.1



Under/over break flange (chime) connection

Figure 2.2

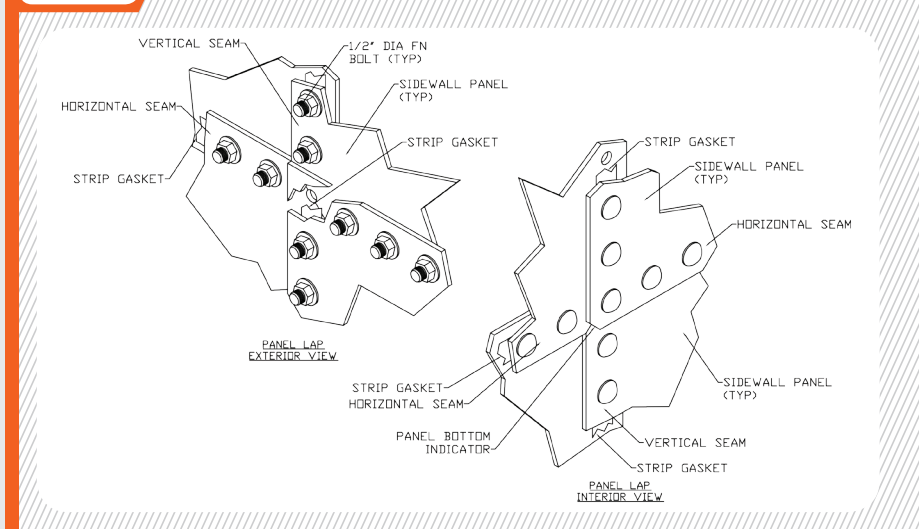


THE GOAL WAS CLEAR...

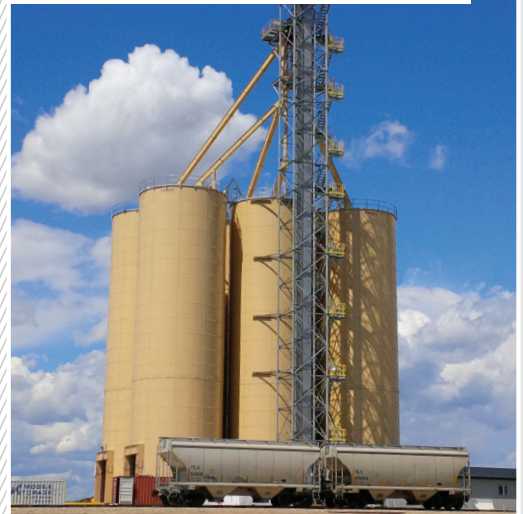
The Tank Connection goal was to take the FP (flat panel) tank design that was outdated the API 12B tank in the liquid market and establish it in the dry bulk market with industrial process standards. The FP (flat panel) tank designs at one time were the best bolted tank designs in the liquid markets with field performance that far exceeded the API 12B specification for liquid storage. **The FP tank designs will always outperform the API 12B tank in every performance rating.**

- ◆ No leaks
- ◆ No problematic exterior flange connection
- ◆ Improved field construction techniques

Figure 3.1 RTP precision panel connection



RTP (rolled, tapered panel) bolted design



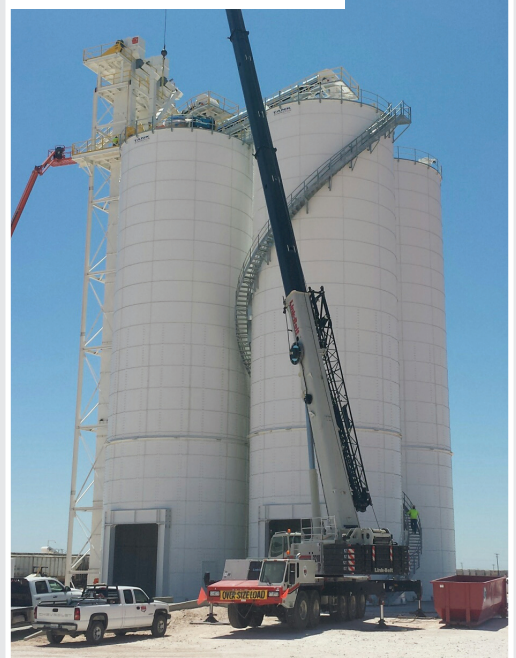
THE SOLUTION IDENTIFIED...

The FP (flat panel) designs could be improved with a precision taper and mitered corner connection (see figure 3.1), “state-of-the-art” powder coating technology and further development of a synchronized field jacking process that would improve quality and safety in the field, while keeping field crews on the ground. Needless to say, this field construction process would become the #1 rated process for tank construction within a short period of time.

Today's storage market requires the following:

- ◆ No leak storage containment
- ◆ Heavier tank designs for industrial process applications
- ◆ The best powder coat system technology for extended service life
- ◆ Safe field construction

RTP tank under construction



THE OUTCOME...

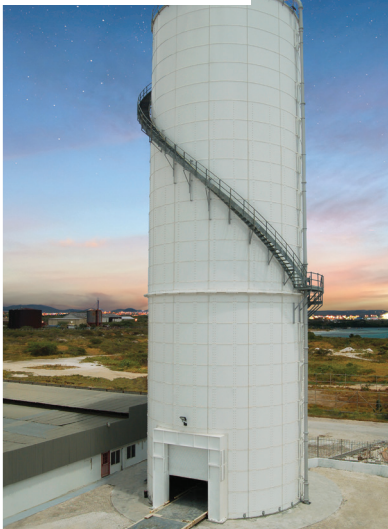
Tank Connection has now crossed the 10 year mark and we are the largest global supplier of tanks for dry bulk and liquid storage applications. By addressing the problems associated with API 12B tanks and developing a precision RTP tank design with high performance coating system and advanced field construction processes, Tank Connection restored customer confidence in bolted tank construction.

TC's advancements in bolted tank construction has outdated API 12B construction in every storage application except small tanks used for "oil field drilling fluids". API 12B construction remains relevant today only when used in the context in which it was intended.

With 5 tank manufacturing facilities and over 500 employees dedicated to storage tank systems, the Tank Connection Affiliate Group stands alone as the SINGLE SOURCE approach for dry bulk and liquid storage applications.

RTP Bolted Tank Construction - The BEST features of bolted and field-welded tank construction have been combined together in the RTP (rolled, tapered panel) tank design. In liquid and bulk storage, it remains unmatched in performance in all category ratings including long life and low maintenance storage. Bolted RTP construction features exact manufacturing tolerances with sidewall plate thickness up to 1/2" plate. No external reinforcement webbies/web stiffeners are required on our design. Field construction is accomplished utilizing a synchronized, hydraulic screw jack process, which keeps field crews on the ground. This field construction process receives the highest industry ratings for quality control and safety in the field. RTP construction by TC is the #1 and best storage tank product selected in the industry today.

RTP dry bulk storage



RTP potable water storage



RTP clarifiers



Tank Connection is an ISO certified company. TC leads the storage industry in application expertise, storage innovation and solutions, storage tank manufacturing technology, vertical integration of operations and field construction services. When you specify Tank Connection, you have selected the top performance storage systems and field construction services available globally.

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