

---

## Storage Tank & Silo Selection – Liquid & Dry Bulk Storage

*By Bill Neighbors – President Tank Connection*

In liquid and dry bulk storage/containment, quality and value drives today's tank selection process. With advances in fabrication technology, engineering design, coating processes and field construction techniques, some storage products utilized in the past have become outdated, while other products have pushed to the front of the line in product development and field performance.

The process of selecting a "liquid tank" or a "dry bulk storage silo" starts with a series of questions that require answers before proceeding. This is one of the main problems witnessed in today's containment and storage markets. Many times tank selection is based on a preferred "construction type" in lieu of "stored product" performance requirements. Tank manufacturers tend to process customer information relative to their standard storage products and design parameters, which leaves the client responsible for the outcome. This is an archaic approach which is safe for the vendor, but often misses the mark in achieving a functional and efficient storage system that performs per your requirements.

The "top 10" list below includes basic considerations that should be addressed on every storage application. If the application under review is routine and no problem areas exist with the product/liquid stored, a standard tank quotation can be generated. If any items listed are a concern, a specialist in storage applications should advise you on the correct approach.

### ***Considerations – DRY BULK SILOS***

1. How much material will be stored....tons / cubic feet?
2. Are there any unique characteristics of the stored material to consider?
3. What materials of construction should be used?
4. What product density should be used for volume and design calculation?
5. Is material degradation a concern?
6. Is material segregation a concern?
7. What type of material discharge pattern is preferred or required for the application?  
(funnel flow, mass flow, expanded flow, etc.)
8. Is a hopper flow aid device required for reliable discharge?
9. Should my material be tested by a "flow specialist"?
10. Do I need a reliable performance guarantee from the silo supplier?

### ***Considerations – LIQUID TANKS***

1. Capacity requirements in gallons/cubic meters?
2. Project design conditions (specific gravity, wind, seismic, snow loads, etc.)?
3. Are there any unique "storage process" requirements (agitation, digester, pressure/vac., etc.)?
4. PH and temperature of stored liquid?
5. What materials of construction should be used?
6. System interface responsibility?
7. Configuration type (flat bottom, sloped bottom, elevated, etc.)?
8. Corrosion allowance and/or cathodic protection requirements?
9. Foundation requirements (concrete ring wall with compacted fill, base setting ring, concrete slab, steel bottom with external saddles, etc.)?
10. Specific design code (AWWA, API 650, NFPA, FM, AISC, NSF, etc.) requirements?

You don't need to have all the answers, but you do need to know a reliable storage/containment specialist that can advise you in these areas. With the basics covered, the selection process can be narrowed for customer review and preference.

**Example 1:**

Liquid storage application requires 2 million gallons of wastewater storage. The PH of stored WW is relatively neutral. Tank construction evaluation is narrowed down to field-weld, concrete and bolted RTP (rolled, tapered panel) designs. Bolted RTP design is selected due to recognized field performance of non-leak design and factory applied powder coat system. Based on system configuration, two tanks are utilized.



**Example 2:**

We need to store 5000 cubic feet of hydrated lime. Based on the capacity requirements as detailed below, a bolted or shop-welded tank is correct for the application. Based on experience with the material and an extensive number of applications in the field, a flow aid device is required. A bin activator sized at half the tank diameter will provide reliable material discharge. A bin activator provides a “funnel flow” material discharge pattern. The material does not need to be tested. Material degradation should not be a concern.



**Example 3:**

Potable water storage application requires 1 million gallons of containment. A condensed field construction schedule is critical to the project. AWWA specification requirements are applicable. Tank selection is narrowed to bolted RTP (rolled, tapered panel) and field-weld construction. Based on expedited schedule requirements and superior performance of factory applied powder coat systems available for potable water storage, bolted RTP tank construction is selected. International location – order to installation complete within 15 weeks.



**Example 4:**

Storage application requires 25,000 cubic feet of a granular product. It is desired to minimize material segregation during discharge. First we will note that size selection exceeds a shop-welded tank. This eliminates the shop-weld tank, unless we break the capacity requirements into a two tank package. The correct storage selection is a bolted smoothwall tank. The correct flow discharge selected is mass flow. This does not mean we specify a silo designed for “mass flow” design loads. The correct request is to specify a silo designed for “functional mass flow” discharge. In order to provide reliable “functional mass flow” (FIFO) discharge, the material will need to be tested.

**Tank & Silo Selection****■ Shop-Weld Construction**

Applications: Liquids, plastic resins, food products, dry chemicals, minerals, wood waste & misc. dry other

- Hopper capacities under 10,000 cubic feet
- Liquid storage up to 80,000 gallons
- Shop-controlled quality
- One piece tank construction
- Factory applied coating systems
- Increased freight cost to the jobsite
- Less field installation requirements

**■ Bolted Smoothwall RTP (rolled, tapered panel) Construction**

Applications: Water, wastewater, fire protection, cement, fly ash, coal, limestone, lime, aggregates, minerals, chemicals, plastics, select foods, wood waste & misc. dry other

- Hopper capacities from 1000 – 100,000 cubic feet
- Liquid storage up to 8.2 million gallons
- Shop-controlled quality
- Modular construction requires bolted field assembly
- Decreased field installation timeframe
- Factory applied powder coating systems



**■ Field-Weld Construction**

Applications: Water, wastewater, industrial liquids, minerals, aggregates, dry chemicals & misc. dry other

- Hopper capacities from 20,000 – 250,000 cubic feet
- Liquid storage up to 25 million gallons
- Shop-controlled quality – minimize large piece count
- Modular construction requires field welded assembly
- Increased field installation timeframe
- Field applied coating systems



**■ Slip & Jump-form Concrete Construction**

Applications: Minerals, grains, wood waste & misc. dry other

- Hopper capacities from 20,000 – 300,000 cubic feet
- Liquid storage up to 25 million gallons
- Slip-form quality – high - continuous pour, monolith design
- Jump-form construction - cold joint construction
- Increased field installation timeframe
- Increased foundation requirements



**■ Hybrid Silo Construction** (combines the best qualities of bolted RTP, field-weld & concrete construction)

Applications: Industrial liquids, cement, fly ash, coal, limestone, lime, aggregates, minerals, chemicals & misc. dry other

- Hopper capacities from 20,000 – 150,000 cubic feet
- Liquid storage up to 15 million gallons
- Shop-controlled quality
- Modular construction requires field assembly
- Decreased field installation timeframe
- Factory applied powder coating systems



In general, storage applications that require a storage volume of less than 10,000 cubic feet (dry) or 30,000 gallons (liquid) will utilize a shop-welded or smoothwall bolted tank. Both products are used interchangeably in the industry. Shop-weld and bolted construction maintain advantages as listed above. Under review, the total installed costs (material + freight + field installation) are comparable between both products.

Bolted RTP (rolled, tapered panel), field-weld, concrete and hybrid tanks are typically utilized in large volume storage applications. All four designs are routinely specified in the power industry. In the industrial market, bolted RTP and hybrid construction are the most cost efficient silo designs. Field-weld and concrete construction require extended field installation timeframes, which equates to higher installed cost.

Relative to “materials of construction” selection, bolted, shop-weld and field-weld silos are available in coated carbon steel, stainless steel and aluminum construction. All tanks/silos are customized for the application and are available for installation at grade level or elevated. Typical tank accessories include manway accesses, level control nozzles, maintenance access platforms, agitators, heaters, insulation, caged ladders, spiral stairways, perimeter guardrails, and custom requirements for system integration.

In summary, if the basics are covered in tank selection, years of trouble free containment can be expected. In today’s industrial and municipal storage markets, a storage specialist should advise or confirm your selection. In all cases, a reliable storage system starts with a properly designed and configured tank/silo. Guesswork has been removed from the equation.