SECTION 463613 - STORAGE SILOS

Note that this section has only been edited for NYSOGS standardization and has not been technically edited. The designer shall make all technical edits specific to the project for this section.

This Section includes bolted or field-welded steel storage silos for bulk storage of dry chemicals to be used in water and wastewater treatment processes.

Typical silo construction for water and wastewater applications is bolted, smooth-wall, rolled tapered panels (RTP) for capacities from about 1,000 to 100,000 cu. ft., or shop-welded tanks for capacities under about 10,000 cu. ft. Edit this Section based on Project requirements.

This Section specifies tanks constructed of coated carbon steel. Stainless steel and aluminum tanks are available for storage of incompatible chemicals; modify this Section as required if material other than coated carbon steel is required for Project.

Dry chemical weighing equipment is specified in Section 463623, volumetric feed equipment in Section 463633, and gravimetric feed equipment in Section 463636.

1. GENERAL
   * + 1. SUMMARY
          1. Section Includes: Dry chemical storage silos, bolted or shop-welded construction.
          2. Related Requirements:

List other Sections directly related to or affecting Work of this Section. Include Sections specifying information expected to be found in this Section as well as Sections required to describe complete system or assembly requirements.

Section 055000 - Metal Fabrications: Fasteners, brackets, and other miscellaneous metal fabrications as required by this Section.

Section 460553 - Identification for Water and Wastewater Equipment: Nameplates for equipment specified in this Section.

* + - 1. DEFINITIONS

Limit list of definitions to terms unique to this Section and not provided elsewhere.

* + - * 1. RTP: Rolled tapered panel.
      1. REFERENCE STANDARDS

List reference standards included within text of this Section, with designations, numbers, and complete document titles.

LEED requires compliance with specific editions of referenced standards. American Petroleum Institute:

API 620 - Design and Construction of Large, Welded, Low-Pressure Storage Tanks.

API 650 -Welded Tanks for Oil Storage.

* + - * 1. American Society of Civil Engineers:

ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

* + - * 1. American Welding Society:

AWS B2.1 - Specification for Welding Procedure and Performance Qualification.

AWS D1.1 - Structural Welding Code - Steel.

AWS QC1 - Standard for AWS Certification of Welding Inspectors.

* + - * 1. ASTM International:

ASTM A36 - Standard Specification for Carbon Structural Steel.

ASTM A48 - Standard Specification for Gray Iron Castings.

ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

ASTM A106 - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.

ASTM A139 - Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over).

ASTM A 153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

ASTM A194 - Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.

ASTM A216 - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.

ASTM A283 - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength.

ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

ASTM A490 - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.

ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.

ASTM A572 - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.

ASTM A656 - Standard Specification for Hot-Rolled Structural Steel, High-Strength Low-Alloy Plate with Improved Formability.

ASTM A992 - Standard Specification for Structural Steel Shapes.

ASTM A1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.

ASTM D1171 - Standard Test Method for Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens).

ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

* + - * 1. NSF International:

NSF 61 - Drinking Water System Components - Health Effects.

NSF 372 - Drinking Water System Components - Lead Content.

Twenty-five states, Puerto Rico, and the Virgin Islands have OSHA-approved state plans and have adopted their own standards and enforcement policies. Generally, these states have adopted standards that are identical to federal OSHA, although some states have adopted different standards or may have different enforcement policies.

* + - * 1. Occupational Safety and Health Administration (OSHA):

29 CFR 1910 - Occupational Safety and Health Standards.

* + - 1. COORDINATION
         1. Coordinate Work of this Section with Work of other Sections.
      2. PREINSTALLATION MEETINGS
         1. Convene minimum [**one week**] [**<\_\_\_\_\_\_\_\_> weeks**] prior to commencing Work of this Section.
      3. SUBMITTALS

Only request submittals needed to verify compliance with Project requirements.

* + - * 1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
        2. Manufacturer’s installation instructions shall be provided along with product data.
        3. Submittals shall be provided in the order in which they are specified and tabbed (for

combined submittals).

* + - * 1. Product Data:

Submit manufacturer information for construction and fabrication materials and coatings.

Submit data for ladder and ladder safety devices.

* + - * 1. Shop Drawings:

Complete plan, elevation, and sectional drawings showing critical dimensions.

Structural plate and support member sizes and thicknesses.

Weld types and sizes.

Ladder and ladder safety device details.

Handrail details.

Access hatch details.

<**\_\_\_\_\_\_\_\_**>.

* + - * 1. Manufacturer's Certificate:

Certify that tanks and appurtenances meet or exceed specified requirements.

Submit certified list of tank installations storing same dry chemicals and density, in service for period of not less than [**five**] <**\_\_\_\_\_\_\_\_**> years.

* + - * 1. Welder Certificates: Certify welders and welding procedures employed on Work, according to AWS B2.1

Include separate Paragraphs for additional certifications.

* + - * 1. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for tank structural calculations.
        2. Test and Evaluation Reports:

[**Submit mill test reports.**]

Submit installation certificate from equipment manufacturer's representative as described in PART 3.

* + - * 1. Manufacturer Instructions: Submit detailed instructions on installation requirements, including silo component handling procedures, anchoring, and layout.
        2. Source Quality-Control Submittals: Indicate results of [**shop**] [**factory**] tests and inspections.
        3. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
        4. Manufacturer Reports: Submit certification after installation that [**silo has**] [**silos have**] been installed according to manufacturer instructions.
        5. Qualifications Statements:

Coordinate following Subparagraphs with requirements specified in QUALIFICATIONS Article.

Submit qualifications for manufacturer, erector, and licensed professional.

Submit manufacturer's approval of erector.

Welder Certificates: Submit welder certification of compliance with AWS D1.1

* + - 1. SUSTAINABLE DESIGN SUBMITTALS
         1. Manufacturer's Certificate: Certify that following products meet or exceed specified sustainable design requirements.

Insert material certifications list below to suit products specified in this Section and Project sustainable design requirements. Specific certificate submittal and supporting data requirements are specified in Section 018113.

Materials Resources Certificates:

Certify source and origin for [**salvaged**] [**and**] [**reused**] products.

Certify recycled material content for recycled content products.

Certify source for regional materials and distance from Project Site.

* + - * 1. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

Provide cost data for following products:

Edit list of material cost data below to suit products specified in this Section and Project sustainable design requirements. Specific cost data requirements are specified in Section 018113.

Salvaged, refurbished, and reused products.

Products with recycled material content.

Regional products.

* + - 1. CLOSEOUT SUBMITTALS
         1. Project Record Documents: Record actual location and orientation of silos and appurtenances.
      2. MAINTENANCE MATERIAL SUBMITTALS
         1. Extra Stock Materials: Furnish [**two**] <**\_\_\_\_\_\_\_\_**> safety harnesses for ladder safety rail system.
      3. QUALITY ASSURANCE

Include this Article to specify compliance with overall reference standards affecting products and installation included in this Section.

* + - * 1. Materials in Contact with Potable Water: Certified to NSF Standards 61 and 372.

In following Paragraph insert "State of New York Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

* + - * 1. Perform Work according to <**\_\_\_\_\_\_\_\_**> standards.

Include following Paragraph only when cost of acquiring specified standards is justified.

* + - * 1. Maintain <**\_\_\_\_\_\_\_\_**> [**copy**] [**copies**] of each standard affecting Work of this Section on Site.
      1. QUALIFICATIONS

Coordinate following Paragraphs with requirements specified in SUBMITTALS Article.

* + - * 1. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience.
        2. Erector: Company specializing in performing Work of this Section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience [**and approved by manufacturer**].
        3. Welders: AWS qualified according to AWS B2.1 within previous 12 months for employed weld types.
        4. [**Welding Inspector: According to AWS QC1.**]
        5. Licensed Professional: [**Professional engineer**] <**\_\_\_\_\_\_\_\_**> experienced in design of specified Work and licensed in the State ofNew York.
      1. DELIVERY, STORAGE, AND HANDLING
         1. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
         2. Storage:

Store materials according to manufacturer instructions.

Store materials in areas protected from weather and moisture.

Do not store products directly on ground.

* + - * 1. Handling: Handle and transport materials in a manner to prevent damage to interior or exterior surfaces.
        2. Protection:

Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

Provide additional protection according to manufacturer instructions.

* + - 1. EXISTING CONDITIONS
         1. Field Measurements:

Verify field measurements prior to fabrication.

Indicate field measurements on Shop Drawings.

* + - 1. WARRANTY

This Article extends warranty period beyond one year. Extended warranties may increase construction costs and Director’s Representative enforcement responsibilities. Specify warranties with caution.

* + - * 1. Furnish [**five**] [**25**] <**\_\_\_\_\_\_\_\_**>-year manufacturer's warranty for storage silos.

1. PRODUCTS
   * + 1. STORAGE SILOS
          1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=12283&mf=04&src=wd):

Designer to provide two manufacturers and approved equivalent for all listed products.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

In following Subparagraph insert "State of New York Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

Furnish materials according to <**\_\_\_\_\_\_\_\_**> standards.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above. Include configuration, size, color, material composition, and other properties needed to describe product.

* + - * 1. Description:

Design, fabricate, and erect <**\_\_\_\_\_\_\_\_**> cu. ft. ground-level, [**bolted**] [**welded**] steel storage silo and accessories.

Dimensions: <**\_\_\_\_\_\_\_\_**> feet in diameter by <**\_\_\_\_\_\_\_\_**> feet high.

Eave Height: <**\_\_\_\_\_\_\_\_**> feet

Hopper:

As indicated on Drawings.

Outlet Diameter: <**\_\_\_\_\_\_\_\_**> inches

Outlet Clearance to Bottom of Tank: <**\_\_\_\_\_\_\_\_**> inches

Slope: <**\_\_\_\_\_\_\_\_**> degrees.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Hopper: None, flat bottom.

Pile-Supported Foundation: If required, according to manufacturer's design.

Accessways: [**Manufacturer's standard**] [**As indicated on Drawings**].

* + - * 1. Performance and Design Criteria:

Comply with ASCE 7 and IBC.

Dead Load: Minimum <**\_\_\_\_\_\_\_\_**> psf

Snow Loading: Minimum <**\_\_\_\_\_\_\_\_**> psf

Wind Loading: Minimum <**\_\_\_\_\_\_\_\_**> mph

Seismic Load: <**\_\_\_\_\_\_\_\_**> psf

Ladder Load: Minimum <**\_\_\_\_\_\_\_\_**> lb. on each vertical section.

Stored Product:

Description: [**Sodium hydroxide**] <**\_\_\_\_\_\_\_\_**>.

Density: <**\_\_\_\_\_\_\_\_**> pcf

Product Discharge Pattern: [**Funnel flow**] [**Mass flow**] [**Expanded flow**] <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Materials:

Plates and Sheets:

Type: [**RTP**] [**Smooth wall**].

Comply with ASTM [**A36**] [**A283**] [**A656**] [**A572, Grade <\_\_\_\_\_\_\_\_>**] [**A1011]**.

Galvanizing: Comply with ASTM A153 and ASTM B695.

Bolts: Comply with ASTM [**A307**] [**A325**] [**A490**].

Nuts: Comply with ASTM [**A194]** [**A563]**.

Anchor Bolts: Comply with ASTM [**A36**] [**A307**] [**F1554, Grade <\_\_\_\_\_\_\_\_>**].

Structural Shapes: ASTM [**A36**] [**A53, Type <\_\_\_\_\_\_\_\_>, Grade <\_\_\_\_\_\_\_\_>**] [**A106, Grade <\_\_\_\_\_\_\_\_>**] [**A139, Grade <\_\_\_\_\_\_\_\_>**] [**A500]** [**A501**] [**A572, Grade <\_\_\_\_\_\_\_\_>**] [**A992** ].

Castings:

Iron: Comply with ASTM A48, Class <**\_\_\_\_\_\_\_\_**>.

Steel: Comply with ASTM A216, Grade <**\_\_\_\_\_\_\_\_**>.

Gaskets:

Comply with ASTM D1171.

Comply with NSF 61.

Sealants:

Comply with NSF 61.

Flexibility Range: [**Minus 40**] <**\_\_\_\_\_\_\_\_**> to [**plus 170**] <**\_\_\_\_\_\_\_\_**> degrees F

* + - * 1. Finishes:

Coating System: Powder-coated epoxy.

* + - * 1. Accessories:

Level indicators.

Bin vents with filters.

Discharge shutoff valve.

External and internal access ladder.

Fill pipe.

[**Insulation with cladding.**]

[**Lights.**]

[**Heaters.**]

[**Hopper flow aid.**]

* + - 1. SUSTAINABILITY CHARACTERISTICS

Insert sustainable design characteristics in this Article to suit content of this Section and Project sustainable design requirements as specified in Section 018113.

* + - * 1. Material and Resource Characteristics:

Recycled Content Materials: Furnish materials with maximum available recycled content [**including:**] [**.**]

Insert list of materials specified in this Section required to have recycled content.

<**\_\_\_\_\_\_\_\_**>.

Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project Site [**including:**] [**.**]

Insert list of materials specified in this Section required to be regional materials.

<**\_\_\_\_\_\_\_\_**>.

* + - 1. SOURCE QUALITY CONTROL
         1. Provide shop inspection and testing of component parts.

Include one or both of following Paragraphs to require Director’s Representative inspection or witnessing of test at factory.

* + - * 1. Director’s Inspection:

Make completed tank components available for inspection at manufacturer's factory prior to packaging for shipment.

Notify Director’s Representative at least [**seven**] <**\_\_\_\_\_\_\_\_**> days before inspection is allowed.

* + - * 1. Director’s Witnessing:

Allow witnessing of factory inspections and test at manufacturer's test facility.

Notify Director’s Representative at least [**seven**] <**\_\_\_\_\_\_\_\_**> days before inspections and tests are scheduled.

Include following Paragraph if reliance on fabricator's approved quality-control program is sufficient for Project requirements.

* + - * 1. Certificate of Compliance:

If fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.

Specified shop tests are not required for Work performed by approved fabricator.

1. EXECUTION
   * + 1. EXAMINATION
          1. Verify layout and orientation of tank, accessories, and connections.
       2. PREPARATION
          1. Support Pad:

Thoroughly clean tank pad, removing loose concrete, dust, and other debris.

Place building paper on pad according to tank manufacturer's recommendations prior to placing tank.

* + - 1. INSTALLATION
         1. According to manufacturer instructions.
         2. Field-Welded Steel Tanks: Comply with API 620 and API 650.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

In following Paragraph insert "State of New York Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

* + - * 1. Installation Standards: Install Work according to <**\_\_\_\_\_\_\_\_**> standards.
      1. FIELD QUALITY CONTROL
         1. Welding Inspection:

Radiographic:

Tank shell joints and load-bearing risers with complete penetration welded butt joints.

Primary Stress: Primary tensile stress.

Secondary Stress: Primary compression stress.

Primary Stress Joints that Cannot Be Radiographed: Use air carbon arc gouging.

Exceptions to Radiographic Inspection: Roof plates, tank bottoms resting directly on foundation, joints between tank bottom and first ring of shell, and welds connecting accessways or other appurtenances.

Visual: By qualified inspector according to AWS QC1.

Submit certified copy of report including:

Copy of welder performance qualifications.

Summary of radiographic and visual inspections.

Record of welders employed at each joint.

* + - * 1. Manufacturer Services:

Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than <**\_\_\_\_\_\_\_\_**> [**days**] [**hours**] on Site for installation, inspection, startup, field testing, and instructing Director’s Representative in maintenance of equipment.

Director’s Representative Installation Certificate: Obtain from equipment manufacturer's representative and submit, attesting that equipment has been properly installed and is ready for startup and testing.

* + - * 1. Equipment Acceptance:

Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.

Make final adjustments to equipment under direction of manufacturer's representative.

* + - * 1. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.
      1. ATTACHMENTS

When relying on separate schedules, tables, illustrations, or forms to specify product requirements, include list of each attachment. Include identical list of attachments in Project Manual table of contents.

Consider including schedule if Project includes more than one silo. No units of measurement are indicated on following schedule; these may be added to schedule legend or included within each insert.

Insert attachments following END OF SECTION. Consider following example when developing Project schedule.

* + - * 1. Storage Silo Schedule:

SS-1:

Stored Material: <**\_\_\_\_\_\_\_\_**>.

Dimensions: <**\_\_\_\_\_\_\_\_**>.

Capacity: <**\_\_\_\_\_\_\_\_**>.

Connections: <**\_\_\_\_\_\_\_\_**>.

Accessories: <**\_\_\_\_\_\_\_\_**>.

SS-2:

Stored Material: <**\_\_\_\_\_\_\_\_**>.

Dimensions: <**\_\_\_\_\_\_\_\_**>.

Capacity: <**\_\_\_\_\_\_\_\_**>.

Connections: <**\_\_\_\_\_\_\_\_**>.

Accessories: <**\_\_\_\_\_\_\_\_**>.

END OF SECTION 463613