SECTION 466123 - GRAVITY FILTERS

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 high-rate (mixed-media) gravity filters, continuous backwash (sand) filters, and accessories.

Granular filters include a bed of porous media in a structure designed to regenerate the solids-retention capacity of the bed when either the available head loss has been reached or when the effluent criteria has been exceeded. Typically, water flow is downward by gravity, although some manufacturers offer an upflow (or "reverse" flow) filter or some combination of upflow/downflow. Usually, granular media filtration is a discontinuous process, consisting of filtration followed by regeneration (backwashing); however, some manufacturers offer continuous filters.

Granular gravity filters are commonly of three types: slow sand, rapid sand, and high rate (mixed media). Slow-sand filters are infrequently used and high-rate filters dominate the field, especially in larger plants that are greater than 10 MGD.

Rapid-sand, automatic backwash filters are often used in relatively small plants that are less than 10 MGD. Rapid-sand filters are typically constructed with a downflow configuration and use dual media (e.g., sand and coal, with a gravel bed). This Section can be modified to specify this type of filter, or it is available in tank configuration from various manufacturers (refer to SpecAgent).

Activated carbon media may be used for removal of organics and chlorine, and manganese greensand may be used for removal of iron and manganese. If other types of gravity filters or media configurations are required for Project, modify this Section accordingly.

1. GENERAL
   * + 1. SUMMARY
          1. Section Includes:

Mixed-media filters and accessories.

Continuous backwash sand filters and accessories.

* + - * 1. 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 400523 - Stainless Steel Process Pipe and Tubing: Pipe and tubing for process systems.

Section 402323 - Potable Water Process Piping: Piping materials and installation as required for this Section.

Section 407313 - Pressure and Differential Pressure Gauges: Product and installation requirements for pressure gages.

Section 460548 - Vibration and Seismic Control for Water and Wastewater Equipment: Controls for equipment specified in 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. Air Binding: The release of dissolved gases that fill the pores of a filter's media and reduce the rate of filtration. Air binding is caused by a partial vacuum in the lower portion of the filter media due to head losses across the media.
        2. Backwashing: A method of cleaning filters by reversing flow. Clear water from wash-water tank is directed into the filter underdrain piping and distributed upward through the filter media. Dirty wash-water is collected by troughs and is directed to the plant drain.
        3. Floc: A tuft-like mass that forms in a liquid as a result of precipitation or the aggregation of suspended particles.
        4. FRP: Fiberglass-reinforced plastic.
        5. Rapid-Sand Filtration: A process that removes floc and impurities remaining after chemical coagulation and sedimentation of raw water.
        6. Turbidity: The cloudiness or haziness of a fluid caused by individual particles (suspended solids).
      1. REFERENCE STANDARDS

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

* + - * 1. American Water Works Association:

AWWA B100 - Granular Filter Material.

* + - * 1. ASTM International:

ASTM C127 - Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.

ASTM C128 - Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.

ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

* + - * 1. National Sanitation Foundation:

NSF 61 - Drinking Water System Components - Health Effects.

NSF 372 - Drinking Water System Components - Lead Content.

* + - 1. 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).
        4. Product Data: Submit manufacturer's Product Data for system materials and component equipment.
        5. Shop Drawings:

Indicate system materials and component equipment.

Submit installation and anchoring requirements, fasteners, and other details.

* + - * 1. Manufacturer's Certificate: Certify that filters meet or exceed specified requirements.

Include separate Paragraphs for additional certifications.

* + - * 1. Manufacturer's Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
        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: Indicate that equipment has been installed according to manufacturer's instructions.
        5. Qualifications Statements:

Coordinate following Subparagraphs with the requirements specified in QUALIFICATIONS Article.

Submit qualifications for manufacturer and installer.

Submit manufacturer's approval of installer.

* + - 1. CLOSEOUT SUBMITTALS
         1. Project Record Documents: Record actual locations of installed gravity filters.
         2. Operation and Maintenance Data: Submit maintenance instructions for equipment and accessories.
      2. MAINTENANCE MATERIAL SUBMITTALS
         1. Spare Parts:

Furnish [**one set**] [**two sets**] of manufacturer's recommended spare parts.

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

Furnish [**two**] <**\_\_\_\_\_\_\_\_**> of <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Tools: Furnish special [**wrenches**] <**\_\_\_\_\_\_\_\_**> and other devices required for Director’s Representative to maintain gravity filters.
      1. 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: Comply with NSF Standard 61 and NSF Standard 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 the 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. Installer: Company specializing in performing Work of this Section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience [**and approved by manufacturer**].
      1. DELIVERY, STORAGE, AND HANDLING
         1. Deliver materials in manufacturer's packaging including application instructions.
         2. Inspection: Accept materials on-Site in original packaging and inspect for damage.
         3. Store materials according to manufacturer's instructions.
      2. 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 Owner enforcement responsibilities. Specify warranties with caution.

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

1. PRODUCTS
   * + 1. PERFORMANCE AND DESIGN CRITERIA
          1. Influent Characteristics:

Flow Rate:

Design: <**\_\_\_\_\_\_\_\_**> gpm

Maximum: <**\_\_\_\_\_\_\_\_**> gpm

Minimum Available Head: <**\_\_\_\_\_\_\_\_**> feet

Temperature:

Design: <**\_\_\_\_\_\_\_\_**> degrees F

Maximum: <**\_\_\_\_\_\_\_\_**> degrees F

Minimum: <**\_\_\_\_\_\_\_\_**> degrees F

Flow Conditions: [**Intermittent**] [**Continuous**] [**Batch**].

Suspended Solids: <**\_\_\_\_\_\_\_\_**> mg/L.

Particle Size: <**\_\_\_\_\_\_\_\_**> microns.

pH:

Maximum: <**\_\_\_\_\_\_\_\_**>.

Minimum: <**\_\_\_\_\_\_\_\_**>.

Source: [**Well**] [**Surface**] <**\_\_\_\_\_\_\_\_**>.

Alkalinity: <**\_\_\_\_\_\_\_\_**> mg/L as CaCO3.

Calcium Concentration: <**\_\_\_\_\_\_\_\_**> mg/L.

Hardness: <**\_\_\_\_\_\_\_\_**> mg/L.

* + - * 1. Design Criteria:

Number of Filters: <**\_\_\_\_\_\_\_\_**>.

Maximum Effluent:

Suspended Solids: <**\_\_\_\_\_\_\_\_**> mg/L.

Particle Size: <**\_\_\_\_\_\_\_\_**> microns.

Maximum Filtration Rate: <**\_\_\_\_\_\_\_\_**> gal./s/sq. ft

Clean Bed Maximum Head Loss: <**\_\_\_\_\_\_\_\_**> feet at design flow rate and temperature.

* + - 1. MIXED-MEDIA FILTERS
         1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=11710&mf=04&src=wd):

DESIGNER TO PROVIDE TWO MANUFACTURERS AND APPROVED EQUIVALENT FOR ALL LISTED PRODUCTS.

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

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

* + - * 1. Furnish materials according to <**\_\_\_\_\_\_\_\_**> standards.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above.

* + - * 1. Description: Inlet and outlet piping, filter bed, wash-water inlet piping, backwash drains[**, backwash pump**] [**, piping**] [**, and**] [**valves**].
        2. [**Piping: As specified in Division 40.**]
        3. [**Valves: As specified in Division 40.**]
        4. Rate Controller: Valve controlled by venturi meter.
        5. Surface Wash Scrubbers: Fixed nozzles or revolving agitator driven by nozzles 45 to 75 psig
        6. Filter Media:

Comply with AWWA B100.

Sieve Analysis: Comply with ASTM C136 and AWWA B100.

Support Gravel:

Description: Hard, rounded stones, free of shale, mica, clay, sand, loam, and organics.

Specific Gravity:

Average: Not less than <**\_\_\_\_\_\_\_\_**>.

Comply with ASTM C127.

<**\_\_\_\_\_\_\_\_**> or Less: No greater than <**\_\_\_\_\_\_\_\_**> percent by weight.

Silica Sand:

Specific Gravity:

Average: [**2.55**] [**2.60**] [**2.65**] <**\_\_\_\_\_\_\_\_**>.

Comply with ASTM C128.

Uniformity Coefficient: Less than or equal to <**\_\_\_\_\_\_\_\_**>.

Effective Size: Between No. <**\_\_\_\_\_\_\_\_**> sieve and No. <**\_\_\_\_\_\_\_\_**> sieve

Anthracite:

Description: Clean and free of scale.

Specific Gravity:

Average: [**1.45**] [**1.50**] [**1.55**] [**1.73**] <**\_\_\_\_\_\_\_\_**>.

Comply with ASTM C128.

Uniformity Coefficient: Less than or equal to <**\_\_\_\_\_\_\_\_**>.

Effective Size: Between No. <**\_\_\_\_\_\_\_\_**> sieve and No. <**\_\_\_\_\_\_\_\_**> sieve

High-Density Sand:

Material: [**Garnet**] [**Ilmenite**] <**\_\_\_\_\_\_\_\_**>.

Specific Gravity:

Average: [**3.6**] [**4.0**] [**4.2**] <**\_\_\_\_\_\_\_\_**>.

Comply with ASTM C128.

Uniformity Coefficient: Less than or equal to <**\_\_\_\_\_\_\_\_**>.

Effective Size: Between No. <**\_\_\_\_\_\_\_\_**> sieve and No. <**\_\_\_\_\_\_\_\_**> sieve

* + - * 1. Operation:

Control Panel:

NEMA [**4**] [**12**] <**\_\_\_\_\_\_\_\_**>.

Controls:

Head loss gage.

Flow meter.

Rate controller.

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

Operation Sequence:

When operating head loss becomes excessive, initiate backwash cycle.

Stop filtration if low filtration rate, passage of excess turbidity, or air binding.

* + - 1. CONTINUOUS BACKWASH SAND FILTER
         1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=11711&mf=04&src=wd):

DESIGNER TO PROVIDE TWO MANUFACTURERS AND APPROVED EQUIVALENT FOR ALL LISTED PRODUCTS.

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

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

* + - * 1. Furnish materials according to <**\_\_\_\_\_\_\_\_**> standards.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above.

* + - * 1. Description: Continuous backwash [**upflow**] [**downflow**], granular media filter.
        2. Tank:

Configuration: [**Cylindrical**] [**Rectangular**], with sloped bottom.

Material: [**Epoxy-coated steel**] [**Type 304 stainless steel**] [**FRP**] <**\_\_\_\_\_\_\_\_**>.

Minimum Thickness of Exposed Metal Components: <**\_\_\_\_\_\_\_\_**> inch

* + - * 1. Media:

Comply with AWWA B100.

Material: Silica sand.

Specific Gravity:

Average: [**2.55**] [**2.60**] [**2.65**] <**\_\_\_\_\_\_\_\_**>.

Comply with ASTM C128.

Uniformity Coefficient: Less than or equal to <**\_\_\_\_\_\_\_\_**>.

Effective Size: Between No. <**\_\_\_\_\_\_\_\_**> sieve and No. <**\_\_\_\_\_\_\_\_**> sieve

Total Depth: <**\_\_\_\_\_\_\_\_**> feet

* + - * 1. Influent Assembly:

Description: Equipment as required to dose influent stream uniformly over entire media bed and deliver influent to [**bottom**] [**top**] of filter tank.

Material: [**Stainless steel**] [**FRP**] <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Effluent Collection Assembly:

Effluent Weir:

Material: [**Stainless steel**] [**FRP**] <**\_\_\_\_\_\_\_\_**>.

Dimensions: As indicated on Drawings.

Filtrate Chamber:

Description: Cylinder with wedge wire screen periphery and hood.

Screen: Stainless-steel trapezoidal bars with opening smaller than finest media grain.

Dimensions: As indicated on Drawings.

Discharge: <**\_\_\_\_\_\_\_\_**>-inch diameter [**stainless-steel**] [**FRP**] <**\_\_\_\_\_\_\_\_**> piping.

* + - * 1. Media Cleaning System:

Description: Sand lift, sand washer, sand distribution equipment, and reject collection system.

Sand Lift:

Description: [**Type 304**] [**Type 304L**] stainless-steel eductor pipe.

Mounting: [**External**] [**Internal**].

Suction Rate: Sufficient to recycle media once every <**\_\_\_\_\_\_\_\_**> hours.

Sand Washer:

Description: Chamber constructed of [**Type 304 stainless steel**] [**FRP**] <**\_\_\_\_\_\_\_\_**>.

Provide sloped floor and baffles.

Cross-Sectional Area: Sufficient in resulting velocity to transport separated solids into wash chamber and out reject pipe.

Sand Distribution Equipment:

Description: Equipment to return cleaned sand to filter bed, such that media distributes evenly on top of bed.

Components: [**Sand distribution cylinder**] [**Sand distribution cone**] [**Return pipe**] [**Washbox skirt**] <**\_\_\_\_\_\_\_\_**>.

Material: [**FRP**] [**Type 304 stainless steel**] <**\_\_\_\_\_\_\_\_**>.

Size: As indicated on Drawings.

Reject Collection System:

Description: Stainless-steel reject weir and reject nozzle.

Design: Allow no greater than [**2**] [**10**] [**20**] <**\_\_\_\_\_\_\_\_**> percent reject water.

* + - * 1. Effluent Rate Control:

Description: Control of filter operation by sensing liquid level in filter tank.

Automatic Effluent Control Valve:

Type: [**Globe**] [**Ball, as specified in Section 400563 - Ball Valves**] <**\_\_\_\_\_\_\_\_**>.

Provided pneumatic positioner to regulate opening in response to a [**3- to 15-**] [**6- to 30-**] psig pneumatic signal.

* + - * 1. Operation:

Electrical Characteristics:

Voltage: <**\_\_\_\_\_\_\_\_**> V, [**single**] [**three**] phase, 60 Hz.

Maximum [**Fuse Size**] [**Circuit Breaker Size**] [**Overcurrent Protection**]: <**\_\_\_\_\_\_\_\_**> A.

Minimum Circuit Ampacity: <**\_\_\_\_\_\_\_\_**>.

Control Panel:

NEMA [**4**] [**4X**] [**12**] <**\_\_\_\_\_\_\_\_**>.

Mounting: On filter unit.

Operation Sequences:

Pumps START and STOP: Automatic and manual.

Control Valves: Manual.

* + - 1. ACCESSORIES
         1. Flow Meters:

Pneumatic: Variable-area ("rotameter") type.

Influent and Effluent: [**Parshall flume**] [**Sonic**] <**\_\_\_\_\_\_\_\_**> type.

* + - * 1. Pressure Gages: As specified in Section 407313 - Pressure and Differential Pressure Gauges.
        2. Inspection Port:

Description: Inspection port in tank wall.

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

Location: [**At surface of filter media**] [**At media interface**] [**As indicated on Drawings**].

* + - 1. SOURCE QUALITY CONTROL

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

* + - * 1. Director’s Inspection: Make completed gravity filters available for inspection at manufacturer's factory prior to packaging for shipment. Notify Director’s Representative at least [**seven**] <**\_\_\_\_\_\_\_\_**> days before inspection is allowed.
        2. 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 when reliance on fabricator's approved quality-control program is sufficient for Project requirements.

* + - * 1. Certificate of Compliance: When 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 that piping connections are ready to receive gravity filters and appurtenances.
       2. INSTALLATION
          1. Install gravity filter components according to manufacturer's instructions.
          2. Valves: As specified in Section 400523 - Stainless Steel Process Pipe and Tubing.
          3. Underdrains:

Install underdrains as indicated on Shop Drawings.

* + - * 1. Support Gravel:

Place gravel by hand to avoid movement of underdrain system and to ensure free passage of water from underdrain.

Complete each gravel layer before succeeding layer is placed.

Backwash support gravel after it has been placed, according to AWWA B100.

* + - * 1. Filter Media:

Install media under supervision of the filter manufacturer's representative.

Complete each media layer before succeeding layer is placed.

Backwash and clean filter media according to AWWA B100 after placement of each layer.

\*\*\*\*\*\* [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. After installation, inspect and test for proper operation.
         2. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than <**\_\_\_\_\_\_\_\_**> days on-Site for installation, inspection, field testing, and instructing Director’s Representative in maintenance of equipment.
         3. 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 equipment has been properly installed and is ready for startup and testing.
      1. DEMONSTRATION
         1. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Director’s Representative.

END OF SECTION 466123