# Section 33 46 23 MODULAR STORMWATER STORAGE UNITS

# GENERAL

## Summary

### This section includes specifications or the supply and installation of modular stormwater storage units, specifically the R-TankHD, R-TankSD, R-TankMD, R-TankUD or R-TankXD system (hereafter called R-Tank).

## References

### **ASTM D698** - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

### **ASTM D2412** - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.

### **ASTM F2418** - Standard Specification for Polypropylene (PP) Corrugated Wall Stormwater Collection Chambers.

### Manufacturer’s product literature and guidelines for R-Tank product.

## Quality Control

### **Manufacturer Qualifications:** The R-Tank modular stormwater storage units shall be supplied by Ferguson Waterworks and manufactured in ISO certified facilities.

#### Manufacturer samples shall be provided to the client & contractor for review upon request.

#### A manufacturer’s representative is available for pre-installation conference, per Section 1.06A & site review, upon request.

### **Installer Qualifications:** Installation shall be performed by a contractor experienced in the installation of modular stormwater storage units.

#### A minimum of three R-Tank or equivalent projects completed within 2 years; and,

#### A minimum of 25,000 cubic feet of subsurface storage volume completed within 2 years.

#### Contractor experience requirement may be waived if the manufacturer’s representative provides on-site training and review during construction.

#### Installation Contractor shall demonstrate knowledge and experience in the installation of subsurface storage system. Work shall be performed only by skilled workers with experience in bulk earthworks, pipe, chamber, or pond/landfill construction projects of comparable size and quality.

## Submittals

### Submit product data, installation guidelines, and product certifications for the R-Tank modular stormwater storage units.

#### R-Tank layout drawings, including typical sections, details as well as the required base elevation of stone and tanks, minimum cover requirements and tank configuration.

#### R-Tank product data, including compressive strength, and installation guidelines.

#### Accessory material documentation / certificates for geotextile, geogrid, base course and backfill materials.

### Any proposed equal alternative product substitution to this specification must be submitted for review and approved prior to bid opening. Review package should include third party reviewed performance data that meets or exceeds criteria in Table 2.01 B.

## Delivery, Storage, and Handling

### Protect R-Tank and other materials from damage during delivery and offloading. Handling is to be performed with equipment appropriate to the materials and site conditions.

### Storage of materials should be on smooth surfaces, free from dirt, mud and debris, and away from any open flame, welding operations, or other potential heat sources. UV sensitive materials and R-Tank units should be stored under a tarp to protect from sunlight when time from delivery to installation exceeds two weeks.

### When handling and installing product in cold weather:

#### When the air temperature is 40° F or below, care must be taken when handling plastics to ensure no cracking. Do not use frozen materials, or materials coated with ice or frost.

#### Do not build on frozen ground or wet, saturated or muddy subgrade.

## Preinstallation Conference.

### Prior to the start of the installation, a pre-installation conference shall occur with the representatives from the design team, the general contractor, the excavation contractor, the R-Tank installation contractor, and the manufacturer’s representative.

### The pre-installation conference shall review the layout drawings, pre-construction checklist, and discuss key steps of the process. The pre-construction checklist shall be signed and dated by all participants.

## Project Conditions

### Coordinate installation for the R-Tank system with other on-site activities to eliminate all non-installation related construction traffic over the completed R-Tank system.

### Protect adjacent work from damage during R-Tank system installation.

### Provide proper sediment controls to prevent sediment intrusion, if the system is operational during construction.

### Contractor is responsible for any damage to the system during construction.

### All pre-treatment systems must be in place and functional prior to operation of the R-Tank system.

# PRODUCTS

## R-Tank Units

### Injection molded plastic tank components assembled to form a modular structure of predesigned height.

### R-Tank units shall meet the following Physical & Chemical Characteristics:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **PROPERTY** | **DESCRIPTION** | **R-TankHD VALUE** | **R-TankSD VALUE** | **R-TankMD VALUE** | **R-TankUD VALUE** | **R-TankXD VALUE** |
| Void Area | Volume available for water storage | 95% | 95% | 95% | 95% | 90% |
| Surface Void Area | Percentage of exterior available for infiltration | 90% | 90% | 90% | 90% | 90% |
| Vertical Compressive Strength | ASTM D 2412 /  ASTM F 2418 | 33.0 psi | 42.0 psi | 64.0 psi | 134.0 psi | 220.0 psi |
| Lateral Compressive Strength | ASTM D 2412 /  ASTM F 2418 | 20.0 psi | 22.0 psi | 35.0 psi | 19.0 psi | N/A |
| HS-20 Minimum Cover | Cover required to support HS-20 loads | 20” | 18” | 15” | 12” | 6” |
| Maximum Cover | Maximum allowable  cover depth | < 7 feet | < 10 feet | < 10 feet | < 7 feet | < 10 feet |
| Unit Weight | Weight of plastic per  cubic foot of tank | 3.62 lbs/cf | 3.96 lbs/cf | 3.53 lbs/cf | 4.33 lbs/cf | 7.55 lbs/cf |

## Geosynthetics

### Geotextile

#### Standard Application: The standard geotextile shall be an 8 oz per square yard nonwoven geotextile.

#### Infiltration Applications: When water must infiltrate/exfiltrate through the geotextile as a function of the system design, a woven monofilament shall be used. In specialty applications, a microgrid/mesh may be approved as an alternative separation fabric, in consultation with the manufacturer’s representative.

#### Lined Applications: When water must be retained within the tanks to prevent infiltration/exfiltration, an impermeable liner shall be used. The liner material and thickness shall be specified by the project design engineer. This liner should be installed per liner manufacturer specifications and industry accepted techniques.

### Geogrid

#### For installations subject to traffic loads, install geogrid to reinforce backfill above the R-Tank system.

#### Geogrid is not required for R-TankXD and is often not required for non-traffic load applications.

## Bedding, Backfill & Cover Materials

### All materials shall be free from lumps, debris, and any sharp objects that could cut the geotextile.

### **Bedding Materials:** Stone (angular and smaller than 1.5” in diameter) or soil (GW, GP, SW, or SP as classified by the Unified Soil Classification System) shall be used below the R-Tank system (3” minimum and 12” maximum). For infiltration applications bedding material shall be free draining.

### **Side and Top Backfill:** Recommended backfill material should be clean and free of debris, with a particle size distribution that is appropriate for the specific application. Identical backfill material shall be used on the side and top of the units.

#### Traffic Applications: Backfill materials shall be free draining stone (angular and smaller than 1.5” in diameter) or soil (GW, GP, SW, or SP as classified by the Unified Soil Classification System).

#### Non-Traffic Applications - For all R-Tank modules installed in green spaces and not subjected to vehicular loads, backfill materials may either follow the guidelines for Traffic Applications above, or the top backfill layer may consist of AASHTO #57 stone blended with 30-40% (by volume) topsoil to aid in establishing vegetation.

#### Biofiltration / Bioretention Applications - Backfill materials shall be in accordance with the cross-section for the specific biofiltration/bioretention application and media. A layer of bridging stone shall separate the soil media from the R-Tank units.

### **Additional Cover Materials:** Additional cover material shall be structural fill meeting the gradational requirements of SM, SP, SW, GM, GP, or GW as classified by the Unified Soil Classification System. Structural fill shall be specified by the engineer of record.

## Other Materials

### **Utility Marker:** Install metallic tape at corners of R-Tank system to mark the area for future utility detection.

# EXECUTION

## excavation preparation

### Verify the site conditions are suitable for product storage and installation per guidelines.

### All excavations must meet OSHA safety standards for slopes or shoring.

### Stake out, excavate, and prepare the subgrade area per geotechnical engineer's recommendations and/or as shown on the design drawings, to provide adequate support for project design loads.

#### Ensure that the excavation is at least 2 feet greater than R-Tank dimensions in each direction allowing for installation of geotextile filter fabric, R-Tank modules, and free draining backfill materials.

#### Base of the excavation shall be uniform, level, and free of lumps or debris and soft or yielding subgrade areas.

### **Unsuitable Soils or Conditions:** All questions about the base of the excavation shall be directed to the owner’s engineer. The owner’s engineer shall determine the required bearing capacity of the R-Tank subgrade; however, in no case shall a bearing capacity of less than 2,000 pounds per square foot be provided.

## Bedding Preparation

### Where a geotextile wrap is specified between the native soil and stone base, cut strips to length, and install in excavation, removing wrinkles so material lays flat.

#### Overlap geotextile a minimum 12” or as recommended by manufacturer. Use tape, special adhesives, sandbags, or other ballast to secure overlaps.

#### Where an impervious liner is specified, install the liner per manufacturer’s recommendations and the contract documents. The liner should be sandwiched between layers of non-woven geotextile at a minimum.

#### As geotextiles can be damaged by extreme heat, smoking is not permissible on/near the geotextile, and tools using a flame to tack the overlaps, such as propane torches, are prohibited.

### Place a thin layer (3” unless otherwise specified) of bedding material (Section 2.03A), within ½” (+/- ¼”) of level or as shown on the plans. Vibratory tamp or static roll to prepare bedding materials until they are firm and unyielding.

### Outline the footprint of the R-Tank system on the excavation floor using spray paint or chalk line to ensure a 2’ perimeter is available around the R-Tank system for proper installation and compaction of backfill.

## Layout and installation of R-Tank Units

### Install a geotextile wrap by cutting strips to length and removing wrinkles so material lays flat.

#### Overlap geotextile a minimum 12” or as recommended by manufacturer. Use tape, special adhesives, sandbags, or other ballast to secure overlaps.

#### Where an impervious liner is specified, install the liner per manufacturer’s recommendations and the contract documents. The liner should be sandwiched between layers of non-woven geotextile at a minimum.

#### As geotextiles can be damaged by extreme heat, smoking is not permissible on/near the geotextile, and tools using a flame to tack the overlaps, such as propane torches, are prohibited.

### Mark or outline the unit area to ensure a square and straight installation.

### Assemble R-Tank units in accordance with the R-Tank drawings and installation guidelines.

### Install R-Tank modules by placing side by side, in accordance with the design drawings. The modules are to be oriented as per the design drawing with required depth as shown on plans.

#### For HD and SD installations, the large side plate of the tank should be placed on the perimeter of the system. This will typically require that the ends of the tank area will have a row of tanks placed perpendicular to all other tanks. Refer to R-Tank drawings and installation guide for more details.

#### For MD, UD, and XD installations, there is no perpendicular end row required.

#### For MD installation, external side panels shall be installed around the perimeter of the system. Stacking clips shall be installed in each tier and each direction, as shown on design drawing details.

#### For XD installations, install stacking clips as specified in design drawings.

## 3.03 Layout and installation of R-Tank Units (Continued)

### Completely encapsulate the R-Tank units in the specified geotextile to prevent backfill entry into the system. Overlap geotextile 12” or as recommended by manufacturer. Take great care to avoid damage to geotextile (and, if specified, impervious liner) during placement.

### Identify any inlet(s) or outlet(s) locations. The geotextile fabric shall be cut to enable hydraulic continuity between the connections and the R-Tank units. These connections shall be secured using pipe boots with stainless steel pipe clamps. Support pipe in trenches during backfill operations to prevent pipe from settling and damaging the geotextile wrap or pipe. Ensure end of pipe is installed snug against R-Tank system.

### Install inspection and ventilation ports in locations noted on plans. At a minimum one maintenance port shall be installed within 10’ of each inlet & outlet connection, and with a maximum spacing of approximately 50’ on center. Install all ports as noted in the R-Tank Installation Guide.

## Backfilling of the R-Tank Units

### Backfill with materials in accordance with Section 2.03C and project specifications

#### Place material around the perimeter of the units in lifts with a maximum thickness of 12” and compacted with walk behind compaction equipment.

##### Each lift shall be placed around the entire perimeter such that each lift is no more than 24” higher than the side backfill along any other location on the perimeter of the R-Tank system.

##### No fill shall be placed over top of tanks until the side backfill has been completed.

##### Each lift shall be compacted project specifications or until no further densification is observed (for self-compacting stone materials). Even when “self-compacting” backfill materials are selected, a walk behind vibratory compactor must be used.

##### Take care to ensure that the compaction process does not allow the machinery to contact the modules due to the potential for damage to the geotextile and R-Tank units.

##### No compaction equipment is permissible to operate directly on the R-Tank modules.

#### Place a top backfill layer on the units to the thickness specified in the R-Tank drawings and in accordance with project specifications.

##### Only low-pressure track vehicles shall be operated over the R-Tank system during construction. Dump Trucks and Pans shall not be operated within the R-Tank system footprint at any time. Heavy equipment should unload in an area adjacent to the R-Tank system and the material should be moved over the system using low ground pressure tracked equipment.

##### Lightly compacted using a walk-behind trench roller. Alternately, a roller (maximum gross vehicle weight of 6 tons) may be used. Roller must remain in static mode until a minimum of 24” of cover has been placed over the modules. Sheep foot rollers should not be used.

### If specified, completely encapsulate the backfill in the specified geotextile. Overlap geotextile 12” or as recommended by manufacturer. Take great care to avoid damage to geotextile (and, if specified, impervious liner) during placement.

### If required, install a geogrid as shown on plans. Geogrid shall extend a minimum of 3 feet beyond the limits of the excavation wall. In cases of limitations such as curb, property line, etc. consult a manufacturer’s representative about reducing the minimum extension length.

### Following placement and compaction of the initial cover, subsequent lifts of structural fill (Section 2.03D) shall be placed and compacted per engineer of record specifications. Do not exceed maximum cover depths listed in Table 2.01B.

### Ensure that all unrelated construction traffic is kept away from the limits of excavation until the project is complete and final surface materials are in place. It is recommended that high visibility tape or other devices be placed around the system to prevent traffic access.

### Place surfacing materials, such as groundcovers (no large trees), or paving materials over the structure with care to avoid displacement of cover fill and damage to surrounding areas.

## Maintenance Requirements

### A routine maintenance effort is required to ensure proper performance of the R-Tank system. The Maintenance program should be focused on pretreatment systems. Ensuring these structures are clean and functioning properly will reduce the risk of contamination of the R-Tank system and stormwater released from the site. Maintain as needed using acceptable practices or following manufacturer’s guidelines (for proprietary systems).

### All inlet pipes and Inspection and/or Maintenance Ports in the R-Tank system will need to be inspected for accumulation of sediments at least quarterly through the first year of operation and at least yearly thereafter.

### If sediment has accumulated to the level noted in the R-Tank Operation and Maintenance Guide or beyond a level acceptable to the Owner’s engineer, the R-Tank system should be flushed.

## END OF SECTION