

PART 1 – GENERAL

1.01 Related Documents

- A. Drawings, technical specification and general provisions of the Contract as modified herein apply to this section.

1.02 Description of Work Included

- A. Provide excavation and base preparation per geotechnical engineer's recommendations and/or as shown on the design drawings, to provide adequate support for project design loads and safety from excavation sidewall collapse. Excavations shall be in accordance with the Owner's and OSHA requirements.
- B. Provide and install R-Tank^{HD} System and all related products including fill materials, geotextiles, geogrids, inlet and outlet pipe with connections per the manufacturer's installation guidelines provided in this section.
- C. Provide and Construct the cover of the R-Tank^{HD} System including; stone backfill, structural fill cover and pavement section as specified.
- D. Protect R-Tank^{HD} System from construction traffic after installation until after completion of all construction activity in the installation area.

1.03 Quality Control

- A. All materials shall be manufactured in ISO certified facilities.
- B. Installation Contractor shall demonstrate the following experience:
 - 1. A minimum of 3 R-Tank^{HD} or equivalent projects completed within 2 years; and,
 - 2. A minimum of 25,000 cubic feet of storage volume completed within 2 years.
 - 3. Contractor experience requirement may be waived if the manufacturer's representative provides on-site training and review during construction.
- C. Installation Personnel: Performed only by skilled workers with satisfactory record of performance on bulk earthworks, pipe, chamber, or pond/landfill construction projects of comparable size and quality.
- D. Contractor must have manufacturer's representative available for site review if requested by Owner.

1.04 Submittals

- A. Submit proposed R-Tank^{HD} layout drawings. Drawings shall include typical section details as well as the required base elevation of stone and tanks, minimum cover requirements and tank configuration.
- B. Submit manufacturer's product data, including compressive strength and unit weight.
- C. Submit manufacturer's installation instructions.
- D. Submit R-Tank^{HD} sample for review. Reviewed and accepted samples will be returned to the Contractor.
- E. Submit material certificates for geotextile, geogrid, base course and backfill materials.
- F. Submit required experience and personnel requirements as specified in Section 1.03.

1.05 Delivery, Storage, and Handling

- A. Protect R-Tank^{HD} and other materials from damage during delivery and store UV sensitive materials under tarp to protect from sunlight when time from delivery to installation exceeds one week. Storage of materials should be on smooth surfaces, free from dirt, mud and debris.
- B. Handling is to be performed with equipment appropriate to the materials and site conditions, and may include hand, handcart, forklifts, extension lifts, etc.
- C. Cold weather:
 - 1. Care must be taken when handling plastics when air temperature is at 40 degrees or below as plastic becomes brittle.
 - 2. Do not use frozen materials or materials mixed or coated with ice or frost.
 - 3. Do not build on frozen ground or wet, saturated or muddy subgrade.

1.06 Preinstallation Conference.

- A. Prior to the start of the installation a preinstallation conference shall occur with the representatives from the design team, the general contractor, the excavation contractor, the R-Tank^{HD} installation contractor and the Manufacturer.

1.07 Project Conditions

- A. Coordinate installation for the R-Tank^{HD} System with other on-site activities to eliminate all non-installation related construction traffic over the completed R-Tank^{HD} System. No loads heavier than the design loads shall be allowed over the system and in no case shall loads higher than a standard AASHTO H20 loads be allowed on the system at any time.
- B. Protect adjacent work from damage during R-Tank^{HD} System installation.
- C. All Pre-Treatment Systems to remove debris and heavy sediments must be in place and functional prior to operation of the R-Tank^{HD} System. Additional pretreatment measures may be needed if unit is operational during construction due to increased sediment loads.
- D. Contractor is responsible for any damage to the system during construction.

PART 2 – PRODUCTS

2.01 R-Tank^{HD} Units

- A. R -Tank^{HD} - Injection molded plastic tank plates assembled to form a 95% void modular structure of predesigned height (custom for each project).
- B. R-Tank^{HD} units shall meet the following Physical & Chemical Characteristics:

	Standard 4-Plate Unit	Heavy Duty 5-Plate Unit
Material	100% Recycled Polypropylene	
Void Area	95%	
Void Surface Area	95%	
Unit Weight	3.25 lbs / cf	3.75 lbs / cf
Service Temperature	-14 to 167 degrees Fahrenheit	
Unconfined Crush Strength <small>(tested with load plate covering entire unit)</small>	30 psi	40 psi

-Supplier: ACF Environmental 2831 Cardwell Road Richmond, VA 23234
 (T): 800-448-3636; (F): 804-743-7779 www.acfenvironmental.com

2.02 Geosynthetics

- A. Geotextile for Standard Application: A geotextile envelope is required to prevent soil material from entering R-Tank^{HD} Area. The standard geotextile shall be an 8 oz per square yard nonwoven geotextile (ACF N080 or equivalent).
- B. Applications requiring water to infiltrate/exfiltrate through the geotextile as a function of the design shall utilize a woven monofilament (ACF M200 or equivalent).
- C. Geogrid: Where required install Synteen SF12 or equivalent to reinforce backfill above the R-Tank^{HD} System to stiffen the subgrade when subject to design traffic loads (Geogrid is often not required for non-traffic load applications).

2.03 Structural Fill

- A. Free Draining backfill shall be utilized as the bedding materials below the R-Tank^{HD} System and for backfill of the sides of the tank (Side backfill for a minimum of 2 feet), and the initial 12 inches of material placed above the R-Tank^{HD} system. Structural fill is to be utilized above the R-Tank^{HD} system following the initial 12 inch lift.
- B. Free Draining Backfill: Stone (smaller than 1.5" in diameter) or soil (GW, GP SW or SP as classified by the Unified Soil Classification System) can be used. Material must be free from lumps, debris and any sharp objects that could cut the geotextile. Material shall be within 3 percent of the optimum moisture content as determined by ASTM D698 at the time of installation.
- C. Structural Fill: Structural Fill shall consist of granular materials meeting the gradational requirements of SM, SP, SW, GM, GP or GW as classified by the Unified Soil Classification System. Structural fill shall have a maximum of 25 percent passing the No. 200 sieve, shall have a maximum clay content of 10 percent and a maximum Plasticity Index of 4. Material shall be within 3 percent of the optimum moisture content as determined by ASTM D698 at the time of installation.

2.04 General

- A. Utility Marker: Install metallic tape at corners of R-Tank^{HD} System to mark the area for future utility detection.

PART 3 - EXECUTION

3.01 Assembly of R-Tank^{HD} Units

- A. Assembly of R-Tank^{HD}. On-site assembly of tanks shall be performed in accordance with the R-Tank^{HD} Installation Manual Section 2.

3.02 Layout and Excavation

- A. Installer shall stake out, excavate and prepare the subgrade area to the required plan grades and dimensions, ensuring that the excavation is at least 2 feet greater than R-Tank^{HD} dimensions in each direction allowing for installation of geotextile filter fabric, R-Tank^{HD} modules and free draining backfill materials.
- B. All excavations must be prepared with OSHA approved excavated sides and sufficient working space.
- C. Protect partially completed installation against damage from other construction traffic by establishing a perimeter with high visibility construction tape, fencing, barricades or other means until construction is complete.
- D. Base of the excavation shall be smooth, level (variation of less than 1/2"), firm, flat and free of lumps or debris and soft or yielding subgrade areas. For standard applications, compact base to a minimum of 95% of Standard Proctor (ASTM D698) density or as required by the Owner's engineer. For Infiltration applications, base shall be prepared in accordance with the contract documents. Compaction of subgrade should not be performed in infiltration applications. If unsuitable soils are encountered at the base, or if the base is pumping or appears excessively soft, repair the area in accordance with contract documents and as directed by the Owner's engineer.
- E. Base of the excavation shall be reviewed by the Owner's Engineer prior to placement of stone. If unsuitable soils are encountered at the base, or if the base is pumping or appears excessively soft, repair the area in accordance with contract documents and as directed by the Owner's Engineer. The Owner's Engineer shall determine the required bearing capacity of the R-Tank^{HD} subgrade; however in no case shall a bearing capacity of less than 2,000 pounds per square foot be provided.
- F. If indications of the water table are observed during excavation, the engineer shall be contacted to provide recommendations.
- G. Do not start installation of the R-Tank^{HD} System until unsatisfactory subgrade conditions are corrected and the subgrade conditions are accepted by the Owner's engineer. If existing conditions are found unsatisfactory, the Owner's Engineer should be contacted for resolution prior to installation.

3.03 Preparation of Base

- A. Place a thin layer (3" unless otherwise specified) of freely draining backfill materials (Section 2.03 B), over the subgrade to establish a level working platform for the R-Tank^{HD} units. Level to within 1/2" or as shown on the plans. Native subgrade soils may be used if determined to be stable and freely draining by the Owner's Engineer.
- B. Outline the footprint of the R-Tank^{HD} System on the excavation floor using spray paint or chalk line to ensure a 2' perimeter is available around the R-Tank^{HD} System for proper installation and compaction of backfill.

3.04 Installation of the R-Tank^{HD} Units

- A. Where a geotextile wrap is specified on the base of the excavation, cut strips to length and install in excavation, removing wrinkles so material lays flat. Overlap geotextile a minimum 12" or as recommended by manufacturer.
- B. Where an impervious liner (for containment) is specified, install the liner per manufacturer's recommendations and the contract documents. The R-Tank^{HD} units shall be separated from impervious liner by a non-woven geotextile fabric installed accordance with Section 3.04A.
- C. Install R-Tank^{HD} Units by placing side by side, in accordance with the design drawings. No lateral connections are required. It is advisable to use a string line to form square corners and straight edges along the perimeter of the R-Tank^{HD} System. The modules are to be oriented as per the design drawing (15.75" x 28.15") with required depth as per plans. The large side plate of the tank should be placed on the perimeter of the system.

This will typically require that the two ends of the tank area will have a row of tanks placed perpendicular to all other tanks. If this is not shown in the construction drawings, it is a simple field adjustment that will have minimal effect on the overall system footprint. Refer to R-Tank^{HD} Installation Guide for more details.

- D. Wrap the R-Tank^{HD} top and sides in specified geotextile. Cut strips of geotextile so that it will cover the sides and top, encapsulating the entire system to prevent soil 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.
- E. Identify locations of inlet, outlet and any other penetrations of the geotextile (and optional liner). These connections should be installed flush (buted up to the R-Tank^{HD}) and the geotextile fabric shall be cut to enable hydraulic continuity between the connections and the R-Tank^{HD} 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, impervious liner (if specified) or pipe. Connecting pipes at 90 degree angles facilitates construction, unless otherwise specified. Ensure end of pipe is installed snug against R-Tank^{HD} System.
- F. Install Inspection and Maintenance Ports in locations noted on plans. At a minimum one maintenance port shall be installed within 10' of each inlet & outlet connections, and with a maximum spacing of one maintenance port for every 2,500 square feet. Install all ports as noted in the R-Tank^{HD} Installation Guide.
- G. Install ventilation pipes and vents as specified on drawings to provide required ventilation for proper hydraulic performance. The number of pipes and vents will depend on the size of the system. Vents are often installed using a 90 degree elbow with PVC pipe into a landscaped area with 'U' bend or venting bollard to inhibit the ingress of debris. A ground level concrete steel cover can be used.

3.05 Backfilling of the R-Tank^{HD} Units

- A. Backfill and fill with recommended materials as follows:
 - 1. Place freely draining backfill materials (Section 2.03 B) around the perimeter in lifts with a maximum thickness of 12". 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^{HD} System. No fill shall be placed over top of tanks until the side backfill has been completed.
 - 2. Each lift shall be compacted at the specified moisture content to a minimum of 95% of the Standard Proctor Density until no further densification is observed (for self-compacting stone materials). The side lifts must be compacted with walk behind compaction equipment. Even when "self-compacting" backfill materials are selected, a walk behind vibratory compactor must be used
 - 3. Take care to ensure that the compaction process does not allow the machinery to come into contact with the modules due to the potential for damage to the geotextile and R-Tank^{HD} Units.
 - 4. No compaction equipment is permissible to operate directly on the R-Tank^{HD} Units.
 - 5. Following placement of Side Backfill, a lift of the freely draining material (Section 2.03 B) shall be placed over the R-Tank^{HD} Units before any structural backfill is placed over the R-Tank^{HD} System.
 - 6. Each lift of structural fill (Section 2.03 C) shall be placed at the specified moisture content and compacted to a minimum of 95% of the Standard Proctor Density and shall cover the entire footprint of the R-Tank^{HD} System. During placement of fill above the system, unless otherwise specified, a uniform elevation of fill shall be maintained to within 12" across the footprint of the R-Tank^{HD} System.
 - 7. Place additional layers of geotextile and/or geogrid at elevations and extent as specified in the design details. Each layer of geosynthetic reinforcement placed above the R-Tank^{HD} System shall extend a minimum of 3 feet beyond the extent of the excavation wall.
- B. Only low pressure tire or track vehicles shall be operated over the R-Tank^{HD} System during construction. Compaction equipment shall be limited to a maximum gross vehicle weight of 6 tons. No machinery should drive on top of the tank until a minimum of 18" of backfill and compaction is achieved. "Triaxial Dump Trucks" and "Pans" shall not be operated within the R-Tank^{HD} System footprint at any time. Where necessary the heavy equipment should unload in an area adjacent to the R-Tank^{HD} System and the material should be moved over the system with tracked equipment.
- C. Ensure that all unrelated construction traffic be kept away from the limits of excavation until the project is complete and final surface materials are in place. No non-installation related loading should be allowed over the R-Tank^{HD} system until the final design section has been constructed (including pavement).
- D. 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.

- E. Backfill depth over R-Tank^{HD} System must be a minimum of 18" prior to placing compaction equipment directly above R-Tank^{HD} System. If the total backfill depth is less than 18", contact engineer or manufacturer's representative for assistance.

PART 4 – USING THE SYSTEM

4.01 Maintenance Requirements

- A. A routine maintenance effort is required to ensure proper performance of the R-Tank^{HD} 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^{HD} System and stormwater released from the site. Pre-treatment systems shall be inspected yearly, or as directed by the regulatory agency and by the manufacturer (for proprietary systems). Maintain as needed using acceptable practices or following manufacturer's guidelines (for proprietary systems).
- B. Inspection and/or Maintenance Ports in the R-Tank^{HD} System will need to be inspected for accumulation of sediments at least quarterly through the first year of operation and at least yearly thereafter. This is done by removing the cap of the port and using a measuring device long enough to reach the bottom of the R-Tank^{HD} System and stiff enough to push through the loose sediments, allowing a depth measurement.
- C. If sediment has accumulated to the level noted in the R-Tank^{HD} Maintenance Guide or beyond a level acceptable to the Owner's engineer, the R-Tank^{HD} System should be flushed.
- D. A flushing event consists of pumping water into the Maintenance Port and/or adjacent structure, allowing the turbulent flows through the R-Tank^{HD} System to re-suspend the fine sediments. If multiple Maintenance Ports have been installed, water should be pumped into each port to maximize flushing efficiency. Sediment-laden water can be shall be filtered through a Dirtbag™ or approved equivalent if permitted by the locality.

END OF SECTION