



SECTION _

SPECIFICATION FOR TERRE KLEEN™ HYDRODYNAMIC SEPARATOR US Patent No. US 6,676,832 B2

BY

TERRE HILL STORMWATER SYSTEMS, Division of Terre Hill Concrete products
485 WEAVERLAND VALLEY ROAD
TERRE HILL, PA 17581
TEL.: (717) 445-3100 FAX: (717) 445-0242.
www.terrestorm.com

Verify latest version of specifications

PART 1-GENERAL

1.1 DESCRIPTION

- A.** This work shall consist of manufacturing, delivering to the job site and installing a **Terre Kleen™ (US Patent No. US 6,676,832 B2)**; an inclined plate cell hydrodynamic separator (containing the specified number of inclined plates for each unit) at each location as shown on the contract plans. The unit shall treat all stormwater without loss of floatable matter, such as trash, debris, litter and oil and grease captured in the oil booms; there shall be no scour of settled sediment from the baffled sediment hopper located under the inclined plates in the grit chamber. External by-pass structures are not allowed. Each unit has a primary chamber and grit chamber. The primary chamber separates oil, grease and floatable debris contained in a fully baffled area to prevent loss or re-suspension of captured oil, grease, and floatable trash and debris including captured sediment. This chamber is followed by an inclined plate sedimentation unit placed above a protected sediment collection hopper in a grit chamber into which the stormwater flows after passing through a nutrient screen in the divider wall between the two chambers. The unit shall contain an internal flow through duct located between the primary chamber and the grit chamber. Flows in excess of the design flow shall pass through the unit through the internal flow through duct. This

product is produced by Terre Hill Concrete Products under the name "Terre Kleen™". All rights are reserved.(US Patent No. 6,676,832 B2)

- B. The Terre Kleen™ (US Patent No. US 6,676,832 B2)** inclined plate separator shall operate based on the hydrostatic pressure differential between the inlet and outlet pipe. The flow is split in proportion to the number of inclined plate cells. The cells treat the water in parallel and combine the flow at the overflow weir. The inclined plate cell surfaces facilitate sliding of the sediment to the hopper below where it is protected from scour from subsequent flows. The design of the device shall prevent loss of captured pollutants including oil, grease, trash, debris, and sediment through scouring or other causes during all flows and conditions. The nutrient screen shall be positioned to allow passage of all flows without allowing loss of captured pollutants.
- C.** The internal flow through duct provides additional flow area in addition to the inclined plate cells. All flows pass through the primary chamber so as to capture oil grease and floatable trash and debris and to allow by-pass of the excess flows only in the internal flow through duct while requiring design flows to continue to be treated in both the primary and the sedimentation grit chamber. The internal by-pass shall not allow loss of any captured pollutants during excess flows.
- D.** Both the primary and the grit chambers shall be accessible through removable covers at grade for the removal of floatable material, water and the settled solids and floating particulates using a standard vacuum truck. No confined space entry shall be required for removal of captured pollutants.
- E.** The grit chamber hopper shall contain a sludge dispersion manifold that shall be pressurized with water causing dislodging of the settled sludge below the inclined plate settler for drainage towards the vacuum suction points.
- F.** Captured sediment storage shall be not less than $0.7 \text{ Ft}^3/\text{Ft}^2$ of settling area in the Terre Kleen.
- G.** Oil Storage shall be not less than $1.5 \text{ gallons}/\text{Ft}^2$ in the in the **Terre Kleen™ (US Patent No. US 6,676,832 B2)**

1.2 SUBMITTALS

- A. Shop drawings shall be submitted as described in Division 1 – General Requirements.
- B. Certifications by a Professional Engineer licensed in the state of installation shall be submitted that the **Terre Kleen™ (US Patent No. US 6,676,832 B2)** inclined plate hydrodynamic separator structure conforms to the standards listed in this Specification.

1.3 REFERENCES

- A. ASTM International (ASTM):
 - A-48 Specification for Gray Iron Castings
 - C-32 Specification for Sewer and Manhole Brick
 - C-270 Specification for Mortar for Unit Masonry
 - C-478 Specification for Precast Reinforced Concrete Manhole Sections
 - C-913 Standard Specification for Precast Concrete Water and Wastewater Structures
 - US Patent No. US 6676832 B2; Surface water purifying catch basin.
- B. Federal Specifications (FS):
 - FS-SS-S-210 Sealing Compound, Preformed Plastic for Expansion Joints and Pipe Joints

1.4 MANUFACTURERS

- A. The products furnished by named manufacturers are specified as a standard of quality and performance.
- B. The manufacture of the concrete structure shall be performed at a precast production facility certified by the National Precast Concrete Association (NPCA).
- C. The manufacturer of the **Terre Kleen™ (US Patent No. US 6,676,832 B2)** shall be licensed to produce and or sell the entire

device or any components thereof by Terre Hill Concrete Products of Terre Hill Pennsylvania 717-445-3100.

PART 2- PRODUCTS

2.1 MATERIALS AND DESIGN

- A.** The reinforced concrete vault structure shall be designed for HS-25 traffic loading, and existing soil pressure, ground water pressure and buoyancy. The materials and structural design shall be per ASTM C-478 and ASTM C-913. The concrete shall have a minimum compressive strength of 5000 psi.
- B.** The access cover shall be designed for HS-25 traffic loading and shall provide a minimum of 27 1/2 inches clear opening. Manhole frame and cover shall be East Jordan or Quirin manufactured from gray iron conforming to ASTM A-48 Class 35B. The cover shall contain the words "Stormwater Treatment System" and the Terre Kleen™ logo as approved by Terre Hill Concrete Products.
- C.** Butyl mastic sealant for joints shall conform to ASTM C-990.
- D.** Pipe openings shall be sized to accept pipes of the specified sizes and shall be sealed with hydraulic cement conforming to ASTM C-595M.
- E.** The metal components of the inclined cell separator, baffle wall Aluminum Alloy 5052 (UNS # A95052) or equal.
- F.** The hinge pins of the inclined cell separator shall be manufactured from stainless steel AISI Type 304L (UNS # S30403).
- G.** All fasteners used in combination or connecting the inclined cell separator to the concrete structure shall be made from stainless steel AISI 316 (UNS # 31600) and the threads shall be properly lubricated with Permatex anti-seize Item 80078 lubricant or equal. All surfaces of aluminum components that are to be embedded or in contact with fresh, unhydrated concrete shall be coated with Koppers Bitumastic 300M.
- H.** Per 57 Ft² of sedimentation area, four (4) Ø 2 ¼" x 12" long sorbent booms with an absorption capacity of ¼ gallon per lineal

foot shall be placed in the primary chamber for the absorption of gasoline; diesel fuel, lube oil, jet fuel, transformer oils, chlorinated solvents, aromatic solvents, hydraulic oils, light crude. The sorbent boom or Rubberizer® boom shall be manufactured by Haz-Mat Response Technologies Inc. or approved equal.

2.2 PERFORMANCE

- A.** The inlet pipe shall discharge the storm water into the primary chamber. In the primary chamber, the separator shall facilitate the floatation of liquids and particles lighter than the density of water. Floatable solids, greater than 19mm [3/4"], and liquids shall be retained in the primary chamber, and shall not be subject to loss through re-suspension or any other cause. Emulsified oils are not captured and are not part of the floatable mass.
- B.** The heavy fraction of the solids shall settle in the bottom of the primary chamber.
- C.** Particles in the range of 50 to 500 micro meters (μM) kept in suspension due to turbulence in the primary chamber shall pass through a nutrient screen with a maximum screen opening of 16mm x 16mm [5/8"x 5/8"] and enter the grit chamber (sediment grit chamber) through a parallelogram port at the bottom of the inclined cell walls. This opening shall be approximately mid-elevation between the inlet pipe invert and the vault invert.
- D.** The solids and water between the inclined cell plate walls shall travel in an inclined direction toward the overflow weir at the top of the inclined plate cell. During this process, the solids shall settle and slide down towards the bottom of each plate cell and drop into the receiving hopper of the sedimentation grit chamber. The water shall discharge at the top of the cell, pass across a V-notch weir and cascade onto a baffle plate and drain to the effluent outlet pipe.
- E.** The particles that shall be removed in the grit chamber shall be silt, fine sand, and sand. The typical density of these particles is 2400 kg/M³ [150lbs/ft³], and their size between 2 microns and 1000 microns with a d_{50} = 70 Micron. The projected sedimentation surface area of the grit chamber shall be the cumulative horizontal projection of the sedimentation cell-floors that make up the

sedimentation grit chamber. The total projected sedimentation surface area of the sedimentation cells, contained within the total structure footprint shall not be less than as follows:

<u>Model</u>	<u>Structure Size</u>	<u>Sedimentation Surface Area</u>
1. Terre Kleen 09	4'6" x 7'0" (31.50 ft ²)	57 ft ²
2. Terre Kleen 18	6'6" x 7'0" (45.50 ft ²)	115 ft ²
3. Terre Kleen 27	8'6" x 7'0" (59.50 ft ²)	172 ft ²
4. Terre Kleen 36	10'6" x 7'0" (73.50 ft ²)	230 ft ²
5. Terre Kleen 45	12'6" x 7'0" (87.50 ft ²)	288 ft ²
6. Terre Kleen 54	14'6" x 7'0" (101.50 ft ²)	345 ft ²
7. Terre Kleen 63	16'6" x 7'0" (115.50 ft ²)	403 ft ²

F. The design flow in M³/sec [GPM or CFS] for each **Terre Kleen™ (US Patent No. US 6,676,832 B2)** inclined plate hydrodynamic separator water quality treatment device shall be as noted on the drawings.

PART 3-INSTALLATION

3.1 INCLINED PLATE SEPARATOR FABRICATION

A. Fabrication of the **Terre Kleen™ (US Patent No. US 6,676,832 B2)** inclined plate hydrodynamic separator water quality device shall be in strict accordance with the design.

B. The **Terre Kleen™ (US Patent No. US 6,676,832 B2)** inclined plate hydrodynamic separator water quality device shall be provided with mounting brackets for installation into the precast concrete structure with stainless steel mounting anchors.

C. The **Terre Kleen™ (US Patent No. US 6,676,832 B2)** inclined plate hydrodynamic separator shall be provided with a flow channel on the effluent side of the settler and a clean-out opening next to the channel.

D. The nutrient screen shall be placed as an extension of the baffle wall at the entrance to the parallelogram port in the divider wall.

E. Certified welders experienced in the welding of specified thin

metals shall place all welds.

- F. The fabricator shall remove shop soils, discoloration, and welding slag.

3.2 PRECAST CONCRETE STRUCTURE

- A. The utility contractor installing the precast concrete structure shall be responsible installing the structure so as to stop the infiltration or loss of water into or out of the precast concrete structure.
- B. The precast concrete structure shall be installed level and plumb at the specified elevation shown on the signed, approved plans, on a compacted stone sub base 150mm [6"] thick.
- C. Excavation and backfill shall be as specified in the signed, approved plans.

3.3 MANUFACTURER INSTALLATION TECHNICAL ASSISTANCE

- A. At the time and place of installation of any **Terre Kleen™ (US Patent No. US 6,676,832 B2)** the manufacturer, Terre Hill Concrete Products will provide a Product Liaison on site to offer technical assistance to the installation contractor to assure proper installation of the **Terre Kleen™ (US Patent No. US 6,676,832 B2)** in accordance with the signed, approved plans.

3.4 OPERATION AND MAINTENANCE

- A. The maintenance of the **Terre Kleen™ (US Patent No. US 6,676,832 B2)** is the responsibility of the Owner. Each site has unique site conditions. It is the responsibility of the Owner to establish a schedule according to the conditions of the specific **Terre Kleen™ (US Patent No. US 6,676,832 B2)** location. Failure to clean the sediment from the **Terre Kleen™ (US Patent No. US 6,676,832 B2)** and to replace oil absorption booms will cause the **Terre Kleen™ (US Patent No. US 6,676,832 B2)** to not maintain its design performance capabilities. It is strongly recommended that the Owner follow the prescribe maintenance specifications and procedures published by Terre Hill Concrete Products and

copy thereof given to the installation contractor for delivery to the Owner.(A copy of the Maintenance Procedures are attached hereto and made a part hereof.)

PART 4 Maintenance Procedures for Terre Kleen™

4.1 General

A Inspection and maintenance must be performed on a regular basis, All captured pollutants must be removed from the **Terre Kleen™ (US Patent No. US 6,676,832 B2)**. During the first year after installation inspections should be performed every three (3) months to determine the type and amount of pollutants in the **Terre Kleen™ (US Patent No. US 6,676,832 B2)**. Site conditions and weather will influence the rate of pollutant capture. A schedule of regular maintenance can then be established based upon the quarterly inspections.

4.2 Pollutant Removal

A Access to both the primary and grit chambers is provided by manhole openings. The gross pollutants such as litter and the oil absorption booms should be removed first. A vacuum truck or similar equipment is then utilized to remove the water and the sediment. Disposal of all of the removed pollutants should be properly documented in accordance with all applicable regulations. Removal may be done anytime after a rain event.

At all times keep sparks and flames away from the **Terre Kleen™ (US Patent No. US 6,676,832 B2)** as it may contain flammable material.

The **Terre Kleen™ (US Patent No. US 6,676,832 B2)** is designed for inspection and cleaning from grade. If “confined entry” is desired, trained and certified personnel using OSHA regulation equipment is required.

Manhole covers and inlet grates must be put back securely to the frames after inspection or maintenance.

4.3 Documentation

A Proper documentation should include:

- a) dates and results of each inspection;
- b) proposed and installed repairs, renovations, improvements;
- c) type and amount of captured pollutants;

- d) disposal of pollutants;
- e) preparation and submittal of reports;
- f) document nutrient and sediment trading credits.

4.4 Measurement

A A carefully lowered stadia rod or similar instrument may be used to determine amount of captured sediment. The sludge dispersion manifold can assist in the removal of sediment. Manifold pipes mounted to the floor of the grit chamber connect to a hose that leads to the grade level manhole. The hose is pressurized by the vacuum truck's spray nozzle. The pressurized manifold sprays water through small horizontal holes in the manifold pipes, which liquefies and disperses the sludge blanket for removal by the suction nozzle.

5.0 LIMITED WARRANTY

Terre Hill Stormwater Systems provides the following Express Written Limited Warranty in lieu of any other warranty, whether oral , written , express, or implied. (the Warranty). All other warranties, representations, remedies, guarantees claims, or legal or equitable causes of action, in contract, tort or otherwise; including the Implied Warranties of Merchantability and Fitness for a Particular Purpose are excluded.

- 1. This Warranty applies solely to the Terre Kleen™ (US Patent No. US 6,676,832 B2) products manufactured by Terre Hill Stormwater Systems and sold to the original purchaser (the Purchaser)**
- 2. The structural integrity of the Terre Kleen™ (US Patent No. US 6,676,832 B2); when installed in accordance with Terre Hill Stormwater System's written installation specifications, and in accordance with site conditions, requirements of all laws and regulations, are warranted to the Purchaser against defective materials and workmanship for four (4) years from the date of installation.**
- 3. Terre Hill Stormwater Systems agrees to provide the labor and material to remove the installed Terre Kleen™ (US Patent No. US 6,676,832 B2) and reinstall the Terre Kleen™ (US Patent No. US 6,676,832 B2), upon satisfactory proof of a breach of this Warranty.**
- 4. Excluded from Warranty are claims resulting from or caused by**

damage; alteration; accident; misuse; abuse involving the Terre Kleen™ (US Patent No. US 6,676,832 B2), or negligence of the Purchaser or any third party. to the Terre Kleen™ (US Patent No. US 6,676,832 B2)

- 5. Terre Hill Stormwater Systems sole liability to the Purchaser shall be as expressly set forth in this Warranty, whether the claim is based upon contract, tort, equity or any other legal or equitable theory.**
- 6. Under no circumstances shall Terre Hill Stormwater Systems be liable to Purchaser or any third party for product liability claims ; or the cost of goods or services related to the purchase or installation of the Terre Kleen™ (US Patent No. US 6,676,832 B2).**

The Warranty is contingent upon verification of installation in strict accordance with the Terre Hill Stormwater Systems specifications, and use of the product strictly for the application specified. The construction plans for installation of the product shall be approved in writing by Terre Hill Stormwater Systems, and the construction installation plans shall be sealed by a professional engineer, licensed to perform civil engineering in the jurisdiction wherein the product will be installed.

All conditions for product usage as specified by Terre Hill Stormwater Systems must be satisfied in order for any of the terms of the Warranty to be valid, in full or in part.

The Warranty guarantees that any product of the Terre Hill Stormwater System will equal or exceed the Terre Hill Stormwater System written performance claim for stormwater treatment.

This Warranty of Terre Hill Stormwater Systems does not extend to incidental, consequential, special, or indirect claims , expenses or damages. Terre Hill Stormwater Systems shall not be liable for penalties or liquidated damages, including loss of profits or production and overhead costs; or other loss or expense incurred by the Purchaser or any third party.

The Warranty is limited to those claims filed in writing with Terre Hill Stormwater Systems, a Division of Terre Hill Concrete Products on or before four

(4) years from the date of substantial completion of installation. The written claim shall specify and describe the alleged defect upon which the breach of Warranty is claimed in reasonable detail.

The Warranty with all of its obligations, rights and limitations and protections shall apply to Terre Hill Concrete Products.

END OF SECTION