



RUCK A FINS - R1032C (PATENTED)

MANUAL  
DESIGN AND INSTALLATION

CONNECTICUT  
2009

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# **RUCK ACCORDIONS**

## **SUMMARY**

EFFECTIVE LEACHING AREA = 7.0 SF/LF

NEW SYSTEMS SPACING 9 FEET c to c

6" OF COMPACTED SAND ASTM C-33 (OR EQUIV.) BELOW,  
6" INSIDE AND SIDES

PIPES USE ASTM SCH# 40,  
purchased from local lumber yard.

No fabric cover over trench

## **Introduction**

The RUCK ACCORDION system is a cost effective, treatment based upgrade from conventional stone and other leach field systems. The ACCORDION system is based on proven enhancements. Evapotranspiration, oxygen transfer, biodegradation, soil treatment and long-term operation are accomplished by using biotextile prefiltration and controlled soil loading.

Biofabric technology is based on 25 years of published research work and field experience.

Multiple vertical infiltrating surfaces of biofabric and sand is provided per square foot of trench bottom area. ACCORDIONS are installed on top of 6" of sand by stretching the unit to specified length in 42-INCH wide trench and filling with sand. The accordion modules are interconnected using PVC pipes.

The primary biomat layer forms within the biofabric. The ACCORDION leach field is sized for the long-term acceptance rate (LTAR). RUCK ACCORDION leach fields are designed to operate indefinitely, not for a half-life of 25 years as with other systems. The soil directly below the sand and accordion module develops only a minor secondary biomat layer. The result is a greater long-term infiltration capacity.

A list of published references is included in the manual.

ACCORDIONS can be used in all standard configurations:

- Fill and in-ground installations
- Level or sloped topography
- Trench layouts
- D-Box, serial or dosing distribution methods

RUCK SYSTEMS is actively pursuing product research and development in on-site systems. ACCORDIONS are also used in RUCK nutrient removal systems for more environmentally sensitive sites.

This design and installation manual must be used in conjunction with the current CODE.

We are available to assist you with specific design problems. We can review your designs prior to submission for approval.

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## **Advantages of RUCK ACCORDION System**

1. RUCK accordion fields are designed to last indefinitely. They are based on long term acceptance rates (LTAR) of the Bio-Mat fabric and the site, not the 15-30 year half life of conventional systems.
2. RUCK accordions are cost efficient.
3. Failure of soil interface is minimized because primary biomat layer forms inside the fabric.
4. Effluent infiltrates into the soil beneath after being filtered through fabric and 6" of sand.
5. Accordions provide better protection of ground water because of fabric and 6" of sand filtration prior to parent soil treatment. Unlike other systems, accordions do not permit high static heads that push the pollutants into the soil.
6. Accordions and sand cause steady infiltration, minimizing occurrence of sudden ponding on parent soil. This results in aerobic-anaerobic stability in soil and biodegrading bio-resistant pollutants in the effluent. Sudden soil ponding in other leach fields results in aerobic-anaerobic destabilization so that a bioresistant pollutants such as phenolic compounds move into the soil.
7. Long term siltation, that can bring about failure in other leach fields, is prevented.
8. Accordions, permitting shallower installation, provide greater evapotranspiration than occurs with the conventional stone leach or chamber leach fields because fabrics permit capillary flow and vapor transfer.
9. The accordion fins are surrounded by sand. The external loads are carried by the sand.

## Terms and Definitions

**RUCK ACCORDION:** A 7" high accordion of cusped core covered with biofabric

**ACCORDION BIOFABRIC:** EXXON typar 3401 non-woven geotextile satisfying AASHO M288-92 requirements for drainage and erosion control, permeability = 0.03 cm/s.

**CUSPATED CORE:** Rigid plastic core 1.25" wide used to separate biofabric, thereby creating multiple channels

**LTAR:** Long Term Acceptance Rate

**STE:** Septic Tank Effluent

**MGWT:** Maximum Ground Water Table Elevation

**DESIGN FLOW per bedroom** = 150 gallon per day

**CODE:** Connecticut Public Health Code, regulations and technical standards for subsurface sewage disposal systems

**D.B.:** Distribution Box

**CONCRETE SAND:** Effective size > 0.16mm ; Uniformity coefficient < 5 ;  
Passing # 100 < 5% ; Silica sand ;  
Coefficient of permeability > 5 ft/day ; ASTM C-33

## **1.0 Basic System Design**

1.1 Design and installation of ACCORDIONS system must comply with CT State regulations and the requirements of this manual.

1.1 The effective leaching area is 7.0 SF / LF. For commercial systems leach field areas increase depending on type of premises. Refer to section 4 for recommended size increases.

1.2 Normal design for CT requires 1.5 feet from bottom of any leach system to GWT. The ACCORDION BOTTOM can be 1.5 feet from GWT.

1.3 Accordions are placed on 6" of washed compacted concrete sand level base. Refer to section 6.2 for sand specifications. Solid 3" PVC sch 40 is used for gravity flow distribution and 2" PVC sch 40 is used for pumped systems. Accordion modules are connected as shown in FIG.2. Sand in accordion must also be compacted evenly. This ensures more equal distribution of effluent. Clean backfill and seeded topsoil completes accordion installation.

1.4 Top of accordions should be at least 4" lower than the DB outlet invert elevation. No fabric cover needed prior to backfill.

1.5 A 9 FT c to c space is required between parallel rows of accordions for new systems.

1.6 Optimum leach field layout is a single row of trench running along a contour line perpendicular to ground water flow direction. This provides best treatment, dispersion and minimum ground water mounding. This can be particularly important for large systems in poorly drained soils.

1.7 The wastewater must be equivalent to domestic wastewater. Garbage grinders and addition of garbage is not acceptable. The minimum pretreatment required is a two-compartment septic tank as required by Code.

## 2.0 Systems for Level Sites

**2.1 System Configuration:** Level system layouts may employ all leach field configurations. The bottom of the system and accordions are installed level at their design elevations.

**2.2 In-Ground Systems:** The first 6" of sand directly under the ACCORDIONS must conform to Section 6.2 of this manual.

**2.3 Raised Systems:** Fill material used in raised systems must conform to Sections 6.2 of this manual.

## 3.0 Systems for Sloped Sites

**3.1 System Configuration:** Field sizing is the same as for level systems. A distribution box is recommended between the septic tank and the leach area as an access port and for flow velocity reduction.

**3.2 TRENCH Spacing:** Minimum spacing of adjacent rows of trenches is 9 FT c to c.

**3.3 TRENCH Overflow Piping:** Overflow is handled by connecting the manifold with a high overflow D.B. and solid pipe down to the next manifold.

**3.4 Sand and Fill Specifications:** Fill material, sand bed bottom and backfill are the same as in level systems.

## 4.0 Commercial Systems

**4.1 System Sizing:** 7.0 SF / LF apply for commercial and non-commercial systems. Utilize CODE, section 4 to determine design flow for various commercial facilities.

**4.2 Problem Effluents:** Commercial systems for the food service industry should employ grease-trapping methods to limit excess grease to the leach field. Commercial laundry effluent contains fibers or suspended solids that will quickly clog a leach field. Prefiltering is recommended here. Other problem systems include milk product plants, service stations, slaughterhouses and rendering plants. Contact RUCK SYSTEMS for additional recommendations on commercial system design.



**4.3 Multiple Tanks:** Multiple septic tanks are recommended as a method of extending leach field life. Frequency of pumping of septic tanks and grease traps should be consistent with maximizing leach field life.

**4.4 Ground Water Mounding:** Large systems can produce ground water mounding in poorly drained soils. Designers should avoid square leach field geometries. A rectangular system, with the narrow field width dimension in the perpendicular direction to the groundwater gradient, produces the least ground water mounding. Level sites also require more rectangular geometries in order to maximize radial dispersion of effluent. State of CT requires MLSS calculations. Large systems require more engineering using coefficient of permeability and saturated flow models for mounding analysis.

## **5.0 Pumped Systems**

**5.1 D.B. Systems:** When topography dictates, the pumped system includes a force main to the D.B. and gravity distribution to the leach field. Provide velocity reduction in the D.B. For single homes the volume of effluent pumped per pump cycle should not exceed 75 gal. To avoid distribution box flooding, use large D. B. and elevate D. B. 6" higher than the distribution pipes.

**5.2 Pressure Dosing:** Pressure dosed ACCORDION designs are sometimes used for large engineered systems. Sizing for pressure dosed leach system is the same as for gravity-dosed system. Multiple pumps or siphon dosed distribution boxes ensure close to equal distribution between separate leach areas.

## INSTALLATION GUIDELINES

### 6.1 Site Preparation:

A. Remove obstructing items such as stumps, boulders, etc... The organic soil layer must be removed out from the field perimeter or trench area. The field area should not be dug during wet weather. Bottom and side areas (infiltration surfaces) must not be smeared or compacted by foot or vehicular traffic. The best bottom and sidewall infiltration surfaces are surfaces that are scarified.

B. Surface drainage must be diverted from the field. Curtain drains need to be installed when necessary to intercept ground water flow above a restrictive layer.

### 6.2 Sand and Fill Specifications:

A. The 6" of sand under accordions and between the accordions should be medium to coarse textured washed sand, with an effective size of 0.16 to 2.0 mm, no greater than 5% passing a #100 sieve, and no particles larger than 1/4 inch. ASTM C-33 sand specification is acceptable. Concrete or washed sand is a reliable choice.

Suitability of bank run sand or on-site soil must be verified.

B. Fill material required for raised systems should be run of the bank gravel as described in CODE (clean soil, free of topsoil, dredging or stones no more than 2" in any dimension).

Fill must be compacted sufficiently to prevent uneven settling or consolidation.

### 6.3 ACCORDION Field Installation:

3.5-foot wide trenches are excavated as specified in CODE. Place sand, **compact** 6" of sand in the bottom of the trench. The accordion unit is anchored at one end and stretched to 10-foot length. The sand filling must be above the top of the accordions after the sand is **compacted** evenly. See Fig. 2 and photos for connection details.

### 6.4 Backfill and Erosion Control:

A. **No fabric is required over accordions.**

B. Place 6" minimum to 24" maximum of clean porous backfill including 3" to 4" of topsoil over the ACCORDIONS. Backfill must be free of large rocks. Normal installation uses bank run sand as fill material. Topsoil should be seeded and protected from erosion (hay or equivalent method). Finished grades should not be greater than 3:1 slope. Surface drainage must be directed away from the field area at all times.

**6.5 System Grading:**

In the leach bed area during construction and upon completion surface runoff from buildings, parking areas and nearby sloped terrain must be diverted. Grade bed area in level systems at a minimum 1% to prevent surface ponding.

**6.6 Light Vehicular Traffic:**

ACCORDIONS can be used under drive and parking areas. Use ASTM Sch 40 rated pipes and appropriate bedding for pipes. Air tight pavement is not recommended.

ACCORDIONS allow maximum air diffusion and evapotranspiration, enhancing treatment and longevity.

**6.6 CONSTRUCTION:**

The accordion leach fields shall be carried out by licensed installers who have studied this manual and understand every detail. Inspection of installations must be carried out by the designer or a qualified professional.

## ELU - CT

RUCK ACCORDION

STATE OF CT PARAMETERS:

SAND LTAR = 0.6 GAL/SFT/D

SOIL 1-10 mpi, TLR = 660 SFT

STONE\SOIL INTERFACE =1 (FOR STE)

FABRIC\SAND INTERFACE =1.5 (FOR STE)

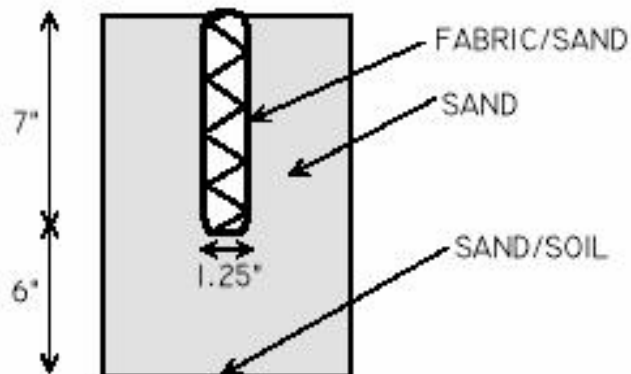
SAND\SOIL INTERFACE = 2 (FOR STE)

FOUR BEDROOM HOME, DESIGN FLOW = 600 GAL/D

MEASURED PARAMETERS:

FABRIC LTAR = 1 GAL/SFT/D

### RUCK ACCORDION CROSS SECTION



THE RUCK ACCORDION TRENCH EXAMPLE:

ACCORDIONS ARE 7" HIGH

TRENCH IS 42" WIDE

NUMBER OF FEET OF ACCORDIONS PER ONE FOOT OF TRENCH = 8 ft /ft of trench

$$ELU = \frac{TLR \times LTA \times WPU}{Q}$$

**SOIL APPLICATION:**

BOTTOM AREA OF TRENCHES = 42" = 3.5 SFT /LF  
SIDEWALL AREA = 14" + 14" = 28 = 2.33 SFT /LF  
 $ELU = 0.6 (2.0) (5.83 \text{ SFT/LT}) = 7.0 \text{ SFT / LF}$

**FILTER FABRIC FINS ONLY:**

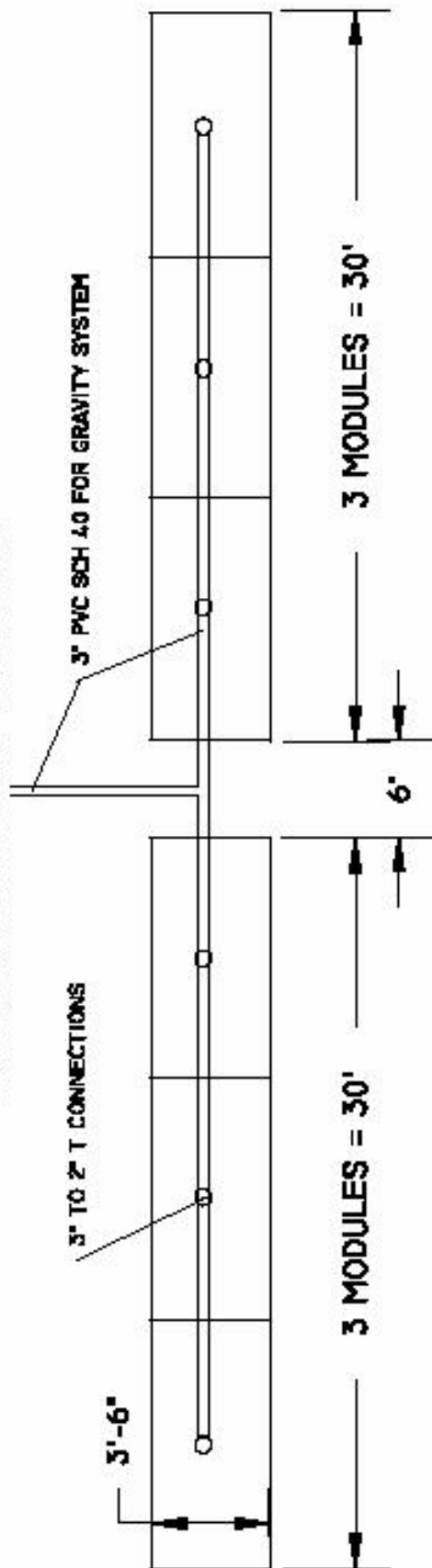
BOTTOM AREA OF FINS = 1.25" /12 x 8 BOTTOMS = 0.83 SFT/ LF  
SIDEWALL AREA = 6.75 /12 x 16 SIDES = 9 SFT / LF  
 $ELU = 0.6 (1.5)(9.83) = 8.8 \text{ SFT /LF}$

***THE ELU GOVERNING IS = 7.0 SFT /LF***

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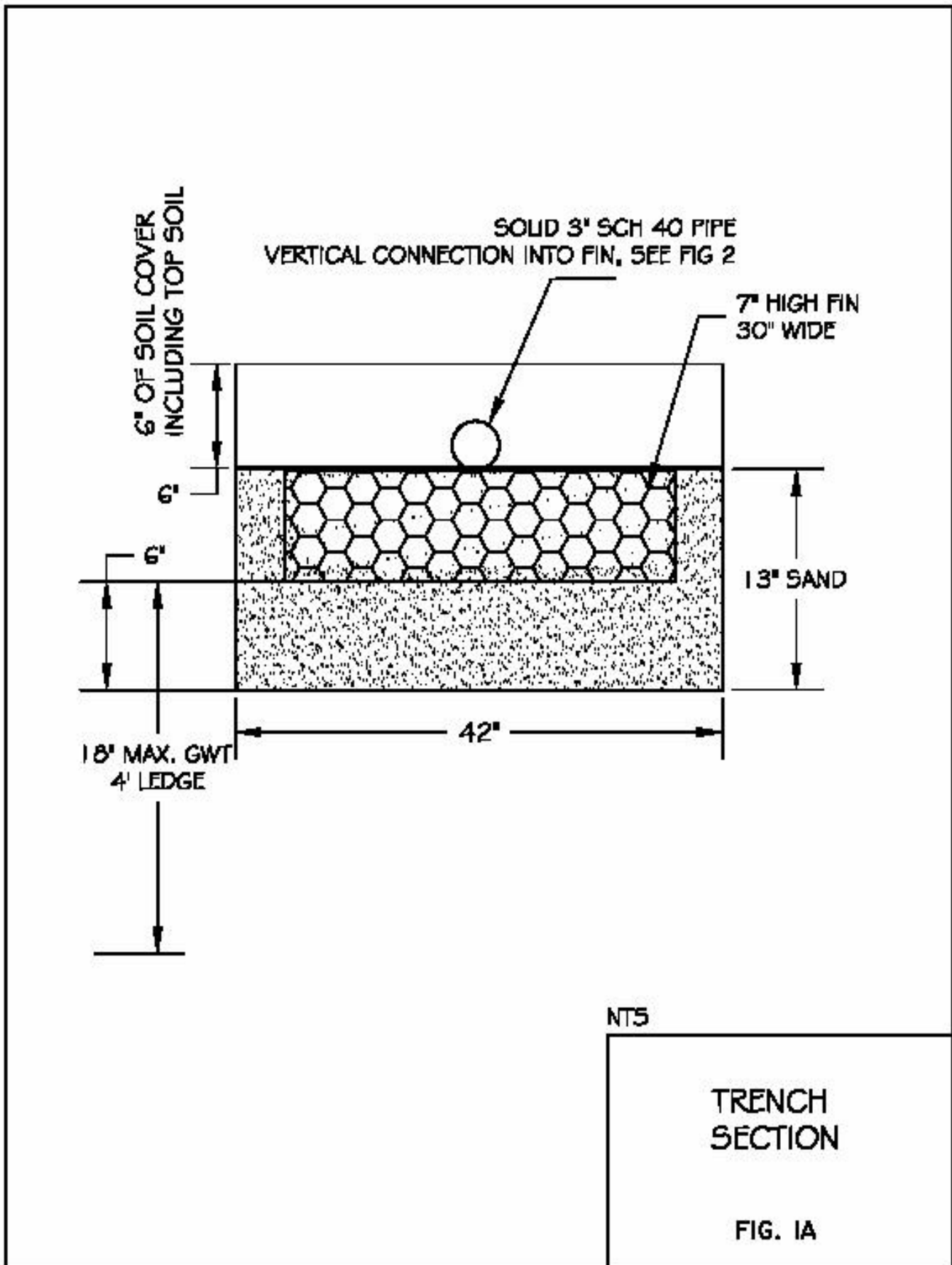
FROM TWO COMPARTMENT SEPTIC TANK



FOR PUMPED SYSTEM USE 2" SCH 40 PIPES  
 SEE FIG.2 VERTICAL CONNECT DETAILS  
 TYPICAL LAYOUT FOR 2 BEDROOM HOUSE :  
 60 FEET OF ACCORDIONS, PRK RATE< 10 MPI

VERTICAL CONNECT  
 RUCK ACCORDION LAYOUT  
 TRENCH 3'-6" WIDE

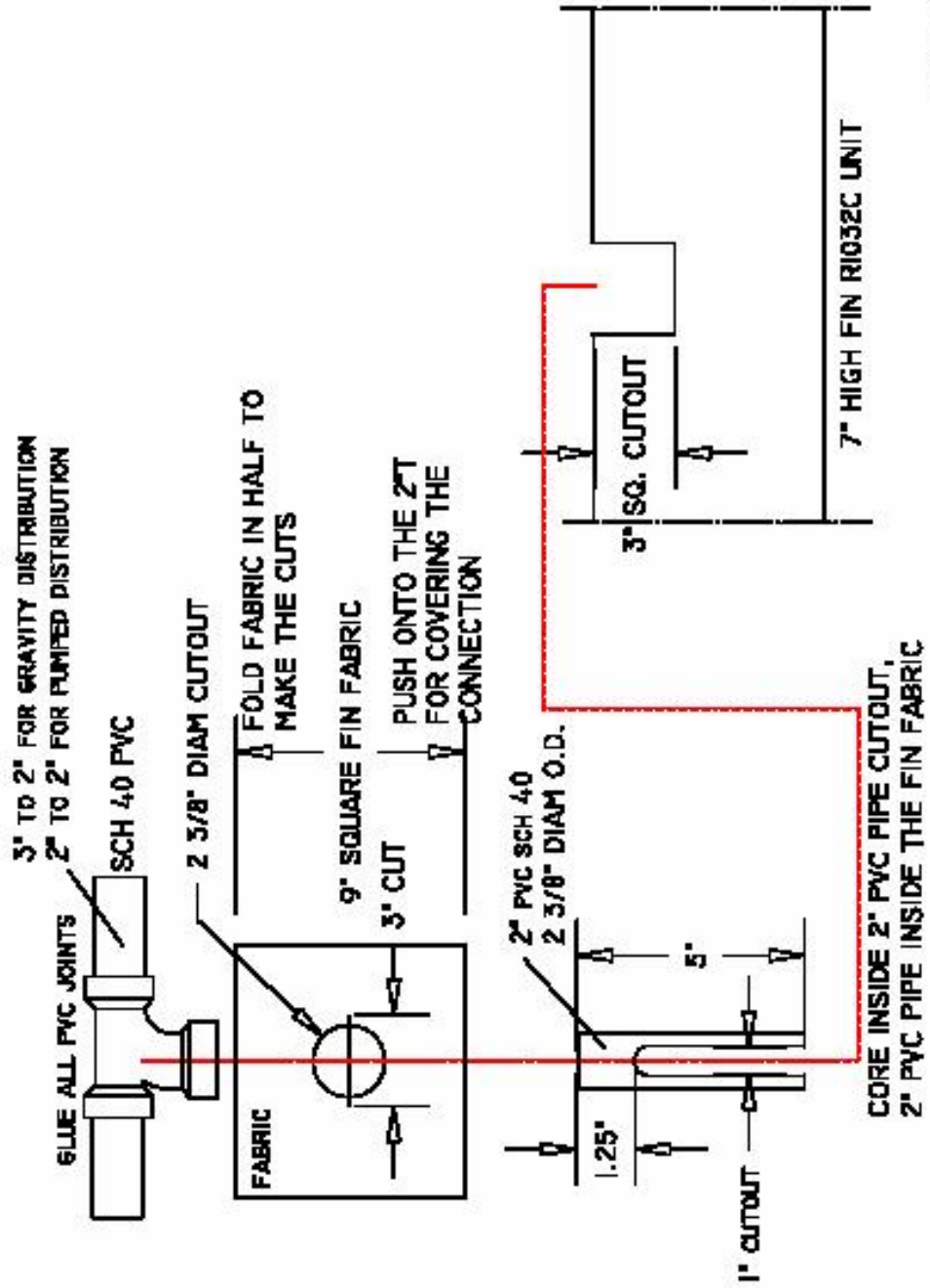
FIG. 1

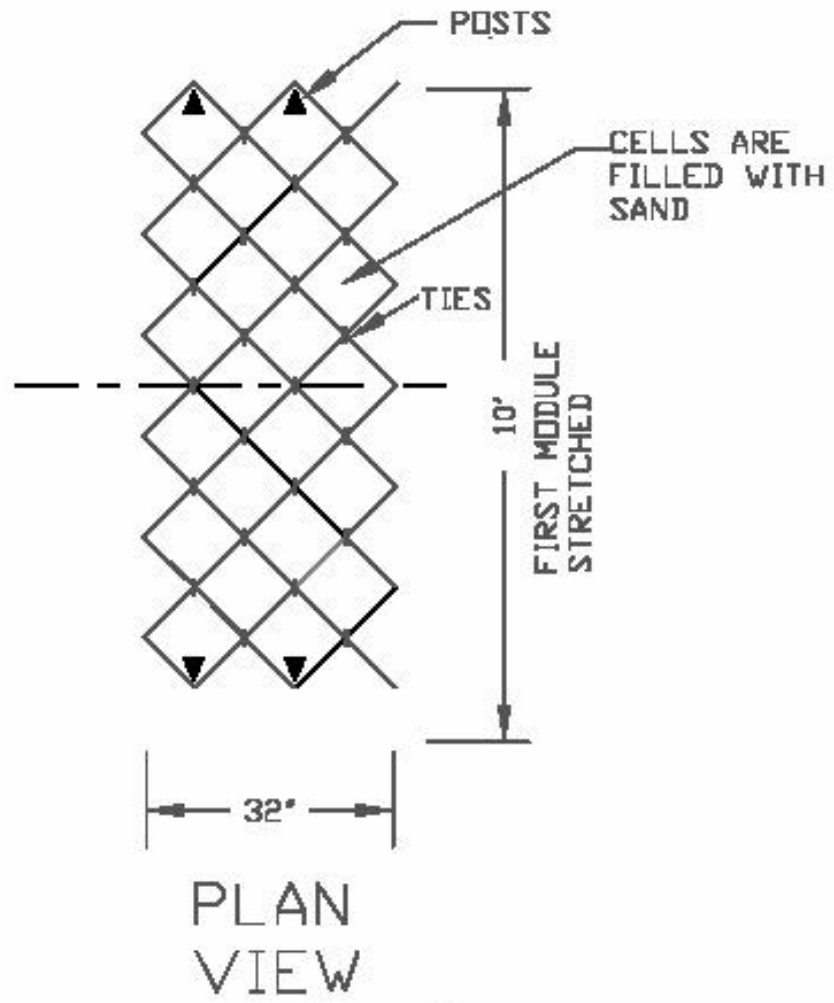




# 2" VERTICAL CONNECTION AT CENTER OF EACH RI032C UNIT

FIG. 2 VERTICAL CONNECT DETAIL

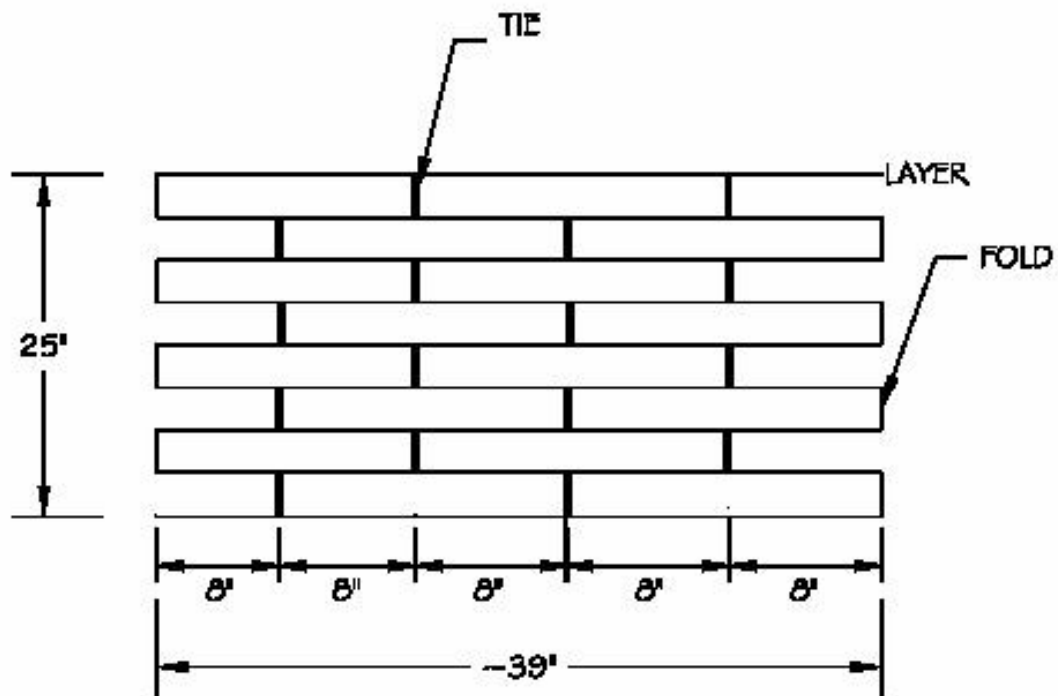




80 FEET OF FIN PER MODULE  
MODULE = 25' x 39'  
PACKAGE, 12 lbs

ACCORDION TOP

FIG. 3



PLAN VIEW

WEIGHT = 12 lbs  
44 TIES

7' DEEP  
SHIPPING BUNDLE  
23 LAYERS, 80 FT OF FIN

FIG. 4

## RUCK ACCORDION INSTALLATION PHOTOS



1. SET POSTS FOR STRETCHING OUT THE ACCORDION ON 6" OF SPEC. SAND



2. LAYOUT FIRST ROW



3. FIELD OR FILTER LAYOUT SPACING AS PER DESIGN

## VERTICAL CONNECTION DETAIL



4. SLOTTED 2" PIPE FITS OVER CORE AND INSIDE FIN FABRIC  
9" x 9" FABRIC COVERS THE CONNECTION, SEE FIG. 2



5. SAND FILLED ACCORDION CONNECTION IN CENTER SHIPPING BUNDLE IN BACKGROUND

# **APPENDIX**

## **RUCK ACCORDION LEACH FIELD SYSTEM**

### **BIOFABRIC PROPERTIES.**

FABRIC PERMEABILITY = 0.03 cm/s OR 100 FT/DAY  
THE FABRIC IS EXXON TYPAR 3401 OR EQUIVALENT  
THE VOID SPACE IN THE FABRIC IS 70%.

**DESCRIPTION.** GRAVEL IS REPLACED WITH A PROPRIETARY PREMANUFACTURED ACCORDIONS, GEOTEXTILE FABRIC AND CUSPATED PLASTIC SUPPORT/CIRCULATION CORES. THE MODULE IS 7" HIGH AND ELIMINATES THE OCCASIONAL PROBLEM OF STONE DUST. THE SPACES BETWEEN THE ACCORDIONS ARE FILLED WITH CONCRETE SAND. THE ACCORDIONS ARE INSTALLED WITH 6" OF CONCRETE SAND ON BOTTOM TO PROVIDE ADDITIONAL TREATMENT, MINIMIZE SMEARING AND PROVIDE SEPARATION AND PROTECTION FOR THE SOIL INFILTRATION CAPACITY (LTAR). THE LEACH FIELD SYSTEM IS SMALLER THAN A CONVENTIONAL STONE TRENCH...WITHOUT OPERATIONAL OR ENVIRONMENTAL COMPROMISE. THE FABRIC IS AMOCO TYPAR 3401. THE PLASTIC CUSPATED CORE IS 1.25" WIDE. THE ACCORDION UNIT IS SEWN, BANDED AND STRETCHES TO 10 FOOT LENGTH. THE FABRIC ACCORDIONS WILL BE IDENTIFIED BY USING A LABEL ON EACH ACCORDION. THE ACCORDION UNIT IS LOADED BY USING PVC PIPES ASTM SCH 40, THE PIPE IS CONNECTED INTO THE ACCORDION AND THE CORE IS INSERTED INTO THE PIPE.

**CONDITIONS FOR APPROVAL.** THE RUCK ACCORDION SYSTEM MUST BE DESIGNED AND INSTALLED IN ACCORDANCE WITH THE MANUAL.

1. DESIGNED ON BASIS OF LONG TERM ACCEPTANCE RATE AND INDEFINITE LIFE OF SYSTEM.
2. PROVIDES RELIABLE PRETREATMENT BY PREFILTRATION THROUGH BIOMAT ON GEOTEXTILE AND 6 " OF CONCRETE SAND.
3. CAN BE USED IN VERY POROUS SOILS.
4. IS SUITABLE FOR STRONG BIODEGRADABLE WASTEWATERS.
5. IS INSTALLED IN THE UPPER SOIL LAYER, ENHANCING EVAPOTRANSPIRATION, BIODEGRADATION, GAS EXCHANGE AND NUTRIENT UPTAKE
6. THE SOIL LOADING AND TREATMENT IS OPTIMIZED BY UNIFORM LOADING RATE THOUGH GEOTEXTILE AND SAND.
7. THE SYSTEM CAN BE USED FOR MOUNDS, SAND FILTERS, LARGE LEACH FIELDS AND COMMERCIAL SYSTEMS.

**SEPTIC TANK SYSTEM DESIGN FLOW PEAKS****ON - SITE WASTEWATER SYSTEMS**

AVERAGE WASTEWATER FLOW (USING CONVENTIONAL PLUMBING FIXTURES)  
= 40 TO 50 GALLONS PER CAPITA PER DAY

PEAKING FACTORS, **F** ARE AS FOLLOWS:

ANNUAL	.....	1
MAX. MONTH	.....	1.25 to 1.5
MAX. DAY	.....	1.5 to 3.5
MAX. HOUR	.....	3 to 12
MAX. MINUTE	.....	100 to 1000

PIPE		F= 12
THE SEPTIC TANK OR A PROCESS TANK LIQUID PORTION		F=1.5 to 3.5
SOIL INTERFACE		F=1.25 to 1.5

SEPTIC TANK SYSTEMS ARE DESIGNED ALMOST EXCLUSIVELY USING  $F=1.5$  OR ON THE BASIS OF 75 GAL/C/D AND TWO PERSONS PER BEDROOM. THE TWO PEAKING FACTORS ARE MULTIPLIED TOGETHER e.g.  $1.5 \times 2$ . THEREFORE, A CUMULATIVE SAFETY FACTOR IS USED TO SIZE SEPTIC SYSTEMS.

REF.: LAAK, R. 1986 WASTEWATER ENGINEERING DESIGN FOR UNSEWERED AREAS. TECHNOMIC PUB. CO. Pg.26-29 (THESE TWO PAGES REFER TO ALL OTHER REFERENCES REQUIRED TO FORM THE BACKGROUND)