



DEVELOPMENTAL SPECIFICATIONS
FOR
WICK DRAINS

Effective Date
April 18, 2006

THE STANDARD SPECIFICATIONS, SERIES 2001, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

01079.01 GENERAL

This work consists of furnishing all necessary labor, equipment, and materials and performing operations necessary for installation of prefabricated vertical drainage wicks (wick drains) in accordance with the contract documents. Wick drains shall consist of a band-shaped plastic case which permits continuous vertical drainage, wrapped in a filter material, installed in the subsoils by displacement methods, and spaced and arranged as shown on the plans.

01079.02 MATERIALS AND EQUIPMENT

A. Materials

Wick drains shall be a manufactured prefabricated type and shall consist of a plastic drainage core encased in or integrated with a filter jacket. The jacket shall allow free passage of pore water to the core without loss of soil material or piping. The core shall provide continuous vertical drainage. The drain shall be band-shaped with an aspect ratio (width divided by thickness) not exceeding 50. Prefabricated wick drains meeting this specification and contained in the following list may be used.

- Alidrain
- Geodrain with polyester/cellulose filter
- Mebradrain
- Amer-Drain
- Or approved equal

1. Jacket

The jacket shall be a synthetic non-woven geotextile capable of resisting all bending, punching, and tensile forces imposed during installation and during the design life of the drain. The jacket material shall not be subject to localized damage (e.g., punching through the filter by sand/gravel particles). This material shall be sufficiently rigid to withstand lateral earth pressures due to embedment and surcharge so that the vertical flow capacity through the core will not be adversely affected. The jacket material shall be sufficiently flexible to bend smoothly during installation and induced consolidation settlement without damage. Jacket material shall not undergo cracking and peeling during installation of the drain. The jacket material shall conform to the following specifications:

<u>Test Item</u>	<u>Designation</u>	<u>Minimum Roll Value*</u>
Grab Tensile Strength	ASTM D 4632	80 lb. (355 N)
Trapezoidal Tear	ASTM D 4533	25 lb. (110 N)
Puncture Strength	ASTM D 4833	50 lb. (220 N)
Burst Strength	ASTM D 3796	130 psi (900 kPa)
Permittivity	ASTM D 4491	100 gal/min/ft ² (4285 L/min/m ²)

*The jacket material shall be tested in saturated and dry conditions.

2. Core

The core shall be a continuous plastic material fabricated to promote drainage along the axis of the vertical drain.

3. Assembled Drain

The mechanical properties (strength and modulus) of the assembled vertical drain shall equal or exceed those specified for the component jacket and core. The assembled drain shall be resistant against wet rot, mildew, bacterial action, insects, salts in solution in the groundwater, acids, alkalis, solvents, and any other significant ingredients in the site groundwater. One single type of assembled drain shall be used on the project unless approved by the Engineer. The assembled drain shall have a minimum discharge capacity of 3500 ft³/yr (100 m³/yr) when measured under a gradient of one at a lateral confining pressure of 25 psi (172 kPa). The assembled drain shall have a minimum equivalent diameter of 2 inches (50 mm) using the following definition of equivalent diameter.

$$d_w = (a+b)/2$$

d_w = diameter of a circular drain equivalent to the band shaped drain (inches (mm)).

a = width of the band shaped drain (inches (mm))

b = thickness of the band shaped drain (inches (mm)).

Drain material shall be labeled or tagged in such a manner that the information for sample identification and other quality control purposes can be read from the label. As a minimum, each roll shall be identified by the manufacturer as to lot or control numbers, individual roll number, date of manufacture, manufacturer, and product identification of the jacket and core. During shipment and storage the drain shall be wrapped in heavy paper, burlap, or similar heavy duty protective covering and in accordance with the manufacturer's recommendations. The Engineer may reject material that is damaged during shipment, storage, or handling; or which does not meet the minimum requirements of the drain material.

At least two weeks prior to construction, the Contractor shall submit wick drain samples and certification indicating the source and material properties of the drain materials.

B. EQUIPMENT

Wick drains shall be installed with equipment of a type that will cause minimum disturbance of the subsoil during the installation operation.

The wick drains shall be installed using a mandrel, which shall be pushed through the sand blanket and into the soil with a continuous static movement, and vibrated or driven with the approval of the Engineer. The mandrel shall protect the wick material from tears, cuts, and abrasions during installation; and shall be rectangular in shape; and of a cross sectional area not to exceed 10 square inches (6500 mm²). The mandrel shall be provided with an "anchor" rod or plate at the bottom to prevent soil from entering the bottom of the mandrel during installation of the drain and to anchor the bottom of the drain at the required depth at the time of mandrel removal.

At the Preconstruction Conference, the Contractor shall submit to the Engineer for review and approval, details of the sequence and method of installation. Approval by the Engineer will not relieve the Contractor of the responsibility of installing the wick drains in accordance with the contract documents.

01079.03 CONSTRUCTION

The Contractor shall be familiar with site conditions and the available geotechnical information. Prior to installation of the wick drains the Contractor shall demonstrate that the equipment, method, and materials produce a satisfactory drain installation. The Contractor shall drill at least two borings within the area designated on the plans to select the equipment, method, and materials suitable for the existing site conditions and capable of producing a satisfactory drain installation to the minimum elevation. The Contractor may be required to install up to ten trial drains in each of two to four test locations designated by the Engineer. The Contractor will be compensated for each trial drain if the installation satisfies the requirements of the contract documents. No compensation will be allowed for installing unsatisfactory trial drains.

Approval by the Engineer of the method and equipment used to install the trial drains shall not constitute acceptance of the method for the remainder of the project. If the Engineer considers that the method of installation does not produce a wick drain that satisfies the requirements of the contract documents, the Contractor shall alter the method and/or equipment in order to achieve compliance.

Prior to installing the drains, the site shall be graded sufficiently level to allow vertical and proper drain installation. This grading work shall be incidental.

The wick drains shall be installed following placement of the sand blanket. The granular blanket shall have sufficient coarse material and sufficient compaction to provide a stable working surface.

Wick drains shall be located, numbered, and staked by the Contractor. The Contractor shall take all reasonable precautions to preserve the stakes. The locations of the drains shall not vary by more than 3 inches (75 mm) from the locations indicated on the drawings. Two weeks prior to construction, the Contractor shall submit drawings to the Engineer for approval showing the method of field locations, drain layout, and numbering plan.

The Contractor may use auguring or other methods to loosen stiff upper soils prior to the installation of the drains provided that such operations do not extend more than 2 feet (600 mm) below the bottom of the sand blanket. All holes or voids created by such operations shall be filled with sand after the wick drain has been satisfactorily installed.

The installation equipment shall be checked for plumbness prior to advancing each drain. The plumbness of the mandrel shall not deviate more than 1/4 inch per foot (50 mm per meter) from vertical. The drains shall be installed to the minimum elevation as shown on the plans. If the penetration shown on the plans is more than 1 foot (300 mm) into the underlying foundation layer and difficulties are encountered prior to achieving the indicated depths, the drains shall be installed to a depth of 1 foot (300 mm) below the bottom of the soil layer(s) being improved by wick drain installation as shown on the plans.

The Engineer will reject wick drains that vary from their proper location by more than 6 inches (150 mm) at the ground surface, drains that are damaged during installation or subsequent construction, or drains that are improperly completed, and no compensation will be allowed for any materials furnished or for any work performed on such drains.

During installation, the Contractor shall provide the Engineer with suitable means of measuring the vertical length of each wick drain installed at a given location and deriving a tip elevation for each drain.

Splices or connections in the wick drain material will not be allowed.

Where obstructions are encountered below the working surface that cannot be penetrated by the drain installation equipment, the Contractor shall notify the Engineer and complete the drain from the elevation of the obstruction to the working surface. At the direction of the Engineer, the Contractor shall attempt to install a new drain within an 18 inch (450 mm) radius from the obstructed drain. A maximum of two attempts shall be made as directed by the Engineer. The Contractor will be compensated for each obstructed drain unless the drain is improperly completed, in which case no compensation will be allowed.

After installation, the Contractor shall cut each drain horizontally such that approximately 6 inches (150 mm) of drain material extends above the top of the sand blanket.

The Engineer will keep a daily log which lists for each drain the date of installation, top elevation, tip elevation, and pay length. A copy of each daily log will be provided to the Contractor.

01079.04 METHOD OF MEASUREMENT

The Engineer will calculate the number of feet (meters) of Wick Drains (including trial wick drains) installed according to the contract documents. The calculations will be based on measurements taken from the top of the drain to the tip elevation of the drain.

In the case of obstructions, the Engineer will calculate the number of feet (meters) from measurements taken from the top of the drain to the elevation at which the obstruction was encountered.

01079.05 BASIS OF PAYMENT

For the number of feet (meters) of Wick Drains measured as provided above, the Contractor will be paid the contract unit price. This price shall include field staking for the location of wick drains; and all labor, equipment, and materials necessary to complete the installation in accordance with the contract documents. No payment will be made for unacceptable drain or trial drain installations.

In instances where pre-auguring is permitted, the cost of pre-auguring and subsequent backfilling with sand shall be considered incidental to the price bid for Wick Drains.

The cost of borings drilled to select the equipment, method, and materials suitable for the existing site conditions to produce a satisfactory drain installation shall be considered incidental to the price bid for Wick Drains.