

III.DRAINAGE

This section describes the use of geotextiles in underdrains for two different field conditions:

“Protected” (or light duty installations) and,
“Unprotected” (for heavy duty installations).

Both specifications can be applied to either trench drains (aggregate with drain pipe) or French drains (aggregate with no pipe). These specifications are written to address properties required, which are a function of the anticipated installation stresses.

Read each description and determine which most closely parallels the site conditions of your particular project. The corresponding specification addresses the requirements of a geotextile installation necessary to perform its intended function.

Geotextiles in underdrains are used to allow groundwater to pass into the drain while retaining the soil fines, preventing clogging of the drain. Each specification is written to select the geotextile that will serve the following functions:

- Installation survivability
- Separation
- Filtration
- Environmental stability

These specifications make certain basic design assumptions relating to the particular application. If you have any questions about design or selection methods, or if your application does not fit into one of the descriptive categories, contact the LINQ QA line (1-800-543-9966) for assistance.

III. DRAINAGE

A1. PROTECTED DRAINAGE - DESCRIPTION

- Soil Type: -Inorganic silts, ML
 -Silty gravels, poorly graded sand- silt mixtures including GP, GM, SM
 -All cohesive soils including CL, CLML, SC,
 (Care is to be taken when gap graded soils are present, or soils consisting of uniform fine silts)
- Aggregate Backfill: -Rounded stone no greater than 2 inches
 -Angular stone no greater than 1 inch
 -Open graded with little or no fines
- Backfilling: -Maximum drop height of less than one foot
- Compaction: -Compaction equipment is lightweight, or is not utilized
- Trench depth: - Limited to less than 3 feet in depth
- Examples: -Roadway shoulder drains
 -Athletic field underdrains
 -Agricultural drains
 -Curtain drains near walls
 -Internal embankment drainage
 -Relief wells
 -Groundwater recharge wells
 -Interceptor drainage

PROTECTED DRAINAGE

SECTION 027***

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Product specifications, installation and method of payment for geotextile for drainage application.

1.02 RELATED SECTIONS

A. Section 02207 - Aggregate materials.

B. Section 01410 - Testing fill compaction.

1.03 UNIT PRICE - MEASUREMENT AND PAYMENT

In-trench applications measurement shall be made by the linear foot of trench installed or as required by the Engineer.

The measurement for payment excludes the geotextile used for overlapping.

The accepted pay quantities for geotextiles will be paid for at the contract price per the linear foot of trench installed.

Payment will be made under:

| <u>Pay Item</u> | <u>Pay Unit</u> |
|-----------------------|-----------------|
| Linear foot of trench | Linear foot |

1.04 SUBMITTALS

A. Certificate of compliance: The contractor shall submit to the engineer a certificate of compliance which shall include the following information:

- Full product name by trademark and style number
- Geotextile polymer type(s),
- Geotextile physical properties,

B. The manufacturer shall maintain test records of the production of this lot of material. These records shall be made available to the Engineer upon request.

If more than one style or product code number has been produced under the same product name, the style, or product code number of the geotextile to be approved must be specifically identified. The certificate of compliance shall be attested to by a person having legal authority to bind the company.

C. Samples: At the engineers option sample(s) of the geotextile shall be submitted for source approval. Each sample shall have minimum dimensions of 1.5 yards by the full roll width of the geotextile.

The geotextile machine direction shall be marked clearly on each sample submitted for testing. The machine direction is defined as the roll length direction.

D Seams: At the Engineers option, when seams are to be used, at least one sewn sample, with a minimum of 2 yards of seam length per sample and with a minimum of 18 inches of geotextile width on each side of the seam shall also be submitted.

1.05 QUALITY CONTROL TESTING

A. Samples may be randomly taken by the Engineer at the job site to confirm that the geotextile meets the property values specified. Sampling shall be in accordance with ASTM D4354.

B. If sampling is performed, approval will be based on testing of samples from each lot. A "lot" shall be defined for the purposes of this specification as all geotextile rolls within the consignment (i.e., all rolls sent to the project site) which were manufactured at the same manufacturing plant, have the same product name, and have the same style, merge, or product code number.

C. All geotextile which has defects, deterioration, or damage, as determined by the Engineer, may be rejected. All rejected geotextile shall be replaced at no cost to the owner.

1.05 ACCEPTANCE REQUIREMENTS

Acceptance/rejection of geotextiles shall be determined in accordance with ASTM D4759 "Standard Practice for Determining the Specification Conformance of Geosynthetics."

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

Fibers used in the manufacture of geotextiles,, shall consist of long chain polymers composed of at least 95% by weight of polypropylenes. They shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other. These materials shall conform to the properties found in Section 2.02. Thread used for factory or field sewing shall be of contrasting color composed of polypropylene, polyester, polyamids, or polyaramids.

2.02 GEOTEXTILE PHYSICAL PROPERTIES

A. Geotextile shall meet or exceed the following “Minimum Average Roll Values”. The minimum average property value of any roll within a shipment or lot of geotextile rolls shall meet or exceed the values required below.

| <u>Property</u> | <u>Test Method</u> | <u>Property Value</u> |
|-----------------------------------|--------------------|-----------------------|
| Grab Tensile (lbs) | ASTM D4632 | 120 |
| Elongation (%) | ASTM D4632 | 50 |
| Trapezoid Tear (lbs) | ASTM D4533 | 40 |
| Puncture (lbs) | ASTM D4833 | 30 |
| U V Stability | ASTM D4355 | |
| (% Strength retained) | 150 hrs exposure | 70 |
| Permittivity (sec ⁻¹) | ASTM D4491 | .7 |
| AOS (US Sieve#) | ASTM D4751 | 60 |

Product shall be LINQ 140 EX, or approved equivalent.

2.03 SHIPMENT

A. Packaging: Each roll of geotextile shall be packaged individually in a suitable sheet, wrapper or container to protect the fabric from damage due to ultraviolet light and moisture during normal storage and handling.

B. Labelling: Each roll shall be identified by a tag or label securely affixed to the outside of the roll on one end. Identification shall be in accordance with ASTM D 4873.

C. Storage: The geotextile shall be stored so as not to expose it to sunlight, or to damage. Storage shall be in accordance with ASTM D 4873.

PART 3 EXECUTION

Geotextile shall be installed in accordance with the project drawings and this specification. In the event of a discrepancy between the specification and the drawings, the drawings shall govern.

3.1 INSTALLATION

The trench shall be dug in the native soil as outlined in the project drawings. Vertical as possible sides shall be constructed where soil conditions allow. Where soft or saturated conditions are encountered, “V” shaped trenches shall be allowed at the appropriate slope angle to allow stability during construction.

Once the trench is constructed, the geotextile shall be cut to the required width, making allowances for conformance of the geotextile during subsequent compaction and lapping the top. Contact between the geotextile and the adjacent soil shall be assured during construction.

The geotextile shall be overlapped a minimum of 18 inches at all longitudinal and transverse joints. In those cases where the trench width is less than 18 inches, the minimum overlap shall be the trench width.

Care should be taken to place the Geotextile tightly against the soil so no void spaces occur behind the fabric. Also, folds or wrinkles shall be avoided. The geotextile which will be used for top overlap of the filled trench shall be temporarily used to cover the excavated material on either side of the trench, to protect the underdrain from contamination by backfill soil falling into and mixing with the filter/drainage material.

The granular material shall be placed and compacted in the bottom of the trench. Drop height shall be less than one foot. Additional lifts shall be added until the depth of trench aggregate meets the requirements shown on the design drawings.

After completion of aggregate placement the protruding edges of the geotextile shall be overlapped onto the top of the granular drainage material. The overlap shall protect the drainage material from contamination. A minimum of 18 inches overlap is required to assure complete coverage and to provide separation.

Cover soil shall then be placed and compacted up to finish grade elevation as shown on the design drawings.

END OF SECTION

III. DRAINAGE

B1. UNPROTECTED DRAINAGE - DESCRIPTION

- Soil Type: -Inorganic silts, ML
 -Silty gravels, poorly graded sand- silt mixtures including GP, GM, SM
 -All cohesive soils including CL, CLML, SC,
 (Care to be taken when gap graded soils are present, or soils consisting of uniform fine silts)
- Aggregate Backfill: -Rounded stone no greater than 6 inches
 -Angular stone no greater than 3 inch
 -Open graded with little or no fines
- Backfilling: -Maximum drop height of less than three feet
- Compaction: -Compaction equipment is lightweight, or is not utilized
- Trench depth: -Limited to less than 8 feet in depth
- Examples: -Deep curtain drains
 -Large capacity underdrains
 -Internal embankment drainage
 -Roadway underdrains
 -Recharge basins
 -Interceptor drains

UNPROTECTED DRAINAGE

SECTION 27***

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Product specifications, installation and method of payment for geotextile for drainage application.

1.02 RELATED SECTIONS

A. Section 02207 - Aggregate materials.

B. Section 01410 - Testing fill compaction.

1.03 UNIT PRICE - MEASUREMENT AND PAYMENT

In-trench applications measurement shall be made for the linear foot of trench installed or as required by the Engineer.

The measurement for payment excludes the geotextile used for overlapping.

The accepted pay quantities for geotextiles will be paid for at the contract price per the linear foot of trench installed.

Payment will be made under:

| <u>Pay Item</u> | <u>Pay Unit</u> |
|-----------------------|-----------------|
| Linear foot of trench | Linear foot |

1.04 SUBMITTALS

A. Certificate of compliance: The contractor shall submit to the engineer a certificate of compliance which shall include the following information:

- Full product name by trademark and style number
- Geotextile polymer type(s),
- Geotextile physical properties,

B. The manufacturer shall maintain test records of the production of this lot of material. These records shall be made available to the Engineer upon request.

If more than one style or product code number has been produced under the same product name, the style, or product code number of the geotextile to be approved must be specifically identified. The certificate of compliance shall be attested to by a person having legal authority to bind the company.

C. Sample(s): At the owners option samples of the geotextile shall be submitted for source approval. Each sample shall have minimum dimensions of 1.5 yards by the full roll width of the geotextile.

The geotextile machine direction shall be marked clearly on each sample submitted for testing. The machine direction is defined as the roll length direction.

D Seams: At the Engineers option, when seams are to be used at least one sewn sample, with a minimum of 2 yards of seam length per sample and with a minimum of 18 inches of geotextile width on each side of the seam shall also be submitted

1.05 QUALITY CONTROL TESTING

A. Samples may be randomly taken by the Engineer at the job site to confirm that the geotextile meets the property values specified. Sampling shall be in accordance with ASTM D4354.

B. If sampling is performed, approval will be based on testing of samples from each lot. A "lot" shall be defined for the purposes of this specification as all geotextile rolls within the consignment (i.e., all rolls sent to the project site) which were manufactured during a continuous period of production at the same manufacturing plant, have the same product name, and have the same style, merge, or product code number.

C. All geotextile which has defects, deterioration, or damage, as determined by the Engineer, may be rejected. All rejected geotextile shall be replaced at no cost to the owner.

1.05 ACCEPTANCE REQUIREMENTS

Acceptance/rejection of geotextiles shall be determined in accordance with ASTM D4759 "Standard Practice for Determining the Specification Conformance of Geosynthetics."

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

Fibers used in the manufacture of geotextiles, shall consist of long chain polymers composed of at least 95% by weight of polypropylenes. They shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other. These materials shall conform to the properties found in Section 2.02. Thread used for factory or field sewing shall be of contrasting color composed of polypropylene, polyester, polyamids, or polyaramids.

2.02 GEOTEXTILE PHYSICAL PROPERTIES

A. Geotextile property values should be expressed in terms of “Minimum Average Roll Values” and should be compared directly to the corresponding specification values. The minimum average property value of any roll within a shipment or lot of geotextile rolls shall meet or exceed the values required below.

| <u>Property</u> | <u>Test Method</u> | <u>Property Value</u> Unprotected |
|---|--------------------------------|--------------------------------------|
| Grab Tensile (lbs) (Weakest principal dir) | ASTM D4632 | 200 |
| Elongation (%) | ASTM D4632 | 50 |
| Trapezoid Tear (lbs) | ASTM D4533 | 75 |
| Puncture (lbs) | ASTM D4833 | 80 |
| U V Stability (% Strength retained) | ASTM D4355 150 hrs exposure | 70 |
| Permittivity (sec ⁻¹) | ASTM D4491 | .1 |
| AOS (US Sieve#) | ASTM D4751 | 80 |

Product shall be LINQ 180EX or approved equivalent.

2.03 SHIPMENT

A. Packaging: Each roll of geotextile shall be packaged individually in a suitable sheet, wrapper or container to protect the geotextile from damage due to ultraviolet light and moisture during normal storage and handling.

B. Labelling: Each roll shall be identified by a tag or label securely affixed to the outside of the roll on one end. Identification shall be in accordance with ASTM D 4873.

C. Storage: The geotextile shall be stored so as not to expose it to the sun or other damage. Storage shall be in accordance with ASTM D 4873.

PART 3 EXECUTION

Geotextile shall be installed in accordance with the project drawings and this specification. In the event of a discrepancy between the specification and the drawings, the drawings shall govern.

3.1 INSTALLATION

The trench shall be dug in the native soil as outlined in the project drawings. Vertical as possible sides shall be constructed where soil conditions allow. Where soft or saturated conditions are encountered, "V" shaped trenches shall be allowed at the appropriate slope angle to allow stability during construction.

Once the trench is constructed, the geotextile shall be cut to the required width, making allowances for conformance of the geotextile during subsequent compaction. Contact between the geotextile and the adjacent soil shall be assured during construction.

The geotextile shall be overlapped a minimum of 2 feet at all longitudinal and transverse joints. In those cases where the trench width is less than 2 feet, the minimum overlap shall be the trench width.

Care should be taken to place the Geotextile tightly against the soil so no void spaces occur behind the fabric. Also, folds or wrinkles shall be avoided. The geotextile which will be used for top overlap of the filled trench shall be temporarily used to cover the excavated material on either side of the trench, to protect the underdrain from contamination by backfill soil falling into and mixing with the filter/drainage material.

The granular material shall be placed and compacted in the bottom of the trench. A Maximum drop height of 3 feet will be allowed. Additional lifts shall be added until the depth of trench aggregate meets the requirements shown on the design drawings.

After compaction the protruding edges of the geotextile shall be overlapped onto the top of the granular drainage material. The overlap shall protect the drainage material from contamination. A minimum of 18 inches overlap is required to assure complete coverage and separation.

Cover soil shall be placed and compacted up to the final grade elevation shown on the design drawings.

END OF SECTION