



# Engineering Specifications for **SeaShield Series 500** Steel, Concrete and Timber Pile Protection

## 1.0 Scope

- 1.1 This specification may be used for the materials and application of SeaShield Series 500 Pile Encapsulation System.
- 1.2 The engineer shall select appropriate sections of the specifications to ensure that the specification is comprehensive for specified work.

## 2.0 General Requirements

- 2.1 Contractor shall comply with all written recommendations of the manufacturer regarding application of the specified system.
- 2.2 The manufacturer of specified materials shall be Denso North America, 9747 Whithorn Drive, Houston, TX 77095, Tel: 281-821-3355 or 90 Ironside Crescent, Unit 12, Toronto, Ontario, Canada M1X1M3 Tel: 416-291-3435. E-mail: info@denso.com

## 3.0 Materials

- 3.1 Fiberglass Jacket (SeaShield Fiber-Form)
  - 3.1.1 The fiberglass jacket thickness shall be a minimum of 1/8 inch (3-mm) constructed of layers of woven roving and mat.
  - 3.1.2 The jacket shall be translucent to provide visual inspection during the injection of the epoxy grout.
  - 3.1.3 The jacket shall have minimum one-inch injection ports spaced at intervals not to exceed five feet. To provide even distribution of the epoxy grout, the injection ports shall be placed on alternate sides.
  - 3.1.4 The jackets shall have stand-offs adhered to the inside of the jacket to provide a minimum of a 3/8 inch (8 mm) annulus (or per project spec) between the pile and the jacket. A UV inhibitor shall be included in the polyester resin to provide long-term UV stability.
  - 3.1.5 The fiberglass jackets shall have the following properties:

Ultimate Tensile Strength	ASTM D638	16,000 PSI
IZOD Impact Strength	ASTM D256	20 ft.-lbf/in.
Barcol Hardness	ASTM D2583	40
Water Absorption	ASTM D570	1% Max
UV Stability	ASTM G23	500 Hr. Pass

3.1.6 The fiberglass jacket may be manufactured as either a single unit or as two pieces that shall be joined in the field. The jackets can be placed one above the other with the overlapping jacket having a molded open cavity to receive a bottom seal gasket.

## 3.2 Epoxy Grout

3.2.1 The epoxy grout shall be SeaShield 550 Epoxy Grout as manufactured by Denso North America Inc. The grout shall exhibit the following properties:

### Physical Properties (unmixed) @ 77°F

Component "A" (resin):	
Specific Gravity	1.13
Viscosity	600 cps
Component "B" (hardener):	
Specific Gravity	.96
Viscosity	100 cps
Component "C" (aggregate):	
Specific Gravity	2.6
Free flowing powder	

### Physical Properties (mixed) @ 77°F with 3.5 parts Aggregate I to 1 part mixed "A" & "B"

Specific Gravity	1.88
Solids by Weight	100%

### Physical Properties (mixed) @ 77°F with 5 parts Aggregate I to 1 part mixed "A" & "B"

Specific Gravity	2.05
Solids by Weight	100%

The grout shall be pre-mixed prior to pumping. The 3.5:1 or 5:1 mixing ratio shall provide a free flowing grout which can be pumped without segregation and voids between the pile and jacket.

The pot life of the mixed grout is 120 minutes at 77°F and should not be pumped beyond this time frame.

3.2.2 The cured epoxy grout shall exhibit the following physical properties:

7 Day Compressive Strength	ASTM C579	10,500 PSI
7 Day Tensile Strength	ASTM C307	2,200 PSI
7 Day Bond/Shear Strength	ASTM C882	2,000 PSI
Shrinkage After 7 Day Cure	ASTM C531	0.07%
Water Absorp. After 7 Day	ASTM C413	0.45% Max.

### 3.3 Marine Epoxy

3.3.1 The SeaShield 525 Epoxy shall be used to adhere the fiberglass vertical seams. The 525 Epoxy may be used to finish the tops of the encapsulation and to seal in-situ bond test locations.

## 4.0 Equipment

4.1 The epoxy grout shall be pre-mixed and pumped through a peristaltic pump. The equipment shall be capable of delivering mixed grout through hoses into the jackets at a rate 1 GPM or greater.

4.2 Prior to using the pump, all lines shall be primed by circulating 1 gallon of the SeaShield hose lubricant.

## 5.0 Material Handling and Storage

### 5.1 Epoxy Grout Components

5.1.1 All liquid epoxy components shall be clearly marked with product name, component designation ("A" or "B"), manufacturer's name, batch number and ratio of component mixtures.

5.1.2 Epoxy components shall be stored in a covered, well ventilated space. The storage temperature shall not be less than 40°F (5°C) and no more than 120°F (49°C).

5.2 Fiberglass jackets on jobsite shall be stored in an area to prevent contamination and minimize distortion.

## 6.0 Surface Preparation

6.1 Prior to application, thoroughly clean and remove marine growth, oil, grease, rust and any other deleterious material which might prevent proper bonding between the pile and epoxy grout. Surface preparation shall be accomplished by grit blasting or power rotary tools, to provide a surface profile necessary to meet the bond requirements.

## 7.0 Installation

### 7.1 Preparation of Fiberglass Jacket

7.1.1 The inside surface of the jacket shall be lightly grit blasted to remove residue and contamination.

7.1.2 All stand-offs shall be affixed to the jacket at 18" to 48" intervals (depending on diameter size, length and thickness of jacket) along entire length of jacket. If additional stand-offs are required in the field, SeaShield 525 Epoxy can be used to adhere them.

7.1.3 All longitudinal and transverse seams shall be sealed with SeaShield 525 Epoxy as described in Section 3.3.1 and fastened with 3/16" diameter stainless steel rivets that shall not exceed 6" spacing.

7.1.4 The jacket shall be supported by temporary nylon straps or other means to assure that it will not move or distort during placement of epoxy grout.

7.1.5 A bottom seal shall be fitted on each jacket to prevent any epoxy grout from leaching out of the bottom of the jacket during the placement.

### 7.2 Epoxy Grout Placement

7.2.1 One each of the pre-packaged "A" & "B" components shall be mixed. One bag of the pre-packaged aggregate shall then be added to achieve a 3.5:1 or 5:1 ratio by weight of aggregate to resin. The mixed epoxy shall be pumped through a minimum one-inch ID hose with a suitable pump such as a Quickspray peristaltic pump.

7.2.2 Grout injection shall begin at the bottom injection port and proceed upwards. As the jacket is filled to each port, the lower port shall be capped off and repeated until the top of the jacket is reached.

7.2.3 The injection process shall be continuous, except when the injection hose is moved from port to port. At the contractor's option, he may elect to inject approximately 6" to 12" into the bottom port and allow it to cure before proceeding with subsequent lifts. This can be accomplished by pumping through the lower injection port. After cure, the same injection port can be utilized to pump up to the next port.

### 7.3 Completion

7.3.1 After the injection process is completed and the epoxy grout has cured, all temporary supports shall be removed.

7.3.2 The top of each fiberglass jacket may be finished with the SeaShield 525 Epoxy.



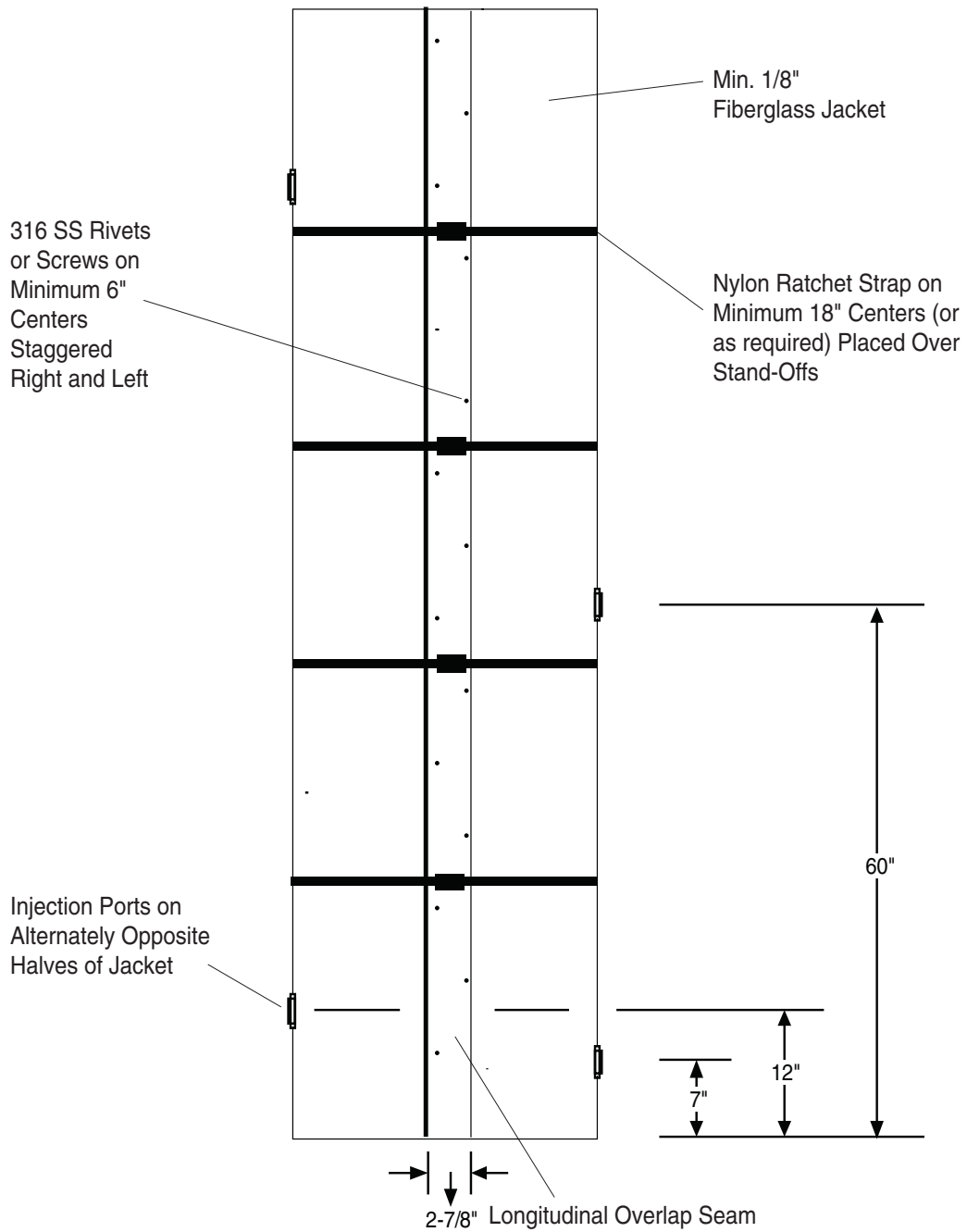
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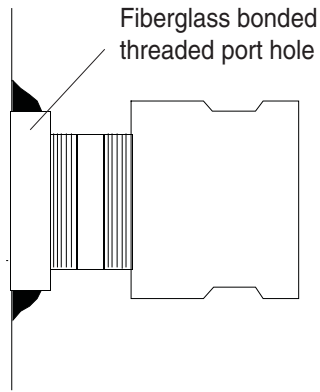
### Elevation View

**Note:** All measurements are approximate and may vary due to diameter and length of jacket.

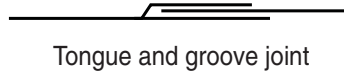
**Sheet 1**  
(Not to Scale)

# SeaShield Series 500 Pile Encapsulation

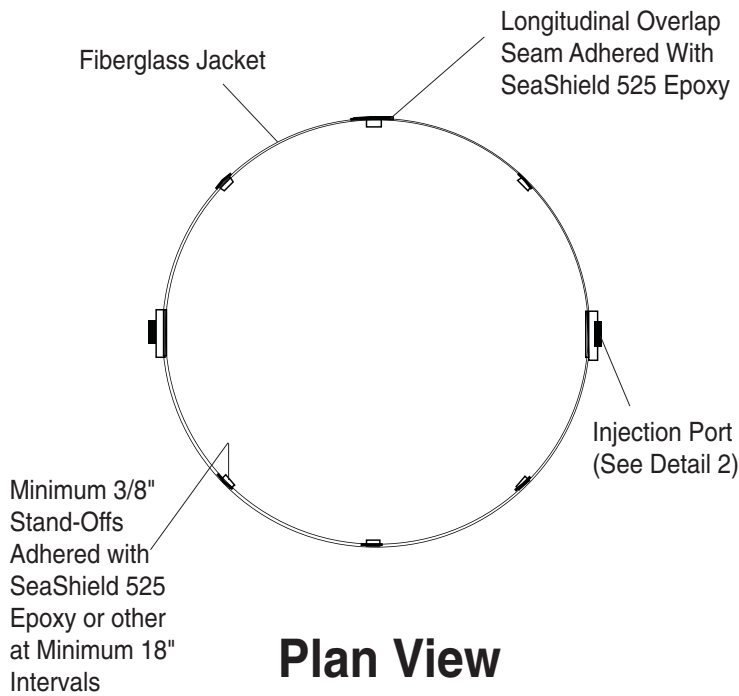




**Port hole Detail**  
Temporary Grout Valve Assembly



**Joint Option Details**



**Plan View**

**Sheet 2**  
(Not to Scale)

**SeaShield Series 500  
Pile Encapsulation**





### Step 1

Position SeaShield Fiber-Form Jacket around pile and seal longitudinal seams.



### Step 2

Affix bottom seal gasket with select strapping.



### Step 3

Connect grout hose to lower injection port and pump SeaShield 550 Epoxy Grout. Visually check for leaks. Plug upper port(s) and pump grout until it reaches top of jacket. (Upper ports are used only if pumping from lower ports becomes difficult.)



### Step 4

#### (Alternate Pumping Method)

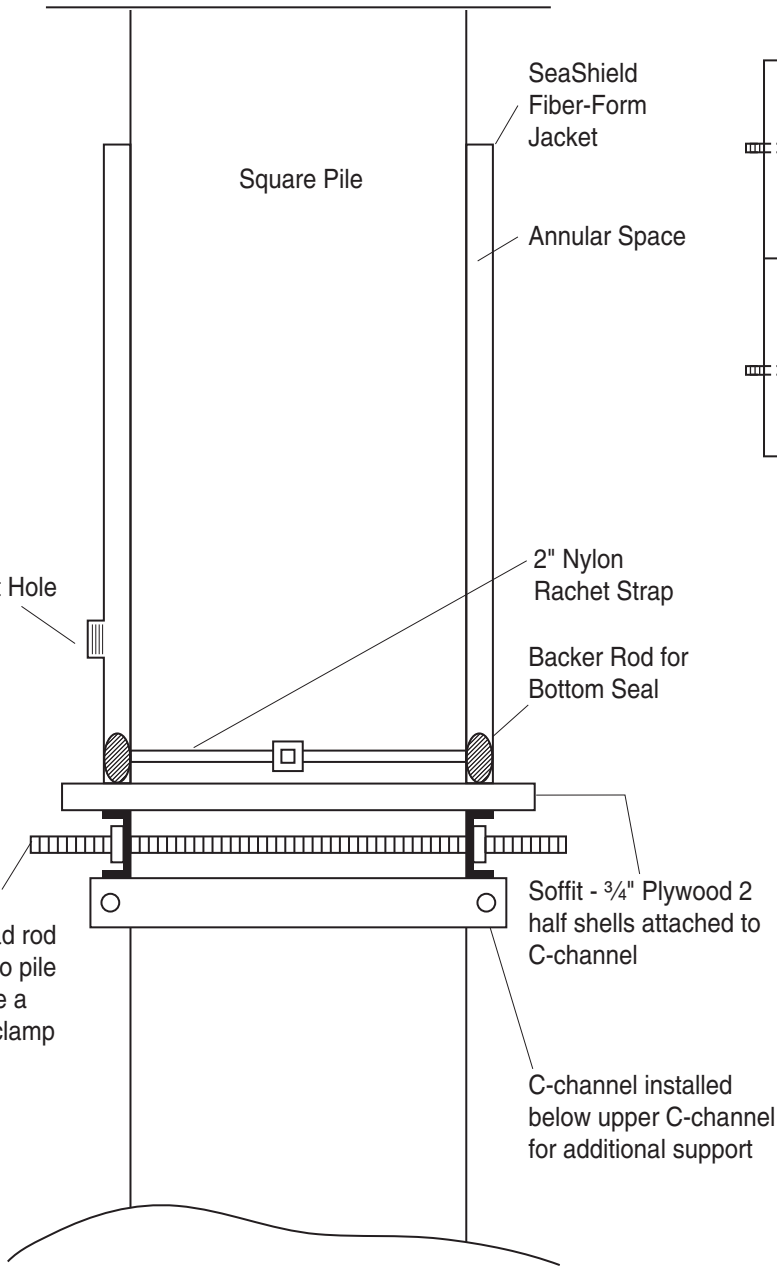
Contractor may choose to inject approximately 6" of SeaShield 550 Epoxy Grout and let cure before moving grout hose to next higher port and pumping remainder of grout. Pumping would then continue until grout reaches top of jacket.

Cured SeaShield 550 Epoxy Grout

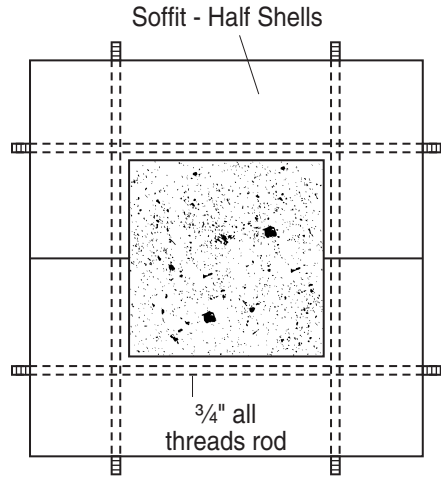
**Sheet 3**  
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## SeaShield Series 500 Grout Placement Sequence





**Elevation View**



**Plan View**

**Note:** All measurements are approximate and may vary due to diameter and length of jacket.

**Sheet 4**  
(Not to Scale)

**SeaShield Series 500  
Soffit Detail**

