40 YEARS OF MARINE PROTECTION

APPLICATION INSTRUCTIONS

SeaShield 400 System

for Timber Pile Protection

1. SCOPE:

Denso SeaShield Series 400 is a three part encapsulation system consisting of SeaShield Fiber-Form Jacket, C-GRID® 450 and SeaShield 510 UW Grout.
This specification may be used for the materials and application of SeaShield Series 400 Timber Pile Rehabilitation System. The engineer shall select appropriate sections of the specification to ensure that the specification is comprehensive for specified work.

2. USES:

Denso SeaShield Series 400 encapsulation system not only protects timber piles from aggressive saltwater environments and marine borers, but also increases the strength of deteriorated piles with a durable, lightweight and non-corrosive reinforcement. This system can be used for splash or tidal zone protection of marine timber piles which are subject to organism attack in sheltered environments.

3. GENERAL REQUIREMENTS:

- Contractor shall comply with all written recommendations of the manufacturer regarding application of the specified system
- The manufacturer of specified materials shall be Denso Australia, 411 Victoria Street, Brunswick 3056, VIC Australia. Tel: +61 3 9356 7600. E-mail: denso@densoaustralia.com.au.
- All materials used to comprise the SeaShield Series 400 System must be purchased from the same manufacturer. These include: Fiber-Form Jackets, C-GRID® 450, SeaShield 510 UW Grout (cementitious) and FB30 Tape Strip and the Neoprene Fiber-Form Jacket Bottomseal

4. MATERIALS LIST:

- Denso SeaShield Fiber-Form Jacket

- Jacket thickness shall be a minimum of 3 mm constructed of layers of woven roving and mat
- Jacket shall be translucent to provide visual inspection during the injection of the grout
- Jacket shall have minimum 32 mm injection ports spaced at intervals not to exceed 1.50 m. In order to provide even distribution of the grout, the injection ports shall be placed on alternative sides
- A UV gel coat shall be applied to the outside of the completed fiberglass jacket
- The fiberglass jacket shall have the following properties;

Ultimate tensile strength	**ASTM D638**	**103 MPa**
IZOD impact strength	**ASTM D256**	**1068 N**
Barcol hardness	**ASTM D2583**	**35**
Water Absorption	**ASTM D570**	**1% max**
UV stability	**ASTM G23**	**500 hr. pass**

- The jackets may be manufactured as either a single unit or as two pieces that shall be joined in field. The jackets can be placed one above the other via bell and spigot

Figure 1. *▲ A stand-off used in the SeaShield 400 system.*

- Denso SeaShield Carbon Fiber Grid (C-GRID® 450)

- Stand-offs (**Figure 1**) shall be placed throughout the C-GRID®450 to maintain the specified annulus between the pile and the jacket.

- Grout (SeaShield 510 UW (cementitious) Grout)
- FB30 Tape Strip (sealing of vertical seams and spigot on stacker jacket)
- Neoprene Fiber-Form Jacket Bottomseal (Refer to **Section 7c**) shall be used to prevent the leaching of grout into the

5. EQUIPMENT LIST:

- Wire brush, powered wire brush, scraper, water blasting equipment (optional)
- Brush cleaning solvent, utility knife, cleaning cloth, hand cleaner, barrier cream
- All lines shall be primed with by circulating 3.8 L (1 gallon) of the SeaShield Hose Lubricant. The grout shall be pre-mixed and pumped through a peristaltic pump or other suitable pump. The equipment shall be capable of delivering mixed grout through hoses into the jackets at a rate of ≥ 3.8 L/min. The maximum hose length should be no longer than 15 m
- Diving gear and equipment or overalls, gloves and any other personal protection equipment deemed necessary by the Safety Data Sheets and Job Safety Analysis conducted prior to the commencement of any work undertaken.

6. SURFACE PREPARATION:

Surfaces to be protected must free from all marine growth, perished timber, previous coatings, dirt, sharp splints etc. Trim around holes, cavities and sudden changes of profile.
The surface can be prepared by high pressure water jetting and hand tools such as wire brushes and scrapers. The choice of method will depend on a number of factors and will need to take into account the most practical. Precautions may need to be taken during the preparation process due to environmental concerns. Measures should be taken to minimise the amount of debris being deposited into the marine environment. Local regulations may dictate specific precautions and conditions that need to be met as part of these works. A job site Environmental Management Plan may be available for guidance in these matters.

First Inspection: When all marine growth has been removed a close examination must be made of the surface area that has been prepared to ensure a thoroughly clean surface without growth, sharp or protruding surfaces is obtained.

7. APPLICATION:

a)- Installation of the C-GRID® 450

- The C-GRID® 450 shall be unrolled and cut using tin snips or other suitable method. The cut width of C-GRID® 450 shall be determined by including enough material to be imbedded within the grout and a 150 mm (6”) overlap along vertical seam. The grid will require a minimum of 6 mm (1/4”) grout cover
- Locate C-GRID® 450 between the elevations indicated in the specification drawing (**Figure 7**). The C-GRID® 450 shall be wrapped around the timber pile with a minimum 150 mm overlap over the vertical seam (**Figure 2**).
- Stand-offs shall be placed throughout the C-GRID®450 at 0.5 m (18”) and 1.2 m (48”) intervals along the length of the C-GRID® 450 (depending on diameter size, length and thickness of the pile)
- Use nylon zip ties, plastic clips or other plastic accessories to secure vertical seam and maintain the position of the grid during the pumping of grout. On long length repairs requiring more than one panel of grid, the C-GRID® 450 shall be overlapped 150 mm above or below the first panel of grid.

b)- Installation of the SeaShield Fiberglass Jacket

- All longitudinal and transverse seams shall be sealed with FB30 Tape Strip and fastened with 5 mm (3/16”) diameter stainless steel hex screws that shall not exceed 150 mm spacing
- The Fiberglass Jacket shall be installed around the pile and C-GRID® 450 (**Figure 3**). The jacket shall be supported by temporary nylon straps or other means to assure that the jacket or C-GRID® 450 will not move or distort during placement of grout (**Figure 4**).
- A foam seal shall be installed at the bottom of each jacket to prevent any grout from leaching out of the bottom of the jacket during installation.

Figure 2. *▲ Lightweight and non corrosive C-Grid® 450 is installed around the pipe*

Figure 3. *▲SeaShield Fiber-Form Jacket is then snapped in place around the C-Grid® 450*

Figure 4. *▲ Grout can be pumped as soon as the Fiber-Form Jacket is secured*

7. APPLICATION (continued):

***c)*- Neoprene Fiber-Form Jacket Bottomseal Placement**

- Once jacket is in place, secure Neoprene Fiber-Form Jacket Bottomseal around the circumference of jacket allowing 200 mm over jacket surface (**Figure 5**)
- Secure the top as well as directly below the Fiber-Form Jacket with selected strapping (ratchet or 19 mm Smartband)

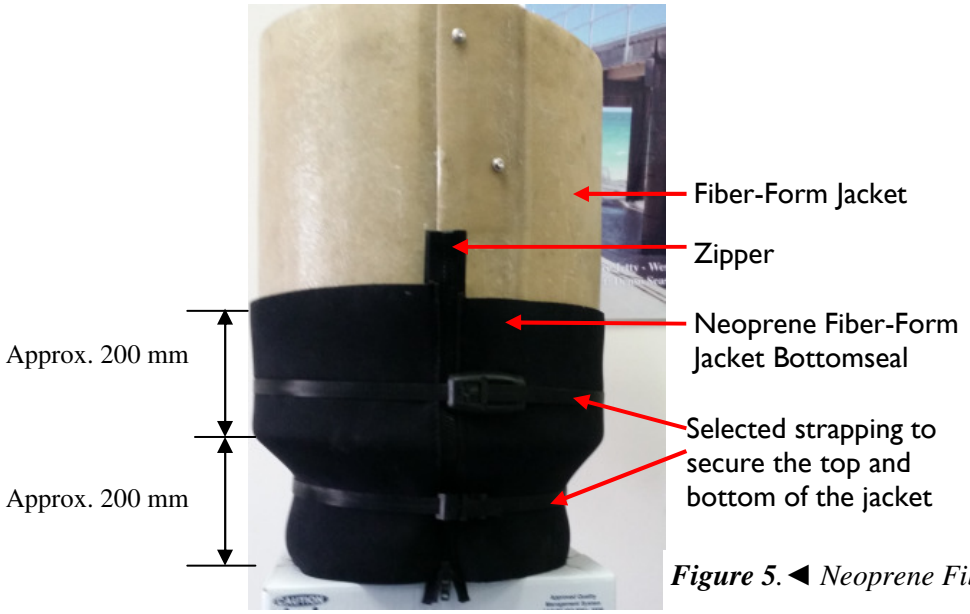

Figure 5. ◄ *Neoprene Fiber-Form Jacket Bottomseal*

***d)*- Grout Placement**

- Once jacket is in place, inject grout approximately 150 mm to 300 mm into the bottom port and allow it to cure before proceeding with subsequent lifts
- 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
- The injection process shall be continuous, except when the injection hose is moved from port to port

***e)*- Completion**

- After the injection process is completed and the grout is cured, all temporary supports shall be removed
- The top of each fiberglass jacket may be finished with the FB30 Tape Strip

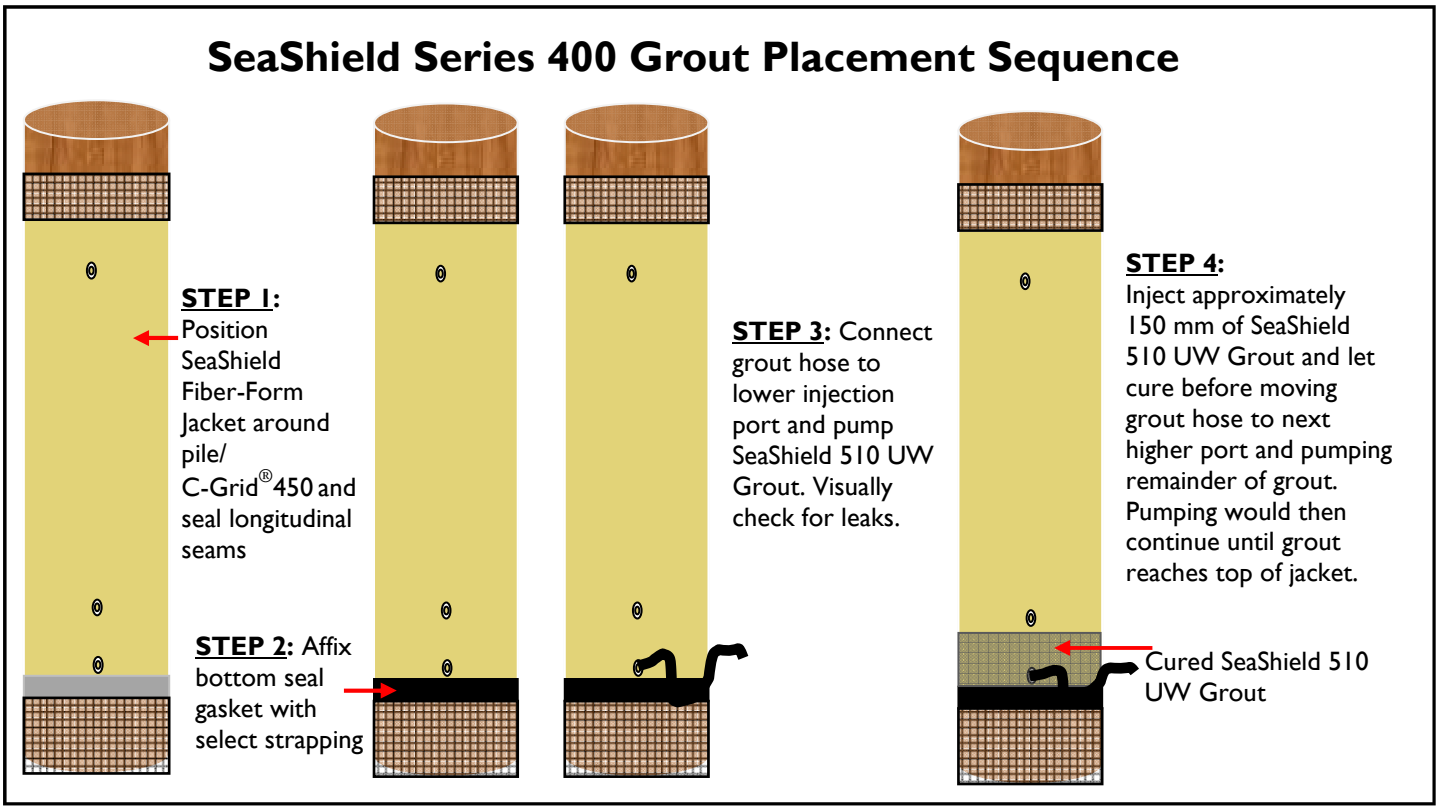

Figure 6. ▲ *SeaShield Series 400 Grout Placement Sequence (not to scale)*

SeaShield Series 400 Detailed Drawing

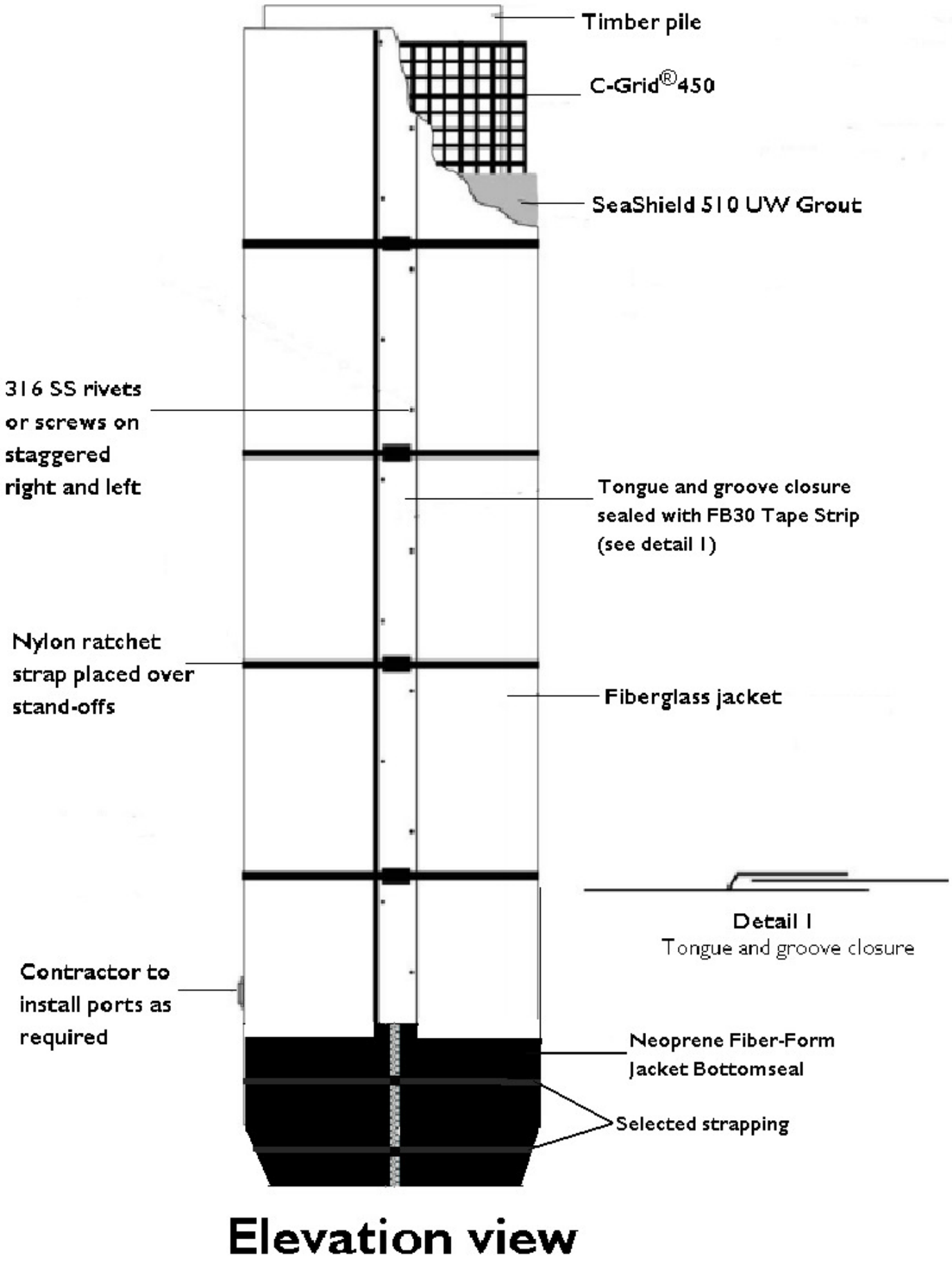

Figure 7. *▲ SeaShield Series 400 Detailed Drawing (not to scale)*

8. SAFETY DATA:

Storage:	Store Fiber-Form Jackets away from open flame. Grout must be stored in cool ambient conditions away from water, sunlight and sources of heat and corrosives. C-GRID® 450 must be stored in a sheltered area to prevent degradation of the epoxy resin due to UV exposure.
Transport:	Avoid prolonged exposure to high temperatures during transit, preferably in an enclosed vehicle.
Handling:	Avoid contact with eyes. Use sturdy plastic, aluminium, tin, steel when handling grout. Use dust respirator if using SeaShield 510 UW Grout
Action in case of fire:	Extinguish with water fog, dry powder, carbon dioxide or chemical foam. Self-contained breathing apparatus may be required.
Skin Contact:	Wash with warm water and mild soap.
Swallowing:	If feeling unwell, seek medical advice.
Eye Contact:	Wash eyes with water for at least 15 minutes while holding eyelids open
Inhalation:	In a fire situation avoid inhaling fumes.
Spillage:	Refer to Denso Safety Data sheets of system components.
Disposal:	Incineration or landfill in accordance with local regulations.
Other:	For more information please refer to Denso safety data and technical data sheets. Available for all system components.

Approved Quality Management System
AS/NZS ISO 9001:2008
Lloyds Register – Certificate Nº Mel 0927759

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