40 YEARS OF MARINE PROTECTION

APPLICATION INSTRUCTIONS

SeaShield 500 System

for Marine Pile Protection

1. SCOPE:

Denso SeaShield Series 500 is a two part system consisting of SeaShield Fiber-Form Jacket and SeaShield 550 Epoxy Grout. This specification may be used for the materials and application of SeaShield Series 500 Pile Encapsulation System. The engineer shall select appropriate sections of the specification to ensure that the specification is comprehensive for specified work.

2. USES:

Denso SeaShield 500 System can be applied above and/or below the water with inexpensive pumping equipment or poured into the pile jacket. The Series 500 System is tough, durable and provides the ultimate protection to restore steel, concrete and timber piles.

Figure 1.^ & 2.> *Marine piles protected by Denso SeaShield Series 500 System*

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 500 System must be purchased from the same manufacturer.
  These include: Fiber-Form Jackets, SeaShield 550 Grout and FB30 Tape Strip and the Neoprene/Vinyl Fiber-Form Jacket Bottomseal

4. MATERIALS LIST:

- Denso SeaShield Fiber-Form Jacket

- Jacket thickness shall be a minimum of 3.0 mm or 4.8 mm thickness, depending on the application and diameter size
- Jacket shall be translucent to provide visual inspection during the injection of the epoxy 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 (can be field installed by contractor)
- Jackets shall have stand-offs (grout spacers) adhered to the inside of the jacket to provide a minimum 8 mm annulus (or per project spec) between the pile and the jacket (can be field installed by contractor using SeaShield 525 Epoxy)
- A UV inhibitor shall be included to provide long-term UV stability
- 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**	**40**
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 with the overlapping jacket having a moulded open cavity to receive a bottom seal gasket

- Denso SeaShield 550 Epoxy Grout.

- The grout shall be pre-mixed prior to pumping. The ratio A/B, 2:1 or A/B:C, 5:1 mixing ratio will be free flowing and can be pumped without segregation and voids between pile and jacket.
- The pot life of the mixed grout is approximately 100 - 120 minutes at 25^{o}C and should not be pumped beyond this timeframe. Pot life will be considerably less at higher temperatures.

- FB30 Tape Strip (for sealing of vertical seams and spigot on stacker jacket).
- Neoprene/Vinyl Fiber-Form Jacket Bottomseal shall be used to prevent the leaching of grout into the marine environment.

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 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. Maximum hose length 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 SeaShield Fiberglass Jacket

- If a mud-line repair is required, excavate the mud at the base of the pile and install the jacket.
- If tidal zone repair is required , install a work platform at the proper height using friction clamps secured to the pile
- All stand offs shall be affixed to the jacket at 0.5 m to 1.2 m intervals (depending on diameter, length and thickness of the jacket) along the length of jacket. If additional stand-offs are required in the field, SeaShield 525 Epoxy can be used to adhere them
- Position the jacket around the pile and secure with a select strapping system every 0.5 m or as required to assure that jacket will not move or distort during placement of epoxy grout
- All longitudinal and transverse seams shall be sealed with FB30 Tape Strip and fastened with a 4.8 mm diameter stainless steel rivets that shall not exceed 150 mm spacing
- Denso Petrolatum Tape may be installed at the bottom of each jacket to assist the bottom seal placement and prevent grout from leaching out of the bottom of the jacket during installation

b)- Neoprene/Vinyl Fiber-Form Jacket Bottomseal Placement

- Once jacket is in place, secure Neoprene/Vinyl Fiber-Form Jacket Bottomseal around the circumference of jacket allowing 200 mm over jacket surface (**Figure 3**)
- Secure the top as well as directly below the Fiber-Form Jacket with selected strapping (ratchet or 19 mm Smartband)

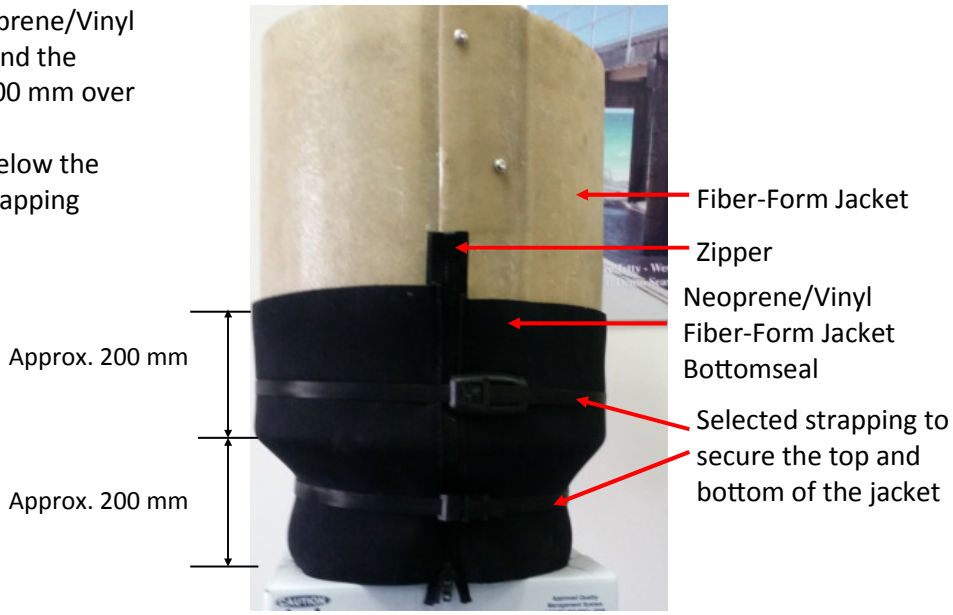

Figure 3*. Neoprene/Vinyl Fiber-Form Jacket Bottomseal*

b)- Epoxy Grout Placement

- One of each of pre-packaged Part A and B components shall be mixed. One bag of the pre-packaged aggregate shall then be added to achieve a 5 to 1 ratio by weight of aggregate to resin. The mixed epoxy shall be pumped through a minimum 25 mm internal diameter hose with a suitable pump such as a peristaltic or rotor stator pump.
- A bottom plug of 150 mm - 300 mm of epoxy grout shall first be pumped into the lowest injection port. The epoxy grout shall be allowed to cure before proceeding with subsequent lifts
- Once epoxy grout is cured, the 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.

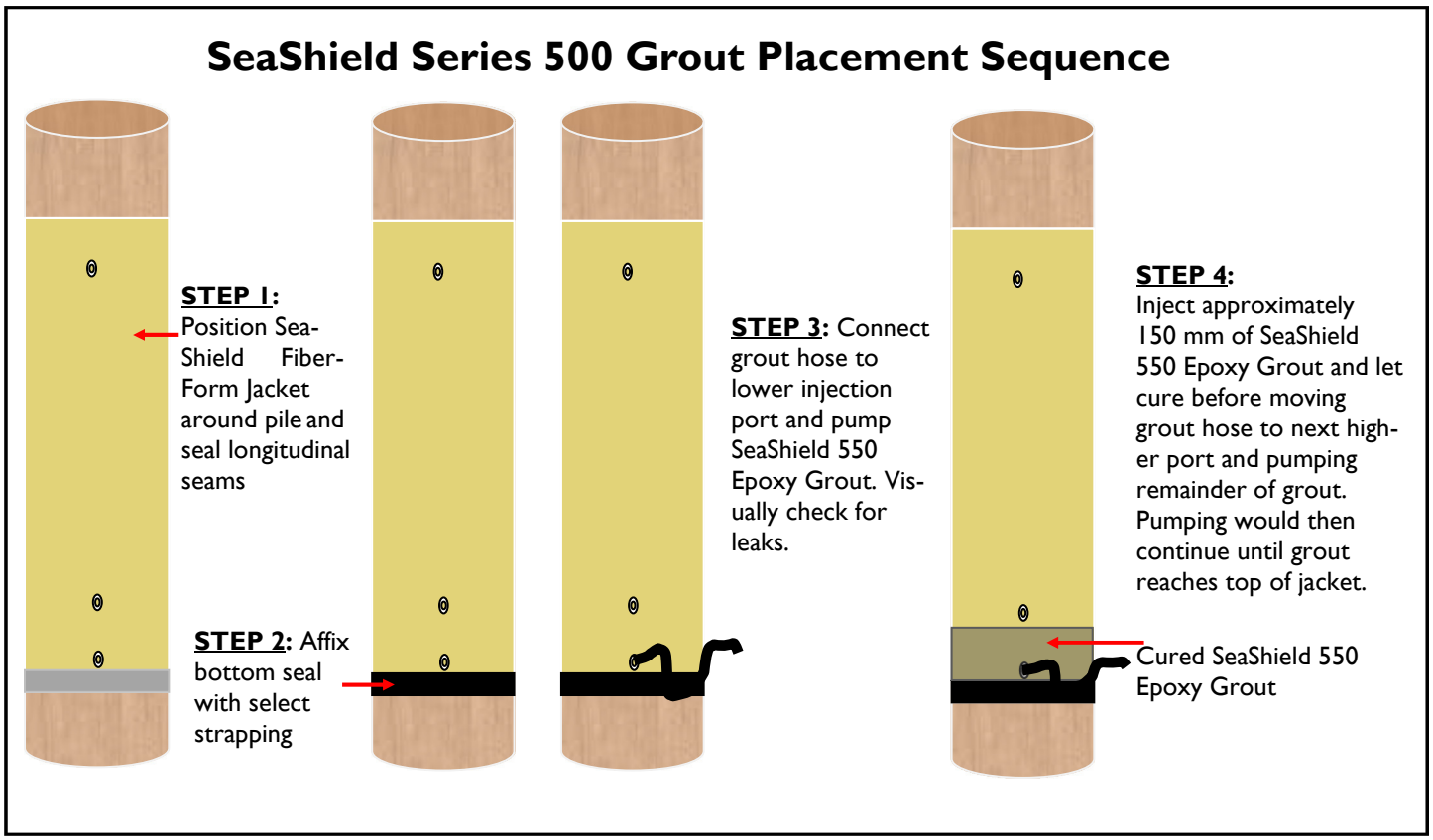

Figure 4*.SeaShield Series 500 Grout Placement Sequence*

c)- Completion

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

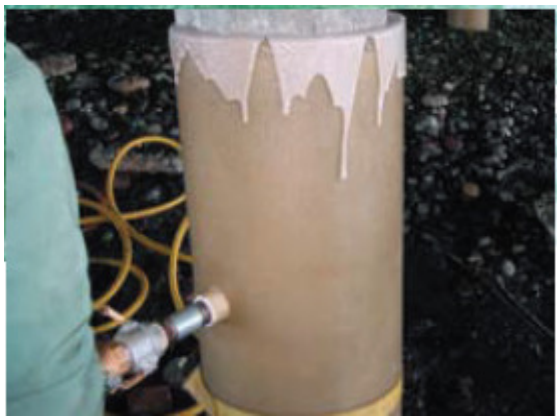

Figure 5.< *SeaShield 550 Epoxy Grout being pumped into the SeaShield Series 500 Fiber-Form*

Figure 6.> *SeaShield 550 Epoxy Grout pumped into the annulus around an existing octagonal concrete pile*

SeaShield Series 500 Pile Encapsulation System (not to scale)

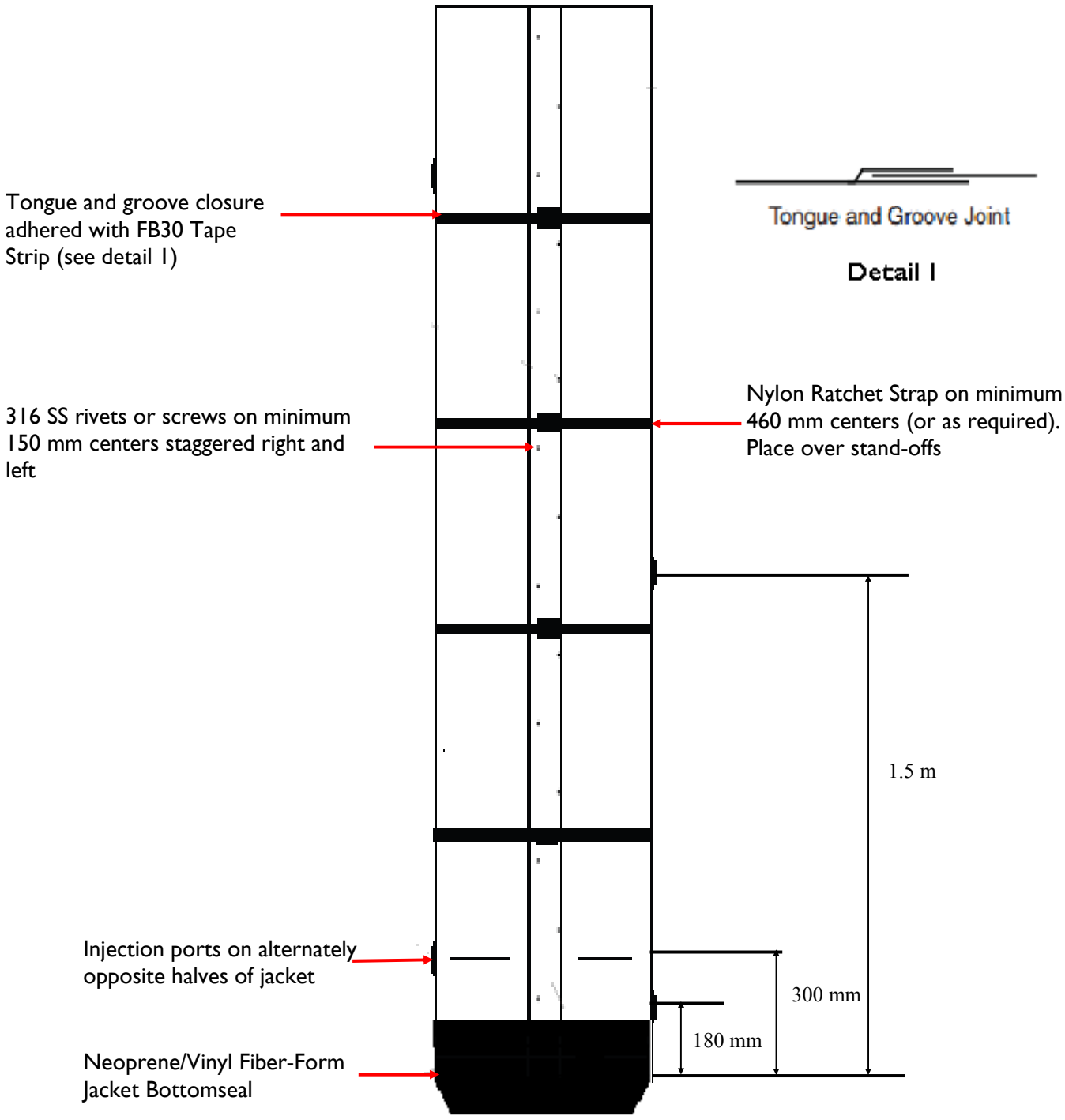

***Figure 7**.Elevation view of SeaShield Series 500 Pile Encapsulation System.*
***Note:** all measurements are approximate and may vary due to diameter and length of jacket*

8. SAFETY DATA:

Storage:	Store Fiber-Form jackets away from open flame. Grout must be stored between 5°C and 49°C in ambient conditions away from water, sunlight and sources of heat and corrosives. It is recommended to store grout at 20°C to 30°C for 24 h prior to use.
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.
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 individual Safety Data Sheets
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 N° Mel 0927759

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