

Sheet piling interlock sealants in port construction applications

A brief case study of the Bremerhaven Container Port

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Over thousands of years, dating back to the port construction of Amathus in southern Cyprus, man has waged mostly losing battles on the effects of water infiltration on large-scale port construction projects. Until recently, many port designers seemed resigned that a certain amount of water infiltration through retaining structures was an inevitable reality.

However, recent advances in water-resistant material engineering have led to revolutionary developments in steel sheet piling interlock sealants. These sealants are not only leak-resistant under sustained high pressure, and a wide range of temperatures and environmental conditions, but, just as importantly, are easy and cost efficient to apply.

The number of German and worldwide port construction projects that require interlock sealant to prevent hydraulic penetration has risen dramatically over the last decade. Port authorities, such as those who oversaw the construction of a combined sheet piling wall for Bremerhaven container port, increasingly demand the application of interlock sealants. This is for two main reasons:

1. The desire for protection against water infiltration, which is most important when working inside a cofferdam surrounded by water.
2. Sealants can prevent corrosion in sheet piling interlocks, because they prevent salt water and oxygen from coming into direct contact with the inner interlock. Coatings are not suitable at this point because they cannot be applied in the interlock in full layers, and could cause slide-down stoppage of threaded interlocks. Therefore, sealants with high ad- and cohesion features are required in sheet pile interlocks, according to the displacement principle.

While there are only a few interlock sealants for port construction applications available on the market today, only one – WADIT® – combines three essential factors for a port designer: water resistance under extreme pressure and temperature fluctuations, ease of application and low cost.

WADIT is a proven sheet piling interlock sealant that can be used with all types of hot-rolled and cold-formed sheet piling interlocks in every possible environment (tropical to arctic), and is particularly useful for port construction projects.

Accredited hydraulic sealant tests have demonstrated that leakage through sheet pile walls is reduced by more than 95 per cent when interlock sealants are used. Furthermore, the studies show that sealed joint sheet pile cutoff walls are anywhere from 100 to 10,000 times more effective as groundwater flow barriers than unsealed interlock walls.

Civil engineers started out using WADIT mainly for sheet and pipe pile wall constructions for cofferdams, dams, and cutoff walls at environmental remediation sites. However, port construction engineers in Germany soon realised the sealant was ideally suited for the Bremerhaven container port expansion in particular, because of its following properties:

1. Water pressure resistance.

The sealant has been laboratory tested to withstand five bars (~70 psi) of differential water pressure, in various types of steel sheet pile interlocks. This means it will remain in place and be functional with more than 130 feet of head water pressure against it.

2. Optimal flexibility.

The sealant remains extremely flexible even in ground water, or in similar cool and cold environments like Bremerhaven. It is materially flexible enough that it will not break out of the interlock after the sheet pile walls are inserted (paired), which is a leading cause of leakage in other sealant brands, especially by shore water attack. Even in low water temperatures such as Bremerhaven Port, its unique 'memory effect' guarantees excellent sealant behavior, even in the event of torsion and other movement in the sheet pile wall interlock.

3. Environmentally friendly.

It is non-toxic and is made from sustainable natural raw materials – essential in Germany today. 'WADIT sealant can be used without any restrictions in sheet pile wall interlocks in ground and surface water areas... [With] no fear of harmful effects if it is used in the area of drinking water extraction systems,' according to a report from the Institute for Environmental Geology and Contaminated Land, Nuremberg.



Figure 1. Using the Wadit applicator pictured above, more than 10,000 feet of sealant can be applied by a crew of two in an eight hour shift.



Figure 2. Wadit can be quickly and efficiently applied into any steel sheet piling interlock including cold formed sheets like that above.



Figure 3. Wadit is the world's leading sheet piling interlock sealant because it can be applied quickly, it can withstand high water pressures, is environmentally friendly and is extremely durable.

4. Application ease.

Piling can be driven as soon as 30 minutes after installing WADIT, or it can sit in the yard or job site for months before driving. Either way, it retains its sealant properties and can easily be transported. This unique time flexibility factor was of particular importance in the Bremerhaven container port expansion, just as it is for most large scale port projects. In just one day, with a two man crew, more than 10,000 feet of interlock can be filled with WADIT – more than 10 times the application rate of the leading competitor sealant.

5. Ease of delivery.

The sealant can be delivered already installed in the sheet piling interlocks to almost any port construction project in the world, or can be applied directly at the job site.

Additional information about the use of WADIT in port constructions, not only in Germany but around the world, can be seen at www.wadit.com where you can also watch the informational video.

ABOUT THE AUTHORS



Brian Lenzi is an American Professional Engineer with more than 40 years of civil engineering experience with the U.S. military, state and local governments as well as private industry. In addition to working on numerous high-profile civil engineering projects around the world, he is currently head of WADIT installation programs for North America.

Martin Petry is a German civil engineer and steel sheet pile expert, with a broad range of experience

working for such companies as HSP Hoesch Spundwand und Profil GmbH, where he started in their technical office by doing static calculations, and went on to add marketing and sales, research and product development as well as quality management to his technical knowledge. Now as a consultant with such companies as PilePro®, his special interests have moved to steel sheet piling driving situations at job sites, and engineering associated with various types of combined sheet piling.



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