Materials & Products – Coatings
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Comparison of Sintakote® vs Epoxy coatings for steel water pipe

Introduction

This coating comparison is made for Sintakote® versus epoxy coatings for the external corrosion protection of buried steel water pipe. Sintakote is a fusion bonded polyethylene (FBPE) coating, applied to steel pipes in accordance with AS 4321.

FBPE is the coating system recommended for steel water pipes by all the major water authorities in Australia, as indicated by WSAA (Water Services Association of Australia) WSA 03-2002 (Product and Material Information and Guidance - Water Supply Code of Australia) and WSAA's Product Specification WSA PS – 203 (Steel pipe for water supply and sewerage). Note that WSAA is the peak body representing Water Authorities in Australia and their members deliver water to approx. 20 million Australians.

The WSAA members are:

ACTEW Corporation, Allconnex Water, Barwon Water, Ben Lomond Water, Central Highlands Water, City West Water, Coliban Water, Cradle Mountain Water, Gippsland Water, Gladstone Area Water Board, Goulburn Valley Water, Gosford City Council, Hunter Water Corporation, LinkWater, Melbourne Water Corporation, Onstream, Power and Water Corporation, Queensland Urban Utilities, Seqwater, SA Water Corporation , South East Water Limited, Southern Water, Sydney Catchment Authority, Sydney Water Corporation, Townsville City Council, Unitywater, Water Corporation, WaterSecure, Western Water, and Yarra Valley Water. In addition to these members there are a number of associate members.

WSAA do not recommend the use of epoxy coatings for external protection of buried steel water pipes. Additionally there is currently there is only one Australian Standard applicable to epoxy coatings for buried service, AS 3862, which covers fusion bonded epoxy (FBE). That standard specifies a minimum coating thickness of 400µm. There is no Australian standard for liquid applied epoxy (LAE) coatings for buried steel pipes. The lack of appropriate standards for epoxy coatings reflects the industry view that such coatings are unsuitable for the external corrosion protection of buried steel water pipes. Nonetheless this document provides a comparison of the expected performance from FBPE coating compared to FBE and LAE coatings.

Coating performance review

A number of required coating performance measures are compared in the following sections as they relate to buried steel water pipe service. The overall performance is then summarised.

Damage resistance

The required impact resistance of FBPE is 18J (AS 4321), compared to 1.5J required for FBE (AS 3862). It is estimated that the thickness of LAE coatings would need to be at least 1.5mm or higher in order to provide the same impact resistance as FBPE. The required impact resistance of FBPE is more than 10 times that of FBE.

In addition FBPE meets ASTM G13, impact from falling stones after 10 drops. Thermosetting resin coatings such as FBE are more brittle than FBPE and as a result FBE fails the ASTM G13 test after just one drop.

Penetration resistance

No comparable penetration test requirements are available for FBE or LAE, but they are hard coatings, and like FBPE are resistant to penetration.

Cathodic disbonding

The cathodic disbonding resistance of FBPE is ≤ 15mm. FBE is ≤ 7mm. FBPE has been successfully used on cathodically protected pipelines in Australia for almost 40 years. The CP currents remain low, and the pipelines remain well protected. Cathodic disbonding is not an issue for FBPE, and is not expected to be an issue for well applied FBE or LAE.

Water Absorption

Of concern is the higher water absorption of FBE and LAE. With FBE this water absorption means it is not possible to field holiday test FBE coating at a sufficiently high enough voltage because water absorption reduces the dielectric strength of the coating to a level at which the air gap cannot be reliably bridged at the maximum allowable voltage for the coating. LAE would have a similar concern. In addition to this concern over holiday detection there is a concern over the deterioration in coating properties due to water absorption of LAE coatings.

In contrast FBPE has a very low water absorption of ≤0.2% after 12 months, and requires no derating for field holiday testing. The properties of FBPE do not change due to water absorption.

Adhesion

The adhesion of both FBPE and FBE is very good when applied correctly. Tests on FBPE coating after 26 years of service show excellent adhesion. A concern with both FBE and LAE is that they require a very high level of surface preparation to ensure adhesion is retained in long term service.

CP current density

Very low current densities are reported for FBPE coatings on steel water pipelines. The current density of FBE and LAE will depend on the damage incurred during installation (which will be higher than for FBPE due to the much lower impact resistance) and the

change in performance due to water absorption. The low impact resistance of FBE and LAE means that they will require cathodic protection to be applied whereas this remains an option for FBPE coated pipelines due to the low level of coating damage with FBPE.

Soil stress resistance

FBPE, FBE and LAE coatings are all strong, well bonded, smooth coating systems and are all immune to damage from soil stresses. No cases of soil stress damage have been reported for FBPE during almost 40 years of service in Australia.

Application skill

Successful application of FBE and LAE coatings requires careful control of the steel surface preparation to produce the required degree of cleanliness, surface roughness, and freedom from contaminants such as salt. During application critical aspects are mix ratios (for LAE), temperature control (especially for FBE) and humidity control. Coatings applied without due care may look satisfactory from a visual perspective, but may not perform appropriately in service.

The application of FBPE requires dedicated equipment, but is a more straight forward process to deliver the required quality. The thermoplastic nature of FBPE means no curing process is involved; it simply involves a melting and solidification process.

Apart from the critical application requirements needed to produce a high quality LAE coating another significant issue is the lack of a detailed application standard. The only International Standard of note is AWWA C210 and that provides little in the way of detailed and thorough QA/QC testing. Surface preparation, atmospheric control, and batch testing requirements for the degree of cure are the biggest issues of concern.

Summary

The enclosed Table 1 summarises the performance of FBPE, FBE and LAE coatings for steel water pipelines in buried service applications. Together with the information provided above it indicates FBPE is a superior coating system with a much higher assurance of long term performance compared to both FBE and LAE coatings. For reasons such as these, WSAA recommend FBPE as the preferred coating system for buried steel water pipes, and do not recommend either FBE or LAE coatings.

The aspects of improved performance for FBPE include:

1. Much greater damage resistance
2. Much reduced water absorption
3. Much longer track record / assurance of log term performance
4. Easier to apply and achieve required performance properties

In summary FBPE provides the best assurance of long term corrosion protection for buried steel water pipe service compared to both FBE and LAE coatings.

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TABLE 1 Review of FBPE, FBE and LAE coatings

Property	FBPE	FBE	LAE
Damage resistance	√	X	X
Penetration resistance	√	√	√
Cathodic disbonding	√	√	√
Water Absorption / property change	√	X	?
Long term adhesion	√	?	?
Long term CP current density	√	?	?
Soil stress resistance	√	√	√
Application skill	√	X	X