PHOENIX corrosion protection that stays.
INTERNATIONAL A/S

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Advantages in the Use of Water-Based Primer

To meet the restrictions from 2007 in the use of solvent based primer PHOENIX INTERNATIONAL A/S has developed a water-based primer for bitumen based coating systems for steel pipes. The development started some years ago and in 2005 we succeed. The major reason for the need of such a primer is to reduce or remove the use of solvent based primer due to the impact it has on health and the environment.

Over the years severe problems have been reported for citizens living around or very close to factories using solvent based primer despite the use of incinerators to remove fumes containing solvent. Personnel working at the factories have also been facing heavy impact from the fumes during their daily shift.

For sure it is possible to reduce the fumes exposed by building up cabins in which the pipes are then spray-applied with solvent based primers and afterwards during drying time. However, in an inline coating yard it may result in difficulties to maintain the continuously coating process - not to mention the investment in such a system.

Also, one of the side effects in the use of a water-based primer is the reduction of gas for running the incinerator. This is not only a cost reduction in gas and power consumption for the incinerator alone, but also a reduction in costs of maintenance of the equipment, again with reduced power consumption as a positive impact on the environment.

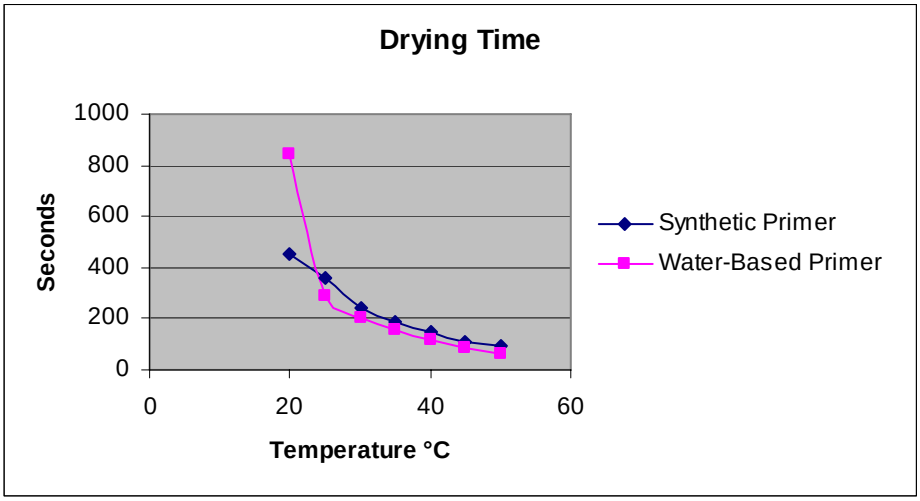
Laboratory Test:

The water-based primer is a single component and general characteristics and properties are as follows:

- Very low VOC (Volatile Organic Compound)
- Non-flammable
- Non-toxic
- Rapid drying
- High surface and coverage rate
- Excellent toughness and peel resistance.
- Single component
- Airless spray application

Drying Time

Drying time is an important factor when it comes to pipe coating speed. Tests have monitored excellent drying time for the water-based primer when pipes are preheated to more than 30°C (max. 50°C). See below a comparison in drying time between the conventional synthetic and water-based primer:



Coverage:

Due to a higher solid content in the water-based primer the coverage of pipe surface per litre is higher. PHOENIX Water-Based Primer gives approximately 1.6 times higher coverage than the synthetic primer based on obtaining the same dry film thickness.

General Information:

Colour:	Black
Storage:…..	Preferably stored between 5-30°C. Protect from frost. Storage minimum 12 months if stored under recommended conditions.
Surface preparation:	Blast cleaned to Swedish Standard 2½.
Mixing:	Stir well before use
Application:	The product can be applied by spray (airless, or air assisted) or by brush.
Drying time:	See graph above
Recommended dry film thickness:	25µm dry film thickness/ 60 µm wet film thickness
Coverage:	16-20 m^2/ litre
Cleaning:	When application is complete, wash equipment with water before the coating dries. Dried paint can be removed with aromatic or oxygenated solvents.
Sensible precautions:	Avoid deliberated contact with skin. Consult MSDS (Material Safety Data Sheet) for full safety details.

Test results:

Test	Procedure	Bitumen Enamel	Procedure	Bituseal® Enamel
Peel	BS4147	30°C: 1,0 mm 40°C: 2,0 mm 50°C: 1,0 mm 60°C: 0,5 mm	Shell DEP 31403033	30°C: 110 N/20 mm 40°C 70 N/ 20 mm 50°C: 47 N/ 20 mm 60°C: 25 N/ 20 mm
Impact	BS4147	4500 mm2 @ 25°C	Shell DEP 31403033	4500 mm2 @ -10°C
Bend	BS4147	>15 mm @ 0°C	Shell DEP 31403033	>15 mm @ -10°C
Sag	BS4147	0,5 @ 75°C	Shell DEP 31403033	0,5 @ 110°C
Cathodic Dis-bondment	BS3900 Part F11	8-12 mm	BS 3900 Part F11	5-6 mm

25 µm dry thickness film of water-based-primer is applied on grit blasted metal plate acc. Sa 2½ .
Enamel is then applied according to standard.

Third Party Full Scale Test

Introduction:
At present all bitumen enamel coating plants use primer type B according to BS4147. This primer contains a maximum of 75% volatile matter and also contains chlorinated rubber and plasticizer.

PHOENIX Water-Based Primer is a water-based primer with a much lower VOC level. The report describes the plant trial, using the newly developed water based primer. Obviously, this primer is not specified in BS4147 but tests for adhesion peel, sag, impact, bend and cathodic disbondment have demonstrated that an effective bond between the pipe steel and the coating was achieved.

Dimension of pipes used:
18" x 14.2mm

Materials used:

Primer:	Water-based primer
Enamel:	Asphalt enamel BS4147, type 2 grade B
Wraps:	Inner wrap (double layer)
	Woven heavy duty outer wrap in accordance with specification for Wrapped Asphalt

Prior to the trial, all primer supply and feed lines were cleaned free from solvent-based primer using firstly cellulose thinners then flushed thoroughly with hot water. It was decided prior to the trial that the plant would be set up as if to successfully coat 40 joints per hour. Five pipes in total would be coated and full inline testing would be performed on all pipes.

Results:
All comply with specification for wrapped asphalt.

	Amb. Temp.	Rel. Hum.	Profil	Surface Temp.	Time Until Tacky	Fully Dry	Primer Coverage	Visual Appear.	Warm Bond Test	Cold Bond Test	Full System Thick.
All Pipes	13.6°C	48.3%	77um	38-42°C	58 sec.	1m 35s	20-38um	Pass	Pass	Pass	5.4 –7.1mm

The time between priming the pipe and enamel coating the pipe was 21 minutes.

Comments:
Very small areas of primer were noted to take up to 3 minutes too fully dry (operations commented that the introduction of fans in the priming station could totally eliminate this problem).

The visual appearance of the dry primed pipe was consistent - flawless mat black finish was always apparent, and no runs, rips or sags were visible. The amount of enamel left on the primed surface after a warm bond test was very reassuring.
The cold bond tests passed easily with only cohesive failure within the enamel being visible.

Laboratory results of used material:

Bitumen Enamel softening point	122°C (BS4147 limits 115-130°C)
Primer viscosity @23 ºC	29 seconds (ISO flow cup #4). This value differs from the PHOENIX test result due to the different flow cups that were used for this test.
Primer volatile content @110 ºC	48% (BS4147 appendix A)

Cathodic Disbondment:
Results were taken from one pipe sample. Tests carried out in accordance with British Gas Standard CW6.

Pipe No	Test Temperature	Test Duration	Radial Disbondment
66212	65 C	48 Hours	0mm
66212	65 C	48 Hours	0mm
66212	65C	7 Days	0mm
66212	65C	7 Days	0mm
66212	23C	30 Days	0mm
66212	23C	30 Days	0mm
66212	23C	30 Days	0mm
66212	23C	30 Days	0mm

Conclusion:
It was concluded that the water-based primer is suitable for use and the newly developed water-borne primer is fully matching the conventional synthetic primer in regards to drying time, adhesion, flexibility, peel and other parameters which have to meet the specifications.

The water-based primer comply with EN 10.300:2005 which replaces BS4147 and is described under point 4.2.2.4. It is suitable for the use to Category 1 enamel – oxidized bitumen enamel containing filler- and Category 2 enamel –modified bitumen enamel containing filler- both described in EN10.300:2005.

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