

INTRODUCING THE

MULTISTAGE BITUMEN CONVERTER FROM SPRAYPAVE

SPRAYPAVE

SprayPave is a leading manufacturer and supplier of bitumen, modified binders and emulsions for road construction in South Africa.

The company was established in 1981 to offer binder spraying and hauling services and expanded to include the manufacture of bitumen binders in 2007, with its first bitumen emulsion produced in Alrode, Gauteng.

In 2010 SprayPave purchased an emulsion business in Durban, not only increasing its footprint, but also broadening its range of bitumen emulsions, cutbacks, pre-coating fluids and primes.

In 2012 SprayPave responded to the bitumen supply crisis in South Africa by exploring global technologies. The result was the acquisition of a multistage bitumen converter with the capability to change conventionally available refinery penetration grade bitumen to grades that are both lower in penetration and higher in softening point than the feedstock bitumen.

SprayPave opened its Cape Town emulsion plant in 2014 and the converter was commissioned on this site in 2016. Testing commenced immediately to prepare for SABS accreditation of the converted bitumen products as per the SANS BT1:2016 specification.

Mobile capability

SprayPave's completely autonomous and self-powered mobile emulsion and modified binder plants manufacture up to 6 000 litres of product per hour and can remain on remote locations for months at a time. The mobile plants come with fully equipped quality control laboratories.





MULTISTAGE BITUMEN CONVERTER

Bitumen is an essential component of asphalt as a binder. It is produced by refineries as a byproduct of crude oil, but can only be supplied in broad grade ranges that seldom meet asphalt design specifications. SprayPave has acquired technology unique to Africa that can make the shortage of high grade bitumen for asphalt production a thing of the past.

A multistage bitumen converter, acquired from Technix Industries in New Zealand, enables SprayPave to convert bituminous products from one grade to another and therefore enhance the penetration grades of bitumen required for asphalt production.

Technix Industries has been in the bitumen business for over 100 years and is a global leader in bitumen technologies.

Predictable and repeatable conversion

The 20 tonne per hour bitumen converter, now operating in Cape Town, is the second to be commissioned worldwide. The first is located in Fiji.

The technology uses pressure, heat and air to precisely convert bituminous products in a way that is predictable and repeatable.

Various properties of the bitumen, including softness, penetration index and physical properties, can be changed to exact design specifications.

Not only can the technology convert a range of refinery feedstocks on a molecular level into a superior quality bitumen, but with certain chemical additives the converter can also enhance bitumen to become a multigrade bitumen with specifications and performance characteristics spanning several penetration grades.

Performance Grade Specifications

The availability of high specification multigrade bitumen will facilitate compliance with the new Performance Grade (PG) bitumen specifications in South Africa. The PG specifications aim to improve the assessment of deformation resistance, fatigue properties, long term performance and cracking potential of bitumen as an asphalt binder.

By enhancing bitumen penetration grades, the multistage bitumen converter will help asphalt producers ensure they are using high specification multigrade bitumen complying with the PG specifications.

SprayPave also owns one of the few IATROSCAN units in Southern Africa that can undertake SARA (saturates, aromatics, resins and asphaltenes) compositional analysis to ensure that quality bitumen is produced at its facilities in Alberton, Durban and Cape Town.

Challenges around bitumen supply in South Africa

SprayPave's multistage bitumen converter addresses current and future issues around local bitumen supply, particularly in regions such as the Western Cape where refineries are unable to provide suitable penetration grades of bitumen for road binders. The converter can modify 70/100 penetration grade bitumen to 50/70 or even 10/20, which is required for new high modulus asphalt designs.

Asphalt manufacturers can now rest assured that their bitumen specification requirements will be met timeously and professionally.





THE TECHNOLOGY

To understand the technology, one needs to be aware of the complexity of bitumen as a substance

- There are more than 1 500 different crude oils in existence.
- Bitumen yield ranges from 60% to practically 0%.
- Each crude composition differs, as does the bitumen produced from it.

The chemistry of bitumen

- Over 100 000 hyrdrocarbons;
- Essentially a "wild mixture" of different substance groups: saturates, aromatics, resins and asphaltenes (SARA).

It is fundamentally insufficient to define the quality of bitumen by its physical properties only. You have a good quality bitumen if the substance groups (SARA) are present in the right balance to each other.

Asphaltenes are important as they build the backbone of the bitumen. A well

balanced ratio of asphaltenes to resins yields a high quality bitumen. This can be achieved by engineering bitumen with the multistage bitumen converter.

Through the controlled processes in a bitumen converter, including the addition of pressure, heat and air, it is possible to rearrange chemical structures respectively to create asphaltenes. The gentle process and highly efficient addition of air, and therefore oxygen (air rectification), preserves the highly polar aromatic/resin fraction and minimises the coke build-up.

The following bitumen deficiencies can be addressed through use of the bitumen converter

- 1. Too hard
- 2. Too soft
- 3. PI too high
- 4. PI too low
- 5. Ductility too low
- 6. Polymer compatibility.





Cornerstones of the technology

- Creates asphaltenes;
- Preserves high polar aromatics/resins, thereby improving the overall bitumen composition;
- Offers multiple feedstock options bitumen, vacuum residue/bottoms, refinery sidestreams and blends thereof;
- Properties can be adjusted to measure (with and without using reagents);
- Similar or better product quality compared to a conventional blowing process;
- Minimal volatile product loss: 0.01% on average;
- Continuous process no batch limitations;
- A bitumen grade change (e.g. 70/100 to 50/70) can be achieved at a capacity of about 20t/hr;
- Can achieve a specific PI of within 5 decimetres (e.g. 65/70).



MULTIGRADE BITUMEN

Multigrade bitumen is higher performance "premium grade" bitumen with performance characteristics that span multiple grades of bitumen. It is produced by chemically modifying conventional grade bitumen to obtain improved properties over a wider road surface temperature range.

The bitumen feedstock is permanently modified in terms of its major physical properties, viscosity and penetration, using reagents and air rectification, at briefly elevated temperatures, in the multistage bitumen converter plant, to achieve molecular re-arrangements. The process stabilises the composition of the bitumen while preserving precious resins.

The modifications made to the feedstock bitumen by the converter are



permanent and will not revert back to the lower performance characteristics of conventional grade bitumen.

Multigrade bitumen is characterised by being less temperature sensitive when compared with conventional grade bitumen. It has the properties of hard grade bitumen at high pavement temperatures coupled with the properties of soft grade bitumen at low pavement temperatures.

Compared with conventional grades, Multigrade bitumen

- is less pavement temperature sensitive when used as a binder, characterised by a positive penetration index;
- has lower viscosity at low pavement temperatures;
- has higher viscosity at elevated pavement temperatures;
- performs well, as a pavement binder, over a wider temperature range;
- requires a lower level of polymer modification than conventional bitumen to provide further advanced bitumen binder properties.

Roads paved using asphalt with multigrade bitumen benefit from

- improved resistance to deformation, leading to reduced rutting and shoving of hot mix asphalt pavements;
- reduced seal cracking at low pavement temperatures;
- reduced bleeding and chip stripping of chip sealed roads;
- greatly enhanced pavement life and reduced maintenance costs;
- achieving the best of both options by using multigrade bitumen with small amounts of polymers.

Multigrade bitumen has better temperature stability; is more cost effective compared to conventional grade bitumen; can be used wherever conventional grade bitumen is used for hot mix asphalt and chip sealing; can be emulsified in the same way as conventional bitumen; transported and stored cold or hot; and handled and applied as for conventional bitumen.

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