Kinetrol Application Guide – The Asphalt Industry

What is asphalt pavement?

Then National Asphalt Paving Association defines asphalt pavement as a combination of approximately 95 percent stone, sand, or gravel bound together by 5 percent asphalt cement, a product of crude oil. Asphalt cement is heated and mixed with the aggregate at a mixing facility. The resulting asphalt pavement material is loaded into trucks for transport to the paving site. The trucks dump the pavement material into hoppers located at the front of paving machines. The asphalt is placed, then compacted using a heavy roller, which is driven over the asphalt. Traffic is generally permitted on the pavement as soon as the pavement has cooled.

The Asphalt Pavement Market

Asphalt mixtures are used to pave roads, streets, highways, parking lots, airports, biking and walking trails, and other paved surfaces in the Nation's transportation networks. Roughly 3,500 asphalt mix production sites operate across the United States, producing about 350 million tons of asphalt pavement material per year. Most of these production facilities are small, family-owned businesses that employ the many workers who build America's network of highways and roads.

Roads

There are almost 4.1 million miles of public roads in the U.S. Per the Federal Highway Administration, more than 1.3 million miles are unpaved.

About 1.8 million miles are paved local roads for which FHWA does not track pavement type. Of the remaining 953,000 miles of paved roads, about 796,000 miles are asphalt and 158,000 miles are concrete.1 Many concrete pavements, however, are surfaced with asphalt for maintenance reasons, to extend their life or to address safety and noise issues.

There is approximately 18 billion tons of asphalt pavement in American roads, all of which could be mined for reuse in new asphalt pavements. Currently, the asphalt pavement industry reclaims more than 99 percent of asphalt pavement removed from projects for reuse in future projects.2

Airports

Between 85 and 90 percent of all runways at the nation's 3,330 FAA National Plan of Integrated Airport Systems (NPIAS) airports are surfaced with asphalt pavement.

Approximately $4 billion per year from Airport Improvement Program grants and passenger facility charges is spent on airfield runways, taxiways, and aprons.

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Types of Asphalt

Different kinds of asphalt are manufactured or 'mixed' on site depending upon the application it will be used for. Factors such as traffic volume, type of traffic, temperature & weather conditions and noise restrictions are considered when choosing a mix to ensure the asphalt has sufficient stiffness and resistance to withstand traffic but also to have the necessary flexural strength to resist cracking. Asphalt plants are generally fully automated and mix ingredients are pre-programmed allowing a wide range of asphalt products to be produced on site.

Hot Mix Asphalt (HMA) – Generally produced at a temperature between 150°C and 180°C.
Warm Mix Asphalt (WMA) – Produced at a temperature around 20°C and 40°C below that of equivalent HMA. Less energy is used in the manufacture of WMA and it has improved functional benefits.
Cold Mix Asphalt – Mixed without heating the aggregate but uses a specific bitumen emulsion. This breaks down either during compaction or mixing to bind the aggregates.

There are two main types of asphalt plants, batch and continuous. Batch plants are the most widespread and offer the greatest flexibility. Single batch mixes can be produced per each customer's requirements. Individual components are weighed and metered separately every 50-60 seconds to produce a complete batch. Continuous plants produce single mix asphalt in large quantities without interruption. The production system is simplified, which reduces maintenance, but offers less flexibility.

This Application Guide concentrates on batch plants, although similarities exist between both.

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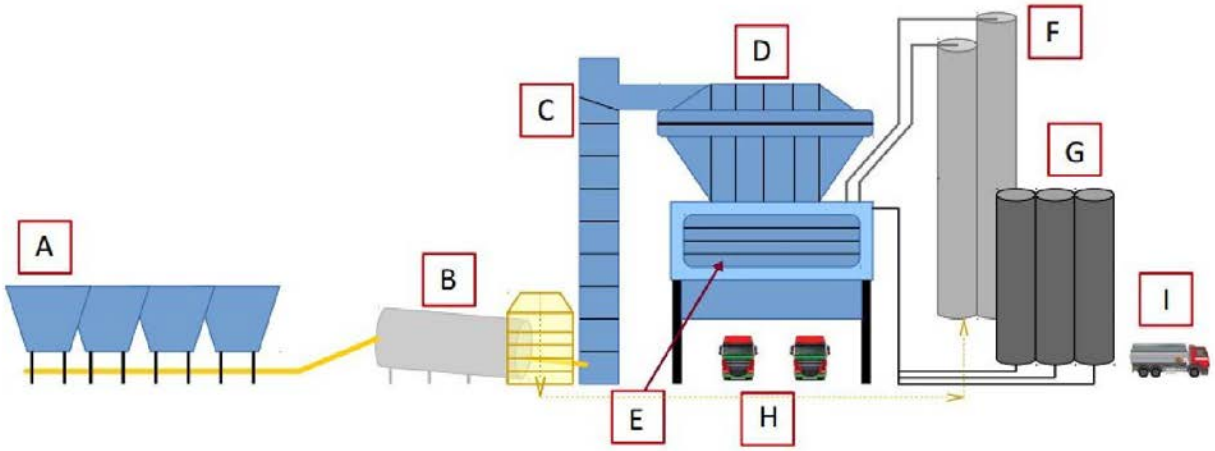
Batch Plant



A Cold Feed Bins

Aggregate Cold Feed Bins hold the different types of aggregate used to produce asphalt. The type and quantity of aggregate is metered onto the conveyor and sent to the dryer.

B Dryer & Dust Filtration

For the manufacture of asphalt it is essential to remove moisture from the base material. The aggregates are dried and heated through a hot air stream in the dryer. The drying process aids production as the removal of moisture and the heating up of the aggregate improves the mixing process. The dust filtration system on the dryer allows for the extraction of very fine aggregate which can be later used as a filler.

C Hot Elevator

The heated aggregate is transported up to the screening floor via a Hot Elevator. The design of the elevator allows for the transfer of heat throughout the aggregate.

D Screening

Most stationary plants have 5-fold screening as standard. The vibratory screening allows the filtering of aggregates to match asphalt recipes and ensure uniform batches. Oversized aggregates are rejected.

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E Mixing

The mixer is the key component within the asphalt plant. Here the aggregates are mixed with bitumen and filler to form the asphalt. Bitumenand filler are added to the mix from the tanks. If the plants has RAP (recycled asphalt paving) facilities this is also added in the mixing stage. A mixing cycle, including filling and emptying takes around 45 seconds.

F Filler Tower

Filler plays an important role in regulating the asphalt adhesion. In addition it improves the binding of the bitumen to the aggregates. Filler can either be reclaimed mineral filler, from the dust filtration system, or imported filler, such a fibre filler or hydrated lime. Kinetrol units control diverter valves which control the flow of filler to designated silos.

G Heated Bitumen Tanks

Bitumen is the core component of asphalt. Different types of bitumen are stored separately in thermally insulated storage tanks. These tanks are electrically heated to maintain the required temperature of the bitumen, approximately 160-180°C. Hot bitumen is pumped from the tanks via insulated pipes to the mixer. Automated flow of the bitumen is controlled by Kinetrol assemblies.

H Loading/Storage

Completed asphalt is either discharged directly onto a lorry or if present on site can be diverted to storage silos. These silos are insulated to prevent loss of temperature and can store production asphalt for a certain duration of time.

I Bitumen Tankers

Bitumen tanks are filled regularly by tanker lorries via a fill pump controlled through pipelines to respective tanks. These tanker lorries have Kinetrol units controlling the outlet valves through which the bitumen is discharged.

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Opportunities for Kinetrol

Although the number of actuated valve packages in asphalt is small, the sheer number of plants makes it a worthwhile industry to pursue.

The main area for Kinetrol assemblies is the control of flow of bitumen from the heated tanks to the mixer. The nature of bitumen as a heavy, viscous fluid means the actuators have to overcome sticking valves and/or issues of valve reseating. This is an area where Kinetrol's single vane design out-performs rack & pinion units. Other areas where Kinetrol assemblies can be used are on diverter valves for the filler towers and air inlet valves on filter units.

Reliability

On most plants asphalt batches can be produced every 50 - 60 seconds. This means the flow of bitumen from the tanks to mixer is also switching on/off at the same frequency. The simple single vane design of the Kinetrol units and its proven lifetime cycling means it is highly suited for this type of application.

The propensity of bitumen to result in sticking valves and the need for the accurate reseating of valves means Kinetrol actuators are again advantageous. The units' direct drive, meaning there is no loss in motion, no backlash or deadband means even after a long time period the actuator continues to perform its function, something that motor drives, cylinders and rack & pinion actuators cannot warrant.

Downtime at a plant can be expensive, especially if during busy periods , such as during contracted road laying programmes. Maintenance or equipment replacement is costly. However it is not only these actual service costs that need to be considered. On top of this is the cost of lost production, the cost of rejected product and the possible cost of overtime worked to make up lost time. Therefore the real cost of a failure is significant.

Kinetrol's simple design, with its single moving part combined with the unit's durability in harsh, hot, dusty environments means its reliability is unrivalled. This means sustained production, with a reduction in maintenance and downtime, will protecting a plant's economic viability.

These attributes of the Kinetrol unit can also be specified as reasons for their installation on bitumen tankers and other similar vehicles.