

Rotary Vane Vacuum Technology for the Chemical Industry



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Once-through oil-lubricated rotary vane vacuum pumps – the robust and proven solution for difficult applications

Oil-lubricated rotary vane vacuum pumps have been successfully used in many fields for decades. Today, they are amongst the most widely used mechanical vacuum pumps in the industry.

Busch already developed the a two-stage once-through oil-lubricated rotary vane vacuum pump (Figure 1) in the 1960s, which was specially designed for chemical and pharmaceutical processing technology. Busch has constantly further developed this vacuum pump, which continues to enjoy great acceptance in processing technology today thanks to its robustness and reliability.

Once-through oil-lubricated rotary vane vacuum pumps have three significant distinguishing features when compared to other vacuum pumps that operate according to the rotary vane principle (Figure 2):

1. Two compression stages are stacked and connected to each other which facilitates initial compression of the process gas in the first stage and secondary compression in the subsequent second stage. This makes it possible to achieve a lower ultimate pressure.
2. These vacuum pumps feature an oil-lubrication which means that a defined amount of operating fluid, oil or other media-compatible fluid is injected into the compression chamber. In contrast, other rotary vane vacuum pumps use oil circulating lubrication.
3. Once-through oil-lubricated rotary vane vacuum pumps are water cooled, thus allowing the operating temperature to be regulated within a certain range.

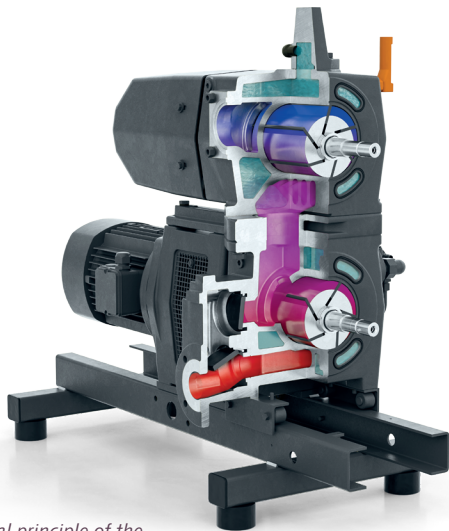


Figure 2: Operational principle of the Huckepack once-through oil-lubricated rotary vane vacuum pump



Figure 1: Huckepack once-through oil-lubricated rotary vane vacuum pump by Busch

Once-through oil-lubricated rotary vane vacuum pumps are rotating positive displacement pumps. The pump stages are mounted one on top of the other. The upper cylinder, where the compression is lower has a six vane rotor and the lower cylinder has a five vane rotor for a higher compression ratio. The low and high pressure stages contain an eccentrically mounted rotor. The vanes are placed in slots in a rotor, which rotates eccentrically in a cylindrical housing. Because of the centrifugal force created by the rotating motion of the rotor the vanes slide out of the slots and they come into contact with the cylinder wall. This creates spaces with different volumes, which in turn generate the suction and compression effect. The carbon fiber composite vanes especially designed to handle aggressive gases have emergency running properties which guarantee operational safety and a high performance even with insufficient lubrication.

To reduce friction and improve the seal, oil is continuously injected into the compression chamber. This process takes place in both compression stages before the process gas is discharged together with the operating fluid via the outlet and can subsequently be removed. Both stages are water cooled. The operating temperature can be kept at an optimum level thanks to the cooling channels integrated into the housing. Versions with once-through water cooling and water circulation are available. Because the lubricant only flows through the vacuum pump once, nearly all liquids with a viscosity in the range of 150 centistokes (cSt) can be used. These constantly flush the vacuum pump during operation, protecting it from corrosion and deposits. Vanes are available out of three different materials to ensure resistance to most solvents.

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The once-through oil-lubricated rotary vane vacuum pumps have been especially designed for particularly complex processes in the chemical and pharmaceutical industry as well as special vacuum packaging machines where considerable amounts of water vapor need to be handled. They are resistant to aggressive substances, and the fresh oil lubrication allows corrosive gases or vapors to be conveyed without difficulties. Depending on the process conditions, once-through oil-lubricated vacuum pumps can last for decades with only minimal maintenance which can easily be carried out by the operator. Apart from changing oil and filters at regular service intervals, no further maintenance is required.

For the use in potentially explosive environments, once-through oil-lubricated rotary vane vacuum pumps are also available in an explosion proof (ATEX) version. This version has been configured for the safe use in hazardous areas to provide extra protection in explosive environments. This makes it possible for these vacuum pumps to be adjusted to suit any process anywhere in the world when other technologies are limited.



Figure 3: Vacuum system with two Huckepack once-through oil-lubricated rotary vane vacuum pumps for chemical applications



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