Single-Vane Vacuum Pumps
for Vacuum Generation
Mechanical single-vane vacuum pump

Pneumatically acting brake boosters are installed in passenger cars and light-duty trucks to increase braking reliability and ease of handling. For diesel engines and increasingly also for gasoline engines, specifically those with direct injection, vacuum pumps are used for supplying brake boosters and servo valves with vacuum, for controlling exhaust gas recirculation systems and turbo chargers, for example. Based on longstanding experience with pistons, membrane and swinging-vane vacuum pumps a single-vane vacuum pump was developed in line with optimization measures. The rugged pump is equipped with a rotary drive and complies with all technical requirements. Its design additionally offers the benefit of lower production costs thanks to a reduced number of component parts. The single-vane vacuum pump can...

Fig. 1: Single-vane vacuum pump 190 EVO

Fig. 2: Single-vane vacuum pump 190 N3

Fig. 3: Tandem oil / vacuum pump 260 EVO

Fig. 4: Tandem oil / vacuum pump 260 EVO
be fitted with a secondary vacuum port for servo devices. Moreover, the single-vane vacuum pump is also available in combination with an oil pump as a so-called tandem pump.

The rotor with integrated shaft is arranged overhung in the customer-specific pump flange. The single-vane vacuum pump needs lube oil for sealing the internal gaps, for heat dissipation and for lubricating the sliding counter parts. The oil is supplied from the engine by means of a pressure or splash lubricating system. The exhausted air and the lube oil are returned to the engine.

The single-vane vacuum pump is available as a modular system in various sizes. Different sizes can be realized optionally via a radial and/or axial installation space so that maximum flexibility is ensured for accommodating the system on the engine. All presently known vacuum conditions specified by the various customers can be met with the single-vane vacuum pump model range available.

Pierburg Pump Technology offers the vacuum pump in three model series. A common feature of all series is their sturdy design and high efficiency.

**N2 series**

In the pump housing, a vane rotates such that it describes a virtually elliptical path, steered by an eccentrically arranged rotor. Both vane ends are fitted with pivoted slide shoes for

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**Fig. 5:** Typical evacuation characteristics of the various pump sizes
efficient buildup of the lubricating film, contributing to extremely low wearing rates and reduced power consumption. Thanks to the selective use of steel components the N2 series is applicable even at extreme temperatures which may prevail, for example, in the direct surrounds of the exhaust system.

**N3 series**

In the N3 series, the basic principle of the N2 technology is preserved but this series relies on the use of robust, advanced engineering plastics. The concomitant reduction of the moving masses and of the frictional coefficients combined with the deployment of purpose-designed geometries make for extremely low power consumption. In addition, an extraordinarily smooth run thanks to minimized rotational imbalances at the driving shaft contributes to the high quality standard of this series. The choice of a deep-drawn steel body ensures excellent cost efficiency.

**EVO series**

Based on the N3 technology, the EVO model range features an aluminum flange housing. With this design, the pump flange and pump body form one rugged unit. The resulting system features permit further optimization in terms of efficiency and power consumption. The EVO series boasts characteristics which are top in the entire market segment.

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**Fig. 6:** Typical power consumption characteristics of the various series with the example of the same pump size (190 cc)
Paying tribute to increased rev demands, e.g. for tandem pumps, high-speed resistant applications are developed.

The low power consumption achieved with the diverse installation sizes and technologies contributes to fuel savings.

All series can be driven via the camshaft or a secondary shaft. The connecting element is a coupling designed to compensate for offsets due to the assembly or to tolerances. Oil is supplied from the engine’s oil circuit. Single-vane vacuum pumps are delivered ready for installation, with customer-specific intake connections and integrated check valve as well as a sealing device between pump and engine.

All materials employed in the single-vane vacuum pump are environment-friendly and easily recyclable.

**Benefits at a glance**

- Reliable performance to meet exhaust requirements at all operating conditions
- Low power consumption, fuel savings
- Very low wearing rate, even under extreme conditions, long service life
- Applicable up to the highest temperatures
- Reduced number of components
- Low weight of single-vane vacuum pumps
- Excellent recyclability of all materials, environment-friendly
- Small overall installed size
- Low cost
- Clockwise or counterclockwise rotation possible, design adaptation to customer-specific pump flange
- Separate vacuum ports for brake boosters and servo devices available

<table>
<thead>
<tr>
<th>Delivery volume per revolution [ccm]</th>
<th>Available pump series N2</th>
<th>Available pump series N3</th>
<th>Available pump series EVO</th>
<th>Drive speed</th>
<th>Power consumption vs. final vacuum ( (n=2,500\text{min}^{-1}) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>130</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>max. 6,800 min(^{-1})</td>
<td>≥ 110 watt</td>
</tr>
<tr>
<td>190</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>max. 5,500 min(^{-1})</td>
<td>≥ 140 watt</td>
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<tr>
<td>210</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>max. 5,000 min(^{-1})</td>
<td>≥ 160 watt</td>
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<tr>
<td>240</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>max. 5,000 min(^{-1})</td>
<td>≥ 180 watt</td>
</tr>
<tr>
<td>260</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>max. 5,000 min(^{-1})</td>
<td>≥ 200 watt</td>
</tr>
<tr>
<td>280</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>max. 4,200 min(^{-1})</td>
<td>≥ 220 watt</td>
</tr>
</tbody>
</table>

*hs = high-speed application*

**Tab. 1: Single-vane vacuum pump – typical pump sizes and application of the single-vane vacuum pump product portfolio**