

## **Energy Efficiency with Vacuum Technology: The VAGG Vacuum Unit**

### **Dramatic reduction of energy consumption**

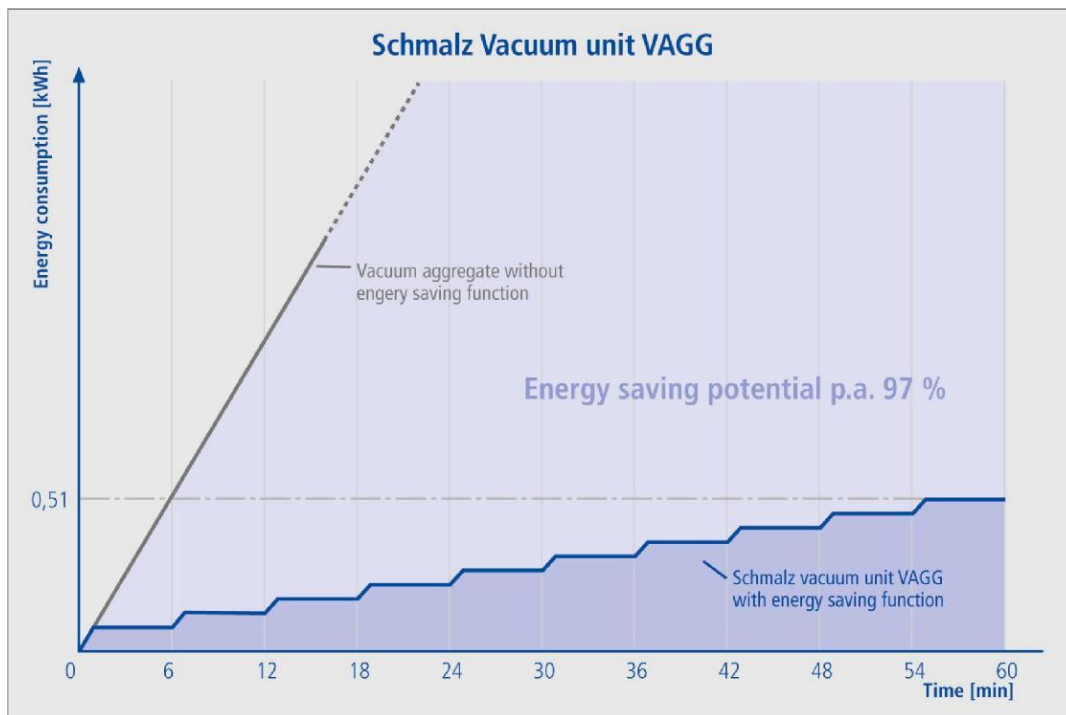
Here, we compare a conventional vacuum generator with the VAGG vacuum unit from Schmalz. This is used, for example, for clamping workpieces in CNC machining centres. The power consumption of both vacuum generators is 1.1 kW. The other performance data for each unit is the same. This includes the duration of the clamping/milling process (60 minutes) and the evacuation time (20 seconds to - 850 mbar).

Unlike the conventional vacuum generator, which runs throughout the entire clamping/milling process, continuing to consume energy, the VAGG vacuum unit's integrated energy-saving regulation enables the user to save enormous amounts of energy. This system interrupts vacuum generation once a particular vacuum value has been reached. Vacuum generation is switched back on only when this value exceeds the preset minimum vacuum value.

There are considerable differences in the total running time of the vacuum generator. With the conventional vacuum generator, the running time per clamping/milling process is 60.33 minutes (including evacuation time). With the Schmalz VAGG vacuum unit, the running time is only 2 minutes. When calculated for use in two operating shifts with 14 milling processes per day, there is a dramatic difference in the operating time between the two units. Here, the VAGG vacuum generator has a clear advantage: This unit requires only 28 minutes in comparison to 844.62 for the conventional unit. This results in an energy consumption of 0.51 kWh/day instead of 15.48 kWh. With 245 work days per year, the total energy consumption is reduced by 3,668 kWh.

## Significant savings on operating costs, better for the environment

At an average industrial electricity price of EUR 0.1255/kWh, the annual cost of energy generation for the VAGG vacuum unit is only EUR 15.70 compared to EUR 476 for the conventional vacuum generator. This translates to an annual savings of around 97% on operating costs. CO<sub>2</sub> emissions are reduced from 3,500 kg to 125 kg (around 97% reduction).



## Energy efficiency and sustainability – The VAGG vacuum aggregate from Schmalz

Sample calculation:

	Vacuum generation using a standard vacuum generator	Vacuum generation using a VAGG vacuum aggregate
<b>Basic application data</b>		
Power consumption of pump [kW]	1.1	1.1
Duration of milling process (without evacuation) [min.]	60	60
Consideration of evacuation times		
- Evacuation time (up to -850 mbar) [sec.]	20.0	20.0
- Evacuation time (from -600 mbar to -850 mbar) [sec.]		10.0
Number of readjustments per milling process <sup>1</sup>	No adjustment possible	10
Total vacuum generation time per milling process [min.]	60.33	2 <sup>2</sup>
Number of milling processes per day (double-shift system)	14	14
<b>Calculation of annual energy consumption</b>		
Total vacuum generation time per day [min./day] <sup>3</sup>	844.62	28.00
Daily energy consumption (double-shift system) [kWh] <sup>4</sup>	15.48	0.51
Days of operation per year <sup>5</sup>	245	245
Annual energy consumption [kWh]	3,792.6	124.95
<b>Calculation of the resulting CO<sub>2</sub> emissions</b>		
CO <sub>2</sub> emissions for energy generation [kg CO <sub>2</sub> / kWh] <sup>6</sup>	0.921	0.921
Annual CO <sub>2</sub> emissions [kg CO <sub>2</sub> ] <sup>7</sup>	3,492.98	115.08
<b>Calculation of annual operating costs</b>		
Cost of energy generation [€/ kWh] <sup>8</sup>	0.255	0.1255
Annual operating costs [€] <sup>9</sup>	475.97	15.68

<b>Potential savings for electricity (input factor)</b>	<b>3,667.65 kWh per year</b>
<b>Reduction in emissions</b>	<b>3,377.90 kg CO<sub>2</sub> per year</b>
<b>Savings in operating costs</b>	<b>€460.29 per year</b>
<b>Savings in operating costs</b>	<b>97% per year</b>

<sup>1</sup> Only possible on VAGG units with energy-saving mode

<sup>2</sup> Evacuation time up to -850 mbar [sec.] + (Evacuation time from -600 mbar to -850 mbar [sec.] \* Number of readjustments per milling process)

<sup>3</sup> Total vacuum generation time per milling process [min.] \* Number of milling processes per day (double-shift system)

<sup>4</sup> (Running time [min./day] / 60) \* Power consumption of pump [kW]

<sup>5</sup> Assuming the average number of working days per year on a company level

<sup>6</sup> 1 kWh = 0.921 kg CO<sub>2</sub>, source: <http://172.16.1.34/xampp/mediawiki/index.php/Kohlendioxid>

<sup>7</sup> CO<sub>2</sub> emissions for energy generation [kg CO<sub>2</sub> / kWh] \* Annual energy consumption [kWh]

<sup>8</sup> Average commercial electricity price (incl. electricity tax) in Germany, source: VEA, BVDE, April 2008

<sup>9</sup> Cost of energy generation [€/ kWh] \* Annual energy consumption [kWh]

## Energieeffizienz und Nachhaltigkeit – Das Vakuum-Aggregat VAGG von Schmalz

Beispielrechnung:

	Vakuum-Erzeugung mit marktgängigem Vakuum- Aggregat	Vakuum-Erzeugung mit Vakuum- Aggregat VAGG
<b>Basisdaten zur Anwendung</b>		
Leistungsaufnahme Pumpe [kW]	1,1	1,1
Dauer Fräsvorgang (ohne Evakuierung) [min]	60	60
Betrachtung Evakuierungszeiten		
- Evakuierungszeit bis -850 mbar [sek]	20,0	20,0
- Evakuierungszeit von -600 mbar bis -850 mbar [sek]		10,0
Anzahl Nachregelungen je Fräsvorgang <sup>10</sup>	Keine Regelung möglich	10
Gesamtlaufzeit Vakuumherzeugung je Fräsvorgang [min]	60,33	2 <sup>11</sup>
Anzahl Fräsvorgänge pro Tag, 2-Schicht-Betrieb	14	14
<b>Berechnung Energieverbrauch pro Jahr</b>		
Gesamtlaufzeit Vakuumherzeugung je Tag [min/Tag] <sup>12</sup>	844,62	28,00
Energieverbrauch pro Tag, 2-Schicht-Betrieb [kWh] <sup>13</sup>	15,48	0,51
Betriebstage pro Jahr <sup>14</sup>	245	245
Energieverbrauch pro Jahr [kWh]	3.792,6	124,95
<b>Berechnung des resultierenden CO<sub>2</sub>-Ausstoßes</b>		
CO <sub>2</sub> -Ausstoß zur Energieerzeugung [kg CO <sub>2</sub> / kWh] <sup>15</sup>	0,921	0,921
CO <sub>2</sub> -Ausstoß pro Jahr [kg CO <sub>2</sub> ] <sup>16</sup>	3.492,98	115,08
<b>Berechnung der Betriebskosten pro Jahr</b>		
Kosten für Energieerzeugung [€/ kWh] <sup>17</sup>	0,1255	0,1255
Betriebskosten pro Jahr [€] <sup>18</sup>	475,97	15,68

<b>Einsparpotenzial Inputfaktor Strom</b>	<b>3.667,65 kWh p. a.</b>
<b>Umweltentlastung</b>	<b>3.377,90 kg CO<sub>2</sub> p. a.</b>
<b>Betriebskostensparnis</b>	<b>460,29 € p. a.</b>
<b>Betriebskostensparnis</b>	<b>97 % p. a.</b>

<sup>10</sup> Nur bei VAGG inklusive Energiesparschaltung möglich

<sup>11</sup> Evakuierungszeit bis -850 mbar [sek] + (Evakuierungszeit von -600 mbar bis -850 mbar [sek] \* Anzahl Nachregelungen je Fräsvorgang)

<sup>12</sup> Gesamtlaufzeit Vakuumherzeugung je Fräsvorgang [min] \* Anzahl Fräsvorgänge pro Tag, 2-Schicht-Betrieb

<sup>13</sup> (Laufzeit [min/Tag] / 60) \* Leistungsaufnahme Pumpe [kW]

<sup>14</sup> Annahme: Durchschnittliche Anzahl Arbeitstage pro Jahr auf Unternehmensebene

<sup>15</sup> 1 kWh = 0,921 kg CO<sub>2</sub>, Quelle: <http://172.16.1.34/xampp/mediawiki/index.php/Kohlendioxid>

<sup>16</sup> CO<sub>2</sub>-Ausstoß zur Energieerzeugung [kg CO<sub>2</sub> / kWh] \* Energieverbrauch pro Jahr [kWh]

<sup>17</sup> Durchschnittlicher Industriestrompreis (inkl. Stromsteuer) in Deutschland, Quelle: VEA, BVDE, April 2008

<sup>18</sup> Kosten für Energieerzeugung [€/ kWh] \* Energieverbrauch pro Jahr [kWh]